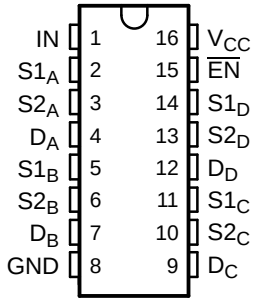
TS3V330
QUAD SPDT WIDE-BANDWIDTH VIDEO SWITCH WITH LOW ON-STATE RESISTANCE

SCDS162C – MAY 2004 – REVISED JULY 2005

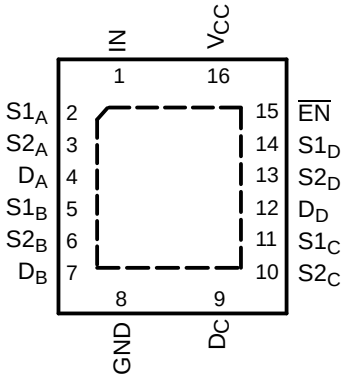
FEATURES

- **Low Differential Gain and Phase (D_G = 0.82%, D_P = 0.1 Degree Typ)**
- **Wide Bandwidth (BW = 300 MHz Min)**
- **Low Crosstalk (X_{TALK} = –80 dB Typ)**
- **Low Power Consumption (I_{CC} = 10 μA Max)**
- **Bidirectional Data Flow With Near-Zero Propagation Delay**
- **Low ON-State Resistance (r_{on} = 3 Ω Typ)**
- **Rail-to-Rail Switching on Data I/O Ports (0 to V_{CC})**
- **V_{CC} Operating Range From 3 V to 3.6 V**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Data and Control Inputs Provide Undershoot Clamp Diode**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Performance Tested Per JESD 22**
  - **2000-V Human-Body Model (A114-B, Class II)**
  - **1000-V Charged-Device Model (C101)**
- **Suitable for Both RGB and Composite-Video Switching**

D, DBQ, DGV, OR PW PACKAGE
(TOP VIEW)



RGY PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The TS3V330 video switch is a 4-bit 1-of-2 multiplexer/demultiplexer, with a single switch-enable ($\overline{EN}$) input. When $\overline{EN}$ is low, the switch is enabled and the D port is connected to the S port. When $\overline{EN}$ is high, the switch is disabled and the high-impedance state exists between the D and S ports. The select (IN) input controls the data path of the multiplexer/demultiplexer.

Low differential gain and phase make this switch ideal for composite and RGB video applications. This device has wide bandwidth and low crosstalk, making it suitable for high-frequency applications as well.

ORDERING INFORMATION

T_A	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	TS3V330RGYR	TF330
	SOIC – D	Tube	TS3V330D	TS3V330
		Tape and reel	TS3V330DR	
	SSOP (QSOP) – DBQ	Tape and reel	TS3V330DBQR	TF330
	TSSOP – PW	Tube	TS3V330PW	TF330
		Tape and reel	TS3V330PWR	
	TVSOP – DGV	Tape and reel	TS3V330DGVR	TF330

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

DESCRIPTION/ORDERING INFORMATION

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} feature ensures that damaging current will not backflow through the device when it is powered down. This switch maintains isolation during power off.

To ensure the high-impedance state during power up or power down, $\overline{EN}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

FUNCTION TABLE

INPUTS		INPUT/OUTPUT D	FUNCTION
$\overline{EN}$	IN		
L	L	S1	D port = S1 port
L	H	S2	D port = S2 port
H	X	Z	Disconnect

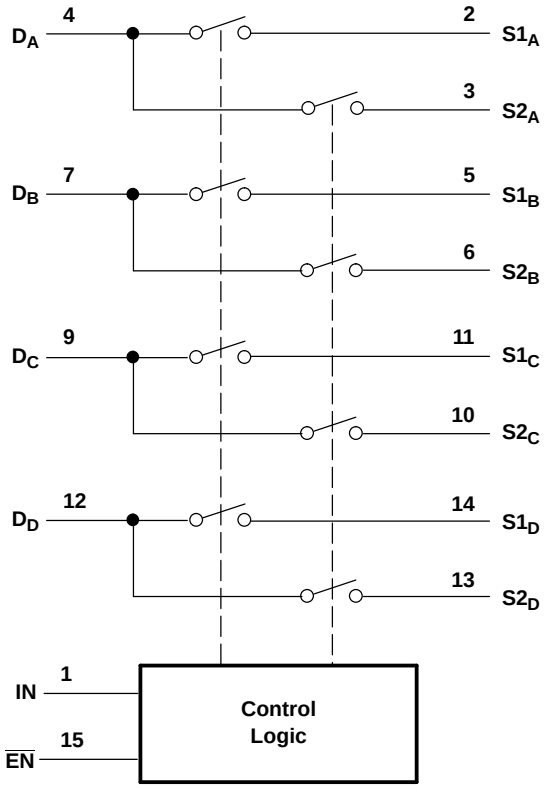
PIN DESCRIPTION

NAME	DESCRIPTION
S1, S2	Analog video I/Os
D	Analog video I/Os
IN	Select input
$\overline{EN}$	Switch-enable input

PARAMETER DEFINITIONS

PARAMETER	DESCRIPTION
R_{on}	Resistance between the D and S ports, with the switch in the ON state
I_{OZ}	Output leakage current measured at the D and S ports, with the switch in the OFF state
I_{OS}	Short-circuit current measured at the I/O pins
V_{IN}	Voltage at IN
V_{EN}	Voltage at $\overline{EN}$
C_{IN}	Capacitance at the control ($\overline{EN}$, IN) inputs
C_{OFF}	Capacitance at the analog I/O port when the switch is OFF
C_{ON}	Capacitance at the analog I/O port when the switch is ON
V_{IH}	Minimum input voltage for logic high for the control ($\overline{EN}$, IN) inputs
V_{IL}	Minimum input voltage for logic low for the control ($\overline{EN}$, IN) inputs
V_H	Hysteresis voltage at the control ($\overline{EN}$, IN) inputs
V_{IK}	I/O and control ($\overline{EN}$, IN) inputs diode clamp voltage
V_I	Voltage applied to the D or S pins when D or S is the switch input
V_O	Voltage applied to the D or S pins when D or S is the switch output
I_{IH}	Input high leakage current of the control ($\overline{EN}$, IN) inputs
I_{IL}	Input low leakage current of the control ($\overline{EN}$, IN) inputs
I_I	Current into the D or S pins when D or S is the switch input
I_O	Current into the D or S pins when D or S is the switch output
I_{off}	Output leakage current measured at the D or S ports, with $V_{CC} = 0$
t_{ON}	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned ON
t_{OFF}	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned OFF
BW	Frequency response of the switch in the ON state measured at –3 dB
X_{TALK}	Unwanted signal coupled from channel to channel. Measured in –dB. $X_{TALK} = 20 \log V_O/V_I$. This is a nonadjacent crosstalk.
O_{IRR}	Off isolation is the resistance (measured in –dB) between the input and output with the switch OFF.
D_G	Magnitude variation between analog input and output pins when the switch is ON and the dc offset of composite-video signal varies at the analog input pin. In the NTSC standard, the frequency of the video signal is 3.58 MHz, and dc offset is from 0 to 0.714 V.
D_P	Phase variation between analog input and output pins when the switch is ON and the dc offset of composite-video signal varies at the analog input pin. In the NTSC standard, the frequency of the video signal is 3.58 MHz, and dc offset is from 0 to 0.714 V.
I_{CC}	Static power-supply current
I_{CCD}	Variation of I_{CC} for a change in frequency in the control ($\overline{EN}$, IN) inputs
ΔI_{CC}	This is the increase in supply current for each control input that is at the specified voltage level, rather than V_{CC} or GND.

FUNCTIONAL DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		–0.5	4.6	V
V_{IN}	Control input voltage range(2)(3)		–0.5	4.6	V
$V_{I/O}$	Switch I/O voltage range(2)(3)(4)		–0.5	4.6	V
I_{IK}	Control input clamp current	V_{IN} < 0		–50	mA
$I_{I/OK}$	I/O port clamp current	$V_{I/O}$ < 0		–50	mA
$I_{I/O}$	ON-state switch current(5)			±128	mA
	Continuous current through V_{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance	D package(6)		73	C/W
		DBQ package(6)		90	
		DGV package		120	
		PW package(6)		108	
		RGY package(7)		39	
T_{stg}	Storage temperature range		–65	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 voltages are with respect to ground, unless otherwise specified.
(3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(4) V_I and V_O are used to denote specific conditions for $V_{I/O}$.
(5) I_I and I_O are used to denote specific conditions for $I_{I/O}$.
(6) The package thermal impedance is calculated in accordance with JESD 51-7.
(7) The package thermal impedance is calculated in accordance with JESD 51-5.

Recommended Operating Conditions(1)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	3	3.6	V
V_{IH}	High-level control input voltage (EN, IN)	2	V_{CC}	V
V_{IL}	Low-level control input voltage (EN, IN)	0	0.8	V
V_{ANALOG}	Analog I/O voltage	0	V_{CC}	V
T_A	Operating free-air temperature	–40	85	°C

(1) All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Electrical Characteristics

over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS(1)				MIN	TYP(2)	MAX	UNIT
V_{IK}	$\overline{EN}$, IN	V_{CC} = 3 V,	I_{IN} = –18 mA					–1.8	V
V_{hys}	$\overline{EN}$, IN						150		mV
I_{IH}	$\overline{EN}$, IN	V_{CC} = 3.6 V,	V_{IN} and V_{EN} = V_{CC}					±1	µA
I_{IL}	$\overline{EN}$, IN	V_{CC} = 3.6 V,	V_{IN} and V_{EN} = GND					±1	µA
I_{OZ}(3)		V_{CC} = 3.6 V,	V_O = 0 to 3.6 V,	V_I = 0,	Switch OFF			±1	µA
I_{OS}(4)		V_{CC} = 3.6 V,	V_O = 0.5 V_{CC},	V_I = 0,	Switch ON	50			mA
I_{off}		V_{CC} = 0 V,	V_O = 0 to 3.6 V,	V_I = 0				15	µA
I_{CC}		V_{CC} = 3.6 V,	$I_{I/O}$ = 0,	Switch ON or OFF				10	µA
ΔI_{CC}	$\overline{EN}$, IN	V_{CC} = 3.6 V,	One input at 3.4 V,	Other inputs at V_{CC} or GND				750	µA
I_{CCD}		V_{CC} = 3.6 V, V_{IN} input switching 50% duty cycle	V_{EN} = GND	D and S ports open,				0.45	mA/ MHz
C_{IN}	$\overline{EN}$, IN	V_{IN} of V_{EN} = 0,	f = 1 MHz				3.5		pF
C_{OFF}	D port	V_I = 0,	f = 1 MHz,	Outputs open,	Switch OFF		10		pF
	S port						5		
C_{ON}		V_I = 0,	f = 1 MHz,	Outputs open,	Switch ON		17		pF
r_{on}(5)		V_{CC} = 3 V	V_I = 1 V,	I_O = 13 mA,	R_L = 75 Ω		5	7	Ω
			V_I = 2 V,	I_O = 26 mA,	R_L = 75 Ω		7	10	

(1) V_I, V_O, I_I, and I_O refer to I/O pins.
(2) All typical values are at V_{CC} = 5 V (unless otherwise noted), T_A = 25°C.
(3) For I/O ports, I_{OZ} includes the input leakage current.
(4) The I_{OS} test is applicable to only one ON channel at a time. The duration of this test is less than one second.
(5) Measured by the voltage drop between the D and S terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (D or S) terminals.

Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V, R_L = 75 Ω, C_L = 20 pF (unless otherwise noted) (see Figure 5)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP	MAX	UNIT
t_{ON}	S	D		2.5	6.5	ns
t_{OFF}	S	D		1.1	3.5	ns

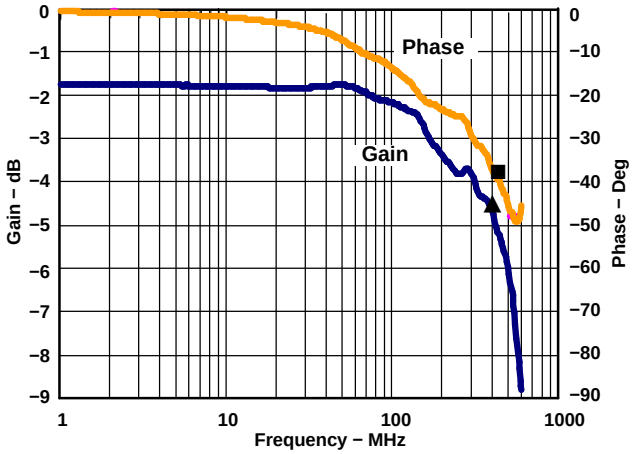
Dynamic Characteristics

over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted)

PARAMETER	TEST CONDITIONS			TYP(1)	UNIT
D_G(2)	R_L = 150 Ω,	f = 3.58 MHz,	See Figure 6	0.82	%
D_P(2)	R_L = 150 Ω,	f = 3.58 MHz,	See Figure 6	0.1	Deg
BW	R_L = 150 Ω,	See Figure 7		300	MHz
X_{TALK}	R_L = 150 Ω,	f = 10 MHz,	RIN = 10 Ω, See Figure 8	–80	dB
O_{IRR}	R_L = 150 Ω,	f = 10 MHz,	See Figure 9	–50	dB

(1) All typical values are at V_{CC} = 5 V (unless otherwise noted), T_A = 25°C.
(2) D_G and D_P are expressed in absolute magnitude.

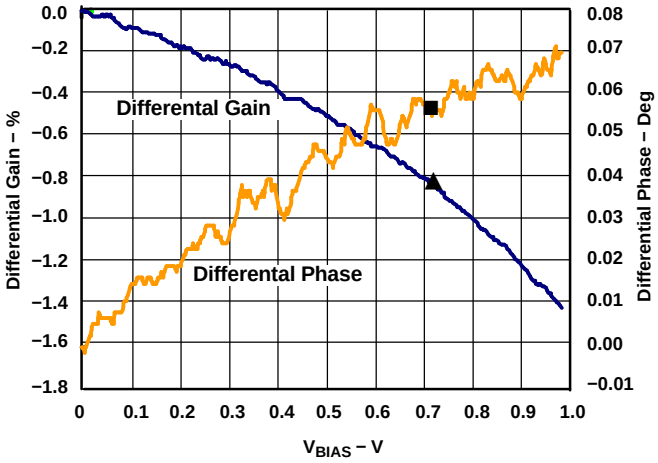
TYPICAL CHARACTERISTICS



▲ Gain 3 dB at 400 MHz

■ Phase at 3-dB Frequency, −38.28 Degrees

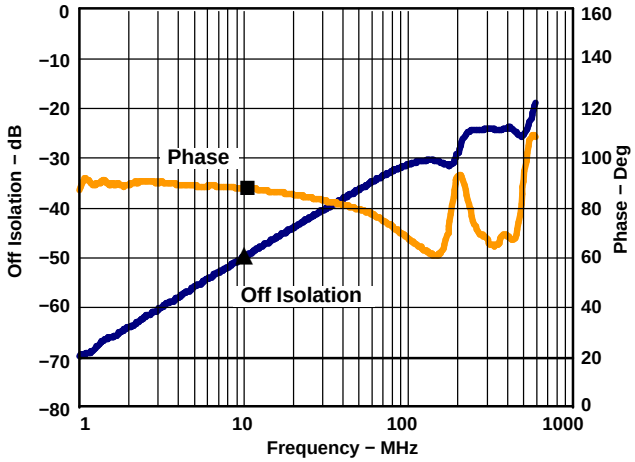
Figure 1. Gain/Phase vs Frequency



▲ Differential Gain at 0.714 V, −0.81%

■ Differential Phase at 0.714 V, 0.06 Degree

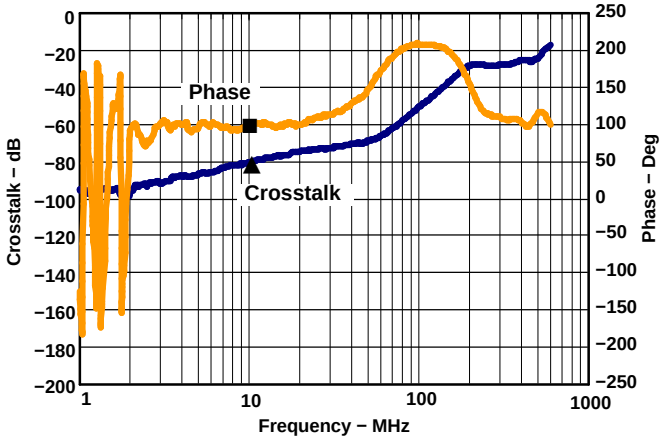
Figure 2. Differential Gain/Phase vs V_{BIAS}



▲ Off Isolation at 10 Mhz, −50.08 dB

■ Phase at 10 MHz, 87.8 Degrees

Figure 3. Off Isolation vs Frequency

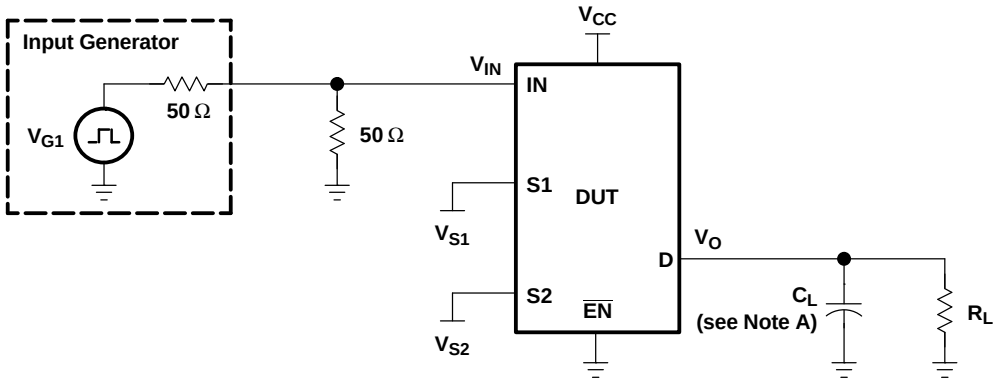


▲ Crosstalk at 10 MHz, −80 dB

■ Phase at 10 MHz, 100.62 Degrees

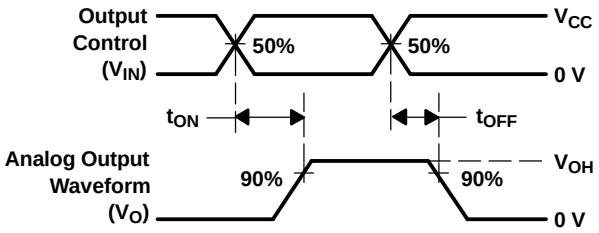
Figure 4. Crosstalk vs Frequency

PARAMETER MEASUREMENT INFORMATION



TEST	V_{CC}	R_L	C_L	V_{S1}	V_{S2}
t_{ON}	3.3 V ± 0.3 V	75	20	GND	V_{CC}
	3.3 V ± 0.3 V	75	20	V_{CC}	GND
t_{OFF}	3.3 V ± 0.3 V	75	20	GND	V_{CC}
	3.3 V ± 0.3 V	75	20	V_{CC}	GND

TEST CIRCUIT

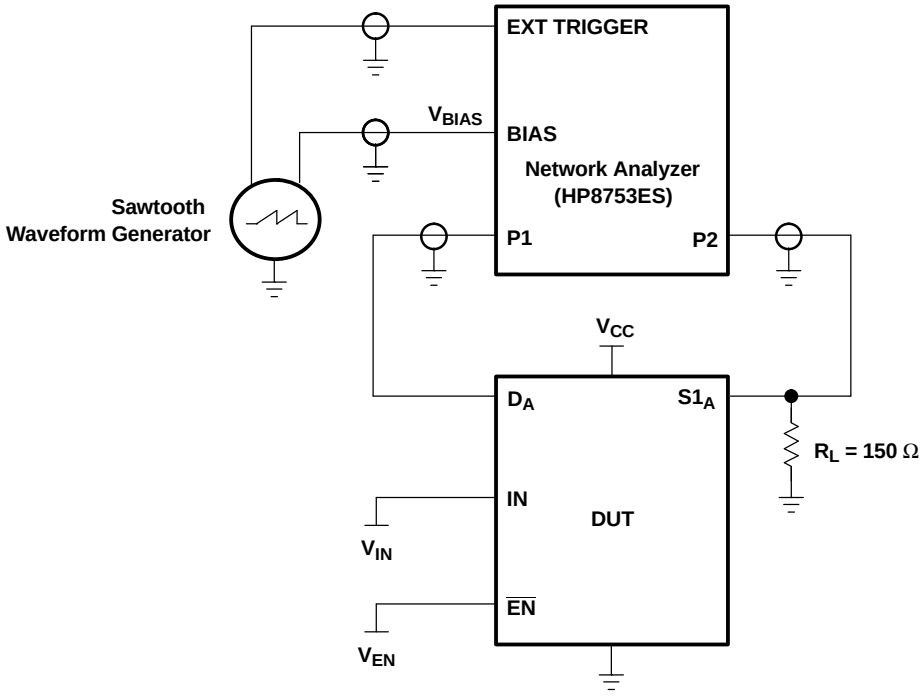


VOLTAGE WAVEFORMS
t_{ON} AND t_{OFF} TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
C. The outputs are measured one at a time, with one transition per measurement.

Figure 5. Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



NOTE: For additional information on measurement method, refer to the TI application report, *Measuring Differential Gain and Phase*, literature number SLOA040.

Figure 6. Test Circuit for Differential Gain/Phase Measurement

Differential gain and phase are measured at the output of the ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at $S1_A$.

HP8753ES Setup

Average = 20
RBW = 300 Hz
ST = 1.381 s
P1 = -7 dBM
CW frequency = 3.58 MHz

Sawtooth Waveform Generator Setup

V_{BIAS} = 0 to 1 V
Frequency = 0.905 Hz

PARAMETER MEASUREMENT INFORMATION

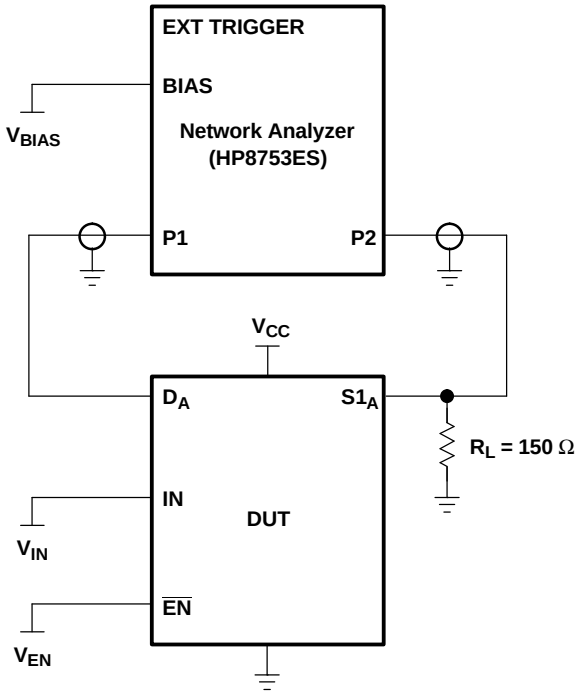


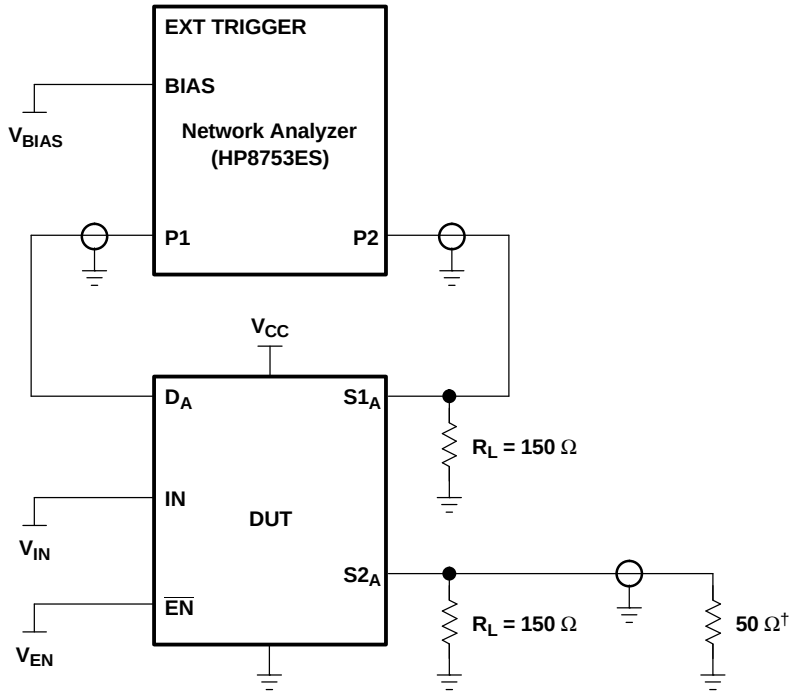
Figure 7. Test Circuit for Frequency Response (BW)

Frequency response is measured at the output of the ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at $S1_A$. All unused analog I/O ports are left open.

HP8753ES Setup

Average = 4
RBW = 3 kHz
V_{BIAS} = 0.35 V
ST = 2 s
P1 = 0 dBM

PARAMETER MEASUREMENT INFORMATION



† A 50-Ω termination resistor is needed for the Network Analyzer.

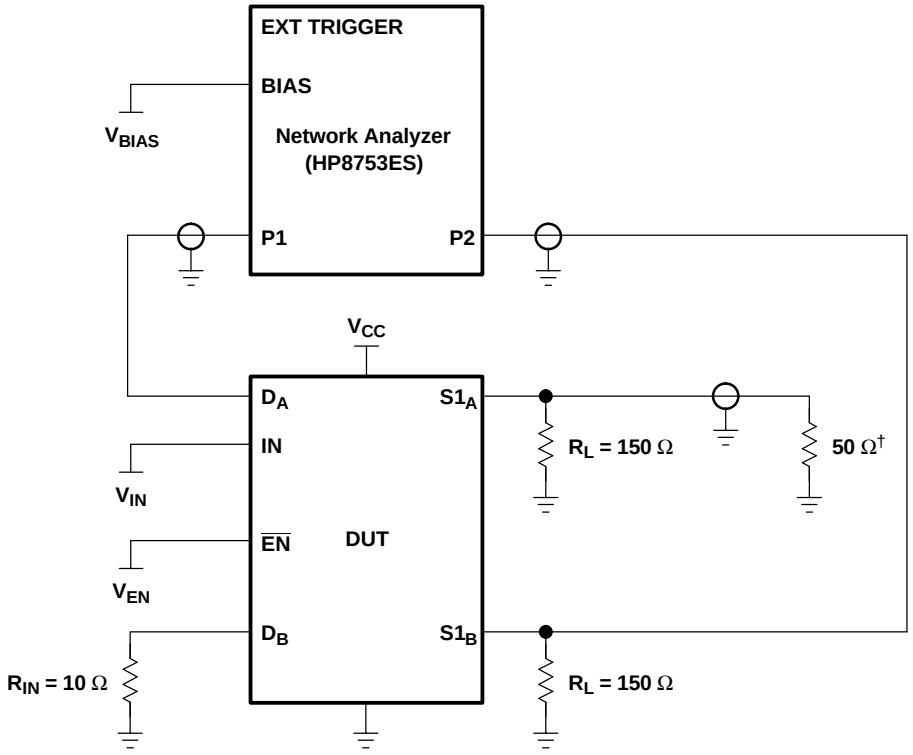
Figure 8. Test Circuit for Crosstalk (X_{TALK})

Crosstalk is measured at the output of the nonadjacent ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at $S1_B$. All unused analog input (D) ports and output (S) ports are connected to GND through 10-Ω and 50-Ω pulldown resistors, respectively.

HP8753ES Setup

Average = 4
RBW = 3 kHz
V_{BIAS} = 0.35 V
ST = 2 s
P1 = 0 dBM

PARAMETER MEASUREMENT INFORMATION



† A 50-Ω termination resistor is needed for the network analyzer.

Figure 9. Test Circuit for Off Isolation (O_{IRR})

Off isolation is measured at the output of the OFF channel. For example, when $V_{IN} = V_{CC}$, $V_{EN} = 0$, and D_A is the input, the output is measured at $S1_A$. All unused analog input (D) ports are left open, and output (S) ports are connected to GND through 50-Ω pulldown resistors.

HP8753ES Setup

Average = 4
RBW = 3 kHz
V_{BIAS} = 0.35 V
ST = 2 s
P1 = 0 dBM

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TS3V330D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DBQR	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TS3V330DBQRE4	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TS3V330DBQRG4	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TS3V330DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DGVRG4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3V330RGYR	ACTIVE	VQFN	RGY	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TS3V330RGYRG4	ACTIVE	VQFN	RGY	16	3000	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.

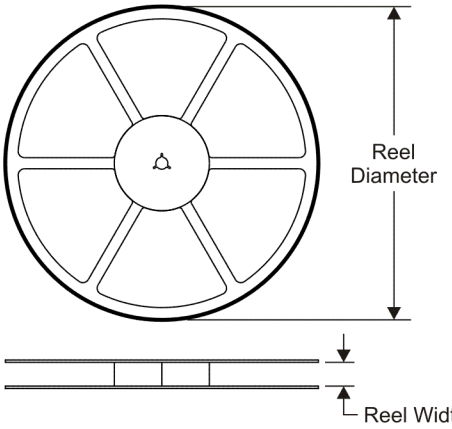
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

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)

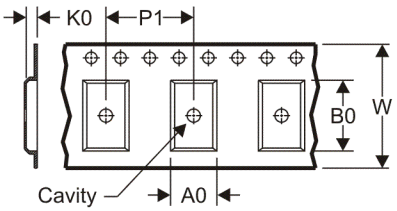
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

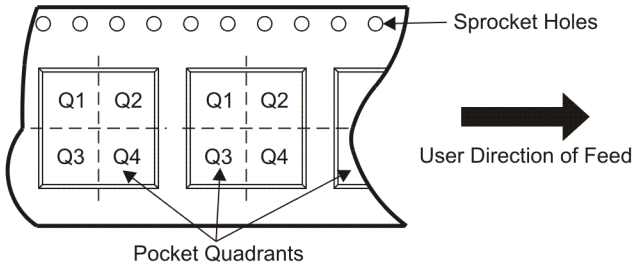


TAPE DIMENSIONS



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

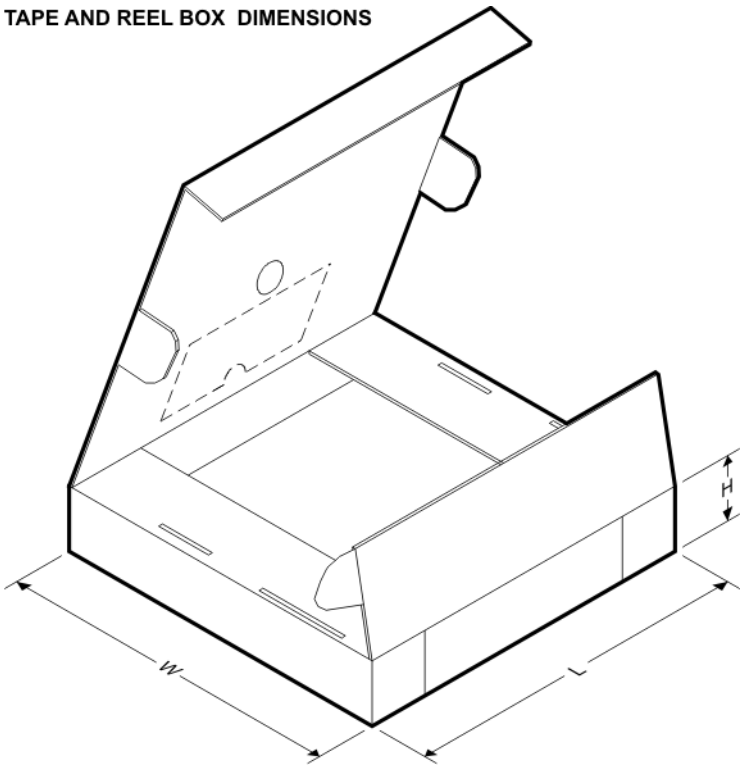
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TS3V330DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
TS3V330DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
TS3V330PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TS3V330RGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

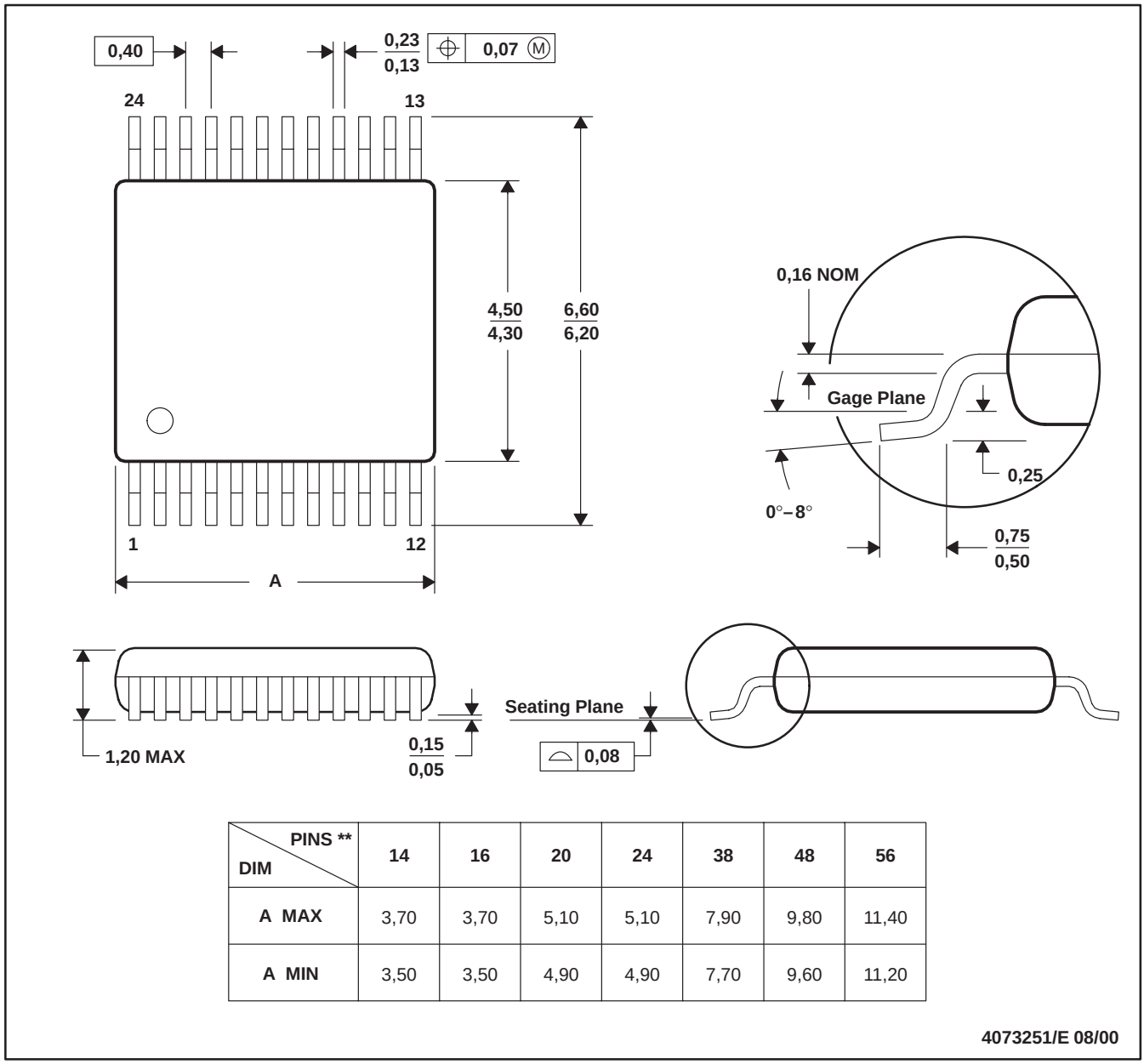


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3V330DGVR	TVSOP	DGV	16	2000	346.0	346.0	29.0
TS3V330DR	SOIC	D	16	2500	333.2	345.9	28.6
TS3V330PWR	TSSOP	PW	16	2000	346.0	346.0	29.0
TS3V330RGYR	VQFN	RGY	16	3000	346.0	346.0	29.0

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN



DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

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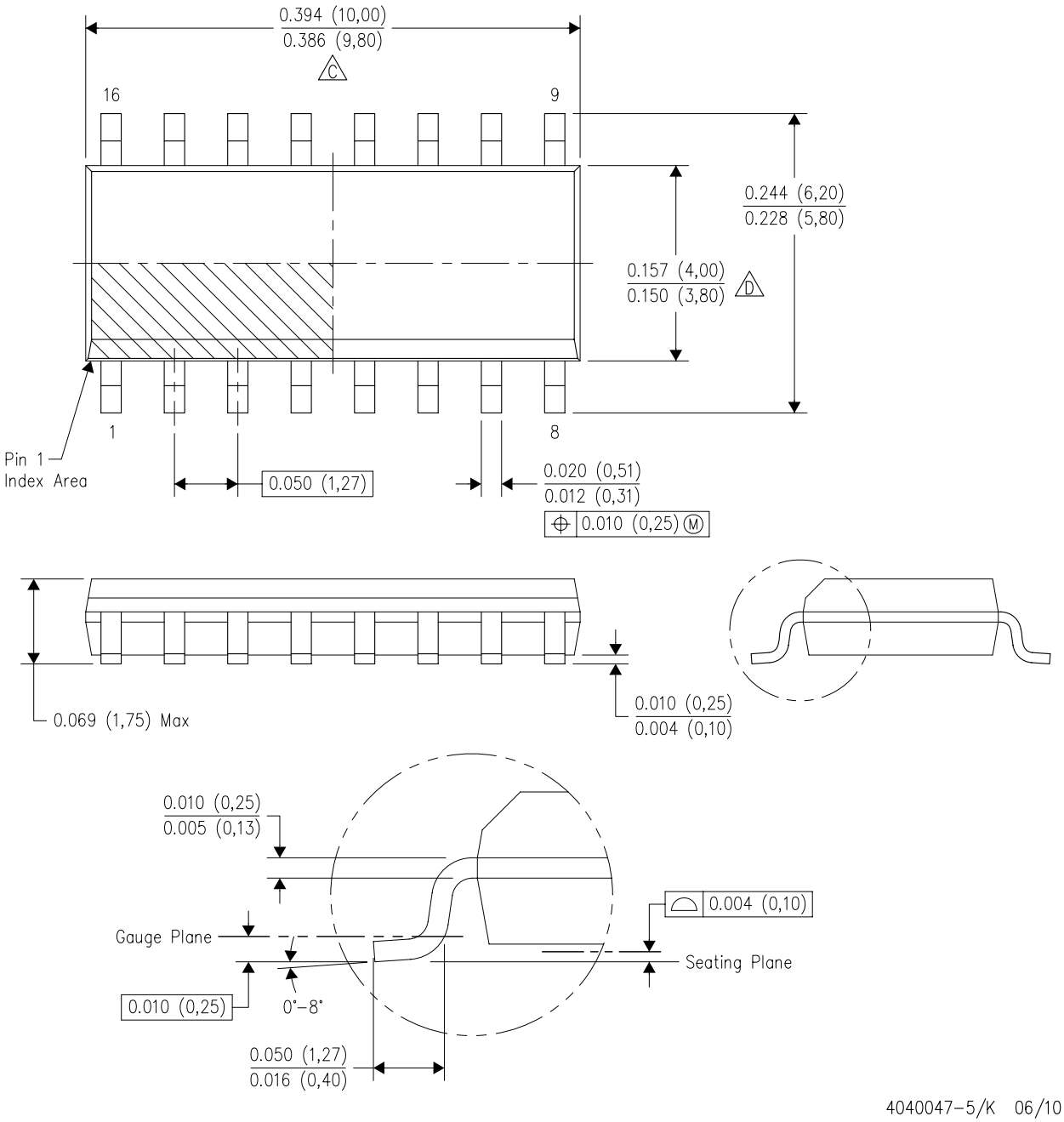
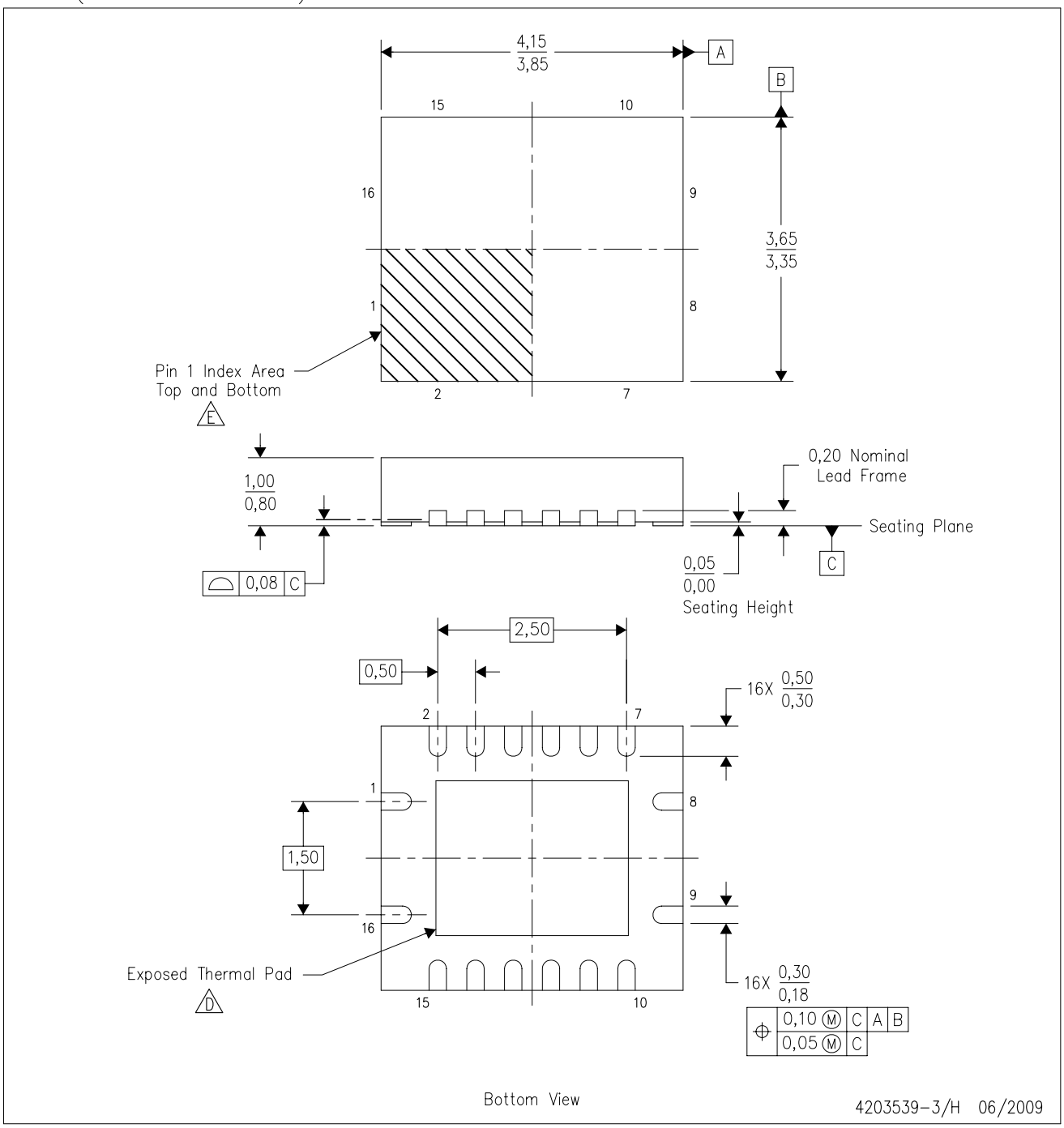
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

D (R–PDSO–G16) PLASTIC SMALL–OUTLINE PACKAGE



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 .006 (0,15) per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
E. Reference JEDEC MS–012 variation AC.

RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



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. QFN (Quad Flatpack No–Lead) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad dimensions.
E. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
F. Package complies to JEDEC MO–241 variation BB.

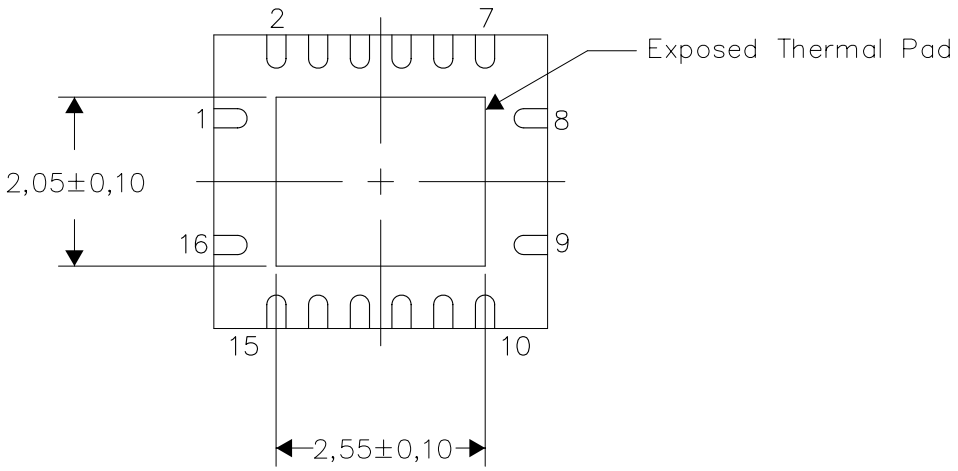
RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No–Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.

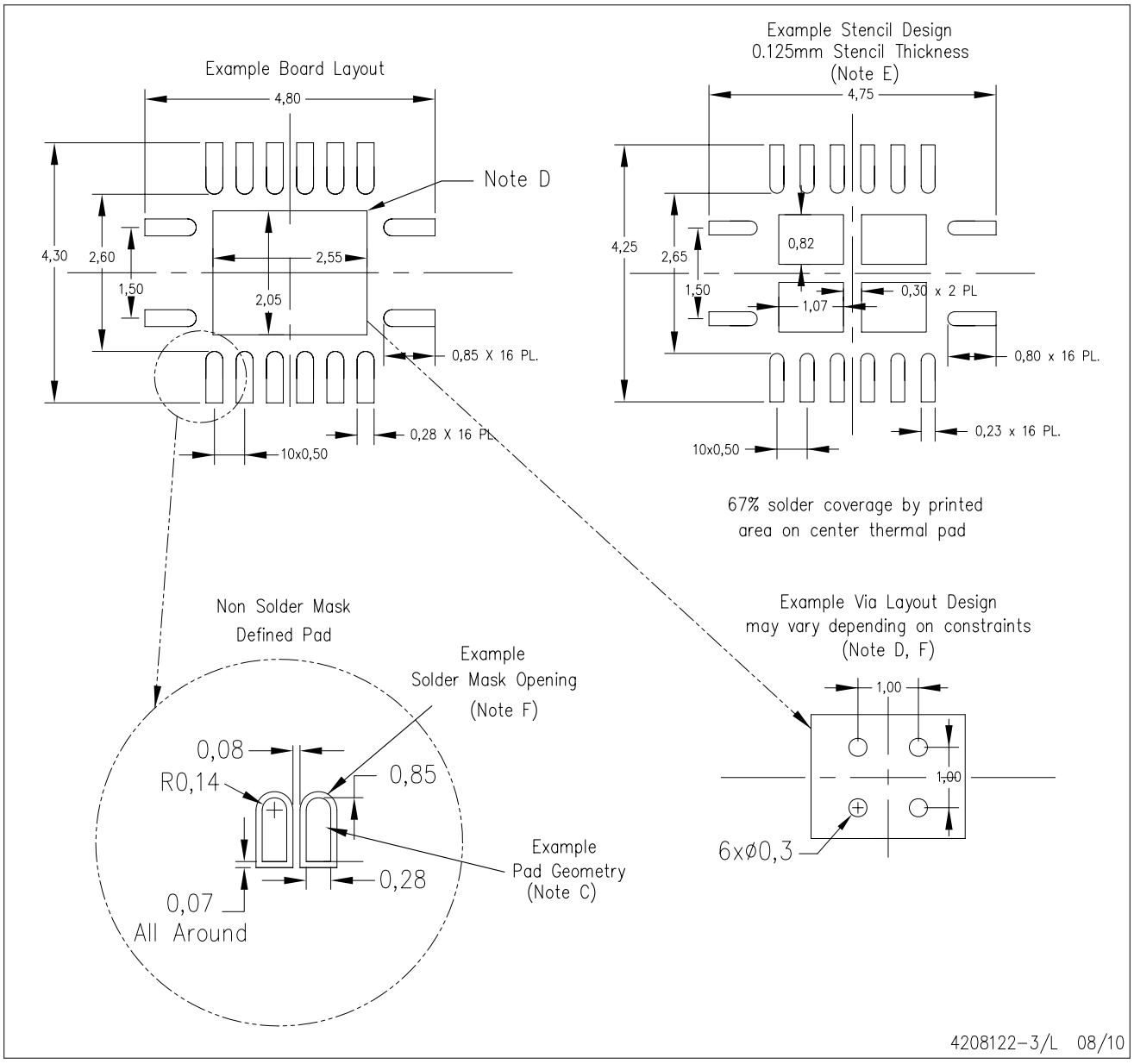


Bottom View

NOTE: All linear dimensions are in millimeters

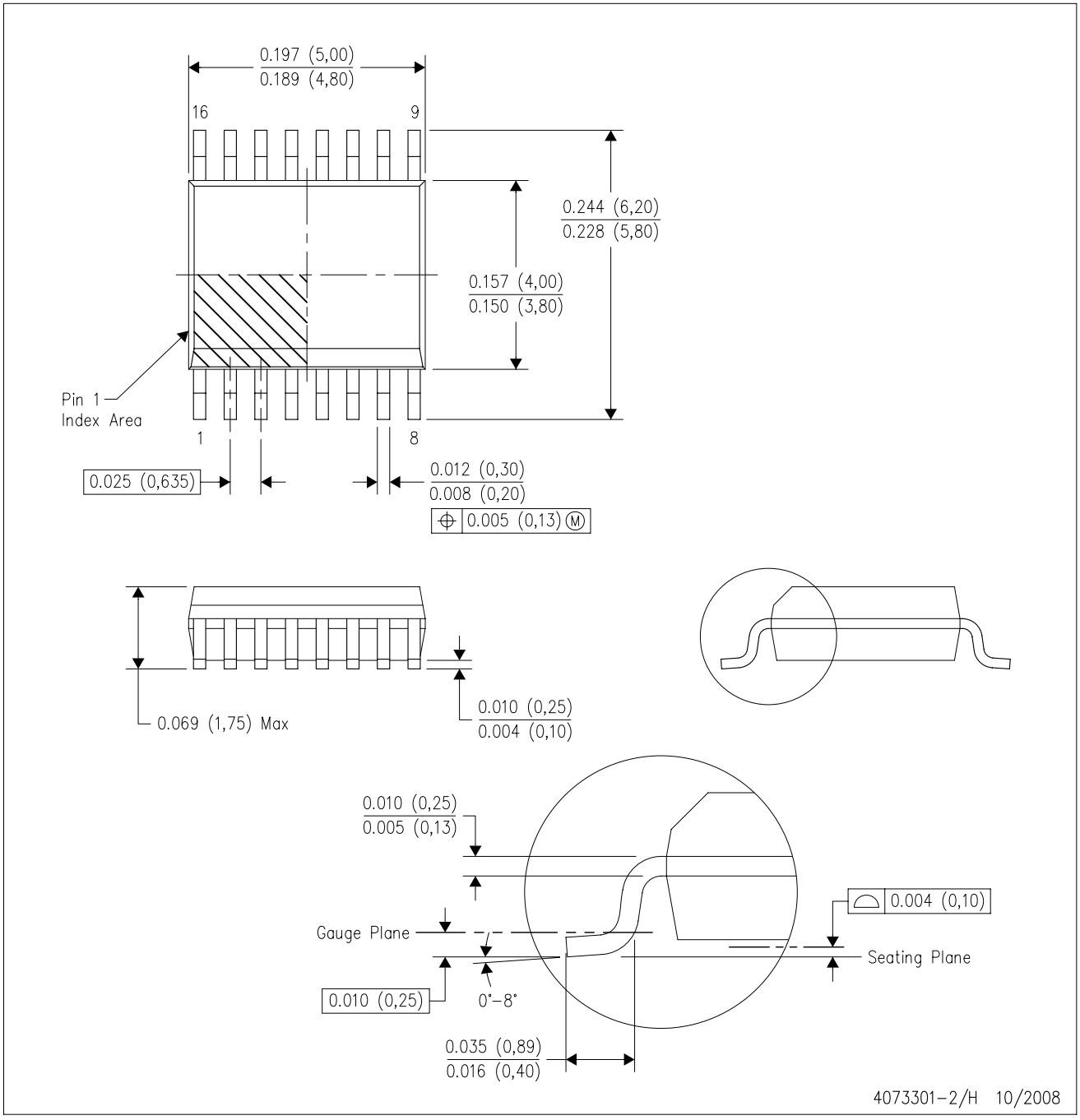
Exposed Thermal Pad Dimensions

RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



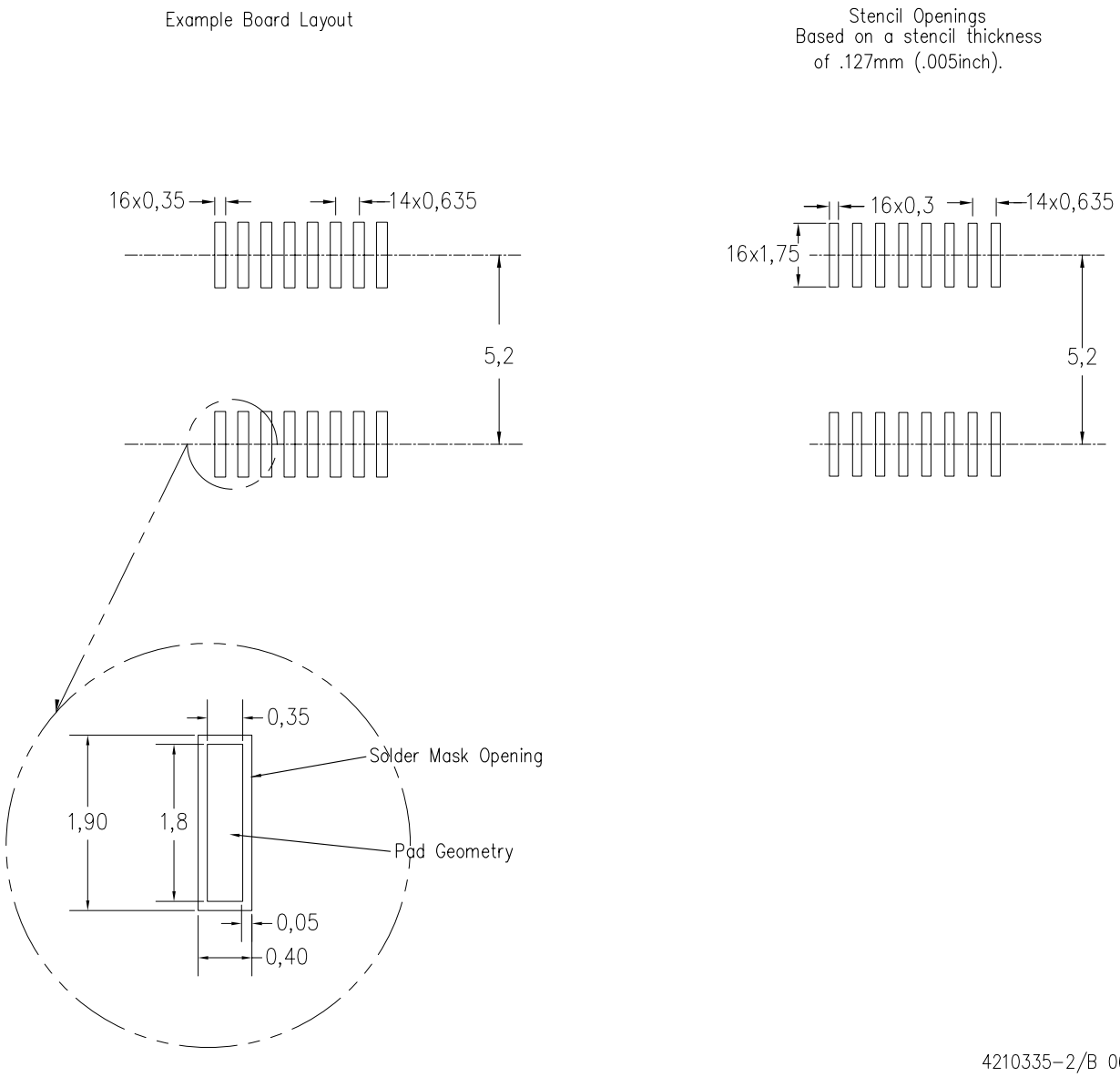
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat–Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http://www.ti.com>.
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. Refer to IPC 7525 for stencil design considerations.
F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

DBQ (R–PDSO–G16) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
D. Falls within JEDEC MO–137 variation AB.

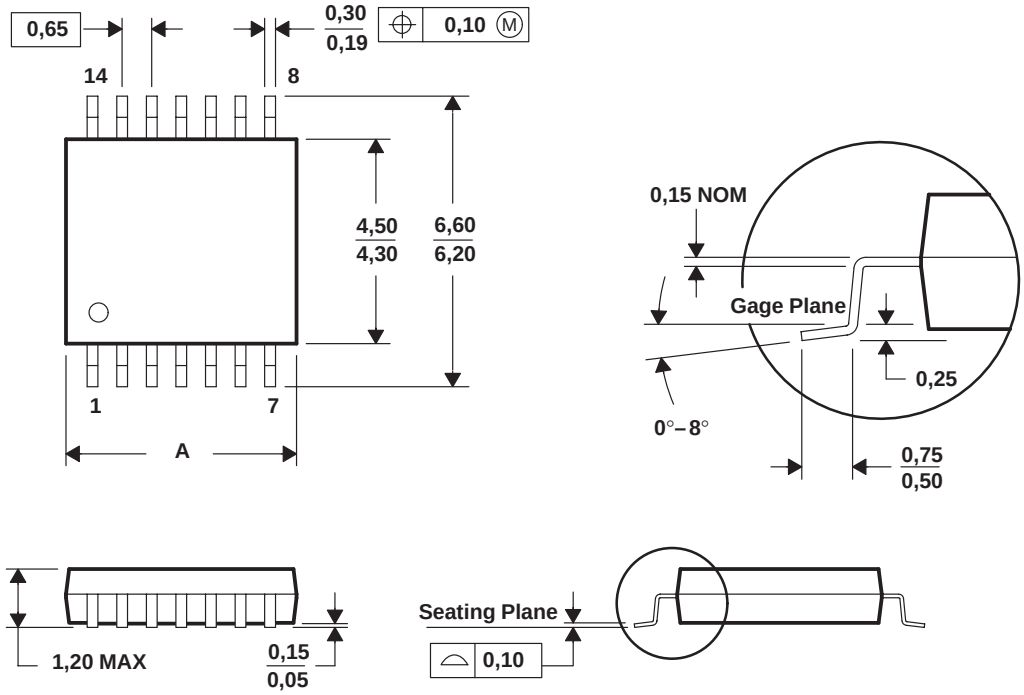
DBQ (R–PDSO–G16) PLASTIC SMALL OUTLINE PACKAGE



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.

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

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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 not to exceed 0,15.
D. Falls within JEDEC MO-153

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