



# TEB1033 TEF1033-TEC1033

## PRECISION DUAL OPERATIONAL AMPLIFIERS

- VERY LOW INPUT OFFSET VOLTAGE : 1mV max.
- LOW DISTORTION RATIO
- LOW NOISE
- VERY LOW SUPPLY CURRENT
- LOW INPUT OFFSET CURRENT
- LARGE COMMON-MODE RANGE
- HIGH OUTPUT CURRENT
- GAIN-BANDWIDTH PRODUCT : 2MHz
- TEMPERATURE DRIFT :  $2\mu\text{V}/^\circ\text{C}$
- LONG TERM STABILITY :  $8\mu\text{V}/\text{YEAR}$  (for  $T_{\text{amb}} \leq 50^\circ\text{C}$ )
- SHORT CIRCUIT PROTECTION

### DESCRIPTION

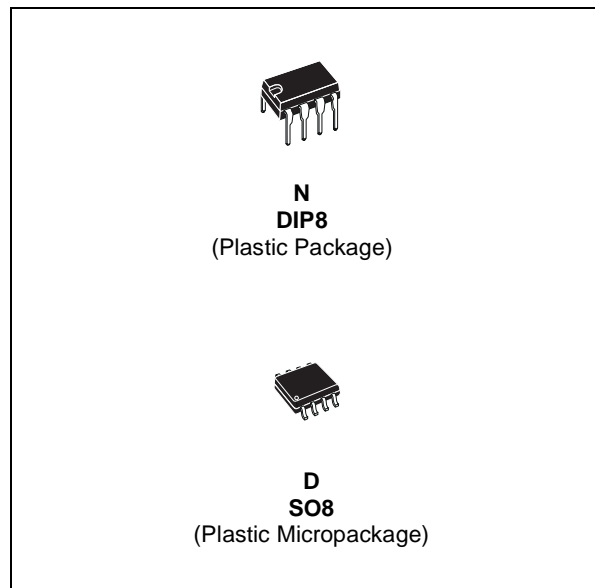
The TEB1033, TEF1033 and TEC1033 are high performance dual operational amplifiers intended for active filter applications. The internal phase compensation allows stable operation as voltage follower in spite of their high gain-bandwidth product.

The circuit presents very stable electrical characteristics over the entire supply voltage range.

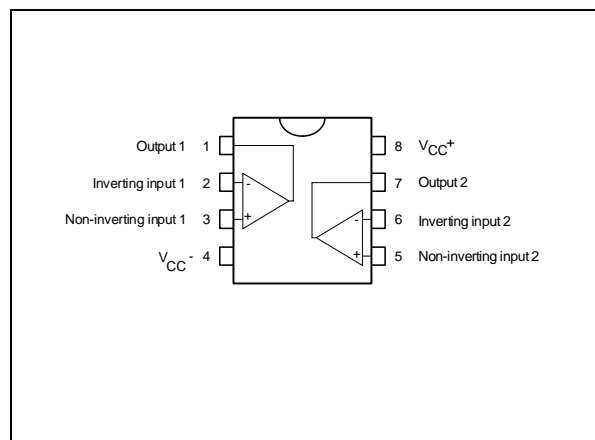
### ORDER CODE

Part Number	Temperature Range	Package	
		N	D
TEB1033	0°C, +70°C	•	•
TEF1033	-40°C, +105°C	•	•
TEC1033	-55°C, +125°C	•	•
<b>Example : TEB1033N</b>			

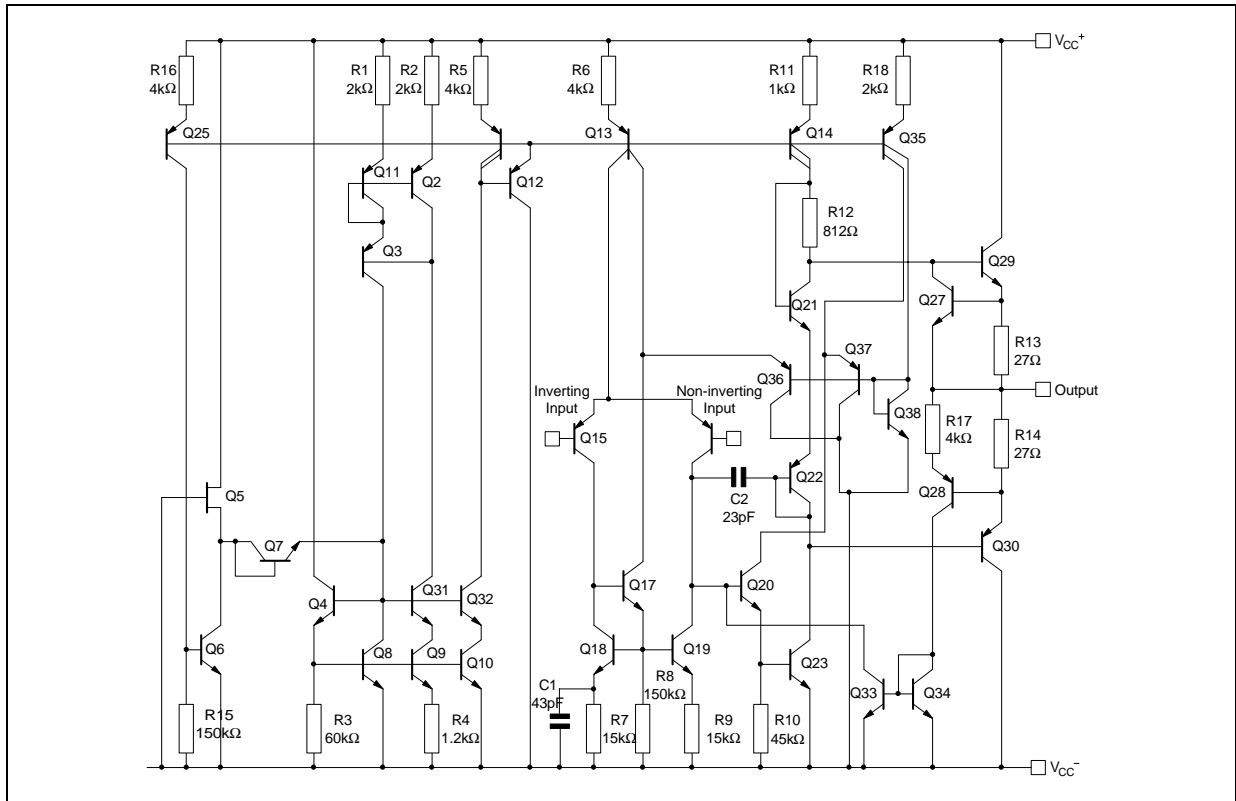
**N** = Dual in Line Package (DIP)  
**D** = Small Outline Package (SO) - also available in Tape & Reel (DT)



### PIN CONNECTIONS (top view)



SCHMATIC DIAGRAM (1/2 TEB1033)



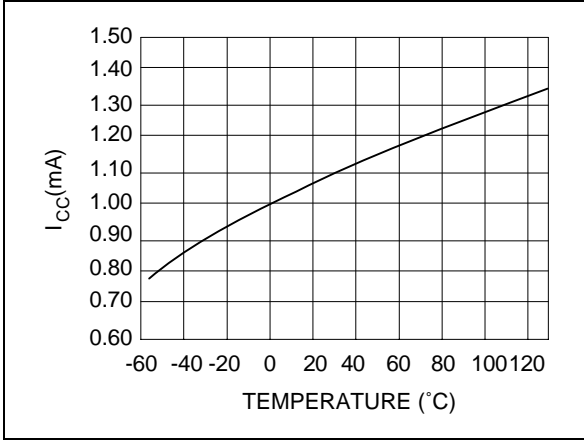
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage	$\pm 18$	V	
$V_{id}$	Differential Input Voltage	$\pm (V_{CC} - 1)$	V	
$V_i$	Input Voltage	$\pm V_{CC}$	V	
$P_{tot}$	Power Dissipation	D suffix N suffix	400 665	mW
$T_{oper}$	Operating Free-Air Temperature Range	TEB1033 TEF1033 TEC1033	0 to +70 -40 to 105 -55 to +125	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature		-65 to +150	$^{\circ}\text{C}$

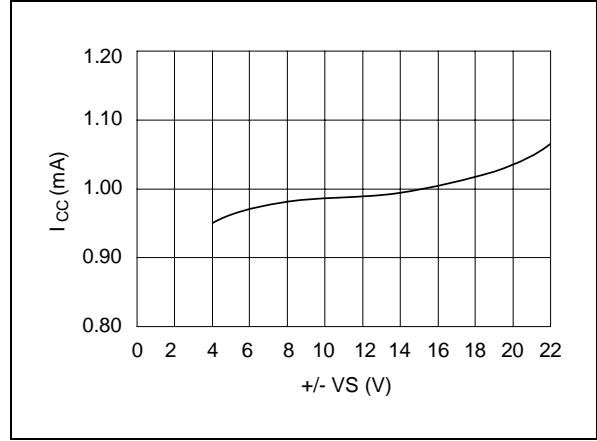
**ELECTRICAL CHARACTERISTICS** $V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input Offset Voltage ( $R_s \leq 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .		0.3	1 3	mV
$DV_{io}$	Input Offset Voltage Drift		2		$\mu V/^{\circ}C$
$I_{io}$	Input Offset Current $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .		5	20 40	nA
$I_{ib}$	Input Bias Current $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .		50	100 200	nA
$A_{vd}$	Large Signal Voltage Gain ( $R_L = 2k\Omega$ , $V_o = \pm 10V$ ) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .	80 40	120		V/mV
SVR	Supply Voltage Rejection Ratio ( $DV_{CC}$ from $\pm 15V$ to $\pm 4V$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .	80 70	100		dB
$I_{CC}$	Supply Current, all amplifiers, no load $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .		1	1.5 2	mA
$V_{icm}$	Input Common Mode Voltage Range $T_{amb} = 25^{\circ}C$	$\pm 12$			V
CMR	Common-mode Rejection Ratio ( $R_s \leq 10k\Omega$ , $V_i = \pm 10V$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .	80 70	100		dB
$I_{os}$	Output Short Circuit Current $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ .	10 10	23	40 40	mA
$\pm V_{opp}$	Output Voltage Swing $T_{amb} = 25^{\circ}C$ $R_L = 2k\Omega$ $T_{min} \leq T_{amb} \leq T_{max}$ $R_L = 2k\Omega$ $V_{CC} = \pm 4V$ , $R_L = 2k\Omega$ , $T_{amb} = 25^{\circ}C$ $V_{CC} = \pm 6V$ , $R_L = 600\Omega$ , $T_{amb} = 25^{\circ}C$	13 12 2.8 4.6	14 3		V
SR	Slew Rate ( $V_i = \pm 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain)	0.6	1		$V/\mu s$
GBP	Gain Bandwidth Product ( $f = 100kHz$ , $T_{amb} = 25^{\circ}C$ ? $V_{in} = 10mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ )	1.5	2		MHz
$R_i$	Input Resistance		1		$M\Omega$
THD	Total Harmonic Distortion ( $f = 1kHz$ , $A_v = 20dB$ , $R_L = 2k\Omega$ , $V_o = 2V_{pp}$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ )		0.008		%
$e_n$	Equivalent Input Noise Voltage ( $f = 1kHz$ ) $R_S = 50\Omega$ $R_S = 1k\Omega$ $R_S = 10k\Omega$		8 10 18		$\frac{nV}{\sqrt{Hz}}$
$V_{opp}$	Large Signal Voltage Swing $R_L = 10k\Omega$ , $f = 10kHz$	26	28		V
$\phi_m$	Phase Margin		45		Degrees
$V_{O1}/V_{O2}$	Channel Separation		120		dB

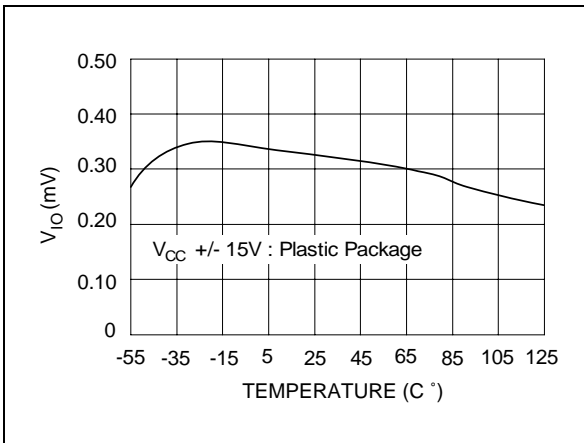
**SUPPLY CURRENT vs AMBIENT TEMPERATURE**



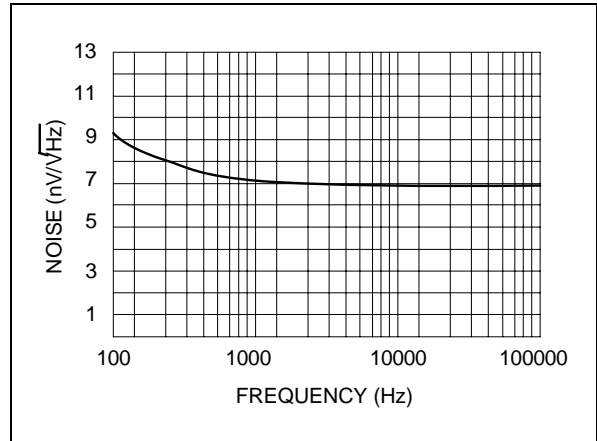
**SUPPLY CURRENT vs SUPPLY VOLTAGE**



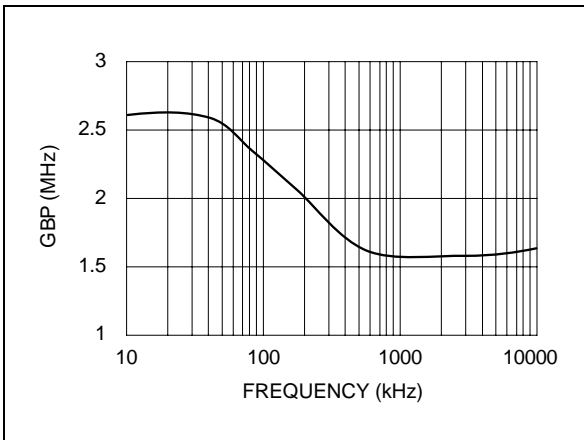
**OFFSET VOLTAGE vs AMBIENT TEMPERATURE**



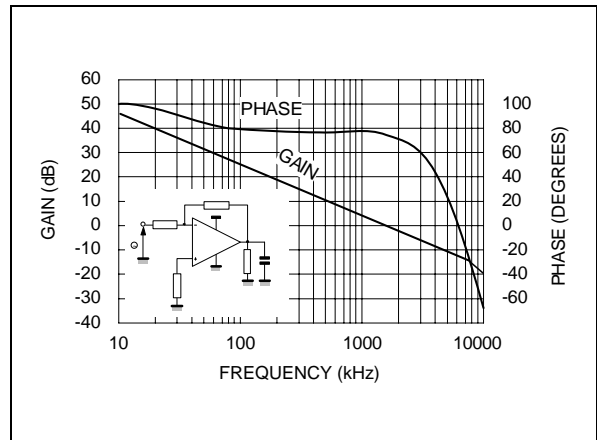
**TOTAL INPUT NOISE vs FREQUENCY**



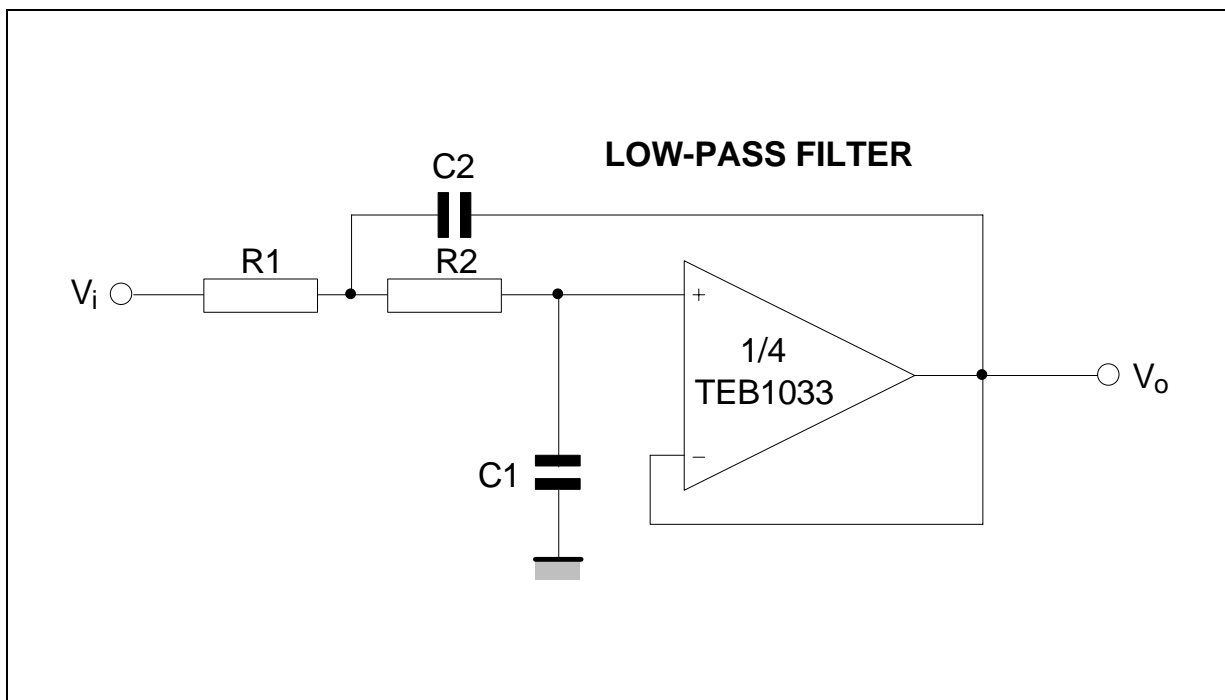
**GAIN BANDWIDTH PRODUCT vs FREQUENCY**



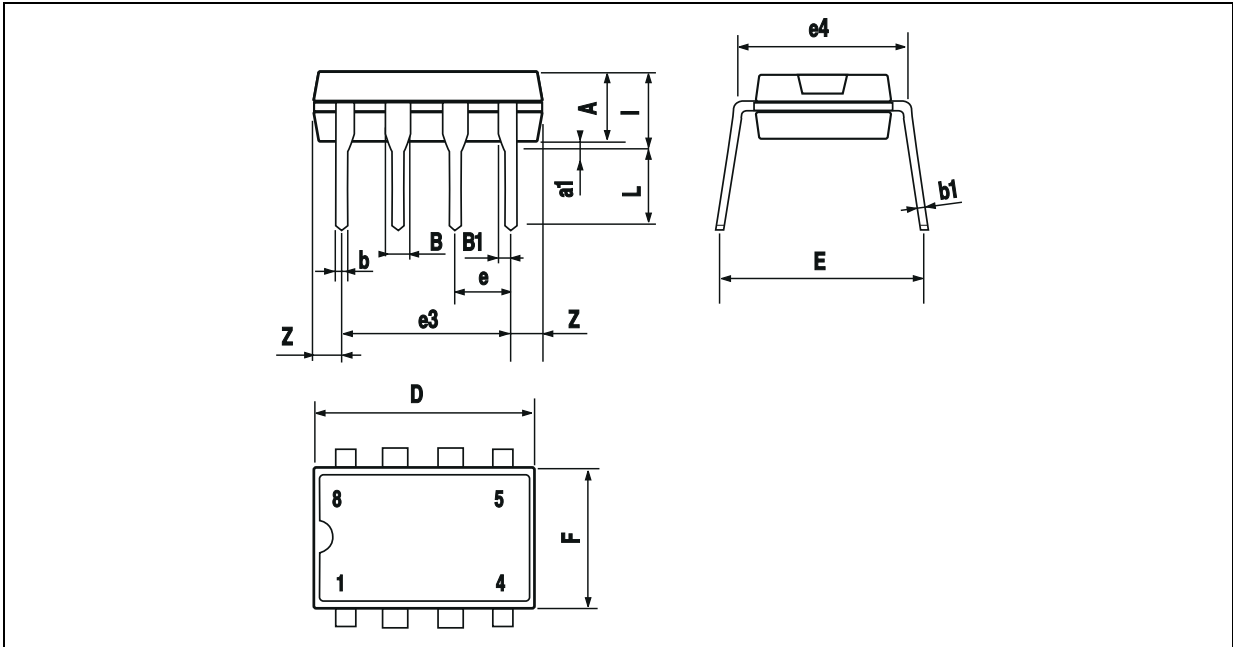
**OPEN LOOP FREQUENCY & PHASE RESPONSE**



## TYPICAL APPLICATION

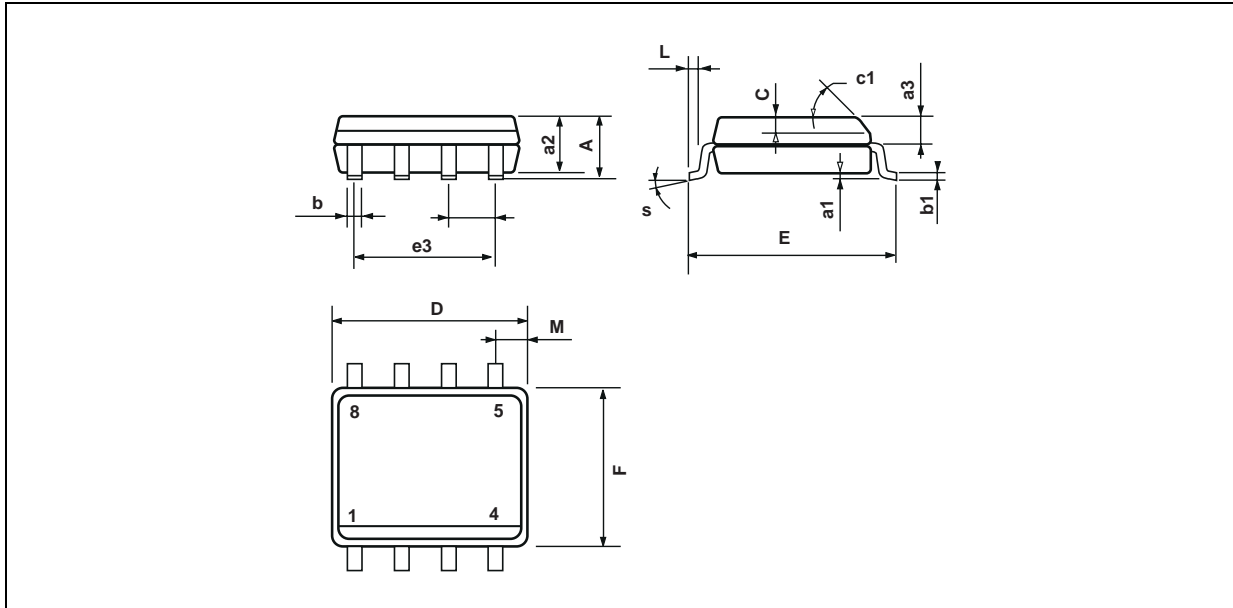


**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC MICROPACKAGE (SO)



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

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