



TS5A22362 負の信号能力を持つ0.65Ω、2チャンネルSPDTアナログ・スイッチ

1 特長

- Break-Before-Make スイッチングを規定
- 負の信号能力：最大スイングは $-2.75\text{V} \sim 2.75\text{V}$ ($V_{CC} = 2.75\text{V}$)
- 低いオン抵抗 (0.65Ω)
- 低い電荷注入
- 非常に優れたオン抵抗マッチング
- 電源電圧範囲：2.3V～5.5V (V_{CC})
- 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
 - 人体モデルで 2500V (A114-B、クラス II)
 - 荷電デバイス・モデルで 1500V (C101)
 - マシン・モデルで 200V (A115-A)

2 アプリケーション

- 携帯電話
- パーソナル・デジタル・アシスタント (PDA)
- ポータブル計測装置
- オーディオ配線
- 医療用画像処理

3 概要

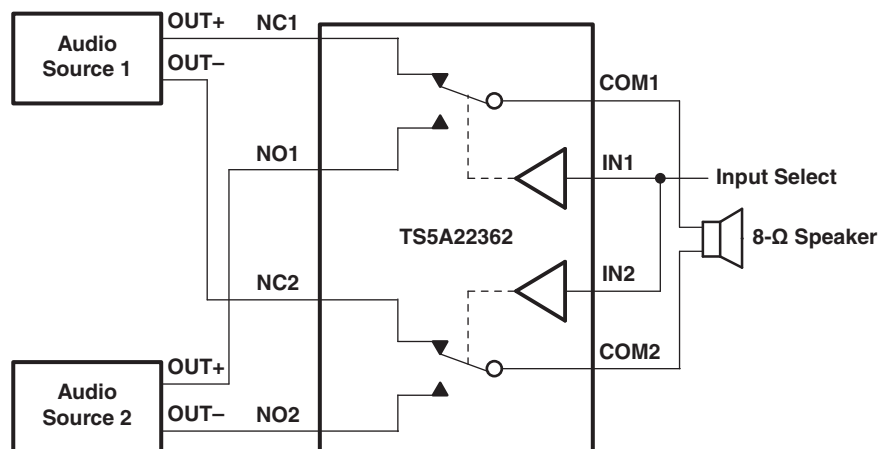
TS5A22362は双方向、2チャンネルの単極双投(SPDT)アナログ・スイッチで、2.3V～5.5Vで動作するよう設計されています。このデバイスには負の信号スイング能力があり、グランドより低い信号が歪みなしにスイッチを通過できます。Break-Before-Make機能により、1つのパスから別のパスに信号を転送するときの信号の歪みが防止されます。オン抵抗が低く、チャンネル間のオン抵抗マッチングが非常に優れており、全高調波歪み(THD)が最小限であるため、オーディオ・アプリケーションに理想的です。3.00mm×3.00mmのDRCパッケージには、医療イメージング・アプリケーション向けの非磁性パッケージも用意されています。

製品情報⁽¹⁾

型番	パッケージ	本体サイズ(公称)
TS5A22362	VSON (10)	3.00mm×3.00mm
	DSBGA (10)	1.86mm×1.36mm
	VSSOP (10)	3.00mm×3.00mm

(1) 提供されているすべてのパッケージについては、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。

代表的なアプリケーションの回路図



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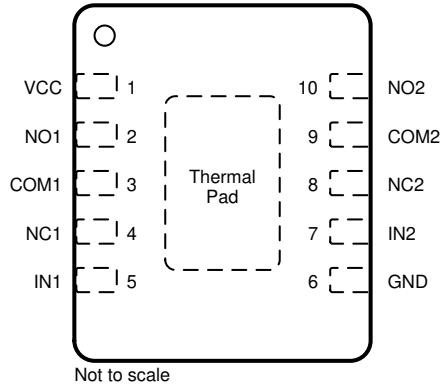
4 改訂履歴

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 D (March 2018) から Revision E に変更	Page
• Changed the YZP Package view From: Top View To: Bottom View	3
Revision C (June 2017) から Revision D に変更	Page
• Changed the YZP Package From: Laser Marketing View and Bump View To: Top View	3
• Changed the Q_C TYP value From: 10 pC To: 150 pC in the <i>Electrical Characteristics for 5-V Supply</i> table	8
Revision B (September 2015) から Revision C に変更	Page
• Changed the V_{IN} MAX value From: V_{CC} To: 5.5 V in the <i>Recommended Operating Conditions</i> table	4
Revision A (August 2015) から Revision B に変更	Page
• Changed C_L TEST CONDITION value for all THD PARAMETERS from 15 pf to 35 pf.	6
2015年6月発行のものから更新	Page
• Changed the Functional Block Diagram	15

5 Pin Configuration and Functions

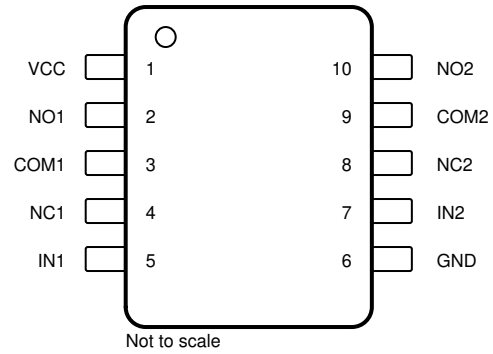
**DRC Package
10-Pin VSON
Top View**



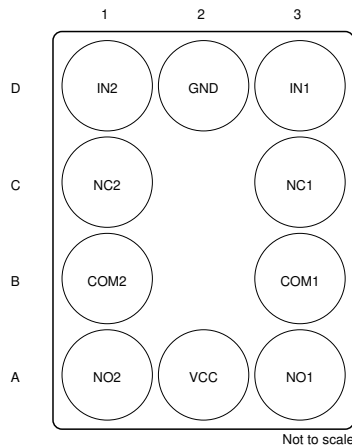
The exposed center pad, if used, must be

connected as a secondary GND or left electrically open.

**DGS Package
10-Pin VSSOP
Top View**



**YZP Package
10-Pin DSBGA
Bottom View**



Pin Functions

PIN				TYPE	DESCRIPTION
NAME	VSON	VSSOP	DSBGA		
VCC	1	1	A2	—	Power Supply
NO1	2	2	A3	I/O	Normally Open (NO) signal path, Switch 1
COM1	3	3	B3	I/O	Common signal path, Switch 1
NC1	4	4	C3	I/O	Normally Closed (NC) signal path, Switch 1
IN1	5	5	D3	I	Digital control pin , Switch 1
GND	6	6	D2	—	Ground
IN2	7	7	D1	I	Digital control pin, Switch 2
NC2	8	8	C1	I/O	Normally Closed (NC) signal path, Switch 2
COM2	9	9	B1	I/O	Common signal path, Switch 2
NO2	10	10	A1	I/O	Normally Open (NO) signal Path, Switch 2

6 Specifications

6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
$V_{CC}^{(2)}$ Supply voltage ⁽³⁾			−0.5	6	V
V_{NC} V_{NO} V_{COM} Analog voltage ⁽³⁾ ⁽⁴⁾ ⁽⁵⁾			$V_{CC} - 6$	$V_{CC} + 0.5$	V
$I_{I/OK}$	Analog port diode current	$V_{NC}, V_{NO}, V_{COM} < 0$ or $V_{NC}, V_{NO}, V_{COM} > V_{CC}$	−50	50	mA
I_{NC} I_{NO} I_{COM}	ON-state switch current ON-state peak switch current ⁽⁶⁾	$V_{NC}, V_{NO}, V_{COM} = 0$ to V_{CC}	−150 −300	150 300	mA
$I_{NC}^{(3) (7) (8)}$ $I_{NO}^{(3) (7) (8)}$ $I_{COM}^{(3) (7) (8)}$	ON-state switch current ON-state peak switch current ⁽⁶⁾		−350 −500	350 500	
V_I	Digital input voltage		−0.5	6.5	V
I_{IK}	Digital input clamp current ⁽³⁾ ⁽⁴⁾	$V_I < 0$	−50	50	mA
I_{CC} I_{GND}	Continuous current through V_{CC} or GND		−100	100	mA
T_{stg}	Storage temperature		−65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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) $V_{CC} = 3.0$ V to 5.0 V, $T_A = -40^\circ\text{C}$ to 85°C .
- (8) For YZP package only.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2500	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1500	

- (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_{CC}	Supply voltage	2.3	5.5	V
V_{NC} V_{NO} V_{COM}	Signal path voltage	$V_{CC} - 5.5$	V_{CC}	V
V_{IN}	Digital control	GND	5.5	V

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		TS5A22362			UNIT
		DGS (VSSOP)	DRC (VSON)	YZP (DSBGA)	
		10 PINS	10 PINS	10 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	163.3	44.3	90.9	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	56.4	70.1	0.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	83.1	19.3	8.3	°C/W
ψ _{JT}	Junction-to-top characterization parameter	6.8	2.0	3.2	°C/W
ψ _{JB}	Junction-to-board characterization parameter	81.8	19.4	8.3	°C/W

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

6.5 Electrical Characteristics for 2.5-V Supply

V_{CC} = 2.3 V to 2.7 V, T_A = –40°C to 85°C (unless otherwise noted) ⁽¹⁾

PARAMETER	TEST CONDITIONS	T _A	V _{CC}	MIN	TYP	MAX	UNIT
Analog Switch							
V _{COM} , V _{NO} , V _{NC}	Analog signal range			V _{CC} – 5.5		V _{CC}	V
R _{on}	ON-state resistance	V _{NC} or V _{NO} = V _{CC} , 1.5 V, V _{CC} – 5.5 V I _{COM} = –100 mA, COM to NO or NC, see Figure 13	25°C Full	2.7 V	0.65 1.3	0.94 1.3	Ω
ΔR _{on}	ON-state resistance match between channels	V _{NC} or V _{NO} = 1.5 V, I _{COM} = –100 mA, COM to NO or NC, see Figure 13	25°C Full	2.7 V	0.023 0.15	0.11 0.15	Ω
R _{on(flat)}	ON-state resistance flatness	V _{NC} or V _{NO} = V _{CC} , 1.5 V, V _{CC} – 5.5 V I _{COM} = –100 mA, COM to NO or NC, see Figure 13	25°C Full	2.7 V	0.18 0.5	0.46 0.5	Ω
I _{NC(OFF)} , I _{NO(OFF)}	NC, NO OFF leakage current	V _{NC} = 2.25 V, V _{CC} – 5.5 V V _{COM} = V _{CC} – 5.5 V, 2.25 V V _{NO} = Open COM to NO or V _{NO} = 2.25 V, V _{CC} – 5.5 V, V _{COM} = V _{CC} – 5.5 V, 2.25 V V _{NC} = Open COM to NC See Figure 14	25°C Full	2.7 V	–50 –375	50 375	nA
I _{COM(ON)}	COM ON leakage current	V _{NC} and V _{NO} = Floating, V _{COM} = V _{CC} , V _{CC} – 5.5 V See Figure 15	25°C Full	2.7 V	–50 –375	50 375	nA
Digital Control Inputs (IN) ⁽²⁾							
V _{IH}	Input logic high		Full		1.4	5.5	V
V _{IL}	Input logic low					0.6	
I _{IH} , I _{IL}	Input leakage current	V _{IN} = V _{CC} or 0	25°C Full	2.7 V	–250 –250	250 250	nA
Dynamic							
t _{ON}	Turnon time	V _{COM} = V _{CC} , R _L = 300 Ω, C _L = 35 pF, see Figure 17	25°C Full	2.5 V 2.3 V to 2.7 V	44 120	80 120	ns
t _{OFF}	Turnoff time	V _{COM} = V _{CC} , R _L = 300 Ω, C _L = 35 pF, see Figure 17	25°C Full	2.5 V 2.3 V to 2.7 V	22 70	70 70	ns
t _{BBM}	Break-before-make time	See Figure 18	25°C	2.5 V	1	7	ns
Q _C	Charge injection	V _{GEN} = 0, R _{GEN} = 0, C _L = 1 nF, see Figure 22	25°C	2.5 V	150		pC
C _{NC(OFF)} , C _{NO(OFF)}	NC, NO OFF capacitance	V _{NC} or V _{NO} = V _{CC} or GND, See Figure 16	25°C	2.5 V	70		pF

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

(2) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, [Implications of Slow or Floating CMOS Inputs](#), [SCBA004](#).

Electrical Characteristics for 2.5-V Supply (continued)

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

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
$C_{COM(ON)}$	NC, NO, COM ON capacitance $V_{COM} = V_{CC}$ or GND, Switch ON, $f = 10 \text{ MHz}$ See Figure 16	25°C	2.5 V		370		pF
C_i	Digital input capacitance $V_i = V_{CC}$ or GND See Figure 16	25°C	2.5 V		2.6		pF
BW	Bandwidth $R_L = 50 \Omega$, -3 dB See Figure 18	25°C	2.5 V		17		MHz
O_{ISO}	OFF isolation $R_L = 50 \Omega$ $f = 100 \text{ kHz}$, see Figure 20	25°C	2.5 V		-66		dB
X_{TALK}	Crosstalk $R_L = 50 \Omega$ $f = 100 \text{ kHz}$, see Figure 21	25°C	2.5 V		-75		dB
THD	Total harmonic distortion $R_L = 600 \Omega$, $C_L = 35 \text{ pF}$ $f = 20 \text{ Hz to } 20 \text{ kHz}$, see Figure 23	25°C	2.5 V		0.01%		
Supply							
I_{CC}	Positive supply current V_{COM} and $V_{IN} = V_{CC}$ or GND, V_{NC} and $V_{NO} = \text{Floating}$	25°C	2.7 V		0.2	1.1	μA
		Full				1.3	
I_{CC}	Positive supply current $V_{COM} = V_{CC} - 5.5 \text{ V}$, $V_{IN} = V_{CC}$ or GND, V_{NC} and $V_{NO} = \text{Floating}$	Full	2.7 V			3.3	μA

6.6 Electrical Characteristics for 3.3-V Supply

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

PARAMETER		TEST CONDITIONS		T _A	V _{CC}	MIN	TYP	MAX	UNIT
ANALOG SWITCH									
V _{COM} , V _{NO} , V _{NC}	Analog signal range					V _{CC} – 5.5		V _{CC}	V
R _{on}	ON-state resistance	V _{NC} or V _{NO} ≤ V _{CC} , 1.5 V, V _{CC} – 5.5 V, I _{COM} = –100 mA	COM to NO or NC, see Figure 13	25°C	3 V	0.61		0.87	Ω
				Full		0.97			
ΔR _{on}	ON-state resistance match between channels	V _{NC} or V _{NO} = 1.5 V, I _{COM} = –100 mA,	COM to NO or NC, see Figure 13	25°C	3 V	0.024		0.13	Ω
				Full		0.13			
R _{on(flat)}	ON-state resistance flatness	V _{NC} or V _{NO} ≤ V _{CC} , 1.5 V, V _{CC} – 5.5 V, I _{COM} = –100 mA	COM to NO or NC, see Figure 13	25°C	3 V	0.12		0.46	Ω
				Full		0.5			
I _{NC(OFF)} , I _{NO(OFF)}	NC, NO OFF leakage current	V _{NC} = 3 V, V _{CC} – 5.5 V V _{COM} = V _{CC} – 5.5 V, 3 V V _{NO} = Open COM to NO or V _{NO} = 3 V, V _{CC} – 5.5 V, V _{COM} = V _{CC} – 5.5 V, 3 V V _{NC} = Open COM to NC	See Figure 14	25°C	3.6 V	–50		50	nA
				Full		–375		375	
I _{COM(ON)}	COM ON leakage current	V _{NC} and V _{NO} = Floating, V _{COM} = V _{CC} , V _{CC} – 5.5 V	COM to NO or NC, see Figure 15	25°C	3.6 V	–50		50	nA
				Full		–375		375	
DIGITAL CONTROL INPUTS (IN) ⁽²⁾									
V _{IH}	Input logic high			Full		1.4		5.5	V
V _{IL}	Input logic low					0.8			
I _{IH} , I _{IL}	Input leakage current	V _{IN} = V _{CC} or 0	25°C	3.6 V	–250		250	nA	
			Full		–250		250		

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

(2) All unused digital inputs of the device must be held at V_{CC} 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 for 3.3-V Supply (continued)

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

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
DYNAMIC							
t_{ON} Turnon time	$V_{COM} = V_{CC}$, $R_L = 300 \Omega$ $C_L = 35 \text{ pF}$, see Figure 17	25°C	3.3 V		34	80	ns
		Full	3 V to 3.6 V			120	
t_{OFF} Turnoff time	$V_{COM} = V_{CC}$, $R_L = 300 \Omega$ $C_L = 35 \text{ pF}$, see Figure 17	25°C	3.3 V		19	70	ns
		Full	3 V to 3.6 V			70	
t_{BBM} Break-before-make time	See Figure 18	25°C	3.3 V	1	7		ns
Q_C Charge injection	$V_{GEN} = 0$, $R_{GEN} = 0$ $C_L = 1 \text{ nF}$, see Figure 22	25°C	3.3 V		150		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$ NC, NO OFF capacitance	V_{NC} or $V_{NO} = V_{CC}$ or $V_{CC} - 5.5 \text{ V}$ See Figure 16	25°C	3.3 V		70		pF
$C_{COM(ON)}$ NC, NO, COM ON capacitance	$V_{COM} = V_{CC}$ or GND, $f = 10 \text{ MHz}$ See Figure 16	25°C	3.3 V		370		pF
C_I Digital input capacitance	$V_I = V_{CC}$ or GND See Figure 16	25°C	3.3 V		2.6		pF
BW Bandwidth	$R_L = 50 \Omega$, -3 dB Switch ON, see Figure 18	25°C	3.3 V		17.5		MHz
O_{ISO} OFF isolation	$R_L = 50 \Omega$ $f = 100 \text{ kHz}$, see Figure 20	25°C	3.3 V		-68		dB
X_{TALK} Crosstalk	$R_L = 50 \Omega$ $f = 100 \text{ kHz}$, see Figure 21	25°C	3.3 V		-76		dB
THD Total harmonic distortion	$R_L = 600 \Omega$, $C_L = 35 \text{ pF}$ $f = 20 \text{ Hz to } 20 \text{ kHz}$, see Figure 23	25°C	3.3 V		0.008%		
SUPPLY							
I_{CC} Positive supply current	V_{COM} and $V_{IN} = V_{CC}$ or GND, V_{NC} and $V_{NO} = \text{Floating}$	25°C	3.6 V		0.1	1.2	μA
		Full				1.3	
	$V_{COM} = V_{CC} - 5.5 \text{ V}$, $V_{IN} = V_{CC}$ or GND, V_{NC} and $V_{NO} = \text{Floating}$	Full	3.6 V			3.4	μA

6.7 Electrical Characteristics for 5-V Supply

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

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
ANALOG SWITCH							
V_{COM} , V_{NO} , V_{NC} Analog signal range				$V_{CC} - 5.5$		V_{CC}	V
R_{on} ON-state resistance	V_{NC} or $V_{NO} = V_{CC}$, 1.6 V, $V_{CC} = -5.5 \text{ V}$, $I_{COM} = -100 \text{ mA}$ COM to NO or NC, see Figure 13	25°C	4.5 V		0.52	0.74	Ω
		Full				0.83	
ΔR_{on} ON-state resistance match between channels	V_{NC} or $V_{NO} = 1.6 \text{ V}$, $I_{COM} = -100 \text{ mA}$ COM to NO or NC, see Figure 13	25°C	4.5 V		0.04	0.23	Ω
		Full				0.30	
$R_{on(Flat)}$ ON-state resistance flatness	V_{NC} or $V_{NO} = V_{CC}$, 1.6 V, $V_{CC} = -5.5 \text{ V}$, $I_{COM} = -100 \text{ mA}$ COM to NO or NC, see Figure 13	25°C	4.5 V		0.076	0.46	Ω
		Full				0.5	
$I_{NC(OFF)}$, $I_{NO(OFF)}$ NC, NO OFF leakage current	$V_{NC} = 4.5 \text{ V}$, $V_{CC} - 5.5 \text{ V}$, $V_{COM} = V_{CC} - 5.5 \text{ V}$, 4.5 V, $V_{NO} = \text{Open}$, COM to NO or $V_{NO} = 4.5 \text{ V}$, $V_{CC} - 5.5 \text{ V}$, $V_{COM} = V_{CC} - 5.5 \text{ V}$, 4.5 V, $V_{NC} = \text{Open}$, COM to NC See Figure 14	25°C	5.5 V	-50		50	nA
		Full		-375		375	
$I_{COM(ON)}$ COM ON leakage current	V_{NC} and $V_{NO} = \text{Floating}$, $V_{COM} = V_{CC}$, $V_{CC} - 5.5 \text{ V}$ See Figure 15	25°C	5.5 V	-50		50	nA
		Full		-375		375	

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

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

PARAMETER		TEST CONDITIONS		T _A	V _{CC}	MIN	TYP	MAX	UNIT
DIGITAL CONTROL INPUTS (IN) ⁽²⁾									
V _{IH}	Input logic high			Full		2.4		5.5	V
V _{IL}	Input logic low							0.8	
I _{IH} , I _{IL}	Input leakage current	V _{IN} = V _{CC} or 0		25°C	5.5 V	−250		250	nA
				Full		−250	250		
DYNAMIC									
t _{ON}	Turnon time	V _{COM} = V _{CC} , R _L = 300 Ω	C _L = 35 pF, see Figure 17	25°C	5 V	27		80	ns
				Full	4.5 V to 5.5 V			80	
t _{OFF}	Turnoff time	V _{COM} = V _{CC} , R _L = 300 Ω	C _L = 35 pF, see Figure 17	25°C	5 V	13		70	ns
				Full	4.5 V to 5.5 V			70	
t _{BBM}	Break-before-make time	V _{NC} = V _{NO} = V _{CC} /2 R _L = 300 Ω	C _L = 35 pF, see Figure 18	25°C	5 V	1	3.5		ns
Q _C	Charge injection	V _{GEN} = 0, R _{GEN} = 0	C _L = 1 nF, see Figure 22	25°C	5 V		150		pC
C _{NC(OFF)} , C _{NO(OFF)}	NC, NO OFF capacitance	V _{NC} or V _{NO} = V _{CC} or V _{CC} − 5.5 V	See Figure 16	25°C	5 V		70		pF
C _{COM(ON)}	NC, NO, COM ON capacitance	V _{COM} = V _{CC} or GND,	See Figure 16	25°C	5 V		370		pF
C _I	Digital input capacitance	V _I = V _{CC} or GND	See Figure 16	25°C	5 V		2.6		pF
BW	Bandwidth	R _L = 50 Ω	See Figure 18	25°C	5 V		18.3		MHz
O _{ISO}	OFF isolation	R _L = 50 Ω	f = 100 kHz, see Figure 20	25°C	5 V		−70		dB
X _{TALK}	Crosstalk	R _L = 50 Ω	f = 100 kHz, see Figure 21	25°C	5 V		−78		dB
THD	Total harmonic distortion	R _L = 600 Ω, C _L = 35 pF	f = 20 Hz to 20 kHz, see Figure 23	25°C	5 V		0.009%		
SUPPLY									
I _{CC}	Positive supply current	V _{COM} and V _{IN} = V _{CC} or GND, V _{NC} and V _{NO} = Floating	25°C	5.5 V		0.2		1.3	μA
			Full				3.5		
		V _{COM} = V _{CC} − 5.5 V, V _{IN} = V _{CC} or GND, V _{NC} and V _{NO} = Floating	Full				5		

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

6.8 Typical Characteristics

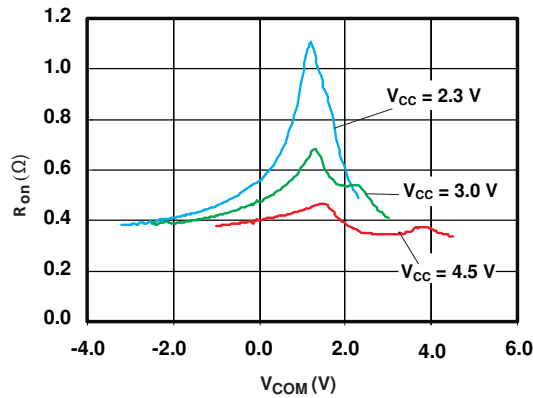


Figure 1. R_{on} vs V_{COM}

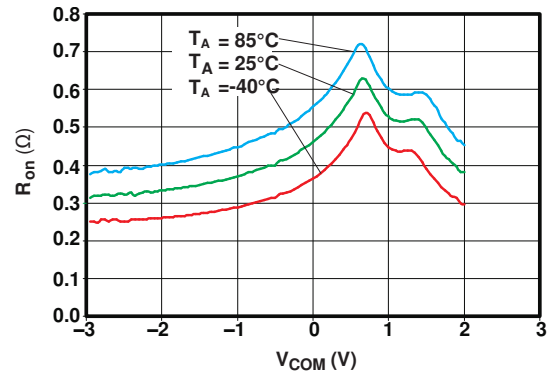


Figure 2. R_{on} vs V_{COM} ($V_{CC} = 2.7$ V)

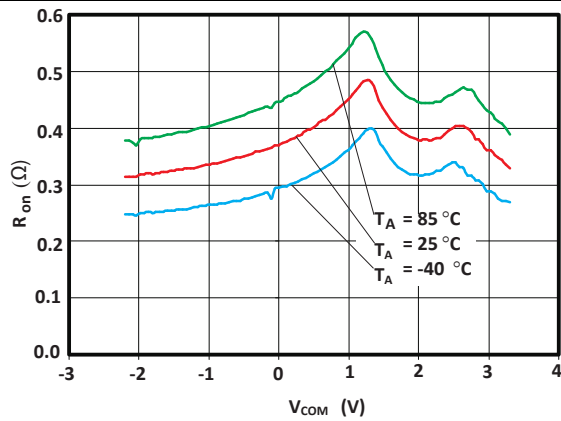


Figure 3. R_{on} vs V_{COM} ($V_{CC} = 3.3$ V)

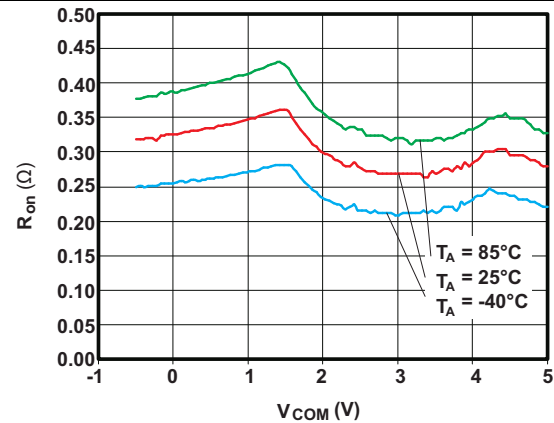


Figure 4. R_{on} vs V_{COM} ($V_{CC} = 5$ V)

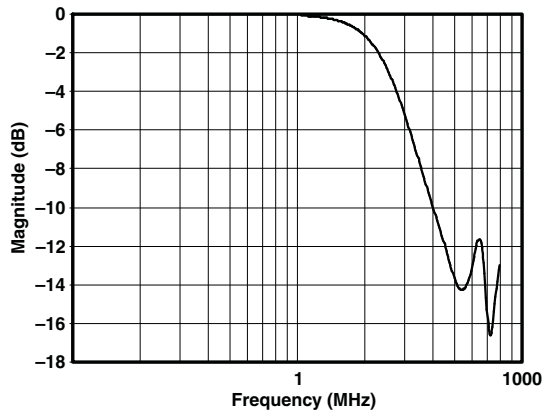


Figure 5. Insertion Loss

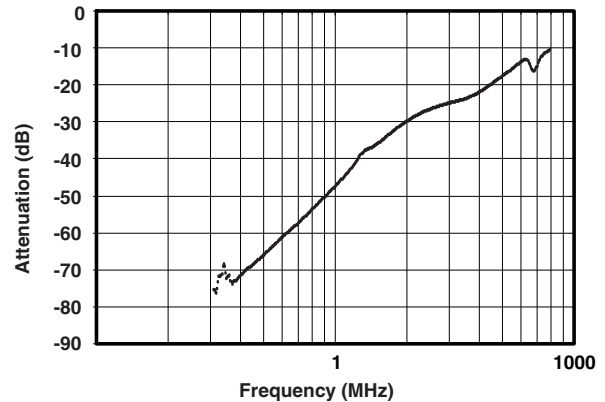


Figure 6. Off Isolation vs Frequency

Typical Characteristics (continued)

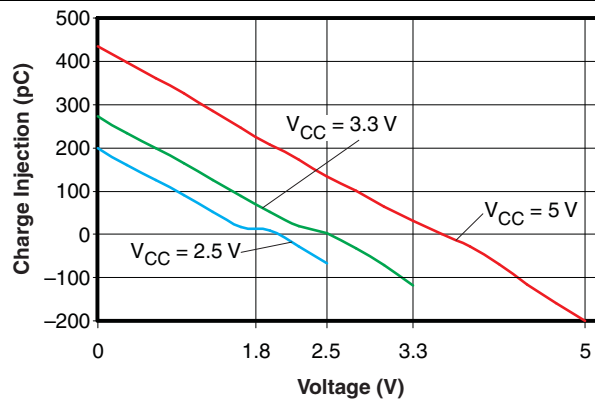


Figure 7. Charge Injection (Q_C) vs V_{COM}

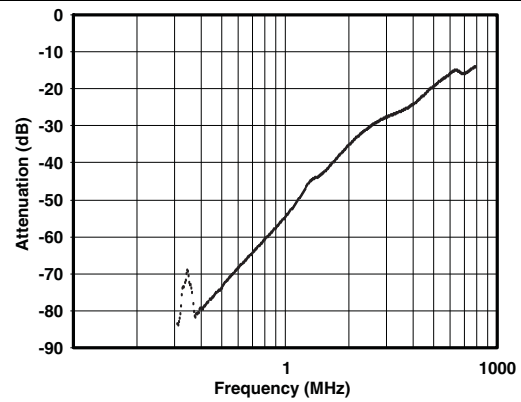


Figure 8. Crosstalk ($V_{CC} = 3.3\text{ V}$)

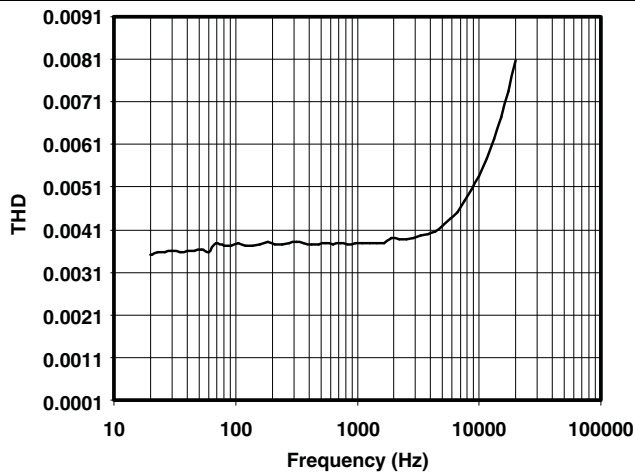


Figure 9. Total Harmonic Distortion vs Frequency

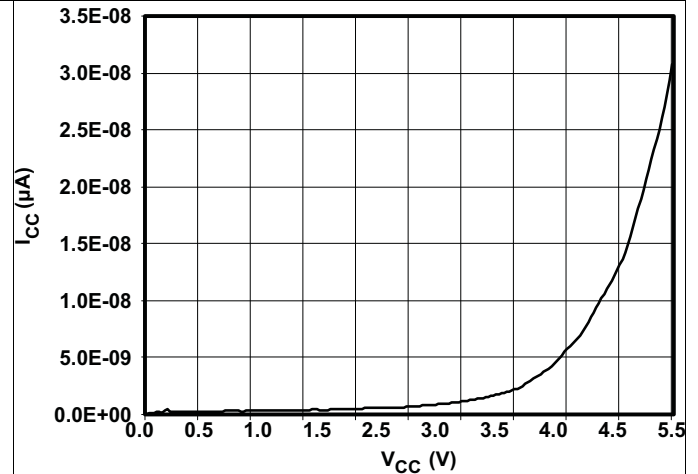


Figure 10. Power-Supply Current vs V_{CC}

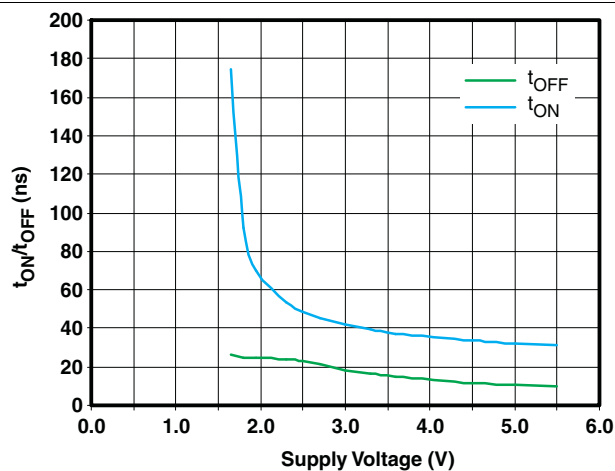


Figure 11. t_{ON} And t_{OFF} vs Supply Voltage

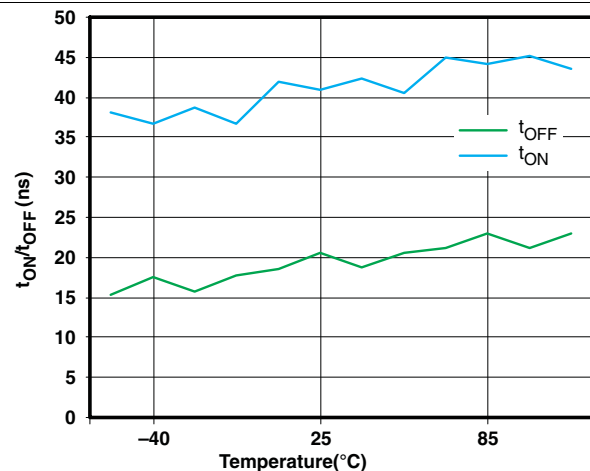


Figure 12. t_{ON} And t_{OFF} vs Temperature (2.5-V Supply)

7 Parameter Measurement Information

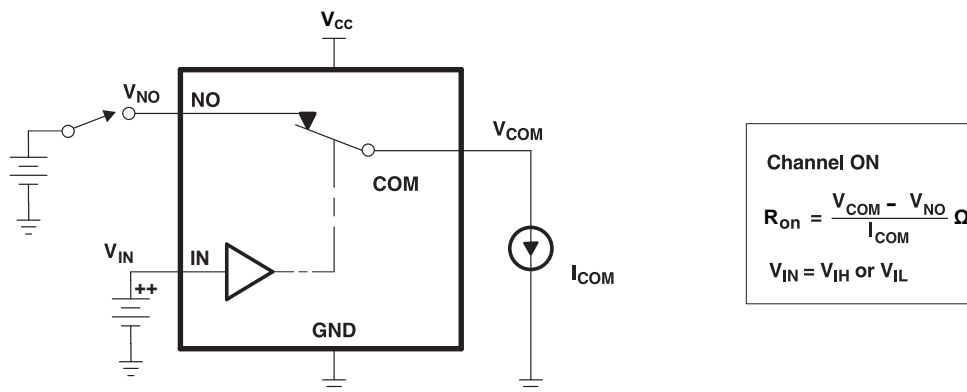


Figure 13. ON-state resistance (R_{on})

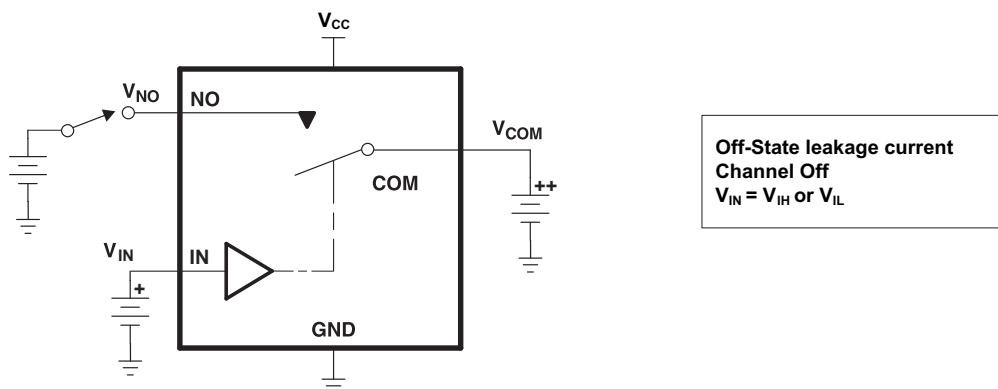


Figure 14. OFF-state leakage current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

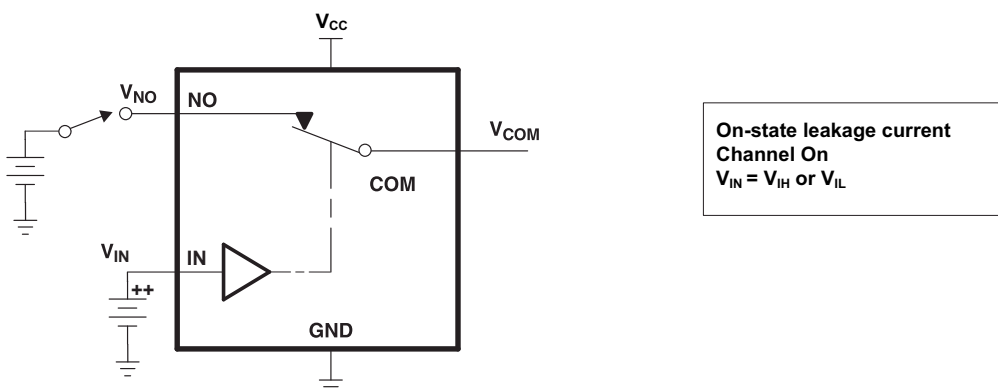


Figure 15. ON-state leakage current
($I_{COM(ON)}$, $I_{NO(ON)}$)

Parameter Measurement Information (continued)

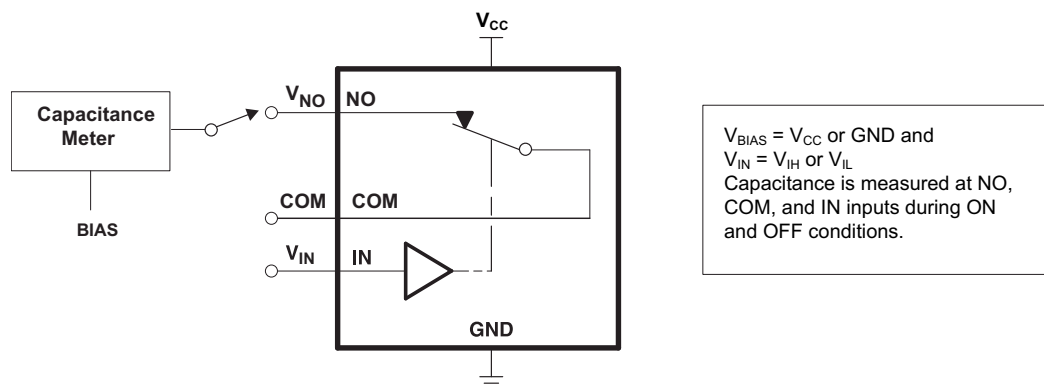
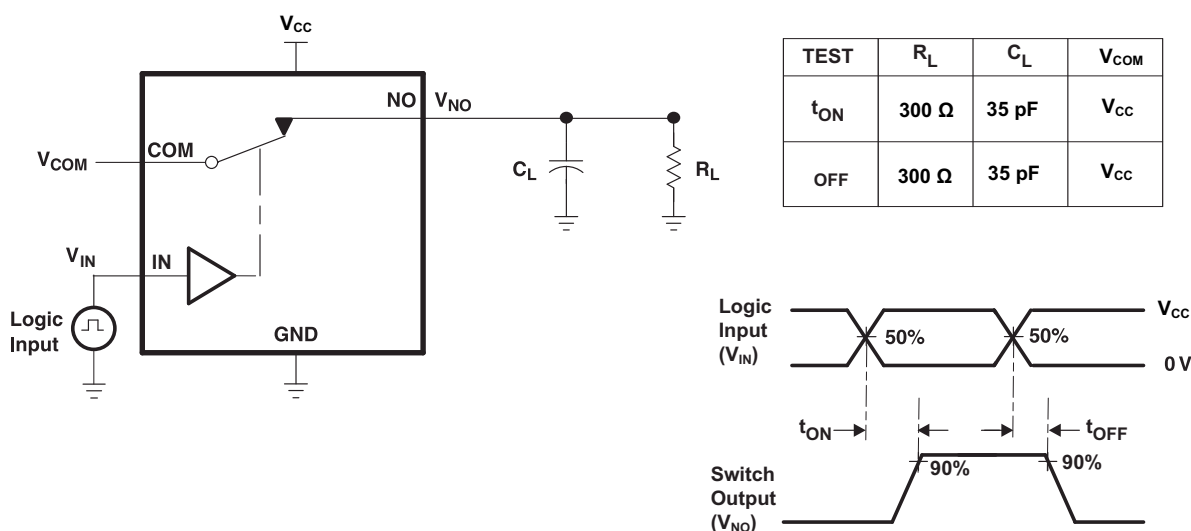


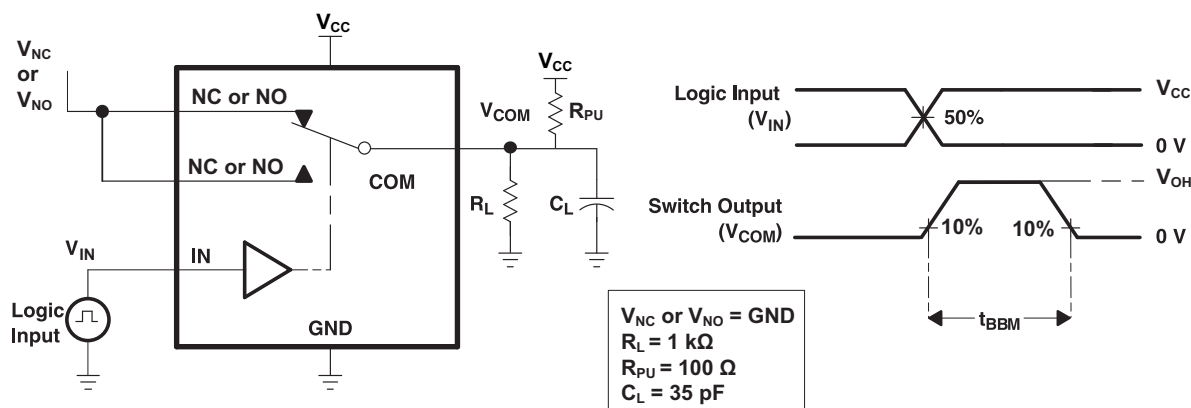
Figure 16. Capacitance
(C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)



- A. 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.
- B. C_L includes probe and jig capacitance.

Figure 17. Turnon (t_{ON}) and Turnoff time (t_{OFF})

Parameter Measurement Information (continued)



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

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

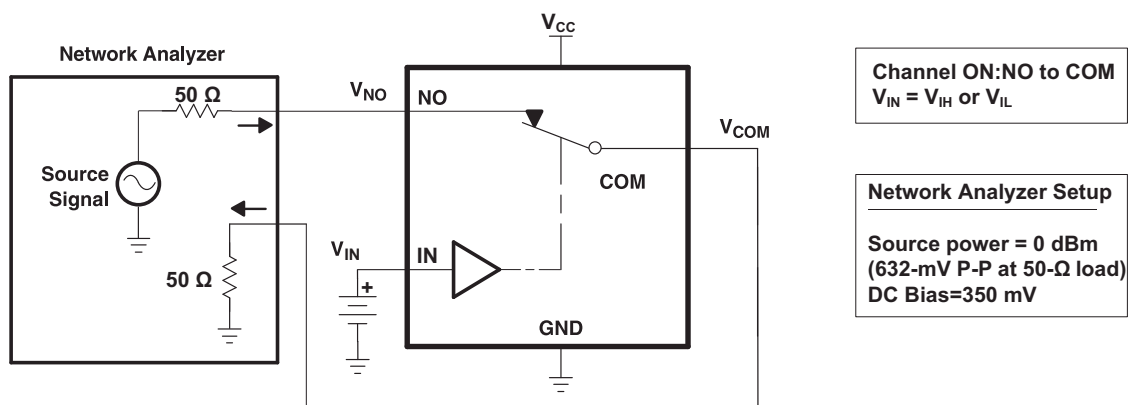


Figure 19. Bandwidth (BW)

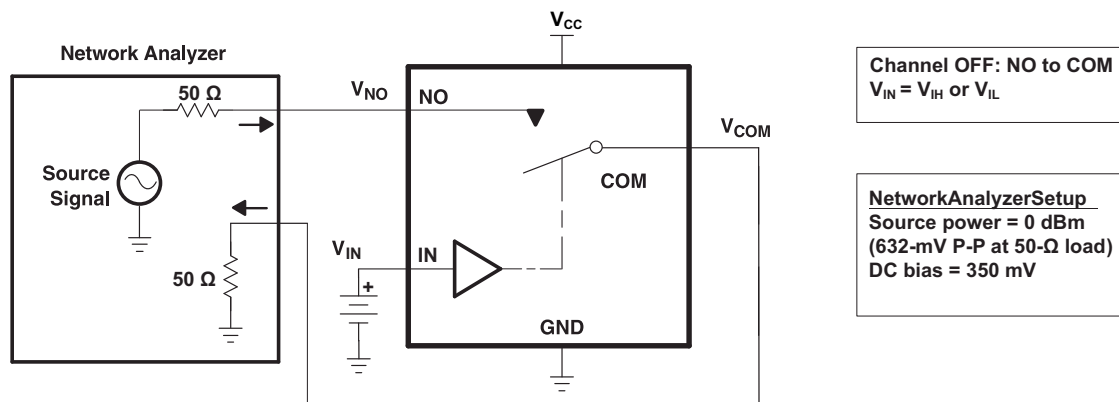


Figure 20. OFF isolation (O_{ISO})

Parameter Measurement Information (continued)

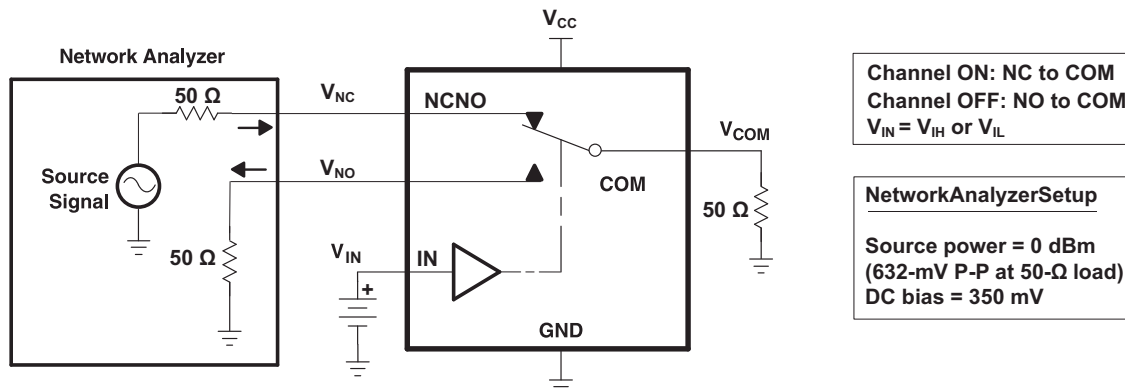
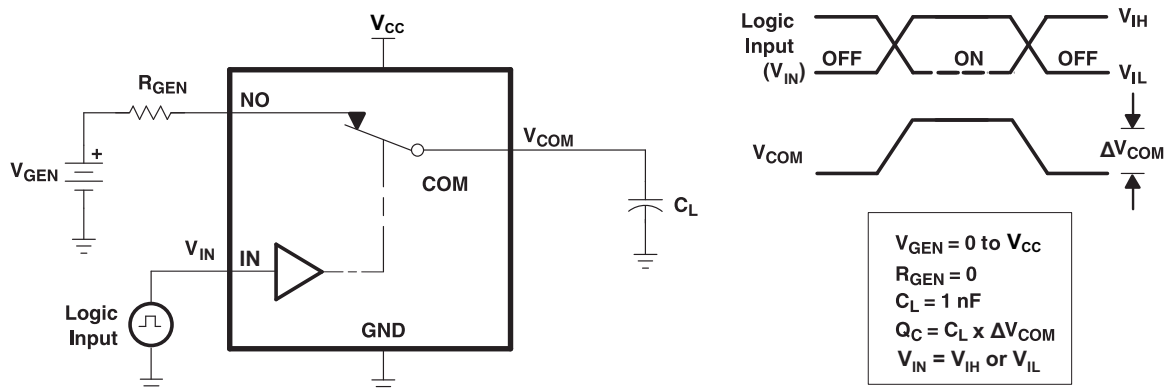


Figure 21. Crosstalk (X_{TALK})



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

Figure 22. Charge injection (Q_C)

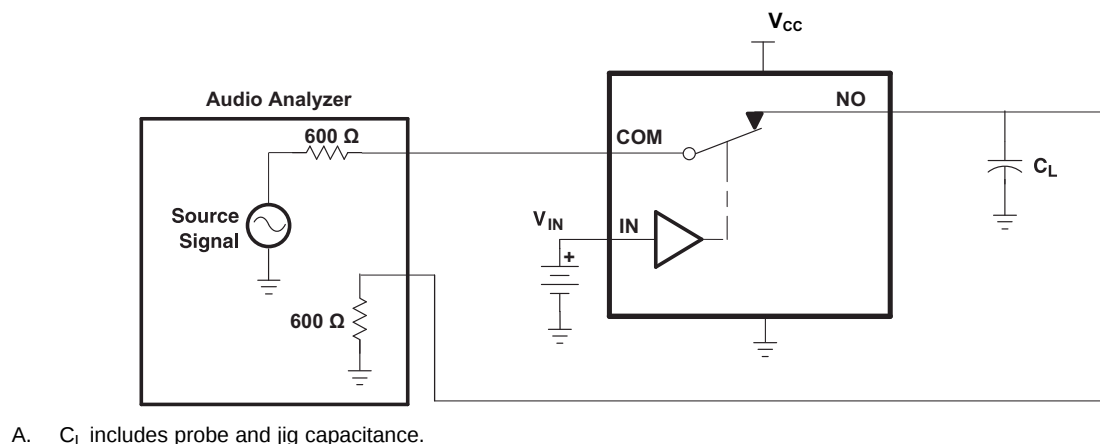
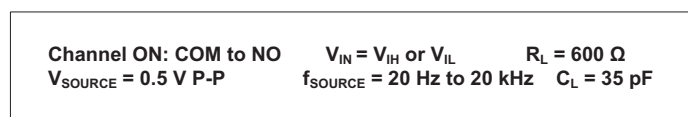


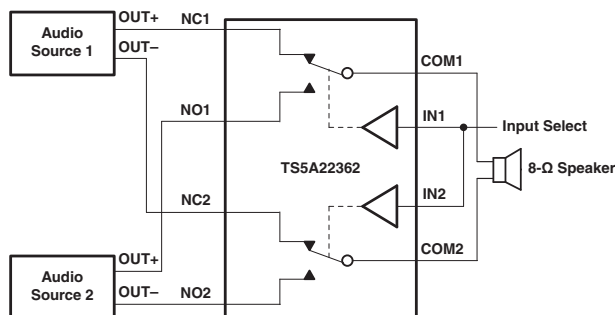
Figure 23. Total Harmonic Distortion (THD)

8 Detailed Description

8.1 Overview

The TS5A22362 is a bidirectional, 2-channel single-pole double-throw (SPDT) analog switches designed to operate from 2.3 V to 5.5 V. The devices feature negative signal capability that allows signals below ground to pass through the switch without distortion. The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another. Low ON-state resistance, excellent channel-to-channel ON-state resistance matching, and minimal total harmonic distortion (THD) performance are ideal for audio applications.

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 Negative Signaling Capacity

The TS5A22362 dual SPDT switches feature negative signal capability that allows signals below ground to pass through without distortion. These analog switches operate from a single +2.3-V to +5.5-V supply. The input and output signal swing of the device is dependant of the supply voltage V_{CC} : the devices pass signals as high as V_{CC} and as low as $V_{CC} - 5.5$ V, including signals below ground with minimal distortion.

Table 1 shows the input/output signal swing the user can get with different supply voltages.

Table 1. Input/Output signal swing

SUPPLY VOLTAGE, V_{CC}	MINIMUM (V_{NC} , V_{NO} , V_{COM}) = $V_{CC} - 5.5$	MAXIMUM (V_{NC} , V_{NO} , V_{COM}) = V_{CC}
5.5 V	0 V	5.5 V
4.5 V	–1.9 V	4.5 V
3.6 V	–2.5 V	3.6 V
3.0 V	–2.5 V	3.0 V
2.7 V	–2.8 V	2.7 V
2.3 V	–3.2 V	2.3 V

8.4 Device Functional Modes

The function table for TS5A22362 is shown in Table 2

Table 2. Function Table

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

9 Application and Implementation

NOTE

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

9.1 Application Information

Ensure that the device is powered up with a supply voltage on VCC before a voltage can be applied to the signal paths NC and NO.

Tie the digitally controlled inputs select pins IN1 and IN2 to VCC or GND to avoid unwanted switch states that could result if the logic control pins are left floating.

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

9.2 Typical Application

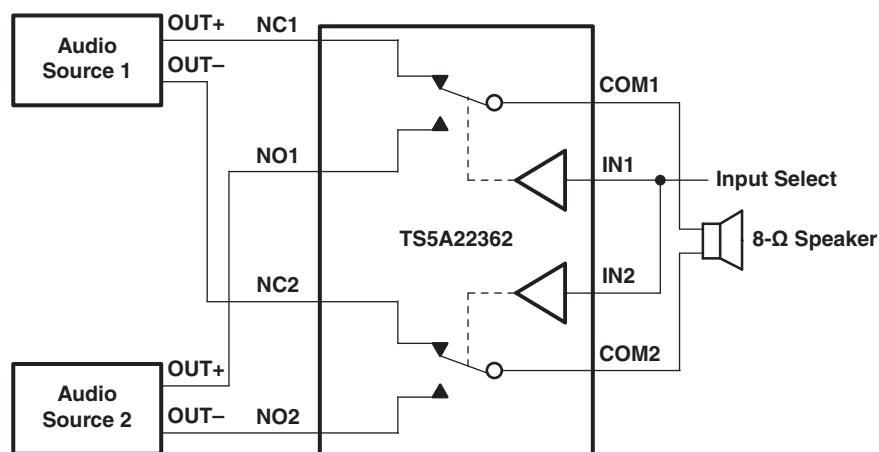


Figure 24. Typical Application

9.2.1 Design Requirements

Tie the digitally controlled inputs select pins IN1 and IN2 to VCC or GND to avoid unwanted switch states that could result if the logic control pins are left floating.

9.2.2 Detailed Design Procedure

Select the appropriate supply voltage to cover the entire voltage swing of the signal passing through the switch because the TS5A22362 operates from a single +2.3-V to +5.5-V supply and the input/output signal swing of the device is dependant of the supply voltage VCC. The device will pass signals as high as VCC and as low as VCC – 5.5 V. Use table 2 as a guide for selecting supply voltage based on the signal passing through the switch.

Ensure that the device is powered up with a supply voltage on VCC before a voltage can be applied to the signal paths NC and NO.

Typical Application (continued)

9.2.3 Application Curve

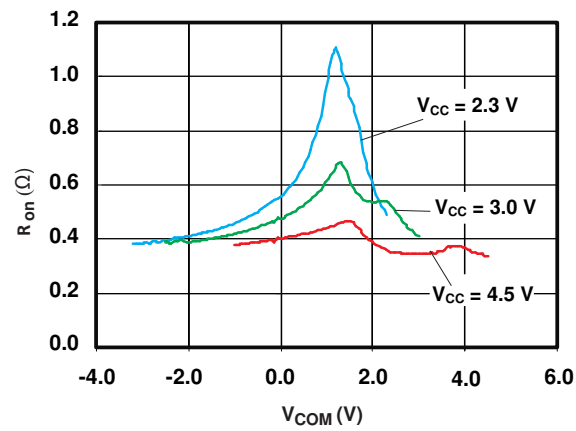


Figure 25. R_{on} vs V_{COM}

10 Power Supply Recommendations

The TS5A22362 operates from a single 2.3-V to 5.5-V supply. The device must be powered up with a supply voltage on VCC before a voltage can be applied to the signal paths NC and NO. It is recommended to include a 100- μ s delay after VCC is at voltage before applying a signal on NC and NO paths.

It is also good practice to place a 0.1- μ F bypass capacitor on the supply pin VCC to GND to smooth out lower frequency noise to provide better load regulation across the frequency spectrum.

11 Layout

11.1 Layout Guidelines

TI recommends placing a bypass capacitor as close to the supply pin VCC as possible to help smooth out lower frequency noise to provide better load regulation across the frequency spectrum.

Minimize trace lengths and vias on the signal paths in order to preserve signal integrity.

11.2 Layout Example

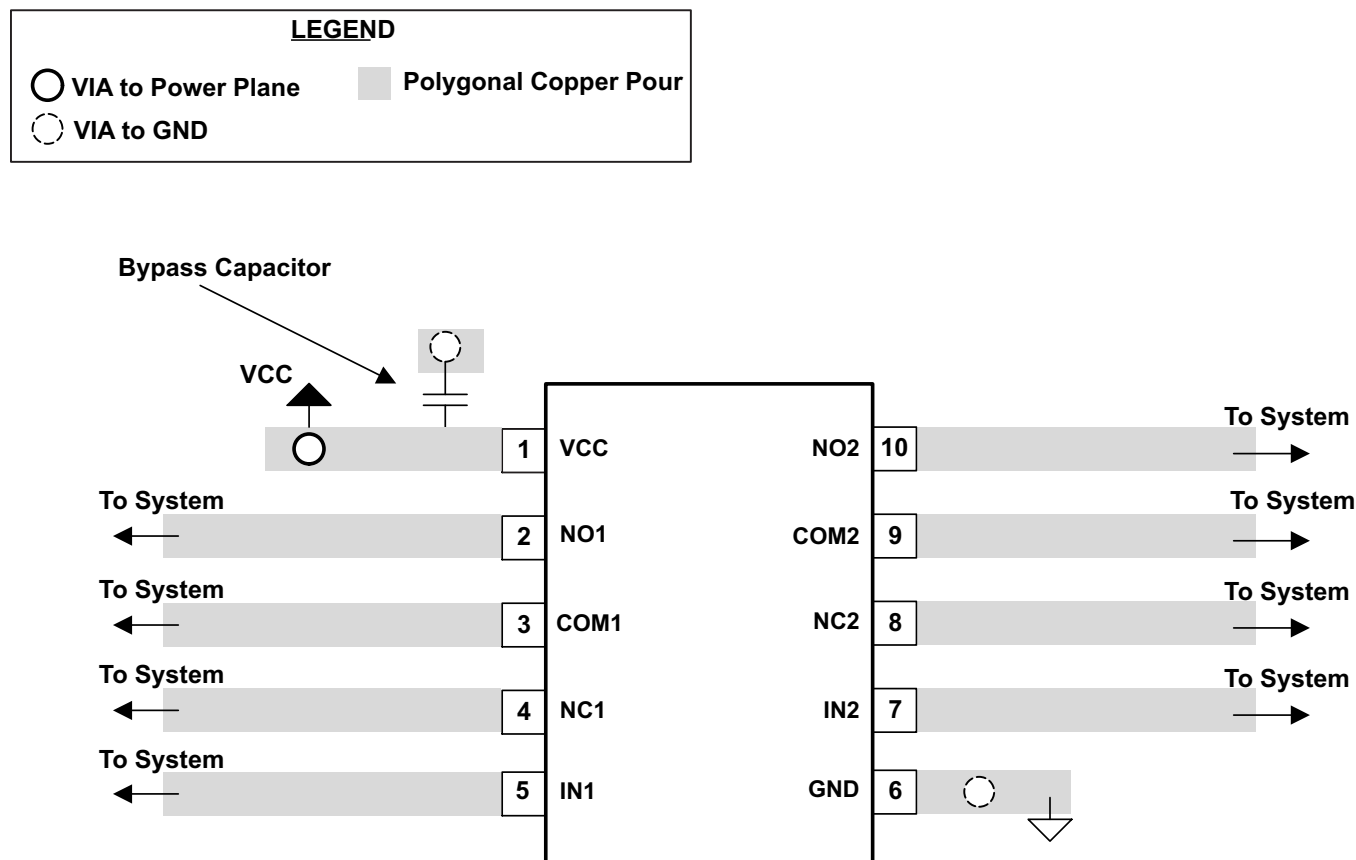


Figure 26. Layout example of TS5A22362

12 デバイスおよびドキュメントのサポート

12.1 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。

12.2 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](#).

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12.5 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 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)
TS5A22362DGSR	Active	Production	VSSOP (DGS) 10	2500 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	39R
TS5A22362DGSR.B	Active	Production	VSSOP (DGS) 10	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	39R
TS5A22362DRCR	Active	Production	VSON (DRC) 10	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZVG
TS5A22362DRCR.B	Active	Production	VSON (DRC) 10	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZVG
TS5A22362DRCRG4	Active	Production	VSON (DRC) 10	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZVG
TS5A22362DRCRG4.B	Active	Production	VSON (DRC) 10	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZVG
TS5A22362YZPR	Active	Production	DSBGA (YZP) 10	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(39, 392)
TS5A22362YZPR.B	Active	Production	DSBGA (YZP) 10	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(39, 392)

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

⁽²⁾ **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.

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

⁽⁴⁾ **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.

⁽⁵⁾ **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.

⁽⁶⁾ **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.

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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



*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
TS5A22362DGSR	VSSOP	DGS	10	2500	330.0	12.4	5.25	3.35	1.25	8.0	12.0	Q1
TS5A22362DGSR	VSSOP	DGS	10	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TS5A22362DRCR	VSON	DRC	10	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2
TS5A22362DRCRG4	VSON	DRC	10	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2
TS5A22362YZPR	DSBGA	YZP	10	3000	178.0	9.2	1.49	1.99	0.63	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

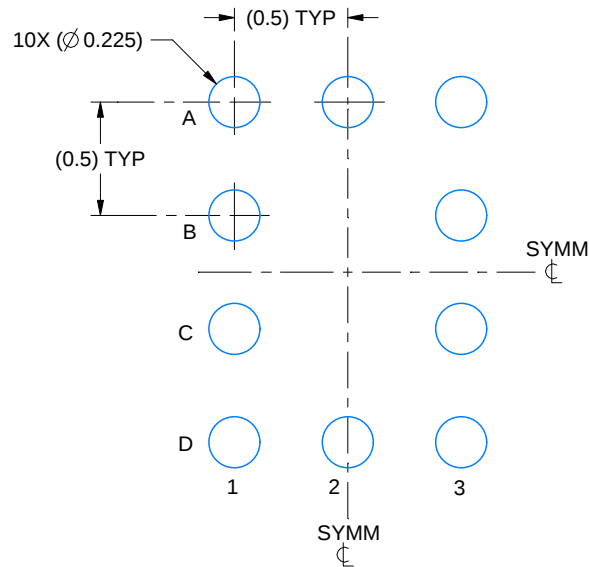
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A22362DGSR	VSSOP	DGS	10	2500	366.0	364.0	50.0
TS5A22362DGSR	VSSOP	DGS	10	2500	358.0	335.0	35.0
TS5A22362DRCR	VSON	DRC	10	3000	353.0	353.0	32.0
TS5A22362DRCRG4	VSON	DRC	10	3000	353.0	353.0	32.0
TS5A22362YZPR	DSBGA	YZP	10	3000	220.0	220.0	35.0

EXAMPLE BOARD LAYOUT

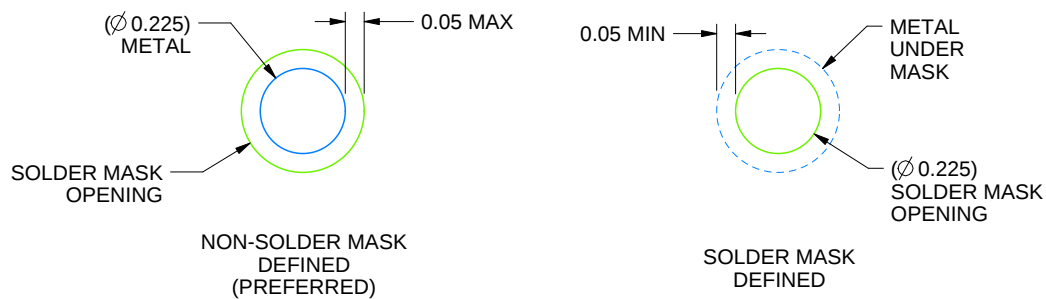
YZP0010

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:30X



SOLDER MASK DETAILS
NOT TO SCALE

4219350/B 11/2017

NOTES: (continued)

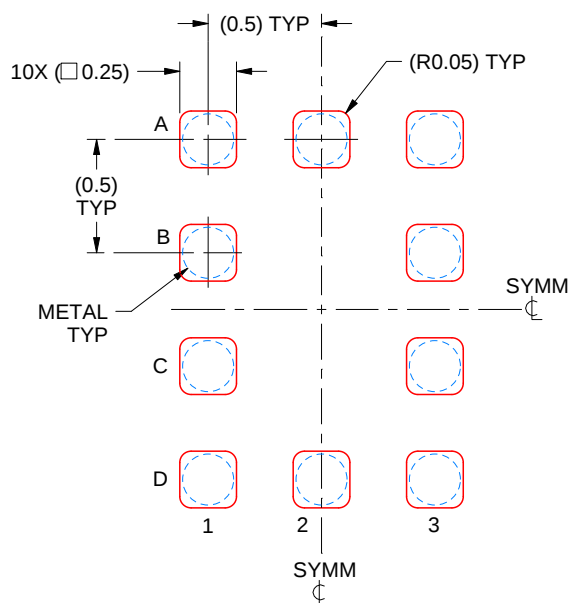
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 (www.ti.com/lit/sbva017).

EXAMPLE STENCIL DESIGN

YZP0010

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

4219350/B 11/2017

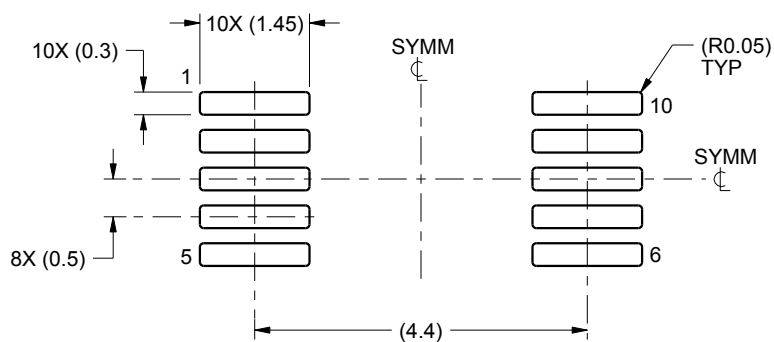
NOTES: (continued)

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

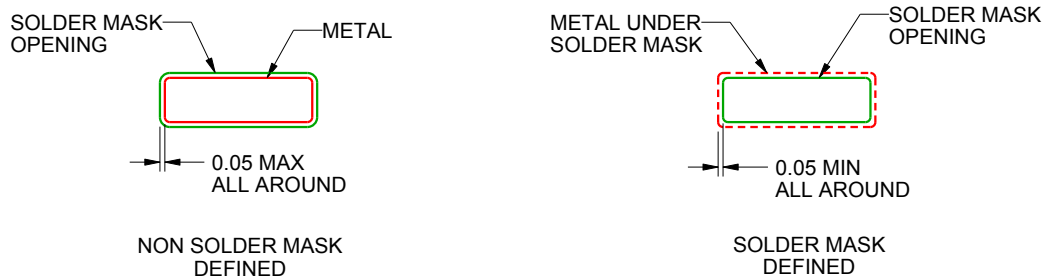
DGS0010A

VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:10X



SOLDER MASK DETAILS
NOT TO SCALE

4221984/A 05/2015

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

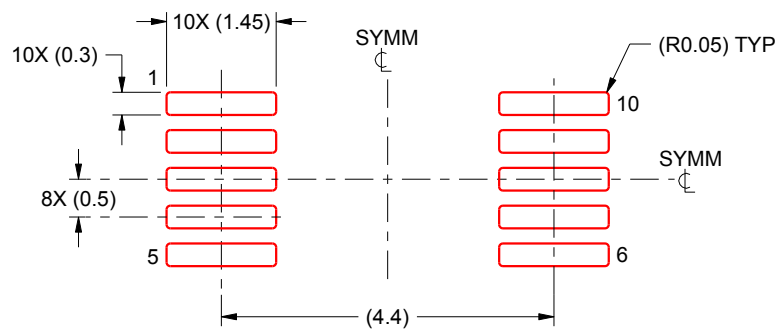
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGS0010A

VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:10X

4221984/A 05/2015

NOTES: (continued)

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

GENERIC PACKAGE VIEW

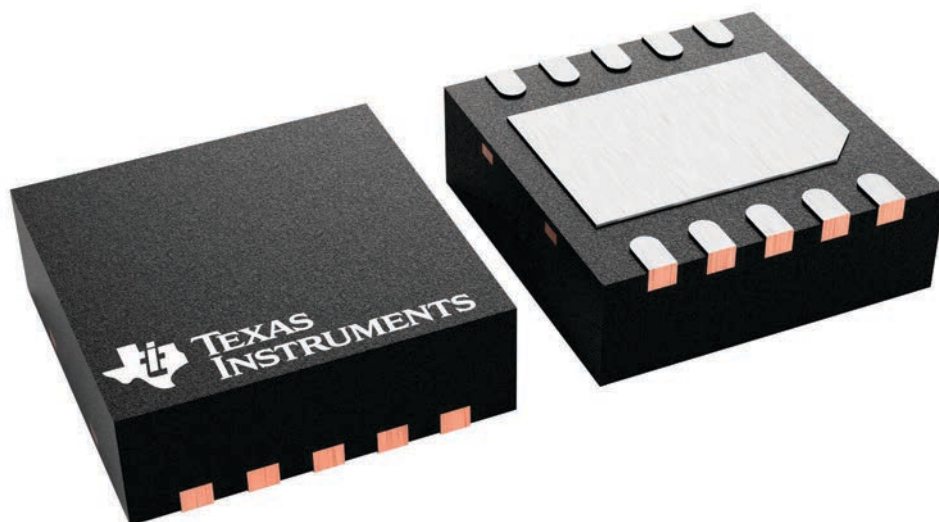
DRC 10

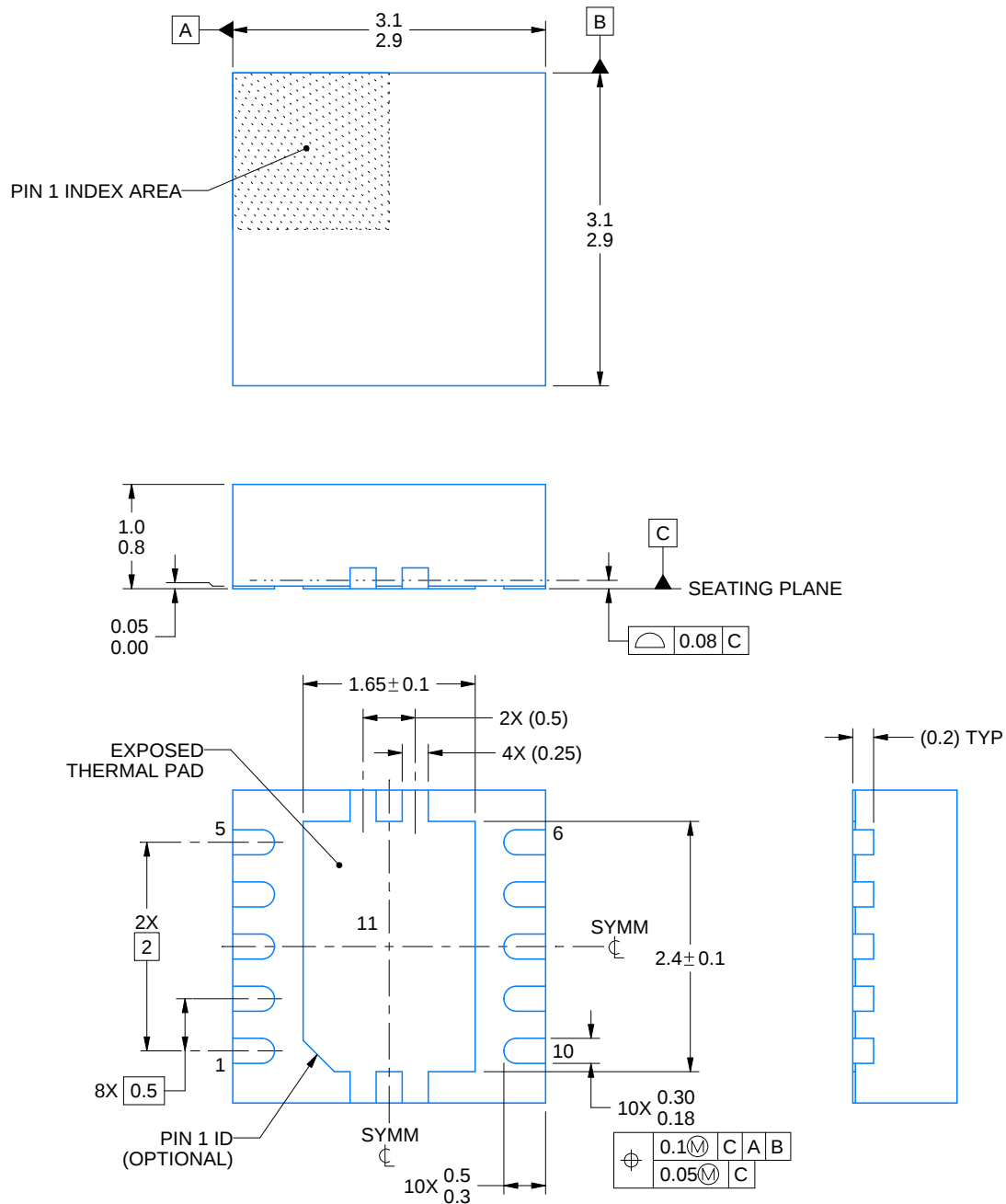
VSON - 1 mm max height

3 x 3, 0.5 mm pitch

PLASTIC SMALL OUTLINE - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.





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NOTES:

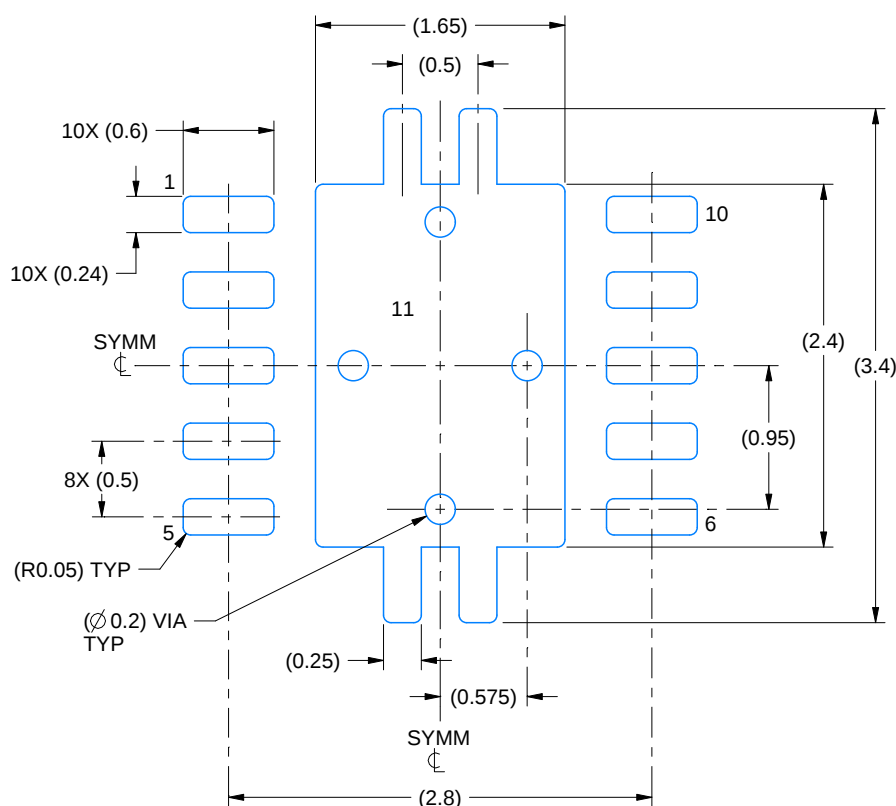
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

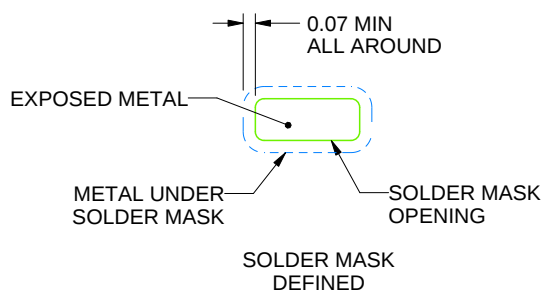
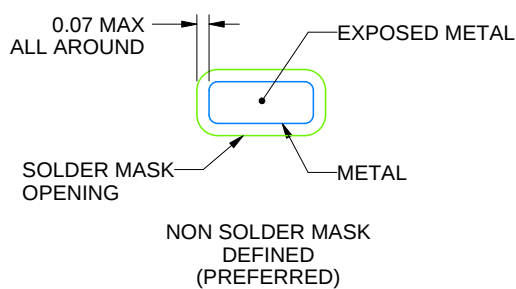
DRC0010J

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X



SOLDER MASK DETAILS

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NOTES: (continued)

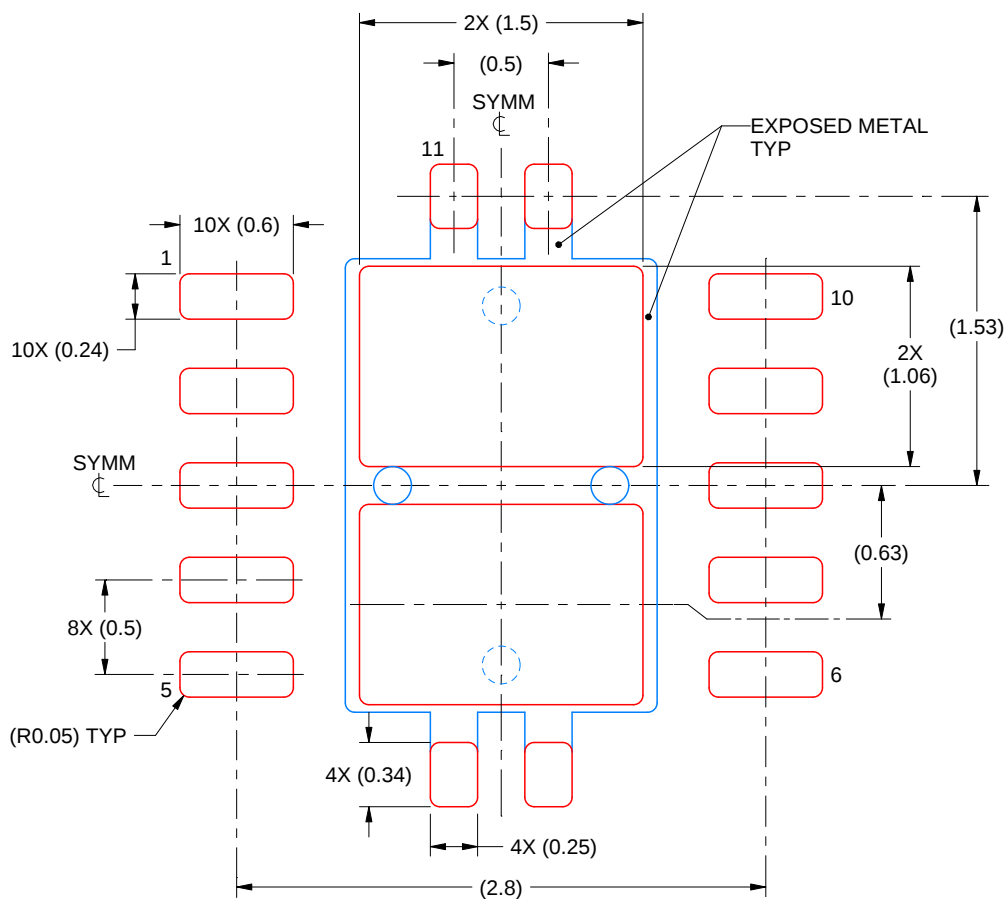
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).

5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

DRC0010J

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 11:
80% PRINTED SOLDER COVERAGE BY AREA
SCALE:25X

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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