

■ FEATURES

- Operating Current from 10 μ A to 20mA.
- Low Temperature Coefficient.
- Low Voltage Reference: 1.235V.
- 1% and 2% Initial Tolerance.

■ APPLICATIONS

- Portable, Battery-Powered Equipment.
- Instrumentation.
- Process Control.
- Energy Management.
- Product Testing.
- Automotive.
- Precision Audio Components.

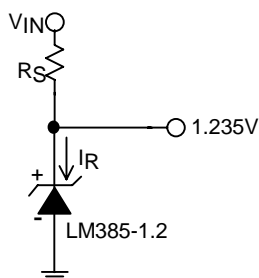
■ DESCRIPTION

The LM385-1.2 is a micropower 2-terminal bandgap voltage reference. Operating over a 10 μ A to 20mA current range, it features exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to achieve tight voltage tolerance. Since the LM385-1.2 bandgap reference uses only bipolar transistors and resistors, low noise and good long-term stability result.

Careful design of the LM385-1.2 has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows for its use with widely varying supplies with excellent regulation.

The extremely low power drain of the LM385-1.2 makes it useful for micropower circuitry. This voltage reference can be used to make portable meters, regulators, or general-purpose analog circuitry with battery life approaching shelf life. Further, the wide operating current allows it to replace older references with a tighter tolerance.

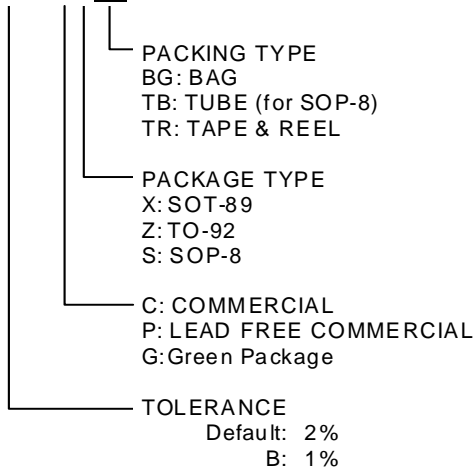
■ TYPICAL APPLICATION CIRCUIT



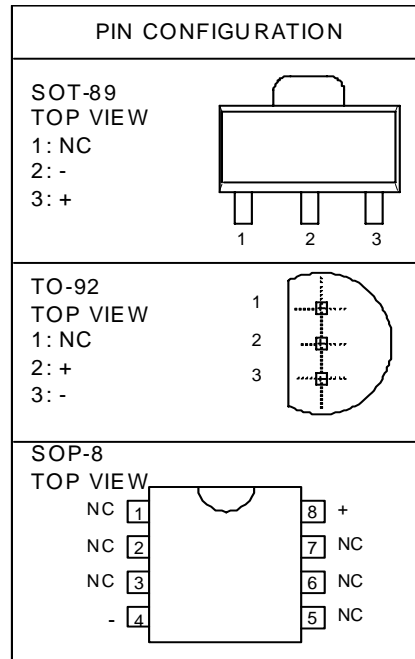
Precision 1.235V Voltage Reference

ORDERING INFORMATION

LM385X-1.2XXXX



- Example: LM385-1.2CXTR
 → 2% version, in SOT-89 Package & Taping & Reel Packing Type
 (CS is not available in BAG packing type.)
- LM385B-1.2PXTR
 → 1% version, in SOT-89 Lead Free Package & Taping & Reel Packing Type
- LM385B-1.2GXTR
 → 1% version, in SOT-89 Green Package & Taping & Reel Packing Type



SOT-89 Marking

Part No.	Marking	Part No.	Marking	Part No.	Marking
LM385-12CX	A112	LM385-12PX	A112P	LM385-12GX	A112G
LM385B-12CX	A1B12	LM385B-12PX	A11BP	LM385B-12GX	A11BG

ABSOLUTE MAXIMUM RATINGS

Reverse Current	30mA
Forward Current	10mA
Operating Temperature Range	-40°C to 85°C
Junction Temperature	125°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (soldering, 10s)	260°C

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

TEST CIRCUIT

Refer to TYPICAL APPLICATION CIRCUIT.

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified.) (Note1)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Reverse Breakdown Voltage	I _R =100μA	LM385B-1.2	1.222	1.235	1.248	V
		LM385-1.2	1.210	1.235	1.260	
Reverse Breakdown Voltage Change with Current	10μA ≤ I _R ≤ 1mA	ΔV _R			1	mV
	1mA ≤ I _R ≤ 20mA	ΔV _R			20	mV
Reverse Dynamic Impedance	I _R =100μA, f=20Hz	Z _R			1	Ω
Minimum Operating Current		I _{RMIN}		8	15	μA
Wideband Noise (rms)	I _R =100μA, 10Hz ≤ f ≤ 10KHz	e _N		60		μVrms
Average Temperature Coefficient (Note)	I _R =100μA	αV _R		100		ppm/°C
Long Term Stability	I _R =100μA, T=1000Hrs, T _A =25°C	ΔV _R /Δt		20		ppm

Note 1: Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note 2: The average temperature coefficient is defined as the maximum deviation of reverse breakdown voltage at all measured temperatures from T_{MIN} to T_{MAX}, divided by T_{MAX} - T_{MIN}. The measured temperatures are 0°C, 25°C, 50°C and 70°C.

The total over temperature tolerance for the different grades follows:

LM385B-1.2: ±1.70% = ±1.0% ± 100ppm/°C x 70°C

LM385-1.2: ±2.7% = ±2.0% ± 100ppm/°C x 70°C

TYPICAL PERFORMANCE CHARACTERISTICS

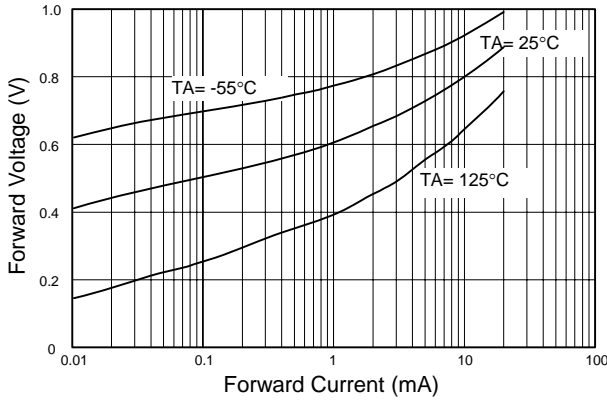


Fig. 1 Forward characteristics

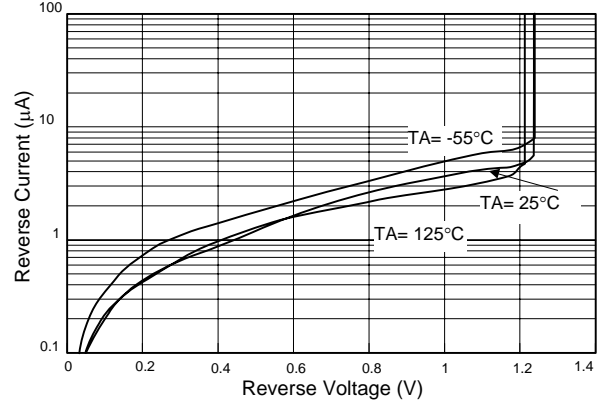


Fig. 2 Reverse Characteristics

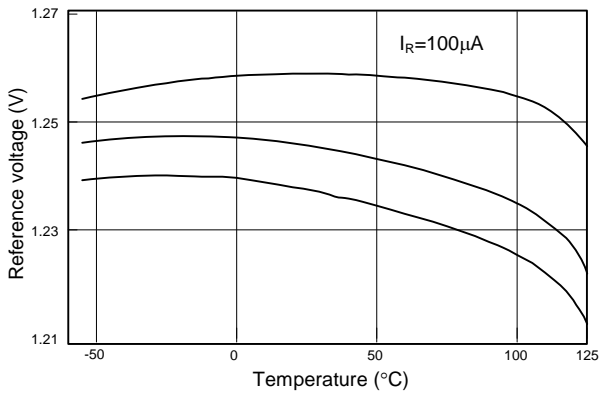


Fig. 3 Temperature Drift of 3 Representative Units

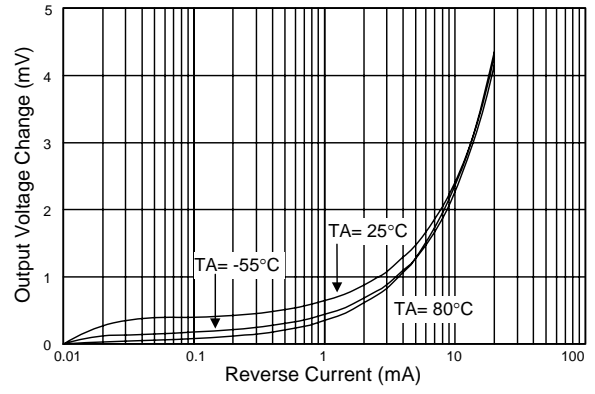


Fig. 4 Reverse Characteristics

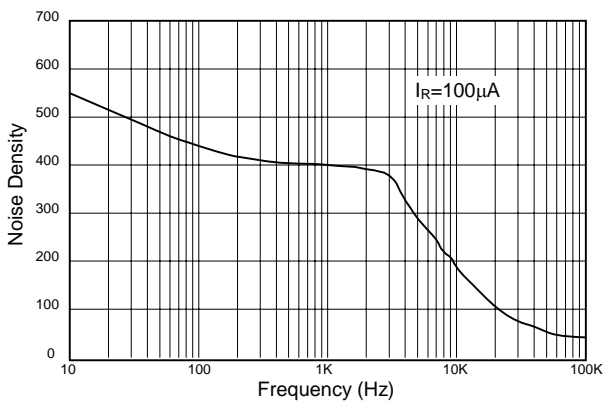


Fig. 5 Output Noise Voltage (nV/\sqrt{Hz})

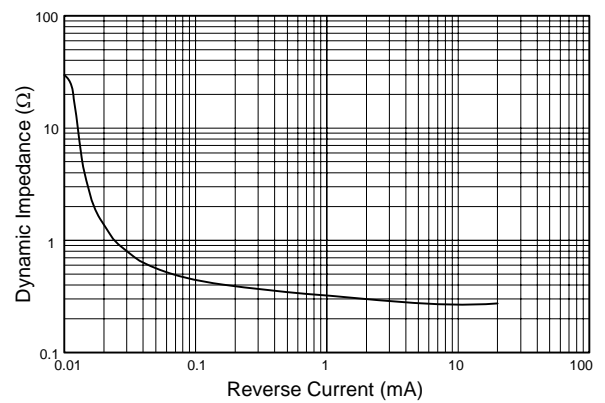


Fig. 6 Reverse Characteristics

■ **TYPICAL PERFORMANCE CHARACTERISTICS** (Continued)

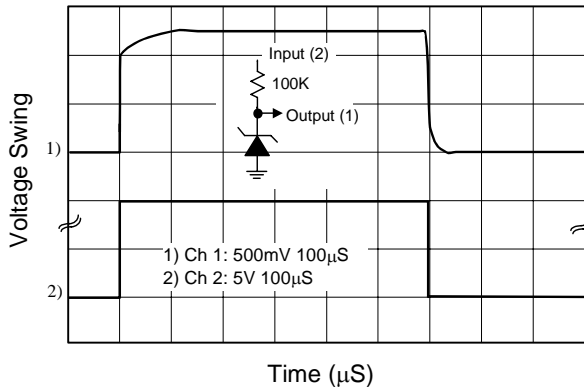
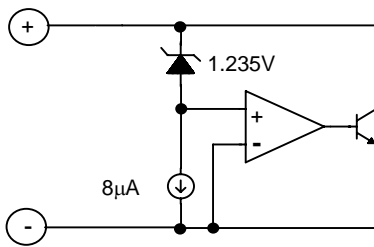


Fig. 7 Response Time

■ **BLOCK DIAGRAM**



● **SYMBOL**



■ **PIN DESCRIPTIONS**

- PIN + - sinks current with a range from 20µA to 20mA for normal applications. And a stable positive voltage, relative to Pin-, occurs on Pin+.
- PIN - - Pin- sources current for normal application. The current value is the same as Pin+.
- PIN NC - Not connected.

■ APPLICATION EXAMPLES

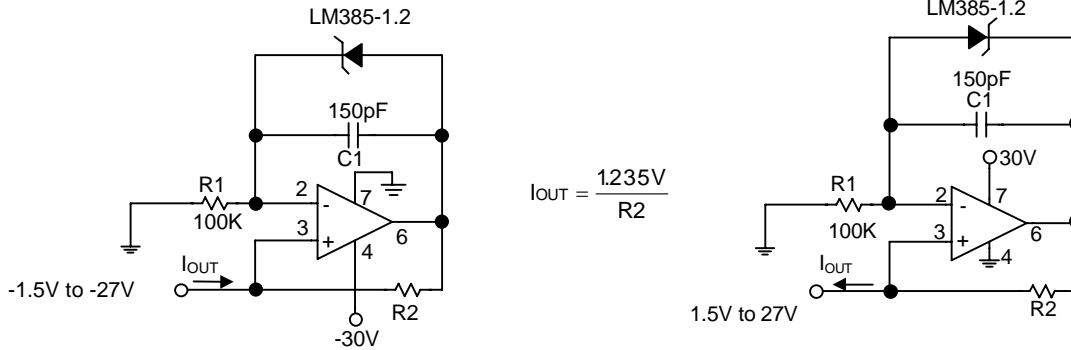


Fig. 8 Precision 1μA to 1mA Current Source

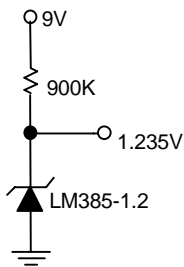


Fig. 9 Micropower Reference from 9V Battery

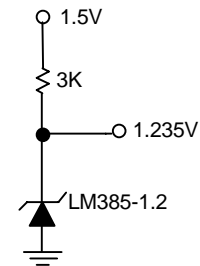


Fig. 10 Reference from 1.5V Battery

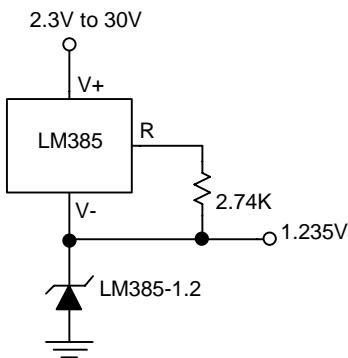
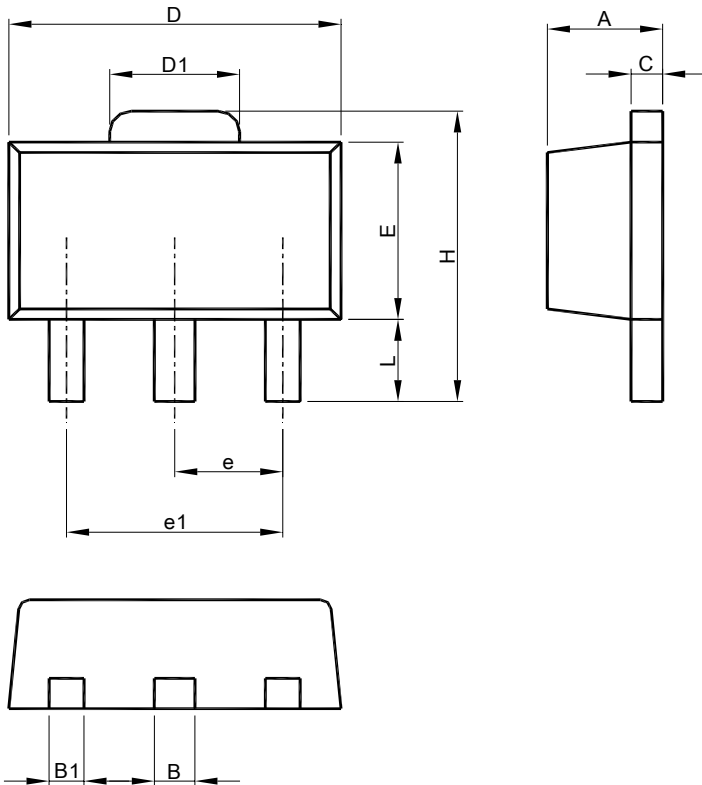


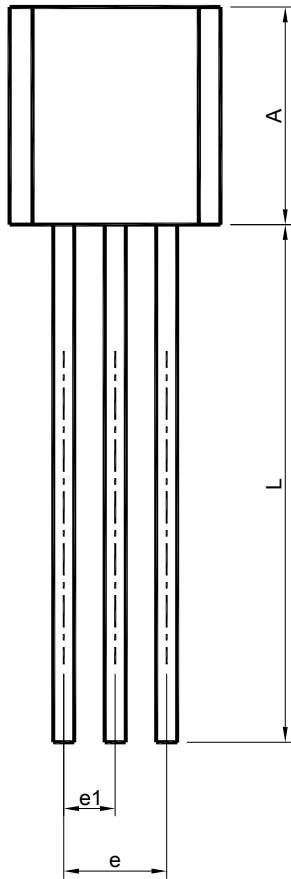
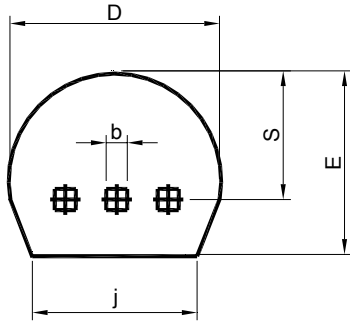
Fig. 11 Operation over a wide Supply Range

■ PHYSICAL DIMENSIONS (unit: mm)
● SOT-89


SYMBOL	SOT-89	
	MILLIMETERS	
	MIN.	MAX.
A	1.40	1.60
B	0.44	0.56
B1	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.50	1.83
E	2.29	2.60
e	1.50 BSC	
e1	3.00 BSC	
H	3.94	4.25
L	0.89	1.20

- Note: 1. Refer to JEDEC TO-243AA.
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
 3. Dimension "E" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

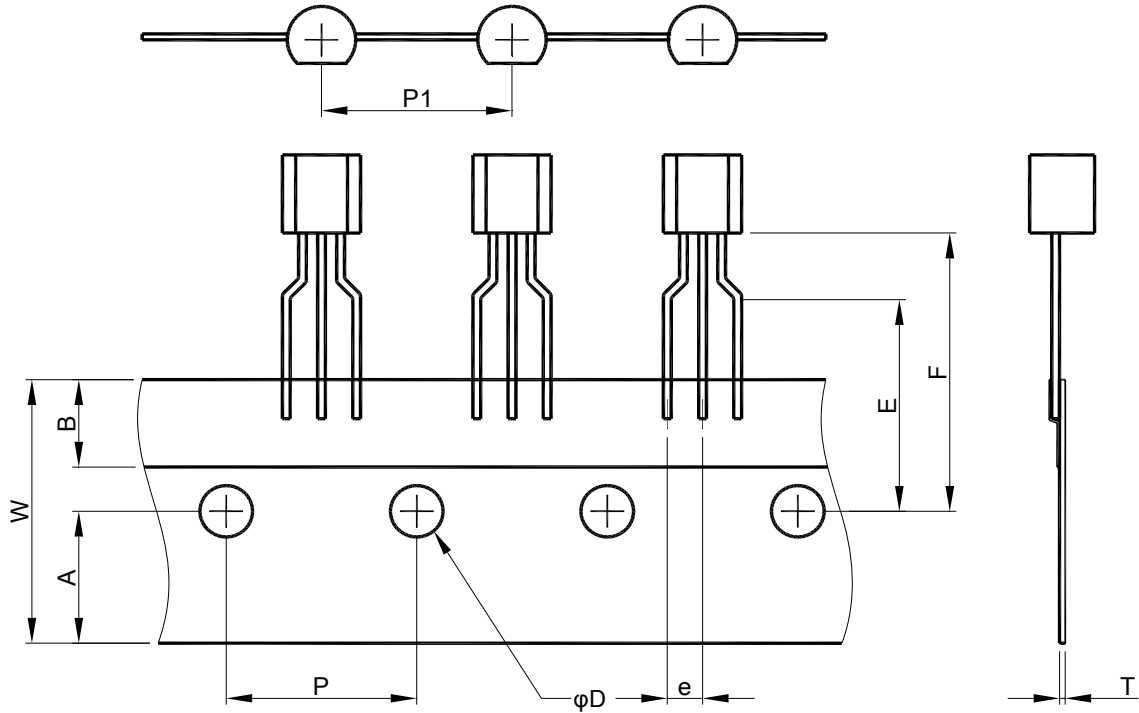
● TO-92 (BAG)



SYMBOL	TO-92	
	MILLIMETERS	
	MIN.	MAX.
A	4.32	5.33
b	0.36	0.47
D	4.45	5.20
E	3.18	4.19
e	2.42	2.66
e1	1.15	1.39
j	3.43	
L	12.70	
S	2.03	2.66

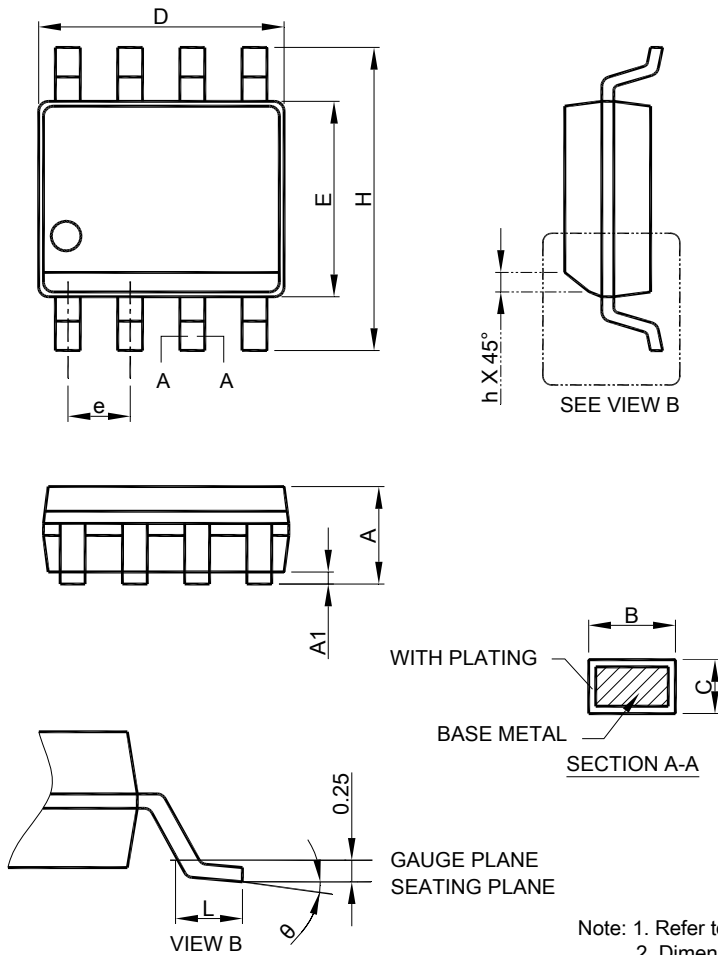
- Note: 1. Refer to JEDEC TO-226.
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
 3. Dimension "A" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

- TO-92 (Tape & Reel)



SYMBOL	W	A	B	E	F
SPEC.	18.0±0.2	9.0±0.2	6.0±0.20	16.0±0.5	19.0±0.5
SYMBOL	P	P1	D	e	T
SPEC.	12.7 BSC	12.7 BSC	4.0±0.2	2.5 BSC	0.6±0.1

● SOP-8



SYMBOL	SOP-8	
	MILLIMETERS	
	MIN.	MAX.
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
θ	0°	8°

- Note: 1. Refer to JEDEC MS-012AA.
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
 3. Dimension "E" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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