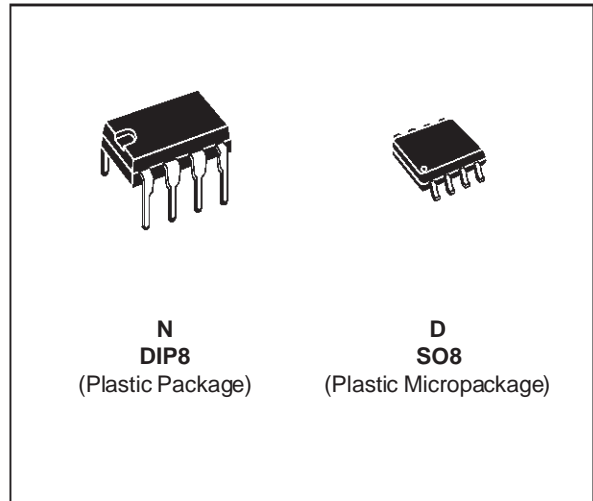




# TEB1033 TEF1033-TEC1033

## 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

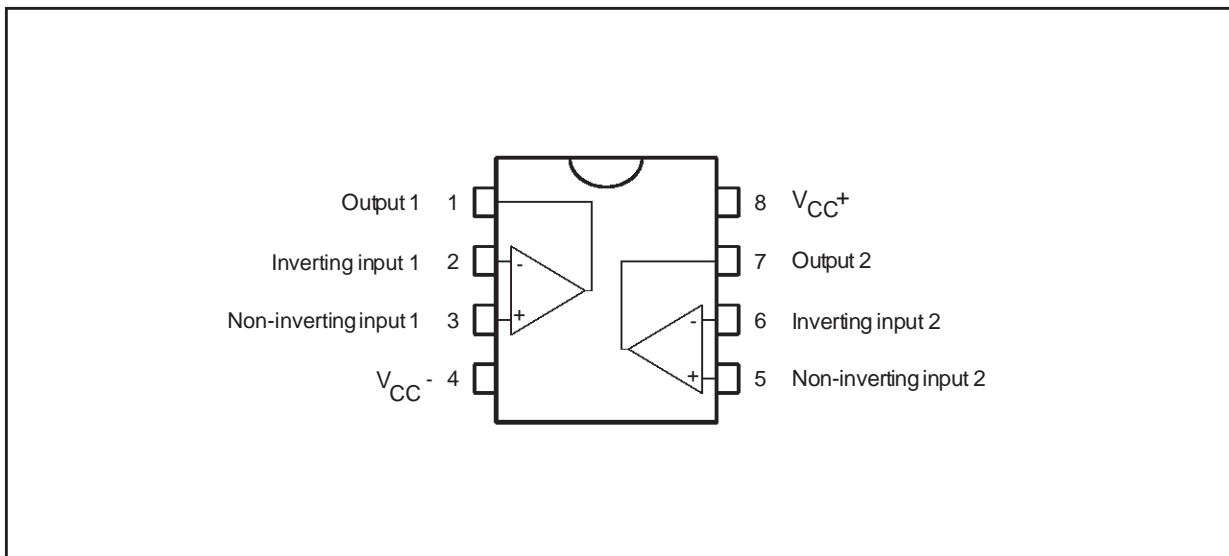
The TEB1033, TEF1033 and TEC1033 are high performance dual-operational amplifiers intended for active filter applications. The internal phase compensation allows stable operation as voltage follower in spite of their high gain-bandwidth product. The circuits present very stable electrical characteristics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

### ORDER CODES

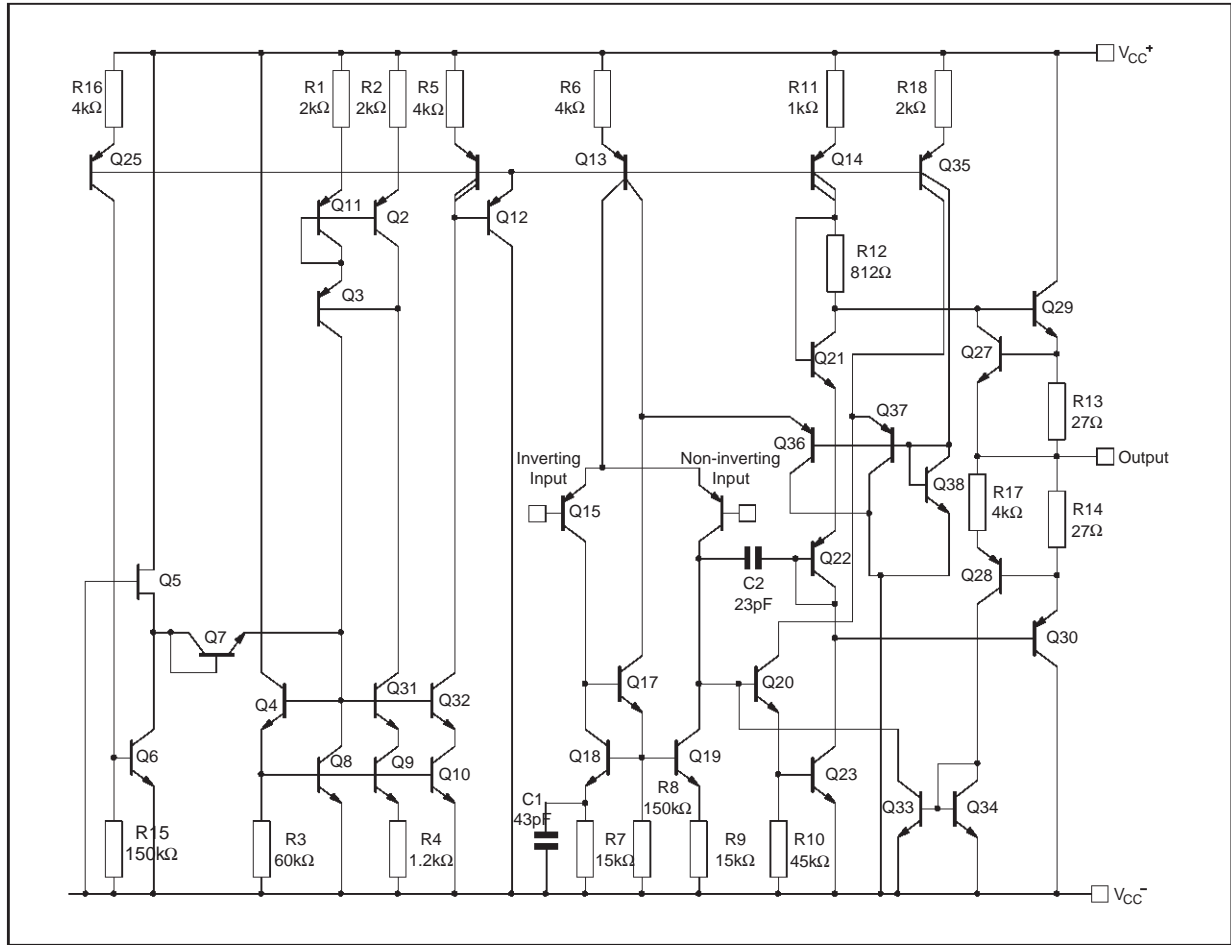
Part Number	Temperature Range	Package	
		N	D
TEB1033	0°C, +70°C	•	•
TEF1033	-40°C, +105°C	•	•
TEC1033	-55°C, +125°C	•	•

**Example :** TEB1033N

### PIN CONNECTIONS (top view)



BLOCK DIAGRAM (1/4 TEB1033)



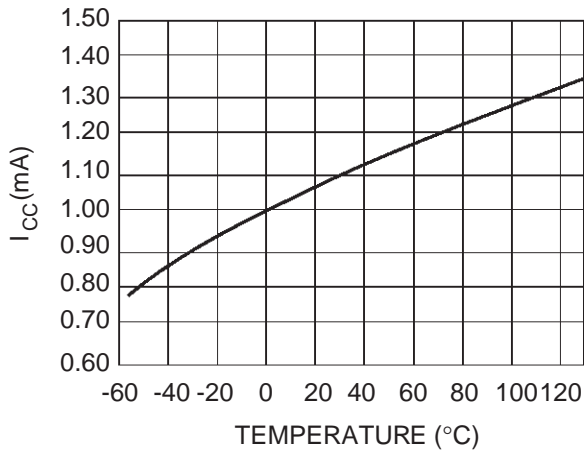
ABSOLUTE MAXIMUM RATINGS

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

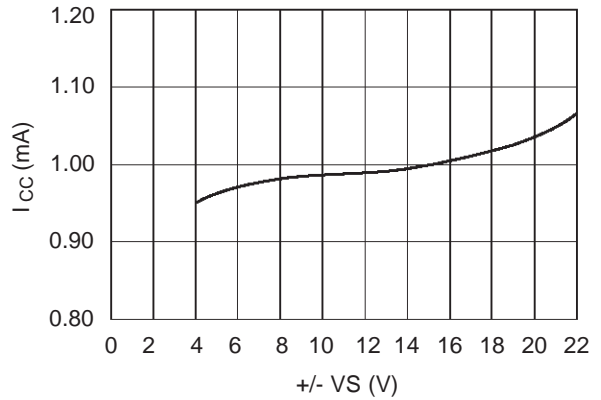
**ELECTRICAL CHARACTERISTICS**V<sub>CC</sub> = ±15V, T<sub>amb</sub> = +25°C (unless otherwise specified)

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	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

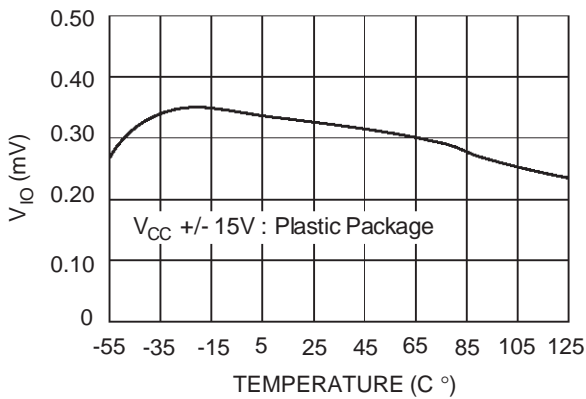
**SUPPLY CURRENT VERSUS AMBIENT TEMPERATURE**



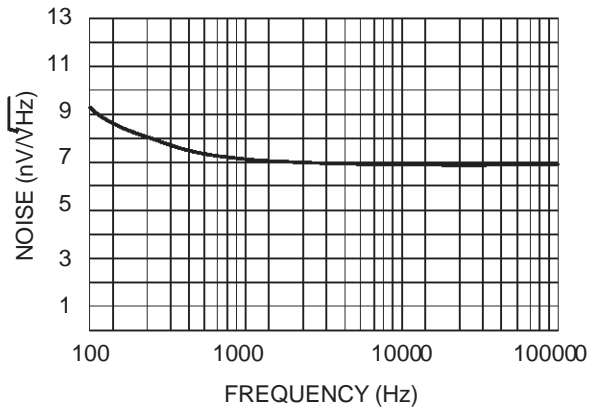
**SUPPLY CURRENT VERSUS SUPPLY VOLTAGE**



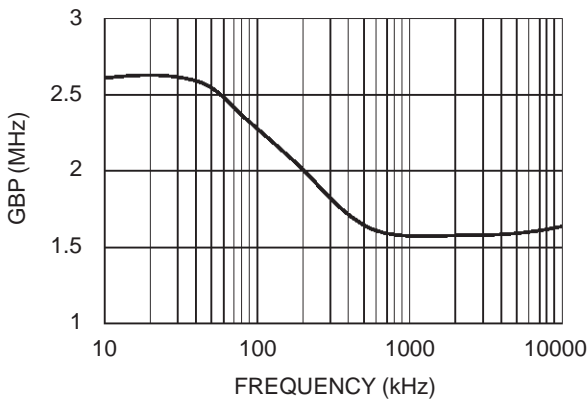
**OFFSET VOLTAGE VERSUS AMBIENT TEMPERATURE**



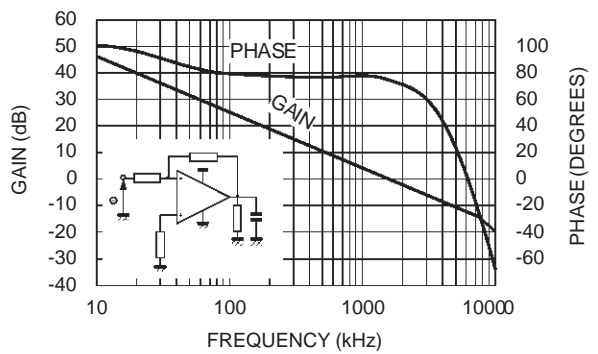
**TOTAL INPUT NOISE VERSUS FREQUENCY**



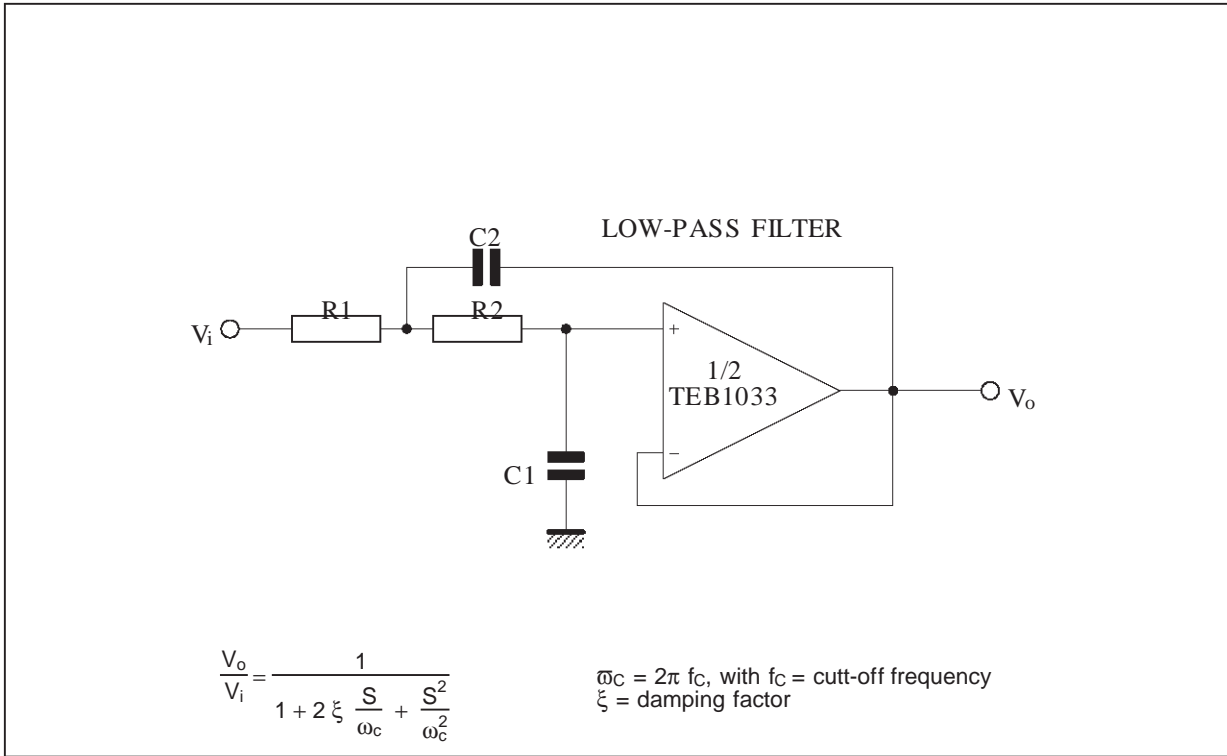
**GAIN BANDWIDTH PRODUCT VERSUS FREQUENCY**



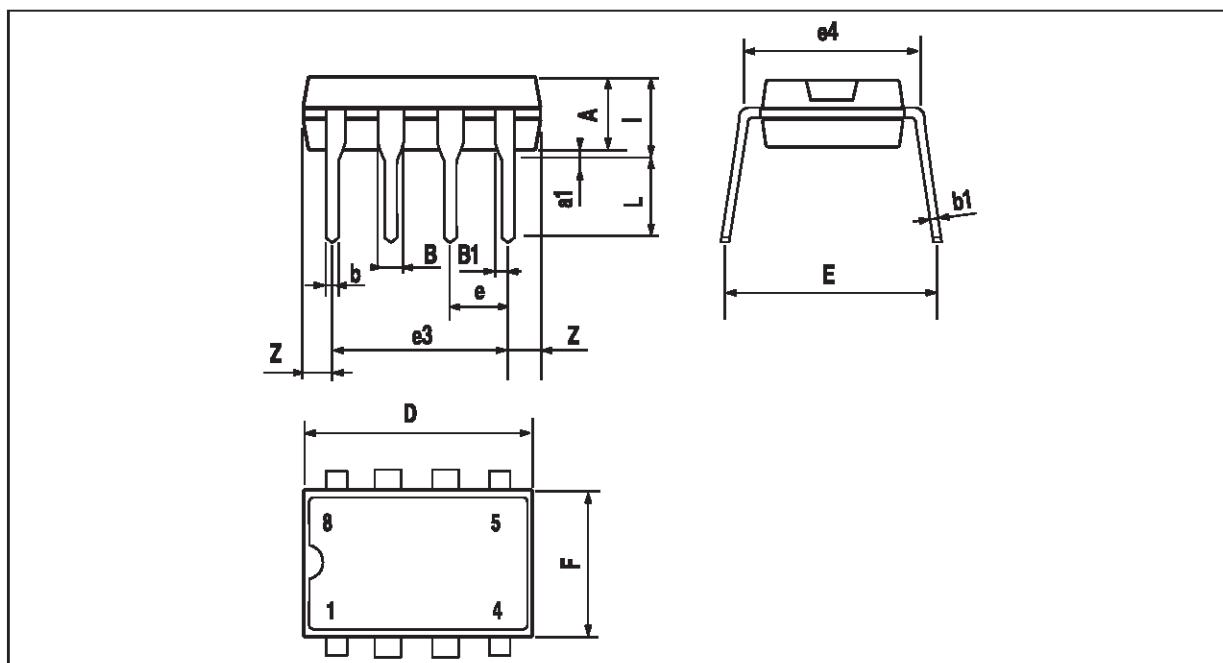
**DODE PLOT**



TYPICAL APPLICATION

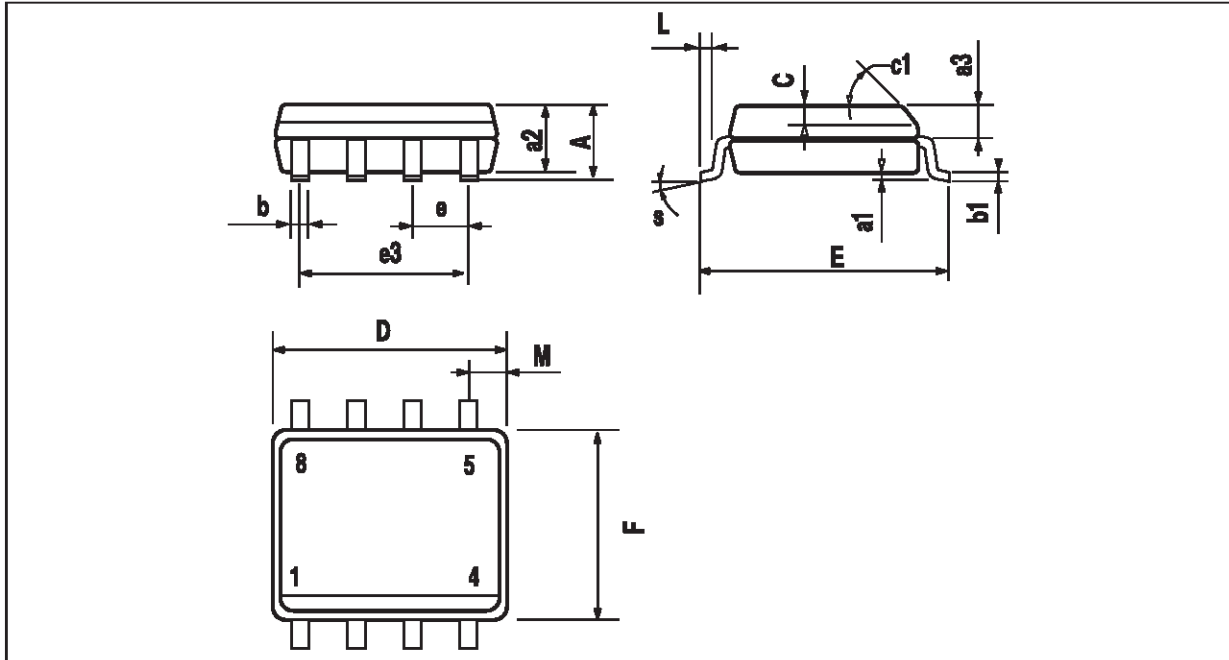


**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP



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.)					

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a trademark of STMicroelectronics

© 1998 STMicroelectronics – Printed in Italy – All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Italy - Japan - Korea - Malaysia - Malta - Morocco  
The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.

ORDER CODE :