

TGP110

10 MHz Pulse Generator
Service Manual



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Specification

PERIOD

100ns to 10s (10MHz to 0.1Hz) in 8 overlapping decade ranges, with separate vernier providing continuously variable control within each range.

Jitter: <0.1%.

PULSE WIDTH

50ns to 5s in 8 overlapping decade ranges, with separate vernier providing continuously variable control within each range. The Overlap lamp lights when the pulse width is set greater than the period.

Jitter: <0.1%.

PULSE DELAY

100ns to 5s in 8 overlapping decade ranges, with separate vernier providing continuously variable control within each range. The overlap lamp lights when the pulse delay is set greater than the period.

GATED OPERATION

0.1Hz to 10MHz pulse train, parameters set by Period and Pulse Width controls, starts synchronously with leading edge of Gate input. Last pulse is completed at the end of gating period.

TRIGGERED OPERATION

DC to 10MHz pulse train in synchronism with external Trigger pulses; pulse width determined by Pulse Width controls.

DOUBLE PULSE

A second pulse is generated after a delay from the leading edge of the first pulse set by the Pulse Delay controls.

DELAYED PULSE

The pulse is generated after a delay from the Trigger signal set by the Pulse Delay controls.

SQUAREWAVE

0.1Hz to 10MHz squarewave, frequency set by the Period controls.
Mark: Space ratio 1:1 \pm 10%.


COMPLEMENT

Inverts both the MAIN (50 Ω) and AUX outputs.

MANUAL

- With Triggered selected: Pressing Manual initiates a single pulse of duration determined by the Pulse Width controls.
- With Gate selected: 0.1Hz to 10MHz pulse train set by the Period and Pulse Width controls for the duration of button depression.

TRIGGER/GATE IN

- Frequency Range: DC - 10MHz
- Signal Range: Threshold nominally TTL level;  maximum input $\pm 10V$.
- Trigger Delay: Typically 100ns from trigger edge to MAIN OUT transition.
- Gate Delay: Approximately 20% of the PERIOD range setting +80ns from gate leading edge to MAIN OUT transition.
- Minimum Pulse Width: >30ns.
- Input Impedance: Typically 10k Ω .

MAIN 50 Ω OUTPUT

- Amplitude: Two switch selectable ranges of 0.1V - 1.0V and 1V - 10V from 50 Ω . (50mV to 500mV and 500mV to 5V into 50 Ω). Adjustable within ranges by a single turn vernier.
- Rise/Fall Times: Typically 10ns into 50 Ω load.
Maximum 15ns.
- Aberrations: Typically <5%, for output set at >20% of range maximum, into 50 Ω .

AUX OUTPUT

CMOS/TTL level, signal with the same timings as MAIN OUT; leads MAIN OUT by typically 15ns.

SYNC OUTPUT

- Amplitude: A positive going pulse at CMOS/TTL level.
- Timing: Leading edge occurs typically 40ns before the MAIN OUT transition in all pulse modes and typically 10ns after MAIN OUT in Square mode.
- Duration: Typically 30ns.

GENERAL

- Power: 230V or 115V nominal, 50/60Hz, adjustable internally; operating range $\pm 14\%$ of nominal; 20VA max. Installation Category II.
- Operating Range: + 5°C to 40°C, 20-80% RH.
- Storage Range: -40°C to 70°C.
- Environmental: Indoor use at altitudes up to 2000m, Pollution Degree 1.
- Safety: Complies with EN61010-1.
- EMC: Complies with EN55081-1 and EN50082-1.
- Size: 220(W) x 130(H) x 230(D)mm, excluding feet.
- Weight: 1.6kg.

This instrument is Safety Class I according to IEC classification and has been designed to meet the requirements of EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use). It is an Installation Category II instrument intended for operation from a normal single phase supply.

This instrument has been tested in accordance with EN61010-1 and has been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

This instrument has been designed for indoor use in a Pollution Degree 1 environment (no pollution, or only dry non-conductive pollution) in the temperature range 5°C to 40°C, 20% - 80% RH (non-condensing). It may occasionally be subjected to temperatures between +5° and -10°C without degradation of its safety.

Use of this instrument in a manner not specified by these instructions may impair the safety protection provided. Do not operate the instrument outside its rated supply voltages or environmental range. In particular excessive moisture may impair safety.

WARNING! THIS INSTRUMENT MUST BE EARTHED

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited. The protective action must not be negated by the use of an extension cord without a protective conductor.

When the instrument is connected to its supply, terminals may be live and opening the covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts. The apparatus shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

Any adjustment, maintenance and repair of the opened instrument under voltage shall be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

If the instrument is clearly defective, has been subject to mechanical damage, excessive moisture or chemical corrosion the safety protection may be impaired and the apparatus should be withdrawn from use and returned for checking and repair.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders is prohibited.

Do not wet the instrument when cleaning it.

The following symbols are used on the instrument and in this manual:-



Caution -refer to the accompanying documentation, incorrect operation may damage the instrument.



alternating current.



terminal connected to chassis (ground).

Installation

MAINS OPERATING VOLTAGE

The operating voltage of the instrument is shown on the rear panel. Should it be necessary to change the operating voltage from 230V to 115V or vice-versa, proceed as follows:

1. Disconnect the instrument from all voltage sources.
2. Remove the 4 screws which hold the upper and lower case halves together and lift off the case upper.
3. Remove the 4 screws which hold the power supply printed circuit board to the case lower.
4. Change the appropriate zero-ohm links in the pcb:
Link LK1 only for 230V operation
Link LK2 and LK3 only for 115V operation
5. Refit the pcb to the case lower, ensuring all connections (especially safety earth) are remade as before, and refit the case upper.
6. To comply with safety standard requirements the operating voltage marked on the rear panel must be changed to clearly show the new voltage setting.

MAINS LEAD

When a three core mains lead with bare ends is provided it should be connected as follows:

Brown	-	Mains live
Blue	-	Mains Neutral
Green/Yellow	-	Earth

WARNING! THIS INSTRUMENT MUST BE EARTHED

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited.

Service Handling Precautions

Service work or calibration should only be carried out by skilled engineers.

Please note the following points before commencing work.

The tracks on the printed circuit board are very fine and may lift if subjected to excessive heat.

Use only a miniature temperature controlled soldering iron and remove all solder (on both sides of the joint) with solder wick or suction before attempting to remove a component.

Care should be taken when handling to avoid damage by static discharge

Dismantling the instrument

1. Invert the instrument and remove the 4 screws securing the case upper. Holding the case halves together, turn the instrument the correct way up and lift off the case upper.
2. To remove the main pcb from the front panel, proceed as follows.
Pull off the control knobs and lift the front panel assembly clear of the case. Remove the 4 screws retaining the pcb screen, noting the position of the safety earth connection and unplug the connection from the power supply board. Remove the 4 hexagonal spacers and two screws that secure the pcb to the front panel. Carefully completely desolder the 4 centre BNC connections from the pcb and lift the pcb clear of the panel.
3. To remove the power supply pcb remove the 4 screws which hold the pcb to the case lower.
4. Reassemble in the reverse order.

Caution EMC

To ensure continued compliance with the EMC directive the following precautions should be observed:

- a) after dismantling the unit for any reason ensure that any signal and ground connections are remade correctly. Always ensure all screws are correctly refitted and tightened.
- b) In the event of part replacement becoming necessary, only use components of an identical type.

Circuit Descriptions

Power Supply

The transformer and two voltage regulators are mounted on the power supply pcb. The primary of the transformer is protected by an integral thermal fuse. Pcb mounted fuses FS1 and FS2 provide protection in the event of secondary side faults.

IC12 provides +17V set by R46 and R47; IC13 provides -5V. IC14 on the main pcb provides +5V from the +17V supply; D11 reduces its overhead voltage by 6·8V, reducing dissipation in the regulator.

Period Generation

IC1 and associated components comprise an oscillator that can be gated. IC1 forms a window comparator with thresholds of 1·2V and 2·2V set by R1, R3 and R4, giving an oscillator ramp of 1V peak-peak. When the oscillator is free running in Run mode the ramp up and down times are set by VR3, the Period control, and appropriate range capacitor selected by SW1. When the oscillator is stopped in Gated mode the ramp is held just above the ramp peak via D14; when the oscillator is enabled by signal E, IC3A turns off and IC3B turns on, rapidly discharging the timing capacitor to the lower threshold voltage via D1, independently of VR3. IC9A then turns off IC3B and the oscillator free runs until the gating signal E is removed.

Pulse Width

Pulse width is determined by high-speed monostable IC8A and associated timing components VR6, the Pulse Width control, and appropriate Pulse Width range capacitor selected by SW2. IC5A is clocked high if the trigger signal appears while the output of IC8A is still high, lighting the Overlap LED.

Pulse Delay

Pulse delay is determined by high-speed monostable IC8B and associated timing components VR9, the Pulse Delay control, and appropriate Pulse Delay range capacitor selected by SW3. IC5B is clocked high if the trigger signal for the next pulse, from IC4D, appears while the output of IC8B is still high, lighting the Overlap LED.

Run Modes

With Pulse selected the period generator IC1 free runs and its output triggers the pulse width monostable IC8A via IC4D, IC6D and IC6C which generate a narrow pulse (typically 20-40ns), IC2B and IC6A.

With Square selected the period generator IC1 free runs and its output is routed via SW4B to the output circuits.

With Double Pulse selected the free running period generator triggers the pulse width monostable IC8A as described for Pulse mode above and also the pulse delay monostable IC8B via signal A. At the end of the pulse delay time the output of IC8B, signal B, triggers the pulse width generator a second time via IC7A and IC7B which generate a narrow pulse (typically 20-40ns), and IC6A.

With Delayed Pulse selected the free running period generator triggers the pulse delay generator, via signal A, which triggers the pulse width generator via signal B.

Triggered and Gated Modes

When Triggered mode is selected the period generator is turned off and the pulse width generator is triggered by signal E via IC4C and then IC4D, etc. as described for Run modes.

When Gated mode is selected the period generator is gated by signal E applied to IC2A.

Signal E originates from either the Trigger/Gate In socket via IC10 or from the Manual button via IC9B and IC10.

Trigger/Gate Input and Manual

External signals applied to the Trigger/Gate Input are routed to one of the buffers in IC10; R15 gives positive feedback to form a Schmitt trigger.

Signals from the Manual push-switch, SW6, are de-bounced by IC9B and routed to the same buffer in IC10 via isolating diode D3.

Outputs

The Aux and Sync outputs are provided by IC10.

IC10 also drives the Main Out output stage. Q1 is turned on or off by IC10 and its output high is set by the voltage on its collector resistors, R35 and R36. The Amplitude control VR11 varies the adjustable regulator IC11 which provides this voltage. Q4 and Q3 are complimentary emitter followers with Q2 and D4 providing bias.

Equipment Required

Oscilloscope (60MHz or better).
Counter/Timer

Only the case upper needs to be removed to gain access to all adjustments. Apertures in the screen (see diagram) and holes through the pcb give access to all trimmers.

Allow a 30 minute warm-up before commencing.
Note that pulse width is measured at the 50% points.

Amplitude

Function to Square.
Mode to Run.
Amplitude to Maximum.
Adjust VR12 for 5.2V into 50Ω.

Period

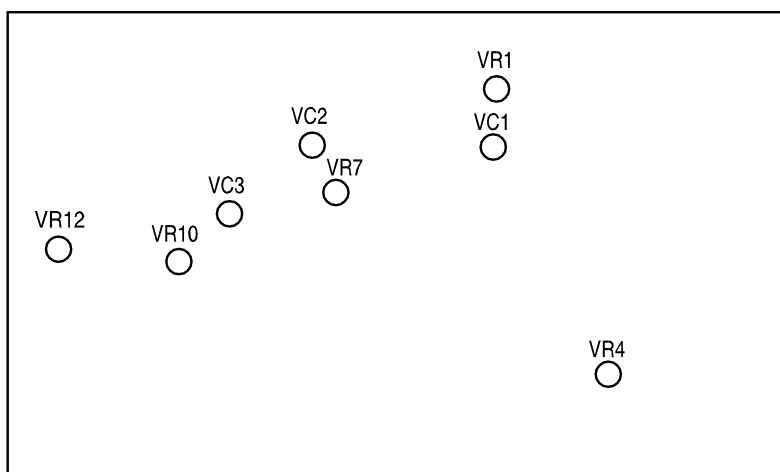
Connect counter to any output.
Period to 100us, vernier to x1, check the period is 80 to 95us.
Vernier to x10, adjust VR4 for 1.2ms.
100ns range, adjust VC1 for 990 to 995kHz.
Vernier to x1, adjust VR1 for 10.1MHz.

Pulse Width

Function to Pulse.
Connect Main Out to oscilloscope.
Pulse Width to 50ns, vernier to x1.
Adjust VC2 for a pulse width of 45 to 49ns.
Set period to 1us, set pulse width vernier to x10.
Adjust VR7 for a pulse width of 520ns.

Pulse Delay

Function to Double Pulse, period to 100ns, vernier to x5, pulse width to 50ns and vernier to x1.
Adjust VC3 until the second pulse just disappears.
Function to Delayed Pulse, period to 1us and vernier to x5, pulse width to 50ns and vernier to x5.
Connect Sync Out to second channel of oscilloscope and trigger off this.
Adjust VR10 for 520ns from positive edge of sync pulse.



Parts List

PCB ASSY - MAIN - TGP110 (44912-0400)

PART NUMBER	DESCRIPTION	POSITION
20661-0801	SPACER TRANSISTOR MTG TO5	FOR Q4
20670-0045	HEATSINK TO5 44°C/W	FOR Q4
22040-0901	BEAD FERRITE FX1115	FB1,2
22218-0213	SWITCH SLIDE 2P2W	SW5,7,8
22218-0215	SWITCH SLIDE 2P3W	SW9
22219-0500	SWITCH 2 POLE MOMENTARY	SW6
22220-0009	SWITCH ROTARY 1P12W	SW1,2,3
22220-0010	SWITCH ROTARY 2P6W	SW4
22573-0041	HEADER 2 WAY STRAIGHT	TP1 (0.5)
23202-0100	RES 10R0F W25 MF 50PPM	R26,27
23202-0102	RES 10R2F W25 MF 50PPM	R34
23202-1100	RES 100RF W25 MF 50PPM	R5,43,49
23202-1120	RES 120RF W25 MF 50PPM	R18,19,20,22,23,24
23202-1150	RES 150RF W25 MF 50PPM	R39,40
23202-1220	RES 220RF W25 MF 50PPM	R2
23202-1270	RES 270RF W25 MF 50PPM	R21
23202-1680	RES 680RF W25 MF 50PPM	R7,9
23202-2100	RES 1K00F W25 MF 50PPM	R3,17,25,45
23202-2120	RES 1K20F W25 MF 50PPM	R4
23202-2150	RES 1K50F W25 MF 50PPM	R8,10
23202-2280	RES 2K80F W25 MF 50PPM	R1
23202-2390	RES 3K90F W25 MF 50PPM	R41
23202-3100	RES 10K0F W25 MF 50PPM	R6,11,12,13,14,16,37,38,42
23202-3270	RES 27K0F W25 MF 50PPM	R48
23202-4100	RES 100KF W25 MF 50PPM	R15,44
23206-0412	RES 41R2F W60 MF 50PPM	R32,33,50
23206-1180	RES 180RF W60 MF 50PPM	R28,29,30,31
23206-1360	RES 360RF W60 MF 50PPM	R35,36
23347-0310	POT 2K LIN FLAT SHAFT 30MM	VR11
23347-0320	POT 20K LOG FLAT SHAFT 30MM	VR3,6,9
23377-1470	RES PS/H 470R CF 10MM	VR1
23377-3220	RES PS/H 22K CF 10MM	VR12
23377-4470	RES PS/H 470K CF 10MM	VR4,7,10
23427-0280	CAP 2P2C 100V CER NPO P2.5	C9,10,30

PCB ASSY - MAIN - TGP110 (44912-0400) continued/.....

PART NUMBER	DESCRIPTION	POSITION
23427-0325	CAP 10NZ63V CER HI K P5	C43,44
23428-1100	CAP 100PG 100V CER NPO P2.5	C13,14,48,49
23557-0540	CAP 4U7 50V ELEC BIPOLAR P2	C17,24
23557-0560	CAP 47U 16V ELEC BIPOLAR P2	C16,23
23557-0570	CAP 470U 6V3 ELEC BIPOLAR P3	C15,22
23557-0591	CAP 68U 40V ELEC P3.5	C6
23557-0647	CAP 10U 35V ELEC RE2 P2	C32,34,47
23557-0668	CAP 220U 10V ELEC RE2 P2.5	C46
23557-0672	CAP 470U 10V ELEC RE2 P3.5	C7
23594-0226	CAP 6U8 10V 10% TANT P5	C5
23620-0232	CAP 47NK 63V P/E 435/1 P5	C19,26
23620-0244	CAP 470NK 63V P/E P5	C18,25
23620-0245	CAP 4N7K 63V P/E MMP P5	C20,27
23620-0246	CAP 100NK 63V P/E P5	C8,31,33,35,36,37,45,50-60
23620-0258	CAP 6N8K 63V P/E P5	C2
23620-0265	CAP 68NK 63V P/E P5	C3
23620-0266	CAP 680NK 63V P/E P5	C4
23662-0205	CAP 330PK 100V P/C FKC2 P5	C21,28
23662-0210	CAP 680PK 100V P/C FKC2 P5	C1
23984-0001	TRIMCAP 4-65P P/P 109-3801-065	VC1-3
25021-0901	DIO 1N4148 B/R	D2,3,4,12,13,14
25031-0020	DIO BAT81	D1
25061-0200	LED - T1 ROUND (3MM) - RED	LED1-3
25115-0907	DIO 1N4002 B/R	5,6
25131-0223	DIO ZEN 6V8 1W3	D11
25341-0218	TRAN PNP 2N3906	Q3
25380-0230	TRAN NPN MPS2369	Q1
25381-0404	TRAN NPN 2N3904	Q2
25389-0010	TRAN NPN 2N3866	Q4
27160-0009	IC V/REG 7805 TO220	IC14
27160-0230	IC V/REG LM317L TO92	IC11
27222-0660	IC DM96S02N	IC8
27229-0000	IC 74HCT00N	IC4,6,7
07229-0740	IC 74HCT74	IC5,9
27229-2440	IC 74HCT244	IC10
27230-0530	IC 74HC4053	IC3

PCB ASSY - MAIN - TGP110 (44912-0400) continued/.....

PART NUMBER	DESCRIPTION	POSITION
27231-0320	IC 74HC32	IC2
27254-0010	IC NE521N	IC1
35555-2690	PCB - MAIN	

PCB ASSY - PSU - TGP110 (44912-0410)

PART NUMBER	DESCRIPTION	POSITION
20030-0263	WASHER M3 ZPST	FOR PJ3
20038-9501	WASHER M3 SPRING	FOR PJ3
20205-0610	STUD M3 X 10 KFH-M3-10ET	FOR PJ3
20210-0101	NUT M3 ZPST	FOR PJ3
20613-0006	WASHER (SIL-PAD) TO220	FOR IC12
20670-0135	CLIP GP02 FOR PCB MTG H/SINKS	FOR IC12
20670-0320	HEATSINK PCB MTG 50MM PLAIN	FOR IC12
20670-0340	HEATSINK TO220 CLIP-ON 20°C/W	FOR IC13
22115-0360	TRANSFORMER	T1
22315-0450	FUSE 500mAT SUBMIN PCB MNT	FS1,2
22520-0160	AC MAINS RECEP 10AMP R/ANG MTG	PJ3
22573-0211	HEADER3 WAY STR LATCHED .156	PJ2
23185-0000	RES ZERO OHM	LK1
23202-1240	RES 240RF W25 MF 50PPM	R47
23202-2309	RES 3K09F W25 MF 50PPM	R46
23424-0443	CAP 10NZ 1KV CER D10 P5	C38
23557-0647	CAP 10U 35V ELEC RE2 P2	C41,42
23557-0655	CAP 470U 35V ELEC RE2 P5	C40
23557-0664	CAP 1000U 35V ELEC RE2 P5	C39
25115-0907	DIO 1N4002 B/R	D9,10
25211-9302	RECTIFIER BRIDGE W02G	BR1
27160-0014	IC V/REG 7905 TO220	IC13
27160-0200	IC V/REG LM317 TO220	IC12
35515-1500	PCB - PSU	

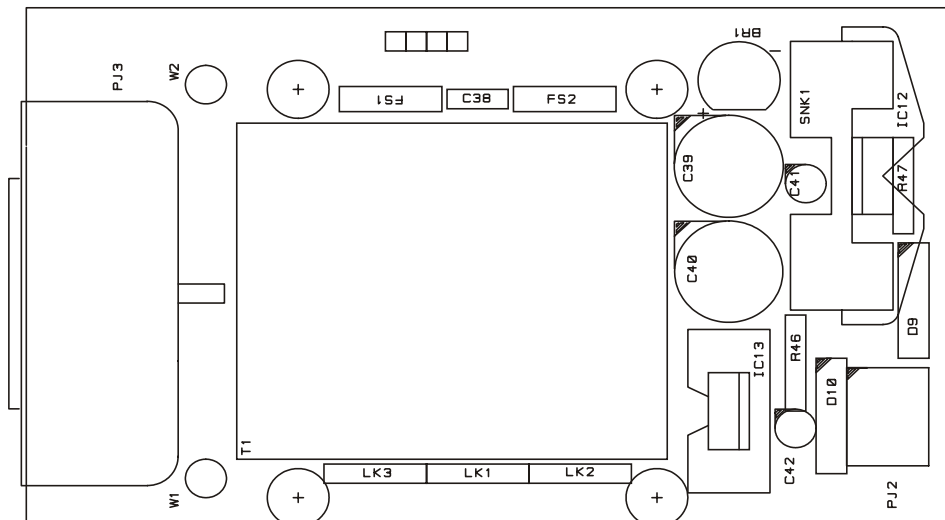
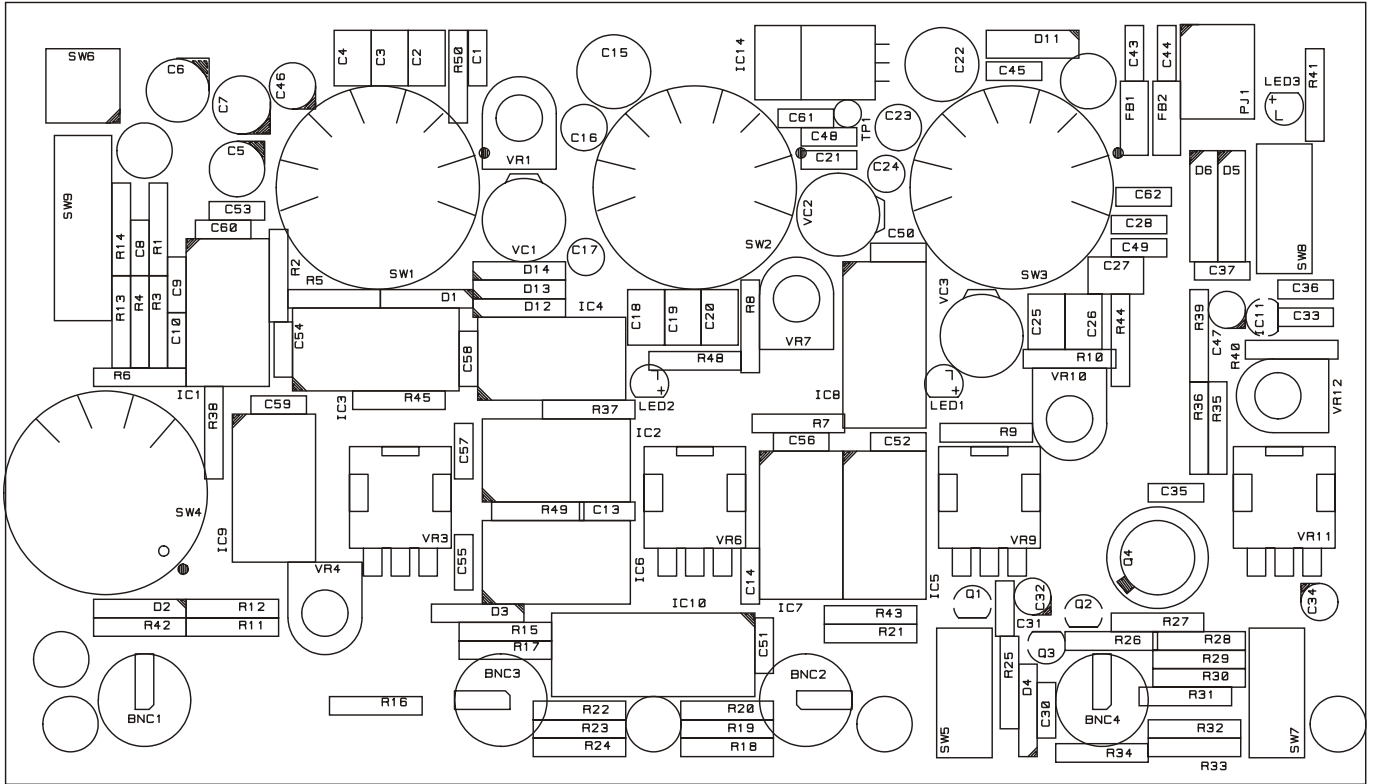
CASE PARTS - TGP110

PART NUMBER	DESCRIPTION	POSITION
20030-0263	WASHER M3 ZPST	P CLIP
20030-0266	WASHER M4 ZPST	REAR PANEL EARTH
20037-0400	SOLDER TAG SHAKEPROOF - 6BA	SCREEN EARTH
20037-0401	SOLDER TAG SHAKEPROOF - 4BA	REAR PANEL EARTH

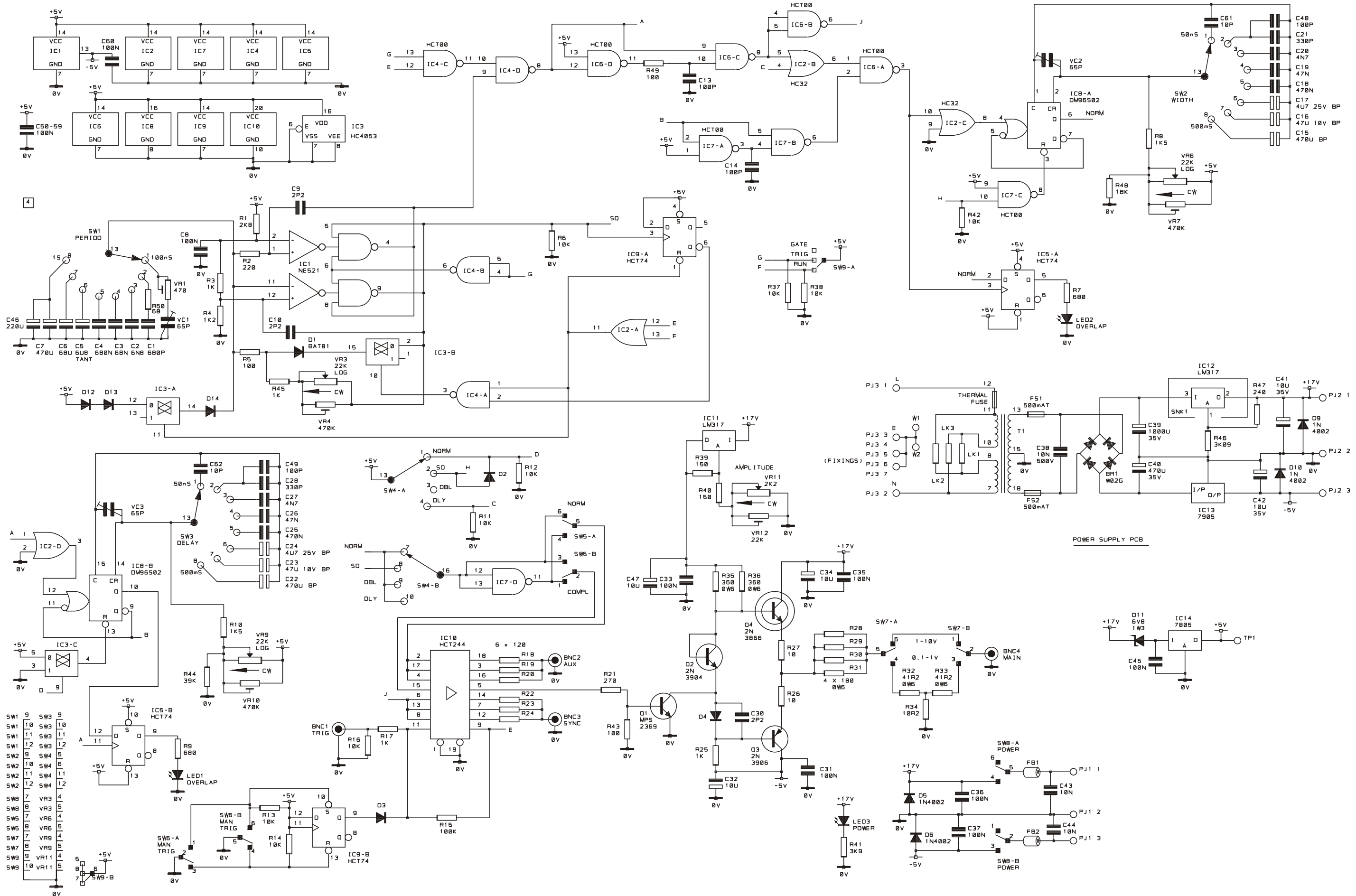
CASE PARTS - TGP110/continued.....

	PART NUMBER	DESCRIPTION	POSITION
	20038-9501	WASHER M3 Spring	PSU PCB/CASE, SCREEN, MAIN PCB/FRONT PANEL
	20038-9502	WASHER M4 Spring	REAR PANEL EARTH
	20065-0030	SCREW N0 4 X 3/8 PLASTT PNHDPZ	PSU PCB/CASE
	20073-9801	SCREW No.4x1/4in. Plastite	P CLIP
	20210-0102	NUT M4 ZPST	REAR PANEL EARTH
	20234-0027	SCREW M3 X 6 PNHDPZ ZPST	MAIN PCB/FRONT PANEL, SCREEN
	20234-9009	SCREW M3x115mm. Pozi Pan	CASE
	20236-0010	SCREW M4 X 12 TAMPERPROOF	REAR PANEL EARTH
	20612-0011	WASHER FIBRE M3	PSU PCB/CASE, MAIN PCB/FRONT PANEL
	20651-0008	CLAMP CABLE (P CLIP) 3.2MMD	
	20657-0070	KNOB 21MM DA217 180 GREY 99	
	20657-0072	CAP BLK LINE C217/125 GREY 99	
	20661-0280	SPACER HEX STUD M3 X 8 NPBR	SCREEN/PCB
	20662-0560	FOOT SELF ADHESIVE 10MM	
	22040-0030	FERRITE SLEEVE APPROX 7/14/15L	
	22491-0120	MAINS LD 2M ST IEC SKT/UK PL	FOR UK
or	22491-0270	MAINS LD 2M ST IEC SKT/EURO PL	FOR EURO
or	22491-0040	MAINS LD 2M ST IEC SKT/USA PL	FOR USA
	22575-0203	SKT3W .156 20AWG (YELLOW) IDT	
	22588-0004	BNC SKT BKHD 50R STANDARD	
	31346-0210	SCREEN	
	33111-9010	TILT STAND	
	33331-4830	FRONT PANEL	
	33331-4840	OVERLAY FRONT PANEL	
	33331-4850	REAR PANEL	
	33562-9010	CASE UPPER	
	33562-9020	CASE LOWER	
	33562-9030	CASE EXPANDER	
	33562-9040	FOOT TYPE A	
	33562-9050	FOOT TYPE B	
	33562-9080	EXTENSION PIECE	
	37113-0170	BUTTON, SWITCHBANKS, MID-GREY	
	48591-0530	INSTRUCTION BOOK	

Component Layouts



Circuit Diagram





Thurlby Thandar Instruments Ltd
Glebe Road, Huntingdon, Cambridgeshire PE29 7DR, England
Telephone: (44) 01480 412451 Fax: (44) 01480 450409
e mail: sales@tti-test.com web site: www.tti-test.com