



TS822

## 2.5V MICROPPOWER SHUNT VOLTAGE REFERENCE

- 2.50V TYP. OUTPUT VOLTAGE
- ULTRA LOW CURRENT CONSUMPTION: 40µA TYP.
- HIGH PRECISION @ 25°C  
±2% (Standard version)  
±1% (A grade)
- HIGH STABILITY WHEN USED WITH CAPACITIVE LOAD
- INDUSTRIAL TEMPERATURE RANGE: -40 to +85°C
- 100ppm/°C MAXIMUM TEMPERATURE COEFFICIENT

### DESCRIPTION

The TS822 is a low power shunt voltage reference providing a stable 2.5V output voltage over the industrial temperature range (-40 to +85°C). Available 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 TS822 is very stable and can be used in a broad range of application conditions.

### APPLICATION

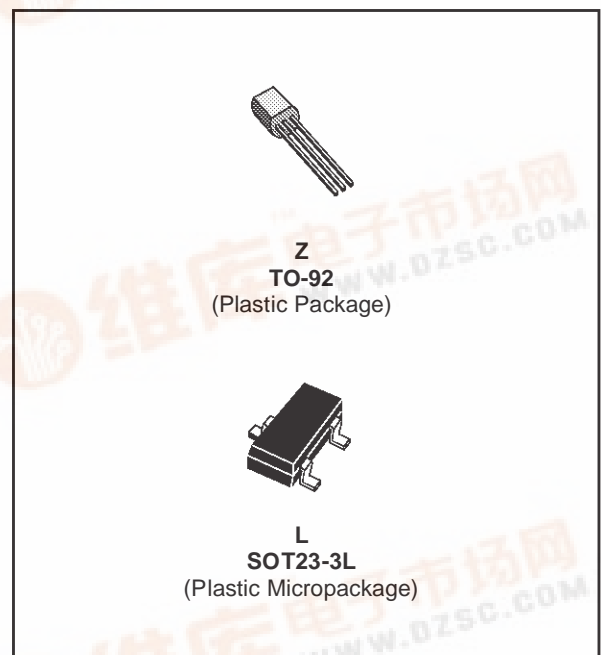
- Computers
- Instrumentation
- Battery chargers
- Switch Mode Power Supply
- Battery operated equipments

### ORDER CODE

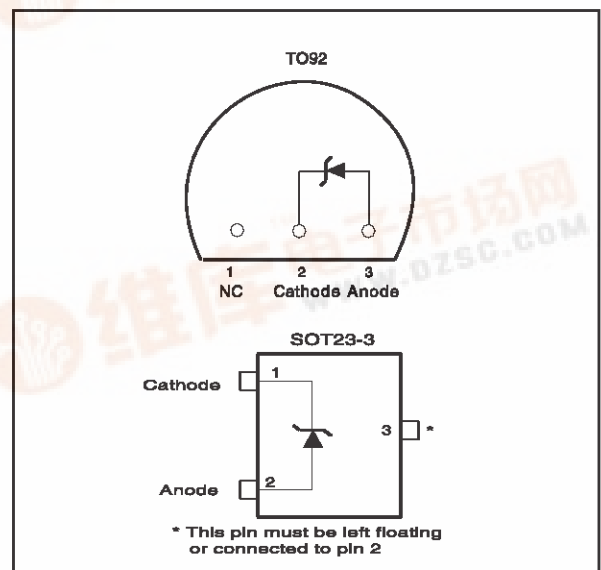
Precision	TO92	SOT23-3	SOT23 Marking
2%	TS822IZ	TS822IL	L223
1%	TS822AIZ	TS822AIL	L222
Single temperature range: -40 to +85°C			

Z = TO92 Plastic package

LT = Tiny Package (SOT23-5) - 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 <sup>1)</sup> SOT23-3 TO-92	360 625	mW
$T_{oper}$	Operating Free Air Temperature Range	-40 to +85	°C
$T_{std}$	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.  $P_d$  has been calculated with  $T_{amb} = 25^\circ\text{C}$  and  $R_{thja} = 200^\circ\text{C/W}$  for the TO92 package  
 $R_{thja} = 340^\circ\text{C/W}$  for the STO23-3L package

**OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$I_{kmin}$	Minimum Operating Current	50	$\mu\text{A}$
$I_{kmax}$	Maximum Operating Current	15	mA

## TS822

### ELECTRICAL CHARACTERISTICS

#### TS822 (2% Precision)

Tamb = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V <sub>k</sub>	Reverse Breakdown Voltage	I <sub>k</sub> = 100μA	2.45	2.5	2.55	V
	Reverse Breakdown Voltage Tolerance	I <sub>k</sub> = 100μA -40°C < T < +85°C	-50 -66		50 66	mV
I <sub>kmin</sub>	Minimum Operating Current	T = 25°C		40	50	μA
		-40°C < T < +85°C			60	
ΔV <sub>ref</sub> /ΔT	Average Temperature Coefficient	I <sub>k</sub> = 100μA		30	100	ppm/°C
ΔV <sub>k</sub> /ΔI <sub>k</sub>	Reverse Breakdown Voltage Change with Operating Current Range	I <sub>kmin</sub> < I <sub>k</sub> < 1mA -40°C < T < +85°C		0.4	1 1.2	mV
		1mA < I <sub>k</sub> < 15mA -40°C < T < +85°C		2.5	8 10	
R <sub>ka</sub>	Reverse Static Impedance	I <sub>k</sub> = I <sub>kmin</sub> to 1mA -40°C < T < +85°C		0.4	1 1.2	Ω
		I <sub>k</sub> = 1 to 15mA -40°C < T < +85°C		0.2	0.6 0.7	
K <sub>vh</sub>	Long Term Stability	I <sub>k</sub> = 100μA, t = 1000hrs		120		ppm
E <sub>n</sub>	Wide Band Noise	I <sub>k</sub> = 100μA 10Hz < f < 10kHz		35		μV <sub>rms</sub>

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

### ELECTRICAL CHARACTERISTICS

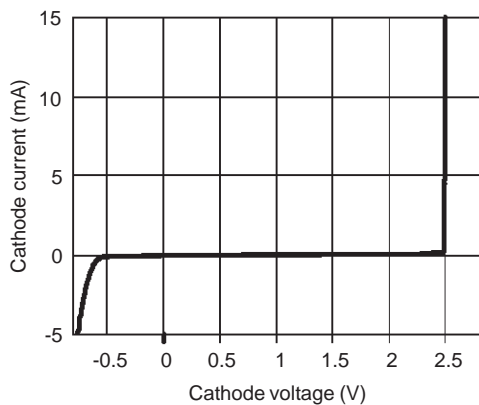
#### TS822A (1% Precision)

Tamb = 25°C (unless otherwise specified)

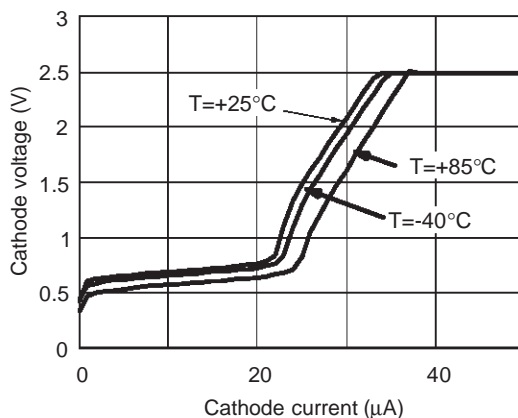
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V <sub>k</sub>	Reverse Breakdown Voltage	I <sub>k</sub> = 100μA	2.475	2.5	2.525	V
	Reverse Breakdown Voltage Tolerance	I <sub>k</sub> = 100μA -40°C < T < +85°C	-25 -41		25 41	mV
I <sub>kmin</sub>	Minimum Operating Current	T = 25°C		40	50	μA
		-40°C < T < +85°C			60	
ΔV <sub>ref</sub> /ΔT	Average Temperature Coefficient	I <sub>k</sub> = 100μA		30	100	ppm/°C
ΔV <sub>k</sub> /ΔI <sub>k</sub>	Reverse Breakdown Voltage Change with Operating Current Range	I <sub>kmin</sub> < I <sub>k</sub> < 1mA -40°C < T < +85°C		0.4	1 1.2	mV
		1mA < I <sub>k</sub> < 15mA -40°C < T < +85°C		2.5	8 10	
R <sub>ka</sub>	Reverse Static Impedance	I <sub>k</sub> = I <sub>kmin</sub> to 1mA -40°C < T < +85°C		0.4	1 1.2	Ω
		I <sub>k</sub> = 1mA to 15mA -40°C < T < +85°C		0.2	0.6 0.7	
K <sub>vh</sub>	Long Term Stability	I <sub>k</sub> = 100μA, t = 1000hrs		120		ppm
E <sub>n</sub>	Wide Band Noise	I <sub>k</sub> = 100μA 10Hz < f < 10kHz		35		μV <sub>rms</sub>

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

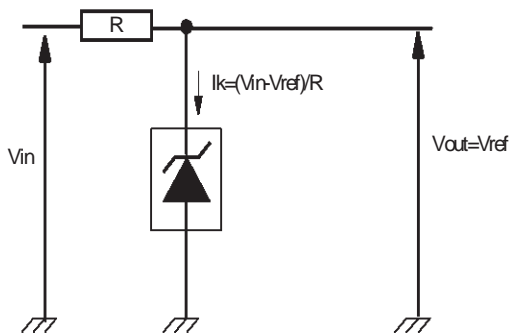
Reference voltage versus cathode current



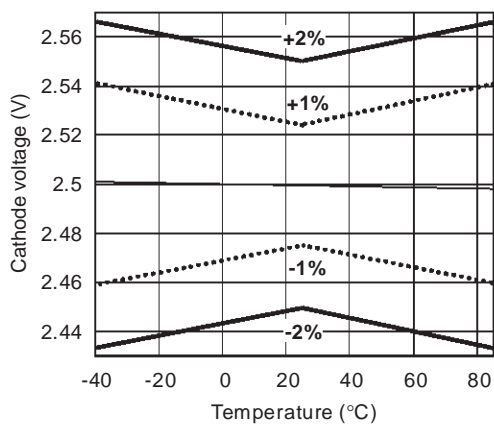
Minimum operating current



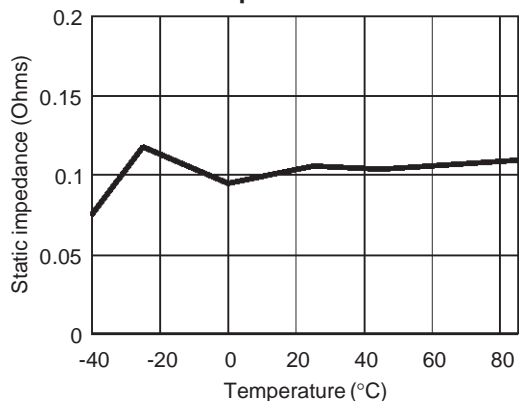
Test circuit



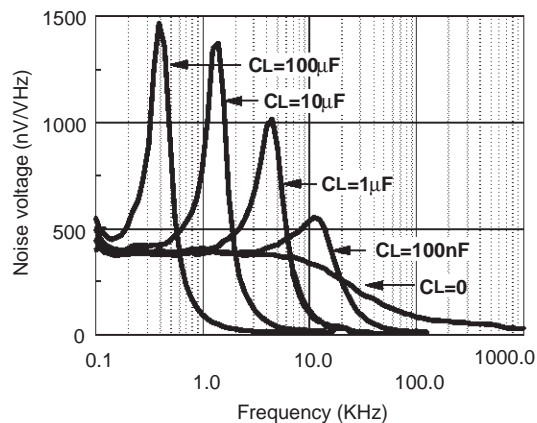
Reference voltage versus Temperature

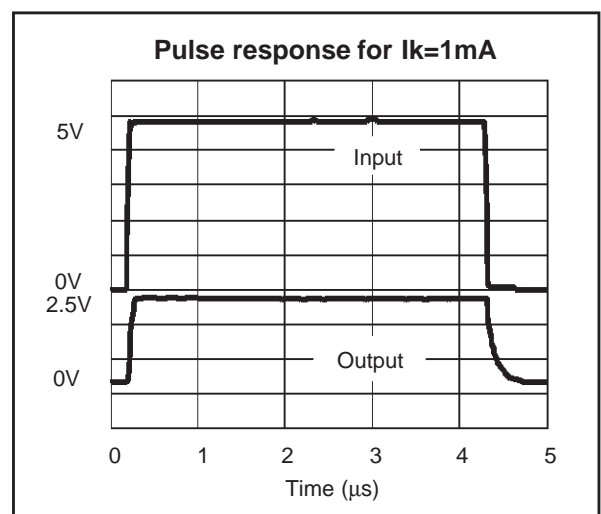
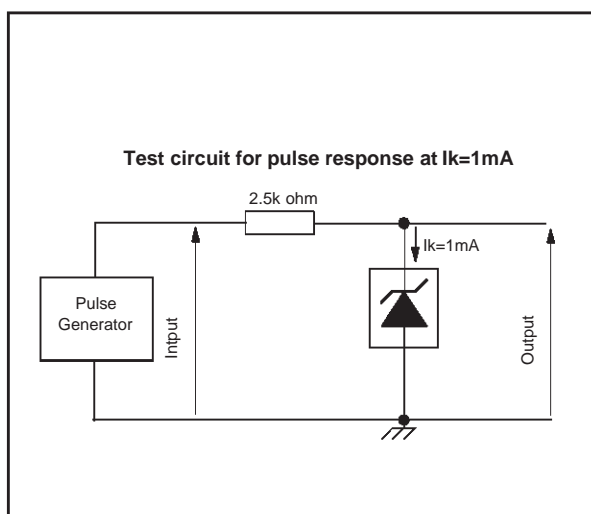
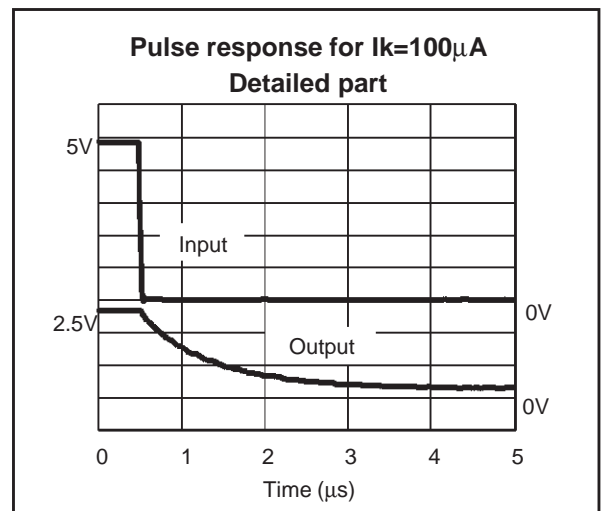
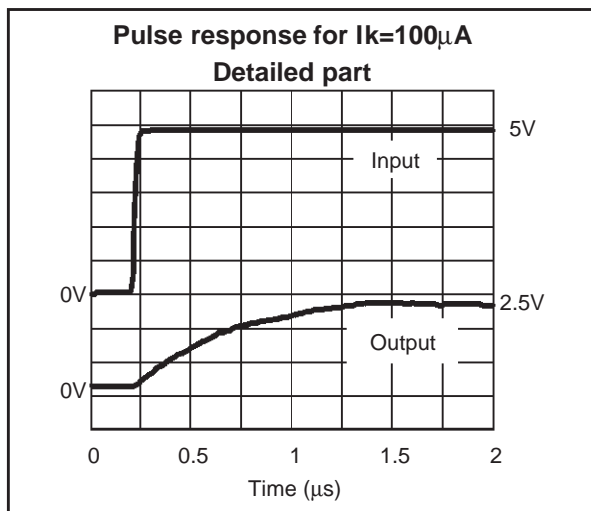
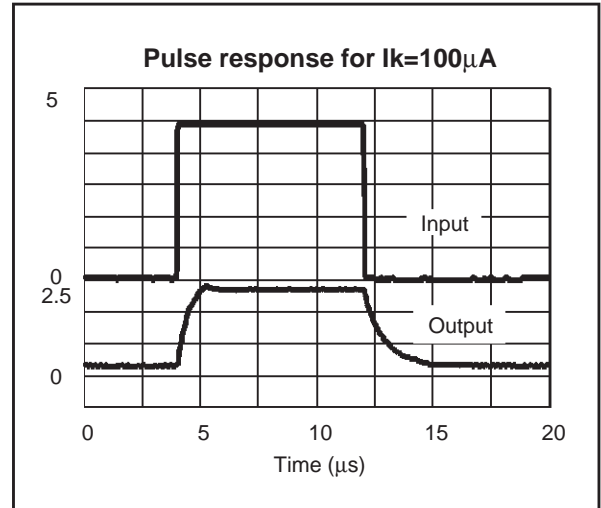
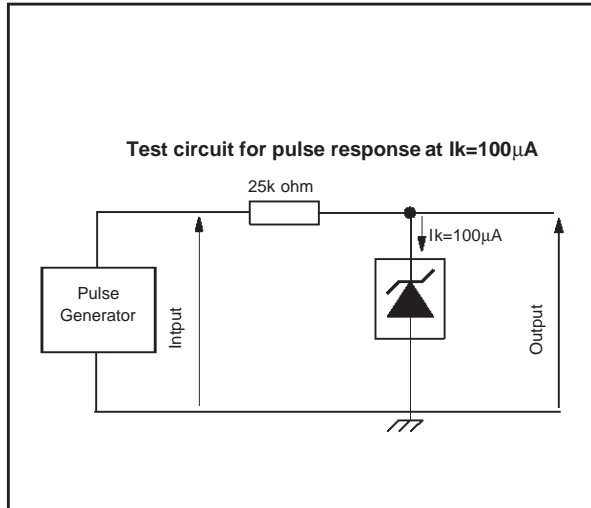


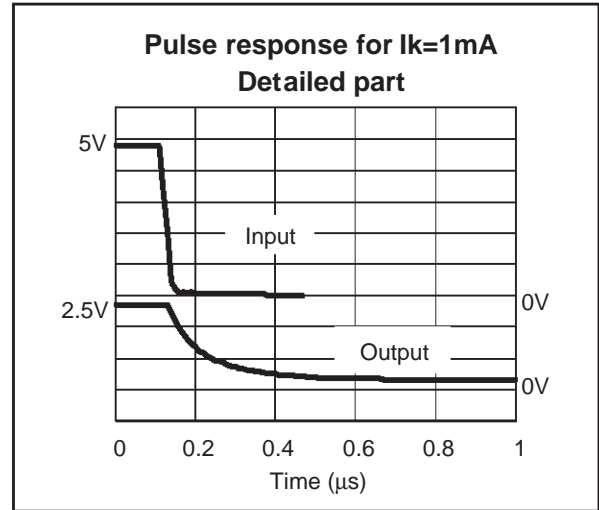
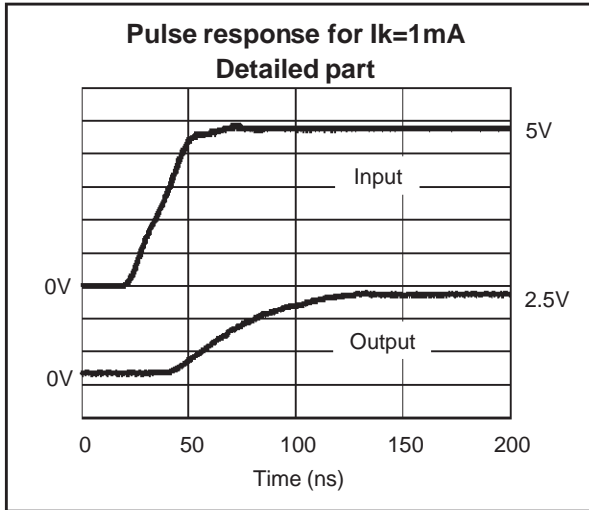
Static impedance (Rka) versus temperature



Noise voltage versus Frequency

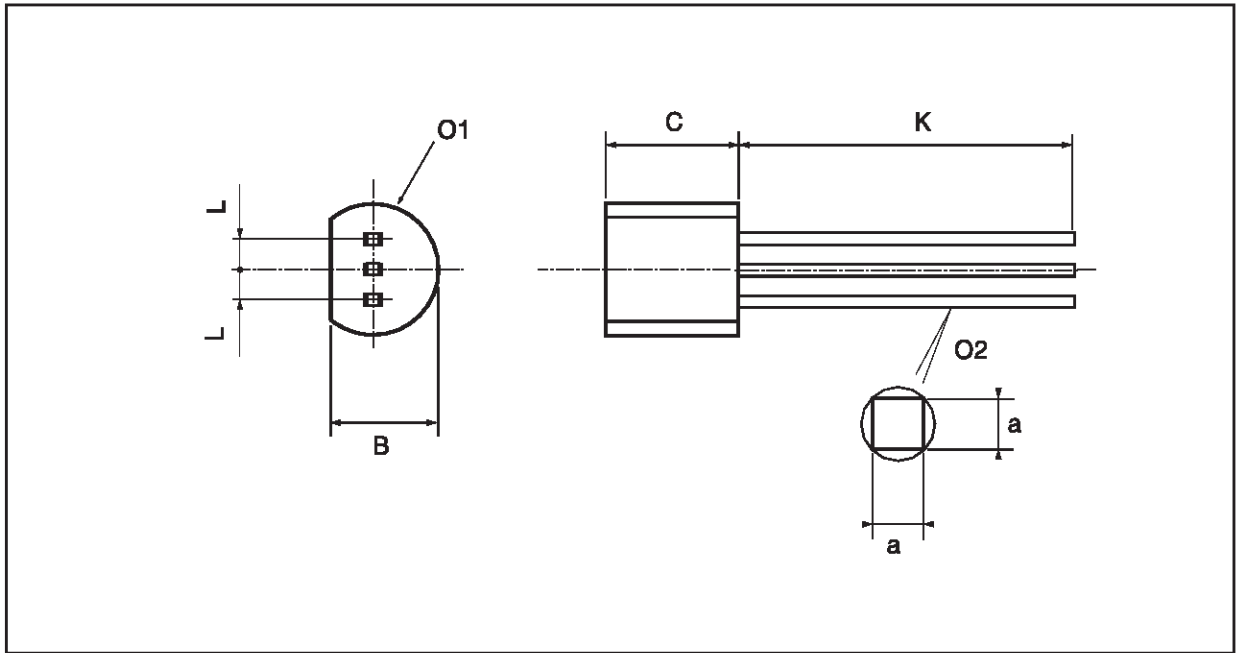




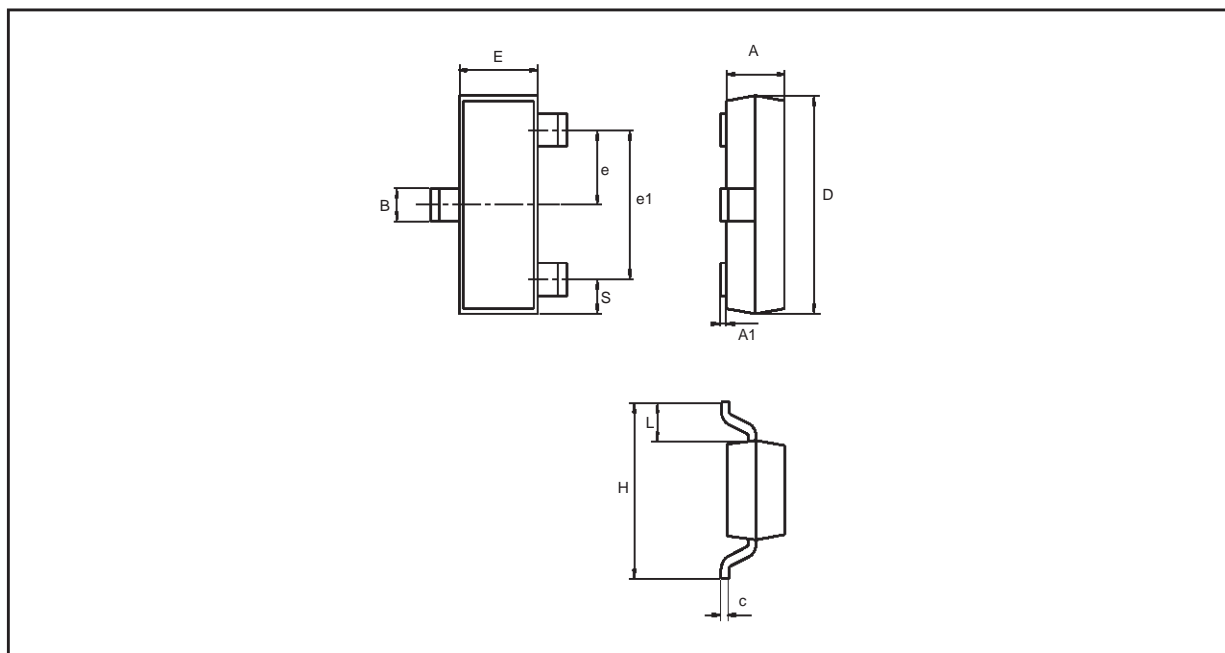


**TS822**

**PACKAGE MECHANICAL DATA**  
**3 PINS - PLASTIC PACKAGE TO-92**



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 (SOT-23)**

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.>
A	0.85		1.1	33.4		43.3
B	0.65		0.95	25.6		37.4
C	1.20		1.4	47.2		55.1
D	2.80		3	110.2		118
E	0.95		1.05	37.4		41.3
F	1.9		2.05	74.8		80.7
G	2.1		2.5	82.6		98.4
H	0.38		0.48	14.9		18.8
L	0.3		0.6	11.8		23.6
M	0		0.1	0		3.9
N	0.3		0.65	11.8		25.6
O	0.09		0.17	2.5		6.7

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