LM285
LM385, B

MICROPOWER VOLTAGE REFERENCE DIODES

SEMICONDUCTOR TECHNICAL DATA

Micropower Voltage Reference Diodes

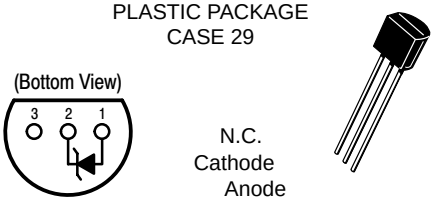
The LM285/LM385 series are micropower two–terminal bandgap voltage regulator diodes. Designed to operate over a wide current range of 10 μA to 20 mA, these devices feature exceptionally low dynamic impedance, low noise and stable operation over time and temperature. Tight voltage tolerances are achieved by on–chip trimming. The large dynamic operating range enables these devices to be used in applications with widely varying supplies with excellent regulation. Extremely low operating current make these devices ideal for micropower circuitry like portable instrumentation, regulators and other analog circuitry where extended battery life is required.

The LM285/LM385 series are packaged in a low cost TO–226AA plastic case and are available in two voltage versions of 1.235 and 2.500 V as denoted by the device suffix (see Ordering Information table). The LM285 is specified over a –40°C to +85°C temperature range while the LM385 is rated from 0°C to +70°C.

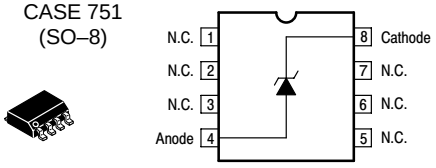
The LM385 is also available in a surface mount plastic package in voltages of 1.235 and 2.500 V.

- Operating Current from 10 μA to 20 mA
- 1.0%, 1.5%, 2.0% and 3.0% Initial Tolerance Grades
- Low Temperature Coefficient
- 1.0 Ω Dynamic Impedance
- Surface Mount Package Available

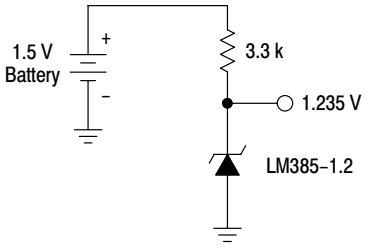
Z SUFFIX
PLASTIC PACKAGE
CASE 29



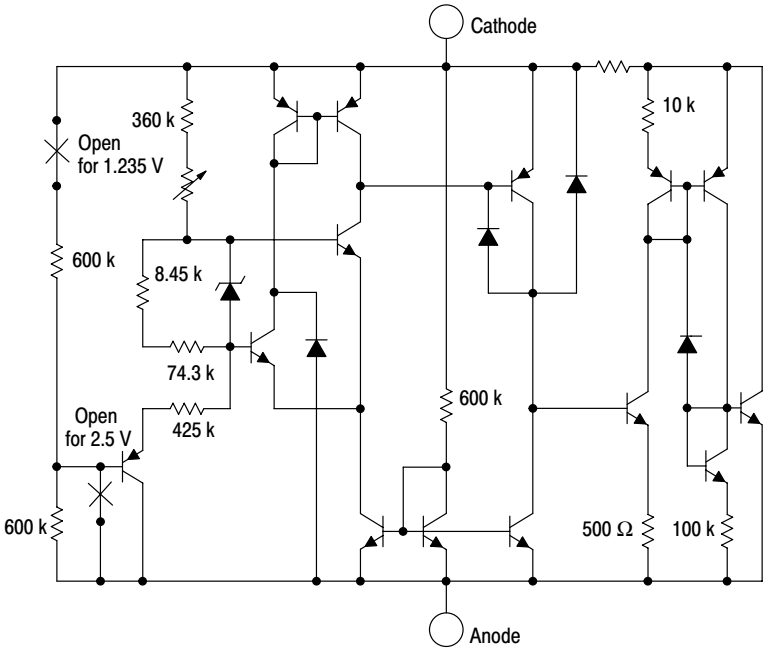
D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO–8)



Standard Application



Representative Schematic Diagram



ORDERING INFORMATION

Device	Operating Temperature Range	Reverse Break–down Voltage	Tolerance
LM285D–1.2 LM285Z–1.2	T_A = –40° to +85°C	1.235 V	±1.0%
LM285D–2.5 LM285Z–2.5		2.500 V	±1.5%
LM385BD–1.2 LM385BZ–1.2	T_A = 0° to +70°C	1.235 V	±1.0%
LM385D–1.2 LM385Z–1.2		1.235 V	±2.0%
LM385BD–2.5 LM385BZ–2.5		2.500 V	±1.5%
LM385D–2.5 LM385Z–2.5		2.500 V	±3.0%

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Symbol	Value	Unit
Reverse Current	I_R	30	mA
Forward Current	I_F	10	mA
Operating Ambient Temperature Range LM285 LM385	T_A	 – 40 to + 85 0 to +70	°C
Operating Junction Temperature	T_J	+ 150	°C
Storage Temperature Range	T_{stg}	– 65 to + 150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	LM285–1.2			LM385–1.2/LM385B–1.2			Unit
		Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leq I_R \leq$ 20 mA)	$V_{(BR)R}$							V
LM285–1.2/LM385B–1.2		1.223	1.235	1.247	1.223	1.235	1.247	
$T_A = T_{low}$ to T_{high} (Note 1)		1.200	–	1.270	1.210	–	1.260	
LM385–1.2		–	–	–	1.205	1.235	1.260	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	–	1.192	–	1.273	
Minimum Operating Current	I_{Rmin}							μA
T_A = 25°C		–	8.0	10	–	8.0	15	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	20	–	–	20	
Reverse Breakdown Voltage Change with Current	$\Delta V_{(BR)R}$							mV
$I_{Rmin} \leq I_R \leq$ 1.0 mA, T_A = +25°C		–	–	1.0	–	–	1.0	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	1.5	–	–	1.5	
1.0 mA $\leq I_R \leq$ 20 mA, T_A = +25°C		–	–	10	–	–	20	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	20	–	–	25	
Reverse Dynamic Impedance I_R = 100 μA, T_A = +25°C	Z		0.6	–	–	0.6	–	W
Average Temperature Coefficient 10 μA $\leq I_R \leq$ 20 mA, $T_A = T_{low}$ to T_{high} (Note 1)	$\Delta V_{(BR)}/\Delta T$	–	80	–	–	80	–	ppm/°C
Wideband Noise (RMS) I_R = 100 μA, 10 Hz $\leq$ f $\leq$ 10 kHz	n	–	60	–	–	60	–	μV
Long Term Stability I_R = 100 μA, T_A = +25°C ± 0.1°C	S	–	20	–	–	20	–	ppm/ kHR

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	LM285–2.5			LM385–2.5/LM385B–2.5			Unit
		Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leq I_R \leq$ 20 mA)	$V_{(BR)R}$							V
LM285–2.5/LM385B–2.5		2.462	2.5	2.538	2.462	2.5	2.538	
$T_A = T_{low}$ to T_{high} (Note 1)		2.415	–	2.585	2.436	–	2.564	
LM385–2.5		–	–	–	2.425	2.5	2.575	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	–	2.400	–	2.600	
Minimum Operating Current	I_{Rmin}							μA
T_A = 25°C		–	13	20	–	13	20	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	30	–	–	30	
Reverse Breakdown Voltage Change with Current	$\Delta V_{(BR)R}$							mV
$I_{Rmin} \leq I_R \leq$ 1.0 mA, T_A = +25°C		–	–	1.0	–	–	2.0	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	1.5	–	–	2.5	
1.0 mA $\leq I_R \leq$ 20 mA, T_A = +25°C		–	–	10	–	–	20	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	20	–	–	25	
Reverse Dynamic Impedance I_R = 100 μA, T_A = +25°C	Z		0.6	–	–	0.6	–	W
Average Temperature Coefficient 20 μA $\leq I_R \leq$ 20 mA, $T_A = T_{low}$ to T_{high} (Note 1)	$\Delta V_{(BR)}/\Delta T$	–	80	–	–	80	–	ppm/°C
Wideband Noise (RMS) I_R = 100 μA, 10 Hz $\leq$ f $\leq$ 10 kHz	n	–	120	–	–	120	–	μV
Long Term Stability I_R = 100 μA, T_A = +25°C ± 0.1°C	S	–	20	–	–	20	–	ppm/ kHR

NOTES: 1. T_{low} = – 40°C for LM285–1.2, LM285–2.5
= 0°C for LM385–1.2, LM385B–1.2, LM385–2.5, LM385B–2.5
T_{high} = +85°C for LM285–1.2, LM285–2.5
= +70°C for LM385–1.2, LM385B–1.2, LM385–2.5, LM385B–2.5

TYPICAL PERFORMANCE CURVES FOR LM285−1.2/385−1.2/385B−1.2

Figure 1. Reverse Characteristics

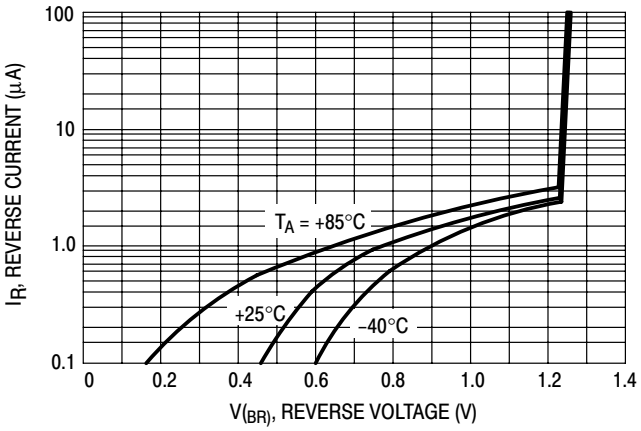


Figure 2. Reverse Characteristics

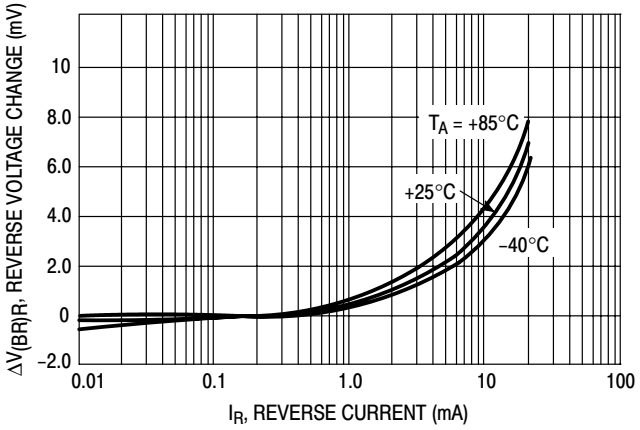


Figure 3. Forward Characteristics

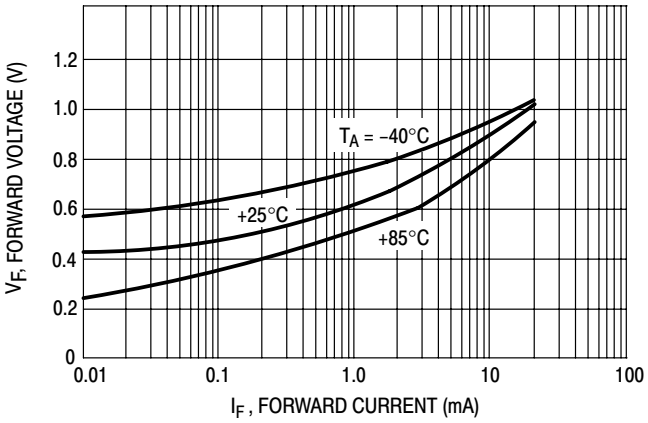


Figure 4. Temperature Drift

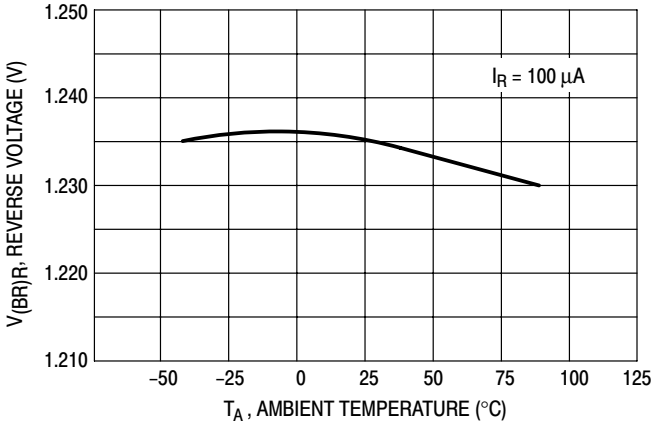


Figure 5. Noise Voltage

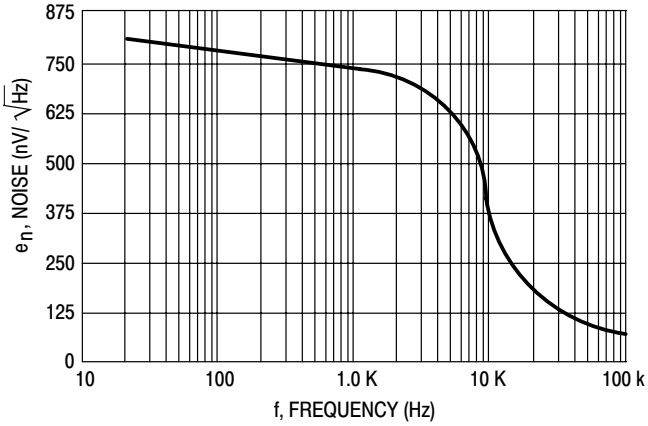
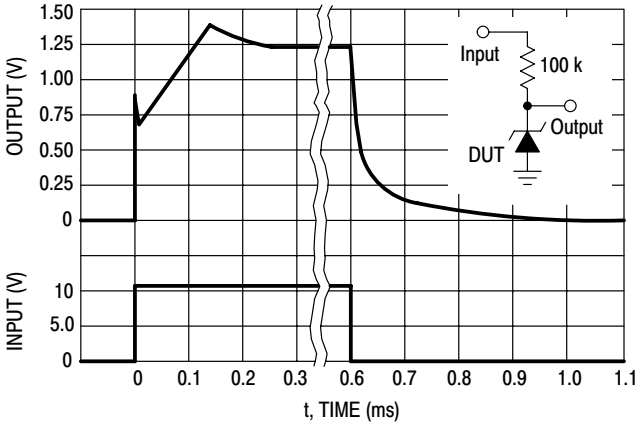


Figure 6. Response Time



TYPICAL PERFORMANCE CURVES FOR LM285−2.5/385−2.5/385B−2.5

Figure 7. Reverse Characteristics

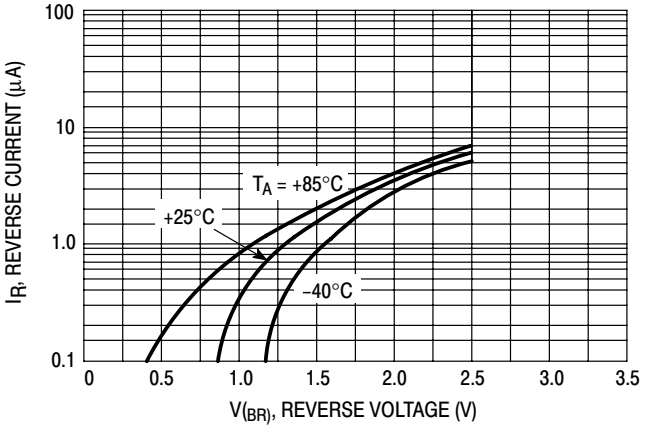


Figure 8. Reverse Characteristics

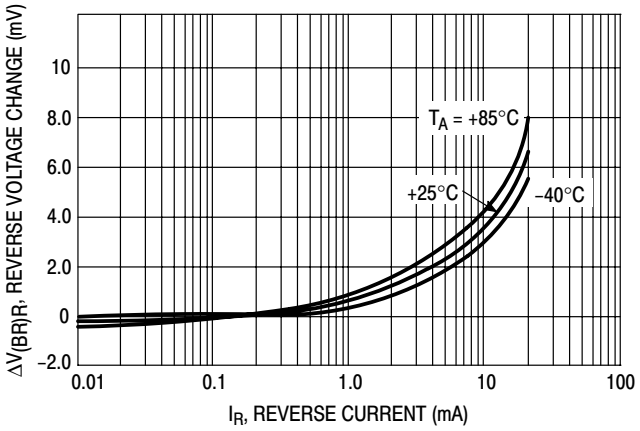


Figure 9. Forward Characteristics

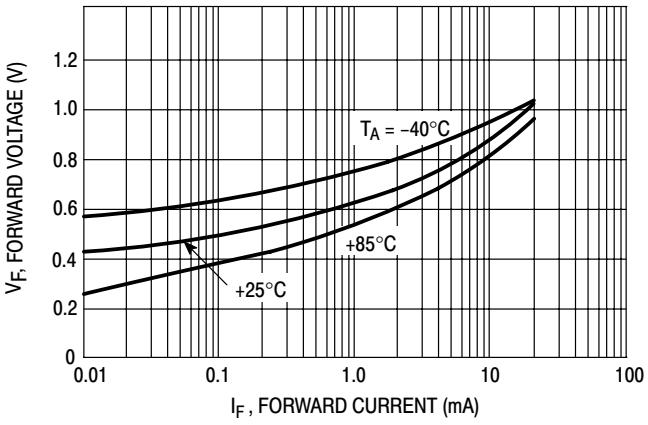


Figure 10. Temperature Drift

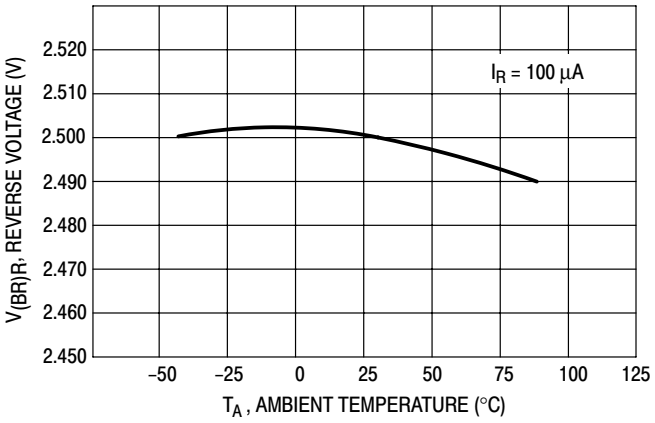


Figure 11. Noise Voltage

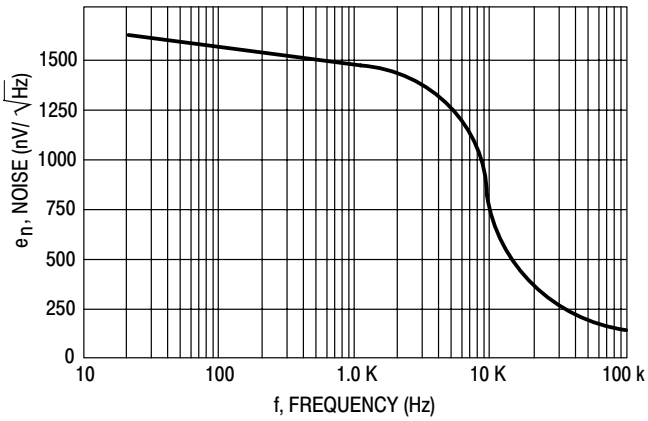
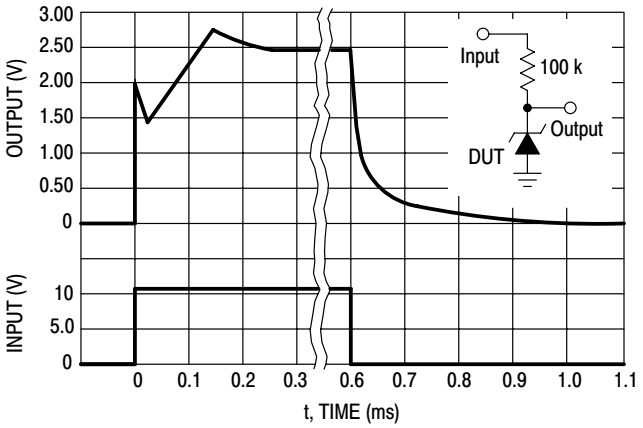
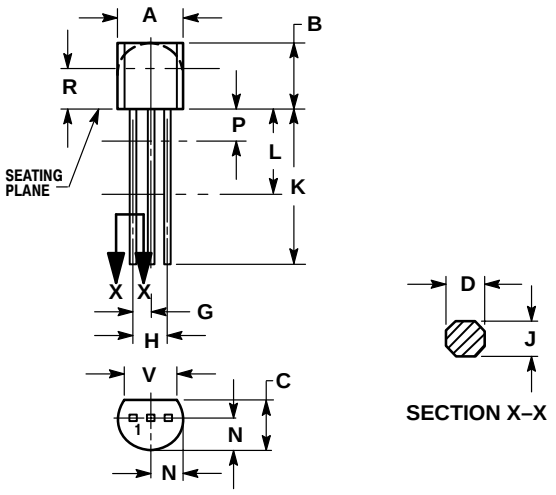


Figure 12. Response Time



PACKAGE DIMENSIONS

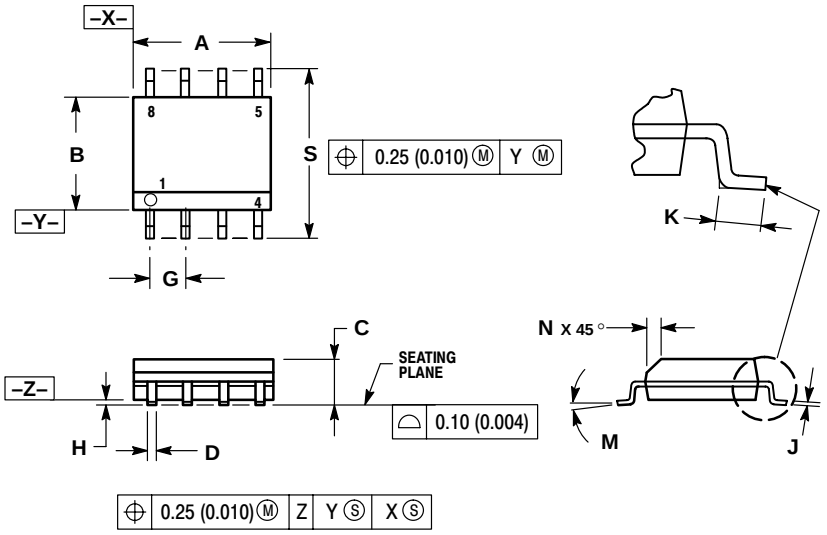
Z SUFFIX
PLASTIC PACKAGE
CASE 29–11
ISSUE AL



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---

D SUFFIX
PLASTIC PACKAGE
CASE 751–07
(SO–8)
ISSUE W



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

Notes

PUBLICATION ORDERING INFORMATION

NORTH AMERICA Literature Fulfillment:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com
Fax Response Line: 303–675–2167 or 800–344–3810 Toll Free USA/Canada

N. American Technical Support: 800–282–9855 Toll Free USA/Canada

EUROPE: LDC for ON Semiconductor – European Support
German Phone: (+1) 303–308–7140 (Mon–Fri 2:30pm to 7:00pm CET)
Email: ONlit–german@hibbertco.com
French Phone: (+1) 303–308–7141 (Mon–Fri 2:00pm to 7:00pm CET)
Email: ONlit–french@hibbertco.com
English Phone: (+1) 303–308–7142 (Mon–Fri 12:00pm to 5:00pm GMT)
Email: ONlit@hibbertco.com

EUROPEAN TOLL–FREE ACCESS*: 00–800–4422–3781
*Available from Germany, France, Italy, UK, Ireland

CENTRAL/SOUTH AMERICA:
Spanish Phone: 303–308–7143 (Mon–Fri 8:00am to 5:00pm MST)
Email: ONlit–spanish@hibbertco.com
Toll–Free from Mexico: Dial 01–800–288–2872 for Access –
then Dial 866–297–9322

ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support
Phone: 1–303–675–2121 (Tue–Fri 9:00am to 1:00pm, Hong Kong Time)
Toll Free from Hong Kong & Singapore:
001–800–4422–3781
Email: ONlit–asia@hibbertco.com

JAPAN: ON Semiconductor, Japan Customer Focus Center
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan 141–0031
Phone: 81–3–5740–2700
Email: r14525@onsemi.com

ON Semiconductor Website: http://onsemi.com

For additional information, please contact your local
Sales Representative.