



Low-Power, Precision SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

FEATURES

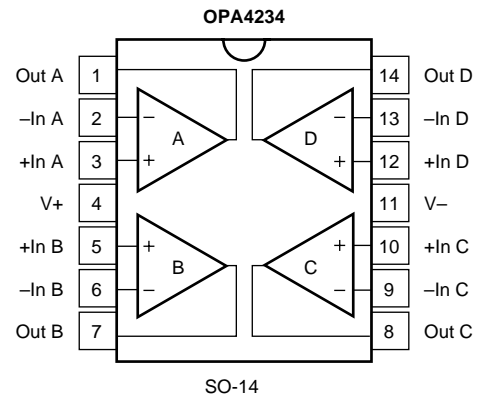
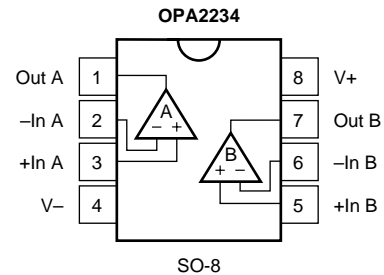
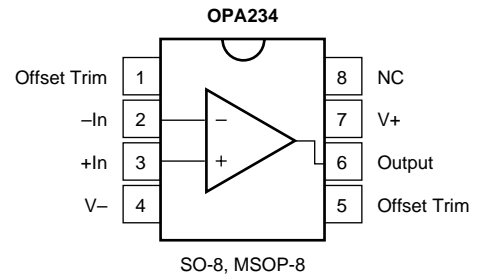
- **WIDE SUPPLY RANGE:**
Single Supply: $V_S = +2.7V$ to $+36V$
Dual Supply: $V_S = \pm 1.35V$ to $\pm 18V$
- **SPECIFIED PERFORMANCE:**
 $+2.7V$, $+5V$, and $\pm 15V$
- **LOW QUIESCENT CURRENT:** $250\mu A/amp$
- **LOW INPUT BIAS CURRENT:** $25nA$ max
- **LOW OFFSET VOLTAGE:** $100\mu V$ max
- **HIGH CMRR, PSRR, and A_{OL}**
- **SINGLE, DUAL, and QUAD VERSIONS**

DESCRIPTION

The OPA234 series low-cost op amps are ideal for single-supply, low-voltage, low-power applications. The series provides lower quiescent current than older "1013"-type products and comes in current industry-standard packages and pinouts. The combination of low offset voltage, high common-mode rejection, high power-supply rejection, and a wide supply range provides excellent accuracy and versatility. Single, dual, and quad versions have identical specifications for maximum design flexibility. These general-purpose op amps are ideal for portable and battery-powered applications.

The OPA234 series op amps operate from either single or dual supplies. In single-supply operation, the input common-mode range extends below ground and the output can swing to within 50mV of ground. Excellent phase margin makes the OPA234 series ideal for demanding applications, including high load capacitance. Dual and quad designs feature completely independent circuitry for lowest crosstalk and freedom from interaction.

Single version packages are in an SO-8 surface-mount and a space-saving MSOP-8 surface-mount. Dual packages are in an SO-8 surface-mount. Quad packages are in an SO-14 surface-mount. All are specified for $-40^\circ C$ to $+85^\circ C$ operation.



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ELECTRICAL CHARACTERISTICS: $V_S = +5V$

At $T_A = 25^\circ C$, $V_S = +5V$, $R_L = 10k\Omega$ connected to $V_S/2$, and $V_{OUT} = V_S/2$, unless otherwise noted.

PARAMETER	CONDITION	OPA234U, E OPA2234U			OPA234UA, EA OPA2234UA OPA4234UA, U			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
OFFSET VOLTAGE Input Offset Voltage OPA234E, EA vs Temperature ⁽¹⁾ vs Power Supply vs Time Channel Separation (Dual, Quad)	V_{OS} dV_{OS}/dT PSRR	$V_{CM} = 2.5V$ Operating Temperature Range $V_S = +2.7V$ to $+30V$, $V_{CM} = 1.7V$	 ± 40 ± 100 ± 0.5 3 0.2 0.3	 ± 100 ± 150 ± 3 10	 *	 *	 ± 250 ± 350 *	 μV μV $\mu V/^\circ C$ $\mu V/V$ $\mu V/mo$ $\mu V/V$
INPUT BIAS CURRENT Input Bias Current ⁽²⁾ Input Offset Current	I_B I_{OS}	$V_{CM} = 2.5V$ $V_{CM} = 2.5V$	 -15 ± 1	 -30 ± 5	 *	 *	 -50 *	 nA nA
NOISE Input Voltage Noise Density Current Noise Density	v_n i_n	$f = 1kHz$	 25 80	 	 *	 *	 	 nV/\sqrt{Hz} fA/\sqrt{Hz}
INPUT VOLTAGE RANGE Common-Mode Voltage Range Common-Mode Rejection	CMRR	$V_{CM} = -0.1V$ to $4V$	-0.1 91	106	$(V+) -1$	*	*	V dB
INPUT IMPEDANCE Differential Common-Mode		$V_{CM} = 2.5V$		$10^7 \parallel 5$ $10^{10} \parallel 6$		*	*	$\Omega \parallel pF$ $\Omega \parallel pF$
OPEN-LOOP GAIN Open-Loop Voltage Gain	A_{OL}	$V_O = 0.25V$ to $4V$ $R_L = 10k\Omega$ $R_L = 2k\Omega$	108 86	120 96	100 *	*	*	dB dB
FREQUENCY RESPONSE Gain-Bandwidth Product Slew Rate Settling Time: 0.1% 0.01% Overload Recovery Time	GBW SR	$C_L = 100pF$ $G = 1$, 3V Step, $C_L = 100pF$ $G = 1$, 3V Step, $C_L = 100pF$ (V_{IN}) (Gain) = V_S	 0.35 0.2 15 25 16	 	 	*	*	MHz V/ μs μs μs μs
OUTPUT Voltage Output: Positive Negative Positive Negative Short-Circuit Current Capacitive Load Drive (Stable Operation) ⁽³⁾	I_{SC}	$R_L = 10k\Omega$ to $V_S/2$ $R_L = 10k\Omega$ to $V_S/2$ $R_L = 10k\Omega$ to Ground $R_L = 10k\Omega$ to Ground $G = +1$	$(V+) -1$ 0.25 $(V+) -1$ 0.1	$(V+) -0.65$ 0.05 $(V+) -0.65$ 0.05 ± 11 1000	*	*	*	V V V V mA pF
POWER SUPPLY Specified Operating Voltage Operating Voltage Range Quiescent Current (per amplifier)	I_Q	$I_O = 0$	+2.7	+5 250	+36 300	*	*	V V μA
TEMPERATURE RANGE Specified Range Operating Range Storage Thermal Resistance 8-Pin DIP SO-8 Surface-Mount MSOP-8 Surface-Mount 14-Pin DIP SO-14 Surface-Mount	θ_{JA}		-40 -40 -55		+85 +125 +125	*	*	$^\circ C$ $^\circ C$ $^\circ C$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$

* Specifications same as OPA234U, E.

NOTES: (1) Wafer-level tested to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See *Small-Signal Overshoot vs Load Capacitance* typical curve.

ELECTRICAL CHARACTERISTICS: $V_S = +2.7V$

At $T_A = 25^\circ C$, $V_S = +2.7V$, $R_L = 10k\Omega$ connected to $V_S/2$, and $V_{OUT} = V_S/2$, unless otherwise noted.

PARAMETER	CONDITION	OPA234U, E OPA2234U			OPA234UA, EA OPA2234UA OPA4234UA, U			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
OFFSET VOLTAGE								
Input Offset Voltage OPA234E, EA	V_{OS}		± 40	± 100		*	± 250	μV
vs Temperature ⁽¹⁾	dV_{OS}/dT		± 100	± 150		*	± 350	μV
vs Power Supply	PSRR		± 0.5	± 3		*	*	$\mu V/^\circ C$
vs Time			3	10		*	20	$\mu V/V$
Channel Separation (Dual, Quad)			0.2			*		$\mu V/mo$
			0.3			*		$\mu V/V$
INPUT BIAS CURRENT								
Input Bias Current ⁽²⁾	I_B	$V_{CM} = 1.35V$	-15	-30		*	-50	nA
Input Offset Current	I_{OS}	$V_{CM} = 1.35V$	± 1	± 5		*	*	n
NOISE		$f = 1kHz$						
Input Voltage Noise Density	V_n		25			*		nV/\sqrt{Hz}
Current Noise Density	i_n		80			*		fA/\sqrt{Hz}
INPUT VOLTAGE RANGE								
Common-Mode Voltage Range			-0.1		$(V+) - 1$	*	*	V
Common-Mode Rejection	CMRR	$V_{CM} = -0.1V$ to $1.7V$	91	106		86	*	dB
INPUT IMPEDANCE								
Differential		$V_{CM} = 1.35V$		$10^7 \parallel 5$		*		$\Omega \parallel pF$
Common-Mode				$10^{10} \parallel 6$		*		$\Omega \parallel pF$
OPEN-LOOP GAIN								
Open-Loop Voltage Gain	A_{OL}	$V_O = 0.25V$ to $1.7V$ $R_L = 10k\Omega$ $R_L = 2k\Omega$	108 86	125 96		100 86	*	dB dB
FREQUENCY RESPONSE								
Gain-Bandwidth Product	GBW	$C_L = 100pF$		0.35		*		MHz
Slew Rate	SR			0.2		*		$V/\mu s$
Settling Time: 0.1%		$G = 1, 1V$ Step, $C_L = 100pF$		6		*		μs
0.01%		$G = 1, 1V$ Step, $C_L = 100pF$		16		*		μs
Overload Recovery Time		(V_{IN}) (Gain) = V_S		8		*		μs
OUTPUT								
Voltage Output: Positive		$R_L = 10k\Omega$ to $V_S/2$	$(V+) - 1$	$(V+) - 0.6$		*	*	V
Negative		$R_L = 10k\Omega$ to $V_S/2$	0.25	0.05		*	*	V
Positive		$R_L = 10k\Omega$ to Ground	$(V+) - 1$	$(V+) - 0.65$		*	*	V
Negative		$R_L = 10k\Omega$ to Ground	0.1	0.05		*	*	V
Short-Circuit Current	I_{SC}			± 8		*	*	mA
Capacitive Load Drive (Stable Operation) ⁽³⁾		$G = +1$		1000		*	*	pF
POWER SUPPLY								
Specified Operating Voltage			+2.7	+2.7		*	*	V
Operating Voltage Range				+36		*	*	V
Quiescent Current (per amplifier)	I_Q	$I_O = 0$		250		300	*	μA
TEMPERATURE RANGE								
Specified Range			-40		+85	*	*	$^\circ C$
Operating Range			-40		+125	*	*	$^\circ C$
Storage			-55		+125	*	*	$^\circ C$
Thermal Resistance	θ_{JA}							
8-Pin DIP				100		*		$^\circ C/W$
SO-8 Surface-Mount				150		*		$^\circ C/W$
MSOP-8 Surface-Mount				220		*		$^\circ C/W$
14-Pin DIP				80		*		$^\circ C/W$
SO-14 Surface-Mount				110		*		$^\circ C/W$

* Specifications same as OPA234U, E.

NOTES: (1) Wafer-level tested to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See *Small-Signal Overshoot vs Load Capacitance* typical curve.

ELECTRICAL CHARACTERISTICS: $V_S = \pm 15V$

At $T_A = 25^\circ C$, $V_S = \pm 15V$, and $R_L = 10k\Omega$ connected to ground, unless otherwise noted.

PARAMETER	CONDITION	OPA234U, E OPA2234U			OPA234UA, EA OPA2234UA OPA4234UA, U			UNITS	
		MIN	TYP	MAX	MIN	TYP	MAX		
OFFSET VOLTAGE Input Offset Voltage OPA4234U Model vs Temperature ⁽¹⁾ vs Power Supply vs Time Channel Separation (Dual, Quad)	V_{OS} dV_{OS}/dT $PSRR$	$V_{CM} = 0V$ Operating Temperature Range $V_S = \pm 1.35V$ to $\pm 18V$, $V_{CM} = 0V$		± 70 ± 0.5 3 0.2 0.3	± 250 ± 5 10		* ± 70 * * *	± 500 ± 250 * 20	μV μV $\mu V/^\circ C$ $\mu V/V$ $\mu V/mo$ $\mu V/V$
INPUT BIAS CURRENT Input Bias Current ⁽²⁾ Input Offset Current	I_B I_{OS}	$V_{CM} = 0V$ $V_{CM} = 0V$		-12 ± 1	-25 ± 5		* *	-50 *	nA nA
NOISE Input Voltage Noise Density Current Noise Density	V_n i_n	$f = 1kHz$		25 80			* *		nV/\sqrt{Hz} fA/\sqrt{Hz}
INPUT VOLTAGE RANGE Common-Mode Voltage Range Common-Mode Rejection	CMRR	$V_{CM} = -15V$ to $14V$	(V-) 91	106	(V+) -1	* 86	* *	* *	V dB
INPUT IMPEDANCE Differential Common-Mode		$V_{CM} = 0V$		$10^7 \parallel 5$ $10^{10} \parallel 6$			* *		$\Omega \parallel pF$ $\Omega \parallel pF$
OPEN-LOOP GAIN Open-Loop Voltage Gain	A_{OL}	$V_O = -14.5V$ to $14V$	110	120		100	*		dB
FREQUENCY RESPONSE Gain-Bandwidth Product Slew Rate Settling Time: 0.1% 0.01% Overload Recovery Time	GBW SR	$C_L = 100pF$ $G = 1$, 10V Step, $C_L = 100pF$ $G = 1$, 10V Step, $C_L = 100pF$ (V_{IN}) (Gain) = V_S		0.35 0.2 41 47 22			* * * * *		MHz V/ μs μs μs μs
OUTPUT Voltage Output: Positive Negative Short-Circuit Current Capacitive Load Drive (Stable Operation) ⁽³⁾	I_{SC}	$G = +1$	(V+) -1 (V-) +0.5	(V+) -0.7 (V-) +0.15 ± 22 1000		* *	* * * *		V V mA pF
POWER SUPPLY Specified Operating Voltage Operating Voltage Range Quiescent Current (per amplifier)	I_Q	$I_O = 0$	± 1.35	± 15 ± 275	± 18 ± 350	* *	* *	* *	V V μA
TEMPERATURE RANGE Specified Range Operating Range Storage Thermal Resistance 8-Pin DIP SO-8 Surface-Mount MSOP-8 Surface-Mount 14-Pin DIP SO-14 Surface-Mount	θ_{JA}		-40 -40 -55		+85 +125 +125	* * *	* * *	* * *	$^\circ C$ $^\circ C$ $^\circ C$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$

* Specifications same as OPA234U, E.

NOTES: (1) Wafer-level tested to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See *Small-Signal Overshoot vs Load Capacitance* typical curve.



ELECTROSTATIC DISCHARGE SENSITIVITY

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.

PACKAGE INFORMATION

PRODUCT	PACKAGE	PACKAGE MARKING
Single OPA234EA OPA234E OPA234UA OPA234U	MSOP-8 Surface-Mount " SO-8 Surface-Mount "	A34 " OPA234UA OPA234U
Dual OPA2234UA OPA2234U	SO-8 Surface-Mount "	OPA2234UA OPA2234U
Quad OPA4234UA OPA4234U	SO-8 Surface-Mount "	OPA4234UA OPA4234U

NOTE: (1) For the most current package and ordering information, see the Package Option Addendum located at the end of this data sheet.

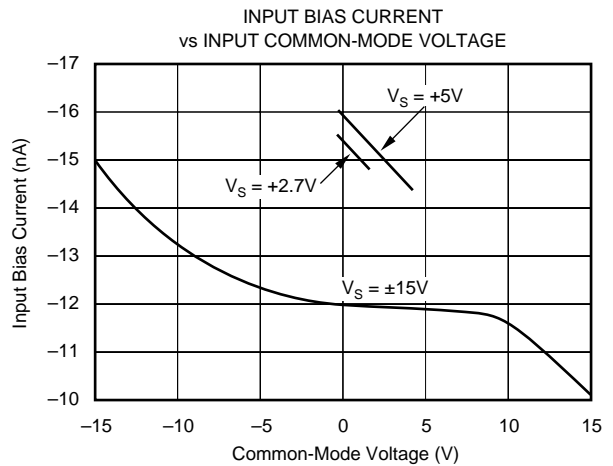
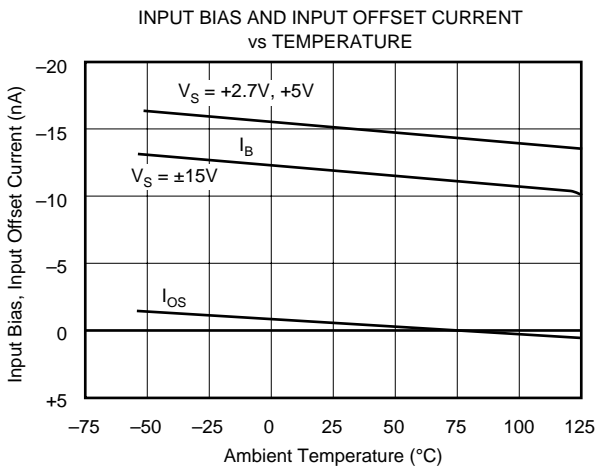
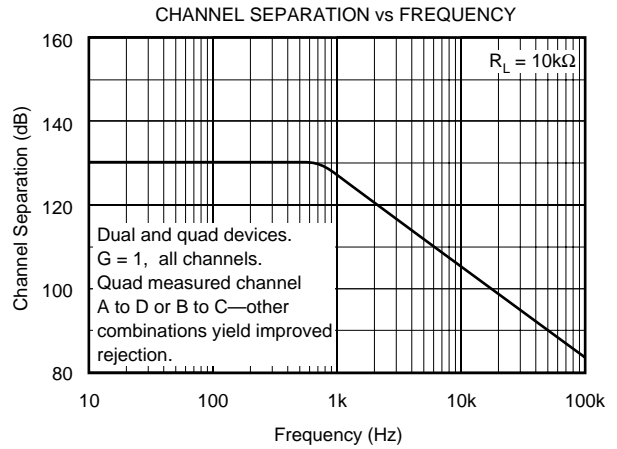
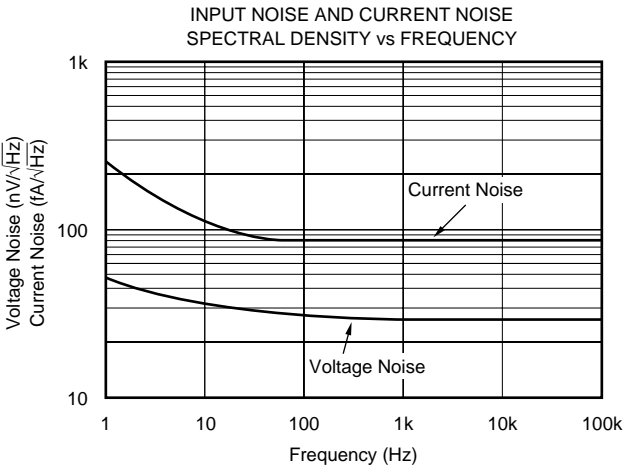
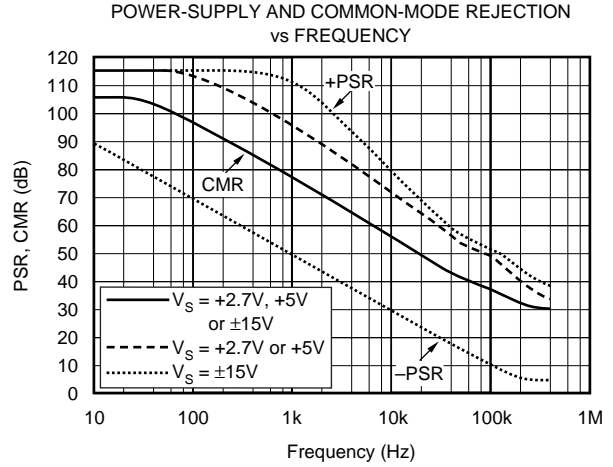
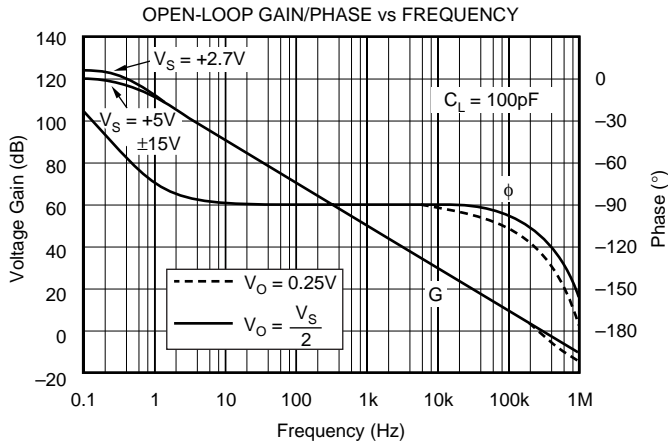
ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V+ to V-	36V
Input Voltage	(V-) -0.7V to (V+) +0.7V
Output Short-Circuit ⁽¹⁾	Continuous
Operating Temperature	-40°C to +125°C
Storage Temperature	-55°C to +125°C
Junction Temperature	150°C
Lead Temperature (soldering, 10s)	300°C

NOTE: (1) Short-circuit to ground, one amplifier per package.

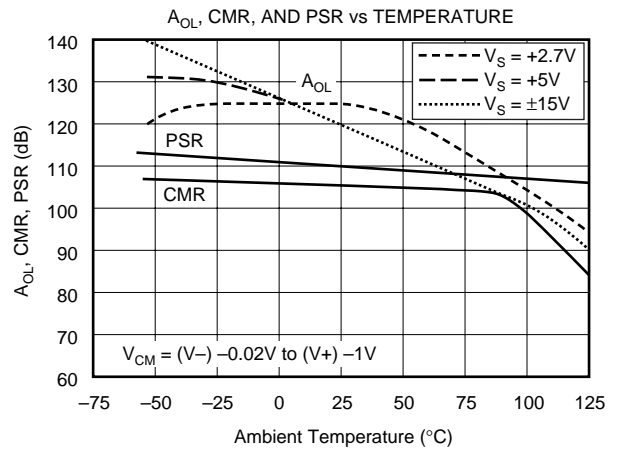
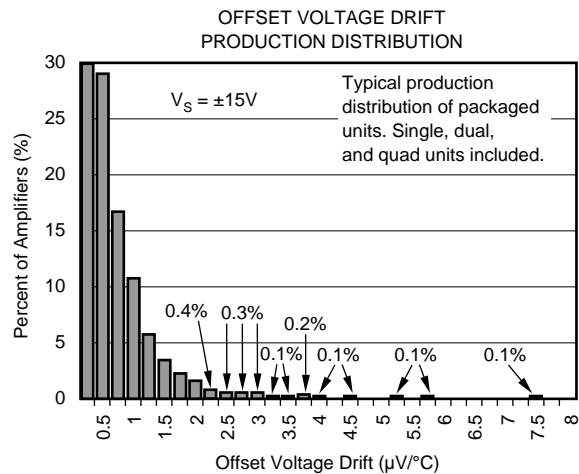
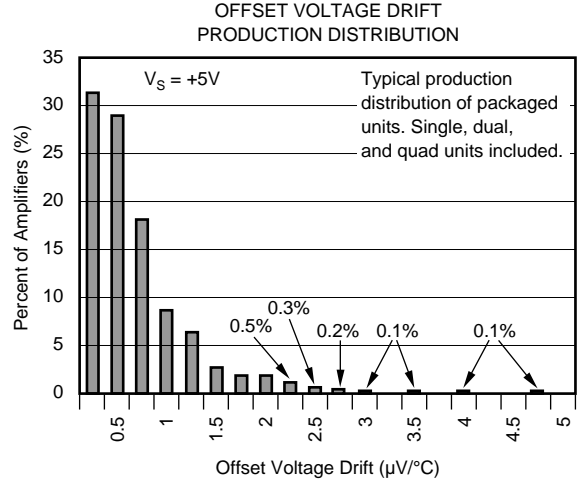
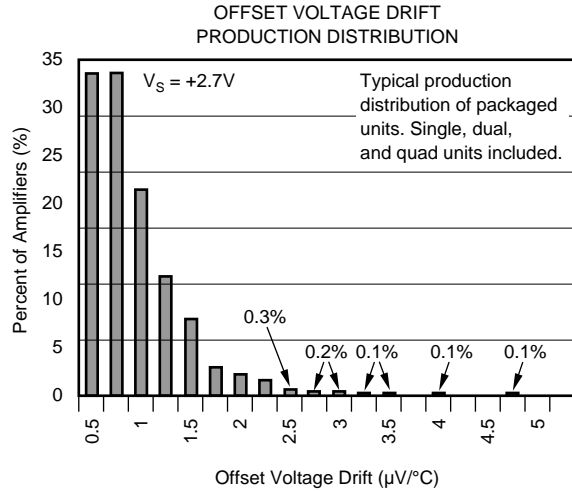
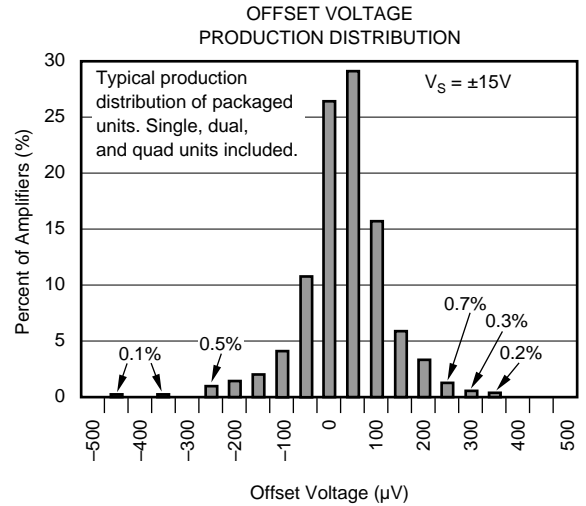
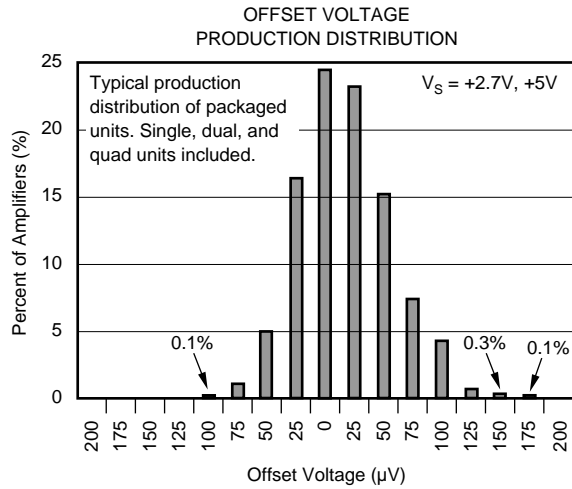
TYPICAL CHARACTERISTIC CURVES

At $T_A = +25^\circ\text{C}$ and $R_L = 10\text{k}\Omega$, unless otherwise noted.



TYPICAL CHARACTERISTIC CURVES (Cont.)

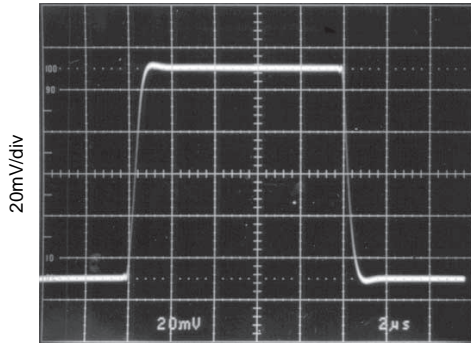
At $T_A = +25^\circ\text{C}$ and $R_L = 10\text{k}\Omega$, unless otherwise noted.



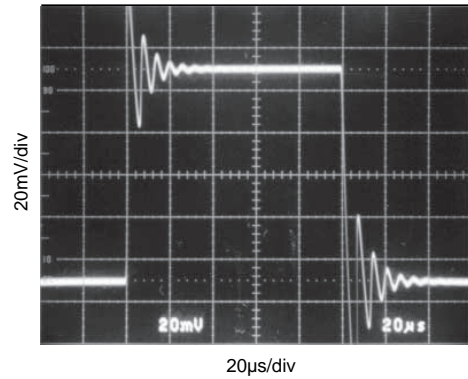
TYPICAL CHARACTERISTIC CURVES (Cont.)

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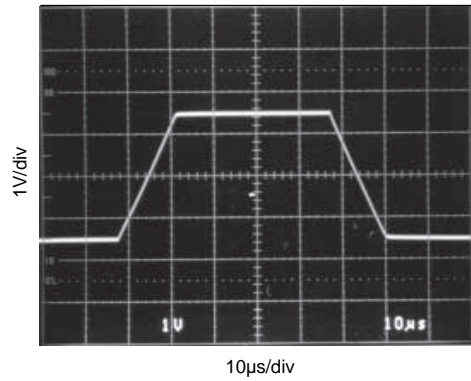
SMALL-SIGNAL STEP RESPONSE
 $G = 1$, $C_L = 100\text{pF}$, $V_S = +5\text{V}$



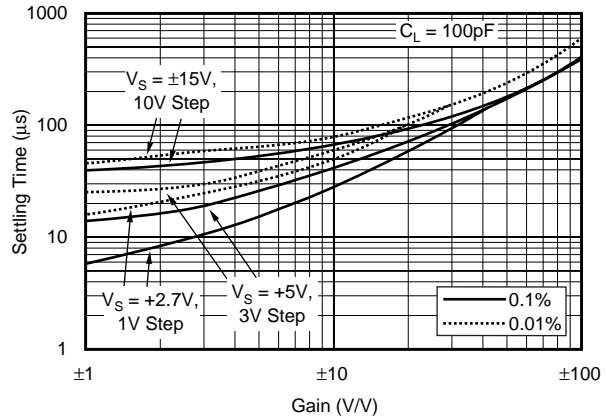
SMALL-SIGNAL STEP RESPONSE
 $G = 1$, $C_L = 10,000\text{pF}$, $V_S = +5\text{V}$



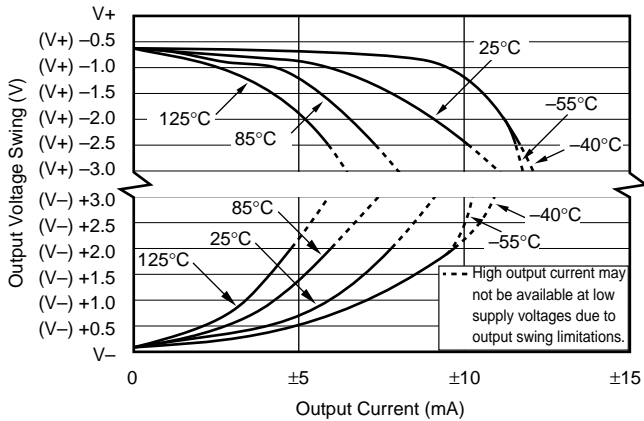
LARGE-SIGNAL STEP RESPONSE
 $G = 1$, $C_L = 100\text{pF}$, $V_S = +5\text{V}$



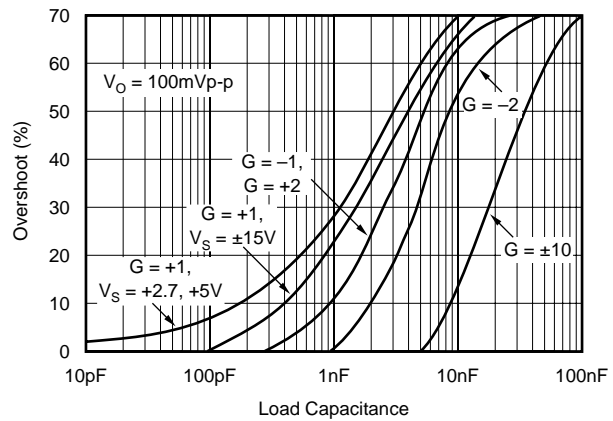
SETTLING TIME vs CLOSED-LOOP GAIN



OUTPUT VOLTAGE SWING vs OUTPUT CURRENT

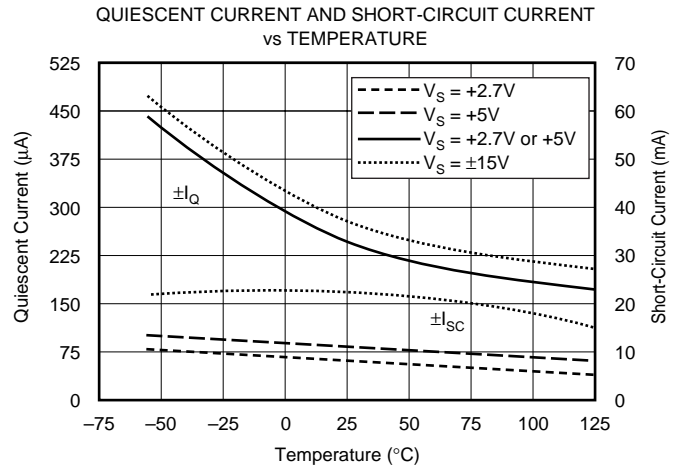
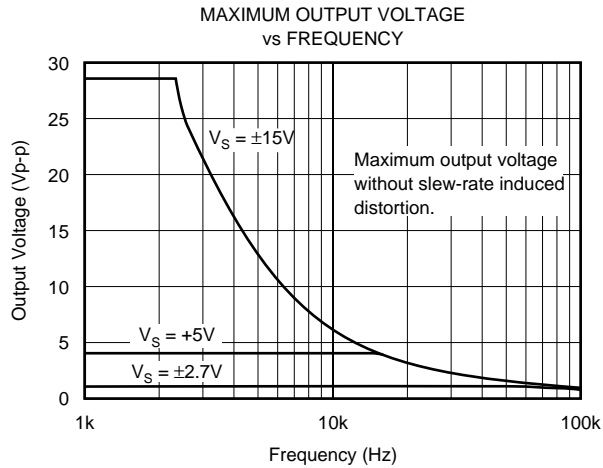


SMALL-SIGNAL OVERSHOOT vs LOAD CAPACITANCE



TYPICAL CHARACTERISTIC CURVES (Cont.)

At $T_A = +25^\circ\text{C}$ and $R_L = 10\text{k}\Omega$, unless otherwise noted.



APPLICATIONS INFORMATION

The OPA234 series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. Power-supply pins should be bypassed with 10nF ceramic capacitors.

OPERATING VOLTAGE

The OPA234 series op amps operate from single (+2.7V to +36V) or dual ($\pm 1.35\text{V}$ to $\pm 18\text{V}$) supplies with excellent performance. Specifications are production tested with +2.7V, +5V, and $\pm 15\text{V}$ supplies. Most behavior remains unchanged throughout the full operating voltage range. Parameters which vary significantly with operating voltage are shown in the Typical Characteristic curves.

OFFSET VOLTAGE TRIM

Offset voltage of the OPA234 series amplifiers is laser trimmed and usually requires no user adjustment. The OPA234 (single op amp version) provides offset voltage trim connections on pins 1 and 5. Offset voltage can be adjusted by connecting a potentiometer, as shown in Figure 1. This adjustment should be used only to null the offset of the op amp, not to adjust system offset or offset produced by the signal source. Nulling offset could degrade the offset drift behavior of the op amp. While it is not possible to predict the exact change in drift, the effect is usually small.

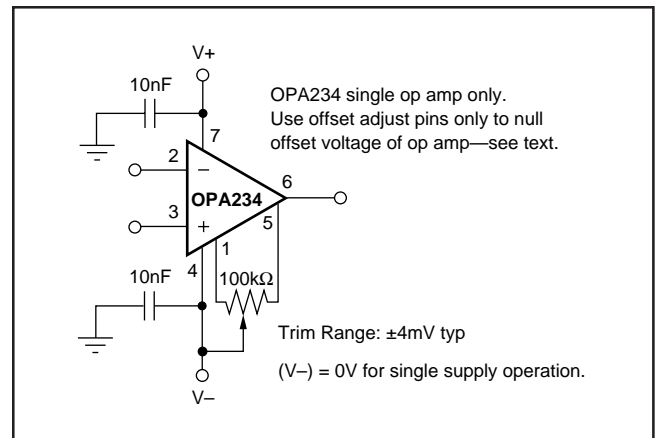


FIGURE 1. OPA234 Offset Voltage Trim Circuit.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
OPA2234U	LIFEBUY	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U	
OPA2234U/2K5	LIFEBUY	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U	
OPA2234UA	LIFEBUY	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U A	
OPA2234UA/2K5	LIFEBUY	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U A	
OPA2234UA/2K5G4	LIFEBUY	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U A	
OPA2234UG4	LIFEBUY	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA 2234U	
OPA234E/250	LIFEBUY	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234E/250G4	LIFEBUY	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234E/2K5	LIFEBUY	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234EA/250	LIFEBUY	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234EA/250G4	LIFEBUY	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234EA/2K5	LIFEBUY	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU Call TI	Level-3-260C-168 HR	-40 to 125	A34	
OPA234U	LIFEBUY	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 125	OPA 234U	
OPA234U/2K5	LIFEBUY	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 125	OPA 234U	
OPA234UA	LIFEBUY	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 125	OPA 234U A	

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
OPA234UA/2K5	LIFEBUY	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 125	OPA 234U A	
OPA4234U	LIFEBUY	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U	
OPA4234U/2K5	LIFEBUY	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U	
OPA4234UA	LIFEBUY	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U A	
OPA4234UA/2K5	LIFEBUY	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U A	
OPA4234UA/2K5G4	LIFEBUY	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U A	
OPA4234UAG4	LIFEBUY	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U A	
OPA4234UG4	LIFEBUY	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4234U	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

⁽⁵⁾ Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽⁶⁾ Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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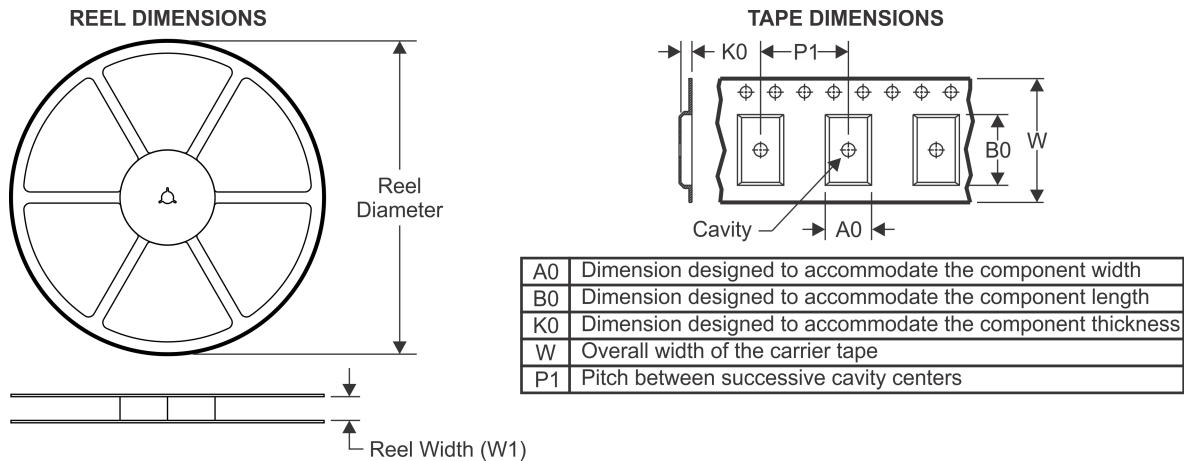
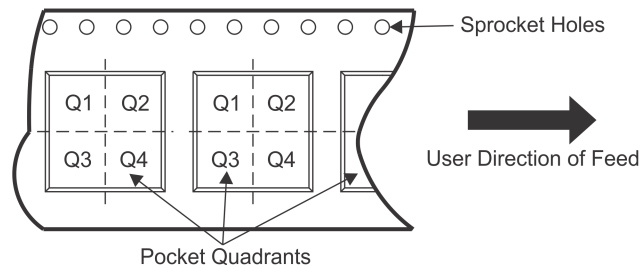
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OTHER QUALIFIED VERSIONS OF OPA2234 :

- Military: [OPA2234M](#)

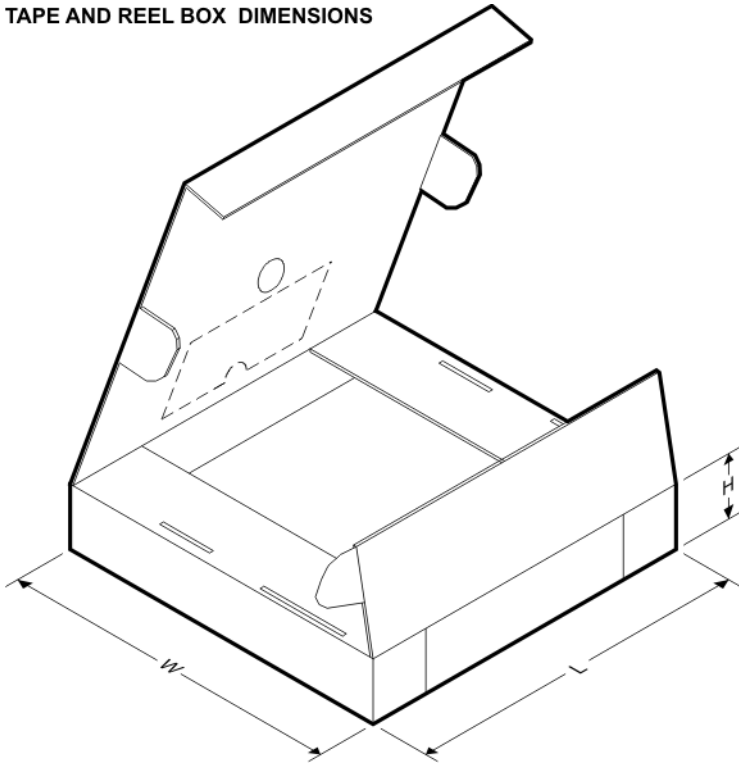
NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
OPA2234U/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA2234UA/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA234E/250	VSSOP	DGK	8	250	180.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
OPA234E/2K5	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
OPA234EA/250	VSSOP	DGK	8	250	180.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
OPA234EA/2K5	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
OPA234U/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA234UA/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA4234U/2K5	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
OPA4234UA/2K5	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

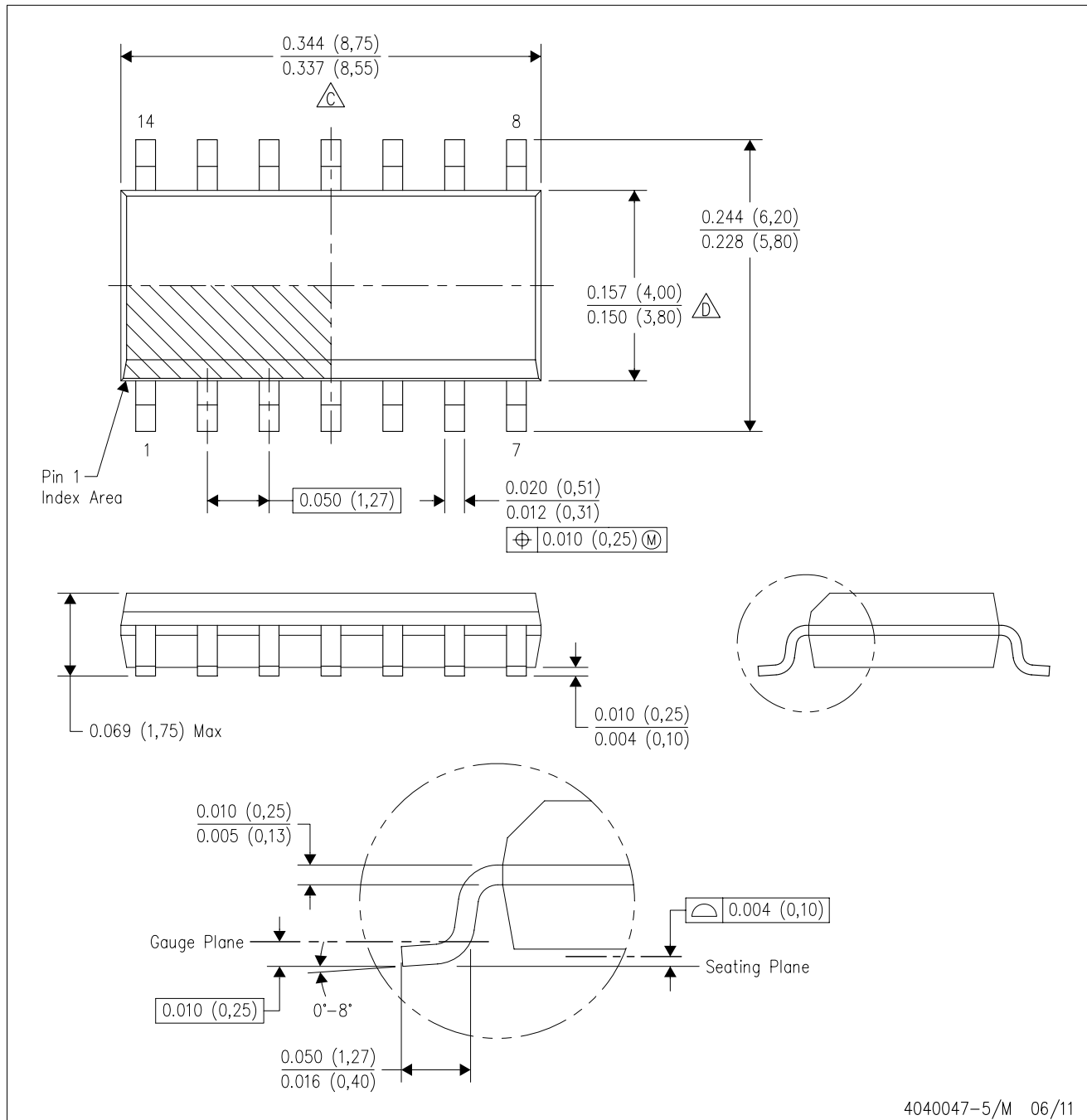
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
OPA2234U/2K5	SOIC	D	8	2500	367.0	367.0	35.0
OPA2234UA/2K5	SOIC	D	8	2500	367.0	367.0	35.0
OPA234E/250	VSSOP	DGK	8	250	210.0	185.0	35.0
OPA234E/2K5	VSSOP	DGK	8	2500	367.0	367.0	35.0
OPA234EA/250	VSSOP	DGK	8	250	210.0	185.0	35.0
OPA234EA/2K5	VSSOP	DGK	8	2500	367.0	367.0	35.0
OPA234U/2K5	SOIC	D	8	2500	367.0	367.0	35.0
OPA234UA/2K5	SOIC	D	8	2500	367.0	367.0	35.0
OPA4234U/2K5	SOIC	D	14	2500	367.0	367.0	38.0
OPA4234UA/2K5	SOIC	D	14	2500	367.0	367.0	38.0

D (R-PDSO-G14)

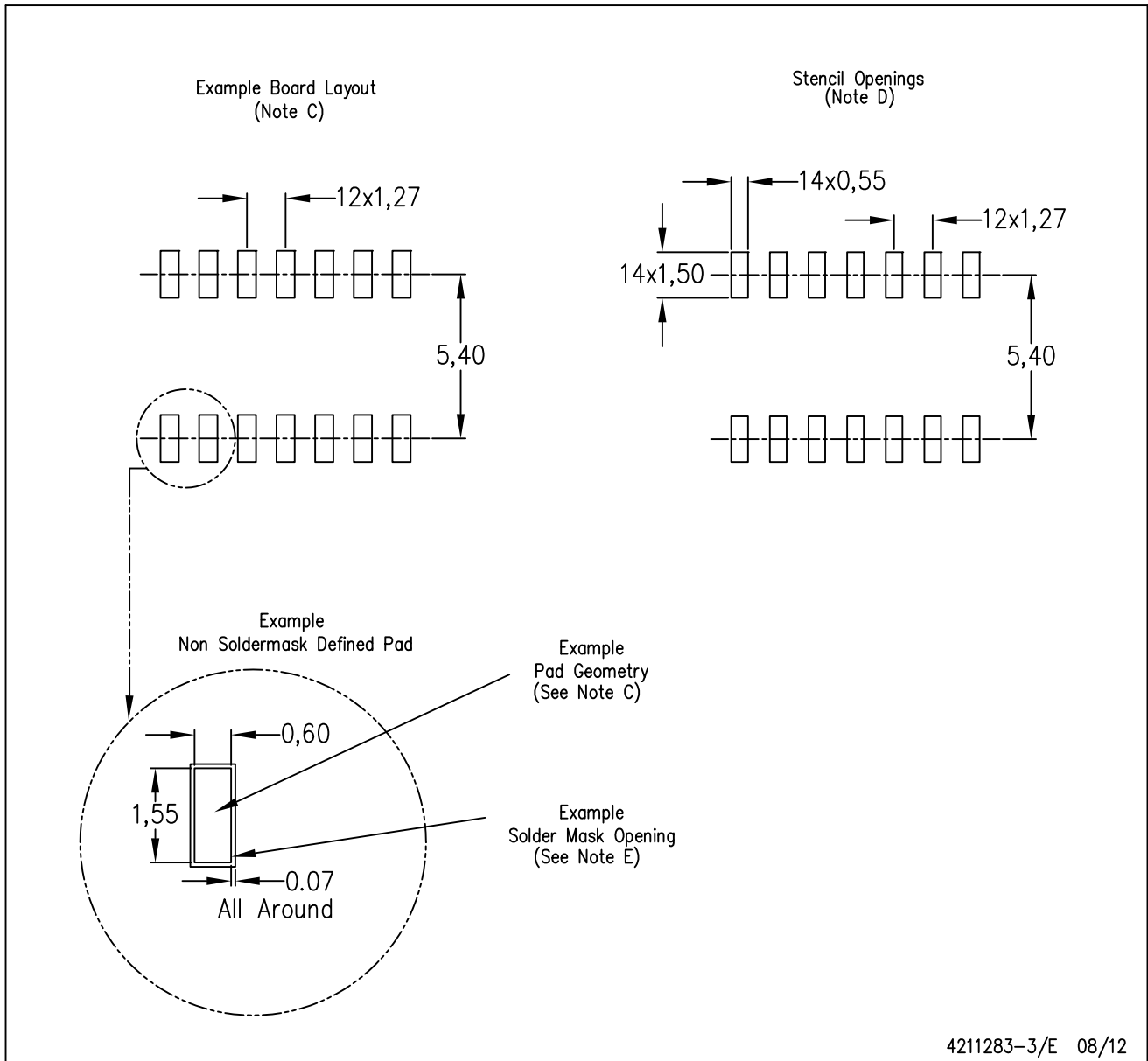
PLASTIC SMALL OUTLINE



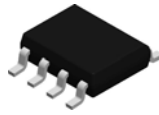
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

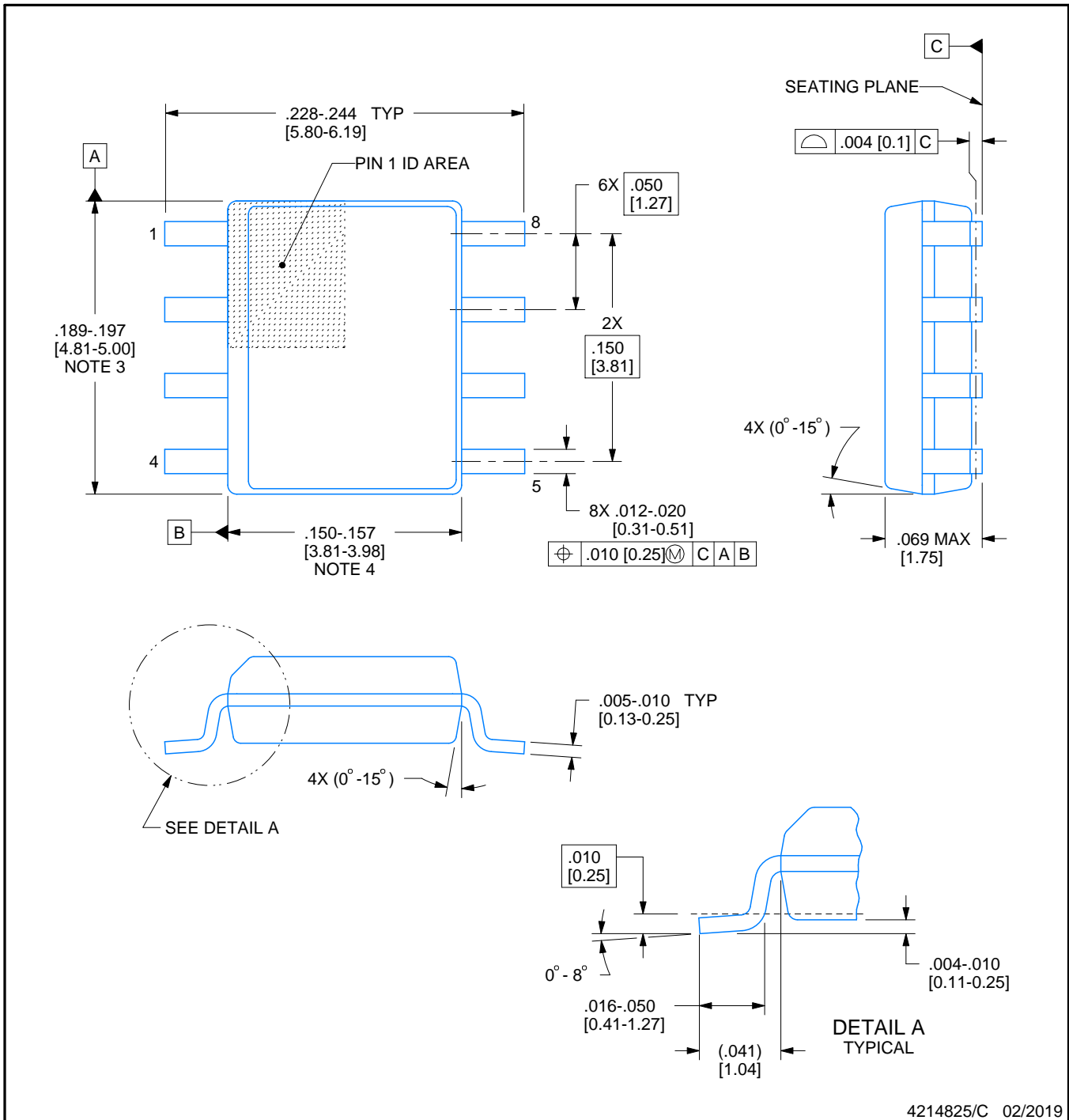


D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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NOTES:

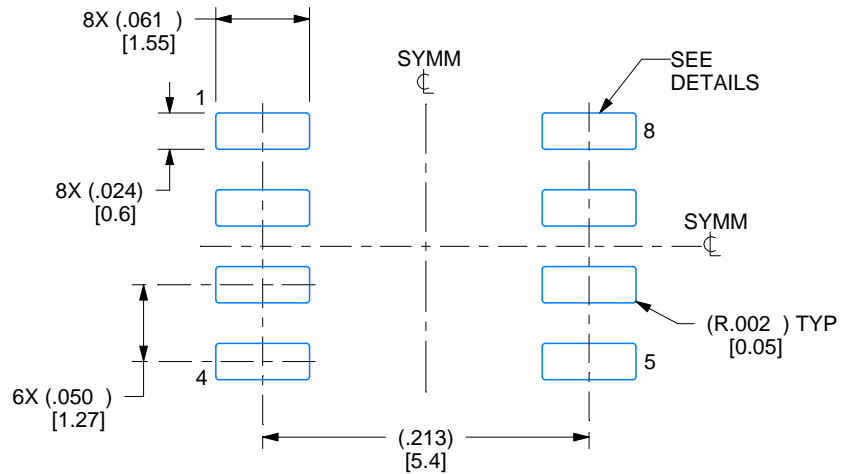
- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed $.006$ [0.15] per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

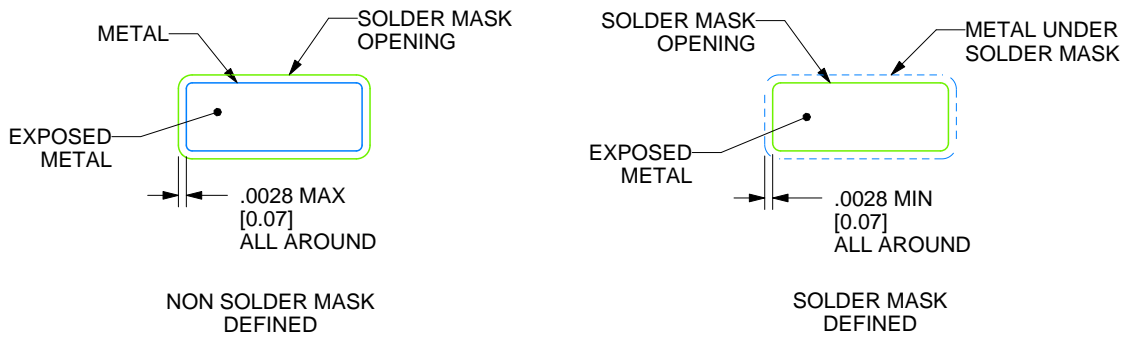
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
 EXPOSED METAL SHOWN
 SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

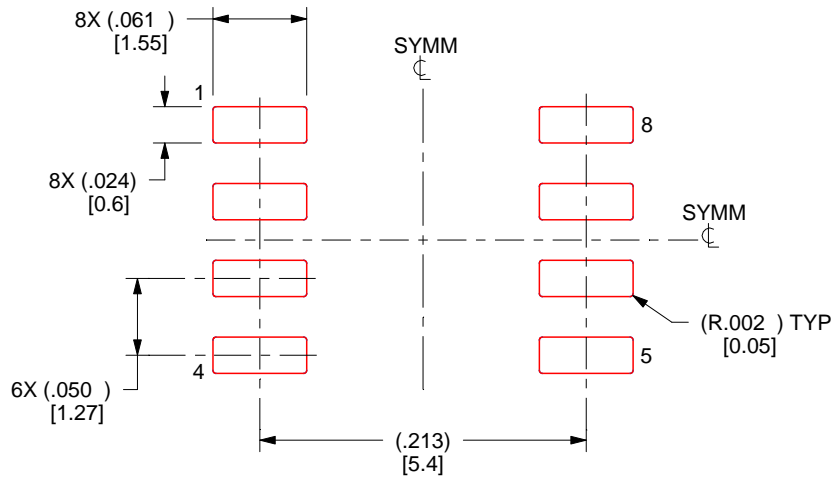
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

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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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