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

description

The TLE208x 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. The TLE208x also have 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 TLE208x 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 these amplifiers 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.

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 voltage 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 TLE208x 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.

For BiFET circuits requiring low noise and/or tighter dc precision, the TLE207x offer the same ac response as the TLE208x with more stringent dc and noise specifications.

TLE2081 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 mV 6 mV	TLE2081ACD TLE2081CD	—	—	TLE2081ACP TLE2081CP	— TLE2081Y
–40°C to 85°C	3 mV 6 mV	TLE2081AID TLE2081ID	—	—	TLE2081AIP TLE2081IP	—
–55°C to 125°C	3 mV 6 mV	—	TLE2081AMFK TLE2081MFK	TLE2081AMJG TLE2081MJG	—	—

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2081ACDR).
‡ Chip forms are tested at T_A = 25°C only.

TLE2082 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	4 mV 7 mV	TLE2082ACD TLE2082CD	—	—	TLE2082ACP TLE2082CP	—
–40°C to 85°C	4 mV 7 mV	TLE2082AID TLE2082ID	—	—	TLE2082AIP TLE2082IP	TLE2082Y
–55°C to 125°C	4 mV 7 mV	TLE2082AMD TLE2082MD	TLE2082AMFK TLE2082MFK	TLE2082AMJG TLE2082MJG	TLE2082AMP TLE2082MP	—

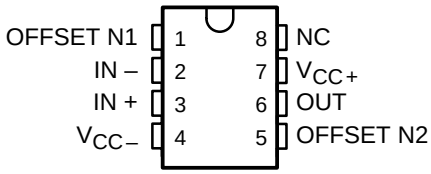
‡ The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2082ACDR).
‡ Chip forms are tested at T_A = 25°C only.

TLE2084 AVAILABLE OPTIONS

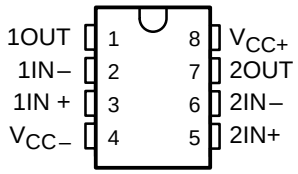
T_A	V_{IO}max AT 25°C	PACKAGED DEVICES				CHIP FORM (Y)
		SMALL OUTLINE (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	
0°C to 70°C	4 mV 7 mV	TLE2084ACDW TLE2084CDW	—	—	TLE2084ACN TLE2084CN	— TLE2084Y
–55°C to 125°C	4 mV 7 mV	—	TLE2084AMFK TLE2084MFK	TLE2084AMJ TLE2084MJ	—	—

† The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2084ACDWR).
‡ Chip forms are tested at T_A = 25°C only.

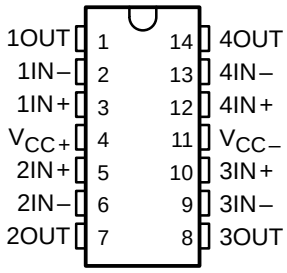
TLE2081
D, JG, OR P PACKAGE
(TOP VIEW)



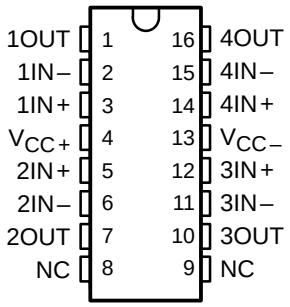
TLE2082
D, JG, OR P PACKAGE
(TOP VIEW)



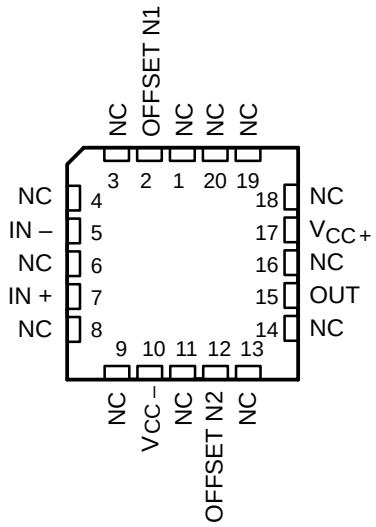
TLE2084
J OR N PACKAGE
(TOP VIEW)



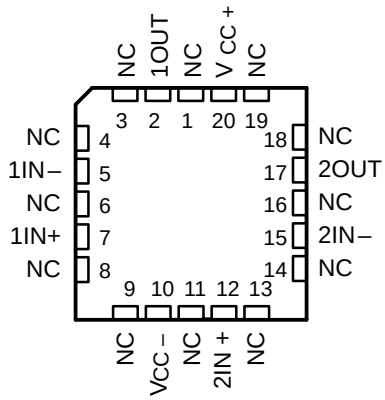
TLE2084
DW PACKAGE
(TOP VIEW)



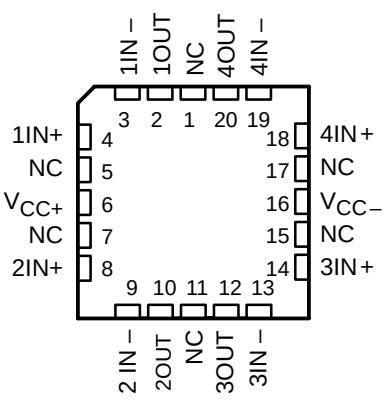
TLE2081
FK PACKAGE
(TOP VIEW)



TLE2082
FK PACKAGE
(TOP VIEW)

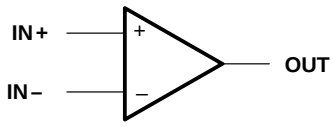


TLE2084
FK PACKAGE
(TOP VIEW)



NC – No internal connection

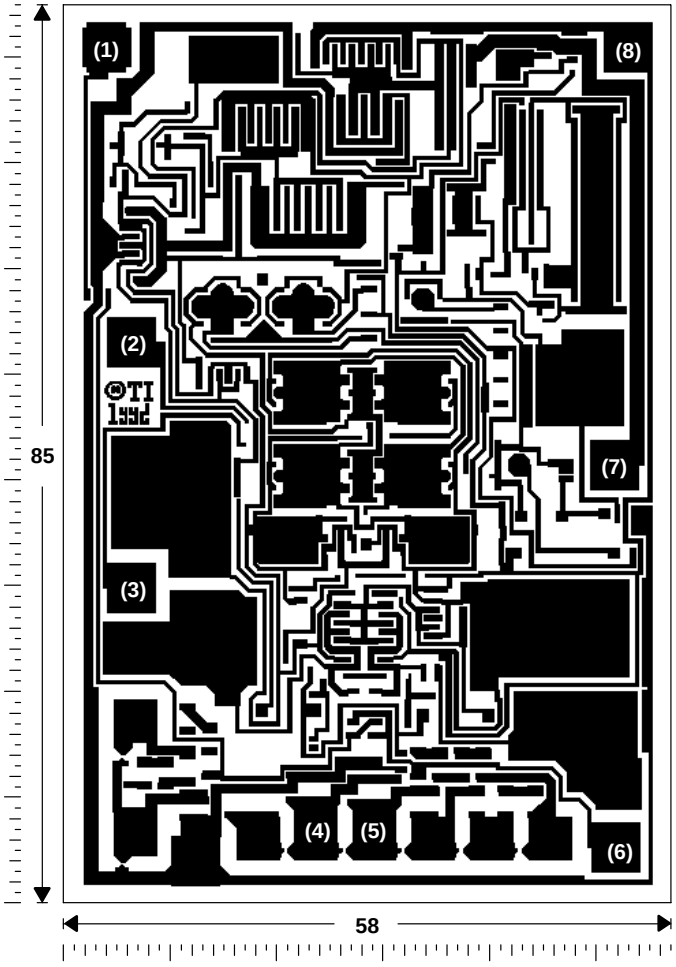
symbol

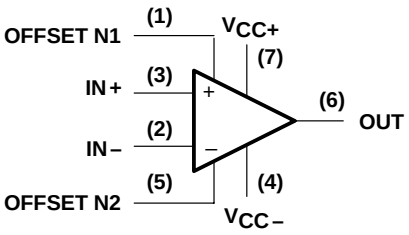


TLE2081Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2081. 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%.

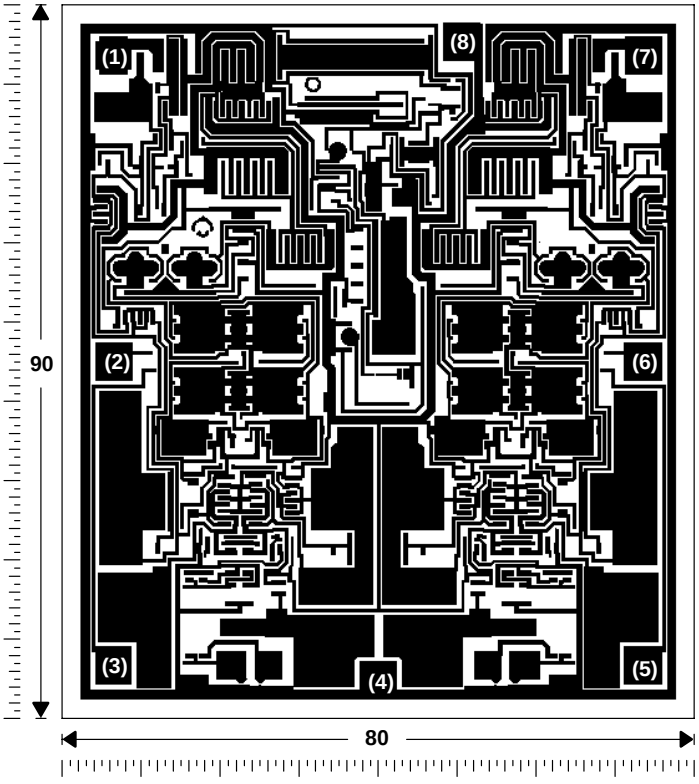
ALL DIMENSIONS ARE IN MILS.

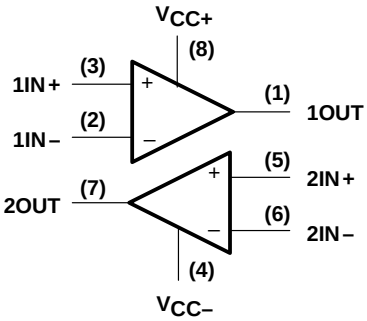
PIN (4) IS INTERNALLY CONNECTED TO BACKSIDE OF THE CHIP.

TLE2082Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2082. 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%.

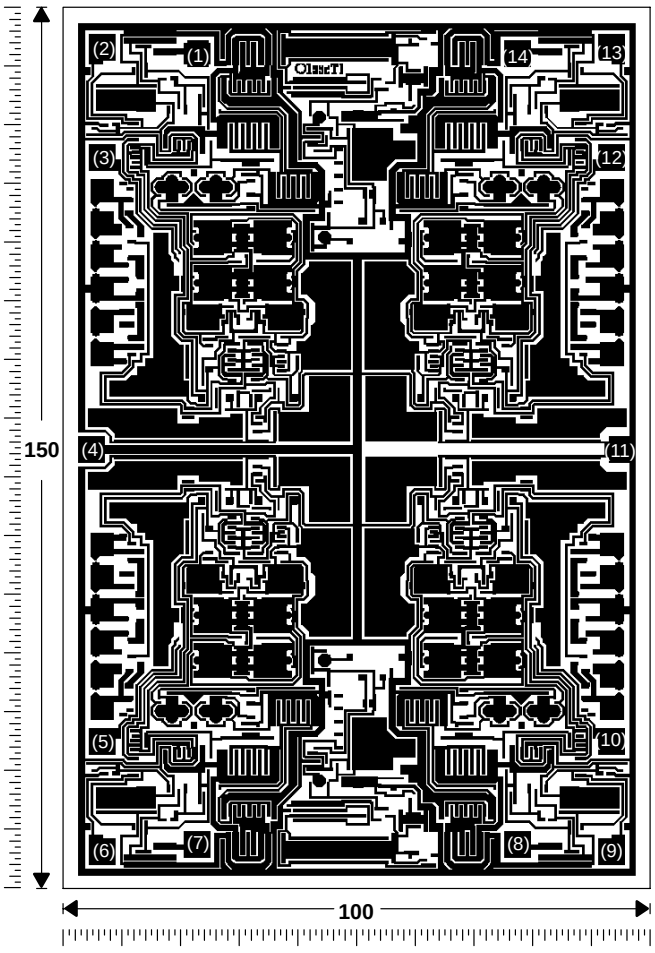
ALL DIMENSIONS ARE IN MILS.

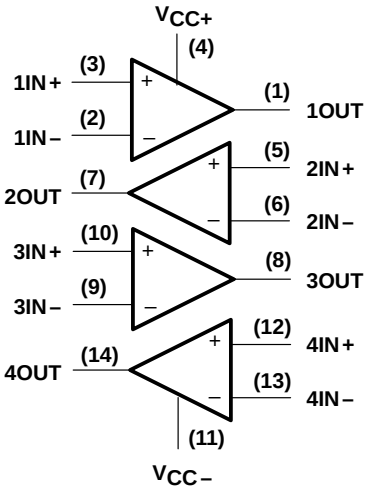
PIN (4) IS INTERNALLY CONNECTED TO BACKSIDE OF THE CHIP.

TLE2084Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2084. 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

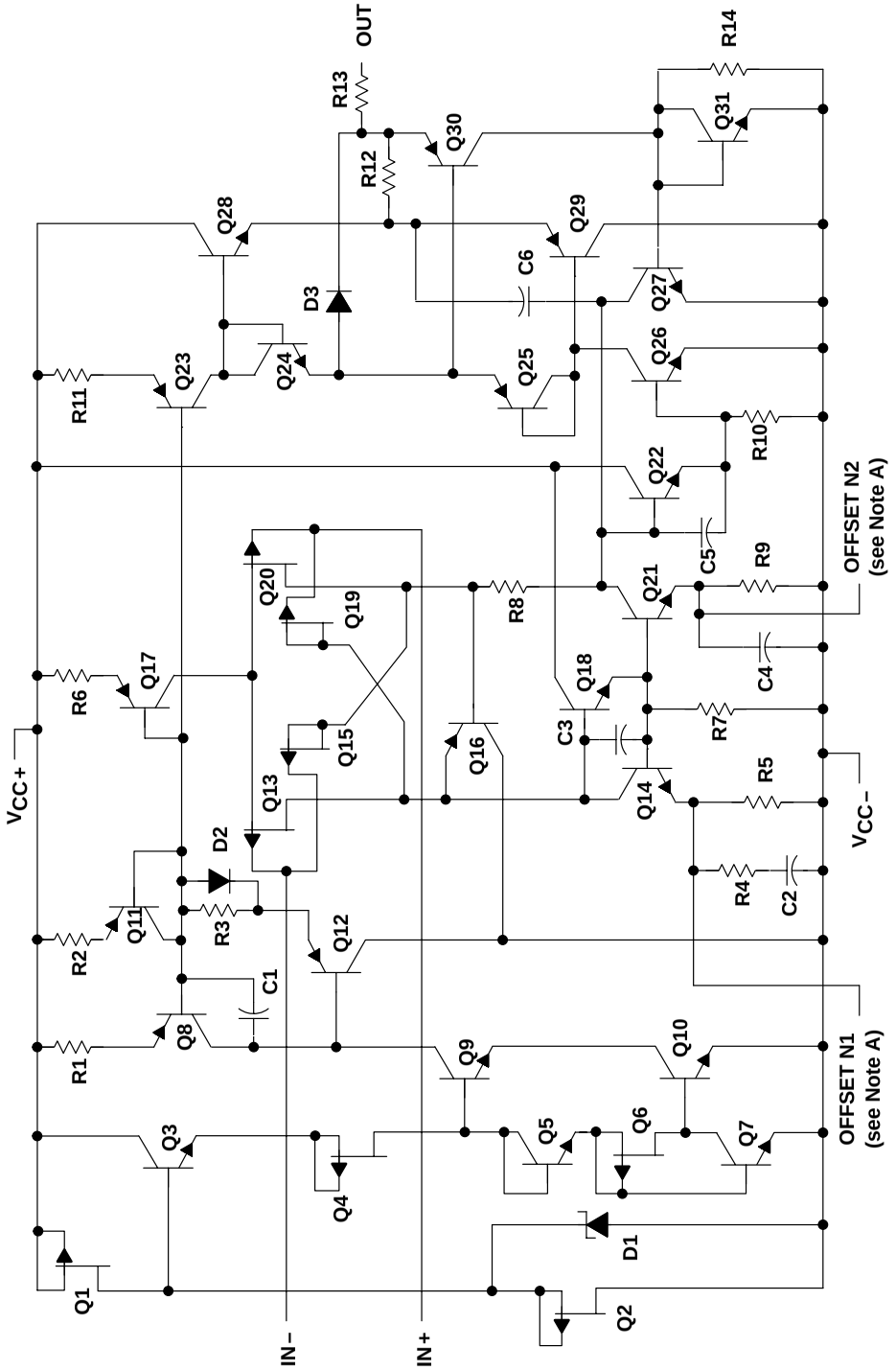
$T_J$max = 150°C

TOLERANCES ARE ±10%.

ALL DIMENSIONS ARE IN MILS.

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

equivalent schematic (each channel)



NOTE A: OFFSET N1 and OFFSET N2 are only availiable on the TLE2081x devices.

ACTUAL DEVICE COMPONENT COUNT			
COMPONENT	TLE2081	TLE2082	TLE2084
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 IN+ with respect to IN–.
3. The output can 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	145 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	200 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

TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			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	6		0.3	3	mV
				Full range			8			5	
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	nA
				Full range			1.4			1.4	
I_{IB}	Input bias current			25°C		15	175		15	175	nA
				Full range			5			5	
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.

TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			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.

TLE2081C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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, A_{VD} = 10, f = 1 kHz, R_L = 2 kΩ, R_S = 25 Ω		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, A_{VD} = –1, R_L = 2 kΩ , 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.

TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			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	6		0.47	3	mV
				Full range			8			5	
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	nA
				Full range			1.4			1.4	
I_{IB}	Input bias current			25°C		20	175		20	175	nA
				Full range			5			5	
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.

TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			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.

TLE2081C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081C			TLE2081AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, A_{VD} = −1, R_L = 2 kΩ, C_L = 100 pF, See Figure 1		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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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, A_{VD} = 10, f = 1 kHz, R_L = 2 kΩ, R_S = 25 Ω		25°C		0.008%			0.008%		
B_1	Unity-gain bandwidth	V_I = 10 mV, R_L = 2 kΩ, C_L = 25 pF, See Figure 2		25°C	8	10		8	10		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 20 V, A_{VD} = −1, R_L = 2 kΩ, C_L = 25 pF		25°C	478	637		478	637		kHz
ϕ_m	Phase margin at unity gain	V_I = 10 mV, R_L = 2 kΩ, C_L = 25 pF, See Figure 2		25°C		57°			57°		

† Full range is 0°C to 70°C.

TLE2081I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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	6		0.3	3	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.

TLE2081I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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.

TLE2081I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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, A_{VD} = 10, f = 1 kHz, R_L = 2 kΩ, R_S = 25 Ω		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, A_{VD} = –1, R_L = 2 kΩ , 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.

TLE2081I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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	6		0.47	3	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.

TLE2081I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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.

TLE2081I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081I			TLE2081AI			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50Ω		25°C		0.34	6		0.3	3	mV
				Full range			11.2			8.2	
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			65			65	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			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.

TLE2081M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			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	6		0.47	3	mV
				Full range			11.2			8.2	
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			65			65	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	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)(continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			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.

TLE2081M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2081M			TLE2081AM			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	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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2081Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			TLE2081Y MIN	TLE2081Y TYP	TLE2081Y MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0,	V_O = 0,	R_S = 50 Ω		0.49	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	
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	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		

TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082C			TLE2082AC			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	4	mV
				Full range			8.1			5.1	
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, Common mode	V_{IC} = 0, See Figure 5		25°C		11			11		pF
	Input capacitance, 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($\Delta V_{CC\pm}$ /ΔV_{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			
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	

† Full range is 0°C to 70°C.

TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2082C			TLE2082AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
	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		

TLE2082C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082C			TLE2082AC			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2082C			TLE2082AC			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	7		0.7	4	mV
					Full range			8.1			5.1	
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	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.

TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2082C			TLE2082AC			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	
	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		

TLE2082C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082C			TLE2082AC			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	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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T_A†	TLE2082I			TLE2082AI			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	7		0.65	4	mV
					Full range			8.5			5.5	
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	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			
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	

† Full range is −40°C to 85°C.

TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2082I			TLE2082AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
	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		

TLE2082I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082I			TLE2082AI			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082I			TLE2082AI			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	7		0.7	4	mV
				Full range			8.5			5.5	
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	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.

TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2082I			TLE2082AI			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	
	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		

TLE2082I operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082I			TLE2082AI			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	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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			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	7		0.65	4	mV
				Full range			9.5			6.5	
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, Common mode	V_{IC} = 0, See Figure 5		25°C		11			11		pF
	Input capacitance, 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 ($\Delta V_{CC\pm}$ / ΔV_{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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels)	V_O = 0,	No load	25°C	2.7	2.9	3.6	2.7	2.9	3.6	mA
				Full range			3.6			3.6	
	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.

TLE2082M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			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	7		0.7	4	mV
				Full range			9.5			6.5	
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			65			65	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is −55°C to 125°C.

TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			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	
	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.

TLE2082M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2082M			TLE2082AM			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2082Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER			TEST CONDITIONS			TLE2082Y MIN	TLE2082Y TYP	TLE2082Y MAX	UNIT
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	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, R_S = 50 Ω		V_O = 0,	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		

TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			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	7		–0.5	4	mV
				Full range			9.1			6.1	
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			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	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 ($\Delta V_{CC\pm}$ /ΔV_{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			
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	
a_X	Crosstalk attenuation	V_{IC} = 0, R_L = 2 kΩ		25°C		120			120		dB

† Full range is 0°C to 70°C.

TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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.

TLE2084C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			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	7		–0.5	4	mV
				Full range			9.1			6.1	
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			1.4			1.4	nA
I_{IB}	Input bias current			25°C		25	175		25	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	–13.7	–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	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			
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	
a_X	Crosstalk attenuation	V_{IC} = 0, R_L = 2 kΩ		25°C		120			120		dB

† Full range is 0°C to 70°C.

TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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.

TLE2084C operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2084C			TLE2084AC			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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.

TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084M			TLE2084AM			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	7		–0.5	4	mV
				Full range			12.5			9.5	
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			65			65	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			
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	
a_X	Crosstalk attenuation	V_{IC} = 0, R_L = 2 kΩ		25°C		120			120		dB

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

TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2084M			TLE2084AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I_{OS}	Short-circuit output current	V_O = 0	V_{ID} = 1 V	25°C		–35			–35		mA
			V_{ID} = –1 V			45			45		

TLE2084M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V

PARAMETER		TEST CONDITIONS		T_A†	TLE2084M			TLE2084AM			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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLE2084M			TLE2084AM			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	7		–0.5	4	mV
				Full range			12.5			7.5	
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			65			65	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	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			
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	
a_X	Crosstalk attenuation	V_{IC} = 0, R_L = 2 kΩ		25°C		120			120		dB

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

TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	TLE2084M			TLE2084AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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		

TLE2084M operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

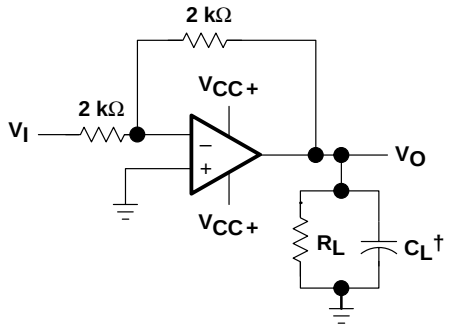
PARAMETER		TEST CONDITIONS		T_A†	TLE2084M			TLE2084AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)}$ = 10 V, A_{VD} = –1, C_L = 100 pF,	R_L = 2 kΩ, See Figure 1	25°C	25	40		25	40		V/µs
				Full range	17			17			
SR–	Negative slew rate			25°C	30	45		30	45		V/µs
				Full range	20			20			
t_s	Settling time	A_{VD} = –1, 10-V step, R_L = 1kΩ, 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			28		nV/√Hz
			f = 10 kHz			11.6			11.6		
$V_{N(PP)}$	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 with MIL-PRF-38535, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.

TLE2084Y electrical characteristics at $V_{CC\pm}$ = ±15 V, T_A = 25°C (unless otherwise noted)

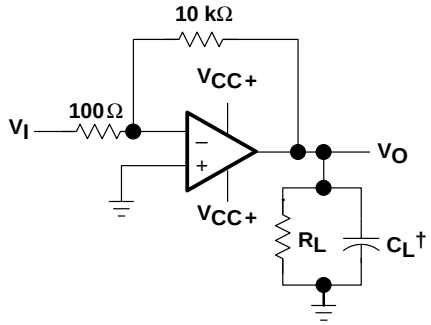
PARAMETER		TEST CONDITIONS		TLE2084Y			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω				7	mV
I_{IO}	Input offset current	V_{IC} = 0, V_O = 0, See Figure 4			15	100	pA
I_{IB}	Input bias current				25	175	pA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		15 to −11	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	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 (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

† Includes fixture capacitance

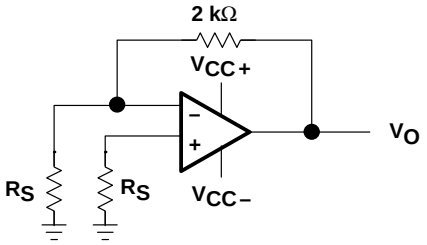


Figure 3. Noise-Voltage Test Circuit

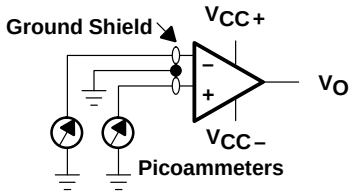


Figure 4. Input-Bias and Offset-Current Test Circuit

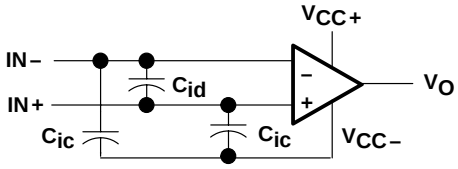


Figure 5. Internal Input Capacitance

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 TLE208x and TLE208xA, accurate measurement of the bias 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}	Input offset voltage temperature coefficient	Distribution	9, 10, 11
I_{IO}	Input offset current	vs Free-air temperature	12 – 15
I_{IB}	Input bias current	vs Free-air temperature vs Supply voltage	12 – 15 16
V_{ICR}	Common-mode input voltage range	vs Free-air temperature	17
V_{ID}	Differential input voltage	vs Output voltage	18, 19
V_{OM+}	Maximum positive peak output voltage	vs Output current vs Free-air temperature vs Supply voltage	20, 21 24, 25 26
V_{OM-}	Maximum negative peak output voltage	vs Output current vs Free-air temperature vs Supply voltage	22, 23 24, 25 26
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	27
V_O	Output voltage	vs Settling time	28
A_{VD}	Large-signal differential voltage amplification	vs Load resistance vs Free-air temperature	29 30, 31
A_{VD}	Small-signal differential voltage amplification	vs Frequency	32, 33
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	34 35
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	36 37
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature vs Differential input voltage	38, 39, 40 41, 42, 43 44 – 49
I_{OS}	Short-circuit output current	vs Supply voltage vs Elapsed time vs Free-air temperature	50 51 52
SR	Slew rate	vs Free-air temperature vs Load resistance vs Differential input voltage	53, 54 55 56
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V_n	Input-referred noise voltage	vs Noise bandwidth frequency Over a 10-second time interval	58 59
	Third-octave spectral noise density	vs Frequency bands	60
THD + N	Total harmonic distortion plus noise	vs Frequency	61, 62
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	Gain-bandwidth product	vs Free-air temperature vs Supply voltage	64 65
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TYPICAL CHARACTERISTICS

Table of Graphs (Continued)

			FIGURE
	Noninverting large-signal pulse response	vs Time	70
	Small-signal pulse response	vs Time	71
z_o	Closed-loop output impedance	vs Frequency	72
a_X	Crosstalk attenuation	vs Frequency	73

DISTRIBUTION OF TLE2081
INPUT OFFSET VOLTAGE

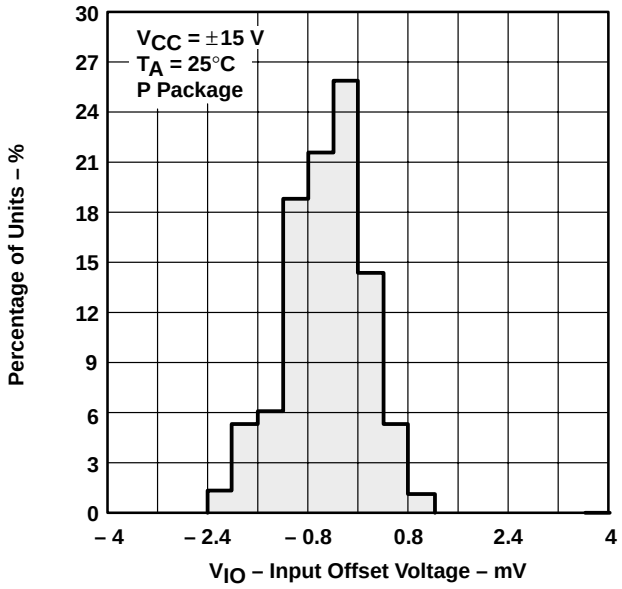


Figure 6

DISTRIBUTION OF TLE2082
INPUT OFFSET VOLTAGE

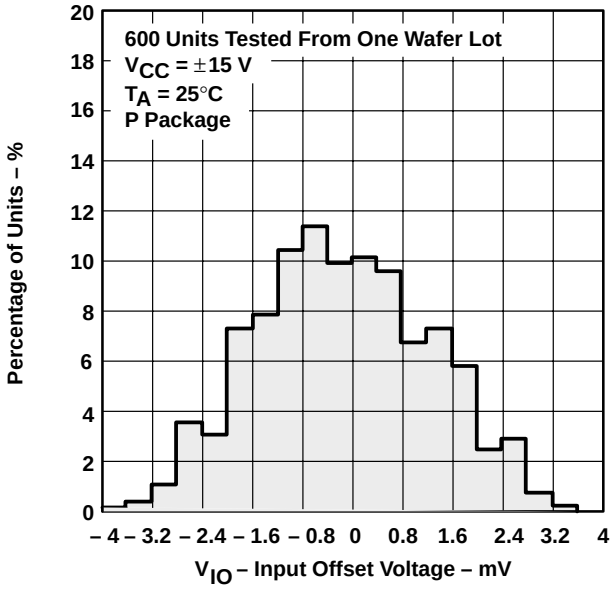


Figure 7

TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2084 INPUT OFFSET VOLTAGE

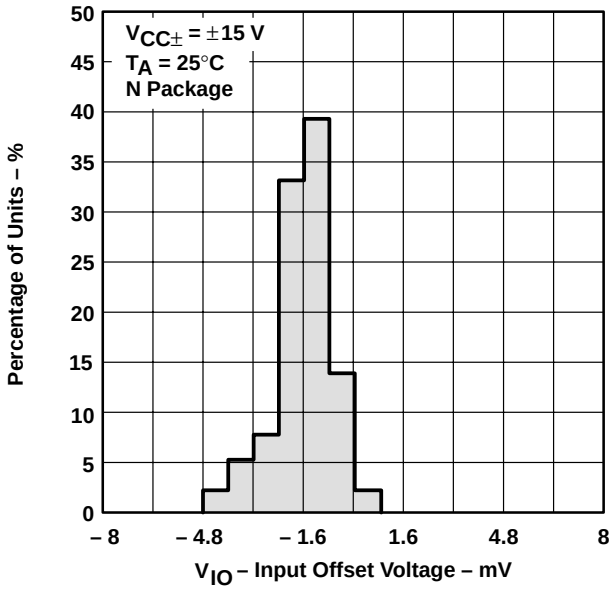


Figure 8

DISTRIBUTION OF TLE2081 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT

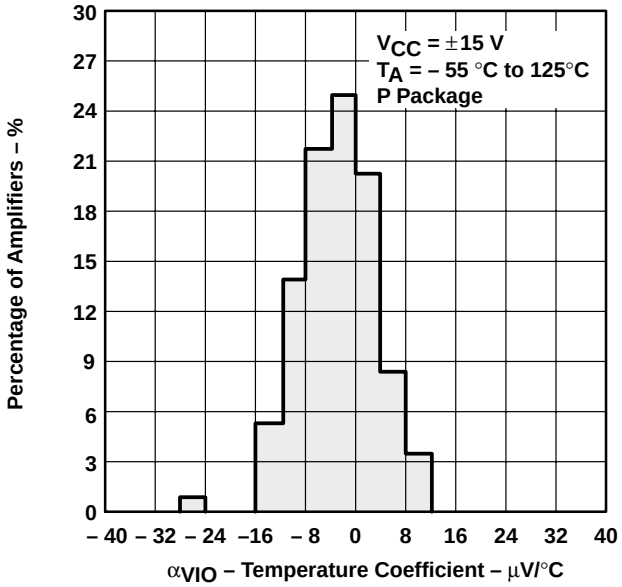


Figure 9

DISTRIBUTION OF TLE2082 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT

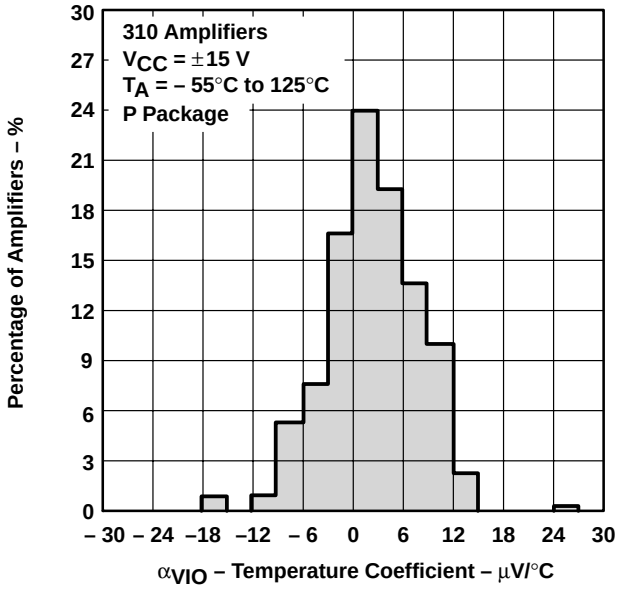


Figure 10

DISTRIBUTION OF TLE2084 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT

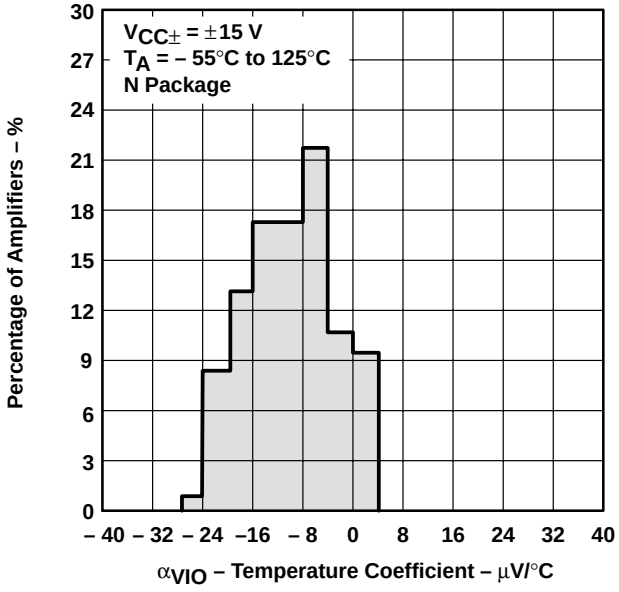


Figure 11

TYPICAL CHARACTERISTICS†

TLE2081 AND TLE2082
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

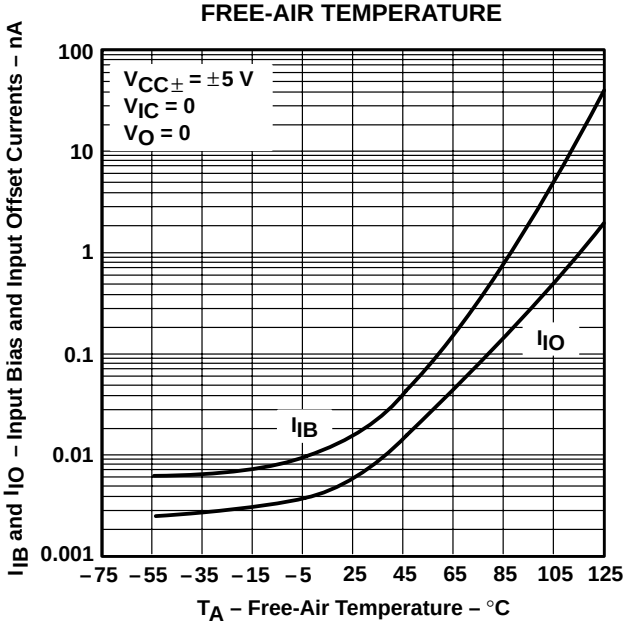


Figure 12

TLE2084
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

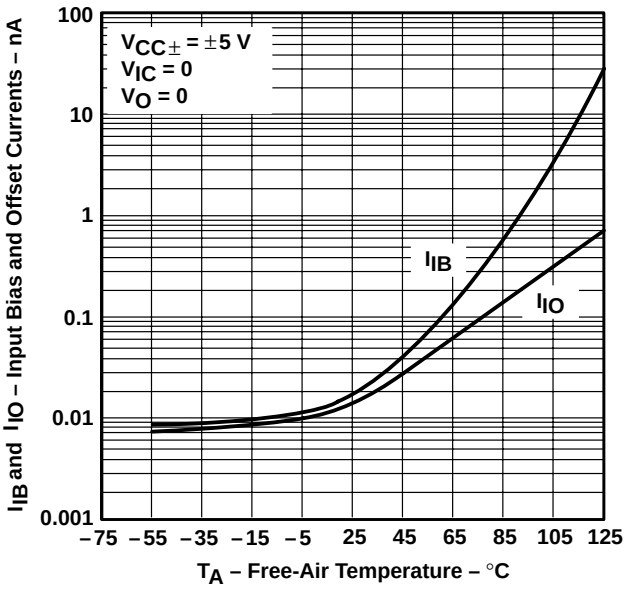


Figure 13

TLE2081 AND TLE2082
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

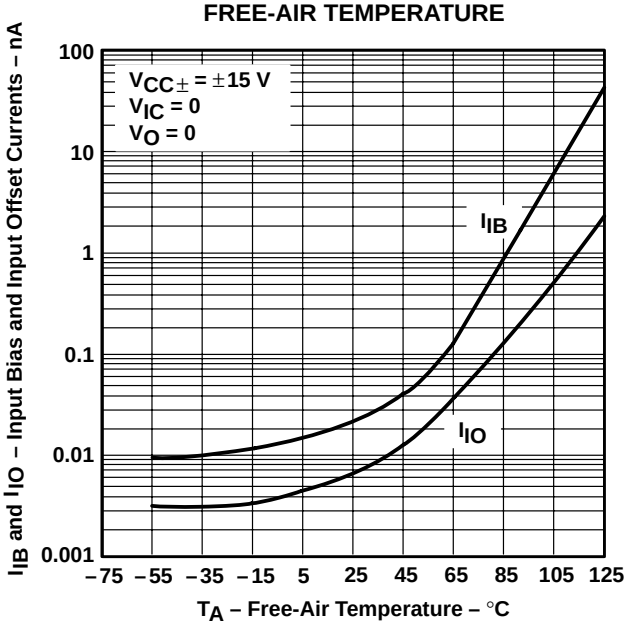


Figure 14

TLE2084
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

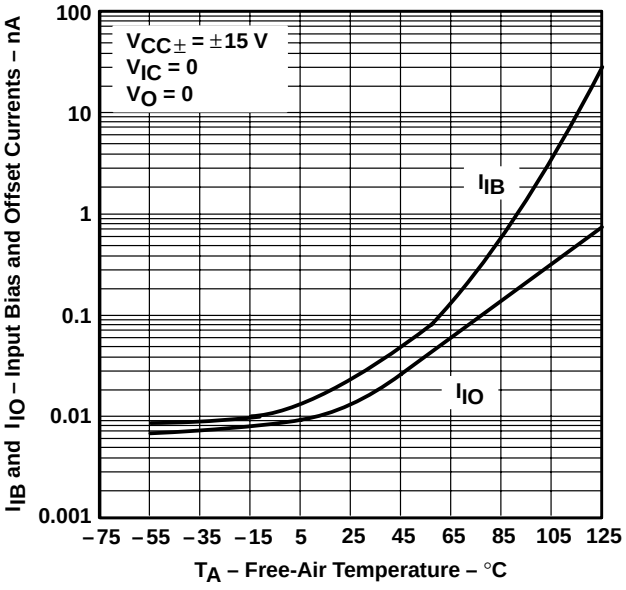


Figure 15

† 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

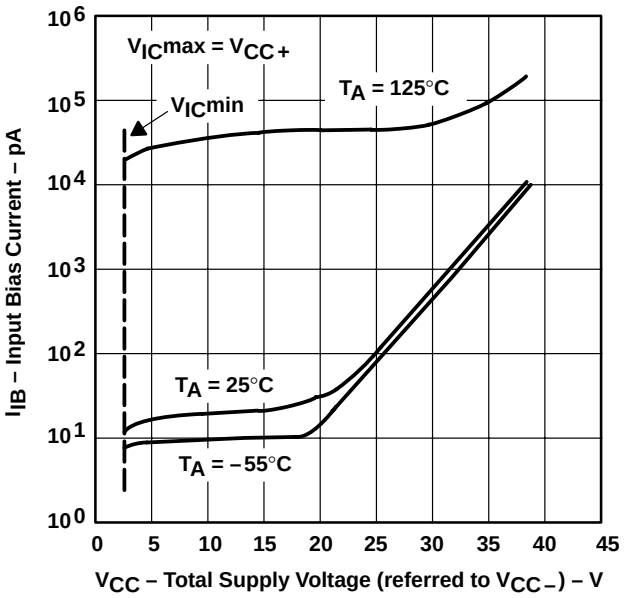


Figure 16

COMMON-MODE INPUT VOLTAGE RANGE vs FREE-AIR TEMPERATURE

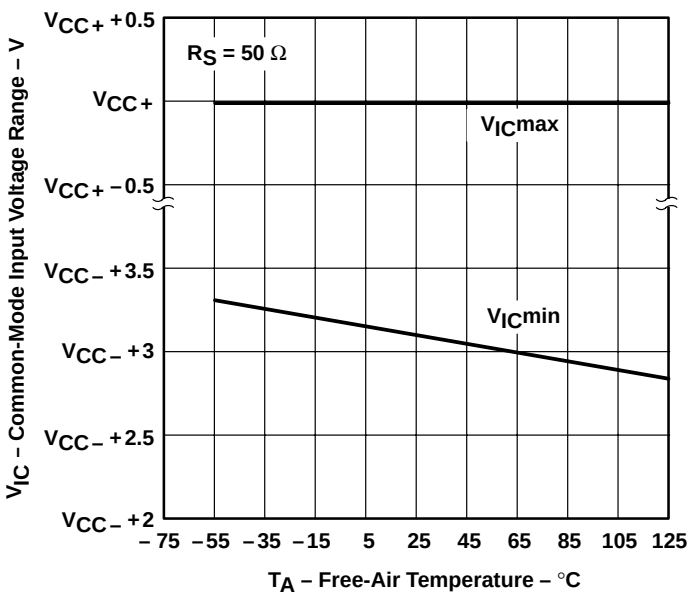


Figure 17

DIFFERENTIAL INPUT VOLTAGE vs OUTPUT VOLTAGE

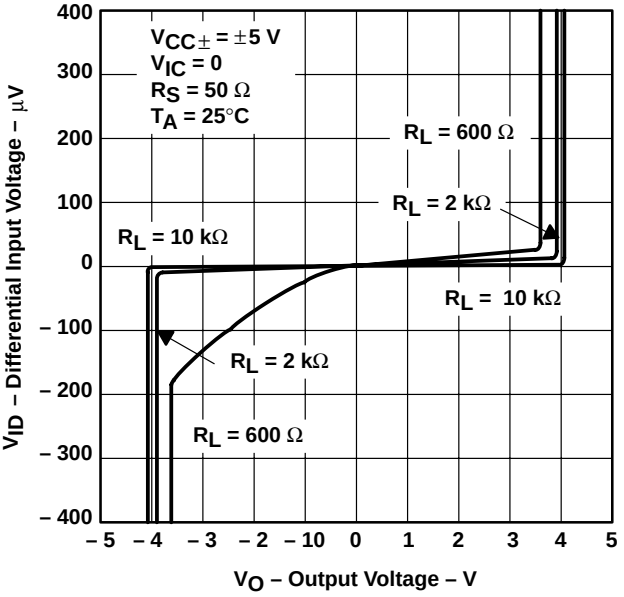


Figure 18

DIFFERENTIAL INPUT VOLTAGE vs OUTPUT VOLTAGE

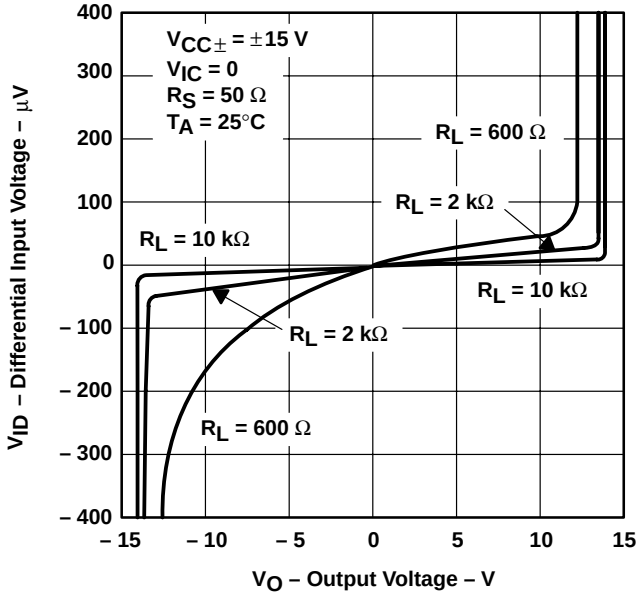


Figure 19

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

TYPICAL CHARACTERISTICS†

**TLE2081 AND TLE2082
MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT**

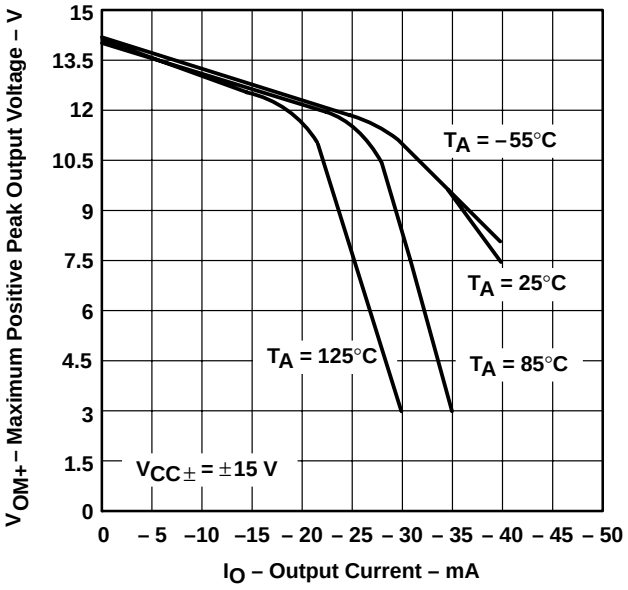


Figure 20

**TLE2084
MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT**

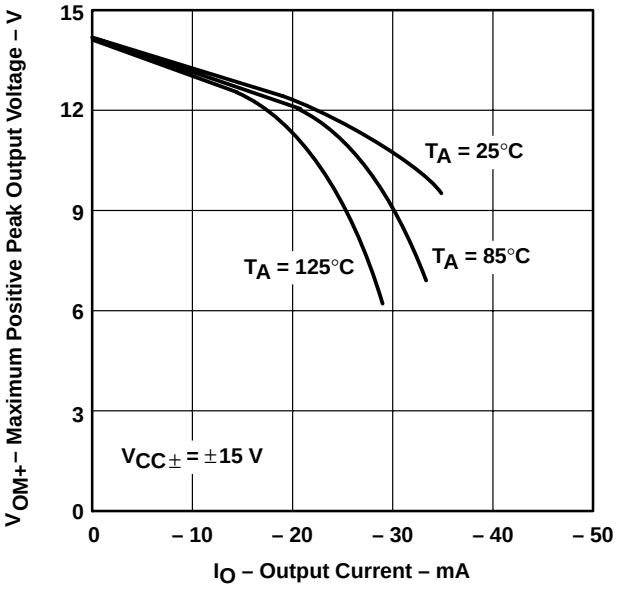


Figure 21

**TLE2081 AND TLE2082
MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT**

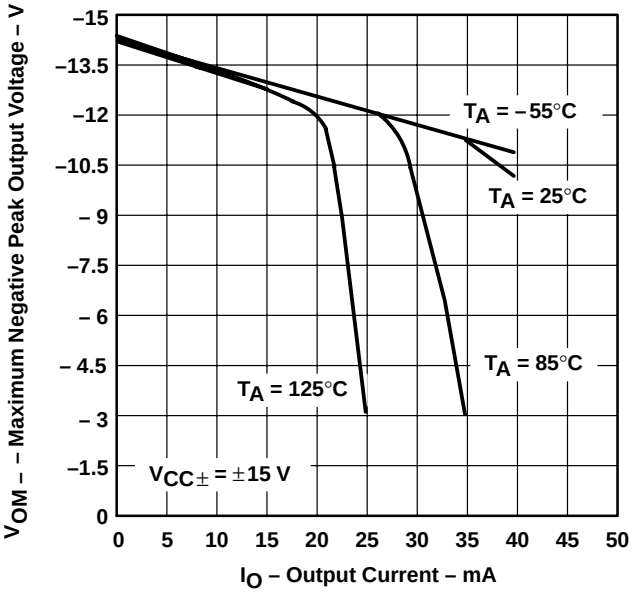


Figure 22

**TLE2084
MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT**

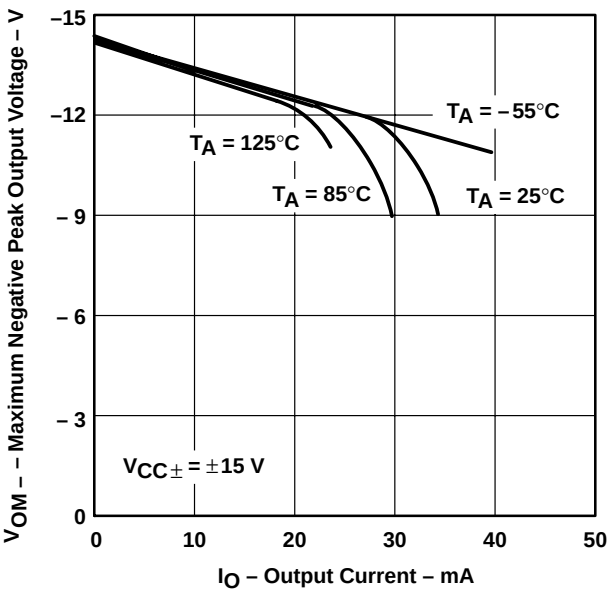


Figure 23

† 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 FREE-AIR TEMPERATURE

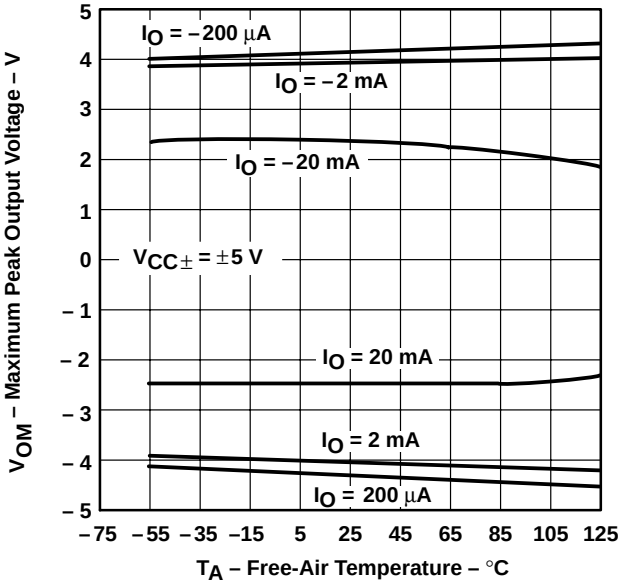


Figure 24

MAXIMUM PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

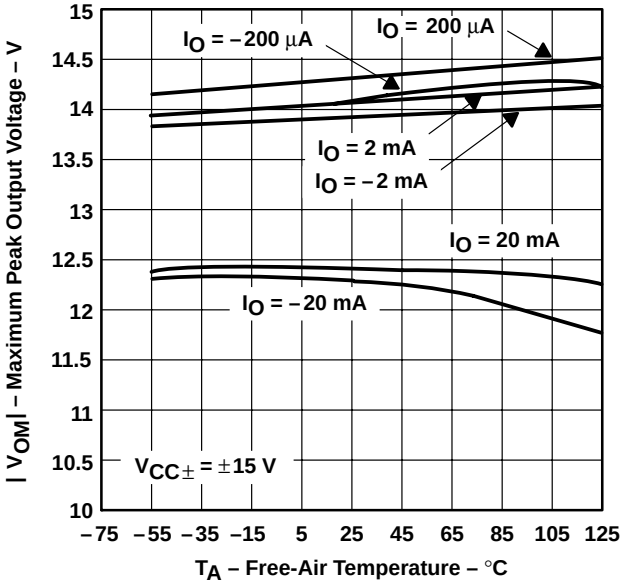


Figure 25

MAXIMUM PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

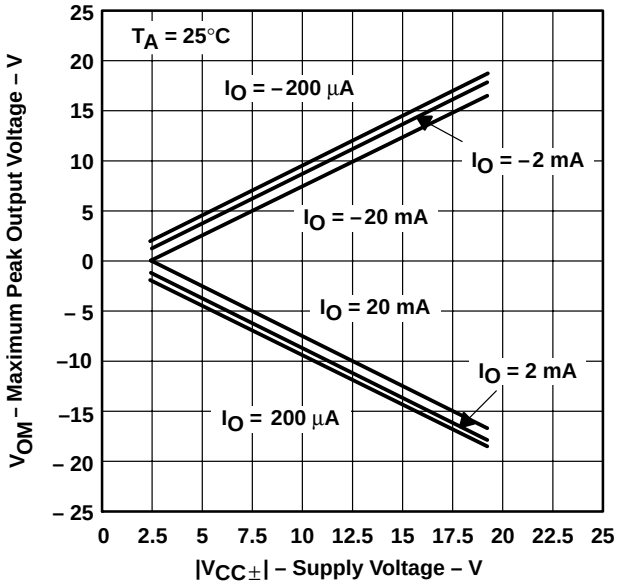


Figure 26

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

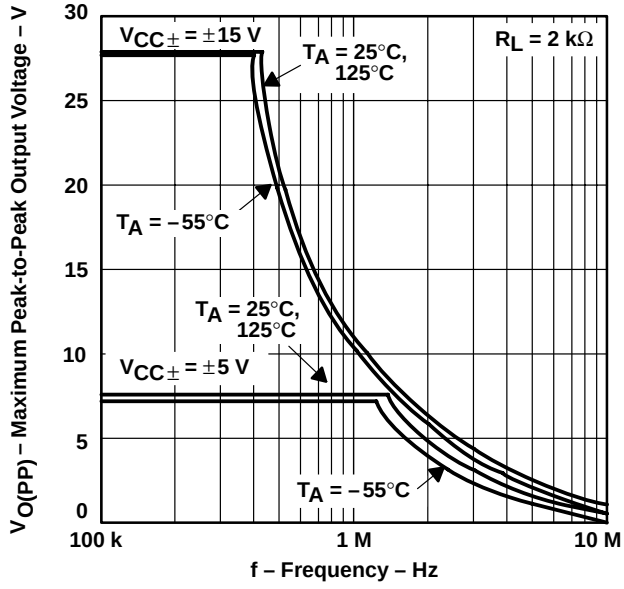


Figure 27

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

TYPICAL CHARACTERISTICS†

OUTPUT VOLTAGE vs SETTLING TIME

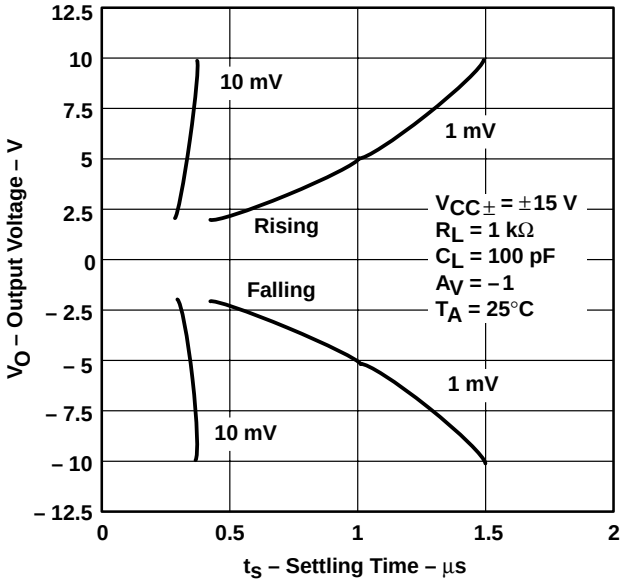


Figure 28

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs LOAD RESISTANCE

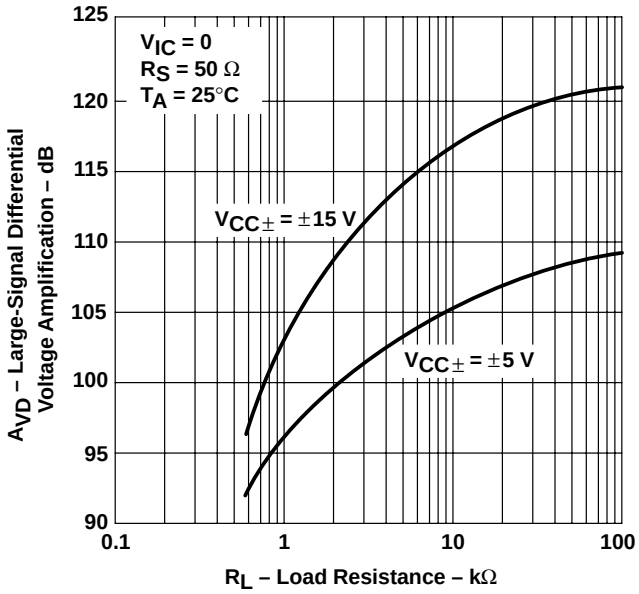


Figure 29

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

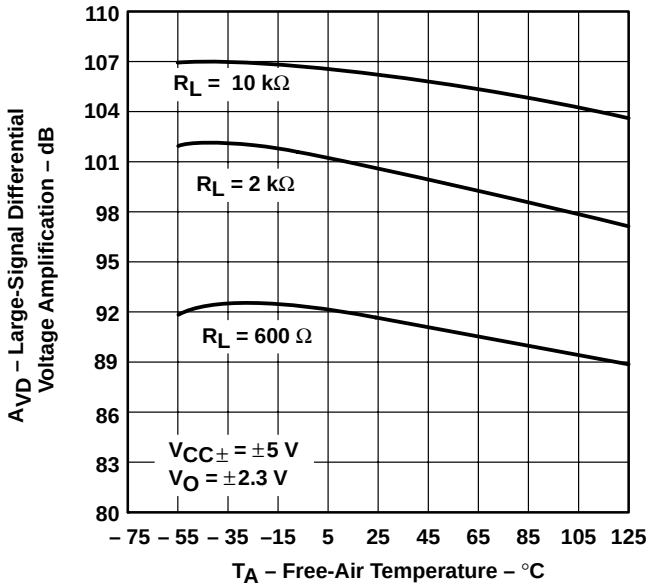


Figure 30

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

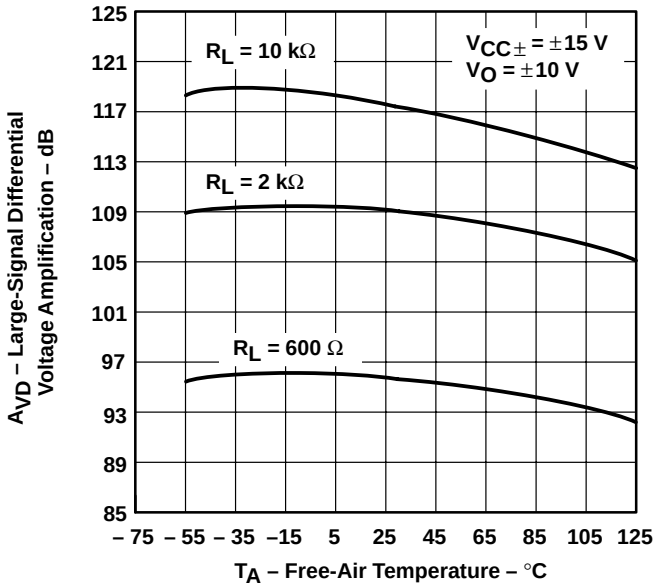


Figure 31

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

TYPICAL CHARACTERISTICS

SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY

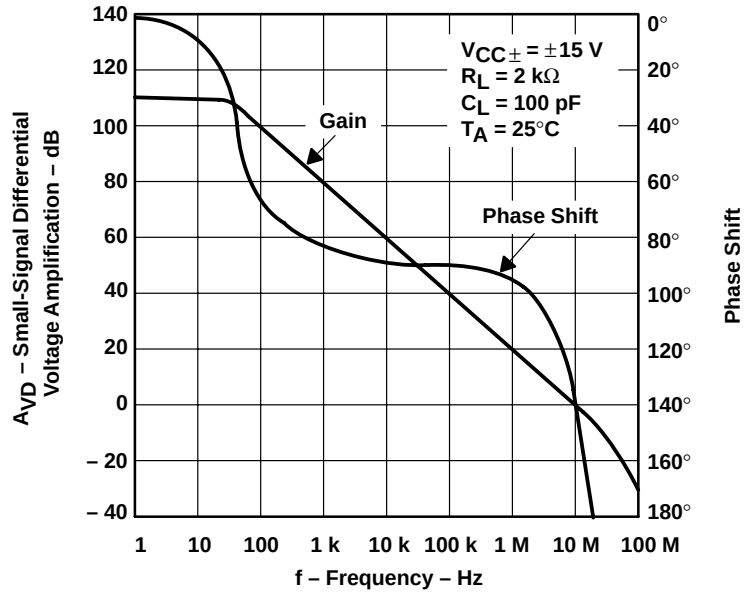


Figure 32

SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY

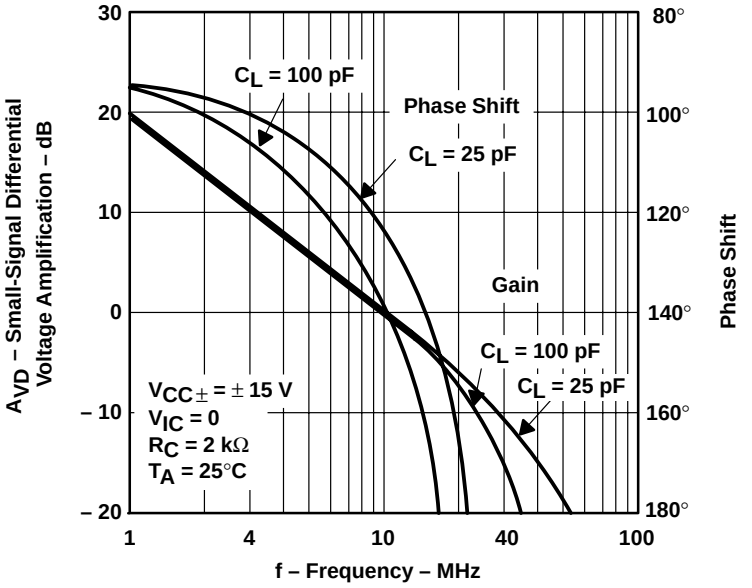


Figure 33

TYPICAL CHARACTERISTICS†

COMMON-MODE REJECTION RATIO vs FREQUENCY

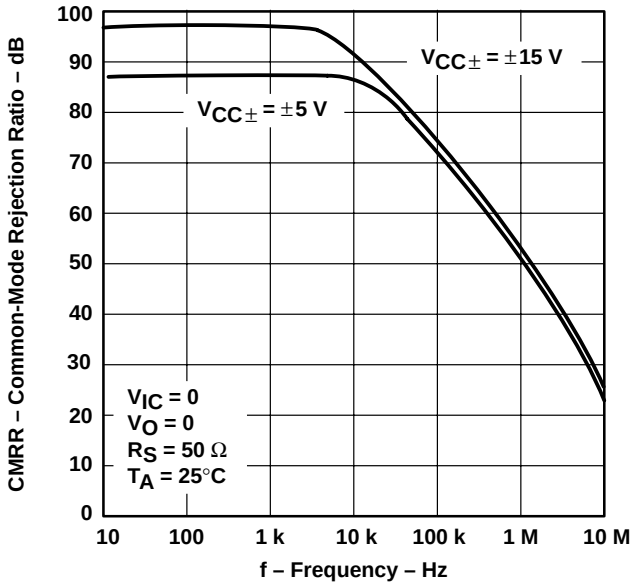


Figure 34

COMMON-MODE REJECTION RATIO vs FREE-AIR TEMPERATURE

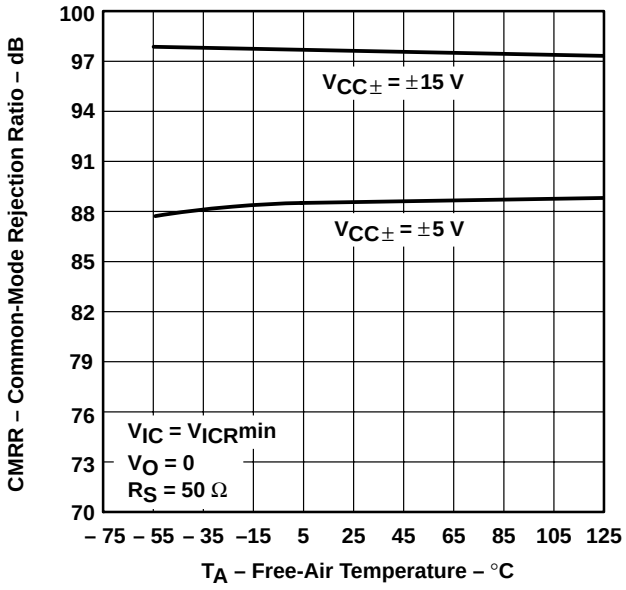


Figure 35

SUPPLY-VOLTAGE REJECTION RATIO vs FREQUENCY

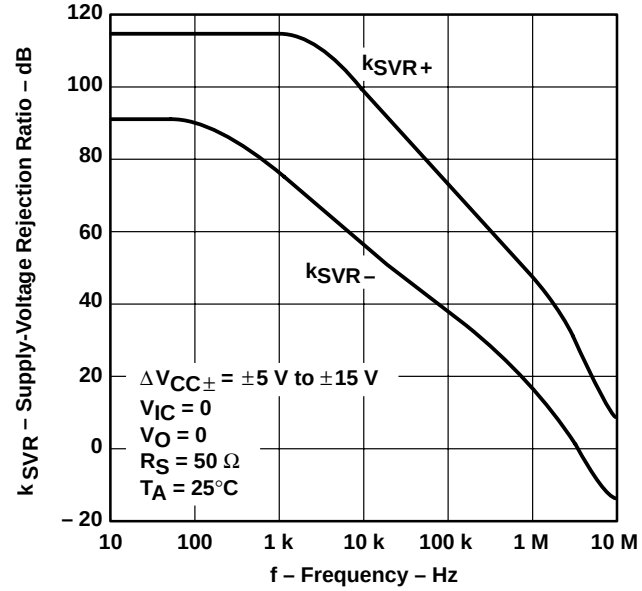


Figure 36

SUPPLY-VOLTAGE REJECTION RATIO vs FREE-AIR TEMPERATURE

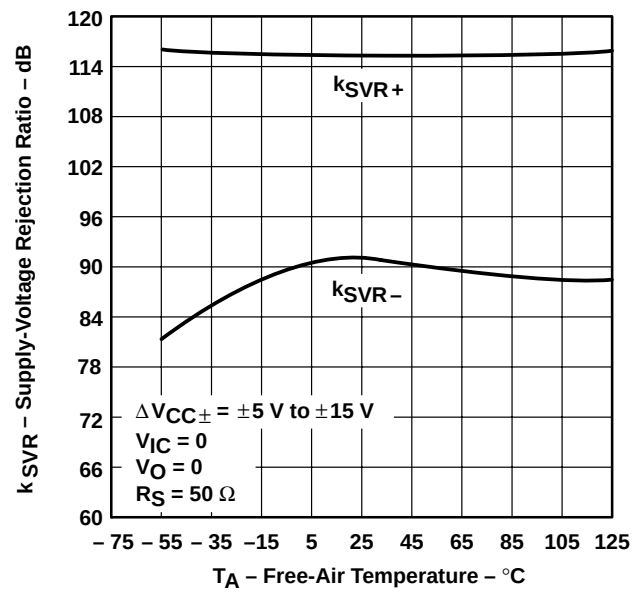


Figure 37

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

TYPICAL CHARACTERISTICS†

TLE2081
SUPPLY CURRENT
vs
SUPPLY VOLTAGE

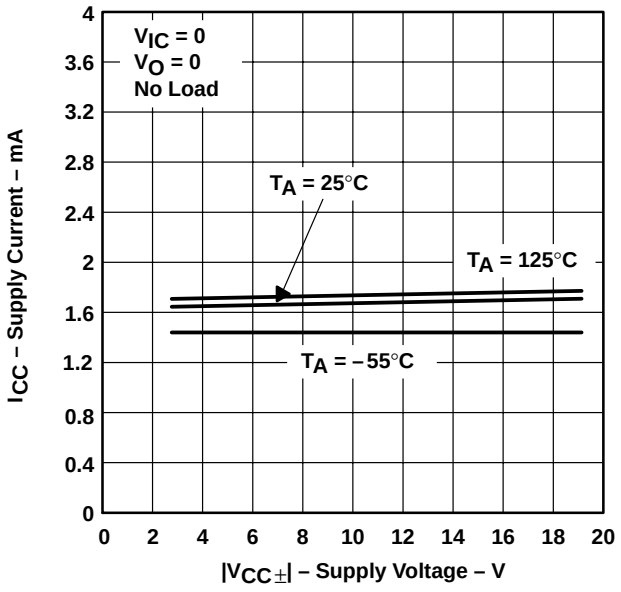


Figure 38

TLE2082
SUPPLY CURRENT
vs
SUPPLY VOLTAGE

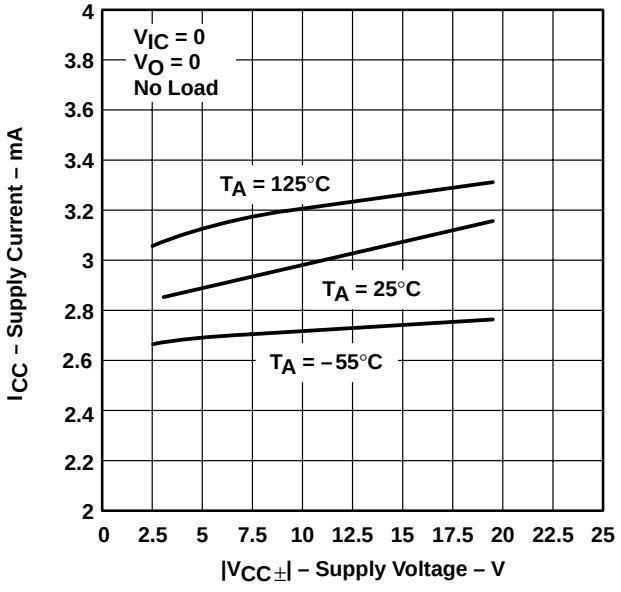


Figure 39

TLE2084
SUPPLY CURRENT
vs
SUPPLY VOLTAGE

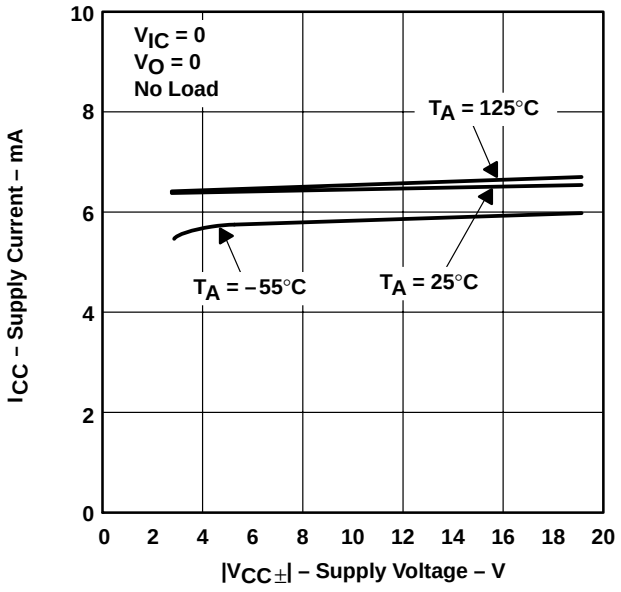


Figure 40

TLE2081
SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

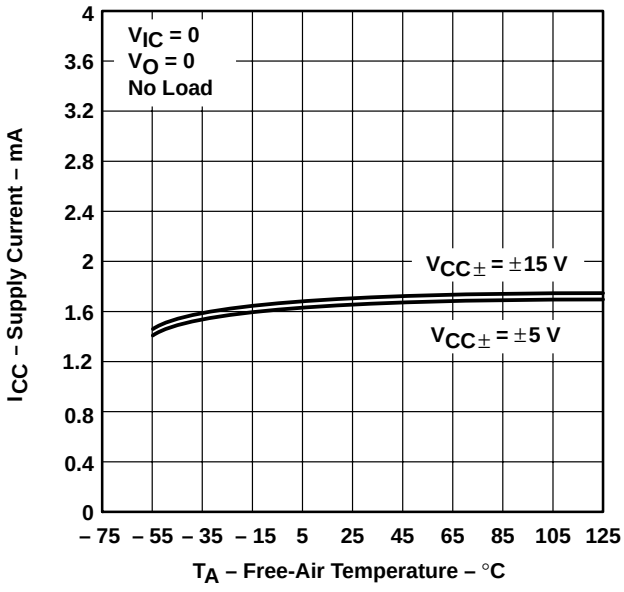


Figure 41

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

TYPICAL CHARACTERISTICS†

TLE2082
SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

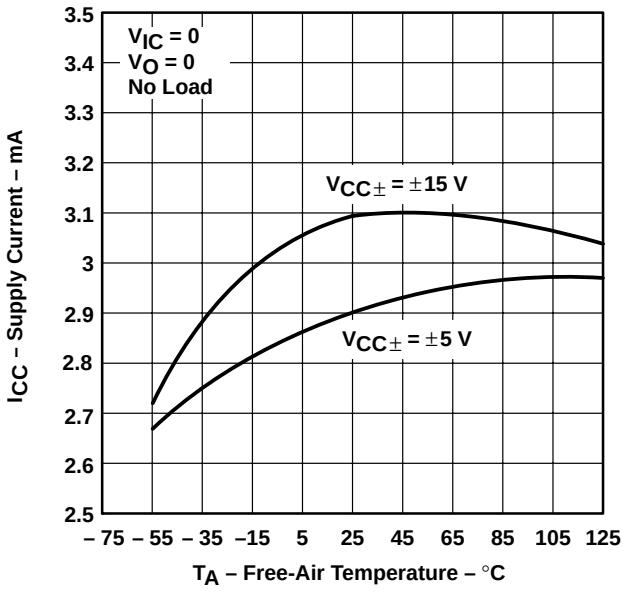


Figure 42

TLE2084
SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

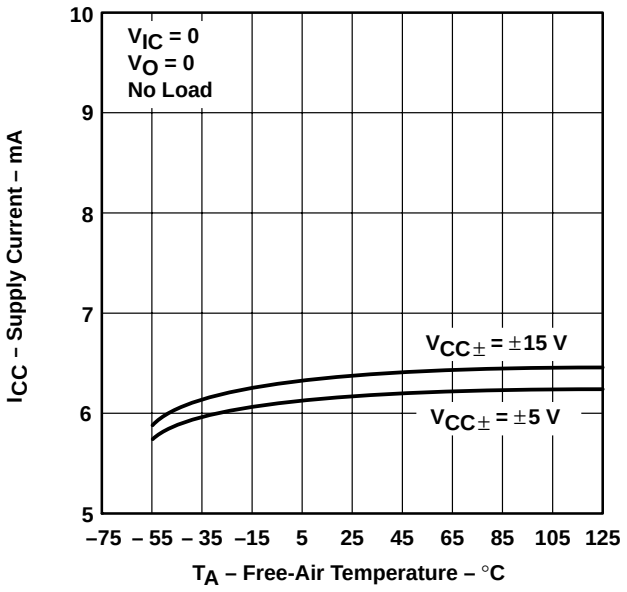


Figure 43

TLE2081
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE

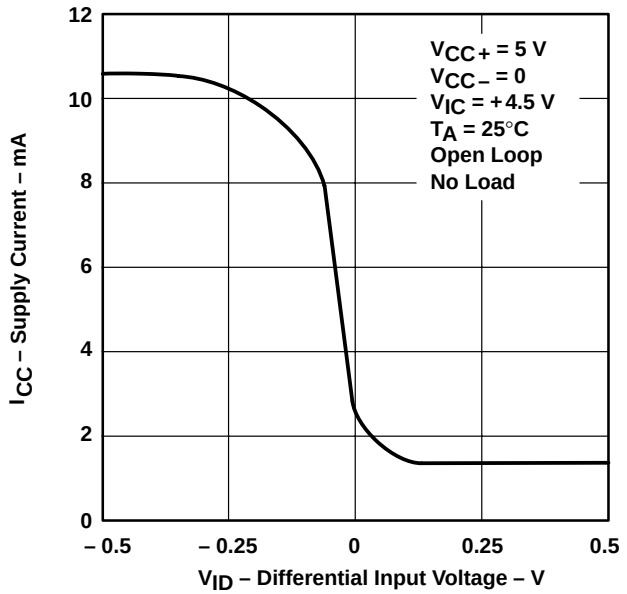


Figure 44

TLE2082
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE

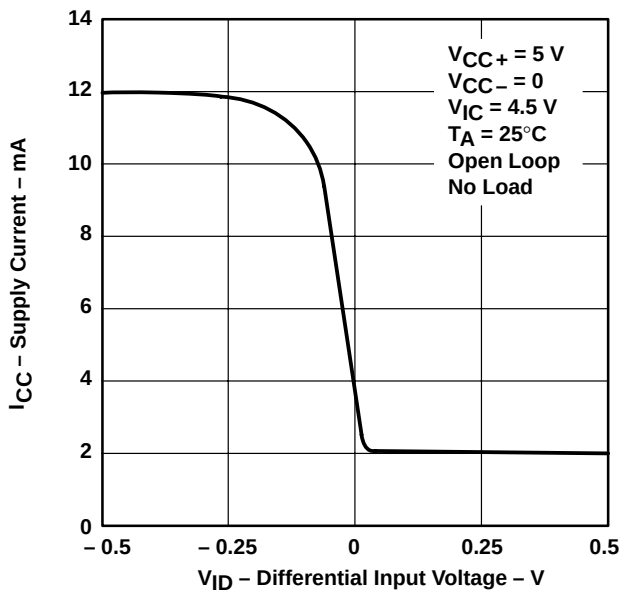


Figure 45

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

TYPICAL CHARACTERISTICS

**TLE2084
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

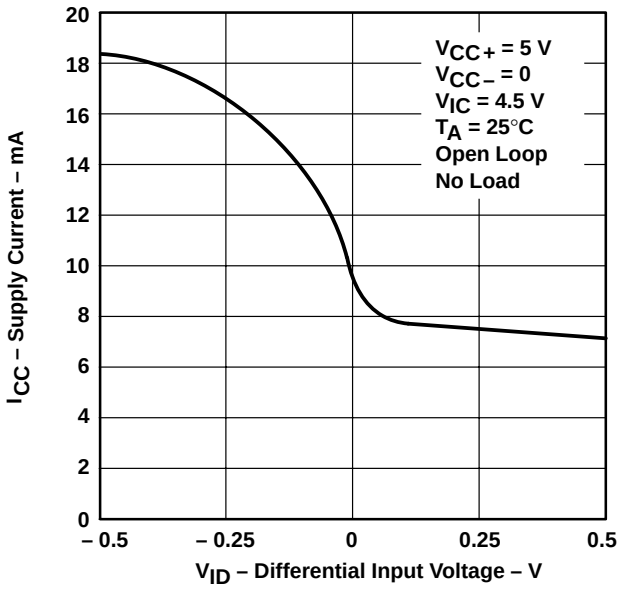


Figure 46

**TLE2081
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

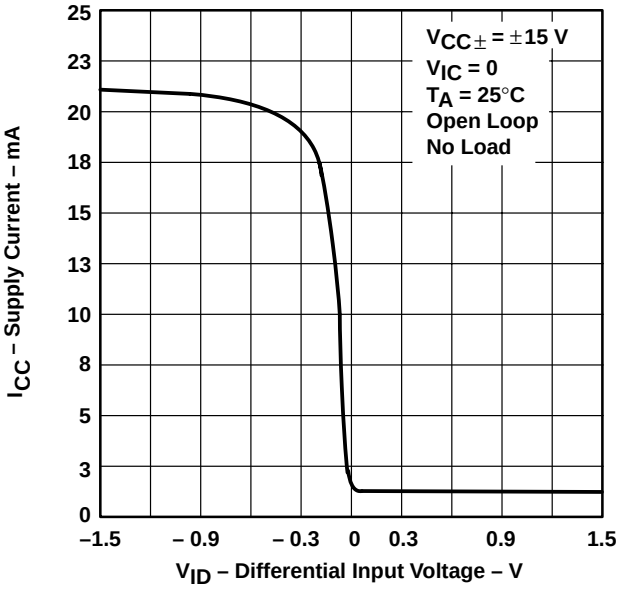


Figure 47

**TLE2082
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

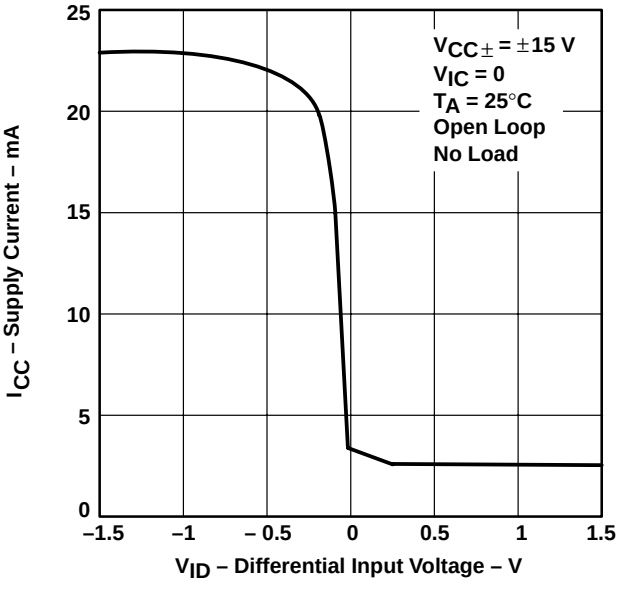


Figure 48

**TLE2084
SUPPLY CURRENT
vs
DIFFERENTIAL INPUT VOLTAGE**

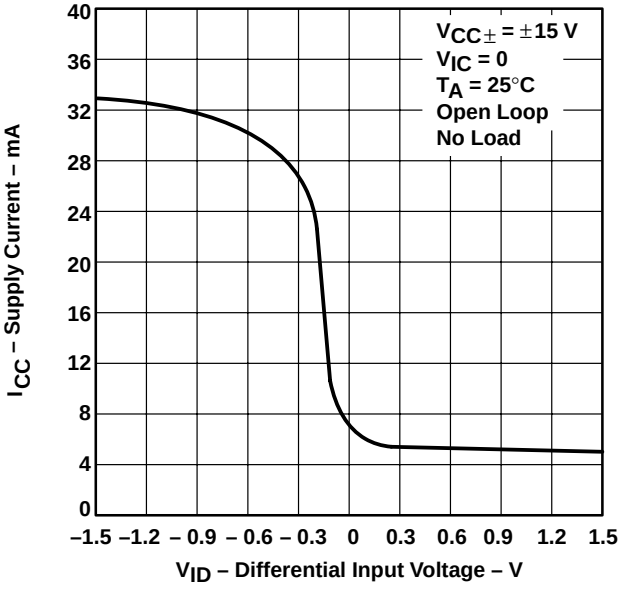


Figure 49

TYPICAL CHARACTERISTICS†

SHORT-CIRCUIT OUTPUT CURRENT vs SUPPLY VOLTAGE

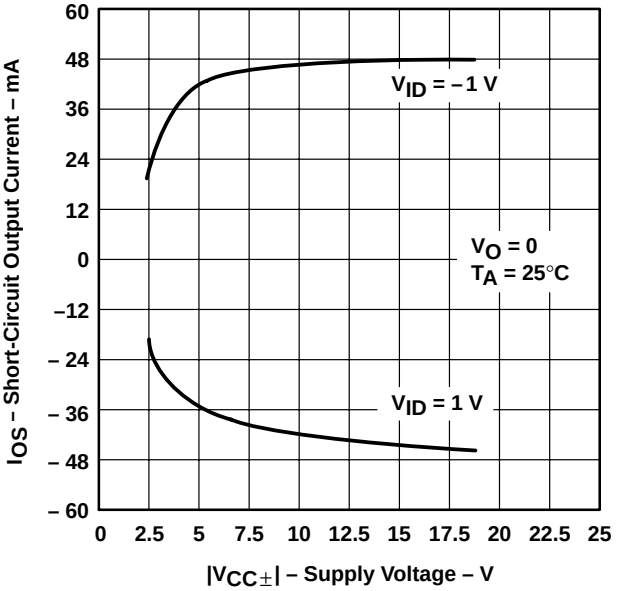


Figure 50

SHORT-CIRCUIT OUTPUT CURRENT vs ELAPSED TIME

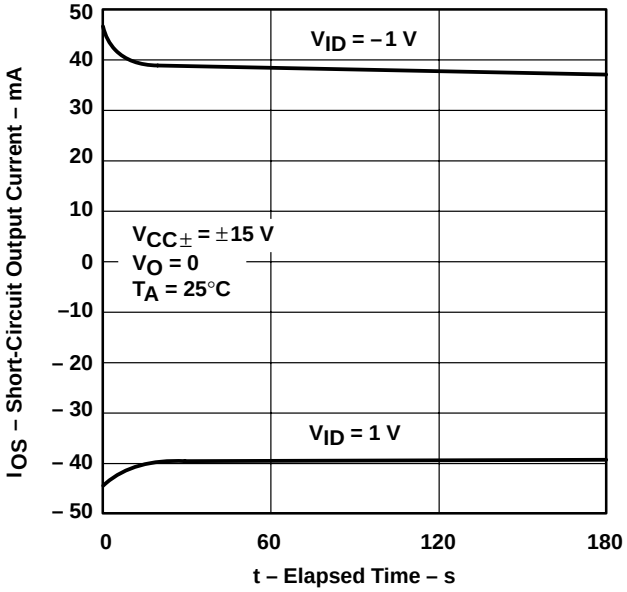


Figure 51

SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

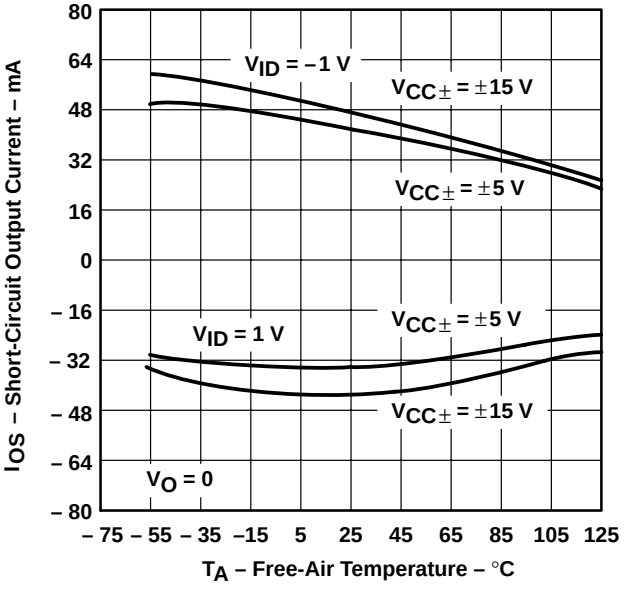


Figure 52

SLEW RATE vs FREE-AIR TEMPERATURE

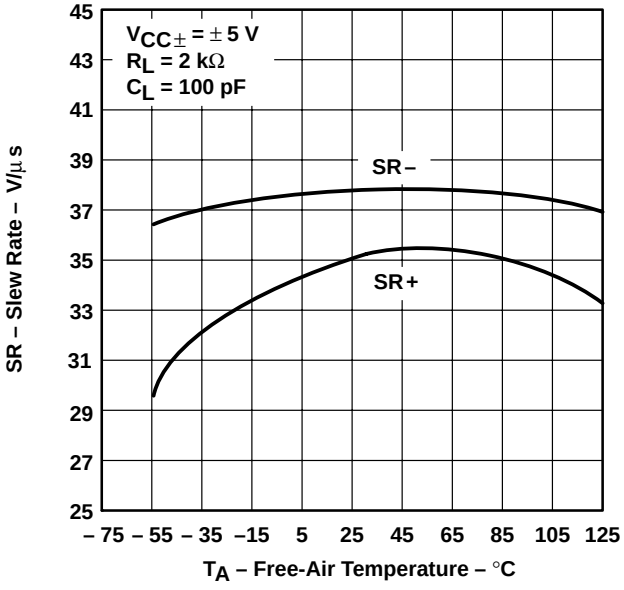


Figure 53

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

TYPICAL CHARACTERISTICS†

SLEW RATE vs FREE-AIR TEMPERATURE

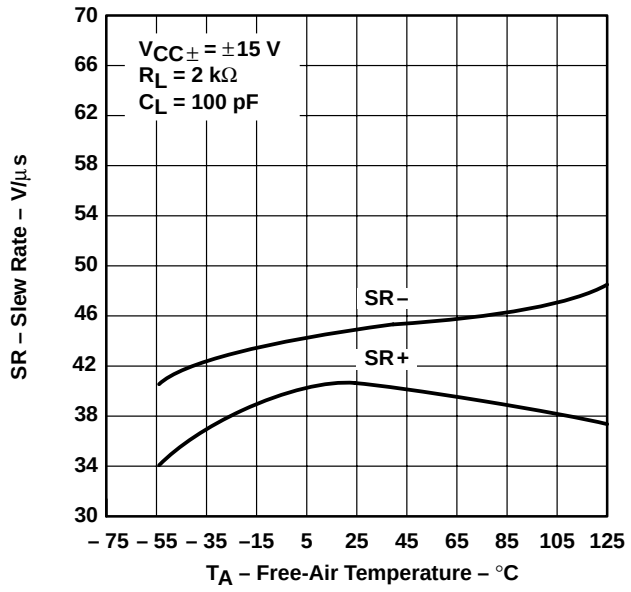


Figure 54

SLEW RATE vs LOAD RESISTANCE

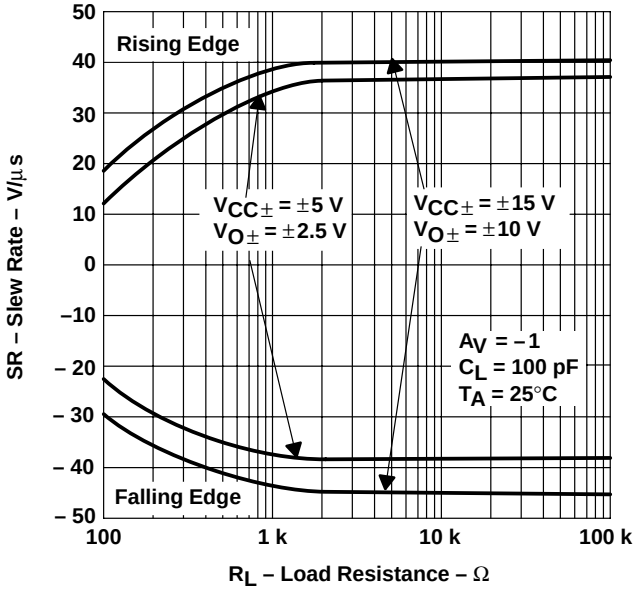


Figure 55

SLEW RATE vs DIFFERENTIAL INPUT VOLTAGE

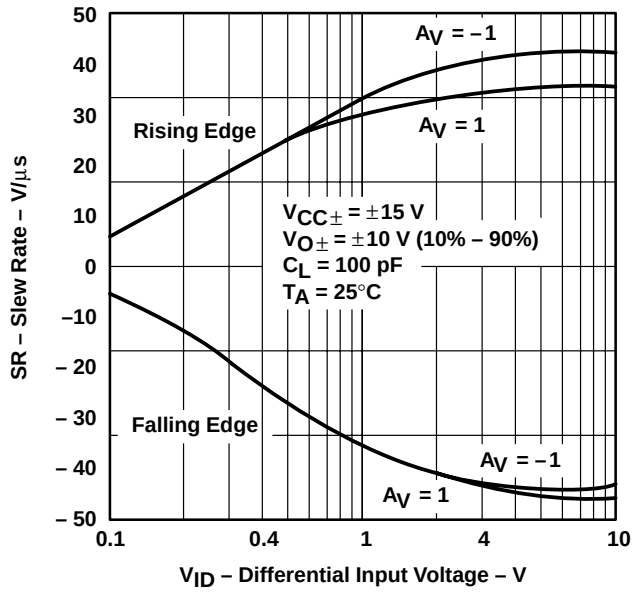


Figure 56

EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

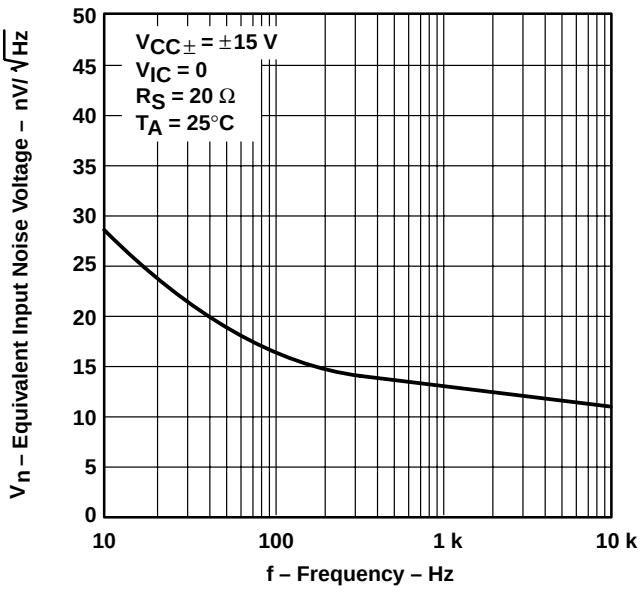


Figure 57

† 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 FREQUENCY

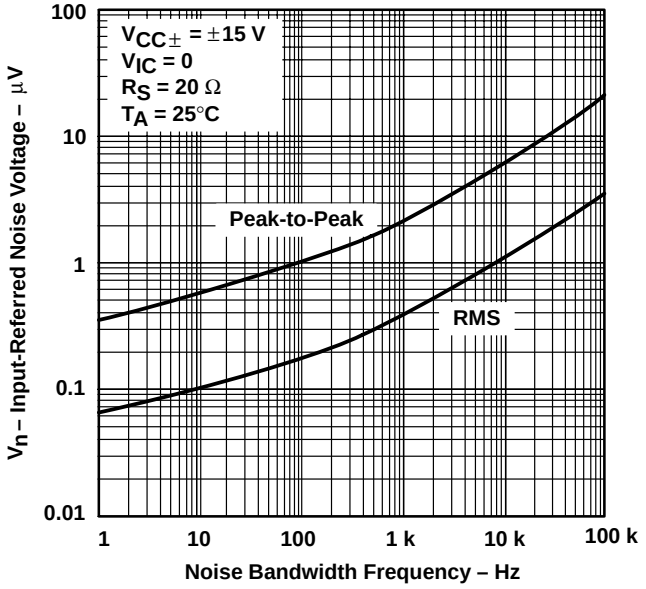


Figure 58

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

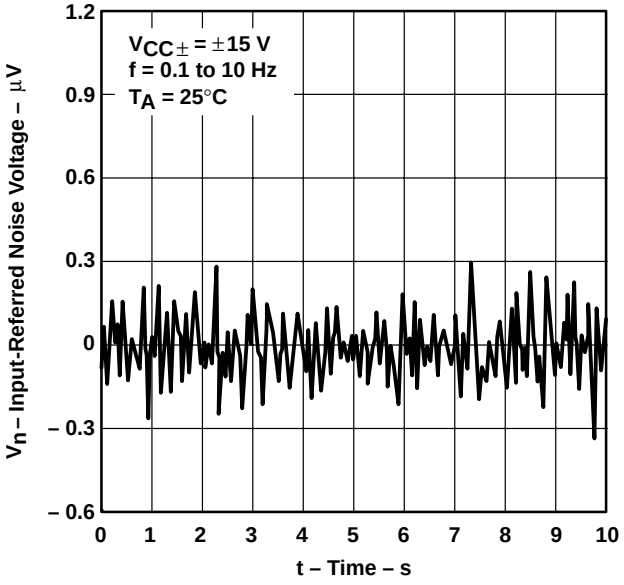


Figure 59

THIRD-OCTAVE SPECTRAL NOISE DENSITY vs FREQUENCY BANDS

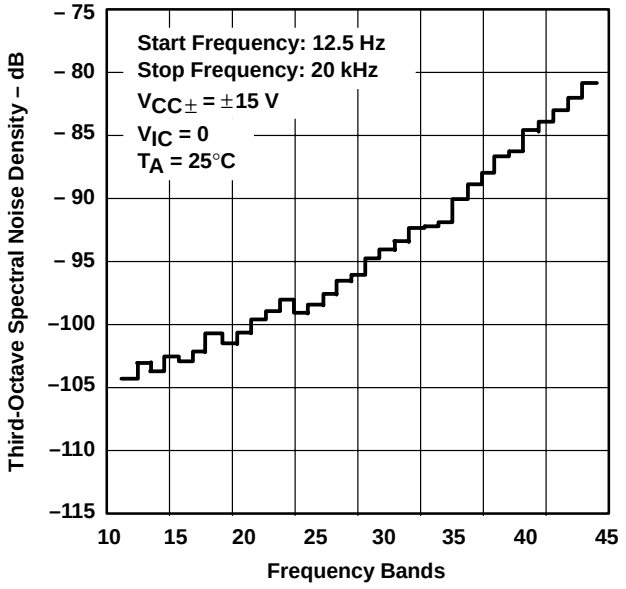


Figure 60

TOTAL HARMONIC DISTORTION PLUS NOISE vs FREQUENCY

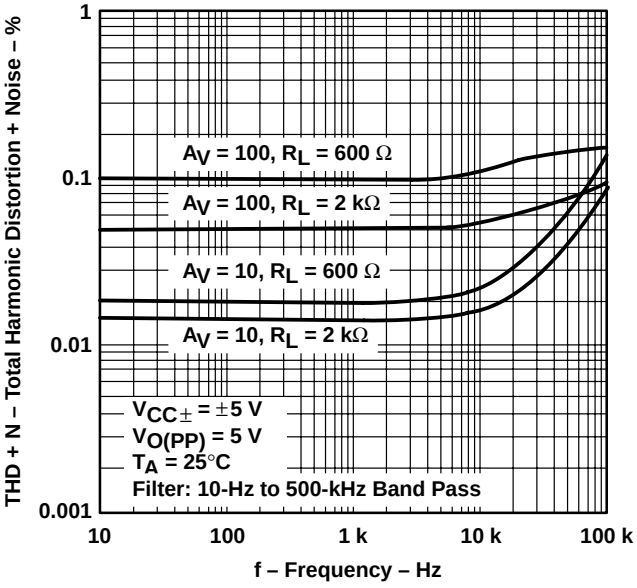


Figure 61

TYPICAL CHARACTERISTICS†

TOTAL HARMONIC DISTORTION PLUS NOISE vs FREQUENCY

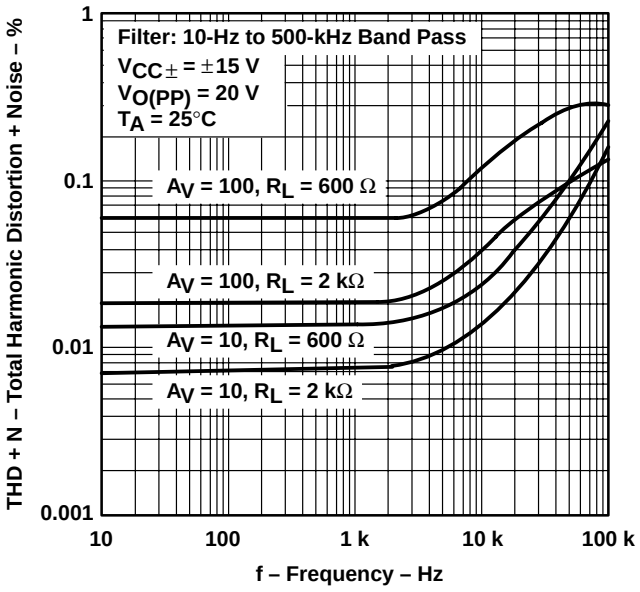


Figure 62

UNITY-GAIN BANDWIDTH vs LOAD CAPACITANCE

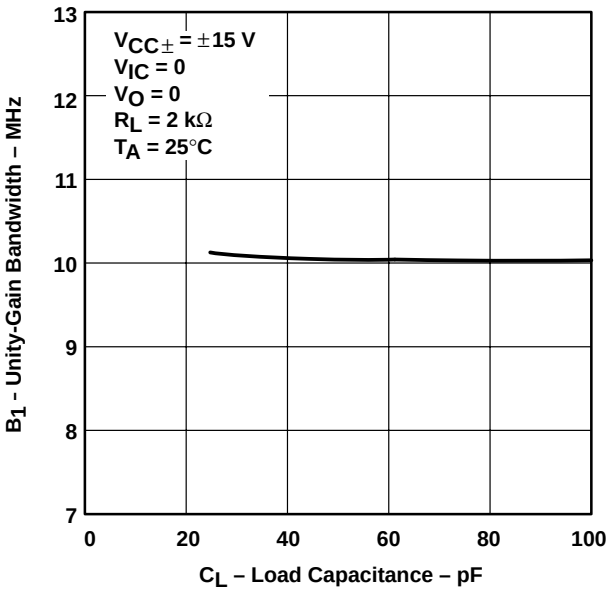


Figure 63

GAIN-BANDWIDTH PRODUCT vs FREE-AIR TEMPERATURE

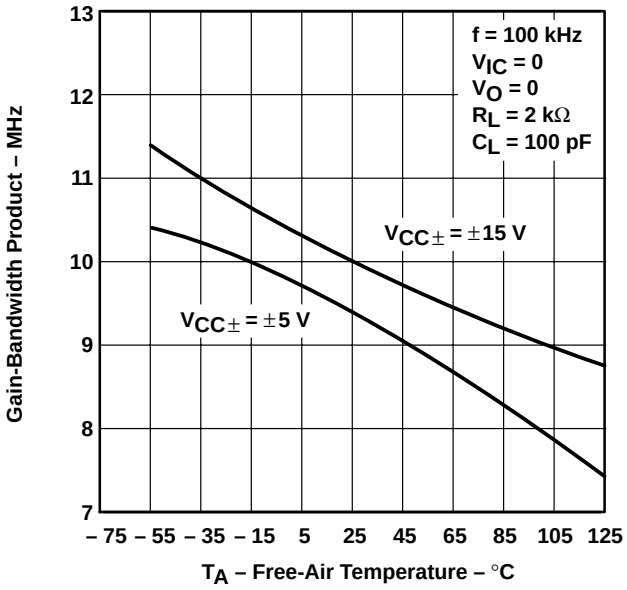


Figure 64

GAIN-BANDWIDTH PRODUCT vs SUPPLY VOLTAGE

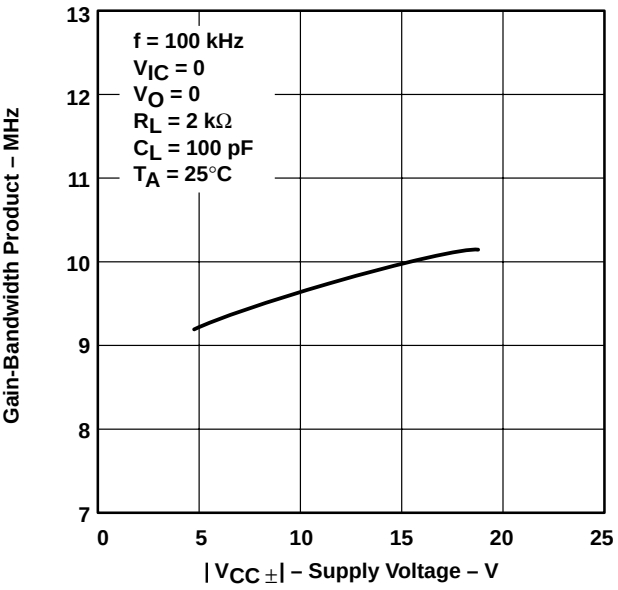


Figure 65

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

TYPICAL CHARACTERISTICS†

GAIN MARGIN vs LOAD CAPACITANCE

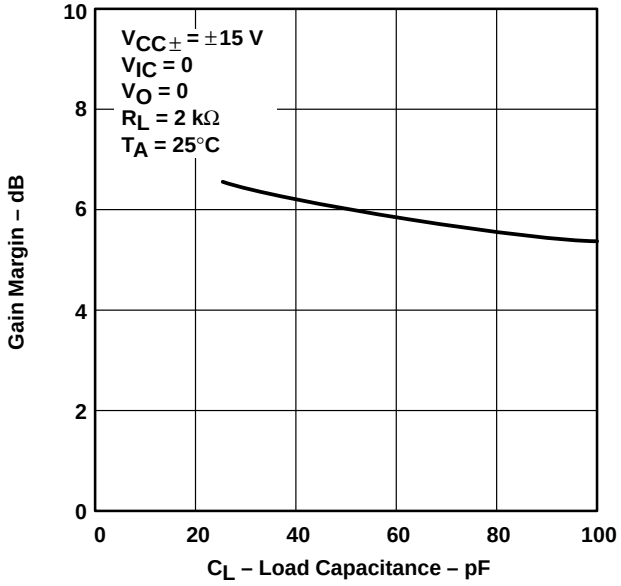


Figure 66

PHASE MARGIN vs FREE-AIR TEMPERATURE

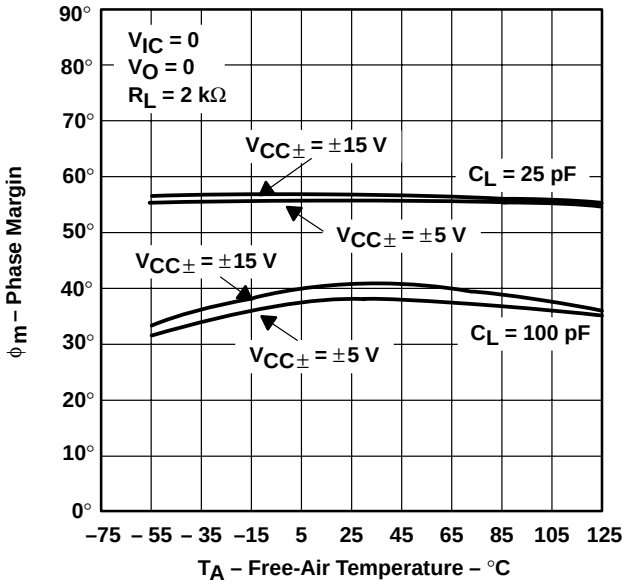


Figure 67

PHASE MARGIN vs SUPPLY VOLTAGE

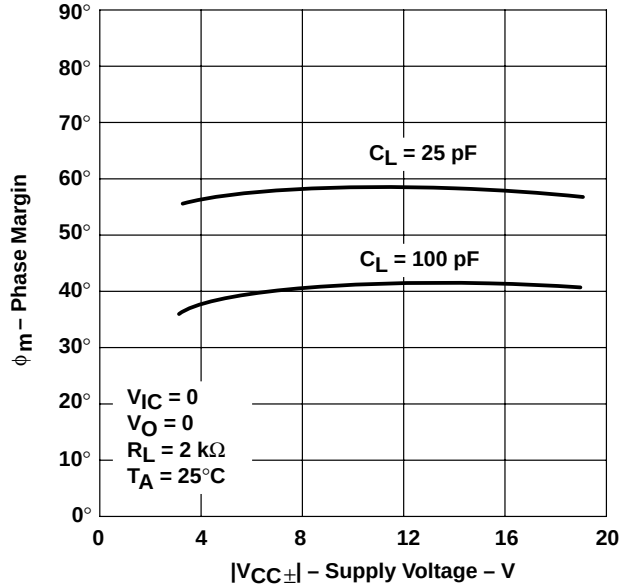


Figure 68

PHASE MARGIN vs LOAD CAPACITANCE

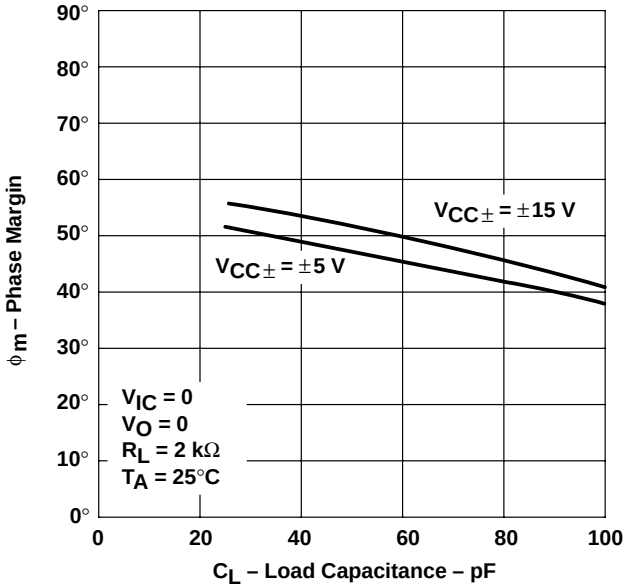


Figure 69

† 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

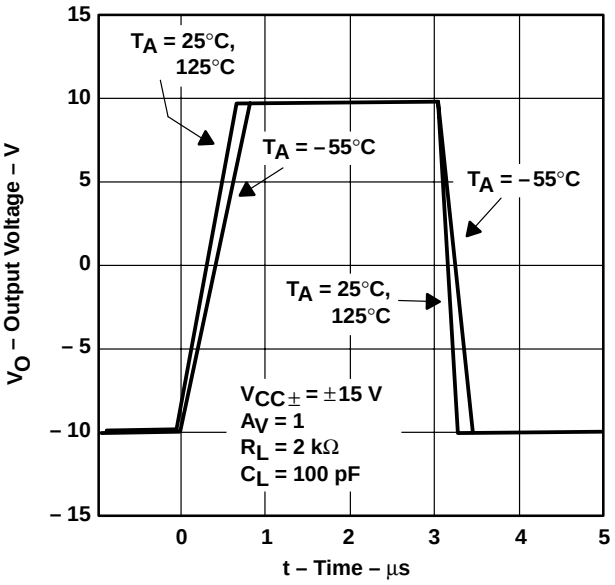


Figure 70

SMALL-SIGNAL PULSE RESPONSE

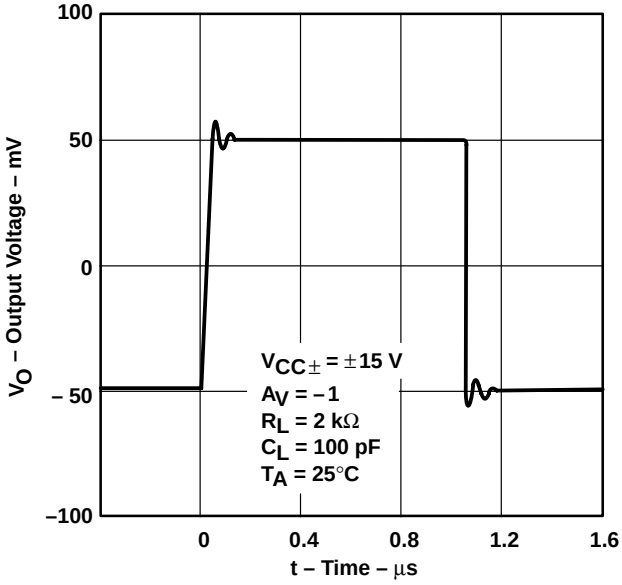


Figure 71

CLOSED-LOOP OUTPUT IMPEDANCE vs FREQUENCY

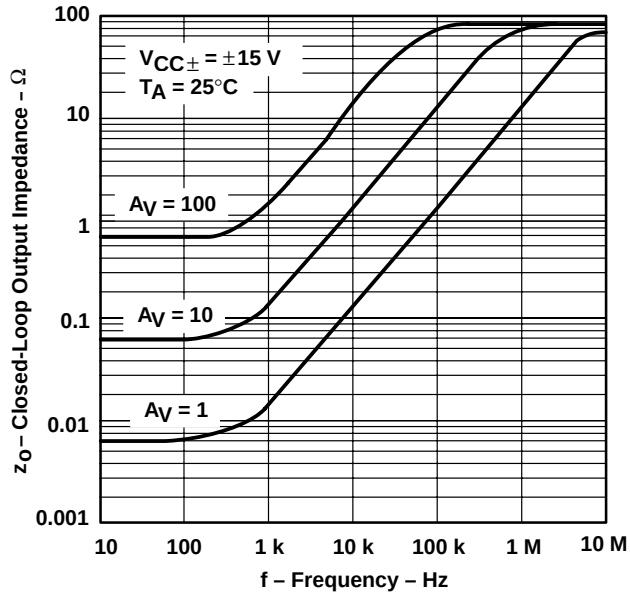


Figure 72

TLE2082 AND TLE2084 CROSSTALK ATTENUATION vs FREQUENCY

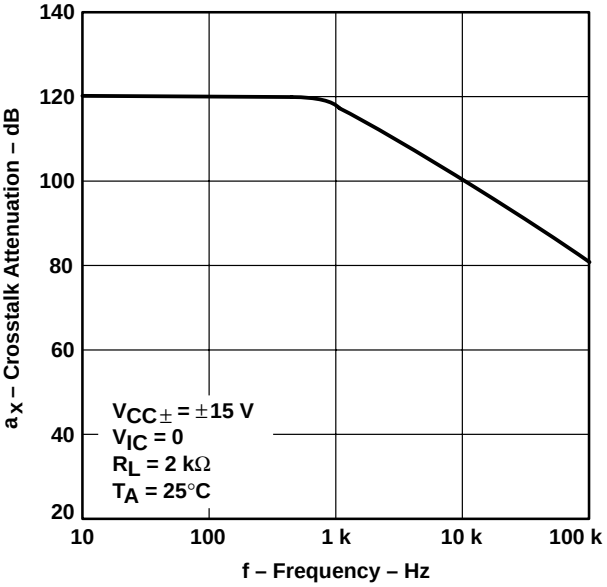


Figure 73

† 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 TLE208x, TLE208xA, and TLE208xB 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 TLE208x, TLE208xA, and TLE208xB 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 74). These guards should be driven from a low-impedance source at the same voltage level as the common-mode input.

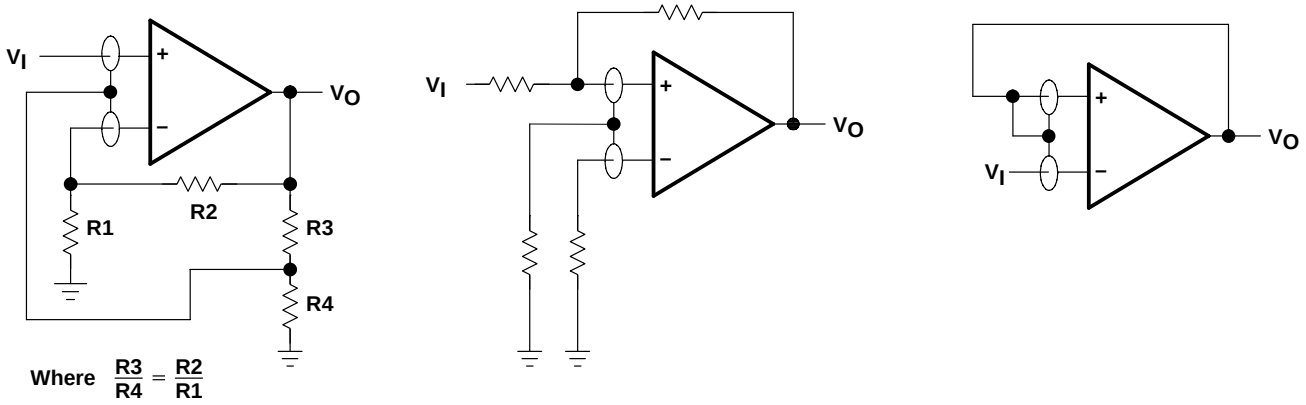


Figure 74. Use of Guard Rings

TLE2081 input offset voltage nulling

The TLE2061 series offers external null pins that can be used to further reduce the input offset voltage. The circuit of Figure 75 can be connected as shown if the feature is desired. When external nulling is not needed, the null pins may be left unconnected.

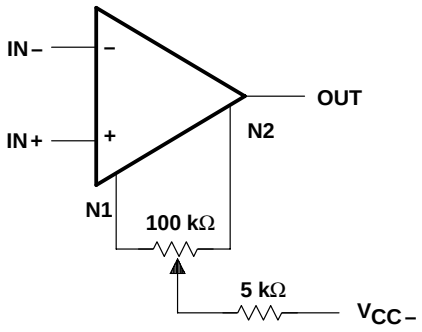


Figure 75. Input Offset Voltage Nulling

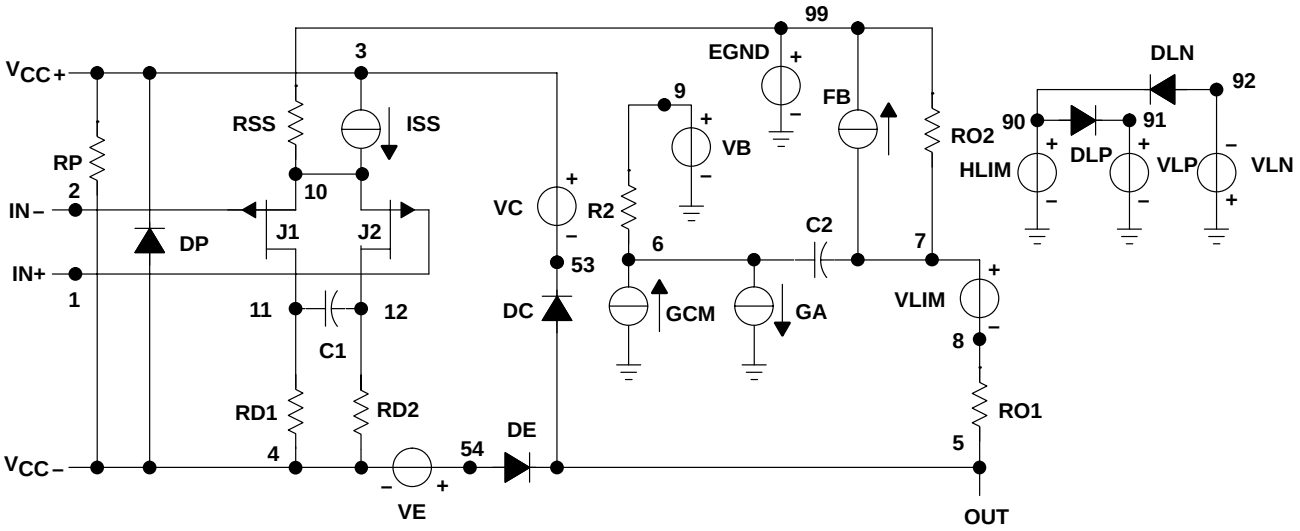
APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using *PSpice*™ *Parts*™ model generation software. The Boyle macromodel (see Note 4) and subcircuit in Figure 58 were generated using the TLE208x 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 TLE208x 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 76. Boyle Macromodel and Subcircuit

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2081ACD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2081AC	Samples
TLE2081ACDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2081AC	Samples
TLE2081ACP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	-40 to 85	TLE2081AC	Samples
TLE2081AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2081AI	Samples
TLE2081AIP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	-40 to 85	TLE2081AI	Samples
TLE2081CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2081C	Samples
TLE2081CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2081C	Samples
TLE2081CP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	0 to 70	TLE2081CP	Samples
TLE2081ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2081I	Samples
TLE2081IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2081I	Samples
TLE2081IP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2081IP	Samples
TLE2082ACD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2082AC	Samples
TLE2082ACDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2082AC	Samples
TLE2082ACDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082AC	Samples
TLE2082ACDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082AC	Samples
TLE2082ACP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2082AC	Samples
TLE2082AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2082AI	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2082AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082AI	Samples
TLE2082AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082AI	Samples
TLE2082AIP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2082AI	Samples
TLE2082CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2082C	Samples
TLE2082CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	2082C	Samples
TLE2082CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082C	Samples
TLE2082CP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2082CP	Samples
TLE2082CPE4	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2082CP	Samples
TLE2082ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2082I	Samples
TLE2082IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2082I	Samples
TLE2082IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082I	Samples
TLE2082IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		2082I	Samples
TLE2082IP	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2082IP	Samples
TLE2084ACDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLE2084AC	Samples
TLE2084ACN	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	0 to 70	TLE2084ACN	Samples
TLE2084CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLE2084C	Samples
TLE2084CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM		TLE2084C	Samples
TLE2084CN	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type		TLE2084CN	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2084IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLE2084I	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

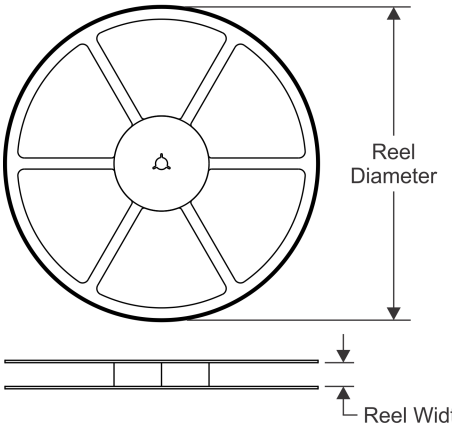
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

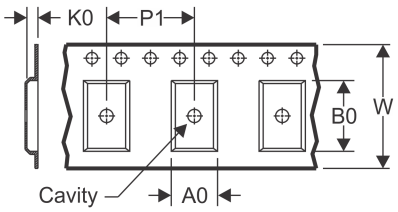
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

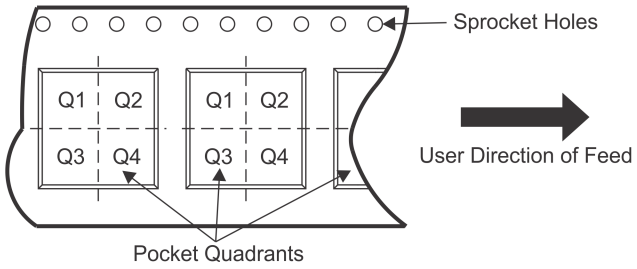


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

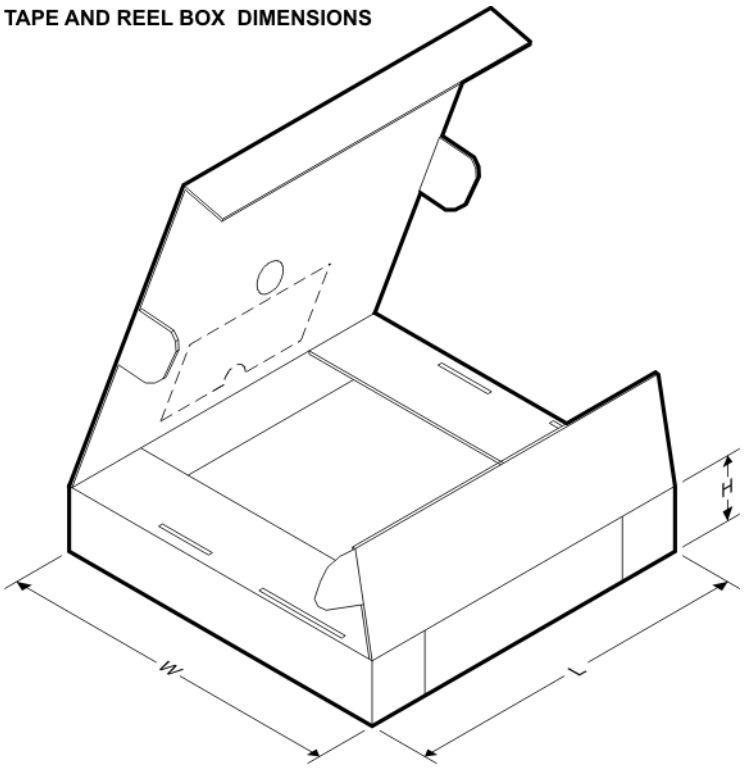
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLE2081ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2081CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2081IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2082ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2082AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2082CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2082IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2084CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLE2081ACDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2081CDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2081IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2082ACDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2082AIDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2082CDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2082IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2084CDWR	SOIC	DW	16	2000	350.0	350.0	43.0

GENERIC PACKAGE VIEW

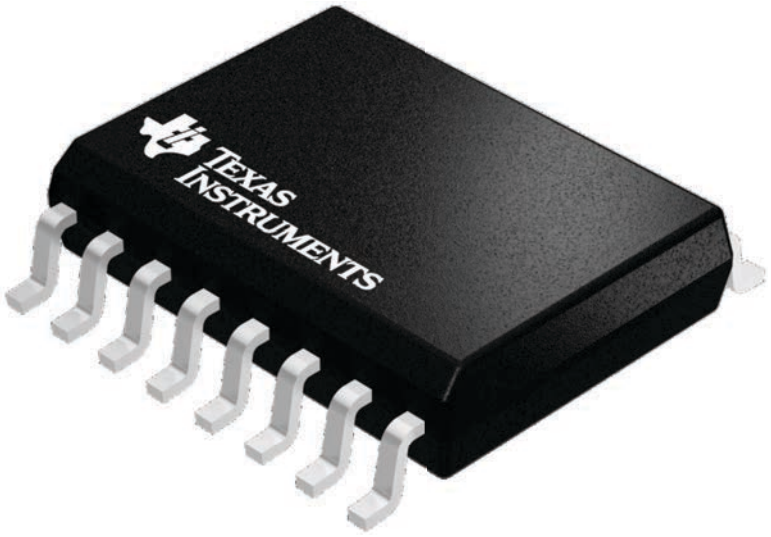
DW 16

SOIC - 2.65 mm max height

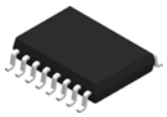
7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4224780/A

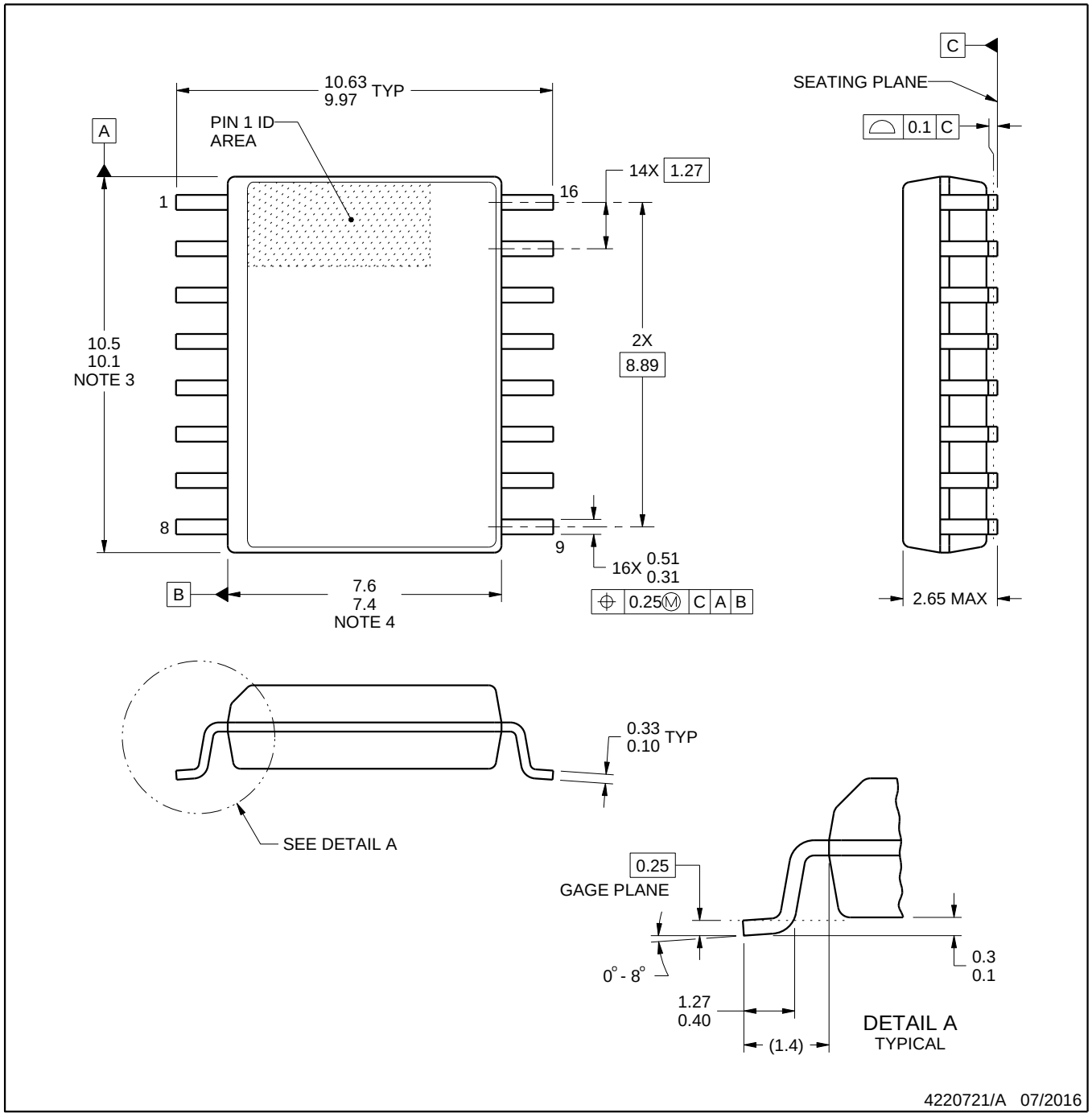


PACKAGE OUTLINE

DW0016A

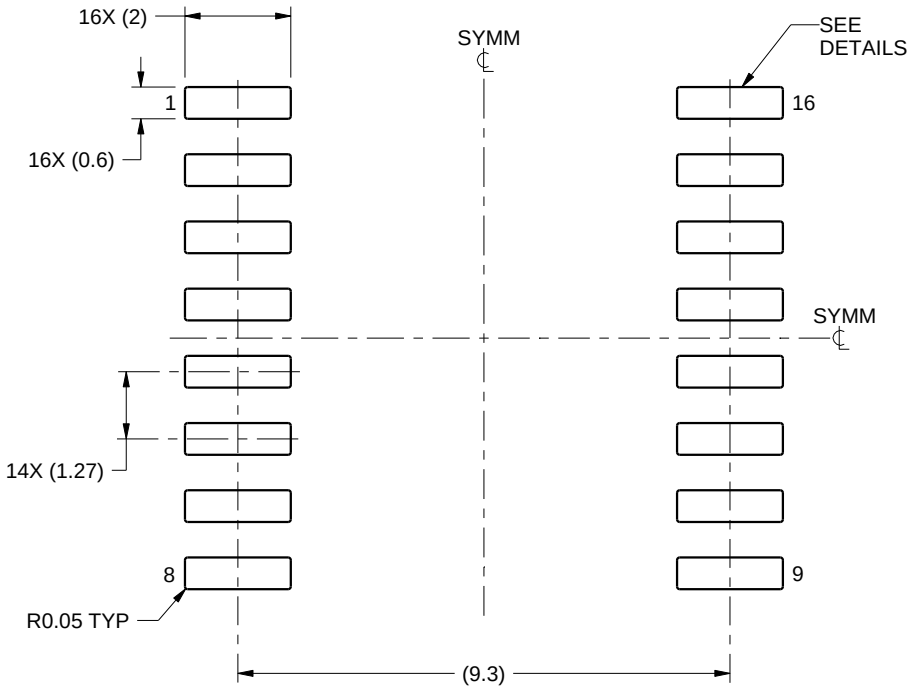
SOIC - 2.65 mm max height

SOIC

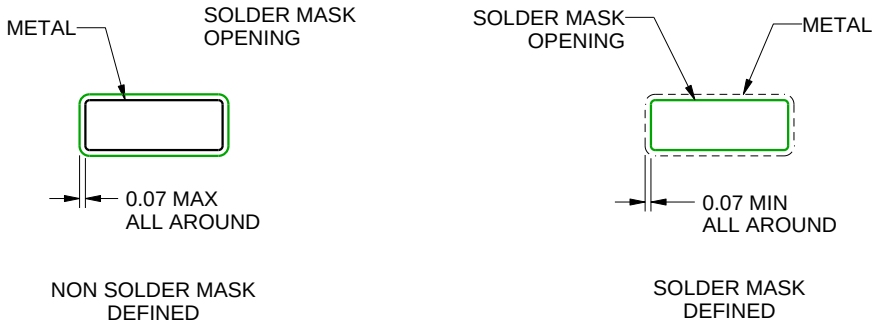


NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.



LAND PATTERN EXAMPLE
SCALE:7X

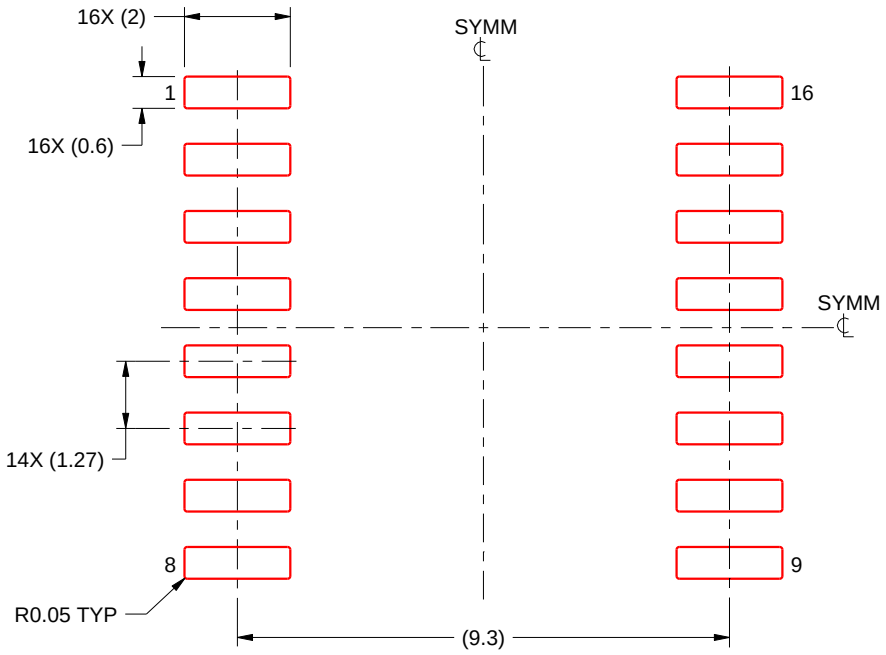


SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

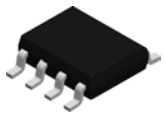


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220721/A 07/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

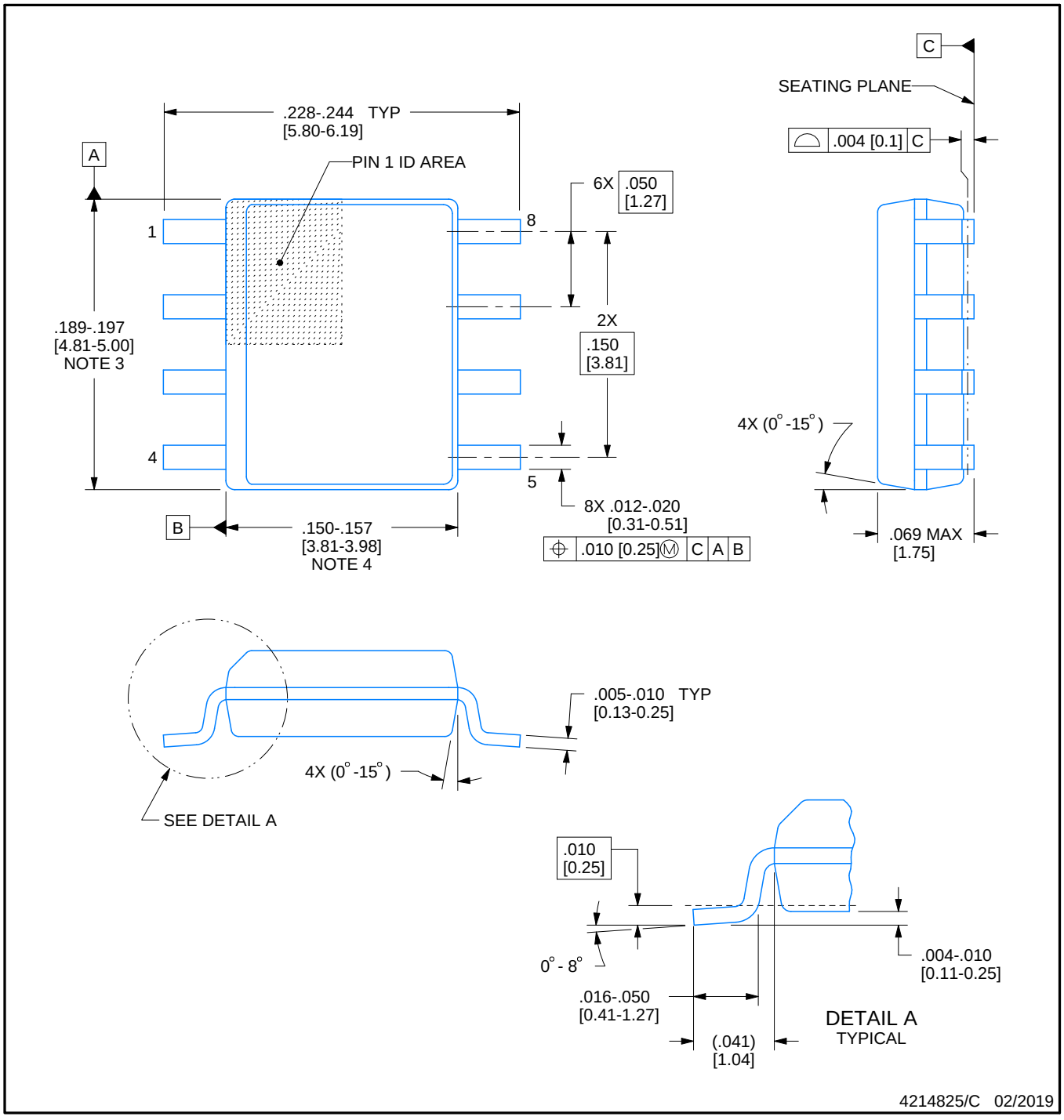


PACKAGE OUTLINE

D0008A

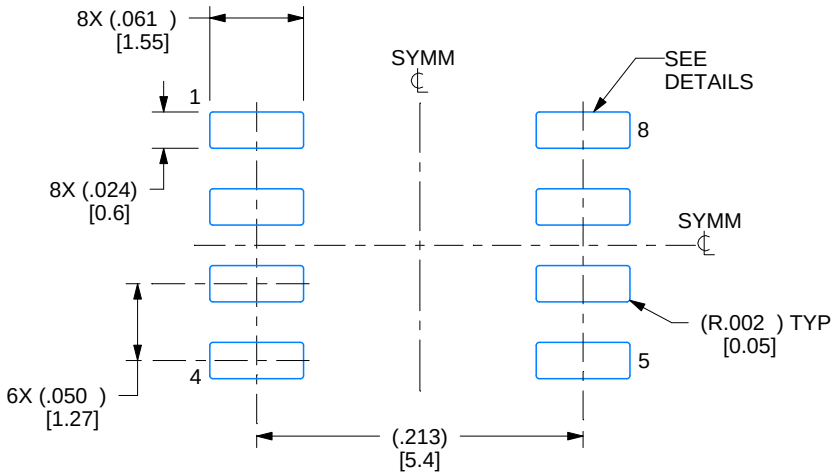
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

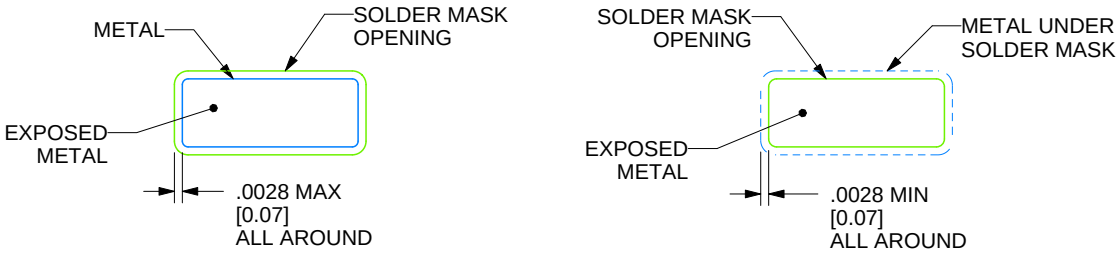


NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

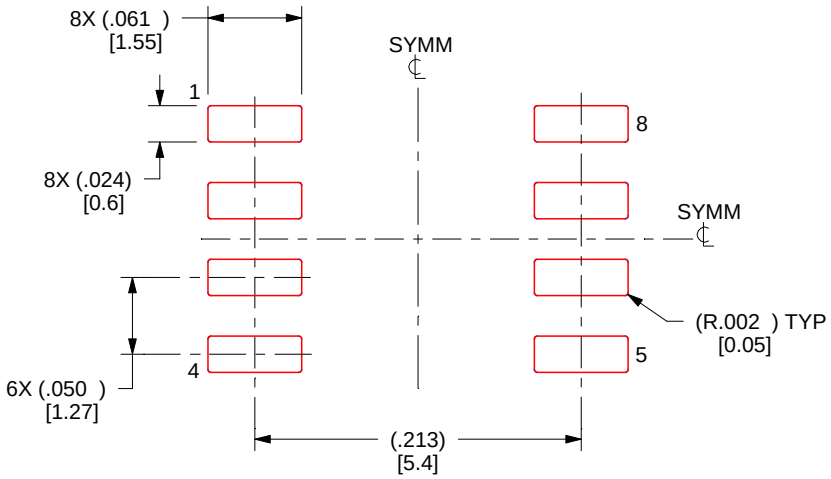
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



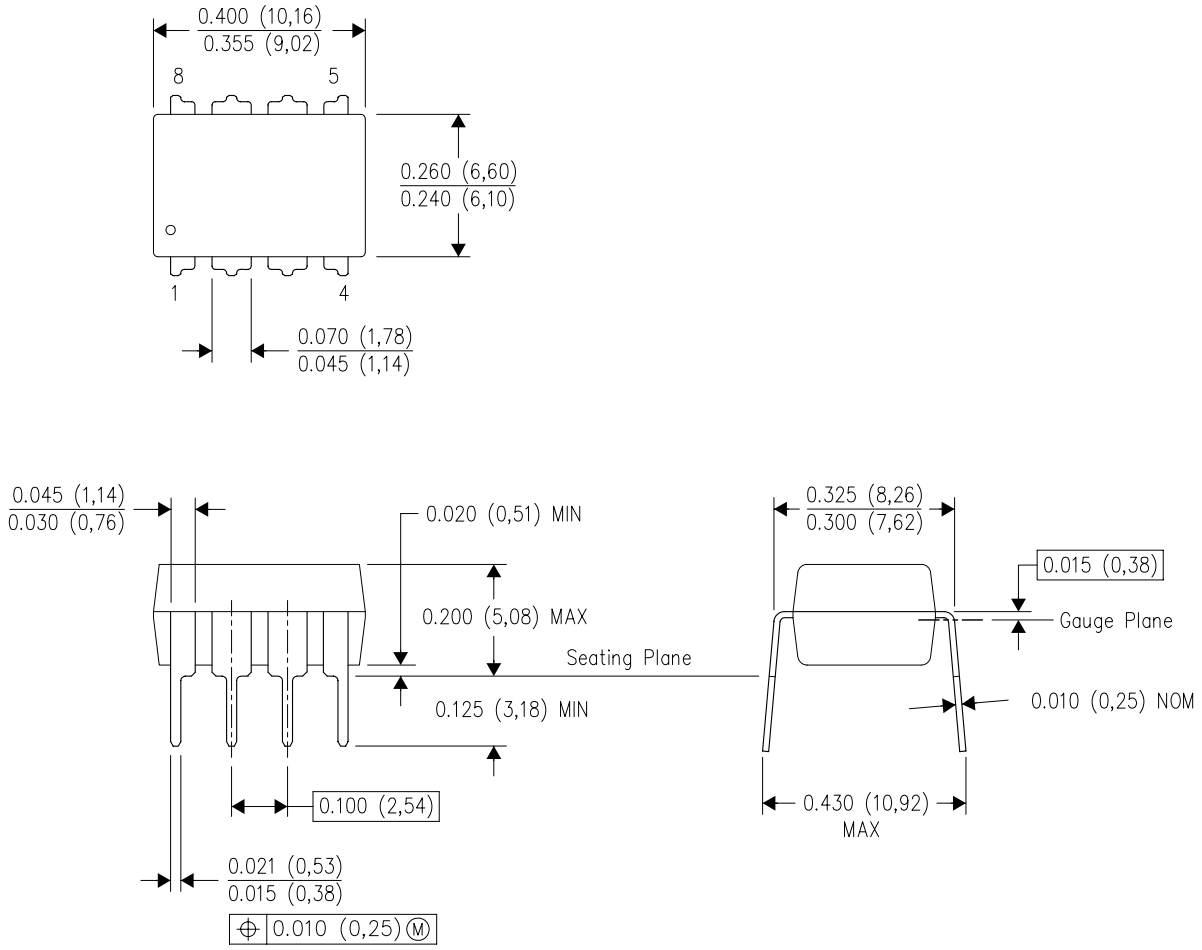
SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE

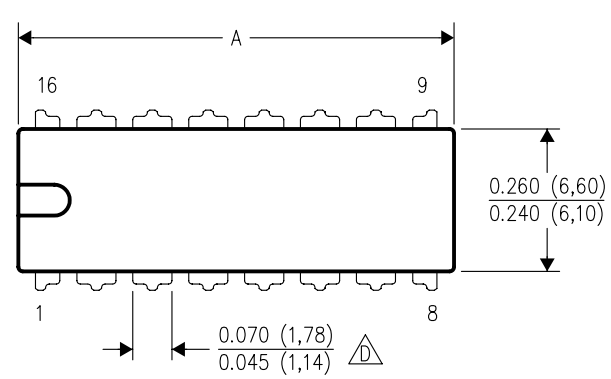


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

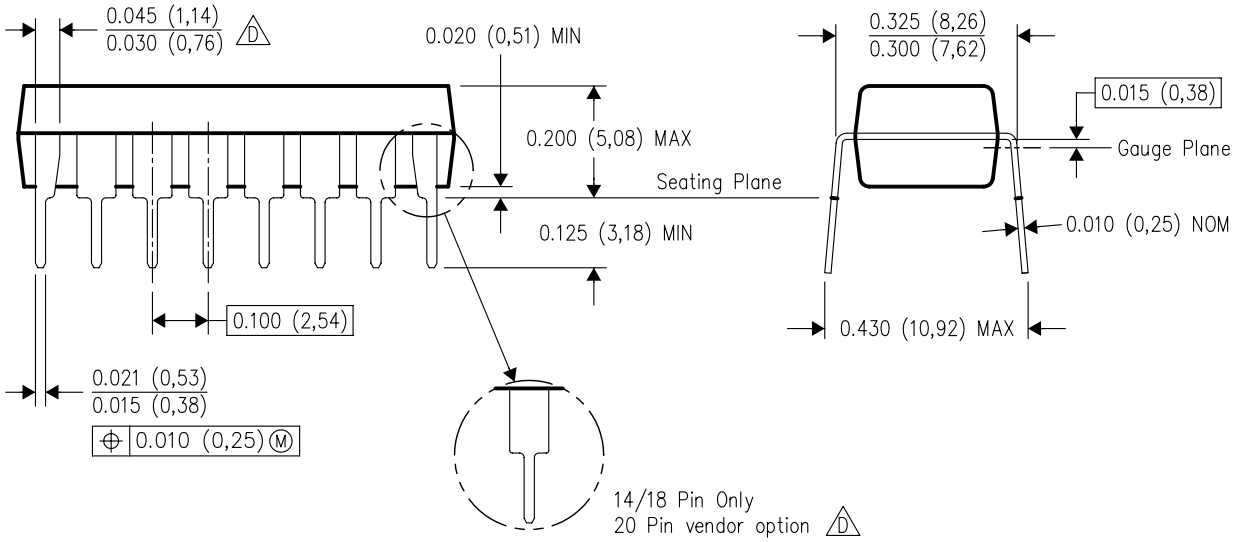
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265