

TS3A24159 0.3Ω、2 チャンネル SPDT 双方向アナログ・スイッチ デュアル・チャンネル 2 : 1 マルチプレクサ / デマルチプレクサ

1 特長

- ブレイク・ビフォー・メイクのスイッチングを規定
- 低いオン抵抗 (最大値 0.3Ω)
- 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~3.6V の単一電源で動作
- 制御入力は 1.8V ロジック互換
- JESD 78、Class II 準拠で 100mA 超のラッチアップ性能
- JESD 22 準拠で ESD 性能を試験済み
 - 2000V、人体モデル (A114-B、Class II)
 - 1000V、荷電デバイス・モデル (C101)

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
- コンピュータ周辺機器
- ワイヤレス端末およびペリフェラル

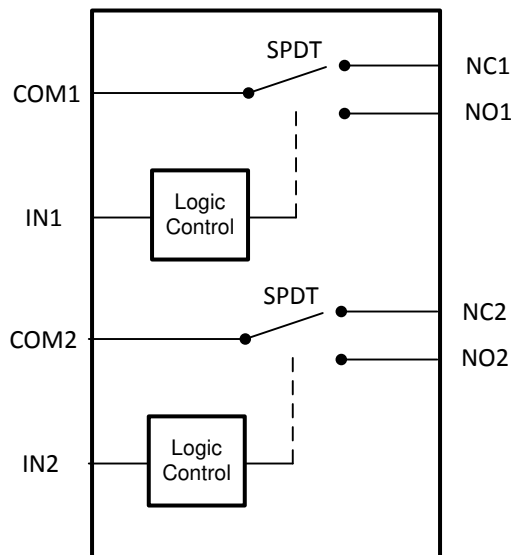
3 概要

TS3A24159 は 2 チャンネルの単極双投 (SPDT) 双方向アナログ・スイッチで、1.65V~3.6V で動作するように設計されています。このデバイスはオン抵抗が低く、オン抵抗マッチングが非常に優れており、Break-Before-Make 機能によってチャンネル間の信号転送時に信号が歪むのを防ぎます。このデバイスは全高調波歪み (THD) 特性が非常に優れており、オン抵抗が低く、極めて低消費電力です。これらの特長も含めた多くの特長から、このデバイスは各種の市場、多くの種類のアプリケーションに適しています。

製品情報 (1)

部品番号	パッケージ	本体サイズ (公称)
TS3A24159	VSSOP (10)	3.00mm × 3.00mm
	VSON (10)	3.00mm × 3.00mm
	DSBGA (10)	1.86mm × 1.35mm

- (1) 利用可能な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。



機能ブロック図



Table of Contents

1 特長.....	1	8.2 Functional Block Diagram.....	18
2 アプリケーション.....	1	8.3 Feature Description.....	18
3 概要.....	1	8.4 Device Functional Modes.....	18
4 Revision History.....	2	9 Application and Implementation.....	19
5 Pin Configuration and Functions.....	3	9.1 Application Information.....	19
6 Specifications.....	5	9.2 Typical Application.....	19
6.1 Absolute Maximum Ratings.....	5	10 Power Supply Recommendations.....	20
6.2 ESD Ratings.....	5	11 Layout.....	21
6.3 Recommended Operating Conditions.....	5	11.1 Layout Guidelines.....	21
6.4 Thermal Information.....	6	11.2 Layout Example.....	21
6.5 Electrical Characteristics for 3-V Supply.....	6	12 Device and Documentation Support.....	22
6.6 Electrical Characteristics for 2.5-V Supply.....	7	12.1 Documentation Support.....	22
6.7 Electrical Characteristics for 1.8-V Supply.....	9	12.2 Receiving Notification of Documentation Updates.....	22
6.8 Switching Characteristics for a 3-V Supply.....	10	12.3 サポート・リソース.....	22
6.9 Switching Characteristics for a 2.5-V Supply.....	10	12.4 Trademarks.....	22
6.10 Switching Characteristics for a 1.8-V Supply.....	10	12.5 Electrostatic Discharge Caution.....	22
6.11 Typical Characteristics.....	12	12.6 Glossary.....	22
7 Parameter Measurement Information.....	14	13 Mechanical, Packaging, and Orderable Information.....	22
8 Detailed Description.....	18		
8.1 Overview.....	18		

4 Revision History

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。

Changes from Revision G (February 2022) to Revision H (August 2022)	Page
• Changed the maximum V_{CC} from: 3.6 V to: 4 V	5
Changes from Revision F (September 2019) to Revision G (February 2022)	Page
• 文書全体にわたって表、図、相互参照の採番方法を更新.....	1
• Updated the part number in the <i>Detailed Design Procedure</i>	20
Changes from Revision E (March 2019) to Revision F (September 2019)	Page
• Changed the YZP package image view From: Top-Through View To: Bottom View.....	3
Changes from Revision D (July 2015) to Revision E (March 2019)	Page
• Changed the YZP package image and deleted the <i>YZP Package, Terminal Assignments</i> table.....	3
• Changed Turnon time V_{CC} (Full) value From: 2.3 V to 2.7 V To: 2.7 V to 3.6 V in <i>Switching Characteristics for a 3-V Supply</i>	10
• Changed Turnon time V_{CC} (Full) value From: 2.3 V to 2.7 V To: 2.7 V to 3.6 V in <i>Switching Characteristics for a 2.5-V Supply</i>	10
Changes from Revision C (February 2008) to Revision D (March 2015)	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.....	1
• JEDEC 規格を満たすように、文書全体にわたって $V+$ を V_{CC} に変更.....	1

5 Pin Configuration and Functions

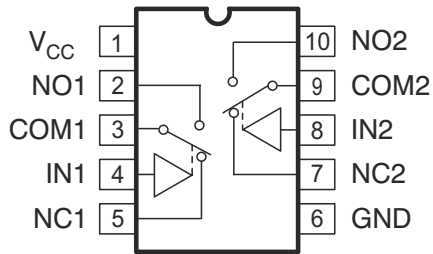


图 5-1. DGS Package, 10-Pin VSSOP (Top View)

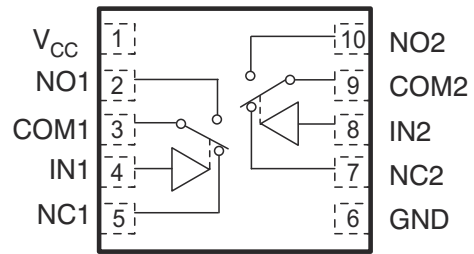


图 5-2. DRC Package, 10-Pin VSON (Top View)

表 5-1. Pin Functions – VSSOP and VSON

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	V _{CC}	—	Power supply
2	NO1	I/O	Normally open signal path
3	COM1	I/O	Common signal path
4	IN1	I	Digital control to connect COM to NO or NC
5	NC1	I/O	Normally closed signal path
6	GND	—	Ground
7	NC2	I/O	Normally closed signal path
8	IN2	I	Digital control to connect COM to NO or NC
9	COM2	I/O	Common signal path
10	NO2	I/O	Normally open signal path

(1) I = input, O = output

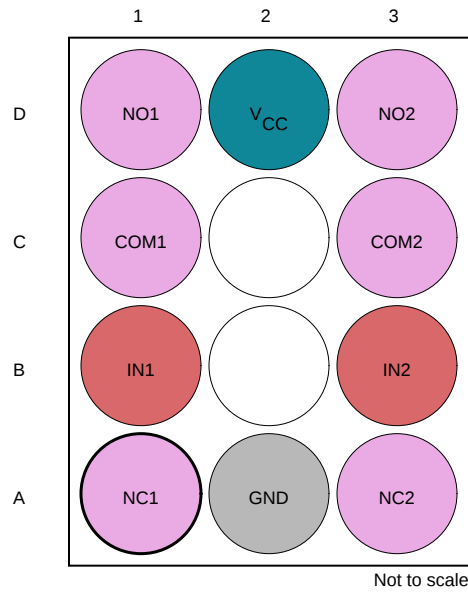


图 5-3. YZP Package, 10-Pin DSBGA (Bottom View)

Legend	
Input or Output	Input
Ground	Power

表 5-2. Pin Functions – DSBGA

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
A1	NC1	I/O	Normally closed signal path
A2	GND	—	Ground
A3	NC2	I/O	Normally closed signal path
B1	IN1	I	Digital control to connect COM to NO or NC
B3	IN2	I	Digital control to connect COM to NO or NC
C1	COM1	I/O	Common signal path
C3	COM2	I/O	Common signal path
D1	NO1	I/O	Normally open signal path
D2	V _{CC}	—	Power supply
D3	NO2	I/O	Normally open signal path

(1) I = input, O = output

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾ ⁽²⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage ⁽³⁾	-0.5	4	V
V _{NC} V _{NO} V _{COM}	Signal voltage ⁽³⁾ ⁽⁴⁾	-0.5	V _{CC} + 0.5	V
I _{I/OK}	Analog port diode current	V _{NC} , V _{NO} , V _{COM} < 0		-50 50 mA
I _{NC} I _{NO} I _{COM}	ON-state switch current	V _{NC} , V _{NO} , V _{COM} = 0 to V _{CC}		-300 300 mA
	ON-state peak switch current ⁽⁵⁾			-500 500 mA
V _{IN}	Digital input voltage	-0.5	3.6	V
I _{IK}	Digital input clamp current ⁽³⁾	V _I < 0		-50 mA
I _{CC}	Continuous current through V _{CC}		100	mA
I _{GND}	Continuous current through GND	-100		mA
T _{stg}	Storage temperature	-65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, 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) This value is limited to 5.5 V maximum.
- (5) Pulse at 1-ms duration <10% duty cycle.

6.2 ESD Ratings

		VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	2000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 or ANSI/ESDA/JEDEC JS-002 ⁽²⁾	1000

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V _{CC}	Supply Voltage	1.65	3.6	V
V _{NC} V _{NO} V _{COM}	Signal Voltage	0	V _{CC}	V
V _{IN}	Digital Input Voltage	0	V _{CC}	V

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		TS3A24159			UNIT
		DGS (VSSOP)	DRC (VSON)	YZP (DSBGA)	
		10 PINS	10 PINS	10 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	154	49.4	90.9	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	37.9	71.2	0.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	83.6	23.8	8.3	°C/W
ψ _{JT}	Junction-to-top characterization parameter	1.4	2.2	3.2	°C/W
ψ _{JB}	Junction-to-board characterization parameter	82.2	23.8	8.3	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	6.1	N/A	°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 3-V Supply

V_{CC} = 2.7 V to 3.6 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							
Analog signal range	V _{COM} , V _{NO} , V _{NC}			0		V _{CC}	V
Peak ON resistance	r _{peak} 0 ≤ (V _{NO} or V _{NC}) ≤ V _{CC} , I _{COM} = –100 mA,	25°C Full	2.7 V		0.2	0.3 0.35	Ω
ON-state resistance	r _{on} V _{NO} or V _{NC} = 2 V, I _{COM} = –100 mA,	25°C Full	2.7 V		0.26	0.3 0.34	Ω
ON-state resistance match between channels	Δr _{on} V _{NO} or V _{NC} = 2 V, 0.8 V, I _{COM} = –100 mA,	25°C Full	2.7 V		0.01	0.05 0.05	Ω
ON-state resistance flatness	r _{on(flat)} 0 ≤ (V _{NO} or V _{NC}) ≤ V _{CC} , I _{COM} = –100 mA, V _{NO} or V _{NC} = 2 V, 0.8 V, I _{COM} = –100 mA,	25°C Full	2.7 V		0.13	0.01 0.04 0.05	Ω
NC, NO OFF leakage current	I _{NC(OFF)} , I _{NO(OFF)} V _{NC} or V _{NO} = 1 V, V _{COM} = 3 V, or V _{NC} or V _{NO} = 3 V, V _{COM} = 1 V,	25°C Full	3.6 V	–10		10 50	nA
NC, NO ON leakage current	I _{NC(ON)} , I _{NO(ON)} V _{NC} or V _{NO} = 1 V, V _{COM} = Open, or V _{NC} or V _{NO} = 3 V, V _{COM} = Open,	25°C Full	3.6 V	–10		10 100	nA
COM ON leakage current	I _{COM(ON)} V _{NC} or V _{NO} = Open, V _{COM} = 1 V, or V _{NC} or V _{NO} = Open, V _{COM} = 3 V,	25°C Full	3.6 V	–10		10 100	nA
DIGITAL CONTROL INPUTS (IN1, IN2)⁽²⁾							
Input logic high	V _{IH}	Full		1.4			V
Input logic low	V _{IL}	Full				0.5	V
Input leakage current	I _{IH} , I _{IL}	25°C Full	3.6 V	–40	5	40 50	nA

6.5 Electrical Characteristics for 3-V Supply (continued)

$V_{CC} = 2.7\text{ V to }3.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted) ⁽¹⁾

PARAMETER		TEST CONDITIONS		T_A	V_{CC}	MIN	TYP	MAX	UNIT
DYNAMIC									
Charge injection	Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$,	$C_L = 1\text{ nF}$, See 7-10	25°C	3 V		9		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_{CC}$ or GND, Switch OFF,	See 7-4	25°C	3 V		90		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_{CC}$ or GND, Switch ON,	See 7-4	25°C	3 V		224		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See 7-4	25°C	3 V		250		pF
Digital input capacitance	C_I	$V_{IN} = V_{CC}$ or GND,	See 7-4	25°C	3 V		2		pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See 7-7	25°C	3 V		23		MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-8	25°C	3 V		-72		dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-9	25°C	3 V		-96		dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 20\text{ Hz to }20\text{ kHz}$, See 7-11	25°C	3 V		0.003%		
SUPPLY									
Positive supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		25°C	3.6 V		15	100	nA
				Full			1		μA

- (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](#).

6.6 Electrical Characteristics for 2.5-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_{CC}	MIN	TYP	MAX	UNIT
ANALOG SWITCH									
Analog signal range	V_{COM} , V_{NO} , V_{NC}					0		V_{CC}	V
Peak ON resistance	r_{peak}	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_{CC}$, $I_{COM} = -8\text{ mA}$,	Switch ON, See 7-1	25°C	2.3 V		0.35		Ω
				Full			0.45		
ON-state resistance	r_{on}	V_{NO} or $V_{NC} = 1.8\text{ V}$, $I_{COM} = -8\text{ mA}$,	Switch ON, See 7-1	25°C	2.3 V				Ω
				Full			0.4		
ON-state resistance match between channels	Δr_{on}	V_{NO} or $V_{NC} = 1.8\text{ V}, 0.8\text{ V}$, $I_{COM} = -8\text{ mA}$,	Switch ON, See 7-1	25°C	2.3 V		0.01	0.05	Ω
				Full			0.05	0.05	
ON-state resistance flatness	$r_{on(Flat)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_{CC}$, $I_{COM} = -8\text{ mA}$,	Switch ON, See 7-1	25°C	2.3 V		0.05		Ω
				25°C			0.03	0.08	
				Full			0.1		
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or $V_{NO} = 0.5\text{ V}$, $V_{COM} = 2.2\text{ V}$, or V_{NC} or $V_{NO} = 2.2\text{ V}$, $V_{COM} = 0.5\text{ V}$,	Switch OFF, See 7-2	25°C	2.7 V		-10	10	nA
				Full			-50	50	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or $V_{NO} = 0.5\text{ V}$, $V_{COM} = \text{Open}$, or V_{NC} or $V_{NO} = 2.2\text{ V}$, $V_{COM} = \text{Open}$,	Switch ON, See 7-3	25°C	2.7 V		-10	10	nA
				Full			-100	100	

6.6 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
ANALOG SWITCH (continued)							
COM ON leakage current $I_{COM(ON)}$	V_{NC} or $V_{NO} = \text{Open}$, $V_{COM} = 0.5\text{ V}$, Switch ON, or V_{NC} or $V_{NO} = \text{Open}$, $V_{COM} = 2.2\text{ V}$, See 7-3	25°C	2.7 V	-10		10	nA
		Full		-100		100	
DIGITAL CONTROL INPUTS (IN1, IN2)⁽²⁾							
Input logic high V_{IH}		Full		1.25			V
Input logic low V_{IL}		Full				0.5	V
Input leakage current I_{IH} , I_{IL}	$V_I = 2.7\text{ V or }0$	25°C	2.7 V	-40	5	40	nA
		Full		-50		50	
DYNAMIC							
Charge injection Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$,	$C_L = 1\text{ nF}$, See 7-10	25°C	2.5 V		8	pC
NC, NO OFF capacitance $C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_{CC}$ or GND, Switch OFF,	See 7-4	25°C	2.5 V		90	pF
NC, NO ON capacitance $C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_{CC}$ or GND, Switch ON,	See 7-4	25°C	2.5 V		250	pF
COM ON capacitance $C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See 7-4	25°C	2.5 V		250	pF
Digital input capacitance C_I	$V_I = V_{CC}$ or GND,	See 7-4	25°C	2.5 V		2	pF
Bandwidth BW	$R_L = 50\ \Omega$, Switch ON,	See 7-7	25°C	2.5 V		23	MHz
OFF isolation O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-8	25°C	2.5 V		-72	dB
Crosstalk X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-9	25°C	2.5 V		-96	dB
Total harmonic distortion THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 20\text{ Hz to }20\text{ kHz}$, See 7-11	25°C	2.5 V		0.003%	
SUPPLY							
Positive supply current I_{CC}	$V_I = V_{CC}$ or GND	25°C	2.7 V		10	100	nA
		Full			700		

(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](#).

6.7 Electrical Characteristics for 1.8-V Supply

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

PARAMETER		TEST CONDITIONS		T_A	V_{CC}	MIN	TYP	MAX	UNIT
ANALOG SWITCH									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_{CC}	V
Peak ON resistance	r_{peak}	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_{CC}$, $I_{COM} = -2\text{ mA}$,	Switch ON, See 7-1	25°C Full	1.65 V		0.4	0.7 0.8	Ω
ON-state resistance	r_{on}	$V_{NO} \text{ or } V_{NC} = 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, See 7-1	25°C Full	1.65 V		0.3	0.45 0.5	Ω
ANALOG SWITCH (continued)									
ON-state resistance match between channels	Δr_{on}	$V_{NO} \text{ or } V_{NC} = 0.6\text{ V}, 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, See 7-1	25°C Full	1.65 V		0.02	0.04 0.05	Ω
ON-state resistance flatness	$r_{on(Flat)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_{CC}$, $I_{COM} = -2\text{ mA}$, $V_{NO} \text{ or } V_{NC} = 0.6\text{ V}, 1.5\text{ V}$, $I_{COM} = -8\text{ mA}$,	Switch ON, See 7-1 Switch ON, See 7-1	25°C 25°C Full	1.65 V		0.13	0.08 0.15 0.2	Ω
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 0.3\text{ V}, V_{COM} = 1.65\text{ V}$, or $V_{NC} \text{ or } V_{NO} = 1.65\text{ V}, V_{COM} = 0.3\text{ V}$,	Switch OFF, See 7-2	25°C Full	1.95	-10 -50		10 50	nA
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 0.3\text{ V}, V_{COM} = \text{Open}$, or $V_{NC} \text{ or } V_{NO} = 1.65\text{ V}, V_{COM} = \text{Open}$,	Switch ON, See 7-3	25°C Full	1.95 V	-10 -100		10 100	nA
COM ON leakage current	$I_{COM(ON)}$	$V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 0.3\text{ V}$, or $V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 1.65\text{ V}$,	Switch ON, See 7-3	25°C Full	1.95 V	-10 -100		10 100	nA
DIGITAL CONTROL INPUTS (IN1, IN2)⁽²⁾									
Input logic high	V_{IH}			Full		1			V
Input logic low	V_{IL}			Full				0.4	V
Input leakage current	I_{IH}, I_{IL}	$V_I = 1.95\text{ V or }0$		25°C Full	1.95 V	-40 -50	5	40 50	nA
DYNAMIC									
Charge injection	Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$,	$C_L = 1\text{ nF}$, See 7-10	25°C	1.8 V		5		pC
NC, NO OFF capacitance	$C_{NC(OFF)}, C_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = V_{CC} \text{ or } \text{GND}$, Switch OFF,	See 7-4	25°C	1.8 V		90		pF
NC, NO ON capacitance	$C_{NC(ON)}, C_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = V_{CC} \text{ or } \text{GND}$, Switch ON,	See 7-4	25°C	1.8 V		250		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC} \text{ or } \text{GND}$, Switch ON,	See 7-4	25°C	1.8 V		250		pF
Digital input capacitance	C_{IN}	$V_I = V_{CC} \text{ or } \text{GND}$,	See 7-4	25°C	1.8 V		2		pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See 7-7	25°C	1.8 V		23		MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-8	25°C	1.8 V		-73		dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See 7-9	25°C	1.8 V		-97		dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 20\text{ Hz to }20\text{ kHz}$, See 7-11	25°C	1.8 V		0.005%		

6.7 Electrical Characteristics for 1.8-V Supply (continued)

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

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
SUPPLY							
Positive supply current	I_{CC}	$V_I = V_{CC}$ or GND	25°C	1.95 V	100	50	nA
			Full				

- (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](#).

6.8 Switching Characteristics for a 3-V Supply

 $V_{CC} = 2.7\text{ V to }3.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted) ⁽¹⁾

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT		
Dynamic									
Turnon time	t_{ON}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-5	25°C	3.0 V	20	35	ns	
				Full	2.7 V to 3.6 V		40		
Turnoff time	t_{OFF}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-5	25°C	3.0 V	12	25	ns	
				Full	2.7 V to 3.6 V		30		
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-6	25°C	3.0 V	1	10	25	ns
				Full	2.7 V to 3.6 V	0.5		30	

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

6.9 Switching Characteristics for a 2.5-V Supply

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

PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT		
Dynamic									
Turnon time	t_{ON}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-5	25°C	2.5 V	23	45	ns	
				Full	2.3 V to 2.7 V		50		
Turnoff time	t_{OFF}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-5	25°C	2.5 V	17	27	ns	
				Full	2.3 V to 2.7 V		30		
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_{CC}$, $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$, See 7-6	25°C	2.5 V	2	14	30	ns
				Full	2.3 V to 2.7 V	1		35	

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

6.10 Switching Characteristics for a 1.8-V Supply

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

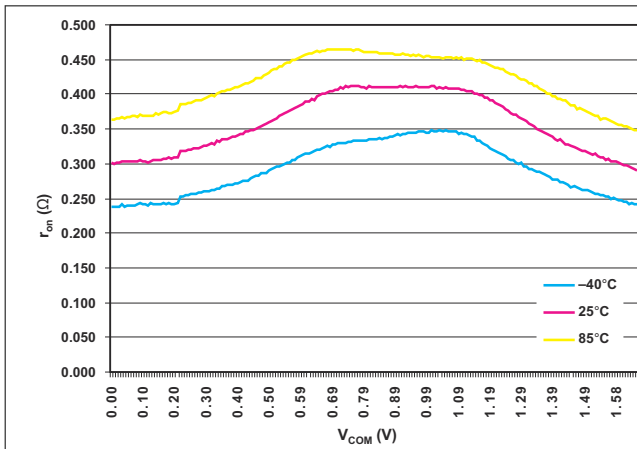
PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
Dynamic							

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

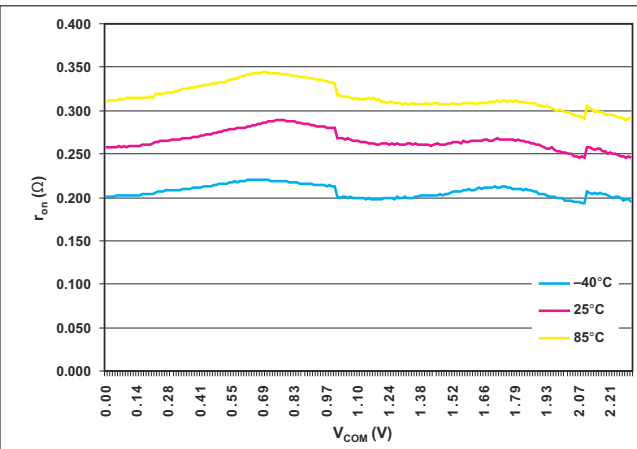
PARAMETER	TEST CONDITIONS	T_A	V_{CC}	MIN	TYP	MAX	UNIT
Turnon time t_{ON}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$ $C_L = 35\text{ pF}$, See 7-5	25°C	1.8 V	53	75		ns
		Full	1.65 V to 1.96 V			80	
Turnoff time t_{OFF}	$V_{COM} = V_{CC}$, $R_L = 50\ \Omega$ $C_L = 35\text{ pF}$, See 7-5	25°C	1.8 V	24	35		ns
		Full	1.65 V to 1.96 V			40	
Break-before- make time t_{BBM}	$V_{NC} = V_{NO} = V_{CC}$, $R_L = 50\ \Omega$ $C_L = 35\text{ pF}$, See 7-6	25°C	1.8 V	2	30	40	ns
		Full	1.65 V to 1.96 V	1		50	

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

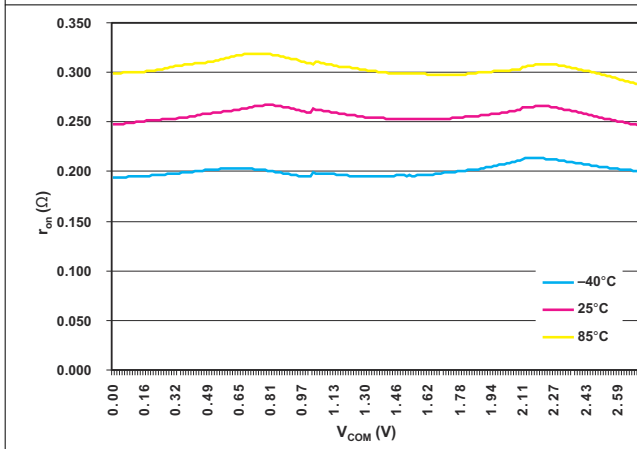
6.11 Typical Characteristics



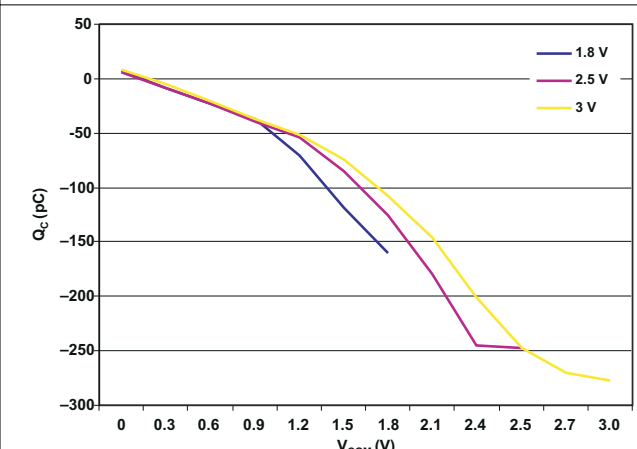
6-1. r_{on} vs V_{COM} ($V_{CC} = 1.65$ V)



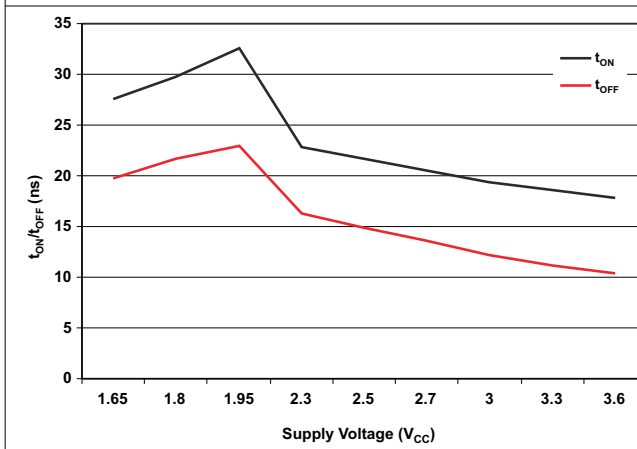
6-2. r_{on} vs V_{COM} ($V_{CC} = 2.3$ V)



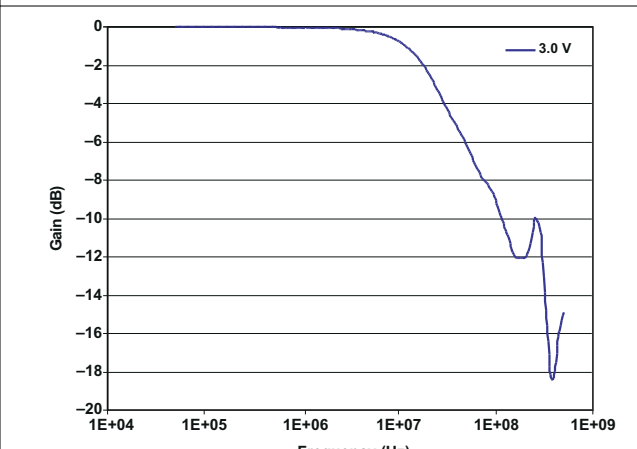
6-3. r_{on} vs V_{COM} ($V_{CC} = 2.7$ V)



6-4. Charge Injection (Q_C) vs V_{COM} ($T_A = 25^\circ\text{C}$)

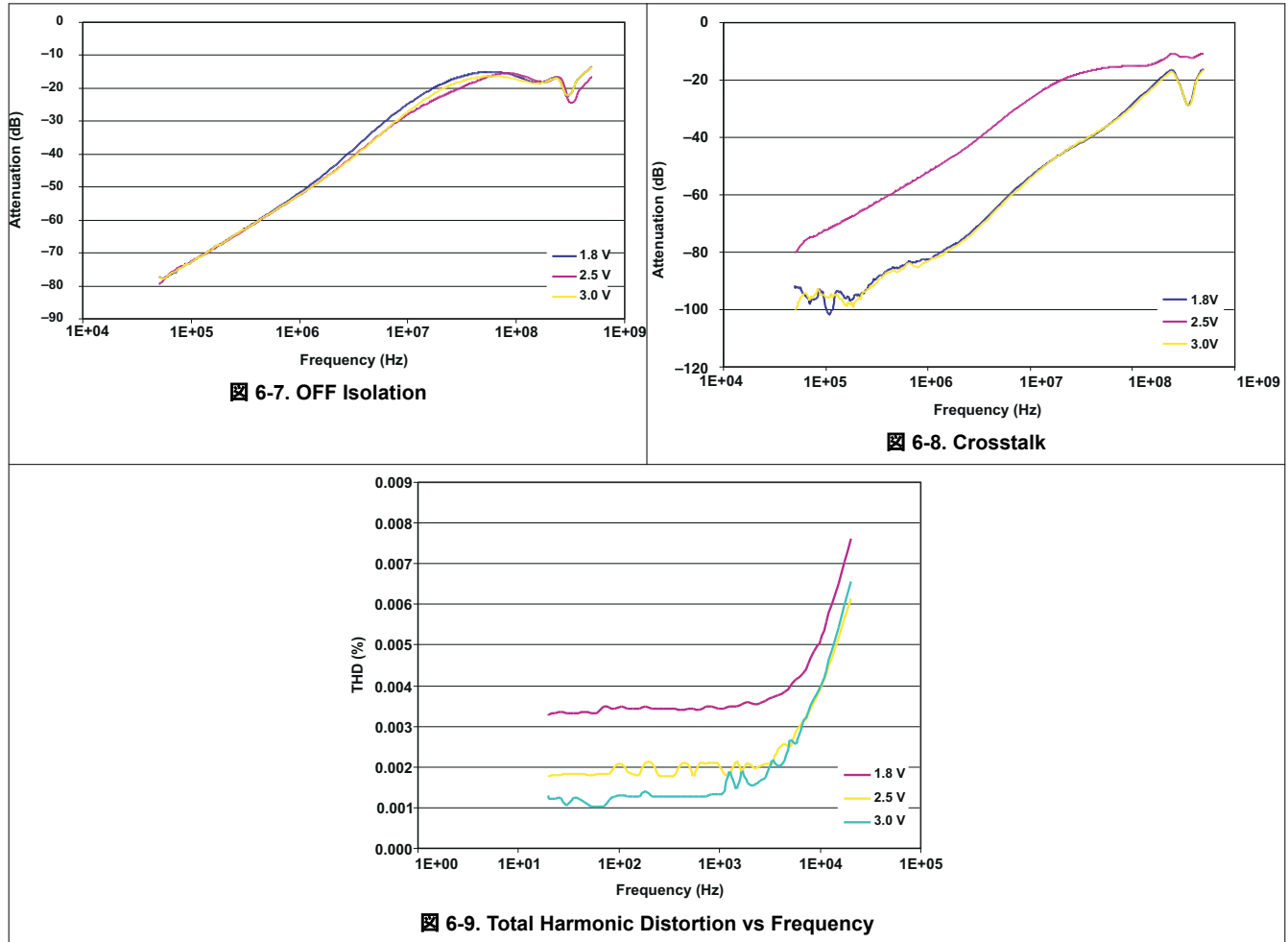


6-5. t_{ON} and t_{OFF} vs Supply Voltage ($T_A = 25^\circ\text{C}$)

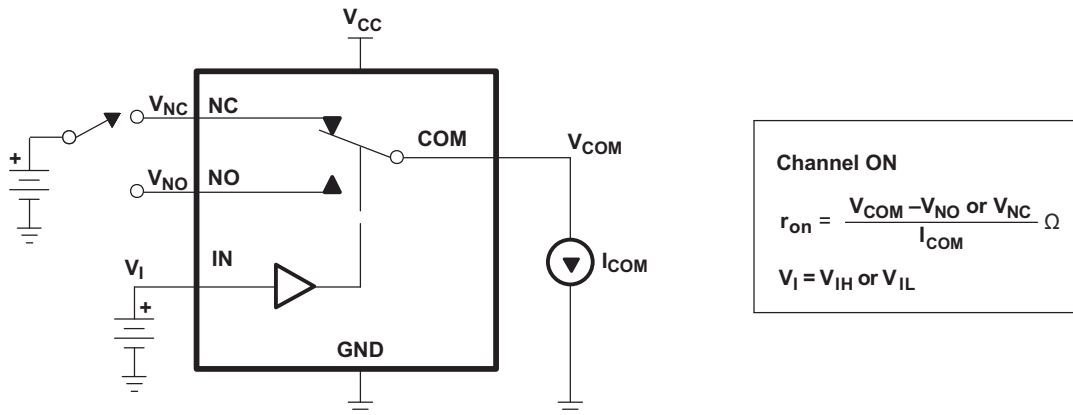


6-6. Bandwidth

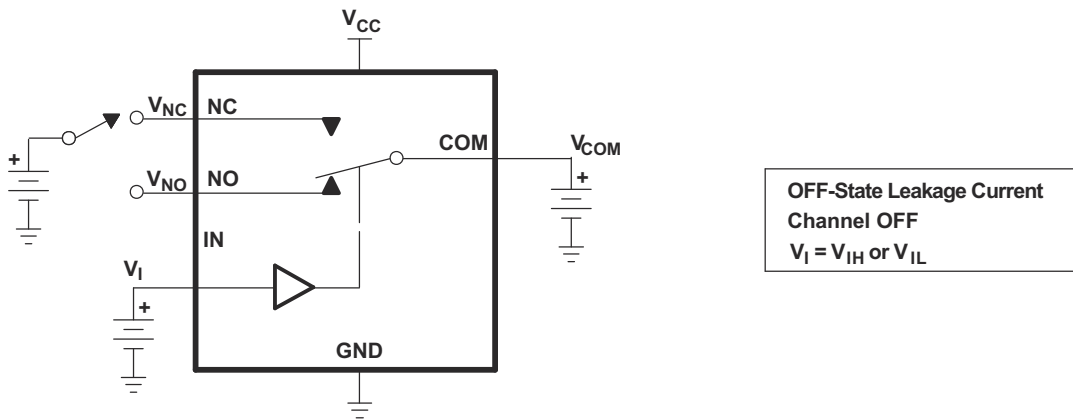
6.11 Typical Characteristics (continued)



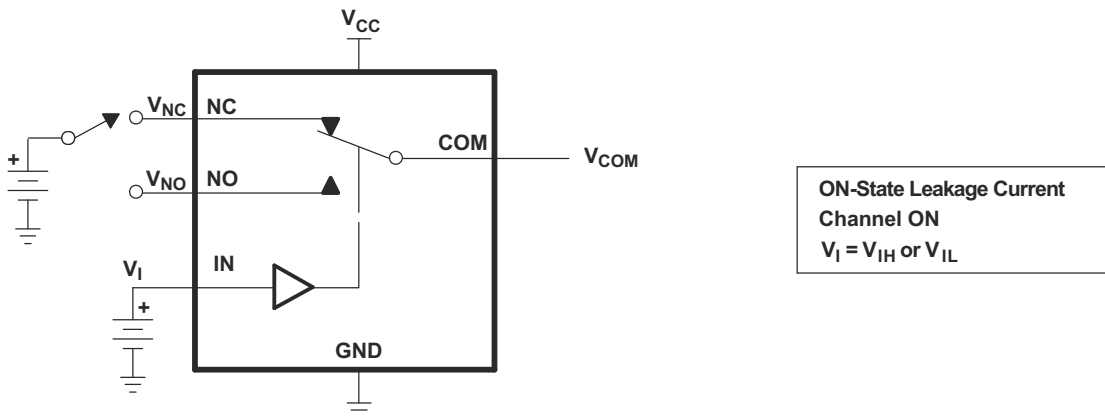
7 Parameter Measurement Information



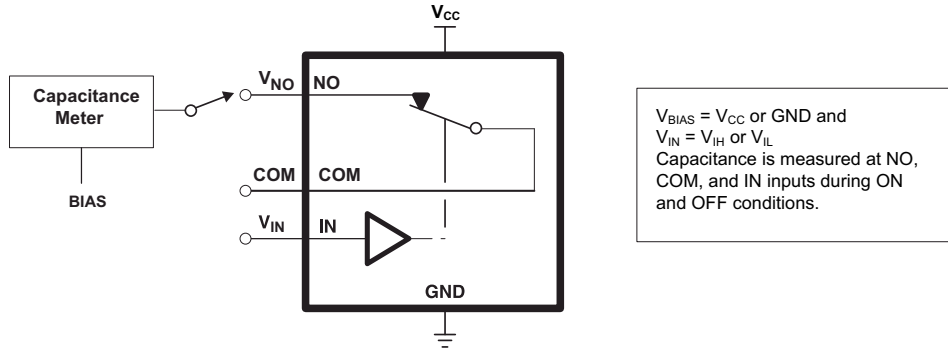
7-1. ON-State Resistance



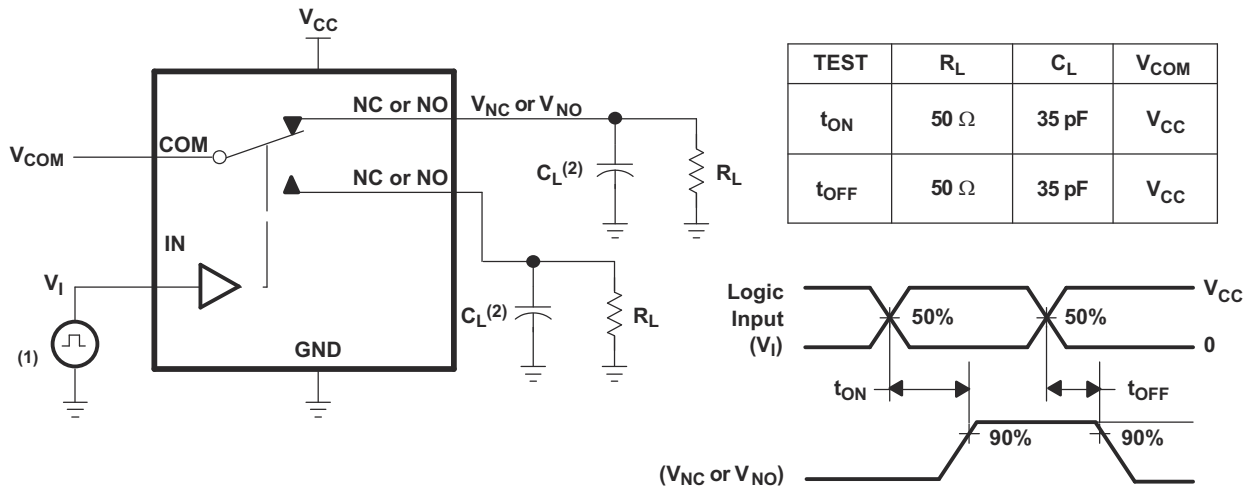
7-2. OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NC(PWROFF)}$, $I_{NO(OFF)}$, $I_{NO(PWROFF)}$, $I_{COM(OFF)}$, $I_{COM(PWROFF)}$)



7-3. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

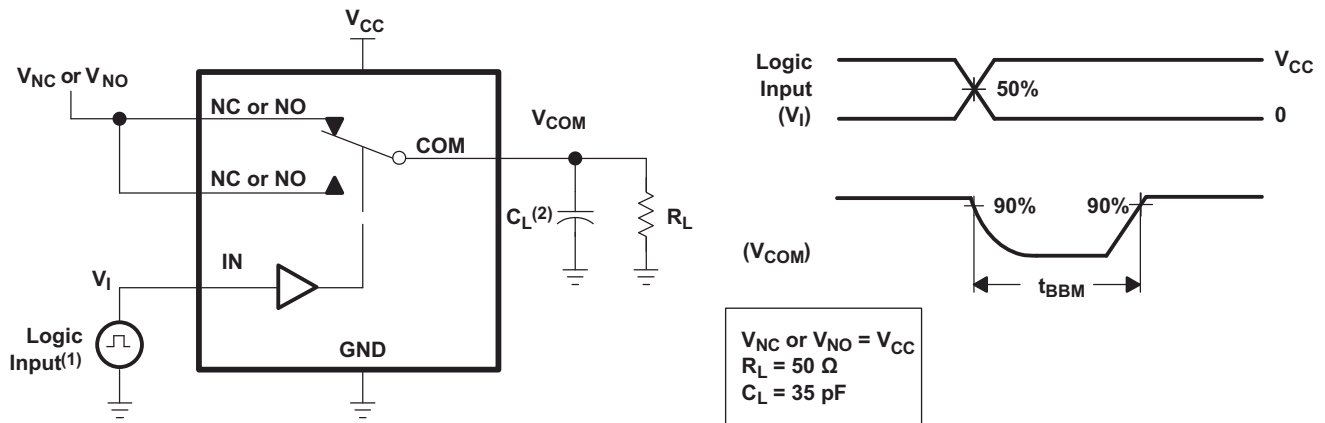


7-4. Capacitance C_I , $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$



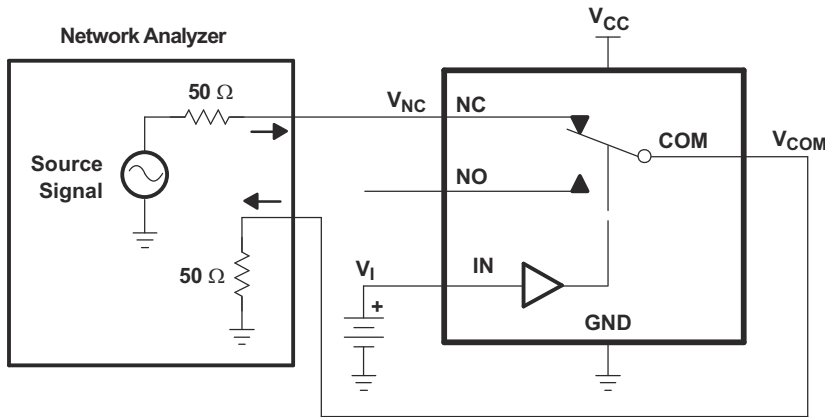
- A. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50 \Omega$, $t_r < 5$ ns, $t_f < 5$ ns.
- B. C_L includes probe and jig capacitance.

7-5. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})



- 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.

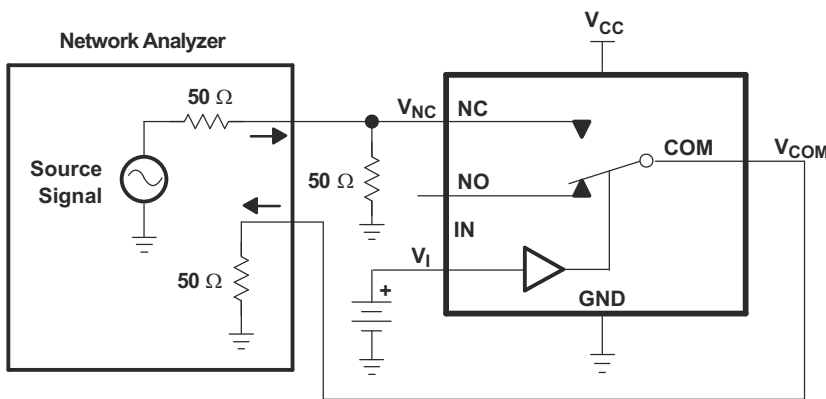
7-6. Break-Before-Make Time (t_{BBM})



Channel ON: NC to COM
 $V_I = V_{CC}$ or GND

Network Analyzer Setup
 Source Power = 0 dBm
 (632-mV P-P at 50- Ω load)
 DC Bias = 350 mV

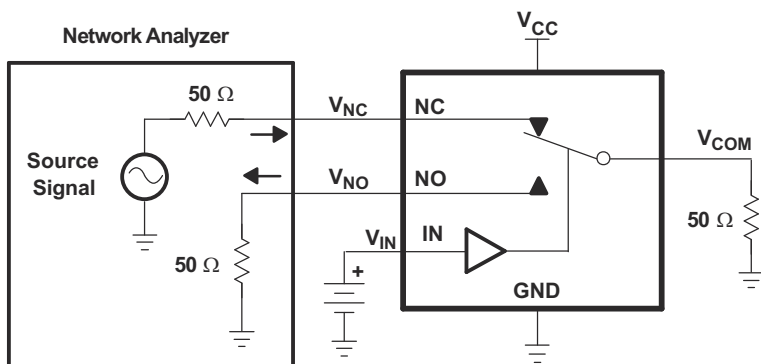
7-7. Bandwidth (BW)



Channel OFF: NC to COM
 $V_I = V_{CC}$ or GND

Network Analyzer Setup
 Source Power = 0 dBm
 (632-mV P-P at 50- Ω load)
 DC Bias = 350 mV

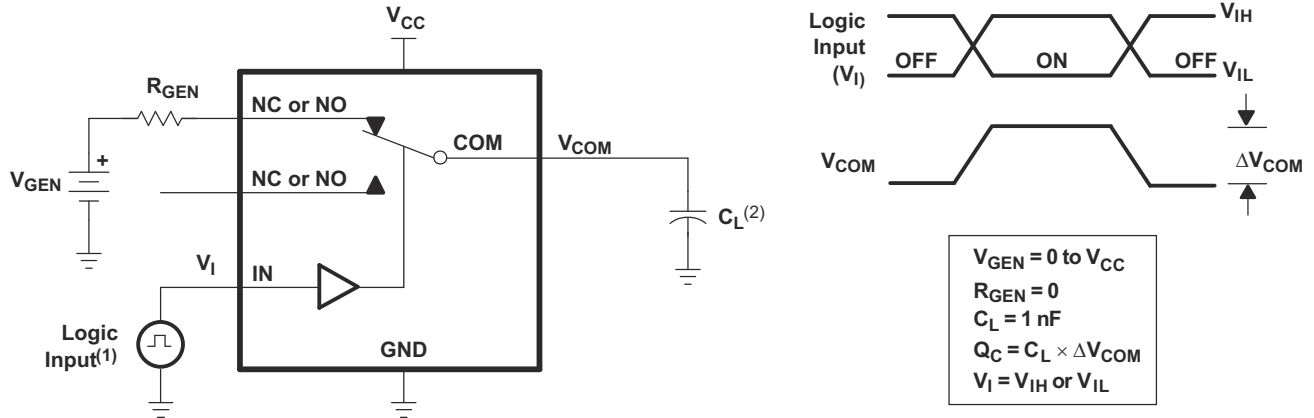
7-8. OFF Isolation (O_{ISO})



Channel ON: NC to COM
 Channel OFF: NO to COM
 $V_{IN} = V_{CC}$ or GND

Network Analyzer Setup
 Source Power = 0 dBm
 (632-mV P-P at 50- Ω load)
 DC Bias = 350 mV

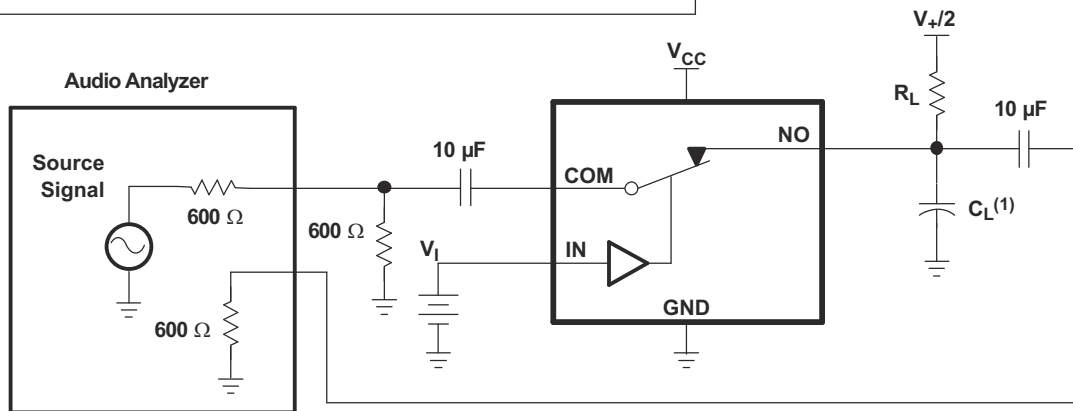
7-9. Crosstalk (X_{TALK})



- 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.

7-10. Charge Injection (Q_C)

Channel ON: COM to NO	$V_I = V_{IH} \text{ or } V_{IL}$	$R_L = 600 \Omega$
$V_{SOURCE} = V_{CC} \text{ P-P}$	Source Signal = 20 Hz to 20 kHz	$C_L = 50 \text{ pF}$



- A. C_L includes probe and jig capacitance.

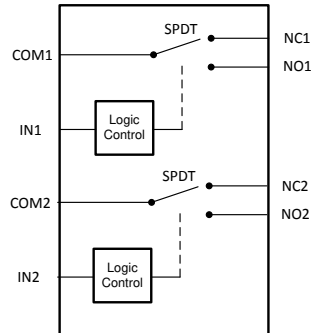
7-11. Total Harmonic Distortion (THD)

8 Detailed Description

8.1 Overview

The TS3A24159 is a 2-channel single-pole double-throw (SPDT) bidirectional analog switch that is designed to operate from 1.65 V to 3.6 V. It offers low ON-state resistance and excellent ON-state resistance matching with the break-before-make feature, to prevent signal distortion during the transferring of a signal from one channel to another. The device has excellent total harmonic distortion (THD) performance, low ON-state resistance, and consumes very low power. These are some of the features that make this device suitable for a variety of markets and many different applications.

8.2 Functional Block Diagram



8.3 Feature Description

The TS3A24159 device is bidirectional with two single-pole, double-throw switches. Each of the two switches are controlled independently by two digital signals.

8.4 Device Functional Modes

表 8-1. Function Table

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

9 Application and Implementation

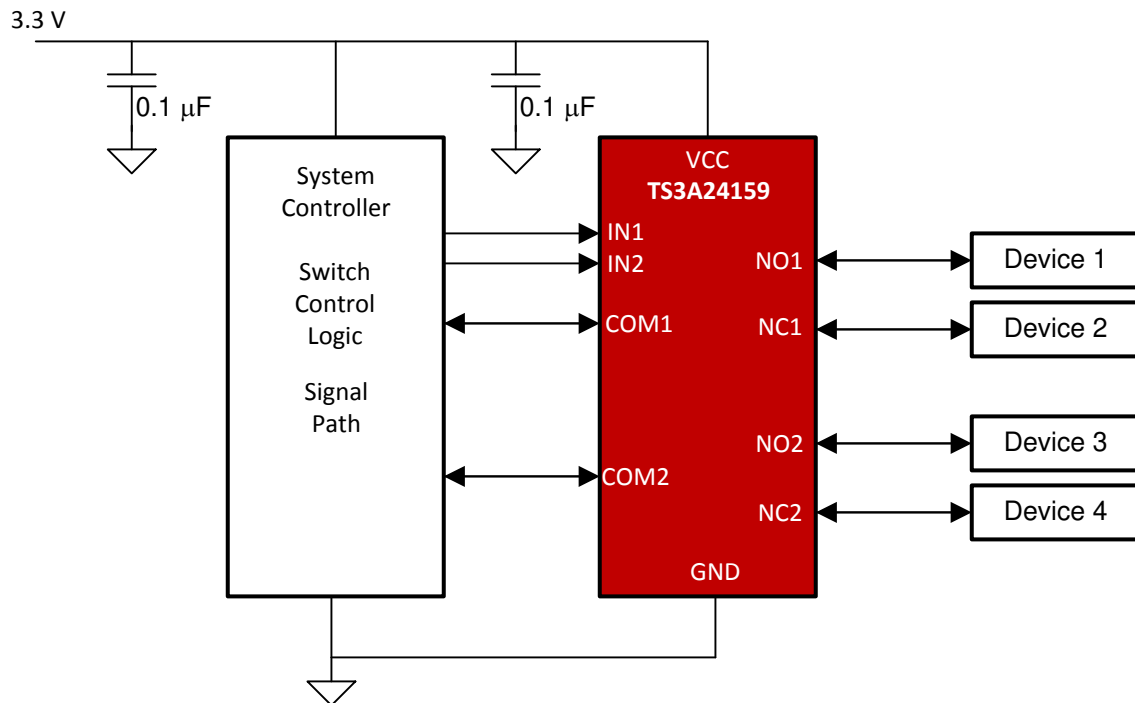
注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくこととなります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

9.1 Application Information

The switch of the TS3A24159 device is bidirectional. Hence, NO, NC, and COM pins can be used as both inputs or outputs.

9.2 Typical Application



9.2.1 Design Requirements

Ensure that all of the signals passing through the switch are within the specified ranges to ensure proper performance.

表 9-1. Design Parameters

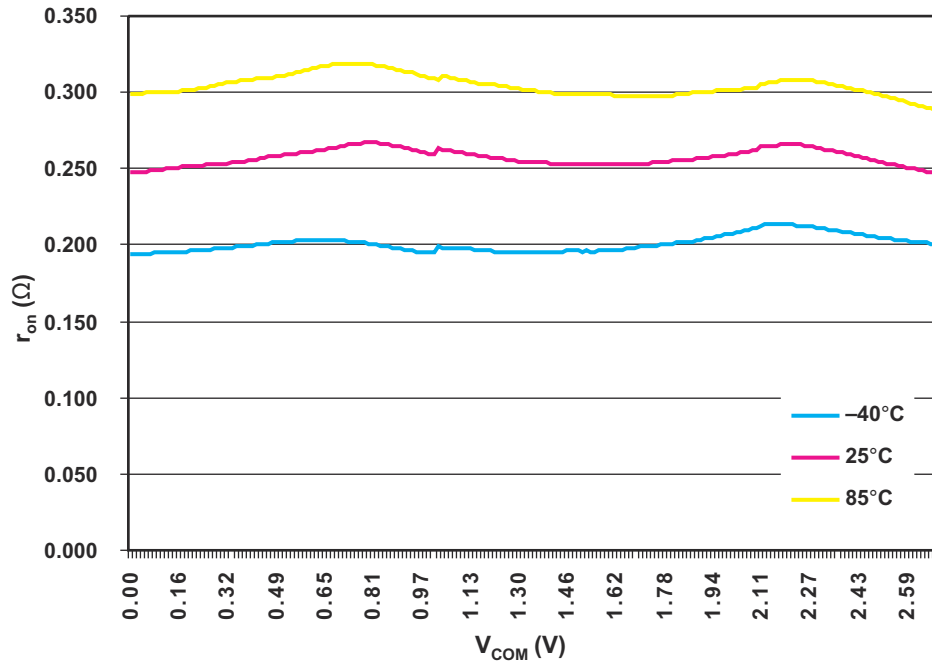
		MIN	MAX	UNIT
V_{CC}	Supply Voltage	1.65	3.6	V
V_{NC} V_{NO} V_{COM}	Signal Voltage	0	V_{CC}	V
V_{IN}	Digital Input Voltage	0	V_{CC}	V

9.2.2 Detailed Design Procedure

The TS3A24159 device can be properly operated without any external components. However, it is recommended to connect the unused pins to ground through a 50- Ω resistor to prevent signal reflections back into the device. It is also recommended that the digital control pins (IN1 and IN2) be pulled up to V_{CC} or down to GND to avoid undesired switch positions that could result from the floating pin.

Select the appropriate supply voltage to cover the entire voltage swing of the signal passing through the switch because the TS3A24159 input/output signal swing through NO and COM are dependant of the supply voltage V_{CC} .

9.2.3 Application Curve



9-1. r_{ON} vs V_{COM}

10 Power Supply Recommendations

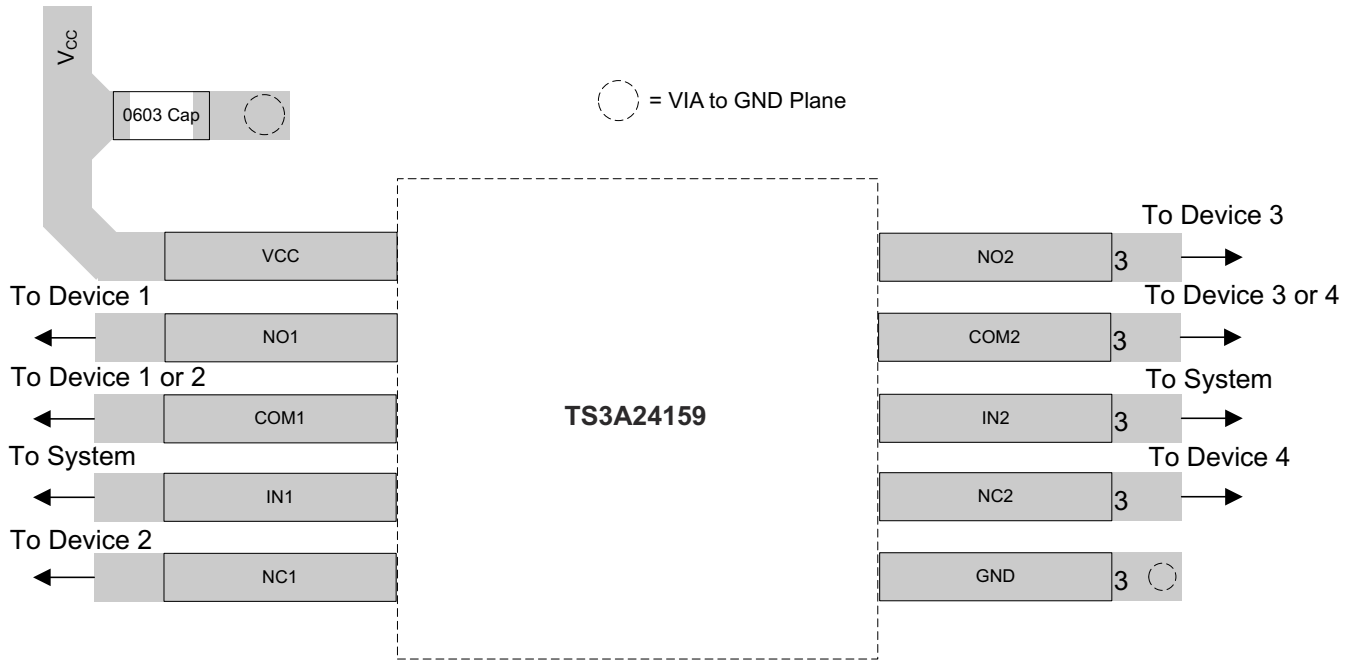
- Proper power-supply sequencing is recommended for all CMOS devices.
- Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the device.
- Always sequence V_{CC} on first, followed by NO or COM.
- Although it is not required, power-supply bypassing improves noise margin and prevents switching noise propagation from the V_{CC} supply to other components.
- A 0.1- μ F capacitor, connected from V_{CC} to GND, is adequate for most applications.

11 Layout

11.1 Layout Guidelines

To ensure reliability of the device, following common printed-circuit board layout guidelines is recommended. Bypass capacitors must be used on power supplies. Short trace lengths should be used to avoid excessive loading.

11.2 Layout Example



☒ 11-1. Layout Example

12 Device and Documentation Support

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Implications of Slow or Floating CMOS Inputs application note](#)

12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on [Subscribe to updates](#) to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

12.3 サポート・リソース

TI E2E™ サポート・フォーラムは、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

リンクされているコンテンツは、該当する貢献者により、現状のまま提供されるものです。これらは TI の仕様を構成するものではなく、必ずしも TI の見解を反映したものではありません。TI の[使用条件](#)を参照してください。

12.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

すべての商標は、それぞれの所有者に帰属します。

12.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

12.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS3A24159DGSR	ACTIVE	VSSOP	DGS	10	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(L8Q, L8R)	Samples
TS3A24159DGSRG4	LIFEBUY	VSSOP	DGS	10	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(L8Q, L8R)	
TS3A24159DRCR	ACTIVE	VSON	DRC	10	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZWS	Samples
TS3A24159DRCRG4	LIFEBUY	VSON	DRC	10	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ZWS	
TS3A24159YZPR	ACTIVE	DSBGA	YZP	10	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	L87	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

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
TS3A24159DGSR	VSSOP	DGS	10	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TS3A24159DRCR	VSON	DRC	10	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2
TS3A24159YZPR	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)
TS3A24159DGSR	VSSOP	DGS	10	2500	358.0	335.0	35.0
TS3A24159DRCR	VSON	DRC	10	3000	356.0	356.0	35.0
TS3A24159YZPR	DSBGA	YZP	10	3000	220.0	220.0	35.0

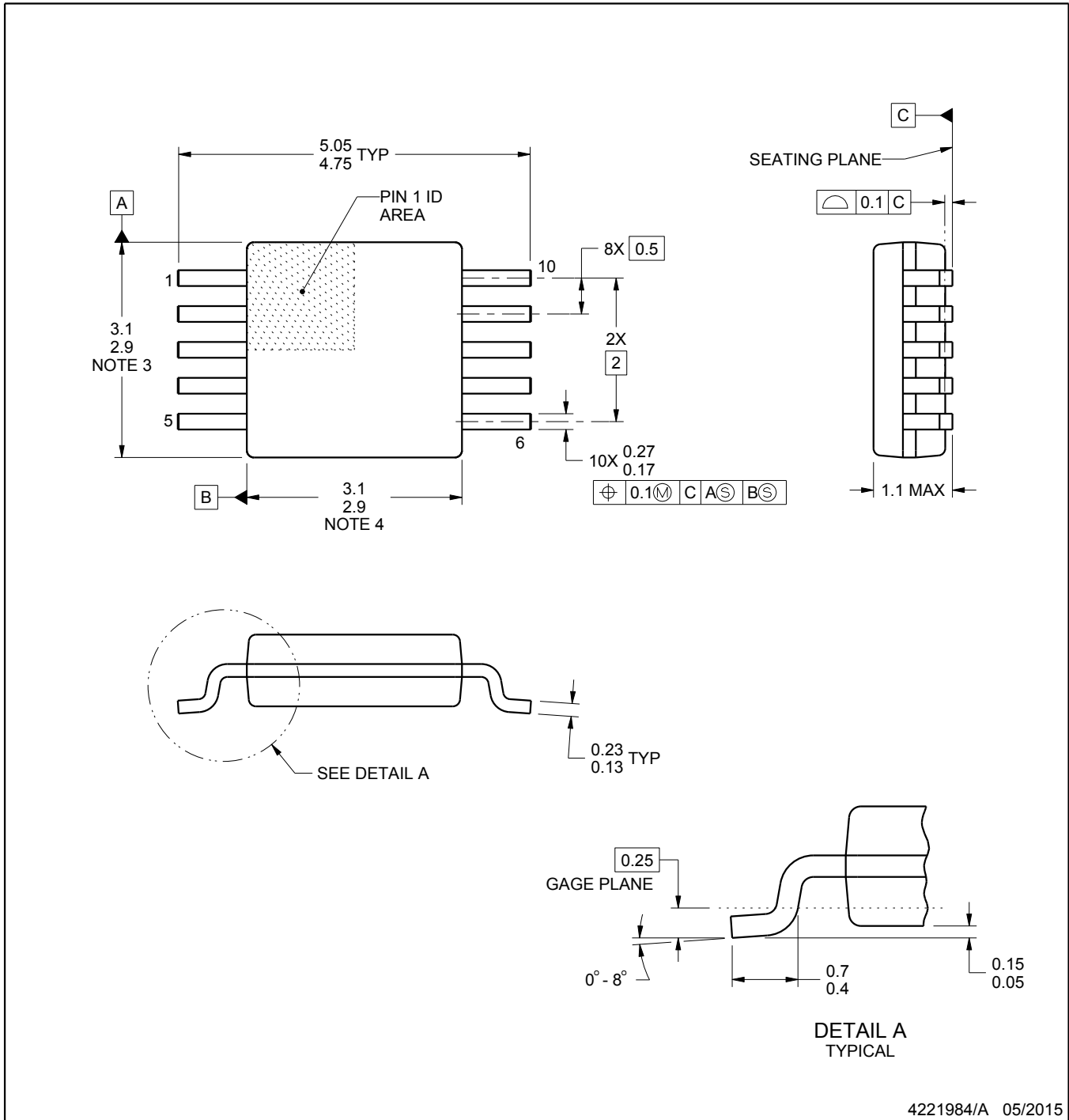
DGS0010A



PACKAGE OUTLINE

VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



4221984/A 05/2015

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. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187, variation BA.

EXAMPLE BOARD LAYOUT

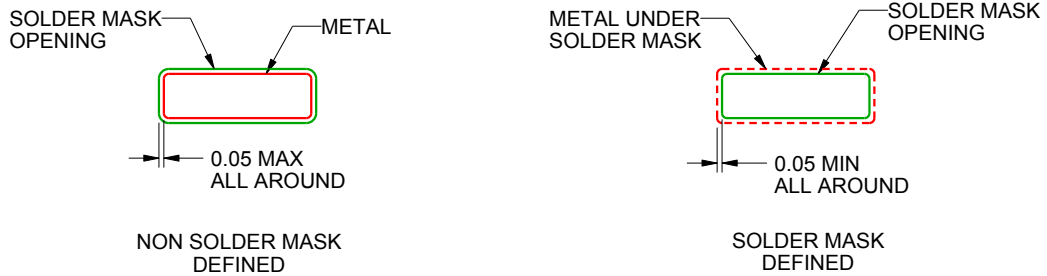
DGS0010A

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

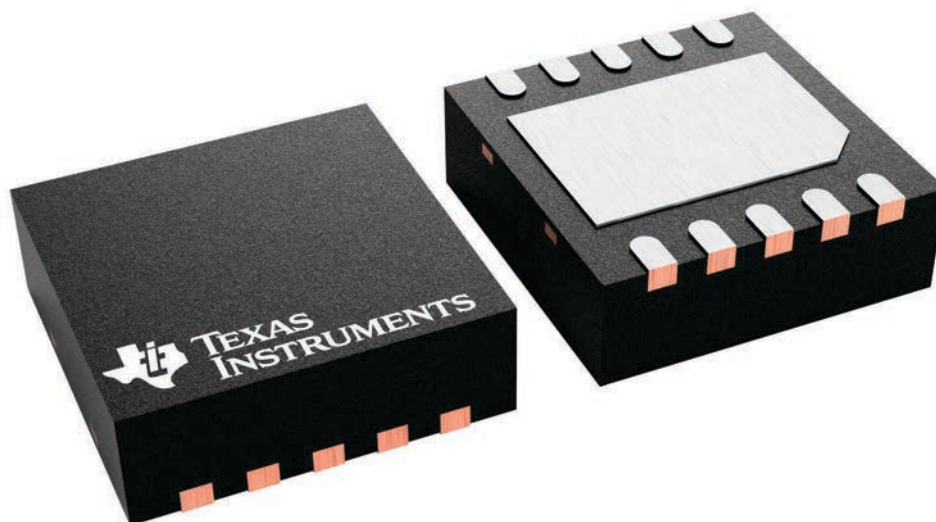
DRC 10

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.



4226193/A

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

4218878/B 07/2018

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/slua271).
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.

EXAMPLE STENCIL DESIGN

DRC0010J

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



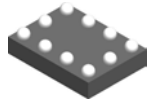
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

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

4218878/B 07/2018

NOTES: (continued)

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

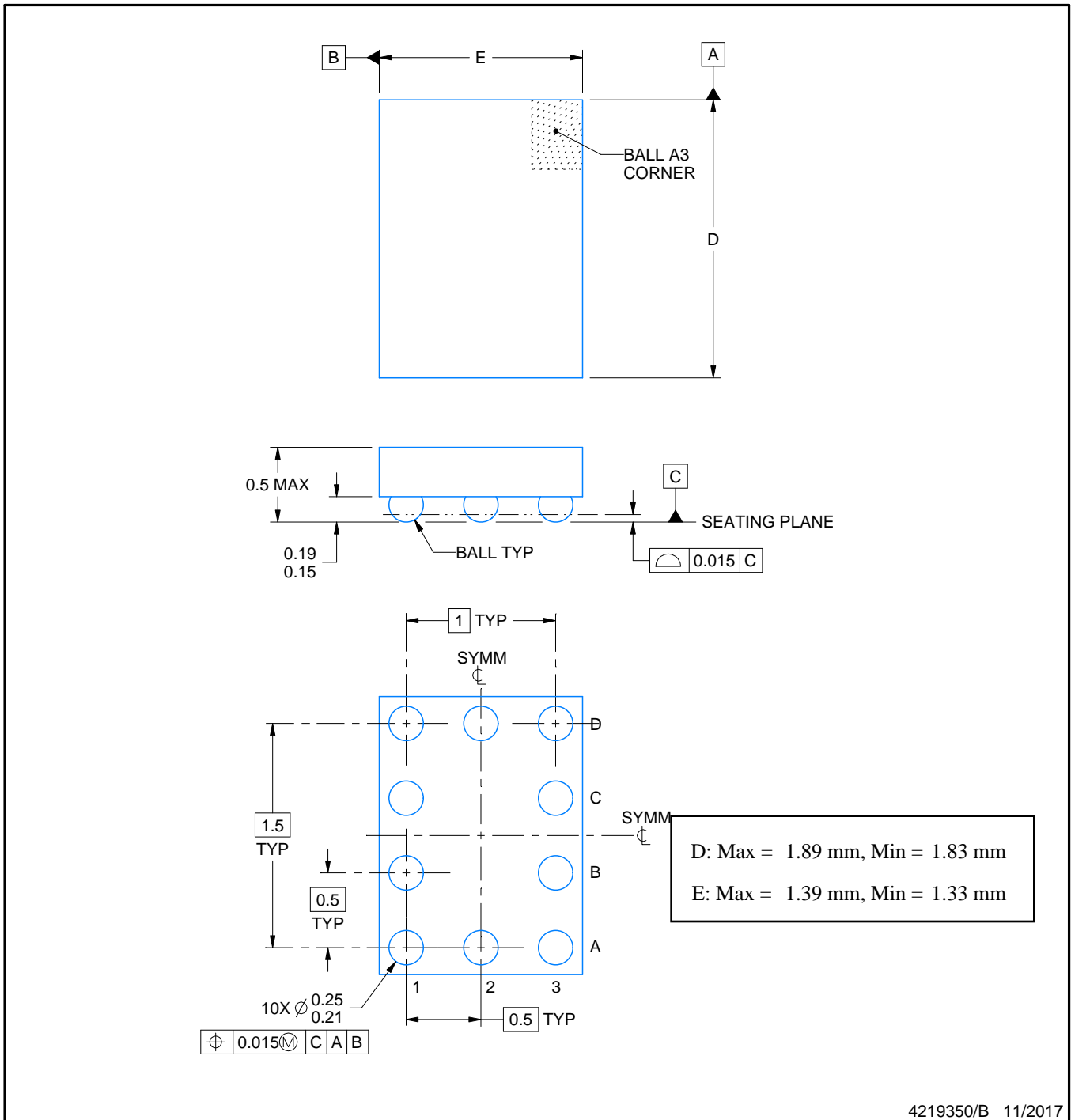


PACKAGE OUTLINE

YZP0010

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



NOTES:

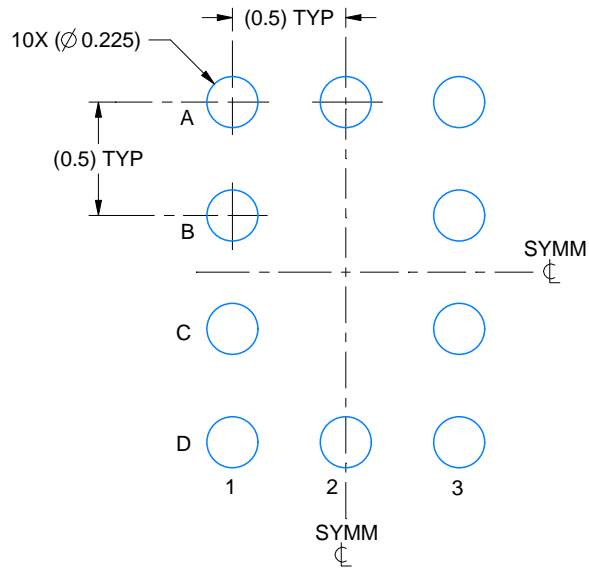
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

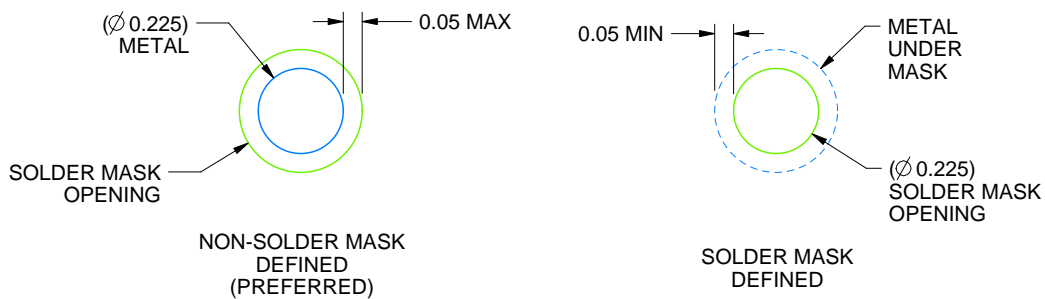
YZP0010

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)

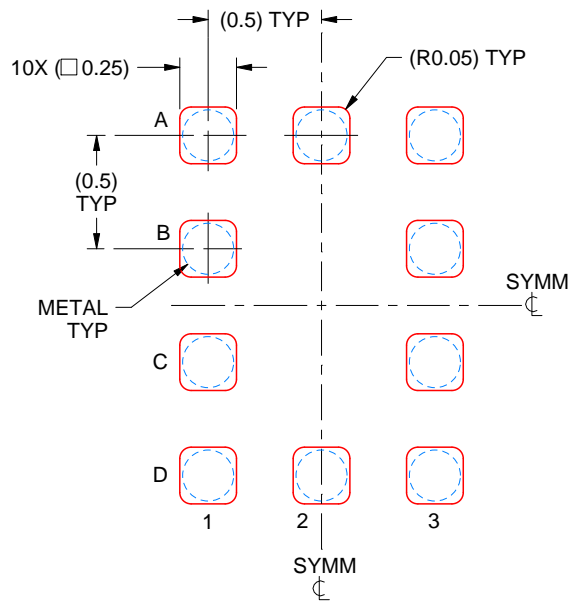
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 (www.ti.com/lit/sbva017).

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.

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ます。

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