# Dream Tech International Ltd

## DTM0660

## product brochures

4000/6000 indexing

T-RMS Digital Multimeter ASIC

# Eye record

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## 1 Brief introduction

**DTM0660 is Taiwan's latest revolutionary digital multimeter standard of chip development, built more than 14 noise free ΣΔ ADC,** so that each can easily reach 6600 Counts range of performance. While providing high-speed output mode, the output rate of up to 12.5kHz. With internal digital processor (DSP) can be done digital 1kHz True RMS measurements, without any external components.

DTM0660 built multi-functional automatic range of very elastic network, in addition to each range can be done fast automatic transmission, but also simplify smart meter outside line, you can easily plan the needs of their specific measuring function. Built-in calibration program with external EEPROM, can easily complete a variety of high-precision digital correction and support multiple user settings.

## 2 main feature

2.1 Maximum Display: 4000/6000 (frequency, capacitance 9999).

2.2 Conversion rate: 3 times / sec.

2.3 Range: automatic / manual range.

2.4 Polarity Indication: Automatic.

**2.5 Operating voltage: 2.4V ~ 3.6V.**

2.6 Operating Current: (less than 2μA during sleep) ≤1mA.

AC rectifier 2.7: True RMS equipped with a digital processor, no external rectifying circuit, a bandwidth of 1kHz, error is less than 0.5%, high-speed response.

2.8 Flexible application multifunctional switching network, can quickly automatic range shifting.

2.9 Measurement function definition with the EEPROM and calibration.

2.10 built 100ppm / ℃ 1.2V low temperature drift voltage reference.

2.11 function keys: SELECT, RANGE, REL, HZ / DUTY, HOLD / (BACKLIGHT), MAX / MIN, BACKLIGHT.

2.12 LCD is 4 × 15, with a display and a backlight unit symbol.

2.13 may be equipped with a temperature detector thermocouple cold junction compensation of the temperature measurement, without the compensation circuit.

2.14 settable voltage and current value of OL and Alarm.

2.15 MAX / MIN data logging.

Automatic shutdown 2.16: 15 or 30 minutes (adjustable).

2.17 Low voltage detection: internal or external input can be set, two inner low-voltage detection 3V supply, 4.5 ~ 9V supply low voltage detection period.

2.18 tone frequency: about 1.95kHz.

2.19 LQFP64 for encapsulating sheet and die.

## 3 Measurement category

3.1 DC voltage: 60.00mV / 600.0mV, (600.0mV) /6.000V/60.00V/600.0V/1010V

3.2 AC voltage: 60.00mV / 600.0mV, (600.0mV) /6.000V/60.00V/600.0V/750V

3.3 DC current: 600.0μA / 6000μA, 60.00mA / 600.0mA, 6.000A / 60.00A

3.4 AC Current: 600.0μA / 6000μA, 60.00mA / 600.0mA, 6.000A / 60.00A

3.5 Resistance: 600.0Ω / 6.000kΩ / 60.00kΩ / 600.0kΩ / 6.000MΩ / 60.00MΩ

3.6 Capacitance: 9.999nF / 99.99nF / 999.9nF / 9.999μF / 99.99μF / 999.9μF / 9.999mF / 99.99mF

3.7 Frequency: 9.999Hz / 99.99Hz / 999.9Hz / 9.999kHz / 99.99 kHz / 999.9kHz / 9.999MHz

**The duty ratio of 3.8: 1% ~ 99%**

**3.9 Diode: 0.000V ~ 3.000V, 3.0V above the display OL**

3.10 Continuity Check: less than <utterance when 50Ω,> 600Ω display OL

3.11 clamp meter current: the user can set the range, decimal, alone or in two auto range

3.12 Temperature Measurement: ℃ / ℉

**3.13 Transistor: 0 ~ 2000 (hFE)**

3.14 Non-contact AC voltage detector (NCV)

## 4 Applications

4.1 autoranging / manual range handheld digital multimeter.

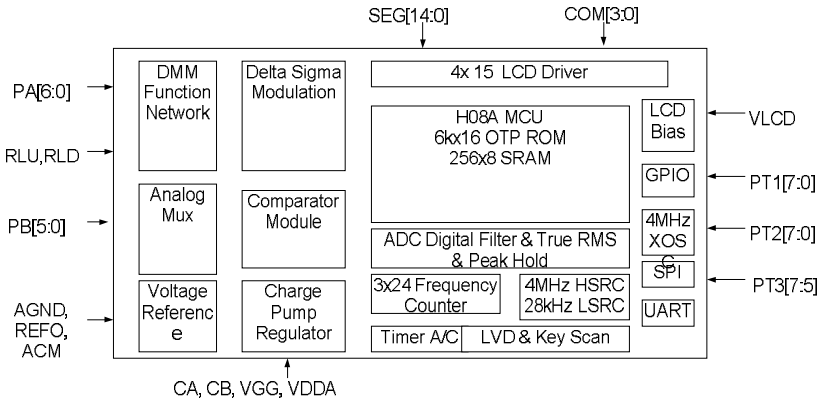
4.2 autoranging / manual range Card Digital Meter.

4.3 auto-range digital multimeter pen.

4.4 autoranging clamp meter.

4.5 Digital Panel Meters.

## 5 internal block diagram




1 DTM0660 block diagram of FIG.

## 6 sheet package pin-out position of FIG.

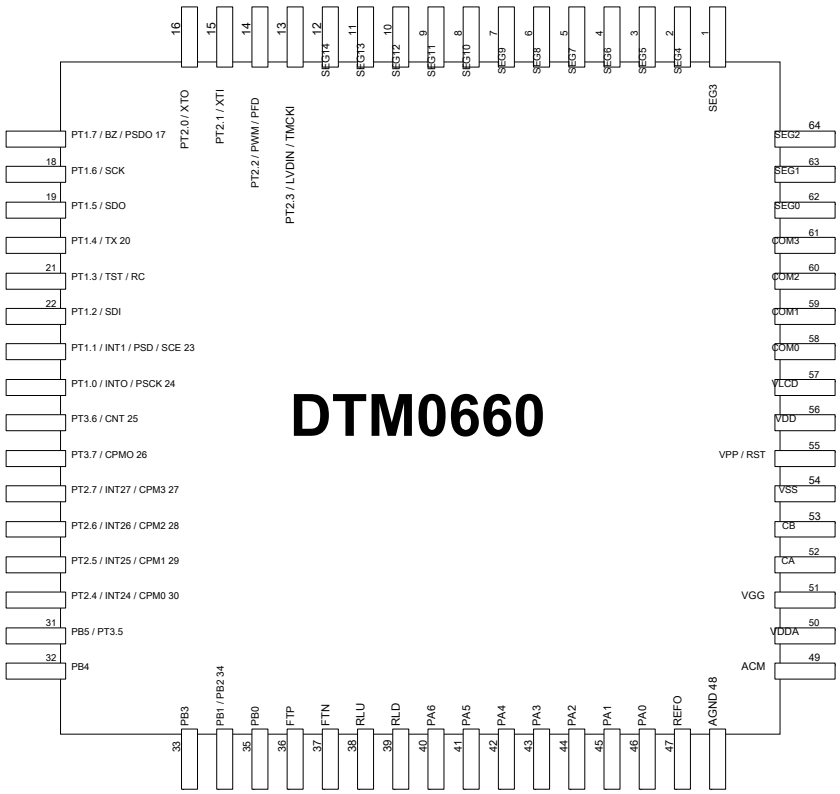



figure 2 DTM0660 LQFP64 pin map

## 7 Pin Description

| Pin number | symbol | port | Trace State |
|---|---|---|---|
| 1 ~ 12 | SEG3 ~ SEG14 | O | Strokes 3 ~ Strokes 14 . |
| 13 | PT2.3<br>TMCK1, LVDIN | I / OI | Data input / output port.<br>RC Clock input interface, LVD External input interface. |
| 14 | PT2.2<br>PWM, PFD | I / OI | Data input / output port. A pulse width modulated output, a<br>frequency-modulated output. |
| 15 | PT2.1, XTI | I / O, I | Data input / output port, an external oscillator input. |
| 16 | PT2.0, XTO | I / O, O | Data input / output port, an external oscillator output. |
| 17 | PT1.7, PSDO, BZ | I / O, O | Data input / output port, buzzer output, OTP Read / write interface<br>(PSDO) . |
| 18 | PT1.6, SCK | I / O | Data input / output port, SPI Communication output interface ( SCK) . |
| 19 | PT1.5, SDO | I / O, O | Data input / output port, SPI Communication output interface ( SDO) . |
| 20 | PT1.4, TX | I / O, O | Data input / output port, EUART Communication Interface( TX) . |
| twenty one | PT1.3, RC, TST | I | Data input, EUART Communication Interface( RC), Test mode enable. |
| twenty two | PT1.2, SDI | I / O, I | Data input / output port, SPI Communication Interface( SDI) . |
| twenty three | PT1.1 SCE,<br>PSDI, INTI | I / OI | Data input / output port,<br>SPI Communication Interface( SCE) , OTP Read / write interface ( PSDI), Interrupt Source<br>INTI . |
| twenty four | PT1.0<br>PSCK, INTO | I / OI | Data input / output port,<br>OTP Read / write interface ( PSCK), Interrupt Source INTO . |
| 25 | PT3.6, CNT | I / O, I | Data input / output port, a frequency count input interface. |
| 26 | PT3.7, CMPO | I / O, O | Data input / output, the comparator output interfaces. |
| 27 | PT2.7 CMP3,<br>INT27 | I / OI | Data input / output port, a comparator input interface,<br>interrupt sources E27IF . |
| 28 | PT2.6 CMP2,<br>INT26 | I / OI | Data input / output port, a comparator input interface,<br>interrupt sources E26IF. |
| 29 | PT2.5 CMP1,<br>INT25 | I / OI | Data input / output port, a comparator input interface,<br>interrupt sources E25IF . |
| 30 | PT2.4 CMP0,<br>INT24 | I / OI | Data input / output port, a comparator input interface,<br>interrupt sources E24IF . |
| 31 | PT3.5, PB5 | I / O, I | Data input / output port, a digital / analog inputs. |
| 32 | PB4 | I | A digital / analog inputs. |
| 33 | PB3 | I | A digital / analog inputs. |
| 34 | PB1 / PB2 | I | A digital / analog inputs. |
| 35 | PB0 | I | A digital / analog inputs. |
| 36 | FTP | I / O | Prefilter capacitor connection port. |
| 37 | FTN | I / O | Prefilter capacitor connection port. |
| 38 | RLU | I / O | An analog / digital converter switch network interface. |
| 39 | RLD | I / O | An analog / digital converter switch network interface. |
| 40 | PA6 | I / O | An analog / digital converter switch network interface. |
| 41 | PA5 | I / O | An analog / digital converter switch network interface. |
| 42 | PA4 | I / O | An analog / digital converter switch network interface. |
| 43 | PA3 | I / O | An analog / digital converter switch network interface. |
| 44 | PA2 | I / O | An analog / digital converter switch network interface. |
| 45 | PA1 | I / O | An analog / digital converter switch network interface. |
| 46 | PA0 | I / O | An analog / digital converter switch network interface. |
| 47 | REFO | I / O | 1.2V The reference voltage output. |
| 48 | AGND | I / O | Common reference point of the measurement ( COM) . |
| 49 | ACM | I / O | Reference voltage interface. |
| 50 | VDDA | I / O | After power supply voltage doubler. |
| 51 | VGG | O | Power supply voltage doubler. |
| 52 | CA | I / O | Voltage doubling capacitor connection point. |
| 53 | CB | I / O | Voltage doubling capacitor connection point. |
| 54 | VSS | P | IC Negative supply. |
| 55 | RST, VPP | I, P | IC Reset mouth, EEPROM Source voltage when the read / write. |
| 56 | VDD | P | IC Positive supply. |
| 57 | VLCD | I / O | LCD power source. |
| 58 ~ 61 | COM0 ~ COM3 | O | Public backplanes 0 ~ Public backplanes 3 . |
| 62 ~ 64 | SEG0 ~ SEG2 | O | Strokes 0 ~ Strokes 2 . |

Note: I- enter; O- Output; I / O- input Output.

## 8 Technical Specifications (VDD = 3V, Ta = 25 ℃)

### 8.1 Maximum rating

| parameter | symbol | quota |
|---|---|---|
| voltage | VDD (VDDA) -VSS (VSSA) | -0.2V ~ 4V |
| Voltage may be applied to any range of foot | | -0.3V ~ VDD + 0.3V |
| Each leg receiving current protection diode | | ± 2mA |
| Storage temperature | Tstg | --50 ℃ ~ + 150 ℃ |
| Foot soldering temperature | Temp | 300 ℃ |
| Welding time | Time | 10 second |
| Total power consumption | | 500mW |

### 8.2 Recommended operating conditions

| symbol | parameter | | The test strip condition | | Least | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|---|---|
| VDD | voltage | | All peripheral components and CPU | | 2.2 | | 3.6 | V |
| | | | Analog Peripheral Component | | 2.4 | | 3.6 | |
| VSS | voltage | | | | 0 | | 0 | |
| XT External oscillation frequency | | Clock crystal | VDD = 2.2V ENXT [0] = 1 | XTSP [0] = 0, XTHSP [0] = 0 | 32.768kHz | | | Hz |
| | | Ceramic oscillator | | XTSP [0] = 1, XTHSP [0] = 0 | 400k | | 8M | |
| | | Quartz crystal | | XTSP [0] = 1, XTHSP [0] = 0 | 1M | | 8M | |

### 8.3 internal RC oscillation

| symbol | parameter | The test strip condition | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|
| HAO | High speed oscillation frequency | ENHAO [0] = 1 | | 4 | | MHz |
| LPO | Low power oscillator frequency VDD can | LPO | | 32 | | kHz |

### 8.4 V DD Total current

| symbol | parameter | The test strip condition | The minimum | typical | maximum | single Place |
|---|---|---|---|---|---|---|
| IAM 1 | Active mode 1 | OSC_CY = 8MHz, OSC_HAO = off, CPU_CK = 8MHz | | 1.34 | 2 | mA |
| IAM 2 | Active mode 2 | OSC_CY = off, OSC_HAO = 4MHz, CPU_CK = 4MHz | | 0.36 | 0.55 | mA |
| IAM 3 | Active mode 3 | OSC_CY = off, OSC_HAO = 4MHz, CPU_CK = 2MHz | | 0.2 | 0.3 | mA |
| ILP1 | Low Power 1 | OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = 16384Hz | | 7 | 12 | μA |
| ILP2 | Low Power 2 | OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state | | 1.65 | 3 | μA |
| ILP3 | Low Power 3 | OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state | | 0.65 | 1.3 | μA |

**8.5 end mouth 1 ~ End mouth 3**

| symbol parameter | The test strip condition | Least typical maximum unit | | | |
|---|---|---|---|---|---|
| Input voltage, Schmitt trigger, leak Current time | | | | | |
| VIH Input High | | | | 2.2 V | |
| VIL Input low | | 0.9 | | | |
| VHYS Enter the delay ( VIH-VIL) | | | 0.8 | | |
| ILKG Leakage Current | | | | 0.1 μA | |
| RPU Port pullup | | | 180 | | kΩ |
| Output voltage and current | | | | | |
| VOH Output high | IOH = 10mA | Vdd-0.3 | | | V |
| VOL Output low | IOL = 10mA | | | Vss + 0.3 | |

**8.6 Reset (Down, external reset , Low voltage detection)**

| symbol | parameter | Test Conditions | Minimum Typical Maximum unit | | | |
|---|---|---|---|---|---|---|
| BOR | Internal reset pulse width in need, td-LVR | | 2 | | | μs |
| | VDD Starting voltage required to undergo internal reset ( L ⇒ H ), VLVR | | 1.6 | 1.85 | 2.1 V | |
| | Hysteresis voltage, VHYS-VLVR, | | | 70 | | mV |
| RST | Required as a reset pulse width / VPP Foot required to undergo internal reset, td-RST | | 2 | | | μs |
| | Receiving an input voltage for an internal reset, | | 0.9 | | | V |
| | Hysteresis voltage, VHYS-RST | | | 0.8 | | V |
| LVD | Working current, ILVD | | | 10 | 15 | μA |
| | The reference voltage | | | 1.2 | | V |
| | The reference voltage coefficient | TA = -45 ℃ ~ 85 ℃ | | 100 | | ppm / ℃ |
| | Inside the first point LVD Detection | | | 2.4 | | V |
| | Inside the second point LVD Detection | | | 2.2 | | |

Note: BOR = Brownout Reset
LVR = Low Voltage Reset of BOR LVD =
Low Voltage Detect RST = Reset ( External Reset Pin )

**8.7 For digital multimeters table( DMM) The electrical parameters**

| parameter | Test Conditions | Minimum Typical Maximum unit | | | |
|---|---|---|---|---|---|
| Zero input reading | VIN = 0V, in 500mV Input calibration. - 1 | | 0 | + 1 | Word Count |
| Zero input temperature drift | VIN = 0V, in 500mV Input calibration. TA = 0 ℃ ~ 70 ℃ | - 0.00 3 | 0 | + 0.003 | Word Count / ℃ |
| Linear | in 500mV Input calibration. | - 1 | 0 | + 1 | Word Count |
| Input leakage current | VIN = 0V . | | 1 | 10 | pA |
| Comparison of Bandwidth ( CMPH versus CMPL ) | VIN = 600mVp-p (Sine wave) | | 62 | | MHz |
| | VIN = 400mVp-p (Sine wave) | | | | MHz |
| Compare current | CMPH versus CMPL | | 40 | | μA |
| Network switch resistance | PS0 ~ PS1 DS0 ~ DS1 DS2 ~ DS6, PS2 ~ PS6 SS0 ~ SS6, FS0 ~ FS6 | | 204 080 400 | | Ω |
| ADI Working current | No reference input buffer | | 90 | | μA |
| Current low-pass filter | | | 50 | | μA |
| True RMS current converter | | | 210 | | μA |
| Sleep Current | | | 1 | | μA |

# 9 Key Definitions

## 9.1 K1 : SELECT

SELECT The function selection button to trigger action, with the key as the measurement function selection key.

## 9.2 K2 : RANGE

RANGE Key to Auto / When the manual range switching button to trigger action, power or turn the dial, auto preset range. Clicking switches to manual range. In the manual range mode, each press this button will move upward to the most high after Press to return to the lowest, followed by cycle. Frequency and capacitance measurement does not have manual range. Such as by RANGE Button for more than 2 Second switch or dial, manual range state is exited.

## 9.3 K3 : REL / RS232

REL Key is the relative value measurement button to trigger actions, in addition to Hz / Duty , Diode , CONT External functions are measured as a relative value. When this button is pressed to exit the autorange mode, enter the manual range mode, displays the current value as a reference value, and then displays the difference between the measured value and the reference value, Press again to exit the relative value measurement. Pressing this key is greater than 2 Seconds, enter RS232 Data transmission mode. in RS232 Mode, auto-off function will be canceled. in RS232 State, press this key is greater than 2 S exit RS232 mode. (Note: The user can EEPROM The keys have not within the set RS232 Switching function)

## 9.4 K4 : HZ / DUTY

HZ / DUTY Bond is a frequency / duty cycle selector button to trigger action, measured at a frequency range, press the keys to select the frequency or duty cycle measurement mode; when the AC voltage or AC current measurements, press the key can be a voltage / frequency / duty cycle or current / frequency / duty cycle measurement mode selection.

## 9.5 K5 : HOLD / BACKLIGHT

HOLD Key is the reading hold key to trigger action function is to hold the display reading. Click to display the value when keys are locked, it has remained the same, pressing a key HOLD Function is canceled. Press to greater than 2 Seconds, turn on the backlight display, then press this key 2 Seconds to turn off the backlight. Backlit display about 30 Seconds (set). (Note: The user can EEPROM The set HOLD There is no key backlight switch function)

## 9.6 K6 : MAX / MIN

MAX / MIN Key data record button to trigger action. Press enter after the manual range mode automatically, the automatic shutdown function is canceled and MAX Value, then press this button to display MIN Value, then the display MAX-MIN Value, this cycle. press MAX / MIN Key for more than 2 Seconds, the exit data logging mode.

## 9.7 K7 : BACKLIGHT

BACKLIGHT Independent key backlight function key switch, with trigger operation. Open press backlit display, in a case where the backlight is opened Press again to turn off the backlight. Backlit display of greater than 30 Seconds (set) automatically turn off the backlight.

# 10 Other Function

10.1 Full power on display 2 After the second, normal measurement state. Such as EEPROM Error display ErrE .

10.2 Automatic shut-down

In the measurement process, 15 Within minutes (adjustable) position switch function keys and no action, the meter will enter the sleep state. In the sleep state, press Select Function keys, the instrument will return to work mode. Press and hold the power off state SELECT Key and then turn on the power, auto power off function is canceled. Shutdown reopened the reply automatic shutdown.

10.3 buzzer

Press any key switch or turn function, if the function key is valid, the buzzer will "Beep" I heard (about 0.25 second).

In the alarm value measured voltage or current is greater than a set of, for example, an AC voltage> 600V DC voltage> 1000V , AC / DC Current> 10A When the buzzer will continue to sound as over-range warning. Automatic shutdown before about 1 Minute buzzer will emit a continuous 5 Sound warning buzzer will shut down before 1 Long acoustic warning. When the automatic shutdown function is canceled, each 15 Min (i.e., the set time of automatic shutdown) continuously emits 5 Sound alerts.

10.4 Low voltage detector

3V Detecting when the internal power supply VDD When less than 2.4V , The battery symbol is displayed, but can still work; if less than 2.2V After the display, the whole power of the battery only significant symbols, can not work.

4.5 ~ 9V The power supply, the design condition is when the supply voltage drops below the voltage of the original 75% When the PT2.3 / LVD for 1.2V . This is done two resistors connected in series between the positive and negative power supply voltage, which is connected to the connection point PT2.3 / LVD , So that the resistance of the resistor connecting point voltage 1.2V . enter PT2.3 Mouth with IC internal 1.2V A voltage comparator falls below 1.2V , Battery symbol is displayed, but can still work.

10.5 PT1.2 Work output at a high level, output low when dormant, the power switch can be used as other external devices.

## 11 EEPROM option setting

### 11 . 1 EEPROM Initialization data

| Address | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **00** | FF | FF | FF FF | | FF | FF FF | | FF | FF 52 | | 00 FA | | 00 | 00 BE | | 03 |
| **10** | 70 | 17 | 3818 | | 44 | 02 6E | | 4B | 64 3C | | 3C 3C | | 0A | FF 40 | | FF |
| **20** | 99 | 99 | 0080 | | 64 | 0096 | | 00 | 0080 | | 0080 | | 00 | 8000 | | 80 |
| **30** | 4E | 02 | 09 4E | | 02 | 0977 | | FD | 0A 9A | | 19 0A | | 00 | 00 0A | | 00 |
| **40** | 00 | 01 | 0001 | | 00 | 0798 | | 00 | 6400 | | 6400 | | 64 | 0000 | | 00 |
| **50** | 00 | 80 | 0080 | | 00 | 8000 | | 80 | 0080 | | 0080 | | 00 | 8000 | | 80 |
| **60** | 00 | 80 | 0083 | | 01 | 00 6D | | 2A | 0000 | | 0000 | | 00 | 0000 | | 00 |
| **70** | 00 | 80 | 0080 | | 00 | 80 E0 | | 7C | 1801 | | 0000 | | 00 | 0000 | | 00 |
| **80** | 00 | 00 | 0000 | | 00 | 0000 | | 00 | 0000 | | 0000 | | 00 | 0000 | | 00 |
| **90** | 00 | 00 | 0000 | | 00 | 0000 | | 00 | 0000 | | 0000 | | 00 | 0000 | | 00 |
| **A0** | 00 | 00 | 0000 | | 00 | 0000 | | 00 | 0000 | | 0000 | | 00 | 0000 | | 00 |
| **B0** | 00 | 00 | 0000 | | 00 | 0000 | | 00 | 0000 | | 0000 | | 00 | 0000 | | 00 |
| **C0** | 0D | 00 | 0210 | | 0D | 0003 | | 20 | 2000 | | 0320 | | 20 | 0003 | | 10 |
| **D0** | 41 | 00 | 0308 | | 41 | 0003 | | 05 | 4100 | | 0305 | | 0D | 0002 | | 20 |
| **E0** | 00 | 80 | 0080 | | 00 | 8000 | | 80 | 0080 | | 0080 | | 00 | 8000 | | 80 |
| **F0** | 00 | 80 | FF FF | | FF | FF FF | | FF | 5A C7 | | CC 0F | | 0F | 8200 | | 00 |

**11.2 EEPROM Set data Description** ( Unspecified reservations and do not modify the data to fill in a default value )

| Description | Address default settings F9H | |
|---|---|---|
| | Bit7: 1 | Retention |
| | Bit6: 1 | Retention |
| | Bit54: 00 | Voltage VDDA 00 = 3.6V, 01 = 3.2V, 10 = 2.8V, 11 = 2.4V |
| | Bit32: 01 | VLCD voltage 00 = 3.3V 01 = 3.0V 10 = 2.8V 11 = 2.5V |
| | Bit1: 1 | PT1.2 boot state is set: = 1 PT1.2 = 1; = 0 PT1.2 = 0 (Note: PT1.2 open NCV synchronization function changes, set to 1 only) |
| | Bit0: 1 | . = 1 NCV function PT1.2 be synchronized with a buzzer sound changes to 1, when the ring is not 0; 0 = None |
| **FAH** | Bit7: 1 | = 1 MV profile for 60.00mv / 600.0mv; = 0 MV profile for 600.0mv |
| | Bit6: 1 | Retention |
| | Bit43: 01 | Time = 00 BL ON PT2.2 = 0; when OFF PT2.2 = 1 = time of 01 BL ON PT2.2 = 1; when OFF PT2.2 = 0 Time = 10 BL ON PT2.2 = pwm, PT2.3 = 0; when OFF PT2.2 = 1, PT2.3 = when 1 = 11 BL ON PT2.2 = pwm, PT2.3 = 1; when OFF PT2 .2 = 1, PT2.3 = 0 (Note: backlight high / low output mode, PT2.3 as LVD detection port; backlight mode PWM output, PT2.3 power source used as a backlight switch.) |
| | Bit2: 1 | = 1 HOLD key press can be on / off the backlight, No = 0 |
| | Bit1: 0 | = 1 REL bond may press the on / off RS232, = 0 None |
| | Bit0: 0 | 0 = Normal 1 = Table Clamp |
| **FBH** | 0FH | Auto off time setting, the default 15 minutes (units: minutes, from 1 to 255, does not automatically shut 0) |
| **FCH** | 0FH | Auto-off time of the backlight setting, default 15 seconds (unit: sec, 1 to 255, 0 does not automatically close) |
| **FDH** | 82H | bit7 = 1 Frequency shift effective measuring frequency channel switching. Pt3.6 & RLD = 0 A fixed measuring frequency channel Pt3.6 Bit6 = 1 UART Transmission format bit3 ~ 0-> com0 ~ 3 = 0 bit3 ~ 0-> com3 ~ 0 Bit5 = 1 UART send 14bytes (seg0 seg13) = 0 15bytes (seg0 seg14) Bit4 = 1 PT1.2 Only for ncv led ~ ~ = 0 PT1.2 Make ncv led and power led Bit3 ~ bit0 = 2 Low voltage power off delay seconds 2s, most 15s |
| **10H, 11H** 1770H | | Index number of the default settings 6000D (Note: 10H: 70H is low byte, 11H: 17H is high byte, hereinafter the same) |
| **12H, 13H** 1838H | | The upper limit bit shift 6200d (4000 indexing set 4200d) |

| | | |
|---|---|---|
| **14H, 15H** | 0244H | The lower limit of the shift position 580d (4000 indexing to 380d) |
| **16H** | 6EH | OL 1100V DC voltage value (unit: * 10V) |
| **17h** | 4BH | OL AC voltage value 750V (Unit: * 10V) |
| **18H** | 64H | Alarm DC voltage 1000V (Unit: * 10V) |
| **19H** | 3CH | 600V AC warning voltage value (unit: * 10V) |
| **1AH** | 3CH | uA current alarm file value 6000uA (Unit: * 100uA) |
| **1BH** | 3CH | of mA current 600mA alarm value (Unit: * 10mA) |
| **1CH** | 0AH | A value of the current alarm file 10A (Unit: * 1A) |
| **1EH** | 40H | NCV display symbols, the default section G (bit0 ~ 6 sequentially correspond ABCDEFG '8' word segment 7) |
| **20H, 21H** | 9999H | Amplifier parameters |
| **22H, 23H** | 8000H | 500mV correction rate |
| **24H, 25H** | 0064H | NCV base number (10.0mv) |
| **26H, 27H** | 0096H | NCV resolution (15.0mv) |
| **28H, 29H** | 8000H | Voltage compensation ratio AC6V speed (frequency) |
| **2AH, 2BH** | 8000H | 500uA correction rate |
| **2CH, 2DH** | 8000H | 50mA correction rate |
| **2EH, 2FH** | 8000H | 5A correction rate |
| **60H, 61H** | 8000H | Resistor 50K correction rate |
| **62H, 63H** | 8300H | 50M resistance profile correction ratio |
| **70H, 71H** | 8000H | Correction rate 500nF capacitor |
| **74H, 75H** | 8000H | 50uF capacitance correction rate |
| **76H, 77H** | 7CE0H | Gear ratio correcting capacitance 50mF |
| **0BH, 0CH** | 00FAH | Ambient temperature (25.0 ℃) |
| **0DH ~ 0FH** | 03BE00H | The default value of the ambient temperature ADC |
| **50H, 51H** | 8000H | 6A speed correction rate |
| **52H, 53H** | 8000H | Gear ratio correcting 60A |
| **54H, 55H** | 8000H | Gear ratio correcting 600A |
| **56H, 57H** | 8000H | 6000A shift correction rate |
| **40H, 41H** | 0100H | The number of gear noise deduction AC60mV (direct input signal and the internal amplification) |
| **42H, 43H** | 0100H | The deduction AC600mV gear noise (internal signal is not directly input amplification) |
| **44H, 45H** | 0700H | AC600mV gear noise deduction number (10M / 1.111M resistor divider and amplified) |
| **46H, 47H** | 0098H | AC6V gear noise deduction number (10M / 1.111M resistor divider) |
| **48H, 49H** | 0064H | AC60V gear noise deduction number (10M / 101k resistor divider) |
| **4AH, 4BH** | 0064H | AC600V gear noise deduction number (10M / 10k resistor divider) |
| **4CH, 4DH** | 0064H | File number AC1000V noise deduction (10M / 1k resistor divider) |
| **78H, 79H** | 0118H | The deduction in base capacitance 9nF profile (load capacitance of the display is not modify this number is 0, the unit is 0.001nF) |
| **80H ~ BFH** | | **Measurement function setting region ( Blue section ), According to need to refer to 11.3 / 11.4 description Modify** |
| **E8H, E9H** | 8000H | DCV correction rate in DC600mV |
| **EAH, EBH** | 8000H | DCV correction rate in DC6V |
| **ECH, EDH** | 8000H | DCV correction rate in DC60V |
| **EEH, EFH** | 8000H | DCV correction rate in DC600V |
| **F0H, F1H** | 8000H | DCV in correction rate DC1000V |

**11.3 EEPROM measurement function setting (80H ~ BFH)**

| Measurements Code | Jumper | Function Description |
|---|---|---|
| 00H | - | No function |
| 01H | J1A, J1B DCmV: 60.00mV / 600.0mV 02H | |
| | J1A, J1B ACmV: 60.00mV / 600.0mV 03H | |
| | X | DCV (without mV): 6.000V / 60.00V / 600.0V / 1000V |
| 04H | X | ACV (without mV): 6.000V / 60.00V / 600.0V / 750V |
| 05H | X | DCVmV (with mV): 600.0mV / 6.000V / 60.00V / 600.0V / 1000V |
| 06H | X | ACVmV (with mV): 600.0mV / 6.000V / 60.00V / 600.0V / 750V |
| 07H | J1A, J1B 600.0Ω / 6.000kΩ / 6.000kΩ / 60.00kΩ / 600.0kΩ / 6.000MΩ / 60.00MΩ | |
| 08H | - | - |
| 09H | J1A, J1B Cont 0AH | |
| | J1A, J1B Diode 0BH | |
| | J1A, J1B Cap: 9.999nF / 99.99nF / 999.9nF / 9.999μF / 99.99μF / 999.9μF / 9.999mF / 99.99mF | |
| 0CH | J4 (or J5) DCuA 600.0μA / 6000μA (or clamp DCA 600.0A / 6000A) 0DH | |
| | J4 (or J5) ACuA 600.0μA / 6000μA (or clamp ACA 600.0A / 6000A) 0EH | |
| | J3 (or J5) DCmA 60.00mA / 600.0mA (or clamp DCA 60.00A / 600.0A) 0FH | |
| | J3 (or J5) ACmA 60.00mA / 600.0mA (or clamp ACA 60.00A / 600.0A) 10H | |
| | X (or J5) DCA 6.000A / 60.00A (or clamp DCA 6.000A / 60.00A) 11H | |
| | X (or J5) ACA 6.000A / 60.00A (or clamp ACA 6.000A / 60.00A) 12H | |
| | J1A and J2, j2 ' Hz / Duty | |
| 13H | J1A | Temp (℃) |
| 14H | J6 | hFE |
| 15H | J1A | Temp (℉) |
| 16H | J1A | DCA 6.000A |
| 17H | J1A | ACA 6.000A |
| 18H | J1A | DCA 60.00A |
| 19H | J1A | ACA 60.00A |
| 1AH | J1A | DCA 600.0A |
| 1BH | J1A | ACA 600.0A |
| 1CH | J1A | DCA 6000A |
| 1DH | J1A | ACA 6000A |
| 1EH | X | NCV |

Jumper Description:

Jx indicates that this jumper to be

short-circuited X represents do not pick any jumpers

**11.4 Measurement Function Select**

11.4.1 selecting dial encoding MEA4 ~ MEA1 measurements, a total of 16 selected 0000,0001,0010,0011, ...

1110, 1111. Float "1", then VSS is "0."

11.4.2 Each dial encoding the EEPROM 4 functions to set up, with the SELECT key switch function. (Note: the same jumper

before dial into the same coding)

**11.4.3 The following measurement functions at a store address EEPROM, Required fields measuring function code (PT2.4 ~ PT2.7 hanging**

**Empty is "1", then VSS "0 ";.) PT2.7**

| (MEA4) | PT2.6 (MEA3) | PT2.5 (MEA2) | PT2.4 (MEA1) | Function 1 | Function 2 | Function 3 | Function 4 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 80H | 90H | A0H | B0H |
| 0 | 0 | 0 | 1 | 81H | 91H | A1H | B1H |
| 0 | 0 | 1 | 0 | 82H | 92H | A2H | B2H |
| ... | ... ... ... | | | ... | ... | ... | ... |
| 1 | 1 | 1 | 1 | 8FH | 9FH | AFH | BFH |

Example 1: dial encoding MEA4 ~ 1 = 1111, function to DCV / ACV; fill in the EEPROM address 8FH

Into 03H, 9FH fill 04H, AFH fill 00H, BFH filled 00H Example 2: encoding a dial MEA4 ~ 1 = 1101, functionality

is provided to Ohm / Diode / Cont / Cap, the EEPROM

Address 8DH fill 07H, 9DH fill 0AH, ADH fill 0BH, BDH fill 09H.

**Common measurements combined 1** (PT2.4 ~ PT2.7 float "1", then VSS is "0"):

| PT2.7 | PT2.6 PT2.5 | | PT2.4 | Function 1 | Function 2 | Function 3 | Function 4 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | DCV | ACV | | |
| 1 | 1 | 1 | 0 | Ohm | Diode | Cont | Cap |
| 1 | 1 | 0 | 1 | DCmV | AC mV | | |
| 1 | 0 | 1 | 1 | DCμA | AC μA | | |
| 1 | 1 | 0 | 0 | DCmA | AC mA | | |
| 1 | 0 | 0 | 1 | DCA | ACA | | |
| 1 | 0 | 1 | 0 | Temp ℃ | Temp ℉ | | |
| 1 | 0 | 0 | 0 | Hz / Duty | | | |
| 0 | 1 | 1 | 1 | AC6000A | DC6000A | | |
| 0 | 1 | 1 | 0 | AC600.0A | DC600.0A | | |
| 0 | 1 | 0 | 1 | AC60.00A | DC60.00A | | |
| 0 | 0 | 1 | 1 | AC6.000A | DC6.000A | | |
| 0 | 1 | 0 | 0 | AC 6A / 60A | DC 6A / 60A | | |
| 0 | 0 | 1 | 0 | AC 60A / 600A | DC 60A / 600A | | |
| 0 | 0 | 0 | 1 | AC 600A / 6000A | DC 600A / 6000A | | |
| 0 | 0 | 0 | 0 | hFE | | | |

**Common measurements composition 2** (PT2.4 ~ PT2.7 float "1", then VSS is "0") :

| PT2.7 | PT2.6 | PT2.5 | PT2.4 | | Function 1 | Function | Function | Function 2 3 4 |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | | DCV | | | |
| 1 | 1 | 1 | 0 | | ACV | | | |
| 1 | 1 | 0 | 1 | | Ohm | | | |
| 1 | 0 | 1 | 1 | | Diode | Cont | | |
| 1 | 1 | 0 | 0 | | Diode | Cont | Cap | |
| 1 | 0 | 0 | 1 | | Cap | | | |
| 1 | 0 | 1 | 0 | | DC mV | AC mV | | |
| 1 | 0 | 0 | 0 | | DCμA | AC μA | | |
| 0 | 1 | 1 | 1 | | DC mA | AC mA | | |
| 0 | 1 | 1 | 0 | | DC A | AC A | | |
| 0 | 1 | 0 | 1 | | Temp ℃ | Temp ℉ | | |
| 0 | 0 | 1 | 1 | | Hz / Duty | | | |
| 0 | 1 | 0 | 0 | | AC 6000A | DC 6000A | | |
| 0 | 0 | 1 | 0 | | AC 600.0A | DC 600.0A | | |
| 0 | 0 | 0 | 1 | | AC 60.00A | DC 60.00A | | |
| 0 | 0 | 0 | 0 | | AC 6.000A | DC 6.000A | | |

Note: the above table is only for illustrative current range, the current need to use ordinary multimeter separated from the clamp current, i.e., the only available current.

## The method of correcting process 12

The following describes a flow of the calibration circuit of FIG subject to this specification. (See the circuit diagram). Button assignments during calibration:

**SELECT:** Skip / function selection

**HOLD:** Less(-)

Remaining keys: plus (+)

**12.1 Calibration mode is entered**

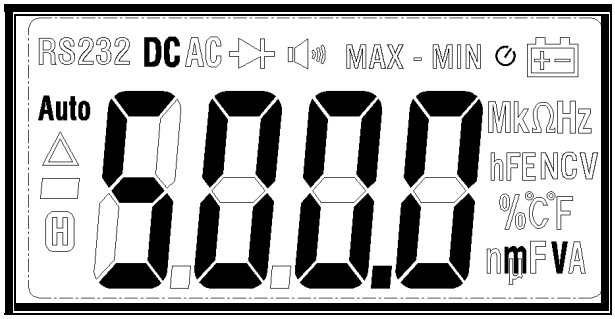
J8 short boot into calibration mode. (Resistance profile measurement function should be placed, and remove the input pen)

**12.1.1** After checking automatically displayed CAL IC internal circuit, LCD display ADC code value, if there is an error prompting Err0 ~ 4, this time off the measurement view dividing resistor is connected for a short circuit, open circuit, the size of the resistance is correct, checked and after the error, and then reboot, start the calibration process, the self-test parameters are automatically saved to E2 is completed, the buzzer BEEP beep prompts to complete. If too has been detected, press the SELECT button to skip the examination.

**12.1.2** Then automatically check the internal amplifier-related parameters, the parameters are automatically saved to the E2 self-test is completed, the buzzer sounds for instructions to complete BEEP. If too has been detected, press the SELECT button to skip the examination.

**12.2 correction voltage (DC 500.0mV)**

Measurement function to be placed in the calibration table DC millivolt range (or resistivity profile (J1A, J1B short circuit)).

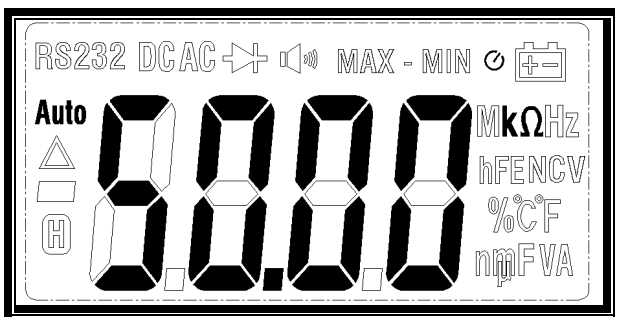



The positive voltage output terminal of the correction instrument lead into V / CAP Port, a negative terminal lead into the COM Port, an output correction device DC500.0mV Press +/- to adjust the display 500.0mV It can be. If you have already adjusted, press the SELECT button to skip this adjustment.

Correcting the output values may be used: 100mV ~ 500mV (100mV integer multiple thereof), the recommended value 500.0mV. Adjust the displayed value to output the same to the instrument, similar steps.

**12.3 resistance calibration (50.00KΩ)**

Measurement function to be placed in the calibration table resistance profile (J1A, J1B short circuit).

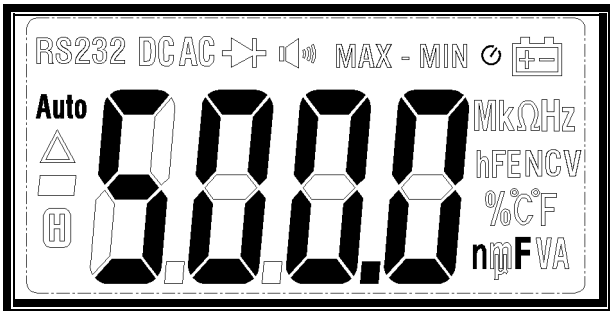



Calibrator output 50.00KΩ, adjust the display according to +/- 50.00 KΩ can be. If you have already adjusted, press the SELECT button to skip this adjustment.

Correcting the output values may be used: 10KΩ ~ 50KΩ (10KΩ integer multiple thereof), the recommended value 50.00KΩ.

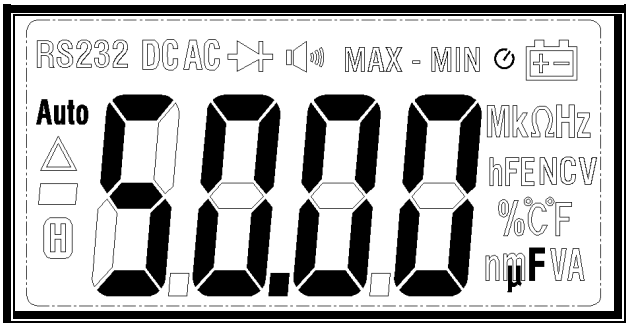
**12.4 Correction capacitor (500.0nF, 50.00μF)**

Measurement function to be placed in the calibration table gear capacitance (or resistance profile (J1A, J1B short circuit)).




**Correction device outputs 500.0nF, after waiting for a stable display, adjust the display according to +/- 500.0 nF; can be**

used to correct an output value of: 200nF ~ 600nF (100nF integer multiple thereof), the recommended value 500.0nF.



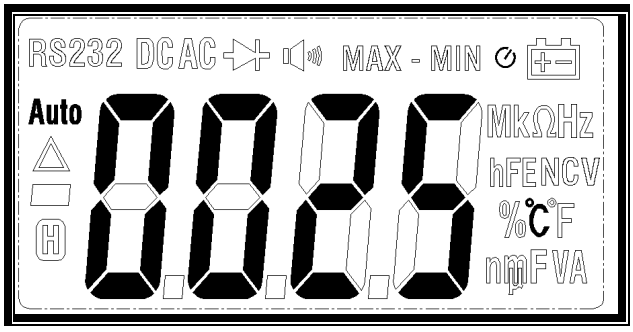

**Calibrator output 50.00μF, After waiting for a stable display, press +/- to adjust the display 50.00 μF. If you have already adjusted, press the SELECT** button to skip this adjustment.

Correcting the output values may be used: 20μF ~ 60μF (10μF integer multiple thereof), the recommended value 50.00μF. Note: The

above adjustments capacitor requires two points, the corresponding direct output capacitance value range, the program will automatically switching range.

**12.5 Ambient temperature correction (input actual ambient temperature)**

Measurement function to be subjected to a temperature profile of the calibration table (or resistance profile (J1A, J1B short circuit)).

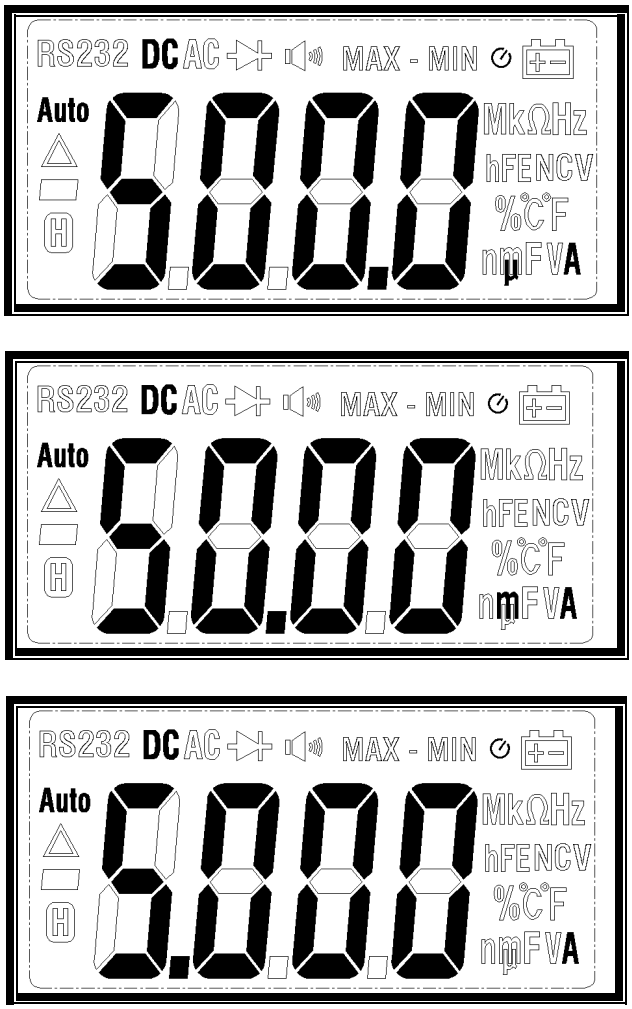



LCD displays ambient temperature (the temperature of the non-current) at the default value or the last adjustment 25 ℃. Based on the ambient **temperature correction, according to the display +/- adjusted to ambient temperature (adjustable range 0 ~ 50 Deg.] C).**

**Note: If not adjusted and LCD The default display of the temperature is the current ambient temperature, At this point at least once by +/- adjustment, If** you had to adjust before you do not need to adjust again, press SELECT jump over.

**12.6 multimeter correction current (DC 500.0uA, 50.00mA, 5.000A)**

Measurements were to be placed in the calibration table DCμA / mA / A to be adjusted.




The positive output terminal of the current correctors pen then the corresponding measurement port, then the negative terminal lead COM port, direct current outputs DC 500.0μA / 50.00mA / 5.000A, adjusted by +/- corresponding range.

Correcting the output values may be used: uA profile 100μA ~ 500μA (100μA integer multiple thereof), recommended values 500.0μA;

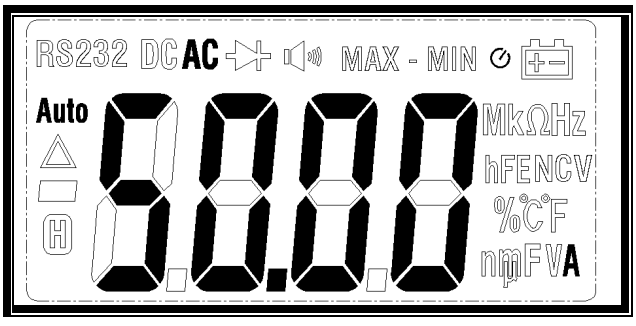
mA mode 10mA ~ 50mA (10mA integer multiple thereof), recommended values 50.00mA;

A Profile 1A ~ 5A (1A integer multiple thereof), the recommended value 5.000A.

Note: The base current adjustment of voltage, voltage adjustment needed to be so correct and then adjust the current, the current clamp similar.

**12.7 clamp current correction**

To be measured is placed in the calibration table clamp function section, according to an appropriate range of the input current can be corrected, to adjust the display to a +/- standard output value.



60HZ AC output signal recommended adjustment, output correction value of each range as follows:

6.000A: 1A ~ 5A (1A integer multiple thereof), the recommended value 5.000A;

6.000A / 60.00A, 60.00A / 600.0A, 60.00A, 600.0A: 10A ~ 50A (10A integer multiple thereof), recommended values 50.00A;

600.0A / 6000A, 6000A: 100A ~ 500A (100A integer multiple thereof), the recommended value 500.0A; Note: 1 can separate automatic shift range when corrected to a small-scale, low current output corrected easily. The correction profile 6000A automatically shift between the measured values 600.0A / 6000A, this time to adjust the output current of 500.0A, 6.000A and if speed is automatically switched between 600.0mA / 6.000A, 5.000 direct output A current is adjusted.

2. Meter output current should be corrected before the full-scale signal of about 600mV (corresponding to 6000count), Do not too much deviation, the signal is too large can cause overflow signal is too small may result in insufficient resolution.

**Correction voltage range 12.8**

Measurement function to be placed in the calibration table DC voltage profile, if the range is set to: DC600Mv / 6V / 60V / 600V / 1000V, calibration input signal is recommended: DC500mv / 5v / 50v / 500v / 1000v, appropriate parameters may also be provided on their own calibration, to adjust the display to a +/- standard output value to the calibration current range.

Note:

Step 1. Power On Self Test (12.1) After completion, can go directly to adjust the function, if the dial unmodified coding When varying (PT2.7 ~ 2.4), press Select key, you can ignore the current adjustments, go to the next adjustment. The default voltage adjustments 12.2, 12.3 resistors, capacitors 12.4, 12.5 four ambient temperature, and can be done without having to switch dial adjustment converted to the corresponding function in the default function of the resistance profile.

2. When the adjustment process, standard input signal, to wait for the display stabilizes before Press +/- adjustment. Avoid exceeding output Allowing the signal value range.

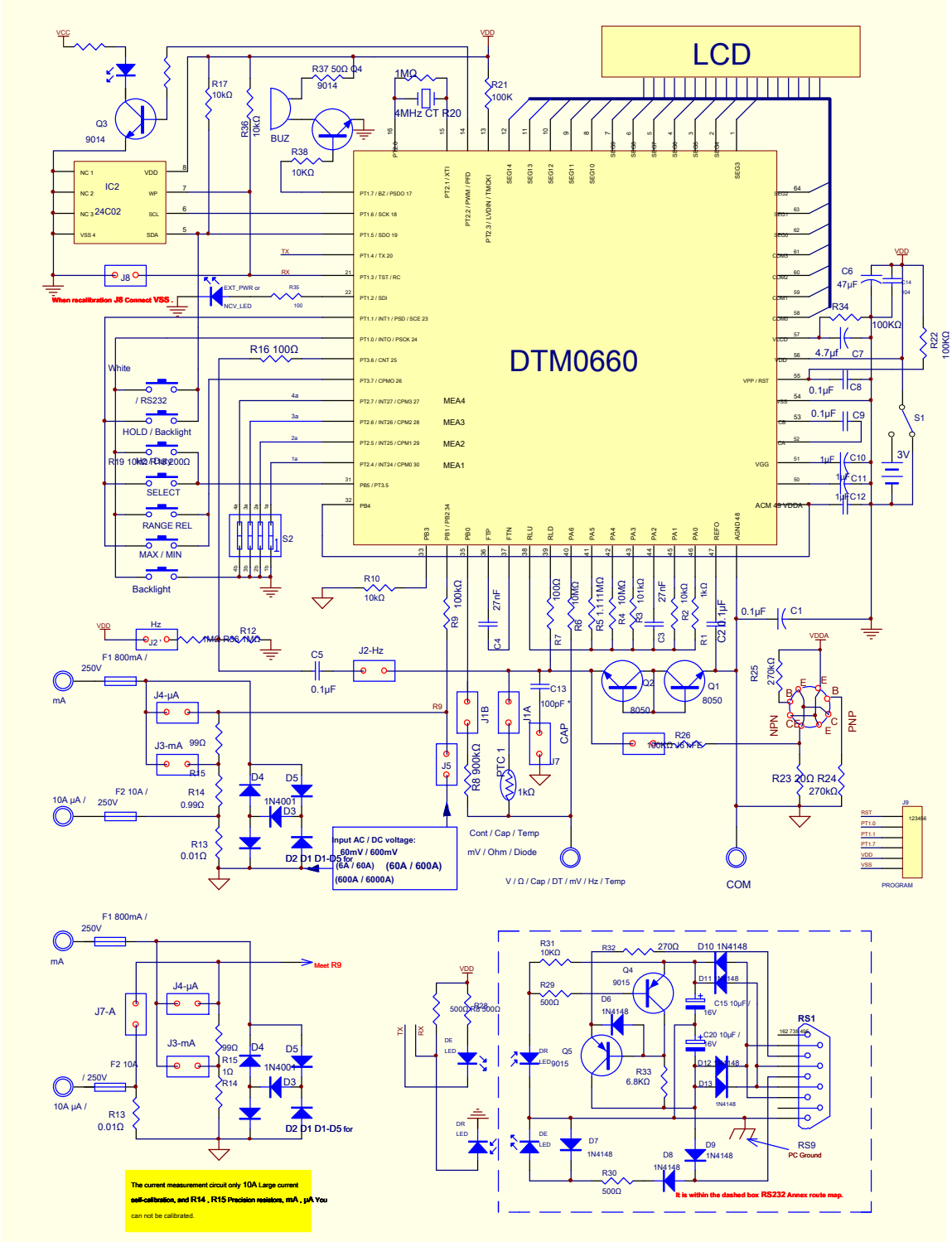
3. The error will affect the voltage regulator adjustment current readjusted if the voltage, the current also needs readjustment. 4. Correction function is set in the process does not shift, a signal short circuit, open circuit or jitters will cause an error or adjustment error becomes large. If adjustment data over the allowable error (+/- 80%), and the highest digit LCD display or show greater than 6 +/- key press operation will not respond to "OL", no buzzer sound. Normal operation and calibration data is written right after E2 buzzer BEEP beep, data may alter normal but no buzzer sound indicates that the data is not stored properly, readjust again. If the check is still valid E2 line, and J8 jumper is shorted.

5. Please do not adjust the data other than the recommended value.

6. After calibration is complete, determines J8 jumper has been disconnected, normally after power test.

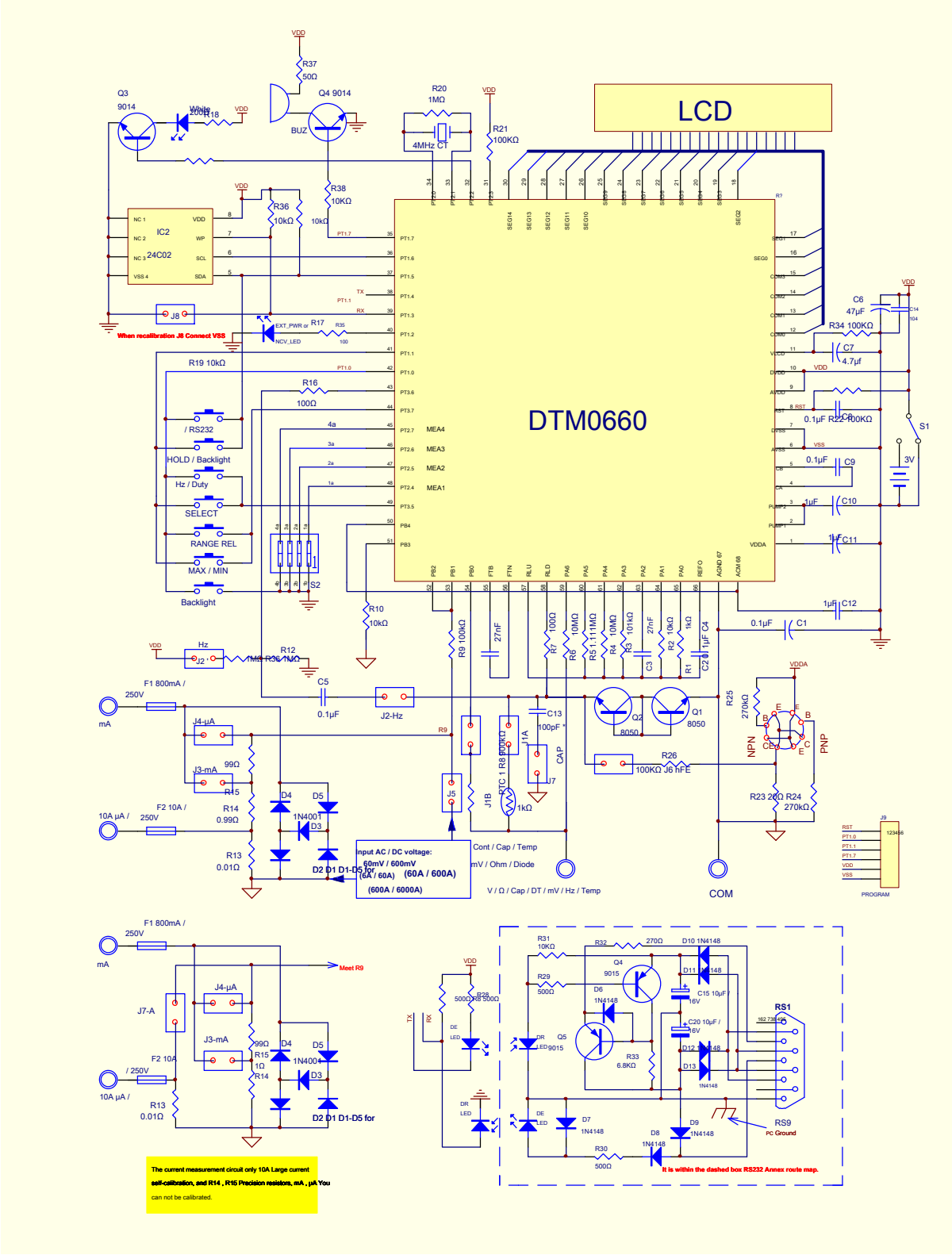
## 13 and the application circuit described

### 13.1 3V power supply circuit diagram



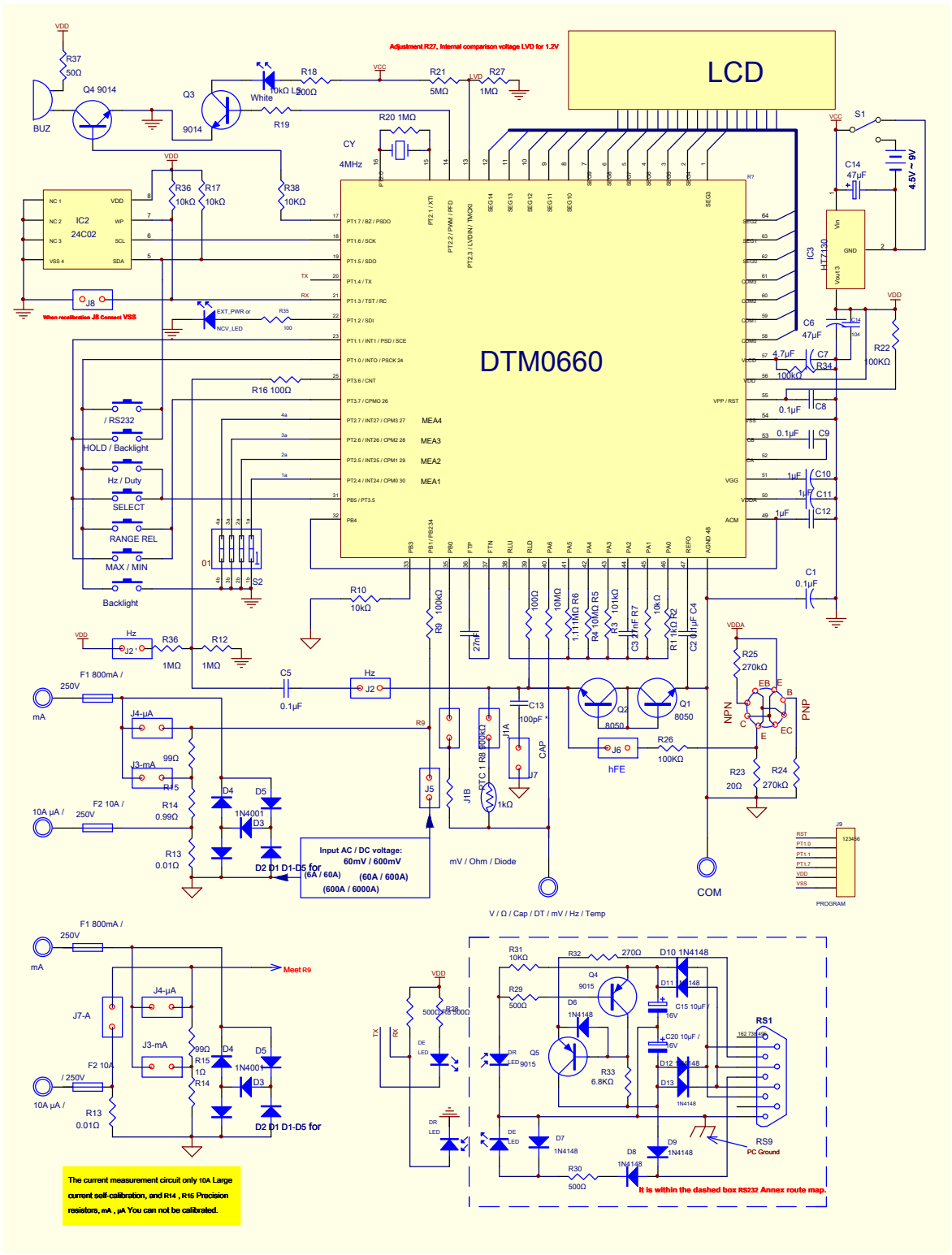

3 3V power supply circuit diagram of FIG.

**13.2 3V power supply circuit diagram die**




3V power supply circuit diagram of the die 4

**13.3 9V power supply circuit diagram**




5 9V power supply circuit diagram of FIG.

NOTE: Component Parameters are for reference to FIG 1., the specific use of the process according to the user depending on their design.

2. For the LCD 4 × 14, SEG14 can not empty.

**13.4 Power Systems**

13.4.1 VA, VB of IC internal bias voltage input points.

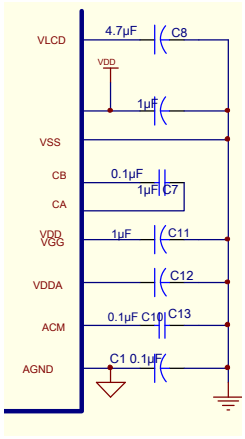
13.4.2 AGND is an analog ground point, which corresponds to the midpoint potential of the battery voltage. The point potential is generated in the IC, and not connected to the midpoint of the battery.

13.4.3 C1 and capacitor C7 bypath, on the other hand to make AGND VDD and VSS stability. C11 is a charge pump, IC let through C11 VDD VGG charging and discharging up to about 2 times VDD.

13.4.4 VDDA VGG after the IC is regulated by the output voltage with respect to VSS is approximately 3.6V.

13.4.5 REFO an IC internal power bandgap reference, relative to AGND is about 1.2V, a stable of 100ppm / ℃ of.

13.4.6 ACM VSS to about 1.2V, a stable of 50ppm / ℃ of



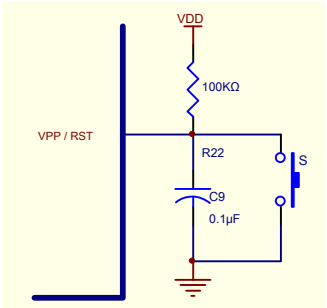

The power supply circuit 6 in FIG.

**Voltage 13.5 points as follows:**

VDD ← → VSS: 2.4 ~ 3.6V VGG ← → VSS: 4.2V VDDA ← → VSS: 3.6V

(Without the use CHARGE PUMP, LDO another 3.2V, 2.8V, 2.4V selectable) AGND ← → VSS: 0.5VDDA, 0.3VDDA, 0.1VDDA select REFO ← → AGND: 1.2V ACM ← → VSS: 1.2V

**13.6 Triggered reset circuit**



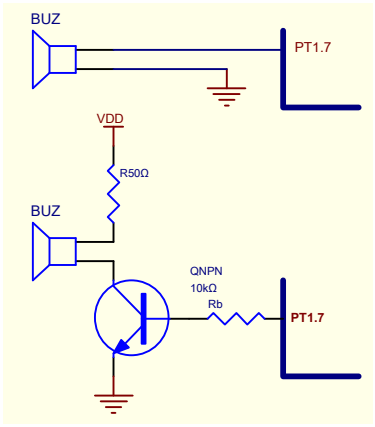

The reset circuit 7 in FIG.

Note: 1. R22 and C9 are automatically reset when the reset assembly, power is turned on.

2. S manual reset button, if the manual reset function, do not use S.

**13.7 buzzer driving circuit**

DTM0660 can directly drive the buzzer, the output frequency of about 1.95 kHz. If too little sound, driving transistor can be used, R is the resistance depends on the actual situation.




8 buzzer driving circuit of FIG.

**13.8 backlight circuitry**

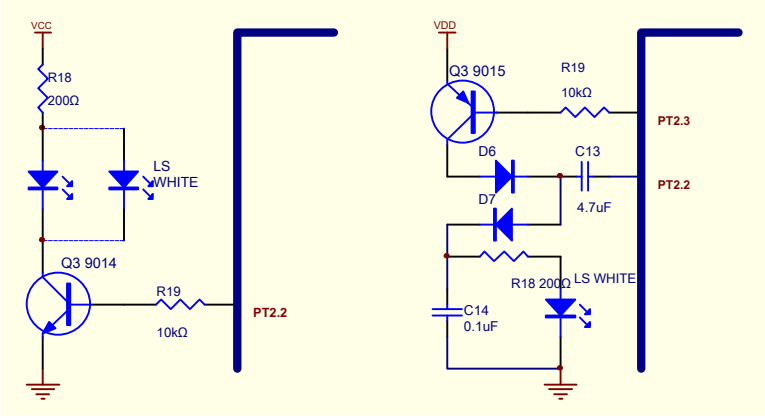


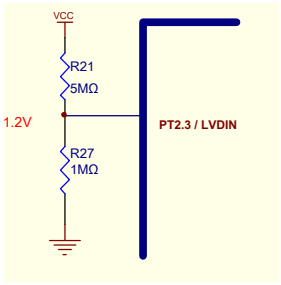

FIG backlight circuit 9 (1)

The backlight circuit (2)

Description:. 1 VCC back circuit (1), depending on the type of light-emitting diodes may be, VDD is 3V power supply, VCC from VDD to The light emitting diode to a desired boost voltage, the circuit may employ a backlight (2) PT2.3 output low, PT2.2 boosting mode to the PWM output to drive the light emitting diode. See E2 parameter setting PWM output of the backlight.

2. R18 visual reality determined.

**13.9 higher than 3V supply low voltage detecting circuit**




10 low voltage detection circuit of FIG.

Description: R21, R27 is selected when the power supply voltage to a minimum, so adjust the resistance R27 of 13 feet 1.2V.

**13.10 AC rectifier circuit**

DTM0660 using True RMS internal digital circuit, therefore, there is no need of any external components of the rectifier circuit.

**Voltage measuring 13.11**

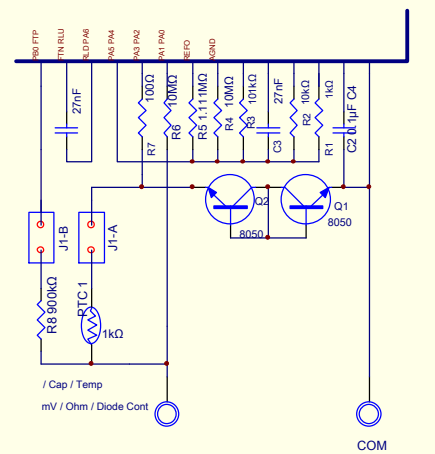
13.11.1 voltage measurement circuit shown in Figure 11. J1A, J1B off.

13.11.2 When the voltage measurement, the measured voltage by the resistor R6 input directly into the IC; 6V, 60V, 600V, 1000V voltage obtaining profile 1 / 10,1 input voltage by R5, R3, R2, R1 and R6 dividing / 100,1 / 1000, 1/10000 and then into the IC. REFO voltage of 1.2V, without adjustment.

13.11.3 600mV voltage profile measured by the input resistor R6, R5 partial pressure, and then 10 times magnification is fed via the internal ADC IC.

**13.11.4 formula dividing the measured voltage is: $V_{out} = V_{in} \times [R_{x/(}$ R6 + $R_{53}]$ ; R & It. As R1, R2, R3 or R5. Thus, R1, R2, R3,** R5, R6 determines the accuracy of the measurement accuracy of each range.

13.11.5 Q1, protection of high voltage power source when inserted into the table typo Q2 and also as a PTC resistance, capacitance, frequency, diodes, and other off measurement, not when the frequency measurement, Ql can not, as long as the base of Q2 after the product is connected to the ground electrode (AGND) on it.



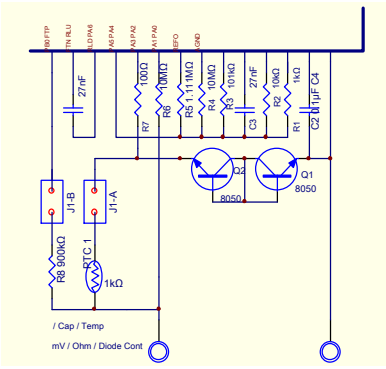

Voltage measuring circuit 11 of FIG.

Note: The maximum input voltage rating is DC1000V, AC750V.

**13.12 AC / DC millivolt measurement**

AC / DC millivolt (AC / DC 60 / 600mV) voltage measurements shown in Figure 12. J1A, J1B turned on. DC millivolt RLD from entering the IC, **the maximum range of 600mV (200mV, 400mV can be set), the input impedance is infinite (10 ¹¹ [Omega]), measured without attenuating the weak** signal, so high accuracy. However, there will be some number displayed in the case where the input open circuit, the figures appear to be normal, as **long as the lead into the measured point, the readings will stabilize. To prevent large input voltage causes an exception, mV Range can be increased schematic R7 Resistance to 100k Other range is**

100 Europe.




12 AC / DC voltage measuring circuit millivolt

**Current measuring 13.13**

13.13.1 μA profile sampling resistance is R13 + R14 + R15, mA is the profile sampling resistor R14 + R15,10A sampling resistance profile is R15. Were measured by switching the mode switch, when the measured uA, J3 is turned off, the closing J4; when measuring mA, disconnect J4, J3 close; when measuring the bulk current gear 10A, J3, J4 OFF .

13.13.2 μA, mA third gear 10A, and the voltage drop generated up to 0.6V and 0.1V. These voltages are fed to the comparator compares the voltage, if more than 60mV, the voltage signal directly into the A / D converter; if less than 60mV, the internal electronic switch is closed, a 10x magnification and then into the A / D converter.

13.13.3 method for measuring current in FIG 13, the self-calibration method can be corrected μA, mA and 10A stalls, R13, R14 and R15 does not affect the accuracy of the accuracy of current measurement. It may also be precision resistors R14 and R15, R13 and manual tuning embodiment to calibrate a large current, i.e., the same as the conventional DMM.

13.13.4 method for measuring current in FIG 14, the self-calibration method can be corrected only file 10A, no manual adjustment R13. Accuracy μA and mA measured is the precision resistors R14 and R15 to the guaranteed.

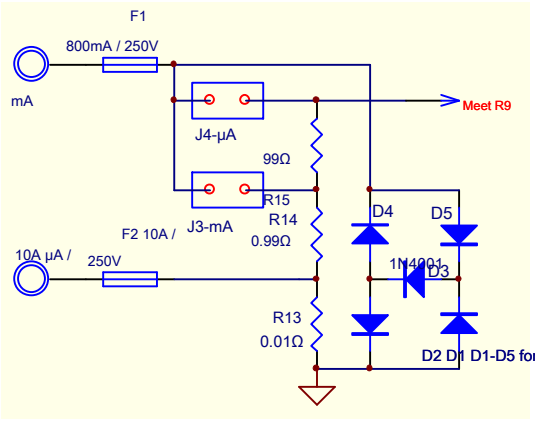
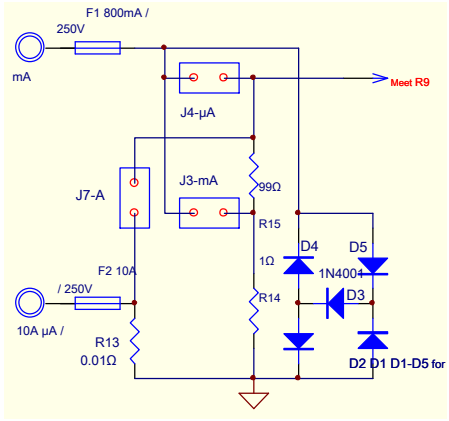



FIG current measurement circuit 13 (a)



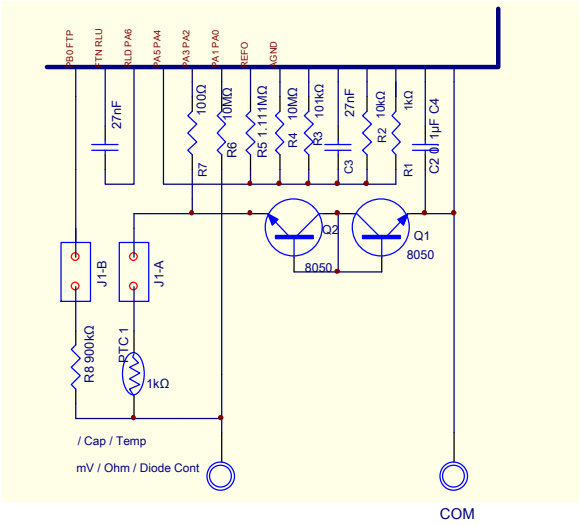

Current measurement circuit 14 in FIG. (B)

**13.14 resistance measurement**

Measuring the resistance shown in Figure 15. J1A, J1B turned on.

The resistance is measured as a reference standard resistor, the resistance to be measured with a standard resistance test comparing measured resistance value is obtained. Profile for the standard resistance 60MΩ 10MΩ (R6), of other modes are standard resistors R4, R5, R3, R2, R1, measuring the resistance, a voltage of 1.0V IC internal (with respect to AGND), respectively, by the voltage resistors R1, R2, R3, R4, R5 outputted through R7, PTC resistor under test to generate a current I, this current flows through the resistor to produce a measured voltage VR, the voltage IC and the voltage by the return R8 standard resistance compared calculating the resistance of the measured resistance. (60 M [Omega voltage output gear directly to the test by the resistor R6)

When resistance measurement J1A, J1B to be turned. Filter capacitor C3 is a reference resistor, C4 is a filter capacitor of the measured resistance.

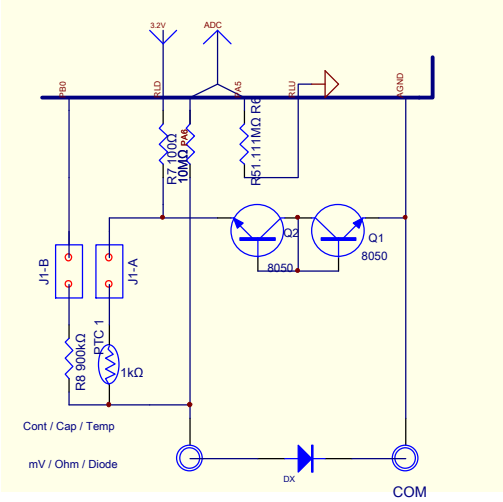



Resistance measurement circuit 15 in FIG.

**13.15 diode measurements**

Figure 16 diode measurement.

Diode IC 3.2V measurements generated by the internal voltage (relative to AGND), was applied to the diodes through PTC R7 positive output terminal. Diodes forward voltage drop VD of about 0.5V-0.7V, VD through VD R6 and R5 partial weight of 1/10 into the ADC, the VD value display. J1A, J1B are mode switch, J1A diode measurement; J1B closed. DTM0660 diode output when the test voltage is measured 3.2V, a detectable contour LED diode forward conduction. When the detection diode voltage drop exceeds 3.0V, indicating overflow to "OL" tabular. Appears "OL" reverse diode may be damaged or measurement.




Diode measurement circuit 16 in FIG.

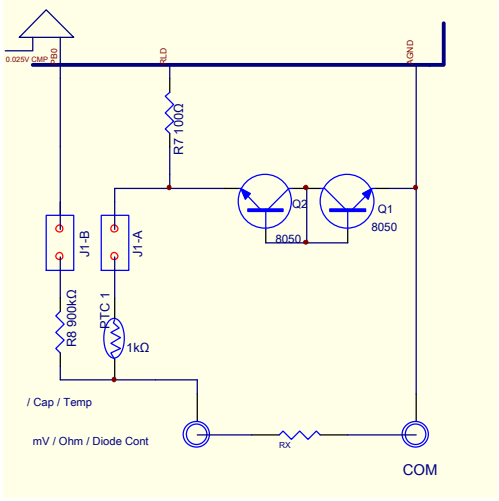
**13.16 Continuity Check**

Figure 17 is detected off.

When off internal IC and generates 1.0V voltage (relative to AGND) outputted by R7, applied through PTC-off point to be detected. J1A, **J1B are mode switch, on closing, when the Rx made off detection voltage $V_{Rx}$ By R8 input IC. Seen from FIG., 1.0V * Rx / (R7 + PTC + Rx) =** 0.025V

$$Rx = 0.025 (R7 + PTC) /0.975$$

Known R7 = 100Ω, if PTC = 1kΩ, the Rx ≒ 28.2Ω, if PTC = 1.5K, the Rx ≒ 41Ω. Thus, when the PTC between 1kΩ ~ 1.5kΩ, the buzzer is turned off at point Rx between 28Ω ~ 41Ω.



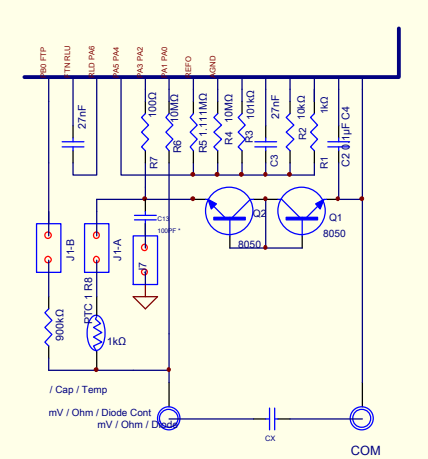

Off detecting circuit 17 of FIG.

**13.17 capacitance measurement**

Capacitance measurement and generate a waveform shown in Figure 18 and 19.

Counted divided frequency capacitance measurement and width measurement cycles in two parts, 0 ~ 1μF frequency counting type, 1μF than width measurement cycle. Measuring the capacitance charge and discharge resistor is formed by shaking the measured capacitance, the frequency of oscillation or cycle required capacitance value. When J1A, J1B of the mode switch, the capacitance measurement, J1A, J1B, J7 closed.

C13 100pF * improving linearity by measuring small capacitance is determined according to the actual situation. PTC resistance mF file size can affect the accuracy of range, the resistance should be less than 2KΩ .




Capacitance measuring circuit 18 of FIG.

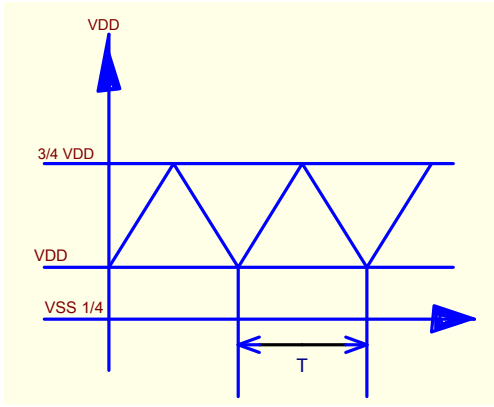
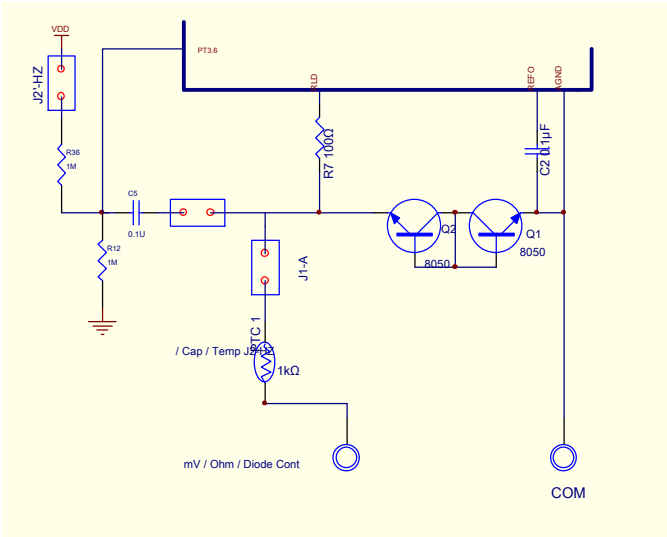



FIG 19 is typically input capacitance measurement waveform

**13.18 Frequency Measurement**

Frequency measurement shown in Figure 20, the frequency measurement J1A and J2, J2 'ON.




Frequency measurement circuit 20 in FIG.

**13.19 Transistor hFE measurement**

Transistor hFE measured in Figure 21, when measuring the hFE ON J6.

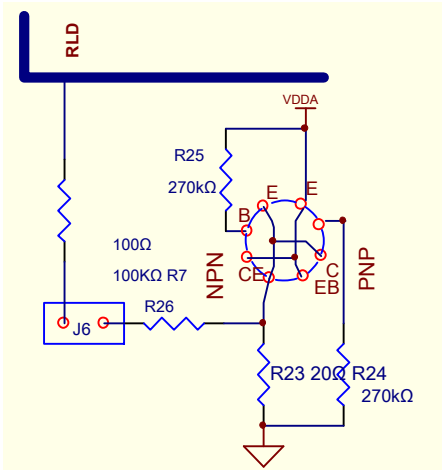
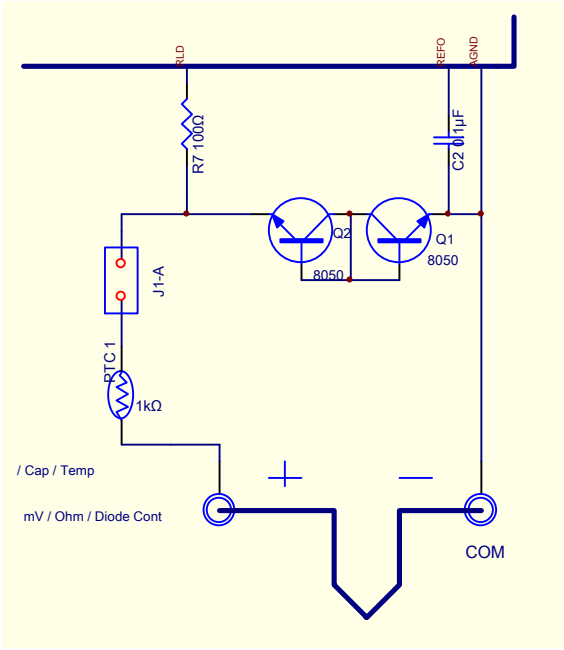



FIG hFE measurement transistor 21

**13.20 Temperature Measurement**

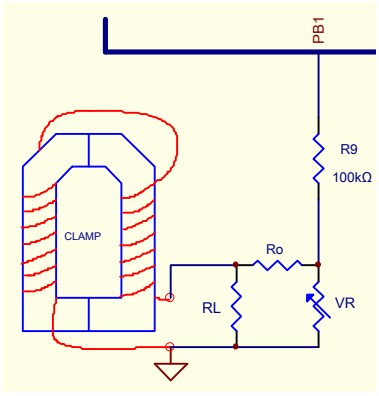
Figure 22 temperature measurement.



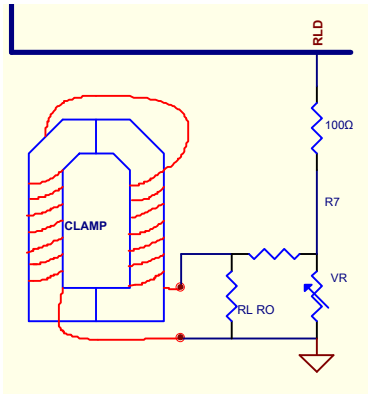

Temperature measurement circuit 22 in FIG.

Description: Temperature is measured using a type K thermocouple, the cold junction compensation is processed by the IC, it turned J1A measured.

**13.21 AC clamp meter Application Circuit**




23 AC current measuring clamp meter circuit of FIG. (A)




24 AC current measuring clamp meter circuit of FIG. (B)

Description:

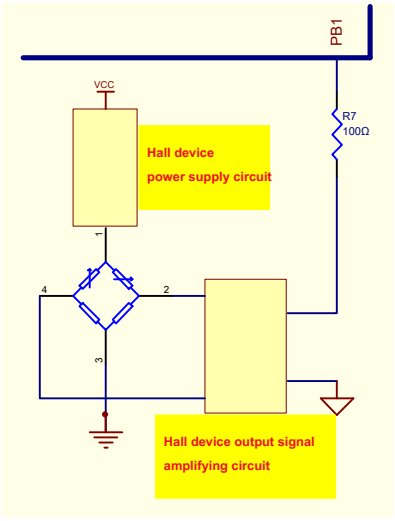
1. A (FIG. 23) PB1 input, there are three current measuring range options, namely 6.000A / 60.00A,

   60.00A / 600.0A, 600.0A / 6000A. Each automatic range shifting.

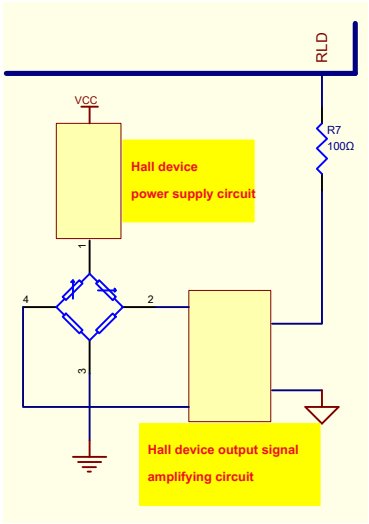
2. RLD by the input port (FIG. 24), there are four current measurement range options, namely 6.000A, 60.00A, 600.0A, 6000A.

   When the correction can automatically switch to the enlarged state, easy to adjust, but not the normal measurement range automatically.

**13.22 AC / DC Clamp Meter Application Circuit**




25 AC / DC clamp meter current measurement circuit (a)




26 AC / DC clamp meter current measuring circuit (II)

Description:

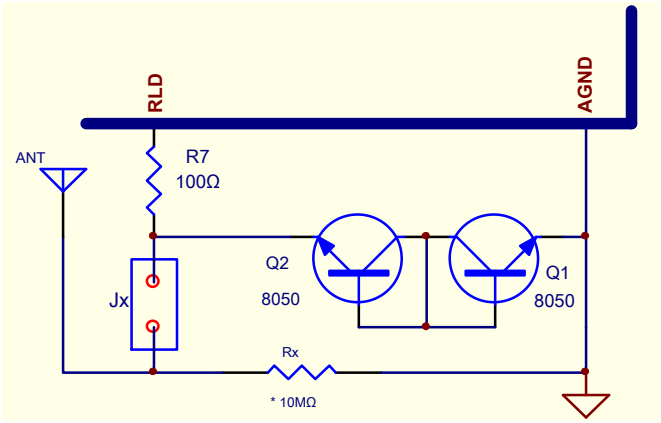
1. Hall device made using AC / DC clamp meter can be calibrated manually.

2. Since different materials jaws, the current intensity of the magnetic induction are different, the user may need DTM0660

   2000/4000/6000 display count set to form.

**13.23 NCV measurements**

NCV measurements shown in Figure 27.




27 NCV measurement circuit of FIG.

NCV measurement alternating voltage signal from the RLD into the IC, the measurement results of five grades display, 0 ~ 50mV display EF, 50 ~ 100mV / 100 ~ 150mV / 150 ~ 200mV / 250mV above show 1-4 '-' word (available setting), and with different rhythms buzzer sound. Applications need to be adjusted according to the value of Rx and the induction line. NCV measurement and the minimum resolution can be set E2 (in 0.1mV): 25h (H) & 24h (L) set in base NCV measurements, 27h (H) & 26h (L) resolution setting NCV, calculated is the measured value :( - in base) / = 0 ~ 4 resolution (rounded result), the count is greater than 4. 4. Such as: 25h (H) & 24h (L) = 0064h, 27h (H) & 26h (L) = 0096h, measuring the induced signal = 50.0mV, the LEVEL = (50.0-10.0) /15.0~=2, the display section 2 ' - -. "

Optional PT1.2 NCV function as a control indicator (E2 provided F9h.bit0 = 1). When no signal PT1.2 = 0, when the output signal PT1.2 with the buzzer, the buzzer sound PT1. 2 = 1, and 0 otherwise. This setting has no effect on other functions, PT1.2 = 1.

**13.25 RS232 transmission protocol**

n Direction: one-way to the computer
n Baud Rate: 2400 bps.
n Data bits: 8 bit.
n Parity: None.
n Data Format: Hex.
n Data length: 15 Bytes.
n Data: LCD table on-off information.
n Data Format:

1st byte → 1X (X is seg1, 4 bits represent the data on the LCD table), 2nd byte → 2X (X is seg2, 4 bits represent the data on the LCD table), 3rd byte → 3X (X is seg3, 4 bits represent the data on the LCD table), .....

1X → 4 bit, 2X → 4 bit, 3X → 4 bit, ....., FXH → 4 bit.

n X represents: Bit3 ~ Bit 0 → segn (COM3-COM0)

## The liquid crystal display 14

### 14.1 4 × 15 liquid crystal display structure

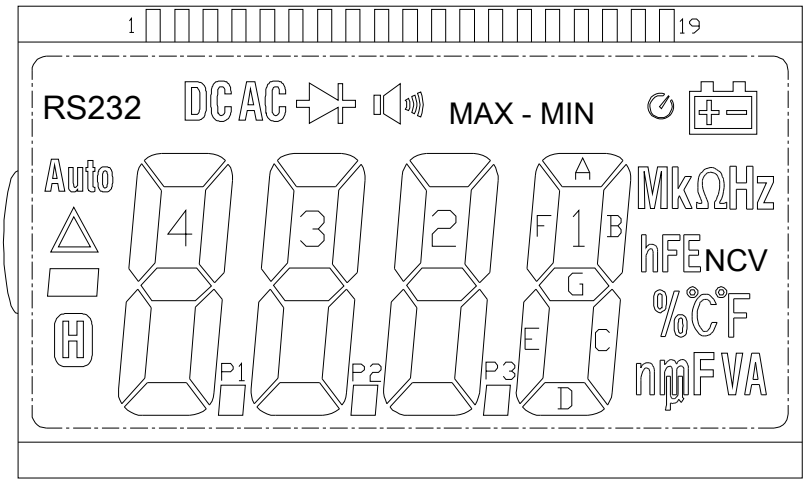



FIG 28 4 × 15 liquid crystal display structure of FIG.

### The liquid crystal display truth table 14.2

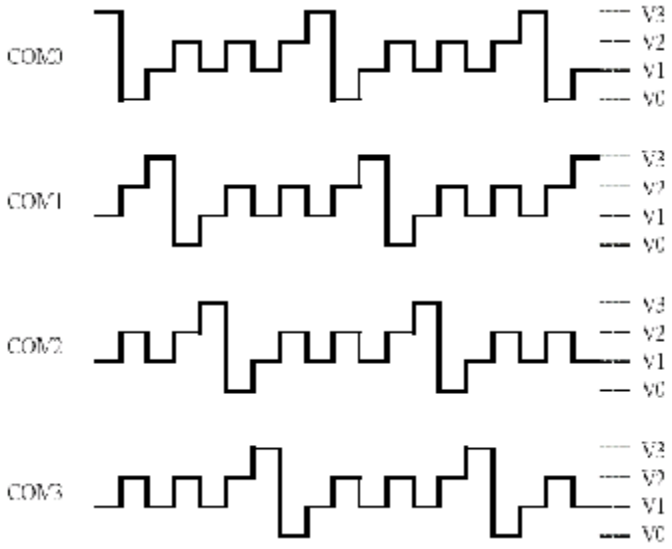
| PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEG | / | / | / | / | SEG0 | SEG1 | SEG2 | SEG3 | SEG4 | SEG5 | SEG6 | SEG7 | SEG8 | SEG9 | SEG10 | SEG11 | SEG12 | SEG13 | SEG14 |
| COM3 | / | / | / | COM3 | RS232 | A4 | B4 | A3 | B3 | A2 | B2 | A1 | B1 | | | | | NCV | MAX |
| COM2 | / | / | COM2 | / | AUTO | F4 | G4 | F3 | G3 | F2 | G2 | F1 | G1 | K | M | | Hz | hFE | |
| COM1 | / | COM1 | / | / | DC | E4 | C4 | E3 | C3 | E2 | C2 | E1 | C1 | n | % | Ω | V | ℃ | MIN |
| COM0 | COM0 | / | / | / | AC | | D4 | P1 | D3 | P2 | D2 | P3 | D1 | μ | m | F | A | ℉ | |

29 LCD truth table of FIG.

Note: 1 Operating voltage:. 3V.

2. Drive method: 1/4 Duty, 1/3 Bias.

### The liquid crystal display waveform 14.3

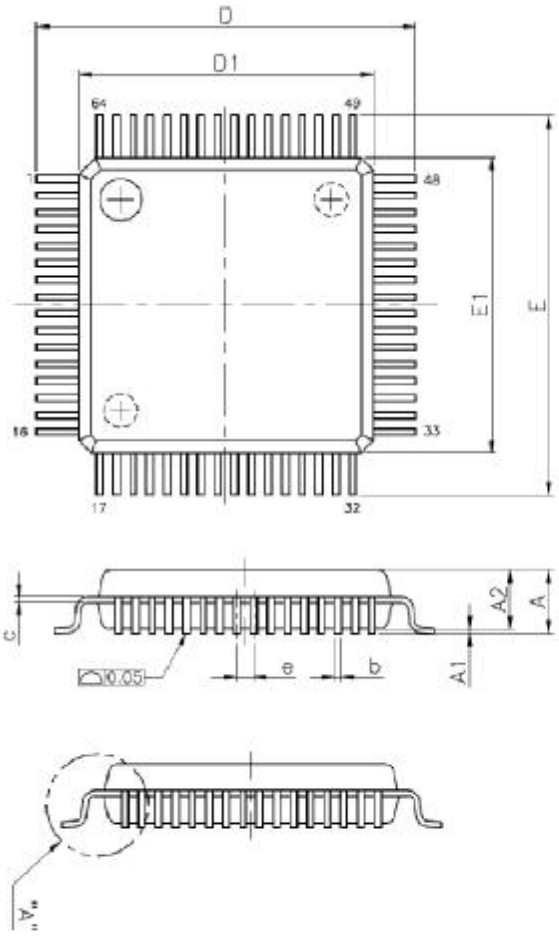



The liquid crystal display 30 FIG driving waveform COM

**The liquid crystal display Description of Symbols 14.4**

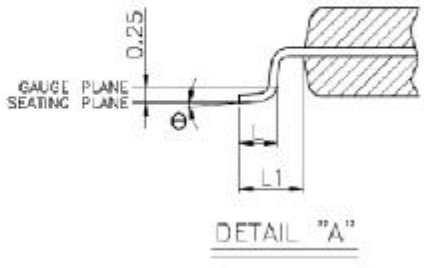
| symbol | Say Bright | symbol | Say Bright |
|---|---|---|---|
| | Battery voltage is less indication | △ | Relative value measuring mode |
| AUTO | Automatic range | mV, V | Voltage unit |
| AC | AC voltage or alternating current | μA, mA, A | Current unit |
| DC | DC voltage or DC current | Ω, kΩ, MΩ resistor units | |
| | DC voltage or current indicative of negative | nF, μF, mF capacitor unit | |
| | Diode measurement mode indication | Hz, kHz, MHz<br>% | Frequency Unit<br>Percent of duty cycle pulse signal |
| | Off measurement instruction | RS232 | RS232 function indicator |
| | Data Hold mode | ℃ ℉ | Temperature units |
| hFE | Transistor DC magnification | MAX, MIN, MAX-MIN maximum, minimum, difference | |
| NCV | NCV function indicator | | Automatic shutdown instructions |

## Encapsulating sheet 15 Dimensions




VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

| SYMBOLS | MIN. | NOM. | MAX. |
|---|---|---|---|
| A | – | – | 1.60 |
| A1 | 0.05 | – | 0.15 |
| A2 | 1.35 | 1.40 | 1.45 |
| b | 0.13 | 0.18 | 0.23 |
| c | 0.09 | – | 0.20 |
| D | | 9.00 BSC | |
| D1 | | 7.00 BSC | |
| e | | 0.40 BSC | |
| E | | 9.00 BSC | |
| E1 | | 7.00 BSC | |
| L | 0.45 | 0.60 | 0.75 |
| L1 | | 1.00 REF | |
| θ | 0° | 3.5° | 7° |




JEDEC MS-026 Compliant

FIG package sheet 31 Dimension

V1.5 Modify records

1: eprom Setting content changes ( fdh) = 82h .

2: Buzzer output frequency parameter to 1.95k. V1.6 Modify

records

1 : Change the application circuit. J1 change to J1A, J1B 2:

24C02 WP Feet to 10k Pull-up resistor

V1.7 Modify records

1: Increasing the voltage range calibration, changing the eprom set up e8h ~ f1h The default values.

2 : Change the frequency measurement.

V1.8 Modify records

1: ACM Meet PB4, EMC Strengthen immunity test.

2: increase J11 Jumper, as mV Speed input channels.

V1.9 Modify records

1: cancel mV enter J11 Jumpers can be adjusted depending on the application R7 Resistance, see mV Measuring instructions.

2: VDD End increase 0.1uF Filter capacitor

3: ACM Stabilizing capacitance to the end . 1uF

4: increase UART Upload options

24c02 FDH.6 = 1 selected 9721 Compatible format, FDH.6 = 0 (dtm0660L version)

FDH.5 = 1 send 14Bytes, FDH.5 = 0 send 15Bytes (dtm0660L version)

5: increase Ncv Indicator Control Options

24c02 FDH.4 = 1 pt1.2 Only ncv led, Active high, other modes is low.

24c02 FDH.4 = 0 pt1.2 As a ncv led And the power indicator.

6 :increase diode / cont Relative value Control Options

24c02 FAH.5 = 0 No relative value function

24c02 FAH.5 = 1 Relative value function