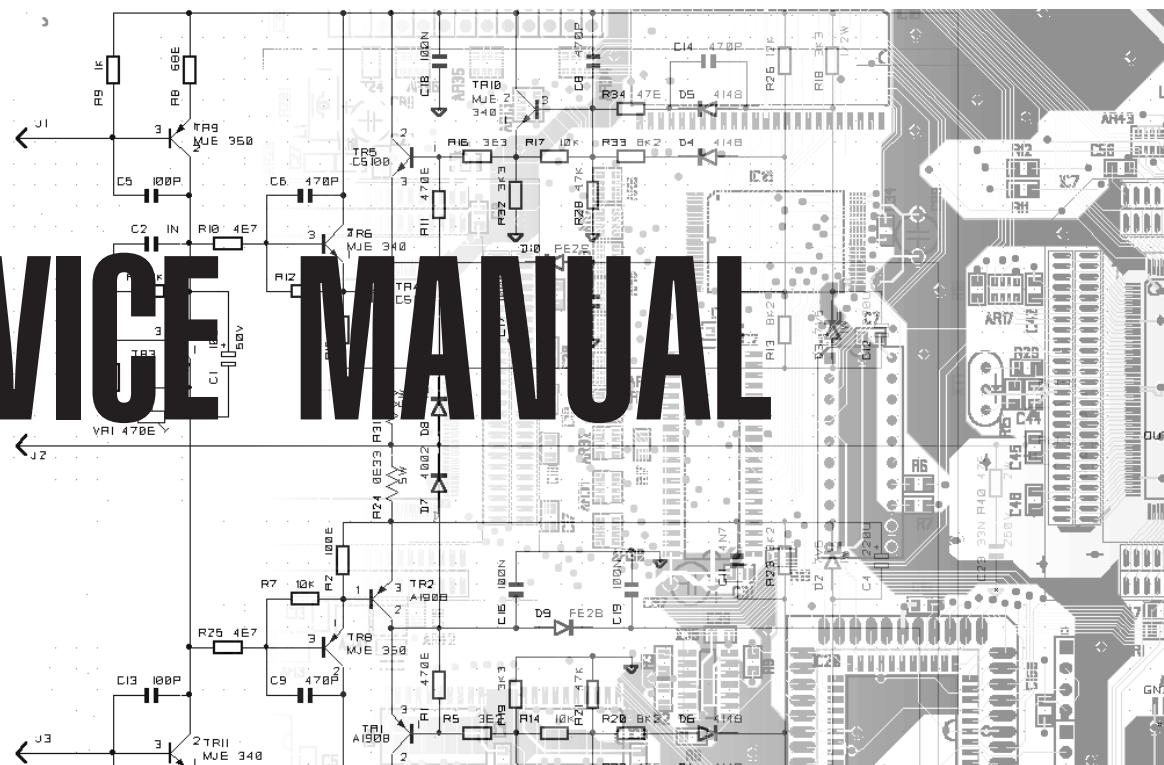




PFX 2.0

SWITCHING POWER AMPLIFIER

SERVICE MANUAL



Index

- 2 Technical Specifications, Test Procedures & Adjustments
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Warnings



Notice

Service must be carried out by qualified personnel only. Any tampering carried out by unqualified personnel during the guarantee period will forfeit the right to guarantee.

For a correct operation of the instrument, after having switched off, be careful to wait at least 3 seconds before switching on again.

To improve the device's specifications, the schematic diagrams may be subject to change without prior notice.



All components marked by this symbol have special safety characteristics, when replacing any of these components use only manufacturer's specified parts.

The (μ) micro symbol of capacitance value is substituted by U.

The (Ω) omega symbol of resistance value is substituted by E.

The electrolytic capacitors are 25Vdc rated voltage unless otherwise specified.

All resistors are 1/8W unless otherwise specified.

All switches shown in the "OFF" position. All DC voltages measured to ground with a voltmeter 20KOhm/V.

↓ Signal supply ground.

⏏ Analog supply ground.

⏏ Chassis ground.



ATTENTION

Observe precautions when handling electrostatic sensitive devices.

Address



GENERALMUSIC S.p.A. Sales Division: 47842 S.Giovanni in Marignano (RN) ITALY - Via delle Rose, 12



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▶ CODE: 270268 ◀

TECHNICAL SPECIFICATIONS

Dimensions:	(WxHxD)	483x89x450mm (2U)
Weight:		12.5Kg
Power Requirements:	(230Vac±10% 50/60Hz)	2900VA
Output Power*:	(4Ω dual)	2x 850Wrms
	(8Ω dual)	2x 600Wrms
	(8Ω bridge)	1700Wrms
Max. Undistorted Out*:	(4Ω dual)	165Vpp
	(8Ω dual)	195Vpp
	(8Ω bridge)	330Vpp
Input Sensitivity:	(0dB)	0.775Vrms
Input Impedance:	(balanced)	20KΩ
	(unbalanced)	10KΩ
Voltage Gain:		39±0.5dB
Slew Rate:	(8Ω stereo)	30V/μS
	(8Ω bridge)	40V/μS
Damping Factor:	(8Ω stereo)	>200
Frequency Response	(-0.2dB)	20Hz÷20KHz
at Full Power:	(-3dB)	10Hz÷55KHz
IMD:	(SMPTE 60Hz/7KHz 4:1)	<0.1%
THD:	(THD+N)	<0.1%
S/N Ratio:	(unweighted)	>100dB
Crosstalk:	(1KHz)	>60dB
* Measured with limiter circuit operative.		

TEST PROCEDURES & ADJUSTMENTS

Precaution

- ⚡ To prevent short circuit during any test, **the oscilloscope must be EARTH insulated**, this occurs because some test require to connect its probe to the amplifier output, non-compliance may cause damages to oscilloscope inputs circuitry.
- ⚡ Before removing or installing any modules and connectors, **disconnect the amplifier from AC MAINS** and measure the DC supply voltages across each of the power supply capacitors (C301, C302, C401, C402, C318, C321, C320, C323, C326, C329, C328, C331, C418, C421, C420, C423, C425, C429, C428, C431). If your measurement on any of the caps is greater than 10Vdc, connect a 1KΩ 100W resistor across the applicable caps to discharge them for your safety. Remember to remove the discharge resistor immediately after discharging caps. **Do not power up the amplifier with the discharge resistor connected.**
- ⚡ Read these notes entirely before proceeding to any operation. These notes are not comprehensive of all damages that possibly occur, but includes some specifically advices, checks and adjustments relative to this amplifier.

Remarks

- ⚡ The power supply utilizes a dual SMPS (Switching Mode Power Supply) circuit assuring an high efficiency on power requirements with a reduced weight toghether with a musical behaviour.
- ⚡ The two SMPS circuits are connected together in DC to obtain more supply stability in bridge mode operation.
- ⚡ Each SMPS circuit operates with a fixed PWM (Pulse Width Modulation) of about 50% with a behaviour similar to a traditional transformer supply circuit but with the high efficiency of the switching technology.
- ⚡ Each amplifier utilizes a dual bipolar DC rail configuration with low and high voltages; one positive and one negative low rail (+/-Vc) and one positive and one negative high rail (+/-Vcc), this kind of circuit optimizes the power dissipation requirements with a musical signal.
- ⚡ All component referments outside brackets are referred to CH1 while those enclosed are referred to CH2.

Visual Check

- ⚡ Use compressed air to clear dust in the amplifier chassis.
- ⚡ Before proceed to supply the amplifier check visually the internal assembly, if appears an evident damage find the most possible reasons that cause it.
- ⚡ Check the wiring cables for possible interruptions or shorts.
- ⚡ If the damage has burnt a printed circuit board don't try to repair it, replace with a new one.

Test Instrument

- ⚡ Audio Generator
- ⚡ Dual Trace Oscilloscope
- ⚡ Digital Multimeter
- ⚡ 4Ω 1000W, 8Ω 2000W, 1KΩ 100W resistors
- ⚡ Variac
- ⚡ Temperature Meter

Setup

- ⚡ Connect the Variac between the DRV & PRT board and the SMPS board, disconnecting L1 and N1 faston sockets from DRV & PRT board.
- ⚡ Set the Variac at zero voltage.
- ⚡ Set the amplifier in DUAL MODE and turn full counter-clockwise the LEVEL potentiometers.
- ⚡ Connect the audio generator to the channel inputs and set it to 1KHz 775mV_{RMS} (0dB) sinusoidal signal.
- ⚡ Set the oscilloscope in DC at 5V/div. 5μS/div.
- ⚡ The procedures that follow must be executed subsequently in the order specified.

Supply Check

- ⚡ Disconnect the supplies from CH1 and CH2 PWR AMP boards extracting W301 and W401 connectors.
- ⚡ Turn on the Amplifier, the T1 Transformer supply the DRV & PRT board and also the double SMPS driver circuit, check these voltages:
CON5 pin 8 = +12Vdc
CON5 pin 4 = +15±1Vdc
on DRV & PRT board.
- ⚡ The cooling fans voltage runs at their minimum.
- ⚡ Each KA3525A, U301 and U401, IC have the PWM fixed at 50% with the soft start circuit generated by it-self (pin 8), it also be locked externally by Q305,306,405,406 from DRV & PRT board if a protection trips. Check with the oscilloscope if each SMPS driver circuit works right: connect its probe 1 between GND (clip) and pin 11 (tip) and pin 14 of U301, U401 alternatively, the scope screen must show the wave form of figure 1.
- ⚡ **CAUTION: Be sure you have all the capacitors completely discharged before proceeding further.**
Move the probe 1 clip to a SOURCE pin of a power MOSFET Q301-304, check alternatively with the probe tip each GATE of these MOSFETs: the scope screen must show the wave form of figure 2, repeat the check for Q401-404 MOSFETs.
- ⚡ **Note:** When the amplifier goes in protect mode with the load attached to the AMP channel one of the most probably reasons is the unbalancing of the power supplies, normally this is due to the fact that only one SMPS supply circuit, connected in parallel, works correctly. This could happen even if all DC voltages are regular, in fact the unbalancing could be caused by a broken MOSFET on primary windings of the transformers, even these devices are connected in parallel two by two: check each one separately to find shorts between GATE and DRAIN/SOURCE pins (note: each MOSFET have an internal diode between DRAIN and SOURCE pins).
- ⚡ Set the Variac to the nominal mains voltage.
- ⚡ Verify the PWR AMP supply voltages on each female connector as follows:
Red wire = +110±5Vdc
Orange wire = +46±3Vdc
Brown wire = -46±3Vdc
Blue wire = -110±5Vdc
Verify all others DC supplies on DRV & PRT board checking:
CON5 pin 4 = +25±3Vdc
CON5 pin 5 = +25±3Vdc
CON5 pin 6 = -25±3Vdc
CON5 pin 3 = -12±1Vdc
CON5 pin 2 = +46±3Vdc
CON5 pin 1 = -46±3Vdc
- ⚡ If one of these voltages does not correspond re-check the doubled SMPS circuit on SMPS board, figure 3 thru 5 must appear for each supply circuit, if necessary check rectifiers, capacitors and transformers disconnecting them from circuitry, refer to schematics.

Channels Check

- ⚡ These procedures are intended for one channel at a time, repeat these operation for the other channel.
- ⚡ Check the channels one at time to determine which is right (note: if you have a spare amplifier module that you know as right, use it).
- ⚡ The CH1 channel is on the left and CH2 channel is on the right.

CH1 and CH2 channels have the same circuit but the printed circuit are mirrored.

- Re-set the Variac at zero voltage, turn off the amplifier. Re-connect the supply connector W301 (W401) to the CH1 (CH2) PWR AMP board.

Be Careful: do not invert the supply connectors of each channel between them, they have different connections.

- Note:** verify, with the multimeter as ohm-meter, the insulation between the heatsink and the transistor collectors placing the multimeter tips between the screw heads and the collector pins, this simple trick exclude an erroneous reading due to the insulation of the heatsink anodization.

➤ **SETUP:**

Connect the trace 1 probe clip to the output GND black terminal.

Connect the trace 1 probe tip to output wire H301 (H401) of the channel under test.

Connect the trace 2 probe tip to the cathode of D315 (D415) on PWR AMP board.

Set both to 50V/div. 200μS/div in DC position.

Connect the multimeter to the VARIAC output.

The load resistor is disconnected.

Be sure you have the output wire connected to the relative faston on DRV & PRT Board, this is necessary to run the amplifier in closed-loop.

Be Careful: if you supply any PWR AMP board in open-loop, without the output wire connected to DRV & PRT board, you will have DC on the output and R325 (R425), R328 (R428) will burn.

➤ **INITIAL TEST:**

Set up the Variac slowly monitoring the output with the oscilloscope, trace 1 should display nothing, while trace 2 increase up to about 46VDC, if a DC voltage occur on trace 1 or the protection trips, turn down the Variac and turn off the amplifier, wait some minutes and disconnect the supplies from the outputs modules (W301 and W401 on PWR AMP boards).

✓ If you have determinate that the problem is a short on a rail, you must check the output transistors.

✓ To determine which transistor devices are bad, use a soldering iron to lift one leg of each emitter pin and measure the emitter-collector resistance on each device. Unsolder and lift one leg of each base pin and check the base-collector resistance of each transistor and replace any that measure as a short.

✓ If all the transistors are OK, unsolder and lift one leg of each diode and check them.

✓ Check the circuit board for open foil traces.

✓ Use the Multimeter as Ohm-meter to check the resistors, particularly the base and emitter resistors of damaged transistor.

➤ **SIGNAL TEST:**

When you have reached the 230VAC mains voltage set up slowly the LEVEL potentiometer, the channel output signal must be symmetrical respect the GND without visible distortion and oscillation as shown by the centre trace of figure 6, if a distortion occur check the DRV & PRT and the PWR AMP boards as following suggested:

✓ If the input sinewave appears to be distorted during the negative cycle, you can assume that the problem is located somewhere in the circuitry of the positive low rail.

✓ If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative low rail.

Verify that the cooling fans run faster when the signal exceed about 20V.

➤ **HIGH RAIL CHECK:**

When the output signal (Positive half-wave) is less than 40Vp the voltage on D315 (D415) cathode must remain constant at 46V, when the output signal exceeds 40Vp the voltage must follow the output signal with 6V offset as shown by the upper trace of figure 6, to check the negative high rail move the probe to D322 (D422) anode the trace appears as shown in

the bottom of figure 6.

✓ If the high rails appear distorted or are not modulating as shown in figure, then the problem probably exists somewhere in the circuitry of the respective (+ or -) defective high rail. Refer to the schematics.

➤ **POWER CHECK:**

Connect the 4Ω 1000W load on the output and repeat the INITIAL, SIGNAL and HIGH RAIL checks.

Check the signal clipping, it must occur at 165±5Vpp.

✓ If the protection trip re-check the SMPS supply circuit.

➤ **BANDWIDTH CHECK:**

Sweep the generator frequency from 20Hz to 20KHz, the output level must have not detectable level changes.

➤ **SIGNAL/CLIP SENSOR CHECK:**

Set the LEVEL pot to minimum, set the scope timebase at 1V/div. 200μS/div., then increase the level and check the SIGNAL led activity: it lights when the amplifier output is higher than 5Vpp.

Set the scope at 50V/div. and increase the level, check the CLIP led: it lights when the amplifier output signal clip.

➤ **OFFSET SENSOR CHECK:**

Set the LEVEL pot at minimum, set the Variac to zero voltage output, disconnect the load, disconnect the supply connection W301 (W401) from the PWR AMP board and disconnect the output wire from DRV & PRT board, turn on the amplifier, connect temporarily the +47Vdc (by means of a suitable conductor wire from the orange conductor of the PWR AMP supply plug) to the respective channel faston on DRV & PRT board, the PROTECT led must turn on immediately, the relay disconnect the output, the fan must run at maximum speed.

Wait about 20sec. and the relay restore the output connection, connect temporarily the faston to -47Vdc (brown wire), the led PROTECT must turn on again, wait about 20sec. and the relay restore the output connection.

Reconnect the load, reconnect the supply connection W301 (W401) to the PWR AMP board and reconnect the output wire to DRV & PRT board.

➤ **BIAS ADJUSTMENT:**

SETUP:

Connect the trace 1 probe clip to the output GND black terminal.

Connect the trace 1 probe tip to output wire H301 (H401) of the channel under test.

Connect the Multimeter across TR305 (TR405) and TR308 (TR408) collectors of AMP PWR board.

Place the temperature meter in the same location of the NTC Resistor at centre of heatsink: TH301 (TH401).

ADJUSTMENT:

Set up the Variac to the mains voltage, adjust the VR301 (VR401) trimmer to read 5.9±0.1Vdc on the Multimeter.

VERIFICATION:

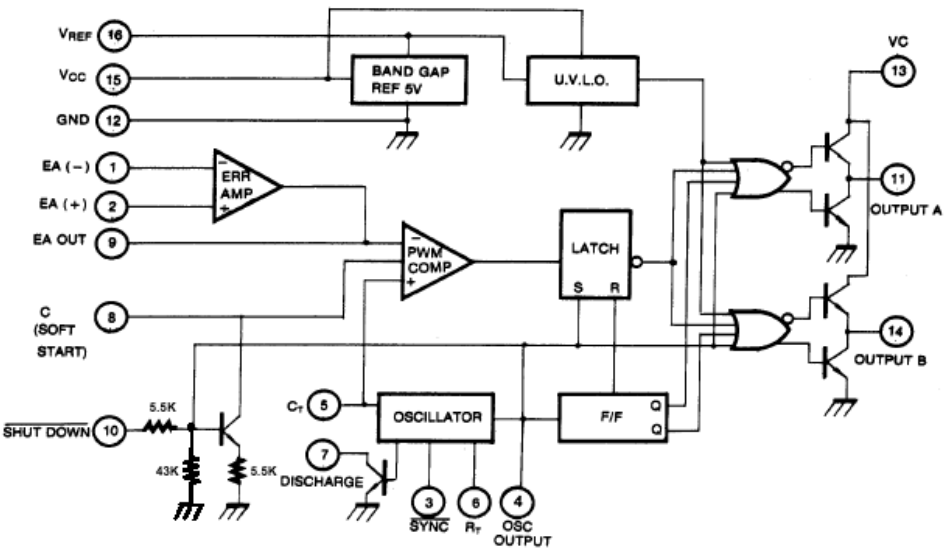
Set up the LEVEL pot, after some minutes the heatsink temperature rises at 50°C, turn down the LEVEL, read the value on the multimeter, it must be within 5.6±0.1Vdc.

Set the scope sensitivity at 1V/div. adjust the generator level until the sinewave appears at full screen amplitude, **no crossover distortion must be detectable: if necessary re-adjust VR301 (VR401).**

➤ **SIGNAL TO NOISE RATIO CHECK**

Set LEVEL to minimum, the output signal (noise) must be less 2mVpp.

KA3525A Block Diagram



Packages & Pin Outs

TO92

TL431

1 = Cathode 2 = Anode 3 = Reference

KSA1268, KSC3200, KTC3198

1 = Emitter 2 = Collector 3 = Base

2N4401 or eq. 2N5550

1 = Emitter 2 = Base 3 = Collector

2SK30AGR

1 = Source 2 = Gate 3 = Drain

TO92L

KTA1023, KTA1027

1 = Emitter 2 = Collector 3 = Base

TO126

KSE340 or MJE340, KSE350 or MJE350

1 = Emitter 2-4 = Collector 3 = Base

TO220

KSE3055T, KSE2955T

1 = Base 2-4 = Collector 3 = Emitter

TO3P

2SC3856, 2SA1492

1 = Base 2-4 = Collector 3 = Emitter

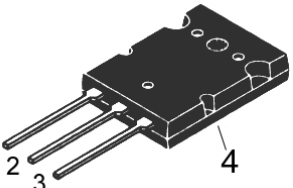
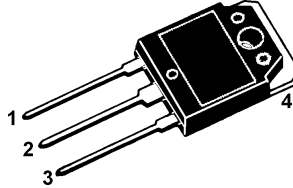
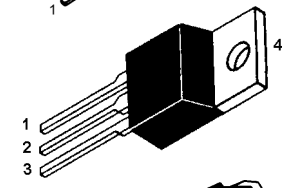
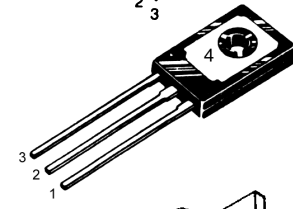
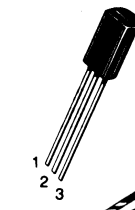
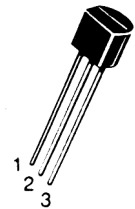
SSH11N90

1 = Gate 2-4 = Drain 3 = Source

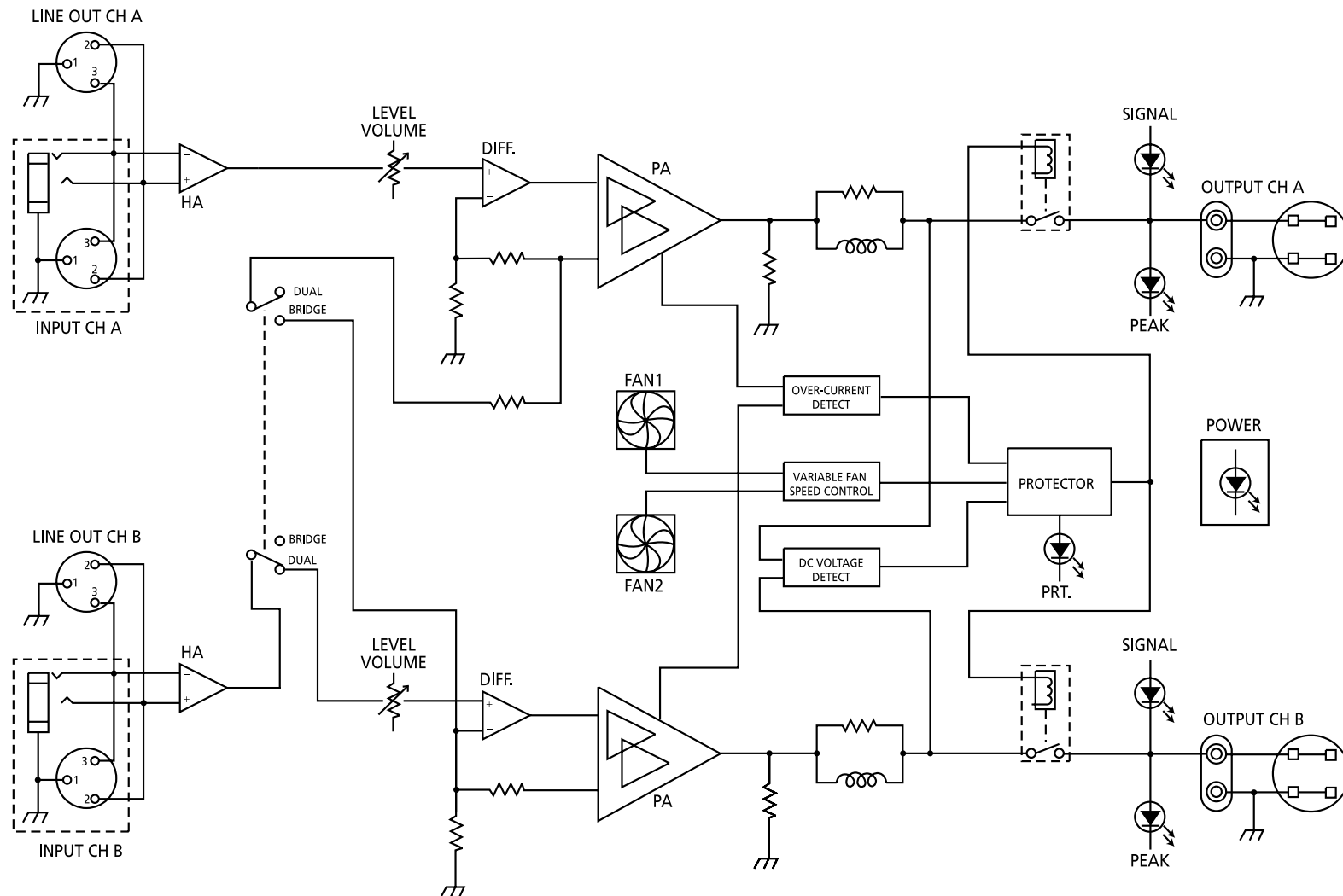
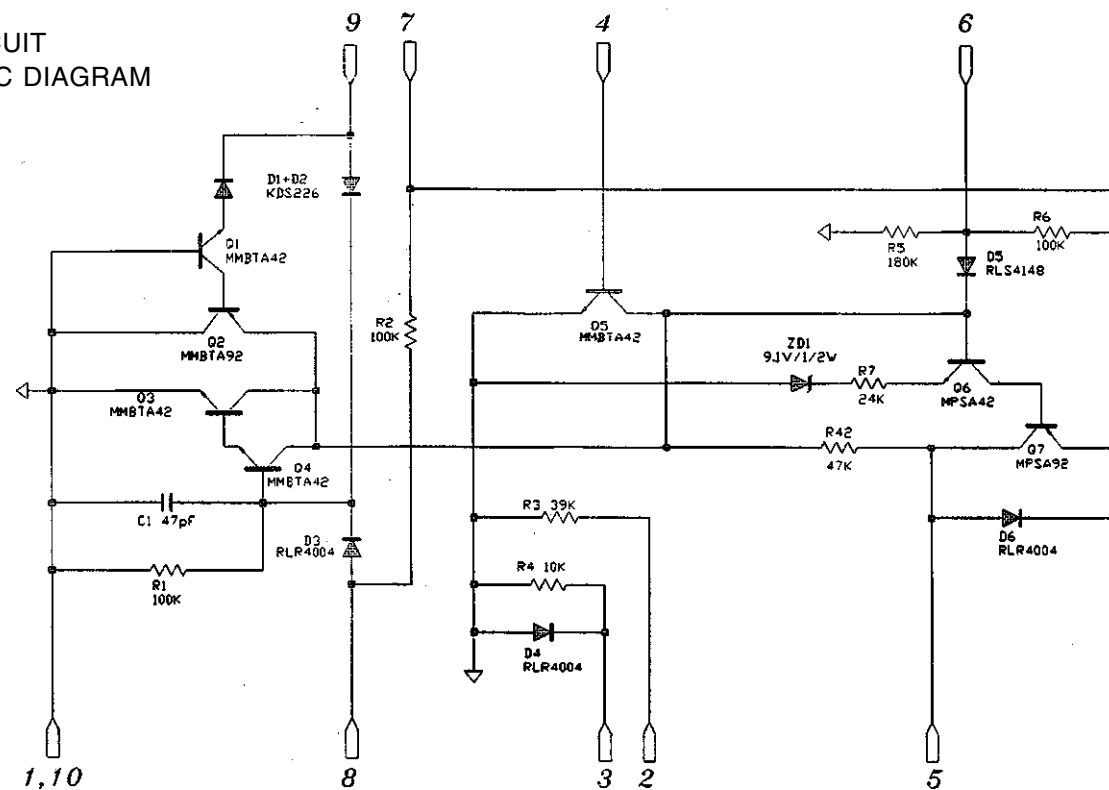
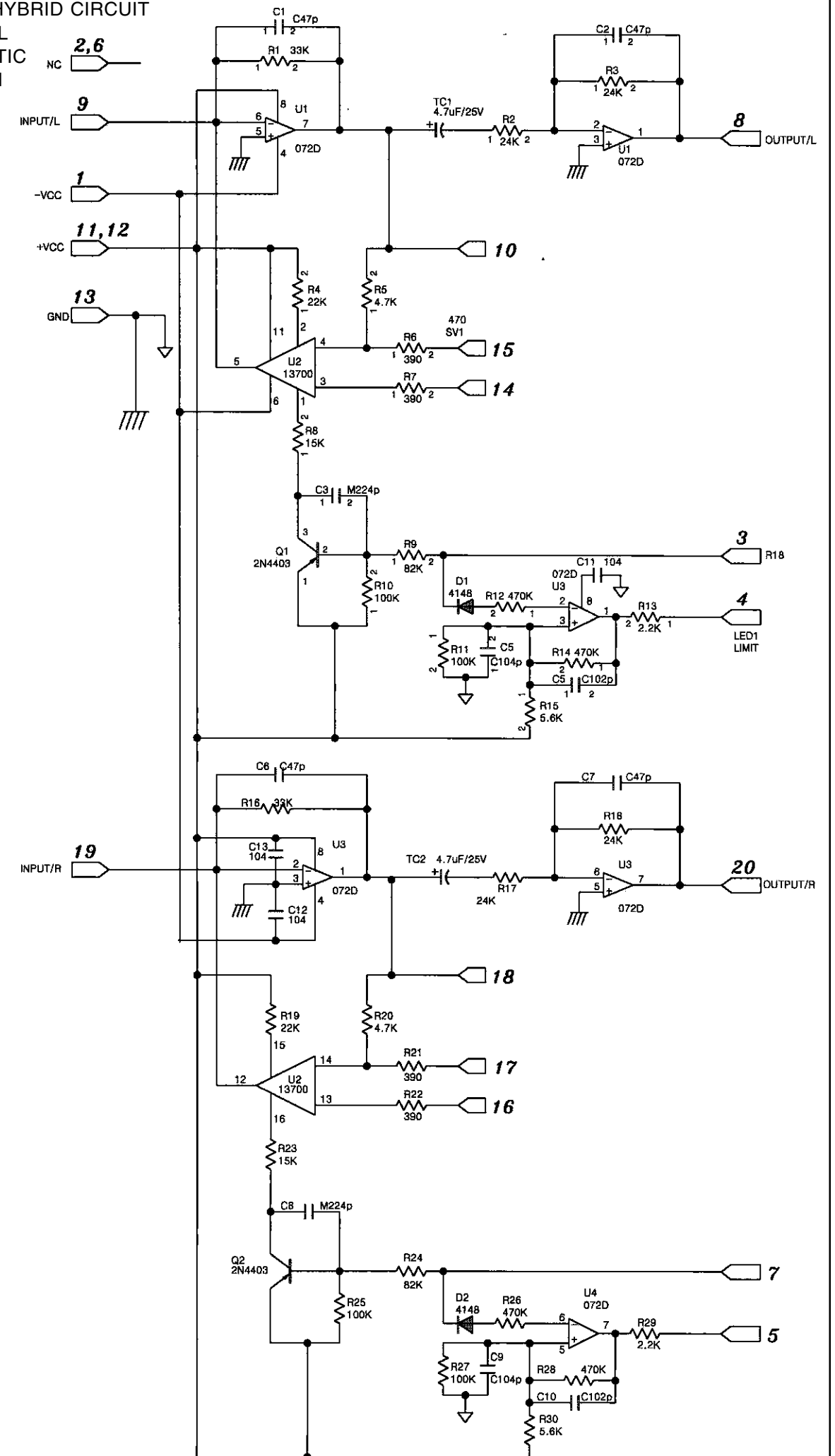
TO264

2SC5200, 2SA1943

1 = Base 2 = Collector 3 = Emitter

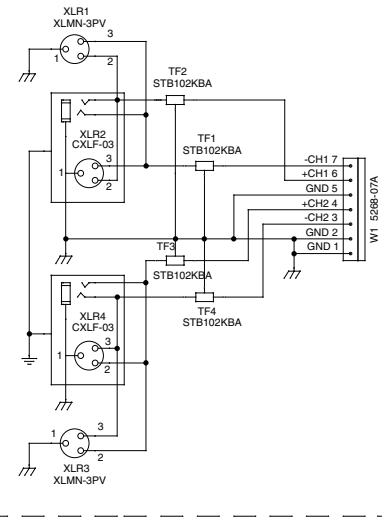


BLOCK DIAGRAM

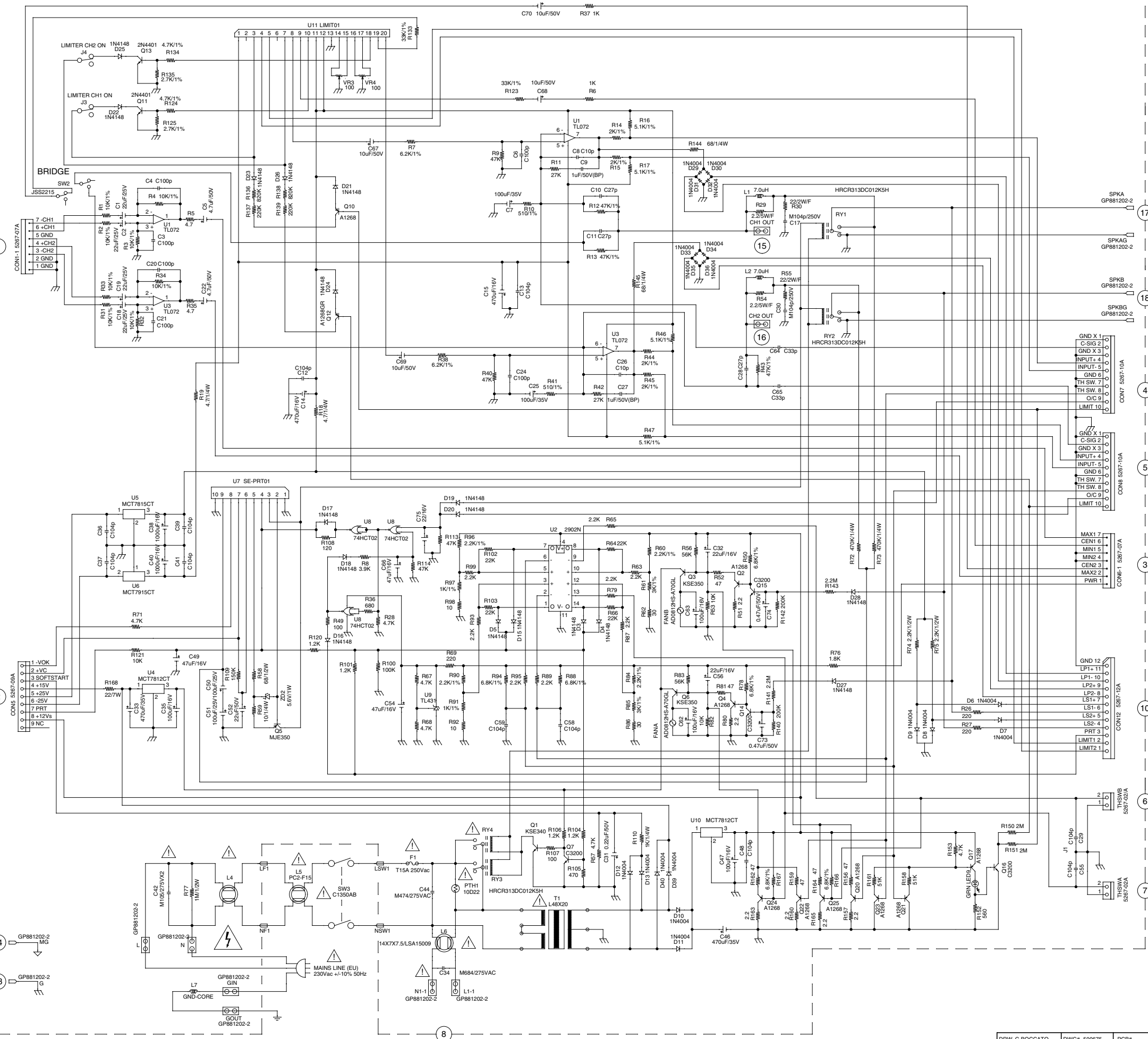
PROT01 HYBRID CIRCUIT
INTERNAL SCHEMATIC DIAGRAMLIMIT01 HYBRID CIRCUIT
INTERNAL SCHEMATIC
DIAGRAM

CH1 INPUT CH1 LINK
CH2 INPUT CH2 LINK

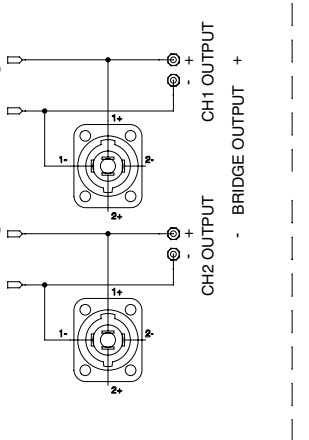
TNS768000 - INPUT BOARD



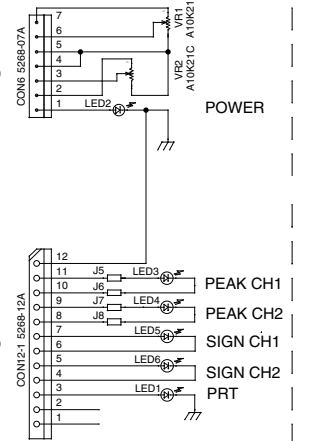
TNS768004 - DRV & PRT BOARD



TNS768001 - OUTPUT BOARD



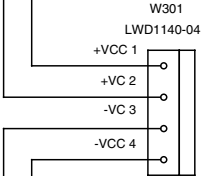
TNS768002 - CTRL BOARD



8



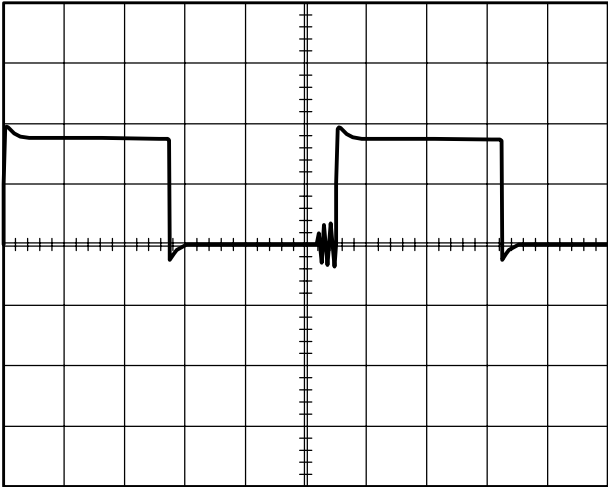
TSN768010 - CH2 PWR AMP BOARD (PFX2.0)



Notes: the numbers enclosed into squares are approximate DC voltages measured with 230Vac of mains line voltage at 25°C.
All component references are relative to Channel1, Channel2 references are prefixed by 4 and 6 instead 3 and 5 respectively

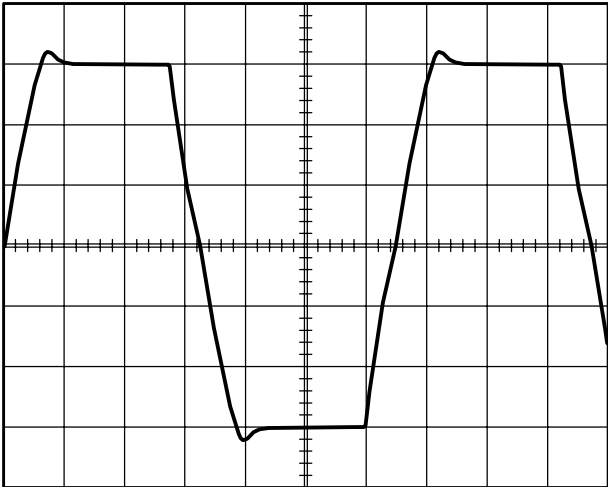
DRW. G. BOCCATO	DWG# 500578	PCB#	GENERALMUSIC S.p.A. ITALY
CKD. G. RICCI	DISK: 2 PRT: 1/1	PFX2.0 CHANNEL 1/2	ALL RIGHTS ARE RESERVED. NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC.
APP. R. FALCONI	REV: 15/03/01	PWR AMP BOARD	

Figure 1



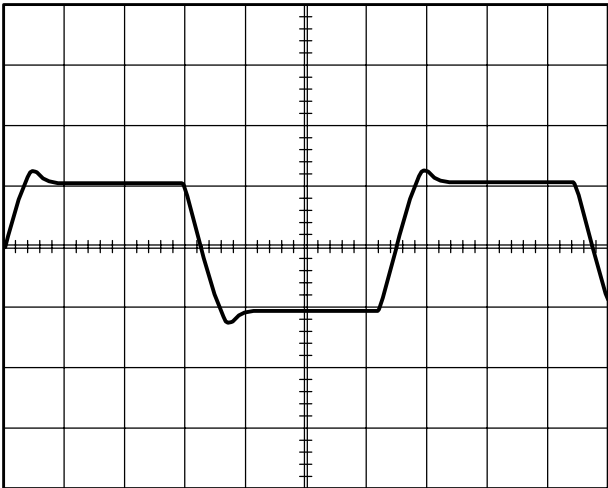
5V/div. clip: GND
5µS/div. tip: PIN11/14 IC301/401

Figure 3



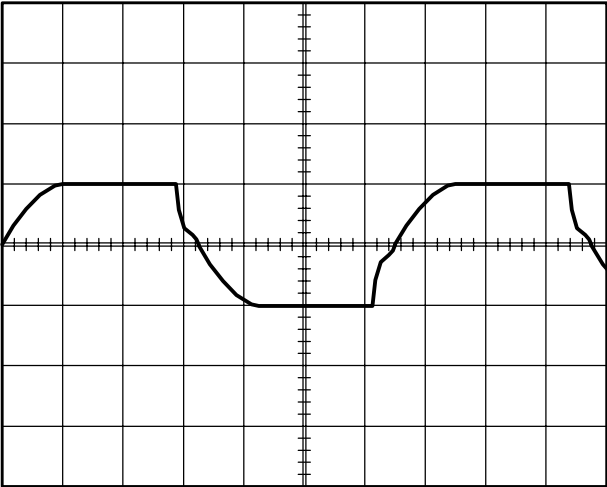
100V/div. clip: any MOSFET Source
5µS/div. tip: each MOSFET Drain

Figure 5



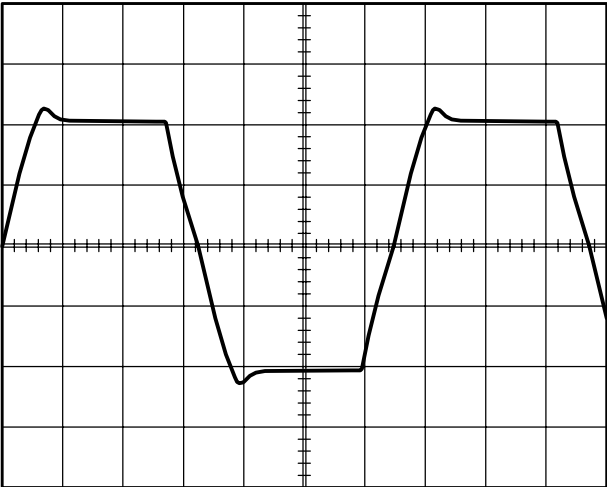
50V/div. clip: F302/F402
5µS/div. tip: F303/F403

Figure 2



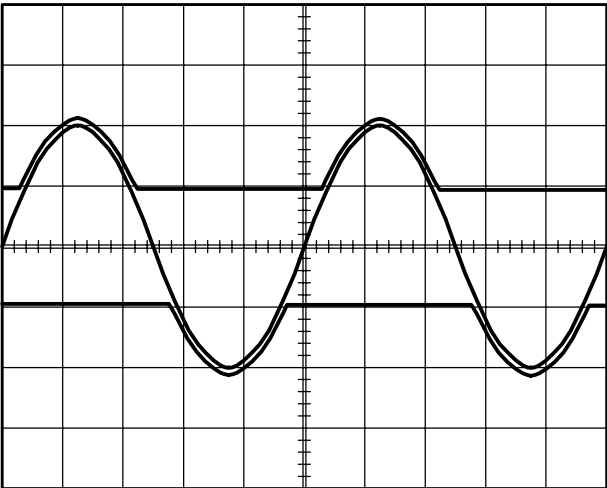
5V/div. clip: any MOSFET Source
5µS/div. tip: each MOSFET Gate

Figure 4



50V/div. clip: F304/F404
5µS/div. tip: F305/F405

Figure 6



50V/div. clip1: GND
200µS/div. tip1: OUT CH1/OUT CH2
tip2: D315/D415 CATHODE
tip2: D322/D422 ANODE

Spare Part List

Code	Description
Accessories	
277356	Owner's Manual PFX-Series
Assembly	
TSN667004	Bottom Chassis
TSN667005	Top Cover
TSN778001	Cables Kit
TSN230500	Mains Line Filter PC2-F15 250Vac 15A

Rear Panel Assembly

TSN110301	Fan 12Vdc-0.25A 80x80x25mm
130285	Mains Cable (EU)
347201	Cord Lock (use this lock when replace the mains cable)
TSN768000	Inputs Board
TSN768001	Outputs Board
TSN667002	Rear Panel

Front Panel Assembly

TSN667001	Controls Panel
110285	Bipolar Mains Switch
TSN657000	Potentiometer Knob
TSN768002	CTRL Board
TSN074000	10KA Rotary Potentiometer with 20 steps

DRV & PRT Board

TSN768004	DRV & PRT Board
110038	T15A Fuse 6.3x32mm
TSN080800	NTC 10D Surge Current Limiter
TSN020000	470nF 275Vac Capacitor
TSN020001	680nF 275Vac Capacitor
TSN020002	1uF 275Vac Capacitor
TSN230501	LH316042 Mains Line Dual Coil Filter
TSN230502	LSA15009 Mains Line Dual Coil Filter
TSN237000	Z 4121.5 230Vac/15+15Vac Transformer
TSN110302	HRCR313DC012K5H Relay
080158	1N4004 1A 400V Rectifier Diode
080103	1N4148 100mA 75V Signal Diode
080241	5V6 1W 5% Zener Diode
080242	6V2 1W 5% Zener Diode
080173	1N5817 1A 40V High Current Schottky Diode
TNS080007	TL431 Adjustable Voltage Reference Diode
090200	2N5550 TO92 Npn Transistor (2N4401 equivalent)
090917	MJE350 TO126 Pnp Transistor (KSE350 equivalent)
090916	MJE340 TO126 Npn Transistor (KSE340 equivalent)
TSN090001	KTA1268GR TO92 LN Pnp Transistor
TSN090000	KTC3200GR TO92 LN Npn Transistor
100601	74HCT02 DIP Quad 2-In Nor Gate
100061	TL072 Dual J-Fet Operational Amplifier
100045	7812 +12V 1A Voltage Regulator
100049	7915 -15V 1A Voltage Regulator
100060	7815 +15V 1A Voltage Regulator
TSN100000	NJM2902 SOIC Quad Single Supply Operational Amplifier
TSN102000	PRT01 Protection Hybrid Circuit
TSN102001	LIMIT01 Limiter Hybrid Circuit
340079	TO220 Mica Washer

SMPS Board

TSN768006	SPMS Board
TSN110000	5A 125V Picofuse
TSN110001	7A 125V Picofuse
TSN110002	10A 125V Picofuse
TSN230503	BFR631126B5NA EMI Suppression Ferrite Bead
TSN230504	BAR6x30 (1mH) Supply Core Coil
TSN230505	DR3-222K Supply Core Coil
TSN230506	UU11x16(3.3mH) SWT-Driver Transformer
TSN238001	ZP46113TCP Toroidal SWT-Power Transformer
030652	470uF 35V 20% Vert Electrolytic Capacitor
030653	470uF 63V 20% Vert Electrolytic Capacitor
030722	1000uF 35V 20% Vert Electrolytic Capacitor
TSN030000	680uF 160V 20% Snap-in Electrolytic Capacitor
TSN030001	1000uF 160V 20% Snap-in Electrolytic Capacitor
TSN030002	2200uF 200V 20% Snap-in Electrolytic Capacitor

TSN080801	FTD5-410J (100K) NTC Thermistor
TSN080802	67F095 AIRPAX Thermostat 95°C
TSN080000	FMG33R 20A 300V Ultra Fast Recovery Dual Rectifier Diode
TSN080001	FMG33S 20A 300V Ultra Fast Recovery Dual Rectifier Diode
TSN080002	FMG36R 15A 600V Ultra Fast Recovery Dual Rectifier Diode
TSN080003	FMG36S 15A 600V Ultra Fast Recovery Dual Rectifier Diode
TSN080004	FR107 or BA159GP 0,5A 1000V Fast Switching Rectifier Diode
TSN090002	KTC3198Y TO92 Pnp Transistor
TSN090003	2SK30AGR N-Channel J-Fet Transistor
TSN090004	SSH11N90 Mosfet-N 900V 11A
TSN100001	KA3525A SMPS Controller
340154	TO3P Mica Washer

CH1/CH2 PWR AMP Board

TSN768009	CH1 PWR AMP Board
TSN768010	CH2 PWR AMP Board
TSN061000	0.22ohm 5% 7W Dual Resistor
080243	6V8 1W 5% Zener Diode
080258	8V2 1W 5% Zener Diode
042505	1K50 1/4W 1% Metalized Film Resistor
042485	1K00 1/4W 1% Metalized Film Resistor
042535	2K74 1/4W 1% Metalized Film Resistor
042564	4K75 1/4W 1% Metalized Film Resistor
TSN080801	FTD5-410J (100K) NTC Thermistor
TSN080005	FR103 or 1N4936 0.5A 400V Fast Switching Rectifier Diode
TSN080006	FMU-G26S 10A 600V Fast Recovery Rectifier Diode
TSN090001	KTA1268GR TO92 LN Pnp Transistor
TSN090000	KTC3200GR TO92 LN Npn Transistor
TSN090006	KTA1023Y TO92L Pnp Transistor
TSN090005	KTC1027Y TO92L Npn Transistor
090917	MJE350 TO126 Pnp Transistor (KSE350 equivalent)
090916	MJE340 TO126 Npn Transistor (KSE340 equivalent)
TSN090007	KSE3055T TO220 Npn Transistor
TSN090008	KSE2955T TO220 Pnp Transistor
TSN090009	2SC3856Y TO3P Npn Transistor
TSN090010	2SA1492Y TO3P Pnp Transistor
TSN090013	2SC5200 TO264 Npn Transistor
TSN090014	2SA1943 TO264 Pnp Transistor
340750	TO126 Mica Washer
340079	TO220 Mica Washer
340154	TO3P Mica Washer
340783	TO264 Mica Washer

Note:

Each spare part is single quantity unless otherwise specified.

Asterisk prefix explanation:

Omitted = First level spare part.

One asterisk = Second level, part of previous listed first level part.

Two asterisk = Third level, part of previous listed second level part.

Three asterisk =

Any request for not above mentioned part must encompass specific description including:

1) Model name,

2) Section name,

3) Module code,

4) Reference name,

5) Quantity number.

DRW G.BOCCATO	DWG# 550678	PCB#	GENERALMUSIC S.p.A. ITALY
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APP. R.FALCONI	REV: B	SCOPE WAVEFORMS FIG.1-6	