1-Ω SPDT ANALOG SWITCH

Check for Samples: TS5A3159-Q1

FEATURES

- **Qualified for Automotive Applications**
- **AEC-Q100 Qualified with the Following Results:**
  - **Device Temperature Grade 1: –40°C to 125°C Ambient Operating Temperature Range**
  - **Device HBM ESD Classification Level H2**
  - **Device CDM ESD Classification Level C3B**
- **Specified Break-Before-Make Switching**
- **Low ON-State Resistance (1 Ω)**
- **Control Inputs are 5-V Tolerant**
- **Low Charge Injection**
- **Excellent ON-Resistance Matching**
- **Low Total Harmonic Distortion**
- **1.65-V to 5.5-V Single-Supply Operation**

APPLICATIONS

- **Cell Phones**
- **PDAs**
- **Portable Instrumentation**

DESCRIPTION

The TS5A3159-Q1 is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance and an excellent ON-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.

SOT-23 PACKAGE
(TOP VIEW)

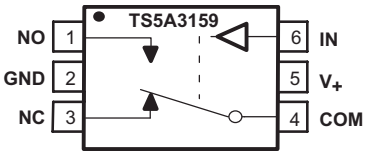


Table 1. FUNCTION TABLE

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

Table 2. Summary of Characteristics

V_+ = 5 V and T_A = 25°C

Configuration	2:1 Multiplexer / Demultiplexer (1 × SPDT)
Number of channels	1
ON-state resistance (r_{on})	1.3 Ω
ON-state resistance match (Δr_{on})	0.1 Ω
ON-state resistance flatness ($r_{on(flat)}$)	0.15 Ω
Turn on/turn off time (t_{ON} / t_{OFF})	20 ns / 15 ns
Break-before-make time (t_{BBM})	12 ns
Charge injection (Q_C)	36 pC
Bandwidth (BW)	100 MHz
OFF isolation (O_{ISO})	–65 dB at 1 MHz
Crosstalk (X_{TALK})	–65 dB at 1 MHz
Total harmonic distortion (THD)	0.01%
Leakage current ($I_{NO(OFF)}$ / $I_{NC(OFF)}$)	±6 nA
Package option	6-pin DBV

ORDERING INFORMATION(1)

T_A	ORDERABLE PART NUMBER(2)	TOP-SIDE MARKING
–40°C to 125°C	TS5A3159QDBVRQ1	UAAQ

(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 web site at www.ti.com.

ABSOLUTE MAXIMUM RATINGS(1)

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

			MIN	MAX	UNIT
V_+	Supply voltage range(2)		–0.5	6.5	V
V_{NO}, V_{COM}	Analog voltage range(2)(3)(4)		–0.5	V_+ + 0.5	V
I_I / OK	Analog port diode current	V_{NO}, V_{COM} < 0 or V_{NO}, V_{COM} > V_+		±50	mA
I_{NO}, I_{COM}	ON−state switch current	V_{NO}, V_{COM} = 0 to V_+		±200	mA
	ON−state peak switch current(5)			±400	mA
V_{IN}	Digital input voltage range(2)(3)		−0.5	6.5	V
I_{IK}	Digital input clamp current	V_{IN} < 0		−50	mA
	Continuous current through V_+ or GND			±100	mA
T_{stg}	Storage temperature range		–65	150	°C
ESD Rating	Human body model (HBM) AEC-Q100 classification level H2			2	kV
	Charged device model (CDM) AEC-Q100 classification level C3B			750	V

(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) This value is limited to 5.5 V maximum.
(5) Pulse at 1 ms duration < 10% duty cycle.

THERMAL INFORMATION

THERMAL METRIC(1)		TS5A3159-Q1 DBV (6 PINS)	UNIT
θ_{JA}	Junction-to-ambient thermal resistance	192.9	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	133.3	
θ_{JB}	Junction-to-board thermal resistance	37.6	
ψ_{JT}	Junction-to-top characterization parameter	38.9	
ψ_{JB}	Junction-to-board characterization parameter	37.1	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	N/A	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

Electrical Characteristics for 5-V Supply

V_+ = 4.5 V to 5.5 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
Analog Switch									
V_{COM}, V_{NO},V_{NC}	Analog signal range					0		V_+	V
r_{peak}	Peak ON resistance	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −30 mA	Switch ON, See Figure 11	25°C	4.5 V		1	1.5	Ω
				Full				1.5	
r_{on}	ON-state resistance	V_{NO} or V_{NC} = 2.5 V, I_{COM} = −30 mA	Switch ON, See Figure 11	25°C	4.5 V		0.75	1.3	Ω
				Full				1.3	
Δr_{on}	ON-state resistance match between channels	V_{NO} or V_{NC} = 2.5 V, I_{COM} = −30 mA	Switch ON, See Figure 11	25°C	4.5 V		0.1		Ω
$r_{on(flat)}$	ON-state resistance flatness	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −30 mA	Switch ON, See Figure 11	25°C	4.5 V		0.233		Ω
		V_{NO} or V_{NC} = 1 V, 1.5 V, 2.5 V, I_{COM} = −30 mA		25°C			0.15		
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO OFF leakage current	V_{NC} or V_{NO} = 4.5 V, V_{COM} = 0	Switch OFF, See Figure 12	25°C	5.5 V	−6	0.2	6	nA
				Full		−150		150	
$I_{NC(ON)}$, $I_{NO(ON)}$	NC, NO ON leakage current	V_{NC} or V_{NO} = 4.5 V, VCOM = Open	Switch ON, See Figure 13	25°C	5.5 V	−6	2.8	6	nA
				Full		−150		150	
$I_{COM(ON)}$	COM ON leakage current	V_{NC} or V_{NO} = 4.5 V or Open, V_{COM} = 4.5 V	Switch ON, See Figure 13	25°C	5.5 V	−8	0.47	8	nA
				Full		−150		150	
Digital Inputs (IN)									
V_{IH}	Input logic high			Full		2.4		5.5	V
V_{IL}	Input logic low			Full		0		0.8	V
I_{IH}, I_{IL}	Input leakage current	V_{IN} = 5.5 V or 0		Full	5.5 V	−1		1	µA
Dynamic									
t_{ON}	Turn-on time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	4.5 V to 5.5 V		20	35	ns
				Full				40	
t_{OFF}	Turn-off time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	4.5 V to 5.5 V		15	20	ns
				Full				35	
t_{BBM}	Break-before-make time	V_{NC} = V_{NO} = V_+ / 2, R_L = 50 Ω,	C_L = 35 pF, See Figure 16	25°C	4.5 V to 5.5 V	1	12	14.5	ns
				Full		1			
Q_C	Charge injection	C_L = 1 nF, V_{GEN} = 0 V,	See Figure 20	25°C	5 V		36		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 14	25°C	5 V		23		pF

(1) T_A = 25°C

Electrical Characteristics for 5-V Supply (continued)

V_+ = 4.5 V to 5.5 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 14	25°C	5 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_+ or GND, Switch ON,	See Figure 14	25°C	5 V		84		pF
C_{IN}	Digital input capacitance	V_{IN} = V_+ or GND,	See Figure 14	25°C	5 V		2.1		pF
BW	Bandwidth	R_L = 50 Ω, Switch ON,	See Figure 17	25°C	5 V		100		MHz
O_{ISO}	OFF isolation	R_L = 50 Ω, f = 1 MHz,	Switch OFF, See Figure 18	25°C	5 V		–65		dB
X_{TALK}	Crosstalk	R_L = 50 Ω, f = 1 MHz,	Switch ON, See Figure 19	25°C	5 V		–65		dB
THD	Total harmonic distortion	R_L = 600 Ω, C_L = 50 pF,	f = 600 Hz to 20 kHz, See Figure 21	25°C	5 V		0.01		%
Supply									
I_+	Positive supply current	V_{IN} = V_+ or GND,	Switch ON or OFF	25°C	5.5 V			0.1	µA
				Full				0.5	

Electrical Characteristics for 3.3-V Supply

V_+ = 3 V to 3.6 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
Analog Switch									
V_{COM}, V_{NO}, V_{NC}	Analog signal range					0		V_+	V
r_{peak}	Peak ON-state resistance	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −24 mA,	Switch ON, See Figure 11	25°C	3 V		1.35	2.2	Ω
				Full				2.2	
r_{on}	ON-state resistance	V_{NO} or V_{NC} = 2 V, I_{COM} = −24 mA,	Switch ON, See Figure 11	25°C	3 V		1.15	1.8	Ω
				Full				1.8	
Δr_{on}	ON-state resistance match between channels	V_{NO} or V_{NC} = 2 V, 0.8 V, I_{COM} = −24 mA,	Switch ON, See Figure 11	25°C	3 V		0.11		Ω
$r_{on(flat)}$	ON-state resistance flatness	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −24 mA,	Switch ON, See Figure 11	25°C	3 V		0.225		Ω
		V_{NO} or V_{NC} = 2 V, 0.8 V, I_{COM} = −24 mA,		25°C			0.25		
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO OFF leakage current	V_{NC} or V_{NO} = 3 V, V_{COM} = 0,	Switch OFF, See Figure 12	25°C	3.6 V		0.2		nA
$I_{NC(ON)}$, $I_{NO(ON)}$	NC, NO ON leakage current	V_{NC} or V_{NO} = 3 V, V_{COM} = Open,	Switch ON, See Figure 13	25°C	3.6 V		2.8		nA
$I_{COM(ON)}$	COM ON leakage current	V_{NC} or V_{NO} = 3 V or Open, V_{COM} = 3 V,	Switch ON, See Figure 13	25°C	3.6 V		0.47		nA
Digital Inputs (IN)									
V_{IH}	Input logic high			Full		2		5.5	V
V_{IL}	Input logic low			Full		0	0.6		V
I_{IH}, I_{IL}	Input leakage current	V_{IN} = 5.5 V or 0		Full	3.6 V	–1		1	µA
Dynamic									
t_{ON}	Turn-on time	V_{COM} = V_+, R_L = 50 Ω	C_L = 35 pF, See Figure 15	25°C	3 V to 3.6 V		30	40	ns
				Full				55	
t_{OFF}	Turn-off time	V_{COM} = V_+, R_L = 50 Ω	C_L = 35 pF, See Figure 15	25°C	3 V to 3.6 V		20	25	ns
				Full				40	

(1) T_A = 25°C

Electrical Characteristics for 3.3-V Supply (continued)

V_+ = 3 V to 3.6 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
t_{BBM}	Break-before-make time	V_{NC} = V_{NO} = V_+ / 2, R_L = 50 Ω	C_L = 35 pF, See Figure 16	25°C	3 V to 3.6 V	1	21	29	ns
				Full		1			
Q_C	Charge injection	C_L = 1 nF, V_{GEN} = 0 V	See Figure 20	25°C	3.3 V		20		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch OFF	See Figure 14	25°C	3.3 V		23		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch ON	See Figure 14	25°C	3.3 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_+ or GND, Switch ON	See Figure 14	25°C	3.3 V		84		pF
C_{IN}	Digital input capacitance	V_{IN} = V_+ or GND	See Figure 14	25°C	3.3 V		2.1		pF
BW	Bandwidth	R_L = 50 Ω, Switch ON	See Figure 17	25°C	3.3 V		100		MHz
O_{ISO}	OFF isolation	R_L = 50 Ω, f = 1 MHz	Switch OFF, See Figure 18	25°C	3.3 V		–65		dB
X_{TALK}	Crosstalk	R_L = 50 Ω, f = 1 MHz	Switch ON, See Figure 19	25°C	3.3 V		–65		dB
THD	Total harmonic distortion	R_L = 600 Ω, C_L = 50 pF	f = 600 Hz to 20 kHz, See Figure 21	25°C	3.3 V		0.015		%
Supply									
I_+	Positive supply current	V_{IN} = V_+ or GND	Switch ON or OFF	25°C	3.6 V			0.1	μA
				Full				0.5	

Electrical Characteristics for 2.5-V Supply

V_+ = 2.3 V to 2.7 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
Analog Switch									
V_{COM}, V_{NO},V_{NC}	Analog signal range					0		V_+	V
r_{peak}	Peak ON-state resistance	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −8 mA	Switch ON, See Figure 11	25°C	2.5 V		1.7	2.9	Ω
				Full				2.9	
r_{on}	ON-state resistance	V_{NO} or V_{NC} = 1.8 V, I_{COM} = −8 mA	Switch ON, See Figure 11	25°C	2.5 V		1.45	2.3	Ω
				Full				2.3	
Δr_{on}	ON-state resistance match between channels	V_{NO} or V_{NC} = 0.8 V, 1.8 V, I_{COM} = −8 mA	Switch ON, See Figure 11	25°C	2.5 V		0.7		Ω
$r_{on(flat)}$	ON-state resistance flatness	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −8 mA	Switch ON, See Figure 11	25°C	2.5 V		0.5		Ω
		V_{NO} or V_{NC} = 0.8 V, 1.8 V, I_{COM} = −8 mA		25°C			0.45		
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO Off leakage current	V_{NC} or V_{NO} = 2.3 V, V_{COM} = 0	Switch OFF, See Figure 12	25°C	2.7 V		0.2		nA
$I_{NC(ON)}$, $I_{NO(ON)}$	NC, NO On leakage current	V_{NC} or V_{NO} = 2.3 V, V_{COM} = Open	Switch ON, See Figure 13	25°C	2.7 V		2.8		nA
$I_{COM(ON)}$	COM On leakage current	V_{NC} or V_{NO} = 2.3 V or Open, V_{COM} = 2.3 V	Switch ON, See Figure 13	25°C	2.7 V		0.47		nA
Digital Inputs (IN)									
V_{IH}	Input logic high			Full		1.8		5.5	V
V_{IL}	Input logic low			Full		0	0.6		V
I_{IH}, I_{IL}	Input leakage current	V_{IN} = 5.5 V or 0		Full	2.7 V	−1		1	μA

(1) T_A = 25°C

Electrical Characteristics for 2.5-V Supply (continued)

V_+ = 2.3 V to 2.7 V and T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
Dynamic									
t_{ON}	Turn-on time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	2.3 V to 2.7 V		40	55	ns
				Full				70	
t_{OFF}	Turn-off time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	2.3 V to 2.7 V		30	40	ns
				Full				55	
t_{BBM}	Break-before-make time	V_{NC} = V_{NO} = V_+ / 2, R_L = 50 Ω,	C_L = 35 pF, See Figure 16	25°C	2.3 V to 2.7 V	1	33	39	ns
				Full		1			
Q_C	Charge injection	C_L = 1 nF, V_{GEN} = 0 V,	See Figure 20	25°C	2.5 V		13		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 14	25°C	2.5 V		23		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 14	25°C	2.5 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_+ or GND, Switch ON,	See Figure 14	25°C	2.5 V		84		pF
C_{IN}	Digital input capacitance	V_{IN} = V_+ or GND,	See Figure 14	25°C	2.5 V		2.1		pF
BW	Bandwidth	R_L = 50 Ω, Switch ON,	See Figure 17	25°C	2.5 V		100		MHz
O_{ISO}	OFF isolation	R_L = 50 Ω, f = 1 MHz,	Switch OFF, See Figure 18	25°C	2.5 V		–64		dB
X_{TALK}	Crosstalk	R_L = 50 Ω, f = 1 MHz,	Switch ON, See Figure 19	25°C	2.5 V		–64		dB
THD	Total harmonic distortion	R_L = 600 Ω, C_L = 50 pF,	f = 600 Hz to 20 kHz, See Figure 21	25°C	2.5 V		0.025		%
Supply									
I_+	Positive supply current	V_{IN} = V_+ or GND,	Switch ON or OFF	25°C	2.7 V			0.1	μA
				Full				0.5	

Electrical Characteristics for 1.8-V Supply

V_+ = 1.65 V to 1.95 V and T_A = −40°C to 125°C (unless otherwise noted

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
Analog Switch									
V_{COM}, V_{NO}, V_{NC}	Analog signal range					0		V_+	V
r_{peak}	Peak ON-state resistance	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −2 mA	Switch ON, See Figure 11	25°C	1.8 V		4	5.2	Ω
				Full				5.2	
r_{on}	ON-state resistance	V_{NO} or V_{NC} = 1.5 V, I_{COM} = −2 mA	Switch ON, See Figure 11	25°C	1.8 V		1.7	3.5	Ω
				Full				3.5	
Δr_{on}	ON-state resistance match between channels	V_{NO} or V_{NC} = 0.6 V, 1.5 V, I_{COM} = −2 mA	Switch ON, See Figure 11	25°C	1.8 V		0.7		Ω
				Full			0.7		
$r_{on(flat)}$	ON-state resistance flatness	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −2 mA	Switch ON, See Figure 11	25°C	1.8 V		1.85		Ω
				Full			1.85		
		V_{NO} or V_{NC} = 0.6 V, 1.5 V, I_{COM} = −2 mA		25°C			0.9		
				Full			0.9		
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO Off leakage current	V_{NC} or V_{NO} = 1.65 V, V_{COM} = 0	Switch OFF, See Figure 12	25°C	1.95 V		0.2		nA

(1) T_A = 25°C

Electrical Characteristics for 1.8-V Supply (continued)

V_+ = 1.65 V to 1.95 V and T_A = −40°C to 125°C (unless otherwise noted

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
$I_{NC(ON)}$, $I_{NO(ON)}$	NC, NO On leakage current	V_{NC} or V_{NO} = 1.65 V, V_{COM} = Open	Switch ON, See Figure 13	25°C	1.95 V		2.8		nA
$I_{COM(ON)}$	COM On leakage current	V_{NC} or V_{NO} = 1.65 V or Open, V_{COM} = 1.65 V	Switch ON, See Figure 13	25°C	1.95 V		0.47		nA
Digital Inputs (IN)									
V_{IH}	Input logic high			Full		1.5		5.5	V
V_{IL}	Input logic low			Full		0		0.6	V
I_{IH}, I_{IL}	Input leakage current	V_{IN} = 5.5 V or 0		Full	1.95 V	−1		1	µA
Dynamic									
t_{ON}	Turn-on time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	1.65 V to 1.95 V		65	70	ns
				Full				95	
t_{OFF}	Turn-off time	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 15	25°C	1.65 V to 1.95 V		40	55	ns
				Full				70	
t_{BBM}	Break-before-make time	V_{NC} = V_{NO} = V_+ / 2, R_L = 50 Ω,	C_L = 35 pF, See Figure 16	25°C	1.65 V to 1.95 V	1	60	72	ns
				Full		0.5			
Q_C	Charge injection	C_L = 1 nF, V_{GEN} = 0 V,	See Figure 20	25°C	1.8 V		13		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 14	25°C	1.8 V		23		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 14	25°C	1.8 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_+ or GND, Switch ON,	See Figure 14	25°C	1.8 V		84		pF
C_{IN}	Digital input capacitance	V_{IN} = V_+ or GND,	See Figure 14	25°C	1.8 V		2.1		pF
BW	Bandwidth	R_L = 50 Ω, Switch ON,	See Figure 17	25°C	1.8 V		100		MHz
O_{ISO}	OFF isolation	R_L = 50 Ω, f = 1 MHz,	Switch OFF, See Figure 18	25°C	1.8 V		–63		dB
X_{TALK}	Crosstalk	R_L = 50 Ω, f = 1 MHz,	Switch ON, See Figure 19	25°C	1.8 V		–63		dB
Supply									
I_+	Positive supply current	V_{IN} = V_+ or GND,	Switch ON or OFF	25°C	1.95 V			0.1	µA
				Full				0.5	

TYPICAL CHARACTERISTICS

r_{on} vs V_{COM}

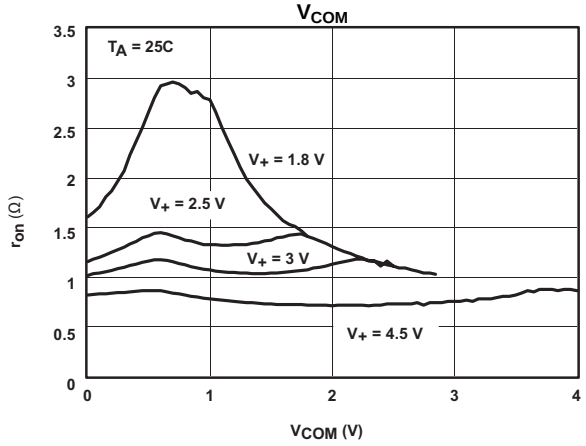


Figure 1.

r_{on} vs V_{COM}

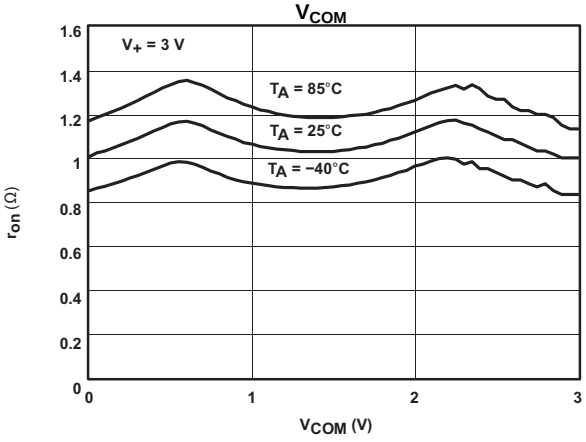


Figure 2.

Leakage Current vs Temperature

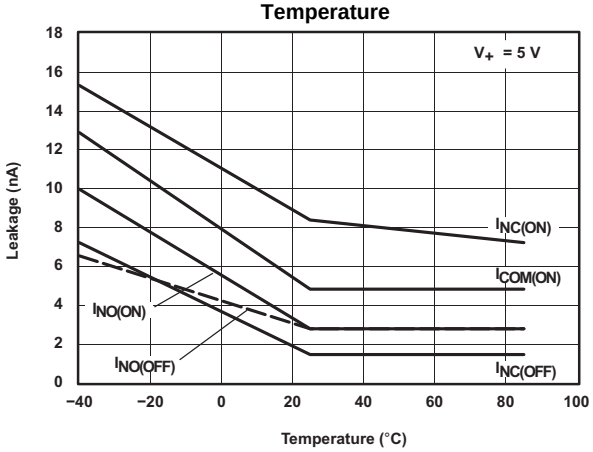


Figure 3.

$t_{ON/OFF}$ vs V_+

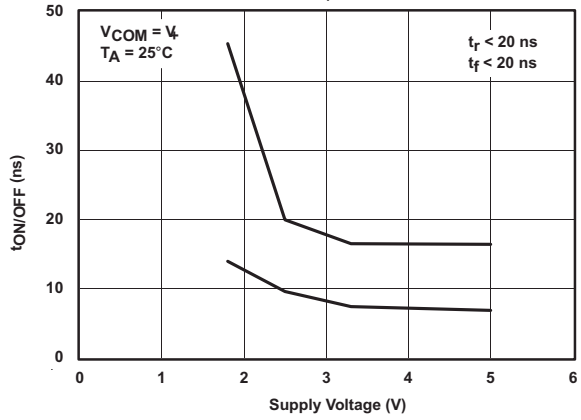


Figure 4.

$t_{ON/OFF}$ vs Temperature

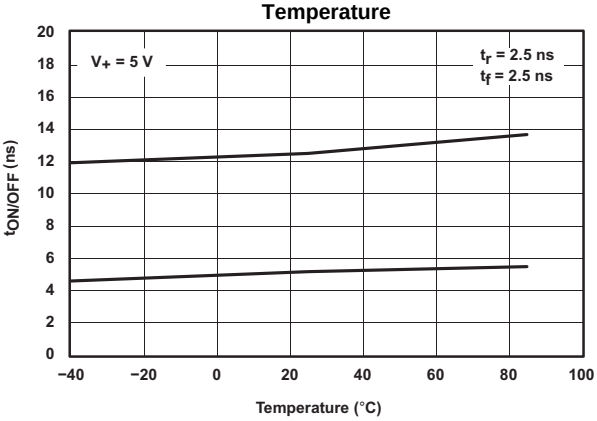


Figure 5.

Logic Threshold vs Power Supply

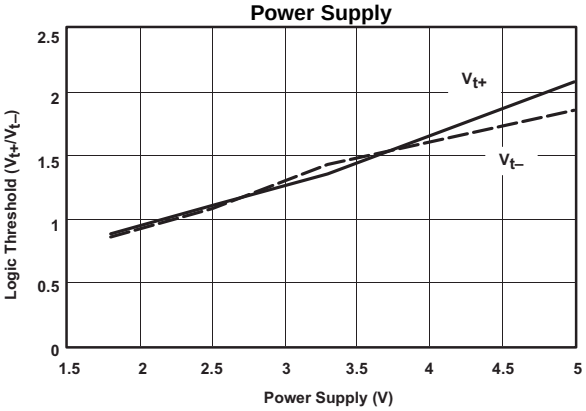


Figure 6.

TYPICAL CHARACTERISTICS (continued)

Frequency Response

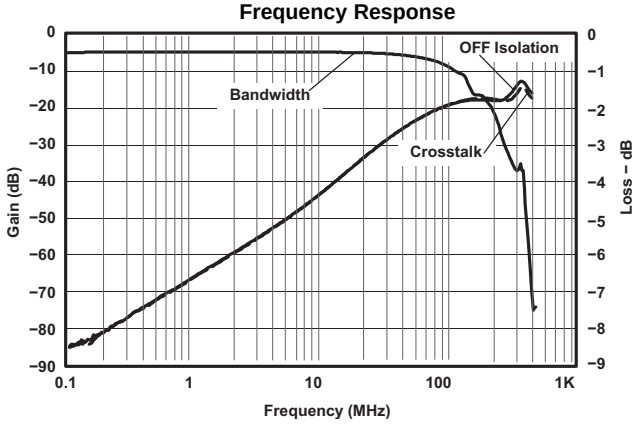


Figure 7.

Power-Supply Current vs Temperature

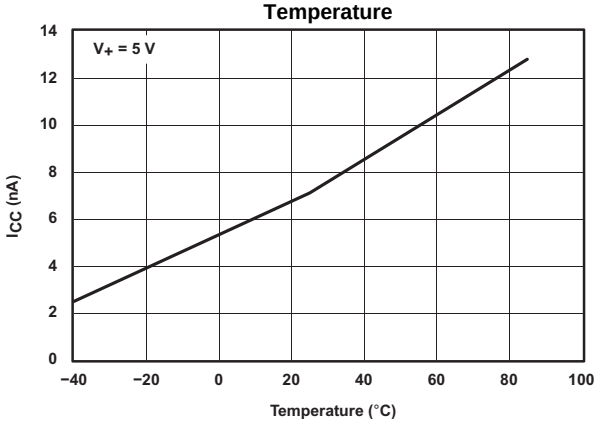


Figure 8.

Total Harmonic Distortion (THD) vs Frequency

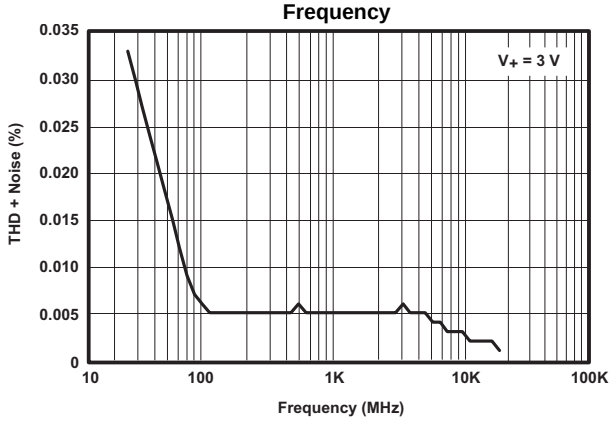


Figure 9.

PIN DESCRIPTION

PIN		DESCRIPTION
NO.	NAME	
1	NO	Normally-open terminal
2	GND	Digital ground
3	NC	Normally-closed terminal
4	COM	Common terminal
5	V_+	Power supply
6	IN	Digital control pin to connect COM terminal to NO or NC terminals

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
r_{peak}	Peak ON-state resistance over a specified voltage range
Δr_{on}	Difference of r_{on} between channels
ron(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 (COM to NO or COM to NC) 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 IN
I_{IH}, I_{IL}	Leakage current measured at 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, or 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, or 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 coulomb (C) 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 (NO 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 (NO 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_{IN}	Capacitance of IN
O_{ISO}	OFF isolation of the switch is a measurement 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.
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 in a specific frequency and in dB.
BW	Bandwidth of the switch. This is the frequency in which the gain of an ON channel is −3 dB below the DC gain.

PARAMETER DESCRIPTION (continued)

SYMBOL	DESCRIPTION
I_+	Static power-supply current with the control (IN) pin at V_+ or GND
ΔI_+	This is the increase in I_+ for each control (IN) input that is at the specified voltage, rather than at V_+ or GND.

PARAMETER MEASUREMENT INFORMATION

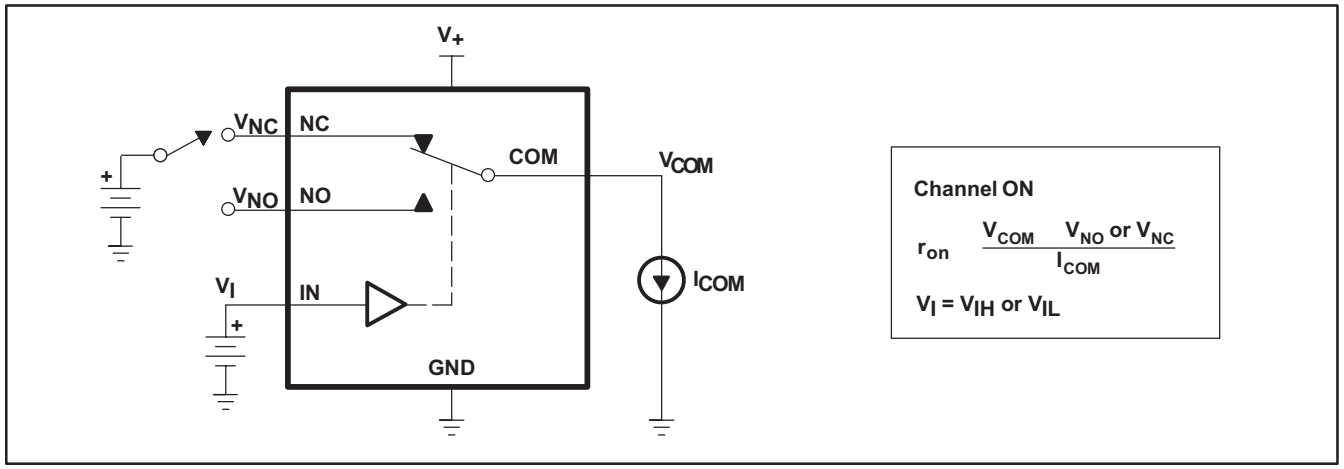


Figure 10. ON-State Resistance (r_{on})

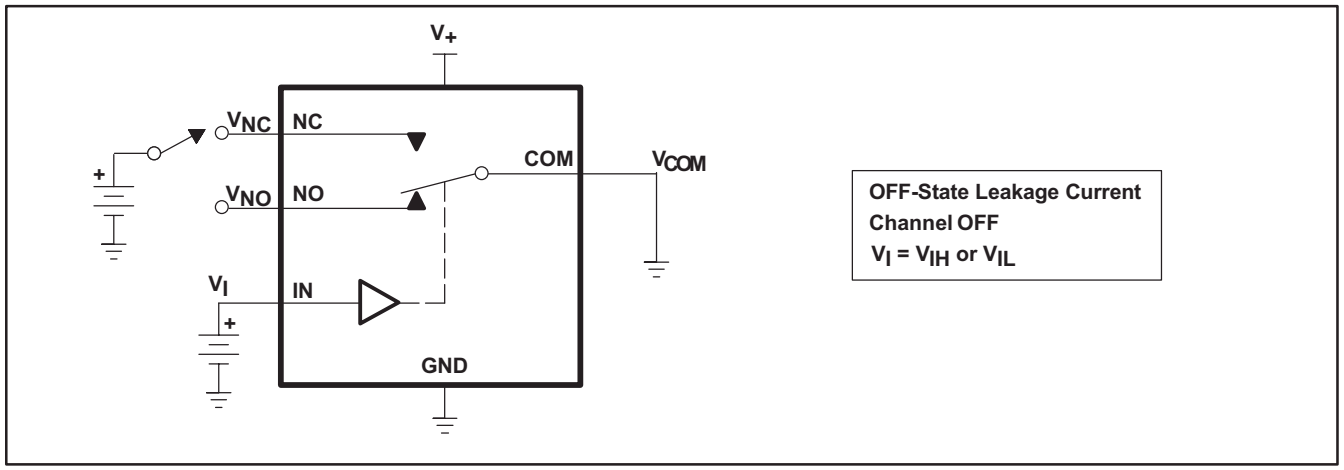


Figure 11. OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NO(OFF)}$)

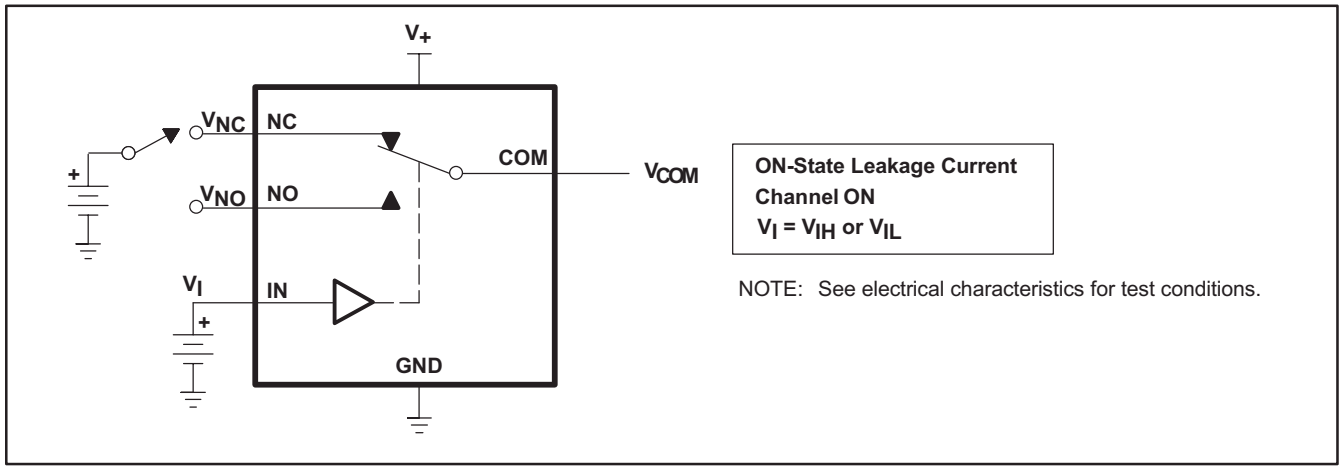


Figure 12. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

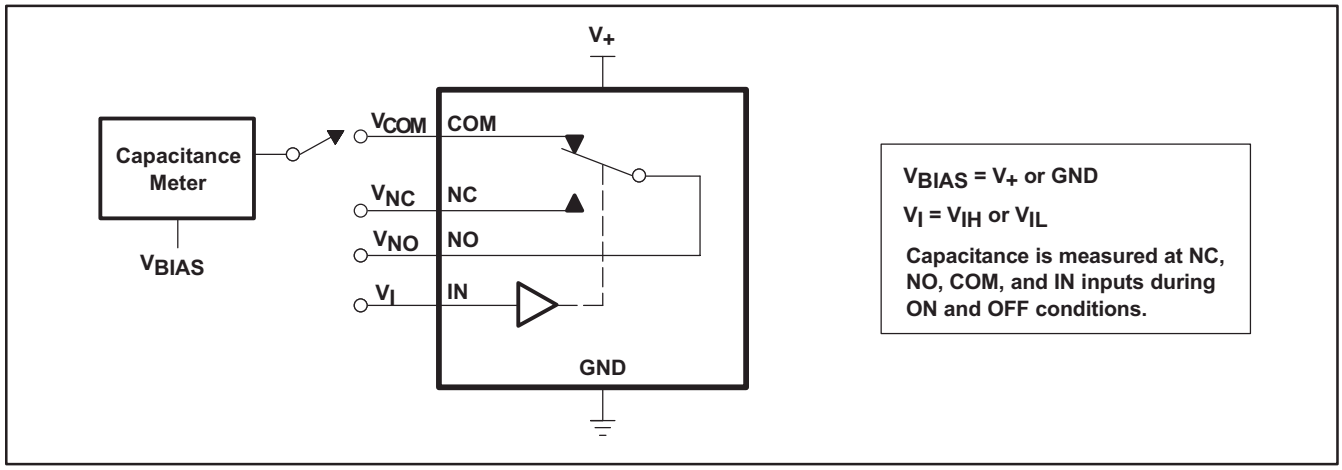
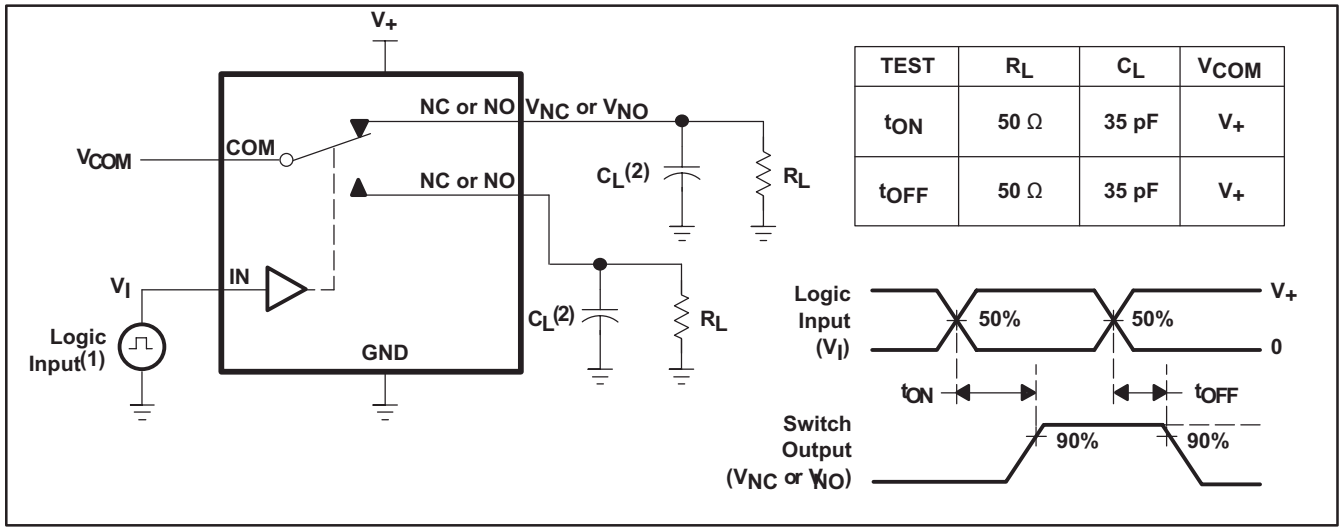


Figure 13. Capacitance (C_I, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)

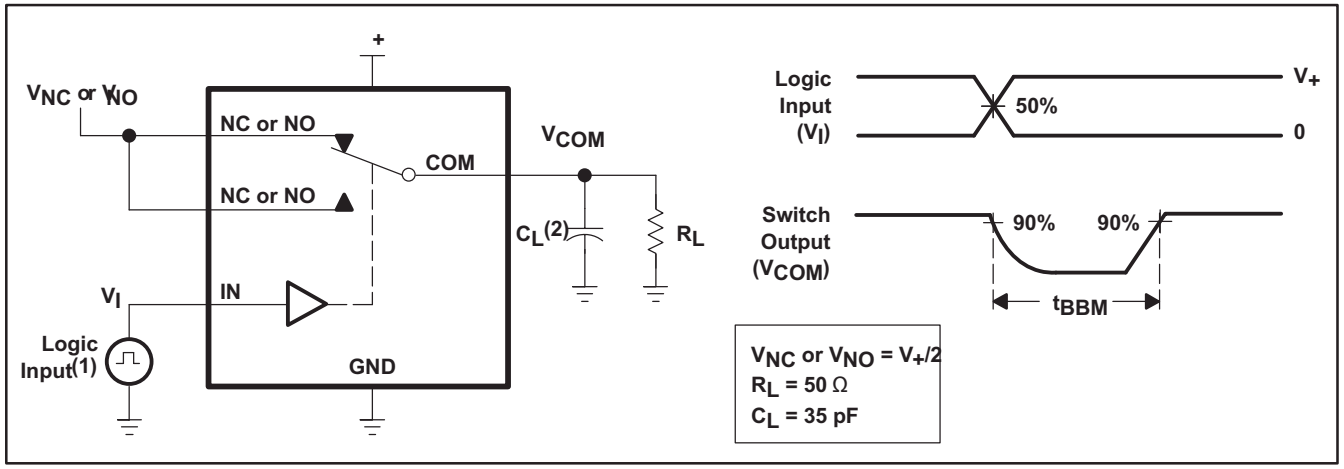


TEST	R_L	C_L	V_{COM}
t_{ON}	50 Ω	35 pF	V_+
t_{OFF}	50 Ω	35 pF	V_+

(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.

Figure 14. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

PARAMETER MEASUREMENT INFORMATION (continued)



(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.

Figure 15. Break-Before-Make Time (t_{BBM})

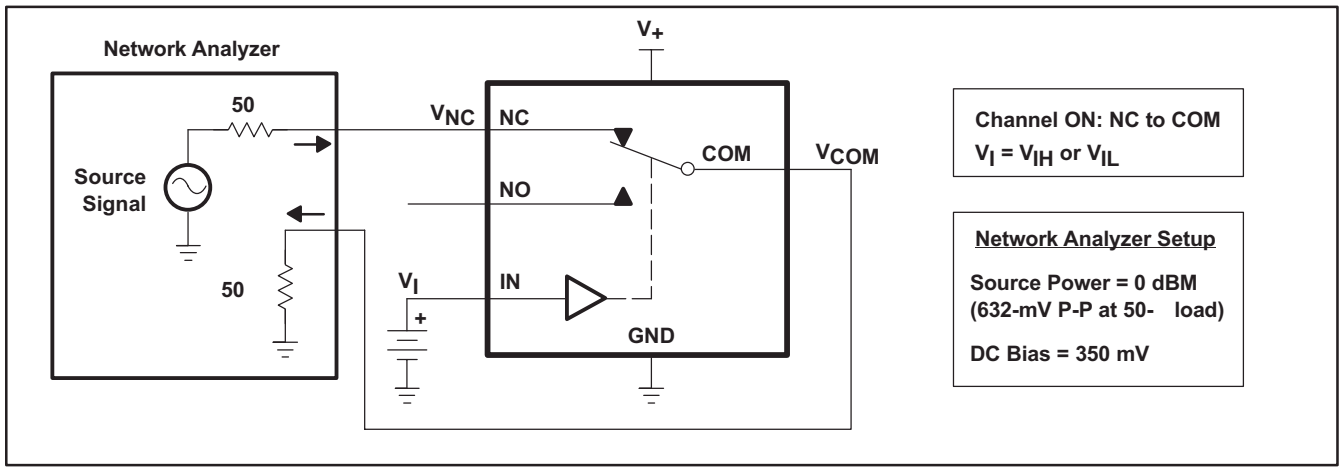


Figure 16. Bandwidth (BW)

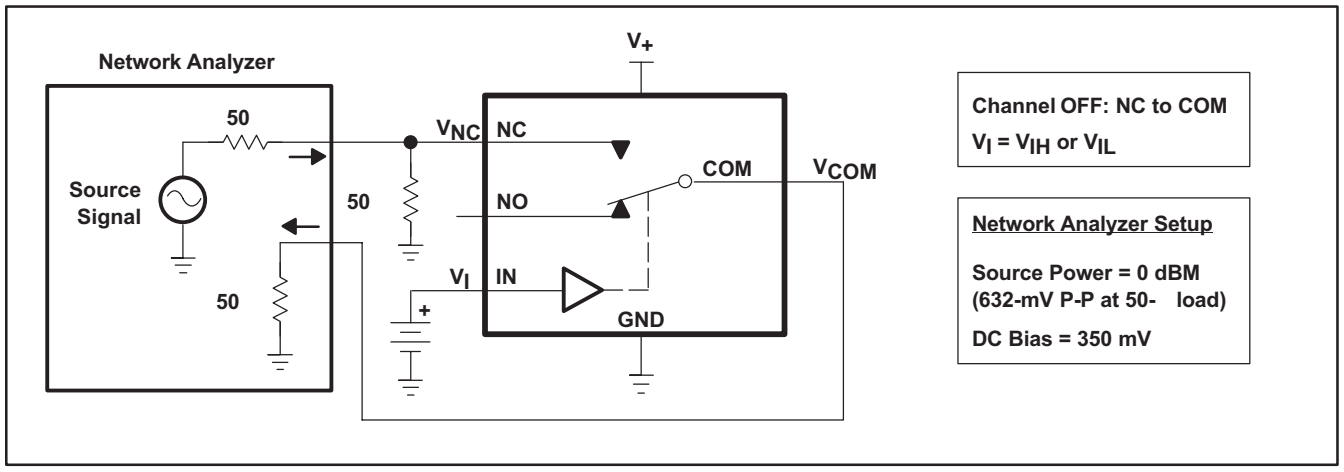


Figure 17. OFF Isolation (O_{ISO})

PARAMETER MEASUREMENT INFORMATION (continued)

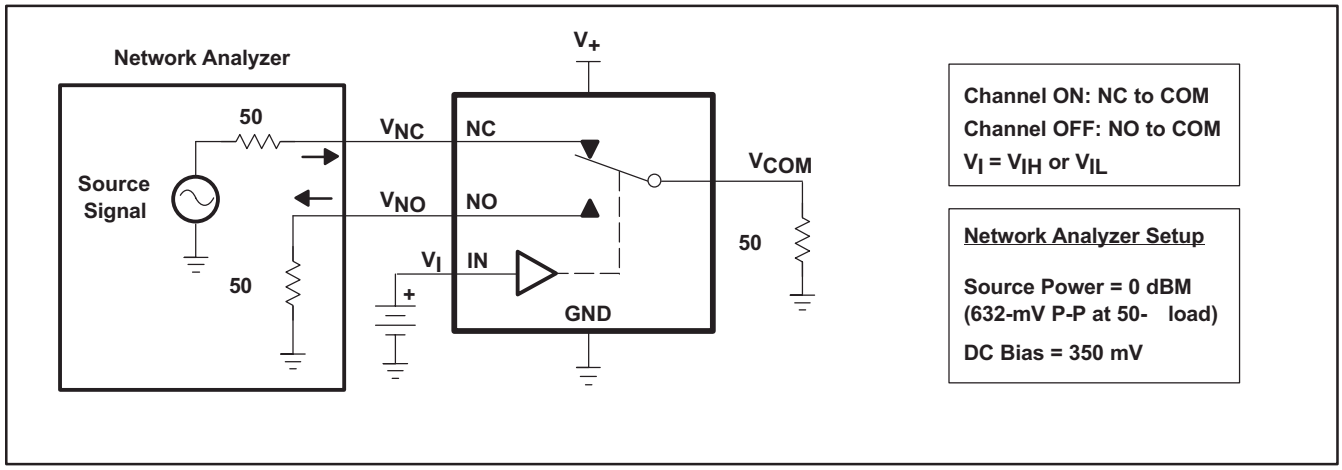
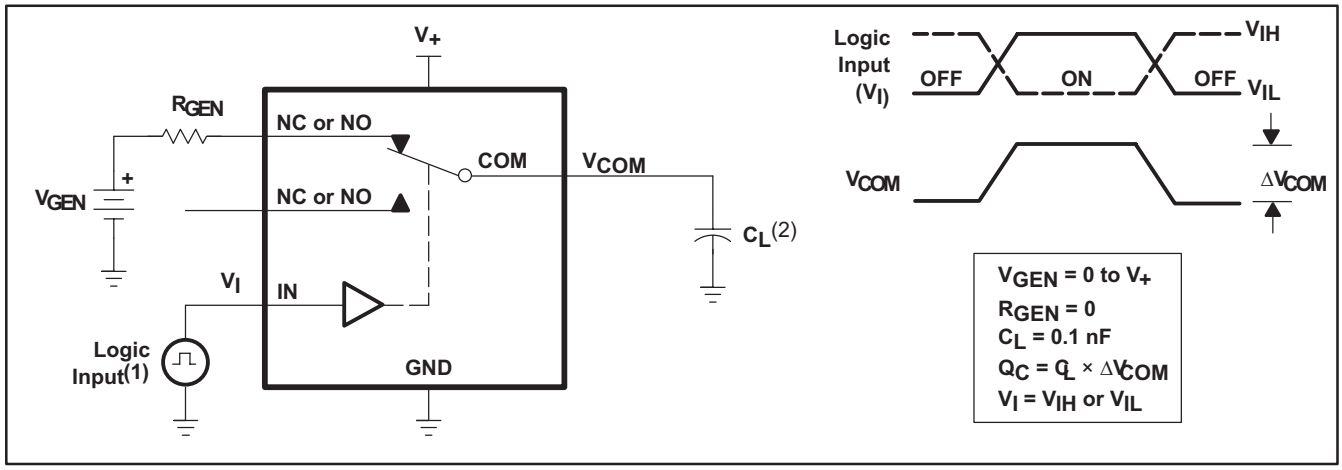


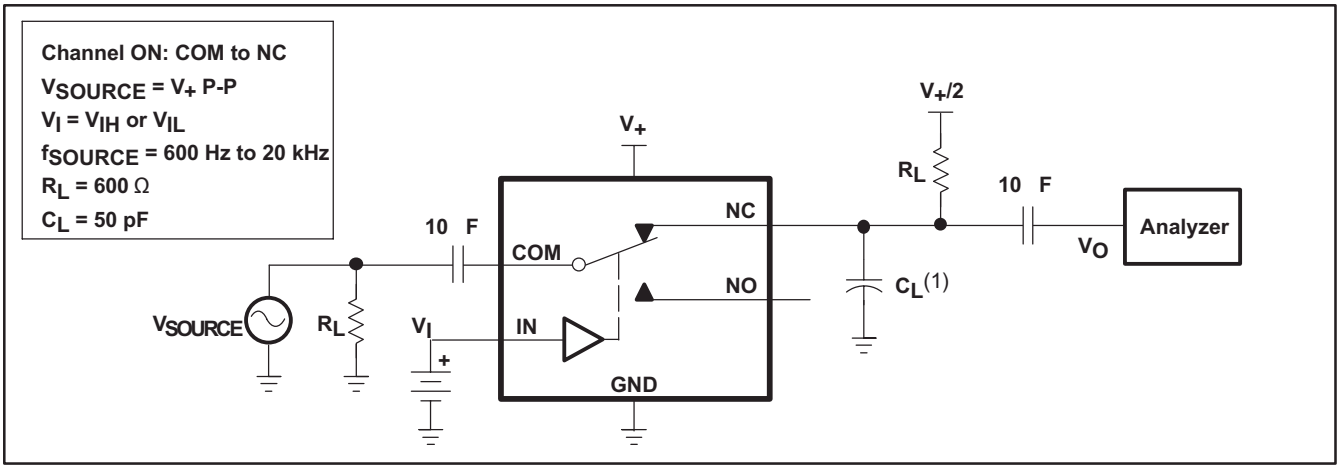
Figure 18. Crosstalk (X_{TALK})



(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.

Figure 19. Charge Injection (Q_C)

PARAMETER MEASUREMENT INFORMATION (continued)



(1) C_L includes probe and jig capacitance.

Figure 20. Total Harmonic Distortion (THD)

REVISION HISTORY

Changes from Original (November, 2012) to Revision A **Page**

- Device going from Preview to Production 1
- Changed ON-state resistance from 1.1 to 1.3 Ω. 2
- Changd leakage current from ±20 nA to ±6 nA. 2
- Changed r_{on} max values from 1.1 to 1.3 3
- Changed $I_{NC(OFF)}$, $I_{NO(OFF)}$ min and max values for 25°C from –2 and 2 to –6 and 6, respectively. Changed min and max values for Full from –20 and 20 to –150 and 150, respectively. 3
- Changed $I_{NC(ON)}$, $I_{NO(ON)}$ min and max values for 25°C from –4 and 4 to –6 and 6, respectively. Changed min and max values for Full from –40 and 40 to –150 and 150, respectively. 3
- Changed $I_{COM(ON)}$ min and max values for 25°C from –4 and 4 to –8 and 8, respectively. Changed min and max values for Full from –40 and 40 to –150 and 150, respectively. 3
- Inserted 25°C above Full in T_A column and inserted 0.5 µA max value for I_+ 4
- Changed max values for r_{peak} from 2.1 to 2.2. 4
- Changed max values for r_{on} from 1.5 to 1.8. 4
- Added 25°C to T_A column and added 0.5 max value to I_+ 5
- Changed r_{peak} max values from 2.7 to 2.9. 5
- Changed r_{on} max values from 2 to 2.3. 5
- Added 25°C to T_A column and added 0.5 max value to I_+. 6
- Changed r_{peak} max values from 4.9 to 5.2. 6
- Changed r_{on} max values from 3.2 to 3.5. 6
- Added 25°C to T_A column and added 0.5 max value to I_+. 7

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
TS5A3159QDBVRQ1	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

(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.

OTHER QUALIFIED VERSIONS OF TS5A3159-Q1 :

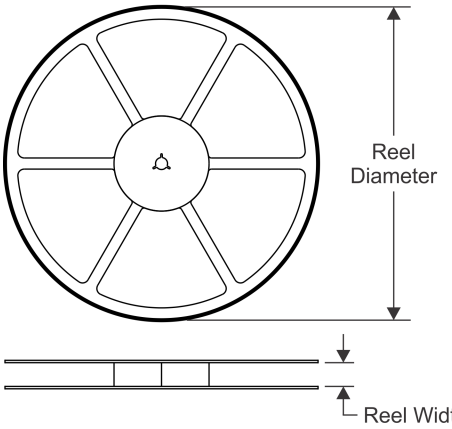
- Catalog: TS5A3159
- Enhanced Product: TS5A3159-EP

NOTE: Qualified Version Definitions:

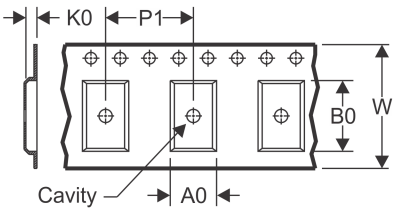
- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

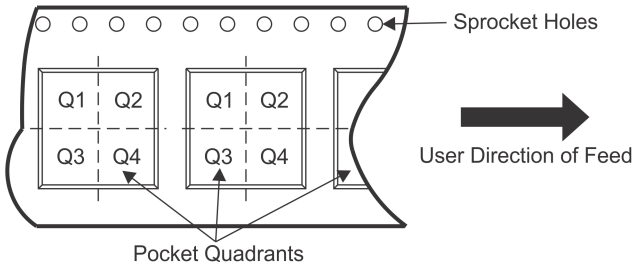


TAPE DIMENSIONS



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

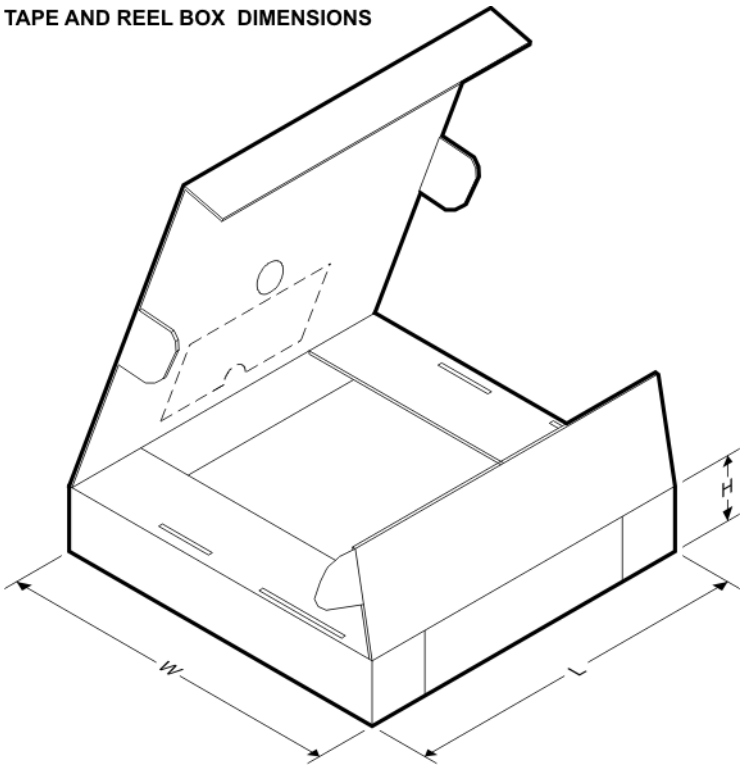
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TS5A3159QDBVRQ1	SOT-23	DBV	6	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3

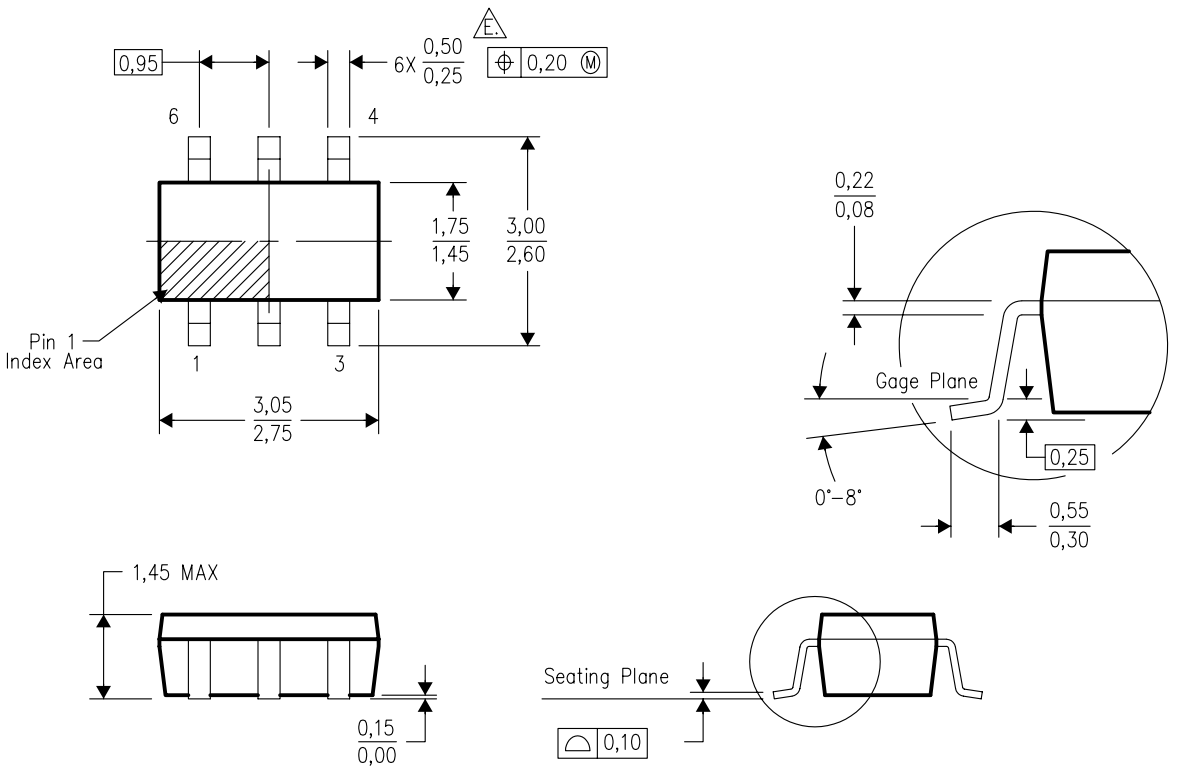
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A3159QDBVRQ1	SOT-23	DBV	6	3000	202.0	201.0	28.0

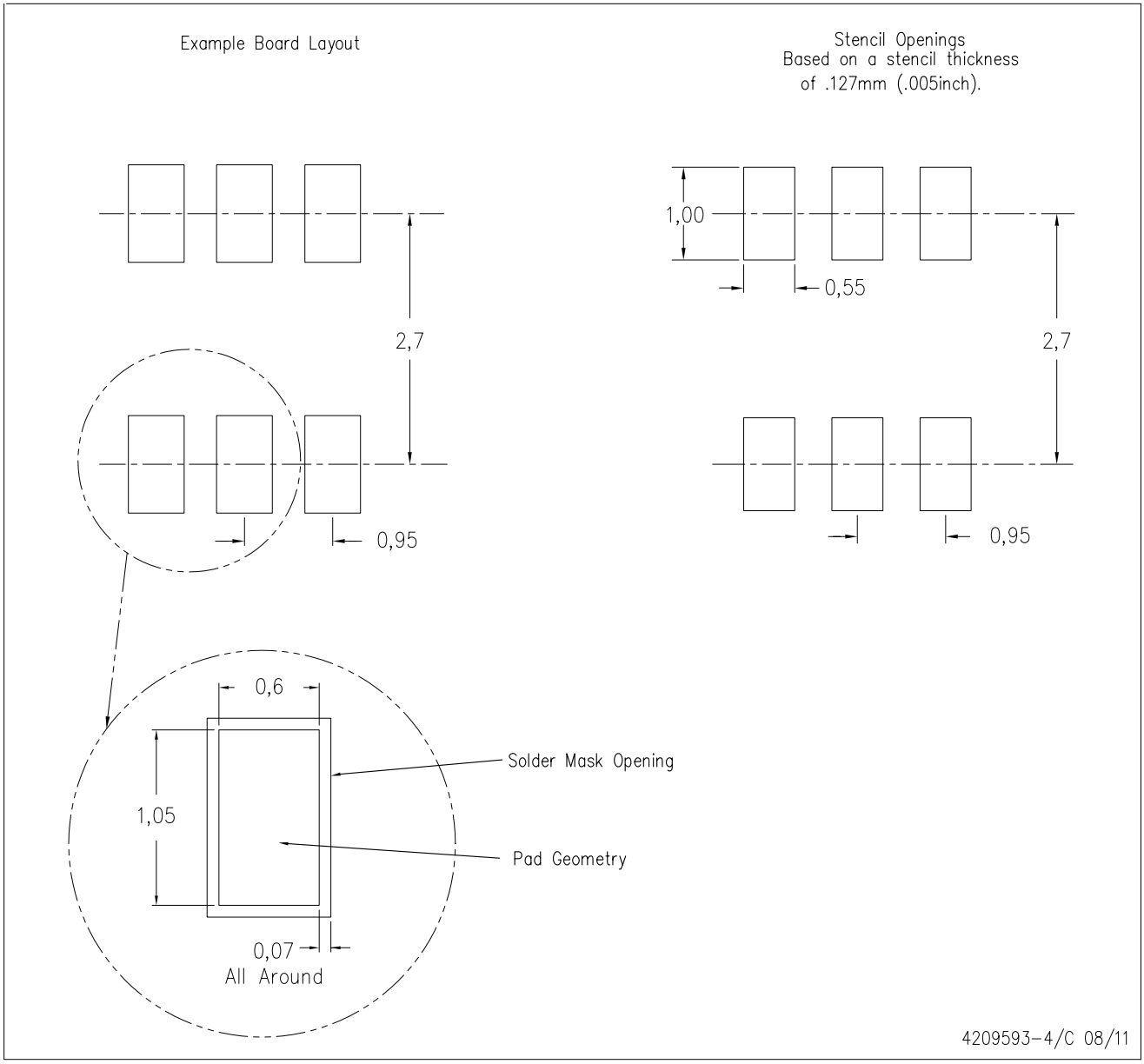
DBV (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4073253–5/K 03/2006

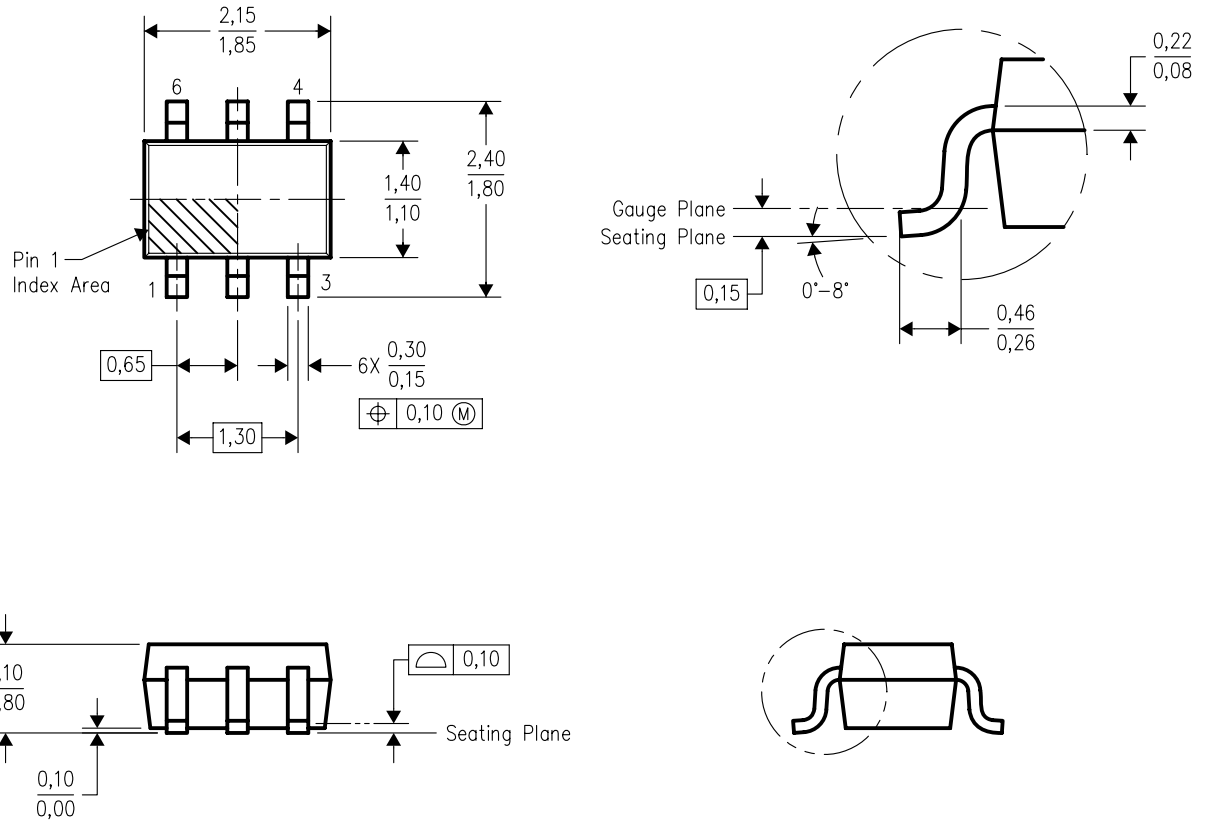
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
E. Falls within JEDEC MO–178 Variation AB, except minimum lead width.

DBV (R–PDSO–G6) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

DCK (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4093553–4/G 01/2007

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AB.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

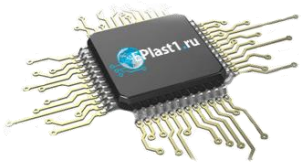
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.