

LMV341-Q1, LMV344-Q1 Rail-to-Rail Output CMOS Operational Amplifiers

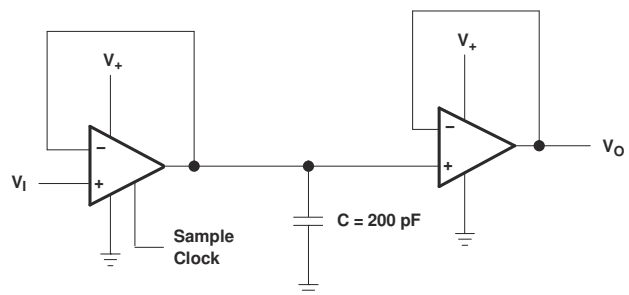
1 Features

- Qualified for Automotive Applications
- 2.7V and 5V Performance
- Rail-to-Rail Output Swing
- Input Bias Current: 1pA typical
- Input Offset Voltage: 0.25mV typical
- Low Supply Current: 100µA typical
- Gain Bandwidth: 1MHz typical
- Slew Rate: 1V/µs typical
- Turn-On Time From Shutdown: 5µs typical
- Input Referred Voltage Noise (at 10kHz): 20nV/√Hz

2 Description

The LMV341 and LMV344 devices are single and quad CMOS operational amplifiers, respectively, with low voltage, low power, and rail-to-rail output swing capabilities. The PMOS input stage offers an ultra-low input bias current of 1pA (typical) and an offset voltage of 0.25mV (typical). The single supply amplifier is designed specifically for low-voltage (2.7V to 5V) operation, with a wide common-mode input voltage range that typically extends from $-0.2V$ to $0.8V$ from the positive supply rail. Additional features are a $20nV/\sqrt{Hz}$ voltage noise at 10kHz, 1MHz unity-gain bandwidth, 1V/µs slew rate, and 100µA current consumption per channel.

An extended industrial temperature range from $-40^{\circ}C$ to $125^{\circ}C$ makes this device an excellent choice for automotive applications.



Application Circuit: Sample-and-Hold Circuit



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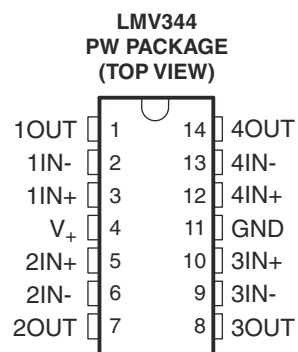
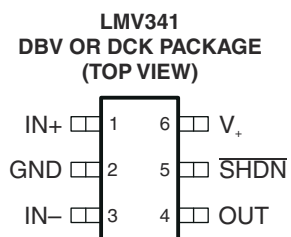
3 Device Comparison Table

(1)

T _A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽³⁾
–40°C to 125°C	SC-70 – DCK	Reel of 3000	LMV341QDCKRQ1	RR_
	SOT-23 – DBV	Reel of 3000	LMV341QDBVRQ1	RCH_
	TSSOP – PW	Reel of 2000	LMV344IPWRQ1	LMV344Q

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

4 Pin Configuration and Functions



5 Specifications

5.1 Absolute Maximum Ratings

(1)

over operating free-air temperature range (unless otherwise noted)

V ₊	Supply voltage ⁽²⁾		5.5V
V _{ID}	Differential input voltage ⁽³⁾		±5.5V
V _I	Input voltage range (either input)		0 to 5.5V
θ _{JA}	Package thermal impedance ^{(4) (5)}	DBV package	165°C/W
		DCK package	259°C/W
		PW package	113°C/W
T _J	Operating virtual junction temperature		150°C
T _{stg}	Storage temperature range		–65°C to 150°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values (except differential voltages and V₊ specified for the measurement of I_{OS}) are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Maximum power dissipation is a function of T_{J(max)}, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_{J(max)} – T_A)/θ_{JA}. Operating at the absolute maximum T_J of 150°C can affect reliability.
- (5) The package thermal impedance is calculated in accordance with JESD 51-7.

5.2 Recommended Operating Conditions

	MIN	MAX	UNIT
V ₊ Supply voltage (single-supply operation)	2.5	5.5	V
T _A Operating free-air temperature	–40	125	°C

5.3 ESD Ratings

TEST CONDITIONS	TYP	UNIT
Human-Body Model (HBM)	2000	V
Machine Model (MM)	200	V

5.4 Electrical Characteristics 2.7V

$V_+ = 2.7V$, $GND = 0V$, $V_{IC} = V_O = V_+/2$, $R_L > 1M\Omega$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A	LMV341			LMV344			UNIT
					MIN	TYP ⁽¹⁾	MAX	MIN	TYP ⁽¹⁾	MAX	
V _{IO}	Input offset voltage			25°C	0.25		4	0.25		4	mV
				Full range		4.5		4.5			
α _{VIO}	Average temperature coefficient of input offset voltage			Full range	1.7			1.7			μV/°C
I _{IB}	Input bias current			25°C	1	120		1	120		pA
				–40°C to 85°C		250		250			
				–40°C to 125°C		3		3		nA	
I _{IO}	Input offset current			25°C	6.6			6.6			fA
CMRR	Common-mode rejection ratio	0 ≤ V _{ICR} ≤ 1.7V		25°C	40	80		56	80		dB
		0 ≤ V _{ICR} ≤ 1.6V		Full range	36			50			
k _{SVR}	Supply-voltage rejection ratio	2.7V ≤ V ₊ ≤ 5V		25°C	45	82		65	82		dB
				Full range	60			60			
V _{ICR}	Common-mode input voltage range	CMRR ≥ 50dB		25°C	0	–0.2 to 1.9	1.7	0	–0.2 to 1.9	1.7	V
A _V	Large-signal voltage gain ⁽²⁾	R _L = 10kΩ to 1.35V		25°C	73	113		78	113		dB
				Full range	66			70			
		R _L = 2kΩ to 1.35V		25°C	70	103		72	103		
				Full range	63			64			
V _O	Output swing (delta from supply rails)	R _L = 2kΩ to 1.35V	Low level	25°C	24		60	24		60	mV
				Full range	95		95				
			High level	25°C	26		60	26		60	
				Full range	95		95				
		R _L = 10kΩ to 1.35V	Low level	25°C	5		30	5		30	
				Full range	40		40				
			High level	25°C	5.3		30	5.3		30	
				Full range	40		40				
I _{CC}	Supply current (per channel)			25°C	100	170	150		200	μA	
				Full range	230		230				
I _{OS}	Output short-circuit current	Sourcing		25°C	20	32		18	24	mA	
		Sinking			15	24		15	24		
SR	Slew rate	R _L = 10kΩ ⁽³⁾		25°C	1			1			V/μs
GBM	Unity-gain bandwidth	R _L = 10kΩ, C _L = 200pF		25°C	1			1			MHz
Φ _m	Phase margin	R _L = 100kΩ		25°C	72			72			deg
G _m	Gain margin	R _L = 100kΩ		25°C	20			20			dB
V _n	Equivalent input noise voltage	f = 1kHz		25°C	40			40			nV/√ Hz
I _n	Equivalent input noise current	f = 1kHz		25°C	0.001			0.001			pA/√ Hz
THD	Total harmonic distortion	f = 1kHz, A _V = 1, R _L = 600Ω, V _I = 1 V _{PP}		25°C	0.017			0.017			%

(1) Typical values represent the most likely parametric norm.

(2) $GND + 0.2V \leq V_O \leq V_+ - 0.2V$

(3) Connected as voltage follower with $2V_{PP}$ step input. Number specified is the slower of the positive and negative slew rates.

5.5 Shutdown Characteristics 2.7V

$V_+ = 2.7V$, $GND = 0V$, $V_{IC} = V_O = V_+/2$, $R_L > 1M\Omega$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$I_{CC(SHDN)}$ Supply current in shutdown mode (per channel)	$V_{SD} = 0V$	25°C		0.045	1000	nA
		Full range			1.5	μA
$t_{(on)}$ Amplifier turn-on time		25°C		5		μs
V_{SD} Shutdown pin voltage range	ON mode	25°C	1.7 to 2.7	2.4 to 2.7		V
	Shutdown mode		0 to 1	0 to 0.2		

5.6 Electrical Characteristics 5V

$V_+ = 5V$, $GND = 0V$, $V_{IC} = V_O = V_+/2$, $R_L > 1M\Omega$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A	LMV341			LMV344			UNIT
					MIN	TYP ⁽¹⁾	MAX	MIN	TYP ⁽¹⁾	MAX	
V _{IO}	Input offset voltage			25°C	0.25		4	0.25		4	mV
				Full range	4.5		4.5				
α _{VIO}	Average temperature coefficient of input offset voltage			Full range	1.9			1.9			μV/°C
I _{IB}	Input bias current			25°C	1	200		1	200		pA
				−40°C to 85°C	375		375				
				−40°C to 125°C	5		5			nA	
I _{IO}	Input offset current			25°C	6.6			6.6			fA
CMRR	Common-mode rejection ratio	0 ≤ V _{ICR} ≤ 4V		25°C	46	86		56	86		dB
		0 ≤ V _{ICR} ≤ 3.9V		Full range	47			50			
k _{SVR}	Supply-voltage rejection ratio	2.7V ≤ V ₊ ≤ 5V		25°C	45	82		65	82		dB
				Full range	44			60			
V _{ICR}	Common-mode input voltage range	CMRR ≥ 50dB		25°C	0	−0.2 to 4.2	4	0	−0.2 to 4.2	4	V
A _V	Large-signal voltage gain ⁽²⁾	R _L = 10kΩ to 2.5V		25°C	78	116		78	116		dB
				Full range	70			70			
		R _L = 2kΩ to 2.5V		25°C	72	107		72	107		
				Full range	64			64			
V _O	Output swing (delta from supply rails)	R _L = 2kΩ to 2.5V	Low level	25°C	32	67		32	60		mV
				Full range	95		95				
			High level	25°C	34	60		34	60		
				Full range	95		95				
		R _L = 10kΩ to 2.5V	Low level	25°C	7	30		7	30		
				Full range	45		40				
			High level	25°C	7	30		7	30		
				Full range	40		40				
I _{CC}	Supply current (per channel)			25°C	150	200		150	200		μA
				Full range	260		260				
I _{OS}	Output short-circuit current	Sourcing		25°C	85	113		70	90		mA
		Sinking			50	75		50	75		
SR	Slew rate	R _L = 10kΩ ⁽³⁾		25°C	1			1			V/μs
GBM	Unity-gain bandwidth	R _L = 10kΩ, C _L = 200pF		25°C	1			1			MHz
Φ _m	Phase margin	R _L = 100kΩ		25°C	70			70			deg
G _m	Gain margin	R _L = 100kΩ		25°C	20			20			dB
V _n	Equivalent input noise voltage	f = 1kHz		25°C	39			39			nV/√ Hz
I _n	Equivalent input noise current	f = 1kHz		25°C	0.001			0.001			pA/√ Hz
THD	Total harmonic distortion	f = 1kHz, A _V = 1, R _L = 600Ω, V _I = 1 V _{PP}		25°C	0.012			0.012			%

(1) Typical values represent the most likely parametric norm.

(2) $GND + 0.2V \leq V_O \leq V_+ - 0.2V$

(3) Connected as voltage follower with $2V_{PP}$ step input. Number specified is the slower of the positive and negative slew rates.

5.7 Shutdown Characteristics 5V

$V_+ = 5V$, $GND = 0V$, $V_{IC} = V_O = V_+/2$, $R_L > 1M\Omega$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$I_{CC(SHDN)}$	Supply current in shutdown mode (per channel)	$V_{SD} = 0V$	25°C		0.033	1	μA
			Full range			1.5	
$t_{(on)}$	Amplifier turn-on time		25°C		5		μs
V_{SD}	Shutdown pin voltage range	ON mode	25°C		3.1 to 5	4.5 to 5	V
		Shutdown mode			0 to 1	0 to 0.2	

6 Typical Characteristics

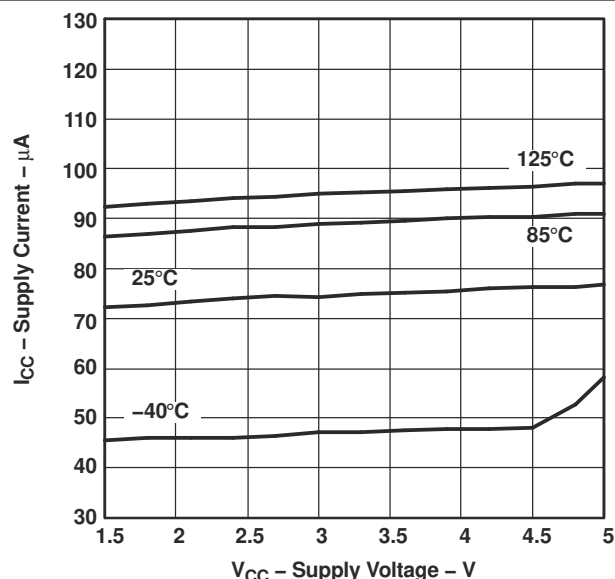


Figure 6-1. Supply Current
vs
Supply Voltage

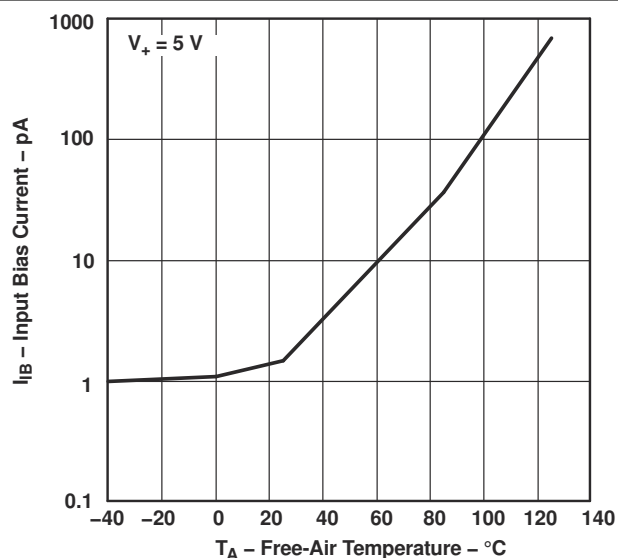


Figure 6-2. Input Bias Current
vs
Temperature

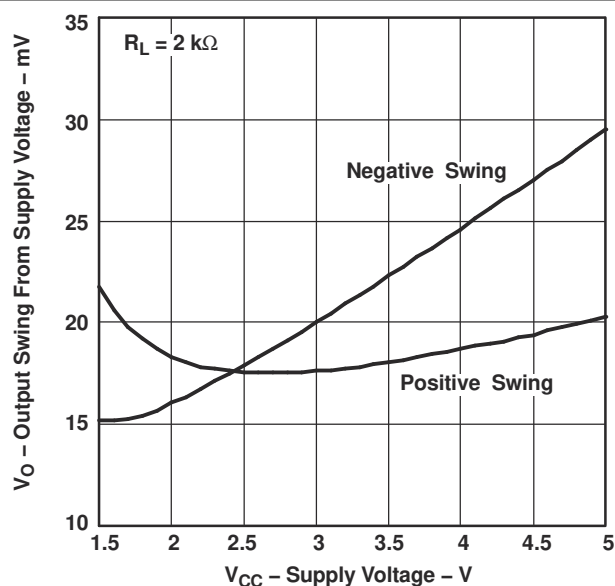


Figure 6-3. Output Voltage Swing
vs
Supply Voltage

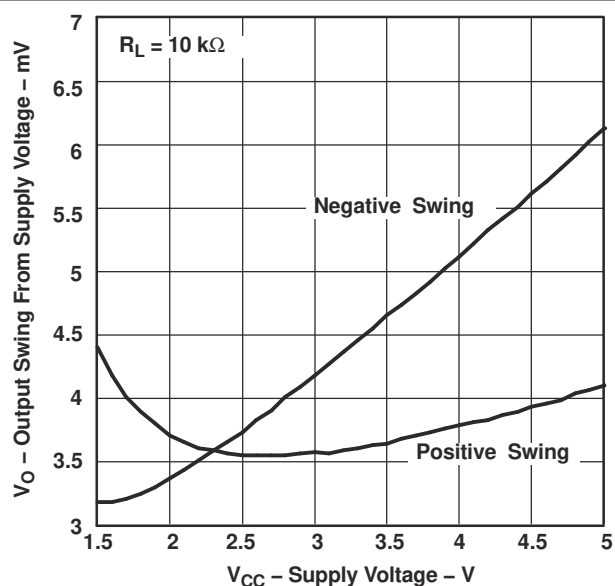
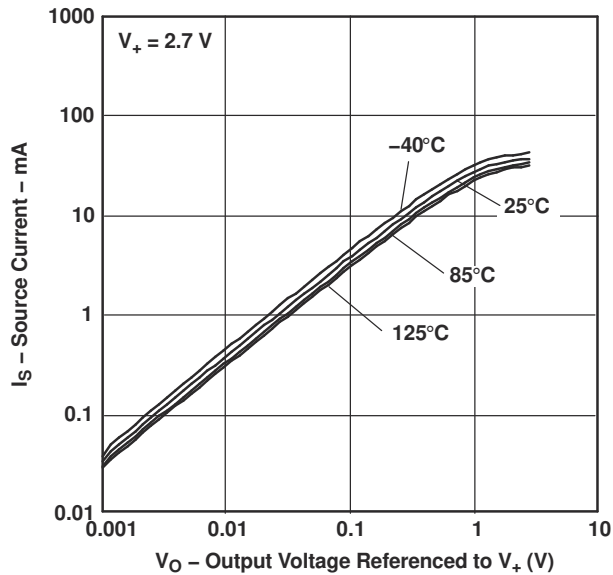
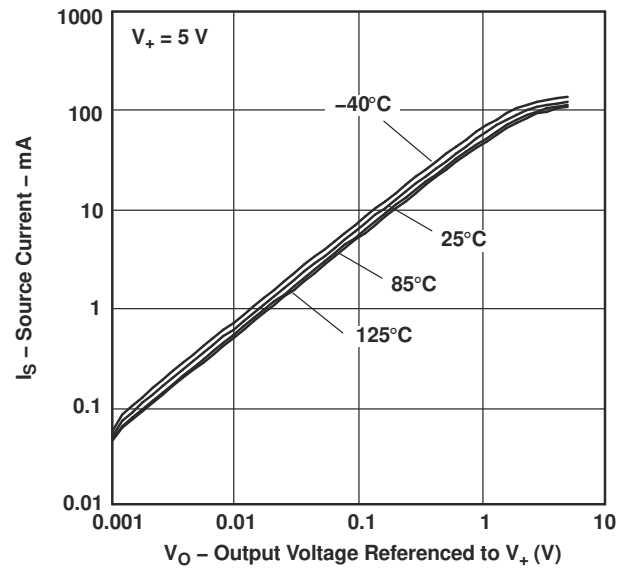


Figure 6-4. Output Voltage Swing
vs
Supply Voltage

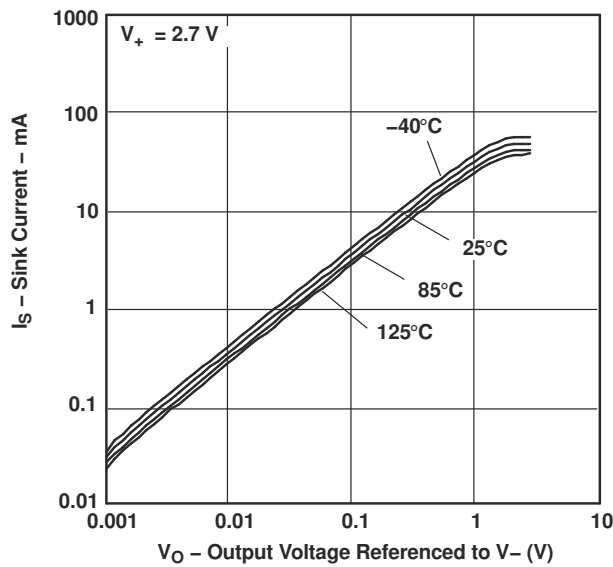
6 Typical Characteristics (continued)



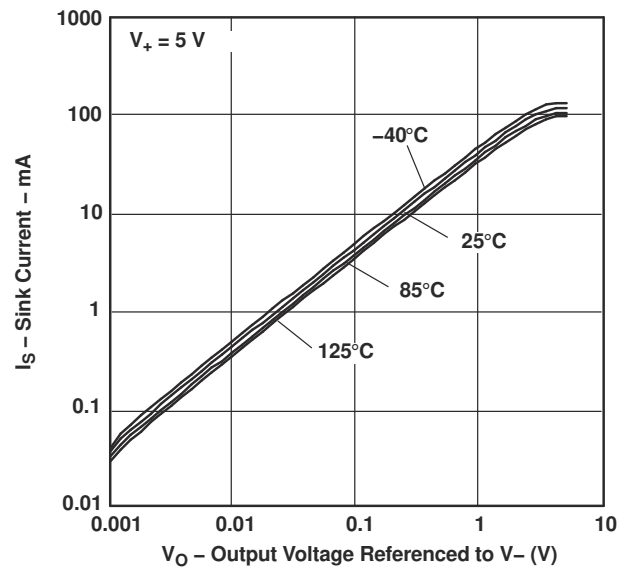
**Figure 6-5. Source Current
vs
Output Voltage**



**Figure 6-6. Source Current
vs
Output Voltage**

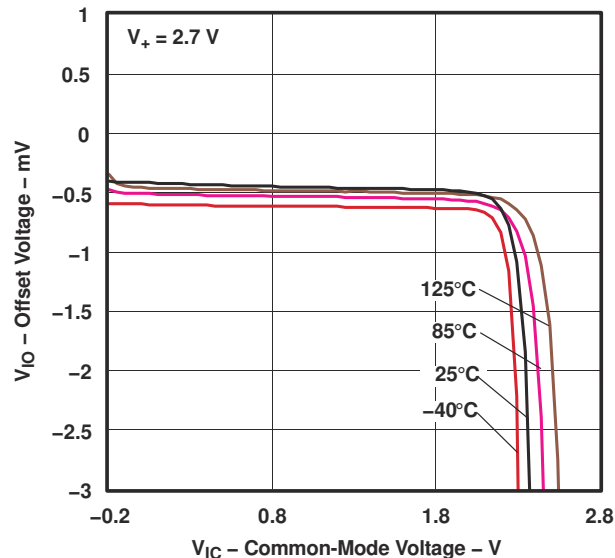


**Figure 6-7. Sink Current
vs
Output Voltage**

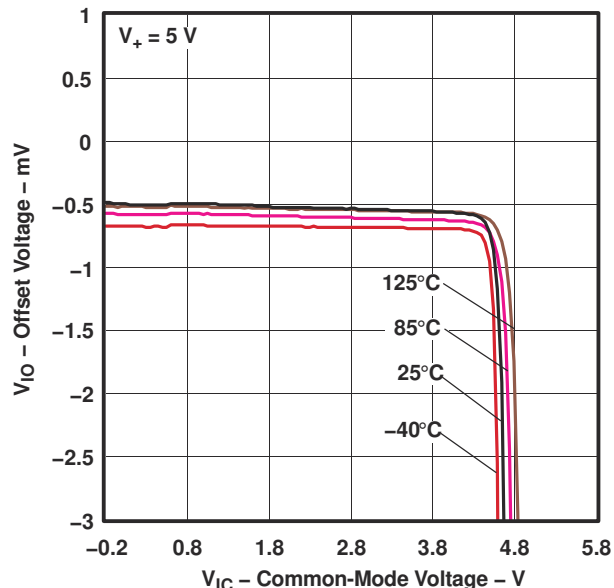


**Figure 6-8. Sink Current
vs
Output Voltage**

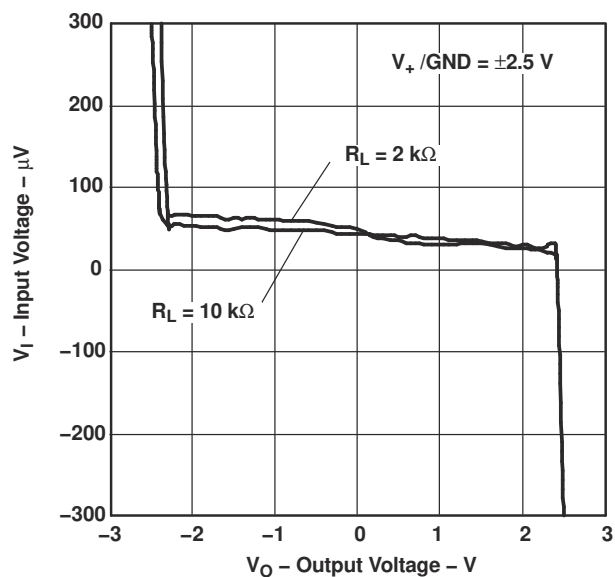
6 Typical Characteristics (continued)



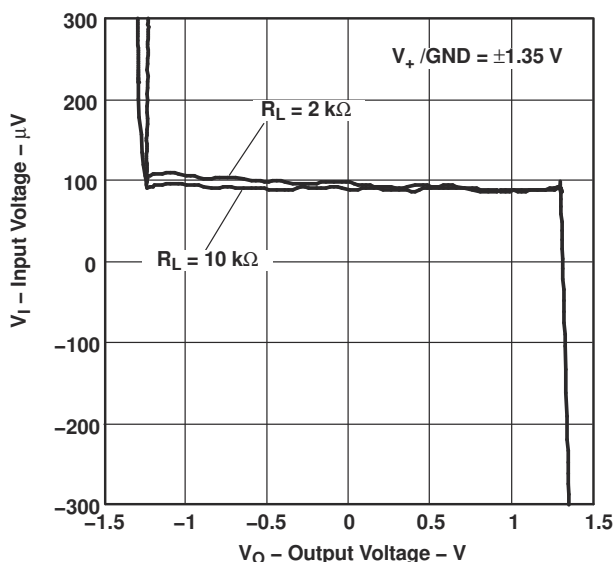
**Figure 6-9. Offset Voltage
vs
Common-mode Voltage**



**Figure 6-10. Offset Voltage
vs
Common-mode Voltage**

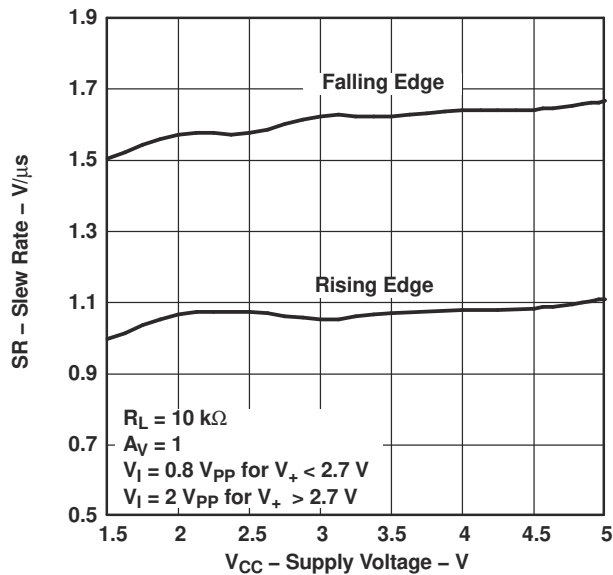


**Figure 6-11. Input Voltage
vs
Output Voltage**

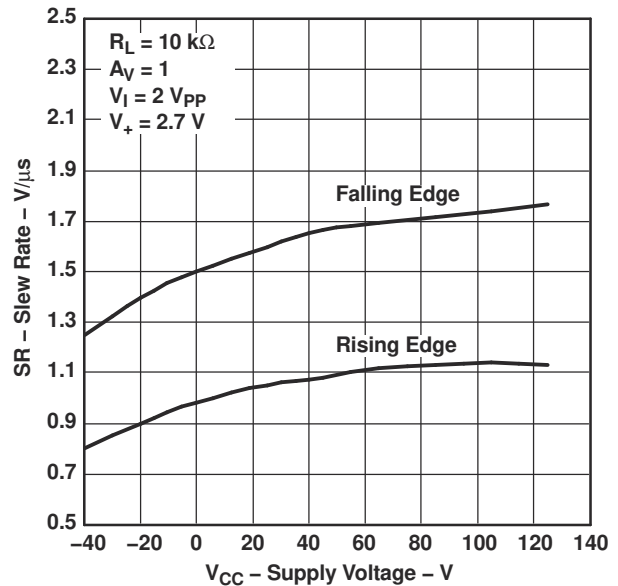


**Figure 6-12. Input Voltage
vs
Output Voltage**

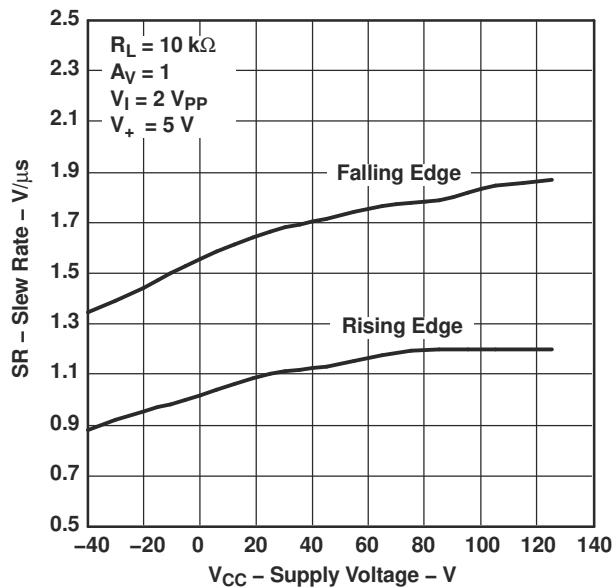
6 Typical Characteristics (continued)



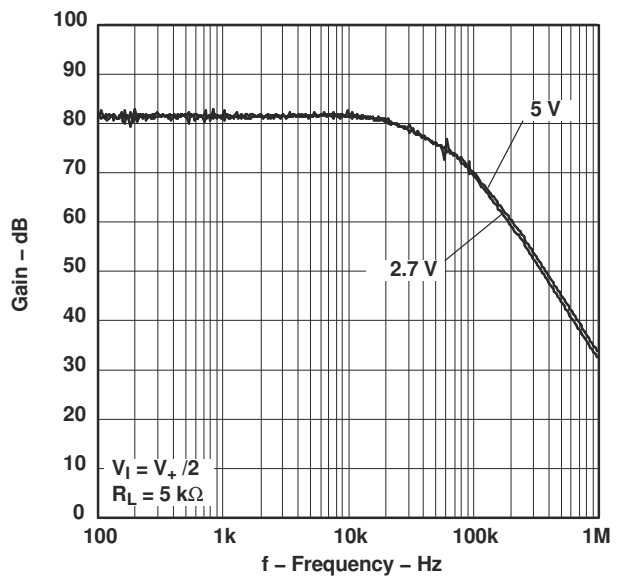
**Figure 6-13. Slew Rate
vs
Supply Voltage**



**Figure 6-14. Slew Rate
vs
Temperature**



**Figure 6-15. Slew Rate
vs
Temperature**



**Figure 6-16. Cmr
vs
Frequency**

6 Typical Characteristics (continued)

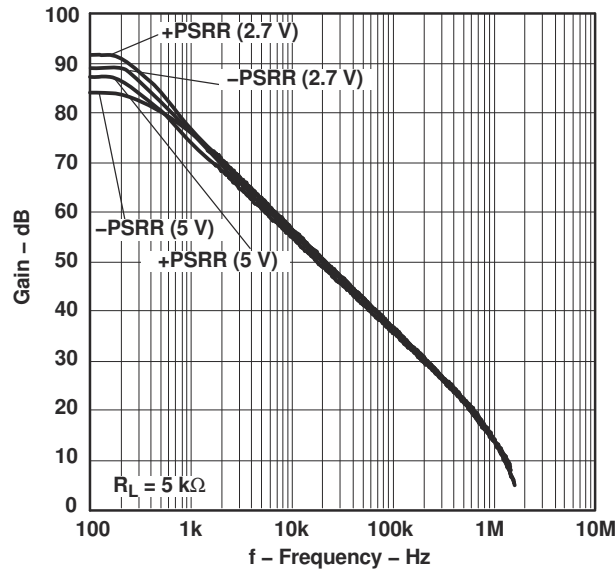


Figure 6-17. Psrr
vs
Frequency

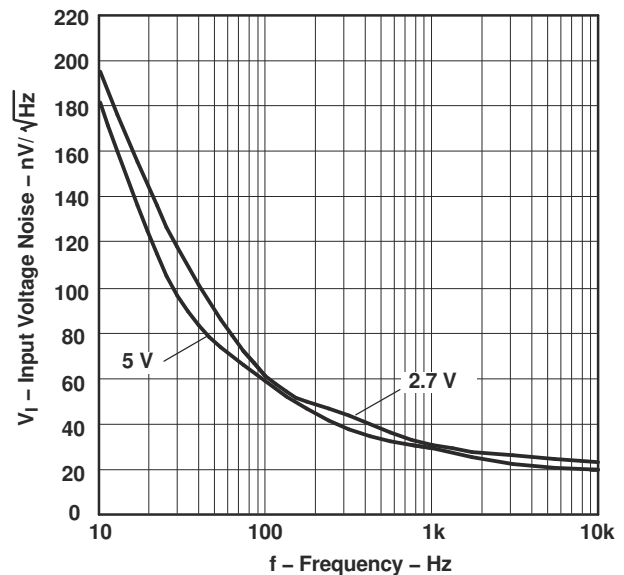


Figure 6-18. Input Voltage Noise
vs
Frequency

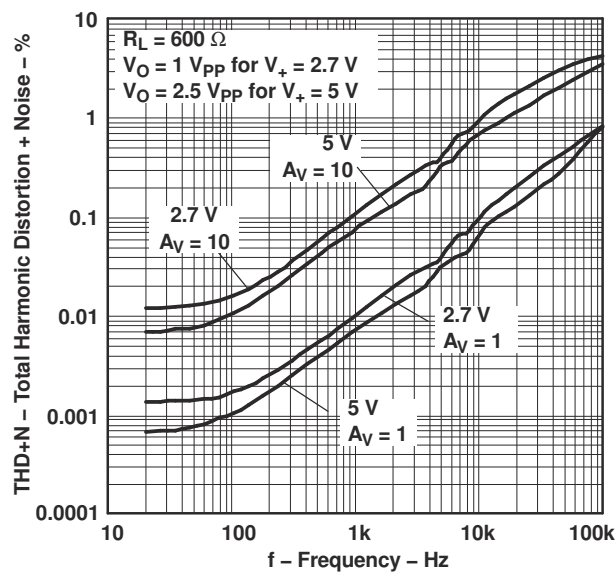


Figure 6-19. Total Harmonic Distortion + Noise
vs
Frequency

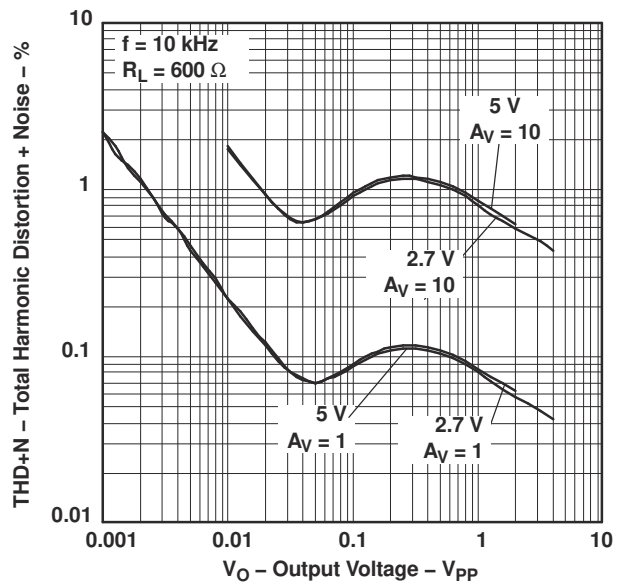


Figure 6-20. Total Harmonic Distortion + Noise
vs
Output Voltage

6 Typical Characteristics (continued)

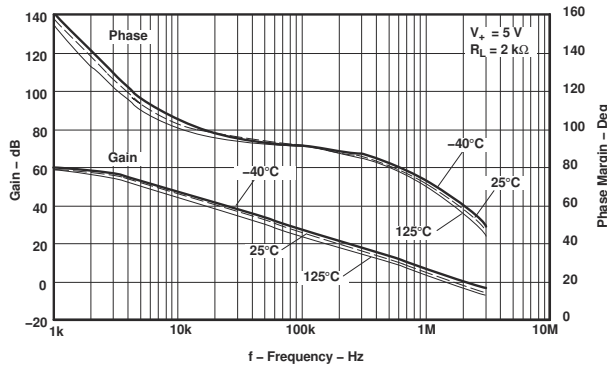


Figure 6-21. Gain And Phase Margin vs Frequency
($t_a = -40^\circ\text{C}, 25^\circ\text{C}, 125^\circ\text{C}$)

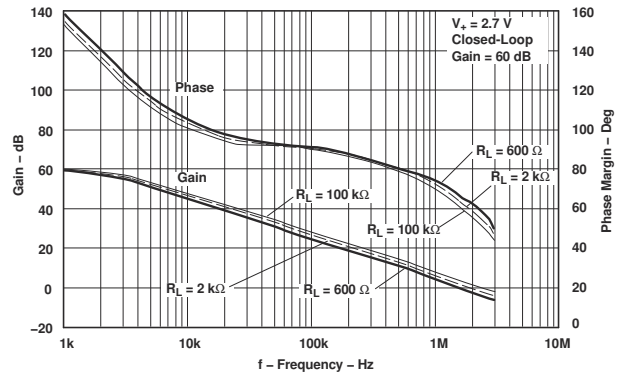


Figure 6-22. Gain And Phase Margin vs Frequency
($r_l = 600\omega, 2k\omega, 100k\omega$)

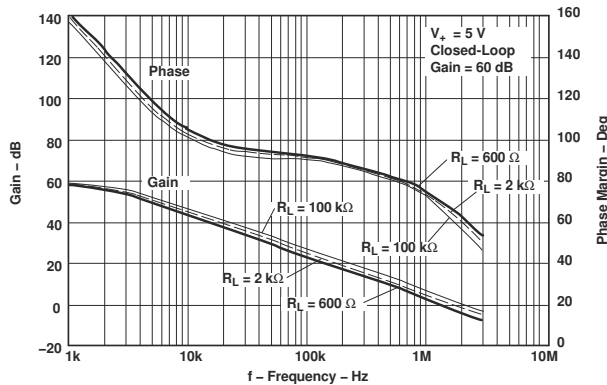


Figure 6-23. Gain And Phase Margin vs Frequency
($r_l = 600\omega, 2k\omega, 100k\omega$)

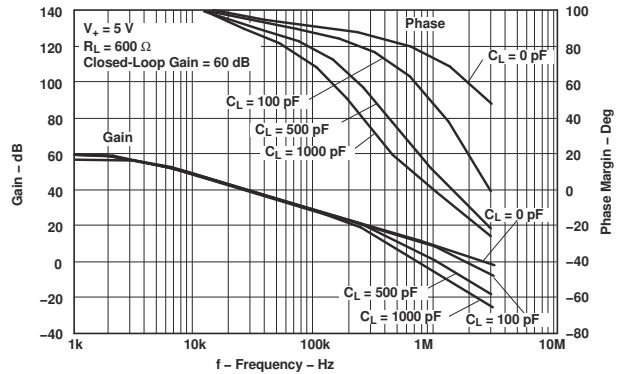


Figure 6-24. Gain And Phase Margin vs Frequency
($c_l = 0\text{pf}, 100\text{pf}, 500\text{pf}, 1000\text{pf}$)

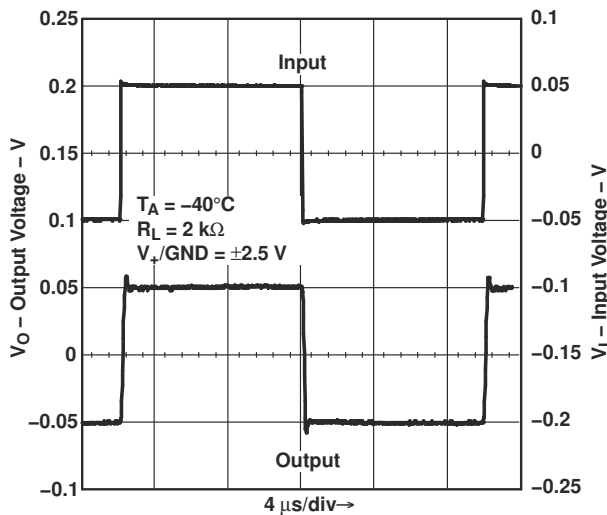


Figure 6-25. Small-Signal Noninverting Response

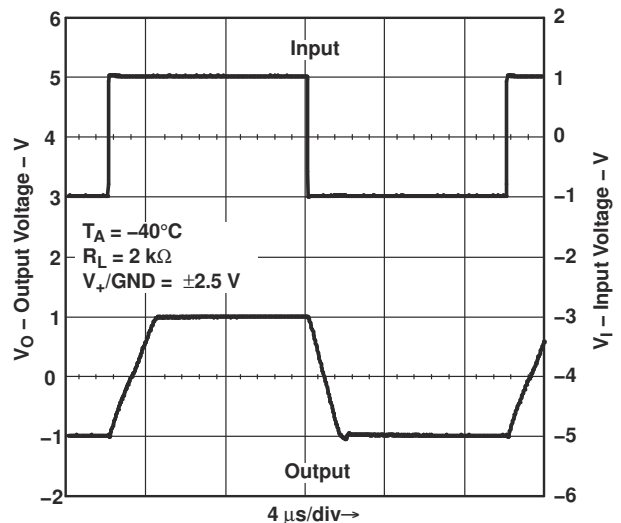


Figure 6-26. Large-Signal Noninverting Response

6 Typical Characteristics (continued)

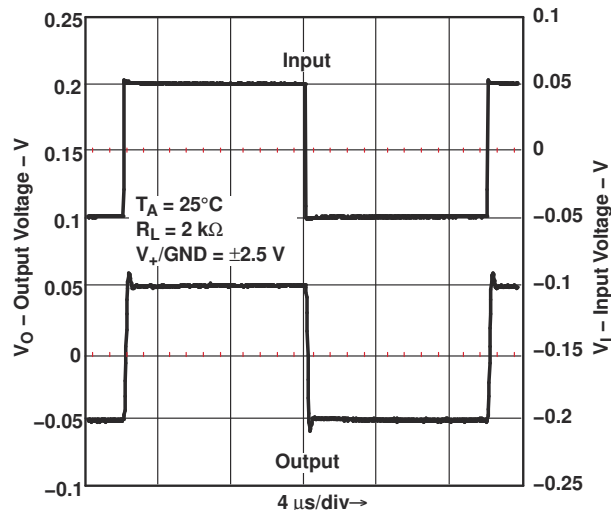


Figure 6-27. Small-Signal Noninverting Response

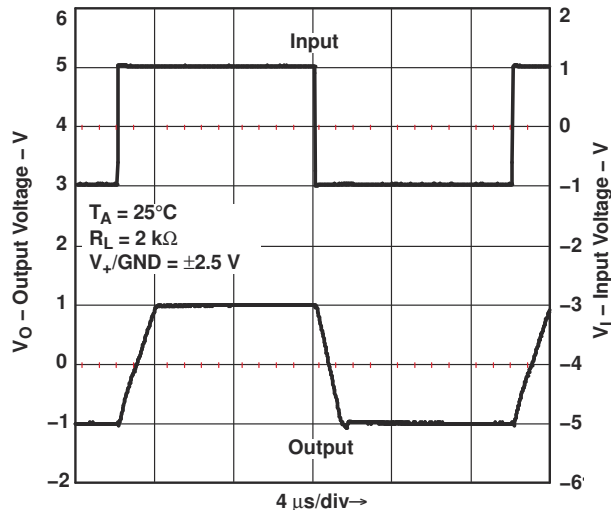


Figure 6-28. Large-Signal Noninverting Response

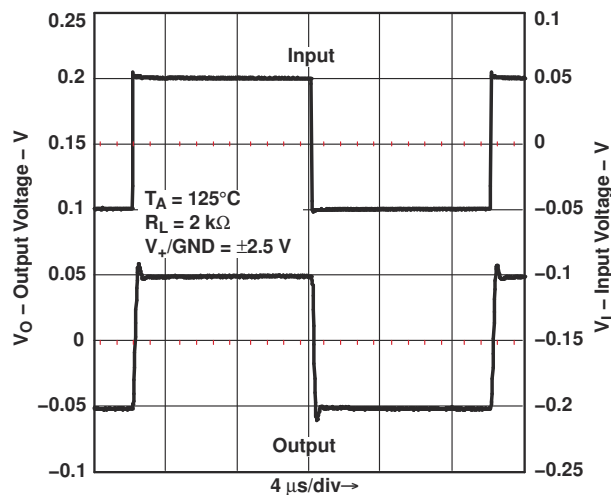


Figure 6-29. Small-Signal Noninverting Response

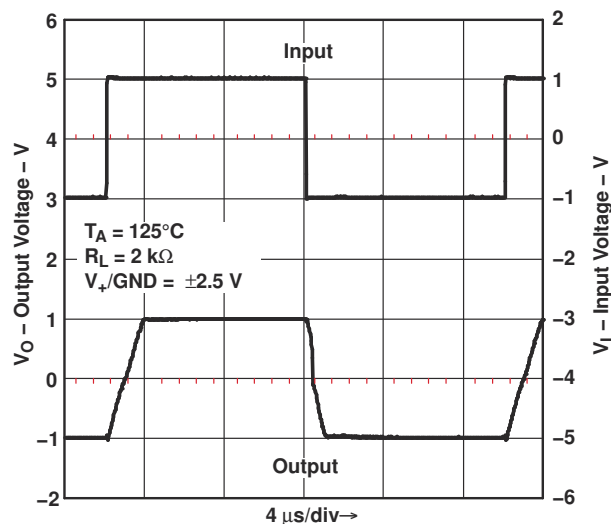


Figure 6-30. Large-Signal Noninverting Response

6 Typical Characteristics (continued)

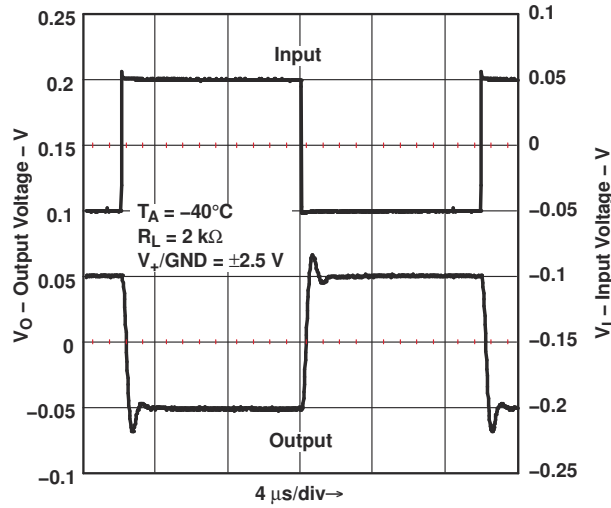


Figure 6-31. Small-Signal Inverting Response

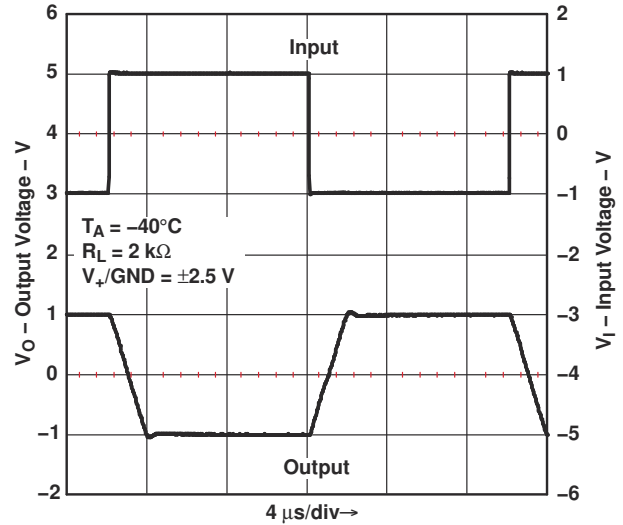


Figure 6-32. Large-Signal Inverting Response

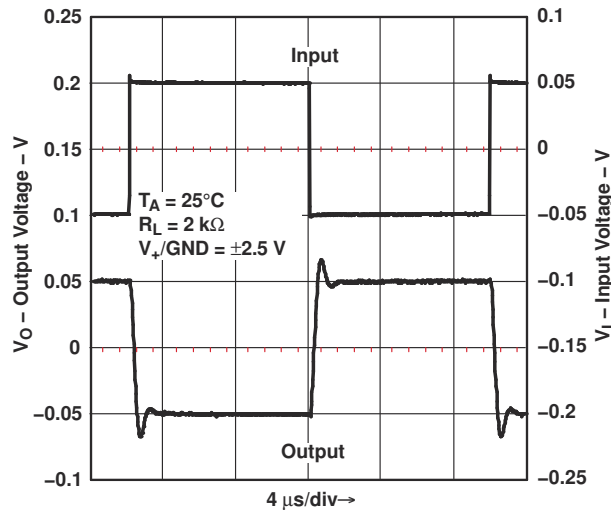


Figure 6-33. Small-Signal Inverting Response

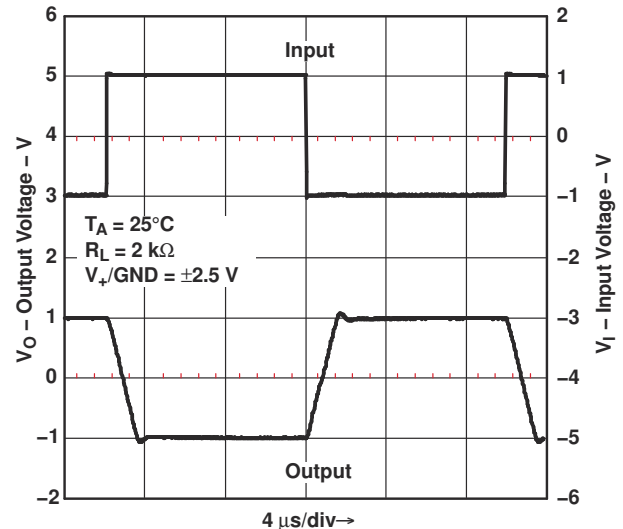


Figure 6-34. Large-Signal Inverting Response

6 Typical Characteristics (continued)

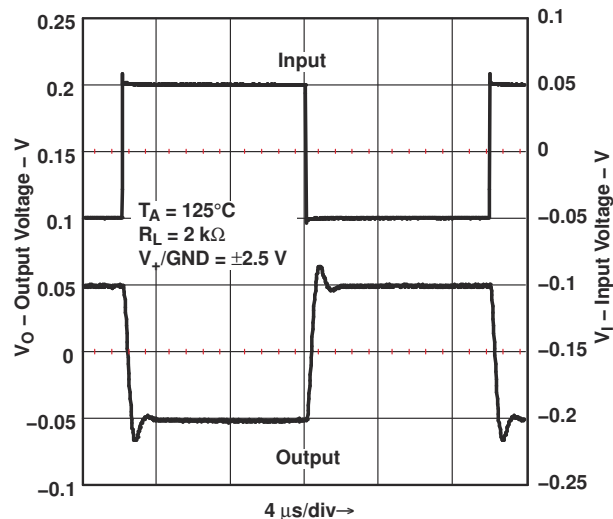


Figure 6-35. Small-Signal Inverting Response

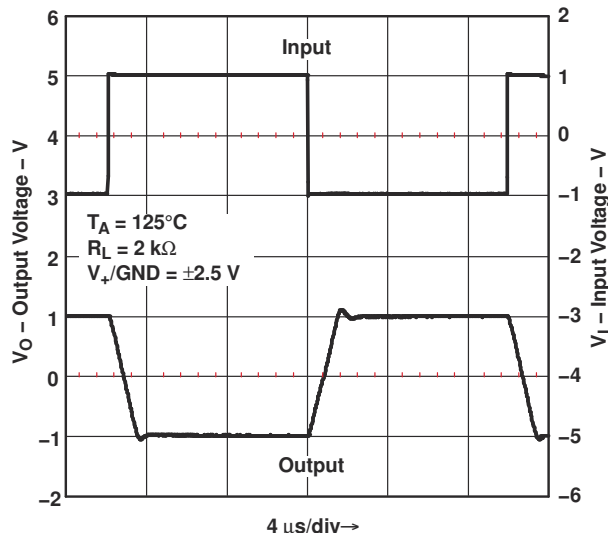


Figure 6-36. Large-Signal Inverting Response

7 Device and Documentation Support

7.1 Documentation Support

7.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

7.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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7.4 Trademarks

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7.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

8 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision C (June 2009) to Revision D (July 2025)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Changed supply current per channel specification at V+ = 2.7V from 100µA to 150µA (typical) and from 170µA to 200µA (maximum at 25°C).....	6
• Changed recommended shutdown pin voltage range, shutdown mode specification at V+ = 2.7V from 0 to 0.8V to 0 to 0.2V (maximum).....	7
• Changed supply current per channel specification at V+ = 5V from 100µA to 150µA (typical).....	8
• Changed recommended shutdown pin voltage range, shutdown mode specification at V+ = 5V from 0 to 0.8V to 0 to 0.2V (maximum).....	9

9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LMV341QDBVRQ1	Active	Production	SOT-23 (DBV) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	RCHE
LMV341QDBVRQ1.A	Active	Production	SOT-23 (DBV) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	RCHE
LMV341QDCKRQ1	Active	Production	SC70 (DCK) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	RRE
LMV341QDCKRQ1.A	Active	Production	SC70 (DCK) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	RRE
LMV341QDCKRQ1G4	Active	Production	SC70 (DCK) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(R4E, RRE)
LMV341QDCKRQ1G4.A	Active	Production	SC70 (DCK) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(R4E, RRE)
LMV344IPWRQ1	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LMV344Q
LMV344IPWRQ1.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LMV344Q

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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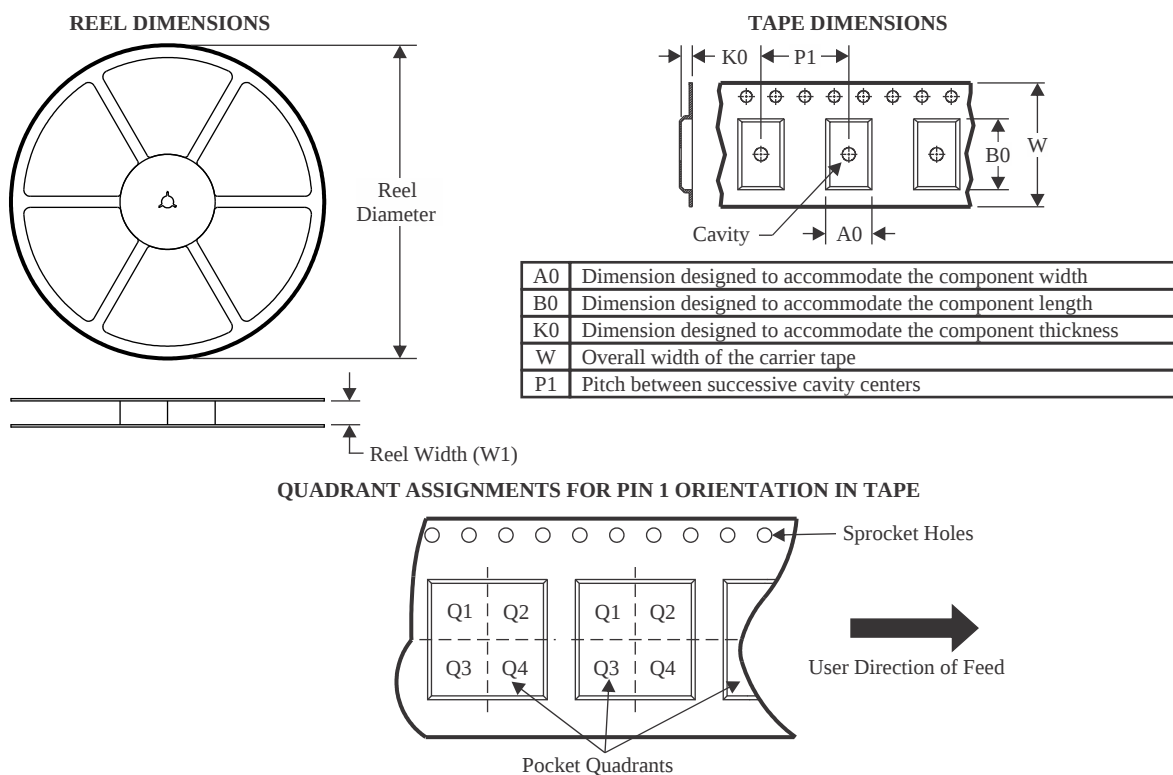
OTHER QUALIFIED VERSIONS OF LMV341-Q1, LMV344-Q1 :

- Catalog : [LMV341](#), [LMV344](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

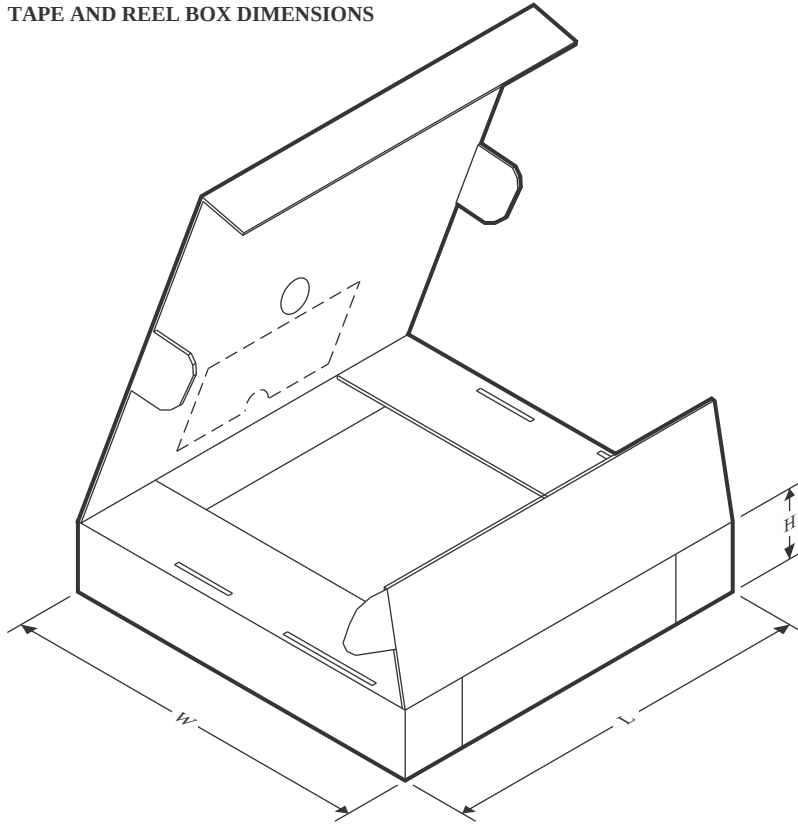
TAPE AND REEL INFORMATION



*All dimensions are nominal

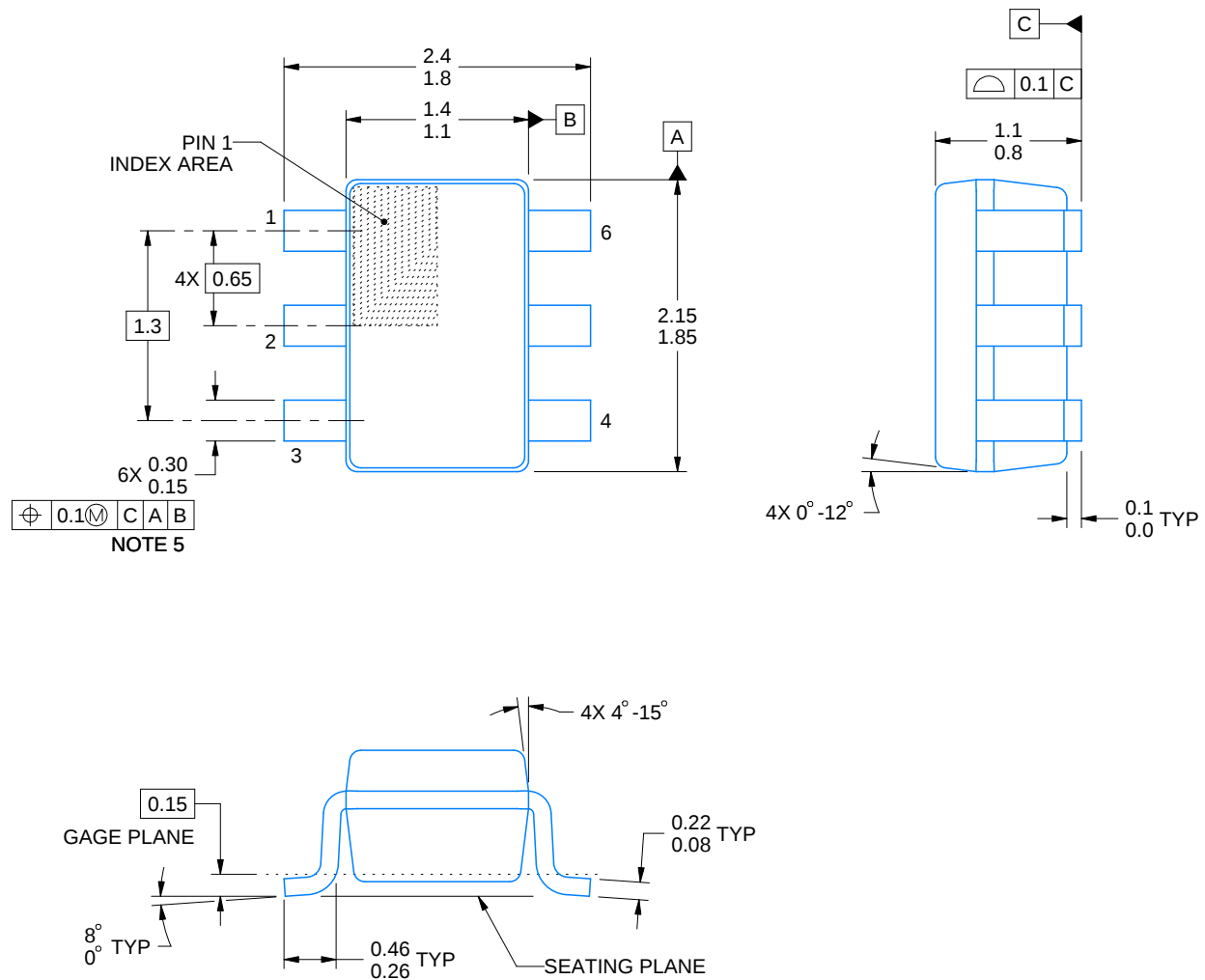
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LMV341QDBVRQ1	SOT-23	DBV	6	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LMV341QDCKRQ1	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LMV341QDCKRQ1G4	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LMV344IPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

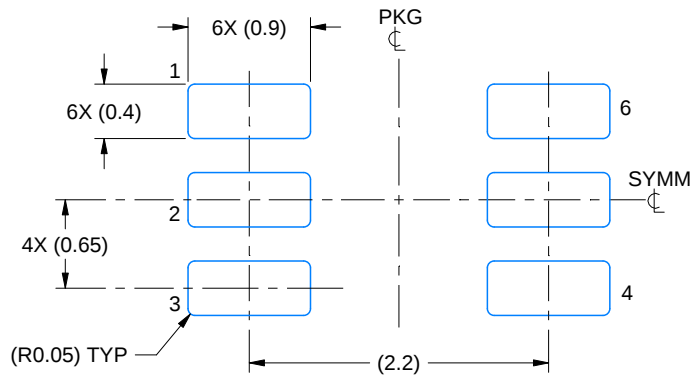
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMV341QDBVRQ1	SOT-23	DBV	6	3000	200.0	183.0	25.0
LMV341QDCKRQ1	SC70	DCK	6	3000	200.0	183.0	25.0
LMV341QDCKRQ1G4	SC70	DCK	6	3000	200.0	183.0	25.0
LMV344IPWRQ1	TSSOP	PW	14	2000	353.0	353.0	32.0



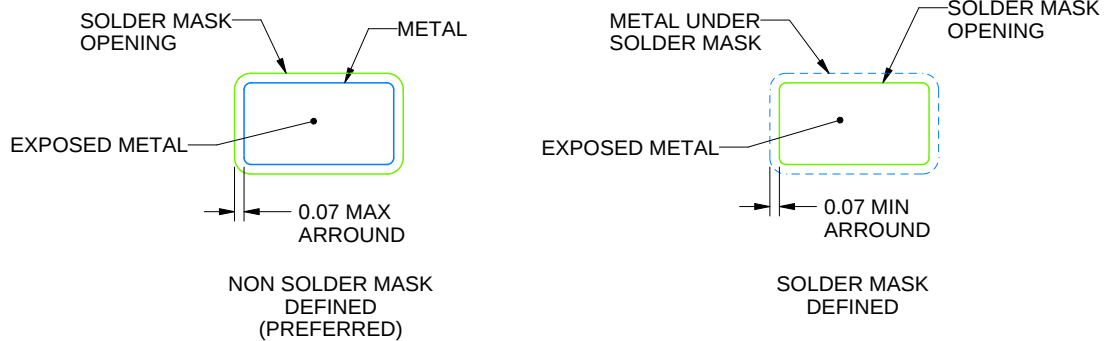
4214835/D 11/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

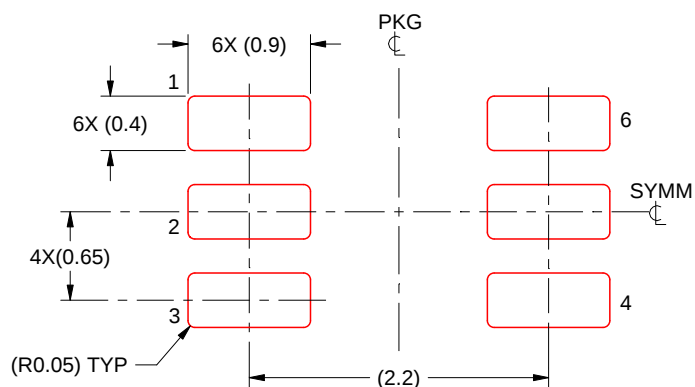


SOLDER MASK DETAILS

4214835/D 11/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:18X

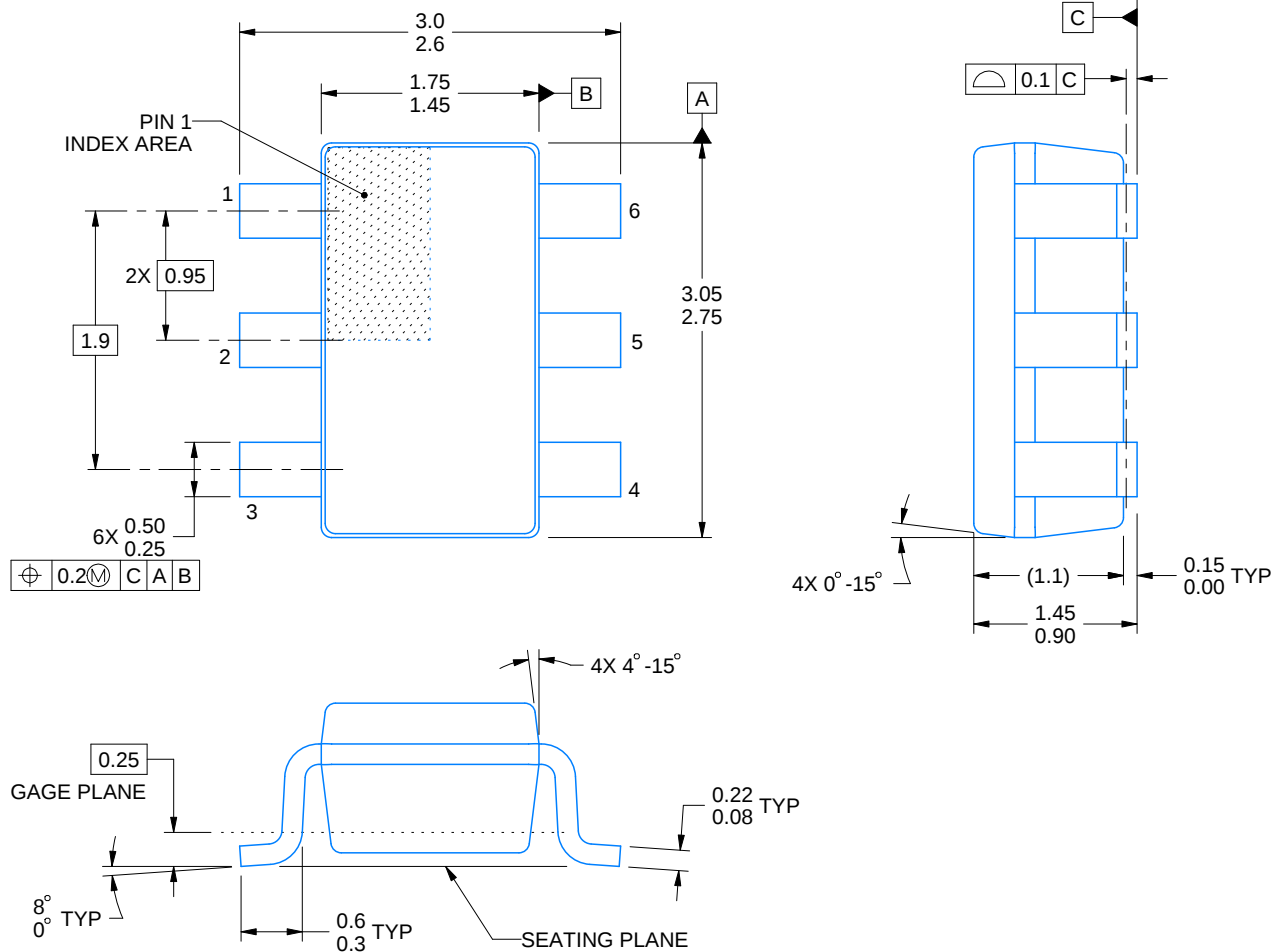
4214835/D 11/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

DBV0006A**PACKAGE OUTLINE****SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR



4214840/G 08/2024

NOTES:

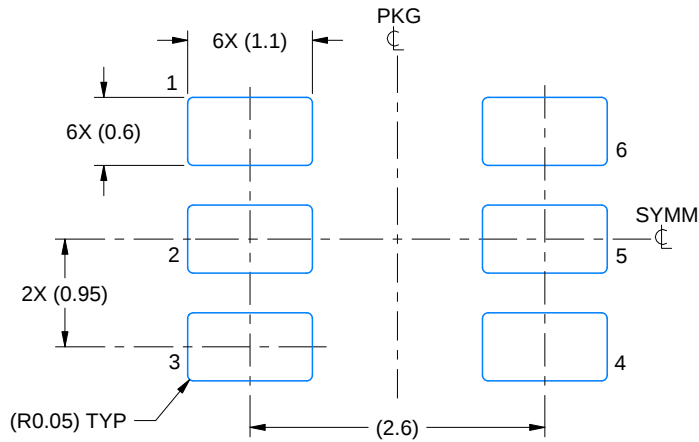
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

EXAMPLE BOARD LAYOUT

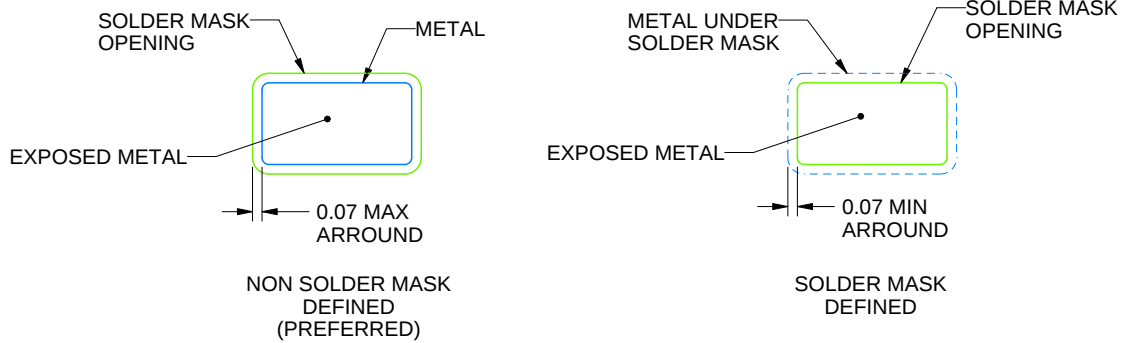
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214840/G 08/2024

NOTES: (continued)

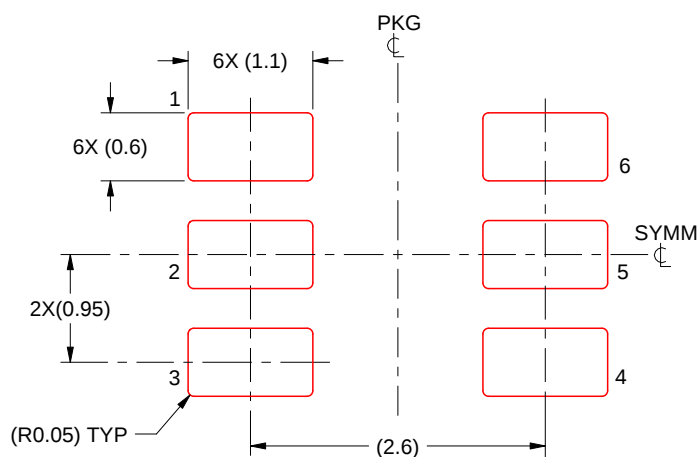
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214840/G 08/2024

NOTES: (continued)

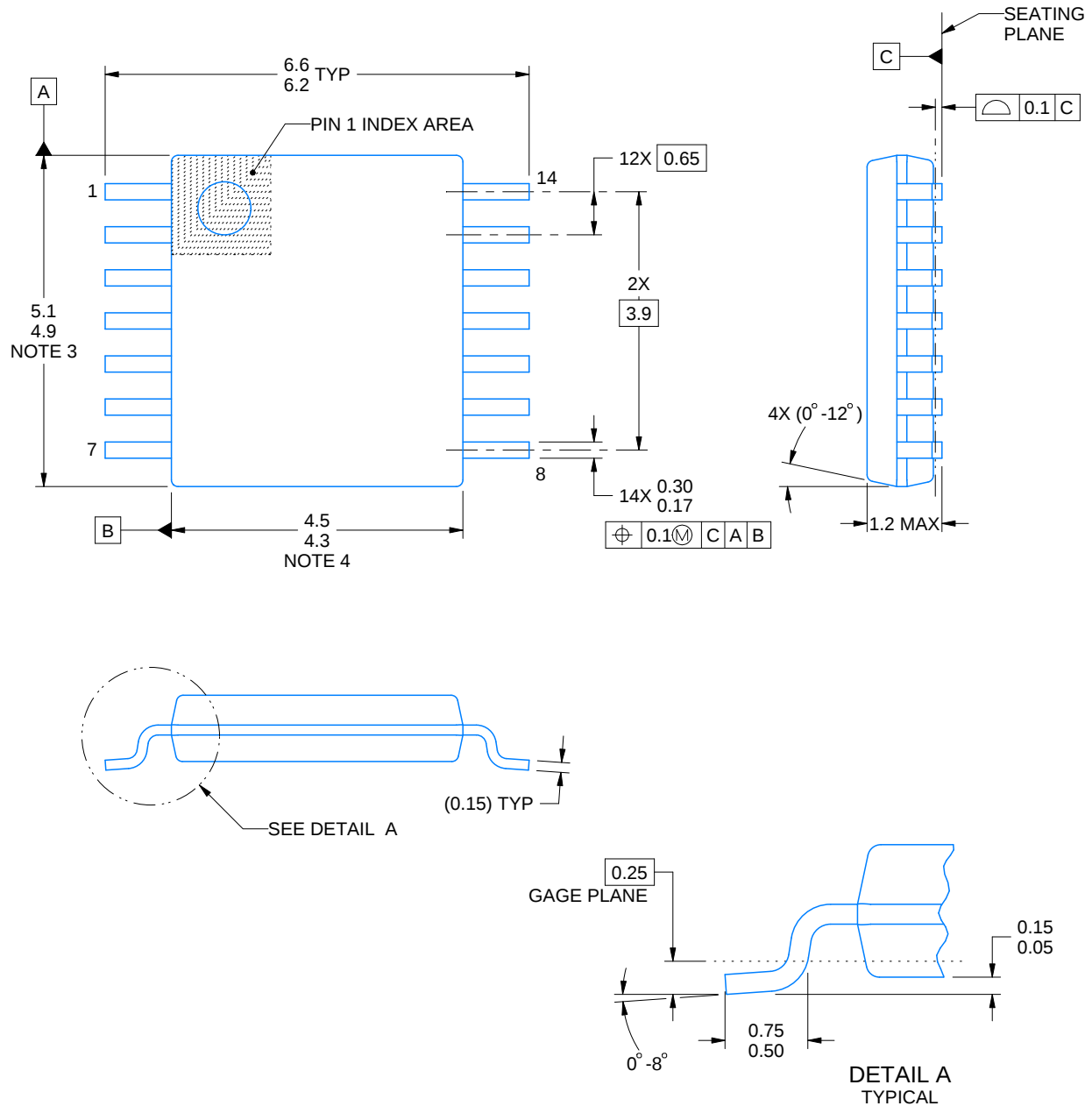
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PW0014A

PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220202/B 12/2023

NOTES:

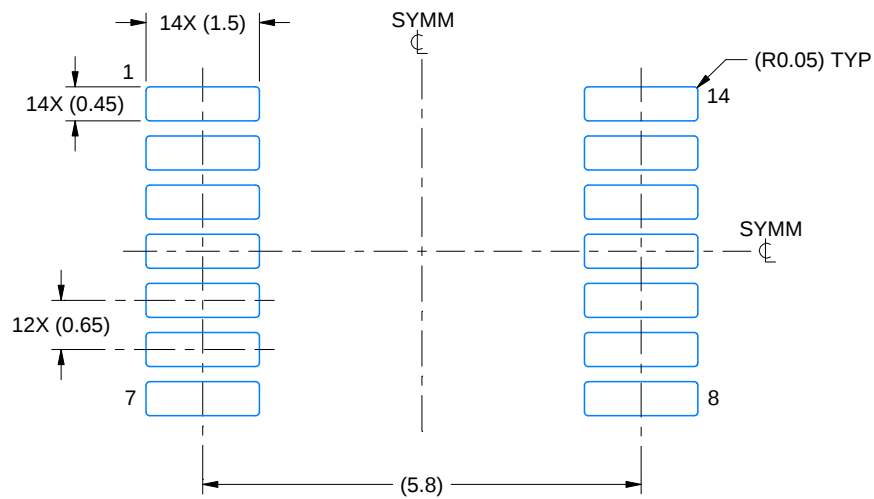
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

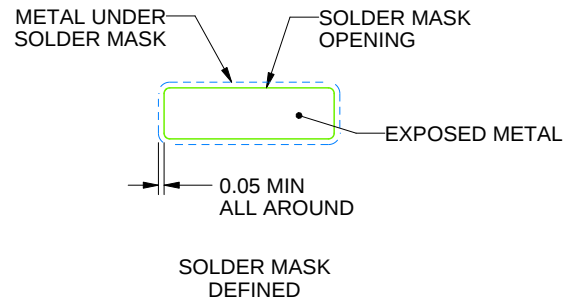
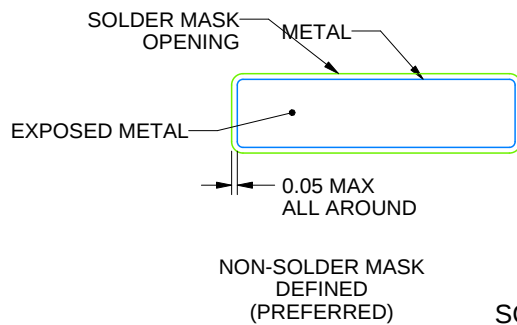
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

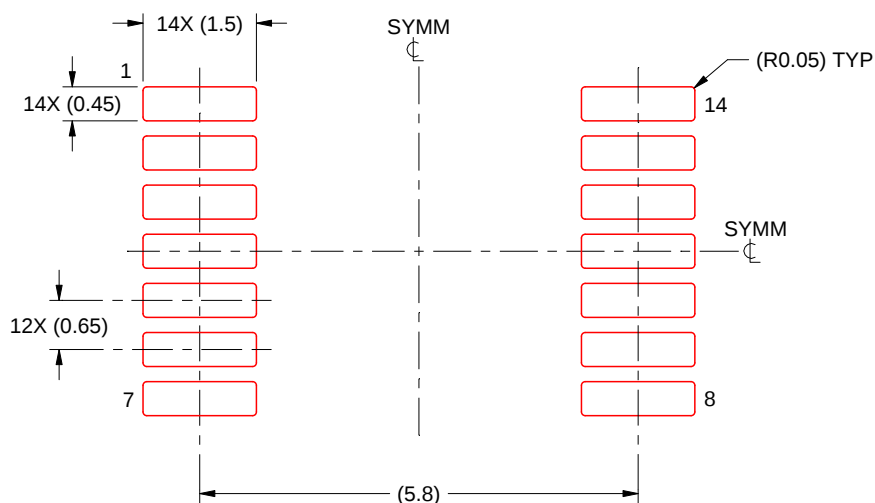
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220202/B 12/2023

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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