DIODES INCORPORATED

Lead-free Green

TLC271, TLC271A, TLC271B

CMOS PROGRAMMABLE LOW POWER OPERATIONAL AMPLIFIERS

New Product

Description

The TLC271 operational amplifier combines a wide range of input offset voltage grades with low offset voltage drift and high input impedance. In addition, the TLC271 offers a bias-select mode that allows the user to select the best combination of power dissipation and AC performance for a particular application.

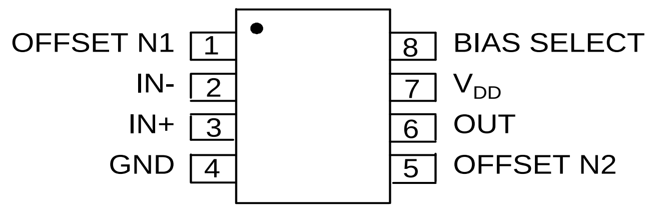
Using the bias-select option, these devices can be programmed to fit a wide range of applications. Three offset voltage grades are available, ranging from the low-cost TLC271 (10mV) to the TLC271B (2mV) low-offset version. The devices are offered in both commercial and industrial operating temperature ranges.

The extremely high input impedance and low bias currents, in conjunction with good common-mode and supply voltage rejection make these devices an excellent choice for high performance designs.

The devices also feature low-voltage single-supply operation with a common-mode input voltage range which includes the negative rail.

Pin Assignments

(Top View)



SO-8

Features

- Wide range of supply voltages over specified temperature range:
  - 0°C to 70°C . . . 3 V to 16 V
  - -40°C to 85°C . . . 4 V to 16 V
- Single-Supply Operation
- Common-Mode Input Voltage Range
- Extends Below the Negative Rail
- Low Noise:
  - 20 nV/√Hz Typical @ f = 1kHz
  - (High-Bias Mode)
- Output Voltage Range Includes Negative Rail
- High Input Impedance
- ESD-Protection Circuitry
- Designed-In Latch-Up Immunity
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**

Applications

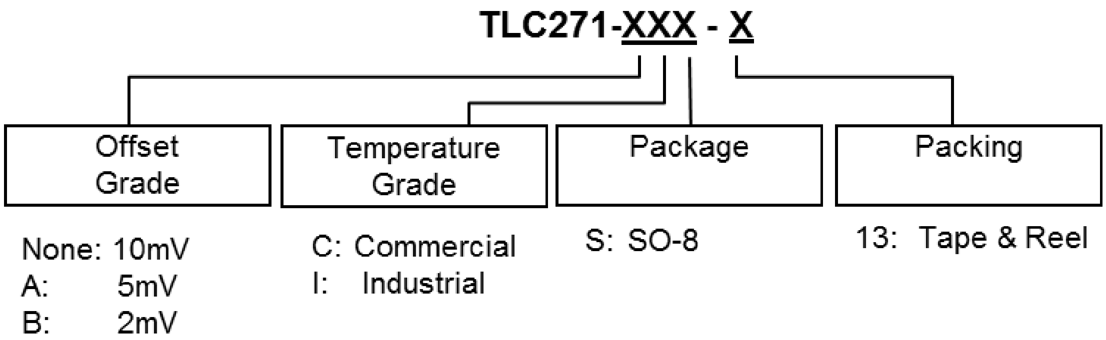
With the programmability options of the TLC271, a designer can choose a very low current option allowing for extended battery life or choose a higher current option for more performance. It is possible to switch performance modes as the application demands change.

The TLC271 is well suited for many consumer audio, industrial and other low power applications.

- Audio
  - Microphone Preamplifier
  - Filtering – Equalizers
  - Signal Amplification
- Industrial
  - Power Supply
  - Instrumentation
  - Metering
- Medical
  - Portable Meters and Measurement
  - Instrumentation

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Ordering Information



Device	Package Code	Offset Voltage	Operating Temperature Range	Packaging (Note 4)	13" Tape and Reel	
					Quantity	Part Number Suffix
TLC271CS-13	S	10mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271ACS-13	S	5mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271BCS-13	S	2mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271IS-13	S	10mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13
TLC271AIS-13	S	5mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13
TLC271BIS-13	S	2mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13

Note: 4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

Pin Descriptions

Pin Name	Pin number	Description
OFFSET N1	1	Offset Control Inverting Input
IN-	2	Inverting Input
IN+	3	Non-Inverting Input
GND	4	Ground
OFFSET N2	5	Offset Control Non-Inverting Input
OUT	6	Output
V_{DD}	7	Supply
BIAS SELECT	8	Bias Mode Select

Absolute Maximum Ratings (Notes 5, 6, 7, 8, 9)

Symbol	Parameter		Rating	Unit
V_{DD}	Supply Voltage (Note 6)		18	V
V_{ID}	Differential Input Voltage (Note 7)		$\pm V_{DD}$	V
V_{IN}	Input Voltage Range (either input)		-0.3 to V_{DD}	V
I_{IN}	Input Current		±5	mA
I_o	Output Current		±30	mA
	Output Short-Circuit to GND (Note 8)		Continuous	—
P_D	Power Dissipation (Note 9)		1065	mW
T_A	Operating Temperature Range	C Grade	0 to +70	°C
		I Grade	-40 to +85	
T_J	Operating Junction Temperature		150	°C
T_{ST}	Storage Temperature Range		-65 to +150	°C
ESD HBM	Human Body Model ESD Protection (1.5kΩ in series with 100pF)		1.5	kV

Notes:
5. Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only; 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.
6. All voltage values, except differential voltages, are with respect to ground.
7. Differential input voltages are at IN+ with respect to IN-.
8. The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.
9. For operating at high temperatures, the TLC271 must be derated 8.5mW/°C to zero based on a +150°C maximum junction temperature and a thermal resistance of +117 °C/W when the device is soldered to a printed circuit board, operating in a still air ambient.

Recommended Operating Conditions

Symbol	Parameter		C grade		I grade		Unit
			Min	Max	Min	Max	
V_{DD}	Supply Voltage		3	16	4	16	V
V_{IC}	Common Mode Input Voltage	V_{DD} = 5V	-0.2	3.5	-0.2	3.5	V
		V_{DD} = 10V	-0.2	8.5	-0.2	8.5	
T_A	Operating Free Air Temperature		0	+70	-40	+85	°C

Electrical Characteristics

High Bias Mode											
Parameter			Conditions	T_A	TLC271C, TLC271AC, TLC271BC						Unit
					V_{DD} = 5V			V_{DD} = 10V			
					Min	Typ	Max	Min	Typ.	Max	
V_{IO}	Input Offset Voltage	TLC271C	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 10kΩ	+25°C	—	1.1	10	—	1.1	10	mV
				0 to +70°C	—	—	12	—	—	12	
		TLC271AC		+25°C	—	0.9	5	—	0.9	5	
				0 to 70°C	—	—	6.5	—	—	6.5	
		TLC271BC		25°C	—	0.34	2	—	0.39	2	
				0 to +70°C	—	—	3	—	—	3	
α_{VIO}	Average Temperature Coefficient of Input Offset Voltage		—	+25°C to 70°C	1.8			2			µV/°C
I_{IO}	Input Offset Current (Note 10)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.1	60	—	0.1	60	pA
				+70°C	—	7	300	—	7	300	
I_{IB}	Input Bias Current (Note 10)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.6	60	—	0.7	60	pA
				+70°C	—	40	600	—	50	600	
V_{ICR}	Common Mode Input Voltage (Note 11)		—	+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				0 to +70°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High Level Output Voltage		V_{ID} = 100mV, R_L = 10kΩ	+25°C	3.2	3.8	—	8	8.5	—	V
				0°C	3	3.8	—	7.8	8.5	—	
				+70°C	3	3.8	—	7.8	8.4	—	
V_{OL}	Low Level Output Voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				0°C	—	0	50	—	0	50	
				+70°C	—	0	50	—	0	50	
A_{VD}	Large Signal Differential Voltage Gain		R_L = 10kΩ (Note 12)	+25°C	5	23	—	10	36	—	V/mV
				0°C	4	27	—	7.5	42	—	
				+70°C	4	20	—	7.5	32	—	
CMRR	Common Mode Rejection Ratio		V_{IC} = V_{ICRmin}	+25°C	65	80	—	65	85	—	dB
				0°C	60	84	—	60	88	—	
				+70°C	60	85	—	60	88	—	
k_{SVR}	Supply Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	65	95	—	65	95	—	dB
				0°C	60	94	—	60	94	—	
				+70°C	60	96	—	60	96	—	
$I_{I(SEL)}$	Input Current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	-1.4	—	—	-1.9	—	µA
I_{DD}	Supply Current		V_O = V_{DD}/2, V_{IC} = V_{DD}/2, No load	+25°C	—	675	1600	—	950	2000	µA
				0°C	—	775	1800	—	1125	2200	
				+70°C	—	575	1300	—	750	1700	

Notes: 10. The typical values of input bias current and input offset current below 5pA were calculated.
11. This range also applies to each input individually.
12. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

Electrical Characteristics

High bias mode											
Parameter			Conditions	T_A	TLC271I, TLC271AI, TLC271BI						Unit
					V_{DD} = 5V			V_{DD} = 10V			
					Min	Typ	Max	Min	Typ.	Max	
V_{IO}	Input Offset Voltage	TLC271I	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 10kΩ	+25°C	—	1.1	10	—	1.1	10	mV
				-40 to 85°C	—	—	13	—	—	13	
		TLC271AI		+25°C	—	0.9	5	—	0.9	5	
				-40 to 85°C	—	—	7	—	—	7	
		TLC271BI		+25°C	—	0.34	2	—	0.39	2	
				-40 to 85°C	—	—	3.5	—	—	3.5	
α_{VIO}	Average Temperature Coefficient of Input Offset Voltage		—	+25 to 85°C		1.8			2		µV/°C
I_{IO}	Input Offset Current (Note 13)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.1	60	—	0.1	60	pA
				+85°C	—	24	1000	—	26	1000	
I_{IB}	Input Bias Current (Note 13)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.6	60	—	0.7	60	pA
				+85°C	—	200	2000	—	220	2000	
V_{ICR}	Common Mode Input Voltage (Note 14)		—	+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				-40 to +85°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High Level Output Voltage		V_{ID} = 100mV, R_L = 10kΩ	+25°C	3.2	3.8	—	8	8.5	—	V
				-40°C	3	3.8	—	7.8	8.5	—	
				+85°C	3	3.8	—	7.8	8.5	—	
V_{OL}	Low Level Output Voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				-40°C	—	0	50	—	0	50	
				+85°C	—	0	50	—	0	50	
A_{VD}	Large Signal Differential Voltage Gain		R_L = 10kΩ (Note 15)	+25°C	5	23	—	10	36	—	V/mV
				-40°C	3.5	32	—	7	46	—	
				+85°C	3.5	19	—	7	31	—	
CMRR	Common Mode Rejection Ratio		V_{IC} = V_{ICRmin}	+25°C	65	80	—	65	85	—	dB
				-40°C	60	81	—	60	87	—	
				+85°C	60	86	—	60	88	—	
k_{SVR}	Supply Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	65	95	—	65	95	—	dB
				-40°C	60	92	—	60	92	—	
				+85°C	60	96	—	60	96	—	
$I_{I(SEL)}$	Input Current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	-1.4	—	—	-1.9	—	µA
I_{DD}	Supply Current		V_O = V_{DD}/2, V_{IC} = V_{DD}/2, No load	+25°C	—	675	1600	—	950	2000	µA
				-40°C	—	950	2200	—	1375	2500	
				+85°C	—	525	1200	—	725	1600	

Notes: 13. The typical values of input bias current and input offset current below 5pA were calculated.
14. This range also applies to each input individually.
15. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

Electrical Characteristics

High bias mode: V_{DD} = 5V								
Parameter		Conditions		T_A	TLC271C, TLC271AC, TLC271BC			Unit
					Min	Typ	Max	—
SR	Slew Rate at Unity Gain	R_L = 10kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	3.6	—	V/µs
				0°C	—	4	—	
				+70°C	—	3	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	2.9	—	
				0°C	—	3.1	—	
				+70°C	—	2.5	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	25	—	nV/√Hz
$B_{\circ M}$	Maximum Output Swing Bandwidth	$V_\circ = V_{\circ H}$, C_L = 20pF, R_L = 10kΩ See Figure 92		+25°C	—	200	—	kHz
				0°C	—	220	—	
				+70°C	—	140	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	2.2	—	MHz
				0°C	—	2.5	—	
				+70°C	—	1.8	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	49°	—	—
				0°C	—	50°	—	
				+70°C	—	46°	—	

High bias mode: V_{DD} = 10V								
Parameter		Conditions		T_A	TLC271C, TLC271AC, TLC271BC			Unit
					Min	Typ	Max	—
SR	Slew Rate at Unity Gain	R_L = 10kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	5.3	—	V/µs
				0°C	—	5.9	—	
				+70°C	—	4.3	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	4.6	—	
				0°C	—	5.1	—	
				+70°C	—	3.8	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	25	—	nV/√Hz
$B_{\circ M}$	Maximum Output Swing Bandwidth	$V_\circ = V_{\circ H}$, C_L = 20pF, R_L = 10kΩ See Figure 92		+25°C	—	200	—	kHz
				0°C	—	220	—	
				+70°C	—	140	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	2.2	—	MHz
				0°C	—	2.5	—	
				+70°C	—	1.8	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	49°	—	—
				0°C	—	50°	—	
				+70°C	—	46°	—	

New Product

Electrical Characteristics

High bias mode: V_{DD} = 5V								
Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI			Unit
					Min	Typ	Max	—
SR	Slew rate at unity gain	R_L = 10kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	3.6	—	V/µs
				-40°C	—	4.5	—	
				+85°C	—	2.8	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	2.9	—	
				-40°C	—	3.5	—	
				+85°C	—	2.3	—	
V_n	Equivalent input noise voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	25	—	nV/√Hz
B_{OM}	Maximum output swing bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 10kΩ See Figure 92		+25°C	—	320	—	kHz
				-40°C	—	380	—	
				+85°C	—	250	—	
B_1	Unity gain bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	1.7	—	MHz
				-40°C	—	2.6	—	
				+85°C	—	1.2	—	
ϕ_m	Phase margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	46°	—	—
				-40°C	—	49°	—	
				+85°C	—	43°	—	
High bias mode: V_{DD} = 10V								
Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI			Unit
					Min	Typ	Max	
SR	Slew rate at unity gain	R_L = 10kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	5.3	—	V/µs
				-40°C	—	6.8	—	
				+85°C	—	4	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	4.6	—	
				-40°C	—	5.8	—	
				+85°C	—	3.5	—	
V_n	Equivalent input noise voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	25	—	nV/√Hz
B_{OM}	Maximum output swing bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 10kΩ See Figure 92		+25°C	—	200	—	kHz
				-40°C	—	260	—	
				+85°C	—	130	—	
B_1	Unity gain bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	2.2	—	MHz
				-40°C	—	3.1	—	
				+85°C	—	1.7	—	
ϕ_m	Phase margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	49°	—	
				-40°C	—	52°	—	
				+85°C	—	46°	—	

New Product

Electrical Characteristics

Medium bias mode

Symbol	Parameter	Device	Conditions	T_A	TLC271C, TLC271AC, TLC271BC V_{DD} = 5V Min	Typ	Max	V_{DD} = 10V Min	Typ.	Max	Unit
V_{IO}	Input Offset Voltage	TLC271C	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 100kΩ	+25°C	—	1.1	10	—	1.1	10	mV
				0 to +70°C	—	—	12	—	—	12	
		TLC271AC		+25°C	—	0.9	5	—	0.9	5	
				0 to +70°C	—	—	6.5	—	—	6.5	
		TLC271BC		+25°C	—	0.25	2	—	0.26	2	
				0 to +70°C	—	—	3	—	—	3	
α_{VIO}	Average temperature coefficient of input offset voltage			25 to +70°C		1.7			2.1		μV/°C
I_{IO}	Input offset current (Note 16)		$V_O = V_{DD}/2$, $V_{IC} = V_{DD}/2$	+25°C	—	0.1	60	—	0.1	60	pA
				+70°C	—	7	300	—	7	300	
I_{IB}	Input bias current (Note 16)		$V_O = V_{DD}/2$, $V_{IC} = V_{DD}/2$	+25°C	—	0.6	60	—	0.7	60	pA
				+70°C	—	40	600	—	50	600	
V_{ICR}	Common mode input voltage (Note 17)			+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				0 to +70°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High level output voltage		V_{ID} = 100mV, R_L = 100kΩ	+25°C	3.2	3.9	—	8	8.7	—	V
				0°C	3	3.9	—	7.8	8.7	—	
				+70°C	3	4	—	7.8	8.7	—	
V_{OL}	Low level output voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				0°C	—	0	50	—	0	50	
				+70°C	—	0	50	—	0	50	
A_{VD}	Large signal differential voltage gain		R_L = 100kΩ (Note 18)	+25°C	25	170	—	25	275	—	V/mV
				0°C	15	200	—	15	320	—	
				+70°C	15	140	—	15	230	—	
CMRR	Common mode rejection ratio		$V_{IC} = V_{ICRmin}$	+25°C	65	91	—	65	94	—	dB
				0°C	60	91	—	60	94	—	
				+70°C	60	92	—	60	94	—	
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	70	93	—	70	93	—	dB
				0°C	60	92	—	60	92	—	
				+70°C	60	94	—	60	94	—	
$I_{I(SEL)}$	Input current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	-130	—	—	-160	—	nA
I_{DD}	Supply current		$V_O = V_{DD}/2$, $V_{IC} = V_{DD}/2$, No load	+25°C	—	105	280	—	143	300	μA
				0°C	—	125	320	—	173	400	
				+70°C	—	85	220	—	110	280	

Notes: 16. The typical values of input bias current and input offset current below 5pA were calculated.
17. This range also applies to each input individually.
18. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

New Product

Electrical Characteristics

Medium bias mode

Parameter			Conditions	T_A	TLC271I, TLC271AI, TLC271BI						Unit
					V_{DD} = 5V			V_{DD} = 10V			
					Min	Typ	Max	Min	Typ.	Max	
V_{IO}	Input Offset Voltage	TLC271I	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 100kΩ	+25°C	—	1.1	10	—	1.1	10	mV
				-40 to +85°C	—	—	13	—	—	13	
		TLC271AI		+25°C	—	0.9	5	—	0.9	5	
				-40 to +85°C	—	—	7	—	—	7	
		TLC271BI		+25°C	—	0.25	2	—	0.26	2	
				-40 to +85°C	—	—	3.5	—	—	3.5	
α_{VIO}	Average temperature coefficient of input offset voltage			+25 to +85°C		1.7			2.1		µV/°C
I_{IO}	Input offset current (Note 19)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.1	60	—	0.1	60	pA
				+85°C	—	24	1000	—	26	1000	
I_{IB}	Input bias current (Note 19)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.6	60	—	0.7	60	pA
				+85°C	—	200	2000	—	220	2000	
V_{ICR}	Common mode input voltage (Note 20)			+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				-40 to +85°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High level output voltage		V_{ID} = 100mV, R_L = 100kΩ	+25°C	3.2	3.9	—	8	8.7	—	V
				-40°C	3	3.9	—	7.8	8.7	—	
				+85°C	3	4	—	7.8	8.7	—	
V_{OL}	Low level output voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				-40°C	—	0	50	—	0	50	
				+85°C	—	0	50	—	0	50	
A_{VD}	Large signal differential voltage gain		R_L = 100kΩ (Note 21)	+25°C	25	170	—	25	275	—	V/mV
				-40°C	15	270	—	15	390	—	
				+85°C	15	130	—	15	220	—	
CMRR	Common mode rejection ratio		V_{IC} = V_{ICRmin}	+25°C	65	91	—	65	94	—	dB
				-40°C	60	90	—	60	93	—	
				+85°C	60	90	—	60	94	—	
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	70	93	—	70	93	—	dB
				-40°C	60	91	—	60	91	—	
				+85°C	60	94	—	60	94	—	
$I_{I(SEL)}$	Input current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	-130	—	—	-160	—	nA
I_{DD}	Supply current		V_O = V_{DD}/2, V_{IC} = V_{DD}/2, No load	+25°C	—	105	280	—	143	300	µA
				-40°C	—	158	400	—	225	450	
				+85°C	—	80	200	—	103	260	

Notes: 19. The typical values of input bias current and input offset current below 5pA were calculated.
20. This range also applies to each input individually.
21. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

Electrical Characteristics

Medium bias mode: V_{DD} = 5V

Symbol	Parameter	Conditions		T_A	TLC271C, TLC271AC, TLC271BC Min	Typ	Max	Unit
SR	Slew rate at unity gain	R_L = 100kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.43	—	V/µs
				0°C	—	0.46	—	
				+70°C	—	0.36	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	0.4	—	
				0°C	—	0.43	—	
				+70°C	—	0.34	—	
V_n	Equivalent input noise voltage	F = 1kHz, R_S = 20Ω See Figure 93		25°C	—	32	—	nV/√Hz
B_{OM}	Maximum output swing bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 100kΩ See Figure 92		+25°C	—	55	—	kHz
				0°C	—	60	—	
				+70°C	—	50	—	
B_1	Unity gain bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	525	—	MHz
				0°C	—	600	—	
				+70°C	—	400	—	
ϕ_m	Phase margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	40°	—	—
				0°C	—	41°	—	
				+70°C	—	39°	—	

Medium bias mode: V_{DD} = 10V

Symbol	Parameter	Conditions		T_A	TLC271C, TLC271AC, TLC271BC Min	Typ	Max	Unit
SR	Slew Rate at Unity Gain	R_L = 100kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.62	—	V/µs
				0°C	—	0.67	—	
				+70°C	—	0.51	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	0.56	—	
				0°C	—	0.61	—	
				+70°C	—	0.46	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	32	—	nV/√Hz
B_{OM}	Maximum Output Swing Bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 100kΩ See Figure 92		+25°C	—	35	—	kHz
				0°C	—	40	—	
				+70°C	—	30	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	635	—	MHz
				0°C	—	710	—	
				+70°C	—	510	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	43°	—	—
				0°C	—	44°	—	
				+70°C	—	42°	—	

Electrical Characteristics

Medium bias mode: V_{DD} = 5V

Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI Min	Typ	Max	Unit
SR	Slew rate at unity gain	R_L = 100kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.43	—	V/µs
				-40°C	—	0.51	—	
				+85°C	—	0.35	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	0.4	—	
				-40°C	—	0.48	—	
				+85°C	—	0.32	—	
V_n	Equivalent input noise voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	32	—	nV/√Hz
$B_{\circ M}$	Maximum output swing bandwidth	$V_{\circ} = V_{\circ H}$, C_L = 20pF, R_L = 100kΩ See Figure 92		+25°C	—	55	—	kHz
				-40°C	—	75	—	
				+85°C	—	45	—	
B_1	Unity gain bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	525	—	MHz
				-40°C	—	770	—	
				+85°C	—	370	—	
ϕ_m	Phase margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	40°	—	—
				-40°C	—	43°	—	
				+85°C	—	38°	—	

Medium bias mode: V_{DD} = 10V

Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI Min	Typ	Max	Unit
SR	Slew Rate at Unity Gain	R_L = 100kΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.62	—	V/µs
				-40°C	—	0.77	—	
				+85°C	—	0.47	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	0.56	—	
				-40°C	—	0.7	—	
				+85°C	—	0.44	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	32	—	nV/√Hz
$B_{\circ M}$	Maximum Output Swing Bandwidth	$V_{\circ} = V_{\circ H}$, C_L = 20pF, R_L = 100kΩ See Figure 92		+25°C	—	35	—	kHz
				-40°C	—	45	—	
				+85°C	—	25	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	635	—	MHz
				-400°C	—	880	—	
				+85°C	—	480	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	43°	—	—
				-40°C	—	46°	—	
				+85°C	—	41°	—	

Electrical Characteristics

Low bias mode

Parameter			Conditions	T_A	TLC271C, TLC271AC, TLC271BC						Unit
					V_{DD} = 5V			V_{DD} = 10V			
					Min	Typ	Max	Min	Typ.	Max	
V_{IO}	Input Offset Voltage	TLC271C	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 1MΩ	+25°C	—	1.1	10	—	1.1	10	mV
				0 to +70°C	—	—	12	—	—	12	
		TLC271AC		+25°C	—	0.9	5	—	0.9	5	
				0 to +70°C	—		6.5	—		6.5	
		TLC271BC		+25°C	—	0.24	2	—	0.26	2	
				0 to +70°C	—	—	3	—	—	3	
α_{VIO}	Average Temperature Coefficient of Input Offset Voltage		—	+25 to +70°C		1.1			1		µV/°C
I_{IO}	Input Offset Current (Note 22)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.1	60	—	0.1	60	pA
				+70°C	—	7	300	—	8	300	
I_{IB}	Input Bias Current (Note 22)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.6	60	—	0.7	60	pA
				+70°C	—	40	600	—	50	600	
V_{ICR}	Common Mode Input Voltage (Note 23)		—	+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				0 to +70°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High Level Output Voltage		V_{ID} = 100mV, R_L = 1MΩ	+25°C	3.2	4.1	—	8	8.9	—	V
				0°C	3	4.1	—	7.8	8.9	—	
				+70°C	3	4.2	—	7.8	8.9	—	
V_{OL}	Low Level Output Voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				0°C	—	0	50	—	0	50	
				+70°C	—	0	50	—	0	50	
A_{VD}	Large Signal Differential Voltage Gain		R_L = 1MΩ (Note 24)	+25°C	50	520	—	50	870	—	V/mV
				0°C	50	700	—	50	1030	—	
				+70°C	50	380	—	50	660	—	
CMRR	Common Mode Rejection Ratio		V_{IC} = V_{ICRmin}	+25°C	65	94	—	65	97	—	dB
				0°C	60	95	—	60	97	—	
				+70°C	60	95	—	60	97	—	
k_{SVR}	Supply Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	70	97	—	70	97	—	dB
				0°C	60	97	—	60	97	—	
				+70°C	60	98	—	60	98	—	
$I_{I(SEL)}$	Input Current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	65	—	—	95	—	nA
I_{DD}	Supply Current		V_O = V_{DD}/2, V_{IC} = V_{DD}/2, No load	+25°C	—	10	17	—	14	23	µA
				0°C	—	12	21	—	18	33	
				+70°C	—	8	14	—	11	20	

Notes: 22. The typical values of input bias current and input offset current below 5pA were calculated.
23. This range also applies to each input individually.
24. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

Electrical Characteristics

Low bias mode

Symbol	Parameter		Conditions	T_A	TLC271I, TLC271AI, TLC271BI V_{DD} = 5V Min	Typ	Max	V_{DD} = 10V Min	Typ.	Max	Unit
V_{IO}	Input Offset Voltage	TLC271I	V_O = 1.4V, V_{IC} = 0V, R_S = 50Ω, R_L = 1MΩ	+25°C	—	1.1	10	—	1.1	10	mV
				-40 to +85°C	—	—	13	—	—	13	
		TLC271AI		+25°C	—	0.9	5	—	0.9	5	
				-40 to +85°C	—	—	7	—	—	7	
		TLC271BI		+25°C	—	0.24	2	—	0.26	2	
				-40 to +85°C	—	—	3.5	—	—	3.5	
α_{VIO}	Average Temperature Coefficient of Input Offset Voltage			+25 to +85°C		1.1			1		µV/°C
I_{IO}	Input Offset Current (Note 25)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.1	60	—	0.1	60	pA
				+85°C	—	24	1000	—	26	1000	
I_{IB}	Input Bias Current (Note 25)		V_O = V_{DD}/2, V_{IC} = V_{DD}/2	+25°C	—	0.6	60	—	0.7	60	pA
				+85°C	—	200	2000	—	220	2000	
V_{ICR}	Common Mode Input Voltage (Note 26)		—	+25°C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	—	V
				-40 to +85°C	-0.2 to 3.5	—	—	-0.2 to 8.5	—	—	V
V_{OH}	High Level Output Voltage		V_{ID} = 100mV, R_L = 1MΩ	+25°C	3	4.1	—	8	8.9	—	V
				-40°C	3	4.1	—	7.8	8.9	—	
				+85°C	3	4.2	—	7.8	8.9	—	
V_{OL}	Low Level Output Voltage		V_{ID} = -100mV, I_{OL} = 0	+25°C	—	0	50	—	0	50	mV
				-40°C	—	0	50	—	0	50	
				+85°C	—	0	50	—	0	50	
A_{VD}	Large Signal Differential Voltage Gain		R_L = 1MΩ (Note 27)	+25°C	50	520	—	50	870	—	V/mV
				-40°C	50	900	—	50	1550	—	
				+85°C	50	330	—	50	585	—	
CMRR	Common Mode Rejection Ratio		V_{IC} = V_{ICRmin}	+25°C	65	94	—	65	97	—	dB
				-40°C	60	95	—	60	97	—	
				+85°C	60	95	—	60	98	—	
k_{SVR}	Supply Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)		V_{DD} = 5V to 10V, V_O = 1.4V	+25°C	70	97	—	70	97	—	dB
				-40°C	60	97	—	60	97	—	
				+85°C	60	98	—	60	98	—	
$I_{I(SEL)}$	Input Current (BIAS SELECT)		$V_{I(SEL)}$ = 0	+25°C	—	65	—	—	95	—	nA
I_{DD}	Supply Current		V_O = V_{DD}/2, V_{IC} = V_{DD}/2, No load	+25°C	—	10	17	—	14	23	µA
				-40°C	—	16	27	—	25	43	
				+85°C	—	17	13	—	10	18	

Notes: 25. The typical values of input bias current and input offset current below 5pA were calculated.
26. This range also applies to each input individually.
27. At V_{DD} = 5 V, V_O = 0.25 V to 2 V; at V_{DD} = 10 V, V_O = 1 V to 6 V.

Electrical Characteristics

Low bias mode: V_{DD} = 5V

Parameter		Conditions		T_A	TLC271C, TLC271AC, TLC271BC			Unit
					Min	Typ	Max	—
SR	Slew Rate at Unity Gain	R_L = 1MΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.03	—	V/µs
				0°C	—	0.04	—	
				+70°C	—	0.03	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	0.03	—	
				0°C	—	0.03	—	
				+70°C	—	0.02	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	68	—	nV/√Hz
B_{OM}	Maximum Output Swing Bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 1MΩ See Figure 92		+25°C	—	5	—	kHz
				0°C	—	6	—	
				+70°C	—	4.5	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	85	—	MHz
				0°C	—	100	—	
				+70°C	—	65	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	34°	—	—
				0°C	—	36°	—	
				+70°C	—	30°	—	

Low bias mode: V_{DD} = 10V

Parameter		Conditions		T_A	TLC271C, TLC271AC, TLC271BC			Unit
					Min	Typ	Max	—
SR	Slew Rate at Unity Gain	R_L = 1MΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.05	—	V/µs
				0°C	—	0.05	—	
				+70°C	—	0.04	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	0.04	—	
				0°C	—	0.05	—	
				+70°C	—	0.04	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	68	—	nV/√Hz
B_{OM}	Maximum Output Swing Bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 1MΩ See Figure 92		+25°C	—	1	—	kHz
				0°C	—	1.3	—	
				+70°C	—	0.9	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	110	—	MHz
				0°C	—	125	—	
				+70°C	—	90	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	38°	—	—
				0°C	—	40°	—	
				+70°C	—	34°	—	

Electrical Characteristics

Low bias mode: V_{DD} = 5V

Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI Min	Typ	Max	Unit
SR	Slew Rate at Unity Gain	R_L = 1MΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.03	—	V/µs
				-40°C	—	0.04	—	
				+85°C	—	0.03	—	
			$V_{I(PP)}$ = 2.5V	+25°C	—	0.03	—	
				-40°C	—	0.04	—	
				+85°C	—	0.02	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	68	—	nV/√Hz
B_{OM}	Maximum Output Swing Bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 1MΩ See Figure 92		+25°C	—	5	—	kHz
				-40°C	—	7	—	
				+85°C	—	4	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	85	—	MHz
				-40°C	—	130	—	
				+85°C	—	55	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	34°	—	—
				-40°C	—	38°	—	
				+85°C	—	28°	—	

Low bias mode: V_{DD} = 10V

Parameter		Conditions		T_A	TLC271I, TLC271AI, TLC271BI Min	Typ	Max	Unit
SR	Slew Rate at Unity Gain	R_L = 1MΩ, C_L = 20pF See Figure 92	$V_{I(PP)}$ = 1V	+25°C	—	0.05	—	V/µs
				-40°C	—	0.06	—	
				+85°C	—	0.03	—	
			$V_{I(PP)}$ = 5.5V	+25°C	—	0.04	—	
				-40°C	—	0.05	—	
				+85°C	—	0.03	—	
V_n	Equivalent Input Noise Voltage	F = 1kHz, R_S = 20Ω See Figure 93		+25°C	—	68	—	nV/√Hz
B_{OM}	Maximum Output Swing Bandwidth	V_O = V_{OH}, C_L = 20pF, R_L = 1MΩ See Figure 92		+25°C	—	1	—	kHz
				-40°C	—	1.4	—	
				+85°C	—	0.8	—	
B_1	Unity Gain Bandwidth	V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	110	—	MHz
				-400°C	—	155	—	
				+85°C	—	80	—	
ϕ_m	Phase Margin	F = B_1, V_I = 10mV, C_L = 20pF See Figure 94		+25°C	—	38°	—	—
				-40°C	—	42°	—	
				+85°C	—	32°	—	

New Product

Typical Performance Characteristics   Table Index of Graphs

			Figure		
			High Bias Mode	Medium Bias Mode	Low Bias Mode
V_{IO}	Input Offset Voltage	Distribution	1,2	31,32	61,62
V_{OH}	High Level Output Voltage	vs. High Level Output Current	3,4	33,34	63,64
		vs. Supply Voltage	5	35	65
		vs. Free Air Temperature	6	36	66
V_{OL}	Low Level Output Voltage	vs. Common Mode Input Voltage	7,8	37,38	67,68
		vs. Differential Input Voltage	9	39	69
		vs. Free Air Temperature	10	40	70
		vs. Low Level Output Current	11,12	41,42	71,72
A_{VD}	Large Signal Differential Voltage Gain	vs. Supply Voltage	13	43	73
		vs. Free Air Temperature	14	44	74
I_{IB}	Input Bias Current	vs. Free Air Temperature	15	45	75
I_{IO}	Input Offset Current	vs. Free Air Temperature	15	45	75
V_{IC}	Common Mode Input Voltage	vs. Supply Voltage	16	46	76
I_{DD}	Supply Current	vs. Supply Voltage	17	47	77
		vs. Free Air Temperature	18	48	78
SR	Slew Rate	vs. Supply Voltage	19	49	79
		vs. Free Air Temperature	20	50	80
I_{sel}	Bias Select Current	vs. Supply Voltage	21	51	81
$V_{O(PP)}$	Maximum Peak to Peak Output Voltage	vs. Frequency	22	52	82
B_1	Unity Gain Bandwidth	vs. Free Air Temperature	23	53	83
		vs. Supply Voltage	24	54	84
A_{VD}	Large Signal Differential Voltage Gain	vs. Frequency	29,30	59,60	89,90
ϕ_m	Phase Margin	vs. Supply Voltage	25	55	85
		vs. Free Air Temperature	26	56	86
		vs. Capacitive Load	27	57	87
V_n	Equivalent Input Noise Voltage	vs. Frequency	28	58	88
ϕ_{shift}	Phase Shift	vs. Frequency	29,30	59,60	89,90

Typical Performance Characteristics High Bias Mode

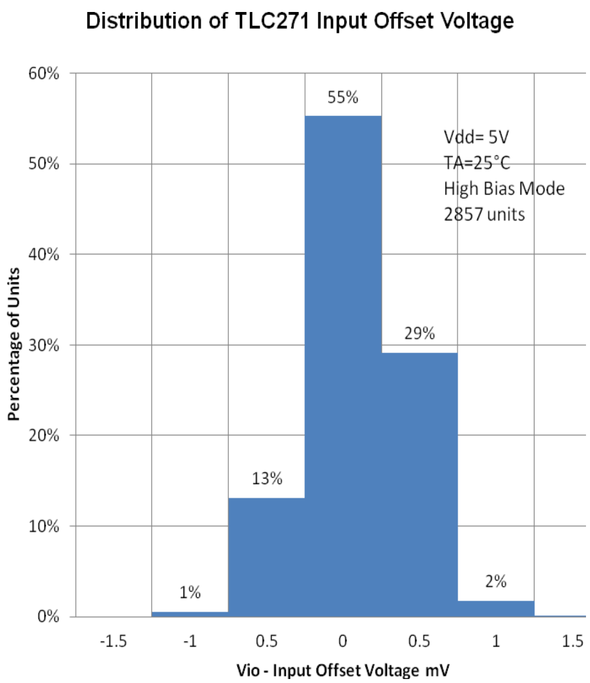


Figure 1

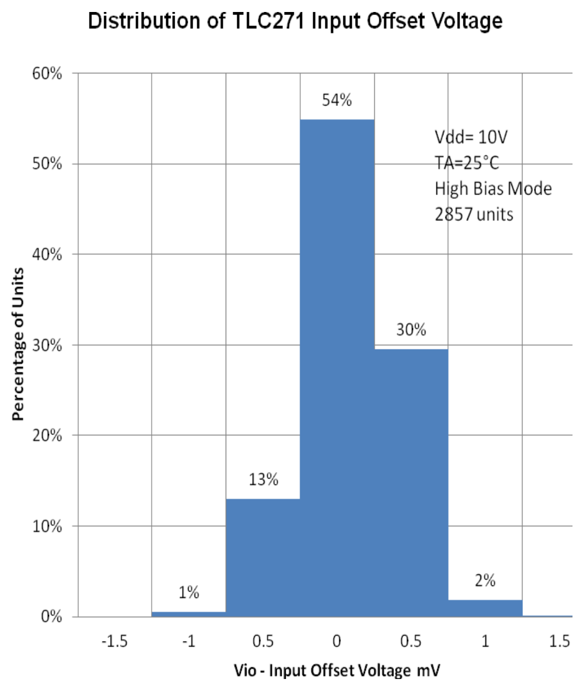


Figure 2

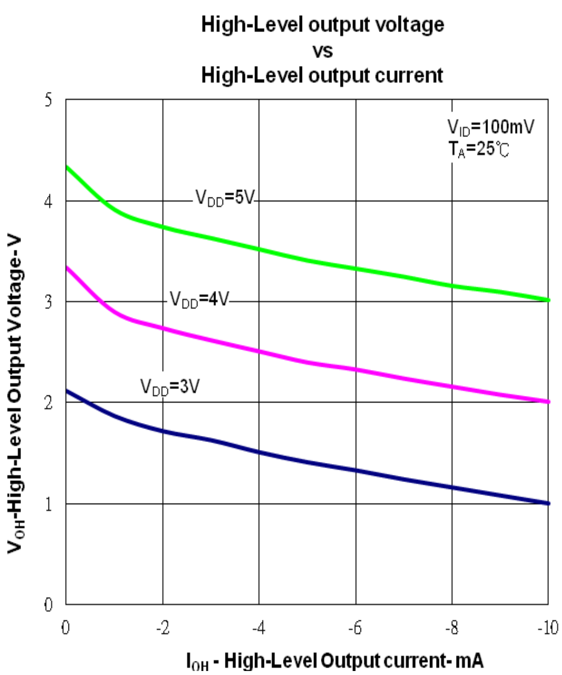


Figure 3

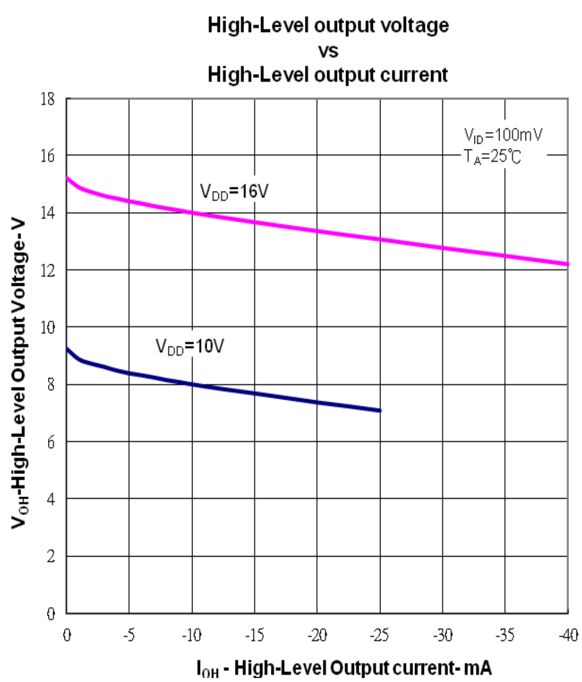


Figure 4

New Product

Typical Performance Characteristics High Bias Mode

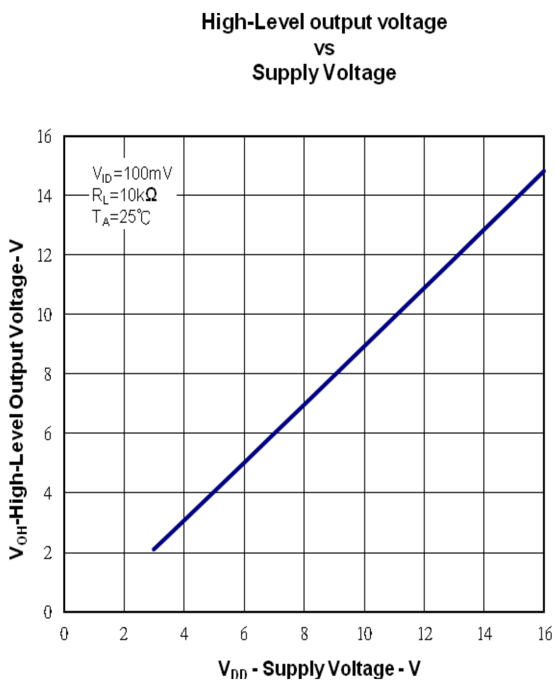


Figure 5

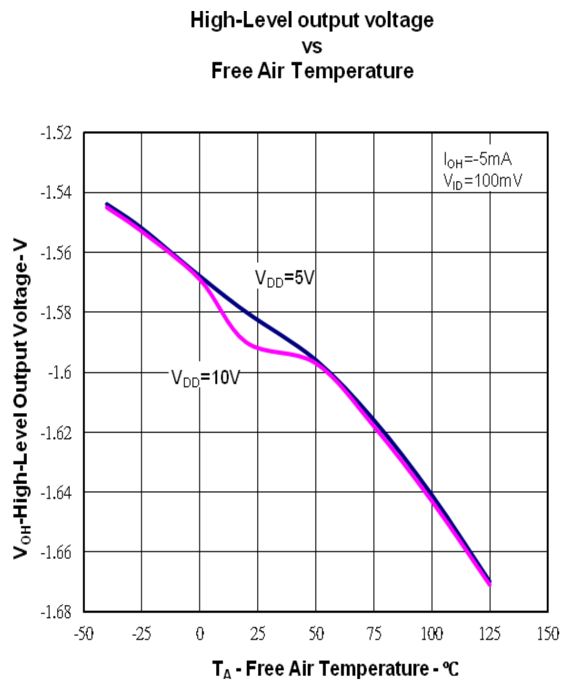


Figure 6

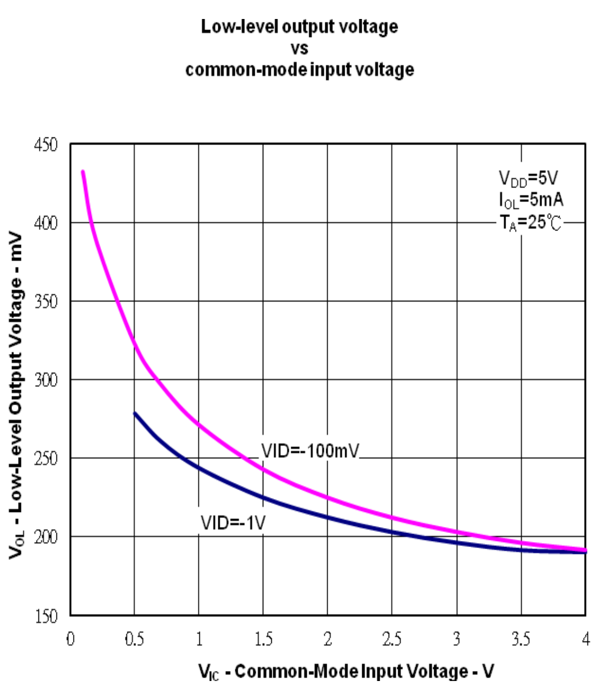


Figure 7

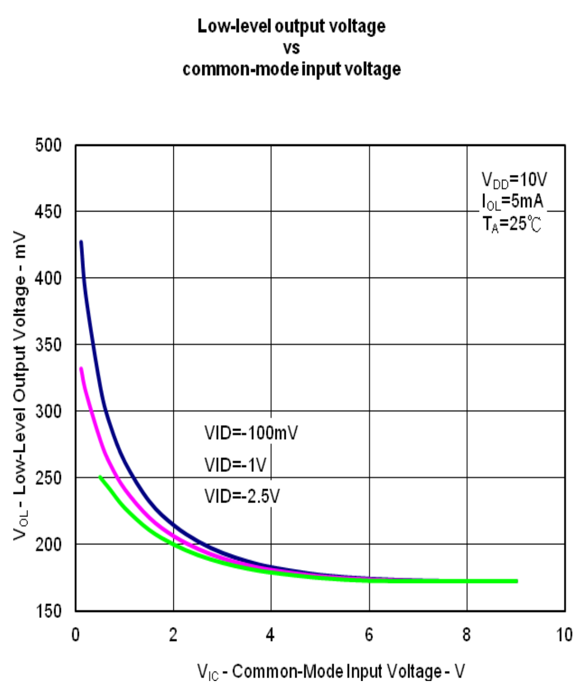


Figure 8

Typical Performance Characteristics High Bias Mode

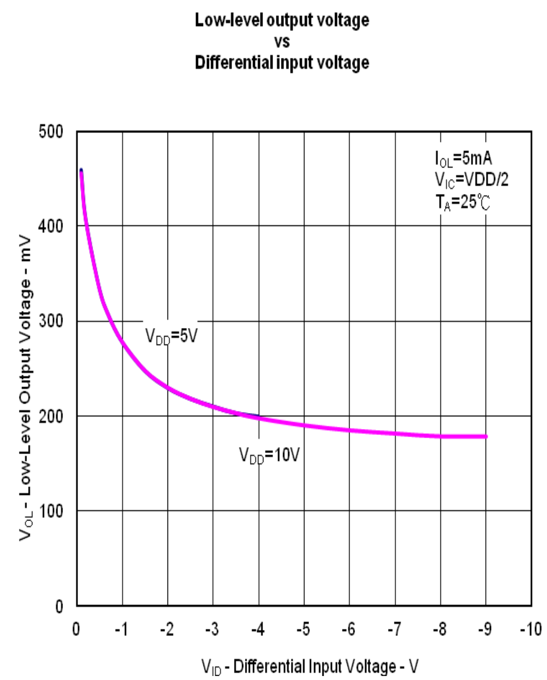


Figure 9

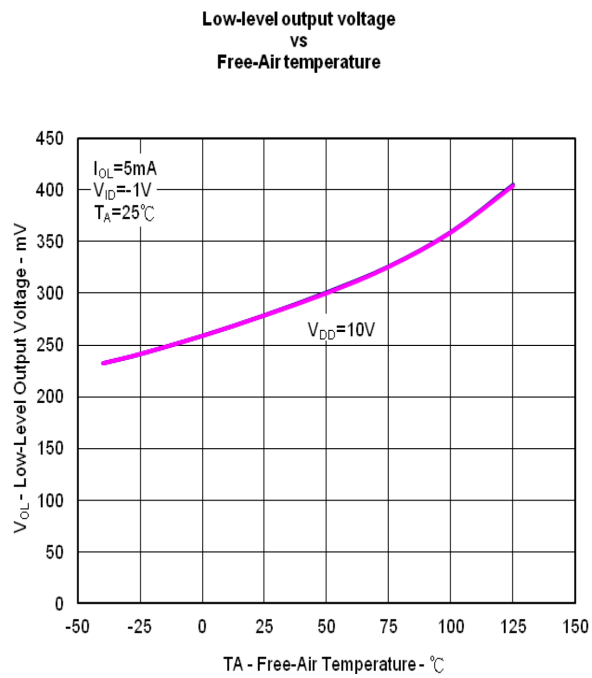


Figure 10

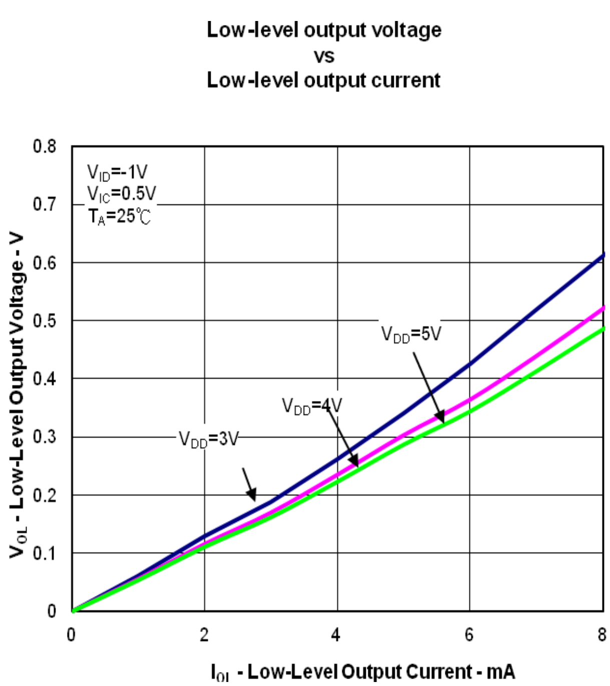


Figure 11

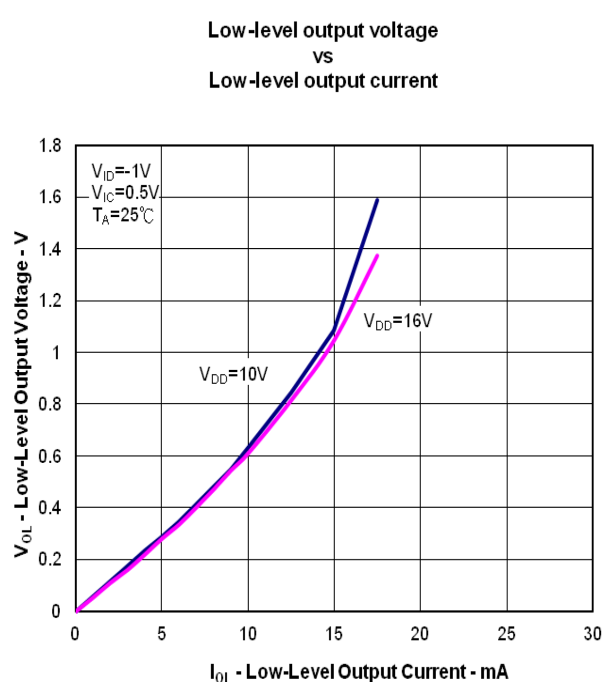


Figure 12

Typical Performance Characteristics High Bias Mode

Large-Signal Differential Voltage Amplification
vs
Supply Voltage

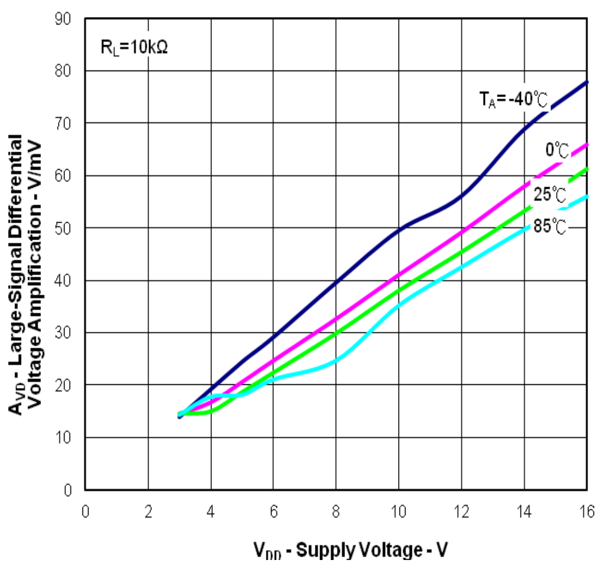


Figure 13

Large-Signal Differential Voltage Amplification
vs
Free-Air Temperature

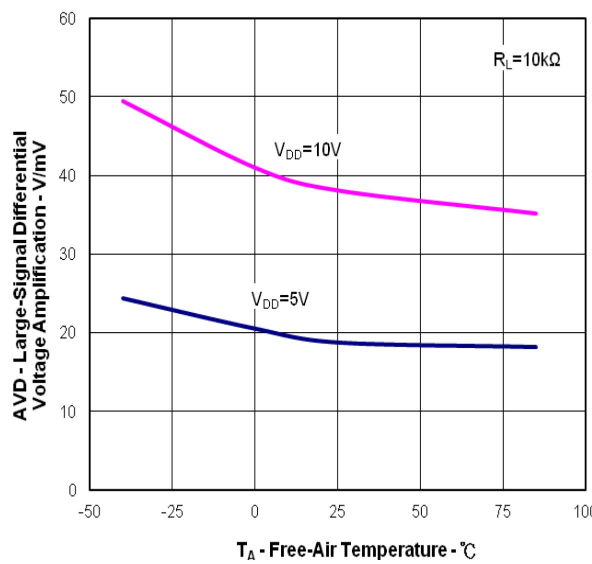


Figure 14

Input Bias Current and Input Offset Current
vs
Free-Air Temperature

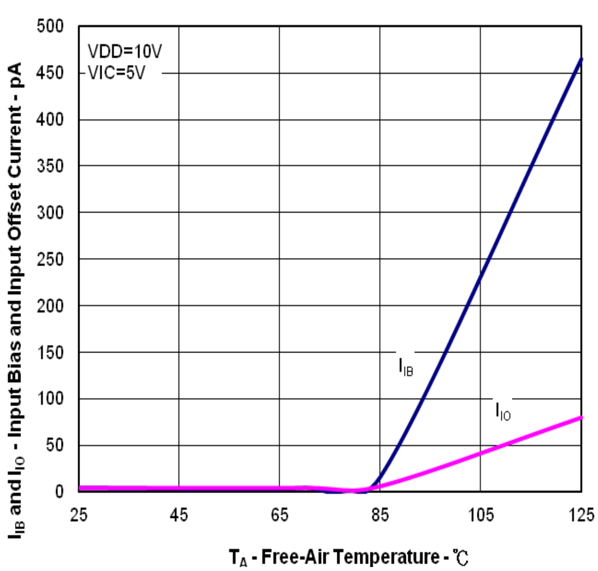


Figure 15

Common-mode input voltage
(positive limit)
vs
Supply Voltage

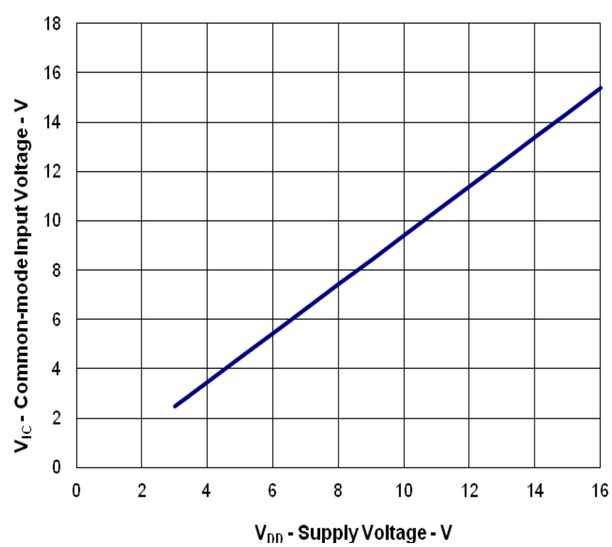
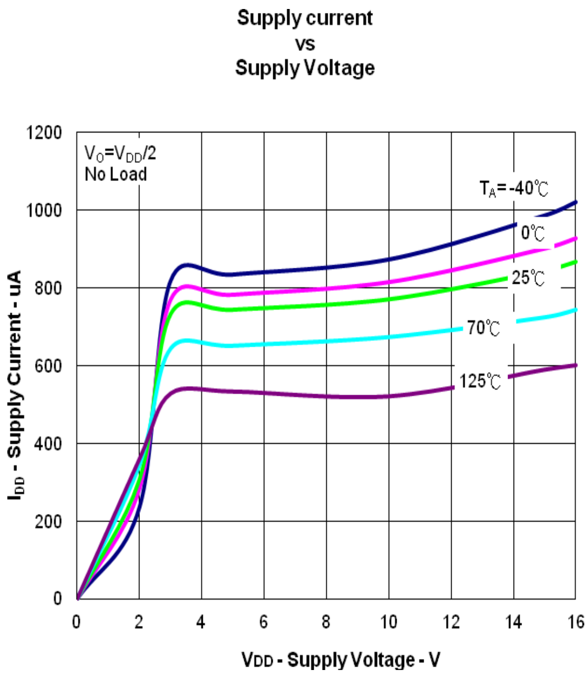


Figure 16

New Product

Typical Performance Characteristics High Bias Mode



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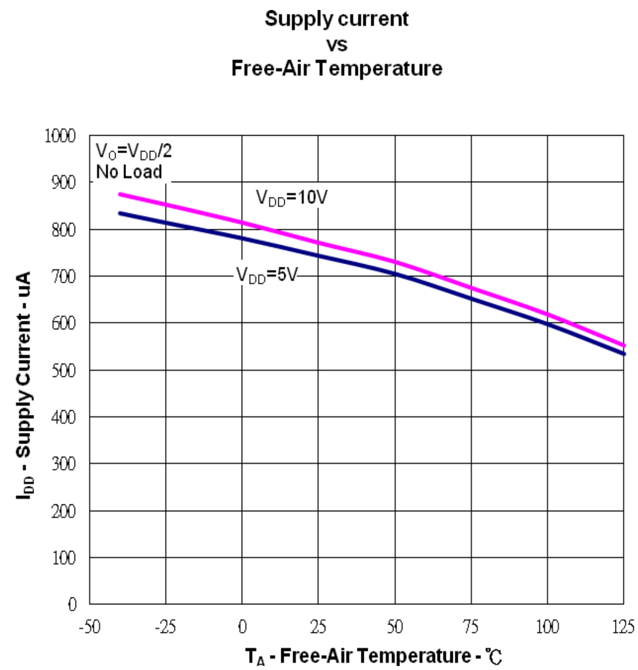

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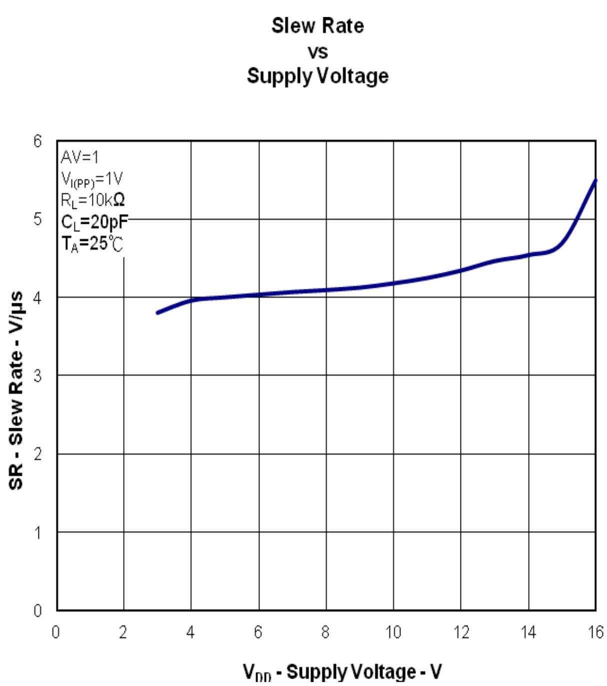


Figure 19

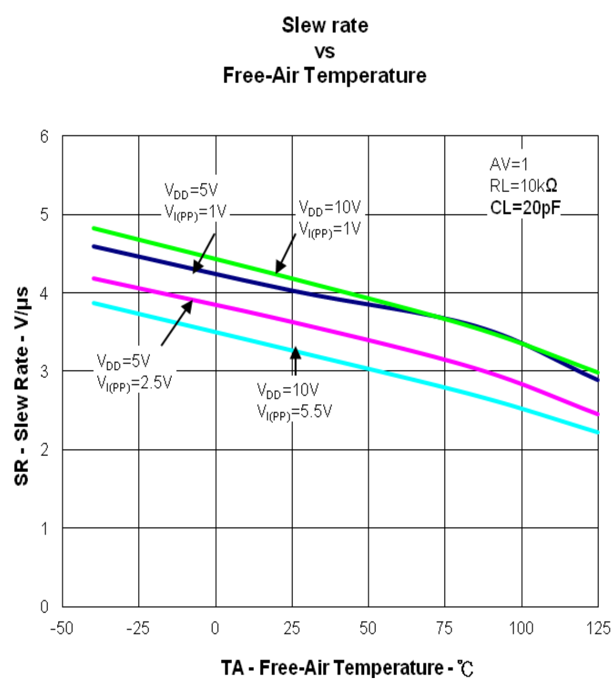


Figure 20

Typical Performance Characteristics High Bias Mode

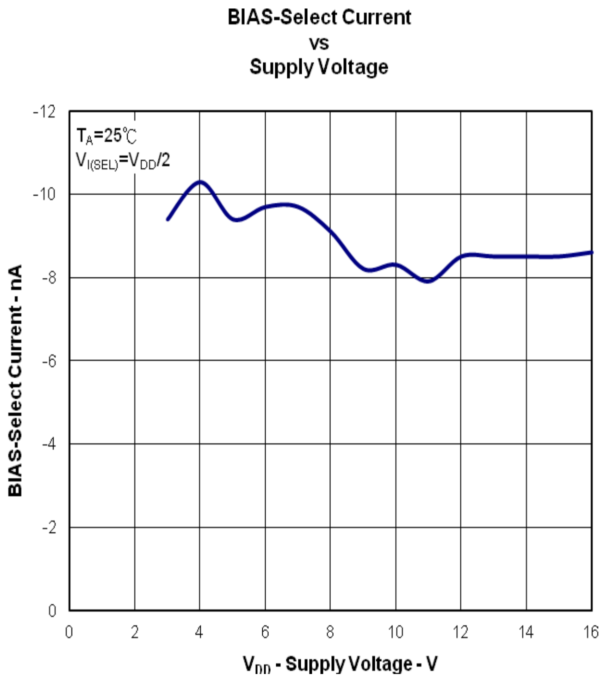


Figure 21

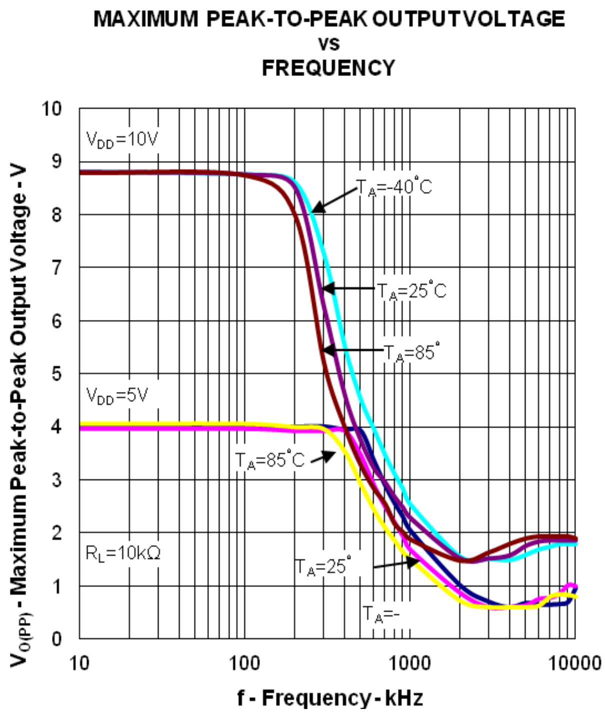
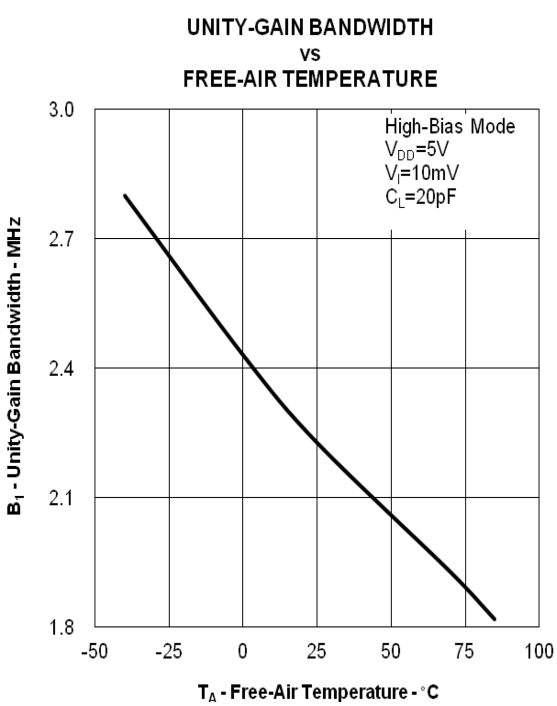


Figure 22



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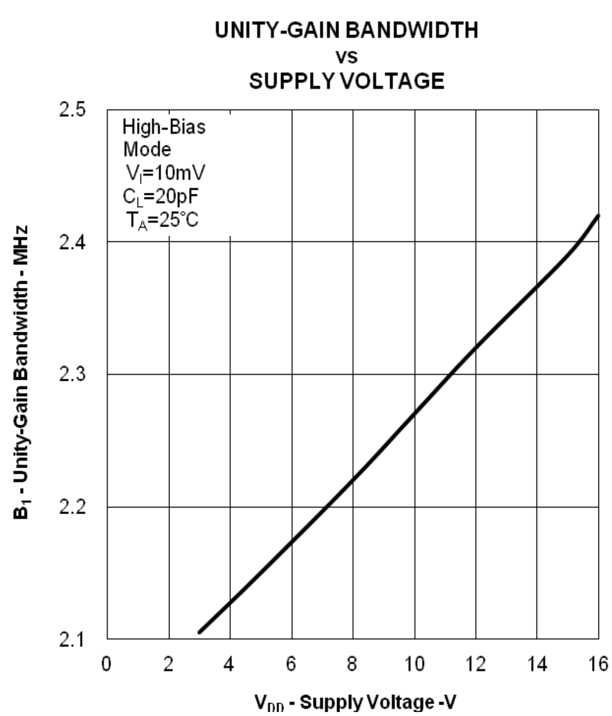


Figure 24

New Product

Typical Performance Characteristics High Bias Mode

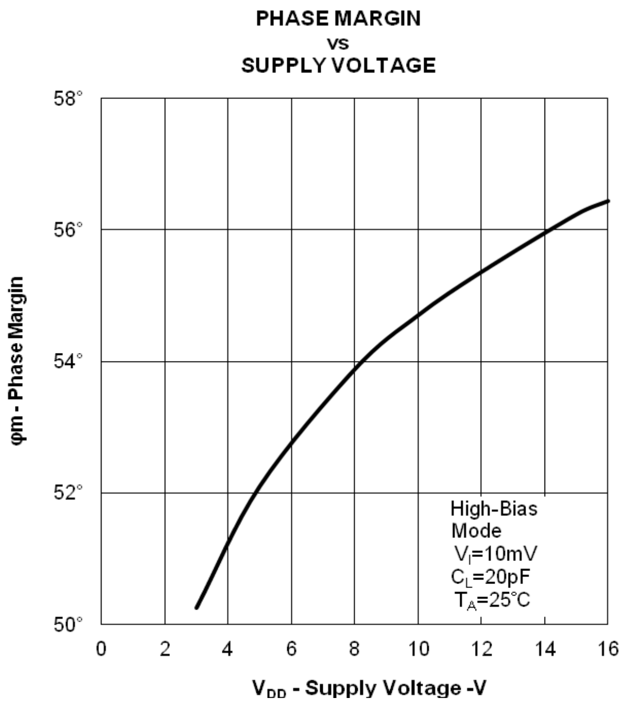


Figure 25

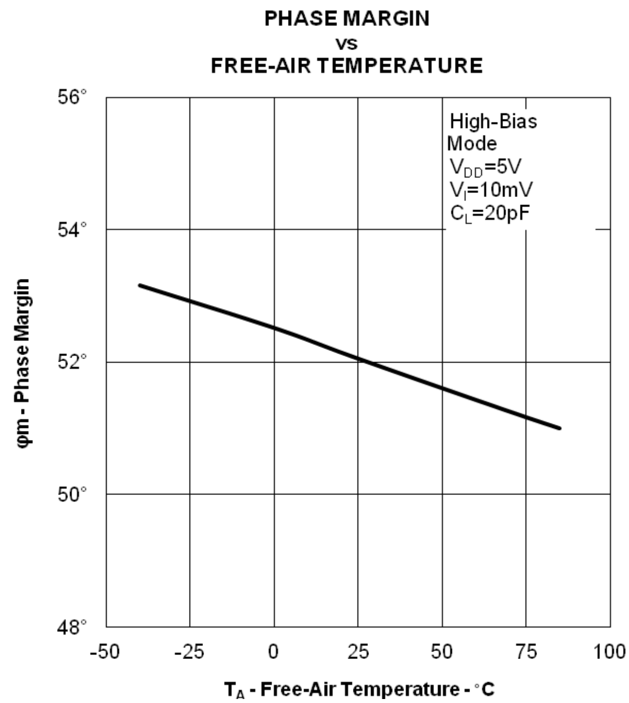
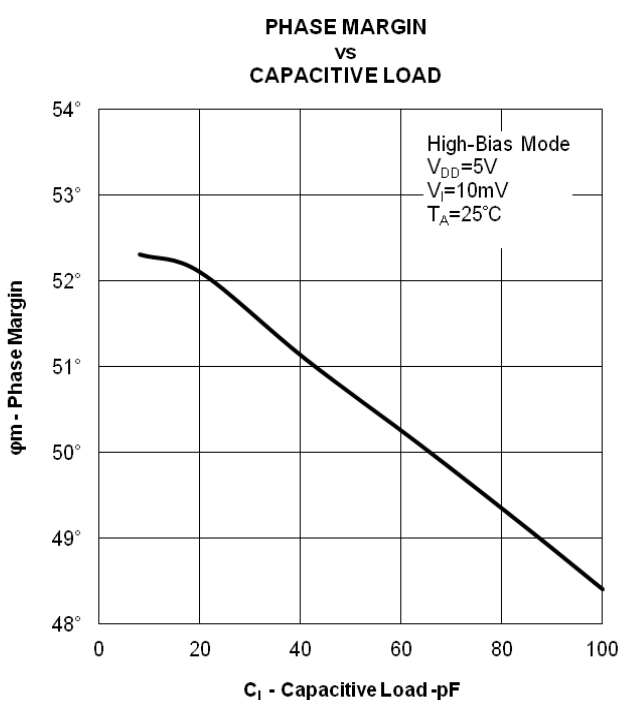


Figure 26



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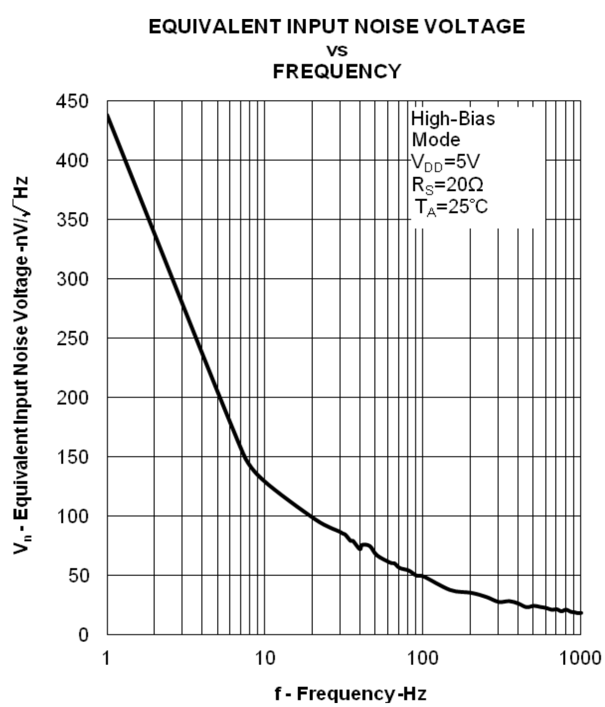


Figure 28

Typical Performance Characteristics High Bias Mode

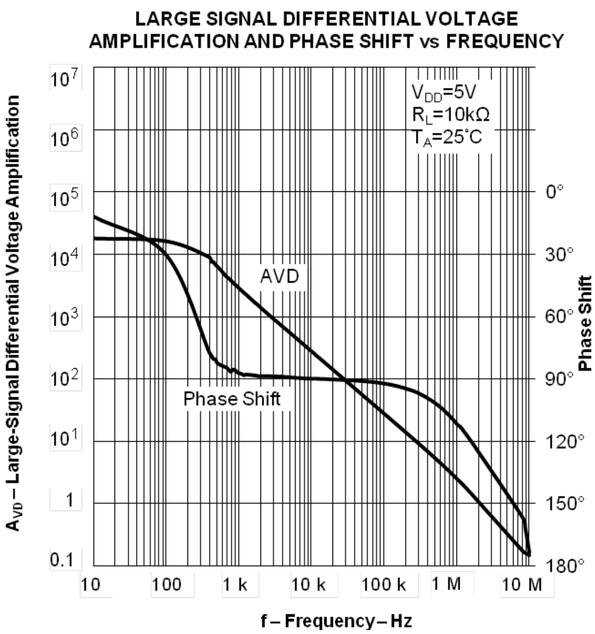


Figure 29

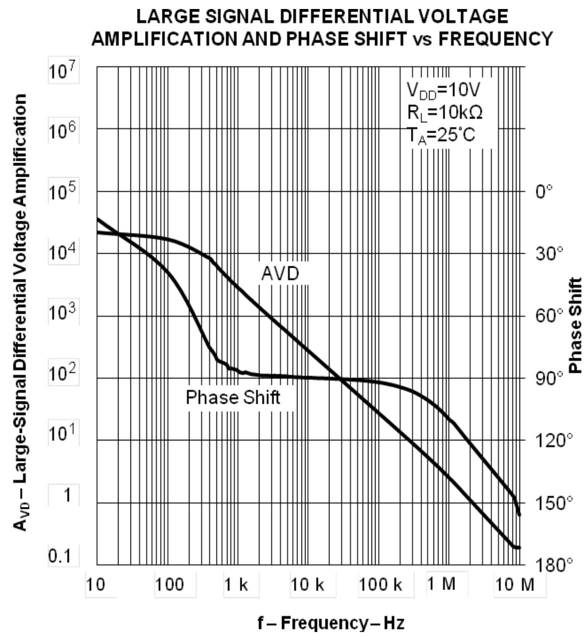


Figure 30

Typical Performance Characteristics Medium Bias Mode

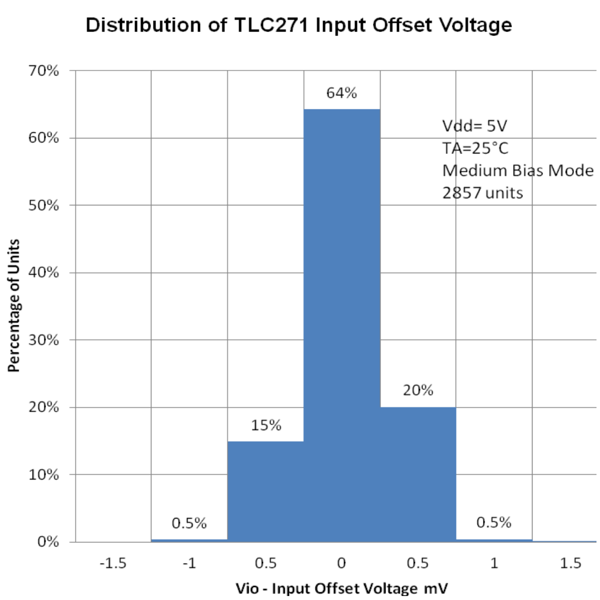


Figure 31

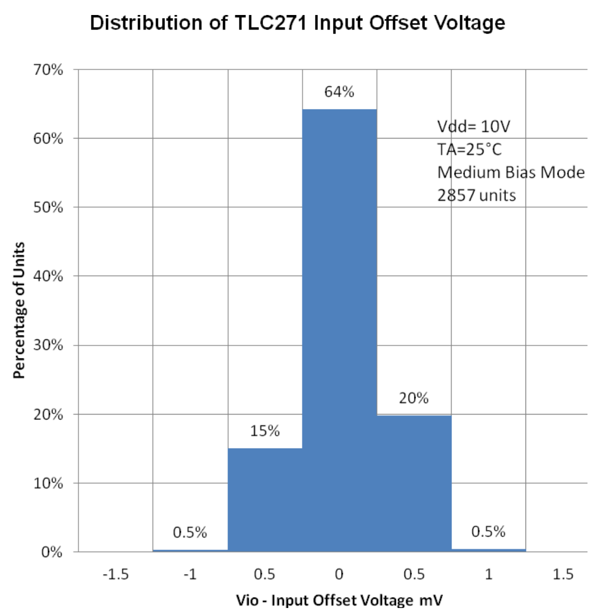


Figure 32

New Product

Typical Performance Characteristics Medium Bias Mode

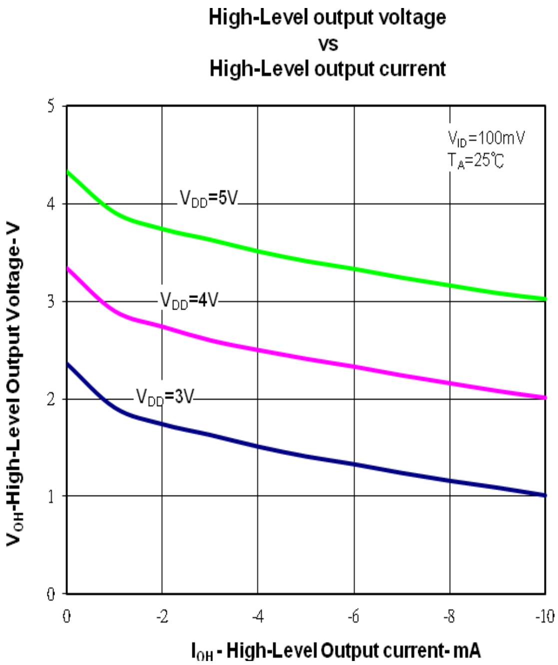


Figure 33

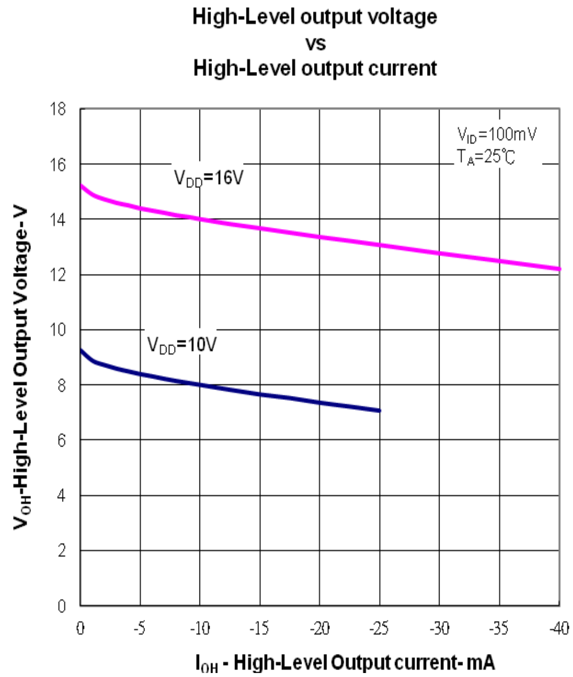
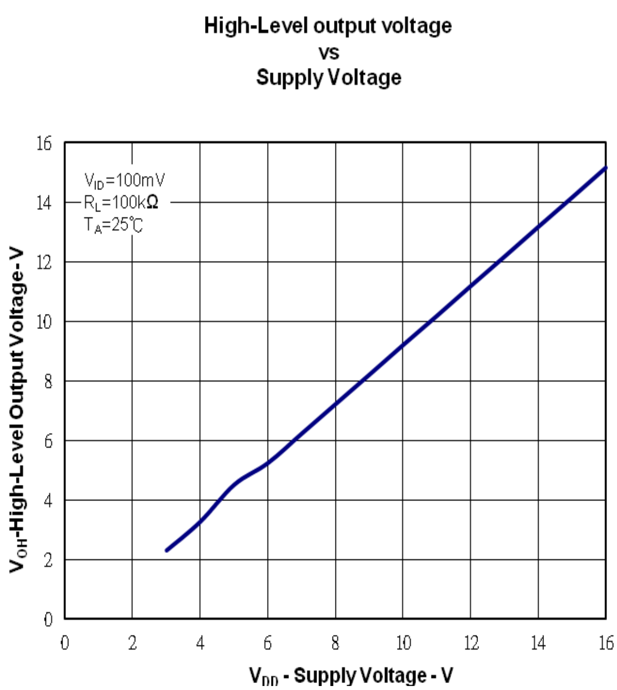


Figure 34



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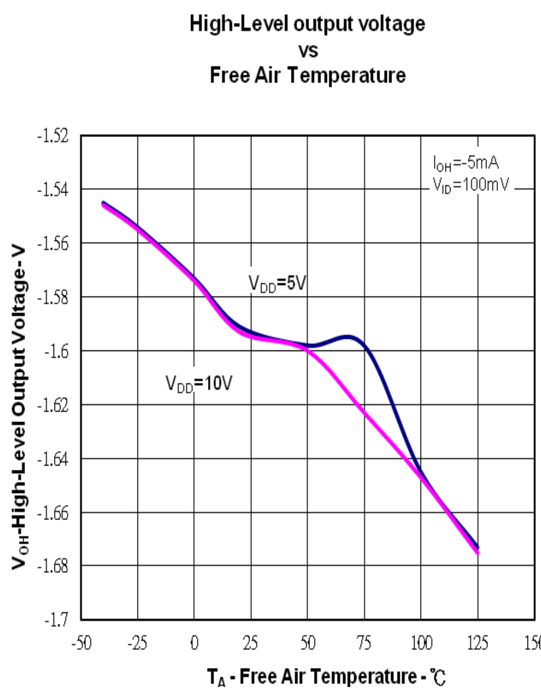
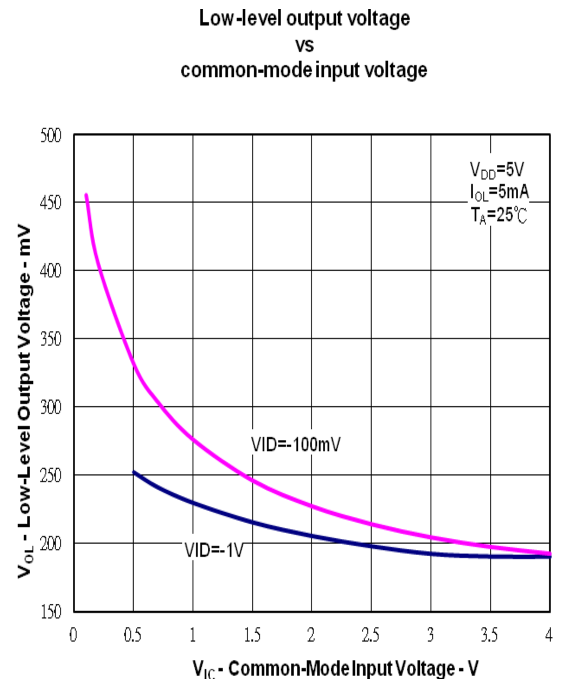


Figure 36

Typical Performance Characteristics Medium Bias Mode



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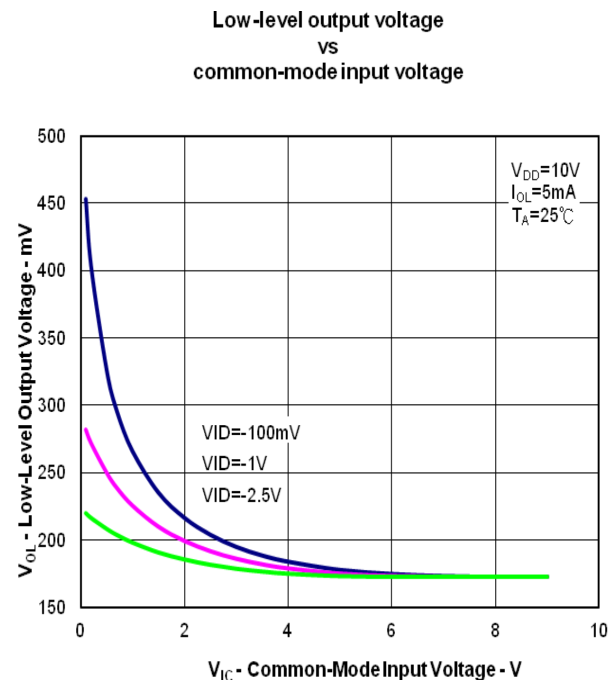

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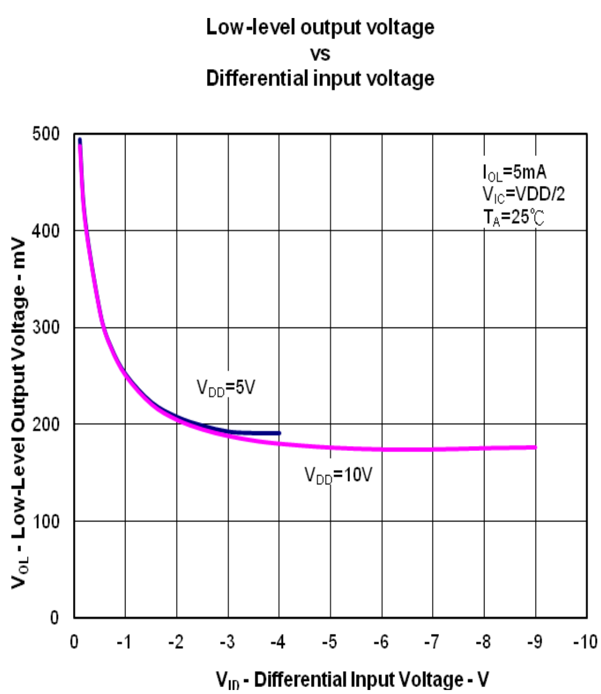

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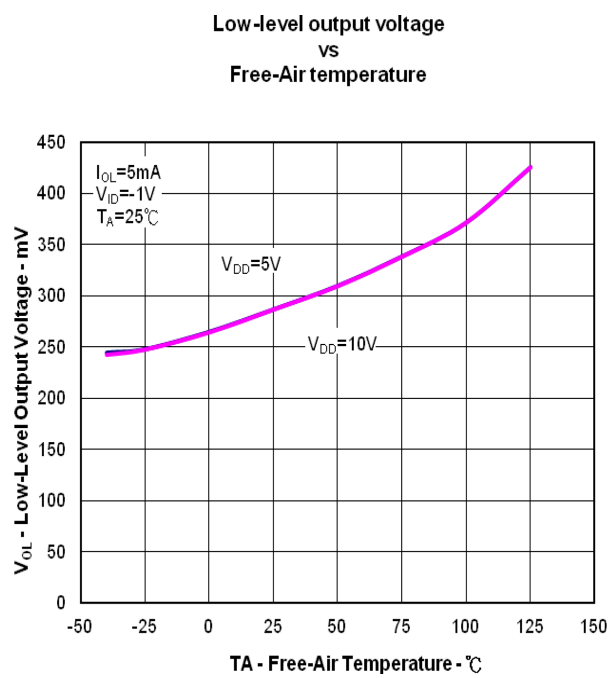


Figure 40

New Product

Typical Performance Characteristics Medium Bias Mode

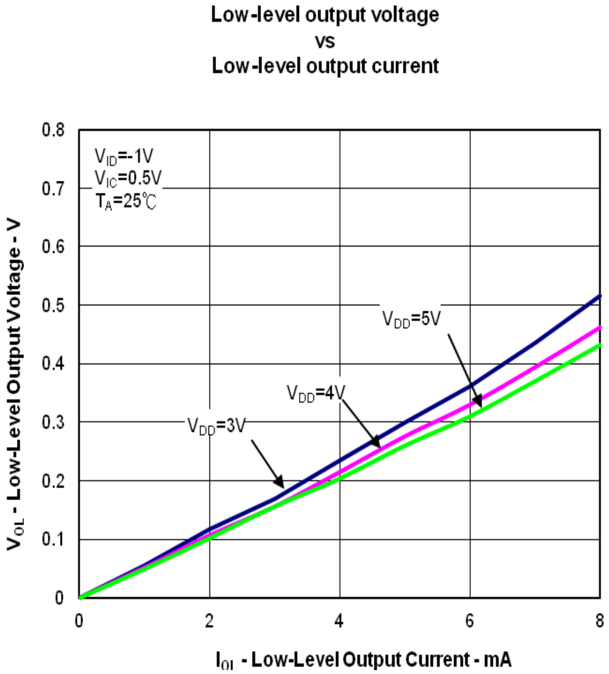


Figure 41

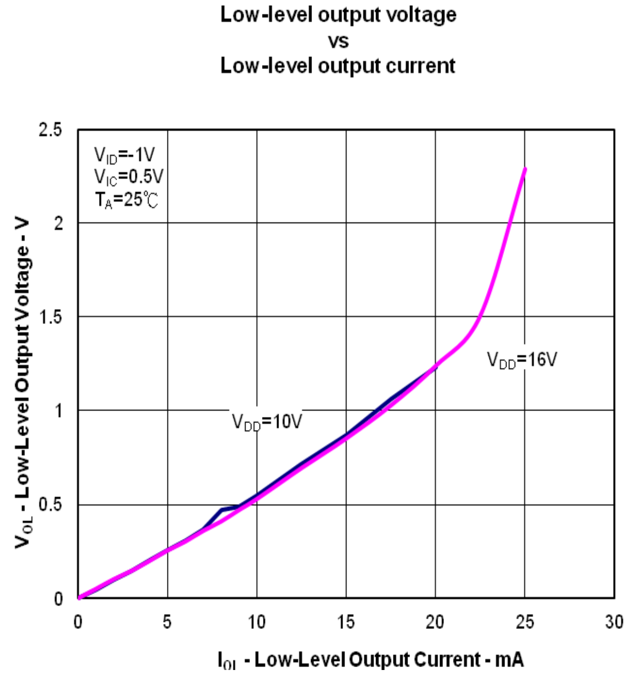
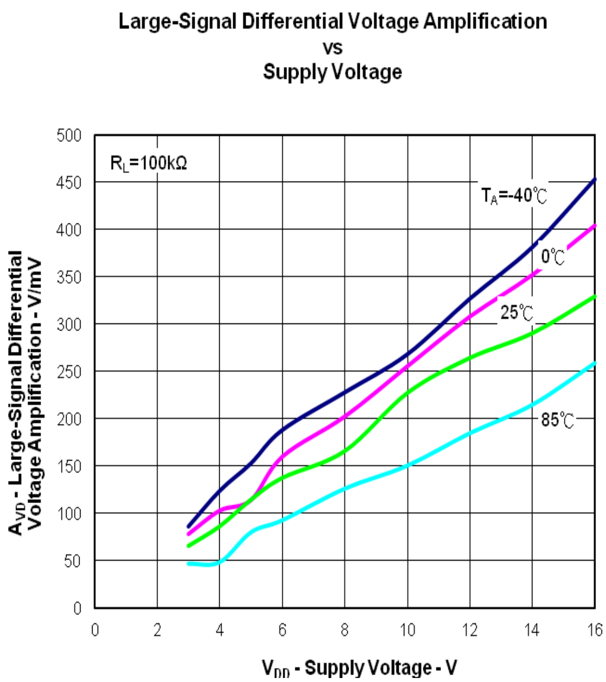


Figure 42



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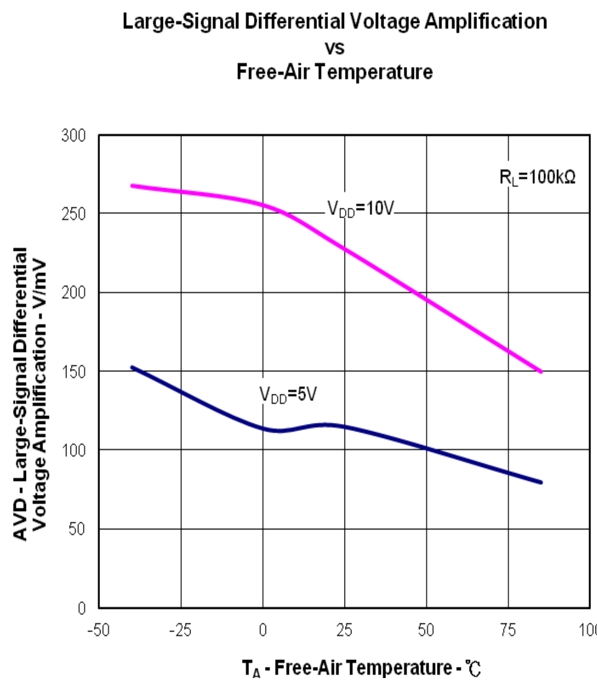
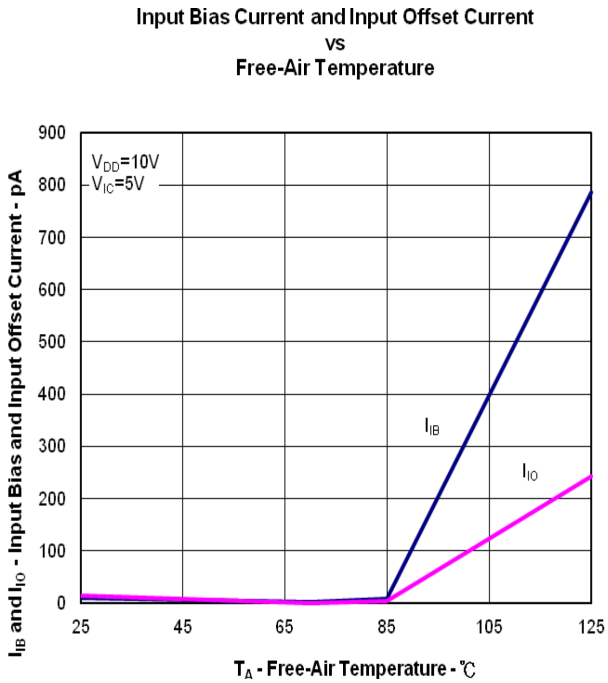


Figure 44

Typical Performance Characteristics Medium Bias Mode



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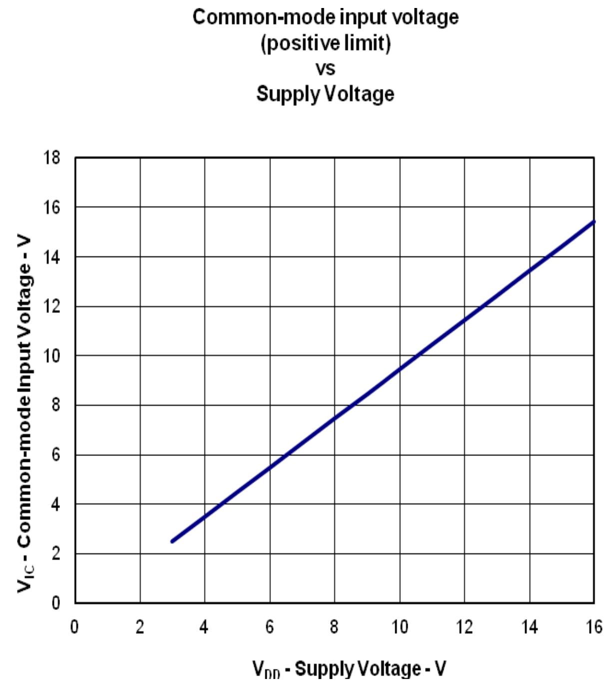

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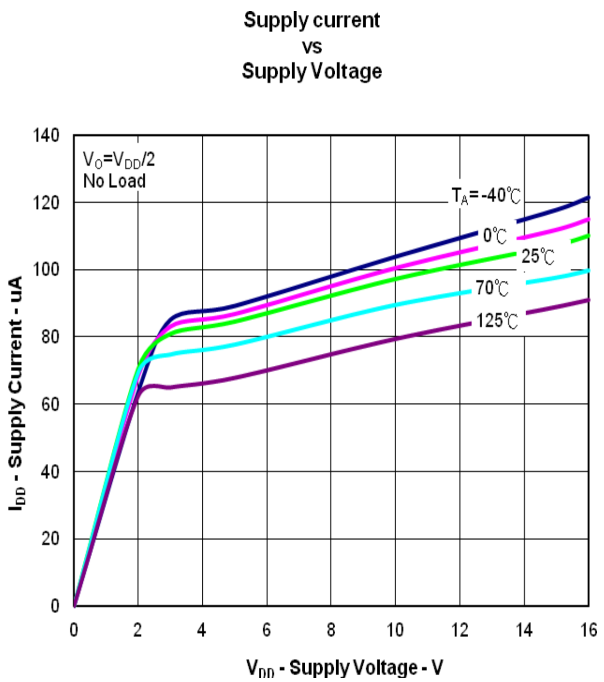

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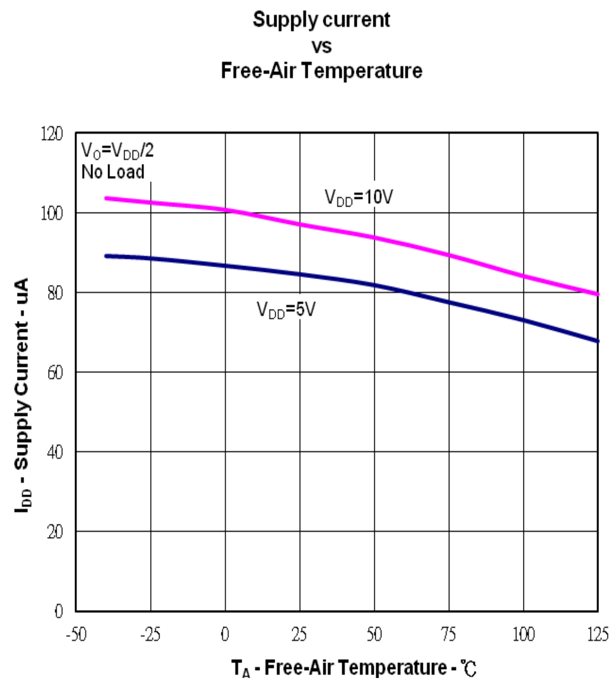
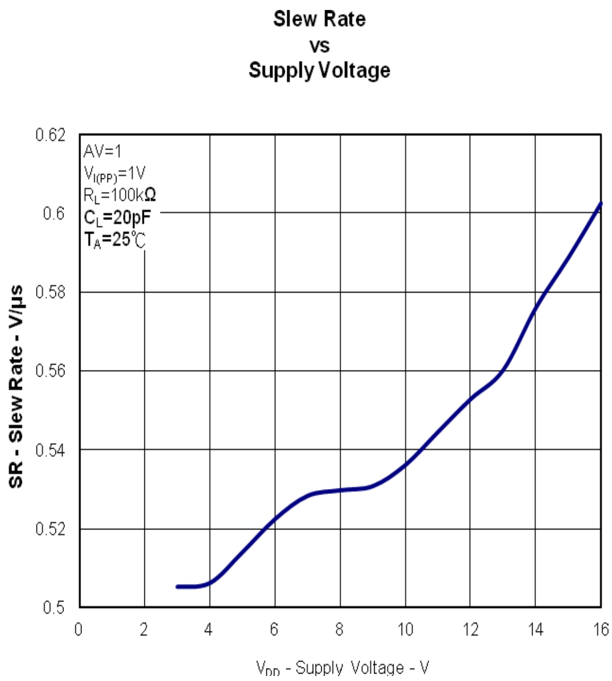


Figure 48

Typical Performance Characteristics Medium Bias Mode



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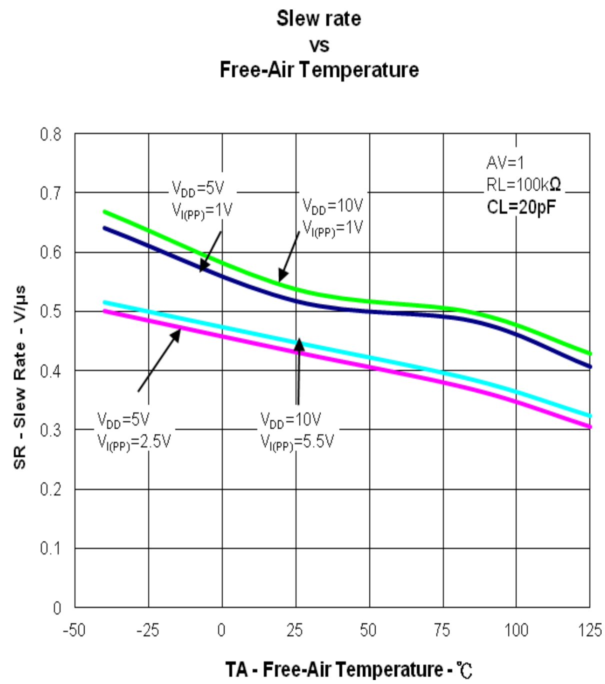


Figure 50

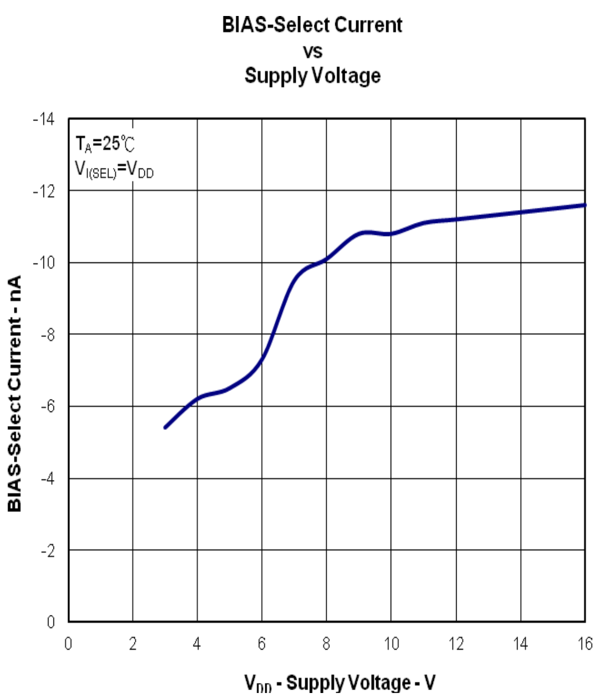


Figure 51

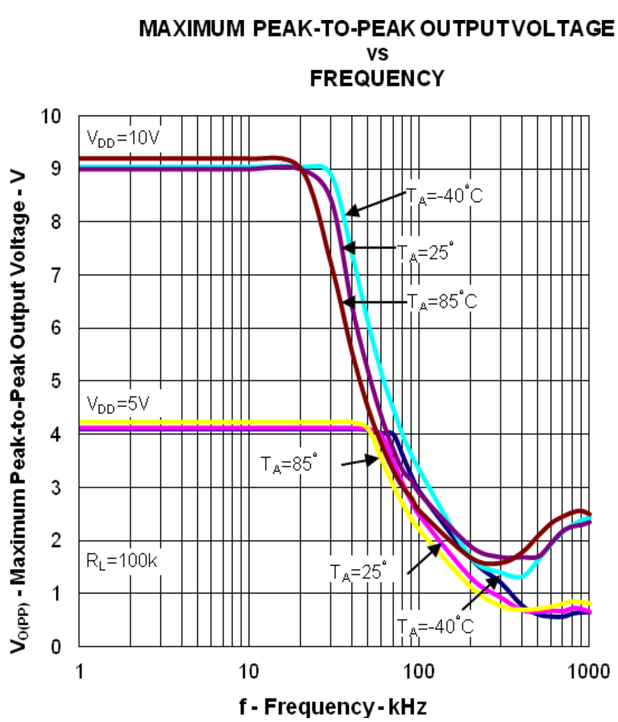


Figure 52

New Product

Typical Performance Characteristics Medium Bias Mode

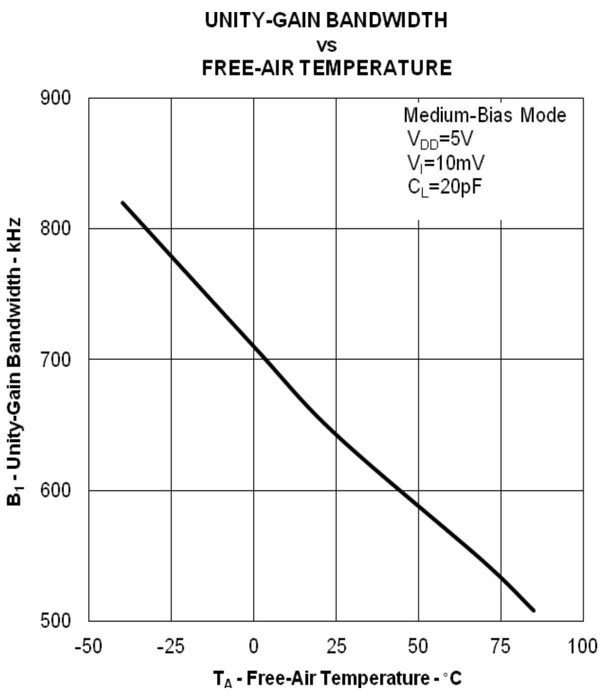


Figure 53

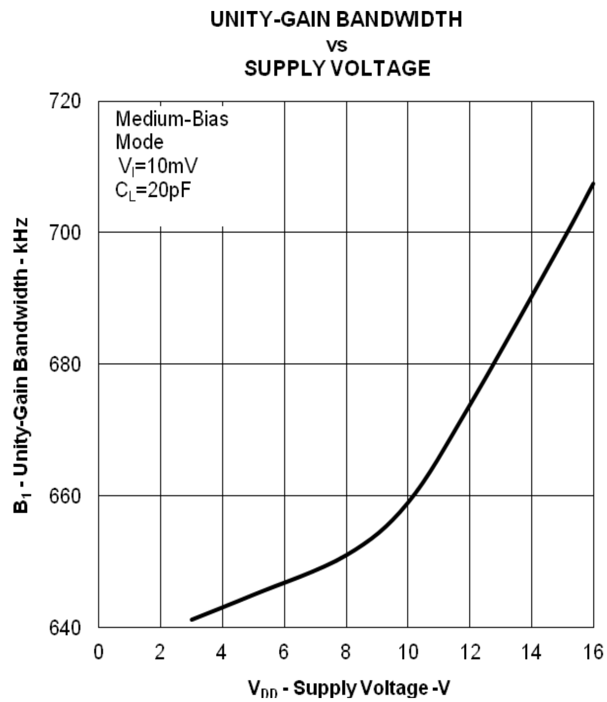


Figure 54

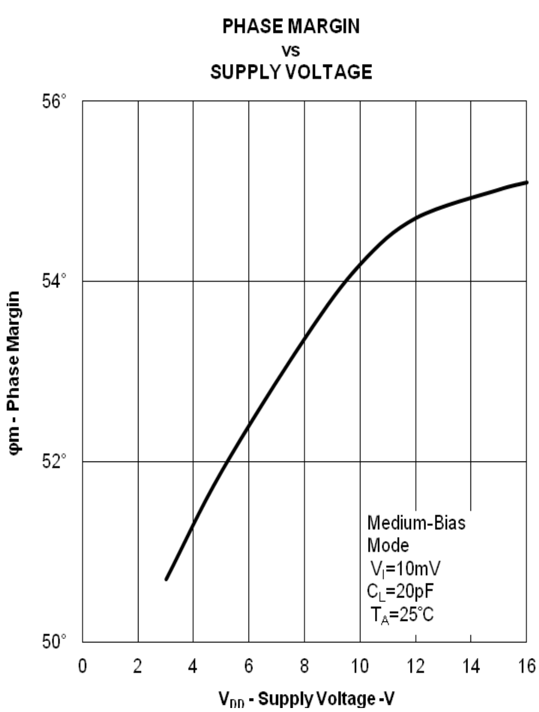


Figure 55

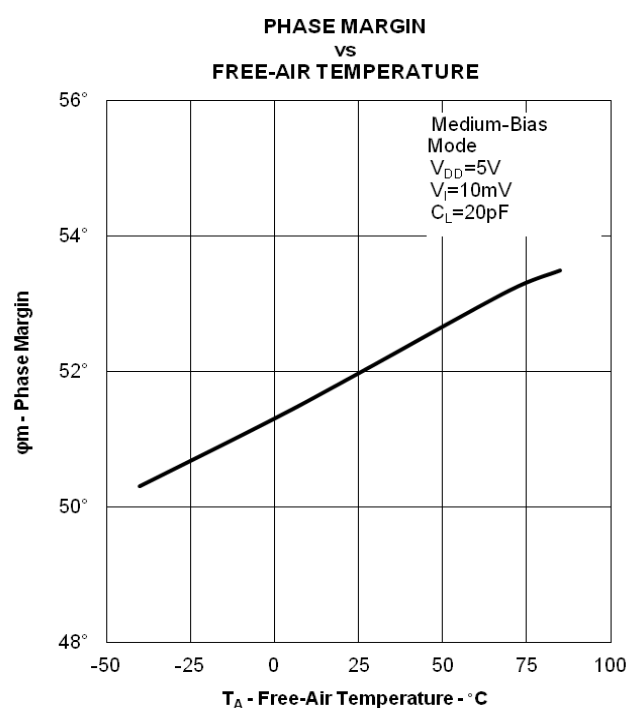


Figure 56

New Product

Typical Performance Characteristics Medium Bias Mode

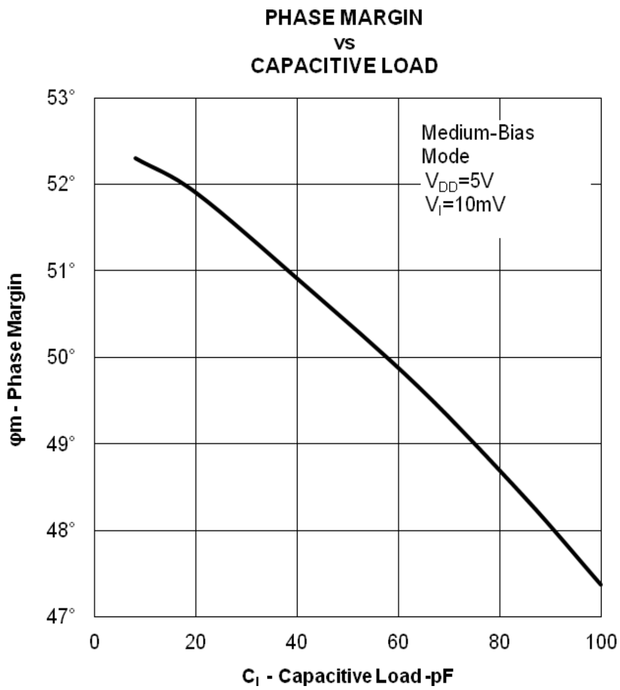
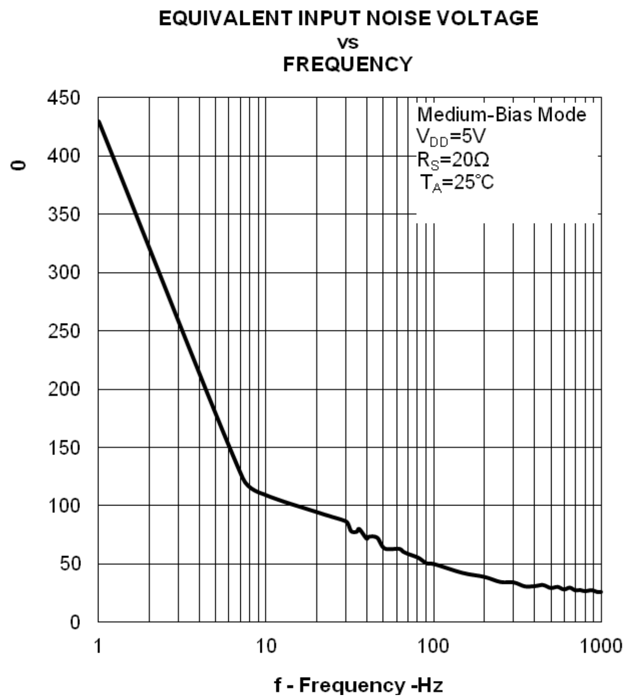


Figure 57



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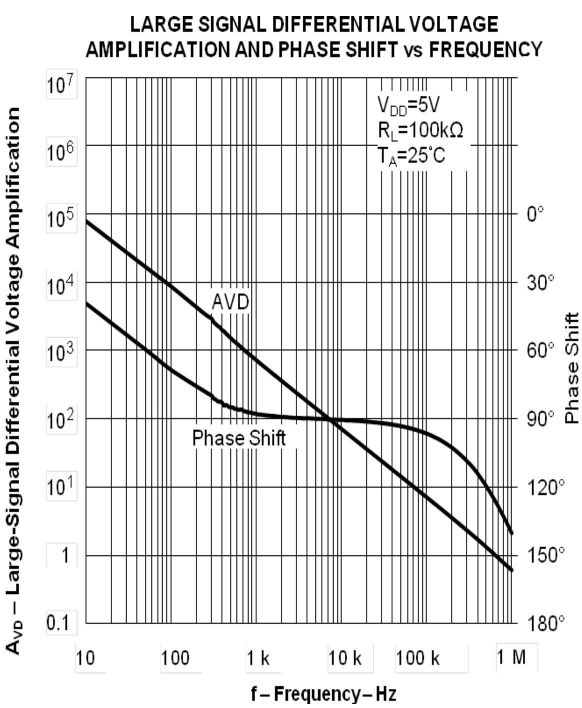


Figure 59

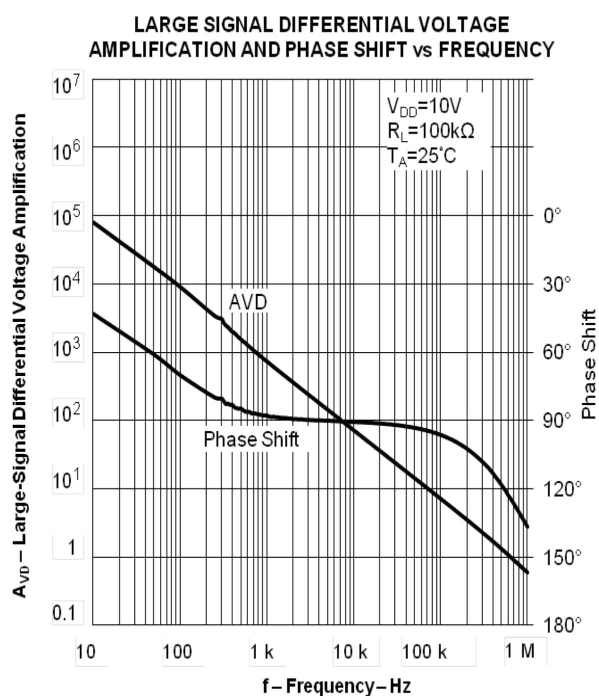


Figure 60

Typical Performance Characteristics Low Bias Mode

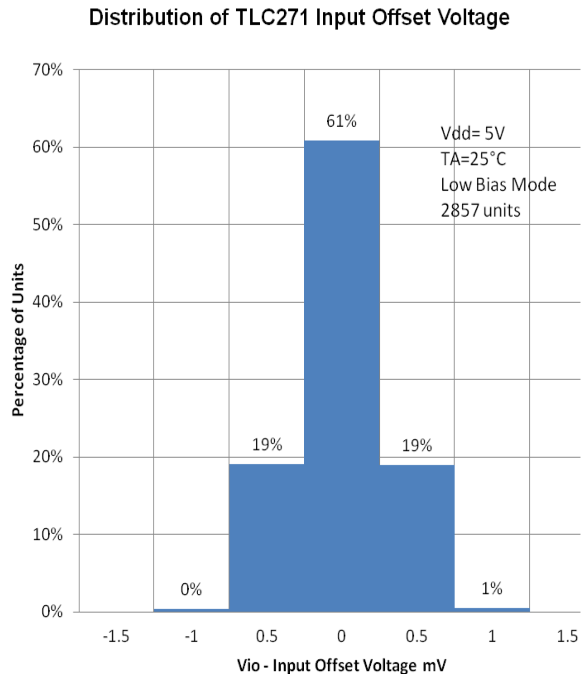


Figure 61

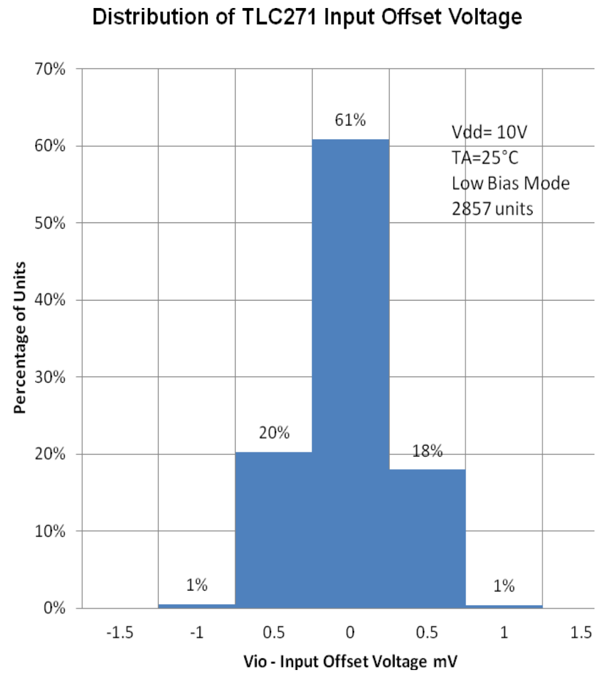


Figure 62

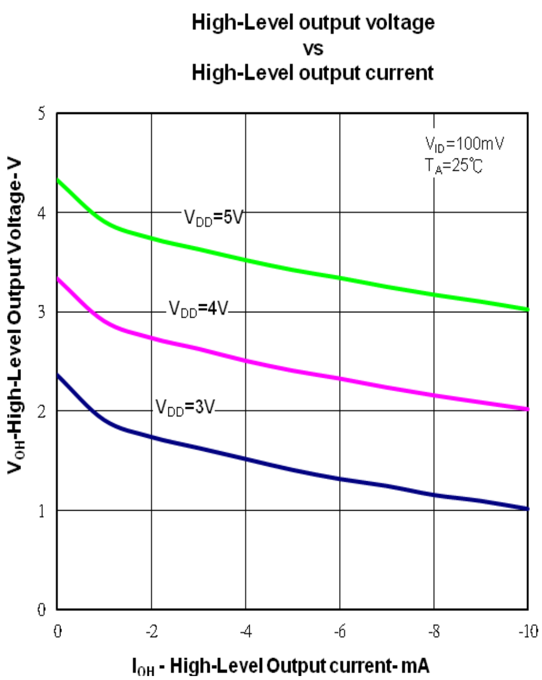


Figure 63

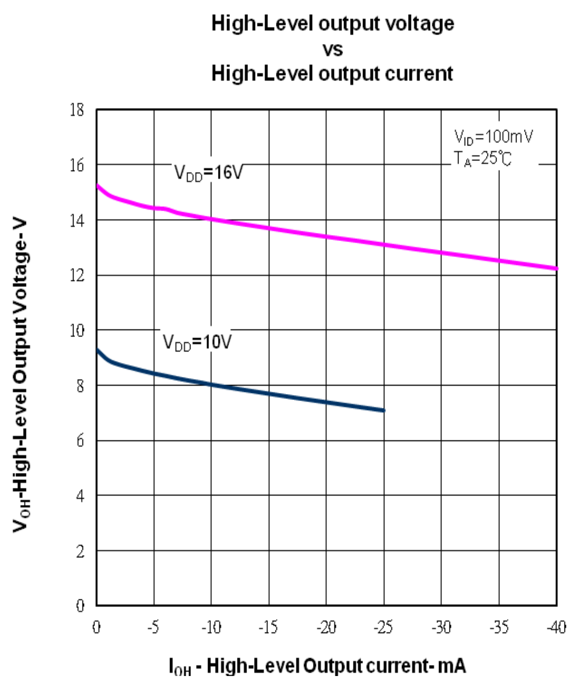


Figure 64

Typical Performance Characteristics Low Bias Mode

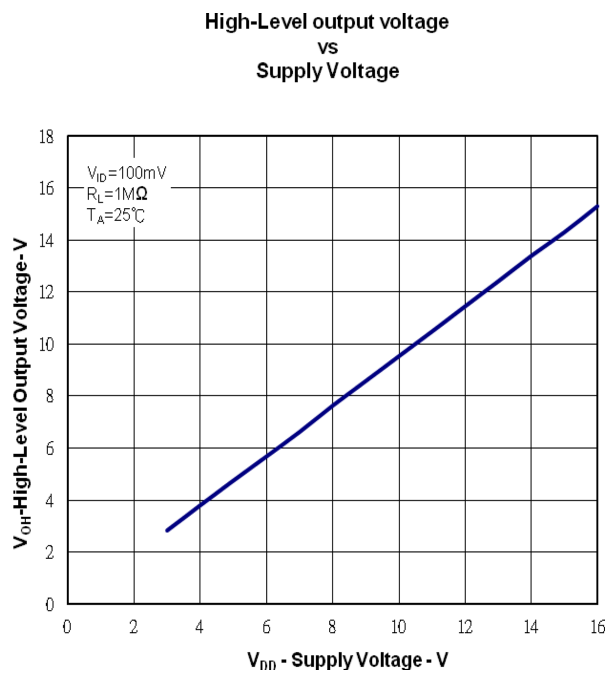


Figure 65

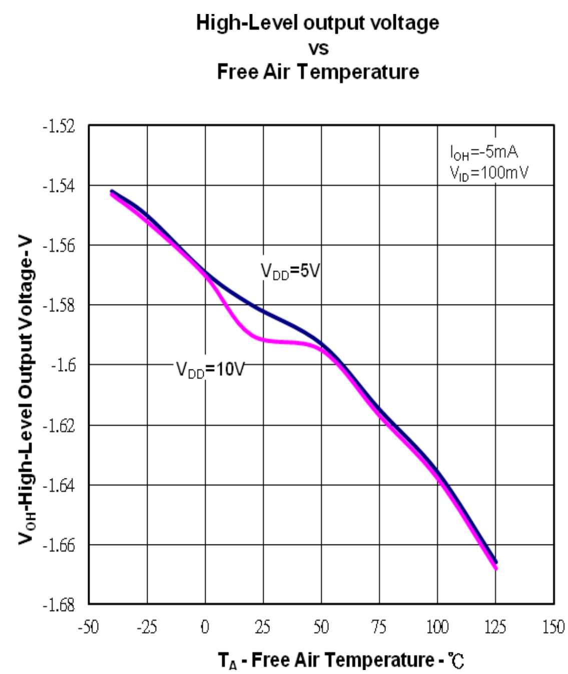


Figure 66

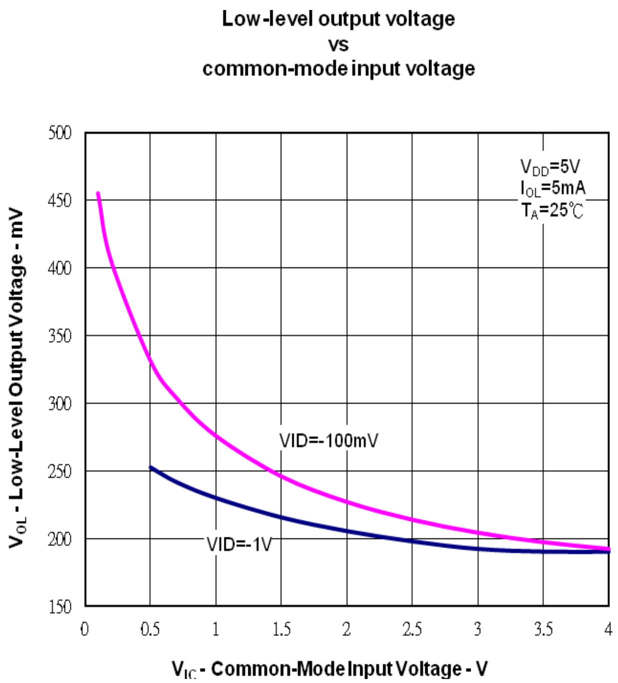


Figure 67

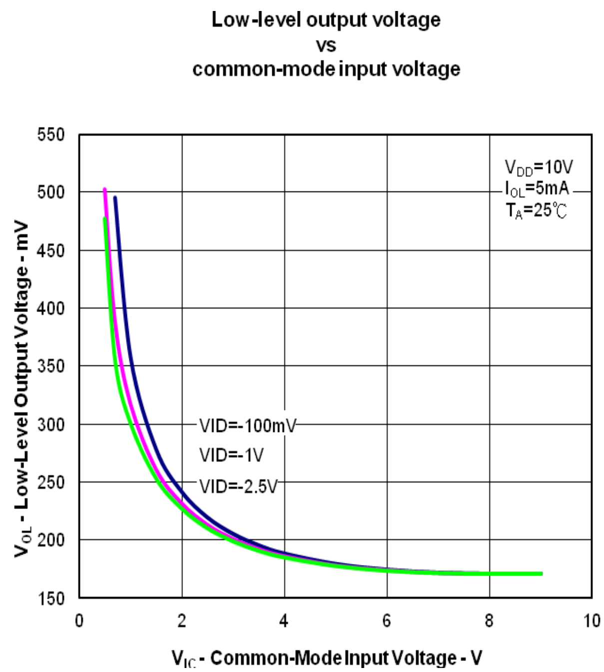


Figure 68

Typical Performance Characteristics Low Bias Mode

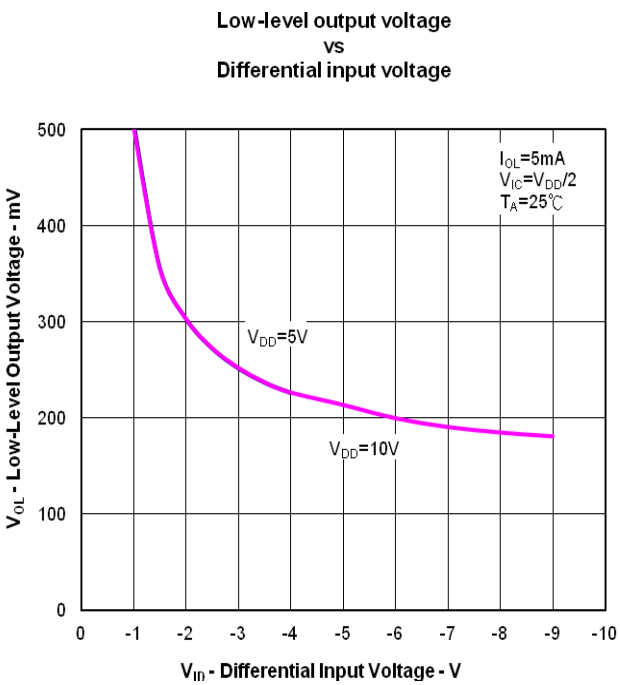


Figure 69

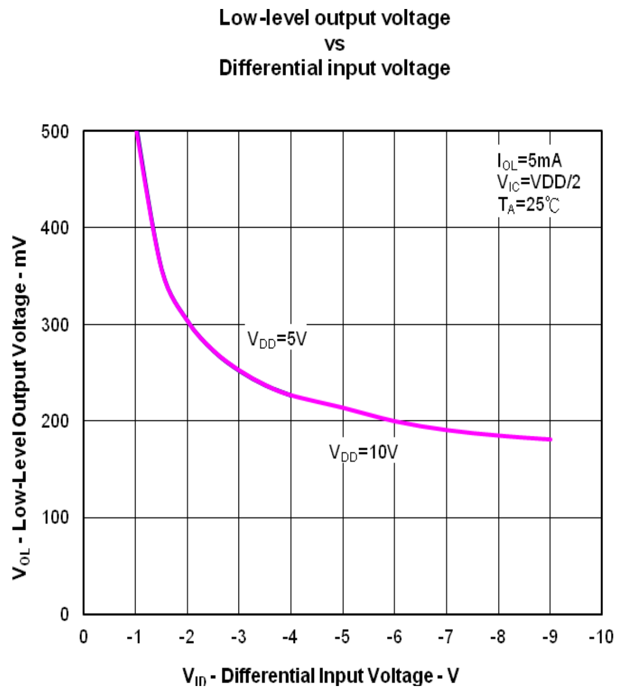


Figure 70

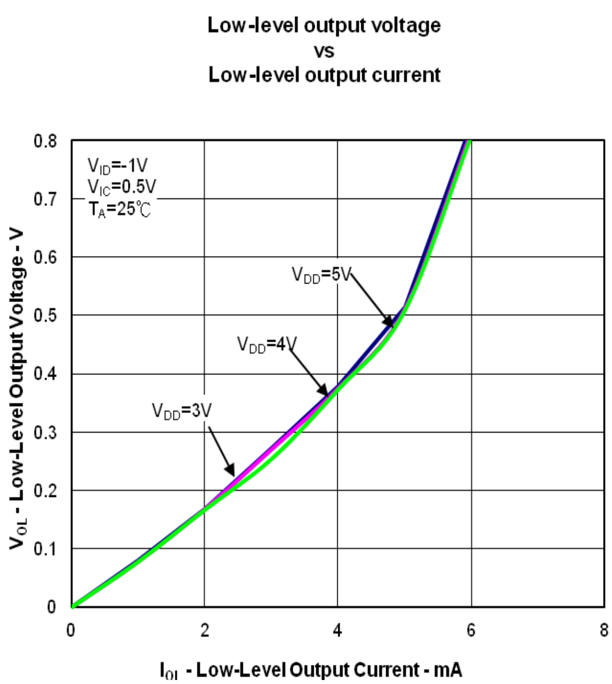


Figure 71

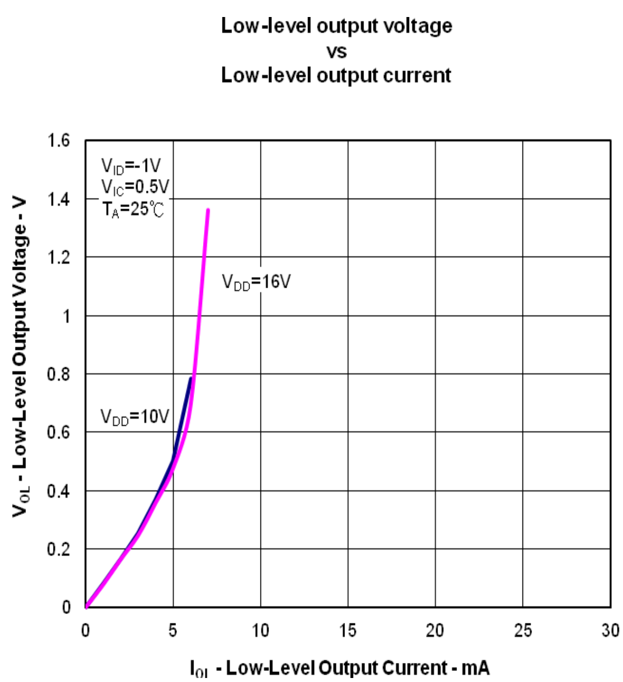


Figure 72

New Product

Typical Performance Characteristics Low Bias Mode

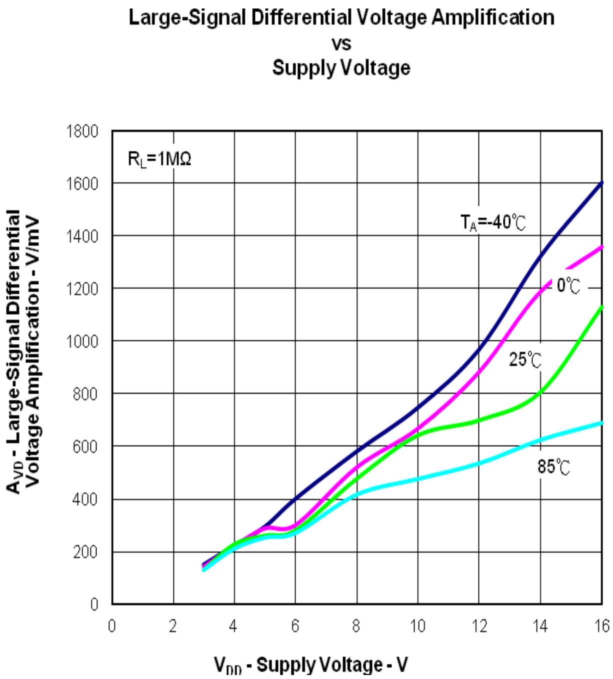


Figure 73

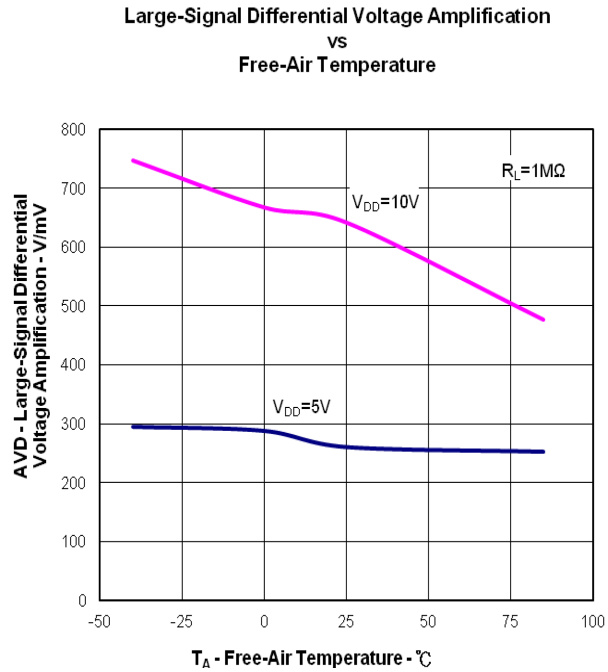


Figure 74

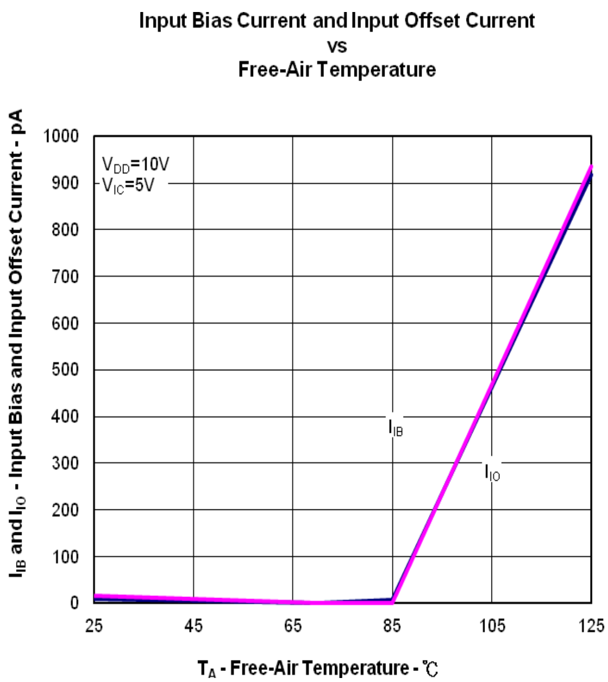


Figure 75

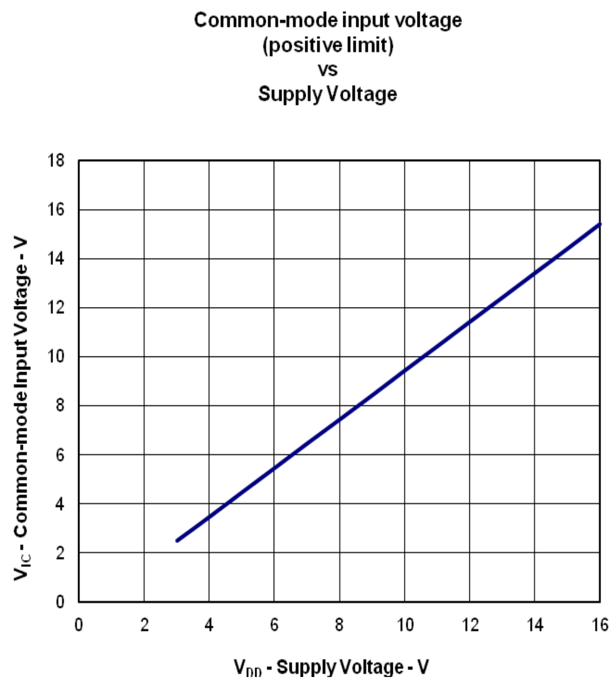


Figure 76

Typical Performance Characteristics Low Bias Mode

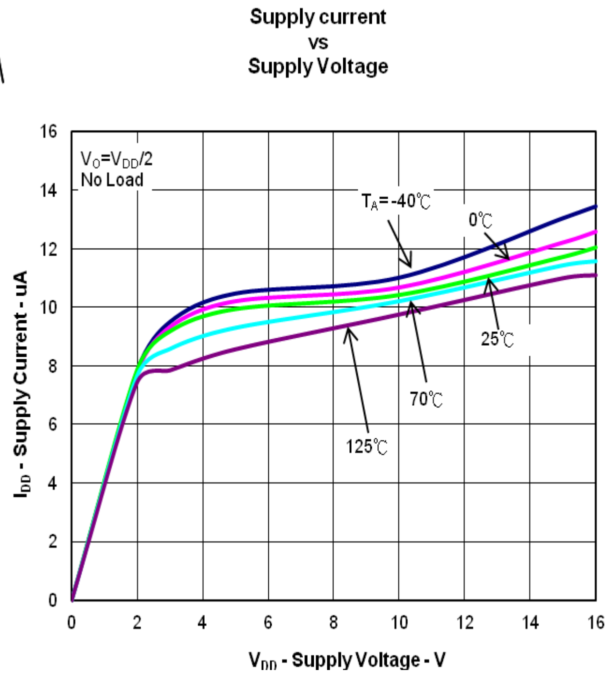


Figure 77

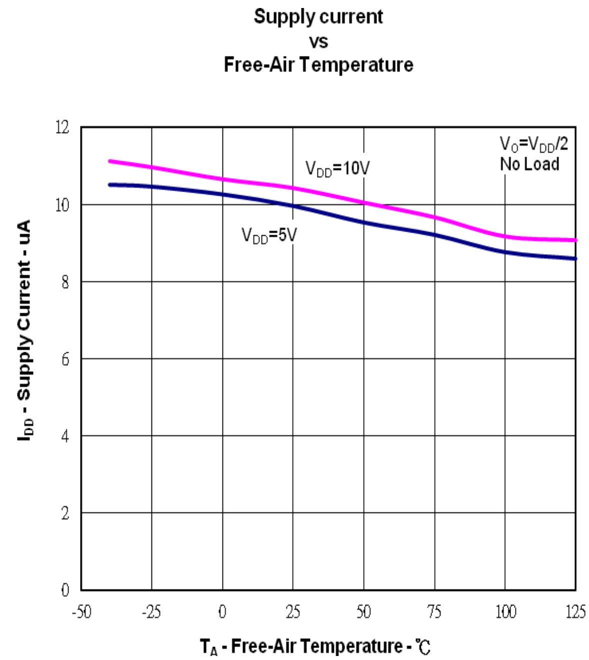


Figure 78

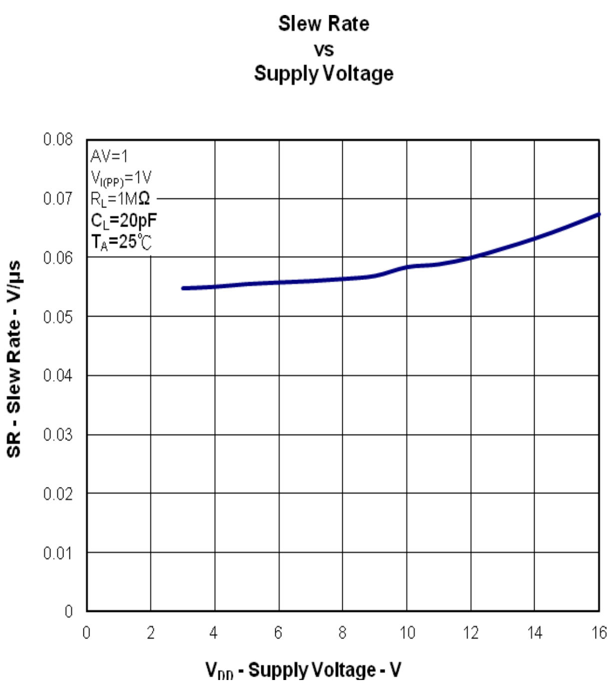


Figure 79

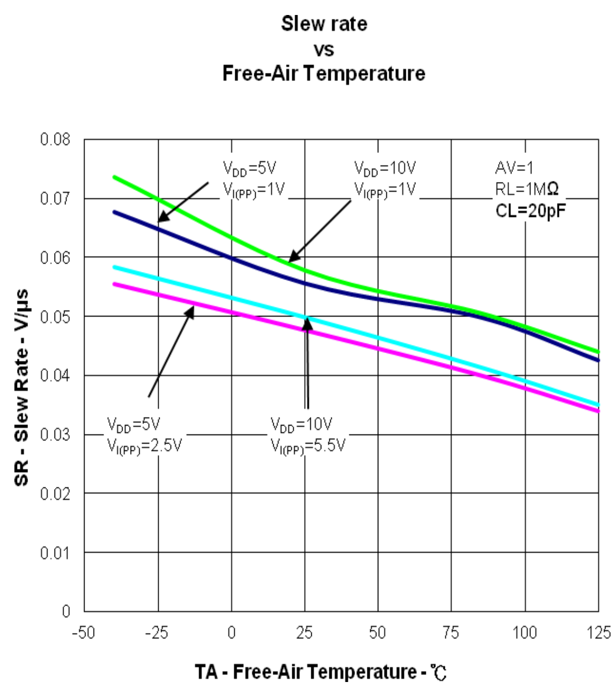


Figure 80

Typical Performance Characteristics Low Bias Mode

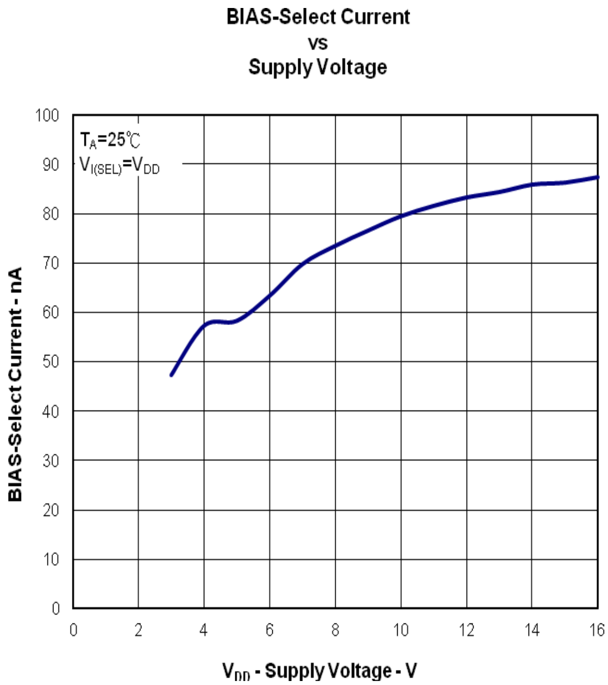


Figure 81

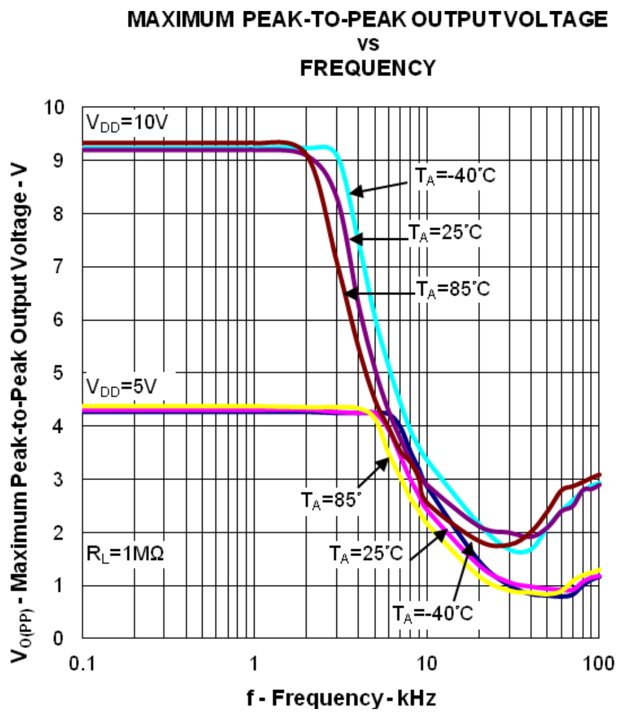


Figure 82

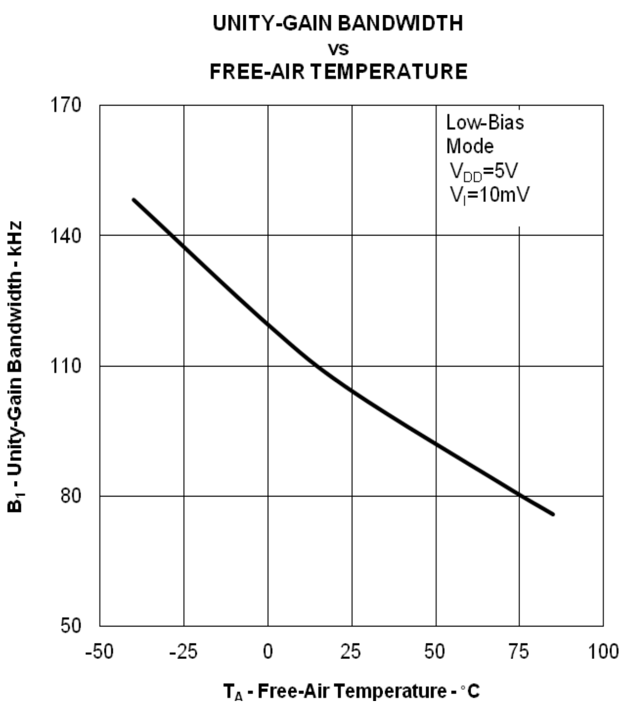


Figure 83

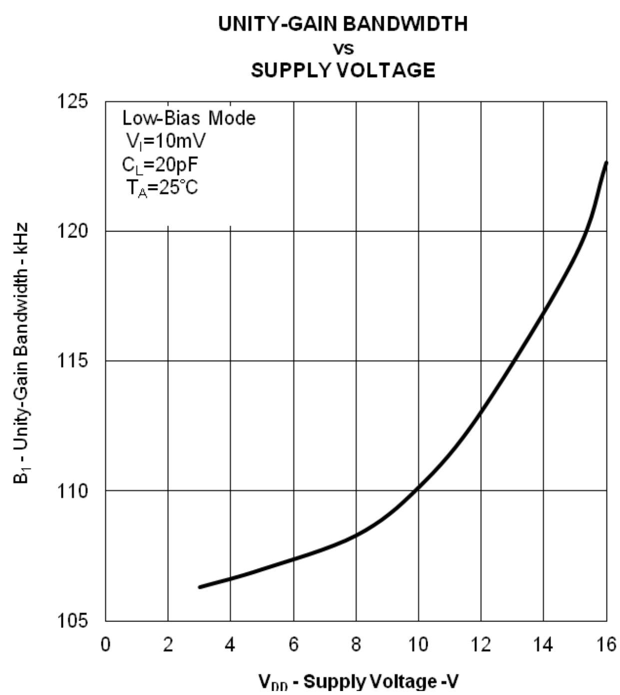


Figure 84

Typical Performance Characteristics Low Bias Mode

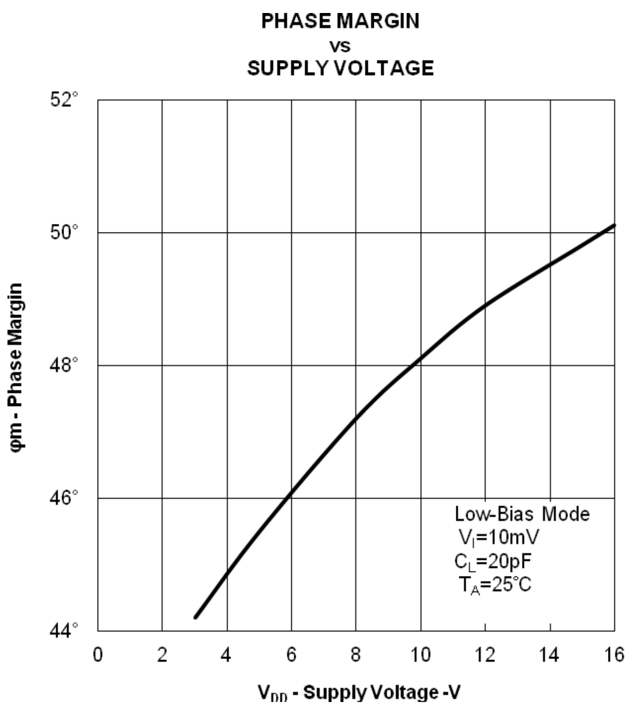


Figure 85

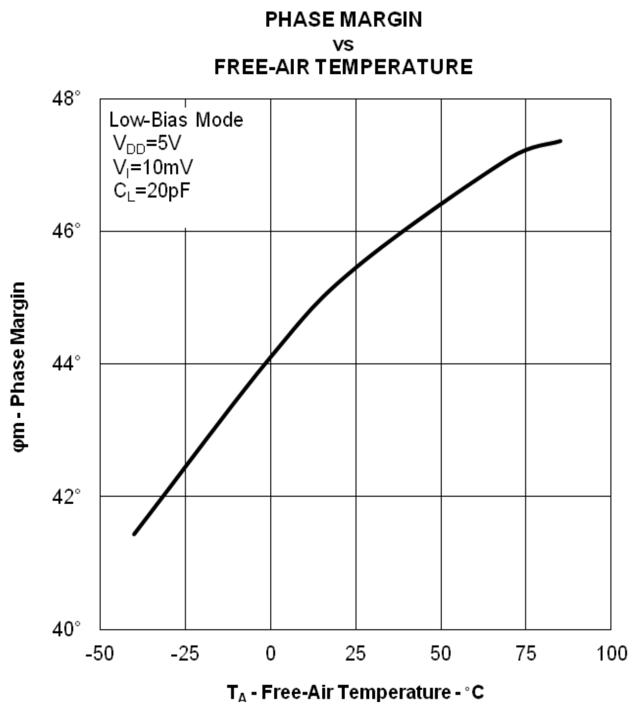


Figure 86

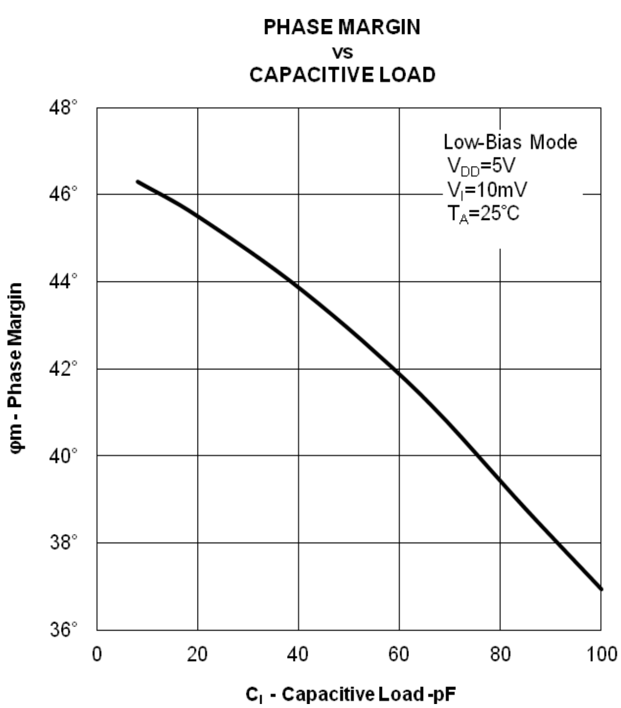


Figure 87

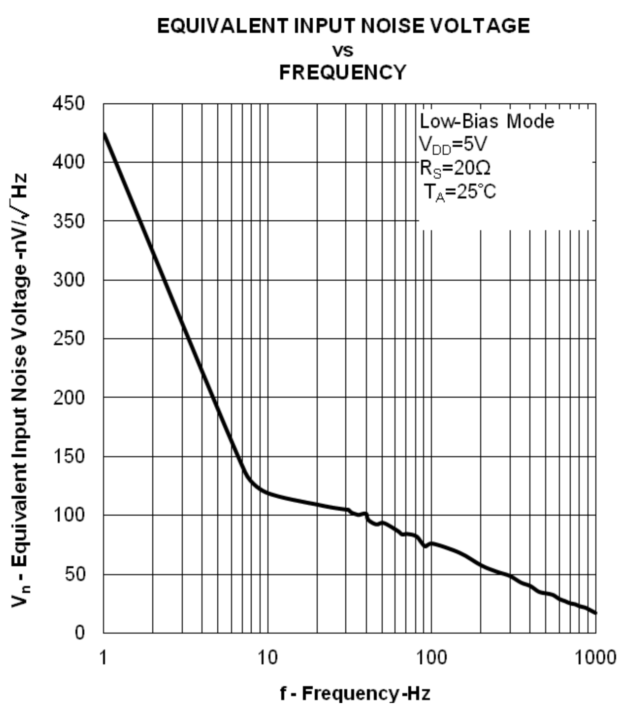


Figure 88

Typical Performance Characteristics Low Bias Mode

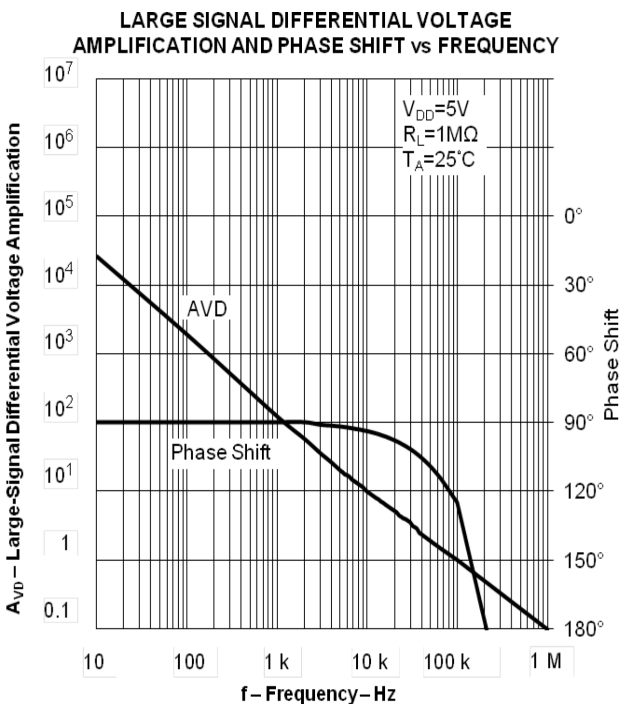


Figure 89

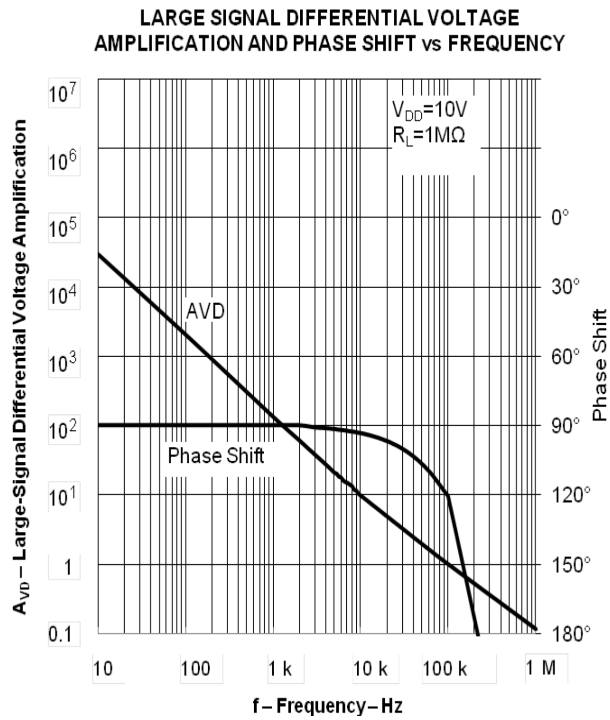


Figure 90

Application Information

Bias select feature

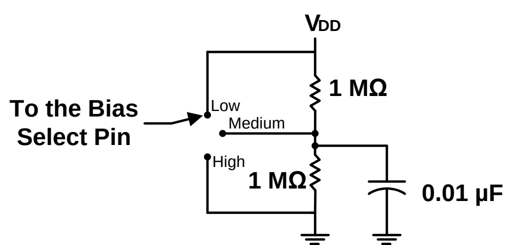
The TLC271 offers a bias-select feature that allows the user to select any one of three bias levels depending on the level of performance desired. The trade-off between bias levels relates to ac performance and power dissipation as below.

Typical values T_A = +25°C, V_{DD} = 5V		Mode			Units
		High bias R_L =10kΩ	Medium bias R_L =100kΩ	Low bias R_L =1MΩ	
P_D	Power Dissipation	3.4	0.5	0.05	mW
SR	Slew Rate	3.6	0.4	0.03	V/µs
V_n	Equivalent Input Noise Voltage at f=1kHz	20	25	28	nV√Hz
B_1	Unity Gain Bandwidth	1.7	0.5	0.09	MHz
ϕ_m	Phase Margin	46°	40°	34°	—
A_{VD}	Large Signal Differential Voltage Amplification	23	170	480	V/mV

Bias selection

Bias selection is achieved by connecting the bias select pin to one of three voltage levels (see below). For medium-bias applications, it is recommended that the bias select pin be connected to the midpoint between the supply rails. This procedure is simple in split-supply applications, since this point is ground.

In single-supply applications, the medium-bias mode necessitates using a voltage divider as indicated below. The use of large-value resistors in the voltage divider reduces the current drain of the divider from the supply line. However, large-value resistors used in conjunction with a large-value capacitor require significant time to charge the supply to the midpoint after the supply is switched on. A voltage other than the midpoint can be used if it is within the voltages specified table.



Bias Mode	Bias Select Voltage (Single Supply)
Low	V_{DD}
Medium	1 V to V_{DD} -1 V
High	GND

Figure 91

High-Bias Mode

In high-bias mode, the TLC271 series features low offset voltage drift, high input impedance and low noise. Speed in this mode approaches that of BiFET devices but at only a fraction of the power dissipation. Unity-gain bandwidth is typically greater than 1 MHz.

Medium-Bias Mode

The TLC271 in medium-bias mode features low offset voltage drift, high input impedance and low noise. Speed in this mode is similar to general-purpose bipolar devices, but power dissipation is only a fraction of that consumed by bipolar devices.

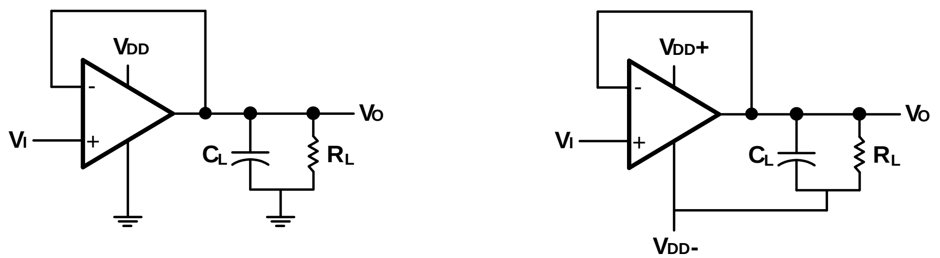
Low-Bias Mode

In low-bias mode, the TLC271 features low offset voltage drift, high input impedance, extremely low power consumption and high differential voltage gain.

Application Information (cont.)

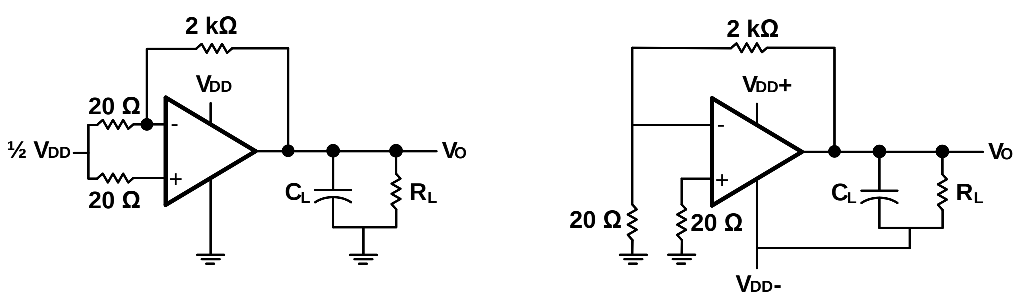
Parameter measurement circuits

Because the TLC271 is optimized for single-supply operation, circuit configurations used for the various tests can present some difficulties since the input signal must be offset from ground. This issue can be avoided by testing the device with split supplies and the output load tied to the negative rail. Example circuits are shown below.



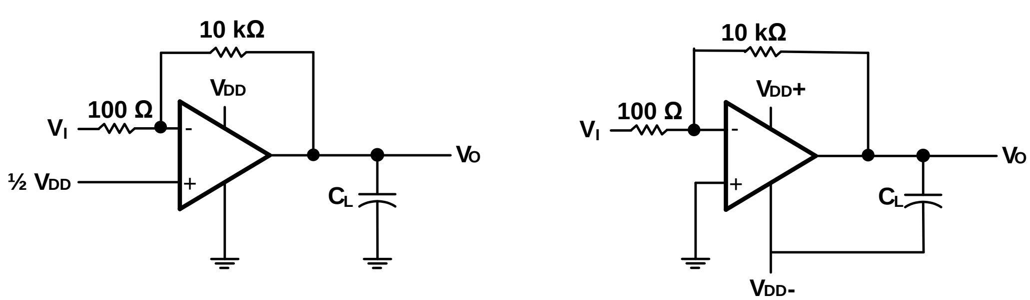
(a) Single Supply (b) Split Supply

Figure 92 Measurement circuit with either single or split supply



(a) Single Supply (b) Split Supply

Fig 93 Noise measurement with single or split supply



(a) Single Supply (b) Split Supply

Figure 94 Gain of 100 with single or split supply

New Product

New Product

Application Notes

Offset Voltage Nulling Circuit

The TLC271 offers external input offset null control. Nulling of the input off set voltage may be achieved by adjusting a 100-kΩ potentiometer connected between the offset null terminals with the wiper connected as shown in Figure 95. The amount of nulling range varies with the bias selection. In the high-bias mode, the nulling range allows the maximum offset voltage specified to be trimmed to zero. In low-bias and medium-bias modes, total nulling may not be possible.

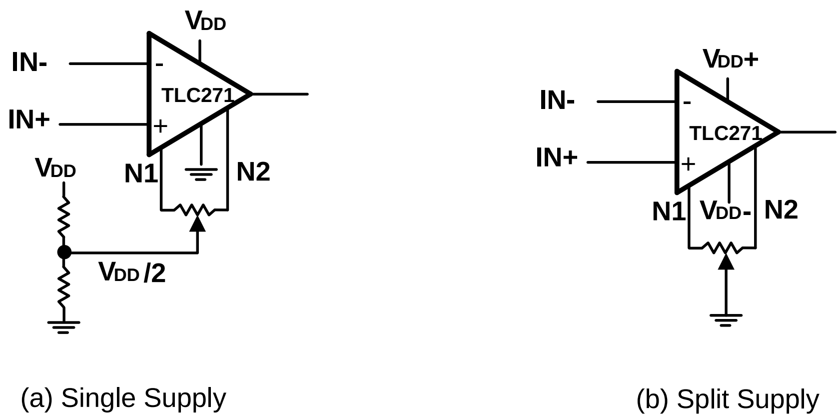


Figure 95 Offset Nulling Circuits

Input Bias Current – Error Protection

The TLC271 has an extremely high input impedance. To use the inputs as a high impedance node, for example, greater than 100K, or to accurately measure bias current, it will be necessary to place a guard ring around the input pins and drive this ring to a potential equivalent to the common mode input voltage. In many cases this common mode potential may exist as a part of the feedback circuit and can be obtained from one of the appropriate nodes. In the case for the SO8 package, pin 4 is connected to ground or Vdd-. Input pins 2 and 3 are normally well above the voltage on pin 4 so a large potential voltage on the order of several volts is likely between pins 3 and 4. To prevent interference with a 1 pA bias current the board resistance would need to be in the order of gigaohms to have a minimum impact. The goal is to have the common mode potential on the guard ring, therefore reducing the stray voltage near the input pins to millivolts in normal applications. Any solder flux residue, excess moisture, humidity or board contamination will be detrimental to using the device in a high impedance input mode.

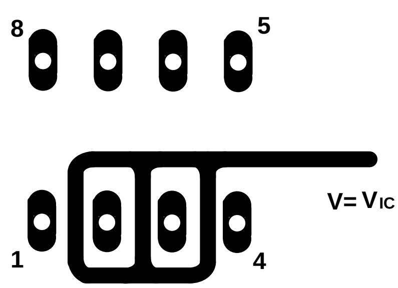


Figure 96 Bias Current Guarding for High Input Impedance Applications

Typical Application Circuits

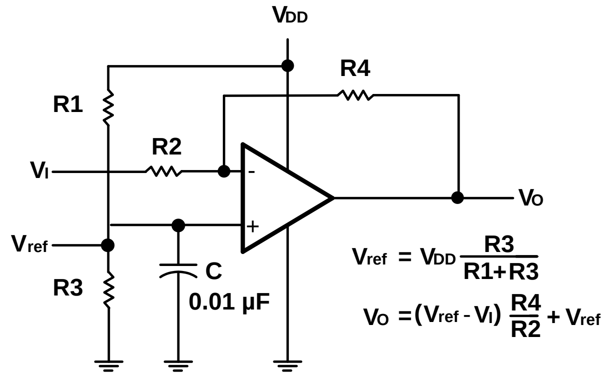


Figure 97 Inverting Amplifier With Voltage Reference

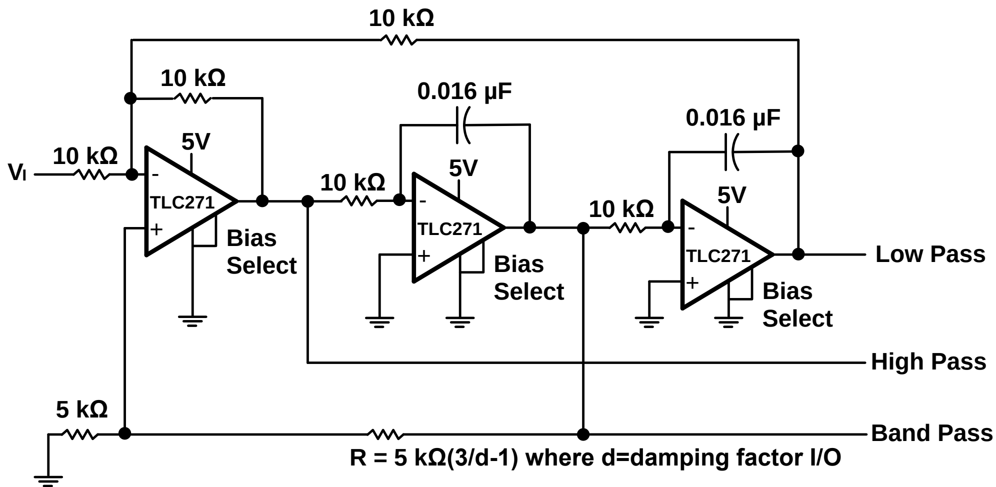


Figure 98 State Variable Filter

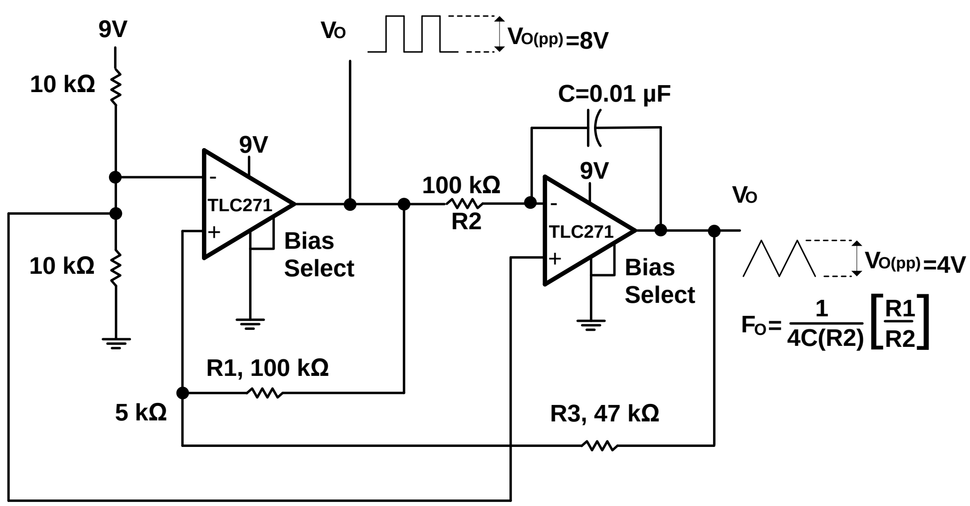


Figure 99 Single Supply Function Generator

Typical Application Circuits (cont.)

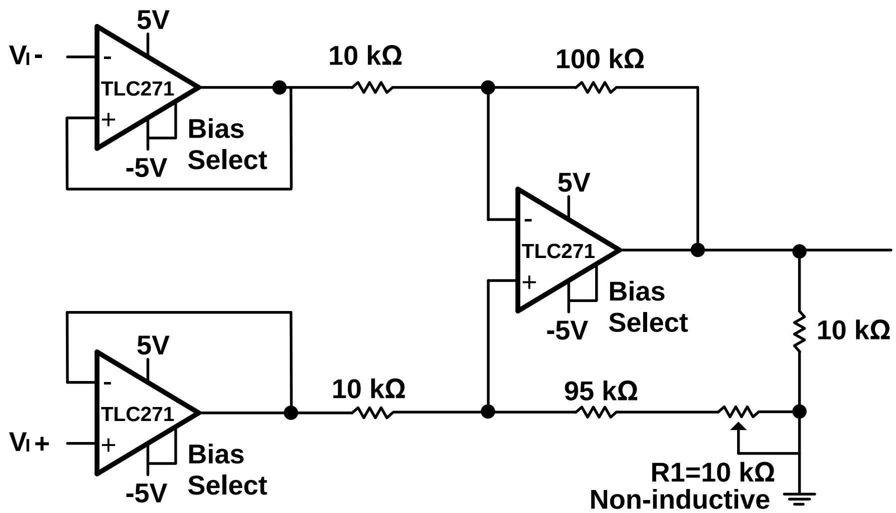
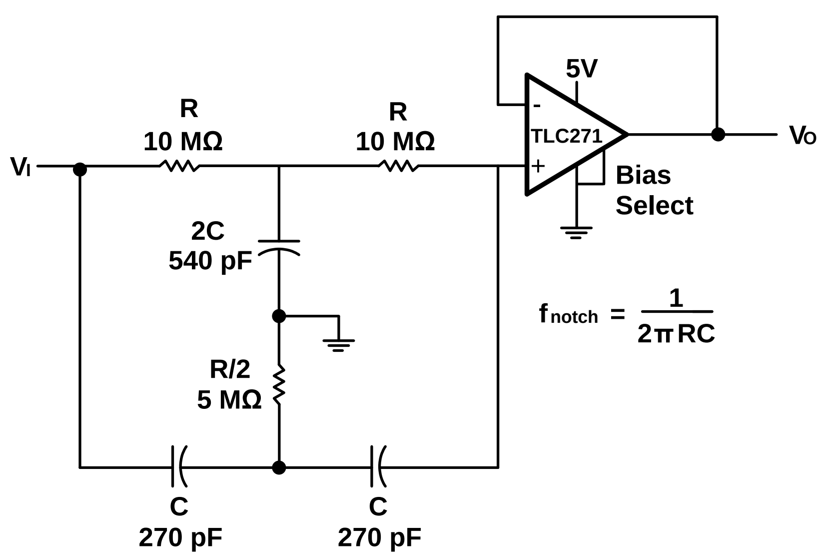


Figure 100 Low Power Instrumentation Amplifier



$$f_{notch} = \frac{1}{2\pi RC}$$

Figure 101 Single Supply Twin-T Notch Filter

Typical Application Circuits (cont.)

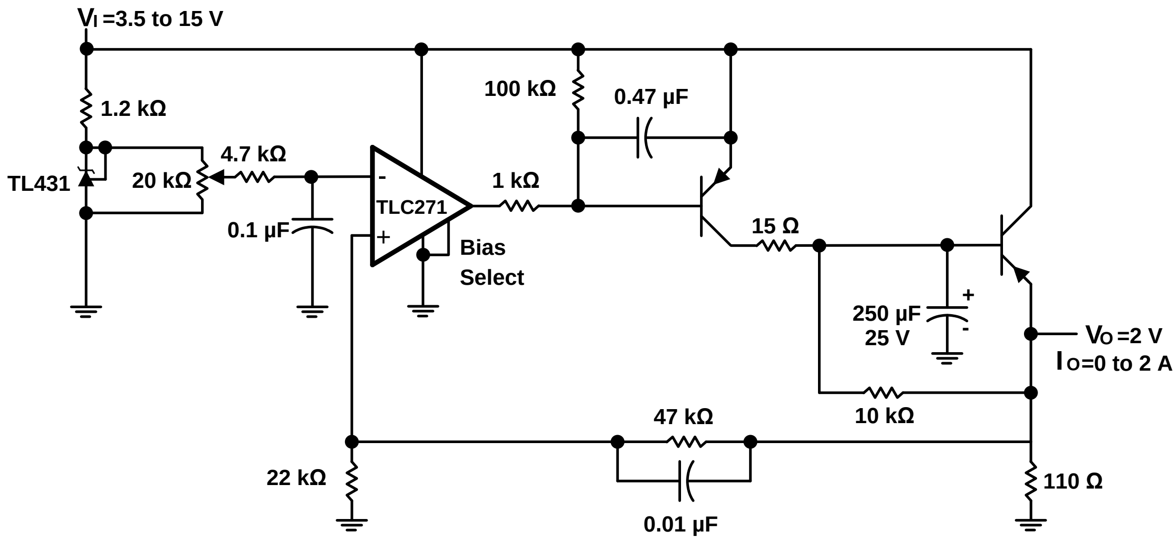


Figure 102 Power Supply

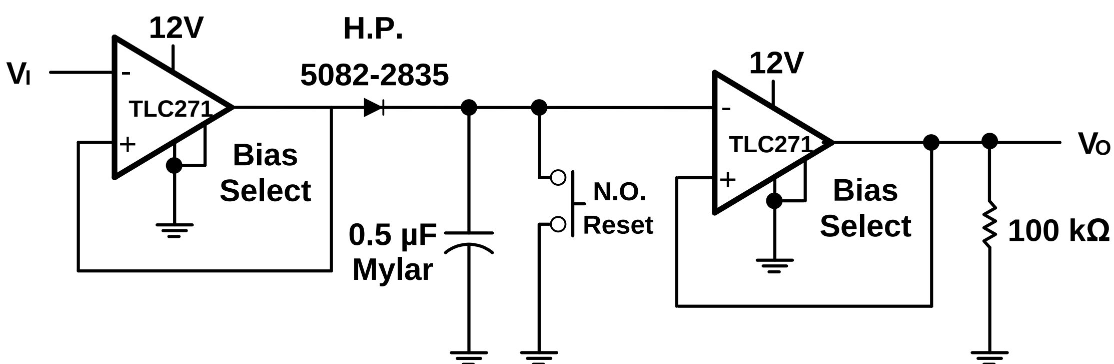


Figure 103 Positive Peak Detector

New Product

Typical Application Circuits (cont.)

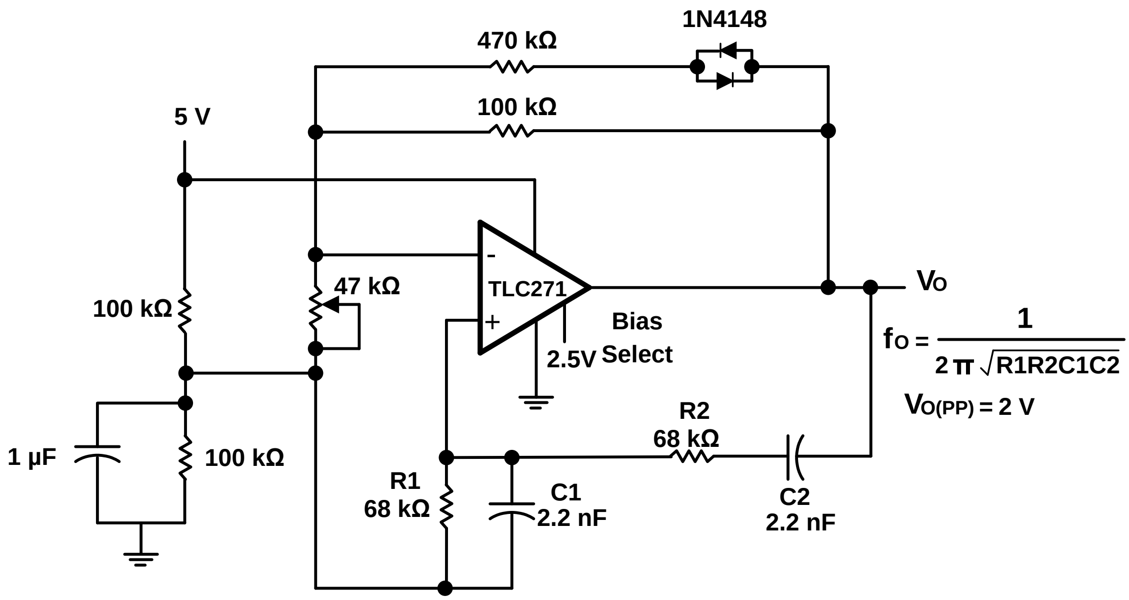


Figure 104 Wein Oscillator

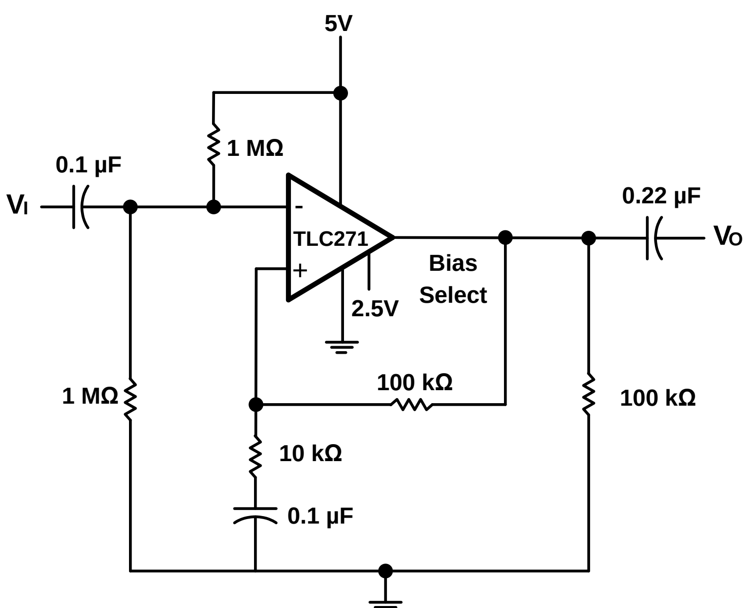


Figure 105 Single-Supply AC Amplifier

Typical Application Circuits (cont.)

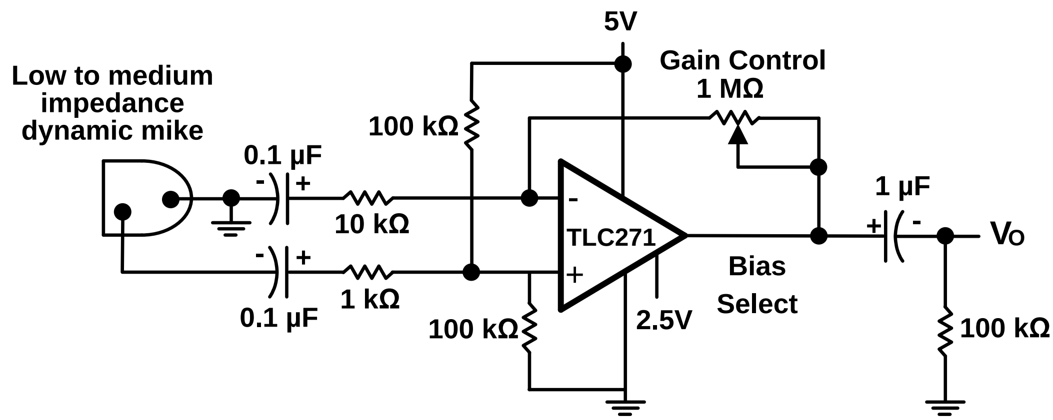


Figure 106 Microphone Preamplifier

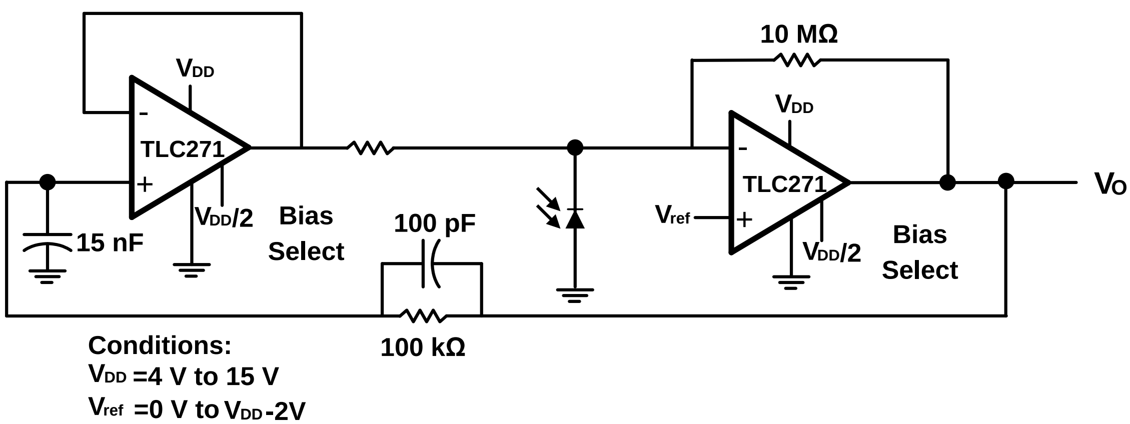


Figure 107 Photo-Diode Amplifier With Ambient Light Rejection

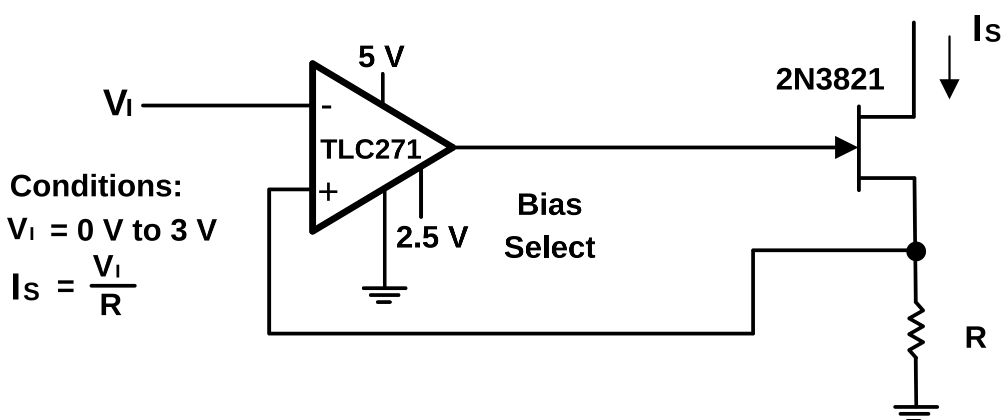
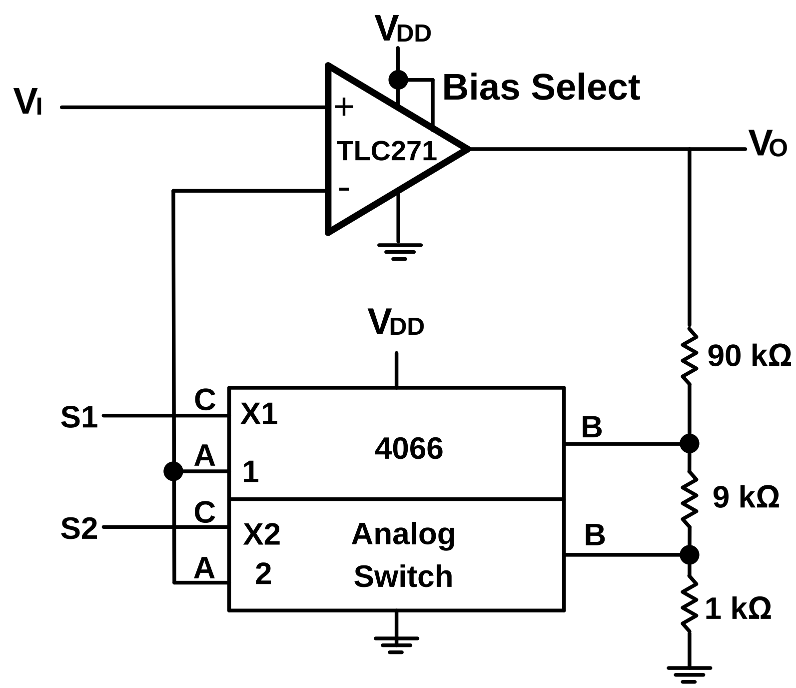


Figure 108 Precision Low-Current Sink

Typical Application Circuits (cont.)



Select	S1	S2
A_V	10	100

V_{DD} =5 V to 12 V

Figure 109 Amplifier With Digital Gain Selection

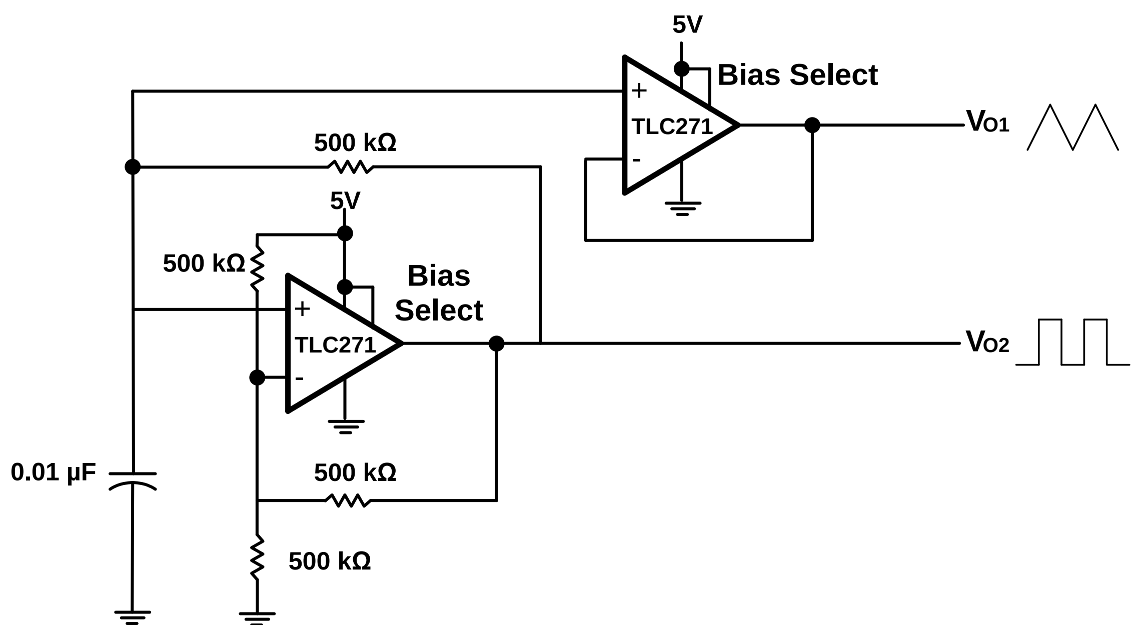


Figure 110 Multivibrator

Typical Application Circuits (cont.)

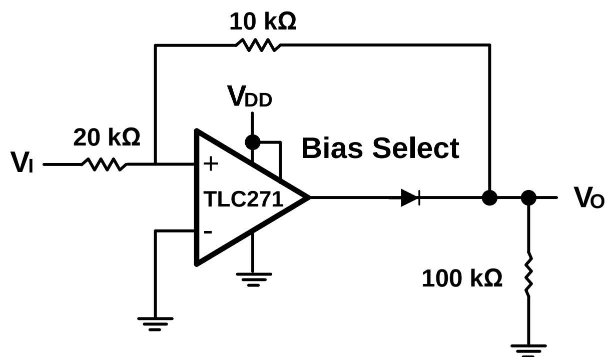


Figure 111 Full Wave Rectifier

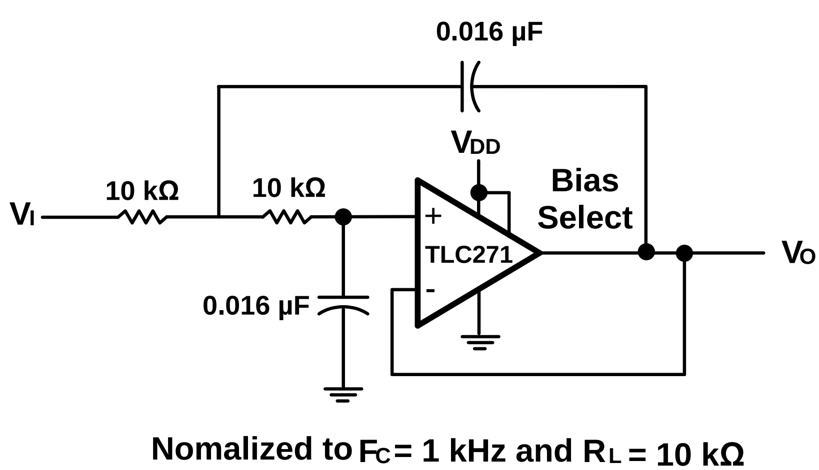


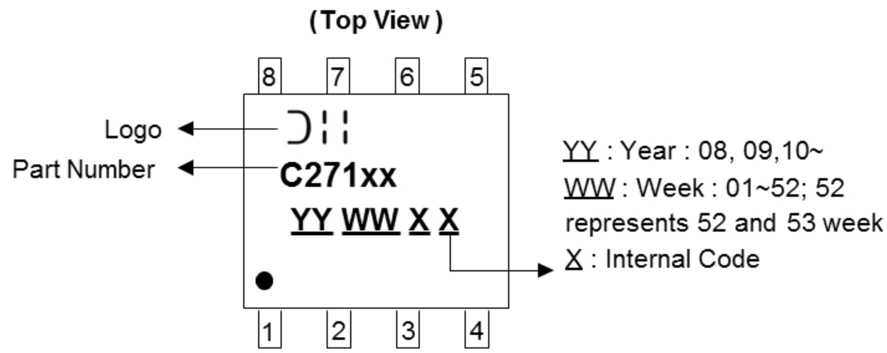
Figure 112 Two-Pole Low-Pass Butterworth Filter

New Product

Marking Information

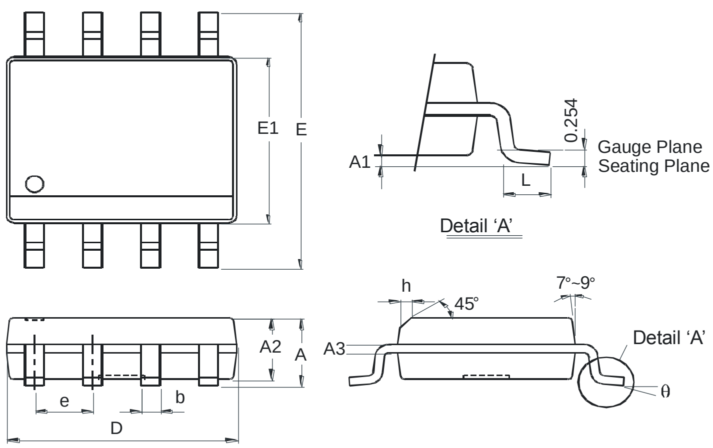
SO-8

Part mark	Part number
C271C	TLC271CS
C271AC	TLC271ACS
C271BC	TLC271BCS
C271I	TLC271IS
C271AI	TLC271AIS
C271BI	TLC271BIS



Package Outline Dimensions

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



SO-8		
Dim	**Min**	**Max**
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		