

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

- **Low Noise**
10 Hz . . . 15 nV/ $\sqrt{\text{Hz}}$
1 kHz . . . 10.5 nV/ $\sqrt{\text{Hz}}$
- **10000-pF Load Capability**
- **20-mA Min Short-Circuit Output Current**
- **27-V/ μs Min Slew Rate**
- **High Gain-Bandwidth Product . . . 5.9 MHz**
- **Low V_{IO} . . . 500 μV Max at 25°C**
- **Single or Split Supply . . . 4 V to 44 V**
- **Fast Settling Time**
340 ns to 0.1%
400 ns to 0.01%
- **Saturation Recovery . . . 150 ns**
- **Large Output Swing**
 $V_{\text{CC-}} + 0.1 \text{ V}$ to $V_{\text{CC+}} - 1 \text{ V}$

description

The TLE214x and TLE214xA devices are high-performance, internally compensated operational amplifiers built using Texas Instruments complementary bipolar Excalibur process. The TLE214xA is a tighter offset voltage grade of the TLE214x. Both are pin-compatible upgrades to standard industry products.

The design incorporates an input stage that simultaneously achieves low audio-band noise of 10.5 nV/ $\sqrt{\text{Hz}}$ with a 10-Hz 1/f corner and symmetrical 40-V/ μs slew rate typically with loads up to 800 pF. The resulting low distortion and high power bandwidth are important in high-fidelity audio applications. A fast settling time of 340 ns to 0.1% of a 10-V step with a 2-k Ω /100-pF load is useful in fast actuator/positioning drivers. Under similar test conditions, settling time to 0.01% is 400 ns.

The devices are stable with capacitive loads up to 10 nF, although the 6-MHz bandwidth decreases to 1.8 MHz at this high loading level. As such, the TLE214x and TLE214xA are useful for low-droop sample-and-holds and direct buffering of long cables, including 4-mA to 20-mA current loops.

The special design also exhibits an improved insensitivity to inherent integrated circuit component mismatches as is evidenced by a 500- μV maximum offset voltage and 1.7- $\mu\text{V}/^\circ\text{C}$ typical drift. Minimum common-mode rejection ratio and supply-voltage rejection ratio are 85 dB and 90 dB, respectively.

Device performance is relatively independent of supply voltage over the $\pm 2\text{-V}$ to $\pm 22\text{-V}$ range. Inputs can operate between $V_{\text{CC-}} - 0.3$ to $V_{\text{CC+}} - 1.8 \text{ V}$ without inducing phase reversal, although excessive input current may flow out of each input exceeding the lower common-mode input range. The all-npn output stage provides a nearly rail-to-rail output swing of $V_{\text{CC-}} - 0.1$ to $V_{\text{CC+}} - 1 \text{ V}$ under light current-loading conditions. The device can sustain shorts to either supply since output current is internally limited, but care must be taken to ensure that maximum package power dissipation is not exceeded.

Both versions can also be used as comparators. Differential inputs of $V_{\text{CC}\pm}$ can be maintained without damage to the device. Open-loop propagation delay with TTL supply levels is typically 200 ns. This gives a good indication as to output stage saturation recovery when the device is driven beyond the limits of recommended output swing.

Both the TLE214x and TLE214xA are available in a wide variety of packages, including both the industry-standard 8-pin small-outline version and chip form for high-density system applications. The C-suffix devices are characterized for operation from 0°C to 70°C, I-suffix devices from -40°C to 105°C, and M-suffix devices over the full military temperature range of -55°C to 125°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1997 – 2004, Texas Instruments Incorporated

TLE214x, TLE214xA EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141 AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES		
		SMALL OUT- LINE† (D)	CERAMIC DIP (JG)	PLASTIC DIP (P)
0°C to 70°C	500 µV 900 µV	TLE2141ACD TLE2141CD	—	TLE2141ACP TLE2141CP
–40°C to 105°C	500 µV 900 µV	TLE2141AID TLE2141ID	—	TLE2141AIP TLE2141IP
–55°C to 125°C	500 µV 900 µV	— TLE2141MD	TLE2141AMJG TLE2141MJG	— —

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2141ACDR).

TLE2142 AVAILABLE OPTIONS

PACKAGED DEVICES							
T _A	V _{IO} max AT 25°C	SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	TSSOP‡ (PW)	CERAMIC FLAT PACK (U)
0°C to 70°C	750 µV 1200 µV	TLE2142ACD	—	—	TLE2142ACP	—	—
		TLE2142CD	—	—	TLE2142CP	TLE2142CPWLE	—
–40°C to 105°C	750 µV 1200 µV	TLE2142AID	—	—	TLC2142AIP	—	—
		TLE2142ID	—	—	TLC2142IP	—	—
–55°C to 125°C	750 µV 1200 µV	TLE2142AMD	TLE2142AMFK	TLE2142AMJG	—	—	TLE2142AMU
		TLE2142MD	TLE2142MFK	TLE2142MJG	—	—	TLE2142MU

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2142ACDR).

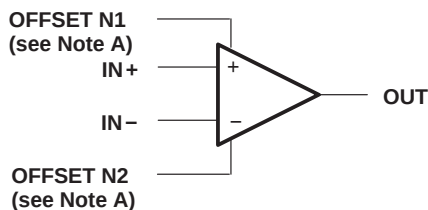
‡ The PW packages are available left-ended taped and reeled. Add LE the suffix to device type (e.g., TLC2142CPWLE).

TLE2144 AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES			
		SMALL OUTLINE† (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	1.5 mV 2.4 mV	— TLE2144CDW	— —	— —	TLE2144ACN TLE2144CN
		— TLE2144IDW	— —	— —	TLE2144AIN TLE2144IN
–40°C to 105°C	1.5 mV 2.4 mV	— TLE2144MDW	TLE2144AMFK TLE2144MFK	TLE2144AMJ TLE2144MJ	— —

† The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2144CDWR).

symbol

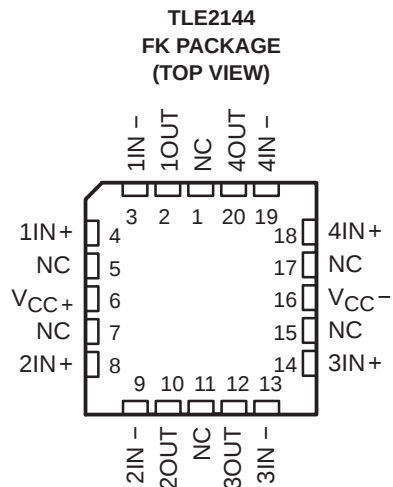
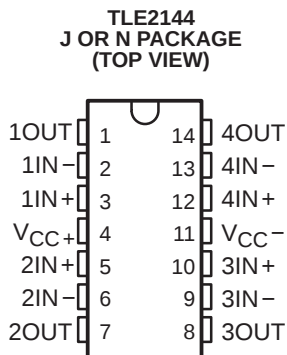
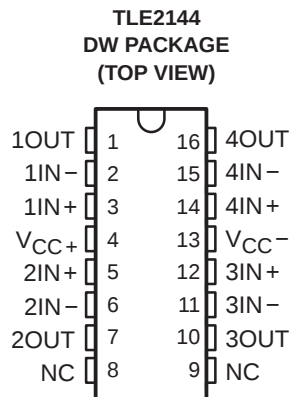
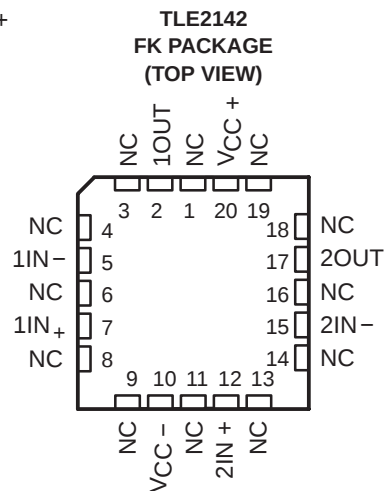
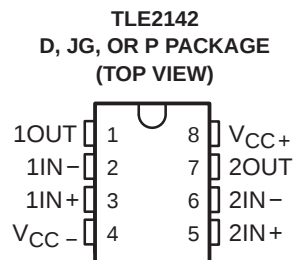
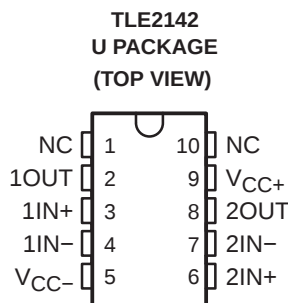
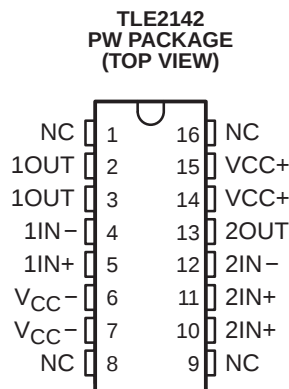
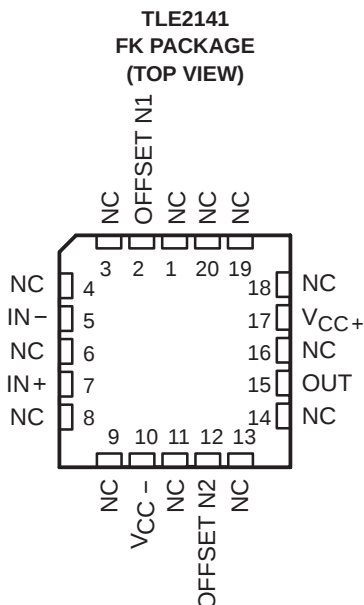
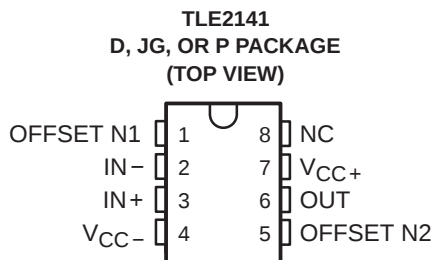


NOTES: A. OFFSET N1 AND OFFSET N2 are only available on the TLE2241x devices.

TLE214x, TLE214xA

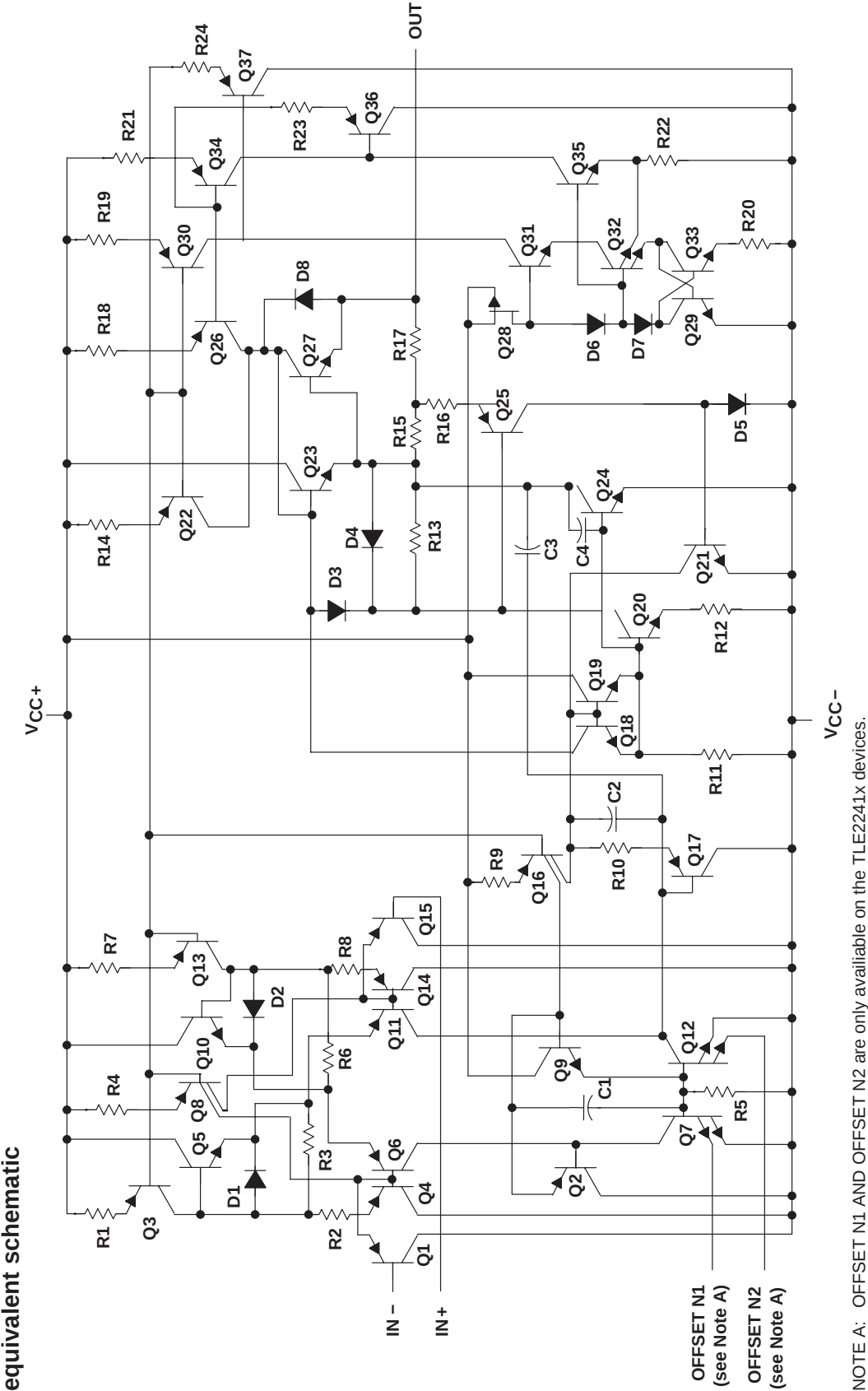
EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004



NC – No internal connection

TLE214x, TLE214xA, TLE214xY
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS
SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004



ACTUAL DEVICE COMPONENT COUNT				
COMPONENT	TLE2241	TLE2242	TLE2244	
Transistors	46	65	130	
Resistors	24	43	86	
Diodes	8	14	28	
Capacitors	4	8	16	
Epi-FET	1	1	2	

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141C electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2141C			TLE2141AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$ $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	225	1400		200	1000		μV
		Full range		1700			1300		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range		150			150		
I_{IB} Input bias current		25°C	-0.8	-2		-0.8	-2		μA
		Full range		-2.1			-2.1		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.9			0 to 2.9			
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
		Full range	3.8			3.8			
	$I_{OH} = -1.5\text{ mA}$	25°C	3.8	4		3.8	4		
		Full range	3.7			3.7			
	$I_{OH} = -15\text{ mA}$	25°C	3.2	3.7		3.2	3.7		
		Full range	3.2			3.2			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C		75	125		75	125	mV
		Full range			150			150	
	$I_{OL} = 1.5\text{ mA}$	25°C		150	225		150	225	
		Full range			250			250	
	$I_{OL} = 15\text{ mA}$	25°C		1.2	1.6		1.2	1.6	V
		Full range			1.7			1.7	
A_{VD} Large-signal differential voltage amplification	$V_{CC} = \pm 2.5\text{ V}$, $R_L = 2\text{ k}\Omega$, $V_O = 1\text{ V to } -1.5\text{ V}$	25°C	50	220		50	220		V/mV
		Full range	25			25			
r_i Input resistance		25°C		70			70		M Ω
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, No load, $V_{IC} = 2.5\text{ V}$	25°C	3.4	4.4		3.4	4.4		mA
		Full range		4.6			4.6		

† Full range is 0°C to 70°C.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141C operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141C			TLE2141AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}^\dagger$, $R_L = 2\text{ k}\Omega^\dagger$,		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$		15			15			nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$		10.5			10.5			
$V_{N(\text{PP})}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $A_{VD} = 2$, $R_L = 2\text{ k}\Omega^\dagger$, $f = 10\text{ kHz}$		0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$		5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$, $f = 100\text{ kHz}$		5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(\text{PP})} = 2\text{ V}$, $A_{VD} = 1$, $R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$		660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$		57°			57°			

[†] R_L and C_L terminated to 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2141C			TLE2141AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω, V _O = 0		25°C	200		900	175		500	μV
	Full range			1300		800					
αV _{IO}	Temperature coefficient of input offset voltage			Full range	1.7		1.7		μV/°C		
I _{IO}	Input offset current			25°C	7		100	7		100	nA
				Full range	150		150				
I _{IB}	Input bias current			25°C	−0.7		−1.5	−0.7		−1.5	μA
		Full range	−1.6		−1.6						
V _{ICR}	Common-mode input voltage range	R _S = 50 Ω		25°C	−15 to 13	−15.3 to 13.2	−15 to 13		−15.3 to 13.2	V	
				Full range	−15 to 12.9	−15.3 to 13.1	−15 to 12.9		−15.3 to 13.1		
V _{OM+}	Maximum positive peak output voltage swing	I _O = −150 μA		25°C	13.8	14.1	13.8		14.1	V	
				Full range	13.7		13.7				
		I _O = −1.5 mA		25°C	13.7	14	13.7		14		
				Full range	13.6		13.6				
		I _O = −15 mA		25°C	13.1	13.7	13.1		13.7		
				Full range	13		13				
V _{OM−}	Maximum negative peak output voltage swing	I _O = 150 μA		25°C	−14.7	−14.9	−14.7		−14.9	V	
				Full range	−14.6		−14.6				
		I _O = 1.5 mA		25°C	−14.5	−14.8	−14.5		−14.8		
				Full range	−14.4		−14.4				
		I _O = 15 mA		25°C	−13.4	−13.8	−13.4		−13.8		
				Full range	−13.3		−13.3				
A _{VD}	Large-signal differential voltage amplification	V _O = ±10 V		25°C	100	450	100		450	V/mV	
				Full range	75		75				
r _i	Input resistance	R _L = 2 kΩ		25°C	65		65		MΩ		
c _i	Input capacitance			25°C	2.5		2.5		pF		
z _o	Open-loop output impedance	f = 1 MHz		25°C	30		30		Ω		
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICRmin} , R _S = 50 Ω		25°C	85	108	85		108	dB	
				Full range	80		80				
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±2.5 V to ±15 V, R _S = 50 Ω		25°C	90	106	90		106	dB	
				Full range	85		85				
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−25	−50	−25		−50	mA	
			V _{ID} = −1 V		20	31	20		31		
I _{CC}	Supply current	V _O = 0, No load		25°C	3.5		4.5	3.5		4.5	mA
				Full range	4.7		4.7				

† Full range is 0°C to 70°C.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141C operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141C			TLE2141AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$	$R_L = 2\text{ k}\Omega$	27	45		27	45		V/ μs
SR–	Negative slew rate			27	42		27	42		
t_s	Settling time	$A_{VD} = -1$, 10-V step	To 0.1%		0.34			0.34		μs
			To 0.01%		0.4			0.4		
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$	$f = 10\text{ Hz}$		15			15		nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$	$f = 1\text{ kHz}$		10.5			10.5		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$			0.48			0.48		μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$			0.51			0.51		
I_n	Equivalent input noise current	$f = 10\text{ Hz}$			1.89			1.89		pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$			0.47			0.47		
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 10$	$R_L = 2\text{ k}\Omega$, $f = 10\text{ kHz}$		0.01%			0.01%		
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega$	$C_L = 100\text{ pF}$		6			6		MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}$		5.9			5.9		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 1$	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$		668			668		kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega$	$C_L = 100\text{ pF}$		58°			58°		

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142C electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142C			TLE2142AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C		220	1900		200	1500	μV
		Full range			2200			1800	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C		8	100		8	100	nA
		Full range			150			150	
I_{IB} Input bias current		25°C		-0.8	-2		-0.8	-2	μA
		Full range			-2.1			-2.1	
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.9			0 to 2.9			
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C		3.9	4.1		3.9	4.1	V
		Full range		3.8			3.8		
	$I_{OH} = -1.5\text{ mA}$	25°C		3.8	4		3.8	4	
		Full range		3.7			3.7		
	$I_{OH} = -15\text{ mA}$	25°C		3.4	3.7		3.4	3.7	
		Full range		3.4			3.4		
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C		75	125		75	125	mV
		Full range			150			150	
	$I_{OL} = 1.5\text{ mA}$	25°C		150	225		150	225	
		Full range			250			250	
	$I_{OL} = 15\text{ mA}$	25°C		1.2	1.4		1.2	1.4	V
		Full range			1.5			1.5	
A_{VD} Large-signal differential voltage amplification	$V_{CC} = \pm 2.5\text{ V}$, $R_L = 2\text{ k}\Omega$, $V_O = 1\text{ V to } -1.5\text{ V}$	25°C		50	220		50	220	V/mV
		Full range		25			25		
r_i Input resistance		25°C		70			70		$\text{M}\Omega$
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C		85	118		85	118	dB
		Full range		80			80		
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C		90	106		90	106	dB
		Full range		85			85		
I_{CC} Supply current	$V_O = 2.5\text{ V}$, No load, $V_{IC} = 2.5\text{ V}$	25°C		6.6	8.8		6.6	8.8	mA
		Full range			9.2			9.2	

† Full range is 0°C to 70°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142C operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142C			TLE2142AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$ $R_L = 2\text{ k}\Omega^\dagger$,		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$		15			15			$\text{nV}/\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$		10.5			10.5			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			$\text{pA}/\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $A_{VD} = 2$,	$R_L = 2\text{ k}\Omega^\dagger$, $f = 10\text{ kHz}$	0.0052%			0.0052%			
B1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}$	5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}$,	5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $A_{VD} = 1$,	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$	660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}$	57°			57°			

$^\dagger R_L$ terminates at 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142C			TLE2142AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C		290	1200		275	750	μV
		Full range			1600			1200	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu V/^\circ C$
I_{IO} Input offset current		25°C		7	100		7	100	nA
		Full range			150			150	
I_{IB} Input bias current		25°C		-0.7	-1.5		-0.7	-1.5	μA
		Full range			-1.6			-1.6	
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.9	-15.3 to 13.1		-15 to 12.9	-15.3 to 13.1		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C		13.8	14.1		13.8	14.1	V
		Full range			13.7			13.7	
	$I_O = -1.5$ mA	25°C		13.7	14		13.7	14	
		Full range			13.6			13.6	
	$I_O = -15$ mA	25°C		13.3	13.7		13.3	13.7	
		Full range			13.2			13.2	
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C		-14.7	-14.9		-14.7	-14.9	V
		Full range			-14.6			-14.6	
	$I_O = 1.5$ mA	25°C		-14.5	-14.8		-14.5	-14.8	
		Full range			-14.4			-14.4	
	$I_O = 15$ mA	25°C		-13.4	-13.8		-13.4	-13.8	
		Full range			-13.3			-13.3	
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V	25°C		100	450		100	450	V/mV
		Full range			75			75	
r_i Input resistance	$R_L = 2$ k Ω	25°C		65			65		M Ω
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C		85	108		85	108	dB
		Full range			80			80	
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C		90	106		90	106	dB
		Full range			85			85	
I_{OS} Short-circuit output current	$V_O = 0$	25°C		-25	-50		-25	-50	mA
				20	31		20	31	
I_{CC} Supply current	$V_O = 0, \text{ No load}$	25°C		6.9	9		6.9	9	mA
		Full range			9.4			9.4	

† Full range is 0°C to 70°C.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142C operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142C			TLE2142AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	AVD = −1, RL = 2 kΩ, CL = 500 pF		27	45		27	45	V/μs	
SR −	Negative slew rate			27	42		27	42		
ts	Settling time	AVD = −1, 10-V step	To 0.1%	0.34			0.34			μs
			To 0.01%	0.4			0.4			
Vn	Equivalent input noise voltage	RS = 20 Ω, f = 10 Hz		15			15			nV/√Hz
		RS = 20 Ω, f = 1 kHz		10.5			10.5			
VN(PP)	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48			0.48			μV
		f = 0.1 Hz to 10 Hz		0.51			0.51			
In	Equivalent input noise current	f = 10 Hz		1.89			1.89			pA/√Hz
		f = 1 kHz		0.47			0.47			
THD + N	Total harmonic distortion plus noise	VO(PP) = 20 V, RL = 2 kΩ, AVD = 10, f = 10 kHz		0.01%			0.01%			
B1	Unity-gain bandwidth	RL = 2 kΩ, CL = 100 pF		6			6			MHz
	Gain-bandwidth product	RL = 2 kΩ,, f =100 kHz		5.9			5.9			MHz
BOM	Maximum output-swing bandwidth	VO(PP) = 20 V, RL = 2 kΩ, AVD = 1, CL = 100 pF		668			668			kHz
φm	Phase margin at unity gain	RL = 2 kΩ, CL = 100 pF		58°			58°			

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144C electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144C			TLE2144AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	0.5	3.8		0.5	3		mV
		Full range			4.4			3.6	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range		150			150		
I_{IB} Input bias current		25°C	-0.8	-2		-0.8	-2		μA
		Full range		-2.1			-2.1		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.9			0 to 2.9			
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
		Full range	3.8			3.8			
	$I_{OH} = -1.5\text{ mA}$	25°C	3.8	4		3.8	4		
		Full range	3.7			3.7			
	$I_{OH} = -15\text{ mA}$	25°C	3.4	3.7		3.4	3.7		
		Full range	3.4			3.4			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C		75	125		75	125	mV
		Full range			150			150	
	$I_{OL} = 1.5\text{ mA}$	25°C		150	225		150	225	
		Full range			250			250	
	$I_{OL} = 15\text{ mA}$	25°C		1.2	1.6		1.2	1.6	V
		Full range			1.7			1.7	
A_{VD} Large-signal differential voltage amplification	$V_{CC} = \pm 2.5\text{ V}$, $V_O = 1\text{ V to } -1.5\text{ V}$ $R_L = 2\text{ k}\Omega$	25°C	50	95		50	95		V/mV
		Full range	25			25			
r_i Input resistance		25°C		70			70		$\text{M}\Omega$
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC} / \Delta V_{IO}$)	$V_{CC} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ No load,	25°C		13.2	17.6		13.2	17.6	mA
		Full range			18.5			18.5	

† Full range is 0°C to 70°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144C operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144C			TLE2144AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $R_L = 2\text{ k}\Omega^\dagger$, $C_L = 500\text{ pF}$		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$		15			15			nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$		10.5			10.5			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $A_{VD} = 2$,	$R_L = 2\text{ k}\Omega^\dagger$, $f = 10\text{ kHz}$	0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}$	5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}$	5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $A_{VD} = 1$,	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$	660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}$	57°			57°			

$^\dagger R_L$ terminates at 2.5 V

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144C			TLE2144AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	0.6	2.4		0.5	1.5		mV
		Full range		3.2			2.4		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		150			150		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.6			-1.6		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.9	-15.3 to 13.1		-15 to 12.9	-15 to 13.1		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
		Full range	13.7			13.7			
	$I_O = -1.5$ mA	25°C	13.7	14		13.7	14		
		Full range	13.6			13.6			
	$I_O = -15$ mA	25°C	13.1	13.7		13.1	13.7		
		Full range	13			13			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
		Full range	-14.6			-14.6			
	$I_O = 1.5$ mA	25°C	-14.5	-14.8		-14.5	-14.8		
		Full range	-14.4			-14.4			
	$I_O = 15$ mA	25°C	-13.4	-13.8		-13.4	-13.8		
		Full range	-13.3			-13.3			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V	25°C	100	170		100	170		V/mV
		Full range	75			75			
r_i Input resistance	$R_L = 2$ k Ω	25°C		65			65		M Ω
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0, \text{ No load}$	25°C	13.8	18		13.8	18		mA
		Full range		18.8			18.8		

† Full range is 0°C to 70°C.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144C operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144C			TLE2144AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	A _{VD} = −1, R _L = 2 kΩ, C _L = 500 pF		27	45		27	45	V/μs	
SR −	Negative slew rate			27	42		27	42		
t _s	Settling time	A _{VD} = −1, 10-V step	To 0.1%	0.34			0.34			μs
			To 0.01%	0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, f = 10 Hz	15			15			nV/√Hz	
		R _S = 20 Ω, f = 1 kHz	10.5			10.5				
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48			0.48			μV
		f = 0.1 Hz to 10 Hz		0.51			0.51			
I _n	Equivalent input noise current	f = 10 Hz		1.89			1.89			pA/√Hz
		f = 1 kHz		0.47			0.47			
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10,	R _L = 2 kΩ, f = 10 kHz	0.01%			0.01%			
B ₁	Unity-gain bandwidth	R _L = 2 kΩ,	C _L = 100 pF	6			6			MHz
	Gain-bandwidth product	R _L = 2 kΩ, f = 100 kHz	C _L = 100 pF,	5.9			5.9			MHz
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, A _{VD} = 1,	R _L = 2 kΩ, C _L = 100 pF	668			668			kHz
φ _m	Phase margin at unity gain	R _L = 2 kΩ,	C _L = 100 pF	58°			58°			

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141I electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2141I			TLE2141AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	225	1400		200	1000		μV
		Full range			1900			1500	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range			200			200	
I_{IB} Input bias current		25°C	-0.8	-2		-0.8	-2		μA
		Full range			-2.2			-2.2	
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\text{ mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\text{ mA}$		3.2	3.7		3.2	3.7		
	$I_{OH} = -100\ \mu\text{A}$	Full range	3.8			3.8			
	$I_{OH} = -1\text{ mA}$		3.7			3.7			
	$I_{OH} = -10\text{ mA}$		3.3			3.3			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\ \mu\text{A}$		150	225		150	225		
	$I_{OL} = 15\text{ mA}$		1.2	1.6		1.2	1.6		V
	$I_{OL} = 100\ \mu\text{A}$	Full range	175			175			mV
	$I_{OL} = 1\text{ mA}$		225			225			
	$I_{OL} = 10\text{ mA}$		1.4			1.4			V
A_{VD} Large-signal differential voltage amplification	$V_{CC} = \pm 2.5\text{ V}$, $R_L = 2\text{ k}\Omega$, $V_O = 1\text{ V to } -1.5\text{ V}$	25°C	50	220		50	220		V/mV
		Full range	10			10			
r_i Input resistance		25°C	70			70			$\text{M}\Omega$
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ No load,	25°C	3.4	4.4		3.4	4.4		mA
		Full range			4.6			4.6	

† Full range is -40°C to 105°C .



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141I operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141I			TLE2141AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$ $R_L = 2\text{ k}\Omega^\dagger$,		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$		15			15			nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$		10.5			10.5			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $R_L = 2\text{ k}\Omega^\dagger$, $A_{VD} = 2$, $f = 10\text{ kHz}$		0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$		5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$ $f = 100\text{ kHz}$		5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $R_L = 2\text{ k}\Omega^\dagger$, $A_{VD} = 1$, $C_L = 100\text{ pF}^\dagger$		660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}^\dagger$		57°			57°			

$^\dagger R_L$ and C_L terminated to 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2141I			TLE2141AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, R_S = 50 \Omega, V_O = 0$	25°C	200	900		175	500		μV
		Full range		1500			1000		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		200			200		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.7			-1.7		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5 mA$		13.7	14		13.7	14		
	$I_O = -15 mA$		13.1	13.7		13.1	13.7		
	$I_O = -100 \mu A$	Full range	13.7			13.7			
	$I_O = -1 mA$		13.6			13.6			
	$I_O = -10 mA$		13.1			13.1			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5 mA$		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15 mA$		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \mu A$	Full range	-14.6			-14.6			
	$I_O = 1 mA$		-14.5			-14.5			
	$I_O = 10 mA$		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10 V, R_L = 2 k\Omega$	25°C	100	450		100	450		V/mV
		Full range	40			40			
r_i Input resistance		25°C	65			65			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1 MHz$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5 V$ to $\pm 15 V, R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0, \text{ No load}$	25°C	3.5	4.5		3.5	4.5		mA
		Full range		4.7			4.7		

† Full range is -40°C to 105°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141I operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141I			TLE2141AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$	$R_L = 2\text{ k}\Omega$	27	45		27	45		V/ μs
SR-	Negative slew rate			27	42		27	42		
t_s	Settling time	$A_{VD} = -1$, 10-V step	To 0.1%		0.34			0.34		μs
			To 0.01%		0.4			0.4		
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$	$f = 10\text{ Hz}$		15			15		nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$	$f = 1\text{ kHz}$		10.5			10.5		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$			0.48			0.48		μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$			0.51			0.51		
I_n	Equivalent input noise current	$f = 10\text{ Hz}$			1.89			1.89		pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$			0.47			0.47		
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 10$,	$R_L = 2\text{ k}\Omega$, $f = 10\text{ kHz}$		0.01%			0.01%		
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega$	$C_L = 100\text{ pF}$		6			6		MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}$		5.9			5.9		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 1$,	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$		668			668		kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega$	$C_L = 100\text{ pF}$		58°			58°		

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142I electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142I			TLE2142AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}, R_S = 50\ \Omega, V_{IC} = 2.5\text{ V}$	25°C	220	1900		220	1500		μV
		Full range		2400			2000		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range		200			200		
I_{IB} Input bias current		25°C	-0.8	-2		-0.8	-2		μA
		Full range		-2.2			-2.2		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\text{ mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\text{ mA}$		3.4	3.7		3.4	3.7		
	$I_{OH} = 100\ \mu\text{A}$	Full range	3.8			3.8			
	$I_{OH} = 1\text{ mA}$		3.7			3.7			
	$I_{OH} = 10\text{ mA}$		3.5			3.5			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\text{ mA}$		150	225		150	225		
	$I_{OL} = 15\text{ mA}$		1.2	1.4		1.2	1.4		V
	$I_{OL} = 100\ \mu\text{A}$	Full range	175			175			mV
	$I_{OL} = 1\text{ mA}$		225			225			
	$I_{OL} = 10\text{ mA}$		1.2			1.2			V
A_{VD} Large-signal differential voltage amplification	$V_{IC} = \pm 2.5\text{ V}, R_L = 2\text{ k}\Omega, V_O = 1\text{ V to } -1.5\text{ V}$	25°C	50	220		50	220		V/mV
		Full range	10			10			
r_i Input resistance		25°C	70			70			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}, R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}, V_{IC} = 2.5\text{ V}$	25°C	6.6	8.8		6.6	8.8		mA
		Full range		9.2			9.2		

† Full range is -40°C to 105°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142I operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142I			TLE2142AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$ $R_L = 2\text{ k}\Omega^\dagger$		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$	15			15			$\text{nV}/\sqrt{\text{Hz}}$	
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$	10.5			10.5				
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			$\text{pA}/\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $A_{VD} = 2$, $R_L = 2\text{ k}\Omega^\dagger$, $f = 10\text{ kHz}$		0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$, $f = 100\text{ kHz}$		5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $A_{VD} = 1$, $R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		57°			57°			

[†] R_L terminates at 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142I			TLE2142I			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, R_S = 50 \Omega, V_O = 0$	25°C	290	1200		275	750		μV
		Full range		1800			1400		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		200			200		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.7			-1.7		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5$ mA		13.7	14		13.7	14		
	$I_O = -15$ mA		13.3	13.7		13.3	13.7		
	$I_O = -100 \mu A$	Full range	13.7			13.7			
	$I_O = -1$ mA		13.6			13.6			
	$I_O = -10$ mA		13.3			13.3			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5$ mA		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15$ mA		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \mu A$	Full range	-14.6			-14.6			
	$I_O = 1$ mA		-14.5			-14.5			
	$I_O = 10$ mA		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2$ k Ω	25°C	100	450		100	450		V/mV
		Full range	40			40			
r_i Input resistance		25°C	65			65			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$	25°C	85	108		85	108		dB
	$R_S = 50 \Omega$	Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0$, No load	25°C	6.9	9		6.9	9		mA
		Full range		9.4			9.4		

† Full range is $-40^\circ C$ to $105^\circ C$.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142I operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142I			TLE2142AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	A _{VD} = −1, R _L = 2 kΩ, C _L = 500 pF		30	45		30	45	V/μs	
SR −	Negative slew rate			30	42		30	42		
t _s	Settling time	A _{VD} = −1, 10-V step	To 0.1%	0.34		0.34		μs		
			To 0.01%	0.4		0.4				
V _n	Equivalent input noise voltage	R _S = 20 Ω, f = 10 Hz	15		15		nV/√Hz			
		R _S = 20 Ω, f = 1 kHz	10.5		10.5					
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48		0.48		μV		
		f = 0.1 Hz to 10 Hz		0.51		0.51				
I _n	Equivalent input noise current	f = 10 Hz		1.89		1.89		pA/√Hz		
		f = 1 kHz		0.47		0.47				
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10,	R _L = 2 kΩ, f = 10 kHz	0.01%		0.01%				
B ₁	Unity-gain bandwidth	R _L = 2 kΩ,	C _L = 100 pF	6		6		MHz		
	Gain-bandwidth product	R _L = 2 kΩ, f =100 kHz	C _L = 100 pF,	5.9		5.9		MHz		
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, A _{VD} = 1,	R _L = 2 kΩ, C _L = 100 pF	668		668		kHz		
φ _m	Phase margin at unity gain	R _L = 2 kΩ,	C _L = 100 pF	58°		58°				

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144I electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144I			TLE2144AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$ $R_S = 50\ \Omega$	25°C	0.5	3.8		0.5	3		mV
		Full range			4.8			4	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range			200			200	
I_{IB} Input bias current		25°C	–0.8	–2		–0.8	–2		μA
		Full range			–2.2			–2.2	
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	–0.3 to 3.2		0 to 3	–0.3 to 3.2		V
		Full range	0 to 2.7	–0.3 to 2.9		0 to 2.7	–0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\ \text{mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\ \text{mA}$		3.4	3.7		3.4	3.7		
	$I_{OH} = 100\ \mu\text{A}$	Full range	3.8			3.8			
	$I_{OH} = 1\ \text{mA}$		3.7			3.7			
	$I_{OH} = 10\ \text{mA}$		3.5			3.5			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\ \mu\text{A}$		150	225		150	225		
	$I_{OL} = 15\ \text{mA}$		1.2	1.6		1.2	1.6		V
	$I_{OL} = 100\ \mu\text{A}$	Full range		175			175		mV
	$I_{OL} = 1\ \text{mA}$			225			225		
	$I_{OL} = 10\ \text{mA}$			1.4			1.4		V
A_{VD} Large-signal differential voltage amplification	$V_{IC} = \pm 2.5\ \text{V}$, $V_O = 1\ \text{V to } -1.5\ \text{V}$ $R_L = 2\ \text{k}\Omega$	25°C	50	95		50	95		V/mV
		Full range	10			10			
r_i Input resistance		25°C		70			70		M Ω
c_i Input capacitance		25°C		2.5			2.5		pF
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C		30			30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC} \pm / \Delta V_{IO}$)	$V_{CC} \pm = \pm 2.5\ \text{V to } \pm 15\ \text{V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\ \text{V}$, $V_{IC} = 2.5\ \text{V}$ No load,	25°C		13.2	17.6		13.2	17.6	mA
		Full range			18.4			18.4	

† Full range is -40°C to 105°C .



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144I operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144I			TLE2144AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	A _{VD} = −1, R _L = 2 kΩ [†] , C _L = 500 pF		45			45			V/μs
SR −	Negative slew rate			42			42			
t _s	Settling time	A _{VD} = −1, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V _n	Equivalent input noise voltage	R _S = 20 Ω, f = 10 Hz		15			15			nV/√Hz
		R _S = 20 Ω, f = 1 kHz		10.5			10.5			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48			0.48			μV
		f = 0.1 Hz to 10 Hz		0.51			0.51			
I _n	Equivalent input noise current	f = 10 Hz		1.92			1.92			pA/√Hz
		f = 10 kHz		0.5			0.5			
THD + N	Total harmonic distortion plus noise	V _O = 1 V to 3 V, R _L = 2 kΩ [†] , A _{VD} = 2, f = 10 kHz		0.0052%			0.0052%			
B ₁	Unity-gain bandwidth	R _L = 2 kΩ [†] , C _L = 100 pF		5.9			5.9			MHz
	Gain-bandwidth product	R _L = 2 kΩ [†] , C _L = 100 pF, f = 100 kHz		5.8			5.8			MHz
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 2 V, R _L = 2 kΩ [†] , A _{VD} = 1, C _L = 100 pF		660			660			kHz
φ _m	Phase margin at unity gain	R _L = 2 kΩ [†] , C _L = 100 pF		57°			57°			

[†] R_L terminates at 2.5 V

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144I			TLE2144AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, R_S = 50 \Omega, V_O = 0$	25°C	0.6	2.4		0.5	1.5		mV
		Full range			3.2			2.8	
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		200			200		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.7			-1.7		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5$ mA		13.7	14		13.7	14		
	$I_O = -15$ mA		13.1	13.7		13.1	13.7		
	$I_O = -100 \mu A$	Full range	13.7			13.7			
	$I_O = -1$ mA		13.6			13.6			
	$I_O = -10$ mA		13.1			13.1			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5$ mA		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15$ mA		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \mu A$	Full range	-14.6			-14.6			
	$I_O = 1$ mA		-14.5			-14.5			
	$I_O = 10$ mA		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2$ k Ω	25°C	100	170		100	170		V/mV
		Full range	40			40			
r_i Input resistance		25°C	65			65			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0$, No load	25°C	13.8	18		13.8	18		mA
		Full range		18.8			18.8		

† Full range is -40°C to 105°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144I operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144I			TLE2144AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	A _{VD} = −1, R _L = 2 kΩ, C _L = 500 pF		27	45		27	45	V/μs	
SR −	Negative slew rate			27	42		27	42		
t _s	Settling time	A _{VD} = −1, 10-V step	To 0.1%	0.34		0.34		μs		
			To 0.01%	0.4		0.4				
V _n	Equivalent input noise voltage	R _S = 20 Ω, f = 10 Hz	15		15		nV/√Hz			
		R _S = 20 Ω, f = 1 kHz	10.5		10.5					
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48		0.48		μV		
		f = 0.1 Hz to 10 Hz		0.51		0.51				
I _n	Equivalent input noise current	f = 10 Hz		1.89		1.89		pA/√Hz		
		f = 1 kHz		0.47		0.47				
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, R _L = 2 kΩ, A _{VD} = 10, f = 10 kHz		0.01%		0.01%				
B ₁	Unity-gain bandwidth	R _L = 2 kΩ, C _L = 100 pF	6		6		MHz			
	Gain-bandwidth product	R _L = 2 kΩ, C _L = 100 pF, f = 100 kHz	5.9		5.9		MHz			
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, R _L = 2 kΩ, A _{VD} = 1, C _L = 100 pF	668		668		kHz			
φ _m	Phase margin at unity gain	R _L = 2 kΩ, C _L = 100 pF	58°		58°					

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141M electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2141M			TLE2141AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$ $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	225	1400		200	1000		μV
		Full range		2100			1700		
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range		250			250		
I_{IB} Input bias current		25°C	-0.8	-2		-0.8	-2		μA
		Full range		-2.3			-2.3		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
		Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\text{ mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\text{ mA}$		3.2	3.7		3.2	3.7		
	$I_{OH} = -100\ \mu\text{A}$	Full range	3.75			3.75			
	$I_{OH} = -1\text{ mA}$		3.65			3.65			
	$I_{OH} = -10\text{ mA}$		3.25			3.25			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\ \mu\text{A}$		150	225		150	225		
	$I_{OL} = 15\text{ mA}$		1.2	1.4		1.2	1.4		V
	$I_{OL} = 100\ \mu\text{A}$	Full range	200			200			mV
	$I_{OL} = 1\text{ mA}$		250			225			
	$I_{OL} = 10\text{ mA}$		1.25			1.25			V
A_{VD} Large-signal differential voltage amplification	$V_{IC} = \pm 2.5\text{ V}$, $R_L = 2\text{ k}\Omega$, $V_O = 1\text{ V to } -1.5\text{ V}$	25°C	50	220		50	220		V/mV
		Full range	5			5			
r_i Input resistance		25°C	70			70			$\text{M}\Omega$
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ No load,	25°C	3.4	4.4		3.4	4.4		mA
		Full range		4.6			4.6		

† Full range is -55°C to 125°C .

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141M operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141M			TLE2141AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$ $R_L = 2\text{ k}\Omega^\dagger$		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$		15			15			nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$		10.5			10.5			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise current	$f = 10\text{ Hz}$		1.92			1.92			pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $R_L = 2\text{ k}\Omega^\dagger$, $A_{VD} = 2$, $f = 10\text{ kHz}$		0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}^\dagger$	5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}^\dagger$,	5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $A_{VD} = 1$	$R_L = 2\text{ k}\Omega^\dagger$,	660			660			kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega^\dagger$,	$C_L = 100\text{ pF}^\dagger$	57°			57°			

$^\dagger R_L$ and C_L terminated to 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2141M			TLE2141AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, \quad R_S = 50 \, \Omega$	25°C	200	900		175	500		μV
		Full range		1700			1200		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		250			250		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.8			-1.8		
V_{ICR} Common-mode input voltage range	$R_S = 50 \, \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \, \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5 \, mA$		13.7	14		13.7	14		
	$I_O = -15 \, mA$		13.1	13.7		13.1	13.7		
	$I_O = -100 \, \mu A$	Full range	13.7			13.7			
	$I_O = -1 \, mA$		13.6			13.6			
	$I_O = -10 \, mA$		13.1			13.1			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \, \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5 \, mA$		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15 \, mA$		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \, \mu A$	Full range	-14.6			-14.6			
	$I_O = 1 \, mA$		-14.5			-14.5			
	$I_O = 10 \, mA$		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10 \, V, \quad R_L = 2 \, k\Omega$	25°C	100	450		100	450		V/mV
		Full range	20			20			
r_i Input resistance		25°C	65			65			$M\Omega$
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1 \, MHz$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, \quad R_S = 50 \, \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5 \, V$ to $\pm 15 \, V, \quad R_S = 50 \, \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0, \quad V_{IC} = 2.5 \, V$	25°C	3.5	4.5		3.5	4.5		mA
		Full range		4.7			4.7		

† Full range is -55°C to 125°C.



TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141M operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2141M			TLE2141AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$A_{VD} = -1$, $C_L = 100\text{ pF}$	$R_L = 2\text{ k}\Omega$	27	45		27	45		V/ μs
SR–	Negative slew rate			27	42		27	42		
t_s	Settling time	$A_{VD} = -1$, 10-V step	To 0.1%		0.34			0.34		μs
			To 0.01%		0.4			0.4		
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$			15			15		nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$			10.5			10.5		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$			0.48			0.48		μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$			0.51			0.51		
I_n	Equivalent input noise current	$f = 10\text{ Hz}$			1.89			1.89		pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$			0.47			0.47		
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, $R_L = 2\text{ k}\Omega$, $A_{VD} = 10$, $f = 10\text{ kHz}$			0.01%			0.01%		
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$			6			6		MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, $f = 100\text{ kHz}$			5.9			5.9		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $R_L = 2\text{ k}\Omega$, $A_{VD} = 1$, $C_L = 100\text{ pF}$			668			668		kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$			58°			58°		

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142M electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142M			TLE2142AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	220	1900		200	1500		μV
		Full range			2600			2200	
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range			200			200	
I_{IB} Input bias current		25°C	–0.8	–2		–0.8	–2		μA
		Full range			–2.3			–2.3	
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	–0.3 to 3.2		0 to 3	–0.3 to 3.2		V
		Full range	0 to 2.7	–0.3 to 2.9		0 to 2.7	–0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\text{ mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\text{ mA}$		3.4	3.7		3.4	3.7		
	$I_{OH} = 100\ \mu\text{A}$	Full range	3.75			3.75			
	$I_{OH} = 1\text{ mA}$		3.65			3.65			
	$I_{OH} = 10\text{ mA}$		3.45			3.45			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\text{ mA}$		150	225		150	225		
	$I_{OL} = 15\text{ mA}$		1.2	1.4		1.2	1.4		V
	$I_{OL} = 100\ \mu\text{A}$	Full range	200			200			mV
	$I_{OL} = 1\text{ mA}$		250			250			
	$I_{OL} = 10\text{ mA}$		1.25			1.25			V
A_{VD} Large-signal differential voltage amplification	$V_{IC} = \pm 2.5\text{ V}$, $R_L = 2\text{ k}\Omega$, $V_O = 1\text{ V to } -1.5\text{ V}$	25°C	50	220		50	220		V/mV
		Full range	5			5			
r_i Input resistance		25°C	70			70			$\text{M}\Omega$
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ No load,	25°C	6.6	8.8		6.6	8.8		mA
		Full range			9.2			9.2	

† Full range is –55°C to 125°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142M operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142M			TLE2142AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	$A_{VD} = -1$, $C_L = 500\text{ pF}$ $R_L = 2\text{ k}\Omega^\dagger$,		45			45			V/ μs
SR –	Negative slew rate			42			42			
t_s	Settling time	$A_{VD} = -1$, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
V_n	Equivalent input noise volt- age	$R_S = 20\text{ }\Omega$, $f = 10\text{ Hz}$	15			15			nV/ $\sqrt{\text{Hz}}$	
		$R_S = 20\text{ }\Omega$, $f = 1\text{ kHz}$	10.5			10.5				
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$		0.48			0.48			μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$		0.51			0.51			
I_n	Equivalent input noise cur- rent	$f = 10\text{ Hz}$		1.92			1.92			pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$		0.5			0.5			
THD + N	Total harmonic distortion plus noise	$V_O = 1\text{ V to }3\text{ V}$, $A_{VD} = 2$, $R_L = 2\text{ k}\Omega^\dagger$, $f = 10\text{ kHz}$		0.0052%			0.0052%			
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		5.9			5.9			MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega^\dagger$, $f = 100\text{ kHz}$		5.8			5.8			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 2\text{ V}$, $A_{VD} = 1$, $R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		660			660			kHz
ϕ_m	Phase margin	$R_L = 2\text{ k}\Omega^\dagger$, $C_L = 100\text{ pF}$		57°			57°			

$^\dagger R_L$ terminates at 2.5 V.

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2142M			TLE2142AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, R_S = 50 \Omega$	25°C	290	1200		275	750		μV
		Full range		2000			1600		
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		250			250		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.8			-1.8		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5$ mA		13.7	14		13.7	14		
	$I_O = -15$ mA		13.3	13.7		13.3	13.7		
	$I_O = -100 \mu A$	Full range	13.7			13.7			
	$I_O = -1$ mA		13.6			13.6			
	$I_O = -10$ mA		13.3			13.3			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5$ mA		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15$ mA		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \mu A$	Full range	-14.6			-14.6			
	$I_O = 1$ mA		-14.5			-14.5			
	$I_O = 10$ mA		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2$ k Ω	25°C	100	450		100	450		V/mV
		Full range	20			20			
r_i Input resistance		25°C	65			65			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0, V_{IC} = 2.5$ V No load,	25°C	6.9	9		6.9	9		mA
		Full range		9.4			9.4		

† Full range is -55°C to 125°C.

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142M operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2142M			TLE2142AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	R _L = 2 kΩ, C _L = 100 pF	A _{VD} = −1,	27	45		27	45	V/μs	
SR −	Negative slew rate			27	42		27	42		
t _s	Settling time	A _{VD} = −1, 10-V step	To 0.1%	0.34			0.34			μs
			To 0.01%	0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω,	f = 10 Hz	15			15			nV/√Hz
		R _S = 20 Ω,	f = 1 kHz	10.5			10.5			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48			0.48			μV
		f = 0.1 Hz to 10 Hz		0.51			0.51			
I _n	Equivalent input noise current	f = 10 Hz		1.89			1.89			pA/√Hz
		f = 1 kHz		0.47			0.47			
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, R _L = 2 kΩ, A _{VD} = 10, f = 10 kHz		0.01%			0.01%			
B ₁	Unity-gain bandwidth	R _L = 2 kΩ,	C _L = 100 pF	6			6			MHz
	Gain-bandwidth product	R _L = 2 kΩ, f = 100 kHz	C _L = 100 pF,	5.9			5.9			MHz
B _{OM}	Maximum output-swing band- width	V _{O(PP)} = 20 V, A _{VD} = 1,	R _L = 2 kΩ, C _L = 100 pF	668			668			kHz
φ _m	Phase margin at unity gain	R _L = 2 kΩ,	C _L = 100 pF	58°			58°			

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144M electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144M			TLE2144AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ $R_S = 50\ \Omega$	25°C	0.5	3.8		0.5	3		mV
		Full range			5.2			4.4	
α_{VIO} Temperature coefficient of input offset voltage		Full range		1.7			1.7		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C	8	100		8	100		nA
		Full range		250			250		
I_{IB} Input bias current		25°C	–0.8	–2		–0.8	–2		μA
		Full range		–2.3			–2.3		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	0 to 3	–0.3 to 3.2		0 to 3	–0.3 to 3.2		V
		Full range	0 to 2.7	–0.3 to 2.9		0 to 2.7	–0.3 to 2.9		
V_{OH} High-level output voltage	$I_{OH} = -150\ \mu\text{A}$	25°C	3.9	4.1		3.9	4.1		V
	$I_{OH} = -1.5\text{ mA}$		3.8	4		3.8	4		
	$I_{OH} = -15\text{ mA}$		3.4	3.7		3.4	3.7		
	$I_{OH} = 100\ \mu\text{A}$	Full range	3.75			3.75			
	$I_{OH} = 1\text{ mA}$		3.65			3.65			
	$I_{OH} = 10\text{ mA}$		3.45			3.45			
V_{OL} Low-level output voltage	$I_{OL} = 150\ \mu\text{A}$	25°C	75	125		75	125		mV
	$I_{OL} = 1.5\ \mu\text{A}$		150	225		150	225		
	$I_{OL} = 15\text{ mA}$		1.2	1.6		1.2	1.6		V
	$I_{OL} = 100\ \mu\text{A}$	Full range	200			200			mV
	$I_{OL} = 1\text{ mA}$		250			250			
	$I_{OL} = 10\text{ mA}$		1.45			1.45			V
A_{VD} Large-signal differential voltage amplification	$V_{IC} = \pm 2.5\text{ V}$, $V_O = 1\text{ V to } -1.5\text{ V}$ $R_L = 2\text{ k}\Omega$	25°C	50	95		50	95		V/mV
		Full range	5			5			
r_i Input resistance		25°C	70			70			$\text{M}\Omega$
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	25°C	85	118		85	118		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC} \pm / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{CC} Supply current	$V_O = 2.5\text{ V}$, $V_{IC} = 2.5\text{ V}$ No load,	25°C	13.2	17.6		13.2	17.6		mA
		Full range		18.4			18.4		

† Full range is -55°C to 125°C .

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144M operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144M			TLE2144AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	AVD = − 1, RL = 2 kΩ†, CL = 500 pF		45			45			V/μs
SR −	Negative slew rate			42			42			
ts	Settling time	AVD = − 1, 2.5-V step	To 0.1%	0.16			0.16			μs
			To 0.01%	0.22			0.22			
Vn	Equivalent input noise voltage	RS = 20 Ω, f = 10 Hz	15			15			nV/√Hz	
		RS = 20 Ω, f = 1 kHz	10.5			10.5				
VN(PP)	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.48			0.48			μV
		f = 0.1 Hz to 10 Hz		0.51			0.51			
In	Equivalent input noise current	f = 10 Hz		1.92			1.92			pA/√Hz
		f = 1 kHz		0.5			0.5			
THD + N	Total harmonic distortion plus noise	VO = 1 V to 3 V, RL = 2 kΩ†, AVD = 2, f = 10 kHz		0.0052%			0.0052%			
B1	Unity-gain bandwidth	RL = 2 kΩ†, CL = 100 pF	5.9			5.9			MHz	
	Gain-bandwidth product	RL = 2 kΩ†, CL = 100 pF, f = 100 kHz	5.8			5.8			MHz	
BOM	Maximum output-swing bandwidth	VO(PP) = 2 V, RL = 2 kΩ†, AVD = 1	660			660			kHz	
φm	Phase margin	RL = 2 kΩ†, CL = 100 pF	57°			57°				

[†] R_L terminates at 2.5 V

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2144M			TLE2144AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0, R_S = 50 \Omega$	25°C	0.6	2.4		0.5	1.5		mV
		Full range			4			3.2	
α_{VIO} Temperature coefficient of input offset voltage		Full range	1.7			1.7			$\mu V/^\circ C$
I_{IO} Input offset current		25°C	7	100		7	100		nA
		Full range		250			250		
I_{IB} Input bias current		25°C	-0.7	-1.5		-0.7	-1.5		μA
		Full range		-1.8			-1.8		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		V
		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150 \mu A$	25°C	13.8	14.1		13.8	14.1		V
	$I_O = -1.5$ mA		13.7	14		13.7	14		
	$I_O = -15$ mA		13.1	13.7		13.1	13.7		
	$I_O = -100 \mu A$	Full range	13.7			13.7			
	$I_O = -1$ mA		13.6			13.6			
	$I_O = -10$ mA		13.1			13.1			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150 \mu A$	25°C	-14.7	-14.9		-14.7	-14.9		V
	$I_O = 1.5$ mA		-14.5	-14.8		-14.5	-14.8		
	$I_O = 15$ mA		-13.4	-13.8		-13.4	-13.8		
	$I_O = 100 \mu A$	Full range	-14.6			-14.6			
	$I_O = 1$ mA		-14.5			-14.5			
	$I_O = 10$ mA		-13.4			-13.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2$ k Ω	25°C	100	170		100	170		V/mV
		Full range	20			20			
r_i Input resistance		25°C	65			65			M Ω
c_i Input capacitance		25°C	2.5			2.5			pF
z_o Open-loop output impedance	$f = 1$ MHz	25°C	30			30			Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, R_S = 50 \Omega$	25°C	85	108		85	108		dB
		Full range	80			80			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5$ V to ± 15 V, $R_S = 50 \Omega$	25°C	90	106		90	106		dB
		Full range	85			85			
I_{OS} Short-circuit output current	$V_O = 0$	25°C	-25	-50		-25	-50		mA
			20	31		20	31		
I_{CC} Supply current	$V_O = 0, V_{IC} = 2.5$ V No load,	25°C	13.8	18		13.8	18		mA
		Full range		18.8			18.8		

† Full range is -55°C to 125°C

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144M operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2144M			TLE2144AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$	$A_{VD} = -1$,	27	45		27	45		V/ μs
SR–	Negative slew rate			27	42		27	42		
t_s	Settling time	$A_{VD} = -1$, 10-V step	To 0.1%		0.34			0.34		μs
			To 0.01%		.4			.4		
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$,	$f = 10\text{ Hz}$		15			15		nV/ $\sqrt{\text{Hz}}$
		$R_S = 20\text{ }\Omega$,	$f = 1\text{ kHz}$		10.5			10.5		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$			0.48			0.48		μV
		$f = 0.1\text{ Hz to }10\text{ Hz}$			0.51			0.51		
I_n	Equivalent input noise current	$f = 10\text{ Hz}$			1.89			1.89		pA/ $\sqrt{\text{Hz}}$
		$f = 10\text{ kHz}$			0.47			0.47		
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 10$,	$R_L = 2\text{ k}\Omega$, $f = 10\text{ kHz}$		0.01%			0.01%		
B_1	Unity-gain bandwidth	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$		6			6		MHz
	Gain-bandwidth product	$R_L = 2\text{ k}\Omega$, $f = 100\text{ kHz}$	$C_L = 100\text{ pF}$,		5.9			5.9		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $A_{VD} = 1$,	$R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$		668			668		kHz
ϕ_m	Phase margin at unity gain	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$		58°			58°		

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2141Y electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLE2141Y			UNIT
		MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0$, $R_S = 50\ \Omega$, $V_O = 0$		200	1000	μV
I_{IO} Input offset current			7	100	nA
I_{IB} Input bias current			-0.7	-1.5	μA
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	-15 to 13	-15.3 to 13.2		V
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150\ \mu\text{A}$	13.8	14.1		V
	$I_O = -1.5\ \text{mA}$	13.7	14		
	$I_O = -15\ \text{mA}$	13.3	13.7		
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150\ \mu\text{A}$	-14.7	-14.9		V
	$I_O = 1.5\ \text{mA}$	-14.5	-14.8		
	$I_O = 15\ \text{mA}$	-13.4	-13.8		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$, $R_L = 2\ \text{k}\Omega$	100	450		V/mV
r_i Input resistance			65		$\text{M}\Omega$
c_i Input capacitance			2.5		pF
z_o Open-loop output impedance	$f = 1\ \text{MHz}$		30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	80	108		dB
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\ \text{V}$ to $\pm 15\ \text{V}$, $R_S = 50\ \Omega$	85	106		dB
I_{OS} Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	-25	-50	mA
		$V_{ID} = -1\ \text{V}$	20	31	
I_{CC} Supply current	$V_O = 0$, No load		3.5	4.5	mA

TLE214x, TLE214xA
EXCALIBUR LOW-NOISE HIGH-SPEED
PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2142Y electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TLE2142Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$, $V_O = 0$ $R_S = 50\ \Omega$		150	875	μV
I_{IO}	Input offset current			7	100	nA
I_{IB}	Input bias current			-0.7	-1.5	μA
V_{ICR}	Common-mode input voltage range	$R_S = 50\ \Omega$	-15 to 13	-15.3 to 13.2		V
V_{OM+}	Maximum positive peak output voltage swing	$I_O = -150\ \mu\text{A}$	13.8	14.1		V
		$I_O = -1.5\ \text{mA}$	13.7	14		
		$I_O = -15\ \text{mA}$	13.3	13.7		
V_{OM-}	Maximum negative peak output voltage swing	$I_O = 150\ \mu\text{A}$	-14.7	-14.9		V
		$I_O = 1.5\ \text{mA}$	-14.5	-14.8		
		$I_O = 15\ \text{mA}$	-13.4	-13.8		
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$, $R_L = 2\ \text{k}\Omega$	100	450		V/mV
r_i	Input resistance			65		M Ω
c_i	Input capacitance			2.5		pF
z_o	Open-loop output impedance	$f = 1\ \text{MHz}$		30		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	80	108		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\ \text{V}$ to $\pm 15\ \text{V}$, $R_S = 50\ \Omega$	85	106		dB
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	-25	-50	mA
			$V_{ID} = -1\ \text{V}$	20	31	
I_{CC}	Supply current	$V_O = 0$, No load		6.9	9	mA

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TLE2144Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLE2144Y			UNIT
		MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50\ \Omega$,		0.3	1.8	mV
I_{IO} Input offset current			7	100	nA
I_{IB} Input bias current			-0.7	-1.5	μA
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	-15 to 13	-15.3 to 13.2		V
V_{OM+} Maximum positive peak output voltage swing	$I_O = -150\ \mu\text{A}$	13.8	14.1		V
	$I_O = -1.5\text{ mA}$	13.7	14		
	$I_O = -15\text{ mA}$	13.3	13.7		
V_{OM-} Maximum negative peak output voltage swing	$I_O = 150\ \mu\text{A}$	-14.7	-14.9		V
	$I_O = 1.5\text{ mA}$	-14.5	-14.8		
	$I_O = 15\text{ mA}$	-13.4	-13.8		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}$, $R_L = 2\text{ k}\Omega$	100	450		V/mV
r_i Input resistance			65		$\text{M}\Omega$
c_i Input capacitance			2.5		pF
z_o Open-loop output impedance	$f = 1\text{ MHz}$		30		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	80	108		dB
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 2.5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$	85	106		dB
I_{OS} Short-circuit output current	$V_O = 0$	$V_{ID} = 1\text{ V}$	-25	-50	mA
		$V_{ID} = -1\text{ V}$	20	31	
I_{CC} Supply current	$V_O = 0$, No load		13.8	18	mA

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution	1, 2, 3
I_{IO}	Input offset current	vs Free-air temperature	4
I_{IB}	Input bias current	vs Common-mode input voltage vs Free-air temperature	5 6
V_{OM+}	Maximum positive peak output voltage	vs Supply voltage vs Free-air temperature vs Output current vs Settling time	7 8 9 11
V_{OM-}	Maximum negative peak output voltage	vs Supply voltage vs Free-air temperature vs Output current vs Settling time	7 8 10 11
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	12
V_{OH}	High-level output voltage	vs Output current	13
V_{OL}	Low-level output voltage	vs Output current	14
A_{VD}	Large-signal differential voltage amplification	vs Frequency vs Free-air temperature	15 16
z_o	Closed-loop output impedance	vs Frequency	17
I_{OS}	Short-circuit output current	vs Free-air temperature	18
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	19 20
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	21 22
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature	23 24
V_n	Equivalent input noise voltage	vs Frequency	25
V_n	Input noise voltage	Over a 10-second period	26
I_n	Noise current	vs Frequency	27
THD + N	Total harmonic distortion plus noise	vs Frequency	28
SR	Slew rate	vs Free-air temperature vs Load capacitance	29 30
Pulse response	Noninverting large signal	vs Time	31
	Inverting large signal	vs Time	32
	Small signal	vs Time	33
B_1	Unity-gain bandwidth	vs Load capacitance	34
	Gain margin	vs Load capacitance	35
ϕ_m	Phase margin	vs Load capacitance	36
	Phase shift	vs Frequency	15

TLE214x, TLE214xA EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TYPICAL CHARACTERISTICS

**TLE2141
DISTRIBUTION OF
INPUT OFFSET VOLTAGE**

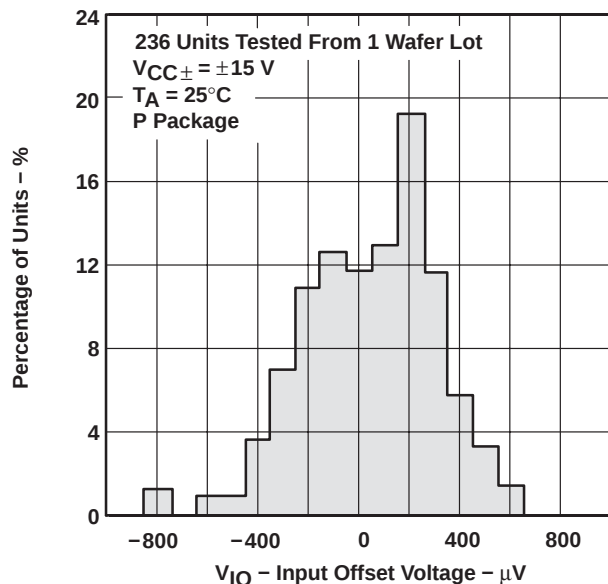


Figure 1

**TLE2142
DISTRIBUTION OF
INPUT OFFSET VOLTAGE**

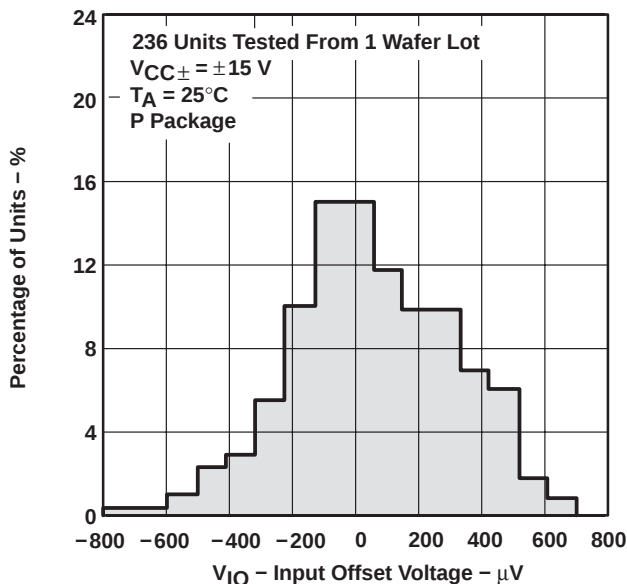


Figure 2

**TLE2144
DISTRIBUTION OF
INPUT OFFSET VOLTAGE**

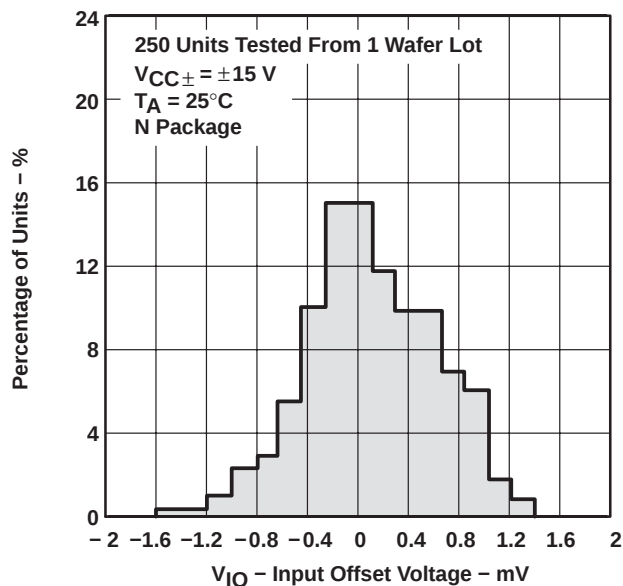


Figure 3

**INPUT OFFSET CURRENT[†]
VS
FREE-AIR TEMPERATURE**

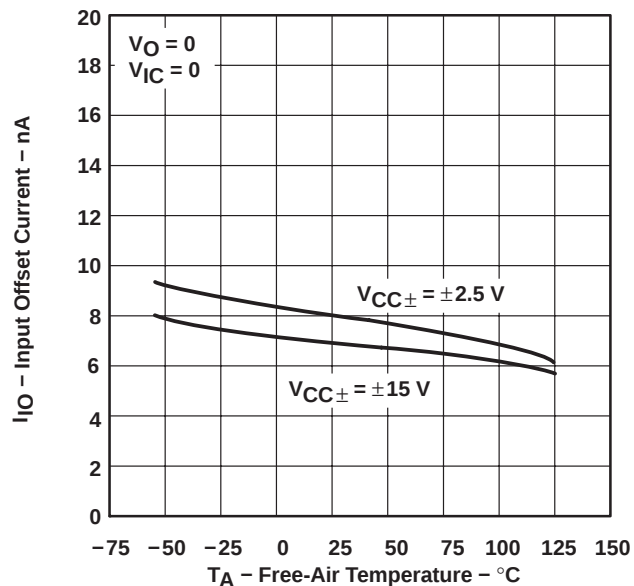
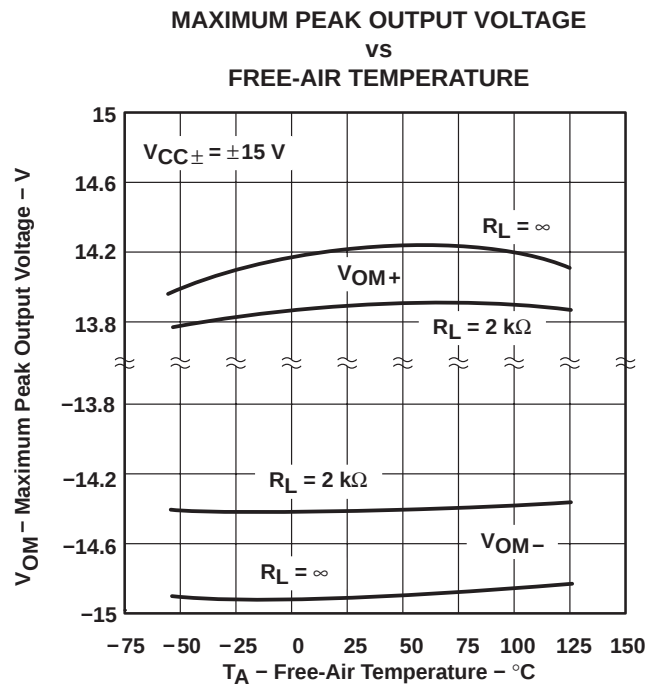
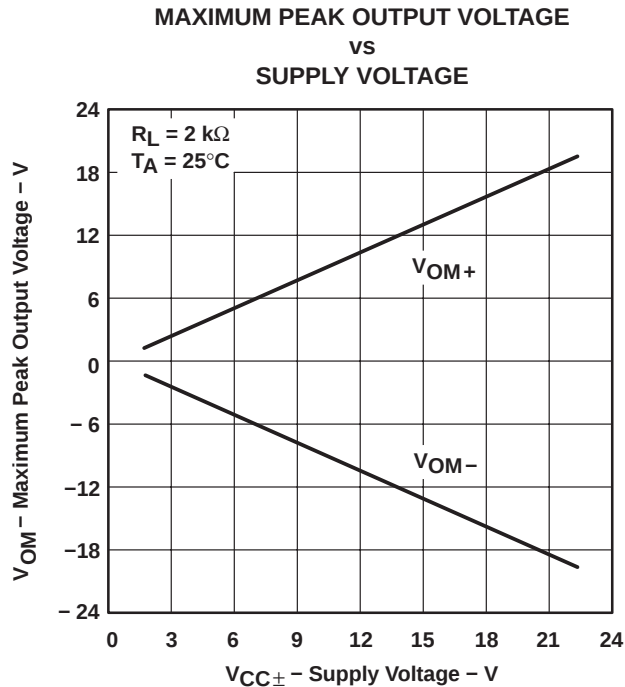
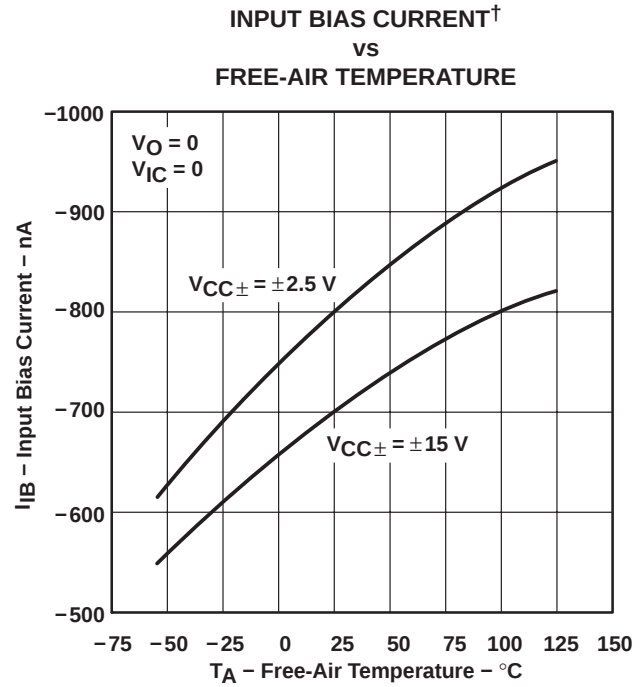
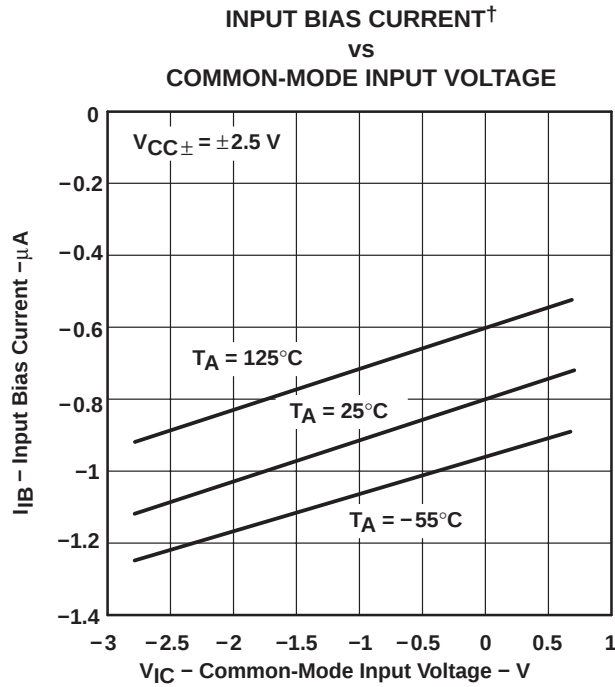


Figure 4

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

TYPICAL CHARACTERISTICS



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

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED

PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TYPICAL CHARACTERISTICS

MAXIMUM POSITIVE PEAK
OUTPUT VOLTAGE[†]
VS
OUTPUT CURRENT

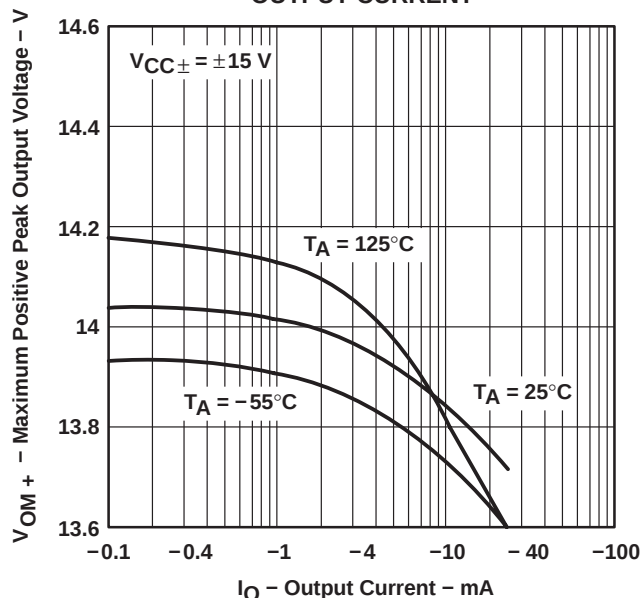


Figure 9

MAXIMUM NEGATIVE PEAK
OUTPUT VOLTAGE[†]
VS
OUTPUT CURRENT

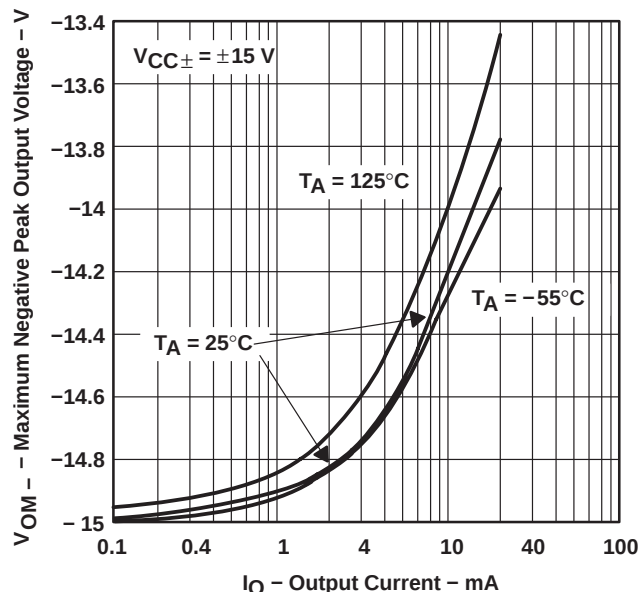


Figure 10

MAXIMUM PEAK OUTPUT VOLTAGE
VS
SETTLING TIME

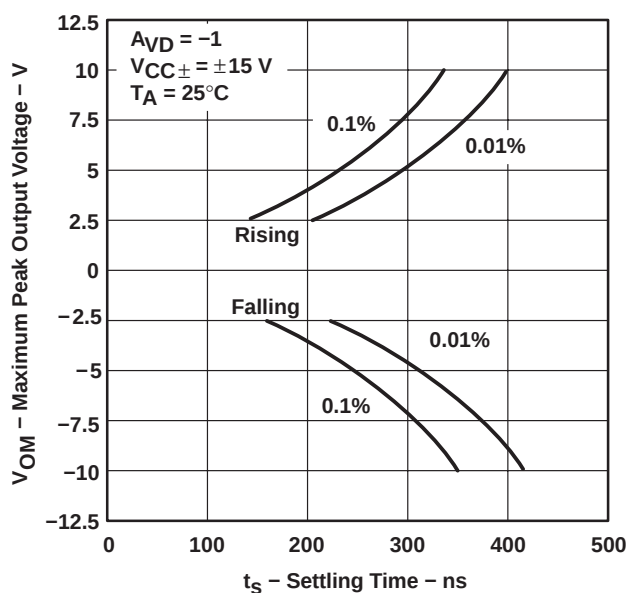


Figure 11

MAXIMUM PEAK-TO-PEAK
OUTPUT VOLTAGE[†]
VS
FREQUENCY

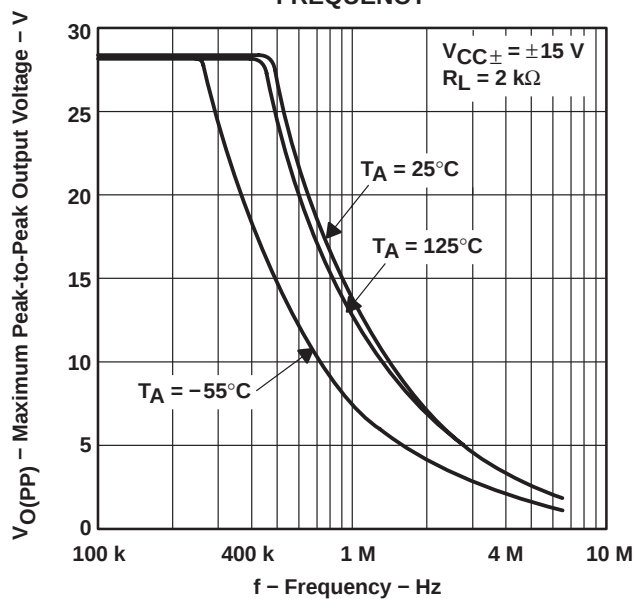
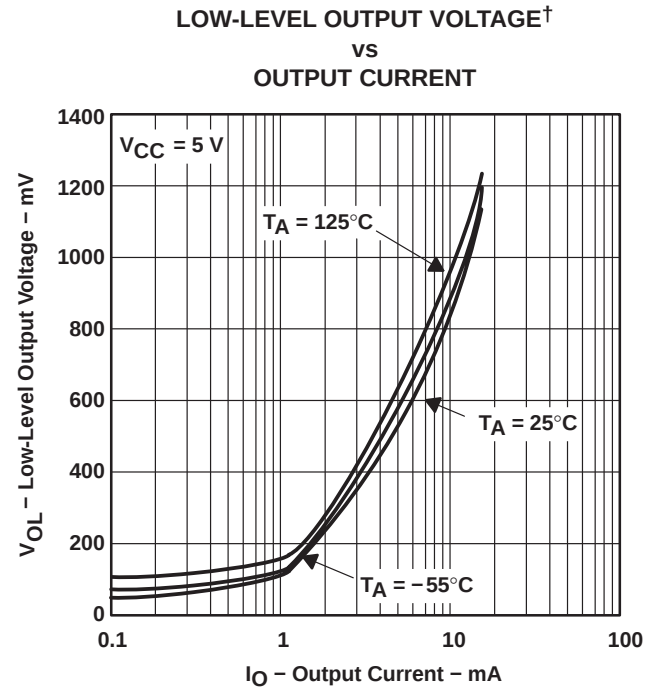
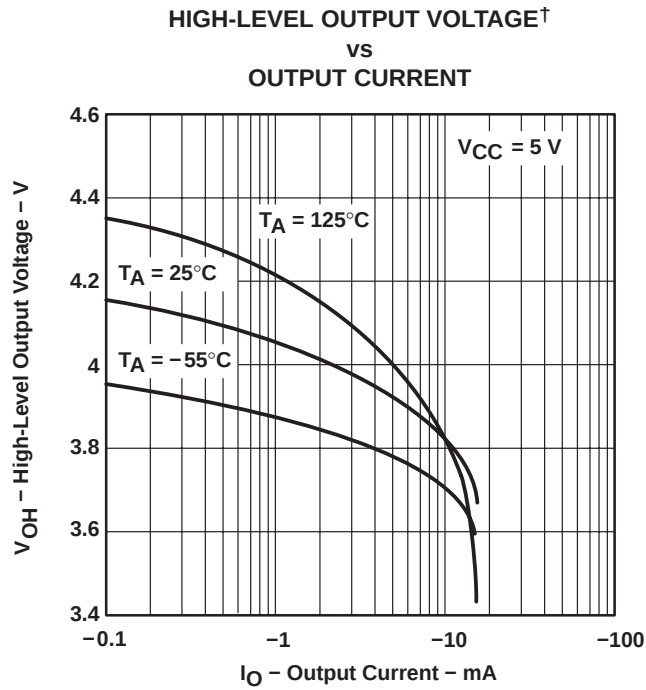


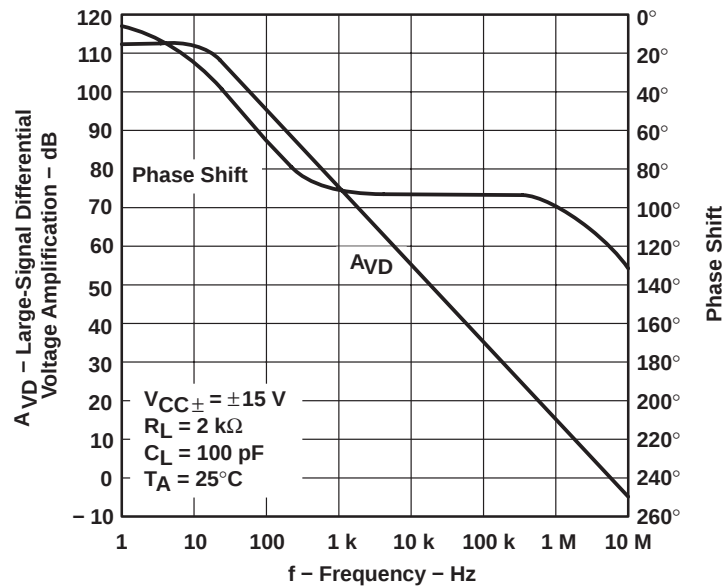
Figure 12

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

TYPICAL CHARACTERISTICS



LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VS FREQUENCY



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

TLE214x, TLE214xA EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION[†]

VS

FREE-AIR TEMPERATURE

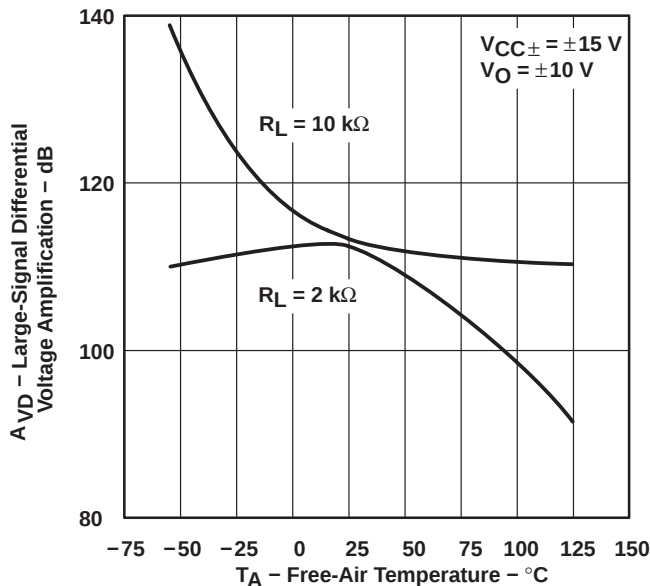


Figure 16

CLOSED-LOOP OUTPUT IMPEDANCE

VS

FREQUENCY

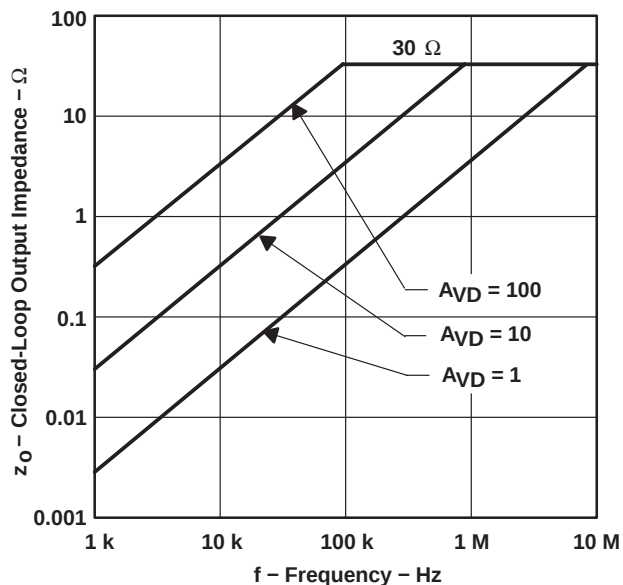


Figure 17

SHORT-CIRCUIT OUTPUT CURRENT[†]

VS

FREE-AIR TEMPERATURE

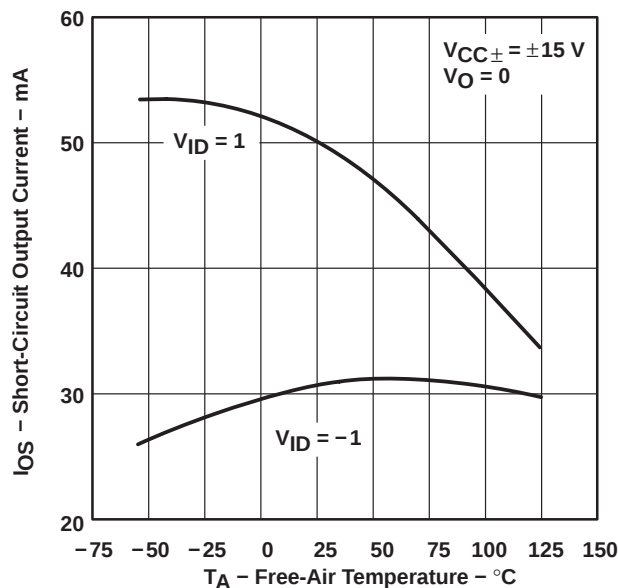


Figure 18

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

TYPICAL CHARACTERISTICS

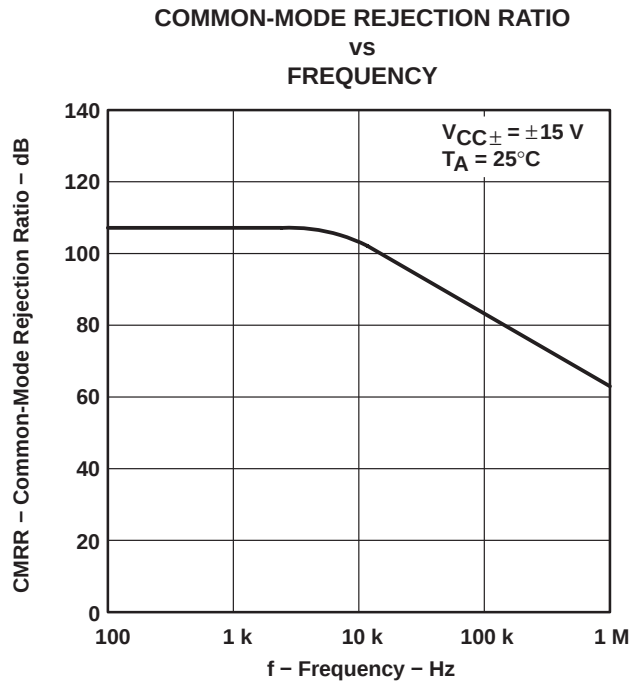


Figure 19

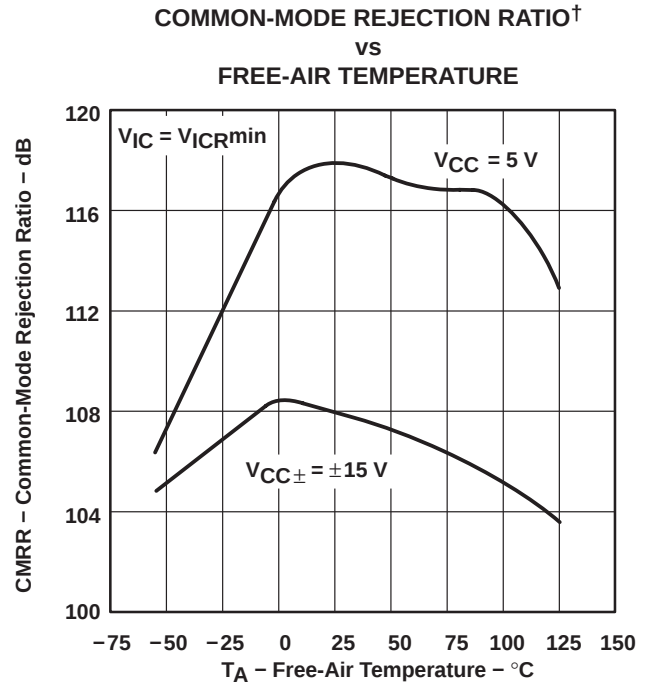


Figure 20

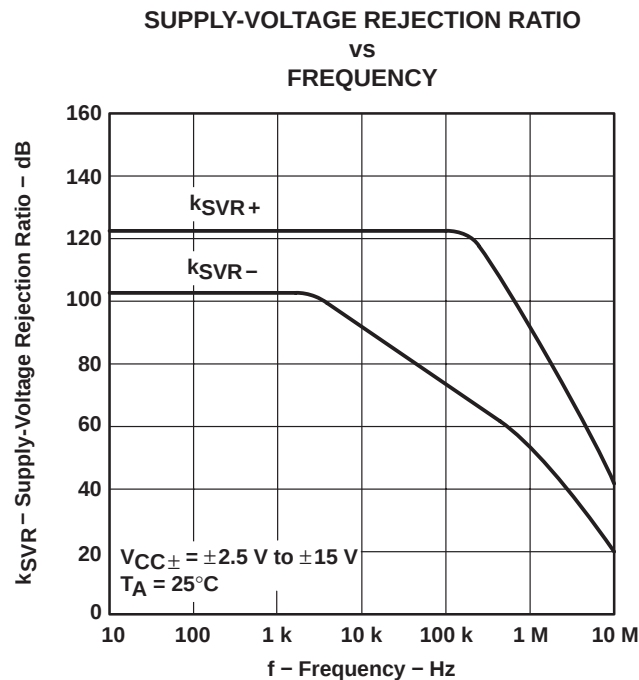


Figure 21

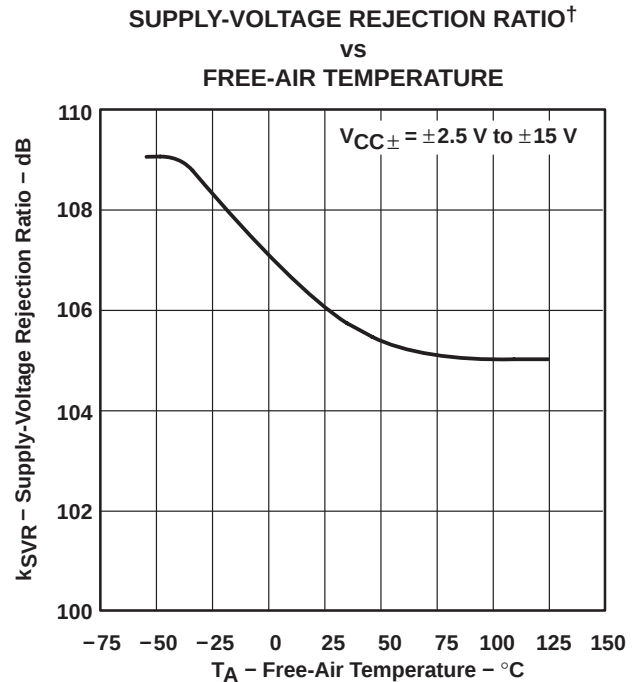


Figure 22

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

TLE214x, TLE214xA

EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TYPICAL CHARACTERISTICS

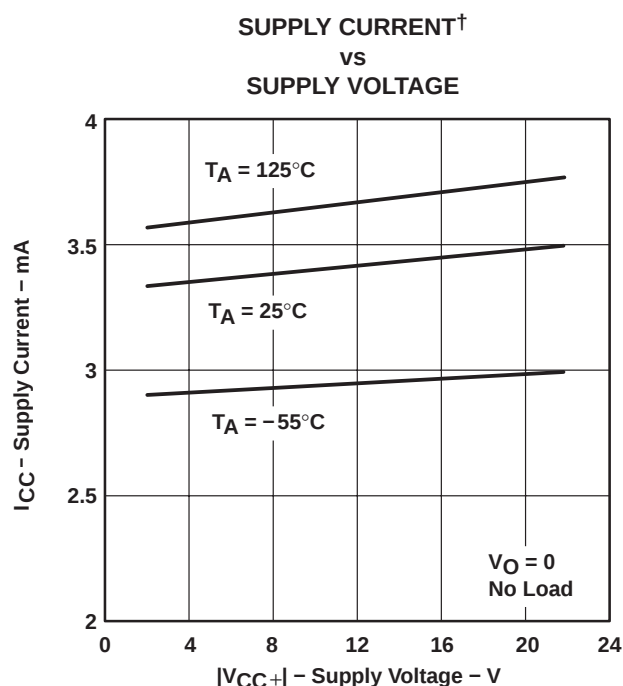


Figure 23

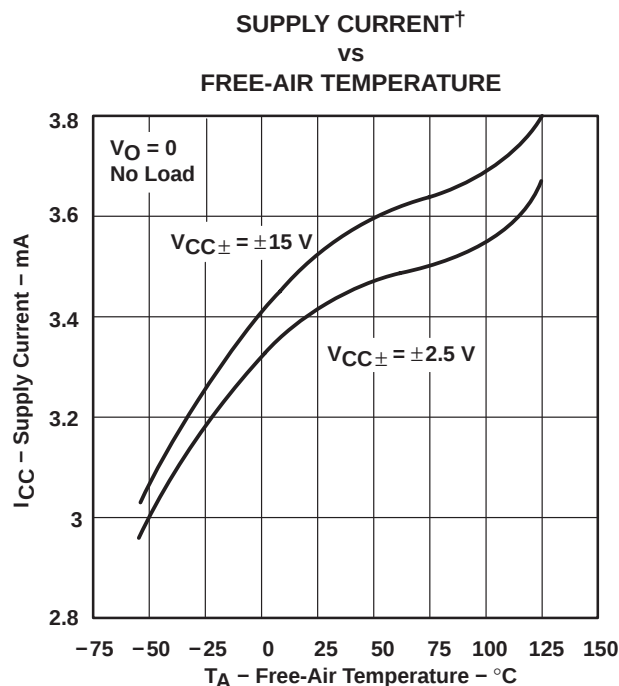


Figure 24

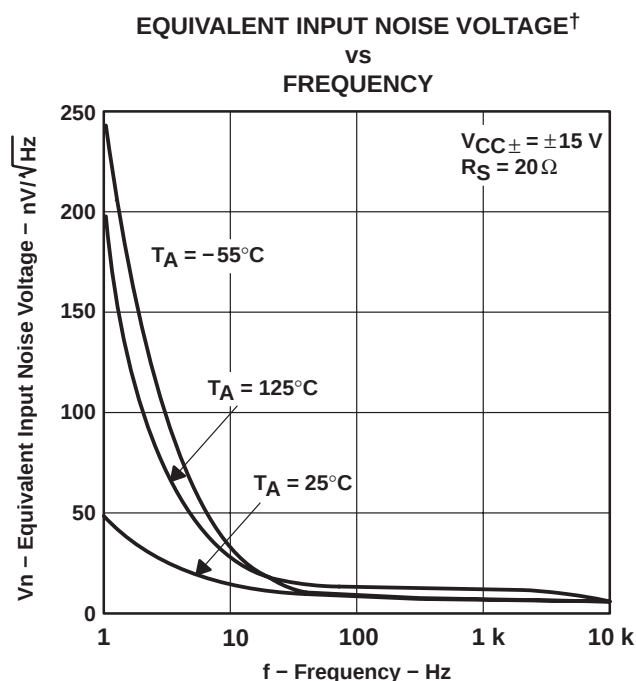


Figure 25

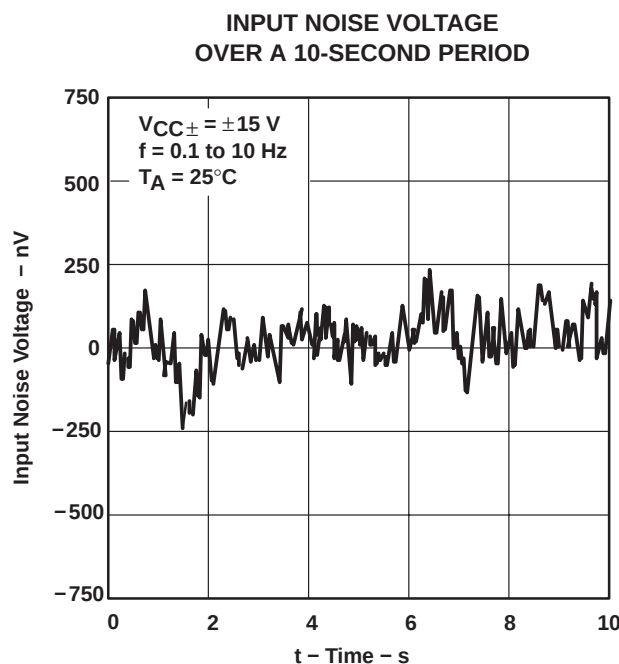
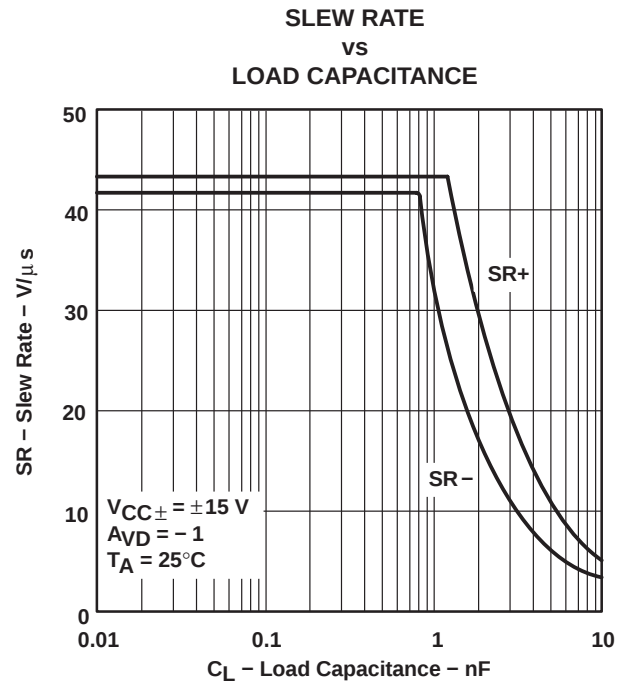
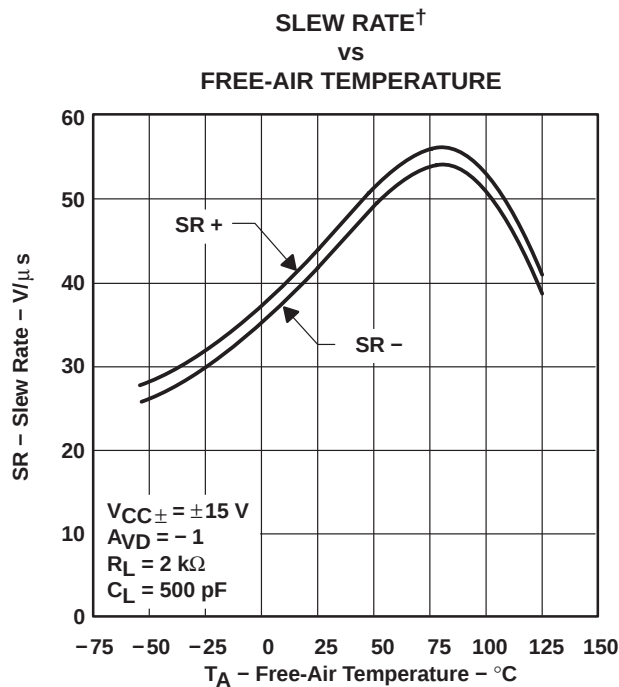
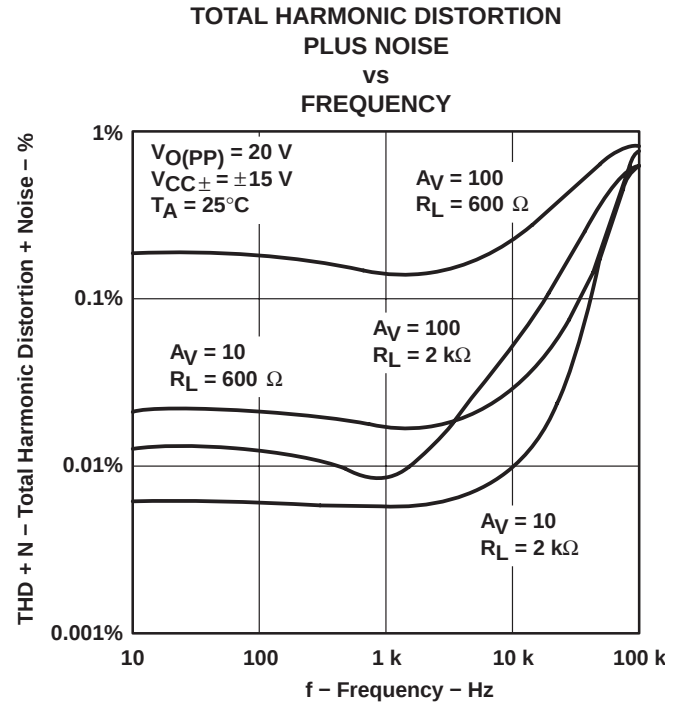
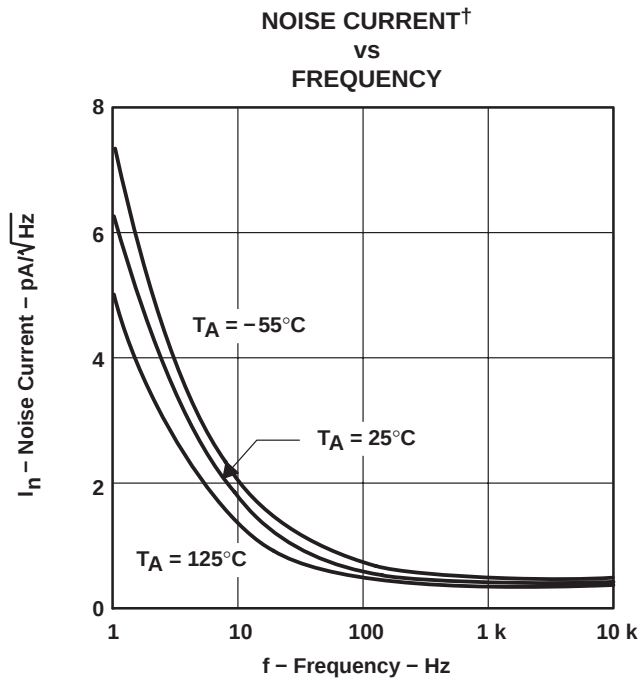


Figure 26

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

TYPICAL CHARACTERISTICS



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

TLE214x, TLE214xA EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

TYPICAL CHARACTERISTICS

NONINVERTING
LARGE-SIGNAL
PULSE RESPONSE†

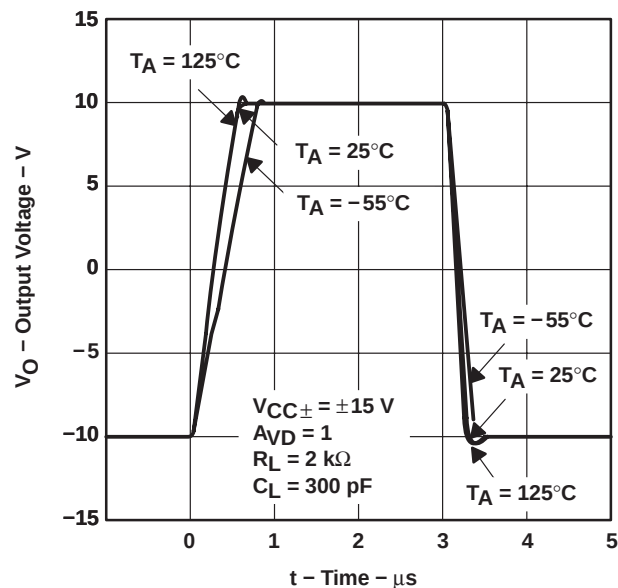


Figure 31

INVERTING
LARGE-SIGNAL
PULSE RESPONSE†

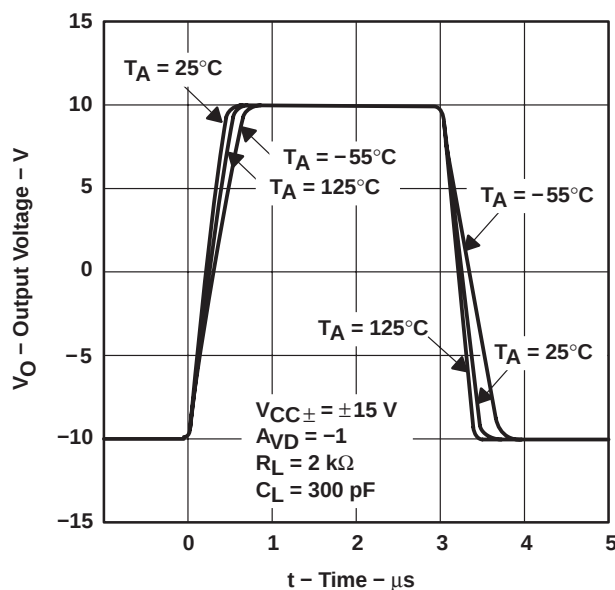


Figure 32

SMALL-SIGNAL
PULSE RESPONSE

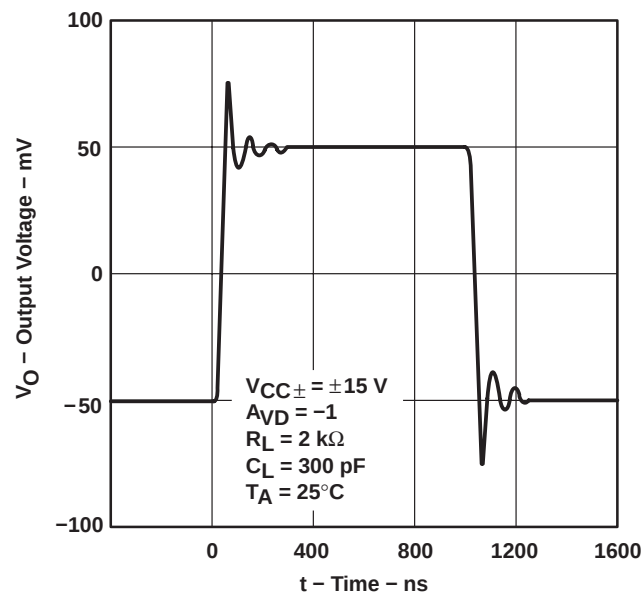


Figure 33

UNITY-GAIN BANDWIDTH†
VS
LOAD CAPACITANCE

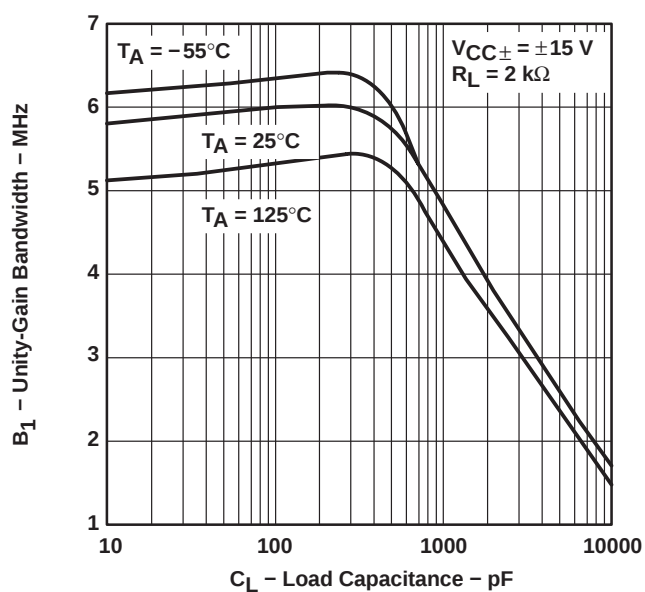


Figure 34

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

TYPICAL CHARACTERISTICS

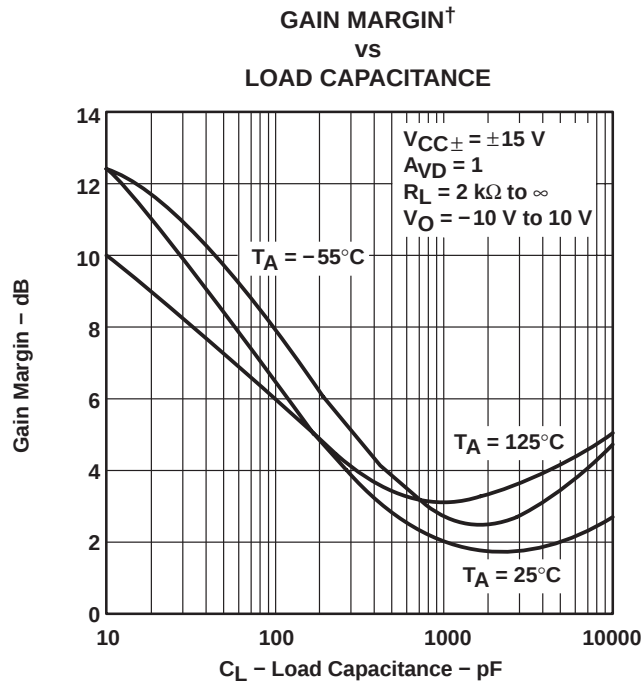


Figure 35

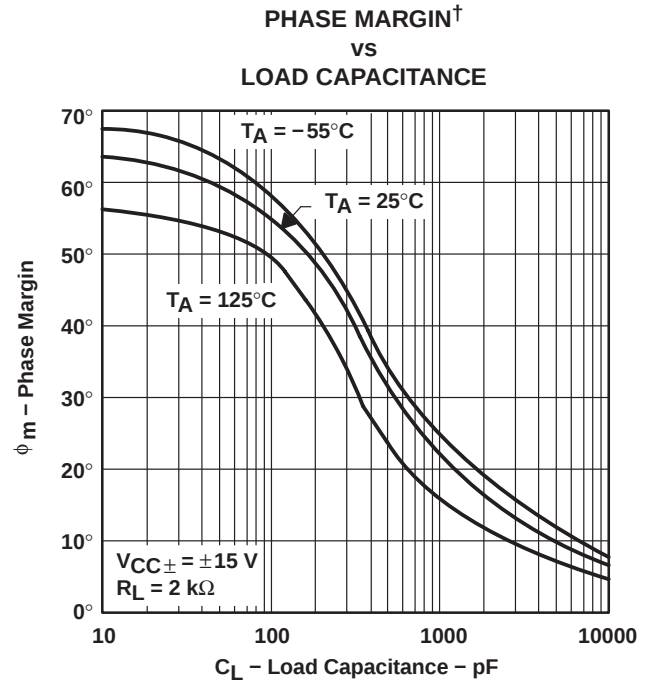


Figure 36

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

TLE214x, TLE214xA EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

SLOS183B – FEBRUARY 1997 – REVISED APRIL 2004

APPLICATION INFORMATION

input offset voltage nulling

The TLE2141 series offers external null pins that can be used to further reduce the input offset voltage. If this feature is desired, connect the circuit of Figure 37 as shown. If external nulling is not needed, the null pins may be left unconnected.

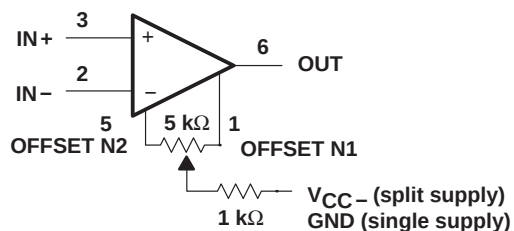


Figure 37. Input Offset Voltage Null Circuit

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9321601QPA	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321602QPA	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321603Q2A	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
5962-9321603QHA	ACTIVE	CFP	U	10	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321603QPA	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321604Q2A	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
5962-9321604QHA	ACTIVE	CFP	U	10	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321604QPA	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321605Q2A	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
5962-9321605QCA	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
5962-9321606Q2A	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
5962-9321606QCA	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
TLE2141ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2141AID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141AIDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2141AMFKB	OBSOLETE	LCCC	FK	20		None	POST-PLATE	Level-NC-NC-NC
TLE2141AMJGB	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
TLE2141CD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141CDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2141ID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141IDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2141IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2141MD	ACTIVE	SOIC	D	8	75	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2141MDR	ACTIVE	SOIC	D	8	2500	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2141MFKB	OBSOLETE	LCCC	FK	20		None	POST-PLATE	Level-NC-NC-NC
TLE2141MJGB	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
TLE2142ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142ACDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142ACP	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TLE2142AID	ACTIVE	SOIC	D	8	75	Pb-Free	CU NIPDAU	Level-2-260C-1YEAR/

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
						(RoHS)		Level-1-220C-UNLIM
TLE2142AIDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142AIP	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TLE2142AMD	ACTIVE	SOIC	D	8	75	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142AMDR	ACTIVE	SOIC	D	8	2500	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142AMFKB	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
TLE2142AMJGB	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
TLE2142AMUB	ACTIVE	CFP	U	10	1	None	A42 SNPB	Level-NC-NC-NC
TLE2142CD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142CDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2142CPW	ACTIVE	TSSOP	PW	16	90	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142CPWLE	OBSOLETE	TSSOP	PW	16		None	Call TI	Call TI
TLE2142CPWR	ACTIVE	TSSOP	PW	16	2000	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142ID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142IDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TLE2142IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2142MD	ACTIVE	SOIC	D	8	75	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142MDR	ACTIVE	SOIC	D	8	2500	None	CU NIPDAU	Level-1-220C-UNLIM
TLE2142MFKB	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
TLE2142MJGB	ACTIVE	CDIP	JG	8	1	None	A42 SNPB	Level-NC-NC-NC
TLE2142MUB	ACTIVE	CFP	U	10	1	None	A42 SNPB	Level-NC-NC-NC
TLE2144ACN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2144AIN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2144AMFKB	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
TLE2144AMJB	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
TLE2144CDW	ACTIVE	SOIC	DW	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1YEAR/ Level-1-220C-UNLIM
TLE2144CDWR	ACTIVE	SOIC	DW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1YEAR/ Level-1-220C-UNLIM
TLE2144CN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2144IDW	ACTIVE	SOIC	DW	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1YEAR/ Level-1-220C-UNLIM
TLE2144IDWR	ACTIVE	SOIC	DW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1YEAR/ Level-1-220C-UNLIM
TLE2144IN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NA-NA-NA
TLE2144MDW	ACTIVE	SOIC	DW	16	40	None	CU NIPDAU	Level-1-220C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLE2144MFKB	ACTIVE	LCCC	FK	20	1	None	POST-PLATE	Level-NC-NC-NC
TLE2144MJB	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
TLE2144MN	OBSOLETE	PDIP	N	14		None	Call TI	Call TI

⁽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⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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

Copyright © 2005, Texas Instruments Incorporated