BOSE®
Better sound through research®

Lifestyle® PS 18, 28 and 48
Digital Acoustimass® Powered Speakers

100V, 120V, 230V, Dual Voltage

Lifestyle® 35 Home Theater System
5 Jewel Cube® Speakers
PS48 bass module

Lifestyle® 28 Home Theater System
5 Double Cube Speakers
PS28 bass module

Lifestyle® 18 Home Theater System
5 Single Cube Speakers
PS18 bass module

Power PCB, Assembly - 260327-001, Bare PCB - 266459-001
AMP PCB, Assembly - 266999-0, Bare PCB - 267083-001
DSP PCB, Assembly - 267391-0, Bare PCB - 267086-001

Service Manual

Reference Number 268795-SM
Rev 04
Electronic copy only

Contents

Warranty

The Lifestyle® PS18/28/35 powered speaker system is covered by a limited 1-year transferable warranty.

SAFETY INFORMATION

1. Parts that have special safety characteristics are identified by the symbol on  schematics or by special notes on the parts list. Use only replacement parts that have critical characteristics recommended by the manufacturer.

2. Make leakage current or resistance measurements to determine that exposed parts are acceptably insulated from the supply circuit before returning the unit to the customer. Use the following checks to perform these measurements:

A. Leakage Current Hot Check-With the unit completely reassembled, plug the AC line cord directly into a 120V AC outlet. (Do not use an isolation transformer during this test.) Refer to UL6500 paragraph 9.1.1. Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.1 “Leakage Current for Appliances” and Underwriters Laboratories (UL) 6500, IEC 60065 paragraph 9.1.1. With the unit AC switch first in the ON position and then in OFF position, measure from a known earth ground (metal waterpipe, conduit, etc.) to all exposed metal parts of the unit (antennas, handle bracket, metal cabinet, screwheads, metallic overlays, control shafts, etc.), especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 0.5 milliamp. Reverse the unit power cord plug in the outlet and repeat test. ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE UNIT TO THE CUSTOMER.

B. Insulation Resistance Test Cold Check-(1) Unplug the power supply and connect a jumper wire between the two prongs of the plug. (2) Turn on the power switch of the unit. (3) Measure the resistance with an ohmmeter between the jumpered AC plug and each exposed metallic cabinet part on the unit. When testing 3 wire products, the resistance measured to the product enclosure should be between 2 and infinite Meg ohms. Also, the resistance measured to exposed output/input connectors should be between 4 and infinite Meg ohms. When testing 2 wire products, the resistance measured to exposed output/input connectors should be between 4 and infinite Meg ohms. If it is not within the limits specified, there is the possibility of a shock hazard, and the unit must be repaired and rechecked before it is RETURNED TO THE CUSTOMER.

ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICE HANDLING

This unit contains ESDS devices. We recommend the following precautions when repairing, replacing or transporting ESDS devices:

• Perform work at an electrically grounded work station.

• Wear wrist straps that connect to the station or heel straps that connect to conductive floor mats.

• Avoid touching the leads or contacts of ESDS devices or PC boards even if properly grounded. Handle boards by the edges only.

• Transport or store ESDS devices in ESD protective bags, bins, or totes. Do not insert unprotected devices into materials such as plastic, polystyrene foam, clear plastic bags, bubble wrap or plastic trays.

CAUTION: THE BOSE® PS 28 AND PS 35 POWERED SPEAKER CONTAINS NO USER-SERVICEABLE PARTS. TO PREVENT WARRANTY INFRACTIONS, REFER SERVICING TO WARRANTY SERVICE STATIONS OR FACTORY SERVICE.

Specifications

Mechanical

Dimensions:	Bass Module:	8.0" W x 23.0" D x 16.0" H (20.32 x 58.42 x 40.64 cm)
	Single Satellite:	3.1” W x 4.0” D x 3.1” H (7.0 x 10.2 x 7.9 cm)
	Double Satellite:	3.1" W x 4.0" D x 6.02" H (7.8 x 10.2 x 15.7 cm)
	Jewel Cube® speaker:	2.2" W x 8.0" D x 2.6" H (39.4 x 20.3 x 6.6 cm)
Weight:	Module:	35.9 lb (16.3 kg)
	Single Satellite:	1.1 lb (0.5 kg)
	Double Satellite:	2.4 lb (1.1 kg)
	Jewel Cube speaker:	1 lb (0.5 kg)

Electrical

Drivers:	Bass module:	Two woofers, 5 1/4", 2.33 Ohms, (wired in parallel)
	Single Satellite speaker:	One Twiddler™ speakers per cube, 50 mm, 4 Ohms
	Double Satellite speaker:	Two Twiddler speakers per cube, 50 mm, 4 Ohms (wired in series)
	Jewel Cube speaker:	Two Twiddler speakers per cube, 2 1/4", 3.2 Ohms (wired in series)
Amplifier power:	Bass Channel:	125W, <0.2% THD, 40 Hz-200 Hz, 120 Vrms AC mains
	L/R/C/LS/RS:	20W, <0.2% THD, 200 Hz-15 kHz, 120 Vrms AC mains
Input impedance:	Bass Module:	1.16 Ohms (two 2.33 Ohm woofers wired in parallel)
	Single Satellite:	4 Ohms (one 4 Ohm Twiddler speaker)
	Double Satellite:	8 Ohms (two 4 Ohm Twiddler speakers wired in series)
	Jewel Cube Speaker:	6.4 Ohms (two 3.2 Ohm Twiddler speakers wired in series)
L/R/C/LS/RS output distortion:	<0.1% THD at 0.5W	
Bass distortion:	<0.2% THD at 0.5W	
L/R/C/LS/RS output noise:	<500 uVrms, A weighted	
Bass output noise:	<2 mVrms, unweighted	
L/R/C/LS/RS DC offset:	<25 mVdc	
L/R/C/LS/RS balance:	±2.0 dB	
Channel separation:	>40 dB at 1 kHz >30 dB at 10 kHz	(stereo mode)
Turn-on delay:	1.5 seconds maximum	
Turn-off delay:	200 ms maximum	
Main voltage:	USA/Canada : 120 VAC, 60Hz Europe, UK, AUS : 230/240VAC, 50Hz Dual Voltage : 115/230VAC, 50/60Hz	
Inrush current:	20A peak for first 33.3 msec.	

Part List Notes

1. This part is not normally available from customer service. Approval from the Field Service Manager is required before ordering.

2. The individual parts located on the PCB are listed in the part list.

3.  This part is critical for safety purposes. Failure to use a substitute replacement with the same safety characteristics as the recommended replacement part might create shock, fire and/or other hazards.

4. This part is set to the Lifestyle® 28/38 system equalization. To use this part on a Lifestyle® 18, 35 or 48 system, refer to the instructions located on page 31 for setting the Equalizer using TAP commands. Except for the Lifestyle® 18 system, in place of using TAP commands to set the EQ, the customer may use the Bose® AdaptIQ™ audio calibration system to customize the EQ to their room. The Lifestyle® 18 system bass module is set to provide a lower outut to match the single cubes, which can only be set using TAP commands. The AdaptIQ audio calibration system is shipped with the Lifestyle® 18,28,35,38,48 system.

Part List Table of Contents

The part list is broken into sections relative to the way the system is packaged and built, starting from the system level and ending at the component level.

System Packaging - Console, bass module, cube pack, essentials kit.
Essentials Kit - Remote, batteries, antennas, power pack, line cords, IR Blaster, TV sensor.
Lit Kit - Feet, owner's guide, installer's guide.
Cube Speaker Pack - Cubes, connection cables
Bass Module Assembly - Amplifier module, woofer, grille
Amplifier Module Assembly - Power PCB, amplifier PCB, DSP PCB
Electrical Part List - Resistors, Capacitors, Diodes, Transistors, ICs, Misc.

Lifestyle® 18 Home Theater System Packaging

Item Number	Description	Part Number	Note
1	CARTON	268787-001	
2	PACKING, INSERT, GRILL	258465	
3	PACKING, END CAP, EPS, FRONT	258466	
4	PACKING, END CAP, EPS, REAR	258475	
5	BAG, POLY	196638	
6	PACKING PAD, 29.38X21.38	258469	
7	AV28, US TUNER, RC1 AV28, EURO TUNER, RC4 AV28, JAP, IR REMOTE, RC2	266440-1019 266440-2049 266440-3029	1
8	PS18 BASS MODULE, 120V, BLACK PS18 BASS MODULE, 120V, WHITE PS18 BASS MODULE, 230V, BLACK PS18 BASS MODULE, 230V, WHITE PS18 BASS MODULE, DUAL, BLACK PS18 BASS MODULE, DUAL, WHITE	269720-119 269720-129 269720-219 269720-229 269720-619 269720-629	1, 4
9	SINGLE SAT, 5 PK, BLACK SINGLE SAT, 5 PK, WHITE	268791-119 268791-129	1
10	ESSENTIALS KIT, LS18, 120V, (US) ESSENTIALS KIT, LS18, 220V, (EURO) ESSENTIALS KIT, LS18, 230V, (UK) ESSENTIALS KIT, LS18, 240V, (AUS) ESSENTIALS KIT, LS18, DUAL	269660-1 269660-2 269660-4 269660-5 269660-6	1
11	FOAM, SHT, ADHESIVE BACK	263426	
12	GUIDE, QUICK SETUP	268796	
13	COMMITMENT LETTER	251001	

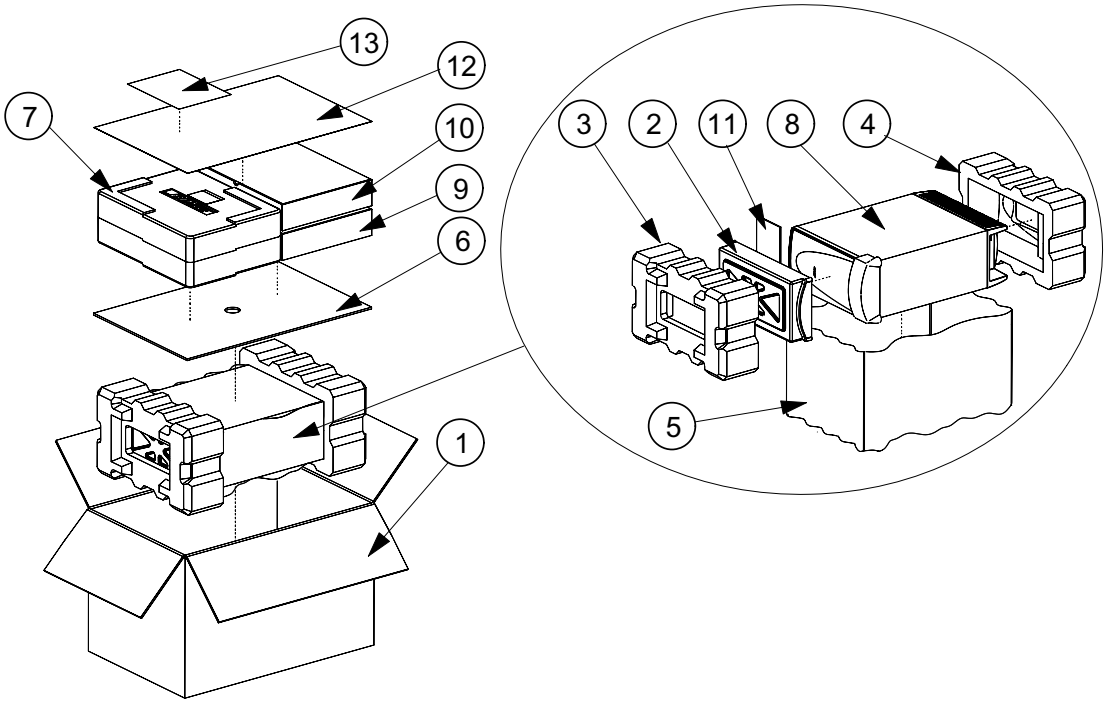


Figure 1. LS18 System Packaging Exploded View

Lifestyle® 28 Home Theater System Packaging

Item Number	Description	Part Number	Note
1	CARTON, RSC	258474-002	
2	PACKING INSERT GRILLE	258465	
3	PACKING END CAP EPS FRONT	258466	
4	PACKING END CAP EPS REAR	258475	
5	BAG POLY	196638	
6	PACKING PAD 29.38X21.38	258469	
7	AV28, US TUNER, RC1 AV28, EURO TUNER, RC4 AV28, JAP, IR REMOTE, RC2	266440-1019 266440-2049 266440-3029	1
8	BASS MODULE, BLACK, 120V BASS MODULE, WHITE, 120V BASS MODULE, BLACK, 220V BASS MODULE, WHITE, 220V BASS MODULE, BLACK, DUAL BASS MODULE, WHITE, DUAL	269498-119 OR 269720-119 267498-129 OR 269720-129 269498-219 OR 269720-219 269498-229 OR 269720-229 269498-619 OR 269720-619 269498-629 OR 269720-629	1, 4
9	SAT ASSY, 5 PK, BLACK SAT ASSY, 5 PK, WHITE	256815-113 OR -119 256815-123 OR -129	1
10	ESSENTIALS KIT, LS-35, 120V, (US) ESSENTIALS KIT, LS-35, 220V, (EURO) ESSENTIALS KIT, LS-35, 230V, (UK) ESSENTIALS KIT, LS-35, 240V, (AUS) ESSENTIALS KIT, LS-35, DUAL	266217-1 266217-2 266217-4 266217-5 266217-6	1
11	FOAM, SHT, ADHESIVE BACK	263426	
12	GUIDE, QUICK SETUP	266254	
13	COMMITMENT LETTER	251001	

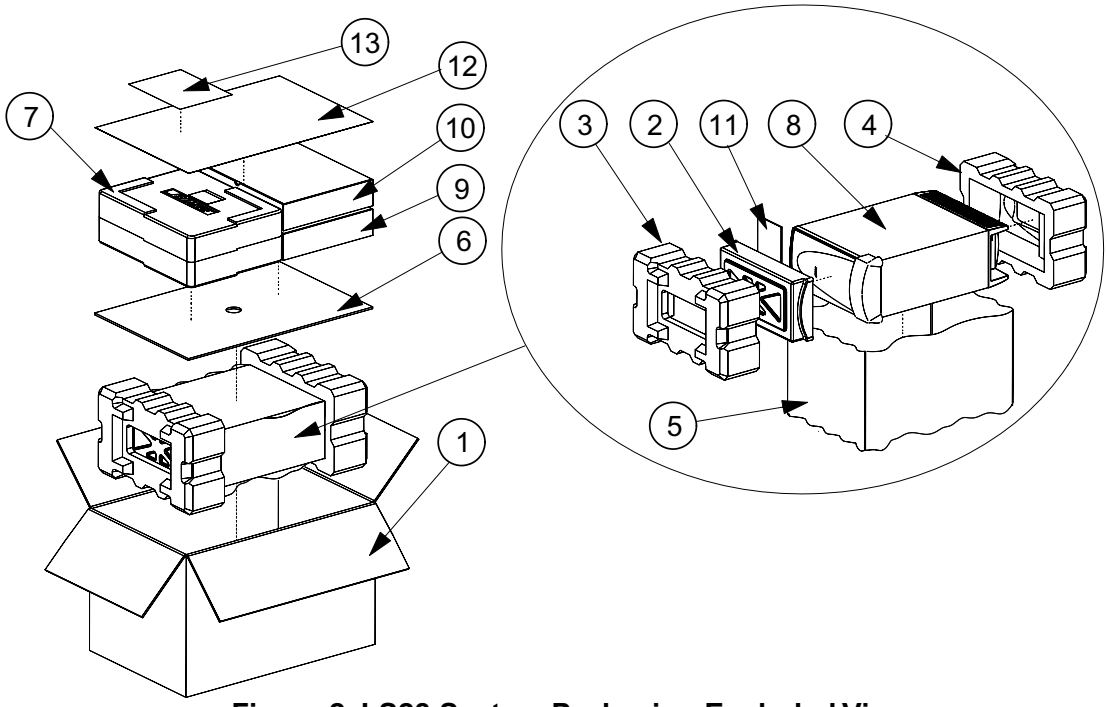


Figure 2. LS28 System Packaging Exploded View

Lifestyle® 35 Home Theater System Packaging

Item Number	Description	Part Number	Note
1	CARTON, RSC	258474-002	
2	PACKING INSERT GRILLE	258465	
3	PACKING END CAP EPS FRONT	258466	
4	PACKING END CAP EPS REAR	258475	
5	BAG POLY	196638	
6	PACKING PAD 29.38X21.38	258469	
7	AV28, US TUNER, RC1 AV28, EURO TUNER, RC4 AV28, JAP, IR REMOTE, RC2	266440-1019 266440-2049 266440-3029	1
8	PS18/28/35, BASS MODULE, BLACK, 120V PS18/28/35, BASS MODULE, WHITE, 120V PS18/28/35, BASS MODULE, BLACK, 220V PS18/28/35, BASS MODULE, WHITE, 220V PS18/28/35, BASS MODULE, BLACK, DUAL PS18/28/35, BASS MODULE, WHITE, DUAL	269499-119 or 269720-119 266499-129 or 269720-129 266499-219 or 269720-219 266499-229 or 269720-229 266499-619 or 269720-619 266499-629 or 269720-629	1, 4
9	SAT ASSY, 5 PK, BLACK SAT ASSY, 5 PK, WHITE	256816-013 OR -019 256816-023 OR -029	1
10	ESSENTIALS KIT, LS-35, 120V, (US) ESSENTIALS KIT, LS-35, 220V, (EURO) ESSENTIALS KIT, LS-35, 230V, (UK) ESSENTIALS KIT, LS-35, 240V, (AUS) ESSENTIALS KIT, LS-35, DUAL	266218-1 266218-2 266218-4 266218-5 266218-6	1
11	FOAM, SHT, ADHESIVE BACK	263426	
12	GUIDE, QUICK SETUP	266255	
13	COMMITMENT LETTER	251001	

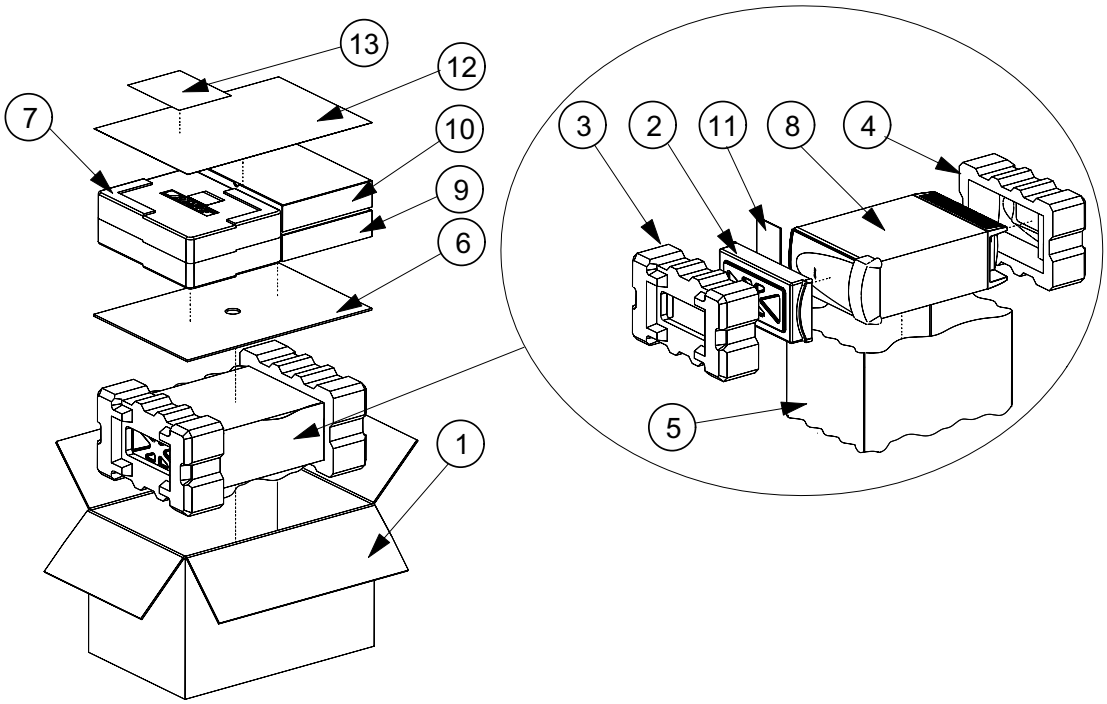


Figure 3. LS35 System Packaging Exploded View

Lifestyle® 18/28/35 Essentials Kit Part List

Refer to figure 4

Item Number	Description	Part Number	Variant Packaging	QTY	Note
1	REMOTE CONTROL	256119-001	US, CAN, AUS, EU, UK, SE ASIA/EAST ASIA, SING	1	
	REMOTE, CONTROL EU, 40MHZ	256119-002	S. AF, MID E, DUAL-V		
2	BATTERY, AAA SIZE	179223-01	ALL	4	
3	ANTENNA, FM DIPOLE, F-CONN	148589	US, CAN, DUAL-V	1	
	ANTENNA, FM DIPOLE, PAL CONN	143185	AUS, EU, UK, SE ASIA/EAST ASIA, SING, S. AF, MID E, DUAL-V		
4	POWER PACK, 35W, 120V, DCS-91	256764-001	US, CAN	1	3
	POWER PACK, 35W, 230V, DCS-92	256764-007	AUS, UK, SE ASIA/EAST ASIA, SING		
	POWER PACK, 35W, DUAL-V, DCS-94	256764-004	EU, LATIN AMERICA, S. AF, MID E, DUAL-V		
5	ANTENNA, ASSY, AM	199824-002	ALL	1	
6	TV POWER SENSOR	258359	ALL	1	
7	LINE CORD, 120V, AV28	258491-001	US, CAN, DUAL-V	1	3
	LINE CORD, 220V, AV28	148203	EU, LATIN AMERICA, MID E, S. AF, SE ASIA/EAST ASIA, DUAL-V		
	LINE CORD, 230V, AV28	134725	UK, SING		
	LINE CORD, 240V, AV28	134726	AUS		
8	LINE CORD, 120V, PS18/28/48	263453-006	US, CAN, DUAL-V	1	3
	LINE CORD, 220V, PS18/28/48	264355-006	EU, LATIN AMERICA, MID E, S. AF, SE ASIA/EAST ASIA, DUAL-V		
	LINE CORD, 230V, PS18/28/48	264356-006	UK, SING		
	LINE CORD, 240V, PS18/28/48	264357-006	AUS		
9	BAG, POLY, 3X3MIL	194392	ALL	1	
10	IR BLASTER	260335	ALL	1	
11	TRAY PACK INSERT	258471	ALL	1	
12	CARTON, ACCY KIT	258470-001	ALL	1	
13	KIT, ADAPTIQ™	258363	ALL	1	
14	SCART ADAPTOR	266221-001	AUS, SING, EU, UK, SE ASIA/EAST ASIA, S. AF, MID E, DUAL-V	1	
15	LIT KIT, LS18	268793-1	US, CAN, LATIN AMERICA	1	
	LIT KIT, LS18	268793-2	EU, S. AF, MID E		
	LIT KIT, LS18	268793-4	AUS, UK, SING, SE ASIA/EAST ASIA		
	LIT KIT, LS28	266219-1	US, CAN, LATIN AMERICA		
	LIT KIT, LS28	266219-2	AUS, EU, S. AF, MID E		
	LIT KIT, LS28	266219-4	UK, SING, SE ASIA/EAST ASIA		
	LIT KIT, LS35	266220-1	US, CAN, LATIN AMERICA		
	LIT KIT, LS35	266220-2	AUS, EU, S. AF, MID E		
	LIT KIT, LS35	266220-4	UK, SING, SE ASIA/EAST ASIA		

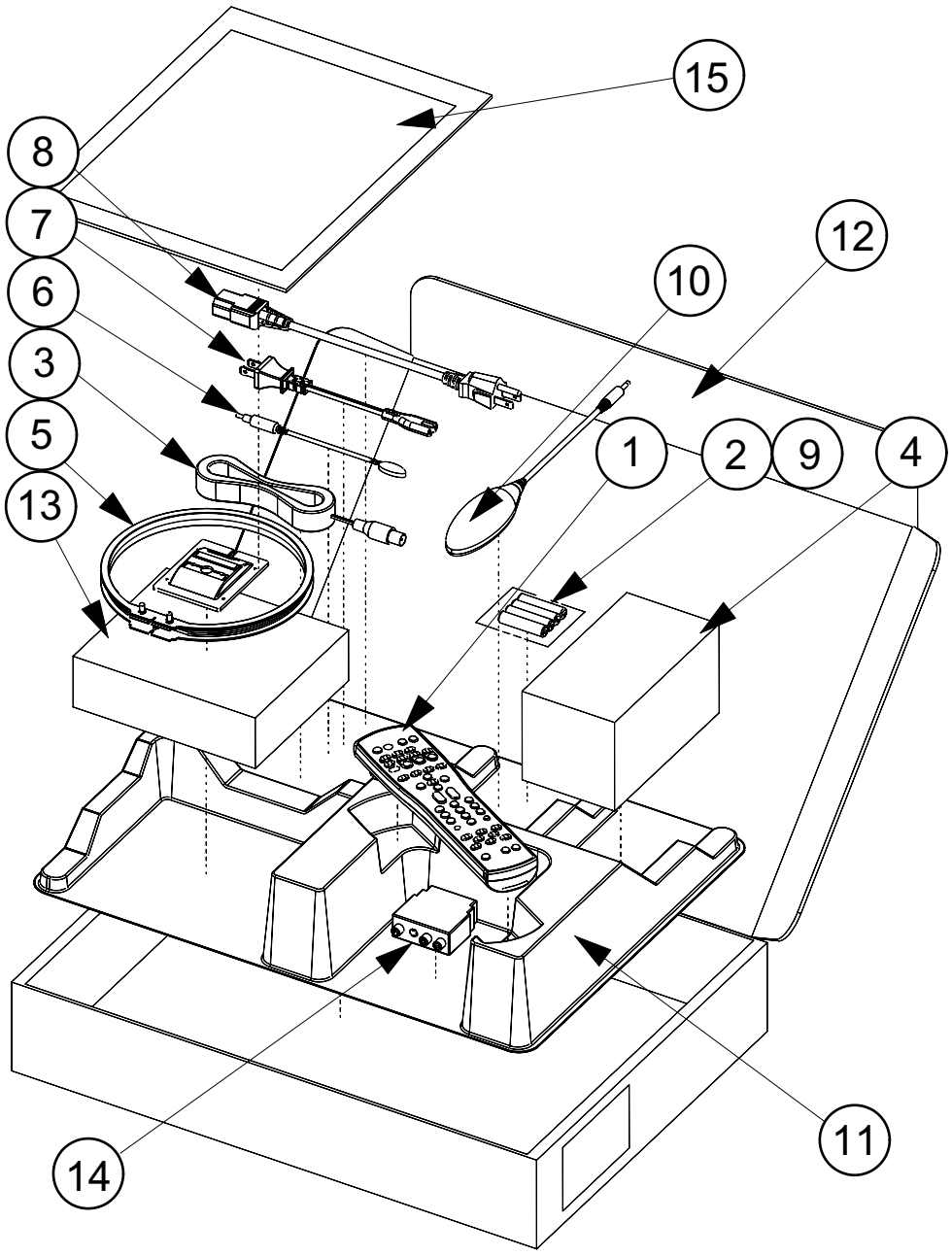


Figure 4. LS18, 28, 35 Essentials Kit Exploded View

Lifestyle® 18 Lit Kit Part List

Description	Part Number	Variant Packaging	QTY	Note
FOOT, CUBES	178321-04	ALL	4	
FOOT, BASS MODULE	142839	ALL	4	
OPERATING GUIDE, 3 LANG	269711	ALL	1	
OPERATING GUIDE, 5 LANG	269713	EU, S. AF, MID E, DUAL-V		
INSTALL GUIDE, 3 LANG	269712	US, CAN, AUS, UK, EU, S. AF, MID E, SING, SE ASIA/EAST ASIA, DUAL-V	1	
INSTALL GUIDE, 5 LANG	269714	EU, S. AF, MID E, DUAL-V		
BAG, POLY, 14.38x9.87x2 mil	103351	ALL	1	
CARD, INFO, WARRANTY, MULTI LANG	181460	EU, S. AF, MID E, DUAL-V, AUS, UK, SING, SE ASIA/EAST ASIA, DUAL-V		
SHEET SLIP COMPONENT AUDIO	255805	ALL	1	
ADDRESS PAGE	259434	US, CAN, LATIN AMERICA	1	
CARD REGISTRATION AND WARRANTY	262933	US, CAN, LATIN AMERICA	1	
CARD, LIFESTYLE UPDATE	268157	US, CAN, LATIN AMERICA	1	
DEC OF CONF	268794	AUS, UK, SING, SE ASIA/EAST ASIA, DUAL-V	1	

Lifestyle® 28 Lit Kit Part List

Description	Part Number	Variant Packaging	QTY	NOTE
FOOT, CUBES	178321-04	ALL	4	
FOOT, BASS MODULE	142839	ALL	4	
OPERATING GUIDE, 3 LANG	264341	ALL	1	
OPERATING GUIDE, 5 LANG	264342	AUS, EU, S. AF, MID E.		
INSTALL GUIDE, 3 LANG	264343	ALL	1	
INSTALL GUIDE, 5 LANG	264344	AUS, EU, S. AF, MID E.		
BAG, POLY, 14.38x9.87x2 mil	103351	ALL	1	
CARD, INFO, WARRANTY, MULTI LANG	181460	AUS, EU, S. AF, MID E., UK, SING, SE ASIA/EAST ASIA	1	
SHEET SLIP COMPONENT AUDIO	255805	ALL	1	
ADDRESS PAGE, BOSE	259434	US, CAN, LATIN AMERICA	1	
CARD REGISTRATION AND WARRANTY	262933	US, CAN, LATIN AMERICA	1	
CARD, LIFESTYLE UPDATE	268157	US, CAN, LATIN AMERICA	1	
DEC OF CONF	266994	AUS, EU, S. AF, MID E., UK, SING, SE ASIA/EAST ASIA	1	

Lifestyle® 35 Lit Kit Part List

Description	Part Number	Variant Packaging	QTY	NOTE
FOOT, CUBES	183621	ALL	4	
FOOT BASS MODULE	142839	ALL	4	
OPERATING, GUIDE, 3 LANG	264341	ALL	1	
OPERATING GUIDE, 5 LANG	264342	AUS, EU, S. AF, MID E.		
INSTALL GUIDE, 3 LANG	264343	ALL	1	
INSTALL, GUIDE, 5 LANG	264344	AUS, EU, S. AF, MID E.		
BAG, POLY, 14.38x9.87x2 mil	103351	ALL	1	
CARD, INFO, WARRANTY, MULTI LANG	181460	AUS, EU, S. AF, MID E., UK, SING, SE ASIA/EAST ASIA	1	
SHEET SLIP COMPONENT AUDIO	255805	ALL	1	
ADDRESS PAGE, BOSE	259434	US, CAN, LATIN AMERICA	1	
CARD REGISTRATION AND WARRANTY	262933	US, CAN, LATIN AMERICA	1	
CARD, LIFESTYLE UPDATE	268157	US, CAN, LATIN AMERICA	1	
DEC OF CONF	266994	AUS, EU, S. AF, MID E., UK, SING, SE ASIA/EAST ASIA	1	

Lifestyle® 18 Single Cube Speaker, 5 Pack Packaging List

Item Number	Description	Part Number	Qty	Note
1	SATELLITE ASSEMBLY, SINGLE, BLACK SATELLITE ASSEMBLY, SINGLE, WHITE	250490-119 250490-129	5	
2	CABLE, RJ-45/8 PIN DIN	260351-002	1	
3	CABLE, AUDIO, DUAL RCA	185931-01	1	
4	CABLE, VIDEO, 6', YL	183200	1	
5	CABLE, S-VIDEO, 6’	258369	1	
6	CABLE, COMPONENT, VIDEO, ADAPTOR	260350	1	
7	CABLES, SPKR, 18 AWG, L/C/R, BLACK CABLES, SPKR, 18 AWG, L/C/R, WHITE	180643-4 176201-4	1	
8	CABLE, SPEAKER, REAR, BLACK CABLE, SPEAKER, REAR, BLACK	180644 176202	1	
9	BAG, POLY, 10X12X2mil	144677	5	
10	PACKING, INSERT	258473	1	
11	CARTON, CHIPBOARD, SATELLITE	250555-001	5	
12	CARTON, D/C	258472-001	1	

Lifestyle® 28 Double Cube Speaker, 5 Pack Packaging List

Item Number	Description	Part Number	Qty	Note
1	SATELLITE ASSEMBLY, SINGLE, BLACK SATELLITE ASSEMBLY, SINGLE, WHITE	192420-119 192420-129	5	
2	CABLE, RJ-45/8 PIN DIN	260351-002	1	
3	CABLE, AUDIO, DUAL RCA	185931-01	1	
4	CABLE, VIDEO, 6', YL	183200	1	
5	CABLE, S-VIDEO, 6'	258369	1	
6	CABLE, COMPONENT, VIDEO ADAPTOR	260350		
7	CABLES, SPKR, 18 AWG, L/C/R, BLACK CABLES, SPKR, 18 AWG, L/C/R, WHITE	180643-4 176204-4	1	
8	CABLE, SPEAKER, REAR, BLACK CABLE, SPEAKER, REAR, WHITE	180644 176202	1	
9	BAG, POLY, 10X12X2 mil	144677	5	
10	PACKING, INSERT	258473		
11	CARTON, CHIPBOARD, SATELLITE, BLUE	197330-002	5	
12	CARTON, D/C, SAT KIT	258472-001	1	

Lifestyle® 35 Jewel Cube® Speaker, 5 Pack Packaging List

Item Number	Description	Part Number	Qty	Note
1	JEWEL CUBE SPEAKER, BLACK JEWEL CUBE SPEAKER, WHITE	194420-019 194420-029	5	
2	CABLE, RJ-45/8 PIN DIN	260351-002	1	
3	CABLE, AUDIO, DUAL RCA	185931-01	1	
4	CABLE, VIDEO, 6', YL	183200	1	
5	CABLE, S-VIDEO, 6'	258369	1	
6	CABLE, COMPONENT, VIDEO ADAPTOR	260350		
7	CABLESET, 3PK, L/C/R, BLACK CABLESET, 3PK, L/C/R, WHITE	193145-04 193145-14	1	
8	CABLESET, 2PK, LS/RS, BLACK CABLESET, 2PK, LS/RS, WHITE	193146-03 193146-13	1	
9	BAG, POLY, 3X3.5X.004	185214	5	
10	SATELLITE TRAY	190211-001	1	
11	CARTON, D/C, SAT KIT	258472-001	1	
12	PACKING, INSERT	258473	1	
13	PACKING, PULL TAB, 2.25X1.75	188029-001	5	

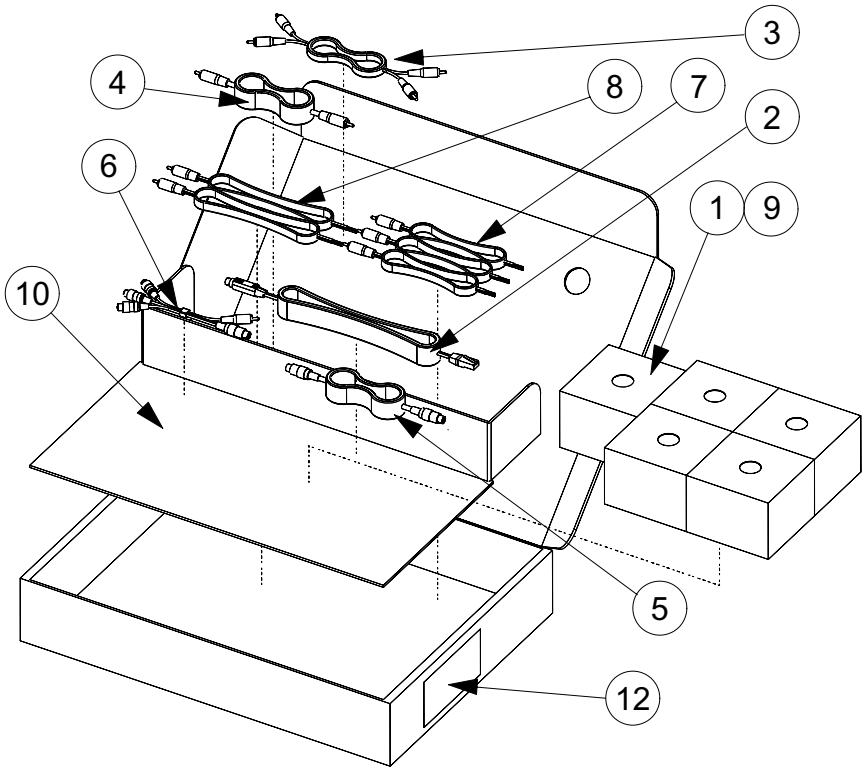


Figure 5. LS18, 28 Cube Pack Exploded View

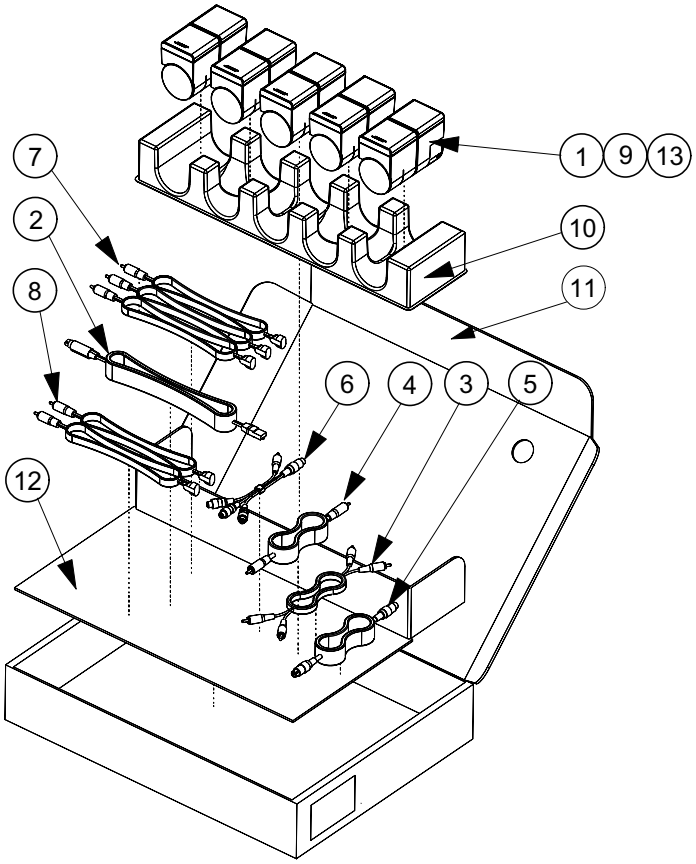


Figure 6. LS35 Cube Pack Exploded View

Jewel Cube® Part List

Item Number	Description	Part Number	Qty	Note
1	TWIDDLER™ ASSY, 50MM	195840	2	
2	GRILLE, CUBE, BLACK, W/O SLOT GRILLE, CUBE, WHITE, W/O SLOT	192935-01 192935-03	1	
3	GRILLE, CUBE, BLACK, W/SLOT GRILLE, CUBE, WHITE, W/SLOT	192935-02 192935-04	1	
4	SNAP RING	178709	1	
5	H-RING, SEAL, BLACK H-RING,SEAL NATURAL	178710-01 178710-02	2	
6	HARNESS ASSY, TWIDDLER	196136-01	1	
7	SCREW, HILO, 4-16x.375, PAN, XREC	181621-06	8	
8	DAMPER, ANTI-BUZZ	185951	8	
9	NAMEPLATE, BOSE, BLACK/PEWTER NAMEPLATE, BOSE, WHITE/PEWTER	178725-01 178725-02	1	

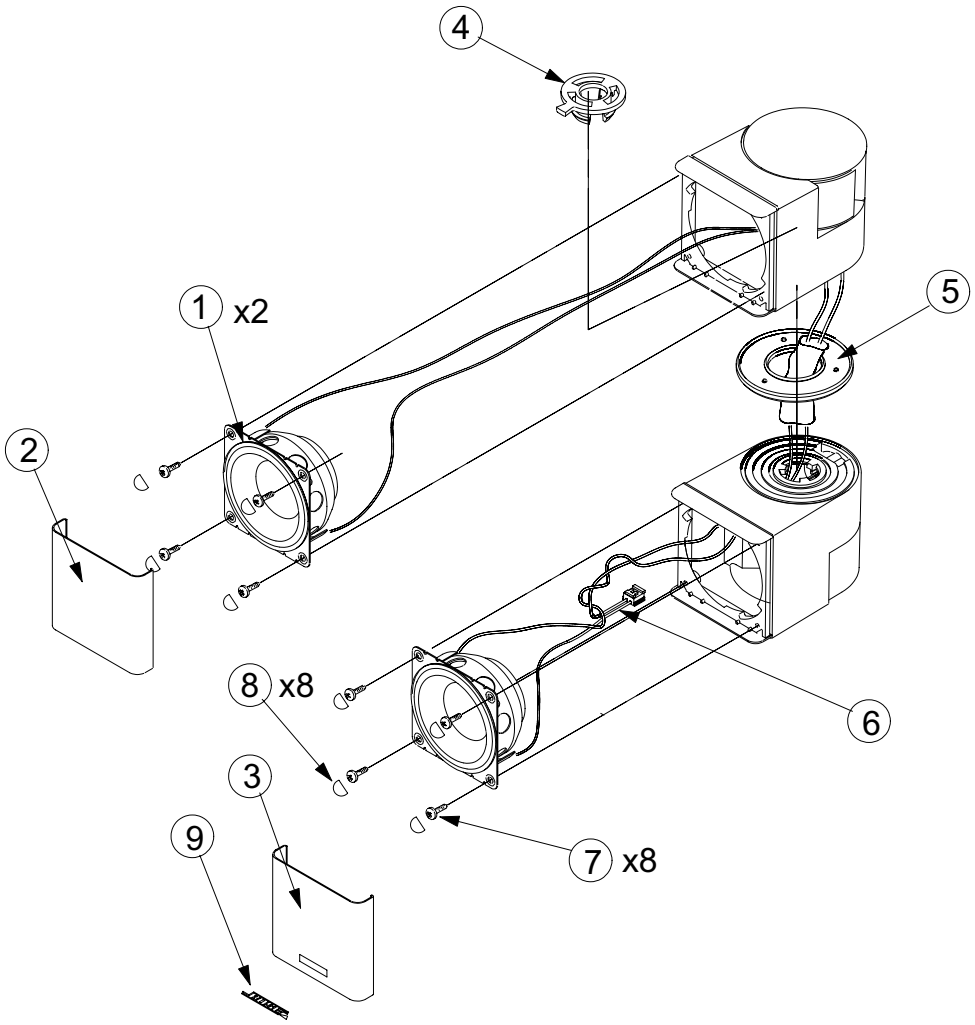


Figure 7. Jewel Cube Exploded View

Single and Dual Cube Speaker Part List

Item Number	Description	Part Number	Qty	Note
1	GRILLE, BLACK GRILLE, WHITE	192410-019 192410-029	2	
2	LOGO, 1" DIAMOND CUT, BLACK LOGO, 1" DIAMOND CUT, WHITE	193250-11 193250-12	1	

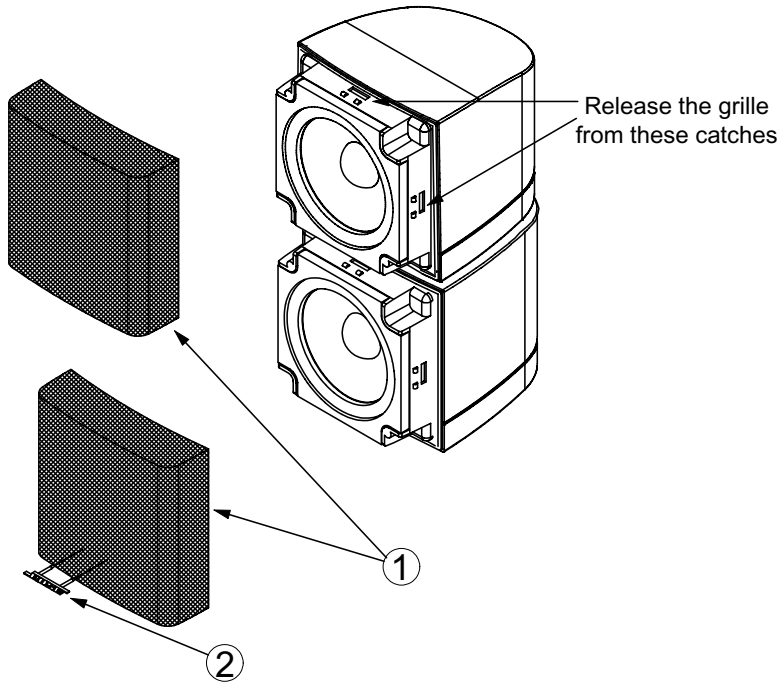


Figure 8. Cube Exploded View

PS18/28/48 Bass Module Assembly Part List

Item Number	Description	Part Number	Qty	Note
1	AMP MODULE ASSY, 120V AMP MODULE ASSY, 230V AMP MODULE ASSY, 100V AMP MODULE ASSY, DUAL-V	277096-132F 277096-631F 277096-631F 277096-631F	1	1, 4
2	SCREW, TAPP, 8-11x.75, PAN, XRC/SQ	172672-12	14	
3	GRILLE, BLACK GRILLE, WHITE	256761-001 256761-002	1	
4	COVER, REAR, BLACK COVER, REAR, WHITE	256762-001 256762-002	1	3
5	SCREW, 8-32X.75, RLX, PN, QDRX, BLACK SCREW, 8-32X.75, RLX, PN, QDRX, WHITE	260400-12 193637-20	2	
6	SCREW TAPP, 8-11X1.25, PAN, XRS/C	172672-20	2	
7	LOGO, NAMEPLATE, GRILL, BLACK LOGO, NAMEPLATE, GRILL, WHITE	258484-01 258484-02	1	
8	INSERT, PLASTIC, REAR COVER, BLACK INSERT, PLASTIC, REAR COVER, WHITE	258485-01 258785-02	1	
9	GASKET, GILLE EDGE	260349	2	
10	TAPE, VHB, REAR, COVER, PLUG	262871	1	
-	WOOFER ASSY,5.25" 2.33 OHM	256765	2	
-	GASKET, WOOFER	263455	2	

Important - Note 4. This part is set to the Lifestyle® 28/38 system equalization. To use this part on a Lifestyle® 18, 35 or 48 system, refer to the instructions located on page 31 for setting the Equalizer using TAP commands. Except for the Lifestyle® 18 system, in place of using TAP commands to set the EQ, the customer may use the Bose® AdaptIQ™ audio calibration system to customize the EQ to their room. The Lifestyle® 18 system bass module is set to provide a lower outut to match the single cubes, which can only be set using TAP commands. The AdaptIQ audio calibration system is shipped with the Lifestyle® 18,28,35,38,48 system.

For other notes referenced, refer to the part list notes at the beginning of the part list section.

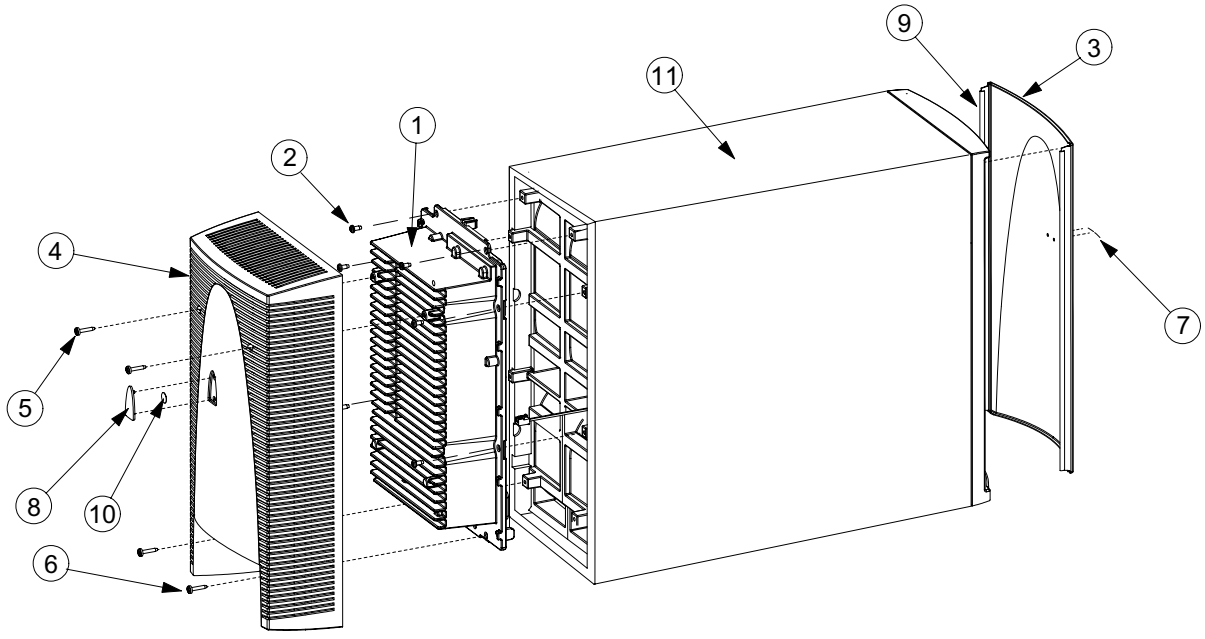


Figure 9. Bass Module Exploded View

PS18/28/48 Amplifier Module Assembly Part List

Item Number	Description	Part Number	Qty	Note
11	POWER PCB ASSY, 120V POWER PCB ASSY, 230V POWER PCB ASSY, 120V/100V POWER PCB ASSY, DUAL-V	285837-001 285837-002 285837-003 285837-006	1	1, 2, 3
12	AMP PCB ASSY	285826-001	1	1, 2
13	DSP PCB ASSY	285828-101	1	1, 2, 4
14	ENCLOSURE, HEATSINK	266998-001	1	3
15	HOUSING, LOWER, AMPLIFIER	256142-001	1	3
16	HEATSINK, ASSY, DSP	260369	1	
17	PAD, CONDUCTIVE, THERMAL	258353-001	1	
18	PAD, CONDUCTIVE, THERMAL	258356-001	1	
19	SCREW, 6-32X1/2 THREAD ROLLING	258492-08	18	
20	GASKETING, EMI	256826-001	1	
21	GASKETING, EMI	256826-002	1	
22	GASKET, CONNECTOR	256827	1	
23	BAR, SPRING, POWER AMPS	260375	1	
24	FOAM, SHIM, DIODES	258483	1	
25	CLIP, GROUNDING, FINGER STOCK	262870-001	4	
26	PAD, HEXAGON, .433 X .063	262869	3	
27	SHIM, ELECTRONICS MODULE	263456	1	
28	GASKET FOAM EMI	262635-025	1	
-	FOAM, SHIM, POWER AMP	263454	1	

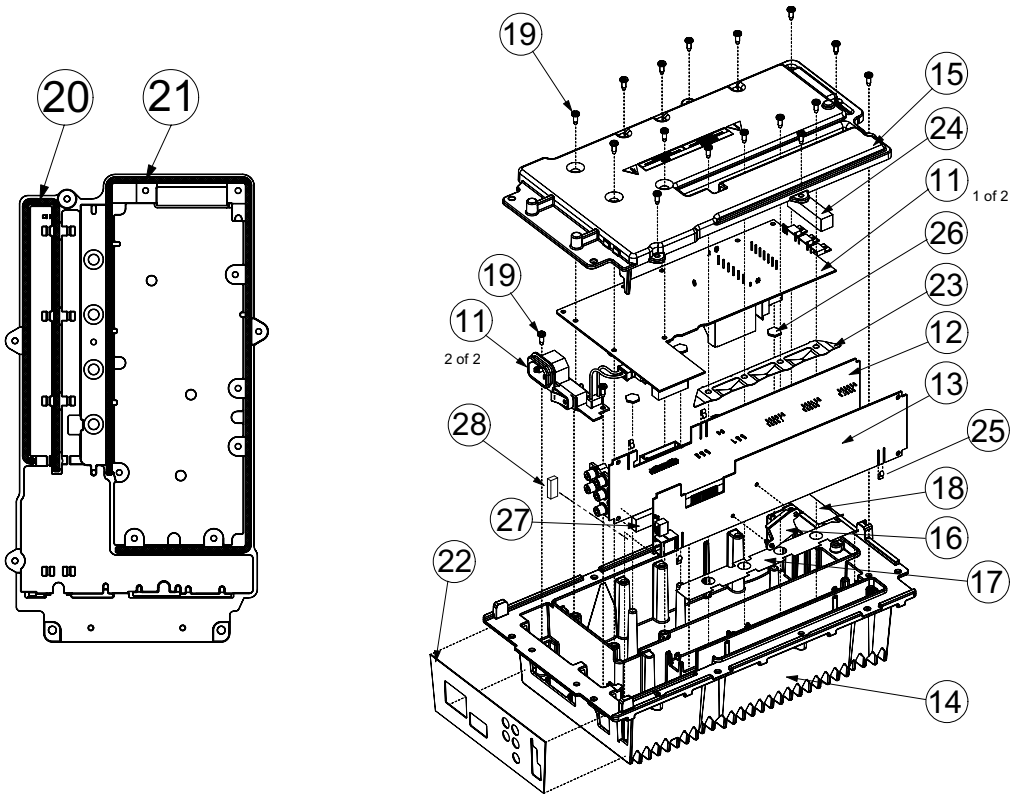


Figure 10. Amplifier Module Exploded View

Power PCB Assembly 260327-XXXX, PCB 266459-001

PS18/28/48 Electrical Part List

Resistors

Reference Designator	Description	Part Number	Note
R101	10 OHM, 1206, 1/8W, 5%	124895-1005	
R102	33 OHM, 1206, 1/8W, 5%	124895-3305	
R103	10 OHM, 1206, 1/8W, 5%	124895-1005	
R104	100 OHM, 1206, 1/8W, 5%	124895-1015	
R106	1.00K, 1206, 1/8W, 5%	124895-1025	
R107	2.0K, 0603, .1W, 5%	199403-202	
R109	20K, 0603, .1W, 5%	199403-203	
R110	1M, 0603, .1W, 5%	199403-105	
R111	43.2K, 0603, .1W, 1%	191465-4322	
R112	60.4K, 0603, .1W, 1%	191465-6042	
R113	47.5K, 0603, .1W, 1%	191465-4752	
R121	75.0K, 1206, 1/8W, 1%	124894-7502	
R122	75.0K, 1206, 1/8W, 1%	124894-7502	
R123	75.0K, 1206, 1/8W, 1%	124894-7502	
R124	75.0K, 1206, 1/8W, 1%	124894-7502	
R127	9.1M, 0603, .1W, 5%	199403-915	
R128	220K, 0603, .1W, 5%	199403-224	
R129	261K, 1206, 1/4W, 1%	124894-2613	
R150	681 OHM, 1206, 1/8W, 1%	124894-6810	
R151	2.87K, 0603, 100MW, 1%	191465-2871	
R152	20K, 0603, .1W, 5%	199403-203	
R153	75.0K, 1206, 1/8W, 1%	124894-7502	
R154	75.0K, 1206, 1/8W, 1%	124894-7502	
R155	75.0K, 1206, 1/8W, 1%	124894-7502	
R156	75.0K, 1206, 1/8W, 1%	124894-7502	
R157	261K, 1206, 1/4W, 1%	124894-2613	
R158	220 OHM, 1206, 1/4W, 5%	124895-2215	DUAL-V
R159	220 OHM, 1206, 1/4W, 5%	124895-2215	DUAL-V
R160	220 OHM, 1206, 1/4W, 5%	124895-2215	DUAL-V
R161	220 OHM, 1206, 1/4W, 5%	124895-2215	DUAL-V
R201	10 OHM, FUSING, AX, RAD TAPE	260352-100	3 
R202	10 OHM, FUSING, AX, RAD TAPE	260352-100	3 
R207	100K, 0603, .1W, 1%	191465-1003	
R208	10K, 0603, .1W, 1%	191465-1002	
R212	10K, 0603, .1W, 1%	191465-1002	
R213	10K, 0603, .1W, 1%	191465-1002	
R216	68.1K, 0603, .1W, 1%	191465-6812	
R217	13.7K, 0603, 0.1W, 1%	191465-1372	
R218	5.11K, 0603, .1W, 1%	191465-5111	
R219	2.1K, 0603, .1W, 1%	191465-2101	
R220	432 OHM, 0603, .1W, 1%	191465-4320	
R223	432 OHM, 1206, 1/4W, 1%	124894-4320	
R224	2.0K, 0603, .1W, 5%	199403-202	
R225	49.9K, 0603, .1W, 1%	191465-4992	
R226	432 OHM, 0603, .1W, 1%	191465-4320	
R227	3.01K, 0603, .1W, 1%	191465-3011	
R228	432 OHM, 0603, .1W, 1%	191465-4320	
R229	3.01K, 0603, .1W, 1%	191465-3011	
R230	100K, 0603, .1W, 1%	191465-1003	
R231	100K, 0603, .1W, 1%	191465-1003	

Power PCB Assembly 260327-XXXX, PCB 266459-001

PS18/28/48 Electrical Part List

Resistors (continued)

Reference Designator	Description	Part Number	Note
R234	5.9K, 0603, .1W, 1%	191465-5901	
R235	10K, 0603, .1W, 1%	191465-1002	
R236	2.2 OHM, FUSING, 1/2W, 5%	188460-2R2	3
R237	2.2 OHM, FUSING, 1/2W, 5%	188460-2R2	3
R238	100K, 0603, .1W, 1%	191465-1003	
R300	2.00K, 1206, 1/8W, 5%	124895-2025	
R301	2.49K, 1206, 1/8W, 1%	124894-2491	
R303	20K, 0603, .1W, 5%	199403-203	
R304	20K, 0603, .1W, 5%	199403-203	
R305	18.7K, 0603, .1W, 1%	191465-1872	
R306	2.87K, 0603, 100MW, 1%	191465-2871	
R403	261K, 1206, 1/4W, 1%	124894-2613	
R404	18.7K, 0603, .1W, 1%	191465-1872	
R405	91K, 0603, .1W, 5%	199403-913	
R406	390 OHM, 0603, .1W, 5%	199403-391	
R407	261K, 1206, 1/4W, 1%	124894-2613	
R410	261K, 1206, 1/4W, 1%	124894-2613	
R411	261K, 1206, 1/4W, 1%	124894-2613	

Capacitors

Reference Designator	Description	Part Number	Note
C101	0.1uF, FILM, X1, 310VAC, 15MM	260387-104B	3
C101	0.1uF, FILM, X2, 275VAC, 15MM	268166-104B	3 100V, 230V, DUAL-V
C102	0.1uF, FILM, X1, 310VAC, 15MM	260387-104B	
C102	0.1uF, FILM, X2, 275VAC, 15MM	268166-104B	100V, 230V, DUAL-V
C103	1.5nF, FILM, Y2, 250VAC	254145-152A	3
C104	1.5nF, FILM, Y2, 250VAC	254145-152A	3
C106	.47uF, BOX, 85, 50V, 5%	137127-474	
C110	.470uF, EL, 105, 250V, 20%	170170	3
C111	.470uF, EL, 105, 250V, 20%	170170	3
C112	.047uF, FILM, 630VDC, 85, 10%	260357-473T21	
C113	470pF, MICA, 10%, 500V	254164-471B	
C114	470pF, MICA, 10%, 500V	254164-471B	
C115	18000pF, FILM, 2KVDC, 5%	258419-183C	
C117	1.0uF, EL, 105, 50V, 20%	196991-1R0H	
C118	10uF, EL, 105, 25V, 20%	196991-100E	
C119	.47uF, BOX, 85, 50V, 5%	137127-474	
C120	.01uF, 0603, X7R, 50V	191470-103	
C121	.01uF, 0603, X7R, 50V	191470-103	

Power PCB Assembly 260327-XXXX, PCB 266459-001

PS18/28/48 Electrical Part List

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C122	220pF 0603, COG, 50V, 5%	188454-221	
C126	.047uF, 0603, X7R, 5%, 25V	196999-473	
C128	.047uF, 0603, X7R, 5%, 25V	196999-473	
C129	.47uF, BOX, 85, 50V, 5%	137127-474	
C130	.047uF, 0603, X7R, 5%, 25V	196999-473	
C201	5.6uF, FILM, 10%, 100VDC	260333-565C	
C202	5.6uF, FILM, 10%, 100VDC	260333-565C	
C211	1.0uF, FILM, 10%, 100 VDC	260333-105A	
C212	1.0uF, FILM, 10%, 100 VDC	260333-105A	
C213	10uF, EL, 105, 25V, 20%	190382-100E	
C214	10uF, EL, 105, 25V, 20%	190382-100E	
C215	.022uF, 0603, X7R, 25V	196999-223	
C219	.047uF, 0603, X7R, 5%, 25V	196999-473	
C220	.047uF, 0603, X7R, 5%, 25V	196999-473	
C233	.001uF, BOX, 85, 100V, 5%	137127-102	
C234	.001uF, BOX, 85, 100V, 5%	137127-102	
C235	.001uF, BOX, 85, 100V, 5%	137127-102	
C236	.001uF, BOX, 85, 100V, 5%	137127-102	
C237	3300pF, 1206, X7R, 50V, 10%	124957-332	
C238	3300pF, 1206, X7R, 50V, 10%	124957-332	
C239	3300pF, 1206, X7R, 50V, 10%	124957-332	
C240	22uF, EL, 105, 63V, 20%	196991-220I	
C241	22uF, EL, 105, 63V, 20%	196991-220I	
C255	.1uF, 0805, X7R, 10%, 25V	181264-104	
C256	.1uF, 0805, X7R, 10%, 25V	181264-104	
C300	.47uF, BOX, 85, 50V, 5%	137127-474	
C301	.047uF, 0603, X7R, 5%, 25V	196999-473	
C401	100pF, 0603, COG, 50V, 5%	188454-101	
C402	47uF, EL, 105, 16V, 20%	126767-470	DUAL-V
C408	.047uF, FILM, 630VDC, 85, 10%	260357-473T21	DUAL-V

Diodes

Reference Designator	Description	Part Number	Note
BR1	BRIDGE, 600V, 4A	256789-600	3 
D101	MMBD914LT1, SOT	148582	
D102	MMBD914LT1, SOT	148582	
D103	MMBD914LT1, SOT	148582	
D105	MMBD914LT1, SOT	148582	
D106	MMBD914LT1, SOT	148582	
D108	SHOTTKY, BAT42W, SOD-123	196984-002	
D111	MMBD914LT1, SOT	148582	
D112	SHOTTKY, BAT42W, SOD-123	196984-002	
D150	BAV70, SOT-23	147249	
D201	PWR SCHOTTKY, 8AX2, 80V	258432-080	
D202	MMBD914LT1, SOT	148582	
D203	PWR SCHOTTKY, 8A, 80V	258437-080	
D204	PWR SCHOTTKY, 8A, 80V	258437-080	
D205	MMBD914LT1, SOT	148582	
D206	MMBD914LT1, SOT	148582	

Power PCB Assembly 260327-XXXX, PCB 266459-001

PS18/28/48 Electrical Part List

Resistors (continued)

Reference Designator	Description	Part Number	Note
D207	BAV70, SOT-23	147249	
D208	SOT23, BAV99	147239	
D209	1N4001, RECTIFIER, 400V, 1A	260340-1	
D210	1N4001, RECTIFIER, 400V, 1A	260340-1	
D211	BAV99, SOT23	147239	
D401	RECTIFIER, 700V, 1A, 12.5MM	260340-7	DUAL-V
ZR101	1N5246, ZEN, 12V, 225MW, 5%	135247-5242	
ZR102	1N5246, ZEN, 12V, 225MW, 5%	135247-5242	
ZR103	ZENER, 3.3V	135247-5226	
ZR300	SOT-23, ZEN, 6.2V, 225MW, 5%	135247-5234	

Transistors

Reference Designator	Description	Part Number	Note
Q101	CLIP, TINNERMAN	258354	
Q101	MOS FET, N-CH, 500V, 6.6A	254121-001	
Q102	CLIP, FET	258354	
Q102	MOSFET, N-CH, 500V, 6.6A	254121-001	
Q103	MFET, N, SOT	252043	
Q104	MMBT3906, PNP, SOT	148596	
Q201	MMBT3904, TRANSISTOR, NPN, SOT	146819	
Q300	MMBT3906, PNP, SOT	148596	
Q301	MMBT3904, TRANSISTOR, NPN, SOT	146819	
Q401	TRIAC, AVS12CB	254188-001	DUAL-V

Integrated Circuits

Reference Designator	Description	Part Number	Note
U101	HV RESONANT CONTROL, L6598	254119-001	
U102	OPTO ISOLATOR, CNY17F-1	254120-001	3 
U103	OPTO ISOLATOR, CNY17F-1	254120-001	3 
U201	VOLT REG, 37V, POS,	137927	
U202	VOLT REG, 37V, NEG	137927	
U203	TLO74D, QUADOPAMP, SOIC	186112	
U401	AUTO V, SW, 110/220V, 50/60HZ	254187-001	DUAL-V

Power PCB Assembly 260327-XXXX, PCB 266459-001

PS18/28/48 Electrical Part List

Miscellaneous

Reference Designator	Description	Part Number	Note
L101	2.2uH, COMMON MODE	187598-2R2	3
L102	2.2uH, COMMON MODE	187598-2R2	3
L103	1.5MH, 2.0A, TOROIDAL	269334-001	100V, 230V
L201	12.5uH	176500	
L202	12.5uH	176500	
L103	1.5MH, 2.0A,TOROIDAL	269334-001	DUAL-V
T101	CHOKE, LINE, COMMON MODE, 3MH	260371-001	3
T102	XFORMER, PWR, HIGH-FREQ, EE42/20	258422-001	
F101	FUSE, 4.0A, SLO BLO	177311-04000	3
F101	FUSE CLIP, 5MM	178548	3
J101	CONN, AC INPUT, IEC320, W/O WINGS	256777-001	3
J102	CABLE, AC INPUT	258454-001	3
J103	CONNECTOR, 2 POS, POWER	258436	3
J104	CLIP, GROUND, SPRING	260365-001	
J105	CLIP, GROUND, SPRING	260365-001	
J204	CONNECTOR, CARDEDGE, 20-POS	258423-020	
J205	CONN, BRD TO BRD, 24 POS	258426-24	
RT100	PTC, TEMP SENSE, 16V, 125C, 20%	258497-125	
VR101	VARISTOR, MET OX, 275V, 75 JOULE	170189	100V, 230V, DUAL-V
VR102	VARISTOR, METOX, 150V, 45 JOULE	170186	3 120V
VR103	VARISTOR, METOX, 150V, 45 JOULE	170186	3
JP1	JUMPER, 22AWG, INSUL, 5MM, TAPED	179645	120V
S1	SWITCH, POWER, 16A, PC MOUNT	196101-001	

Amplifier PCB Assembly 266999-0, PCB 267083-001

PS18/28/48 Electrical Part List

Resistors

Reference Designator	Description	Part Number	Note
R1	5.1K, 0603, .1W, 5%	199403-512	
R2	100K, 0603, .1W, 5%	199403-104	
R3	2.0K, 0603, .1W, 1%	191465-2001	
R4	1.0K, 0603, .1W, 1%	191465-1001	
R5	10K, 0603, .1W, 5%	199403-103	
R6	10K, 0603, .1W, 5%	199403-103	
R7	2.32K, 0603, .1W, 1%	191465-2321	
R9	JUMPER, CHIP 0805	133627	
R101	560 OHMS, 0603, .1W, 5%	199403-561	
R102	10K, 0603, .1W, 1%	191465-1002	
R103	3.9K, 0603, .1W, 1%	191465-3901	
R104	4.7 OHM, 0805, 1/10W,5%	133626-4R75	
R105	100K, 0603, .1W, 5%	199403-104	
R106	15K, 0603, .1W, 5%	199403-153	
R201	560 OHMS, 0603, .1W, 5%	199403-561	
R203	3.9K, 0603, .1W, 1%	191465-3901	
R204	4.7 OHM, 0805, 1/10W, 5%	133626-4R75	
R301	560 OHMS, 0603, .1W, 5%	199403-561	
R302	10K, 0603, .1W, 1%	191465-1002	
R303	3.9K, 0603, .1W, 1%	191465-3901	
R304	4.7 OHM, 0805, 1/10W, 5%	133626-4R75	
R305	100K, 0603, .1W, 5%	199403-104	
R401	560 OHMS, 0603, .1W, 5%	199403-561	
R402	10K, 0603, .1W, 1%	191465-1002	
R403	3.9K, 0603, .1W, 1%	191465-3901	
R404	4.7 OHM, 0805, 1/10W, 5%	133626-4R75	
R405	100K, 0603, .1W, 5%	199403-104	
R406	5.1K, 0603, .1W, 5%	199403-512	
R407	15K, 0603, .1W, 5%	199403-153	
R501	560 OHMS, 0603, .1W, 5%	199403-561	
R502	10K, 0603, .1W, 1%	191465-1002	
R503	3.9K, 0603, .1W, 1%	191465-3901	
R504	4.7 OHM, 0805, 1/10W, 5%	133626-4R75	
R505	100K, 0603, .1W, 5%	199403-104	
R506	10K, 0603, .1W, 1%	191465-1002	
R601	3.9K, 0603, .1W, 1%	191465-3901	
R602	10K, 0603, .1W, 1%	191465-1002	
R603	4.7 OHM, 0805, 1/10W, 5%	133626-4R75	
R604	10.0 OHM, 0805, 1/10W, 1%	133625-10R0	
R605	100K, 0603, .1W, 5%	199403-104	
R606	10.0 OHM, 0805, 1/10W, 1%	133625-10R0	
R607	5.1K, 0603, .1W, 5%	199403-512	
R608	100 OHM, 1206, 1/8W, 5%	124895-1015	
R609	100K, 0603, .1W, 5%	199403-104	
R610	200 OHMS, 0603, .1W, 5%	199403-201	
R612	300 OHMS, 0603, .1W, 5%	199403-301	

Amplifier PCB Assembly 266999-0, PCB 267083-001

PS18/28/48 Electrical Part List

Capacitors

Reference Designator	Description	Part Number	Note
C1	10uF, EL, 85, 25V, 20%	177902-100E	
C4	0.1uF, 0805, X7R, 50V, 10%	133624	
C10	0.1uF, 0805, X7R, 50V, 10%	133624	
C12	0.1uF, 0805, X7R, 50V, 10%	133624	
C13	0.1uF, 0805, X7R, 50V, 10%	133624	
C14	0.1uF, 0805, X7R, 50V, 10%	133624	
C15	0.1uF, 0805, X7R, 50V, 10%	133624	
C16	0.1uF, 0805, X7R, 50V, 10%	133624	
C17	0.1uF, 0805, X7R, 50V, 10%	133624	
C18	0.1uF, 0805, X7R, 50V, 10%	133624	
C19	0.1uF, 0805, X7R, 50V, 10%	133624	
C20	0.1uF, 0805, X7R, 50V, 10%	133624	
C21	0.1uF, 0805, X7R, 50V, 10%	133624	
C101	1uF, EL, 85, 50V, 20%	177902-010H	
C102	.0068uF, 0603, X7R, 50V	191470-682	
C104	0.1uF, 0805, X7R, 50V, 10%	133624	
C106	.01uF, 0603, X7R, 50V	191470-103	
C109	470pF, 0603, COG, 50V, 5%	188454-471	
C110	68pF, 0805, COG, 50V, 5%	133622-680	
C111	68pF, 0805, COG, 50V, 5%	133622-680	
C201	1uF, EL, 85, 50V, 20%	177902-010H	
C202	.0068uF, 0603, X7R, 50V	191470-682	
C205	.01uF, 0603, X7R, 50V	191470-103	
C209	470pF, 0603, COG, 50V, 5%	188454-471	
C301	1uF, EL, 85, 50V, 20%	177902-010H	
C302	.0068uF, 0603, X7R, 50V	191470-682	
C304	0.1uF, 0805, X7R, 50V, 10%	133624	
C305	.01uF, 0603, X7R, 50V	191470-103	
C309	470pF, 0603, COG, 50V, 5%	188454-471	
C310	68pF, 0805, COG, 50V, 5%	133622-680	
C401	1uF, EL, 85, 50V, 20%	177902-010H	
C402	.0068uF, 0603, X7R, 50V	191470-682	
C404	0.1uF, 0805, X7R, 50V, 10%	133624	
C406	.01uF, 0603, X7R, 50V	191470-103	
C409	470pF, 0603, COG, 50V, 5%	188454-471	
C410	68pF, 0805, COG, 50V, 5%	133622-680	
C501	1uF, EL, 85, 50V, 20%	177902-010H	
C502	.0068uF, 0603, X7R, 50V	191470-682	
C504	0.1uF, 0805, X7R, 50V, 10%	133624	
C505	.01uF, 0603, X7R, 50V	191470-103	
C506	0.1uF, 0805, X7R, 50V, 10%	133624	
C507	0.1uF, 0805, X7R, 50V, 10%	133624	
C508	0.1uF, 0805, X7R, 50V, 10%	133624	
C509	470pF, 0603, COG, 50V, 5%	188454-471	
C510	68pF, 0805, COG, 50V, 5%	133622-680	
C601	10uF, EL, 85, 25V, 20%	177902-100E	
C602	22uF, EL, 85, 20%, 16V	177902-220C	
C603	0.1uF, 0805, X7R, 50V, 10%	133624	
C604	.047uF, 0603, X7R, 5%, 25V	196999-473	
C606	.047uF, 0603, X7R, 5%, 25V	196999-473	
C607	.047uF, 0805, X7R, 50V, 10%	133623-473	
C608	100pF, 0805, COG, 50V, 5%	133622-101	

Amplifier PCB Assembly 266999-0, PCB 267083-001

PS18/28/48 Electrical Part List

Diodes

Reference Designator	Description	Part Number	Note
D101	BAV70, SOT-23	147249	
D301	BAV70, SOT-23	147249	
D401	BAV70, SOT-23	147249	
D402	BAV70, SOT-23	147249	
ZR1	DIODE, ZENER, 3.3V	135247-5226	
ZR2	1N5236, DIODE, ZEN, 7.5V, 225 mW	135247-5236	

Transistors

Reference Designator	Description	Part Number	Note
Q1	2SC2812 SOT23	134741	
Q2	NPN, SOT, 47K	146817	
Q3	NPN, SOT, 47K	146817	
Q4	2SA1179N6-CPA-TB	258007	
Q5	2SA1179N6-CPA-TB	258007	
Q6	2SA1179N6-CPA-TB	258007	
Q7	NPN, SOT, 47K	146817	
Q401	2SC2812 SOT23	134741	
Q601	NPN, 25A, 80V	256095-001 OR 256095-002	
Q602	PNP, 25A, 80V	256096-001 OR 256096-002	
Q603	2SC2812 SOT23	134741	
Q604	NPN, SOT, 47K	146817	

Integrated Circuits

Reference Designator	Description	Part Number	Note
U1	LM4766T, 2X25W	267330-001	
U2	LM4766T, 2X25W	267330-001	
U3	LM4766T, 2X25W	267330-001	

Miscellaneous

Reference Designator	Description	Part Number	Note
J2	CONNECTOR, BRD-TO-BRD, 24-POS	258455-24	
J3	CONN, PHONO JACK, 5 POS, CUSTOM	260382-001	
J4	CONN, HEADER, RTANG, JSTS2P-VH	190552-02	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Resistors

Reference Designator	Description	Part Number	Note
R6	2.2K, 0603, .1W, 5%	199403-222	
R8	47K, 0603, .1W, 5%	199403-473	
R9	47K, 0603, .1W, 5%	199403-473	
R13	22 OHMS, 0603, .1W, 5%	199403-220	
R14	47K, 0603, .1W, 5%	199403-473	
R17	4.99K, 0603, .1W, 1%	191465-4991	
R18	75 OHMS, 0603, 0.1W, 5%	199403-750	
R19	75 OHMS, 0603, 0.1W, 5%	199403-750	
R20	47K, 0603, .1W, 5%	199403-473	
R23	47K, 0603, .1W, 5%	199403-473	
R24	75 OHMS, 0603, 0.1W, 5%	199403-750	
R25	10K, 0603, .1W, 5%	199403-103	
R26	4.7K, 0603, .1W, 5%	199403-472	
R29	1K, 0603, .1W, 5%	199403-102	
R30	510 OHMS, 0603, .1W, 5%	199403-511	
R31	100K, 0603, .1W, 5%	199403-104	
R32	47K, 0603, .1W, 5%	199403-473	
R34	100K, 0603, .1W, 5%	199403-104	
R35	4.7K, 0603, .1W, 5%	199403-472	
R36	100K, 0603, .1W, 5%	199403-104	
R38	JUMPER, CHIP 0805	133627	
R40	330 OHMS, 0603, .1W, 5%	199403-331	
R41	100 OHM, 0603, .1W, 5%	199403-101	
R101	270 OHMS, 0603, .1W, 5%	199403-271	
R104	4.7K, 0603, .1W, 5%	199403-472	
R105	4.7K, 0603, .1W, 5%	199403-472	
R106	33K, 0603, .1W, 5%	199403-333	
R107	4.7K, 0603, .1W, 5%	199403-472	
R108	4.7K, 0603, .1W, 5%	199403-472	
R109	4.7K, 0603, .1W, 5%	199403-472	
R117	75 OHMS, 0603, 0.1W, 5%	199403-750	
R118	75 OHMS, 0603, 0.1W, 5%	199403-750	
R119	75 OHMS, 0603, 0.1W, 5%	199403-750	
R120	75 OHMS, 0603, 0.1W, 5%	199403-750	
R121	75 OHMS, 0603, 0.1W, 5%	199403-750	
R122	75 OHMS, 0603, 0.1W, 5%	199403-750	
R123	75 OHMS, 0603, 0.1W, 5%	199403-750	
R201	4.7K, 0603, .1W, 5%	199403-472	
R203	4.7K, 0603, .1W, 5%	199403-472	
R204	4.7K, 0603, .1W, 5%	199403-472	
R205	75 OHMS, 0603, 0.1W, 5%	199403-750	
R206	75 OHMS, 0603, 0.1W, 5%	199403-750	
R207	75 OHMS, 0603, 0.1W, 5%	199403-750	
R208	75 OHMS, 0603, 0.1W, 5%	199403-750	
R209	7.87K, 0603, .1W, 1%	191465-7871	
R210	75 OHMS, 0603, 0.1W, 5%	199403-750	
R211	4.7K, 0603, .1W, 5%	199403-472	
R212	4.7K, 0603, .1W, 5%	199403-472	
R213	4.7K, 0603, .1W, 5%	199403-472	
R217	6.81K, 0603, 0.1W, 1%	191465-6811	
R218	47 OHM, 0603, SMD, 100mW	199403-470	
R219	4.7K, 0603, .1W, 5%	199403-472	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Resistors (continued)

Reference Designator	Description	Part Number	Note
R301	100K, 0603, .1W, 5%	199403-104	
R302	10K, 0603, .1W, 5%	199403-103	
R303	4.7K, 0603, .1W, 5%	199403-472	
R416	100K, CHIP, 0805, 1%	133625-1003	
R417	4.7K, 0603, .1W, 5%	199403-472	
R421	18.2K, 0603, .1W, 1%	191465-1822	
R422	18.2K, 0603, .1W, 1%	191465-1822	
R423	18.2K, 0603, .1W, 1%	191465-1822	
R424	18.2K, 0603, .1W, 1%	191465-1822	
R427	18.2K, 0603, .1W, 1%	191465-1822	
R428	18.2K, 0603, .1W, 1%	191465-1822	
R429	300 OHMS, 0603, .1W, 5%	199403-301	
R430	300 OHMS, 0603, .1W, 5%	199403-301	
R431	300 OHMS, 0603, .1W, 5%	199403-301	
R432	300 OHMS, 0603, .1W, 5%	199403-301	
R440	10K, 0603, .1W, 5%	199403-103	
R441	100K, 0603, .1W, 1%	191465-1003	
R443	20.0K, 0603, .1W, 1%	191465-2002	
R444	20.0K, 0603, .1W, 1%	191465-2002	
R448	36.5K, 0603, .1W, 1%	191465-3652	
R449	10K, 0603, .1W, 1%	191465-1002	
R450	10K, 0603, .1W, 1%	191465-1002	
R451	10K, 0603, .1W, 1%	191465-1002	
R452	10K, 0603, .1W, 1%	191465-1002	
R453	10K, 0603, .1W, 1%	191465-1002	
R454	10K, 0603, .1W, 1%	191465-1002	
R455	10K, 0603, .1W, 1%	191465-1002	
R456	10K, 0603, .1W, 1%	191465-1002	
R501	49.9K, 0603, .1W, 1%	191465-4992	
R502	10K, 0603, .1W, 1%	191465-1002	
R504	0.1 OHM, 2512, 1W, 5%	149322-100	
R505	2.2 OHM, 2512, 1W, 5%	181895-2R2	
R506	3.32K, 0603, .1W, 1%	191465-3321	
R507	1.69K, 0603, .1W, 1%	191465-1691	
R508	1 OHM, 0805, 1/10W, 5%	133626-1R05	
R509	300 OHMS, 0603, .1W, 5%	199403-301	
R510	300 OHMS, 0603, .1W, 5%	199403-301	
R512	1.0 OHMS, 1210, 1/4W, 5%	187607-1R05	
R601	75 OHMS, 0603, 0.1W, 5%	199403-750	
R602	330 OHMS, 0603, .1W, 5%	199403-331	
R603	330 OHMS, 0603, .1W, 5%	199403-331	
R604	330 OHMS, 0603, .1W, 5%	199403-331	
R605	4.7K, 0603, .1W, 5%	199403-472	
R607	2.0K, 0603, .1W, 5%	199403-202	
R608	1K, 0603, .1W, 5%	199403-102	
R609	1K, 0603, .1W, 5%	199403-102	
R610	4.7K, 0603, .1W, 5%	199403-472	
R611	4.7K, 0603, .1W, 5%	199403-472	
R612	4.7K, 0603, .1W, 5%	199403-472	
R613	10K, 0603, .1W, 1%	191465-1002	
R614	30.1K, 0603, 1W, 1%	191465-3012	
R615	10 OHM, 0603, .1W, 5%	199403-100	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Resistors (continued)

Reference Designator	Description	Part Number	Note
R616	100K, 0603, .1W, 5%	199403-104	
R617	4.7K, 0603, .1W, 5%	199403-472	
R619	3.32K, 0603, .1W, 1%	191465-3321	
R620	36.5K, 0603, .1W, 1%	191465-3652	
R621	36.5K, 0603, .1W, 1%	191465-3652	
R622	36.5K, 0603, .1W, 1%	191465-3652	
R623	36.5K, 0603, .1W, 1%	191465-3652	
R624	300 OHMS, 0603, .1W, 5%	199403-301	
R625	300 OHMS, 0603, .1W, 5%	199403-301	
R626	18.2K, 0603, .1W, 1%	191465-1822	
R627	18.2K, 0603, .1W, 1%	191465-1822	
R628	18.2K, 0603, .1W, 1%	191465-1822	
R629	36.5K, 0603, .1W, 1%	191465-3652	
R630	36.5K, 0603, .1W, 1%	191465-3652	
R631	36.5K, 0603, .1W, 1%	191465-3652	
R632	18.2K, 0603, .1W, 1%	191465-1822	
R633	36.5K, 0603, .1W, 1%	191465-3652	
R634	10K, 0603, .1W, 1%	191465-1002	
R635	10K, 0603, .1W, 1%	191465-1002	
R636	10K, 0603, .1W, 1%	191465-1002	
R637	10K, 0603, .1W, 1%	191465-1002	
R639	18.2K, 0603, .1W, 1%	191465-1822	
R640	18.2K, 0603, .1W, 1%	191465-1822	
R641	24.3K, 0603, .1W, 1%	191465-2432	
R642	39.2K, 0603, .1W, 1%	191465-3922	
R643	33.2K, 0603, .1W, 1%	191465-3322	
R644	36.5K, 0603, .1W, 1%	191465-3652	
R645	36.5K, 0603, .1W, 1%	191465-3652	
R646	36.5K, 0603, .1W, 1%	191465-3652	
R647	330 OHMS, 0603, .1W, 5%	199403-331	
R648	100K, 0603, .1W, 5%	199403-104	
R649	100K, 0603, .1W, 5%	199403-104	
R650	510 OHMS, 0603, .1W, 5%	199403-511	
R651	4.7K, 0603, .1W, 5%	199403-472	
R652	75 OHMS, 0603, 0.1W, 5%	199403-750	
R653	100K, 0603, .1W, 5%	199403-104	
R654	100K, 0603, .1W, 5%	199403-104	
R655	4.02K, 0603, .1W, 1%	191465-4021	
R901	4.7K, 0603, .1W, 5%	199403-472	
R902	4.7K, 0603, .1W, 5%	199403-472	
R903	10 OHM, 0603, .1W, 5%	199403-100	
R908	75 OHMS, 0603, 0.1W, 5%	199403-750	
R909	4.7K, 0603, .1W, 5%	199403-472	
R910	75 OHMS, 0603, 0.1W, 5%	199403-750	
RT600	10K, THERMISTOR, 0805, 5%	197229	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Capacitors

Reference Designator	Description	Part Number	Note
C5	47pF, 0603, COG, 50V, 5%	188454-470	
C7	.047uF, 0603, X7R, 25V, 5%	196999-473	
C8	2200pF, 0805, 50V, COG, 5%	133622-222	
C9	.047uF, 0603, X7R, 25V, 5%	196999-473	
C11	.047uF, 0603, X7R, 25V, 5%	196999-473	
C12	.047uF 0603, X7R, 25V, 5%	196999-473	
C13	100pF, 0603, COG, 50V, 5%	188454-101	
C17	100pF, 0603, COG, 50V, 5%	188454-101	
C18	.047uF, 0603, X7R, 25V, 5%	196999-473	
C22	.047uF, 0603, X7R, 25V, 5%	196999-473	
C23	.047uF, 0603, X7R, 25V, 5%	196999-473	
C30	.047uF, 0603, X7R, 25V, 5%	196999-473	
C31	75pF, 0603, COG, 50V, 5%	188454-750	
C32	.047uF, 0603, X7R, 25V, 5%	196999-473	
C34	75pF, 0603, COG, 50V, 5%	188454-750	
C40	.047uF, 0805, X7R, 50V, 10%	133623-473	
C41	100pF, 0603, COG, 50V, 5%	188454-101	
C42	100pF, 0603, COG, 50V, 5%	188454-101	
C43	100pF, 0603, COG, 50V, 5%	188454-101	
C44	100pF, 0603, COG, 50V, 5%	188454-101	
C101	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	
C102	33pF, 0603, COG, 50V, 5%	188454-330	
C103	.047uF, 0603, X7R, 25V, 5%	196999-473	
C104	.047uF, 0603, X7R, 25V, 5%	196999-473	
C105	.047uF, 0603, X7R, 25V, 5%	196999-473	
C106	470pF, 0603, COG, 50V, 5%	188454-471	
C107	.047uF, 0603, X7R, 25V, 5%	196999-473	
C108	.01uF, 0603, X7R, 50V	191470-103	
C109	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	
C110	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	
C111	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	
C112	.047uF, 0603, X7R, 25V, 5%	196999-473	
C201	27pF, 0603, COG, 50V, 5%	188454-270	
C202	20pF, 0603, COG, 50V	188454-200	
C203	.01uF, 0603, X7R, 50V	191470-103	
C204	220pF, 0805, COG, 50V, 5%	133622-221	
C205	47pF, 0603, COG, 50V, 5%	188454-470	
C301	.047uF, 0603, X7R, 25V, 5%	196999-473	
C303	.047uF, 0603, X7R, 25V, 5%	196999-473	
C304	.047uF, 0603, X7R, 25V, 5%	196999-473	
C305	.047uF, 0603, X7R, 25V, 5%	196999-473	
C306	.047uF, 0603, X7R, 25V, 5%	196999-473	
C307	.047uF, 0603, X7R, 25V, 5%	196999-473	
C308	.047uF, 0603, X7R, 25V, 5%	196999-473	
C309	.047uF, 0603, X7R, 25V, 5%	196999-473	
C310	.047uF, 0603, X7R, 25V, 5%	196999-473	
C311	.047uF, 0603, X7R, 25V, 5%	196999-473	
C312	.047uF, 0603, X7R, 25V, 5%	196999-473	
C313	.047uF, 0603, X7R, 25V, 5%	196999-473	
C314	.047uF, 0603, X7R, 25V, 5%	196999-473	
C407	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	
C410	2.2uF, TANT, 10V, A SIZE, 20%	196981-A225A2	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C415	0603, X7R, 5%, 25V, .047uF	196999-473	
C416	2.2uF, TANT, 10V, 20%, A SIZE	196981-A225A2	
C418	220pF, 0603, COG, 50V, 5%	188454-221	
C419	220pF, 0603, COG, 50V, 5%	188454-221	
C420	220pF, 0603, COG, 50V, 5%	188454-221	
C424	470pF, 0603, COG, 50V, 5%	188454-471	
C425	470pF, 0603, COG, 50V, 5%	188454-471	
C426	470pF, 0603, COG, 50V, 5%	188454-471	
C427	470pF, 0603, COG, 50V, 5%	188454-471	
C428	4700pF, 0603, X7R, 50V	191470-472	
C429	4700pF, 0603, X7R, 50V	191470-472	
C430	4700pF, 0603, X7R, 50V	191470-472	
C431	4700pF, 0603, X7R, 50V	191470-472	
C432	470pF, 0603, COG, 50V, 5%	188454-471	
C433	470pF, 0603, COG, 50V, 5%	188454-471	
C434	220pF, 0603, COG, 50V, 5%	188454-221	
C435	220pF, 0603, COG, 50V, 5%	188454-221	
C436	.047uF, 0603, X7R, 5%, 25V	196999-473	
C437	.047uF, 0603, X7R, 5%, 25V	196999-473	
C438	.047uF, 0603, X7R, 5%, 25V	196999-473	
C439	.047uF, 0603, X7R, 5%, 25V	196999-473	
C440	.047uF, 0603, X7R, 5%, 25V	196999-473	
C441	.047uF, 0603, X7R, 5%, 25V	196999-473	
C442	220pF, 0603, COG, 50V, 5%	188454-221	
C443	.047uF, 0603, X7R, 5%, 25V	196999-473	
C444	.047uF, 0603, X7R, 5%, 25V	196999-473	
C450	4700pF, 0603, X7R, 50V	191470-472	
C451	4700pF, 0603, X7R, 50V	191470-472	
C500	.047uF, 0603, X7R, 5%, 25V	196999-473	
C501	.047uF, 0603, X7R, 5%, 25V	196999-473	
C502	.047uF, 0603, X7R, 5%, 25V	196999-473	
C503	.047uF, 0603, X7R, 5%, 25V	196999-473	
C504	.047uF, 0603, X7R, 5%, 25V	196999-473	
C505	.047uF, 0603, X7R, 5%, 25V	196999-473	
C507	.047uF, 0603, X7R, 5%, 25V	196999-473	
C508	.047uF, 0603, X7R, 5%, 25V	196999-473	
C509	1000pF, 0603, X7R, 50V	191470-102	
C510	.22uF, TANT, SMT, 35V	262073-V224A	
C511	.015uF, 0603, X7R, 50V, 10%	191470-153	
C513	.1uF, 1206, X7R, 25V, 5%	131754-104	
C515	2.2uF, TANT, 10V, 20%, ASIZE	196981-A225A2	
C517	330uF, EL, SMD, 105, 10V, 20%	256772-331A	
C519	330uF, EL, SMD, 105, 35V, 20%	256772-331V	
C520	22uF, EL, 85, 20%, 16V	177902-220C	
C525	.047uF, 0603, X7R, 5%, 25V	196999-473	
C526	.047uF, 0603, X7R, 5%, 25V	196999-473	
C527	.047uF, 0603, X7R, 5%, 25V	196999-473	
C528	.047uF, 0603, X7R, 5%, 25V	196999-473	
C532	.047uF, 0805, X7R, 50V, 10%	133623-473	
C533	100pF, 0805, COG, 50V, 5%	133622-101	
C535	68pF, 0805, COG, 50V, 5%	133622-680	
C536	.047uF, 0805, X7R, 50V, 10%	133623-473	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C601	100pF, 0603, COG, 50V, 5%	188454-101	
C602	.047uF, 0603, X7R, 5%, 25V	196999-473	
C603	.047uF, 0603, X7R, 5%, 25V	196999-473	
C604	2.2uF, TANT, 10V, 20%, A SIZE	196981-A225A2	
C605	2.2uF, TANT, 10V, 20%, A SIZE	196981-A225A2	
C606	100pF, 0603, COG, 50V, 5%	188454-101	
C611	0603, X7R, 5%, 25V, .047uF	196999-473	
C612	100pF, 0603, COG, 50V, 5%	188454-101	
C613	100pF, 0603, COG, 50V, 5%	188454-101	
C614	10pF, 0603, COG, 50V, .5pF	188454-100	
C620	10uF, EL, 85, 16V, 20%	177902-100C	
C900	.047uF, 0603, X7R, 5%, 25V	196999-473	
C903	1000pF, 0805, COG, 50V, 5%	133622-102	
C904	1000pF, 0805, COG, 50V, 5%	133622-102	
C905	1000pF, 0805, COG, 50V, 5%	133622-102	
C906	1000pF, 0805, COG, 50V, 5%	133622-102	
C911	1000pF, 0603, X7R, 50V	191470-102	
C912	.047uF, 0603, X7R, 5%, 25V	196999-473	
C913	.01uF, 0603, X7R, 50V	191470-103	

Diodes

Reference Designator	Description	Part Number	Note
D3	SOT23, BAV99	147239	
D14	SOT23, BAV99	147239	
D17	SOT23, BAV99	147239	
D18	SOT23, BAV99	147239	
D20	SHOTTKY, BAT42W, SOD-123	196984-002	
D21	1N5239, ZEN, 9.1V, 225MW, 5%	135247-5239	
D200	SOT23, BAV99	147239	
D501	SCHOTTKY, 40V, 3A, SMB	193847-001	
D502	SCHOTTKY, 40V, 3A, SMB	193847-001	
DS601	LED, SMD, GREEN	256781-002	
DS602	LED, SMD, YELLOW	256781-003	

Transistors

Reference Designator	Description	Part Number	Note
Q1	NPN, SOT, 47K	146817	
Q4	NPN, SOT, 47K	146817	
Q6	NPN, SOT, 47K	146817	
Q7	NPN, SOT, 47K	146817	
Q8	NPN, SOT, 47K	146817	
Q300	NPN, SOT, 47K	146817	
Q602	NPN, SOT, 47K	146817	
Q603	NPN, SOT, 47K	146817	
Q604	PNP, SOT, 47K	146818	
Q605	NPN, SOT, 47K	146817	

DSP PCB Assembly 267391-0, PCB 267086-001

PS18/28/48 Electrical Part List

Integrated Circuits

Reference Designator	Description	Part Number	Note
U2	RECEIVER, SPDIF, CS8415A, SOIC	254193-001	
U3	VOLTAGE COMPARATOR, LM339	187618-001	
U4	DSP, QFP208, ADSP21065LKS	254191-001	
U101	AND GATE, QUAD2-INPUT, CMOS	256124-001	
U103	DSP, CS49329CL	254105-001	
U105	74LCX157, QUAD 2 CHANNEL MUX	260377-001	
U301	PROM, FLASH, 4MBIT	260332-001	
U302	SD RAM, 64KX16	254195-010	
U303	SD RAM, 64KX16	254195-010	
U401	CODEC, 24-BIT, CS4228A-KS, TS	254192-001	
U402	QUAD OPAMP, TLO74D, SOIC	186112	
U404	QUAD OPAMP, TLO74D, SOIC	186112	
U406	QUAD OPAMP, TLO74D, SOIC	186112	
U407	QUAD OPAMP, TLO74D, SOIC	186112	
U501	VOLTREG, 3.3V, 1.5A,	254196-001	
U502	VOLTAGE, REGULATOR, 3.3V	256094-03R3	
U503	VOLT REG, ADJ., 500MA, DPAK	258496-001	
U601	OCTAL BUFFER, 3V, TSSOP-20	193841-004	
U602	RESET, 3.3V, SOT23, 5-PIN	256123-001	

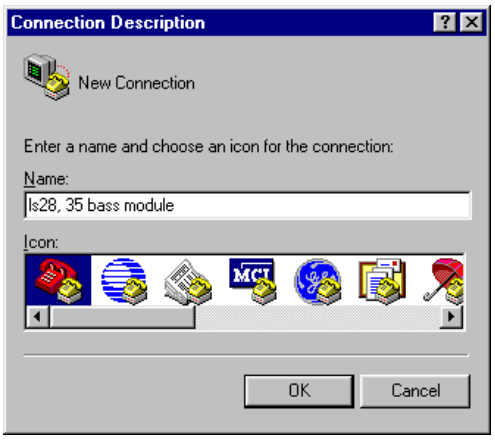
Miscellaneous

Reference Designator	Description	Part Number	Note
FB1	400 OHMS, CHIP, 0805	188587-401	
FB2	400 OHMS, CHIP, 0805	188587-401	
FB3	400 OHMS, CHIP, 0805	188587-401	
FB4	400 OHMS, CHIP, 0805	188587-401	
FB5	400 OHMS, CHIP, 0805	188587-401	
FB6	400 OHMS, CHIP, 0805	188587-401	
FB7	400 OHMS, CHIP, 0805	188587-401	
FB101	400 OHMS, CHIP, 0805	188587-401	
FB102	400 OHMS, CHIP, 0805	188587-401	
FB103	400 OHMS, CHIP, 0805	188587-401	
FB104	400 OHMS, CHIP, 0805	188587-401	
FB401	400 OHMS, CHIP, 0805	188587-401	
FB402	400 OHMS, CHIP, 0805	188587-401	
FB403	400 OHMS, CHIP, 0805	188587-401	
L1	2.2uH, 10%, SMD, LFC32	178336-2R2K	
L501	22uH, 20%, SMD	173273-220	
L502	100uH, SMD, 20%	256773-101	
J1	CONN, MODULAR, SMT, 8 POS, TH MECH	260334-0012	
JP400	1K, CHIP, 0805, 5%	133626-1025	
S1	SWITCH, SMD, RTANG, DIP, 4-POS	256774-004	
T1	TRANSFORMER, PULSE	254185-001	
Y201	XTAL, 30.0MHZ, 50PPM, HC-49S	256128-001	

Setting up a computer to issue TAP commands

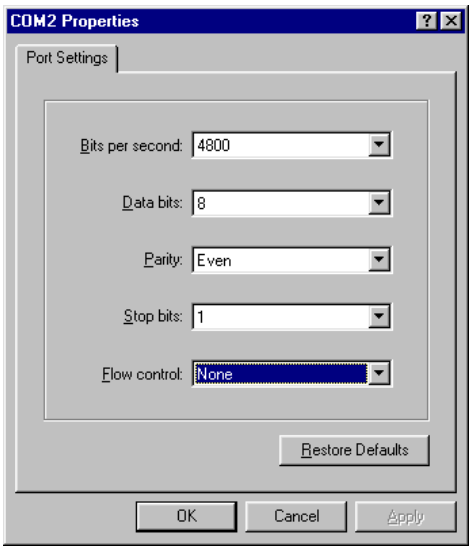
1. Open a terminal window. Click: Start/Program/Accessories/Hyperterminal/Hyperterminal.

2. In the “Connection Description” window, type the name “LS28, 35 bass module test” then click “OK”; any name may be entered.

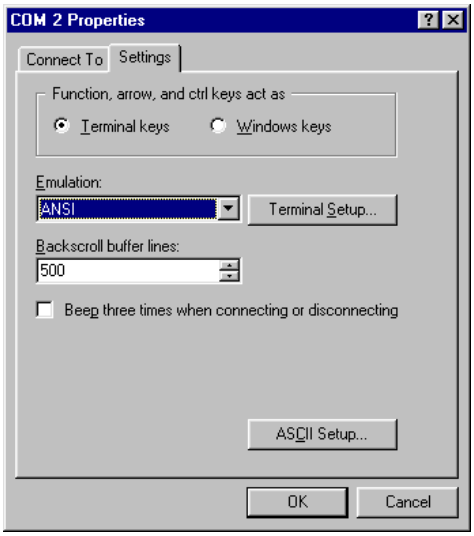


3. In the “Connect To” window, select the COM port on your computer that you will be connecting the bass module to and then click OK.

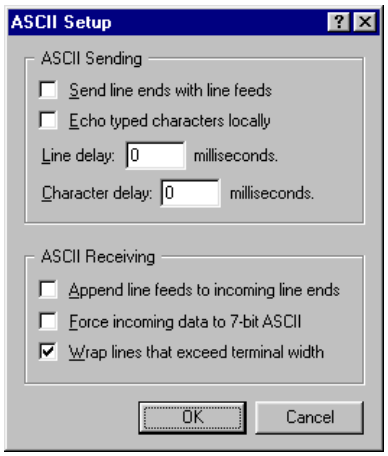
4. In the “COM1 Properties” window, make the selections in the various fields as shown.



5. In the Hyper Terminal window, click on File/Properties. In the Properties window, click on the Settings tab, make the selections in the various fields as shown.



6. In the Settings window, click on ACSII setup and make the selections and changes as shown.



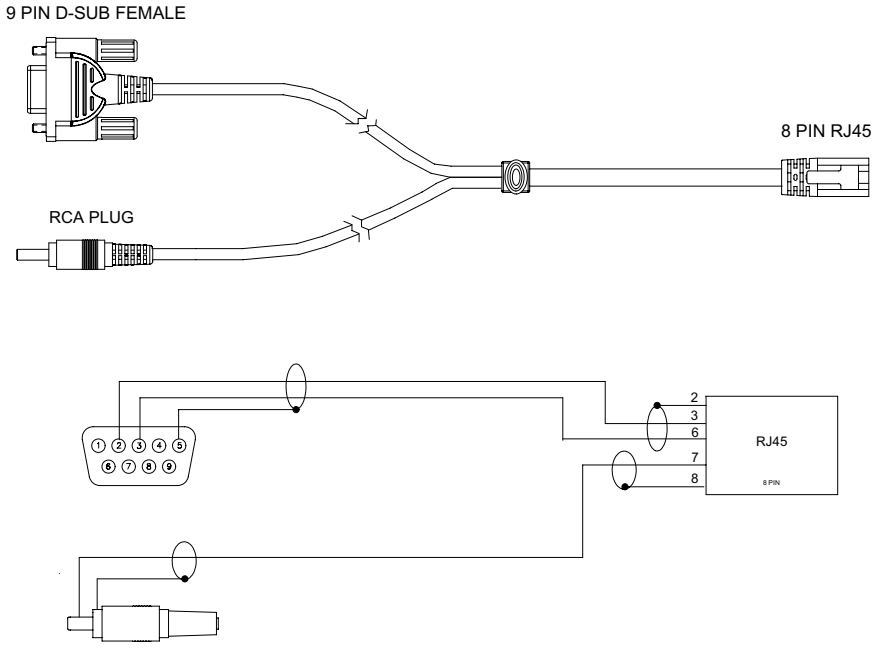


Figure 11. Test cable part number 264564

Placing the Bass Module into TAP Mode

! Place all four DIP switches to the down position before returning the unit to the customer !

1. Place the bass module into TAP mode

1.1 Set all four DIP switches into the "up" position. Apply power to the bass module using the AC line switch and wait until the amber LED blinks twice and the green LED blinks briefly at least once (approximately 3 seconds after power up). Then, within twenty seconds, flip ALL four switches down, then flip switch #4 (closest to the RJ-45 connector) back up. The unit will now communicate in TAP mode. The amber and green LED will blink alternately when no S/PDIF signal is applied. Note that when TAP mode is activated in this manner, the DSP will echo characters sent by the terminal.

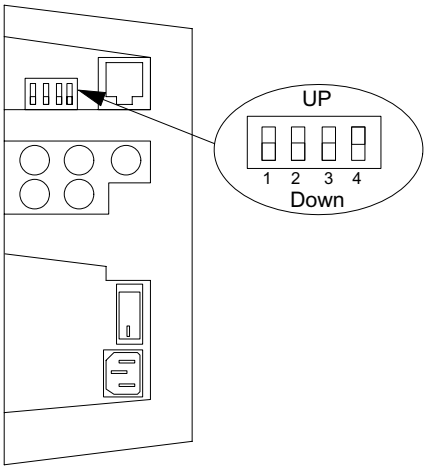


Figure 12. DIP switch Up/Down orientation

2. Verify the bass module communicates in TAP mode.

2.1 Connect the test cable's, part number 264564, DB-9 connector to the RS-232 COM port on your computer. Connect the test cable's RJ-45 connector to the bass module.

2.2 Type the command ST S and hit "Enter". The following response should be seen on your computer screen. The results may differ depending on the unit settings. If no S/PDIF signal is applied, the sample rate will be 29 kHz.

SAMPLE RATE : 44101.30
SPKR TYPE : 02
DIP VALUE : 1111
LCRB_MUTE : 1
LSRS_MUTE : 1
SAT_CLIP : 1
BASS_CLIP : 1
EURO_BASS : 1
EURO_TREBLE : 0

2.3 Check the software by typing (issuing) the command TN 4 and then hitting "Enter". A typical response would be as follows.
03DE6455, 010808
03DE6455 is the checksum
010808 is the software version

Setting the Equalizer

Type the equalization setup command SE [SPEAKER TYPE], [EUROPEAN BASS], [EUROPEAN TREBLE]

Command	Condition		
	SPEAKER TYPE	EURO BASS	EURO TREBLE
SE	A = singleshot (18) D = doubleshot (28) C = cricket (35) U = User EQ	ON	OFF

Example: To set the equalization to cricket cubes, euro bass off and euro treble off, type the command as follows. SE C,OFF,OFF

Verify the changes have been made by typing the command ST S.
The speaker type (SPKR TYPE) and other information will be displayed. Decode the numerical two digit speaker type as follows.

01 Doubleshots (Later version dual cube)
02 Cricket (Jewel® Cube)
128 Dublin (Single Cube)

05 User EQ (ADATiQ™ audio calibration)

Test Procedures

Test setup procedures

Place the bass module into TAP mode using the procedures on page 26.
Note: Place all four DIP switches into the down position before returning the unit to the customer.

Test cable part number 264564, Figure 16, is needed to test the bass module.

Connect the D-sub, 9 pin connector on the test cable to the COM port on your computer. Connect the RJ-45, 8 pin connector to the bass module.

The bass module requires a digital audio input. Connect the analog output of an oscillator to the analog input of an Analog to Digital (A-D) converter. Connect the test cable's RCA connector to the A-D converter S/PDIF output.

1. Sweep Test

1.1 Issue the following TAP commands:

SO ALL D (select all digital source inputs)
SP 5 (5 speaker mode)
VO CB 0 (set volume to full output, 0dB)
MU AMP OFF (unmute the amp)

1.2 Apply a 200 mVrms, 25 Hz signal to the left and right input of the analog to digital (A-D) converter. Listen for any extraneous noises such as rubbing, scraping, or ticking.
Note: No extraneous noises such as rubbing, scraping or ticking should be heard. To distinguish between normal suspension noise, rubs and ticks, displace the woofer cone with your finger. If the sound can be made to go away or get worse, it's a rub or tick and the woofer should be replaced. If the noise stays the same, it's normal suspension noise and it will not be heard with regular program material.

1.3 Sweep the bass module from 40 Hz to 300 Hz. Listen carefully for any buzzes, rattles or extraneous noises coming from the bass module.
Note: Redress any wire or component that buzzes.

2 Bass Module Air Leak Test

2.1 Apply a 200 mVrms, 40 Hz signal to the input of the A-D converter.

2.2 Check for air leaks from the cabinet. Listen near the areas where the plastic seals to the wood.

Test setup procedures

Remove the amplifier module from the bass module assembly. Refer to the disassembly/assembly procedures located in this manual.

Connect an 8 Ohm, 50W resistive load to the left, center, right, left surround, and right surround speaker outputs. Connect a 1.6 Ohm, 150W resistive load to the woofer output, J4.
Note: Do not tie the five RCA speaker output grounds together.

Turn the amplifier off and then place it into TAP mode using the procedures on page 26.

Issue the TAP command: VO CB -20
(set volume output to -20dB)

Note: Because the DSP has just booted (or rebooted) prior to being put into TAP mode and issuing this command, the amplifier module is now in a known state.

3. Input to Output Gain

3.1 Apply a 500 mVrms signal, at a frequency and phase listed in the following table, to the left and right input of the A-D converter.
Note: For a 180^0 phase output, apply the positive output of a balanced output oscillator to the negative input of the A-D converter and the negative to the positive.

Channel	Frequency	Input	Phase	
			Right	Left
L	1 kHz	500 mVrms	0^0	0^0
C	1 kHz	500 mVrms	0^0	0^0
R	1 kHz	500 mVrms	0^0	0^0
LS	1 kHz	500 mVrms	0^0	180^0
RS	1 kHz	500 mVrms	0^0	180^0
B	50 Hz	500 mVrms	0^0	0^0

Test Procedures

3.2 Measure the gain from the input to the A-D converter to the speaker output listed in the table below.

Channel	Gain
Left	8dB ± 2.0dB
Center	16dB ± 2.0dB
Right	8dB ± 2.0dB
Left Surround	16dB ± 2.0dB
Right Surround	16dB ± 2.0dB
Bass	22dB ± 2.0dB

4. Speaker Output Noise

4.1 Short the right and left inputs to the A-D converter.

4.2 Measure the output at the left, right, center, left surround, right surround, and bass channel output. It should be ≤ 500 uVrms.

5. Cube Channel Large Signal Distortion

5.1 Apply a 1.0 kHz signal to the A-D converter input at a level to obtain 11 Vrms measured at the channel's resistive output load.
Note: When measuring the left or right channel output, apply the signal to one channel only. When measuring the center channel, apply the signal to the left and right channel. When measuring the surround channels, apply the balanced output signal to the left and right channel with one channel 180^0 out of phase with the other.

5.2 Issue the TAP command: VO CB 0 (set volume output to 0dB, full output)

5.3 Measure the distortion at the left, right, center, left surround, right surround output. It should be <0.1% THD+N.

6. Cube Channel DC Offset

6.1 With no signal applied, measure the DC offset at the left, right, center, left surround, right surround, and bass channel output. It should be <70 mVdc.

7. Bass Channel Large Signal Distortion

7.1 Apply a 100 Hz signal to the A-D converter input at a level to obtain 11 Vrms measured at the bass channel resistive output load.

7.2 Measure the distortion at the bass channel output. It should be <.2% THD+N

8. Bass Channel DC Offset

8.1 With no signal applied, measure the DC offset at the bass channel output. It should be <25 mVdc.

9. Place the Unit in Normal Operation Mode

9.1 Before returning the bass module to the customer, place the unit in normal operation mode. Place all four DIP switches into the down position (toward RCA plugs).

10. Cube Speaker Phase Test

Note: The DC voltage should only be momentarily applied to the cube speaker input to avoid damaging the speakers.

10. 1 Observing polarity, momentarily apply 8 Vdc to the input of the cube speaker.

10.2 The speakers should move outward with the application of the dc voltage. Check the cube wiring if it moves inward.

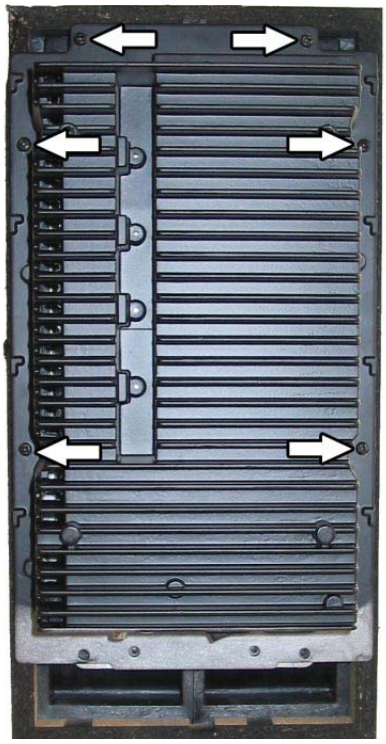
11. Cube Speaker Sweep Test

11.1 Apply an 11 Vrms, 20 Hz signal to the input of the cube. Change the applied signal to 8 Vrms, 150 Hz. Sweep the oscillator from 150 Hz to 2 kHz.

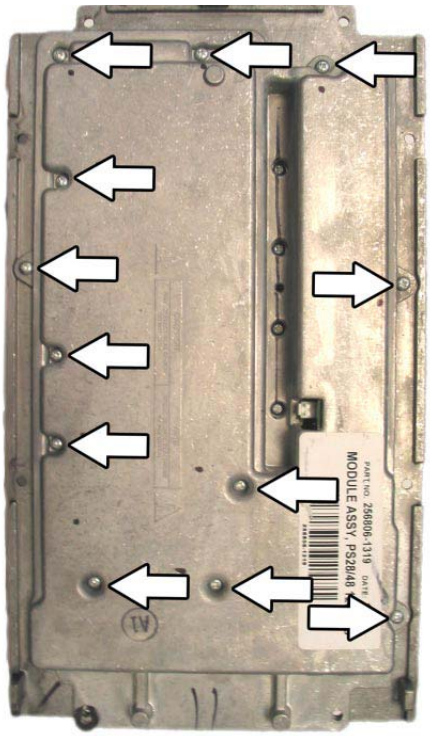
11.2 Listen for rubs, ticks, air leaks, buzzes or other extraneous noises.
Note: Defects such as rubs, ticks and air leaks will typically be most audible during the 20 Hz test. Defects such as buzzes will typically be heard during the 150 Hz to 2 kHz sweep.
Note: The cube cubes are not repairable. The Jewel Cube® speakers are repairable.

Bass Module Disassembly Procedures

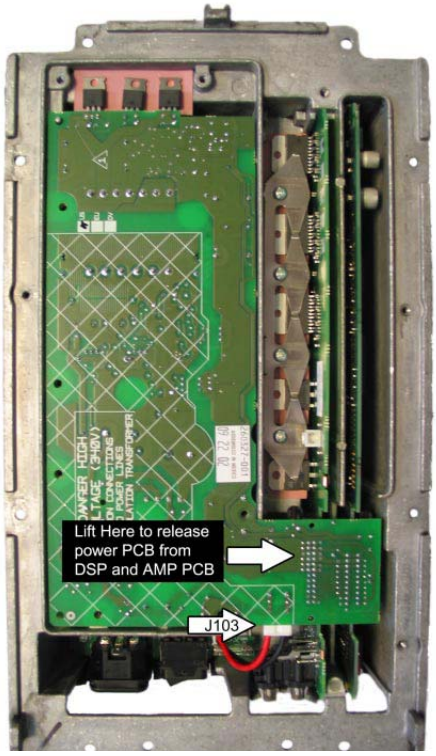
1. Rear Cover Removal
Remove four screws - pull off cover



2. Amp Module Removal
Remove six screws - pull off amp module - unplug woofer harness

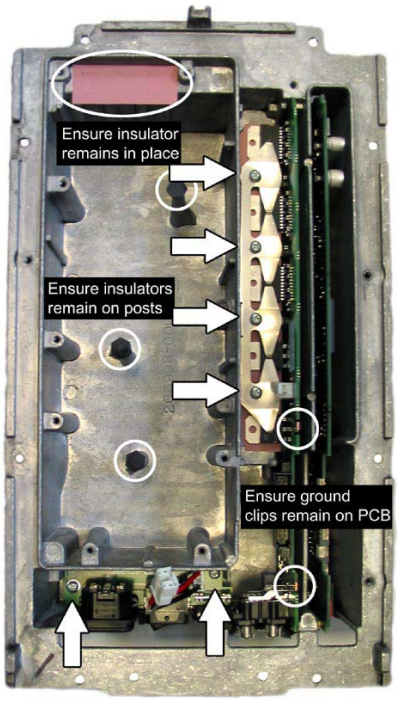


3. Amplifier Module Cover Removal
Remove 12 screws



4. Power PCB Removal
Disconnect J103, lift up PCB

Bass Module Disassembly Procedures



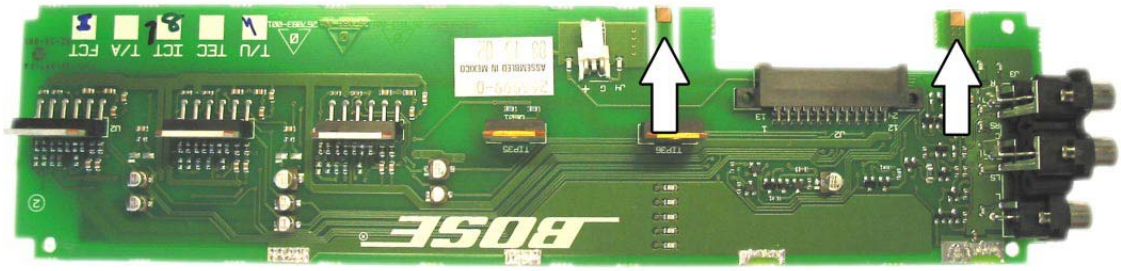
5. DSP, AMP, AC Jack PCB Removal

DSP PCB - Lift up DSP PCB. (ensure grounding clips remain in place)

AMP PCB - Remove four screws, lift up AMP PCB. (ensure grounding clips and heat sink insulator remain in place, note spring bar location for reference when replacing)

AC Jack PCB - Remove 2 screws, lift up AC Jack PCB.

DSP PCB
Ensure grounding clips indicated remain in place



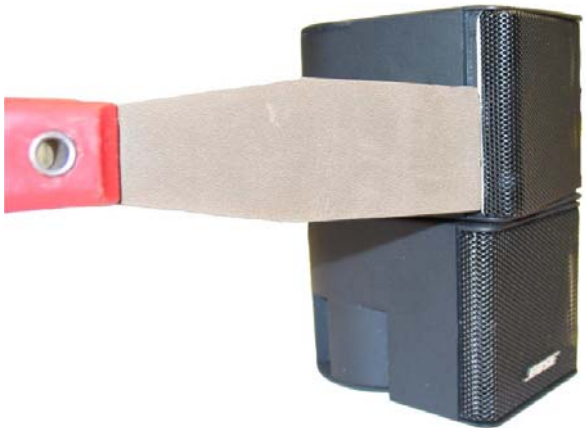
AMP PCB
Ensure grounding clips indicated remain in place

Cube Speaker Disassembly Procedures

Double and Single Cube Disassembly

1. Double and Single Cube Grille Removal
Remove grille with a flat plastic blade tool
Note: The Twiddler™ speakers are not removable

Jewel® Cube Disassembly



1. Grille Removal
Remove grille with a flat plastic blade tool

2. Twiddler Speaker Removal

Pull off rubber screw covers
then remove four screws

3. Twiddler Speaker Removal

Pull out Twiddler speaker
Note wire configuration
Cut wires close to terminals

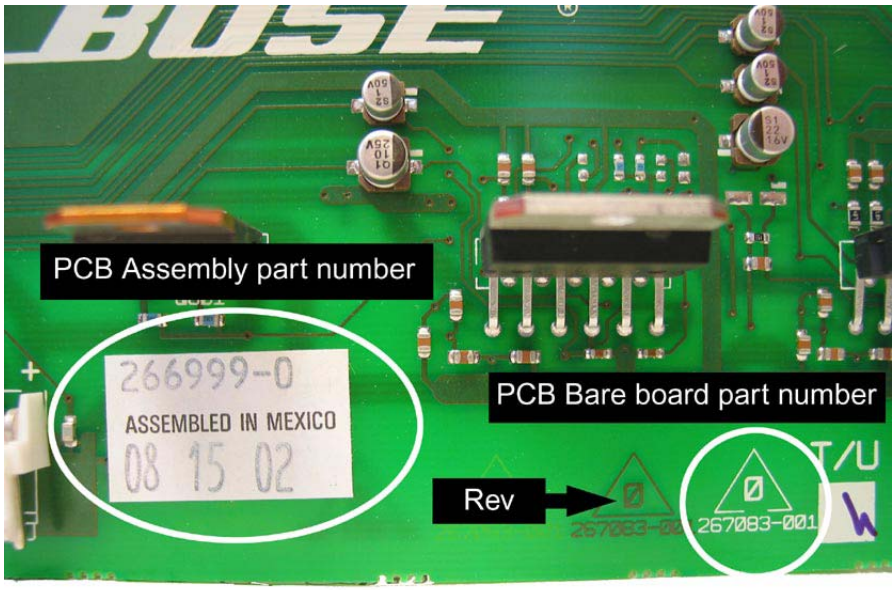


Figure 13. PCB Part Number Identification

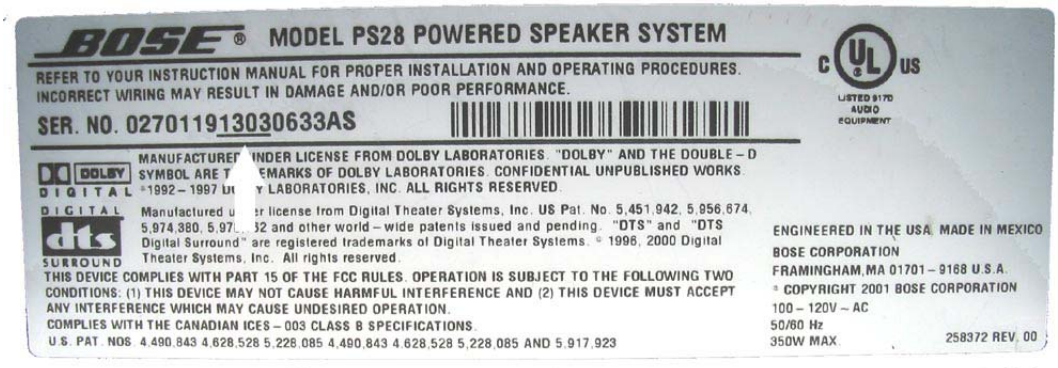


Figure 14. Date Of Manufacture (DOM) Identification

The DOM is the four underlined numbers in the serial number.
Example: DOM 1303 -YDDD = 303rd day of 2001.

Revision Page

Revison 00 - 01: Changed part number 260351-001 to 260351-002 per ECN32954

Revision 03-04 - Add new service bom part numbers for PCBs - new DSP PCB: ECN 36696

Specifications and Features Subject to Change Without Notice

Bose Corporation
The Mountain
Framingham Massachusetts USA 01701
R/N 268795-SM REV. 04 08/05 (H)
http://serviceops.bose.com

Lifestyle DVD Home Entertainment Systems

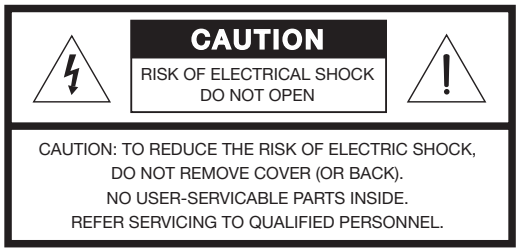
Installation Guide

August 13, 2001

AM 259777 Rev.00 PDF

Safety Information

WARNING: *To reduce the risk of fire or electric shock, do not expose the system to rain or moisture.*



These CAUTION marks may be located on the back and bottom panels of your Lifestyle® media center and on the bottom panel of your Acoustimass® module:

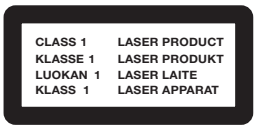
The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated dangerous voltage within the system enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

The exclamation point within an equilateral triangle, as marked on the system, is intended to alert the user to the presence of important operating and maintenance instructions in this owner's guide.

CAUTION: *To prevent electric shock, match wide blade of plug to wide slot, insert fully.*

Class 1 laser product

The DVD player contained within the media center is classified as a Class 1 Laser Product according to EN 60825-1:1994 + A11. The Class 1 Laser Product label is located on the bottom of the media center.



CAUTION: *Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. The compact disc player should not be adjusted or repaired by anyone except properly qualified service personnel.*

Class B emissions limits

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Batteries

Please dispose of used batteries properly, following any local regulations. Do not incinerate.

Additional safety information

See the additional instructions on the *Important Safety Information* sheet enclosed in the shipping carton.

Please read this owner's guide

Please take the time to follow this owner's guide carefully. It will help you set up and operate your system properly, and enjoy all of its advanced features. Save your owner's guide for future reference.

1. **Read these instructions** – for all components before using this product.
2. **Keep these instructions** – for future reference.
3. **Heed all warnings** – on the product and in the owner's guide.
4. **Follow all instructions.**
5. **Do not use this apparatus near water or moisture** – Do not use this product near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, near a swimming pool, or anywhere else that water or moisture are present.
6. **Clean only with a dry cloth** – and as directed by Bose® Corporation. Unplug this product from the wall outlet before cleaning.
7. **Do not block any ventilation openings. Install in accordance with the manufacturer's instructions** – To ensure reliable operation of the product and to protect it from overheating, put the product in a position and location that will not interfere with its proper ventilation. For example, do not place the product on a bed, sofa, or similar surface that may block the ventilation openings. Do not put it in a built-in system, such as a bookcase or a cabinet that may keep air from flowing through its ventilation openings.
8. **Do not install near any heat sources, such as radiators, heat registers, stoves or other apparatus (including amplifiers) that produce heat.**
9. **Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wider blade or third prong are provided for your safety. If the provided plug does not fit in your outlet, consult an electrician for replacement of the obsolete outlet.**
10. **Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.**
11. **Only use attachments/accessories specified by the manufacturer.**
12. **Use only with the cart, stand, tripod, bracket or table specified by the manufacturer or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.**

13. **Unplug this apparatus during lightning storms or when unused for long periods of time** – to prevent damage to this product.
14. **Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way: such as power-supply cord or plug is damaged; liquid has been spilled or objects have fallen into the apparatus; the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped** – Do not attempt to service this product yourself. Opening or removing covers may expose you to dangerous voltages or other hazards. Please call Bose to be referred to an authorized service center near you.
15. **To prevent risk of fire or electric shock, avoid overloading wall outlets, extension cords, or integral convenience receptacles.**
16. **Do not let objects or liquids enter the product** – as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock.
17. **See product enclosure for safety related markings.**

Information about products that generate electrical noise

If applicable, this equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, this is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a different circuit than the one to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: *Unauthorized modification of the receiver or radio remote control could void the user's authority to operate this equipment.*

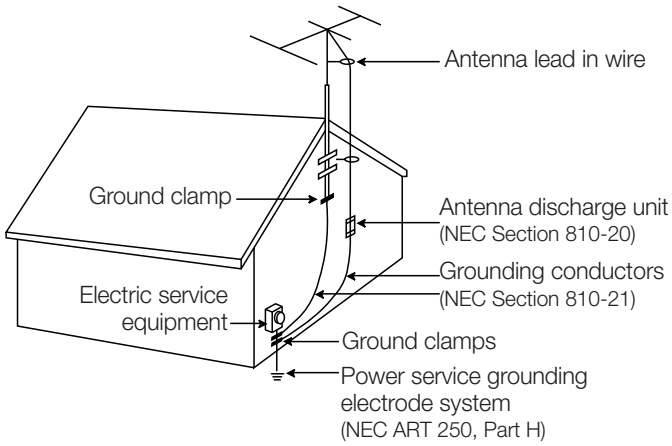
This product complies with the Canadian ICES-003 Class B specifications.

18. **Use proper power sources** – Plug the product into a proper power source, as described in the operating instructions or as marked on the product.
19. **Avoid power lines** – Use extreme care when installing an outside antenna system to keep from touching power lines or circuits, as contact with them may be fatal. Do not install external antennas near overhead power lines or other electric light or power circuits, nor where an antenna can fall into such circuits or power lines.
20. **Ground all outdoor antennas** – If an external antenna or cable system is connected to this product, be sure the antenna or cable system is grounded. This will provide some protection against voltage surges and built-up static charges.

    Section 810 of the National Electrical Code ANSI/NFPA No. 70 provides information with respect to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna-discharge unit, connection to grounding electrodes, and requirements for the ground electrode. Refer to the antenna grounding illustration on this page.

Antenna grounding

Example of antenna grounding as per National Electrical Code, ANSI/NFPA 70.



Note to CATV system installer

This reminder is provided to call the CATV system installer's attention to Article 820-40 of the NEC (of USA) that provides guidelines for proper grounding. In particular, it specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as is practical.

BOSE®
Better sound through research®

The Mountain, Framingham, MA
01701-9168 USA
255805 AM Rev.00 JN10494

Where to find ...

For your records

Serial numbers are located on the bottom of the media center and the bottom panel of the Acoustimass module.

Media center serial number: _____ Acoustimass module serial number: _____

Dealer name:_____ Dealer phone: _____ Purchase date: _____

Bose® recommends that you keep your sales slip and warranty card together with this guide.

Welcome

Thank you for purchasing a Bose® Lifestyle® home entertainment system.

If you have successfully installed your new Lifestyle® system using the Quick Setup Guide, congratulations! You can now skip to "Checking your installation" on page 20.

If not, the information provided on the following pages will guide you through the installation.

Region numbers

Region numbers are assigned to DVD players and discs according to where they are sold. Look for the region number marked on the carton or on the bottom of the media center.

For example, a region 1 DVD player should be marked like this: 

Your system can play only DVD discs marked with the same region number.

Types of discs you can play

The DVD player in your system can play the following types of discs:

- Video DVDs
- Audio CDs
- CD-Rs or CD-R/Ws
- MP3 CDs

Getting started

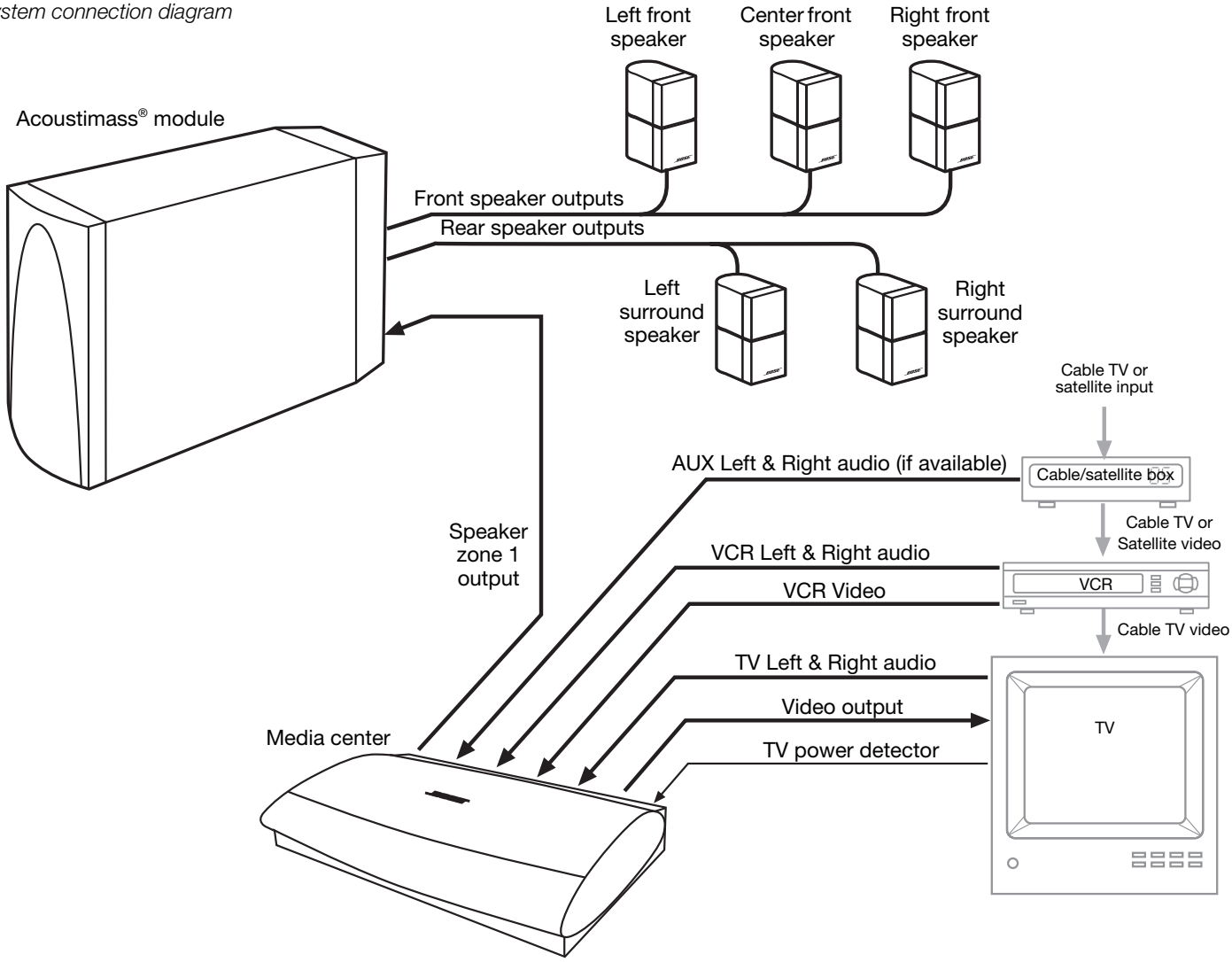
After unpacking your new system, save all packing materials. The original packing materials provide the safest way to transport your system if necessary. If any part of your system is missing or appears damaged, contact your authorized Bose® dealer immediately, or contact Bose directly.

The instructions in this section tell you how to connect your system as shown in Figure 1. For alternate system connections, see the Reference section.

♪ ***Note:*** *You should not connect the video output of your Lifestyle® system to a VCR, since playing copy-protected DVDs may result in poor picture quality.*

Figure 1

System connection diagram

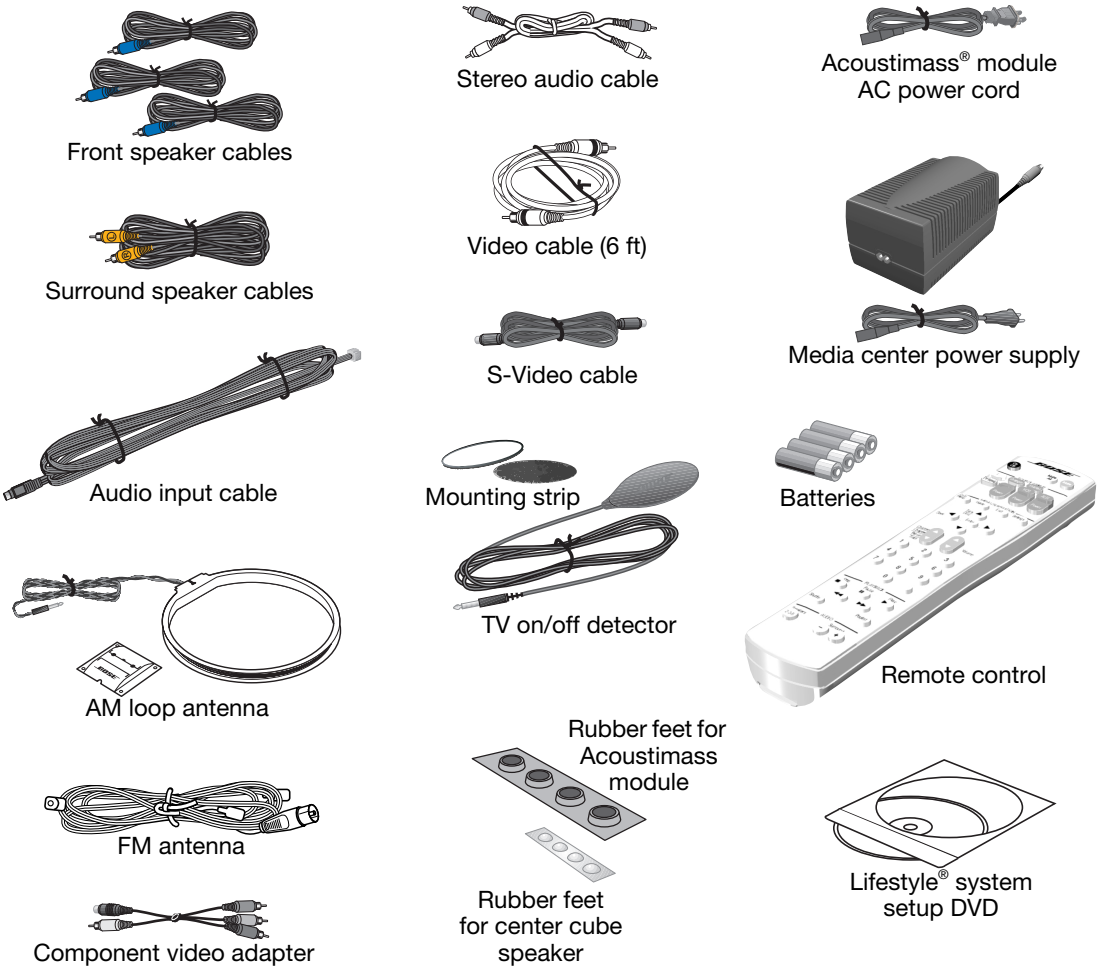


Cables and accessories

The following accessories are included with your system.

Figure 2

Accessories included with your system



Placing your speakers

When you place your speakers according to the guidelines below, a combination of reflected and direct sound provides the audio atmosphere of a home theater. You may experiment with the placement and orientation of the speakers to produce the sound most pleasing to you.

⚠ ***CAUTION:*** *Choose a stable and level surface for your speakers. Vibration can cause the speakers to move, particularly on smooth surfaces like marble, glass, or highly polished wood. If you are placing the center speaker on top of the television, use the smaller of the two sets of rubber feet provided. You may obtain additional rubber feet (part number 178321) by contacting Bose® Customer Service.*

♪ ***Note:*** *Do not place a cube speaker on its side, as this diminishes performance.*

Left and right front speaker placement

To best match sound and picture, the left and right front speakers should be placed at the edge of the TV picture (Figure 3).

- Place the speakers up to 3 feet (1 m) from the edge of the TV screen and line them up with the center of the TV screen.

  Bose recommends a maximum distance of 3 feet (1 m) from the edge of the TV screen so that the sound does not become too separated from the picture. You may wish to vary this distance based on room conditions and personal preference. The front cables allow the cube speakers to be placed up to 20 feet (6.1 m) from the Acoustimass® module.

- Direct one cube of each speaker array forward. Direct the other cube toward the wall or in a different direction to create reflected sound. See the illustration of reflected sound patterns in Figure 4.

Figure 3

Recommended speaker locations

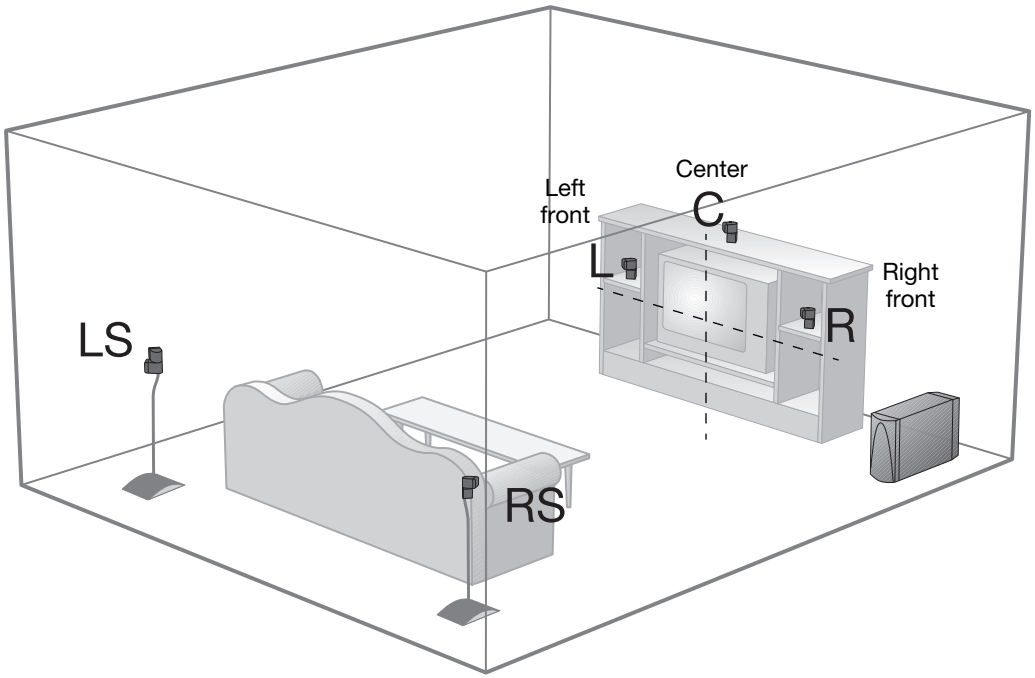
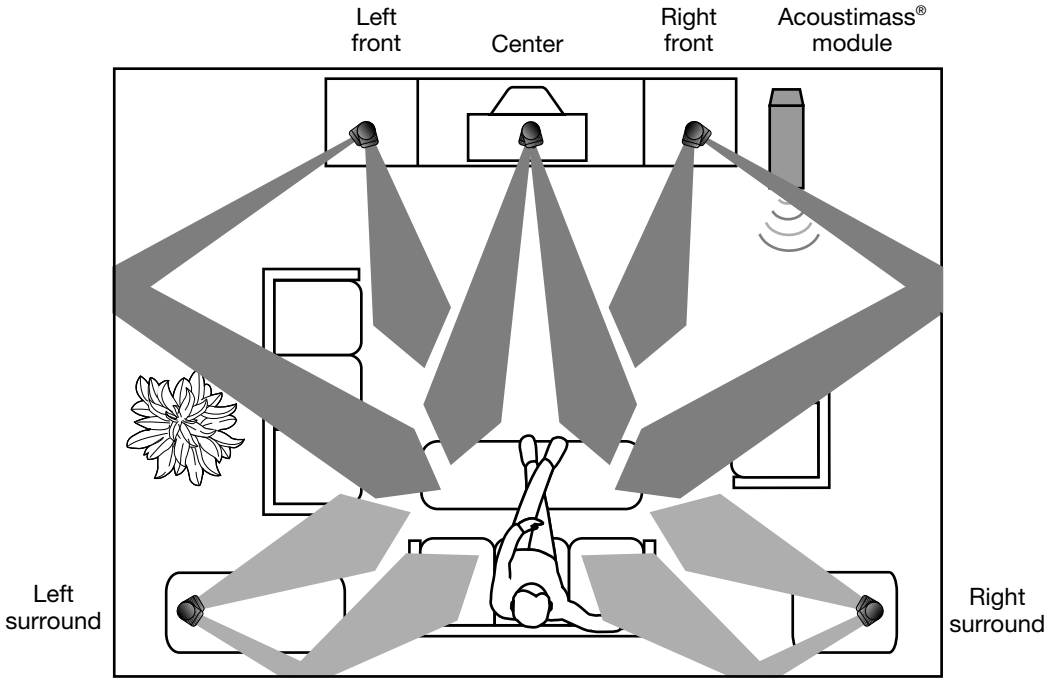


Figure 4

Speaker placement and reflection rays



Center speaker placement

The sound from the center speaker should appear to come directly from the center of the picture. The center speaker cable allows up to 20 feet (6.1 m) distance from the Acoustimass® module.

1. Place the center speaker directly above or below the center of the TV screen, or at the closest convenient location.
2. Align the speaker with the front of the TV screen (not pushed to the back of the TV).
3. Direct each of the cubes slightly away from center, to create a wider area of direct sound.

Note: *If you put the speakers in a bookcase unit, be sure to place them at the front edge of the shelf. Placing speakers in an enclosed space can change the tonal quality of the sound.*

Surround speaker placement

The rear surround speakers create an area of sound around the listener. Place them in the back half of your room. Direct the cubes slightly away from the listeners so that you cannot pinpoint the exact location of the sound source. The surround cables allow up to 50 feet (15.2 m) distance from the Acoustimass module.

1. Place the speakers at ear height (when seated) or higher, if possible.
2. Adjust the rear surround speakers to direct the sound to the front and back of the listener.

Acoustimass® module placement

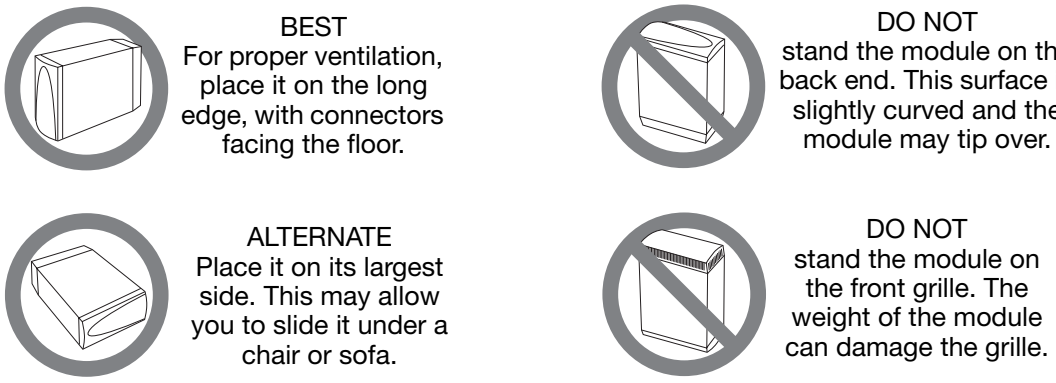
Follow these guidelines to select a location for the Acoustimass module:

♪ ***Note:*** *To avoid interference with the TV picture, place the Acoustimass module at least 18 inches (45 cm) from the TV.*

- Place the Acoustimass module along the same wall as the TV, or close to the same end of the room as the front speakers (see Figure 4).
- Place the Acoustimass module so that the grille with the Bose® emblem faces into the room or along the wall to avoid blocking the sound output or creating too much bass.
- For best bass performance, DO NOT place the Acoustimass module at equal distances from any two walls or from a wall and the ceiling.
- For convenience, you may want to slide the Acoustimass module under a table or behind a sofa. However, DO NOT allow furniture or drapes to block the ventilation openings of the module.
- Place the Acoustimass module within reach of the audio input cable, speaker cables, and an AC power (mains) outlet.
- Place the Acoustimass module on the floor on its long edge or lay it down on its largest side. DO NOT stand it on either end. See Figure 5.

Figure 5

Right and wrong placements for the Acoustimass module



- Once you have selected a position for the module, place the four self-adhesive rubber feet near the corners of the bottom surface. The rubber feet provide increased stability and protection from scratches.

⚠ ***CAUTION:*** *DO NOT cover the ventilation openings of the Acoustimass module. The slots on the end provide ventilation for the built-in electronic circuitry, and should not be blocked.*

⚠ ***CAUTION:*** *The magnetic field from the Acoustimass module is not an immediate risk to your video tapes, audio tapes, and other magnetic media. However, you should not store tapes directly on or near the Acoustimass module.*

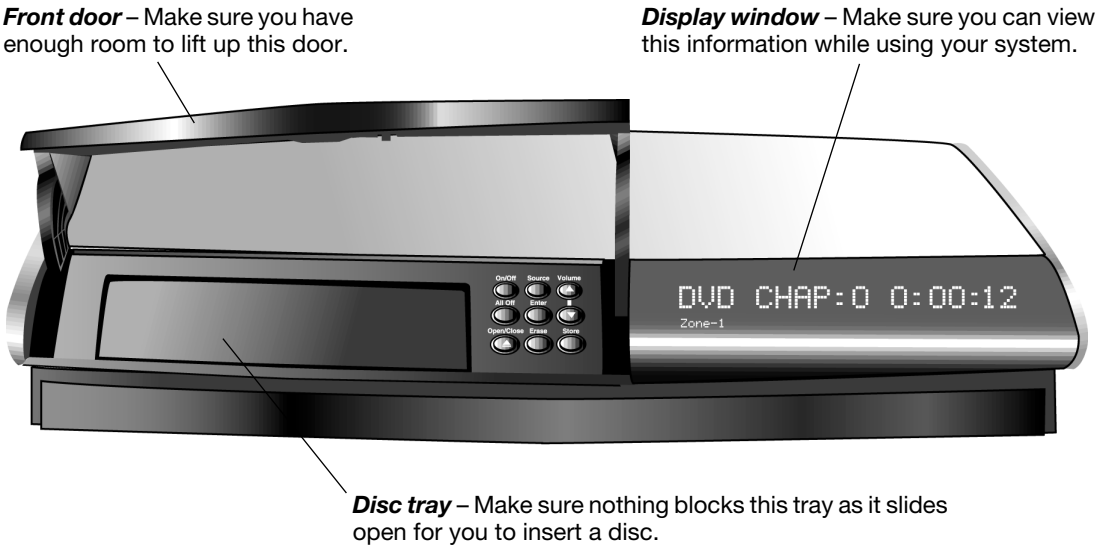
Placing your media center

Select a location for the media center, keeping in mind the following guidelines:

- Do not block the front of the media center. Make sure you allow enough room to lift up the front cover and open the CD tray of the CD/DVD player. Also, position the media center so that you can clearly view the display window to the right of the CD tray cover. See Figure 6 for a description of the front of the media center.
- Place the media center close enough to other sound sources (TV and VCR) to allow for easy cable connections. If you need additional audio and/or video cables to connect all of your components, see your dealer or call Bose® Customer Service.
- Place the media center within 30 feet (9.1 m) of the Acoustimass® module (the length of the audio input cable).

Figure 6

Front features of media center



Connecting the speakers to the Acoustimass® module

♪ ***Note:*** *Before you start making system connections, make sure that the media center, the Acoustimass module, and any additional equipment are not connected to AC power.*

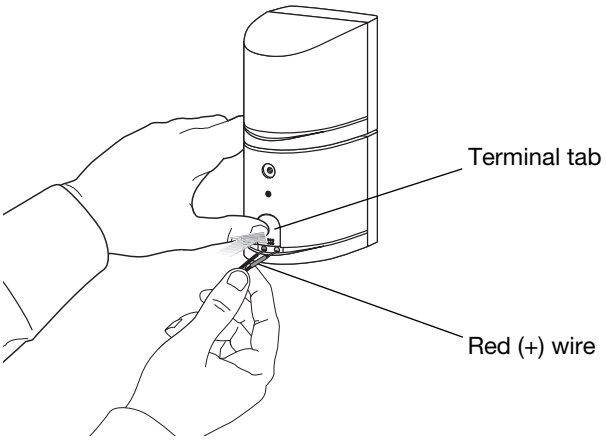
The five dual-cube speakers that come with your system will either have a two-wire cable connector (Figure 7) or a plug-in cable connector (Figure 8). Identify your type of speaker and then follow the corresponding instructions.

♪ ***Note:*** *To lengthen the speaker cables, use heavy-duty RCA extension cables, or splice in 18-gauge or thicker cord (connecting + to + and – to –). To purchase extension cables, see your dealer or electronics store, or call Bose® Customer Service.*

Making a two-wire speaker connection

Figure 7

A two-wire connection type speaker



In a two-wire connection, the wire marked with a red collar is positive (+) and the plain one is negative (–). These wires match the positive (red) and negative (black) terminals on the back of each speaker.

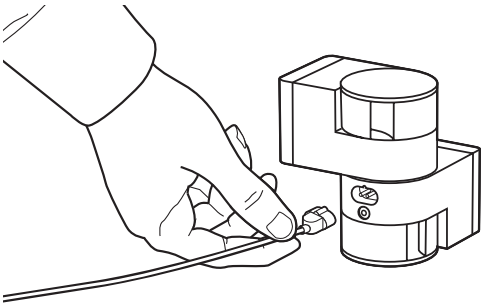
♪ ***Note:*** *The surround speaker cables are joined together for your convenience, providing an easy-to-use cable for connecting the surround speakers. To run the cables in different directions from the Acoustimass module, simply pull apart the cables as needed.*

1. Match the correct cable to the corresponding speaker location. Front speaker cables have blue connectors at one end, with L, R, or C molded into the connectors. The red collars on the + wire are labeled Left, Right, and Center. Surround speaker cables have orange connectors at one end, with L or R molded into the connectors. The red collars on the + wire are labeled Left and Right.
2. Connect the wire end of one speaker cable to the terminals on the rear of the matching speaker. Press the terminal tab on the back of the speaker and insert the marked wire (+) into the red terminal and the plain wire (-) into the black terminal. Release the tab to secure the wire. Repeat this step for each of the five speakers.
3. Connect each cable to the corresponding jack on the Acoustimass module (Figure 9). Plug the blue connectors into the matching left front, center, and right front jacks. Plug the orange connectors into the matching left surround and right surround jacks.

Making a plug-in cable speaker connection

Figure 8

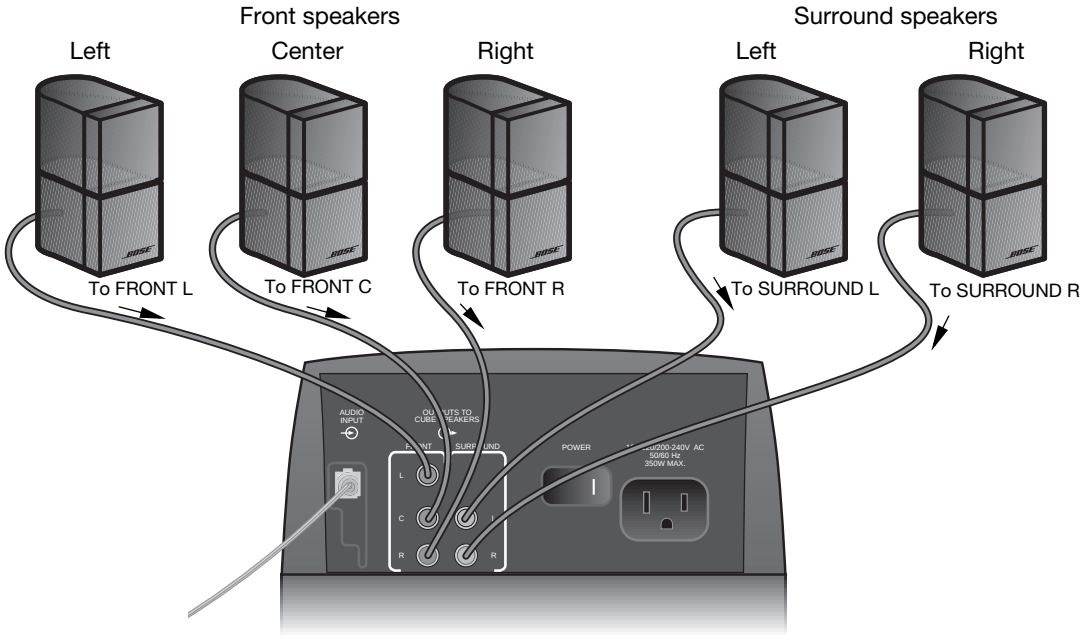
A plug-in cable type speaker



1. Match the correct cable to the corresponding speaker location. Front speaker cables have blue RCA connectors at one end, with L, R, or C molded into both the RCA connectors and the speaker connectors at the other end. Surround speaker cables have orange RCA connectors at one end, with L or R molded into both the RCA connectors and the speaker connectors at the other end.
2. Insert the speaker connector of each cable fully into the jack on the rear of each of the five speakers. Match the ridge of the connector to the notch at the top of the jack.
3. Connect each cable to the corresponding jack on the Acoustimass® module (Figure 9). Plug the blue connectors into the matching left front, center, and right front jacks. Plug the orange connectors into the matching left surround and right surround jacks.

Figure 9

Speaker connections to the Acoustimass module



Connecting the Acoustimass® module to the media center

Connect the Acoustimass module to the media center with the audio input cable (Figure 10).

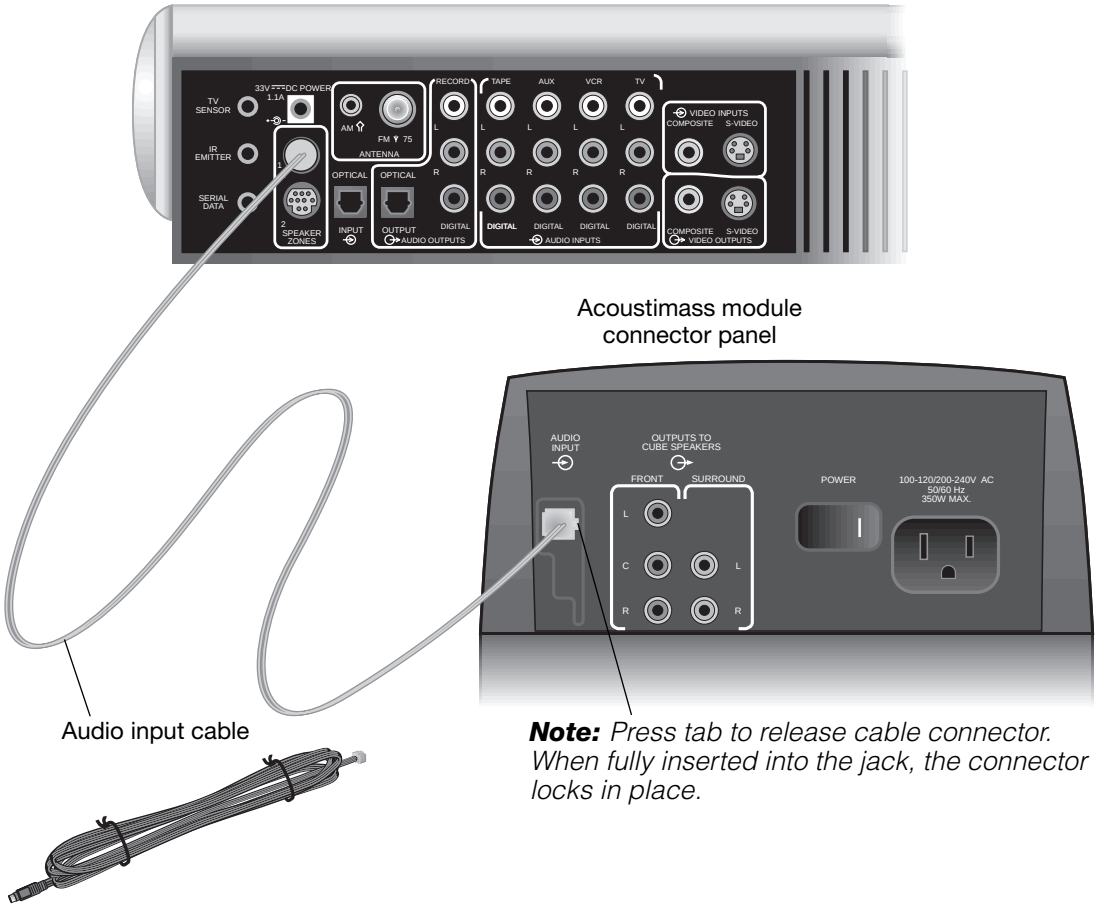
♪ ***Note:*** *Be sure that each connector is fully inserted into each jack.*

1. Plug the small black multi-pin connector (flat side facing up) into the SPEAKER ZONES jack labeled “1” on the back of the media center.
2. Insert the telephone-style RJ-45 connector on the other end of the audio input cable into the AUDIO INPUT jack on the Acoustimass module. Align the connector at the angle shown in Figure 10. When properly connected, it should lock in place.

♪ ***Note:*** *Refer to “Setting up a second listening zone” on page 23 for information on connecting a second zone.*

Figure 10

Acoustimass connection to media center



Note: *Press tab to release cable connector. When fully inserted into the jack, the connector locks in place.*

⚠ ***CAUTION:*** *Do not place strain on the audio input cable, especially on the connection to the Acoustimass module. Placing excessive strain on the cable may cause damage to the cable connection at the Acoustimass module. When disconnecting the cable from the Acoustimass module, be sure to press the tab on the connector.*

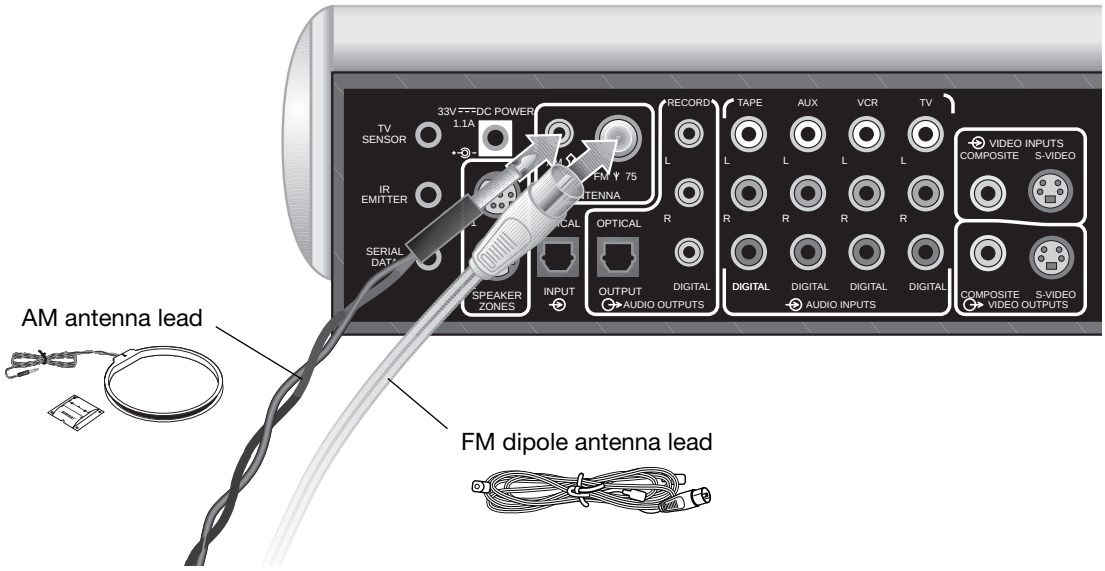
Connecting the antennas

The rear panel of the media center provides connections for AM and FM antennas (Figure 11). Be sure to unwind the wires of each antenna to ensure the best reception.

Note: *Outdoor antennas may be used. To install an outdoor antenna, consult a qualified installer. Follow all safety instructions supplied with the antenna.*

Figure 11

Connections for the AM and FM antennas



Connecting an FM antenna

Plug the connector on the FM dipole antenna lead into the FM antenna jack. Spread out the antenna arms. Change the orientation of the antenna arms to get optimum FM reception. Place the antenna as far from the media center and other external equipment as possible.

Connecting the AM antenna

Note: *To mount the AM antenna on a wall, follow the instructions enclosed with the antenna.*

1. Plug the connector on the AM antenna lead into the AM antenna jack.
2. Stand the loop antenna on the base, following the instructions enclosed with the AM antenna.
3. Move the AM loop antenna as far as possible (at least 20 inches [50 cm]) from the media center, and at least 4 feet (1.2 m) from the Acoustimass® module. Experiment with the orientation of the loop for optimum AM reception.

Connecting to a cable radio provider

Some cable TV providers make FM radio signals available through the cable service to your home. This connection is made to the external FM jack on the back panel of the media center. To connect to this service, contact your cable TV provider for assistance.

Note: *Make sure that the cable radio installation includes a signal splitter so that only the FM radio band, not the cable TV band, is received by the media center. If necessary, contact a qualified installer.*

Connecting your TV to the system

The media center provides audio and video connections for your TV. See Figure 12.

Making audio connections

Using the supplied stereo audio cable, connect the left (L) and right (R) audio outputs on the rear panel of your TV to the L and R TV audio inputs on the rear panel of the media center.

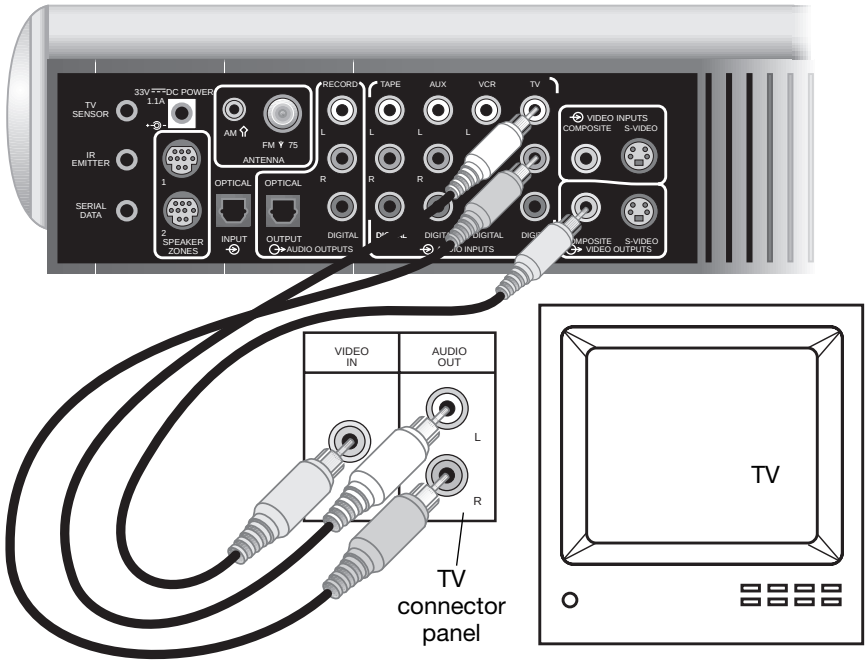
Making video connections

Using the supplied video cable (with yellow connectors), connect the COMPOSITE video output on the rear panel of the media center to the VIDEO INPUT on the rear panel of your TV.

Note: *If you prefer to use S-video or component video connections, see the following information on alternate video connections.*

Figure 12

Media center-to-TV video and audio connections



Alternate video connections

Before using either of these alternate video connections, you will need to change the video output setting in your system. See your operating guide for instructions.

S-VIDEO

The S-VIDEO OUTPUT provides a higher quality picture on your TV than the COMPOSITE VIDEO OUTPUT. This jack is provided on many TVs. To make this connection you will need to use the S-video cable which is included with your system.

Component video

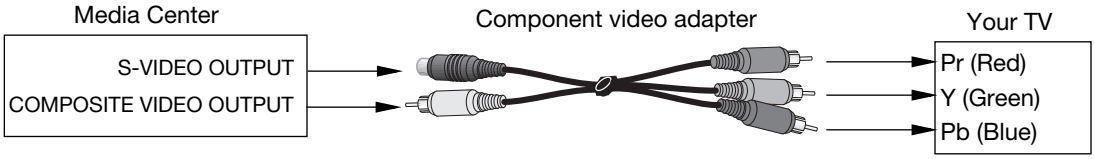
Some newer televisions are equipped with component video input jacks. Component video consists of three separate video signals (Y, Pb, and Pr) which deliver a very high quality picture to your TV.

To make component video connections, you will need video-grade cables for the Y, Pb, and Pr jacks and the Bose® component video adapter (Figure 13). This adapter plugs into the S-VIDEO and COMPOSITE outputs. Your system will send the correct signals to these jacks when you change the video output setting to YPbPr. See your *Lifestyle® 28/35 Operating Guide* for instructions on how to change system settings.

♪ ***Note:*** *Component video jacks are often color-coded and it is essential that you match the color-coded connections with the cables.*

Figure 13

Component video adapter connections



Connecting your VCR to the system

♪ ***Note:*** *If your VCR did not come with the stereo audio and video cables required to connect it to your Lifestyle® system, contact your local electronics store or authorized Bose dealer.*

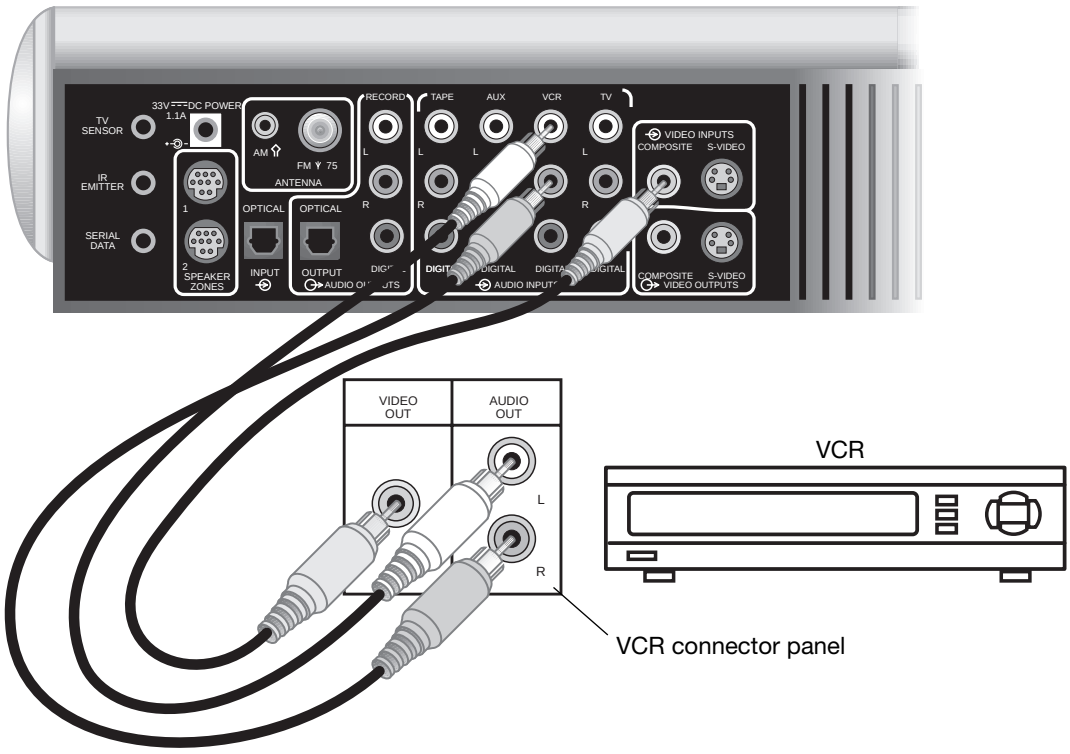
♪ ***Note:*** *The type of video connection used with your TV must match the type of connection used with your VCR. If you connected your TV to the COMPOSITE VIDEO OUTPUT, connect your VCR output to the COMPOSITE VIDEO INPUT. If you connected your TV to the S-VIDEO OUTPUT, connect your VCR to the S-VIDEO INPUT. If your VCR does not have an S-VIDEO output, you may be able to connect your VCR composite video output directly to your TV.*

The rear panel of the media center provides audio and video connections for your VCR.

1. Using the supplied stereo audio cable, connect the left (L) and right (R) audio outputs on the rear panel of your VCR to the L and R VCR audio inputs on the rear panel of the media center.
2. Using the supplied video cable, connect the COMPOSITE video input on the rear panel of the media center to the VIDEO OUT on the rear panel of your VCR.

Figure 14

Media center-to-VCR video and audio connections



Connecting your cable/satellite box to the system

♪ ***Note:*** *If your cable/satellite box did not come with the stereo audio and video cables required to connect it to your Lifestyle® system, contact your local electronics store or authorized Bose® dealer.*

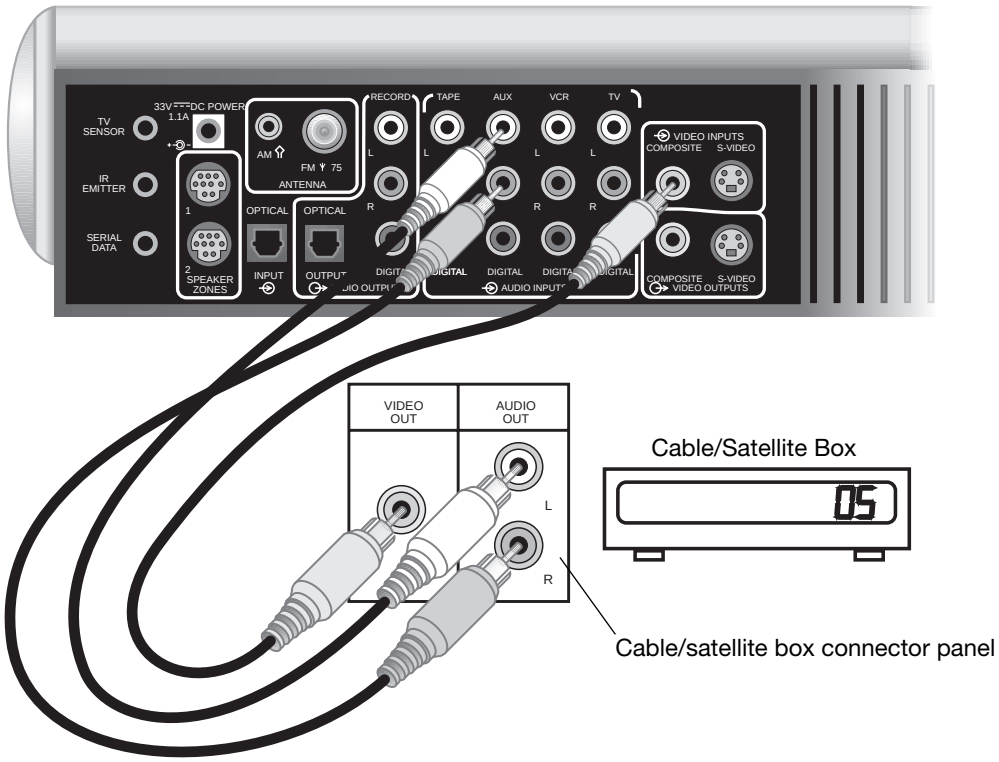
♪ ***Note:*** *The type of video connection used with your TV and VCR must match the type of connection used with your cable/satellite box. If you connected your TV to the COMPOSITE VIDEO OUTPUT, connect your cable/satellite box output to the COMPOSITE VIDEO INPUT. If you connected your TV to the S-VIDEO OUTPUT, connect your cable/satellite box to the S-VIDEO INPUT.*

The rear panel of the media center provides audio and video connections for your cable/satellite box.

1. Using a stereo audio cable, connect the left (L) and right (R) audio outputs (if available) on the rear panel of your cable/satellite box to the L and R AUX audio inputs on the rear panel of the media center.
2. Using a video cable, connect the VIDEO OUT on the rear panel of your cable/satellite box to the COMPOSITE video input on the rear panel of your VCR. You may also connect the VIDEO OUT from your cable/satellite box directly to your media center's COMPOSITE video input (as shown in Figure 15) if your VCR is not using it.

Figure 15

Media center-to-cable/satellite box video and audio connections (if VCR not used)



Installing the TV on/off detector

The TV on/off detector senses whether your TV is on or off and enables the media center to automatically switch your TV on and off as needed. If this device is not installed, you will need to turn your TV on and off using the remote control that came with your TV.

- Attach the TV on/off detector to the back of your TV using the mounting strip included with your new system (Figure 16).
- Plug the connector on the end of the cord into the TV SENSOR jack on the back of the media center.

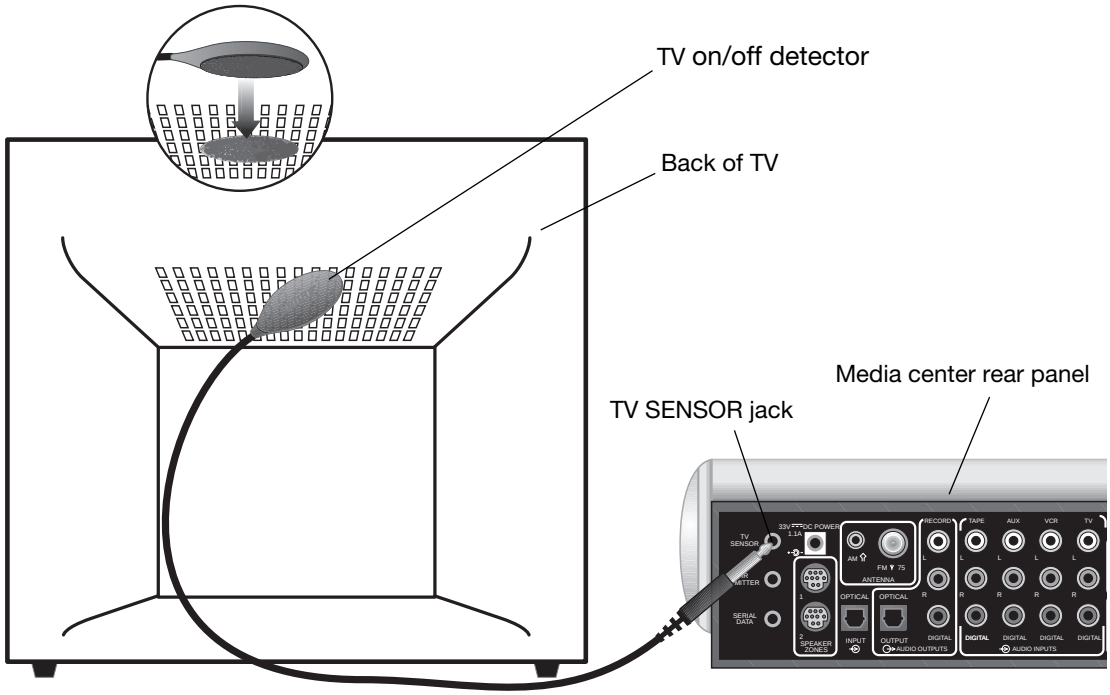
Note: *This device will work correctly only after your system is programmed to operate your brand of TV. See "Programming your remote control to control your TV" in your operating guide.*

Note: *If you have a projection TV, mount this device on the lower back portion of the enclosure opposite the connector panel.*

Note: *This device will not work with LCD and plasma TVs.*

Figure 16

TV on/off detector installed on your TV



Connecting the system to power

1. Plug the small end of the Acoustimass® power cord into the AC power jack on the connector panel of the Acoustimass module (Figure 17). Plug the other end of the power cord into an AC (mains) outlet.
2. Plug the small round connector of the media center power supply cable into the DC POWER jack on the back of the media center (Figure 18). Plug one end of the power supply line cord into the power supply, and plug the other end into an AC (mains) outlet.
3. Turn the Acoustimass **POWER** switch to on (**I**).

Figure 17

Power connection to Acoustimass module

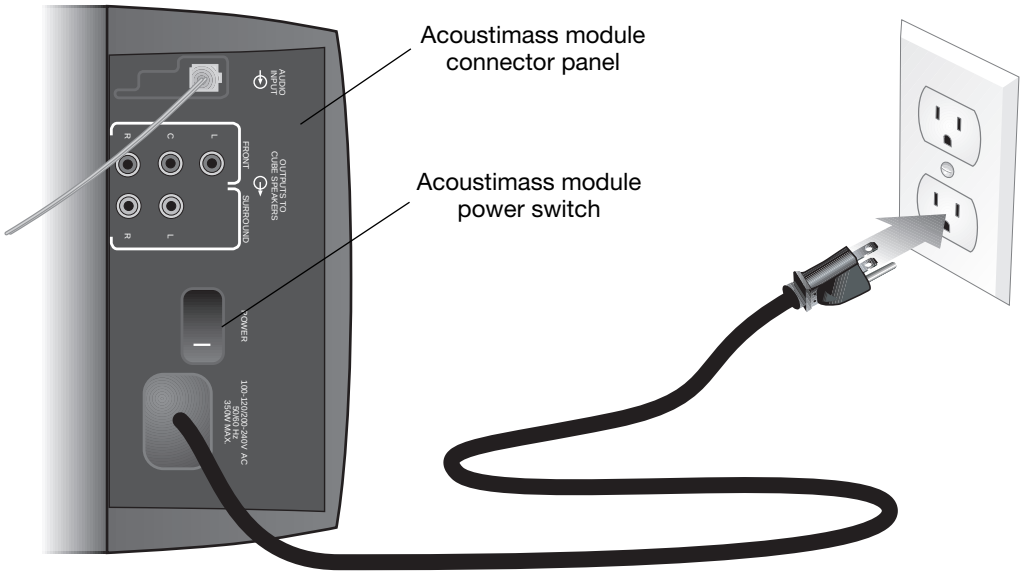
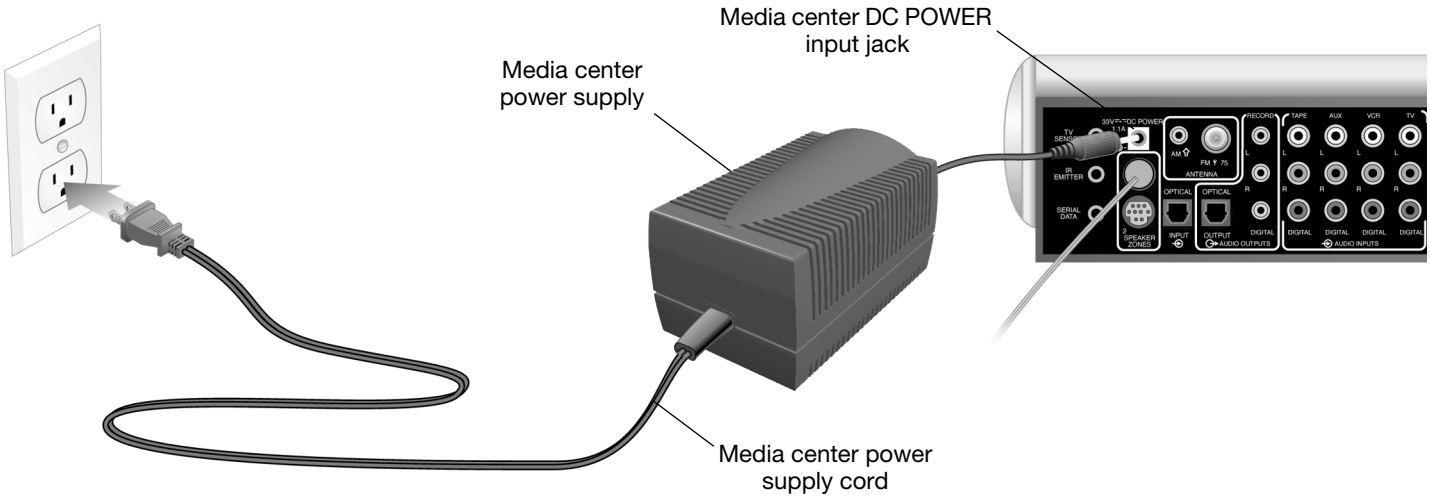


Figure 18

Power connection to media center



Installing the remote control batteries

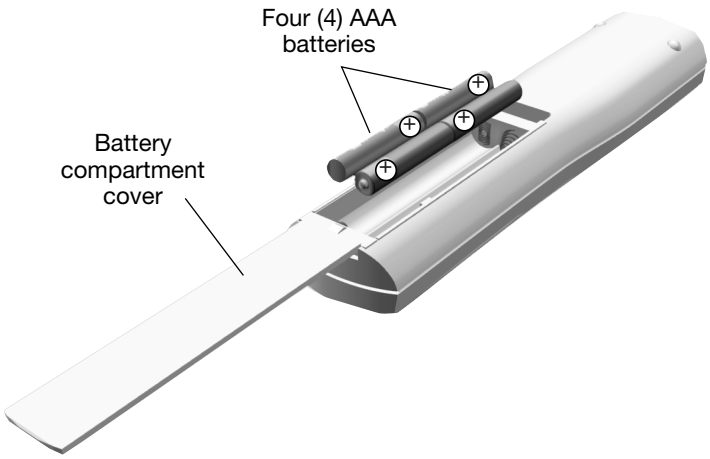
Slide the battery compartment cover off of the back of the remote. Find the polarity markings (+ and –) inside the compartment and install the four batteries accordingly. Slide the cover back on the remote and snap it closed.

Replace the batteries when the remote control stops operating or its range seems reduced. Alkaline batteries are recommended.

♪ ***Note:*** *Do not change the settings of the factory-preset miniature switches. See your Operating Guide for information on how to prevent conflicts with other Lifestyle® music systems.*

Figure 19

Remote control battery installation



Turning off the internal speakers in your TV

When you listen to TV sound through your Lifestyle® system, the speakers in your TV should not be on. Use the on-screen menus in your TV to select “INTERNAL SPEAKERS: OFF” (the exact on-screen message may be different for different TVs). You can also lower the volume of your TV to its lowest setting. Refer to your TV owner’s guide for detailed instructions.

Checking your installation

Before you reach for your operating guide, Bose® recommends that you take the time to play the *Lifestyle® Home Entertainment System Setup DVD*. The setup DVD provides an audio-visual guide for checking your system connections.

To get started:

1. Turn your television on.
2. Lift up the media center front cover and press **Open/Close** Open/Close .
3. Insert the DVD into the tray (label side up) and press **Open/Close** Open/Close again.
4. Press **CD/DVD** CD/DVD on the remote.
5. If the DVD disc does not start to play automatically, press **Play** ▶.

Using alternate system connections

The following describes alternate ways to connect your VCR and TV to your Lifestyle® home entertainment system.

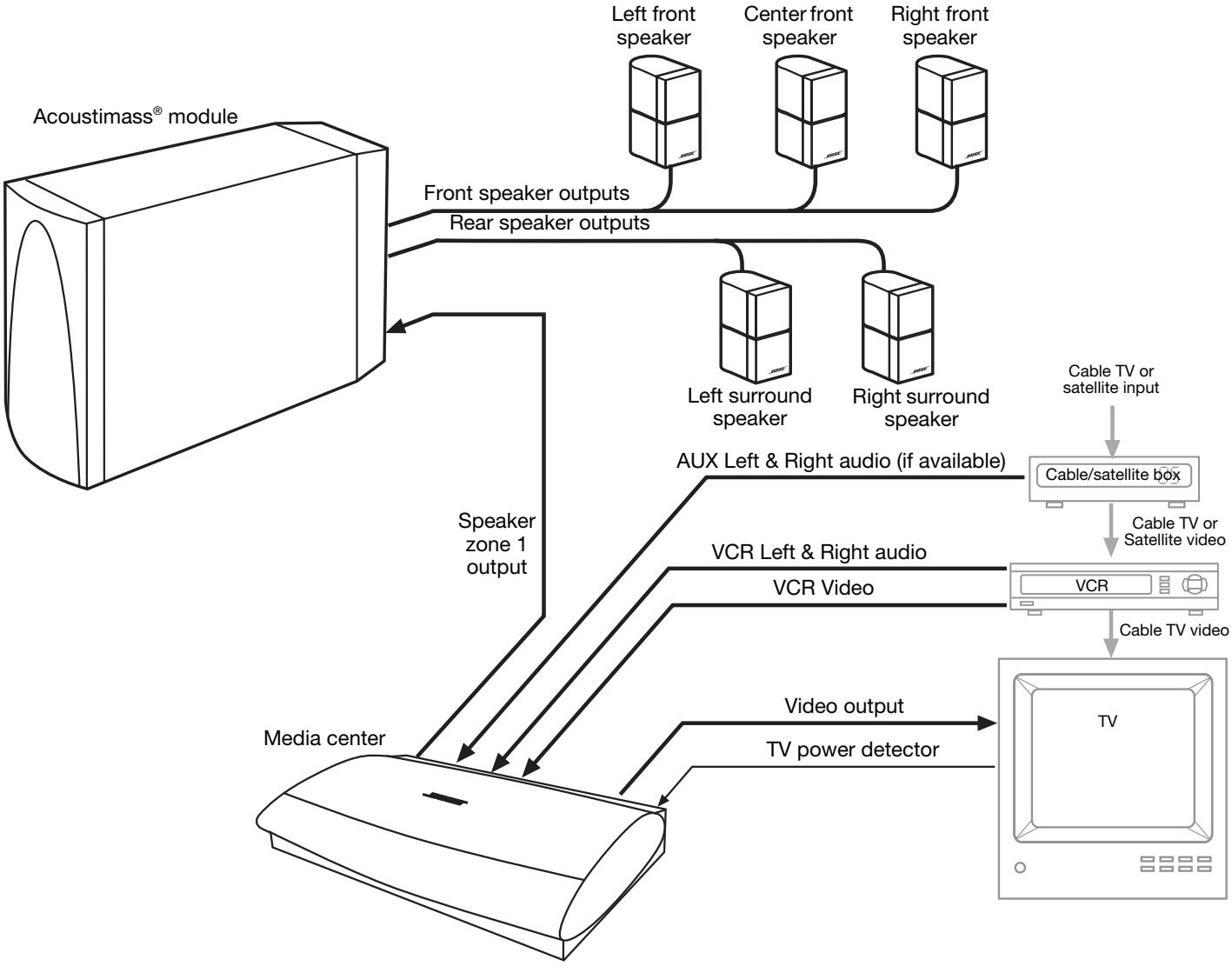
To play VCR audio (not TV audio) through your system

Connect the VCR audio outputs to the TV inputs of the media center as in Figure 1, but do not connect the TV audio outputs.

In this configuration, your VCR audio is played through your system, but the TV audio is played directly from the TV. You must have the VCR turned on to hear any surround sound effects.

Figure 19

Diagram of a typical system



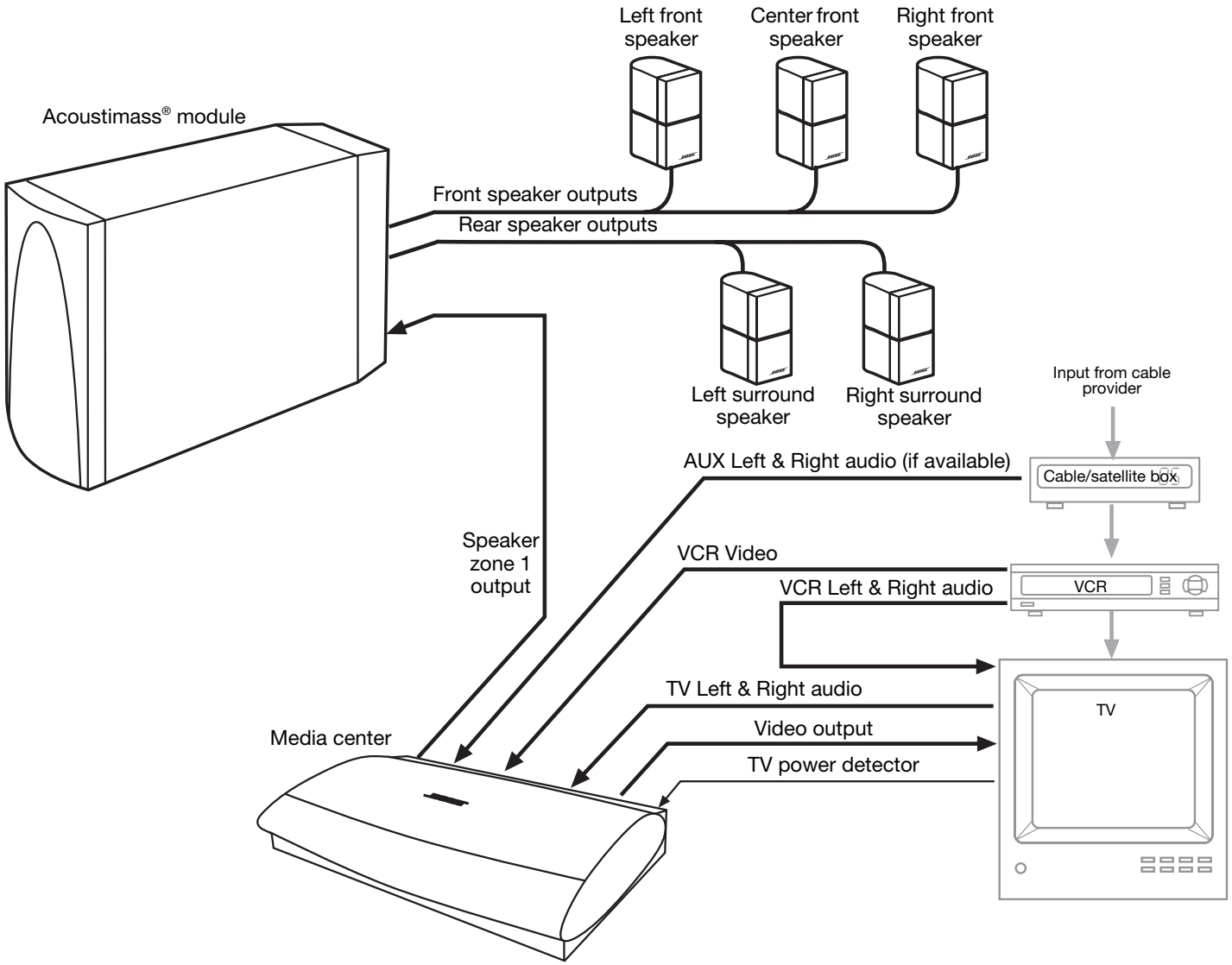
To play TV audio through your system with VCR audio fed to the TV

Connect the VCR audio outputs to the audio inputs of the TV. Connect the TV audio outputs to the TV inputs on the media center.

In this configuration, the VCR can be off, but the Lifestyle® system TV source must always be selected.

Figure 20

Diagram of a typical system



Setting up a second listening zone

Your Lifestyle® home entertainment system can direct sound from one or two sound sources (such as CD, AM/FM tuner, TAPE, or AUX) to two different listening zones at the same time.

What is a zone?

Each listening area, whether a room or a group of rooms (including outdoor areas), is called a zone. Your primary listening area is set up as zone 1.

What do I need for setting up a second zone?

- A Bose® powered speaker system that is compatible with your home entertainment system. An existing stereo system can also be connected (special adapter required).
- The appropriate Lifestyle® system cable to connect the zone 2 speaker system to the SPEAKER ZONES 2 connector on the rear panel of the media center.
- A second Lifestyle® system remote control to operate the zone 2 sound.

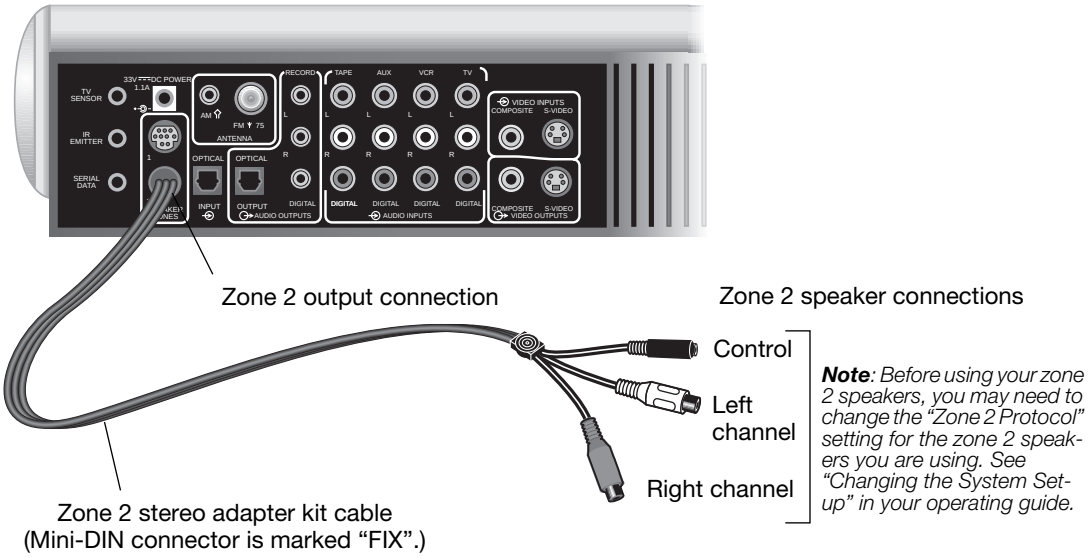
See your dealer or contact Bose for information on obtaining additional powered speakers, remote controls, cables, and adapters for connecting additional equipment.

How do I set up a speaker system in a second zone?

1. Set up a speaker system in zone 2.
2. Connect the audio input cable from the zone 2 system to the SPEAKER ZONE 2 output on the rear panel of the media center.
3. When power is connected and you are ready to set up your second remote control, see "Setting up a second listening zone" in your Lifestyle® system operating guide.

Figure 21

Media center-to-Zone 2 connections



♪ ***Note:*** *For zone 2, use only cables that have a mini-DIN connector marked "FIX". Cables marked "VAR" should not be used.*

Connecting external equipment

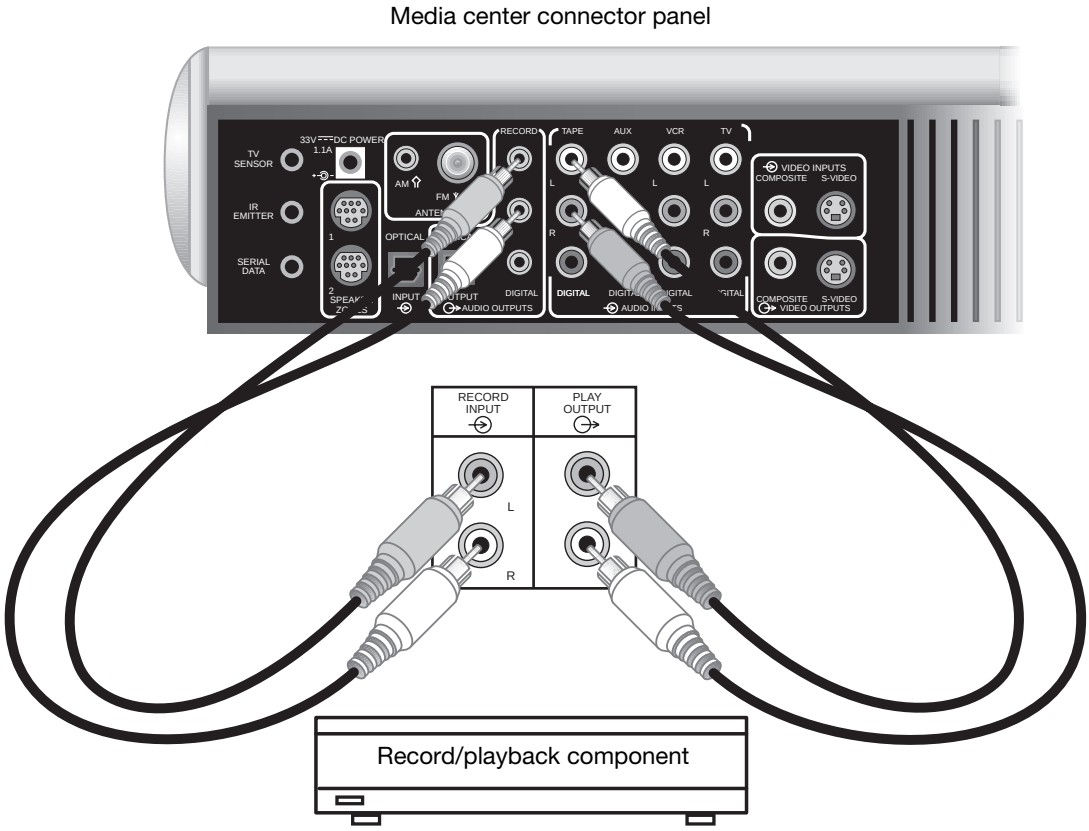
Other equipment can be connected to your system using standard RCA audio cables. Be sure to match the red connector to the R (right) channel and the white (or black) connector to the L (left) channel. A Y adapter can be used to connect mono sources. The appropriate cables are available at most electronic stores.

Connecting record/playback equipment

The rear panel of the media center provides input (TAPE) and output (RECORD) connections for a cassette tape deck.

Figure 22

Record/playback connections

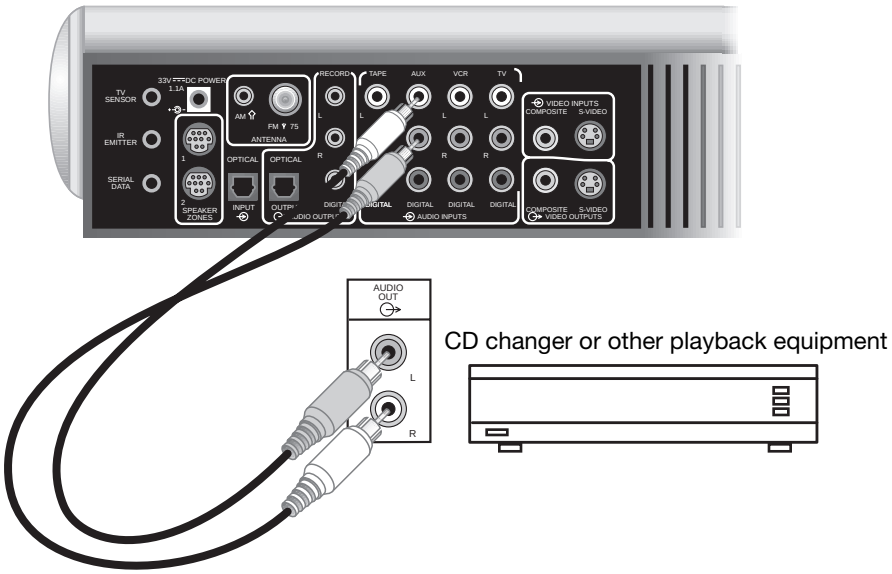


Connecting other playback equipment

Other playback components such as an audio CD changer can be connected to the AUX inputs on the rear panel of the media center.

Figure 23

AUX input connections



Using digital audio connections

If your TV, VCR, tape deck, or AUX component has electrical digital audio connections, you may connect them to the media center using the corresponding DIGITAL connector. You will need a 75Ω cable with RCA connectors (such as a video cable).

Using optical digital audio connections

If your TV, VCR, tape deck, or AUX component has an optical digital audio connection, you may connect it to the media center using the OPTICAL INPUT/OUTPUT connectors. You will need an optical digital cable to make this connection.

♪ ***Note:*** *Before you can listen to a source through the OPTICAL input, you need to assign the OPTICAL connection to TV, VCR, TAPE or AUX. See your operating guide for instructions on using the system settings menus.*

Technical information

Media center power pack rating

USA/Canada: 120V, 60 Hz, 66W

Speaker system power rating

USA/Canada: 120V, 50/60 Hz, 350W

Media center inputs

TAPE: 2Vrms, maximum

AUX: 2Vrms, maximum

VCR: 2Vrms, maximum

TV: 2Vrms, maximum

DIGITAL: SPDIF (1 each for TV, VCR, TAPE, and AUX)

COMPOSITE VIDEO: NTSC or PAL format $1V_{p-p}$ with sync 75 Ω

S-VIDEO: Luminance $1V_{p-p}$, Chrominance $0.3V_{p-p}$

Component video: NTSC or PAL $1V_{p-p}$ with sync on Y

OPTICAL INPUT: SPDIF digital, mapped to input

FM antenna: 75 Ω

AM antenna: 12µH

TV SENSOR: NTSC/PAL/HDTV/480p compatible

Media center outputs

SPEAKER ZONES 1 and 2: Variable audio, user selectable

RECORD L and R: Fixed audio

RECORD DIGITAL: SPDIF

OPTICAL OUTPUT: SPDIF, –15 to –21 dbm

COMPOSITE VIDEO: NTSC or PAL $1V_{p-p}$ with sync 75 Ω

S-VIDEO: Luminance $1V_{p-p}$, Chrominance $0.3V_{p-p}$

Remote control range

65 ft (20 m)

Dimensions/Weights

Media Center:	15.8" W x 11.0" D x 3.5" H (40.1 cm x 27.9 cm x 8.9 cm)	8.2 lb (3.7 kg)
Cube speakers: ***(2-wire conn.)***	3.1" W x 4.0" D x 6.2" H (7.8 cm x 10.2 cm x 15.7 cm)	2.4 lb (1.1 kg)
Cube speakers: ***(plug-in conn.)***	2.2" W x 3.2" D x 4.4" H (5.6 cm x 8.1 cm x 11.2 cm)	1.0 lb (0.5 kg)
Acoustimass® module:	8.0" W x 24.5" D x 16.0" H (20.3 cm x 62.2 cm x 40.6 cm)	35.9 lb (16.3 kg)

Finish

Media center: Aluminum

Cube speakers: Polymer painted

Acoustimass module: Vinyl veneer, Polymer

Accessories

For information on speaker mounting brackets and stands, additional remote controls, and connecting additional Bose® powered loudspeakers, contact your Bose dealer or call Bose customer service.

Warranty period

Your Lifestyle® home entertainment system is covered by a one-year transferable limited warranty. See your warranty card for details. Please be sure to fill out the information section on the card and mail it to Bose.

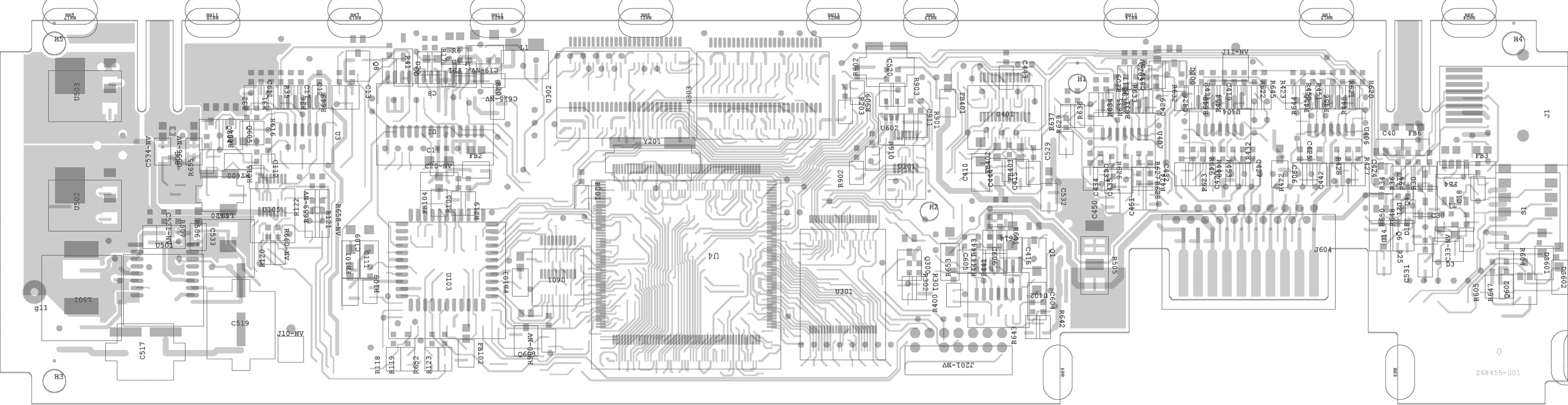
Contacting customer service

For additional help in solving problems, contact Bose customer service. See the address and phone number list provided with your system.

BOSE®

Better sound through research®

The Mountain, Framingham, MA 01701-9168 USA
259777 AM Rev.00 JN10719


H5
H4
H3
H1
H2
U503
U502
L502
g11
C534-NV
C536-NV
R655
R604
Q605
R616
U3
R32
R31
C611
R35
R26
C17
C12
R649
C13
Q8
R41
D20
R17
R6
C5
C7
FB1
C19-NV
L1
R20
C8
C615-NV
U302
U2
C11
FB2
C20-NV
R615
C112
R1600
U105
R122
R659-NV
R121
R658-NV
C521-NV
R507
R506
C533
L500
U501
R120
R660-NV
C517
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FB104
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FB101
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C111
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U103
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R123
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R900-NV
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U303
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C520
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R441
Q606
R614
R641
C416
Q1
Q300
R302
R301
R400
U402
C604
R642
R643
J201-NV
J604
R636
R634
R635
R630
R209
R633
C513
C530-NV
C429
R632
C426
D200
J11-NV
R431
R640
R454
C419
U404
R622
R645
R423
R644
R455
R452
R451
R456
R448
R621
R620
U407
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R624
R628
C432
C451
C40
FB6
FB3
J1
C424
R34
R36
R29
D1
R30
FB4
C18
L1
Q4
D21
C30
R650
R648
D14
Q6
D18
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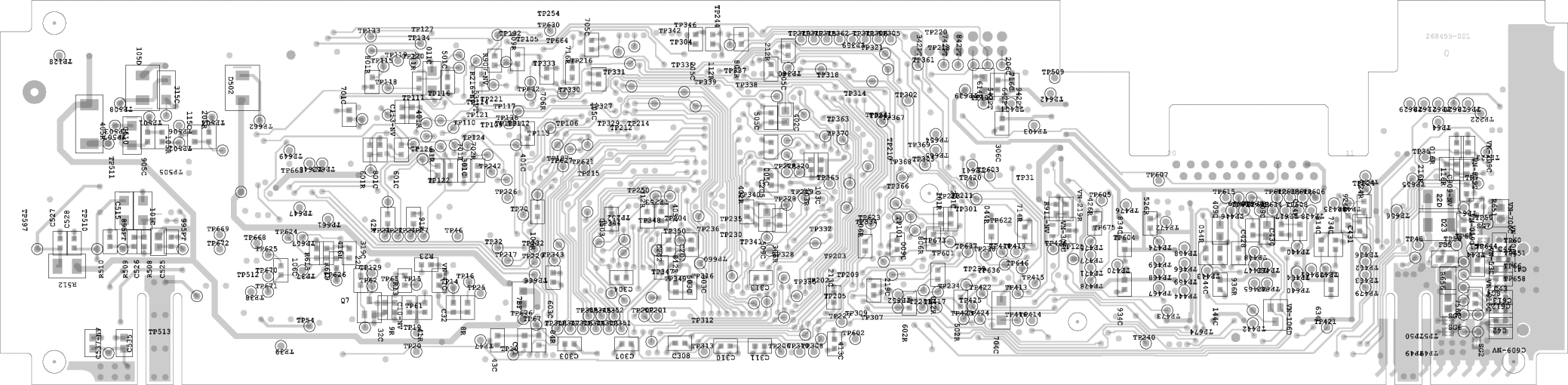
DS602
R605
R647
Q602
BH3
BH4
268455-001



SERVICE BULLETIN

Bulletin Part Number: 268795-B1

Product: Lifestyle® 18, 28, 35 Bass Module - PS18, PS28, PS48

Subject: Failed output ICs U1, U2, and U3.

Disposition: If U1, U2, or U3 fails in a PS18, PS28 or PS48 bass module that has amp PCB 266999-0, replace the amp PCB with part number 267332-0, which has improved output ICs.

Note: The improved outputs ICs U1, U2, and U3, part number 267330-001 are not compatible with the older amp PCB part number 266999-0. Phase in of the new amp PCB began in November 2003 and was completed in January 2004.

Earlier production amp PCB part number:	266999-0
U1, U2, U3 identification markings:	TDA7265

Later production amp PCB part number:	267332-0
U1, U2, U3 identification markings:	LM4766T

ECN: 33251
FRACAS: 362
Date Issued: 03/2004

Contents

SAFETY INFORMATION

1. Parts that have special safety characteristics are identified by the symbol on  schematics or by special notes on the parts list. Use only replacement parts that have critical characteristics recommended by the manufacturer.

2. Make leakage current or resistance measurements to determine that exposed parts are acceptably insulated from the supply circuit before returning the unit to the customer. Use the following checks to perform these measurements:

A. **Leakage Current Hot Chec**k-With the unit completely reassembled, plug the AC line cord directly into a 120V AC outlet. (Do not use an isolation transformer during this test.) Refer to UL6500 paragraph 9.1.1. Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.1 “Leakage Current for Appliances” and Underwriters Laboratories (UL) 6500, IEC 60065 paragraph 9.1.1. With the unit AC switch first in the ON position and then in OFF position, measure from a known earth ground (metal waterpipe, conduit, etc.) to all exposed metal parts of the unit (antennas, handle bracket, metal cabinet, screwheads, metallic overlays, control shafts, etc.), especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 0.5 milliamp. Reverse the unit power cord plug in the outlet and repeat test. ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE UNIT TO THE CUSTOMER.

B. **Insulation Resistance Test Cold Chec**k-(1) Unplug the power supply and connect a jumper wire between the two prongs of the plug. (2) Turn on the power switch of the unit. (3) Measure the resistance with an ohmmeter between the jumpered AC plug and each exposed metallic cabinet part on the unit. When testing 3 wire products, the resistance measured to the product enclosure should be between 2 and infinite Meg ohms. Also, the resistance measured to exposed output/input connectors should be between 4 and infinite Meg ohms. When testing 2 wire products, the resistance measured to exposed output/input connectors should be between 4 and infinite Meg ohms. If it is not within the limits specified, there is the possibility of a shock hazard, and the unit must be repaired and rechecked before it is RETURNED TO THE CUSTOMER.

ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICE HANDLING

This unit contains ESDS devices. We recommend the following precautions when repairing, replacing or transporting ESDS devices:

• Perform work at an electrically grounded work station.

• Wear wrist straps that connect to the station or heel straps that connect to conductive floor mats.

• Avoid touching the leads or contacts of ESDS devices or PC boards even if properly grounded. Handle boards by the edges only.

• Transport or store ESDS devices in ESD protective bags, bins, or totes. Do not insert unprotected devices into materials such as plastic, polystyrene foam, clear plastic bags, bubble wrap or plastic trays.

CAUTION: THE BOSE® PS 28 AND PS 35 POWERED SPEAKER CONTAINS NO USER-SERVICEABLE PARTS. TO PREVENT WARRANTY INFRACTIONS, REFER SERVICING TO WARRANTY SERVICE STATIONS OR FACTORY SERVICE.

Specifications

Mechanical

Dimensions:	Module:	8.0" W x 23.0" D x 16.0" H (20.32 x 58.42 x 40.64 cm)
	Satellite:	3.1" W x 4.0" D x 6.02" H (7.8 x 10.2 x 15.7 cm)
	Jewel Cube® speaker:	2.2" W x 8.0" D x 2.6" H (39.4 x 20.3 x 6.6 cm)
Weight:	Module:	35.9 lb (16.3 kg)
	Satellite:	2.4 lb (1.1 kg)
	Jewel Cube speaker:	1 lb (0.5 kg)

Electrical

Drivers:	Bass module:	Two woofers, 5 1/4", 2.33 Ohms, (wired in parallel)
	Satellite speaker:	Two Twiddler™, speakers, 50 mm, 4 Ohms (wired in series)
	Jewel Cube speaker:	Two Twiddler speakers, 2 1/4", 3.2 Ohms (wired in series)
Amplifier power:	Bass Channel:	125W, <0.2% THD, 40 Hz-200 Hz, 120 Vrms AC mains
	L/R/C/LS/RS:	20W, <0.2% THD, 200 Hz-15 kHz, 120 Vrms AC mains
Input impedance:	Module:	1.16 Ohms (two 2.33 Ohm woofers wired in parallel)
	Satellite:	8 Ohms (two 4 Ohm Twiddler speakers wired in series)
	Jewel Cube Speaker:	6.4 Ohms (two 3.2 Ohm Twiddler speakers wired in series)
L/R/C/LS/RS output distortion:	<0.1% THD at 0.5W	
Bass distortion:	<0.2% THD at 0.5W	
L/R/C/LS/RS output noise:	<500 uVrms, A weighted	
Bass output noise:	<2 mVrms, unweighted	
L/R/C/LS/RS DC offset:	<25 mVdc	
L/R/C/LS/RS balance:	±2.0 dB	
Channel separation:	>40 dB at 1 kHz >30 dB at 10 kHz	(stereo mode)
Turn-on delay:	1.5 seconds maximum	
Turn-off delay:	200 ms maximum	
Main voltage:	USA/Canada : 120 VAC, 60Hz Europe, UK, AUS : 230/240VAC, 50Hz Japan: 100VAC, 50/60Hz Dual Voltage : 115/230VAC, 50/60Hz	
Inrush current:	20A peak for first 33.3 msec.	

Theory of Operation

1. Power Supply, Switch-Mode Audio Tracking

1.1 Introduction

There is a growing demand for power in home theater systems. Traditionally a Bose® home theater system uses an unregulated linear power supply to power multiple linear audio amplifiers. The power supply is typically based on a line-frequency transformer and the audio amplifiers are either Class-B or Class-G linear amplifiers. However, there exists a limit to power and size with such a technology. High-frequency switching technology in the power supply and audio amplifier enables us to achieve a higher power at a smaller package size. Nevertheless, such an approach is usually not very cost effective because of the complexity of the circuit and the extra effort needed to reduce EMI emissions associated with high frequency switching.

A new technology, switch-mode audio tracking power supply, has been developed for Lifestyle® home entertainment systems to achieve higher power from a small package at a reasonable cost. A tracking power supply delivers power on demand to multiple amplifiers. When the audio signal is low, the power supply output voltage is low. When the audio signal is high, the power supply output voltage is high. A rail voltage that tracks audio level reduces the voltage drop at the power amplifier, resulting in lower power loss and hence less heat dissipation at the power amplifier. Consequently, traditional low-cost Class-B amplifiers can be used. While high frequency switching makes it possible to keep the size small, Class-B amplification makes it possible to keep the cost down.

This document describes the theory of operation of a high-frequency switch-mode audio tracking power supply, SD 254165, which is used as a power source for multiple audio power amplifiers in Lifestyle® home entertainment systems. The purpose of this document is to assist in the troubleshooting of the switch-mode audio tracking power supply. Brief descriptions of major function blocks of the power supply is presented first, followed by more detailed discussions on each function block.

1.2 Functional Block Diagram

Figure 1 shows a block diagram of a switch-mode tracking power supply. Power flows from the AC line input at left to the DC output at right. Control signal flows from right to left.

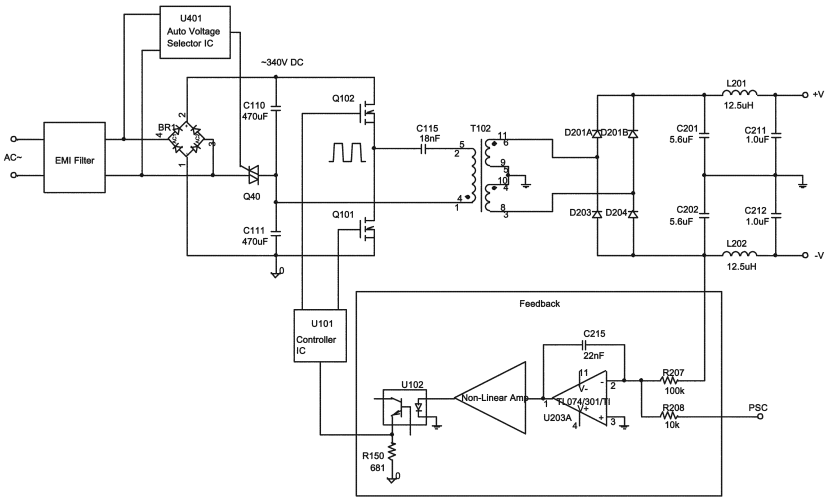


Figure 1. Block diagram of a switch-mode tracking power supply

Theory of Operation

AC power comes from line source to an EMI filter first, which prevents noise generated by high frequency switching from flowing back to the line source. A bridge rectifier BR1 converts AC power into DC power. There are three versions of the power supply; US, Euro, and Dual. For the US version, the bridge rectifier BR1 is configured to a voltage doubler rectifier. For the Euro version, the bridge rectifier BR1 is configured to a full wave rectifier. For the Dual version, an automatic voltage selector IC turns on or turns off the triac Q401 depending on the line voltage, re-configuring the bridge rectifier into a full wave rectifier for 220V/240V line or a voltage doubler rectifier for 100V/120V line. Electrolytic capacitors C110 and C111 filter out line frequency and its harmonics. A DC voltage at about 340V is obtained across the two capacitors regardless of the line voltage variation.

The DC voltage is then inverted into a high-frequency quasi-square voltage by two power MOSFETs Q101 and Q102 which are turned on and off at a high frequency (100kHz ~ 200kHz) by the controller IC U101. The high-frequency quasi-square voltage is applied to the primary winding of the center-tap transformer T102 via a capacitor C115. Capacitor C115 and leakage inductance of the transformer form a resonant circuit, which shapes the resonant current waveform into a quasi-sinusoidal waveform. The power to the transformer is controlled by adjusting the switching frequency relative to the resonant frequency. A rectifier connected to the secondary of the transformer converts the high-frequency power into DC power and a low pass filter removes high-frequency contents. DC power is obtained at two output terminals. This circuit which converts DC power to DC power is called a half-bridge high-frequency resonant DC-DC converter.

A negative feedback circuit made of an integrator, a nonlinear amplifier, an opto-coupler, and a controller IC controls the above power converter in such a way that the output voltage of the power converter follows or tracks the power supply control (PSC) signal, which is generated at the DSP board to track the audio signal.

In addition to the above basic functions, overvoltage, amplifier fault, and over temperature protection circuits are designed to prevent the power supply and amplifiers from catastrophic failure. The power-down circuit is also designed so that the power supply outputs decay slowly when the AC input power is turned off. Two linear regulators are tapped off the two output rails to provide two regulated low voltage rails.

The high-frequency transformer and the opto-coupler provide electrical isolation between the AC line source and audio circuitry that is powered by the power supply.

Since the transformer is operated at a high frequency, it can be designed to be very small and yet very efficient. The size of power supply is significantly reduced compared with a power supply using a line-frequency transformer.

1.3 Resonant Controller IC

This section describes the high-voltage resonant controller IC that controls the resonant power converter which is the brain of the power supply. Figure 2 shows the block diagram of the IC. Its main function is to generate a high-frequency signal at a voltage-controlled-oscillator (VCO) and to drive two power MOSFETs in a half-bridge circuit.

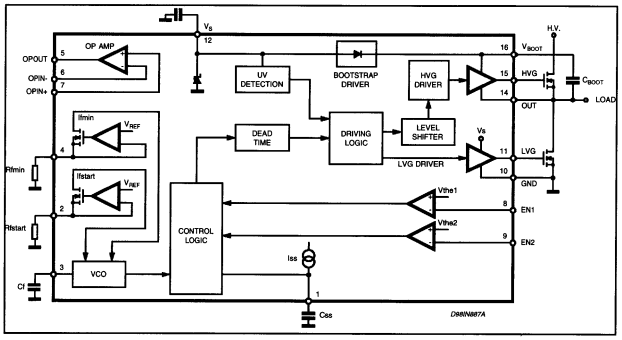


Figure 2. Block Diagram of high-voltage resonant controller IC

Theory of Operation

The IC has two enable pins, one of which (pin-8) disables the operation while the other (pin-9) enables the operation. A voltage pulse higher than 0.6V at pin-8 shuts down the IC and a voltage pulse higher than 1.2V at pin-9 wakes up the IC. An opamp, an under voltage lockout circuit, and a soft start circuit are also built into the IC.
Figure 3 is a circuit diagram that shows how the IC is used in the tracking power supply. With a 12V voltage established at pin-12 (Vs), the VCO starts to oscillate, sweeping oscillation frequency from its start frequency (350 kHz) downward. A gate-driving signal for a low-side MOSFET is generated at pin-11 with respect to pin-10, and another gate driving signal for a high-side MOSFET is obtained at pin-15 with respect to pin-14.

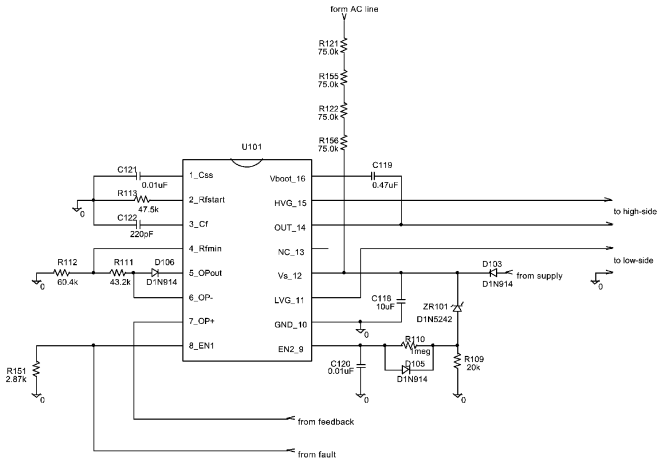


Figure 3. Resonant controller IC used in tracking power supply

Figure 4 shows the oscillograms of the two gate driving signals, when the IC alone is powered on by a 12V DC supply. A dead time of about 280ns, during which both signals are at low level, exists between the two gate signals. Such a dead time avoids shoot-through of the two power MOSFETs. It also allows zero-voltage switching as will be explained later.
The frequency of the two signals is controlled by a voltage at pin-7, which is connected to the output of an opto-coupler. The frequency is about 200 kHz with 0V at pin-7 and 100 kHz with 2V at pin-7.

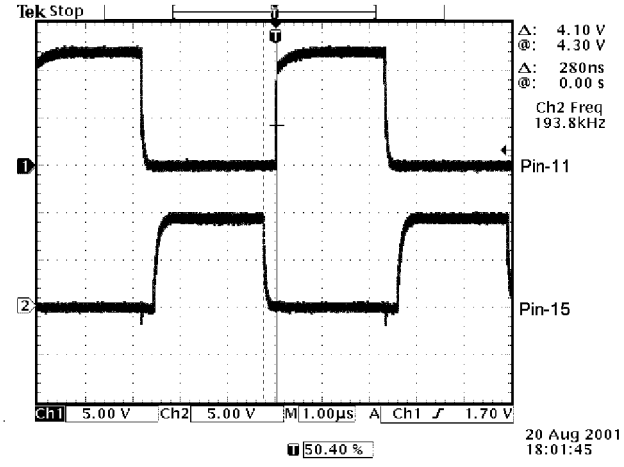


Figure 4. Scope photo of two gate driving signals

Theory of Operation

1.4 High-frequency Resonant Converter

This section describes the theory of operation for a high-frequency half-bridge resonant DC-DC converter, the heart of the power supply. Figure 5 shows its detailed circuit, where the high-frequency transformer is represented by a leakage inductor Llk, a magnetizing inductor Lm, and an ideal step-down transformer.

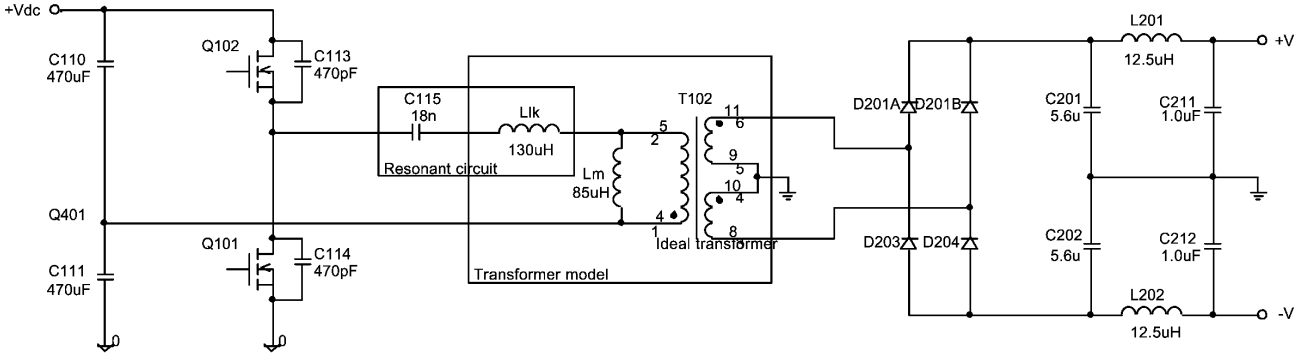


Figure 5. High-frequency half-bridge resonant DC-DC converter

With gate signals from the controller IC, the two power MOSFETs Q101 and Q102 are turned on and off alternately to invert the DC input voltage to a high-frequency square wave voltage. The high-frequency square wave voltage is applied to a series resonant circuit made of a resonant capacitor C115 and leakage inductor Llk of the transformer. The resonant circuit shapes the current waveform to a quasi sinusoidal waveform. Figure 6 shows oscillograms of the voltage across MOSFET Q101 and current through capacitor C115. Such a smooth current waveform lowers electromagnetic interference (EMI) emissions from the power supply.

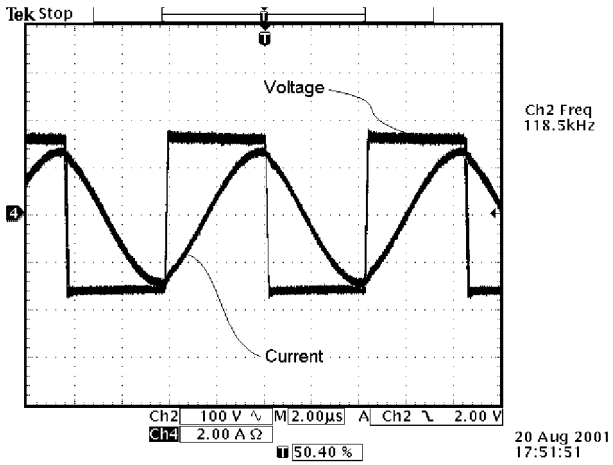


Figure 6. MOSFET Q101 voltage and C115 current waveforms

The transformer transfers high-frequency power from the primary winding to two secondary windings. The rectifier diodes D201A, D201B, D203, D204 rectify the high-frequency power and the two capacitors C201 and C202 filter out high-frequency contents. A low pass L-C filter is added to each rail to further reduce the high-frequency noise. Two DC voltages, one positive and one negative, are obtained at the output.

Theory of Operation

The parameters of capacitor C115 and inductor Llk are selected in such a way that its resonant frequency is lower than the range of switching frequencies. In other words, the switching frequency is always above the resonant frequency. The resonant circuit is operated in inductive mode. Two capacitors C113, C114 are added in parallel with the two MOSFET switches to slow down the voltage transition across the two switches. Inductive mode operation and a dead time provided by the IC, shown in Figure 4, allow the voltage across the two switches to transit smoothly from high to zero and from zero to high. Figure 7 shows gate voltage, drain-source voltage, and drain current for MOSEFT Q101. As can be seen from Figure 7, the power MOSFET is turned on and turned off when its drain-source voltage is zero. Zero-voltage switching like this reduces switching loss and switching noise.

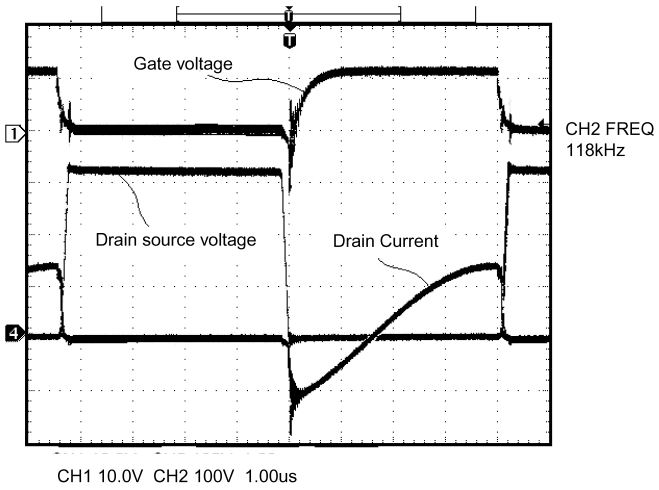


Figure 7. Gate and drain-source voltage, and drain current waveforms for MOSEFT Q101

A characteristic of a resonant converter arrangement shown in Figure 5 is that the ratio of the output DC voltage to the input DC voltage is determined by the ratio of the switching frequency to the resonant frequency of capacitor C115 and inductor Llk. Figure 8 shows a plot of voltage conversion ratio versus normalized switching frequency. Each of the curves represents a different load resistance that is equivalent to the two loads at the two output rails. For example with load L3, voltage conversion ratio decreases with the normalized switching frequency if operated above resonance (inductive mode). Therefore, by moving the switching frequency away from resonance, the output voltage is lowered.

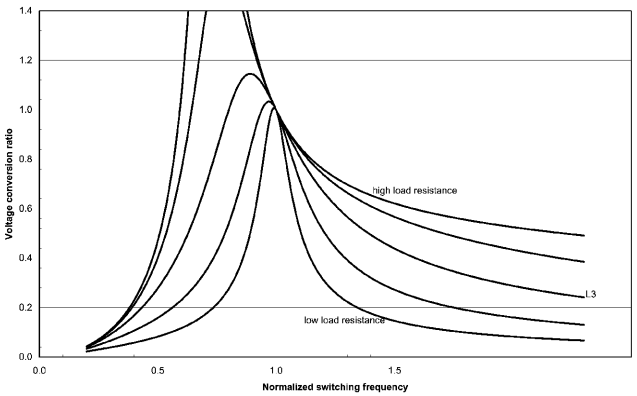


Figure 8. Plot of voltage conversion ratio versus normalized switching frequency

Theory of Operation

1.5 Feedback Control Circuit

The feedback circuit controls the above power converter in such a way that its output voltage follows or tracks the power supply control (PSC) signal. This section describes the feedback circuit shown in Figure 9.

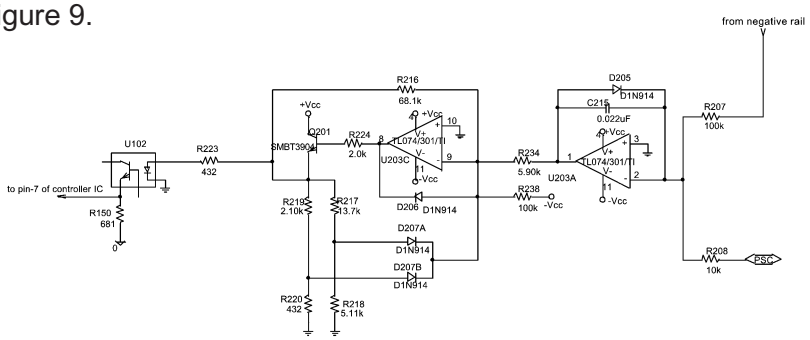


Figure 9. Feedback circuit

The feedback control circuit senses the negative output of the power converter and compares it with the PSC signal. The error is amplified by an integrator. The amplified error is compensated by a nonlinear amplifier for loop stability and is then applied to the resonant controller IC via an opto-coupler.

If the magnitude of the negative voltage is lower than what the PSC signal demands, the output voltage of the opto-coupler is higher, lowering the oscillation frequency of the resonant controller IC. The IC moves the switching frequency closer to the resonant frequency of the power converter, increasing the magnitude of output voltage. Such a negative feedback control minimizes the error between the rail voltage and the PSC signal. The voltage at the power supply output terminals tracks the audio signal. Figure 10 shows waveforms of a PSC voltage, two output voltages, and an amplifier output voltage for a tracking power supply used as power source for one audio amplifier. The PSC is derived from the audio signal and an offset is added for voltage drop at the amplifier (amp saturation voltage). The two rails track PSC very well.

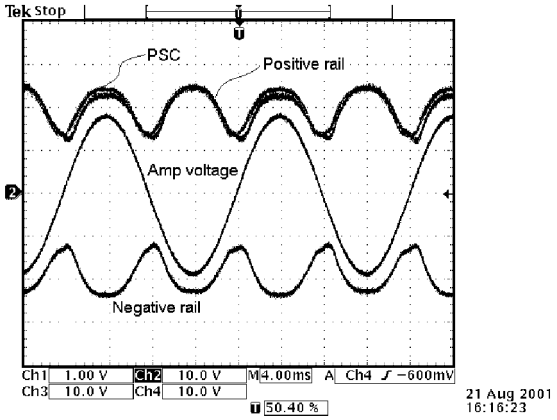


Figure 10. Power supply waveform showing tracking voltage

1.6 Protection Circuits and Others

This section describes protection circuits and some other circuits that are added to the power supply. Figure 11 shows an over-temperature protection circuit and an AMP_FAULT protection circuit.

Theory of Operation

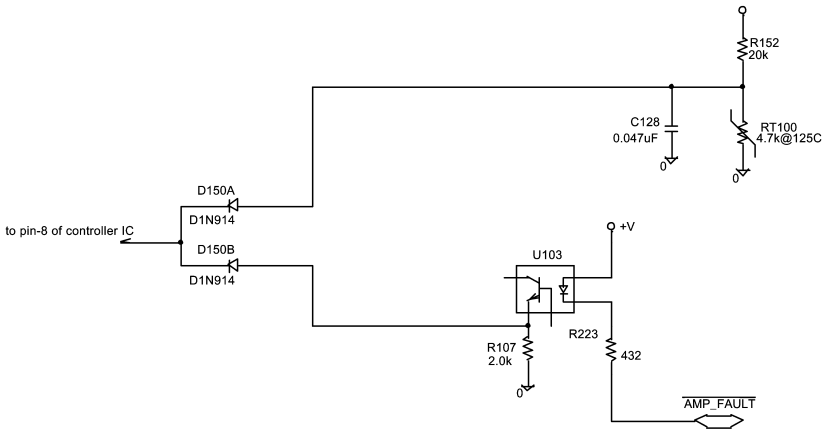


Figure 11. Over-temperature and AMP_FAULT protection circuit

A positive-temperature-coefficient (PTC) resistor RT100 is placed next to a heat sink for two power MOSFETs. When the PTC RT100 is heated up to 125°C by the heat sink, the resistance of the PTC increases dramatically, resulting in a logic-high at the PTC. Independently, when any audio amplifier is in fault condition, the AMP-FAULT is pulled down, setting a logic-high at the output of a second opto-coupler U103. Either over-temperature or amplifier fault sends a voltage pulse to pin-8 of the resonant controller IC, shutting down the IC and hence the power supply.

Referring to the resonant controller IC circuit shown in Figure 3, the Vs-pin (pin-12) of the IC will be slowly charged up beyond 12V in shutdown mode by a current through R156 since the IC consumes very little power after it is shut down. Zener diode ZR101 starts conducting, charging voltage at pin-9 up. Once the voltage at pin-9 reaches 1.2V, the IC is enabled. The power supply resumes operation. The above shut down and recovery process repeats until both over-temperature and AMP-FAULT conditions are removed.

During normal operation, the resonant controller IC is powered by rectifying the dv/dt current through capacitor C114 that is connected across MOSFET Q101 (Figure 5).

An overvoltage protection circuitry shown in Figure 12 is designed to protect the rail-to-rail voltage from exceeding 52V. If the rail-to-rail voltage exceeds 52V, Zener diode ZR300 starts conduction, activating transistor Q301 and hence transistor Q300. Current to opto-coupler U102 is pulled away.

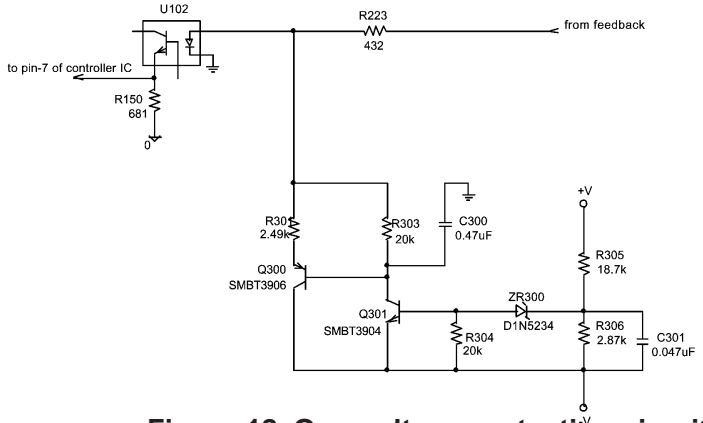


Figure 12. Overvoltage protection circuit

The consequence of such is a lower rail-to-rail voltage.

A power-down circuit, shown in Figure 13, is designed for the output voltage to decay slowly after the power switch on the AC line is turned off. Upon detection of low voltage at the AC line, transistor Q104 turns on, turning on transistor Q103. With the turn-on of transistor Q103, the power converter operates in an open-loop manner. The output voltage of the power supply follows the

Theory of Operation

slow decay of the voltage at the two energy storage capacitors C110, C111. The power down circuit gives the audio power amplifiers enough time to mute before the rail collapses, preventing the speakers from making a pop noise.

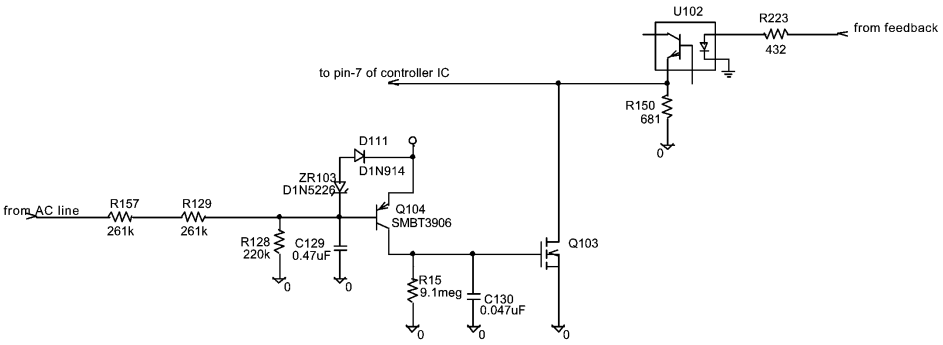


Figure 13. Power down circuit

1.7 Automatic Voltage Selector

An automatic voltage selector is built-in for the dual version of the power supply. Figure 14 shows the automatic voltage selector, which consists of the automatic voltage selector IC U401 and the triac Q401. Jumper JP1 is not installed for the dual version. If the AC line voltage is below 170V rms, IC U401 sends a train of pulses to triac Q401, turning it ON. The rectifier becomes a voltage doubler. If the AC line voltage is above 170V rms, IC U401 sends a low signal to triac Q401, turning it OFF completely. The rectifier becomes a full wave bridge rectifier.

For the US and Europe version, all parts for the automatic voltage selector with reference designation 4XX except SMD parts are left empty. For the US version, jumper JP1 is installed and the choke L103 is not used. For the Europe version, the choke L103 is installed and jumper JP1 is not used. At either 120V US line or 240V European line, a DC voltage at about 340V is obtained at the rectifier output.

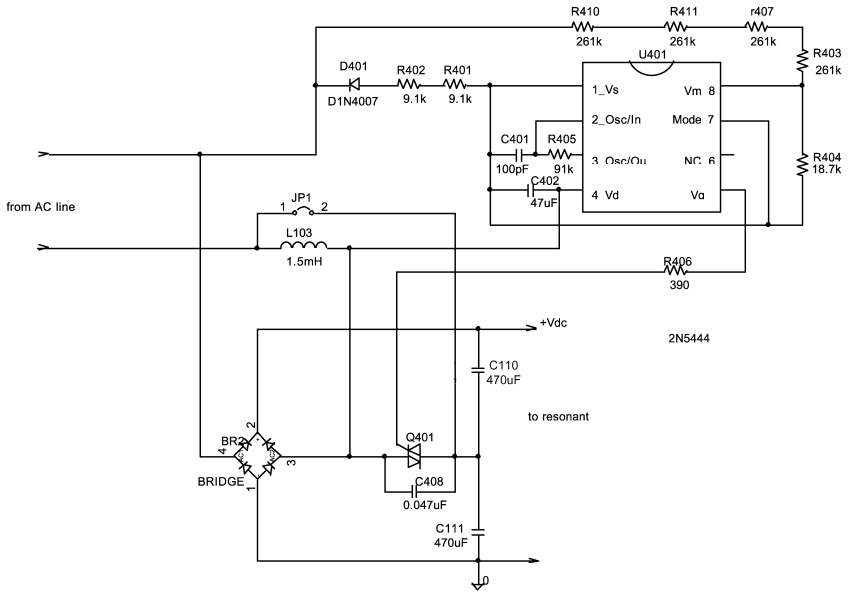


Figure 14. Automatic voltage selector

Theory of Operation

2. DSP PCB

2.1 General Overview

The DSP board contains the majority of the control and signal processing functionality for the PS28 Powered Speaker. The DSP board receives audio data and SmartSpeaker commands from the head-end via the RJ-45 connector. There are no analog audio inputs to the bass module; all audio information comes via S/PDIF input from the head-end. Audio sample rates from 32kHz to 48kHz and PCM, AC-3, and DTS formats are auto-detected and supported.

The DSP is a 4-layer PCB, with all interconnects to the Power Supply PCB and Amp PCB accommodated by J604, a 20-pin card-edge connector. The DSP board has two ground connections to the die-cast aluminum chassis through “spring fingers” formed by two thin PCB features along the edge of the PCB. These “fingers” are displaced by mating sloped features on the bottom of the chassis to make contact when the DSP board is fully inserted into the slots.

2.2 Power Supplies

Sheet 7, 8 of SD254175

“Raw” power for the DSP board is supplied by the Power Supply PCB in the form if “+V” which is the positive DC supply which “tracks” the audio signal and +/-10VDC regulated. The +/-10VDC is brought onto the board at J604 pins 11 and 1, respectively, where they are designated as +VCC and –VCC, respectively. +V is brought onto the DSP board at J604 pins 8 and 18.

+V is solely used to power the 5V switch-mode regulator U501. +VCC and -VCC are used to power all of the OP Amps (U402, U404, U406, and U407) and +VCC is used to power the LM339 comparator U3.

The 5V switch-mode regulator formed by U501, and associated components, operates by chopping the input voltage (13-24VDC) at 120 kHz and filtering it through a LC lowpass filter. The resulting output voltage is divided down by R506/R507 and compared against an internal 3.3V reference in U501, which modulates the pulse width to maintain a regulated 5.0V across C517. When the switching regulator is running, the PWM waveform can be observed at pins 5/6 of U501 using an oscilloscope. R505 and D502 are required to prevent the tracking power supply from “seeing” the 330uF of capacitance at C519, since the +V voltage varies at audio rates between approximately 13V and 24V.

The regulated 5V output is used to generate the 2.5V and 3.3V supplies. The 3.3V supply is generated using a fixed-voltage 3.3V linear regulator, U502. The 2.5V supply is generated using a LM317-series adjustable voltage regulator. R509/510 divide down the output voltage being fed back to the regulator to generate the required 2.5V on the output.

2.3 DSP, FLASH PROM, and SDRAM

Sheet 3 of SD254175

The fundamental heart of the DSP board and LS28/35 bass module functionality is rooted in the Analog Devices 21065L Sharc DSP processor (U4) and the RAM (U302 and U303) and PROM (U301) associated with it. The Sharc DSP is a floating point processor capable of approximately 60MIPs performance and runs typically at 53-55 MIPs. The Sharc provides all control and “housekeeping” functions for the hardware and software as well as all signal processing, except decompression of AC-3 and DTS formats (this is done by the CS49329, U103). Note that on the sche-

Theory of Operation

matic SD254175, that the Sharc, U4, has been schematically broken up into several blocks of similar function/connection pins to make the schematic easier to follow.
The DSPs have no internal program ROM, so all executable program code must be stored in external ROM. This function is provided by U301, a 4Mbit FLASH PROM. This FLASH is programmed at In-Circuit test of the DSP board. The FLASH also contains a Parameter Block, which holds unit specific information, such as EQ type to implement (Double Satellite, Jewel® cube speaker, etc.), tracking power supply calibration info, tone control curve type, etc.

Two Synchronous Dynamic RAM ICs (U302 and U303) are also attached to the Sharc's parallel bus. These are used as real-time RAM for the DSP.

The Sharc, FLASH, and SDRAM are all linked together with a 32 bit data bus and 20 bit address bus, as well as the necessary handshaking and flow control lines, from the Sharc. Also on the lowest 8 bits of the data bus is a 74LCX244 multiplexor IC which allows eight additional input/output lines to be connected to the Sharc. These lines are used for various handshaking, serial communications, and status info communications with the other hardware on the board. Because this single address and data bus structure contains all the key components of the DSP board, any shorts, opens, bridges, or damaged components on any of these lines will cause the DSP to function incorrectly, or, most likely, not at all.

The clock for the Sharc and data bus are generated by the onboard crystal oscillator of U4 (Sharc) and Y201. The internal instruction clock for the Sharc operates at 2x the oscillation frequency of Y201. Because this is the sole source of clocking for the DSP, if this clock does not function, the DSP will cease to function at all.

The Sharc, SDRAM, and FLASH all operate off the 3.3V supply rail.

2.4 Serial data interface, SmartSpeaker and TAP

Sheet 1 of SD254175

The SmartSpeaker interface to the head-end is a single wire, bidirectional serial data interface that operates at 4800 baud, 1 start bit, 8 data bits, no parity, and 1 stop bit. The bus is open-collector, with pull-up on the DSP board to 3.3V. This signal is connected to the head-end via pin 1 of J1. The ground reference/return for all serial communications is pin 2 of J1.

Pins 3 and 6 of J1 form the serial RCV and XMT connections for TAP communications. Unlike previous Lifestyle bass modules, the bass module communicates in RS-232 compliant format, such that a TTL-to-RS232 converter is not needed. TAP communications operate at 4800 baud, 8 bits, even parity, 1 stop bit.

Two sections of the LM339 comparator U3 are used to form the serial data receivers. Since both the TAP and SmartSpeaker receive lines share the same input line on the Sharc, only one communications mode can be supported at any given time.

Theory of Operation

The unit boots into SmartSpeaker mode by default and can be put into TAP mode via two different methods:

• Send out the following 4 bytes using a RS-232 terminal (4800 baud, 8 bits, no parity, 1 stop bit): 0x01,0xFF,0xAA,0x54. This tells the board to switch to ASCII TAP mode. The board will then switch protocols to 4800 baud, 8 bits, even parity, 1 stop bit. It will reply with a single '>' (0x3E). Since the response is 0x3E, the parity bit will be set to 1; there is no need to switch protocols until after the '>' is received since the parity bit will look like a stop bit. Switch the RS-232 terminal to 4800 baud, 8 bits, even parity, 1 stop bit. At this point, normal ASCII TAP commands can be sent to the board. Note that when TAP mode is activated in this manner, the DSP will not echo characters sent by the terminal.

• Set all four DIP switches into the "up" position (away from RCA plugs). Power the PS28 up using the AC line switch and wait until the amber LED blinks twice and the green LED blinks briefly at least once (approx. 3 seconds after power up). Then, within twenty seconds, flip ALL four switches down, then flip switch #4 (closest to the RJ-45 connector) back up. The unit will now communicate in TAP mode. Note that when TAP mode is activated in this manner, the DSP will echo characters sent by the terminal.

2.5 Thermistor Temperature Sensor

Sheet 8 of SD254175

RT600 is a negative temperature coefficient device which is used to measure the ambient temperature in the vicinity of the DSP. This measured temperature is used by the DSP in a complex algorithm which uses the woofer output signal and the PSC_PWM signal (which contains info about the power supply rail voltage) to compute the power being dissipated in the MOSFETs on the Power Supply PCB and, hence, their approximate temperature, then adjusts the system gain over time to keep the unit's operating temperature within safe limits despite the external ambient temperature or how long/loud the unit has played. This algorithm only "turns the volume down" by a few dB in cases where the unit has been operated at maximum volume levels with "heavy" source material.

The resistance of RT600 changes inversely proportional to the temperature of the device, with its resistance nominally 10k at room temperature (25°C). The circuit formed by two of the comparator sections of U3 and the associated parts form an oscillator which has an "on" time determined by C620 charging through R655 and an "off" time determined by C620 discharging through RT600. This makes the oscillator output a waveform with a duty cycle that is a function of the temperature of RT600. The DSP samples the output of the oscillator at a constant rate and averages the total "on" time and total "off" time over 10 cycles of the oscillator to compute the temperature.

2.6 DIP Switches

Sheet 8 of SD254175

The 4-position DIP switch S1 is primarily on the DSP to set the room code of the bass module for situations where there are multiple speakers on a single zone of a Lifestyle® media center. These switches normally ship with all four in the "down" position (towards the PCB). They also serve as a method of setting the Sharc into TAP mode, but only during the first 20 seconds after power has been turned on.

Theory of Operation

2.7 LEDs
Sheet 8 of SD254175

The amber and green LEDs on the DSP board serve to provide a wealth of information about the status and operation of the DSP board. The following is a summary of the various possible states of the LEDs and a functional description of the state(s) represented.

• Green LED: The green LED serves a dual purpose: general system health and serial data received. The green LED will blink once per second with a 50% duty cycle (i.e. on for ½ second, off for ½ second) if the system booted and is running normally. If the unit is in the SmartSpeaker "Off" condition, the green LED will blink briefly (approx. 0.1s ON time) once every 5 seconds.

• The green LED will also toggle whenever a serial data byte is received. This will interrupt the normal 1 second blink rate. The green LED blinking faster than 1 Hz usually indicates that it is receiving serial communications.

• Amber LED: The amber LED serves to signal 3 conditions: power applied/boot status, S/PDIF status and clipping status. When power is first applied the amber LED will light briefly. If the PROM FLASH checksum is incorrect or hardware does not pass power-on self test, the green LED and amber LED will alternately blink at approximately a 5 Hz rate. If the green LED is blinking at its normal, 1 Hz rate, a blinking, 1Hz amber light indicates that there is no valid S/PDIF signal present: If the amber LED is off while the green LED is blinking normally, then valid S/PDIF is present and being received. Finally, if the amber LED will briefly blink (in this case, only when valid S/PDIF is present) when the satellite amps are clipping. This should only occur when playing the system at very high levels.

2.8 Master Reset and Watchdog Timer
Sheet 8 of SD254175

U602 functions as the master Reset controller and watchdog timer. This part will briefly issue a Reset to the Sharc when the +3.3V rail first comes up or if the 3.3V rail drops below 3.08V. The part also contains a timer which will cause a Reset to occur approx. every 1.5 seconds unless the WDI input to the IC is toggled at least once during each 1.5 second cycle. This is useful in the event that the Sharc would become "lost" in program execution, which would prevent it from "petting" the watchdog every second, and the system would get Reset and recover.

2.9 Tracking Power Supply Control Output
Sheet 3, 8 of SD254175

As part of the DSP signal processing, the maximum level of any of the six audio channels in a 256-sample block is computed. This value is then translated into the minimum required power supply rail voltage needed by the power amplifiers to reproduce that block of audio without clipping or distorting. The Sharc adjusts the duty cycle of the pulse-width modulator output DT1B (pin 23) of U4 appropriately so that the resulting "DC" voltage after the RC lowpass filter formed by R209/217 and C203 is $1/10^{th}$ the required power supply rail voltage. This signal, PSC_PWM, is sent to the Power Supply PCB through J604, pin 12. When there is no audio output (or relatively low levels), this output should be at 0% duty cycle, or approx. 1.3V as measured at PSC_PWM.

Theory of Operation

2.10 Bass and Satellite Clip Detect Inputs

Sheet 3, 8 of SD254175

The Power Amplifier board has circuitry to predict signal clipping of the amplifier outputs on positive going peaks. These events are separately sensed for the Bass channel and the satellite channels (all 5 are logic-OR'd together) and brought on to the DSP board through J604. They pass through RC lowpass filters and connect directly to the Sharc's IRQ1 and IRQ2 inputs. At this time, these inputs have no effect on the signal processing other than briefly lighting the amber LED whenever a satellite clip event occurs. The DSP's soft-clipper and limiter algorithms perform all of the compression and gain limiting functions normally associated with feedback limiters. In the near future, this circuitry will be removed from the Amp and DSP boards for cost savings.

2.11 S/PDIF Receiver

Sheet 1 of SD254175

The only audio input for the bass module is through the differential (balanced) S/PDIF input on pins 7,8 of J1 (RJ-45 connector). The S/PDIF signal is coupled into the unit via bypass capacitors (C609/610) to the chassis and SMD ferrite beads (FB3/4) to help alleviate EMI problems. A DC blocking capacitor, C18, prevents DC currents from saturating the coupling transformer T1. T1 is a broadband pulse transformer with a 1:1 turns ratio which performs the function of isolating the incoming signal as well as balanced-to-unbalanced conversion. The secondary of T1 is connected to a pair of back-to-back diodes that provide the "termination" for the input signal. This allows long runs of wire and unknown transmission line impedances to exist between the head-end and bass module and still be able to recover the S/PDIF signal. The clamped signal is fed into a resonated LC lowpass filter which provides a sharp roll off at approximately 8 MHz. This allows S/PDIF data at up to 48 kHz sample rate to pass through, but sharply attenuates out of band noise and transients which might cause interruptions in the S/PDIF data stream. This filtered, single-ended signal is then fed into the RXP0 input (pin 4) of the CS8415A (U2). The RXP0 and RXN0 inputs are internally biased to approx. 1/2Va (or approx. 2.5V). Both of these inputs are AC coupled through capacitors.

The CS8415A (U2) recovers the serial audio data clocks by using a PLL, whose DC detector output is filtered by the components attached to pin 8, R17 and C8/9. These audio clocks are master for the function of the rest of the audio signal processing chain and DACs.

The CS8415A communicates setup and status information to/from the Sharc via an I2C port using the SDA and SCL signals.

The status of the EMPHASIS bit in the S/PDIF stream is reflected on the /EMPH output, pin 3 or U2. This line is connected to the Sharc (U4) and allows the appropriate de-emphasis to be performed on signals which have pre-emphasis.

Errors and problems with the incoming S/PDIF stream are signaled to the Sharc in two ways. The RERR output (pin 11) of the CS8415A is connected via Q8 and R219 (forming a logic inverter) to IRQ0 of the Sharc (U4) so that problems with the audio data stream can be quickly detected and the audio outputs muted before pops, clicks, etc. can be heard. The RERR pin is also logic-OR'd with the output of a simple "missing-pulse detector" formed by Q7. This signal, 8415_CLKERR, goes high when either the CS8415A has detected a problem or the LRCLK (serial audio data frame clock) has stopped. This 8415_CLKERR signal also goes to the Sharc (U4) through the multiplexor U601.

Theory of Operation

Serial audio data comes out of U2 on pins 10, 16, 17, and 18. The audio master clock, SPDIF_256FS clocks at 256 times the audio sample rate.

The analog receiver section of the CS8415A operates off the +5V supply rail and the digital/logic sections operate off the +3.3V supply rail.

2.12 Compressed Audio Decoder

Sheet 2 of SD254175

Serial audio data and clocks from the CS8415A S/PDIF receiver are piped to the CS49329 Decoder DSP, U103. This IC operates in one of three modes, depending on the type of data being received. When the type of data coming in is detected, the firmware corresponding to the type of decoding necessary is downloaded to the CS49329 from the Sharc. Once this appropriate decoder program is running in U103, the decoder will output the decompressed audio (or in the case of stereo PCM, pass it through) on the lines 49300_AUDATA0-2, along with corresponding clocks 49300_64FS and 49300_LRCLK. The clock signals and 49300_AUDATA0 are buffered by U105, since they drive multiple inputs on the Sharc.

The CS49329 (U103) is controlled and program code downloaded from the Sharc via an 8 bit parallel bus and associated handshaking lines. U103's processor clock is derived from the clock input node labeled "10 MHZ", which is created by the Sharc's PWM1 output. This clock actually runs at 7.5 MHz. The CS49329 also has an onboard PLL for clock generation which utilizes R106 and C106/108 for detector output filter.

The CS29329 operates solely off the +2.5V supply rail. It also has separate analog and digital supplies and each individual supply pin(s) are decoupled with ferrite beads and bypass capacitors. The digital inputs and output of the CS49329 are all 3.3V-logic compatible, allowing it to interface with the 3.3V Sharc and S/PDIF receiver.

2.13 Audio Codec

Sheet 5 of SD254175

The audio codec, U401, is a CS4428A, which has stereo A-to-D converters and six D-to-A converters on it. As implemented the A-to-D converters are not used. In fact, they are powered down using an I2C control register in the part.

The codec is controlled via an I2C interface which allows the Sharc to program the device's control registers and read back status information from the device. The digital audio information is read into the codec via 3 two channel serial data lines (4228_SDIN1-3) and their associated bit and frame clocks, 49300_64FS and 49300_LRCLK, respectively. The master, 256*Fs clock in run off of the SPDIF_256FS output from the CS8415A S/PDIF receiver IC (U2).

The circuitry hanging off the codec's analog inputs (pins 16, 17, 19, & 20) is unused in the current application. This circuitry was intended to allow the unit to measure its own Left output channel in order to perform self-diagnostics and calibration of the tracking power supply. The calibration of the tracking power supply is currently performed when the unit is manufactured.

The analog inputs and outputs of the codec are internally biased and referenced around (nominally) 2.3V. This internal reference voltage is brought out at pin 18 (FILT) and bypassed to ground by C407. Since this pin is a high impedance output, no current can be drawn from it without adversely affecting the codec's performance. To match the external circuitry to the analog outputs,

Theory of Operation

one section of U402 is used to buffer a 2.3V reference derived from the regulated 5.0V supply. This external analog reference voltage is marked as “DC_BIAS” on the schematic.

The codec has a mute control output, /MUTEC, which it asserts (active low) immediately whenever it detects problems with incoming clocks or data and the outputs may become unpredictable (i.e., pops, clicks, noise, etc.). This signal is logic-AND’d with the other mute signals from the Sharc that control the power amplifiers. See the section on MUTE control for more details.

The codec’s analog sections operate from +5V supply rail with a ferrite bead and bulk capacitance decoupling. The digital section is fed from the +5V supply, also. The logic interface section is fed from the +3.3V supply to interface with the 3.3V-logic Sharc.

2.14 Codec Output Buffers and Low Pass Filters

Sheet 6 of SD254175

The six audio outputs from the codec’s DACs are fed into differential amplifiers with a gain of 3.65 (11.25dB) which subtracts out the DC bias of the codec and references the audio signal to the ground of the power amplifiers. The power amp reference is accomplished by one section of U402 OP Amp which buffers the ground signal “AMP_GND” which is sourced from the Power Amp PCB via J604, pin 13. This buffered amp ground reference is marked as “GND_REF” on the schematic. After the audio signals are referenced to the power amplifier’s ground, they are passed through a second order Low Pass filter with a corner frequency of approx. 27 kHz. These lowpass filters are used to reduce the amount of out-of-band DAC artifacts that get sent to the power amplifiers and out onto the speaker lines. The outputs of the six LPFs are then passed through a 300 Ohm, 100pF RC lowpass filter for EMI filtering to the Power Amp PCB via J604.

The OP Amps used for the buffers and LPFs are operated off of the +/-VCC supplies (+/-10V). Maximum (full-scale) audio output from DSP board is approximately 6.8Vpeak (4.8Vrms).

2.15 MUTE Controls

Sheet 8 of SD254175

The Sharc uses its FLAG5 and FLAG6 outputs to separately control the muting of the Right/Left/Center/Bass amplifiers and Surround amplifiers, respectively. These mute signals are logic-AND’d with the /MUTEC control output of the codec to provide comprehensive control of the power amplifiers mute. The Sharc will assert the mute lines (active low) under the following conditions:

• When 5-Speaker mode is NOT selected, the /LSRS_MUTE is asserted. This keeps the rear channels from making any sound or background “hiss”.

• When no S/PDIF signal is present. i.e., no audio.

• When the bass module is in the SmartSpeaker “OFF” state.

• When there has been a S/PDIF error, interruption, or sample rate change. Through the use of the S/PDIF error detection methods discussed in the S/PDIF receiver section, the Sharc can “panic mute” the power amplifiers when conditions occur that might cause undesirable artifacts to come out of the speakers. During this process, the PSC_PWM signal is also immediately sent to its minimum value.

Theory of Operation

2.16 Audio Signal Path Flow

All audio input must come into the bass module via the S/PDIF input on the RJ-45 connector. This signal is received and converted into two channels of audio data in serial format using a single data line that carries both the left and right audio sample data, one after another, a frame clock (to tell whether the data is right or left), and a bit clock. The S/PDIF receiver also generates a Master audio clock, running at 256 times the audio sample rate. Also, useful information embedded in the S/PDIF stream, such as pre-emphasis on/off and compressed data on/off, are stripped out and communicated to the Sharc.

The two channels of audio, whether they are stereo PCM information or compressed multichannel audio, are sent to the CS49329 (U103) Compressed Audio Decoder. The format of the incoming data is determined and the Sharc downloads the appropriate decompression program to the CS49329 (either PCM pass-thru, AC-3, or DTS). The CS49329's DSP then performs the necessary decompression and recovery of the audio data and sends up to 6 channels of audio out on three separate serial data lines, using the same serial format as the S/PDIF receiver.

The up-to-six channels of audio from the CS49329, along with their corresponding audio clocks are inputted into the Sharc, where Videostage® processing, equalization, dynamic equalization, limiting, tone controls, volume, etc. are performed on them. The audio data is processed in 256 sample blocks such that one block of audio data is being fed out to the D-to-A converter while the next block is being processed.

The Sharc sends the up-to-six channels of audio out to the audio codec whose D-to-A converters generate the analog audio signals that end up at the audio power amplifiers.

2.17 Signal Processing

The details of the signal processing are beyond the scope of this document, and only a general overview of the processing is presented here. There are no user controls on the bass module as all volume, tone, etc. control is accomplished via the head-end and remote control.

The basic signal processing (EQ and Videostage 5) are essentially identical to that used in the Lifestyle® Series II digital bassboxes. As with the Series II systems, volume and tone control, dynamic equalization, etc. all accomplished in the digital domain. The compressed format audio streams (AC-3 and DTS) are decoded by a separate DSP from the Sharc used to perform the Bose® processing.

2.18 Power On and Boot Up Sequence of Events

When power is first applied, the Sharc boots and loads/executes the first set of instructions found in the FLASH memory. This code is very basic and only runs power on self tests (POST) that check basic communications with all the hardware peripherals (U2, U103, U301, U302, U303, and U401) and computes the version and checksum of the code in FLASH. If all appears to be "well", the Sharc reboots and loads the actual program code that makes it function as a LS28/35 bass module. If the POST fails, the Sharc signals this by rapidly flashing (approx. 3Hz rate) the amber and green LEDs alternately for a couple of seconds and then performs a Reset and tries again.

Theory of Operation

Assuming that the POST is successful, the Sharc sets up the registers for the S/PDIF receiver (U2), codec (U401), and Compressed Audio Decoder (U103) to function as needed. The PSC_PWM control is set to its minimum value, the amplifier Mute control lines LRCB_MUTE and LSRS_MUTE are asserted (low).

After the POST has been successful and the program code is running, the DSP is initially in the SmartSpeaker “Off” state and polls the serial communications input for valid SmartSpeaker commands. It flashes the green LED briefly once every 5 seconds to signal that it is on and in the “Off” state.

2.19 Power Down Sequence

Since the bass module never really “shuts off” (it only puts the audio power amplifiers in Standby mode when sent the SmartSpeaker “Off” command), the only thing that happens when an “Off” command is received is to start sending all zero data to the D-to-A converters and mute the power amplifiers.

When power is lost, the DSP is eventually put into Reset by the master reset IC U602 when the 3.3V supply drops below 3.08V. When power comes back, the process described in “Power On and Boot Up Sequence of Events” will occur.

3. Amplifier PCB

The amplifier board consists of three integrated dual amplifier ICs that provide the six channels of required amplification. This IC, the TDA7265 manufactured by ST Microelectronics, has thermal and short-circuit protection built-in. The five satellite channels directly use the output of these amplifier chips, whereas the bass channel, due to its need to deliver high current, is buffered (in complimentary emitter-follower configuration) by power transistors Q601 and Q602. These transistors provide the necessary current gain required to drive the low impedance bass speaker.

All six amplifier channels have a voltage gain factor of 3.5 (11.0 dB) with flat frequency response.

3.1 Mute Circuit

The amplifier chips operate in standby mode (no output and low power consumption) until the mute pin (pin 5) is pulled 6 volts below the +V power supply (pin 3). This is accomplished by current source transistor Q401 for the surround amp IC (U1) and Q603 for all other channels (U2 and U3). These current sources are controlled by the DSP board mute lines LSRS_mute and LRCB_mute. These signals are either 0 VDC (muted) or 3.3VDC (unmuted).

If the positive supply rail falls below 9 volts the amplifier chips will mute. This feature is primarily used to prevent turn-on or turnoff pop. Under this condition, diode ZR2 and transistor Q604 turnoff and this in-turn causes unmute transistors Q401 and Q603 to turnoff.

3.2 DC Offset Circuit

All six amplifier channels are summed together through 100K resistors (R105, R506, R605, R305,R405,R609) and low pass filtered by capacitor C1 to create an average DC voltage that is normally 0 VDC. If a fault condition occurs, where any one or more amps experience a sustained DC shift of more than 5 volts, transistor Q1 (for a positive fault) or Q6/Q7 (for a negative fault) will turn-on and pull-down J2 pin 24 voltage from 5 Volts to 0 Volts. This signals the power supply board that there is a fault condition.

Theory of Operation

3.3 Clip Detect Circuit

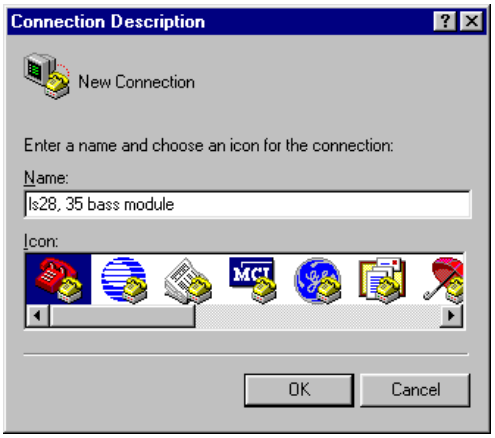
The satellite clip detect circuit consists of diodes D401, D101, D301 and transistors Q3 and Q4 (upper left section of sheet 2). Q4 and Q3 are normally OFF. At high volume levels, if any one of the satellite amplifier outputs comes within 2 volts of the positive power supply rail, Q4 and Q3 turn ON and signal the DSP board through SAT_CLIP that compression is needed.

Similarly, the bass clip detect circuit consists of transistors Q5 and Q2. Note: this circuit has been deleted in later production, due to the DSP board making its own determination as to whether a clip condition exists.

Setting up a computer to issue TAP commands

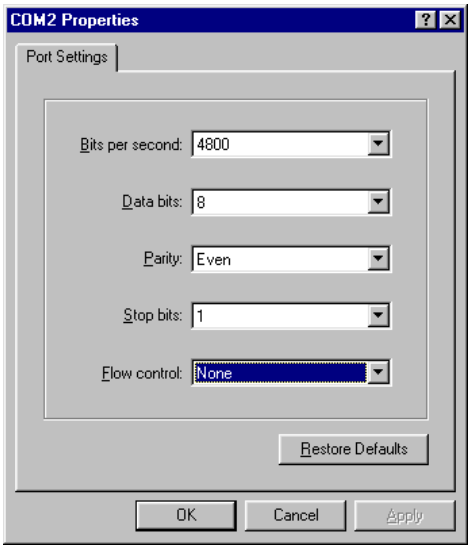
1. Open a terminal window. Click: Start/Program/Accessories/Hyperterminal/Hyperterminal

2. In the “Connection Description” window, type the name “LS28, 35 bass module test” then click “OK”; any name may be entered.

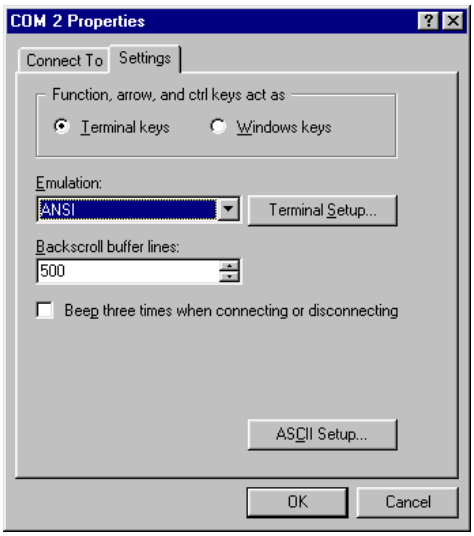


3. In the “Connect To” window, select the COM port on your computer that you will be connecting the bass module to and then click OK.

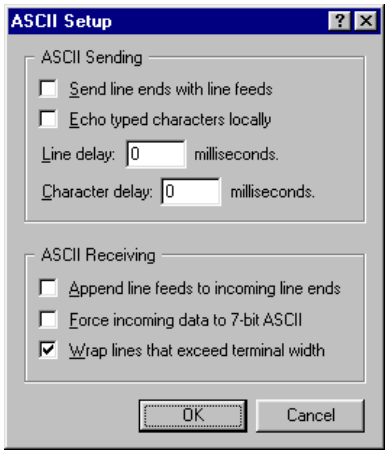
4. In the “COM1 Properties” window, make the selections in the various fields as shown.



5. In the Hyper Terminal window, click on File/Properties. In the Properties window, click on the Settings tab, make the selections in the various fields as shown.



6. In the Settings window, click on ACSII setup and make the selections and changes as shown



Placing the Bass Module into TAP Mode

! Place all four DIP switches to the down position before returning the unit to the customer !

1. Place the bass module into TAP mode

1.1 Set all four DIP switches into the "up" position. Apply power to the bass module using the AC line switch and wait until the amber LED blinks twice and the green LED blinks briefly at least once (approximately 3 seconds after power up). Then, within twenty seconds, flip ALL four switches down, then flip switch #4 (closest to the RJ-45 connector) back up. The unit will now communicate in TAP mode. The amber and green LED will blink alternately when no S/PDIF signal is applied. Note that when TAP mode is activated in this manner, the DSP will echo characters sent by the terminal.

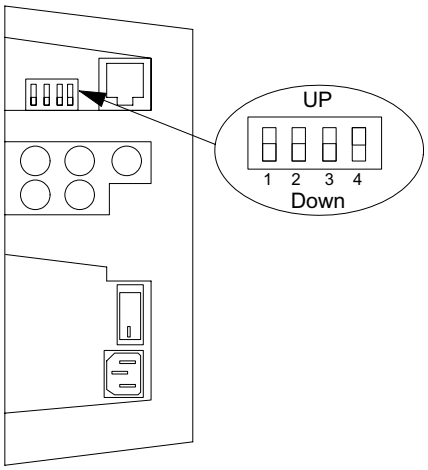


Figure 1. DIP switch Up/Down orientation

2. Verify the bass module communicates in TAP mode.

2.1 Connect the test cable's, part number 264564, DB-9 connector to the RS-232 COM port on your computer. Connect the test cable's RJ-45 connector to the bass module.

2.2 Type the command ST S and hit "Enter". The following response should be seen on your computer screen. The results may differ depending on the unit settings. If no S/PDIF signal is applied, the sample rate will be 29 kHz.

SAMPLE RATE : 44101.30
SPKR TYPE : 02
DIP VALUE : 1111
LCRB_MUTE : 1
LSRS_MUTE : 1
SAT_CLIP : 1
BASS_CLIP : 1
EURO_BASS : 1
EURO_TREBLE: 0

2.3 Check the software by typing (issuing) the command TN 4 and then hitting "Enter". A typical response would be as follows.
03DE6455, 010808
03DE6455 is the checksum
010808 is the software version

Equalizer Programming Method

Type the equalization setup command SE [SPEAKER TYPE], [EUROPEAN BASS], [EUROPEAN TREBLE]

Command	Condition		
	SPEAKER TYPE	**EURO BASS**	**EURO TREBLE**
SE	F = falcon	ON/OFF	ON/OFF
	D = doubleshot		
	C = cricket		
	B = dublin		
	M = mariner		
	U = Installer		

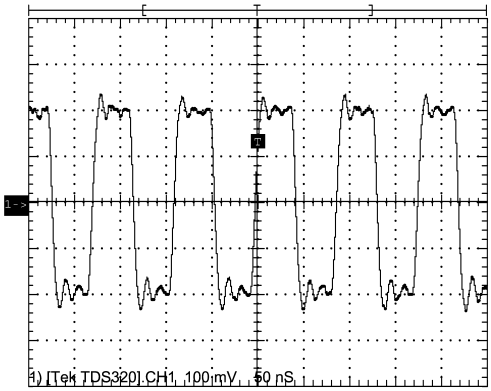
Example: To set the equalization to cricket cubes, euro bass off and euro treble off, type the command as follows. SE C,OFF,OFF

Verify the changes have been made by typing the command ST S.
The speaker type (SPKR TYPE) and other information will be displayed. Decode the numerical two digit speaker type as follows.

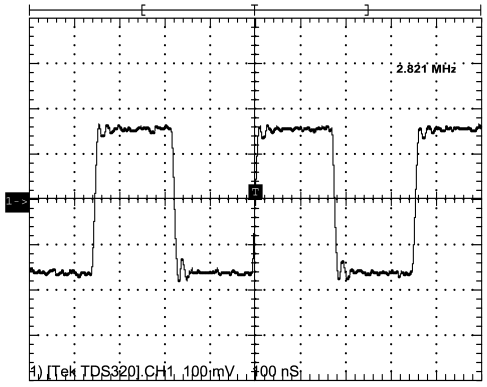
00 Falcon (Early version dual cube)
01 Doubleshots (Later version dual cube)
02 Cricket (Jewel® Cube)
03 Dublin (Single Cube)
04 Mariner (151 environmental speakers)
05 User EQ (Installer)

Scope Photos

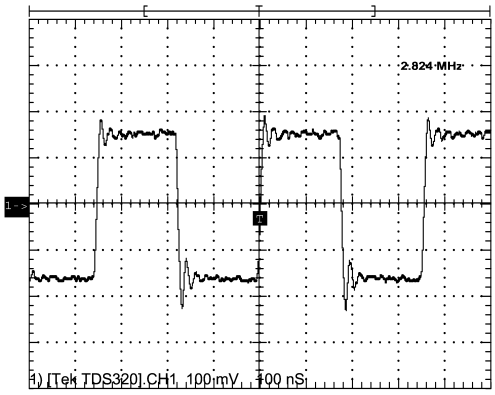
(x10 probe used)



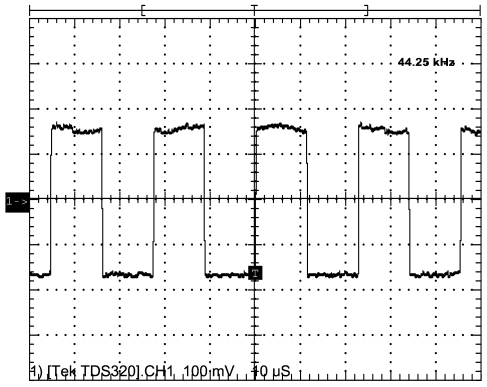
DSP PCB, U2 Pin 10, S/PDIF _256FS



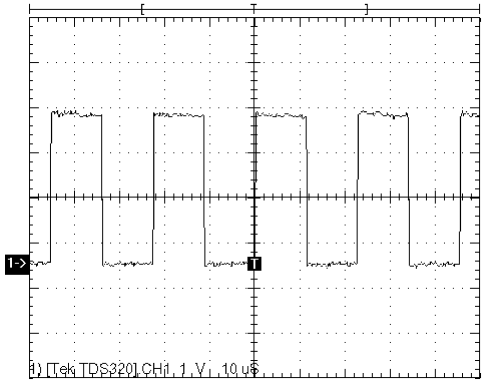
DSP PCB, U103 Pin 25, S/PDIF _64FS



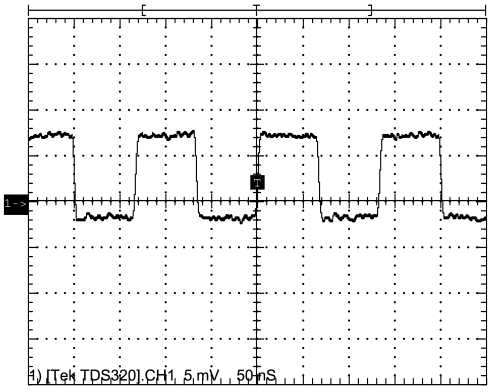
DSP PCB, U2 Pin 16, S/PDIF _64FS



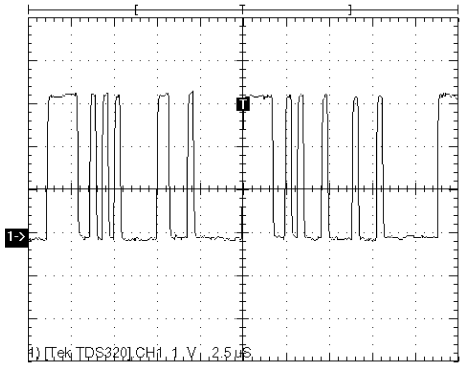
DSP PCB, U103 Pin 26, S/PDIF LRCLK



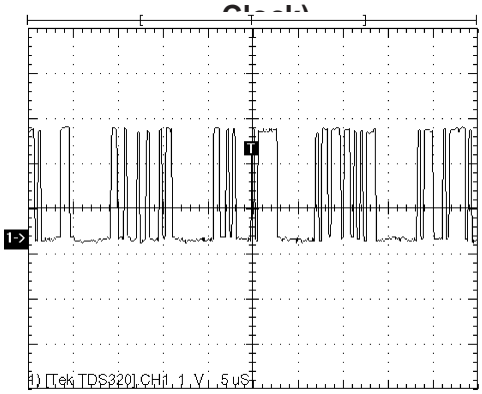
DSP PCB, U2 Pin 17, LRCLK



DSP PCB, U103 Pin 30, 10 MHZ (7.5 MHZ Clock)



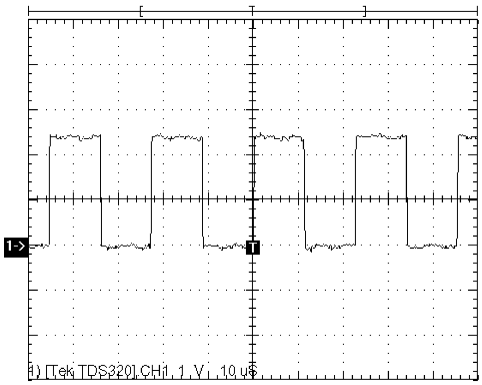
DSP PCB, U2 Pin 18, SERIAL DATA OUTPUT



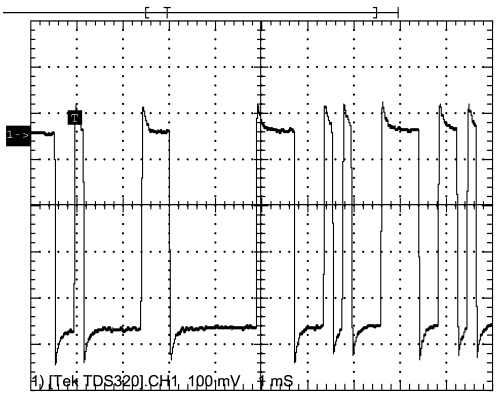
DSP PCB, U103 Pin 41, AUDATA0

Scope Photos

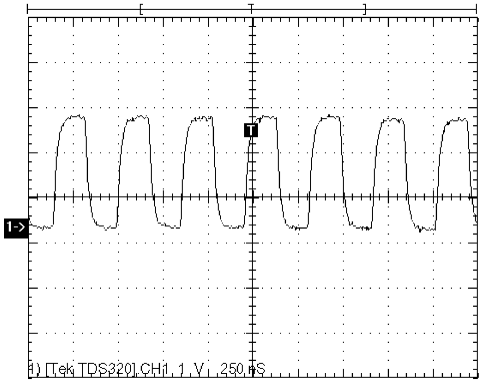
(x10 probe used)



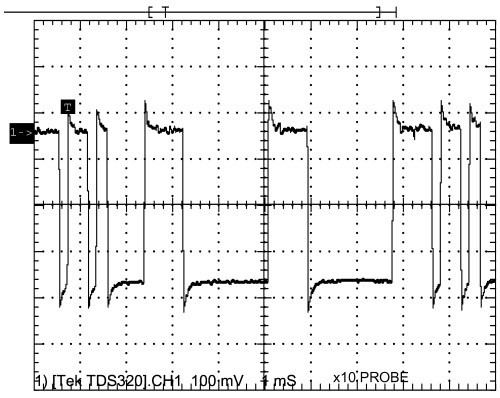
DSP PCB, U103 Pin 42, LRCLK



DSP PCB, Q6 Collector, Serial Data XMT.

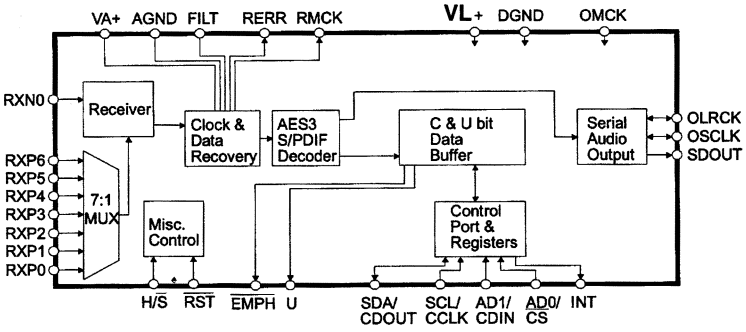


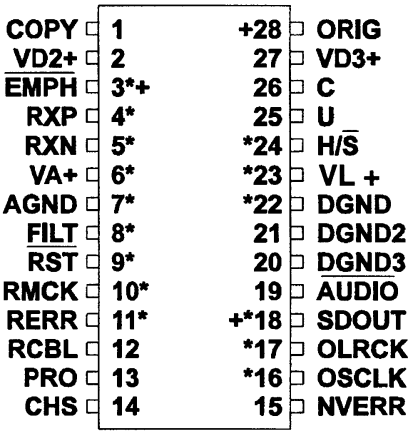
DSP PCB, U103 Pin 43, _64FS



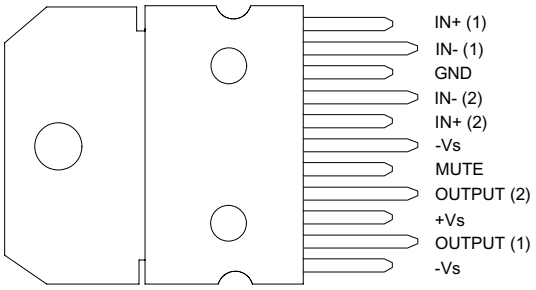
DSP PCB, U3 Pin 13, SERIAL DATA RCV.

Integrated Circuit Diagrams

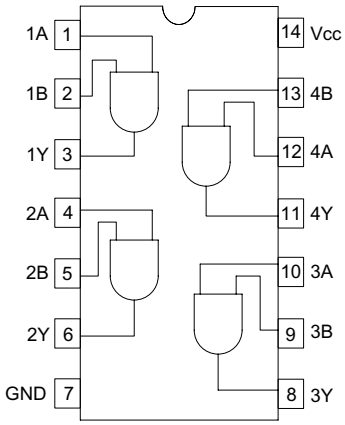




CS8415A, SPDIF receiver
part number 254193-001



TDA7265, power amp, 2 x 25W
part number 256084-001

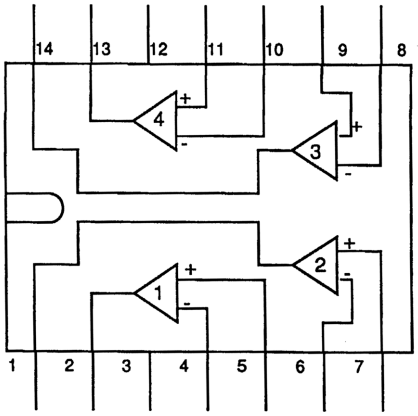


Truth Table

A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

And gate, quad 2-input, CMOS
part number 256124-001

Pin	Connection
1	Output 2
2	Output 1
3	V+
4	INPUT 1-
5	INPUT 1+
6	INPUT 2-
7	INPUT 2+
8	INPUT 3-
9	INPUT 3+
10	INPUT 4-
11	INPUT 4+
12	GND
13	OUTPUT 4
14	OUTPUT 3



LM339, voltage comparator
part number 187618-001

Integrated Circuit Diagrams

DSP ADSP21065LKS
part number 254191-001

Pin	Type	Function
ADDR 23-0	I/O/T	**External Bus Address**. The ADSP-21065L outputs addresses for external memory and peripherals on these pins. In a multiprocessor system the bus master outputs addresses for read/writes of the internal memory or IOP registers of other ADSP-21065L. The ADSP-21065L inputs addresses when a host processor or multiprocessing bus master is reading or writing its internal memory or IOP registers.
DATA 31-0	I/O/T	**External Bus Data.** The ADSP-21065L inputs and outputs data and instructions on these pins. The external data bus transfers 32-bit single-precision floating-point data and 32-bit fixed-point data over 31-0. 16-bit short word data is transferred over Bits 15-0 of the bus. Pull-up resistors on unused DATA pins are not necessary.
$\overline{\text{MS}}_{3\text{-}0}$	O/T	**Memory Select Lines**. These lines are asserted (low) as chip selects for the corresponding banks of external memory. Internal ADDR25-24 are decoded into MS 3-0 . The MS 3-0 lines are decoded memory address lines that change at the same time as the other address lines. When no external memory access is occurring, the MS 3-0 lines are inactive. They are active, however, when a conditional memory access instruction is executed, whether or not the condition is true. Additionally an MS O which is mapped to SDRAM may be asserted even when no SDRAM access is active. In a multiprocessor system, the MS 3-0 lines are output by the bus master.
$\overline{\text{RD}}$	I/O/T	**Memory Read Strobe.** This pin is asserted (low) when the ADSP-21065L's reads from external memory devices or from the internal IOP register of another ADSP-21065L. External devices (including other ADSP 21065L's) must assert RD to read from the ADSP-21065L's internal IOP registers. In a multi-processor system RD is output by the bus master and is input by all other ADSP-21065L.
$\overline{\text{WR}}$	I/O/T	**Memory Write Strobe.** This pin is asserted (low) when the ADSP-21065L writes to external memory devices or to the internal memory of other ADSP-21065L's. External devices must assert WR to write to the ADSP-21065L's IOP registers. In a multiprocessor system WR is output by the bus master and is input by all other ADSP-21065L.
$\overline{\text{SW}}$	I/O/T	**Synchronous Write Select**. This signal is used to interface the ADSP-21065L to synchronous memory devices (including other ADSP-21065L). The ADSP-21065L asserts SW (low) to provide an early indication of an impending write cycle, which can be aborted if WR is not later asserted (e.g. in a conditional write instruction). In a multiprocessor system, SW is output by the bus master and is input by all other ADSP-21065L to determine if the rnultiprocessor memory access is a read or write. SW is asserted at the same time as the address output.
ACK	I/O/S	**Memory Acknowledge.** External devices can deassert ACK (low) to add wait states to an external memory access.. ACK is used by I/O devices, memory controllers or other peripherals to hold off completion of an external memory access. The ADSP-21065 deasserts ACK as an output to add wait states to a synchronous access of its IOP registers. In a multiprocessor system, a slave ADSP-21065 deasserts the bus master's ACK input to add wait state(s) to an access of its IOP registers. The bus master has a keeper latch on its ACK pin that maintains the input at the level it was last driven.
$\overline{\text{SBTS}}$	I/S	**Suspend Bus Three-State.** External devices can assert SBTS (low) to place the external bus address, data, selects, and strobes, but not SDRAM pins in a high impedance state for the following cycle. If the ADSP-21065L attempts to access external memory while SBTS is asserted, the processor will halt and the memory access will not be completed until SBTS is deasserted. SBTS should only be used to recover from PAGE faults or host processor/ADSP-21065L deadlock.
$\overline{\text{IRQ}}_{2\text{-}0}$	I/A	**Interrupt Request Lines.** May be either edge-triggered or level-sensitive.

Integrated Circuit Diagrams

DSP ADSP21065LKS
part number 254191-001

Pin	Type	Function
FLAG 11-0	I/O/A	**Flag Pins.** Each is configured via control bits as either an input or an output. As an input, it can be tested as a condition. As an output, it can be used to signal external peripherals.
____ HBR	I/A	**Host Bus Request.** Must be asserted by a host processor to request control of the ADSP-21065L's external bus. When HBR is asserted in a multiprocessing system, the ADSP-21065L that is bus master will relinquish the bus and assert HBG. To relinquish the bus, the ADSP-21065L places the address, data, select, and strobe lines in a high impedance state. HBR has priority over all ADSF-21065L bus requests (BR 2-1) in a multiprocessing system.
____ HBG	I/0	**Host Bus Grant.** Acknowledges an HBRbus request, indicating that the host processor may take control of the external bus. HBG is asserted by the ADSP-21065L until HBR is released. In a Multiprocessing system, HBG is output by the ADSP-21065L bus master.
___ CS	I/A	**Chip Select.** Asserted by host processor to select the ADSP-21065L.
REDY (O/D)	O	**Host Bus Acknowledge.** The ADSP-21065L de-asserts REDY to add wait states to an asynchronous access of its internal memory or IOP registers by a host. Open drain output (O/D) by default can be programmed in ADREDY bit of SYSCON register to be active drive (A/D). REDY will only be output if the CS and HBR inputs are asserted.
______ DMAR1	I/A	DMA **Request 1** (DMA Channel 9).
______ DMAR2	I/A	DMA **Request 2** (DMA Channel 8).
______ DMAG1	O/T	DMA **Grant 1** (DMA Channel 9).
______ DMAG2	O/T	DMA **Grant 2** (DMA Channel 8).
_____ BR 2-1	I/O/S	**Multiprocessing Bus Requests.** Used by multiprocessing ADSP-21065Ls to arbitrate for bus master ship. An ADSP-21065L drives its own BRx line (corresponding to the value of its ID 2-0 inputs) only and monitors all others. In a uniprocessor system tie both BRx pin to V DD
ID 1-0	I	**Multiprocessing ID**. Determines which multiprocessing bus request (BR 1 -BR 2) is used by ADSP-21065L. ID = 01 corresponds to BR 1 , ID = 10 corresponds to BR 2 , etc. ID = 00 in single-processor systems. These lines are a system configuration selection which should be hardwired or changed only at reset.
____ CPA (O/D)	I/O	**Core Priority Access.** Asserting its CPA pin allows the core processor of an ADSP-21065L bus slave to interrupt background DMA transfers and gain access to the external bus. CPA is an open drain output that is connected to all ADSP-21065Ls in the system. The CPA pin has an internal 5 k pull-up resistor. If core access priority is not required in a system, the CPA pin should be left unconnected.
DTxX	O	**Data Transmit** (Serial Ports 0, 1; channels A, B). Each DTxX pin has a 50k internal pull-up resistor.
DRxX	I	**Data Receive** (Serial Ports 0, 1;channels A, B). Each DRxX pin has a 50 k internal pull-up resistor.
TCLKx	I/O	**Transmit Clock** (Serial Porcs 0, 1). Each TCLKx pin has a 50 k internal pull-up resistor.
RCLKx	I/O	**Receive Clock** (Serial Ports 0. 1). Each RCLKx pin has a 50 k . internal pull-up resistor.
TFSx	I/O	**Transmit Frame Sync** (Serial Ports 0, 1).
RFSx	I/O	**Receive Frame Sync** (Serial Ports 0, 1).

Integrated Circuit Diagrams

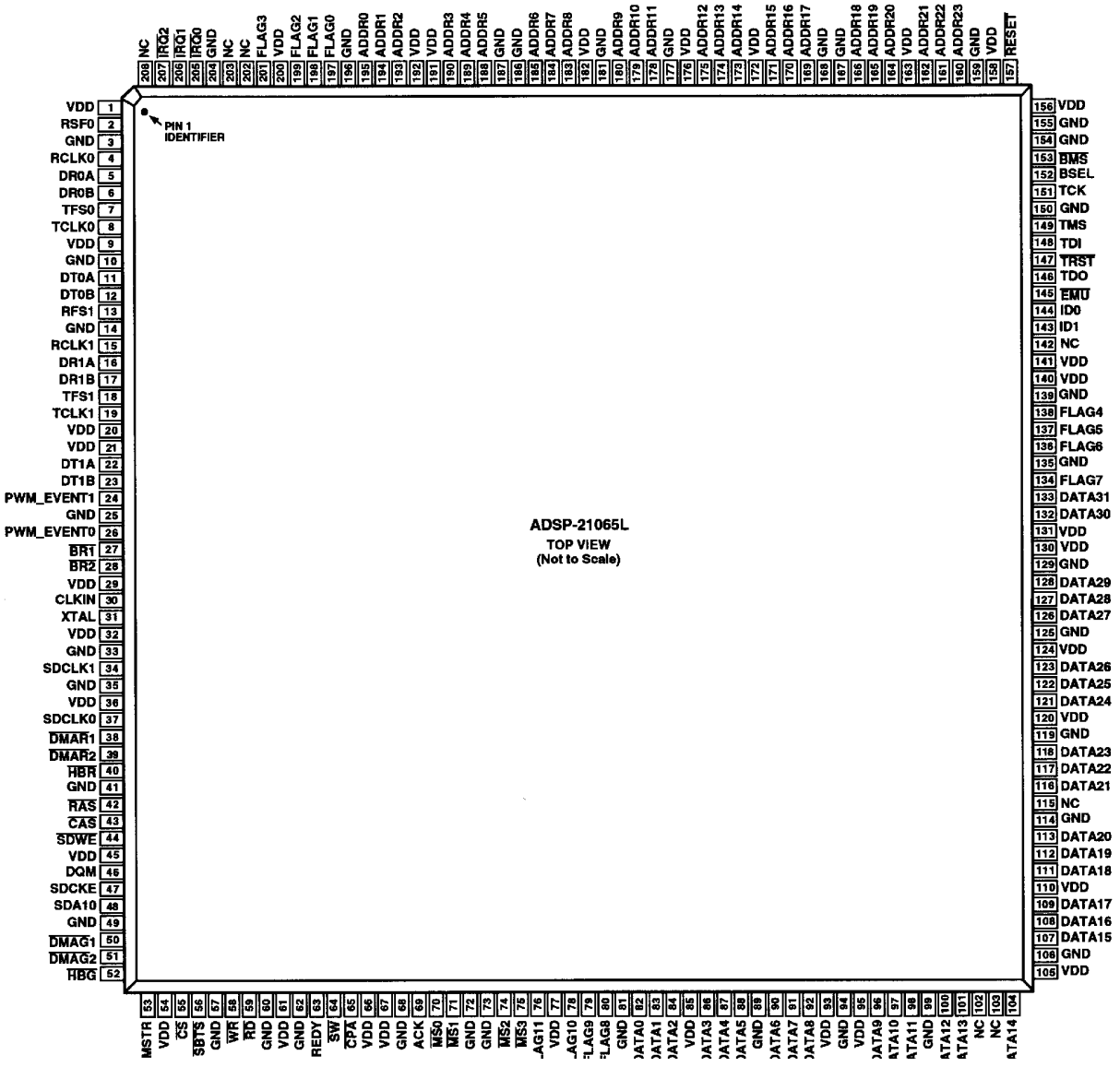
DSP ADSP21065LKS
part number 254191-001

<table>
<tr><th>Pin</th><th>Type</th><th>Function</th></tr>
<tr><td>BSEL</td><td>I</td><td>EPROM Boot Select. When BSEL is high, the ADSP-21065L is configured for booting from 8-bit EPROM. When BSEL is low, the BSEL and BMS inputs determine booting mode. See BMS for details. This signal is a system configuration selection which should be hardwired.</td></tr>
<tr><td>____
BMS</td><td>I/O/T*</td><td>Boot Memory Select. Output Used as chip select for boot EPROM devices (when BSEL = 1). In a multiprocessor system, BMS is output by the bus master. Input: When low, indicates that no booting will occur and that ADSP-21065L will begin executing instructions from external memory. See table below. This input is a system configuration selection which should be hardwired. *Three-statable only in EPROM boot mode (when BMS is an output).
<table>
<tr><th>BSEL</th><th>BMS</th><th>Booting Mode</th></tr>
<tr><td>I</td><td>Output</td><td>EPROM (Connect BMS to EPROM chip select.)</td></tr>
<tr><td>0</td><td>1 (Input)</td><td>Host Processor (HBW [SYSCON] bit select host bus width).</td></tr>
<tr><td>0</td><td>0 (Input)</td><td>No Booting. Processor executes from external memory.</td></tr>
</table></td></tr>
<tr><td>CLKIN</td><td>I</td><td>Clock In. Used in conjuction with XTAL, configures the ADSP-21065L to use either its internal clok generator or an external clock source. The external crystal should be rated at 1x frequency. Connecting necessary components to CLKIN and XTAL enables the internal clock generator. The ADSP-21065L’s internal clock generator multiplies the 1x clock to generate 2x clock for its core and SDRAM. It drives 2x clock out on the SDCLKx pins for SDRAM interface to use. See also SDCLKx Connecting the 1x external clock to CLKIN while leaving XTAL unconnected configures configures the ADSP-21065L to use the external clock source. The instruction cycle rate is 2x CLKIN. CLKIN may not be halted, changed. or operated below the specified frequency.</td></tr>
<tr><td>_____
RESET</td><td>I/A</td><td>Processor Reset. Resets the ADSP-21065L to a known state and begins execution at the program memory location specified by the hardware reset vector address. This input must be asserted (low) at power-up.</td></tr>
<tr><td>TCK</td><td>I</td><td>Test Clock (JTAG). Provides an asynchronous clock for JTAG boundary scan.</td></tr>
<tr><td>TMS</td><td>I/S</td><td>Test Mode Select JTAG). Used to control the test state machine. TMS has a 20 k internal pull-up resistor.</td></tr>
<tr><td>TDI</td><td>I/S</td><td>Test Data Input (JTAG). Provides serial data for the boundary scan logic. TDI has a 20 k internal pull-up resistor.</td></tr>
<tr><td>TDO</td><td>O</td><td>Test Data Output (JTAG). Serial scan output of the boundary scan path.</td></tr>
<tr><td>_____
TRST</td><td>I/A</td><td>Test Reset (JTAG). Resets the test state machine. TRST must be asserted (pulsed low) after power-up or held low for proper operation of the ADSP-21065L. TRST has a 20 k internal pull-up resistor.</td></tr>
<tr><td>____
EMU (O/D)</td><td>O</td><td>Emulation Status. Must be connected to the ADSP-21065L EZ-ICE target board connector only.</td></tr>
<tr><td>BMSTR</td><td>O</td><td>Bus Master Output. In a multi pprocessor system, indicates whether the asserted ADSP-21065L is current bus master of the shared external bus. The ADSP-21065L drives the BMSTR high only while it is the bus master. In a single - processsor system (ID- 00), the processor drives this pin high.</td></tr>
<tr><td>CAS</td><td>I/O/T</td><td>SDRAM Column Access Strobe. provides the column address. In conjunction with RAS MSx, SDWE, SDCLK and sometimes SDA10, defines the operation for the SDRAM to perform.</td></tr>
<tr><td>____
RAS</td><td>I/O/T</td><td>SDRAM Row Access Strobe. provides the column address. In conjunction with CAS MSx, SDWE, SDCLK and sometimes SDA10, defines the operation for the SDRAM to perform.</td></tr>
</table>

Integrated Circuit Diagrams

DSP ADSP21065LKS, part number 254191-001

Pin	Type	Function
SDCLK 1-0	I/O/S/T	**SDRAM 2x Clock Output.** In systems with multiple SDRAM devices connected in parallel, supports the corresponding increase clock load requirements, eliminating need of off-chip clock buffers. Either SDCLK 1 , or both SDCLKx pins can be tri-stated.
_____ SWDE	I/O/T	**SDRAM Write Enable.** in conjunction with CAS MSx, RAS, SDCLKx and sometimes SDA10, defines the operation for the SDRAM to perform.
DQM	O/T	**SDRAM Data Mask.** In write mode DQM has a latency of zero and is used to block write operations.
SDCKE	I/O/T	**SDRAM Clock Enable.** Enables and disables the CLK signal.
SDA10	O/T	**SDRAM A10 Pin.** Enables applications to refresh an SDRAM in parallel with a host access.
XTAL	O	**Crystal Oscillator Terminal.** Used in conjunction with CLKIN to enable the ADSP-21065L's internal clock generator or to disable it to use an external clock source. See CLKIN
_____ PWM_EV ENT 1-0	I/O/A	**PWM Output Event Capture.** In PWMOUT mode, is an output pin and functions as a timer counter. In WIDTH_CNT mode, is an input pin and function as a pulse counter.event capture.
VDD	P	**Power Supply**; Nominally +3.3Vdc (33pins)
GND	G	**Power Supply Return.** (30 Pins)
NC		**Not Connect.** Reserved pins which must be left open and unconnected



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Digital Acoustimass® Powered Speaker
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Troubleshooting Guide
Part Number 268795-TS
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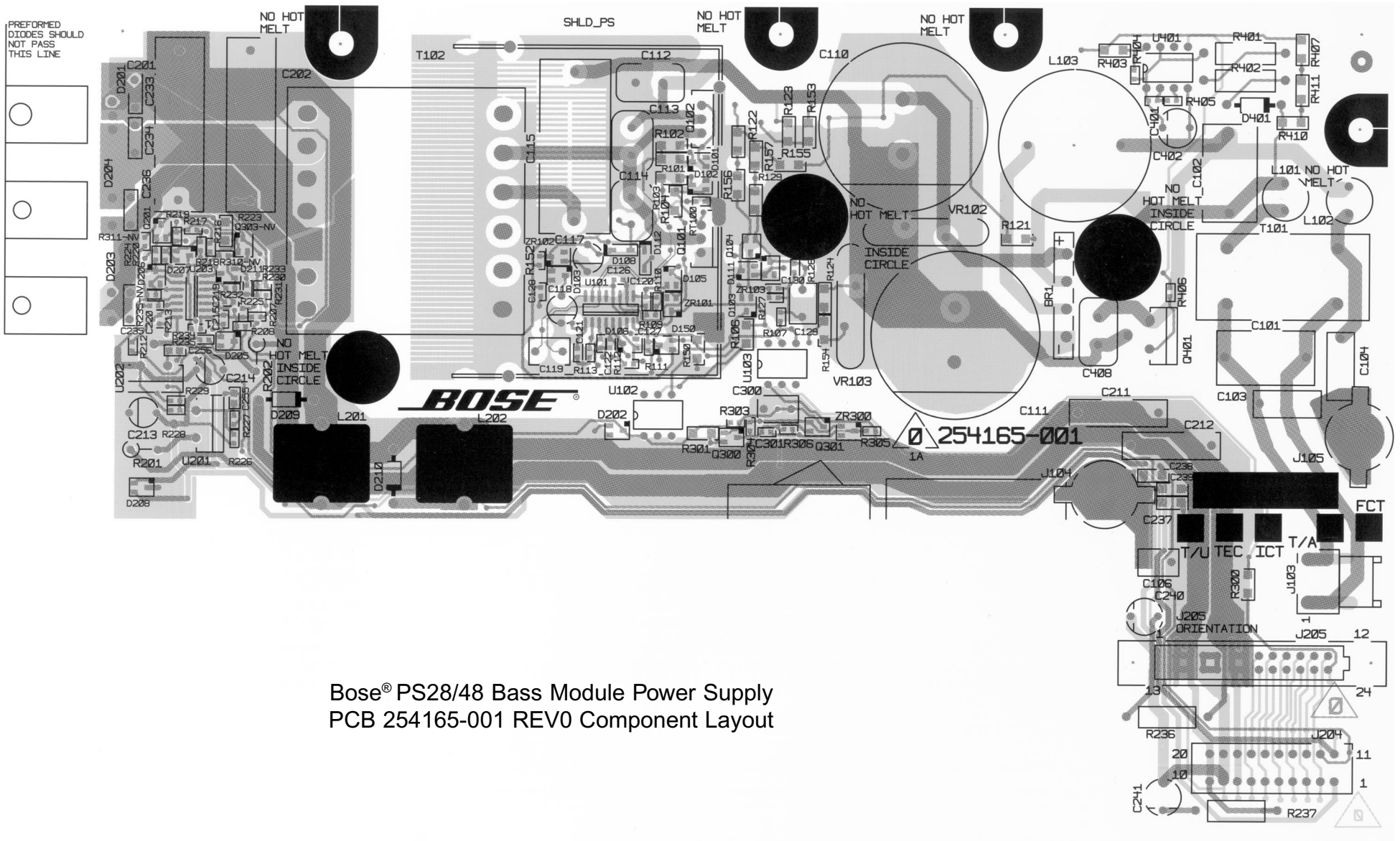
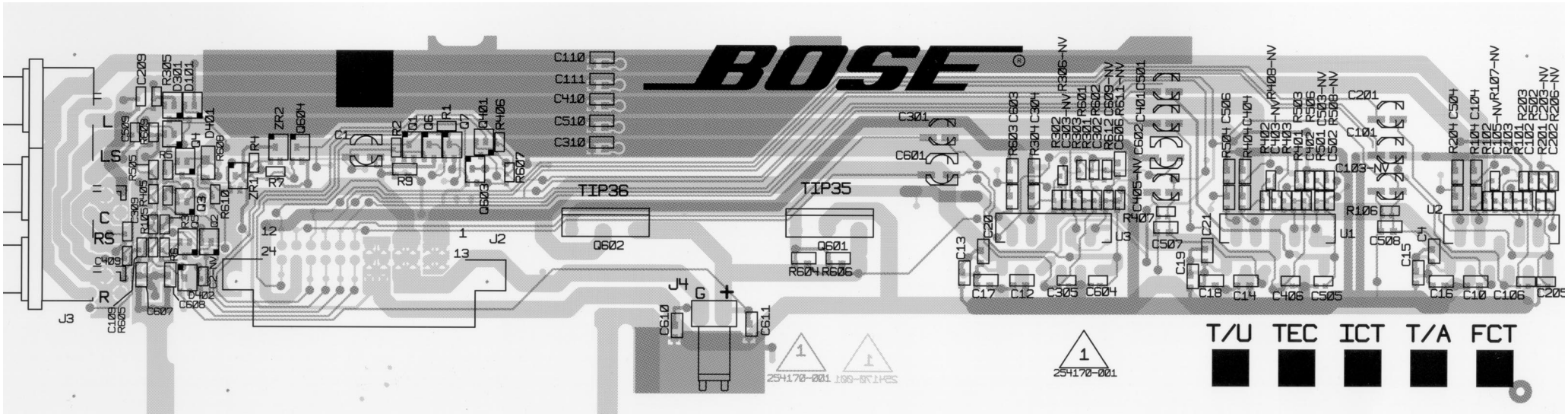
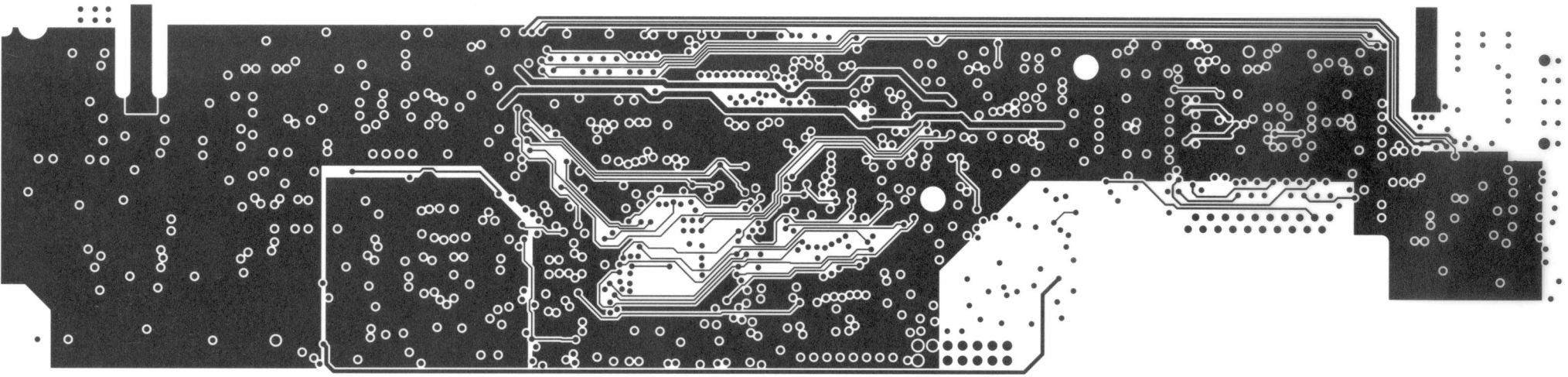


Bose® PS28/48 Bass Module Power Supply
PCB 254165-001 REV0 Component Layout

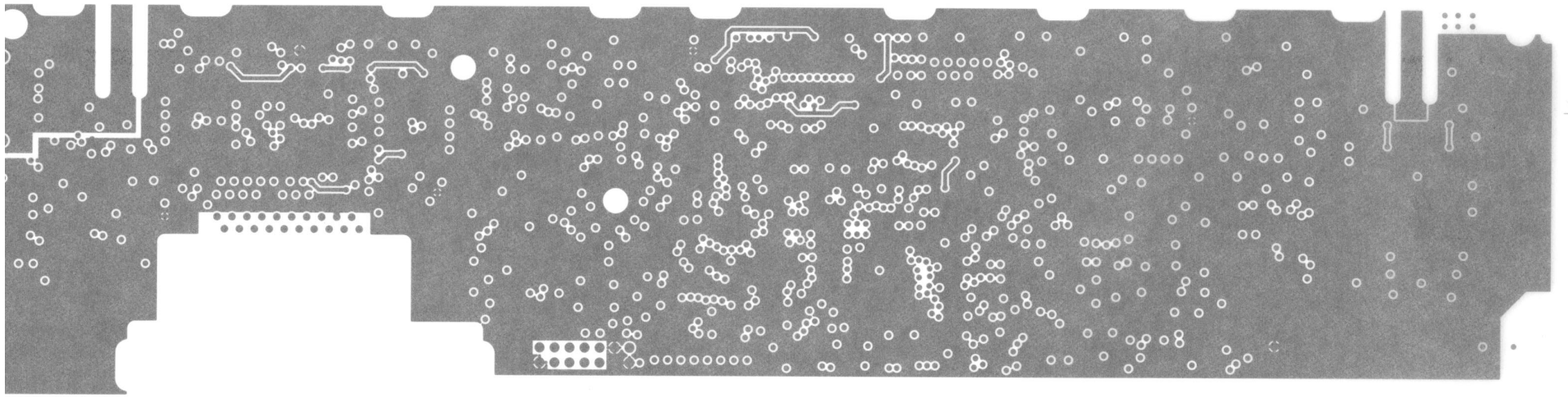


Bose® PS28/48 Bass Module Amplifier
PCB254170 REV01 Component Layout

Bose® PS28/48 Bass Module DSP
PCB 254175-001 REV01 Power Plane-Layer 2



Bose® PS28/48 Bass Module
PCB254175-001 REV01 Ground Plane-Layer 3



Bose® PS28/48 Bass Module DSP
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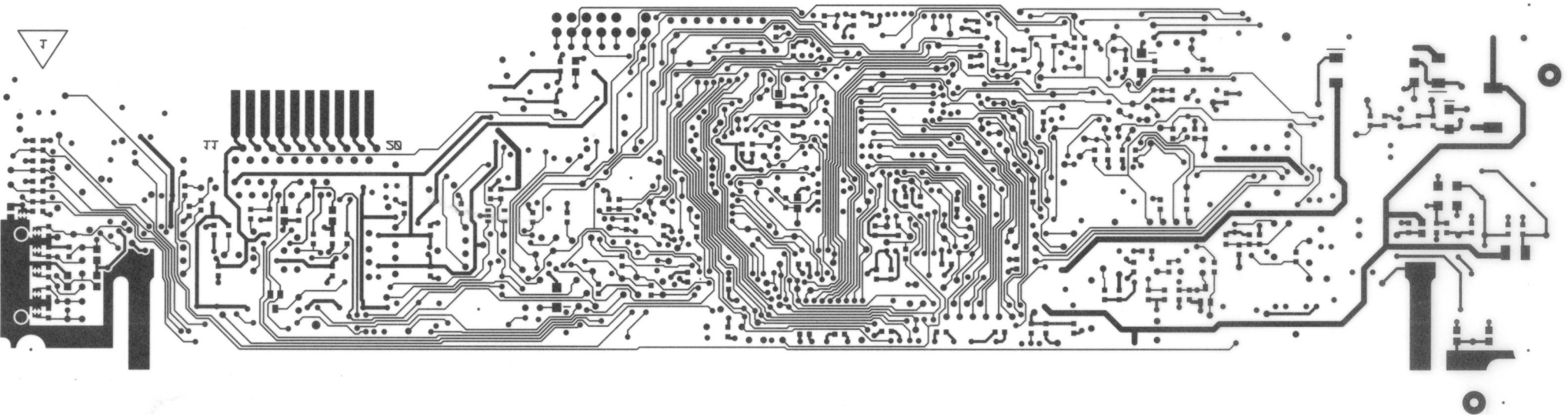

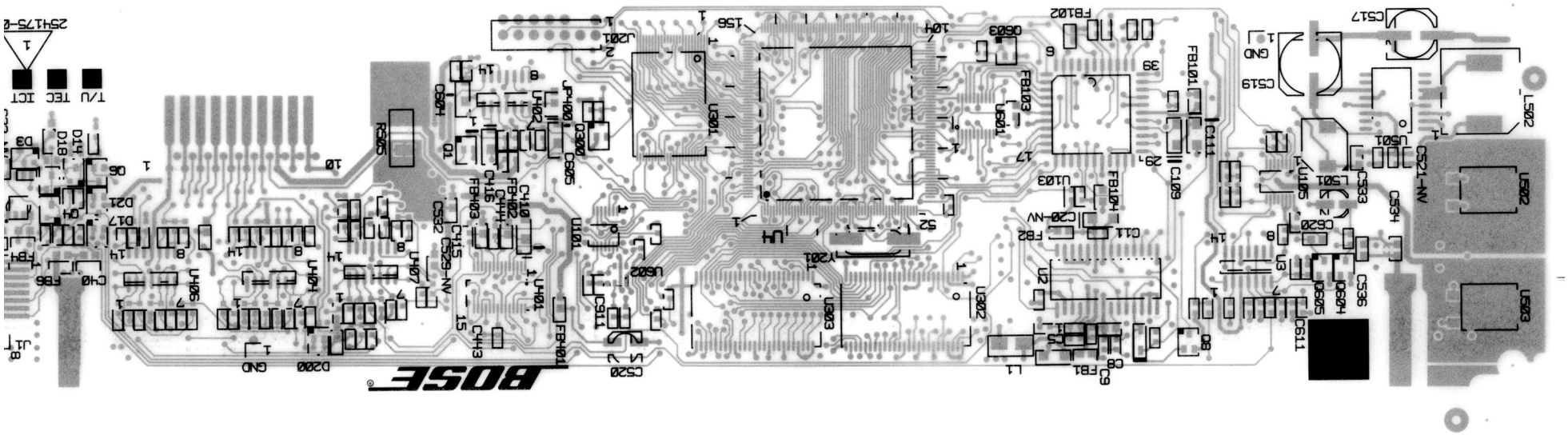

Bose® PS28/48 Bass Module DSP
PCB254175-001 REV01 Topside


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D204
D203
C233
C234
C201
C202
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Q201
R219
R217
R223
R218
R216
R224
R220
D207
D206
D211
R238
R232
R233
R230
R231
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C235
C220
C219
R213
R225
R207
C215
R208
R234
R235
D205
R212
U202
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R202
C214
R237A
C241A
J204A
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R228
C255
U201
R227
R226
R201
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J205A
C240A
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J101_B4
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C113
Q102
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R101
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GL3

GL2

GL1

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Q602A Q601A R604A R606A

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Q602B Q601B R604B R606B

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GL3


GL1
GL2
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L502
U501
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C519
L501
C620
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RT600
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R654
R616
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R32
R35
R31
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R26
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FB1
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FB4
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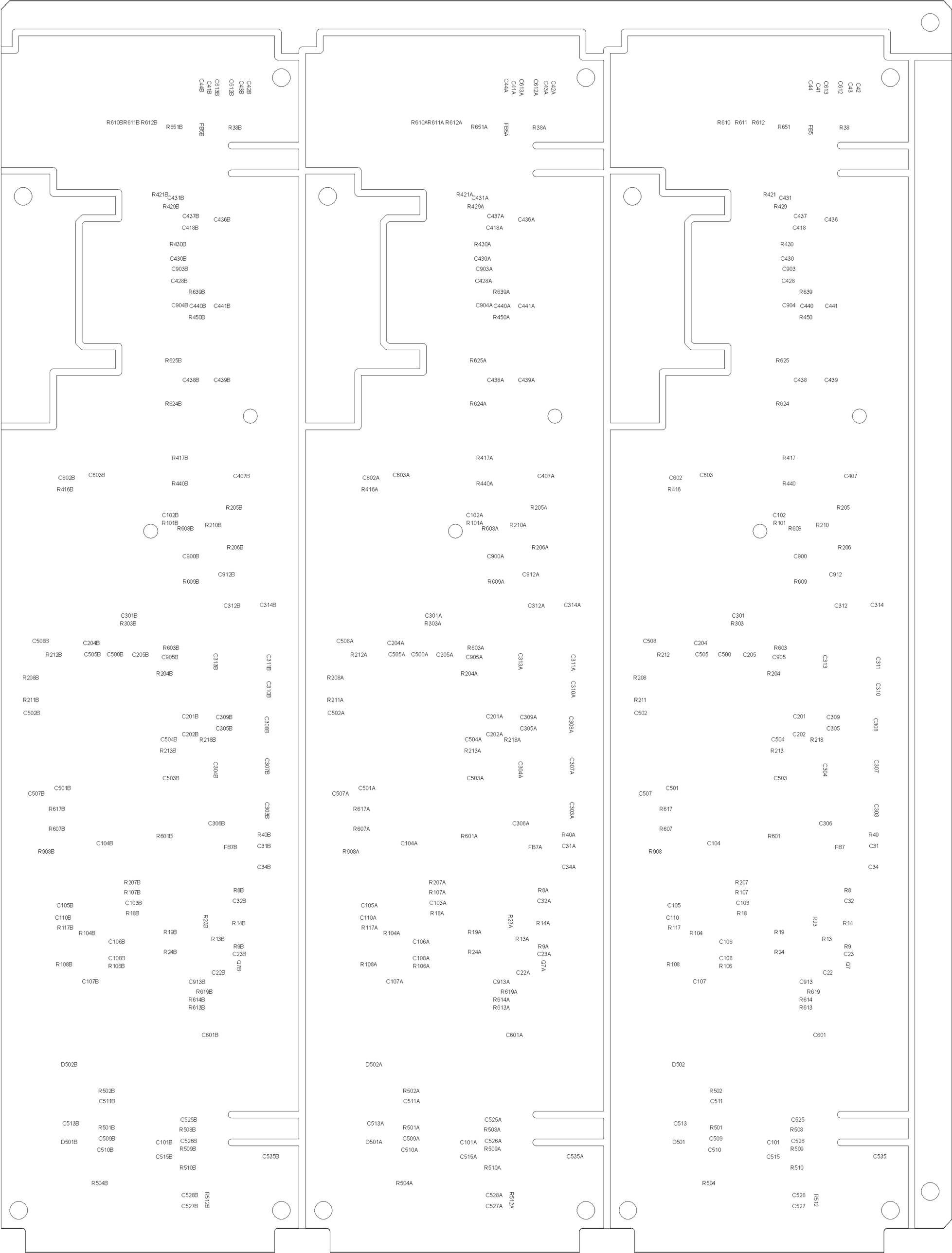
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R625 C438 C439 R624
R417 C602 C603 C407 R416 R440
C102 R101 R608 R210 R205 R206 C900 R609 C912 C312 C314
C301 R303
C508 C204 R212 C505 C500 C205 R603 C905 R204 C313 C311 C310 R208 R211 C502 C201 C309 C305 C202 C504 R218 R213 C308 C307 C503 C304 C501 C507 R617 R607 C306 C303 R601 C104 R908 FB7 R40 C31 C34
R207 R107 C103 R18 C105 C110 R117 R104 C106 C108 R106 R108 C107 R8 C32 R23 R14 R19 R13 R9 C23 Q7 C22 R24 C913 R619 R614 R613
C601
D502 R502 C511 C513 R501 C509 D501 C510 C525 R508 C526 R509 C101 C515 R510 C535 R504 C528 C527 R512

PS28/48 General Test Procedures

1. Initial Product Test
Note: Before taking the unit apart or performing any repair process, an attempt to verify the customer complaint must be made.

1.1 Read any customer note included with the unit.

2. Attempt to verify the complaint before opening the unit or performing any repairs.

2.1 Customer complaint not verified, discuss with customer.

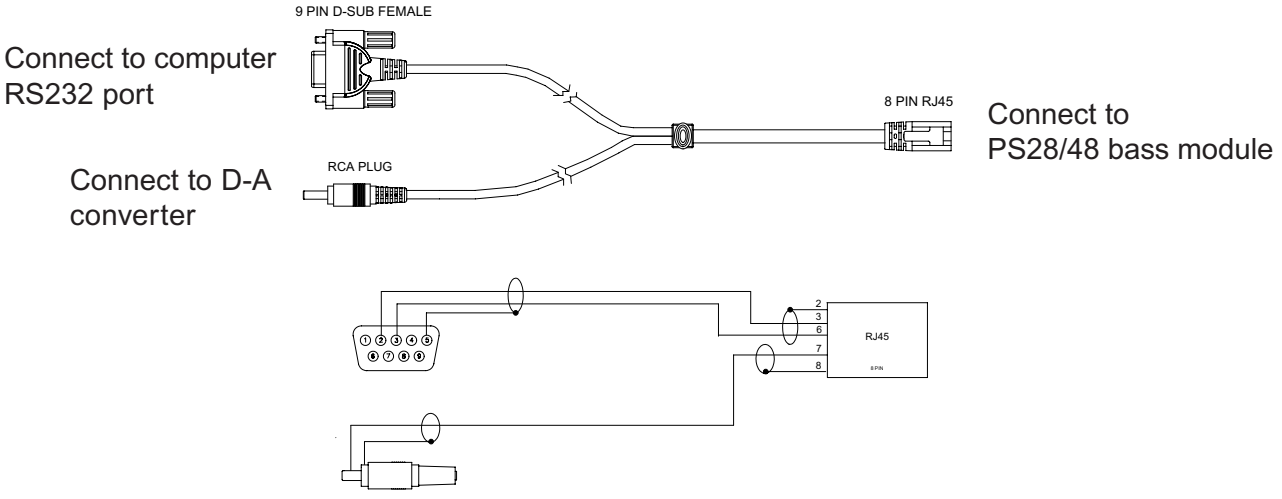
2.2 Customer complaint verified, troubleshoot and repair the unit. Refer to the PS28/28 Troubleshooting Tips/Preventative Repair Measures document.

3. Check the software revision of the unit, using the procedures on page 5, procedure 2.3. Refer to the Bose® service extranet site, http://serviceops.bose.com for information regarding the latest software revision. Update is needed.

4. Verify Performance and all functions.
Note: If a media center is available, use the procedures “With AV28 media center”. if a media center is not available, use the procedures “Without AV28 media center”.

Required Test Equipment and Cables

1. Audio Signal Generator.
2. Digital Converter (A-D) with S/PDIF output, if AV28 Media Center is not availble.
3. PC (IBM compatible), if AV28 Media Center is not availble.
4. DC power supply for cube phase test.
5. Audio amplifier for cube sweep test.
6. PS28/48 test cable part number 264564.
7. RCA to bare wire cables (to connect cube speakers to bass module).
Black rear cable part number 180644
Black Left/Center/Right part number 180643-4
Note: AC2 connector part number 195505-001 is needed to connect bare wire to Jewel® Cube speaker.



Test cable part number 264564

PS28/48 Performance Verification Procedures (Without AV28 Media Center Console)

Test setup procedures

Place the bass module into TAP mode using the procedures located at the end of this document.
Note: Place all four DIP switches into the down position before returning the unit to the customer.

Test cable part number 264564, Figure 16, is needed to test the bass module.

Connect the D-sub, 9 pin connector on the test cable to the COM port on your computer. Connect the RJ-45, 8 pin connector to the bass module.

The bass module requires a digital audio input. Connect the analog output of an oscillator to the analog input of an Analog to Digital (A-D) converter. Connect the test cable's RCA connector to the A-D converter S/PDIF output.

1. Sweep Test

1.1 Issue the following TAP commands:

SO ALL D (select all digital source inputs)
SP 5 (5 speaker mode)
VO CB 0 (set volume to full output, 0dB)
MU AMP OFF (unmute the amp)

1.2 Apply a 200 mVrms, 25 Hz signal to the left and right input of the analog to digital (A-D) converter. Listen for any extraneous noises such as rubbing, scraping, or ticking.
Note: No extraneous noises such as rubbing, scraping or ticking should be heard. To distinguish between normal suspension noise, rubs and ticks, displace the woofer cone with your finger. If the sound can be made to go away or get worse, it's a rub or tick and the woofer should be replaced. If the noise stays the same, it's normal suspension noise and it will not be heard with regular program material.

1.3 Sweep the bass module from 40 Hz to 300 Hz. Listen carefully for any buzzes, rattles or extraneous noises coming from the bass module.
Note: Redress any wire or component that buzzes.

2 Bass Module Air Leak Test

2.1 Apply a 200 mVrms, 40 Hz signal to the input of the A-D converter.

2.2 Check for air leaks from the cabinet. Listen near the areas where the plastic seals to the wood.

3. Cube Speaker Phase Test

Note: The DC voltage should only be momentarily applied to the cube speaker input to avoid damaging the speakers.

3. 1 Observing polarity, momentarily apply 8 Vdc to the input of the cube speaker.

3.2 The speakers should move outward with the application of the dc voltage. Check the cube wiring if it moves inward.

4. Cube Speaker Sweep Test

4.1 Apply an 11 Vrms, 20 Hz signal to the input of the satellite. Change the applied signal to 8 Vrms, 150 Hz. Sweep the oscillator from 150 Hz to 2 kHz.

4.2 Listen for rubs, ticks, air leaks, buzzes or other extraneous noises.
Note: Defects such as rubs, ticks and air leaks will typically be most audible during the 20 Hz test. Defects such as buzzes will typically be heard during the 150 Hz to 2 kHz sweep.
Note: The satellite cubes are not repairable. The Jewel Cube® speakers are repairable.

5. Listening Test

5.1 Connect the cube speakers to the outputs of the bass module.

5.2 Connect an audio source (i.e. CD player) to the input of the A-D converter.

5.3 Perform procedure 1.1

5.4 Adjust the volume output of the audio source to a comfortable level and listen for a clean undistored audio output from the bass module and cube speakers.

PS28/48 Performance Verification Procedures (With AV28 Media Center Console)

Test Setup

Using the Lifestyle® 28/48 system's audio input cable part number 260351-001, connect the AV28 media center to the PS28/48 bass module.

1. Sweep Test

1.1 Apply a 200 mVrms, 25 Hz signal to the left and right AUX input of the AV28 media center. Adjust the AV28 media center to full volume. Listen for any extraneous noises such as rubbing, scraping, or ticking coming from the bass module.
Note: No extraneous noises such as rubbing, scraping or ticking should be heard. To distinguish between normal suspension noise, rubs and ticks, displace the woofer cone with your finger. If the sound can be made to go away or get worse, it's a rub or tick and the woofer should be replaced. If the noise stays the same, it's normal suspension noise and it will not be heard with regular program material.

1.2 Sweep the bass module from 40 Hz to 300 Hz. Listen carefully for any buzzes, rattles or extraneous noises coming from the bass module.
Note: Redress any wire or component that buzzes.

2 Bass Module Air Leak Test

2.1 Apply a 200 mVrms, 40 Hz signal to the AUX input of the AV28 media center.

2.2 Check for air leaks from the bass module cabinet. Listen near the areas where the plastic seals to the wood.

3. Cube Speaker Phase Test

Note: The DC voltage should only be momentarily applied to the cube speaker input to avoid damaging the speakers.

3. 1 Observing polarity, momentarily apply 8 Vdc to the input of the cube speaker.
Note: Connect the positive side of the dc supply to the positive input of the cube. Connect the negative side of the dc supply to the negative input of the cube speaker.

3.2 The speakers should move outward with the application of the dc voltage. Check the cube wiring if it moves inward.

4. Cube Speaker Sweep Test

4.1 Apply an 11 Vrms, 20 Hz signal directly to the input of the satellite. Change the applied signal to 8 Vrms, 150 Hz and the sweep the oscillator from 150 Hz to 2 kHz.

4.2 Listen for rubs, ticks, air leaks, buzzes or other extraneous noises.
Note: Defects such as rubs, ticks and air leaks will typically be most audible during the 20 Hz test. Defects such as buzzes will typically be heard during the 150 Hz to 2 kHz sweep.
Note: The satellite cubes are not repairable. The Jewel Cube® speakers are repairable.

5. Listening Test

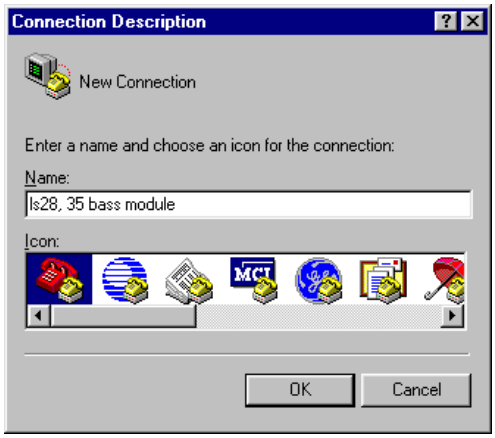
5.1 Connect the cube speakers to the outputs of the bass module.

5.2 Adjust the volume to a comfortable level and listen for a clean undistored audio output from the bass module and cube speakers.

Setting up a computer to issue TAP commands

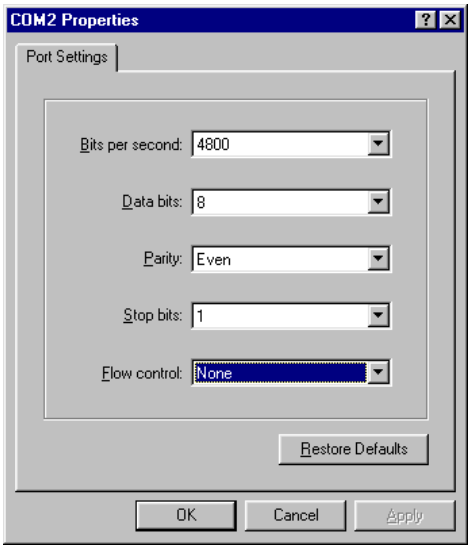
1. Open a terminal window. Click: Start/Program/Accessories/Hyperterminal/Hyperterminal

2. In the “Connection Description” window, type the name “LS28, 35 bass module test” then click “OK”; any name may be entered.

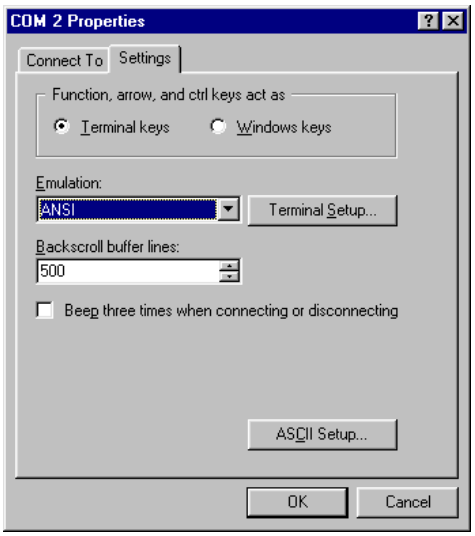


3. In the “Connect To” window, select the COM port on your computer that you will be connecting the bass module to and then click OK.

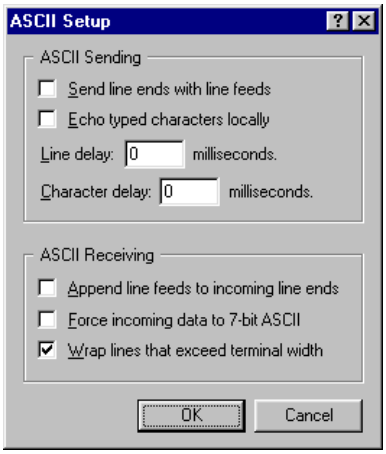
4. In the “COM1 Properties” window, make the selections in the various fields as shown.



5. In the Hyper Terminal window, click on File/Properties. In the Properties window, click on the Settings tab, make the selections in the various fields as shown.



6. In the Settings window, click on ACSII setup and make the selections and changes as shown



Placing the Bass Module into TAP Mode

! Place all four DIP switches to the down position before returning the unit to the customer !

1. Place the bass module into TAP mode

1.1 Set all four DIP switches into the "up" position. Apply power to the bass module using the AC line switch and wait until the amber LED blinks twice and the green LED blinks briefly at least once (approximately 3 seconds after power up). Then, within twenty seconds, flip ALL four switches down, then flip switch #4 (closest to the RJ-45 connector) back up. The unit will now communicate in TAP mode. The amber and green LED will blink alternately when no S/PDIF signal is applied. Note that when TAP mode is activated in this manner, the DSP will echo characters sent by the terminal.

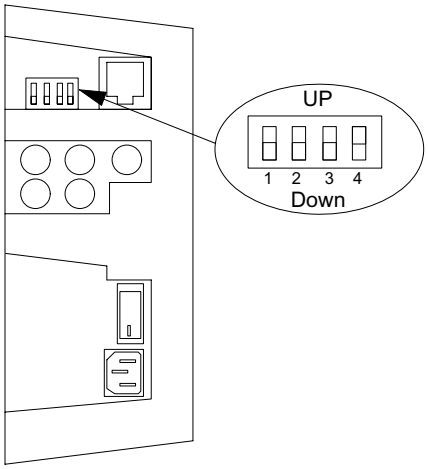


Figure 15. DIP switch Up/Down orientation

2. Verify the bass module communicates in TAP mode.

2.1 Connect the test cable's, part number 264564, DB-9 connector to the RS-232 COM port on your computer. Connect the test cable's RJ-45 connector to the bass module.

2.2 Type the command ST S and hit "Enter". The following response should be seen on your computer screen. The results may differ depending on the unit settings. If no S/PDIF signal is applied, the sample rate will be 29 kHz.

SAMPLE RATE : 44101.30
SPKR TYPE : 02
DIP VALUE : 1111
LCRB_MUTE : 1
LSRS_MUTE : 1
SAT_CLIP : 1
BASS_CLIP : 1
EURO_BASS : 1
EURO_TREBLE: 0

2.3 Check the software by typing (issuing) the command TN 4 and then hitting "Enter". A typical response would be as follows.
03DE6455, 010808
03DE6455 is the checksum
010808 is the software version

Equalizer Programming Method

Type the equalization setup command
SE [SPEAKER TYPE], [EUROPEAN BASS], [EUROPEAN TREBLE]

Command	Condition		
	SPEAKER TYPE	**EURO BASS**	**EURO TREBLE**
SE	F = falcon	ON/OFF	ON/OFF
	D = doubleshot		
	C = cricket		
	B = dublin		
	M = mariner		
	U = Installer		

Example: To set the equalization to cricket cubes, euro bass off and euro treble off, type the command as follows. SE C,OFF,OFF

Verify the changes have been made by typing the command ST S.
The speaker type (SPKR TYPE) and other information will be displayed. Decode the numerical two digit speaker type as follows.

00 Falcon (Early version dual cube)
01 Doubleshots (Later version dual cube)
02 Cricket (Jewel® Cube)
03 Dublin (Single Cube)
04 Mariner (151 environmental speakers)
05 User EQ (Installer)

PS28/48 Bass Module Repair Process Guide

Following the steps below will help to ensure the customer's unit is properly repaired.

1. Read any customer note included with the unit.

2. Refer to the Software/Firmware Update Related Information section of the PS28/48 bass module Service Information page.

3. Attempt to verify the customer's complaint before disassembling the unit or performing any repairs.

3.1 If the customer's complaint can not be verified, discuss this with the customer.

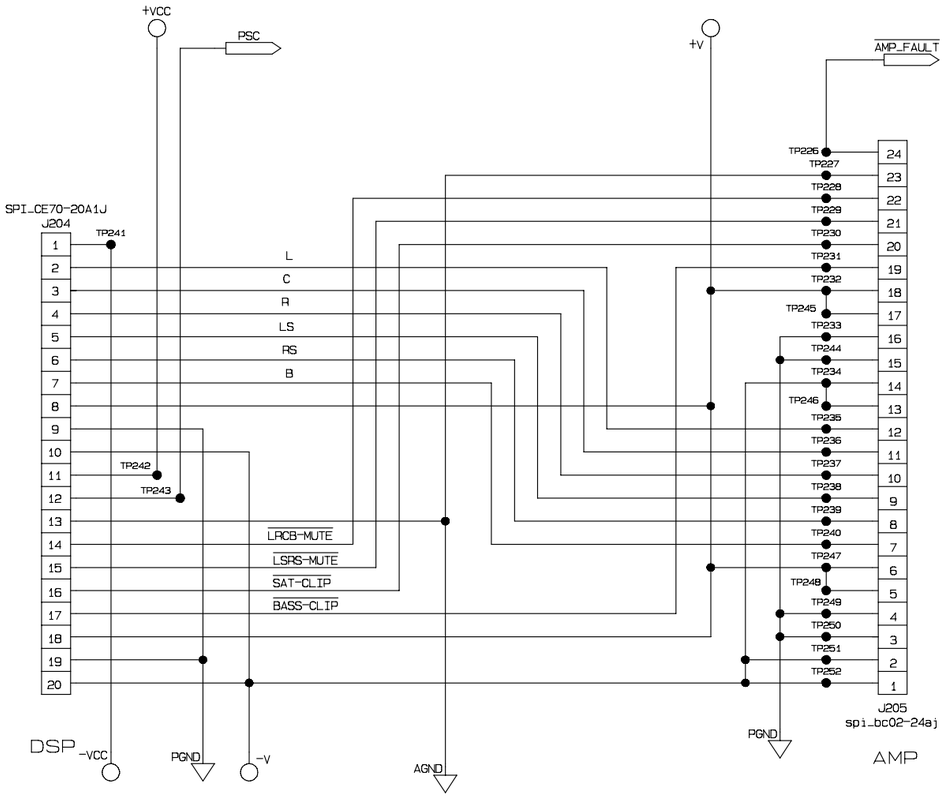
3.2 If the customer's complaint is verified, troubleshoot and repair the unit. Refer to the PS28/48 Troubleshooting Guide document and the PS28/48 service manual located on PS28/48 bass module Service Information Page.

4. Once the PS28/48 bass module has been repaired or updated with the current software revision, refer to the Performance Verification Guide in the Troubleshooting Guide and Performance Verification Procedures section.

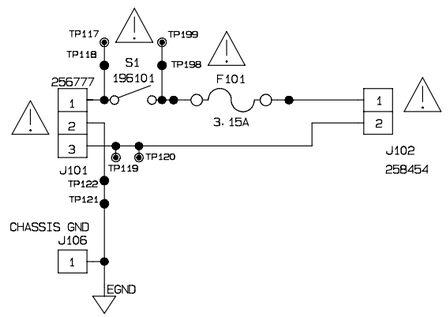
Technical Service Group
created and maintained

CLASS	DWG NO.	SH
SD	254165	1

SD254165 Rev 02
Sheet 1 of 3
LS28/35 Bass Module Service Manual 264562



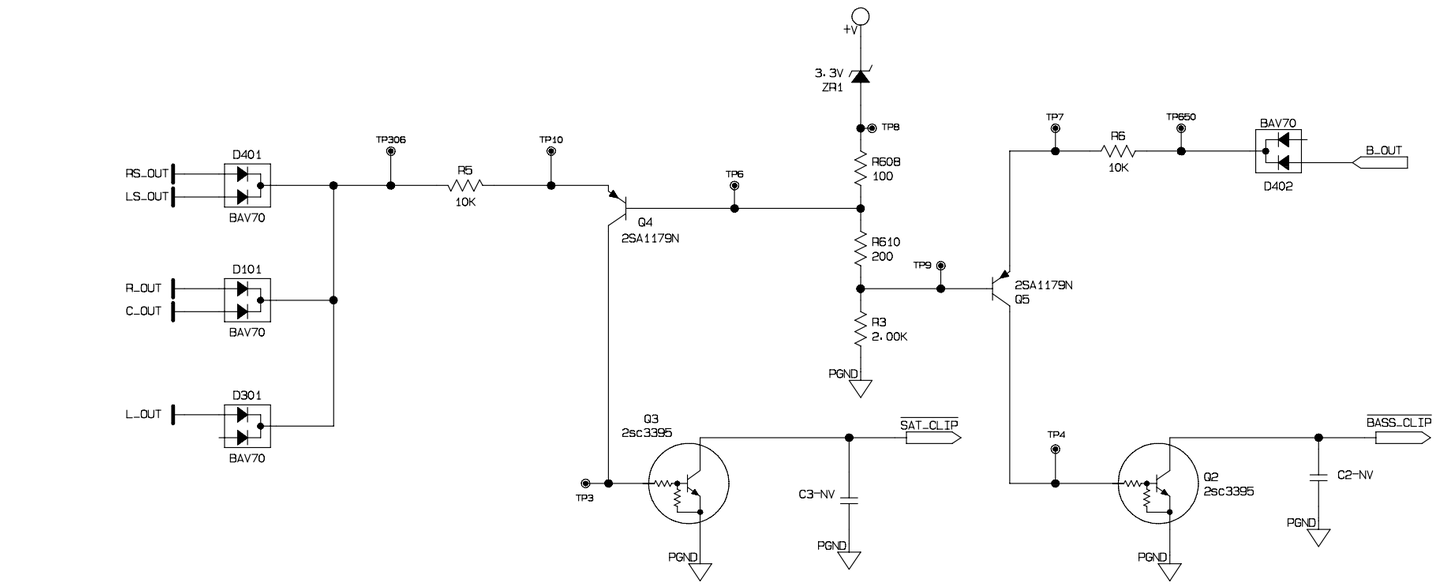
SD254165 Rev 02
Sheet 2 of 3
LS28/35 Bass Module Service Manual 264562

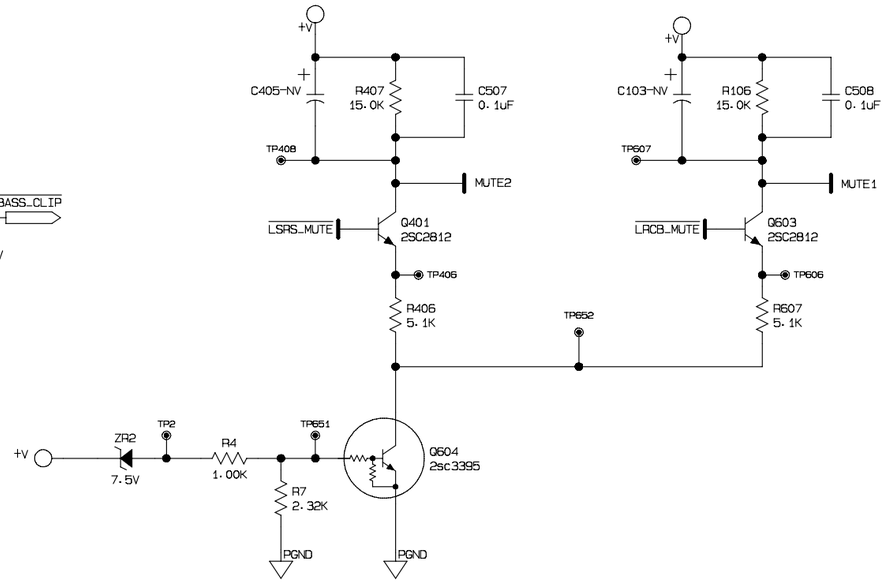


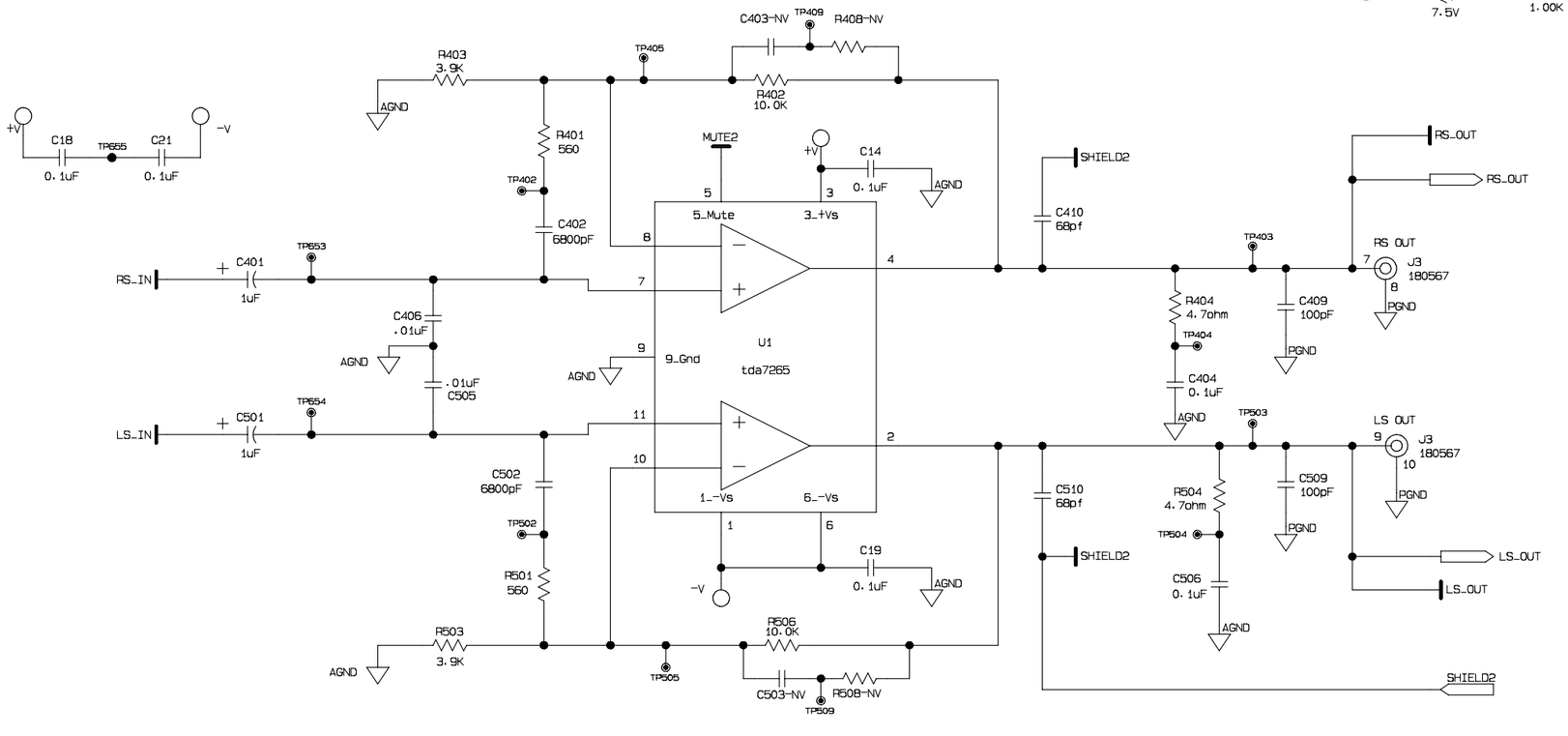
SD254165 Rev 02
Sheet 3 of 3
LS28/35 Bass Module Service Manual 264562

C105-NV TP109 R107-NV
R103 3.9K
TP105
R102 10.0K
SHIELD2
SHIELD2 TOUCHES CHASSIS AT 3 POINTS ALONG TOP OF PCBd
AGND
R101 560
MUTE1
+V
C10 0.1uF AGND
TP658
SHIELD2
C110 68pf
+V -V
TP647
C15 0.1uF C4 0.1uF
TP102
C102 6800pF
5 3
5_Mute 3_+Vs
TP103
R_OUT
J3 180567
C109 100pF
PGND
TP639
8 7 4
R_IN C101 1uF
TP104
R104 4.7ohm
C104 0.1uF
AGND
C105 .01uF
AGND 9 9_Gnd U2 tda7265
TP201
TP640
11 2
L_IN C201 1uF
TP203
L_OUT
J3 180567
C205 .01uF
C202 6800pF
10
TP202
1_-Vs 6_-Vs
C111 68pf
SHIELD2
R204 4.7ohm
C209 100pF
PGND
1 6 C15 0.1uF AGND
TP204
C504 0.1uF
AGND
R201 560
TP205
-V
R203 3.9K
R502 10.0K
L_OUT
AGND
C203-NV TP209 R206-NV
C303-NV TP309 R306-NV
TP646
R303 3.9K
R302 10.0K
AGND
R301 560
MUTE1
+V
C12 0.1uF AGND
+V -V
TP648
C17 0.1uF C20 0.1uF
TP302
C302 6800pF
5 3
5_Mute 3_+Vs
SHIELD2
C310 68pf
TP303
C_OUT
J3 180567
TP642
8 7 4
C_IN C301 1uF
C_OUT
R304 4.7ohm
C309 100pF
PGND
C305 .01uF
9 9_Gnd U3 tda7643
AGND AGND
TP304
C304 0.1uF
AGND
C604 .047uF
TP643
11 2
B_IN C601 10uF
TP601
Q601 2SB695
+V
TP604
B_OUT
C606 .047uF
10
TP656
R612 300
1_-Vs 6_-Vs
R603 4.7ohm
R604 10.0
B_OUT
1 6 C13 0.1uF AGND
TP603
C603 0.1uF
AGND
R606 10.0
Q602 2SB696
-V
TP638
R601 3.9K
TP602
R602 10.0K
C602 22uF
AGND
TP649
C609-NV R611-NV
TP659
SHIELD1
SHIELD1 TOUCHES CHASSIS NEAR J3
C607 .047uF
C608 220pf
PGND PGND
R_OUT
C_OUT
B_OUT
L_OUT
RS_OUT
LS_OUT
R105 100K
R505 100K
R605 100K
R305 100K
R405 100K
R609 100K
TP1
C1 10uF
R2 100K
PGND PGND
AMP_FAULT
Q1 2SC2812
2SA1179N Q6
R1 5.1K
TP630
PGND
TP631
Q7 2SC3395
-V
-V +V
AGND
LRCB_MUTE
LSRS_MUTE
SAT_CLIP
BASS_CLIP
TP617 TP624 TP626 TP627 TP628 TP629 TP610 TP251 TP250 TP614 TP615 TP619 TP620 TP621 TP622 TP623 TP632 TP612 TP613
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
L_IN
C_IN
R_IN
LS_IN
RS_IN
B_IN
spi_bc02-24bj
J2
PGND
R9 0ohm
J4
1 2
BASS OUT
190552
AGND PGND
C610 330pF
C611 330pF
SHIELD3
TP657
SHIELD3
SHIELD3 TOUCHES CHASSIS NEAR J4

SD254170 Rev 02
Sheet 1 of 2
LS28/35 Bass Module Service Manual 264562







SD254170 Rev 02
Sheet 2 of 2
LS28/35 Bass Module Service Manual 264562

CLASS SD | DWG NO. 254175 | SH 1

TP45
C608 100pF
SG1
SHIELD1
R648 100K
TP655
D14 BAV99
+VCC
GND
R649 100K
TP657
C13 100pF
GND
+VCC
C12 .047uF
TP54
GND
+3.3V
R26 4.7K
11
3
1/4
13
10
12
U3 LM339
V_REF
READ0
GND
+3.3V
R25 10K
R650 510
9.1V D21
GND
DIO
TP656
Q6 2sc3395
FLAG1
GND
SHIELD1 TOUCHES CHASSIS NEAR J1
FB6 400-100MHz
TP68
C40 .047uF
GND
SHIELD1
TP644
C607-NV
GND
SG7
GND
lab_stock J10-NV
1
GND
lab_stock J11-NV
1
GND
+5.0V
+3.3V
FB1 400-100MHz
FB2 400-100MHz
C19-NV
C24-NV
C20-NV
GND
GND
C7 .047uF
TP47
TP46
C11 .047uF
GND
GND
U2
CS8415A
6_VA+
26_RXP6
25_RXP5
15_RXP4
14_RXP3
13_RXP2
12_RXP1
4_RXP0
5_RXN0
10_RMCK
3_EMPH
11_RERR
9_RST
7_AGND
8_FILT
22_DGND
23_VD+
OLRCK_17
OSCLK_16
SDOUT_18
SDA_CDOUT_1
AD0_CS_2
SCL_CCLK_28
AD1_CDIN_27
INT_19
U_20
OMCK_21
H_S_24
TP22
R18 75
TP23
R24 75
TP24
R19 75
TP25
R20 47K
TP26
TP27
R23 47K
SPDIF_LRCLK
SPDIF_64FS
SPDIF_DATA
TP31
SDA
TP32
SCL
10MHZ
GND
GND
GND
GND
GND
GND
GND
TP44
C35 100pF
SHIELD1
260334-08
J1
1
2
3
4
5
6
7
8
TP60
FB5 400-100MHz
GND
TP651
R37-NV
GND
TP66
R38 0ohm
SHIELD1
TP50
TP51
TP48
TP49
SG2
C609 100pF
SHIELD1
SG6
C610 100pF
SHIELD1
FB3 400-100MHz
TP55
C18 .047uF
TP6
T1
SPDIF
TP7
FB4 400-100MHz
TP56
TP64
D3 BAV99
C30 .047uF
GND
R40 330
C33-NV
GND
C34 75pF
GND
TP67
C31 75pF
L1 2.2uH
TP10
C615-NV
GND
C5 47pf
R6 2.2K
C32 .047uF
GND
TP14
SPDIF_256FS
R13 75
TP15
FLAG11
TP16
R8 47K
GND
8415_RERR
Q8 2SC3395
GND
TP65
D20 Schottky
TP70
FLAG8
C10-NV
R14 47K
GND
GND
TP19
C8 2200pf
GND
R17 4.99K
TP20
C9 0.047uF
GND
+VCC
GND
D17 BAV99
TP658
R34 100K
TP39
R31 100K
TP37
SG3
C612 100pF
SHIELD1
R36 100K
GND
C17 100pF
GND
4
5
1/4
U3 LM339
2
READ0
C611 .047uF
GND
V_REF
+VCC
R32 47K
TP38
R35 4.7K
GND
+3.3V
+3.3V
GND
D18 BAV99
R30 510
C613 100pF
SG4
SHIELD1
DIO
Q4 2sc3395
GND
R29 1K
TP35
+3.3V
R9 47K
TP62
R41 100
8415_CLKERR
C23 .047uF
GND
SPDIF_LRCLK
C22 .047uF
TP61
Q7 2SC3395
GND

SD254175 Rev 01
Sheet 1 of 8
LS28/35 Bass Module Service Manual 264562

+2.5V
C110
2.2uF
GND

+2.5V +2.5V
FB103 400-100MHz
FB104 400-100MHz
FB102 400-100MHz
FB101 400-100MHz
VA
C111 2.2uF
C103 .047uF
C104 .047uF
C105 .047uF
C107 .047uF
GND
TP136
TP135
TP109
TP111
TP112
TP113
R105 4.7K
R107 4.7K
R108 4.7K
R109 4.7K

D(0-31)
D(7) 8_DATA7
D(6) 9_DATA6
D(5) 10_DATA5
D(4) 11_DATA4
D(3) 14_DATA3
D(2) 15_DATA2
D(1) 16_DATA1
D(0) 17_DATA0
20_INTREQ
A(1) 6_A1
A(0) 7_A0
RD 5_RD
WR 4_WR
18_CS
36_RESET
VD1_1 VD2_12 VD3_23 VA_34 GP108_21 PSEL_19
29_CMPREQ 2_DGND 13_DGND 24_DGND 35_AGND 33_FLT1 32_FLT2

U103
CS49300

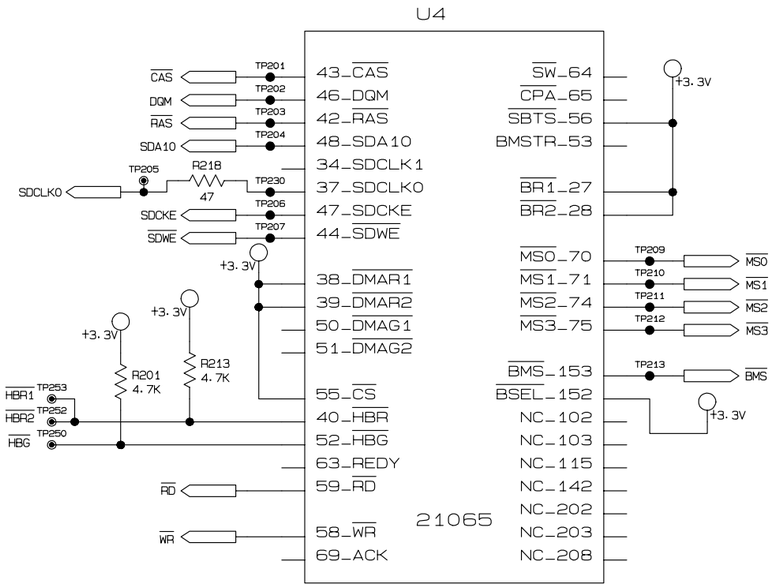
DC_38 DD_37 SCLK_43 AUDATA2_39 AUDATA1_40 AUDATA0_41 LRCLK_42 AUDATA3_3 SCLKN1_25 SDATAN1_22 LRCLKN1_26 CMPCLK_28 MCLK_44 CLKIN_30 CLKSEL_31 CMPDAT_27
TP115 TP116 TP117 TP118 TP119 TP120 TP121 TP122 TP123 TP124 TP125 TP126
R123 75
R117 75
R118 75
R119 75
R652 75
TP653 TP661 TP132 TP133 TP134
49300_AUDATA2
49300_AUDATA1
SPDIF_64FS
SPDIF_DATA
SPDIF_LRCLK
SPDIF_256FS
10MHZ

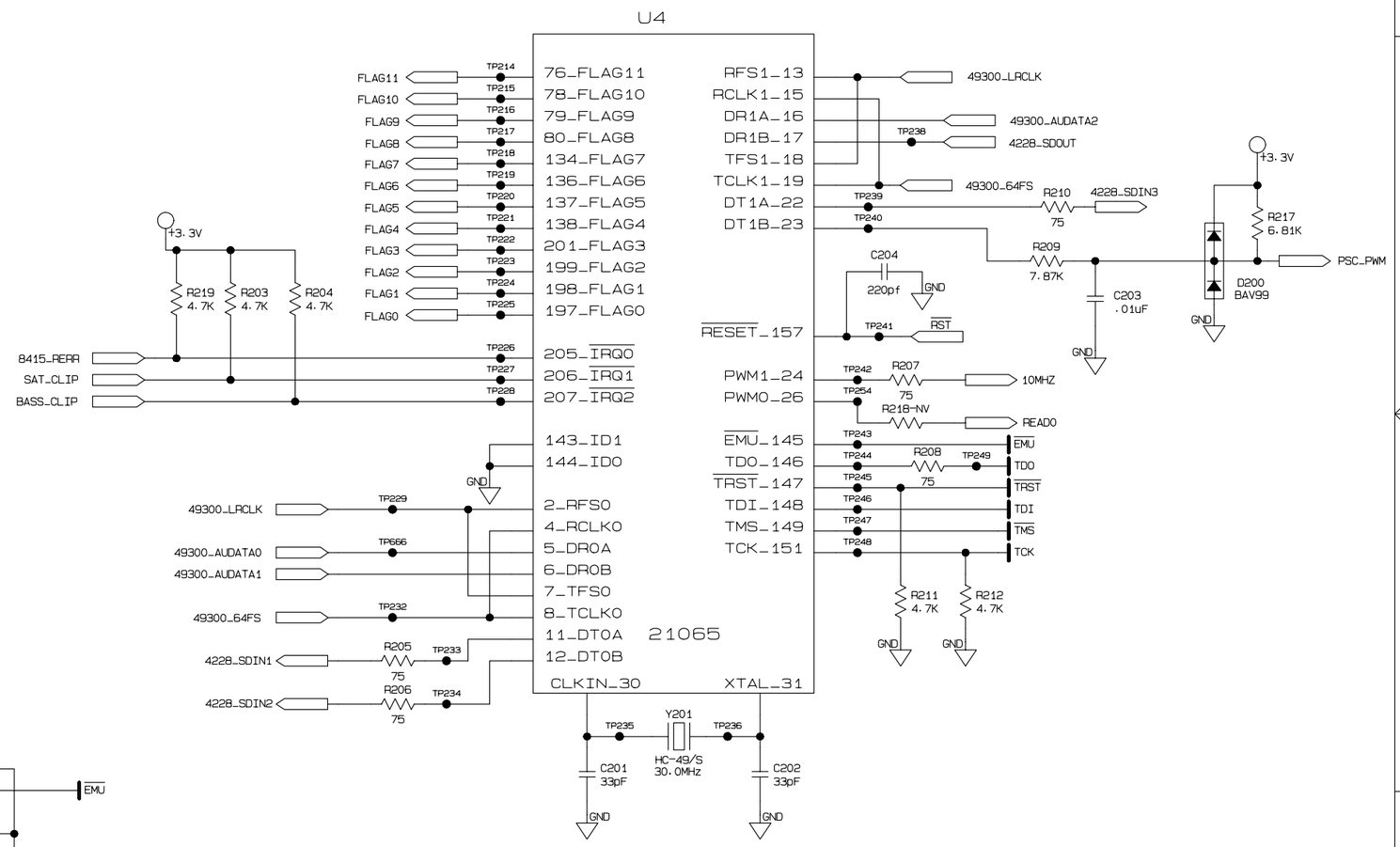
+3.3V
U101 74VHC08
R101 270
TP101 TP105 TP106 TP107
MS3
C102 33pF
FLAG4
C113-NV
R104 4.7K
C106 470pf
R106 33K
C108 .01uF
C109 2.2uF
TP110 TP114
VA

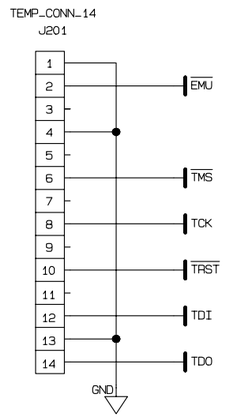
R657-NV
R658-NV
R659-NV

+3.3V
C112 .047uF
U105
74LCX157
SELECT 16_VCC
2_1A 5_2A 11_3A 14_4A
1Y_4 2Y_7 3Y_9 4Y_12
3_1B 6_2B 10_3B 13_4B
STROBE 8_GND
TP649 TP648 TP647
R120 75
R121 75
R122 75
49300_AUDATA0
49300_64FS
49300_LRCLK

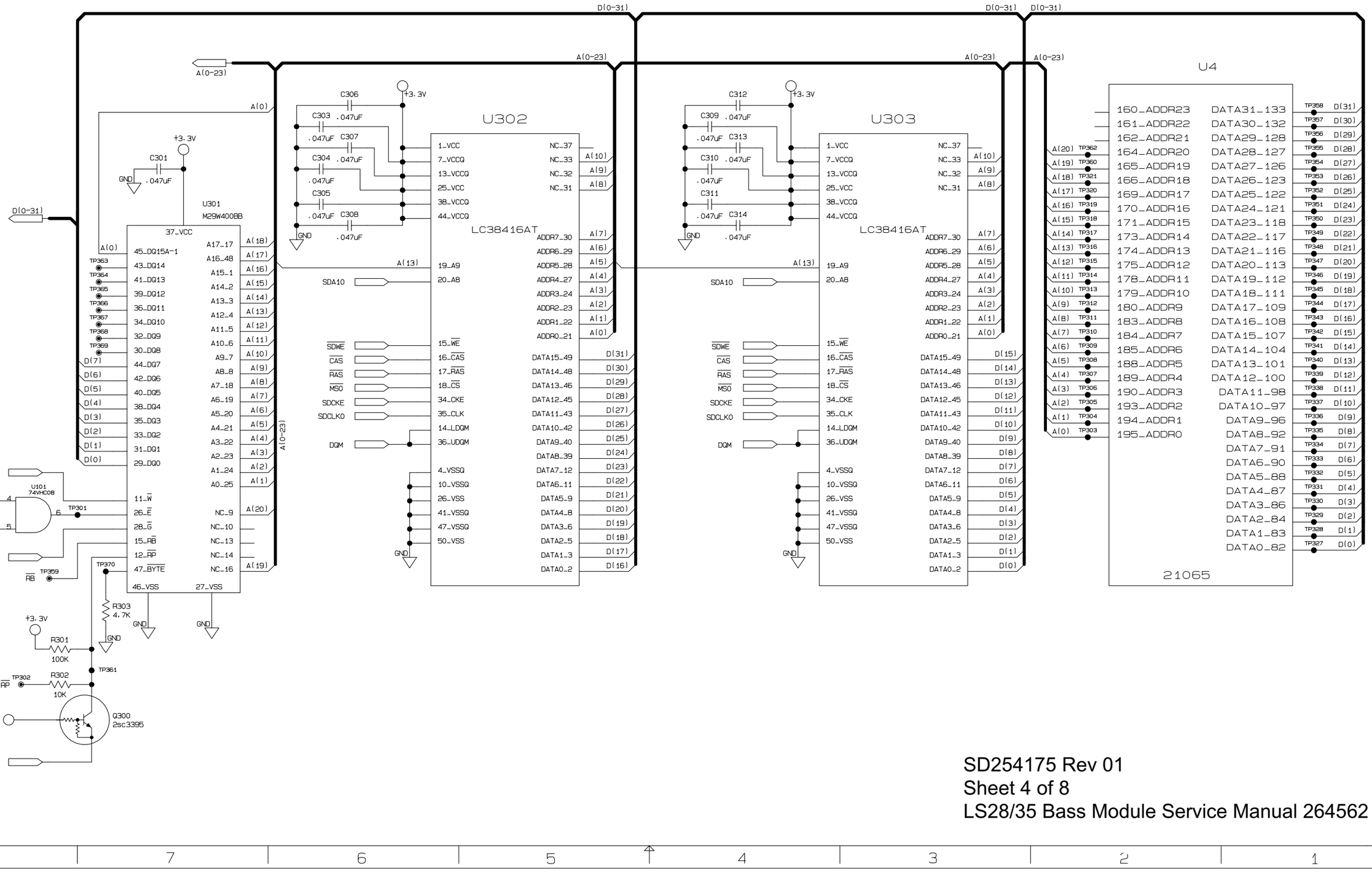
SD254175 Rev 01
Sheet 2 of 8
LS28/35 Bass Module
Service Manual 264562



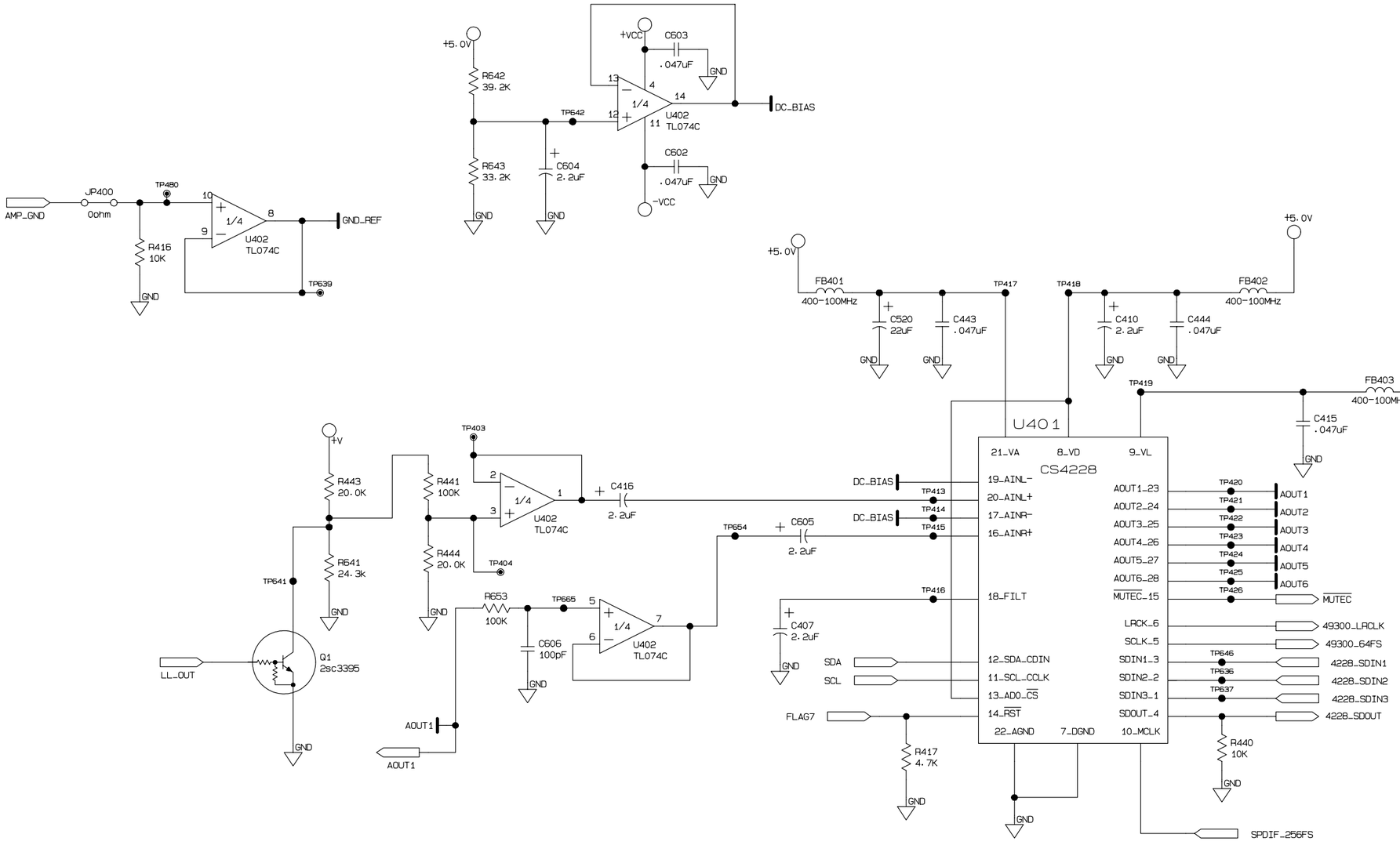




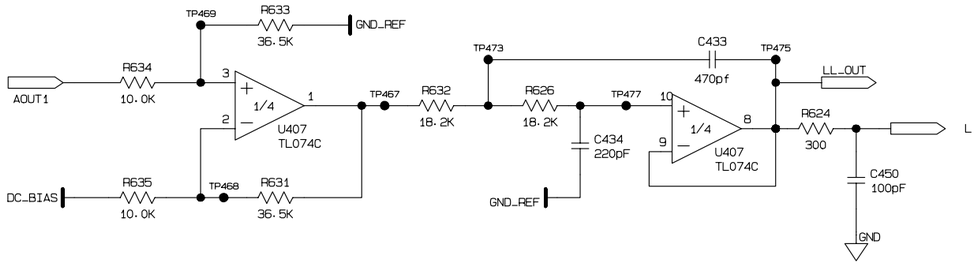
SD254175 Rev 01
Sheet 3 of 8
LS28/35 Bass Module Service Manual 264562

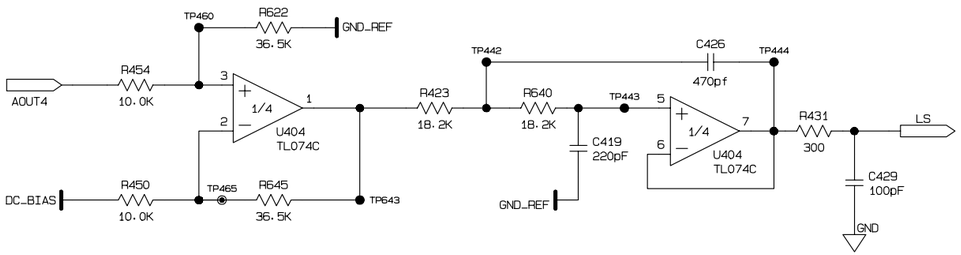


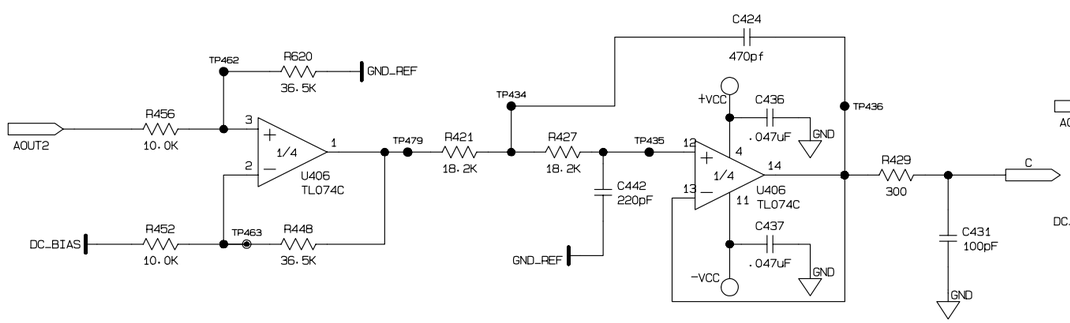
SD254175 Rev 01
Sheet 4 of 8
LS28/35 Bass Module Service Manual 264562

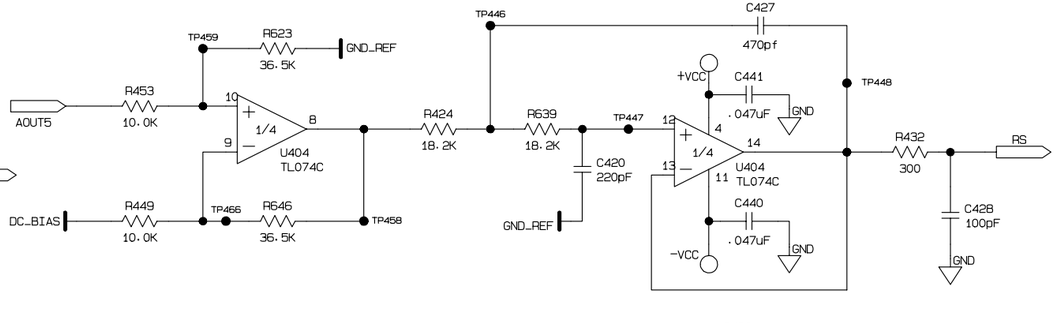


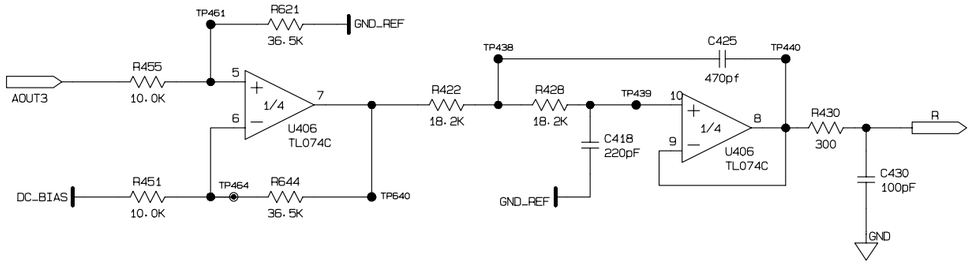
SD254175 Rev 01
Sheet 5 of 8
LS28/35 Bass Module Service Manual 264562

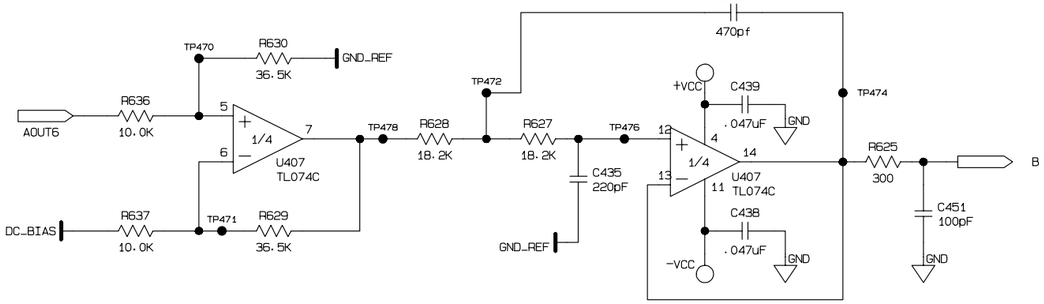




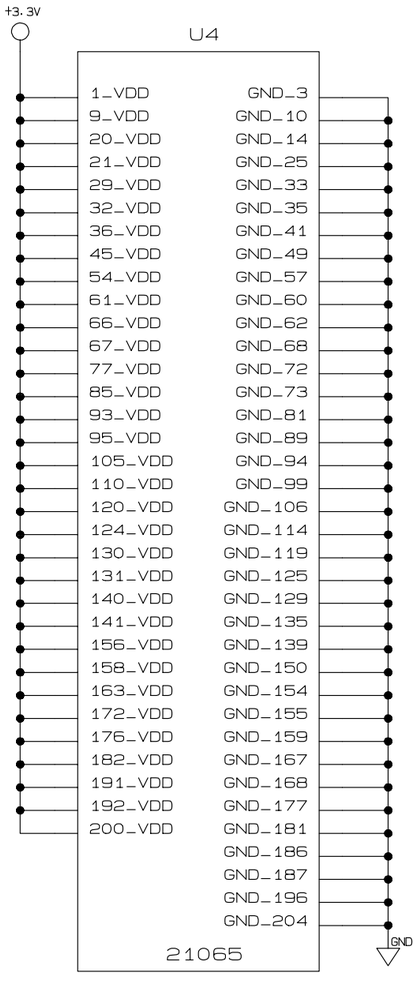


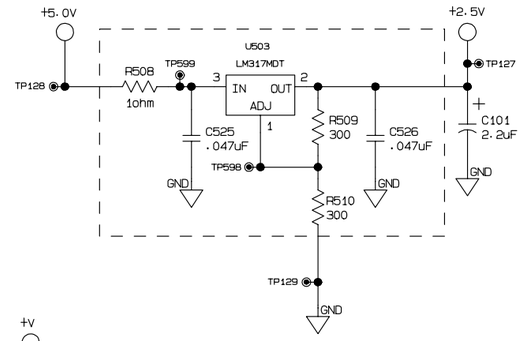


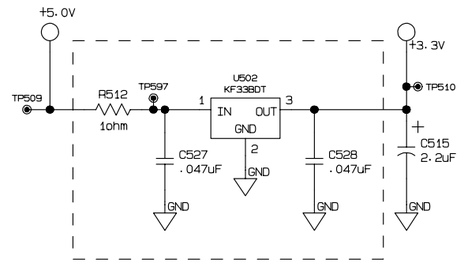


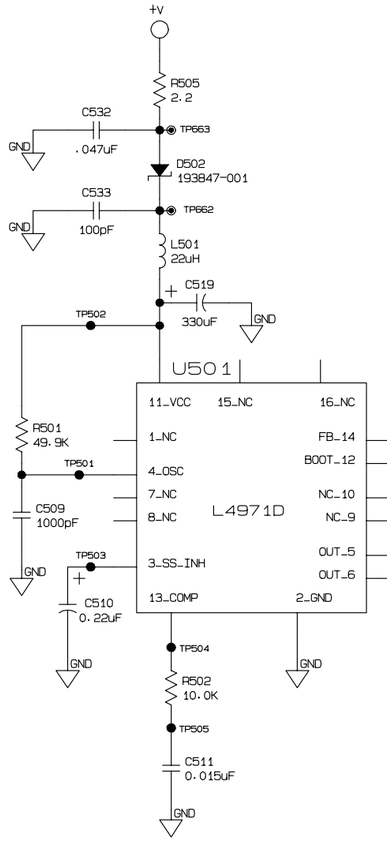


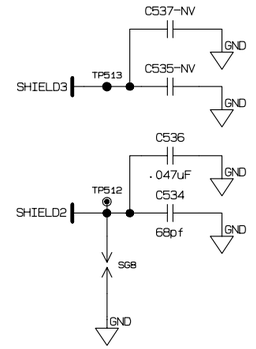
SD254175 Rev 01
Sheet 6 of 8
LS28/35 Bass Module Service Manual 264562

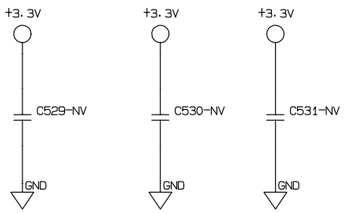


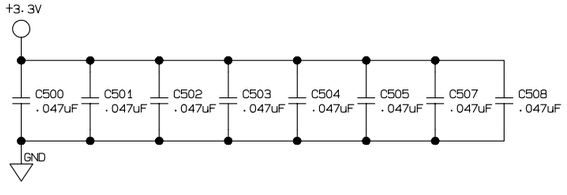




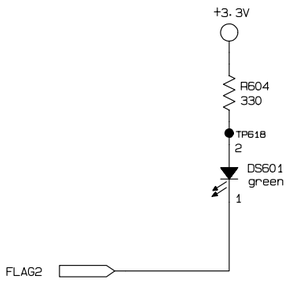


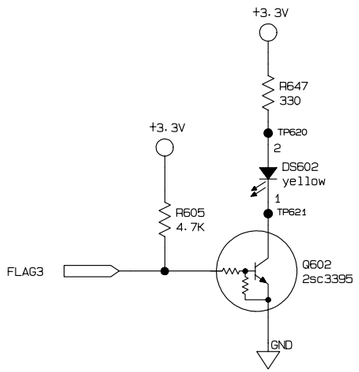


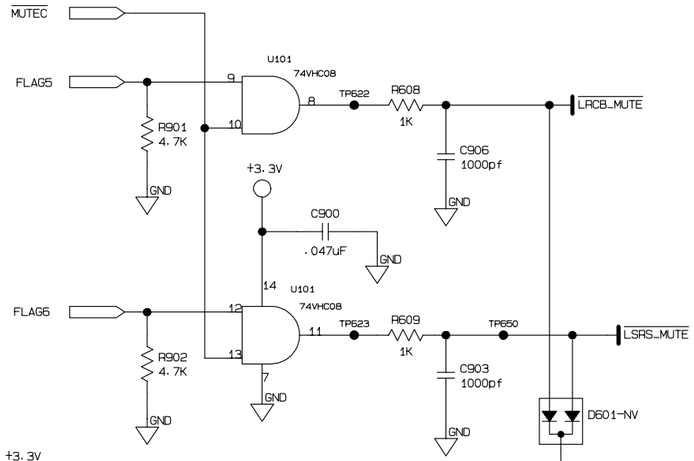


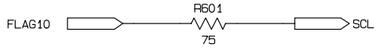


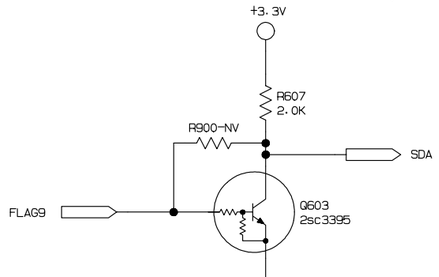
SD254175 Rev 01
Sheet 7 of 8
LS28/35 Bass Module Service Manual 264562

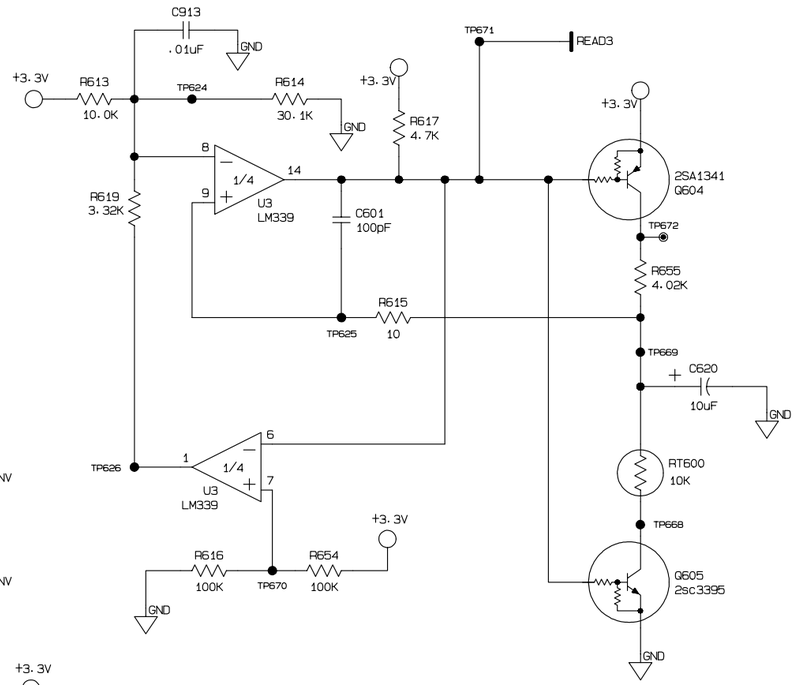


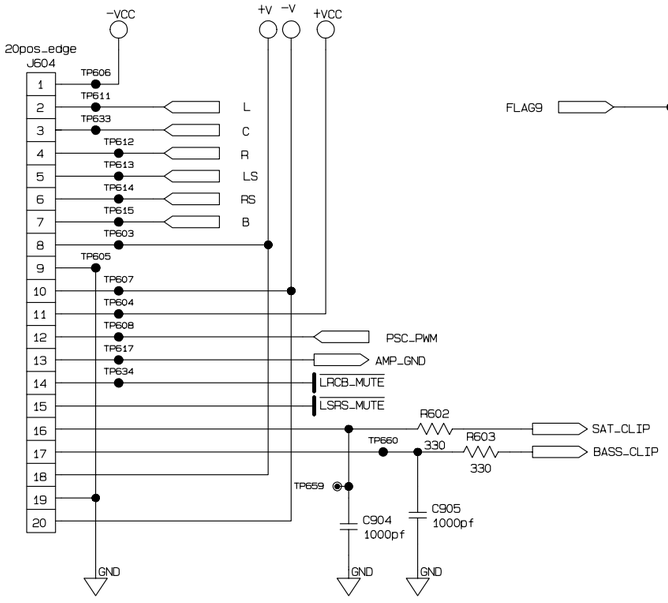


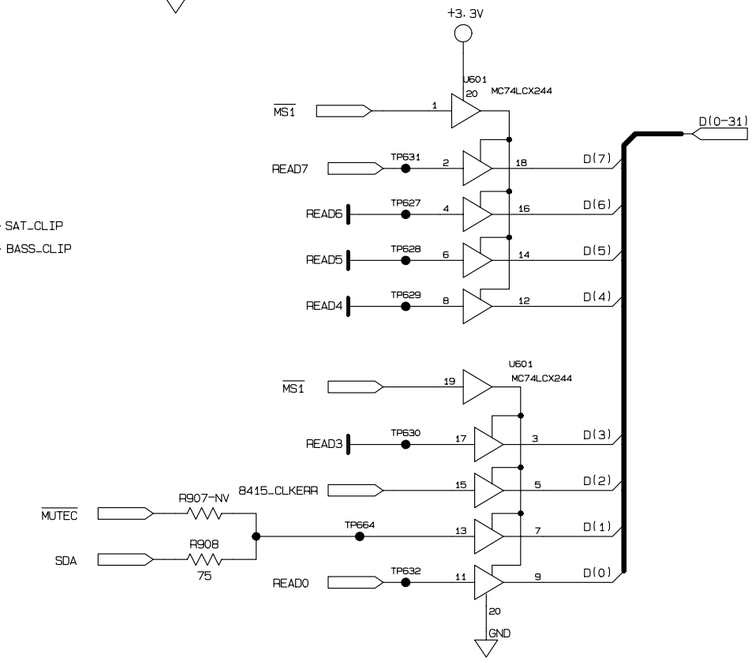


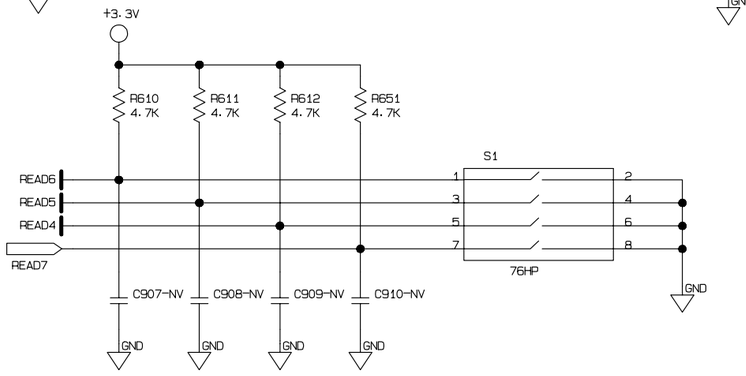


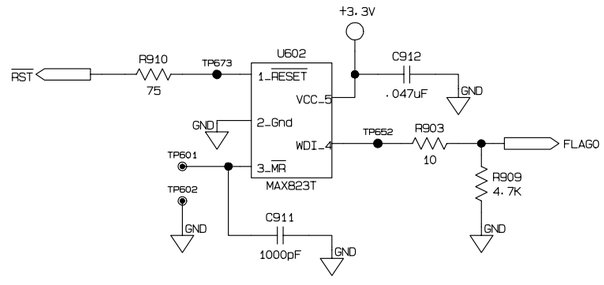








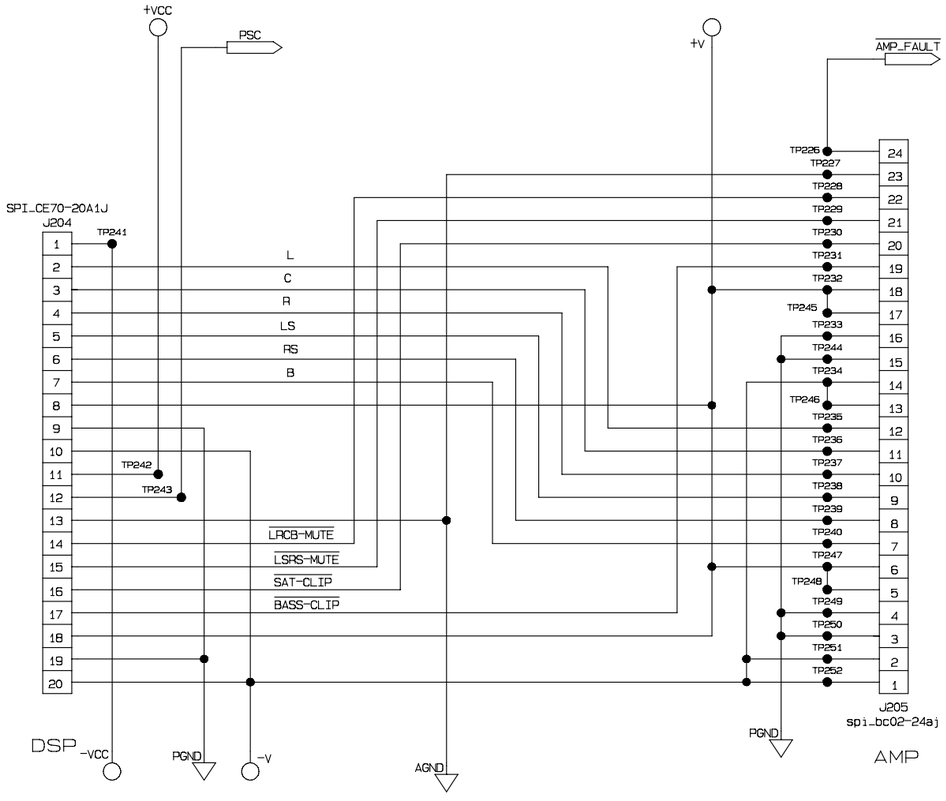




SD254175 Rev 01
Sheet 8 of 8
LS28/35 Bass Module Service Manual 264562

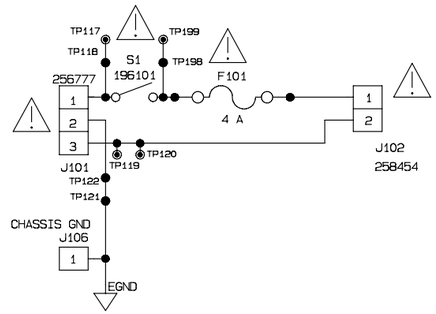
CLASS	DWG NO.	SH
SD	266459	1

SD266459 REV 00
SHEET 1 OF 3
PS28/28 SERVICE MANUAL 264562-S1



SD266459 REV 00
SHEET 2 OF 3
PS28/48 SERVICE MANUAL 264562-S1

	120V US	240V EURO	120V/240V DUAL
D401	———	———	INSTALLED
R401	———	———	INSTALLED
R402	———	———	INSTALLED
C402	———	———	INSTALLED
U401	———	———	INSTALLED
C408	———	———	INSTALLED
Q401	———	———	INSTALLED
L103	———	INSTALLED	INSTALLED
JP1	INSTALLED	———	———



SD266459 REV 00
SHEET 3 OF 3
PS28/48 SERVICE MANUAL 264562-S1

CLASS SD | DWG NO. 267083 | SH 1

SHIELD2 TOUCHES CHASSIS AT 3 POINTS ALONG TOP OF PCBd

SHIELD1 TOUCHES CHASSIS NEAR J3

SHIELD4 TOUCHES CHASSIS ALONG TOP OF PCB NEAR J3

SHIELD3 TOUCHES CHASSIS NEAR J4

SD267083 REV 00
SHEET 1 OF 2
PS28/48 SERVICE MANUAL 264562-S1

D401
BAV70
RS_OUT
LS_OUT
D101
BAV70
R_OUT
C_OUT
D301
BAV70
L_OUT
TP306
R5
10K
TP10
Q4
2SA1179N
TP6
+V
3.3V
ZR1
TP8
R608
100
R610
200
TP9
2SA1179N
Q5
R3
2.00K
PGND
TP7
R6
10K
TP650
BAV70
D402
B_OUT
Q3
2sc3395
TP3
SAT_CLIP
C3-NV
PGND
TP4
Q2
2sc3395
BASS_CLIP
C2-NV
PGND
+V
C405-NV
R407
15.0K
C507
0.1uF
TP408
MUTE2
LSRS_MUTE
Q401
2SC2812
TP406
R406
5.1K
+V
C103-NV
R106
15.0K
C508
0.1uF
TP607
MUTE1
LRCB_MUTE
Q603
2SC2812
TP606
R607
5.1K
TP652
+V
ZR2
7.5V
TP2
R4
1.00K
TP651
R7
2.32K
Q604
2sc3395
PGND
PGND
+V
C18
0.1uF
TP655
C21
0.1uF
-V
C403-NV
TP409
R408-NV
R403
3.9K
AGND
TP405
R402
10.0K
R401
560
TP402
C402
6800pF
MUTE2
+V
C14
0.1uF
AGND
5
5_Mute
3
3_+Vs
8
7
4
U1
tda7265
9
9_Gnd
11
10
2
1_-Vs
6_-Vs
1
6
C19
0.1uF
AGND
-V
SHIELD2
C410
68pf
RS_OUT
RS_OUT
TP403
RS OUT
7
J3
180567
8
PGND
R404
4.7ohm
C409
470pf
PGND
TP404
C404
0.1uF
AGND
RS_IN
C401
1uF
TP653
C406
.01uF
AGND
.01uF
C505
AGND
LS_IN
C501
1uF
TP654
C502
6800pF
TP502
R501
560
R503
3.9K
AGND
TP505
R506
10.0K
C503-NV
R508-NV
TP509
TP503
LS OUT
9
J3
180567
10
PGND
C510
68pf
SHIELD2
R504
4.7ohm
TP504
C509
470pf
PGND
C506
0.1uF
AGND
LS_OUT
LS_OUT
SHIELD2

SD267083 REV 00
SHEET 2 OF 2
PS28/48 SERVICE MANUAL 264562-S1

SHIELD1 TOUCHES CHASSIS NEAR J1

lab_stock J10-NV

lab_stock J11-NV

260334-08 J1

CS8415A U2

SD267086 REV 00
SHEET 1 OF 8
PS28/48 SERVICE MANUAL 264562-S1

+2.5V
C110 2.2uF
GND

+2.5V +2.5V
FB103 400-100MHz
FB104 400-100MHz
FB102 400-100MHz
FB101 400-100MHz
VA
C111 2.2uF
GND
C103 .047uF
C104 .047uF
C105 .047uF
C107 .047uF
GND
TP136
TP135
TP109
TP111
TP112
TP113
+2.5V
R105 4.7K
R107 4.7K
GND
+2.5V +2.5V
R108 4.7K
R109 4.7K

VD1-1
VD2-12
VD3-23
VA-34
GP10B-21
PSEL-19

D(0-31)

U103
CS49300

20-INTREQ
8-DATA7
9-DATA6
10-DATA5
11-DATA4
14-DATA3
15-DATA2
16-DATA1
17-DATA0
D(7)
D(6)
D(5)
D(4)
D(3)
D(2)
D(1)
D(0)
D(0-31)

A(1)
A(0)
RD
WR
6-A1
7-A0
5-RD
4-WR
18-CS
36-RESET
TP105
TP106
TP107

+3.3V
U101
74VHC08
MS3
R101 270
TP101
C102 33pF
GND

FLAG4
C113-NV
R104 4.7K
GND
GND

29-CMPREG
2-DGND
13-DGND
24-DGND
35-AGND
33-FLT1
32-FLT2
GND
GND
TP110
C109 2.2uF
TP114
VA
C106 470pf
R106 33K
TP126
C108 .01uF
GND

DC-38
DD-37
SCLK-43
AUDATA2-39
AUDATA1-40
AUDATA0-41
LRCLK-42
AUDATA3-3
SCLKN1-25
SDATAN1-22
LRCLKN1-26
CMPCLK-28
MCLK-44
CLKIN-30
CLKSEL-31
CMPDAT-27
TP115
TP116
TP117
TP118
TP119
TP120
TP121
TP122
TP123
TP124
TP125
R123
R117 75
R118 75
R119 75
R652 75
TP653
TP661
TP132
TP133
TP134
49300-AUDATA2
49300-AUDATA1
SPDIF-64FS
SPDIF-DATA
SPDIF-LRCLK
SPDIF-256FS
10MHZ
GND

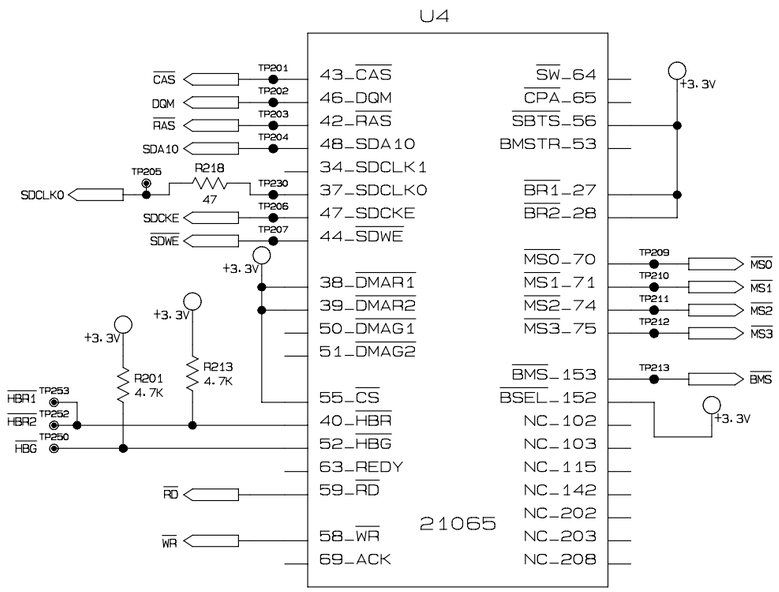
R657-NV
R658-NV
R659-NV

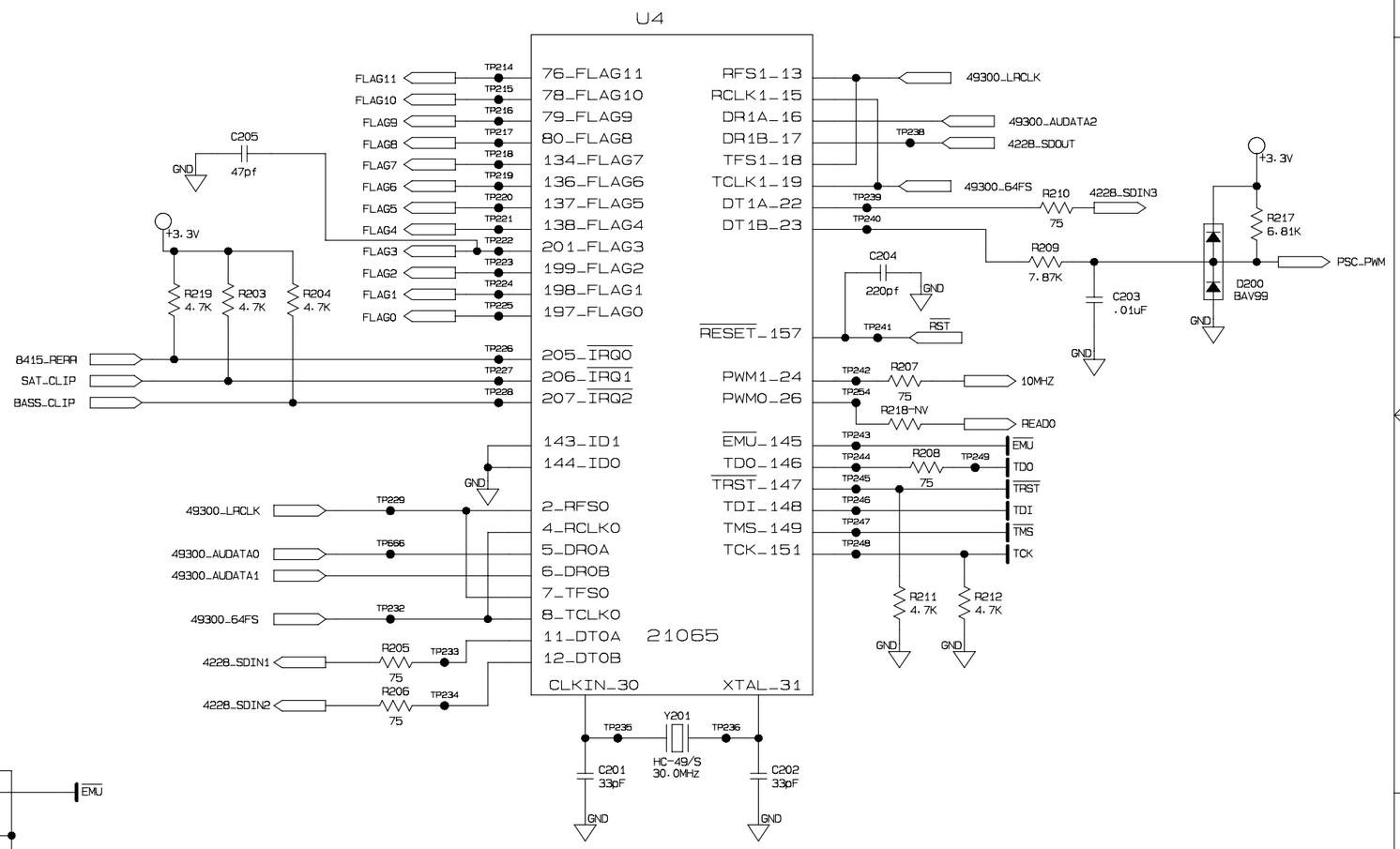
+3.3V
C112 .047uF
GND

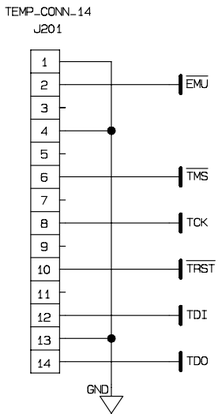
U105
74LCX157
1-Select
Vcc-16
2-1A
5-2A
3A-11
4A-14
3-1B
6-2B
3B-10
4B-13
Strobe-15
8-GND
GND
GND
GND

4-1Y
7-2Y
3Y-9
4Y-12
TP649
TP648
TP647
R120 75
R121 75
R122 75
49300-AUDATA0
49300-64FS
49300-LRCLK

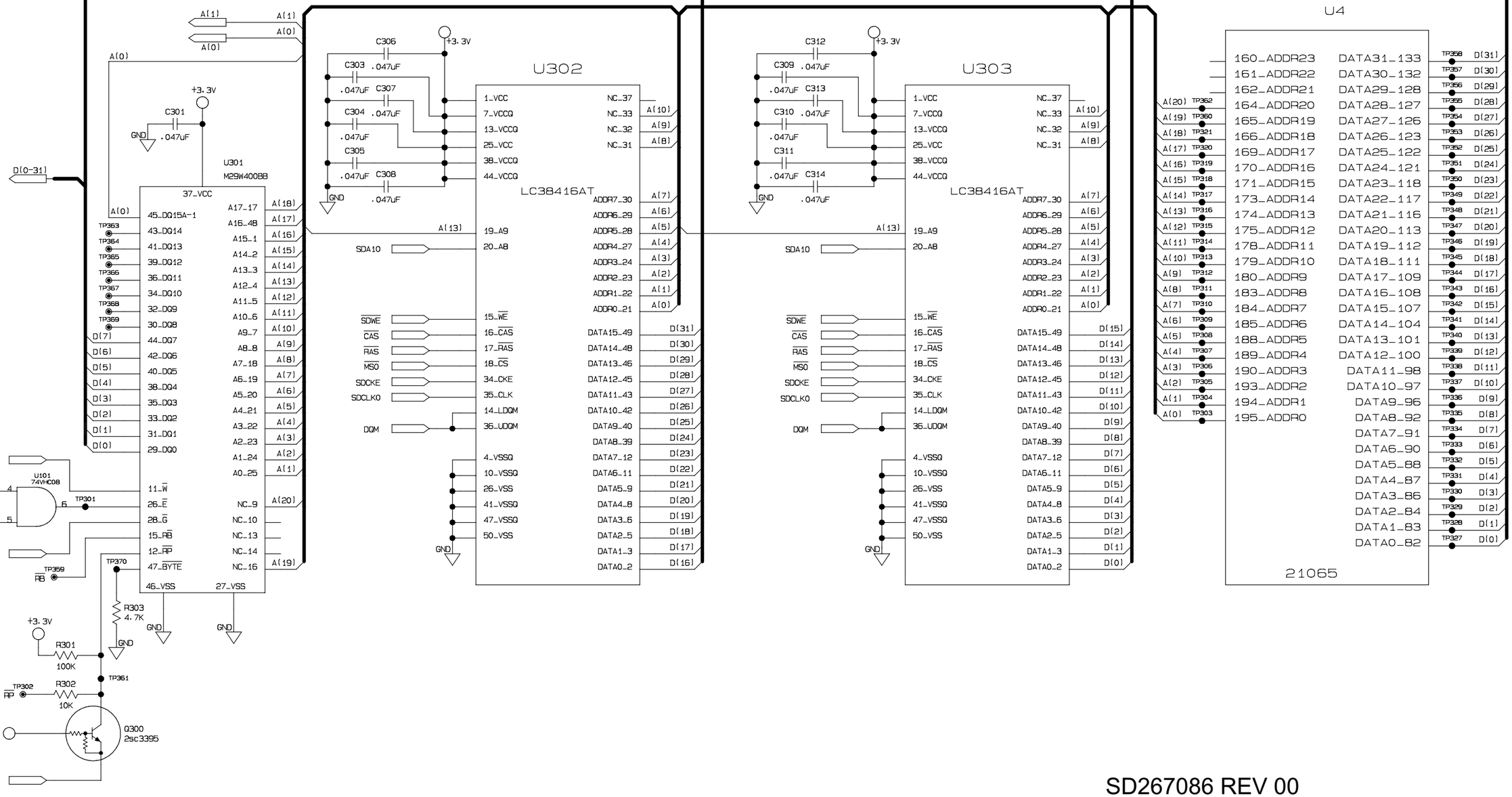
SD267086 REV 00
SHEET 2 OF 8
PS28/48 SERVICE MANUAL 264562-S1







SD267086 REV 00
SHEET 3 OF 8
PS28/48 SERVICE MANUAL 264562-S1



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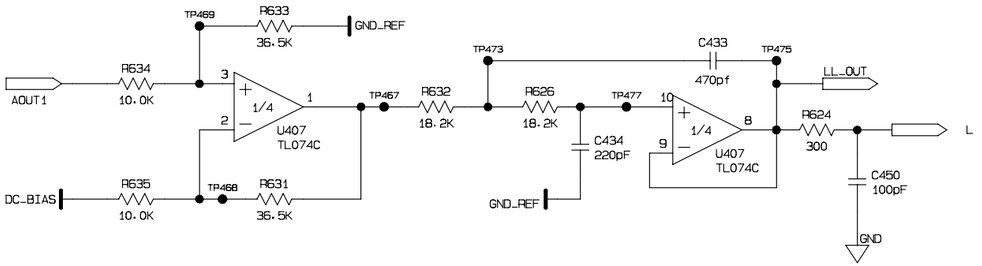
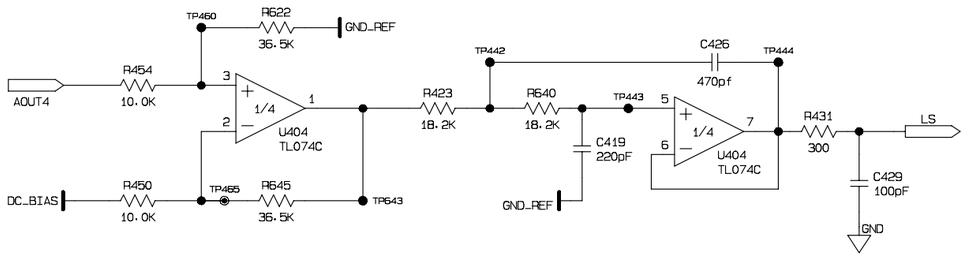
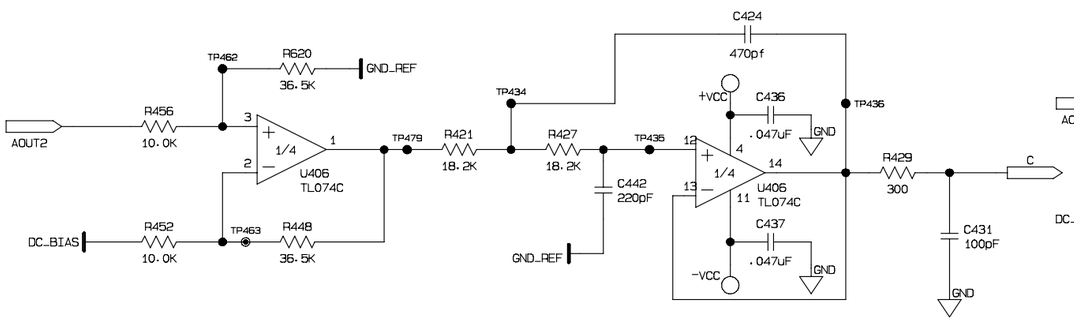
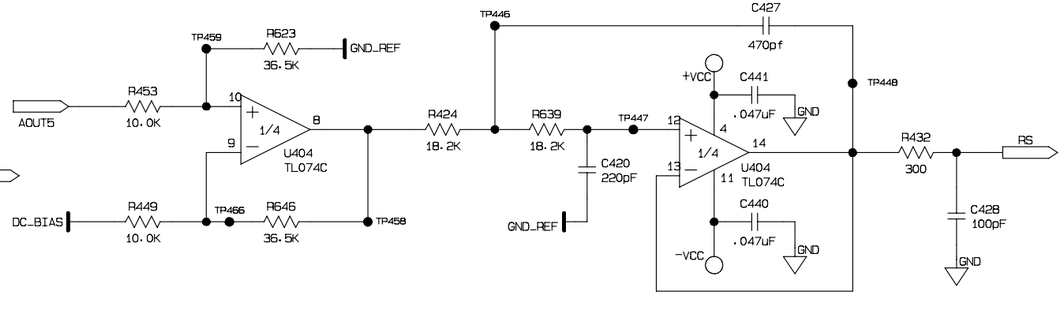
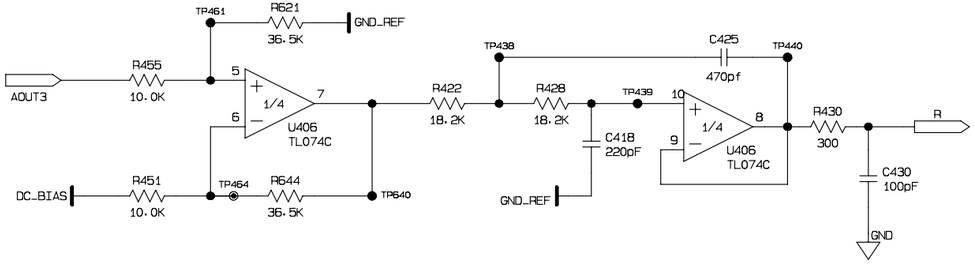
SHEET 4 OF 8
PS28/48 SERVICE MANUAL 264562-S1

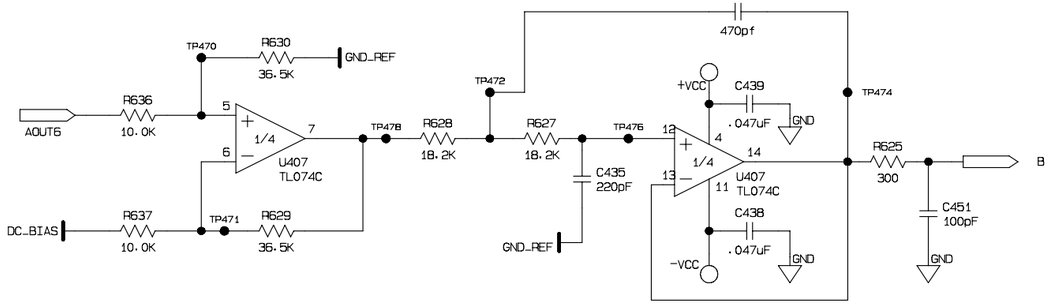




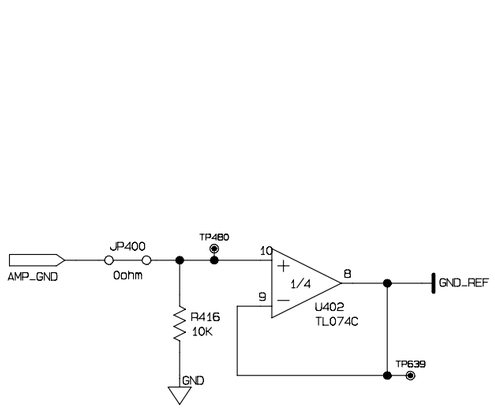


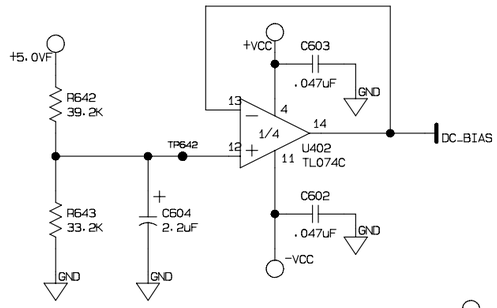


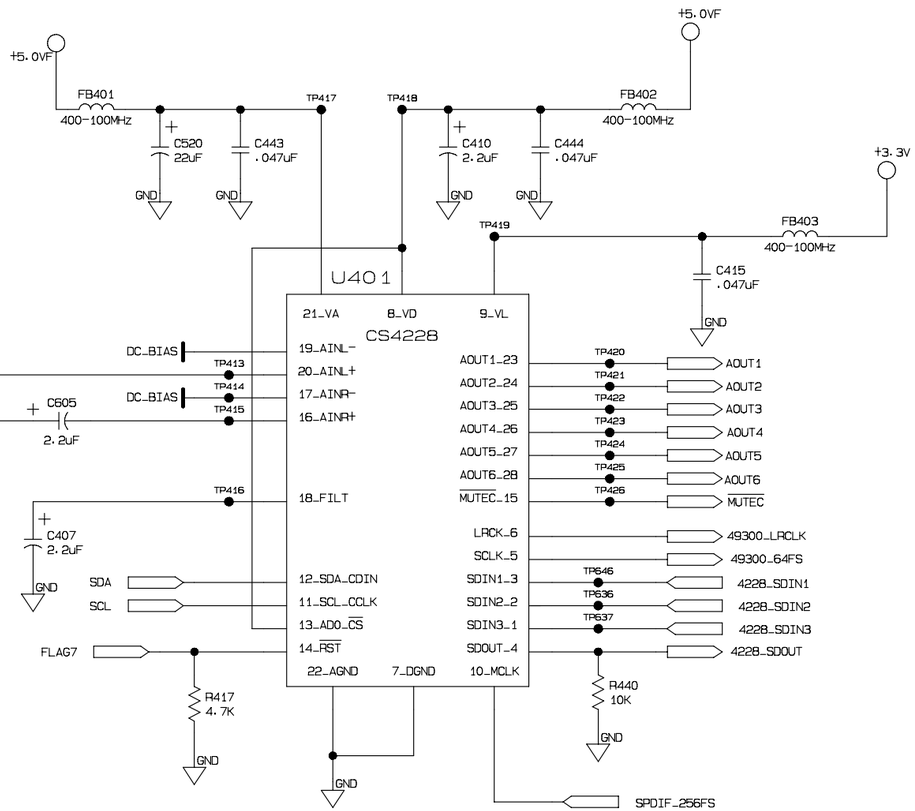


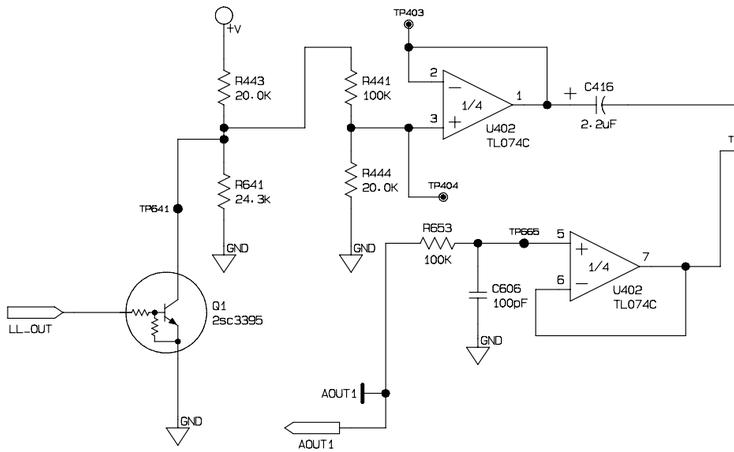


SD267086 REV 00
SHEET 6 OF 8
PS28/48 SERVICE MANUAL 264562-S1

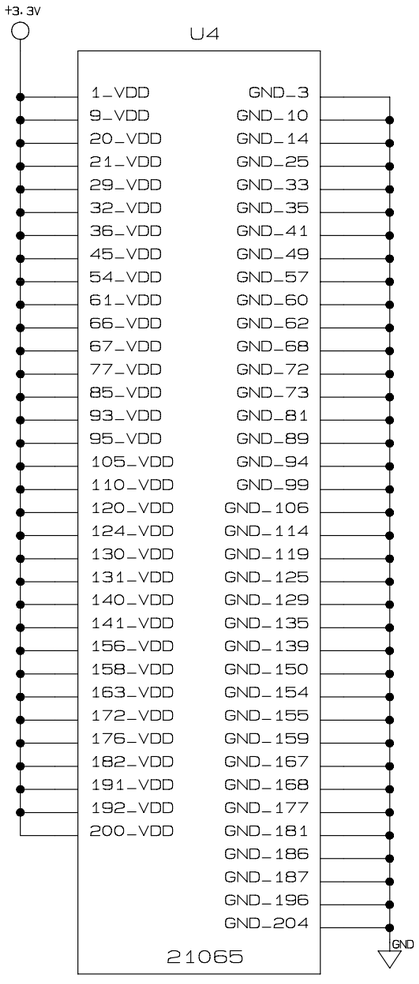


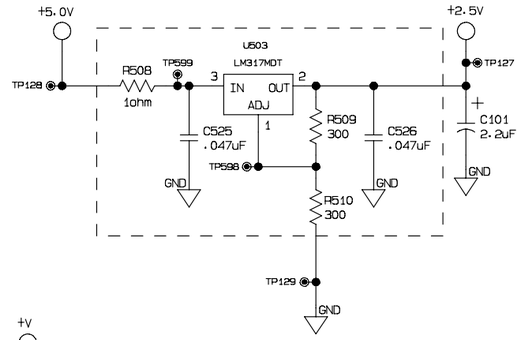


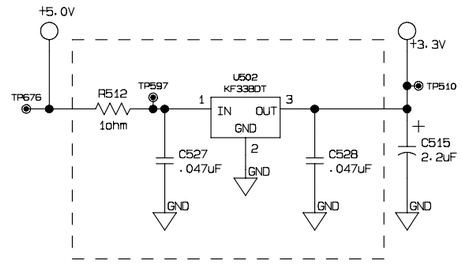


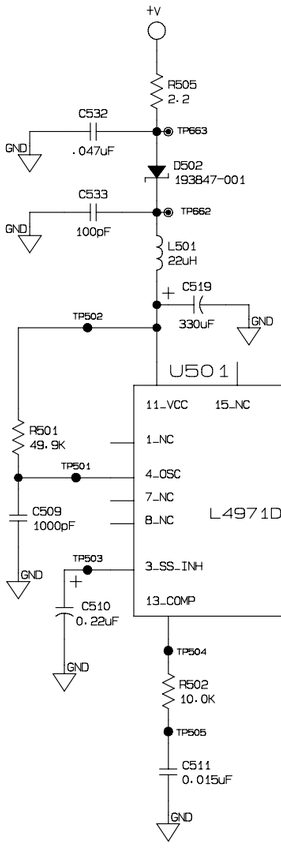


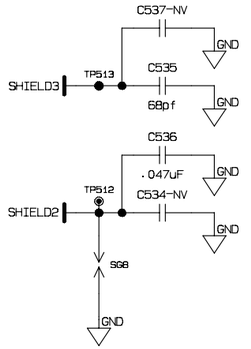
SD267086 REV 00
SHEET 5 OF 8
PS28/48 SERVICE MANUAL 264562-S1

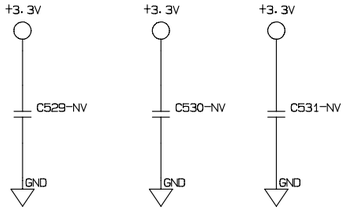


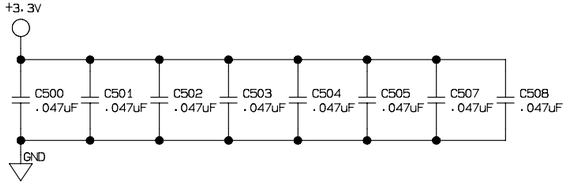




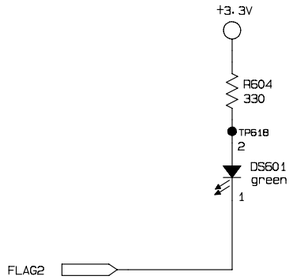


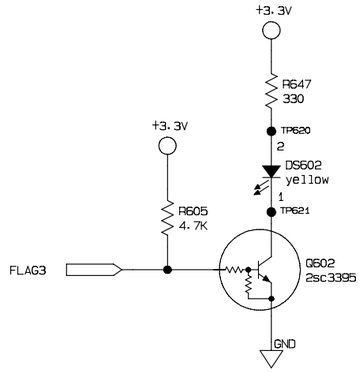


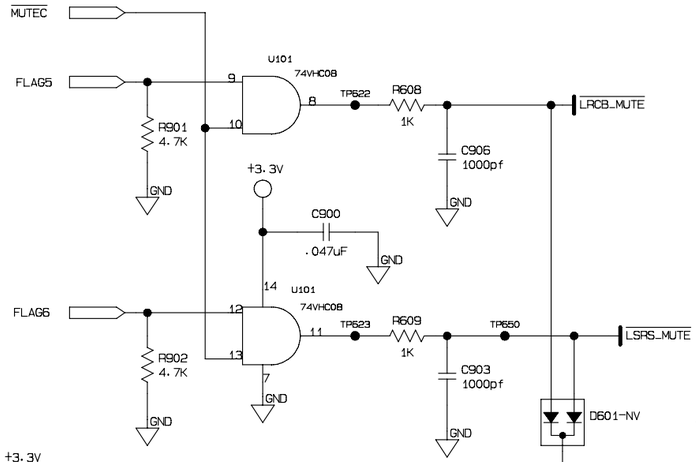


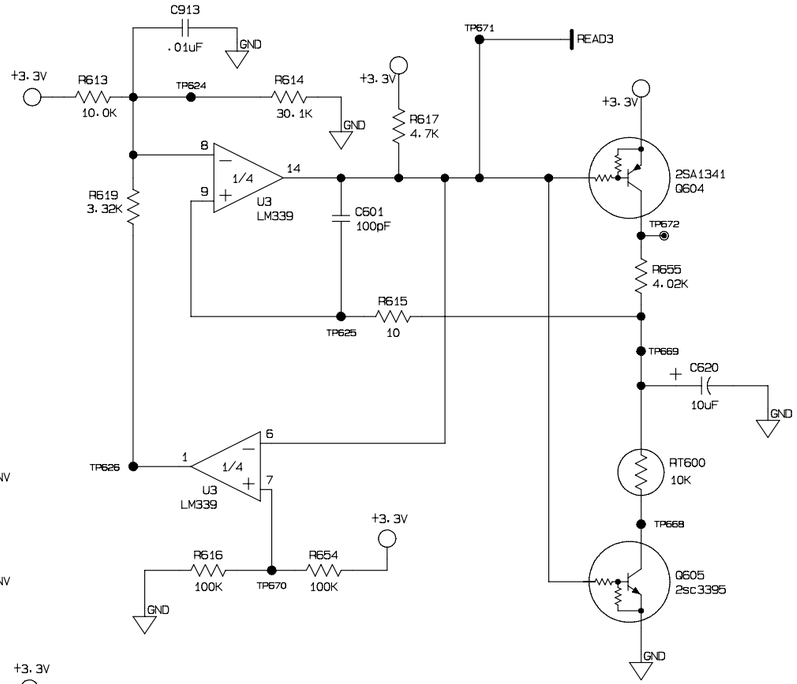


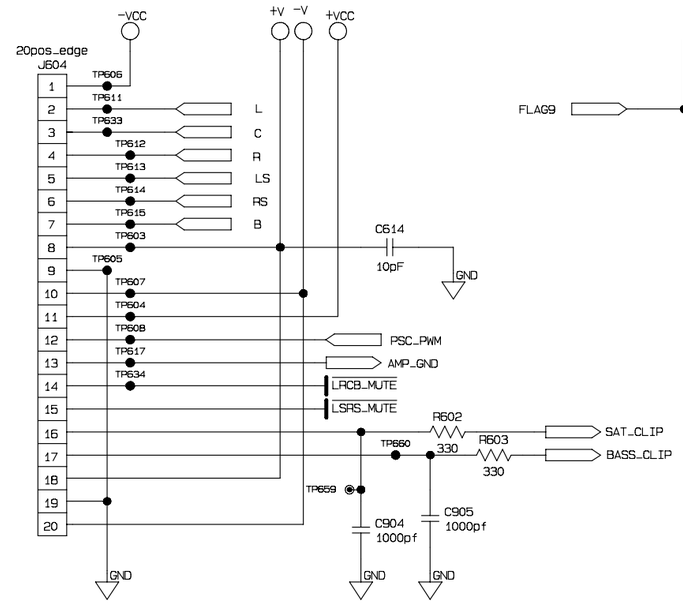
SD267086 REV 00
SHEET 7 OF 8
PS28/48 SERVICE MANUAL 264562-S1

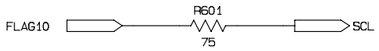


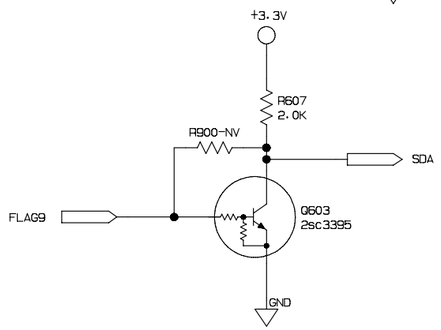


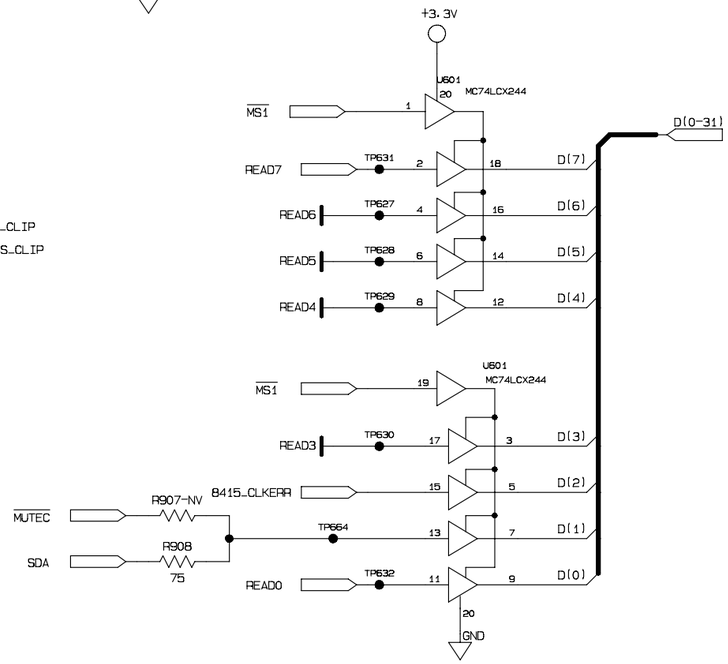


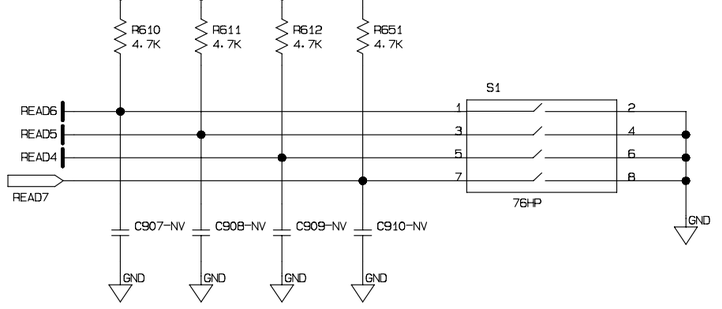


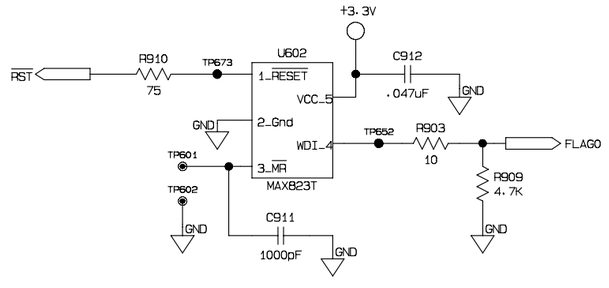












SD267086 REV 00
SHEET 8 OF 8
PS28/48 SERVICE MANUAL 264562-S1

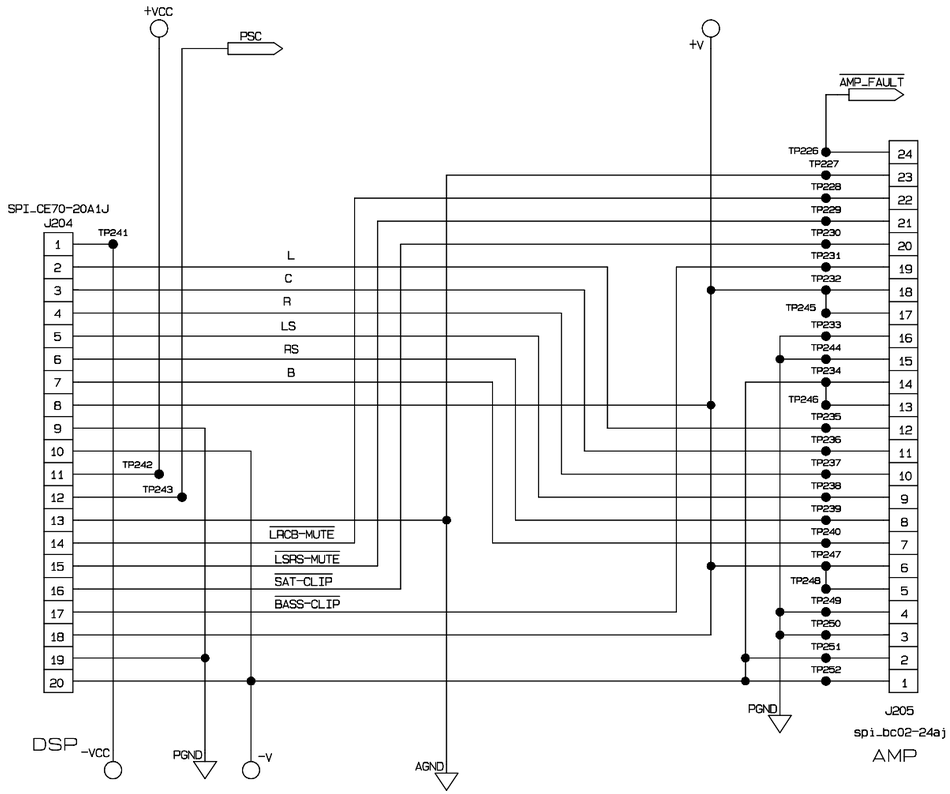
CLASS	DWG NO.	SH
SD	268573	1

REVISIONS

REV	DESCRIPTION	CHK	ENG	DATE

J103 jst_s2p3-vh
J104 260365
J105 260365
T101 3mH
T102 EE42-20
L101 2.2uH
L102 2.2uH
L103 1.5mH
L201 12.5uH
L202 12.5uH
JP1
VR101 170189
VR102 170186
VR103 170186
BR1 25678S-600
Q401 AVS12
Q102 AS258429
Q101 AS258429
U101 L6598
1_Css
2_Rfstart
3_Cf
4_Rfmin
5_OP
6_OP-
7_OP+
8_EN1
Vboot_16
HVG_15
OUT_14
NC_13
Vs_12
LVG_11
GND_10
EN2_9
U401 AVS12
1_Vss
2_Osc/In
3_Osc/Out
4_Vdd
Vm_8
Mode_7
NC_6
Vg_5
U102 254120-001
U103 254120-001
U201 LM317T
U202 lm337t
U203 TL074C
1/4
Adj
ADJ
IN
OUT
VIN
VOut
D101 MMBD914LT1
D102 MMBD914LT1
D103 MMBD914LT1
D105 MMBD914LT1
D106 MMBD914LT1
D111 MMBD914LT1
D201 16CTQ80
D202 MMBD914LT1
D203 8TQ080
D204 8TQ080
D205 MMBD914LT1
D206 MMBD914LT1
D207 BAV70
D208 BAV99
D209 1N4001
D210 1N4001
D211 BAV99
D401 1N4007
D108 Schottky
D112 Schottky
D150 BAV70
Q103 252043
Q104 MMBT3906
Q201 MMBT3904
Q300 MMBT3906
Q301 MMBT3904
ZR101 12V
ZR102 12V
ZR103 3.3V
ZR300 6.2v
264489 SHLD_PS
PCOM
EGND1
EGND2
PGND
+V
-V
+VCC
-VCC
MID
AMP_FAULT
PSC

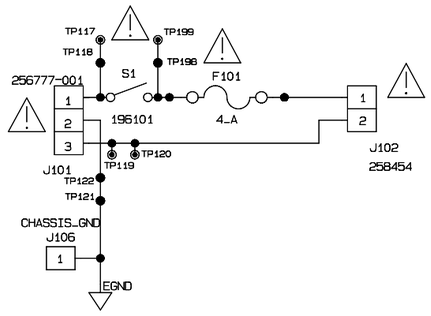
SD268573 REV 00
SHEET 1 OF 3
PS18/28/48 AMP PCB



THIS DRAWING IS BASED ON VISULA DATA ALL CHANGES MUST BE MADE USING THE VISULA FILES ATTACHED TO

MD268573

	120V US	240V EURO	120V/240V DUAL	100V JAPAN
D401	———	———	INSTALLED	———
R401	———	———	INSTALLED	———
R402	———	———	INSTALLED	———
C402	———	———	INSTALLED	———
U401	———	———	INSTALLED	———
C408	JUMPER	———	INSTALLED	JUMPER
Q401	———	———	INSTALLED	———
L103	———	INSTALLED	INSTALLED	INSTALLED
JP1	INSTALLED	———	———	———
VR102	———	INSTALLED	INSTALLED	———
VR103	———	INSTALLED	INSTALLED	———



SD268573 REV 00
SHEET 3 OF 3
PS18/28/48 AMP PCB