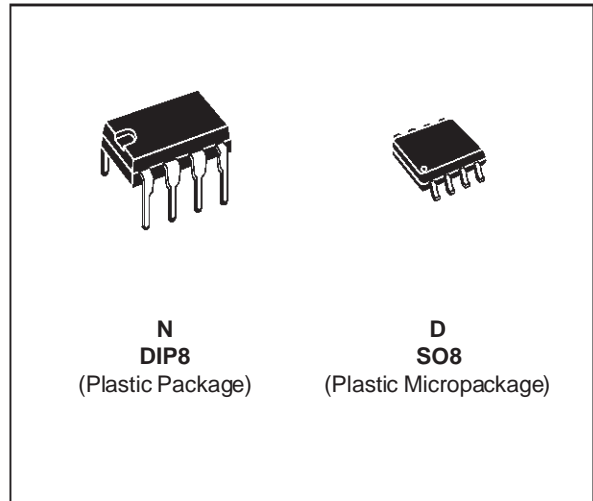




# TEB1033 TEF1033-TEC1033

## 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  $T_{\text{amb}} \leq 50^\circ\text{C}$ )



### DESCRIPTION

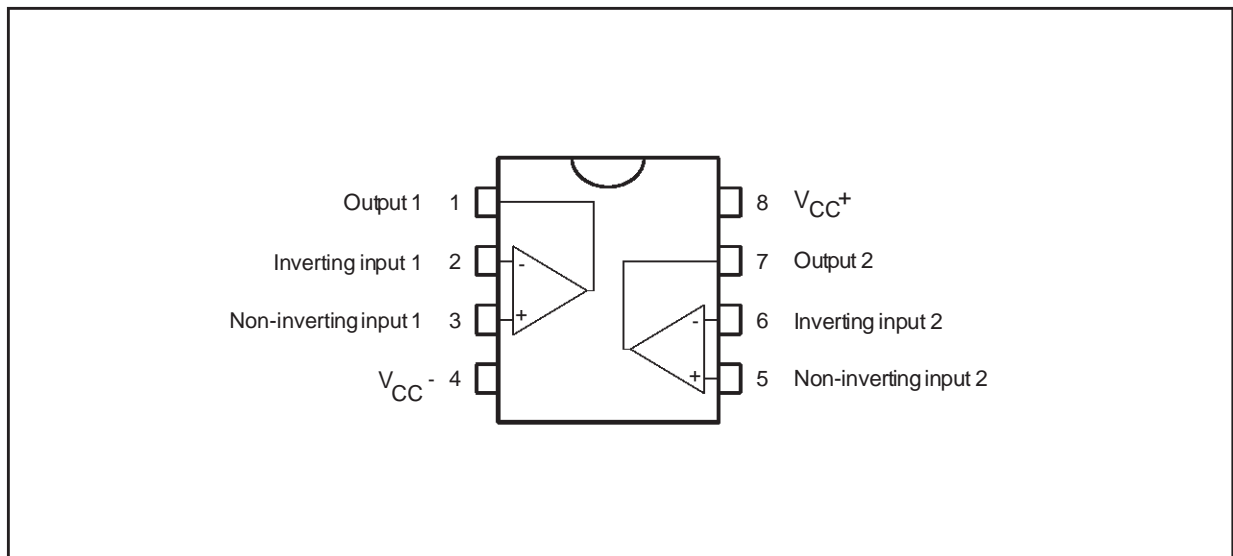
The TEB1033, TEF1033 and TEC1033 are high performance dual-operational amplifiers intended for active filter applications. The internal phase compensation allows stable operation as voltage follower in spite of their high gain-bandwidth product. The circuits present very stable electrical characteristics over the entire supply voltage range.

### ORDER CODES

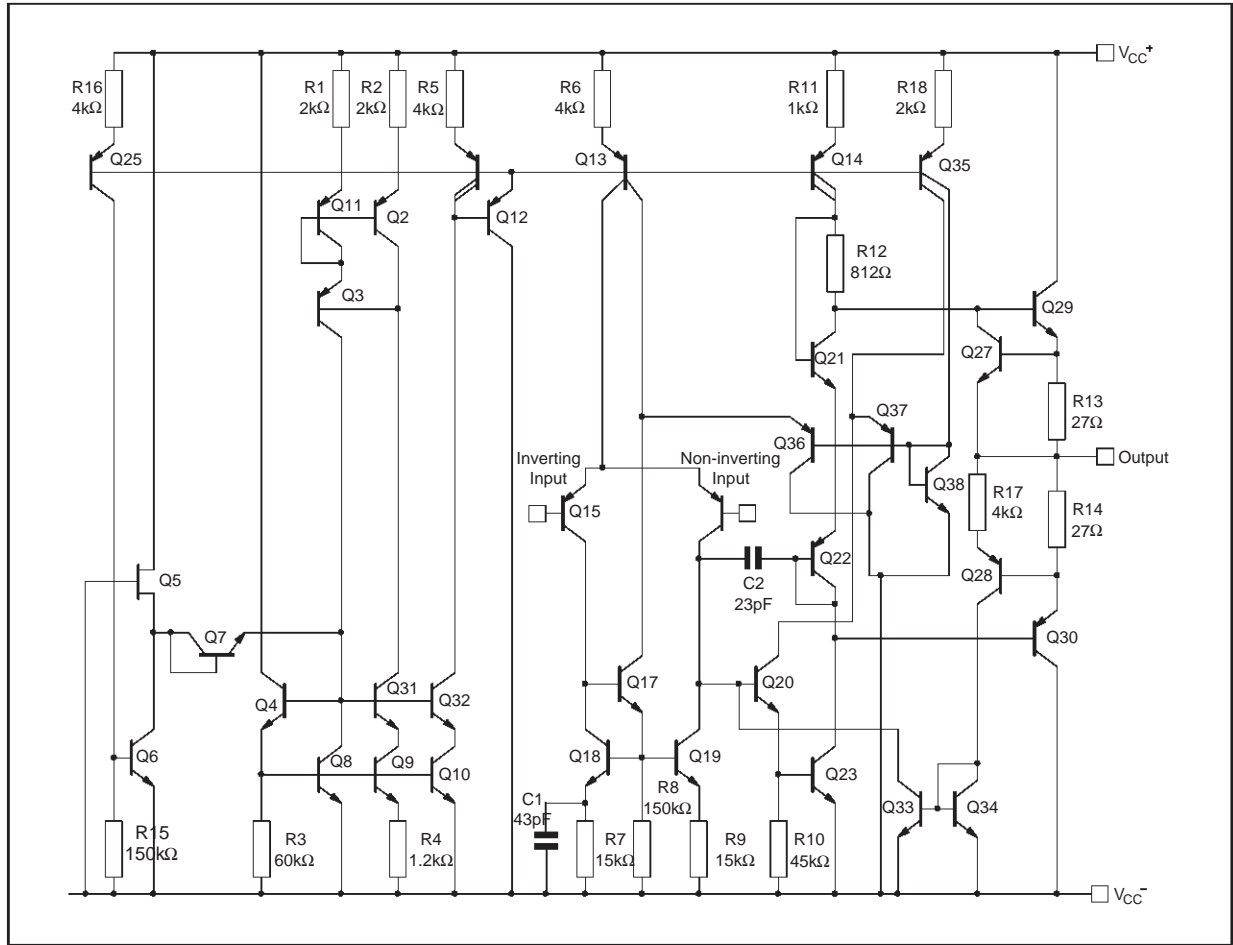
Part Number	Temperature Range	Package	
		N	D
TEB1033	0°C, +70°C	•	•
TEF1033	-40°C, +105°C	•	•
TEC1033	-55°C, +125°C	•	•

**Example :** TEB1033N

### PIN CONNECTIONS (top view)



BLOCK DIAGRAM (1/4 TEB1033)



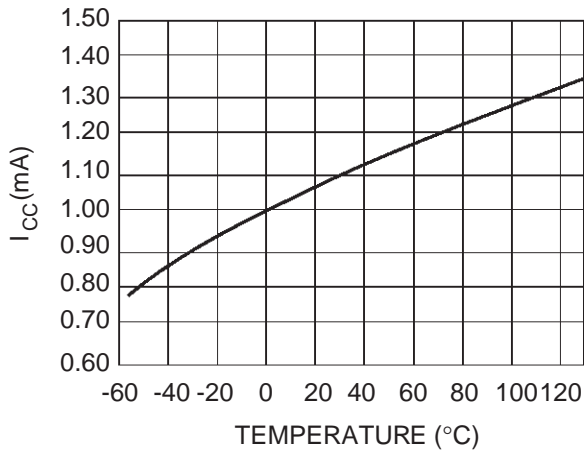
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
V <sub>cc</sub>	Supply Voltage	± 18	V	
V <sub>i</sub>	Input Voltage	± V <sub>cc</sub>	V	
V <sub>id</sub>	Differential Input Voltage	± (V <sub>cc</sub> - 1)	V	
P <sub>tot</sub>	Power Dissipation	D suffix N suffix	400 665	mW
T <sub>oper</sub>	Operating Free-air Temperature Range	TEB1033 TEF1033 TEC1033	0 to +70 -40 to +105 -55 to +125	°C
T <sub>stg</sub>	Storage Temperature Range		-65 to +150	°C

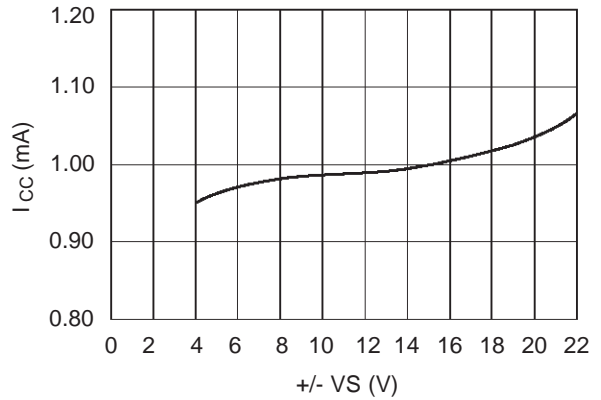
**ELECTRICAL CHARACTERISTICS**V<sub>CC</sub> = ±15V, T<sub>amb</sub> = +25°C (unless otherwise specified)

Symbol	Parameter	TEB 1033 TEF 1033 TEC 1033			Unit
		Min.	Typ.	Max.	
V <sub>io</sub>	Input Offset Voltage (R <sub>S</sub> ≤ 10kΩ) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		0.3	1 3	mV
DV <sub>io</sub>	Input Offset Voltage Drift		2		μV/°C
I <sub>io</sub>	Input Offset Current T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		5	20 40	nA
I <sub>ib</sub>	Input Bias Current T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		50	100 200	nA
A <sub>vd</sub>	Large Signal Voltage Gain (R <sub>L</sub> = 2kΩ, V <sub>O</sub> = ±10V) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 40	120		V/mV
SVR	Supply Voltage Rejection Ratio (DV <sub>CC</sub> from ±15V to ±4V) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 70	100		dB
I <sub>CC</sub>	Supply Current, all Amp, no Load T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		1	1.5 2	mA
V <sub>icm</sub>	Input Common Mode Voltage Range T <sub>amb</sub> = 25°C	±12			V
CMR	Common Mode Rejection Ratio (R <sub>S</sub> ≤ 10kΩ, V <sub>I</sub> = ±10V) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 70	100		dB
I <sub>os</sub>	Output Short-circuit Current T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	10 10	23	40 40	mA
± V <sub>opp</sub>	Output Voltage Swing T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub> V <sub>CC</sub> = ±4V, R <sub>L</sub> = 2kΩ, T <sub>amb</sub> = 25°C V <sub>CC</sub> = ±6V, R <sub>L</sub> = 600Ω, T <sub>amb</sub> = 25°C		R <sub>L</sub> = 2kΩ 13 12 3 4.6	R <sub>L</sub> = 2kΩ 14 3	V
SR	Slew-rate (V <sub>I</sub> = ±10V, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)	0.6	1		V/μs
GBP	Gain Bandwidth Product (f = 100kHz, T <sub>amb</sub> = 25°C, V <sub>in</sub> = 10mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF)	1.5	2		MHz
R <sub>i</sub>	Input Resistance		1		MΩ
THD	Total Harmonic Distortion (f = 1kHz, A <sub>v</sub> = 20dB, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, V <sub>o</sub> = 2V <sub>pp</sub> )		0.008	0.05	%
e <sub>n</sub>	Equivalent Input Noise Voltage (f = 1kHz) R <sub>S</sub> = 50Ω R <sub>S</sub> = 1kΩ R <sub>S</sub> = 10kΩ		8 10 18	15	$\frac{nV}{\sqrt{Hz}}$
V <sub>OPP</sub>	Large Signal Voltage Swing R <sub>L</sub> = 10kΩ, f = 10kHz	26	28		V
∅ <sub>m</sub>	Phase Margin		45		Degrees
V <sub>o1</sub> /V <sub>o2</sub>	Channel Separation	100	120		dB

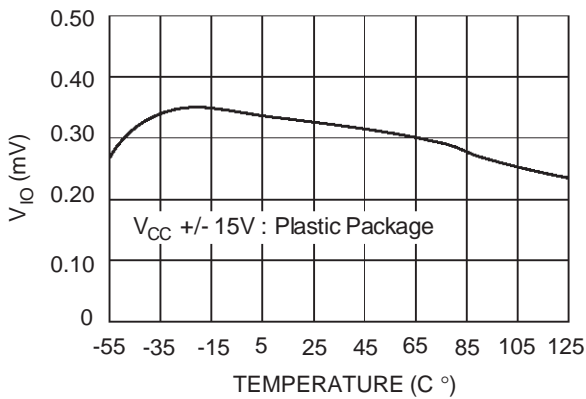
**SUPPLY CURRENT VERSUS AMBIENT TEMPERATURE**



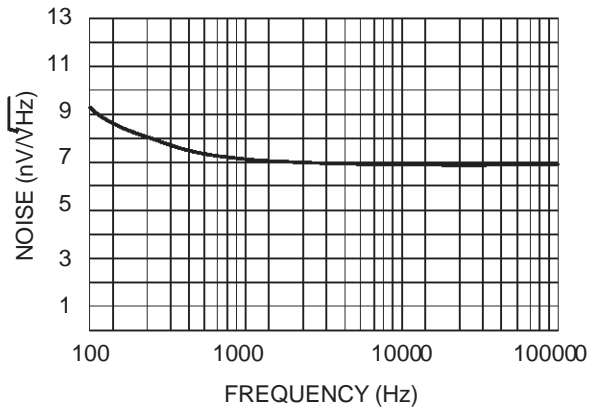
**SUPPLY CURRENT VERSUS SUPPLY VOLTAGE**



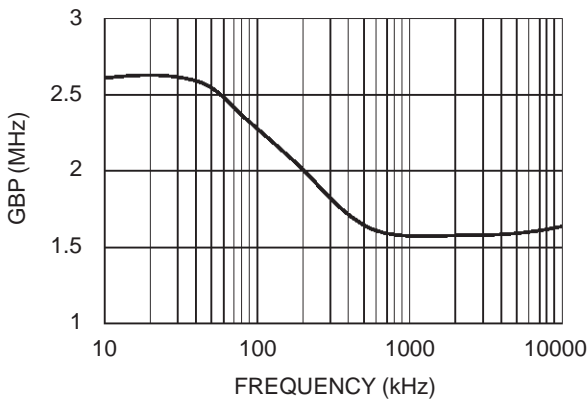
**OFFSET VOLTAGE VERSUS AMBIENT TEMPERATURE**



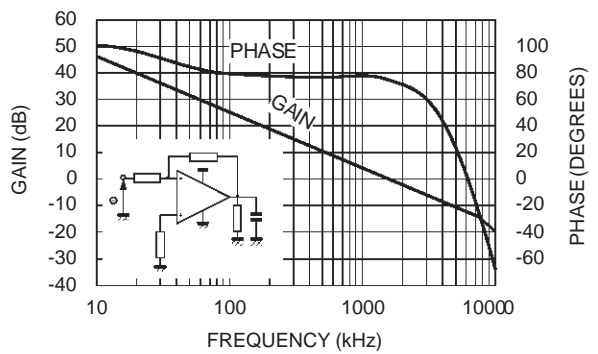
**TOTAL INPUT NOISE VERSUS FREQUENCY**



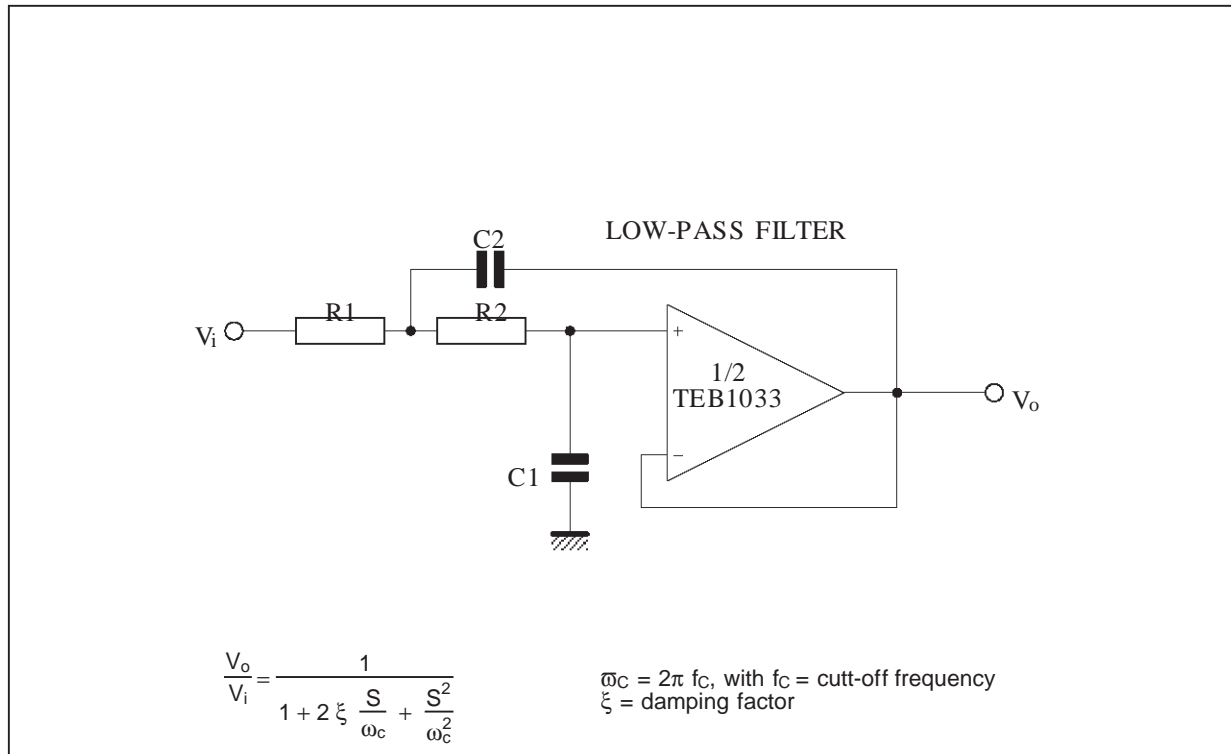
**GAIN BANDWIDTH PRODUCT VERSUS FREQUENCY**



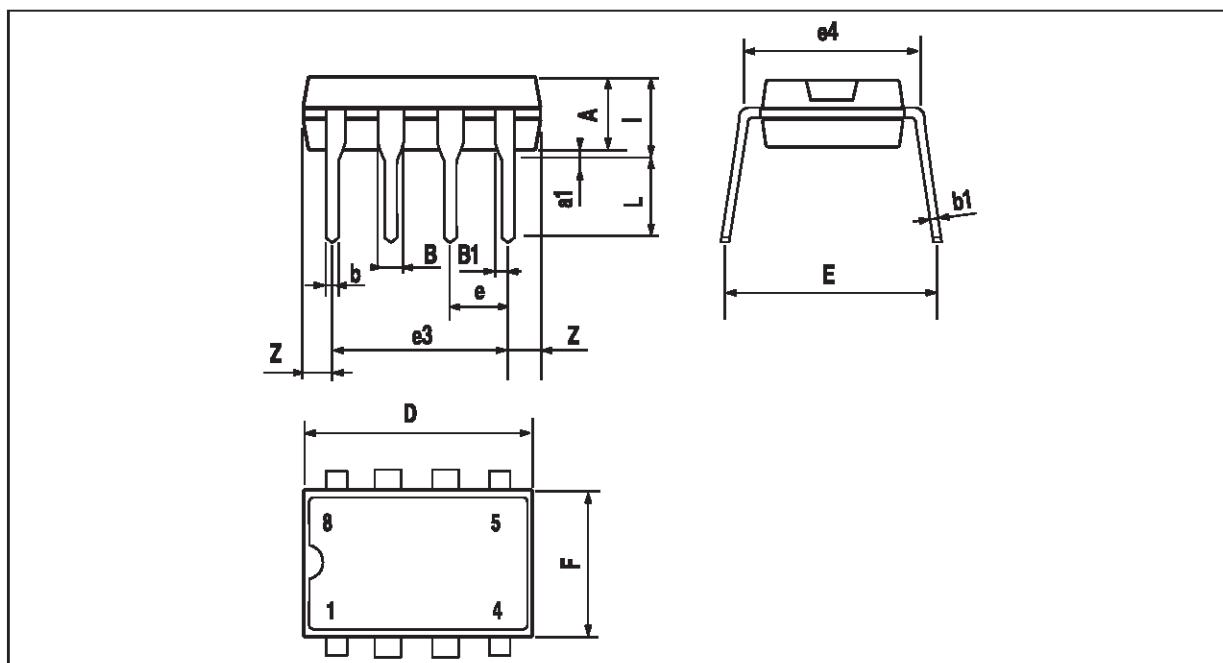
**DODE PLOT**



## TYPICAL APPLICATION

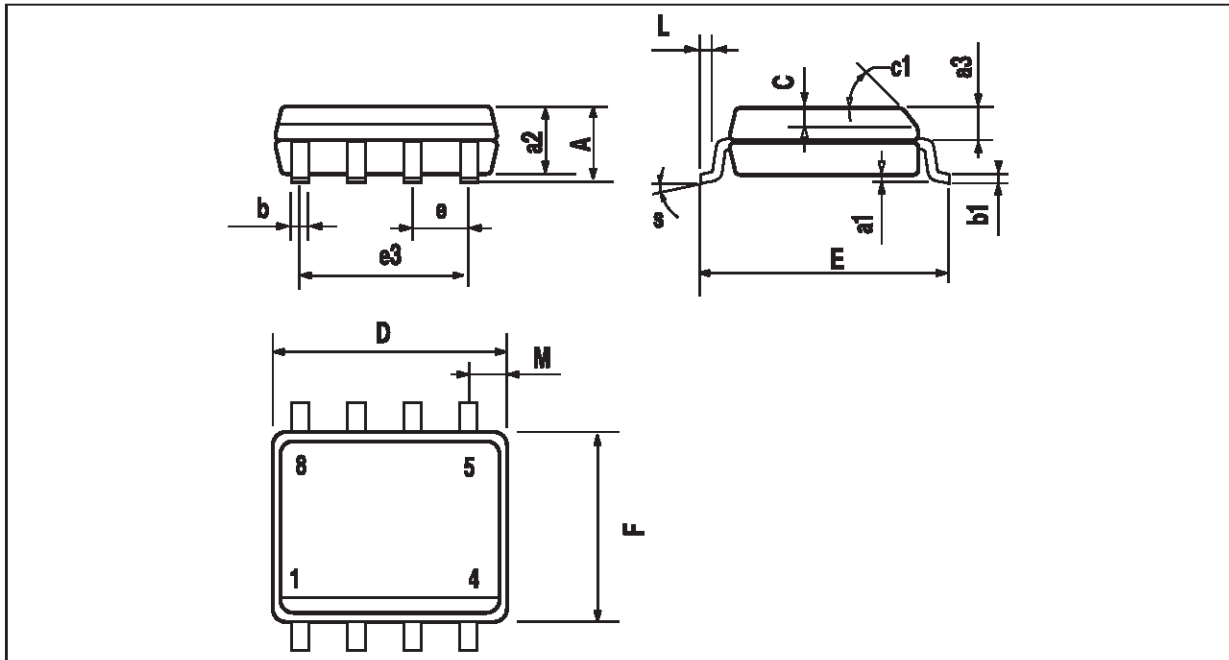


**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP



Dim.	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)



Dim.	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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