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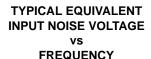
- TLC2201B Is 100% Tested for Noise: 30 nV/√Hz Max at f = 10 Hz 12 nV/√Hz Max at f = 1 kHz
- Low Input Offset Voltage . . . 200 μV Max
- Excellent Offset Voltage Stability
 With Temperature . . . 0.5 μV/°C Typ

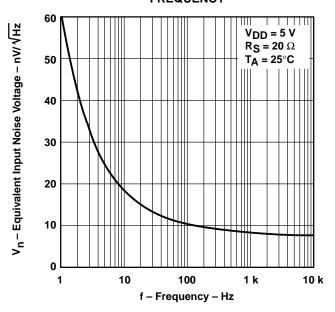
description

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.

- 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





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

					PACKAGE	DEVICES		CHIP
TA	V _{IO} max AT 25°C	V _n max f = 10 Hz AT 25°C	V _n max f = 1 kHz AT 25°C	SMALL OUTLINE (D)	CHIP CERAMIC CARRIER DIP (FK) (JG)		PLASTIC DIP (P)	FORM (Y)
0°C to 70°C	200 μV 200 μV 500 μV	35 nV/√ <u>Hz</u> 30 nV/√Hz —	15 nV/√ <u>Hz</u> 12 nV/√Hz —	TLC2201ACD TLC2201BCD TLC2201CD	_	_	TLC2201ACP TLC2201BCP TLC2201CP	TLC2201Y
-40°C to 85°C	200 μV 200 μV 500 μV	35 nV/√ <u>Hz</u> 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/√ <u>Hz</u> 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.

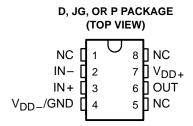
Advanced LinCMOS is a trademark of Texas Instruments Incorporated.

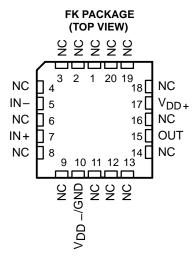


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description (continued)

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.

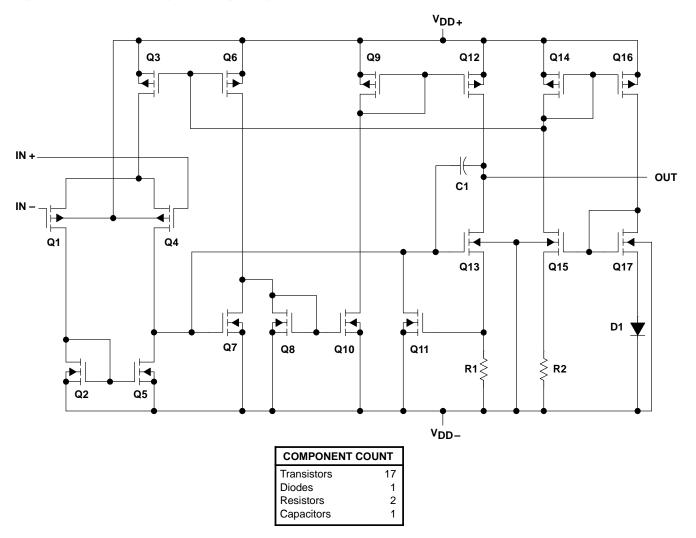




NC - No internal connection



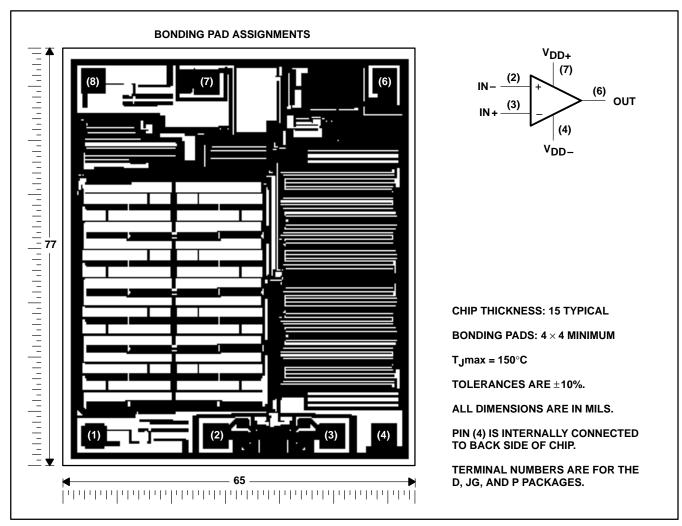
equivalent schematic (each amplifier)



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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.



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

8 V
O V
6 V
8 V
mΑ
mΑ
ited
able
0°C
5°C
5°C
0°C
0°C
0°C
0°C
i a () () ()

[†] 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	$T_{\mbox{\scriptsize A}} \le 25^{\circ}\mbox{\scriptsize C}$ 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
Р	1000 mW	8.0 mW/°C	640 mW	520 mW	200 mW

recommended operating conditions

	Č	SUFFIX	15	SUFFIX	М	SUFFIX	UNIT
	MIN	MAX	MAX MIN MAX MIN MAX		ONIT		
Supply voltage, V _{DD±}	±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, TA	0	70	-40	85	-55	125	°C



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

	DADAMETED	TEST O	CANDITIONS	T. †	TI	LC22010	2	LIAUT
	PARAMETER	1551 0	CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
VIO	Input offset voltage			25°C		100	500	μV
VIO	input onset voitage			Full range			600	μν
αΛΙΟ	Temperature coefficient of input offset voltage			Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	V _{IC} = 0,	$R_S = 50 \Omega$	25°C		0.001	0.005	μV/mo
1	Input offset ourrent	$V_{1}C = 0$	KS = 50 12	25°C		0.5		nΛ
lio	Input offset current			Full range			100	pA
	Input bias current			25°C		1		Λ
IВ	input bias current			Full range			100	pА
VICR	Common-mode input voltage range	R _S = 50 Ω		Full range	-5 to 2.7			٧
\/	Manipular positive post- cutout valtage and cutour			25°C	4.7	4.8		V
VOM+	Maximum positive peak output voltage swing	D. 401-0		Full range	4.7			V
V	Maximum negative peak output voltage swing	$R_L = 10 \text{ k}\Omega$		25°C	-4.7	-4.9		V
VOM-	Maximum negative peak output voltage swing			Full range	-4.7			٧
		V0 - +4 V	$R_L = 500 \text{ k}\Omega$	25°C	400	560		
Δ. / Δ.	Large-signal differential voltage amplification	VO = ±4 V,	NC = 300 K22	Full range	300			V/mV
AVD	Large-signal differential voltage amplification	\/o = +4 \/	$R_{\parallel} = 10 \text{ k}\Omega$	25°C	90	100		V/IIIV
		VO = ±4 V,	N_ = 10 K22	Full range	70			
CMRR	Common-mode rejection ratio	VIC = VICRm		25°C	90	115		dB
OWINT	Common mode rejection ratio	$V_{O} = 0$,	$R_S = 50 \Omega$	Full range	85			
ksvr	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	V _{DD±} = ±2.3	3 V to +8 V	25°C	90	110		dB
"SVK	Sapply remage rejoinion rame (AvDD±7AvIO)	*DD± - ±2.0	, , , , , , , , , , , , , , , , , , ,	Full range	85			<u> </u>
I _{DD}	Supply current	$V_{O} = 0$,	No load	25°C		1.1	1.5	mA
טט.		.0 = 0,		Full range			1.5	1117 \

[†]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, $V_{DD\pm}$ = $\pm 5~V$

	PARAMETER	TEST CONDITIONS	T. †	TL	C2201C	;	LINUT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$V_O = \pm 2.3 \text{ V}, R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C	2	2.7		V/us
SIX	Siew rate at unity gain	C _L = 100 pF	Full range	1.5			ν/μ5
V	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√ Hz
Vn	Equivalent input hoise voltage	f = 1 kHz	25°C		8		nv/√HZ
\/	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
VN(PP)	r eak-to-peak equivalent input hoise voltage	f = 0.1 to 10 Hz	25°C		0.7		μν
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz}, \qquad R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C		1.9		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		48°		

[†] Full range is 0°C to 70°C.



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

	DADAMETED	TEST SOMBITIONS		TL	.C2201	AC OA	TL	.C2201E	3C	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V. 0	Input offset voltage		25°C		80	200		80	200	μV
VIO	input onset voltage		Full range			300			300	μν
αVIO	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio	Input offset current		25°C		0.5			0.5		pА
IIO	input onset current		Full range			100			100	рΑ
I _{IB}	Input bias current		25°C		1			1		pА
чВ	input bias current		Full range			100			100	РΛ
V _{ICR}	Common-mode input voltage range	$R_S = 50 \Omega$	Full range	-5 to 2.7			-5 to 2.7			٧
V _{OM+}	Maximum positive peak		25°C	4.7	4.8		4.7	4.8		V
VOM+	output voltage swing	$R_{I} = 10 \text{ k}\Omega$	Full range	4.7			4.7			V
V _{OM} _	Maximum negative peak		25°C	-4.7	-4.9		-4.7	-4.9		V
VOIVI —	output voltage swing		Full range	-4.7			-4.7			V
		$V_{O} = \pm 4 \text{ V}, R_{I} = 500 \text{ k}\Omega$	25°C	400	560		400	560		
A _{VD}	Large-signal differential	VO = ± + V, T(E = 000 K32	Full range	300			300			V/mV
7.00	voltage amplification	$V_{\Omega} = \pm 4 \text{ V}, R_{I} = 10 \text{ k}\Omega$	25°C	90	100		90	100		V/111V
		VO = = 1 V, T(_ = 10 KBB	Full range	70			70			
CMRR	Common-mode rejection ratio	VIC = VICRmin,	25°C	90	115		90	115		dB
J		$V_O = 0$, $R_S = 50 \Omega$	Full range	85			85			
ksvr	Supply voltage rejection ratio	$V_{DD\pm} = \pm 2.3 \text{ V to } \pm 8 \text{ V}$	25°C	90	110		90	110		dB
SVK	$(\Delta V_{DD\pm}/\Delta V_{IO})$. DD = = 22.0 V to 20 V	Full range	85			85			<u> </u>
IDD	Supply current	$V_{O} = 0$, No load	25°C		1.1	1.5		1.1	1.5	mA
יטט.		1.0 0, 1.0 .000	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, $V_{DD\pm}$ = $\pm 5~\text{V}$

	-				_					
	PARAMETER	TEST CONDITIONS	T. †	TL	C2201A	C	TL	C2210B	C	UNIT
	FARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR	Class rate at units gain	$V_0 = \pm 2.3 \text{ V, R}_L = 10 \text{ k}\Omega$	25°C	2	2.7		2	2.7		V/us
SK	Slew rate at unity gain	C _L = 100 pF	Full range	1.5			1.5			V/μS
V	Equivalent input noise	f = 10 Hz	25°C		18	35		18	30	nV/√ Hz
V _n	voltage (see Note 5)	f = 1 kHz	25°C		8	15		8	12	nv/√Hz
\/=\	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
VN(PP)	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μν
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$ f = 10 \text{ kHz}, R_L = 10 \text{ k}\Omega, $ $ C_L = 100 \text{ pF} $	25°C		1.9			1.9		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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.



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

	DADAMETED	TEGT COMPITIONS	- t	Т	LC22010	3	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
\/.a	Input offeet voltage		25°C		100	500	μV
VIO	Input offset voltage		Full range			600	μν
ανιο	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	V 0 Po - 50 O	25°C		0.001	0.005	μV/mo
l.a	Input offset current	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.5		pА
lio	input onset current		Full range			100	ρτ
	Input bigg gurrent		25°C		1		Λ
ΙΒ	Input bias current		Full range			100	pА
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	0 to 2.7			V
V	Manian and high lavel autout valtage	D. 4010	25°C	4.7	4.8		V
VOH	Maximum high-level output voltage	$R_L = 10 \text{ k}\Omega$	Full range	4.7			V
V	Maximum law lavel autout valtage	10 0	25°C		0	50	mV
VOL	Maximum low-level output voltage	IO = 0	Full range			50	IIIV
		$V_0 = 1 \ V \text{ to } 4 \ V,$	25°C	150	315		
۸ –	Large signal differential voltage emplification	$R_L = 500 \text{ k}\Omega$	Full range	100			V/mV
AVD	Large-signal differential voltage amplification	$V_0 = 1 \text{ V to 4 V},$	25°C	25	55		V/IIIV
		$R_L = 10 \text{ k}\Omega$	Full range	15			
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min,	25°C	90	110		dB
CIVIKK	Common-mode rejection ratio	$V_O = 0$, $R_S = 50 \Omega$	Full range	85			u D
ko) (D	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	V _{DD} = 4.6 V to 16 V	25°C	90	110		dB
ksvr	- Supply voltage rejection ratio (ΔνDD±/ΔνΙΟ)	VDD = 4.0 V to 10 V	Full range	85			uБ
loo	Supply current	V _O = 2.5 V, No load	25°C		1	1.5	mA
IDD	Зарріу сапені	VO = 2.5 V, 140 load	Full range			1.5	шА

[†] 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 TA = 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	т. †	ΤL	_C2201C	;	UNIT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNII
SR	Slew rate at unity gain	$V_0 = 0.5 \text{ V to } 2.5 \text{ V},$	25°C	1.8	2.5		V/µs
SK	Siew rate at unity gain	$R_L = 10 \text{ k}\Omega, \qquad C_L = 100 \text{ pF}$	Full range	1.3			ν/μδ
V	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√ Hz
V _n	Equivalent input noise voltage	f = 1 kHz	25°C		8		nv/√Hz
\/=.\	Dook to mook aguiralant innut naise valtage	f = 0.1 to 1 Hz	25°C		0.5		\/
VN(PP)	Peak-to-peak equivalent input noise voltage	f = 0.1 to 10 Hz	25°C		0.7		μV
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	$ f = 10 \text{ kHz}, \qquad R_L = 10 \text{ k}\Omega, $ $C_L = 100 \text{ pF} $	25°C		1.8		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		45°		

[†] Full range is 0°C to 70°C.



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

	DADAMETED	TEST SOMBITIONS	- +	TL	C2201	/C	TL	C2201E	3C	LINUT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
VIO	Input offset voltage		25°C		80	200		80	200	μV
VIO	input onset voltage		Full range			300			300	μν
αVIO	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio	Input offset current		25°C		0.5			0.5		pA
10	input onset surrent		Full range			100			100	p/ t
IB	Input bias current		25°C		1			1		рA
,ID	mpat blad dantin		Full range			100			100	PΛ
VICR	Common-mode input voltage range	$R_S = 50 \Omega$	Full range	0 to 2.7			0 to 2.7			V
Vон	Maximum high-level output	$R_1 = 10 \text{ k}\Omega$	25°C	4.7	4.8		4.7	4.8		V
νон	voltage	TC = 10 K22	Full range	4.7			4.7			v
VOL	Maximum low-level output	I _O = 0	25°C		0	50		0	50	mV
-OL	voltage	0 0	Full range			50			50	
		$V_0 = 1 V \text{ to } 4 V,$	25°C	150	315		150	315		
AVD	Large-signal differential	$R_L = 500 \text{ k}\Omega$	Full range	100			100			V/mV
7.00	voltage amplification	$V_0 = 1 \text{ V to 4 V},$	25°C	25	55		25	55		.,
		$R_L = 10 \text{ k}\Omega$	Full range	15			15			
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min,	25°C	90	110		90	110		dB
		$V_O = 0$, $R_S = 50 \Omega$	Full range	85			85			
ksvr	Supply voltage rejection ratio	V _{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
	$(\Delta V_{DD\pm}/\Delta V_{IO})$		Full range	85			85			<u> </u>
IDD	Supply current	V _O = 2.5 V, No load	25°C		1	1.5		1	1.5	mA
50	11 2 2 2 2 2		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. †	TL	C2201A	'C	TL	C2210B	C	UNIT
	PARAMETER	1E31 CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
CD	Class note at smith main	$V_O = 0.5 \text{ V to } 2.5 \text{ V},$	25°C	1.8	2.5		1.8	2.5		11/
SR	Slew rate at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	Full range	1.3			1.3			V/μs
V	Equivalent input noise voltage	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
Vn	(see Note 5)	f = 1 kHz	25°C		8	15		8	12	110/1002
VALCED	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
V _{N(PP)}	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μν
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz}$, $R \Gamma_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		1.8			1.8		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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.



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

	DADAMETED	TEOT 0	CAUDITIONS	T +	Т	LC2201	I	LINUT
	PARAMETER	IESIC	ONDITIONS	T _A †	MIN	TYP	MAX	UNIT
V. 0	Input offset voltege			25°C		100	500	μV
VIO	Input offset voltage			Full range			650	μν
αΛΙΟ	Temperature coefficient of input offset voltage			Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	V _{IC} = 0,	$R_S = 50 \Omega$	25°C		0.001	0.005	μV/mo
1	Input offset current	$V_{1}C = 0$	KS = 50 12	25°C		0.5		nΛ
lio	input onset current			Full range			150	рA
	Input bias current			25°C		1		pА
lВ	input bias current			Full range			150	рΑ
VICR	Common-mode input voltage range	R _S = 50 Ω		Full range	-5 to 2.7			V
V	Manian and a state of the state			25°C	4.7	4.8		V
VOM+	Maximum positive peak output voltage swing	R _I = 10 kΩ		Full range	4.7			V
Vou	Maximum negative peak output voltage swing	KL = 10 K22		25°C	-4.7	-4.9		V
VOM-	waximum negative peak output voltage swing			Full range	-4.7			V
		$V_{O} = \pm 4 \text{ V},$	$R_1 = 500 \text{ k}\Omega$	25°C	400	560		
A _{VD}	Large-signal differential voltage amplification	VO = ± + v,	TC = 300 K22	Full range	250			V/mV
۸۷۵	Large signal differential voltage amplification	V _O = ±4 V,	R _L = 10 kΩ	25°C	90	100		V/111V
		VO = ± + v,	11 - 10 1/22	Full range	65			
CMRR	Common-mode rejection ratio	VIC = VICRM		25°C	90	115		dB
OWINCE	Common mode rejection ratio	$V_{O} = 0$,	$R_S = 50 \Omega$	Full range	85			uВ
ksvr	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	$V_{DD\pm} = \pm 2.3$	3 V to +8 V	25°C	90	110		dB
ovk		. DD± - ±2.0		Full range	85			<u> </u>
I _{DD}	Supply current	$V_{O} = 0$,	No load	25°C		1.1	1.5	mA
טט		J -,		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, $V_{DD\pm}$ = $\pm 5~\text{V}$

	PARAMETER	TEST CONDITIONS	T. †	TI	_C2201I		LINIT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$V_0 = \pm 2.3 \text{ V}, R_L = 10 \text{ k}\Omega,$	25°C	2	2.7		V/us
SIX	Siew rate at unity gain	C _L = 100 pF	Full range	1.4			ν/μ5
V	Equivalent input noise voltage	f = 10 Hz	25°C		18		***///II=
V _n	Equivalent input noise voltage	f = 1 kHz	25°C		8		nV/√Hz
\/	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
VN(PP)	r eak-to-peak equivalent input hoise voltage	f = 0.1 to 10 Hz	25°C		0.7		μν
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz}, \qquad R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C		1.9		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		48°		

[†]Full range is -40°C to 85°C.



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

	PARAMETER	TEST CONDITIONS	- +	TI	_C2201	Al	TI	LC2210	BI	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
۷IO	Input offset voltage		25°C		80	200		80	200	μV
10	par oncor voltago		Full range			350			350	μν
αΛΙΟ	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio	Input offset current	1	25°C		0.5			0.5		рA
Ō	input onset current		Full range			150			150	ΡΛ
lв	Input bias current		25°C		1			1		pА
'ID	mpat blac carront		Full range			150			150	p, t
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	-5 to 2.7			-5 to 2.7			V
.,	Maximum positive peak		25°C	4.7	4.8		4.7	4.8		.,
VOM+	output voltage swing	D. 40 kg	Full range	4.7			4.7	-		V
V	Maximum negative peak	$R_L = 10 \text{ k}\Omega$	25°C	-4.7	-4.9		-4.7	-4.9		V
V _{OM} -	output voltage swing		Full range	-4.7			-4.7]
		V _O = ±4 V, R _L = 500 F	25°C	400	560		400	560		
AVD	Large-signal differential	VO = ± + V,	Full range	250			250			V/mV
7.00	voltage amplification	$V_0 = \pm 4 \text{ V}, R_1 = 10 \text{ kg}$	25°C	90	100		90	100] */!!!*
		VO = = 1 V, INC = 10 No.	Full range	65			65			
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min,$	25°C	90	115		90	115		dB
		$V_0 = 0$, $R_S = 50 \Omega$	Ŭ	85			85			
ksvr	Supply voltage rejection ratio	$V_{DD \pm} = \pm 2.3 \text{ V to } \pm 8 \text{ V}$	25°C	90	110		90	110		dB
OVIC	$(\Delta V_{DD\pm}/\Delta V_{IO})$	55 -	Full range	85			85			
IDD	Supply current	$V_O = 0$, No load	25°C		1.1	1.5		1.1	1.5	mA
55	Supply current v	VO = 0, NO load	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, $V_{DD+} = \pm 5 \text{ V}$

	DADAMETED	TEST CONDITIONS	T. #	TL	.C2201	٩I	TL	C2210	ы	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
CD	Class note at smith main	$V_0 = \pm 2.3 \text{ V},$	25°C	2	2.7		2	2.7		1//
SR	Slew rate at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	Full range	1.4			1.4			V/μs
V	Equivalent input noise voltage	f = 10 Hz	25°C		18	35		18	30	nV/√Hz
V _n	(see Note 5)	f = 1 kHz	25°C		8	15		8	12	110/10
\/\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
VN(PP)	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μν
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz,R}$ $\Gamma_L = 10 \text{ k}\Omega$, $\Gamma_L = 100 \text{ pF}$	25°C		1.9			1.9		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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.



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

	DADAMETED	TEST COMPLETIONS	T. †	Т	LC2201	I	LIAUT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
\/10	Input offset voltage		25°C		100	500	μV
VIO	input onset voitage		Full range			650	μν
ανιο	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005	μV/mo
l.a	Input offset current	VIC = 0, INS = 30 22	25°C		0.5		nΛ
lio	input onset current		Full range			150	рA
	Input bias current		25°C		1		pА
ΙΒ	input bias current		Full range			150	PΑ
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	0 to 2.7			٧
V	Marian as high lavel autout valtage	D: 4010	25°C	4.7	4.8		V
VOH	Maximum high-level output voltage	$R_L = 10 \text{ k}\Omega$	Full range	4.7			V
V.0.	Maximum low-level output voltage	lo = 0	25°C		0	50	mV
VOL	Maximum low-level output voltage	IO = 0	Full range			50	IIIV
		$V_0 = 1 \ V \text{ to } 4 \ V,$	25°C	150	315		
A _{VD}	Large-signal differential voltage amplification	$R_L = 500 \text{ k}\Omega$	Full range	100			V/mV
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Large signal differential voltage amplification	$V_0 = 1 \ V \text{ to } 4 \ V,$	25°C	25	55		V/111V
		$R_L = 10 \text{ k}\Omega$	Full range	15			
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min,	25°C	90	110		dB
OWITE	Common mode rejection ratio	$V_O = 0$, $R_S = 50 \Omega$	Full range	85			
ksvr	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	V _{DD} = 4.6 V to 16 V	25°C	90	110		dB
SVK		.00	Full range	85			
I _{DD}	Supply current	V _O = 2.5 V, No load	25°C		1	1.5	mA
טט		10 =10 1, 110 1000	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 $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ 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. †	T	LC2201I		LIAUT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$V_0 = 0.5 \text{ V to } 2.5 \text{ V},$	25°C	1.8	2.5		V/us
SIX	Siew rate at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	Full range	1.2			ν/μ5
V	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√ Hz
Vn	Equivalent input noise voltage	f = 1 kHz	25°C		8		nv/√HZ
\/\.\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Peak-to-peak equivalent input noise voltage	f = 0.1 to 1 Hz	25°C		0.5		μV
VN(PP)	r eak-to-peak equivalent input hoise voitage	f = 0.1 to 10 Hz	25°C		0.7		μν
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product	$ f = 10 \text{ kHz}, \qquad R_L = 10 \text{ k}\Omega, $ $C_L = 100 \text{ pF} $	25°C		1.8		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		45°		

[†]Full range is -40°C to 85°C.



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

	DARAMETER	TEST CONDITIONS	- +	TL	C2201	AI	TI	_C2201	ВІ	UNIT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
VIO	Input offset voltage		25°C		80	200		80	200	μΑ
V10	input onset voltage		Full range			350			350	μπ
αVIO	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio	Input offset current	1	25°C		0.5			0.5		рA
10	input onset current		Full range			150			150	рΑ
Iв	Input bias current		25°C		1			1		pА
ΊΒ	input bias current		Full range			150			150	рΑ
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	0 to 2.7			0 to 2.7			٧
1/2	Maximum high-level output	$R_{I} = 10 \text{ k}\Omega$	25°C	4.7	4.8		4.7	4.8		V
VOH	voltage		Full range	4.7			4.7			V
VOL	Maximum low-level output	I _O = 0	25°C		0	50		0	50	mV
VOL	voltage	10 = 0	Full range			50			50	1117
		$V_0 = 1 \ V \ to \ 4 \ V,$	25°C	150	315		150	315		
AVD	Large-signal differential	$R_L = 500 \text{ k}\Omega$	Full range	100			100			V/mV
1,40	voltage amplification	$V_O = 1 V \text{ to } 4 V,$	25°C	25	55		25	55		*/!!!*
		R _L = 10 kΩ	Full range	15			15			
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min,	25°C	90	110		90	110		dB
		$V_O = 0$, $R_S = 50 \Omega$	Full range	85			85		-	
ksvr	Supply voltage rejection ratio	V _{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
SVIX	$(\Delta V_{DD\pm}/\Delta V_{IO})$	55 · · · ·	Full range	85			85			-
IDD	Supply current	V _O = 2.5 V, No load	25°C		1	1.5		1	1.5	mA
† F. II	1000 to 0500		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 $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

	DADAMETED	TEST CONDITIONS	- .+	TL	C2201	٩I	TL	.C2210I	31	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR	Class rate at units gain	$V_O = 0.5 \text{ V to } 2.5 \text{ V},$	25°C	1.8	2.5		1.8	2.5		1////
SK	Slew rate at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	Full range	1.2			1.2			V/μs
Vn	Equivalent input noise voltage	f = 10 Hz	25°C		18	35		18	30	nV/√ Hz
l vn	(see Note 5)	f = 1 kHz	25°C		8	15		8	12	IIV/VIIZ
\/ \ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		μV
VN(PP)	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μν
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz}, R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C		1.8			1.8		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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 or nontesting of other parameters.



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

	242445752	TEOT 0		- +	Т	LC2201	И	
	PARAMETER	1551 C	ONDITIONS	T _A †	MIN	TYP	MAX	UNIT
\/.0	Input offset voltage			25°C		100	500	μV
VIO	input onset voitage			Full range			700	μν
ανιο	Temperature coefficient of input offset voltage			Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	V _{IC} = 0,	$R_S = 50 \Omega$	25°C		0.001	0.005	μV/mo
1	Input offset current	$V_{1C} = 0$	KS = 30.22	25°C		0.5		pА
lio	input onset current			Full range			500	рΑ
	Input bias current			25°C		1		pА
ΙΒ	input bias current			Full range			500	pΑ
VICR	Common-mode input voltage range	R _S = 50 Ω		Full range	-5 to 2.7			V
V	Manipular positive post- cutout valtage and cutour			25°C	4.7	4.8		V
VOM+	Maximum positive peak output voltage swing	D. 401-0		Full range	4.7			V
V	Maximum negative peak output voltage swing	$R_L = 10 \text{ k}\Omega$		25°C	-4.7	-4.9		V
VOM-	Maximum negative peak output voltage swing			Full range	-4.7			٧
		V _O = ±4 V,	$R_1 = 500 \text{ k}\Omega$	25°C	400	560		
A _{VD}	Large-signal differential voltage amplification	VO = ±4 V,	NL = 300 K22	Full range	200			V/mV
	Large-signal differential voltage amplification	\/o = +4 \/	$R_{I} = 10 \text{ k}\Omega$	25°C	90	100		V/IIIV
		VO = ±4 V,	T(L = 10 K22	Full range	45			
CMRR	Common-mode rejection ratio	VIC = VICRm		25°C	90	115		dB
OWINT	Common mode rejection ratio	$V_{O} = 0$,	$R_S = 50 \Omega$	Full range	85			
ksvr	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	$V_{DD\pm} = \pm 2.3$	8 V to +8 V	25°C	90	110		dB
"SVK	Cappi, remage rejourem rame (Av DD±/Av (O)	•DD± - ±2.0		Full range	85			<u> </u>
I _{DD}	Supply current	$V_{O} = 0$,	No load	25°C		1.1	1.5	mA
טט.		10 = 0,		Full range			1.5	1117 \

[†] 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 $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

	DADAMETED	TEST COMPITIONS	T. †	TL	C2201N	/	
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
SR	Class rate at units gain	$V_O = \pm 2.3 \text{ V}, R_L = 10 \text{ k}\Omega,$	25°C	2	2.7		1////
SK	Slew rate at unity gain	C _L = 100 pF	Full range	1.3			V/μs
V	Equivalent input poice valtage	f = 10 Hz	25°C		18		->1/s/ U=
V _n	Equivalent input noise voltage	f = 1 kHz	25°C		8		nV/√Hz
V	Dock to mark againstant input pains valtage	f = 0.1 to 1 Hz	25°C		0.5		\/
VN(PP)	Peak-to-peak equivalent input noise voltage	f = 0.1 to 10 Hz	25°C		0.7		μV
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product		25°C		1.9		MHz
φm	Phase margin	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		48°		

[†] Full range is –55°C to 125°C.



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

	DADAMETED	TEGT COMPLTIONS	- +	TL	C2201A	M	TL	C2210B	М	LINUT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
\/10	Input offset voltage		25°C		80	200		80	200	μV
VIO	input onset voltage		Full range			400			400	μν
αVIO	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio	Input offset current		25°C		0.5			0.5		pА
ΙΟ	input onset current		Full range			500			500	PΑ
lin.	Input bias current		25°C		1			1		pА
İΒ	input bias current		Full range			500			500	PΑ
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	-5 to 2.7			-5 to 2.7			٧
.,	Maximum positive peak		25°C	4.7	4.8		4.7	4.8		
VOM+	output voltage swing	$R_1 = 10 \text{ k}\Omega$	Full range	4.7			4.7			V
\/a	Maximum negative peak	K[= 10 K22	25°C	-4.7	-4.9		-4.7	-4.9		٧
VOM-	output voltage swing		Full range	-4.7			-4.7			V
		$V_0 = \pm 4 V$,	25°C	400	560		400	560		
AVD	Large-signal differential	$R_L = 500 \text{ k}\Omega$	Full range	200			200			V/mV
\\D	voltage amplification	$V_0 = \pm 4 V$,	25°C	90	100		90	100		V/IIIV
		$R_L = 10 \text{ k}\Omega$	Full range	45			45			
CMRR	Common-mode rejection	V _{IC} = V _{ICR} min,	25°C	90	115		90	115		dB
OWNER	ratio	$V_0 = 0$, $R_S = 50 \Omega$	Full range	85			85			ub.
ksvr	Supply voltage rejection	$V_{DD \pm} = \pm 2.3 \text{ V to } \pm 8 \text{ V}$	25°C	90	110		90	110		dB
ovk	ratio (ΔV _{DD±} /ΔV _{IO})	*DD ± - ±2.0	Full range	85			85			GD.
I _{DD}	Supply current	$V_{\Omega} = 0$. No load	25°C		1.1	1.5		1.1	1.5	mA
טט.	Supply current V	$V_O = 0$, No load	Full range			1.5			1.5	1117 \

[†]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 $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

	DADAMETED	TEST	T. †	TL	C2201A	М	TL	C2201B	М	UNIT
	PARAMETER	CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
SR	Claurete et uniturgain	$V_{O} = \pm 2.3 \text{ V},$ $R_{I} = 10 \text{ k}\Omega,$	25°C	2	2.7		2	2.7		1////
SK	Slew rate at unity gain	$C_L = 100 \text{ pF}$	Full range	1.3			1.3			V/μs
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Equivalent input noise voltage	f = 10 Hz	25°C		18	35		18	30	->4/ -
V _n	(see Note 5)	f = 1 kHz	25°C		8	15		8	12	nV/√Hz
V	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		\/
V _{N(PP)}	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μV
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz},$ $R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C		1.9			1.9		MHz
фm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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.



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

	DADAMETED	TEGT COMPITIONS	- +	TLC2201M			UNIT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	UNII
\/10	Input offset voltage		25°C		100	500	μV
VIO	input onset voitage		Full range			700	μν
ανιο	Temperature coefficient of input offset voltage		Full range		0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005*	μV/mo
li o	Input offset current	VIC = 0, ICS = 30 22	25°C		0.5		pА
lio	input onset current		Full range			500	PΑ
Iв	Input bias current		25°C		1		pА
IIB	input bias current		Full range			500	РΑ
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	0 to 2.7			V
V	Manifestore high lavel autout valtage	D: 4010	25°C	4.7	4.8		V
VOH	Maximum high-level output voltage	$R_L = 10 \text{ k}\Omega$	Full range	4.7			V
\/o\	Maximum low-level output voltage	IO = 0	25°C		0	50	mV
VOL	Maximum low-level output voltage	10 = 0	Full range			50	IIIV
		$V_0 = 1 \ V \text{ to } 4 \ V,$	25°C	150	315		
AVD	Large-signal differential voltage amplification	$R_L = 500 \text{ k}\Omega$	Full range	75			V/mV
1,40	Large dignar ameroniar vertage amplification	$V_O = 1 V \text{ to } 4 V,$	25°C	25	55		*******
		$R_L = 10 \text{ k}\Omega$	Full range	10			
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min,	25°C	90	110		dB
	- Common mode rejection ratio	$V_0 = 0$, $R_S = 50 \Omega$	Full range	85			
ksvr	Supply voltage rejection ratio (ΔV _{DD+} /ΔV _{IO})	V _{DD} = 4.6 V to 16 V	25°C	90	110		dB
		100	Full range	85			
I _{DD}	Supply current	V _O = 2.5 V, No load	25°C		1	1.5	mA
ا ا	учерну очитотк	10 = 2.5 v, 10 load	Full range			1.5	IIIA

^{*}On products compliant to MIL-STD-883, Class B, this parameter is not production tested.

NOTE 4: Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ 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. İ	TLC2201M			LINUT
	PARAMETER	1EST CONDITIONS	T _A †	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$V_0 = 0.5 \text{ V to } 2.5 \text{ V},$	25°C	1.8	2.5		V/μs
SIX	Siew rate at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	Full range	1.1			ν/μ5
V	Equivalent input noise voltage	f = 10 Hz	25°C		18		nV/√ Hz
Vn	Equivalent input noise voltage	f = 1 kHz	25°C		8		nv/√Hz
V	Peak-to-peak equivalent	f = 0.1 to 1 Hz	25°C		0.5		\/
VN(PP)	input noise voltage	f = 0.1 to 10 Hz	25°C		0.7		μV
In	Equivalent input noise current		25°C		0.6		fA/√Hz
	Gain-bandwidth product		25°C		1.8		MHz
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	25°C		45°		

[†]Full range is -55°C to 125°C.



[†] Full range is –55°C to 125°C.

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

DADAMETED		TEGT COMPITIONS	T _A †	TL	C2201A	M	TLC2210BM			LINUT
	PARAMETER	TER TEST CONDITIONS		MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V. 0	Input offset voltage	ut offset voltage	25°C		80	200		80	200	μV
VIO	input onset voltage		Full range			400			400	μν
αΛΙΟ	Temperature coefficient of input offset voltage		Full range		0.5			0.5		μV/°C
	Input offset voltage long-term drift (see Note 4)	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C		0.001	0.005		0.001	0.005	μV/mo
lio.	Input offset current		25°C		0.5			0.5		pА
110	input onset current		Full range			500			500	PΑ
l.s	Input bias current		25°C		1			1		pА
IВ	input bias current		Full range			500			500	PΑ
VICR	Common-mode input voltage range	R _S = 50 Ω	Full range	0 to 2.7			0 to 2.7			٧
.,	Maximum high-level output	D 4010	25°C	4.7	4.8		4.7	4.8		
VOH	voltage	$R_L = 10 \text{ k}\Omega$	Full range	4.7			4.7			V
V-2.	Maximum low-level output	10 - 0	25°C		0	50		0	50	٧
VOL	voltage	IO = 0	Full range			50			50	V
		$V_0 = 1 \ V \text{ to } 4 \ V,$	25°C	150	315		150	315		
A. (5)	Large-signal differential	$R_L = 500 \text{ k}\Omega$	Full range	75			75			V/mV
AVD	voltage amplification	V _O = 1 V to 4 V,	25°C	25	55		25	55		V/IIIV
		$R_L = 10 \text{ k}\Omega$	Full range	10			10			
CMRR	Common-mode rejection	V _{IC} = V _{ICR} min,	25°C	90	110		90	110		dB
CIVIKK	ratio	$V_O = 0$, $R_S = 50 \Omega$	Full range	85			85			uБ
ke)/E	Supply voltage rejection	V _{DD} = 4.6 V to 16 V	25°C	90	110		90	110		dB
ksvr	ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	VDD = 4.6 V 10 16 V	Full range	85			85			
IDD	Supply current	Vo = 2.5.V No load	25°C		1.1	1.5		1.1	1.5	mA
IDD	Supply current	$V_O = 2.5 \text{ V}$, No load	Full range			1.5			1.5	ma

[†]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 TA = 150°C extrapolated to $T_A = 25^{\circ}C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

	PARAMETER	TEST CONDITIONS TAT		TL	C2201A	М	TLC2201BM			UNIT
	PARAMETER	TEST CONDITIONS	T _A †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
SR	Slew rate at unity gain	$V_O = 0.5 \text{ V to } 2.5 \text{ V},$ $R_1 = 10 \text{ k}\Omega,$	25°C	1.8	2.5		1.8	2.5		Mus
SK	C _L = 10 k2,	· -	Full range	1.1			1.1			V/μs
\ <u></u>	Equivalent input noise voltage	f = 10 Hz	25°C		18	35		18	30	->4/ -
Vn	(see Note 5)	f = 1 kHz	25°C		8	15		8	12	nV/√Hz
V	Peak-to-peak equivalent input	f = 0.1 to 1 Hz	25°C		0.5			0.5		\/
V _{N(PP)}	noise voltage	f = 0.1 to 10 Hz	25°C		0.7			0.7		μV
In	Equivalent input noise current		25°C		0.6			0.6		fA/√Hz
	Gain-bandwidth product	$f = 10 \text{ kHz},$ $R_L = 10 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	25°C		1.8			1.8		MHz
фm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$, $C_L = 100 \text{ pF}$	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.

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electrical characteristics at $V_{DD\pm}$ = ± 5 V, T_{A} = $25^{\circ}C$ (unless otherwise noted)

PARAMETER		TEST CONF	TEST CONDITIONS		TLC2201Y			
	PARAMETER	IEST CONL	DITIONS	MIN	TYP	MAX	UNIT	
VIO	Input offset voltage				100	500	μV	
	Input offset voltage long-term drift (see Note 4)	\/ 0	D- 50.0		0.001	0.005	μV/mo	
IIO	Input offset current	V _{IC} = 0,	$R_S = 50 \Omega$		0.5		pА	
I _{IB}	Input bias current		1 г		1		pА	
VICR	Common-mode input voltage range	R _S = 50 Ω		0 to 2.7			V	
Vон	Maximum high-level output voltage	$R_L = 10 \text{ k}\Omega$		4.7	4.8		V	
VOL	Maximum low-level output voltage	IO = 0			0	50	mV	
Δ	Lorge signal differential voltage emplification	$V_0 = 1 V to 4 V$	$R_L = 500 \Omega$	25	55		V/mV	
AVD	Large-signal differential voltage amplification	$V_0 = 1 \ V \text{ to 4 V},$	R _L = 10 Ω	25	55		V/IIIV	
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min,$ $V_{O} = 0,$	$R_S = 50 \Omega$	90	110		dB	
kSVR	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 $T_A = 150^{\circ}C$ extrapolated to $T_A = 25^{\circ}C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

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

DADAMETED		TEST COMPITIONS			TLC2201Y					
	PARAMETER	TEST CONDITIONS		PARAMETER TEST CONDITIONS			MIN	TYP	MAX	UNIT
SR	Positive slew rate at unity gain	$V_0 = \pm 0.5 \text{ to } 2.5 \text{ V},$	$R_L = 10 \text{ k}\Omega$,	C _L = 100 pF	1.8	2.5		V/µs		
V	Equivalent input poice veltage	f = 10 Hz				18		->//s/II=		
Vn	Equivalent input noise voltage	f = 1 kHz				8		nV/√Hz		
V	Peak-to-peak equivalent	f = 0.1 to 1 Hz				0.5		\/		
VN(PP)	input noise voltage	f = 0.1 to 10 Hz				0.7		μV		
In	Equivalent input noise current					0.6		pA/√Hz		
	Gain-bandwidth product	f = 10 kHz,	$R_L = 10 \text{ k}\Omega$,	C _L = 100 pF		1.8		MHz		
φm	Phase margin at unity gain	$R_L = 10 \text{ k}\Omega$,	C _L = 100 pF			48°				

PARAMETER MEASUREMENT INFORMATION

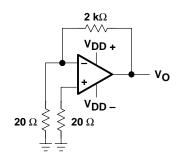
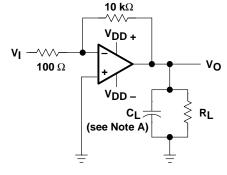
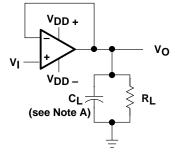


Figure 1. Noise-Voltage Test Circuit



NOTE A: C_L includes fixture capacitance.

Figure 2. Phase-Margin Test Circuit



NOTE A: C_I includes fixture capacitance.

Ground Shield VDD + VDD - Picoammeters

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

Figure 3. Slew-Rate 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
VIO	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
Vом	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
Vон	High-level output voltage	vs Frequency vs High-level output current vs Free-air temperature	12 13 14
VOL	Low-level output voltage	vs Low-level output current vs Free-air temperature	15 16
AVD	Large-signal differential voltage amplification	vs Frequency vs Free-air temperature	17 18
los	Short-circuit output current	vs Supply voltage vs Free-air temperature	19 20
IDD	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
φm	Phase margin	vs Supply voltage vs Free-air temperature	33 34
	Phase shift	vs Frequency	17



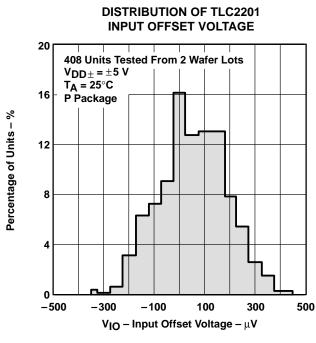


Figure 5

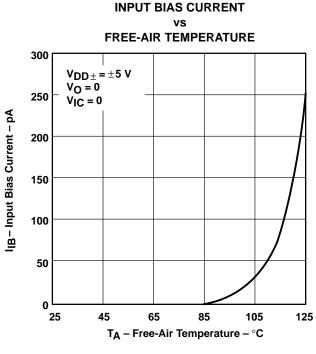


Figure 7

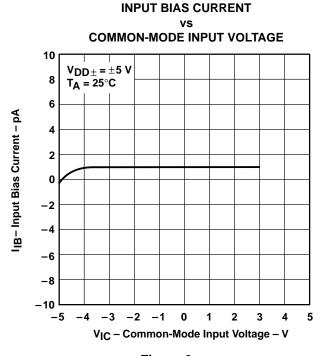
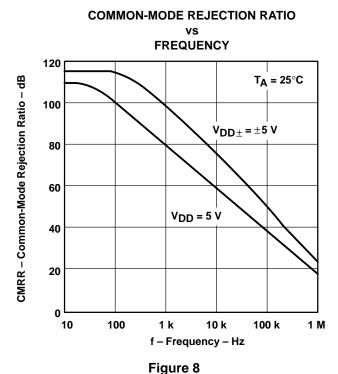


Figure 6



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

MAXIMUM PEAK OUTPUT VOLTAGE OUTPUT CURRENT $V_{DD\pm}$ = ±5 V|VOM| - Maximum Peak Output Voltage - V $T_A = 25^{\circ}C$ VOM+ VOM-3 2 0 0 10 |IO| - Output Current - mA



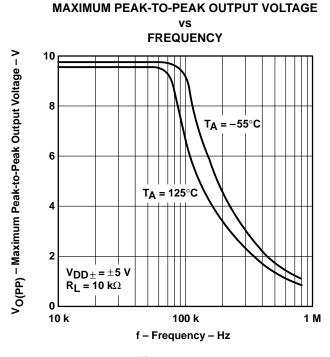


Figure 11

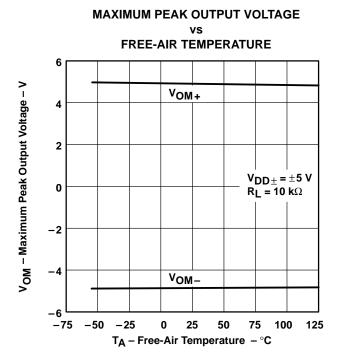


Figure 10

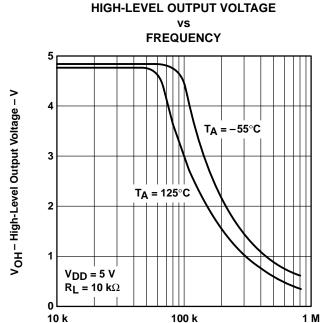


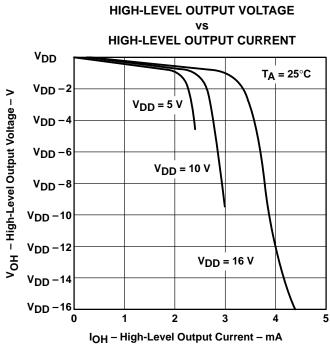
Figure 12

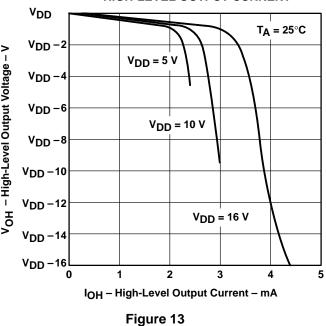
f - Frequency - Hz

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



V_{OH} - High-Level Output Voltage - V





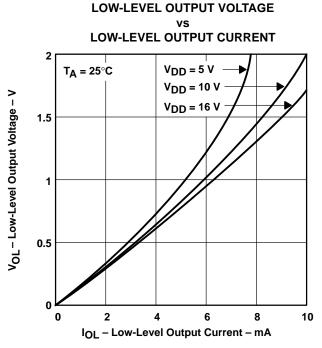


Figure 15

HIGH-LEVEL OUTPUT VOLTAGE FREE-AIR TEMPERATURE

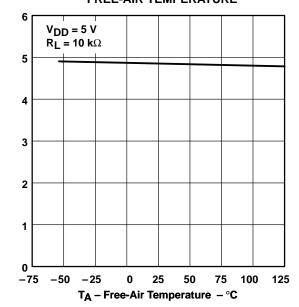


Figure 14

LOW-LEVEL OUTPUT VOLTAGE

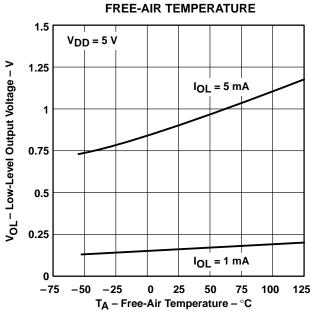


Figure 16

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



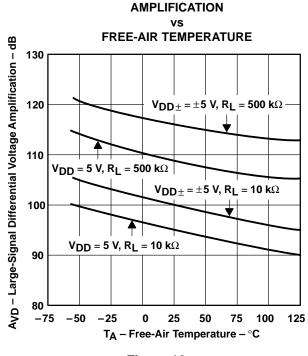
LARGE-SIGNAL DIFFERENTIAL VOLTAGE

TYPICAL CHARACTERISTICS[†]

AMPLIFICATION AND PHASE SHIFT FREQUENCY AVD - Large-Signal Differential Voltage Amplification - dB 120 30° $V_{DD\pm} = \pm 5 V$ $R_L = 10 \text{ k}\Omega$ 100 50° CL = 100 pF A_{VD} $T_A = 25^{\circ}C$ 80 70° 60 90° Phase Shift **Phase Shift** 40 110° 20 130° 0 150° 170° 100 10 k 10 1 k 100 k 1 M

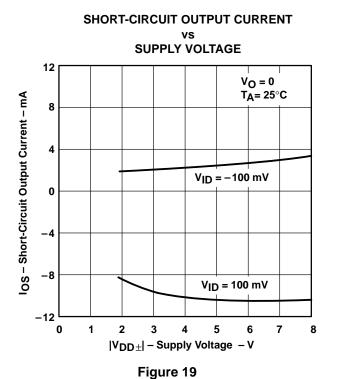
Figure 17

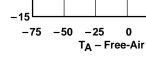
f - Frequency - Hz



LARGE-SIGNAL DIFFERENTIAL VOLTAGE

Figure 18





SHORT-CIRCUIT OUTPUT CURRENT

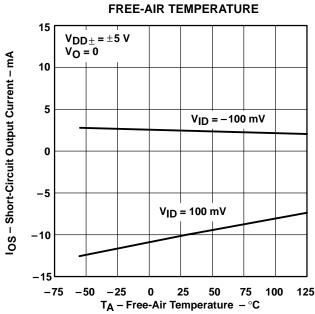


Figure 20

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



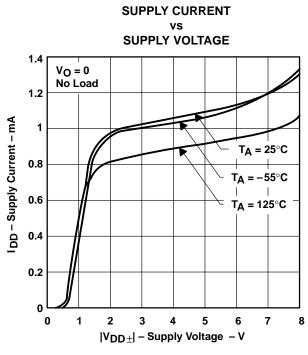
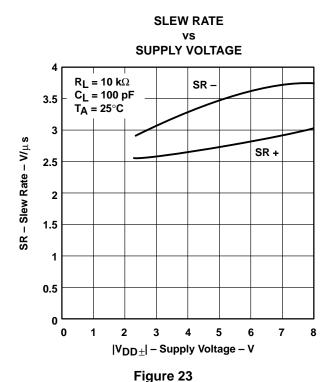


Figure 21



SUPPLY CURRENT

VS

FREE-AIR TEMPERATURE

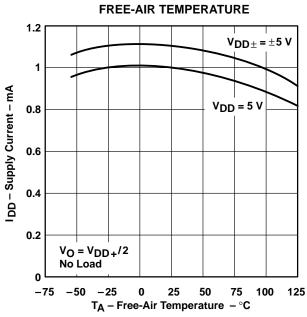


Figure 22

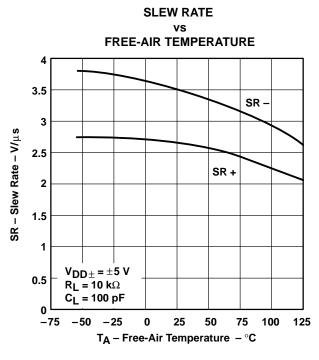


Figure 24

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



TYPICAL CHARACTERISTICS

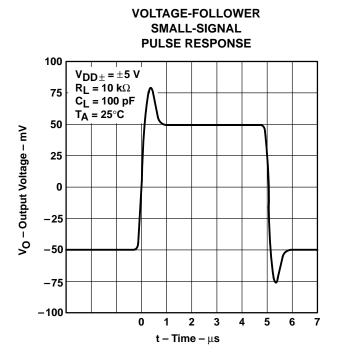


Figure 25

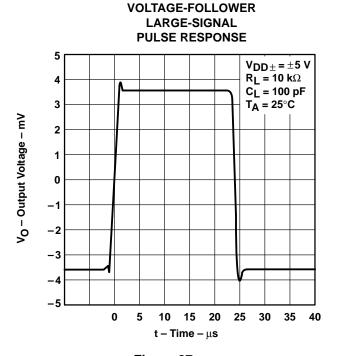


Figure 27

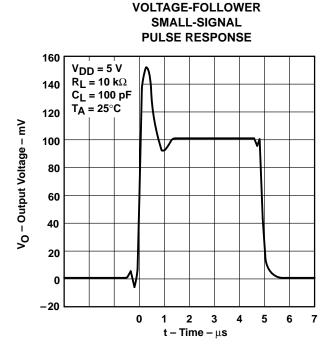


Figure 26

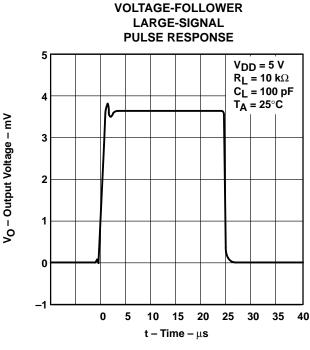


Figure 28

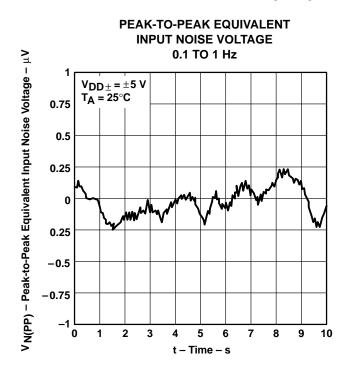


PEAK-TO-PEAK EQUIVALENT

TYPICAL CHARACTERISTICS[†]

-0.8

1 2 3



INPUT NOISE VOLTAGE V N(PP) – Peak-to-Peak Equivalent Input Noise Voltage – μ V 0.1 TO 10 Hz $V_{DD\pm} = \pm 5 V$ T_A = 25°C 0.8 0.6 0.4 0.2 0 -0.2 -0.4-0.6

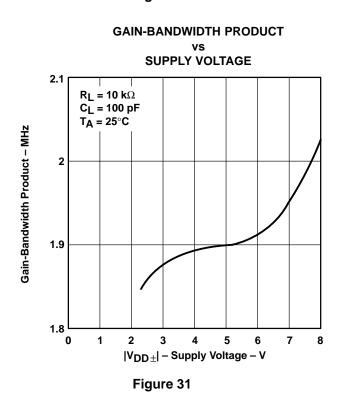
Figure 29

Figure 30

5 6

t - Time - s

8 9 10



GAIN-BANDWIDTH PRODUCT FREE-AIR TEMPERATURE 2.5 $R_L = 10 \text{ k}\Omega$ $C_L = 100 pF$ Gain-Bandwidth Product - MHz $V_{DD\pm} = \pm 5 V$ $V_{DD} = 5 V$ 1.5 -75 -50 75 100 TA - Free-Air Temperature - °C

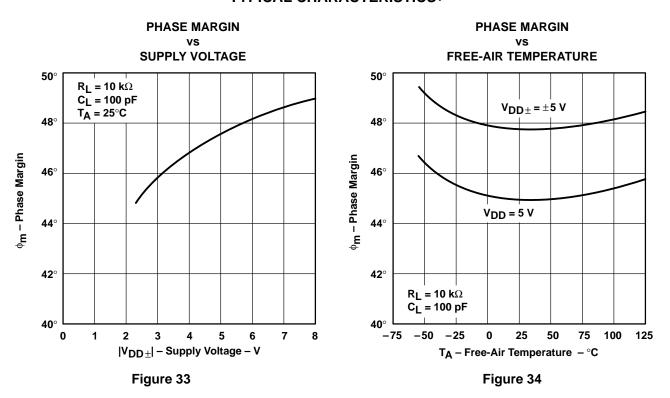
Figure 32

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



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TYPICAL CHARACTERISTICS[†]



† 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 μ F 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.



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