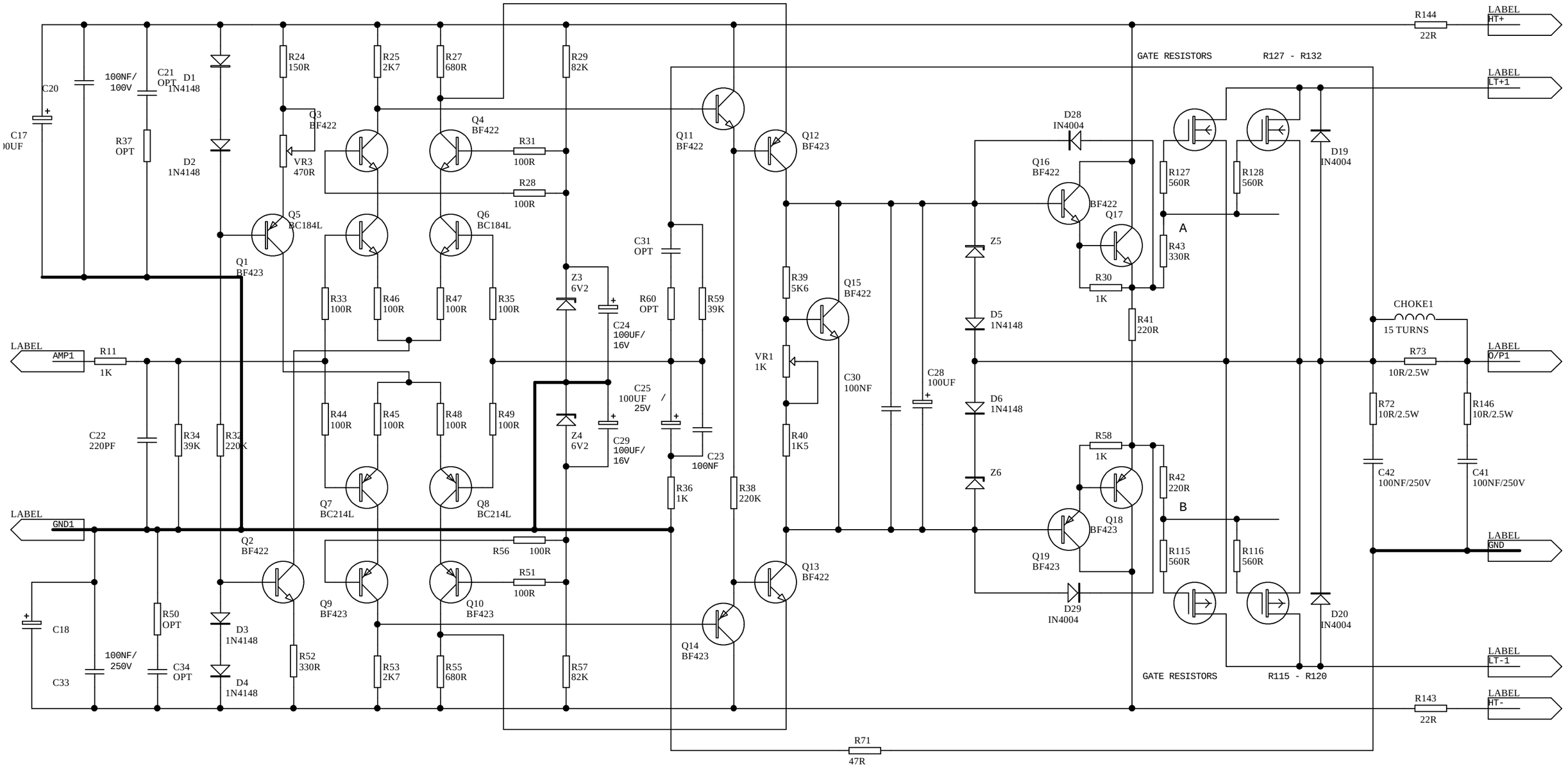


DIAGRAM SHOWS RA1000 OUTPUT STAGE. RA2000 AND RA3000 OUTPUT STAGES DIFFER IN THE NUMBER OF OUTPUT DEVICES PER RAIL. THE RA2000 USES 4 DEVICES PER RAIL AND THE RA3000 USES 6 DEVICES PER RAIL. ADDITIONAL OUTPUT DEVICES ARE CONFIGURED SIMILARLY WITH 560R GATE RESISTORS AS SHOWN.

ON AMPLIFIERS WITH FLAT PACK (J162_K1058) MOSFETS

FIT A 10pF >=250V WORKING ACROSS THE GATE, DRAIN OF EACH K1058 MOSFET

QUIESCENT VOLTAGE ADJUSTMENT

THIS IS MEASURED ACROSS THE GATE DRIVE AT POINTS A_B TO GIVE 300mV +/- 10mV

Title: CHANNEL 1 AMPLIFIER		
Size: A3	Number: RAMAIN 2	Revision: 3
Date: 1-Jul-1999	Sheet of: 2 6	
File: D:\PROTEL\RANEW\RAMAIN S02	Drawn By: LMB	

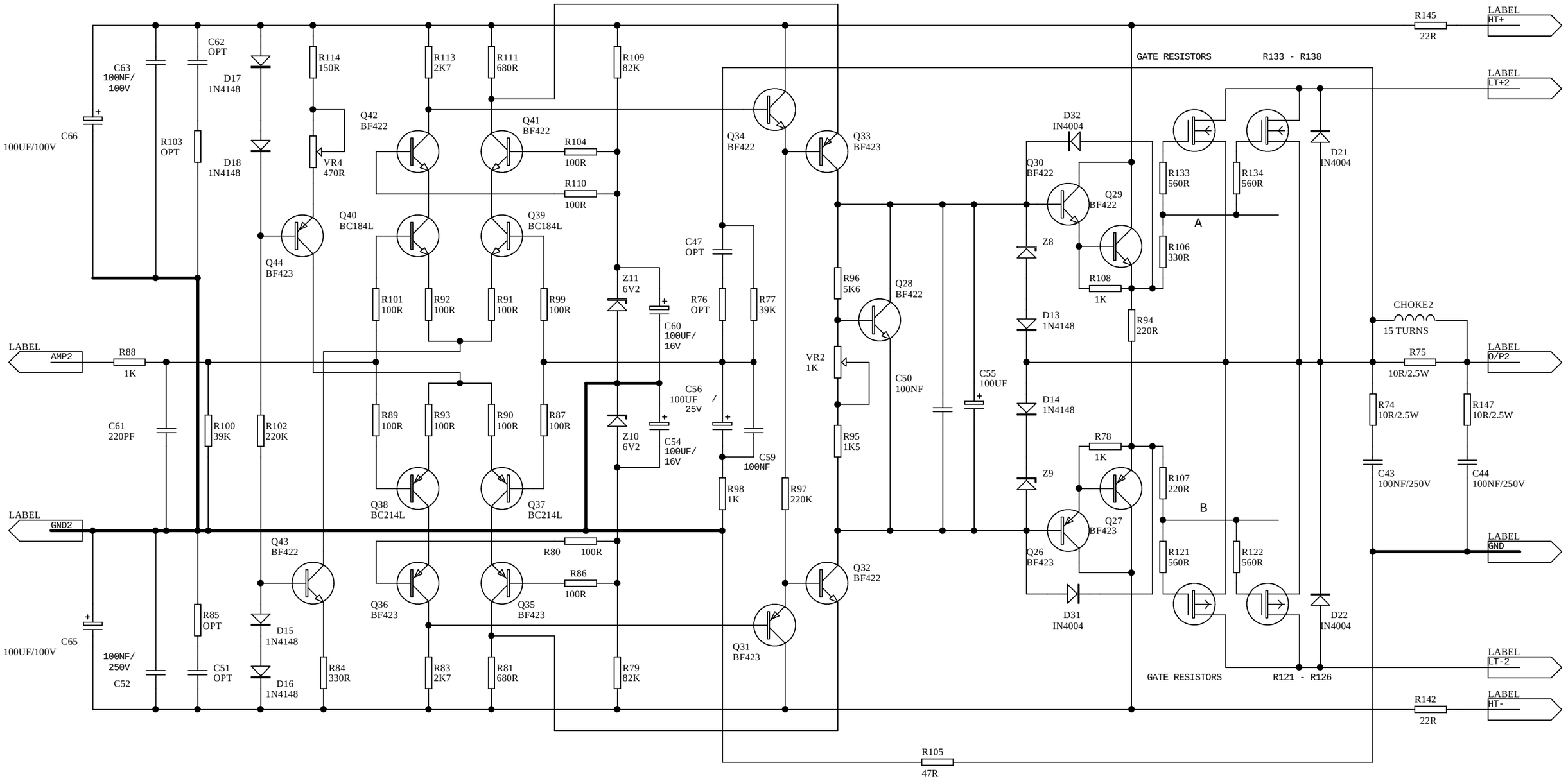


DIAGRAM SHOWS RA1000 OUTPUT STAGE. RA2000 AND RA3000 OUTPUT STAGES DIFFER IN THE NUMBER OF OUTPUT DEVICES PER RAIL. THE RA2000 USES 4 DEVICES PER RAIL AND THE RA3000 USES 6 DEVICES PER RAIL. ADDITIONAL OUTPUT DEVICES ARE CONFIGURED SIMILARLY WITH 560R GATE RESISTORS AS SHOWN.

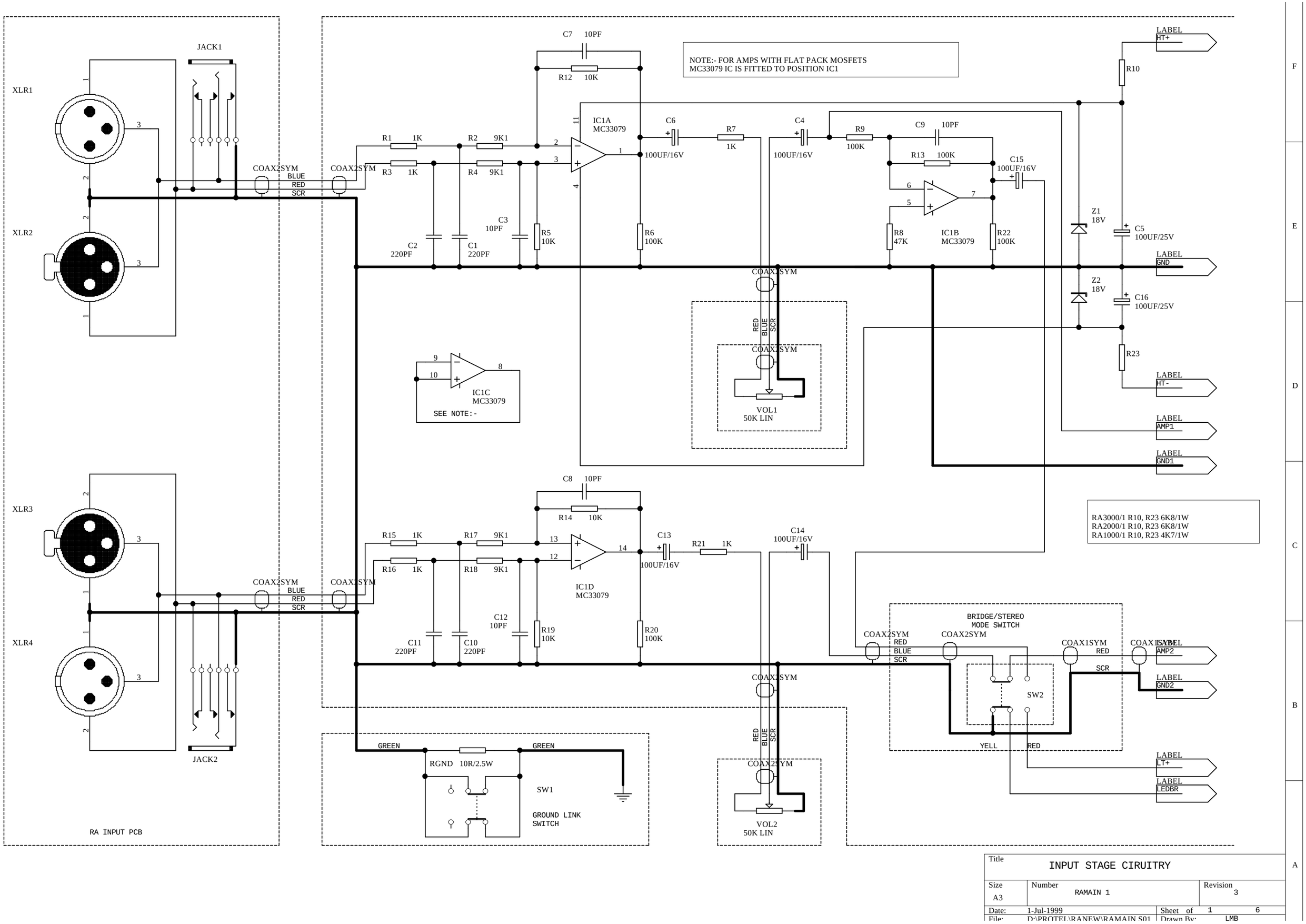
ON AMPLIFIERS WITH FLAT PACK (J162 _K1058) MOSFETS

FIT A 10pF >=250V WORKING ACROSS THE GATE, DRAIN OF EACH K1058 MOSFET

QUIESCENT VOLTAGE ADJUSTMENT

THIS IS MEASURED ACROSS THE GATE DRIVE AT POINTS A _B TO GIVE 300mV +/- 10mV

Title: CHANNEL 2 AMPLIFIER		
Size: A3	Number: RAMAIN 3	Revision: 3
Date: 1-Jul-1999	Sheet of: 3 6	
File: D:\PROTEL\RANEW\RAMAIN S03	Drawn By: LMB	



Title	INPUT STAGE CIRUITRY	
Size: A3	Number: RAMAIN 1	Revision: 3
Date: 1-Jul-1999	Sheet of 1 6	
File: D:\PROTEL\RANEW\RAMAIN.S01	Drawn By: LMB	

55C NORMALLY OPEN
THERMAL SWITCH

FAN
24V DC

THERM1
RTHERM
220R/1W

RED
RED
BLACK

C81
47UF/35V

C82
47UF/35V

D33-D36
IN4004
(4 OFF)

TRANSFORMER SECONDARY VOLTAGES

QUOTED VOLTAGES ARE OFF LOAD AC (RMS)

	RA1000	RA2000	RA3000
RED	47	58	68
ORANGE	47	58	68
YELLOW	0	0	0
GREEN	52	63	73
BLUE	52	63	73

SEE TRANSFORMER
WIRING DETAILS FOR
CORRECT CONNECTION

TX
0V
220V
240V
AC:1
GREEN
AC:2
RED
CT
YELLOW
AC:3
ORANGE
AC:4
BLUE
RA TRANSFORMER

GREEN/YELLOW
E
IEC
N
L
BROWN
CHASSIS
FUSE
ORANGE
S1
GREY
FRONT PANEL
MOUNTED MAINS
SWITCH

BROWN

VOLTAGE	FUSE1	SOFTSTART
100V	2A T	22R/23W
110V	2A T	22R/23W
220V	1.6A F	47R/23W
240V	1.6A F	47R/23W

UNUSED VOLTAGE TAP

MAINS INPUT VOLTAGE
SELECTOR. CONNECT
REQUIRED TRANSFORMER
VOLTAGE TAP.

FUSE 1
SOFTSTART
BLACK
BLUE
YELLOW

RELAY3
RLY3 (A)
RLY3 (B)
LABEL 4
LABEL 5

LABEL 9
CON 5:1
LABEL
LT+1
FUSE2
C68
330NF/
250V
C72
C70
C67
330NF/
250V
C71
C69
DBR1
KBPC3504
LABEL
LT-1
FUSE1
D23-D26
IN4004
(4 OFF)
LABEL
HT+
C79
2200UF/16V
LABEL
LT+
LABEL
LT+2
FUSE3
C73
330NF/
250V
C77
C75
LABEL 2
LABEL
STAR GND
C74
330NF/
250V
C78
C76
DBR2
KBPC3504
LABEL
LT-2
FUSE4
C80
2200UF/16V
LABEL
HT-

RA3000 C69, C70, C71, C72, C75, C76, C77, C78 4700UF/110V

RA2000 C69, C70, C71, C72, C75, C76, C77, C78 4700UF/110V

RA1000 C69, C70, C75, C76 4700UF/110V
C71, C72, C77, C78 NOT FITTED

Title	RA POWER SUPPLY		
Size: A3	Number: RAMAIN 4		Revision: 3
Date: 1-Jul-1999		Sheet of 4	6
File: D:\PROTEL\RANEW\RAMAIN S04		Drawn By:	LMB

D27
IN4004

R139
18k/2W

TO AC:1
TO AC:4
TO LT+2
LABEL 4
LABEL 5

THERM2
90C NORMALLY
CLOSED THERMAL
SWITCH
BLUE
BLUE

R141
18K/1W

R151
10K

LABEL 8
RLY3 (A)
RLY3 (B)
LABEL 2

RELAY2
RELAY1

Q46
BF422

C46
C45
100NF/
250V
100NF/
250V

R152
10K

D12
IN4004

Q45
2SA958

R150
120R

R68
SEE NOTE

D30
IN4004

Q24
BF423

R66
47K

Z12
5V6

DMOD
IN4148

R67
47K

R148
39K

Z7
9V1

R69
24K

R154
100K

R70
18V

100uF
C40

D11
1N4148

R65
47K

RMOD1
100K

Q20
BF422

Q21
BF423

Q25
BF422

Q23
BF422

Q22
BF422

D10
1N4148

R62
100K

R64
47K

R63
47K

D8
IN4004

D9
IN4004

D7
IN4004

R61
4K7

R149
100K

C38
100UF/16V

C39
100UF/16V

C37
680NF

CON 5
LT +VE CH1
GND
LT +VE CH2

INTERCONNECT
FLEXISTRIP
TO DISPLAY

LABEL
O/P1

LABEL
O/P2

R140
8K2

LABEL
LEDBR

6PIN
INTERCONNECT
FLEXISTRIP
6 WAY
6PIN

LED1
POWER
RED

LED2
PROTECT
YELLOW

LED3
BRIDGE
GREEN

STATUS LED PCB

GREEN
GREY
YELLOW
GREEN

CH2
CH1

NOTE:
RA1000/1 RA2000/1 RA3000/1
R68= 330R/5W 1K/5W 1K/5W

Title: RA PROTECTION		
Size: A3	Number: RAMAIN 5	Revision: 1
Date: 1-Jul-1999	Sheet of 5 6	
File: D:\PROTEL\RANEW\RAMAIN.S05	Drawn By: LMB	

TO CON: 5

LT +VE CH1
CH1 O/P
GND
CH2 O/P
LT +VE CH2

LED1 SIGNAL PRESENT -40dB GREEN
LED8 SIGNAL PRESENT -40dB GREEN

C4 100NF
R14 510K
Z13 11V
R13 10K
Q3 BF422
Q4 BF423
R11 10K
C5 1uF
D3 1N4148

R5 510K
C1 100NF
Z14 11V
R4 10K
Q1 BF422
Q2 BF423
R2 10K
D1 1N4148
C2 1uF

R1 *

Q9 BC214L
R28 47K
Q10 BC214L
R31 47R
R26 *
R12 100K
D4 1N4148
R17 1K
R18 56K
R16 *
C6 100NF
R19 56K
Z2 18V/1.3W

YELLOW LED2 -20dB
LED3 -12dB
LED4 -7dB
LED5 -4dB
LED6 0dB

IC2 LB1443N
9
7 SIG
1
2
3
4
6
8
5
Z5 9v1
Z6 8
Z7 4v7
Z8 2V7

R3 100K
D2 1N4148
R8 1K
R9 56K
R7 *
C3 100NF
R10 56K

Q11 BC214L
R29 47K
Q12 BC214L
R32 47R

YELLOW LED9 -20dB
LED10 -12dB
LED11 -7dB
LED12 -4dB
LED13 0dB

IC3 LB1443N
9
7 SIG
1
2
3
4
6
8
5
Z1 18V/1.3W
Z9 9v1
Z10 6v8
Z11 4v7
Z12 2V7

Z3 *

Z4 *
Q7 BF423
Q8 BF423
D6 1N4148
R25 100K
C8 470PF
R23 4K7/1W
C10 47UF/35V
R27 ONLY FIT ON RA4001
R24 100K
LED7 CLIP RED

Q5 BF423
Q6 BF423
D5 1N4148
R22 100K
C7 470PF
R20 4K7/1W
C9 47UF/35V
R30 ONLY FIT ON RA4001
R21 100K
LED14 CLIP RED

RA4001 R1, R26 2K2/4W
R7, R16 5K1
R27, R30 100K
Z3, Z4 10V

RA3001 R1, R26 3K3/4W
R7, R16 6K8
R27, R30 (NOT FITTED) Z3, Z4 6V2

RA2001 R1, R26 3K3/4W
R7, R16 8K2
R27, R30 (NOT FITTED)
Z3, Z4 6V2

RA1001 R1, R26 2K2/4W
R7, R16 13K
R27, R30 (NOT FITTED
Z3, Z4 7V5

Title	RA DISPLAY CARD		
Size A3	Number RA DISPLAY		Revision 3
Date: 1-Jul-1999		Sheet of 6	6
File: D:\PROTEL\RANEW\NEWDISP.S01		Drawn By: LMB	

TO CON: 5

LT +VE CH1
CH1 O/P
GND
CH2 O/P
LT +VE CH2

1
2
3
4
5

C4
100NF

R14
510K

LED1
SIGNAL PRESENT
-40dB
GREEN

R13
10K

R15
1K

Q3
BF422

Q4
BF423

R11
10K

D3
1N4148

C5
470NF

C1
100NF

R5
510K

LED8
SIGNAL PRESENT
-40dB
GREEN

R4
10K

R6
1K

Q1
BF422

Q2
BF423

R2
10K

D1
1N4148

C2
470NF

R12
100K

D4
1N4148

R17
1K

R18
56K

R16

C6
100NF

R19
56K

R26

IC2
U257

SIG
P0
P1
P2
P3
P4

LED2
YELLOW
-20dB

LED3
-12dB

LED4
-7dB

LED5
-4dB

LED6
0dB

Z2
20V/1.3W

R3
100K

D2
1N4148

R8
1K

R9
56K

R7

C3
100NF

R10
56K

R1

IC3
U257

SIG
P0
P1
P2
P3
P4

LED9
YELLOW
-20dB

LED10
-12dB

LED11
-7dB

LED12
-4dB

LED13
0dB

Z1
20V/1.3W

Z4

Q7
BF423

Q8
BF423

R25
100K

D6
1N4148

C8
470PF

R23
4K7/1W

C10
47UF/35V

R24
100K

LED7
CLIP
RED

Z3

Q5
BF423

Q6
BF423

R22
100K

D5
1N4148

C7
470PF

R20
4K7/1W

C9
47UF/35V

R21
100K

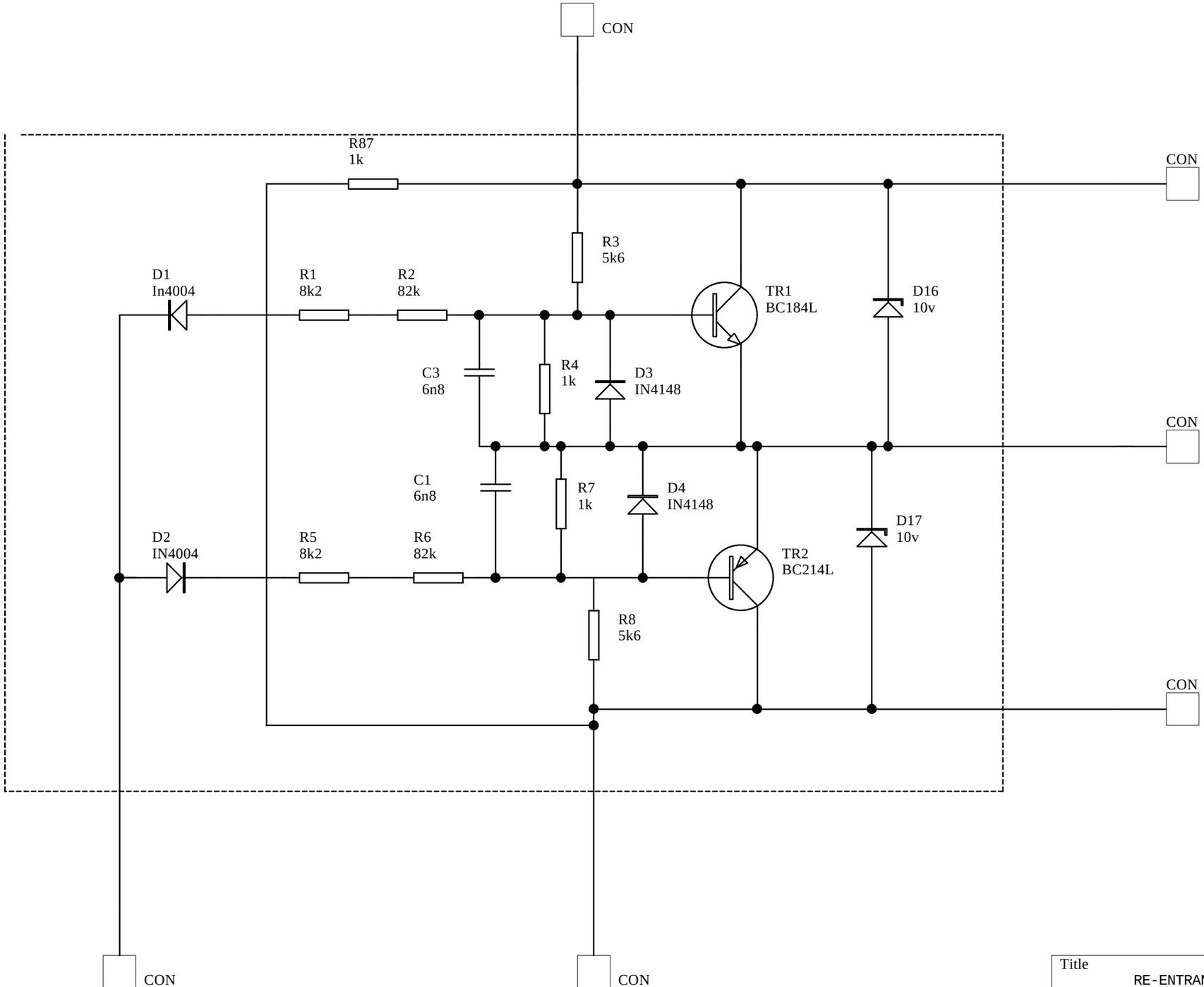
LED14
CLIP
RED

RA3000 R1, R26 3K3/4W
R7, R16 6K8
Z3, Z4 6V2

RA2000 R1, R26 3K3/4W
R7, R16 8K2
Z3, Z4 6V2

RA1000 R1, R26 2K2/4W
R7, R16 13K

Title	RA DISPLAY CARD	
Size: A3	Number: RA DISPLAY	Revision: 3
Date: 1-Jul-1999	Sheet of 6	6
File: D:\PROTEL\RANEW\RADISP.S06	Drawn By: LMB	



Title	RE-ENTRANT PROTECT ION PCB		
Size: A4	Number: PCB1042/P1		Revision:
Date: 22-Jul-1999		Sheet of 1 1	
File: D:\PROTEL\RANEW\REENTRY.S01		Drawn By: L BASHAM	

Protection System

The protection system is based around Q20-Q25. Under normal conditions Q20 – Q23 will be off. At turn-on C40 will charge through R65 towards the +LT supply rail. The voltage is fed to the base of Q25 via D11. When the voltage across C40 reaches approximately 10V Q25 will turn on and thus turn on Q24. Resistor/diode network R67 & D38 connected between Q24 collector and Q25 base provides positive feedback in order to make the turn-on/turn-off of Q24 more defined. The collector of Q24 is connected via R68 R150 & Q45 to the coils of relays RLY1-3.

Transistors Q20 and Q21 are connected in such a way that a voltage of -650mV applied to the emitter of Q20 will turn on Q20 and hence Q21. This will rapidly discharge C40 and hence turn off Q25 and Q24 thus opening the output relays. Similarly Q23 is connected such that a base voltage of +650mV will turn it, and hence Q22, on with the same resultant opening of the output relays.

The output of each channel is fed via resistors R63 and R64 into C38-C39 and then via D9 and D10 to Q23 base and Q20 emitter respectively. The combination of C38-C39 with R63 and R64 forms a low-pass filter, and so at signal frequencies C38-C39 will have no voltage across it. In the event of a DC offset appearing at the output, however, C38-C39 will charge to a DC voltage, turning on Q23 & Q22 or Q20 & Q21 depending upon the polarity, and hence opening the output relays.

The Network consisting of R62, R61 and C37 provide the rapid turn-off feature of the protection system. R61 is connected through the 90 degree thermal switch to D37 and D7, which are connected to the secondaries of the mains transformer. The union of D37 and D7 will, therefore, show a full-wave rectified version of the secondary voltage. This is averaged by C37 to a **negative** DC voltage, reverse biasing D8 and, therefore, having no effect on the protection system. Should one of the thermal switches open, or the power be turned off, C37 will be rapidly charged towards the +LT rail via R61, forward biasing D8, turning Q23 on and opening the output relays. If there is no rapid turn off, suspect R62 (100k) this may be open circuit. It is worth noting that failure of this resistor will render the thermal shutdown useless.