SERVICE MANUAL

MA-950S/850S

2004-10-03

MA-950S/850S Principles and Maintenance

1. Product profile

MA950S is a medium-grade active sound box consisting of five satellite sound boxes, i.e. one subwoofer sound box, two pre-positioned sound boxes, two surround sound boxes and one centrally-positioned sound box. The product features good sound effect in appropriate space, and it has the following features:

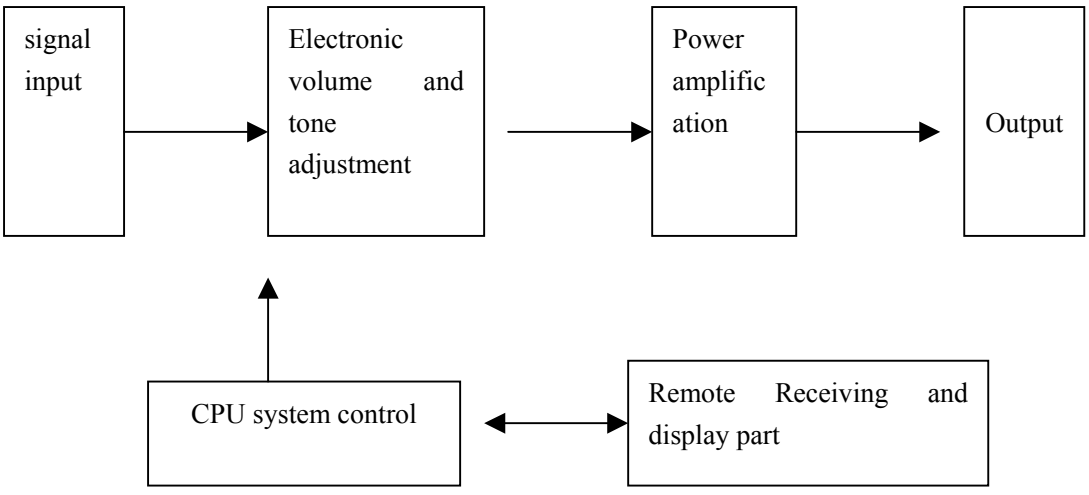
1) 2.1/5.1 sound channel output;

2) Tone and volume adjustment

3) Built-in five sound channel power amplification, and adaptable to AC-3/DTS and stereo music replay;

4) Six sound channel volume control and independent level control, with tone adjustment function.

2. Principle block diagram



3. System composition

The device comprises input board, output board, power amplification board and control panel. The input board and output board only consist of a few terminals. The power amplification board is the most important part, fulfilling control, amplification and power supply for the whole system. In the following is the brief description of the principles for the power amplification board.

1) Power supply part

In consideration of the big output power of the subwoofer, the device employs a ring transformer for power supply. A group of 18V(AC) voltages is output from the transformer, which will be subject to rectification and filtering and will output +22 V voltage to power IC TDA8947 and IC TFA9843 for power supply.

One line of output 22V voltage goes through the current limiting resistor R101, voltage regulating diode VD104 and capacitor C108 and then output +9V voltage to IC 75347; the other line goes through R100 and voltage regulating diode VD105 and then output 5V voltage power supply for the CPU and the control panel.

2. Signal input, volume and tone adjustment

The device has six channels for signal input. The signals input through each channel will go through the filtering capacitor before being directly delivered to the IC LC75347 for volume and tone adjustment. In addition,

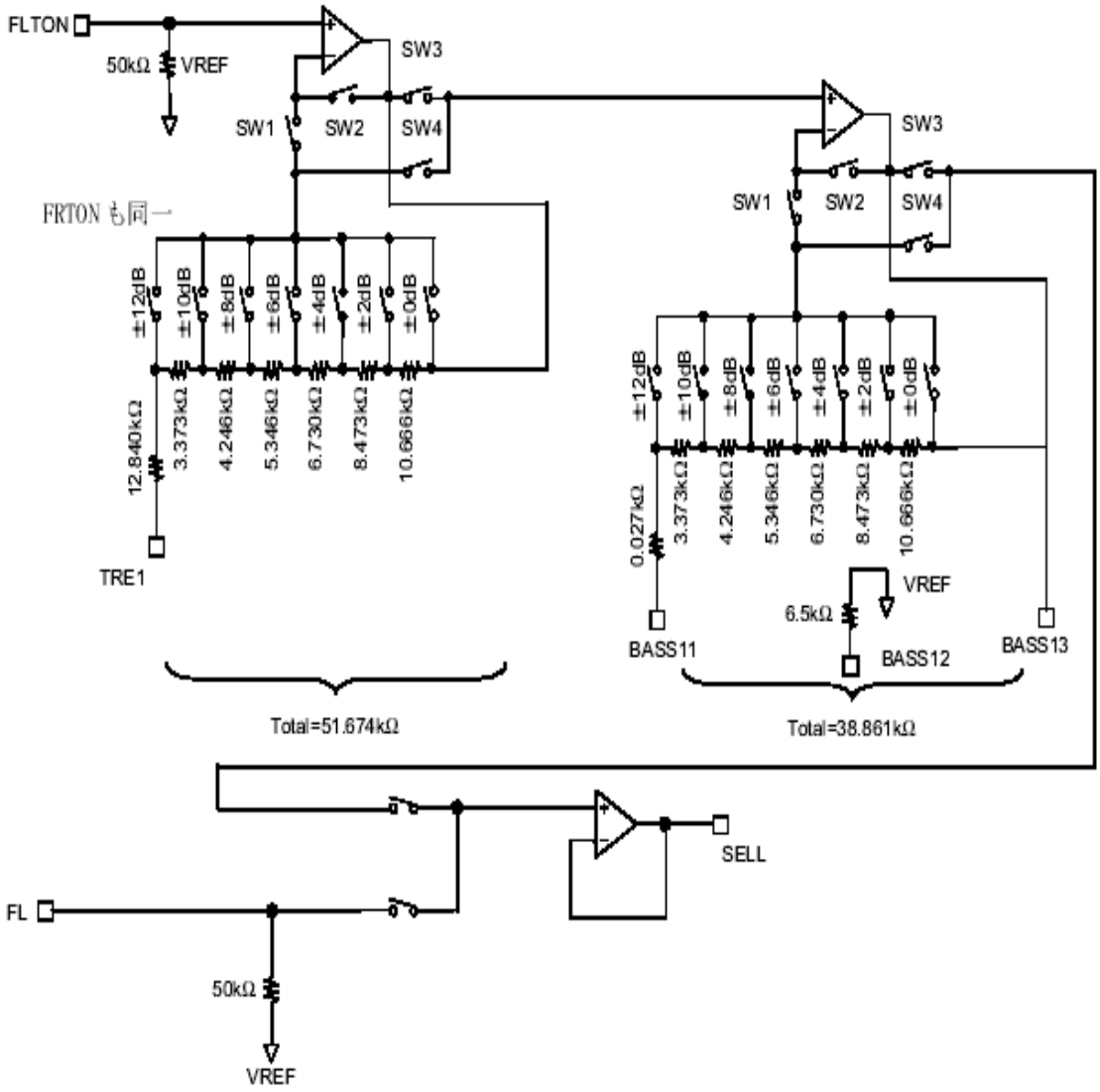
one line of signals will be derived from the L and R main sound channels and overlapped on the SW input. As a result, 2.1 output result will be achieved even when there are only L and R sound channel inputs.

IC LC75347 is an IC with six-channel independent volume adjustment. With its gains adjustable from 0 to 95 single DB, it is applicable to home theater products. With benefits such as big range of power supply, low power consumption and wide temperature scope, it is a quite competent IC, and the functions of its main pins are listed in the following table:

Pin name	Pin Numbering	Function description
FLIN	7	Signal input
FRIN	24	Signal input
RL	20	Signal input
RR	18	Signal input
C	22	Signal input
SBW	16	Signal input
FLOUT	9	Signal input
FROUT	10	Signal input
COUT	11	Signal input
RLOUT	12	Signal input
RROUT	13	Signal input
SBWOUT	14	Signal input
VREF	23	Reference voltage

VDD	37	Power voltage
CE	40	Part signals selection control line
DI	39	Data control line
CL	38	Clock control line
MUTE	35	External mute control

The IC internal unit equivalent circuit:



3. Amplifying circuit part

Principle: as far as the signals output from the IC 75347 are concerned, the signals of the main sound channel will be delivered to the N101 IC TFA9843 for power amplification; the central surround signals will be filtered and delivered to the N106 IC TDA8947 for amplification; the subwoofer signals will first pass experience amplitude limit (the amplitude limit circuit comprises VD110 and VD113 diodes) and pretreatment before being delivered to the N102 IC TFA9843. Amplitude limit is aimed at preventing excessive size of signals, which may, after amplification, damage the loudspeaker due to excessive power. Because the power supply of the amplification IC is fulfilled by a single power source, all amplified and output signals will have DC, therefore, the signals will still experience filtering before being output to the loudspeaker.

IC TFA9843J is used for dual sound channel power amplification. With standby and mute modes, free from switch impact, and with functions such as short circuit protection and overheat protection, it can effectively be prevented from being damaged in case of IC abnormality. In ordinary output mode, the IC can supply for each channel a maximum of 20W power output. When BTL output is employed, the power can be as high as 40W. In addition, the IC features powerful anti-ripple performance, with little power consumption in the standby state.

The functions of the various pins of the IC TFA9843J are listed in the following table:

Symbol	Pin	Function
IN2+	1	2nd channel input
OUT2-	2	2nd channel output
CIV	3	Common mode input signal suppression
1N1+	4	1st channel input
GND	5	Ground
SVR	6	Reference voltage
MODE	7	Mode selection
OUT1+	8	1st channel output
VCC	9	Power supply

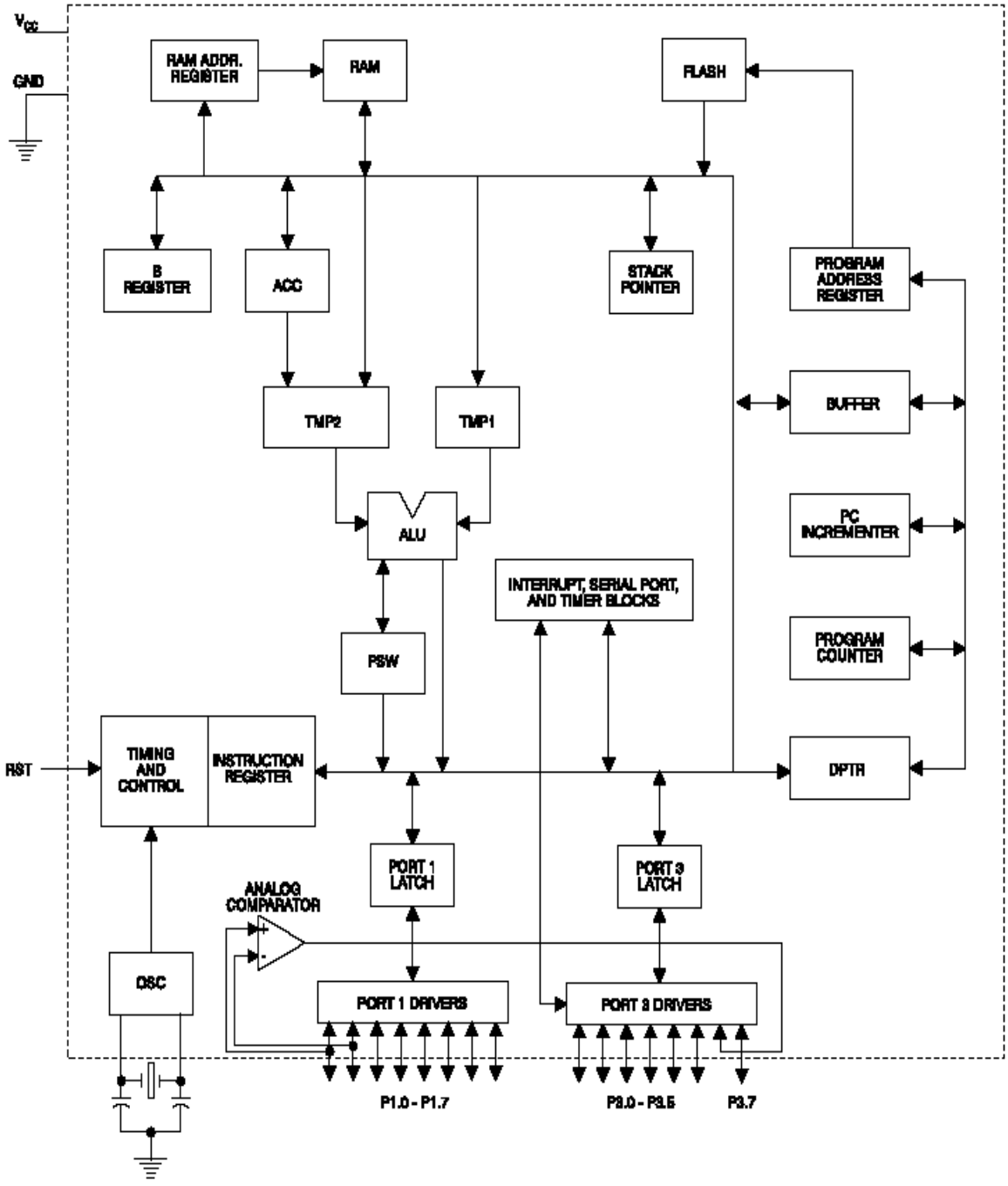
IC TDA8947J is used for four channel power amplification. Its features are similar to those of the IC TFA9843J, however, its output power is bigger, and a single sound channel can be as high as 25 W.

4. Control circuit

MA-950S employs IC AT89C2051 to serve as its core part to control the operation of the whole device. With low voltage and high performance, it employs 8-bit 2K bytes flash and ROM single-chip. Boasting 15 I/O ports and six interrupt sources; it has features such as low power consumption

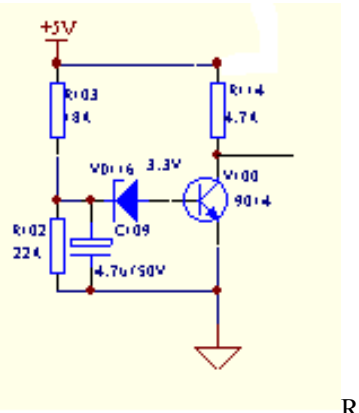
and standby mode.

The principle block diagram of the IC is illustrated in the following figure:



Reset circuit:

MA-950S employs high level for resetting. By making use of the feature of the capacitor C109 that there is no jump for of voltage, the device ensures that there is no jump of capacitor voltage at the instant of power on. The base electrode of the triode V100 has low level, so that the triode is not on, and the 5V voltage is added to the first pin of the CMP through resistor R114. With capacitor charging, the positive voltage of the capacitor gradually climbs; when the voltage attains a certain limit, the voltage regulating diode is reversely on, so that the base electrode of the triode has high level, the triode is on; the reset pin voltage turns into low level, thus fulfilling resetting. The circuit diagram is illustrated in the following figure:



Reset circuit

Mainly remote control is employed for adjustment of the status of the device. The signals received by the remote controller are delivered to the sixth pin of the CPU. After the signals are processed inside the CPU, pins

7，8 and 9 deliver control signals to adjust the volume of the device. Then there will be corresponding display on the control panel through P1 port, so that users are able to understand the status of the device. In addition, pins 2 and 3 of the CPU are used to control the mute state of the main sound channel and the central surround.

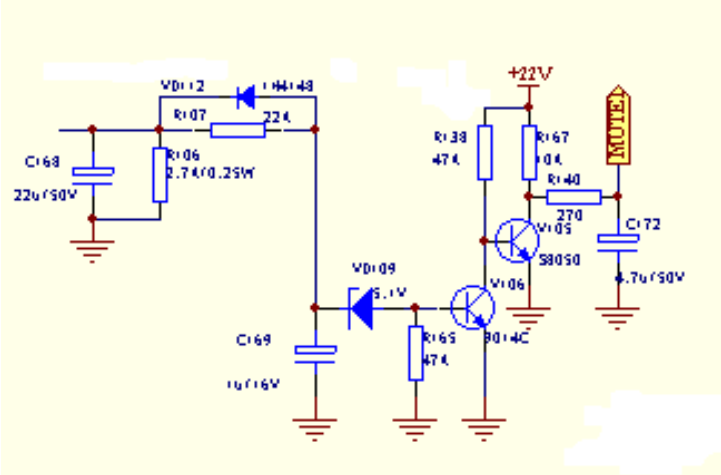
5. Control panel

The control panel of the device consists of a remote control receiver and a nixie tube. Because the device is operated through remote control, the remote control receiver is the sole path for man-machine communication. The nixie tube is used to display the ongoing operation and the state of the whole system.

6. Power on/off mute and mute circuit

Power on/off mute: as shown in the figure, at the instant of power on, the voltages on both sides of capacitor C169 won't experience jump-off, as a result, the low level will remain unchanged, the triode V106 is off, V105 is on, MUTE1 output turns into low level, LRM and SCM signal levels turn lower, and then there is mute. When the capacitor is charged to turn on VD109 5.1V voltage regulator tube and V104 9014 triode, the level of the V105 base electrode will become lower, so that triode V105 turns off, MUTE1 outputs high level, and the mute then comes to an end. The same case applies to power off. Capacitor C169 experiences fast discharge through diode VD112, so that the positive voltage experiences

fast decrease, triode V106 turns off, V105 turns on, MUTE outputs low level and turns on. It is through this circuit that we achieve no impact sound when power is on/off.



Mute circuit: the mute function is realized through the mute signals transmitted by the CPU. Press the MUTE key on the remote controller, the remote control receiver will receive signals and transmitted them to the CPU for processing. Then, pins 2 and 3 of the CPU will transmit high level, so that triodes V107 and V108 turn on, LRM and SCM levels become lower, and the mute is on. It makes use of the mode selection feature of the IC TFA9843 and IC TDA8947. For more details, please refer to the information for the IC TFA9843.

4. Troubleshooting

The electronic circuit inside the device is relatively simple, without too many complicated control and detection circuits. As a result, signal injection method is employed for the maintenance of the device, namely,

signals are added to the input end, and flow along the signal procedure. If signals are interrupted at a certain place, then we can determine that the fault may happen here.

The maintenance of the device is in compliance with the following procedures:

1. Check whether the power supply part is normal; namely, check whether the power supply of 22V, 9V and 5V is normal;

2. In case of abnormal sound but normal power supply, check whether the mute level is normal, and then consider whether it is attributed to the wrongness of other parts;

3. For a device with abnormal display, first determine whether there is anything wrong with the nixie tube, and then check whether there is anything wrong with the CPU.

**********ATTACHMENT**********

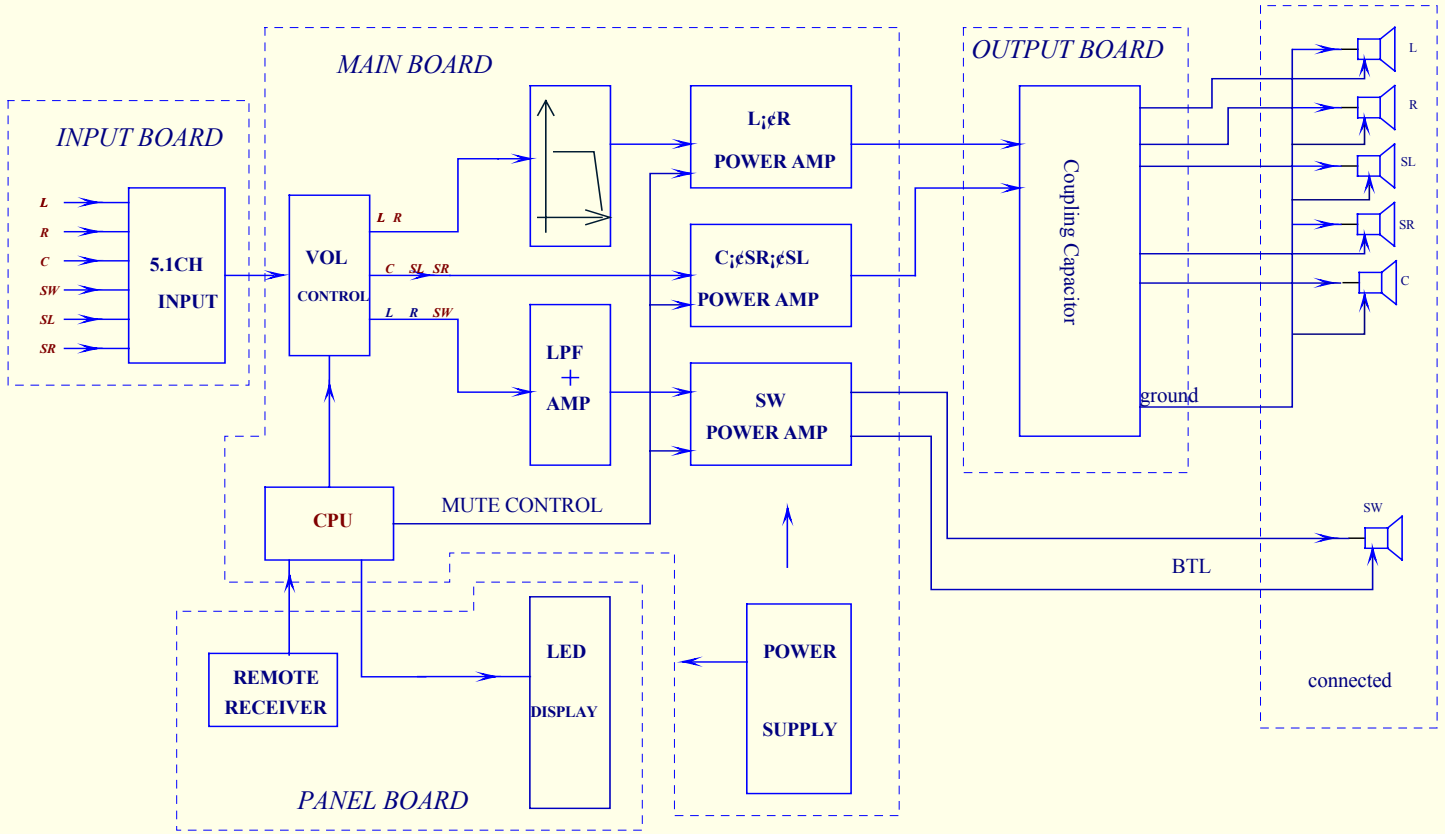
1: Block diagram

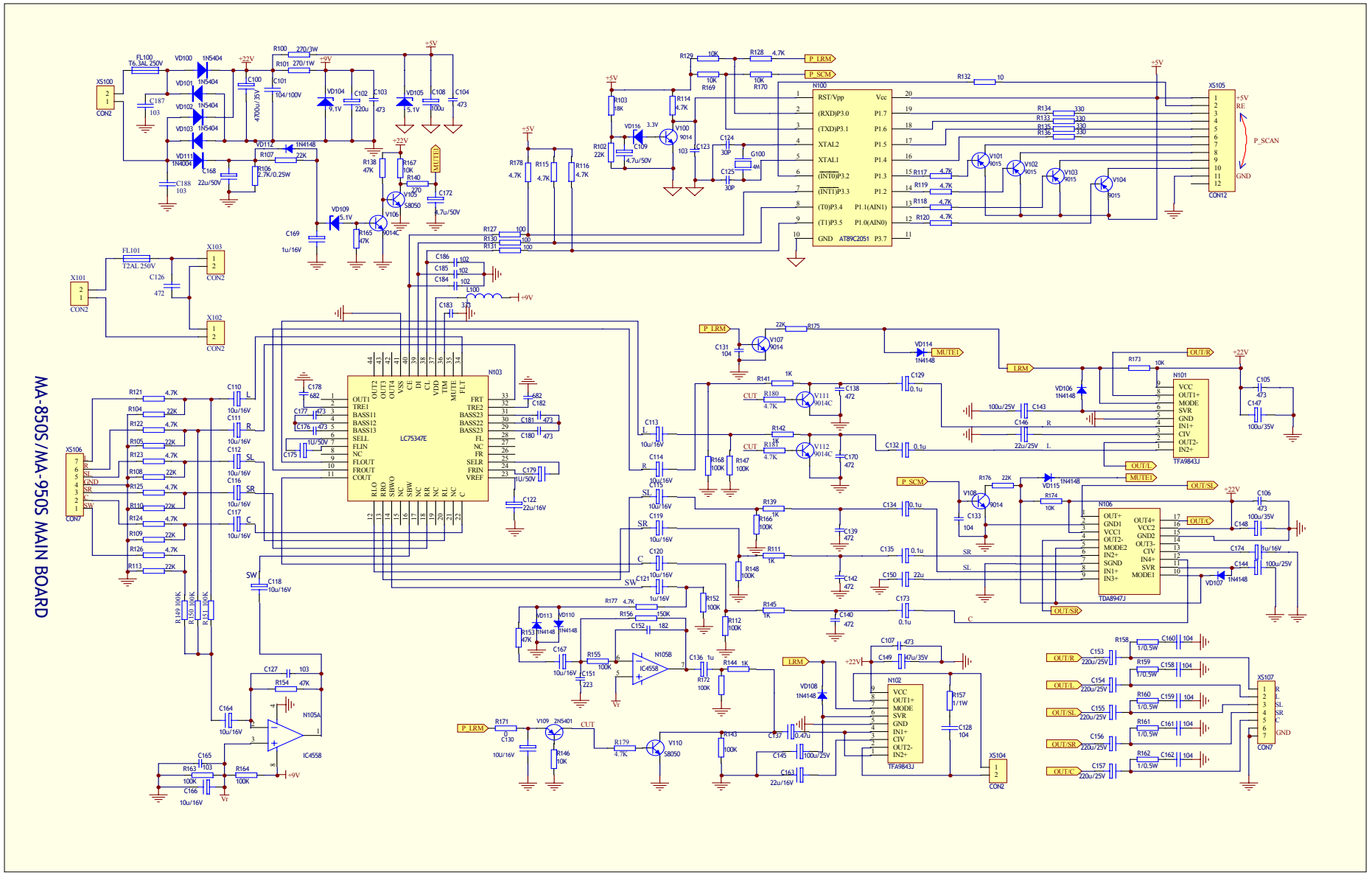
2: Electronic diagram

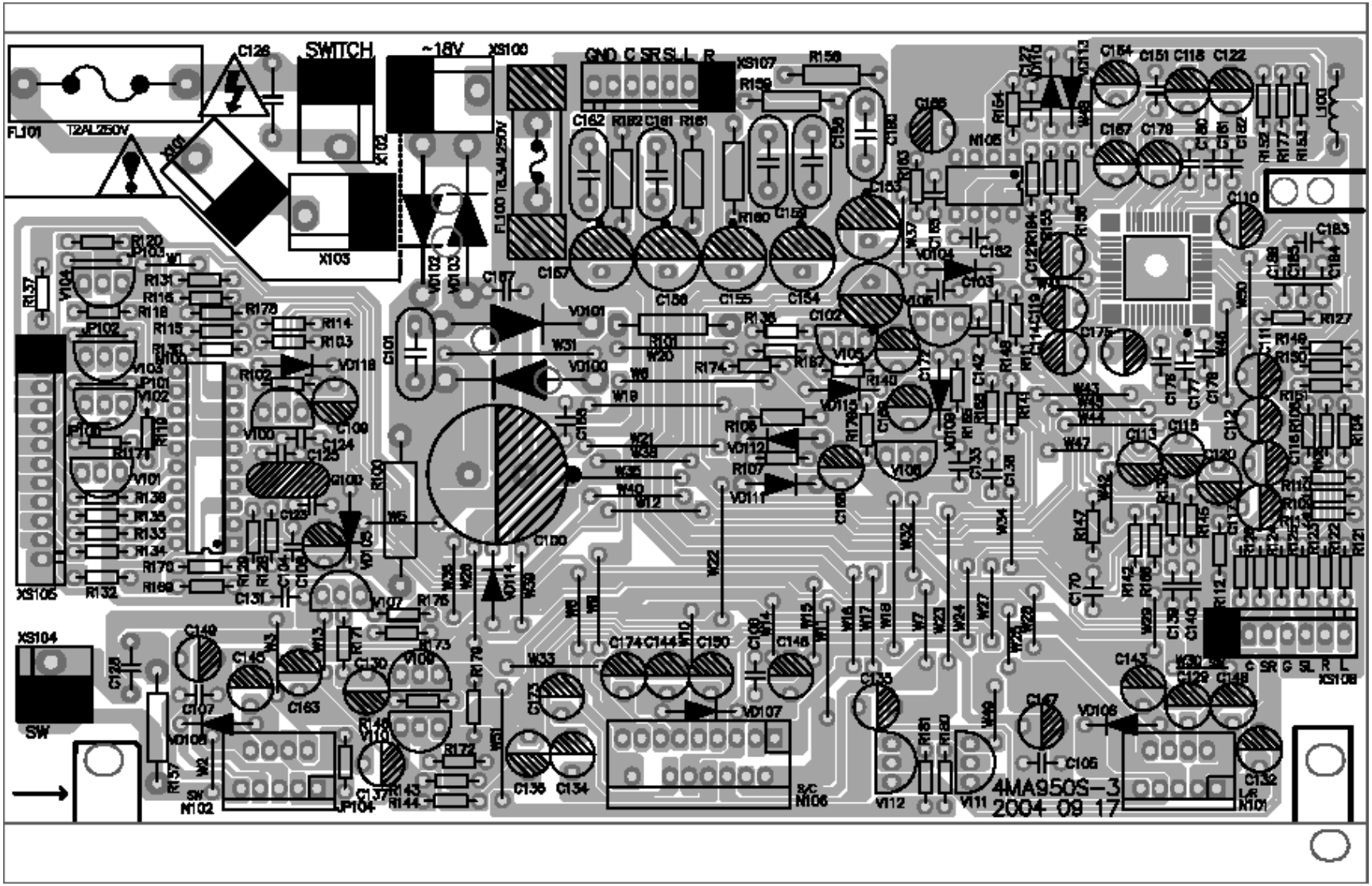
3: PCB silk screen

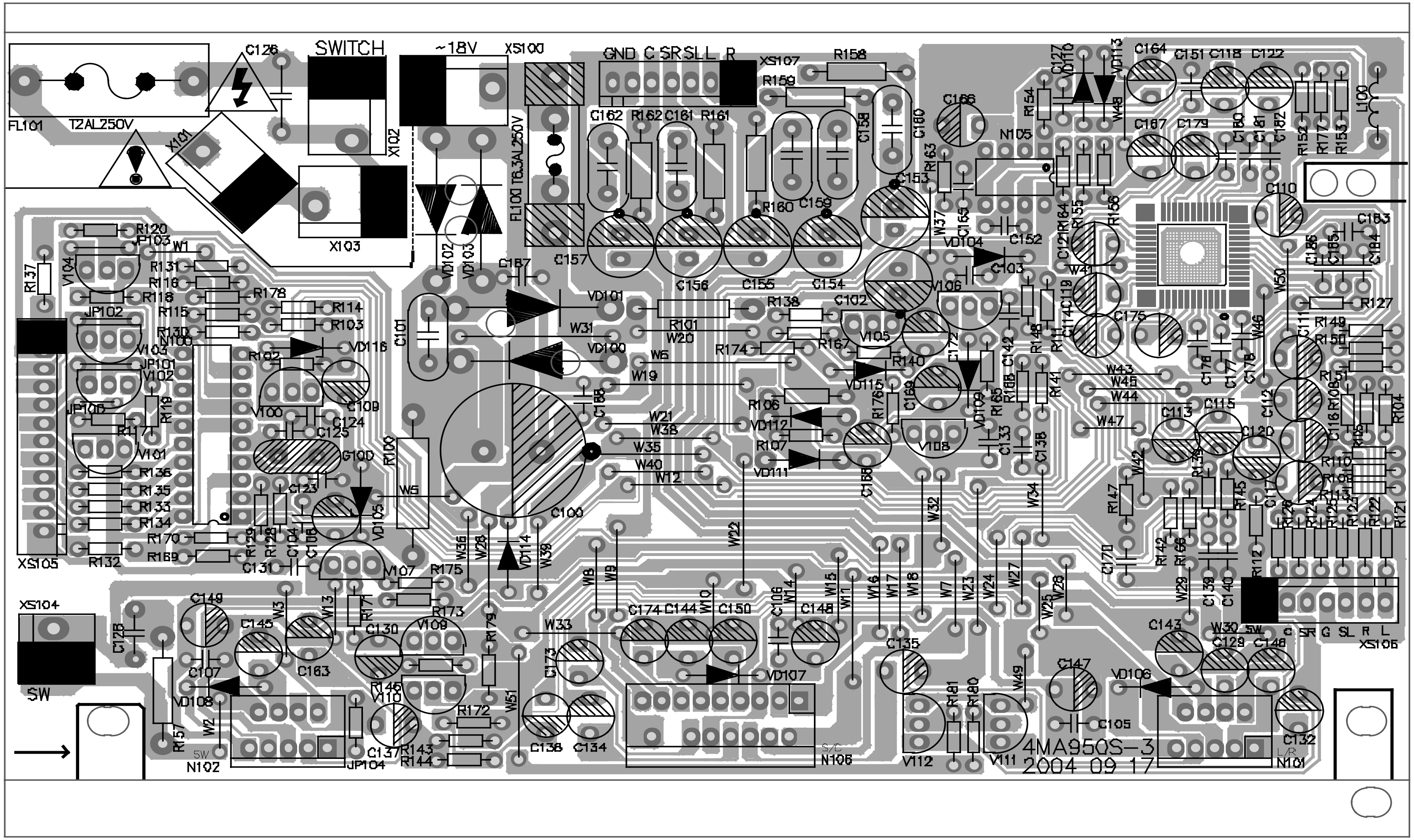
4: IC specifications

CONNECTED BLOCK




MA-850S/MA-950S MAIN BOARD
LC75347E
N100
N101
N102
N103
N105A
N105B
N106
IC4558
TDA8947J
TFA9843J
CON2
CON7
CON12
P_LRM
P_SCM
P_SCAN
MUTE1
LRM
CUT
SW
OUT/R
OUT/L
OUT/SL
OUT/SR
OUT/C
+5V
+9V
+22V
GND


SWITCH
~18V
XS100
GND C SR SL L R
XS107
FL101
T2AL250V
FL100 T6.3AL250V
XS105
XS104
SW
XS106
C SR G SL R L
4MA950S-3
2004 09 17



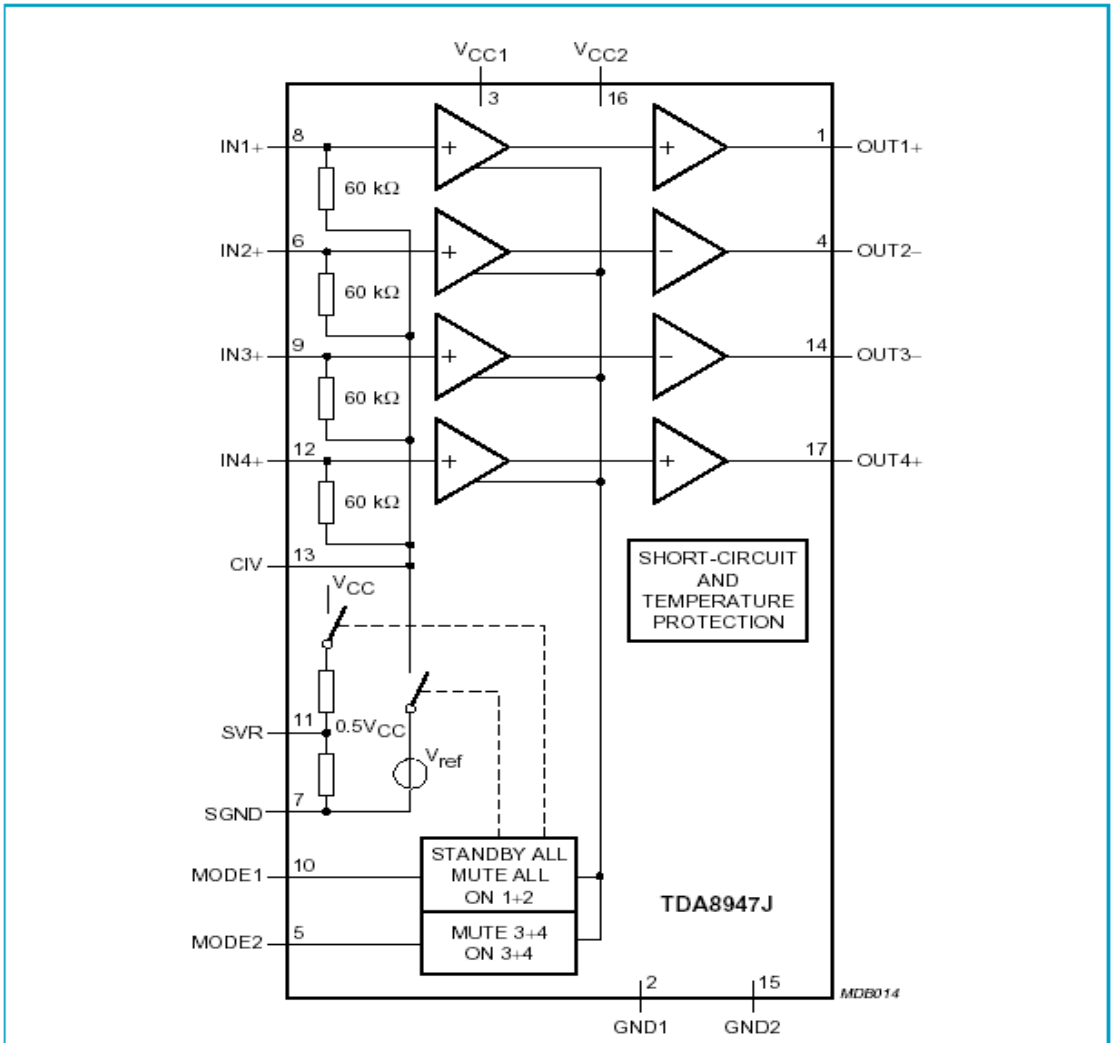
SWITCH
~18V
XS100
GND C SRSLL R
XS107
FL101
T2AL250V
X101
X102
X103
T6.3AL250V
FL100
XS105
XS104
SW
N102
JP104
N106
N101
XS106
4MA950S-3
2004 09 17

4. Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC}	supply voltage	operating		9	18	26	V
		no (clipping) signal	[1]	-	-	28	V
I_q	quiescent supply current	V_{CC} = 18 V; R_L = ∞		-	100	145	mA
I_{stb}	standby supply current			-	-	10	µA
$P_{o(SE)}$	SE output power	THD = 10 %; R_L = 4 Ω					
		V_{CC} = 18 V		7	8.5	-	W
		V_{CC} = 22 V		-	14	-	W
$P_{o(BTL)}$	BTL output power	THD = 10 %; R_L = 8 Ω					
		V_{CC} = 18 V		16	18	-	W
		V_{CC} = 22 V		-	29	-	W
THD	total harmonic distortion	SE; P_o = 1 W		-	0.1	0.5	%
		BTL; P_o = 1 W		-	0.05	0.5	%
$G_{v(max)}$	maximum voltage gain	SE		25	26	27	dB
		BTL		31	32	33	dB
SVRR	supply voltage ripple rejection	SE; f = 1 kHz		-	60	-	dB
		BTL; f = 1 kHz		-	65	-	dB

[1] The amplifier can deliver output power with non clipping output signals into nominal loads as long as the ratings of the IC are not exceeded.

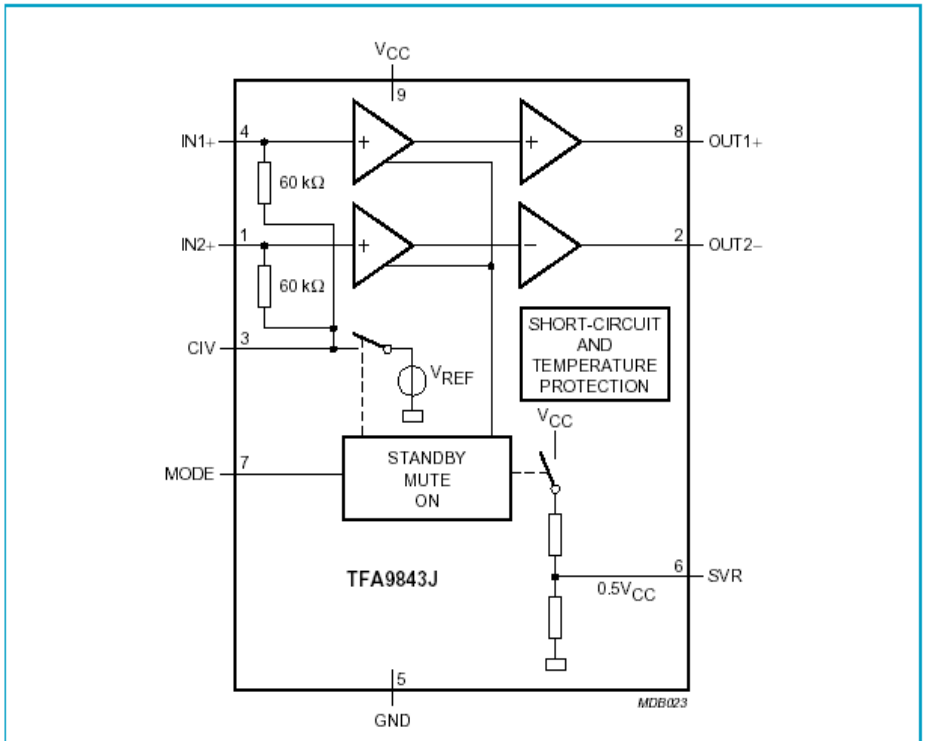


4. Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	operating	9	18	26	V
		no signal	-	-	28	V
I_q	quiescent supply current	V_{CC} = 18 V; R_L = ∞	-	60	100	mA
I_{stb}	standby supply current		-	-	10	µA
P_o	SE output power	THD = 10 %; R_L = 4 Ω; V_{CC} = 18 V	7	8.5	-	W
		THD = 10 %; R_L = 4 Ω; V_{CC} = 22 V	-	14	-	W
	BTL output power	THD = 10 %; R_L = 8 Ω; V_{CC} = 18 V	16	18	-	W
		THD = 10 %; R_L = 8 Ω; V_{CC} = 22 V	-	29	-	W
THD	total harmonic distortion	SE; P_o = 1 W	-	0.1	0.5	%
		BTL; P_o = 1 W	-	0.05	0.5	%
G_v	voltage gain	SE	25	26	27	dB
		BTL	31	32	33	dB
SVRR	supply voltage ripple rejection	SE; f = 1 kHz	-	60	-	dB
		BTL; f = 1 kHz	-	65	-	dB

Block diagram



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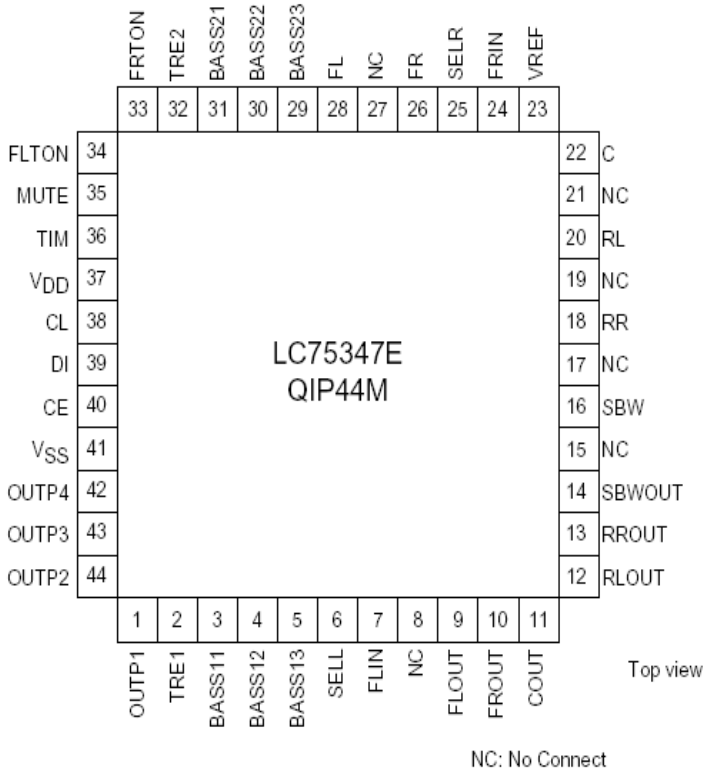
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Overall Characteristics]						
Total harmonic distortion (RL, RR, C and SBW inputs, direct output)	THD1	V_{IN} = 1 Vrms, f = 1 kHz, 80 kHz LPF Flat overall		0.001	0.01	%
Total harmonic distortion (FL and FR inputs, direct output)	THD2	V_{IN} = 1 Vrms, f = 1 kHz, 80 kHz LPF Flat overall FL and FR selected, direct output		0.002	0.01	
Total harmonic distortion (FLTON and FRTON inputs, FLOUT and FROUT outputs)	THD3	V_{IN} = 1 Vrms, f = 1 kHz, 80 kHz LPF Flat overall FLTON and FRTON selected, output after passing though tone controls.		0.003	0.01	
Output noise voltage (RL, RR, C and SBW inputs, direct output)	VN1	80 kHz LPF, Rg = 1 kΩ All controls flat overall		6		μV
		A-WIGHT, Rg = 1 kΩ All controls flat overall		2.5		
Output noise voltage (FL and FR inputs, direct output)	VN2	80 kHz LPF, Rg = 1 kΩ All controls flat overall		7		
		A-WIGHT, Rg = 1 kΩ All controls flat overall		3		
Output noise voltage (FLTON and FRTON inputs, FLOUT and FROUT outputs)	VN3	80 kHz LPF, Rg = 1 kΩ All controls flat overall		9		
		A-WIGHT, Rg = 1 kΩ All controls flat overall		4		
Characteristics at maximum attenuation	Vomin	V_{IN} = 1 Vrms, f = 1 kHz, 80 kHz LPF All controls flat overall		–95		dB
Crosstalk	CT	V_{IN} = 1 Vrms, f = 1 kHz, Rg = 1 kΩ All controls flat overall	80			dB
Current drain	I_{DD}	$V_{DD} - V_{SS}$ = +9 V		38		mA
High-level input current	I_{IH}	CL, DI, CE, MUTE: V_{IN} = 10.5 V, V_{DD} = 10.5 V			10	μA
Low-level input current	I_{IL}	CL, DI, CE, MUTE: V_{IN} = 0 V, V_{DD} = 10.5 V	–10			μA

Pin Assignment



NC: No Connect

Equivalent Circuit/Application Circuit Example