



## TS5A3166-Q1 0.9-Ω SPST Analog Switch

### 1 Features

- Qualified for Automotive Applications
- Isolation in Powered-Off Mode,  $V_+ = 0$
- Low ON-State Resistance (0.9 Ω)
- Control Inputs are 5.5 V Tolerant
- Low Charge Injection
- Low Total Harmonic Distortion (THD)
- 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

- Cell Phones
- PDAs
- Radar System
- Infotainment System
- Portable Instrumentation
- Audio and Video Signal Routing
- Low-Voltage Data-Acquisition Systems
- Communication Circuits
- Modems
- Hard Drives
- Computer Peripherals
- Wireless Terminals and Peripherals
- Microphone Switching – Notebook Docking

### 3 Description

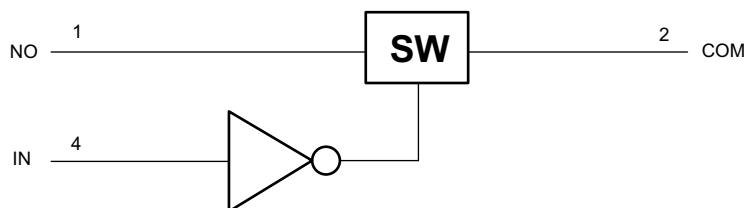
The TS5A3166-Q1 is a single-pole single-throw (SPST) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance. The device has excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications.

#### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TS5A3166-Q	SC70 (5)	2.00 mm × 1.25 mm

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

### 4 Simplified Schematic



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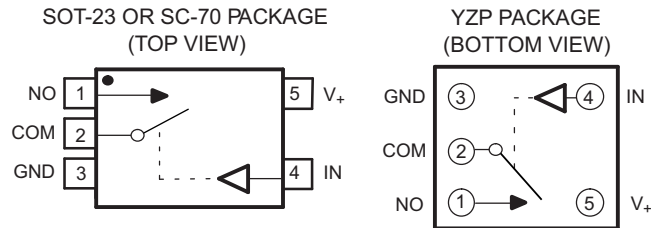
## 5 Revision History

### Changes from Original (July 2014) to Revision A

Page

• Initial release of full document. ....	1
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## 6 Pin Configuration and Functions



### Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
NO	1	IO	Normally closed
COM	2	IO	Common
GND	3	GND	Digital ground
IN	4	Input	Digital control pin to connect COM to NO
V <sub>+</sub>	5	Power	Power Supply

## 7 Specifications

### 7.1 Absolute Maximum Ratings<sup>(1)(2)</sup>

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

			MIN	MAX	UNIT
V <sub>+</sub>	Supply voltage range <sup>(3)</sup>		-0.5	6.5	V
V <sub>NO</sub> V <sub>COM</sub>	Analog voltage range <sup>(3) (4) (5)</sup>		-0.5	V <sub>+</sub> + 0.5	V
I <sub>K</sub>	Analog port diode current	V <sub>NO</sub> , V <sub>COM</sub> < 0	-50		mA
I <sub>NO</sub> I <sub>COM</sub>	On-state switch current	V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>+</sub>	-200	200	mA
	On-state peak switch current <sup>(6)</sup>		-400	400	
V <sub>I</sub>	Digital input voltage range <sup>(3) (4)</sup>		-0.5	6.5	V
I <sub>IK</sub>	Digital clamp current	V <sub>I</sub> < 0	-50		mA
I <sub>+</sub>	Continuous current through V <sub>+</sub>		100		mA
I <sub>GND</sub>	Continuous current through GND		-100		mA
T <sub>stg</sub>	Storage temperature range		-65	150	°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum
- (3) All voltages are with respect to ground, unless otherwise specified.
- (4) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (5) This value is limited to 5.5 V maximum.
- (6) Pulse at 1-ms duration < 10% duty cycle.

### 7.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002 <sup>(1)</sup>	V
		Charged-device model (CDM), per AEC Q100-011	

- (1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

## 7.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
$V_{I/O}$	Input/output voltage	0	5.5	V
$V_+$	Supply voltage	0	5.5	V
$V_I$	Control Input Voltage	0	5.5	V
$T_A$	Operating free-air temperature	–40	125	°C

## 7.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		TS5A3166-Q1	UNIT
		DCK	
		5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	283.1	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	92.2	
$R_{\theta JB}$	Junction-to-board thermal resistance	60.8	
$\Psi_{JT}$	Junction-to-top characterization parameter	1.7	
$\Psi_{JB}$	Junction-to-board characterization parameter	60.0	

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

## 7.5 Electrical Characteristics for 5-V Supply<sup>(1)</sup>

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

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
Analog Switch												
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub>					0		V <sub>+</sub>	0		V <sub>+</sub>	V
Peak ON resistance	r <sub>peak</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	4.5 V	0.8	1.1		0.8	1.1		Ω
				Full			1.2		1.44			
ON-state resistance	r <sub>on</sub>	V <sub>NO</sub> = 2.5 V, I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	4.5 V	0.7	0.9		0.7	0.9		Ω
				Full			1		1.2			
ON-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	4.5 V	0.15		0.15				Ω
		V <sub>NO</sub> = 1 V, 1.5 V, 2.5 V, I <sub>COM</sub> = −100 mA,		25°C		0.09	0.15	0.09	0.15			
				Full		0.15		0.18				
NO OFF leakage current	I <sub>NO(OFF)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 4.5 V, or V <sub>NO</sub> = 4.5 V, V <sub>COM</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	5.5 V	−20	4	20	−80	4	80	nA
				Full		−100		100	−400		400	
	I <sub>NO(PWROFF)</sub>	V <sub>NO</sub> = 0 to 5.5 V, V <sub>COM</sub> = 5.5 V to 0,		25°C	0 V	−5	0.4	5	−5	0.4	5	μA
				Full		−15		15	−30		30	
COM OFF leakage current	I <sub>COM(OFF)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = 4.5 V, or V <sub>COM</sub> = 4.5 V, V <sub>NO</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	5.5 V	−20	4	20	−80	4	80	nA
				Full		−100		100	−400		400	
	I <sub>COM(PWROFF)</sub>	V <sub>COM</sub> = 5.5 V to 0, V <sub>NO</sub> = 0 to 5.5 V,		25°C	0 V	−5	0.4	5	−5	0.4	5	μA
				Full		−15		15	−30		30	
NO ON leakage current	I <sub>NO(ON)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = Open, or V <sub>NO</sub> = 4.5 V, V <sub>COM</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	5.5 V	−2	0.3	2	−80	0.3	80	nA
				Full		−20		20	−400		400	
COM ON leakage current	I <sub>COM(ON)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = Open, or V <sub>COM</sub> = 4.5 V, V <sub>NO</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	5.5 V	−2	0.3	2	−80	0.3	80	nA
				Full		−20		20	−400		400	
Digital Control Inputs (IN)												
Input logic high	V <sub>IH</sub>			Full		2.4		5.5	2.4		5.5	V
Input logic low	V <sub>IL</sub>			Full		0		0.8	0		0.8	V
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0		25°C	5.5 V	−2	0.3	2				nA
				Full		−20		20	−400		400	

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

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**Electrical Characteristics for 5-V Supply<sup>(1)</sup> (continued)**
 $V_+ = 4.5\text{ V to }5.5\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
Dynamic												
Turn-on time	t <sub>ON</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	5 V	2.5	4.5	7	2.5	4.5	7	ns
				Full	4.5 V to 5.5 V	1.5		7.5	1.5		7.5	
Turn-off time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	5 V	6	9	11.5	6	9	11.5	ns
				Full	4.5 V to 5.5 V	4		12.5	4		12.5	
Charge injection	Q <sub>C</sub>	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0 ,	C <sub>L</sub> = 1 nF, See <a href="#">Figure 20</a>	25°C	5 V		1			1		pC
NO OFF capacitance	C <sub>NO(OFF)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	5 V		19			19		pF
COM OFF capacitance	C <sub>COM(OFF)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	5 V		18			18		pF
NO ON capacitance	C <sub>NO(ON)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	5 V		35.5			35.5		pF
COM ON capacitance	C <sub>COM(ON)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	5 V		35.5			35.5		pF
Digital input capacitance	C <sub>I</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	See <a href="#">Figure 16</a>	25°C	5 V		2			2		pF
Bandwidth	BW	R <sub>L</sub> = 50 Ω, Switch ON,	See <a href="#">Figure 18</a>	25°C	5 V		200			200		MHz
OFF isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch OFF, See <a href="#">Figure 19</a>	25°C	5 V		−64			−64		dB
Total harmonic distortion	THD	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF,	f = 20 Hz to 20 kHz, See <a href="#">Figure 21</a>	25°C	5 V		0.005			0.005		%
Supply												
Positive supply current	I <sub>+</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	Switch ON or OFF	25°C	5.5 V	0.01	0.1		0.01	0.1		μA
				Full				0.5		0.8		

## 7.6 Electrical Characteristics for 3.3-V Supply<sup>(1)</sup>

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

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
Analog Switch												
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub>					0	V <sub>+</sub>		0	V <sub>+</sub>		V
Peak ON resistance	r <sub>peak</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	3 V	1.1	1.5		1.1	1.5		Ω
				Full			1.7			2.07		
ON-state resistance	r <sub>on</sub>	V <sub>NO</sub> = 2 V, I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	3 V	1	1.4		1	1.4		Ω
				Full			1.5			1.8		
ON-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	3 V	0.3			0.3			Ω
		V <sub>NO</sub> = 2 V, 0.8 V, I <sub>COM</sub> = −100 mA,		25°C		0.09	0.15		0.09	0.15		
						Full		0.15			0.18	
NO OFF leakage current	I <sub>NO(OFF)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 3 V, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	3.6 V	−2	0.5	2	−2	0.5	2	nA
				Full		−20		20	−360		360	
	I <sub>NO(PWROFF)</sub>	V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0,	Switch OFF, See <a href="#">Figure 14</a>	25°C	0 V	−1	0.1	1	−1	0.1	1	μA
				Full		−5		5	−27		27	
COM OFF leakage current	I <sub>COM(OFF)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = 3 V, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	3.6 V	−2	0.5	2	−72	0.5	72	nA
				Full		−20		20	−360		360	
	I <sub>COM(PWROFF)</sub>	V <sub>COM</sub> = 3.6 V to 0, V <sub>NO</sub> = 0 to 3.6 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	0 V	−1	0.1	1	−2	0.1	2	μA
				Full		−5		5	−27		27	
NO ON leakage current	I <sub>NO(ON)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = Open, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	3.6 V	−2	0.2	2	−72		72	nA
				Full		−20		20	−360		360	
COM ON leakage current	I <sub>COM(ON)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = Open, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	3.6 V	−2	0.2	2	−72		72	nA
				Full		−20		20	−360		360	
Digital Control Inputs (IN)												
Input logic high	V <sub>IH</sub>			Full		2	5.5		2	5.5		V
Input logic low	V <sub>IL</sub>			Full		0	0.8		0	0.8		V
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0		25°C	3.6 V	−2	0.3	2				nA
				Full		−20		20	−360		360	

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

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**Electrical Characteristics for 3.3-V Supply<sup>(1)</sup> (continued)**
 $V_+ = 3\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
Dynamic												
Turn-on time	t <sub>ON</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	3.3 V	2	5	10	2	5	10	ns
				Full	3 V to 3.6 V	1.5		11	1.5		11	
Turn-off time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	3.3 V	6.5	9	12	6.5	9	12	ns
				Full	3 V to 3.6 V	4		13	4		13	
Charge injection	Q <sub>C</sub>	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0,	C <sub>L</sub> = 1 nF, See <a href="#">Figure 21</a>	25°C	3.3 V		1			1		pC
NO OFF capacitance	C <sub>NO(OFF)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	3.3 V		19			19		pF
COM OFF capacitance	C <sub>COM(OFF)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	3.3 V		18			18		pF
NO ON capacitance	C <sub>NO(ON)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	3.3 V		36			36		pF
COM ON capacitance	C <sub>COM(ON)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	3.3 V		36			36		pF
Digital input capacitance	C <sub>I</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	See <a href="#">Figure 16</a>	25°C	3.3 V		2			2		pF
Bandwidth	BW	R <sub>L</sub> = 50 Ω, Switch ON,	See <a href="#">Figure 18</a>	25°C	3.3 V		200			200		MHz
OFF isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch OFF, See <a href="#">Figure 19</a>	25°C	3.3 V		−64			−64		dB
Total harmonic distortion	THD	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF,	f = 20 Hz to 20 kHz, See <a href="#">Figure 21</a>	25°C	3.3 V		0.01			0.01		%
Supply												
Positive supply current	I <sub>+</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	Switch ON or OFF	25°C	3.6 V	0.01	0.1		0.01	0.1		μA
				Full			0.25		0.7			

## 7.7 Electrical Characteristics for 2.5-V Supply<sup>(1)</sup>

 $V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT		
						MIN	TYP	MAX	MIN	TYP	MAX			
Analog Switch														
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub>				2.3 V	0		V <sub>+</sub>	0		V <sub>+</sub>	V		
Peak ON resistance	r <sub>peak</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	2.3 V	1.8		2.4	1.8		2.4	Ω		
				Full					2.6			3.1		
ON-state resistance	r <sub>on</sub>	V <sub>NO</sub> = 2 V, I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	2.3 V	1.2		2.1	1.2		2.1	Ω		
				Full					2.4			2.88		
ON-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA,	Switch ON, See <a href="#">Figure 13</a>	25°C	2.3 V	0.7			0.7			Ω		
		V <sub>NO</sub> = 2 V, 0.8 V, I <sub>COM</sub> = −100 mA,		25°C		0.4		0.6	0.4		0.6			
						Full				0.6				0.72
NO OFF leakage current	I <sub>NO(OFF)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 3 V, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	2.7 V	−5		0.3	5	−64		0.3	64	nA
				Full		−50			50	−320			320	
	I <sub>NO(PWROFF)</sub>	V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0,		25°C	0 V	−2		0.05	2	−2		0.05	2	μA
				Full		−15			15	−24			24	
COM OFF leakage current	I <sub>COM(OFF)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = 3 V, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = 1 V,	Switch OFF, See <a href="#">Figure 14</a>	25°C	2.7 V	−5		0.3	5	−64		0.3	64	nA
				Full		−50			50	−320			320	
	I <sub>COM(PWROFF)</sub>	V <sub>COM</sub> = 3.6 V to 0, V <sub>NO</sub> = 0 to 3.6 V,		25°C	0 V	−2		0.05	2	−2		0.05	2	μA
				Full		−15			15	−24			24	
NO ON leakage current	I <sub>NO(ON)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = Open, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	2.7 V	−2		0.3	2	−64			64	nA
Full				−20				20	−320			320		
COM ON leakage current	I <sub>COM(ON)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = Open, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = Open,	Switch ON, See <a href="#">Figure 15</a>	25°C	2.7 V	−2		0.3	2	−64		0.3	64	nA
Full				−20				20	−320			320		
Digital Control Inputs (IN1, IN2)														
Input logic high	V <sub>IH</sub>			Full		1.8		5.5	1.8		5.5	V		
Input logic low	V <sub>IL</sub>			Full		0		0.6	0		0.6	V		
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0		25°C	2.7 V	−2		0.3	2			nA		
				Full		−20			20	−320				320

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

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## Electrical Characteristics for 2.5-V Supply<sup>(1)</sup> (continued)

$V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
Dynamic												
Turn-on time	t <sub>ON</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	2.5 V	2	6	10	2	6	10	ns
				Full	2.3 V to 2.7 V	1		12	1		12	
Turn-off time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	2.5 V	4.5	8	10.5	4.5	8	10.5	ns
				Full	2.3 V to 2.7 V	3		15	3		15	
Charge injection	Q <sub>C</sub>	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0,	C <sub>L</sub> = 1 nF, See <a href="#">Figure 21</a>	25°C	2.5 V		4			4		pC
NO OFF capacitance	C <sub>NO(OFF)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	2.5 V		19.5			19.5		pF
COM OFF capacitance	C <sub>COM(OFF)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	2.5 V		18.5			18.5		pF
NO ON capacitance	C <sub>NO(ON)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	2.5 V		36.5			36.5		pF
COM ON capacitance	C <sub>COM(ON)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	2.5 V		36.5			36.5		pF
Digital input capacitance	C <sub>I</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	See <a href="#">Figure 16</a>	25°C	2.5 V		2			2		pF
Bandwidth	BW	R <sub>L</sub> = 50 Ω, Switch ON,	See <a href="#">Figure 18</a>	25°C	2.5 V		150			150		MHz
OFF isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch OFF, See <a href="#">Figure 19</a>	25°C	2.5 V		−62			−62		dB
Total harmonic distortion	THD	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF,	f = 20 Hz to 20 kHz, See <a href="#">Figure 21</a>	25°C	2.5 V		0.02			0.02		%
Supply												
Positive supply current	I <sub>+</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	Switch ON or OFF	25°C	2.7 V	0.001	0.02		0.001	0.02		μA
				Full			0.25			0.6		

## 7.8 Electrical Characteristics for 1.8-V Supply<sup>(1)</sup>

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

PARAMETER	SYMBOL	TEST CONDITIONS	T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
Analog Switch											
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub>					0	V <sub>+</sub>	0	V <sub>+</sub>		V
Peak ON resistance	r <sub>peak</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA, Switch ON, See Figure 13	25°C Full	1.65 V		4.2	25	4.2	25		Ω
ON-state resistance	r <sub>on</sub>	V <sub>NO</sub> = 2 V, I <sub>COM</sub> = −100 mA, Switch ON, See Figure 13	25°C Full	1.65 V		1.6	3.9	1.6	3.9		Ω
ON-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ V <sub>NO</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = −100 mA, Switch ON, See Figure 13	25°C	1.65 V		2.8		2.8		Ω	
			25°C			4.1	22	4.1	22		
			Full			27		32.4			
NO OFF leakage current	I <sub>NO(OFF)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 3 V, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = 1 V, Switch OFF, See Figure 14	25°C	1.95 V		−5	5	−58	58	nA	
			Full			−50	50	−320	320		
	I <sub>NO(PWROFF)</sub>	V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0, Switch OFF, See Figure 14	25°C Full	0 V		−2	2	−2	2	μA	
COM OFF leakage current	I <sub>COM(OFF)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = 3 V, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = 1 V, Switch OFF, See Figure 14	25°C	1.95 V		−5	5	−58	58	nA	
			Full			−50	50	−320	320		
	I <sub>COM(PWROFF)</sub>	V <sub>COM</sub> = 0 to 3.6 V, V <sub>NO</sub> = 3.6 V to 0, Switch OFF, See Figure 14	25°C Full	0 V		−2	2	−2	2	μA	
NO ON leakage current	I <sub>NO(ON)</sub>	V <sub>NO</sub> = 1 V, V <sub>COM</sub> = Open, or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = Open, Switch ON, See Figure 15	25°C	1.95 V		−2	2	−58	58	nA	
			Full			−20	20	−320	320		
COM ON leakage current	I <sub>COM(ON)</sub>	V <sub>COM</sub> = 1 V, V <sub>NO</sub> = Open, or V <sub>COM</sub> = 3 V, V <sub>NO</sub> = Open, Switch ON, See Figure 15	25°C	1.95 V		−2	2	−58	58	nA	
			Full			−20	20	−320	320		
Digital Control Inputs (IN1, IN2)											
Input logic high	V <sub>IH</sub>		Full			1.5	5.5	1.5	5.5		V
Input logic low	V <sub>IL</sub>		Full			0	0.6	0	0.6		V
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0	25°C	1.95 V		−2	0.3	2			nA
			Full			−20	20	−320	320		

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

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**Electrical Characteristics for 1.8-V Supply<sup>(1)</sup> (continued)**
 $V_+ = 1.65\text{ V to }1.95\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T <sub>A</sub>	V <sub>+</sub>	85°C			125°C			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
Dynamic												
Turn-on time	t <sub>ON</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	1.8 V	3	9	18	3	9	18	ns
				Full	1.65 V to 1.95 V	1		20	1		20	
Turn-off time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50 Ω,	C <sub>L</sub> = 35 pF, See <a href="#">Figure 17</a>	25°C	1.8 V	5	10	15.5	5	10	15.5	ns
				Full	1.65 V to 1.95 V	4		18.5	4		18.5	
Charge injection	Q <sub>C</sub>	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0,	C <sub>L</sub> = 1 nF, See <a href="#">Figure 21</a>	25°C	1.8 V		2			2		pC
NO OFF capacitance	C <sub>NO(OFF)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	1.8 V		19.5			19.5		pF
COM OFF capacitance	C <sub>COM(OFF)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 16</a>	25°C	1.8 V		18.5			18.5		pF
NO ON capacitance	C <sub>NO(ON)</sub>	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	1.8 V		36.5			36.5		pF
COM ON capacitance	C <sub>COM(ON)</sub>	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 16</a>	25°C	1.8 V		36.5			36.5		pF
Digital input capacitance	C <sub>I</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	See <a href="#">Figure 16</a>	25°C	1.8 V		2			2		pF
Bandwidth	BW	R <sub>L</sub> = 50 Ω, Switch ON,	See <a href="#">Figure 18</a>	25°C	1.8 V		150			150		MHz
OFF isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch OFF, See <a href="#">Figure 19</a>	25°C	1.8 V		−62			−62		dB
Total harmonic distortion	THD	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF,	f = 20 Hz to 20 kHz See <a href="#">Figure 21</a>	25°C	1.8 V		0.055			0.055		%
Supply												
Positive supply current	I <sub>+</sub>	V <sub>I</sub> = V <sub>+</sub> or GND,	Switch ON or OFF	25°C	1.95 V	0.001	0.01		0.001	0.01		μA
				Full			0.15			0.6		

## 7.9 Typical Characteristics

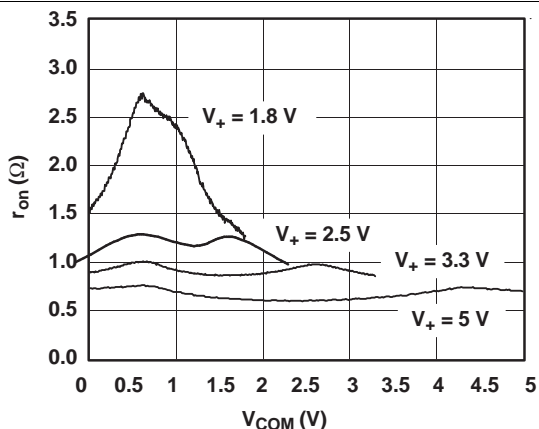


Figure 1.  $r_{on}$  vs  $V_{COM}$

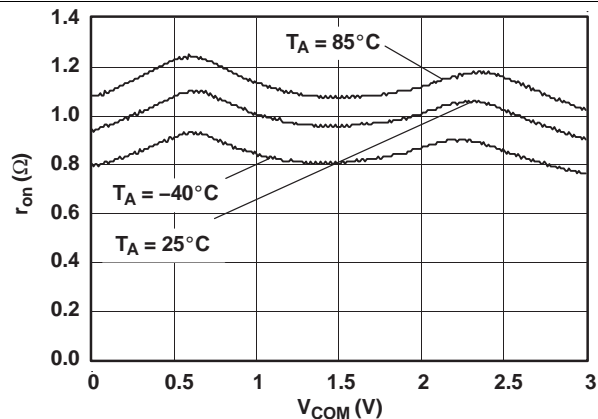


Figure 2.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3$  V)

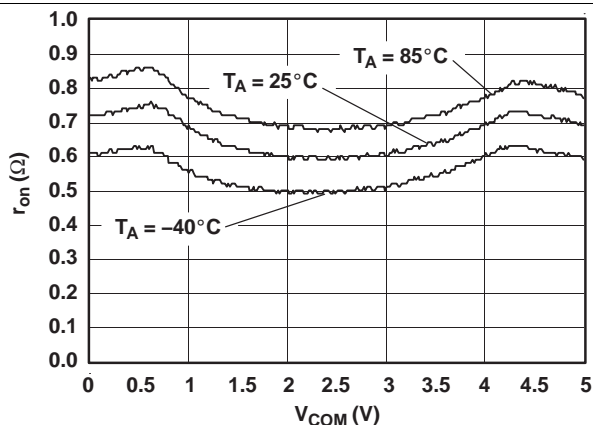


Figure 3.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 5$  V)

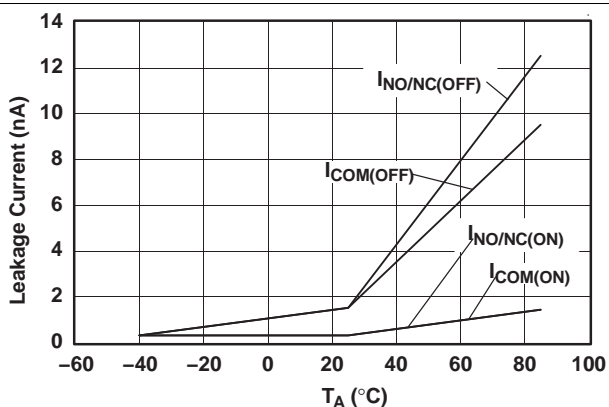


Figure 4. Leakage Current vs Temperature ( $V_+ = 5.5$  V)

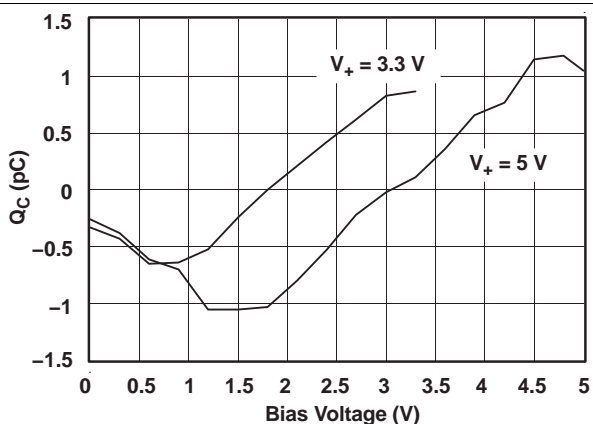


Figure 5. Charge Injection ( $Q_C$ ) vs  $V_{COM}$

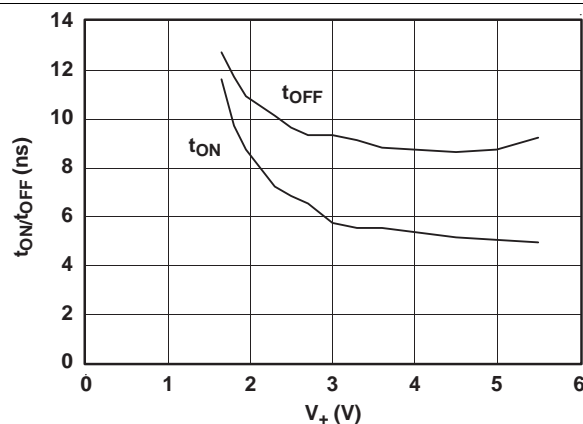


Figure 6.  $t_{ON}$  and  $t_{OFF}$  vs Supply Voltage

## Typical Characteristics (continued)

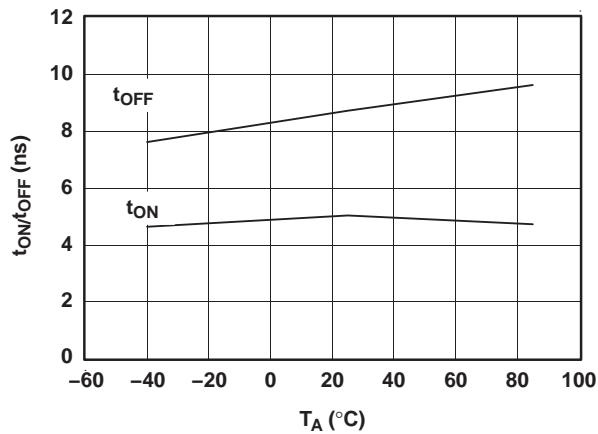


Figure 7.  $t_{ON}$  and  $t_{OFF}$  vs Temperature ( $V_+ = 5$  V)

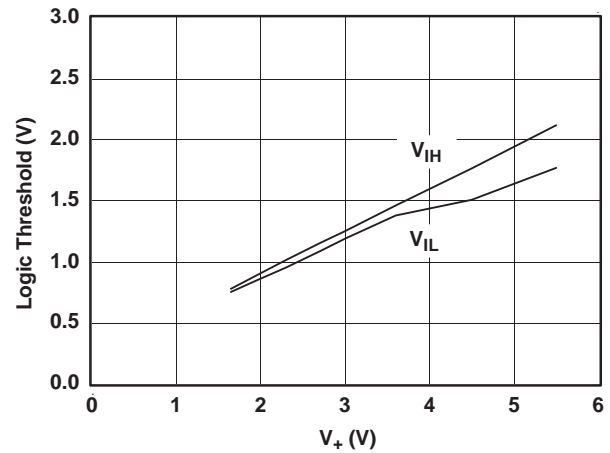


Figure 8. Logic Threshold vs  $V_+$

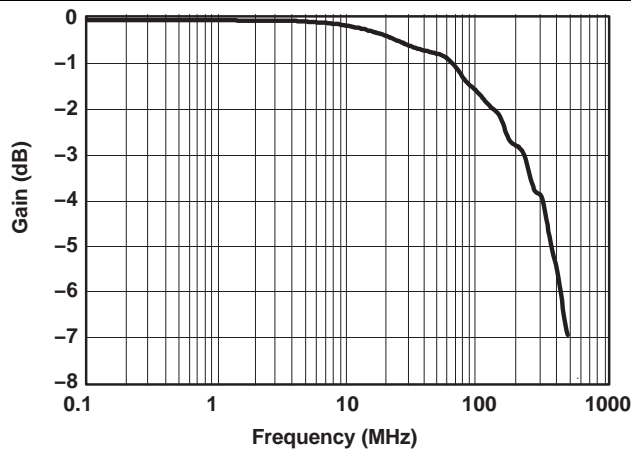


Figure 9. Gain vs Frequency ( $V_+ = 5$  V)

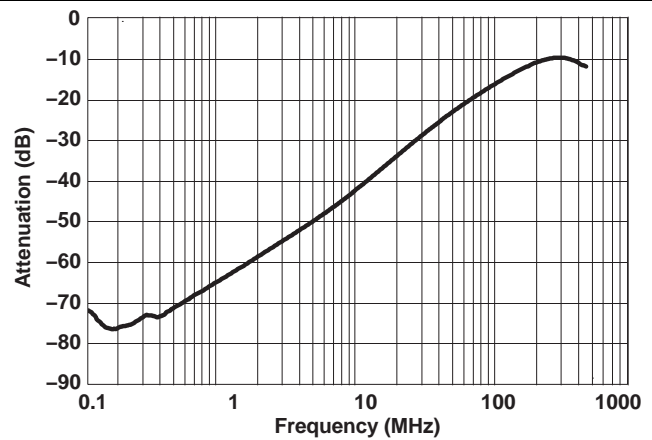


Figure 10. OFF Isolation vs Frequency ( $V_+ = 5$  V)

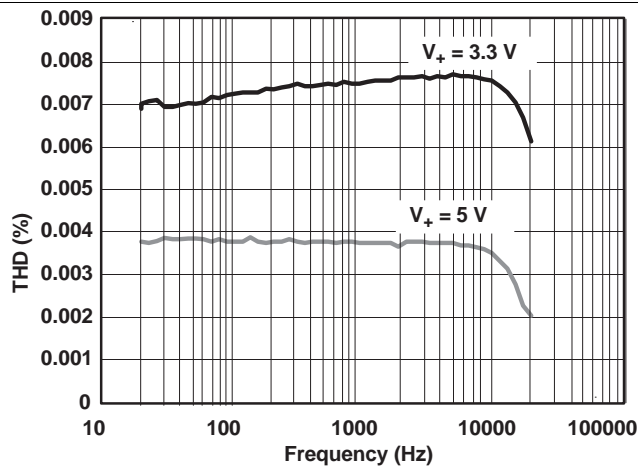


Figure 11. Total Harmonic Distortion vs Frequency ( $V_+ = 5$  V)

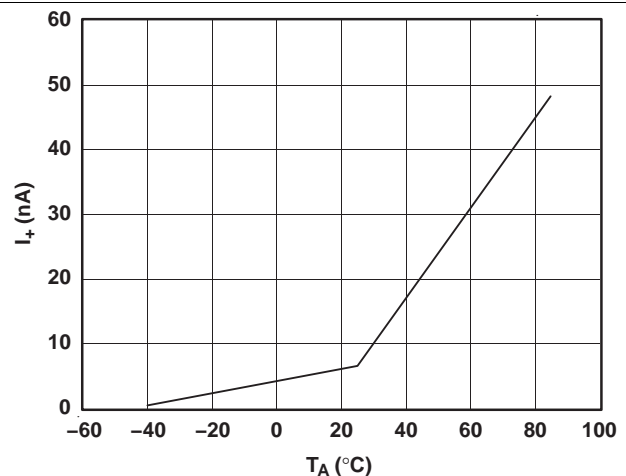
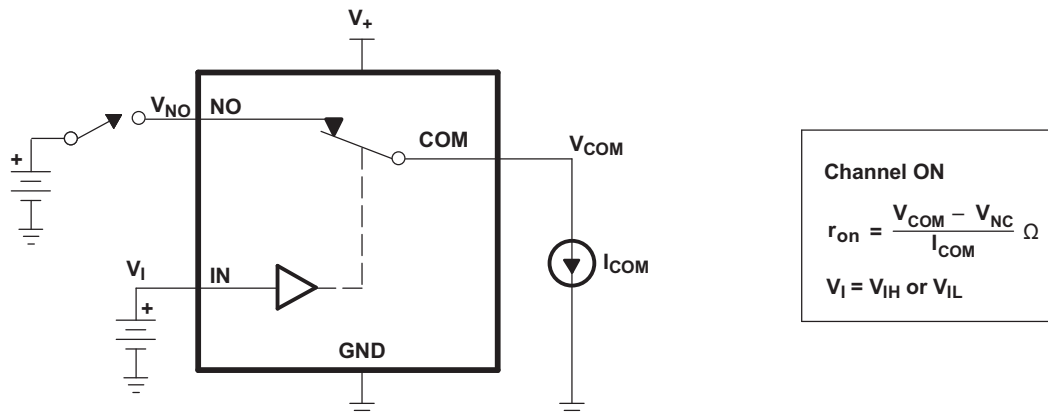
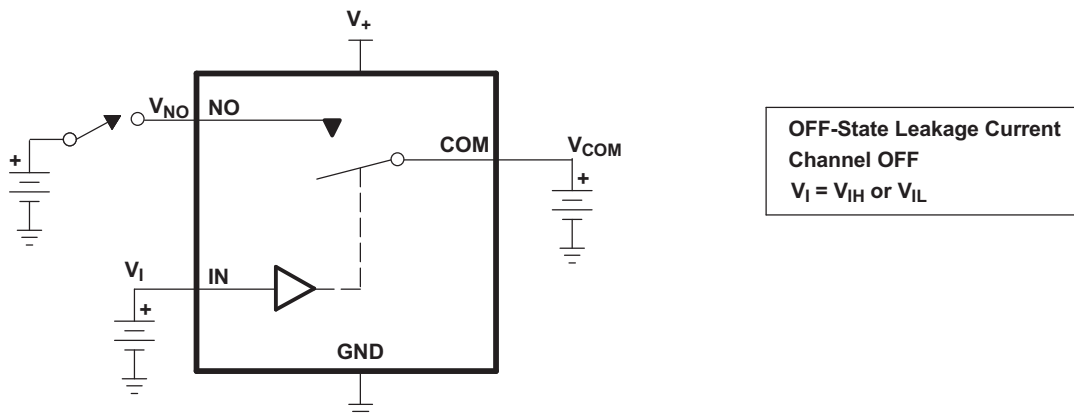


Figure 12. Power-Supply Current vs Temperature ( $V_+ = 5$  V)

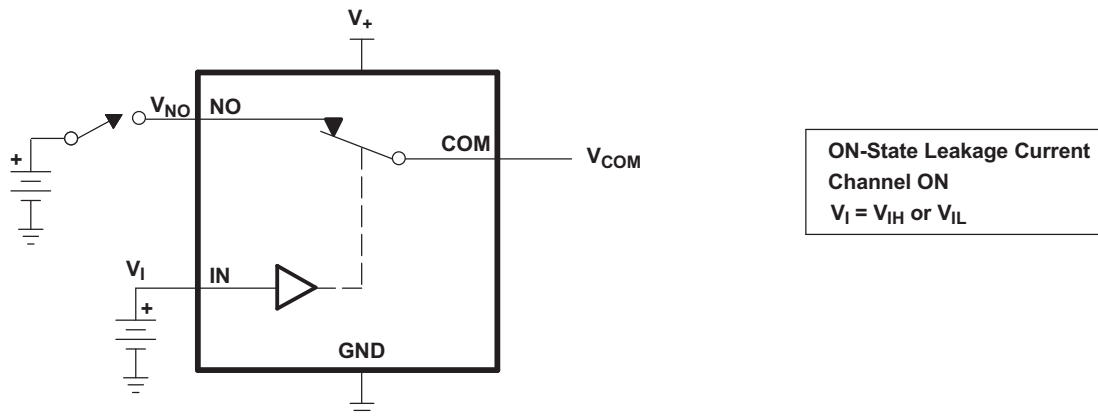
## 8 Parameter Measurement Information



**Figure 13. ON-State Resistance ( $r_{on}$ )**

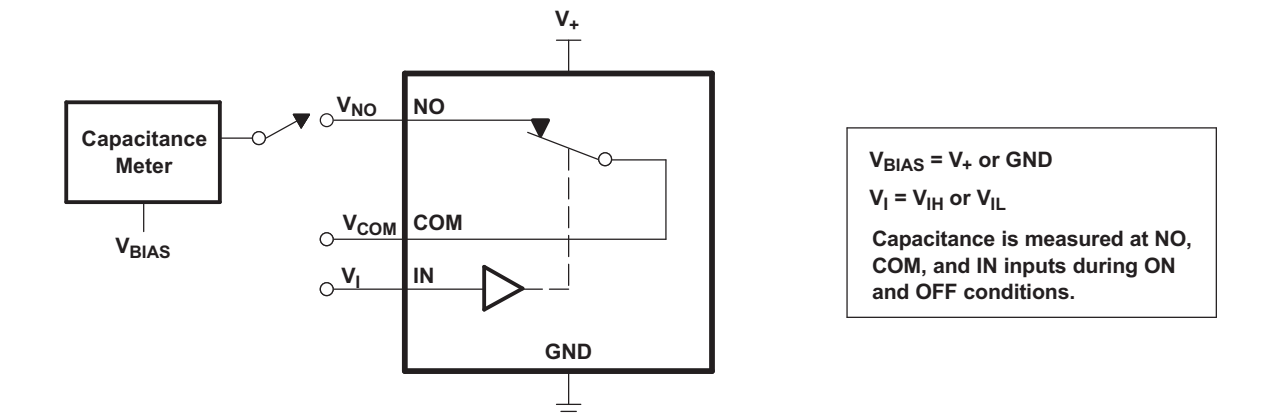


**Figure 14. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NO(OFF)}$ ,  $I_{COM(PWROFF)}$ ,  $I_{NO(PWROFF)}$ )**

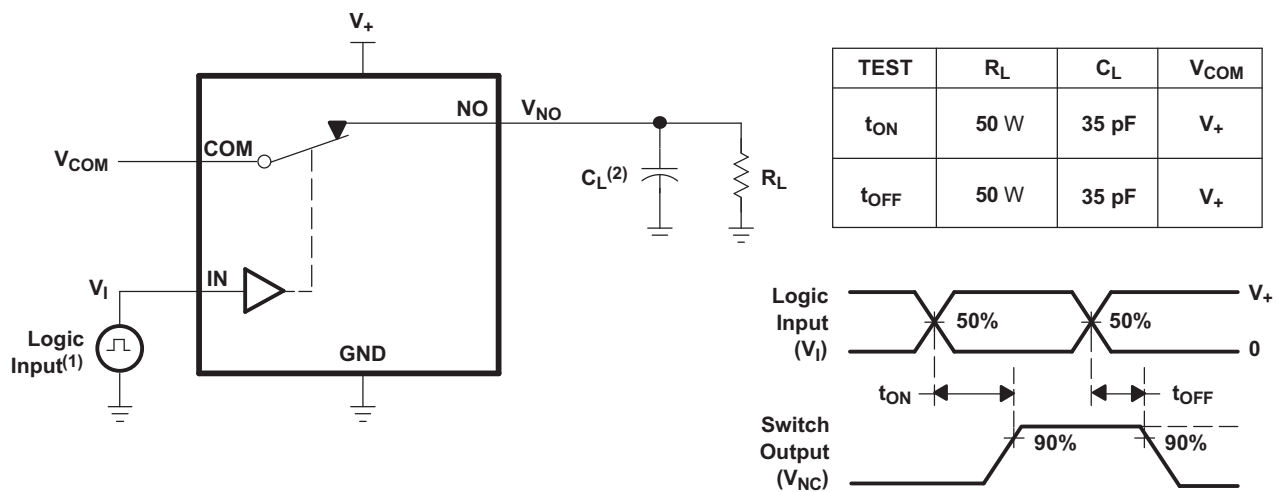


**Figure 15. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NO(ON)}$ )**

## Parameter Measurement Information (continued)

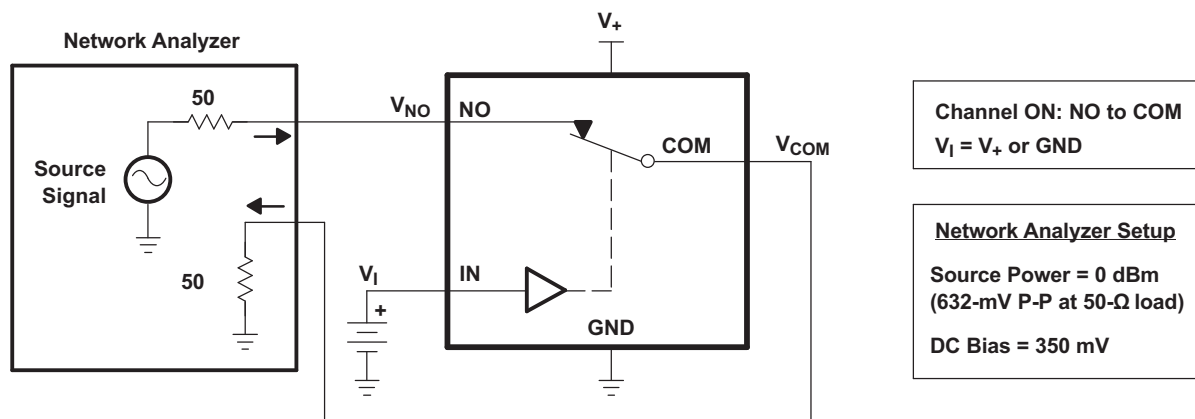


**Figure 16. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{NO(ON)}$ )**



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

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



**Figure 18. Bandwidth (BW)**

## Parameter Measurement Information (continued)

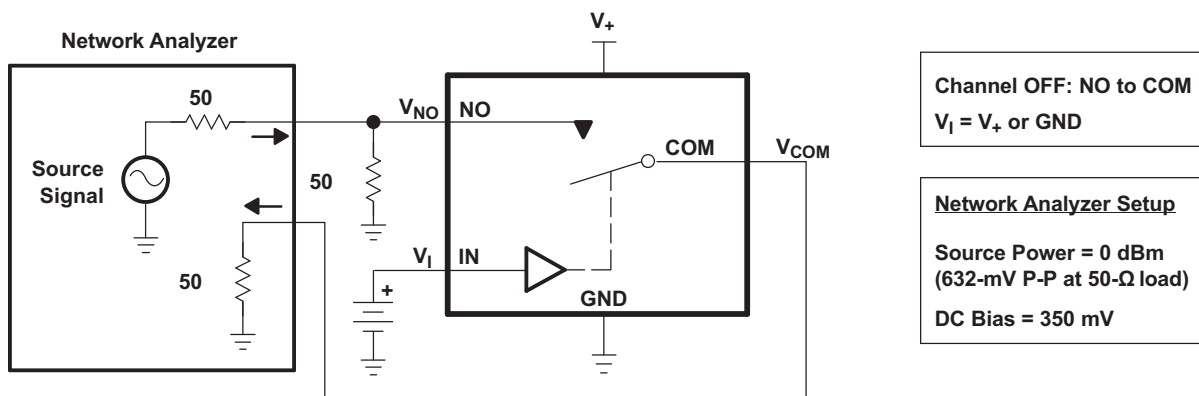
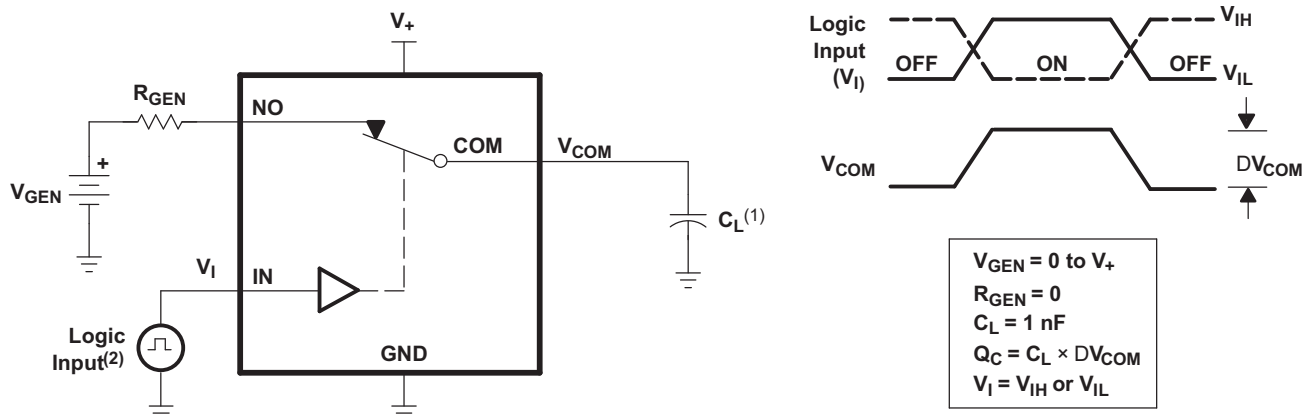
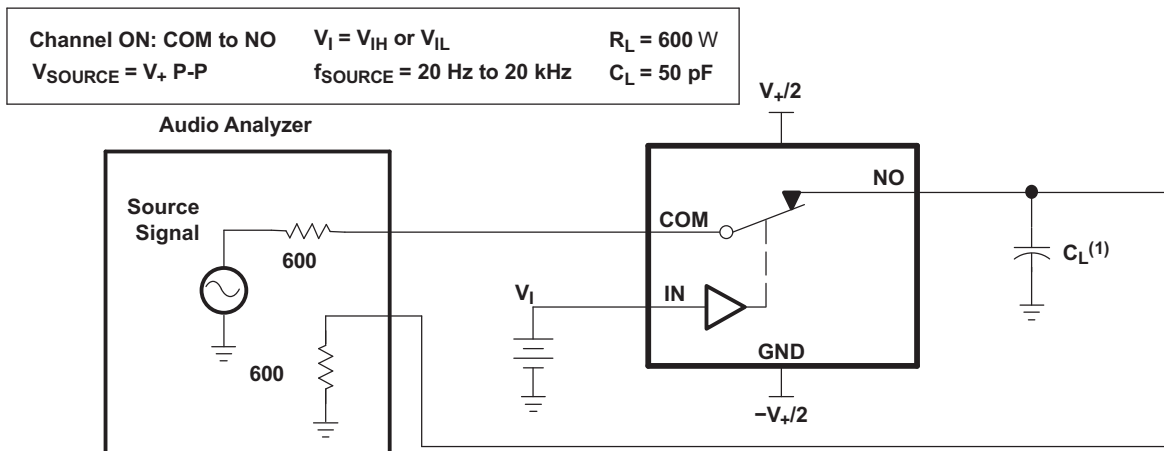


Figure 19. OFF Isolation ( $O_{ISO}$ )



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

Figure 20. Charge Injection ( $Q_C$ )



- (1)  $C_L$  includes probe and jig capacitance.

Figure 21. Total Harmonic Distortion (THD)

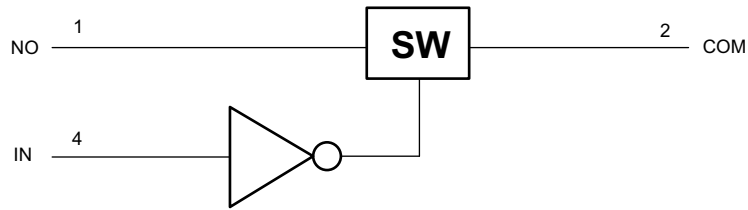
## 9 Detailed Description

### 9.1 Overview

**Table 1. Parameter Description**

SYMBOL	DESCRIPTION
$V_{COM}$	Voltage at COM
$V_{NO}$	Voltage at NO
$r_{on}$	Resistance between COM and NO ports when the channel is ON
$r_{peak}$	Peak on-state resistance over a specified voltage range
$r_{on(Flat)}$	Difference between the maximum and minimum value of $r_{on}$ in a channel over the specified range of 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
$I_{NO(PWROFF)}$	Leakage current measured at the NO port during the power-down condition, $V_+ = 0$
$I_{COM(OFF)}$	Leakage current measured at the COM port, with the corresponding channel (COM to NO) in the OFF state under worst-case input and output conditions
$I_{COM(PWROFF)}$	Leakage current measured at the COM port during the power-down condition, $V_+ = 0$
$I_{NO(ON)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) open
$I_{COM(ON)}$	Leakage current measured at the COM port, with the corresponding channel (COM to NO) in the ON state and the output (NO) open
$V_{IH}$	Minimum input voltage for logic high for the control input (IN)
$V_{IL}$	Maximum input voltage for logic low for the control input (IN)
$V_I$	Voltage at the control input (IN)
$I_{IH}, I_{IL}$	Leakage current measured at the control input (IN)
$t_{ON}$	Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (COM 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 output (COM or NO) signal when the switch is turning OFF.
$Q_C$	Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (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, $Q_C = C_L \times \Delta V_{COM}$ , $C_L$ is the load capacitance, and $\Delta V_{COM}$ is the change in analog output voltage.
$C_{NO(OFF)}$	Capacitance at the NO port when the corresponding channel (NO to COM) is OFF
$C_{COM(OFF)}$	Capacitance at the COM port when the corresponding channel (COM to NO) is OFF
$C_{NO(ON)}$	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 NO) is ON
$C_I$	Capacitance of control input (IN)
$O_{ISO}$	OFF isolation of the switch is a measurement of OFF-state switch impedance. This is measured in dB in a specific frequency, with the corresponding channel (NO to COM) in the OFF state.
BW	Bandwidth of the switch. This is the frequency in which the gain of an ON channel is –3 dB below the DC gain.
THD	Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio of root mean square (RMS) value of the second, third, and higher harmonic to the absolute magnitude of the fundamental harmonic.
$I_+$	Static power-supply current with the control (IN) pin at $V_+$ or GND

## 9.2 Functional Block Diagram



## 9.3 Feature Description

**Table 2. Summary Of Characteristics<sup>(1)</sup>**

Configuration	Single Pole Single Throw (SPST)
Number of channels	1
ON-state resistance ( $r_{on}$ )	0.9 $\Omega$
ON-state resistance flatness ( $r_{on(flat)}$ )	0.15 $\Omega$
Turn-on/turn-off time ( $t_{ON}/t_{OFF}$ )	7.5 ns/12.5 ns
Charge injection ( $Q_C$ )	1 pC
Bandwidth (BW)	200 MHz
OFF isolation ( $O_{ISO}$ )	-64 dB at 1 MHz
Total harmonic distortion (THD)	0.005%
Leakage current ( $I_{COM(OFF)}$ )	$\pm 4$ nA
Power-supply current ( $I_+$ )	0.5 $\mu$ A
Package option	5-pin DSBGA, SOT-23, or SC-70

(1)  $V_+ = 5$  V,  $T_A = 25^\circ\text{C}$

## 9.4 Device Functional Modes

**Table 3. Function Table**

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

## 10 Application and Implementation

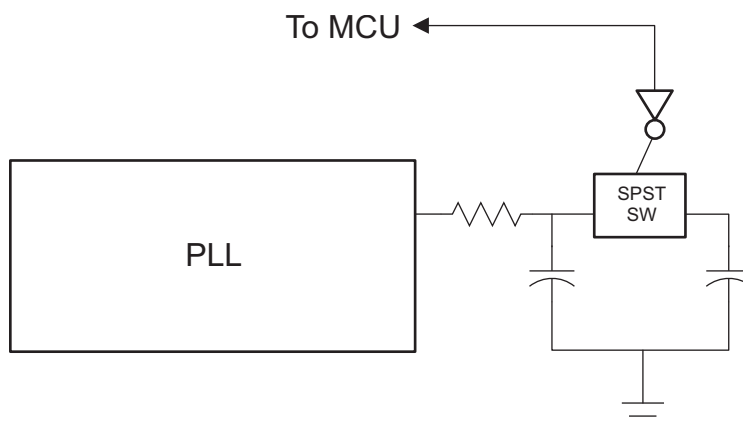
### NOTE

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.

### 10.1 Application Information

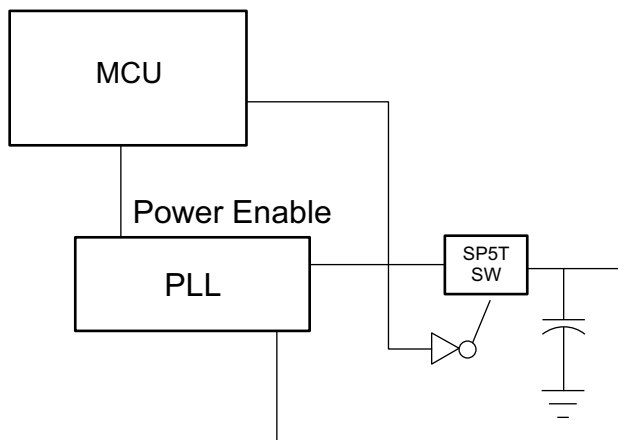
SPST analog switch is a basic component that could be used in any electrical system design. The following are some basic applications that utilize the TS5A3166, more detailed applications may be found in the [Typical Application](#) section.

1. Gain-control circuit for amplifier
  - (a) Additional details are available in the [Typical Application](#) section.
2. Improve lock time of a PLL by changing the time constant
  - (a) Example Diagram:



**Figure 22. Improved Lock Time Circuit Simplified Block Diagram**

1. Improve power consumption for PLL
  - (a) Example Diagram:



**Figure 23. PLL Improved Power Consumption Simplified Block Diagram**

## 10.2 Typical Application

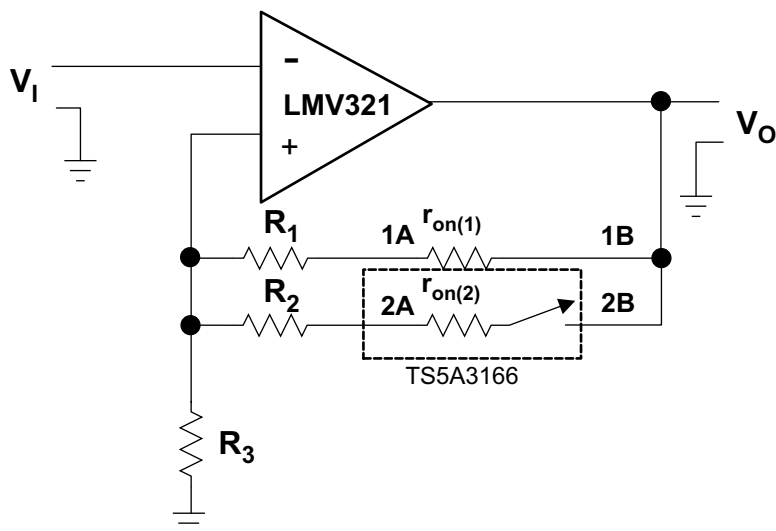


Figure 24. Gain-Control Circuit for OP Amplifier

### 10.2.1 Design Requirements

Place a switch in series with the input of the op amp. Since the op amp input impedance is very large, a switch on  $r_{on(1)}$  is irrelevant.

### 10.2.2 Detailed Design Procedure

By choosing values of  $R_1$  and  $R_2$ , such that  $R_x \gg r_{on(x)}$ ,  $r_{on}$  of TS5A3166 can be ignored. The gain of op amp can be calculated as follow:

$$V_o / V_i = 1 + R_2 / R_3 \quad (1)$$

$$R_2 = (R_1 + r_{on(1)}) \parallel (R_3 + r_{on(2)}) \quad (2)$$

### 10.2.3 Application Curves

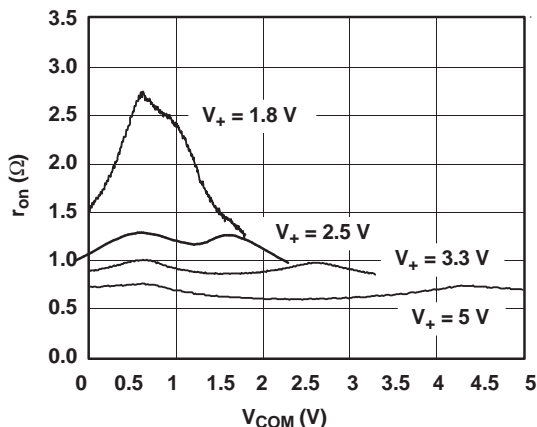


Figure 25.  $r_{on}$  vs  $V_{COM}$

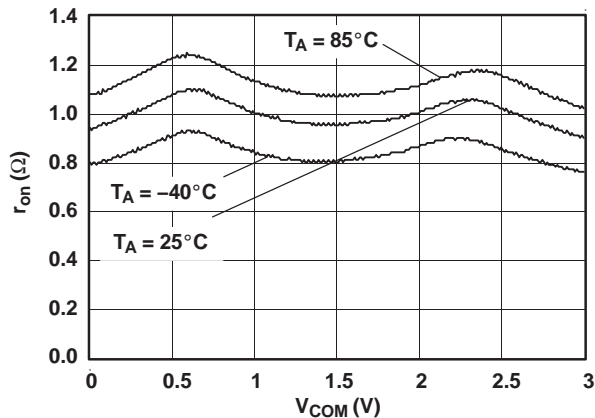


Figure 26.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3$  V)

## Typical Application (continued)

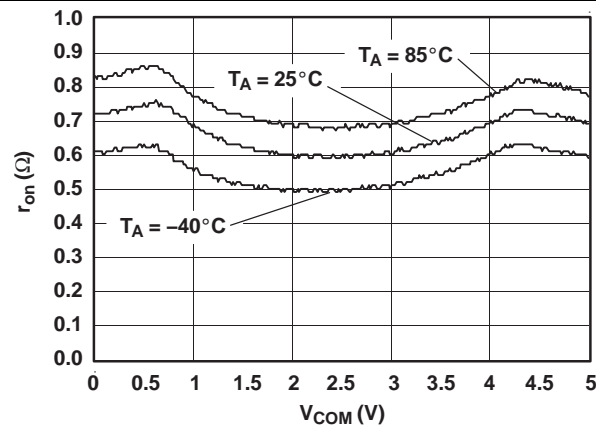


Figure 27.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 5\text{ V}$ )

## 11 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  $0.1\text{ }\mu\text{F}$  bypass capacitor is recommended. If there are multiple  $V_{CC}$  terminals then a  $0.01\text{ }\mu\text{F}$  or  $0.022\text{ }\mu\text{F}$  capacitor is recommended for each power terminal. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise.  $0.1\text{ }\mu\text{F}$  and  $1\text{ }\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results

## 12 Layout

### 12.1 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  $90^\circ$  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.

### 12.2 Layout Example

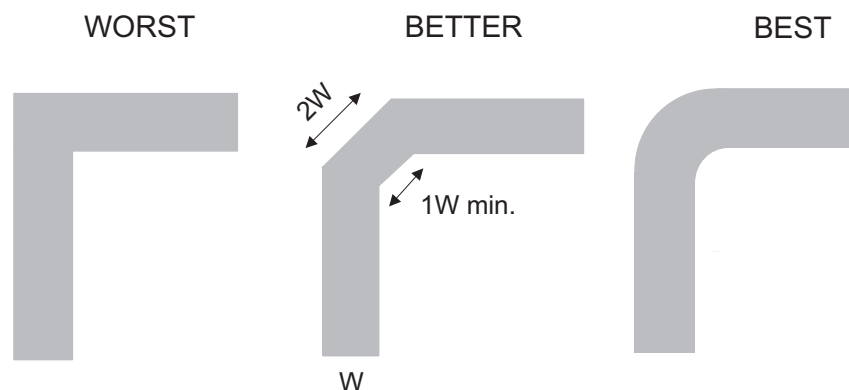


Figure 28. Trace Example

## 13 Device and Documentation Support

### 13.1 Trademarks

All trademarks are the property of their respective owners.

### 13.2 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.

### 13.3 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 14 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 part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TS5A3166QDCKRQ1</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	SIU
TS5A3166QDCKRQ1.B	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	SIU

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**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.

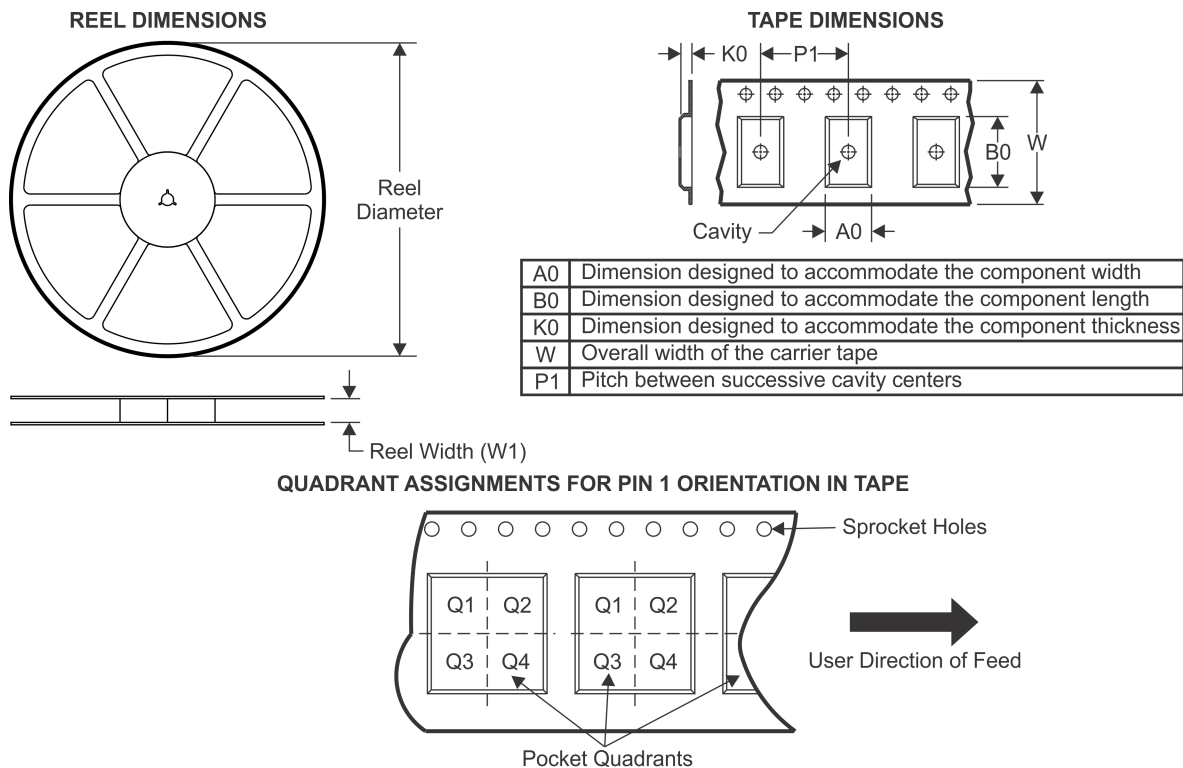
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

### OTHER QUALIFIED VERSIONS OF TS5A3166-Q1 :

- Catalog : [TS5A3166](#)

NOTE: Qualified Version Definitions:

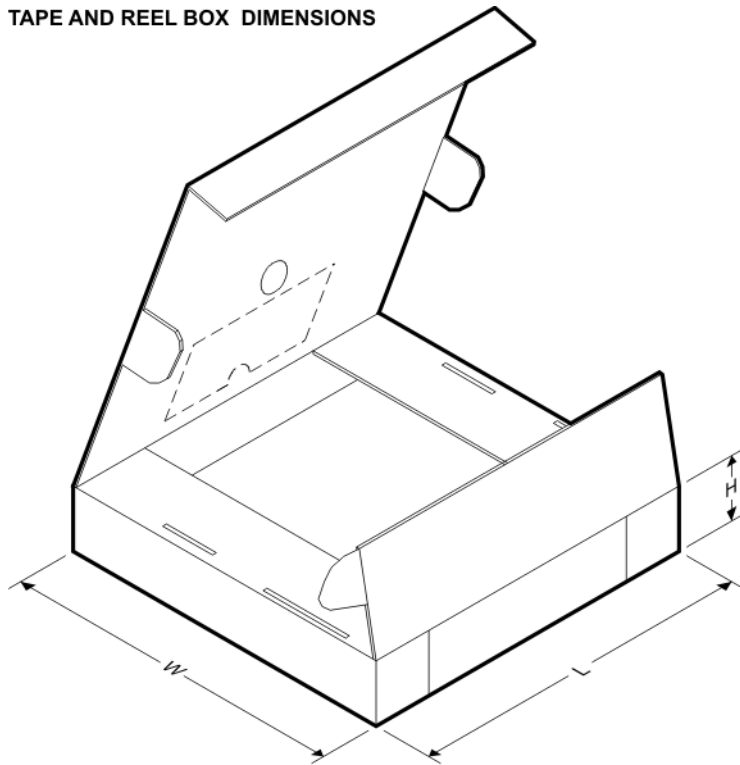
- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS5A3166QDCKRQ1	SC70	DCK	5	3000	178.0	9.0	2.4	2.5	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)
TS5A3166QDCKRQ1	SC70	DCK	5	3000	180.0	180.0	18.0

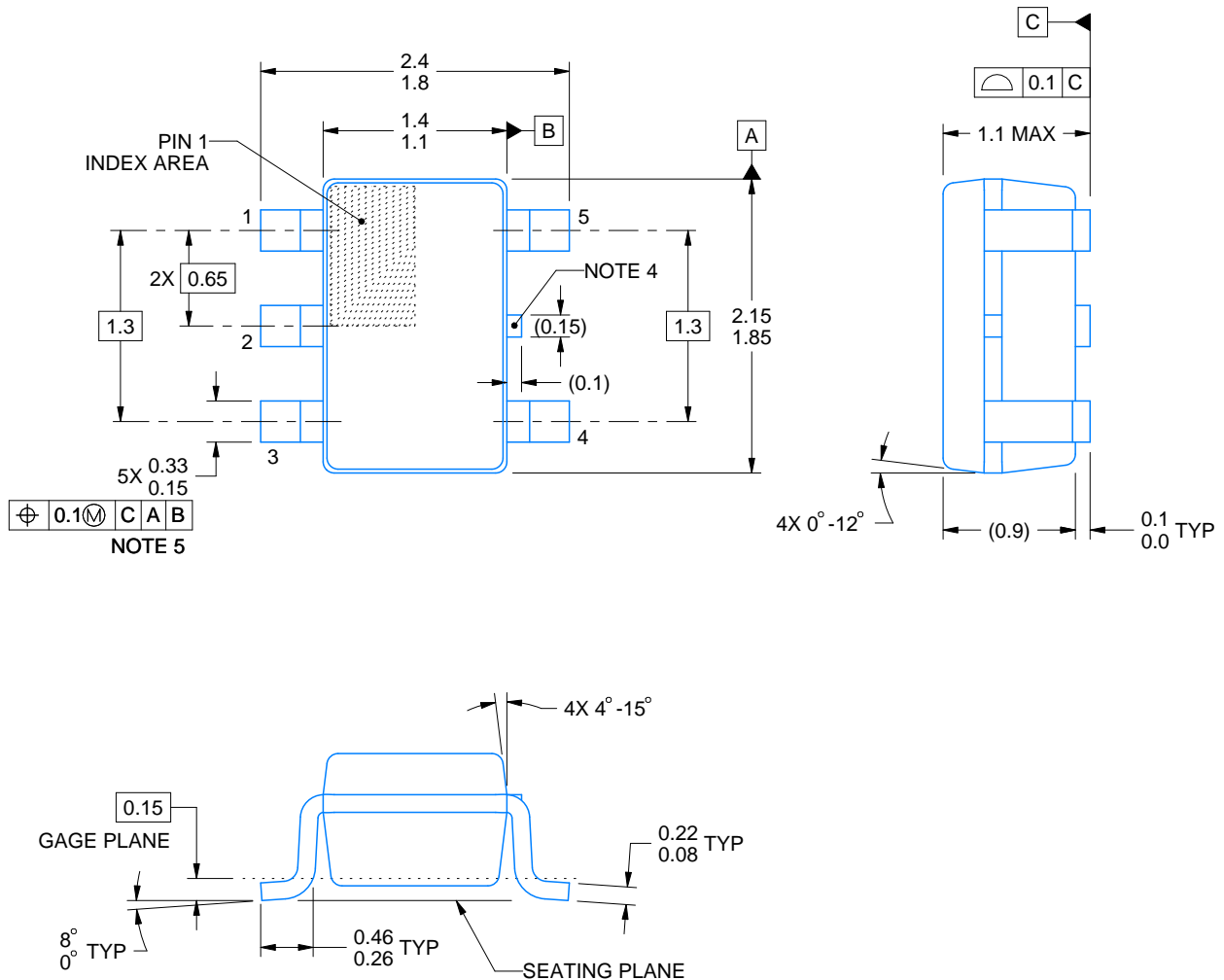
DCK0005A



## PACKAGE OUTLINE

SOT - 1.1 max height

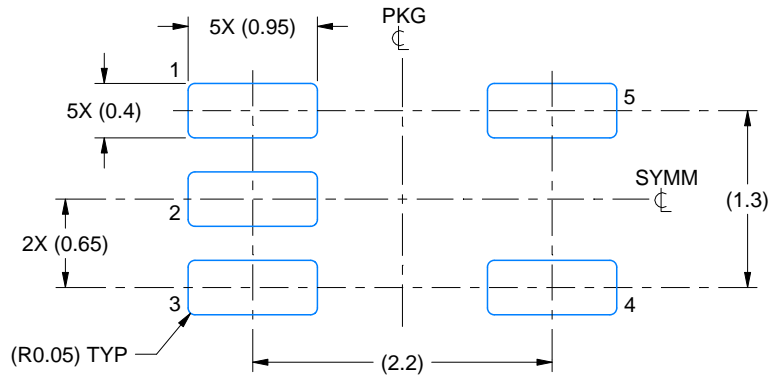
SMALL OUTLINE TRANSISTOR



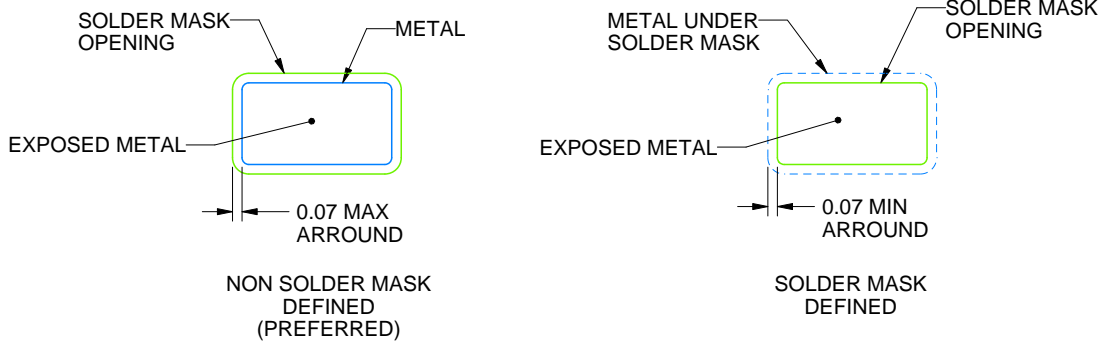
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### NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X

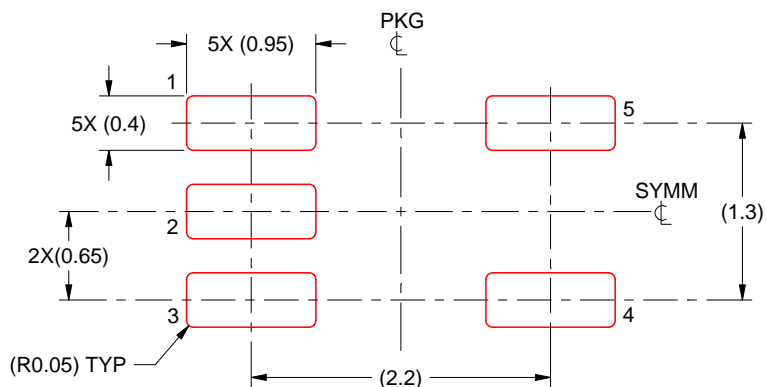


SOLDER MASK DETAILS

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NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:18X

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NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
10. Board assembly site may have different recommendations for stencil design.

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