EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

- **Direct Upgrades to TL05x, TL07x, and TL08x BiFET Operational Amplifiers**
- **Greater Than 2× Bandwidth (10 MHz) and 3× Slew Rate (45 V/μs) Than TL07x**
- **Ensured Maximum Noise Floor 17 nV/√Hz**
- **On-Chip Offset Voltage Trimming for Improved DC Performance**
- **Wider Supply Rails Increase Dynamic Signal Range to ±19 V**

description

The TLE207x series of JFET-input operational amplifiers more than double the bandwidth and triple the slew rate of the TL07x and TL08x families of BiFET operational amplifiers. Texas Instruments Excalibur process yields a typical noise floor of 11.6 nV/√Hz, 17-nV/√Hz ensured maximum, offering immediate improvement in noise-sensitive circuits designed using the TL07x. The TLE207x also has wider supply voltage rails, increasing the dynamic signal range for BiFET circuits to ±19 V. On-chip zener trimming of offset voltage yields precision grades for greater accuracy in dc-coupled applications. The TLE207x are pin-compatible with lower performance BiFET operational amplifiers for ease in improving performance in existing designs.

BiFET operational amplifiers offer the inherently higher input impedance of the JFET-input transistors, without sacrificing the output drive associated with bipolar amplifiers. This makes them better suited for interfacing with high-impedance sensors or very low-level ac signals. They also feature inherently better ac response than bipolar or CMOS devices having comparable power consumption.

The TLE207x family of BiFET amplifiers are Texas Instruments highest performance BiFETs, with tighter input offset voltage and ensured maximum noise specifications. Designers requiring less stringent specifications but seeking the improved ac characteristics of the TLE207x should consider the TLE208x operational amplifier family.

Because BiFET operational amplifiers are designed for use with dual power supplies, care must be taken to observe common-mode input voltage limits and output swing when operating from a single supply. DC biasing of the input signal is required and loads should be terminated to a virtual ground node at mid-supply. Texas Instruments TLE2426 integrated virtual ground generator is useful when operating BiFET amplifiers from single supplies.

The TLE207x are fully specified at ±15 V and ±5 V. For operation in low-voltage and/or single-supply systems, Texas Instruments LinCMOS families of operational amplifiers (TLC- and TLV-prefix) are recommended. When moving from BiFET to CMOS amplifiers, particular attention should be paid to slew rate and bandwidth requirements and output loading.

TLE2071 AVAILABLE OPTIONS

T_A	V_{IO}max AT 25°C	PACKAGED DEVICES				CHIP FORM‡ (Y)
		SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	
0°C to 70°C	2 mV 4 mV	TLE2071ACD TLE2071CD	—	—	TLE2071ACP TLE2071CP	— TLE2071Y
–40°C to 85°C	2 mV 4 mV	TLE2071AID TLE2071ID	—	—	TLE2071AIP TLE2071IP	—
–55°C to 125°C	2 mV 4 mV	— —	TLE2071AMFK TLE2071MFK	TLE2071AMJG TLE2071MJG	— —	—

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2071ACDR).
‡ Chip-form versions are tested at T_A = 25°C.

TLE2072 AVAILABLE OPTIONS

T_A	V_{IO}max AT 25°C	PACKAGED DEVICES				CHIP FORM‡ (Y)
		SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	
0°C to 70°C	3.5 mV 6 mV	TLE2072ACD TLE2072CD	—	—	TLE2072ACP TLE2072CP	— TLE2072Y
–40°C to 85°C	3.5 mV 6 mV	TLE2072AID TLE2072ID	—	—	TLE2072AIP TLE2072IP	—
–55°C to 125°C	3.5 mV 6 mV	—	TLE2072AMFK TLE2072MFK	TLE2072AMJG TLE2072MJG	—	—

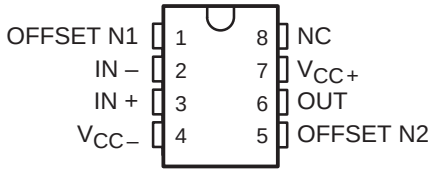
† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).
‡ Chip-form versions are tested at T_A = 25°C.

TLE2074 AVAILABLE OPTIONS

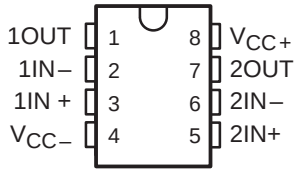
T_A	V_{IO}max AT 25°C	PACKAGED DEVICES				CHIP FORM‡ (Y)
		SMALL OUTLINE† (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	
0°C to 70°C	3 mV 5 mV	TLE2074ACDW TLE2074CDW	—	—	TLE2074ACN TLE2074CN	— TLE2074Y
–40°C to 85°C	3 mV 5 mV	TLE2074AIDW TLE2074IDW	—	—	TLE2074AIN TLE2074IN	—
–55°C to 125°C	3 mV 5 mV	—	TLE2074AMFK TLE2074MFK	TLE2074AMJ TLE2074MJ	—	—

† The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2074ACDWR).
‡ Chip-form versions are tested at T_A = 25°C.

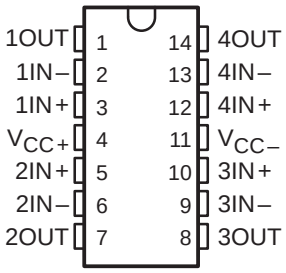
TLE2071 AND TLE2071A
D, JG, OR P PACKAGE
(TOP VIEW)



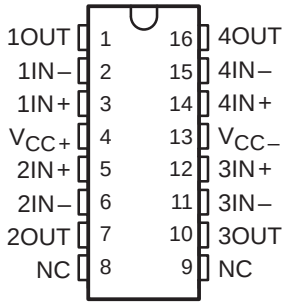
TLE2072 AND TLE2072A
D, JG, OR P PACKAGE
(TOP VIEW)



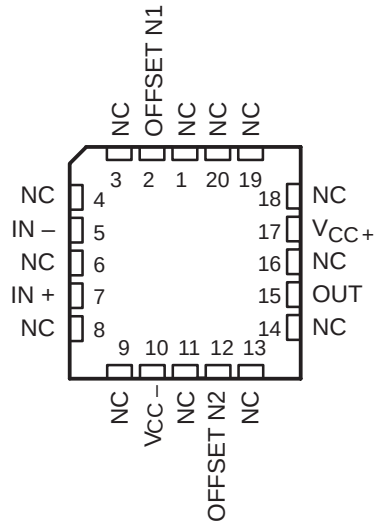
TLE2074 AND TLE2074A
J OR N PACKAGE
(TOP VIEW)



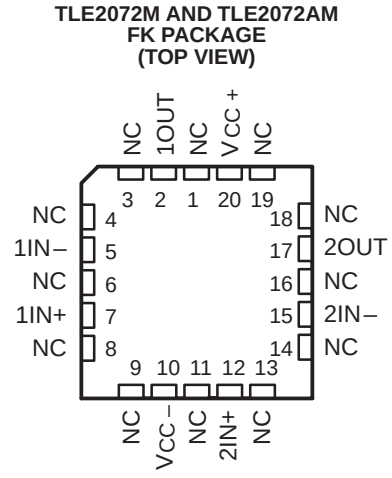
TLE2074 AND TLE2074A
DW PACKAGE
(TOP VIEW)



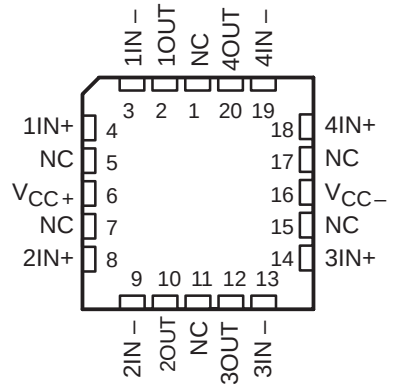
TLE2071M AND TLE2071AM
FK PACKAGE
(TOP VIEW)



TLE2072M AND TLE2072AM
FK PACKAGE
(TOP VIEW)

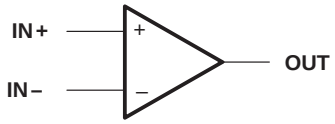


TLE2074M AND TLE2074AM
FK PACKAGE
(TOP VIEW)



NC – No internal connection

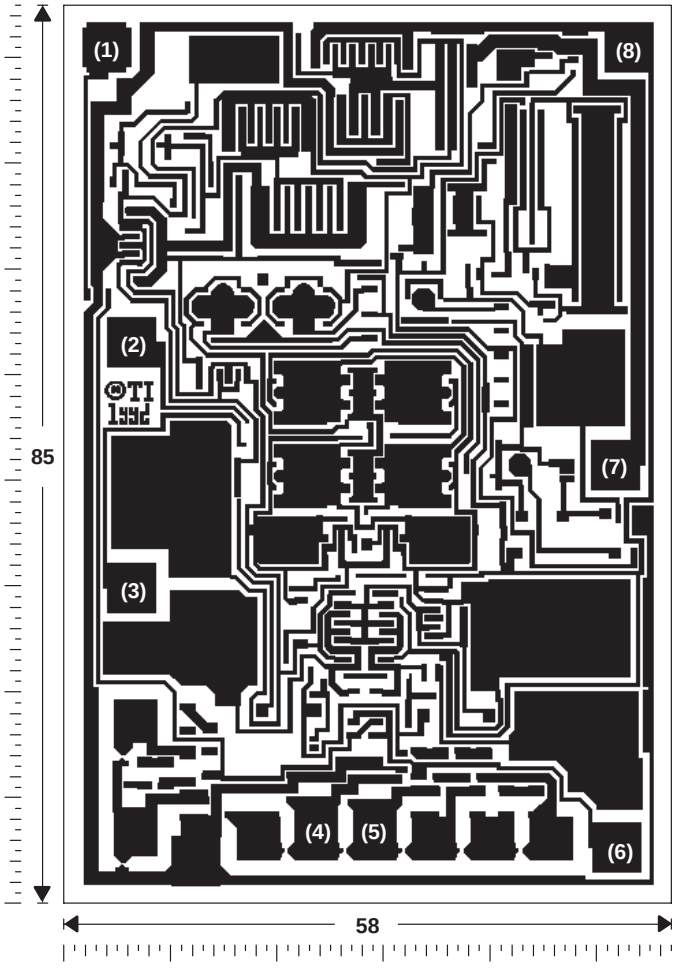
symbol

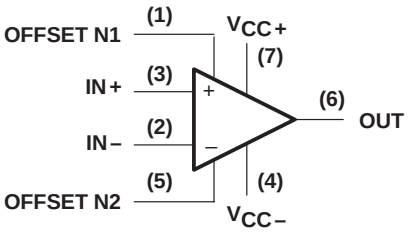


TLE2071Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2071C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS: 15 TYPICAL

BONDING PADS: 4 × 4 MINIMUM

$T_J$max = 150°C

TOLERANCES ARE ±10%.

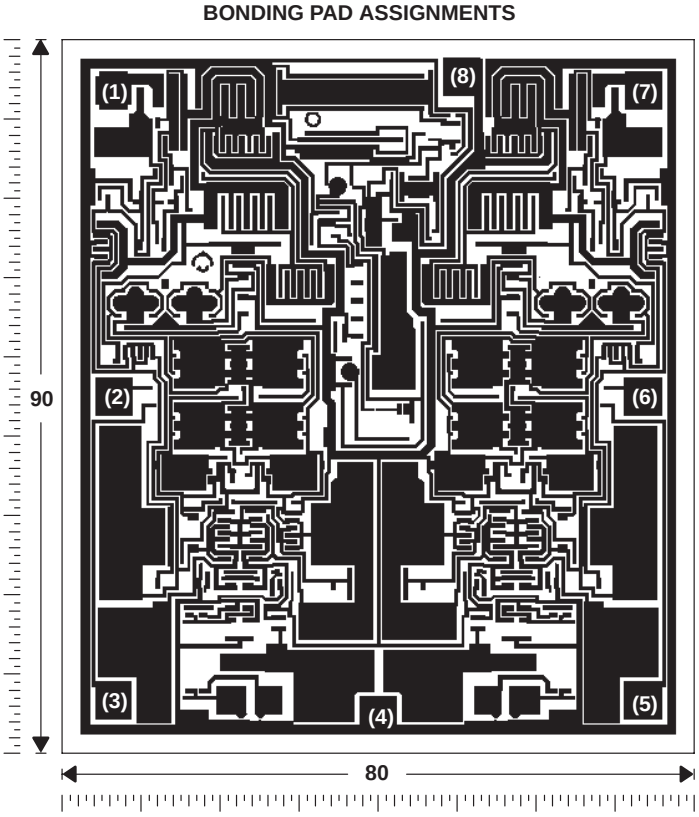
ALL DIMENSIONS ARE IN MILS.

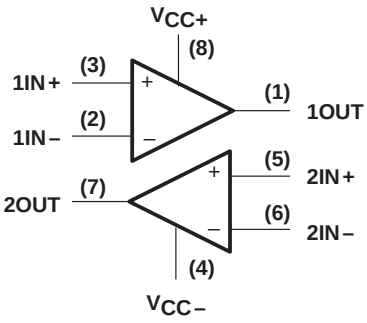
PIN (4) IS INTERNALLY CONNECTED TO BACKSIDE OF THE CHIP.

TLE2072Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2072C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS: 15 TYPICAL

BONDING PADS: 4 × 4 MINIMUM

$T_J$max = 150°C

TOLERANCES ARE ±10%.

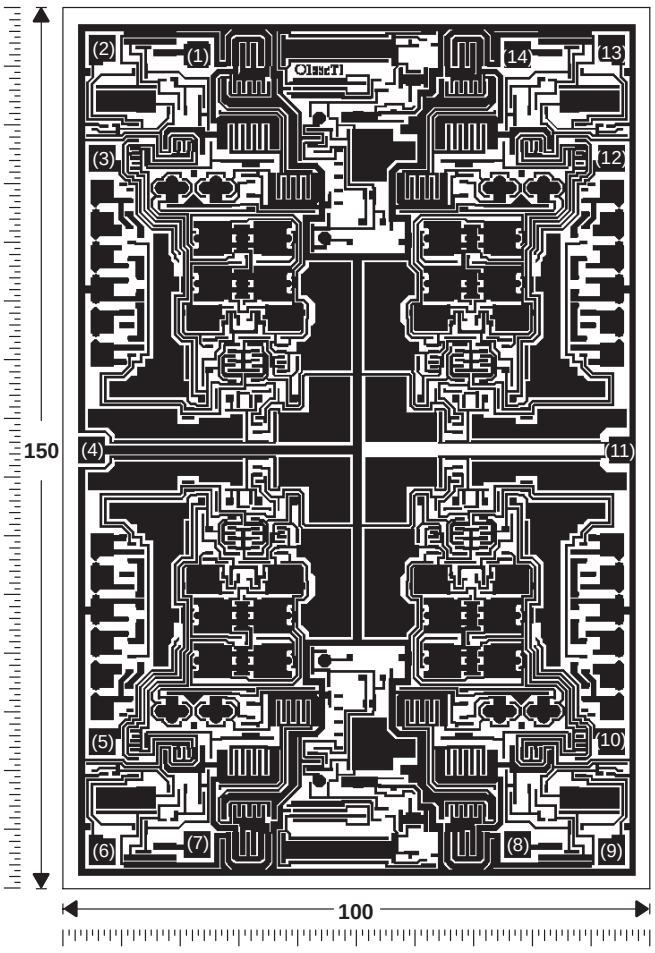
ALL DIMENSIONS ARE IN MILS.

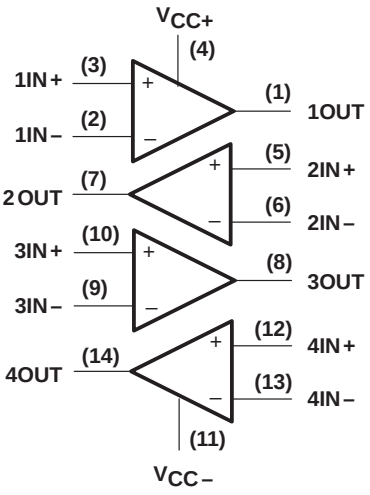
PIN (4) IS INTERNALLY CONNECTED TO BACKSIDE OF THE CHIP.

TLE2074Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2074C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS: 15 TYPICAL

BONDING PADS: 4 × 4 MINIMUM

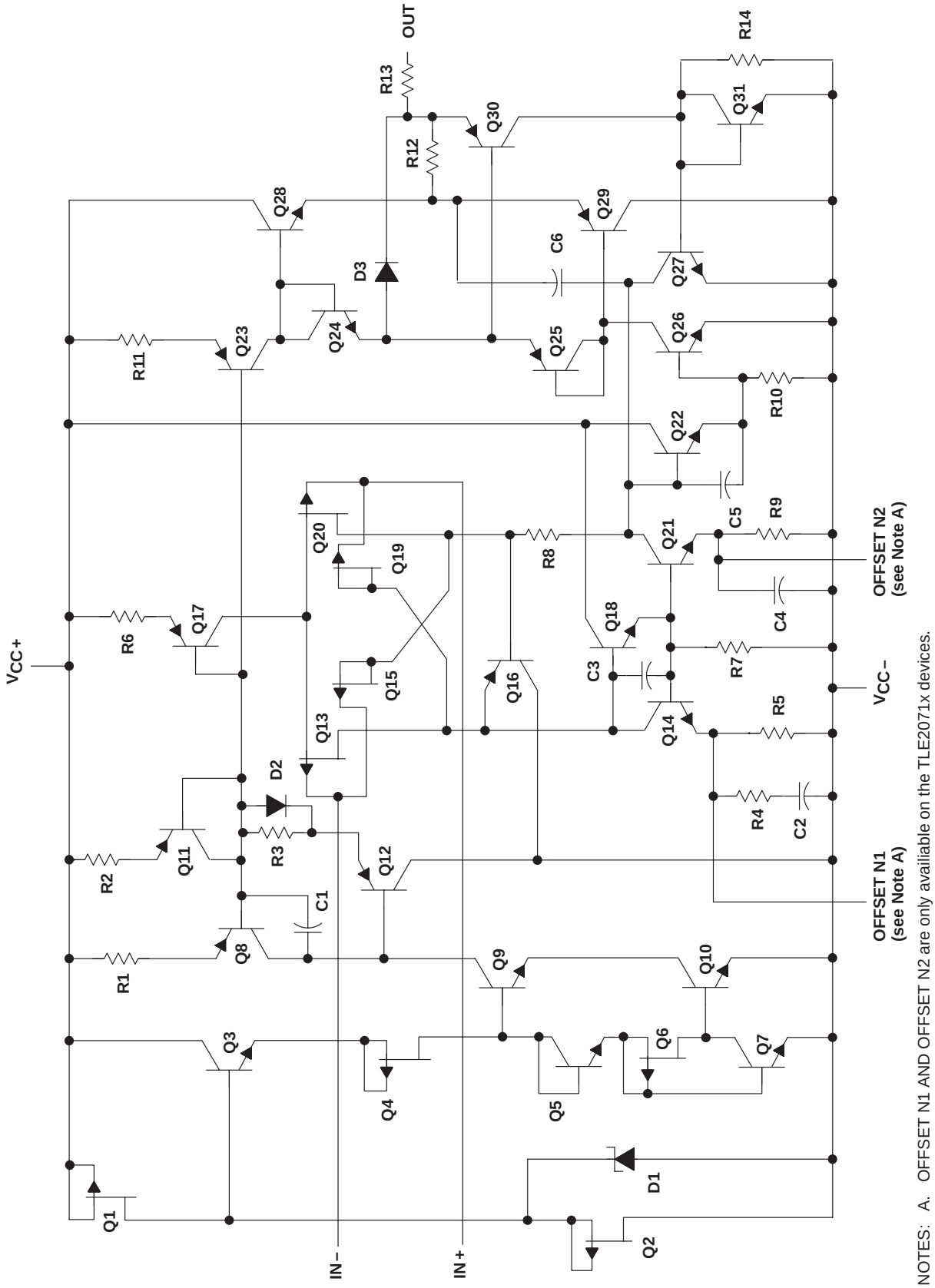
$T_J$max = 150°C

TOLERANCES ARE ±10%.

ALL DIMENSIONS ARE IN MILS.

PIN (11) IS INTERNALLY CONNECTED TO BACKSIDE OF THE CHIP.

equivalent schematic



NOTES: A. OFFSET N1 AND OFFSET N2 are only availiable on the TLE2071x devices.

equivalent schematic (continued)

ACTUAL DEVICE COMPONENT COUNT			
COMPONENT	TLE2071	TLE2072	TLE2074
Transistors	33	57	114
Resistors	25	37	74
Diodes	8	5	10
Capacitors	6	11	22

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC+} (see Note 1) . . . . . 19 V
Supply voltage, V_{CC-} (see Note 1) . . . . . –19 V
Differential input voltage range, V_{ID} (see Note 2) . . . . . V_{CC+} to V_{CC-}
Input voltage range, V_I (any input) . . . . . V_{CC+} to V_{CC-}
Input current, I_I (each input) . . . . . ±1 mA
Output current, I_O (each output) . . . . . ±80 mA
Total current into V_{CC+} . . . . . 160 mA
Total current out of V_{CC-} . . . . . 160 mA
Duration of short-circuit current at (or below) 25°C (see Note 3) . . . . . unlimited
Continuous total dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A: C suffix . . . . . 0°C to 70°C
I suffix . . . . . –40°C to 85°C
M suffix . . . . . –55°C to 125°C
Storage temperature range . . . . . –65°C to 150°C
Case temperature for 60 seconds: FK package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: DW or N package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package . . . . . 300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. Differential voltages are at the noninverting input with respect to the inverting input.
3. The output may be shorted to either supply. Temperatures and/or supply voltages must be limited to ensure that the maximum dissipation rate is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	—
DW	1025 mW	8.2 mW/°C	656 mW	533 mW	205 mW
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
J	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW	230 mW
P	1000 mW	8.0 mW/°C	640 mW	344 mW	—

recommended operating conditions

		C SUFFIX		I SUFFIX		M SUFFIX		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, $V_{CC\pm}$		±2.25	±19	±2.25	±19	±2.25	±19	V
Common-mode input voltage, V_{IC}	$V_{CC\pm}$ = ±5 V	–0.9	5	–0.8	5	–0.8	5	V
	$V_{CC\pm}$ = ±15 V	–10.9	15	–10.8	15	–10.8	15	
Operating free-air temperature, T_A		0	70	–40	85	–55	125	°C

TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		0.34	4		0.3	2	mV
				Full range			6			4	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29		3.2	29	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			1.4			1.4	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			5			5	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.9			5 to −0.9			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.7			3.7			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.4			3.4			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.5			1.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−3.5	−4.2		−3.5	−4.2		V
				Full range	−3.4			−3.4			
		I_O = 2 mA		25°C	−3.7	−4.1		−3.7	−4.1		
				Full range	−3.6			−3.6			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.5			−1.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is 0°C to 70°C.

TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0,	No load	25°C	1.35	1.6	2.2	1.35	1.6	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is 0°C to 70°C.

TLE2071C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	23			23			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	23			23			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

† Full range is 0°C to 70°C.

TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		0.49	4		0.47	2	mV
				Full range			6			4	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29		3.2	29	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			1.4			1.4	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			5			5	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.9			15 to −10.9			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.7			13.7			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.4			13.4			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.5			11.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.7			−13.7			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.4			−13.4			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.5			−11.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			81			

† Full range is 0°C to 70°C.

TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0, No load		25°C	1.35	1.7	2.2	1.35	1.7	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is 0°C to 70°C.

TLE2071C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, R_L = 2 kΩ, See Figure 1	A_{VD} = –1, C_L = 100 pF,	25°C	30	40		30	40		V/µs
				Full range	27			27			
SR–	Negative slew rate			25°C	30	45		30	45		V/µs
				Full range	27			27			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		µs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		µV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is 0°C to 70°C.

TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		0.34	4		0.3	2	mV
				Full range			7.6			5.6	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29		3.2	29	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			5			5	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			10			10	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.8			5 to −0.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.7			3.7			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.4			3.4			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.5			1.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.7			−3.7			
		I_O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.4			−3.4			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.5			−1.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is −40°C to 85°C.

TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0, No load		25°C	1.35	1.6	2.2	1.35	1.6	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is –40°C to 85°C.

TLE2071I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF, R_L = 2 kΩ, See Figure 1		25°C		35			35		V/µs
				Full range	22			22			
SR–	Negative slew rate			25°C		38			38		V/µs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		µs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		µV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0, f = 10 kHz		25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω, A_{VD} = 10, R_L = 2 kΩ,		25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF, R_L = 2 kΩ, See Figure 2		25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ , A_{VD} = –1, C_L = 25 pF		25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF, R_L = 2 kΩ, See Figure 2		25°C		56°			56°		

† Full range is –40°C to 85°C.

TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		0.49	4		0.47	2	mV
				Full range			7.6			5.6	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29		3.2	29	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			5			5	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			10			10	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.8			15 to −10.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.7			13.7			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.4			13.4			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.5			11.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.7			−13.7			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.4			−13.4			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.5			−11.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is −40°C to 85°C.

TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0, No load		25°C	1.35	1.7	2.2	1.35	1.7	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is –40°C to 85°C.

TLE2071I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±10 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C	30	40		30	40		V/μs
				Full range	24			24			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	24			24			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is –40°C to 85°C.

TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		0.34	4		0.3	2	mV
				Full range			9.2			7.2	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29*		3.2	29*	μV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			20			20	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			60			60	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.8			5 to −0.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 μA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.6			3.6			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.3			3.3			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.4			1.4			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 μA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.6			−3.6			
		I_O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.3			−3.3			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.4			−1.4			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	78			78			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	88			88			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	93			93			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0, No load		25°C	1.35	1.6	2.2	1.35	1.6	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is –55°C to 125°C.

TLE2071M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF, R_L = 2 kΩ, See Figure 1		25°C		35			35		V/µs
				Full range	20*			20*			
SR–	Negative slew rate			25°C		38			38		V/µs
				Full range	20*			20*			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		µs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		µV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		0.49	4		0.47	2	mV
				Full range			9.2			7.2	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		3.2	29*		3.2	29*	μV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			20			20	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			60			60	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.9			15 to −10.9			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 μA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.6			13.6			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.3			13.3			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.4			11.4			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 μA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.6			−13.6			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.3			−13.3			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.4			−11.4			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	78			78			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	88			88			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	93			93			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	78			78			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_O = 0, No load		25°C	1.35	1.7	2.2	1.35	1.7	2.2	mA
				Full range			2.2			2.2	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is –55°C to 125°C.

TLE2071M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, R_L = 2 kΩ, See Figure 1	A_{VD} = –1, C_L = 100 pF,	25°C	30	40		30	40		V/μs
				Full range	22			22			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8*	10		8*	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478*	637		478*	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2071Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			TLE2071Y MIN	TLE2071Y TYP	TLE2071Y MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0,	V_O = 0,	R_S = 50 Ω		0.49	4	mV
I_{IO}	Input offset current	V_{IC} = 0,	V_O = 0,	See Figure 4		6	100	pA
I_{IB}	Input bias current					20	175	pA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω			15 to −11	15 to 11.9		V
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA			13.8	14.1		V
		I_O = −2 mA			13.5	13.9		
		I_O = −20 mA			11.5	12.3		
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA			−13.8	−14.2		V
		I_O = 2 mA			−13.5	−14		
		I_O = 20 mA			−11.5	−12.4		
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω		80	96		dB
			R_L = 2 kΩ		90	109		
			R_L = 10 kΩ		95	118		
r_i	Input resistance	V_{IC} = 0				10^{12}		Ω
c_i	Input capacitance	V_O = 0, See Figure 5	Common mode			7.5		pF
			Differential			2.5		
z_o	Open-loop output impedance	f = 1 MHz				80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, R_S = 50 Ω		V_O = 0,	80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, R_S = 50 Ω		V_O = 0,	82	99		dB
I_{CC}	Supply current	V_O = 0,	No load		1.35	1.7	2.2	mA
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V		−30	−45		mA
			V_{ID} = −1 V		30	48		

TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		0.9	6		0.65	3.5	mV
				Full range			7.8			5.3	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.3	25		2.3	25	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			1.4			1.4	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			5			5	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.9			5 to −0.9			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.7			3.7			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.4			3.4			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.5			1.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.7			−3.7			
		I_O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.4			−3.4			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.5			−1.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is 0°C to 70°C.

TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA
				Full range			3.9			3.9	
a_x	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

TLE2072C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	22			22			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

† Full range is 0°C to 70°C.

TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		1.1	6		0.7	3.5	mV
				Full range			7.8			5.3	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.4	25		2.4	25	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			1.4			1.4	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			5			5	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.9			15 to −10.9			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.6			13.6			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.4			13.4			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.5			11.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.7			−13.7			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.4			−13.4			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.5			−11.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	81			81			

† Full range is 0°C to 70°C.

TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	3.1	3.9	2.7	3.1	3.9	mA
				Full range			3.9			3.9	
a_X	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

TLE2072C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C	28	40		28	40		V/μs
				Full range	25			25			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	25			25			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is 0°C to 70°C.

TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		0.9	6		0.65	3.5	mV
				Full range			9.1			6.4	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.4	25		2.4	25	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			5			5	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			10			10	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.8			5 to −0.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.7			3.7			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.4			3.4			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.5			1.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.7			−3.7			
		I_O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.4			−3.4			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.5			−1.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is −40°C to 85°C.

TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA
				Full range			3.9			3.9	
a_X	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

TLE2072I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	20			20			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	20			20			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

† Full range is 40°C to 85°C.

TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		1.1	6		0.7	3.5	mV
				Full range			9.1			6.4	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.4	25		2.4	25	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			5			5	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			10			10	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.8			15 to −10.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.7			13.7			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.4			13.4			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.5			11.5			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.7			−13.7			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.4			−13.4			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.5			−11.5			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	79			79			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	94			94			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is −40°C to 85°C.

TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	3.1	3.9	2.7	3.1	3.9	mA
				Full range			3.9			3.9	
a_X	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

TLE2072I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±10 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C	28	40		28	40		V/μs
				Full range	22			22			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 0 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is –40°C to 85°C.

TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω,		25°C		0.9	6		0.65	3.5	mV
				Full range			10.5			8	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.3	25*		2.3	25*	μV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		5	100		5	100	pA
				Full range			20			20	nA
I_{IB}	Input bias current			25°C		15	175		15	175	pA
				Full range			60			60	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	5 to −1	5 to −1.9		5 to −1	5 to −1.9		V
				Full range	5 to −0.8			5 to −0.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 μA		25°C	3.8	4.1		3.8	4.1		V
				Full range	3.6			3.6			
		I_O = −2 mA		25°C	3.5	3.9		3.5	3.9		
				Full range	3.3			3.3			
		I_O = −20 mA		25°C	1.5	2.3		1.5	2.3		
				Full range	1.4			1.4			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 μA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.6			−3.6			
		I_O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.3			−3.3			
		I_O = 20 mA		25°C	−1.5	−2.4		−1.5	−2.4		
				Full range	−1.4			−1.4			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
				Full range	78			78			
			R_L = 2 kΩ	25°C	90	100		90	100		
				Full range	88			88			
			R_L = 10 kΩ	25°C	95	106		95	106		
				Full range	93			93			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		11			11		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
				Full range	68			68			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0,	R_S = 50 Ω	Full range	80			80			dB
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	2.9	3.6	2.7	2.9	3.6	mA
				Full range			3.6			3.6	
a_x	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is –55°C to 125°C.

TLE2072M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	18*			18*			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	18*			18*			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		1.1	6		0.7	3.5	mV
				Full range			10.5			8	
α_{VIO}	Temperature coefficient of input offset voltage			Full range		2.4	25*		2.4	25*	µV/°C
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4		25°C		6	100		6	100	pA
				Full range			20			20	nA
I_{IB}	Input bias current			25°C		20	175		20	175	pA
				Full range			60			60	nA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C	15 to −11	15 to −11.9		15 to −11	15 to −11.9		V
				Full range	15 to −10.8			15 to −10.8			
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 µA		25°C	13.8	14.1		13.8	14.1		V
				Full range	13.6			13.6			
		I_O = −2 mA		25°C	13.5	13.9		13.5	13.9		
				Full range	13.3			13.3			
		I_O = −20 mA		25°C	11.5	12.3		11.5	12.3		
				Full range	11.4			11.4			
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 µA		25°C	−13.8	−14.2		−13.8	−14.2		V
				Full range	−13.6			−13.6			
		I_O = 2 mA		25°C	−13.5	−14		−13.5	−14		
				Full range	−13.3			−13.3			
		I_O = 20 mA		25°C	−11.5	−12.4		−11.5	−12.4		
				Full range	−11.4			−11.4			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
				Full range	78			78			
			R_L = 2 kΩ	25°C	90	109		90	109		
				Full range	89			89			
			R_L = 10 kΩ	25°C	95	118		95	118		
				Full range	93			93			
r_i	Input resistance	V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
			Differential	25°C		2.5			2.5		
z_o	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
				Full range	78			78			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	3.1	3.6	2.7	3.1	3.6	mA
				Full range			3.6			3.6	
a_x	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is –55°C to 125°C.

TLE2072M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, R_L = 2 kΩ, See Figure 1	A_{VD} = –1, C_L = 100 pF,	25°C	28	40		28	40		V/µs
				Full range	20			20			
SR–	Negative slew rate			25°C	30	45		30	45		V/µs
				Full range	20			20			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		µs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		µV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8*	10		8*	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478*	637		478*	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2072Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TLE2072Y			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω			1.1	6	mV
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4			6	100	pA
I_{IB}	Input bias current				20	175	pA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		15 to −11	15 to 11.9		V
V_{OM+}	Maximum positive peak output voltage swing	I_O = −200 μA		13.8	14.1		V
		I_O = −2 mA		13.5	13.9		
		I_O = −20 mA		11.5	12.3		
V_{OM-}	Maximum negative peak output voltage swing	I_O = 200 μA		−13.8	−14.2		V
		I_O = 2 mA		−13.5	−14		
		I_O = 20 mA		−11.5	−12.4		
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V	R_L = 600 Ω	80	96		dB
			R_L = 2 kΩ	90	109		
			R_L = 10 kΩ	95	118		
r_i	Input resistance	V_{IC} = 0			10^{12}		Ω
c_i	Input capacitance	V_{IC} = 0, See Figure 5	Common mode		7.5		pF
			Differential		2.5		
z_o	Open-loop output impedance	f = 1 MHz			80		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		82	99		dB
I_{CC}	Supply current (both channels)	V_O = 0, No load		2.7	3.1	3.9	mA
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	−30	−45		mA
			V_{ID} = −1 V	30	48		

TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			7.1			5.1	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30		10.1	30	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			1400			1400	
I_{IB}	Input bias current				25°C		20	175		20	175	pA
					Full range			5000			5000	
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	5 to –1	5 to –1.9		5 to –1	5 to –1.9		V
					Full range	5 to –0.9			5 to –0.9			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	3.8	4.1		3.8	4.1		V
					Full range	3.7			3.7			
			I_O = –2 mA		25°C	3.5	3.9		3.5	3.9		
					Full range	3.4			3.4			
			I_O = –20 mA		25°C	1.5	2.3		1.5	2.3		
					Full range	1.5			1.5			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–3.8	–4.2		–3.8	–4.2		V
					Full range	–3.7			–3.7			
			I_O = 2 mA		25°C	–3.5	–4.1		–3.5	–4.1		
					Full range	–3.4			–3.4			
			I_O = 20 mA		25°C	–1.5	–2.4		–1.5	–2.4		
					Full range	–1.5			–1.5			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
					Full range	79			79			
				R_L = 2 kΩ	25°C	90	100		90	100		
					Full range	89			89			
				R_L = 10 kΩ	25°C	95	106		95	106		
					Full range	94			94			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		11			11		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
					Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	80			80			

† Full range is 0°C to 70°C.

TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.3	7.5	5.2	6.3	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is 0°C to 70°C.

TLE2074C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	22			22			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

† Full range is 0°C to 70°C.

TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			7.1			5.1	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30		10.1	30	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			1400			1400	
I_{IB}	Input bias current				25°C		25	175		25	175	pA
					Full range			5000			5000	
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		V
					Full range	15 to –10.9			15 to –10.9			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	13.8	14.1		13.8	14.1		V
					Full range	13.7			13.7			
			I_O = –2 mA		25°C	13.5	13.9		13.5	13.9		
					Full range	13.4			13.4			
			I_O = –20 mA		25°C	11.5	12.3		11.5	12.3		
					Full range	11.5			11.5			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–13.8	–14.2		–13.8	–14.2		V
					Full range	–13.7			–13.7			
			I_O = 2 mA		25°C	–13.7	–14		–13.7	–14		
					Full range	–13.6			–13.6			
			I_O = 20 mA		25°C	–11.5	–12.4		–11.5	–12.4		
					Full range	–11.5			–11.5			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
					Full range	79			79			
				R_L = 2 kΩ	25°C	90	109		90	109		
					Full range	89			89			
				R_L = 10 kΩ	25°C	95	118		95	118		
					Full range	94			94			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		7.5			7.5		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
					Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	81			81			

† Full range is 0°C to 70°C.

TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is 0°C to 70°C.

TLE2074C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, R_L = 2 kΩ, See Figure 1	A_{VD} = –1, C_L = 100 pF,	25°C	25	40		25	40		V/μs
				Full range	22			22			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	25			25			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is 0°C to 70°C.

TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			9			7	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30		10.1	30	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			5			5	nA
I_{IB}	Input bias current				25°C		20	175		20	175	pA
					Full range			10			10	nA
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	5 to –1	5 to –1.9		5 to –1	5 to –1.9		V
					Full range	5 to –0.8			5 to –0.8			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	3.8	4.1		3.8	4.1		V
					Full range	3.7			3.7			
			I_O = –2 mA		25°C	3.5	3.9		3.5	3.9		
					Full range	3.4			3.4			
			I_O = –20 mA		25°C	1.5	2.3		1.5	2.3		
					Full range	1.5			1.5			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–3.8	–4.2		–3.8	–4.2		V
					Full range	–3.7			–3.7			
			I_O = 2 mA		25°C	–3.5	–4.1		–3.5	–4.1		
					Full range	–3.4			–3.4			
			I_O = 20 mA		25°C	–1.5	–2.4		–1.5	–2.4		
					Full range	–1.5			–1.5			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
					Full range	79			79			
				R_L = 2 kΩ	25°C	90	100		90	100		
					Full range	89			89			
				R_L = 10 kΩ	25°C	95	106		95	106		
					Full range	94			94			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		11			11		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
					Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	80			80			

† Full range is –40°C to 85°C.

TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.3	7.5	5.2	6.3	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is –40°C to 85°C.

TLE2074I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	20			20			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	20			20			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

† Full range is –40°C to 85°C.

TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			9			7	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30		10.1	30	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			5			5	nA
I_{IB}	Input bias current				25°C		25	175		25	175	pA
					Full range			10			10	nA
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		V
					Full range	15 to –10.8			15 to –10.8			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	13.8	14.1		13.8	14.1		V
					Full range	13.7			13.7			
			I_O = –2 mA		25°C	13.5	13.9		13.5	13.9		
					Full range	13.4			13.4			
			I_O = –20 mA		25°C	11.5	12.3		11.5	12.3		
					Full range	11.5			11.5			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–13.8	–14.2		–13.8	–14.2		V
					Full range	–13.7			–13.7			
			I_O = 2 mA		25°C	–13.5	–14		–13.5	–14		
					Full range	–13.4			–13.4			
			I_O = 20 mA		25°C	–11.5	–12.4		–11.5	–12.4		
					Full range	–11.5			–11.5			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
					Full range	79			79			
				R_L = 2 kΩ	25°C	90	109		90	109		
					Full range	89			89			
				R_L = 10 kΩ	25°C	95	118		95	118		
					Full range	94			94			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		7.5			7.5		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
					Full range	79			79			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	80			80			

† Full range is –40°C to 85°C.

TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is –40°C to 85°C.

TLE2074I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±10 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C	25	40		25	40		V/μs
				Full range	19			19			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	22			22			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55		28	55	nV/√Hz
			f = 10 kHz			11.6	17		11.6	17	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

† Full range is –40°C to 85°C.

TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			10.5			8.5	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30*		10.1	30*	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			20			20	nA
I_{IB}	Input bias current				25°C		20	175		20	175	pA
					Full range			60			60	nA
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	5 to –1	5 to –1.9		5 to –1	5 to –1.9		V
					Full range	5 to –0.8			5 to –0.8			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	3.8	4.1		3.8	4.1		V
					Full range	3.6			3.6			
			I_O = –2 mA		25°C	3.5	3.9		3.5	3.9		
					Full range	3.3			3.3			
			I_O = –20 mA		25°C	1.5	2.3		1.5	2.3		
					Full range	1.4			1.4			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–3.8	–4.2		–3.8	–4.2		V
					Full range	–3.6			–3.6			
			I_O = 2 mA		25°C	–3.5	–4.1		–3.5	–4.1		
					Full range	–3.3			–3.3			
			I_O = 20 mA		25°C	–1.5	–2.4		–1.5	–2.4		
					Full range	–1.4			–1.4			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 2.3 V	R_L = 600 Ω	25°C	80	91		80	91		dB
					Full range	78			78			
				R_L = 2 kΩ	25°C	90	100		90	100		
					Full range	88			88			
				R_L = 10 kΩ	25°C	95	106		95	106		
					Full range	93			93			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		11			11		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	70	89		70	89		dB
					Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	80			80			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.3	7.5	5.2	6.3	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

† Full range is –55°C to 125°C.

TLE2074M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = ±2.3 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C		35			35		V/μs
				Full range	18*			18*			
SR–	Negative slew rate			25°C		38			38		V/μs
				Full range	18*			18*			
t_s	Settling time	A_{VD} = –1, 2-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.25			0.25		μs
			To 1 mV			0.4			0.4		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 5 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.013%			0.013%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		9.4			9.4		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 4 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C		2.8			2.8		MHz
f_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		56°			56°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω		25°C		–1.6	5		–0.5	3	mV
					Full range			10.5			8.5	
α_{VIO}	Temperature coefficient of input offset voltage				Full range		10.1	30*		10.1	30*	µV/°C
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4		25°C		15	100		15	100	pA
					Full range			20			20	nA
I_{IB}	Input bias current				25°C		25	175		25	175	pA
					Full range			60			60	nA
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		V
					Full range	15 to –10.8			15 to –10.8			
V_{OM+}	Maximum positive peak output voltage swing		I_O = –200 µA		25°C	13.8	14.1		13.8	14.1		V
					Full range	13.6			13.6			
			I_O = –2 mA		25°C	13.5	13.9		13.5	13.9		
					Full range	13.3			13.3			
			I_O = –20 mA		25°C	11.5	12.3		11.5	12.3		
					Full range	11.4			11.4			
$V_{OM–}$	Maximum negative peak output voltage swing		I_O = 200 µA		25°C	–13.8	–14.2		–13.8	–14.2		V
					Full range	–13.6			–13.6			
			I_O = 2 mA		25°C	–13.5	–14		–13.5	–14		
					Full range	–13.3			–13.3			
			I_O = 20 mA		25°C	–11.5	–12.4		–11.5	–12.4		
					Full range	–11.4			–11.4			
A_{VD}	Large-signal differential voltage amplification		V_O = ± 10 V	R_L = 600 Ω	25°C	80	96		80	96		dB
					Full range	78			78			
				R_L = 2 kΩ	25°C	90	109		90	109		
					Full range	88			88			
				R_L = 10 kΩ	25°C	95	118		95	118		
					Full range	93			93			
r_i	Input resistance		V_{IC} = 0		25°C		10^{12}			10^{12}		Ω
c_i	Input capacitance	Common mode	V_{IC} = 0, See Figure 5		25°C		7.5			7.5		pF
		Differential			25°C		2.5			2.5		
z_o	Open-loop output impedance		f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		25°C	80	98		80	98		dB
					Full range	78			78			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		25°C	82	99		82	99		dB
					Full range	80			80			

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (four amplifiers)	V_O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range			7.5			7.5	
	Crosstalk attenuation	V_{IC} = 0,	R_L = 2 kΩ	25°C		120			120		dB
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C	–30	–45		–30	–45		mA
			V_{ID} = –1 V		30	48		30	48		

† Full range is –55°C to 125°C.

TLE2074M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

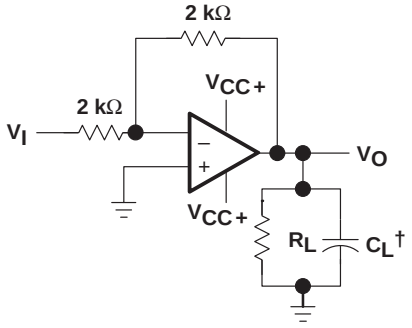
PARAMETER		TEST CONDITIONS		T_A†	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, R_L = 2 kΩ, See Figure 1	A_{VD} = –1, C_L = 100 pF,	25°C	25	40		25	40		V/μs
				Full range	17			17			
SR–	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	20			20			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1 kΩ, C_L = 100 pF	To 10 mV	25°C		0.4			0.4		μs
			To 1 mV			1.5			1.5		
V_n	Equivalent input noise voltage	R_S = 20 Ω, See Figure 3	f = 10 Hz	25°C		28	55*		28	55*	nV/√Hz
			f = 10 kHz			11.6	17*		11.6	17*	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C		6			6		μV
			f = 0.1 Hz to 10 Hz			0.6			0.6		
I_n	Equivalent input noise current	V_{IC} = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, R_S = 25 Ω	A_{VD} = 10, R_L = 2 kΩ,	25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C	8*	10		8*	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ,	A_{VD} = –1, C_L = 25 pF	25°C	478*	637		478*	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, C_L = 25 pF,	R_L = 2 kΩ, See Figure 2	25°C		57°			57°		

*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2074Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C (unless otherwise noted)

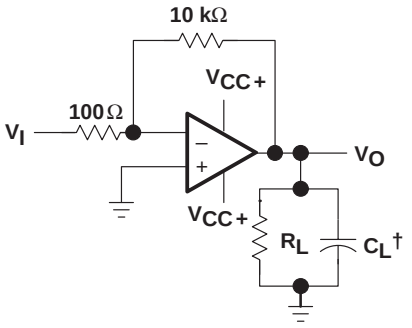
PARAMETER			TEST CONDITIONS		TLE2074Y MIN	TLE2074Y TYP	TLE2074Y MAX	UNIT
V_{IO}	Input offset voltage		V_{IC} = 0, V_O = 0, R_S = 50 Ω				5	mV
I_{IO}	Input offset current		V_{IC} = 0, V_O = 0, See Figure 4			15	100	pA
I_{IB}	Input bias current					25	175	pA
V_{ICR}	Common-mode input voltage range		R_S = 50 Ω		15 to −11	15 to 11.9		V
V_{OM+}	Maximum positive peak output voltage swing		I_O = −200 µA		13.8	14.1		V
			I_O = −2 mA		13.5	13.9		
			I_O = −20 mA		11.5	12.3		
V_{OM-}	Maximum negative peak output voltage swing		I_O = 200 µA		−13.8	−14.2		V
			I_O = 2 mA		−13.5	−14		
			I_O = 20 mA		−11.5	−12.4		
A_{VD}	Large-signal differential voltage amplification		V_O = ± 10 V	R_L = 600 Ω	80	96		dB
				R_L = 2 kΩ	90	109		
				R_L = 10 kΩ	95	118		
r_i	Input resistance		V_{IC} = 0			10^{12}		Ω
c_i	Input capacitance	Common mode	V_O = 0, See Figure 5			7.5		pF
		Differential				2.5		
z_o	Open-loop output impedance		f = 1 MHz			80		Ω
CMRR	Common-mode rejection ratio		V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω		80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)		$V_{CC\pm}$ = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω		82	99		dB
I_{CC}	Supply current (four amplifiers)		V_O = 0, No load		5.2	6.5	7.5	mA
I_{OS}	Short-circuit output current		V_O = 0	V_{ID} = 1 V	−30	−45		mA
				V_{ID} = −1 V	30	48		

PARAMETER MEASUREMENT INFORMATION



† Includes fixture capacitance

Figure 1. Slew-Rate Test Circuit



† Includes fixture capacitance

Figure 2. Unity-Gain Bandwidth and Phase-Margin Test Circuit

PARAMETER MEASUREMENT INFORMATION

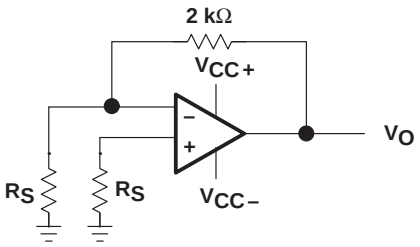


Figure 3. Noise-Voltage Test Circuit

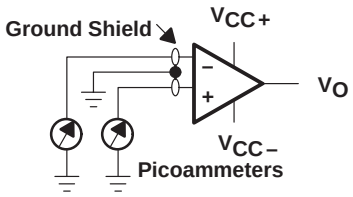


Figure 4. Input-Bias and Offset-Current Test Circuit

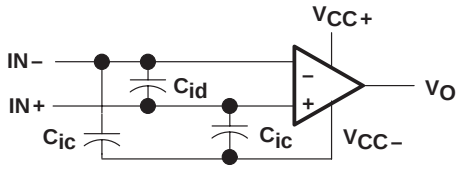


Figure 5. Internal Input Capacitance

typical values

Typical values presented in this data sheet represent the median (50% point) of device parametric performance.

input bias and offset current

At the picoampere bias current level typical of the TLE207x and TLE207xA, accurate measurement of the bias current becomes difficult. Not only does this measurement require a picoammeter but test socket leakages can easily exceed the actual device bias currents. To accurately measure these small currents, Texas Instruments uses a two-step process. The socket leakage is measured using picoammeters with bias voltages applied but with no device in the socket. The device is then inserted in the socket and a second test is performed that measures both the socket leakage and the device input bias current. The two measurements are then subtracted algebraically to determine the bias current of the device.

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution	6, 7, 8
α_{VIO}	Temperature coefficient of input offset voltage	Distribution	9, 10, 11
I_{IO}	Input offset current	vs Free-air temperature	12, 13
I_{IB}	Input bias current	vs Free-air temperature vs Total supply voltage	12, 13 14
V_{ICR}	Common-mode input voltage range	vs Free-air temperature	15
V_O	Output voltage	vs Differential input voltage	16, 17
V_{OM+}	Maximum positive peak output voltage	vs Output current	18
V_{OM-}	Maximum negative peak output voltage	vs Output current	19
V_{OM}	Maximum peak output voltage	vs Free-air temperature vs Supply voltage	20, 21 22
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	23
V_O	Output voltage	vs Settling time	24
A_{VD}	Large-signal differential voltage amplification	vs Load resistance vs Free-air temperature	25 26, 27
A_{VD}	Small-signal differential voltage amplification	vs Frequency	28, 29
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	30 31
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	32 33
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature vs Differential input voltage	34, 35, 36 37, 38, 39 40 – 45
I_{OS}	Short-circuit output current	vs Supply voltage vs Elapsed time vs Free-air temperature	46 47 48
SR	Slew rate	vs Free-air temperature vs Load resistance vs Differential input voltage	49, 50 51 52
V_n	Equivalent Input noise voltage (spectral density)	vs Frequency	53
V_n	Input referred noise voltage	vs Noise bandwidth Over a 10-second time interval	54 55
	Third-octave spectral noise density	vs Frequency bands	56
THD + N	Total harmonic distortion plus noise	vs Frequency	57, 58
B_1	Unity-gain bandwidth	vs Load capacitance	59
	Gain-bandwidth product	vs Free-air temperature vs Supply voltage	60 61
	Gain margin	vs Load capacitance	62
ϕ_m	Phase margin	vs Free-air temperature vs Supply voltage vs Load capacitance	63 64 65
	Phase shift	vs Frequency	28, 29
	Noninverting large-signal pulse response	vs Time	66
	Small-signal pulse response	vs Time	67
z_o	Closed-loop output impedance	vs Frequency	68
	Crosstalk attenuation	vs Frequency	69

TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2071
INPUT OFFSET VOLTAGE

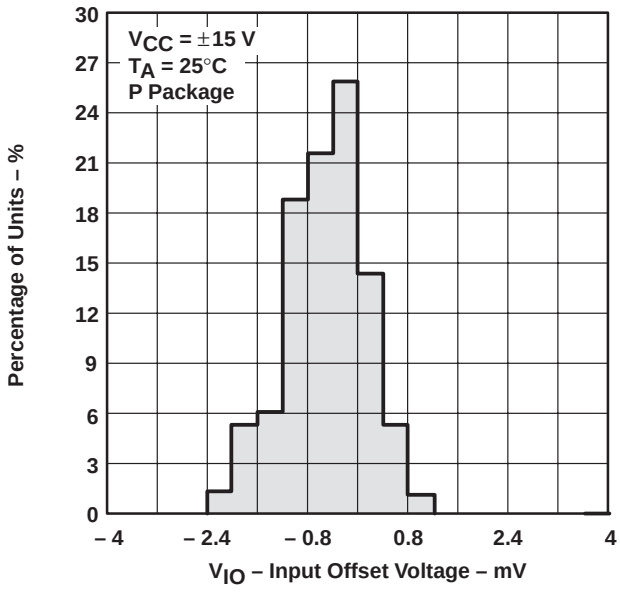


Figure 6

DISTRIBUTION OF TLE2072
INPUT OFFSET VOLTAGE

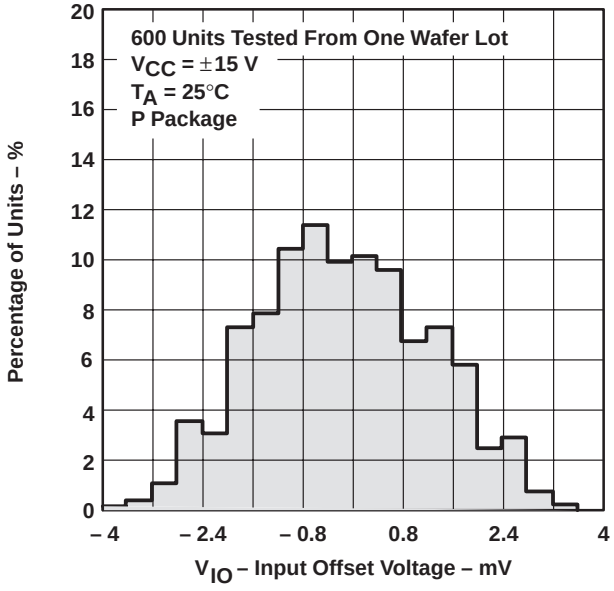


Figure 7

DISTRIBUTION OF TLE2074
INPUT OFFSET VOLTAGE

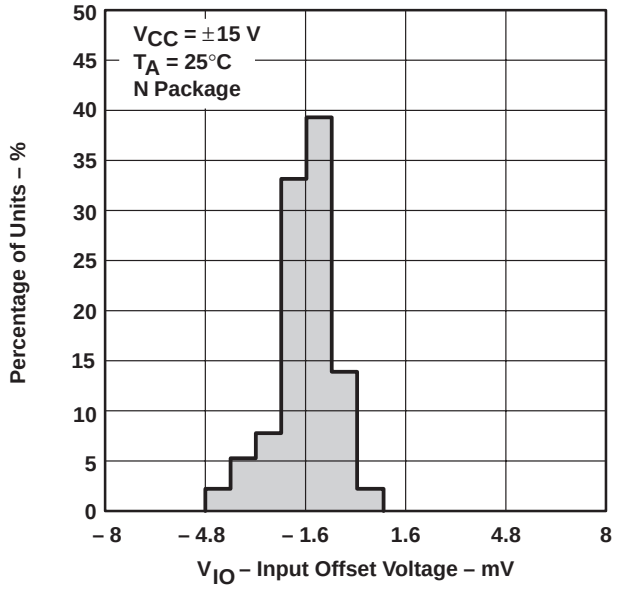


Figure 8

DISTRIBUTION OF TLE2071 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

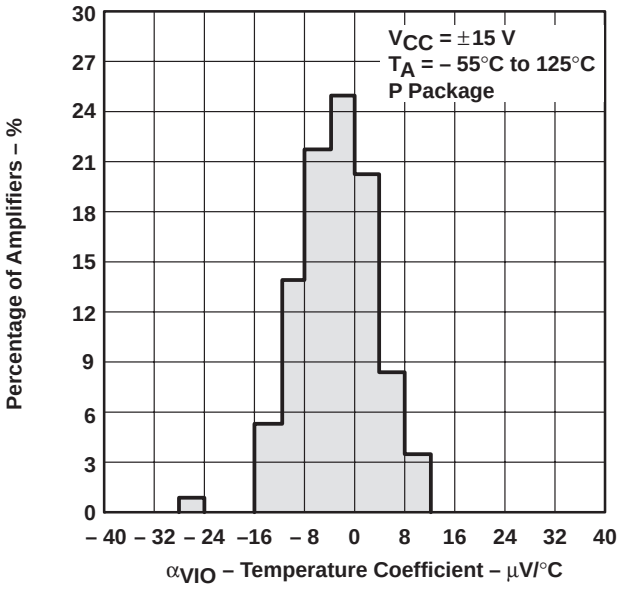


Figure 9

TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2072 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT

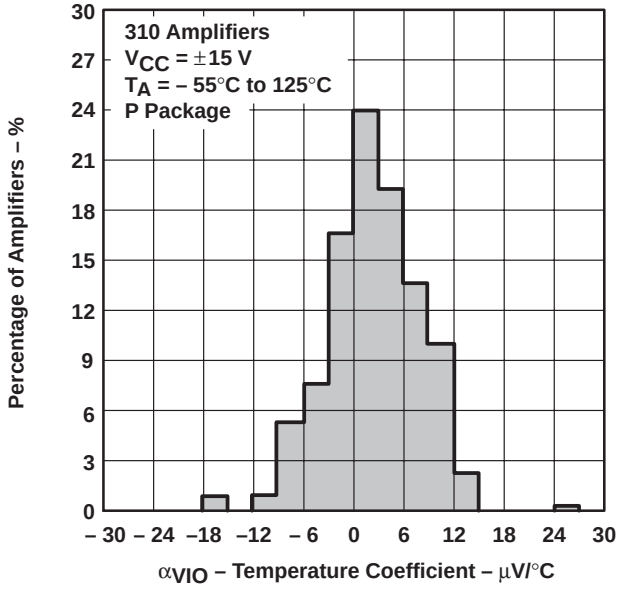


Figure 10

DISTRIBUTION OF TLE2074 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT

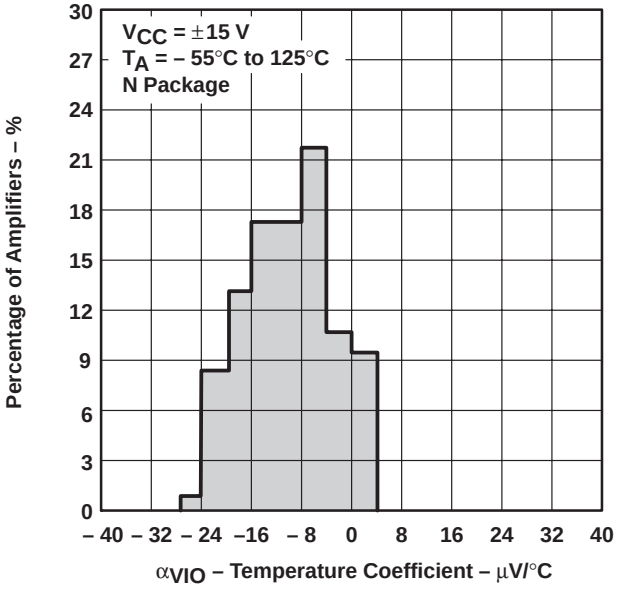


Figure 11

INPUT BIAS CURRENT AND INPUT OFFSET CURRENT† vs FREE-AIR TEMPERATURE

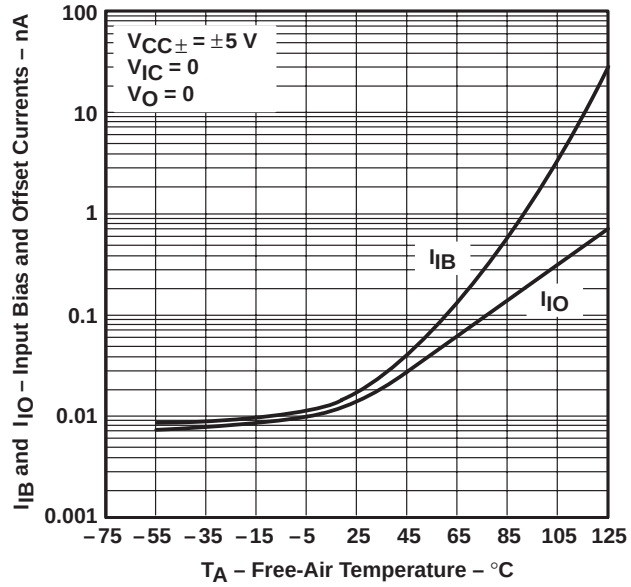


Figure 12

INPUT BIAS CURRENT AND INPUT OFFSET CURRENT† vs FREE-AIR TEMPERATURE

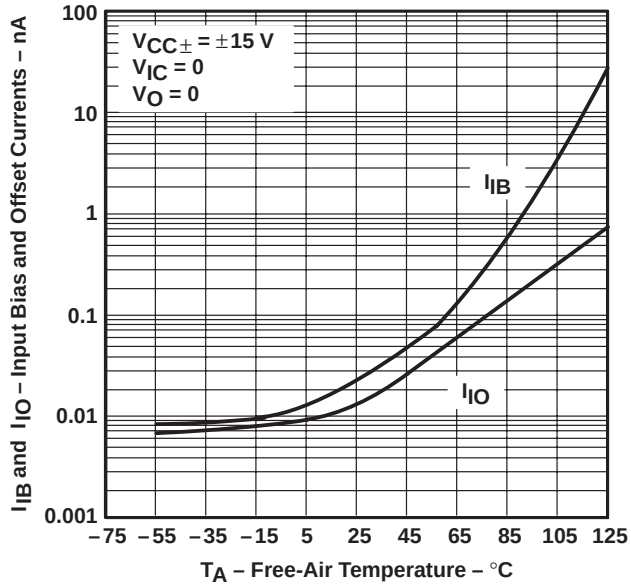


Figure 13

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

INPUT BIAS CURRENT vs TOTAL SUPPLY VOLTAGE

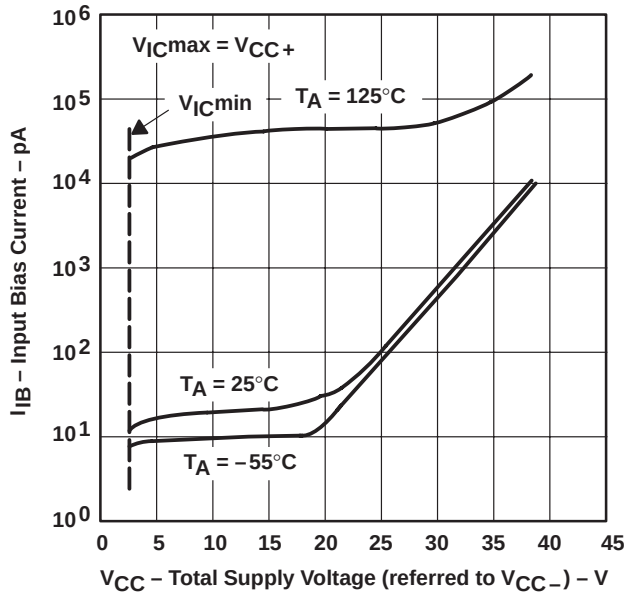


Figure 14

COMMON-MODE INPUT VOLTAGE RANGE† vs FREE-AIR TEMPERATURE

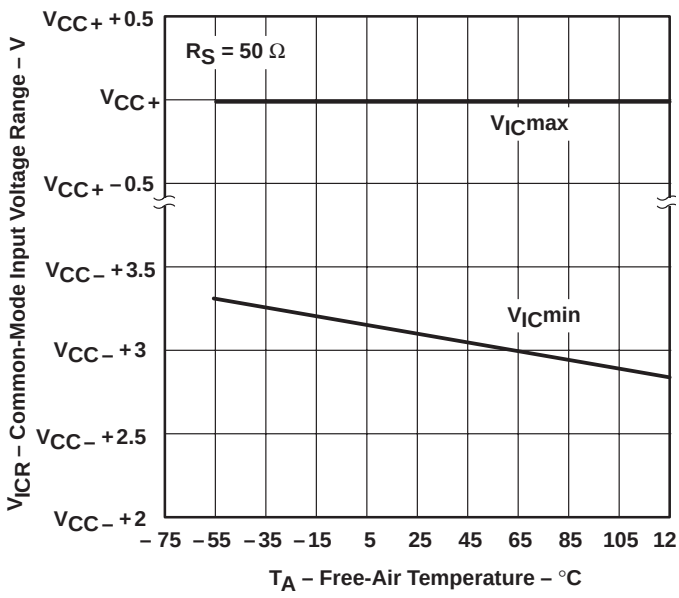


Figure 15

OUTPUT VOLTAGE vs DIFFERENTIAL INPUT VOLTAGE

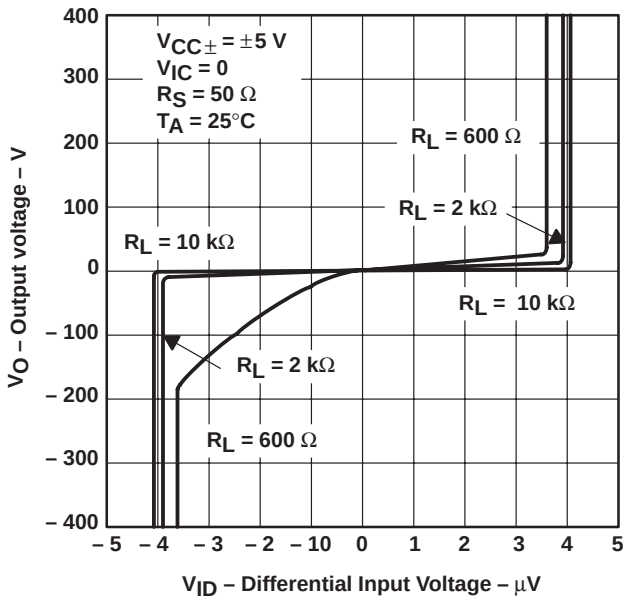


Figure 16

OUTPUT VOLTAGE vs DIFFERENTIAL INPUT VOLTAGE

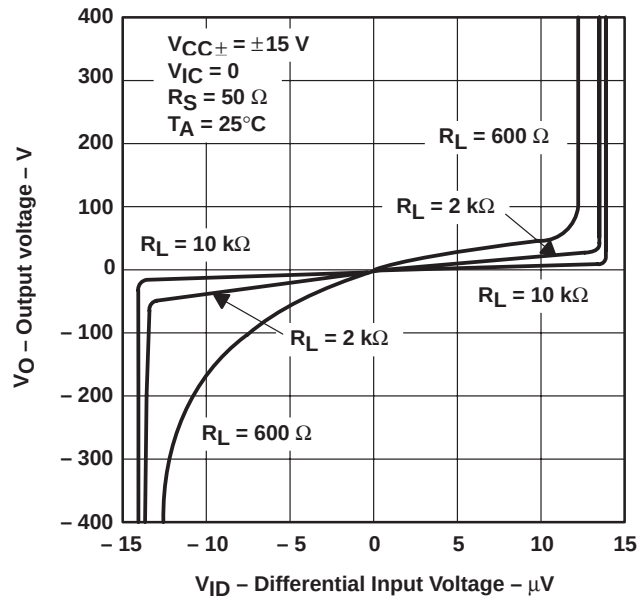


Figure 17

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE† vs OUTPUT CURRENT

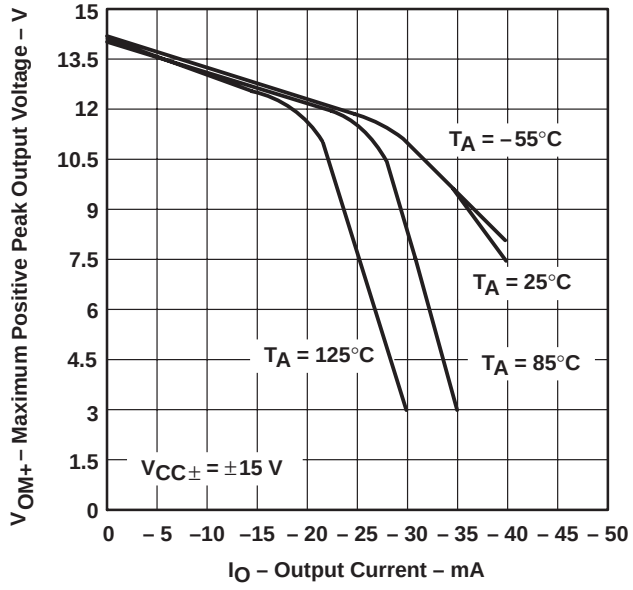


Figure 18

MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE† vs OUTPUT CURRENT

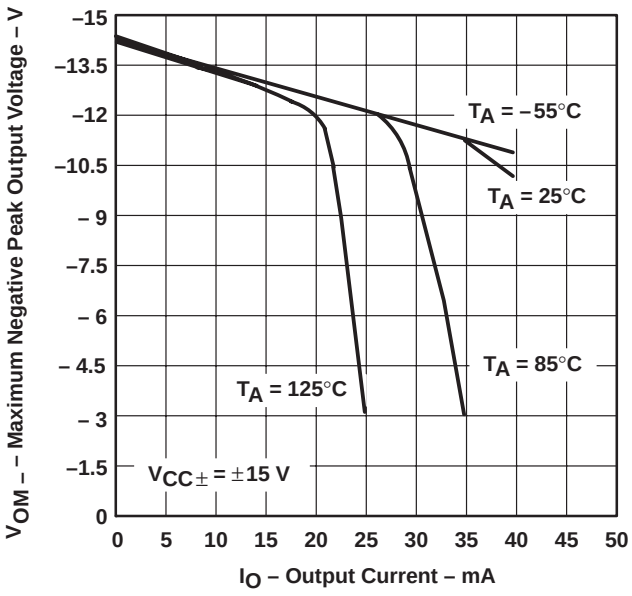


Figure 19

MAXIMUM PEAK OUTPUT VOLTAGE† vs FREE-AIR TEMPERATURE

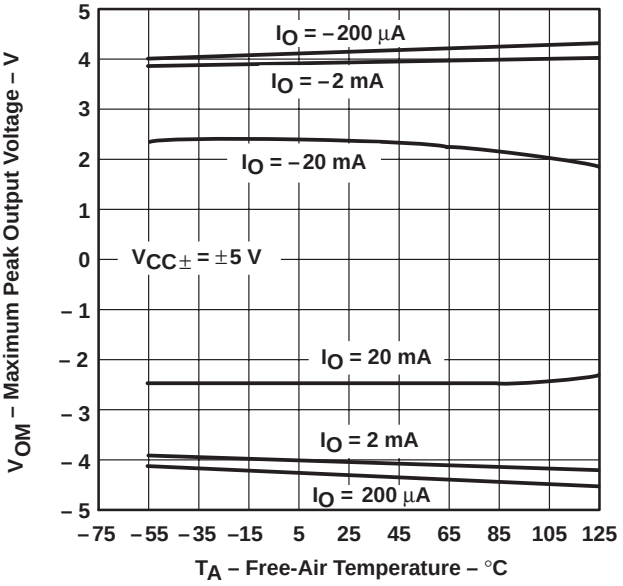


Figure 20

MAXIMUM PEAK OUTPUT VOLTAGE† vs FREE-AIR TEMPERATURE

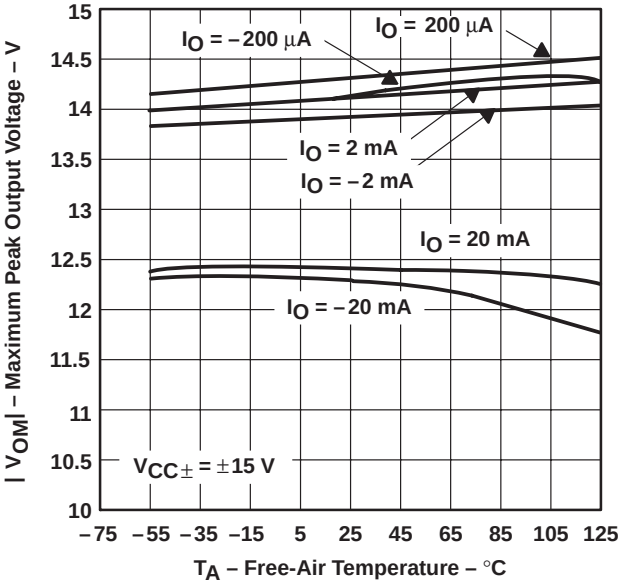


Figure 21

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

MAXIMUM PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

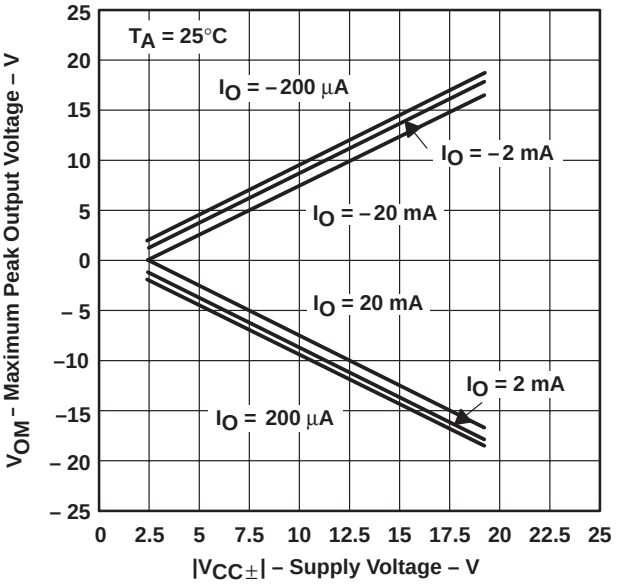


Figure 22

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE† vs FREQUENCY

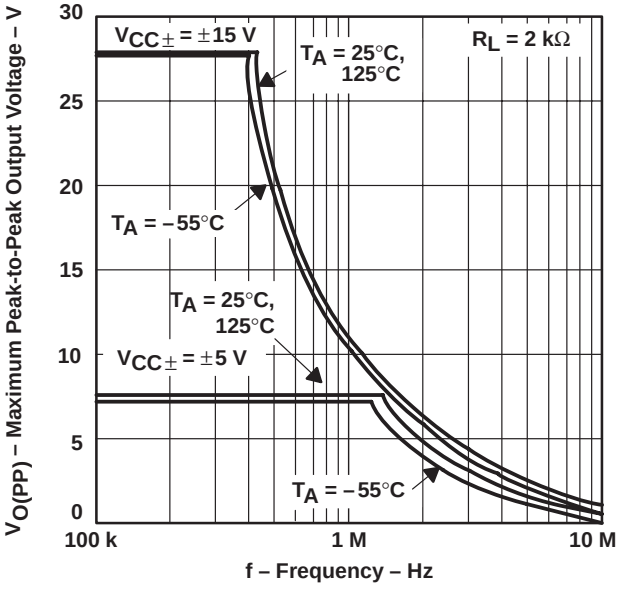


Figure 23

OUTPUT VOLTAGE vs SETTLING TIME

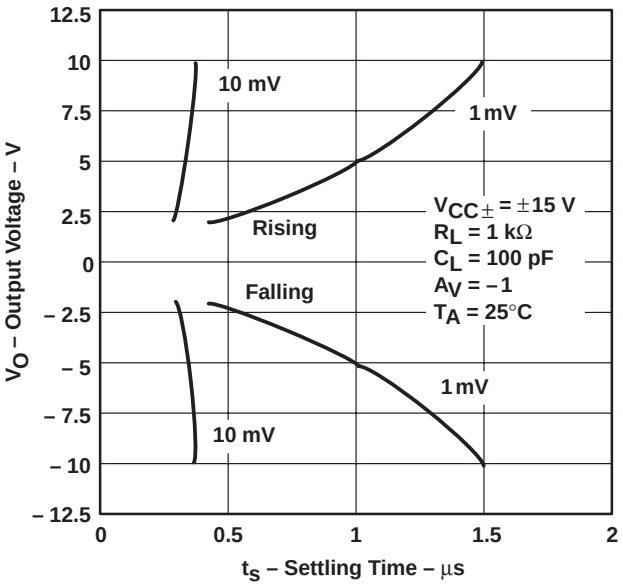


Figure 24

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs LOAD RESISTANCE

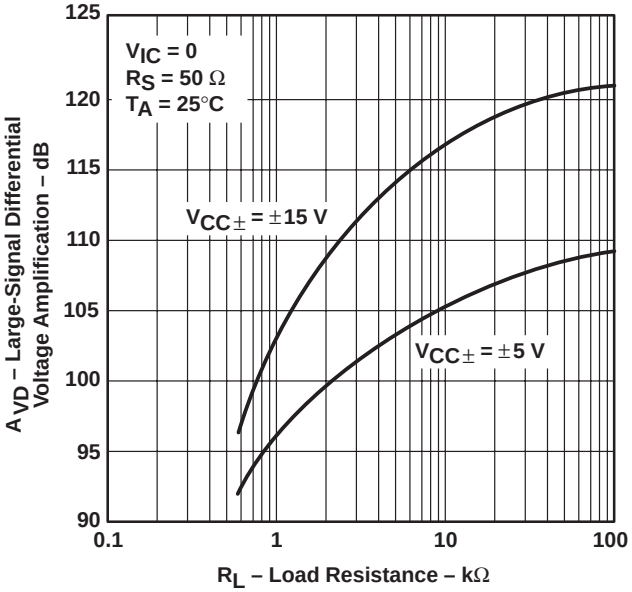


Figure 25

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION† vs FREE-AIR TEMPERATURE

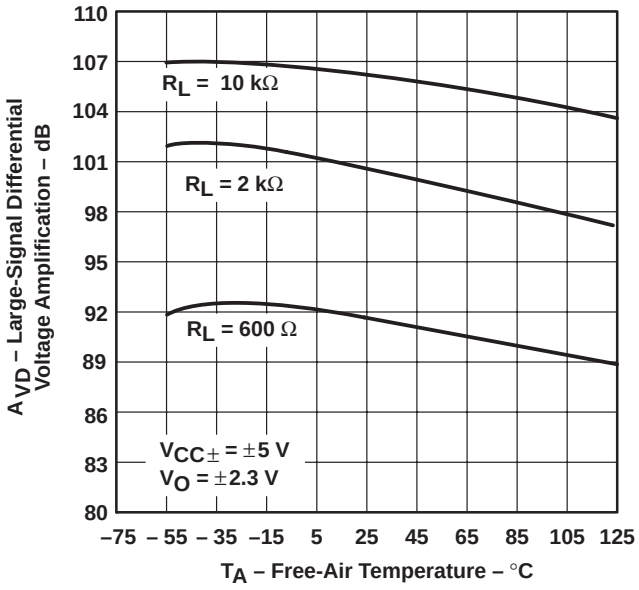


Figure 26

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION† vs FREE-AIR TEMPERATURE

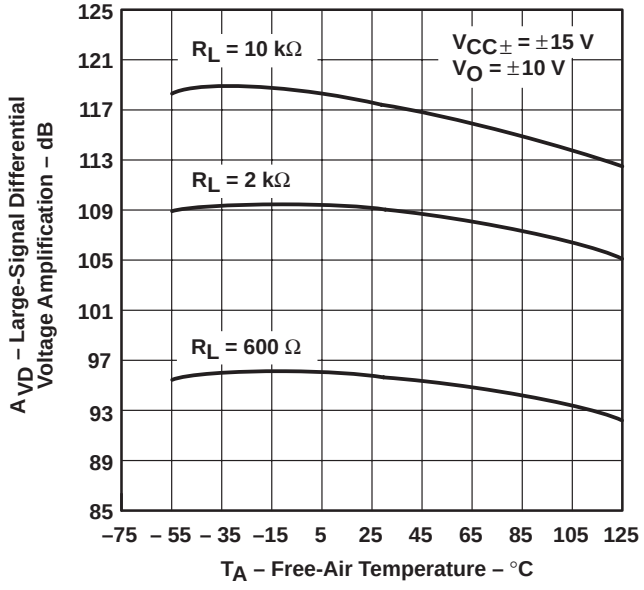


Figure 27

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

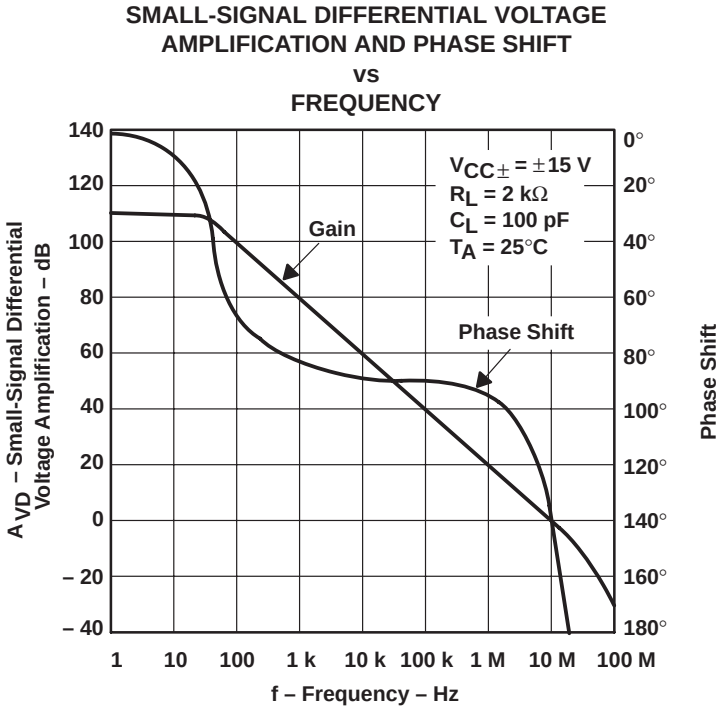


Figure 28

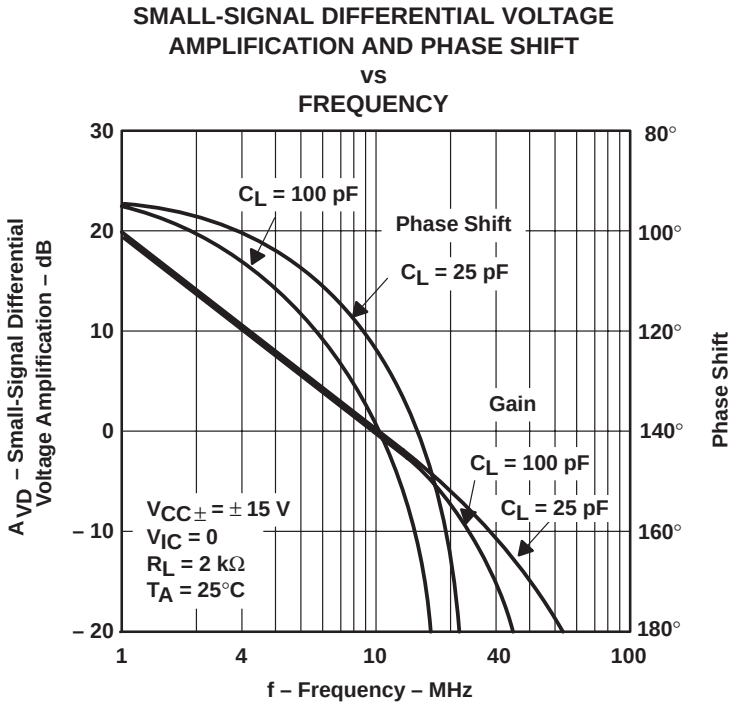


Figure 29

TYPICAL CHARACTERISTICS

COMMON-MODE REJECTION RATIO vs FREQUENCY

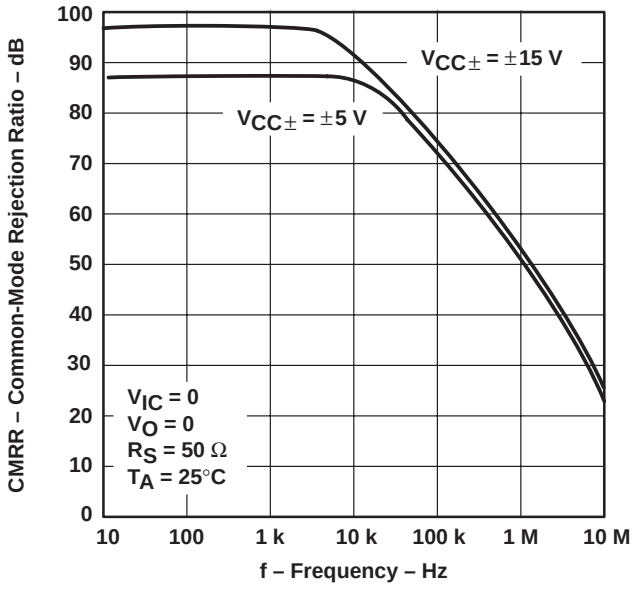


Figure 30

COMMON-MODE REJECTION RATIO† vs FREE-AIR TEMPERATURE

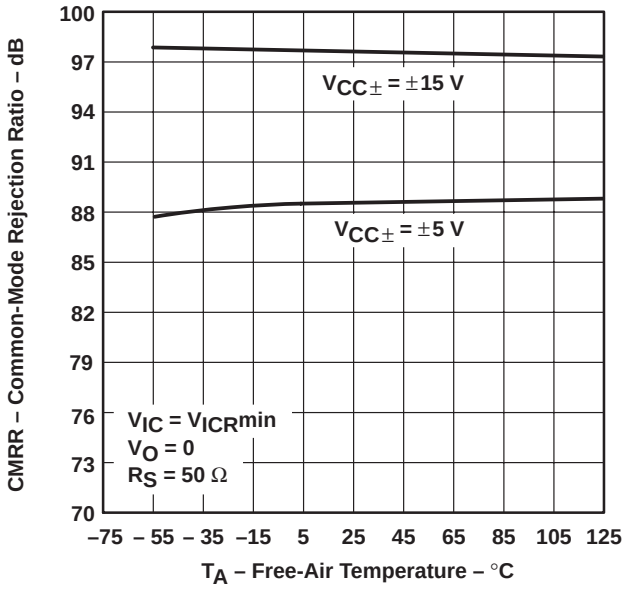


Figure 31

SUPPLY-VOLTAGE REJECTION RATIO vs FREQUENCY

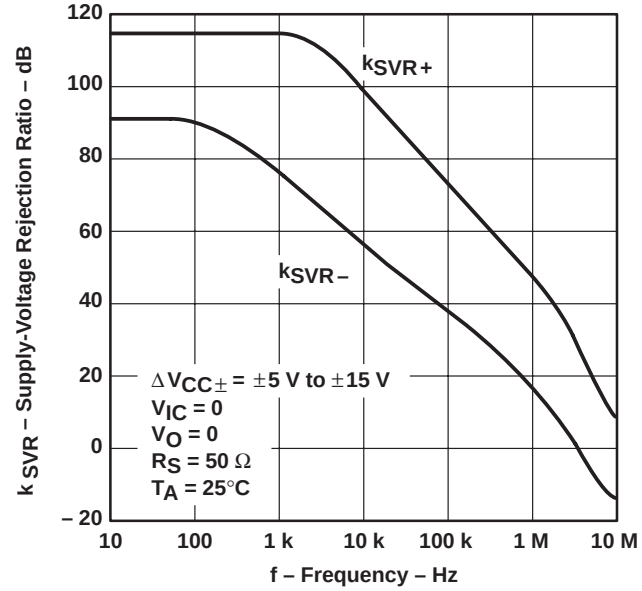


Figure 32

SUPPLY-VOLTAGE REJECTION RATIO† vs FREE-AIR TEMPERATURE

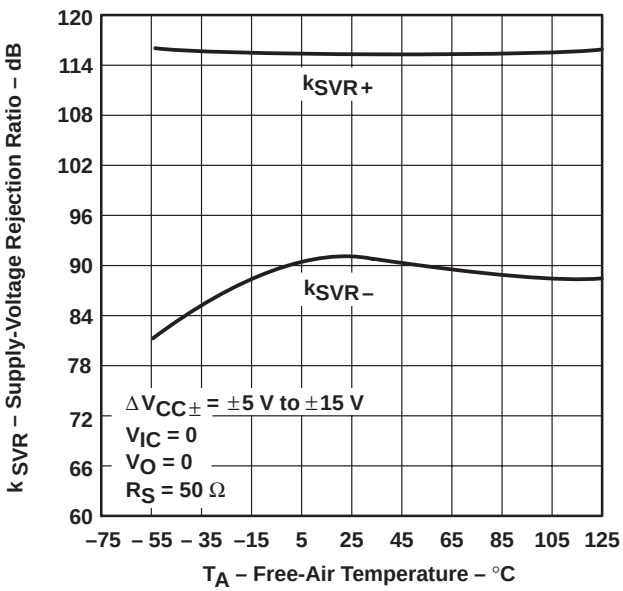


Figure 33

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

**TLE2071
SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

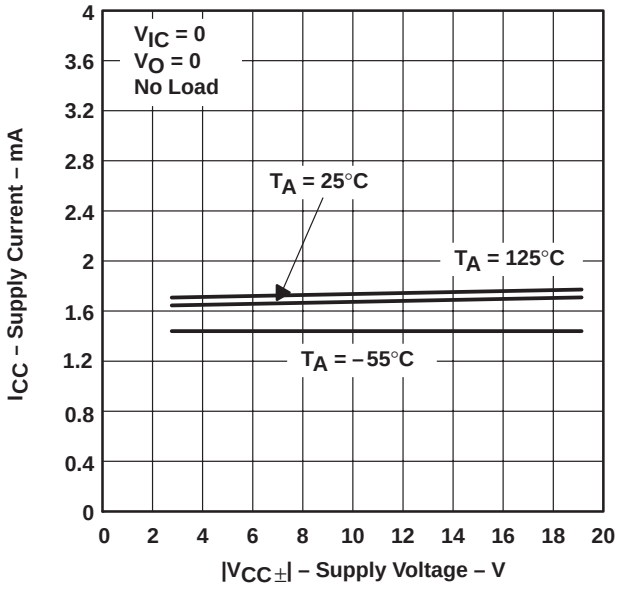


Figure 34

**TLE2072
SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

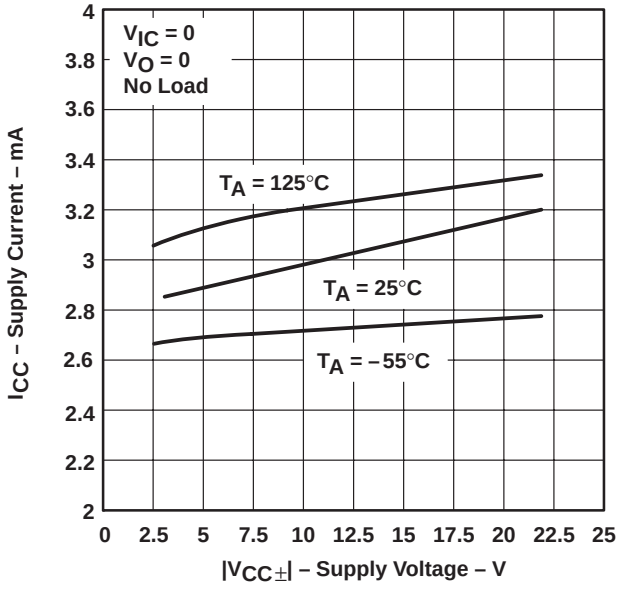


Figure 35

**TLE2074
SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

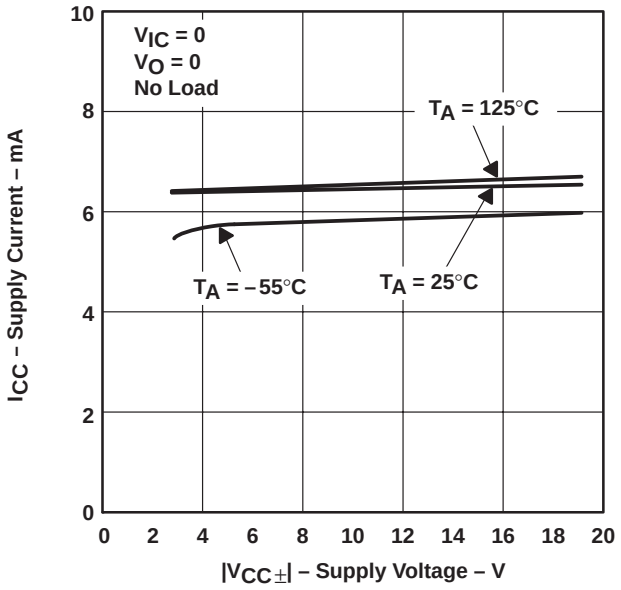


Figure 36

**TLE2071
SUPPLY CURRENT† vs
FREE-AIR TEMPERATURE**

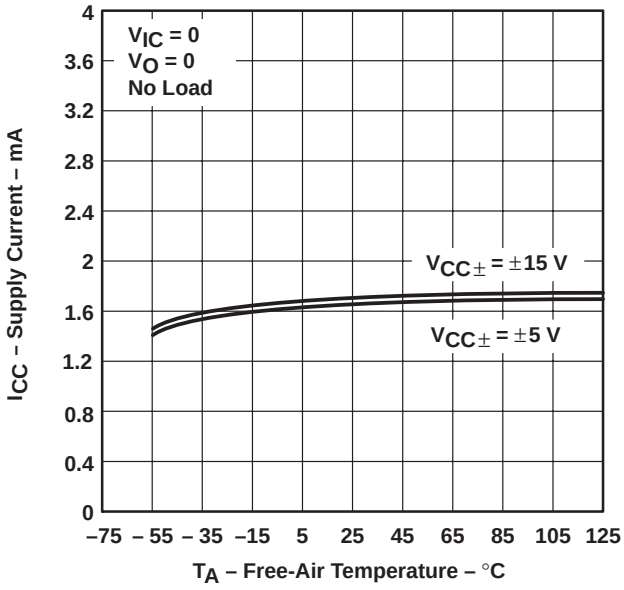


Figure 37

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

TLE2072
SUPPLY CURRENT† vs FREE-AIR TEMPERATURE

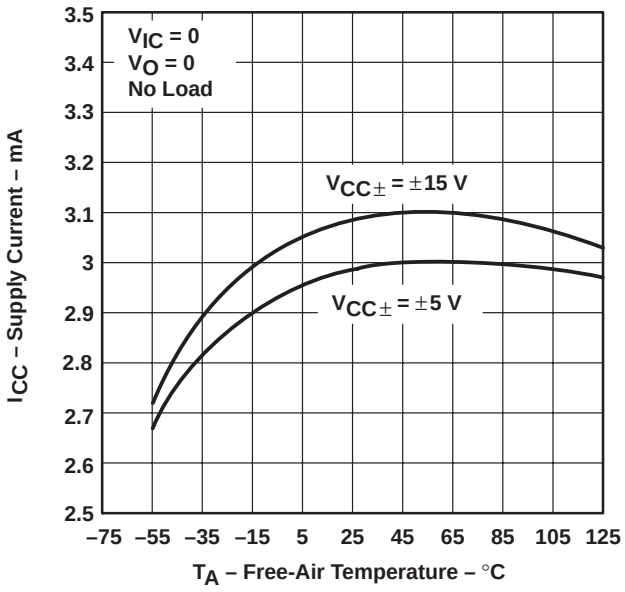


Figure 38

TLE2074
SUPPLY CURRENT† vs FREE-AIR TEMPERATURE

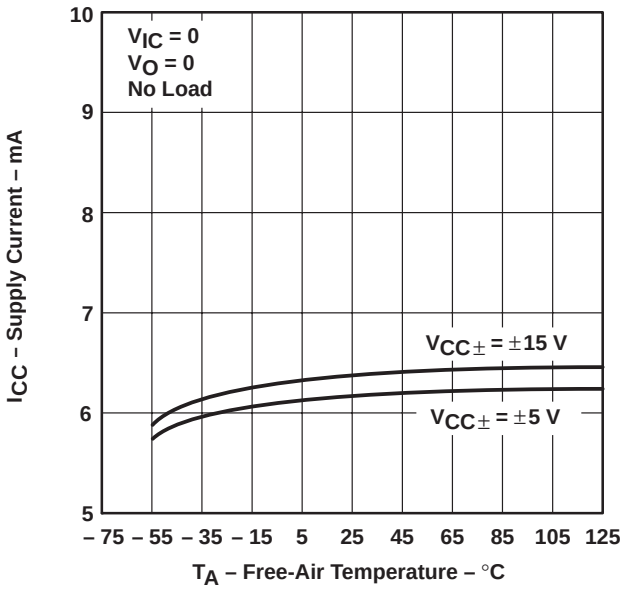


Figure 39

TLE2071
SUPPLY CURRENT vs DIFFERENTIAL INPUT VOLTAGE

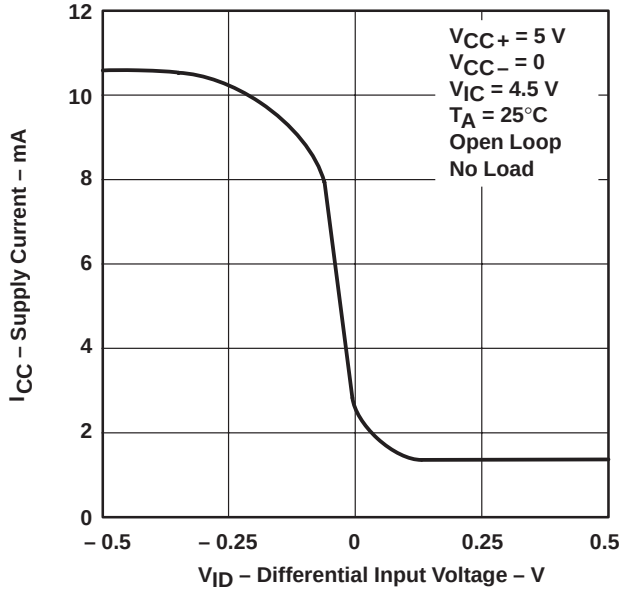


Figure 40

TLE2072
SUPPLY CURRENT vs DIFFERENTIAL INPUT VOLTAGE

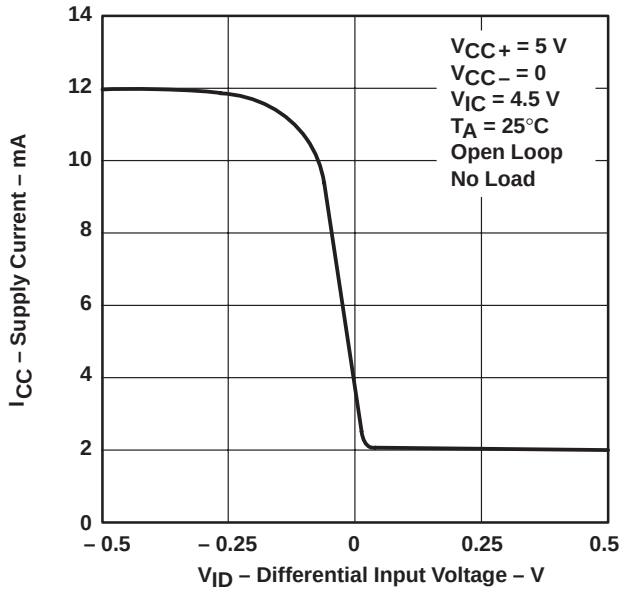


Figure 41

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

**TLE2074
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

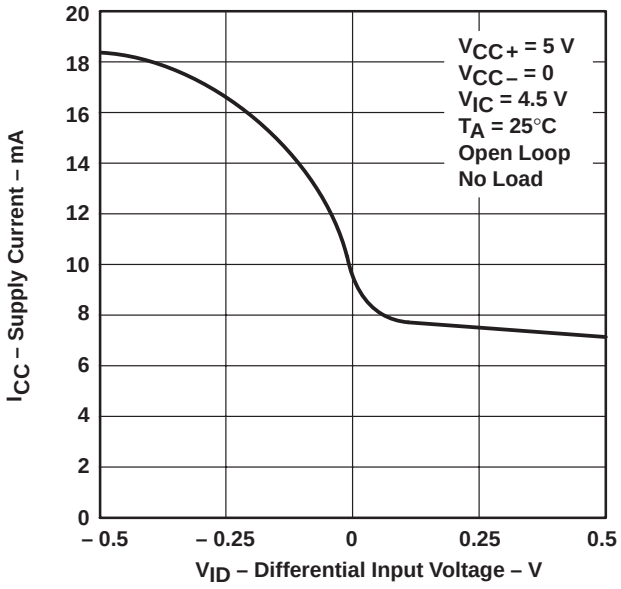


Figure 42

**TLE2071
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

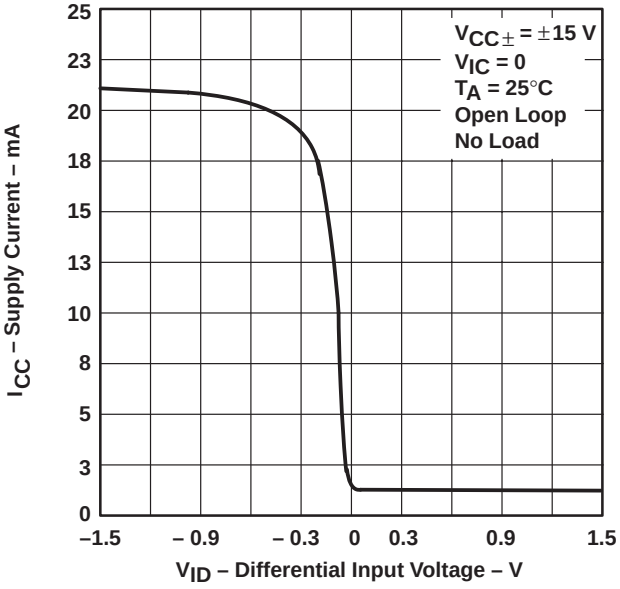


Figure 43

**TLE2072
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

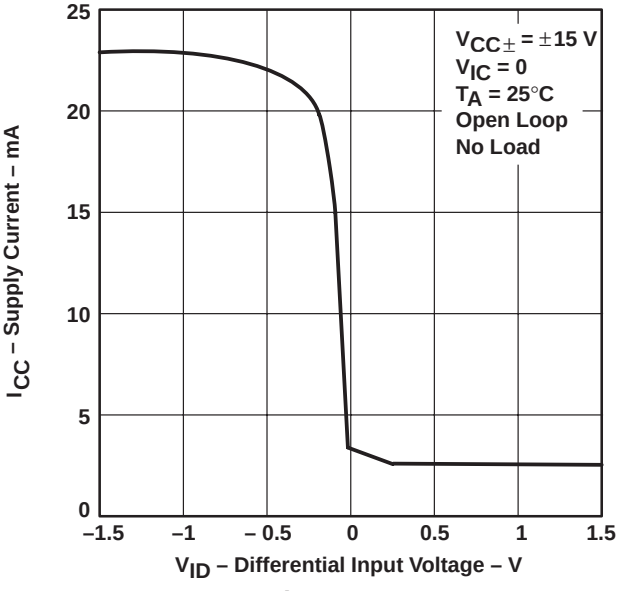


Figure 44

**TLE2074
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

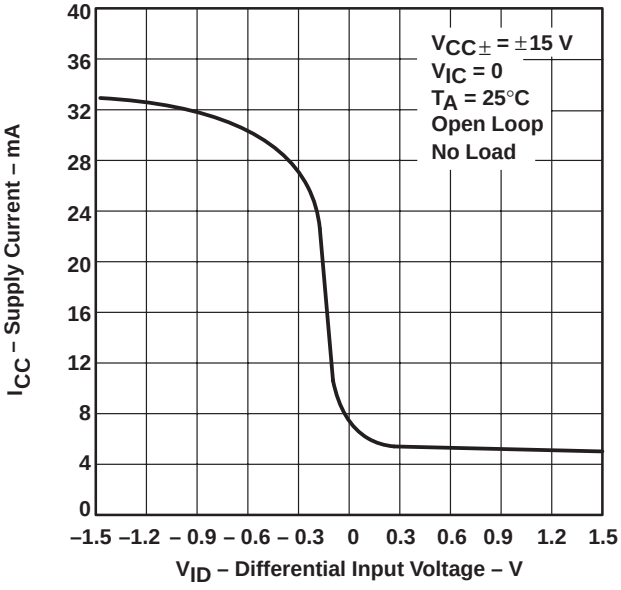


Figure 45

TYPICAL CHARACTERISTICS

SHORT-CIRCUIT OUTPUT CURRENT vs SUPPLY VOLTAGE

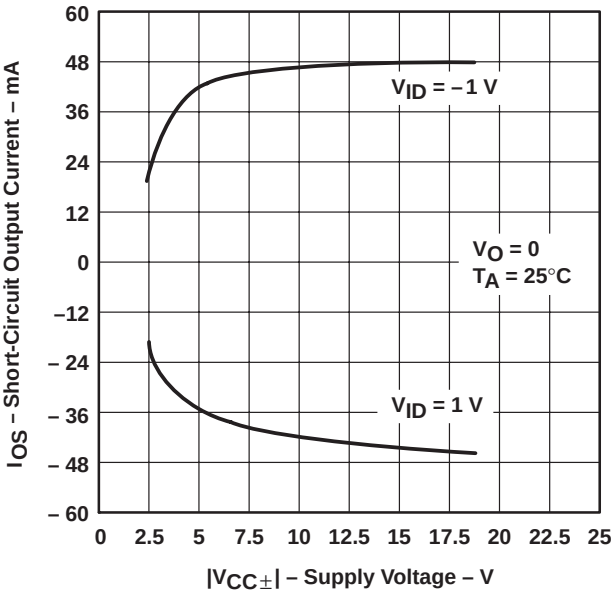


Figure 46

SHORT-CIRCUIT OUTPUT CURRENT vs ELAPSED TIME

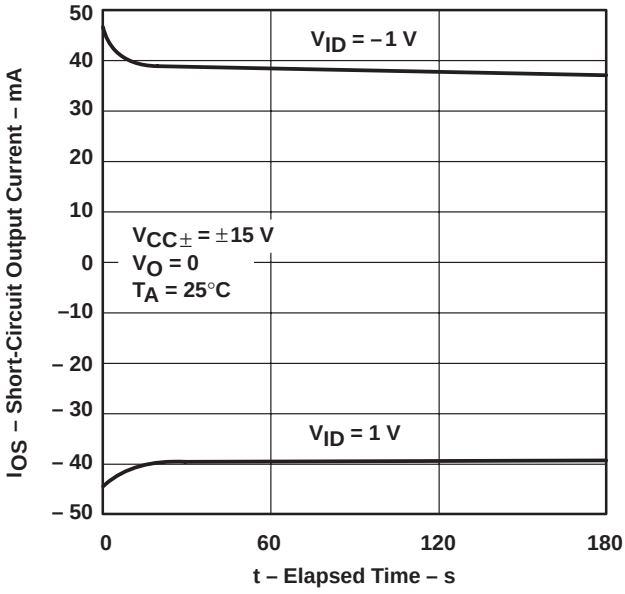


Figure 47

SHORT-CIRCUIT OUTPUT CURRENT† vs FREE-AIR TEMPERATURE

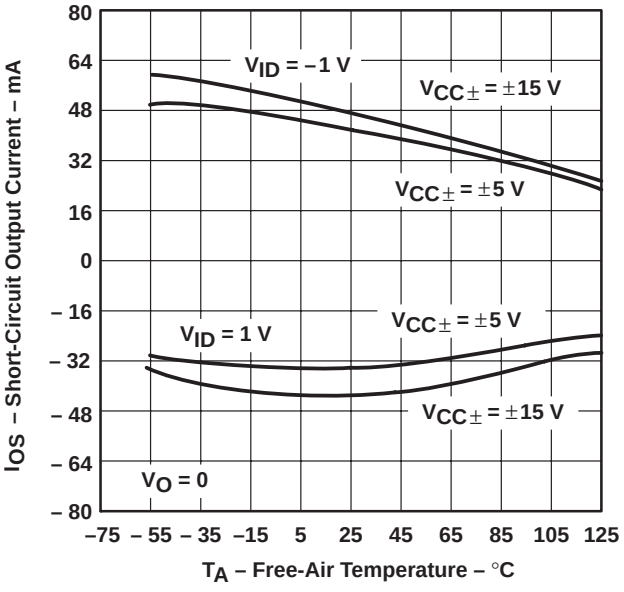


Figure 48

SLEW RATE† vs FREE-AIR TEMPERATURE

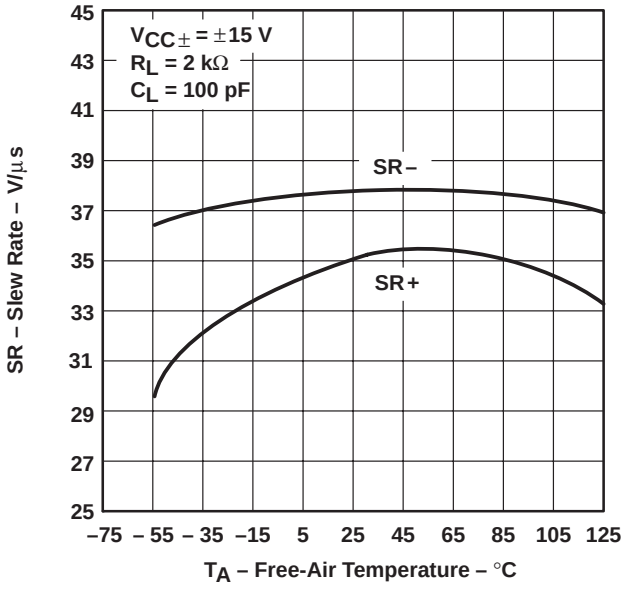


Figure 49

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

SLEW RATE† vs FREE-AIR TEMPERATURE

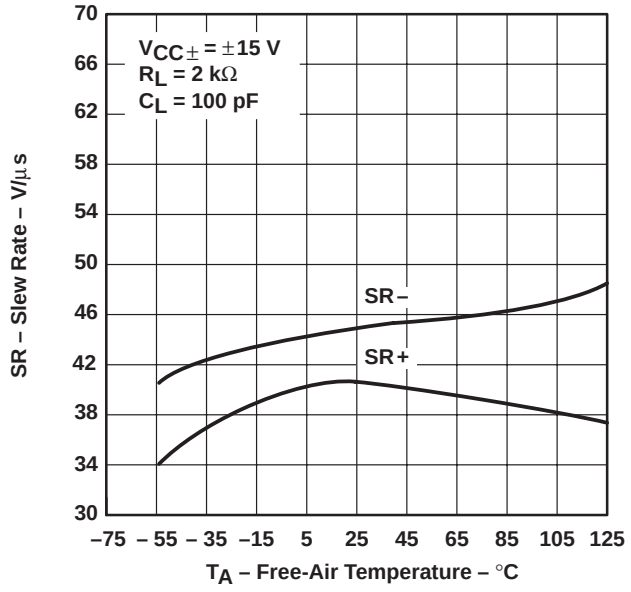


Figure 50

SLEW RATE vs LOAD RESISTANCE

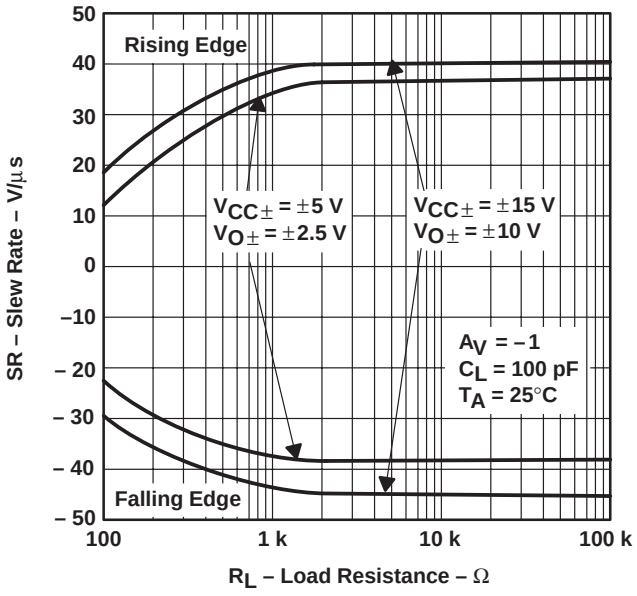


Figure 51

SLEW RATE vs DIFFERENTIAL INPUT VOLTAGE

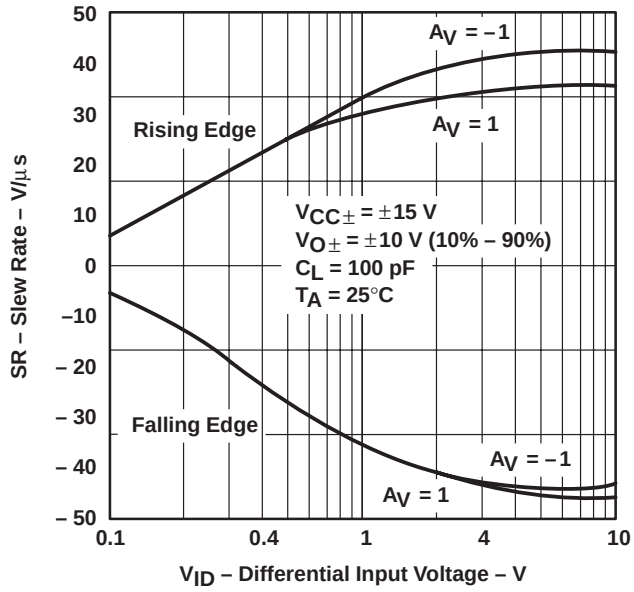


Figure 52

EQUIVALENT INPUT NOISE VOLTAGE (SPECTRAL DENSITY) vs FREQUENCY

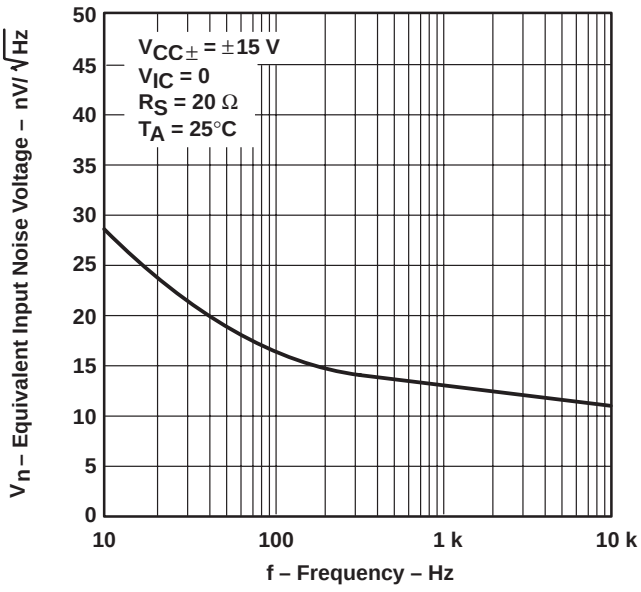


Figure 53

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE vs NOISE BANDWIDTH

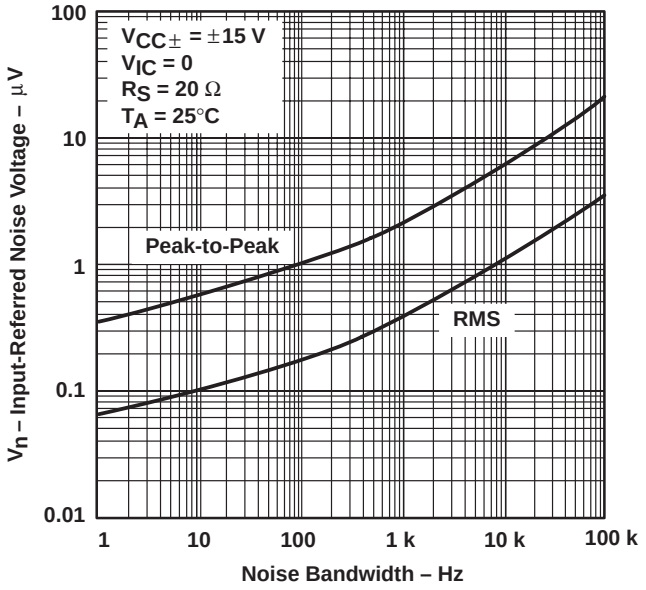


Figure 54

INPUT-REFERRED NOISE VOLTAGE OVER A 10-SECOND TIME INTERVAL

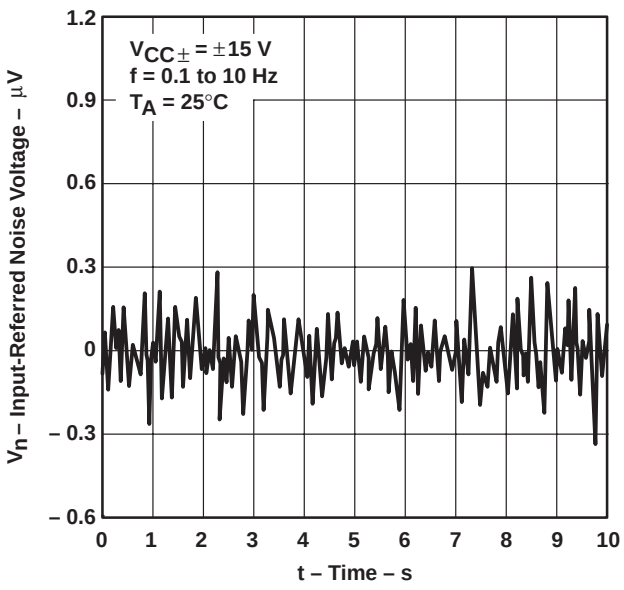


Figure 55

THIRD-OCTAVE SPECTRAL NOISE DENSITY vs FREQUENCY BANDS

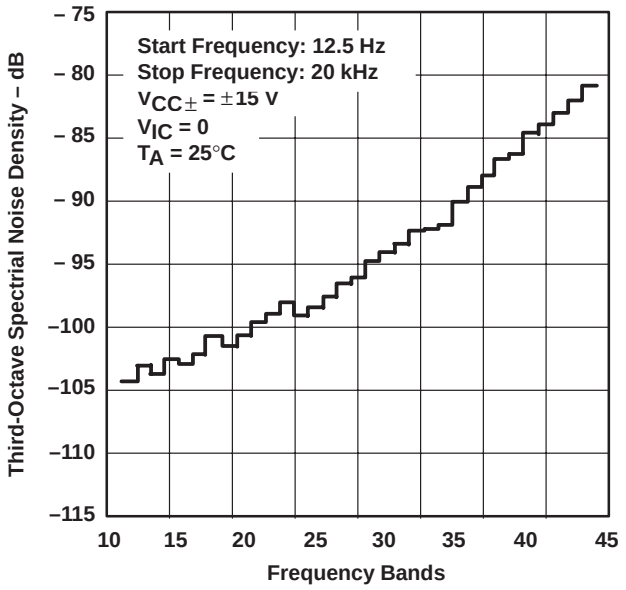


Figure 56

TOTAL HARMONIC DISTORTION PLUS NOISE vs FREQUENCY

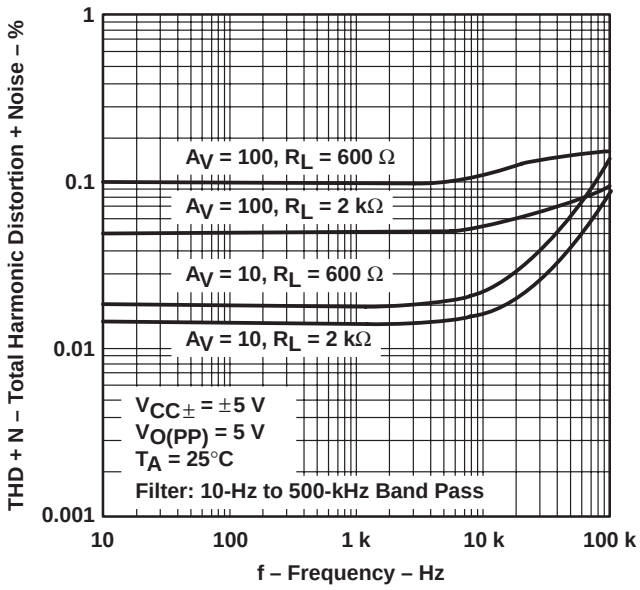


Figure 57

TYPICAL CHARACTERISTICS

TOTAL HARMONIC DISTORTION PLUS NOISE vs FREQUENCY

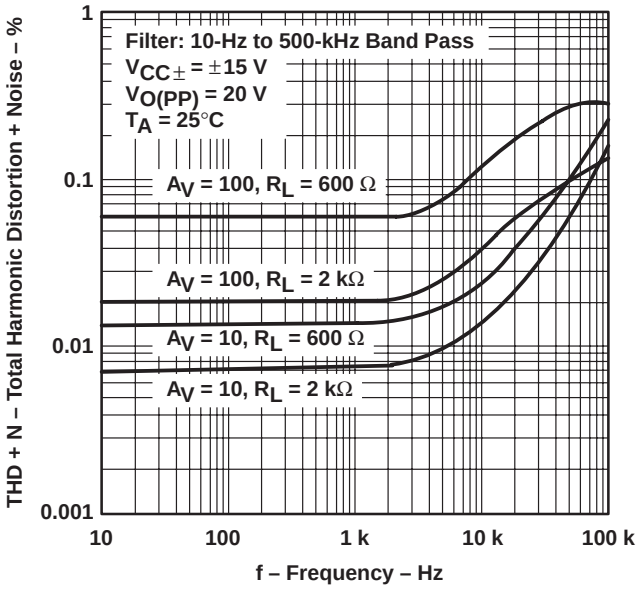


Figure 58

UNITY-GAIN BANDWIDTH vs LOAD CAPACITANCE

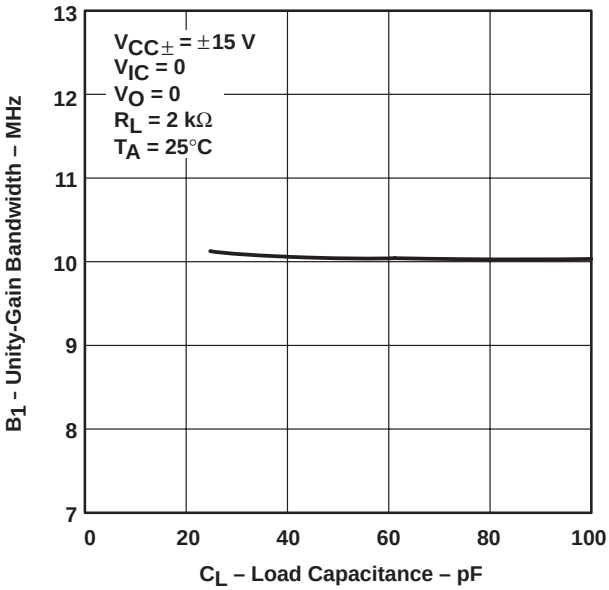


Figure 59

GAIN-BANDWIDTH PRODUCT† vs FREE-AIR TEMPERATURE

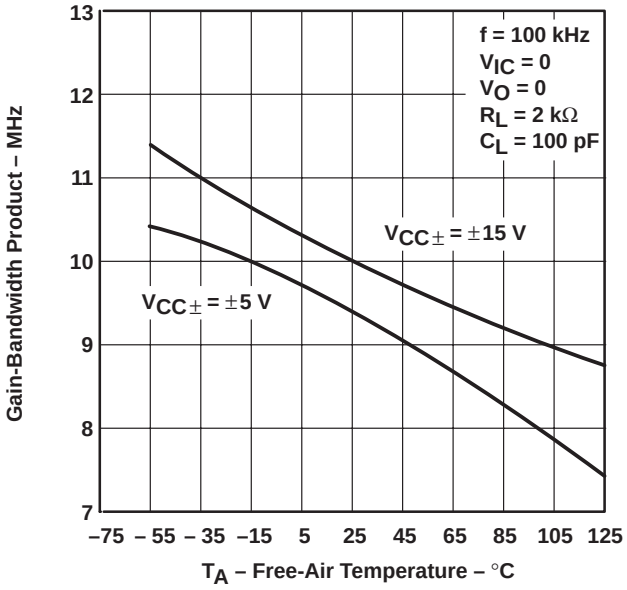


Figure 60

GAIN-BANDWIDTH PRODUCT vs SUPPLY VOLTAGE

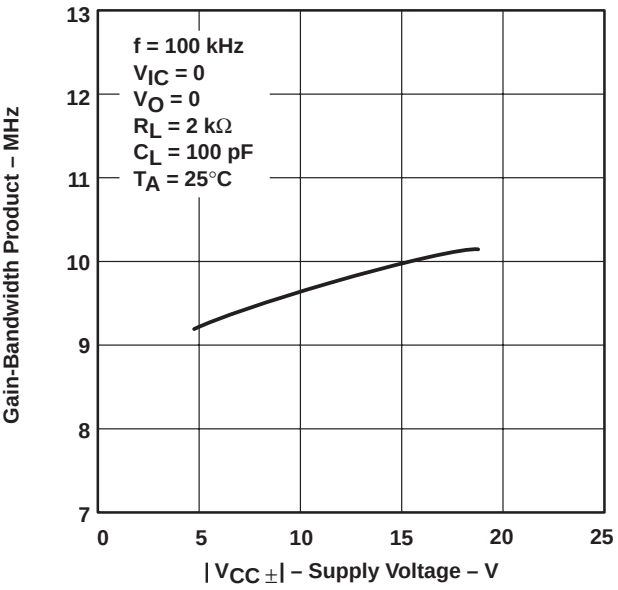


Figure 61

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

GAIN MARGIN vs LOAD CAPACITANCE

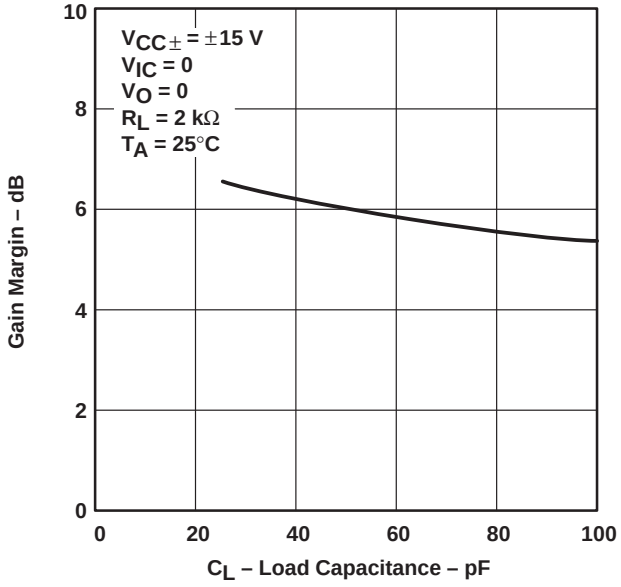


Figure 62

PHASE MARGIN† vs FREE-AIR TEMPERATURE

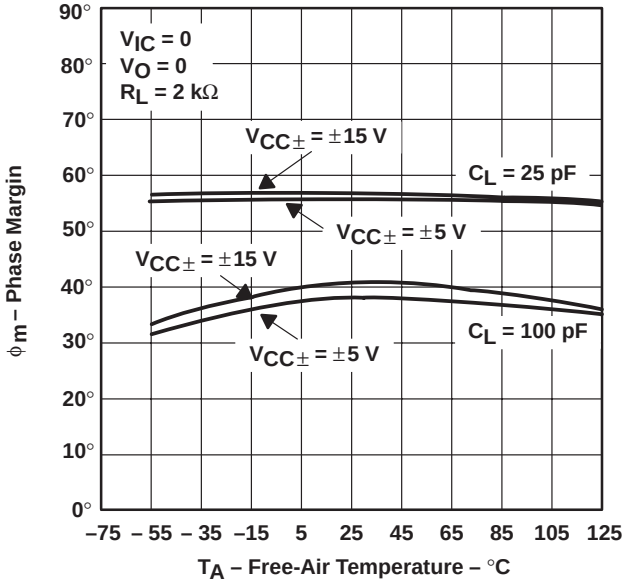


Figure 63

PHASE MARGIN vs SUPPLY VOLTAGE

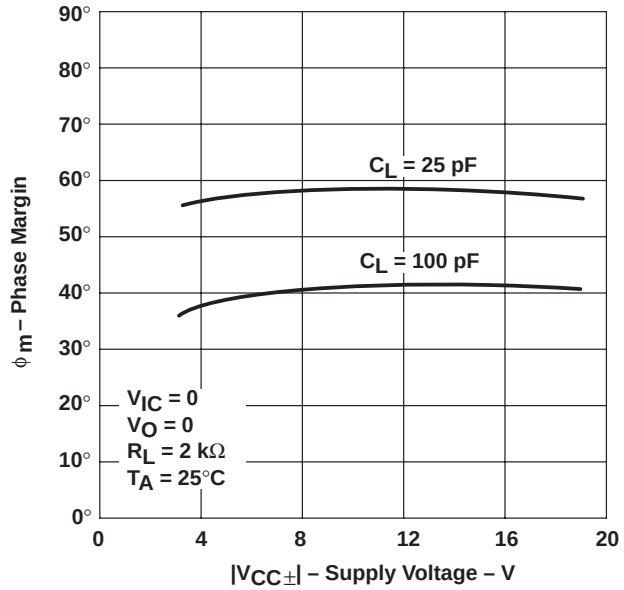


Figure 64

PHASE MARGIN vs LOAD CAPACITANCE

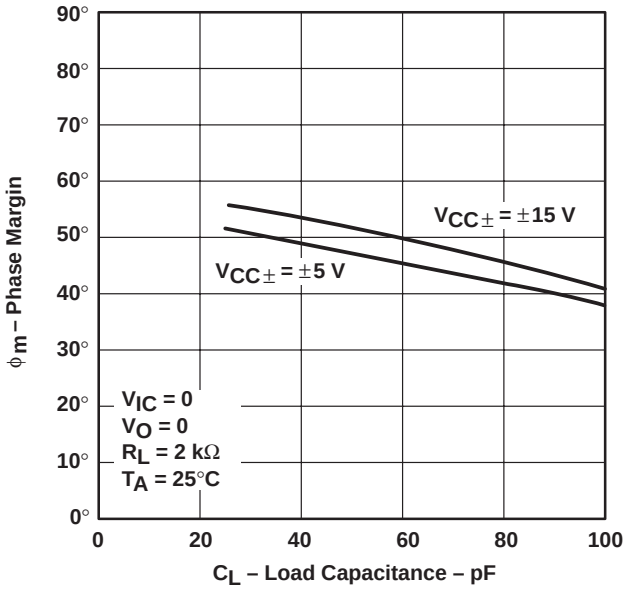


Figure 65

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

NONINVERTING LARGE-SIGNAL PULSE RESPONSE†

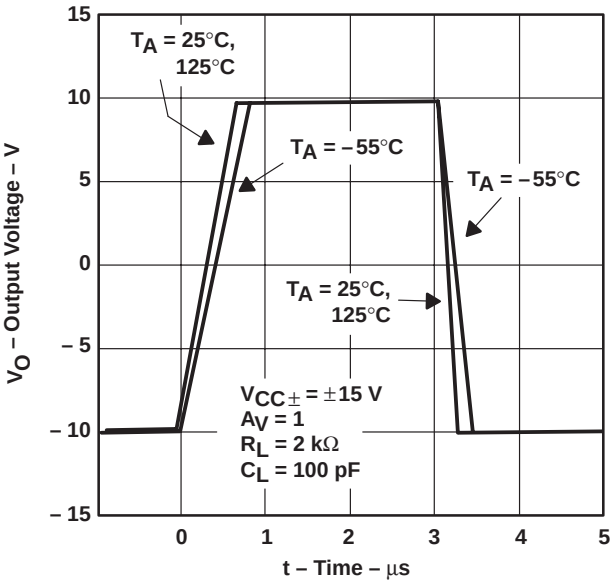


Figure 66

SMALL-SIGNAL PULSE RESPONSE

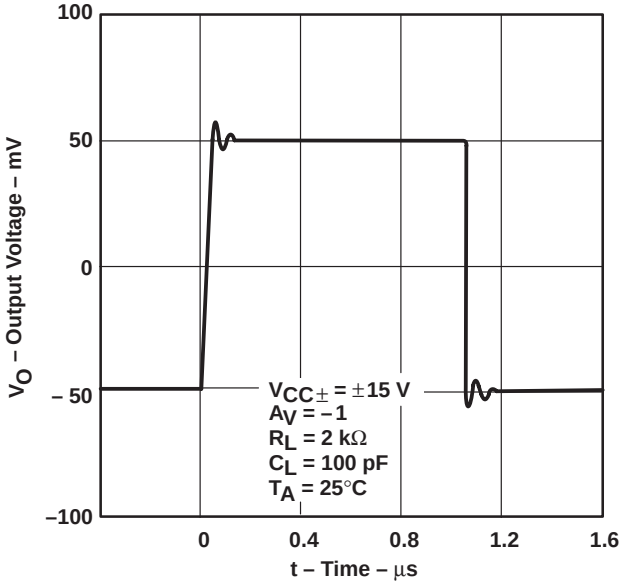


Figure 67

CLOSED-LOOP OUTPUT IMPEDANCE vs FREQUENCY

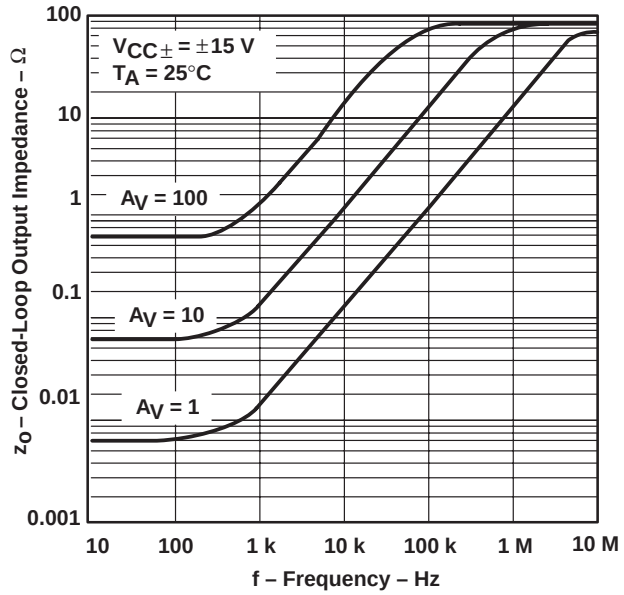


Figure 68

TLE2072 AND TLE2074 CROSSTALK ATTENUATION vs FREQUENCY

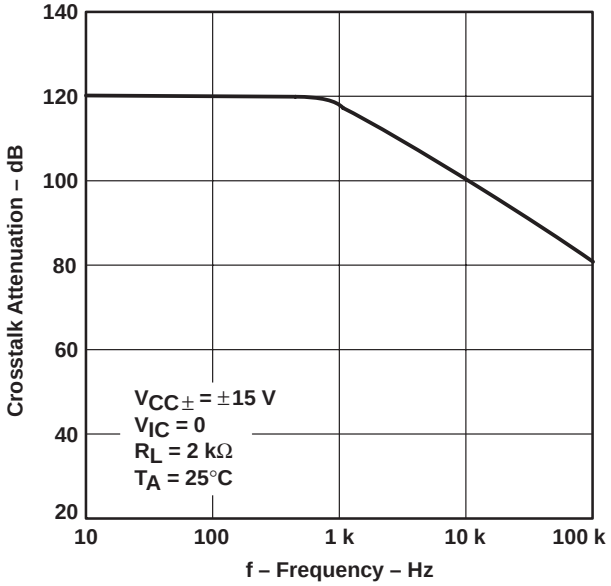


Figure 69

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

APPLICATION INFORMATION

input characteristics

The TLE207x, TLE207xA, and TLE207xB are specified with a minimum and a maximum input voltage that if exceeded at either input could cause the device to malfunction. Because of the extremely high input impedance and resulting low bias current requirements, the TLE207x, TLE207xA, and TLE207xB are well suited for low-level signal processing; however, leakage currents on printed-circuit boards and sockets can easily exceed bias current requirements and cause degradation in system performance. It is good practice to include guard rings around inputs (see Figure 70). These guards should be driven from a low-impedance source at the same voltage level as the common-mode input.

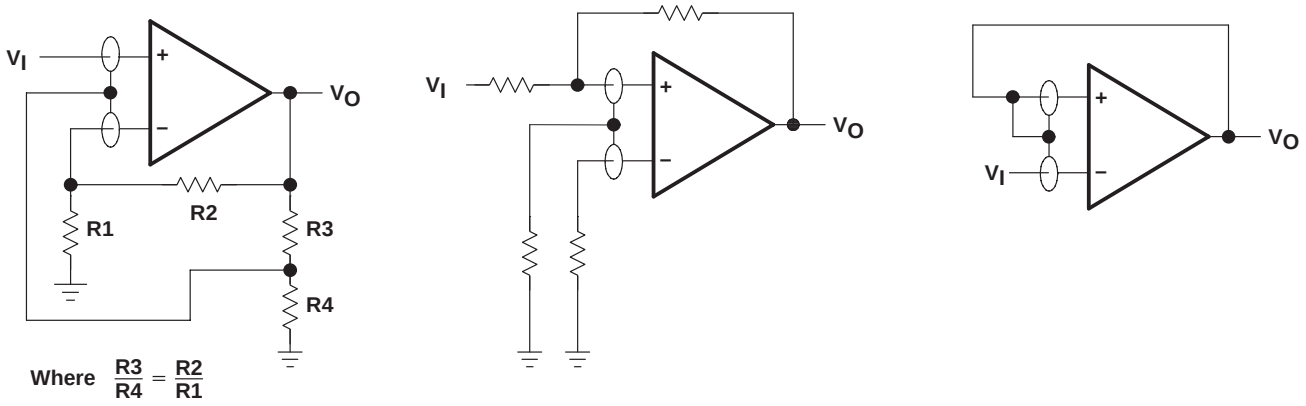


Figure 70. Use of Guard Rings

TLE2071 input offset voltage nulling

The TLE2071 series offers external null pins that can be used to further reduce the input offset voltage. The circuit of Figure 71 can be connected as shown if the feature is desired. When external nulling is not needed, the null pins may be left unconnected.

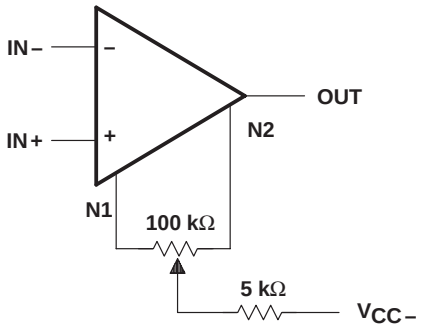


Figure 71. Input Offset Voltage Nulling

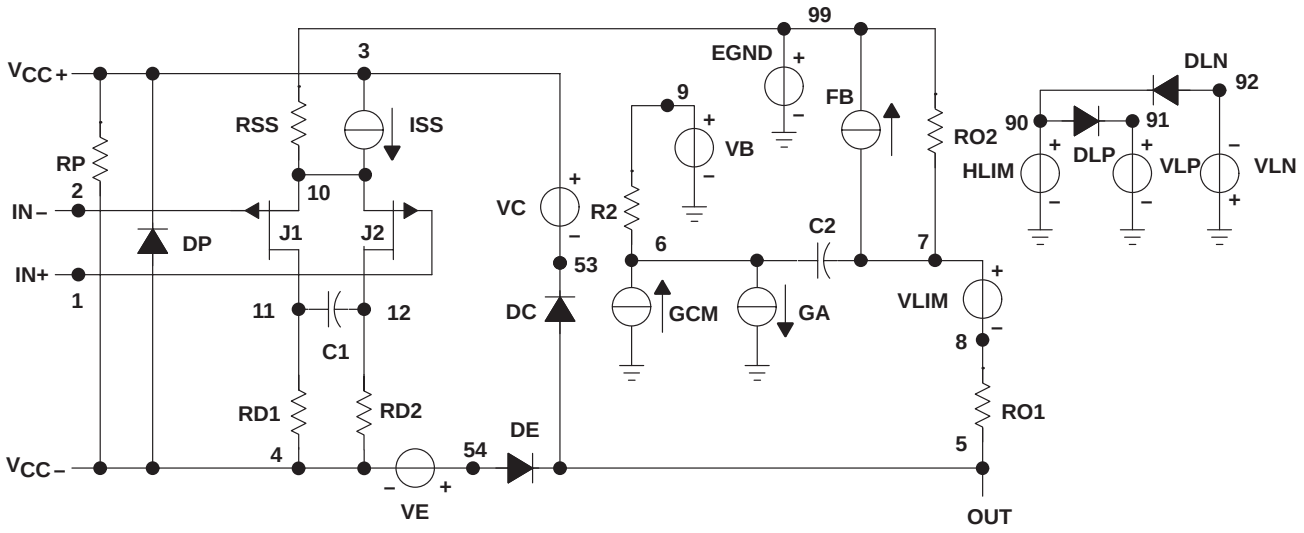
APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using *PSpice*™ *Parts*™ model generation software. The Boyle macromodel (see Note 4) and subcircuit Figure 72 were generated using the TLE207x typical electrical and operating characteristics at $T_A = 25°C$. Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification
- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 4: G.R. Boyle, B.M. Cohn, D. O. Pederson, and J. E. Solomon, "Macromodeling of Integrated Circuit Operational Amplifiers", *IEEE Journal of Solid-State Circuits*, SC-9, 353 (1974).




```
.SUBCKT TLE2074 1 2 3 4 5
C1      11      12      2.2E–12
C2      6       7       10.00E–12
DC      5       53      DX
DE      54      5       DX
DLP     90      91      DX
DLN     92      90      DX
DP      4       3       DX
EGND    99      0       POLY (2) (3,0) (4,0) 0 .5 .5
FB      7       99      POLY (5) VB VC VE VLP VLN 0
+ 5.607E6 –6E6 6E6 6E6 –6E6
GA      6       0       11 12 333.0E–6
GCM     0       6       10 99 7.43E–9
ISS     3       10      DC 400.0E–6
HLIM    90      0       VLIM 1K
J1      11      2       10 JX
J2      12      1       10 JX
R2      6       9       100.0E3
RD1     4       11      3.003E3
RD2     4       12      3.003E3
R01     8       5       80
R02     7       99      80
RP      3       4       27.30E3
RSS     10      99      500.0E3
VB      9       0       DC 0
VC      3       53      DC 2.20
VE      54      4       DC 2.20
VLIM    7       8       DC 0
VLP     91      0       DC 45
VLN     0       92      DC 45
.MODEL DX D (IS=800.0E–18)
.MODEL JX PJF (IS=15.00E–12 BETA=554.5E–6
+ VTO=–.6)
.ENDS
```

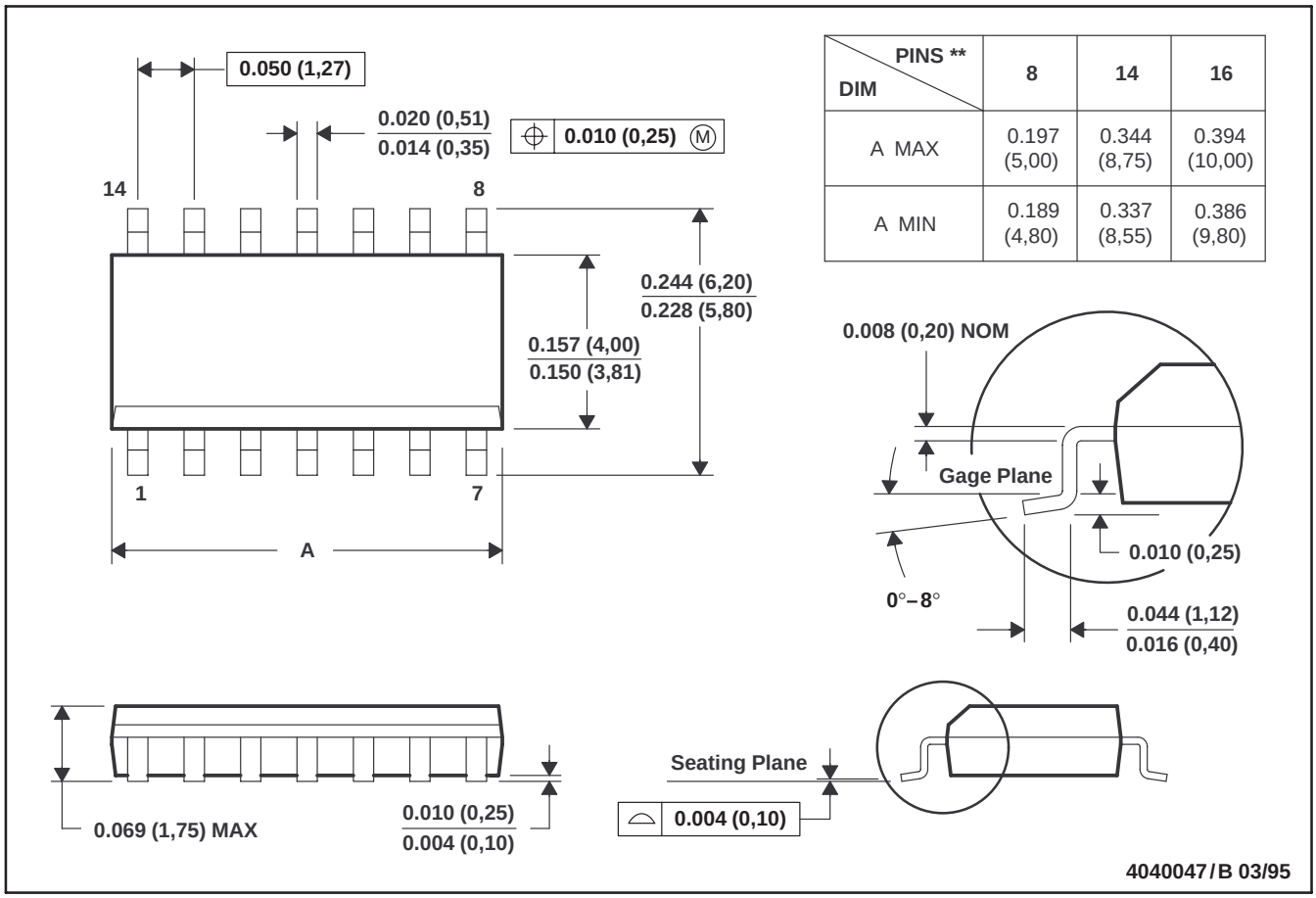
Figure 72. Boyle Macromodel and Subcircuit

PSpice and *Parts* are trademarks of MicroSim Corporation.

MECHANICAL INFORMATION

D (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN



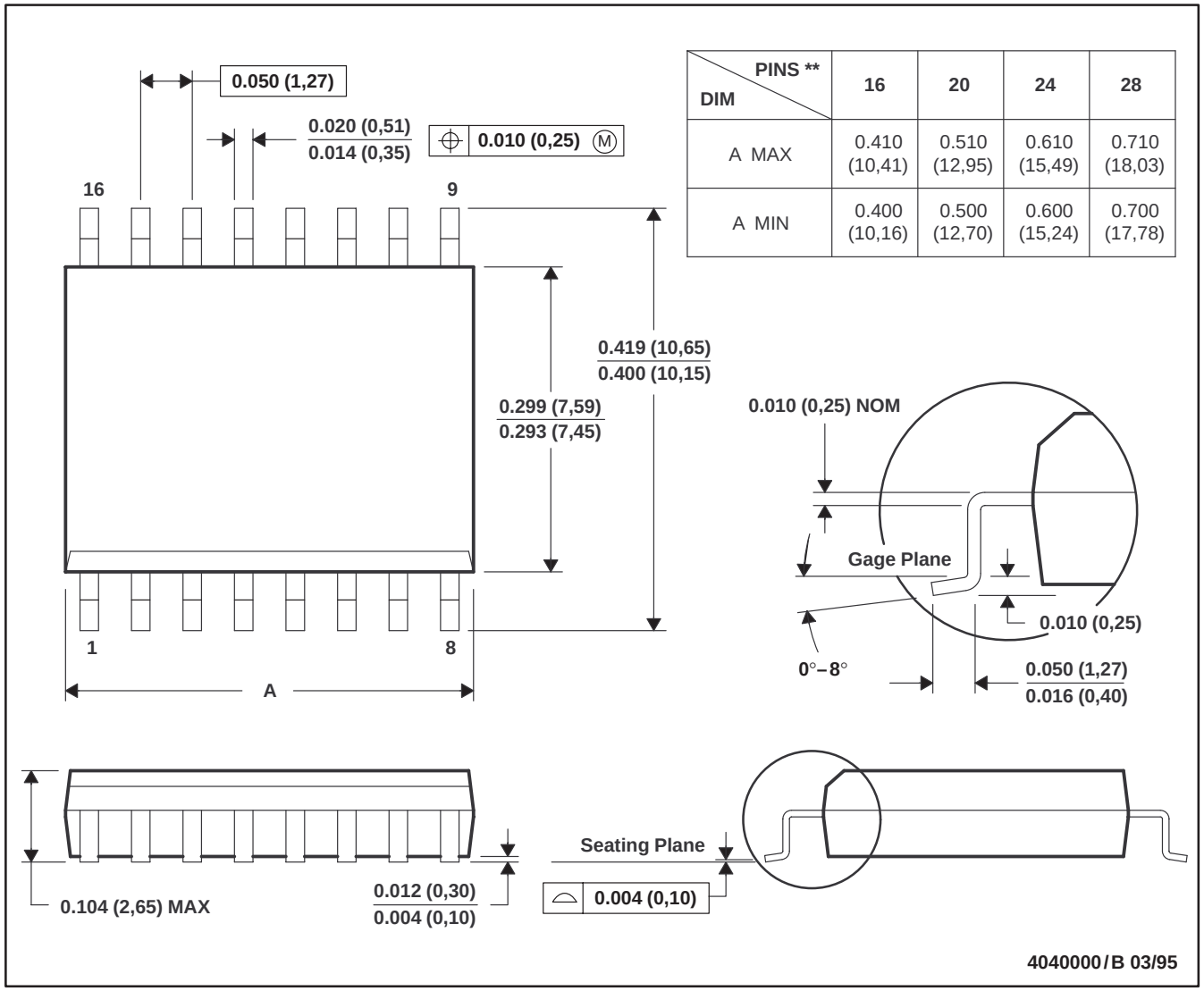
DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Four center pins are connected to die mount pad.
E. Falls within JEDEC MS-012

MECHANICAL INFORMATION

DW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

16 PIN SHOWN



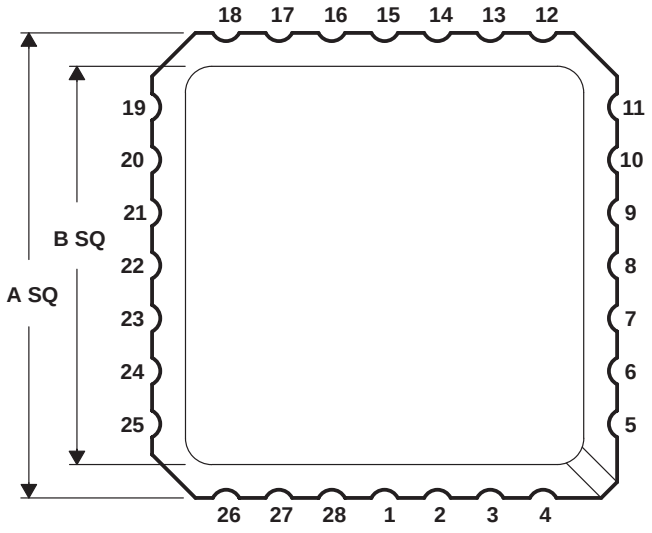
DIM \ PINS **	16	20	24	28
A MAX	0.410 (10,41)	0.510 (12,95)	0.610 (15,49)	0.710 (18,03)
A MIN	0.400 (10,16)	0.500 (12,70)	0.600 (15,24)	0.700 (17,78)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

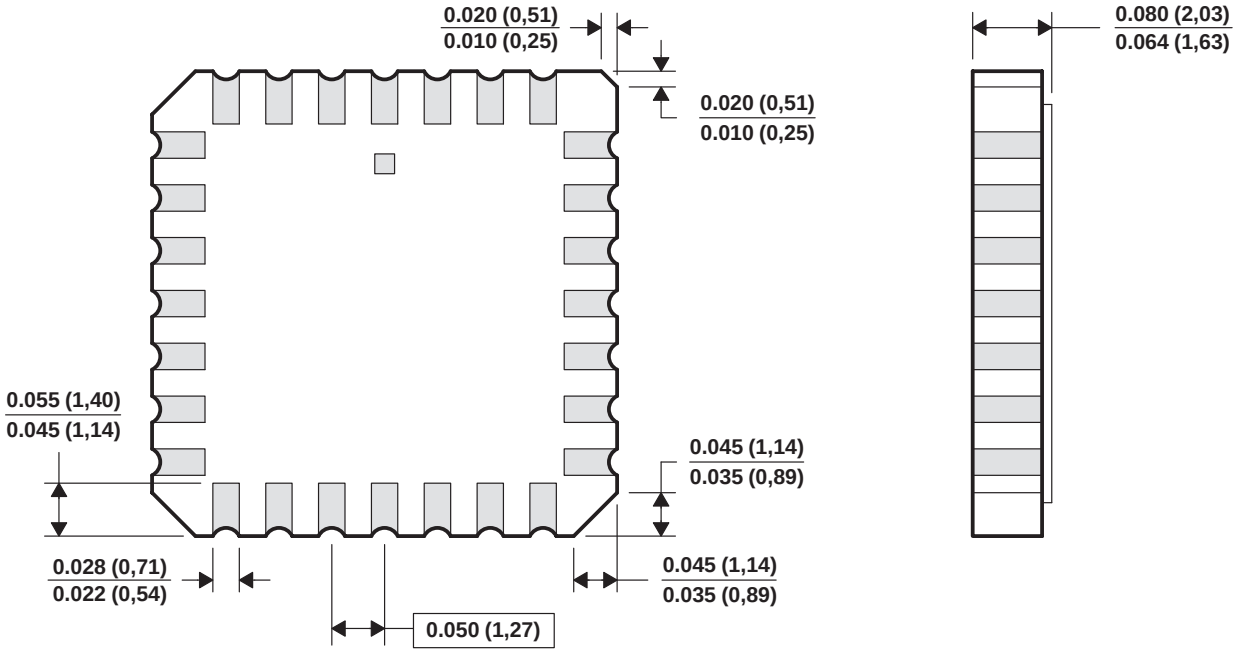
MECHANICAL INFORMATION

FK (S-CQCC-N)** **LEADLESS CERAMIC CHIP CARRIER**

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.739 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



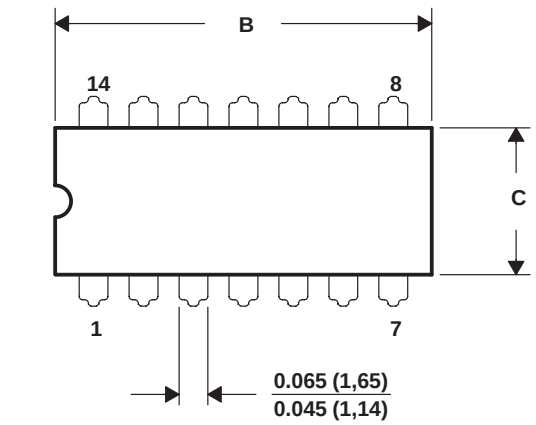
4040140/D 10/96

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

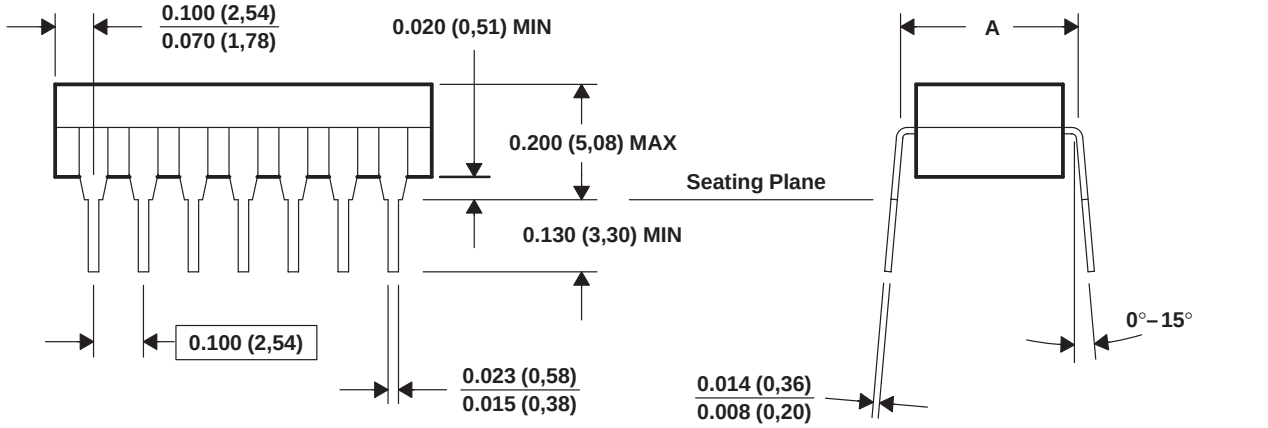
MECHANICAL INFORMATION

J (R-GDIP-T)** **CERAMIC DUAL-IN-LINE PACKAGE**

14 PIN SHOWN



DIM \ PINS **	14	16	18	20	22
A MAX	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)	0.410 (10,41)
A MIN	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)	0.390 (9,91)
B MAX	0.785 (19,94)	0.785 (19,94)	0.910 (23,10)	0.975 (24,77)	1.100 (28,00)
B MIN	0.755 (19,18)	0.755 (19,18)	—	0.930 (23,62)	—
C MAX	0.280 (7,11)	0.300 (7,62)	0.300 (7,62)	0.300 (7,62)	0.388 (9,65)
C MIN	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)	—

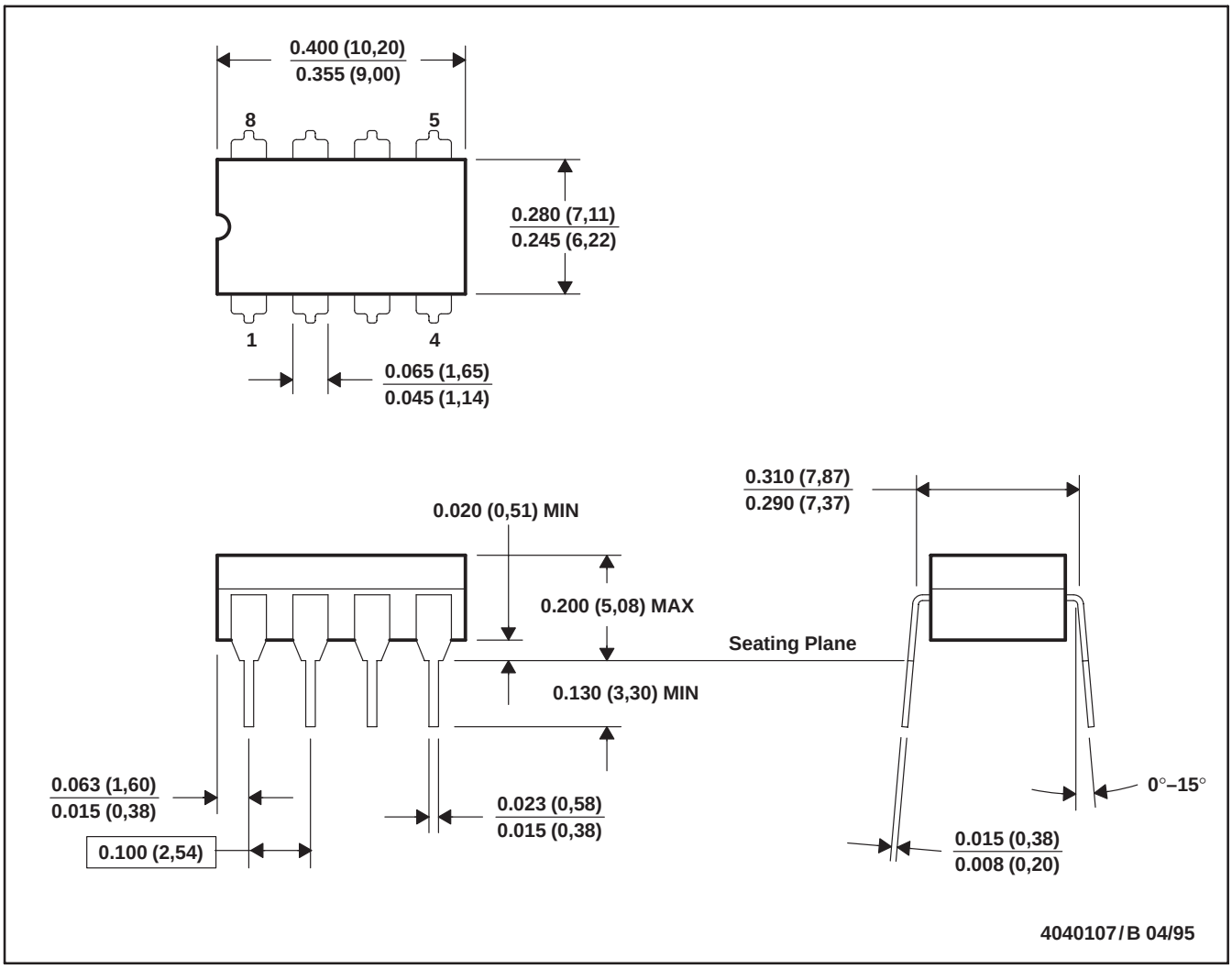


4040083/B 04/95

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL-STD-1835 GDIP1-T14, GDIP1-T16, GDIP1-T18, GDIP1-T20, and GDIP1-T22

MECHANICAL INFORMATION

JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE PACKAGE**



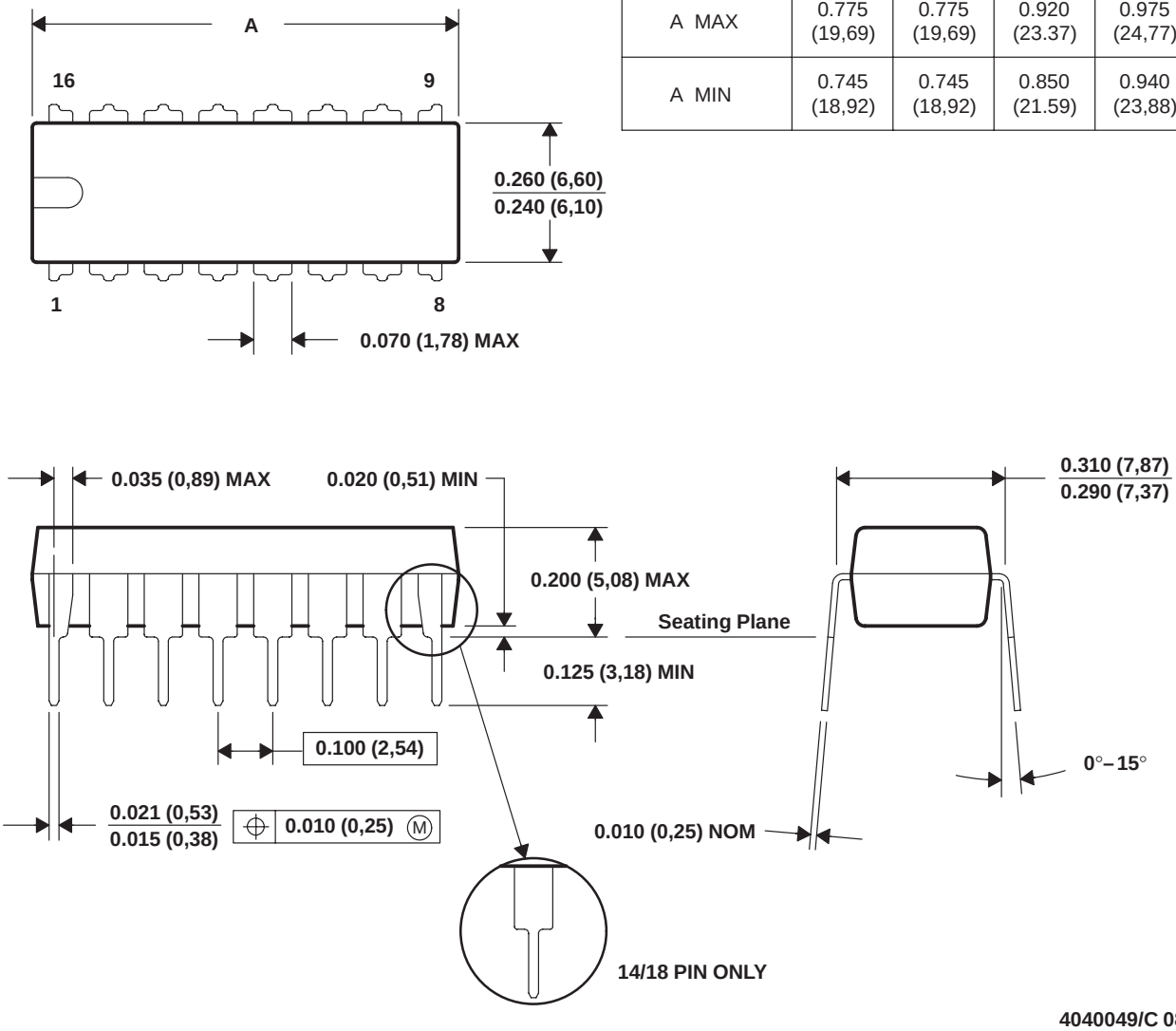
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP1-T8

MECHANICAL INFORMATION

N (R-PDIP-T)** **PLASTIC DUAL-IN-LINE PACKAGE**

16 PIN SHOWN

DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23.37)	0.975 (24,77)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21.59)	0.940 (23,88)

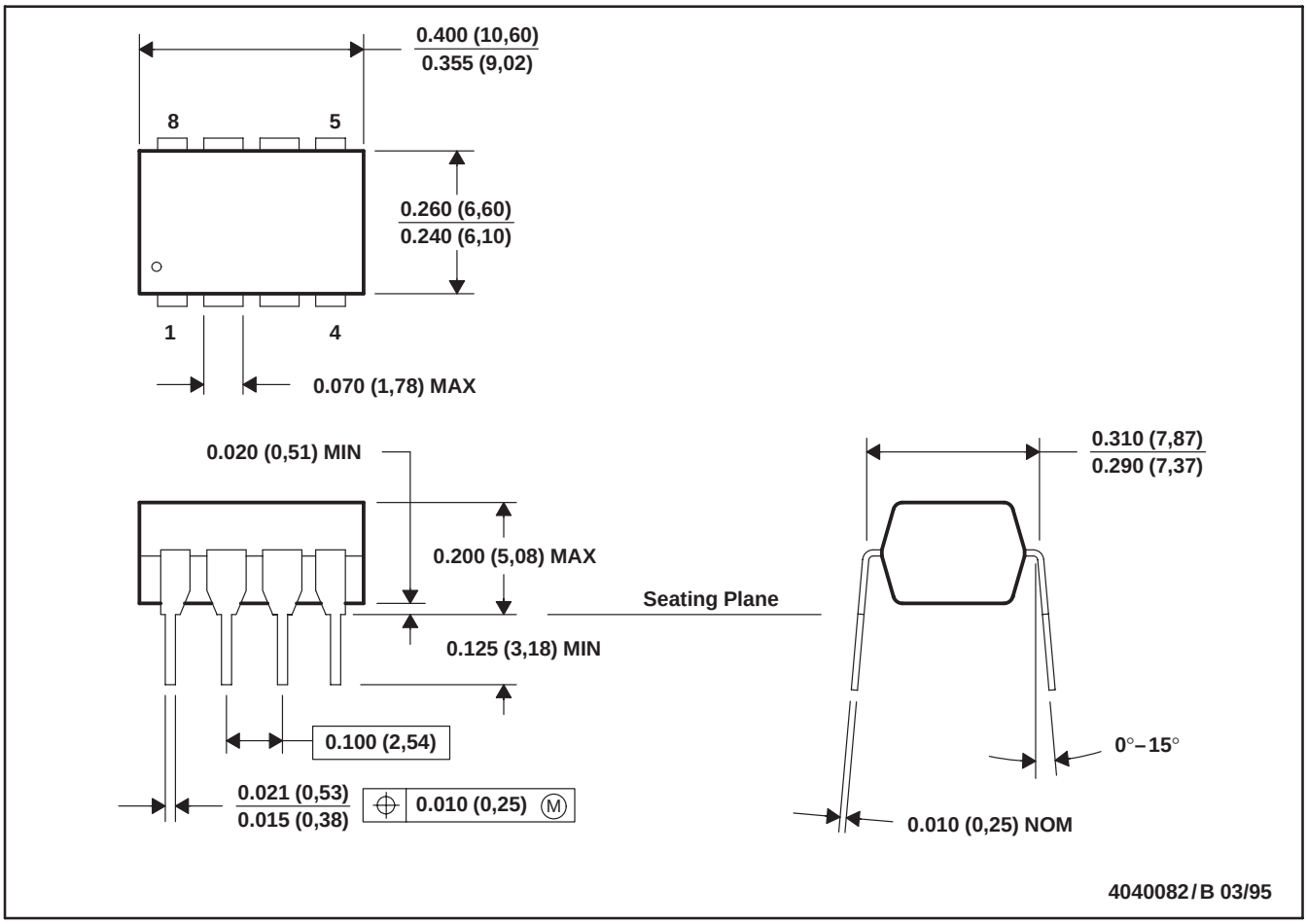


4040049/C 08/95

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001 (20 pin package is shorter then MS-001.)

MECHANICAL INFORMATION

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.