

TS5A3159 1- Ω SPDT Analog Switch

1 Features

- 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
- 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)

2 Applications

- Mobile Phones
- Consumer and Computing
- Portable Instrumentation

3 Description

The TS5A3159 device 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-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 excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TS5A3159	SOT-23 (6)	2.90 mm x 1.60 mm
	SC70 (6)	2.00 mm x 1.25 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Block Diagram

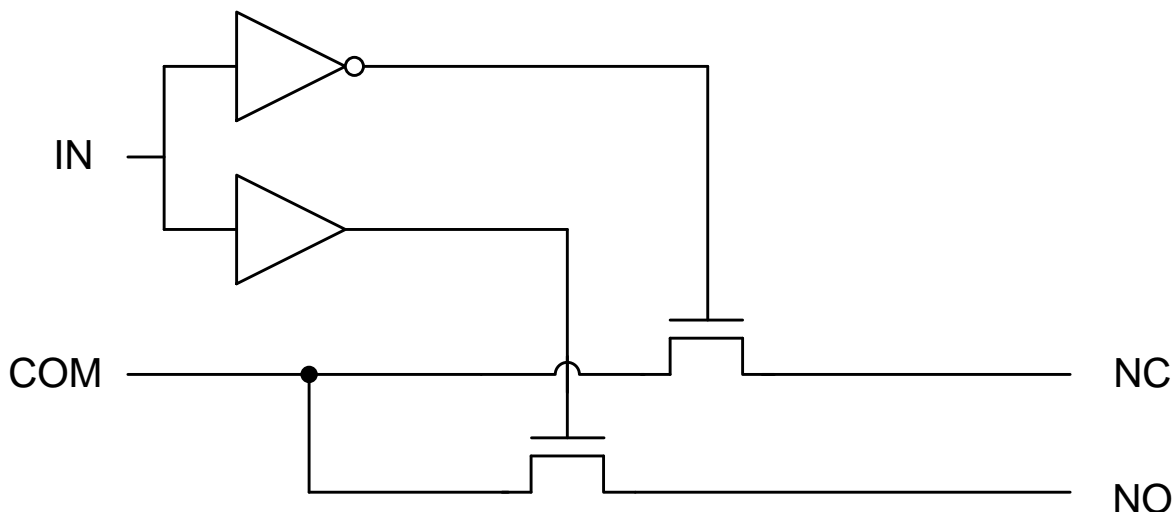


Table of Contents

1 Features 1 2 Applications 1 3 Description 1 4 Revision History 2 5 Pin Configuration and Functions 3 6 Specifications 3 6.1 Absolute Maximum Ratings 3 6.2 ESD Ratings 3 6.3 Recommended Operating Conditions 4 6.4 Thermal Information 4 6.5 Electrical Characteristics for 5-V Supply 4 6.6 Electrical Characteristics for 3.3-V Supply 5 6.7 Electrical Characteristics for 2.5-V Supply 6 6.8 Electrical Characteristics for 1.8-V Supply 8 6.9 Switching Characteristics for 5-V Supply 9 6.10 Switching Characteristics for 3.3-V Supply 9 6.11 Switching Characteristics for 2.5-V Supply 9 6.12 Switching Characteristics for 1.8-V Supply 9 6.13 Typical Characteristics 10 7 Parameter Measurement Information 12	8 Detailed Description 16 8.1 Overview 16 8.2 Functional Block Diagram 16 8.3 Feature Description 16 8.4 Device Functional Modes 16 9 Application and Implementation 17 9.1 Application Information 17 9.2 Typical Application 17 10 Power Supply Recommendations 18 11 Layout 18 11.1 Layout Guidelines 18 11.2 Layout Example 18 12 Device and Documentation Support 19 12.1 Device Support 19 12.2 Documentation Support 20 12.3 Trademarks 20 12.4 Electrostatic Discharge Caution 20 12.5 Glossary 20 13 Mechanical, Packaging, and Orderable Information 20
---	---

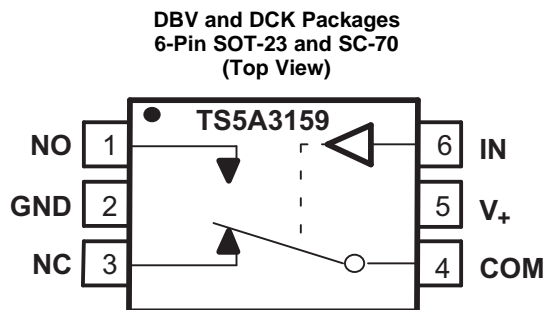
4 Revision History

Changes from Revision B (September 2004) to Revision C	Page
<ul style="list-style-type: none"> • Added <i>Applications</i>, <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Typical Characteristics</i>, <i>Feature Description</i> section, <i>Device Functional Modes</i>, <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. 	1

Changes from Revision A (September 2004) to Revision B	Page
<ul style="list-style-type: none"> • Removed <i>Ordering Information</i> table. 	1

Changes from Original (August 2004) to Revision A	Page
<ul style="list-style-type: none"> • Corrected Figure 11 graphic 	12

5 Pin Configuration and Functions



Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	NO	I/O	Digital control pin to select between NC and NO
2	GND	—	Ground
3	NC	I/O	Normally closed switch port
4	COM	I/O	Common switch port
5	V+	—	Power supply
6	IN	I	Switch select. High = COM connected to NO; Low = COM connected to NC.

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT	
V ₊	Supply voltage ⁽²⁾	-0.5	6.5	V	
V _{NO} V _{COM}	Analog voltage ⁽²⁾⁽³⁾⁽⁴⁾	-0.5	V ₊ + 0.5	V	
I _{I/O}	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 ⁽²⁾⁽³⁾	-0.5	6.5	V	
I _{I/K}	Digital input clamp current	V _{IN} < 0		-50	mA
	Continuous current through V ₊ or GND			±100	mA
T _{stg}	Storage temperature	-65	150	°C	

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to ground, unless otherwise specified.

(3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

(4) This value is limited to 5.5 V maximum.

(5) Pulse at 1-ms duration < 10% duty cycle.

6.2 ESD Ratings

		VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
$V_{I/O}$	Switch input/output voltage	0	V_+	V
V_+	Supply voltage	1.65	5.5	V
V_I	Control input voltage	0	5.5	V
T_A	Operating temperature	-40	85	°C

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾	TS5A3159		UNIT	
	DBV (SOT-23)	DCK (SC-70)		
	6 PINS	6 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	165	165	°C/W

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

6.5 Electrical Characteristics for 5-V Supply

 $V_+ = 4.5\text{ V to }5.5\text{ V}$ and $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (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	$0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -30\text{ mA}$, Switch ON, see Figure 10	25°C Full	4.5 V	1	1.5	Ω	
r_{on}	ON-state resistance	V_{NO} or $V_{NC} = 2.5\text{ V}$, $I_{COM} = -30\text{ mA}$, Switch ON, see Figure 10	25°C Full	4.5 V	0.75	1.1	Ω	
Δr_{on}	ON-state resistance match between channels	V_{NO} or $V_{NC} = 2.5\text{ V}$, $I_{COM} = -30\text{ mA}$, Switch ON, see Figure 10	25°C	4.5 V	0.1		Ω	
$r_{on(Flat)}$	ON-state resistance flatness	$0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -30\text{ mA}$, V_{NO} or $V_{NC} = 1\text{ V}, 1.5\text{ V}, 2.5\text{ V}$, $I_{COM} = -30\text{ mA}$, Switch ON, see Figure 10	25°C 25°C	4.5 V	0.233	0.15	Ω	
$I_{NC(OFF)}, I_{NO(OFF)}$	NC, NO Off leakage current	V_{NC} or $V_{NO} = 4.5\text{ V}$, $V_{COM} = 0\text{ V}$, Switch OFF, see Figure 11	25°C Full	5.5 V	-2	0.2	2	nA
$I_{NC(ON)}, I_{NO(ON)}$	NC, NO On leakage current	V_{NC} or $V_{NO} = 4.5\text{ V}$, $V_{COM} = \text{Open}$, Switch ON, see Figure 12	25°C Full	5.5 V	-4	2.8	4	nA
$I_{COM(ON)}$	COM On leakage current	V_{NC} or $V_{NO} = 4.5\text{ V}$ or Open, $V_{COM} = 4.5\text{ V}$, Switch ON, see Figure 12	25°C Full	5.5 V	-4	0.47	4	nA
Digital Input (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	$V_{IN} = 5.5\text{ V}$ or 0	Full	5.5 V	-1	1	μA	
Dynamic								
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, see Figure 14	25°C Full	4.5 V to 5.5 V	20	35	ns	
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, see Figure 14	25°C Full	4.5 V to 5.5 V	15	20	ns	

 (1) $T_A = 25^\circ\text{C}$.

Electrical Characteristics for 5-V Supply (continued)

 $V_+ = 4.5 \text{ V to } 5.5 \text{ V}$ and $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
t_{BBM}	Break-before-make time	$V_{\text{NC}} = V_{\text{NO}} = V_+ / 2$, $R_L = 50 \Omega$,	$C_L = 35 \text{ pF}$, see Figure 15	25°C	4.5 V to 5.5 V	1	12	14.5	ns
				Full		1			
Q_C	Charge injection	$C_L = 1 \text{ nF}$, $V_{\text{GEN}} = 0 \text{ V}$,	See Figure 19	25°C	5 V		36		pC
$C_{\text{NC(OFF)}}$, $C_{\text{NO(OFF)}}$	NC, NO OFF capacitance	V_{NC} or $V_{\text{NO}} = V_+$ or GND,	Switch OFF, see Figure 13	25°C	5 V		23		pF
$C_{\text{NC(ON)}}$, $C_{\text{NO(ON)}}$	NC, NO ON capacitance	V_{NC} or $V_{\text{NO}} = V_+$ or GND,	Switch ON, see Figure 13	25°C	5 V		84		pF
$C_{\text{COM(ON)}}$	COM ON capacitance	$V_{\text{COM}} = V_+$ or GND,	Switch ON, see Figure 13	25°C	5 V		84		pF
C_{IN}	Digital input capacitance	$V_{\text{IN}} = V_+$ or GND,	See Figure 13	25°C	5 V		2.1		pF
BW	Bandwidth	$R_L = 50 \Omega$,	Switch ON, see Figure 16	25°C	5 V		100		MHz
O_{ISO}	OFF isolation	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$,	Switch OFF, see Figure 17	25°C	5 V		-65		dB
X_{TALK}	Crosstalk	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$,	Switch ON, see Figure 18	25°C	5 V		-65		dB
THD	Total harmonic distortion	$R_L = 600 \Omega$, $C_L = 50 \text{ pF}$,	$f = 600 \text{ Hz to } 20 \text{ kHz}$, see Figure 20	25°C	5 V		0.01%		
Supply									
I_+	Positive supply current	$V_{\text{IN}} = V_+$ or GND,	Switch ON or OFF	Full	5.5 V			0.1	μA

6.6 Electrical Characteristics for 3.3-V Supply

 $V_+ = 3 \text{ V to } 3.6 \text{ V}$ and $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (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	$0 \leq V_{\text{NO}}$ or $V_{\text{NC}} \leq V_+$, $I_{\text{COM}} = -24 \text{ mA}$,	Switch ON, see Figure 10	25°C	3 V		1.35	2.1	Ω
				Full			2.1		
r_{on}	ON-state resistance	V_{NO} or $V_{\text{NC}} = 2 \text{ V}$, $I_{\text{COM}} = -24 \text{ mA}$,	Switch ON, see Figure 10	25°C	3 V		1.15	1.5	Ω
				Full			1.5		
Δr_{on}	ON-state resistance match between channels	V_{NO} or $V_{\text{NC}} = 2 \text{ V}$, 0.8 V, $I_{\text{COM}} = -24 \text{ mA}$,	Switch ON, see Figure 10	25°C	3 V		0.11		Ω
$r_{\text{on(Flat)}}$	ON-state resistance flatness	$0 \leq V_{\text{NO}}$ or $V_{\text{NC}} \leq V_+$, $I_{\text{COM}} = -24 \text{ mA}$,	Switch ON, see Figure 10	25°C	3 V		0.225		Ω
				25°C			0.25		
$I_{\text{NC(OFF)}}$, $I_{\text{NO(OFF)}}$	NC, NO Off leakage current	V_{NC} or $V_{\text{NO}} = 3 \text{ V}$, $V_{\text{COM}} = 0$,	Switch OFF, see Figure 11	25°C	3.6 V		0.2		nA
$I_{\text{NC(ON)}}$, $I_{\text{NO(ON)}}$	NC, NO On leakage current	V_{NC} or $V_{\text{NO}} = 3 \text{ V}$, $V_{\text{COM}} = \text{Open}$,	Switch ON, see Figure 12	25°C	3.6 V		2.8		nA
$I_{\text{COM(ON)}}$	COM On leakage current	V_{NC} or $V_{\text{NO}} = 3 \text{ V}$ or Open, $V_{\text{COM}} = 3 \text{ V}$,	Switch ON, see Figure 12	25°C	3.6 V		0.47		nA
Digital Inputs (IN)									

(1) $T_A = 25^\circ\text{C}$.

Electrical Characteristics for 3.3-V Supply (continued)

 $V_+ = 3\text{ V to }3.6\text{ V}$ and $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
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	$V_{IN} = 5.5\text{ V or }0$		Full	3.6 V	-1		1	μA
Dynamic									
t_{ON}	Turnon time	$V_{COM} = V_+,$ $R_L = 50\ \Omega,$	$C_L = 35\text{ pF},$ see Figure 14	25°C	3 V to 3.6 V		30	40	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+,$ $R_L = 50\ \Omega,$	$C_L = 35\text{ pF},$ see Figure 14	25°C	3 V to 3.6 V		20	25	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+ / 2,$ $R_L = 50\ \Omega,$	$C_L = 35\text{ pF},$ see Figure 15	25°C	3 V to 3.6 V		1	21	29
				Full					
Q_C	Charge injection	$C_L = 1\text{ nF},$ $V_{GEN} = 0\text{ V},$	see Figure 19	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 13	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 13	25°C	3.3 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	$V_{COM} = V_+$ or GND,	Switch ON, see Figure 13	25°C	3.3 V		84		pF
C_{IN}	Digital input capacitance	$V_{IN} = V_+$ or GND,	See Figure 13	25°C	3.3 V		2.1		pF
BW	Bandwidth	$R_L = 50\ \Omega,$	Switch ON, see Figure 16	25°C	3.3 V		100		MHz
O_{ISO}	OFF isolation	$R_L = 50\ \Omega,$ $f = 1\text{ MHz},$	Switch OFF, see Figure 17	25°C	3.3 V		-65		dB
X_{TALK}	Crosstalk	$R_L = 50\ \Omega,$ $f = 1\text{ MHz},$	Switch ON, see Figure 18	25°C	3.3 V		-65		dB
THD	Total harmonic distortion	$R_L = 600\ \Omega,$ $C_L = 50\text{ pF},$	$f = 600\text{ Hz to }20$ kHz, see Figure 20	25°C	3.3 V		0.015%		
Supply									
I_+	Positive supply current	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	3.6 V			0.1	μA

6.7 Electrical Characteristics for 2.5-V Supply

 $V_+ = 2.3\text{ V to }2.7\text{ V}$ and $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (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	$0 \leq V_{NO}$ or $V_{NC} \leq V_+,$ $I_{COM} = -8\text{ mA},$	Switch ON, see Figure 10	25°C	2.5 V		1.7	2.7	Ω
				Full					
r_{on}	ON-state resistance	V_{NO} or $V_{NC} = 1.8\text{ V},$ $I_{COM} = -8\text{ mA},$	Switch ON, see Figure 10	25°C	2.5 V		1.45	2	Ω
				Full					
Δr_{on}	ON-state resistance match between channels	V_{NO} or $V_{NC} = 0.8\text{ V}, 1.8\text{ V},$ $I_{COM} = -8\text{ mA},$	Switch ON, see Figure 10	25°C	2.5 V		0.7		Ω

 (1) $T_A = 25^\circ\text{C}.$

Electrical Characteristics for 2.5-V Supply (continued)
 $V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ and $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
$r_{\text{on(flat)}}$	ON-state resistance flatness	$0 \leq V_{\text{NO}}$ or $V_{\text{NC}} \leq V_+$, $I_{\text{COM}} = -8 \text{ mA}$,	Switch ON, see Figure 10	25°C	2.5 V	0.5			Ω
		V_{NO} or $V_{\text{NC}} = 0.8 \text{ V}, 1.8 \text{ V}$ $I_{\text{COM}} = -8 \text{ mA}$,		25°C		0.45			
$I_{\text{NC(OFF)}}$, $I_{\text{NO(OFF)}}$	NC, NO Off leakage current	V_{NC} or $V_{\text{NO}} = 2.3 \text{ V}$, $V_{\text{COM}} = 0$,	Switch OFF, see Figure 11	25°C	2.7 V	0.2			nA
$I_{\text{NC(ON)}}$, $I_{\text{NO(ON)}}$	NC, NO On leakage current	V_{NC} or $V_{\text{NO}} = 2.3 \text{ V}$, $V_{\text{COM}} = \text{Open}$,	Switch ON, see Figure 12	25°C	2.7 V	2.8			nA
$I_{\text{COM(ON)}}$	COM On leakage current	V_{NC} or $V_{\text{NO}} = 2.3 \text{ V}$ or Open, $V_{\text{COM}} = 2.3 \text{ V}$,	Switch ON, see Figure 12	25°C	2.7 V	0.47			nA
Digital Input (IN)									
V_{IH}	Input logic high			Full		1.8		5.5	V
V_{IL}	Input logic low			Full		0		0.6	V
$I_{\text{IH}}, I_{\text{IL}}$	Input leakage current	$V_{\text{IN}} = 5.5 \text{ V}$ or 0		Full	2.7 V	-1		1	μA
Dynamic									
t_{ON}	Turnon time	$V_{\text{COM}} = V_+$, $R_L = 50 \Omega$,	$C_L = 35 \text{ pF}$, see Figure 14	25°C	2.3 V to 2.7 V	40	55	ns	
				Full		70			
t_{OFF}	Turnoff time	$V_{\text{COM}} = V_+$, $R_L = 50 \Omega$,	$C_L = 35 \text{ pF}$, see Figure 14	25°C	2.3 V to 2.7 V	30	40	ns	
				Full		55			
t_{BBM}	Break-before-make time	$V_{\text{NC}} = V_{\text{NO}} = V_+ / 2$, $R_L = 50 \Omega$,	$C_L = 35 \text{ pF}$, see Figure 15	25°C	2.3 V to 2.7 V	1	33	39	ns
				Full		1			
Q_C	Charge injection	$C_L = 1 \text{ nF}$, $V_{\text{GEN}} = 0 \text{ V}$,	See Figure 19	25°C	2.5 V	13			pC
$C_{\text{NC(OFF)}}$, $C_{\text{NO(OFF)}}$	NC, NO OFF capacitance	V_{NC} or $V_{\text{NO}} = V_+$ or GND,	Switch OFF, see Figure 13	25°C	2.5 V	23			pF
$C_{\text{NC(ON)}}$, $C_{\text{NO(ON)}}$	NC, NO ON capacitance	V_{NC} or $V_{\text{NO}} = V_+$ or GND,	Switch ON, see Figure 13	25°C	2.5 V	84			pF
$C_{\text{COM(ON)}}$	COM ON capacitance	$V_{\text{COM}} = V_+$ or GND,	Switch ON, see Figure 13	25°C	2.5 V	84			pF
C_{IN}	Digital input capacitance	$V_{\text{IN}} = V_+$ or GND,	See Figure 13	25°C	2.5 V	2.1			pF
BW	Bandwidth	$R_L = 50 \Omega$,	Switch ON, see Figure 16	25°C	2.5 V	100			MHz
O_{ISO}	OFF isolation	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$,	Switch OFF, see Figure 17	25°C	2.5 V	-64			dB
X_{TALK}	Crosstalk	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$,	Switch ON, see Figure 18	25°C	2.5 V	-64			dB
THD	Total harmonic distortion	$R_L = 600 \Omega$, $f = 600 \text{ Hz to } 20 \text{ kHz}$,	$C_L = 50 \text{ pF}$, see Figure 20	25°C	2.5 V	0.025%			
Supply									
I_+	Positive supply current	$V_{\text{IN}} = V_+$ or GND,	Switch ON or OFF	Full	2.7 V	0.1			μA

6.8 Electrical Characteristics for 1.8-V Supply

 $V_+ = 1.65\text{ V to }1.95\text{ V}$ and $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Analog Switch									
V_{COM}, V_{NO}, V_{NC}	Analog signal					0		V_+	V
r_{peak}	Peak ON-resistance	$0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -2\text{ mA}$,	Switch ON, see Figure 10	25°C	1.8 V		4	4.9	Ω
				Full					
r_{on}	ON-state resistance	V_{NO} or $V_{NC} = 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, see Figure 10	25°C	1.8 V		1.7	3.2	Ω
				Full					
Δr_{on}	ON-state resistance match between channels	V_{NO} or $V_{NC} = 0.6\text{ V}, 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, see Figure 10	25°C	1.8 V		0.7		Ω
				Full					
$r_{on(Flat)}$	ON-state resistance flatness	$0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -2\text{ mA}$,	Switch ON, see Figure 10	25°C	1.8 V		1.85		Ω
				Full					
				25°C					
				Full					
$I_{NC(OFF)}, I_{NO(OFF)}$	NC, NO OFF leakage current	V_{NC} or $V_{NO} = 1.65\text{ V}$, $V_{COM} = 0$,	Switch OFF, see Figure 11	25°C	1.95 V		0.2		nA
$I_{NC(ON)}, I_{NO(ON)}$	NC, NO ON leakage current	V_{NC} or $V_{NO} = 1.65\text{ V}$, $V_{COM} = \text{Open}$,	Switch ON, see Figure 12	25°C	1.95 V		2.8		nA
$I_{COM(ON)}$	COM ON leakage current	V_{NC} or $V_{NO} = 1.65\text{ V}$ or open, $V_{COM} = 1.65\text{ V}$,	Switch ON, see Figure 12	25°C	1.95 V		0.47		nA
Digital Input (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	$V_{IN} = 5.5\text{ V}$ or 0		Full	1.95 V	-1		1	μA
Dynamic									
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, see Figure 14	25°C	1.65 V to 1.95 V		65	70	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, see Figure 14	25°C	1.65 V to 1.95 V		40	55	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+ / 2$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, see Figure 15	25°C	1.65 V to 1.95 V		1	60	72
				Full					
Q_C	Charge injection	$C_L = 1\text{ nF}$, $V_{GEN} = 0\text{ V}$,	See Figure 19	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 13	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 13	25°C	1.8 V		84		pF
$C_{COM(ON)}$	COM ON capacitance	$V_{COM} = V_+$ or GND,	Switch ON, see Figure 13	25°C	1.8 V		84		pF
C_{IN}	Digital input capacitance	$V_{IN} = V_+$ or GND,	See Figure 13	25°C	1.8 V		2.1		pF
BW	Bandwidth	$R_L = 50\ \Omega$,	Switch ON, see Figure 16	25°C	5.5 V		100		MHz
O_{ISO}	OFF isolation	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch OFF, see Figure 17	25°C	1.8 V		-63		dB
X_{TALK}	Crosstalk	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch ON, see Figure 18	25°C	1.8 V		-63		dB

 (1) $T_A = 25^\circ\text{C}$.

Electrical Characteristics for 1.8-V Supply (continued)

 $V_+ = 1.65\text{ V to }1.95\text{ V}$ and $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Supply									
I_+	Positive supply current	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	1.8 V			0.1	μA

6.9 Switching Characteristics for 5-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	4.5 V to 5.5 V		20	35	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	4.5 V to 5.5 V		15	20	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 15	25°C	4.5 V to 5.5 V	1	12	14.5	ns
				Full					

6.10 Switching Characteristics for 3.3-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	3 V to 3.6 V		30	40	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	3 V to 3.6 V		20	25	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 15	25°C	3 V to 3.6 V	1	21	29	ns
				Full					

6.11 Switching Characteristics for 2.5-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	2.3 V to 2.7 V		40	55	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	2.3 V to 2.7 V		30	40	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 15	25°C	2.3 V to 2.7 V	1	33	39	ns
				Full					

6.12 Switching Characteristics for 1.8-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
t_{ON}	Turnon time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	1.65 V to 1.95 V		65	70	ns
				Full					
t_{OFF}	Turnoff time	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 14	25°C	1.65 V to 1.95 V		40	55	ns
				Full					
t_{BBM}	Break-before-make time	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\ \text{pF}$, see Figure 15	25°C	1.65 V to 1.95 V	1	60	72	ns
				Full					

6.13 Typical Characteristics

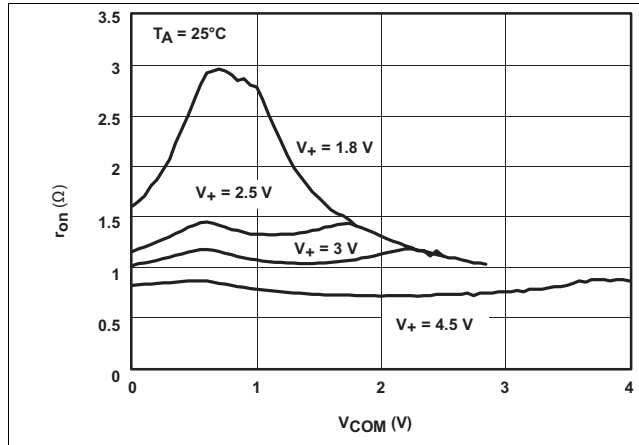


Figure 1. r_{on} vs V_{COM}

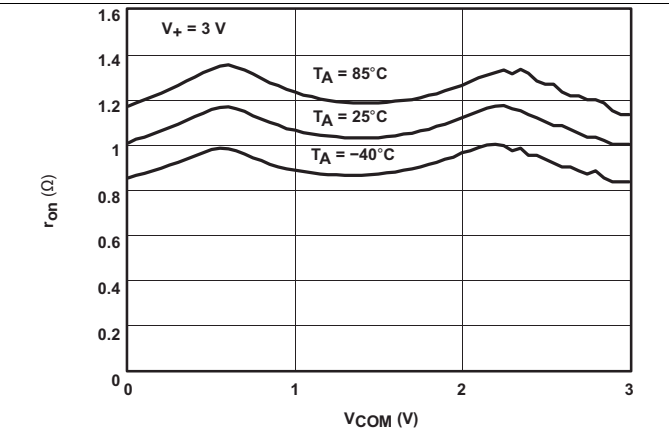


Figure 2. r_{on} vs V_{COM}

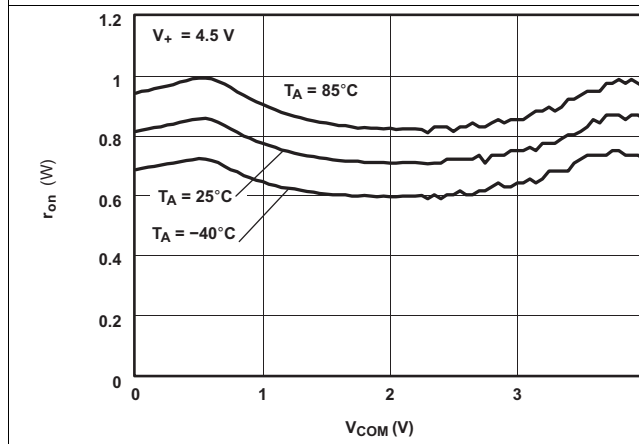


Figure 3. r_{on} vs V_{COM}

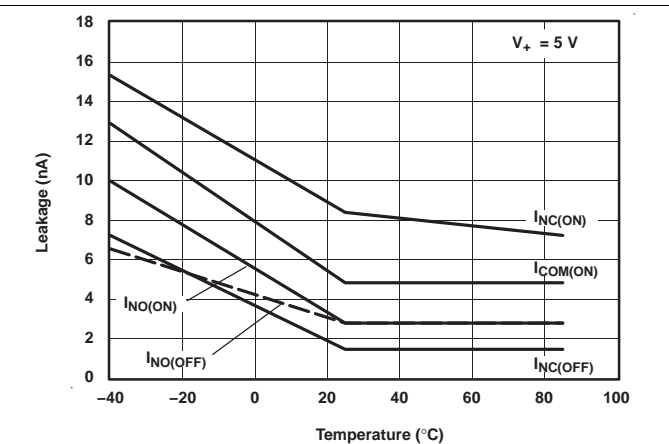


Figure 4. Leakage Current vs Temperature

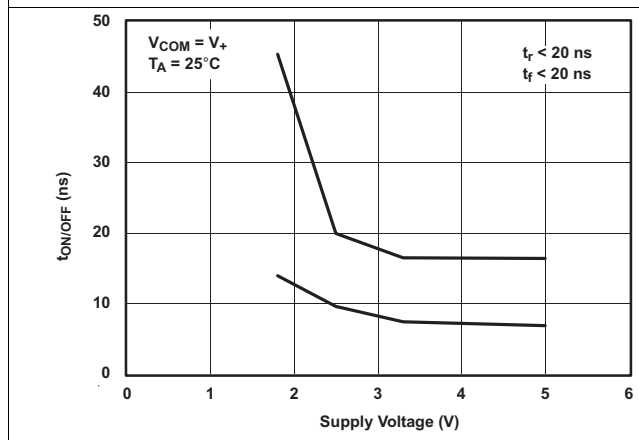


Figure 5. $t_{ON/OFF}$ vs V_+

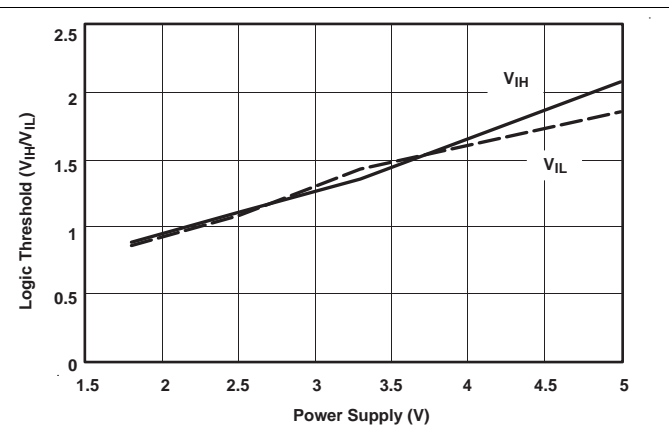


Figure 6. Logic Threshold vs Power Supply

Typical Characteristics (continued)

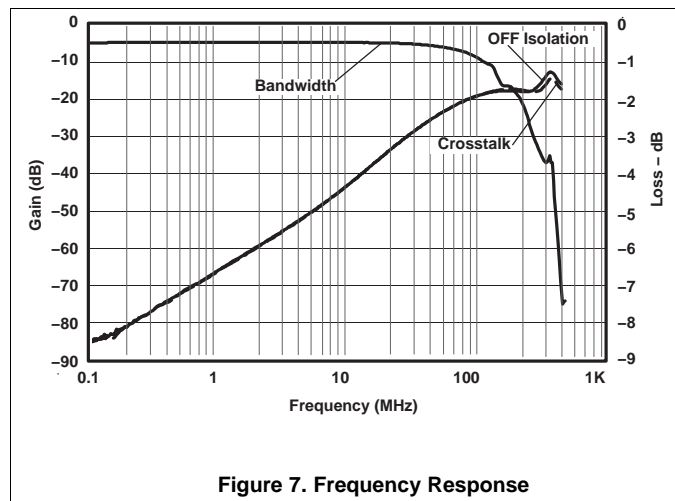


Figure 7. Frequency Response

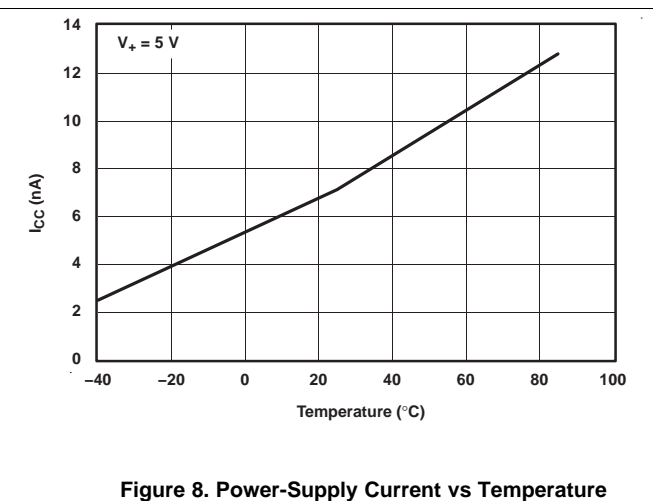


Figure 8. Power-Supply Current vs Temperature

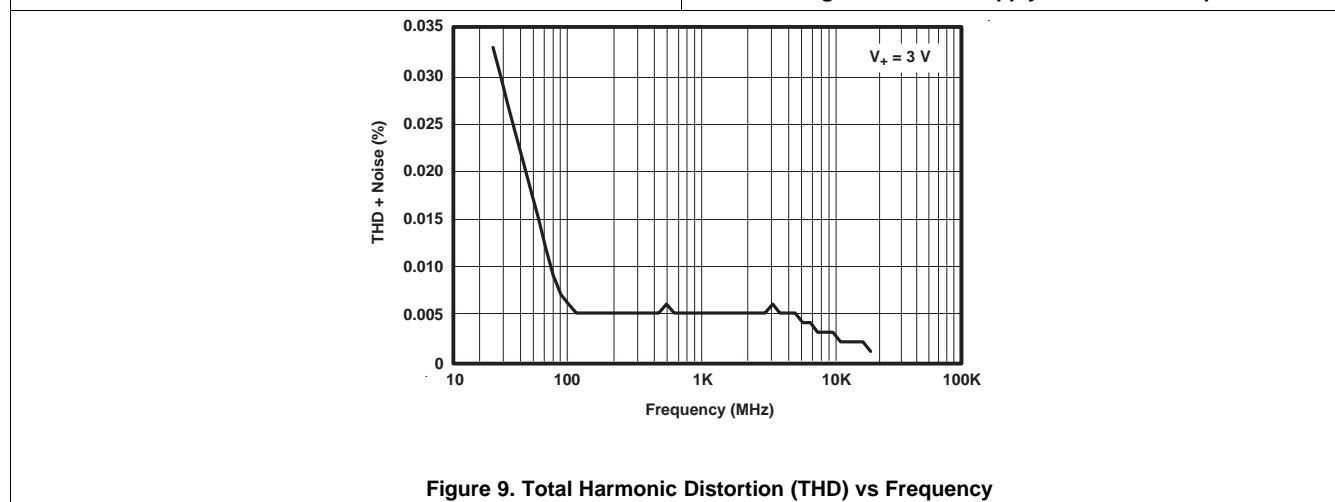


Figure 9. Total Harmonic Distortion (THD) vs Frequency

7 Parameter Measurement Information

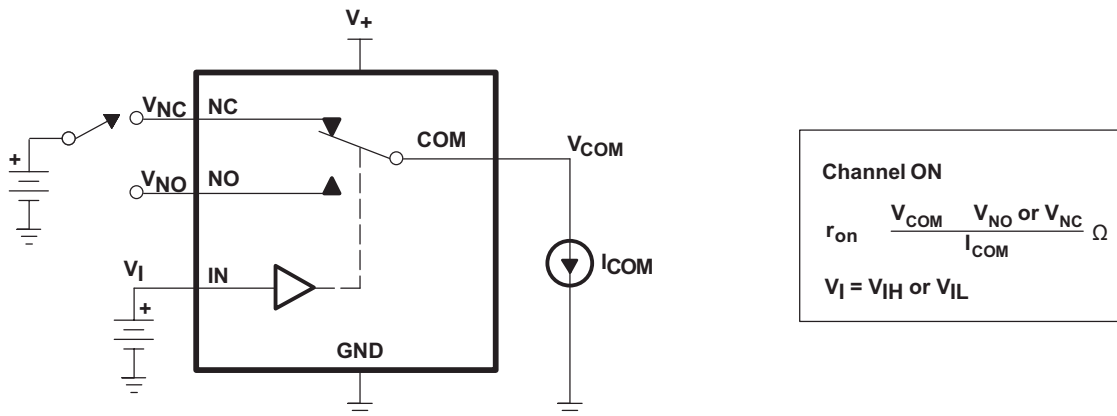


Figure 10. ON-State Resistance (r_{on})

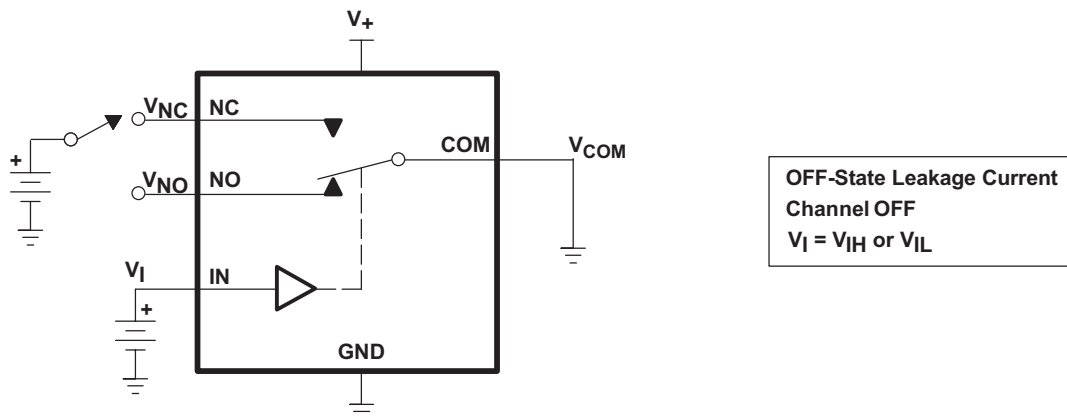


Figure 11. OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NO(OFF)}$)

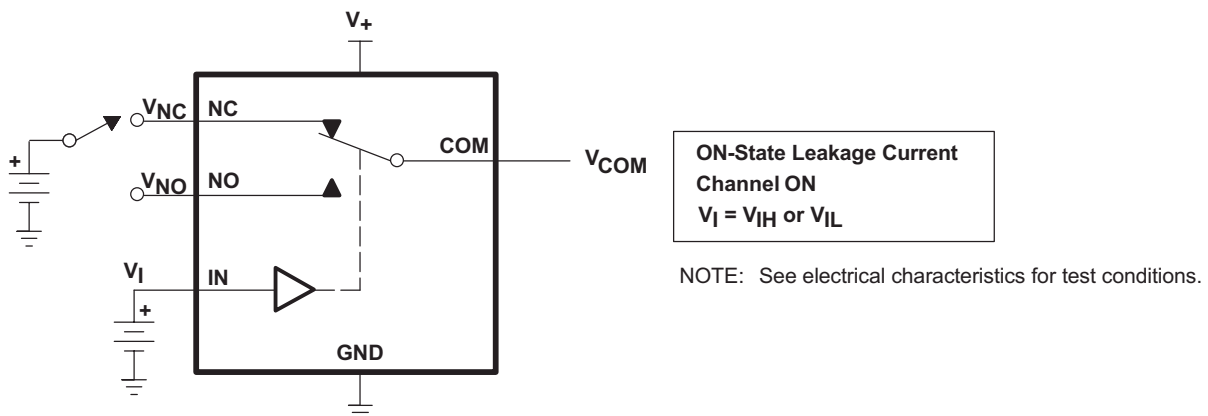


Figure 12. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

Parameter Measurement Information (continued)

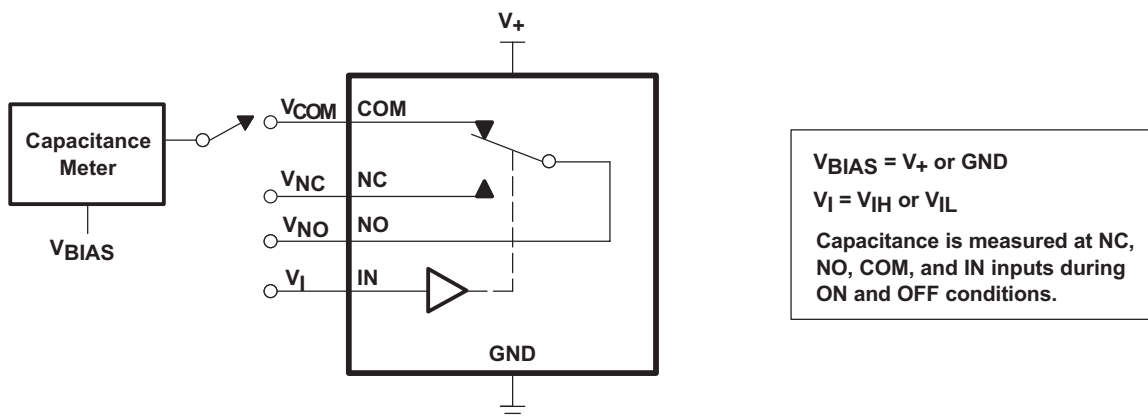
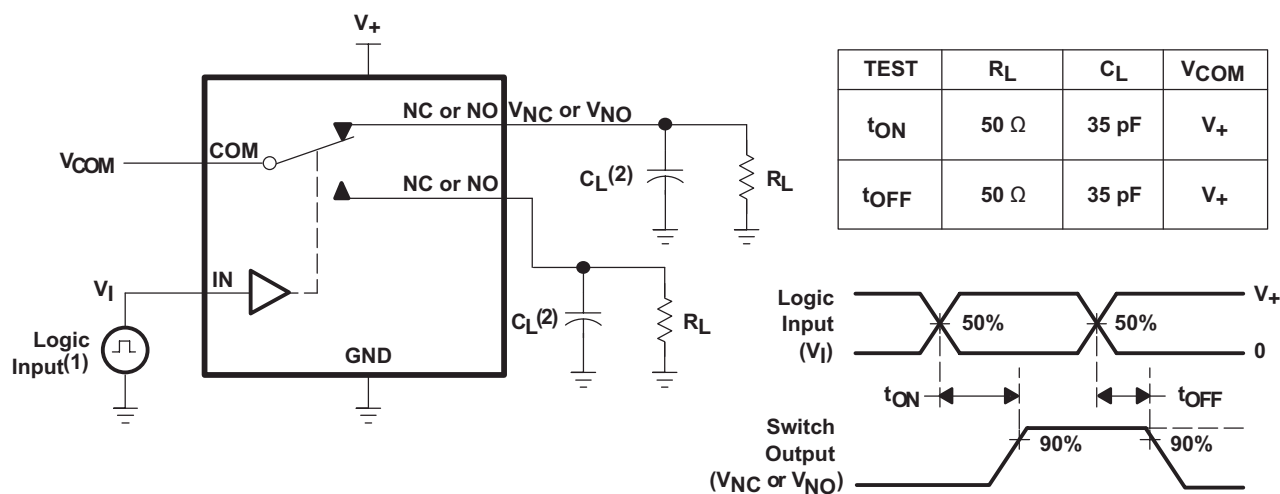


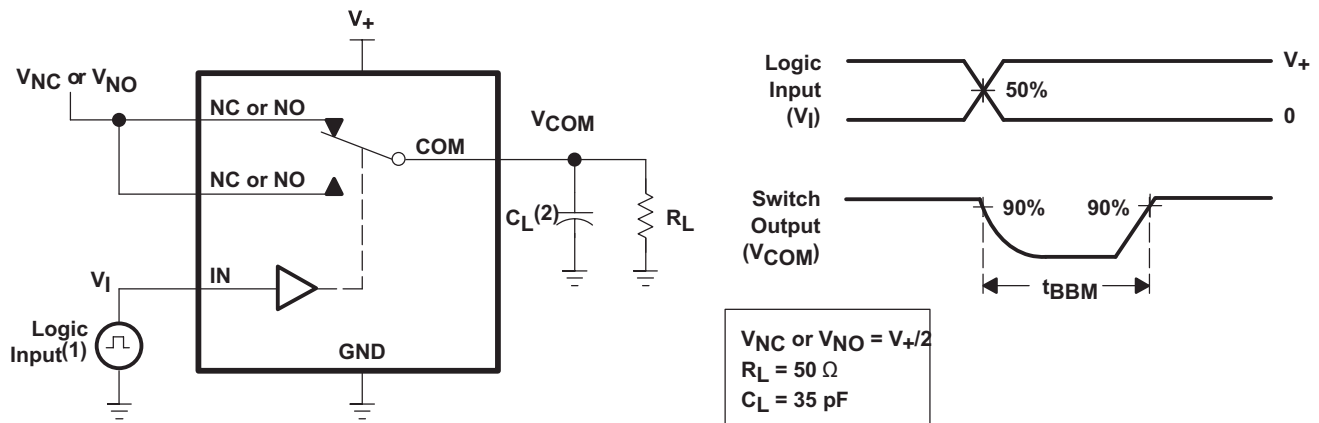
Figure 13. Capacitance (C_I , $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)



- (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. Turnon (t_{ON}) and Turnoff Time (t_{OFF})

Parameter Measurement Information (continued)



- (1) All input pulses are supplied by generators having the following characteristics: PRR $\leq 10 \text{ MHz}$, $Z_0 = 50 \Omega$, $t_r < 5 \text{ ns}$, $t_f < 5 \text{ ns}$.
- (2) C_L includes probe and jig capacitance.

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

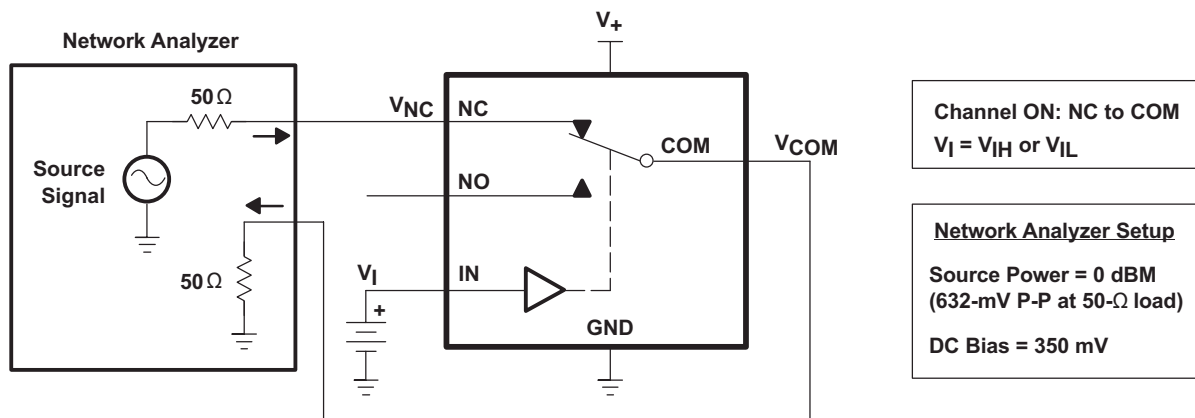


Figure 16. Bandwidth (BW)

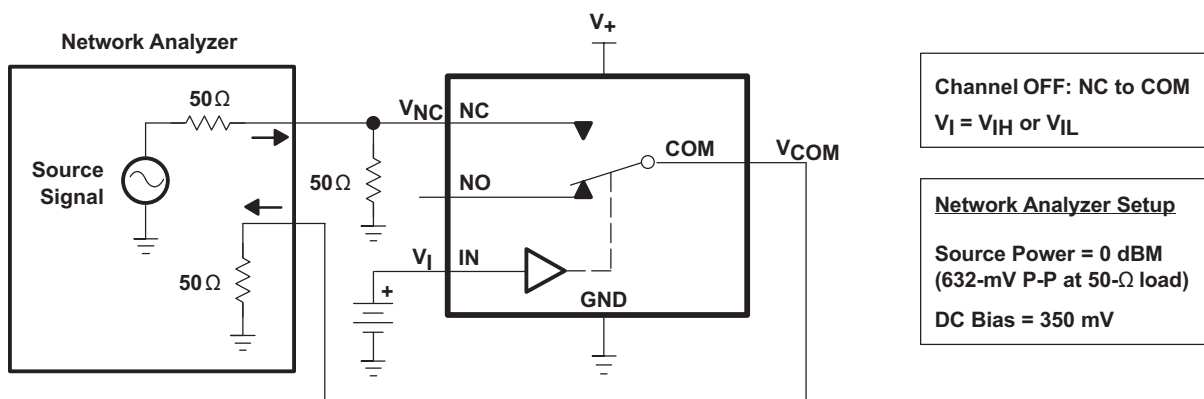


Figure 17. OFF Isolation (O_{ISO})

Parameter Measurement Information (continued)

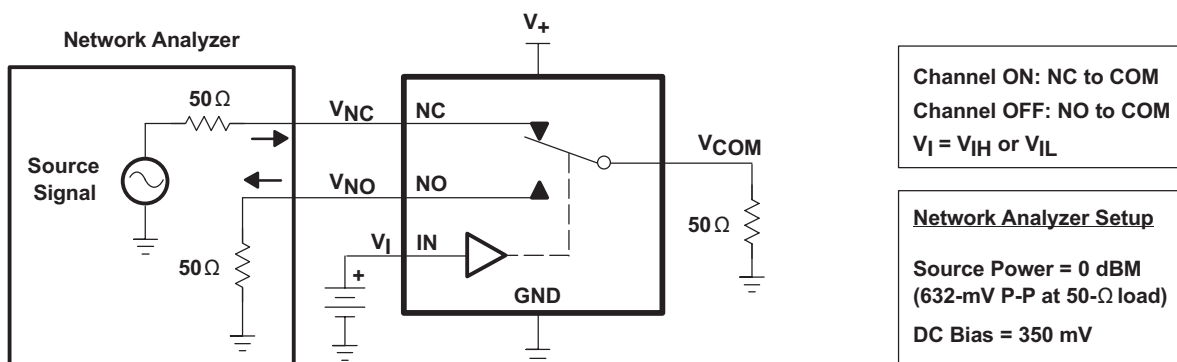
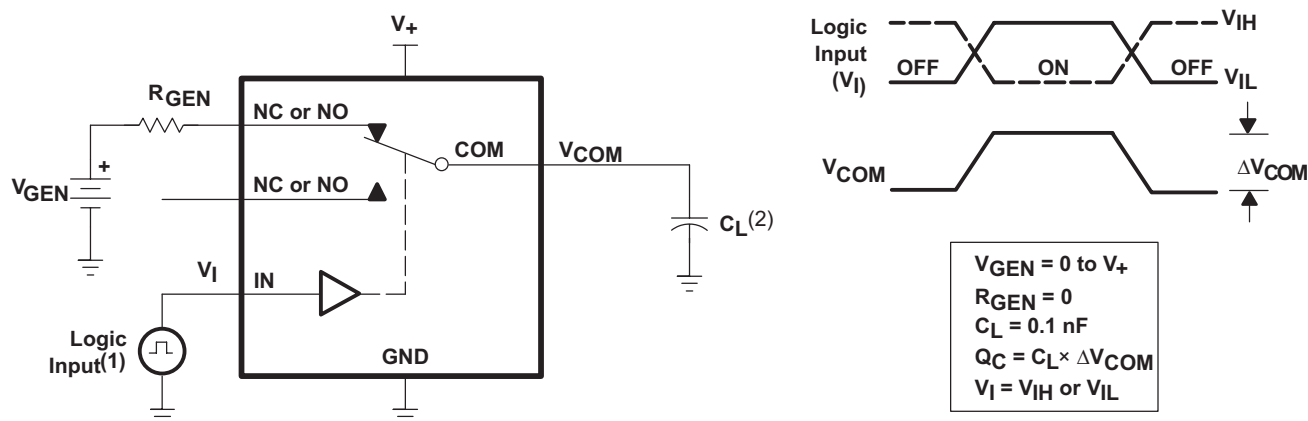
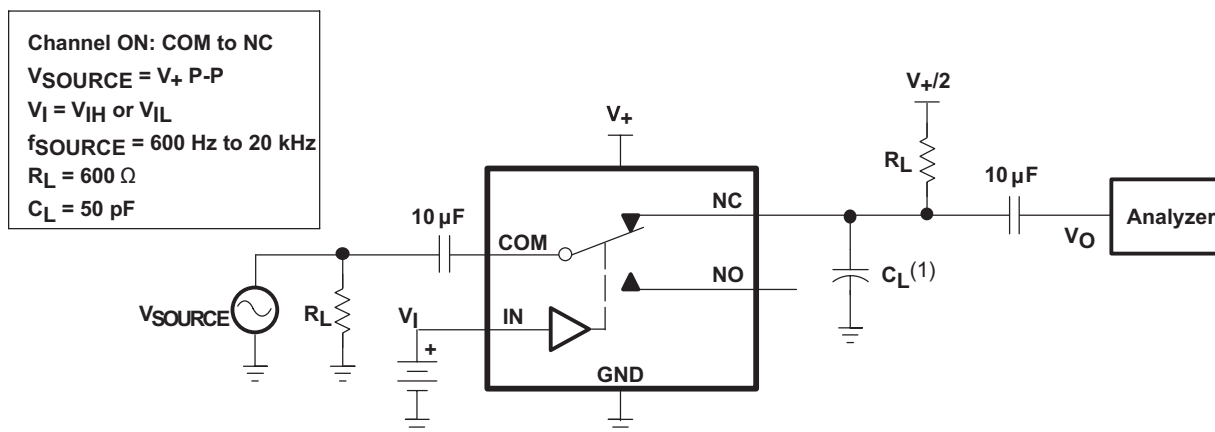


Figure 18. Crosstalk (X_{TALK})



- (1) All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_0 = 50 \Omega$, $t_r < 5$ ns, $t_f < 5$ ns.
- (2) C_L includes probe and jig capacitance.

Figure 19. Charge Injection (Q_C)



- (1) C_L includes probe and jig capacitance.

Figure 20. Total Harmonic Distortion (THD)

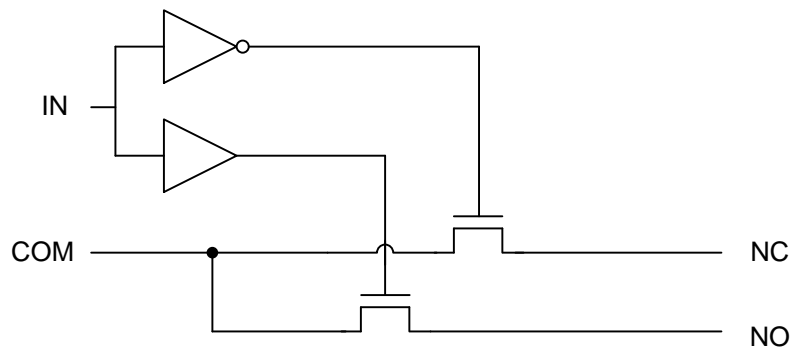
8 Detailed Description

8.1 Overview

The TS5A3159 is a single-pole-double-throw (SPDT) solid-state analog switch. The TS5A3159, like all analog switches, is bidirectional. When powered on, each COM pin is connected to the NC pin. For this device, NC stands for *normally closed* and NO stands for *normally open*. If IN is low, COM is connected to NC. If IN is high, COM is connected to NO.

The TS5A3159 is a break-before-make switch. This means that during switching, a connection is broken before a new connection is established. The NC and NO pins are never connected to each other.

8.2 Functional Block Diagram



8.3 Feature Description

The low ON-state resistance, ON-state resistance matching, and charge injection in the TS5A3159 make this switch an excellent choice for analog signals that require minimal distortion. In addition, the low THD allows audio signals to be preserved more clearly as they pass through the device.

The 1.65-V to 5.5-V operation allows compatibility with more logic levels, and the bidirectional I/Os can pass analog signals from 0 V to V_+ with low distortion.

8.4 Device Functional Modes

Table 1. Function Table

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

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The TS5A3159 can be used in a variety of customer systems. The TS5A3159 can be used anywhere multiple analog or digital signals must be selected to pass across a single line.

9.2 Typical Application

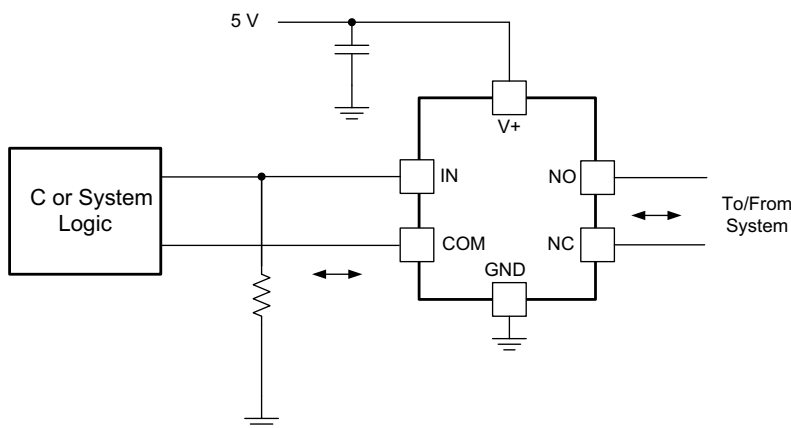


Figure 21. System Schematic for TS5A3159

9.2.1 Design Requirements

In this particular application, V_+ was 1.8 V, although V_+ is allowed to be any voltage specified in [Recommended Operating Conditions](#). A decoupling capacitor is recommended on the V_+ pin. See [Power Supply Recommendations](#) for more details.

9.2.2 Detailed Design Procedure

In this application, IN is, by default, pulled low to GND. Choose the resistor size based on the current driving strength of the GPIO, the desired power consumption, and the switching frequency (if applicable). If the GPIO is open-drain, use pullup resistors instead.

9.2.3 Application Curve

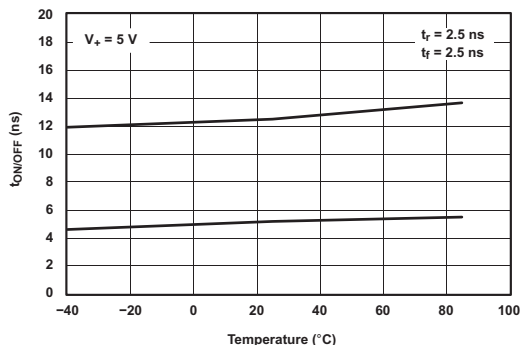


Figure 22. $t_{ON/OFF}$ vs Temperature

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [Recommended Operating Conditions](#).

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- μF bypass capacitor is recommended. If there are multiple pins labeled V_{CC} , then a 0.01- μF or 0.022- μF capacitor is recommended for each V_{CC} because the VCC pins will be tied together internally. For devices with dual supply pins operating at different voltages, for example V_{CC} and V_{DD} , a 0.1- μF bypass capacitor is recommended for each supply pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1- μF and 1- μF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

11 Layout

11.1 Layout Guidelines

Reflections and matching are closely related to loop antenna theory, but different enough to warrant their own discussion. When a PCB trace turns a corner at a 90° angle, a reflection can occur. This is primarily due to the change of width of the trace. At the apex of the turn, the trace width is increased to 1.414 times its width. This upsets the transmission line characteristics, especially the distributed capacitance and self-inductance of the trace — resulting in the reflection. It is a given that not all PCB traces can be straight, and so they will have to turn corners. Below figure shows progressively better techniques of rounding corners. Only the last example maintains constant trace width and minimizes reflections.

Unused switch I/Os, such as NO, NC, and COM, can be left floating or tied to GND. However, the IN pin must be driven high or low. Due to partial transistor turnon when control inputs are at threshold levels, floating control inputs can cause increased I_{CC} or unknown switch selection states.

11.2 Layout Example

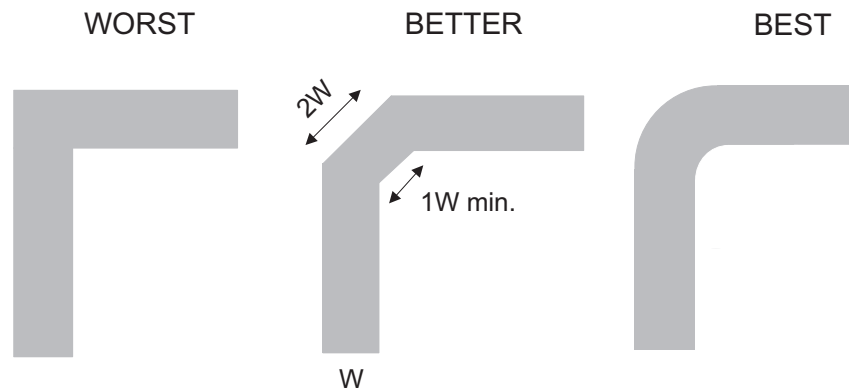


Figure 23. Trace Example

12 Device and Documentation Support

12.1 Device Support

12.1.1 Device Nomenclature

Table 2. 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
$r_{on(Flat)}$	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 (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}	Turnon 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}	Turnoff 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.

Table 2. Parameter Description (continued)

SYMBOL	DESCRIPTION
$C_{NC(OFF)}$	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.
I_+	Static power-supply current with the control (IN) terminal 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.

12.2 Documentation Support

12.2.1 Related Documentation

For related documentation, see the following:

- *Implications of Slow or Floating CMOS Inputs*, [SCBA004](#)

12.3 Trademarks

All trademarks are the property of their respective owners.

12.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5A3159DBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DBVRE4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DBVRG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DBVBT	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DBVTE4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DBVTG4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JA8K ~ JA8R)	Samples
TS5A3159DCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAK ~ JAR ~ JAZ)	Samples
TS5A3159DCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAK ~ JAR ~ JAZ)	Samples
TS5A3159DCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAK ~ JAR ~ JAZ)	Samples
TS5A3159DCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAK ~ JAR ~ JAZ)	Samples
TS5A3159DCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAK ~ JAR ~ JAZ)	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.

⁽⁶⁾ Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TS5A3159 :

● Automotive: [TS5A3159-Q1](#)

● Enhanced Product: [TS5A3159-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

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
TS5A3159DBVR	SOT-23	DBV	6	3000	180.0	9.2	3.17	3.23	1.37	4.0	8.0	Q3
TS5A3159DBVT	SOT-23	DBV	6	250	180.0	9.2	3.17	3.23	1.37	4.0	8.0	Q3
TS5A3159DCKR	SC70	DCK	6	3000	180.0	9.2	2.3	2.55	1.2	4.0	8.0	Q3
TS5A3159DCKT	SC70	DCK	6	250	180.0	9.2	2.3	2.55	1.2	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

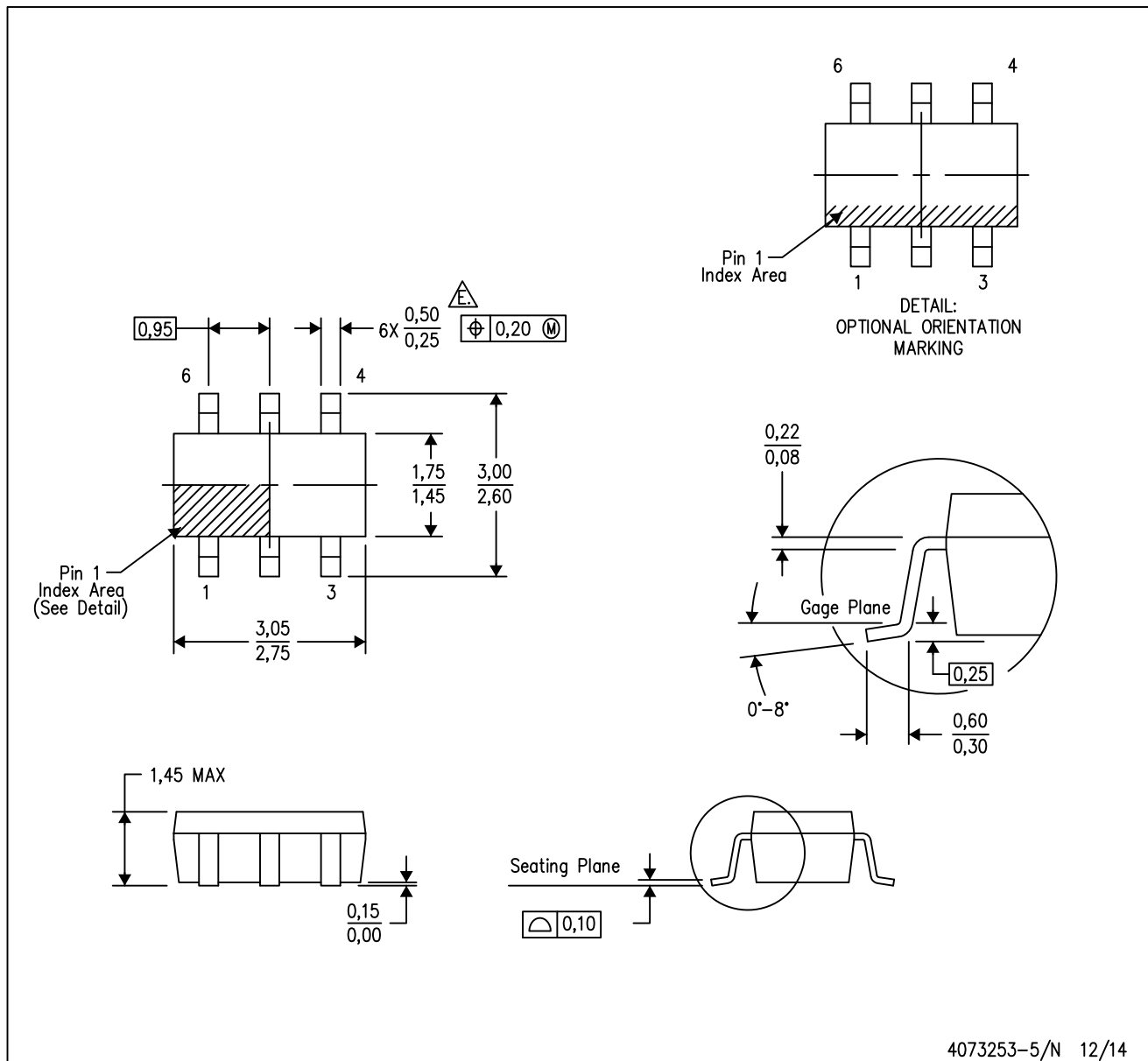

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A3159DBVR	SOT-23	DBV	6	3000	205.0	200.0	33.0
TS5A3159DBVT	SOT-23	DBV	6	250	205.0	200.0	33.0
TS5A3159DCKR	SC70	DCK	6	3000	205.0	200.0	33.0
TS5A3159DCKT	SC70	DCK	6	250	205.0	200.0	33.0

MECHANICAL DATA

DBV (R-PDSO-G6)

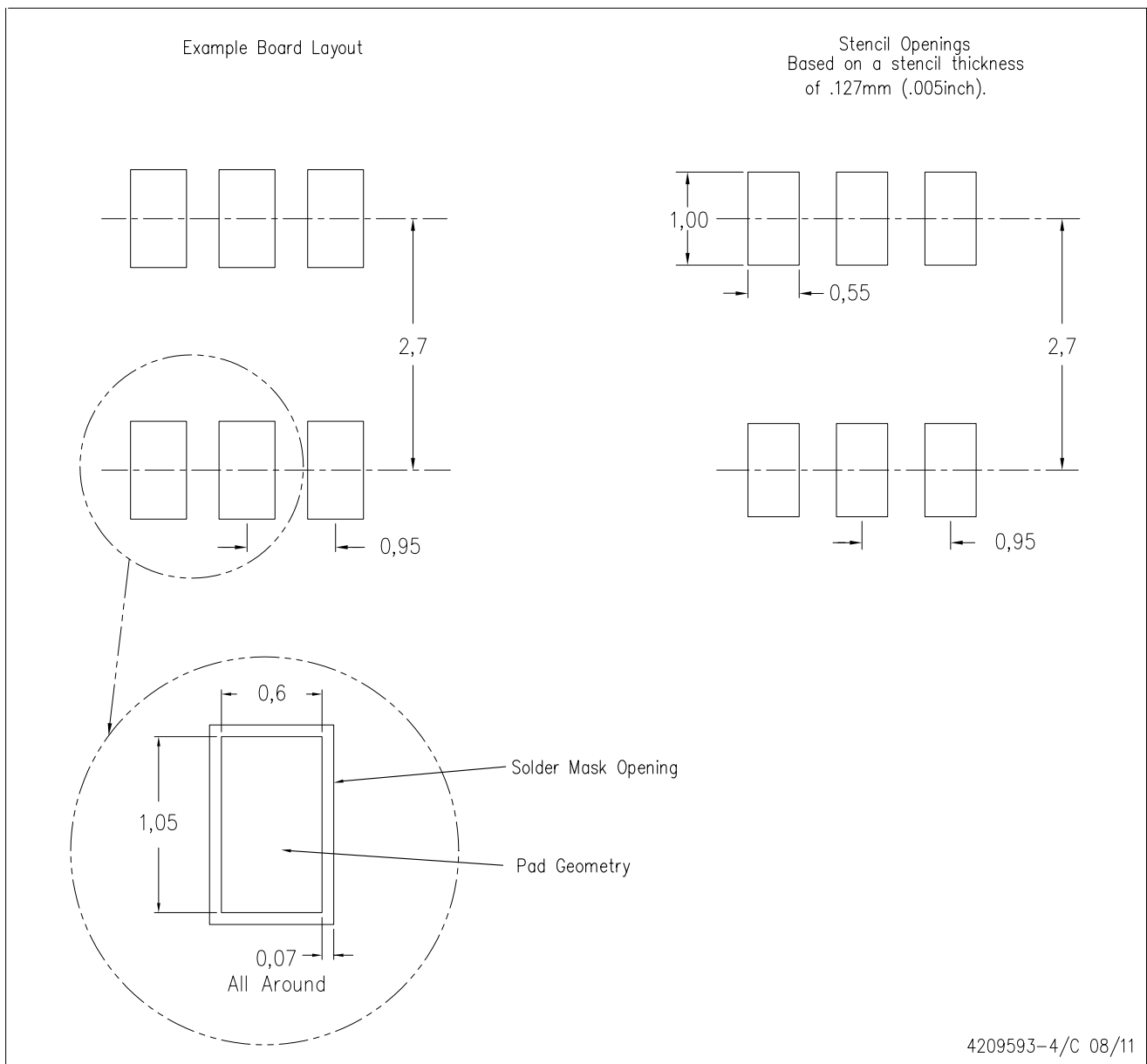
PLASTIC SMALL-OUTLINE PACKAGE



- 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. 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.
- 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)

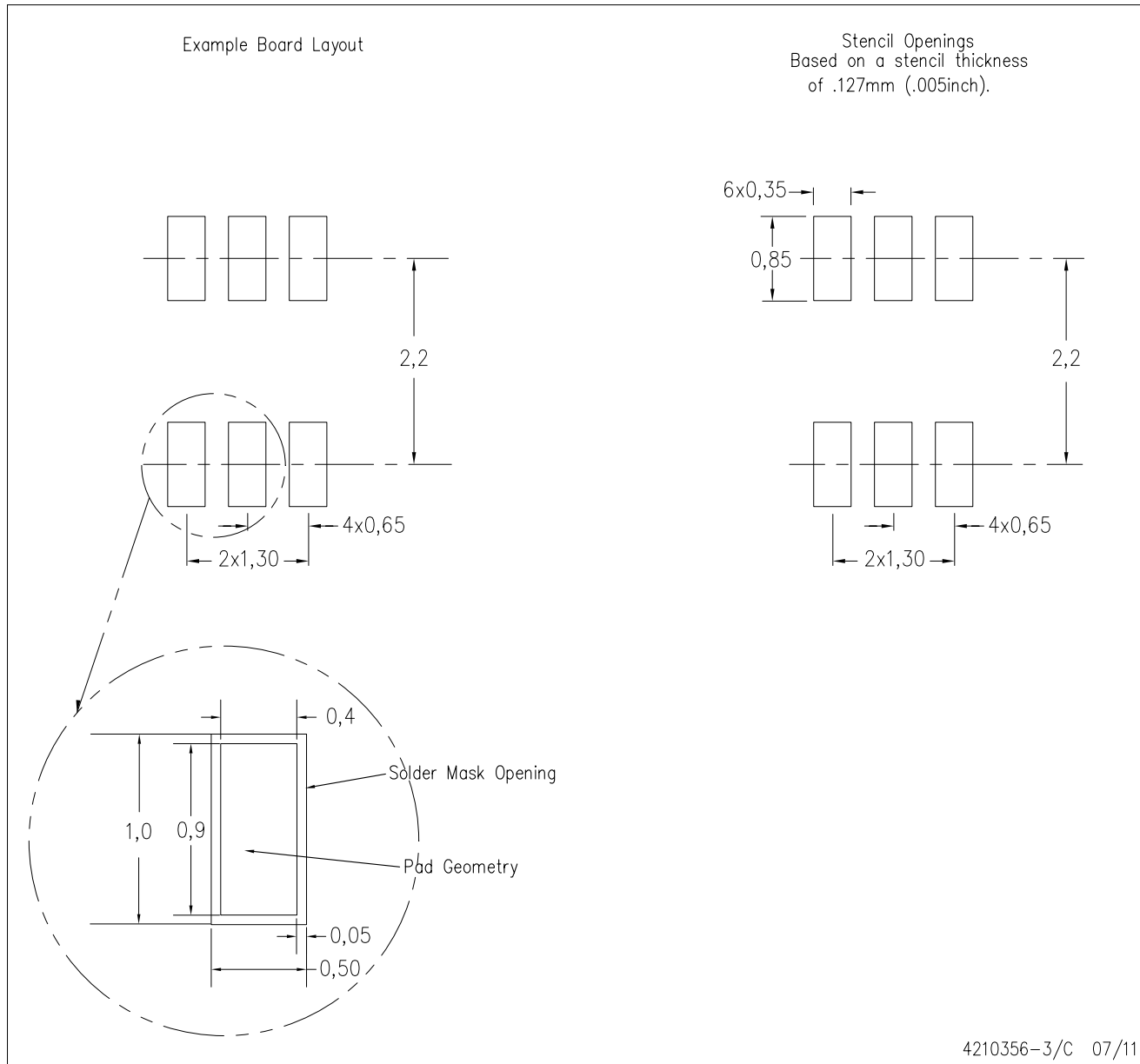
PLASTIC SMALL-OUTLINE PACKAGE



- 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.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.

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

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com