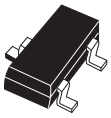
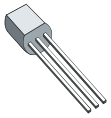
TS3431

1.24V PROGRAMMABLE SHUNT VOLTAGE REFERENCE

- **ADJUSTABLE OUTPUT VOLTAGE 1.24 to 24V**
- **SEVERAL PRECISION @ 25°C ±2%, ±1% and ±0.5%**
- **SINK CURRENT CAPABILITY 0.4 to 100mA**
- **INDUSTRIAL TEMPERATURE RANGE: -40 to +125°C**
- **PERFORMANCES COMPATIBLE WITH INDUSTRY STANDARD TL431**



L
SOT23-3L
(Plastic Micropackage)



Z
TO92
(Plastic Package)

DESCRIPTION

The TS3431 is a programmable shunt voltage reference with guaranteed temperature stability over the entire temperature range of operation (-40 to +125°C). The output voltage may be set to any value between 1.24V and 24V with an external resistor bridge.

Available in SOT23-3 surface mount package, it can be designed in applications where space saving is a critical issue.

APPLICATION

- Computers
- Instrumentation
- Battery chargers
- Switch Mode Power Supply
- Battery operated equipments

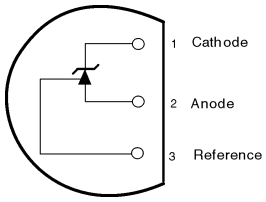
ORDER CODE

Part Number	Temperature Range	Package		SOT-23 Marking
		Z	L	
TS3431I	-40°C, +125°C	•	•	L280
TS3431AI		•	•	L281
TS3431BI		•	•	L282

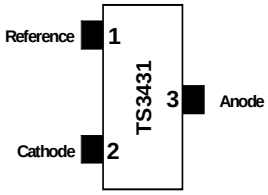
Z = TO92 Plastic package
LT = Tiny Package (SOT23-3) - only available in Tape & Reel (LT)

PIN CONNECTIONS (top view)

TO92
(Top view)



SOT23-3
(Top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{KA}	Cathode to Anode voltage		25	V
I_K	Reverse Breakdown Current		-100 to +150	mA
I_{REF}	Reference Current		-0.05 to10	mA
P_D	Power Dissipation [1]	SOT23-3 TO92	360 625	mW
T_{std}	Storage Temperature		-65 to +150	°C
ESD	Human Body Model (HBM)		2	kV
	Machine Model (MM)		200	V
Tlead	Lead Temperature (soldering, 10 seconds)		250	°C

1. Pd has been calculated with T_{amb} = 25°C and T_j = 150°C and
Rthja = 200°C/W for the TO92 package
Rthja = 340°C/W for the SOT23-3L package

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
I_K	Cathode operating current	0.5 to 100	mA
V_K	Cathode operating voltage	1.24 to 24	V
T_{oper}	Operating Free Air Temperature Range	-40 to +125	°C

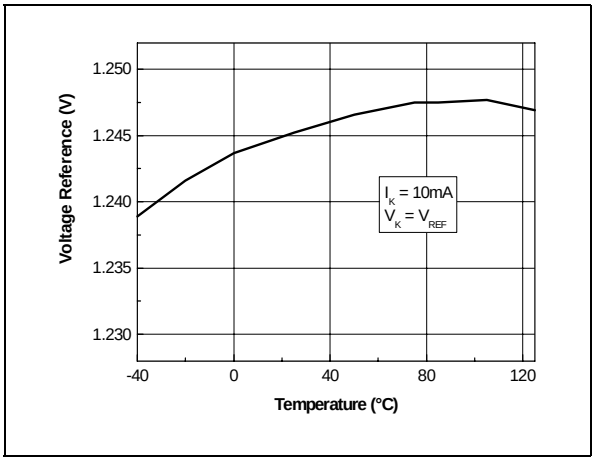
ELECTRICAL CHARACTERISTICS

Tamb = 25°C (unless otherwise specified)

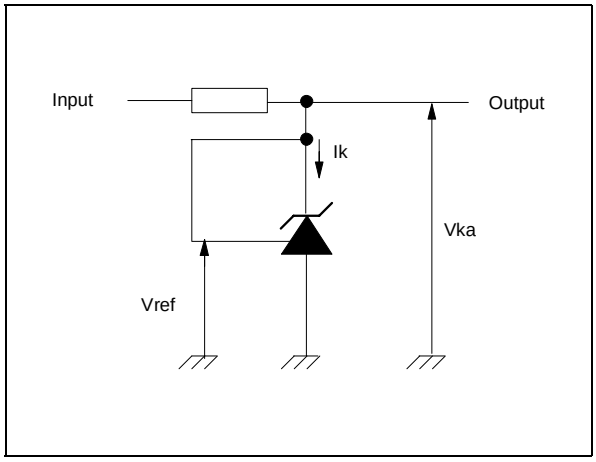
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_K	Reference input voltage I_K = 10mA	TS3431 (2%)	1.215	1.24	1.265	V
		TS3431A (1%)	1.228		1.252	
		TS3431B (0.5%)	1.234		1.246	
ΔV_K	Variation of reference input voltage over temperature	0°C < T < +70°C			10	mV
		-40°C < T < +105°C			18	
		-40°C < T < +125°C			21	
T_C	Temperature coefficient	-40°C < T < +125°C			100	ppm/°C
I_{KMIN}	Minimum Operating Current	T = 25°C		0.35	0.4	mA
		-40°C < T < +125°C			0.5	
$\left\|\frac{\Delta Vref}{\Delta Vka}\right\|$	Ratio of change in reference input voltage to change in cathode to anode voltage	I_K=10mA V_K= 24 to 1.24V		1.2	1.5	mV/V
		-40°C < T < +125°C			2	
I_{REF}	Reference input current I_K=10mA, R1=10KΩ, R2=+∞	T=25°C		0.9	1.5	µA
		-40°C < T < +125°C			2	
ΔI_{REF}	Reference input current deviation I_K=10mA, R1=10KΩ, R2=+∞	0°C < T < +70°C		0.5	1	µA
		-40°C < T < +125°C		0.9	1.5	
I_{OFF}	Off-state cathode current V_K=24V	T=25°C		35	500	nA
		-40°C < T < +105°C			1000	
		-40°C < T < +125°C			2000	
R_{KA}	Reverse Static Impedance	I_K = 1 to 100mA		0.2	0.4	Ω
E_N	Wideband Noise	I_K = 10mA 1kHz < f < 100kHz		100		nV/√Hz

Note: Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design.

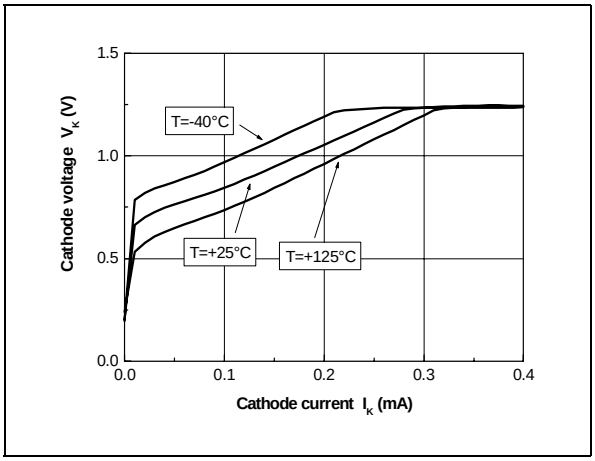
Reference voltage vs temperature



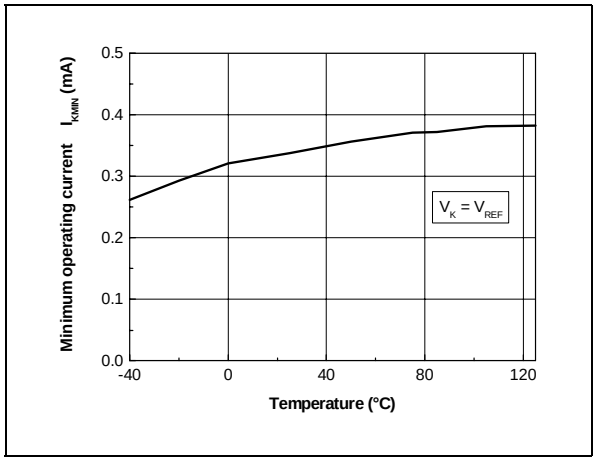
Test circuit for V_K = Vref



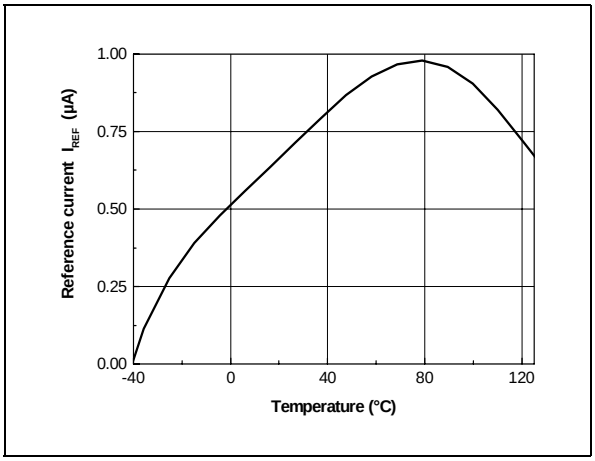
Cathode voltage vs cathode current



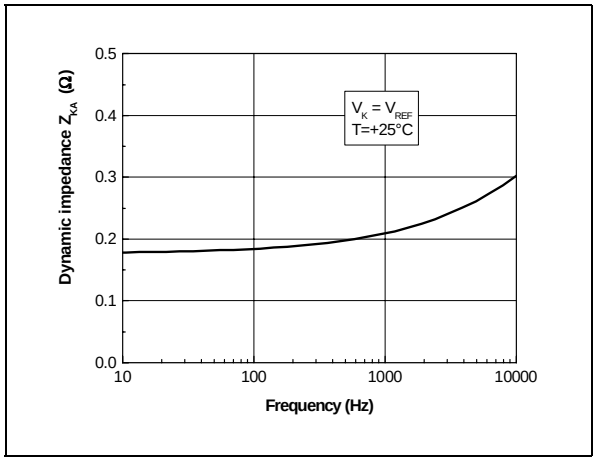
Minimum Operating current vs temperature



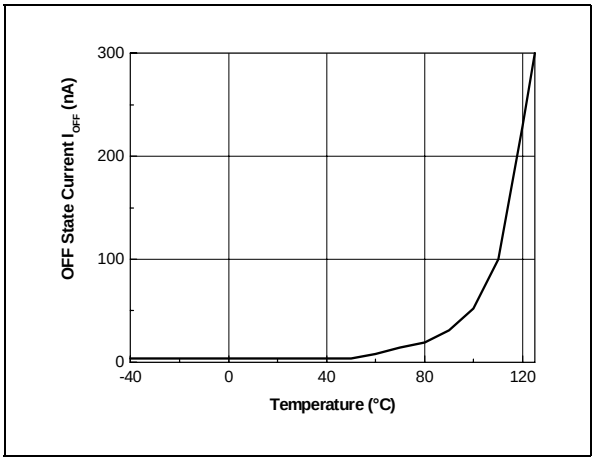
Reference input current vs temperature



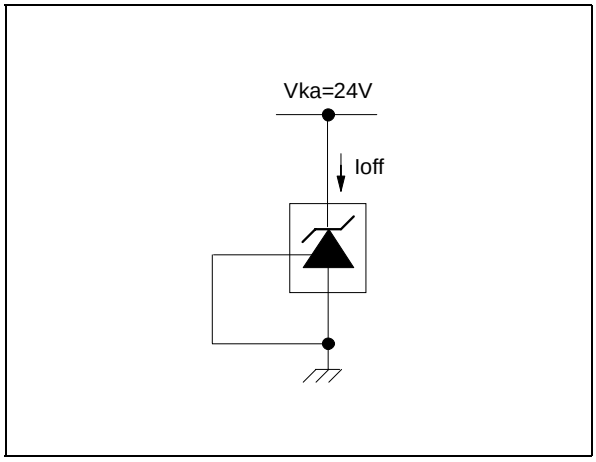
Dynamic impedance vs frequency



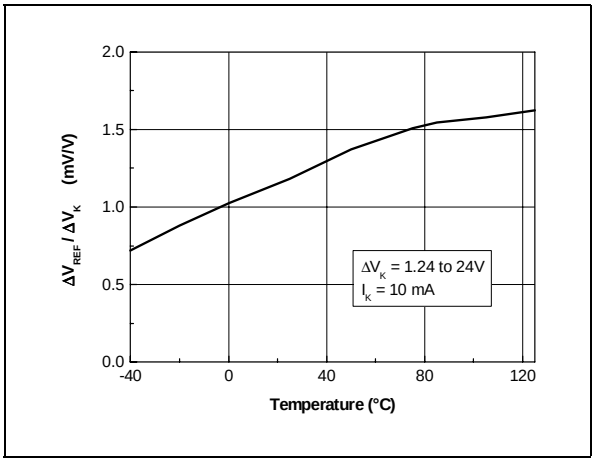
Off-State current vs temperature



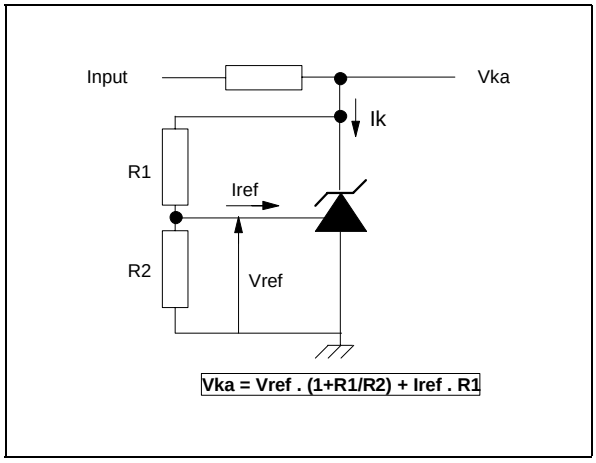
Test circuit for Off-State current measurement



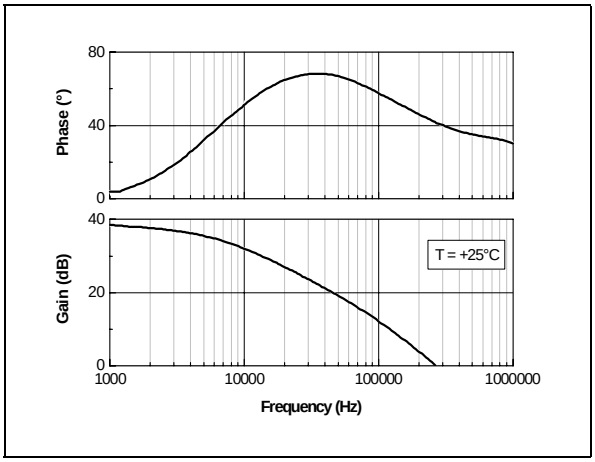
Ratio of change in reference input voltage to change in Vka voltage vs temperature



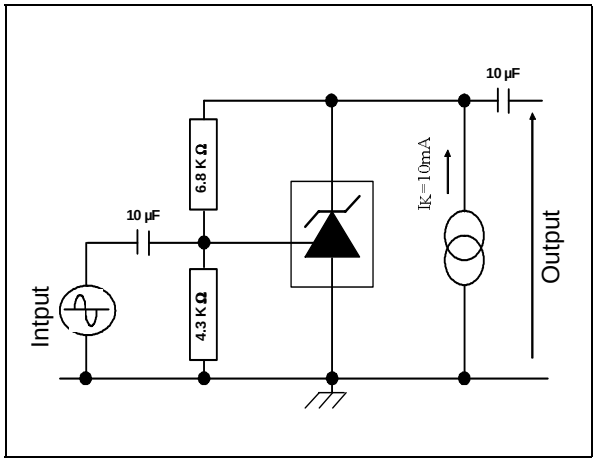
Test circuit for $V_K > V_{REF}$



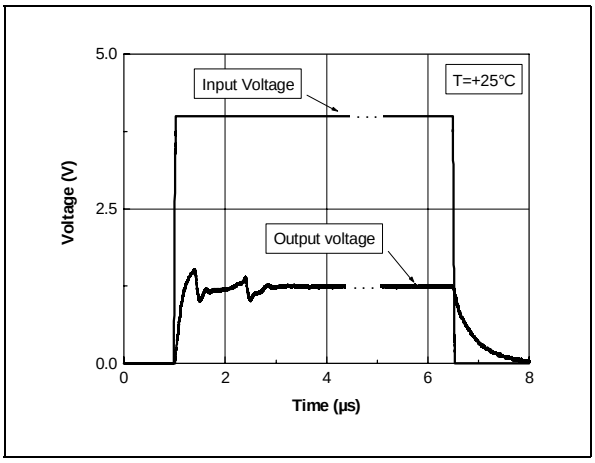
Phase and Gain vs frequency



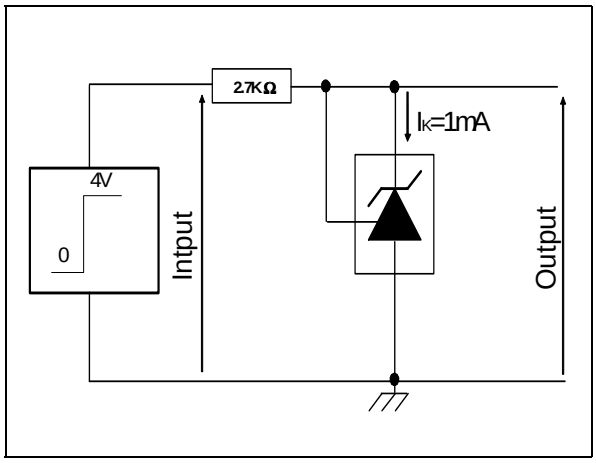
Test circuit for phase and gain measurement



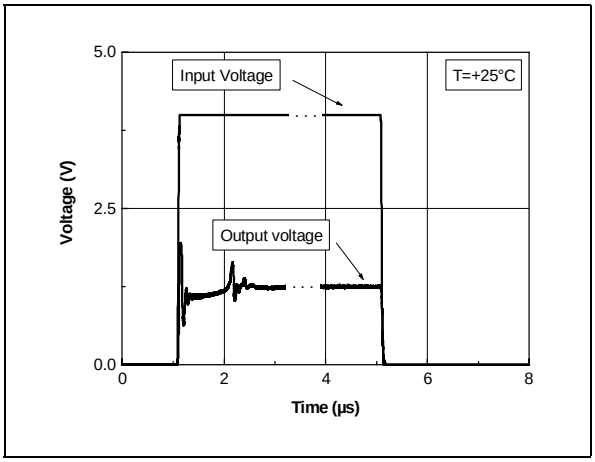
Pulse response at Ik=1mA



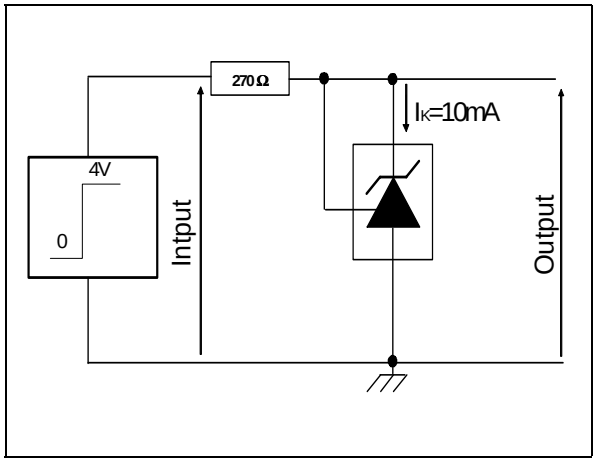
Test circuit for pulse response at Ik = 1mA



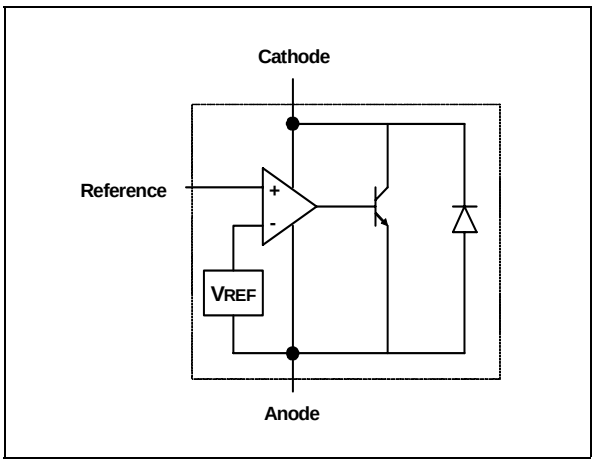
Pulse response at Ik = 10mA



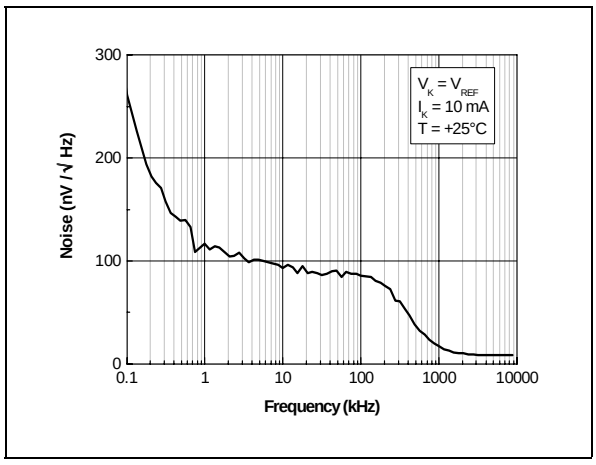
Test circuit for pulse response at Ik = 10mA



Block Diagram

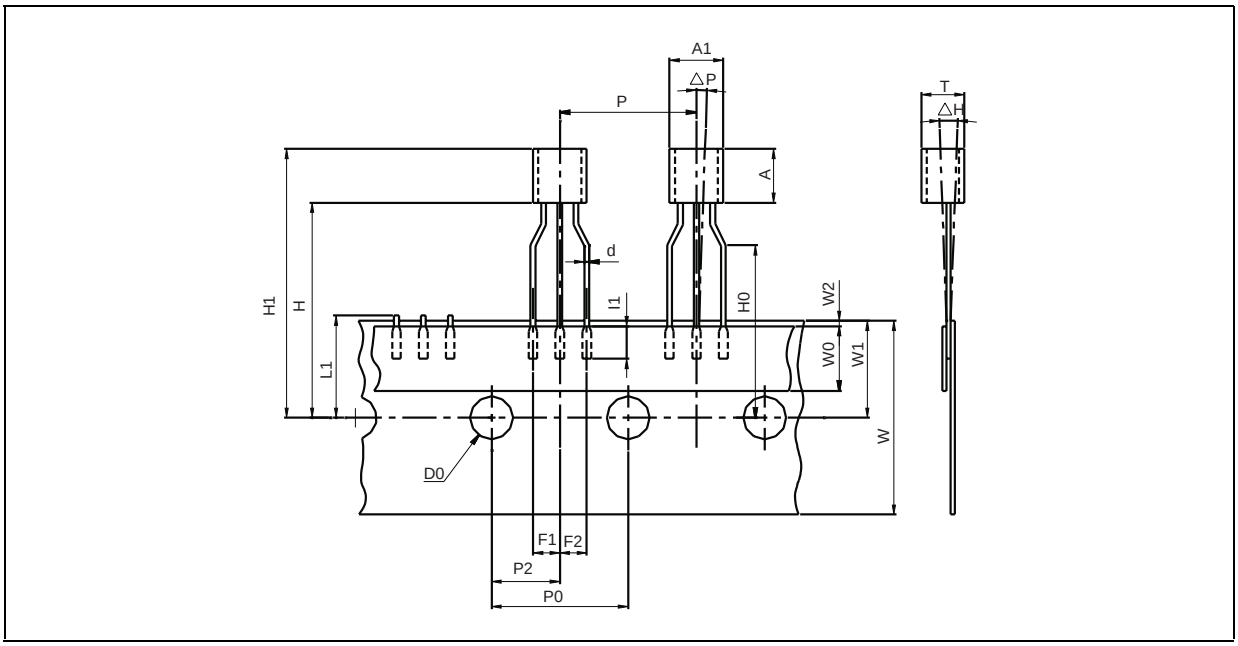


Equivalent input noise vs frequency



PACKAGE MECHANICAL DATA

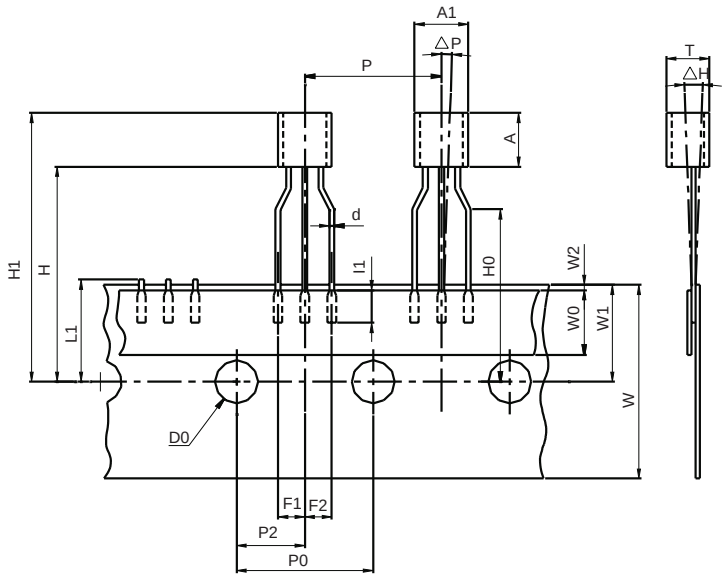
3 PINS - PLASTIC PACKAGE TO92 (TAPE & REEL)



Dim.	Millimeters			Inches		
	Min	Typ.	Max.	Min.	Typ.	Max.
AL			5.0			0.197
A			5.0			0.197
T			4.0			0.157
d		0.45			0.018	
I1	2.5			0.098		
P	11.7	12.7	13.7	0.461	0.500	0.539
PO	12.4	12.7	13	0.488	0.500	0.512
P2	5.95	6.35	6.75	0.234	0.250	0.266
F1/F2	2.4	2.5	2.8	0.094	0.098	0.110
∆h	-1	0	1	-0.039	0	0.039
∆P	-1	0	1	-0.039	0	0.039
W	17.5	18.0	19.0	0.689	0.709	0.748
W0	5.7	6	6.3	0.224	0.236	0.248
W1	8.5	9	9.75	0.335	0.354	0.384
W2			0.5			0.020
H			20			0.787
H0	15.5	16	16.5	0.610	0.630	0.650
H1			25			0.984
DO	3.8	4.0	4.2	0.150	0.157	0.165
L1			11			0.433

PACKAGE MECHANICAL DATA

3 PINS - PLASTIC PACKAGE TO92 (TAPE AMMO PACK)



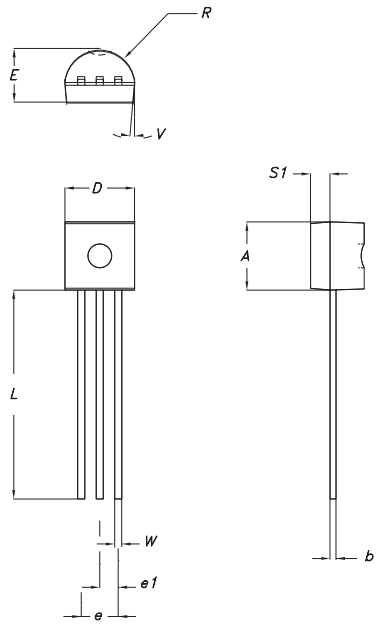
Dim.	Millimeters			Inches		
	Min	Typ.	Max.	Min.	Typ.	Max.
AL			5.0			0.197
A			5.0			0.197
T			4.0			0.157
d		0.45			0.018	
I1	2.5			0.098		
P	11.7	12.7	13.7	0.461	0.500	0.539
PO	12.4	12.7	13	0.488	0.500	0.512
P2	5.95	6.35	6.75	0.234	0.250	0.266
F1/F2	2.4	2.5	2.8	0.094	0.098	0.110
Δh	-1	0	1	-0.039	0	0.039
ΔP	-1	0	1	-0.039	0	0.039
W	17.5	18.0	19.0	0.689	0.709	0.748
W0	5.7	6	6.3	0.224	0.236	0.248
W1	8.5	9	9.75	0.335	0.354	0.384
W2			0.5			0.020
H			20			0.787
H0	15.5	16	16.5	0.610	0.630	0.650
H1			25			0.984
DO	3.8	4.0	4.2	0.150	0.157	0.165
L1			11			0.433

PACKAGE MECHANICAL DATA

3 PINS - PLASTIC PACKAGE TO92 (BULK)

TO-92 MECHANICA DATA

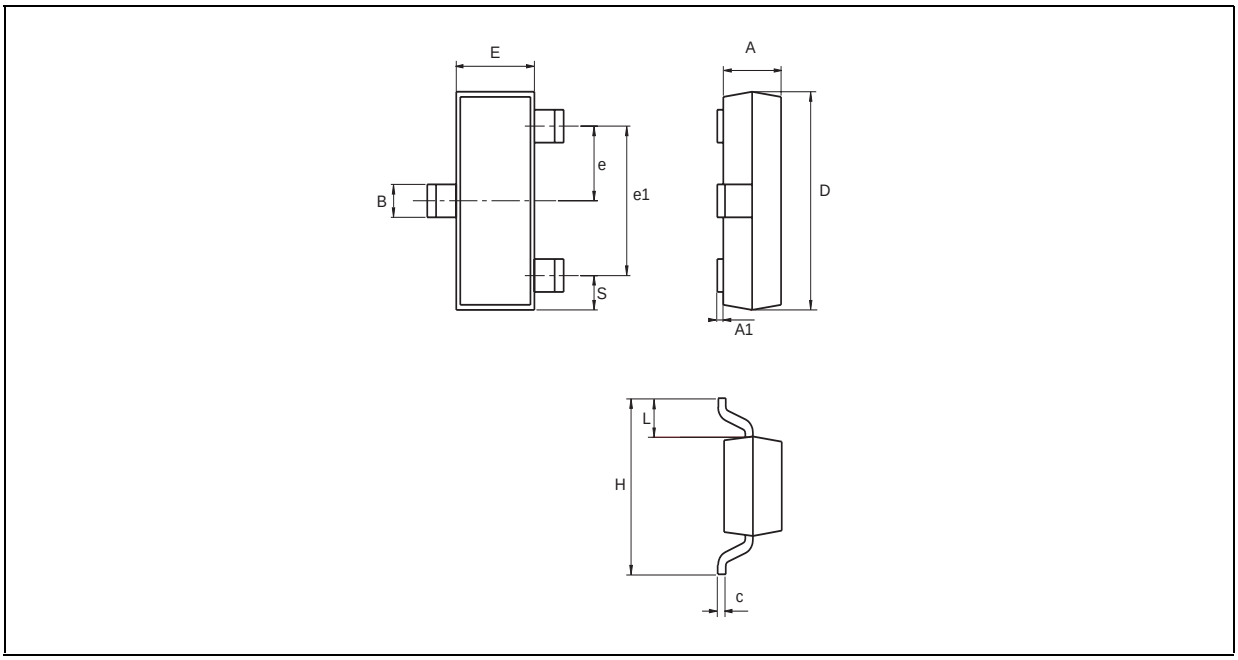
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0



0102782/C

PACKAGE MECHANICAL DATA

3 PINS - TINY PACKAGE (SOT23)



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.890		1.120	0.035		0.044
A1	0.010		0.100	0.0004		0.004
A2	0.880	0.950	1.020		0.037	0.040
b	0.300		0.500	0.012		0.020
c	0.080		0.200	0.003		0.008
D	2.800	2.900	3.040	0.110	0.114	0.120
E	2.100		2.640	0.083		0.104
E1	1.200	1.300	1.400	0.047	0.051	0.055
e		0.950			0.037	
e1		1.900			0.075	
L	0.400	0.500	0.600	0.016	0.020	0.024
L1		0.540			0.021	
k	0°		8°			