Pass Laboratories

Aleph 4 Service Manual

Rev 0 8/18/1997

Aleph 4 Service Manual.

The Aleph 4 is a stereo 100 watt audio power amplifier which operates in single-ended class A mode.

The Aleph 4 has only two gain stages which are biased by current sources. Because of the inherent simplicity of the circuit, it is easy to understand and repair. There are no adjustments.

Figure 1 shows the simplified schematic of the amplifier. Two p channel Mosfets form an input differential pair biased by a current source operating at about 20 ma. The drain of the input Mosfet is attached to the gate of an n channel power Mosfet which forms the active output stage. It is biased by a current source at slightly greater than 3 amps.

The voltage rails of the supply are at 48 volts, and each channel draws approximately 250 watts.

Fig. 2 and 3 show the actual schematic for the amplifier.

F1 is a slow blow fuse, set at 8 amps for 100-120 volt operation, and 4 amps for 220-240 volt operation.

S1 is the power switch, which has two sets of 25 amp contacts wired in parallel.

T1 is a thermostatic switch rated at 75 degrees Centigrade. It is mounted to the rear heat sink.

TH2 is a power thermistor used to connect the circuit and chassis ground to the AC outlet ground. It will normally operate at 5 ohms, suppressing ground loops in the system, but will drop to a low impedance if significant current is passed through it.

TH1 and TH3 are power thermistors (Keystone CL-60) which are used to suppress inrush current.

The power transformer drives a high current bridge and 100,000 uF of capacitance to form a plus and minus 48 volt supply.

Referring to the channel itself, Q1A1 and Q1A2 form the differential input pair of Mosfets. They are biased by the current source formed by Q1A5. Q1A5 is biased to about 20 ma by the reference Zener diode Z9 which sets about 5 volts across R11.

Z1, 2, 7 and 8 protect the input from static spikes. R5, R14-18 and R53 form the input networks and feedback loops.

The output of the differential input pair drives the gates of output devices Q18-29. These parallel devices are matched gate to source voltages as close as .01 volts, however variations as high as .1 volts will not impede operation.

The voltage across R24 shows the drive voltage for the output stage, and it should have 4-5 volts across it.

The output of the amplifier is taken from the drains of Q18-20. Q18-20 are provided a bias current by the current source circuitry of Q6-8, also a matched set of n channel Mosfets.

Q6-8 are set at 3 amps DC by the network consisting of Q3 and the components surrounding it. Q3 is biased by R25 and R27 in series. A capacitor C8 is used to reduce supply noise. R28 serves to sense the current running through Q6, and feeds that to the base of Q3, forming a loop that holds the output current at 3 amps. The pn junction drop of Q3 forms the reference voltage for the system.

R26 is a fixed resistor which trims the DC current value. R29 and C9 adjust the current against output current as sensed by the voltage across R42-46 and R52.

Fig. 4 and 5 show the component layout of the central circuit board. This board holds the power supply components, the front end circuitry, and connects the power stages together.

On this diagram you can see the wiring arrangements for the various AC line voltages: 100-120, and 220-240 volts.

There are no adjustments to the amplifier. Values for biasing various components are taken from physical constants, such as pn junctions and zener voltages, and through matching of Mosfet transistors.

The input Mosfets are match Vgs to within .01 volts, and the output Mosfets are in matched pairs within .1 volt, although production tolerance is typically .01 volt.

For a 120 volts AC line, the amplifier will draw about 4 amps RMS. If you measure current draw with an averaging meter, you will get a smaller number.

The amplifier is designed so that the heat sinks will operate approximately 30 degrees C. above ambient, for a typical temperature of 55 degrees C. Temperature protection occurs at 75 degrees C.

The amplifier will not be damaged by driving a short circuit, and it is probable that the only failures you will see will be random component failure.

SPECIFICATIONS

Gain	20 dB balanced
Freq. Response	- 3 dB at 0.3 Hz, -3 dB at 100 KHz
Power Output	100 watts/ch 8 ohms
Distortion (1KHz)	<1%THD
Output Impedance	0.1ohm
Input Impedance	10 Kohm unbalanced
	25 Kohm differential
Input CMRR	> -50 dB Typical
Power Consumption	500 watts
Dimensions	16 " W x 16" D x 10.5" H
Shipping Weight	105 lb.

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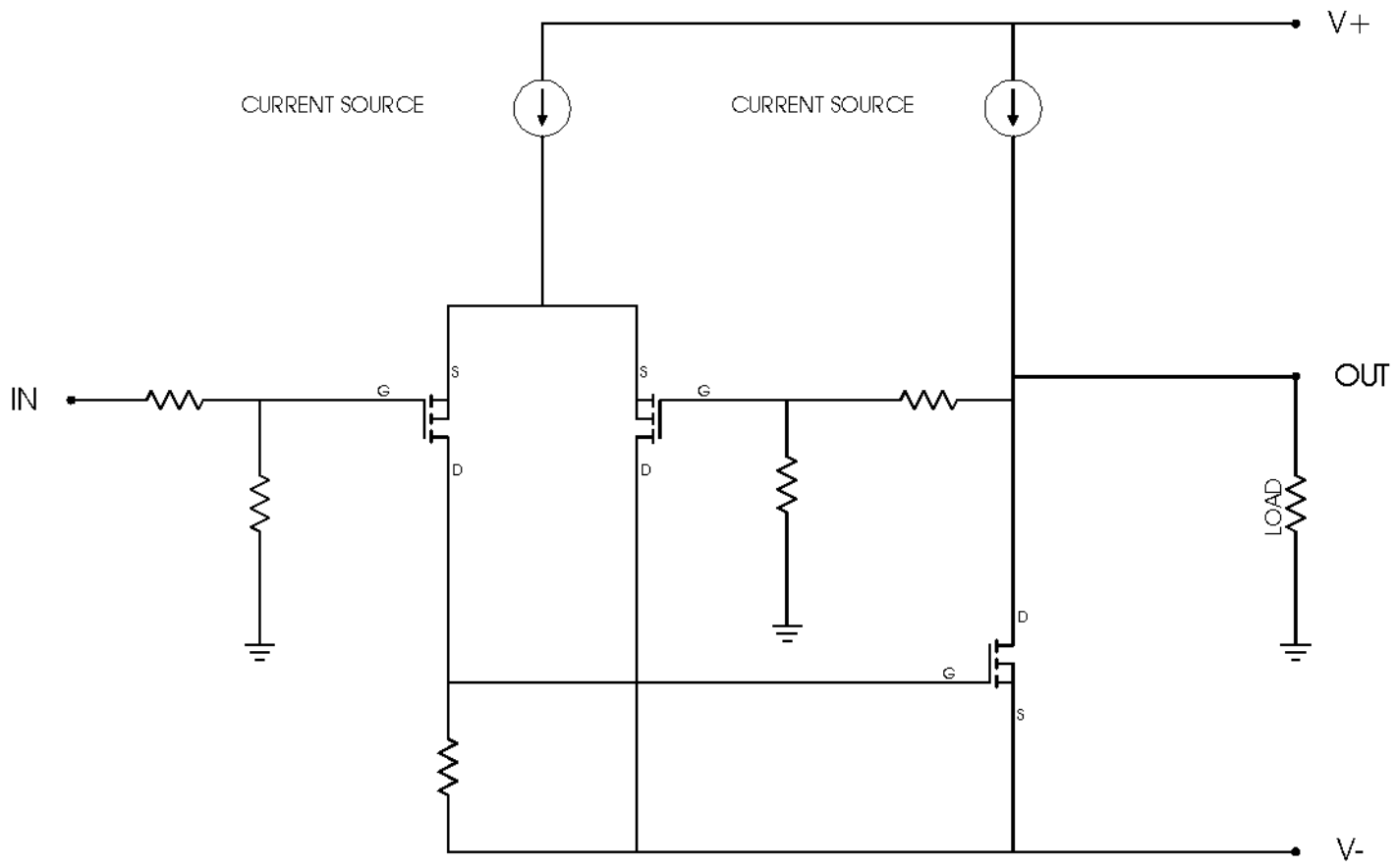

SIMPLIFIED SCHEMATIC
TWO GAIN STAGE
SINGLE-ENDED CLASS A
POWER AMPLIFIERS

Title	PASS LABORATORIES	
Size A	Number	Rev
Date 2/1/96		Drawn by PASS
Filename SIMFEB.SCI		Sheet of

4-5V
R3 221
Z9 9.1
9V
Q1A5
IRF9610
R36 221
R1 10K
+4V
R25 4.75K
R27 1.5K
R26 121K
X6
IRF244
221
C1 103
R28 1K
4-5V
Q3
ZTX450
C8 220UF
C9 220UF
.6V
1.5
R29 619
523 ON RIGHT
V+
+48V
OUTPUTBD
10K
LED1
RED
25A 400V
BR1
ORANGE
ORANGE
BLUE
C1A 25000
C2A 25000
C3A 25000
C4A 25000
CX3 .47/250
CX4 47/250
T1
CX1 .22/250
TH3
TH1
S1
T1 75C
8A SLO 120
4A SLO 240
F1
TH2 THERMISTOR
-IN
R17 10K
GND
R18 10K
+IN
R16 10K
R37 221
IRF9610
Q1A2
IRF9610
Q1A1
R38 221
C11 220UF
R5 100K
C12 10PF
C4 680pF
U IN
R15 1K
Z8 9.1
R14 10K
R53 100K
Z2 9.1
Z1 9.1V
Z7 9.1V
ZTX450
Q2
R22 221
R23 75
R24 392
4-5V
.6V
1.5
X6
IRF244
221
R52 .47
R46 .47
R43 .47
R45 .47
R44 .47
R42 .47
OUT
V-
-48V

LEFT CHANNEL SHOWN

Title	ALEPH 4		
Size B	Number PL50FE01		Rev
Date	05/16/97	Drawn by	PASS
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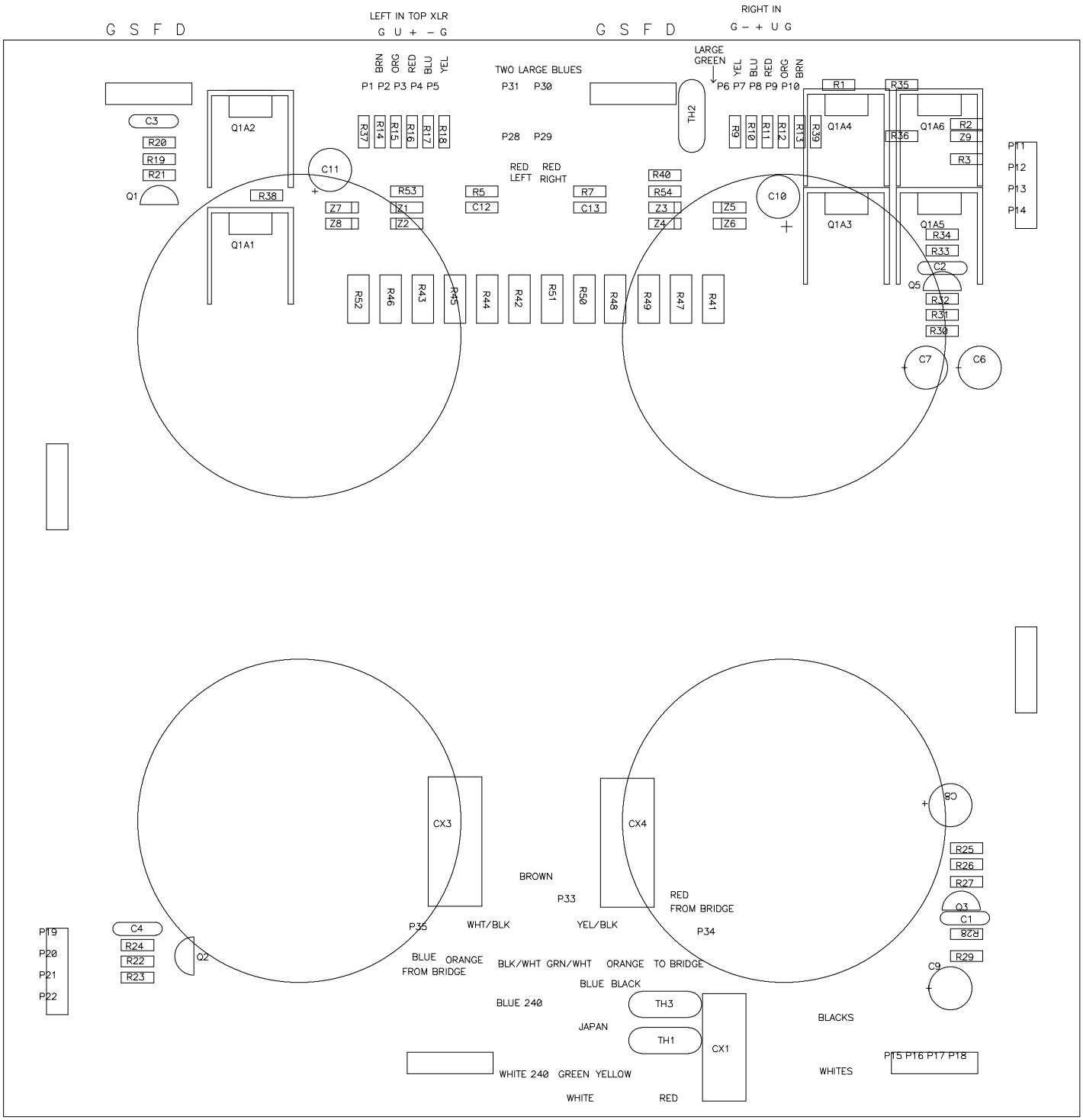
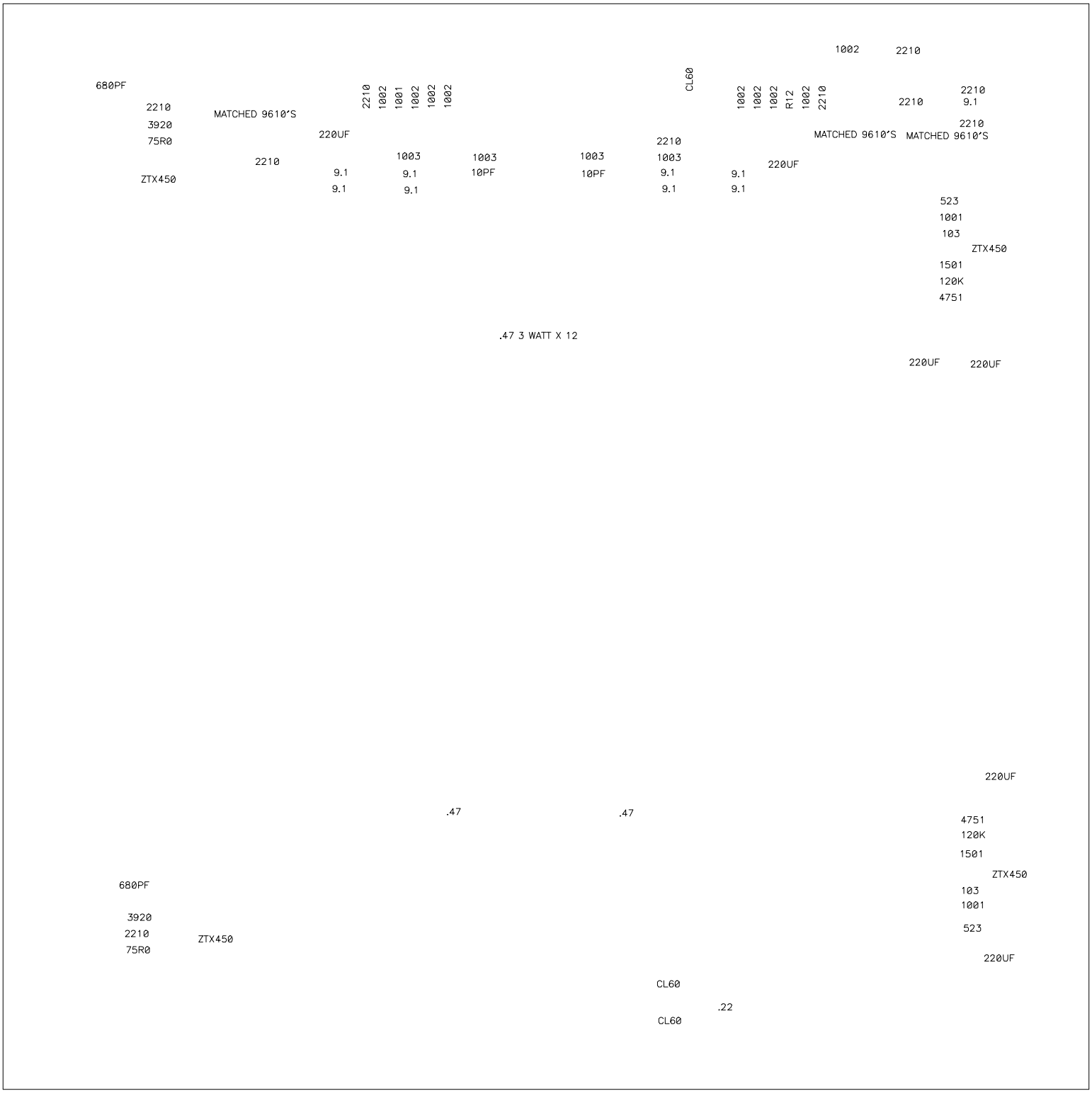

G S F D
LEFT IN TOP XLR
G U + – G
G S F D
RIGHT IN
G – + U G
BRN ORG RED BLU YEL
P1 P2 P3 P4 P5
TWO LARGE BLUES
P31 P30
LARGE GREEN
YEL BLU RED ORG BRN
P6 P7 P8 P9 P10
TH2
P28 P29
RED LEFT
RED RIGHT
C3
R20
R19
R21
Q1
Q1A2
Q1A1
R38
C11
R37 R14 R15 R16 R17 R18
R53
Z7
Z8
Z1
Z2
R5
C12
R7
C13
R40
R54
Z3
Z4
Z5
Z6
C10
R9 R10 R11 R12 R13
R39
Q1A4
Q1A3
R1
R35
R36
Q1A6
R2
Z9
R3
Q1A5
R34
R33
C2
Q5
R32
R31
R30
C7
C6
P11
P12
P13
P14
GATE
SOURCE
SENSE
DRAIN
R52 R46 R43 R45 R44 R42 R51 R50 R48 R49 R47 R41
CX3
CX4
C8
R25
R26
R27
Q3
C1
R28
R29
C9
BROWN
P33
RED
FROM BRIDGE
P34
P35
WHT/BLK
YEL/BLK
C4
R24
R22
R23
Q2
P19
P20
P21
P22
BLUE ORANGE
FROM BRIDGE
BLK/WHT GRN/WHT ORANGE TO BRIDGE
BLUE BLACK
BLUE 240
TH3
TH1
JAPAN
CX1
BLACKS
WHITES
P15 P16 P17 P18
WHITE 240 GREEN YELLOW
WHITE
RED
G S F D
G S F D
G S F D
G S F D


680PF
2210
3920
75R0
ZTX450
MATCHED 9610'S
2210
220UF
9.1
9.1
2210
1002
1001
1002
1002
1002
1003
9.1
9.1
1003
10PF
1003
10PF
CL60
2210
1003
9.1
9.1
1002
1002
1002
R12
1002
2210
9.1
9.1
220UF
1002
2210
MATCHED 9610'S
2210
MATCHED 9610'S
2210
9.1
523
1001
103
ZTX450
1501
120K
4751
.47 3 WATT X 12
220UF
220UF
220UF
4751
120K
1501
ZTX450
103
1001
523
220UF
680PF
3920
2210
75R0
ZTX450
.47
.47
CL60
.22
CL60