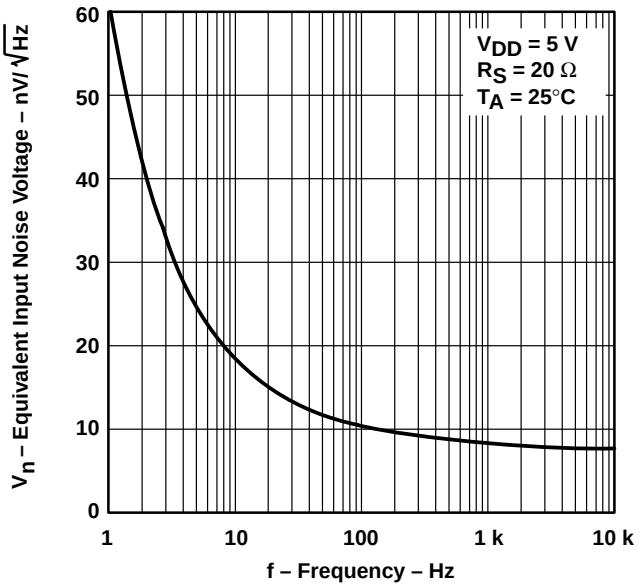
- **TLC2201B Is 100% Tested for Noise:**
  30 nV/√Hz Max at f = 10 Hz
  12 nV/√Hz Max at f = 1 kHz
- **Low Input Offset Voltage . . . 200 μV Max**
- **Excellent Offset Voltage Stability With Temperature . . . 0.5 μV/°C Typ**
- **Low Input Bias Current**
  1 pA at T_A = 25°C
- **Fully Specified for Both Single-Supply and Split-Supply Operation**
- **Common-Mode Input Voltage Range Includes the Negative Rail**

description

The TLC2201, TLC2201A, TLC2201B, and TLC2201Y are precision, low-noise operational amplifiers using Texas Instruments Advanced LinCMOS™ process. These devices combine the noise performance of the lowest-noise JFET amplifiers with the dc precision available previously only in bipolar amplifiers. The Advanced LinCMOS™ process uses silicon-gate technology to obtain input offset voltage stability with temperature and time that far exceeds that obtainable using metal-gate technology. In addition, this technology makes possible input impedance levels that meet or exceed levels offered by top-gate JFET and expensive dielectric-isolated devices.

The combination of excellent dc and noise performance with a common-mode input voltage range that includes the negative rail makes these devices an ideal choice for high-impedance, low-level signal conditioning applications in either single-supply or split-supply configurations.

TYPICAL EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY



The device inputs and outputs are designed to withstand –100-mA surge currents without sustaining latch-up. In addition, internal ESD-protection circuits prevent functional failures at voltages up to 2000 V as tested under MIL-STD-883C, Method 3015.2; however, care should be exercised in handling these devices as exposure to ESD may result in degradation of the device parametric performance.

AVAILABLE OPTIONS

T_A	V_{IO}max AT 25°C	$V_n$max f = 10 Hz AT 25°C	$V_n$max f = 1 kHz AT 25°C	PACKAGED DEVICES				CHIP FORM (Y)
				SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	
0°C to 70°C	200 μV 200 μV 500 μV	35 nV/√Hz 30 nV/√Hz —	15 nV/√Hz 12 nV/√Hz —	TLC2201ACD TLC2201BCD TLC2201CD	—	—	TLC2201ACP TLC2201BCP TLC2201CP	TLC2201Y
–40°C to 85°C	200 μV 200 μV 500 μV	35 nV/√Hz 30 nV/√Hz —	15 nV/√Hz 12 nV/√Hz —	TLC2201AID TLC2201BID TLC2201ID	—	—	TLC2201AIP TLC2201BIP TLC2201IP	—
–55°C to 125°C	200 μV 200 μV 500 μV	35 nV/√Hz 30 nV/√Hz —	15 nV/√Hz 12 nV/√Hz —	TLC2201AMD TLC2201BMD TLC2201MD	TLC2201AMFK TLC2201BMFK TLC2201MFK	TLC2201AMJG TLC2201BMJG TLC2201MJG	TLC2201AMP TLC2201BMP TLC2201MP	—

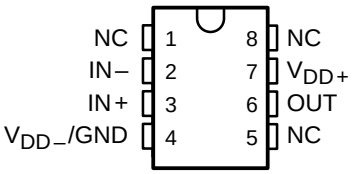
The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2201BCDR). Chip-form versions are tested at 25°C only.

Advanced LinCMOS is a trademark of Texas Instruments Incorporated.

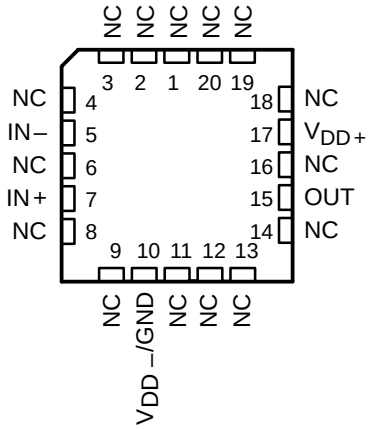
description (continued)

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from –40°C to 85°C. The M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

D, JG, OR P PACKAGE
(TOP VIEW)

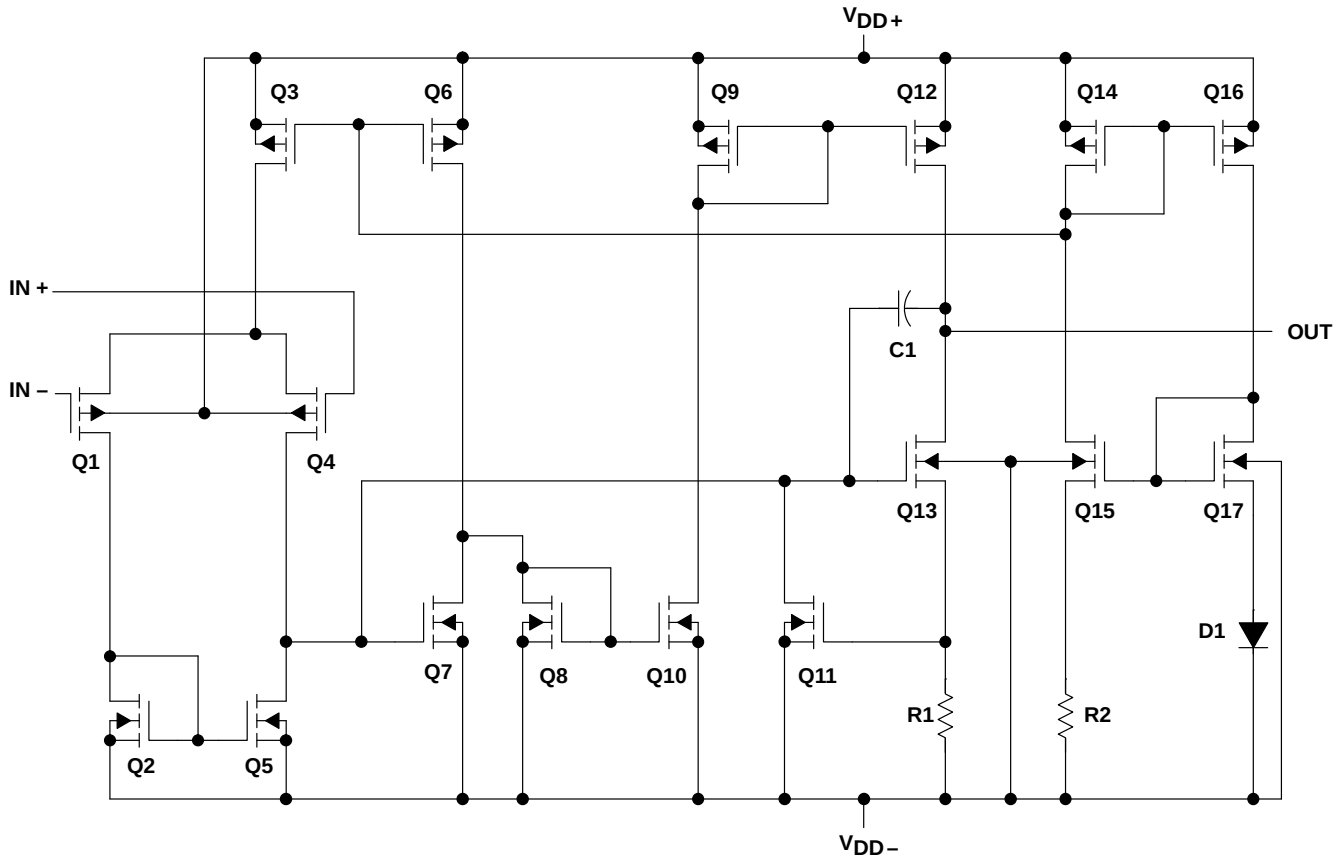


FK PACKAGE
(TOP VIEW)



NC – No internal connection

equivalent schematic (each amplifier)

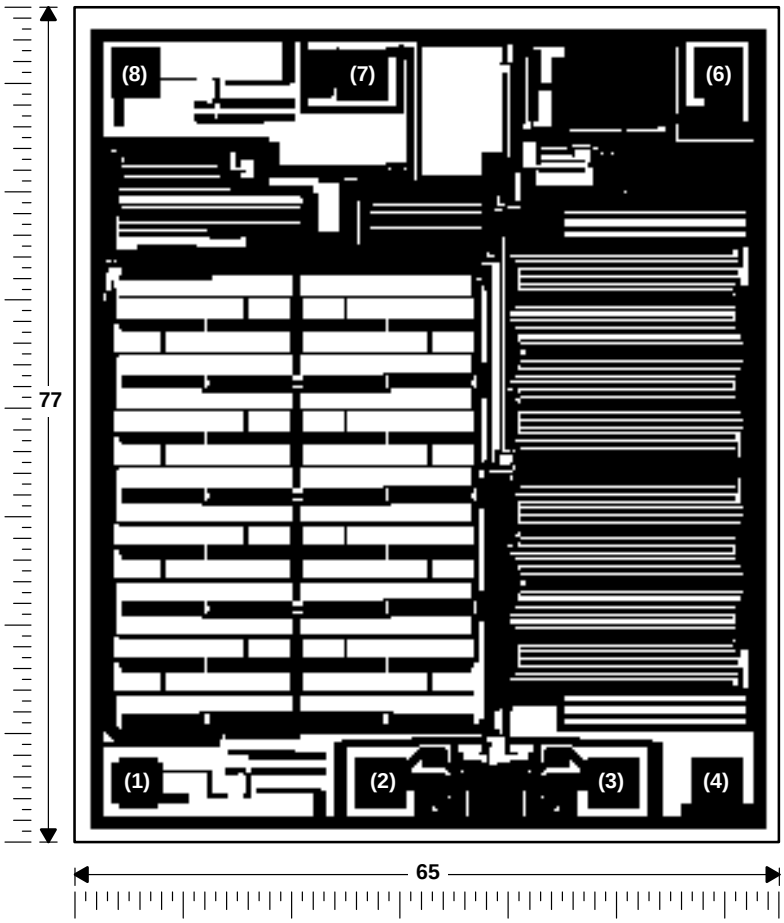


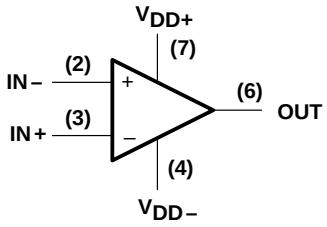
COMPONENT COUNT	
Transistors	17
Diodes	1
Resistors	2
Capacitors	1

TLC2201Y chip information

This chip, when properly assembled, displays characteristics similar to the TLC2201C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding path. Chips may be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS: 15 TYPICAL

BONDING PADS: 4 × 4 MINIMUM

$T_J$max = 150°C

TOLERANCES ARE ±10%.

ALL DIMENSIONS ARE IN MILS.

PIN (4) IS INTERNALLY CONNECTED TO BACK SIDE OF CHIP.

TERMINAL NUMBERS ARE FOR THE D, JG, AND P PACKAGES.

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

Supply voltage, V_{DD+} (see Note 1) . . . . . 8 V
Supply voltage, V_{DD-} (see Note 1) . . . . . –8 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±16 V
Input voltage, V_I (any input) (see Note 1) . . . . . ±8 V
Input current, I_I (each input) . . . . . ±5 mA
Output current, I_O . . . . . ±50 mA
Duration of short-circuit current at (or below) 25°C (see Note 3) . . . . . unlimited
Continuous total dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature. T_A: C suffix . . . . . 0°C to 70°C
I suffix . . . . . –40°C to 85°C
M suffix . . . . . –55°C to 125°C
Storage temperature range . . . . . –65°C to 150°C
Case temperature for 60 seconds: FK package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: JG package . . . . . 300°C

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

NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between V_{DD+} and V_{DD-}.
2. Differential voltages are at IN+ with respect to IN –.
3. The output can be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW	200 mW

recommended operating conditions

	C SUFFIX		I SUFFIX		M SUFFIX		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, $V_{DD\pm}$	±2.3	±8	±2.3	±8	±2.3	±8	V
Common-mode input voltage, V_{IC}	V_{DD-}	$V_{DD+}-2.3$	V_{DD-}	$V_{DD+}-2.3$	V_{DD-}	$V_{DD+}-2.3$	V
Operating free-air temperature, T_A	0	70	–40	85	–55	125	°C

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201C			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	µV
			Full range			600	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		µV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005	µV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			100	
I_{IB}	Input bias current		25°C		1		pA
			Full range			100	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		V
			Full range	−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		V/mV
			Full range	300			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		
			Full range	70			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5	mA
			Full range			1.5	

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201C			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		V/µs
			Full range	1.5			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		µV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		48°		

† Full range is 0°C to 70°C.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AC			TLC2201BC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	μV
			Full range			300			300	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			100			100	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			100			100	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		−4.7	−4.9		V
			Full range	−4.7			−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		400	560		V/mV
			Full range	300			300			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		90	100		
			Full range	70			70			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		90	115		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5		1.1	1.5	mA
			Full range			1.5			1.5	

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150 °C extrapolated to T_A = 25 °C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AC			TLC2210BC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		2	2.7		V/μs
			Full range	1.5			1.5			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9			1.9		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		48°			48°		

† Full range is 0°C to 70°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201C			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	µV
			Full range			600	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		µV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005	µV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			100	
I_{IB}	Input bias current		25°C		1		pA
			Full range			100	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50	mV
			Full range			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		V/mV
			Full range	100			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		
			Full range	15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1	1.5	mA
			Full range			1.5	

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201C			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		V/µs
			Full range	1.3			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		µV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°		

† Full range is 0°C to 70°C.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AC			TLC2201BC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	μV
			Full range			300			300	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			100			100	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			100			100	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50		0	50	mV
			Full range			50			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		150	315		V/mV
			Full range	100			100			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		25	55		
			Full range	15			15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		90	110		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1	1.5		1	1.5	mA
			Full range			1.5			1.5	

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150 °C extrapolated to T_A = 25 °C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AC			TLC2210BC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		1.8	2.5		V/μs
			Full range	1.3			1.3			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8			1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°			45°		

† Full range is 0°C to 70°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201I			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	µV
			Full range			650	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		µV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005	µV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			150	
I_{IB}	Input bias current		25°C		1		pA
			Full range			150	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		V
			Full range	−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		V/mV
			Full range	250			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		
			Full range	65			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5	mA
			Full range			1.5	

† Full range is −40°C to 85°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201I			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		V/µs
			Full range	1.4			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		µV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		48°		

† Full range is −40°C to 85°C.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AI			TLC2210BI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	μV
			Full range			350			350	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			150			150	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			150			150	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		−4.7	−4.9		V
			Full range	−4.7			−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		400	560		V/mV
			Full range	250			250			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		90	100		
			Full range	65			65			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		90	115		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5		1.1	1.5	mA
			Full range			1.5			1.5	

† Full range is −40°C to 85°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150 °C extrapolated to T_A = 25°C using the Arrhenius equation assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AI			TLC2210BI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		2	2.7		V/μs
			Full range	1.4			1.4			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9			1.9		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		48°			48°		

† Full range is −40°C to 85°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201I			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	μV
			Full range			650	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			150	
I_{IB}	Input bias current		25°C		1		pA
			Full range			150	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50	mV
			Full range			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		V/mV
			Full range	100			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		
			Full range	15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1	1.5	mA
			Full range			1.5	

† Full range is –40°C to 85°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201I			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		V/μs
			Full range	1.2			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°		

† Full range is –40°C to 85°C.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AI			TLC2201BI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	µA
			Full range			350			350	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		µV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	µV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			150			150	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			150			150	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50		0	50	mV
			Full range			50			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		150	315		V/mV
			Full range	100			100			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		25	55		
			Full range	15			15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		90	110		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1	1.5		1	1.5	mA
			Full range			1.5			1.5	

† Full range is –40°C to 85°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AI			TLC2210BI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		1.8	2.5		V/µs
			Full range	1.2			1.2			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		µV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8			1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°			45°		

† Full range is –40°C to 85°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201M			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	μV
			Full range			700	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			500	
I_{IB}	Input bias current		25°C		1		pA
			Full range			500	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		V
			Full range	−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		V/mV
			Full range	200			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		
			Full range	45			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5	mA
			Full range			1.5	

† Full range is –55°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201M			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		V/μs
			Full range	1.3			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9		MHz
ϕ_m	Phase margin	R_L = 10 kΩ, C_L = 100 pF	25°C		48°		

† Full range is –55°C to 125°C.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AM			TLC2210BM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	μV
			Full range			400			400	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			500			500	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			500			500	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	−5 to 2.7			−5 to 2.7			V
V_{OM+}	Maximum positive peak output voltage swing	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OM-}	Maximum negative peak output voltage swing		25°C	−4.7	−4.9		−4.7	−4.9		V
			Full range	−4.7			−4.7			
A_{VD}	Large-signal differential voltage amplification	V_O = ±4 V, R_L = 500 kΩ	25°C	400	560		400	560		V/mV
			Full range	200			200			
		V_O = ±4 V, R_L = 10 kΩ	25°C	90	100		90	100		
			Full range	45			45			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	115		90	115		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm}$ = ±2.3 V to ±8 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 0, No load	25°C		1.1	1.5		1.1	1.5	mA
			Full range			1.5			1.5	

† Full range is −55°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observable through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AM			TLC2201BM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = ±2.3 V, R_L = 10 kΩ, C_L = 100 pF	25°C	2	2.7		2	2.7		V/μs
			Full range	1.3			1.3			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.9			1.9		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		48°			48°		

† Full range is –55°C to 125°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201M			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		100	500	μV
			Full range			700	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005*	μV/mo
I_{IO}	Input offset current		25°C		0.5		pA
			Full range			500	
I_{IB}	Input bias current		25°C		1		pA
			Full range			500	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		V
			Full range	4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50	mV
			Full range			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		V/mV
			Full range	75			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		
			Full range	10			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		dB
			Full range	85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		dB
			Full range	85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1	1.5	mA
			Full range			1.5	

*On products compliant to MIL-STD-883, Class B, this parameter is not production tested.
† Full range is –55°C to 125°C.
NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201M			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		V/μs
			Full range	1.1			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√Hz
		f = 1 kHz	25°C		8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7		
I_n	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°		

† Full range is –55°C to 125°C.

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AM			TLC2210BM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, R_S = 50 Ω	25°C		80	200		80	200	μV
			Full range			400			400	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C		0.001	0.005		0.001	0.005	μV/mo
I_{IO}	Input offset current		25°C		0.5			0.5		pA
			Full range			500			500	
I_{IB}	Input bias current		25°C		1			1		pA
			Full range			500			500	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω	Full range	0 to 2.7			0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ	25°C	4.7	4.8		4.7	4.8		V
			Full range	4.7			4.7			
V_{OL}	Maximum low-level output voltage	I_O = 0	25°C		0	50		0	50	V
			Full range			50			50	
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V, R_L = 500 kΩ	25°C	150	315		150	315		V/mV
			Full range	75			75			
		V_O = 1 V to 4 V, R_L = 10 kΩ	25°C	25	55		25	55		
			Full range	10			10			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0, R_S = 50 Ω	25°C	90	110		90	110		dB
			Full range	85			85			
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
			Full range	85			85			
I_{DD}	Supply current	V_O = 2.5 V, No load	25°C		1.1	1.5		1.1	1.5	mA
			Full range			1.5			1.5	

† Full range is –55°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observable through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS	T_A†	TLC2201AM			TLC2201BM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	V_O = 0.5 V to 2.5 V, R_L = 10 kΩ, C_L = 100 pF	25°C	1.8	2.5		1.8	2.5		V/μs
			Full range	1.1			1.1			
V_n	Equivalent input noise voltage (see Note 5)	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
		f = 1 kHz	25°C		8	15		8	12	
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
		f = 0.1 to 10 Hz	25°C		0.7			0.7		
I_n	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	f = 10 kHz, R_L = 10 kΩ, C_L = 100 pF	25°C		1.8			1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ, C_L = 100 pF	25°C		45°			45°		

† Full range is –55°C to 125°C.

NOTE 5: This parameter is tested on a sample basis for the TLC2201A and on all devices for the TLC2201B. For other test requirements, please contact the factory. This statement has no bearing on testing or nontesting of other parameters.

electrical characteristics at $V_{DD\pm}$ = ±5 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TLC2201Y			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0,	R_S = 50 Ω		100	500	μV
	Input offset voltage long-term drift (see Note 4)				0.001	0.005	μV/mo
I_{IO}	Input offset current				0.5		pA
I_{IB}	Input bias current				1		pA
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		0 to 2.7			V
V_{OH}	Maximum high-level output voltage	R_L = 10 kΩ		4.7	4.8		V
V_{OL}	Maximum low-level output voltage	I_O = 0			0	50	mV
A_{VD}	Large-signal differential voltage amplification	V_O = 1 V to 4 V,	R_L = 500 Ω	25	55		V/mV
		V_O = 1 V to 4 V,	R_L = 10 Ω	25	55		
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min, V_O = 0,	R_S = 50 Ω	90	110		dB
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	V_{DD} = 4.6 to 16 V		90	110		dB
I_{DD}	Supply current per amplifier	V_O = 2.5 V,	No load		1	1.5	mA

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at $V_{DD\pm}$ = ± 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			TLC2201Y			UNIT
					MIN	TYP	MAX	
SR	Positive slew rate at unity gain	V_O = ±0.5 to 2.5 V,	R_L = 10 kΩ,	C_L = 100 pF	1.8	2.5		V/μs
V_n	Equivalent input noise voltage	f = 10 Hz				18		nV/√Hz
		f = 1 kHz				8		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz				0.5		μV
		f = 0.1 to 10 Hz				0.7		
I_n	Equivalent input noise current					0.6		pA/√Hz
	Gain-bandwidth product	f = 10 kHz,	R_L = 10 kΩ,	C_L = 100 pF		1.8		MHz
ϕ_m	Phase margin at unity gain	R_L = 10 kΩ,	C_L = 100 pF			48°		

PARAMETER MEASUREMENT INFORMATION

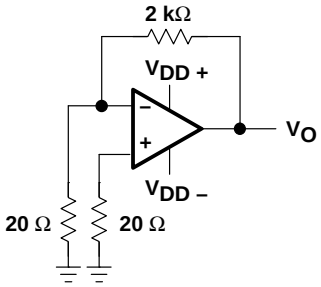
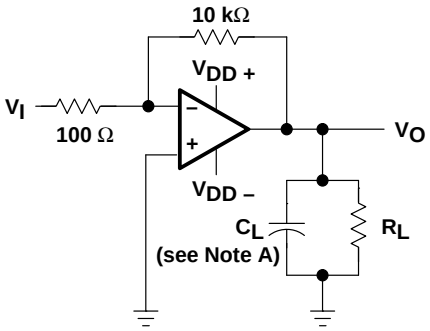
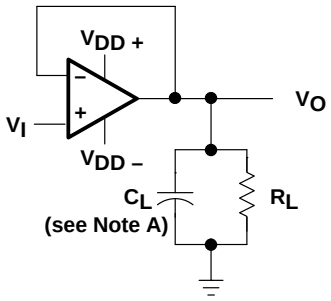


Figure 1. Noise-Voltage Test Circuit



NOTE A: C_L includes fixture capacitance.

Figure 2. Phase-Margin Test Circuit



NOTE A: C_L includes fixture capacitance.

Figure 3. Slew-Rate Test Circuit

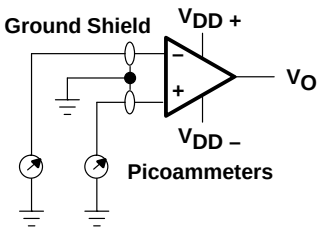


Figure 4. Input-Bias and Offset-Current Test Circuit

typical values

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

Input bias and offset current

At the picoamp bias current level typical of the TLC2201, TLC2201A, and TLC2201B, accurate measurement of the bias current becomes difficult. Not only does this measurement require a picoammeter, but test socket leakages can easily exceed the actual device bias currents. To measure these small currents, Texas Instruments uses a two-step process. The socket leakage is measured using picoammeters with bias voltages applied but with no device in the socket. The device is then inserted in the socket, and a second test measuring both the socket leakage and the device input bias current is performed. The two measurements are then subtracted algebraically to determine the bias current of the device.

noise

Texas Instruments offers automated production noise testing to meet individual applications requirements. Noise voltage at f = 10 Hz and f = 1 kHz is 100% tested on every TLC2201B device, while lot sample testing is performed on the TLC2201A. For other noise requirements, please contact the factory.

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution	5
I_{IB}	Input bias current	vs Common-mode voltage vs Free-air temperature	6 7
CMRR	Common-mode rejection ratio	vs Frequency	8
V_{OM}	Maximum peak output voltage	vs Output current vs Free-air temperature	9 10
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	11
V_{OH}	High-level output voltage	vs Frequency vs High-level output current vs Free-air temperature	12 13 14
V_{OL}	Low-level output voltage	vs Low-level output current vs Free-air temperature	15 16
A_{VD}	Large-signal differential voltage amplification	vs Frequency vs Free-air temperature	17 18
I_{OS}	Short-circuit output current	vs Supply voltage vs Free-air temperature	19 20
I_{DD}	Supply current	vs Supply voltage vs Free-air temperature	21 22
SR	Slew rate	vs Supply voltage vs Free-air temperature	23 24
	Pulse response	Small signal Large signal	25, 26 27, 28
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	0.1 to 1 Hz 0.1 to 10 Hz	29 30
	Gain-bandwidth product	vs Supply voltage vs Free-air temperature	31 32
ϕ_m	Phase margin	vs Supply voltage vs Free-air temperature	33 34
	Phase shift	vs Frequency	17

TYPICAL CHARACTERISTICS†

**DISTRIBUTION OF TLC2201
INPUT OFFSET VOLTAGE**

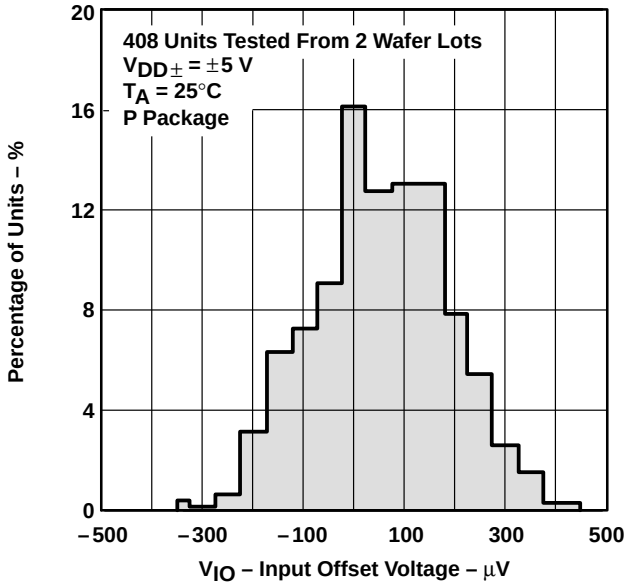


Figure 5

**INPUT BIAS CURRENT
vs
COMMON-MODE INPUT VOLTAGE**

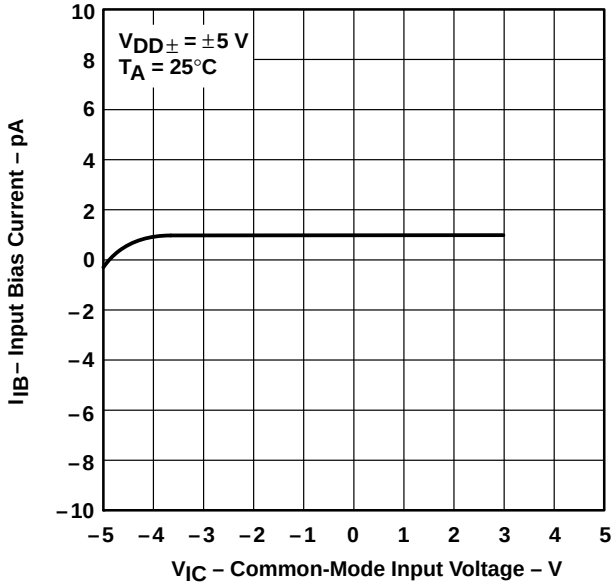


Figure 6

**INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE**

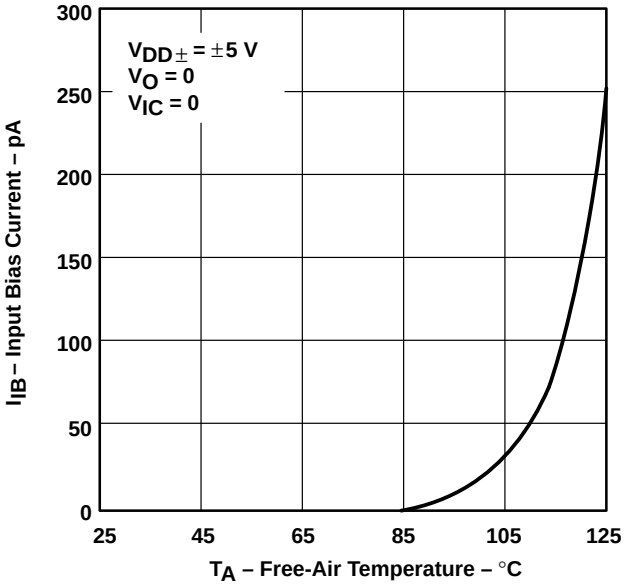


Figure 7

**COMMON-MODE REJECTION RATIO
vs
FREQUENCY**

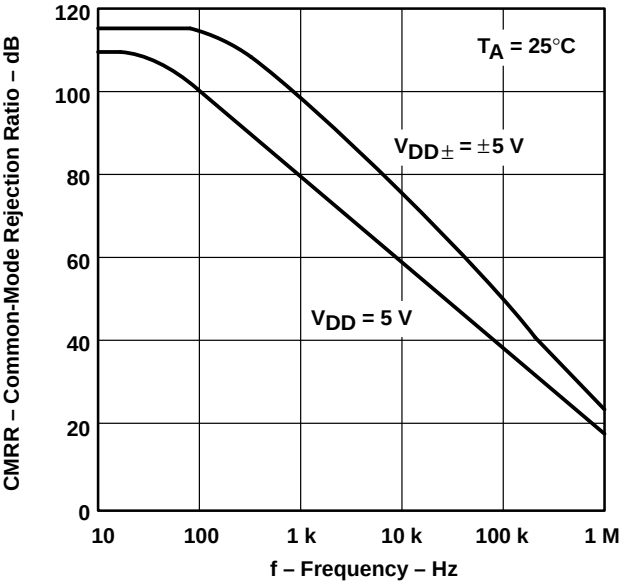


Figure 8

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

TYPICAL CHARACTERISTICS†

MAXIMUM PEAK OUTPUT VOLTAGE vs OUTPUT CURRENT

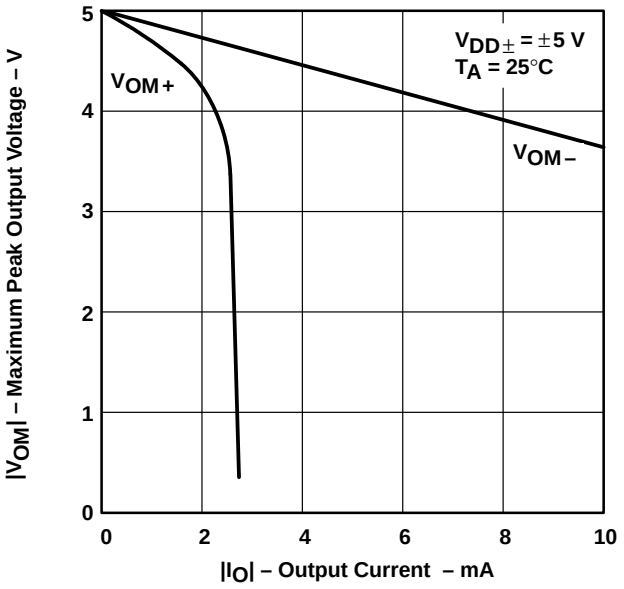


Figure 9

MAXIMUM PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

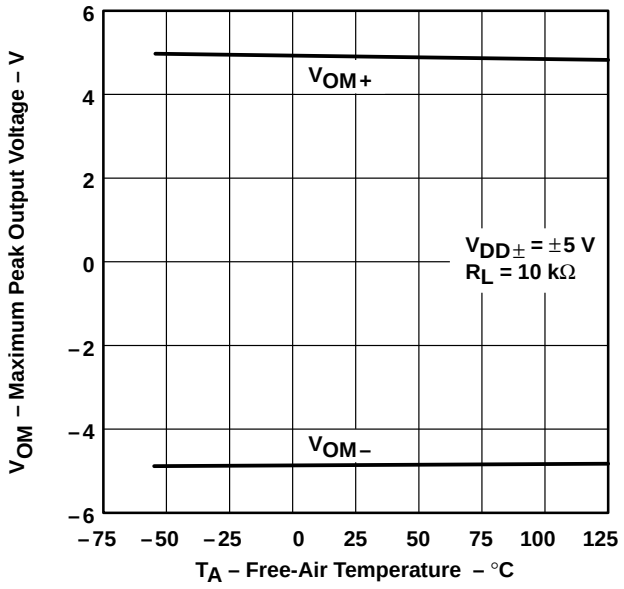


Figure 10

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

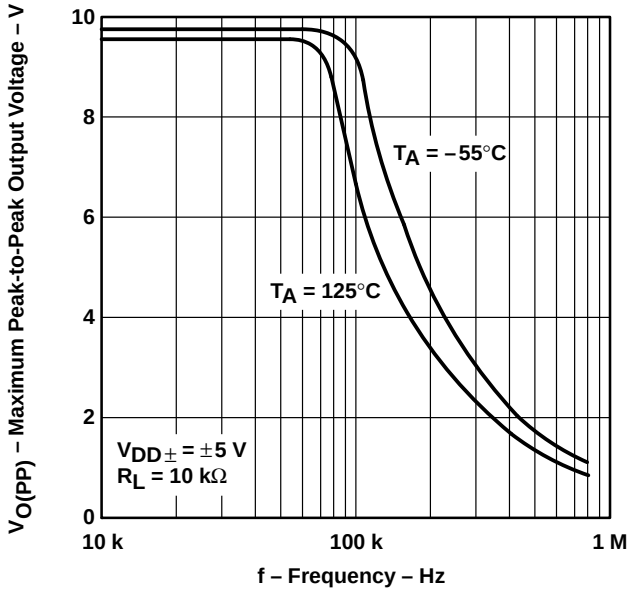


Figure 11

HIGH-LEVEL OUTPUT VOLTAGE vs FREQUENCY

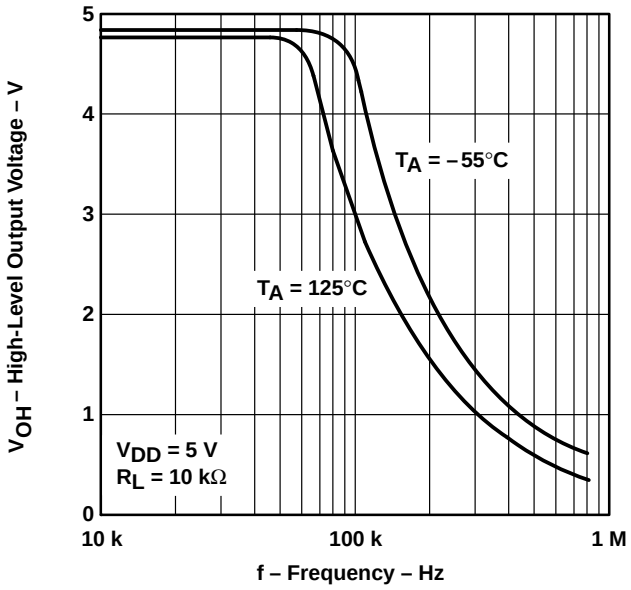


Figure 12

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

TYPICAL CHARACTERISTICS†

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

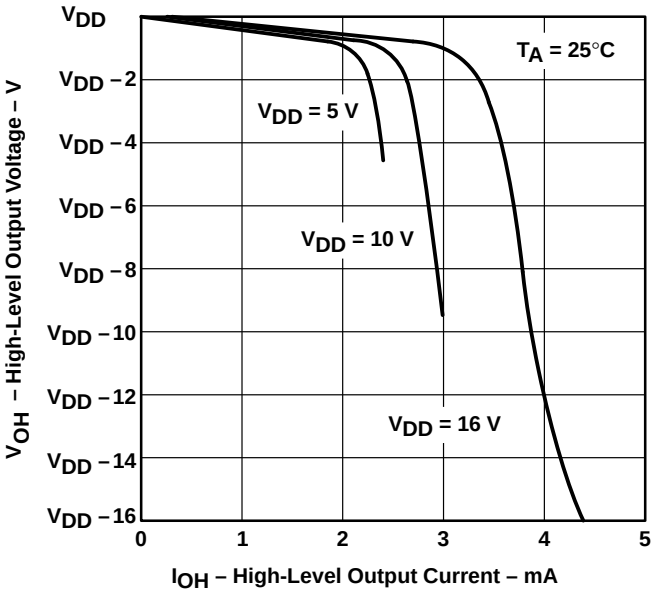


Figure 13

HIGH-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

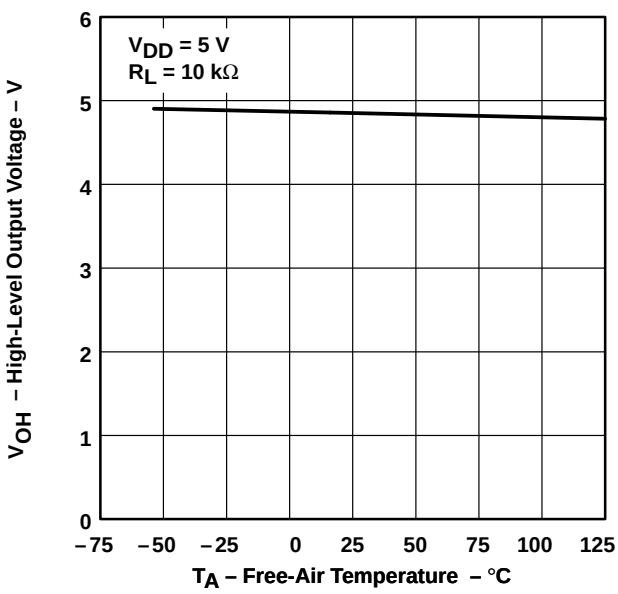


Figure 14

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

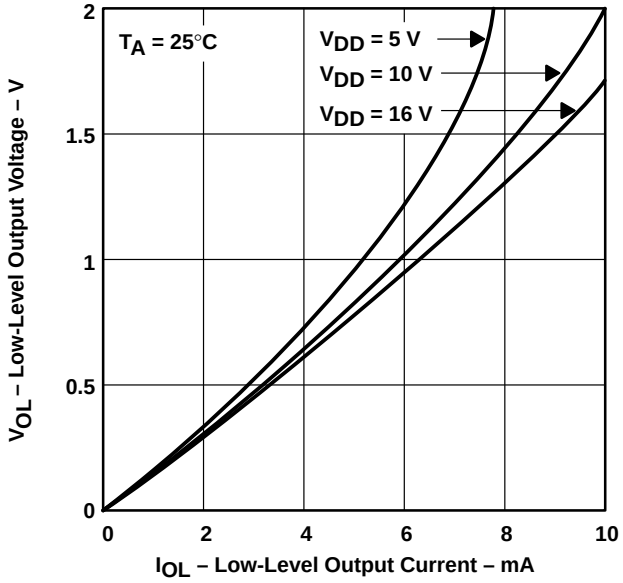


Figure 15

LOW-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

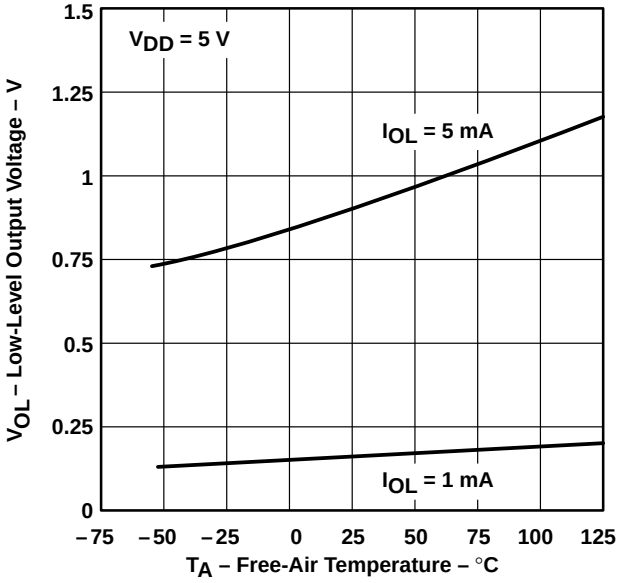


Figure 16

† 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

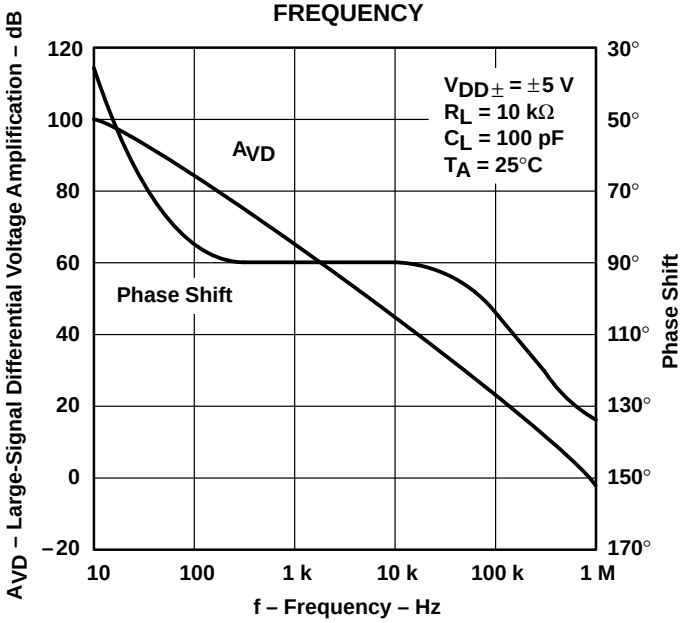


Figure 17

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

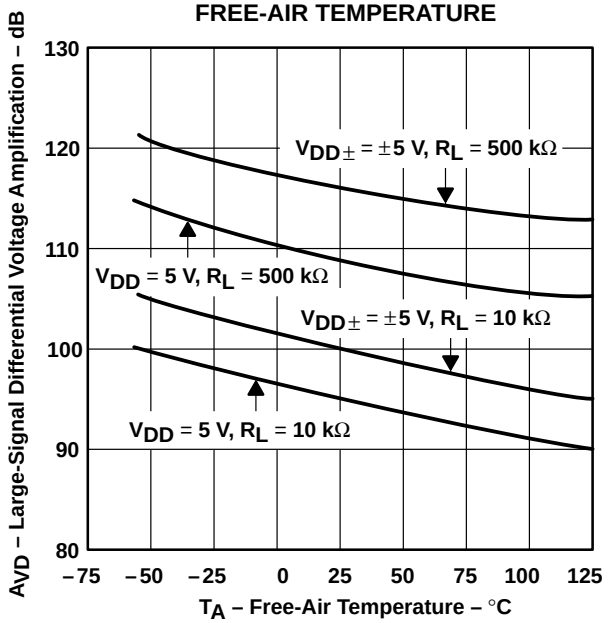


Figure 18

SHORT-CIRCUIT OUTPUT CURRENT vs SUPPLY VOLTAGE

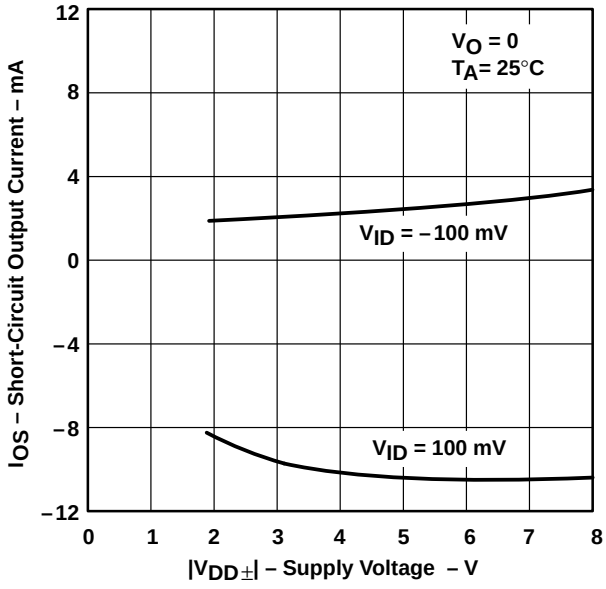


Figure 19

SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

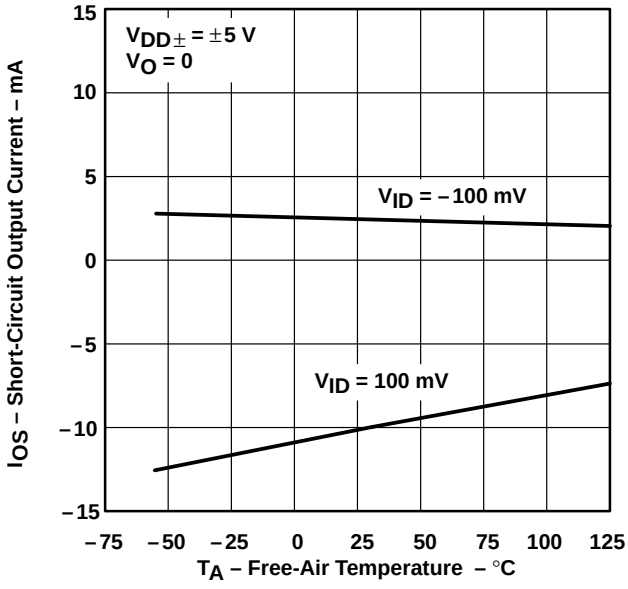


Figure 20

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

TYPICAL CHARACTERISTICS†

SUPPLY CURRENT vs SUPPLY VOLTAGE

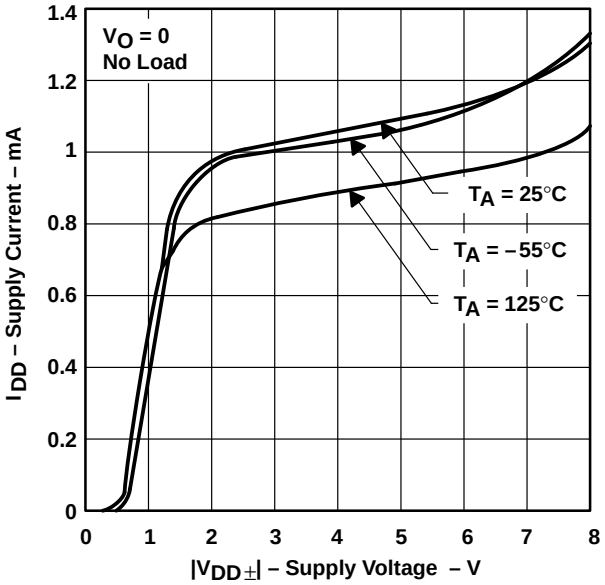


Figure 21

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

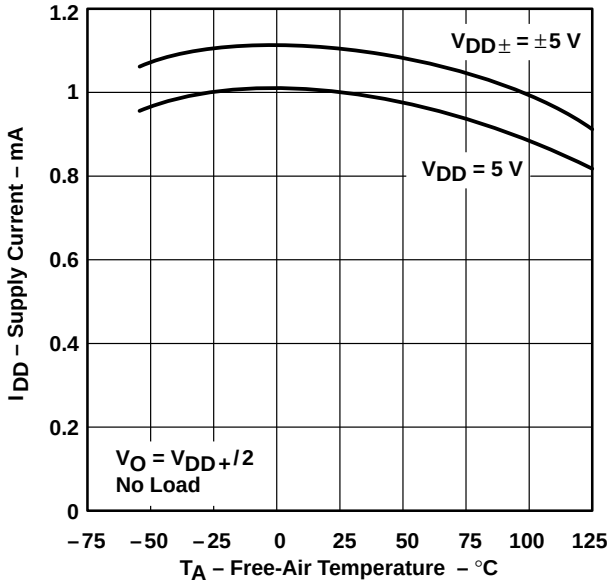


Figure 22

SLEW RATE vs SUPPLY VOLTAGE

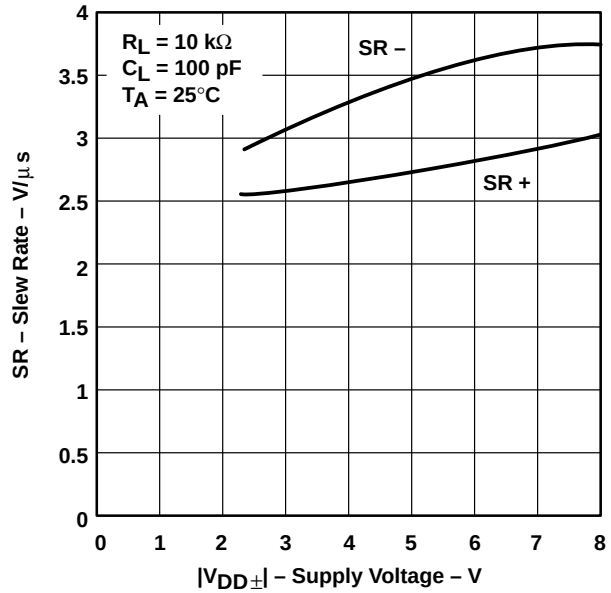


Figure 23

SLEW RATE vs FREE-AIR TEMPERATURE

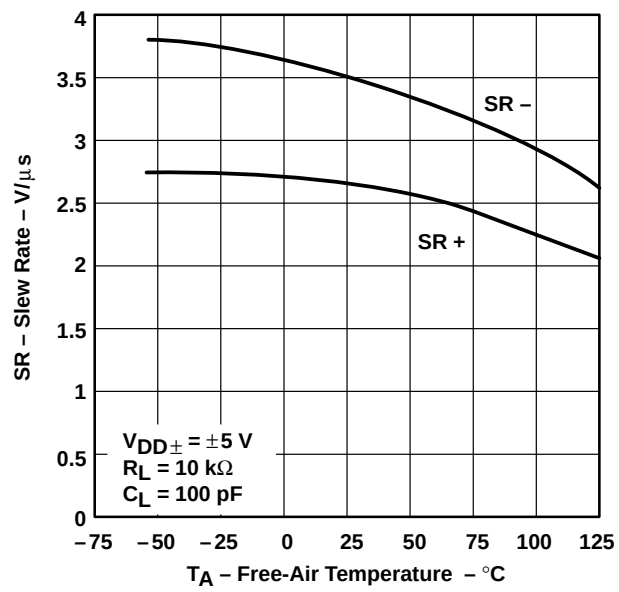


Figure 24

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

TYPICAL CHARACTERISTICS

**VOLTAGE-FOLLOWER
SMALL-SIGNAL
PULSE RESPONSE**

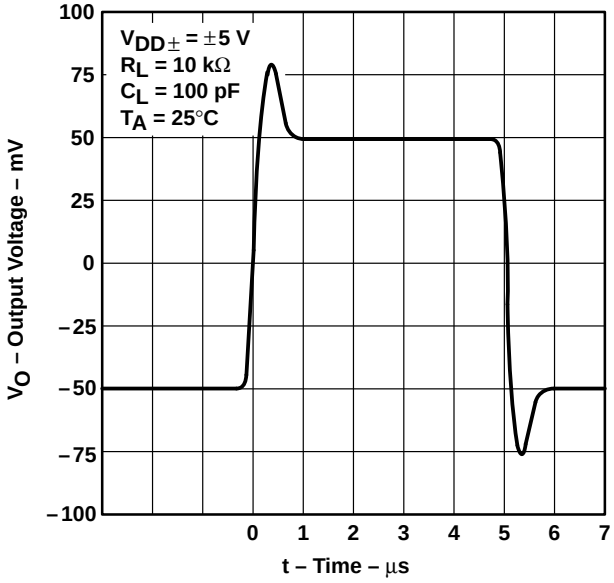


Figure 25

**VOLTAGE-FOLLOWER
SMALL-SIGNAL
PULSE RESPONSE**

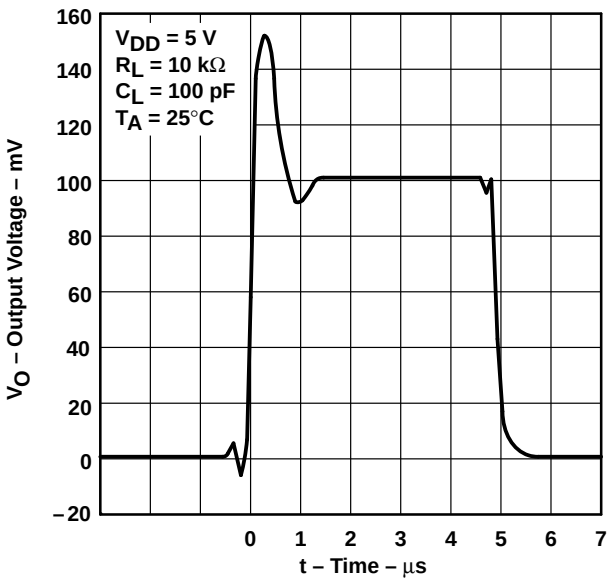


Figure 26

**VOLTAGE-FOLLOWER
LARGE-SIGNAL
PULSE RESPONSE**

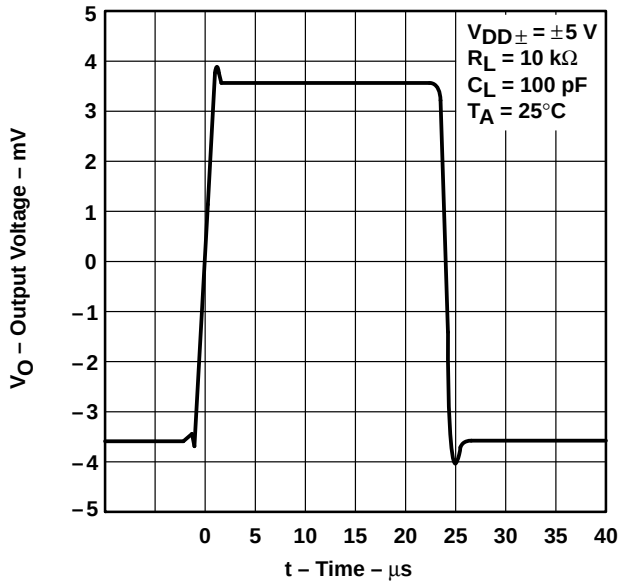


Figure 27

**VOLTAGE-FOLLOWER
LARGE-SIGNAL
PULSE RESPONSE**

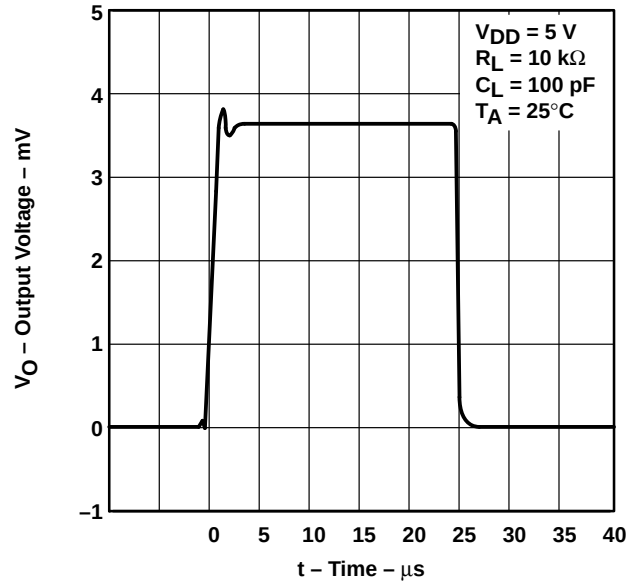


Figure 28

TYPICAL CHARACTERISTICS†

PEAK-TO-PEAK EQUIVALENT INPUT NOISE VOLTAGE 0.1 TO 1 Hz

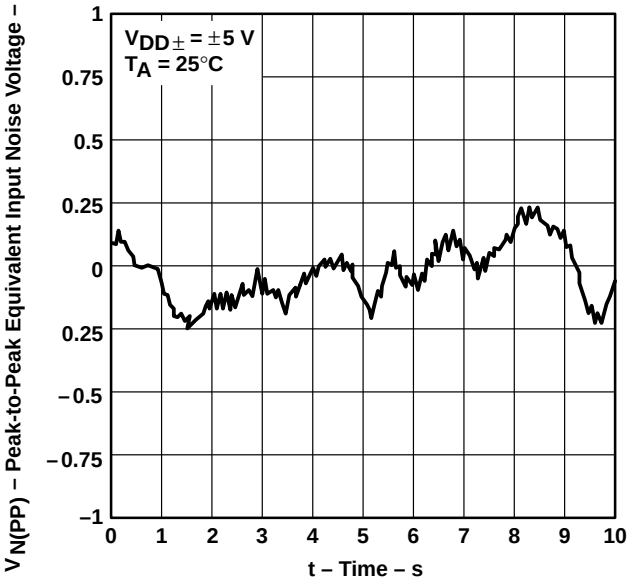


Figure 29

PEAK-TO-PEAK EQUIVALENT INPUT NOISE VOLTAGE 0.1 TO 10 Hz

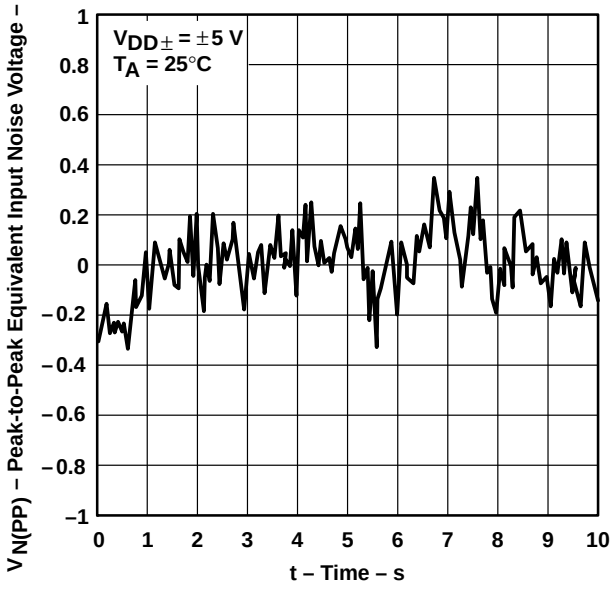


Figure 30

GAIN-BANDWIDTH PRODUCT vs SUPPLY VOLTAGE

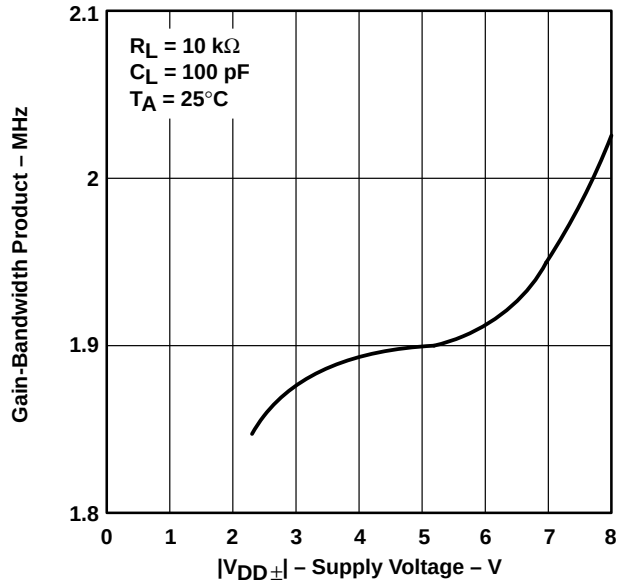


Figure 31

GAIN-BANDWIDTH PRODUCT vs FREE-AIR TEMPERATURE

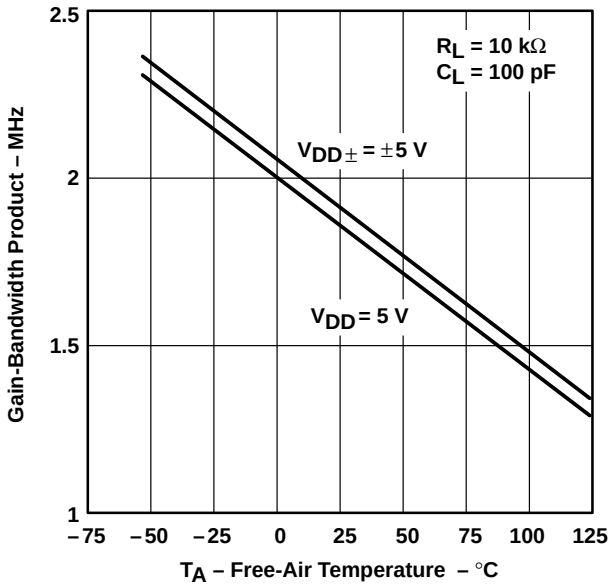


Figure 32

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

TYPICAL CHARACTERISTICS†

PHASE MARGIN vs SUPPLY VOLTAGE

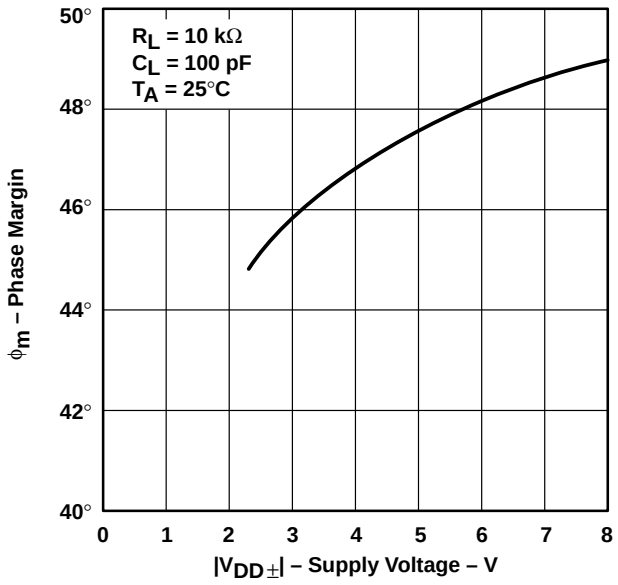


Figure 33

PHASE MARGIN vs FREE-AIR TEMPERATURE

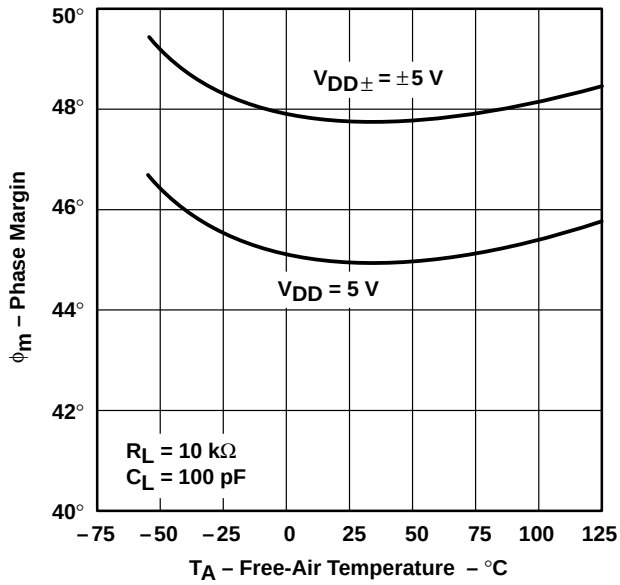


Figure 34

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

APPLICATION INFORMATION

latch-up avoidance

Because CMOS devices are susceptible to latch-up due to their inherent parasitic thyristors, the TLC2201, TLC2201A, and TLC2201B inputs and outputs are designed to withstand –100-mA surge currents without sustaining latch-up; however, techniques reducing the chance of latch-up should be used whenever possible. Internal protection diodes should not be forward biased in normal operation. Applied input and output voltages should not exceed the supply voltage by more than 300 mV. Care should be exercised when using capacitive coupling on pulse generators. Supply transients should be shunted by the use of decoupling capacitors (0.1 μF typical) located across the supply rails as close to the device as possible.

electrostatic discharge protection

These devices use internal ESD-protection circuits that prevent functional failures at voltages at or below 2000 V. Care should be exercised in handling these devices, as exposure to ESD may result in degradation of the device parametric performance.

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

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

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