

## FEATURES

- 20 $\mu$ A to 20mA Operating Range
- Guaranteed 1% Initial Voltage Tolerance
- Guaranteed 1 $\Omega$  Dynamic Impedance
- Very Low Power Consumption


## APPLICATIONS

- Portable Meter References
- Portable Test Instruments
- Battery-Operated Systems
- Panel Meters
- Current Loop Instrumentation

## DESCRIPTION

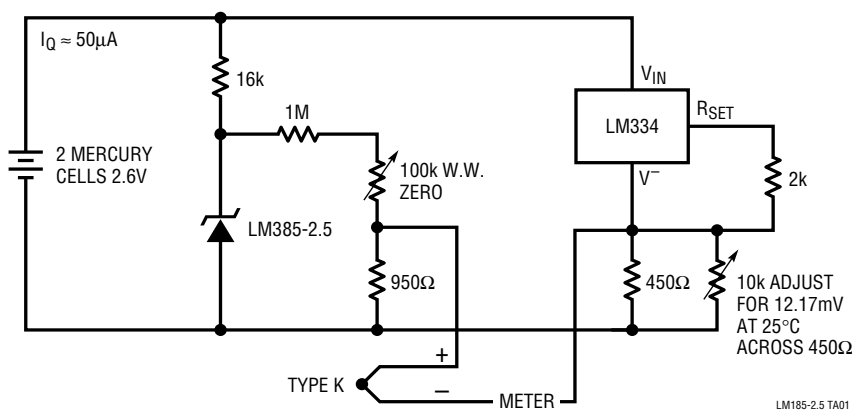
The LM185-2.5 is a two-terminal band gap reference diode that has been designed for applications which require precision performance with micropower operation. The device provides guaranteed operation specifications at currents as low as 20 $\mu$ A. The nominal voltage is 2.5V with both 1% and 2% tolerances available. Some additional features are: maximum dynamic impedance of 1 $\Omega$ , low noise and excellent stability over time and temperature. The advanced design, processing and testing techniques make Linear's LM185-2.5 a superior choice over previous designs. A circuit for cold junction compensation of a thermocouple is shown below.

For applications requiring guaranteed temperature drift, see the LT1034 data sheet.

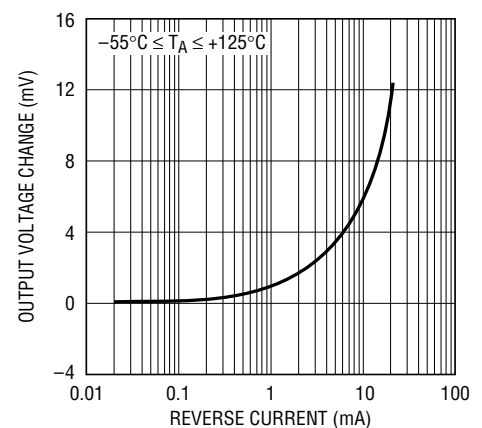
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## TYPICAL APPLICATION

Thermocouple Cold Junction Compensator



Reverse Voltage Change

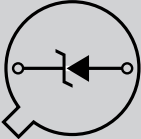
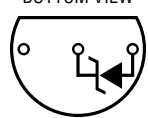
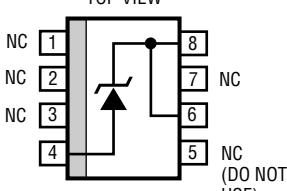


# LM185-2.5/ LM285-2.5/LM385-2.5

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Reverse Breakdown Current .....	30mA	Storage Temperature Range	
Forward Current .....	10mA	LM185-2.5 ( <b>OBSOLETE</b> ) .....	-65°C to 150°C
Operating Temperature Range		LM285-2.5 .....	-65°C to 150°C
LM185-2.5 ( <b>OBSOLETE</b> ) .....	-55°C to 125°C	LM385-2.5 .....	-65°C to 150°C
LM285-2.5 .....	-40°C to 85°C	Lead Temperature (Soldering, 10 sec.) .....	300°C
LM385-2.5 .....	0°C to 70°C		

## PACKAGE/ORDER INFORMATION

<p style="text-align: center;">BOTTOM VIEW</p>  <p style="text-align: center;">H PACKAGE 2-LEAD TO-46 METAL CAN</p> <p style="text-align: center;"><math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 440^{\circ}C/W, \theta_{JC} = 80^{\circ}C/W</math></p> <p style="text-align: center;"><b>OBSOLETE PACKAGE</b> Consider the S8 or Z Packages for Alternate Source</p>	<p style="text-align: center;">ORDER PART NUMBER</p> <p style="text-align: center;">LM185H-2.5 LM285H-2.5 LM385H-2.5 LM385BH-2.5 (NOTE 3)</p>	<p style="text-align: center;">BOTTOM VIEW</p>  <p style="text-align: center;">Z PACKAGE 3-LEAD TO-92 PLASTIC</p> <p style="text-align: center;"><math>T_{JMAX} = 100^{\circ}C, \theta_{JA} = 160^{\circ}C/W</math></p>	<p style="text-align: center;">ORDER PART NUMBER</p> <p style="text-align: center;">LM285Z-2.5 LM385Z-2.5 LM385BZ-2.5 (NOTE 3)</p>
<p style="text-align: center;">TOP VIEW</p>  <p style="text-align: center;">S8 PACKAGE 8-LEAD PLASTIC SO</p> <p style="text-align: center;"><math>T_{JMAX} = 150^{\circ}C, \theta_{JA} = 220^{\circ}C/W</math></p>		<p style="text-align: center;">ORDER PART NUMBER</p> <p style="text-align: center;">LM285S8-2.5 LM385S8-2.5 LM385BS8-2.5</p> <p style="text-align: center;">S8 PART MARKING</p> <p style="text-align: center;">2852 3852 3852B</p>	

Consult LTC Marketing for parts specified with wider operating temperature ranges.

**ELECTRICAL CHARACTERISTICS** The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ . (Note 2)

SYMBOL	PARAMETER	CONDITIONS	LM185-2.5/285-2.5			LM385-2.5/385B-2.5			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_Z$	Reverse Breakdown Voltage	$T_A = 25^\circ\text{C}$ , $20\mu\text{A} \leq I_R \leq 20\text{mA}$ LM185-2.5/285-2.5 LM385-2.5 LM385B-2.5 (Note 3)	2.462	2.500	2.538				V
						2.425	2.500	2.575	V
						2.462	2.500	2.538	V
$\frac{\Delta V_Z}{\Delta \text{Temp}}$	Average Temperature Coefficient	$20\mu\text{A} \leq I_R \leq 20\text{mA}$ (Note 3)		20			20	ppm/ $^\circ\text{C}$	
$I_{\text{MIN}}$	Minimum Operating Current	$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$	●	8	20		8	20	$\mu\text{A}$
$\frac{\Delta V_Z}{\Delta I_R}$	Reverse Breakdown Voltage Change With Current	$20\mu\text{A} \leq I_R \leq 1\text{mA}$ $T_A = 25^\circ\text{C}$ $T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$			1.0		2.0	mV	
					1.5		2.5	mV	
		$1\text{mA} \leq I_R \leq 20\text{mA}$ $T_A = 25^\circ\text{C}$ $T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$			10		20	mV	
			●		20		25	mV	
$r_Z$	Reverse Dynamic Impedance	$I_R = 100\mu\text{A}$ (Note 4) $T_A = 25^\circ\text{C}$ $T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$		0.2	0.6		0.4	1.0	$\Omega$
			●			1.5		1.5	$\Omega$
$e_n$	Wide Band Noise (RMS)	$10\text{Hz} \leq f \leq 10\text{kHz}$ , $I_R = 100\mu\text{A}$		120			120	$\mu\text{V}$	
$\frac{\Delta V_Z}{\Delta \text{Time}}$	Long Term Stability	$T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ , $I_R = 100\mu\text{A}$		20			20	ppm/kHr	

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

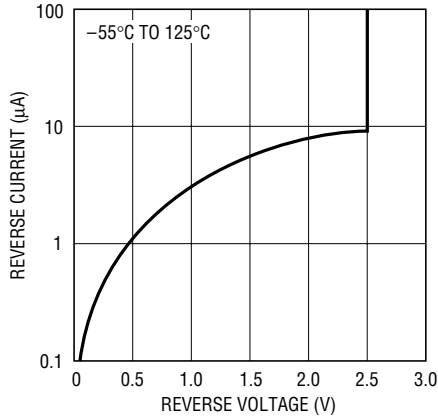
**Note 2:** All specifications are for  $T_A = 25^\circ\text{C}$  unless otherwise noted. For the LM185-2.5  $T_{\text{MIN}} = -55^\circ\text{C}$  and  $T_{\text{MAX}} = 125^\circ\text{C}$ . For LM285-2.5,  $T_{\text{MIN}} = -40^\circ\text{C}$  and  $T_{\text{MAX}} = 85^\circ\text{C}$ . For LM385-2.5,  $T_{\text{MIN}} = 0^\circ\text{C}$  and  $T_{\text{MAX}} = 70^\circ\text{C}$ .

**Note 3:** For very low initial tolerance, consult LT1004 data sheet. The LT1004 is a low cost, pin for pin substitution device. For guaranteed temperature coefficient consult the LT1034-2.5 data sheet.

**Note 4:** Guaranteed but not tested.

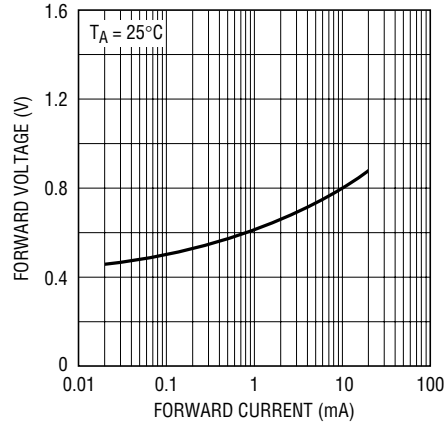
# TYPICAL PERFORMANCE CHARACTERISTICS

**Reverse Characteristics**



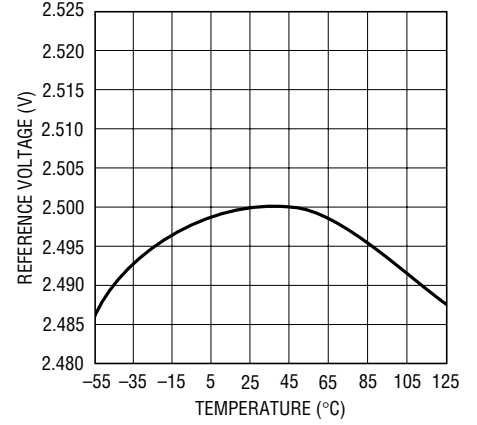
LM185-2.5 • TPC01

**Forward Characteristics**



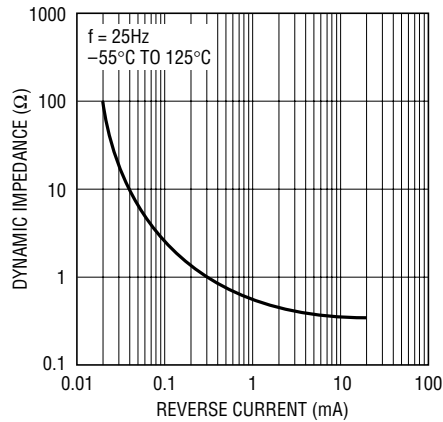
LM185-2.5 • TPC02

**Temperature Drift**



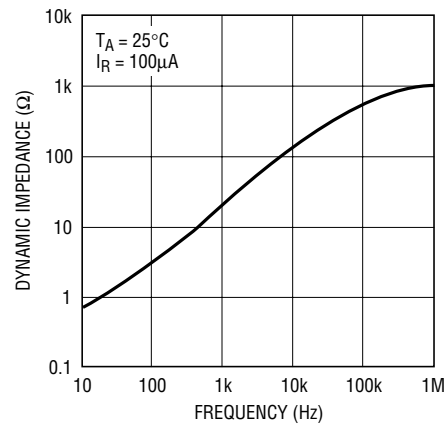
LM185-2.5 • TPC03

**Reverse Dynamic Impedance**



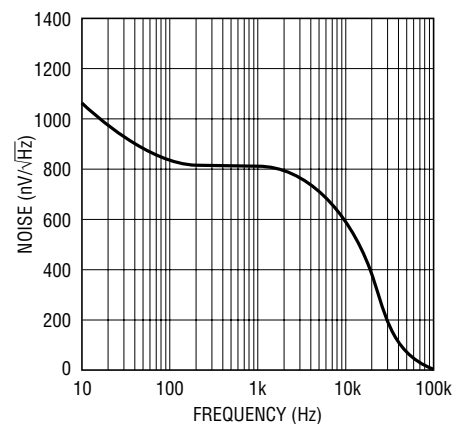
LM185-2.5 • TPC05

**Reverse Dynamic Impedance**



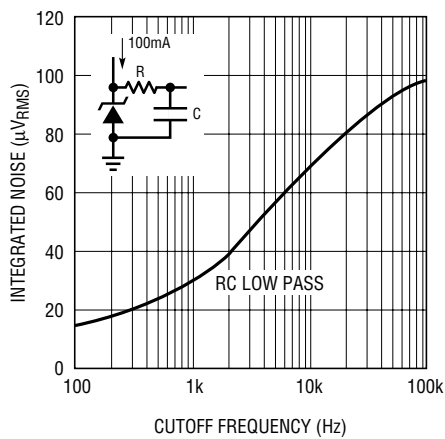
LM185-2.5 • TPC05

**Noise Voltage**



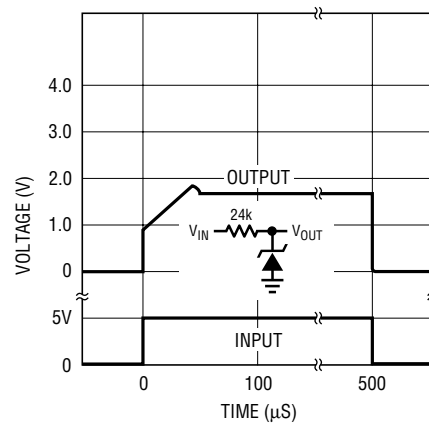
LM185-2.5M • TPC06

**Filtered Output Noise**



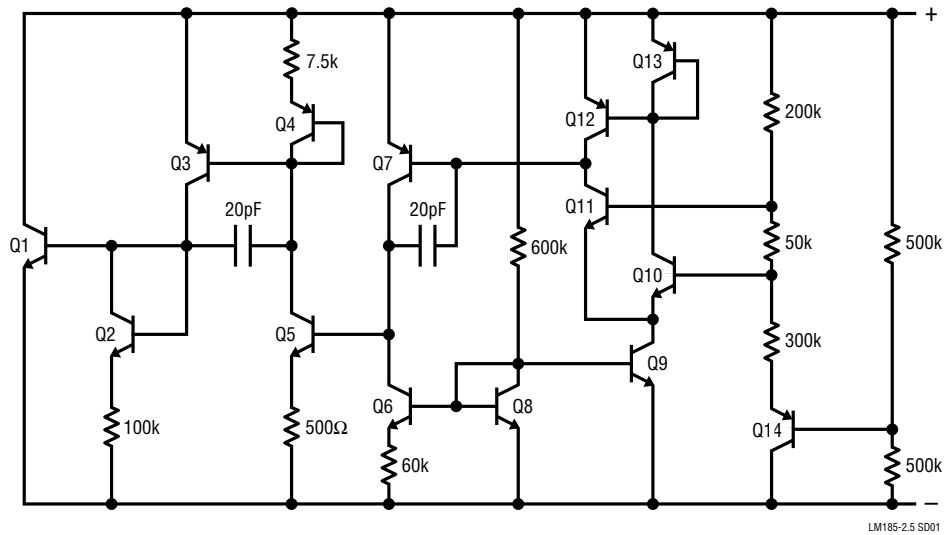
LM185-2.5 • TPC07

**Response Time**



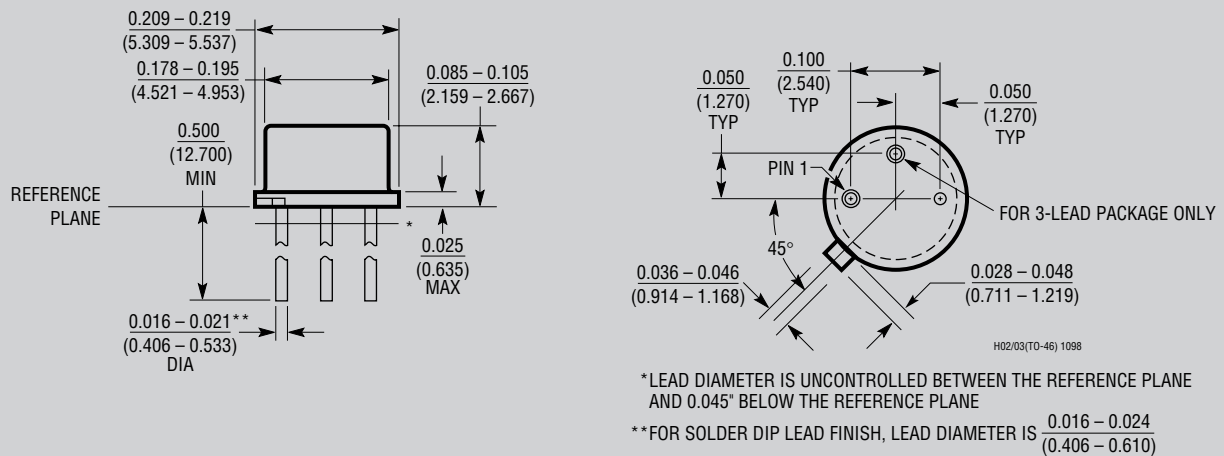
LM185-2.5 • TPC08

## SCHEMATIC DIAGRAM



## PACKAGE DESCRIPTION

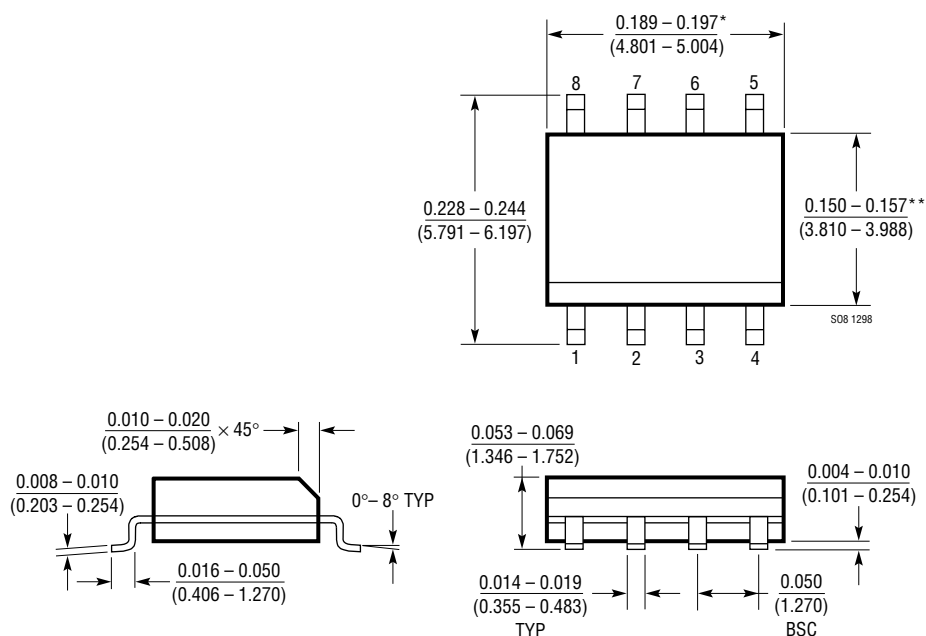
### H Package 2-Lead and 3-Lead TO-46 Metal Can (Reference LTC DWG # 05-08-1340)



**OBSOLETE PACKAGE**

## PACKAGE DESCRIPTION

**S8 Package**  
**8-Lead Plastic Small Outline (Narrow .150 Inch)**  
(Reference LTC DWG # 05-08-1610)

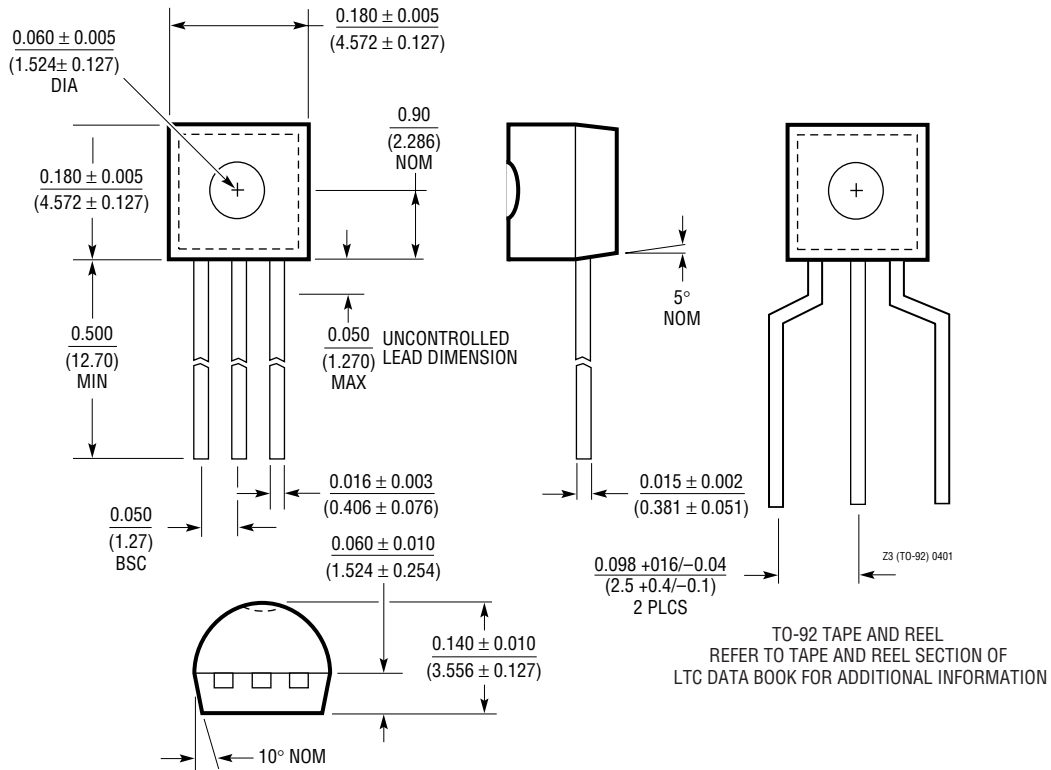


\*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

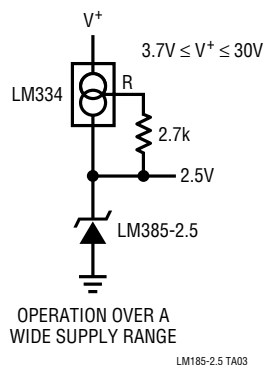
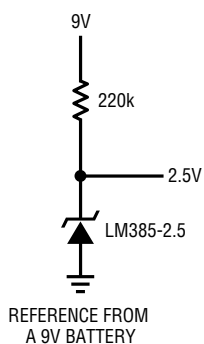
\*\*DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

## PACKAGE DESCRIPTION

**Z Package**  
**3-Lead Plastic TO-92 (Similar to TO-226)**  
(Reference LTC DWG # 05-08-1410)



## TYPICAL APPLICATIONS



## RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1634	Micropower Shunt Voltage Reference	0.05% Initial Accuracy, 10ppm/°C Maximum Tempco Output Voltage: 1.25V, 2.5V, 4.096V and 5V