100 MHz Dual Time Base Oscilloscope
PM3070 / PM3072

Service Manual

MAT3161

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MAT3161

PHILIPS

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IMPORTANT

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

NOTE: The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

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1. INTRODUCTION

This book is intended for use with the PM3070-PM3072 oscilloscope.
It is a supplement to the Service manual PM3065-PM3067 and must be
used together with this manual. Only the differences with respect to
the PM3065-PM3067 are described in this supplement.

The PM3070-PM3072 has cursors as an addition to the basic instrument.
These cursors enable an easy and accurate measurement of time and
voltages on the CRT screen.

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2.   CHARACTERISTICS

Characteristics	Specification	Additional information
2.1 VERTICAL DEFLECTION OR Y AXIS		
* Visible signal delay	>10 ns	Max. intensity, measured from line start to trigger point
2.2 CURSORS		
* Cursor intensity control	Independent of trace intensity but combined with setting read-out intensity	In single mode of MTB, cursors are displayed during max. 0,1 s when RESET button is depressed.
* Modes	Independent	Cursor reading independent of previous reading
	Ratio (Phase)	Cursor reading in % (^{o}) of previous reading
	Track	REF cursor and delta are tracking
	Zoom	Vert. cursors operate the DTB
	Rise	Hor. cursors fixed at 10%/90% and vert. cursors displaceable (4-way)
* Hor. and Vert. resolution	0,1 mm	
* Read-out resolution	4 digits	
* Voltage cursors:		
Error Limit (0...40°C)	See 2.2.1 of Service manual of PM3065	Same accuracy as the vertical channels.
Minimum cursor range	At least 7,6 div.	Within graticule
Read out range: absolute	8 x V/div setting (pos. and neg. sign)	Probe factor incl. when probe is provided with probe read-out
relative	8 div (pos. and neg. sign)	When operating in "uncal"

Characteristics	Specification	Additional information
* Time cursors:		
Error limit (0...40°C)	See 2.3.1 of Service manual of PM3065	Same accuracy as the horizontal channels.
Minimum cursor range	At least 9,6 div.	Within graticule
* Read out range: absolute	10 x s/div setting (pos. and neg. sign)	
relative	10 div (pos. and neg. sign)	When operating in "uncal"

2.3   CRT TEXT

* Intensity control of CRT text	Independent of trace intensity but combined with cursor intensity	In SINGLE mode of MTB, setting readings are displayed during max. 0,1 s when RESET button is pushed.
* Vertical settings	Ch. A deflection coefficient	When channel A is displayed
	Ch. B deflection coefficient	When channel B is displayed
* Horizontal settings	MTB deflection coefficient	In MTB, MTBI and alternate sweep modes
	DTB deflection coefficient	In DTB and alternate sweep mode
* Modes	Settings only	}
	Cursors only	}Incl. cursor readings
	Settings + Cursors	}
	Softkey ON/OFF (text)	For making photographs
	User text	Max. 32 characters on one line at the bottom of the CRT

3. XYZ AMPLIFIER UNIT (A3)

3.1 INTRODUCTION

The amplifiers for the vertical and horizontal deflections are similar
to the basic instrument and are described in the Service manual
PM3065. But the XYZ Amplifier unit for this instrument is extended
with the following circuits:
- vertical text and cursor deflection circuit
- horizontal text and cursor deflection circuit
- unblanking text and cursor circuit.

3.2 VERTICAL TEXT AND CURSOR DEFLECTION CIRCUIT

The input currents YOUT0 and YOUT1 are derived from the
microprocessor unit A9. These currents are routed via V3441 and V3442,
that serve as common base amplifiers for buffering the input. The
output current is fed via a diode switch to the final vertical
amplifier. The diode switch is controlled by the signals XYSW0 and
XYSW1 according to the following table:

	XYSW0	XYSW1
TRACE	1	0
TEXT	0	1

3.3 HORIZONTAL TEXT AND CURSOR DEFLECTION CIRCUIT

The input currents XOUT0 and XOUT1 are derived from the
microprocessor unit A9. These currents are routed via V3406 and V3409,
that serve as common base amplifiers for buffering the input. The
output current is fed to the final horizontal amplifier. Switching
between the normal horizontal deflection and the text/cursor path is
also controlled by the signals XYSW0 and XYSW1.

3.4 UNBLANKING TEXT AND CURSOR CIRCUIT

The blanking current for the Z-amplifier is derived from the Z Pre-
amplifier of unit A4 for trace intensity (Z TRACE) or from the Z-DAC
of unit A9 for text intensity (Z TEXT). The Z TRACE/TEXT switch
switches between these two currents by means of the signal ZSW1
(0 = Z TRACE and 1 = Z TEXT). The selected blanking current is copied
in the long-tailed pair (V3206, V3207) in two anti-phase output
currents.

The output current from R3230 is routed to a shunt feedback amplifier
V3211 and V3213 via the feedback resistor R3236. The amplifier stage
is fed by a current source V3212. The blanking pulse on the collector
of V3213 can vary between +5 V for unblanking and -35 V for fully
blanking.

The anti-phase output current from R3225 is routed to a shunt feedback
amplifier V3216 and V3217 via the feedback resistor R3246. The
amplifier stage is fed by a current source V3218. The AUTO-FOCUS pulse
on the collector of V3217 can vary between -37 V and +7 V for focus
control for various trace and text intensities.

The Z-PULSE signal may contain d.c., l.f. and h.f. components to be applied to grid G1 of the CRT. Since G1 is at a cathode potential of -2000 V, blocking capacitors are required between G1 and the Z-amplifier output. The h.f. component is directly routed via blocking capacitor C3253 to G1. However, the d.c. and l.f. components are blocked, so these components are first modulated on a 200 kHz carrier signal by V3251 and V3252 to pass blocking capacitor C3252. Then the signal is demodulated again by V3259 and V3265. Finally, the reconstitudet d.c. and l.f. components are added to the h.f. component again.

Transistor V3263 forms a nominal 70 V zener circuit which provides the voltage difference between the cathode and G1 of the CRT. This bias voltages ensures blanking when there is no input signal. For adaptation to each CRT, this voltage can be varied between 40 V and 100 V by means of R3272 (BLACK LEVEL). Resistor R3286 maintains the filament at the same potential as the cathode.

Any ripple on the cathode voltage is fed-back via transistor V3221 to the input of the final Z-amplifier and added to the blanking signal. This means that the differential voltage between G1 and the cathode of the CRT is always fixed. Because this differential voltage determines the intensity of the spot, as a result the intensity is almost independent of the ripple.

The amplifier stage V3269, V3271 and V3272 provides amplification for the range of FOCUS control. The range of 0 V ... 10 V gives a final range on G3 of the CRT of -1350 V ... -1600 V. Via blocking capacitor C3259 the AUTOFOCUS signal is added to the focus voltage to achieve a dynamic focus control for trace intensity and text intensity.

Resistor R3244 connects the Z-pulse of the trace to the focus adjustment to maintain a sharply defined trace at varyous brightness.

For optimum presetting of the GEOMETRY, the voltage on G5 of the CRT is set to a fixed level of -30 V. The ASTIGMATISM can be varied by means of potentiometer R3282.
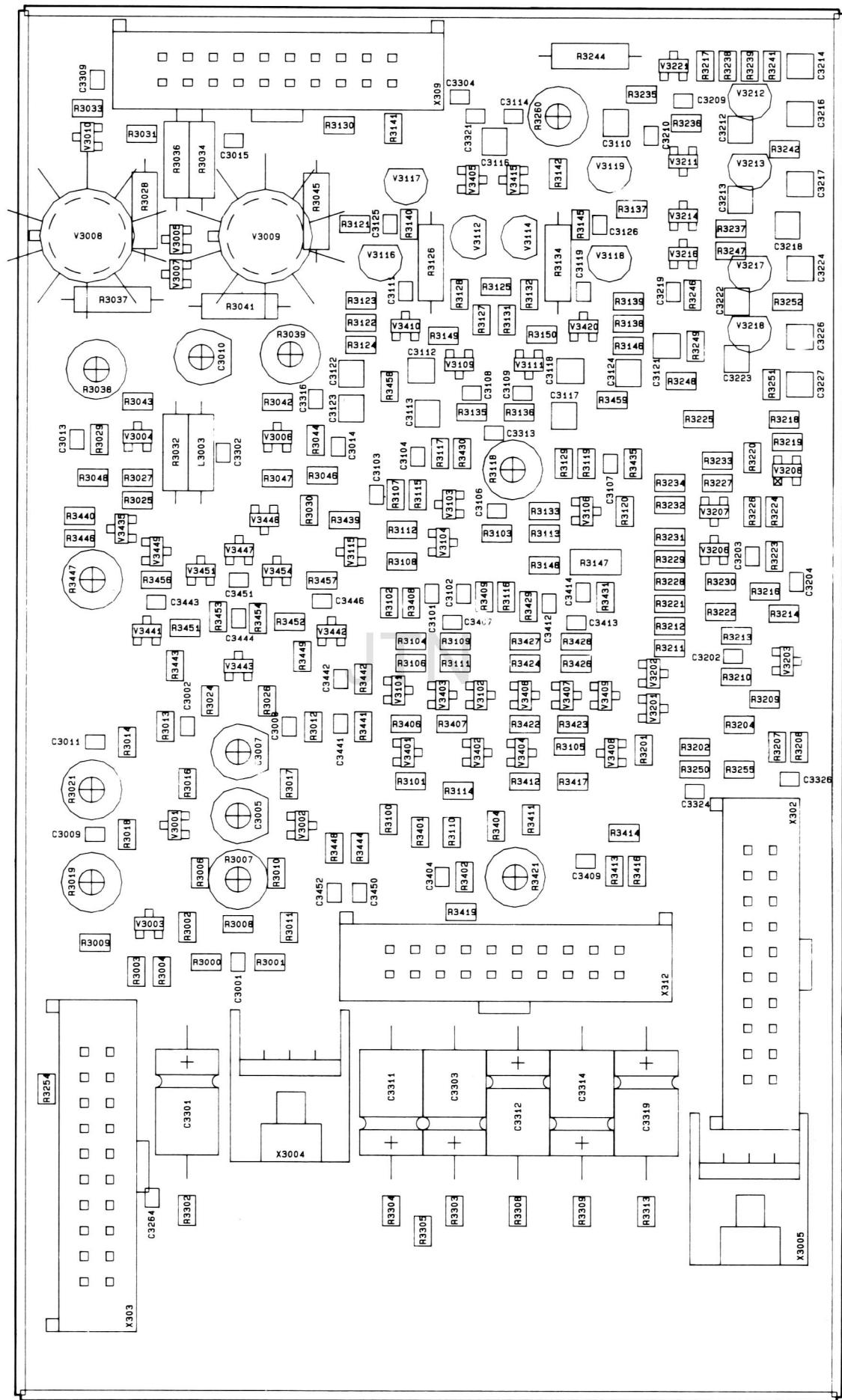
Figure 3.1 XYZ amplifier unit p.c.b., first part

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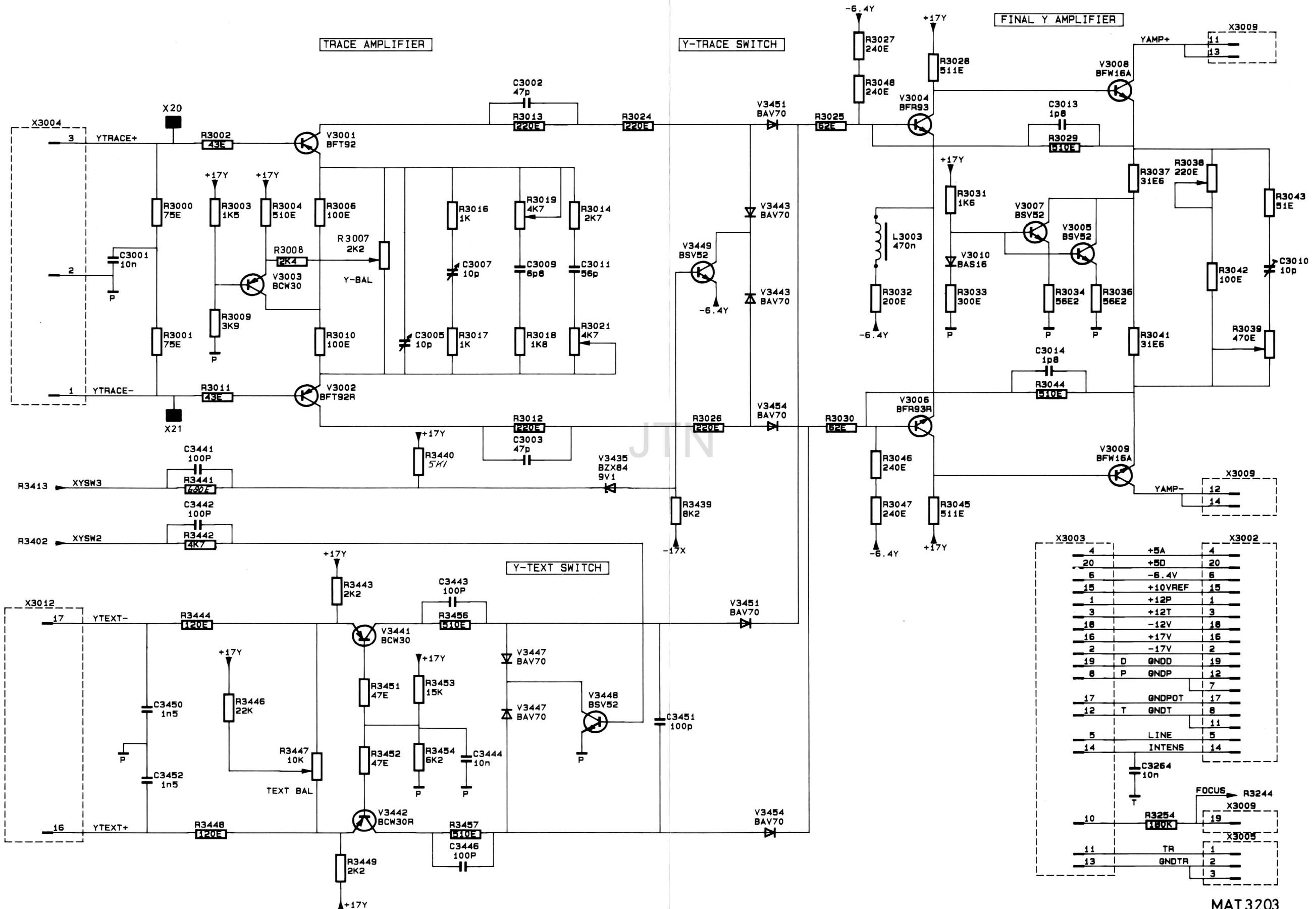
Figure 3.2 Circuit diagram of XYZ amplifier, vertical amplifier
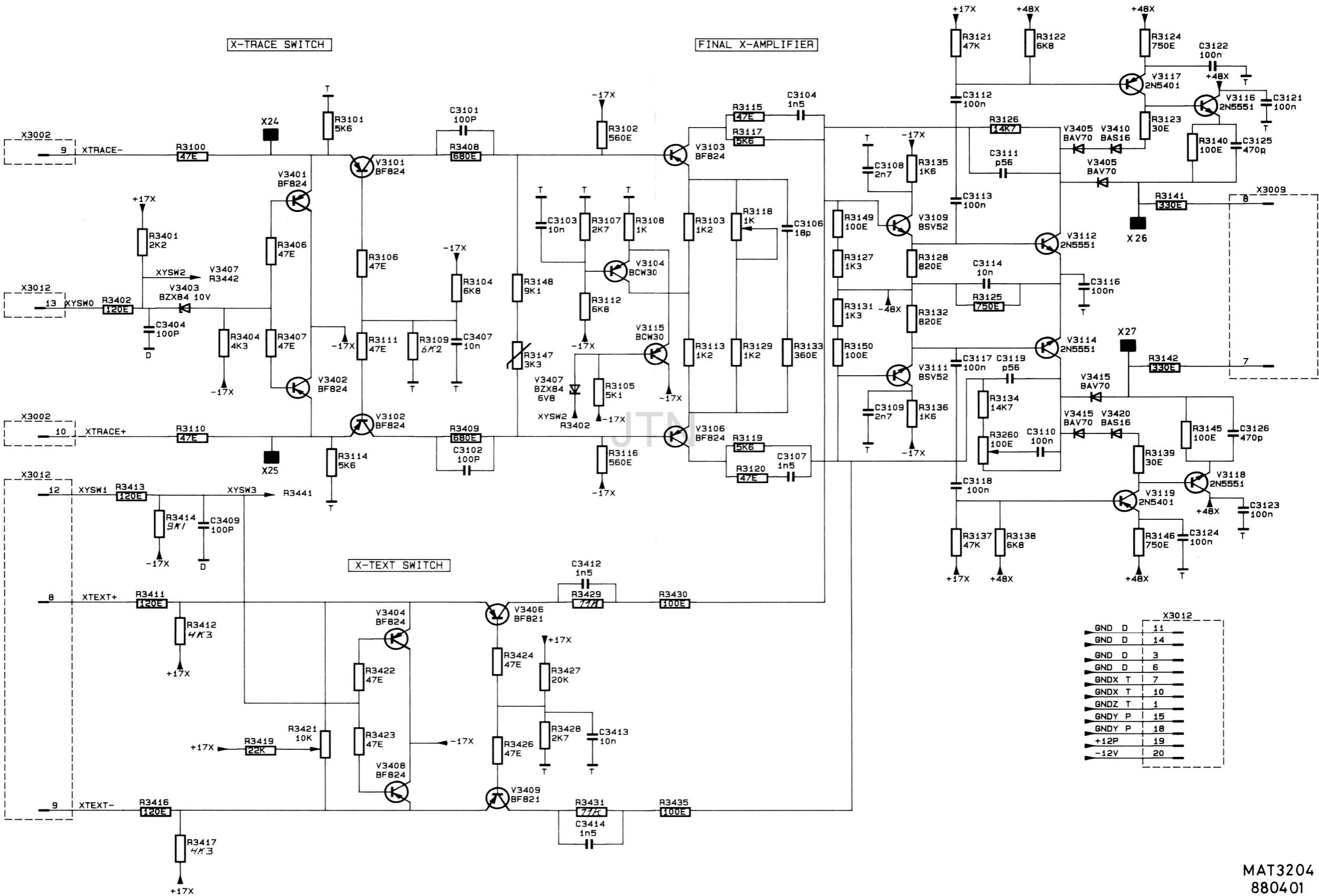
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Figure 3.4 XYZ amplifier unit p.c.b., first part

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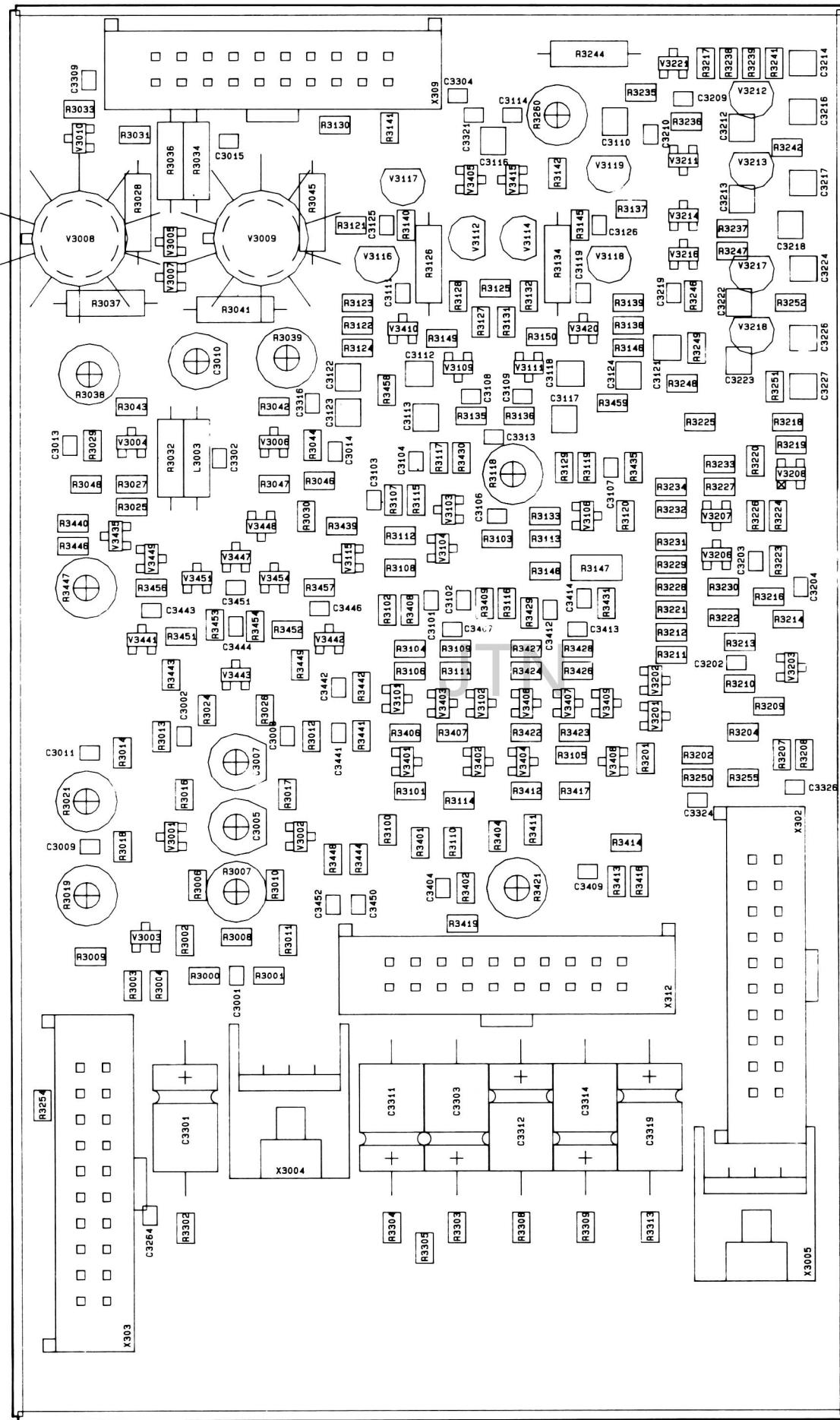
Figure 3.3 Circuit diagram of XYZ amplifier, horizontal amplifier
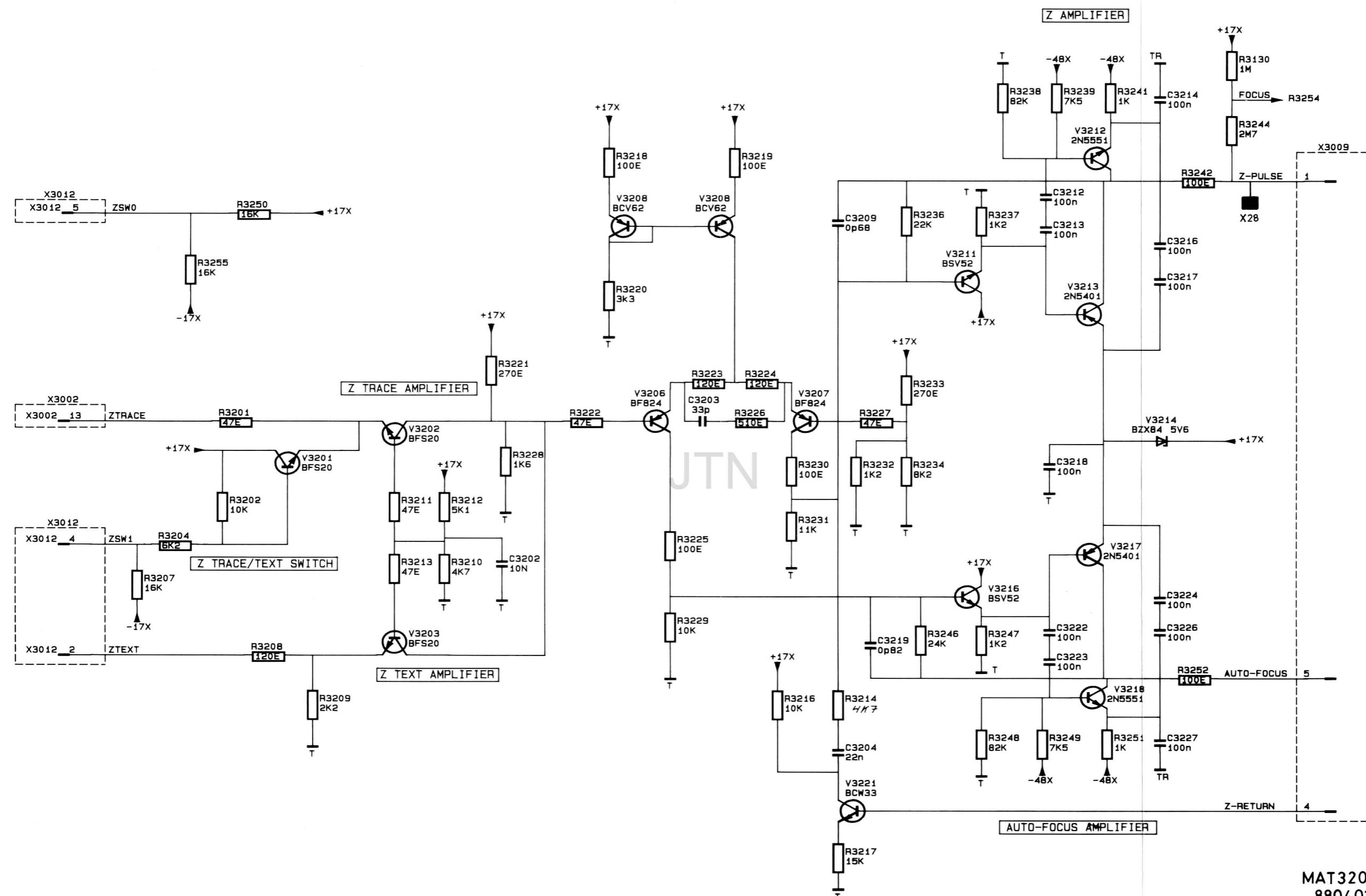
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Figure 3.5 Circuit diagram of XYZ amplifier, blanking amplifier
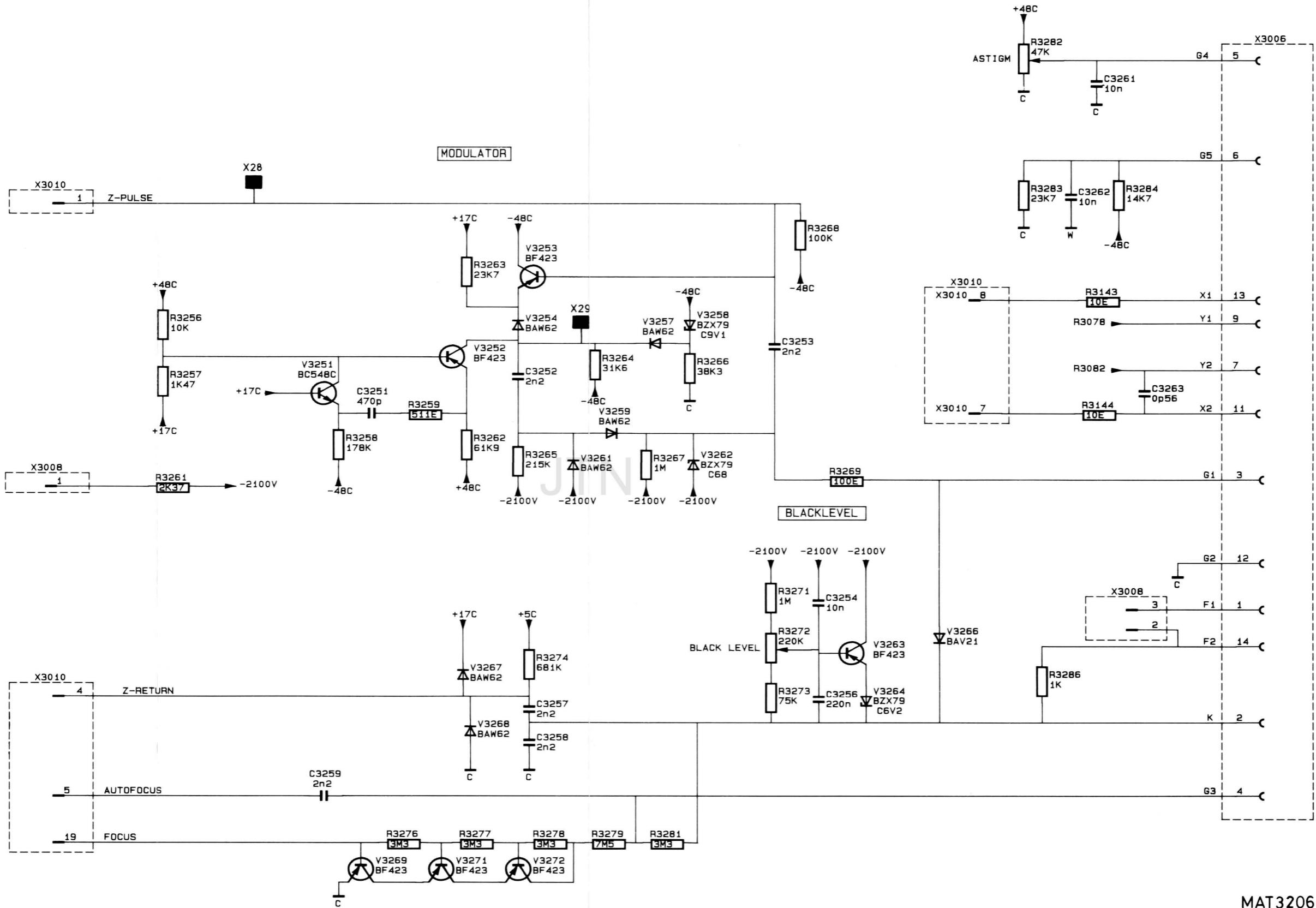
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Figure 3.6 Circuit diagram of XYZ amplifier, blanking amplifier
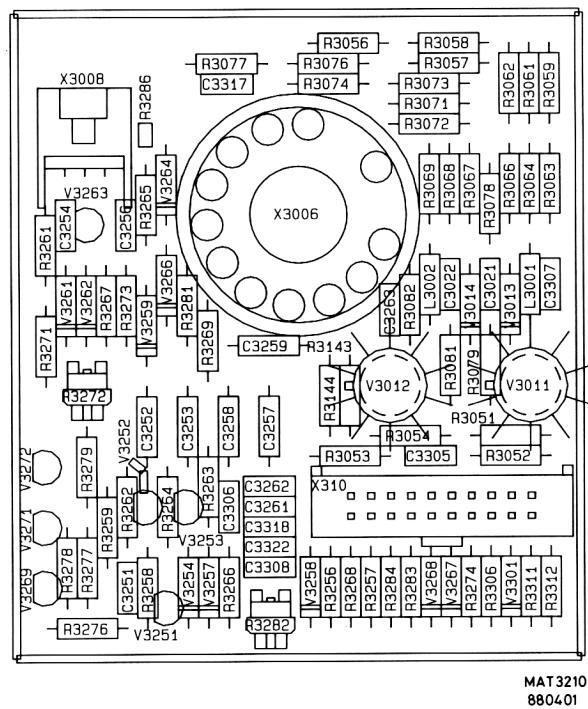
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Figure 3.7 XYZ amplifier unit p.c.b., second part
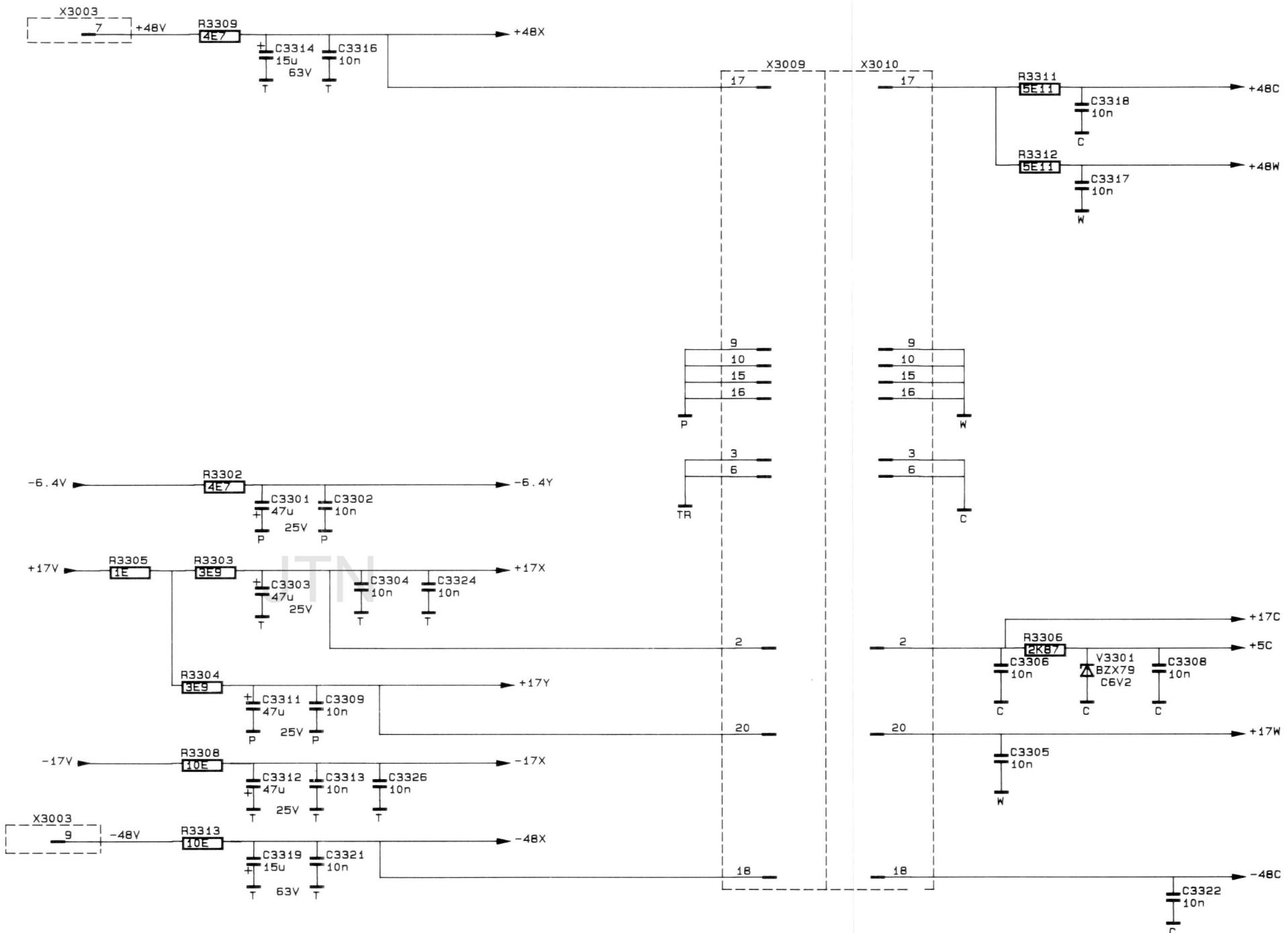
Figure 3.8 Circuit diagram of XYZ amplifier, power supplies

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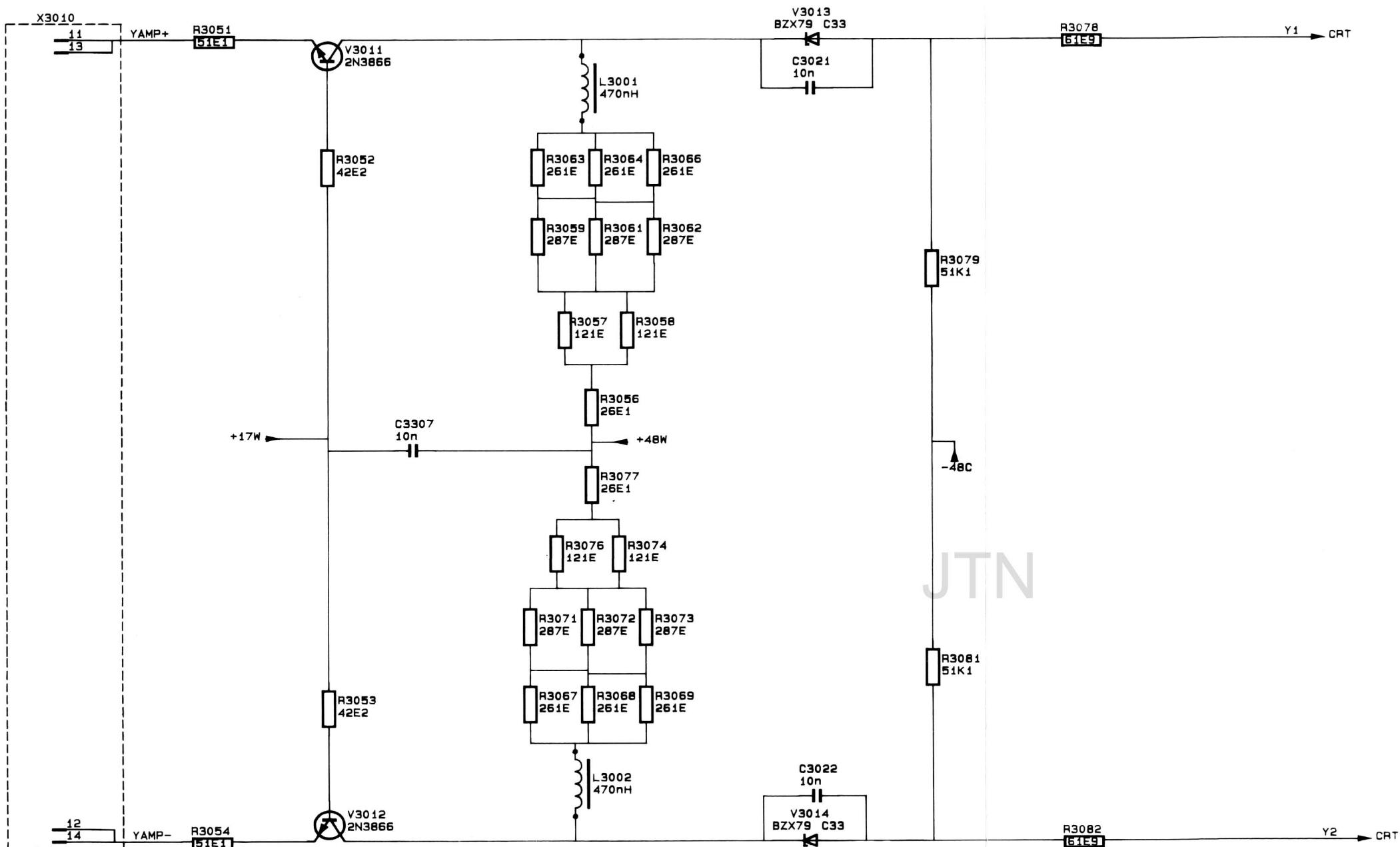
Figure 3.9 Circuit diagram of XYZ amplifier, final Y amplifier

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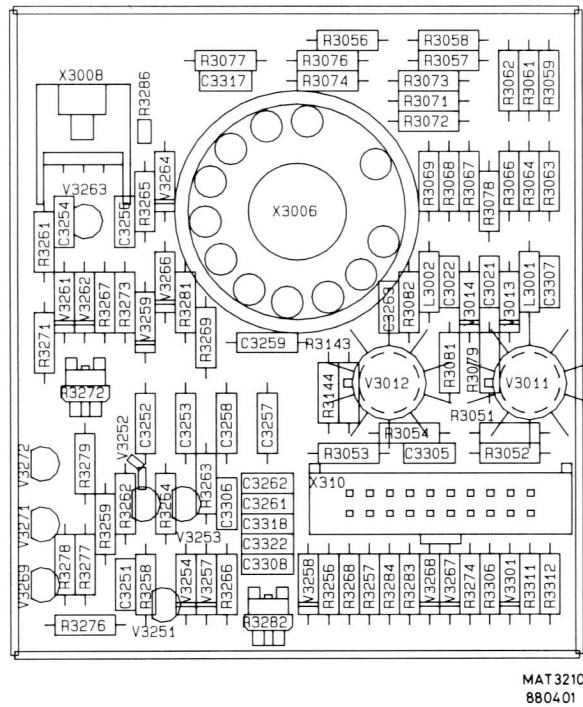
Figure 3.10 XYZ amplifier unit p.c.b., second part

4. FRONT UNIT (A7)

The front unit of the PM3070 is almost similar tp the PM3065 version.
The difference is that the microcomputer, which was present on the
front unit of the PM3065, is now mounted om the microprocessor unit.
Instead of this microcomputer, a 40-pin connector is present. So, all
signals and voltages that were originally applied to the microcomputer
are now applied to the microprocessor unit (see also section 5.1).

5.   MICROPROCESSOR UNIT (A9)

The microprocessor unit consists of:
- microprocessor circuit
- text-cursor circuit

5.1   MICROPROCESSOR CIRCUIT

For this oscilloscope, the microcomputer MAB 8052 has been replaced by
a circuit consisting of the similar microprocessor 8032 AH and
external EPROM D9006. Address latch D9002 serves for separation of the
eight address bits from the eight data bits. This de-multiplexing is
performed with the aid of the signal ALE---HT, generated by the
microprocessor.

The five cursor keys and the WATCHDOG status are read by the 3-state
buffer D9008.

The address decoder D9004 decodes the enable lines for the various
devices at the time that the signal PSE---LT is low.
It gives the following decoding:

Address (Hex)	Signal	Applied to
8000H - 8FFFH	A7AD15	X9016-208
A000H - AFFFH	A7AD15	X9016-208
F000H - F7FFH	CPIN--LT	D9009-1/19
F800H - FFFFH	CPOT--LT	D9007-1/19
F000H - F7FFH	CPRD--LT	--
F800H - FFFFH	CPWR--LT	--
E800H - EBFFH	ASICCSLT	D9012-72
EC00H - ECFFH	INTCS-LT	N9016-12
0000H - 7FFFH	ROMCS-LT	D9006-20
C000H - C0FFH	CURSINLT	D9008-1/19

The devices D9007 and D9009 are for future expansions.

5.2   TEXT-CURSOR CIRCUIT

The ASIC (Application Specific Integrated Circuit) processes fully
independantly all text and cursor information that is put into the
memory of the RAM by the microprocessor. This happens with a clock
frequency of 16 MHz.
D9011 is a 8Kx8 RAM and contains the character set and all
instructions for the ASIC.

The resulting generated text and cursor data is applied to the
X-DAC and Y-DAC (Digital-to-Analog Converter). These DACs convert the
10-bit data information into the XTEXT+, XTEXT-and YTEXT+, YTEXT-
currents, which can vary between 0 mA and +2,5 mA. This range is
adjusted by potentiometers R9006 and R9009. The currents are applied
to the XYZ amplifier unit and drive the vertical and horizontal
position of the text and cursors on the screen.

The intensity of the text and cursors is controlled by the Z-DAC and is adjusted by the microprocessor via the uAAD∅∅...∅7 bus. Output current Z-TEXT is also applied to the XYZ amplifier unit. Timing of switching on the XYZ amplifier between the normal signal path and the text-cursor path is obtained by the Z switch signal ZSW1, XY switch signals XYSW∅/XYSW1 and the Z text intensity signal ZTEXT.
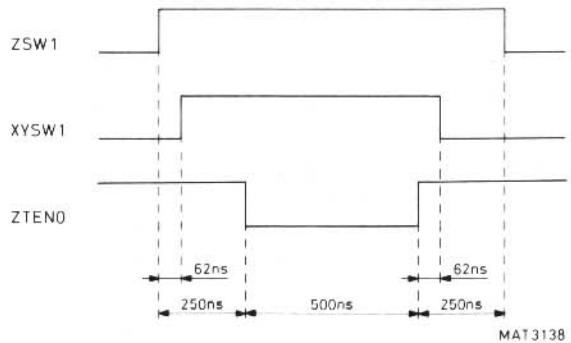
Figure 5.1 Timing for text-cursor display

When ZSW1 is high the signal path for the text and cursor intensity is opened and the path for trace unblanking is closed. Then during XYSW1 the normal signal paths in the final X and Y amplifiers are closed and the currents XTEXT+/- and YTEXT+/- are applied to the final amplifiers. Finally during the 500 ns. of ZTEN0 a single dot of text or cursor is intensified on the screen. The digital input to DAC N9016 determines the amplitude of the resulting ZTEXT current. The place of the dot is determined by the signals XTEXT+/- for horizontal position and YTEXT+/- for vertical position.
This sequence repeats for each single dot to be written on the screen.
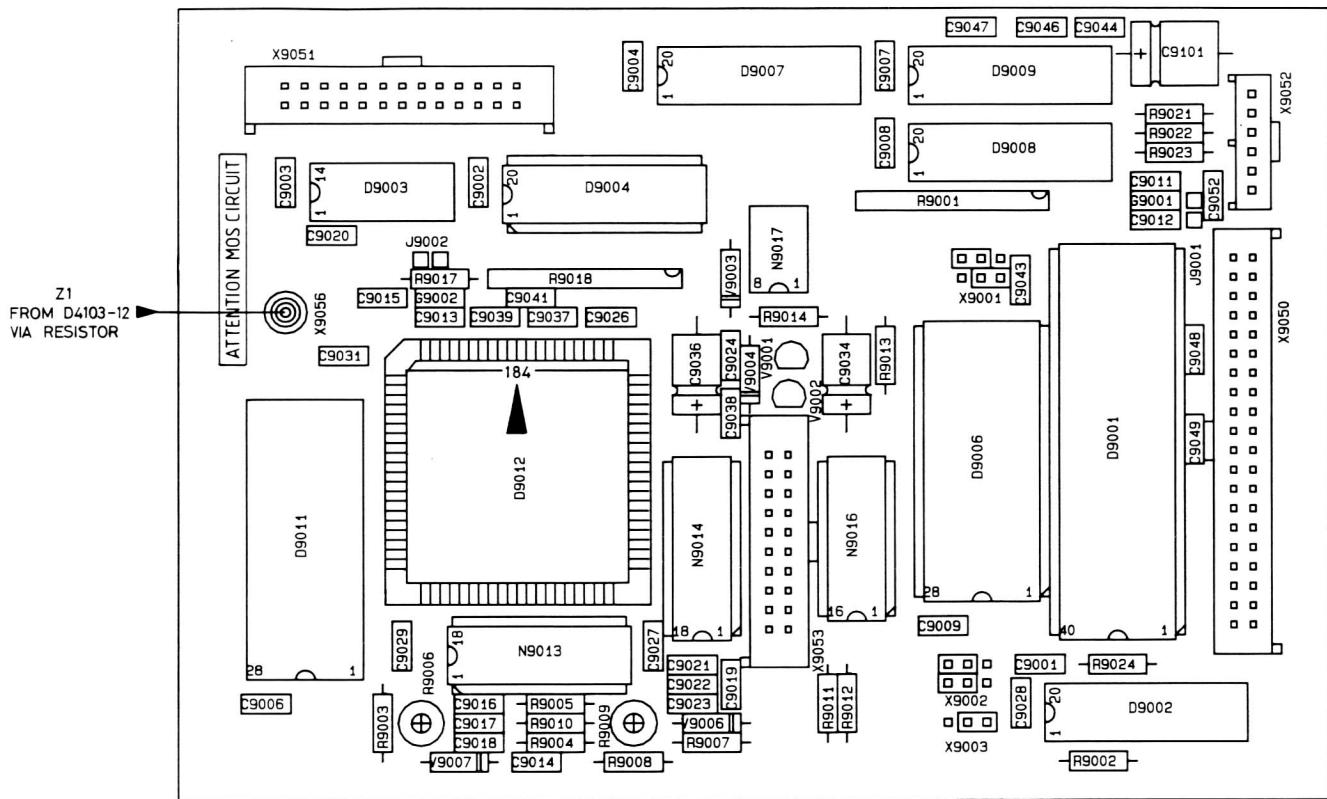
Figure 5.2 Processor unit p.c.b.
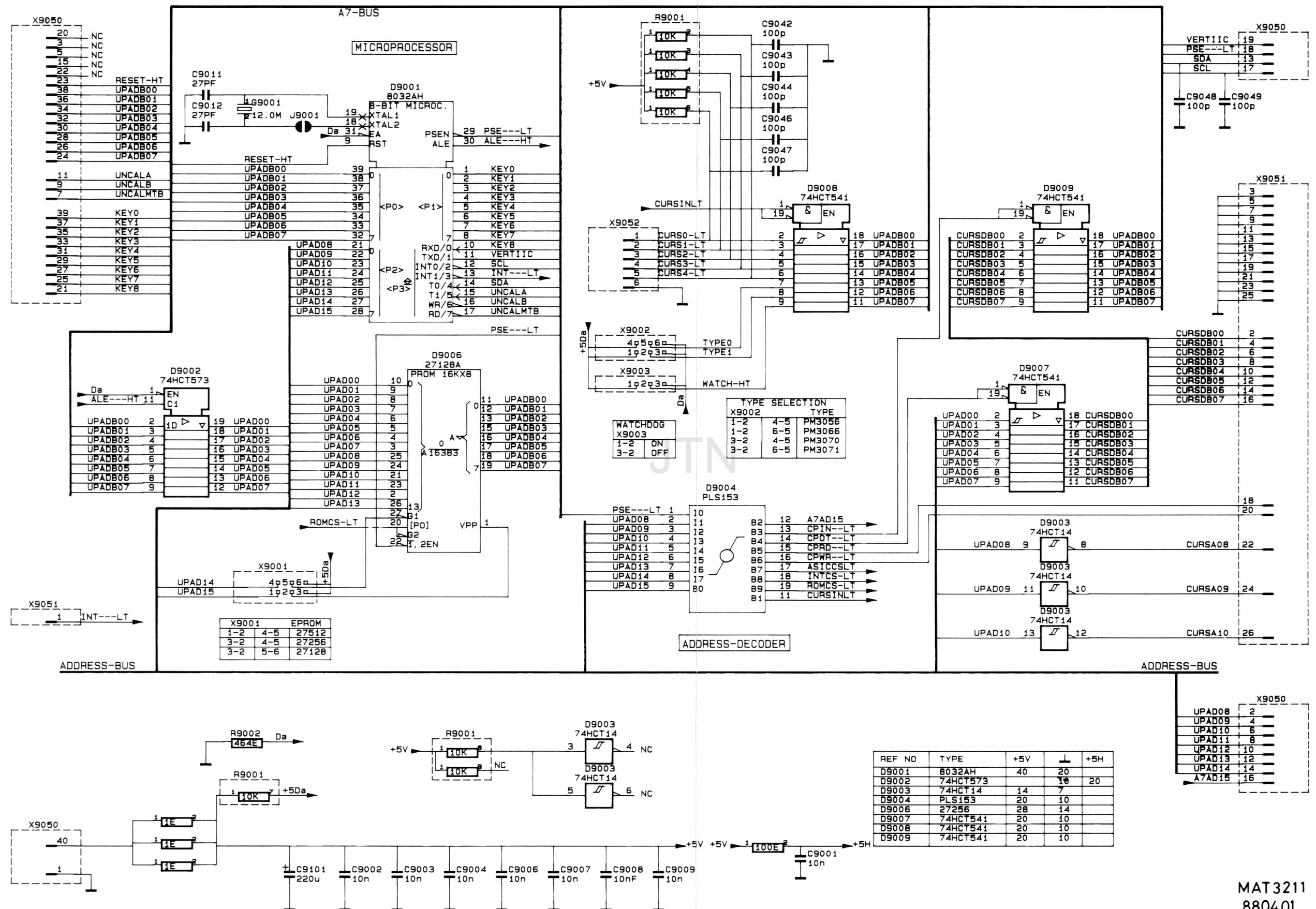
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Figure 5.3 Circuit diagram of processor unit, processor part

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Figure 5.4 Circuit diagram of processor unit, text/cursor part
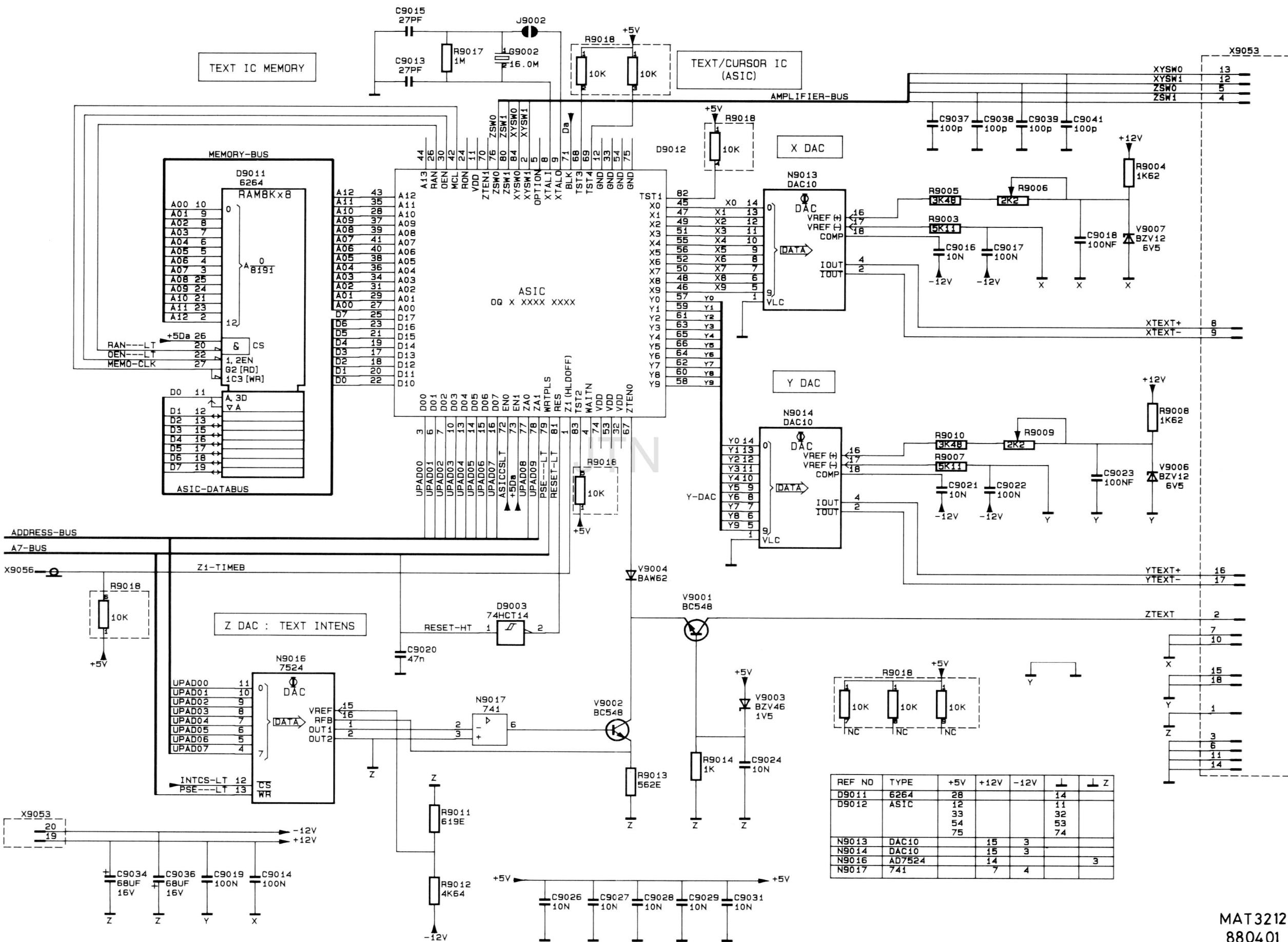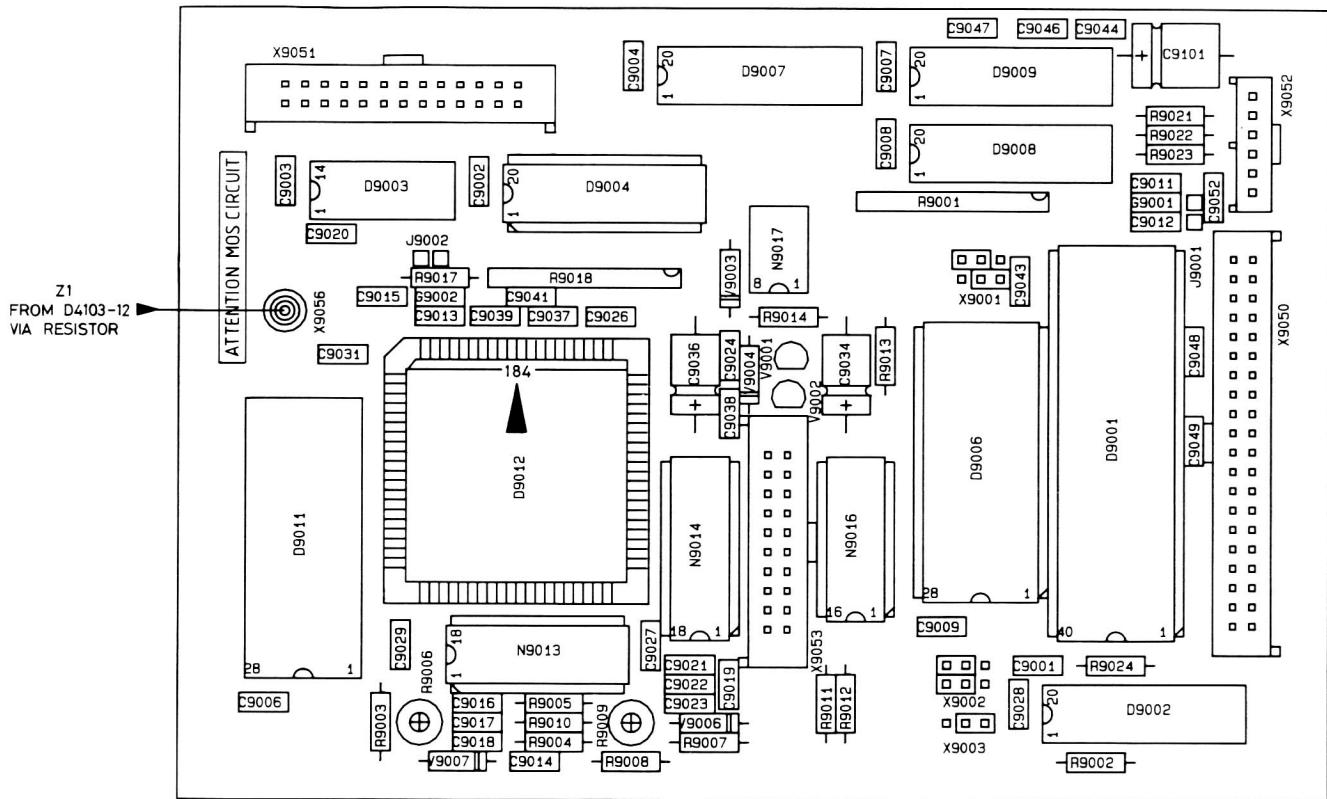
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Figure 5.5 Processor unit p.c.b.

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6. CHECKING AND ADJUSTING

6.1 INTRODUCTION

Because the XYZ-amplifier in the PM3070-PM3072 is different as in the PM3065 oscilloscope, the square-wave response adjustment as described in the PM3065 Service manual must be replaced by the following square-wave response adjustment. As an addition, the text and cursor circuit must be adjusted.

6.2 CHECKING AND ADJUSTING PROCEDURE

The adjusting elements are given in figure 6.1

NOTE: Use always an insulated adjustment tool.
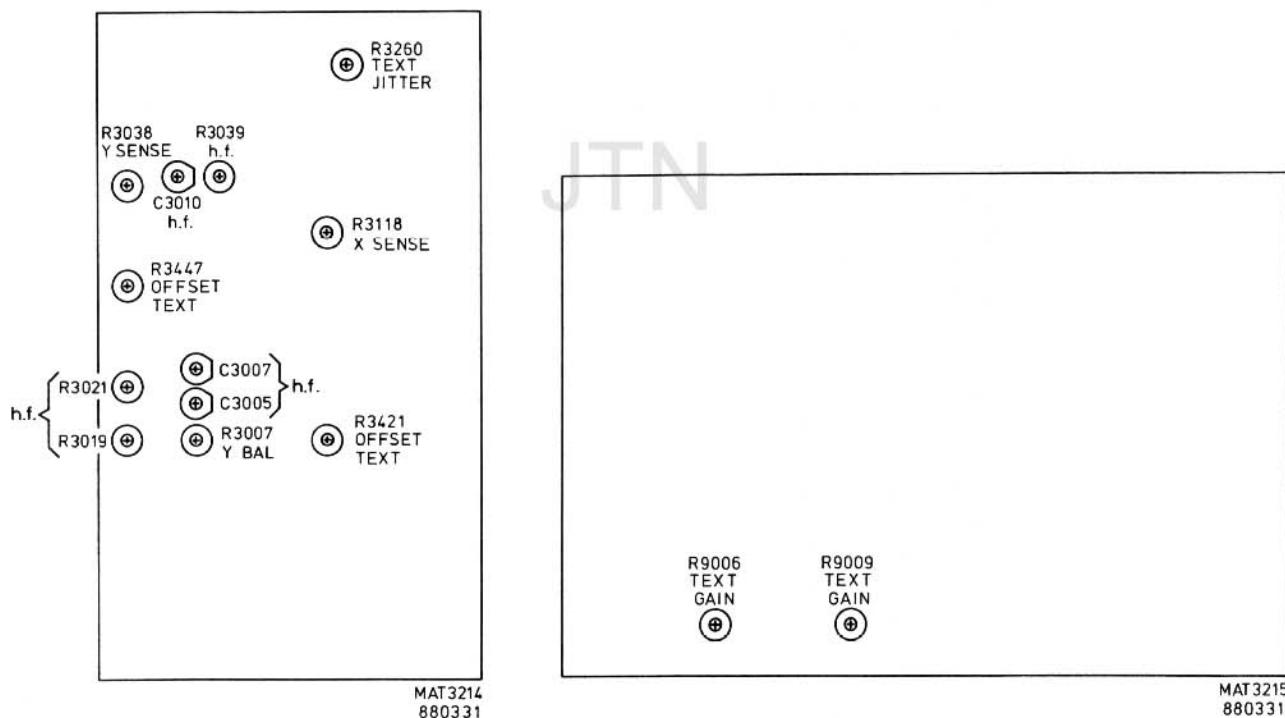
Figure 6.1 Adjusting elements on unit A3 and A9

6.2.1   Square wave response

Adjustment of square-wave response:
- Apply a 500 mV/ 1 MHz calibrated square-wave signal with rise time faster than 1 nsec to input A.
- Press AUTO SET key.
- Set UP-DOWN ch. A to 100 mV.
- Set UP-DOWN MTB to 50 nanosec.
- Press TB MAGN to *10.
- Preset C1051 in mid-position.
- Preset R3039 counter clock-wise.
- Preset C3010 for minimum overshoot.
- Press TB MAGN to *1.
- Set UP-DOWN MTB to 0,5 microsec.
- Adjust the square-wave response with R3021.
- Set UP-DOWN MTB to 0,1 microsec upto 5 nanosec.
- Adjust the square-wave response with R3019, C3007, C3005, C3010 and R3039 for optimum rise-time and minimum overshoot.
- Decrease the input voltage to 50 mV.
- Set UP-DOWN ch. A to 10 mV.
- Adjust the square-wave response with C1056.

- Apply the 500 mV/1 MHz calibrated square-wave signal to input B.
- Press AUTO SET key.
- Set UP-DOWN key ch. B to 100 mV.
- Set UP-DOWN key MTB to 5 nanosec.
- Adjust the square-wave response with C1151.
- Decrease the input voltage to 50 mV.
- Set UP-DOWN ch. B to 10 mV.
- Adjust the square-wave response with C1156.

- Apply the 500 mV/1 MHz calibrated square-wave signal to input EXT.
- Press TRIG VIEW key.
- Press TRIG or X SOURCE key for EXT DC source.
- Press TRIG COUPL key for DC triggering.
- Set the square-wave signal to + and - 2,5 divisions from the screencentre by means of the LEVEL control.
- Adjust the square-wave response with C1216.
- Remove the input signal again.
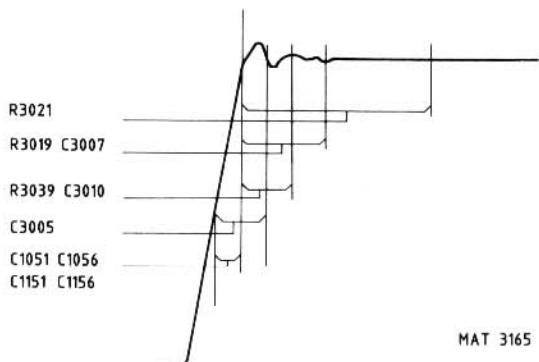

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R3021
R3019 C3007
R3039 C3010
C3005
C1051 C1056
C1151 C1156
                                    MAT 3165
```

Figure 6.2 Square-wave response

Checking the chopper interference:
- Press A/B key so that both channels A and B are displayed.
- Press ALT/CHOP key for a chopped display.
- Set UP-DOWN ch. A and ch. B to 1 V.
- Press TB MAGN again for *1 magnification.
- Set UP-DOWN MTB to 0,5 msec.
- Press both GND keys for channel A and B.
- Adjust Y POS A and Y POS B controls for a 6 division distance between both lines.
- Ensure that the chopper interference between both channels is as small as possible; if necessary, readjust R3021.

NOTE: When readjustment of R3021 is necessary, it is recommended to ensure that the h.f. square-response is still correct. If necessary, readjust the relevant adjusting components

6.2.2   Text and cursor adjustment

Gain and affset adjustment:
The adjustment in this Section is performed in the SERVICE MENU.
To enter this service menu, proceed as follows:
- Press MENU key and keep it pressed.
- Press also AUTO SET key.
- Now the CRT screen shows a square.
- Adjust potentiometers R9006 and R9009 for gain and R3421 and R3447 for offset so that the square area of 6 x 8 divisions lies symmetrically in the centre of the graticule.

NOTE: Because the potentiometers influences each other it is advised to repeat the sequence several times to optimise the adjustment.

- Press AUTO SET for leaving the service menu again.

Text jitter:
- Set UP/DOWN MTB to 0,2 ms.
- Press TB MAGN for *10 magnification.
- Adjust R3260 so that the text remain still.

7. PARTS LIST
(Subject to alteration without notice)

Only the different parts with respect to the PM3065 are given in the partslist below.

7.1 MECHANICAL PARTS

The itemnumber indication corresponds with the list in the Service manual PM3065. The standard bezel has been changed into a new bezel, which includes also the five CRT softkeys. Figure 7.1 gives the different parts of this bezel assembly.

Item	Qty	Ordering code	Description
1	1	5322 459 20502	Bezel
1a	1	5322 414 20213	Button
1b	1	5322 464 90484	Cover
1c	1	5322 216 51209	Cursor unit
3	1	5322 455 81068	Textfilm on bezel PM3070
3	1	5322 455 81069	Textfilm on bezel PM3072
9	1	5322 455 81071	Textfilm for handle PM3070
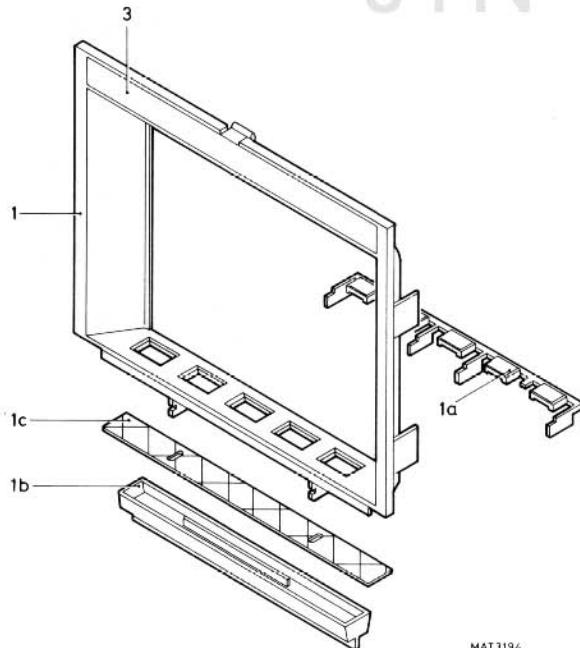
Figure 7.1 Bezel assembly

7.2 UNITS

Item	Unit nr.	Ordering code	Description
3	A3	5322 214 90094	XYZ-amplifier unit
–	A9	5322 214 90095	Processor unit
–	A19	5322 216 51209	Cursor unit
7	A7	5322 214 90096	Front unit

7.3   CABLES AND CONNECTORS

7.3.1   p.c.b.-Connectors (male headers)

Type	Item	Ordering code
3 pole-single	X9003	5322 265 30396
3 pole-single	X3004, X3005, X3008	5322 265 30433
3 pole-double	X9001, X9002	5322 265 30446
6 pole single	X9052	5322 265 30472
20 pole-double	X3002, X3003, X3009, X3010, X3012, X9053	5322 265 51129
40 pole-double	X9050	5322 265 61072

7.3.2   50 Ohm cables and connectors

The 50 Ohm coax-cables are standerdized, so the cable might have a
different length and the tules around the cable end might have the
wrong colour.
- Cable, 30 cm long, 90° type   5322 321 22617

The 50 Ohm coax-connector consists of two parts, bush and pin.
- Outer part (bush)   5322 268 24116
- Inner part (pin)   5322 268 14141

7.3.3   Jumpers

2 pins jumpers, used on unit A9:   5322 263 60062

7.3.4   Miscellaneous sockets

Socket for D9001, 40 pins: 5322 255 44217
Socket for D9004, 20 pins: 5322 255 40425
Socket for D9006, 28 pins: 5322 255 44047
Socket for D9012, 84 pins: 5322 255 40828
Socket for N9013, 18 pins: 5322 255 44233
Socket for N9014. 18 pins: 5322 255 44233
Socket for N9016, 16 pins: 5322 255 44218

7.4 ELECTRICAL PARTS

POSNR	DESCRIPTION	ORDERING CODE
CAPACITORS		
C 3001	50V 10% 10NF	5322 122 34098
C 3002	50V 5% 100PF	5322 122 32532
C 3003	50V 5% 100PF	5322 122 32532
C 3005	7-10.0 PF MUR	5322 125 11013
C 3007	7-10.0 PF MUR	5322 125 11013
C 3009	50V 5% 6.8PF	4822 122 32507
C 3010	7-10.0 PF MUR	5322 125 11013
C 3011	50V 5% 56PF	5322 122 32661
C 3013	50V 5% 1PF	5322 122 32447
C 3014	50V 5% 1PF	5322 122 32447
C 3021	-20+50% 10NF	4822 122 31414
C 3022	-20+50% 10NF	4822 122 31414
C 3101	50V 5% 100PF	5322 122 32532
C 3102	50V 5% 100PF	5322 122 32532
C 3103	50V 10% 10NF	5322 122 34098
C 3104	50V 10% 1.5NF	5322 122 31865
C 3106	50V 5% 15PF	5322 122 32481
C 3107	50V 10% 1.5NF	5322 122 31865
C 3108	50V 10% 2.7NF	4822 122 31783
C 3109	50V 10% 2.7NF	4822 122 31783
C 3110	50V 5% 1PF	5322 122 32447
C 3112	50V 10% 100NF	4822 122 33156
C 3113	50V 10% 100NF	4822 122 33156
C 3114	50V 10% 10NF	5322 122 34098
C 3116	50V 10% 100NF	4822 122 33156
C 3117	50V 10% 100NF	4822 122 33156
C 3118	50V 10% 100NF	4822 122 33156
C 3120	50V 5% 1PF	5322 122 32447
C 3122	50V 10% 100NF	4822 122 33156
C 3124	50V 10% 100NF	4822 122 33156
C 3125	50V 5% 470PF	5322 122 32268
C 3126	50V 5% 470PF	5322 122 32268
C 3201	50V 5% 27PF	4822 122 31825
C 3202	50V 10% 10NF	5322 122 34098
C 3203	50V 5% 33PF	5322 122 32659
C 3204	50V 10% 22NF	5322 122 32654
C 3206	50V 10% 10NF	5322 122 34098
C 3212	50V 10% 100NF	4822 122 33156
C 3213	50V 10% 100NF	4822 122 33156
C 3214	50V 10% 100NF	4822 122 33156
C 3216	50V 10% 100NF	4822 122 33156
C 3217	50V 10% 100NF	4822 122 33156
C 3218	50V 10% 100NF	4822 122 33156
C 3222	50V 10% 100NF	4822 122 33156
C 3223	50V 10% 100NF	4822 122 33156
C 3224	50V 10% 100NF	4822 122 33156
C 3226	50V 10% 100NF	4822 122 33156
C 3227	50V 10% 100NF	4822 122 33156
C 3251	10% 470PF	4822 122 30034
C 3252	-20+50% 2.2NF	5322 122 50093
C 3253	-20+50% 2.2NF	5322 122 50093
C 3254	100V 10% 10NF	5322 121 43086
C 3256	63V 10% 220NF	5322 121 43084
C 3257	-20+50% 1.5NF	5322 122 50092
C 3258	-20+50% 1.5NF	5322 122 50092
C 3259	-20+50% 1.5NF	5322 122 50092
C 3261	-20+50% 10NF	4822 122 31414
C 3262	-20+50% 10NF	4822 122 31414
C 3263	0.25PF 0.56PF	5322 122 32107
C 3264	50V 10% 10NF	5322 122 34098
C 3301	-10+50% 47UF	4822 124 20699
C 3302	50V 10% 10NF	5322 122 34098
C 3303	-10+50% 47UF	4822 124 20699
C 3304	50V 10% 10NF	5322 122 34098
C 3305	-20+50% 10NF	4822 122 31414
C 3306	-20+50% 10NF	4822 122 31414
C 3307	-20+50% 10NF	4822 122 31414
C 3308	-20+50% 10NF	4822 122 31414
C 3309	50V 10% 10NF	5322 122 34098
C 3311	-10+50% 47UF	4822 124 20699
C 3312	-10+50% 47UF	4822 124 20699
C 3313	50V 10% 10NF	5322 122 34098
C 3314	-10+50% 15UF	4822 124 20729
C 3316	50V 10% 10NF	5322 122 34098
C 3317	-20+50% 10NF	4822 122 31414
C 3318	-20+50% 10NF	4822 122 31414
C 3319	-10+50% 15UF	4822 124 20729
C 3321	50V 10% 10NF	5322 122 34098
C 3322	-20+50% 10NF	4822 122 31414
C 3324	50V 10% 10NF	5322 122 34098
C 3326	50V 10% 10NF	5322 122 34098
C 3404	50V 5% 100PF	5322 122 32532
C 3407	50V 10% 10NF	5322 122 34098
C 3409	50V 5% 100PF	5322 122 32532
C 3410	50V 5% 150PF	4822 122 31808
C 3411	50V 5% 100PF	5322 122 32532
C 3412	50V 10% 1.5NF	5322 122 31865
C 3413	50V 10% 10NF	5322 122 34098
C 3414	50V 10% 1.5NF	5322 122 31865
C 3441	50V 5% 100PF	5322 122 32532
C 3442	50V 5% 100PF	5322 122 32532
C 3443	50V 5% 100PF	5322 122 32532
C 3444	50V 10% 10NF	5322 122 34098
C 3446	50V 5% 100PF	5322 122 32532
C 3447	50V 5% 1NF	5322 122 32531
C 3450	50V 5% 1NF	5322 122 32531
C 3451	50V 5% 100PF	5322 122 32532
C 9001	100V 10% 10NF	5322 121 43086
C 9002	100V 10% 10NF	5322 121 43086
C 9003	100V 10% 10NF	5322 121 43086
C 9004	100V 10% 10NF	5322 121 43086
C 9006	100V 10% 10NF	5322 121 43086
C 9007	100V 10% 10NF	5322 121 43086
C 9008	100V 10% 10NF	5322 121 43086
C 9009	100V 10% 10NF	5322 121 43086
C 9011	2% 27PF	4822 122 30045
C 9012	2% 27PF	4822 122 30045
C 9013	2% 27PF	4822 122 30045
C 9014	63V 10% 100NF	5322 121 43083
C 9015	2% 27PF	4822 122 30045
C 9016	100V 10% 10NF	5322 121 43086
C 9017	100V 10% 100NF	5322 121 43083
C 9018	63V 10% 100NF	5322 121 43083
C 9019	63V 10% 100NF	5322 121 43083
C 9021	100V 10% 10NF	5322 121 43086
C 9022	63V 10% 100NF	5322 121 43083
C 9023	63V 10% 100NF	5322 121 43083
C 9024	100V 10% 10NF	5322 121 43086
C 9026	100V 10% 10NF	5322 121 43086
C 9027	100V 10% 10NF	5322 121 43086
C 9028	100V 10% 10NF	5322 121 43086
C 9029	100V 10% 10NF	5322 121 43086
C 9031	100V 10% 10NF	5322 121 43086
C 9034	-10+50% 68UF	4822 124 20689
C 9036	-10+50% 68UF	4822 124 20689
C 9101	-10+50% 220UF	4822 124 20681
RESISTORS		
R 3000	MCR18 1% 75E	4822 111 90371
R 3001	MCR18 1% 75E	4822 111 90371
R 3002	MCR18 1% 22E	4822 111 90186
R 3003	MCR18 1% 1K5	4822 111 90151
R 3004	MCR18 1% 1K	5322 111 90092
R 3006	MCR18 1% 100E	5322 111 91134
R 3007	MCR18 1% 2K4	5322 111 91468
R 3008	0.3W 25% 2K2	5322 105 20033
R 3009	MCR18 1% 3K9	5322 111 91135
R 3010	MCR18 1% 100E	5322 111 91134
R 3011	MCR18 1% 22E	4822 111 90186
R 3012	MCR18 1% 1K2	5322 111 90096
R 3013	MCR18 1% 1K2	5322 111 90096
R 3014	MCR18 1% 5K1	5322 111 91471
R 3016	MCR18 1% 120E	4822 111 90339
R 3017	MCR18 1% 120E	4822 111 90339
R 3018	MCR18 1% 5K1	5322 111 91471
R 3019	0.3W 25% 10K	4822 105 10455
R 3021	0.3W 25% 10K	4822 105 10455
R 3022	0.3W 25% 220K	5322 105 20039
R 3023	MCR18 1% 20K	5322 116 80601
R 3024	MCR18 1% 130E	5322 116 80593
R 3026	MCR18 1% 130E	5322 116 80593
R 3027	MCR18 1% 300E	5322 111 91469
R 3028	MRS25 1% 511E	5322 116 53135
R 3029	MCR18 1% 510E	4822 111 90245
R 3031	MCR18 1% 2K7	4822 111 90569
R 3032	MRS25 1% 196E	5322 116 53492
R 3033	MCR18 1% 620E	5322 116 80607
R 3034	MRS25 1% 51E1	5322 116 53213
R 3036	MRS25 1% 51E1	5322 116 53213
R 3037	MRS25 1% 31E6	5322 116 54964
R 3038	0.3W 25% 220E	5322 105 20031
R 3039	0.3W 25% 470E	5322 105 20729
R 3041	MRS25 1% 31E6	5322 116 54964
R 3042	MCR18 1% 100E	5322 111 91134
R 3043	MCR18 1% 390E	5322 111 91205
R 3044	MCR18 1% 510E	4822 111 90245
R 3045	MRS25 1% 511E	5322 116 53135

POSNR	DESCRIPTION			ORDERING CODE
R 3046	MCR18	1%	300E	5322 111 91469
R 3047	MCR18	1%	300E	5322 111 91469
R 3048	MCR18	1%	300E	5322 111 91469
R 3051	MRS25	1%	51E1	5322 116 53213
R 3052	MRS25	1%	21E5	5322 116 53426
R 3053	MRS25	1%	21E5	5322 116 53426
R 3054	MRS25	1%	51E1	5322 116 53213
R 3056	MRS25	1%	26E1	5322 116 53723
R 3057	MRS25	1%	121E	4822 116 52955
R 3058	MRS25	1%	121E	4822 116 52955
R 3059	MRS25	1%	287E	5322 116 53221
R 3061	MRS25	1%	287E	5322 116 53221
R 3062	MRS25	1%	287E	5322 116 53221
R 3063	MRS25	1%	261E	5322 116 53549
R 3064	MRS25	1%	261E	5322 116 53549
R 3066	MRS25	1%	261E	5322 116 53549
R 3067	MRS25	1%	261E	5322 116 53549
R 3068	MRS25	1%	261E	5322 116 53549
R 3069	MRS25	1%	261E	5322 116 53549
R 3071	MRS25	1%	287E	5322 116 53221
R 3072	MRS25	1%	287E	5322 116 53221
R 3073	MRS25	1%	287E	5322 116 53221
R 3074	MRS25	1%	121E	4822 116 52955
R 3076	MRS25	1%	121E	4822 116 52955
R 3077	MRS25	1%	26E1	5322 116 53723
R 3078	MRS25	1%	42E2	5322 116 53515
R 3079	MRS25	1%	100K	4822 116 52973
R 3081	MRS25	1%	100K	4822 116 52973
R 3082	MRS25	1%	42E2	5322 116 53515
R 3100	MCR18	1%	47E	4822 111 90217
R 3101	MCR18	1%	5K6	4822 111 90572
R 3102	MCR18	1%	560E	5322 111 90113
R 3103	MCR18	1%	1K2	5322 111 90096
R 3104	MCR18	1%	6K8	4822 111 90544
R 3105	MCR18	1%	5K1	5322 111 91471
R 3106	MCR18	1%	47E	4822 111 90217
R 3107	MCR18	1%	2K7	4822 111 90569
R 3108	MCR18	1%	1K	5322 111 90092
R 3109	MCR18	1%	5K6	4822 111 90572
R 3110	MCR18	1%	47E	4822 111 90217
R 3111	MCR18	1%	47E	4822 111 90217
R 3112	MCR18	1%	6K8	4822 111 90544
R 3113	MCR18	1%	1K2	5322 111 90096
R 3114	MCR18	1%	5K6	4822 111 90572
R 3115	MCR18	1%	47E	4822 111 90217
R 3116	MCR18	1%	560E	5322 111 90113
R 3117	MCR18	1%	5K6	4822 111 90572
R 3118	0.3W	25%	1K	5322 105 20032
R 3119	MCR18	1%	5K6	4822 111 90572
R 3120	MCR18	1%	47E	4822 111 90217
R 3121	MCR18	1%	47K	5322 116 80446
R 3122	MCR18	1%	6K8	4822 111 90544
R 3123	MCR18	1%	200E	5322 116 80599
R 3124	MCR18	1%	750E	5322 111 91539
R 3126	MRS25	1%	14K7	4822 116 53531
R 3127	MCR18	1%	1K3	5322 116 80594
R 3128	MCR18	1%	820E	4822 111 90171
R 3129	MCR18	1%	1K2	5322 111 90096
R 3131	MCR18	1%	1K3	5322 116 80594
R 3132	MCR18	1%	820E	4822 111 90171
R 3133	MCR18	1%	1K2	5322 111 90096
R 3134	MRS25	1%	14K7	4822 116 53531
R 3135	MCR18	1%	1K6	5322 116 80596
R 3136	MCR18	1%	1K6	5322 116 80596
R 3137	MCR18	1%	47K	5322 116 80446
R 3138	MCR18	1%	6K8	4822 111 90544
R 3139	MCR18	1%	200E	5322 116 80599
R 3140	MCR18	1%	390E	5322 111 91205
R 3141	MCR18	1%	330E	5322 111 90106
R 3142	MCR18	1%	330E	5322 111 90106
R 3143	MCR18	1%	100E	5322 111 91134
R 3143	MRS25	1%	10E	4822 111 52891
R 3144	MCR18	1%	100E	5322 111 91134
R 3144	MRS25	1%	10E	4822 111 52891
R 3145	MCR18	1%	390E	5322 111 91205
R 3146	MCR18	1%	750E	5322 111 91539
R 3148	MCR18	1%	9K1	5322 116 80611
R 3201	MCR18	1%	47E	4822 111 90217
R 3202	MCR18	1%	10K	4822 111 90249
R 3204	MCR18	1%	6K2	5322 116 80608
R 3207	MCR18	1%	16K	5322 116 80597
R 3208	MCR18	1%	120E	4822 111 90339
R 3209	MCR18	1%	2K2	4822 111 90248
R 3210	MCR18	1%	4K7	5322 111 90111
R 3211	MCR18	1%	47E	4822 111 90217
R 3212	MCR18	1%	5K1	5322 111 91471
R 3213	MCR18	1%	47E	4822 111 90217
R 3214	MCR18	1%	47E	4822 111 90217
R 3216	MCR18	1%	10K	4822 111 90249
R 3217	MCR18	1%	15K	4822 111 90196
R 3218	MCR18	1%	100E	5322 111 91134
R 3219	MCR18	1%	100E	5322 111 91134
R 3220	MCR18	1%	3K3	4822 111 90157
R 3221	MCR18	1%	270E	4822 111 90154
R 3222	MCR18	1%	47E	4822 111 90217
R 3223	MCR18	1%	120E	4822 111 90339
R 3224	MCR18	1%	120E	4822 111 90339
R 3225	MCR18	1%	100E	5322 111 91134
R 3226	MCR18	1%	510E	4822 111 90245
R 3227	MCR18	1%	47E	4822 111 90217
R 3228	MCR18	1%	1K6	5322 116 80596
R 3229	MCR18	1%	10K	4822 111 90249
R 3230	MCR18	1%	100E	5322 111 91134
R 3231	MCR18	1%	11K	5322 111 91467
R 3232	MCR18	1%	1K2	5322 111 90096
R 3233	MCR18	1%	270E	4822 111 90154
R 3234	MCR18	1%	8K2	5322 111 90118
R 3236	MCR18	1%	22K	5322 111 91349
R 3237	MCR18	1%	1K2	5322 111 90096
R 3238	MCR18	1%	82K	4822 111 90575
R 3239	MCR18	1%	7K5	5322 116 80609
R 3241	MCR18	1%	1K	5322 111 90092
R 3242	MCR18	1%	100E	5322 111 91134
R 3244	VR25	5%	2M7	4822 110 72198
R 3246	MCR18	1%	24K	5322 116 80602
R 3247	MCR18	1%	1K2	5322 111 90096
R 3248	MCR18	1%	82K	4822 111 90575
R 3249	MCR18	1%	7K5	5322 116 80609
R 3250	MCR18	1%	16K	5322 116 80597
R 3251	MCR18	1%	1K	5322 111 90092
R 3252	MCR18	1%	100E	5322 111 91134
R 3254	MCR18	1%	180K	5322 116 80598
R 3255	MCR18	1%	16K	5322 116 80597
R 3256	MRS25	1%	10K	4822 116 53022
R 3257	MRS25	1%	1K47	5322 116 53185
R 3258	MRS25	1%	178K	5322 116 53555
R 3259	MRS25	1%	511E	5322 116 53135
R 3261	MRS25	1%	2K37	5322 116 53536
R 3262	MRS25	1%	61K9	5322 116 53233
R 3263	MRS25	1%	23K7	5322 116 53537
R 3264	MRS25	1%	31K6	5322 116 53262
R 3265	MRS25	1%	215K	5322 116 53425
R 3266	MRS25	1%	38K3	4822 116 53526
R 3267	MRS25	1%	1M	4822 116 52843
R 3268	MRS25	1%	100K	4822 116 52973
R 3269	MRS25	1%	100E	5322 116 53126
R 3271	MRS25	1%	1M	4822 116 52843
R 3273	MRS25	1%	75K	5322 116 53266
R 3274	MRS25	1%	681K	5322 116 53593
R 3276	VR25	5%	3M3	4822 110 72201
R 3277	VR25	5%	3M3	4822 110 72201
R 3278	VR25	5%	3M3	4822 110 72201
R 3281	VR25	5%	3M3	4822 110 72201
R 3283	MRS25	1%	23K7	5322 116 53537
R 3284	MRS25	1%	14K7	4822 116 53531
R 3286	MRS25	1%	1K	4822 116 53108
R 3302	RC-01	5%	4E7	5322 111 90376
R 3303	RC-01	5%	3E9	4822 111 90391
R 3304	RC-01	5%	3E9	4822 111 90391
R 3305	RC-01	5%	1E	4822 111 90184
R 3306	MRS25	1%	2K87	5322 116 53513
R 3308	MCR18	1%	10E	5322 111 90095
R 3309	RC-01	5%	4E7	5322 111 90376
R 3311	MRS25	1%	5E11	4822 116 52999
R 3312	MRS25	1%	5E11	4822 116 52999
R 3313	MCR18	1%	10E	5322 111 90095
R 3401	MCR18	1%	2K2	4822 111 90248
R 3402	MCR18	1%	120E	4822 111 90339
R 3404	MCR18	1%	4K3	5322 116 80605
R 3406	MCR18	1%	47E	4822 111 90217
R 3407	MCR18	1%	47E	4822 111 90217
R 3408	MCR18	1%	680E	4822 111 90162
R 3409	MCR18	1%	680E	4822 111 90162
R 3411	MCR18	1%	120E	4822 111 90339
R 3412	MCR18	1%	3K9	5322 111 91135
R 3413	MCR18	1%	120E	4822 111 90339
R 3414	MCR18	1%	33K	5322 116 80441
R 3416	MCR18	1%	120E	4822 111 90339
R 3417	MCR18	1%	3K9	5322 111 91135
R 3418	MCR18	1%	3K6	5322 116 80604
R 3419	MCR18	1%	22K	5322 111 91349
R 3421	0.3W	25%	10K	4822 105 10455
R 3422	MCR18	1%	47E	4822 111 90217
R 3423	MCR18	1%	47E	4822 111 90217
R 3424	MCR18	1%	47E	4822 111 90217
R 3426	MCR18	1%	47E	4822 111 90217
R 3427	MCR18	1%	20K	5322 116 80601
R 3428	MCR18	1%	2K7	4822 111 90569
R 3429	MCR18	1%	8K2	5322 111 90118
R 3430	MCR18	1%	100E	5322 111 91134

POSNR	DESCRIPTION	ORDERING CODE		POSNR	DESCRIPTION	ORDERING CODE
R 3431	MCR18 1% 8K2	5322 111 90118		V 3266	BAV21	4822 130 30842
R 3435	MCR18 1% 100E	5322 111 91134		V 3267	BAW62	4822 130 30613
R 3439	MCR18 1% 13K	5322 116 80595		V 3268	BAW62	4822 130 30613
R 3440	MCR18 1% 16K	5322 116 80597		V 3269	BF423	4822 130 41646
R 3441	MCR18 1% 4K7	5322 111 90111		V 3271	BF423	4822 130 41646
R 3442	MCR18 1% 4K7	5322 111 90111		V 3272	BF423	4822 130 41646
R 3443	MCR18 1% 3K6	5322 116 80604		V 3301	BZX79-C6V2	4822 130 34167
R 3444	MCR18 1% 120E	4822 111 90339		V 3401	BF824	4822 130 60383
R 3446	MCR18 1% 22K	5322 111 91349		V 3402	BF824	4822 130 60383
R 3447	0.3W 25% 10K	4822 105 10455		V 3403	BZX84-C10	4822 130 33698
R 3448	MCR18 1% 120E	4822 111 90339		V 3404	BF824	4822 130 60383
R 3449	MCR18 1% 3K6	5322 116 80604		V 3405	BAV70	5322 130 34331
R 3451	MCR18 1% 47E	4822 111 90217		V 3407	BZX84-C6V8	5322 130 80406
R 3452	MCR18 1% 47E	4822 111 90217		V 3408	BF824	4822 130 60383
R 3453	MCR18 1% 15K	4822 111 90196		V 3410	BAS16	5322 130 31928
R 3454	MCR18 1% 6K2	5322 116 80608		V 3415	BAV70	5322 130 34331
R 3456	MCR18 1% 680E	4822 111 90162		V 3420	BAS16	5322 130 31928
R 3457	MCR18 1% 680E	4822 111 90162		V 3441	BCW30	5322 130 44335
R 9001	-105-103 10K	5322 111 90473		V 3442	BCW30R	5322 130 44341
R 9002	MRS25 1% 464E	5322 116 53232		V 3443	BAV70	5322 130 34331
R 9003	MRS25 1% 5K11	5322 116 53494		V 3447	BAV70	5322 130 34331
R 9004	MRS25 1% 1K62	5322 116 53257		V 3448	BSV52	5322 130 44336
R 9005	MRS25 1% 3K48	4822 116 53315		V 3449	BSV52	5322 130 44336
R 9006	0.3W 25% 2K2	5322 105 20033		V 3451	BAV70	5322 130 34331
R 9007	MRS25 1% 5K11	5322 116 53494		V 3453	BZX84-C9V1	4822 130 33996
R 9008	MRS25 1% 1K62	5322 116 53257		V 3454	BAV70	5322 130 34331
R 9009	0.3W 25% 2K2	5322 105 20033		V 9001	BF199	4822 130 44154
R 9010	MRS25 1% 3K48	4822 116 53315		V 9002	BC548C	4822 130 44196
R 9011	MRS25 1% 619R	5322 116 53337		V 9003	BZV46-C1V5	5322 130 34865
R 9012	MRS25 1% 4K64	5322 116 53212		V 9004	BAW62	4822 130 30613
R 9013	MRS25 1% 562R	5322 116 53214		V 9006	BZV12	5322 130 34269
R 9014	MRS25 1% 1K	4822 116 53108		V 9007	BZV12	5322 130 34269
R 9017	MRS25 1% 1M	4822 116 52843				
R 9018	-105-103	5322 111 90473			INTEGRATED CIRCUITS	

SEMI-CONDUCTORS

POSNR	DESCRIPTION	ORDERING CODE
V 3001	BFT92	5322 130 44711
V 3002	BFT92R	5322 130 44713
V 3003	BCW30	5322 130 44335
V 3004	BFR93	5322 130 44801
V 3005	BSV52	5322 130 44336
V 3006	BFR93R	5322 130 44802
V 3007	BSV52	5322 130 44336
V 3010	BAS16	5322 130 31928
V 3011	2N3866-01	5322 130 41799
V 3012	2N3866-01	5322 130 41799
V 3013	BZX79-C33	4822 130 34142
V 3014	BZX79-C33	4822 130 34142
V 3101	BF824	4822 130 60383
V 3102	BF824	4822 130 60383
V 3103	BF824	4822 130 60383
V 3104	BCW30	5322 130 44335
V 3106	BF824	4822 130 60383
V 3109	BSV52	5322 130 44336
V 3111	BSV52	5322 130 44336
V 3112	2N5551	5322 130 44491
V 3113	BZX84-C5V6	4822 130 80125
V 3114	2N5551	5322 130 44491
V 3115	BCW30	5322 130 44335
V 3116	2N5551	5322 130 44491
V 3117	2N5401	5322 130 42534
V 3118	2N5551	5322 130 44491
V 3119	2N5401	5322 130 42534
V 3201	BFS20	5322 130 42718
V 3202	BFS20	5322 130 42718
V 3203	BFS20	5322 130 42718
V 3206	BF824	4822 130 60383
V 3207	BF824	4822 130 60383
V 3211	BSV52	5322 130 44336
V 3212	2N5551	5322 130 44491
V 3213	2N5401	5322 130 42534
V 3214	BZX84-C5V6	4822 130 80125
V 3216	BSV52	5322 130 44336
V 3217	2N5401	5322 130 42534
V 3218	2N5551	5322 130 44491
V 3221	BCW33	5322 130 44337
V 3251	BC548C	4822 130 44196
V 3252	BF423	4822 130 41646
V 3253	BF423	4822 130 41646
V 3254	BAW62	4822 130 30613
V 3257	BAW62	4822 130 30613
V 3258	BZX79-C9V1	4822 130 30862
V 3259	BAW62	4822 130 30613
V 3261	BAW62	4822 130 30613
V 3262	BZX79-C68	4822 130 30864
V 3263	BF423	4822 130 41646
V 3264	BZX79-C6V2	4822 130 34167

INTEGRATED CIRCUITS

POSNR	DESCRIPTION	ORDERING CODE
D 9001	P8032AH	5322 209 11318
D 9002	PC74HCT573P	5322 209 11488
D 9003	PC74HCT14P	5322 209 11378
D 9004	PLS153AF	5322 209 51389
D 9008	PC74HCT541P	5322 209 11487
D 9011	HM6264LP-15	5322 209 50671
N 9013	DAC10FX	5322 209 71665
N 9014	DAC10FX	5322 209 71665
N 9017	UA741TC	4822 209 80617

COILS

POSNR	DESCRIPTION	ORDERING CODE
L 3001	0.47UH 10%	5322 157 53345
L 3002	0.47UH 10%	5322 157 53345
L 3003	0.47UH 10%	5322 157 53345
L 9001	2.2UH	4822 157 51757

MISCELLANEOUS

POSNR	DESCRIPTION	ORDERING CODE
G 9001	X-TAL 12MHZ	5322 242 71444

JTN