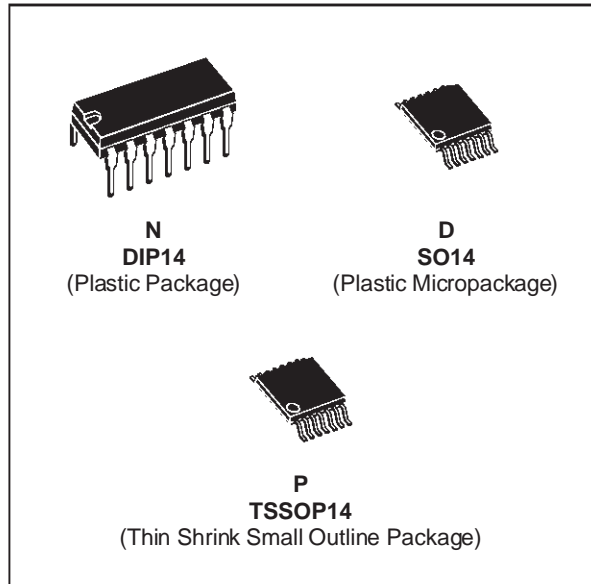




# TL084 TL084A - TL084B

## GENERAL PURPOSE J-FET QUAD OPERATIONAL AMPLIFIERS

- WIDE COMMON-MODE (UP TO  $V_{CC}^+$ ) AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J-FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE :  $16V/\mu s$  (typ)



### DESCRIPTION

The TL084, TL084A and TL084B are high speed J-FET input quad operational amplifiers incorporating well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit.

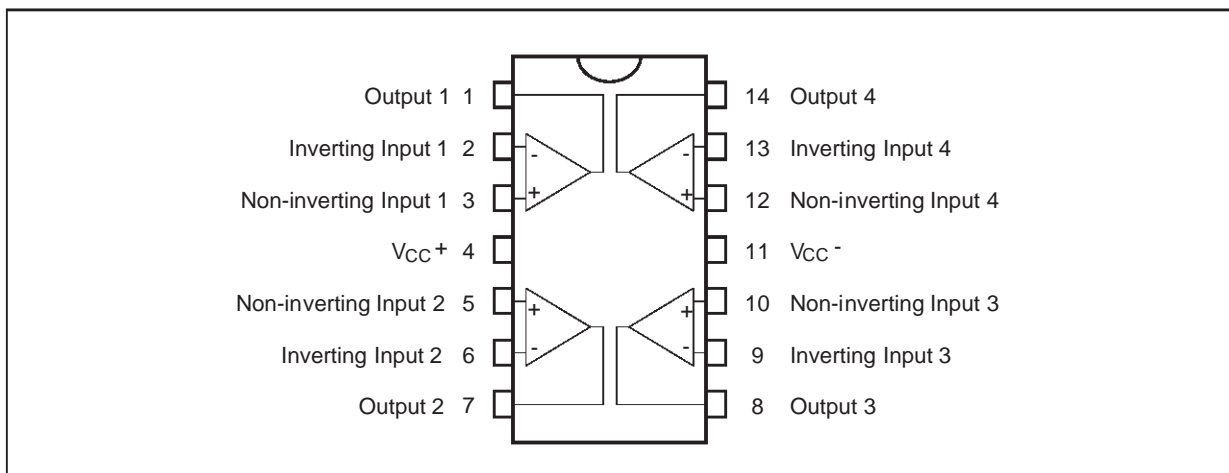
The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.

### ORDER CODES

Part Number	Temperature Range	Package		
		N	D	P
TL084M/AM/BM	-55°C, +125°C	•	•	•
TL084I/AI/BI	-40°C, +105°C	•	•	•
TL084C/AC/BC	0°C, +70°C	•	•	•

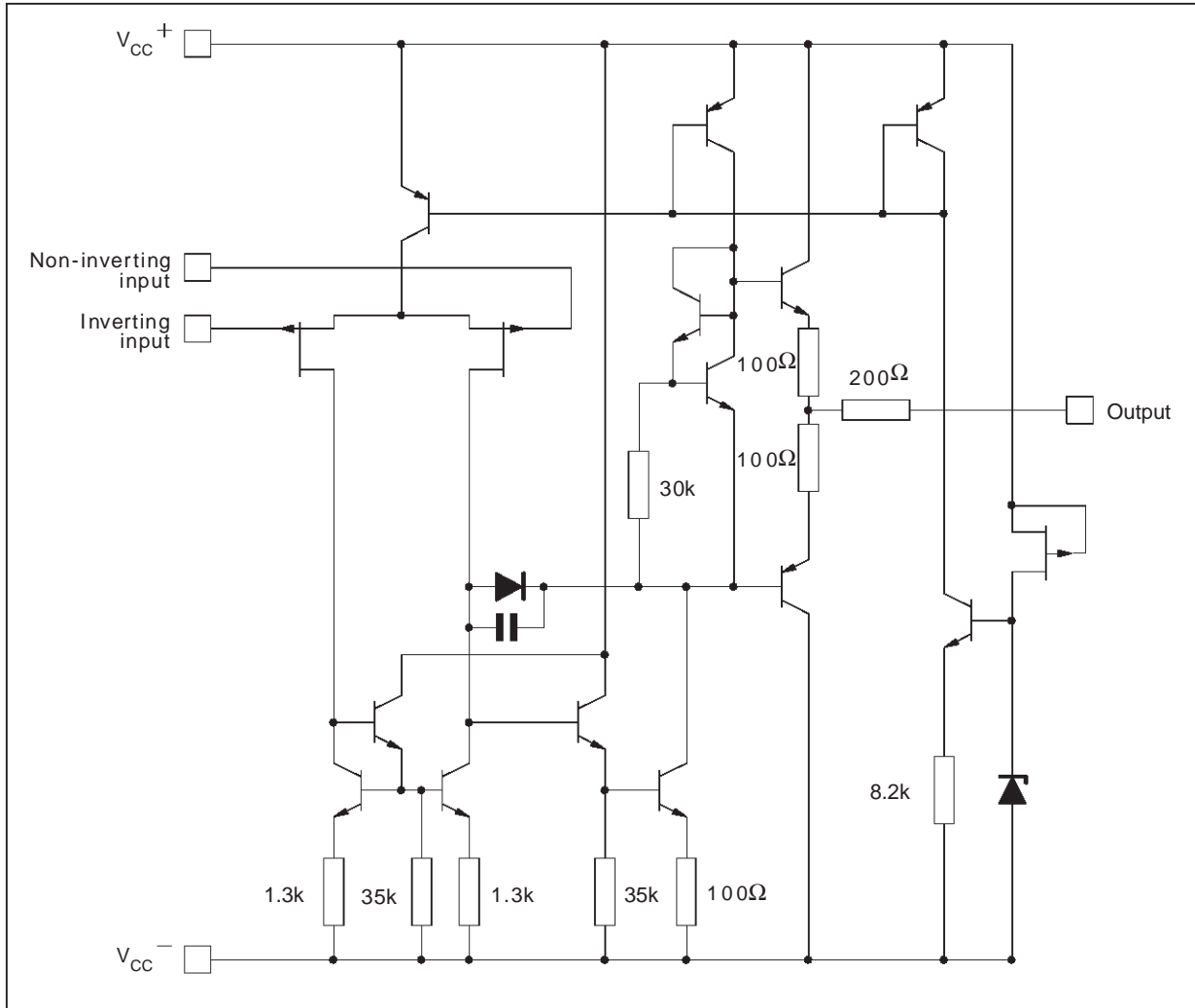
**Examples :** TL084CN, TL084CD

### PIN CONNECTIONS (top view)



# TL084 - TL084A - TL084B

## SCHEMATIC DIAGRAM (each amplifier)



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage - (note 1)	$\pm 18$	V	
$V_i$	Input Voltage - (note 3)	$\pm 15$	V	
$V_{id}$	Differential Input Voltage - (note 2)	$\pm 30$	V	
$P_{tot}$	Power Dissipation	680	mW	
	Output Short-circuit Duration - (note 4)	Infinite		
$T_{oper}$	Operating Free Air Temperature Range	TL084C,AC,BC TL084I,AI,BI TL084M,AM,BM	$0$ to $70$ $-40$ to $105$ $-55$ to $125$	$^{\circ}C$
$T_{stg}$	Storage Temperature Range		$-65$ to $150$	$^{\circ}C$

- Notes :**
1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between  $V_{CC}^+$  and  $V_{CC}^-$ .
  2. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.
  3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
  4. The output may be shorted to ground or to either supply. Temperature and /or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

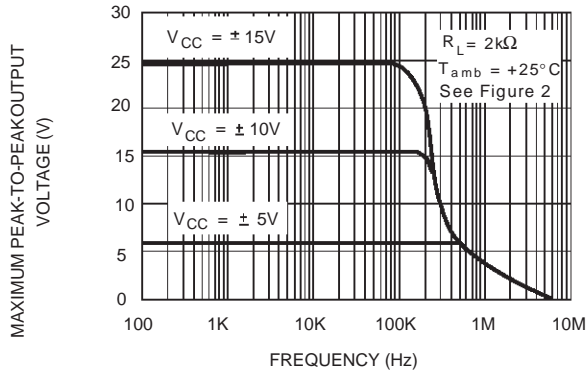
**ELECTRICAL CHARACTERISTICS**

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

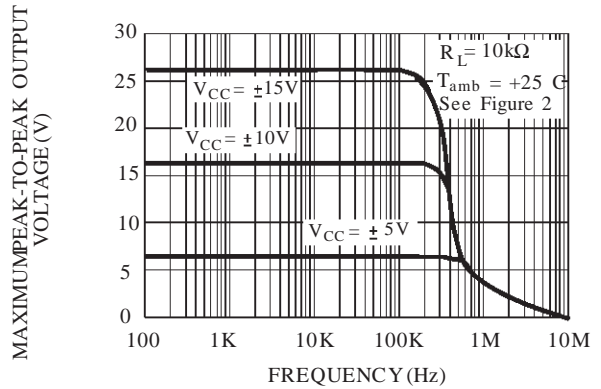
Symbol	Parameter	TL084I,M,AC,AI, AM,BC,BI,BM			TL084C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>io</sub>	Input Offset Voltage (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C  T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		3 3 1	10 6 3 13 7 5		3	10   13	mV
DV <sub>io</sub>	Input Offset Voltage Drift		10			10		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	100 4		5	100 4	pA 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>		20	200 20		30	400 20	pA 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>	50 25	200		25 15	200		V/mV
SVR	Supply Voltage Rejection Ratio (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 80	86		70 70	86		dB
I <sub>CC</sub>	Supply Current, per Amp, no Load T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		1.4	2.5 2.5		1.4	2.5 2.5	mA
V <sub>icm</sub>	Input Common Mode Voltage Range	±11	+15 -12		±11	+15 -12		V
CMR	Common Mode Rejection Ratio (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 80	86		70 70	86		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	40	60 60	10 10	40	60 60	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>		10 12 10 12			10 12 10 12		V
				R <sub>L</sub> = 2kΩ R <sub>L</sub> = 10kΩ R <sub>L</sub> = 2kΩ R <sub>L</sub> = 10kΩ				
SR	Slew Rate (V <sub>in</sub> = 10V, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)	8	16		8	16		V/μs
t <sub>r</sub>	Rise Time (V <sub>in</sub> = 20mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)		0.1			0.1		μs
K <sub>OV</sub>	Overshoot (V <sub>in</sub> = 20mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)		10			10		%
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)	2.5	4		2.5	4		MHz
R <sub>i</sub>	Input Resistance		10 <sup>12</sup>			10 <sup>12</sup>		Ω
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> )		0.01			0.01		%
e <sub>n</sub>	Equivalent Input Noise Voltage (f = 1kHz, R <sub>S</sub> = 100Ω)		15			15		$\frac{nV}{\sqrt{Hz}}$
∅ <sub>m</sub>	Phase Margin		45			45		Degrees
V <sub>O1</sub> /V <sub>O2</sub>	Channel Separation (A <sub>V</sub> = 100)		120			120		dB

\* The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature.

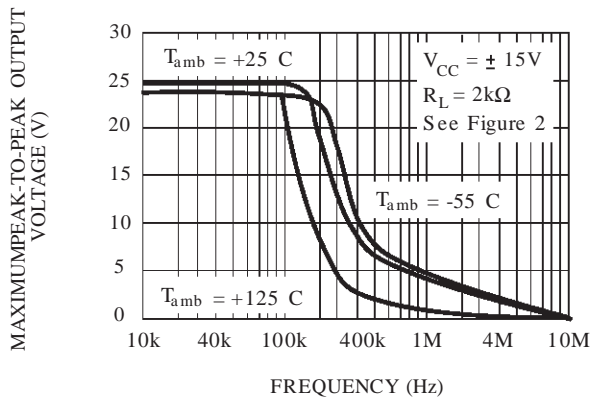
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY**



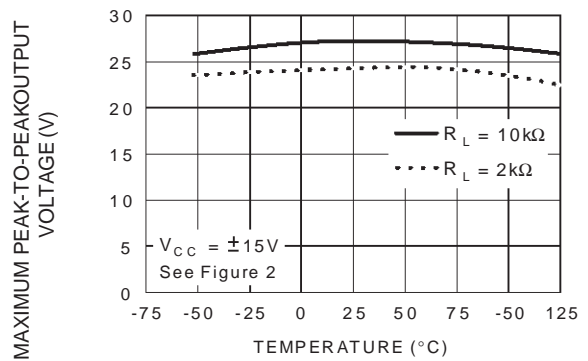
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY**



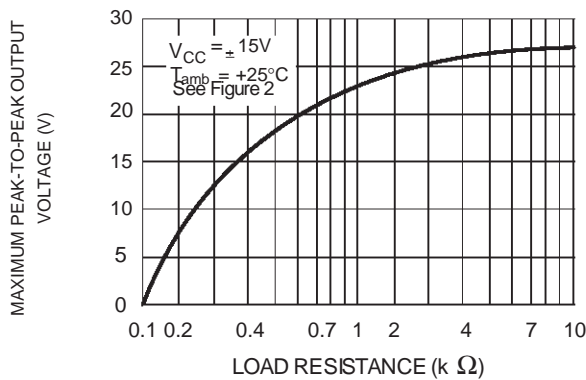
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY**



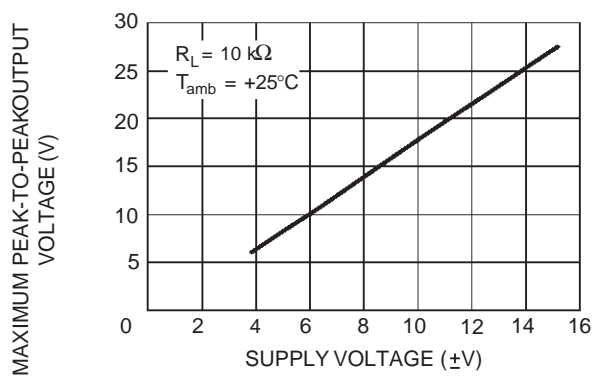
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.**



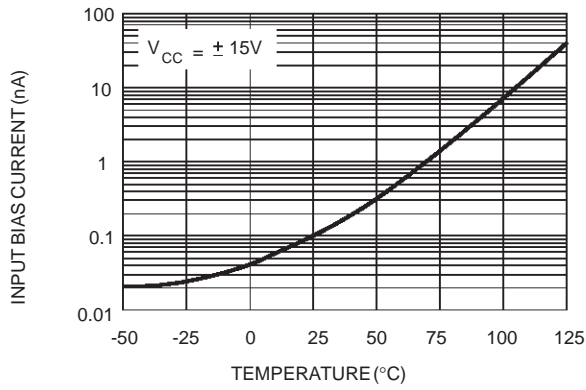
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE**



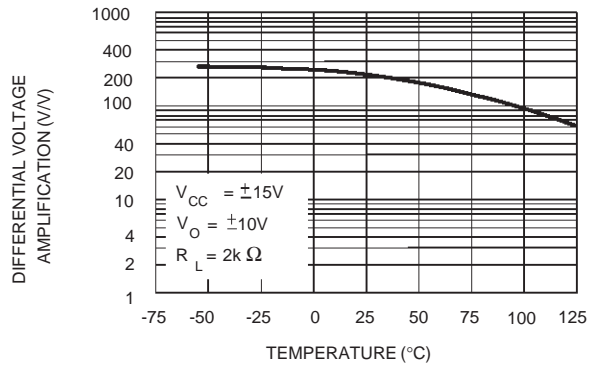
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE**



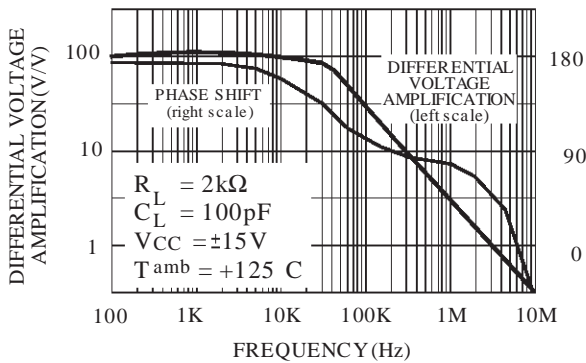
**INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE**



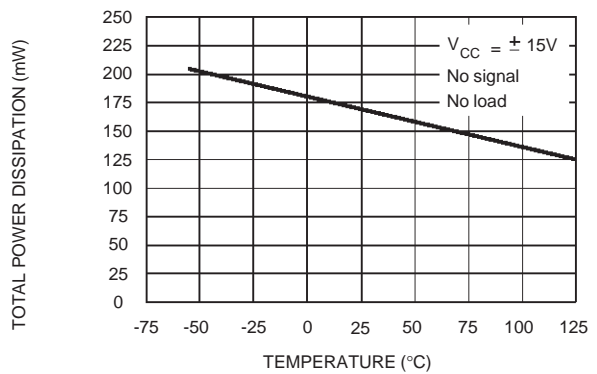
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE**



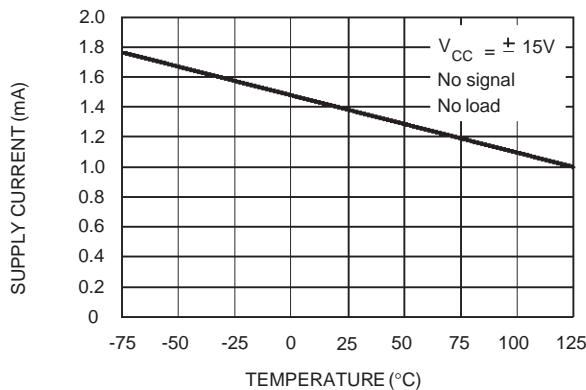
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY**



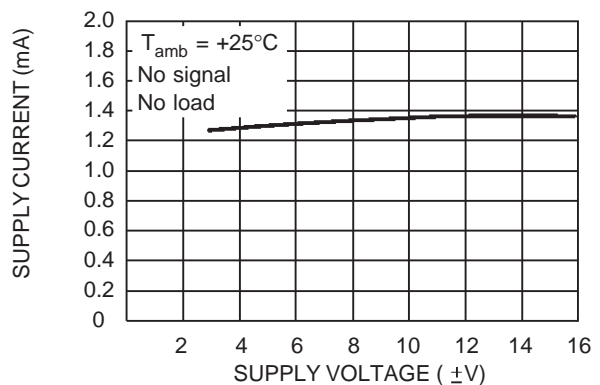
**TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE**



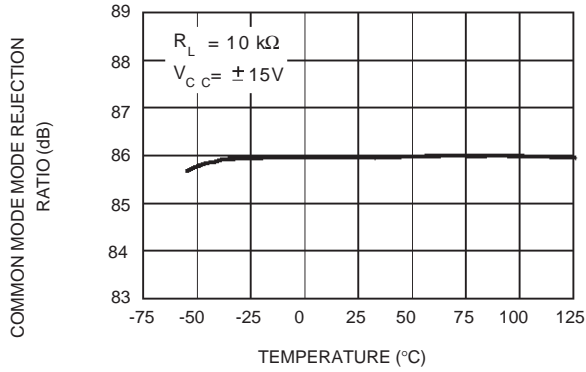
**SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE**



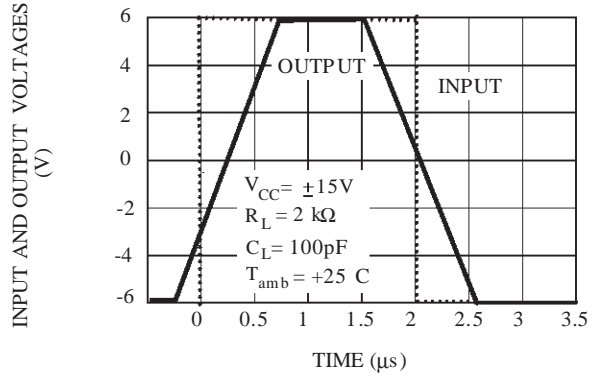
**SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE**



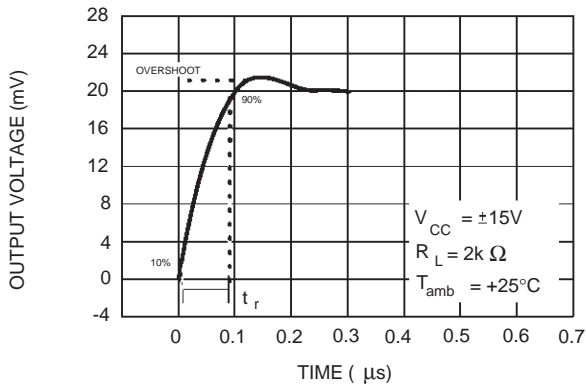
**COMMON MODE REJECTION RATIO VERSUS FREE AIR TEMPERATURE**



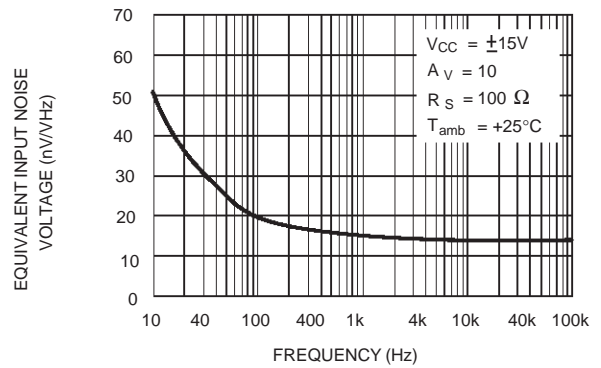
**VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE**



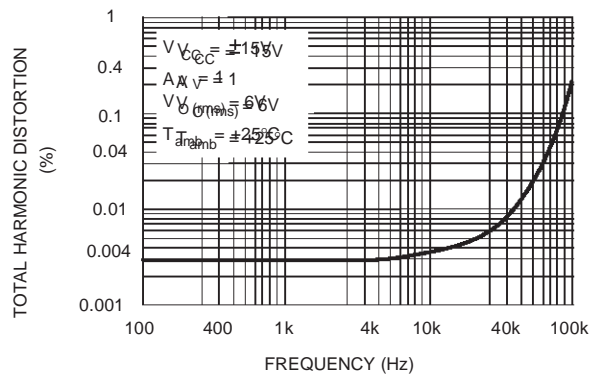
**OUTPUT VOLTAGE VERSUS ELAPSED TIME**



**EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY**



**TOTAL HARMONIC DISTORTION VERSUS FREQUENCY**



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

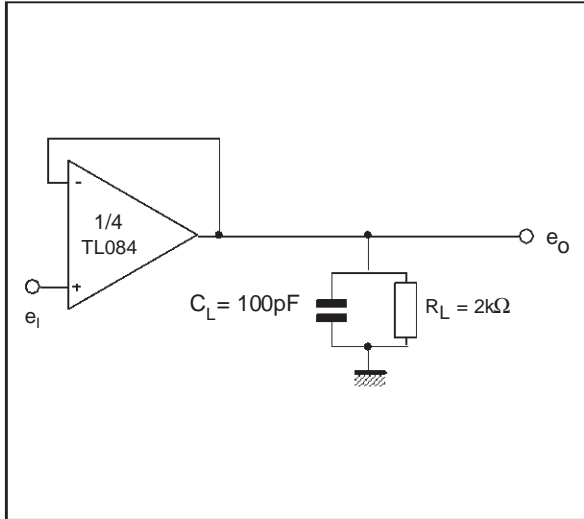
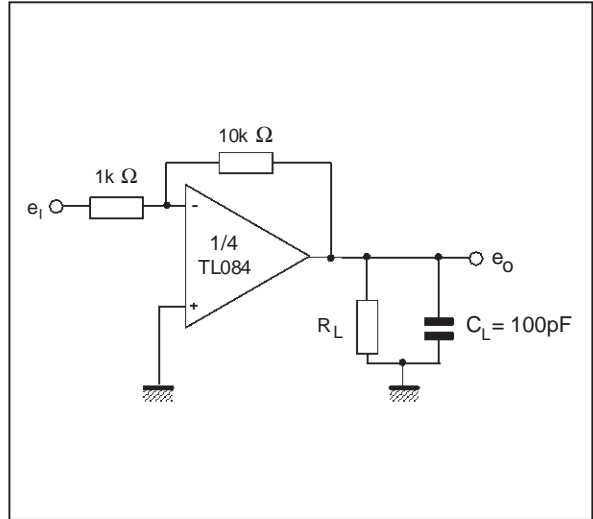
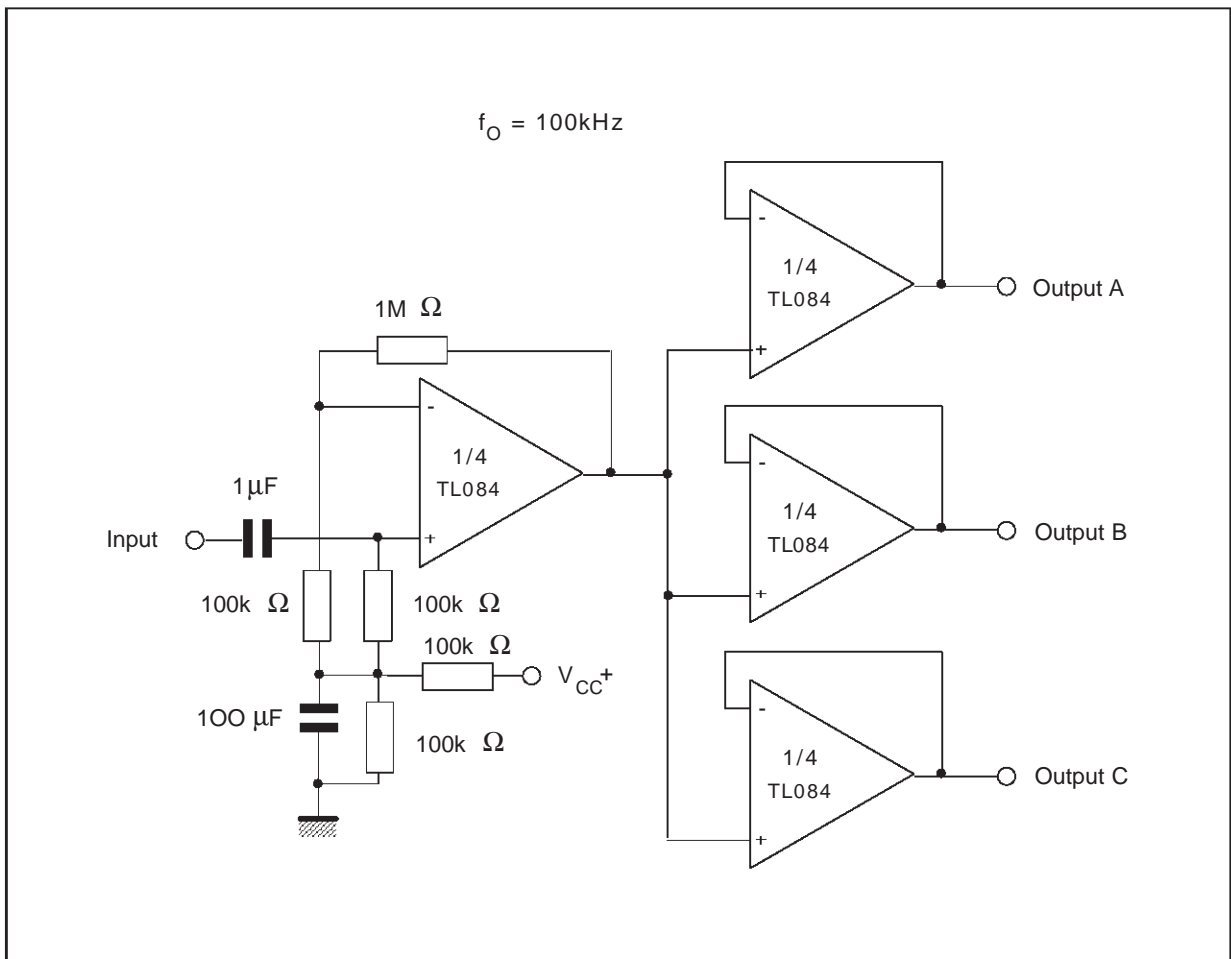


Figure 2 : Gain-of-10 Inverting Amplifier



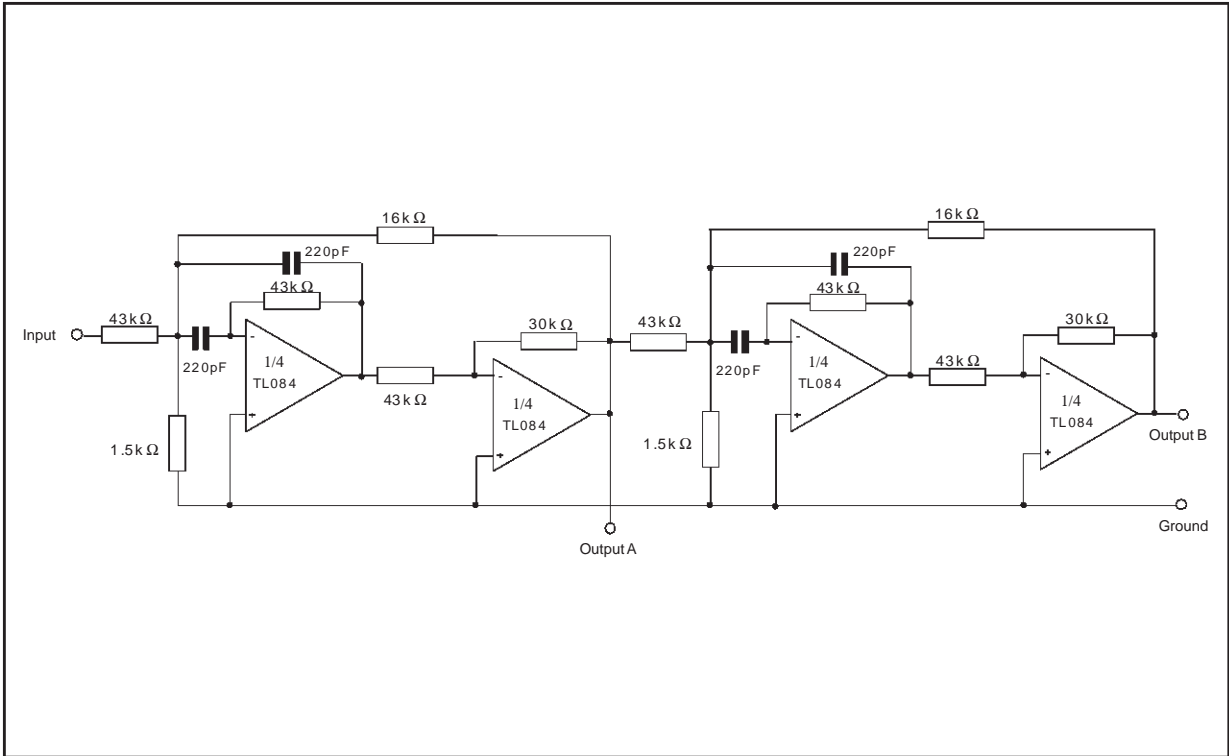
TYPICAL APPLICATIONS

AUDIO DISTRIBUTION AMPLIFIER

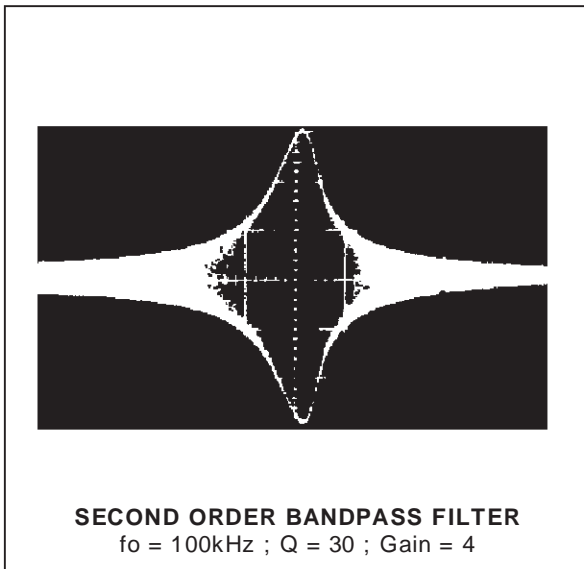


**TYPICAL APPLICATIONS (continued)**

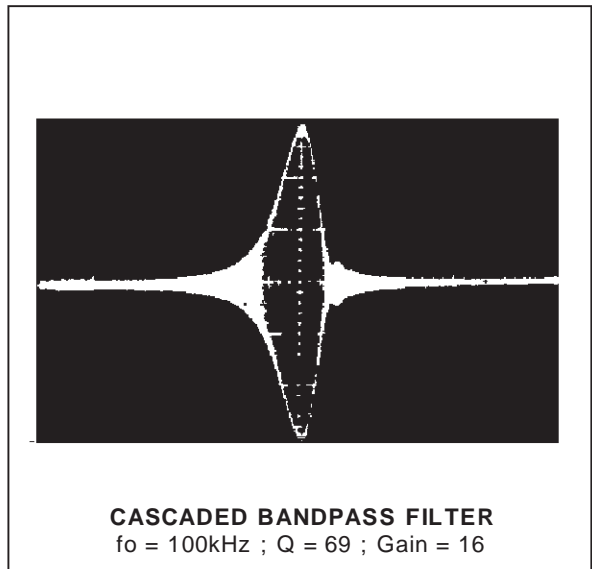
**POSITIVE FEEDBACK BANDPASS FILTER**



**OUTPUT A**

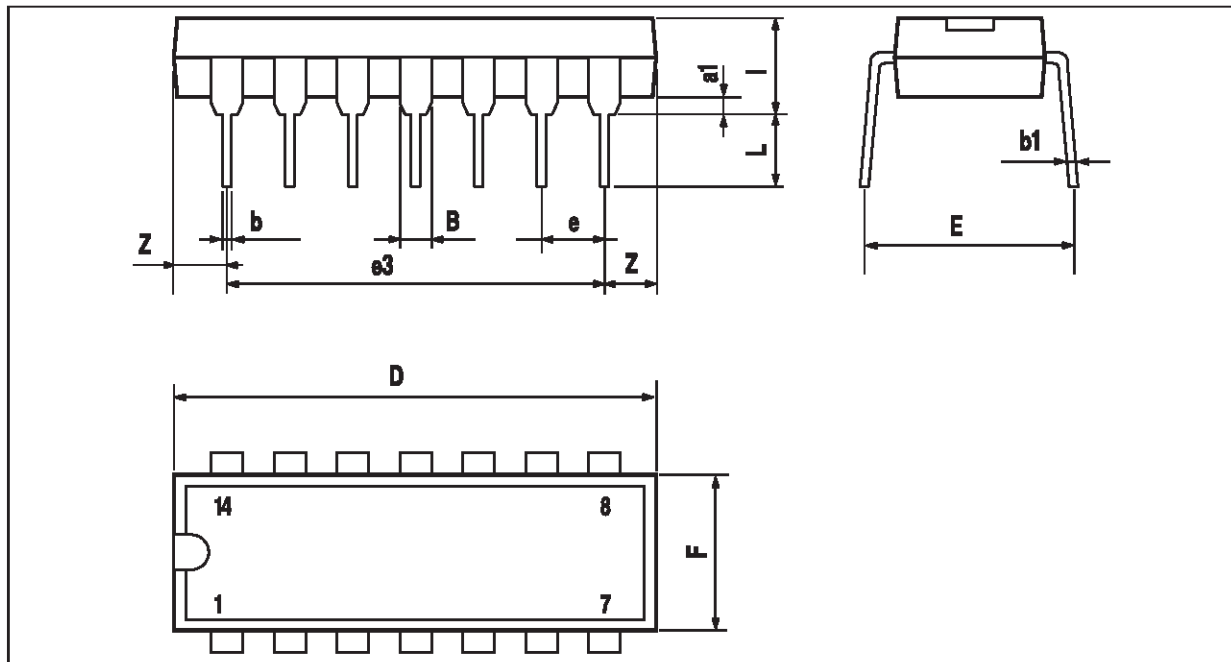


**OUTPUT B**





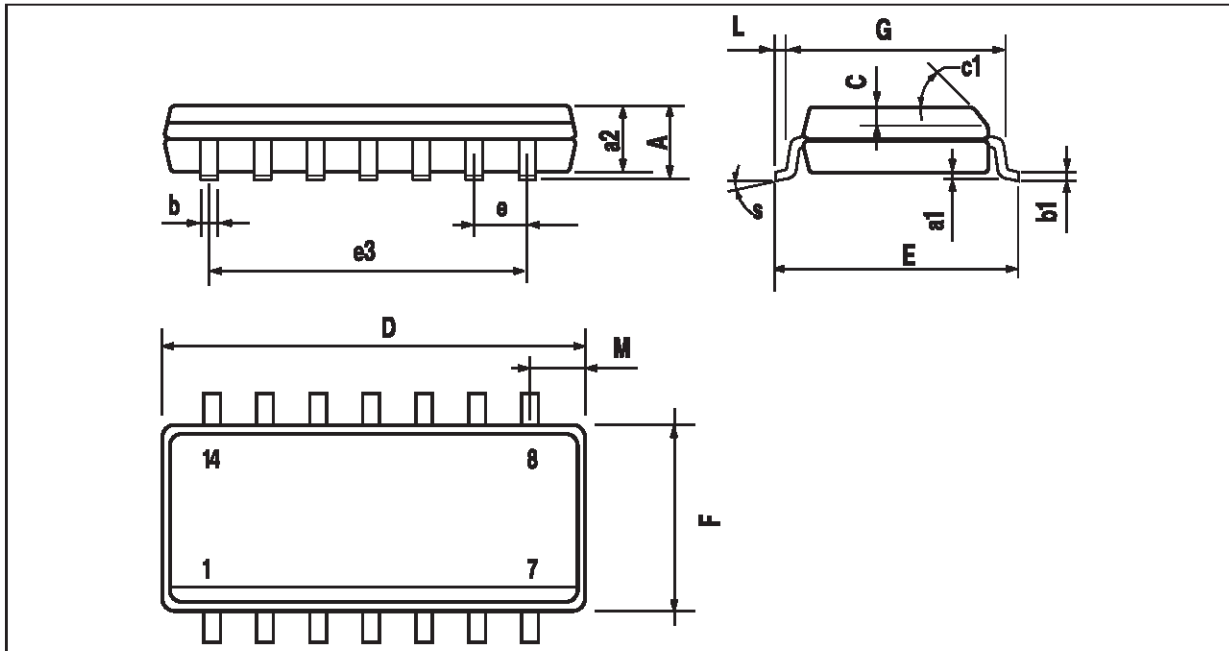
**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

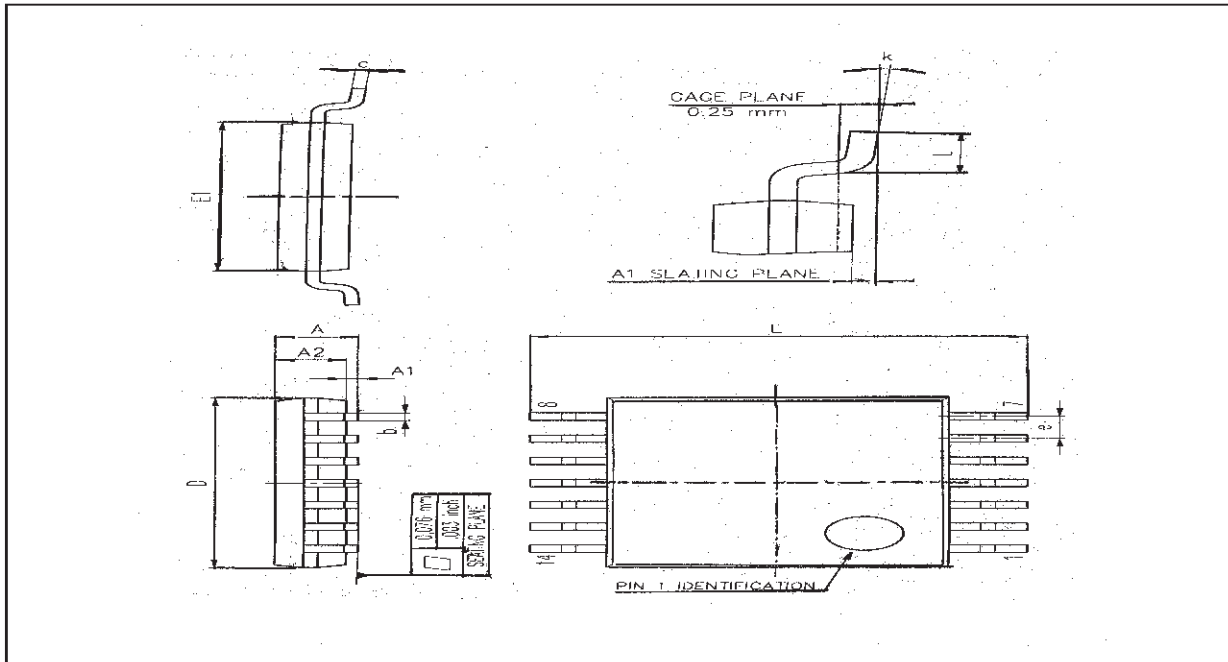
**TL084 - TL084A - TL084B**

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



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.334
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

**PACKAGE MECHANICAL DATA**  
**14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE**



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
l	0.50	0.60	0.75	0.09	0.0236	0.030

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