

# TS5A23166 0.9Ω、デュアルSPSTアナログ・スイッチ 5Vおよび3.3V 2チャンネル・アナログ・スイッチ

## 1 特長

- パワーダウン・モードでの絶縁、 $V_{+} = 0$
- 低いオン抵抗 (0.9Ω)
- 制御入力は 5.5V 許容
- 低い電荷注入
- 非常に優れたオン抵抗マッチング
- 低い全高調波歪 (THD)
- 1.65V~ 5.5Vの単電源で動作
- JESD 78、Class II 準拠で 100mA 超のラッチアップ性能
- ESD 性能は JESD 22 に準拠しテスト済み
  - 2000V、人体モデル (A114-B、クラス II)
  - 1000V、デバイス帯電モデル (C101)

## 2 アプリケーション

- 携帯電話
- ポータブル計測装置
- オーディオおよびビデオ信号のルーティング
- 低電圧のデータ収集システム
- 通信用回路
- モデム
- ハードディスク
- コンピュータ・ペリフェラル
- ワイヤレス端末およびペリフェラル

## 3 概要

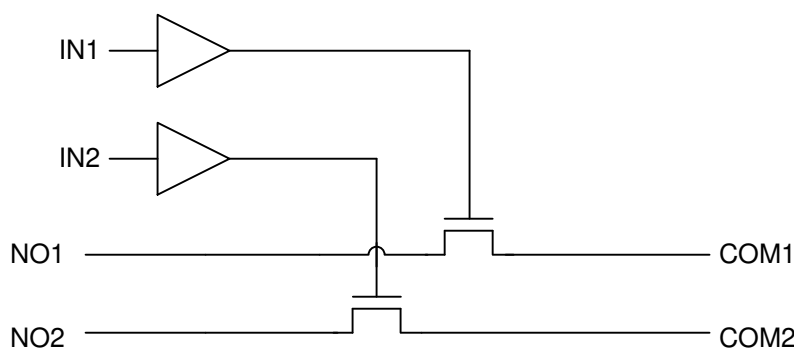
TS5A23166 デバイスはデュアル単極単投 (SPST) のアナログ・スイッチであり、1.65V~5.5V で動作するように設計されています。TS5A23166 デバイスはオン抵抗が低く、チャンネル間のオン抵抗マッチングが非常に優れています。TS5A23166 デバイスは、全高調波歪み (THD) 性能が非常に優れており、極めて低消費電力です。これらの特長から、このデバイスは携帯用オーディオ・アプリケーションに適しています。

### 製品情報<sup>(1)</sup>

型番	パッケージ	本体サイズ (公称)
TS5A23166	VSSOP (8)	2.30mmx2.00mm
	DSBGA (8)	1.91mmx0.91mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。

概略回路図



## 目次

1	特長 .....	1	8	Detailed Description .....	18
2	アプリケーション .....	1	8.1	Overview .....	18
3	概要 .....	1	8.2	Functional Block Diagram .....	18
4	改訂履歴 .....	2	8.3	Feature Description .....	18
5	Pin Configuration and Functions .....	3	8.4	Device Functional Modes .....	18
6	Specifications .....	3	9	Application and Implementation .....	19
6.1	Absolute Maximum Ratings .....	3	9.1	Application Information .....	19
6.2	ESD Ratings .....	4	9.2	Typical Application .....	19
6.3	Recommended Operating Conditions .....	4	10	Power Supply Recommendations .....	20
6.4	Thermal Information .....	4	11	Layout .....	20
6.5	Electrical Characteristics: 5-V Supply .....	4	11.1	Layout Guidelines .....	20
6.6	Electrical Characteristics: 3.3-V Supply .....	6	11.2	Layout Example .....	20
6.7	Electrical Characteristics: 2.5-V Supply .....	7	12	デバイスおよびドキュメントのサポート .....	21
6.8	Electrical Characteristics: 1.8-V Supply .....	9	12.1	デバイス・サポート .....	21
6.9	Switching Characteristics: 5-V Supply .....	10	12.2	ドキュメントの更新通知を受け取る方法 .....	22
6.10	Switching Characteristics: 3.3-V Supply .....	10	12.3	コミュニティ・リソース .....	22
6.11	Switching Characteristics: 2.5-V Supply .....	10	12.4	商標 .....	22
6.12	Switching Characteristics: 1.8-V Supply .....	11	12.5	静電気放電に関する注意事項 .....	22
6.13	Typical Characteristics .....	12	12.6	Glossary .....	22
7	Parameter Measurement Information .....	14	13	メカニカル、パッケージ、および注文情報 .....	22

## 4 改訂履歴

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

### Revision I (March 2018) から Revision J に変更 Page

- Changed the *Thermal Information* table .....

### Revision H (May 2015) から Revision I に変更 Page

- Added Note: "Not tested in production" to leakage current at 25°C in the *Electrical Characteristics* tables .....

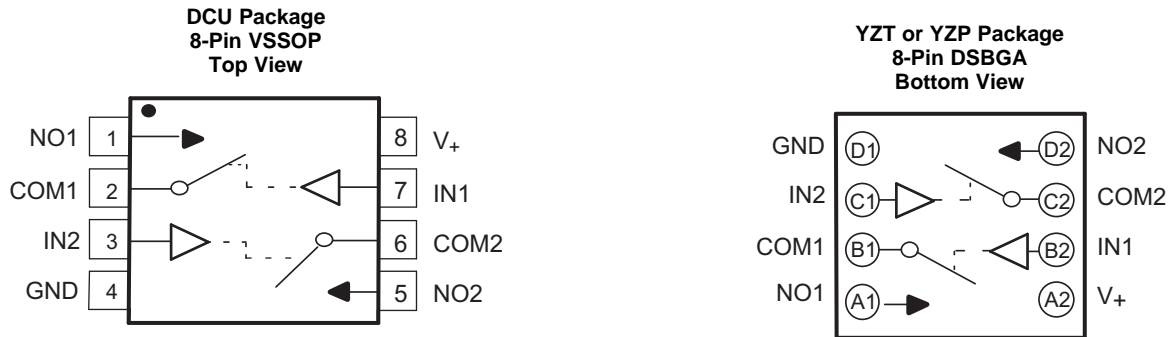
### Revision G (February 2013) から Revision H に変更 Page

- 「ピン構成および機能」セクション、「ESD定格」表、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」セクションを追加 .....
- ドキュメントを新しいTIデータシートのフォーマットに更新 - 仕様の変更なし .....
- 「注文情報」表を削除 .....

### Revision F (September 2012) から Revision G に変更 Page

- Changed pin numbers for YZT or YZP package pinout. ....

## 5 Pin Configuration and Functions



### Pin Functions

PIN			TYPE	DESCRIPTION
NAME	TSSOP NO.	DSBGA NO.		
COM1	2	B1	I/O	Common port for switch 1
COM2	6	C2	I/O	Common port for switch 2
GND	4	D1	GND	Ground
IN1	7	B2	I	Active-high control pin connecting NO1 to COM1.
IN2	3	C1	I	Active-high control pin connecting NO2 to COM2.
NO1	1	A1	I/O	Normally open switch path 1
NO2	5	D2	I/O	Normally open switch path 2
V+	8	A2	PWR	Power supply pin

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)(2)</sup>

		MIN	MAX	UNIT
V <sub>+</sub>	Supply voltage <sup>(3)</sup>	-0.5	6.5	V
V <sub>NO</sub> V <sub>COM</sub>	Analog voltage <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		mA
I <sub>NO</sub>	ON-state switch current	V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>+</sub>		mA
I <sub>COM</sub>	ON-state peak switch current <sup>(6)</sup>	V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>+</sub>		mA
V <sub>I</sub>	Digital input voltage <sup>(3)(4)</sup>	-0.5	6.5	V
I <sub>IK</sub>	Digital input clamp current	V <sub>I</sub> < 0		mA
I <sub>+</sub>	Continuous current through V <sub>+</sub>		100	mA
I <sub>GND</sub>	Continuous current through GND	-100	100	mA

- (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.

## 6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	+2000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	+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
$V_{I/O}$	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 free-air temperature	-40	85	°C

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	TS5A23166			UNIT
	DCU (VSSOP)	YZP (DSBGA)	YZT (DSBGA)	
	8 PINS	8 PINS	8 PINS	
$R_{\theta JA}$ Junction-to-ambient thermal resistance	212.2	99.9	99.7	°C/W
$R_{\theta JC(top)}$ Junction-to-case (top) thermal resistance	77.6	1.0	1.4	°C/W
$R_{\theta JB}$ Junction-to-board thermal resistance	91.7	27.8	27.8	°C/W
$\phi_{JT}$ Junction-to-top characterization parameter	7.1	0.4	0.5	°C/W
$\phi_{JB}$ Junction-to-board characterization parameter	91.1	27.8	27.7	°C/W

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

## 6.5 Electrical Characteristics: 5-V Supply

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

PARAMETER	TEST CONDITIONS	$T_A$	$V_+$	MIN	TYP	MAX	UNIT	
<b>Analog Switch</b>								
$V_{COM}, V_{NO}$	Analog signal			0		$V_+$	V	
$r_{peak}$	Peak ON resistance	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -100\text{ mA}$ , Switch ON, see <a href="#">Figure 11</a>	25°C	4.5 V	0.9	1.1	$\Omega$	
			Full		1.2			
$r_{on}$	ON-state resistance	$V_{NO} = 2.5\text{ V}$ , $I_{COM} = -100\text{ mA}$ , Switch ON, see <a href="#">Figure 11</a>	25°C	4.5 V	0.75	0.9	$\Omega$	
			Full		1			
$\Delta r_{on}$	ON-state resistance match between channels	$V_{NO} = 2.5\text{ V}$ , $I_{COM} = -100\text{ mA}$ , Switch ON, see <a href="#">Figure 11</a>	25°C	4.5 V	0.04	0.1	$\Omega$	
			Full		0.1			
$r_{on(flat)}$	ON-state resistance flatness	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -100\text{ mA}$ , Switch ON, see <a href="#">Figure 11</a>	25°C	4.5 V	0.2		$\Omega$	
			25°C		Full	0.15		0.25
						0.25		
$I_{NO(OFF)}$	NO OFF leakage current	$V_{NO} = 1\text{ V}$ , $V_{COM} = 4.5\text{ V}$ , or $V_{NO} = 4.5\text{ V}$ , $V_{COM} = 1\text{ V}$ , Switch OFF, see <a href="#">Figure 12</a>	25°C	5.5 V	0 V	4	20 <sup>(2)</sup>	nA
			Full		-150	150		
$I_{NO(PWROFF)}$		$V_{NO} = 0\text{ to }5.5\text{ V}$ , $V_{COM} = 5.5\text{ V to }0$ , Switch OFF, see <a href="#">Figure 12</a>	25°C	0 V	-10	0.2	10 <sup>(2)</sup>	$\mu\text{A}$
			Full		-50	50		

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

(2) Not tested in production.

**Electrical Characteristics: 5-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	MIN	TYP	MAX	UNIT
I <sub>COM(OFF)</sub>	COM OFF leakage current	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 12</a>	25°C	5.5 V	0 V	4	20 <sup>(2)</sup>	nA
				Full		-150	150		
I <sub>COM(PWROFF)</sub>		V <sub>COM</sub> = 0 to 5.5 V, V <sub>NO</sub> = 5.5 V to 0,	Switch OFF, see <a href="#">Figure 12</a>	25°C	0 V	-10	0.2	10 <sup>(2)</sup>	μA
				Full		-50	50		
I <sub>NO(ON)</sub>	NO ON leakage current	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 13</a>	25°C	5.5 V	-5	0.4	5 <sup>(2)</sup>	nA
				Full		-50	50		
I <sub>COM(ON)</sub>	COM ON leakage current	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 13</a>	25°C	5.5 V	-5	0.4	5 <sup>(2)</sup>	nA
				Full		-50	50		
<b>Digital Control Inputs (IN1, IN2)<sup>(3)</sup></b>									
V <sub>IH</sub>	Input logic high			Full		2.4		5.5	V
V <sub>IL</sub>	Input logic low			Full		0		0.8	V
I <sub>IH</sub> , I <sub>IL</sub>	Input leakage current	V <sub>I</sub> = 5.5 V or 0		25°C	5.5 V	-2	0.3	2	nA
				Full		-20	20		
<b>Dynamic</b>									
Q <sub>C</sub>	Charge injection	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0,	C <sub>L</sub> = 1 nF, see <a href="#">Figure 19</a>	25°C	5 V		6		pC
C <sub>NO(OFF)</sub>	NO OFF capacitance	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 14</a>	25°C	5 V		19		pF
C <sub>COM(OFF)</sub>	COM OFF capacitance	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch OFF,	See <a href="#">Figure 14</a>	25°C	5 V		18		pF
C <sub>NO(ON)</sub>	NO ON capacitance	V <sub>NO</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 14</a>	25°C	5 V		35.5		pF
C <sub>COM(ON)</sub>	COM ON capacitance	V <sub>COM</sub> = V <sub>+</sub> or GND, Switch ON,	See <a href="#">Figure 14</a>	25°C	5 V		35.5		pF
C <sub>I</sub>	Digital input capacitance	V <sub>I</sub> = V <sub>+</sub> or GND,	See <a href="#">Figure 14</a>	25°C	5 V		2		pF
BW	Bandwidth	R <sub>L</sub> = 50 Ω, Switch ON,	See <a href="#">Figure 16</a>	25°C	5 V		150		MHz
O <sub>ISO</sub>	OFF isolation	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch OFF, see <a href="#">Figure 17</a>	25°C	5 V		-62		dB
X <sub>TALK</sub>	Crosstalk	R <sub>L</sub> = 50 Ω, f = 1 MHz,	Switch ON, see <a href="#">Figure 18</a>	25°C	5 V		-85		dB
THD	Total harmonic distortion	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF,	f = 20 Hz to 20 kHz, see <a href="#">Figure 20</a>	25°C	5 V		0.005%		
<b>Supply</b>									
I <sub>+</sub>	Positive supply current	V <sub>I</sub> = V <sub>+</sub> or GND,	Switch ON or OFF	25°C	5.5 V		0.01	0.1	μA
				Full			1		

(3) All unused digital inputs of the device must be held at V<sub>+</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## 6.6 Electrical Characteristics: 3.3-V Supply

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Analog Switch</b>									
$V_{\text{COM}}, V_{\text{NO}}$	Analog signal range					0		$V_+$	V
$r_{\text{peak}}$	Peak ON resistance	$0 \leq V_{\text{NO}} \leq V_+$ , $I_{\text{COM}} = -100\text{ mA}$ ,	Switch ON, see <a href="#">Figure 11</a>	25°C	3 V	1.3		1.6	$\Omega$
				Full				1.8	
$r_{\text{on}}$	ON-state resistance	$V_{\text{NO}} = 2\text{ V}$ , $I_{\text{COM}} = -100\text{ mA}$ ,	Switch ON, see <a href="#">Figure 11</a>	25°C	3 V	1.1		1.5	$\Omega$
				Full				1.7	
$\Delta r_{\text{on}}$	ON-state resistance match between channels	$V_{\text{NO}} = 2\text{ V}$ , 0.8 V, $I_{\text{COM}} = -100\text{ mA}$ ,	Switch ON, see <a href="#">Figure 11</a>	25°C	3 V	0.04		0.1	$\Omega$
				Full				0.1	
$r_{\text{on(flat)}}$	ON-state resistance flatness	$0 \leq V_{\text{NO}} \leq V_+$ , $I_{\text{COM}} = -100\text{ mA}$	Switch ON, see <a href="#">Figure 11</a>	25°C	3 V	0.3		$\Omega$	
				Full		0.15			0.25
									0.25
$I_{\text{NO(OFF)}}$	NO OFF leakage current	$V_{\text{NO}} = 1\text{ V}$ , $V_{\text{COM}} = 3\text{ V}$ , or $V_{\text{NO}} = 3\text{ V}$ , $V_{\text{COM}} = 1\text{ V}$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	3.6 V	-5	0.5	5 <sup>(2)</sup>	nA
Full						50			
$I_{\text{NO(PWROFF)}}$	NO OFF leakage current	$V_{\text{NO}} = 0\text{ to }3.6\text{ V}$ , $V_{\text{COM}} = 3.6\text{ V to }0$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	0 V	-5	0.1	5 <sup>(2)</sup>	$\mu\text{A}$
Full						25			
$I_{\text{COM(OFF)}}$	COM OFF leakage current	$V_{\text{COM}} = 1\text{ V}$ , $V_{\text{NO}} = 3\text{ V}$ , or $V_{\text{COM}} = 3\text{ V}$ , $V_{\text{NO}} = 1\text{ V}$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	3.6 V	-5	0.5	5 <sup>(2)</sup>	nA
Full						50			
$I_{\text{COM(PWROFF)}}$	COM OFF leakage current	$V_{\text{COM}} = 0\text{ to }3.6\text{ V}$ , $V_{\text{NO}} = 3.6\text{ V to }0$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	0 V	-5	0.1	5 <sup>(2)</sup>	$\mu\text{A}$
Full						25			
$I_{\text{NO(ON)}}$	NO ON leakage current	$V_{\text{NO}} = 1\text{ V}$ , $V_{\text{COM}} = \text{Open}$ , or $V_{\text{NO}} = 3\text{ V}$ , $V_{\text{COM}} = \text{Open}$ ,	Switch ON, see <a href="#">Figure 13</a>	25°C	3.6 V	-2	0.3	2 <sup>(2)</sup>	nA
				Full				20	
$I_{\text{COM(ON)}}$	COM ON leakage current	$V_{\text{COM}} = 1\text{ V}$ , $V_{\text{NO}} = \text{Open}$ , or $V_{\text{COM}} = 3\text{ V}$ , $V_{\text{NO}} = \text{Open}$ ,	Switch ON, see <a href="#">Figure 13</a>	25°C	3.6 V	-2	0.3	2 <sup>(2)</sup>	nA
				Full				20	
<b>Digital Control Inputs (IN1, IN2)<sup>(3)</sup></b>									
$V_{\text{IH}}$	Input logic high			Full		2		5.5	V
$V_{\text{IL}}$	Input logic low			Full		0		0.8	V
$I_{\text{IH}}, I_{\text{IL}}$	Input leakage current	$V_I = 5.5\text{ V or }0$		25°C	3.6 V	-2	0.3	2	nA
				Full				20	

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

(2) Not tested in production.

(3) All unused digital inputs of the device must be held at  $V_+$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## Electrical Characteristics: 3.3-V Supply (continued)

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>									
$Q_C$	Charge injection	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1\text{ nF}$ , see Figure 19	25°C	5 V		6		pC
$C_{NO(OFF)}$	NO OFF capacitance	$V_{NO} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	3.3 V		19.5		pF
$C_{COM(OFF)}$	COM OFF capacitance	$V_{COM} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	3.3 V		18.5		pF
$C_{NO(ON)}$	NO ON capacitance	$V_{NO} = V_+$ or GND, Switch ON,	See Figure 14	25°C	3.3 V		36		pF
$C_{COM(ON)}$	COM ON capacitance	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 14	25°C	3.3 V		36		pF
$C_I$	Digital input capacitance	$V_I = V_+$ or GND,	See Figure 14	25°C	3.3 V		2		pF
BW	Bandwidth	$R_L = 50\ \Omega$ , Switch ON,	See Figure 16	25°C	3.3 V		150		MHz
$O_{ISO}$	OFF isolation	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ,	Switch OFF, see Figure 17	25°C	3.3 V		-62		dB
$X_{TALK}$	Crosstalk	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ,	Switch ON, see Figure 18	25°C	3.3 V		-85		dB
THD	Total harmonic distortion	$R_L = 600\ \Omega$ , $C_L = 50\text{ pF}$ ,	$f = 20\text{ Hz to }20\text{ kHz}$ , see Figure 20	25°C	3.3 V		0.01%		
<b>Supply</b>									
$I_+$	Positive supply current	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	3.6 V	0.001	0.05	0.3	$\mu\text{A}$
				Full					

## 6.7 Electrical Characteristics: 2.5-V Supply

 $V_+ = 2.3\text{ V to }2.7\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Analog Switch</b>									
$V_{COM}, V_{NO}$	Analog signal range					0		$V_+$	V
$r_{peak}$	Peak ON resistance	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -8\text{ mA}$ ,	Switch ON, see Figure 11	25°C	2.3 V		1.8	2.4	$\Omega$
				Full					
$r_{on}$	ON-state resistance	$V_{NO} = 1.8\text{ V}$ , $I_{COM} = -8\text{ mA}$ ,	Switch ON, see Figure 11	25°C	2.3 V		1.2	2.1	$\Omega$
				Full					
$\Delta r_{on}$	ON-state resistance match between channels	$V_{NO} = 1.8\text{ V}, 0.8\text{ V}$ , $I_{COM} = -8\text{ mA}$ ,	Switch ON, see Figure 11	25°C	2.3 V		0.04	0.15	$\Omega$
				Full					
$r_{on(flat)}$	ON-state resistance flatness	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -8\text{ mA}$ ,	Switch ON, see Figure 11	25°C	2.3 V		0.7		$\Omega$
				25°C					
				Full					
$I_{NO(OFF)}$	NO OFF leakage current	$V_{NO} = 0.5\text{ V}$ , $V_{COM} = 2.3\text{ V}$ , or $V_{NO} = 2.3\text{ V}$ , $V_{COM} = 0.5\text{ V}$ ,	Switch OFF, see Figure 12	25°C	2.7 V		-5	0.3	5 <sup>(2)</sup>
				Full					
$I_{NO(PWROFF)}$		$V_{NO} = 0\text{ to }2.7\text{ V}$ , $V_{COM} = 2.7\text{ V to }0$ ,	Switch OFF, see Figure 12	25°C	0 V		-2	0.05	2 <sup>(2)</sup>
				Full					

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

(2) Not tested in production.

**Electrical Characteristics: 2.5-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
$I_{\text{COM(OFF)}}$	COM OFF leakage current	$V_{\text{NO}} = 2.3 \text{ V}$ , $V_{\text{COM}} = 0.5 \text{ V}$ , or $V_{\text{NO}} = 0.5 \text{ V}$ , $V_{\text{COM}} = 2.3 \text{ V}$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	2.7 V	-5	0.3	5 <sup>(2)</sup>	nA
				Full		-50		50	
$I_{\text{COM(PWROFF)}}$		$V_{\text{COM}} = 0 \text{ to } 2.7 \text{ V}$ , $V_{\text{NO}} = 2.7 \text{ V to } 0$ ,	Switch OFF, see <a href="#">Figure 12</a>	25°C	0 V	-2	0.05	2 <sup>(2)</sup>	μA
				Full		-15		15	
$I_{\text{NO(ON)}}$	NO ON leakage current	$V_{\text{NO}} = 0.5 \text{ V}$ , $V_{\text{COM}} = \text{Open}$ , or $V_{\text{NO}} = 2.3 \text{ V}$ , $V_{\text{COM}} = \text{Open}$ ,	Switch ON, see <a href="#">Figure 13</a>	25°C	2.7 V	-2	0.3	2 <sup>(2)</sup>	nA
				Full		-20		20	
$I_{\text{COM(ON)}}$	COM ON leakage current	$V_{\text{COM}} = 0.5 \text{ V}$ , $V_{\text{NO}} = \text{Open}$ , or $V_{\text{COM}} = 2.3 \text{ V}$ , $V_{\text{NO}} = \text{Open}$ ,	Switch ON, see <a href="#">Figure 13</a>	25°C	2.7 V	-2	0.3	2 <sup>(2)</sup>	nA
				Full		-20		20	
<b>Digital Control Inputs (IN1, IN2)</b>									
$V_{\text{IH}}$	Input logic high			Full		1.8		5.5	V
$V_{\text{IL}}$	Input logic low			Full		0		0.6	V
$I_{\text{IH}}, I_{\text{IL}}$	Input leakage current	$V_I = 5.5 \text{ V or } 0$		25°C	2.7 V	-2	0.3	2	nA
				Full		-20		20	
<b>Dynamic</b>									
$Q_C$	Charge injection	$V_{\text{GEN}} = 0$ , $R_{\text{GEN}} = 0$ ,	$C_L = 1 \text{ nF}$ , see <a href="#">Figure 19</a>	25°C	2.5 V		4		pC
$C_{\text{NO(OFF)}}$	NO OFF capacitance	$V_{\text{NO}} = V_+ \text{ or GND}$ , Switch OFF,	See <a href="#">Figure 14</a>	25°C	2.5 V		19.5		pF
$C_{\text{COM(OFF)}}$	COM OFF capacitance	$V_{\text{COM}} = V_+ \text{ or GND}$ , Switch OFF,	See <a href="#">Figure 14</a>	25°C	2.5 V		18.5		pF
$C_{\text{NO(ON)}}$	NO ON capacitance	$V_{\text{NO}} = V_+ \text{ or GND}$ , Switch ON,	See <a href="#">Figure 14</a>	25°C	2.5 V		36.5		pF
$C_{\text{COM(ON)}}$	COM ON capacitance	$V_{\text{COM}} = V_+ \text{ or GND}$ , Switch ON,	See <a href="#">Figure 14</a>	25°C	2.5 V		36.5		pF
$C_I$	Digital input capacitance	$V_I = V_+ \text{ or GND}$ ,	See <a href="#">Figure 14</a>	25°C	2.5 V		2		pF
BW	Bandwidth	$R_L = 50 \Omega$ , Switch ON,	See <a href="#">Figure 16</a>	25°C	2.5 V		150		MHz
$O_{\text{ISO}}$	OFF isolation	$R_L = 50 \Omega$ , $f = 1 \text{ MHz}$ ,	Switch OFF, see <a href="#">Figure 17</a>	25°C	2.5 V		-62		dB
$X_{\text{TALK}}$	Crosstalk	$R_L = 50 \Omega$ , $f = 1 \text{ MHz}$ ,	Switch ON, see <a href="#">Figure 18</a>	25°C	2.5 V		-85		dB
THD	Total harmonic distortion	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ ,	$f = 20 \text{ Hz to } 20 \text{ kHz}$ , see <a href="#">Figure 20</a>	25°C	2.5 V		0.02%		
<b>Supply</b>									
$I_+$	Positive supply current	$V_I = V_+ \text{ or GND}$ ,	Switch ON or OFF	25°C	2.7 V		0.001	0.02	μA
				Full				0.25	



## 6.8 Electrical Characteristics: 1.8-V Supply

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Analog Switch</b>									
$V_{COM}, V_{NO}$	Analog signal range					0		$V_+$	V
$r_{peak}$	Peak ON resistance	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, see Figure 11	25°C	1.65 V		4.2	25	$\Omega$
				Full					
$r_{on}$	ON-state resistance	$V_{NO} = 0.6\text{ V}, 1.5\text{ V}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, see Figure 11	25°C	1.65 V		1.6	3.9	$\Omega$
				Full					
$\Delta r_{on}$	ON-state resistance match between channels	$V_{NO} = 1.5\text{ V}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, see Figure 11	25°C	1.65 V		0.04	0.2	$\Omega$
				Full					
$r_{on(Flat)}$	ON-state resistance flatness	$0 \leq V_{NO} \leq V_+$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, see Figure 11	25°C	1.65 V		2.8		$\Omega$
				25°C					
				Full					
$I_{NO(OFF)}$	NO OFF leakage current	$V_{NO} = 0.3\text{ V}$ , $V_{COM} = 1.65\text{ V}$ , or $V_{NO} = 1.65\text{ V}$ , $V_{COM} = 0.3\text{ V}$ ,	Switch OFF, see Figure 12	25°C	1.95 V	-5	0.3	5 <sup>(2)</sup>	nA
				Full					
$I_{NO(PWROFF)}$		$V_{NO} = 0\text{ to }1.95\text{ V}$ , $V_{COM} = 1.95\text{ V to }0$ ,	Switch OFF, see Figure 12	25°C	0 V	-2	0.05	2 <sup>(2)</sup>	$\mu\text{A}$
				Full					
$I_{COM(OFF)}$	COM OFF leakage current	$V_{NO} = 1.65\text{ V}$ , $V_{COM} = 0.3\text{ V}$ , or $V_{NO} = 0.3\text{ V}$ , $V_{COM} = 1.65\text{ V}$ ,	Switch OFF, see Figure 12	25°C	1.95 V	-5	0.3	5 <sup>(2)</sup>	nA
				Full					
$I_{COM(PWROFF)}$		$V_{COM} = 0\text{ to }1.95\text{ V}$ , $V_{NO} = 1.95\text{ V to }0$ ,	Switch OFF, see Figure 12	25°C	0 V	-2	0.05	2 <sup>(2)</sup>	$\mu\text{A}$
				Full					
$I_{NO(ON)}$	NO ON leakage current	$V_{NO} = 0.3\text{ V}$ , $V_{COM} = \text{Open}$ , or $V_{NO} = 1.65\text{ V}$ , $V_{COM} = \text{Open}$ ,	Switch ON, see Figure 13	25°C	1.95 V	-2	0.3	2 <sup>(2)</sup>	nA
				Full					
$I_{COM(ON)}$	COM ON leakage current	$V_{NO} = \text{Open}$ , $V_{COM} = 0.3\text{ V}$ , or $V_{NO} = \text{Open}$ , $V_{COM} = 1.65\text{ V}$ ,	Switch ON, see Figure 13	25°C	1.95 V	-2	0.3	2	nA
				Full					
<b>Digital Control Inputs (IN1, IN2)</b>									
$V_{IH}$	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	$V_I = 5.5\text{ V or }0$		25°C	1.95 V	-2	0.3	2	$\mu\text{A}$
				Full					
<b>Dynamic</b>									
$Q_C$	Charge injection	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1\text{ nF}$ , see Figure 19	25°C	1.8 V		2		pC
$C_{NO(OFF)}$	NO OFF capacitance	$V_{NO} = V_+ \text{ or GND}$ , Switch OFF,	See Figure 14	25°C	1.8 V		19.5		pF
$C_{COM(OFF)}$	COM OFF capacitance	$V_{COM} = V_+ \text{ or GND}$ , Switch OFF,	See Figure 14	25°C	1.8 V		18.5		pF
$C_{NO(ON)}$	NO ON capacitance	$V_{NO} = V_+ \text{ or GND}$ , Switch ON,	See Figure 14	25°C	1.8 V		36.5		pF

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

(2) Not tested in production.

**Electrical Characteristics: 1.8-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
$C_{\text{COM(ON)}}$	COM ON capacitance	$V_{\text{COM}} = V_+$ or GND, Switch ON,	See Figure 14	25°C	1.8 V		36.5		pF
$C_I$	Digital input capacitance	$V_I = V_+$ or GND,	See Figure 14	25°C	1.8 V		2		pF
BW	Bandwidth	$R_L = 50 \Omega$ , Switch ON,	See Figure 16	25°C	1.8 V		150		MHz
$O_{\text{ISO}}$	OFF isolation	$R_L = 50 \Omega$ , $f = 1 \text{ MHz}$ ,	Switch OFF, see Figure 17	25°C	1.8 V		-62		dB
THD	Total harmonic distortion	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ ,	$f = 20 \text{ Hz to } 20 \text{ kHz}$ , see Figure 20	25°C	1.8 V		0.055%		
<b>Supply</b>									
$I_+$	Positive supply current	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	1.95 V		0.001	0.01	$\mu\text{A}$
				Full				0.15	

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>									
$t_{\text{ON}}$	Turnon time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	5 V	1	4.5	7.5	ns
				Full	4.5 V to 5.5 V	1		9	
$t_{\text{OFF}}$	Turnoff time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	5 V	4.5	8	11	ns
				Full	4.5 V to 5.5 V	3.5		13	

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>									
$t_{\text{ON}}$	Turnon time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	3.3 V	1.5	5	9.5	ns
				Full	3 V to 3.6 V	1		10	
$t_{\text{OFF}}$	Turnoff time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	3.3 V	4.5	8.5	11	ns
				Full	3 V to 3.6 V	3		12.5	

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

**6.11 Switching Characteristics: 2.5-V Supply**
 $V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>									
$t_{\text{ON}}$	Turnon time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	2.5 V	2	6	10	ns
				Full	2.3 V to 2.7 V	1		12	
$t_{\text{OFF}}$	Turnoff time	$V_{\text{COM}} = V_+$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , see Figure 15	25°C	2.5 V	4.5	8	12.5	ns
				Full	2.3 V to 2.7 V	3		15	

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

## 6.12 Switching Characteristics: 1.8-V Supply

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

PARAMETER		TEST CONDITIONS		$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>									
$t_{ON}$	Turnon time	$V_{COM} = V_+$ , $R_L = 50\ \Omega$ ,	$C_L = 35\text{ pF}$ , see <a href="#">Figure 15</a>	25°C	1.8 V	3	9	18	ns
				Full	1.65 V to 1.95 V	1		20	
$t_{OFF}$	Turnoff time	$V_{COM} = V_+$ , $R_L = 50\ \Omega$ ,	$C_L = 35\text{ pF}$ , see <a href="#">Figure 15</a>	25°C	1.8 V	5	10	15.5	ns
				Full	1.65 V to 1.95 V	4		18.5	

(1) The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

### 6.13 Typical Characteristics

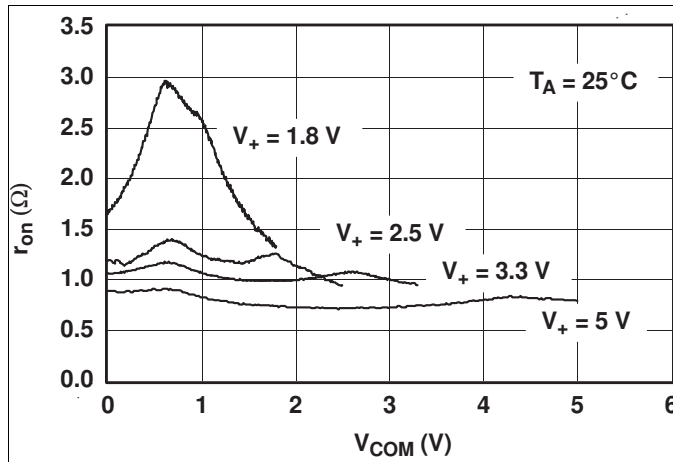


Figure 1.  $r_{on}$  vs  $V_{COM}$

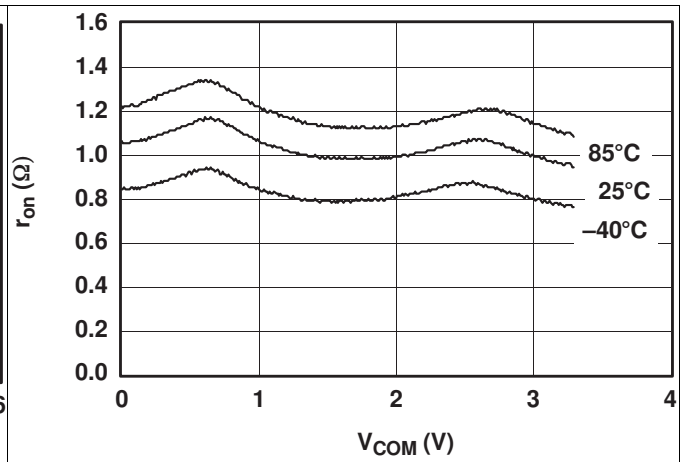


Figure 2.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3.3$  V)

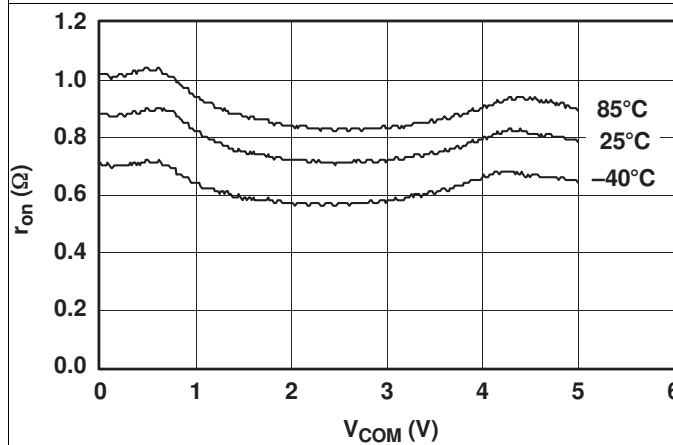


Figure 3.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 5$  V)

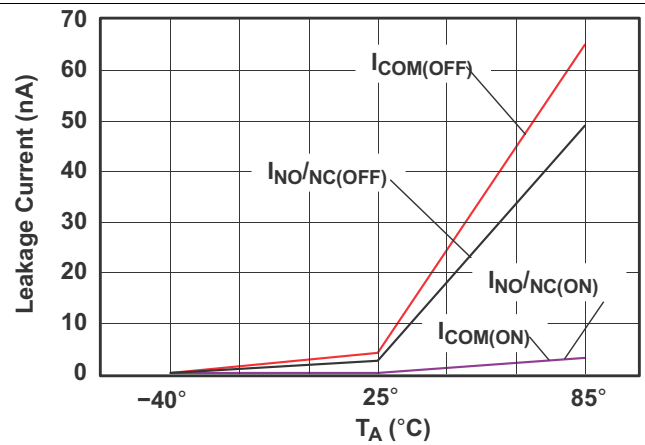


Figure 4. Leakage Current vs Temperature ( $V_+ = 5.5$  V)

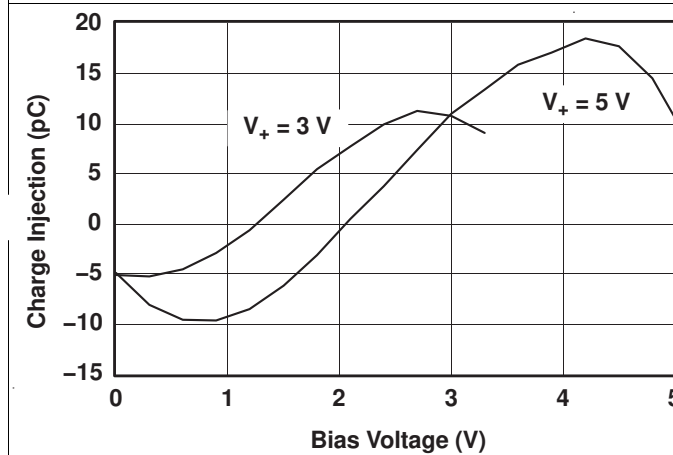


Figure 5. Charge Injection ( $Q_C$ ) vs  $V_{COM}$

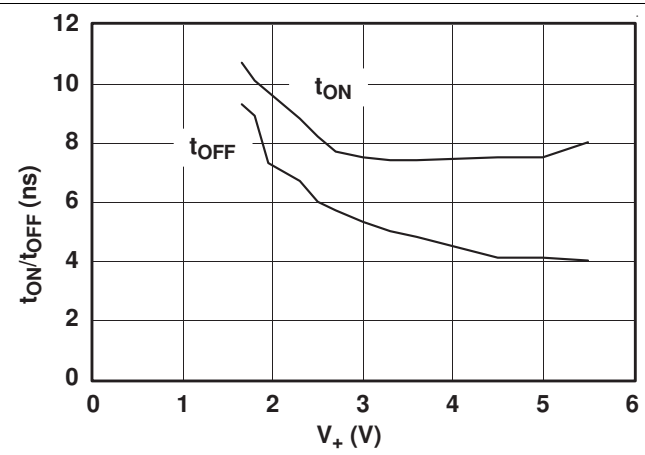


Figure 6.  $t_{ON}$  and  $t_{OFF}$  vs Supply Voltage

Typical Characteristics (continued)

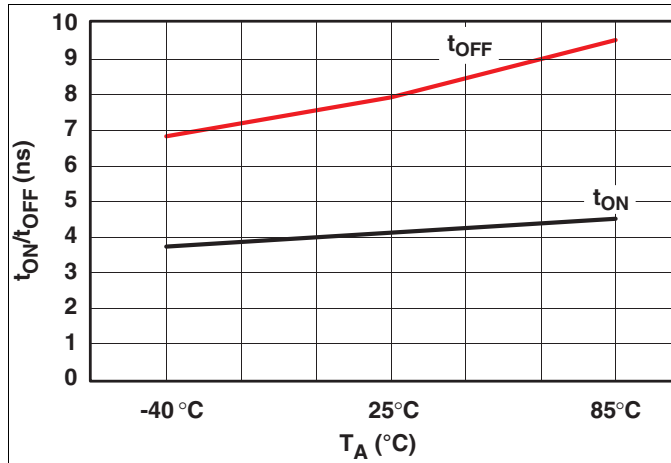


Figure 7. t<sub>ON</sub> and t<sub>OFF</sub> vs Temperature (V<sub>+</sub> = 5 V)

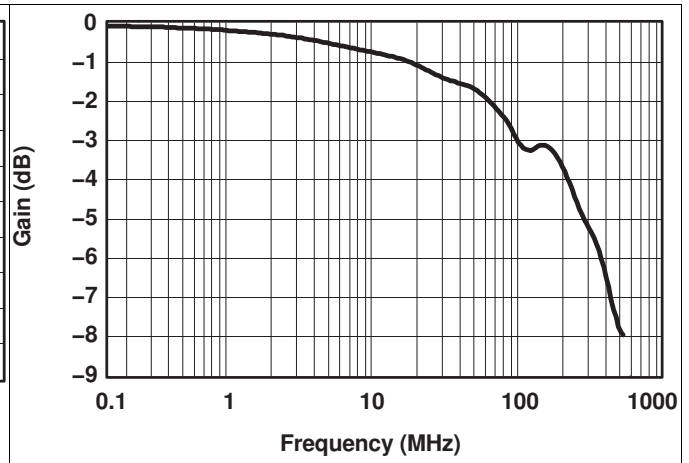


Figure 8. Bandwidth (V<sub>+</sub> = 5 V)

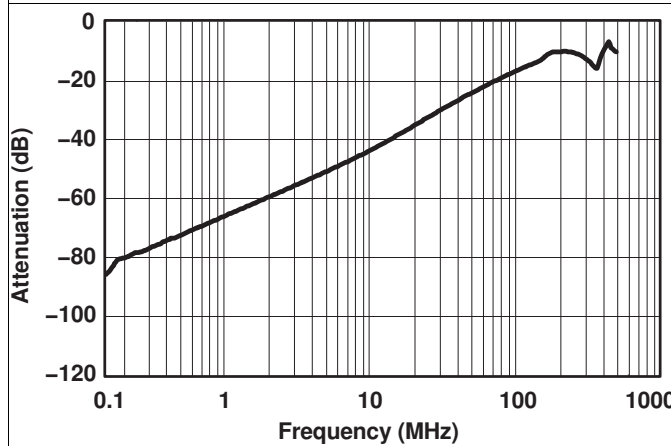


Figure 9. OFF Isolation and Crosstalk (V<sub>+</sub> = 5 V)

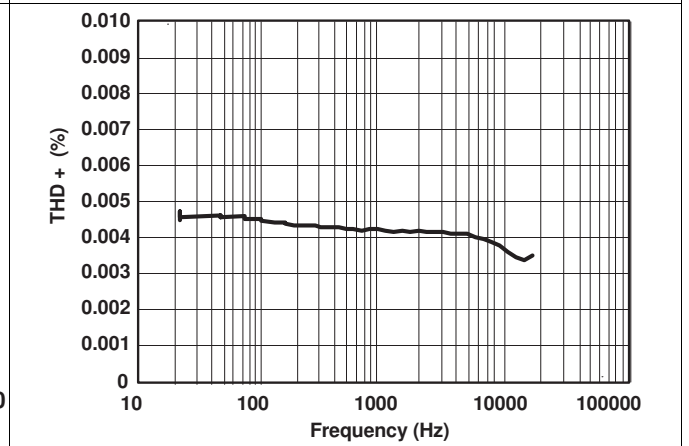


Figure 10. Total Harmonic Distortion vs Frequency

## 7 Parameter Measurement Information

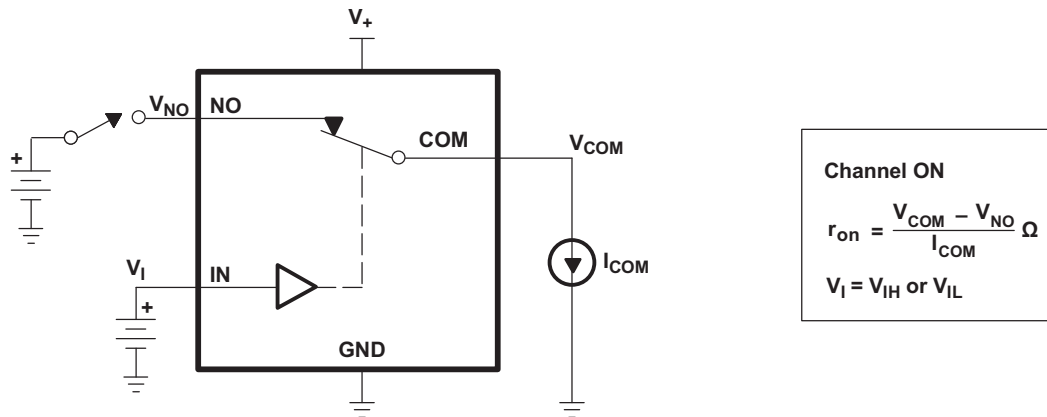


Figure 11. ON-State Resistance ( $r_{on}$ )

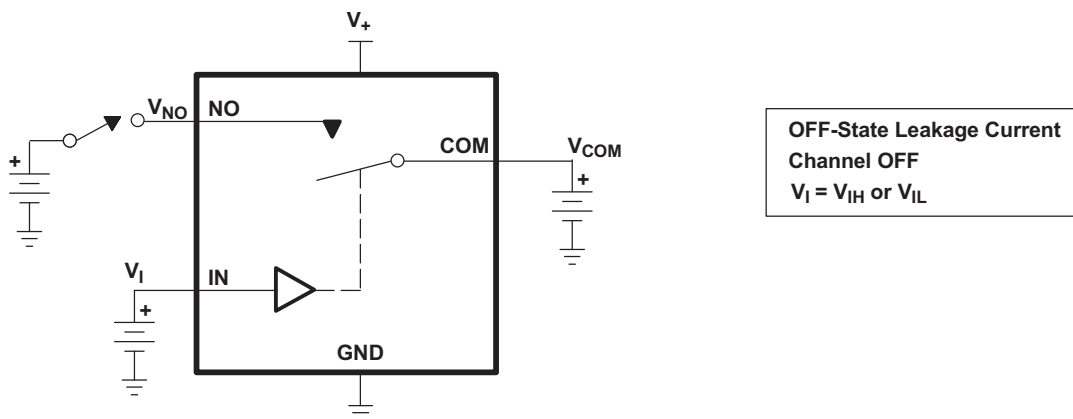


Figure 12. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NC(OFF)}$ ,  $I_{COM(PWROFF)}$ ,  $I_{NC(PWR(F))}$ )

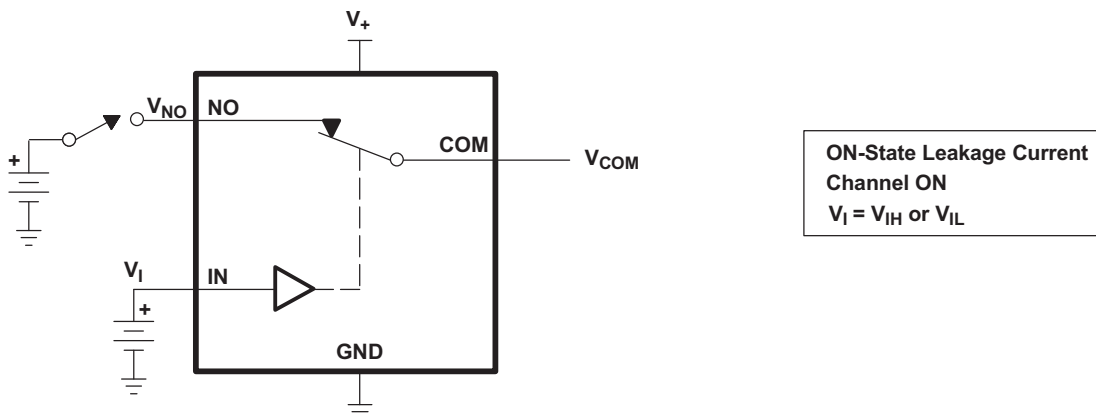


Figure 13. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NC(ON)}$ )

Parameter Measurement Information (continued)

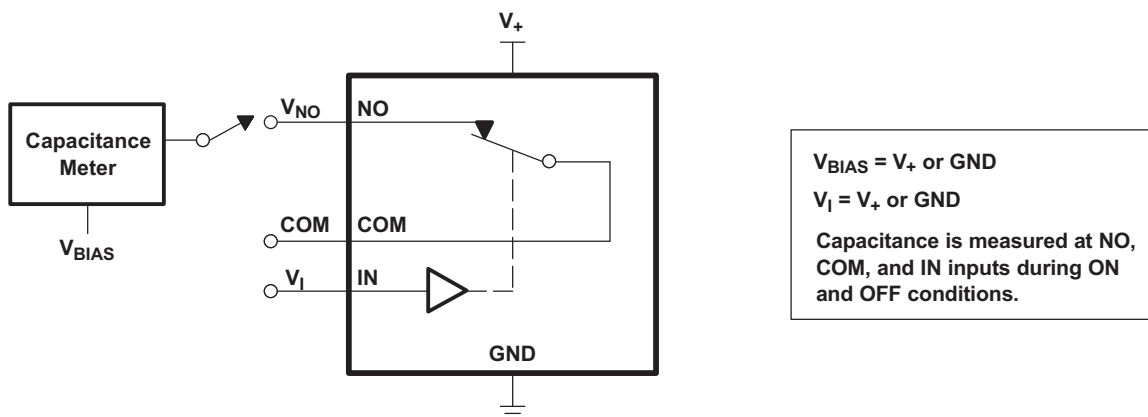
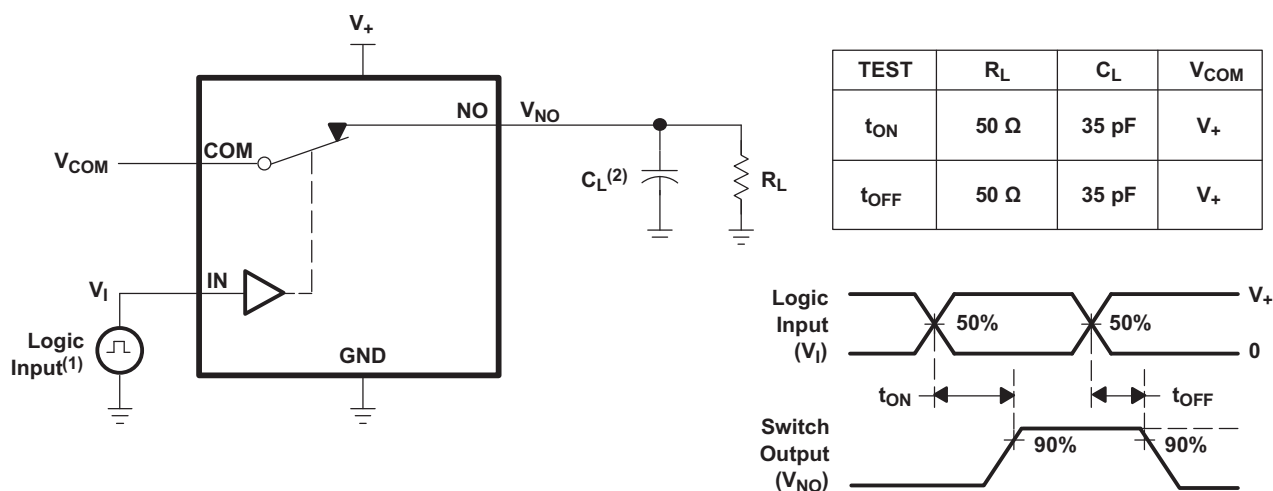


Figure 14. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NC(OFF)}$ ,  $C_{NC(ON)}$ )



- (1) All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> < 5 ns, t<sub>f</sub> < 5 ns.
- (2) C<sub>L</sub> includes probe and jig capacitance.

Figure 15. Turnon (t<sub>ON</sub>) and Turnoff Time (t<sub>OFF</sub>)

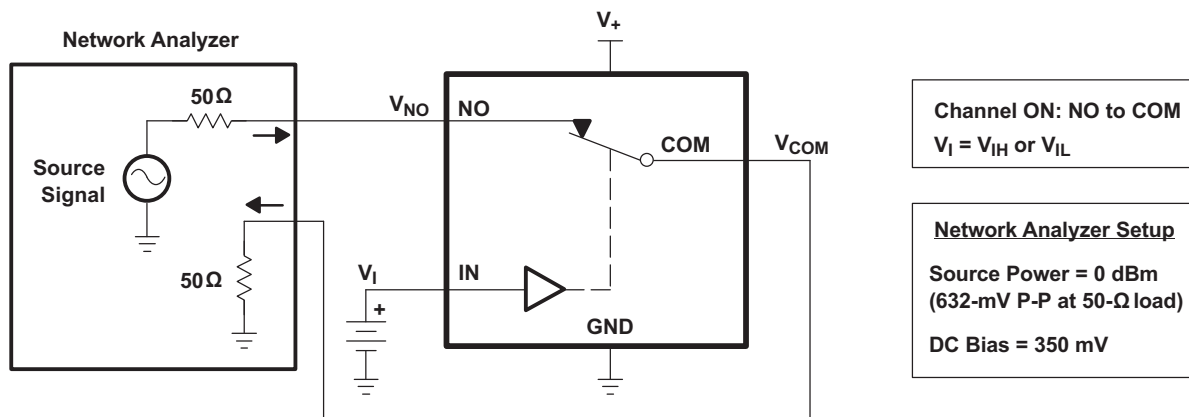


Figure 16. Bandwidth (BW)

Parameter Measurement Information (continued)

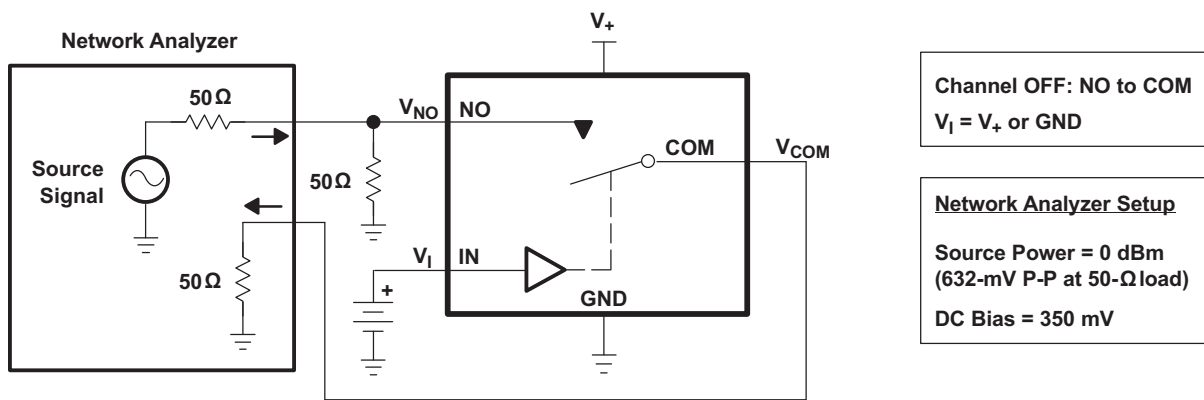


Figure 17. OFF Isolation ( $O_{ISO}$ )

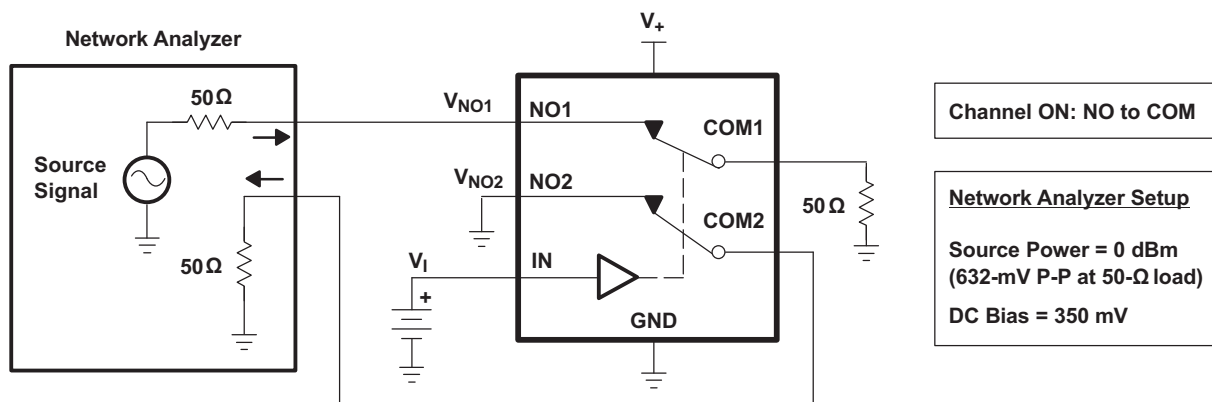
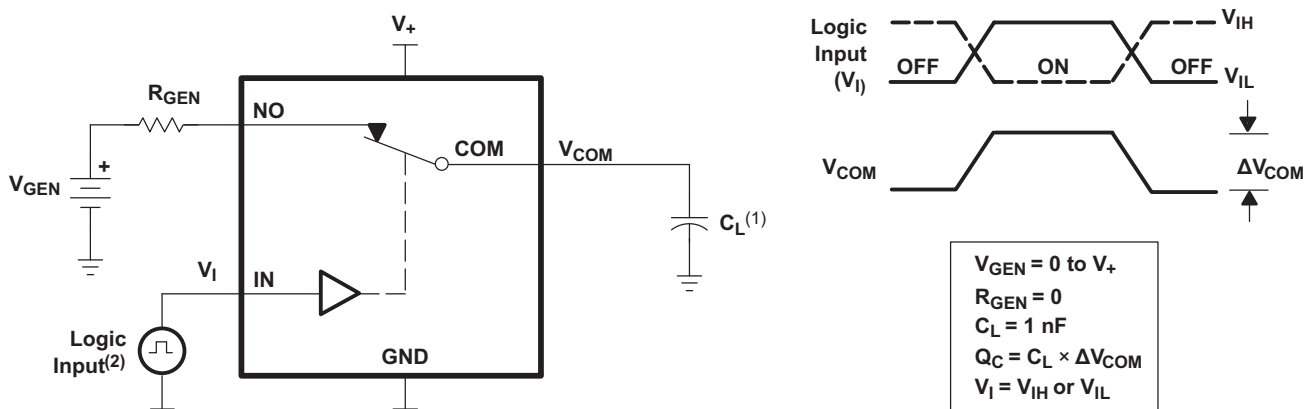


Figure 18. Crosstalk ( $X_{TALK}$ )

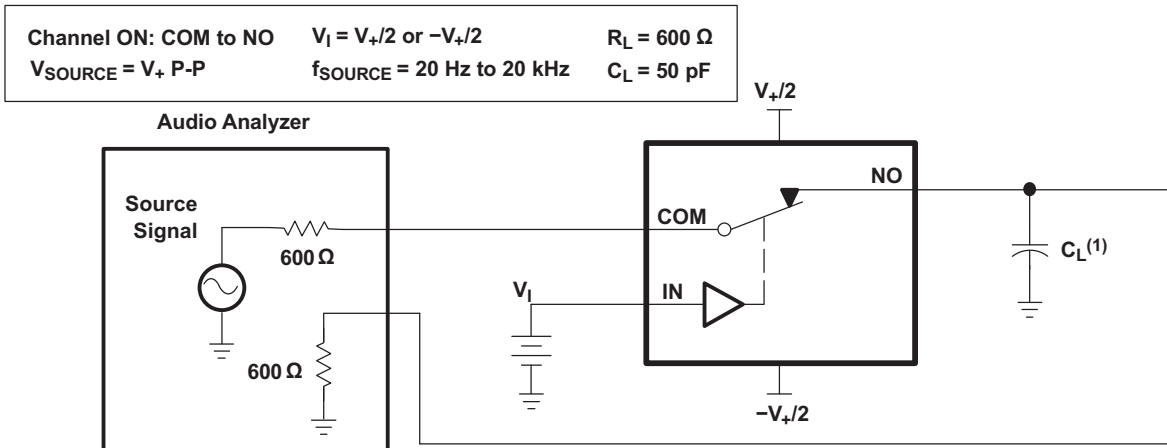


- (1)  $C_L$  includes probe and jig capacitance.
- (2) All input pulses are supplied by generators having the following characteristics:  
 PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ ,  $t_r < 5 \text{ ns}$ ,  $t_f < 5 \text{ ns}$ .

Figure 19. Charge Injection ( $Q_C$ )



Parameter Measurement Information (continued)



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

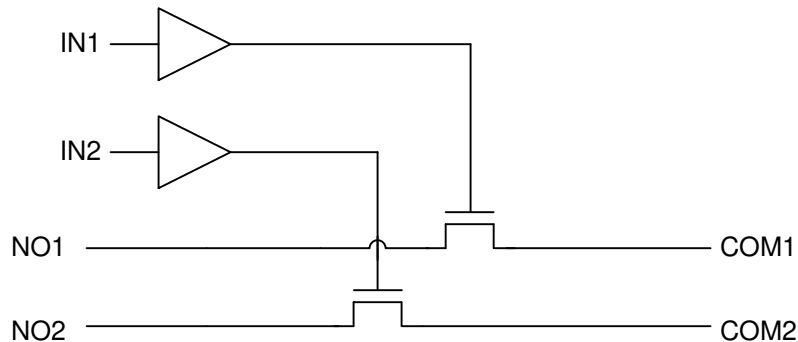
Figure 20. Total Harmonic Distortion (THD)

## 8 Detailed Description

### 8.1 Overview

The TS5A23166 is a dual 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. [表 2](#) shows the descriptions of each parameter specified in the datasheet.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

Tolerant control inputs allow 5-V logic levels to be present on the IN pin at any value of  $V_{CC}$ . Low ON-resistance allows minimal signal distortion through device.

### 8.4 Device Functional Modes

[Table 1](#) shows the functional modes for TS5A23166.

**Table 1. Function Table**

IN	NO TO COM, COM TO NO
L	OFF
H	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 TS5A23166 dual SPST analog switch is a basic component that could be used in any electrical system design. One example application is a gain selector, which is described in the [Typical Application](#) section.

### 9.2 Typical Application

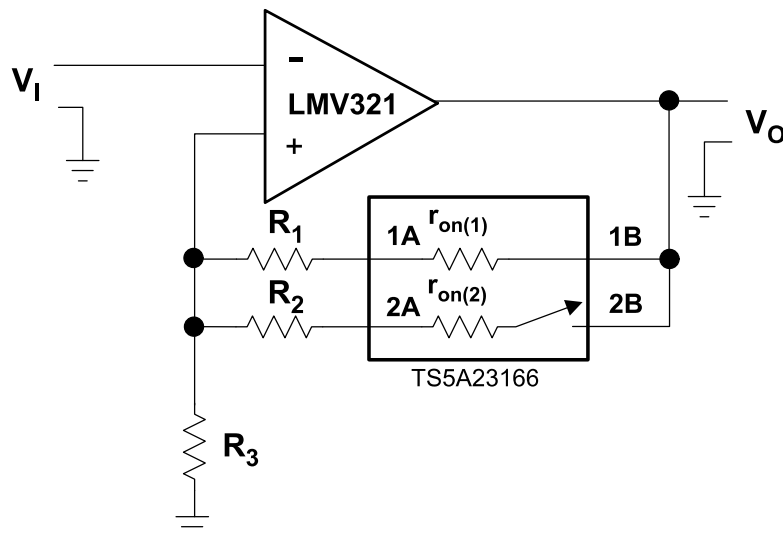


Figure 21. Gain-Control Circuit for OP Amplifier

#### 9.2.1 Design Requirements

By selecting values of  $R_1$  and  $R_2$ , such that  $R_x \gg r_{on(x)}$ ,  $r_{on}$  of TS5A23166 can be ignored. The gain of op amp can be calculated as follow:

$$V_o / V_i = 1 + R_{||} / R_3 \quad (1)$$

$$R_{||} = (R_1 + r_{on(1)}) || (R_2 + r_{on(2)}) \quad (2)$$

#### 9.2.2 Detailed Design Procedure

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

## Typical Application (continued)

### 9.2.3 Application Curve

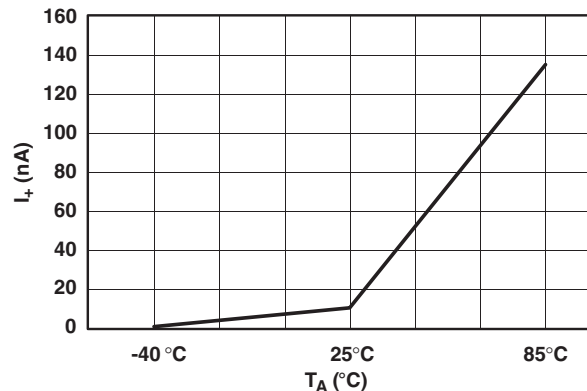


Figure 22. Power-Supply Current vs Temperature (V<sub>+</sub> = 5 V)

## 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<sub>CC</sub> 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<sub>CC</sub>, then a 0.01-μF or 0.022-μF capacitor is recommended for each V<sub>CC</sub> because the VCC pins will be tied together internally. For devices with dual supply pins operating at different voltages, for example V<sub>CC</sub> and V<sub>DD</sub>, 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. [Figure 23](#) shows progressively better techniques of rounding corners. Only the last example maintains constant trace width and minimizes reflections.

### 11.2 Layout Example

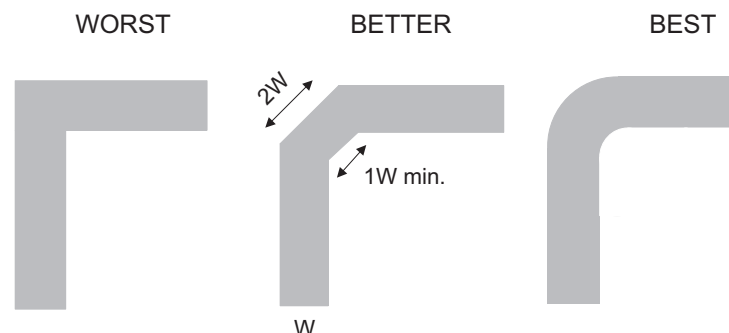


Figure 23. Trace Example

## 12 デバイスおよびドキュメントのサポート

### 12.1 デバイス・サポート

#### 12.1.1 デバイスの項目表記

**表 2. パラメータの説明**

記号	説明
$V_{COM}$	COM電圧
$V_{NO}$	NO電圧
$r_{on}$	チャンネルがオンのときのCOMとNOポート間の抵抗
$r_{peak}$	規定電圧範囲内でのピーク・オン抵抗
$r_{on(flat)}$	規定の条件の範囲における、チャンネルの $r_{on}$ の最大値と最小値との差
$I_{NO(OFF)}$	ワーストケースの入力および出力条件で、対応チャンネル(NOからCOM)がオフ状態のとき、NOポートで測定されるリーク電流
$I_{NO(PWROFF)}$	パワーダウン状況、 $V_+ = 0$ のとき、NOポートで測定されるリーク電流
$I_{COM(OFF)}$	ワーストケースの入力および出力条件で、対応チャンネル(COMからNO)がオフ状態のとき、COMポートで測定されるリーク電流
$I_{COM(PWROFF)}$	パワーダウン状況、 $V_+ = 0$ のとき、COMポートで測定されるリーク電流
$I_{NO(ON)}$	対応チャンネル(NOからCOM)がオン状態、出力(COM)がオープンなとき、NOポートで測定されるリーク電流
$I_{COM(ON)}$	対応チャンネル(COMからNO)がオン状態、出力(NO)がオープンなとき、COMポートで測定されるリーク電流
$V_{IH}$	制御入力(IN)の論理HIGHの最小入力電圧
$V_{IL}$	制御入力(IN)の論理LOWの最大入力電圧
$V_I$	制御入力(IN)の電圧
$I_{IH}, I_{IL}$	制御入力(IN)で測定されるリーク電流
$t_{ON}$	スイッチのターンオン時間。このパラメータは、規定された条件の範囲で、スイッチがオンになるときのデジタル制御(IN)信号とアナログ出力(COM、NO)信号との間の伝搬遅延により測定されます。
$t_{OFF}$	スイッチのターンオフ時間。このパラメータは、規定された条件の範囲で、スイッチがオフになるときのデジタル制御(IN)信号とアナログ出力(COM、NO)信号との間の伝搬遅延により測定されます。
$Q_C$	電荷注入は、制御(IN)入力からアナログ(NO、COM)出力への、望ましくない信号のカップリングの測定値です。この値はクーロン(C)単位で、制御入力のスイッチングによって誘導される合計電荷により測定されます。電荷注入 $Q_C = C_L \times \Delta V_{COM}$ で、 $C_L$ は負荷容量、 $\Delta V_{COM}$ はアナログ出力電圧の変化です。
$C_{NO(OFF)}$	対応チャンネル(NOからCOM)がオフのときのNOポートの容量
$C_{COM(OFF)}$	対応チャンネル(COMからNO)がオフのときのCOMポートの容量
$C_{NO(ON)}$	対応チャンネル(NOからCOM)がオンのときのNOポートの容量
$C_{COM(ON)}$	対応チャンネル(COMからNO)がオンのときのCOMポートの容量
$C_I$	制御入力(IN)の容量
$O_{ISO}$	スイッチのオフ絶縁は、オフ状態のスイッチのインピーダンス測定値です。これは、オフ状態の対応チャンネル(NOからCOM)で、特定の周波数についてdB単位で測定されます。
BW	スイッチの帯域幅。オン状態のチャンネルのゲインがDCゲインより-3dB低くなる周波数です。
THD	全高調波歪は、アナログ・スイッチにより発生する信号の歪みを示します。この値は、2次、3次、およびさらに高次の高調波の二乗平均(RMS)値と、基本波の絶対振幅との比として定義されます。
$I_+$	制御(IN)ピンが $V_+$ またはGNDであるときの静的消費電流

## 12.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[ti.com](http://ti.com)のデバイス製品フォルダを開いてください。右上の「アラートを受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

## 12.3 コミュニティ・リソース

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

## 12.4 商標

E2E is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

## 12.5 静電気放電に関する注意事項



これらのデバイスは、限定的なESD (静電破壊) 保護機能を内蔵しています。保存時または取り扱い時は、MOSゲートに対する静電破壊を防止するために、リード線同士をショートさせておくか、デバイスを導電フォームに入れる必要があります。

## 12.6 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 13 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5A23166DCUR	ACTIVE	VSSOP	DCU	8	3000	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	(AM, JAMQ, JAMR) JZ	<a href="#">Samples</a>
TS5A23166DCURG4	ACTIVE	VSSOP	DCU	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	JAMR	<a href="#">Samples</a>
TS5A23166YZPR	ACTIVE	DSBGA	YZP	8	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	JMN	<a href="#">Samples</a>
TS5A23166YZTR	ACTIVE	DSBGA	YZT	8	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	JMN	<a href="#">Samples</a>

(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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

**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.



**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
TS5A23166DCUR	VSSOP	DCU	8	3000	178.0	9.5	2.25	3.35	1.05	4.0	8.0	Q3
TS5A23166DCUR	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
TS5A23166DCURG4	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
TS5A23166YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1
TS5A23166YZTR	DSBGA	YZT	8	3000	178.0	9.2	1.02	2.02	0.75	4.0	8.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

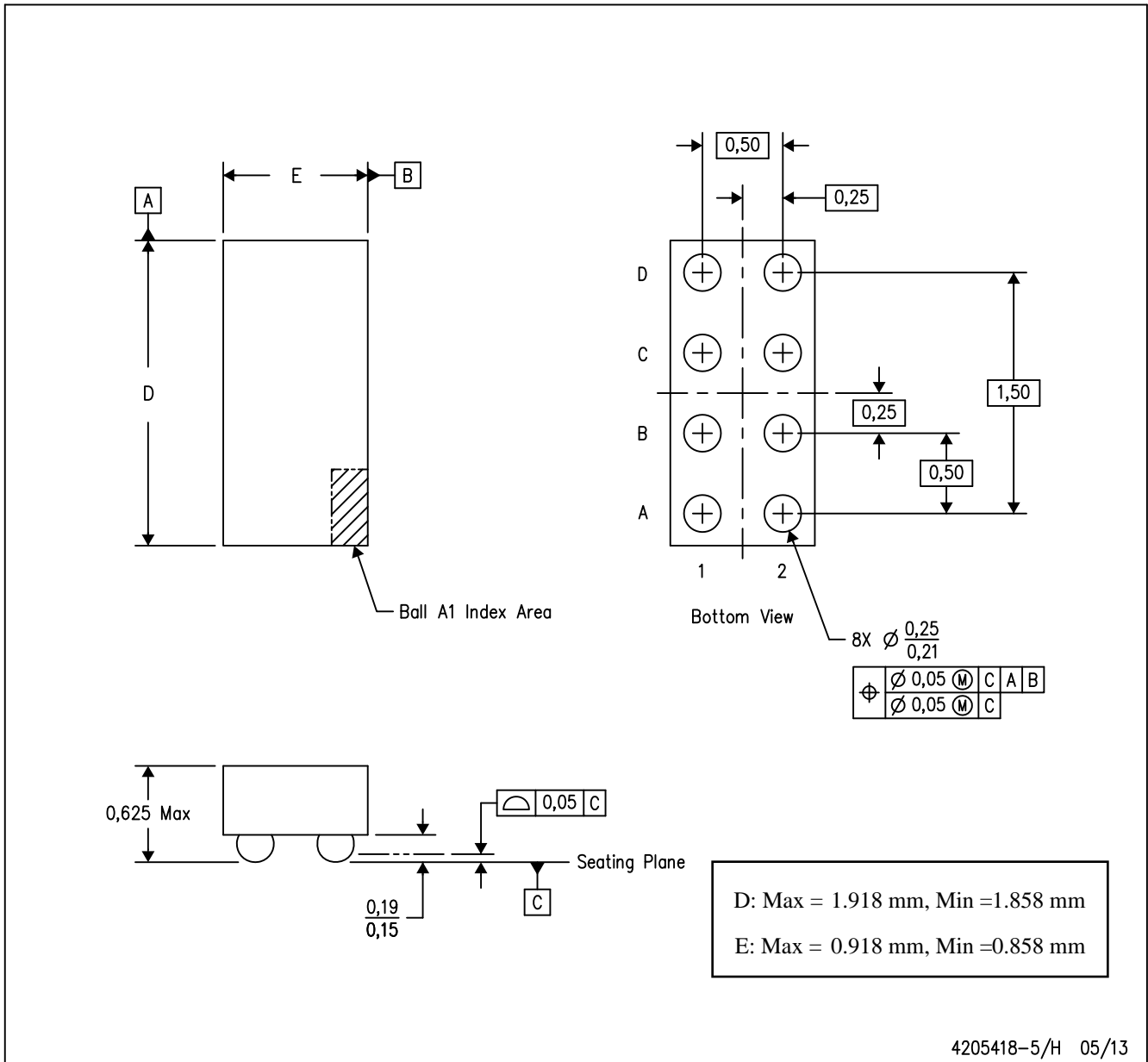

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A23166DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
TS5A23166DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
TS5A23166DCURG4	VSSOP	DCU	8	3000	202.0	201.0	28.0
TS5A23166YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0
TS5A23166YZTR	DSBGA	YZT	8	3000	220.0	220.0	35.0

# MECHANICAL DATA

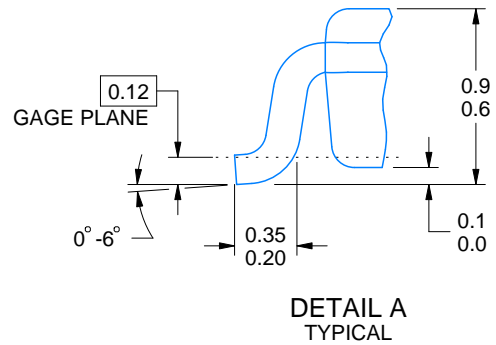
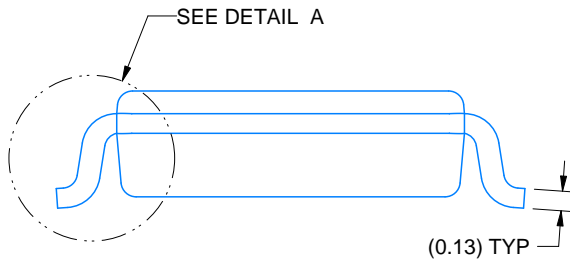
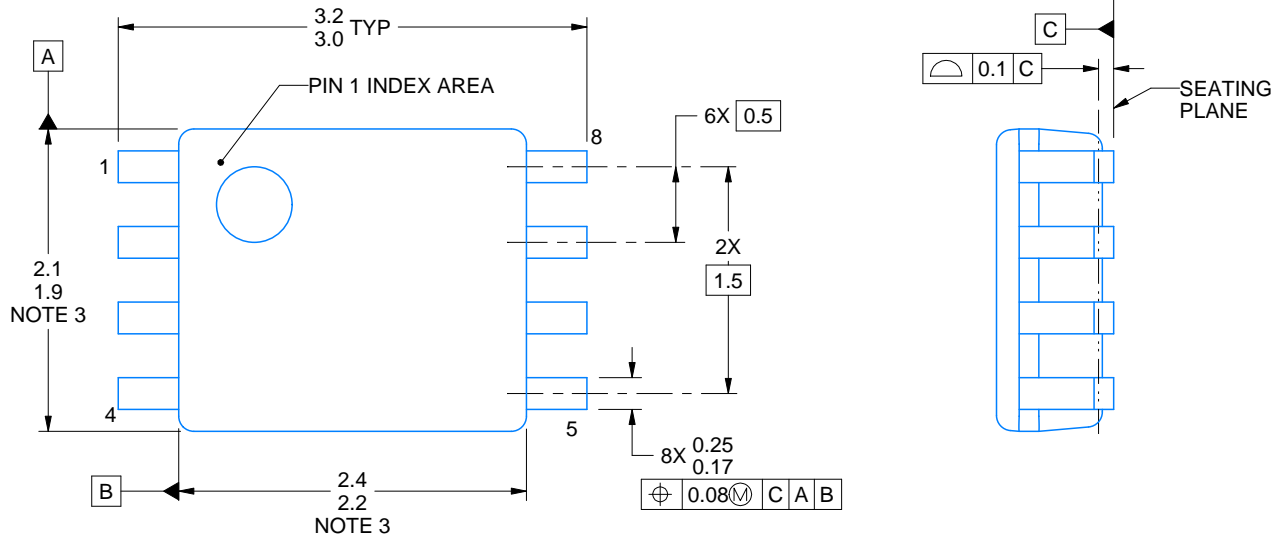
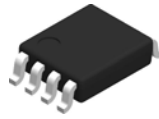
YZT (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.

NanoFree is a trademark of Texas Instruments.



4225266/A 09/2014

NOTES:

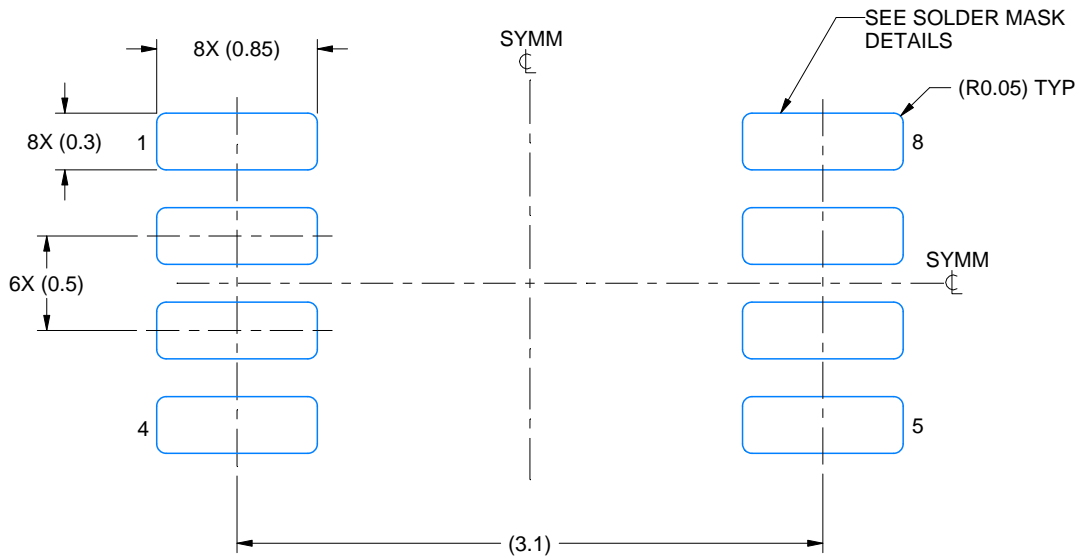
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-187 variation CA.

# EXAMPLE BOARD LAYOUT

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 25X



4225266/A 09/2014

NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 25X

4225266/A 09/2014

NOTES: (continued)

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

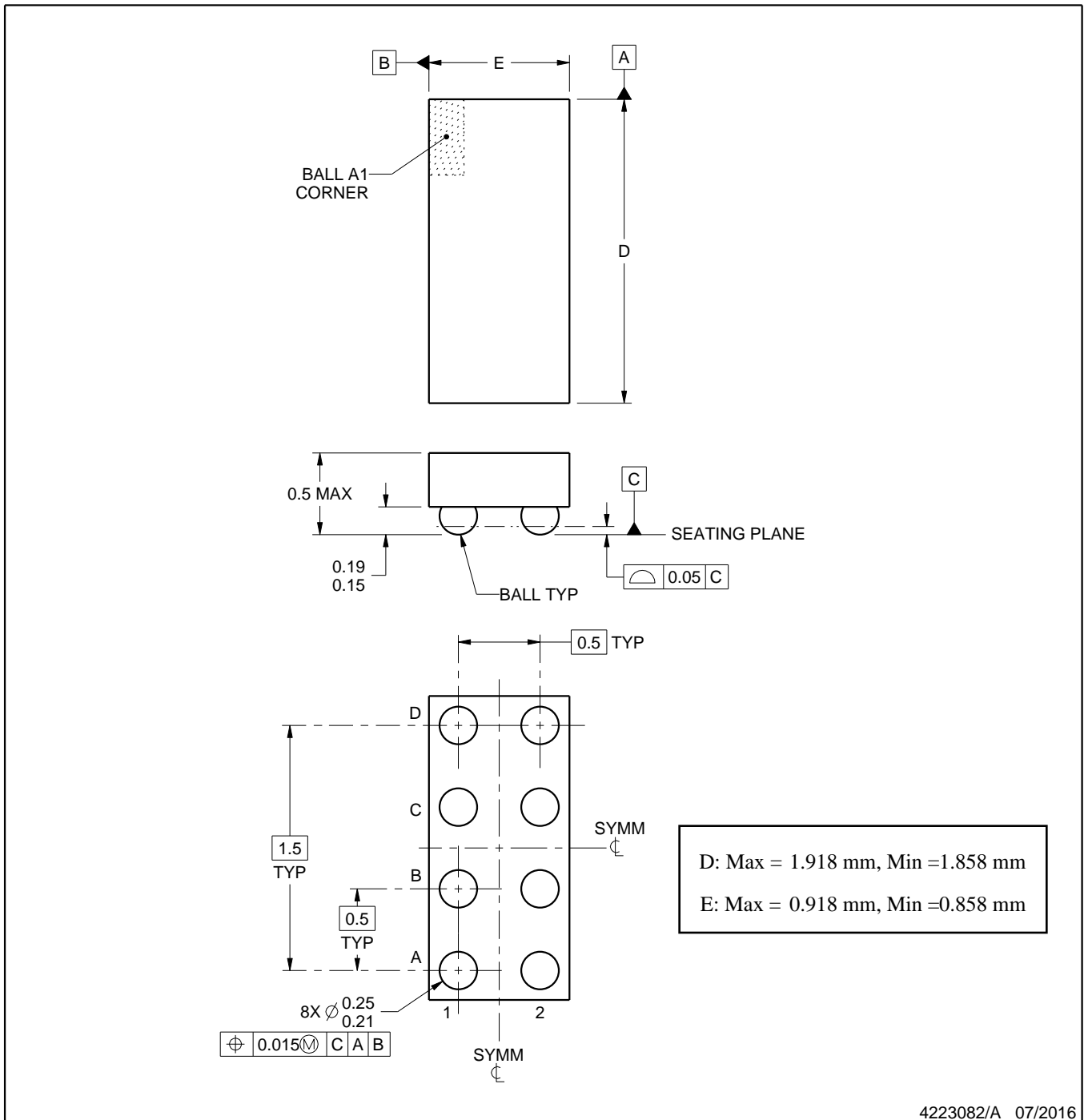
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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.

# EXAMPLE BOARD LAYOUT

YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:40X



SOLDER MASK DETAILS  
NOT TO SCALE

4223082/A 07/2016

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).



# EXAMPLE STENCIL DESIGN

YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:40X

4223082/A 07/2016

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

## 重要なお知らせと免責事項

TI は、技術データと信頼性データ (データシートを含みます)、設計リソース (リファレンス・デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、TI 製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した TI 製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとし、

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている TI 製品を使用するアプリケーションの開発の目的でのみ、TI はその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。TI や第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、TI およびその代理人を完全に補償するものとし、TI は一切の責任を拒否します。

TI の製品は、[TI の販売条件](#)、または [ti.com](#) やかかる TI 製品の関連資料などのいずれかを通じて提供する適用可能な条項の下で提供されています。TI がこれらのリソースを提供することは、適用される TI の保証または他の保証の放棄の拡大や変更を意味するものではありません。

お客様がいかなる追加条項または代替条項を提案した場合でも、TI はそれらに異議を唱え、拒否します。

郵送先住所 : Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2024, Texas Instruments Incorporated