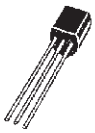
TS821

1.225V MICROPOWER VOLTAGE REFERENCE

- 1.225V TYP OUTPUT VOLTAGE
- ULTRA LOW OPERATING CURRENT : 40µA typ.
- HIGH PRECISION @ 25°C
  +/-2% (Standard version)
  +/-1% (A grade)
  +/-0.5% (B grade)
- HIGH STABILITY WHEN USED WITH CAPACITIVE LOADS
- WIDE TEMPERATURE RANGE : -40 to +85°C
- T092 & SOT23-3 PACKAGES



Z
TO92
(Plastic Package)

L
SOT-23L
(Plastic Micropackage)

DESCRIPTION

The TS821 is a micropower integrated circuit which is a high stability, two terminals, band gap reference providing a stable output voltage over the industrial temperature range (-40 to +85°C). The minimum operating current is guaranteed at 50µA over the full operating temperature range.

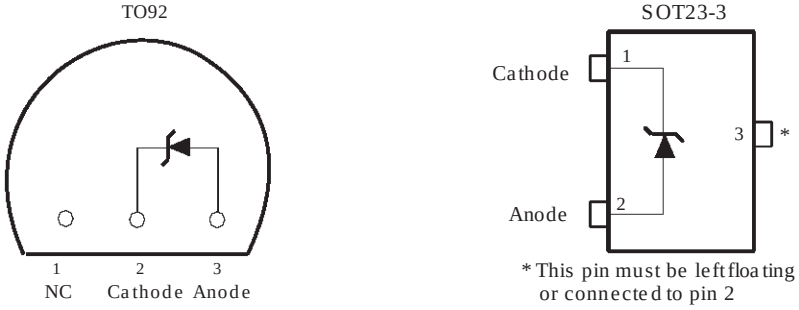
APPLICATIONS

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

ORDER CODES

Precision	TO92	SOT23-3	SOT23 Marking
2%	TS821IZ	TS821ILT	L213
1%	TS821AIZ	TS821AILT	L212
0.5%	TS821BIZ	TS821BILT	L211
Single temperature range : -40 to +85°C			

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	SOT23-3 TO92	360 625	mW
T_{oper}	Operating Free Air Temperature Range		-40 to +85	°C
T_{stg}	Storage Temperature		-65 to +150	°C

Note : P_d has been calculated with T_{amb} = 25°C and T_j = 125°C and
R_{thja} = 200°C/W for TO92 package
R_{thja} = 340°C/W for SOT23 package

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
I_{rmin}	Minimum Operating Current	45	µA
I_{rmax}	Maximum Operating Current	12	mA

ELECTRICAL CHARACTERISTICS

TS821 (2% Precision)

T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_k	Reverse Breakdown Voltage	I_k = 100µA @ T_{amb} = 25°C	1.200	1.225	1.250	V
	Reverse Breakdown Voltage Tolerance	I_k = 100µA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C	-25 -36		+25 +36	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	45	µA
		-40°C < T_{amb} < +85°C			50	µA
$\Delta V_{ref}/\Delta T$	Average Temperature Coefficient	I_K = 100µA			150	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Change	I_{kmin} < I_k < 1mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		0.3	0.7 1	mV
		1mA < I_k < 12mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		2.5	5 7	mV
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_K = 100µA, t = 1000hrs T_{amb} = 25°C		120		ppm
en	Wideband Noise	I_K = 100µA 10Hz < f < 10kHz		200		$nV\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS

TS821A (1% Precision)

T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_k	Reverse Breakdown Voltage	I_k = 100µA @ T_{amb} = 25°C	1.213	1.225	1.237	V
	Reverse Breakdown Voltage Tolerance	I_k = 100µA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C	-12 -24		+12 +24	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	45	µA
		-40°C < T_{amb} < +85°C			50	µA
$\Delta V_{ref}/\Delta T$	Average Temperature Coefficient	I_K = 100µA			150	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Change	I_{kmin} < I_k < 1mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		0.3	0.7 1	mV
		1mA < I_k < 12mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		2.5	5 7	mV
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_K = 100µA, t = 1000hrs T_{amb} = 25°C		120		ppm/kHr
en	Wideband Noise	I_K = 100µA 10Hz < f < 10kHz		200		nV/√Hz

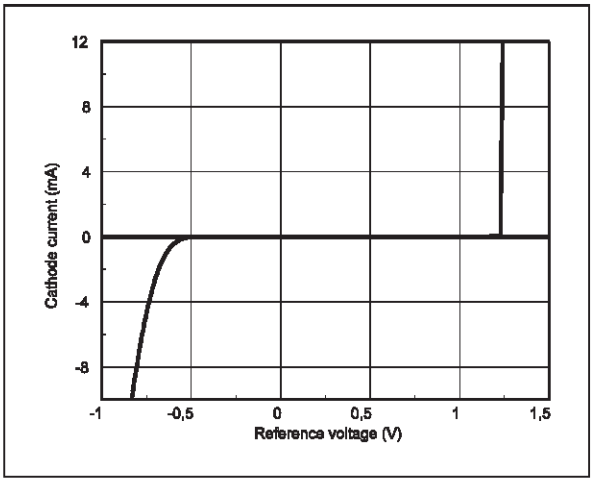
ELECTRICAL CHARACTERISTICS

TS821B (0.5% Precision)

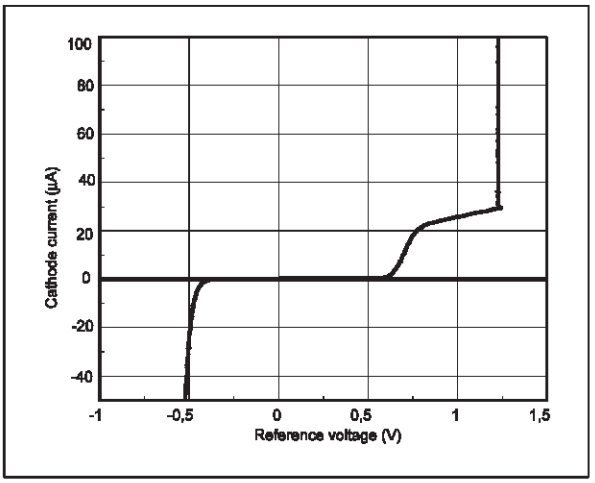
T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_k	Reverse Breakdown Voltage	I_k = 100µA @ T_{amb} = 25°C	1.219	1.225	1.231	V
	Reverse Breakdown Voltage Tolerance	I_k = 100µA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C	-6 -14		+6 +14	mV
I_{kmin}	Minimum Operating Current	T_{amb} = 25°C		40	45	µA
		-40°C < T_{amb} < +85°C			50	µA
ΔVref/ΔT	Average Temperature Coefficient	I_K = 100µA			120	ppm/°C
$\Delta V_k/\Delta I_k$	Reverse Breakdown Voltage Change with Operating Current Change	I_{kmin} < I_k < 1mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		0.3	0.7 1	mV
		1mA < I_k < 12mA @ T_{amb} = 25°C -40°C < T_{amb} < +85°C		2.5	5 7	mV
R_{ka}	Static Impedance	ΔI_k = 45µA to 1mA		0.25	0.5	Ω
K_{vh}	Long Term Stability	I_K = 100µA, t = 1000hrs T_{amb} = 25°C		120		ppm
en	Wideband Noise	I_K = 100µA 10Hz < f < 10kHz		200		nV/√Hz

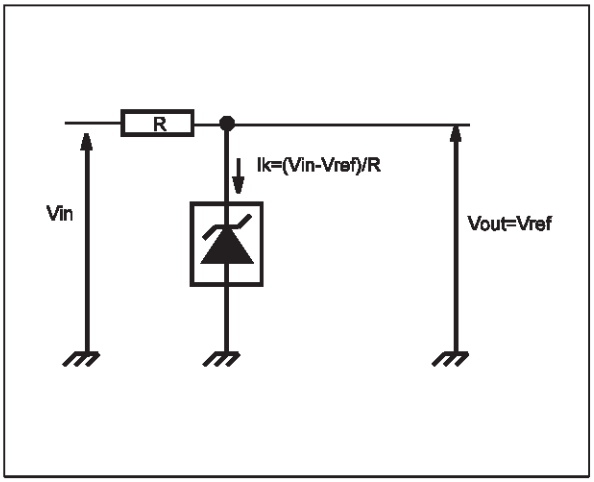
Reference Voltage versus Cathode Current



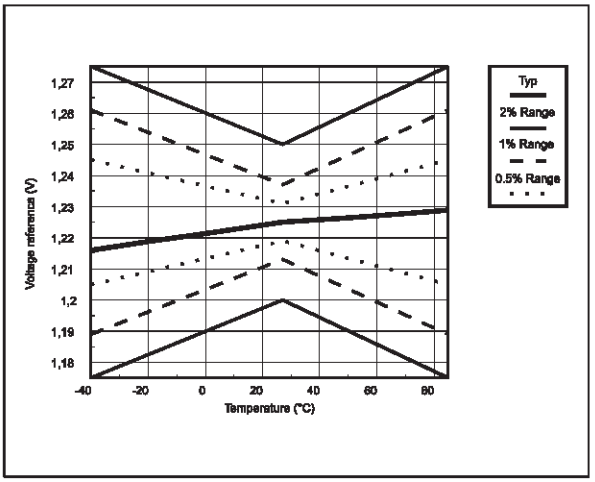
Reference Voltage versus Cathode Current



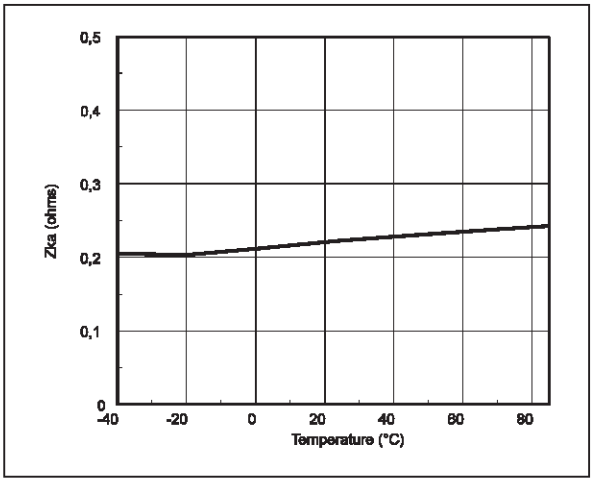
Test Circuit



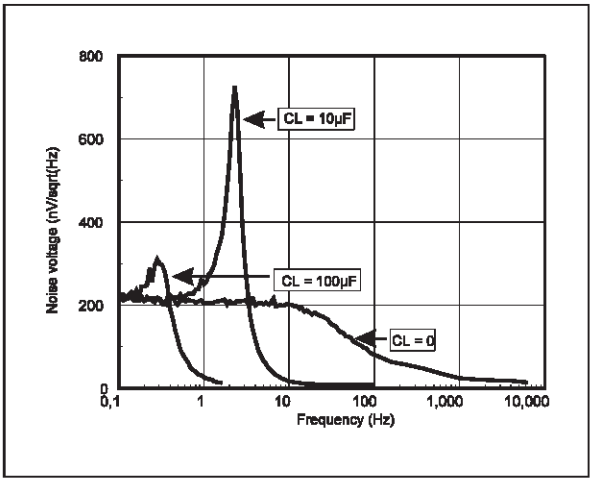
Reference Voltage versus Temperature



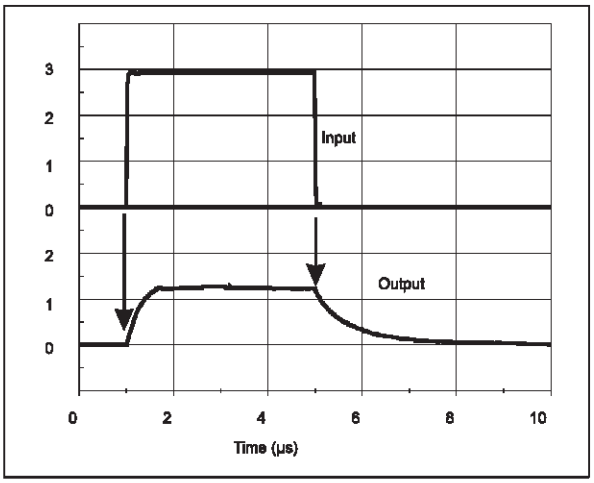
Dynamic Impedance versus Temperature



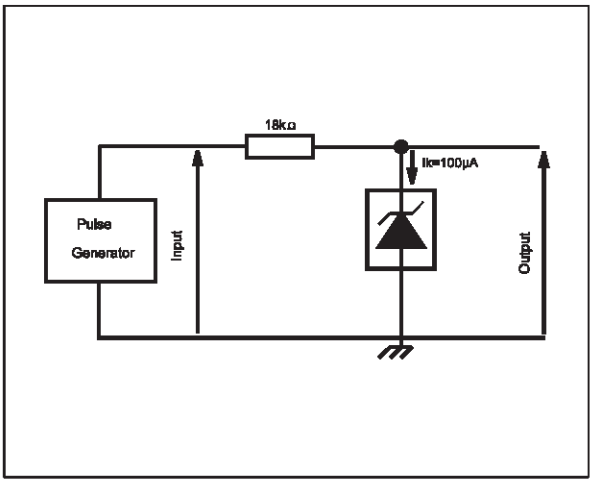
Noise Voltage versus Frequency



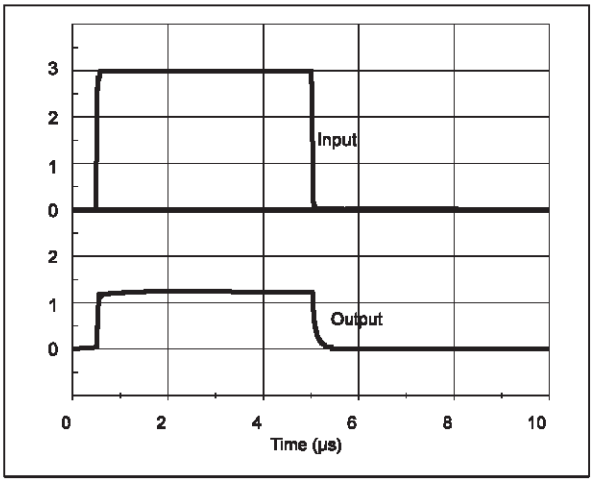
Pulse Response for Ik = 100mA



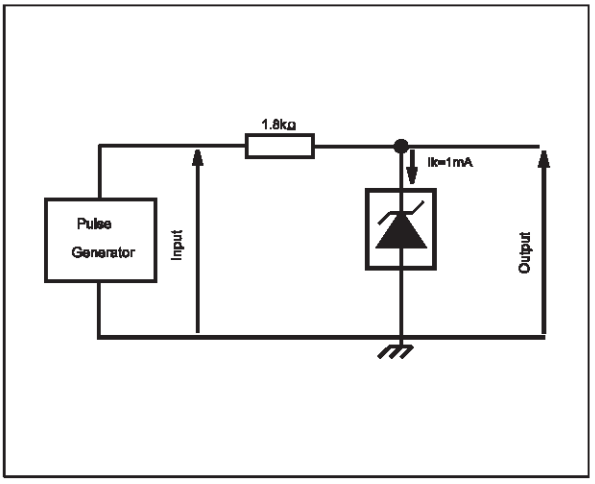
Test Circuit for Pulse Response at Ik = 100mA



Pulse Response for Ik = 1mA

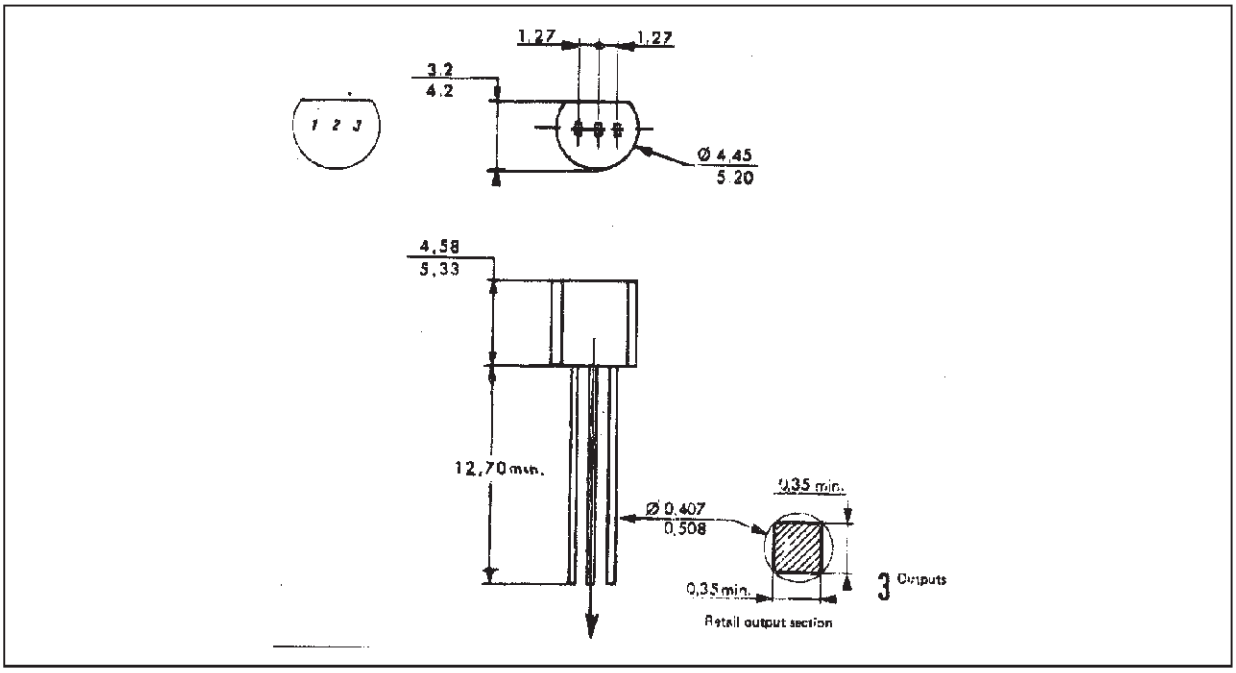


Test Circuit for Pulse Response at Ik = 1mA



PACKAGE MECHANICAL DATA

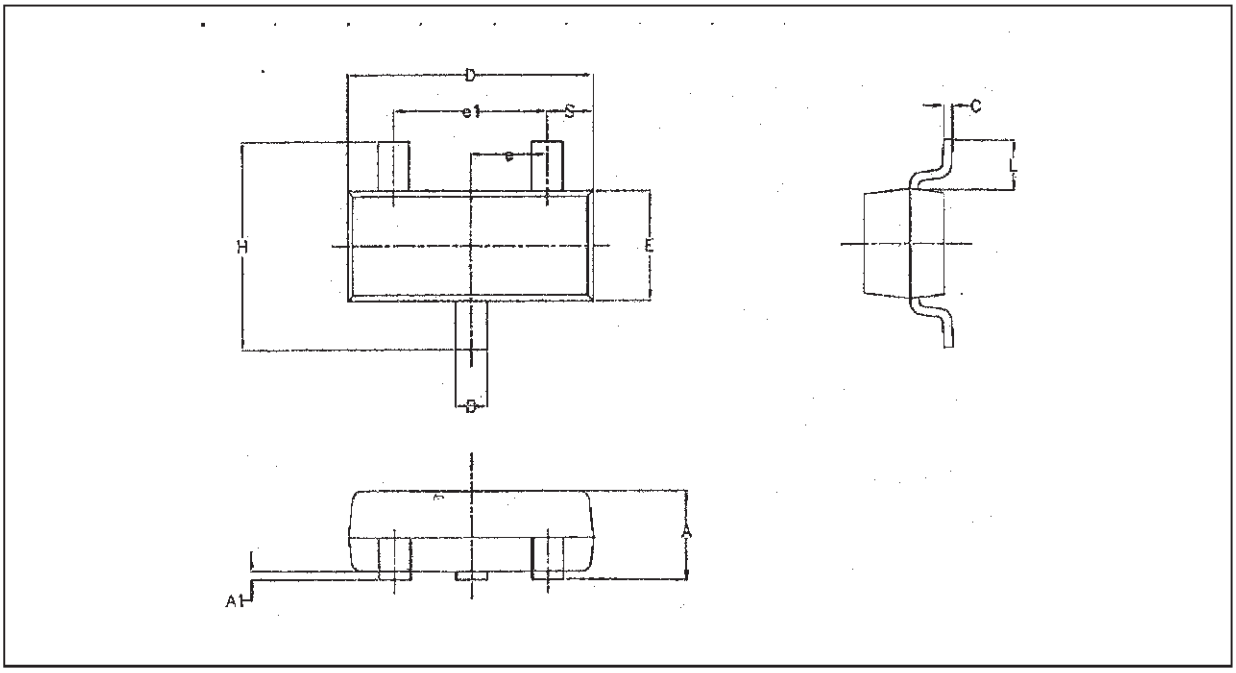
3 PINS - PLASTIC PACKAGE TO92



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)



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°			