

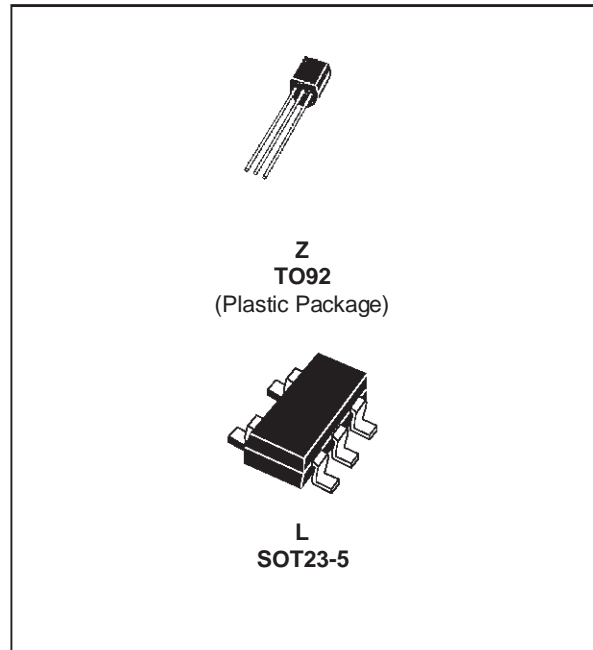


## LOW VOLTAGE ADJUSTABLE SHUNT REFERENCE

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

### DESCRIPTION

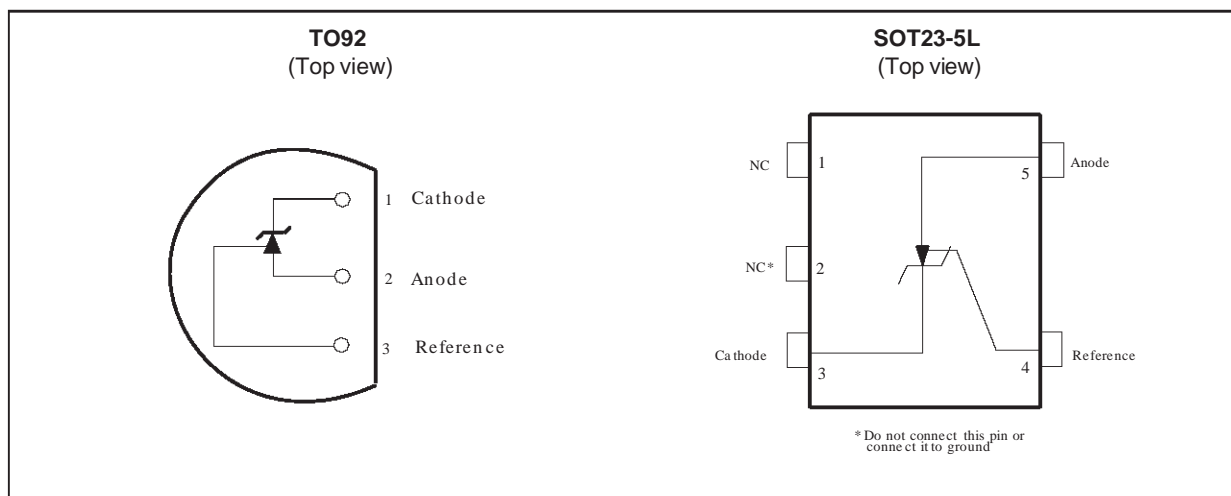
The TS431 is a three terminals programmable shunt Voltage Reference optimized for high temperatures. However, it can operate from -40°C up to +125°C. The output voltage is set by two external resistors to any value between 1.24 and 6V. When driving an optocoupler, the TS431 is particularly interesting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



### ORDER CODES

Part Number	Temperature Range	Package	
		Z	L
TS431/AI	-40°C, +125°C	•	•

### 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 @ $T_{amb.} = 25^{\circ}C$ Power dissipation, SO23-5 package @ $T_{amb.} = 25^{\circ}C$	625 500	mW
$T_{oper}$	Operating Free-air Temperature Range	-40 to +125	$^{\circ}C$
$T_{stg}$	Storage Temperature Range	-65 to +150	$^{\circ}C$

## 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

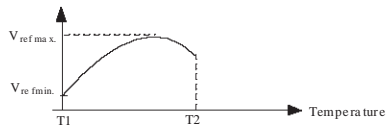
# TS431

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

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

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

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



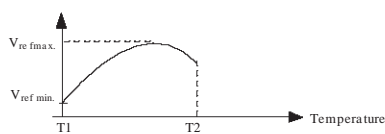
**TS431A**

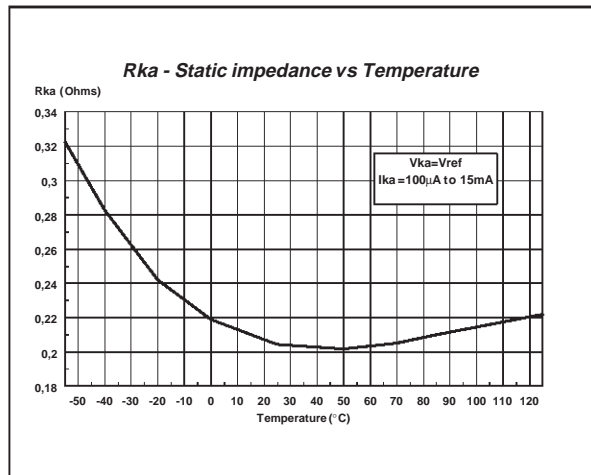
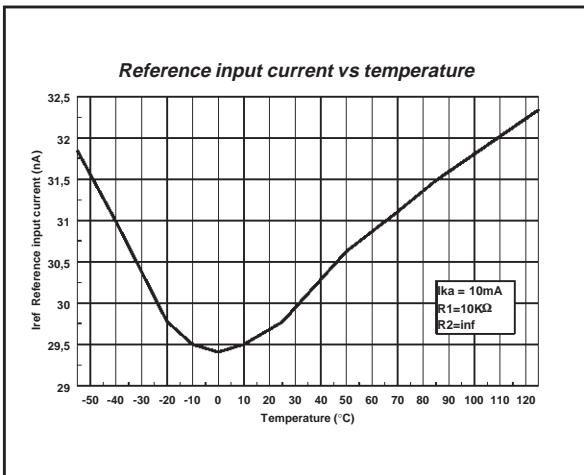
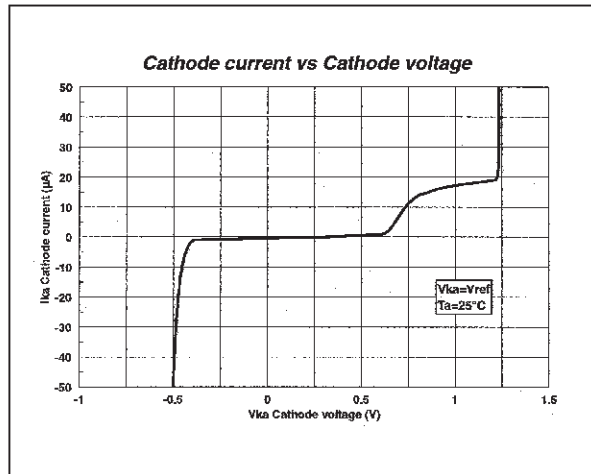
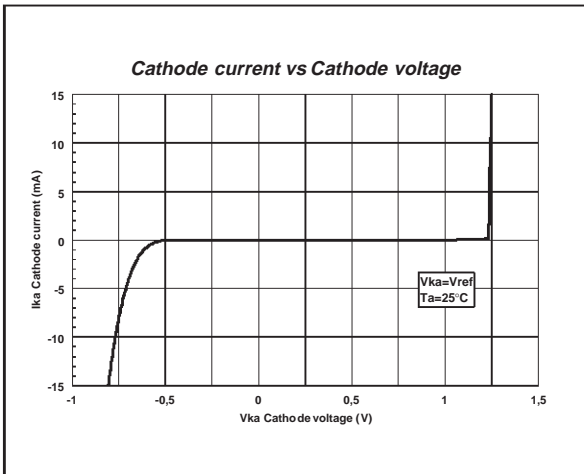
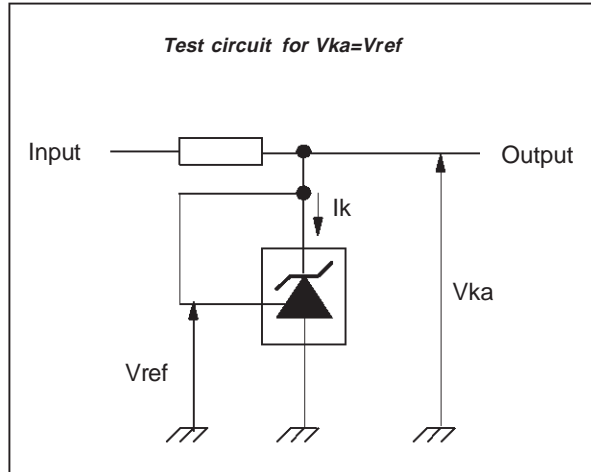
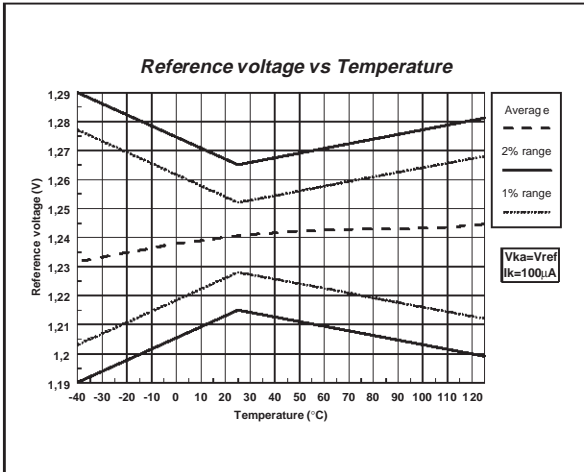
**ELECTRICAL CHARACTERISTICS**  $T_{amb} = 25^{\circ}\text{C}$  (unless otherwise specified)

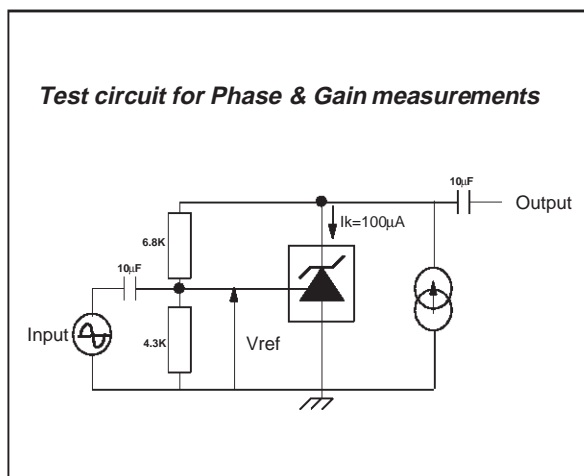
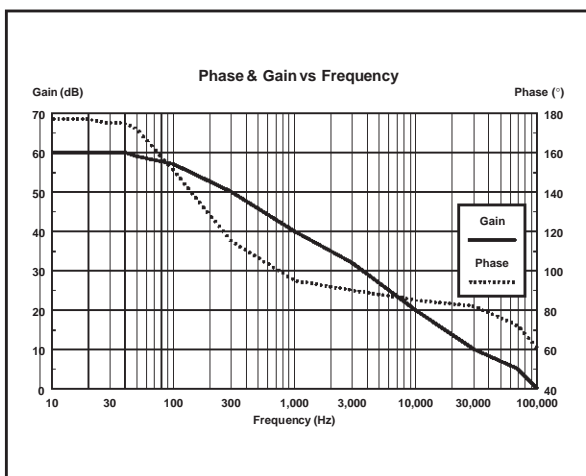
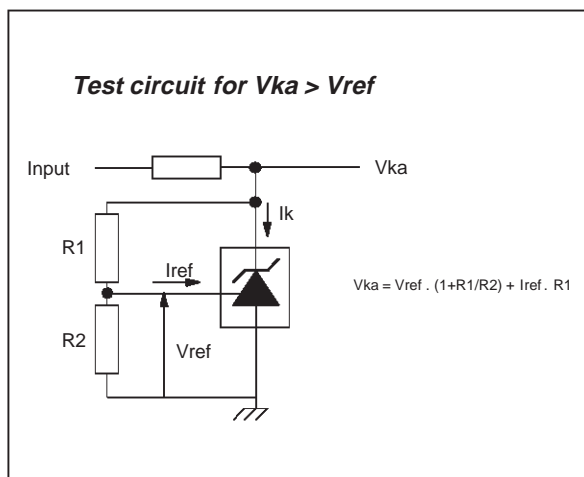
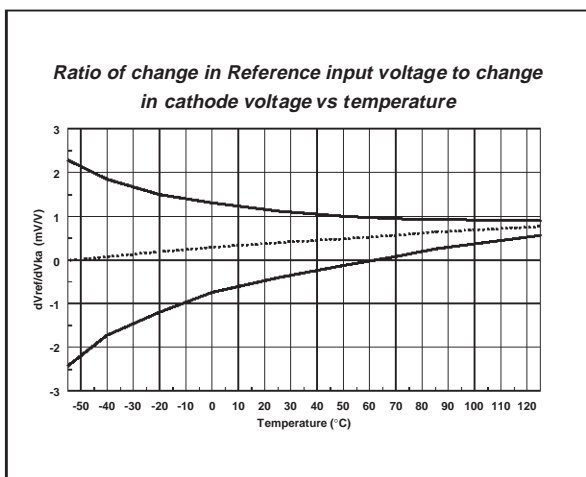
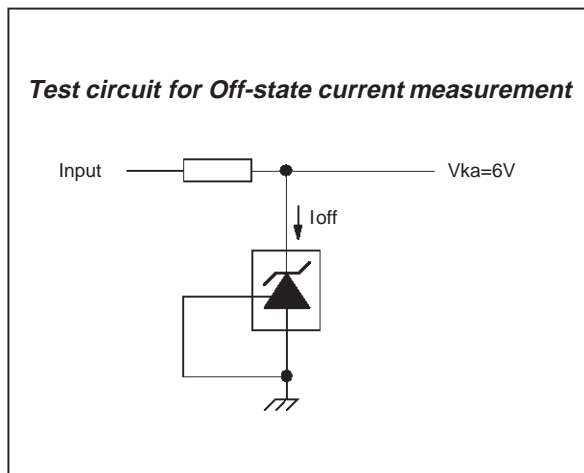
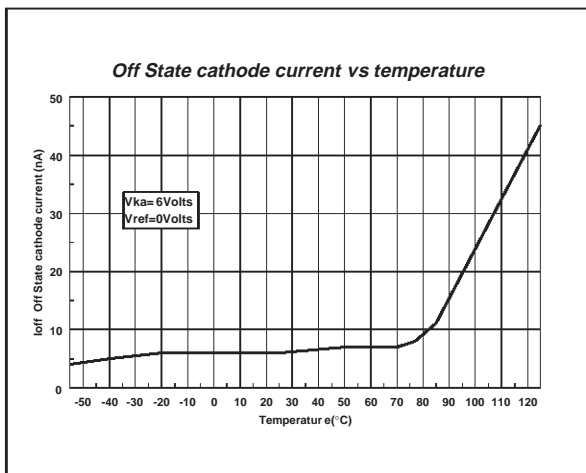
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ref}$	Output Voltage $V_{KA} = V_{ref}$ @ $I_K = 100\mu\text{A}$	$T_{amb} = 25^{\circ}\text{C}$	1.228	1.240	1.252	V
$\Delta V_{ref}$	Output Voltage Change - note 1 $I_K = 100\mu\text{A}$ , $V_{KA} = V_{ref}$	$0 < T_{amb} < +70^{\circ}\text{C}$ $0 < T_{amb} < +105^{\circ}\text{C}$ $0 < T_{amb} < +125^{\circ}\text{C}$ $-20 < T_{amb} < +105^{\circ}\text{C}$ $-40 < T_{amb} < +85^{\circ}\text{C}$ $-40 < T_{amb} < +125^{\circ}\text{C}$			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
$\Delta I_{ref}$	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	$\mu\text{A}$
$I_{off}$	Off-State Cathode Current	$V_{KA} = 6\text{V}$ , $V_{ref} = 0$		0.001	0.1	$\mu\text{A}$
$ 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	$\Omega$

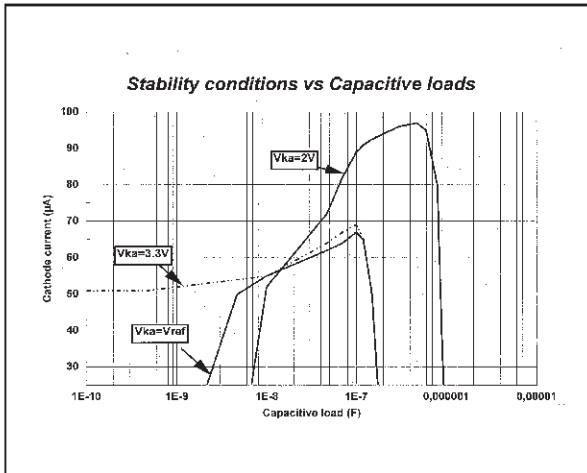
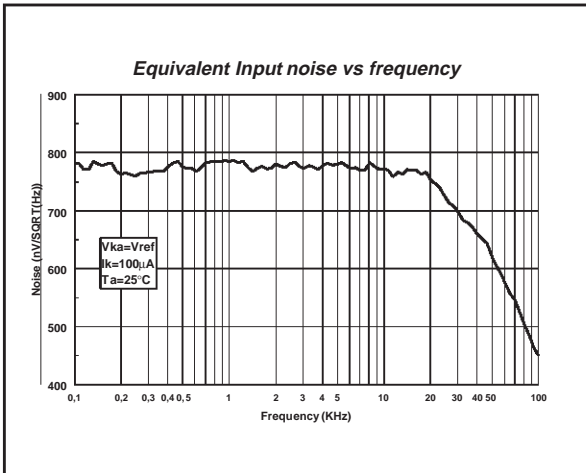
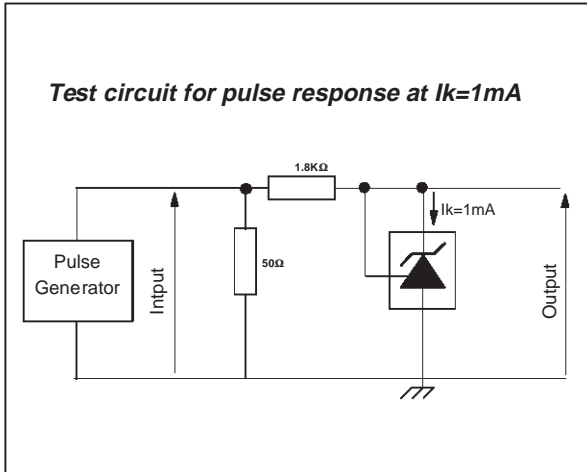
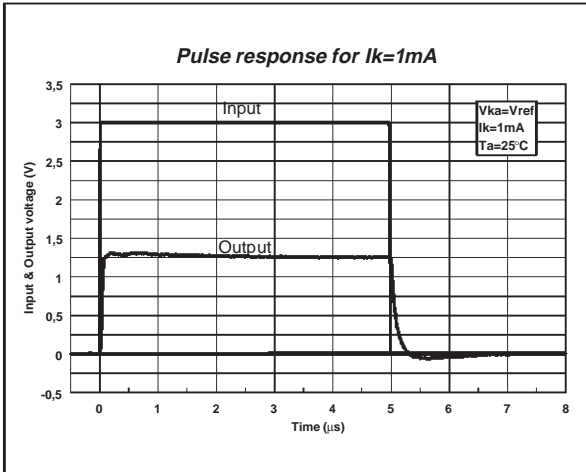
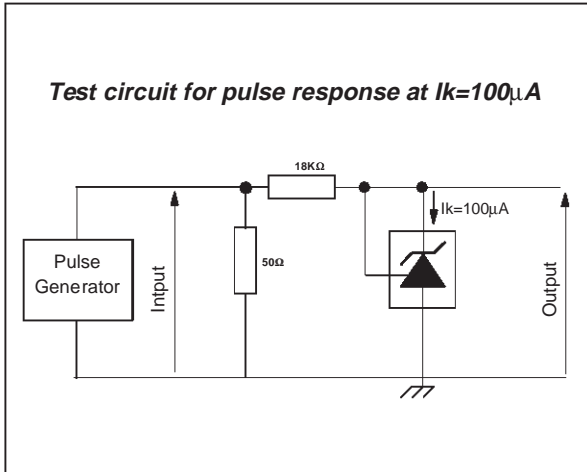
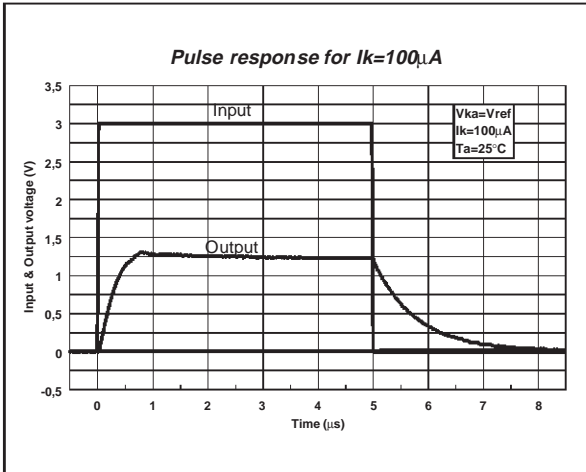
**Notes :** 1.  $\Delta V_{ref}$  is defined as the difference between the maximum and minimum values obtained over the full temperature range.

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



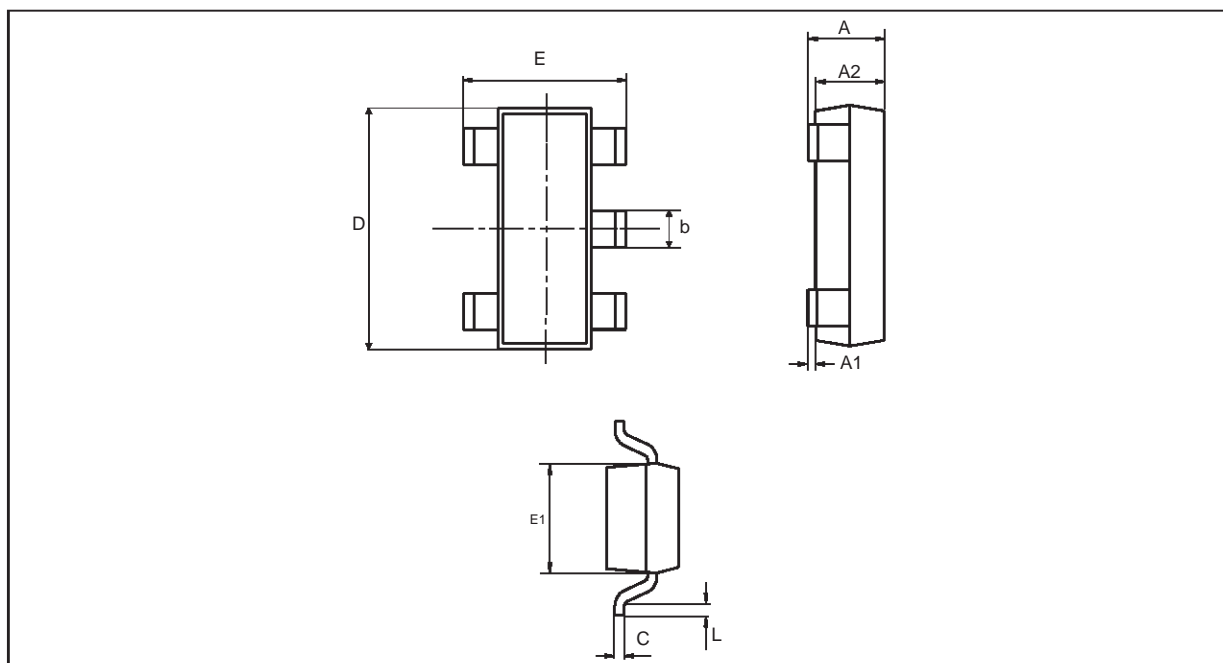






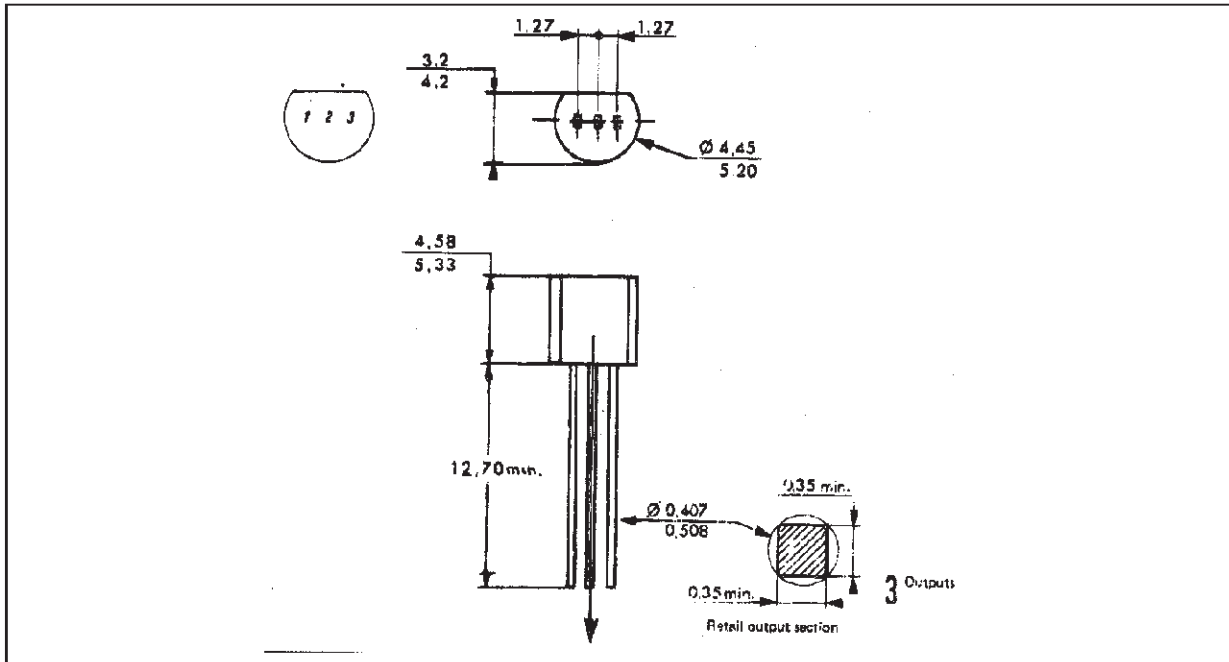
**PACKAGE MECHANICAL DATA**

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**



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