0.45-Ω QUAD SPDT ANALOG SWITCH
QUAD-CHANNEL 2:1 MULTIPLEXER/DEMULTIPLEXER WITH TWO CONTROLS

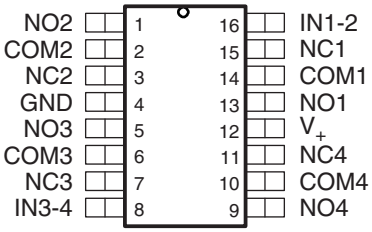
FEATURES

- Specified Break-Before-Make Switching
- Low ON-State Resistance (<0.5 Ω)
- Control Inputs Are 1.8-V Logic Compatible
- Low Charge Injection
- Excellent ON-State Resistance Matching
- Low Total Harmonic Distortion (THD)
- 1.65-V to 4.3-V Single-Supply Operation
- 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)

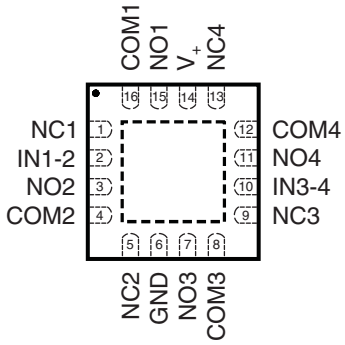
APPLICATIONS

- Cell Phones
- PDAs
- Portable Instrumentation
- Audio and Video Signal Routing
- Low-Voltage Data-Acquisition Systems
- Communication Circuits
- Modems
- Hard Drives
- Computer Peripherals
- Wireless Terminals and Peripherals

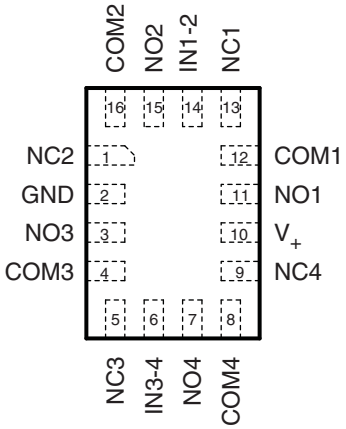
PW PACKAGE
(TOP VIEW)



RGT PACKAGE
(TOP VIEW)



RSV PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The TS3A44159 is a quad single-pole double-throw (SPDT) analog switch with two control inputs, which is designed to operate from 1.65 V to 4.3 V. This device is also known as a dual double-pole double-throw (DPDT) configuration. It offers low ON-state resistance and excellent ON-state resistance matching with the break-before-make feature, to prevent signal distortion during the transferring of a signal from one channel to another. The device has an excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications

ORDERING INFORMATION

T_A	PACKAGE(1)(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	RGT – QFN	Tape and reel	TS3A44159RGTR	ZWH
	RSV – QFN	Tape and reel	TS3A44159RSVR	ZWH
	PW – TSSOP	Tape and reel	TS3A44159PWR	YC4159

(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(2) 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.

SUMMARY OF CHARACTERISTICS(1)

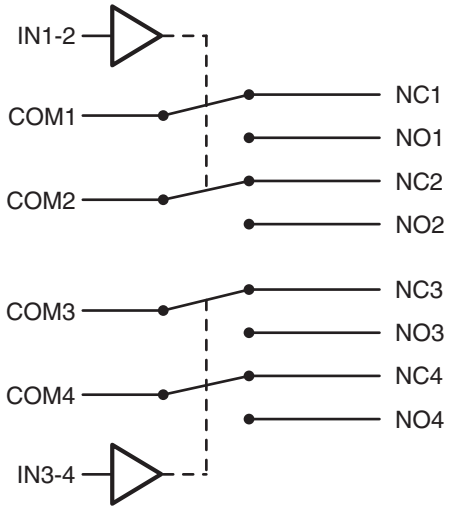
Configuration	Quad 2:1 Multiplexer/Demultiplexer (4 × SPDT or 2 × DPDT)
Number of channels	4
ON-state resistance (r_{on})	0.45 Ω (max)
ON-state resistance match (Δr_{on})	0.07 Ω (max)
ON-state resistance flatness ($r_{ON(flat)}$)	0.1 Ω (max)
Turn-on/turn-off time (t_{ON}/t_{OFF})	23 ns/32 ns
Break-before-make time (t_{BBM})	30 ns
Charge injection (Q_C)	139 pC
Bandwidth (BW)	35 MHz
OFF isolation (O_{ISO})	–71 dB
Crosstalk (X_{TALK})	–73 dB
Total harmonic distortion (THD)	0.003%
Power-supply current (I_+)	0.4 µA
Package option	16-pin QFN

(1) V_+ = 4.3 V, T_A = 25°C

FUNCTION TABLE

IN	NC TO COM, COM TO NC	NO TO COM, COM TO NO
L	ON	OFF
H	OFF	ON

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS(1)(2)

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

			MIN	MAX	UNIT
V_+	Supply voltage range(3)		–0.5	4.6	V
V_{NC} V_{NO} V_{COM}	Analog voltage range(3)(4)(5)		–0.5	V_+ + 0.5	V
I_K	Analog port diode current	V_{NC}, V_{NO}, V_{COM} < 0	–50		mA
I_{NC} I_{NO} I_{COM}	ON-state switch current	V_{NC}, V_{NO}, V_{COM} = 0 to V_+	–200	200	mA
	ON-state peak switch current(6)		–400	400	
V_I	Digital input voltage range		–0.5	4.6	V
I_{IK}	Digital input clamp current(3)(4)	V_I < 0	–50		mA
I_+	Continuous current through V_+			100	mA
I_{GND}	Continuous current through GND		–100		mA
θ_{JA}	Package thermal impedance(7)	PW package		108	°C/W
		RGT package		TBD	
		RSV package		TBD	
T_{stg}	Storage temperature range		–65	150	°C

(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) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum
(3) All voltages are with respect to ground, unless otherwise specified.
(4) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(5) This value is limited to 4.6 V maximum.
(6) Pulse at 1-ms duration <10% duty cycle
(7) The package thermal impedance is calculated in accordance with JESD 51-7.

ELECTRICAL CHARACTERISTICS FOR 4.3-V SUPPLY(1)

T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 2.5 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	4.3 V		0.3	0.45	Ω
				Full				0.5	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 2.5 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	4.3 V		0.05	0.07	Ω
				Full				0.1	
ON-state resistance flatness	$r_{on(flat)}$	V_{NO} or V_{NC} = 1 V, 1.5 V, 2.5 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	4.3 V		0.02	0.1	Ω
				Full				0.1	
NC, NO OFF leakage current	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = 3.0 V, or V_{NO} or V_{NC} = 3.0 V, V_{COM} = 0.3 V,	See Figure 17	25°C	4.3 V	–20	5	20	nA
				Full		–90		90	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = Open, or V_{NO} or V_{NC} = 3.0 V, V_{COM} = Open,	See Figure 18	25°C	4.3 V	–20	5	20	nA
				Full		–90		90	
COM ON leakage current	$I_{COM(ON)}$	V_{NO} or V_{NC} = Open, V_{COM} = 0.3 V, or V_{NO} or V_{NC} = Open, V_{COM} = 3.0 V,	See Figure 18	25°C	4.3 V	–20	5	20	nA
				Full		–90		90	
Digital Control Inputs (IN1-2, IN3-4)(2)									
Input logic high	V_{IH}			Full	4.3 V	1.5		4.3	V
Input logic low	V_{IL}			Full	4.3 V	0		1	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 3.6 V or 0		25°C	4.3 V		0.5	10	nA
				Full				50	

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

(2) All unused digital inputs of the device must be held at V_+ 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 FOR 4.3-V SUPPLY (continued)

T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	4.3 V		17	23	ns
				Full				25	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	4.3 V		12	32	ns
				Full				35	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	4.3 V	2	9	30	ns
				Full		1		35	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 1 nF	25°C	4.3 V		139		pC
NC, NO off capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	4.3 V		50		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	4.3 V		160		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 19	25°C	4.3 V		160		pF
Digital input capacitance	C_I	V_I = V_+ or GND		25°C	4.3 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON	25°C	4.3 V		35		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 100 kHz,	Switch OFF	25°C	4.3 V		–71		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 100 kHz,	Switch ON	25°C	4.3 V		–73		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz	25°C	4.3 V		0.003		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	4.3 V		0.15	0.4	µA
				Full				1.2	

ELECTRICAL CHARACTERISTICS FOR 3.3-V SUPPLY(1)

V_+ = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 2.0 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	3 V		0.37	0.55	Ω
				Full				0.6	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 2.0 V, 0.8 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	3 V		0.06	0.07	Ω
				Full				0.1	
ON-state resistance flatness	$r_{on(flat)}$	V_{NO} or V_{NC} = 2.0 V, 0.8 V I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	3 V		0.05	0.1	Ω
				Full				0.1	
NC, NO OFF leakage current	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = 3.0 V, or V_{NO} or V_{NC} = 3.0 V, V_{COM} = 0.3 V,	See Figure 17	25°C	3.6 V	–15	5	15	nA
				Full		–50		50	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = Open, or V_{NO} or V_{NC} = 3.0 V, V_{COM} = Open,	See Figure 18	25°C	3.6 V	–15	5	15	nA
				Full		–50		50	
COM ON leakage current	$I_{COM(ON)}$	V_{NO} or V_{NC} = Open, V_{COM} = 0.3 V, or V_{NO} or V_{NC} = Open, V_{COM} = 3.0 V,	See Figure 18	25°C	3.6 V	–15	5	15	nA
				Full		–50		50	
Digital Control Inputs (IN1-2, IN3-4)(2)									
Input logic high	V_{IH}			Full		1.25		4.3	V
Input logic low	V_{IL}			Full		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 3.6 V or 0		25°C	3.6 V		0.5	10	nA
				Full				50	

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

(2) All unused digital inputs of the device must be held at V_+ 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 FOR 3.3-V SUPPLY (continued)

V_+ = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	3 V		20	38	ns
				Full	3 V to 3.6 V			40	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	3 V		14	34	ns
				Full	3 V to 3.6 V			35	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	3 V	3	11	35	ns
				Full	3 V to 3.6 V	2		55	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 1 nF	25°C	3 V		109		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	3 V		51		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	3 V		162		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 19	25°C	3 V		162		pF
Digital input capacitance	C_I	V_I = V_+ or GND		25°C	3 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON	25°C	3 V		35		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 100 kHz,	Switch OFF	25°C	3 V		–71		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 100 kHz,	Switch ON	25°C	3 V		–73		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz	25°C	3 V		0.003		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	3.6 V		0.015	0.2	µA
				Full				0.7	

ELECTRICAL CHARACTERISTICS FOR 2.5-V SUPPLY(1)

V_+ = 2.3 V to 2.7 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch								
Analog signal range	V_{COM}, V_{NO}, V_{NC}				0		V_+	V
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 1.8 V, I_{COM} = –100 mA, Switch ON, See Figure 16	25°C	2.3 V		0.45	0.6	Ω
			Full				0.7	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.8 V, 0.8 V, I_{COM} = –100 mA, Switch ON, See Figure 16	25°C	2.3 V		0.045	0.07	Ω
			Full				0.1	
ON-state resistance flatness	$r_{on(flat)}$	V_{NO} or V_{NC} = 1.8 V, 0.8 V I_{COM} = –100 mA, Switch ON, See Figure 16	25°C	2.3 V		0.06	0.15	Ω
			Full				0.2	
NC, NO OFF leakage current	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = 2.3 V, or V_{NO} or V_{NC} = 2.3 V, V_{COM} = 0.3V, See Figure 17	25°C	2.7 V	–10	0.5	10	nA
			Full		–20		20	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = Open, or V_{NO} or V_{NC} = 2.3 V, V_{COM} = Open, See Figure 18	25°C	2.7 V	–10	0.1	10	nA
			Full		–20		20	
COM ON leakage current	$I_{COM(ON)}$	V_{NO} or V_{NC} = Open, V_{COM} = 0.3 V, or V_{NO} or V_{NC} = Open, V_{COM} = 2.3 V, See Figure 18	25°C	2.7 V	–10	0.1	10	nA
			Full		–20		20	
Digital Control Inputs (IN1-2, IN3-4)(2)								
Input logic high	V_{IH}		Full		1.2		4.3	V
Input logic low	V_{IL}		Full		0		0.6	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 3.6 V or 0	25°C	2.7 V		0.5	10	nA
			Full				50	

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

(2) All unused digital inputs of the device must be held at V_+ 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 FOR 2.5-V SUPPLY (continued)

V_+ = 2.3 V to 2.7 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	2.5 V		2.6	47	ns
				Full	2.3 V to 2.7 V			50	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	2.5 V		16.5	34	ns
				Full	2.3 V to 2.7 V			35	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	2.5 V	4	15	35	ns
				Full	2.3 V to 2.7 V	3		35	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 1 nF	25°C	2.5 V		84		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	2.5 V		52		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	2.5 V		163		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND,	See Figure 19	25°C	2.5 V		163		pF
Digital input capacitance	C_I	V_I = V_+ or GND		25°C	2.5 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON	25°C	2.5 V		35		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 100 kHz,	Switch OFF	25°C	2.5 V		–71		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 100 kHz,	Switch ON	25°C	2.5 V		–73		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz	25°C	2.5 V		0.009		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	2.5 V		0.004	0.1	µA
				Full				0.5	

ELECTRICAL CHARACTERISTICS FOR 1.8-V SUPPLY(1)

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 1.5 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	1.65 V		0.5	0.7	Ω
				Full				0.8	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.5 V, 0.6 V I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	1.65 V		0.05	0.07	Ω
				Full				0.1	
ON-state resistance flatness	$r_{on(flat)}$	V_{NO} or V_{NC} = 1.5 V, 0.6 V 1.5 V, 2.5 V, I_{COM} = –100 mA,	Switch ON, See Figure 16	25°C	1.65 V		0.5	0.7	Ω
				Full				0.8	
NC, NO OFF leakage current	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = 1.65 V, or V_{NO} or V_{NC} = 1.65 V, V_{COM} = 0.3 V,	See Figure 17	25°C	1.95 V	–10	0.5	10	nA
				Full		–20		20	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NO} or V_{NC} = 0.3 V, V_{COM} = Open, or V_{NO} or V_{NC} = 1.65 V, V_{COM} = Open,	See Figure 18	25°C	1.95 V	–10	0.1	10	nA
				Full		–20		20	
COM ON leakage current	$I_{COM(ON)}$	V_{NO} or V_{NC} = Open, V_{COM} = 0.3V, or V_{NO} or V_{NC} = Open, V_{COM} = 1.65 V,	See Figure 18	25°C	1.95 V	–10	0.1	10	nA
				Full		–20		20	
Digital Control Inputs (IN1-2, IN3-4)(2)									
Input logic high	V_{IH}			Full		1		4.3	V
Input logic low	V_{IL}			Full		0		0.4	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 3.6 V or 0		25°C	1.95 V		0.5	10	nA
				Full				50	

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

(2) All unused digital inputs of the device must be held at V_+ 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 FOR 1.8-V SUPPLY (continued)

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	1.8 V		40	70	ns
				Full	1.65 V to 1.95 V			75	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	1.8 V		22	45	ns
				Full	1.65 V to 1.95 V			50	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+, R_L = 50 Ω,	C_L = 35 pF	25°C	1.8 V	5	25	70	ns
				Full	1.65 V to 1.95 V	4		75	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 1 nF	25°C	1.8 V		64		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	1.8 V		52		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 19	25°C	1.8 V		164		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 19	25°C	1.8 V		164		pF
Digital input capacitance	C_I	V_I = V_+ or GND		25°C	1.8 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON	25°C	1.8 V		35		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 100 kHz,	Switch OFF	25°C	1.8 V		–71		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 100 kHz,	Switch ON	25°C	1.8 V		–73		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz	25°C	1.8 V		0.1		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	1.95 V		0.001	0.05	µA
				Full				0.15	

TYPICAL PERFORMANCE

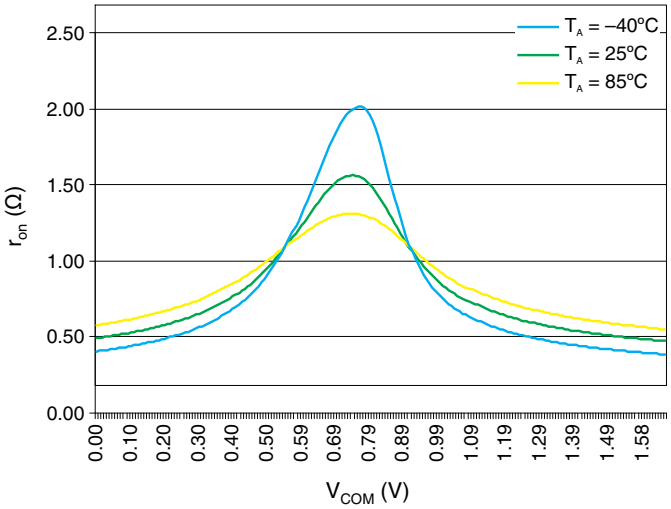


Figure 1. r_{on} vs V_{COM} (V_+ = 1.65 V)

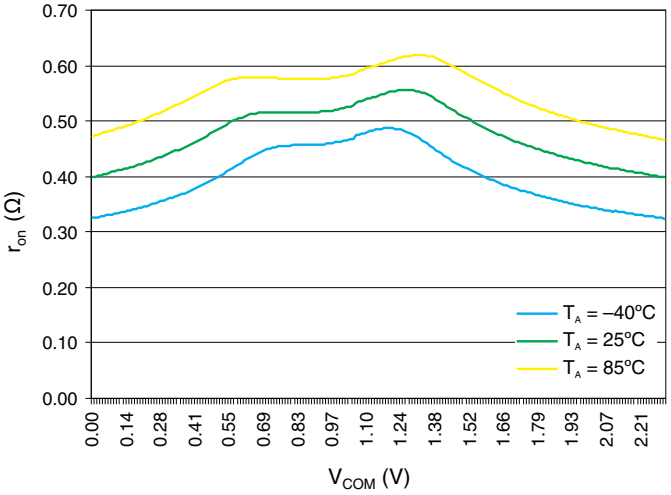


Figure 2. r_{on} vs V_{COM} (V_+ = 2.3 V)

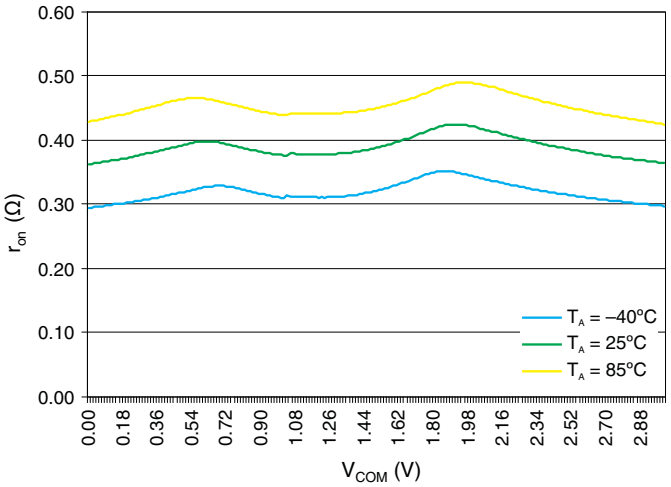


Figure 3. r_{on} vs V_{COM} (V_+ = 3 V)

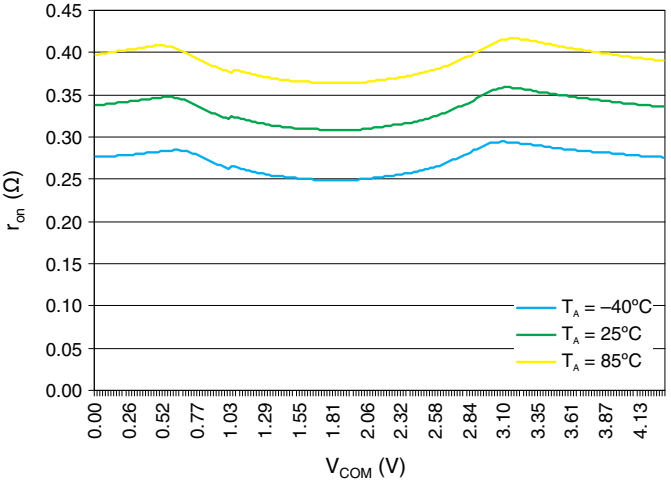


Figure 4. r_{on} vs V_{COM} (V_+ = 4.3 V)

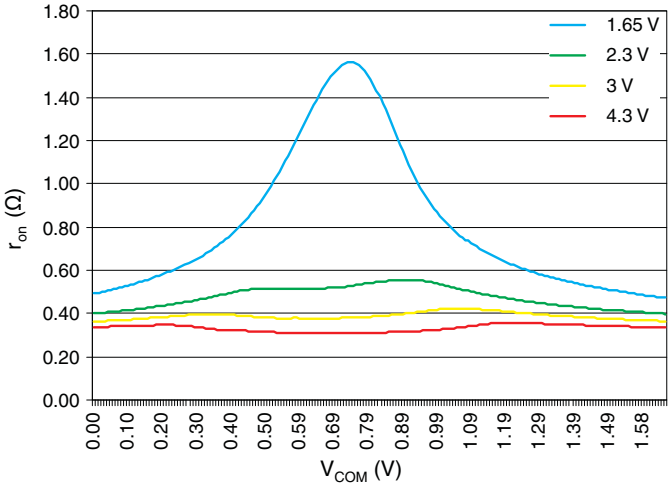


Figure 5. r_{on} vs V_{COM} (All Voltages)

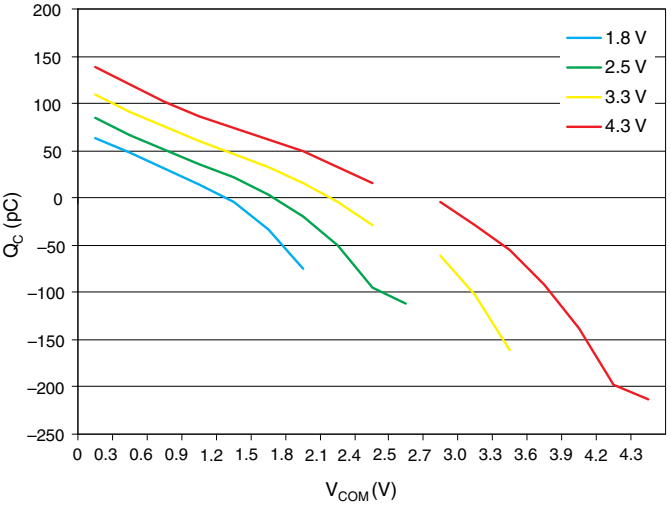


Figure 6. Charge Injection (Q_C) vs V_{COM} (T_A = 25°C)

TYPICAL PERFORMANCE (continued)

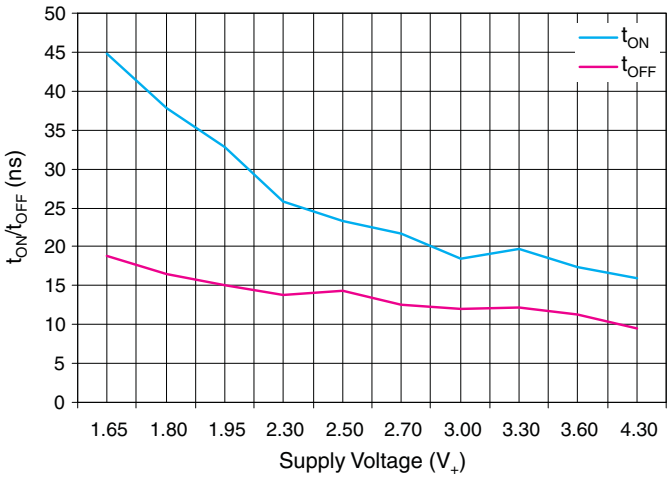


Figure 7. t_{ON} and t_{OFF} vs Supply Voltage (T_A = 25°C)

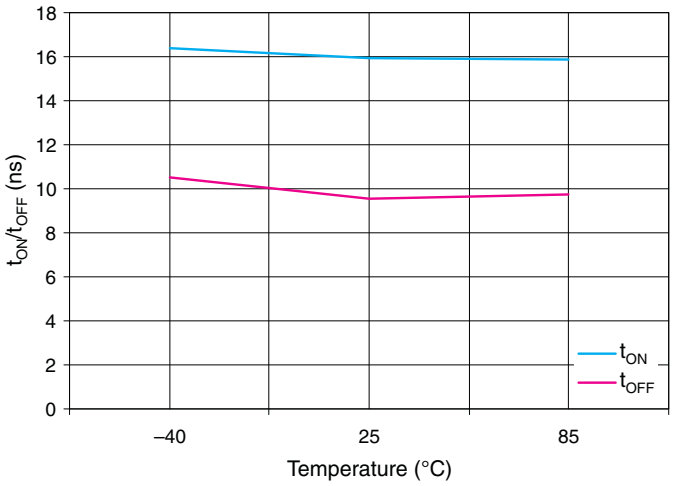


Figure 8. t_{ON} and t_{OFF} vs Temperature (V_+ = 4.3 V)

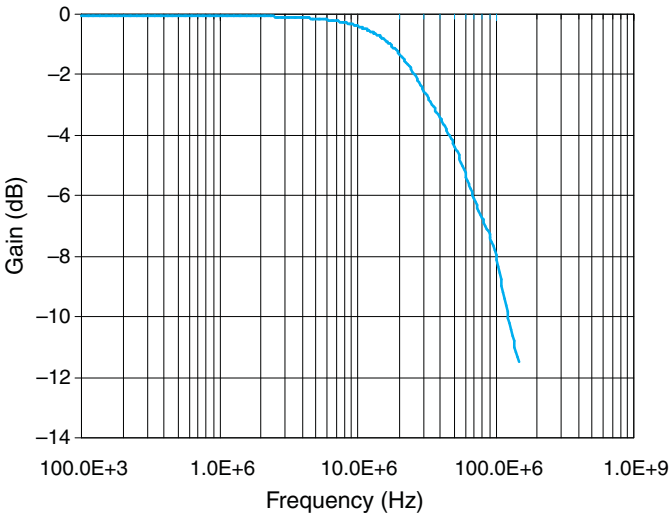


Figure 9. Bandwidth

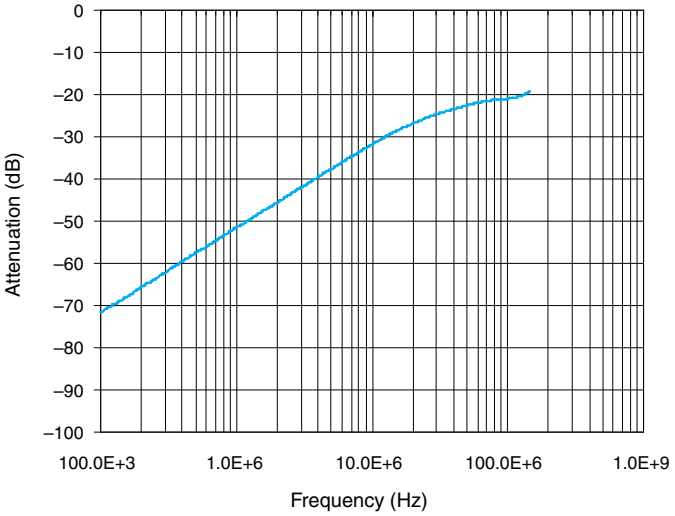


Figure 10. OFF Isolation

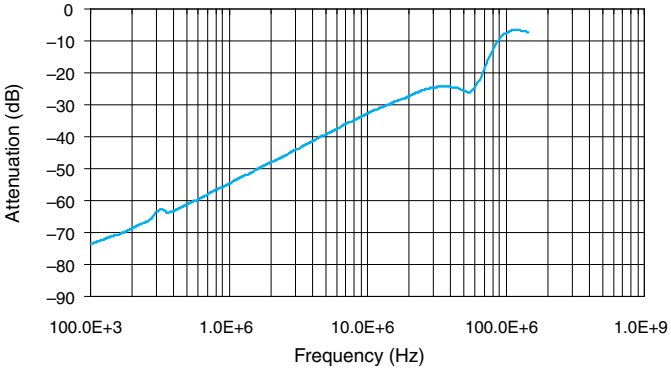


Figure 11. Crosstalk

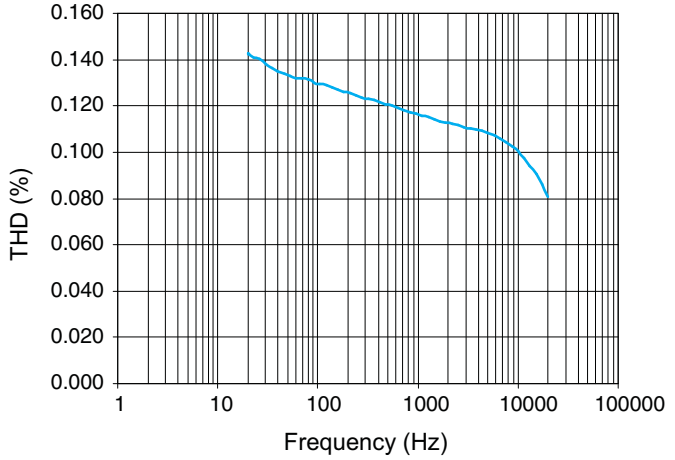


Figure 12. Total Harmonic Distortion vs Frequency (V_+ = 1.8 V)

TYPICAL PERFORMANCE (continued)

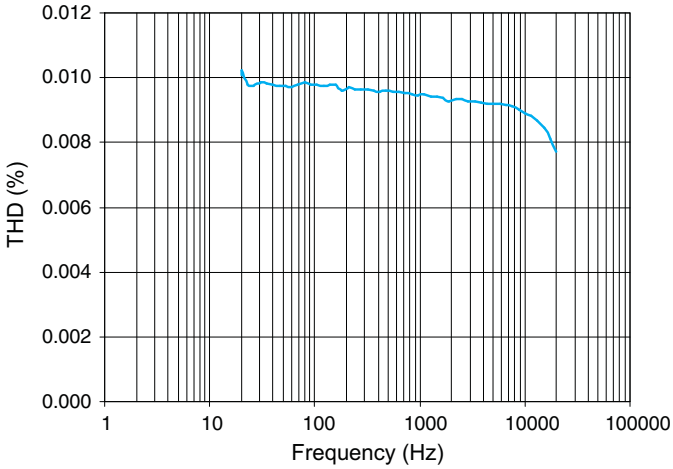


Figure 13. Total Harmonic Distortion vs Frequency (V_+ = 2.5 V)

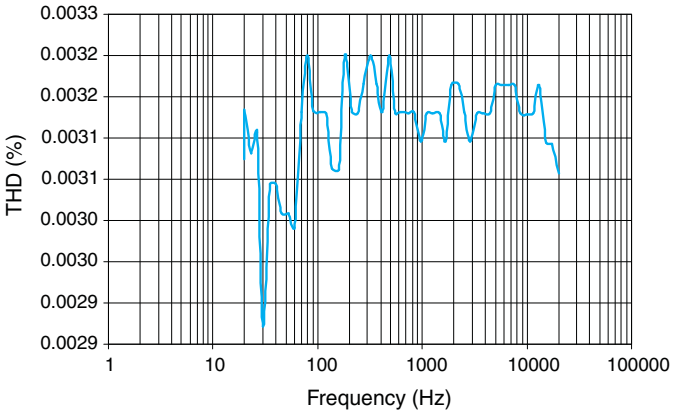


Figure 14. Total Harmonic Distortion vs Frequency (V_+ = 3.3 V)

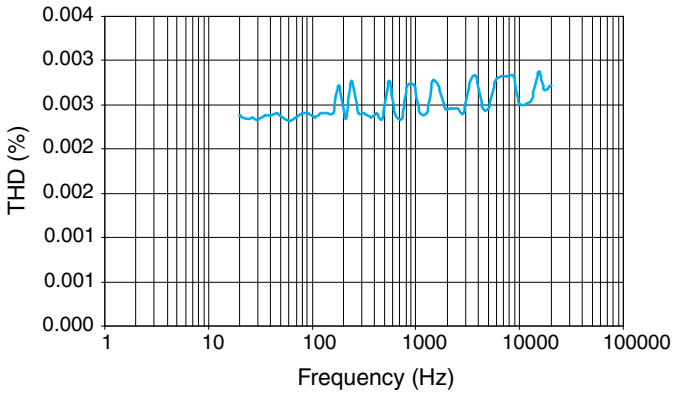


Figure 15. Total Harmonic Distortion vs Frequency (V_+ = 4.3 V)

PARAMETER MEASUREMENT INFORMATION

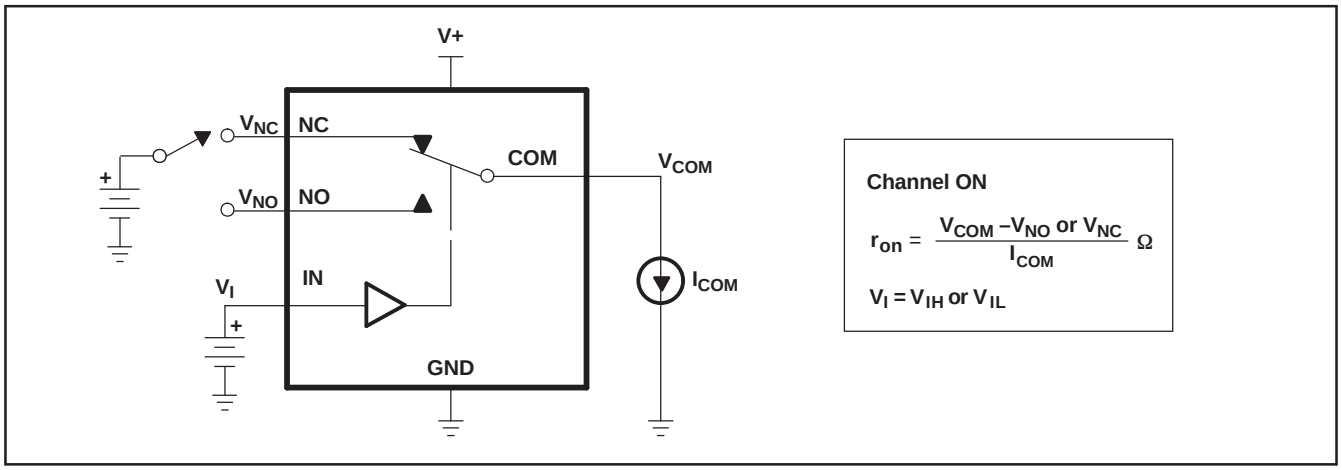


Figure 16. ON-state Resistance (r_{ON})

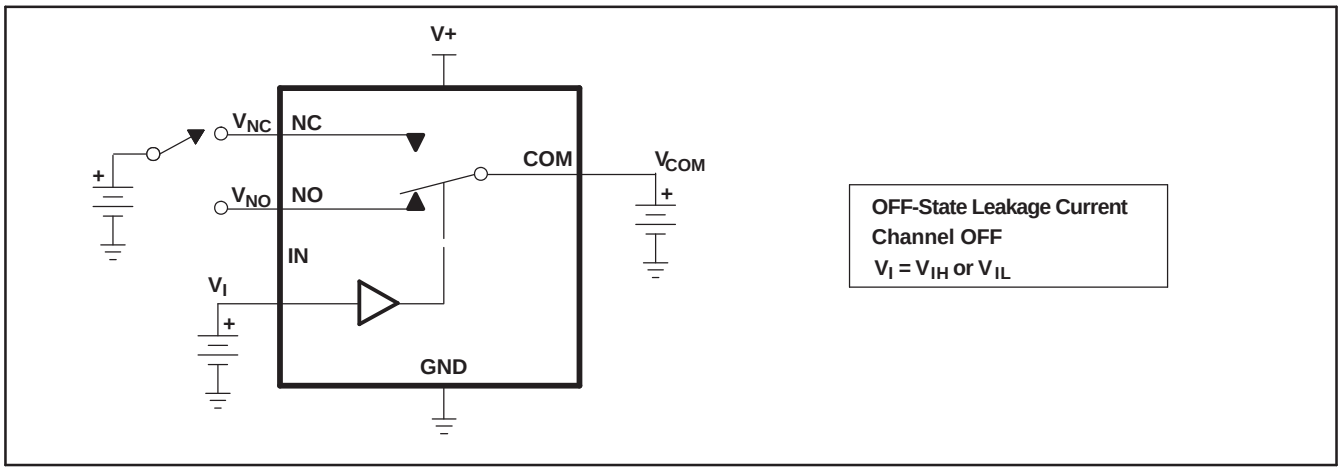


Figure 17. OFF-State Leakage Current
($I_{NC(OFF)}$, $I_{NC(PWROFF)}$, $I_{NO(OFF)}$, $I_{NO(PWROFF)}$, $I_{COM(OFF)}$, $I_{COM(PWROFF)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

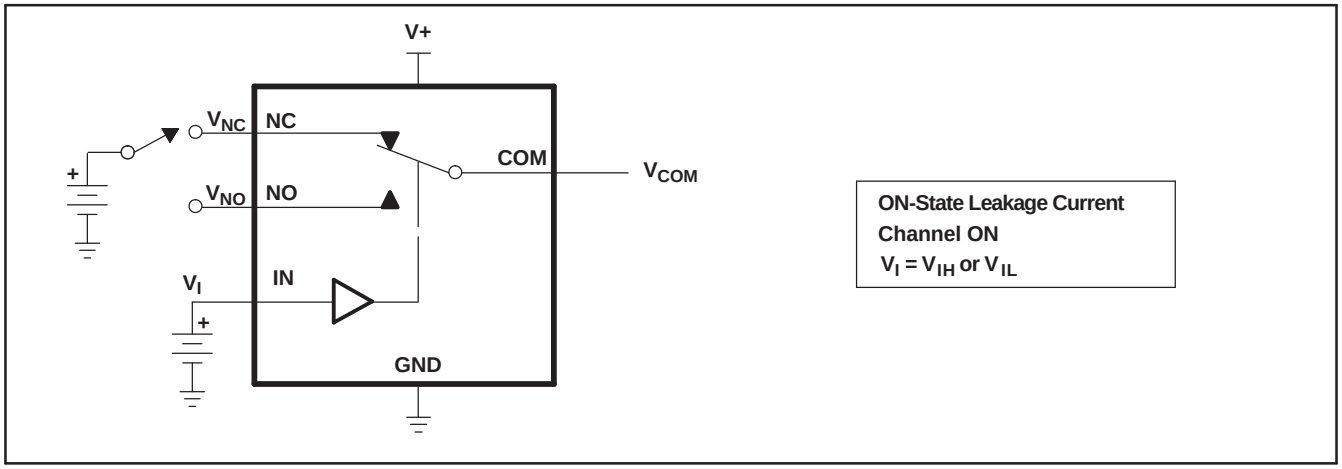


Figure 18. ON-State Leakage Current
($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

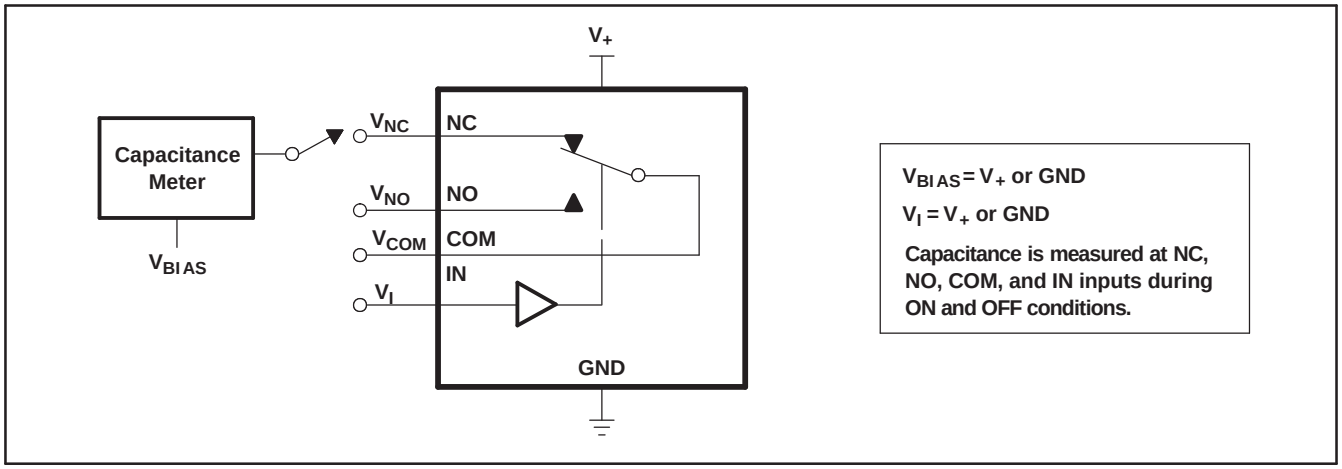
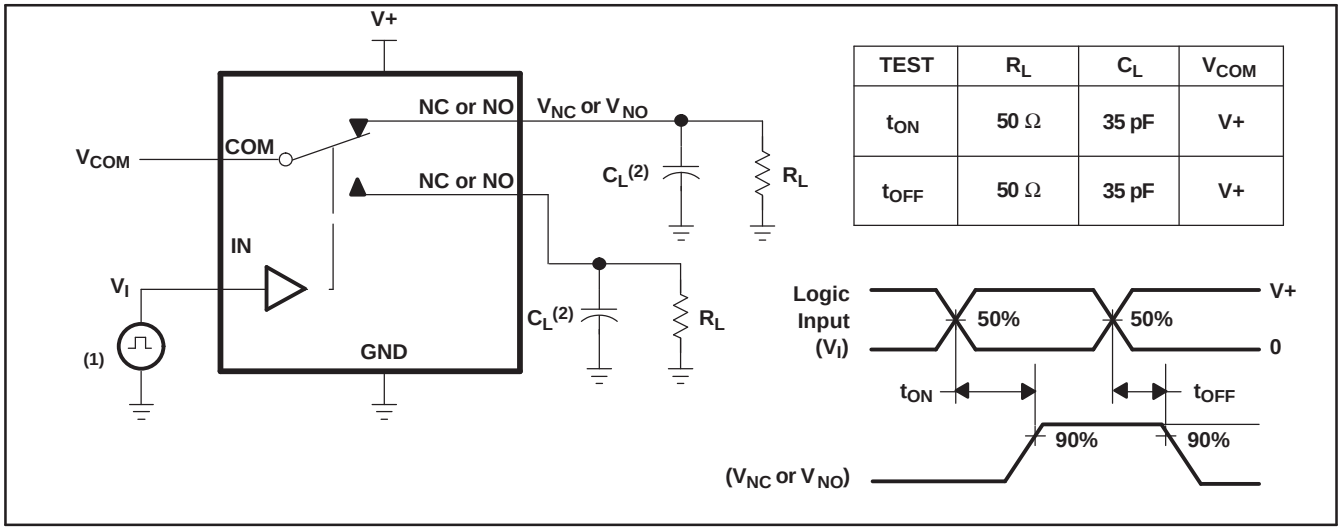


Figure 19. Capacitance
(C_I, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

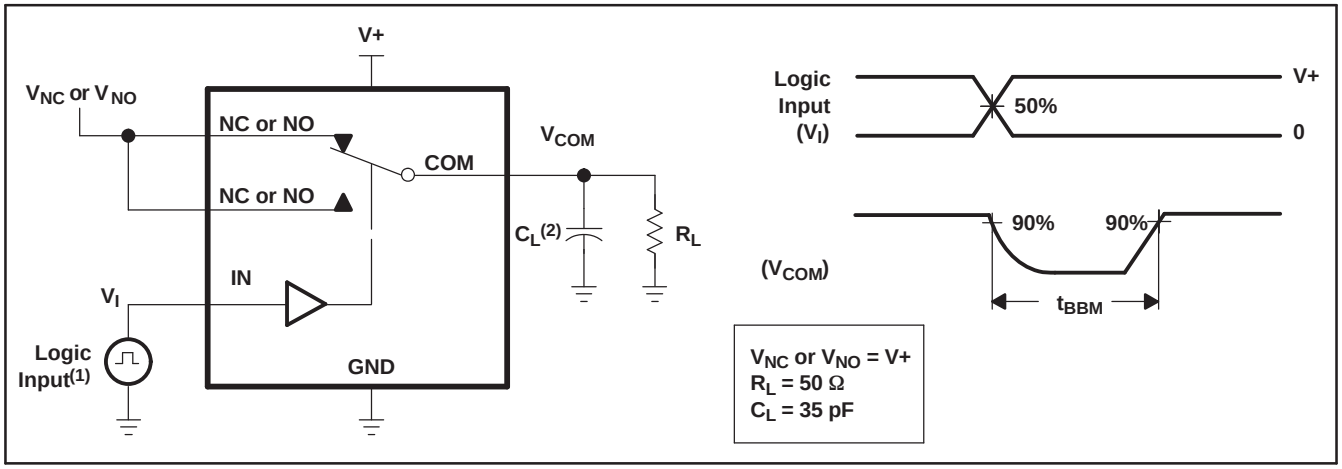


TEST	R_L	C_L	V_{COM}
t_{ON}	50 Ω	35 pF	V+
t_{OFF}	50 Ω	35 pF	V+

A. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

B. C_L includes probe and jig capacitance.

Figure 20. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})



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 < 5 ns, t_f < 5 ns.

Figure 21. Break-Before-Make Time (t_{BBM})

PARAMETER MEASUREMENT INFORMATION (continued)

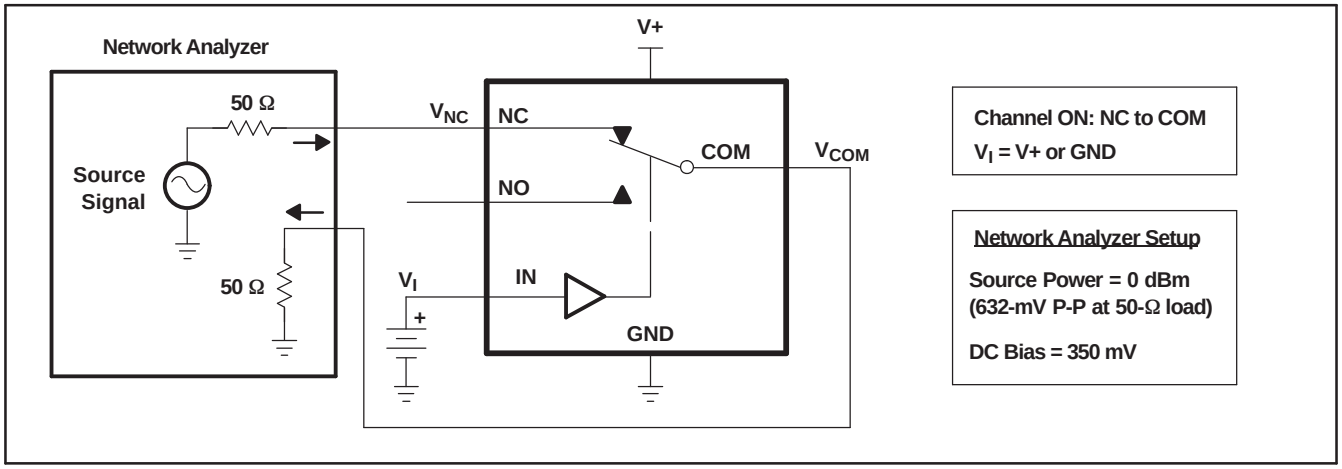


Figure 22. Bandwidth (BW)

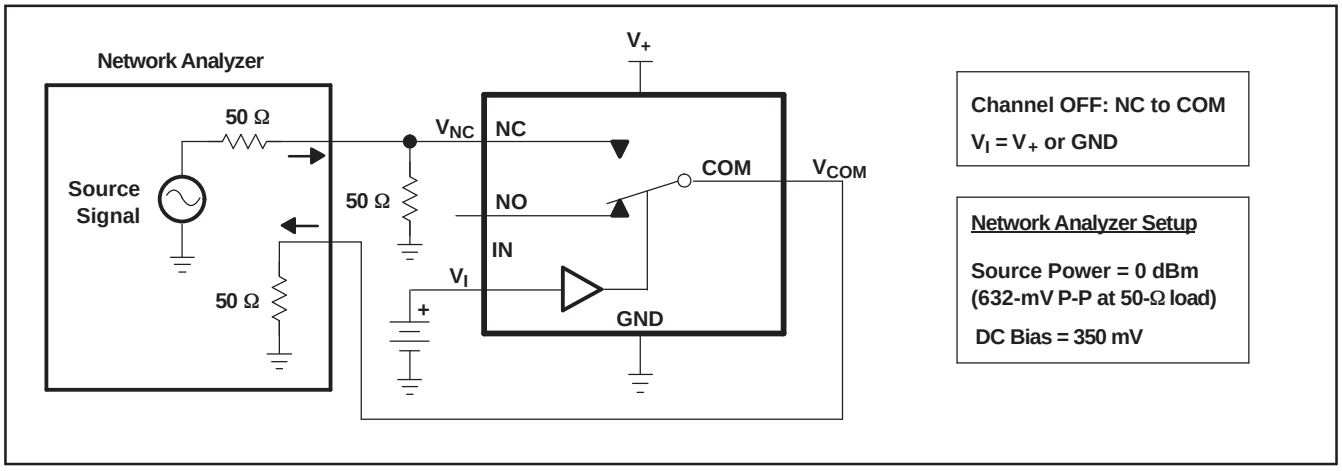


Figure 23. OFF Isolation (O_{ISO})

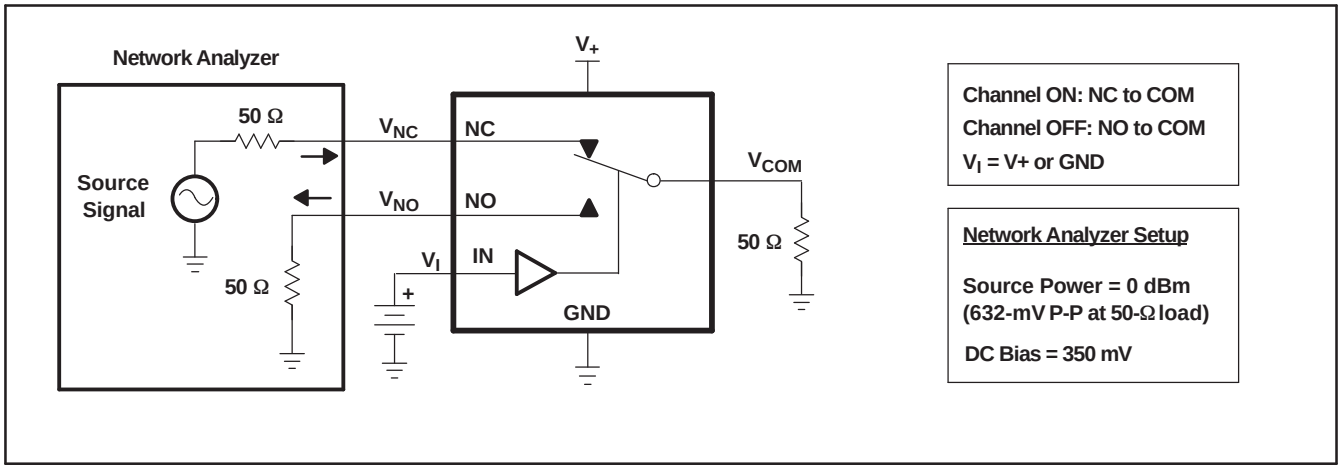
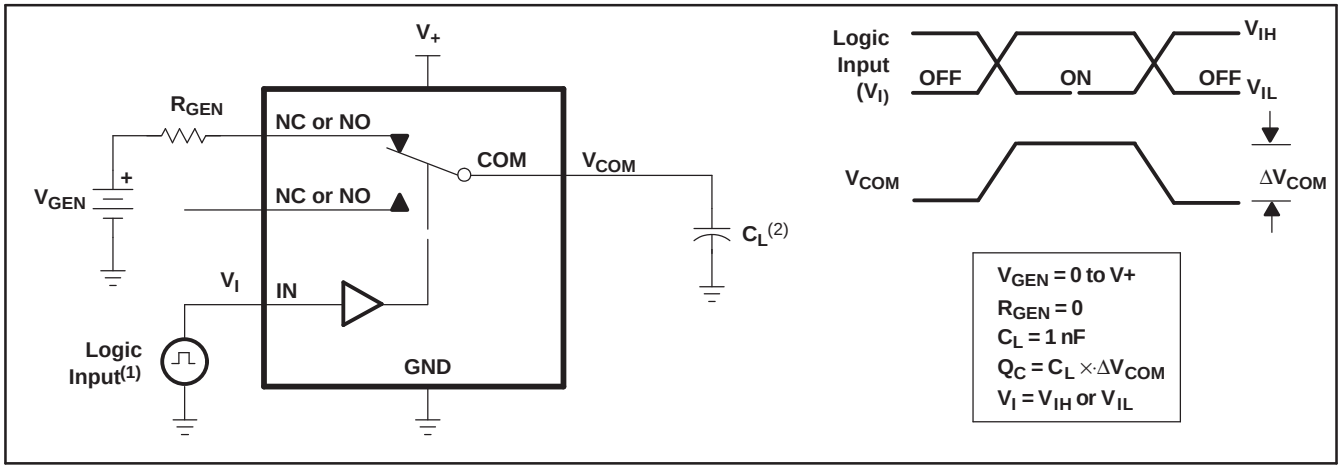


Figure 24. Crosstalk (X_{TALK})

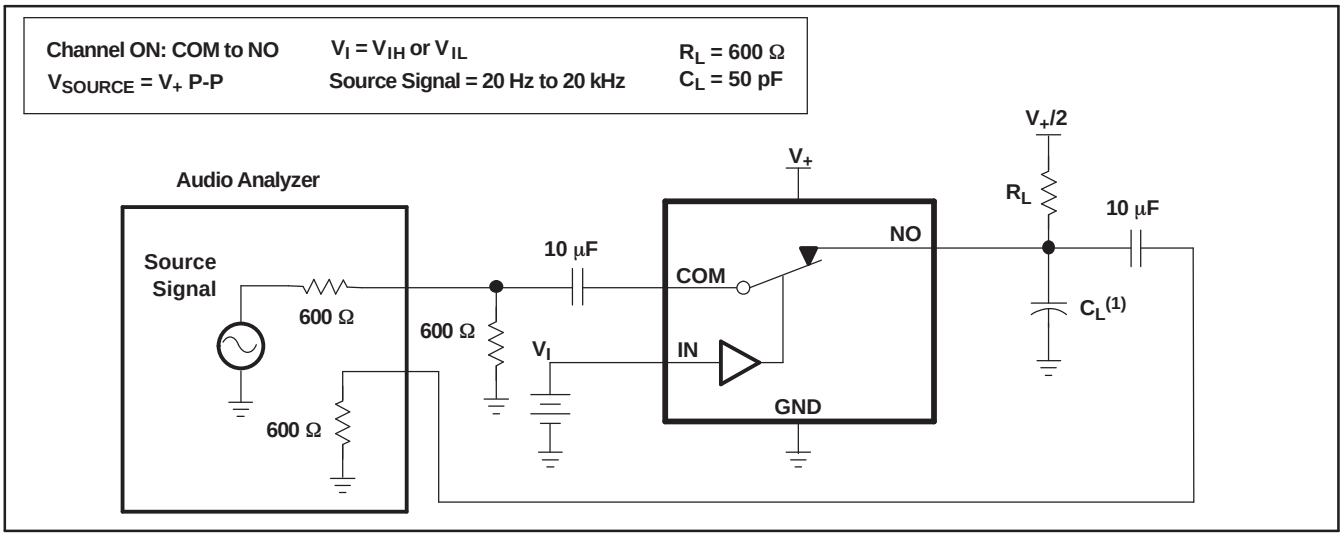
PARAMETER MEASUREMENT INFORMATION (continued)



A. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

B. C_L includes probe and jig capacitance.

Figure 25. Charge Injection (Q_C)



A. C_L includes probe and jig capacitance.

Figure 26. Total Harmonic Distortion (THD)

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS3A44159PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	YC4159	Samples
TS3A44159PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	YC4159	Samples
TS3A44159RGTR	ACTIVE	QFN	RGT	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ZWH	Samples
TS3A44159RGTRG4	ACTIVE	QFN	RGT	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ZWH	Samples
TS3A44159RSVR	ACTIVE	UQFN	RSV	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ZWH	Samples
TS3A44159RSVRG4	ACTIVE	UQFN	RSV	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	ZWH	Samples

(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)

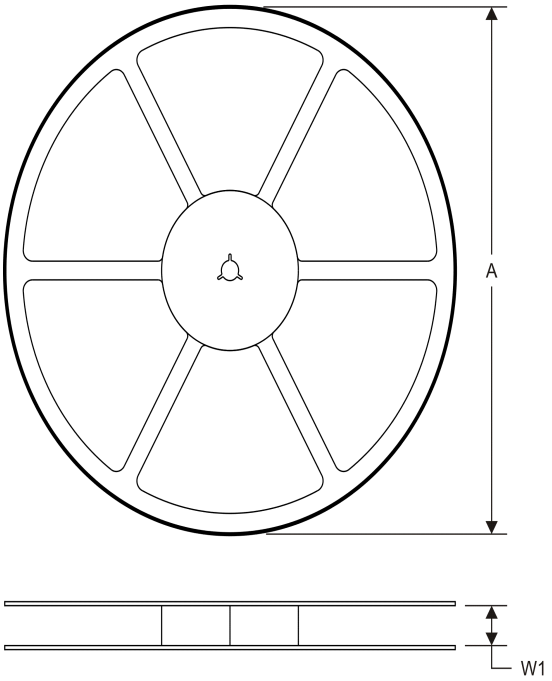
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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

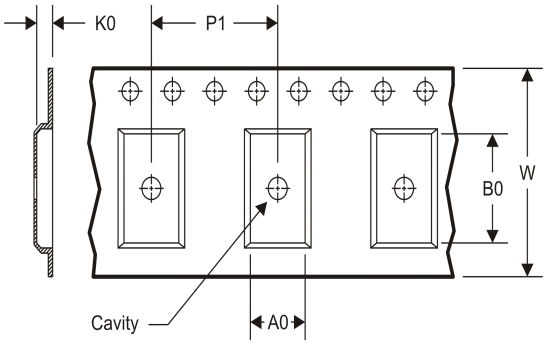
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



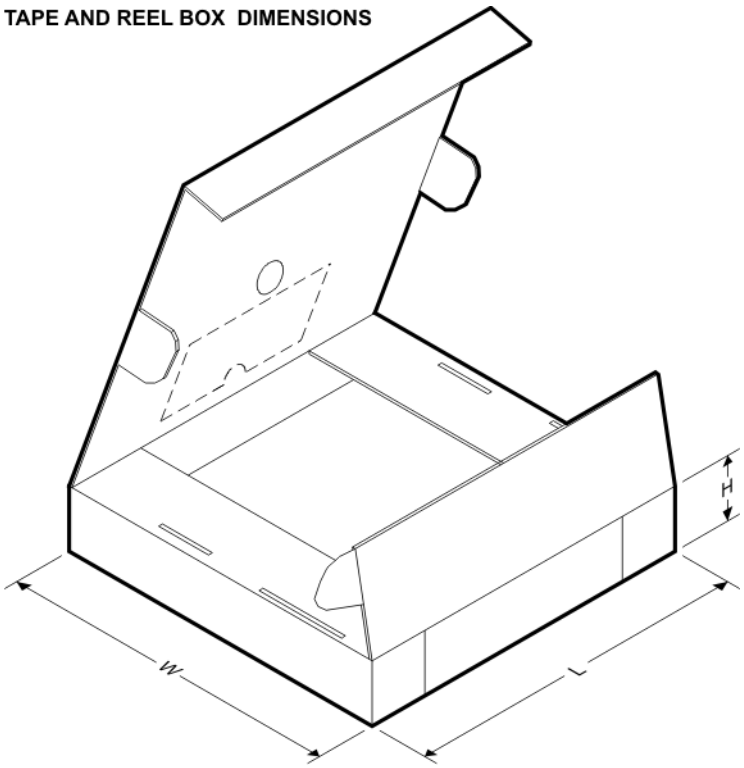
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
TS3A44159PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TS3A44159RGTR	QFN	RGT	16	3000	330.0	12.4	3.3	3.3	1.0	8.0	12.0	Q2
TS3A44159RSVR	UQFN	RSV	16	3000	177.8	12.4	2.0	2.8	0.7	4.0	12.0	Q1

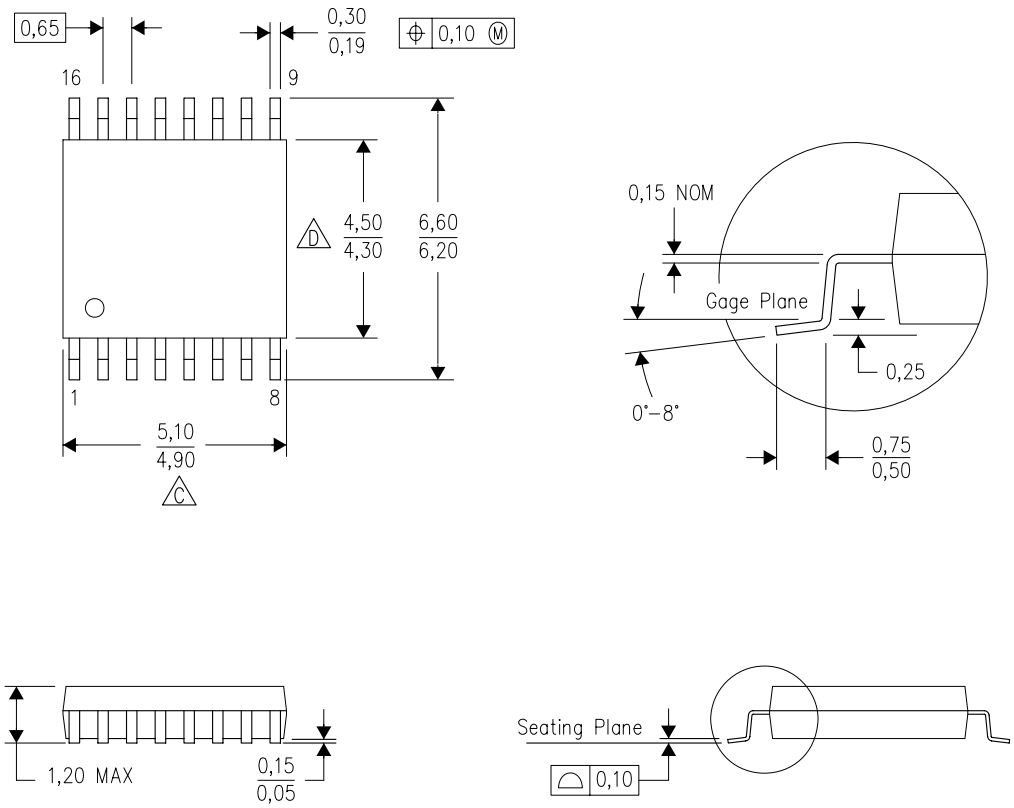
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A44159PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
TS3A44159RGTR	QFN	RGT	16	3000	346.0	346.0	35.0
TS3A44159RSVR	UQFN	RSV	16	3000	202.0	201.0	28.0

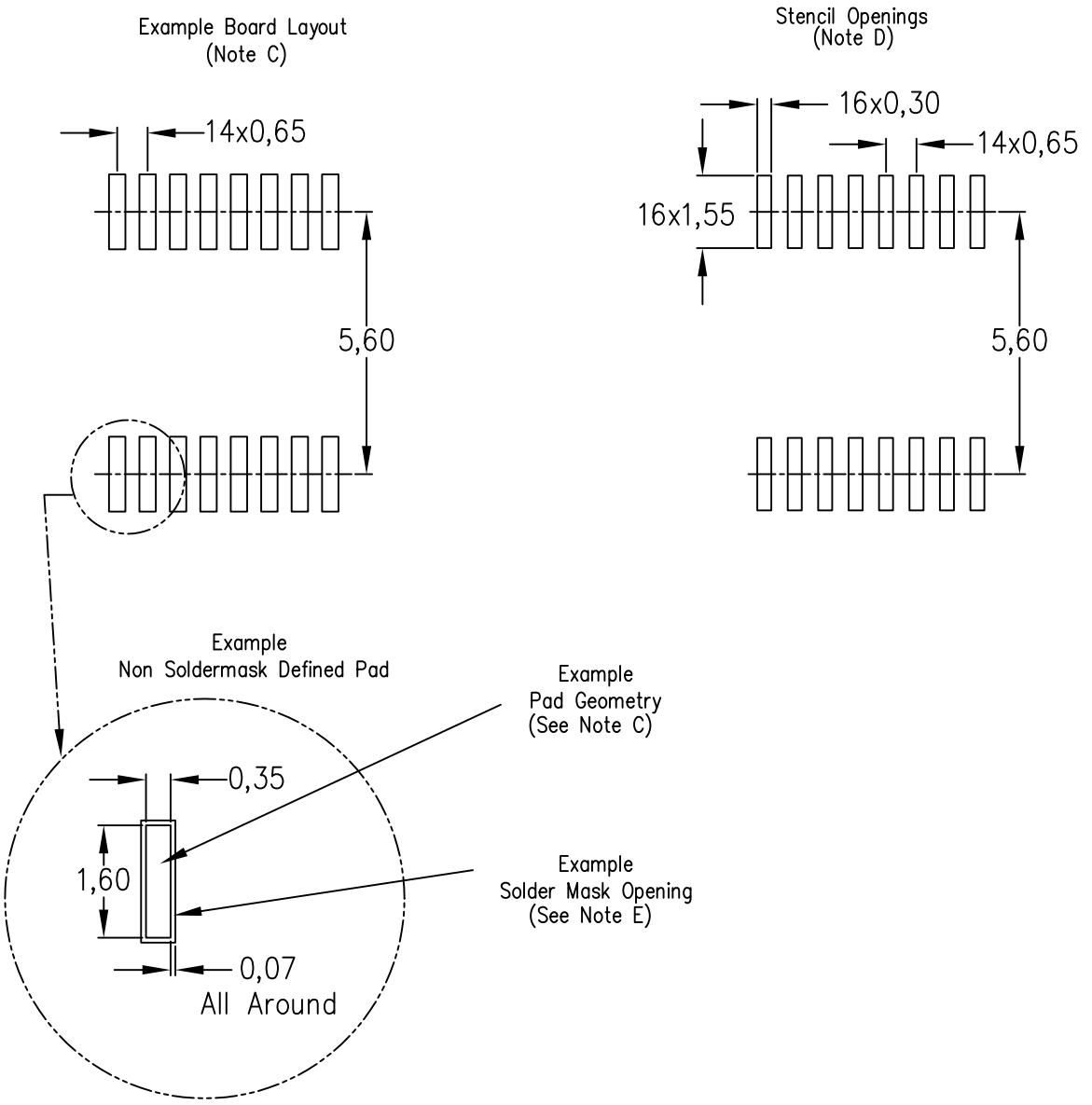
PW (R–PDSO–G16) PLASTIC SMALL OUTLINE



4040064–4/G 02/11

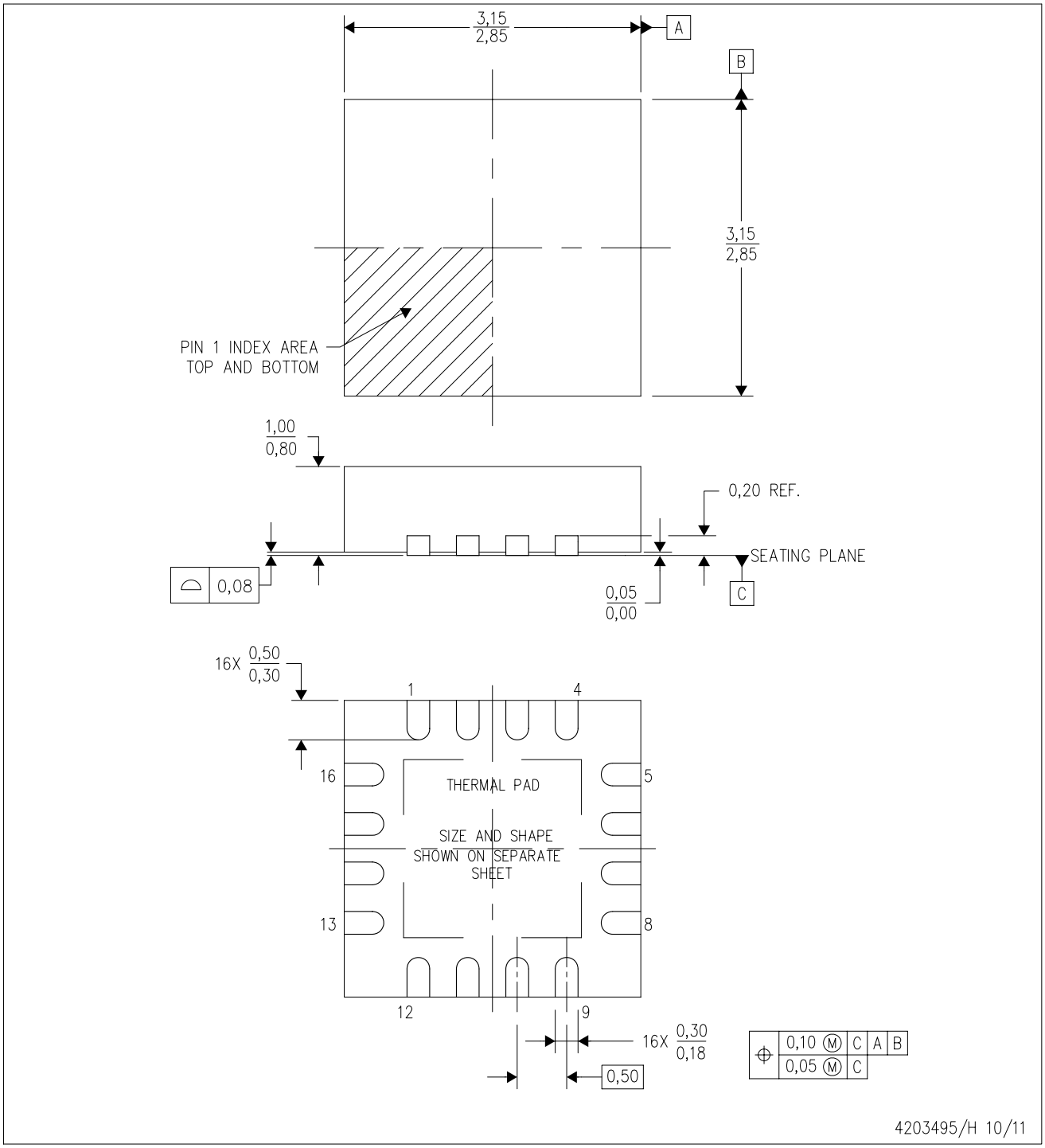
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. 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–G16) 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.

RGT (S–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. Quad Flatpack, No–leads (QFN) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Falls within JEDEC MO–220.

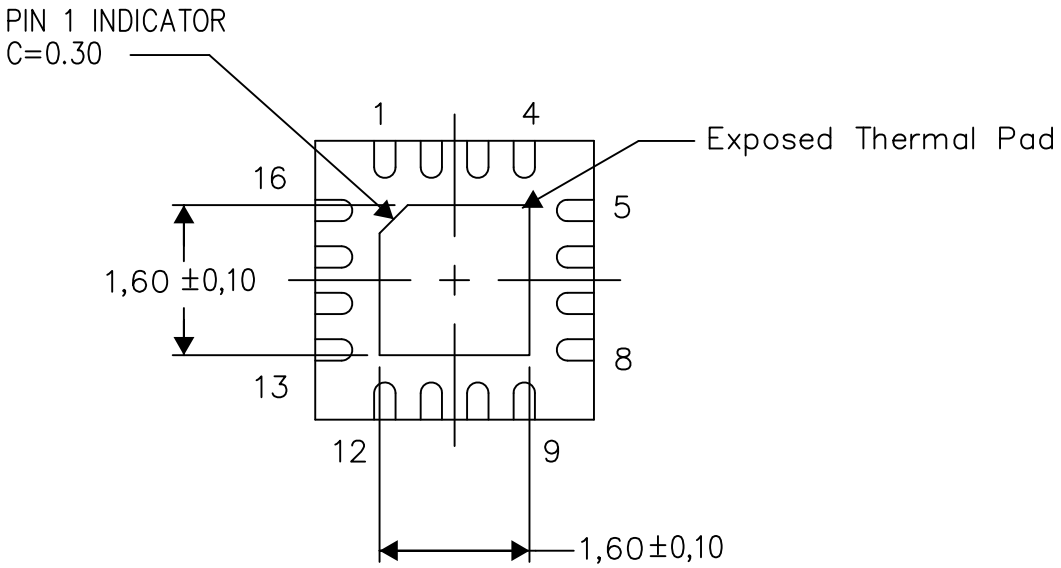
RGT (S–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD

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.



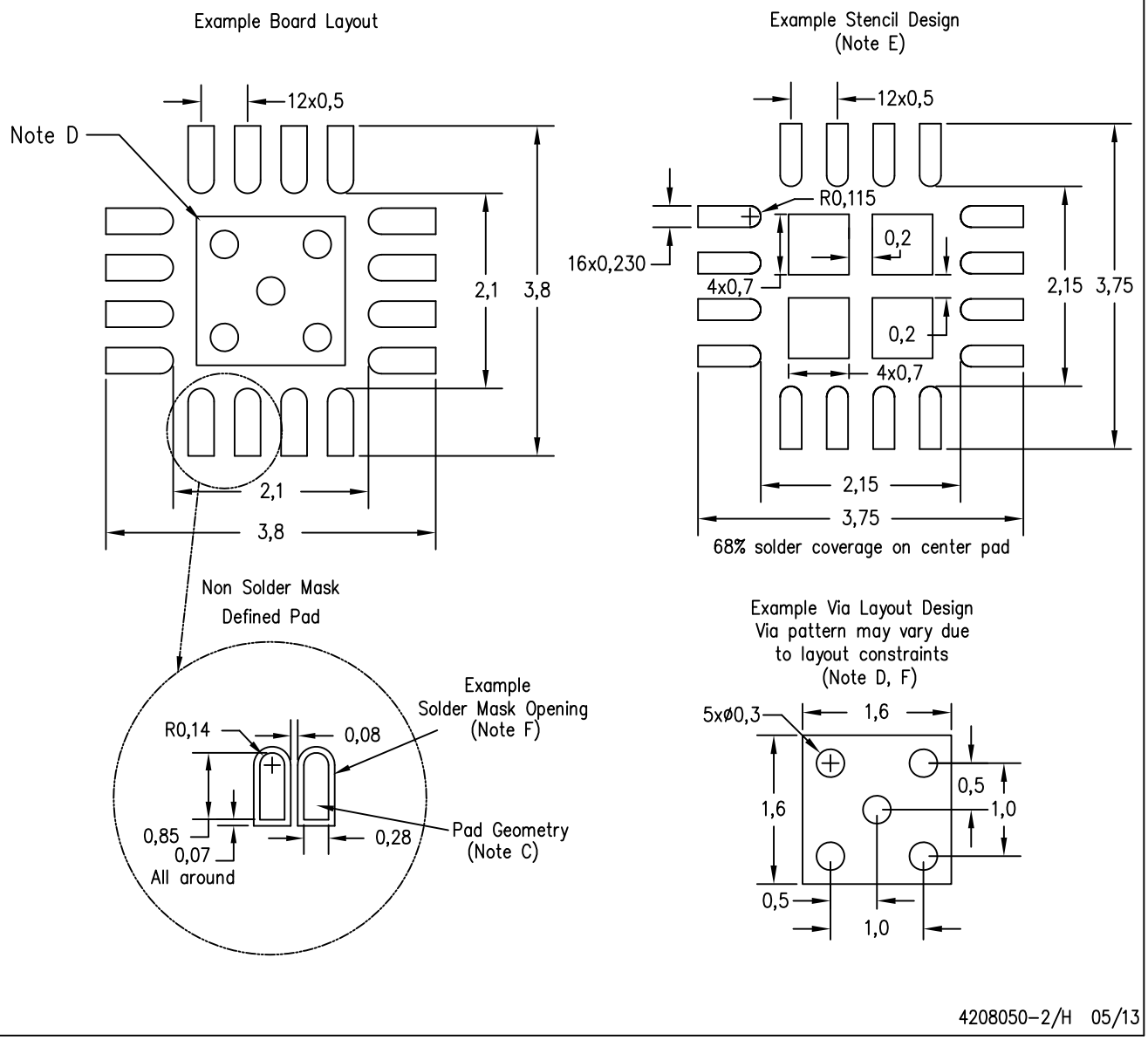
Bottom View

Exposed Thermal Pad Dimensions

4206349–3/S 04/13

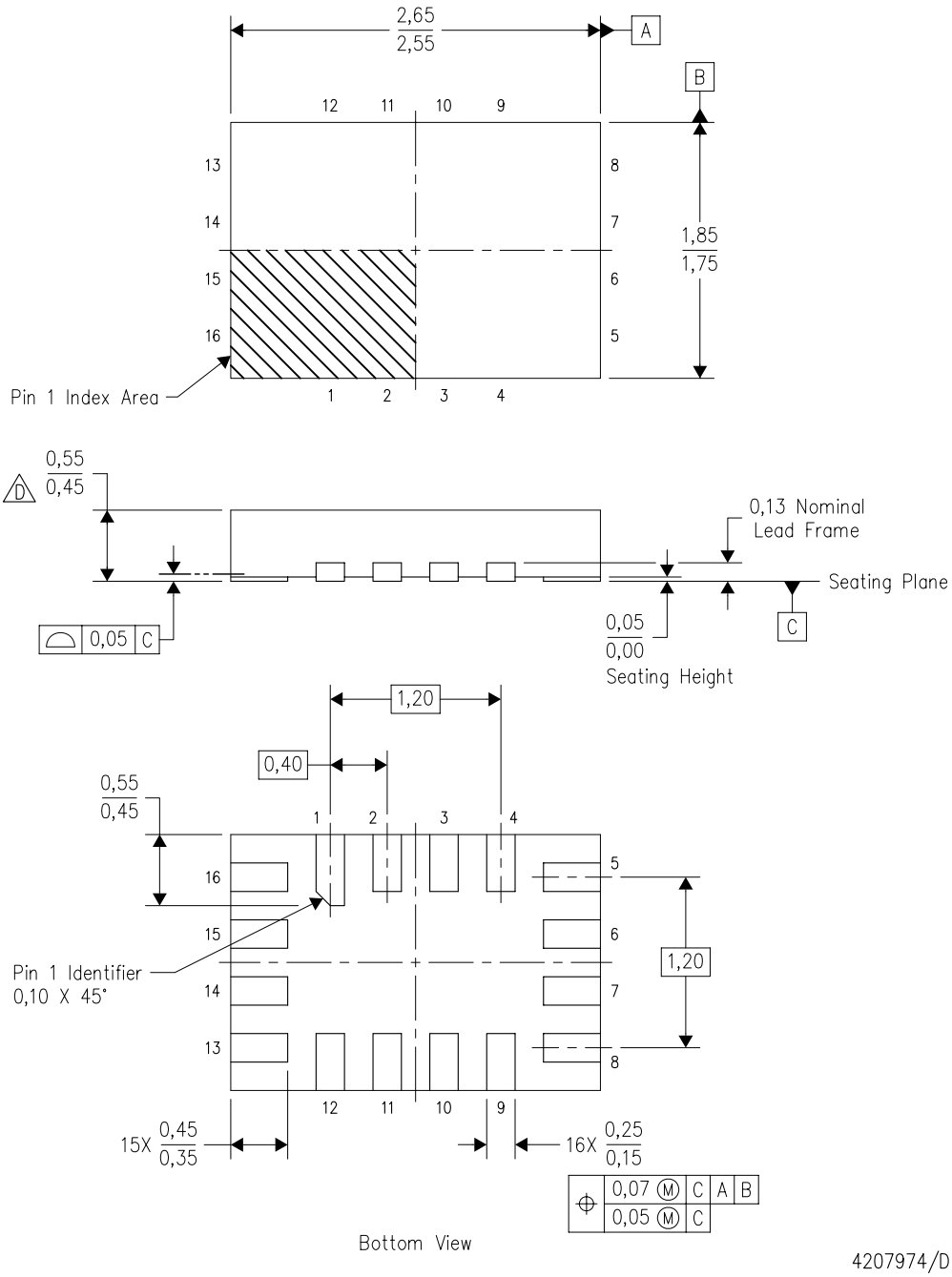
NOTE: All linear dimensions are in millimeters

RGT (S–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



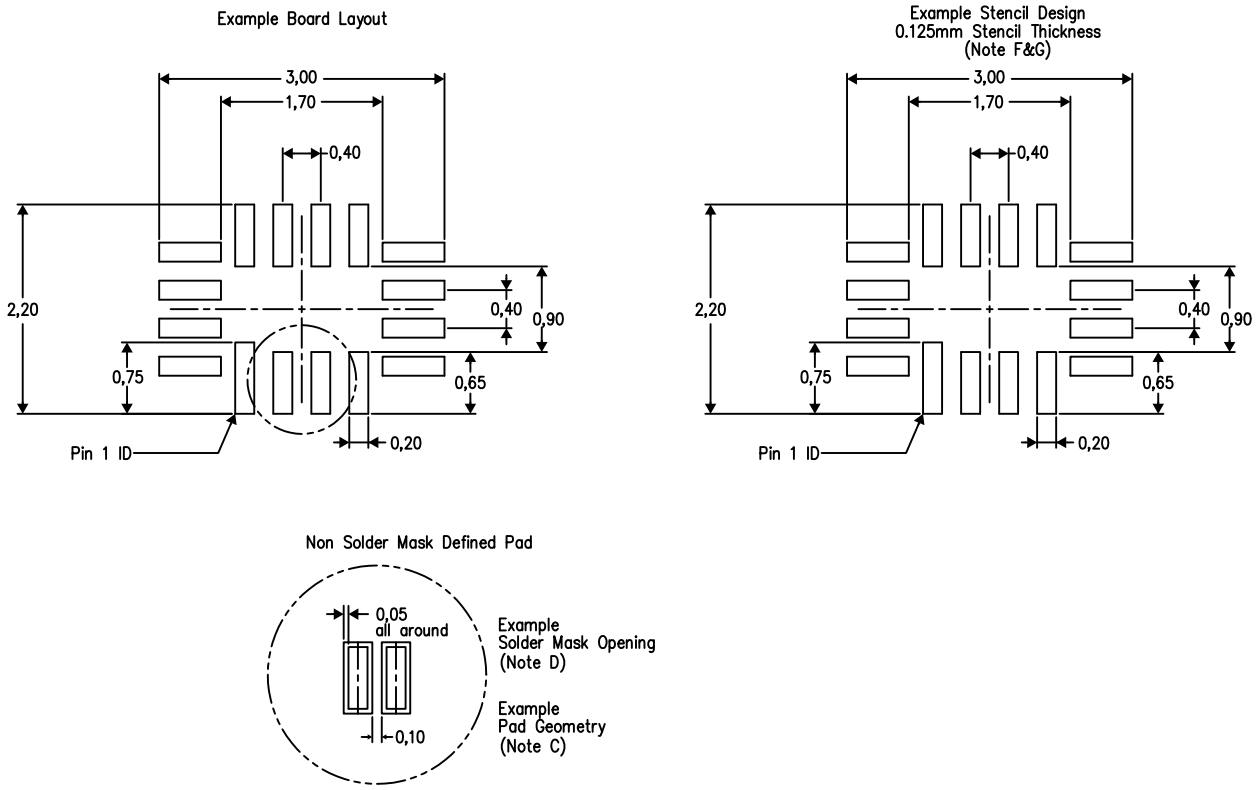
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, QFN/SON PCB Attachment, Texas Instruments 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.

RSV (R–PUQFN–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. This package complies to JEDEC MO–288 variation UFHE, except minimum package thickness.

RSV (R–PUQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



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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. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
F. 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.
G. Side aperture dimensions over–print land for acceptable area ratio > 0.66. Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.

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