

# TS3A4751 0.9Ω、低電圧、単電源、クワッド SPST アナログ・スイッチ

## 1 特長

- 低いオン抵抗 ( $R_{ON}$ )
  - 最大値 0.9Ω (3V 電源)
  - 最大値 1.5Ω (1.8V 電源)
- $R_{ON}$  の平坦性: 最大 0.4Ω (3V)
- $R_{ON}$  のチャンネル間ばらつき
  - 最大値 0.05Ω (3V 電源)
  - 最大値 0.15Ω (1.8V 電源)
- 1.6V~3.6V の単一電源で動作
- 1.8V CMOS ロジックと互換 (3V 電源)
- 大電流処理能力 (連続 100mA)
- 高速スイッチング:  $t_{ON} = 5ns$ ,  $t_{OFF} = 4ns$
- デジタルとアナログの両方のアプリケーションに対応
- JESD 22 を超える ESD 保護
  - 人体モデルで  $\pm 4000V$  (A114-A)
  - マシン・モデルで 300V (A115-A)
  - 荷電デバイス・モデルで  $\pm 1000V$  (C101)

## 2 アプリケーション

- 電カルーティング
- バッテリー駆動システム
- 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
- 通信回路
- PCMCIA カード
- 携帯電話
- モデム
- ハードディスク

## 3 概要

TS3A4751 デバイスは双方向、4 チャンネル、常時開 (NO) の単極単投 (SPST) アナログ・スイッチで、1.6V~3.6V の単一電源で動作します。このデバイスはスイッチングが高速で、レール・ツー・レールのアナログ信号を扱うことができ、静止電力の消費が非常に小さいのが特長です。

3V 電源を使用するとき、デジタル入力は 1.8V CMOS 互換です。

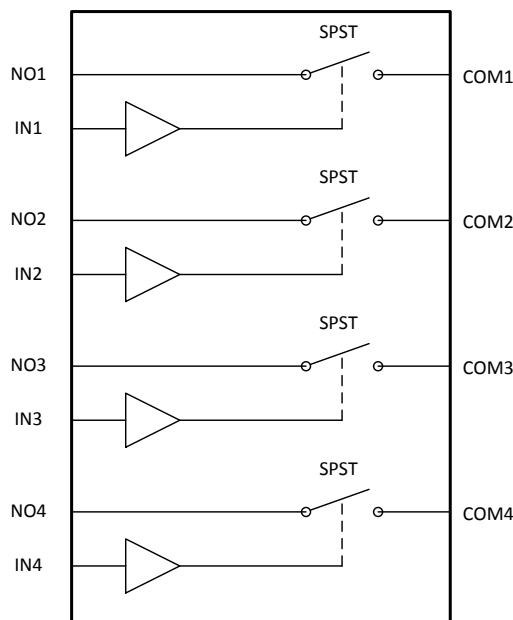
TS3A4751 デバイスには 4 つの常時開 (NO) スイッチがあります。TS3A4751 は、14 ピンのシン・シュリンク・スモールアウトライン・パッケージ (TSSOP) と、省スペースの 14 ピン VQFN (RGY) およびマイクロ X2QFN (RUC) パッケージで供給されます。

### 製品情報<sup>(1)</sup>

型番	パッケージ	本体サイズ(公称)
TS3A4751	TSSOP (14)	5.00mmx4.40mm
	VQFN (14)	3.50mmx3.50mm
	X2QFN (14)	2.00mmx2.00mm

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

### 概略回路図



## 目次

1	特長	1	7.3	Feature Description	13
2	アプリケーション	1	7.4	Device Functional Modes	13
3	概要	1	<b>8</b>	<b>Application and Implementation</b>	<b>14</b>
4	改訂履歴	2	8.1	Application Information	14
5	<b>Pin Configuration and Functions</b>	<b>3</b>	8.2	Typical Application	14
6	<b>Specifications</b>	<b>4</b>	<b>9</b>	<b>Power Supply Recommendations</b>	<b>16</b>
6.1	Absolute Maximum Ratings	4	<b>10</b>	<b>Layout</b>	<b>16</b>
6.2	ESD Ratings	4	10.1	Layout Guidelines	16
6.3	Recommended Operating Conditions	5	10.2	Layout Example	16
6.4	Thermal Information	5	<b>11</b>	<b>デバイスおよびドキュメントのサポート</b>	<b>17</b>
6.5	Electrical Characteristics for 1.8-V Supply	6	11.1	ドキュメントの更新通知を受け取る方法	17
6.6	Electrical Characteristics for 3-V Supply	7	11.2	コミュニティ・リソース	17
6.7	Typical Characteristics	10	11.3	商標	17
<b>7</b>	<b>Detailed Description</b>	<b>13</b>	11.4	静電気放電に関する注意事項	17
7.1	Overview	13	11.5	Glossary	17
7.2	Functional Block Diagram	13	<b>12</b>	<b>メカニカル、パッケージ、および注文情報</b>	<b>17</b>

## 4 改訂履歴

### Revision E (January 2015) から Revision F に変更

**Page**

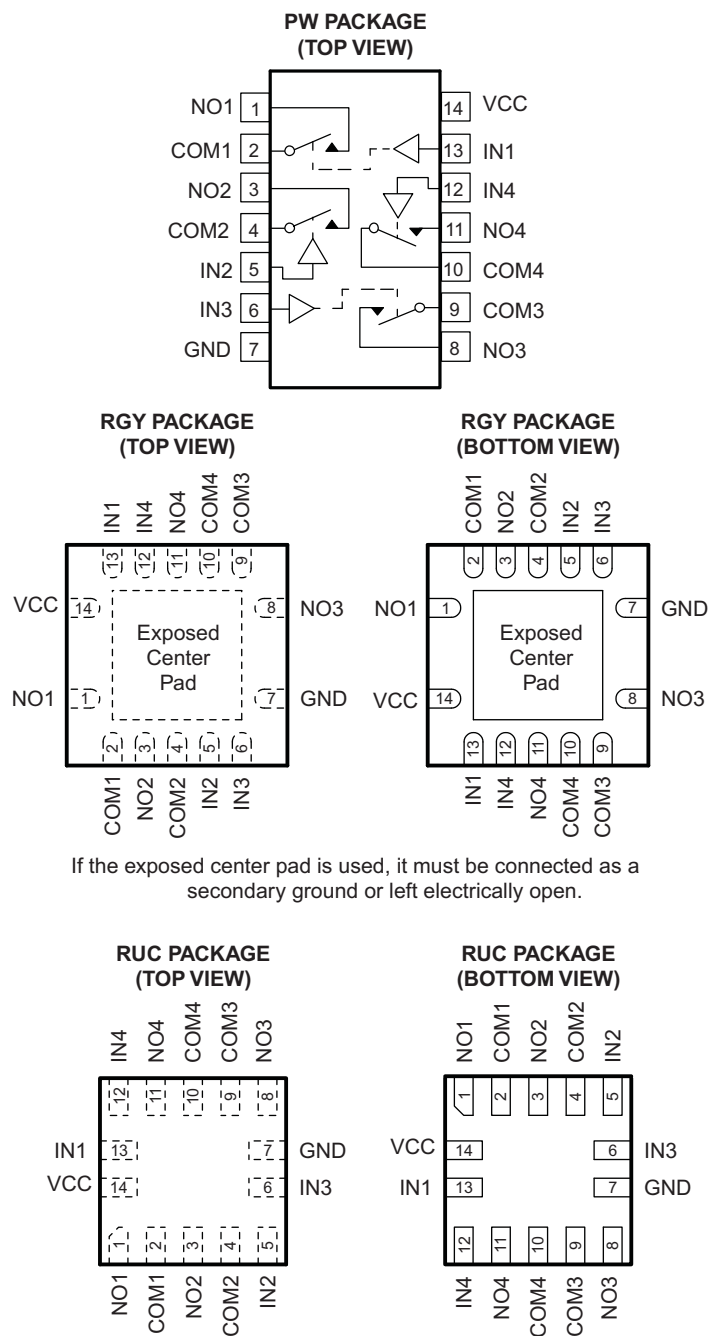
- Changed Supply Voltage from: 3.3 V to: 3.6 V in the *Recommended Operating Conditions* ..... **5**

### Revision D (July 2008) から Revision E に変更

**Page**

- 「ピン構成および機能」セクション、「ESD 定格」表、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」セクション 追加 ..... **1**

## 5 Pin Configuration and Functions



If the exposed center pad is used, it must be connected as a secondary ground or left electrically open.

### Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	NO1	I/O	Normally open signal path
2	COM1	I/O	Common signal path
3	NO2	I/O	Normally open signal path
4	COM2	I/O	Common signal path
5	IN2	I	Logic control input
6	IN3	I	Logic control input
7	GND	—	Ground
8	NO3	I/O	Normally open signal path
9	COM3	I/O	Common signal path
10	COM4	I/O	Common signal path
11	NO4	I/O	Normally open signal path
12	IN4	I	Logic control input
13	IN1	I	Logic control input
14	V <sub>CC</sub>	I	Positive supply voltage

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage referenced to GND <sup>(2)</sup>	−0.3	4	V	
V <sub>NO</sub> V <sub>COM</sub> V <sub>IN</sub>	Analog and digital voltage	−0.3	V <sub>CC</sub> + 0.3	V	
I <sub>NO</sub> I <sub>COM</sub>	On-state switch current	V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>CC</sub>		−100 100	mA
I <sub>CC</sub> I <sub>GND</sub>	Continuous current through V <sub>CC</sub> or GND		±100	mA	
V	Peak current pulsed at 1 ms, 10% duty cycle		±200	mA	
T <sub>A</sub>	Operating temperature	−40	85	°C	
T <sub>J</sub>	Junction temperature		150	°C	
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, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) Signals on COM or NO exceeding V<sub>CC</sub> or GND are clamped by internal diodes. Limit forward diode current to maximum current rating.

### 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>	±4000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 or ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup>	±1000
		Machine Model	±300

(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 <sub>CC</sub>	Supply Voltage	1.65	3.6	V
V <sub>NO</sub> V <sub>COM</sub> V <sub>IN</sub>	Analog and digital voltage range	0	V <sub>CC</sub>	V

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	TS3A4751			UNIT	
	PW	RGY	RUC		
	14 PINS				
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	132.3	68.5	196.4	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	60.6	83.1	73.9	
R <sub>θJB</sub>	Junction-to-board thermal resistance	74.2	44.6	130.7	
ψ <sub>JT</sub>	Junction-to-top characterization parameter	11.2	7.8	2.1	
ψ <sub>JB</sub>	Junction-to-board characterization parameter	73.6	44.7	130.6	
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	N/A	24.6	N/A	

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

## 6.5 Electrical Characteristics for 1.8-V Supply

 $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ ,  $V_{IH} = 1 \text{ V}$ ,  $V_{IL} = 0.4 \text{ V}$  (unless otherwise noted)<sup>(1) (2)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP <sup>(3)</sup>	MAX	UNIT
<b>ANALOG SWITCH</b>								
$V_{COM}, V_{NO}$	Analog signal range				0		$V_{CC}$	V
$R_{on}$	ON-state resistance	$V_{CC} = 1.8 \text{ V}$ , $I_{COM} = -10 \text{ mA}$ , $V_{NO} = 0.9 \text{ V}$		25°C		1	1.5	$\Omega$
				Full			2	
$\Delta R_{on}$	ON-state resistance match between channels <sup>(4)</sup>	$V_{CC} = 1.8 \text{ V}$ , $I_{COM} = -10 \text{ mA}$ , $V_{NO} = 0.9 \text{ V}$		25°C		0.09	0.15	$\Omega$
				Full			0.25	
$R_{on(Flat)}$	ON-state resistance flatness <sup>(5)</sup>	$V_{CC} = 1.8 \text{ V}$ , $I_{COM} = -10 \text{ mA}$ , $0 \leq V_{NO} \leq V_{CC}$		25°C		0.7	0.9	$\Omega$
				Full			1.5	
$I_{NO(OFF)}$	NO OFF leakage current <sup>(6)</sup>	$V_{CC} = 1.95 \text{ V}$ , $V_{COM} = 0.15 \text{ V}$ , $1.65 \text{ V}$ , $V_{NO} = 1.8 \text{ V}$ , $0.15 \text{ V}$		25°C	-1	0.5	1	nA
				Full	-10		10	
$I_{COM(OFF)}$	COM OFF leakage current <sup>(6)</sup>	$V_{CC} = 1.95 \text{ V}$ , $V_{COM} = 0.15 \text{ V}$ , $1.65 \text{ V}$ , $V_{NO} = 1.65 \text{ V}$ , $0.15 \text{ V}$		25°C	-1	0.5	1	nA
				Full	-10		10	
$I_{COM(ON)}$	COM ON leakage current <sup>(6)</sup>	$V_{CC} = 1.95 \text{ V}$ , $V_{COM} = 0.15 \text{ V}$ , $1.65 \text{ V}$ , $V_{NO} = 0.15 \text{ V}$ , $1.65 \text{ V}$ , or floating		25°C	-1	0.01	1	nA
				Full	-3		3	
<b>DYNAMIC</b>								
$t_{ON}$	Turn-on time	$V_{NO} = 1.5 \text{ V}$ , $R_L = 50 \Omega$ , $C_L = 35 \text{ pF}$ , See <a href="#">Figure 1</a>		25°C		6	18	ns
				Full			20	
$t_{OFF}$	Turn-off time	$V_{NO} = 1.5 \text{ V}$ , $R_L = 50 \Omega$ , $C_L = 35 \text{ pF}$ , See <a href="#">Figure 1</a>		25°C		5	10	ns
				Full			12	
$Q_C$	Charge injection	$V_{GEN} = 0$ , $R_{GEN} = 0$ , $C_L = 1 \text{ nF}$ , See <a href="#">Figure 5</a>		25°C		3.2		pC
$C_{NO(OFF)}$	NO OFF capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>		25°C		23		pF
$C_{COM(OFF)}$	COM OFF capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>		25°C		20		pF
$C_{COM(ON)}$	COM ON capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>		25°C		43		pF
BW	Bandwidth	$R_L = 50 \Omega$ , Switch ON		25°C		123		MHz
$O_{ISO}$	OFF isolation <sup>(7)</sup>	$R_L = 50 \Omega$ , $C_L = 5 \text{ pF}$ , See <a href="#">Figure 3</a>		25°C	$f = 1 \text{ MHz}$	-61		dB
					$f = 10 \text{ MHz}$	-36		
$X_{TALK}$	Crosstalk	$R_L = 50 \Omega$ , $C_L = 5 \text{ pF}$ , See <a href="#">Figure 3</a>		25°C	$f = 10 \text{ MHz}$	-95		dB
					$f = 100 \text{ MHz}$	-73		
THD	Total harmonic distortion	$f = 20 \text{ Hz to } 20 \text{ kHz}$ , $V_{COM} = 2 V_{P-P}$		25°C	$R_L = 32 \Omega$	0.14%		
					$R_L = 600 \Omega$	0.013%		
<b>DIGITAL CONTROL INPUTS (IN1-IN4)</b>								
$V_{IH}$	Input logic high			Full		1		V
$V_{IL}$	Input logic low			Full			0.4	V
$I_{IN}$	Input leakage current	$V_I = 0$ or $V_{CC}$		25°C		0.1	5	nA
				Full		-10	10	
<b>SUPPLY</b>								
$V_{CC}$	Power-supply range					1.6	3.6	V
$I_{CC}$	Positive-supply current	$V_I = 0$ or $V_{CC}$		25°C			0.05	$\mu\text{A}$
				Full			0.5	

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

(2) Parts are tested at 85°C and specified by design and correlation over the full temperature range.

(3) Typical values are at  $T_A = 25^\circ\text{C}$ .

(4)  $\Delta r_{on} = r_{on(max)} - r_{on(min)}$

(5) Flatness is defined as the difference between the maximum and minimum value of  $r_{on}$  as measured over the specified analog signal ranges.

(6) Leakage parameters are 100% tested at the maximum-rated hot operating temperature and specified by correlation at  $T_A = 25^\circ\text{C}$ .

(7) OFF isolation =  $20_{\log} 10 (V_{COM}/V_{NO})$ ,  $V_{COM}$  = output,  $V_{NO}$  = input to OFF switch

## 6.6 Electrical Characteristics for 3-V Supply

 $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ ,  $V_{IH} = 1.4 \text{ V}$ ,  $V_{IL} = 0.5 \text{ V}$  (unless otherwise noted).<sup>(1) (2)</sup>

PARAMETER		TEST CONDITIONS	$T_A$	MIN	TYP <sup>(3)</sup>	MAX	UNIT
<b>ANALOG SWITCH</b>							
$V_{COM}, V_{NO}$	Analog signal range			0		$V_{CC}$	V
$R_{on}$	ON-state resistance	$V_{CC} = 2.7 \text{ V}$ , $I_{COM} = -100 \text{ mA}$ , $V_{NO} = 1.5 \text{ V}$	25°C		0.7	0.9	$\Omega$
			Full			1.1	
$\Delta R_{on}$	ON-state resistance match between channels <sup>(4)</sup>	$V_{CC} = 2.7 \text{ V}$ , $I_{COM} = -100 \text{ mA}$ , $V_{NO} = 1.5 \text{ V}$	25°C		0.03	0.05	$\Omega$
			Full			0.15	
$R_{on(Flat)}$	ON-state resistance flatness <sup>(5)</sup>	$V_{CC} = 2.7 \text{ V}$ , $I_{COM} = -100 \text{ mA}$ , $V_{NO} = 1 \text{ V}, 1.5 \text{ V}, 2 \text{ V}$	25°C		0.23	0.4	$\Omega$
			Full			0.5	
$I_{NO(OFF)}$	NO OFF leakage current <sup>(6)</sup>	$V_{CC} = 3.6 \text{ V}$ , $V_{COM} = 0.3 \text{ V}, 3 \text{ V}$ , $V_{NO} = 3 \text{ V}, 0.3 \text{ V}$	25°C		-2	1	nA
			Full		-18	18	
$I_{COM(OFF)}$	COM OFF leakage current <sup>(6)</sup>	$V_{CC} = 3.6 \text{ V}$ , $V_{COM} = 0.3 \text{ V}, 3 \text{ V}$ , $V_{NO} = 3 \text{ V}, 0.3 \text{ V}$	25°C		-2	1	nA
			Full		-18	18	
$I_{COM(ON)}$	COM ON leakage current <sup>(6)</sup>	$V_{CC} = 3.6 \text{ V}$ , $V_{COM} = 0.3 \text{ V}, 3 \text{ V}$ , $V_{NO} = 0.3 \text{ V}, 3 \text{ V}$ , or floating	25°C		-2.5	0.01	nA
			Full		-5	5	
<b>DYNAMIC</b>							
$t_{ON}$	Turn-on time	$V_{NO} = 1.5 \text{ V}$ , $R_L = 50 \Omega$ , $C_L = 35 \text{ pF}$ , See <a href="#">Figure 1</a>	25°C		5	14	ns
			Full			15	
$t_{OFF}$	Turn-off time	$V_{NO} = 1.5 \text{ V}$ , $R_L = 50 \Omega$ , $C_L = 35 \text{ pF}$ , See <a href="#">Figure 1</a>	25°C		4	9	ns
			Full			10	
$Q_C$	Charge injection	$V_{GEN} = 0$ , $R_{GEN} = 0$ , $C_L = 1 \text{ nF}$ , See <a href="#">Figure 5</a>	25°C		3		pC
$C_{NO(OFF)}$	NO OFF capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>	25°C		23		pF
$C_{COM(OFF)}$	COM OFF capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>	25°C		20		pF
$C_{COM(ON)}$	COM ON capacitance	$f = 1 \text{ MHz}$ , See <a href="#">Figure 2</a>	25°C		43		pF
BW	Bandwidth	$R_L = 50 \Omega$ , Switch ON	25°C		125		MHz
$O_{ISO}$	OFF isolation <sup>(7)</sup>	$R_L = 50 \Omega$ , $C_L = 5 \text{ pF}$ , See <a href="#">Figure 3</a>	f = 10 MHz	25°C	-40		dB
			f = 1 MHz		-62		
$X_{TALK}$	Crosstalk	$R_L = 50 \Omega$ , $C_L = 5 \text{ pF}$ , See <a href="#">Figure 3</a>	f = 10 MHz	25°C	-73		dB
			f = 1 MHz		-95		
THD	Total harmonic distortion	$f = 20 \text{ Hz to } 20 \text{ kHz}$ , $V_{COM} = 2 V_{P-P}$	$R_L = 32 \Omega$	25°C	0.04%		
			$R_L = 600 \Omega$		0.003%		
<b>DIGITAL CONTROL INPUTS (IN1–IN4)</b>							
$V_{IH}$	Input logic high		Full		1.4		V
$V_{IL}$	Input logic low		Full			0.5	V
$I_{IN}$	Input leakage current	$V_I = 0 \text{ or } V_{CC}$	25°C		0.5	1	nA
			Full		-20	20	
<b>SUPPLY</b>							
$V_{CC}$	Power-supply range				1.6	3.6	V
$I_{CC}$	Positive-supply current	$V_{CC} = 3.6 \text{ V}$ , $V_{IN} = 0 \text{ or } V_{CC}$	25°C			0.075	$\mu\text{A}$
			Full			0.75	

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

(2) Parts are tested at 85°C and specified by design and correlation over the full temperature range.

(3) Typical values are at  $V_{CC} = 3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

(4)  $\Delta r_{on} = r_{on(max)} - r_{on(min)}$

(5) Flatness is defined as the difference between the maximum and minimum value of  $r_{on}$  as measured over the specified analog signal ranges.

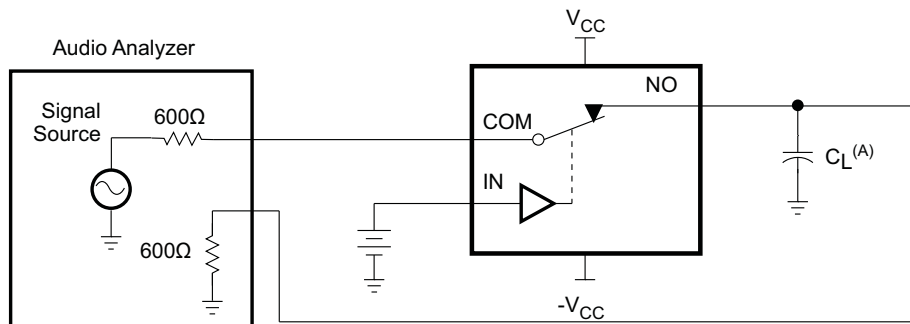
(6) Leakage parameters are 100% tested at the maximum-rated hot operating temperature and specified by correlation at  $T_A = 25^\circ\text{C}$ .

(7) OFF isolation =  $20_{\log} 10 (V_{COM}/V_{NO})$ ,  $V_{COM}$  = output,  $V_{NO}$  = input to OFF switch





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



A.  $C_L$  includes probe and jig capacitance.

Figure 4. Total Harmonic Distortion (THD)

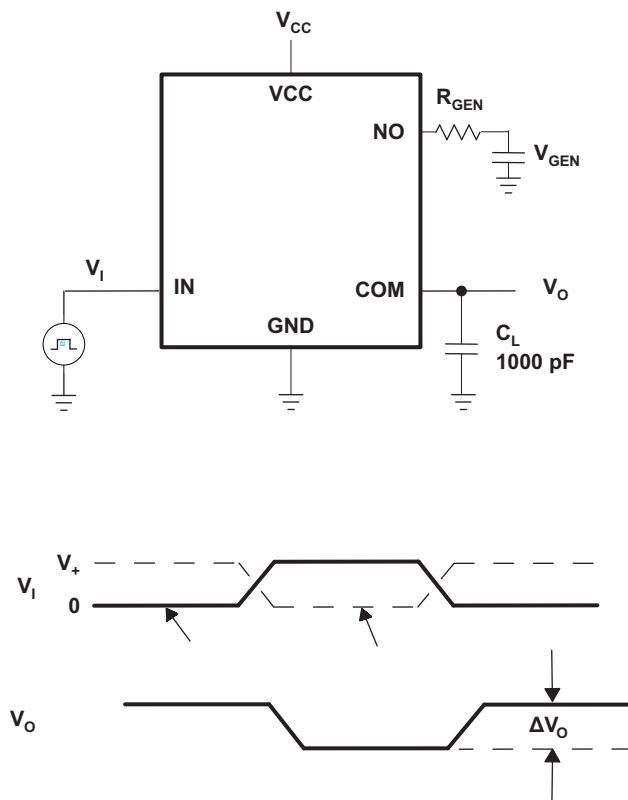
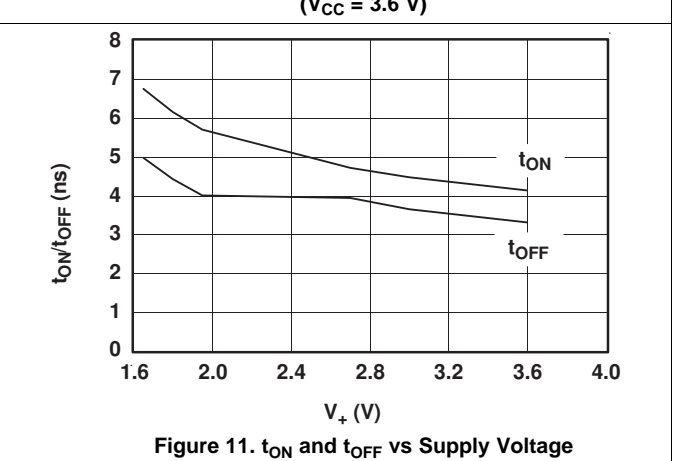
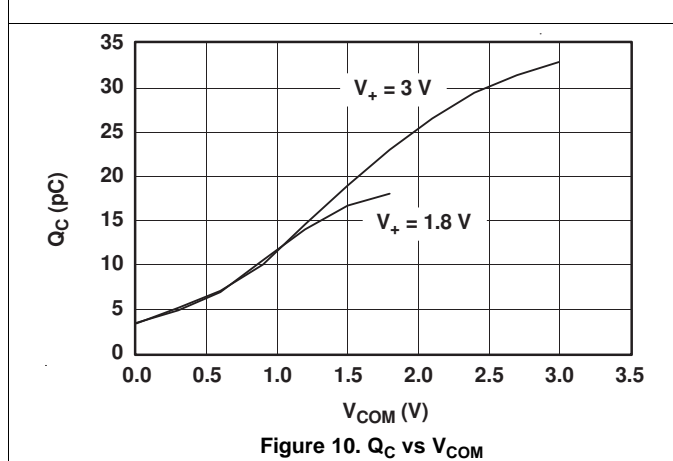
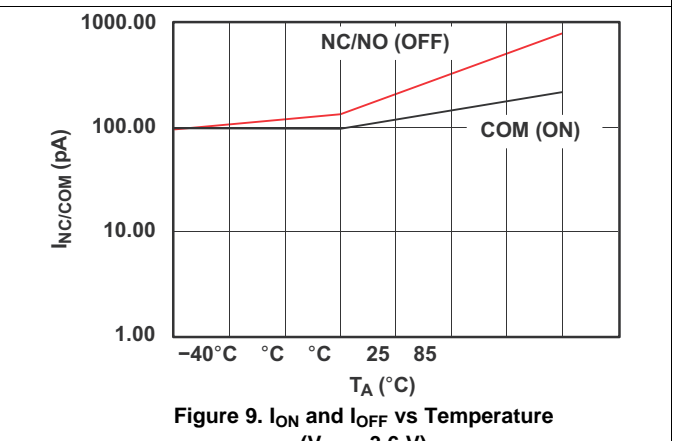
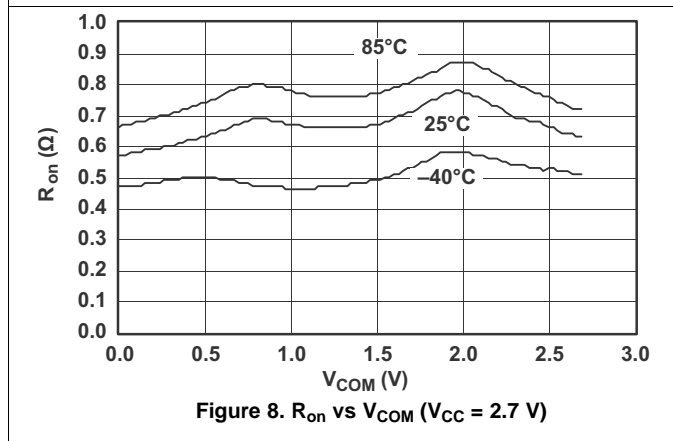
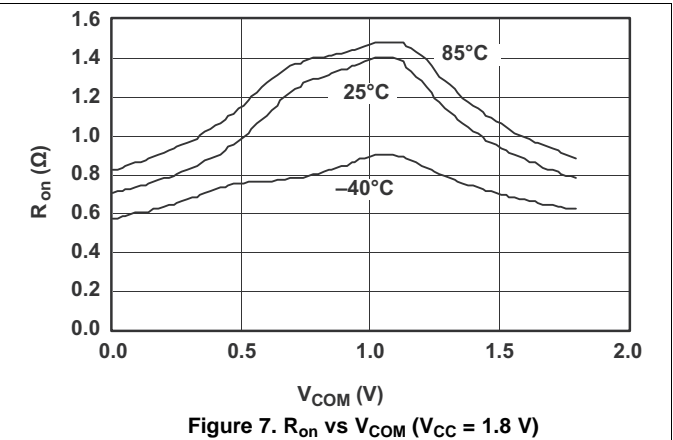
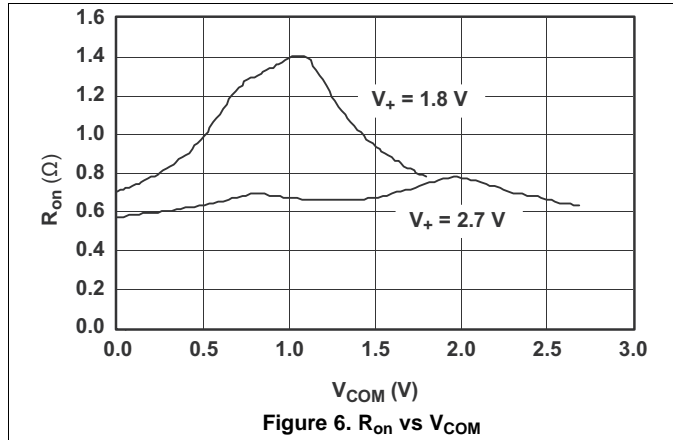
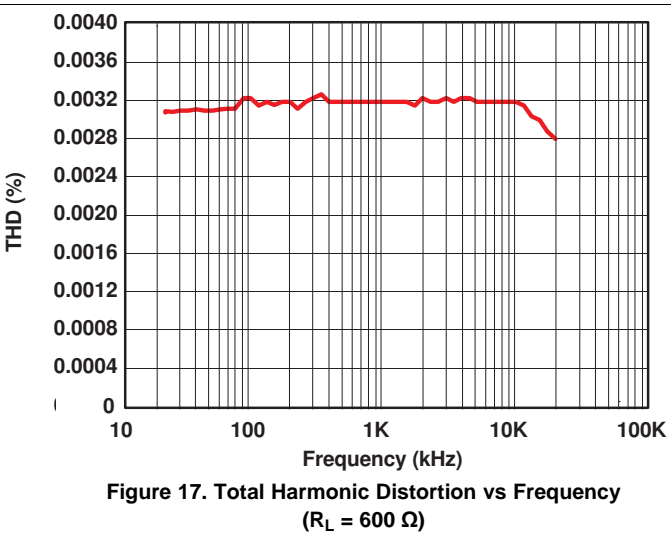
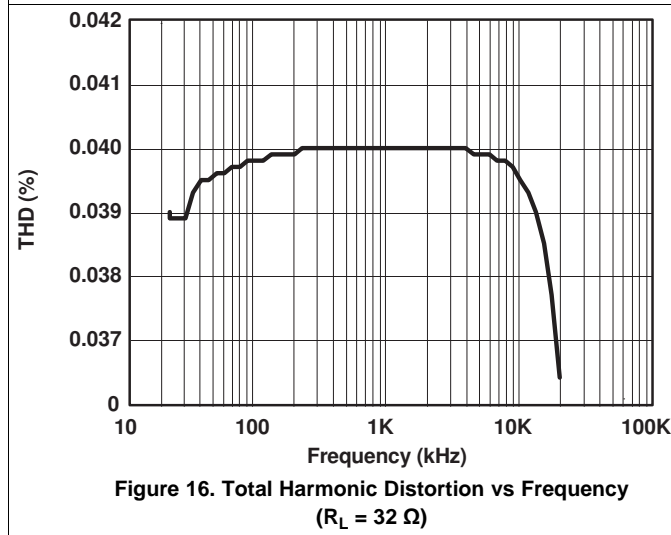
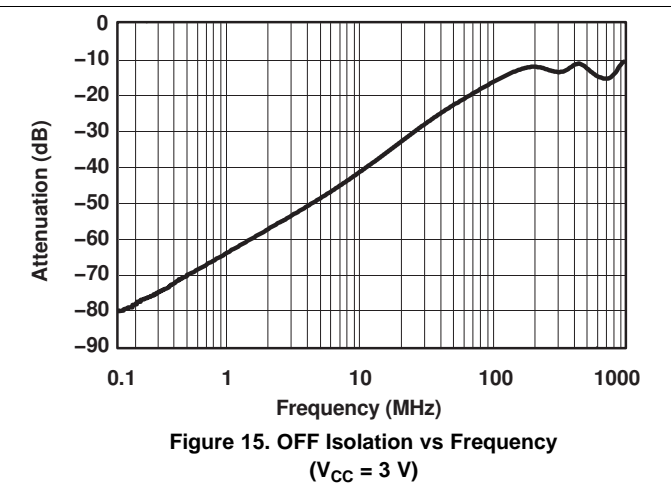
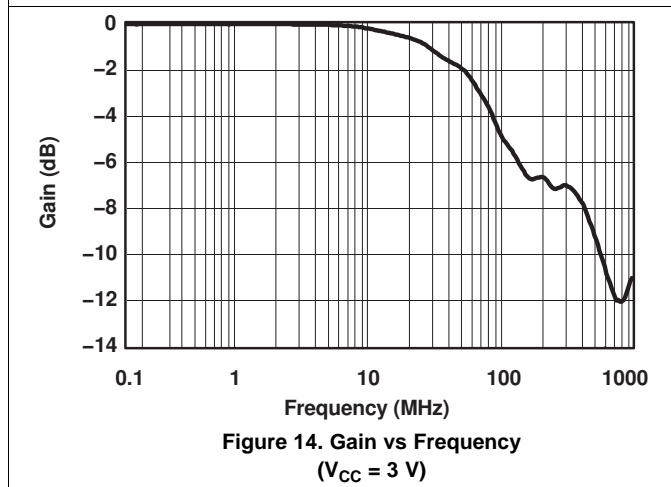
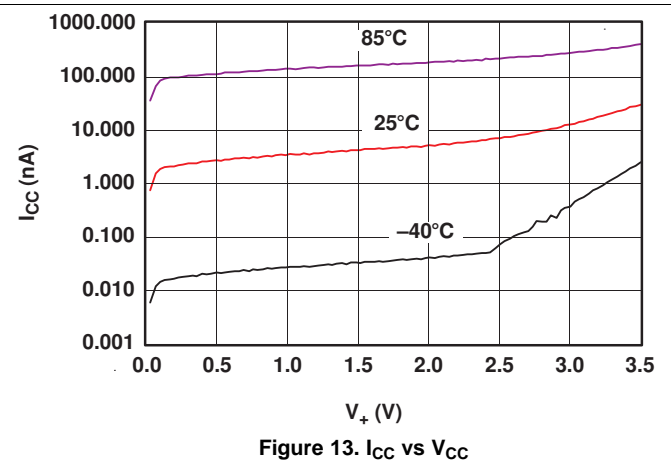
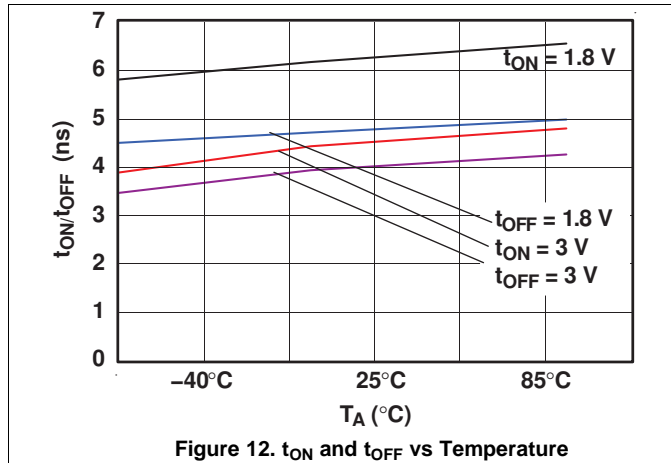


Figure 5. Charge Injection ( $Q_C$ )

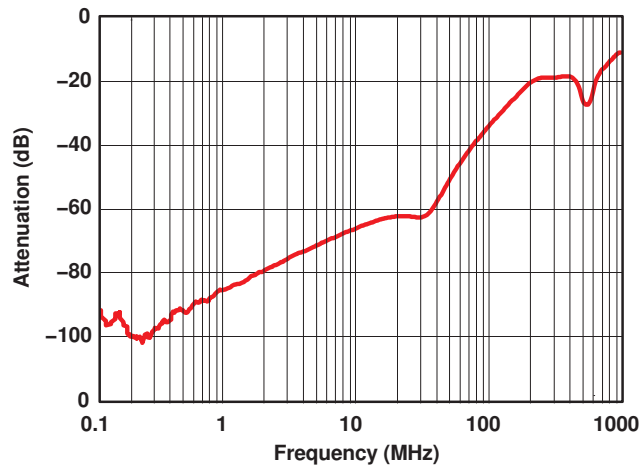
### 6.7 Typical Characteristics



Typical Characteristics (continued)



**Typical Characteristics (continued)**



**Figure 18. Crosstalk vs Frequency ( $V_{CC} = 3\text{ V}$ )**

## 7 Detailed Description

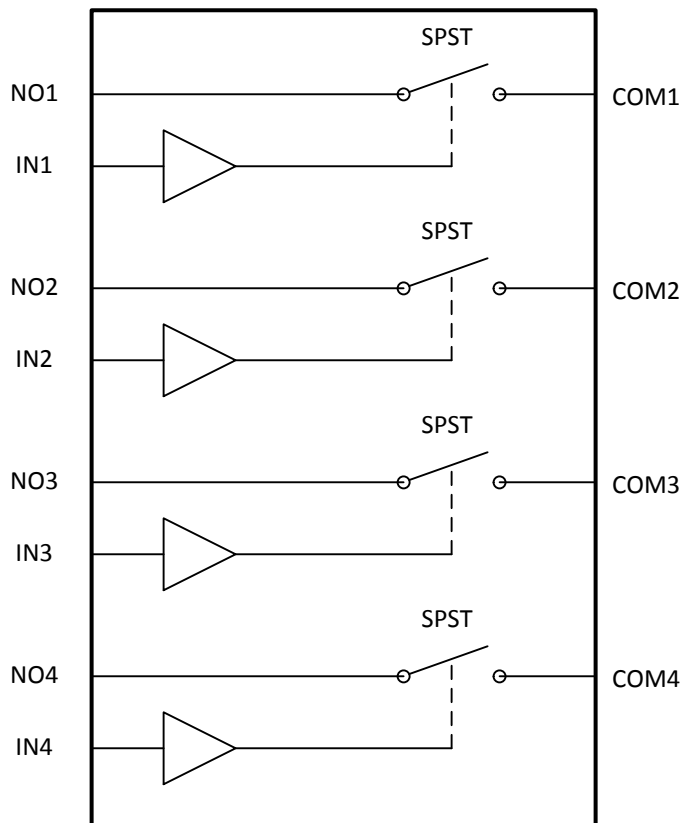
### 7.1 Overview

The TS3A4751 is a bidirectional, 4-channel, normally open (NO) single-pole single-throw (SPST) analog switch that operates from a single 1.6-V to 3.6-V supply. This device has fast switching speeds, handles rail-to-rail analog signals, and consumes very low quiescent power.

The digital input is 1.8-V CMOS compatible when using a 3-V supply.

The TS3A4751 has four normally open (NO) switches. The TS3A4751 is available in a 14-pin thin shrink small-outline package (TSSOP) and in space-saving 14-pin VQFN (RGY) and micro X2QFN (RUC) packages.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

This device has fast switching speeds, handles rail-to-rail analog signals, and consumes very low quiescent power.

The digital input is 1.8-V TTL/CMOS compatible when using a 3-V supply.

### 7.4 Device Functional Modes

Table 1. Function Table

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

## 8 Application and Implementation

### NOTE

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

### 8.1 Application Information

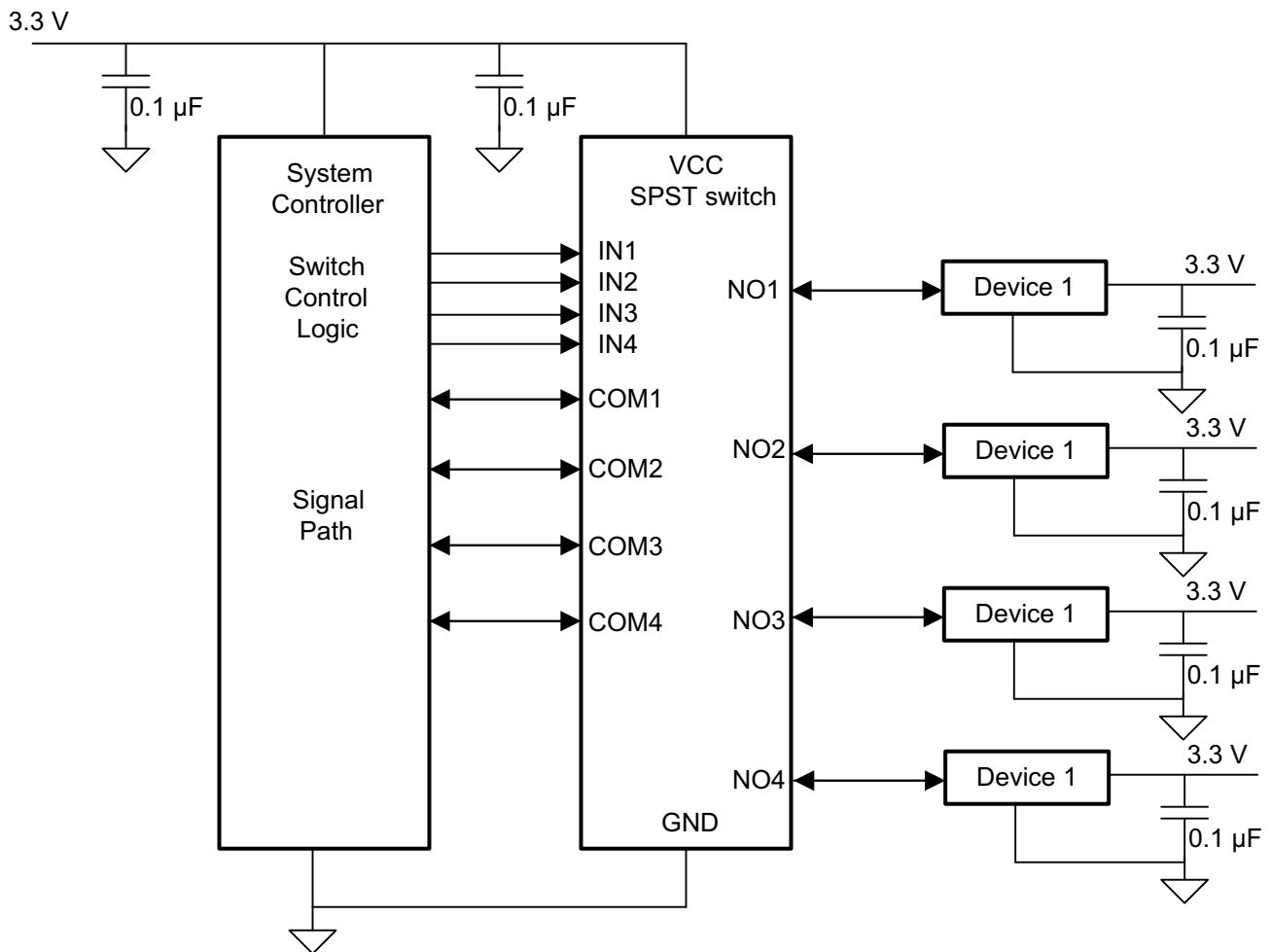
#### 8.1.1 Logic Inputs

The TS3A4751 logic inputs can be driven up to 3.6 V, regardless of the supply voltage. For example, with a 1.8-V supply, IN may be driven low to GND and high to 3.6 V. Driving IN rail to rail minimizes power consumption.

#### 8.1.2 Analog Signal Levels

Analog signals that range over the entire supply voltage ( $V_{CC}$  to GND) can be passed with very little change in  $R_{on}$  (see [Typical Characteristics](#)). The switches are bidirectional, so NO and COM can be used as either inputs or outputs.

### 8.2 Typical Application



**Figure 19. Typical Application Diagram**

## Typical Application (continued)

### 8.2.1 Design Requirements

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

### 8.2.2 Detailed Design Procedure

The TS3A4751 can be properly operated without any external components. However, it is recommended that unused pins should be connected to ground through a 50-Ω resistor to prevent signal reflections back into the device. It is also recommended that the digital control pins (INX) be pulled up to  $V_{CC}$  or down to GND to avoid undesired switch positions that could result from the floating pin.

### 8.2.3 Application Curve

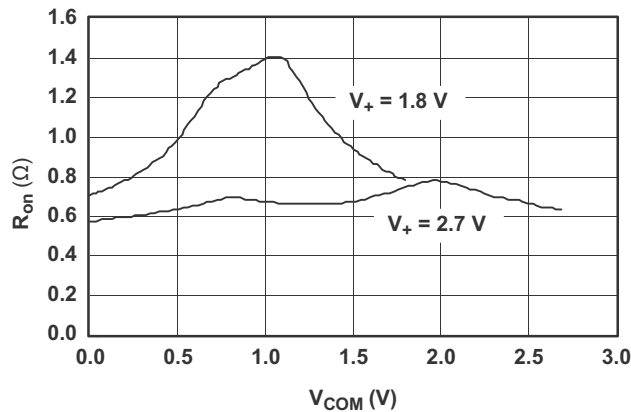


Figure 20.  $R_{on}$  vs  $V_{COM}$

## 9 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 devices. 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- $\mu\text{F}$  capacitor, connected from  $V_{CC}$  to GND, is adequate for most applications.

## 10 Layout

### 10.1 Layout Guidelines

High-speed switches require proper layout and design procedures for optimum performance.

Reduce stray inductance and capacitance by keeping traces short and wide.

Ensure that bypass capacitors are as close to the device as possible.

Use large ground planes where possible.

### 10.2 Layout Example

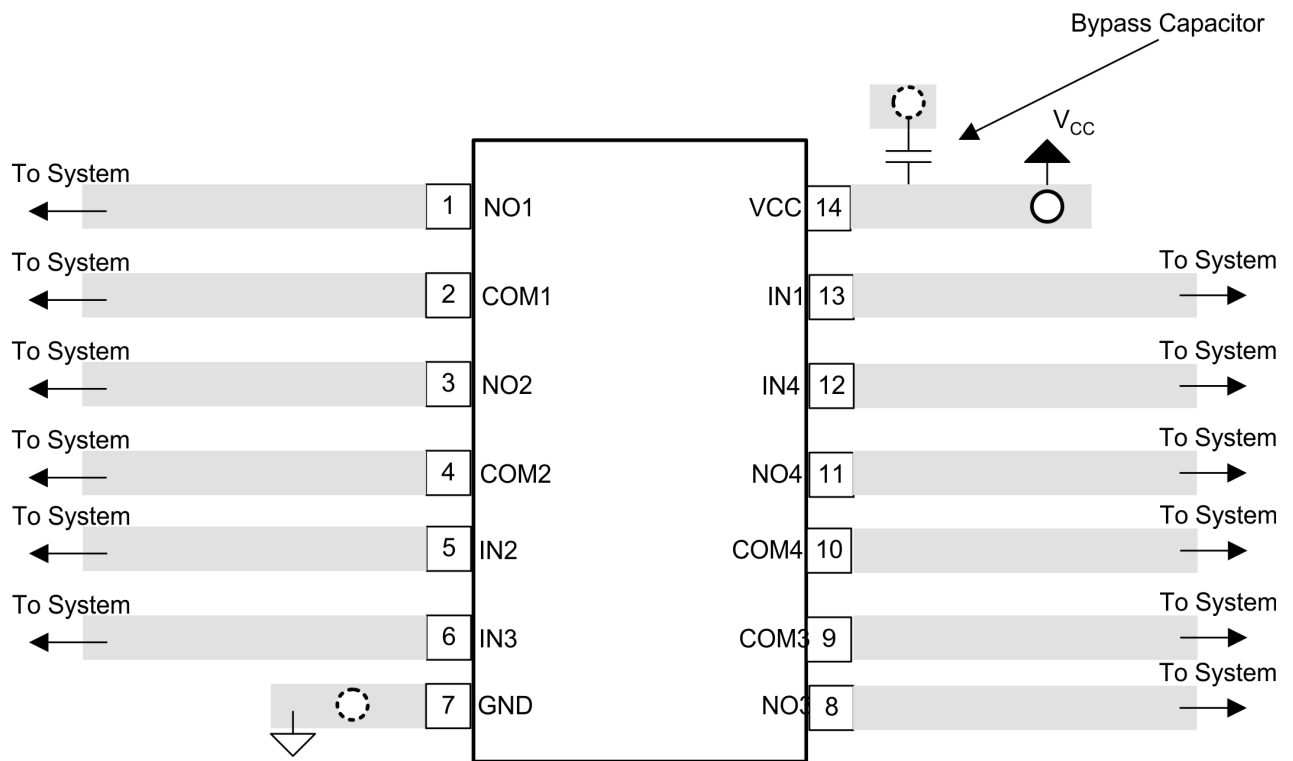
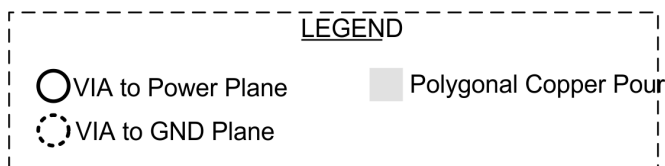


Figure 21. Layout Schematic



## 11 デバイスおよびドキュメントのサポート

### 11.1 ドキュメントの更新通知を受け取る方法

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

### 11.2 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](http://e2e.ti.com), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 11.3 商標

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### 11.4 静電気放電に関する注意事項



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### 11.5 Glossary

**SLYZ022** — *TI Glossary*.

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

## 12 メカニカル、パッケージ、および注文情報

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

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS3A4751PWR	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YC751	<a href="#">Samples</a>
TS3A4751RGYR	ACTIVE	VQFN	RGY	14	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YC751	<a href="#">Samples</a>
TS3A4751RUCR	ACTIVE	QFN	RUC	14	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	3MO	<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.

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**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
TS3A4751PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TS3A4751RGYR	VQFN	RGY	14	3000	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1
TS3A4751RUCR	QFN	RUC	14	3000	180.0	9.5	2.2	2.2	0.5	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)
TS3A4751PWR	TSSOP	PW	14	2000	356.0	356.0	35.0
TS3A4751RGYR	VQFN	RGY	14	3000	356.0	356.0	35.0
TS3A4751RUCR	QFN	RUC	14	3000	189.0	185.0	36.0

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD



4203539-2/1 06/2011

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
  - Package complies to JEDEC MO-241 variation BA.

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD

**THERMAL INFORMATION**

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

Exposed Thermal Pad Dimensions

4206353-2/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD



4208122-2/P 03/14

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.





# EXAMPLE BOARD LAYOUT

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220202/B 12/2023

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

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220202/B 12/2023

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

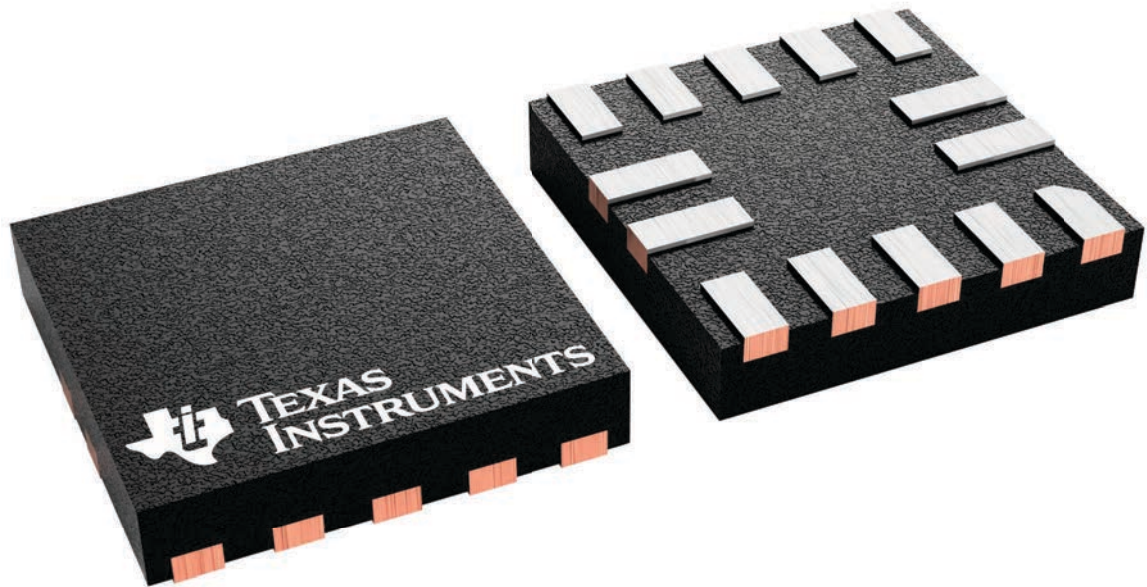
**RUC 14**

**X2QFN - 0.4 mm max height**

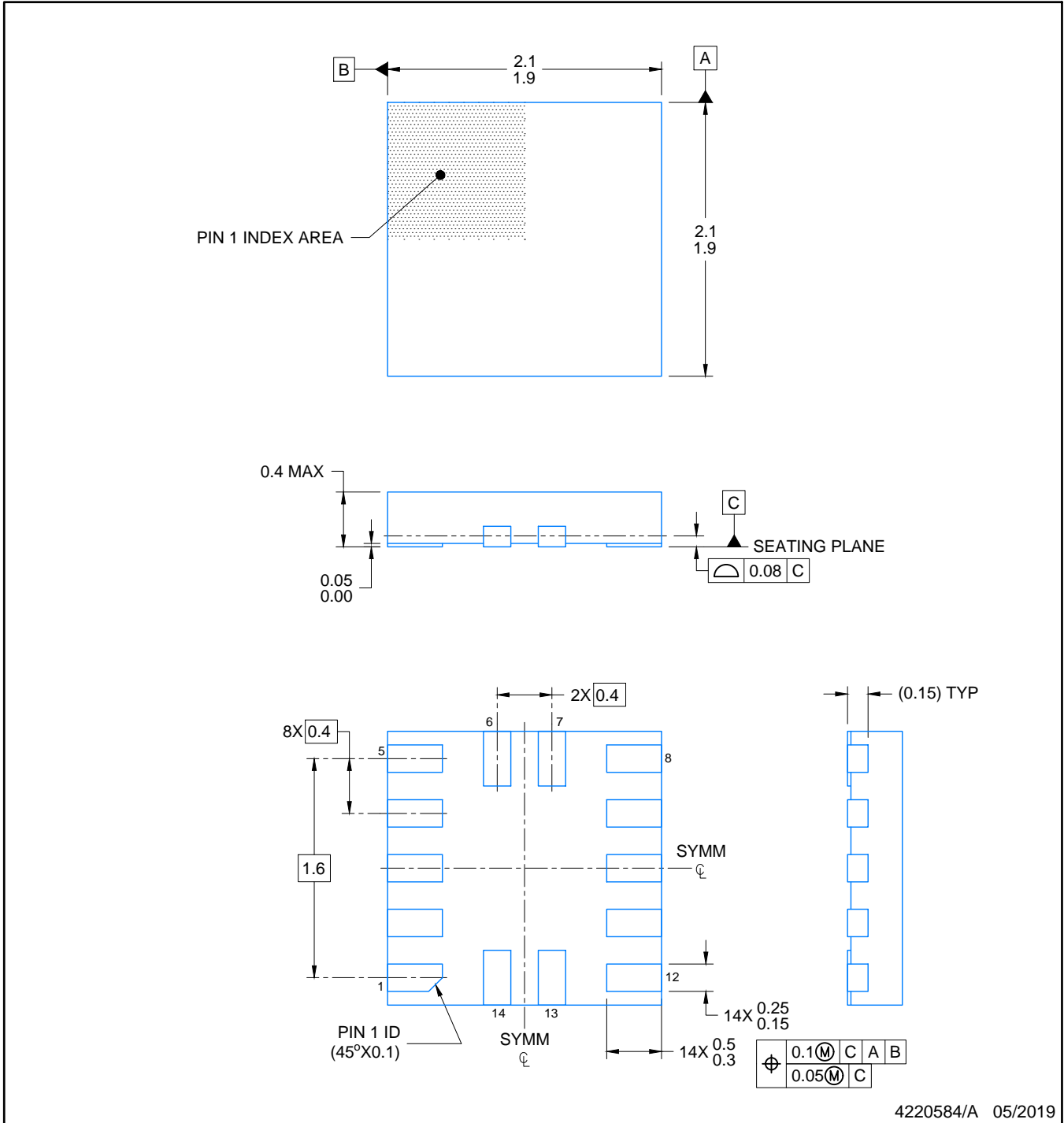
2 x 2, 0.4 mm pitch

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.

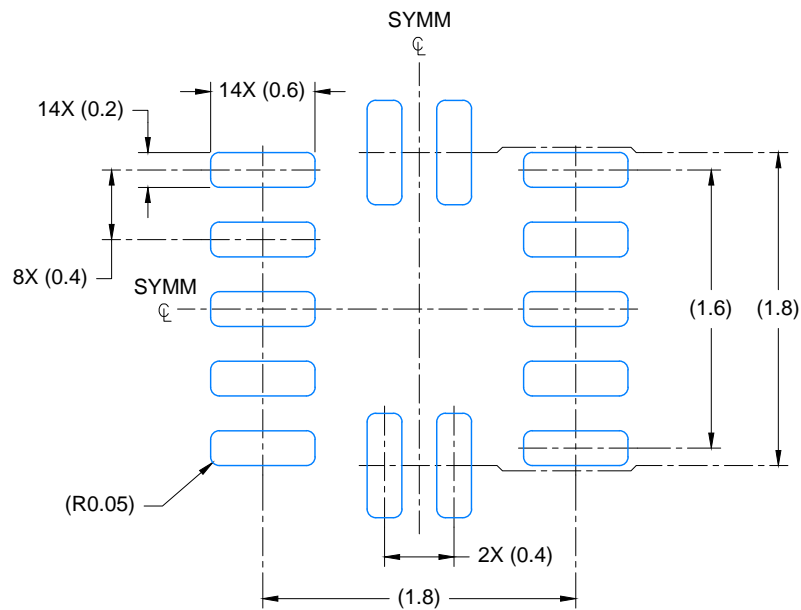


4229871/A

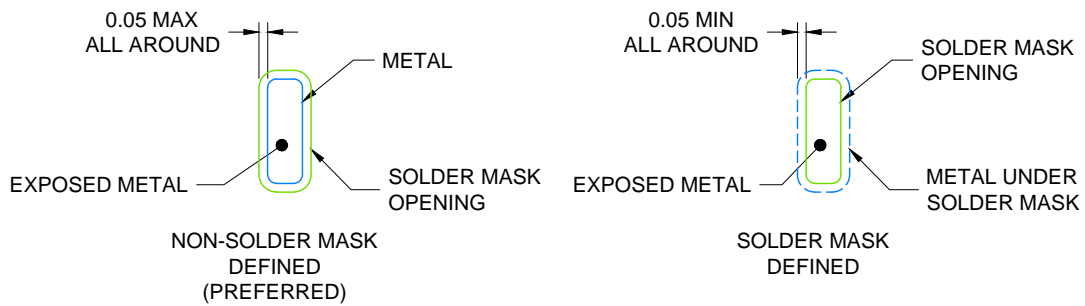


NOTES:

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  
EXPOSED METAL SHOWN  
SCALE: 23X



SOLDER MASK DETAILS

4220584/A 05/2019

NOTES: (continued)

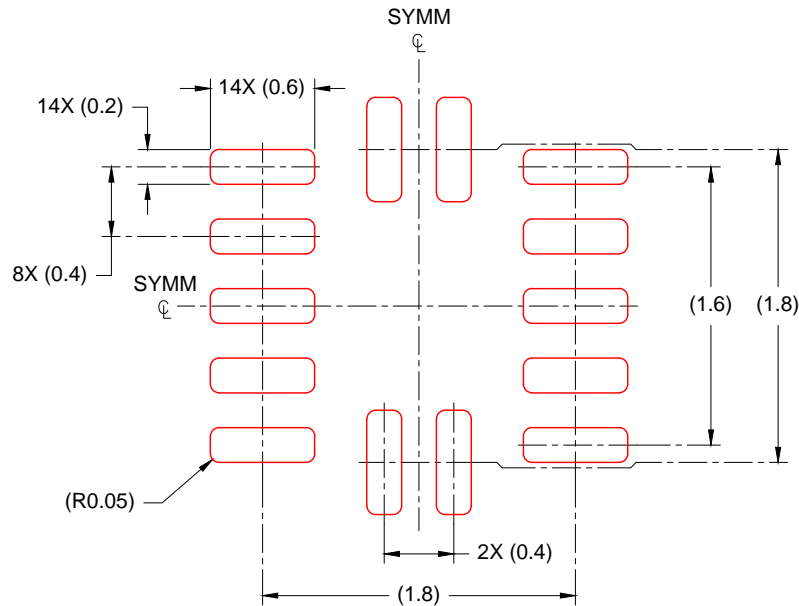
- For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/slua271](http://www.ti.com/lit/slua271)).

# EXAMPLE STENCIL DESIGN

RUC0014A

X2QFN - 0.4 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.100mm THICK STENCIL  
SCALE: 23X

4220584/A 05/2019

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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