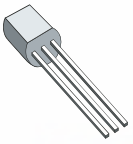
TS4041

1.225V MICROPOWER SHUNT VOLTAGE REFERENCE

- 1.225V TYP OUTPUT VOLTAGE
- ULTRA LOW OPERATING CURRENT : 65µA maximum at 25°C
- HIGH PRECISION @ 25°C
  +/- 2%
  +/- 1%
  +/- 0.5%
- HIGH STABILITY WHEN USED WITH CAPACITIVE LOADS
- INDUSTRIAL TEMPERATURE RANGE: -40 to +85°C
- 150ppm/°C MAXIMUM TEMPERATURE COEFFICIENT



Z
TO92
(Plastic Package)

L
SOT23-3L
(Plastic Micropackage)

DESCRIPTION

The TS4041 is a low power shunt voltage reference providing a stable 1.225V output voltage over the industrial temperature range (-40 to +85°C). Availabe in SOT23-3 surface mount package, it can be designed in applications where space saving is a critical issue.

The low operating current is a key advantage for power restricted designs. In addition, the TS4041 is very stable and can be used in a broad range of application conditions.

APPLICATION

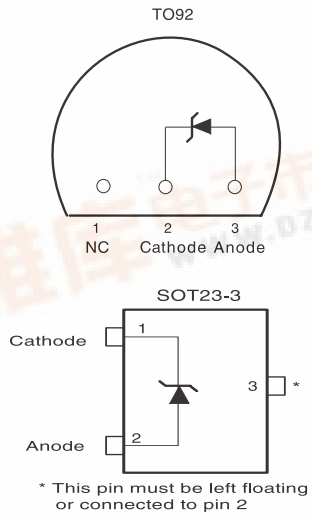
- Computers
- Instrumentation
- Battery chargers
- Switch Mode Power Supply
- Battery operated equipments

ORDER CODE

Precision	TO92	SOT23-3	SOT23 Marking
2%	TS4041EIZ-1.2	TS4041EILT-1.2	L233
1%	TS4041DIZ-1.2	TS4041DILT-1.2	L232
0.5%	TS4041CIZ-1.2	TS4041CILT-1.2	L231
Single temperature range: -40 to +85°C			

Z = TO92 Plastic package - also available in Bulk (Z), Tape & Reel (ZT) and Ammo Pack (AP)
LT = Tiny Package (SOT23-3) - only available in Tape & Reel (LT)

PIN CONNECTIONS (top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
I_k	Reverse Breakdown Current	20	mA
I_f	Forward Current	10	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
T_{lead}	Lead Temperature (soldering, 10 seconds)	260	°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_{min}	Minimum Operating Current	65	µA
I_{max}	Maximum Operating Current	12	mA
T_{oper}	Operating Free Air Temperature Range	-40 to +85	°C

ELECTRICAL CHARACTERISTICS

TS4041E (2% Precision) T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Vk	Reverse Breakdown Voltage	I_k = 100µA	1.200	1.225	1.250	V
	Reverse Breakdown Voltage Tolerance	I_k = 100µA -40°C < T_{amb} < +85°C	-25 -36		+25 +36	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	65	µA
		-40°C < T_{amb} < +85°C			70	
$\Delta V_{ref}/\Delta T$	Average Temperature Coefficient	I_k = 100µA			150	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Range	I_{kmin} < I_k < 1mA -40°C < T_{amb} < +85°C		0.3	2 2.5	mV
		1mA < I_k < 12mA -40°C < T_{amb} < +85°C		2.5	8 10	
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_k = 100µA, t = 1000hrs		120		ppm
En	Wide Band Noise	I_k = 100µA 10Hz < f < 10kHz		200		nV/√Hz

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

ELECTRICAL CHARACTERISTICS

TS4041D (1% Precision) T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Vk	Reverse Breakdown Voltage	I_k = 100µA	1.213	1.225	1.237	V
	Reverse Breakdown Voltage Tolerange	I_k = 100µA -40°C < T_{amb} < +85°C	-12 -25		+12 +25	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	65	µA
		-40°C < T_{amb} < +85°C			70	
$\Delta V_{ref}/\Delta T$	Average Temperature Coefficient	I_k = 100µA			150	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Range	I_{kmin} < I_k < 1mA -40°C < T_{amb} < +85°C		0.3	2 2.5	mV
		1mA < I_k < 12mA -40°C < T_{amb} < +85°C		2.5	8 10	
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_k = 100µA, t = 1000hrs		120		ppm
En	Wide Band Noise	I_k = 100µA 10Hz < f < 10kHz		200		nV/√Hz

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

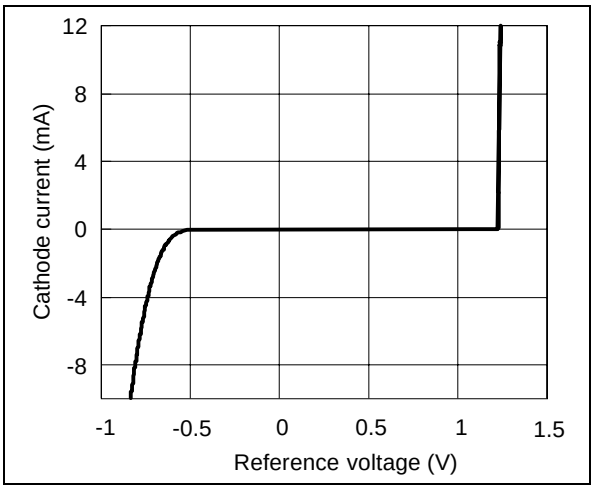
ELECTRICAL CHARACTERISTICS

TS4041C (0.5% Precision) T_{amb} = 25°C (unless otherwise specified)

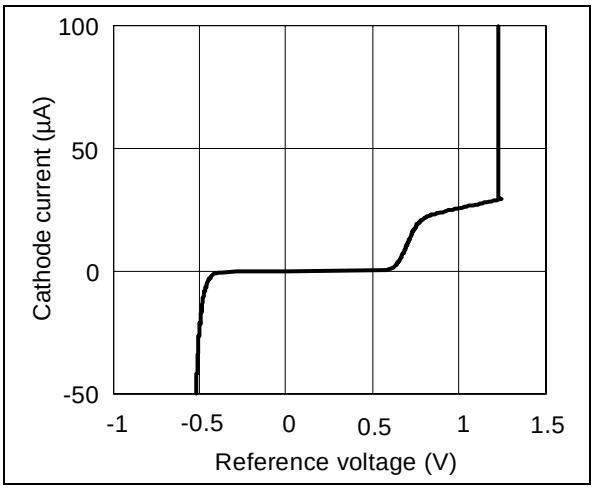
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Vk	Reverse Breakdown Voltage	I_k = 100µA	1.219	1.225	1.231	V
	Reverse Breakdown Voltage Tolerange	I_k = 100µA -40°C < T_{amb} < +85°C	-6 -16		+6 +16	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	60	µA
		-40°C < T_{amb} < +85°C			65	
$\Delta V_{ref}/\Delta T$	Average Temperature Coefficient	I_k = 100µA			120	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Range	I_{kmin} < I_k < 1mA -40°C < T_{amb} < +85°C		0.3	1.5 2	mV
		1mA < I_k < 12mA -40°C < T_{amb} < +85°C		2.5	6 8	
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_k = 100µA, t = 1000hrs		120		ppm
En	Wide Band Noise	I_k = 100µA 10Hz < f < 10kHz		200		nV/√Hz

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

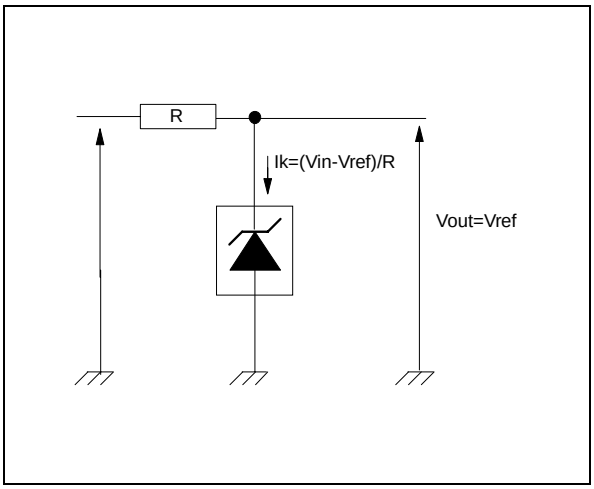
Reference voltage versus cathode current



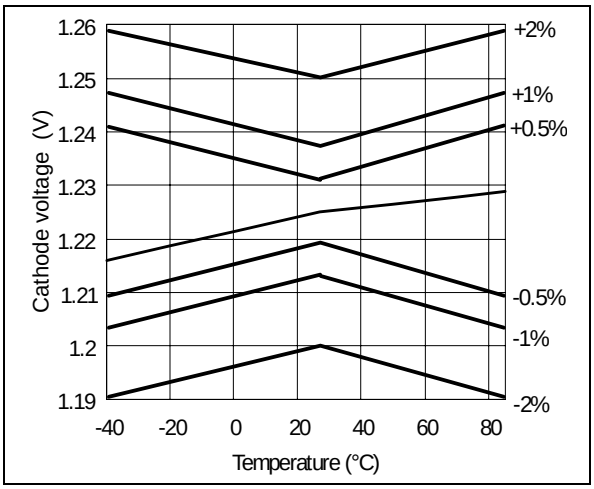
Reference voltage versus cathode current



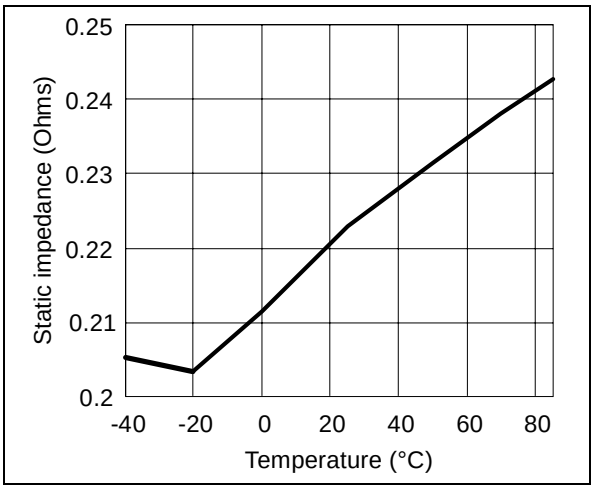
Test circuit



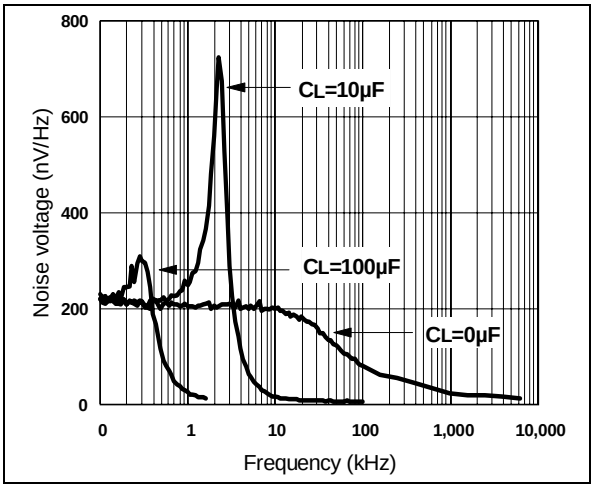
Reference voltage versus Temperature



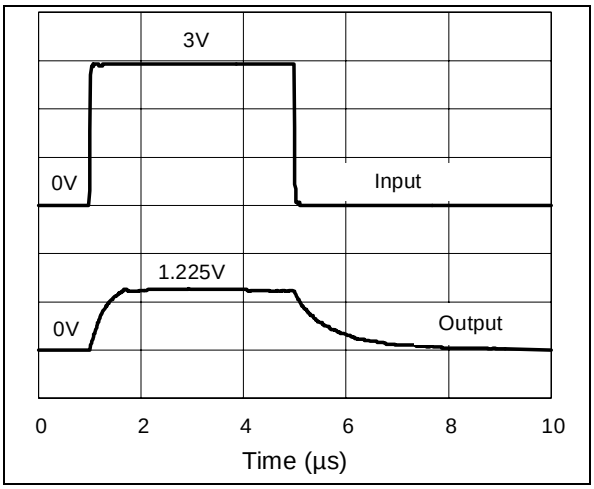
Static impedance versus temperature



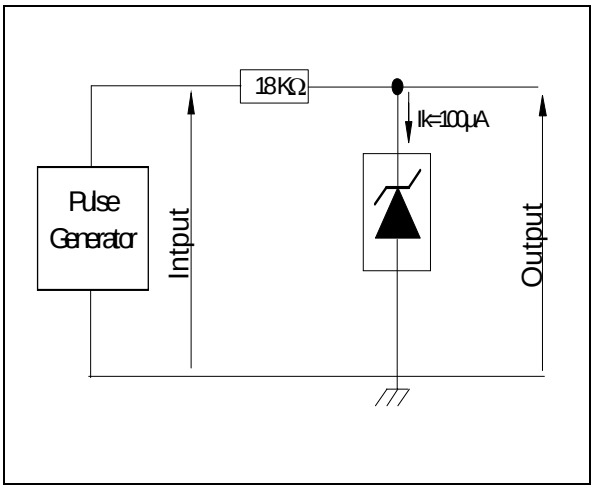
Noise voltage versus frequency



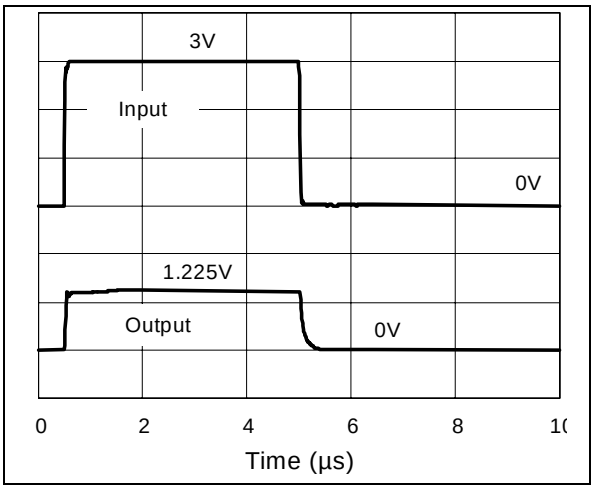
Pulse response for Ik=100µA



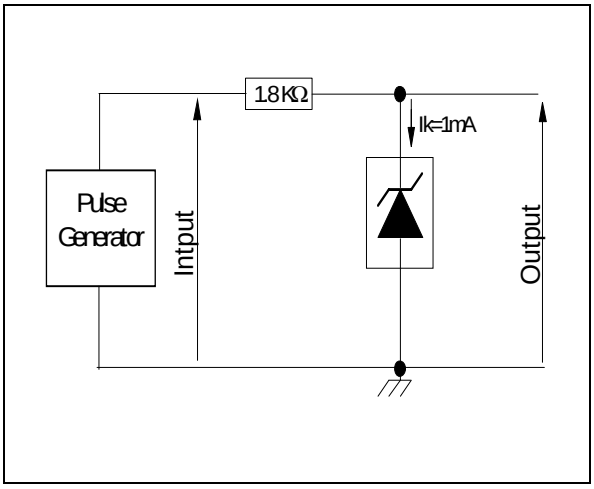
Test circuit for pulse response at Ik=100µA



Pulse response for Ik=1mA

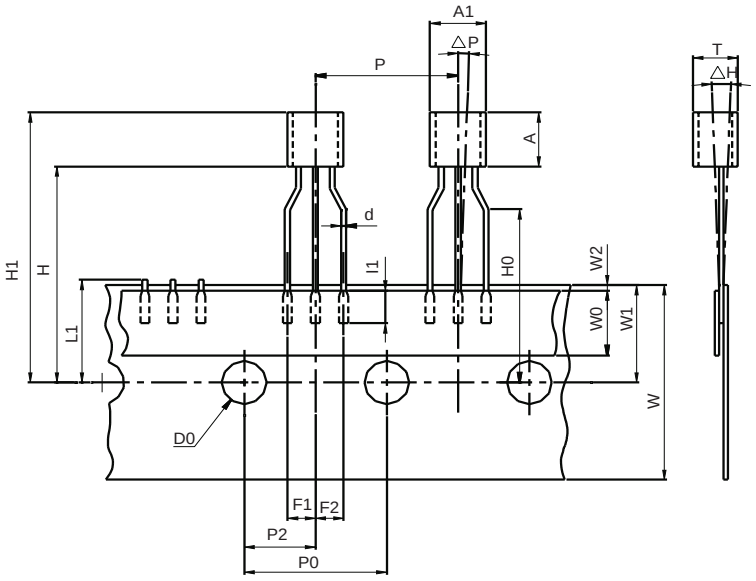


Test circuit for pulse response at Ik=1mA



PACKAGE MECHANICAL DATA

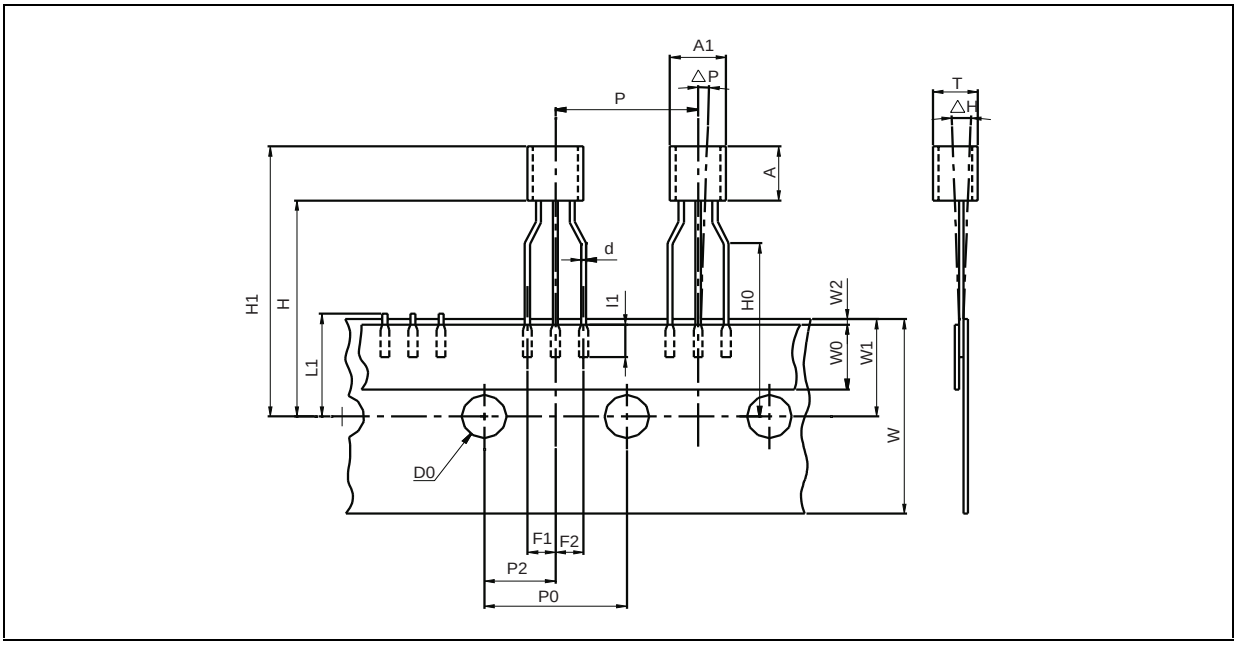
3 PINS - PLASTIC PACKAGE TO92 (TAPE & REEL)



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

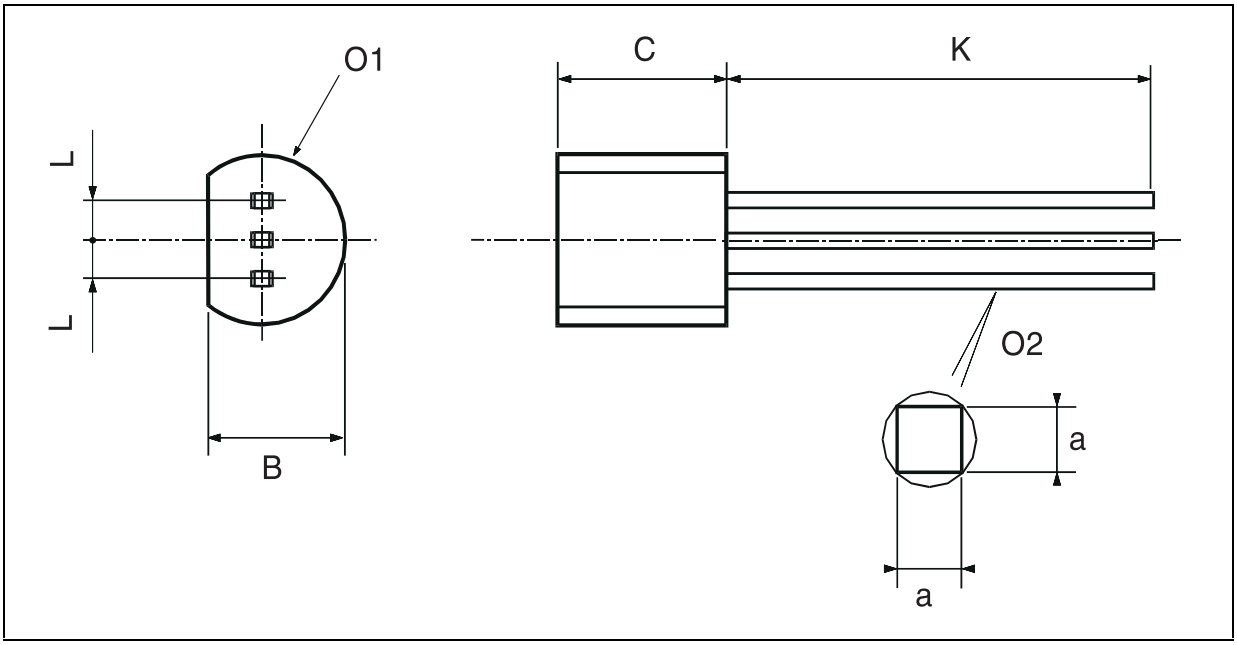
3 PINS - PLASTIC PACKAGE TO92 (TAPE AMMO PACK)



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
∆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

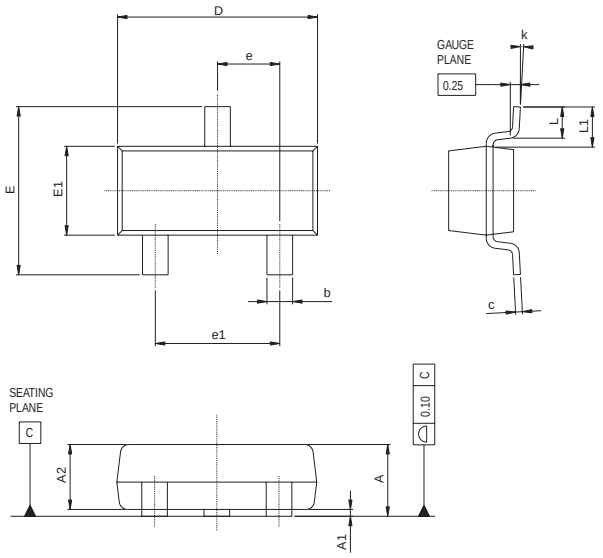
3 PINS - PLASTIC PACKAGE TO92 (BULK)



Dim.	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		

PACKAGE MECHANICAL DATA

3 PINS - TINY PACKAGE (SOT23)



Dimensions	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°			