

# Operational Amplifier, Rail-to-Rail Output, 3 MHz BW

## TLV271, TLV272, NCV272, TLV274, NCV274

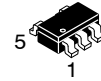
The TLV/NCV27x operational amplifiers provide rail-to-rail output operation. The output can swing within 320 mV to the positive rail and 50 mV to the negative rail. This rail-to-rail operation enables the user to make optimal use of the entire supply voltage range while taking advantage of 3 MHz bandwidth. The opamp can operate on supply voltage as low as 2.7 V over the temperature range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The high bandwidth provides a slew rate of  $2.4\text{ V}/\mu\text{s}$  while only consuming  $550\text{ }\mu\text{A}$  of quiescent current. Likewise the opamp can run on a supply voltage as high as 16 V (single) and 36 V (dual quad) making it ideal for a broad range of battery-operated applications. Since this is a CMOS device it has high input impedance and low bias currents making it ideal for interfacing to a wide variety of signal sensors. In addition it comes in a variety of compact packages with different pinout styles allowing for use in high-density PCB's.

### Features

- Rail-To-Rail Output
- Wide Bandwidth: 3 MHz
- High Slew Rate:  $2.4\text{ V}/\mu\text{s}$
- Wide Power-Supply Range: 2.7 V to 16 V (TLV271), 36 V (TLV/NCV272/274)
- Low Supply Current:  $550\text{ }\mu\text{A}$
- Low Input Bias Current:  $45\text{ pA}$
- Wide Temperature Range:  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- TSOP-5, Micro-8, SOIC-8, SOIC-14, TSSOP-14 Packages
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Notebook Computers
- Portable Instruments
- Signal Conditioning
- Automotive
- Power Supplies
- Current Sensing



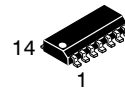
TSOP-5  
CASE 483



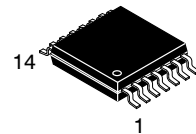
Micro8  
CASE 846A



SOIC-8  
CASE 751



SOIC-14 NB  
CASE 751A



TSSOP-14  
CASE 948G

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 2 of this data sheet.

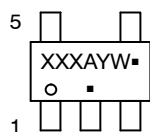
### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# TLV271, TLV272, NCV272, TLV274, NCV274

## MARKING DIAGRAMS

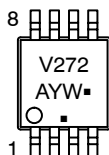
### Single Channel Configuration TLV271



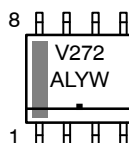
**TSOP-5  
CASE 483**

XXX = ADG (TLV271SN1T1G)  
 = ADH (TLV271SN2T1G)  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ■ = Pb-Free Package  
 (Note: Microdot may be in either location)

### Dual Channel Configuration TLV272, NCV272

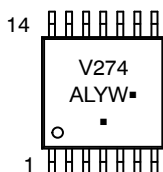


**Micro8  
CASE 846A**

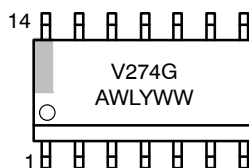


**SOIC-8  
CASE 751**

### Quad Channel Configuration TLV274, NCV274



**TSSOP-14  
CASE 948G**



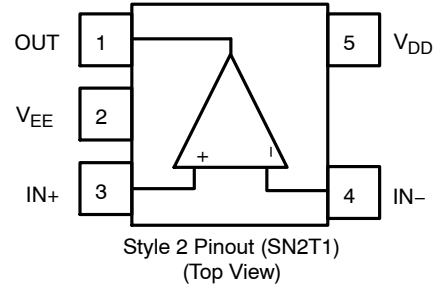
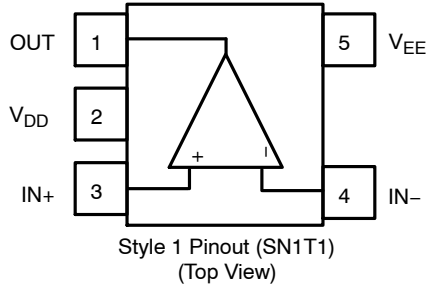
**SOIC-14 NB  
CASE 751A**

XXXXX = Specific Device Code  
 A = Assembly Location  
 WL, L = Wafer Lot  
 Y = Year  
 WW, W = Work Week  
 G or ■ = Pb-Free Package  
 (Note: Microdot may be in either location)

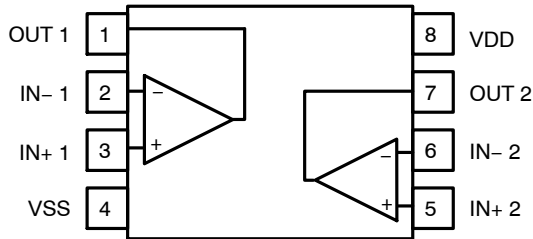
# TLV271, TLV272, NCV272, TLV274, NCV274

## PIN CONNECTIONS

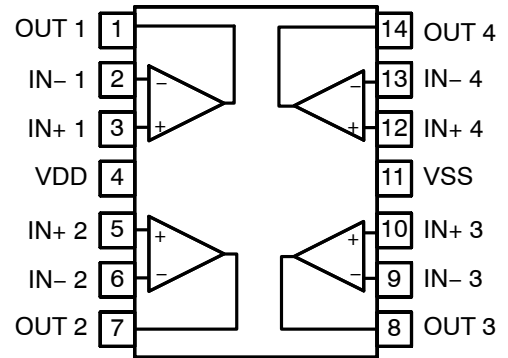
**Single Channel Configuration**  
TLV271



**Dual Channel Configuration**  
TLV272, NCV272



**Quadruple Channel Configuration**  
TLV274, NCV274



## ORDERING INFORMATION

Device	Configuration	Automotive	Marking	Package	Shipping <sup>†</sup>
TLV271SN1T1G (Style 1 Pinout)	Single	No	ADG	TSOP-5	3000 / Tape and Reel
TLV271SN2T1G (Style 2 Pinout)			ADH		3000 / Tape and Reel
TLV272DR2G	Dual		V272	SOIC-8	2500 / Tape and Reel
TLV272DMR2G			V272	Micro-8/MSOP-8	4000 / Tape and Reel
TLV274DR2G	Quad		V274	SOIC-14	2500 / Tape and Reel
TLV274DTBR2G			V274	TSSOP-14	2500 / Tape and Reel
NCV272DR2G*	Dual	Yes	V272	SOIC-8	2500 / Tape and Reel
NCV272DMR2G*			V272	Micro-8/MSOP-8	4000 / Tape and Reel
NCV274DR2G*	Quad		V274	SOIC-14	2500 / Tape and Reel
NCV274DTBR2G*			V274	TSSOP-14	2500 / Tape and Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

# TLV271, TLV272, NCV272, TLV274, NCV274

## MAXIMUM RATINGS

Symbol	Rating	Value	Unit
$V_{DD}$	Supply Voltage (Note 1) TLV271 TLV/NCV272/274	16.5 36	V V
$V_{ID}$	Input Differential Voltage	$\pm$ Supply Voltage	V
$V_I$	Input Common Mode Voltage Range (Note 1)	$-0.2\text{ V to } (V_{DD} + 0.2\text{ V})$	V
$I_I$	Maximum Input Current	$\pm 10$	mA
$I_O$	Output Current Range	$\pm 100$	mA
	Continuous Total Power Dissipation (Note 1)	200	mW
$T_J$	Maximum Junction Temperature	150	°C
$T_A$	Operating Ambient Temperature Range (free-air)	$-40$ to $125$	°C
$T_{STG}$	Storage Temperature Range	$-65$ to $150$	°C
ESD <sub>HBM</sub>	ESD Capability, Human Body Model	2	kV
ESD <sub>CDM</sub>	ESD Capability, Charged Device Model TLV271 TLV/NCV272 TLV/NCV274	TBD 2 1	kV kV kV
	Mounting Temperature (Infrared or Convection – 20 sec)	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Continuous short-circuit operation to ground at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C. Output currents in excess of 45 mA over long term may adversely affect reliability. Shorting output to either V+ or V– will adversely affect reliability.

## THERMAL INFORMATION

Parameter	Symbol	Package	Single Layer Board (Note 2)	Multi-Layer Board (Note 3)	Unit
Junction-to-Ambient	$\theta_{JA}$	TSOP–5	333	195	°C/W
		Micro–8 / MSOP–8	236	167	
		SOIC–8	190	131	
		SOIC–14	142	101	
		TSSOP–14	179	128	

2. Values based on a 1S standard PCB according to JEDEC51–3 with 1.0 oz copper and a 300 mm<sup>2</sup> copper area

3. Values based on a 1S2P standard PCB according to JEDEC51–7 with 1.0 oz copper and a 100 mm<sup>2</sup> copper area

# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV271 DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7V, 3.3V, 5V$  &  $\pm 5V$  (Note 4),  $T_A = 25^\circ C$ ,  $R_L \geq 10 k\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V <sub>IO</sub>	VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ, R <sub>S</sub> = 50 Ω			0.5	5	mV
		T <sub>A</sub> = −40°C to +105°C				7	
Offset Voltage Drift	ICV <sub>OS</sub>	VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ, R <sub>S</sub> = 50 Ω			2		μV/°C
Common Mode Rejection Ratio	CMRR	0 V ≤ VIC ≤ V <sub>DD</sub> − 1.35 V, R <sub>S</sub> = 50 Ω	V <sub>DD</sub> = 2.7 V	58	70		dB
		T <sub>A</sub> = −40°C to +105°C		55			
		0 V ≤ VIC ≤ V <sub>DD</sub> − 1.35 V, R <sub>S</sub> = 50 Ω	V <sub>DD</sub> = 5 V	65	130		
		T <sub>A</sub> = −40°C to +105°C		62			
		0 V ≤ VIC ≤ V <sub>DD</sub> − 1.35 V, R <sub>S</sub> = 50 Ω	V <sub>DD</sub> = ± 5 V	69	140		
		T <sub>A</sub> = −40°C to +105°C		66			
Power Supply Rejection Ratio	PSRR	V <sub>DD</sub> = 2.7 V to 16 V, VIC = V <sub>DD</sub> /2, No Load		70	135		dB
		T <sub>A</sub> = −40°C to +105°C		65			
Large Signal Voltage Gain	A <sub>VD</sub>	V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 2.7 V	97	106		dB
		T <sub>A</sub> = −40°C to +105°C		76			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 3.3 V	97	123		
		T <sub>A</sub> = −40°C to +105°C		76			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 5 V	100	127		
		T <sub>A</sub> = −40°C to +105°C		86			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = ± 5 V	100	130		
		T <sub>A</sub> = −40°C to +105°C		90			
Input Bias Current	I <sub>B</sub>	V <sub>DD</sub> = 5 V, VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>S</sub> = 50 Ω	T <sub>A</sub> = 25°C		45	150	pA
			T <sub>A</sub> = 105°C			1000	
Input Offset Current	I <sub>IO</sub>	V <sub>DD</sub> = 5 V, VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>S</sub> = 50 Ω	T <sub>A</sub> = 25°C		45	150	pA
			T <sub>A</sub> = 105°C			1000	
Differential Input Resistance	r <sub>i(d)</sub>				1000		GΩ
Common-mode Input Capacitance	C <sub>IC</sub>	f = 21 kHz			8		pF

4.  $V_{DD} = \pm 5 V$  is shorthand for  $V_{DD} = +5 V$  and  $V_{EE} = -5 V$ .

# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV271 DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7V, 3.3V, 5V$  &  $\pm 5V$  (Note 4),  $T_A = 25^\circ C$ ,  $R_L \geq 10 k\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Swing (High-level)	$V_{OH}$	$V_{IC} = V_{DD}/2$ , $I_{OH} = -1$ mA	$V_{DD} = 2.7$ V	2.55	2.58		V
		$T_A = -40^\circ C$ to $+105^\circ C$		2.48			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -1$ mA	$V_{DD} = 3.3$ V	3.15	3.21		
		$T_A = -40^\circ C$ to $+105^\circ C$		3.00			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -1$ mA	$V_{DD} = 5$ V	4.8	4.93		
		$T_A = -40^\circ C$ to $+105^\circ C$		4.75			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -1$ mA	$V_{DD} = \pm 5$ V	4.92	4.96		
		$T_A = -40^\circ C$ to $+105^\circ C$		4.9			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -5$ mA	$V_{DD} = 2.7$ V	1.9	2.1		V
		$T_A = -40^\circ C$ to $+105^\circ C$		1.5			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -5$ mA	$V_{DD} = 3.3$ V	2.5	2.89		
		$T_A = -40^\circ C$ to $+105^\circ C$		2.1			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -5$ mA	$V_{DD} = 5$ V	4.5	4.68		
		$T_A = -40^\circ C$ to $+105^\circ C$		4.35			
		$V_{IC} = V_{DD}/2$ , $I_{OH} = -5$ mA	$V_{DD} = \pm 5$ V	4.7	4.78		
		$T_A = -40^\circ C$ to $+105^\circ C$		4.65			
Output Swing (Low-level)	$V_{OL}$	$V_{IC} = V_{DD}/2$ , $I_{OL} = -1$ mA	$V_{DD} = 2.7$ V		0.1	0.15	V
		$T_A = -40^\circ C$ to $+105^\circ C$				0.22	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -1$ mA	$V_{DD} = 3.3$ V		0.03	0.15	
		$T_A = -40^\circ C$ to $+105^\circ C$				0.22	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -1$ mA	$V_{DD} = 5$ V		0.03	0.1	
		$T_A = -40^\circ C$ to $+105^\circ C$				0.15	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -1$ mA	$V_{DD} = \pm 5$ V		0.05	0.08	
		$T_A = -40^\circ C$ to $+105^\circ C$				0.1	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -5$ mA	$V_{DD} = 2.7$ V		0.5	0.7	V
		$T_A = -40^\circ C$ to $+105^\circ C$				1.1	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -5$ mA	$V_{DD} = 3.3$ V		0.13	0.7	
		$T_A = -40^\circ C$ to $+105^\circ C$				1.1	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -5$ mA	$V_{DD} = 5$ V		0.13	0.4	
		$T_A = -40^\circ C$ to $+105^\circ C$				0.5	
		$V_{IC} = V_{DD}/2$ , $I_{OL} = -5$ mA	$V_{DD} = \pm 5$ V		0.16	0.3	
		$T_A = -40^\circ C$ to $+105^\circ C$				0.35	
Output Current	$I_O$	$V_O = 0.5$ V from rail, $V_{DD} = 2.7$ V	Positive rail		4.0		mA
			Negative rail		5.0		
		$V_O = 0.5$ V from rail, $V_{DD} = 5$ V	Positive rail		7.0		
			Negative rail		8.0		
		$V_O = 0.5$ V from rail, $V_{DD} = 10$ V	Positive rail		13		
			Negative rail		12		

4.  $V_{DD} = \pm 5$  V is shorthand for  $V_{DD} = +5$  V and  $V_{EE} = -5$  V.

# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV271 DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7V, 3.3V, 5V$  &  $\pm 5V$  (Note 4),  $T_A = 25^\circ C$ ,  $R_L \geq 10 k\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Supply Quiescent Current	$I_{DD}$	$V_O = V_{DD}/2$	$V_{DD} = 2.7 V$	380	560	$\mu A$
			$V_{DD} = 3.3 V$	385	620	
			$V_{DD} = 5 V$	390	660	
			$V_{DD} = 10 V$	400	800	
		$T_A = -40^\circ C$ to $+105^\circ C$			1000	

4.  $V_{DD} = \pm 5 V$  is shorthand for  $V_{DD} = +5 V$  and  $V_{EE} = -5 V$ .

## TLV271 AC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7 V, 5 V$ , &  $\pm 5 V$  (Note 5),  $T_A = 25^\circ C$ , and  $R_L \geq 10 k\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Unity Gain Bandwidth	UGBW	$R_L = 2 k\Omega, C_L = 10 pF$	$V_{DD} = 2.7 V$	3.2		MHz
			$V_{DD} = 5 V$ to $10 V$	3.5		
Slew Rate at Unity Gain	SR	$V_{O(pp)} = V_{DD}/2, R_L = 10 k\Omega, C_L = 50 pF$	$V_{DD} = 2.7 V$	1.35	2.1	$V/\mu S$
				1		
		$V_{O(pp)} = V_{DD}/2, R_L = 10 k\Omega, C_L = 50 pF$	$V_{DD} = 5 V$	1.45	2.3	
				1.2		
		$V_{O(pp)} = V_{DD}/2, R_L = 10 k\Omega, C_L = 50 pF$	$V_{DD} = \pm 5 V$	1.8	2.6	
				1.3		
Phase Margin	$\theta_m$	$R_L = 2 k\Omega, C_L = 10 pF$		45		$^\circ$
Gain Margin		$R_L = 2 k\Omega, C_L = 10 pF$		14		dB
Settling Time to 0.1%	$t_S$	$V\text{-step}(pp) = 1 V, AV = -1, R_L = 2 k\Omega, C_L = 10 pF$	$V_{DD} = 2.7 V$	2.9		$\mu S$
		$V\text{-step}(pp) = 1 V, AV = -1, R_L = 2 k\Omega, C_L = 47 pF$	$V_{DD} = 5 V, \pm 5 V$	2.0		
Total Harmonic Distortion plus Noise	THD+N	$V_{DD} = 2.7 V, V_{O(pp)} = V_{DD}/2, R_L = 2 k\Omega, f = 10 kHz$	$AV = 1$	0.004		%
			$AV = 10$	0.04		
			$AV = 100$	0.3		
		$V_{DD} = 5 V, \pm 5 V, V_{O(pp)} = V_{DD}/2, R_L = 2 k\Omega, f = 10 kHz$	$AV = 1$	0.004		
			$AV = 10$	0.04		
			$AV = 100$	0.03		
Input-Referred Voltage Noise	$e_n$	$f = 1 kHz$		30		$nV/\sqrt{Hz}$
		$f = 10 kHz$		20		
Input-Referred Current Noise	$i_n$	$f = 1 kHz$		0.6		$fA/\sqrt{Hz}$

5.  $V_{DD} = \pm 5 V$  is shorthand for  $V_{DD} = +5 V$  and  $V_{EE} = -5 V$ .

# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV/NCV 272/274 DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7\text{ V}, 5\text{ V}, 10\text{ V}, 36\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L \geq 10\text{ k}\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V <sub>IO</sub>	VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ			1.3	±3	mV
		T <sub>A</sub> = −40°C to +125°C				±4	
Offset Voltage Drift	ICV <sub>OS</sub>	VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ			2		μV/°C
Common Mode Rejection Ratio	CMRR	V <sub>CM</sub> = V <sub>SS</sub> + 0.2 V to V <sub>DD</sub> − 1.35 V	V <sub>DD</sub> = 2.7 V	90	110		dB
		T <sub>A</sub> = −40°C to +125°C		69			
		V <sub>CM</sub> = V <sub>SS</sub> + 0.2 V to V <sub>DD</sub> − 1.35 V	V <sub>DD</sub> = 5 V	102	125		
		T <sub>A</sub> = −40°C to +125°C		80			
		V <sub>CM</sub> = V <sub>SS</sub> + 0.2 V to V <sub>DD</sub> − 1.35 V	V <sub>DD</sub> = 10 V	110	130		
		T <sub>A</sub> = −40°C to +125°C		87			
		V <sub>CM</sub> = V <sub>SS</sub> + 0.2 V to V <sub>DD</sub> − 1.35 V	V <sub>DD</sub> = 36 V	120	145		
		T <sub>A</sub> = −40°C to +125°C (TLV/NCV272) (TLV/NCV274)		95 85			
Power Supply Rejection Ratio	PSRR	V <sub>DD</sub> = 2.7 V to 36 V, VIC = V <sub>DD</sub> /2, No Load		114	135		dB
		T <sub>A</sub> = −40°C to +125°C		100			
Large Signal Voltage Gain	A <sub>VD</sub>	V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 2.7 V	96	118		dB
		T <sub>A</sub> = −40°C to +125°C		86			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 5 V	96	120		
		T <sub>A</sub> = −40°C to +125°C		86			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 10 V	98	120		
		T <sub>A</sub> = −40°C to +125°C		88			
		V <sub>O(pp)</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 10 kΩ	V <sub>DD</sub> = 36 V	98	120		
		T <sub>A</sub> = −40°C to +125°C		88			
Input Bias Current	I <sub>B</sub>	V <sub>DD</sub> = 5 V, VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2	T <sub>A</sub> = 25°C		5	200	pA
		V <sub>DD</sub> = 2.7 to 36 V, T <sub>A</sub> = −40°C to +125°C	TLV/NCV272			<b>2000</b>	
			TLV/NCV274			<b>1500</b>	
Input Offset Current	I <sub>IO</sub>	V <sub>DD</sub> = 5 V, VIC = V <sub>DD</sub> /2, V <sub>O</sub> = V <sub>DD</sub> /2, R <sub>S</sub> = 50 Ω	T <sub>A</sub> = 25°C		2	75	pA
		V <sub>DD</sub> = 2.7 to 36 V, T <sub>A</sub> = −40°C to +125°C	TLV/NCV272			<b>500</b>	
			TLV/NCV274			<b>200</b>	
Channel Separation	XTLK	DC	TLV/NCV272		100		dB
			TLV/NCV274		115		dB
Differential Input Resistance	R <sub>I(d)</sub>				5		GΩ
Common-mode Input Capacitance	C <sub>IC</sub>				3.5		pF



# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV/NCV 272/274 DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 2.7\text{ V}, 5\text{ V}, 10\text{ V}, 36\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L \geq 10\text{ k}\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Swing (High-level)	$V_{OH}$	$V_{IC} = V_{DD}/2$	$V_{DD} = 2.7\text{ V}$		0.006	0.15	V
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.22</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 5\text{ V}$		0.013	0.20	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.25</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 10\text{ V}$		0.023	0.08	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.10</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 36\text{ V}$		0.074	0.10	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.15</b>	
Output Swing (Low-level)	$V_{OL}$	$V_{IC} = V_{DD}/2$	$V_{DD} = 2.7\text{ V}$		0.005	0.15	V
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.22</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 5\text{ V}$		0.01	0.10	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.15</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 10\text{ V}$		0.022	0.3	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.35</b>	
		$V_{IC} = V_{DD}/2$	$V_{DD} = 36\text{ V}$		0.065	0.3	
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$				<b>0.35</b>	
Output Current	$I_O$	$V_{DD} = 2.7\text{ V}$	Positive rail		50		mA
			Negative rail		70		
		$V_{DD} = 5\text{ V}$	Positive rail		60		
			Negative rail		50		
		$V_{DD} = 10\text{ V}$	Positive rail		65		
			Negative rail		50		
		$V_{DD} = 36\text{ V}$	Positive rail		65		
			Negative rail		50		
Power Supply Quiescent Current	$I_{DD}$	$V_O = V_{DD}/2$ , Per channel, no load	$V_{DD} = 2.7\text{ V}$		405	525	$\mu\text{A}$
			$V_{DD} = 5\text{ V}$		410	530	
			$V_{DD} = 10\text{ V}$		416	540	
			$V_{DD} = 36\text{ V}$		465	600	
		$T_A = -40^\circ\text{C to } +105^\circ\text{C}$				<b>700</b>	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTE: Power dissipation must be limited to prevent junction temperature from exceeding  $150^\circ\text{C}$ . See Absolute Maximum Ratings for more information.

# TLV271, TLV272, NCV272, TLV274, NCV274

## TLV/NCV 272/274 AC ELECTRICAL CHARACTERISTICS

(( $V_{DD} = 2.7\text{ V}, 5\text{ V}, 10\text{ V}, 36\text{ V}$ ),  $T_A = 25^\circ\text{C}$ , and  $R_L \geq 10\text{ k}\Omega$  unless otherwise noted)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Unity Gain Bandwidth	UGBW	$C_L = 25\text{ pF}$	$V_{DD} = 2.7\text{ V}$		3		MHz
Slew Rate at Unity Gain	SR	$C_L = 20\text{ pF}, R_L = 2\text{ k}\Omega$	$V_{DD} = 2.7\text{ V}$		2.8		V/ $\mu\text{S}$
			$V_{DD} = 5\text{ V}$		2.7		
			$V_{DD} = 10\text{ V}$		2.6		
			$V_{DD} = 36\text{ V}$		2.4		
Phase Margin	$\theta_m$	$C_L = 25\text{ pF}$			50		$^\circ$
Gain Margin		$C_L = 25\text{ pF}$			14		dB
Settling Time to 0.1%	$t_S$	$V_O = 1\text{ V}_{pp}$ , Gain = 1, $C_L = 20\text{ pF}$	$V_{DD} = 2.7\text{ V}$		0.6		$\mu\text{S}$
		$V_O = 3\text{ V}_{pp}$ , Gain = 1, $C_L = 20\text{ pF}$	$V_{DD} = 5\text{ V}$		1.2		
		$V_O = 8.5\text{ V}_{pp}$ , Gain = 1, $C_L = 20\text{ pF}$	$V_{DD} = 10\text{ V}$		3.4		
		$V_O = 10\text{ V}_{pp}$ , Gain = 1, $C_L = 20\text{ pF}$	$V_{DD} = 36\text{ V}$		3.2		
Total Harmonic Distortion plus Noise	THD+N	$V_{IN} = 0.5\text{ V}_{pp}$ , $f = 1\text{ kHz}$ , $A_v = 1$	$V_{DD} = 2.7\text{ V}$		0.05		%
		$V_{IN} = 2.5\text{ V}_{pp}$ , $f = 1\text{ kHz}$ , $A_v = 1$	$V_{DD} = 5\text{ V}$		0.009		
		$V_{IN} = 7.5\text{ V}_{pp}$ , $f = 1\text{ kHz}$ , $A_v = 1$	$V_{DD} = 10\text{ V}$		0.004		
		$V_{IN} = 28.5\text{ V}_{pp}$ , $f = 1\text{ kHz}$ , $A_v = 1$	$V_{DD} = 36\text{ V}$		0.001		
Input-Referred Voltage Noise	$e_n$	$f = 1\text{ kHz}$			30		nV/ $\sqrt{\text{Hz}}$
		$f = 10\text{ kHz}$			20		
Input-Referred Current Noise	$i_n$	$f = 1\text{ kHz}$			90		fA/ $\sqrt{\text{Hz}}$



TYPICAL CHARACTERISTICS

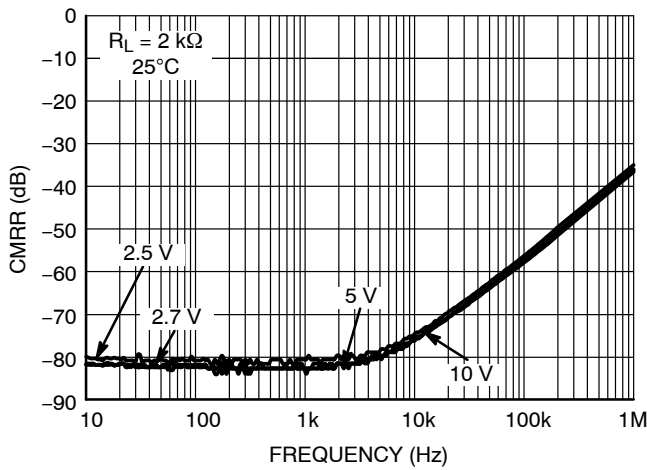


Figure 1. CMRR vs. Frequency for TLV271

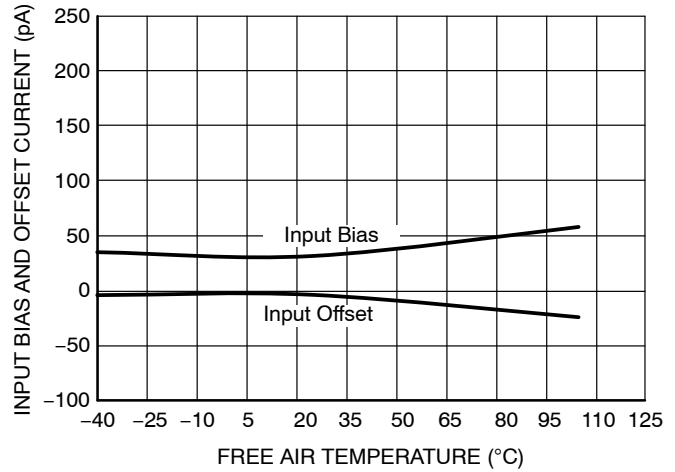


Figure 2. Input Bias and Offset Current vs. Temperature for TLV271

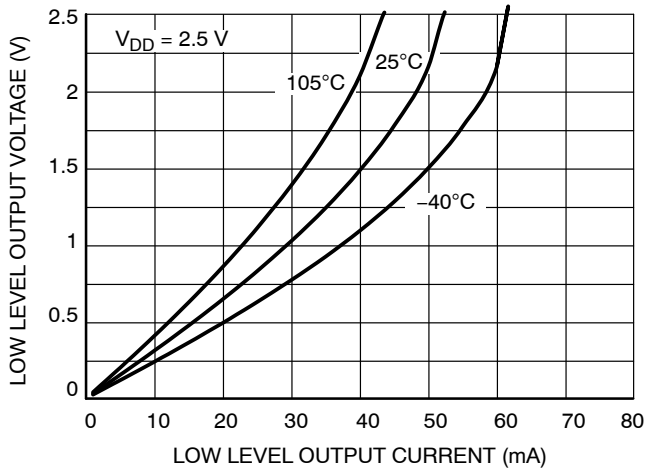


Figure 3. 2.5 V  $V_{OL}$  vs.  $I_{out}$

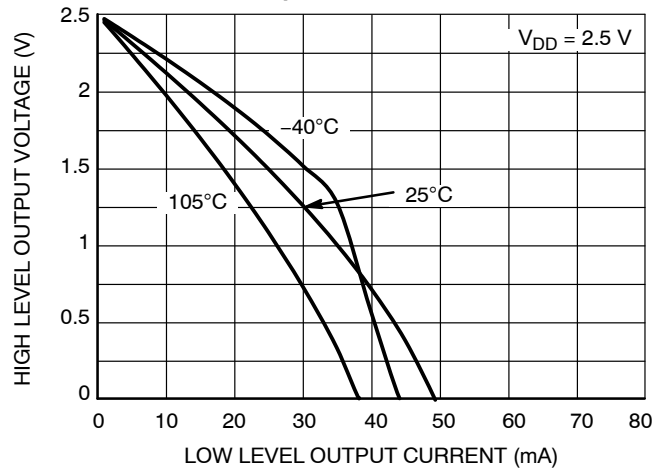


Figure 4. 2.5 V  $V_{OH}$  vs.  $I_{out}$

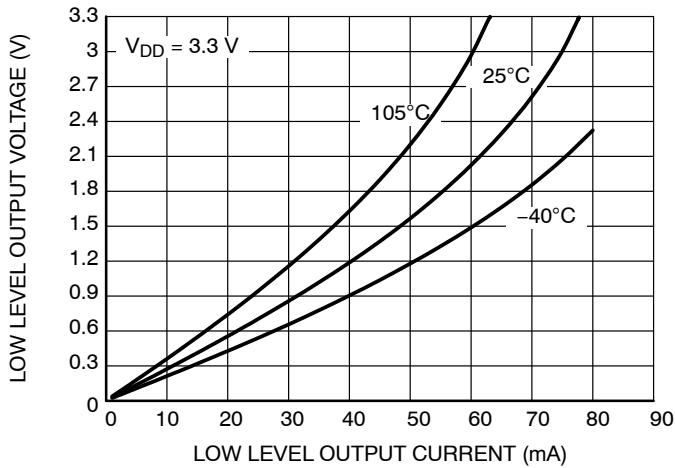


Figure 5. 3.3 V  $V_{OL}$  vs.  $I_{out}$

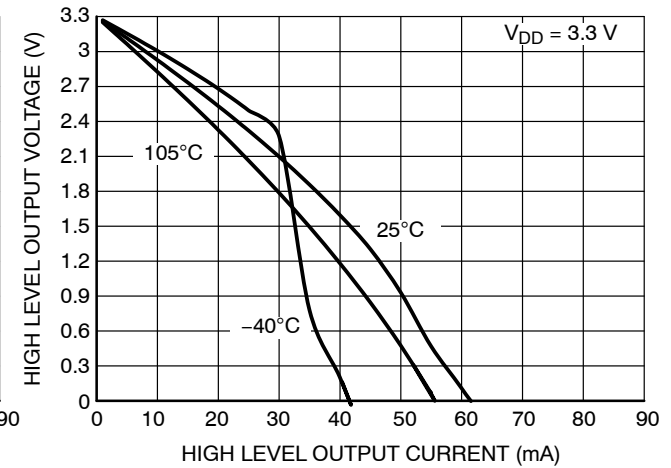


Figure 6. 3.3 V  $V_{OH}$  vs.  $I_{out}$

TYPICAL CHARACTERISTICS

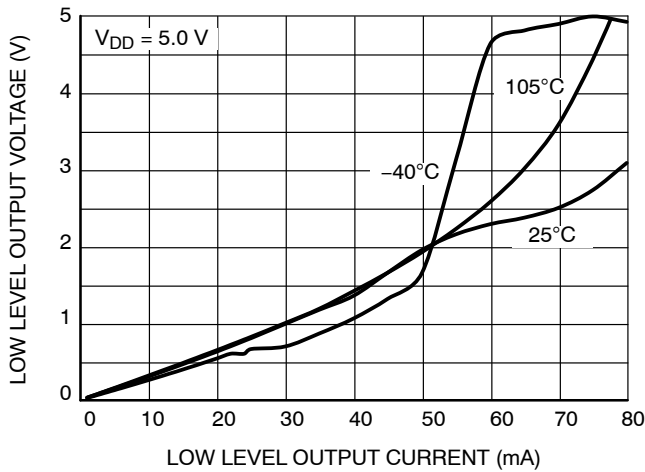


Figure 7.  $V_{OL}$  vs.  $I_{out}$

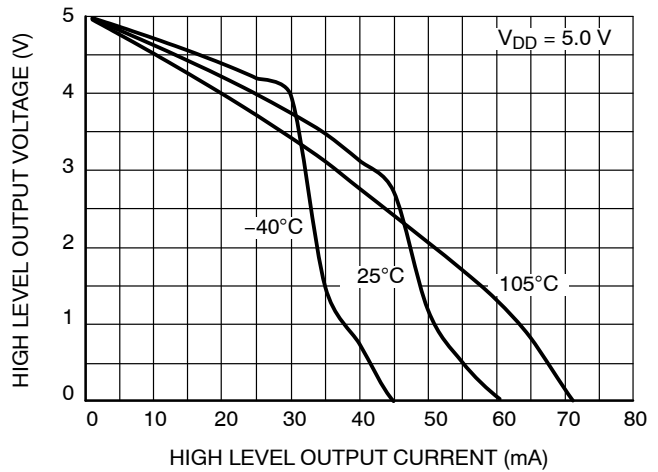


Figure 8.  $V_{OH}$  vs.  $I_{out}$

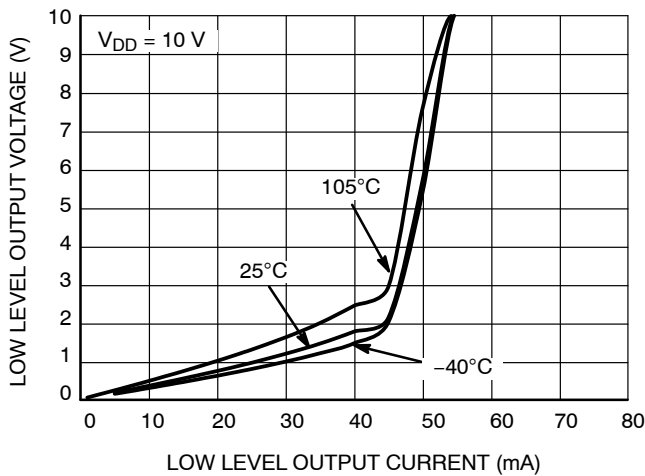


Figure 9. 10 V  $V_{OL}$  vs.  $I_{out}$

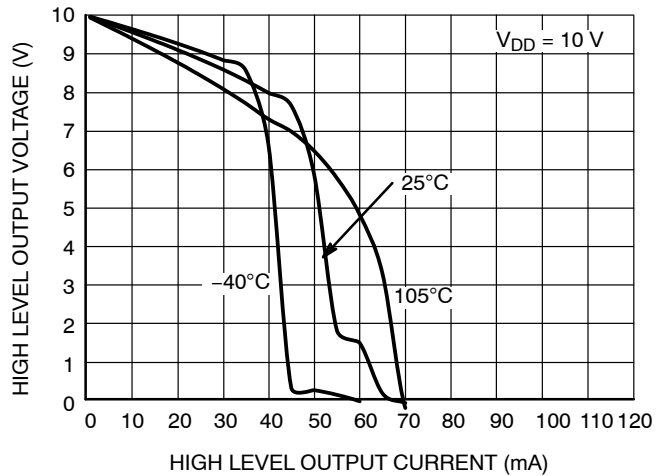


Figure 10. 10 V  $V_{OH}$  vs.  $I_{out}$

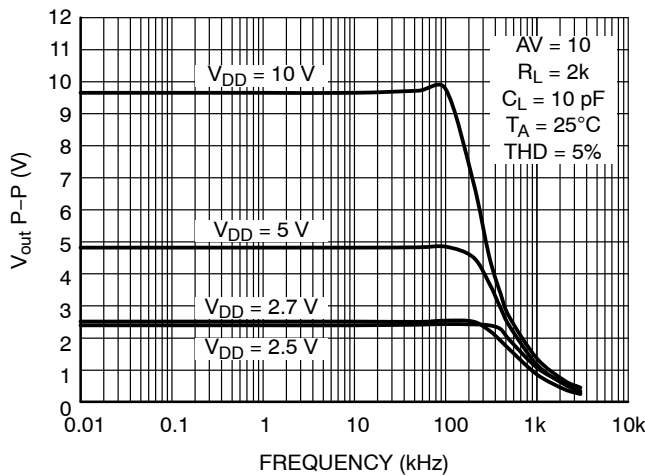


Figure 11. Peak-to-Peak Output vs. Supply vs. Frequency

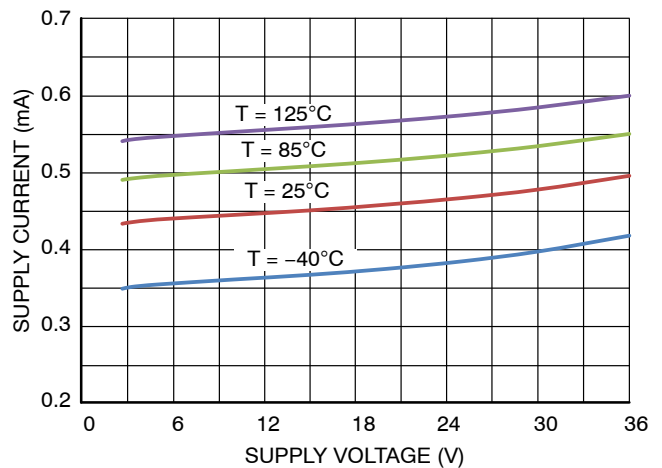


Figure 12. Quiescent Current Per Channel vs. Supply Voltage for TLV/NCV272/274

TYPICAL CHARACTERISTICS

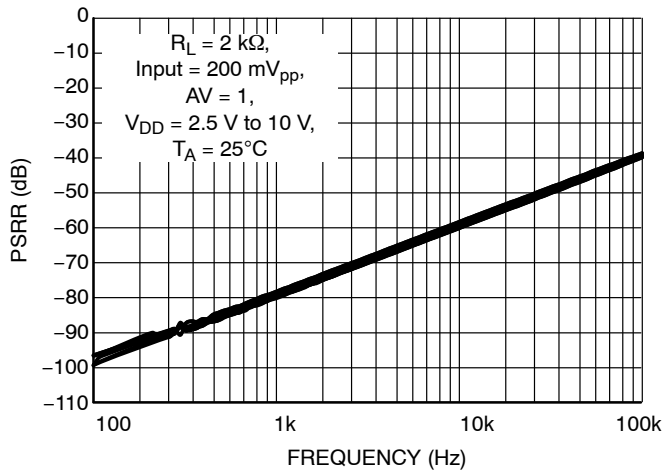


Figure 13. PSRR vs. Frequency for TLV271

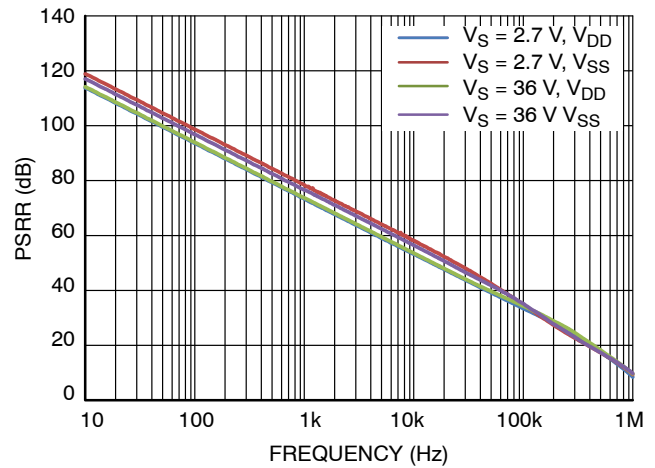


Figure 14. PSRR vs. Frequency for TLV/NCV272/274

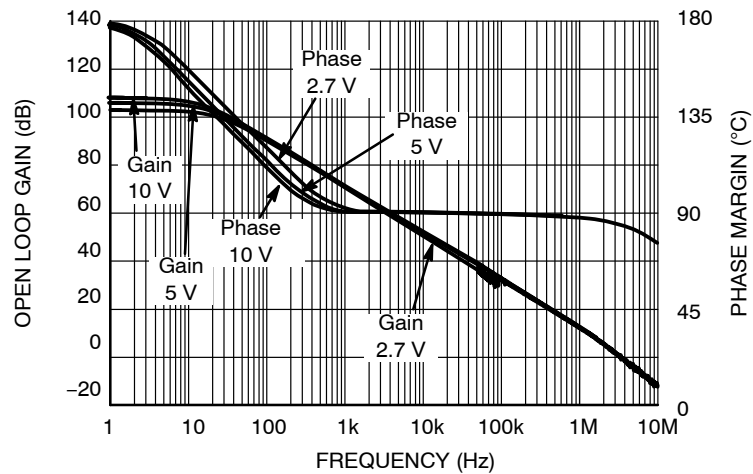


Figure 15. Open Loop Gain and Phase vs. Frequency

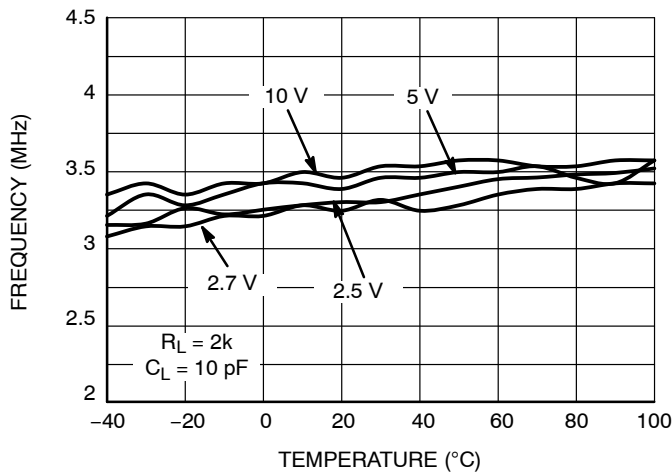


Figure 16. Gain Bandwidth Product vs. Temperature

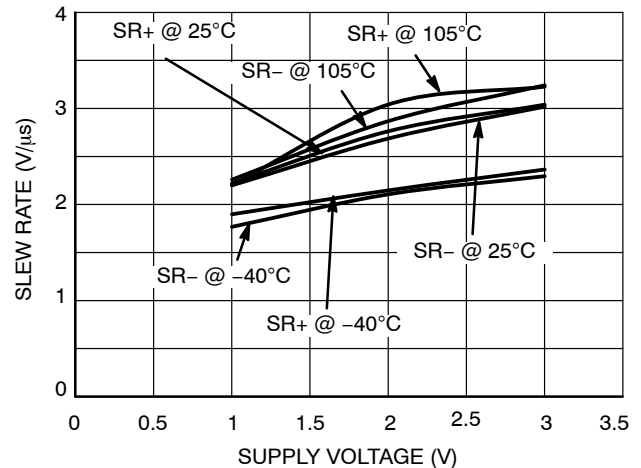


Figure 17. Slew Rate vs. Supply Voltage

TYPICAL CHARACTERISTICS

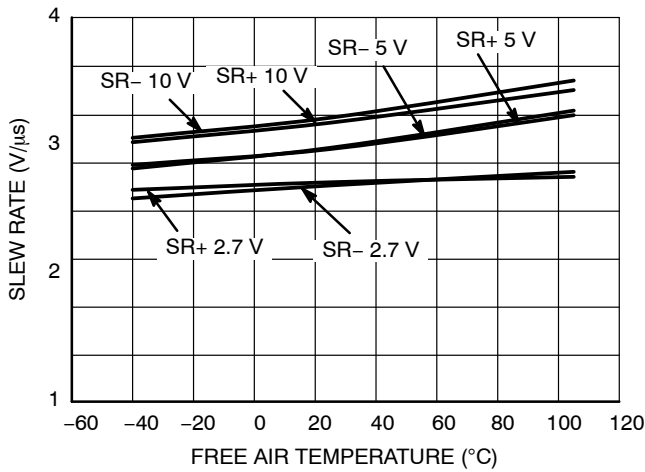


Figure 18. Slew Rate vs. Temperature

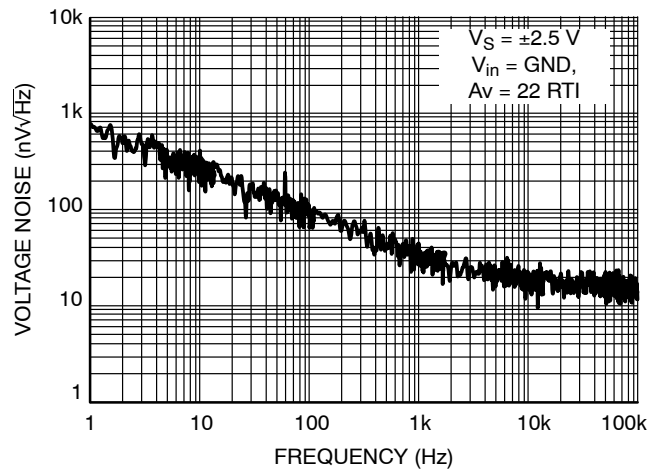


Figure 19. Voltage Noise vs. Frequency

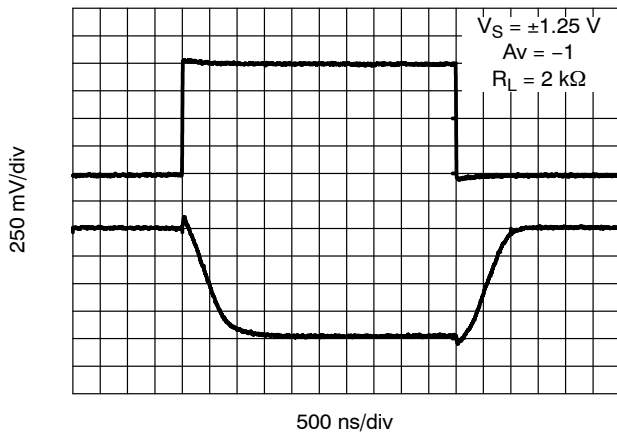


Figure 20. 2.5 V Inverting Large Signal Pulse Response

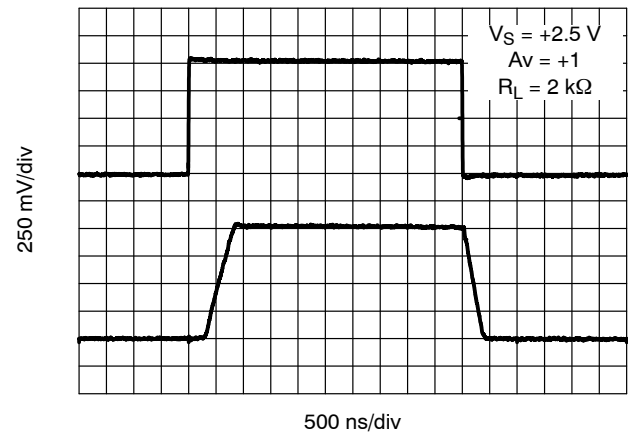


Figure 21. 2.5 V Non-Inverting Large Signal Pulse Response

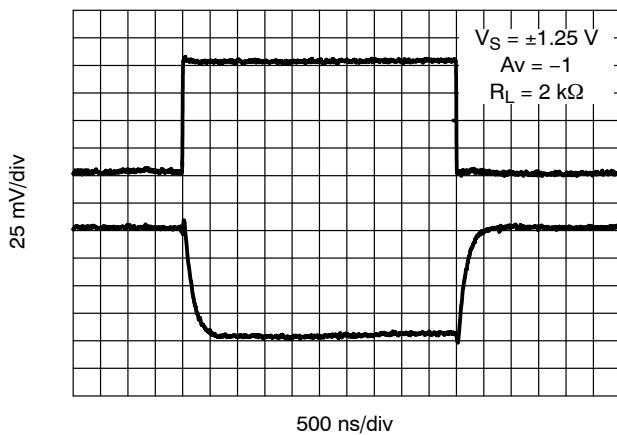


Figure 22. 2.5 V Inverting Small Signal Pulse Response

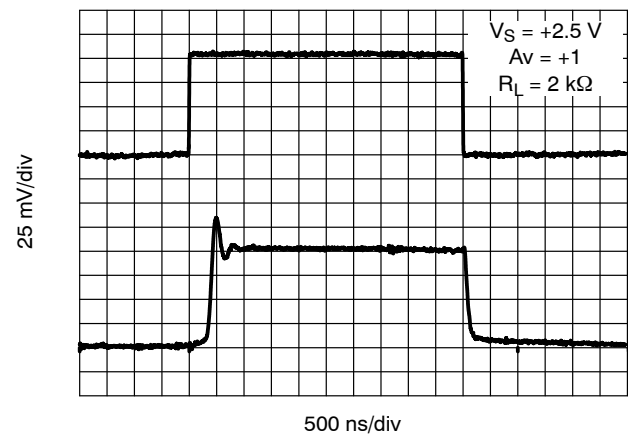
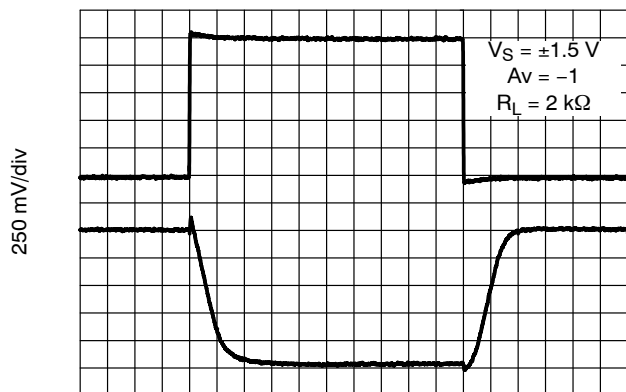


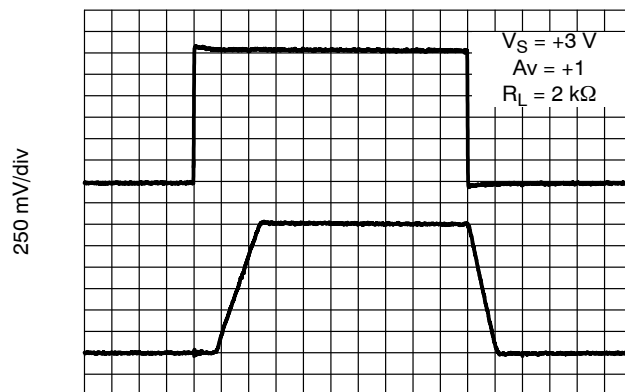
Figure 23. 2.5 V Non-Inverting Small Signal Pulse Response

TYPICAL CHARACTERISTICS



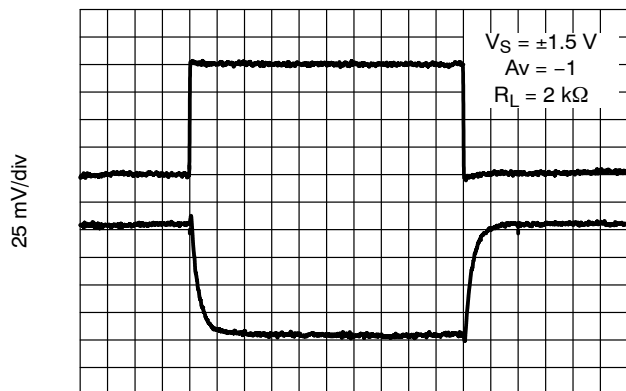
500 ns/div

**Figure 24. 3 V Inverting Large Signal Pulse Response**



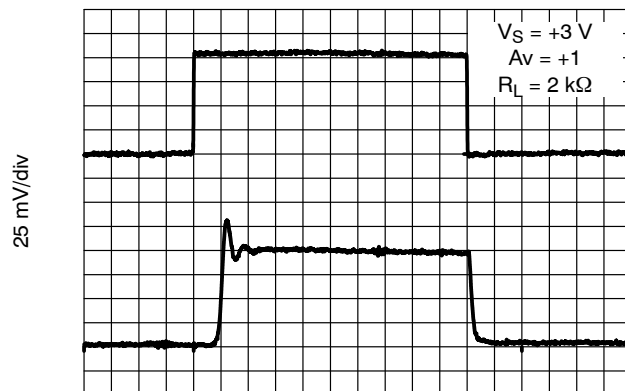
500 ns/div

**Figure 25. 3 V Non-Inverting Large Signal Pulse Response**



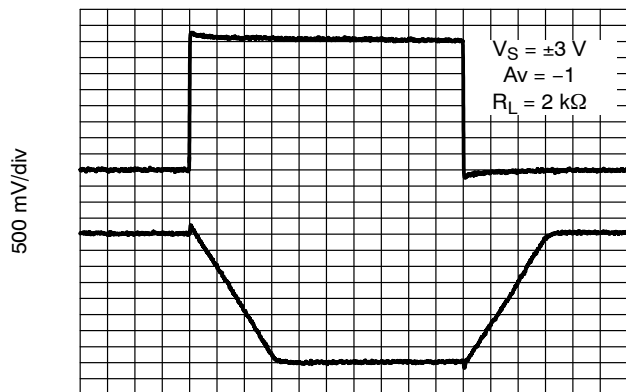
500 ns/div

**Figure 26. 3 V Inverting Small Signal Pulse Response**



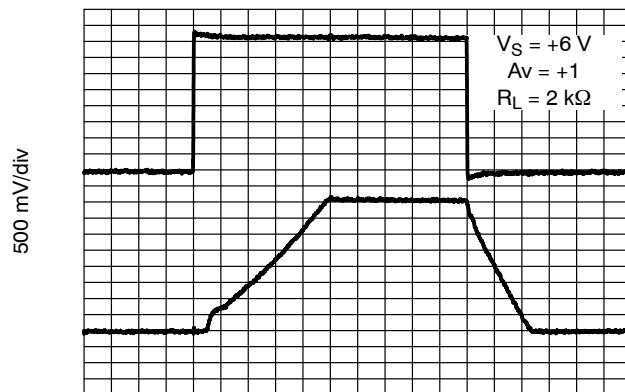
500 ns/div

**Figure 27. 3 V Non-Inverting Small Signal Pulse Response**



500 ns/div

**Figure 28. 6 V Inverting Large Signal Pulse Response**



500 ns/div

**Figure 29. 6 V Non-Inverting Large Signal Pulse Response**

TYPICAL CHARACTERISTICS

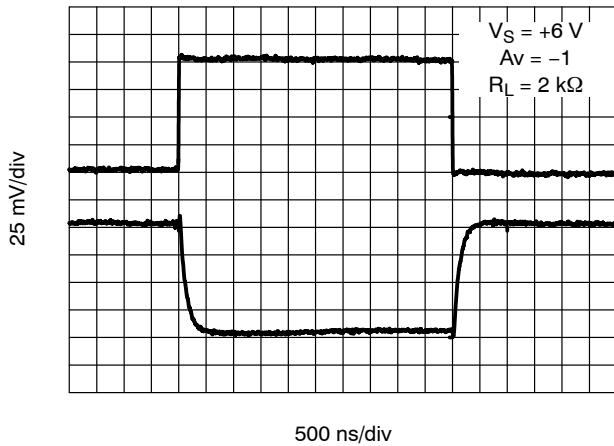


Figure 30. 6 V Inverting Small Signal Pulse Response

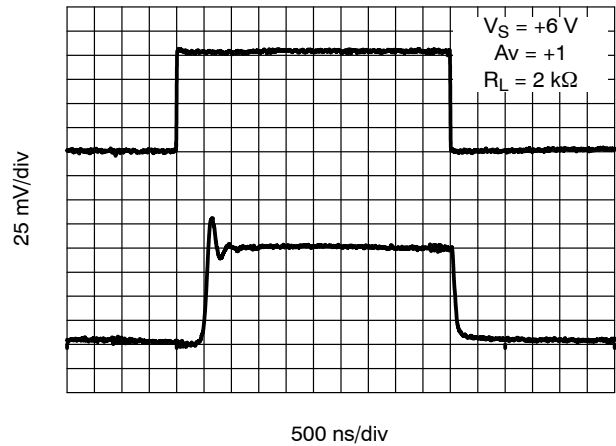


Figure 31. 6 V Non-Inverting Small Signal Pulse Response

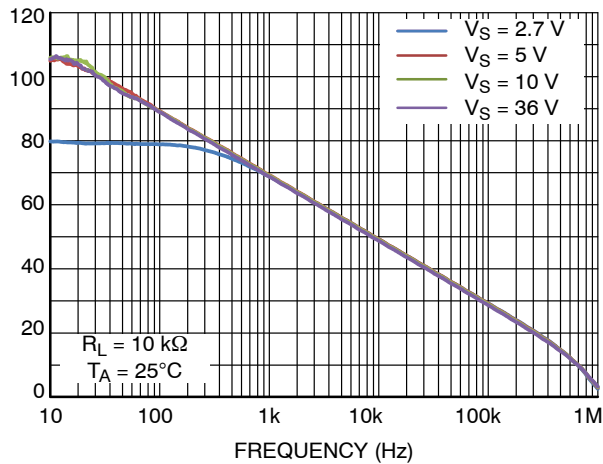


Figure 32. CMRR vs. Frequency for TLV/NCV272/274

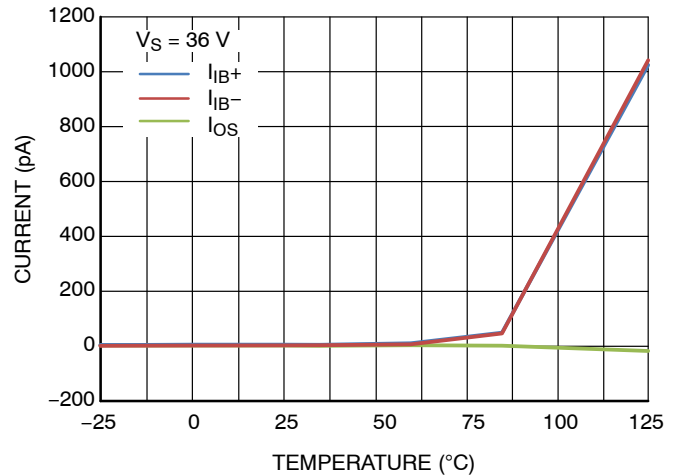


Figure 33. Input Bias and Offset Current vs. Temperature for TLV/NCV272/274

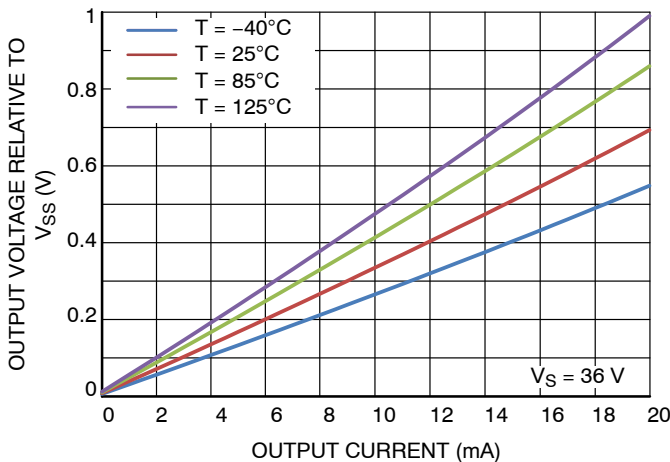


Figure 34. Low Level Output vs. Output Current for TLV/NCV272/274

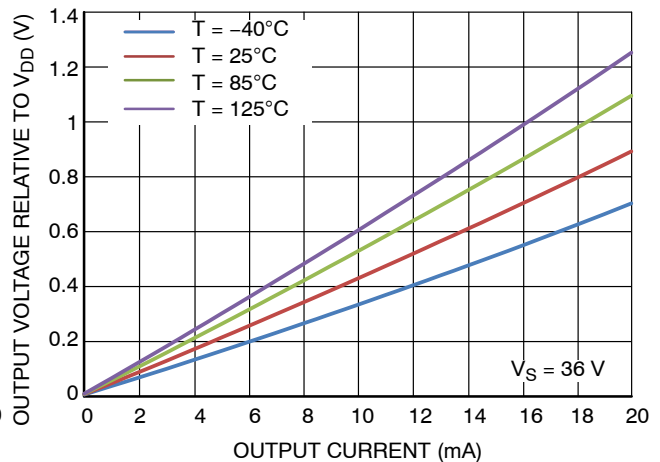


Figure 35. High Level Output vs. Output Current for TLV/NCV272/274



TYPICAL CHARACTERISTICS

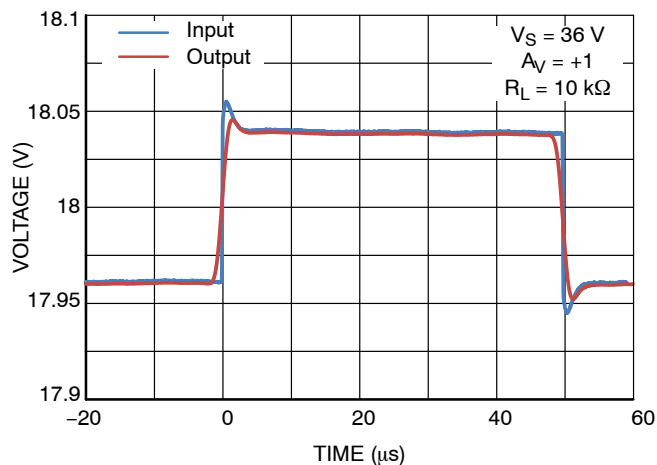


Figure 36. Non-inverting Small Signal Transient Response for TLV/NCV272/274

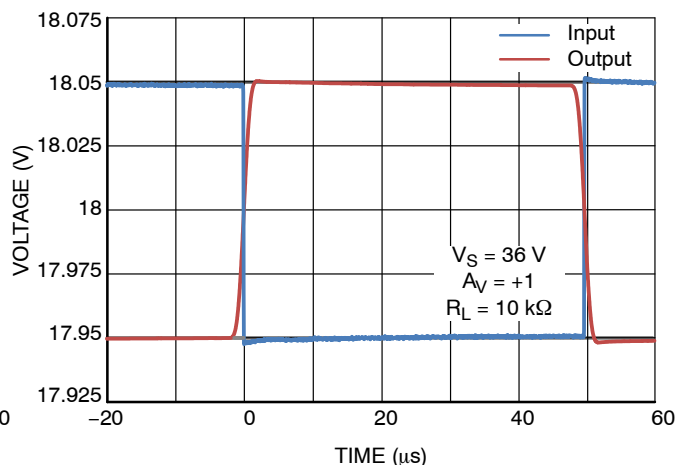


Figure 37. Inverting Small Signal Transient Response for TLV/NCV272/274

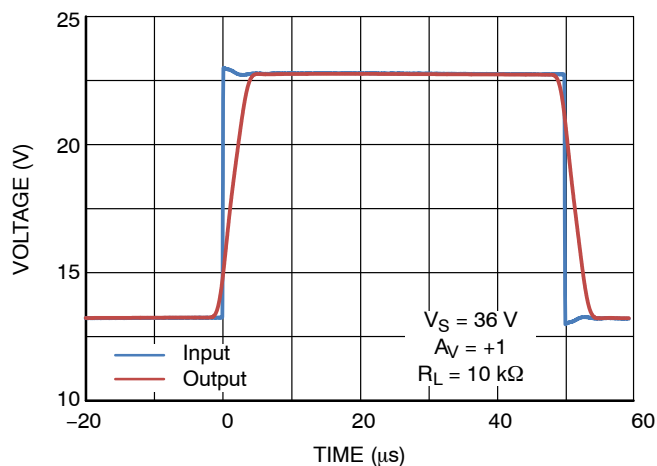


Figure 38. Non-inverting Large Signal Transient Response for TLV/NCV272/274

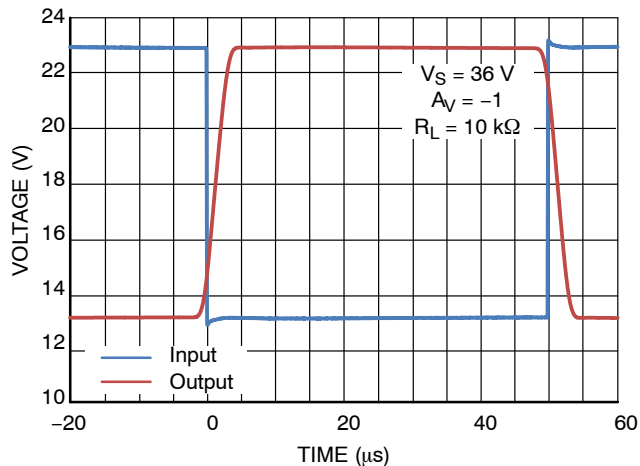


Figure 39. Inverting Large Signal Transient Response for TLV/NCV272/274

## APPLICATIONS

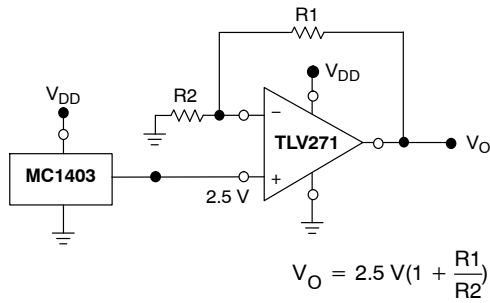


Figure 40. Voltage Reference

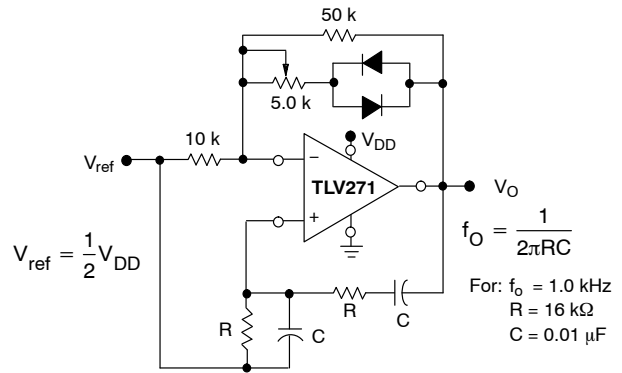


Figure 41. Wien Bridge Oscillator

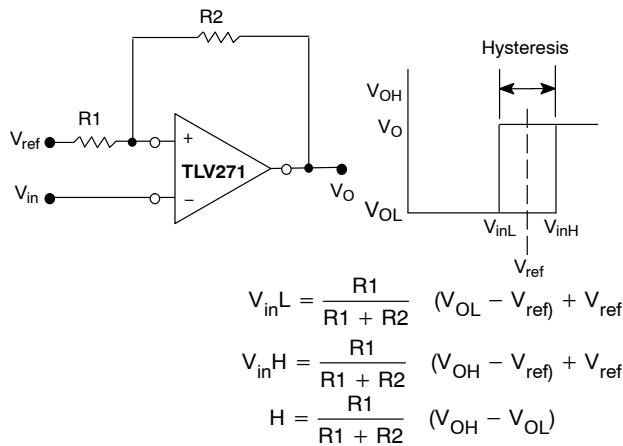
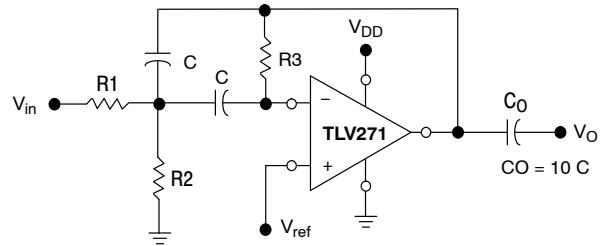


Figure 42. Comparator with Hysteresis



Given:  $f_o$  = center frequency  
 $A(f_o)$  = gain at center frequency

Choose value  $f_o, C$

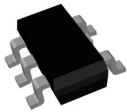
Then:  $R3 = \frac{Q}{\pi f_o C}$

$$R1 = \frac{R3}{2 A(f_o)}$$

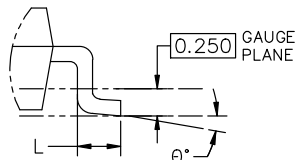
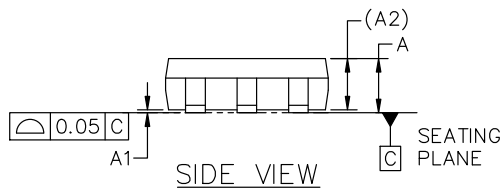
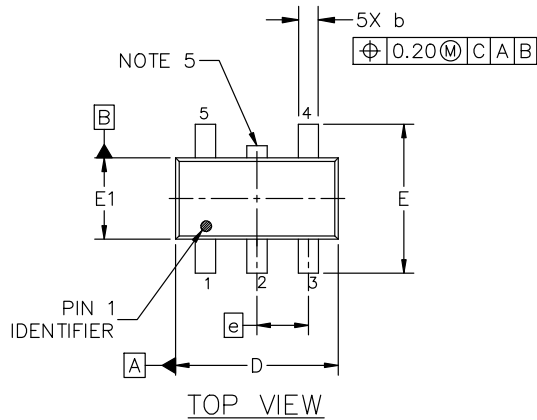
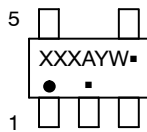
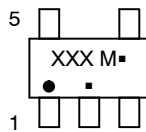
$$R2 = \frac{R1 R3}{4Q^2 R1 - R3}$$

For less than 10% error from operational amplifier,  
 $((Q_o f_o)/BW) < 0.1$  where  $f_o$  and BW are expressed in Hz.  
 If source impedance varies, filter may be preceded with  
 voltage follower buffer to stabilize filter parameters.

Figure 43. Multiple Feedback Bandpass Filter


**TSOP-5 3.00x1.50x0.95, 0.95P**  
**CASE 483**  
**ISSUE P**

DATE 01 APR 2024


**GENERIC**  
**MARKING DIAGRAM\***

**Analog**

**Discrete/Logic**

XXX = Specific Device Code    XXX = Specific Device Code  
A = Assembly Location    M = Date Code  
Y = Year    ■ = Pb-Free Package  
W = Work Week  
■ = Pb-Free Package

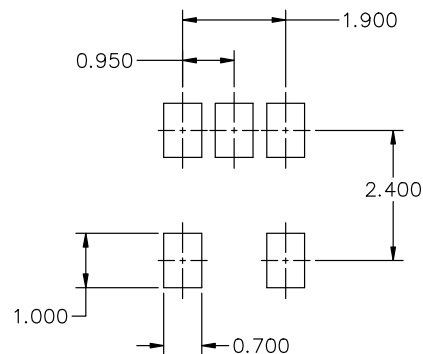
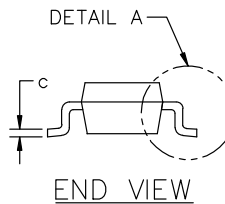
(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

## NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.900	1.000	1.100
A1	0.010	0.055	0.100
A2	0.950 REF.		
b	0.250	0.375	0.500
c	0.100	0.180	0.260
D	2.850	3.000	3.150
E	2.500	2.750	3.000
E1	1.350	1.500	1.650
e	0.950 BSC		
L	0.200	0.400	0.600
θ	0°	5°	10°


**RECOMMENDED MOUNTING FOOTPRINT\***

\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

**DOCUMENT NUMBER:** 98ARB18753C

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**DESCRIPTION:** TSOP-5 3.00x1.50x0.95, 0.95P

**PAGE 1 OF 1**

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SCALE 1:1

SOIC-8 NB  
CASE 751-07  
ISSUE AK

DATE 16 FEB 2011



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

GENERIC  
MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42564B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOIC-8 NB	PAGE 1 OF 2

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**SOIC-8 NB**  
**CASE 751-07**  
**ISSUE AK**

DATE 16 FEB 2011

<b>STYLE 1:</b> PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER	<b>STYLE 2:</b> PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1	<b>STYLE 3:</b> PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1	<b>STYLE 4:</b> PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE
<b>STYLE 5:</b> PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE	<b>STYLE 6:</b> PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE	<b>STYLE 7:</b> PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd	<b>STYLE 8:</b> PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1
<b>STYLE 9:</b> PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON	<b>STYLE 10:</b> PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND	<b>STYLE 11:</b> PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1	<b>STYLE 12:</b> PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
<b>STYLE 13:</b> PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN	<b>STYLE 14:</b> PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN	<b>STYLE 15:</b> PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON	<b>STYLE 16:</b> PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1
<b>STYLE 17:</b> PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC	<b>STYLE 18:</b> PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE	<b>STYLE 19:</b> PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1	<b>STYLE 20:</b> PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
<b>STYLE 21:</b> PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6	<b>STYLE 22:</b> PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND	<b>STYLE 23:</b> PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT	<b>STYLE 24:</b> PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE
<b>STYLE 25:</b> PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT	<b>STYLE 26:</b> PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC	<b>STYLE 27:</b> PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN	<b>STYLE 28:</b> PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN
<b>STYLE 29:</b> PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1	<b>STYLE 30:</b> PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1		

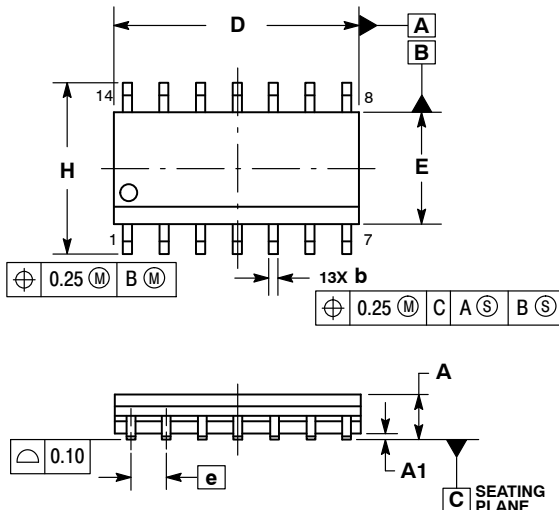
<b>DOCUMENT NUMBER:</b>	<b>98ASB42564B</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>SOIC-8 NB</b>	<b>PAGE 2 OF 2</b>

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**SOIC-14 NB**  
**CASE 751A-03**  
**ISSUE L**

DATE 03 FEB 2016

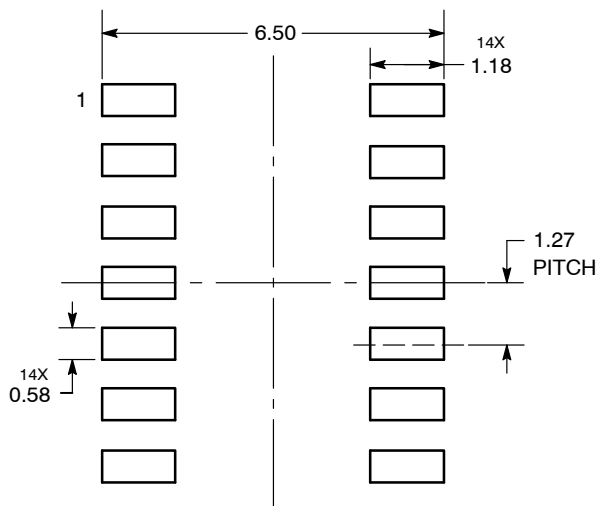


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
M	0°	7°	0°	7°

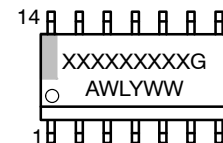
**SOLDERING FOOTPRINT\***



DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC MARKING DIAGRAM\***



XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

**STYLES ON PAGE 2**

<b>DOCUMENT NUMBER:</b>	<b>98ASB42565B</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>SOIC-14 NB</b>	<b>PAGE 1 OF 2</b>

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**SOIC-14**  
**CASE 751A-03**  
**ISSUE L**

DATE 03 FEB 2016

STYLE 1:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. NO CONNECTION  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 2:  
 CANCELLED

STYLE 3:  
 PIN 1. NO CONNECTION  
 2. ANODE  
 3. ANODE  
 4. NO CONNECTION  
 5. ANODE  
 6. NO CONNECTION  
 7. ANODE  
 8. ANODE  
 9. ANODE  
 10. NO CONNECTION  
 11. ANODE  
 12. ANODE  
 13. NO CONNECTION  
 14. COMMON CATHODE

STYLE 4:  
 PIN 1. NO CONNECTION  
 2. CATHODE  
 3. CATHODE  
 4. NO CONNECTION  
 5. CATHODE  
 6. NO CONNECTION  
 7. CATHODE  
 8. CATHODE  
 9. CATHODE  
 10. NO CONNECTION  
 11. CATHODE  
 12. CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 5:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. COMMON ANODE  
 8. COMMON CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 6:  
 PIN 1. CATHODE  
 2. CATHODE  
 3. CATHODE  
 4. CATHODE  
 5. CATHODE  
 6. CATHODE  
 7. CATHODE  
 8. ANODE  
 9. ANODE  
 10. ANODE  
 11. ANODE  
 12. ANODE  
 13. ANODE  
 14. ANODE

STYLE 7:  
 PIN 1. ANODE/CATHODE  
 2. COMMON ANODE  
 3. COMMON CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. COMMON CATHODE  
 12. COMMON ANODE  
 13. ANODE/CATHODE  
 14. ANODE/CATHODE

STYLE 8:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. COMMON ANODE  
 8. COMMON ANODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. NO CONNECTION  
 12. ANODE/CATHODE  
 13. ANODE/CATHODE  
 14. COMMON CATHODE

<b>DOCUMENT NUMBER:</b>	<b>98ASB42565B</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>SOIC-14 NB</b>	<b>PAGE 2 OF 2</b>

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## DATE 16 JUL 2020



1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10 mm IN EXCESS OF MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 mm PER SIDE. DIMENSION E DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.
5. DATUMS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.10
A1	0.05	0.08	0.15
b	0.25	0.33	0.40
c	0.13	0.18	0.23
D	2.90	3.00	3.10
E	2.90	3.00	3.10
e	0.65 BSC		
H <sub>E</sub>	4.75	4.90	5.05
L	0.40	0.55	0.70

XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

### RECOMMENDED MOUNTING FOOTPRINT

■ For additional information on our Pb-Free strategy and soldering details, please download the DN Semiconductor Soldering and Mounting Techniques Reference Manual, [SOLDDRM/D](http://www.dnsemi.com/1-6/SOLDERM/D).

- STYLE 1:

- PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN  
6. DRAIN  
7. DRAIN  
8. DRAIN

- STYLE 2:

- PIN 1. SOURCE 1  
2. GATE 1  
3. SOURCE 2  
4. GATE 2  
5. DRAIN 2  
6. DRAIN 2  
7. DRAIN 1  
8. DRAIN 1

- STYLE 3:

- PIN 1. N-SOURCE  
2. N-GATE  
3. P-SOURCE  
4. P-GATE  
5. P-DRAIN  
6. P-DRAIN  
7. N-DRAIN  
8. N-DRAIN

<b>DOCUMENT NUMBER:</b>	<b>98ASB14087C</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>MICRO8</b>	<b>PAGE 1 OF 1</b>

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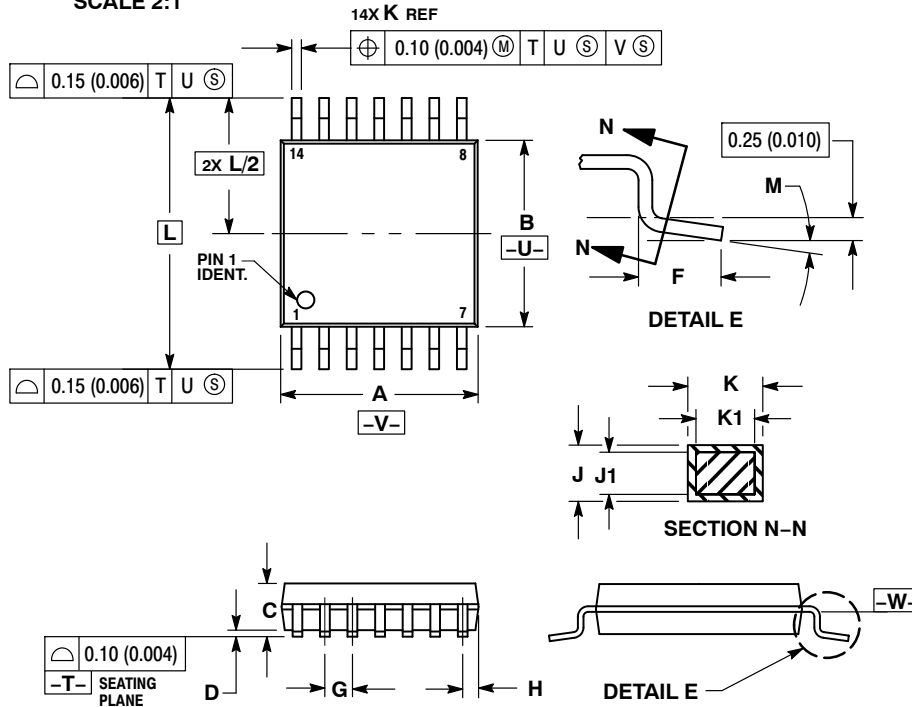




SCALE 2:1

**TSSOP-14 WB**  
CASE 948G  
ISSUE C

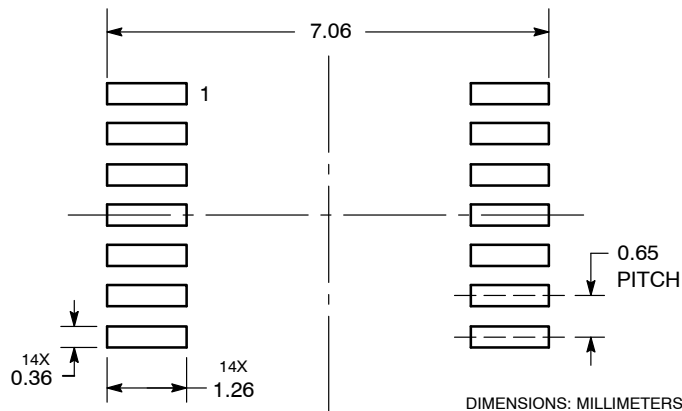
DATE 17 FEB 2016



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

**RECOMMENDED  
SOLDERING FOOTPRINT\***


\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC  
MARKING DIAGRAM\***


A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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<b>DESCRIPTION:</b>	<b>TSSOP-14 WB</b>	<b>PAGE 1 OF 1</b>

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