

# TS3A27518E 6 チャンネル (qSPI)、1:2 マルチプレクサ / デマルチプレクサ、IEC L-4 ESD、1.8V ロジック互換制御入力

## 1 特長

- 1.65V~3.6V 単一電源動作
- パワーダウン・モード、 $V_{CC} = 0$  のとき絶縁
- 低容量スイッチ、21.5pF (標準値)
- 最大 240MHz の帯域幅により、高速のレール・ツー・レール信号処理に対応
- -62dB のクロストークおよびオフ絶縁
- 1.8V ロジック互換制御入力
- 3.6 V 許容の制御入力
- 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
  - 2500V、人体モデル (A114-B、Class II)
  - 1500V、デバイス帯電モデル (C101)
- ESD 性能: NC/NO ポート
  - 接触放電  $\pm 6kV$  (IEC 61000-4-2)
- 24-WQFN (4.00mm  $\times$  4.00mm) および 24-TSSOP (7.90mm  $\times$  6.60mm) パッケージ

## 2 アプリケーション

- SD-SDIO および MMC の 2 ポート・マルチプレクサ
- PC VGA ビデオのマルチプレクサ・ビデオ・システム
- オーディオおよびビデオ信号のルーティング

## 3 概要

TS3A27518E デバイスは、1.65V~3.6V で動作するように設計された、双方向、6 チャンネルの 1:2 マルチプレクサ / デマルチプレクサです。このデバイスはデジタルとアナログの両方の信号を処理でき、 $V_{CC}$  までの信号をどちらの方向にも転送できます。

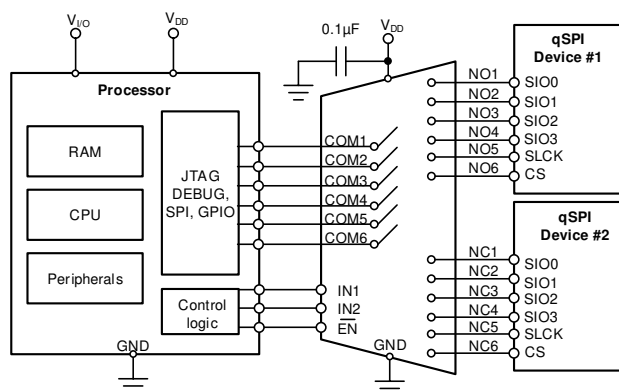
TS3A27518E は 2 つの制御ピンを備えており、それぞれが 3 つの 1:2 マルチプレクサを同時に制御できます。また、すべての出力を高インピーダンス・モードにするイネーブル・ピンを備えています。制御ピンは、1.8V ロジックのスレッシュホールドと互換性があり、2.5V および 3.3V ロジックのスレッシュホールドとも下位互換性があります。

TS3A27518E の SDIO インターフェイスは、6 ビット信号 (CMD、CLK、Data[0:3]) で構成されているため、あらゆる SD、SDIO、マルチメディア・カードのホスト・コントローラを複数のカードまたはペリフェラルに拡張できます。このデバイスは、qSPI など他の 6 ビット・インターフェイスもサポートしています。TS3A27518E には 2 つの制御ピンがあり、ユーザーが柔軟にデバイスを使用できます。たとえば、LCD テレビや LCD モニタ、またはノート PC のドッキング・ステーションなどの機器で、2 つの異なるオーディオ / ビデオ信号を多重化できます。

### 製品情報<sup>(1)</sup>

部品番号	パッケージ	本体サイズ (公称)
TS3A27518E	WQFN (24)	4.00mm $\times$ 4.00mm
	TSSOP (24)	7.90mm $\times$ 6.60mm

(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。



代表的なアプリケーション



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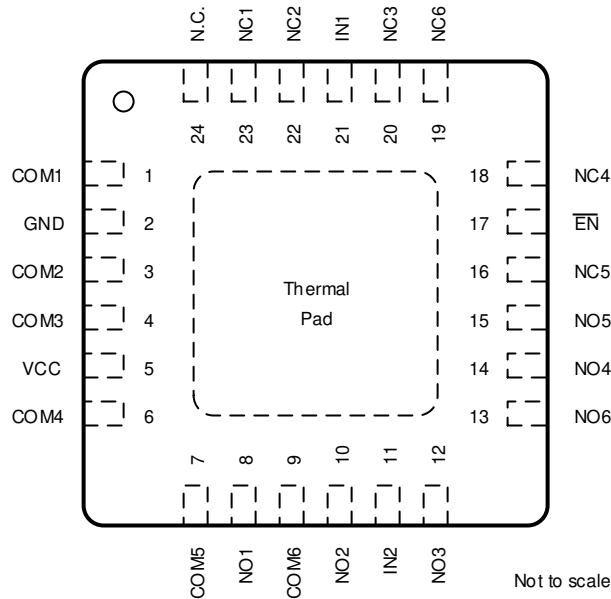
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## 4 Revision History

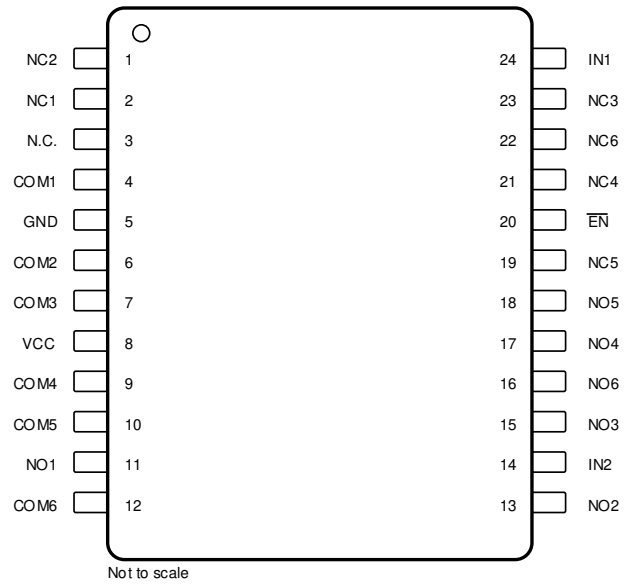
資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。


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• Changed the maximum value for the digital input voltage From: $V_{CC}$ To: 3.6 V.....	5
• Changed the unit for the $r_{on}$ analog switch From: V To: $\Omega$ .....	6
Changes from Revision D (May 2016) to Revision E (March 2019)	Page
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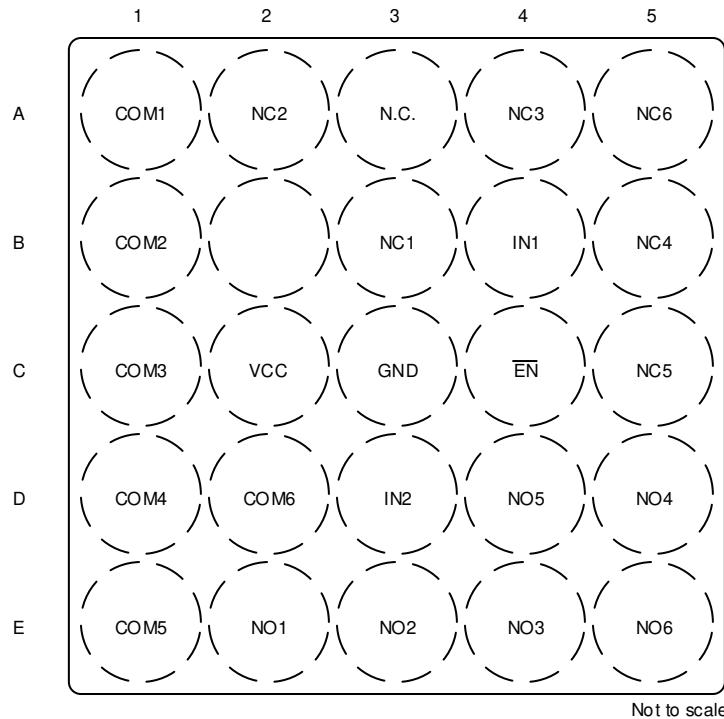
## 5 Pin Configuration and Functions




**5-1. RTW Package  
24-Pin WQFN  
Top View**




**5-2. PW Package  
24-Pin TSSOP  
Top View**




**5-3. ZQS Package  
24-Pin BGA MICROSTAR JUNIOR  
Top View**

表 5-1. Pin Functions

NAME	PIN			I/O	DESCRIPTION
	RTW	ZQS	PW		
COM1	1	A1	4	I/O	Common-signal path
COM2	3	B1	6	I/O	Common-signal path
COM3	4	C1	7	I/O	Common-signal path
COM4	6	D1	9	I/O	Common-signal path
COM5	7	E1	10	I/O	Common-signal path
COM6	9	D2	12	I/O	Common-signal path
EN	17	C4	20	I	Digital control to enable or disable all signal paths
GND	2	C3	5	—	Ground.
IN1	21	B4	24	I	Digital control to connect COM to NC or NO
IN2	11	D3	14	I	Digital control to connect COM to NC or NO
N.C.	24	A3	3	—	Not connected
NC1	23	B3	2	I/O	Normally closed-signal path
NC2	22	A2	1	I/O	Normally closed-signal path
NC3	20	A4	23	I/O	Normally closed-signal path
NC4	18	B5	21	I/O	Normally closed-signal path
NC5	16	C5	19	I/O	Normally closed-signal path
NC6	19	A5	22	I/O	Normally closed-signal path
NO1	8	E2	11	I/O	Normally open-signal path
NO2	10	E3	13	I/O	Normally open-signal path
NO3	12	E4	15	I/O	Normally open-signal path
NO4	14	D5	17	I/O	Normally open-signal path
NO5	15	D4	18	I/O	Normally open-signal path
NO6	13	E5	16	I/O	Normally open-signal path
V <sub>CC</sub>	5	C2	8	—	Voltage supply

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT		
V <sub>CC</sub>	Supply voltage <sup>(3)</sup>	-0.5	4.6	V		
V <sub>NC</sub> V <sub>NO</sub> V <sub>COM</sub>	Analog signal voltage <sup>(3)</sup>	-0.5	4.6	V		
I <sub>K</sub>	Analog port diode current <sup>(4)</sup>	V <sub>CC</sub> < V <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub> < 0		-50	mA	
I <sub>NC</sub> I <sub>NO</sub> I <sub>COM</sub>	ON-state switch current <sup>(5)</sup>	V <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>CC</sub>		-50	50	mA
V <sub>I</sub>	Digital input voltage <sup>(3)</sup>	-0.5	4.6	V		
I <sub>IK</sub>	Digital input clamp current <sup>(3)</sup>	V <sub>IO</sub> < V <sub>I</sub> < 0		-50	mA	
I <sub>CC</sub>	Continuous current through V <sub>CC</sub>		100	mA		
I <sub>GND</sub>	Continuous current through GND	-100		mA		
T <sub>stg</sub>	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) Requires clamp diodes on analog port to V<sub>CC</sub>.
- (5) Pulse at 1-ms duration < 10% duty cycle.

### 6.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2500
		Charged-device model (CDM), per JEDEC specification JESD22-C101 or ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup>	±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
Supply voltage	V <sub>CC</sub>	1.65	3.6	V
Analog signal voltage	V <sub>NC</sub>	0	3.6	V
	V <sub>NO</sub>			
	V <sub>COM</sub>			
Digital input voltage	V <sub>I</sub>	0	3.6	V

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		TS3A27518E			UNIT
		PW (TSSOP)	RTW (WQFN)	ZQS (BGA MICROSTAR JUNIOR)	
		24 PINS	24 PINS	24 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	104	40.7	155.7	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	51.6	42.9	69.9	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	57.5	19.2	94.6	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	9.9	1	9	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	57.1	19.3	92.2	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	—	8	—	°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 3.3-V Supply

V<sub>CC</sub> = 3 V to 3.6 V, T<sub>A</sub> = –40°C to +85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT	
<b>ANALOG SWITCH</b>									
V <sub>COM</sub> , V <sub>NO</sub> , V <sub>NC</sub>	Analog signal voltage				0		3.6	V	
r <sub>on</sub>	ON-state resistance	V <sub>CC</sub> = 3 V	0 ≤ (V <sub>NC</sub> or V <sub>NO</sub> ) ≤ V <sub>CC</sub> , I <sub>COM</sub> = –32 mA	Switch ON, see <a href="#">7-1</a>	T <sub>A</sub> = 25°C	4.4	6.2	Ω	
					T <sub>A</sub> = –40°C to +85°C		7.6		
Δr <sub>on</sub>	ON-state resistance match between channels	V <sub>CC</sub> = 3 V	V <sub>NC</sub> or V <sub>NO</sub> = 2.1 V, I <sub>COM</sub> = –32 mA	Switch ON, see <a href="#">7-1</a>	T <sub>A</sub> = 25°C	0.3	0.7	Ω	
					T <sub>A</sub> = –40°C to +85°C		0.8		
r <sub>on(flat)</sub>	ON-state resistance flatness	V <sub>CC</sub> = 3 V	0 ≤ (V <sub>NC</sub> or V <sub>NO</sub> ) ≤ V <sub>CC</sub> , I <sub>COM</sub> = –32 mA	Switch ON, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	0.95	2.1	Ω	
					T <sub>A</sub> = –40°C to +85°C		2.3		
I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	NC, NO OFF leakage current	V <sub>CC</sub> = 3.6 V	V <sub>NC</sub> or V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 3 V, or V <sub>NC</sub> or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = 1 V	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–0.5	0.05	0.5	μA
I <sub>NC(PWROFF)</sub> , I <sub>NO(PWROFF)</sub>		V <sub>CC</sub> = 0 V	V <sub>NC</sub> or V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0, or V <sub>NC</sub> or V <sub>NO</sub> = 3.6 V to 0, V <sub>COM</sub> = 0 to 3.6 V		T <sub>A</sub> = –40°C to +85°C	–7		7	
I <sub>COM(OFF)</sub>	COM OFF leakage current	V <sub>CC</sub> = 3.6 V	V <sub>NC</sub> or V <sub>NO</sub> = 3 V, V <sub>COM</sub> = 1 V, or V <sub>NC</sub> or V <sub>NO</sub> = 1 V, V <sub>COM</sub> = 3 V	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–1	0.01	1	μA
I <sub>COM(PWROFF)</sub>		V <sub>CC</sub> = 0 V	V <sub>NC</sub> or V <sub>NO</sub> = 3.6 V to 0, V <sub>COM</sub> = 0 to 3.6 V, or V <sub>NC</sub> or V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0		T <sub>A</sub> = –40°C to +85°C	–2		2	
					T <sub>A</sub> = 25°C	–1	0.02	1	
					T <sub>A</sub> = –40°C to +85°C	–12		1	

## 6.5 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT	
$I_{NO(ON)}$ , $I_{NC(ON)}$	NC, NO ON leakage current	$V_{CC} = 3.6\text{ V}$	$V_{NC}$ or $V_{NO} = 1\text{ V}$ , $V_{COM} = \text{open}$ , or $V_{NC}$ or $V_{NO} = 3\text{ V}$ , $V_{COM} = \text{open}$	Switch ON, see <a href="#">7-3</a>	$T_A = 25^\circ\text{C}$	-2.5	0.04	2.2	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-7		7	
$I_{COM(ON)}$	COM ON leakage current	$V_{CC} = 3.6\text{ V}$	$V_{NC}$ or $V_{NO} = \text{open}$ , $V_{COM} = 1\text{ V}$ , or $V_{NC}$ or $V_{NO} = \text{open}$ , $V_{COM} = 3\text{ V}$	Switch ON, see <a href="#">7-3</a>	$T_A = 25^\circ\text{C}$	-2	0.03	2	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-7		7	
<b>DIGITAL CONTROL INPUTS (IN1, IN2, EN) <sup>(1)</sup></b>									
$V_{IH}$	Input logic high	$V_{CC} = 3.6\text{ V}$			$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	1.2		3.6	V
$V_{IL}$	Input logic low	$V_{CC} = 3.6\text{ V}$			$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	0		0.65	V
$I_{IH}$ , $I_{IL}$	Input leakage current	$V_{CC} = 3.6\text{ V}$	$V_I = V_{CC}$ or 0		$T_A = 25^\circ\text{C}$	-0.1	0.05	0.1	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-2.5		2.5	
<b>DYNAMIC</b>									
$t_{ON}$	Turnon time	$V_{CC} = 3.3\text{ V}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$ , see <a href="#">7-5</a>	$T_A = 25^\circ\text{C}$	18.1	59	ns	
		$V_{CC} = 3\text{ V to }3.6\text{ V}$			$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		60		
$t_{OFF}$	Turnoff time	$V_{CC} = 3.3\text{ V}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$ , see <a href="#">7-5</a>	$T_A = 25^\circ\text{C}$	25.4	60.6	ns	
		$V_{CC} = 3\text{ V to }3.6\text{ V}$			$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		61		
$t_{BBM}$	Break-before- make time	$V_{CC} = 3.3\text{ V}$	$V_{NC} = V_{NO} =$ $V_{CC}/2$ , $R_L = 50\ \Omega$	$C_L = 35\text{ pF}$ , see <a href="#">7-6</a>	$T_A = 25^\circ\text{C}$	4	11.1	22.7	ns
		$V_{CC} = 3\text{ V to }3.6\text{ V}$			$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		28		
$Q_C$	Charge injection	$V_{CC} = 3.3\text{ V}$	$V_{GEN} = 0$ , $R_{GEN} = 0$	$C_L = 0.1\text{ nF}$ , see <a href="#">7-10</a>	$T_A = 25^\circ\text{C}$	0.81		pC	
$C_{NC(OFF)}$ , $C_{NO(OFF)}$	NC, NO OFF capacitance	$V_{CC} = 3.3\text{ V}$	$V_{NC}$ or $V_{NO} =$ $V_{CC}$ or GND, Switch OFF	See <a href="#">7-4</a>	$T_A = 25^\circ\text{C}$	13		pF	
$C_{COM(OFF)}$	COM OFF capacitance	$V_{CC} = 3.3\text{ V}$	$V_{NC}$ or $V_{NO} =$ $V_{CC}$ or GND, Switch OFF	See <a href="#">7-4</a>	$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	8.5		pF	
$C_{NC(ON)}$ , $C_{NO(ON)}$	NC, NO ON capacitance	$V_{CC} = 3.3\text{ V}$	$V_{NC}$ or $V_{NO} =$ $V_{CC}$ or GND, Switch OFF	See <a href="#">7-4</a>		21.5		pF	
$C_{COM(ON)}$	COM ON capacitance	$V_{CC} = 3.3\text{ V}$	$V_{COM} = V_{CC}$ or GND, Switch ON	See <a href="#">7-4</a>		21.5		pF	
$C_I$	Digital input capacitance	$V_{CC} = 3.3\text{ V}$	$V_I = V_{CC}$ or GND	See <a href="#">7-4</a>		2		pF	
BW	Bandwidth	$V_{CC} = 3.3\text{ V}$	$R_L = 50\ \Omega$ ,	Switch ON, see <a href="#">7-6</a>		240		MHz	
$O_{ISO}$	OFF isolation	$V_{CC} = 3.3\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch OFF, see <a href="#">7-8</a>		-62		dB	
$X_{TALK}$	Crosstalk	$V_{CC} = 3.3\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-62		dB	
$X_{TALK(ADJ)}$	Crosstalk adjacent	$V_{CC} = 3.3\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-71		dB	
THD	Total harmonic distortion	$V_{CC} = 3.3\text{ V}$	$R_L = 600\ \Omega$ , $C_L = 50\text{ pF}$	$f = 20\text{ Hz to }20\text{ kHz}$ , see <a href="#">7-11</a>		0.05%			

## 6.5 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
<b>SUPPLY</b>								
$I_{CC}$	Positive supply current	$V_{CC} = 3.6\text{ V}$	$V_I = V_{CC}$ or GND	Switch ON or OFF	$T_A = 25^\circ\text{C}$	0.04	0.3	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		3	

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

## 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT	
<b>ANALOG SWITCH</b>									
$V_{COM}$ , $V_{NO}$ , $V_{NC}$	Analog signal voltage				0		3.6	V	
$r_{on}$	ON-state resistance	$V_{CC} = 2.3\text{ V}$	$0 \leq (V_{NC} \text{ or } V_{NO}) \leq V_{CC}$ , $I_{COM} = -32\text{ mA}$	Switch ON, see <a href="#">7-1</a>	$T_A = 25^\circ\text{C}$	5.5	9.6	$\Omega$	
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		11.5		
$\Delta r_{on}$	ON-state resistance match between channels	$V_{CC} = 2.3\text{ V}$	$V_{NC}$ or $V_{NO} = 1.6\text{ V}$ , $I_{COM} = -32\text{ mA}$	Switch ON, see <a href="#">7-1</a>	$T_A = 25^\circ\text{C}$	0.3	0.8	$\Omega$	
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		0.9		
$r_{on(Flat)}$	ON-state resistance flatness	$V_{CC} = 2.3\text{ V}$	$0 \leq (V_{NC} \text{ or } V_{NO}) \leq V_{CC}$ , $I_{COM} = -32\text{ mA}$	Switch ON, see <a href="#">7-2</a>	$T_A = 25^\circ\text{C}$	0.91	2.2	$\Omega$	
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		2.3		
$I_{NC(OFF)}$ , $I_{NO(OFF)}$	NC, NO OFF leakage current	$V_{CC} = 2.7\text{ V}$	$V_{NC}$ or $V_{NO} = 0.5\text{ V}$ , $V_{COM} = 2.3\text{ V}$ , or $V_{NC}$ or $V_{NO} = 2.3\text{ V}$ , $V_{COM} = 0.5\text{ V}$	Switch OFF, see <a href="#">7-2</a>	$T_A = 25^\circ\text{C}$	-0.3	0.04	0.3	$\mu\text{A}$
								$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	
$I_{NC(PWROFF)}$ , $I_{NO(PWROFF)}$		$V_{CC} = 0\text{ V}$	$V_{NC}$ or $V_{NO} = 0$ to $2.7\text{ V}$ , $V_{COM} = 2.7\text{ V to }0$ , or $V_{NC}$ or $V_{NO} = 2.7\text{ V to }0$ , $V_{COM} = 0$ to $2.7\text{ V}$		$T_A = 25^\circ\text{C}$	-0.6	0.02	0.6	
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-10		10	
$I_{COM(OFF)}$	COM OFF leakage current	$V_{CC} = 2.7\text{ V}$	$V_{NC}$ or $V_{NO} = 0.5\text{ V}$ , $V_{COM} = 2.3\text{ V}$ , or $V_{NC}$ or $V_{NO} = 2.3\text{ V}$ , $V_{COM} = 0.5\text{ V}$	Switch OFF, see <a href="#">7-2</a>	$T_A = 25^\circ\text{C}$	-0.7	0.02	0.7	$\mu\text{A}$
								$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	
$I_{COM(PWROFF)}$		$V_{CC} = 0\text{ V}$	$V_{NC}$ or $V_{NO} = 2.7\text{ V to }0$ , $V_{COM} = 0$ to $2.7\text{ V}$ , or $V_{NC}$ or $V_{NO} = 0$ to $2.7\text{ V}$ , $V_{COM} = 2.7\text{ V to }0$		$T_A = 25^\circ\text{C}$	-0.7	0.02	0.7	
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-7.2		7.2	
$I_{NO(ON)}$ , $I_{NC(ON)}$	NC, NO ON leakage current	$V_{CC} = 2.7\text{ V}$	$V_{NC}$ or $V_{NO} = 0.5\text{ V}$ or $2.3\text{ V}$ , $V_{COM} = \text{open}$	Switch ON, see <a href="#">7-3</a>	$T_A = 25^\circ\text{C}$	-2.1	0.03	2.1	$\mu\text{A}$
							$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-6	
$I_{COM(ON)}$	COM ON leakage current	$V_{CC} = 2.7\text{ V}$	$V_{NC}$ or $V_{NO} = \text{open}$ , $V_{COM} = 0.5\text{ V}$ , or $V_{NC}$ or $V_{NO} = \text{open}$ , $V_{COM} = 2.3\text{ V}$	Switch ON, see <a href="#">7-3</a>	$T_A = 25^\circ\text{C}$	-2	0.02	2	$\mu\text{A}$
							$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-5.7	
<b>DIGITAL CONTROL INPUTS (IN1, IN2, EN) <sup>(1)</sup></b>									
$V_{IH}$	Input logic high	$V_{CC} = 2.7\text{ V}$	$V_I = V_{CC}$ or GND		$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	1.15		3.6	V
$V_{IL}$	Input logic low	$V_{CC} = 2.7\text{ V}$				0		0.55	V
$I_{IH}$ , $I_{IL}$	Input leakage current	$V_{CC} = 2.7\text{ V}$	$V_I = V_{CC}$ or 0		$T_A = 25^\circ\text{C}$	-0.1	0.01	0.1	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$	-2.1		2.1	



## 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
<b>DYNAMIC</b>								
$t_{ON}$	Turnon time	$V_{CC} = 2.5 \text{ V}$	$V_{COM} = V_{CC}$ , $R_L = 50 \Omega$	$C_L = 35 \text{ pF}$ , see <a href="#">7-5</a>	$T_A = 25^\circ\text{C}$	17.2	36.8	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$				$T_A = -40^\circ\text{C to } +85^\circ\text{C}$	42.5	
$t_{OFF}$	Turnoff time	$V_{CC} = 2.5 \text{ V}$	$V_{COM} = V_{CC}$ , $R_L = 50 \Omega$	$C_L = 35 \text{ pF}$ , see <a href="#">7-5</a>	$T_A = 25^\circ\text{C}$	17.1	29.8	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$				$T_A = -40^\circ\text{C to } +85^\circ\text{C}$	34.4	
$t_{BBM}$	Break-before-make time	$V_{CC} = 2.5 \text{ V}$	$V_{NC} = V_{NO} = V_{CC}/2$ , $R_L = 50 \Omega$	$C_L = 35 \text{ pF}$ , see <a href="#">7-6</a>	$T_A = 25^\circ\text{C}$	4.5	13	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$				$T_A = -40^\circ\text{C to } +85^\circ\text{C}$	33.3	
$Q_C$	Charge injection	$V_{CC} = 2.5 \text{ V}$	$V_{GEN} = 0$ , $R_{GEN} = 0$	$C_L = 0.1 \text{ nF}$ , see <a href="#">7-10</a>		0.47		pC
$C_{NC(OFF)}$ , $C_{NO(OFF)}$	NC, NO OFF capacitance	$V_{CC} = 2.5 \text{ V}$	$V_{NC}$ or $V_{NO} = V_{CC}$ or GND, switch OFF	See <a href="#">7-4</a>		13.5		pF
$C_{COM(OFF)}$	COM OFF capacitance	$V_{CC} = 2.5 \text{ V}$	$V_{NC}$ or $V_{NO} = V_{CC}$ or GND, switch OFF	See <a href="#">7-4</a>	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$	9		pF
$C_{NC(ON)}$ , $C_{NO(ON)}$	NC, NO ON capacitance	$V_{CC} = 2.5 \text{ V}$	$V_{NC}$ or $V_{NO} = V_{CC}$ or GND, switch OFF	See <a href="#">7-4</a>		22		pF
$C_{COM(ON)}$	COM ON capacitance	$V_{CC} = 2.5 \text{ V}$	$V_{COM} = V_{CC}$ or GND, switch ON	See <a href="#">7-4</a>		22		pF
$C_I$	Digital input capacitance	$V_{CC} = 2.5 \text{ V}$	$V_I = V_{CC}$ or GND	See <a href="#">7-4</a>		2		pF
BW	Bandwidth	$V_{CC} = 2.5 \text{ V}$	$R_L = 50 \Omega$	Switch ON, see <a href="#">7-6</a>		240		MHz
$O_{ISO}$	OFF isolation	$V_{CC} = 2.5 \text{ V}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$	Switch OFF, see <a href="#">7-8</a>		-62		dB
$X_{TALK}$	Crosstalk	$V_{CC} = 2.5 \text{ V}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-62		dB
$X_{TALK(ADJ)}$	Crosstalk adjacent	$V_{CC} = 2.5 \text{ V}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-71		dB
THD	Total harmonic distortion	$V_{CC} = 2.5 \text{ V}$	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$	$f = 20 \text{ Hz to } 20 \text{ kHz}$ , see <a href="#">7-11</a>		0.06%		
<b>SUPPLY</b>								
$I_{CC}$	Positive supply current	$V_{CC} = 2.7 \text{ V}$	$V_I = V_{CC}$ or GND	Switch ON or OFF	$T_A = 25^\circ\text{C}$	0.01	0.1	$\mu\text{A}$
					$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		2	

(1) 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](#).

## 6.7 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
<b>ANALOG SWITCH</b>								
$V_{COM}$ , $V_{NO}$ , $V_{NC}$	Analog signal voltage				0		3.6	V
$r_{on}$	ON-state resistance	$V_{CC} = 1.65 \text{ V}$	$0 \leq (V_{NC} \text{ or } V_{NO}) \leq V_{CC}$ , $I_{COM} = -32 \text{ mA}$	Switch ON, see <a href="#">7-1</a>	$T_A = 25^\circ\text{C}$	7.1	14.4	$\Omega$
					$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		16.3	

### 6.7 Electrical Characteristics for 1.8-V Supply (continued)

V<sub>CC</sub> = 1.65 V to 1.95 V, T<sub>A</sub> = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT	
Δr <sub>on</sub>	ON-state resistance match between channels	V <sub>CC</sub> = 1.65 V	V <sub>NC</sub> or V <sub>NO</sub> = 1.5 V, I <sub>COM</sub> = –32 mA	Switch ON, see <a href="#">7-1</a>	T <sub>A</sub> = 25°C	0.3	1	Ω	
					T <sub>A</sub> = –40°C to +85°C		1.2		
r <sub>on(flat)</sub>	ON-state resistance flatness	V <sub>CC</sub> = 1.65 V	0 ≤ (V <sub>NC</sub> or V <sub>NO</sub> ) ≤ V <sub>CC</sub> , I <sub>COM</sub> = –32 mA	Switch ON, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	2.7	5.5	Ω	
					T <sub>A</sub> = –40°C to +85°C		7.3		
I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	NC, NO OFF leakage current	V <sub>CC</sub> = 1.95 V	V <sub>NC</sub> or V <sub>NO</sub> = 0.3 V, V <sub>COM</sub> = 1.65 V, or V <sub>NC</sub> or V <sub>NO</sub> = 1.65 V, V <sub>COM</sub> = 0.3 V	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–0.25	0.03	0.25	μA
					T <sub>A</sub> = –40°C to +85°C	–5		5	
I <sub>NC(PWROFF)</sub> , I <sub>NO(PWROFF)</sub>	NC, NO OFF leakage current	V <sub>CC</sub> = 0 V	V <sub>NC</sub> or V <sub>NO</sub> = 1.95 V to 0, V <sub>COM</sub> = 0 to 1.95 V, or V <sub>NC</sub> or V <sub>NO</sub> = 0 to 1.95 V, V <sub>COM</sub> = 1.95 V to 0	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–0.4	0.01	0.4	μA
					T <sub>A</sub> = –40°C to +85°C	–7.2		7.2	
I <sub>COM(OFF)</sub>	COM OFF leakage current	V <sub>CC</sub> = 1.95 V	V <sub>NC</sub> or V <sub>NO</sub> = 0.3 V, V <sub>COM</sub> = 1.65 V, or V <sub>NC</sub> or V <sub>NO</sub> = 1.65 V, V <sub>COM</sub> = 0.3 V	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–0.4	0.02	0.4	μA
					T <sub>A</sub> = –40°C to +85°C	–0.9		0.9	
I <sub>COM(PWROFF)</sub>	COM OFF leakage current	V <sub>CC</sub> = 0 V	V <sub>NC</sub> or V <sub>NO</sub> = 1.95 V to 0, V <sub>COM</sub> = 0 to 1.95 V, or V <sub>NC</sub> or V <sub>NO</sub> = 0 to 1.95 V, V <sub>COM</sub> = 1.95 V to 0	Switch OFF, see <a href="#">7-2</a>	T <sub>A</sub> = 25°C	–0.4	0.02	0.4	μA
					T <sub>A</sub> = –40°C to +85°C	–5		5	
I <sub>NO(ON)</sub> , I <sub>NC(ON)</sub>	NC, NO ON leakage current	V <sub>CC</sub> = 1.95 V	V <sub>NC</sub> or V <sub>NO</sub> = 0.3 V, V <sub>COM</sub> = open, or V <sub>NC</sub> or V <sub>NO</sub> = 1.65 V, V <sub>COM</sub> = open	Switch ON, see <a href="#">7-3</a>	T <sub>A</sub> = 25°C	–2	0.02	2	μA
					T <sub>A</sub> = –40°C to +85°C	–5.2		5.2	
I <sub>COM(ON)</sub>	COM ON leakage current	V <sub>CC</sub> = 1.95 V	V <sub>NC</sub> or V <sub>NO</sub> = open, V <sub>COM</sub> = 0.3 V, or V <sub>NC</sub> or V <sub>NO</sub> = open, V <sub>COM</sub> = 1.65 V	Switch ON, see <a href="#">7-3</a>	T <sub>A</sub> = 25°C	–2	0.02	2	μA
					T <sub>A</sub> = –40°C to +85°C	–5.2		5.2	
<b>DIGITAL CONTROL INPUTS (IN1, IN2, EN) <sup>(1)</sup></b>									
V <sub>IH</sub>	Input logic high	V <sub>CC</sub> = 1.95 V	V <sub>I</sub> = V <sub>CC</sub> or GND		T <sub>A</sub> = –40°C to +85°C	1	3.6	V	
V <sub>IL</sub>	Input logic low	V <sub>CC</sub> = 1.95 V			T <sub>A</sub> = –40°C to +85°C	0	0.4	V	
I <sub>IH</sub> , I <sub>IL</sub>	Input leakage current	V <sub>CC</sub> = 1.95 V	V <sub>I</sub> = V <sub>CC</sub> or 0		T <sub>A</sub> = 25°C	–0.1	0.01	0.1	μA
					T <sub>A</sub> = –40°C to +85°C	–2.1		2.1	
<b>DYNAMIC</b>									
t <sub>ON</sub>	Turnon time	V <sub>CC</sub> = 1.8 V	V <sub>COM</sub> = V <sub>CC</sub> , R <sub>L</sub> = 50 Ω	C <sub>L</sub> = 35 pF, see <a href="#">7-5</a>	T <sub>A</sub> = 25°C	14.1	49.3	ns	
		V <sub>CC</sub> = 1.65 V to 1.95 V			T <sub>A</sub> = –40°C to +85°C		56.7		
t <sub>OFF</sub>	Turnoff time	V <sub>CC</sub> = 1.8 V	V <sub>COM</sub> = V <sub>CC</sub> , R <sub>L</sub> = 50 Ω	C <sub>L</sub> = 35 pF, see <a href="#">7-5</a>	T <sub>A</sub> = 25°C	16.1	26.5	ns	
		V <sub>CC</sub> = 1.65 V to 1.95 V			T <sub>A</sub> = –40°C to +85°C		31.2		
t <sub>BBM</sub>	Break-before-make time	V <sub>CC</sub> = 1.8 V	V <sub>NC</sub> = V <sub>NO</sub> = V <sub>CC</sub> /2, R <sub>L</sub> = 50 Ω	C <sub>L</sub> = 35 pF, see <a href="#">7-6</a>	T <sub>A</sub> = 25°C	5.3	18.4	ns	
		V <sub>CC</sub> = 1.65 V to 1.95 V			T <sub>A</sub> = –40°C to +85°C		58		
Q <sub>C</sub>	Charge injection	V <sub>CC</sub> = 1.8 V	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0	C <sub>L</sub> = 1 nF, see <a href="#">7-10</a>		0.21		pC	

## 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)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$C_{NC(OFF)}$ , $C_{NO(OFF)}$	NC, NO OFF capacitance	$V_{CC} = 1.8\text{ V}$	$V_{NC}$ or $V_{NO} = V_{CC}$ or GND, switch OFF	See <a href="#">7-4</a>		9		pF
$C_{NC(ON)}$ , $C_{NO(ON)}$	NC, NO ON capacitance	$V_{CC} = 1.8\text{ V}$	$V_{NC}$ or $V_{NO} = V_{CC}$ or GND, switch OFF	See <a href="#">7-4</a>		22		pF
$C_{COM(ON)}$	COM ON capacitance	$V_{CC} = 1.8\text{ V}$	$V_{COM} = V_{CC}$ or GND, switch ON	See <a href="#">7-4</a>		22		pF
$C_I$	Digital input capacitance	$V_{CC} = 1.8\text{ V}$	$V_I = V_{CC}$ or GND	See <a href="#">7-4</a>		2		pF
BW	Bandwidth	$V_{CC} = 1.8\text{ V}$	$R_L = 50\ \Omega$	Switch ON, see <a href="#">7-6</a>		240		MHz
$O_{ISO}$	OFF isolation	$V_{CC} = 1.8\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch OFF, see <a href="#">7-8</a>		-60		dB
$X_{TALK}$	Crosstalk	$V_{CC} = 1.8\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-60		dB
$X_{TALK(ADJ)}$	Crosstalk adjacent	$V_{CC} = 1.8\text{ V}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$	Switch ON, see <a href="#">7-9</a>		-71		dB
THD	Total harmonic distortion	$V_{CC} = 1.8\text{ V}$	$R_L = 600\ \Omega$ , $C_L = 50\text{ pF}$	$f = 20\text{ Hz to }20\text{ kHz}$ , see <a href="#">7-11</a>		0.1%		
<b>SUPPLY</b>								
$I_{CC}$	Positive supply current	$V_{CC} = 1.95\text{ V}$	$V_I = V_{CC}$ or GND	Switch ON or OFF	$T_A = 25^\circ\text{C}$	0.01	0.1	$\mu\text{A}$
					$T_A = -40^\circ\text{C to }+85^\circ\text{C}$		1.5	

- (1) 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

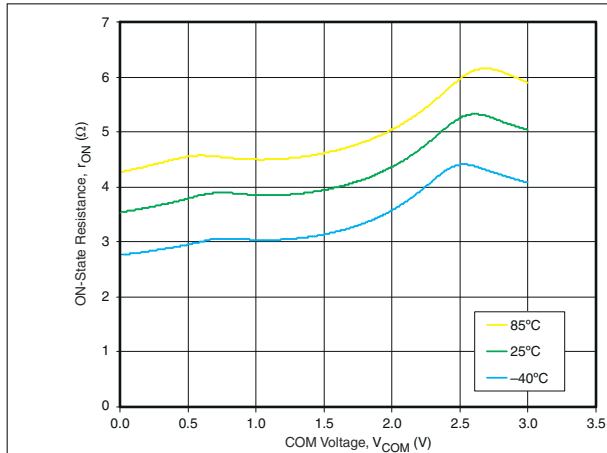


Fig 6-1. ON-State Resistance vs COM Voltage ( $V_{CC} = 3\text{ V}$ )

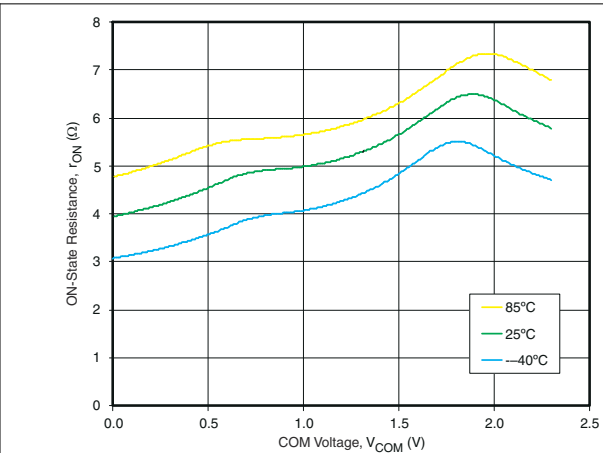


Fig 6-2. ON-State Resistance vs COM Voltage ( $V_{CC} = 2.3\text{ V}$ )

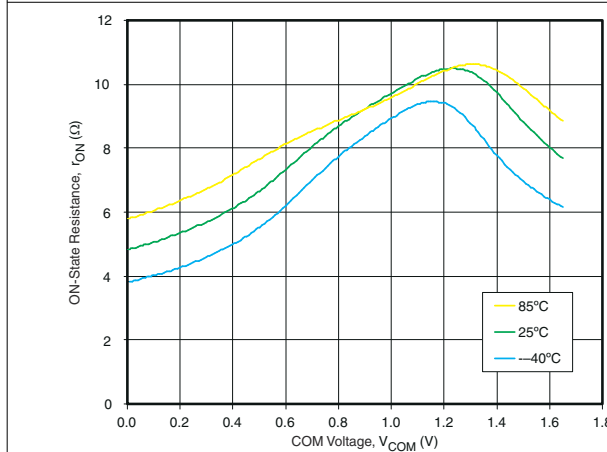


Fig 6-3. ON-State Resistance vs COM Voltage ( $V_{CC} = 1.65\text{ V}$ )

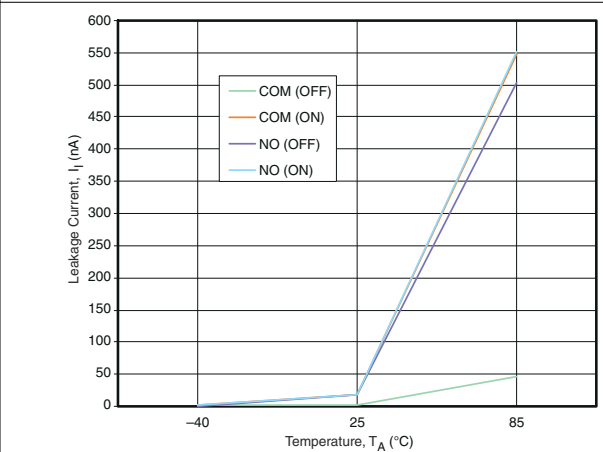


Fig 6-4. Leakage Current vs Temperature ( $V_{CC} = 3.3\text{ V}$ )

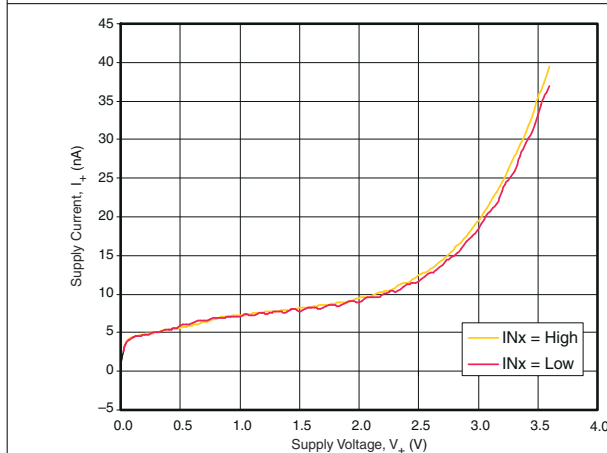


Fig 6-5. Supply Current vs Supply Voltage

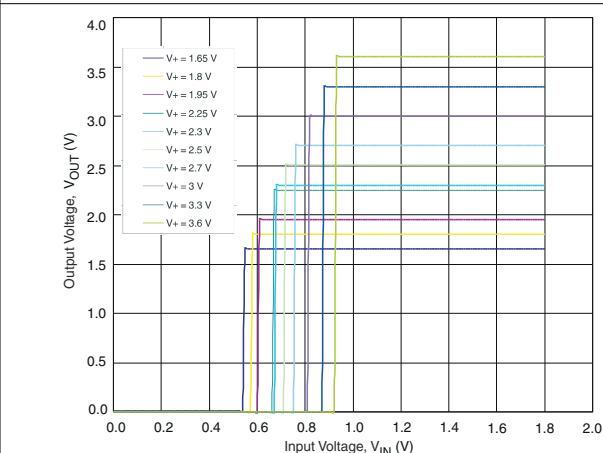
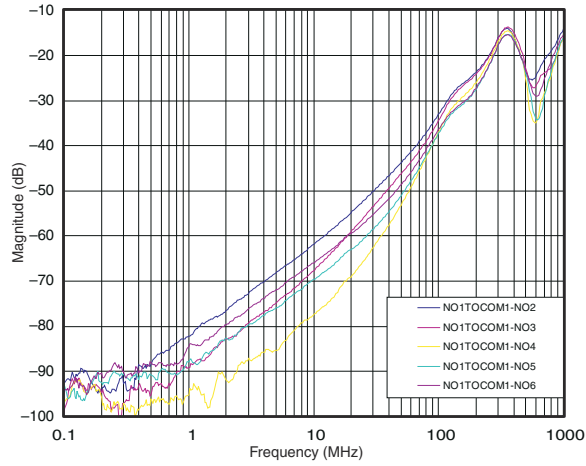
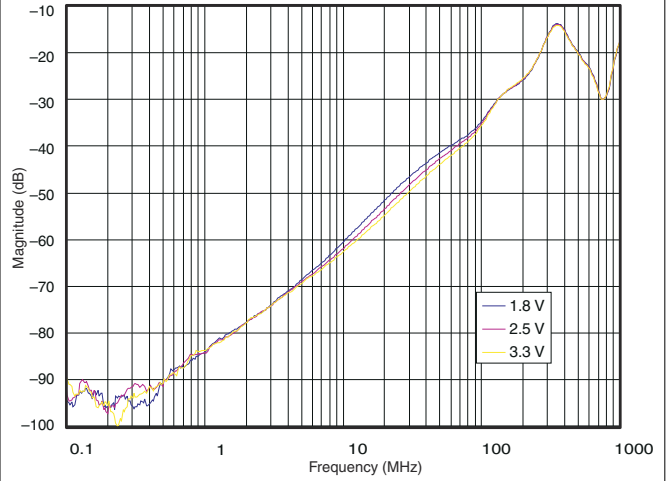


Fig 6-6. Control Input Thresholds ( $IN1, T_A = 25^\circ\text{C}$ )

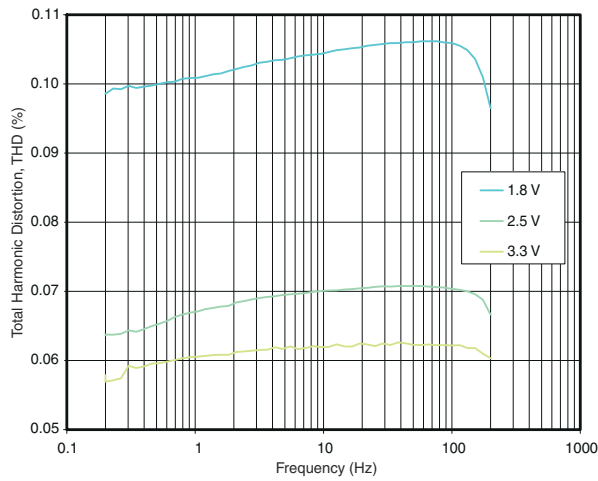
## 6.8 Typical Characteristics (continued)



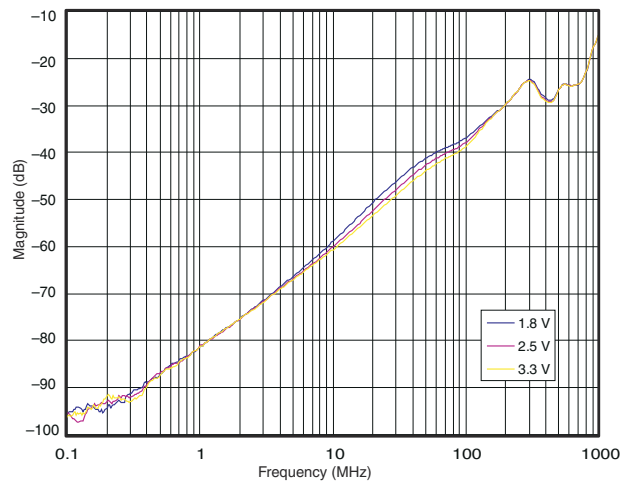
6-7. Crosstalk Adjacent



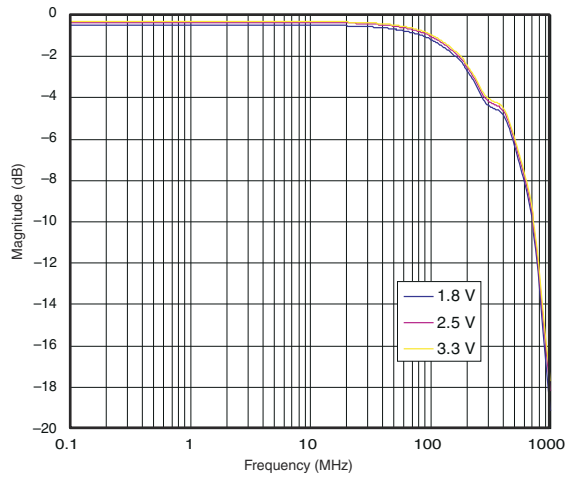
6-8. Crosstalk



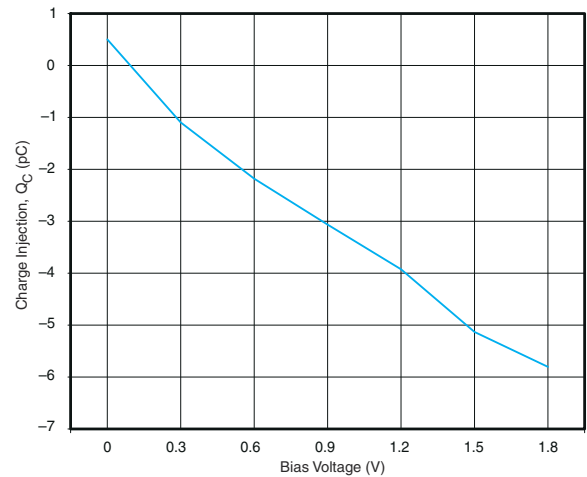
6-9. Total Harmonic Distortion vs Frequency



6-10. OFF Isolation

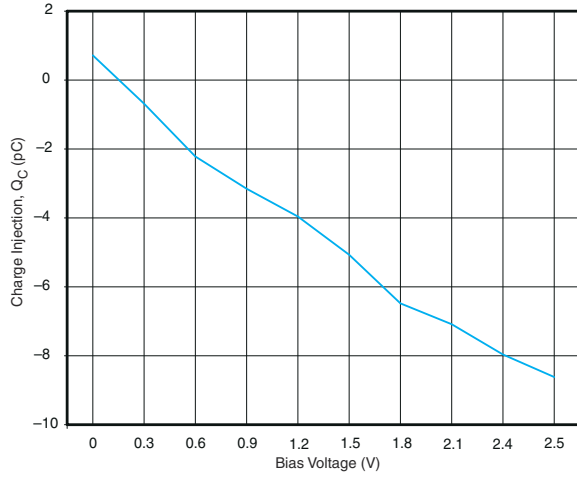


6-11. Insertion Loss

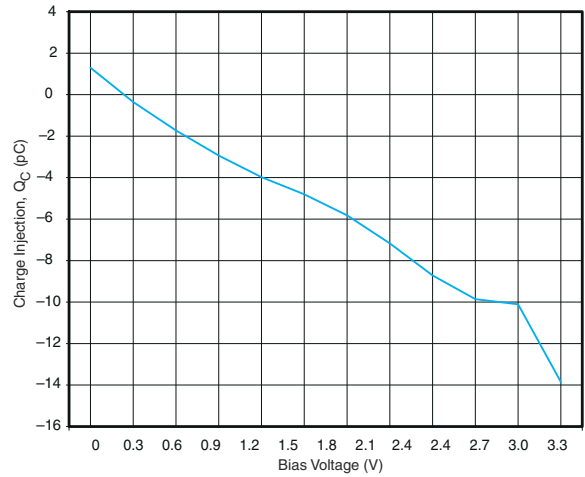


6-12. Charge Injection vs Bias Voltage (1.8 V)

### 6.8 Typical Characteristics (continued)



**6-13. Charge Injection vs Bias Voltage (2.5 V)**



**6-14. Charge Injection vs Bias Voltage (3.3 V)**

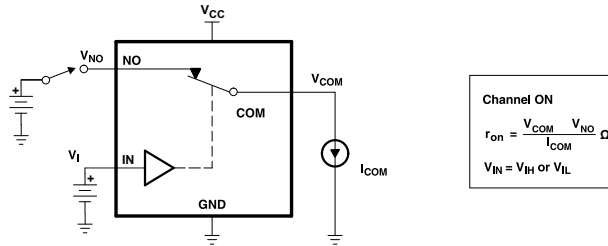
## 7 Parameter Measurement Information

**表 7-1. Parameter Description**

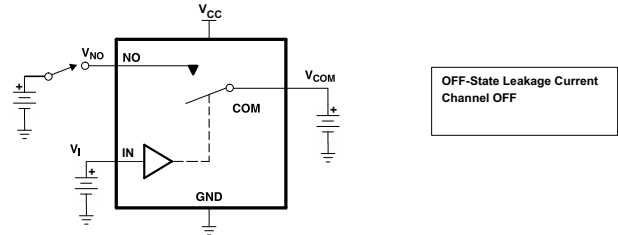
DESCRIPTION	
$V_{COM}$	Voltage at COM.
$V_{NC}$	Voltage at NC.
$V_{NO}$	Voltage at NO.
$r_{on}$	Resistance between COM and NC or NO ports when the channel is ON.
$\Delta r_{on}$	Difference of $r_{on}$ between channels in a specific device.
$r_{on(flat)}$	Difference between the maximum and minimum value of $r_{on}$ in a channel over the specified range of conditions.
$I_{NC(OFF)}$	Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state.
$I_{NC(ON)}$	Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open.
$I_{NO(OFF)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the OFF state.
$I_{NO(ON)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) open.
$I_{COM(OFF)}$	Leakage current measured at the COM port, with the corresponding channel (COM to NC or NO) in the OFF state.
$I_{COM(ON)}$	Leakage current measured at the COM port, with the corresponding channel (COM to NC or NO) in the ON state and the output (NC or NO) open.
$V_{IH}$	Minimum input voltage for logic high for the control input (IN, $\overline{EN}$ ).
$V_{IL}$	Maximum input voltage for logic low for the control input (IN, $\overline{EN}$ ).
$V_I$	Voltage at the control input (IN, $\overline{EN}$ ).
$I_{IH}, I_{IL}$	Leakage current measured at the control input (IN, $\overline{EN}$ ).
$t_{ON}$	Turnon time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (NC or NO) signal when the switch is turning ON.
$t_{OFF}$	Turnoff time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (NC or NO) signal when the switch is turning OFF.
$Q_C$	Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or NO) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge injection, $Q_C = C_L \times \Delta V_{COM}$ , $C_L$ is the load capacitance, and $\Delta V_{COM}$ is the change in analog output voltage.
$C_{NC(OFF)}$	Capacitance at the NC port when the corresponding channel (NC to COM) is OFF.
$C_{NC(ON)}$	Capacitance at the NC port when the corresponding channel (NC to COM) is ON.
$C_{NO(OFF)}$	Capacitance at the NC port when the corresponding channel (NO to COM) is OFF.
$C_{NO(ON)}$	Capacitance at the NC port when the corresponding channel (NO to COM) is ON.
$C_{COM(OFF)}$	Capacitance at the COM port when the corresponding channel (COM to NC) is OFF.
$C_{COM(ON)}$	Capacitance at the COM port when the corresponding channel (COM to NC) is ON.
$C_I$	Capacitance of control input (IN, $\overline{EN}$ ).
$O_{ISO}$	OFF isolation of the switch is a measurement of OFF-state switch impedance. This is measured in dB in a specific frequency, with the corresponding channel (NC to COM) in the OFF state.
$X_{TALK}$	Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel (NC1 to NO1). Adjacent crosstalk is a measure of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC2). This is measured in a specific frequency and in dB.
BW	Bandwidth of the switch. This is the frequency in which the gain of an ON channel is $-3$ dB below the DC gain.
THD	Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio of root mean square (RMS) value of the second, third, and higher harmonic to the absolute magnitude of the fundamental harmonic.
$I_{CC}$	Static power-supply current with the control (IN) pin at $V_{CC}$ or GND.

**TS3A27518E**

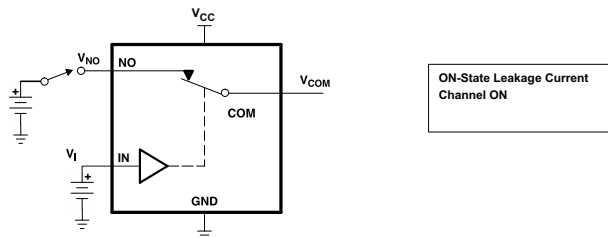
JAJS40F – MARCH 2009 – REVISED DECEMBER 2021



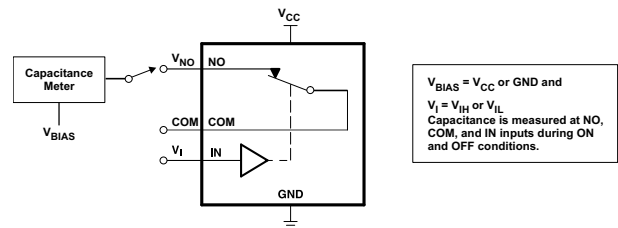
**7-1. ON-State Resistance ( $r_{ON}$ )**



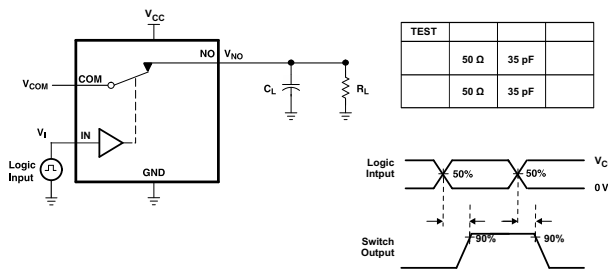
**7-2. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NC(OFF)}$ ,  $I_{COM(PWROFF)}$ ,  $I_{NC(PWROFF)}$ )**



**7-3. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NC(ON)}$ )**



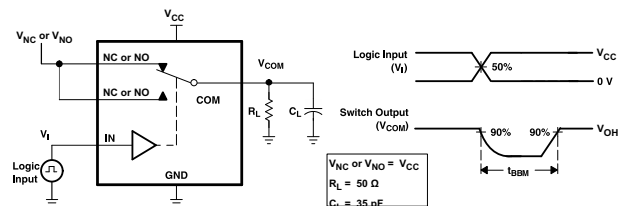
**7-4. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NC(OFF)}$ ,  $C_{NC(ON)}$ )**



All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.

$C_L$  includes probe and jig capacitance.

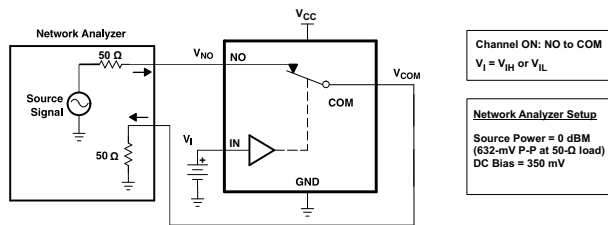
**7-5. Turnon ( $t_{ON}$ ) and Turnoff Time ( $t_{OFF}$ )**



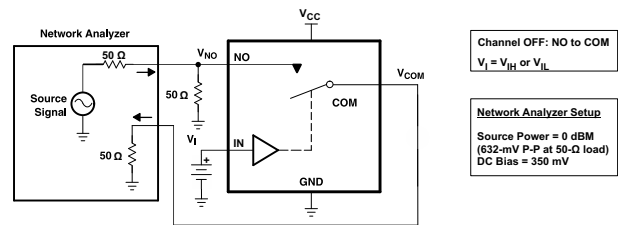
$C_L$  includes probe and jig capacitance.

All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.

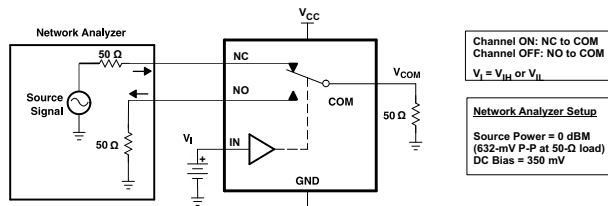
**7-6. Break-Before-Make Time ( $t_{BBM}$ )**



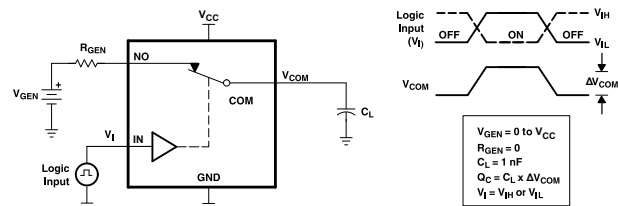
**7-7. Bandwidth (BW)**



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



**7-9. Crosstalk ( $X_{TALK}$ )**

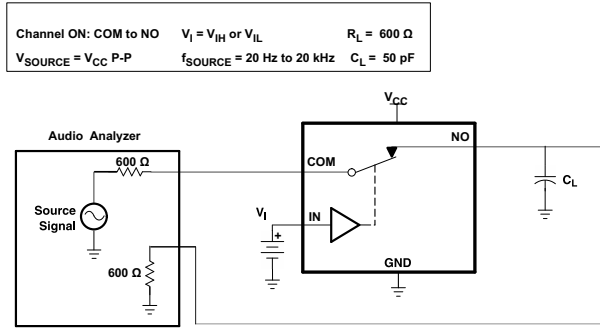


All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.

$C_L$  includes probe and jig capacitance.

**7-10. Charge Injection ( $Q_C$ )**





$C_L$  includes probe and jig capacitance.

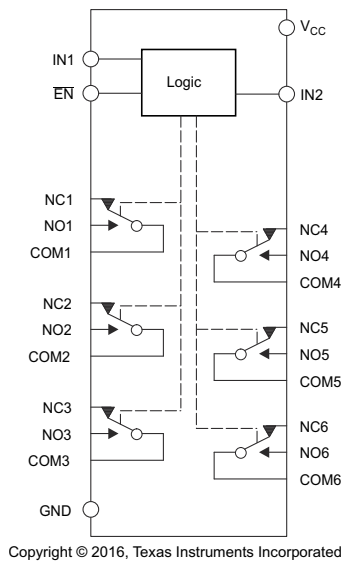
**7-11. Total Harmonic Distortion (THD)**

## 8 Detailed Description

### 8.1 Overview

The TS3A27518E is a bidirectional, 6-channel, 1:2 multiplexer-demultiplexer designed to operate from 1.65 V to 3.6 V. This device can handle both digital and analog signals, and can transmit signals up to  $V_{CC}$  in either direction. The TS3A27518E has two control pins, each controlling three 1:2 muxes at the same time, and an enable pin that puts all outputs in high-impedance mode. The control pins are compatible with 1.8-V logic thresholds and are backward compatible with 2.5-V and 3.3-V logic thresholds.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

The isolation in power-down mode,  $V_{CC} = 0$  feature places all switch paths in high-impedance state (High-Z) when the supply voltage equals 0 V.

### 8.4 Device Functional Modes

The TS3A27518E is a bidirectional device that has two sets of three single-pole double-throw switches. Two digital signals control the 6 channels of the switch; one digital control for each set of three single-pole, double-throw switches. Digital input pin IN1 controls switches 1, 2, and 3, while pin IN2 controls switches 4, 5, and 6.

The TS3A27518 has an  $\overline{EN}$  pin that when set to logic high, it places all channels into a high-impedance or HIGH-Z state. 表 8-1 lists the functions of TS3A27518E.

表 8-1. Function Table

EN	IN1	IN2	NC1/2/3 TO COM1/2/3, COM1/2/3 TO NC1/2/3	NC4/5/6 TO COM4/5/6, COM4/5/6 TO NC4/5/6	NO1/2/3 TO COM1/2/3, COM1/2/3 TO NO1/2/3	NO4/5/6 TO COM4/5/6, COM4/5/6 TO NO4/5/6
H	X	X	OFF	OFF	OFF	OFF
L	L	L	ON	ON	OFF	OFF
L	H	L	OFF	ON	ON	OFF
L	L	H	ON	OFF	OFF	ON
L	H	H	OFF	OFF	ON	ON

## 9 Application and Implementation

### Note

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 switches are bidirectional, so the NO, NC, and COM pins can be used as either inputs or outputs. This functionality allows port expansion to support many different types of bidirectional signal interfaces such as SD, SDIO, GPIO, MMC, and qSPI.

### 9.2 Typical Application

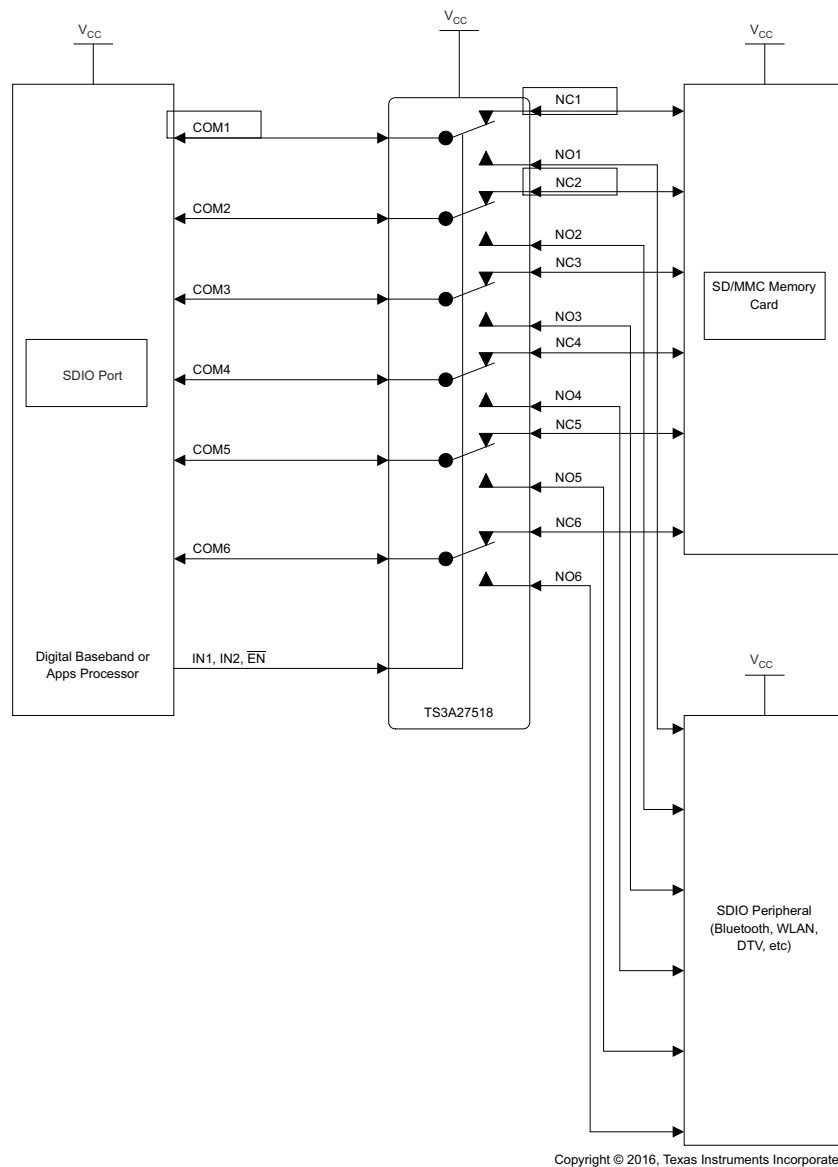


図 9-1. SDIO Expander Application Block Diagram

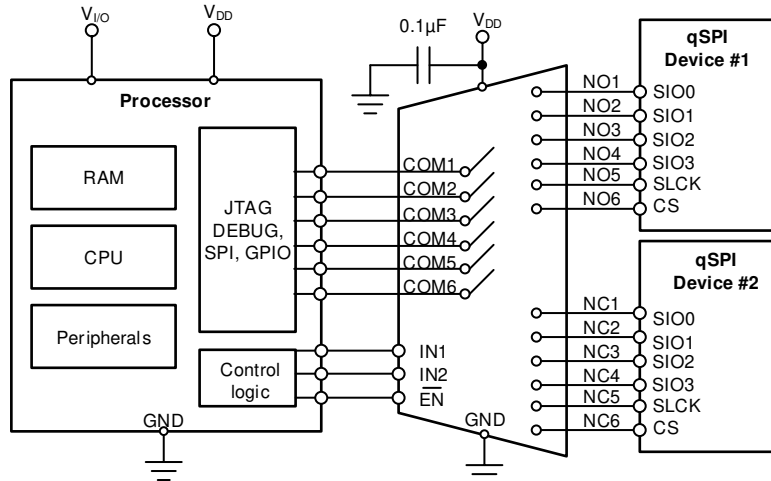


图 9-2. qSPI Expander Application Block Diagram

**9.2.1 Design Requirement**

Ensure that all of the signals passing through the switch are within the recommended operating ranges to ensure proper performance, see [セクション 6.3](#).

**9.2.2 Detailed Design Procedure**

The TS3A27518E can be properly operated without any external components. However, TI recommends connecting unused pins to the ground through a 50-Ω resistor to prevent signal reflections back into the device. TI also recommends that the digital control pins (INX) be pulled up to V<sub>CC</sub> or down to GND to avoid undesired switch positions that could result from the floating pin. Refer to the [Enabling SPI-Based Flash Memory Expansion by Using Multiplexers application brief](#) for more information on using switches and multiplexers for SPI protocol expansion.

For the RTW package, connect the thermal pad to ground.

**9.2.3 Application Curve**

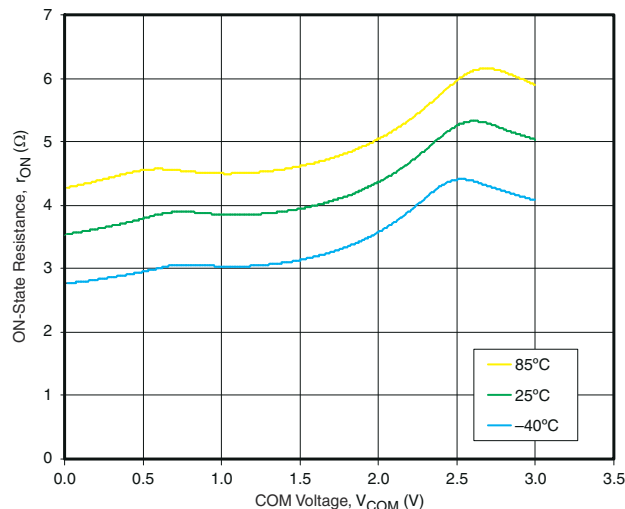


图 9-3. ON-State Resistance vs COM Voltage (V<sub>CC</sub> = 3 V)

## 10 Power Supply Recommendations

TI recommends proper power-supply sequencing 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, NC, 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- $\mu$ F capacitor is adequate for most applications, if connected from  $V_{CC}$  to GND.

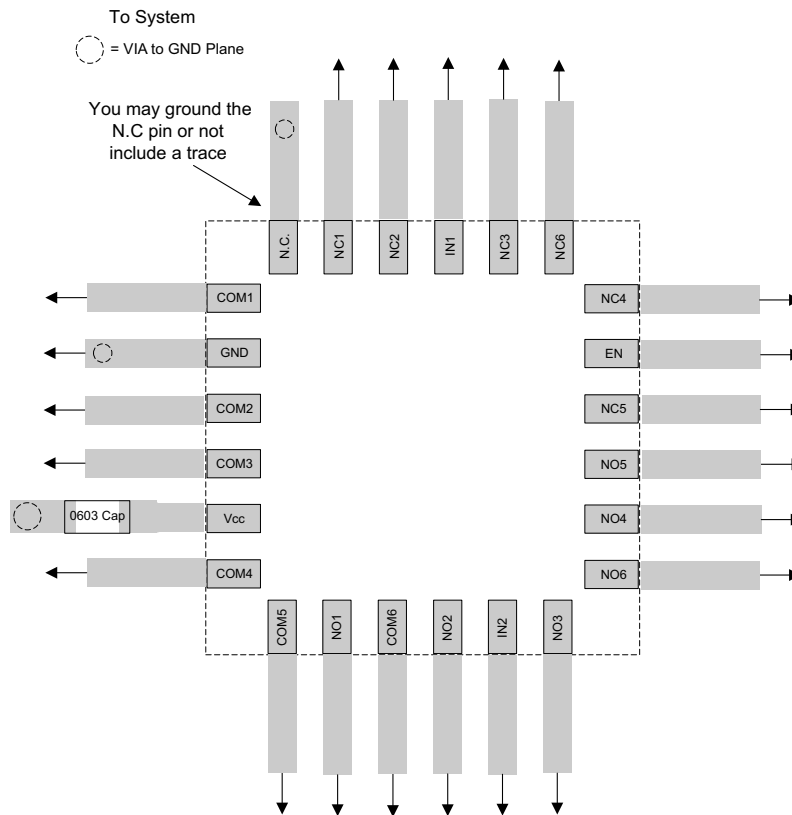
## 11 Layout

### 11.1 Layout Guidelines

To ensure reliability of the device, TI recommends following these common printed-circuit board layout guidelines:

- Bypass capacitors should be used on power supplies, and should be placed as close as possible to the  $V_{CC}$  pin
- Short trace-lengths should be used to avoid excessive loading
- For the RTW package, connect the thermal pad to ground

### 11.2 Layout Example



**11-1. WQFN Layout Recommendation**

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [Enabling SPI-Based Flash Memory Expansion by Using Multiplexers application brief](#)

### 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
TS3A27518EPWR	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YL518E	<a href="#">Samples</a>
TS3A27518ERTWR	ACTIVE	WQFN	RTW	24	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YL518E	<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.

**OBSOLETE:** 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.

**OTHER QUALIFIED VERSIONS OF TS3A27518E :**

- Automotive : [TS3A27518E-Q1](#)

## NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects



**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

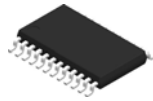
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS3A27518EPWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1
TS3A27518ERTWR	WQFN	RTW	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A27518EPWR	TSSOP	PW	24	2000	356.0	356.0	35.0
TS3A27518ERTWR	WQFN	RTW	24	3000	356.0	356.0	35.0

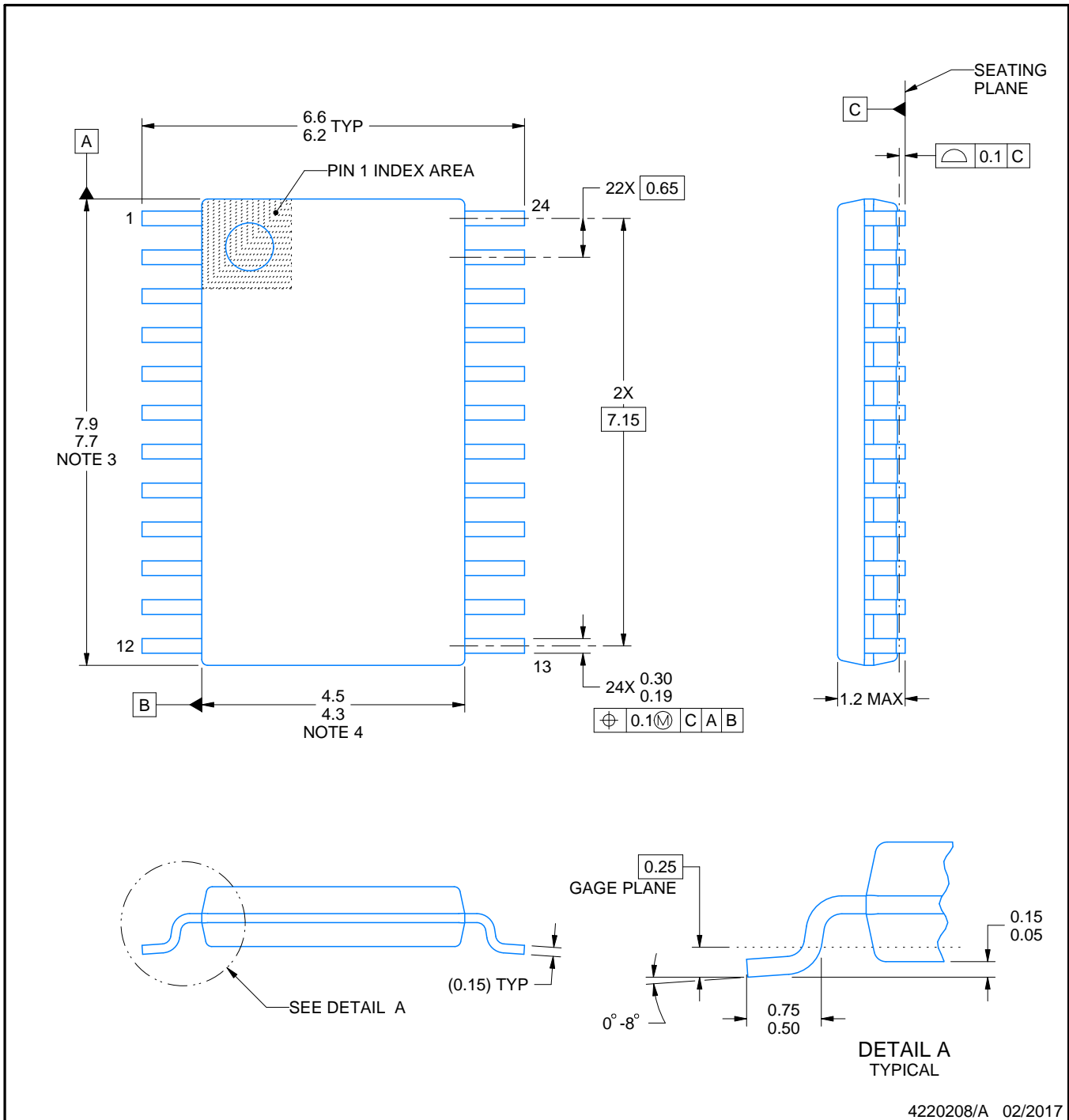
# PW0024A



# PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220208/A 02/2017

### NOTES:

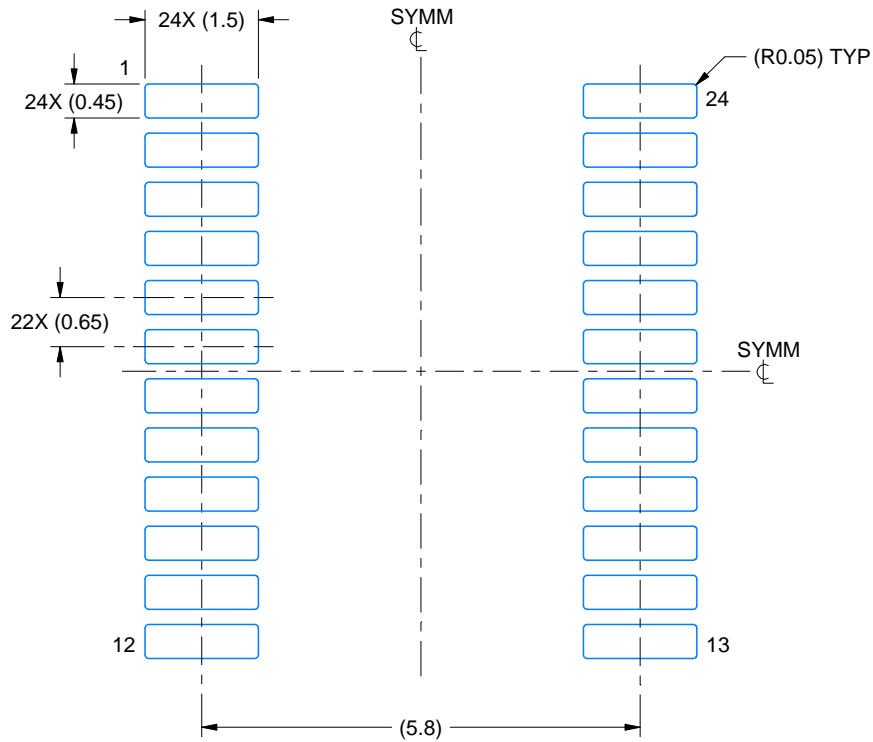
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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-153.

# EXAMPLE BOARD LAYOUT

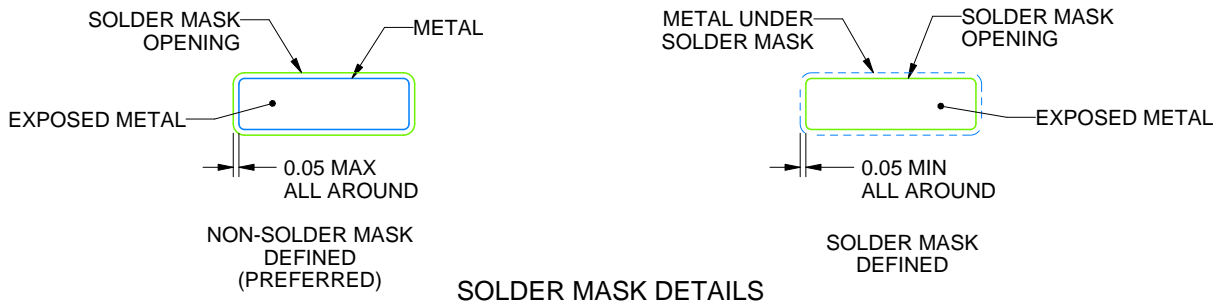
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220208/A 02/2017

NOTES: (continued)

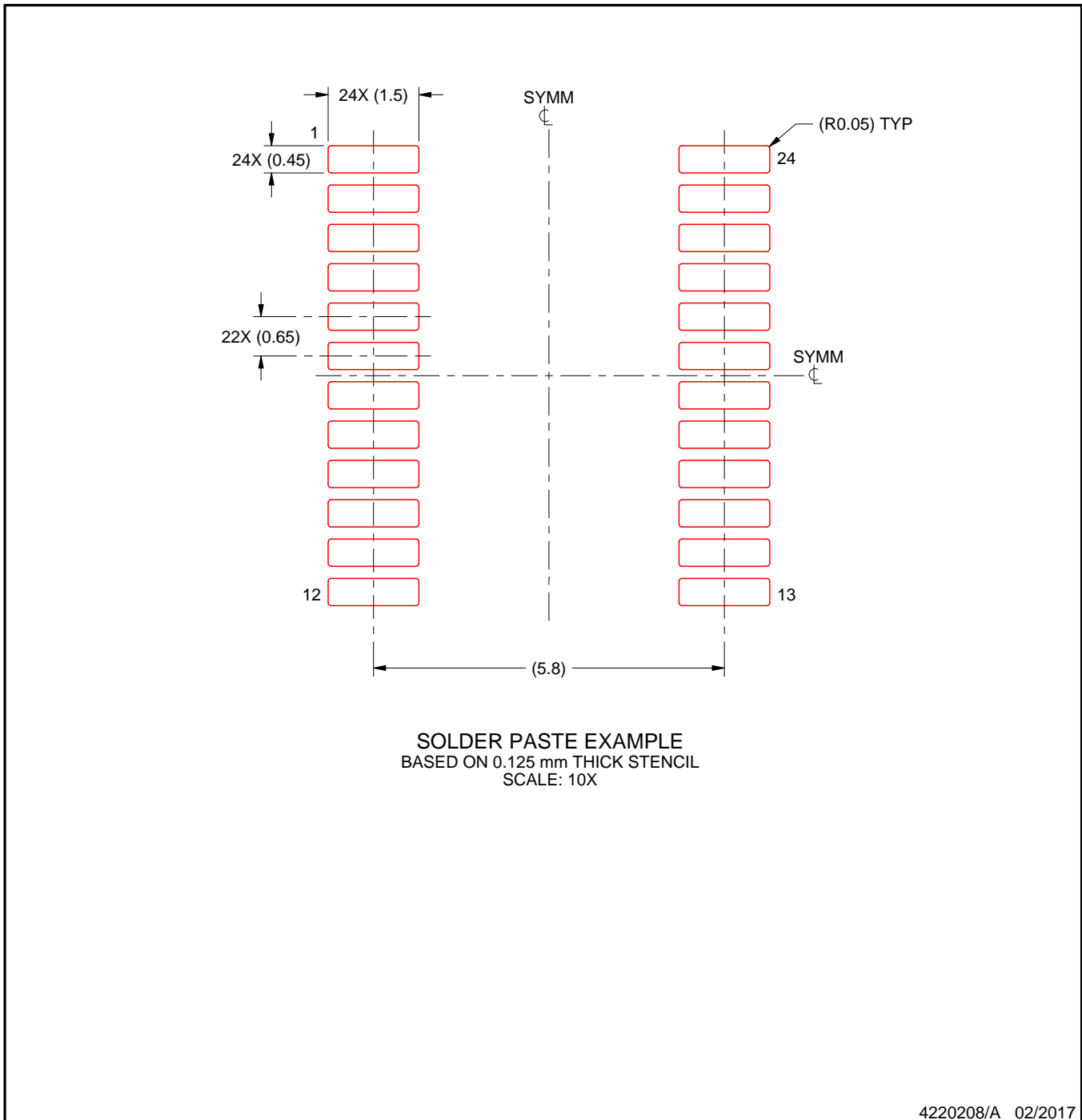
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

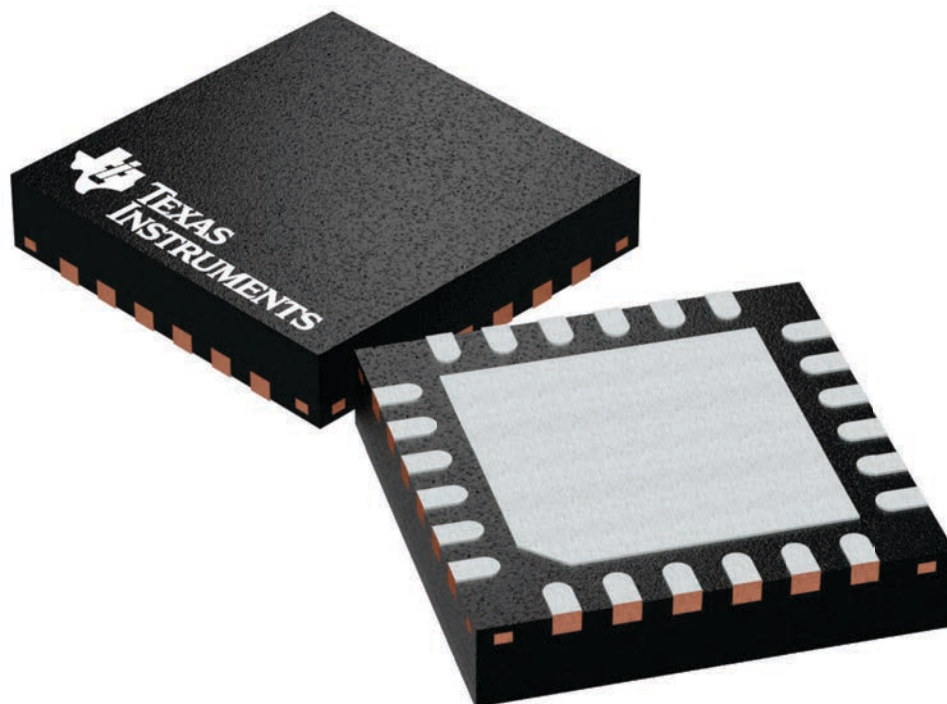
**RTW 24**

**WQFN - 0.8 mm max height**

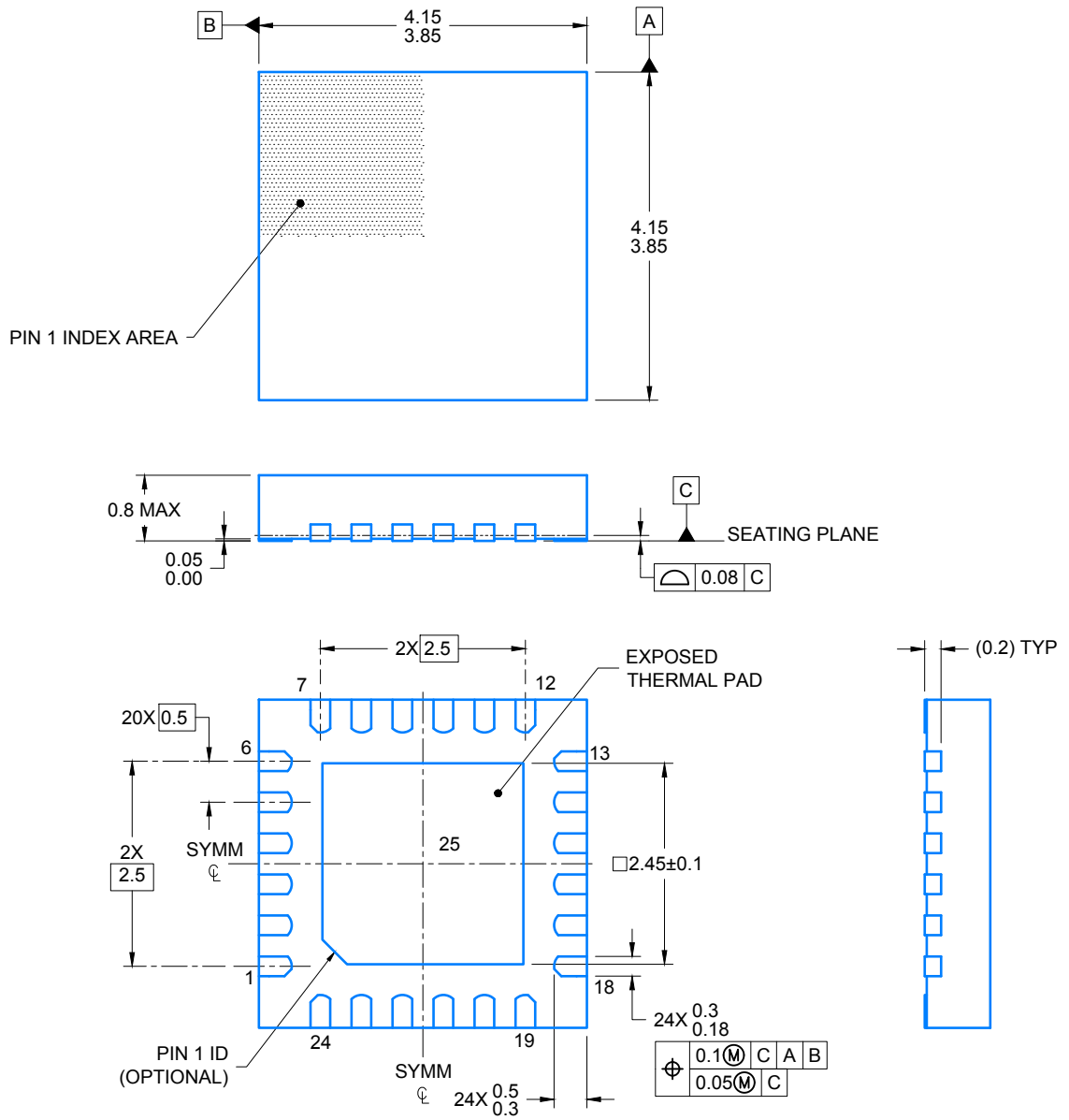
4 x 4, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

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



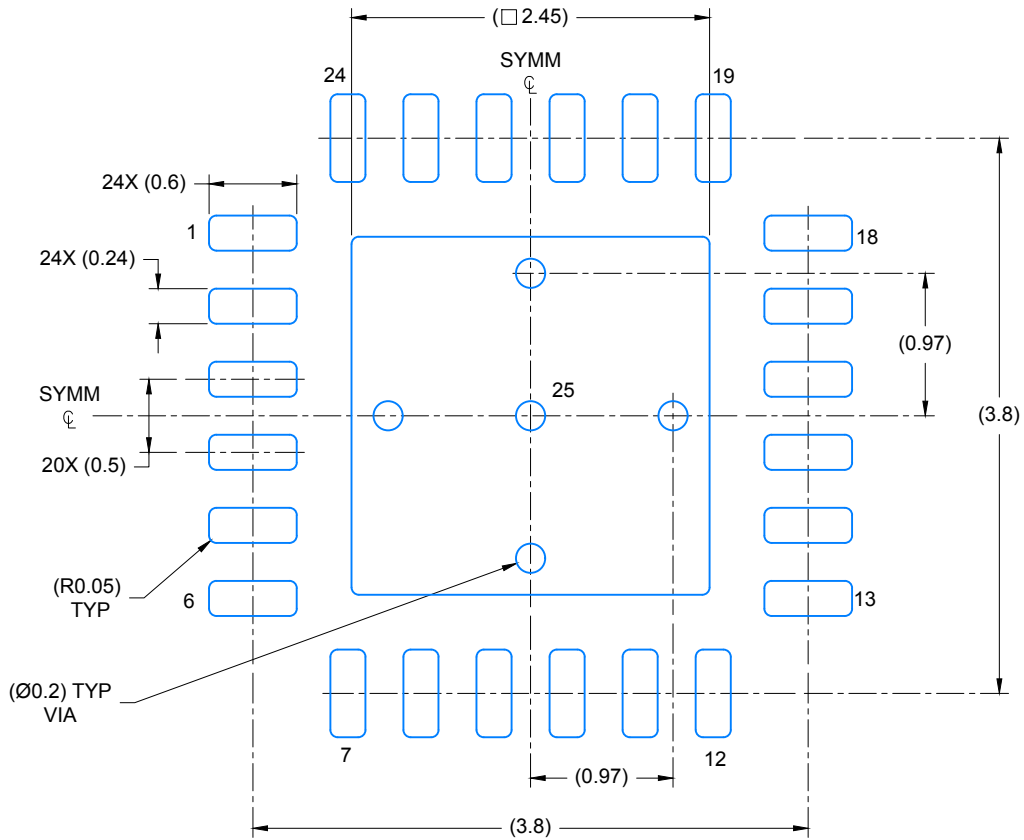
4224801/A



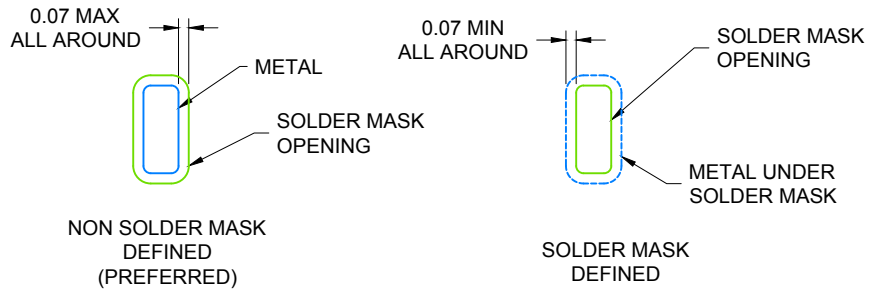
4219135/B 11/2016

**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.



LAND PATTERN EXAMPLE  
SCALE: 20X



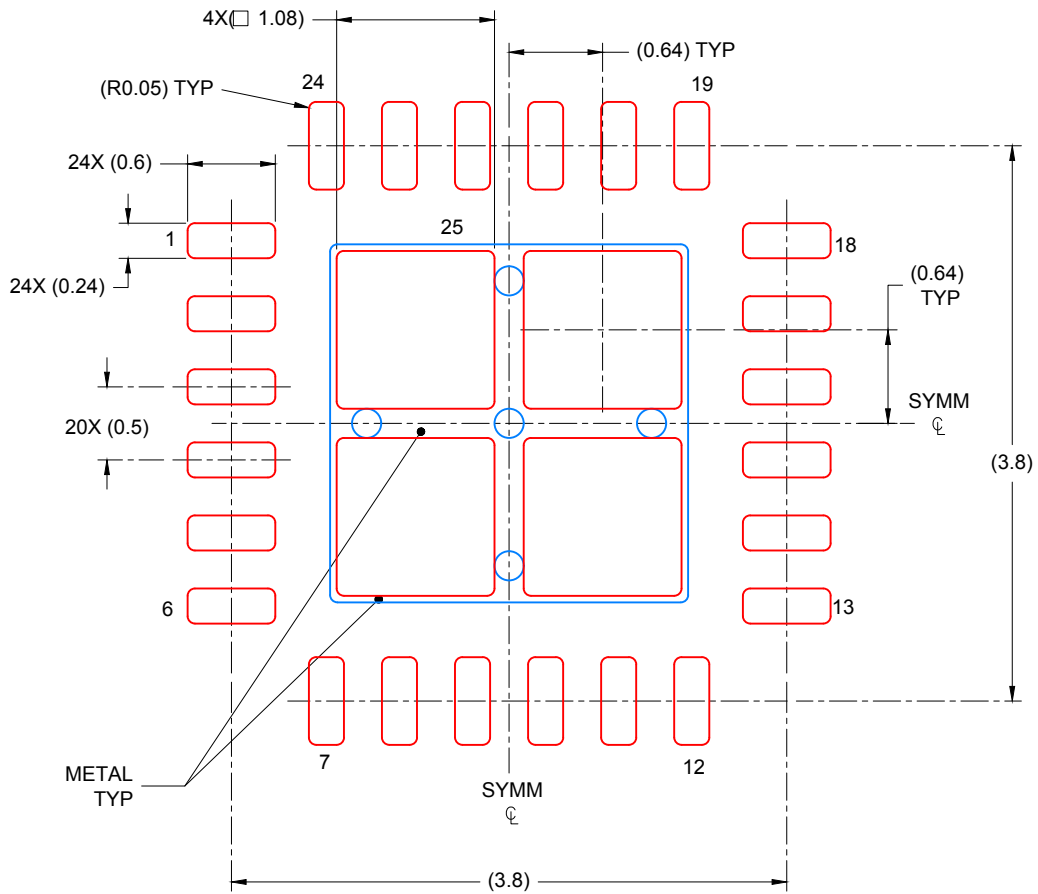
SOLDER MASK DETAILS

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NOTES: (continued)

- For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sl原因271](http://www.ti.com/lit/sl原因271)).





SOLDER PASTE EXAMPLE  
 BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 25:  
 78% PRINTED COVERAGE BY AREA UNDER PACKAGE  
 SCALE: 20X

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NOTES: (continued)

4. 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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