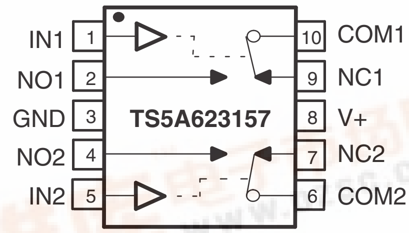
TS5A623157
DUAL 10-Ω SPDT ANALOG SWITCH WITH UNDERSHOOT/OVERSHOOT VOLTAGE PROTECTION

SCDS253–SEPTEMBER 2007

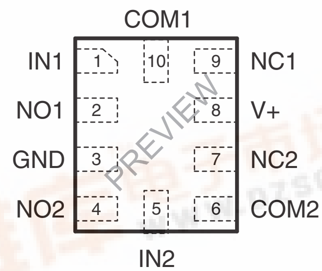
FEATURES

- **Overshoot and Undershoot Voltage Protection**
- **Specified Break-Before-Make Switching**
- **Low ON-State Resistance (10 Ω)**
- **Control Inputs Are 5-V Tolerant**
- **Low Charge Injection**
- **Excellent ON-Resistance Matching**
- **Low Total Harmonic Distortion (THD)**
- **1.8-V to 5.5-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)**
  - **300-V Machine Model (A115-A)**

DGS PACKAGE
(TOP VIEW)



RSE PACKAGE
(TOP VIEW)



APPLICATIONS

- **Sample-and-Hold Circuit**
- **Battery-Powered Equipments**
- **Audio and Video Signal Routing**
- **Communication Circuits**

DESCRIPTION/ORDERING INFORMATION

The TS5A623157 is a dual single-pole, double-throw (SPDT) analog switch designed to operate from 1.65 V to 5.5 V. This device can handle both digital and analog signals. Signals up to V+ (peak) can be transmitted in either direction.

The TS5A623157 senses overshoot and undershoot events at the I/Os and responds by preventing voltage differentials from developing and turning the switch on.

ORDERING INFORMATION

T_A	PACKAGE[(1)(2)]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	VSSOP (MSOP-10) – DGS	Tape and reel	TS5A623157DGSR	35R
	QFN – RSE	Tape and reel	TS5A623157RSER	PREVIEW

(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.

FUNCTION TABLE

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

PRODUCT PREVIEW

PRODUCT PREVIEW

SUMMARY OF CHARACTERISTICS
$V_+ = 5$ V, $T_A = 25°C$

Configuration	2:1 multiplexer/demultiplexer (1 × SPDT)
Number of channels	2
ON-state resistance (r_{on})	10 Ω
ON-state resistance match (Δr_{on})	0.15 Ω
ON-state resistance flatness ($r_{on(flat)}$)	2 Ω
Turn-on/turn-off time (t_{ON}/t_{OFF})	5 ns / 3.4 ns
Break-before-make time (t_{BBM})	0.5 ns
Charge injection (Q_C)	5 pC
Bandwidth (BW)	371 MHz
OFF isolation (O_{ISO})	–61 dB at 10 MHz
Crosstalk (X_{TALK})	–61 dB at 10 MHz
Total harmonic distortion (THD)	0.06%
Leakage current ($I_{NO(OFF)}/I_{NC(OFF)}$)	±1 μA
Power-supply current (I_+)	1.2 μA
Undershoot protection	–2 V
Overshoot protection	V_+ + 2 V
Package options	10-pin VSSOP (DGS), 10-pin QFN (RSE)

Absolute Minimum and Maximum Ratings(1) (2)

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

			MIN	MAX	UNIT
V+	Supply voltage range(3)		–0.5	6.5	V
V_{NC} V_{NO} V_{COM}	Analog voltage range(3) (4) (5)		–0.5	V_+ + 0.5	V
$I_{I/OK}$	Analog port diode current	V+ < 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+		±50	mA
V_{IN}	Digital input voltage range(3) (4)		–0.5	6.5	V
I_{IK}	Digital input clamp current	V_I < 0		–50	mA
I+ I_{GND}	Continuous current through V_+ or GND			±100	mA
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) 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 5.5 V maximum.

Package Thermal Impedance

				UNIT
θ_{JA}	Package thermal impedance(1)	DGS package	165	°C/W
		RSE package	243	

(1) The package thermal impedance is calculated in accordance with JESD 51-7.

Electrical Characteristics for 5-V Supply

V_+ = 4.5 V to 5.5 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
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ –50 mA			5.5 V			–2	V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –30 mA,	Switch ON, See Figure 14	25°C	4.5 V		4.6	11	Ω
				Full				13	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 30 mA	Switch ON, See Figure 14	25°C	4.5 V		4	6.5	Ω
				Full				8	
		V_{NO} or V_{NC} = 2.4 V, I_{COM} = –30 mA		25°C			4	8	
				Full				10	
		V_{NO} or V_{NC} = 4.5 V, I_{COM} = –30 mA		25°C			5.5	10	
				Full				12	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 3.15 V, I_{COM} = –30 mA,	Switch ON, See Figure 14	25°C	4.5 V		0.1	0.14	Ω
				Full				0.15	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –30 mA,	Switch ON, See Figure 14	25°C	4.5 V		1.5	2	Ω
				Full				4	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0	Switch OFF, See Figure 15	25°C	5.5 V		1	20	nA
				Full				150	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 16	25°C	5.5 V		1	20	nA
				Full				150	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 16	25°C	5.5 V		1	20	nA
				Full				150	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.7$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.3$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	5.5 V		0.1	10	nA
				Full				30	

PRODUCT PREVIEW

Electrical Characteristics for 5-V Supply (continued)

V_+ = 4.5 V to 5.5 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_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	5 V	1	3.5	5	ns
				Full	4.5 V to 5.5 V	1		6	
Turn-off time	t_{OFF}	V_{COM} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	5 V	1	2.8	3.4	ns
				Full	4.5 V to 5.5 V	1		3.8	
Output voltage during undershoot	V_{OUTU}	See Figure 24				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 24					V_{OL}+ 0.3	2	V
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 50 pF, See Figure 18	25°C	5 V	0.5	5	12	ns
				Full	4.5 V to 5.5 V	0.5		14	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 22	25°C	5 V		110		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 16	25°C	5 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 16	25°C	5 V		14.5		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 16	25°C	5 V		14.5		pF
Digital input capacitance	C_I	V_I = V_+ or GND,	See Figure 16	25°C	5 V		3.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 19	25°C	5 V		371		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 20	25°C	5 V		–61		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 21	25°C	5 V		–61		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 23	25°C	5 V		0.06		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	5.5 V		0.01	0.15	μA
				Full				1.2	

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Electrical Characteristics for 3.3-V Supply

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
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ –50 mA			3.6 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –24 mA,	Switch ON, See Figure 14	25°C	3 V		8.9	14	Ω
				Full				18	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 24 mA	Switch ON, See Figure 14	25°C	3 V		5.4	8	Ω
				Full				10	
		V_{NO} or V_{NC} = 3 V, I_{COM} = –24 mA		25°C			7.4	12	
				Full				15	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 2.1 V, I_{COM} = –24 mA,	Switch ON, See Figure 14	25°C	3 V		0.1	0.2	Ω
				Full				0.2	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –24 mA,	Switch ON, See Figure 14	25°C	3 V		2.8	4	Ω
				Full				7	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0	Switch OFF, See Figure 15	25°C	3.6 V		0.5	10	nA
				Full				100	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 16	25°C	3.6 V		0.5	10	nA
				Full				100	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 16	25°C	3.6 V		0.5	10	nA
				Full				100	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.7$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.3$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	3.6 V		0.1	10	nA
				Full				20	

PRODUCT PREVIEW

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}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	3.3 V	1	4.7	9.0	ns
				Full	3 V to 3.6 V	1		10.0	
Turn-off time	t_{OFF}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	3.3 V	1	3.2	6.3	ns
				Full	3 V to 3.6 V	1		7.0	
Output voltage during undershoot	V_{OUTU}	See Figure 24				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 24					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, R_L = 50 Ω,	C_L = 50 pF, See Figure 18	25°C	3.3 V	0.5	7	17	ns
				Full	3 V to 3.6 V	0.5		19.5	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 22	25°C	3.3 V		75		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 16	25°C	3.3 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 16	25°C	3.3 V		14.5		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 16	25°C	3.3 V		14.5		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 16	25°C	3.3 V		3.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 19	25°C	3.3 V		370		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 20	25°C	3.3 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 21	25°C	3.3 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 23	25°C	3.3 V		0.1		%
Supply									
Positive supply current	I_+	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	3.6 V		0.05	0.5	μA
				Full				0.75	

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Electrical Characteristics for 2.5-V Supply

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
Voltage undershoot	V_{IKU}	0 mA ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ –50 mA			2.7 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –8 mA,	Switch ON, See Figure 14	25°C	2.3 V		13.9	30	Ω
				Full				35	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 8 mA	Switch ON, See Figure 14	25°C	2.3 V		6.6	8.5	Ω
				Full				12	
		V_{NO} or V_{NC} = 2.3 V, I_{COM} = –8 mA		25°C			8.9	18	
				Full				25	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.6 V, I_{COM} = –8 mA,	Switch ON, See Figure 14	25°C	2.3 V		0.05	0.3	Ω
				Full				0.5	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –8 mA,	Switch ON, See Figure 14	25°C	2.3 V		5	15	Ω
				Full				20	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, See Figure 15	25°C	2.7 V		0.1	10	nA
				Full				100	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 16	25°C	2.7 V		0.1	10	nA
				Full				10	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 16	25°C	2.7 V		0.1	10	nA
				Full				100	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.75$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.25$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	2.7 V		5	10	nA
				Full				20	

PRODUCT PREVIEW

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_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	2.5 V	2	6.2	9.6	ns
				Full	2.3 V to 2.7 V	2		12	
Turn-off time	t_{OFF}	V_{COM} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	2.5 V	1.5	4.5	7.0	ns
				Full	2.3 V to 2.7 V	1.5		7.5	
Output voltage during undershoot	V_{OUTU}	See Figure 24					V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 24					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 50 pF, See Figure 18	25°C	2.5 V	0.5	10	25	ns
				Full	2.3 V to 2.7 V	0.5		28.5	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 22	25°C	2.5 V		58		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 16	25°C	2.5 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 16	25°C	2.5 V		14.5		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 16	25°C	2.5 V		14.5		pF
Digital input capacitance	C_I	V_I = V_+ or GND,	See Figure 16	25°C	2.5 V		3.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 19	25°C	2.5 V		367		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 20	25°C	2.5 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 21	25°C	2.5 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 23	25°C	2.5 V		0.15		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	2.7 V		50	100	nA
				Full				550	

Electrical Characteristics for 1.8-V Supply

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
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ –50 mA			1.95 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –4 mA,	Switch ON, See Figure 14	25°C	1.65 V		41.1	60	Ω
				Full				120	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 4 mA	Switch ON, See Figure 14	25°C	1.65 V		9.2	15	Ω
				Full				15	
		V_{NO} or V_{NC} = 1.65 V, I_{COM} = –4 mA		25°C			1.8	40	
				Full				45	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.15 V, I_{COM} = –4 mA,	Switch ON, See Figure 14	25°C	1.65 V		0.1	0.6	Ω
				Full				0.8	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –4 mA,	Switch ON, See Figure 14	25°C	1.65 V		26.5	80	Ω
				Full				100	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, See Figure 15	25°C	1.95 V		0.05	10	nA
				Full				100	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 16	25°C	1.95 V		0.1	10	μA
				Full				100	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 16	25°C	1.95 V		0.1	10	nA
				Full				100	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.75$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.25$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	1.95 V		0.05	1	nA
				Full				20	

PRODUCT PREVIEW

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}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	1.8 V		9.6	23	ns
				Full	1.65 V to 1.95 V			24	
Turn-off time	t_{OFF}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	1.8 V		6.3	10	ns
				Full	1.65 V to 1.95 V			12	
Output voltage during undershoot	V_{OUTU}	See Figure 24					V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 24					V_{OL} + 0.3		V
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, R_L = 50 Ω,	C_L = 50 pF, See Figure 18	25°C	1.8 V	0.5	18	50	ns
				Full	1.65 V to 1.95 V	0.5		55	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 22	25°C	1.8 V		40		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 16	25°C	1.8 V		5.0		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 16	25°C	1.8 V		14.5		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 16	25°C	1.8 V		14.5		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 16	25°C	1.8 V		3.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 19	25°C	1.8 V		369		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 20	25°C	1.8 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 21	25°C	1.8 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 23	25°C	1.8 V		0.4		%
Supply									
Positive supply current	I_+	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	1.95 V		0.1	50	nA
				Full				400	

PRODUCT PREVIEW

PIN DESCRIPTION

PIN NO.	NAME	DESCRIPTION
1	IN1	Digital control to connect COM to NO or NC
2	NO1	Normally open
3	GND	Digital ground
4	NO2	Normally open
5	IN2	Digital control to connect COM to NO or NC
6	COM2	Common
7	NC2	Normally closed
8	V+	Power supply
9	NC1	Normally closed
10	COM1	Common

PARAMETER DESCRIPTION

SYMBOL	DESCRIPTION
V_{COM}	Voltage at COM
V_{NC}	Voltage at NC
V_{NO}	Voltage at NO
r_{on}	Resistance between COM and NC or COM and NO ports when the channel is ON
Δr_{on}	Difference of r_{on} between channels
$r_{on(flat)}$	Difference between the maximum and minimum value of r_{on} in a channel over the specified range of conditions
$I_{NC(OFF)}$	Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state under worst-case input and output conditions
$I_{NO(OFF)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the OFF state under worst-case input and output conditions
$I_{NC(ON)}$	Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) being open
$I_{NO(ON)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) being open
$I_{COM(ON)}$	Leakage current measured at the COM port, with the corresponding channel (NO to COM or NC to COM) in the ON state and the output (NC or NO) being open
V_{IH}	Minimum input voltage for logic high for the control input (IN)
V_{IL}	Minimum input voltage for logic low for the control input (IN)
V_{IN}	Voltage at control input (IN)
I_{IH}, I_{IL}	Leakage current measured at control input (IN)
t_{ON}	Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog outputs (COM/NC/NO) signal when the switch is turning ON.
t_{OFF}	Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog outputs (COM/NC/NO) signal when the switch is turning OFF.
t_{BBM}	Break-before-make time. This parameter is measured under the specified range of conditions and by the propagation delay between the output of two adjacent analog channels (NC and NO) when the control signal changes state.
Q_C	Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC, NO, or COM) output. This is measured in coulombs =) and measured by the total charge induced due to switching of the control input. Charge injection, $Q_C = C_L \times \Delta V_O$, C_L is the load capacitance and ΔV_O is the change in analog output voltage.
$C_{NC(OFF)}$	Capacitance at the NC port when the corresponding channel (NC to COM) is OFF
$C_{NO(OFF)}$	Capacitance at the NO port when the corresponding channel (NC to COM) is OFF
$C_{NC(ON)}$	Capacitance at the NC port when the corresponding channel (NC to COM) is ON
$C_{NO(ON)}$	Capacitance at the NO port when the corresponding channel (NC to COM) is ON
$C_{COM(ON)}$	Capacitance at the COM port when the corresponding channel (COM to NC or COM to NO) is ON
C_I	Capacitance of control input (IN)
O_{ISO}	OFF isolation of the switch is a measurement of OFF-state switch impedance. This is measured in dB in a specific frequency, with the corresponding channel (NC to COM or NO to COM) in the OFF state.

PRODUCT PREVIEW

PARAMETER DESCRIPTION (continued)

SYMBOL	DESCRIPTION
X_{TALK}	Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel (NC to NO or NO to NC). This is measured at a specific frequency and in dB.
BW	Bandwidth of the switch. This is the frequency where the gain of an ON channel is –3 dB below the dc gain.
THD	Total harmonic distortion is defined as the ratio of the root mean square (RMS) value of the second, third, and higher harmonics to the magnitude of fundamental harmonic.
I+	Static power-supply current with the control (IN) pin at V+ or GND
V_{OUTU}	Output voltage during an undershoot event. This is measured by turning off a specific channel and applying an undershoot voltage at the input of the switch.
V_{OUTO}	Output voltage during an overshoot event. This is measured by turning off a specific channel and applying an overshoot voltage at the input of the switch.

PRODUCT PREVIEW

TYPICAL CHARACTERISTICS

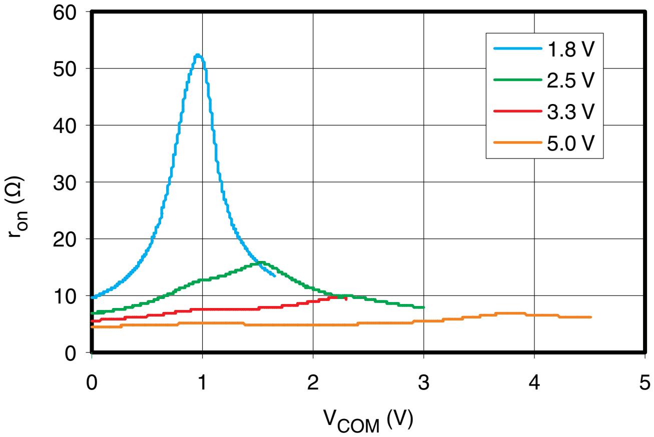


Figure 1. r_{ON} vs V_{COM}

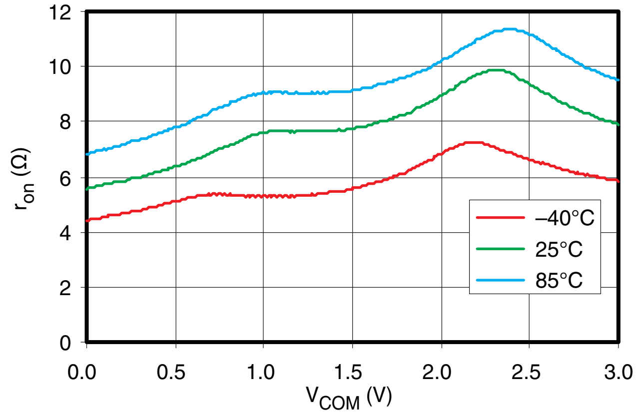


Figure 2. r_{ON} vs V_{COM} (V_+ = 3.3 V)

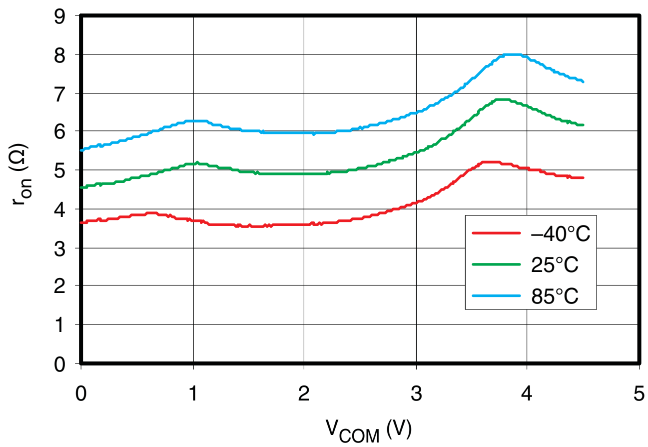


Figure 3. r_{ON} vs V_{COM} (V_+ = 5 V)

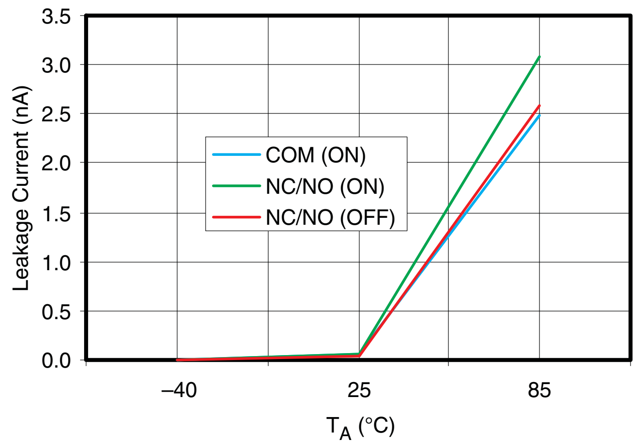


Figure 4. Leakage Current vs Temperature

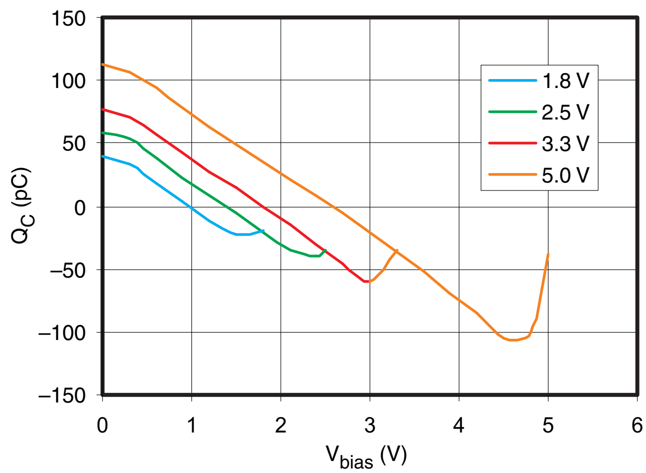


Figure 5. Charge Injection vs V_{COM}

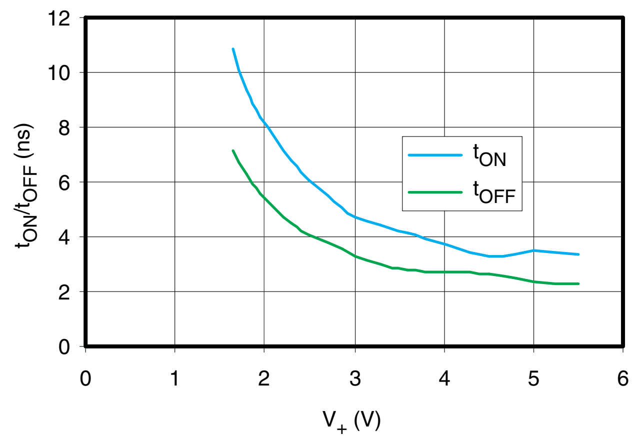


Figure 6. t_{ON} and t_{OFF} vs Supply Voltage

PRODUCT PREVIEW

TYPICAL CHARACTERISTICS (continued)

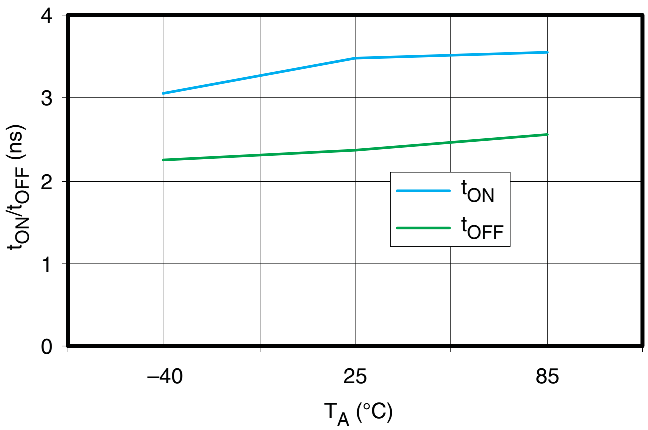


Figure 7. t_{ON} and t_{OFF} vs Temperature

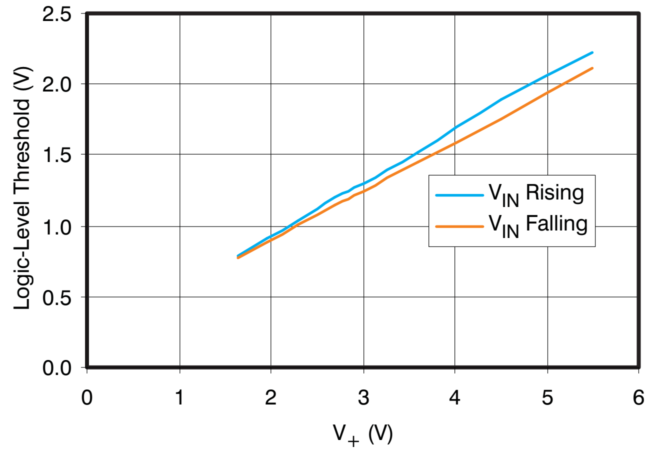


Figure 8. Logic-Level Threshold

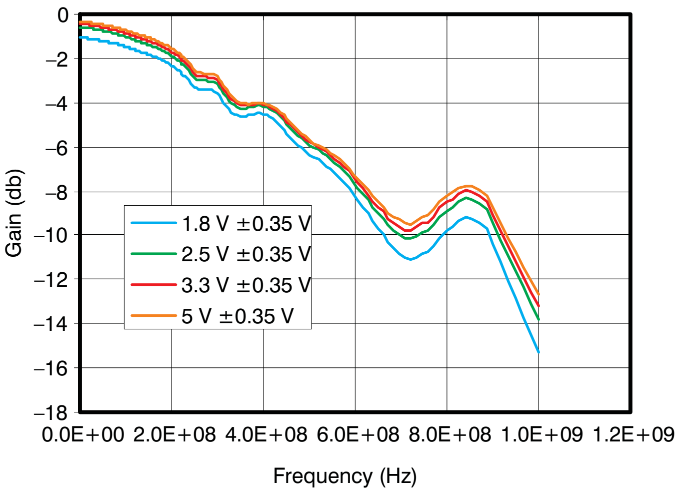


Figure 9. Bandwidth (BW)

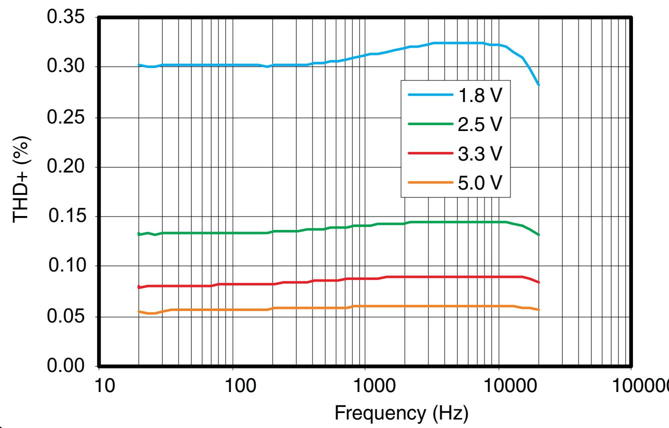


Figure 10. Total Harmonic Distortion (THD) vs Frequency

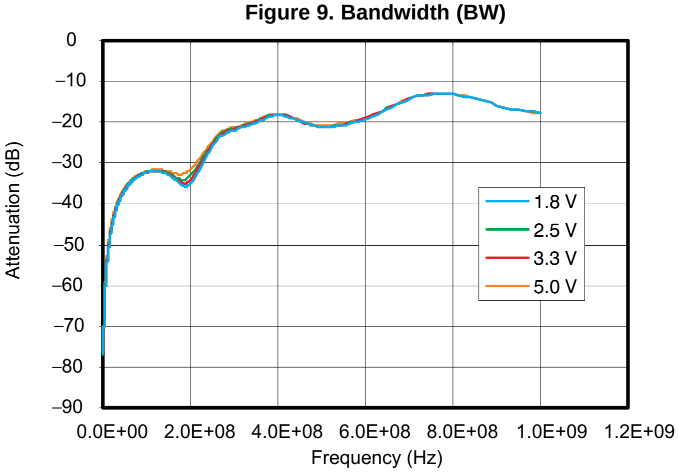


Figure 11. Off Isolation

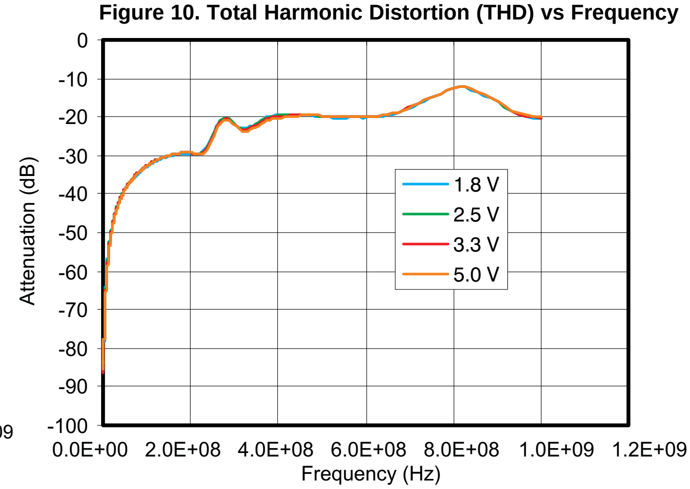


Figure 12. Crosstalk

TYPICAL CHARACTERISTICS (continued)

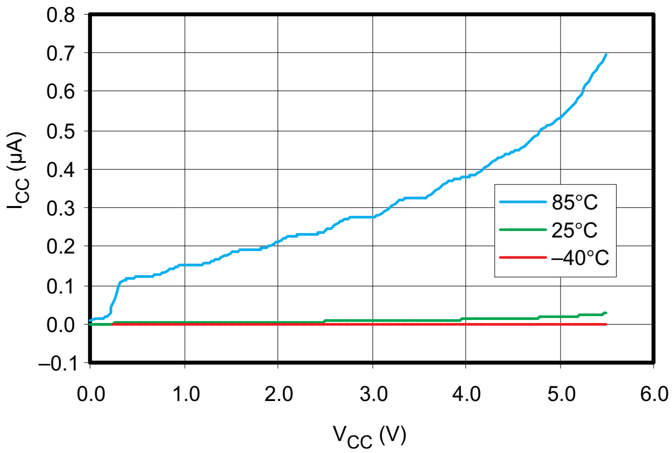


Figure 13. Supply Current vs Supply Voltage

PRODUCT PREVIEW

PARAMETER MEASUREMENT INFORMATION

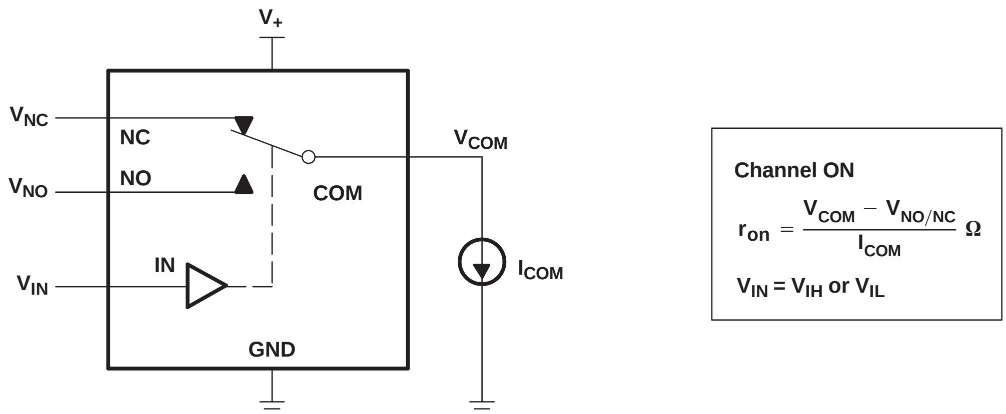


Figure 14. ON-State Resistance (r_{on})

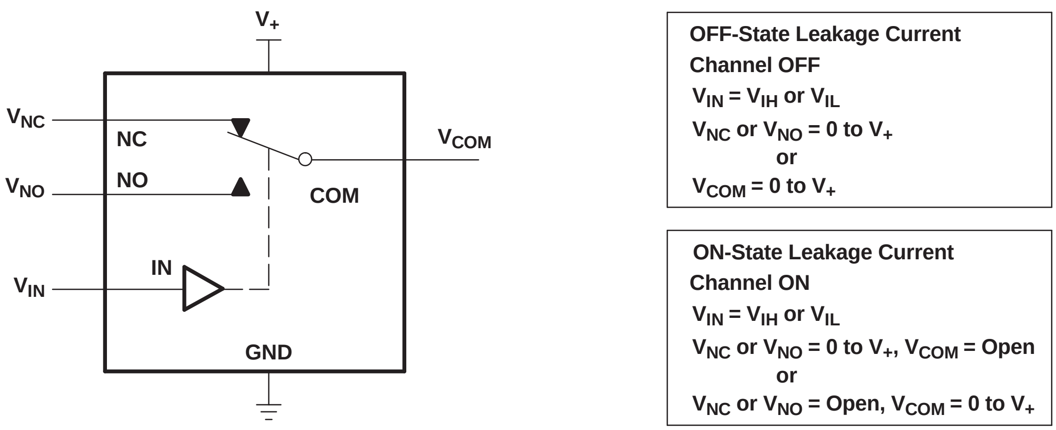


Figure 15. ON- and OFF-State Leakage Current ($I_{COM(ON)}$, $I_{NC(OFF)}$, $I_{NO(OFF)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

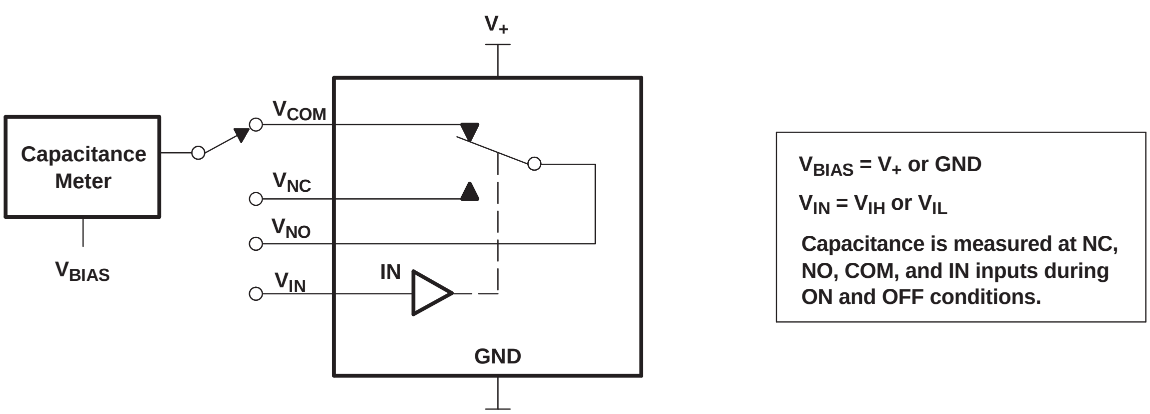
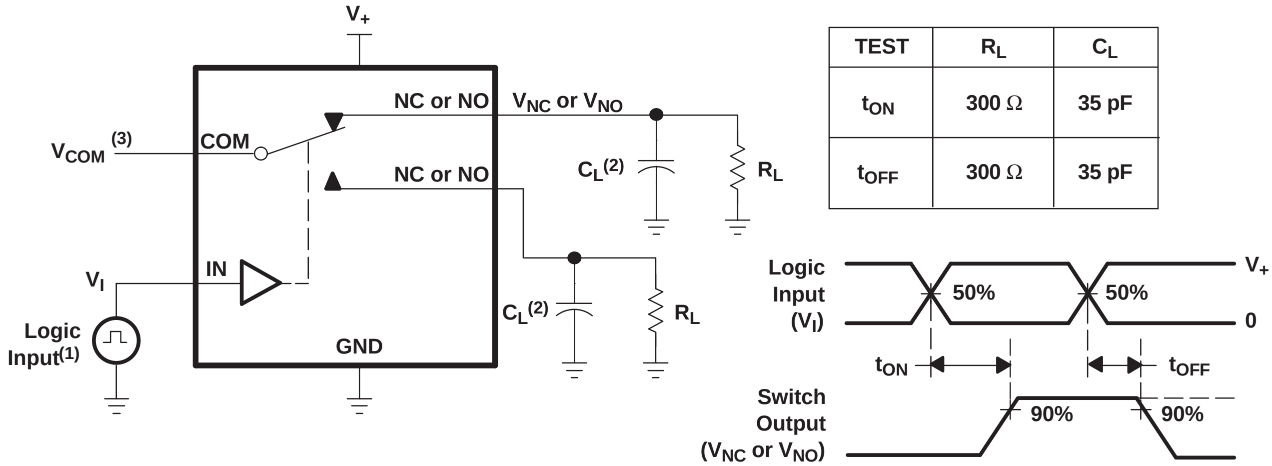


Figure 16. Capacitance (C_{IN}, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)



TEST	R_L	C_L
t_{ON}	300 Ω	35 pF
t_{OFF}	300 Ω	35 pF

(1) 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.
(2) C_L includes probe and jig capacitance.
(3) See Electrical Characteristic for V_{COM}.

Figure 17. Turn-On (t_{ON}) and Turn-Off (t_{OFF}) Time

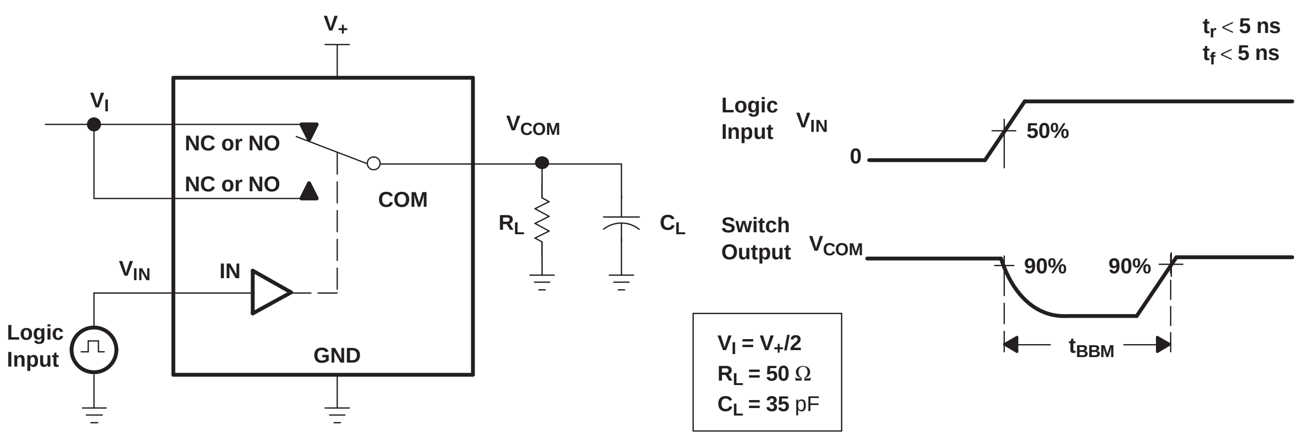


Figure 18. Break-Before-Make (t_{BBM}) Time

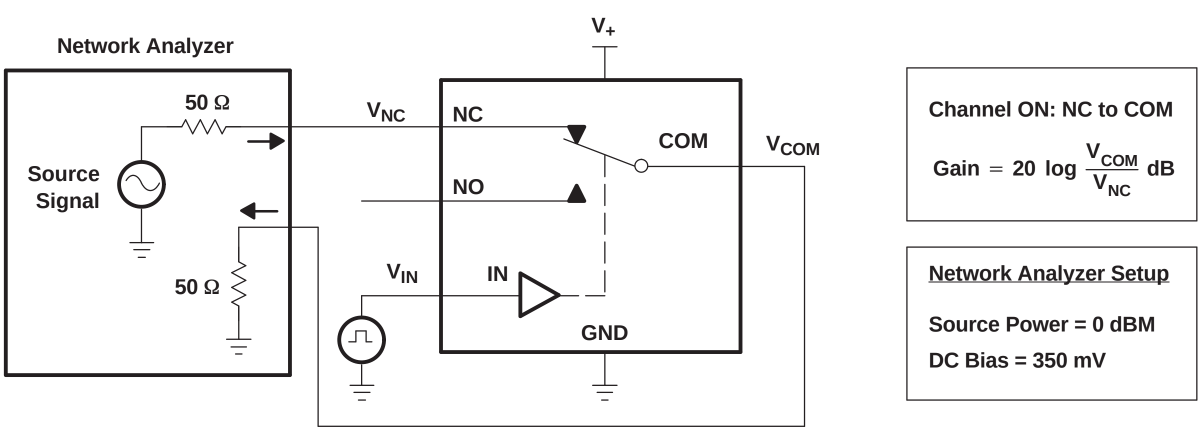


Figure 19. Frequency Response (BW)

PARAMETER MEASUREMENT INFORMATION (continued)

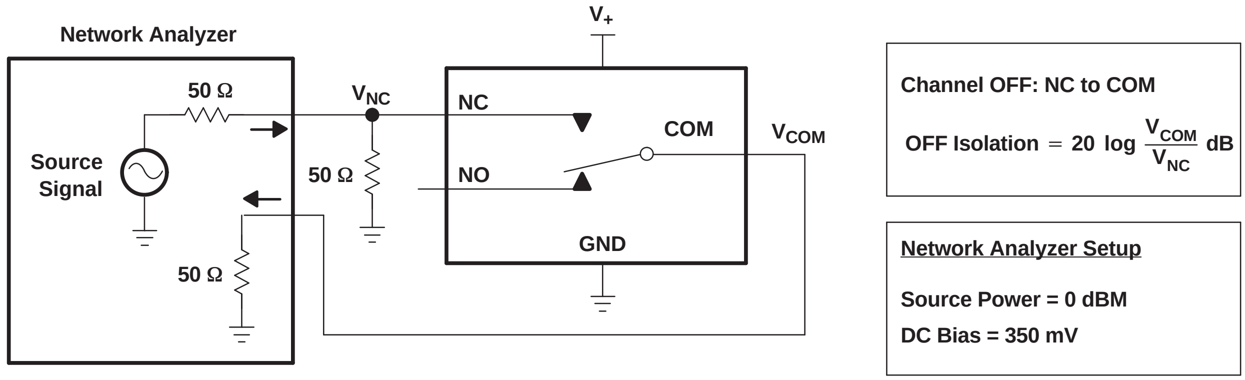


Figure 20. OFF Isolation (O_{ISO})

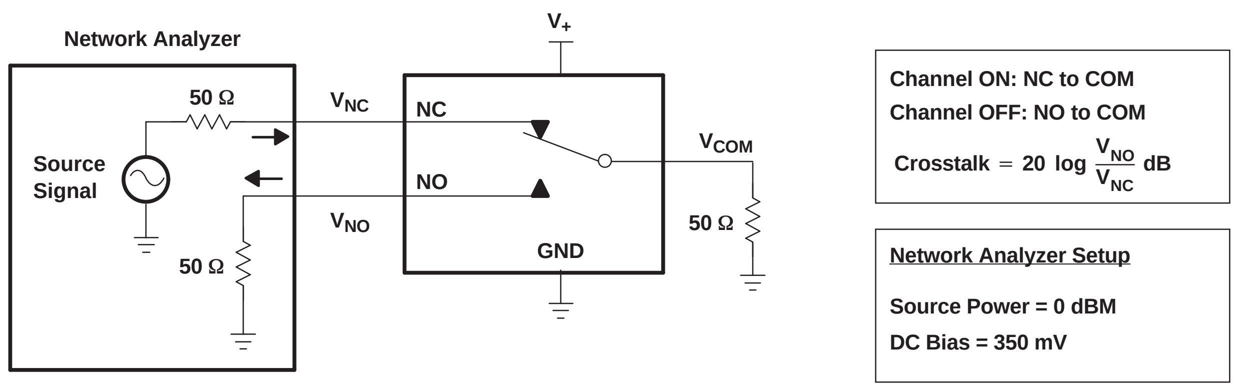


Figure 21. Crosstalk (X_{TALK})

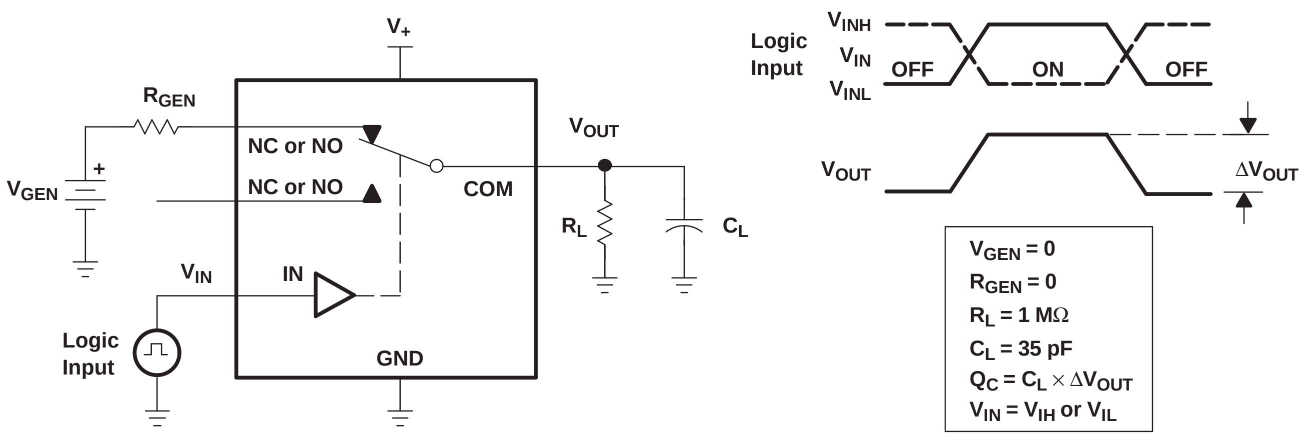


Figure 22. Charge Injection (Q_C)

PRODUCT PREVIEW

PARAMETER MEASUREMENT INFORMATION (continued)

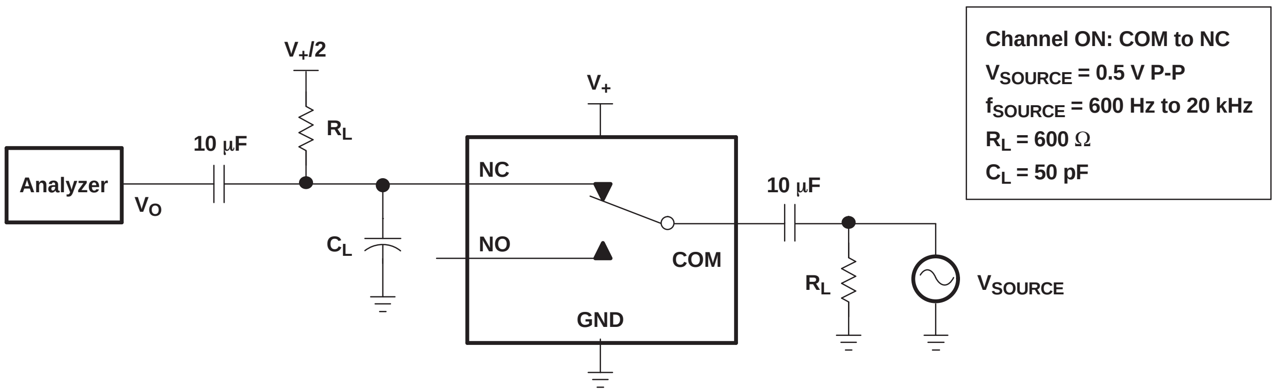
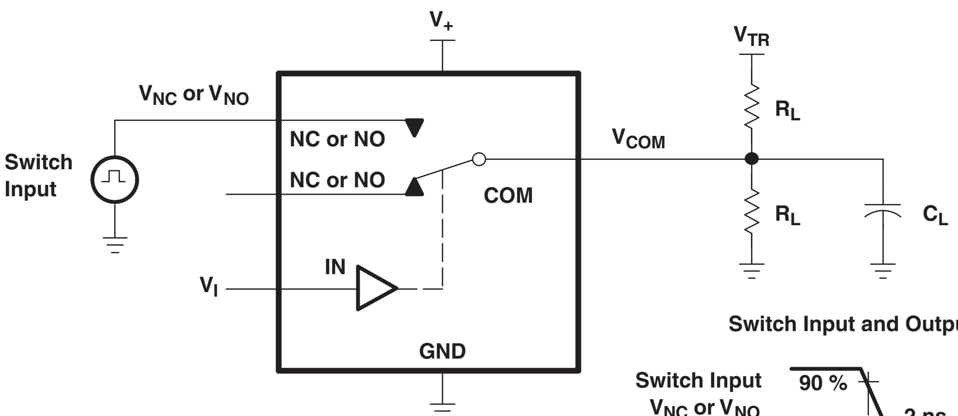
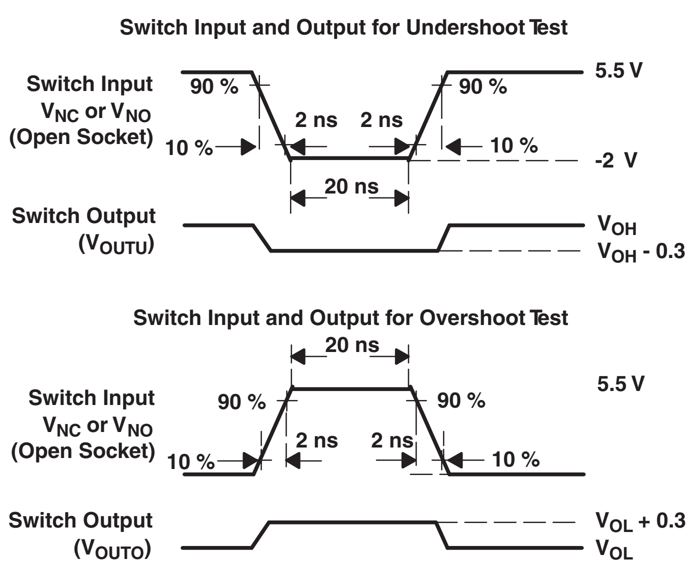


Figure 23. Total Harmonic Distortion (THD)





TEST	R_L	C_L	V_{TR}	V_I
V_{OUTU}	100 kΩ	10 pF	7 V	V_+ or GND Switch OFF
V_{OUTO}	100 kΩ	10 pF	GND	V_+ or GND Switch OFF

Figure 24. Undershoot and Overshoot Test

PRODUCT PREVIEW

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TS5A623157DGSR	ACTIVE	MSOP	DGS	10	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS5A623157DGSRG4	ACTIVE	MSOP	DGS	10	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS5A623157RSER	PREVIEW	QFN	RSE	10	3000	TBD	Call TI	Call TI

[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.

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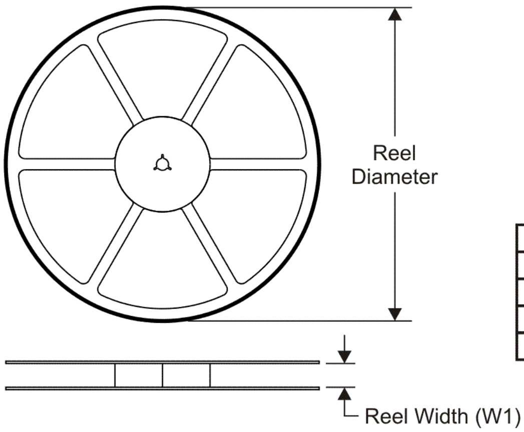
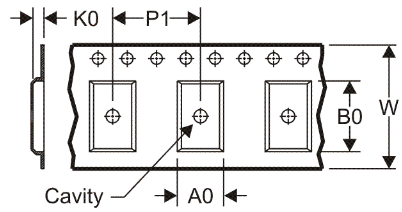
TAPE AND REEL INFORMATION

REEL DIMENSIONS

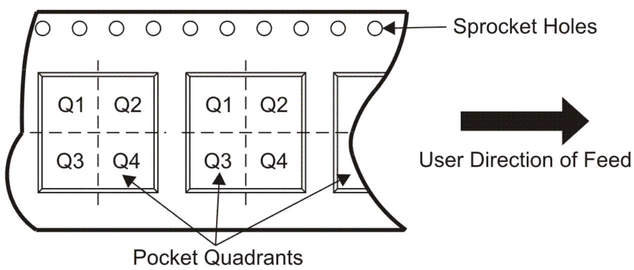


TAPE DIMENSIONS



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

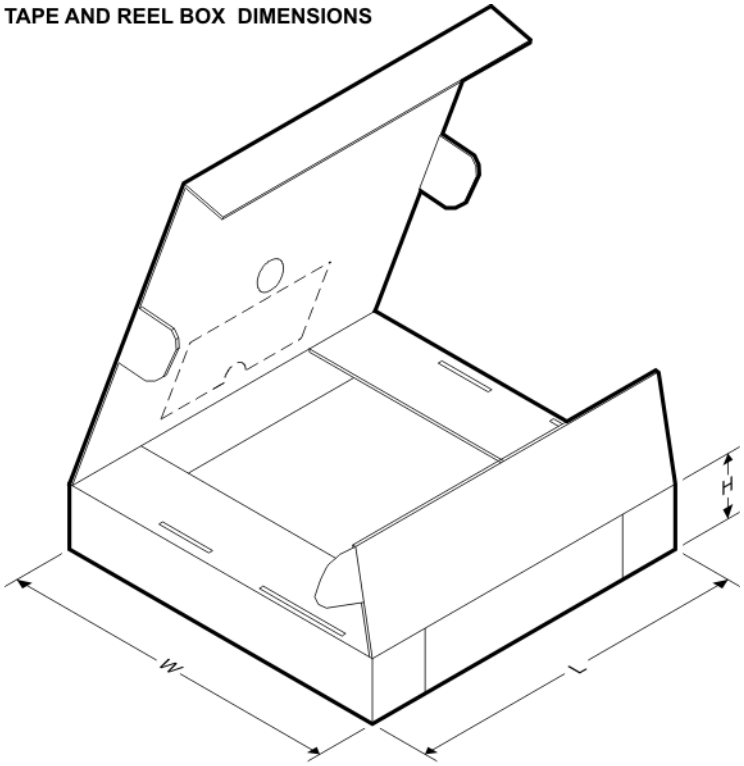
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TS5A623157DGSR	MSOP	DGS	10	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1

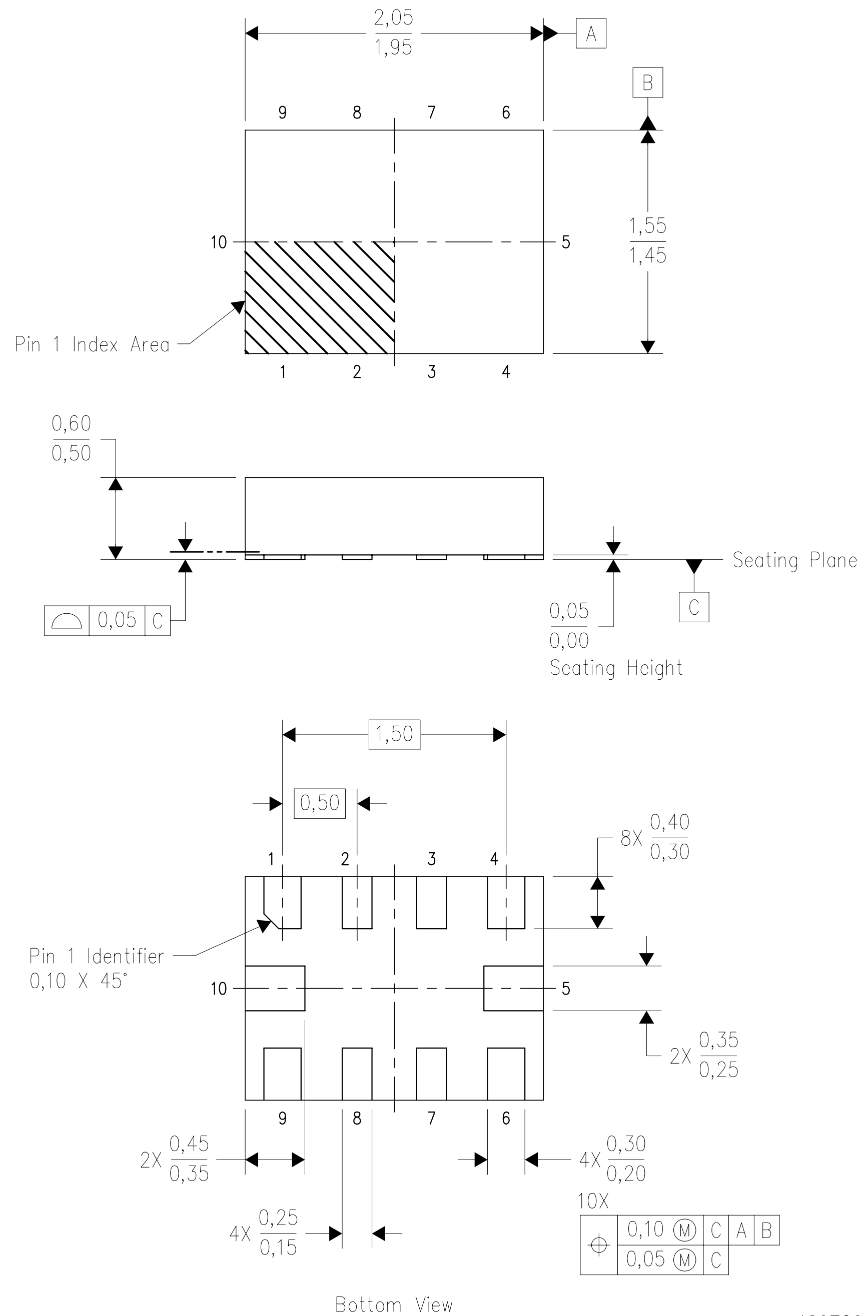
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A623157DGSR	MSOP	DGS	10	2500	358.0	335.0	35.0

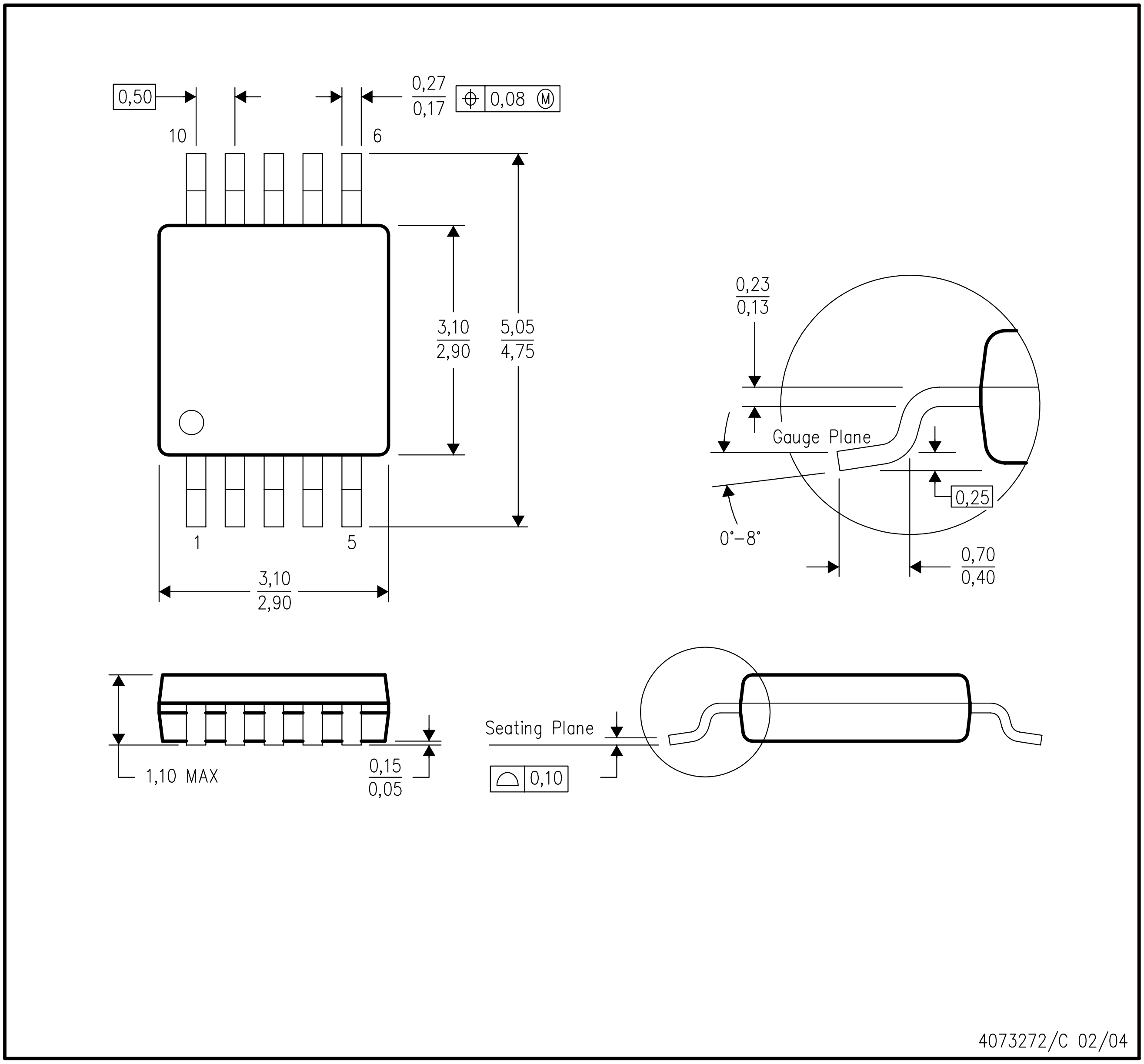
RSE (R-PQFP-N10) PLASTIC QUAD FLATPACK



4207268-3/C 01/2008

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 UEFD.

DGS (S-PDSO-G10) PLASTIC SMALL-OUTLINE PACKAGE



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.
- D. Falls within JEDEC MO-187 variation BA.

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