
harman/kardon
Service Manual

MAS 100

MAS 110

SAS 100

Compact Music System

Service Manual for Amplifier section and MAS 1 loudspeaker



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TECHNICAL SPECIFICATIONS

SYSTEM:

Power output: 65 watts per channel, 20Hz – 20kHz,
THD < 0.07%, into 6 ohms, both channels driven

Bandwidth: 20Hz – 35kHz, –3dB

System frequency response: 20Hz – 20kHz, ± 0.5 dB

Signal-to-noise ratio, A-weighted: 98dB

Channel separation: ≥ 65 dB

Crosstalk between sources: ≥ 70 dB

Line-level input sensitivity at 1kHz: 250mV RMS, ± 1 dB

LOUDSPEAKERS:

Low-frequency transducers: Two 130mm honeycomb
composite drivers, ported

High-frequency transducers: Two 25mm MMD
domes, shielded

Nominal impedance: 8 ohms

Sensitivity (2.83V/1m): 85dB

Frequency response: 60Hz – 25kHz (–3dB)

Crossover frequency: 2200Hz

FM TUNER SECTION:

Frequency range: 76 – 108.0MHz

Usable sensitivity: IHF 1.3 μ V/13.2dBf

Frequency Response: 10Hz to 15.3kHz

Signal-to-noise ratio: mono/stereo 70/68dB

Distortion: mono/stereo 0.15/0.3%

Stereo separation: 35dB @ 1kHz, 100% deviation @ 65dBf

Selectivity: ± 300 kHz: 65dBf

Image rejection: 80dB

IF rejection: 90dB

Tuner output level: 1kHz, ± 50 kHz, Dev 500mV

Number of presets: 30

RDS capability: PS (program service), RT (dynamic radio text)

CD SECTION:

Disc compatibility: CD, CD-R, CD-RW, MP3, WMA

THD+N (20Hz – 20kHz): <0.025%

Frequency response: 20Hz to 20kHz, 0dB ± 0.5

Channel separation: ≥ 65 dB

Signal-to-noise ratio:

- “A” WTG > 96dB
- 22kHz filter > 94dB

GENERAL:

Power requirement: AC 230V/50Hz

Power consumption: <1W full standby (clock not activated);
<2W standby (clock activated); 80W maximum
(both channels driven)

Operating temperature: 0°C to 40°C

Dimensions (H x W x D):

Controller: 90mm x 240mm x 240mm

Amplifier: 90mm x 240mm x 240mm

Loudspeakers (each, with grille): 272mm x 181mm x 196mm

Weight:

System: 8.2kg

Controller: 8kg

Amplifier: 8kg

Loudspeakers (each): 4.4kg



Features, specifications and appearance are subject to change without notice.

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Please register your product at www.harmankardon.com. You’ll need your product’s serial number. At the same time, you can choose to be notified about new products and/or special promotions.

FRONT-PANEL CONTROLS CONTROLLER AND AMPLIFIER

The MAS 100 and MAS 110 use touch-sensitive controls. To use a control, tap gently on its lit icon.

NOTE: Controls are the same for all models.

Power: Turns the MAS 100/MAS 110 on or places it in Standby mode. To completely power off the unit, unplug the power supply.

Message Display: The time and messages are displayed in this two-line text display.

CD Slot: Load compatible discs here.

Skip/Scan Forward/Reverse: These buttons function differently, depending on the current source:

iPod, CD or USB: Press and release to skip to the next track. Press the reverse button twice to skip to the previous track. Press and hold to scan forward or reverse within a track.

Radio: Press and release to select the next programmed preset station. Press and hold to scan quickly through the stations. When you release the button, the tuner continues to scan until it finds a station of acceptably strong signal quality, and then it stops. To stop the scan before a station is found, press the button again.

Play/Pause: Each tap toggles between the Play and Pause functions.

Stop: Fully stops playback.

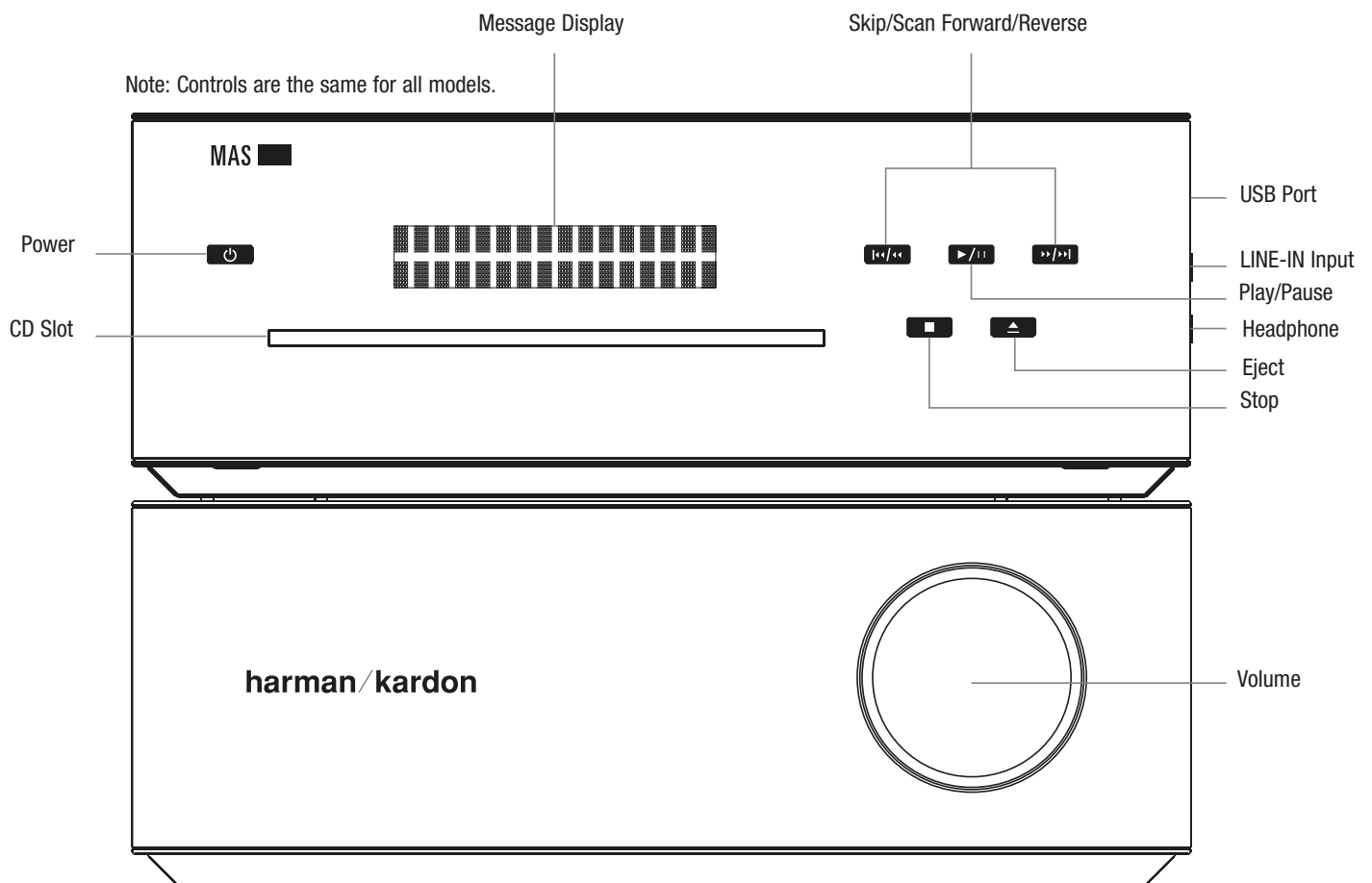
Eject: When a CD is loaded, tap here to eject it.

USB Port A: Connect a compatible USB device here to enjoy playback of audio MP3 or WMA files. Although most USB flash and hard-disk drives in the FAT32 file format, as well as many MP3 players, are compatible with the MAS 100 and MAS 110 systems, due to the wide variety of manufacturers, playback cannot be guaranteed. Do not connect an iPod or iPhone to this port. Do not connect a personal computer or any peripherals to this port.

Line-In Jack (Line Input): Connect a 3.5mm male-to-male cable (not included) to the headphone or line-level output on a portable player or other device.

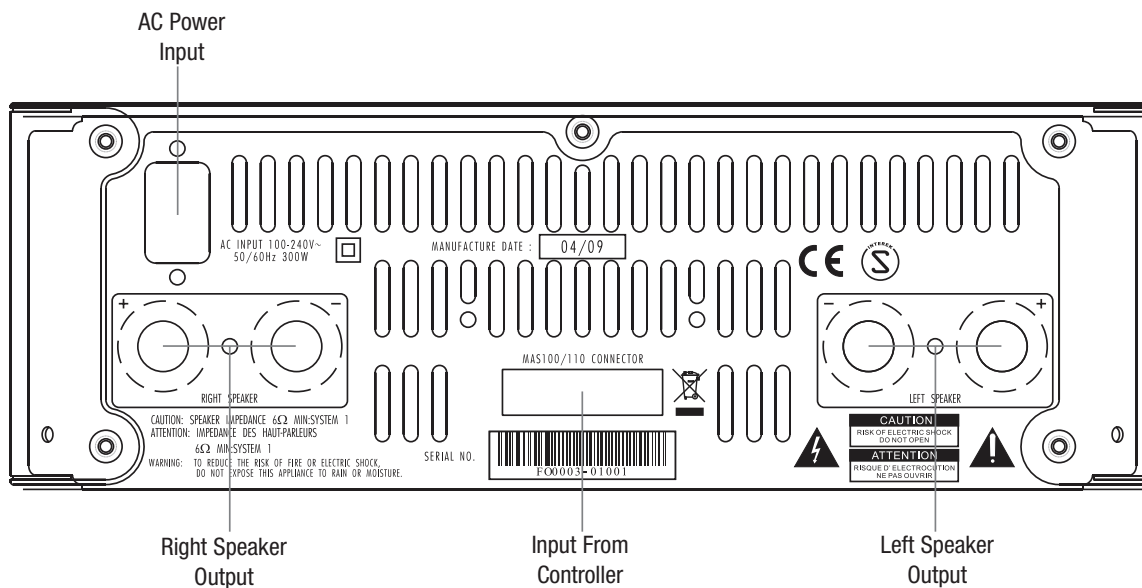
Headphone Jack: Outputs a stereo signal for private listening through most headphones that are equipped with a 3.5mm plug.

Volume Control: Increases or decreases the volume.



REAR-PANEL CONNECTIONS

AMPLIFIER



Right and Left Speaker Output Terminals: Use two-conductor speaker wire to connect each set of terminals to the correct speaker. Remember to observe the correct polarity (positive and negative connections).

Input From Controller: Connect the included ribbon cable to this connector and to the corresponding connector on the MAS controller. This cable passes audio signals from the controller to the amplifier, and it transfers AC power from the amplifier to the controller. If this cable is ever damaged, do not use it, and contact Harman Kardon, Inc., for a replacement.

AC Power Input: After you have made all other connections, plug the AC power cord into this receptacle and into an unswitched wall outlet.

REMOTE CONTROL FUNCTIONS

Power: Turns the MAS 100/MAS 110 on or off. To completely power off the unit, unplug the power supply.

Sleep: Each press increases the time until turn-off, from 10 to 90 minutes, in increments of 10 minutes. The next press after the 90 minutes setting turns off the Sleep function.

Source Selectors: Selects a source input. Each press of the Line In or Digital In Buttons toggles among the available analog (Line Input on right-side panel; TV, AUX or Phono Input on rear panel) or digital audio inputs (Coaxial 1 or 2, Optical 1 or 2), respectively. Press the Bridge Button to select an iPod docked in The Bridge II.

Display: Adjusts the brightness of the Message Display when hold pressed for more than one second in every mode or access to some special information on DAB mode if less than one second. In DAB mode, selects station-defined information when pressed for less than one second. Each press changes the brightness: Full, Half or Off. When the display is fully dimmed while the system is turned on, the LED inside the Volume Knob and the LED behind the Power Button will remain lit to remind you that the system is still on.

Settings: Accesses menus for Speaker Setup (tone controls), Time Setup (clock), Alarm Setup, System Version and System Reset. See the Operation section for more information.

- **Back:** Returns to previous menu level.
- **Info:** Displays status of current source.
- **Radio:** When FM band is in use, each press toggles between the PS (Program Service) and RT (Radio Text) RDS information, if available. When a DAB radio station is playing, press this button to access the menu system for the DAB tuner. See pages 14 and 15 for more information.
- **Audio CD:** Displays CD Text information, if available. Each press displays the following items: Song, Artist, Album.
- **USB or Data CD:** Scrolls all ID3 tag information for current source, if available. Each press displays the following individual items: Song, Artist, Album, File type, Folder, then back to scrolling. If ID3 tags are not available, the filename will appear.

Time: Displays elapsed track time for the current Audio CD (no effect on data CDs or other sources). Each additional press changes the display as follows: remaining track time, elapsed disc time, remaining disc time, then back to elapsed track time.

▲/▼◀/▶ Navigation Buttons: Use the ◀ and ▶ Buttons to scroll forward and reverse through the Settings Menus, or through lists of content, and press the Enter Button to make selections. Press the Back Button to return to the previous menu or content level.

Enter: Selects a menu item, or saves setting changes and returns to the previous menu level.

Clear: Clears the current preset station or a playlist entry.

Radio: To delete the current preset station, press the Clear Button while it is playing.

Playlist: While programming a playlist, press to delete the track just entered. After the playlist has been saved by pressing the Stop Button, press the Clear Button to delete the entire playlist. To delete a single track, stop play, press the Check Button repeatedly until the desired track appears and press the Clear Button. Press the Play Button to exit Check mode.

Program/Memory: Used to program playlists and radio presets.

- **Radio:** If the current station has not been programmed into a preset, press Program/Memory and press the Enter Button to store the station at the current preset number, or use the Numeric Keys to enter a different preset number. The new preset will overwrite the existing one.
- **USB or CD (Audio or Data):** Press the Program Button to begin Program Mode. Add tracks to the playlist by using the Skip/Scan Transport Controls or the Numeric Keys to select the track, then press the Program Button to enter the selection. Add up to 99 files. Press Play to play the playlist, or Stop to save the playlist without playing it. During playback, the order of the track in the playlist will appear on the left, with the disc's track number to the right. See page 16.

Check: After a playlist has been programmed and play has been stopped, each press of the Check Button displays the tracks in the playlist.

Eject: When a CD is loaded, press this button to eject it.

FM Mode: Used with FM radio, each press toggles between Stereo and Monaural playback.

Auto Store: Scans through all frequencies, searching for stations with acceptably strong signal quality, and stores them as presets.

Random: Each press turns Random playback mode (shuffle) on or off. This mode plays the tracks of the current disc or drive in random order.

Transport Controls

Track-Skip/Tuning Up/Down: These buttons function differently, depending on which source has been selected:

- **iPod, CD or USB:** Press and release to skip to the next track. Press the reverse button twice to skip to the previous track.
- **Radio:** Press and release the Track Skip Buttons to tune to the next higher or lower station by one frequency increment. Press and hold to scan quickly through the stations.

Scan Forward/Reverse: Press and hold to scan forward or in reverse within a track when the iPod, CD or USB sources are playing.

Play/Pause: Each tap toggles between the Play and Pause functions.

Stop: Fully stops playback.

REMOTE CONTROL FUNCTIONS

Preset/Folder +/-: Selects a preset station or folder on a USB or data CD.

Radio: Each press changes to the next or previous preset station, if any have been programmed.

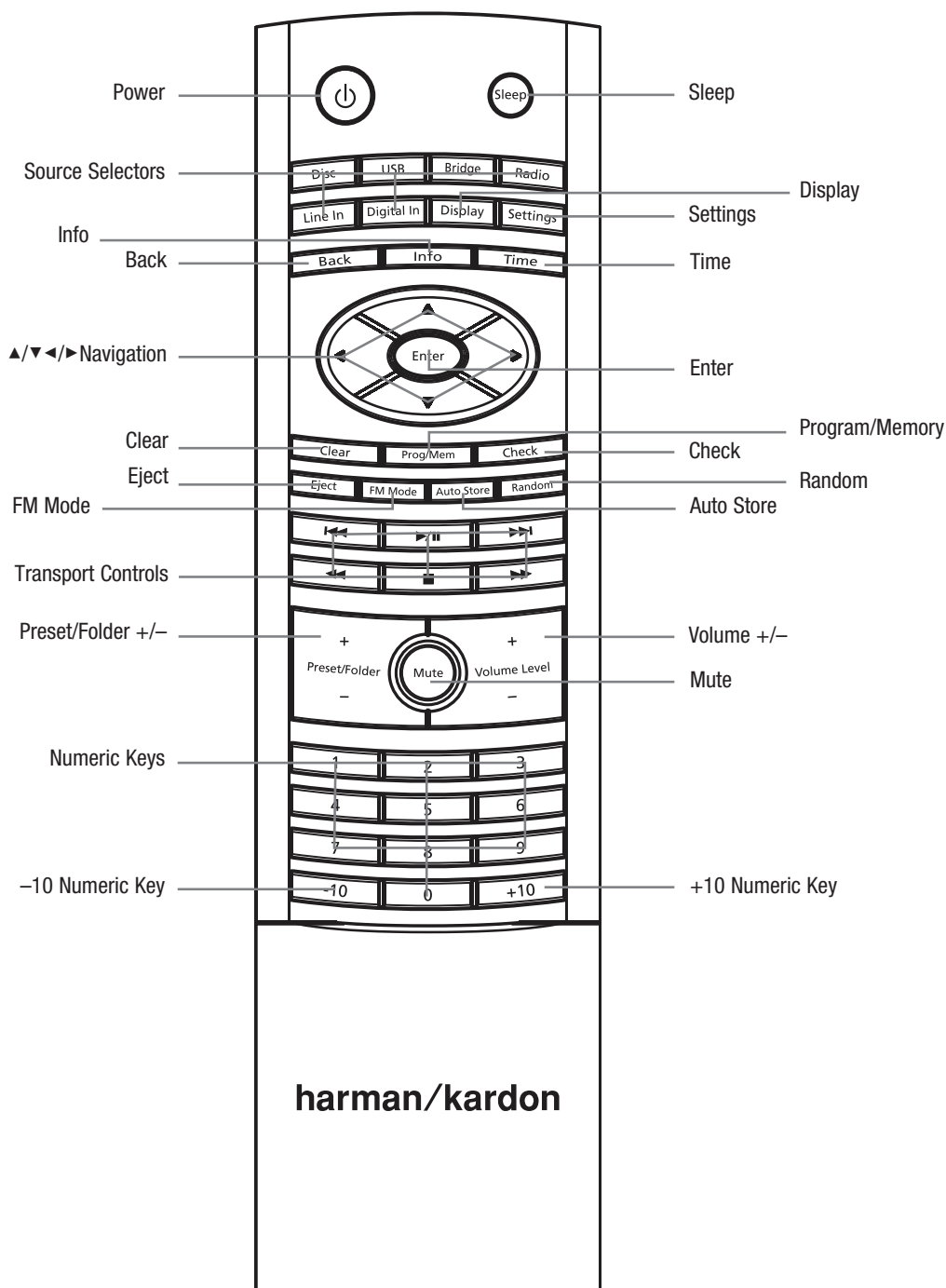
USB or Data CD: Press once to open the current folder. Each additional press changes to the next or previous folder. After 3 seconds, the first track in the new folder will begin playing.

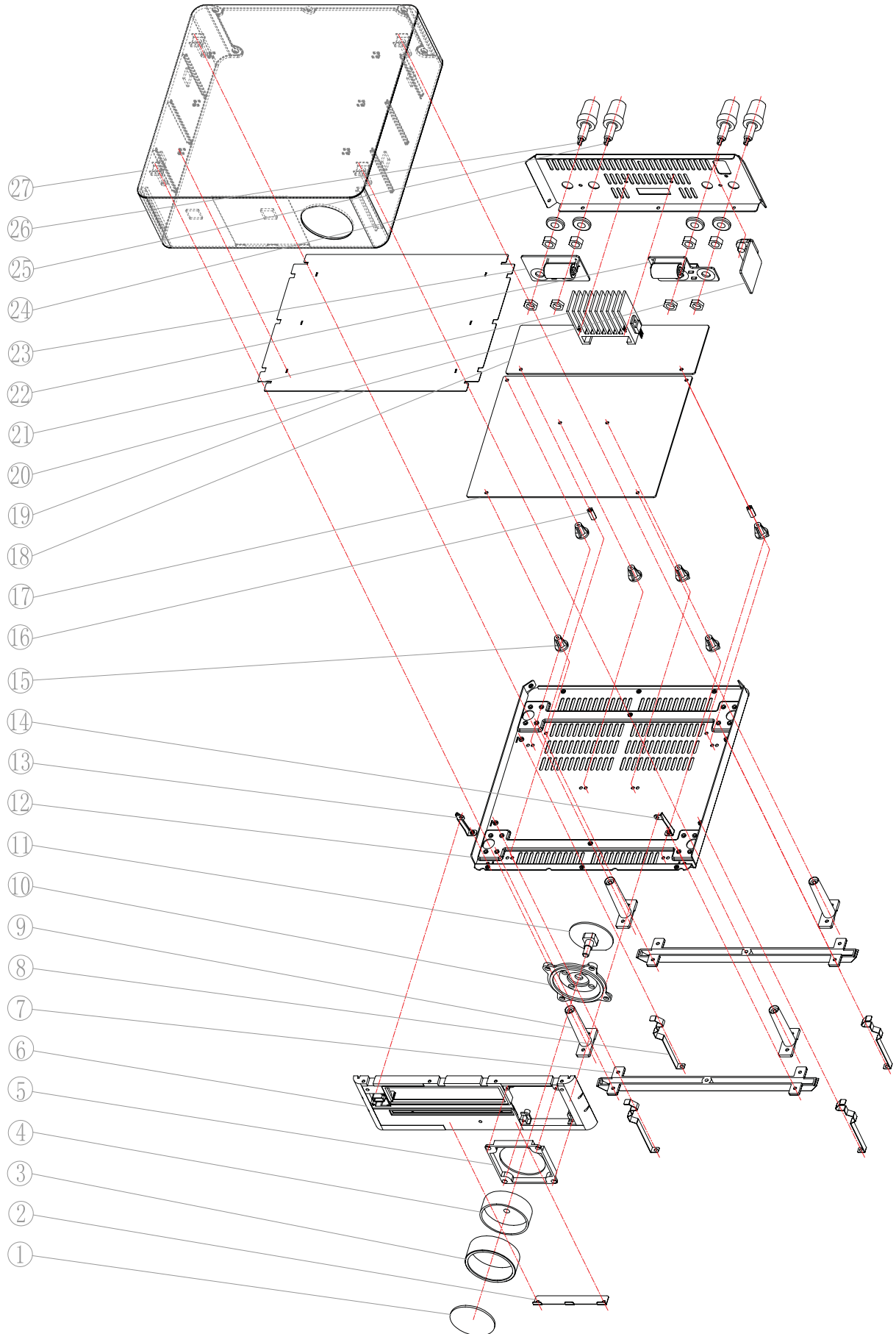
Mute: Press to temporarily silence the speakers. Press again to restore audio. Muting is canceled if the MAS 100/MAS 110 is turned off.

Volume +/-: Increases or decreases the volume. Press and hold to change the volume more quickly.

Numeric Keys: Used to enter track numbers, radio stations or preset numbers, or while adjusting the clock and alarm times.

-10 and +10 Numeric Key: Used with a USB device or CD to quickly advance through a large number of tracks. Each press of these keys changes to the next or previous track in increments of 10.

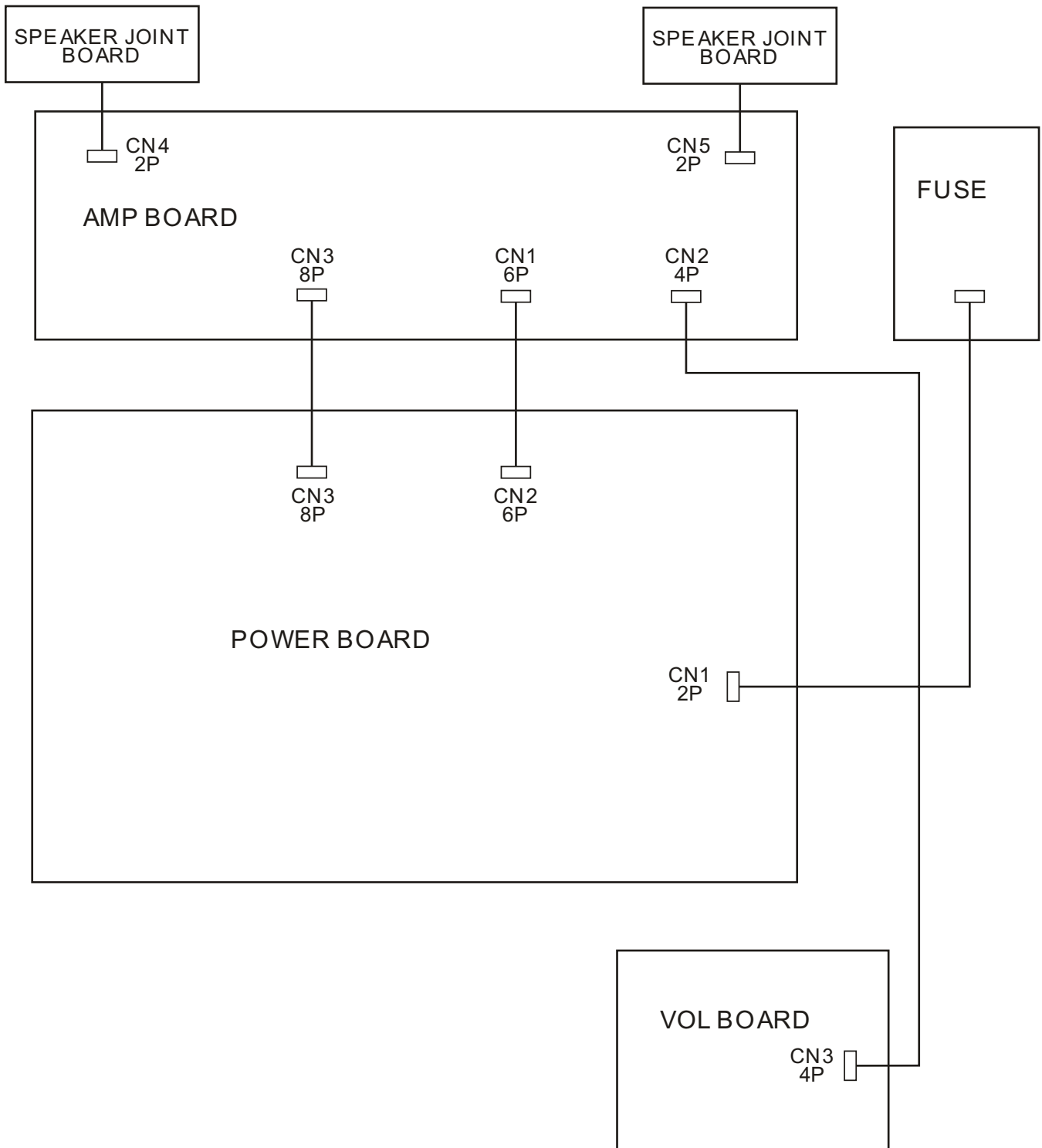




MAS AMP Explode List

NO	PART.NO	DESCRIPTION	QTY
1	7448 1020 0000	VOLUME KNOB LENS	1
2	6950 102A 0000	LOCK SHEET	1
3	7548 101C 0000	VOLUME PASTEM	1
4	7648 1010 0000	VOLUME KNOB COVER	1
5	7550 1020 0000	VOLUME KNOB BRACKET	1
6	7550 501A 0000	SUB PANEL	1
7	7950 5020 0000	FOOT	2
8	5550 102D 0000	GROUNDING COPPER SHEET	4
9	7550 502A 0000	PLASTIC POST	4
10	7549 102B 0000	LAMPSHADE	1
11	0082 1191 0000	LED PCB	1
12	6250 1010 0011	BUTTOM COVER	1
13	5350 5020 0000	SUB PANEL RIGHT BRACKET	1
14	5350 503A 0000	SUB PANEL LEFT BRACKET	1
15	7900 0040 0000	PCB PLASTIC POST	6
16	5350 1010 0000	M3x12 COPPER POST	2
17	0082 1071 0000	POWER PCB	1
18	0082 1001 0000	AMP PCB	1
19	5650 101A 0000	POWER PCB SHIELDING SHEET	1
20	0082 1101 0000	FUSE PCB	1
21	5150 1010 0000	HEATSINK	1
22	0082 1321 0020	SPEAKER JOINT PCB-1	1
23	0082 1321 0010	SPEAKER JOINT PCB-1	1
24	6350 101C 0011	BACK COVER	1
25	2920 0290 6003	SPEAKER Terminal	2
26	2920 0300 6003	SPEAKER Terminal	2
27	7950 1010 0000	TOP COVER	1

REMOTE CONTROL parts number: 9843 3191 091



Bill of Material for AMP.Bom P/N:0082-1001-0000

Used	Part Type	Designator Description	Part number
2	BAV19WS	D10 D13	1000 0192 2391
2	IRS2092SPBF	IC2 IC3	1002 0920 3038
2	TLC081IDR	IC1 IC4	1000 0812 0838
1	C2235	Q13	1132 2350 0162
1	TIP31CL	Q11	1110 0310 6000
2	IRFI4212H-117P	Q6 Q7	1194 2120 1630
3	MMBT5401	Q1 Q2 Q8	1185 4015 1011
3	MMBT5551	Q3 Q9 Q12	1185 5515 1011
4	HZK5C(5.1V)	Z1 Z3 Z4 Z5	1300 5100 0000
1	HZK15ST(15V)	Z2	1300 1500 0000
1	1N4001	D1	1360 1400 1005
3	LL4148	D5 D8 D11	1301 4148 0100
1	MMSZ5256BT1G(30V)	DW2	1303 0002 0100
1	MMSZ5261BT1G(47V)	DW1	1304 7002 0100
6	MURA120T3G	D9 D12 D18 D19 D20 D21	1301 2035 0100
1	02DSB282JSW PTC	RT1	1609 0002 8225
2	DEP1016-220N(sumida)	L1 L2	1842 2010 0001
5	FAIR-RITE 3.5x8x1	FB11 FB12 FB13 FB14 FB15	1893 8780 0001
9	FB0805	FB1 FB3 FB4 FB5 FB6 FB7 FB8 FB9 FB10	1852 0120 9100
2	JRC-27F/012-M(555)	K1 K2	4712 2027 0006
1	IDC 2x10P2.54(90)	JK2	3109 0520 4632
2	2P3.96	CN4 CN5	3100 0602 0001
1	4P(2.0)	CN2	3100 4040 0200
1	6P2.5	CN1	3100 4060 0250
1	8P(2.5)	CN3	3100 4080 0250
4	2.2K/1W	R33 R34 R36 R37	2413 0522 2212
2	10R/1W	R59 R60	2401 0521 0020
1	220R/1W	R70	2413 0322 2112
1	330R/1W	R27	2413 0523 3112
2	300R±1%	R39 R40	2401 1223 3103
2	3.9K±1%	R77 R78	2401 1213 9203
2	4.3K±1%	R24 R28	2401 1214 3203
2	4.7K±1%	R48 R50	2401 1214 7203
4	15K/1%	R91 R92 R93 R94	2401 1211 5303
4	30K/1%	R63 R64 R65 R66	2401 1213 0303
2	33K±1%	R51 R52	2401 0813 3304
2	62K±1%	R86 R87	2401 0816 2304
2	10K±1% 0603	R41 R42	2401 1211 0303
8	10K±1% 0805	R13 R17 R26 R29 R35 R38 R47 R49	2401 0811 0304
4	4.7R 0603	R5 R7 R73 R74	2401 1224 7003
6	4.7R 0805	R32 R43 R45 R61 R62 R71	2401 8247 9400
1	10K/1206	R25	2401 0921 0306
2	10R	R44 R46	2401 8210 0400

4	20R	R53 R54 R55 R56	2401 8220 0400
2	100R	R12 R16	2401 1221 0103
2	330R	R3 R6	2401 1223 3103
1	1.2K	R20	2401 1221 2203
2	2.2K	R57 R58	2401 0922 2305
2	4.7K	R21 R22	2401 1224 7203
1	8.2K	R19	2401 1228 2203
9	10K	R1 R2 R4 R11 R14 R23 R31 R67 R75	2401 1221 0303
1	47K	R30	2401 1224 7303
6	100K	R10 R15 R68 R69 R72 R76	2401 1221 0403
2	10uF/25V(X7R)	C18 C19	2115 6106 0955
6	22uF/16V(X5R)	C14 C15 C16 C17 C39 C40	2103 5226 1355
4	22uF/25V(X5R)	C20 C21 C22 C23	2103 5226 0925
2	47P(NPO)	C38 C47	2103 5470 0130
8	102J/100V(NPO)	C6 C7 C10 C11 C12 C13 C48 C54	2103 5102 0235
4	0.1U/250V	C24 C26 C27 C29	2115 6104 1755
2	0.1U/500V	C1 C4	2115 6104 0355
2	0.1U/100V(POLY)	C25 C28	2207 2104 0200
2	0.47U/100V(POLY)	C34 C35	2207 2474 0200
11	0.1uF	C2 C3 C8 C9 C41 C42 C43 C46 C49 C50 C53	2115 6104 0130
5	104	C5 C36 C37 C51 C52	2115 6104 0130
1	330U/10V	C44	2331 0210 1000
1	10U/50V	C45	2310 0610 1015
4	1000uF/50V	C30 C31 C32 C33	2312 0610 5050

LED-PCB P/N:0082-1191-0000

Used	Part Type	Designator Description	Part number
4	IL0445W31BOLG201(white)H5mm	LED2 LED3 LED4 LED5	1402 0705 0006
1	R122ECA-D1-19.5F-24-W	RV1	4401 2211 9524
1	4P(2.0) JEDEC	CN3	3100 4040 0200
4	220R±5%	R17 R18 R63 R64	2401 0222 2111
1	0.1uF/50V±5%	C10	2115 6104 0113

FUSE-PCB P/N:0082-1101-0000

Used	Part Type	Designator Description	Part number
1	T5AL 250V	FH1	1601 0515 0120
1	SO-222-S-0R-R3(D)	CN5	2810 0302 2203
1	3P(3.96) JEDEC	CN1	3100 0702 0050
1	0.1U/275VAC(X2)	C13	2210 3104 0604
1	10D471K	RZ1	2416 2000 0008

SPEAKER JOINT-2 PCB P/N:0082-1321-0010

Used	Part Type	Designator Description	Part number
1	F1810285	T1	1875 1802 8500
1	1000PF/200V±10% 1206	C2	2103 5102 0150
1	0.1UF/200V±10% 1206	C1	2103 5104 0150

SPEAKER JOINT-2 PCB P/N:0082-1321-0020

Used	Part Type	Designator Description	Part number
1	F1810285	T2	1875 1802 8500
1	1000PF/200V±5% 1206	C3	2103 5102 0150
1	0.1UF/200V±5% 1206	C4	2103 5104 0150

POWER PCB P/N:0082-1071-0000

Used	Part Type	Designator Description	Part number
1	FSFR2100(9-SIP) FAIRCHILD	IC4,IC7	1002 1002 1006
3	LTV817A(DIP4) COSMO	IC6,IC7,IC8	1000 8172 1901
1	SG6961SZ(SOP8) FAIRCHILD	IC5	1006 9610 1913
2	2SA1048(TO-92) (TOSHIBA)	Q5,Q16	1111 0480 0002
4	2SC2458(TO-92) TOSHIBA	Q8,Q9,Q10,Q12	1132 4580 5002
1	DMP3020LSS(SOP-8L) DIODES	Q7	1153 0200 1900
1	FAN7602N(DIP8) FAIRCHILD	IC10	1007 6020 1901
1	FDPF20N50(TO-220) FAIRCHILD	Q3	1172 0500 1000
1	FQPF7N80C(TO-220) FAIRCHILD	Q14	1170 7800 1030
1	ISL9R1560PE2	D1	1191 5600 1000
1	S8050LT1(SOT-23) HAROM	Q4	1108 0502 1828
2	S8550LT1(SOT-23) HAROM	Q1,Q2	1108 5502 1828
1	TIP31CL(TO-220) FAIRCHILD	Q15	1110 0310 6000
1	TIP32CL(TO-220) FAIRCHILD	Q6	1110 0320 6000
3	IN4148	D13,D14,D15	1310 1414 8000
1	4148 SMD LL-34	D5	1310 4414 8000
1	IN5819	D9	1320 1005 8192
6	FR107	D6,D7,D10,D11,D16,D17	1360 7000 1075
3	HZ20-2ST	DW3,DW4,DW5	1300 0205 0102
2	UDZS18B	DW2,DW6	1300 0185 0100
1	UF4007	D2	1360 0004 0075
1	SR360	D18	1360 7000 3604
1	MUR1620CTRG(TO-220) ON Semiconductor	D3	1311 6200 0020
1	MUR1620CTG(TO-220) ON Semiconductor	D4	1311 6200 0000
1	BAV99	D8	1310 5009 9000
1	GBJ806	BL1	1360 0000 8060

1	5D-9	NTC1	1609 2006 0900
3	TL431-A(TO-92) TF	IC1,IC2,IC3	1709 0004 3100
3	15UH/2A	L3,L4,L5	1702 0155 0000
2	50UH/3A	L1,L2	1703 0500 0000
1	BCK-03(8048)D	T5	1709 8048 0000
1	BCK-03(8049)	T3	1709 8049 0000
1	BCK-03(8050)A	T4	1709 8050 0000
1	FAIR-RITE 3.5X8X1(711380)	FB1	1893 8780 0001
2	SG08210(EE25)	T1,T2	1892 5000 0000
1	2P(7.92) SOCKET	CN1	3101 6030 0200
2	390 Ω 1/8W \pm 5%	R77,R90	2401 0223 9111
2	1K Ω 1/8W \pm 5%	R25,R34	2401 0221 0211
2	2.2K Ω 1/8W \pm 5%	R32,R36	2401 0222 2211
1	2K Ω 1/8W \pm 5%	R74,R79	2401 0222 0211
3	4.7K Ω 1/8W \pm 5%	R69,R71,R106	2401 0224 7211
1	6.2K Ω 1/8W \pm 5%	R27	2401 0226 2211
3	10K Ω 1/8W \pm 5%	R8,R11,R33	2401 0221 0311
1	15K Ω 1/8W \pm 5%	R78	2401 0221 5311
1	20K Ω 1/8W \pm 5%	R60	2401 0222 0311
1	47K Ω 1/4W \pm 5%	R85	2401 0224 7311
1	100K Ω 1/8W \pm 5%	R26	2401 0221 0411
1	120K Ω 1/8W \pm 5%	R35	2401 0221 2411
1	150K Ω 1/8W \pm 5%	R19	2401 0221 5411
1	120 Ω 1/4W \pm 5%	R51	2401 0321 2111
1	100 Ω 1/4W \pm 5%	R49	2413 0321 0111
1	10 Ω 0.5W \pm 5%	R101	2401 0421 0011
1	1M Ω 0.5W \pm 5%	R2	2413 0421 0511
1	0.5 Ω 1W \pm 5%	R98	2406 0525 0911
1	68K Ω 1W \pm 5%	R99	2413 0526 8312
2	11M Ω 1W \pm 5%	R53,R54	2413 0521 1611
2	0.1 Ω 2W \pm 5%	R53,R54	2413 0621 0812
1	68K Ω 2W \pm 5%	R55,R56	2413 0626 8312
2	0.15 Ω 3W \pm 5%	R66,R67	2413 0721 5823
2	0.1K Ω 5W \pm 5%	R57,R58	2413 1021 0210
1	0 Ω \pm 5% 0805	R17	2401 0820 0004
1	15 Ω \pm 5% 0805	R1	2401 0821 5004
1	47 Ω \pm 5% 0805	R18	2401 0824 7304
1	100 Ω \pm 5% 0805	R50	2401 0821 0104
1	270 Ω \pm 5% 0805	R102	2401 0822 7104
1	470 Ω \pm 5% 0805	R14	2401 0824 7104
1	680 Ω \pm 5% 0805	R15	2401 0826 8104
6	1K Ω \pm 5% 0805	R23,R24,R28,R29,R30,R31	2401 0821 0204
1	2.4K Ω \pm 5% 0805	R37	2401 0822 4204

2	2K Ω ±5% 0805	R75,R76	2401 0822 0204
1	5.6K Ω ±5% 0805	R70	2401 0825 6204
6	10K Ω ±5% 0805	R3,R4,R5,R6,R7,R9	2401 0821 0304
1	12K Ω ±5% 0805	R40	2401 0821 2304
2	15K Ω ±5% 0805	R39,R72	2401 0821 5304
1	27K Ω ±5% 0805	R97	2401 0822 7304
1	180K Ω ±5% 0805	R95	2401 0821 8404
1	200K Ω ±5% 0805	R47	2401 0822 0404
5	470K Ω ±5% 0805	R42,R43,R44,R45,R46	2401 0824 7404
1	15 Ω ±5% 1206	R100	2401 2215 0500
2	22 Ω ±5% 1206	R22,R48	2401 0922 2005
1	100 Ω ±5% 1206	R20	2401 2210 1500
1	330 Ω ±5% 1206	R21	2402 0923 3105
3	1M Ω ±5% 1206	R13,R16,R94	2401 0921 0505
2	2M Ω ±5% 1206	R92,R93	2401 0922 0505
1	3M Ω ±5% 1206	R96	2401 0923 0505
1	51K Ω ±5% 1210	R12	2401 1725 1318
1	3.6K Ω ±1% 0805	R104	2401 0813 6204
2	3K Ω ±1% 0805	R84,R111	2401 0813 0204
1	12K Ω ±1% 0805	R86	2401 0811 2204
1	15K Ω ±1% 0805	R87	2401 0811 5304
2	7.5K Ω ±1% 0805	R38,R41	2401 0817 5204
1	24K Ω ±1% 0805	R59	2402 0812 4304
4	470K Ω ±1% 1206	R61,R62,R63,R64	2401 0914 7405
1	56PF/50V±10% 0805	C55	2115 6560 0145
4	1000PF/50V±10% 0805	C34,C35,C36,C65	2115 6102 0145
1	0.01UF/50V±10% 0805	C61	2115 6103 0145
8	0.1uF/50V±10% 0805	C10,C20,C22,C26,C29,C30,C31,C32	2115 6104 0145
2	0.1uF/100V±10% 0805	C52,C53	2115 6104 0245
1	0.22uF/50V±10% 0805	C38	2115 6224 0145
1	0.047uF/50V±10% 0805	C56	2115 6473 1945
1	100PF/50V±10% 0805	C57	2115 6101 0145
1	0.47UF/50V±10% 0805	C62	2115 6474 0145
2	0.1UF/100V±10% 1206	C21,C54	2115 6104 0255
2	0.22uF/275VAC(X2)	C1,C4	2210 3224 0604
1	0.33uF/275VAC(X2)	C5	2210 3334 0604
1	0.1uF/50V±10%	C24,C25,C27	2115 6104 0123
1	0.22uF/63V±10%	C37	2207 2223 0843
1	100PF/1KV±10%	C39	2115 6101 0413
3	1000PF/1KV±10%	C12,C17,C33	2118 6102 0413
2	1000PF/250VAC±10%	C42,C43	2115 7102 1015
2	470PF/250VAC±10%	C2,C3	2115 7471 1015
1	4700PF/630V±10%	C67	2207 2472 0700

2	0.047UF/630V±10%	C40,C41	2207 2473 0700
1	0.1UF/630V±10%	C8	2207 2104 0700
1	0.47UF/630V±10%	C6	2207 3474 0700
1	1uF/50V±20% E.CAP	C11	2319 0610 1015
1	2.2uF/50V±20% E.CAP	C16	2329 0610 1015
1	4.7uF/50V±20% E.CAP	C63	2349 0610 1015
2	10uF/50V±20% E.CAP	C9,C18	2310 0610 1015
1	47uF/25V±20% E.CAP	C66	2340 0410 1015
3	47uF/50V±20% E.CAP	C13,C14,C15	2340 0610 2015
2	100uF/25V±20% E.CAP	C76,C77	2311 0410 2015
1	220uF/35V±20% E.CAP	C60	2321 0410 3025
1	470uF/10V±20% E.CAP	C74	2341 0210 2015
1	270uF/450V±20% E.CAP	C7	2371 0611 0075
2	1000uF/10V±20% E.CAP	C72,C73	2312 2101 4000
2	1000uF/25V±20% E.CAP	C68,C69	2312 4105 4000
2	1000uF/25V±20% E.CAP	C70,C71	2312 4105 4000
8	1000uF/50V±20% E.CAP	C44,C45,C46,C47,C48,C49,C50,C51	2312 0610 5050



September 2007

IRS2092

PROTECTED DIGITAL AUDIO AMPLIFIER

Features

- Integrated analog input Class D audio amplifier driver in a small 16 pin package
- Floating inputs enable easy half bridge implementation
- Programmable bidirectional over-current protection with self-reset function
- Programmable preset deadtime for improved THD performances
- Start and stop click noise reduction
- High noise immunity
- ±100 V ratings deliver up to 500 W in output power
- Operates up to 800 kHz
- RoHS compliant

Product Summary

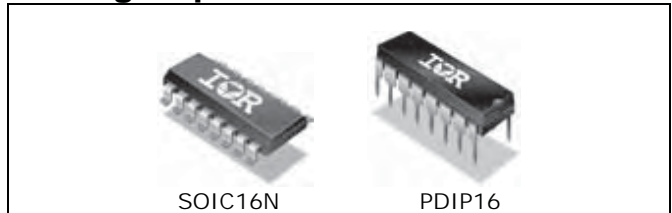
V _{OFFSET} (max)		± 100 V
Gate driver	Io+	1.0 A
	Io-	1.2 A
Selectable Deadtime		25/40/65/105 ns
OC protection delay (max)		500 ns
DC offset		<20 mV
PWM frequency		~800 kHz
Error amplifier open loop gain		>60 dB
THD+N* (1kHz, 50W, 4Ω)		0.01 %
Residual Noise* (AES-17 Filter)		200 µVrms

* measured with recommended circuit

Typical Applications

- Home theater systems
- Mini component stereo systems
- Powered speaker systems
- General purpose audio power amplifiers

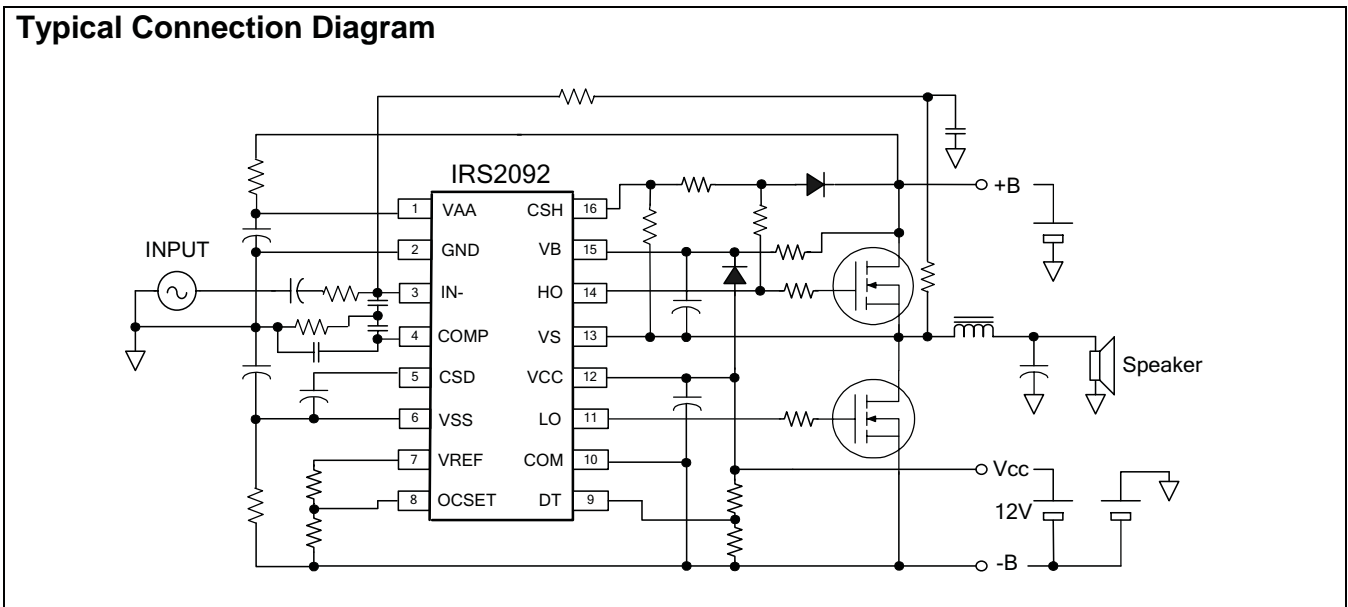
Package Options



SOIC16N

PDIP16

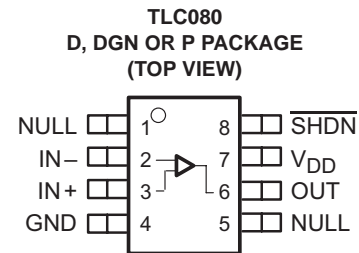
Typical Connection Diagram



TLC080, TLC081, TLC082, TLC083, TLC084, TLC085, TLC08xA FAMILY OF WIDE-BANDWIDTH HIGH-OUTPUT-DRIVE SINGLE SUPPLY OPERATIONAL AMPLIFIERS

SLOS254B – JUNE 1999 – REVISED NOVEMBER 1999

- **Wide Bandwidth . . . 10 MHz**
- **High Output Drive**
 - I_{OH} . . . 57 mA at $V_{DD} - 1.5$
 - I_{OL} . . . 55 mA at 0.5 V
- **High Slew Rate**
 - $SR+$. . . 16 V/ μ s
 - $SR-$. . . 19 V/ μ s
- **Wide Supply Range . . . 4.5 V to 16 V**
- **Supply Current . . . 1.9 mA/Channel**
- **Ultra-Low Power Shutdown Mode**
 I_{DD} . . . 125 μ A/Channel
- **Low Input Noise Voltage . . . 8.5 nV \sqrt{Hz}**
- **Wide V_{ICR} . . . 0 to $V_{DD} - 1$**
- **Input Offset Voltage . . . 60 μ V**
- **Ultra-Small Packages**
 - 8 or 10 Pin MSOP (TLC080/1/2/3)



description

Introducing the first members of TI's new BiMOS general-purpose operational amplifier family—the TLC08x. The BiMOS family concept is simple: provide an upgrade path for BiFET users who are moving away from dual-supply to single-supply systems and demand higher ac and dc performance. With performance rated from 4.5 V to 16 V across commercial (0°C to 70°C) and an extended industrial temperature range (–40°C to 125°C), BiMOS suits a wide range of audio, automotive, industrial and instrumentation applications. Familiar features like offset nulling pins, and new features like MSOP PowerPAD™ packages and shutdown modes, enable higher levels of performance in a multitude of applications.

Developed in TI's patented LBC3 BiCMOS process, the new BiMOS amplifiers combine a very high input impedance, low-noise CMOS front end with a high-drive Bipolar output stage—thus providing the optimum performance features of both. AC performance improvements over the TL08x BiFET predecessors include a bandwidth of 10 MHz (an increase of 300%) and voltage noise of 8.5 nV/ \sqrt{Hz} (an improvement of 60%). DC improvements include an ensured V_{ICR} that includes ground, a factor of 4 reduction in input offset voltage down to 1.5 mV (maximum) in the standard grade, and a power supply rejection improvement of greater than 40 dB to 130 dB. Added to this list of impressive features is the ability to drive ± 50 -mA loads comfortably from an ultra-small-footprint MSOP PowerPAD package, which positions the TLC08x as the ideal high-performance general-purpose operational amplifier family.

FAMILY PACKAGE TABLE

DEVICE	NO. OF CHANNELS	PACKAGE TYPES				SHUTDOWN	UNIVERSAL EVM BOARD
		MSOP	PDIP	SOIC	TSSOP		
TLC080	1	8	8	8	—	Yes	Refer to the EVM Selection Guide (Lit# SLOU060)
TLC081	1	8	8	8	—	—	
TLC082	2	8	8	8	—	—	
TLC083	2	10	14	14	—	Yes	
TLC084	4	—	14	14	20	—	
TLC085	4	—	16	16	20	Yes	



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PowerPAD is a trademark of Texas Instruments Incorporated.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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DIGITAL AUDIO MOSFET

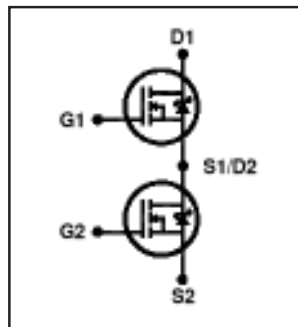
PD - 97249A

IRFI4212H-117P

Features

- Integrated half-bridge package
- Reduces the part count by half
- Facilitates better PCB layout
- Key parameters optimized for Class-D audio amplifier applications
- Low $R_{DS(ON)}$ for improved efficiency
- Low Q_g and Q_{sw} for better THD and improved efficiency
- Low Q_{rr} for better THD and lower EMI
- Can delivery up to 150W per channel into 4Ω load in half-bridge configuration amplifier
- Lead-free package

Key Parameters ⑤		
V_{DS}	100	V
$R_{DS(ON)}$ typ. @ 10V	58	mΩ
Q_g typ.	12	nC
Q_{sw} typ.	6.9	nC
$R_{G(int)}$ typ.	3.4	Ω
T_J max	150	°C



G1, G2	D1, D2	S1, S2
Gate	Drain	Source

Description

This Digital Audio MosFET Half-Bridge is specifically designed for Class D audio amplifier applications. It consists of two power MosFET switches connected in half-bridge configuration. The latest process is used to achieve low on-resistance per silicon area. Furthermore, Gate charge, body-diode reverse recovery, and internal Gate resistance are optimized to improve key Class D audio amplifier performance factors such as efficiency, THD and EMI. These combine to make this Half-Bridge a highly efficient, robust and reliable device for Class D audio amplifier applications.

Absolute Maximum Ratings ⑤

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	100	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	11	A
I_D @ $T_C = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	6.8	
I_{DM}	Pulsed Drain Current ①	44	
P_D @ $T_C = 25^\circ C$	Power Dissipation ④	18	W
P_D @ $T_C = 100^\circ C$	Power Dissipation ④	7.0	
	Linear Derating Factor	0.14	W/°C
E_{AS}	Single Pulse Avalanche Energy②	41	mJ
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

Thermal Resistance ⑤

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	7.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (free air)	—	65	



DMP3020LSS

SINGLE P-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR

NEW PRODUCT

Features

- Low On-Resistance
 - 14mΩ @ V_{GS} = -10V
 - 25mΩ @ V_{GS} = -4.5V
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **Lead Free By Design/RoHS Compliant (Note 2)**
- **"Green" Device (Note 4)**
- **Qualified to AEC-Q101 Standards for High Reliability**

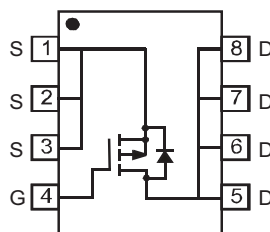
Mechanical Data

- Case: SOP-8L
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals Connections: See Diagram
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 3
- Ordering Information: See Page 3
- Weight: 0.072g (approximate)



TOP VIEW

SOP-8L



TOP VIEW
Internal Schematic

Maximum Ratings @T_A = 25°C unless otherwise specified

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V _{DSS}	-30	V
Gate-Source Voltage			V _{GSS}	±20	V
Drain Current (Note 1)	Steady State	T _A = 25°C	I _D	-12	A
		T _A = 70°C		-6	
Pulsed Drain Current (Note 3)			I _{DM}	-40	A

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 1)	P _D	2.5	W
Thermal Resistance, Junction to Ambient	R _{θJA}	50	°C/W
Operating and Storage Temperature Range	T _J , T _{STG}	-55 to +150	°C

Electrical Characteristics @T_A = 25°C unless otherwise specified

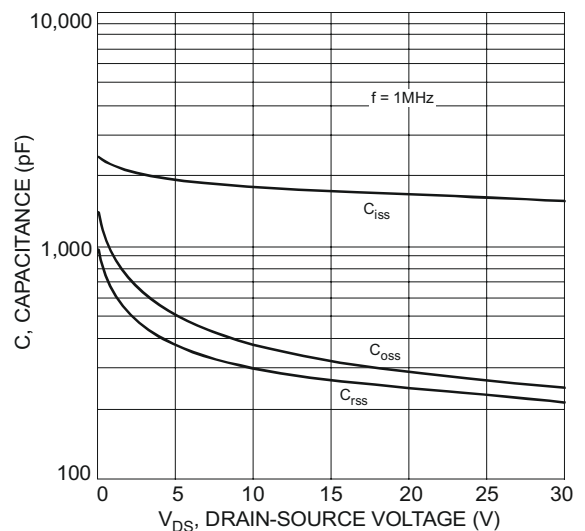
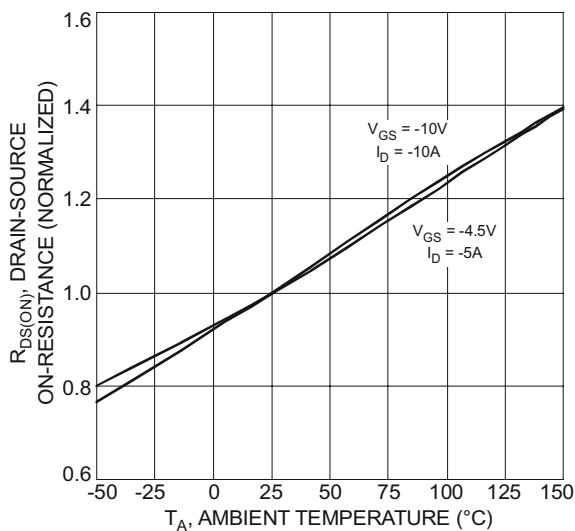
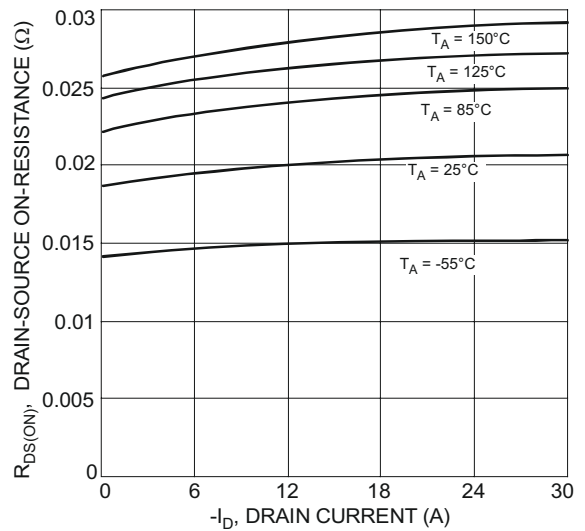
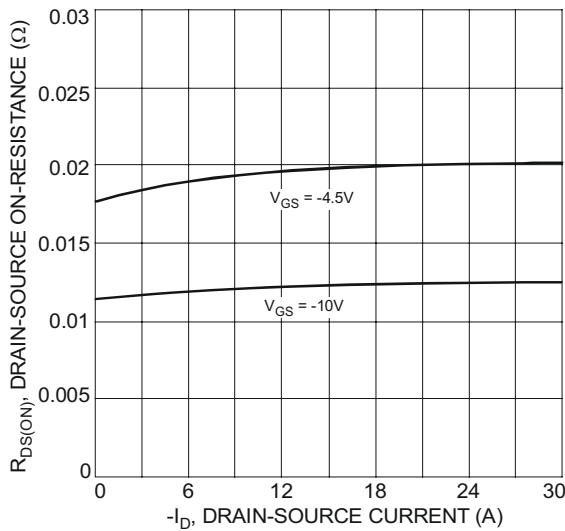
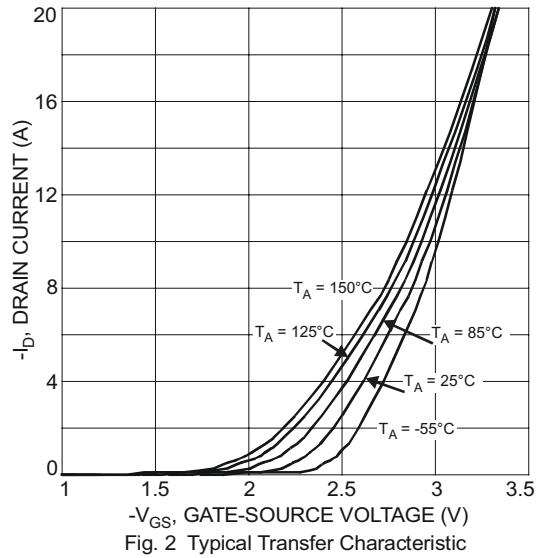
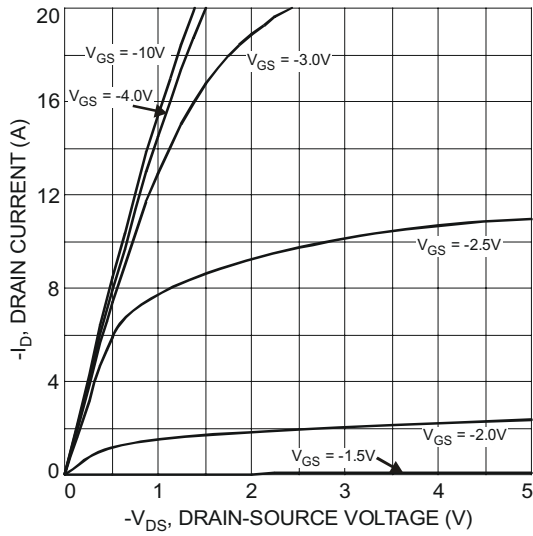
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 5)						
Drain-Source Breakdown Voltage	BV _{DSS}	-30	—	—	V	V _{GS} = 0V, I _D = -250μA
Zero Gate Voltage Drain Current	I _{DSS}	—	—	-1	μA	V _{DS} = -30V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS (Note 5)						
Gate Threshold Voltage	V _{GS(th)}	-1	—	-2	V	V _{DS} = V _{GS} , I _D = -250μA
Static Drain-Source On-Resistance	R _{DS(on)}	—	11.6	14	mΩ	V _{GS} = -10V, I _D = -8A
		—	18.6	25		
Forward Transconductance	g _{fs}	—	12	—	S	V _{DS} = -10V, I _D = -12A
Diode Forward Voltage (Note 5)	V _{SD}	-0.5	—	-1.1	V	V _{GS} = 0V, I _S = -2A
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{iss}	—	1655	—	pF	V _{DS} = -20V, V _{GS} = 0V f = 1.0MHz
Output Capacitance	C _{oss}	—	286	—	pF	
Reverse Transfer Capacitance	C _{rss}	—	240	—	pF	

- Notes:
1. Device mounted on 2 oz. Copper pads on FR-4 PCB with R_{θJA} = 50°C/W.
 2. No purposefully added lead.
 3. Pulse width ≤10μs, Duty Cycle ≤1%.
 4. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com/products/lead_free/index.php.
 5. Short duration pulse test used to minimize self-heating effect.



DMP3020LSS

NEW PRODUCT





DMP3020LSS

NEW PRODUCT

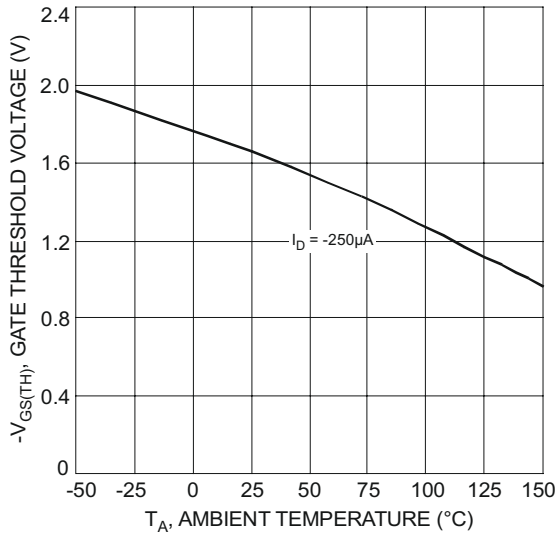


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

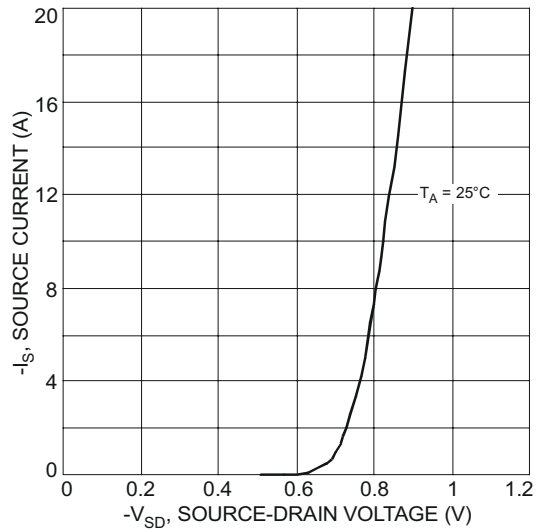


Fig. 8 Diode Forward Voltage vs. Current

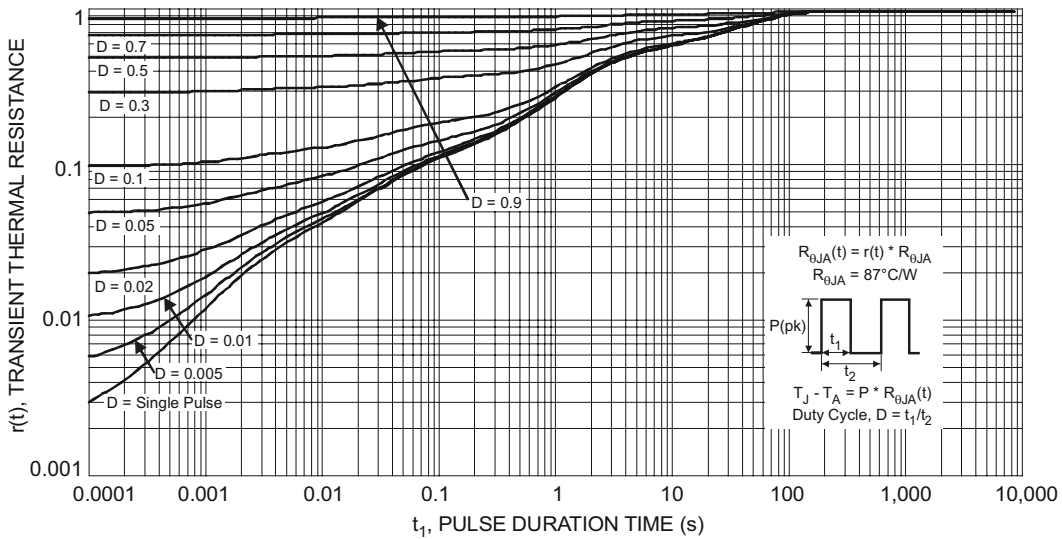


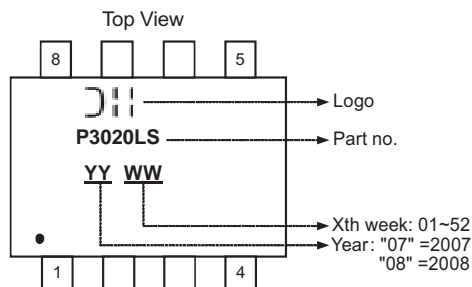
Fig. 9 Transient Thermal Response

Ordering Information (Note 6)

Part Number	Case	Packaging
DMP3020LSS-13	SOP-8L	2500/Tape & Reel

Notes: 6. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

Marking Information

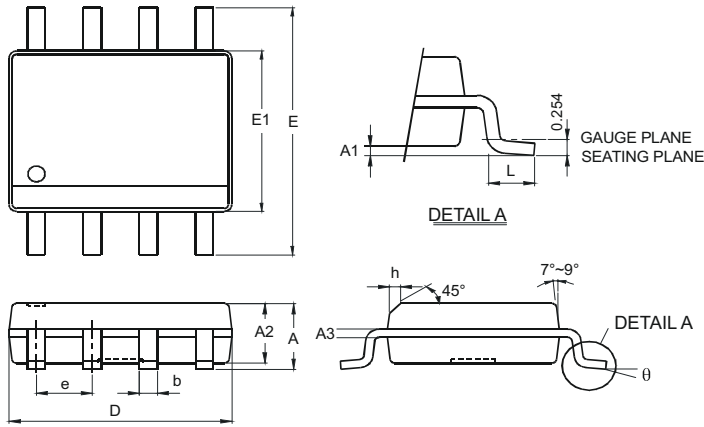




DMP3020LSS

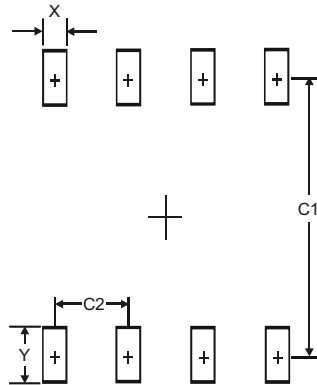
NEW PRODUCT

Package Outline Dimensions



SOP-8L		
Dim	Min	Max
A	—	1.75
A1	0.08	0.25
A2	1.30	1.50
A3	0.20 Typ.	
b	0.3	0.5
D	4.80	5.30
E	5.79	6.20
E1	3.70	4.10
e	1.27 Typ.	
h	—	0.35
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

Suggested Pad Layout



Dimensions	Value (in mm)
X	0.60
Y	1.55
C1	5.4
C2	1.27

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April 2006

FAN7602

Green Current Mode PWM Controller

Features

- Green Current Mode PWM Control
- Fixed 65kHz Operation with Frequency Modulation
- Internal High-Voltage Start-up Switch
- Burst Mode Operation
- Line Voltage Feed Forward to Limit Maximum Power
- Line Under-Voltage Protection
- Latch Protection & Internal Soft-Start (10ms) Function
- Overload Protection
- Over Voltage Protection
- Low Operation Current: Typ. 1mA
- 8-pin DIP

Applications

- Adapter
- LCD Monitor Power
- Auxiliary Power Supply

Related Application Notes

- **AN6014** - Green Current Mode PWM Controller FAN7602

Description

The FAN7602 is a green current mode PWM controller. It is specially designed for off-line adapter application, DVDP, VCR, LCD monitor application, and auxiliary power supplies.

The internal high-voltage start-up switch and the burst mode operation reduce the power loss in standby mode. Because of the internal start-up switch and the burst mode, it is possible to supply 0.5W load limiting the input power under 1W when the input line voltage is 265Vac. On no-load condition, the input power is under 0.3W.

The maximum power can be limited constantly, regardless of the line voltage change using the power limit function.

The switching frequency is internally fixed to be 65kHz and the frequency modulation technique reduces EMI.

The FAN7602 includes various protections for the system reliability and the internal soft start prevents the output voltage over-shoot at start-up.

Ordering Information

Part Number	Operating Temp. Range	Pb-Free	Package	Packing Method	Marking Code
FAN7602N	-25°C to +125°C	Yes	8-DIP	Rail	FAN7602

Typical Application Diagram

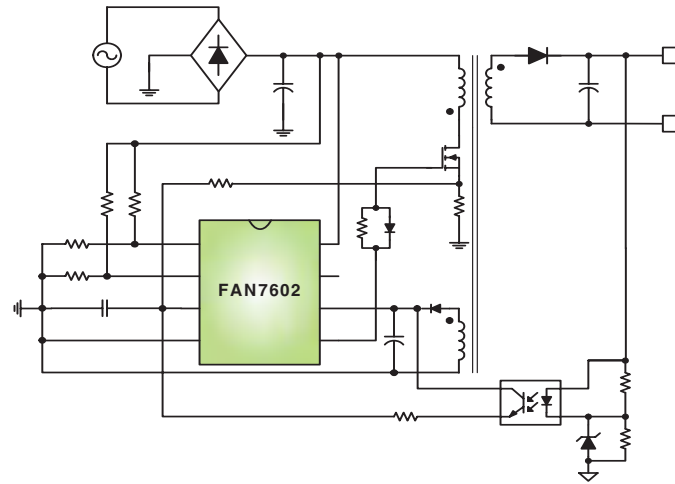


Figure 1. Typical Flyback Application

Internal Block Diagram

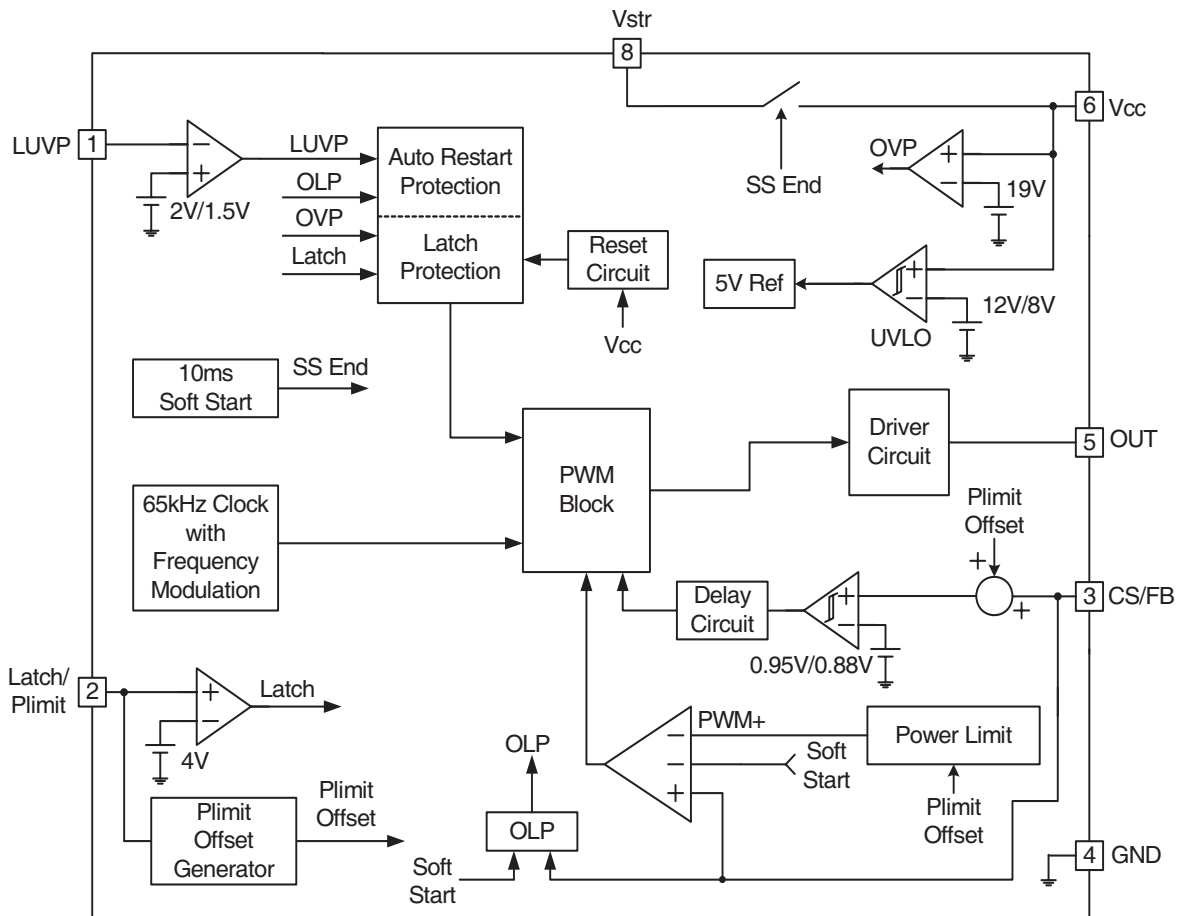


Figure 2. Functional Block Diagram of FAN7602

Pin Assignments

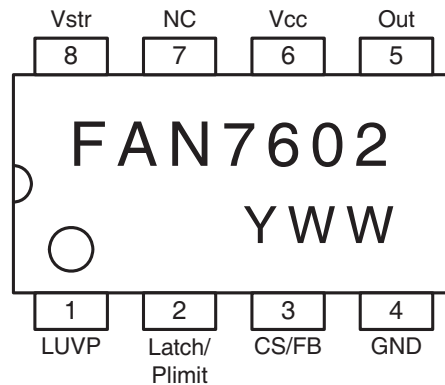


Figure 3. Pin Configuration (Top View)

Pin Definitions

Pin Number	Pin Name	Pin Function Description
1	LUVP	Line Under Voltage Protection Pin. This pin is used to protect the set when the input voltage is lower than the rated input voltage range.
2	Latch/Plimit	Latch Protection and Power Limit Pin. When the pin voltage exceeds 4V, the latch protection works and the latch protection is reset when the Vcc voltage is lower than 5V. For the power limit function, the OCP level decreases as the pin voltage increases.
3	CS/FB	Current Sense and Feedback Pin. This pin is used to sense the MOSFET current for the current mode PWM and OCP. The output voltage feedback information and the current sense information are added using external RC filter.
4	GND	Ground Pin. This pin is used for the ground potential of all the pins. For proper operation, the signal ground and the power ground should be separated.
5	OUT	Gate Drive Output Pin. This pin is an output pin to drive an external MOSFET. The peak sourcing current is 450mA and the peak sinking current is 600mA. For proper operation, the stray inductance in the gate driving path must be minimized.
6	Vcc	Supply Voltage Pin. IC operating current and MOSFET driving current are supplied using this pin.
7	NC	No Connection.
8	Vstr	Start-up Pin. This pin is used to supply IC operating current during IC start-up. After start-up, the internal JFET is turned off to reduce power loss.



February 2007



FDP20N50 / FDPF20N50

500V N-Channel MOSFET

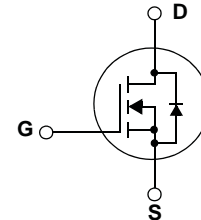
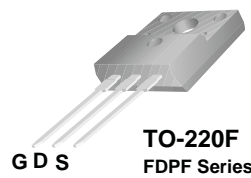
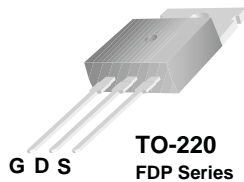
Features

- 20A, 500V, $R_{DS(on)} = 0.23\Omega @V_{GS} = 10V$
- Low gate charge (typical 45.6 nC)
- Low C_{rss} (typical 27 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



Absolute Maximum Ratings

Symbol	Parameter	FDP20N50	FDPF20N50	Unit
V_{DSS}	Drain-Source Voltage	500		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ C$)	20	20 *
		- Continuous ($T_C = 100^\circ C$)	12.9	12.9.....
I_{DM}	Drain Current - Pulsed (Note 1)	80	80.....	A
V_{GSS}	Gate-Source voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1110		mJ
I_{AR}	Avalanche Current (Note 1)	20		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	25		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$)	- Derate above $25^\circ C$	250	62
			2.0	0.5
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ C$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		$^\circ C$

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP20N50	FDPF20N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.5	2.0	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ C/W$

FDP20N50 / FDPF20N50 500V N-Channel MOSFET



QFET™

FQP7N80C/FQPF7N80C

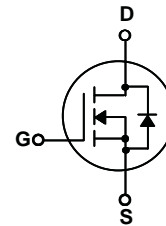
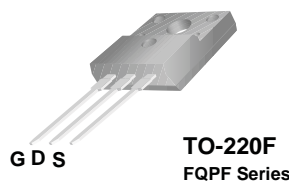
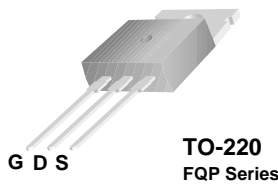
800V N-Channel MOSFET

General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supplies.

Features

- 6.6A, 800V, $R_{DS(on)} = 1.9\Omega @ V_{GS} = 10V$
- Low gate charge (typical 27 nC)
- Low Crss (typical 10 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	FQP7N80C	FQPF7N80C	Units
V _{DSS}	Drain-Source Voltage	800		V
I _D	Drain Current - Continuous (T _C = 25°C)	6.6	6.6 *	A
	- Continuous (T _C = 100°C)	4.2	4.2 *	A
I _{DM}	Drain Current - Pulsed (Note 1)	26.4	26.4 *	A
V _{GSS}	Gate-Source Voltage	± 30		V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	580		mJ
I _{AR}	Avalanche Current (Note 1)	6.6		A
E _{AR}	Repetitive Avalanche Energy (Note 1)	16.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P _D	Power Dissipation (T _C = 25°C)	167	56	W
	- Derate above 25°C	1.33	0.44	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150		°C
T _L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		°C

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FQP7N80C	FQPF7N80C	Units
R _{θJC}	Thermal Resistance, Junction-to-Case	0.75	2.25	°C/W
R _{θJS}	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W



FSFR-Series — Fairchild Power Switch (FPS™) for Half-Bridge Resonant Converters

Features

- Variable Frequency Control with 50% Duty Cycle for Half-Bridge Resonant Converter Topology
- High Efficiency through Zero Voltage Switching (ZVS)
- Internal SuperFET™s with Fast-Recovery Type Body Diode ($t_{rr}=120ns$) for FSFR2100 and UniFETs with Fast-Recovery Type Body Diode ($t_{rr}<160ns$) for FSFR2100U/2000/1900/1800/1700.
- Fixed Dead Time (350ns) Optimized for MOSFETs
- Up to 300kHz Operating Frequency
- Pulse Skipping for Frequency Limit (Programmable) at Light-Load Condition
- Remote On/Off Control Using Control Pin
- Protection Functions: Over-Voltage Protection (OVP), Over-Load Protection (OLP), Over-Current Protection (OCP), Abnormal Over-Current Protection (AOCP), Internal Thermal Shutdown (TSD)

Applications

- PDP and LCD TVs
- Desktop PCs and Servers
- Adapters
- Telecom Power Supplies
- Audio Power Supplies

Description

The FSFR-series are a highly integrated power switches designed for high-efficiency half-bridge resonant converters. Offering everything necessary to build a reliable and robust resonant converter, the FSFR-series simplifies designs and improves productivity, while improving performance. The FSFR-series combines power MOSFETs with fast-recovery type body diodes, a high-side gate-drive circuit, an accurate current controlled oscillator, frequency limit circuit, soft-start, and built-in protection functions. The high-side gate-drive circuit has a common-mode noise cancellation capability, which guarantees stable operation with excellent noise immunity. The fast-recovery body diode of the MOSFETs improves reliability against abnormal operation conditions, while minimizing the effect of the reverse recovery. Using the zero-voltage-switching (ZVS) technique dramatically reduces the switching losses and efficiency is significantly improved. The ZVS also reduces the switching noise noticeably, which allows a small-sized Electromagnetic Interference (EMI) filter.

The FSFR-series can be applied to various resonant converter topologies such as series resonant, parallel resonant, and LLC resonant converters.

Related Resources

[AN4151 — Half-bridge LLC Resonant Converter Design using FSFR-series Fairchild Power Switch \(FPS™\)](#)

Ordering Information

Part Number	Package	Eco Status	Operating Junction Temperature	$R_{DS(ON_MAX)}$	Maximum Output Power without Heatsink ($V_{IN}=350\sim400V$) ^(1,2)	Maximum Output Power with Heatsink ($V_{IN}=350\sim400V$) ^(1,2)
FSFR2100	9-SIP	RoHS	-40 to +130°C	0.38Ω	200W	450W
FSFR2100U				0.51Ω	180W	400W
FSFR2000				0.67Ω	160W	350W
FSFR1900				0.85Ω	140W	300W
FSFR1800				0.95Ω	120W	260W
FSFR1700				1.25Ω	100W	200W

Notes:

- The junction temperature can limit the maximum output power.
- Maximum practical continuous power in an open-frame design at 50°C ambient.

For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Application Circuit Diagram

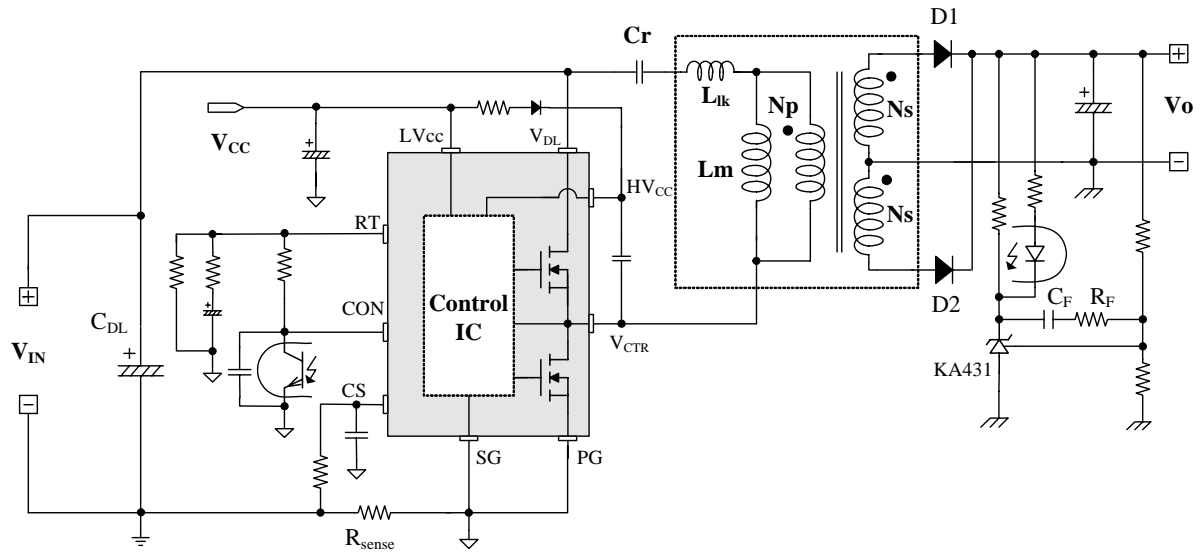


Figure 1. Typical Application Circuit (LLC Resonant Half-Bridge Converter)

Block Diagram

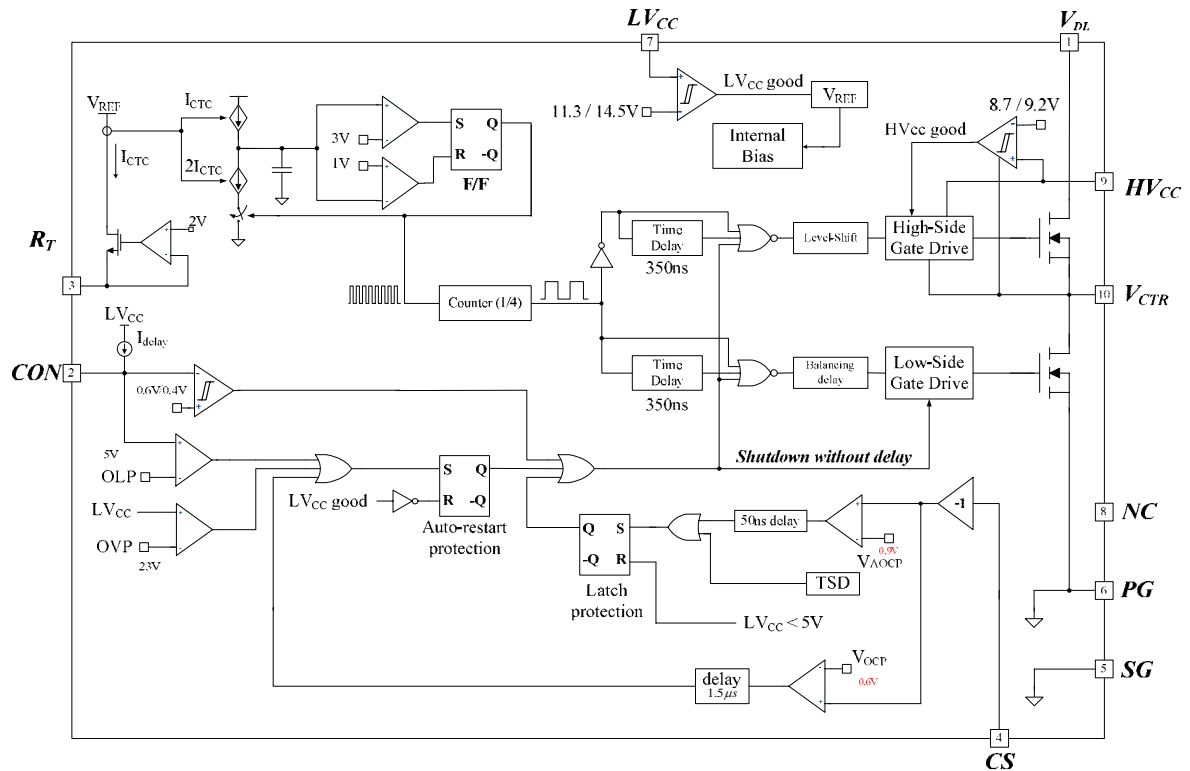


Figure 2. Internal Block Diagram

Pin Configuration

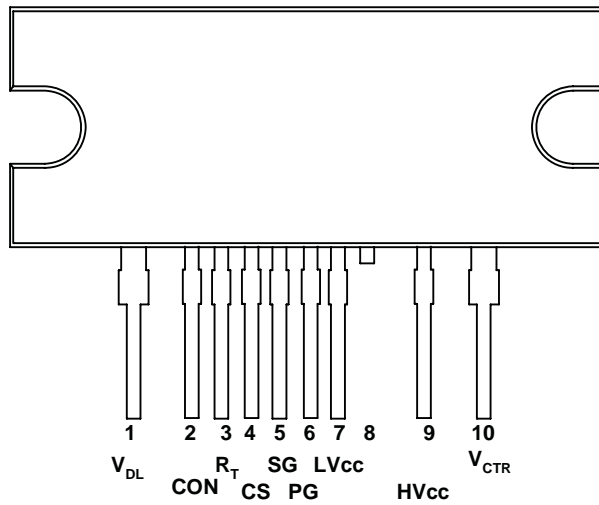


Figure 3. Package Diagram

Pin Definitions

Pin #	Name	Description
1	V_{DL}	This is the drain of the high-side MOSFET, typically connected to the input DC link voltage.
2	CON	This pin is for enable/disable and protection. When the voltage of this pin is above 0.6V, the IC operation is enabled. When the voltage of this pin drops below 0.4V, gate drive signals for both MOSFETs are disabled. When the voltage of this pin increases above 5V, protection is triggered.
3	R_T	This pin programs the switching frequency. Typically, an opto-coupler is connected to control the switching frequency for the output voltage regulation.
4	CS	This pin senses the current flowing through the low-side MOSFET. Typically, negative voltage is applied on this pin.
5	SG	This pin is the control ground.
6	PG	This pin is the power ground. This pin is connected to the source of the low-side MOSFET.
7	LV_{CC}	This pin is the supply voltage of the control IC.
8	NC	No connection.
9	HV_{CC}	This is the supply voltage of the high-side gate-drive circuit IC.
10	V_{CTR}	This is the drain of the low-side MOSFET. Typically, a transformer is connected to this pin.

PRODUCT SPECIFICATION

COSMO ELECTRONICS CO., LTD.	Photocoupler : K1010	SHEET 1 OF 5
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High Reliability Photocoupler

● Features

1. Current transfer ratio
(CTR : MIN. 60% at $I_F=5\text{mA}$ $V_{ce}=5\text{V}$)
2. High isolation voltage between input and output (Viso : 5000Vrms).
3. Compact dual-in-line package.

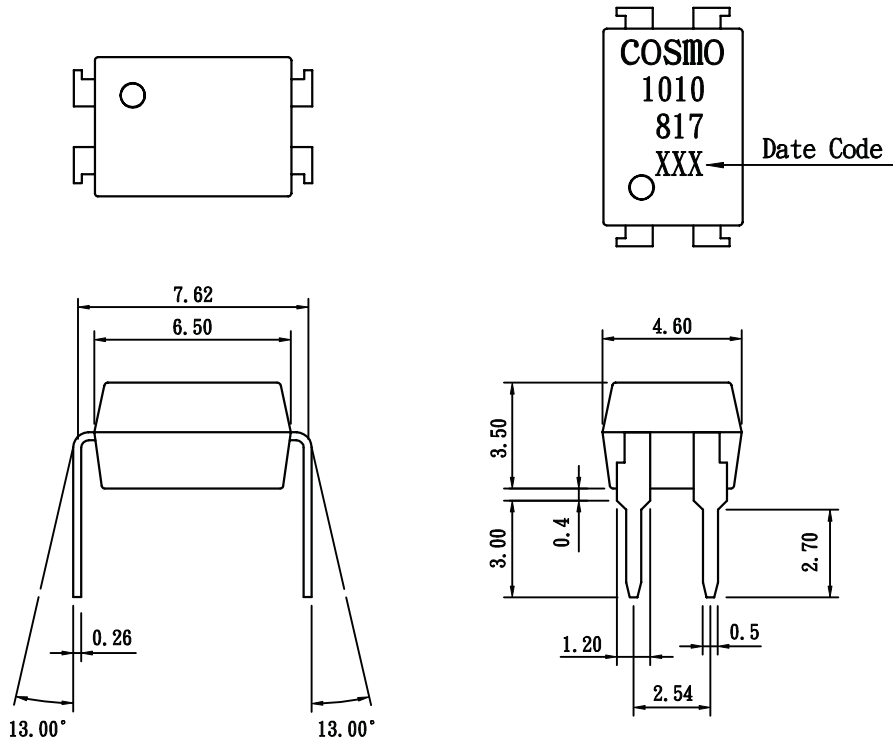
● Applications

1. Registers, copiers, automatic vending machines.
2. System appliances, measuring instruments.
3. Computer terminals, programmable controllers.
4. Communications, telephone, etc.
5. Electric home appliances, such as oil fan heaters, Microwave oven, Washer, Refrigerator, Air conditioner, etc.
6. Medical instruments, physical and chemical equipment.
7. Signal transmission between circuits of different potentials and impedances.
8. Facsimile equipment, Audio, Video.
9. Switching power supply, Laser beam printer.

PRODUCT SPECIFICATION

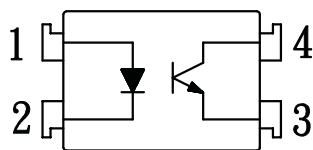
<p>COSMO ELECTRONICS CO., LTD.</p>	<p>Photocoupler : K1010</p>	<p>SHEET 2 OF 5</p>
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1. OUTSIDE DIMENSION : UNIT (mm)



TOLERANCE : ± 0.2mm

2. SCHEMATIC : TOP VIEW



1. Anode
2. Cathode
3. Emitter
4. Collector



SHENZHEN TUOFENG

TFTL431/A

PROGRAMMABLE PRECISION REFERENCES

The TL431 is three-terminal adjustable shunt regulator with specified thermal stability.

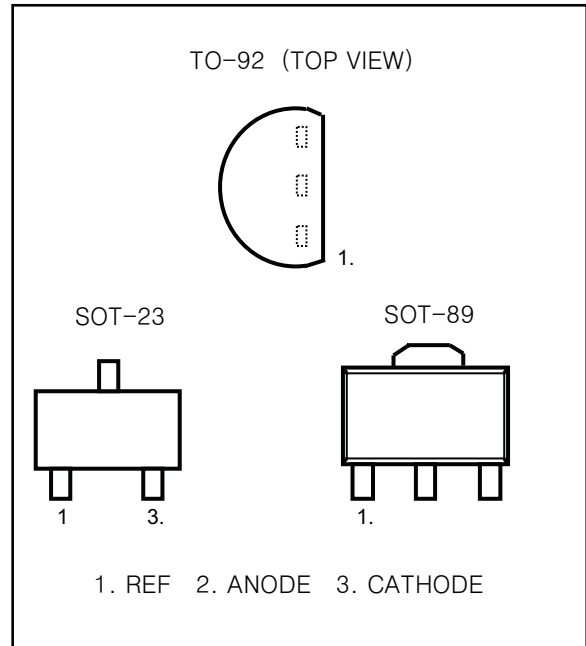
The output voltage may be set to any value between V_{REF} (Approx. 2.5V) and 36V with two external resistors.

This device has a typical output impedance of 0.2Ω.

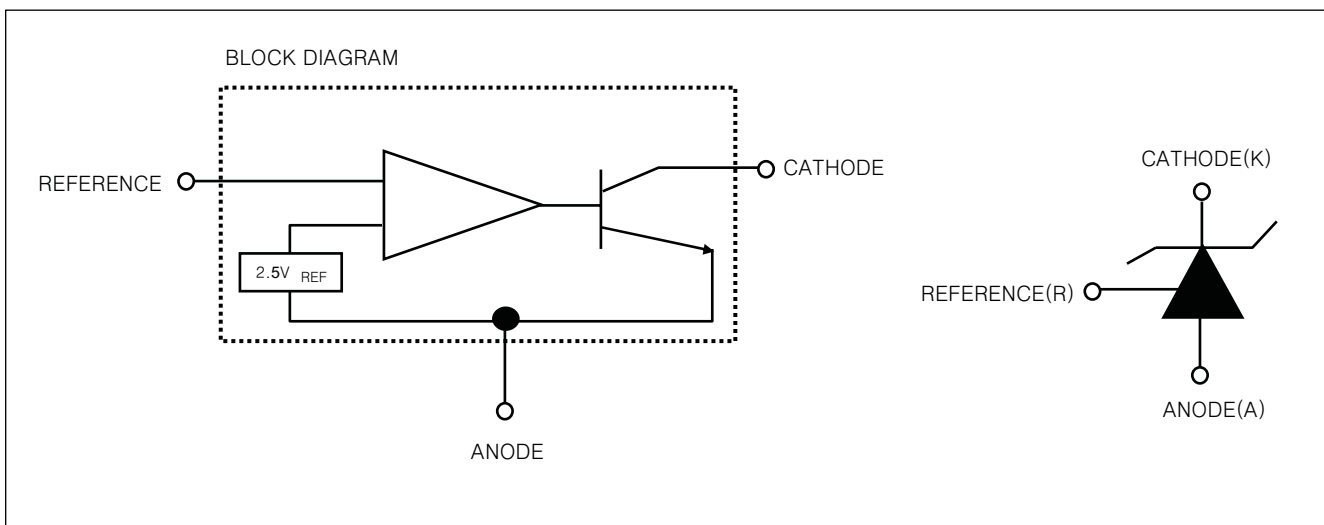
Active output circuitry provides a very sharp turn-on characteristic, making this device excellent replacement for zener diodes in many application.

FEATURES

- Equivalent Full Range Temperature Coefficient 50PPM/°C
- Temperature Compensated For Operation Over Full Rate Operating Temperature Range
- Adjustable Output Voltage
- Fast Turn-on Response
- Sink Current Capability 1mA to 100mA
- Low (0.2Ω Typ.) Dynamic Output Impedance
- Low Output Noise



FUNCTION BLOCK DIAGRAM



Power Factor Controller

SG6961

FEATURES

- Boundary Mode PFC Controller
- Low Input Current THD
- Controlled On-Time PWM
- Zero-Current Detection
- Cycle-by-Cycle Current Limiting
- Leading-Edge Blanking Instead of RC Filtering
- Low Start-up Current (10 μ A Typical)
- Low Operating Current (4.5mA Typical)
- Feedback Open-Loop Protection
- Programmable Maximum On-Time (MOT)
- Output Over-Voltage Clamping Protection
- Clamped Gate Output Voltage 16.5V

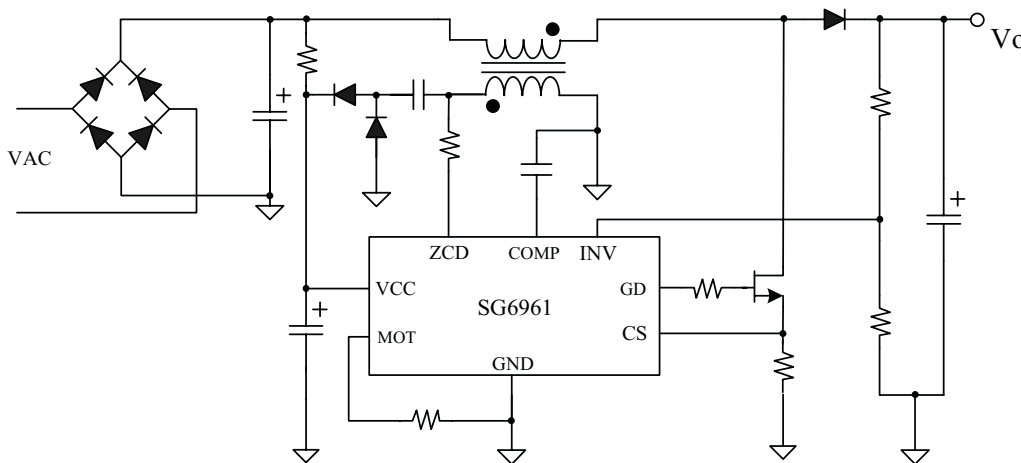
DESCRIPTION

The SG6961 is an 8-pin boundary mode PFC controller IC intended for controlling PFC pre-regulators. The SG6961 provides a controlled on-time to regulate the output DC voltage and achieve natural power factor correction. The maximum on-time of the external switch is programmable to ensure safe operation during AC brownouts. An innovative multi-vector error amplifier is built in to provide rapid transient response and precise output voltage clamping. A built-in circuit disables the controller if the output feedback loop is opened. The start-up current is lower than 20 μ A and the operating current is under 4.5mA. The supply voltage can be up to 20V, maximizing application flexibility.

APPLICATIONS

- Electric Lamp Ballasts
- AC-DC Switching Mode Power Converter
- Open-Frame Power Supplies and Power Adapters
- Flyback Power Converters with ZCS/ZVS

TYPICAL APPLICATION

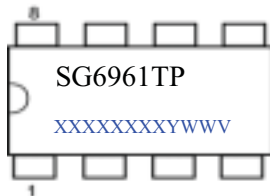




Power Factor Controller

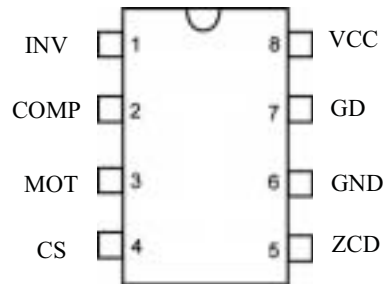
SG6961

MARKING DIAGRAMS



T: D=DIP, S=SOP
 P : Z=Lead Free + ROHS Compatible
 Null=regular package
 XXXXXXXX: Wafer Lot
 Y: Year; WW: Week
 V: Assembly Location

PIN CONFIGURATION



ORDERING INFORMATION

Part Number	Pb-Free	Package
SG6961SZ		8-Pin SOP
SG6961DZ		8-Pin DIP

PIN DESCRIPTIONS

Pin No.	Symbol	Description
1	INV	Inverting input of the error amplifier. INV is connected to the converter output via a resistive divider. This pin is also used for over-voltage clamping and open-loop feedback protection.
2	COMP	The output of the error amplifier. To create a precise clamping protection, a compensation network between this pin and GND is suggested.
3	MOT	A resistor from MOT to GND is used to determine the maximum on-time of the external power MOSFET. The maximum output power of the converter is a function of the maximum on-time.
4	CS	Input to the over-current protection comparator. When the sensed voltage across the sense resistor reaches the internal threshold (0.82V), the switch is turned off to activate cycle-by-cycle current limiting.
5	ZCD	Zero Current Detection. This pin is connected to an auxiliary winding via a resistor to detect the zero crossing of the switch current. When the zero crossing is detected, a new switching cycle is started. If it is connected to GND, the device is disabled.
6	GND	The power ground and signal ground. Placing a 0.1µF decoupling capacitor between the VCC and GND pins is recommended.
7	GD	Totem-pole driver output to drive the external power MOSFET. The clamped gate output voltage is 16.5V.
8	VCC	Driver and control circuit supply voltage.



April 2003

ISL9R1560PF2

15A, 600V Stealth™ Diode

General Description

The ISL9R1560PF2 is a Stealth™ diode optimized for low loss performance in high frequency hard switched applications. The Stealth™ family exhibits low reverse recovery current ($I_{RM(REC)}$) and exceptionally soft recovery under typical operating conditions.

This device is intended for use as a free wheeling or boost diode in power supplies and other power switching applications. The low $I_{RM(REC)}$ and short t_a phase reduce loss in switching transistors. The soft recovery minimizes ringing, expanding the range of conditions under which the diode may be operated without the use of additional snubber circuitry. Consider using the Stealth™ diode with an SMPS IGBT to provide the most efficient and highest power density design at lower cost.

Formerly developmental type TA49410.

Features

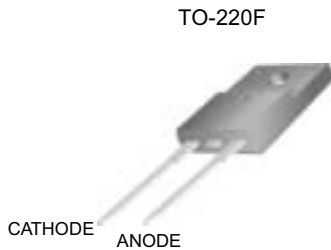
- Soft Recovery $t_b / t_a > 1.2$
- Fast Recovery $t_{rr} < 30ns$
- Operating Temperature 150°C
- Reverse Voltage 600V
- Internally Isolated 1kV
- Avalanche Energy Rated

Applications

- Switch Mode Power Supplies
- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode

Package

Symbol



Device Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{RRM}	Repetitive Peak Reverse Voltage	600	V
V_{RWM}	Working Peak Reverse Voltage	600	V
V_R	DC Blocking Voltage	600	V
$I_{F(AV)}$	Average Rectified Forward Current ($T_C = 25^\circ C$)	15	A
I_{FRM}	Repetitive Peak Surge Current (20kHz Square Wave)	30	A
I_{FSM}	Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60Hz)	200	A
P_D	Power Dissipation	30	W
E_{AVL}	Avalanche Energy (1A, 40mH)	20	mJ
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	°C
T_L	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10s	300	°C

CAUTION: Stresses above those listed in "Device Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

MUR1610CT, MUR1615CT, MUR1620CT, MUR1640CT, MUR1660CT

SWITCHMODE™ Power Rectifiers

... designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Popular TO-220 Package
- Epoxy Meets UL94, V_O @ 1/8"
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1610, U1615, U1620, U1640, U1660

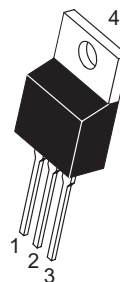
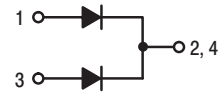
MAXIMUM RATINGS

Please See the Table on the Following Page

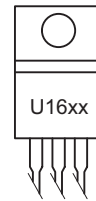


<http://onsemi.com>

**ULTRAFAST
RECTIFIERS
8.0 AMPERES
100-600 VOLTS**



MARKING DIAGRAM



**TO-220AB
CASE 221A
PLASTIC**

U16xx = Device Code
xx = 10, 15, 20, 40 or 60

ORDERING INFORMATION

Device	Package	Shipping
MUR1610CT	TO-220	50 Units/Rail
MUR1615CT	TO-220	50 Units/Rail
MUR1620CT	TO-220	50 Units/Rail
MUR1640CT	TO-220	50 Units/Rail
MUR1660CT	TO-220	50 Units/Rail

MUR1620CTR, MURB1620CTR

Preferred Device

SWITCHMODE™ Power Rectifier

These state-of-the-art devices are designed for use in negative switching power supplies, inverters and as free wheeling diodes. Also, used in conjunction with common cathode dual Ultrafast Rectifiers, makes a single phase full-wave bridge.

Features

- Common Anode Dual Rectifier (8.0 A per Leg or 16 A per Package)
- Ultrafast 35 Nanosecond Reverse Recovery Times
- Exhibits Soft Recovery Characteristics
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Epoxy Meets UL 94 V-0 @ 0.125 in
- Complement to MUR1620CT and MURB1620CT Common Cathode Device
- Pb-Free Packages are Available

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: MUR1620CTR: 1.9 Grams (Approximately)
MURB1620CTR: 1.7 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

MAXIMUM RATINGS (Per Leg)

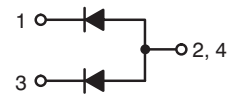
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Voltage (Rated V_R , $T_C = 160^\circ\text{C}$) Per Leg Per Total Device	$I_{F(AV)}$	8.0 16	A
Peak Repetitive Surge Current (Rated V_R , Square Wave, 20 kHz, $T_C = 140^\circ\text{C}$) Per Diode	I_{FM}	16	A
Non-Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-65 to +175	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

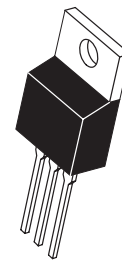


<http://onsemi.com>

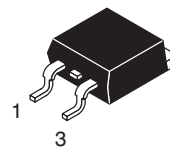
ULTRAFAST RECTIFIER 16 AMPERES, 200 VOLTS



MARKING DIAGRAMS



TO-220AB
CASE 221A
STYLE 7



D2PAK
CASE 418B
STYLE 5



U1620R = Device Code
KAK = Diode Polarity
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

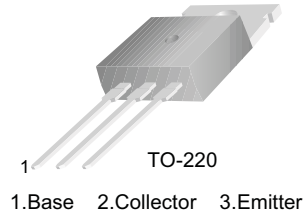
Preferred devices are recommended choices for future use and best overall value.



TIP31 Series(TIP31/31A/31B/31C)

Medium Power Linear Switching Applications

- Complementary to TIP32/32A/32B/32C



NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage : TIP31	40	V
	: TIP31A	60	V
	: TIP31B	80	V
	: TIP31C	100	V
V_{CEO}	Collector-Emitter Voltage : TIP31	40	V
	: TIP31A	60	V
	: TIP31B	80	V
	: TIP31C	100	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current (DC)	3	A
I_{CP}	Collector Current (Pulse)	5	A
I_B	Base Current	1	A
P_C	Collector Dissipation ($T_C=25^\circ\text{C}$)	40	W
P_C	Collector Dissipation ($T_a=25^\circ\text{C}$)	2	W
T_J	Junction Temperature	150	$^\circ\text{C}$
T_{STG}	Storage Temperature	- 65 ~ 150	$^\circ\text{C}$

Electrical Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
$V_{CEO(sus)}$	* Collector-Emitter Sustaining Voltage : TIP31	$I_C = 30\text{mA}, I_B = 0$	40		V
	: TIP31A				
	: TIP31B				
	: TIP31C				
I_{CEO}	Collector Cut-off Current : TIP31/31A	$V_{CE} = 30\text{V}, I_B = 0$		0.3	mA
	: TIP31B/31C	$V_{CE} = 60\text{V}, I_B = 0$		0.3	mA
I_{CES}	Collector Cut-off Current : TIP31	$V_{CE} = 40\text{V}, V_{EB} = 0$		200	μA
	: TIP31A	$V_{CE} = 60\text{V}, V_{EB} = 0$		200	μA
	: TIP31B	$V_{CE} = 80\text{V}, V_{EB} = 0$		200	μA
	: TIP31C	$V_{CE} = 100\text{V}, V_{EB} = 0$		200	μA
I_{EBO}	Emitter Cut-off Current	$V_{EB} = 5\text{V}, I_C = 0$		1	mA
h_{FE}	* DC Current Gain	$V_{CE} = 4\text{V}, I_C = 1\text{A}$	25		
		$V_{CE} = 4\text{V}, I_C = 3\text{A}$	10	50	
$V_{CE(sat)}$	* Collector-Emitter Saturation Voltage	$I_C = 3\text{A}, I_B = 375\text{mA}$		1.2	V
$V_{BE(sat)}$	* Base-Emitter Saturation Voltage	$V_{CE} = 4\text{V}, I_C = 3\text{A}$		1.8	V
f_T	Current Gain Bandwidth Product	$V_{CE} = 10\text{V}, I_C = 500\text{mA}$	3.0		MHz

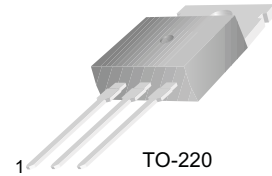
* Pulse Test: $PW \leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$



TIP32 Series(TIP32/32A/32B/32C)

Medium Power Linear Switching Applications

- Complement to TIP31/31A/31B/31C



TO-220
1.Base 2.Collector 3.Emitter

PNP Epitaxial Silicon Transistor

Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage : TIP32	- 40	V
	: TIP32A	- 60	V
	: TIP32B	- 80	V
	: TIP32C	- 100	V
V_{CEO}	Collector-Emitter Voltage : TIP32	- 40	V
	: TIP32A	- 60	V
	: TIP32B	- 80	V
	: TIP32C	-100	V
V_{EBO}	Emitter-Base Voltage	- 5	V
I_C	Collector Current (DC)	- 3	A
I_{CP}	Collector Current (Pulse)	- 5	A
I_B	Base Current	- 3	A
P_C	Collector Dissipation ($T_C=25^\circ\text{C}$)	40	W
P_C	Collector Dissipation ($T_a=25^\circ\text{C}$)	2	W
T_J	Junction Temperature	150	$^\circ\text{C}$
T_{STG}	Storage Temperature	- 65 ~ 150	$^\circ\text{C}$

Electrical Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
$V_{CEO(sus)}$	* Collector-Emitter Sustaining Voltage	$I_C = - 30\text{mA}, I_B = 0$	-40		V
	: TIP32				
	: TIP32A				
	: TIP32B				
I_{CEO}	Collector Cut-off Current	$V_{CE} = - 30\text{V}, I_B = 0$ $V_{CE} = - 60\text{V}, I_B = 0$		- 0.3	mA
	: TIP32/32A				
	: TIP32B/32C				
I_{CES}	Collector Cut-off Current	$V_{CE} = - 40\text{V}, V_{EB} = 0$ $V_{CE} = - 60\text{V}, V_{EB} = 0$ $V_{CE} = - 80\text{V}, V_{EB} = 0$ $V_{CE} = - 100\text{V}, V_{CE} = 0$		- 200	μA
	: TIP32				
	: TIP32A				
	: TIP32B				
I_{EBO}	Emitter Cut-off Current	$V_{EB} = - 5\text{V}, I_C = 0$		- 1	mA
h_{FE}	* DC Current Gain	$V_{CE} = - 4\text{V}, I_C = - 1\text{A}$ $V_{CE} = - 4\text{V}, I_C = - 3\text{A}$	25	50	
$V_{CE(sat)}$	* Collector-Emitter Saturation Voltage	$I_C = - 3\text{A}, I_B = - 375\text{mA}$		- 1.2	V
$V_{BE(sat)}$	* Base-Emitter Saturation Voltage	$V_{CE} = - 4\text{V}, I_C = - 3\text{A}$		- 1.8	V
f_T	Current Gain Bandwidth Product	$V_{CE} = - 10\text{V}, I_C = - 500\text{mA}$	3.0		MHz

* Pulse Test: $PW \leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$



SOT-23 Plastic-Encapsulate Transistors

S8050LT1 TRANSISTOR (NPN)

FEATURES

Power dissipation

P_{CM} : 0.3 W ($T_{amb}=25^{\circ}C$)

Collector current

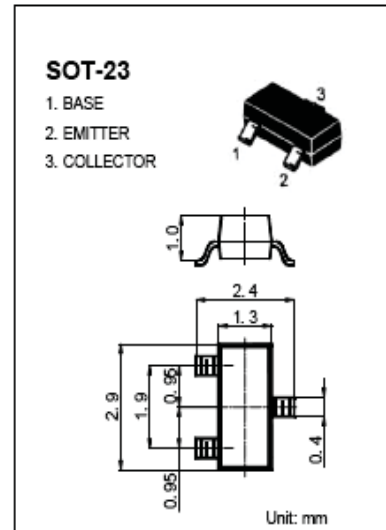
I_{CM} : 0.5 A

Collector-base voltage

$V_{(BR)CBO}$: 40 V

Operating and storage junction temperature range

T_J, T_{stg} : $-55^{\circ}C$ to $+150^{\circ}C$



ELECTRICAL CHARACTERISTICS ($T_{amb}=25^{\circ}C$ unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Collector-base breakdown voltage	$V_{(BR)CBO}$	$I_C=100\mu A, I_E=0$	40			V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C=1mA, I_B=0$	25			V
Emitter-base breakdown voltage	$V_{(BR)EBO}$	$I_E=100\mu A, I_C=0$	5			V
Collector cut-off current	I_{CBO}	$V_{CB}=40V, I_E=0$			0.1	μA
Collector cut-off current	I_{CEO}	$V_{CB}=20V, I_E=0$			0.1	μA
Emitter cut-off current	I_{EBO}	$V_{EB}=5V, I_C=0$			0.1	μA
DC current gain	$h_{FE(1)}$	$V_{CE}=1V, I_C=50mA$	120		350	
	$h_{FE(2)}$	$V_{CE}=1V, I_C=500mA$	50			
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=500mA, I_B=50mA$			0.6	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C=500mA, I_B=50mA$			1.2	V
Transition frequency	f_T	$V_{CE}=6V, I_C=20mA$ $f=30MHz$	150			MHz

CLASSIFICATION OF $h_{FE(1)}$

Rank	L	H
Range	120-200	200-350



SOT-23 Plastic-Encapsulate Transistors

S8550LT1 TRANSISTOR (PNP)

FEATURES

Power dissipation

P_{CM} : 0.3 W ($T_{amb}=25^{\circ}C$)

Collector current

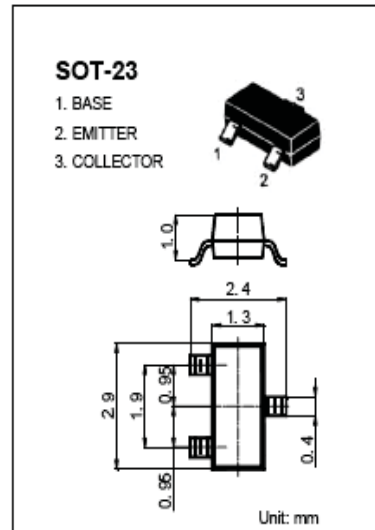
I_{CM} : -0.5 A

Collector-base voltage

$V_{(BR)CBO}$: -40 V

Operating and storage junction temperature range

T_J, T_{stg} : $-55^{\circ}C$ to $+150^{\circ}C$



ELECTRICAL CHARACTERISTICS ($T_{amb}=25^{\circ}C$ unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	MAX	UNIT
Collector-base breakdown voltage	$V_{(BR)CBO}$	$I_C = -100\mu A, I_E = 0$	-40		V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = -1mA, I_B = 0$	-25		V
Emitter-base breakdown voltage	$V_{(BR)EBO}$	$I_E = -100\mu A, I_C = 0$	-5		V
Collector cut-off current	I_{CBO}	$V_{CB} = -40V, I_E = 0$		-0.1	μA
Collector cut-off current	I_{CEO}	$V_{CE} = -20V, I_B = 0$		-0.1	μA
Emitter cut-off current	I_{EBO}	$V_{EB} = -3V, I_C = 0$		-0.1	μA
DC current gain	$h_{FE(1)}$	$V_{CE} = -1V, I_C = -50mA$	120	350	
	$h_{FE(2)}$	$V_{CE} = -1V, I_C = -500mA$	50		
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = -500 mA, I_B = -50mA$		-0.6	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C = -500 mA, I_B = -50mA$		-1.2	V
Transition frequency	f_T	$V_{CE} = -6V, I_C = -20mA$ $f = 30MHz$	150		MHZ

CLASSIFICATION OF $h_{FE(1)}$

Rank	L	H
Range	120-200	200-350

TOSHIBA

2SA1048

TOSHIBA TRANSISTOR SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

2SA1048

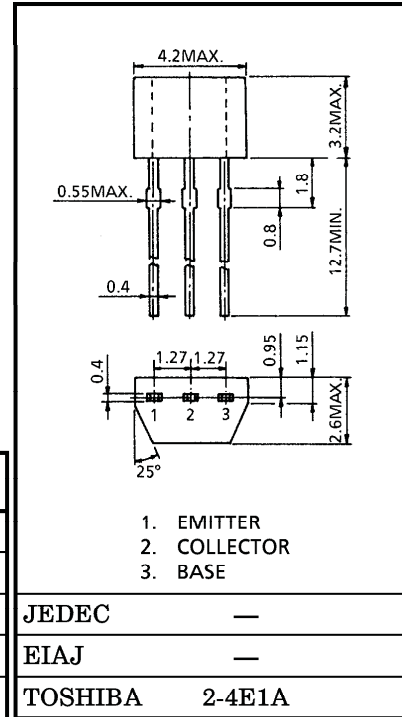
AUDIO FREQUENCY AMPLIFIER APPLICATIONS

Unit in mm

- Small Package
- High Voltage : $V_{CEO} = -50V$ (Min.)
- High h_{FE} : $h_{FE} = 70 \sim 400$
- Excellent h_{FE} Linearity
: $h_{FE}(I_C = -0.1mA) / h_{FE}(I_C = -2mA) = 0.95$ (Typ.)
- Low Noise : $NF = 1dB$ (Typ.), $10dB$ (Max.)
- Complementary to 2SC2458

MAXIMUM RATINGS ($T_a = 25^\circ C$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-50	V
Collector-Emitter Voltage	V_{CEO}	-50	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-150	mA
Base Current	I_B	-50	mA
Collector Power Dissipation	P_C	200	mW
Junction Temperature	T_j	125	$^\circ C$
Storage Temperature Range	T_{stg}	-55~125	$^\circ C$



Weight : 0.13g

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ C$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	$V_{CB} = -50V, I_E = 0$	—	—	-0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V, I_C = 0$	—	—	-0.1	μA
DC Current Gain	h_{FE} (Note)	$V_{CE} = -6V, I_C = -2mA$	70	—	400	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = -100mA, I_B = -10mA$	—	-0.1	-0.3	V
Transition Frequency	f_T	$V_{CE} = -10V, I_C = -1mA$	80	—	—	MHz
Collector Output Capacitance	C_{ob}	$V_{CB} = -10V, I_E = 0, f = 1MHz$	—	4	7	pF
Noise Figure	NF	$V_{CE} = -6V, I_C = -0.1mA$ $f = 1kHz, R_G = 10k\Omega$	—	1.0	10	dB

Note : h_{FE} Classification 0 : 70~140, Y : 120~240, GR : 200~400

961001EAA2

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
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- The information contained herein is subject to change without notice.

TOSHIBA

2SC2458

TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

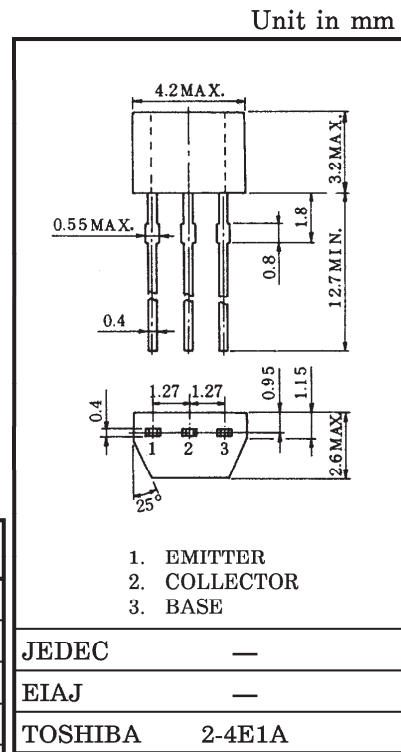
2SC2458

AUDIO AMPLIFIER APPLICATIONS.

- High Current Capability : $I_C = 150\text{mA (Max.)}$
- High DC Current Gain : $h_{FE} = 70 \sim 700$
- Excellent h_{FE} Linearity
: $h_{FE}(I_C = 0.1\text{mA}) / h_{FE}(I_C = 2\text{mA}) = 0.95$ (Typ.)
- Low Noise : $NF(2) = 1\text{dB (Typ.)}$, 10dB (Max.)
- Complementary to 2SA1048.
- Small Package.

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	150	mA
Base Current	I_B	50	mA
Collector Power Dissipation	P_C	200	mW
Junction Temperature	T_j	125	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55~125	$^\circ\text{C}$



Weight : 0.13g

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

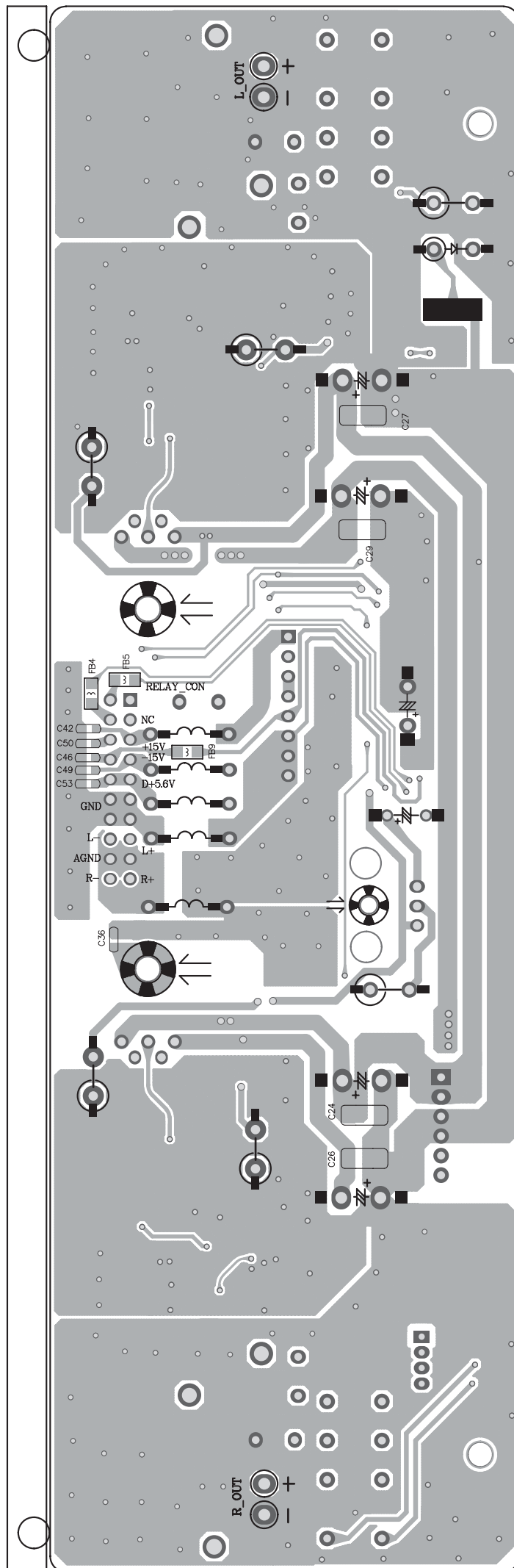
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	$V_{CB} = 50\text{V}$, $I_E = 0$	—	—	0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 5\text{V}$, $I_C = 0$	—	—	0.1	μA
DC Current Gain	h_{FE} (Note)	$V_{CE} = 6\text{V}$, $I_C = 2\text{mA}$	70	—	700	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\text{mA}$, $I_B = 10\text{mA}$	—	0.1	0.25	V
Transition Frequency	f_T	$V_{CE} = 10\text{V}$, $I_C = 1\text{mA}$	80	—	—	MHz
Collector Output Capacitance	C_{ob}	$V_{CB} = 10\text{V}$, $I_E = 0$, $f = 1\text{MHz}$	—	2.0	3.5	pF
Noise Figure	NF	$V_{CE} = 6\text{V}$, $I_C = 0.1\text{mA}$, $f = 1\text{kHz}$, $R_g = 10\text{k}\Omega$	—	1.0	10	dB

Note : h_{FE} Classification O : 70~140, Y : 120~240, GR : 200~400, BL : 350~700

961001EAA2

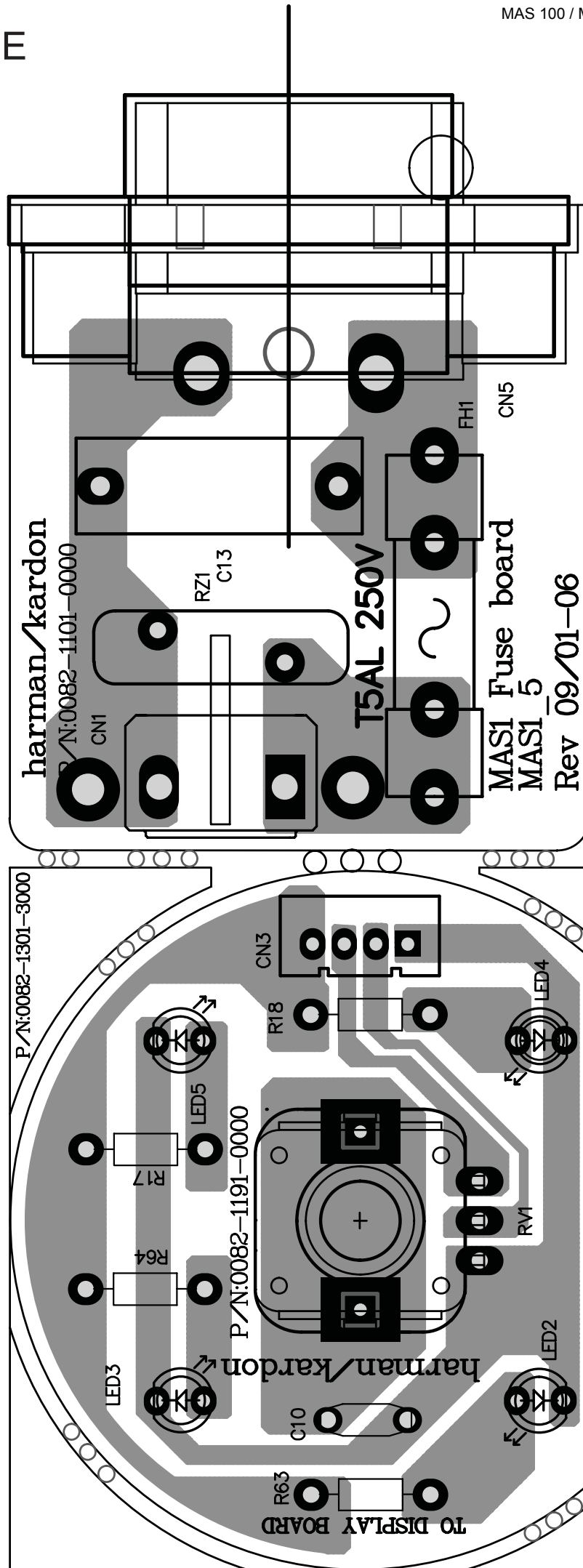
● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

AMP PCB(2/2)



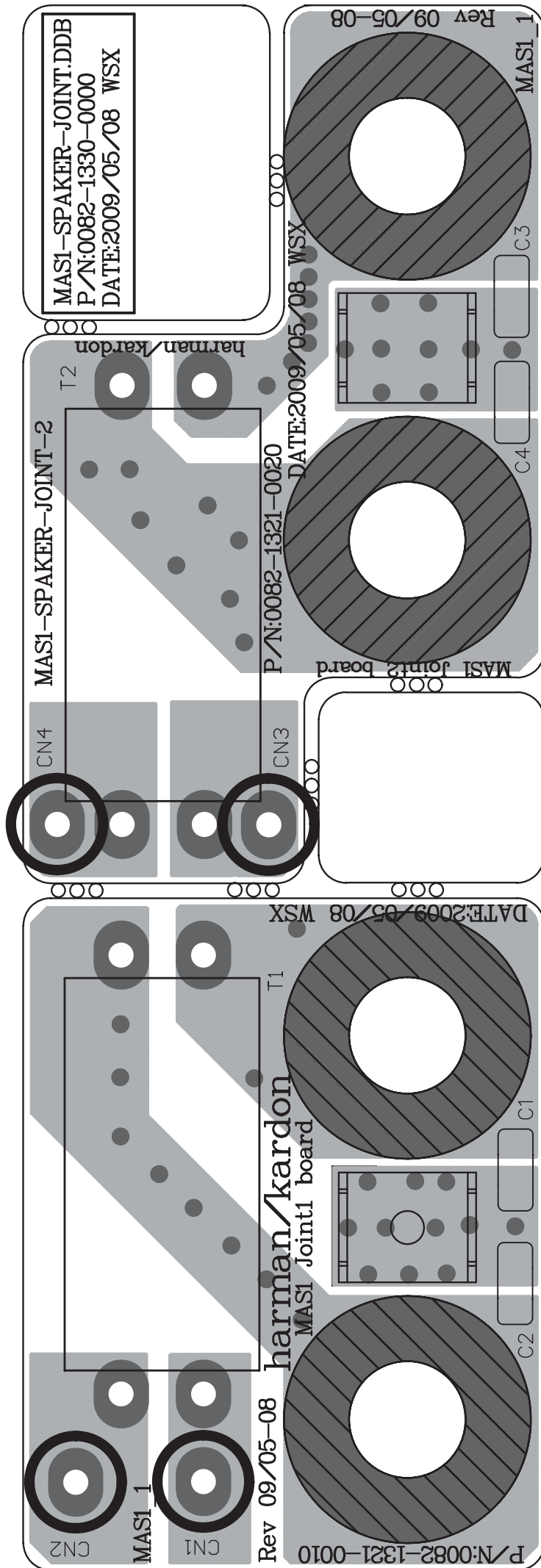
LED & FUSE

PCB

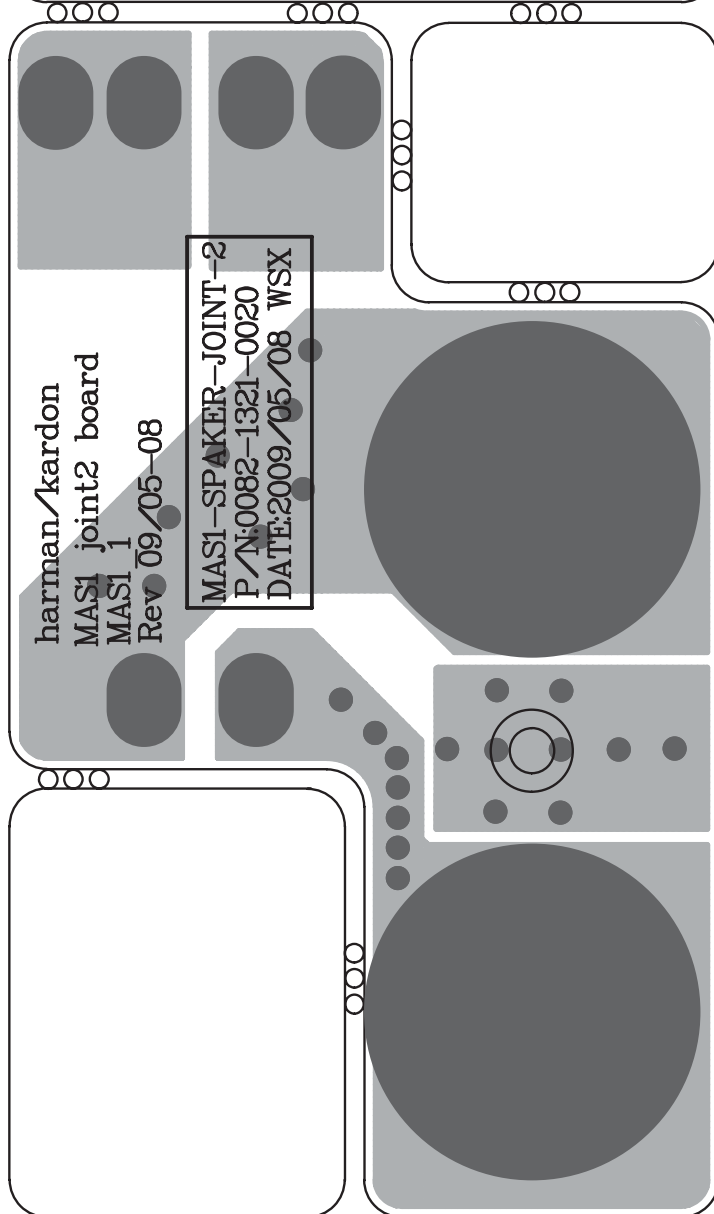
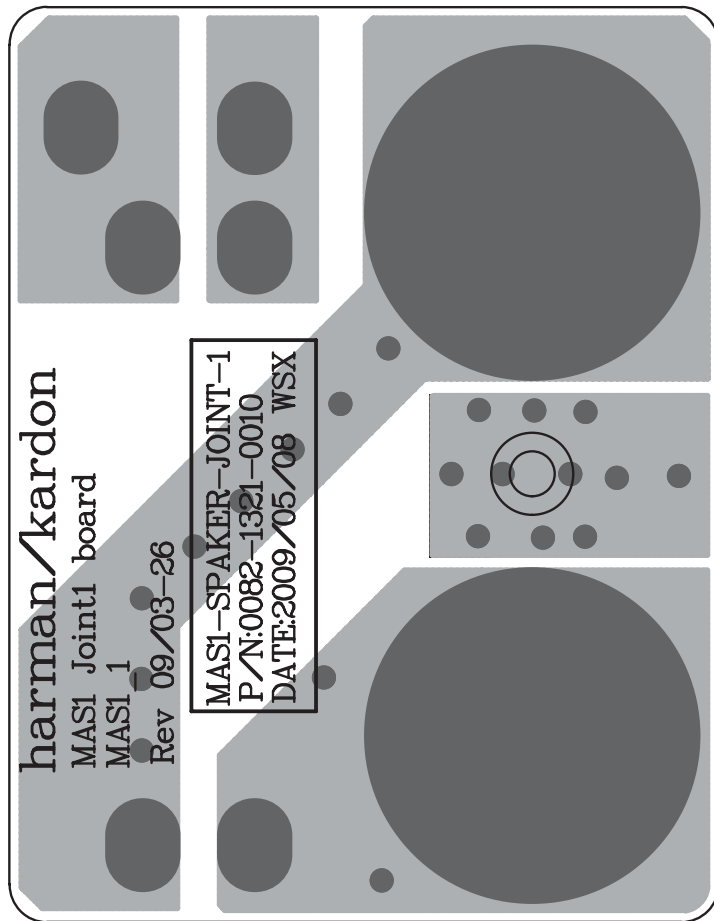


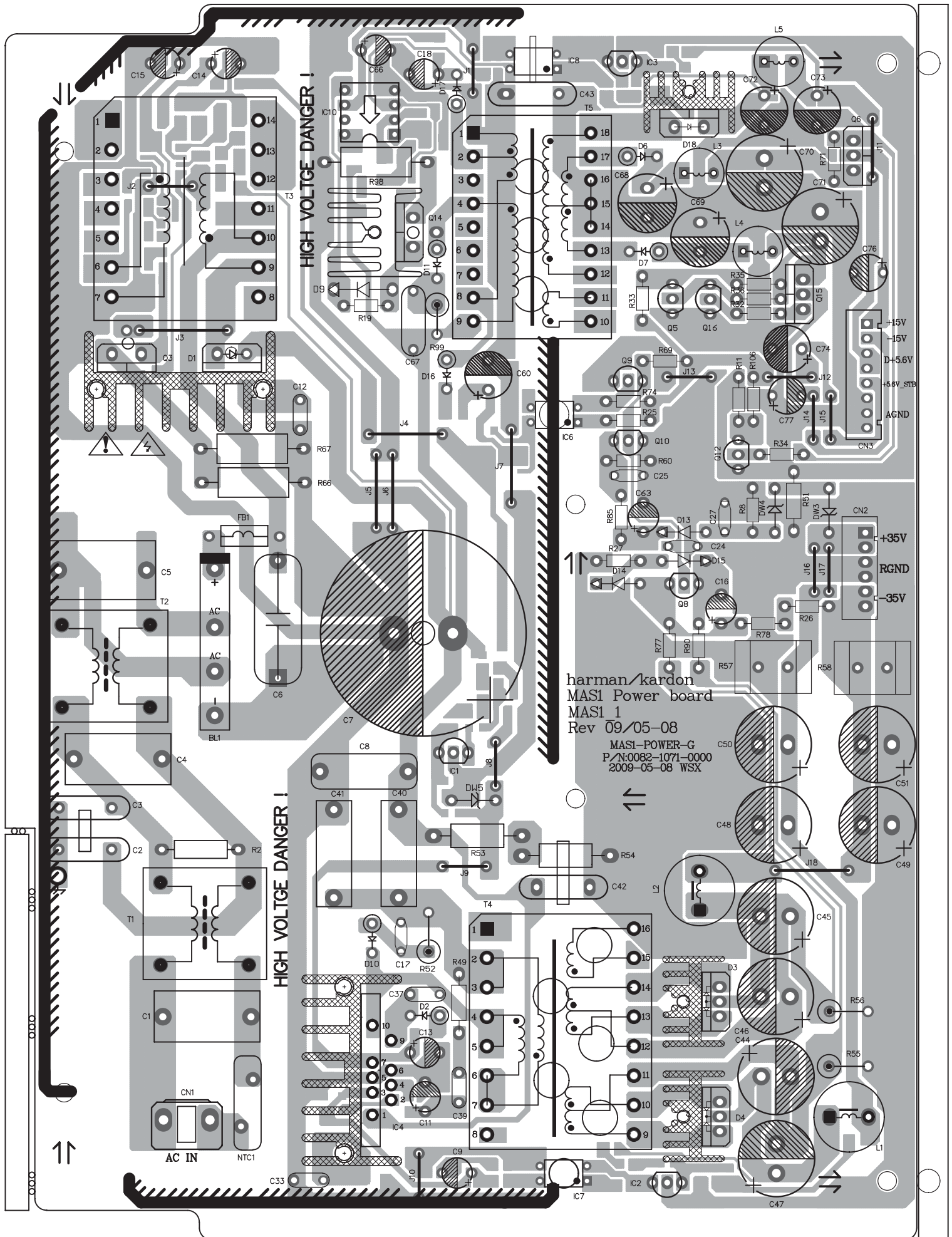
harman/kardon

SPEAKER JOINT PCB (1/2)

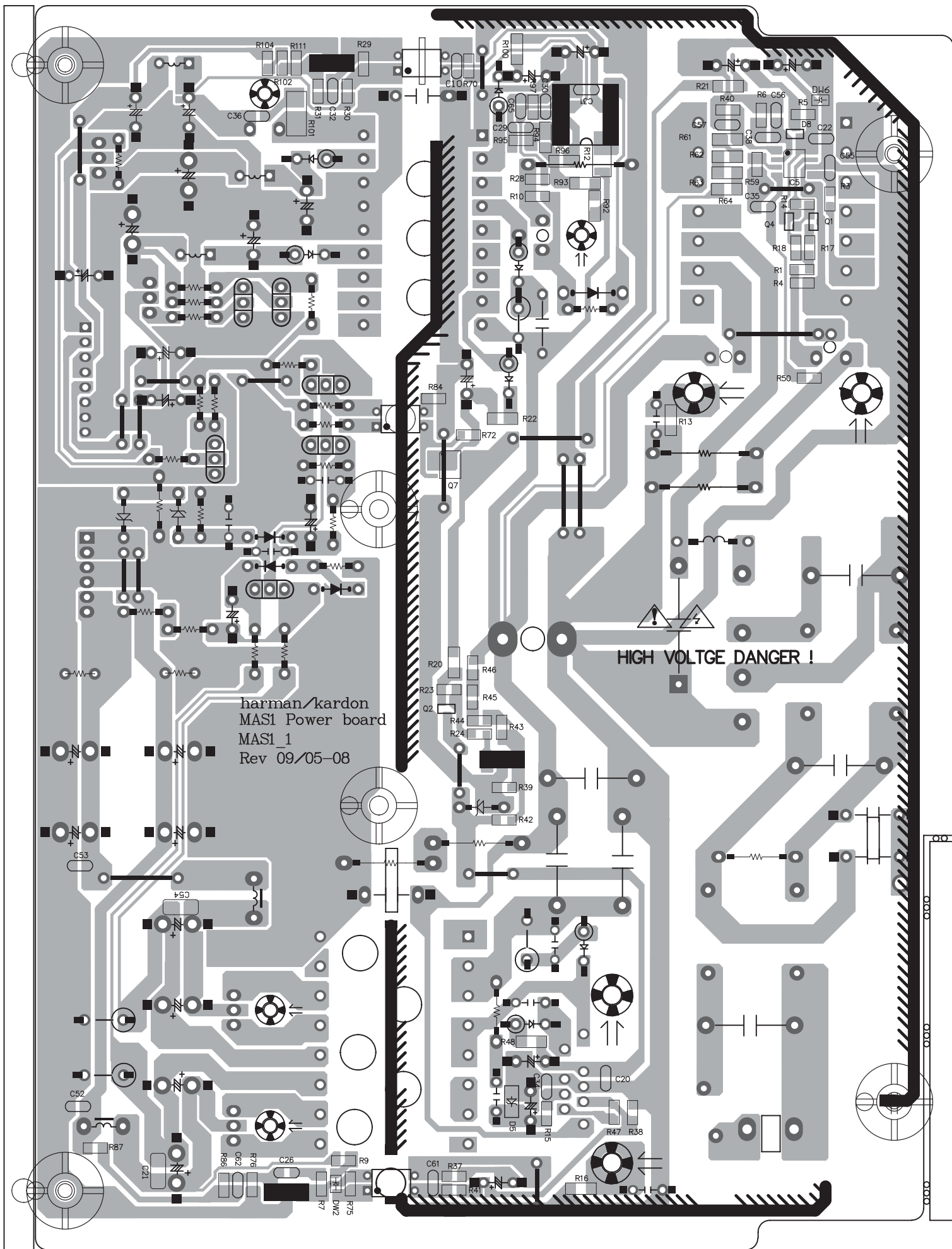


SPEAKER JOINT PCB(2/2)

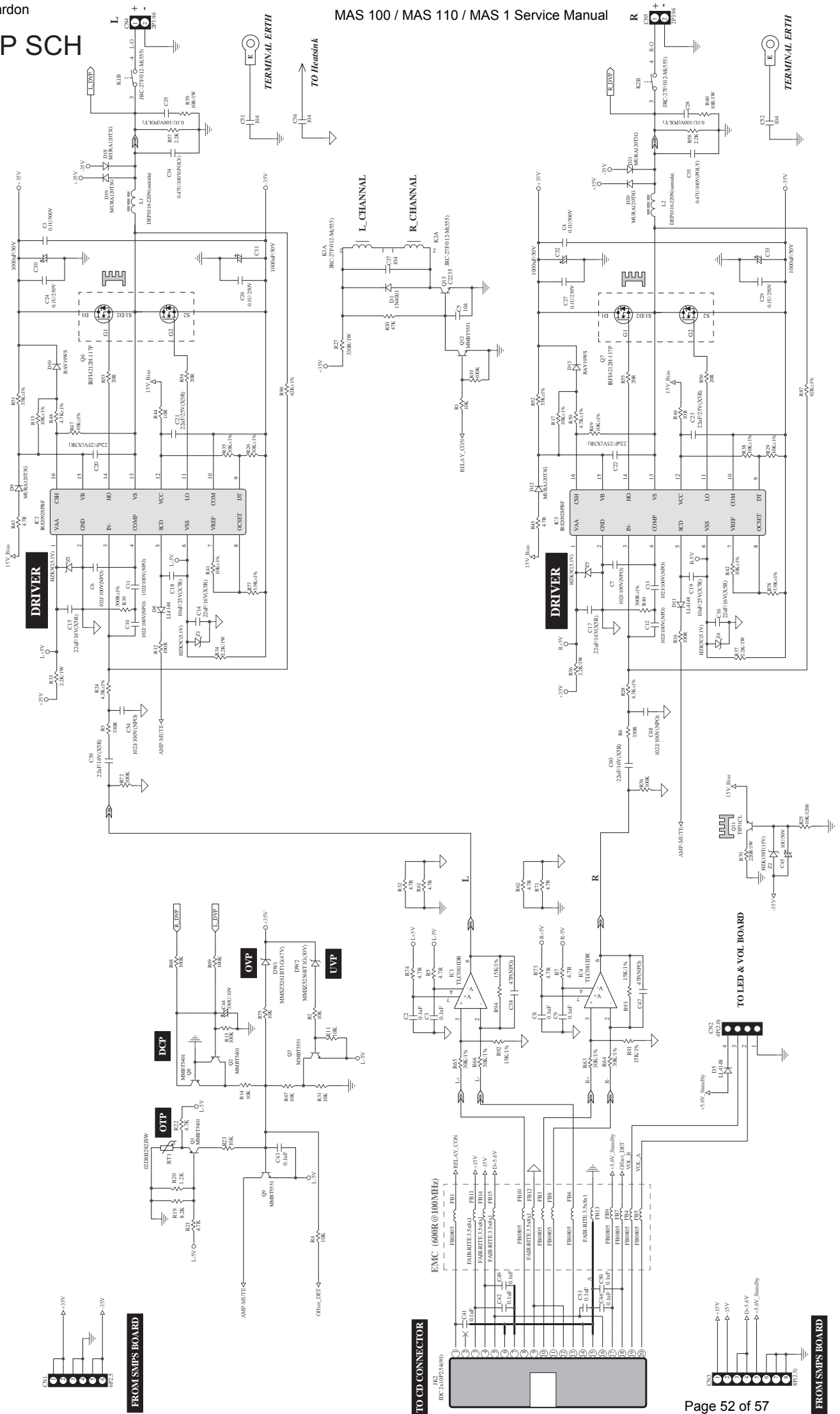




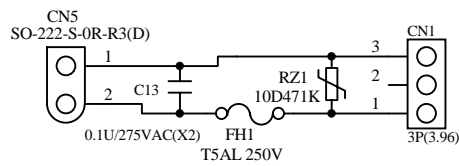
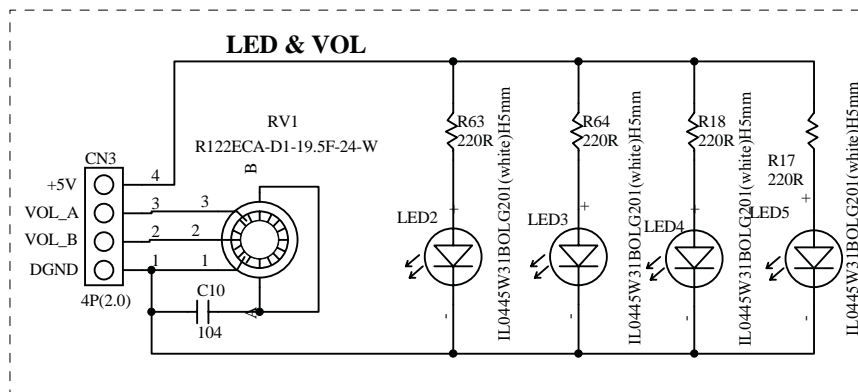
POWER PCB(2/2)



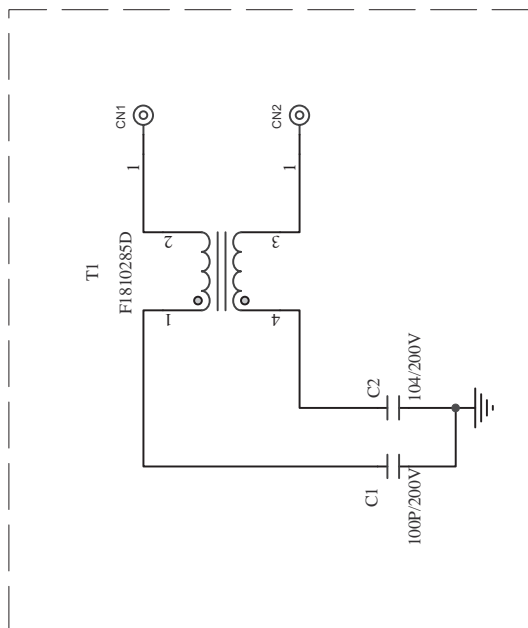
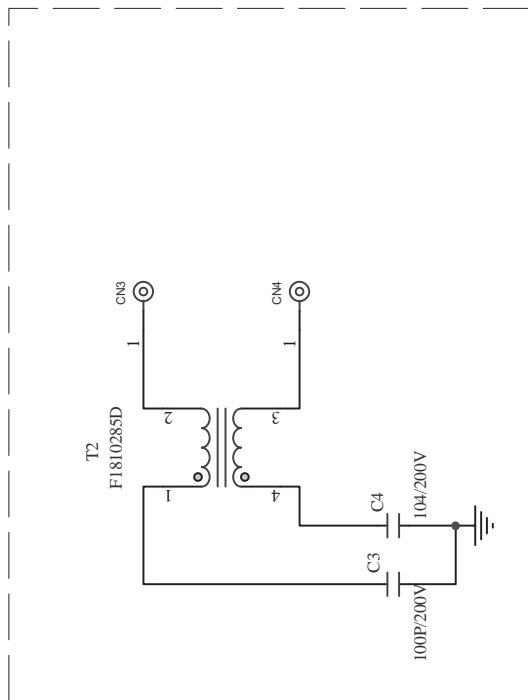
AMP SCH



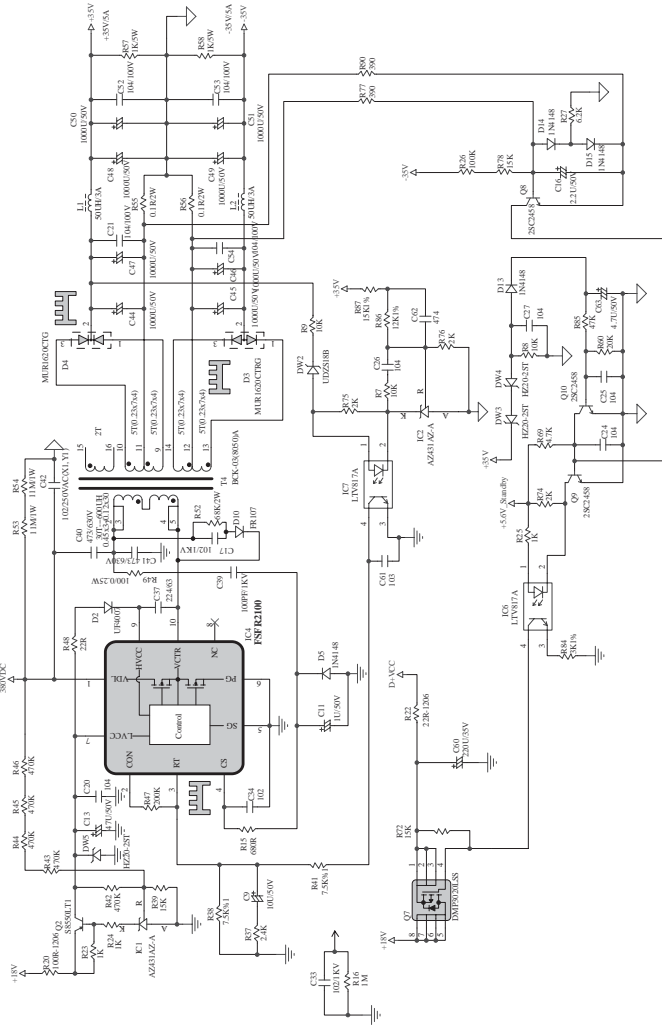
LED & FUSE SCH



JOINT SCH

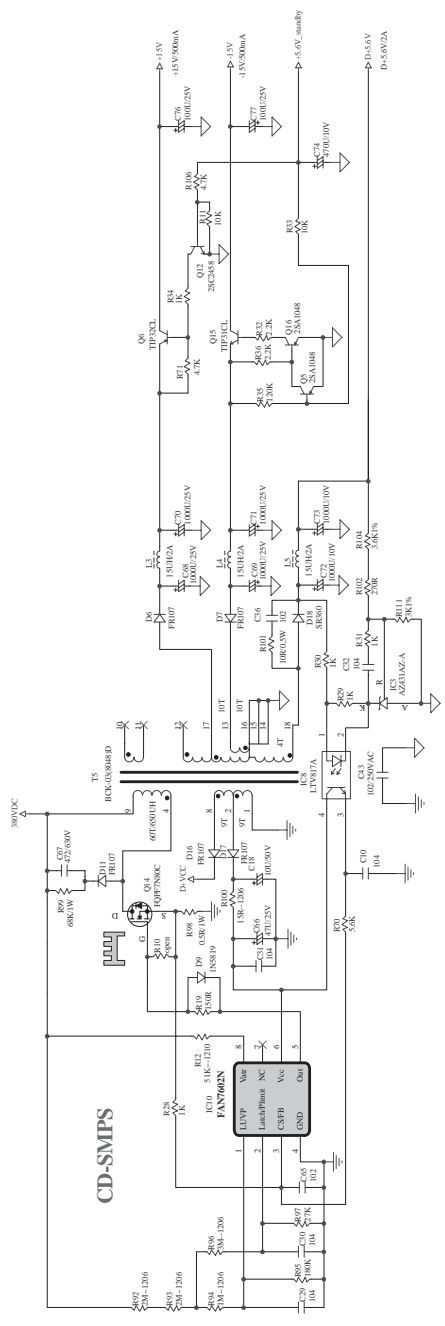
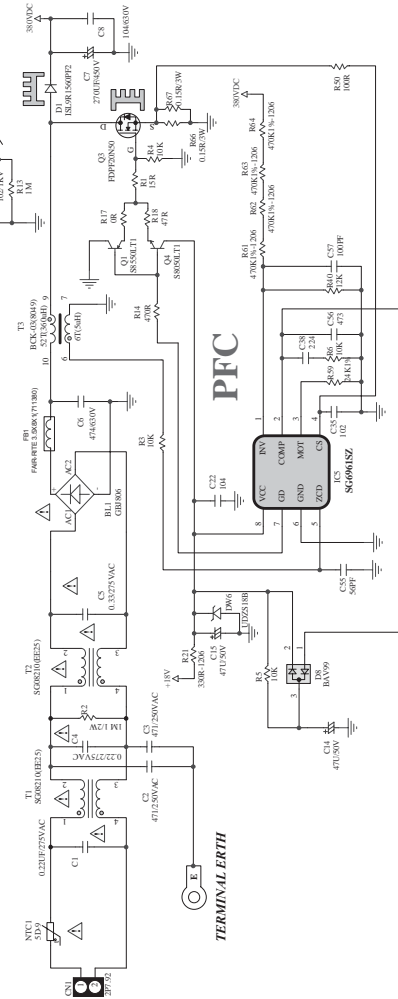
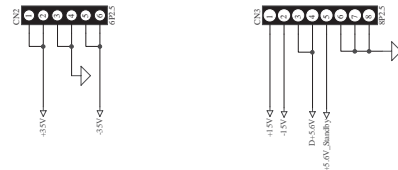


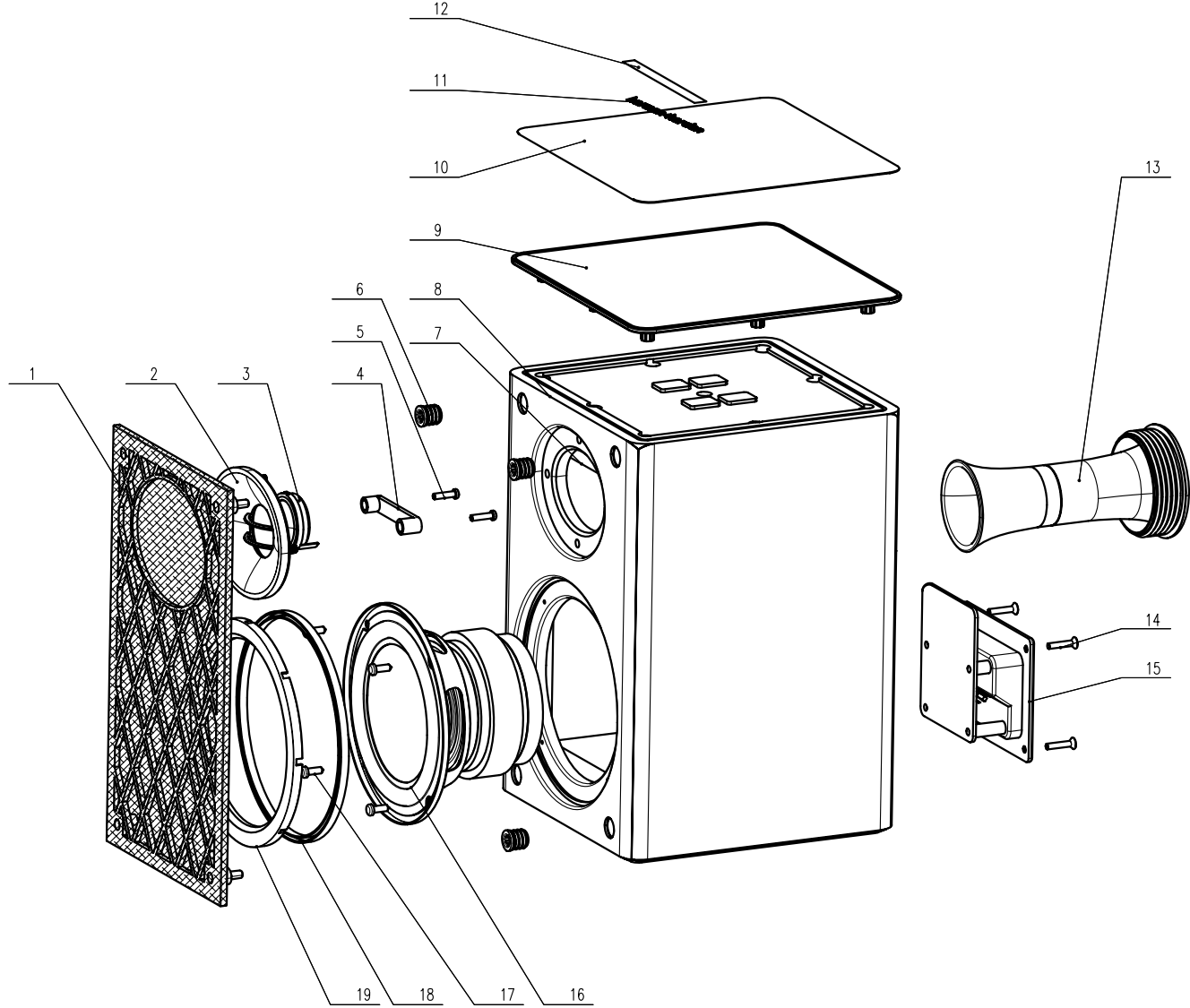
AMP-SMPS



TO AMP BOARD

TO AMP BOARD





item	GSEC part no.	name	qty	comment
1	WT0264001010	assy grill cloth	1	grill+cloth
2	MB0097001010	waveguide	1	
3	320025 10001	tweeter	1	
4	AJ0060001010	tweeter bar	1	
5	JCS69068	screw	2	
6	TT0013014010	grill cup	4	
7	QQ0768001010	damping material	1	
8	XT0268001010	cabinet	1	
9	QT0184001010	plastic cover	1	
10	QT0180005010	aluminum cover	1	
11	MP0080014010	logo	1	
12	815001002512	safe film	1	
13	DG0070018010	port tube	1	
14	SEW040162141	screw	4	
15	FP0080008010	terminal cap with nut&wt	1	
16	110130 06001	woofer	1	
17	SPW0401221A0	screw	4	
18	QT0440001010	gasket	1	
19	QT0140004010	trim ring	1	

SCALE: 1:1	UNIT: MM	MATL:	TREAT:	WEIGHT:	DATE: 2009-5-6
TITLE HARMAN MAS1			MARK	REVISIONS	DATE
CODE 710130 06001/2					
DRAW NO					

SIZE: 199.3*180.5*275.2

All composite wood products are demonstrated compliance with section 93120.2(a), Title 17, California Code of Regulations.

MAS 1 loudspeaker for HK MAS 100 and MAS 110 systems

Description	Harman Part Number
Speaker Assembly (drawing 441037)	
Woofer	110130-06001
Woofer trim ring	441062-001
Tweeter Waveguide	441061-001
Tweeter	300-0058-004
Terminal cup with terminals	?
Port tube	364952-001
Plastic Top	441063-001
Decorative Aluminum (Brushed) Top	442006-001
Grille	442005-001
Logo	MP0080014010
Tweeter Mounting Strap	338059-001
Network	FP0080008010
#6 wood screw	?
#8 wood screw	?
#6 hi-low self threading plastic screw	JG589068
Grille Cloth	?
Grille cup	TT0013014010
Trim ring gasket	QT0440001010
Packaging & Accessories (drawing 441067)	
End Pad - top / bottom	?
Carton	?

Rubber Feet

TT0019006010