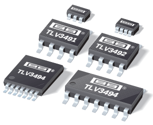


TLV3491
TLV3492
TLV3494

SBOS262D – DECEMBER 2002 – REVISED APRIL 2005

1.8V, Nanopower, PUSH-PULL OUTPUT COMPARATOR

FEATURES

- **VERY LOW SUPPLY CURRENT: 0.8μA (typ)**
- **INPUT COMMON-MODE RANGE 200mV BEYOND SUPPLY RAILS**
- **SUPPLY VOLTAGE: +1.8V to +5.5V**
- **HIGH SPEED: 6μs**
- **PUSH-PULL CMOS OUTPUT STAGE**
- **SMALL PACKAGES:**
  - **SOT23-5 (Single)**
  - **SOT23-8 (Dual)**

APPLICATIONS

- **PORTABLE MEDICAL EQUIPMENT**
- **WIRELESS SECURITY SYSTEMS**
- **REMOTE CONTROL SYSTEMS**
- **HANDHELD INSTRUMENTS**
- **ULTRA-LOW POWER SYSTEMS**

DESCRIPTION

The TLV349x family of push-pull output comparators features a fast 6μs response time and < 1.2μA (max) nanopower capability, allowing operation from 1.8V – 5.5V. Input common-mode range beyond supply rails make the TLV349x an ideal choice for low-voltage applications.

Micro-sized packages provide options for portable and space-restricted applications. The single (TLV3491) is available in SOT23-5 and SO-8. The dual (TLV3492) comes in SOT23-8 and SO-8. The quad (TLV3494) is available in TSSOP-14 and SO-14.

The TLV349x is excellent for power-sensitive, low-voltage (2-cell) applications.

TLV349x RELATED PRODUCTS

PRODUCT	FEATURES
TLV370x	560nA, 2.5V to 16V, Push-Pull CMOS Output Stage Comparator
TLV340x	550nA, 2.5V to 16V, Open Drain Output Stage Comparator

ABSOLUTE MAXIMUM RATINGS(1)

Supply Voltage	+5.5V
Signal Input Terminals, Voltage(2)	(V–) – 0.5V to (V+) + 0.5V
Current(2)	±10mA
Output Short-Circuit(3)	Continuous
Operating Temperature	–40°C to +125°C
Storage Temperature	–65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C
ESD Rating (Human Body Model)	3000V

NOTE: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied. (2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current limited to 10mA or less. (3) Short-circuit to ground, one amplifier per package.

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.

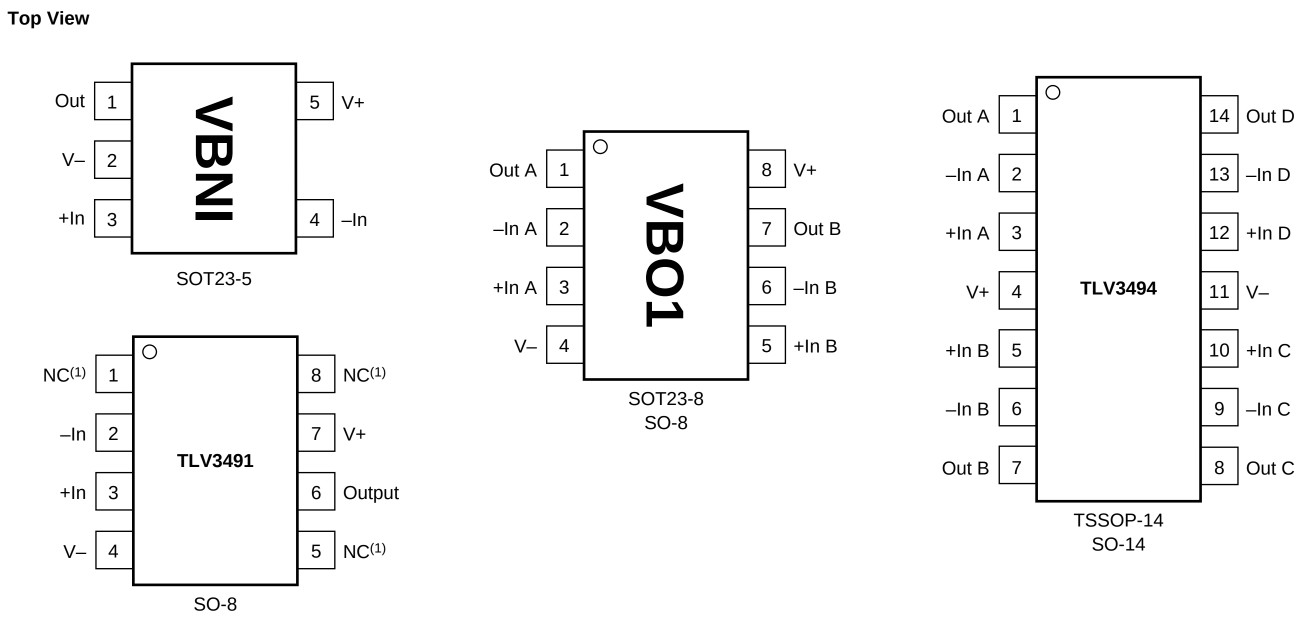
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION(1)

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
TLV3491	SOT23-5	DBV	–40°C to +125°C	VBNI	TLV3491AIDBVT	Tube, 250
"	"	"	"	"	TLV3491AIDBVR	Tape and Reel, 3000
TLV3491	SO-8	D	–40°C to +125°C	TLV3491	TLV3491AID	Tube, 100
"	"	"	"	"	TLV3491AIDR	Tube, 2500
TLV3492	SOT23-8	DCN	–40°C to +125°C	VBO1	TLV3492AIDCNT	Tube, 250
"	"	"	"	"	TLV3492AIDCNR	Tape and Reel, 3000
TLV3492	SO-8	D	–40°C to +125°C	TLV3492	TLV3492AID	Tube, 100
"	"	"	"	"	TLV3492AIDR	Tape and Reel, 2500
TLV3494	TSSOP-14	PW	–40°C to +125°C	TLV3494	TLV3494AIPWT	Tape and Reel, 94
"	"	"	"	"	TLV3494AIPWR	Tape and Reel, 2500
TLV3494	SO-14	D	–40°C to +125°C	TLV3494	TLV3494AID	Tape and Reel, 58
"	"	"	"	"	TLV3494AIDR	Tape and Reel, 2500

NOTE: (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

PIN CONFIGURATIONS



NOTES: (1) NC means no internal connection.

ELECTRICAL CHARACTERISTICS: V_S = +1.8V to +5.5V

Boldface limits apply over the specified temperature range, **T_A = –40°C to +125°C.**

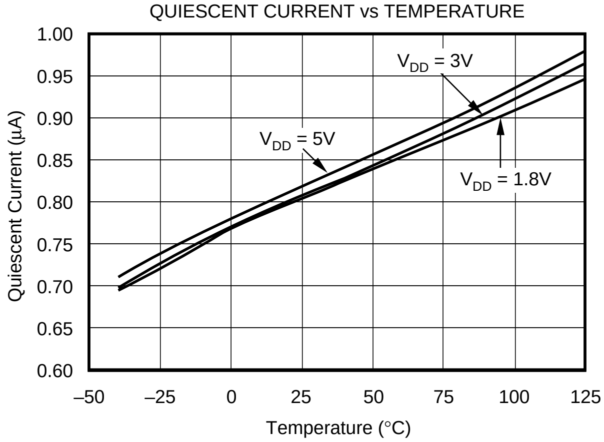
At T_A = +25°C, and V_S = +1.8V to +5.5V, unless otherwise noted.

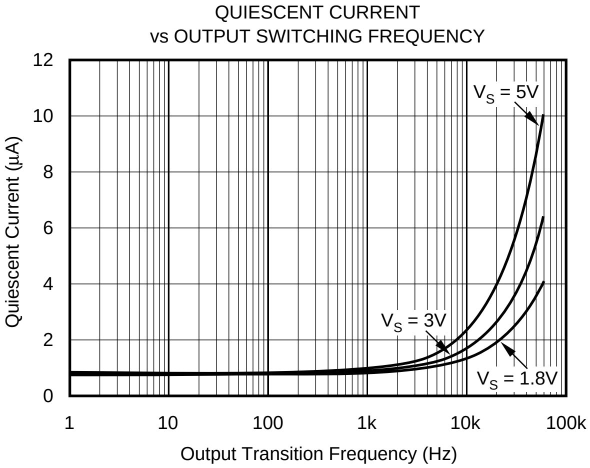
PARAMETER		CONDITION	TLV3491, TLV3492, TLV3494			UNITS
			MIN	TYP	MAX	
OFFSET VOLTAGE	V_{OS}					
Input Offset Voltage		V_{CM} = 0V, I_O = 0V		±3	±15	mV
vs Temperature	**dV_{OS}/dT**	**T_A = –40°C to +125°C**		**±12**		**µV/°C**
vs Power Supply	PSRR	V_S = 1.8V to 5.5V		350	1000	µV/V
INPUT BIAS CURRENT						
Input Bias Current	I_B	V_{CM} = V_{CC}/2		±1	±10	pA
Input Offset Current	I_{OS}	V_{CM} = V_{CC}/2		±1	±10	pA
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}		(V–) – 0.2V		(V+) + 0.2V	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = –0.2V to (V+) – 1.5V	60	74		dB
		V_{CM} = –0.2V to (V+) + 0.2V	54	62		dB
INPUT CAPACITANCE						
Common-Mode				2		pF
Differential				4		pF
SWITCHING CHARACTERISTICS		f = 10kHz, V_{STEP} = 1V				
Propagation Delay Time, Low-to-High	$t_{(PLH)}$	Input Overdrive = 10mV		12		µs
		Input Overdrive = 100mV		6		µs
Propagation Delay Time, High-to-Low	$t_{(PHL)}$	Input Overdrive = 10mV		13.5		µs
		Input Overdrive = 100mV		6.5		µs
Rise Time	t_R	C_L = 10pF		100		ns
Fall Time	t_F	C_L = 10pF		100		ns
OUTPUT		V_S = 5V				
Voltage Output High from Rail	V_{OH}	I_{OUT} = 5mA		90	200	mV
Voltage Output Low from Rail	V_{OL}	I_{OUT} = 5mA		160	200	mV
Short-Circuit Current	I_{SC}			See Typical Characteristics		
POWER SUPPLY						
Specified Voltage	V_S		1.8		5.5	V
Operating Voltage Range			1.8		5.5	V
Quiescent Current(1)	I_Q	V_O = 5V, V_O = High		0.85	1.2	µA
TEMPERATURE RANGE						
Specified Range			–40		+125	°C
Operating Range			–40		+125	°C
Storage Range			–65		+150	°C
Thermal Resistance, θ_{JA}						
SOT23-5, SOT23-8				200		°C/W
SO-8				150		°C/W
SO-14, TSSOP-14				100		°C/W

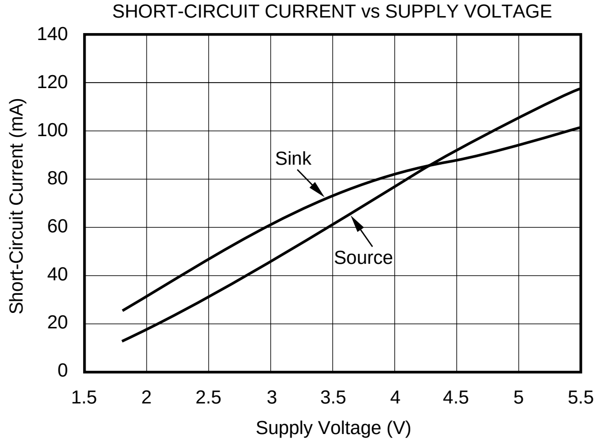
NOTE: (1) I_Q per channel.

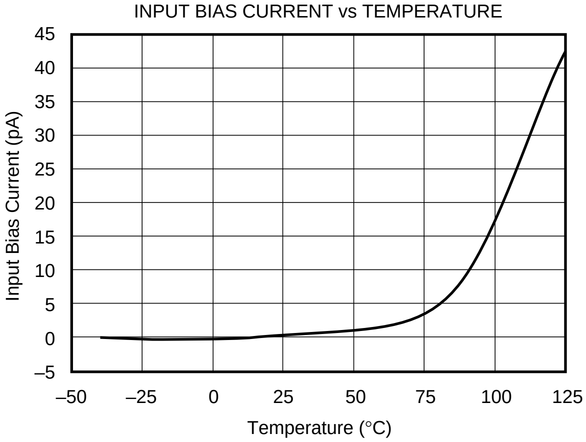
TYPICAL CHARACTERISTICS

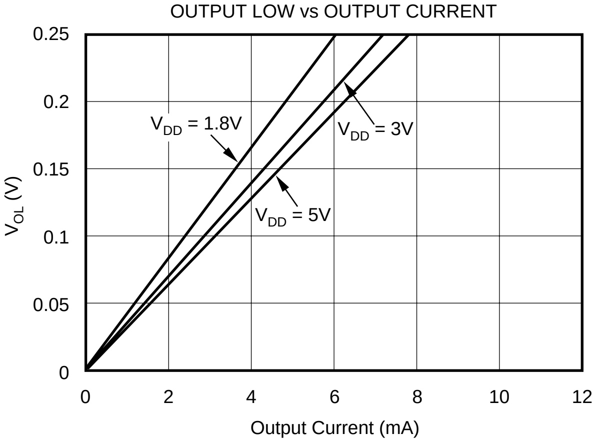
At T_A = +25°C, V_S = +1.8V to +5.5V, and Input Overdrive = 100mV, unless otherwise noted.

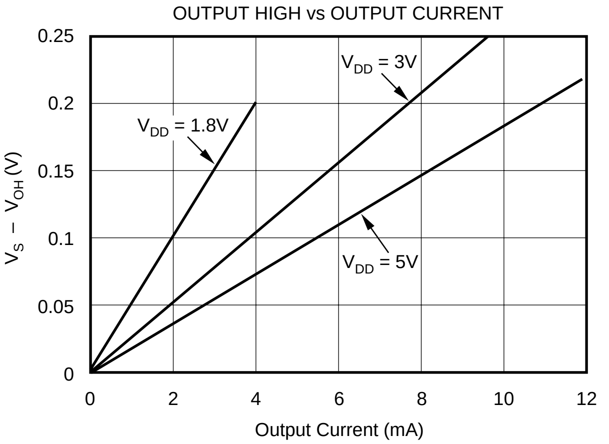

QUIESCENT CURRENT vs TEMPERATURE


QUIESCENT CURRENT vs OUTPUT SWITCHING FREQUENCY


SHORT-CIRCUIT CURRENT vs SUPPLY VOLTAGE


INPUT BIAS CURRENT vs TEMPERATURE

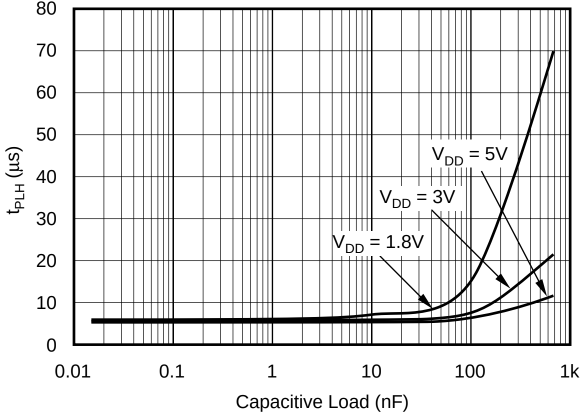

OUTPUT LOW vs OUTPUT CURRENT


OUTPUT HIGH vs OUTPUT CURRENT

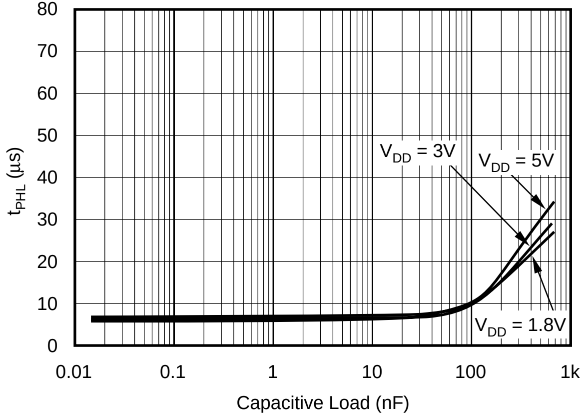
TYPICAL CHARACTERISTICS (Cont.)

At T_A = +25°C, V_S = +1.8V to +5.5V, and Input Overdrive = 100mV, unless otherwise noted.

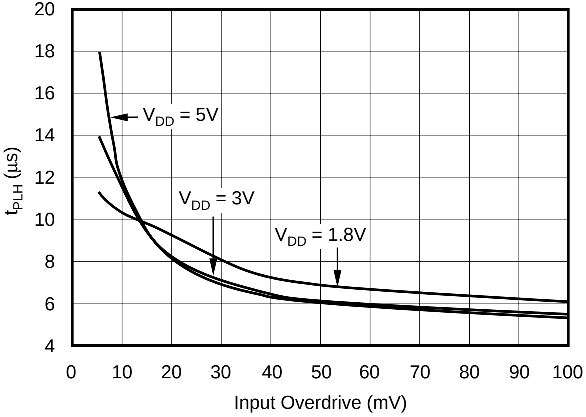
PROPAGATION DELAY (t_{PLH}) vs CAPACITIVE LOAD



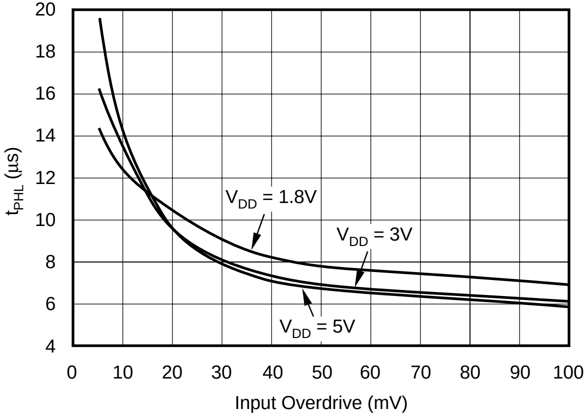
PROPAGATION DELAY (t_{PHL}) vs CAPACITIVE LOAD



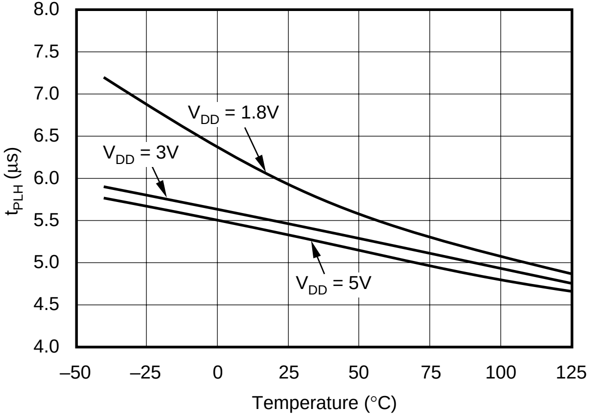
PROPAGATION DELAY (t_{PLH}) vs INPUT OVERDRIVE



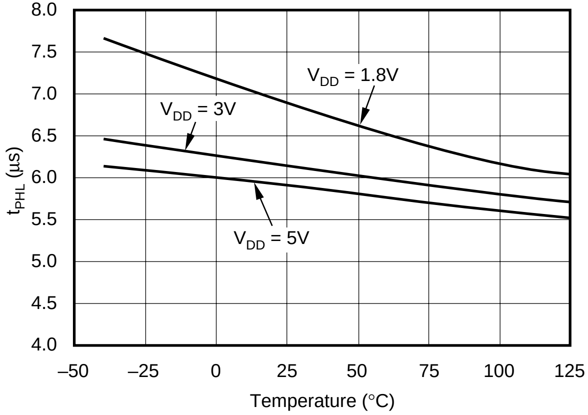
PROPAGATION DELAY (t_{PHL}) vs INPUT OVERDRIVE



PROPAGATION DELAY (t_{PLH}) vs TEMPERATURE



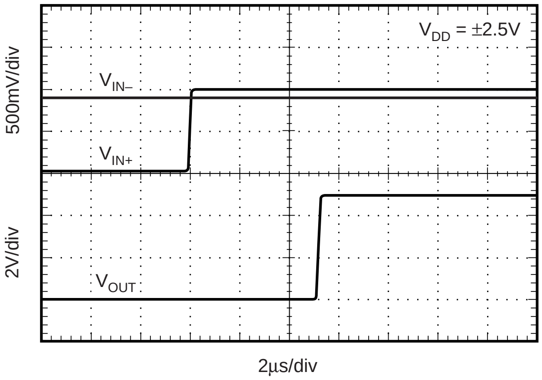
PROPAGATION DELAY (t_{PHL}) vs TEMPERATURE



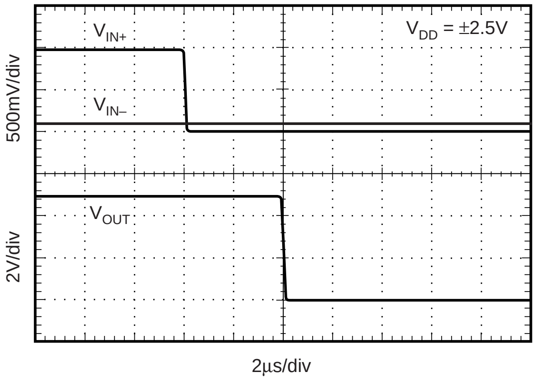
TYPICAL CHARACTERISTICS (Cont.)

At T_A = +25°C, V_S = +1.8V to +5.5V, and Input Overdrive = 100mV, unless otherwise noted.

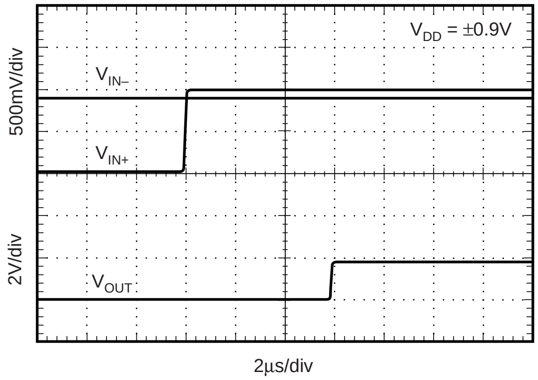
PROPAGATION DELAY (t_{PLH})



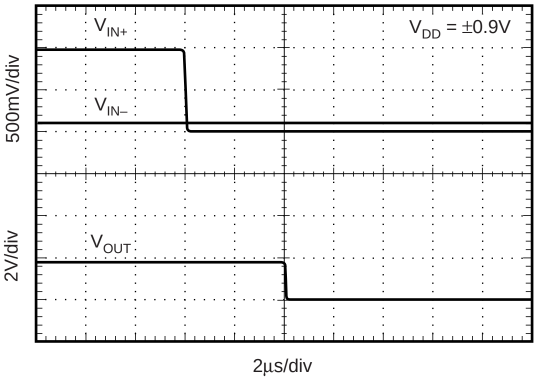
PROPAGATION DELAY (t_{PHL})



PROPAGATION DELAY (t_{PLH})



PROPAGATION DELAY (t_{PHL})



APPLICATIONS INFORMATION

The TLV349x family of comparators features rail-to-rail input and output on supply voltages as low as 1.8V. The push-pull output stage is optimal for reduced power budget applications and features no shoot-through current. Low supply voltages, common-mode input range beyond supply rails, and a typical supply current of 0.8µA make the TLV349x family an excellent candidate for battery-powered applications with single-cell operation.

BOARD LAYOUT

Figure 1 shows the typical connections for the TLV349x. To minimize supply noise, power supplies should be capacitively decoupled by a 0.01µF ceramic capacitor in parallel with a 10µF electrolytic capacitor. Comparators are very sensitive to input noise. Proper grounding (use of ground plane) will help maintain specified performance of the TLV349x family.

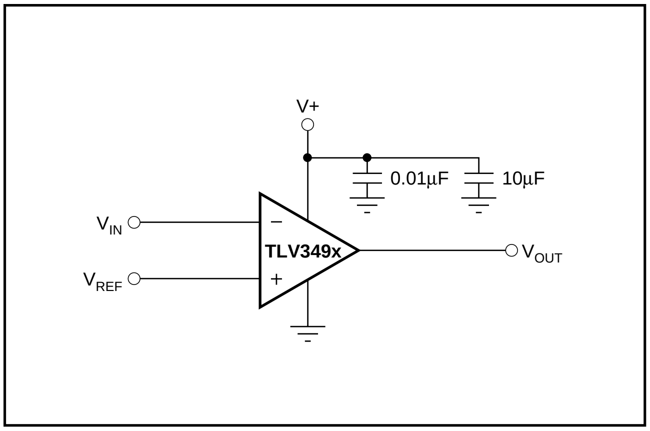


FIGURE 1. Basic Connections of the TLV349x.

SETTING REFERENCE VOLTAGE

It is important to use a stable reference when setting the transition point for the TLV349x. The REF1004 provides a 1.25V reference voltage with low drift and only 8µA of quiescent current.

EXTERNAL HYSTERESIS

Comparator inputs have no noise immunity within the range of specified offset voltage (±15mV). For noisy input signals, the comparator output may display multiple switching as input signals move through the switching threshold. The typical comparator threshold of the TLV349x is ±15mV. To prevent multiple switching within the comparator threshold of the TLV349x, external hysteresis may be added by connecting a small amount of feedback to the positive input. Figure 2 shows a typical topology used to introduce hysteresis, described by the equation:

$$V_{HYST} = \frac{V^{+} \times R_1}{R_1 + R_2}$$

V_{HYST} will set the value of the transition voltage required to switch the comparator output by increasing the threshold region, thereby reducing sensitivity to noise.

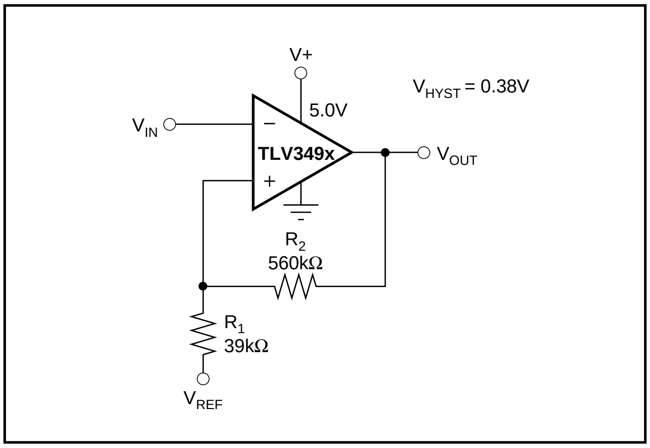


FIGURE 2. Adding Hysteresis to the TLV349x.

APPLICATIONS

RELAXATION OSCILLATOR

The TLV349x can be configured as a relaxation oscillator to provide a simple and inexpensive clock output (see Figure 3.) The capacitor is charged at a rate of 0.69RC. It also discharges at a rate of 0.69RC. Therefore, the period is 1.38RC. R_1 may be a different value than R_2.

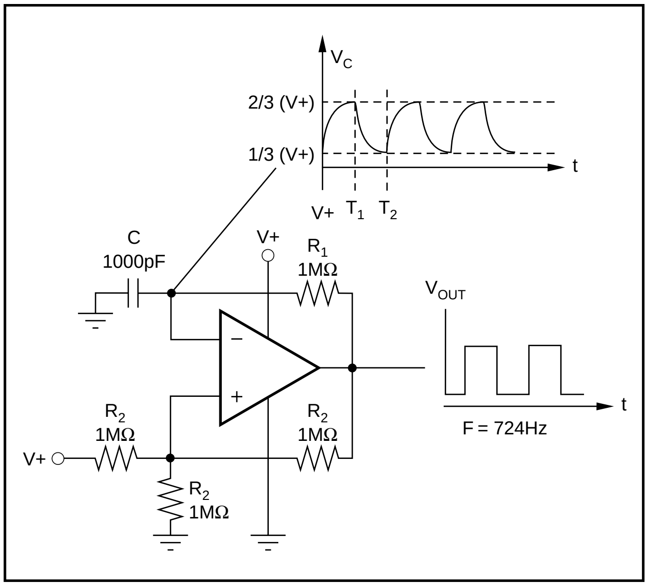


FIGURE 3. TLV349x Configured as a Relaxation Oscillator.

POWER-ON RESET

The reset circuit shown in Figure 4 provides a time delayed release of reset to the MSP430 microcontroller. Operation of the circuit is based on a stabilization time constant of the supply voltage, rather than on a predetermined voltage value. The negative input is a reference voltage created by a simple resistor divider. These resistor values should be relatively high to reduce the current consumption of the circuit. The positive input is an RC circuit that provides a power-up delay. When power is applied, the output of the comparator is low, holding the processor in the reset condition. Only after allowing time for the supply voltage to stabilize does the positive input of the comparator become higher than the negative input, resulting in a high output state and releasing the processor for operation. The stabilization time required for the supply voltage is adjustable by the selection of the RC component values. Use of a lower-valued resistor in this portion of the circuit will not increase current consumption because no current flows through the RC circuit after the supply has stabilized. The reset delay time needed depends on the power-up characteristics of the system power supply. R_1 and C_1 are selected to allow enough time for the power supply to stabilize. D1 provides rapid reset if power is lost. In this example, the $R_1 \bullet C_1$ time constant is 10ms.

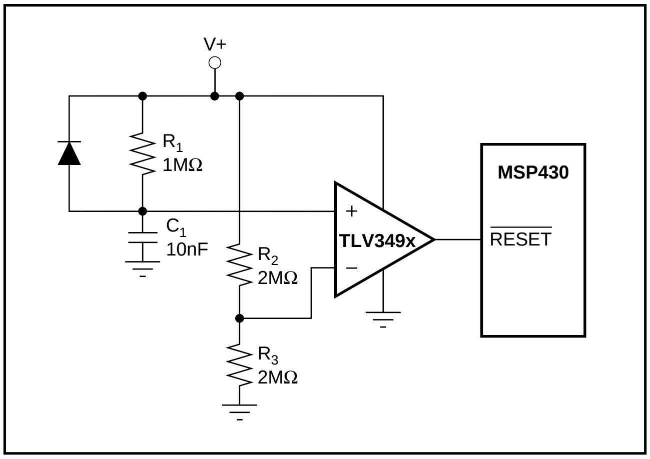


FIGURE 4. The TLV349x Configured as a Reset Circuit for the MSP430.

PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TLV3491AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3491AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3492AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3492AIDCNR	ACTIVE	SOT-23	DCN	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV3492AIDCNRG4	ACTIVE	SOT-23	DCN	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV3492AIDCNT	ACTIVE	SOT-23	DCN	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV3492AIDCNTG4	ACTIVE	SOT-23	DCN	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV3492AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3492AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3492AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AID	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AIDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AIPWR	ACTIVE	TSSOP	PW	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AIPWRG4	ACTIVE	TSSOP	PW	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AIPWT	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLV3494AIPWTG4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR

(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.

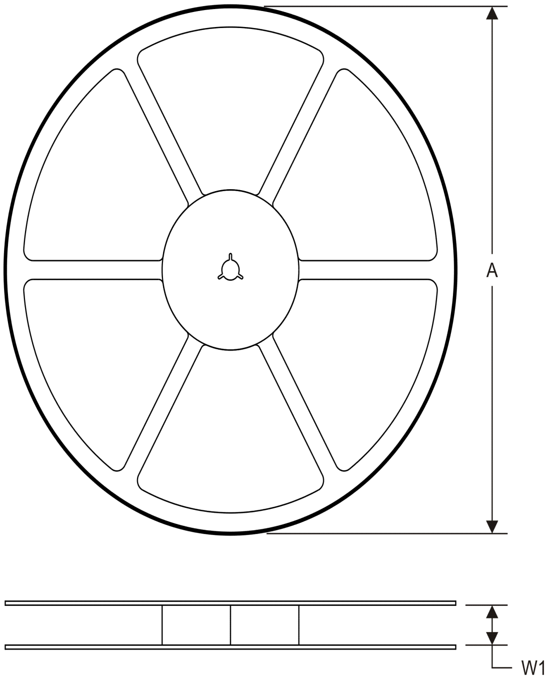
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

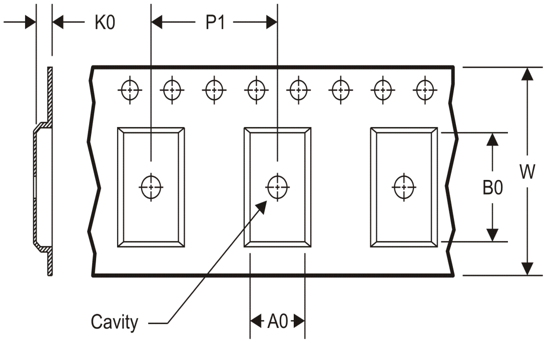
[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



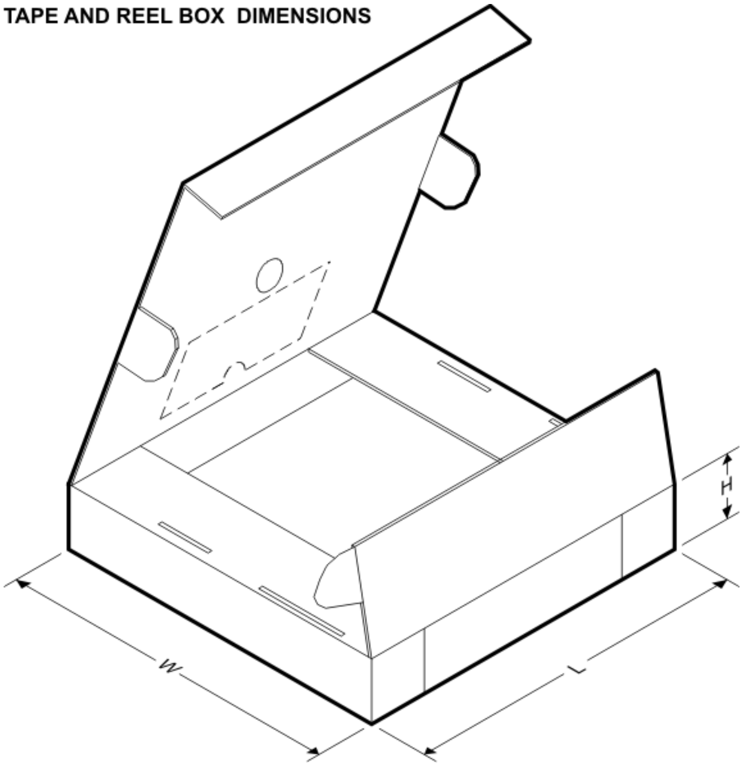
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
TLV3491AIDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TLV3491AIDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TLV3491AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLV3492AIDCNR	SOT-23	DCN	8	3000	180.0	8.4	3.2	3.1	1.39	4.0	8.0	Q3
TLV3492AIDCNT	SOT-23	DCN	8	250	180.0	8.4	3.2	3.1	1.39	4.0	8.0	Q3
TLV3492AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLV3494AIPWR	TSSOP	PW	14	2500	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TLV3494AIPWT	TSSOP	PW	14	250	180.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

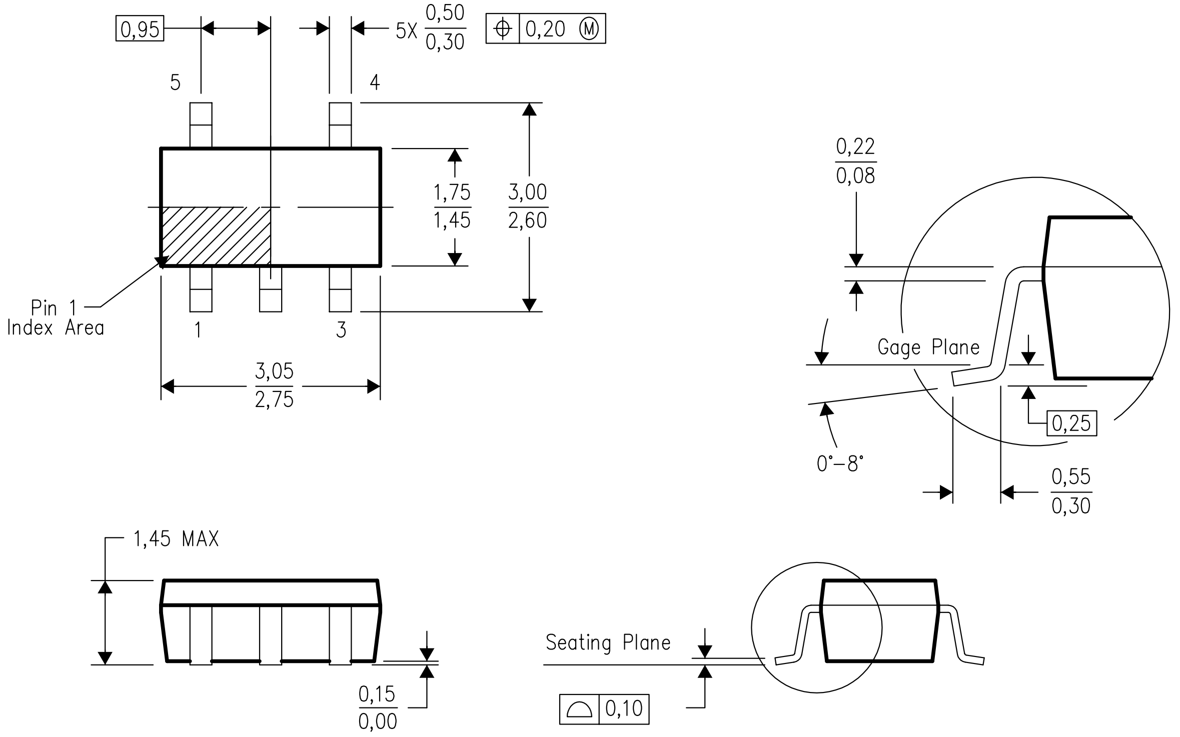
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV3491AIDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TLV3491AIDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TLV3491AIDR	SOIC	D	8	2500	367.0	367.0	35.0
TLV3492AIDCNR	SOT-23	DCN	8	3000	210.0	185.0	35.0
TLV3492AIDCNT	SOT-23	DCN	8	250	210.0	185.0	35.0
TLV3492AIDR	SOIC	D	8	2500	367.0	367.0	35.0
TLV3494AIPWR	TSSOP	PW	14	2500	367.0	367.0	35.0
TLV3494AIPWT	TSSOP	PW	14	250	210.0	185.0	35.0

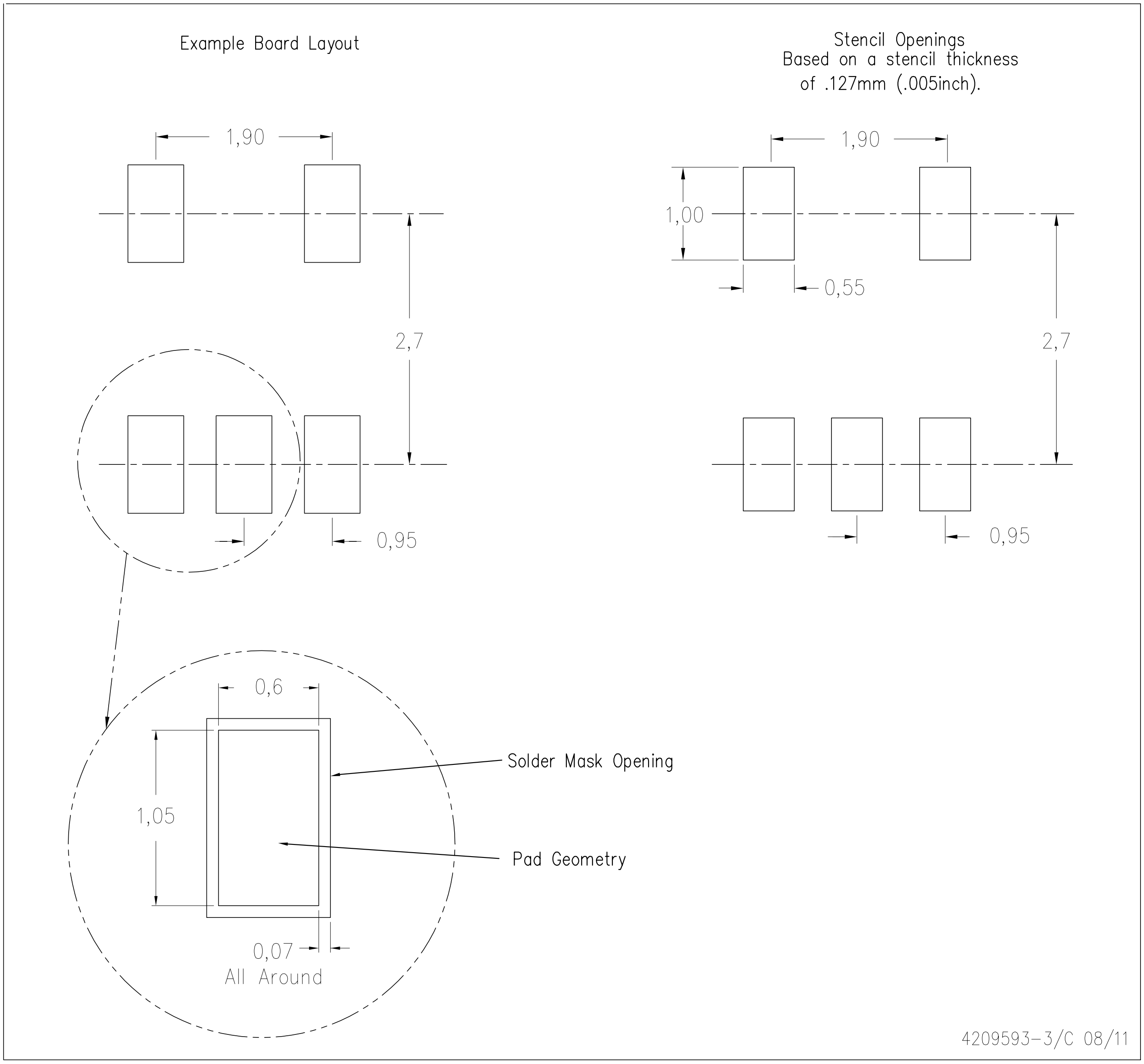
DBV (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



4073253–4/K 03/2006

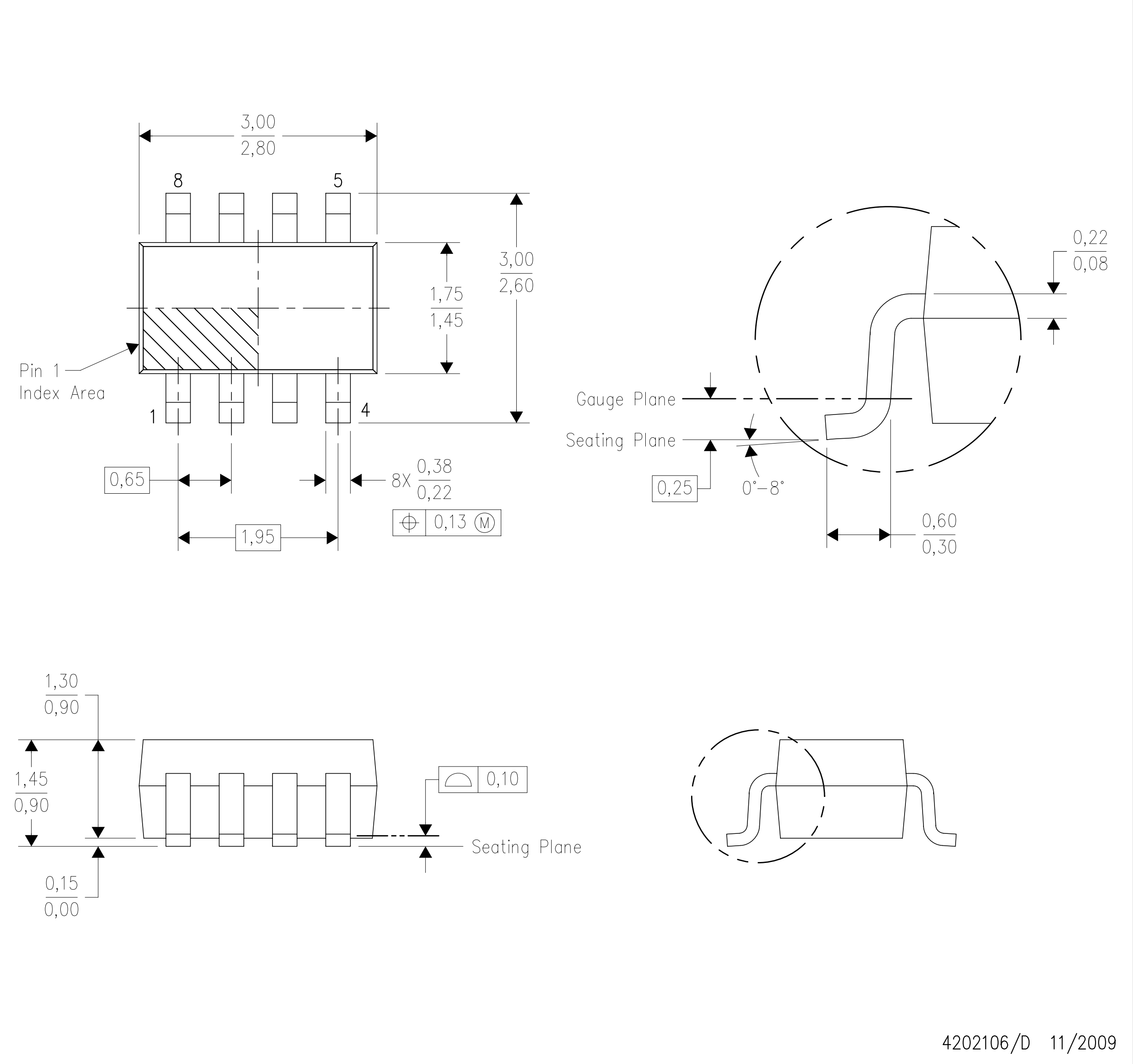
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO–178 Variation AA.

DBV (R–PDSO–G5) PLASTIC SMALL OUTLINE



NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC–7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

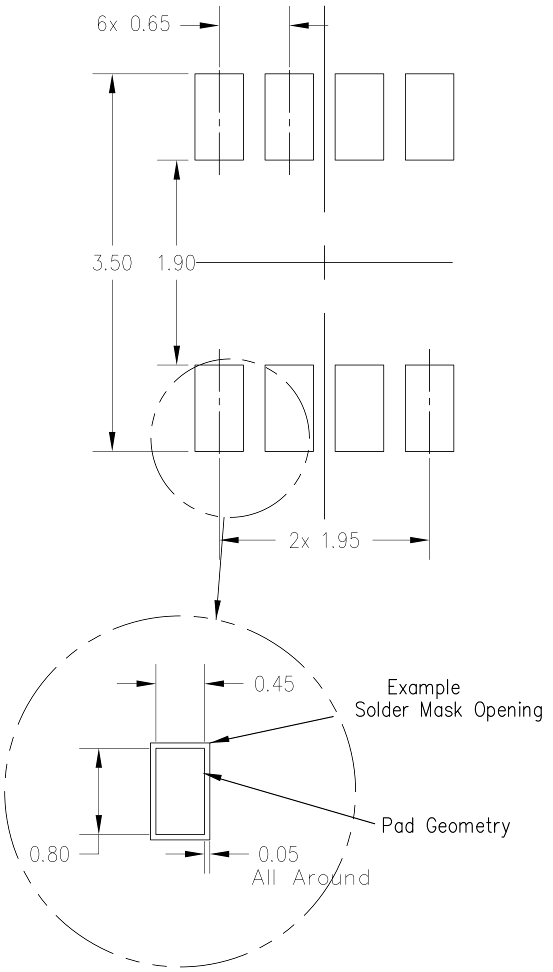
DCN (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE (DIE DOWN)



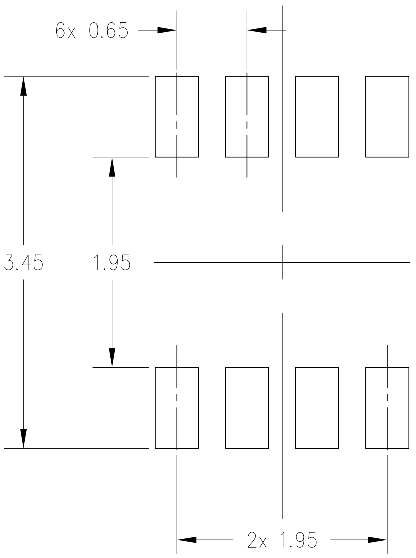
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Package outline exclusive of metal burr & dambar protrusion/intrusion.
- D. Package outline inclusive of solder plating.
- E. A visual index feature must be located within the Pin 1 index area.
- F. Falls within JEDEC MO–178 Variation BA.
- G. Body dimensions do not include flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.

DCN (R-PDSO-G8) PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)

Example Board Layout
(Note C,E)



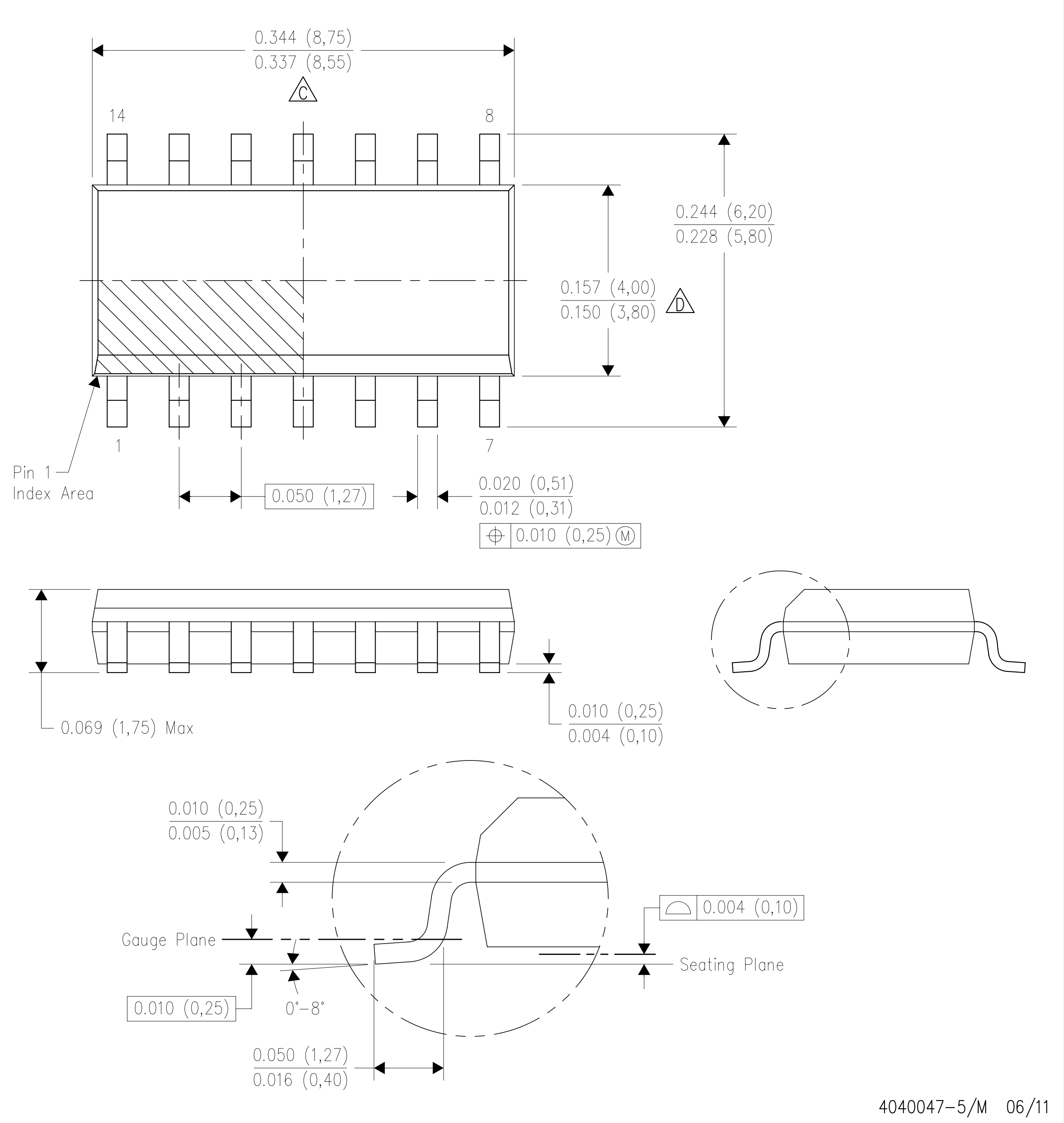
Example Stencil Design
(Note D)



4211034/B 01/12

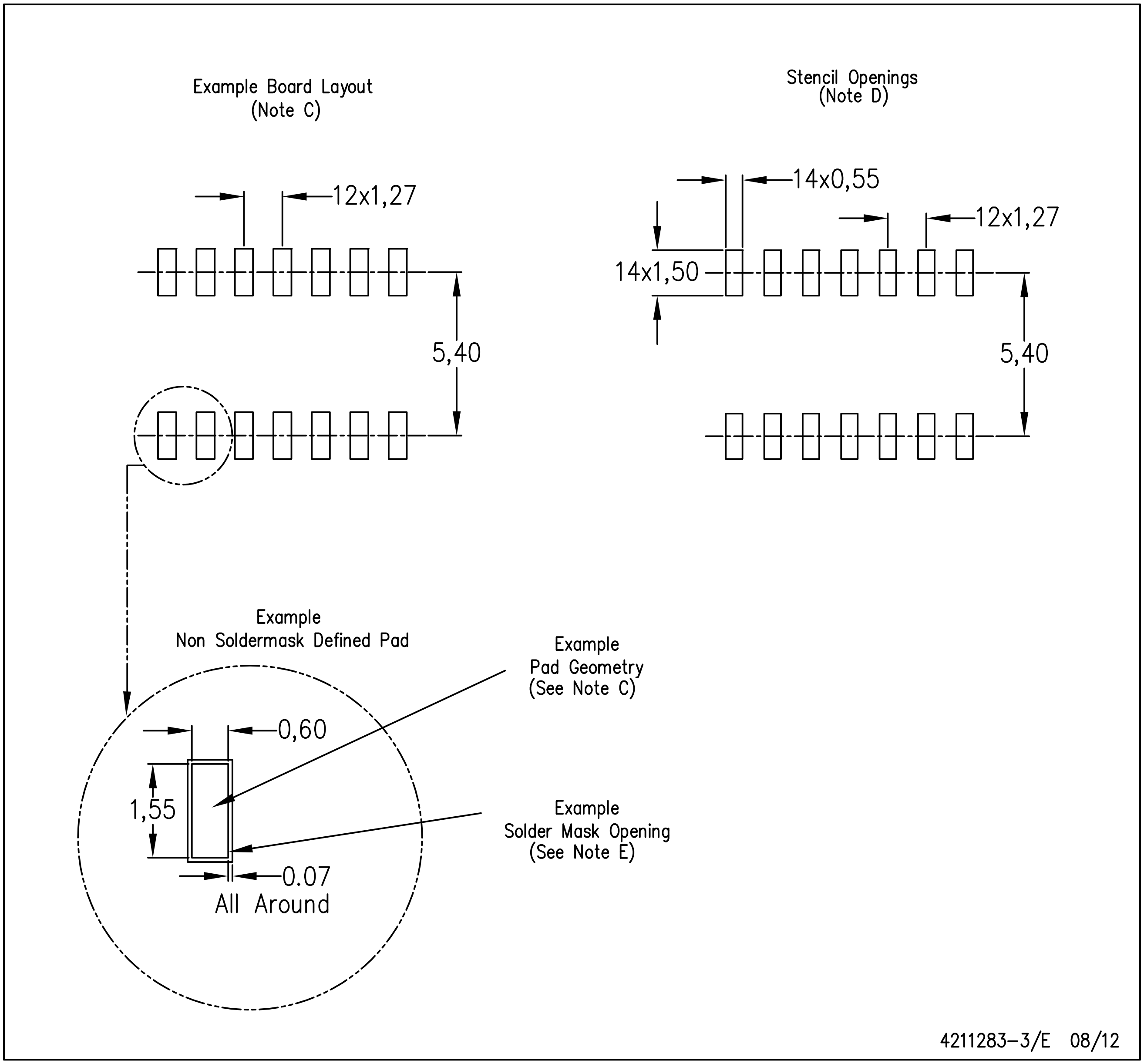
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC-7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact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

D (R–PDSO–G14) PLASTIC SMALL OUTLINE



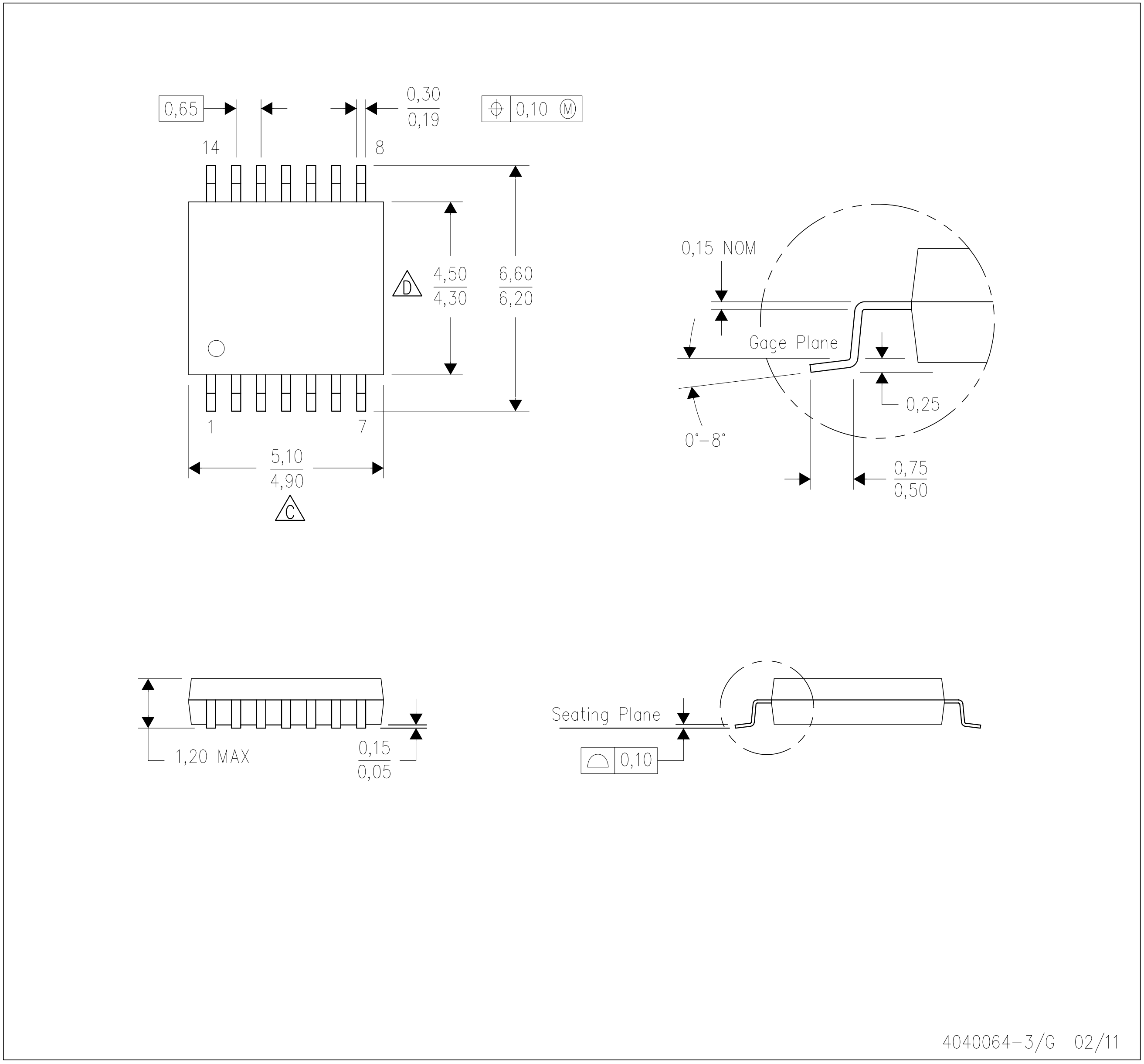
NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include 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



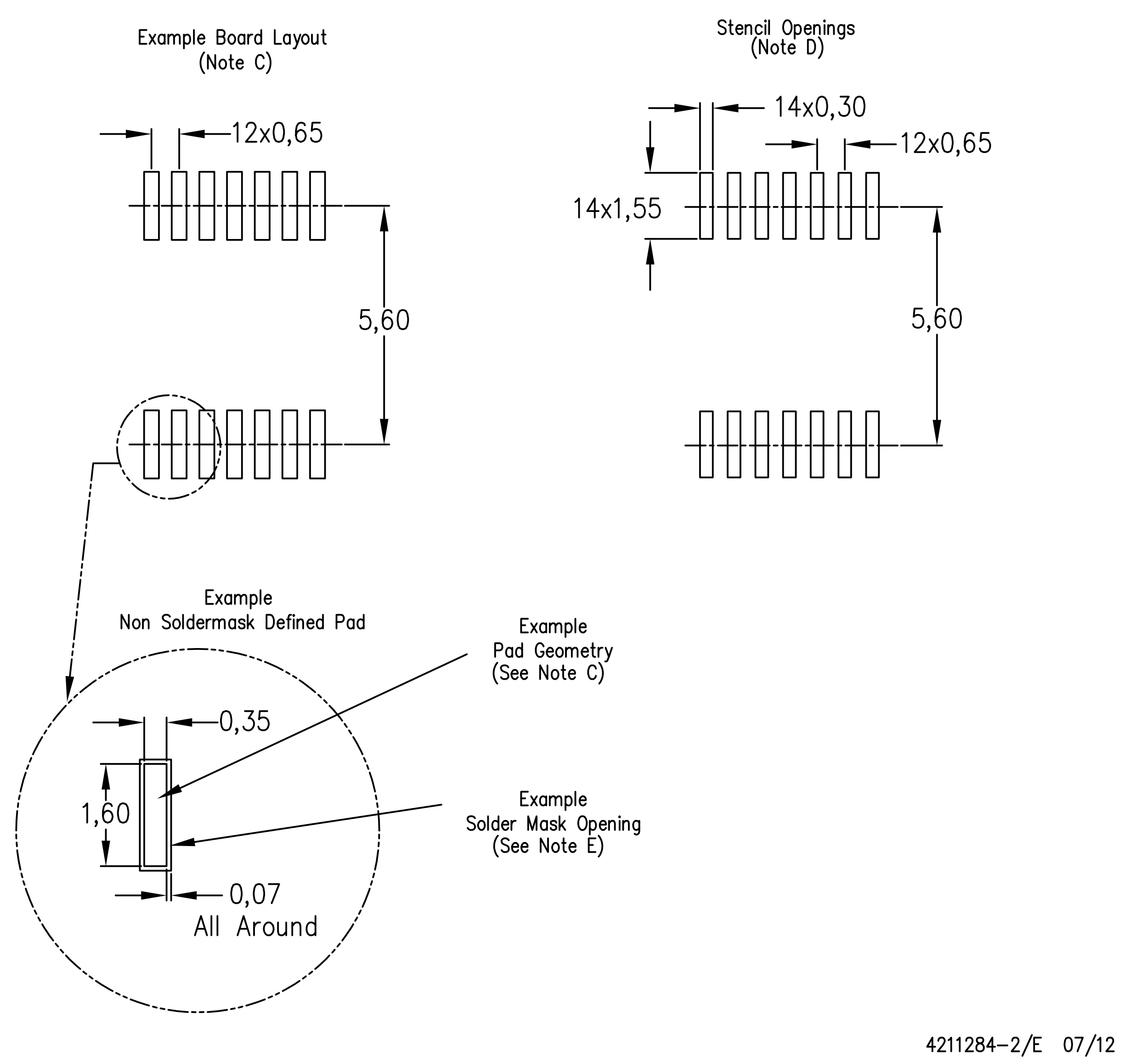
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should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

PW (R–PDSO–G14) PLASTIC SMALL OUTLINE



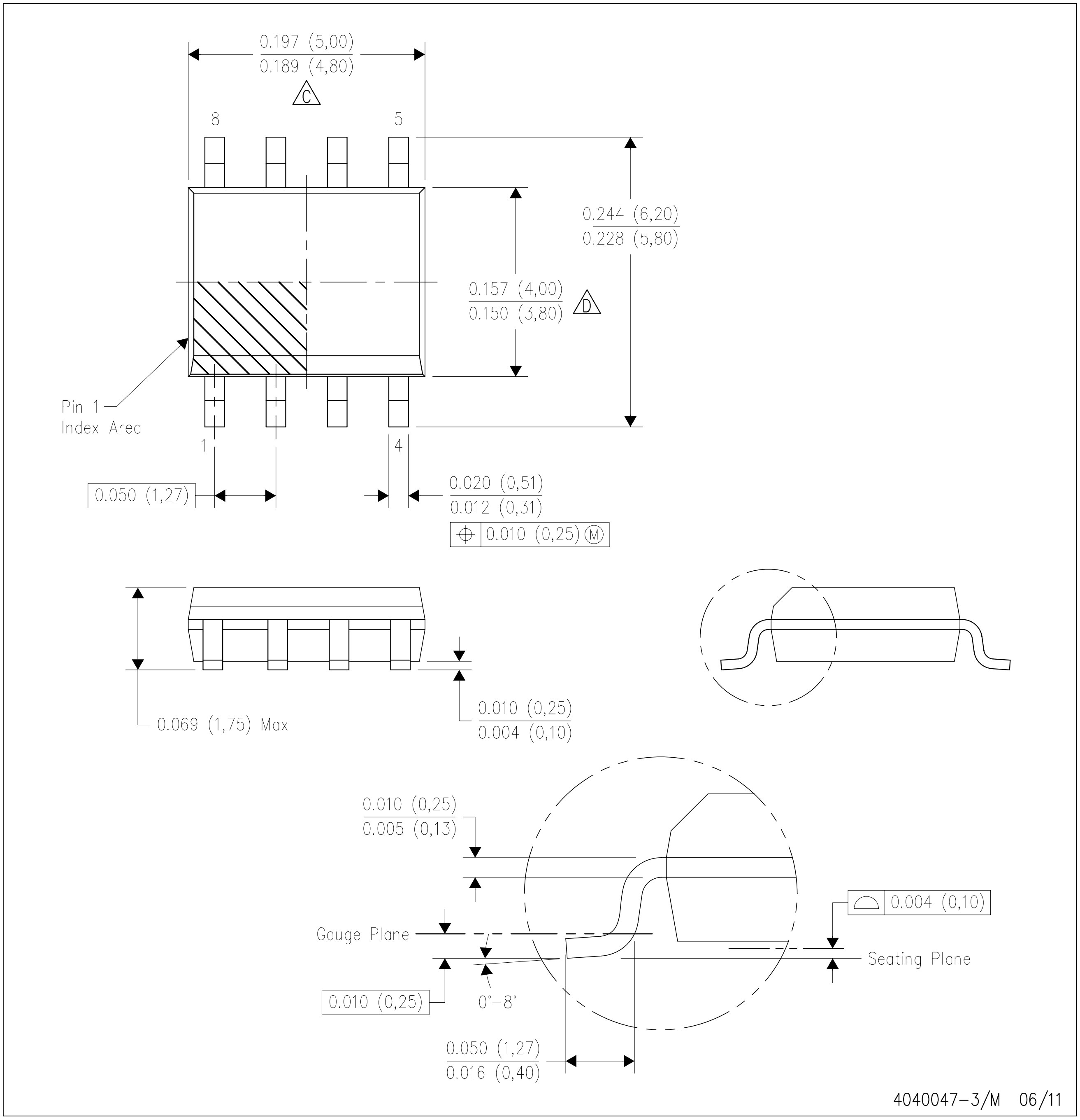
NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO–153

PW (R–PDSO–G14) PLASTIC SMALL OUTLINE



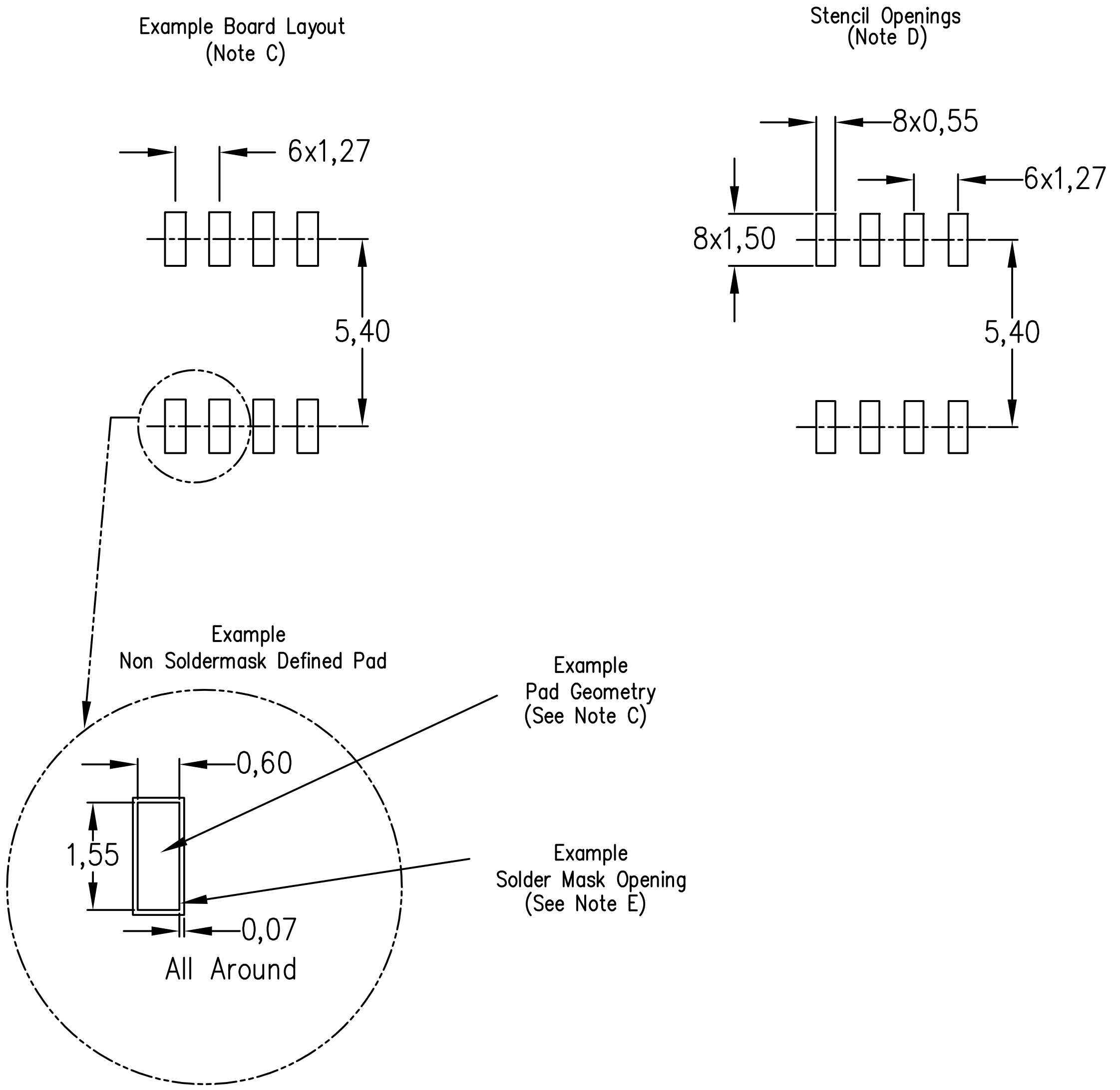
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC–7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should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

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C 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.
D Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

D (R-PDSO-G8) PLASTIC SMALL OUTLINE



4211283-2/E 08/12

NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. 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.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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