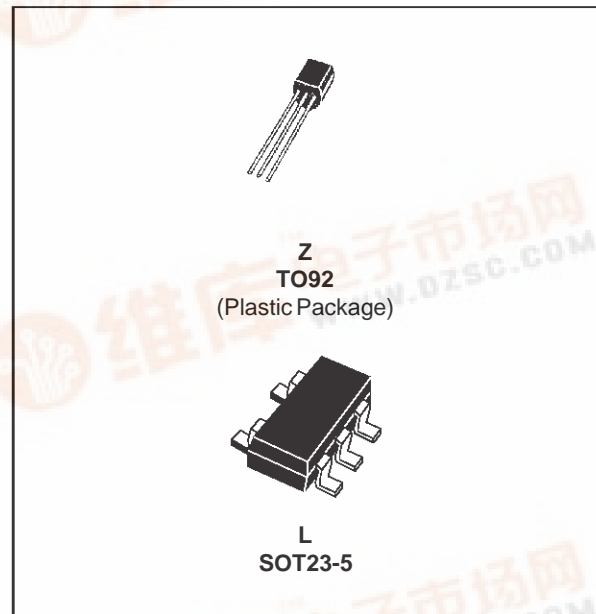




TS431

LOW VOLTAGE ADJUSTABLE SHUNT REFERENCE

- LOW VOLTAGE OPERATION : 1.24 TO 6V
- 2% and 1% VOLTAGE PRECISION
- WIDE RANGE CATHODE CURRENT : 25 μ A TO 30mA
- LOW OUTPUT IMPEDANCE : 0.25W
- HIGH STABILITY WHILE OPERATING WITH CAPACITIVE LOAD
- ESD PROTECTION :
 - 5kV (Human Body Model)
 - 200V (Machine Model)
- OPTIMIZED FOR HIGH TEMPERATURES



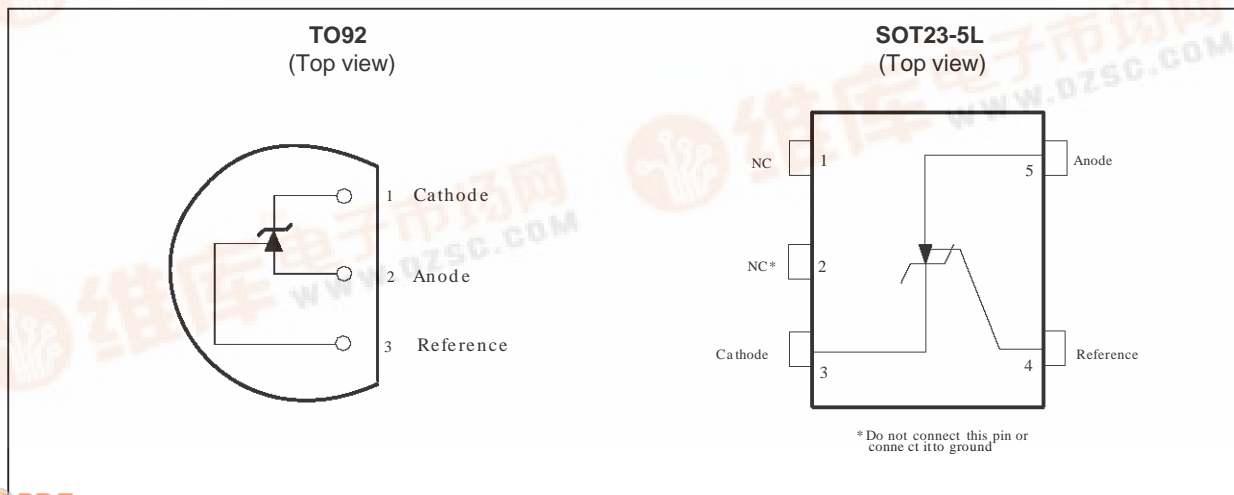
DESCRIPTION

The TS431 is a three terminals programmable shunt Voltage Reference optimized for high temperatures. However, it can operate from -40°C up to +125°C. The output voltage is set by two external resistors to any value between 1.24 and 6V. When driving an optocoupler, the TS431 is particularly interesting to regulate 3.3V switching power supplies.

ORDER CODES

| Part Number | Temperature Range | Package | | SOT23 Marking |
|-------------|-------------------|---------|---|---------------|
| | | Z | L | |
| TS431I | -40°C, +125°C | • | • | L272 |
| TS431AI | -40°C, +125°C | • | • | L271 |

PIN CONNECTIONS (top view)



TS431

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|--|-------------|------------------|
| V_{KA} | Cathode to Anode Voltage | 10 | V |
| I_K | Continuous Cathode Current Range | -20 to +40 | mA |
| I_{ref} | Reference Input Current Range | -0.05 to +3 | mA |
| P_d | Power dissipation, TO92 package @ $T_{amb.} = 25^\circ\text{C}$ Power dissipation, SO23-5 package @ $T_{amb.} = 25^\circ\text{C}$ | 625 500 | mW |
| T_{oper} | Operating Free-air Temperature Range | -40 to +125 | $^\circ\text{C}$ |
| T_{stg} | Storage Temperature Range | -65 to +150 | $^\circ\text{C}$ |

OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|----------|--------------------------|----------------|------|
| V_{KA} | Cathode to Anode Voltage | V_{ref} to 6 | V |
| I_K | Cathode Current | 0.025 to 30 | mA |

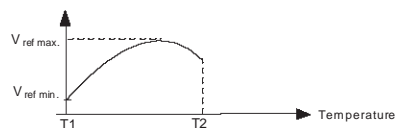
TS431

ELECTRICAL CHARACTERISTICS $T_{amb} = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|-------|-------|----------------------------------|---------------|
| V_{ref} | Output Voltage $V_{KA} = V_{ref}$ @ $I_K = 100\mu\text{A}$ | $T_{amb} = 25^\circ\text{C}$ | 1.215 | 1.240 | 1.265 | V |
| ΔV_{ref} | Output Voltage Change - note 1 $I_K = 100\mu\text{A}$, $V_{KA} = V_{ref}$ | $0 < T_{amb} < +70^\circ\text{C}$ $0 < T_{amb} < +105^\circ\text{C}$ $0 < T_{amb} < +125^\circ\text{C}$ $-20 < T_{amb} < +105^\circ\text{C}$ $-40 < T_{amb} < +85^\circ\text{C}$ $-40 < T_{amb} < +125^\circ\text{C}$ | | | 15 20 25 30 35 40 | mV |
| $\left \frac{\Delta V_{ref}}{\Delta V_{KA}} \right $ | Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage | $I_K = 10\text{mA}$ $V_{KA} = 6\text{V to } V_{ref}$ | | | 2.7 | mV/V |
| I_{ref} | Reference Input Current | $I_K = 10\text{mA}$ | | 30 | 100 | nA |
| ΔI_{ref} | Reference Input Current Deviation Over Temperature Range | $I_K = 10\text{mA}$ $R_1 = 10\text{k}\Omega$ $R_2 = \infty$ | | 30 | 60 | nA |
| I_{min} | Minimum Cathode Current for Regulation | $V_{KA} = V_{ref}$ | | 25 | 40 | μA |
| I_{off} | Off-State Cathode Current | $V_{KA} = 6\text{V}$, $V_{ref} = 0$ | | 0.001 | 0.1 | μA |
| $ Z_{KA} $ | Dynamic Impedance | $V_{KA} = V_{ref}$, $f < 1\text{kHz}$ $I_K = 0.1$ to 15mA | | 0.25 | 0.4 | Ω |

Notes : 1. ΔV_{ref} is defined as the difference between the maximum and minimum values obtained over the full temperature range.

$$\Delta V_{ref} = V_{ref \text{ max.}} - V_{ref \text{ min.}}$$



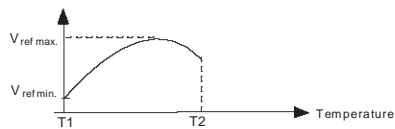
TS431A

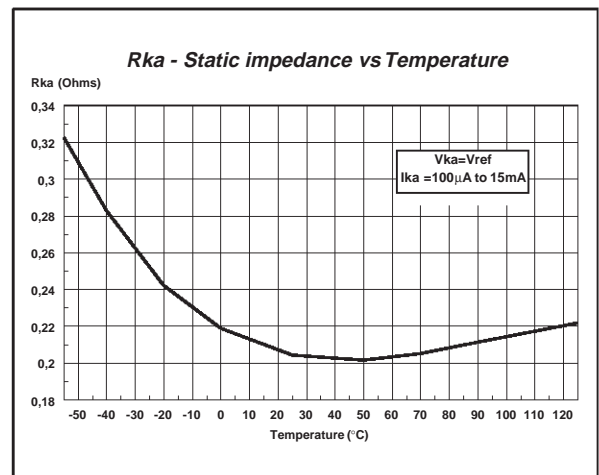
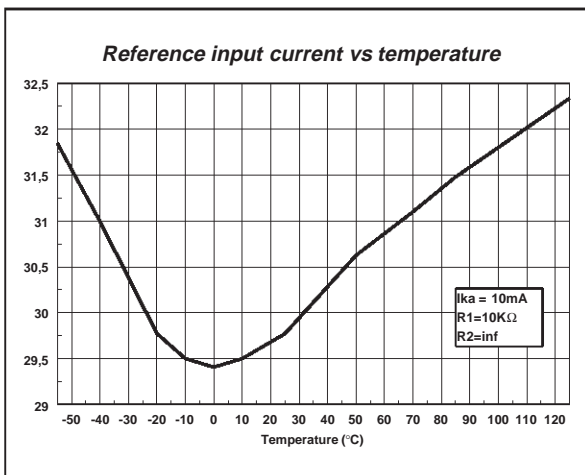
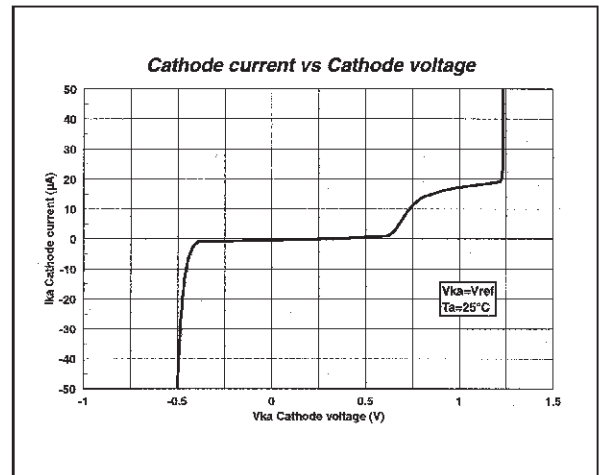
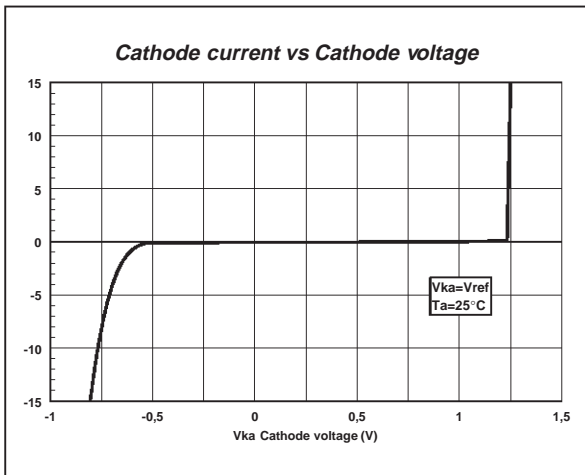
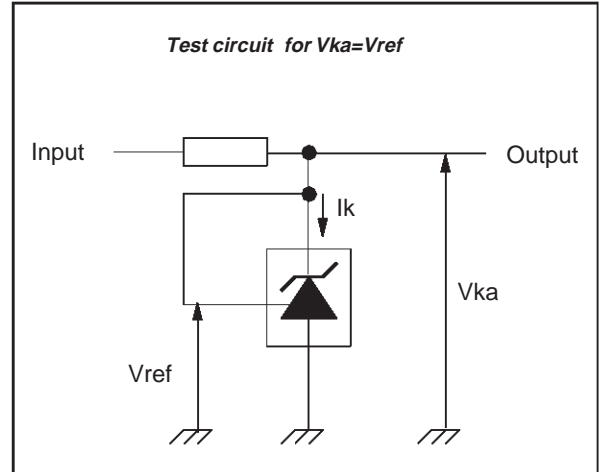
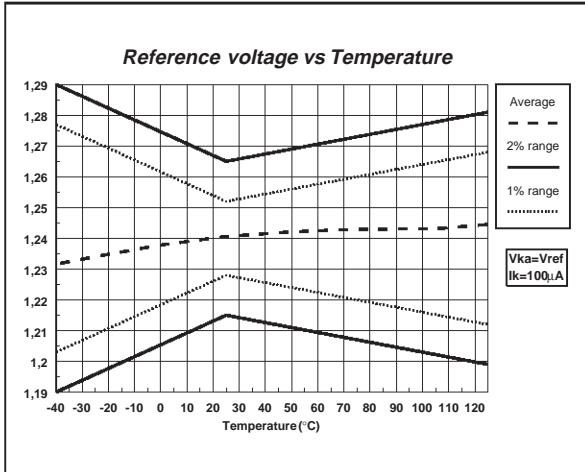
ELECTRICAL CHARACTERISTICS $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise specified)

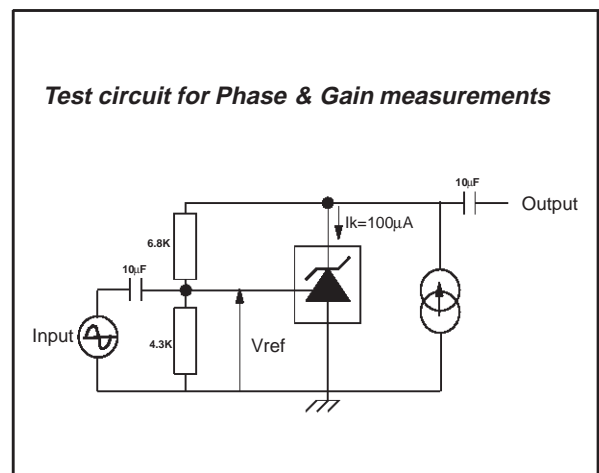
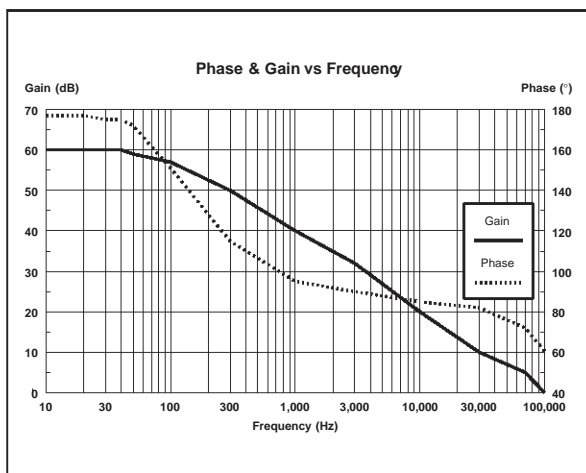
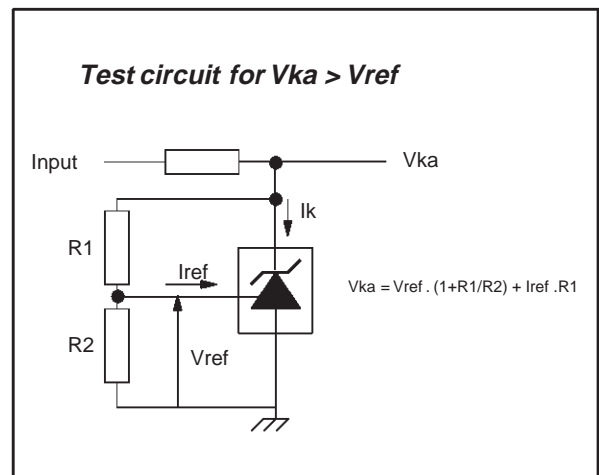
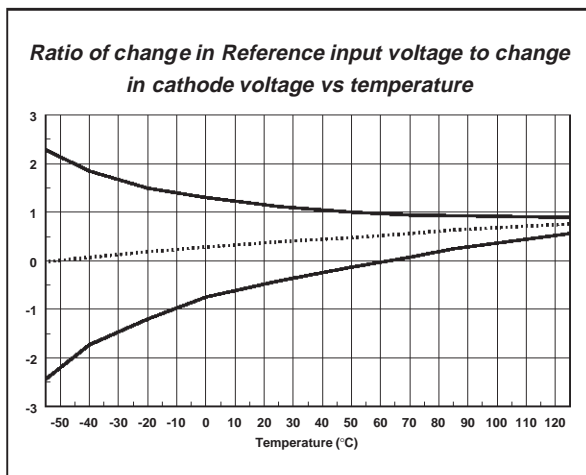
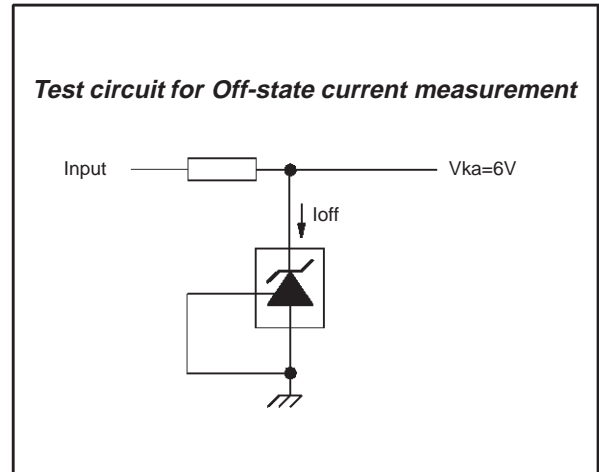
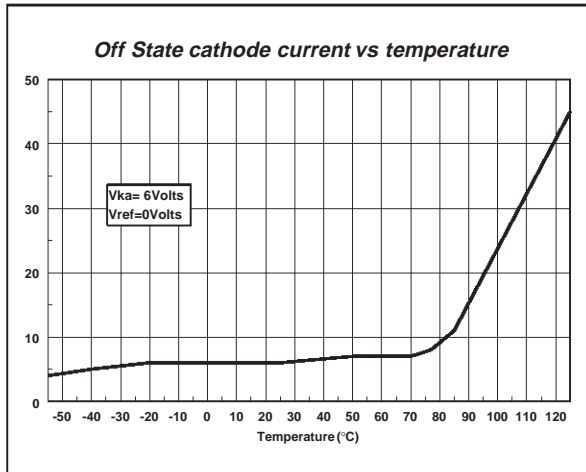
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|-------|-------|----------------------------------|---------------|
| V_{ref} | Output Voltage $V_{KA} = V_{ref}$ @ $I_k = 100\mu\text{A}$ | $T_{amb} = 25^{\circ}\text{C}$ | 1.228 | 1.240 | 1.252 | V |
| ΔV_{ref} | Output Voltage Change - note 1 $I_k = 100\mu\text{A}$, $V_{KA} = V_{ref}$ | $0 < T_{amb} < +70^{\circ}\text{C}$ $0 < T_{amb} < +105^{\circ}\text{C}$ $0 < T_{amb} < +125^{\circ}\text{C}$ $-20 < T_{amb} < +105^{\circ}\text{C}$ $-40 < T_{amb} < +85^{\circ}\text{C}$ $-40 < T_{amb} < +125^{\circ}\text{C}$ | | | 15 20 25 30 35 40 | mV |
| $\left \frac{\Delta V_{ref}}{\Delta V_{KA}} \right $ | Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage | $I_k = 10\text{mA}$ $V_{KA} = 6\text{V to } V_{ref}$ | | | 2.7 | mV/V |
| I_{ref} | Reference Input Current | $I_k = 10\text{mA}$ | | 30 | 100 | nA |
| ΔI_{ref} | Reference Input Current Deviation Over Temperature Range | $I_k = 10\text{mA}$ $R_1 = 10\text{k}\Omega$ $R_2 = \infty$ | | 30 | 60 | nA |
| I_{min} | Minimum Cathode Current for Regulation | $V_{KA} = V_{ref}$ | | 25 | 40 | μA |
| I_{off} | Off-State Cathode Current | $V_{KA} = 6\text{V}$, $V_{ref} = 0$ | | 0.001 | 0.1 | μA |
| $ Z_{KA} $ | Dynamic Impedance | $V_{KA} = V_{ref}$, $f < 1\text{kHz}$ $I_k = 0.1 \text{ to } 15\text{mA}$ | | 0.25 | 0.4 | Ω |

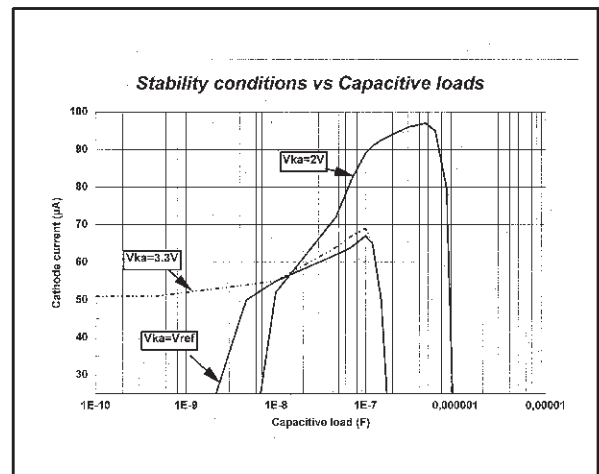
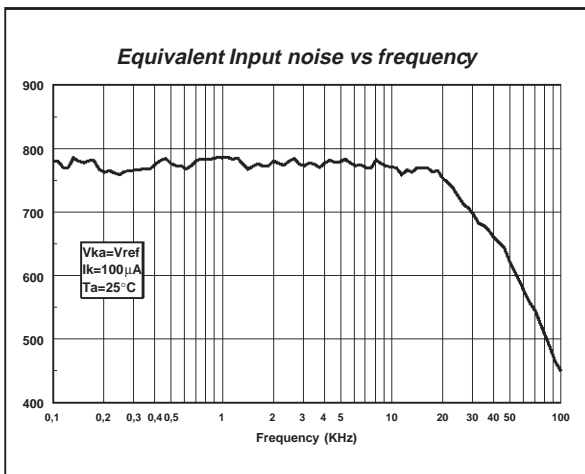
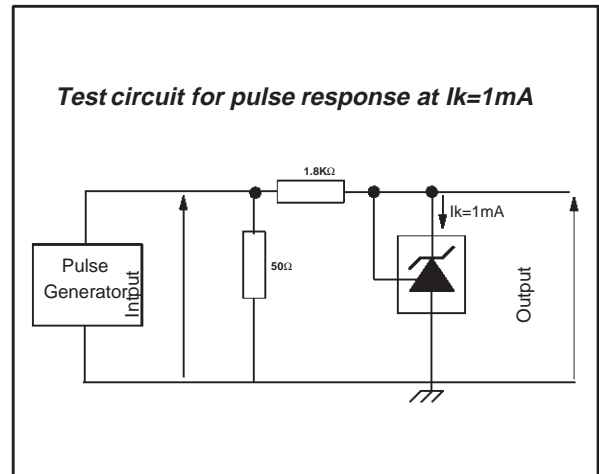
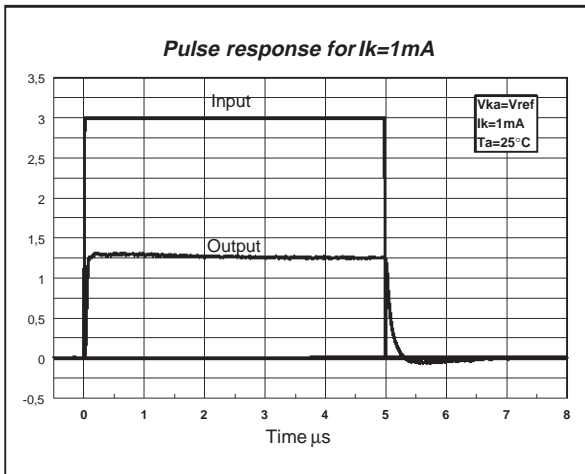
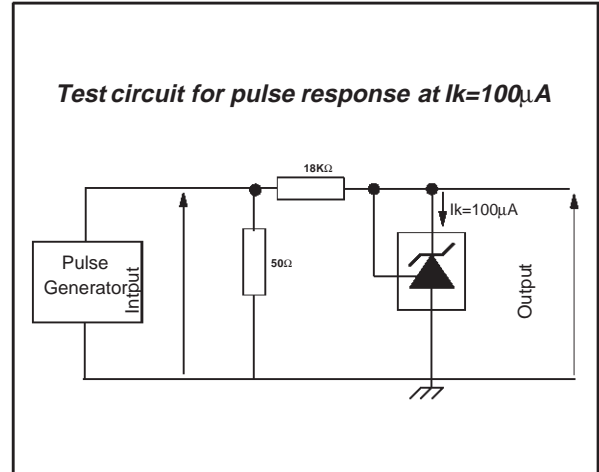
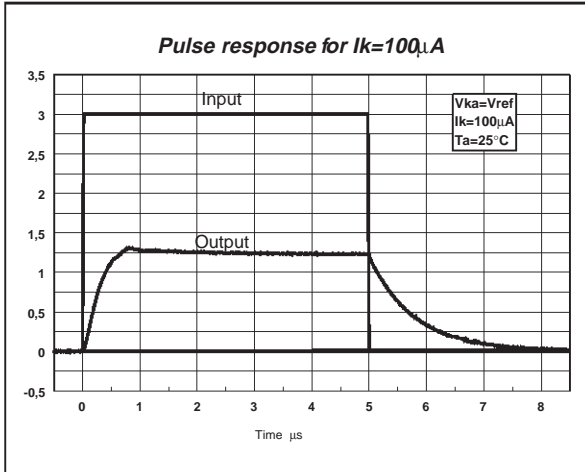
Notes : 1. ΔV_{ref} is defined as the difference between the maximum and minimum values obtained over the full temperature range.

$$\Delta V_{ref} = V_{ref \text{ max.}} - V_{ref \text{ min.}}$$

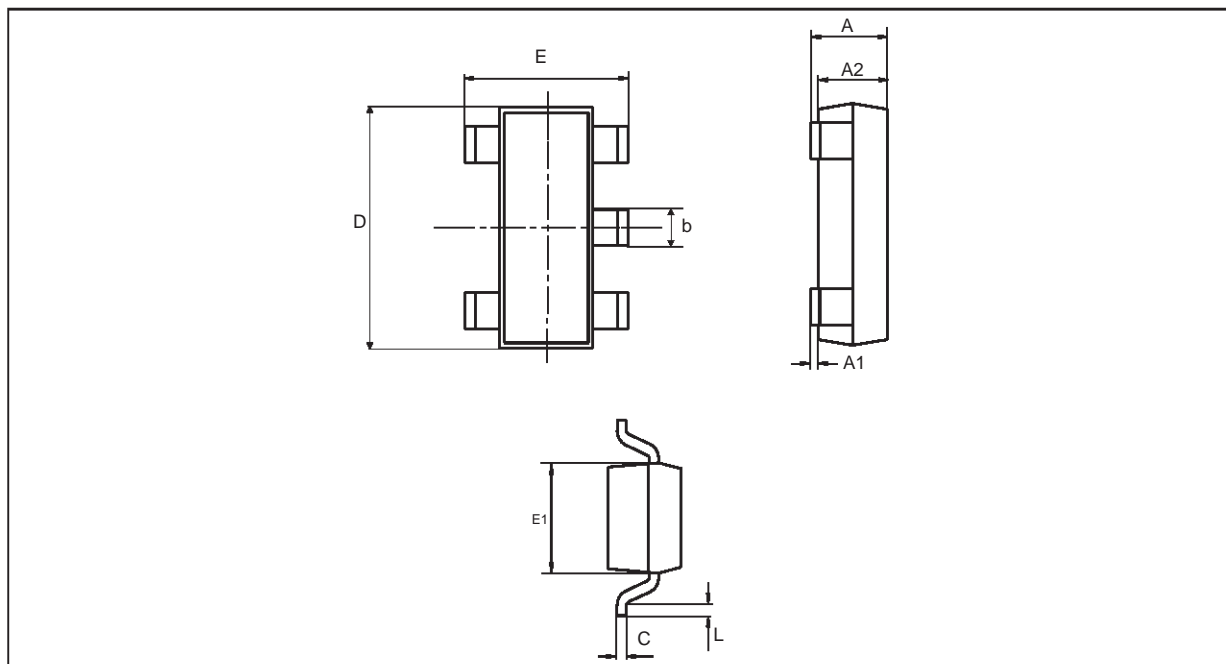






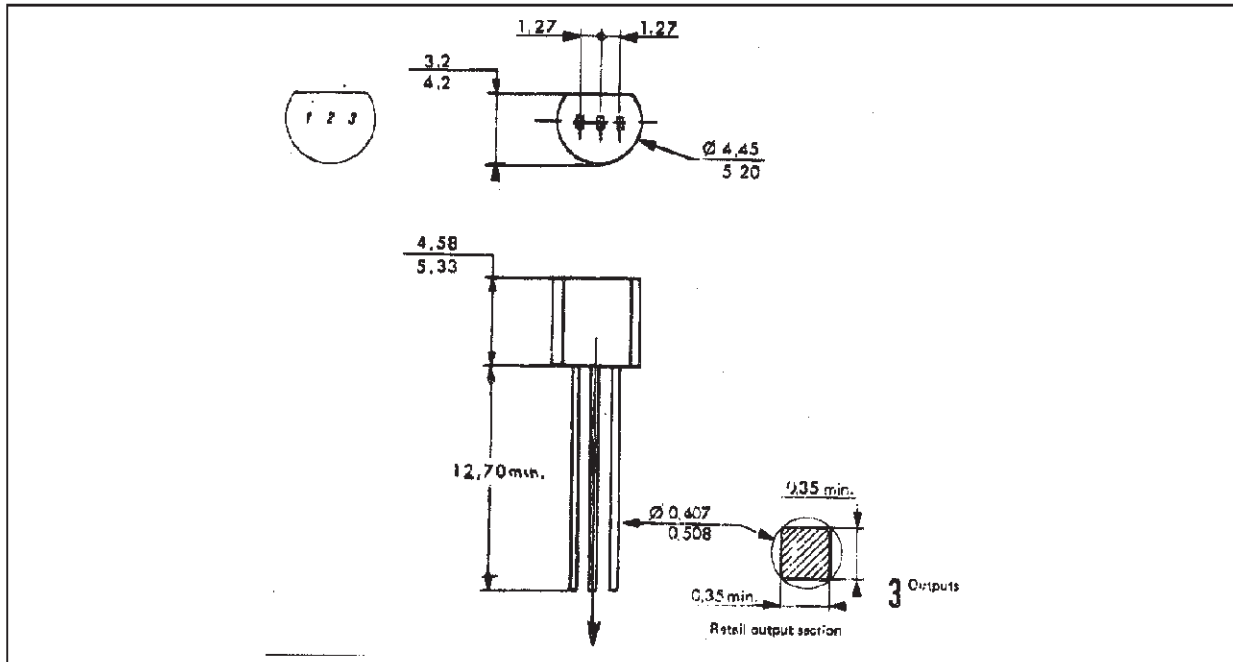


PACKAGE MECHANICAL DATA
SOT23-5L



| Dimensions | Millimeters | | Inches | |
|------------|-------------|------|--------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.90 | 1.45 | 0.035 | 0.057 |
| A1 | | 0.15 | | 0.005 |
| A2 | 0.90 | 1.30 | 0.035 | 0.051 |
| b | 0.35 | 0.50 | 0.013 | 0.019 |
| C | 0.09 | 0.20 | 0.003 | 0.007 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 2.60 | 3.00 | 0.102 | 0.118 |
| E1 | 1.50 | 1.75 | 0.059 | 0.068 |
| L | 0.10 | 0.60 | 0.003 | 0.023 |

PACKAGE MECHANICAL DATA
3 PINS - PLASTIC PACKAGE TO92



| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|-------|--------|--------|--------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| L | | 1.27 | | | 0.05 | |
| B | 3.2 | 3.7 | 4.2 | 0.126 | 0.1457 | 0.1654 |
| O1 | 4.45 | 5.00 | 5.2 | 0.1752 | 0.1969 | 0.2047 |
| C | 4.58 | 5.03 | 5.33 | 0.1803 | 0.198 | 0.2098 |
| K | 12.7 | | | 0.5 | | |
| O2 | 0.407 | 0.5 | 0.508 | 0.016 | 0.0197 | 0.02 |
| a | 0.35 | | | 0.0138 | | |

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