

3.5 MHz, Wide Supply, Operational Amplifier Rail-to-Rail Output

NCS2004, NCS2004A

The NCS2004 operational amplifier provides rail-to-rail output operation. The output can swing within 70 mV to the positive rail and 30 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 3.5 MHz bandwidth. The NCS2004 can operate on supply voltage as low as 2.5 V over the temperature range of -40°C to 125°C . The high bandwidth provides a slew rate of $2.4\text{ V}/\mu\text{s}$ while only consuming a typical $390\text{ }\mu\text{A}$ of quiescent current. Likewise the NCS2004 can run on a supply voltage as high as 16 V 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 either a small SC-88A or UDFN6 package allowing for use in high density PCB's.

Features

- Rail-To-Rail Output
- Wide Bandwidth: 3.5 MHz
- High Slew Rate: $2.4\text{ V}/\mu\text{s}$
- Wide Power Supply Range: 2.5 V to 16 V
- Low Supply Current: $390\text{ }\mu\text{A}$
- Low Input Bias Current: 45 pA
- Wide Temperature Range: -40°C to 125°C
- Small Packages: 5-Pin SC-88A and UDFN6 1.6x1.6
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

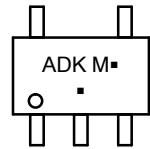
Applications

- Notebook Computers
- Portable Instruments

MARKING DIAGRAMS



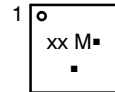
SC-88A
(SC-70-5)
SN SUFFIX
CASE 419A



ADK = Specific Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

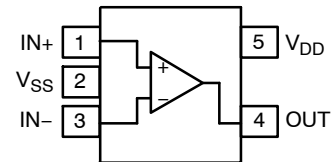


UDFN6
CASE 517AP

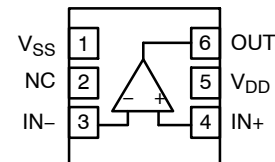


xx = Specific Device Code
AA for NCS2004
AC for NCS2004A
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

PIN CONNECTIONS



SC-88A (Top View)



UDFN6 (Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NCS2004MUTAG	UDFN6 (Pb-Free)	3000 / Tape & Reel

DISCONTINUED (Note 1)

NCS2004SQ3T2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NCS2004AMUTAG	UDFN6 (Pb-Free)	3000 / Tape & Reel

† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, [BRD8011/D](#).

1. **DISCONTINUED:** These devices are not available. Please contact your onsemi representative for information. The most current information on these devices may be available on [www.onsemi.com](#).

MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V_{DD}	Supply Voltage	16.5	V
V_{ID}	Input Differential Voltage	$\pm$ Supply Voltage	V
V_I	Input Common Mode Voltage Range	-0.2 V to $(V_{DD} + 0.2$ V)	V
I_I	Maximum Input Current	± 10	mA
I_O	Output Current Range	± 100	mA
	Continuous Total Power Dissipation (Note 2)	200	mW
T_J	Maximum Junction Temperature	150	$^{\circ}$ C
θ_{JA}	Thermal Resistance	333	$^{\circ}$ C/W
T_{stg}	Operating Temperature Range (free-air)	-40 to 125	$^{\circ}$ C
T_{stg}	Storage Temperature	-65 to 150	$^{\circ}$ C
	Mounting Temperature (Infrared or Convection - 20 sec)	260	$^{\circ}$ C
V_{ESD}	Machine Model Human Body Model	300 2000	V

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.

DC ELECTRICAL CHARACTERISTICS ($V_{DD} = 2.5$ V, 3.3 V, 5 V and ± 5 V, $T_A = 25^{\circ}$ C, $R_L \geq 10$ k Ω unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage (NCS2004)	$V_{IC} = V_{DD}/2$, $V_O = V_{DD}/2$, $R_L = 10$ k Ω , $R_S = 50$ Ω	–	0.5	5.0	mV
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C	–	–	7.0	
V_{IO}	Input Offset Voltage (NCS2004A)	$V_{IC} = V_{DD}/2$, $V_O = V_{DD}/2$, $R_L = 10$ k Ω , $R_S = 50$ Ω	–	–	3.0	mV
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C	–	–	5.0	
ICV _{OS}	Offset Voltage Drift	$V_{IC} = V_{DD}/2$, $V_O = V_{DD}/2$, $R_L = 10$ k Ω , $R_S = 50$ Ω	–	2.0	–	μ V/ $^{\circ}$ C
CMRR	Common Mode Rejection Ratio	0 V $\leq V_{IC} \leq V_{DD} - 1.35$ V, $R_S = 50$ Ω	$V_{DD} = 2.5$ V	55	94	dB
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		52	–	
		0 V $\leq V_{IC} \leq V_{DD} - 1.35$ V, $R_S = 50$ Ω	$V_{DD} = 5$ V	65	130	
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		62	–	
		0 V $\leq V_{IC} \leq V_{DD} - 1.35$ V, $R_S = 50$ Ω	$V_{DD} = \pm 5$ V	69	140	
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		66	–	
PSRR	Power Supply Rejection Ratio	$V_{DD} = 2.5$ V to 16 V, $V_{IC} = V_{DD}/2$, No Load	70	135	–	dB
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C	65	–	–	
A_{VD}	Large Signal Voltage Gain	$V_{O(pp)} = V_{DD}/2$, $R_L = 10$ k Ω	$V_{DD} = 2.5$ V	90	130	dB
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		76	–	
		$V_{O(pp)} = V_{DD}/2$, $R_L = 10$ k Ω	$V_{DD} = 3.3$ V	92	123	
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		76	–	
		$V_{O(pp)} = V_{DD}/2$, $R_L = 10$ k Ω	$V_{DD} = 5$ V	95	127	
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		86	–	
		$V_{O(pp)} = V_{DD}/2$, $R_L = 10$ k Ω	$V_{DD} = \pm 5$ V	95	130	
		$T_A = -40^{\circ}$ C to $+125^{\circ}$ C		90	–	

NCS2004, NCS2004A

DC ELECTRICAL CHARACTERISTICS ($V_{DD} = 2.5\text{ V}, 3.3\text{ V}, 5\text{ V}$ and $\pm 5\text{ V}$, $T_A = 25\text{ }^{\circ}\text{C}$, $R_L \geq 10\text{ k}\Omega$ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_B	Input Bias Current	$V_{DD} = 5\text{ V}$, $V_{IC} = V_{DD}/2$, $V_O = V_{DD}/2$, $R_S = 50\text{ }\Omega$	$T_A = 25\text{ }^{\circ}\text{C}$	–	45	150	pA
			$T_A = 125\text{ }^{\circ}\text{C}$	–	–	1000	
I_{IO}	Input Offset Current	$V_{DD} = 5\text{ V}$, $V_{IC} = V_{DD}/2$, $V_O = V_{DD}/2$, $R_S = 50\text{ }\Omega$	$T_A = 25\text{ }^{\circ}\text{C}$	–	45	150	pA
			$T_A = 125\text{ }^{\circ}\text{C}$	–	–	1000	
$r_{i(d)}$	Differential Input Resistance			–	1000	–	G Ω
C_{IC}	Common-mode Input Capacitance	$f = 21\text{ kHz}$		–	8.0	–	pF
V_{OH}	Output Swing (High-level)	$V_{IC} = V_{DD}/2$, $I_{OH} = -1\text{ mA}$	$V_{DD} = 2.5\text{ V}$	2.35	2.43	–	V
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		2.28	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -1\text{ mA}$	$V_{DD} = 3.3\text{ V}$	3.15	3.21	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		3.00	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -1\text{ mA}$	$V_{DD} = 5\text{ V}$	4.8	4.93	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		4.75	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -1\text{ mA}$	$V_{DD} = \pm 5\text{ V}$	4.92	4.96	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		4.9	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -5\text{ mA}$	$V_{DD} = 2.5\text{ V}$	1.7	2.14	–	V
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		1.5	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -5\text{ mA}$	$V_{DD} = 3.3\text{ V}$	2.5	2.89	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		2.1	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -5\text{ mA}$	$V_{DD} = 5\text{ V}$	4.5	4.68	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		4.35	–	–	
		$V_{IC} = V_{DD}/2$, $I_{OH} = -5\text{ mA}$	$V_{DD} = \pm 5\text{ V}$	4.7	4.78	–	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		4.65	–	–	
V_{OL}	Output Swing (Low-level)	$V_{IC} = V_{DD}/2$, $I_{OL} = -1\text{ mA}$	$V_{DD} = 2.5\text{ V}$	–	0.03	0.15	V
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.22	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -1\text{ mA}$	$V_{DD} = 3.3\text{ V}$	–	0.03	0.15	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.22	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -1\text{ mA}$	$V_{DD} = 5\text{ V}$	–	0.03	0.1	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.15	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -1\text{ mA}$	$V_{DD} = \pm 5\text{ V}$	–	0.05	0.08	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.1	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -5\text{ mA}$	$V_{DD} = 2.5\text{ V}$	–	0.15	0.7	V
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	1.1	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -5\text{ mA}$	$V_{DD} = 3.3\text{ V}$	–	0.13	0.7	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	1.1	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -5\text{ mA}$	$V_{DD} = 5\text{ V}$	–	0.13	0.4	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.5	
		$V_{IC} = V_{DD}/2$, $I_{OL} = -5\text{ mA}$	$V_{DD} = \pm 5\text{ V}$	–	0.16	0.3	
		$T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		–	–	0.35	

NCS2004, NCS2004A

DC ELECTRICAL CHARACTERISTICS ($V_{DD} = 2.5\text{ V}, 3.3\text{ V}, 5\text{ V}$ and $\pm 5\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L \geq 10\text{ k}\Omega$ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_O	Output Current	$V_O = 0.5\text{ V}$ from rail, $V_{DD} = 2.5\text{ V}$	Positive rail	–	4.0	–	mA
			Negative rail	–	5.0	–	
		$V_O = 0.5\text{ V}$ from rail, $V_{DD} = 5\text{ V}$	Positive rail	–	7.0	–	
			Negative rail	–	8.0	–	
		$V_O = 0.5\text{ V}$ from rail, $V_{DD} = 10\text{ V}$	Positive rail	–	13	–	
			Negative rail	–	12	–	
I_{DD}	Power Supply Quiescent Current	$V_O = V_{DD}/2$	$V_{DD} = 2.5\text{ V}$	–	380	560	μA
			$V_{DD} = 3.3\text{ V}$	–	385	620	
			$V_{DD} = 5\text{ V}$	–	390	660	
			$V_{DD} = 10\text{ V}$	–	400	800	
		$T_A = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$		–	–	1000	

AC ELECTRICAL CHARACTERISTICS ($V_{DD} = 2.5\text{ V}, 5\text{ V}$, & $\pm 5\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, and $R_L \geq 10\text{ k}\Omega$ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
UGBW	Unity Gain Bandwidth	$R_L = 2\text{ k}\Omega$, $C_L = 10\text{ pF}$	$V_{DD} = 2.5\text{ V}$	–	3.2	–	MHz
			$V_{DD} = 5\text{ V}$ to 10 V	–	3.5	–	
SR	Slew Rate at Unity Gain	$V_{O(pp)} = V_{DD}/2$, $R_L = 10\text{ k}\Omega$, $C_L = 50\text{ pF}$	$V_{DD} = 2.5\text{ V}$	1.35	2.0	–	V/ μ S
		$T_A = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$		1	–	–	
		$V_{O(pp)} = V_{DD}/2$, $R_L = 10\text{ k}\Omega$, $C_L = 50\text{ pF}$	$V_{DD} = 5\text{ V}$	1.45	2.3	–	
		$T_A = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$		1.2	–	–	
		$V_{O(pp)} = V_{DD}/2$, $R_L = 10\text{ k}\Omega$, $C_L = 50\text{ pF}$	$V_{DD} = \pm 5\text{ V}$	1.8	2.6	–	
		$T_A = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$		1.3	–	–	
θ_m	Phase Margin	$R_L = 2\text{ k}\Omega$, $C_L = 10\text{ pF}$		–	45	–	$^\circ$
	Gain Margin	$R_L = 2\text{ k}\Omega$, $C_L = 10\text{ pF}$		–	14	–	dB
t_S	Settling Time to 0.1%	$V\text{-step(pp)} = 1\text{ V}$, $AV = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 10\text{ pF}$	$V_{DD} = 2.5\text{ V}$	–	2.9	–	μ S–
		$V\text{-step(pp)} = 1\text{ V}$, $AV = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 68\text{ pF}$	$V_{DD} = 5\text{ V}$, $\pm 5\text{ V}$	–	2.0	–	
THD+N	Total Harmonic Distortion plus Noise	$V_{DD} = 2.5\text{ V}$, $V_{O(pp)} = V_{DD}/2$, $R_L = 2\text{ k}\Omega$, $f = 10\text{ kHz}$	$AV = 1$	–	0.004	–	%
			$AV = 10$	–	0.04	–	
			$AV = 100$	–	0.3	–	
		$V_{DD} = 5\text{ V}$, $\pm 5\text{ V}$, $V_{O(pp)} = V_{DD}/2$, $R_L = 2\text{ k}\Omega$, $f = 10\text{ kHz}$	$AV = 1$	–	0.004	–	
			$AV = 10$	–	0.04	–	
			$AV = 100$	–	0.03	–	
e_n	Input-Referred Voltage Noise	$f = 1\text{ kHz}$		–	30	–	nV/ $\sqrt{\text{Hz}}$
		$f = 10\text{ kHz}$		–	20	–	
i_n	Input-Referred Current Noise	$f = 1\text{ kHz}$		–	0.6	–	fA/ $\sqrt{\text{Hz}}$



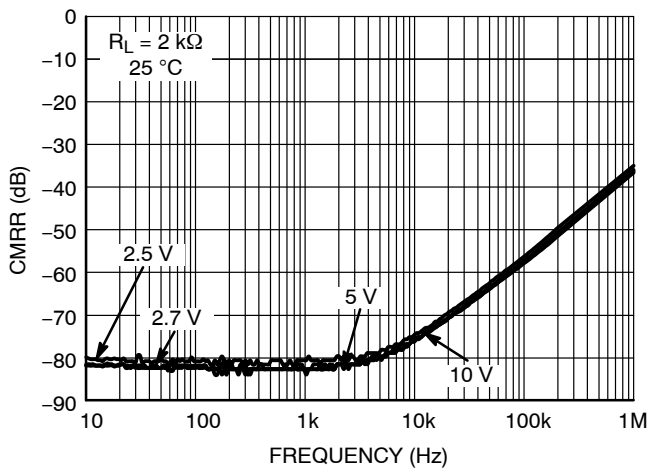


Figure 1. CMRR vs. Frequency

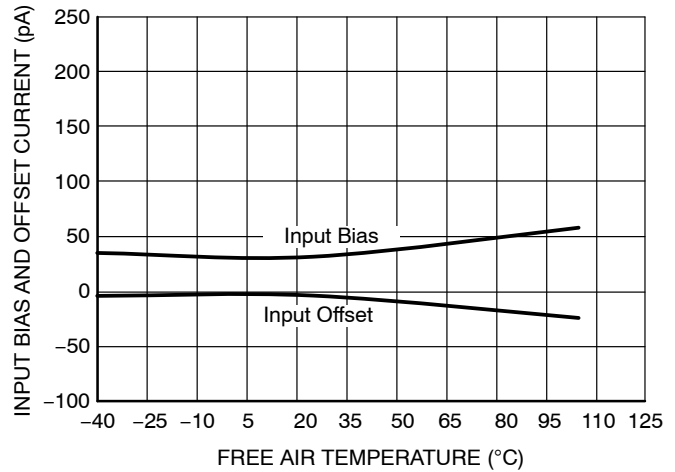


Figure 2. Input Bias and Offset Current vs. Temperature

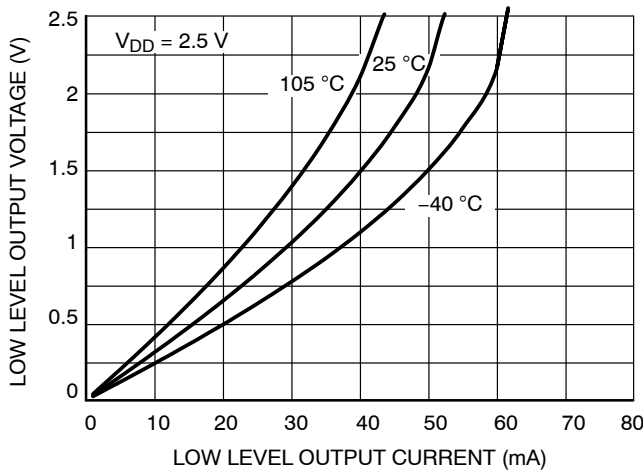


Figure 3. 2.5 V V_{OL} vs. I_{out}

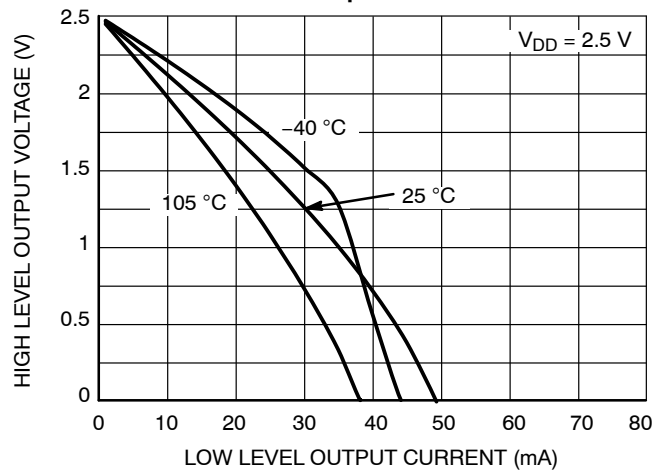


Figure 4. 2.5 V V_{OH} vs. I_{out}

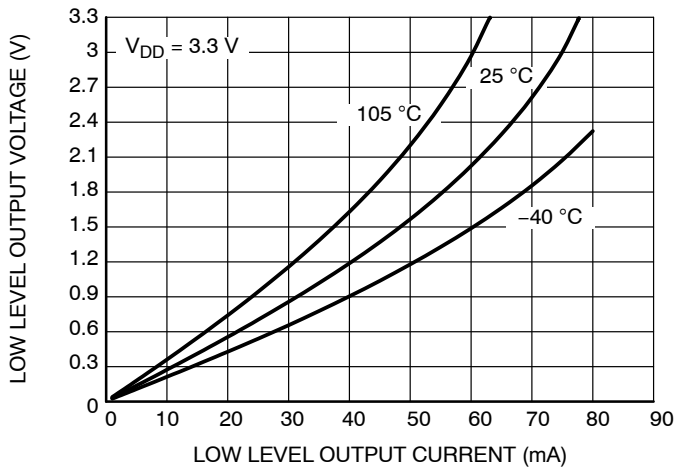


Figure 5. 3.3 V V_{OL} vs. I_{out}

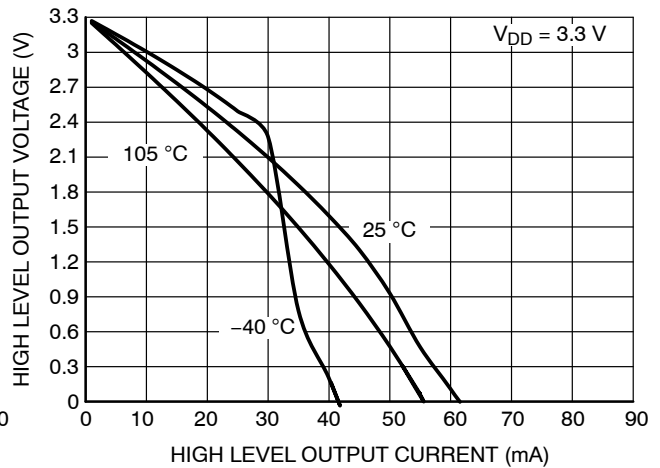


Figure 6. 3.3 V V_{OH} vs. I_{out}

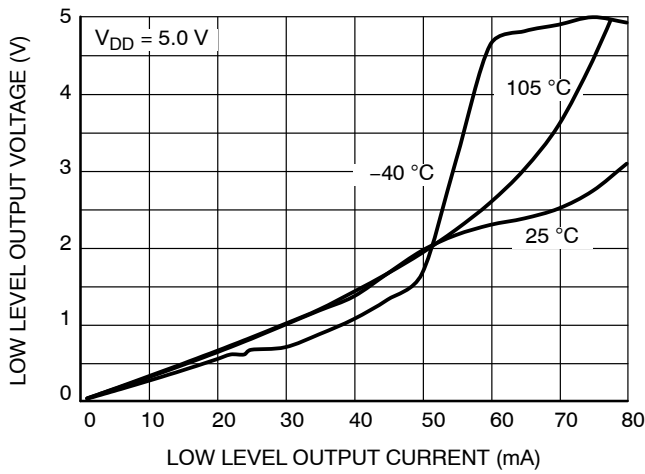


Figure 7. V_{OL} vs. I_{out}

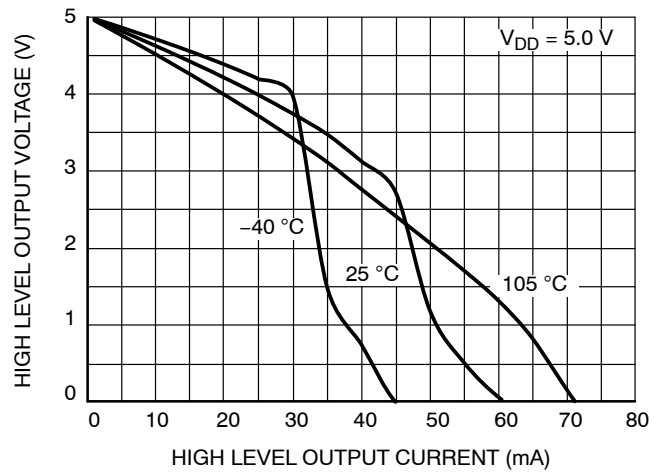


Figure 8. V_{OH} vs. I_{out}

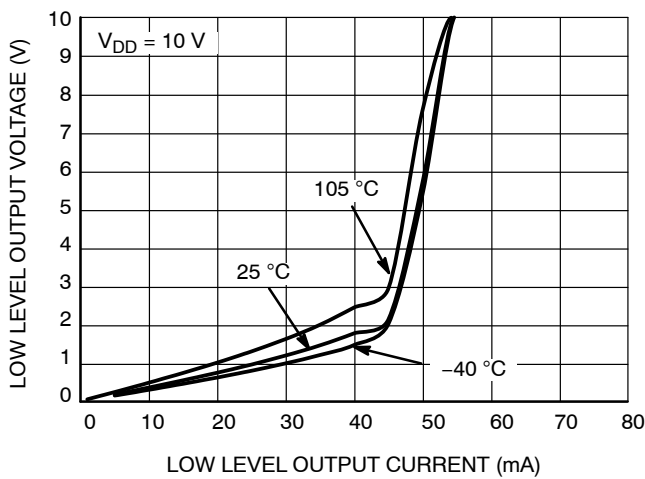


Figure 9. 10 V V_{OL} vs. I_{out}

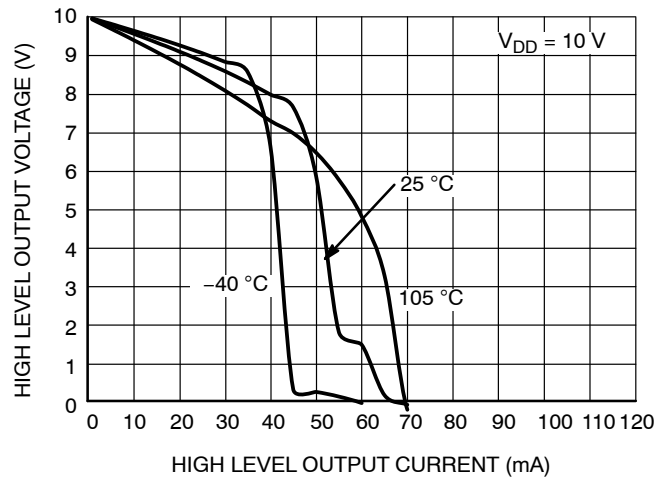


Figure 10. 10 V V_{OH} vs. I_{out}

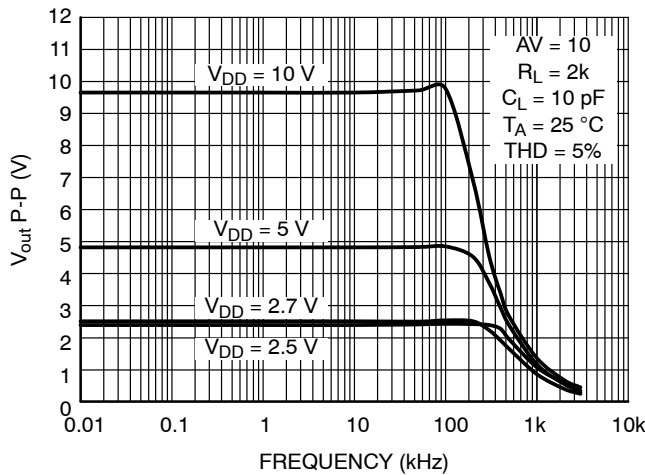


Figure 11. Peak-to-Peak Output vs. Supply vs. Frequency

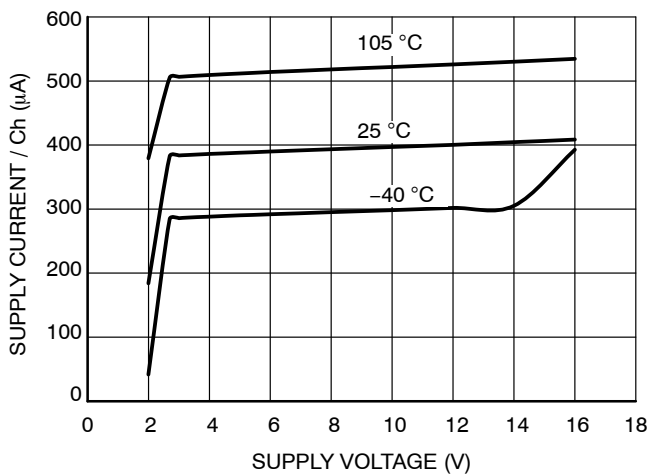


Figure 12. Supply Current vs. Supply Voltage

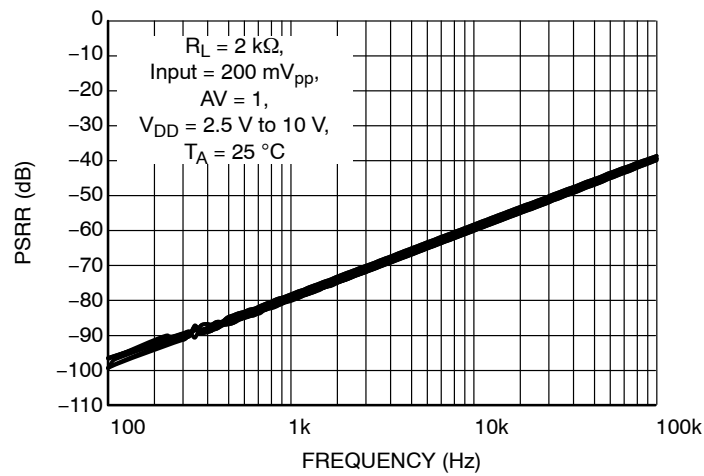


Figure 13. PSRR vs. Frequency

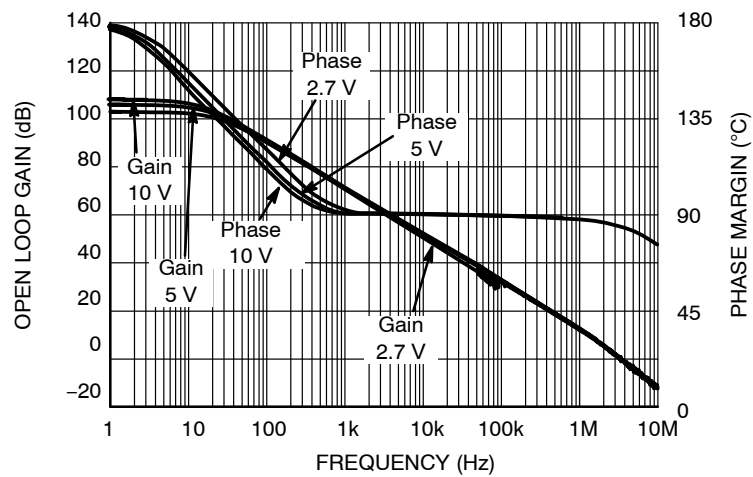


Figure 14. Open Loop Gain and Phase vs. Frequency

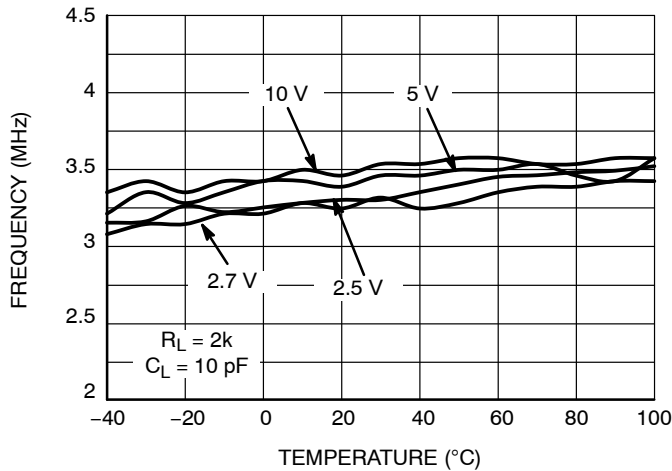


Figure 15. Gain Bandwidth Product vs. Temperature

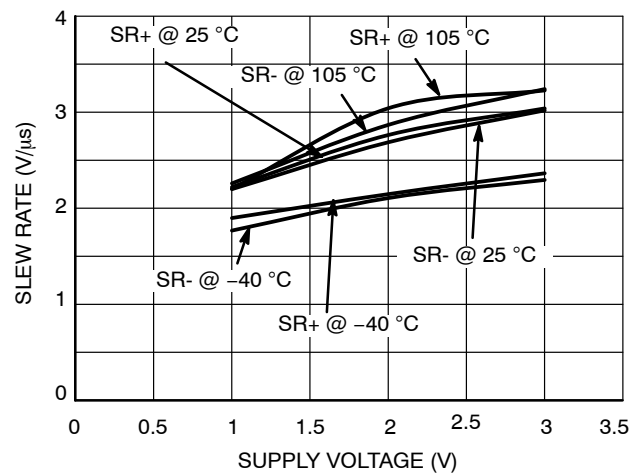


Figure 16. Slew Rate vs. Supply Voltage

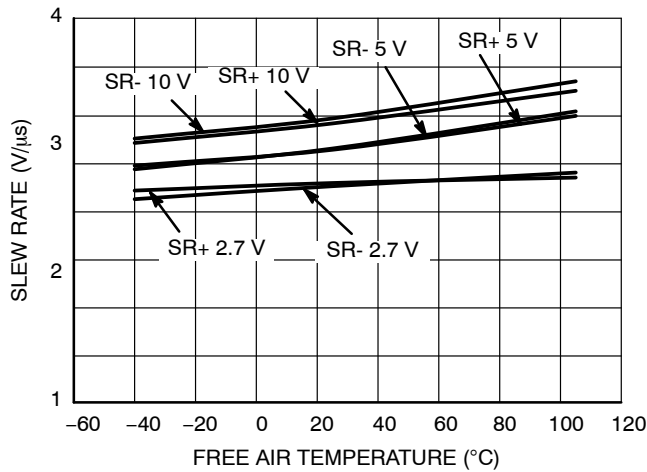


Figure 17. Slew Rate vs. Temperature

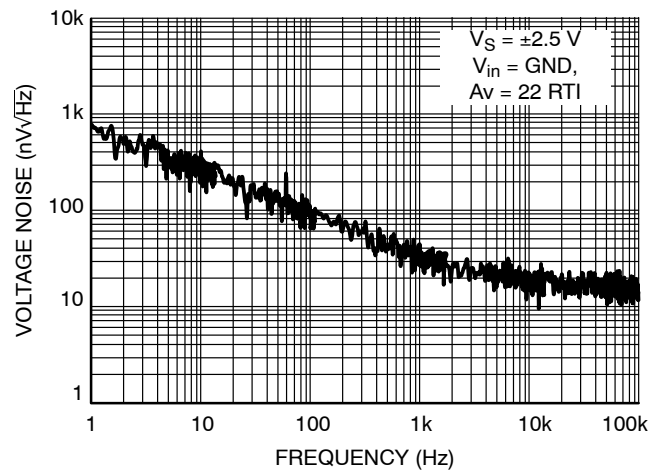


Figure 18. Voltage Noise vs. Frequency

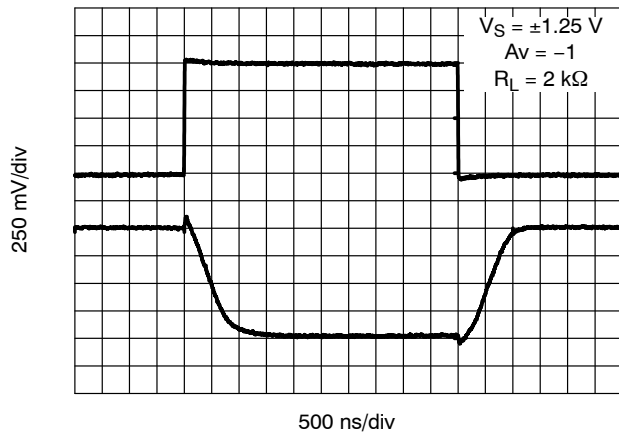


Figure 19. 2.5 V Inverting Large Signal Pulse Response

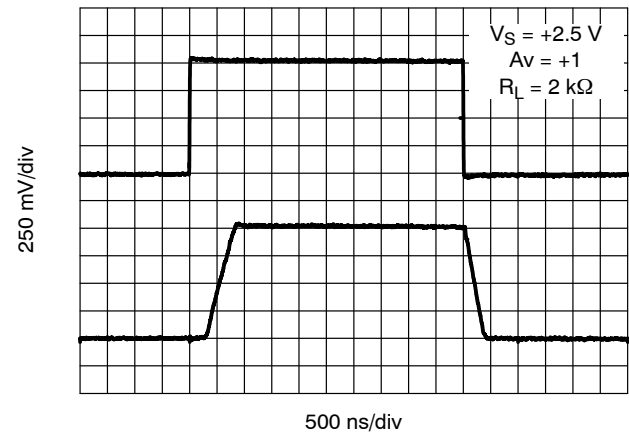


Figure 20. 2.5 V Non-Inverting Large Signal Pulse Response

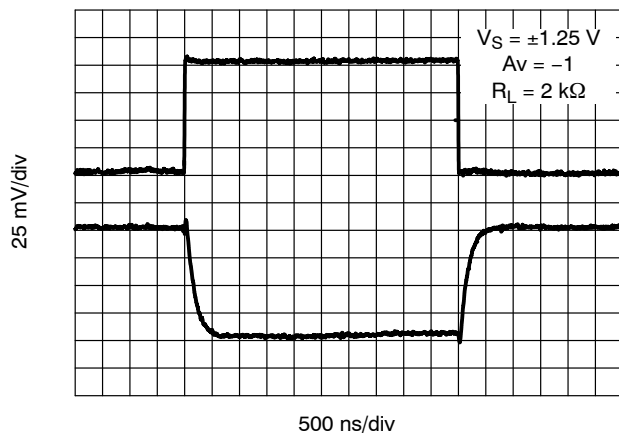


Figure 21. 2.5 V Inverting Small Signal Pulse Response

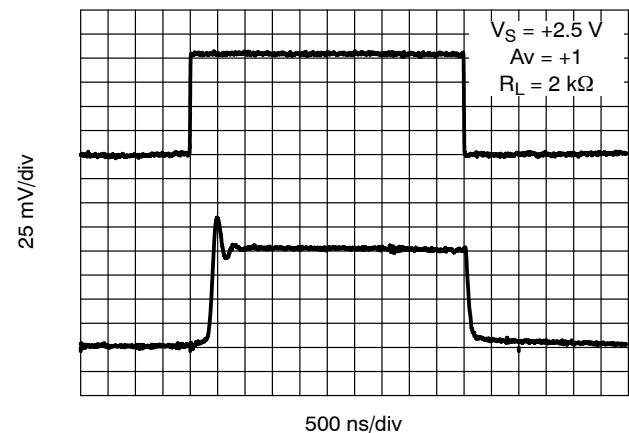
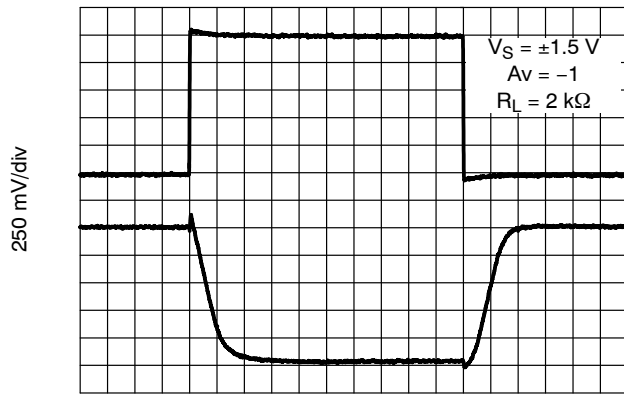
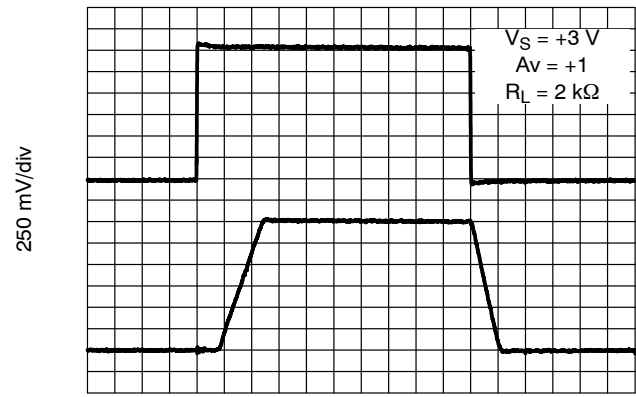


Figure 22. 2.5 V Non-Inverting Small Signal Pulse Response



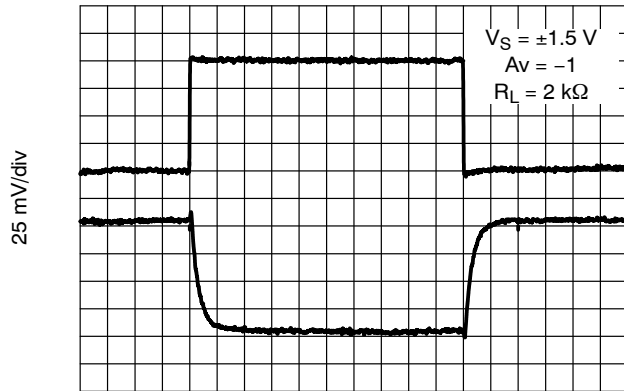
500 ns/div

Figure 23. 3 V Inverting Large Signal Pulse Response



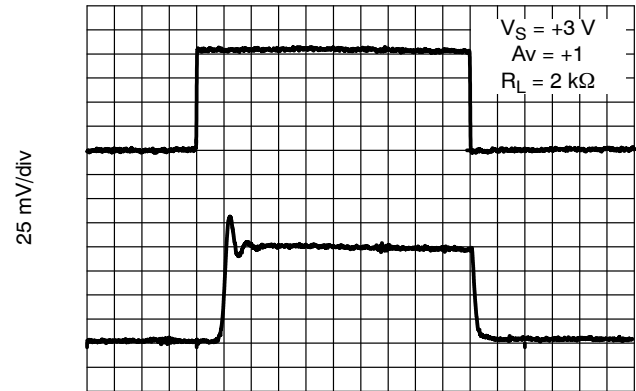
500 ns/div

Figure 24. 3 V Non-Inverting Large Signal Pulse Response



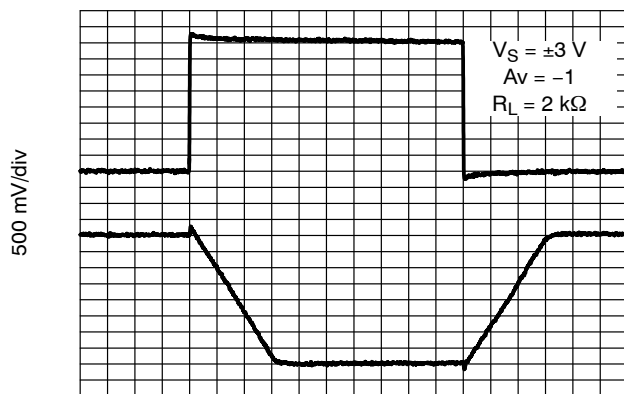
500 ns/div

Figure 25. 3 V Inverting Small Signal Pulse Response



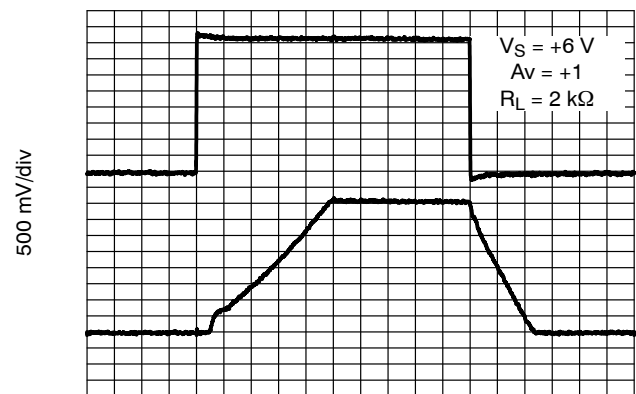
500 ns/div

Figure 26. 3 V Non-Inverting Small Signal Pulse Response



500 ns/div

Figure 27. 6 V Inverting Large Signal Pulse Response



500 ns/div

Figure 28. 6 V Non-Inverting Large Signal Pulse Response

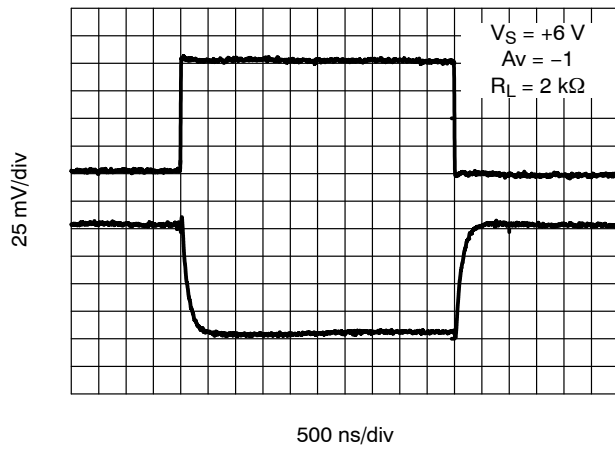


Figure 29. 6 V Inverting Small Signal Pulse Response

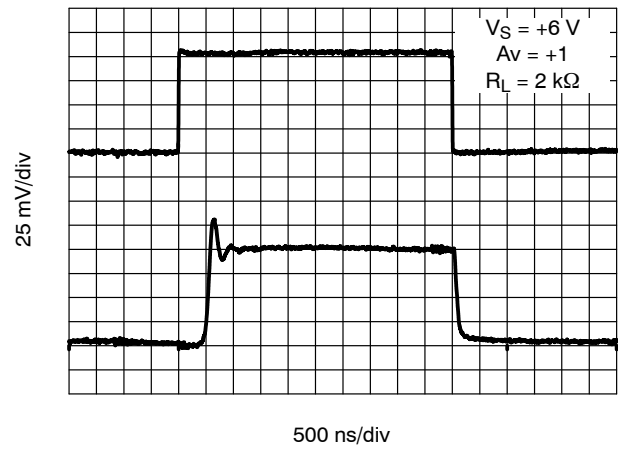


Figure 30. 6 V Non-Inverting Small Signal Pulse Response

APPLICATIONS

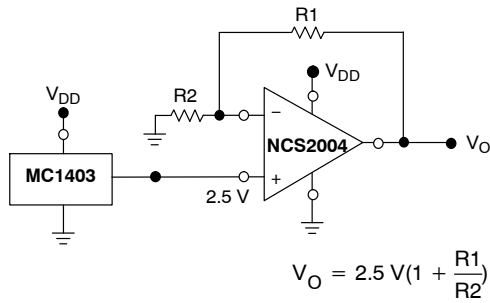


Figure 31. Voltage Reference

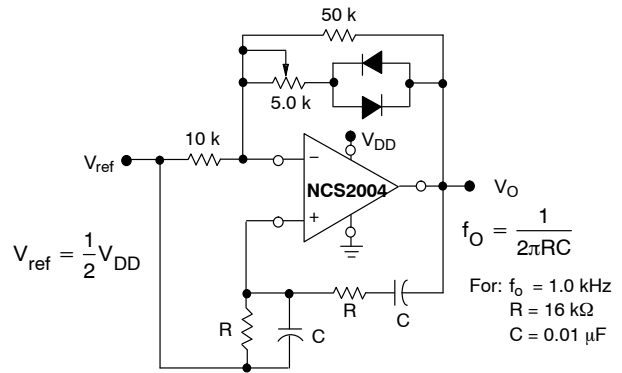


Figure 32. Wien Bridge Oscillator

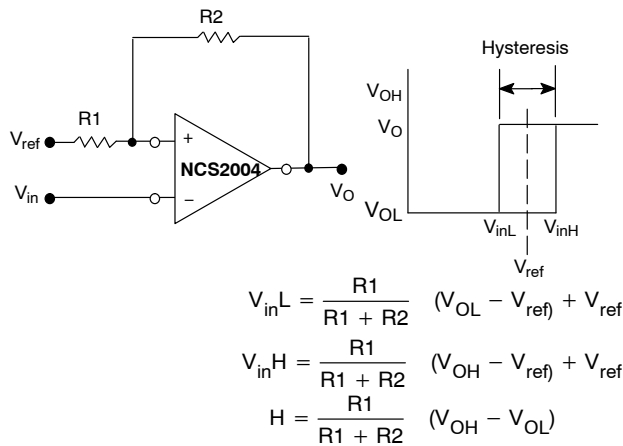
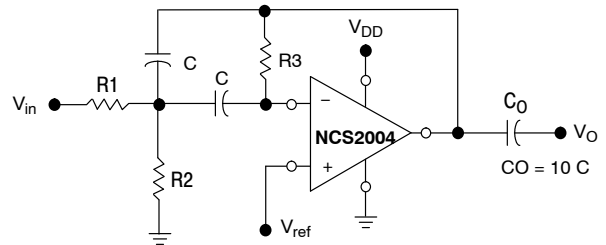


Figure 33. Comparator with Hysteresis



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

Choose value f_o , C

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

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

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

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 34. Multiple Feedback Bandpass Filter

NCS2004, NCS2004A

REVISION HISTORY

Revision	Description of Changes	Date
10	NCS2004AMUTAG, NCS2004SQ3T2G OPN's Marked as Discontinued + Rebranded the Data Sheet to onsemi format.	02/03/2026

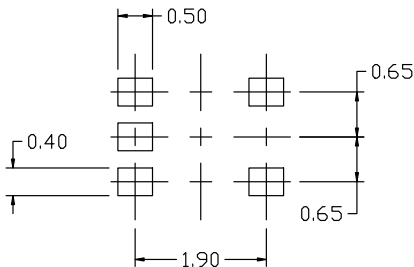
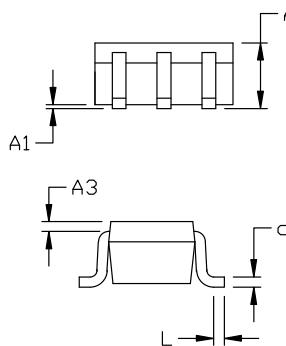
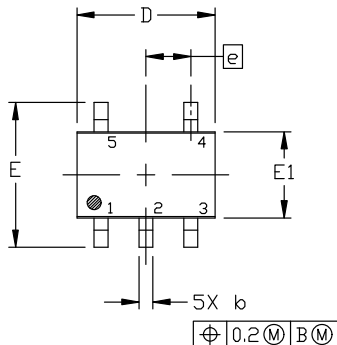




SCALE 2:1

SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE M

DATE 11 APR 2023



RECOMMENDED
MOUNTING FOOTPRINT

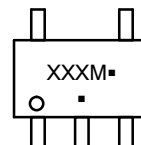
* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

GENERIC MARKING
DIAGRAM*



*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.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

STYLE 1:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:

- PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:

- PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:

- PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:

- PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

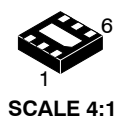
STYLE 9:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

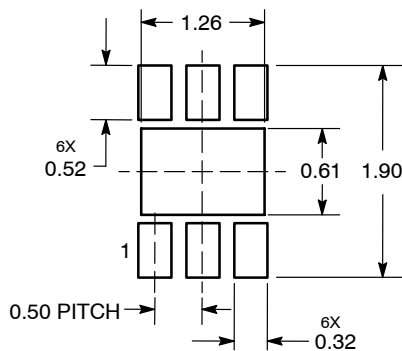
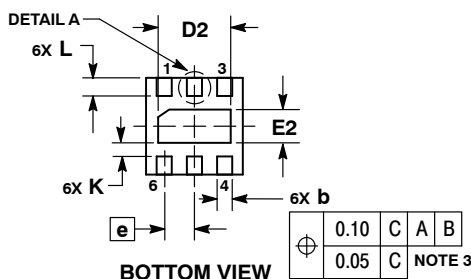
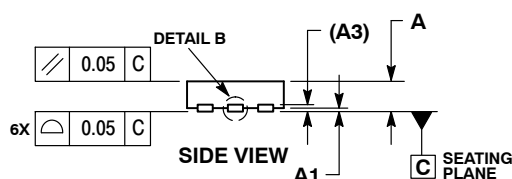
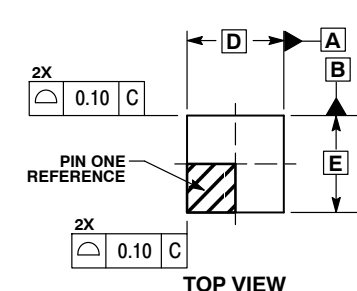
Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

DOCUMENT NUMBER:	98ASB42984B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC-88A (SC-70-5/SOT-353)	PAGE 1 OF 1

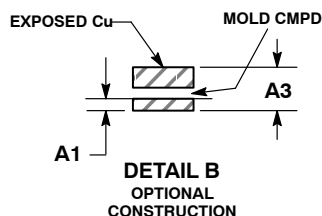
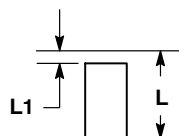
onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.


UDFN6 1.6x1.6, 0.5P
CASE 517AP
ISSUE O

DATE 26 OCT 2007



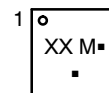
*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERM/D.



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13	REF
b	0.20	0.30
D	1.60	BSC
E	1.60	BSC
e	0.50	BSC
D2	1.10	1.30
E2	0.45	0.65
K	0.20	---
L	0.20	0.40
L1	0.00	0.15

GENERIC
MARKING DIAGRAM*


XX = Specific Device Code
M = Date Code
▪ = 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.

DOCUMENT NUMBER:	98AON25711D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	6 PIN UDFN, 1.6X1.6, 0.5P	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales

