SGS-THOMSON MICROELECTRONICS

TEB1033
TEF1033 - TEC1033

BIPOLAR DUAL OPERATIONAL AMPLIFIERS

- LOW DISTORTION RATIO
- LOW NOISE
- VERY LOW SUPPLY CURRENT
- LOW INPUT OFFSET CURRENT
- VERY LOW INPUT OFFSET VOLTAGE
- LARGE COMMON-MODE RANGE
- HIGH GAIN
- HIGH OUTPUT CURRENT
- GAIN-BANDWIDTH PRODUCT : 2.5 MHz
- TEMPERATURE DRIFT : 2 μV/°C
- LONG TERM STABILITY : 8 μV/YEAR (for $T_{amb} \leq 50$ °C)
- THE TEB1033 AND TEF1033 ARE PIN TO PIN REPLACEMENT OF THE LS204C AND LS204 RESPECTIVELY

N
DIP8
(Plastic Package)

D
SO8
(Plastic Micropackage)

GC
LCC20
(Tricecop (LCC))

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 products.

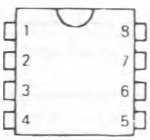
The circuits present very stable electrical characteristics over the entire supply voltage range.

ORDERING INFORMATION

Part Number	Temperature Range	Package		
		N	D	GC
TEB1033	0 °C to + 70 °C	•	•	
TEF1033	– 40 °C to + 105 °C	•	•	
TEC1033	– 55 °C to + 125 °C			•
Examples : TEB1033N, TEC1033GC				

PIN CONNECTIONS (top views)

DIP8/SO8



1 - Output 1
2 - Inverting input 1
3 - Non-inverting input 1
4 - V_{CC}^-
5 - Non-inverting input 2
6 - Inverting input 2
7 - Output 2
8 - V_{CC}^+

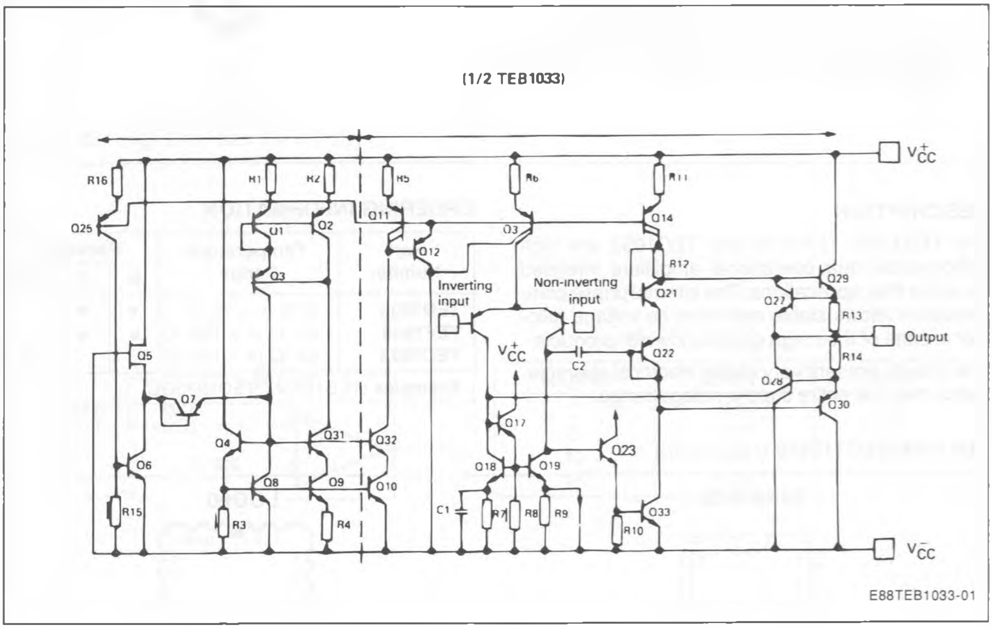
LCC20

1 - NC
2 - Output 1
3 - NC
4 - NC
5 - Inverting input 1
6 - NC
7 - Non-inverting input 1
8 - NC
9 - NC
10 - V_{CC}^-
11 - NC
12 - Non-Inverting input 2
13 - NC
14 - NC
15 - Inverting Input 2
16 - NC
17 - Output 2
18 - NC
19 - NC
20 - V_{CC}^+

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	± 18	V
V_I	Input Voltage	± V_{CC}	V
V_{ID}	Differential Input Voltage	± (V_{CC} −1)	V
P_{tot}	Power Dissipation TEB1033D, TEF1033D TEB1033N TEC1033GC	 400 665 665	mW
T_{oper}	Operating Free-air Temperature Range TEB1033 TEF1033 TEC1033	 0 to + 70 − 40 to + 105 − 55 to + 125	°C
T_{stg}	Storage Temperature Range	− 55 to + 150	°C

BLOCK DIAGRAM



Case	Outputs	Inverting Inputs	Non-inverting Inputs	V_{CC}^+	V_{CC}^-	N. C.
DIP8 SO8	1, 7	2, 6	3, 5	8	4	
LCC20	2, 17	5, 15	7, 12	20	10	*

* **LCC20 :** Other pins are not connected.

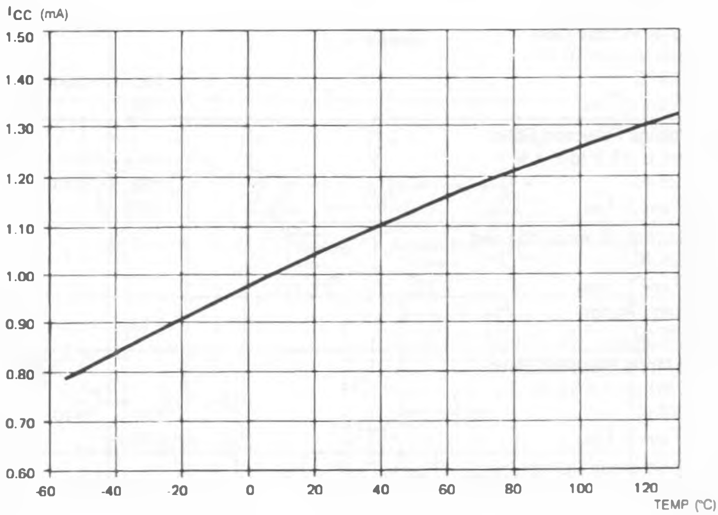
ELECTRICAL CHARACTERISTICS

V_{CC} = ± 15 V (unless otherwise specified)
TEC 1033 : – 55 ≤ T_{amb} ≤ + 125 °C
TEF 1033 : – 40 ≤ T_{amb} ≤ + 105 °C
TEB 1033 : 0 ≤ T_{amb} ≤ + 70 °C

Symbol	Parameter	TEB 1033 TEF 1033 TEC 1033			Unit
		Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage T_{amb} = 25 °C (RS ≤ 10 kΩ) T_{min} ≤ T_{amb} ≤ T_{max}		 0.3	 1 3	mV
DV_{IO}	Input Offset Voltage Drift		2		µV/°C
I_{IO}	Input Offset Current T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}		 5	 20 40	nA
I_{IB}	Input Bias Current T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}		 50	 100 200	nA
A_{vd}	Large Signal Voltage Gain (R_L = 2 kΩ, V_O = ± 10 V) T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}	 100 100	 300		V/mV
SVR	Supply Voltage Rejection Ratio DV_{CC} from ± 15 V to ± 4 V T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}	 100 100	 110		dB
I_{CC}	Supply Current, all Amp, no Load T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}		 1	 1.5 2	mA
V_I	Input Voltage Range T_{amb} = 25 °C	– 12		+ 12	V
CMR	Common Mode Rejection Ratio (R_S ≤ 10 kΩ, V_I = ± 10 V) T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}	 100 100	 110		dB
I_{os}	Output Short-circuit Current T_{amb} = 25 °C T_{min} ≤ T_{amb} ≤ T_{max}	 10 10	 23	 40 40	mA
± V_{opp}	Output Voltage Swing T_{amb} = 25 ° C R_L = 2 kΩ T_{min} ≤ T_{amb} ≤ T_{max} R_L = 2 kΩ V_{CC} = ± 4 V, R_L = 2 KΩ V_{CC} = ± 6 V, R_L = 600 Ω	 13 12 2.8 4.6	 14 3		V
S_{vo}	Slew-rate (V_I = ± 10 V, R_L = 2 kΩ, C_L ≤ 100 pF, T_{amb} = 25 °C, unity gain)	0.6	1	3	V/µs
GBP	Gain Bandwidth Product (f = 100 KHz, T_{amb} = 25 °C, V_{IN} = 10 mV, R_L = 2 kΩ, C_L = 100 pF)	1.8	2.5	3.2	MHz
R_I	Input Resistance (T_{amb} = 25 °C)		1		MΩ

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	TEB 1033 TEF 1033 TEC 1033			Unit
		Min.	Typ.	Max.	
THD	Total Harmonic Distortion ($f = 1KHz$, $A_v = 20$ dB, $R_L = 2$ kΩ $C_L \leq 100$ pF, $T_{amb} = 25$ °C, $V_o = 2\ V_{pp}$)		0.008	0.05	%
V_n	Equivalent Input Noise Voltage ($f = 1$ KHz) $R_S = 50\ \Omega$ $R_S = 1$ kΩ $R_S = 10$ kΩ		 8 10 18	 15	nV/√Hz
V_{OPP}	Large Signal Voltage Swing $R_L = 10$ kΩ, $f = 10$ KHz	26	28		V
φM	Phase Margin		45		Degrees
V_{o1}/V_{o2}	Channel Separation	100	120		dB



SUPPLY CURRENT VS. AMBIENT TEMPERATURE

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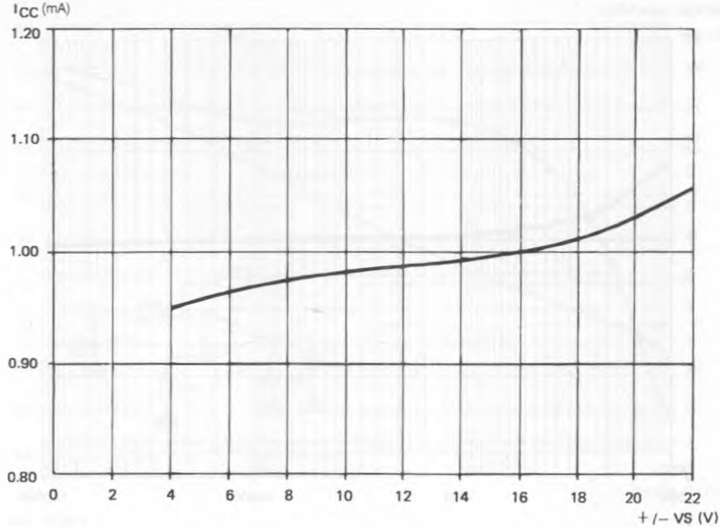

SUPPLY CURRENT VS. SUPPLY VOLTAGE

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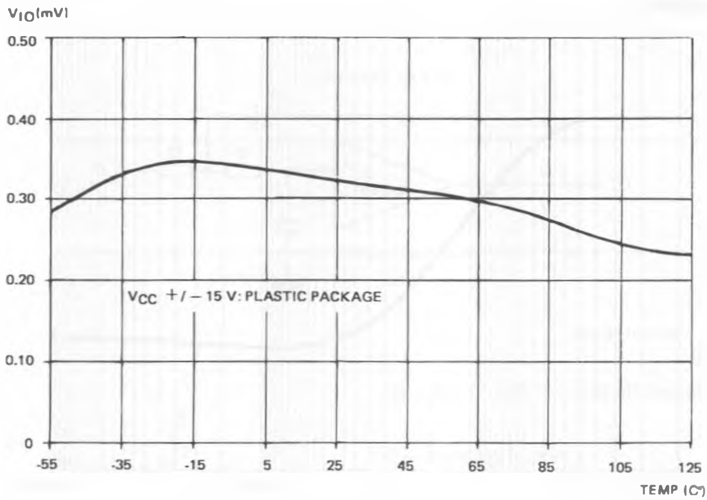

OFFSET VOLTAGE VS. AMBIENT TEMPERATURE

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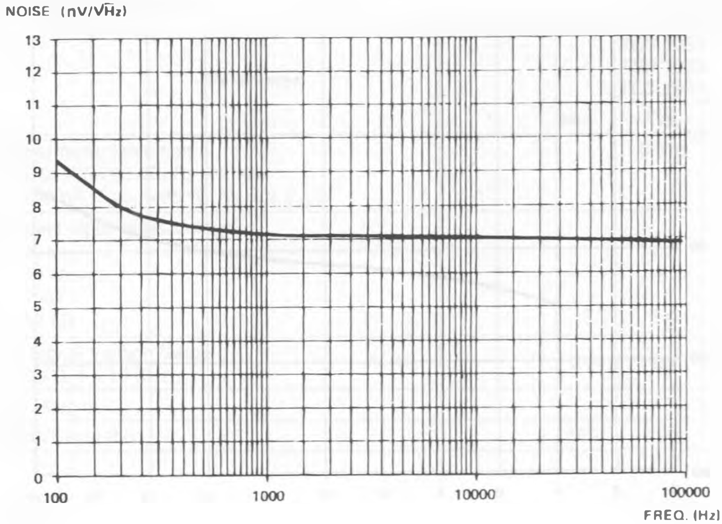

TOTAL INPUT NOISE VS. FREQUENCY

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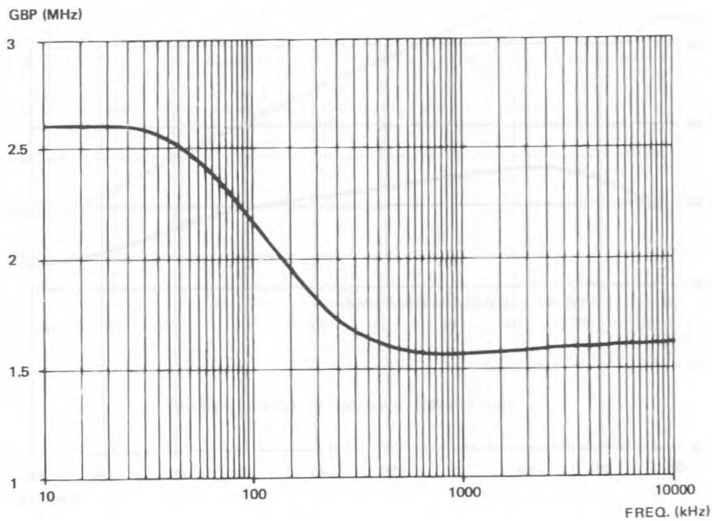

GAIN BANDWIDTH PRODUCT VS. FREQUENCY

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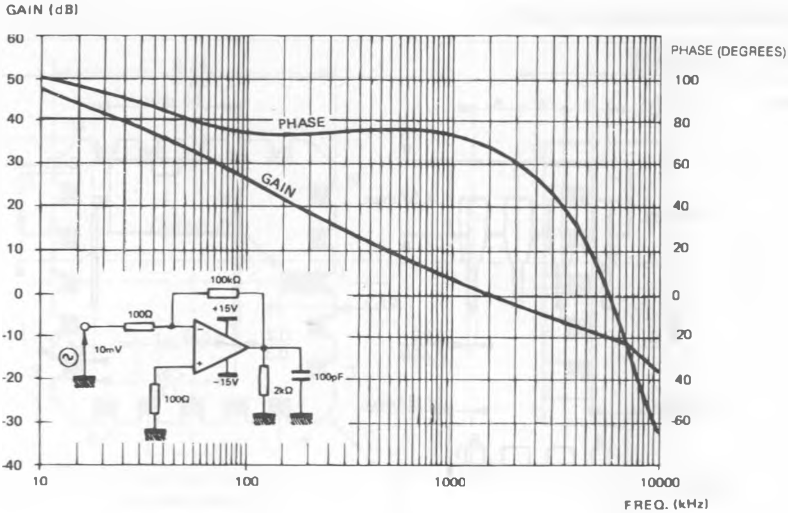

BODE PLOT

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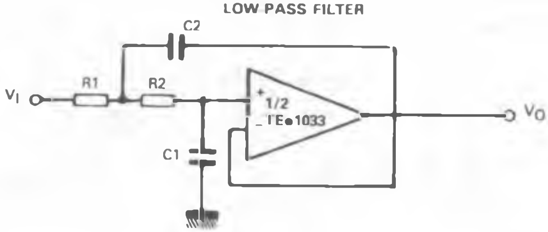
TYPICAL APPLICATION



E88TEB1033-08

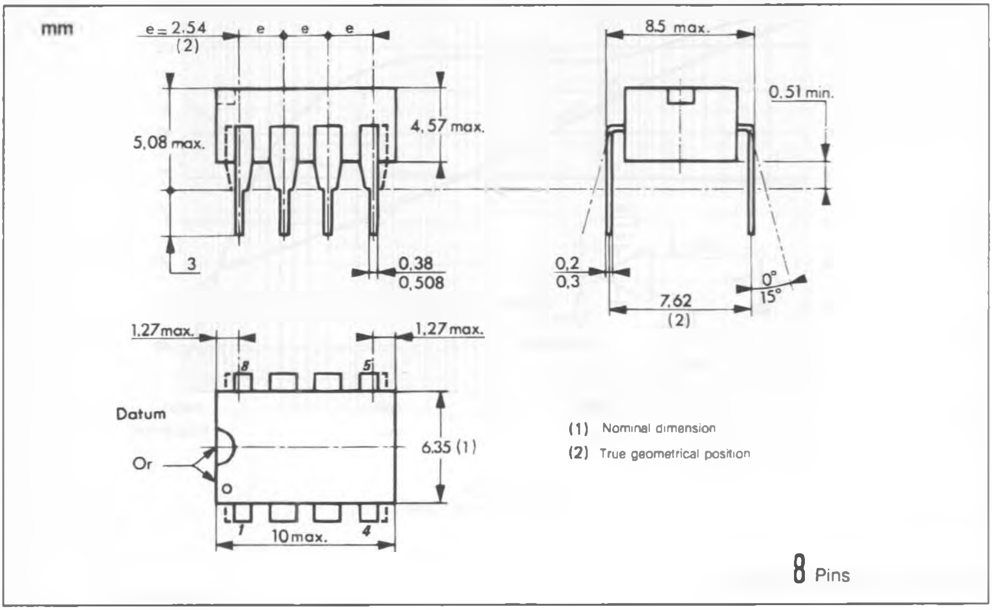
$$\frac{V_o}{V_i} = \frac{1}{1 + 2\xi \frac{S}{\omega_c} + \frac{S^2}{\omega_c^2}}$$

$\omega_c = 2\pi f_c$, with f_c = cutt-off frequency

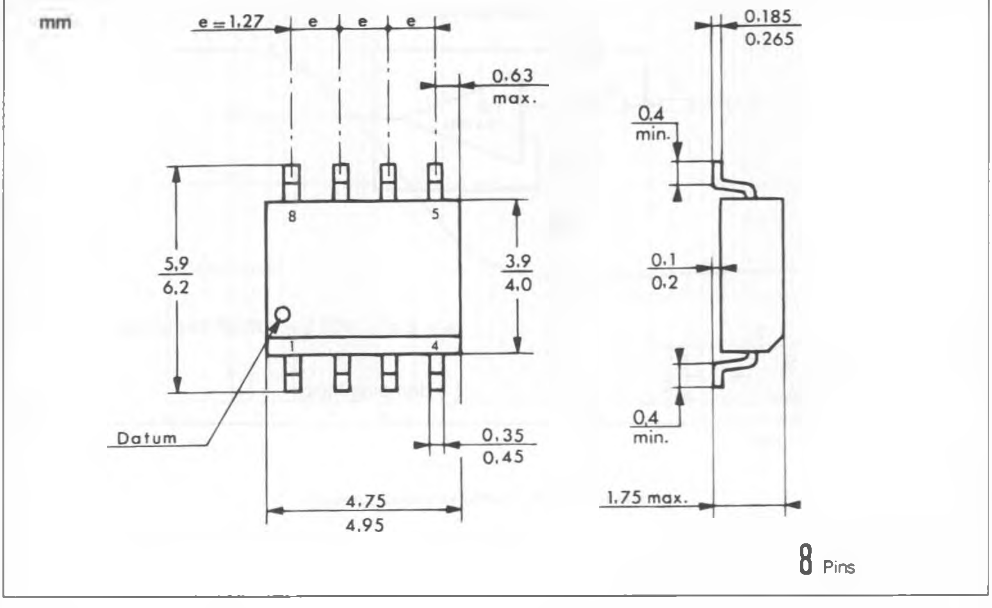
ξ = damping factor

PACKAGE MECHANICAL DATA

8 PINS – PLASTIC DIP



8 PINS – PLASTIC MICROPACKAGE (SO)



20 PINS – TRICECOP (LCC)