TS3A27518E 6-channel (qSPI), 1:2 multiplexer/demultiplexer with integrated IEC L-4 ESD and 1.8-V logic compatible control inputs

1 Features

- 1.65-V to 3.6-V Single-Supply Operation
- Isolation in Power-Down Mode, V_{CC} = 0
- Low-Capacitance Switches, 21.5 pF (Typical)
- Bandwidth Up to 240 MHz for High-Speed Rail-to-Rail Signal Handling
- Crosstalk and OFF Isolation of –62 dB
- 1.8-V Logic Compatible Control Inputs
- 3.6-V Tolerant Control Inputs
- Latch-Up Performance Exceeds 100-mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2500-V Human-Body Model (A114-B, Class II)
  - 1500-V Charged-Device Model (C101)
- ESD Performance: NC/NO Ports
  - ±6-kV Contact Discharge (IEC 61000-4-2)
- 24-WQFN (4.00 mm × 4.00 mm), 24-BGA (3.00 mm × 3.00 mm) and 24-TSSOP (7.90 mm × 6.60 mm) Packages

2 Applications

- SD-SDIO and MMC Two-Port MUX
- PC VGA Video MUX-Video Systems
- Audio and Video Signal Routing

3 Description

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 put 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.

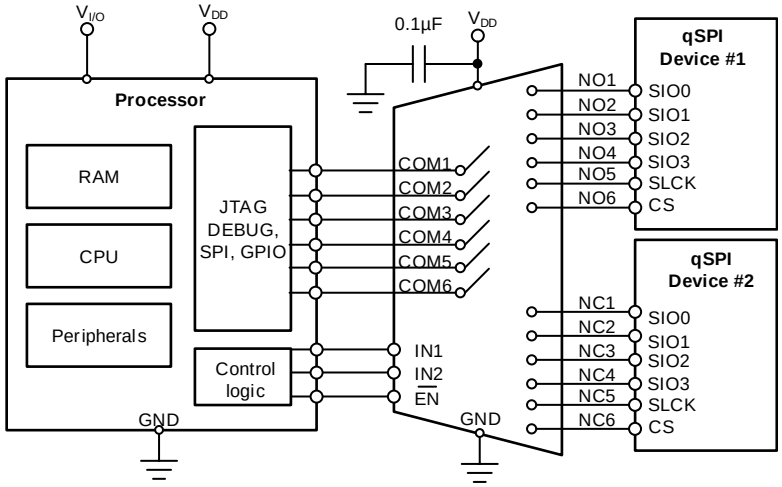
The TS3A27518E allows any SD, SDIO, and multimedia card host controllers to expand out to multiple cards or peripherals because the SDIO interface consists of 6-bits: CMD, CLK, and Data[0:3] signals. This device will support other 6-bit interfaces such a qSPI. The TS3A27518E has two control pins that give additional flexibility to the user. For example, the ability to mux two different audio-video signals in equipment such as an LCD television, an LCD monitor, or a notebook docking station.

Device Information[1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TS3A27518E	WQFN (24)	4.00 mm × 4.00 mm
	TSSOP (24)	7.90 mm × 6.60 mm
	BGA MICROSTAR JUNIOR (24)	3.00 mm × 3.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Typical Application



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

Table of Contents

1 Features ... 1
2 Applications ... 1
3 Description ... 1
4 Revision History ... 2
5 Pin Configuration and Functions ... 3
6 Specifications ... 5
6.1 Absolute Maximum Ratings ... 5
6.2 ESD Ratings ... 5
6.3 Recommended Operating Conditions ... 5
6.4 Thermal Information ... 6
6.5 Electrical Characteristics for 3.3-V Supply ... 6
6.6 Electrical Characteristics for 2.5-V Supply ... 8
6.7 Electrical Characteristics for 1.8-V Supply ... 9
6.8 Typical Characteristics ... 12
7 Parameter Measurement Information ... 15
8 Detailed Description ... 20
8.1 Overview ... 20
8.2 Functional Block Diagram ... 20
8.3 Feature Description ... 20
8.4 Device Functional Modes ... 20
9 Application and Implementation ... 21
9.1 Application Information ... 21
9.2 Typical Application ... 21
10 Power Supply Recommendations ... 23
11 Layout ... 23
11.1 Layout Guidelines ... 23
11.2 Layout Example ... 23
12 Device and Documentation Support ... 24
12.1 Community Resources ... 24
12.2 Trademarks ... 24
12.3 Electrostatic Discharge Caution ... 24
12.4 Glossary ... 24
13 Mechanical, Packaging, and Orderable Information ... 24

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision D (May 2016) to Revision E — **Page**

- Changed the *Typical Application* ... 1
- Changed the *Pin Configuration* images ... 3
- Removed Note: "The input and output voltage ratings..." from the *Absolute Maximum Ratings* table ... 5
- Removed Note: "This value is limited to 5.5-V maximum" from the *Absolute Maximum Ratings* table ... 5
- Changed the *Application Information* section ... 21
- Added Figure 27 ... 22

Changes from Revision C (December 2015) to Revision D — **Page**

- Updated *Pin Functions* table ... 1

Changes from Revision B (May 2009) to Revision C — **Page**

- Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section ... 1

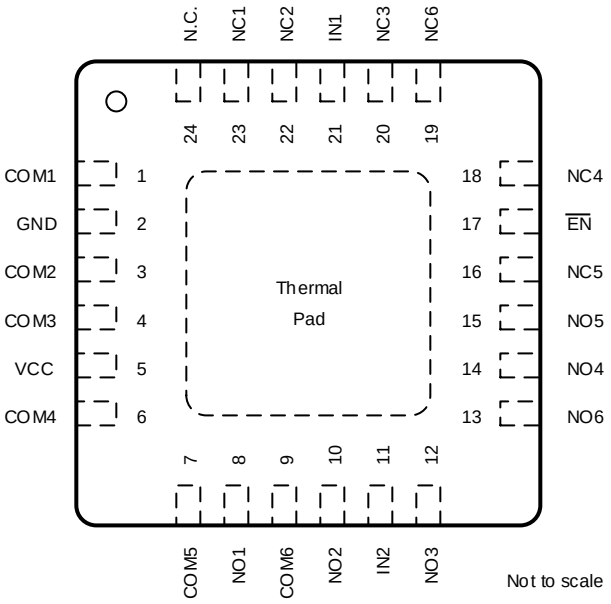
Changes from Revision A (March 2009) to Revision B — **Page**

- Changed the data sheet From: *Product Preview* To: *Production* data ... 1

Copyright © 2009–2019, Texas Instruments Incorporated

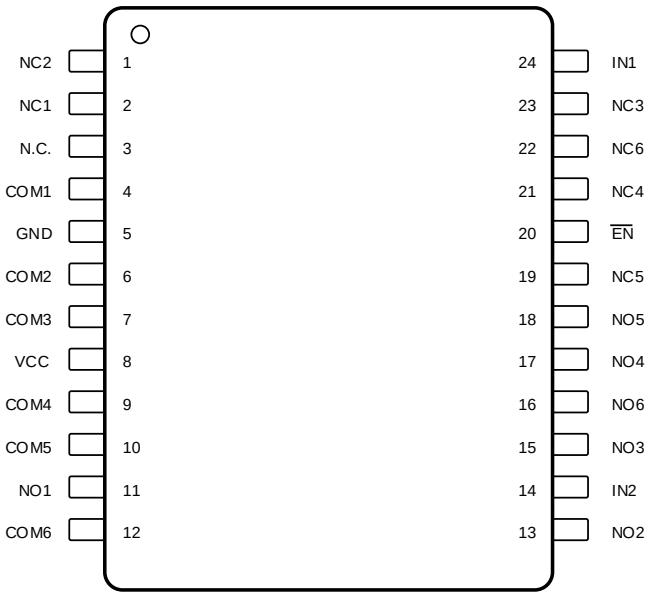
5 Pin Configuration and Functions

RTW Package
24-Pin WQFN
Top View



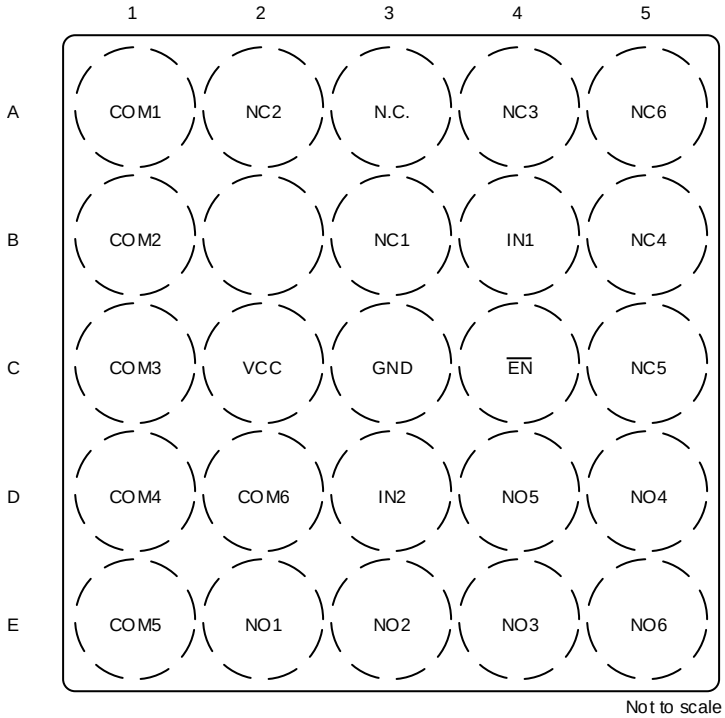
Not to scale

PW Package
24-Pin TSSOP
Top View



Not to scale

ZQS Package
24-Pin BGA MICROSTAR JUNIOR
Top View



Not to scale

Pin Functions

PIN				I/O	DESCRIPTION
NAME	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
$\overline{EN}$	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_{CC}	5	C2	8	—	Voltage supply

Copyright © 2009–2019, Texas Instruments Incorporated

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	4.6	V
V_{NC} V_{NO} V_{COM}	Analog signal voltage (3)		–0.5	4.6	V
I_K	Analog port diode current (4)	$V_{CC} < V_{NC}$, V_{NO}, $V_{COM} < 0$	–50		mA
I_{NC} I_{NO} I_{COM}	ON-state switch current (5)	V_{NC}, V_{NO}, V_{COM} = 0 to V_{CC}	–50	50	mA
V_I	Digital input voltage (3)		–0.5	4.6	V
I_{IK}	Digital input clamp current (3)	$V_{IO} < V_I < 0$	–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) Requires clamp diodes on analog port to V_{CC}.
(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)	±2500	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 or ANSI/ESDA/JEDEC JS-002 (2)	±1500	

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

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
Supply voltage	V_{CC}	1.65	3.6	V
Analog signal voltage	V_{NC}	0	V_{CC}	V
	V_{NO}			
	V_{COM}			
Digital input voltage	V_I	0	V_{CC}	V

6.4 Thermal Information

THERMAL METRIC (1)		TS3A27518E			UNIT
		PW (TSSOP)	RTW (WQFN)	ZQS (BGA MICROSTAR JUNIOR)	
		24 PINS	24 PINS	24 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	104	40.7	155.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	51.6	42.9	69.9	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	57.5	19.2	94.6	°C/W
ψ_{JT}	Junction-to-top characterization parameter	9.9	1	9	°C/W
ψ_{JB}	Junction-to-board characterization parameter	57.1	19.3	92.2	°C/W
$R_{\theta JC(bot)}$	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(1)

V_{CC} = 3 V to 3.6 V, T_A = –40°C to +85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
ANALOG SWITCH									
V_{COM}, V_{NO}, V_{NC}	Analog signal voltage					0		V_{CC}	V
r_{on}	ON-state resistance	V_{CC} = 3 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		4.4	6.2	V
					T_A = –40°C to +85°C			7.6	
Δr_{on}	ON-state resistance match between channels	V_{CC} = 3 V	V_{NC} or V_{NO} = 2.1 V, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		0.3	0.7	Ω
					T_A = –40°C to +85°C			0.8	
$r_{on(flat)}$	ON-state resistance flatness	V_{CC} = 3 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 16	T_A = 25°C		0.95	2.1	Ω
					T_A = –40°C to +85°C			2.3	
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO OFF leakage current	V_{CC} = 3.6 V	V_{NC} or V_{NO} = 1 V, V_{COM} = 3 V, or V_{NC} or V_{NO} = 3 V, V_{COM} = 1 V	Switch OFF, see Figure 16	T_A = 25°C	–0.5	0.05	0.5	µA
					T_A = –40°C to +85°C	–7		7	
$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 0 to 3.6 V, V_{COM} = 3.6 V to 0, or V_{NC} or V_{NO} = 3.6 V to 0, V_{COM} = 0 to 3.6 V		T_A = 25°C	–1	0.05	1	
					T_A = –40°C to +85°C	–12		12	
$I_{COM(OFF)}$	COM OFF leakage current	V_{CC} = 3.6 V	V_{NC} or V_{NO} = 3 V, V_{COM} = 1 V, or V_{NC} or V_{NO} = 1 V, V_{COM} = 3 V	Switch OFF, see Figure 16	T_A = 25°C	–1	0.01	1	µA
					T_A = –40°C to +85°C	–2		2	
$I_{COM(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 3.6 V to 0, V_{COM} = 0 to 3.6 V, or V_{NC} or V_{NO} = 0 to 3.6 V, V_{COM} = 3.6 V to 0		T_A = 25°C	–1	0.02	1	
					T_A = –40°C to +85°C	–12		1	

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

Copyright © 2009–2019, Texas Instruments Incorporated

Electrical Characteristics for 3.3-V Supply[1] (continued)

V_{CC} = 3 V to 3.6 V, T_A = –40°C to +85°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 V	V_{NC} or V_{NO} = 1 V, V_{COM} = open, or V_{NC} or V_{NO} = 3 V, V_{COM} = open	Switch ON, see Figure 17	T_A = 25°C	–2.5	0.04	2.2	µA
					T_A = –40°C to +85°C	–7		7	
$I_{COM(ON)}$	COM ON leakage current	V_{CC} = 3.6 V	V_{NC} or V_{NO} = open, V_{COM} = 1 V, or V_{NC} or V_{NO} = open, V_{COM} = 3 V	Switch ON, see Figure 17	T_A = 25°C	–2	0.03	2	µA
					T_A = –40°C to +85°C	–7		7	
DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{EN}$) [2]									
V_{IH}	Input logic high	V_{CC} = 3.6 V			T_A = –40°C to +85°C	1.2		3.6	V
V_{IL}	Input logic low	V_{CC} = 3.6 V			T_A = –40°C to +85°C	0		0.65	V
I_{IH}, I_{IL}	Input leakage current	V_{CC} = 3.6 V	V_I = V_{CC} or 0		T_A = 25°C	–0.1	0.05	0.1	µA
					T_A = –40°C to +85°C	–2.5		2.5	
DYNAMIC									
t_{ON}	Turnon time	V_{CC} = 3.3 V	V_{COM} = V_{CC}, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		18.1	59	ns
		V_{CC} = 3 V to 3.6 V			T_A = –40°C to +85°C			60	
t_{OFF}	Turnoff time	V_{CC} = 3.3 V	V_{COM} = V_{CC}, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		25.4	60.6	ns
		V_{CC} = 3 V to 3.6 V			T_A = –40°C to +85°C			61	
t_{BBM}	Break-before-make time	V_{CC} = 3.3 V	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50 Ω	C_L = 35 pF, see Figure 20	T_A = 25°C	4	11.1	22.7	ns
		V_{CC} = 3 V to 3.6 V			T_A = –40°C to +85°C			28	
Q_C	Charge injection	V_{CC} = 3.3 V	V_{GEN} = 0, R_{GEN} = 0	C_L = 0.1 nF, see Figure 24	T_A = 25°C		0.81		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{CC} = 3.3 V	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF	See Figure 18	T_A = 25°C		13		pF
$C_{COM(OFF)}$	COM OFF capacitance	V_{CC} = 3.3 V	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF	See Figure 18	T_A = –40°C to +85°C		8.5		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{CC} = 3.3 V	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF	See Figure 18			21.5		pF
$C_{COM(ON)}$	COM ON capacitance	V_{CC} = 3.3 V	V_{COM} = V_{CC} or GND, Switch ON	See Figure 18			21.5		pF
C_I	Digital input capacitance	V_{CC} = 3.3 V	V_I = V_{CC} or GND	See Figure 18			2		pF
BW	Bandwidth	V_{CC} = 3.3 V	R_L = 50 Ω,	Switch ON, see Figure 20			240		MHz
O_{ISO}	OFF isolation	V_{CC} = 3.3 V	R_L = 50 Ω, f = 10 MHz	Switch OFF, see Figure 22			–62		dB
X_{TALK}	Crosstalk	V_{CC} = 3.3 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–62		dB
$X_{TALK(ADJ)}$	Crosstalk adjacent	V_{CC} = 3.3 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–71		dB
THD	Total harmonic distortion	V_{CC} = 3.3 V	R_L = 600 Ω, C_L = 50 pF	f = 20 Hz to 20 kHz, see Figure 25			0.05%		

(2) 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.

Copyright © 2009–2019, Texas Instruments Incorporated

Electrical Characteristics for 3.3-V Supply(1) (continued)

V_{CC} = 3 V to 3.6 V, T_A = –40°C to +85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
SUPPLY									
I_{CC}	Positive supply current	V_{CC} = 3.6 V	V_I = V_{CC} or GND	Switch ON or OFF	T_A = 25°C		0.04	0.3	µA
					T_A = –40°C to +85°C			3	

6.6 Electrical Characteristics for 2.5-V Supply(1)

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

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
ANALOG SWITCH									
V_{COM}, V_{NO}, V_{NC}	Analog signal voltage					0		V_{CC}	V
r_{on}	ON-state resistance	V_{CC} = 2.3 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		5.5	9.6	Ω
					T_A = –40°C to +85°C			11.5	
Δr_{on}	ON-state resistance match between channels	V_{CC} = 2.3 V	V_{NC} or V_{NO} = 1.6 V, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		0.3	0.8	Ω
					T_A = –40°C to +85°C			0.9	
$r_{on(flat)}$	ON-state resistance flatness	V_{CC} = 2.3 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 16	T_A = 25°C		0.91	2.2	Ω
					T_A = –40°C to +85°C			2.3	
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO OFF leakage current	V_{CC} = 2.7 V	V_{NC} or V_{NO} = 0.5 V, V_{COM} = 2.3 V, or V_{NC} or V_{NO} = 2.3 V, V_{COM} = 0.5 V	Switch OFF, see Figure 16	T_A = 25°C	–0.3	0.04	0.3	µA
					T_A = –40°C to +85°C	–6		6	
$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 0 to 2.7 V, V_{COM} =2.7 V to 0, or V_{NC} or V_{NO} = 2.7 V to 0, V_{COM} = 0 to 2.7 V		T_A = 25°C	–0.6	0.02	0.6	
					T_A = –40°C to +85°C	–10		10	
$I_{COM(OFF)}$	COM OFF leakage current	V_{CC} = 2.7 V	V_{NC} or V_{NO} = 0.5 V, V_{COM} = 2.3 V, or V_{NC} or V_{NO} = 2.3 V, V_{COM} = 0.5 V	Switch OFF, see Figure 16	T_A = 25°C	–0.7	0.02	0.7	µA
					T_A = –40°C to +85°C	–1		1	
$I_{COM(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 2.7 V to 0, V_{COM} = 0 to 2.7 V, or V_{NC} or V_{NO} = 0 to 2.7 V, V_{COM} = 2.7 V to 0		T_A = 25°C	–0.7	0.02	0.7	
					T_A = –40°C to +85°C	–7.2		7.2	
$I_{NO(ON)}$ $I_{NC(ON)}$	NC, NO ON leakage current	V_{CC} = 2.7 V	V_{NC} or V_{NO} = 0.5 V or 2.3 V, V_{COM} = open	Switch ON, see Figure 17	T_A = 25°C	–2.1	0.03	2.1	µA
					T_A = –40°C to +85°C	–6		6	
$I_{COM(ON)}$	COM ON leakage current	V_{CC} = 2.7 V	V_{NC} or V_{NO} = open, V_{COM} = 0.5 V, or V_{NC} or V_{NO} = open, V_{COM} = 2.3 V	Switch ON, see Figure 17	T_A = 25°C	–2	0.02	2	µA
					T_A = –40°C to +85°C	–5.7		5.7	
DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{EN}$) (2)									
V_{IH}	Input logic high	V_{CC} = 2.7 V	V_I = V_{CC} or GND		T_A = –40°C to +85°C	1.15		3.6	V
V_{IL}	Input logic low	V_{CC} = 2.7 V				0		0.55	V
I_{IH}, I_{IL}	Input leakage current	V_{CC} = 2.7 V	V_I = V_{CC} or 0		T_A = 25°C	–0.1	0.01	0.1	µA
					T_A = –40°C to +85°C	–2.1		2.1	

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.
(2) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, SCBA004.

Copyright © 2009–2019, Texas Instruments Incorporated

Electrical Characteristics for 2.5-V Supply(1) (continued)

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

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
DYNAMIC									
t_{ON}	Turnon time	V_{CC} = 2.5 V	V_{COM} = VCC, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		17.2	36.8	ns
		V_{CC} = 2.3 V to 2.7 V			T_A = –40°C to +85°C			42.5	
t_{OFF}	Turnoff time	V_{CC} = 2.5 V	V_{COM} = VCC, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		17.1	29.8	ns
		V_{CC} = 2.3 V to 2.7 V			T_A = –40°C to +85°C			34.4	
t_{BBM}	Break-before-make time	V_{CC} = 2.5 V	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50 Ω	C_L = 35 pF, see Figure 20	T_A = 25°C	4.5	13	30	ns
		V_{CC} = 2.3 V to 2.7 V			T_A = –40°C to +85°C			33.3	
Q_C	Charge injection	V_{CC} = 2.5 V	V_{GEN} = 0, R_{GEN} = 0	C_L = 0.1 nF, see Figure 24			0.47		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{CC} = 2.5 V	V_{NC} or V_{NO} = V_{CC} or GND, switch OFF	See Figure 18			13.5		pF
$C_{COM(OFF)}$	COM OFF capacitance	V_{CC} = 2.5 V	V_{NC} or V_{NO} = V_{CC} or GND, switch OFF	See Figure 18	T_A = –40°C to +85°C		9		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{CC} = 2.5 V	V_{NC} or V_{NO} = V_{CC} or GND, switch OFF	See Figure 18			22		pF
$C_{COM(ON)}$	COM ON capacitance	V_{CC} = 2.5 V	V_{COM} = V_{CC} or GND, switch ON	See Figure 18			22		pF
C_I	Digital input capacitance	V_{CC} = 2.5 V	V_I = V_{CC} or GND	See Figure 18			2		pF
BW	Bandwidth	V_{CC} = 2.5 V	R_L = 50 Ω	Switch ON, see Figure 20			240		MHz
O_{ISO}	OFF isolation	V_{CC} = 2.5 V	R_L = 50 Ω, f = 10 MHz	Switch OFF, see Figure 22			–62		dB
X_{TALK}	Crosstalk	V_{CC} = 2.5 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–62		dB
$X_{TALK(ADJ)}$	Crosstalk adjacent	V_{CC} = 2.5 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–71		dB
THD	Total harmonic distortion	V_{CC} = 2.5 V	R_L = 600 Ω, C_L = 50 pF	f = 20 Hz to 20 kHz, see Figure 25			0.06%		
SUPPLY									
I_{CC}	Positive supply current	V_{CC} = 2.7 V	V_I = V_{CC} or GND	Switch ON or OFF	T_A = 25°C		0.01	0.1	µA
					T_A = –40°C to +85°C			2	

6.7 Electrical Characteristics for 1.8-V Supply(1)

V_{CC} = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
ANALOG SWITCH									
V_{COM}, V_{NO}, V_{NC}	Analog signal voltage					0		V_{CC}	V
r_{on}	ON-state resistance	V_{CC} = 1.65 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		7.1	14.4	Ω
					T_A = –40°C to +85°C			16.3	
Δr_{on}	ON-state resistance match between channels	V_{CC} = 1.65 V	V_{NC} or V_{NO} = 1.5 V, I_{COM} = –32 mA	Switch ON, see Figure 15	T_A = 25°C		0.3	1	Ω
					T_A = –40°C to +85°C			1.2	
$r_{on(flat)}$	ON-state resistance flatness	V_{CC} = 1.65 V	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32 mA	Switch ON, see Figure 16	T_A = 25°C		2.7	5.5	Ω
					T_A = –40°C to +85°C			7.3	

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

Copyright © 2009–2019, Texas Instruments Incorporated

Electrical Characteristics for 1.8-V Supply[1] (continued)

V_{CC} = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
$I_{NC(OFF)}$, $I_{NO(OFF)}$	NC, NO OFF leakage current	V_{CC} = 1.95 V	V_{NC} or V_{NO} = 0.3 V, V_{COM} = 1.65 V, or V_{NC} or V_{NO} = 1.65 V, V_{COM} = 0.3 V	Switch OFF, see Figure 16	T_A = 25°C	–0.25	0.03	0.25	µA
					T_A = –40°C to +85°C	–5		5	
$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 1.95 V to 0, V_{COM} = 0 to 1.95 V, or V_{NC} or V_{NO} = 0 to 1.95 V, V_{COM} = 1.95 V to 0		T_A = 25°C	–0.4	0.01	0.4	µA
					T_A = –40°C to +85°C	–7.2		7.2	
$I_{COM(OFF)}$	COM OFF leakage current	V_{CC} = 1.95 V	V_{NC} or V_{NO} = 0.3 V, V_{COM} = 1.65 V, or V_{NC} or V_{NO} = 1.65 V, V_{COM} = 0.3 V	Switch OFF, see Figure 16	T_A = 25°C	–0.4	0.02	0.4	µA
					T_A = –40°C to +85°C	–0.9		0.9	
$I_{COM(PWROFF)}$		V_{CC} = 0 V	V_{NC} or V_{NO} = 1.95 V to 0, V_{COM} = 0 to 1.95 V, or V_{NC} or V_{NO} = 0 to 1.95 V, V_{COM} = 1.95 V to 0		T_A = 25°C	–0.4	0.02	0.4	µA
					T_A = –40°C to +85°C	–5		5	
$I_{NO(ON)}$, $I_{NC(ON)}$	NC, NO ON leakage current	V_{CC} = 1.95 V	V_{NC} or V_{NO} = 0.3 V, V_{COM} = open, or V_{NC} or V_{NO} = 1.65 V, V_{COM} = open	Switch ON, see Figure 17	T_A = 25°C	–2	0.02	2	µA
					T_A = –40°C to +85°C	–5.2		5.2	
$I_{COM(ON)}$	COM ON leakage current	V_{CC} = 1.95 V	V_{NC} or V_{NO} = open, V_{COM} = 0.3 V, or V_{NC} or V_{NO} = open, V_{COM} = 1.65 V	Switch ON, see Figure 17	T_A = 25°C	–2	0.02	2	µA
					T_A = –40°C to +85°C	–5.2		5.2	
DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{EN}$) [2]									
V_{IH}	Input logic high	V_{CC} = 1.95 V	V_I = V_{CC} or GND		T_A = –40°C to +85°C	1		3.6	V
V_{IL}	Input logic low	V_{CC} = 1.95 V			T_A = –40°C to +85°C	0		0.4	V
I_{IH}, I_{IL}	Input leakage current	V_{CC} = 1.95 V	V_I = V_{CC} or 0		T_A = 25°C	–0.1	0.01	0.1	µA
					T_A = –40°C to +85°C	–2.1		2.1	
DYNAMIC									
t_{ON}	Turnon time	V_{CC} = 1.8 V	V_{COM} = V_{CC}, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		14.1	49.3	ns
		V_{CC} = 1.65 V to 1.95 V			T_A = –40°C to +85°C			56.7	
t_{OFF}	Turnoff time	V_{CC} = 1.8 V	V_{COM} = V_{CC}, R_L = 50 Ω	C_L = 35 pF, see Figure 19	T_A = 25°C		16.1	26.5	ns
		V_{CC} = 1.65 V to 1.95 V			T_A = –40°C to +85°C			31.2	
t_{BBM}	Break-before-make time	V_{CC} = 1.8 V	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50 Ω	C_L = 35 pF, see Figure 20	T_A = 25°C	5.3	18.4	58	ns
		V_{CC} = 1.65 V to 1.95 V			T_A = –40°C to +85°C			58	
Q_C	Charge injection	V_{CC} = 1.8 V	V_{GEN} = 0, R_{GEN} = 0	C_L = 1 nF, see Figure 24			0.21		pC
$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{CC} = 1.8 V	V_{NC} or V_{NO} = V_{CC} or GND, switch OFF	See Figure 18			9		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{CC} = 1.8 V	V_{NC} or V_{NO} = V_{CC} or GND, switch OFF	See Figure 18			22		pF
$C_{COM(ON)}$	COM ON capacitance	V_{CC} = 1.8 V	V_{COM} = V_{CC} or GND, switch ON	See Figure 18			22		pF

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

Copyright © 2009–2019, Texas Instruments Incorporated

Electrical Characteristics for 1.8-V Supply(1) (continued)

V_{CC} = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
C_I	Digital input capacitance	V_{CC} = 1.8 V	V_I = V_{CC} or GND	See Figure 18			2		pF
BW	Bandwidth	V_{CC} = 1.8 V	R_L = 50 Ω	Switch ON, see Figure 20			240		MHz
O_{ISO}	OFF isolation	V_{CC} = 1.8 V	R_L = 50 Ω, f = 10 MHz	Switch OFF, see Figure 22			–60		dB
X_{TALK}	Crosstalk	V_{CC} = 1.8 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–60		dB
$X_{TALK(ADJ)}$	Crosstalk adjacent	V_{CC} = 1.8 V	R_L = 50 Ω, f = 10 MHz	Switch ON, see Figure 23			–71		dB
THD	Total harmonic distortion	V_{CC} = 1.8 V	R_L = 600 Ω, C_L = 50 pF	f = 20 Hz to 20 kHz, see Figure 25			0.1%		
SUPPLY									
I_{CC}	Positive supply current	V_{CC} = 1.95 V	V_I = V_{CC} or GND	Switch ON or OFF	T_A = 25°C		0.01	0.1	μA
					T_A = –40°C to +85°C			1.5	

Copyright © 2009–2019, Texas Instruments Incorporated

6.8 Typical Characteristics

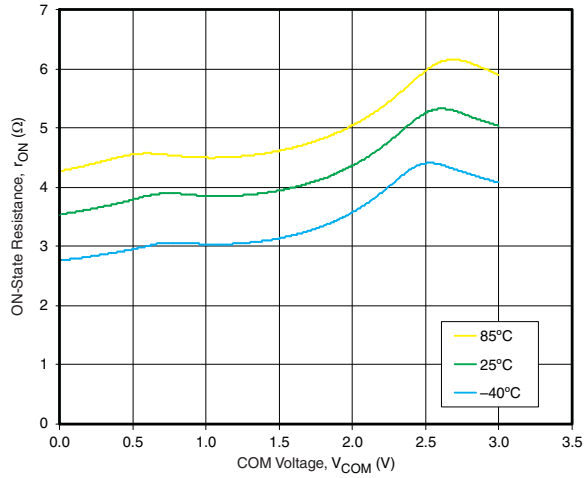


Figure 1. ON-State Resistance vs COM Voltage (V_{CC} = 3 V)

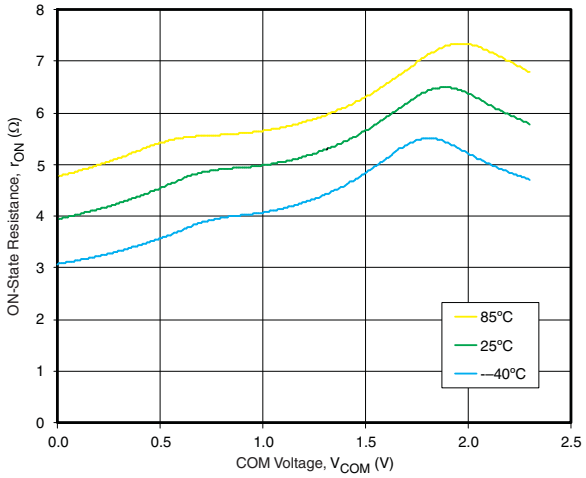


Figure 2. ON-State Resistance vs COM Voltage (V_{CC} = 2.3 V)

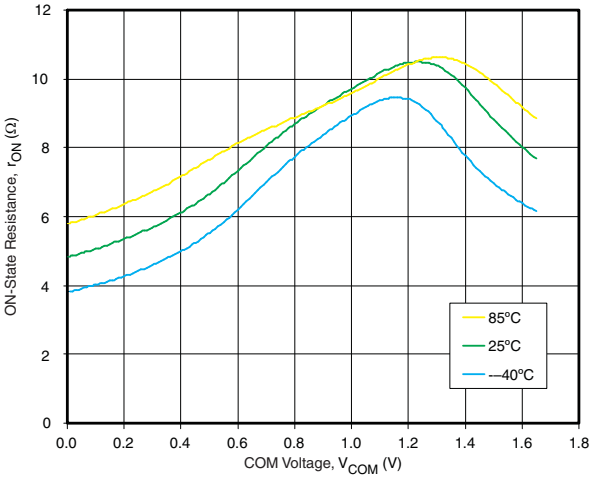


Figure 3. ON-State Resistance vs COM Voltage (V_{CC} = 1.65 V)

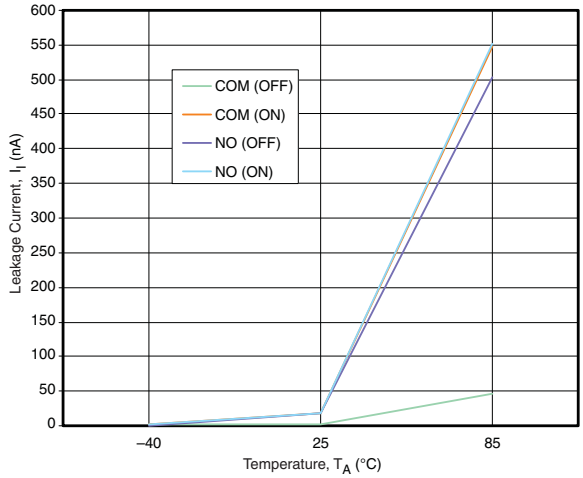


Figure 4. Leakage Current vs Temperature (V_{CC} = 3.3 V)

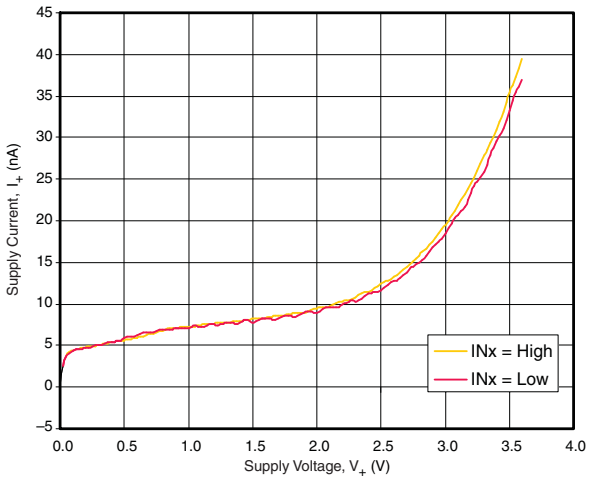


Figure 5. Supply Current vs Supply Voltage

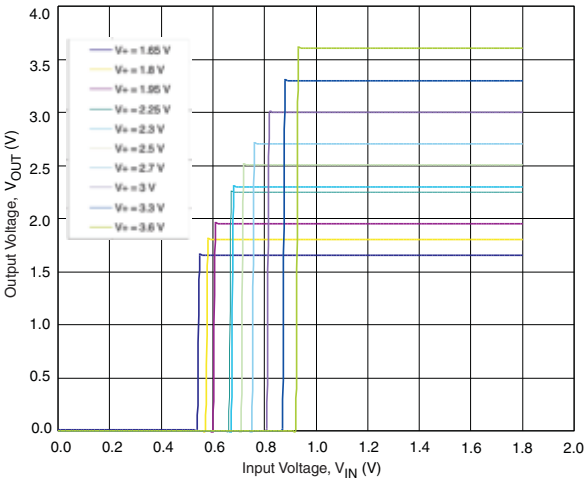


Figure 6. Control Input Thresholds (IN1, T_A = 25°C)

Copyright © 2009–2019, Texas Instruments Incorporated

Typical Characteristics (continued)

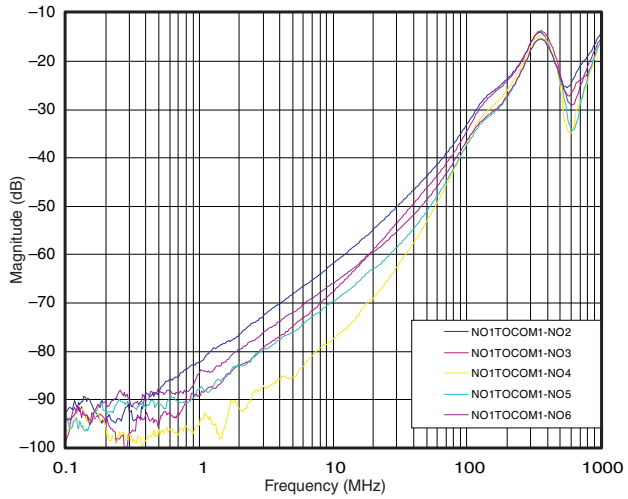


Figure 7. Crosstalk Adjacent

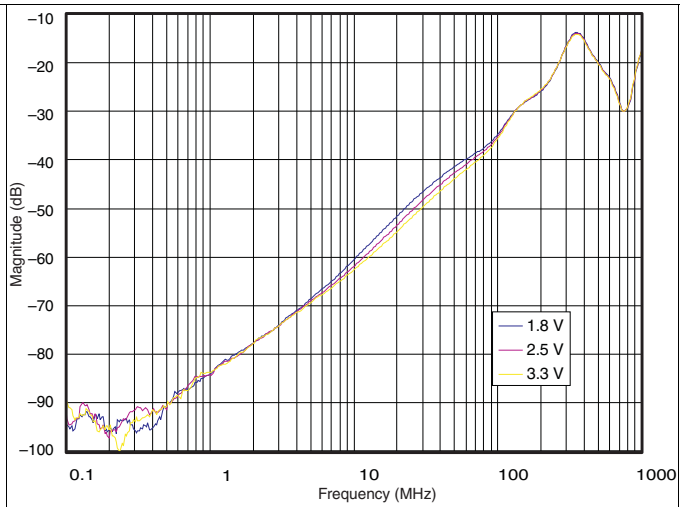


Figure 8. Crosstalk

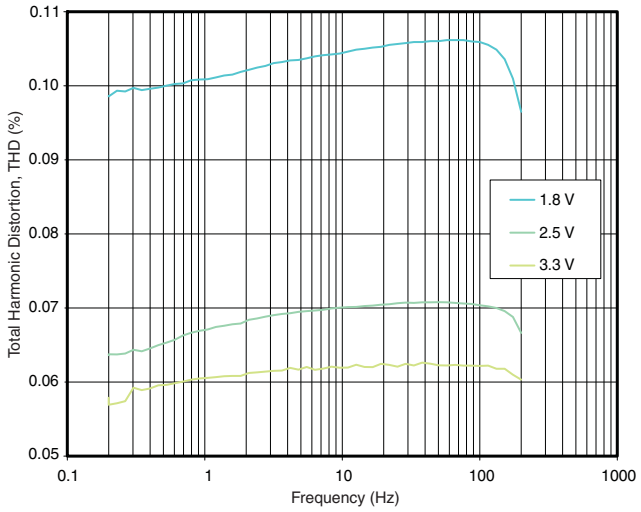


Figure 9. Total Harmonic Distortion vs Frequency

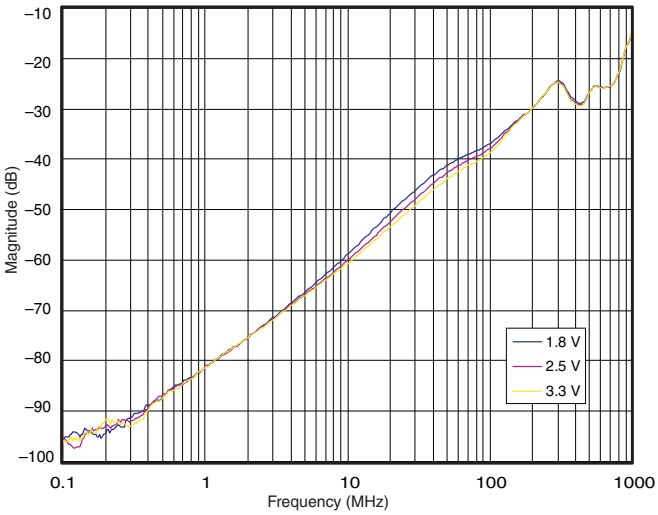


Figure 10. OFF Isolation

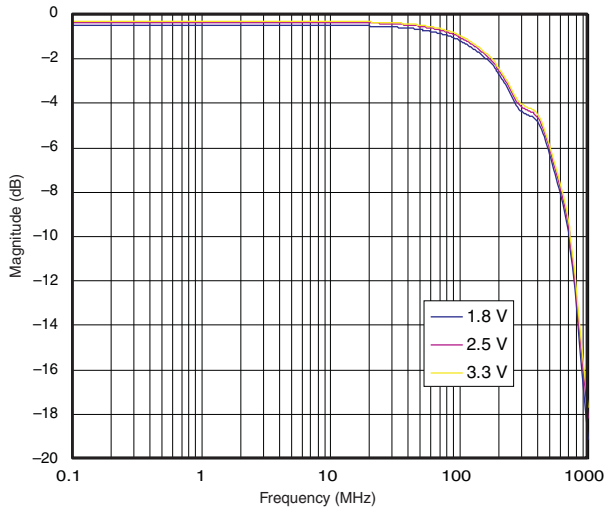


Figure 11. Insertion Loss

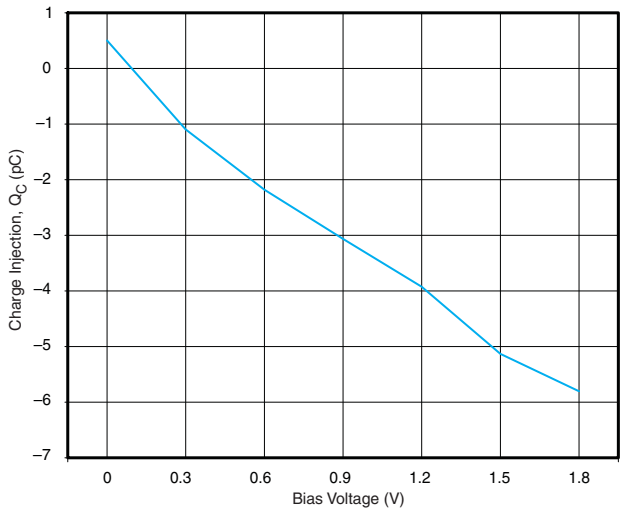


Figure 12. Charge Injection vs Bias Voltage (1.8 V)

Copyright © 2009–2019, Texas Instruments Incorporated

Typical Characteristics (continued)

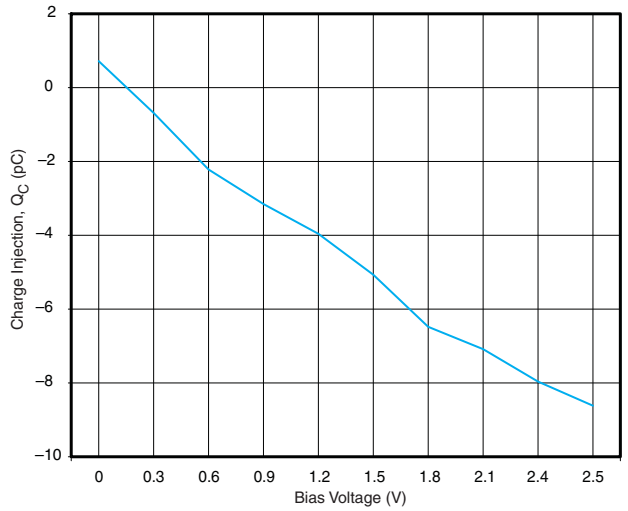


Figure 13. Charge Injection vs Bias Voltage (2.5 V)

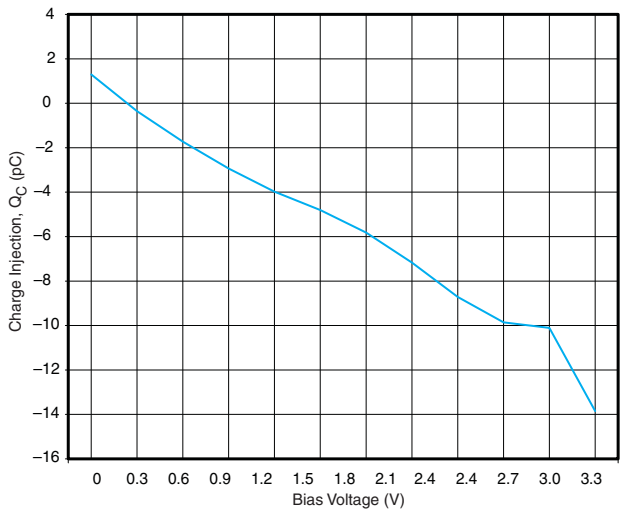


Figure 14. Charge Injection vs Bias Voltage (3.3 V)

Copyright © 2009–2019, Texas Instruments Incorporated

7 Parameter Measurement Information

Table 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.
Δr_{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 ΔV_{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.

Copyright © 2009–2019, Texas Instruments Incorporated

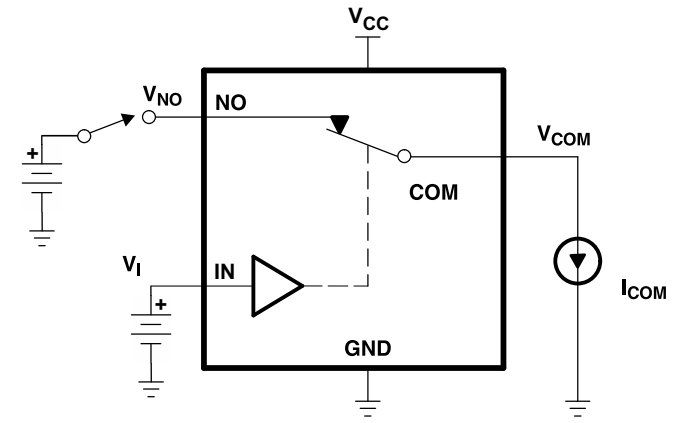


Figure 15. ON-State Resistance (r_{ON})

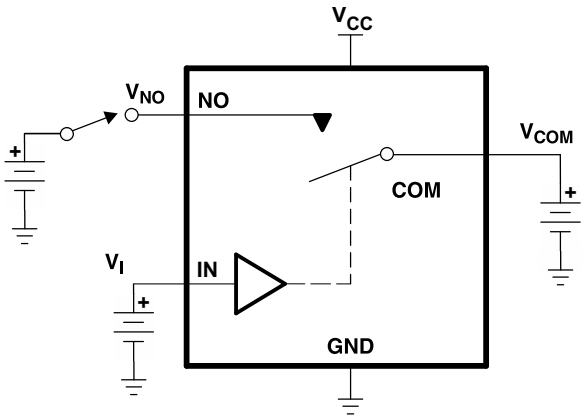


Figure 16. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NC(OFF)}$, $I_{COM(PWROFF)}$, $I_{NC(PWROFF)}$)

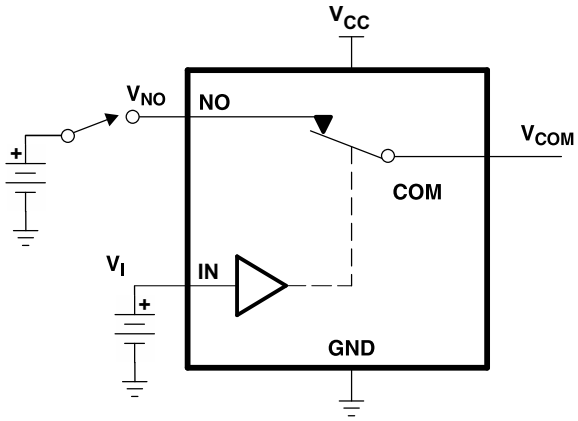


Figure 17. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$)

Copyright © 2009–2019, Texas Instruments Incorporated

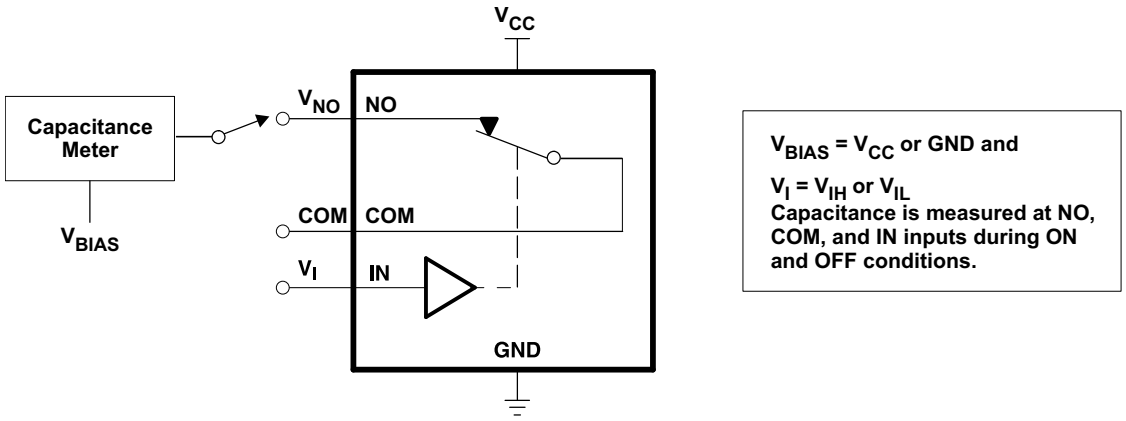
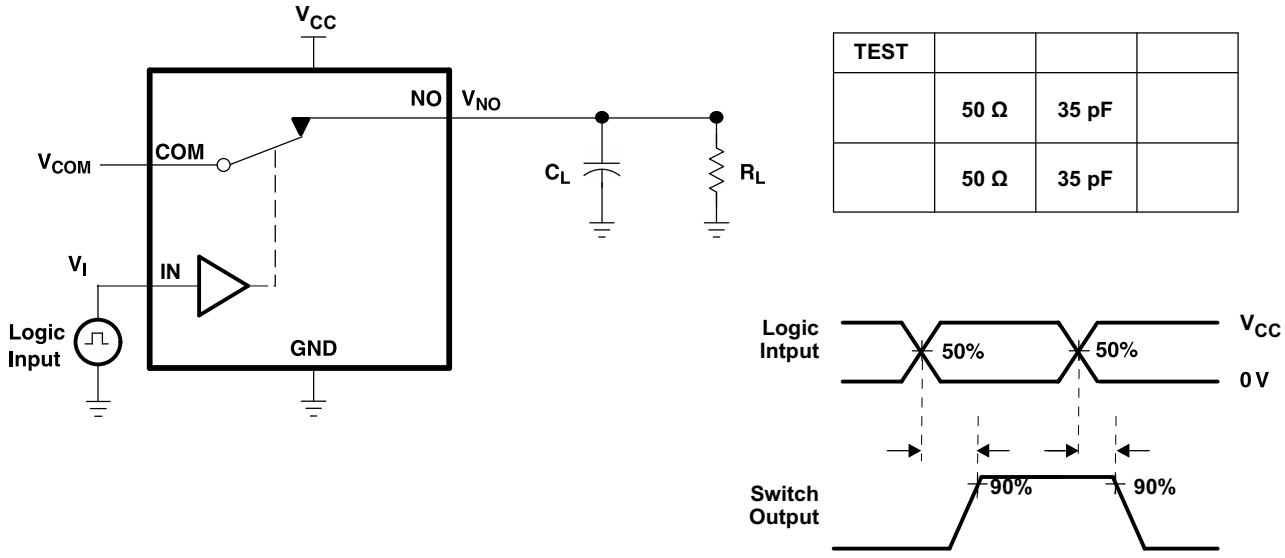


Figure 18. Capacitance
(C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$)

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

C_L includes probe and jig capacitance.



TEST			
	50 Ω	35 pF	
	50 Ω	35 pF	

Figure 19. 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 ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

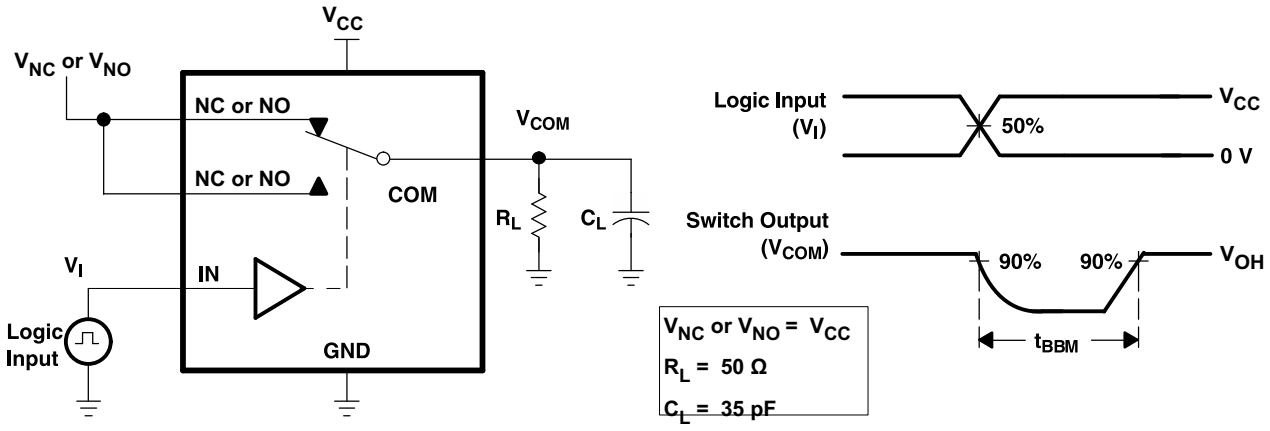
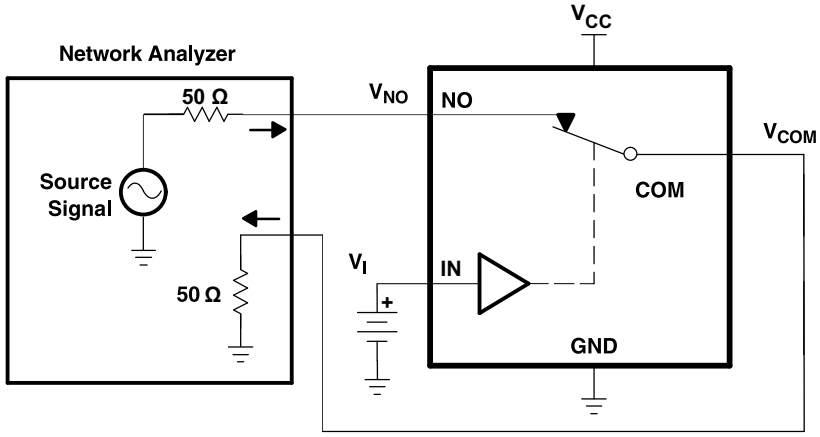


Figure 20. Break-Before-Make Time (t_{BBM})

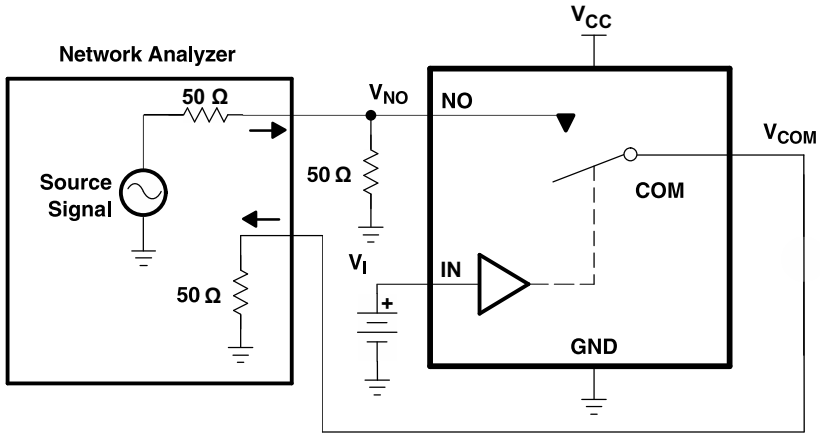


Channel ON: NO to COM
V_I = V_{IH} or V_{IL}

Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at 50-Ω load)
DC Bias = 350 mV

Figure 21. Bandwidth (BW)



Channel OFF: NO to COM
V_I = V_{IH} or V_{IL}

Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at 50-Ω load)
DC Bias = 350 mV

Figure 22. OFF Isolation (O_{ISO})

Copyright © 2009–2019, Texas Instruments Incorporated

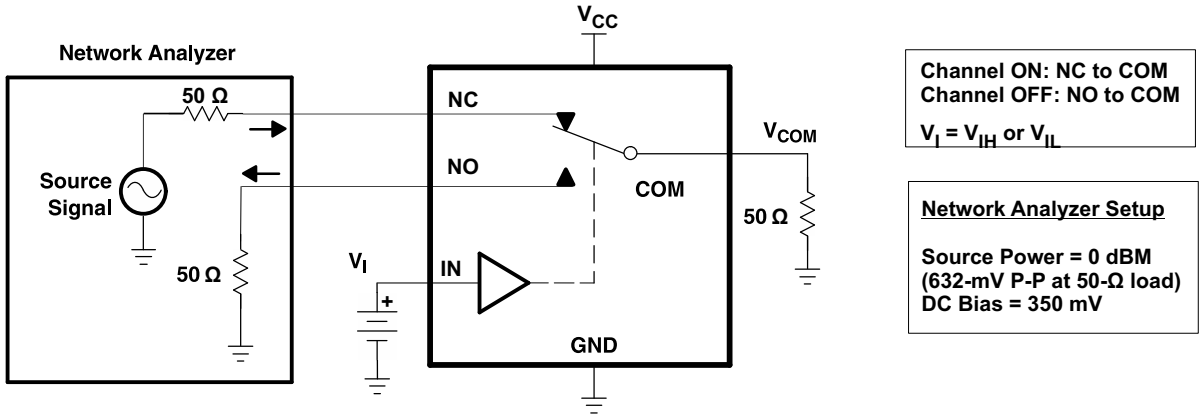


Figure 23. Crosstalk (X_{TALK})

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

C_L includes probe and jig capacitance.

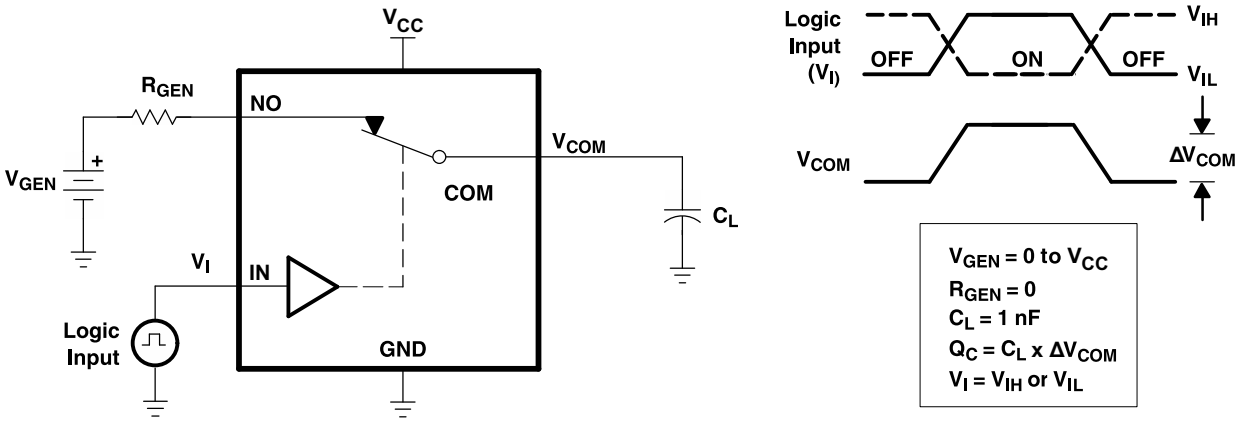


Figure 24. Charge Injection (Q_C)

C_L includes probe and jig capacitance.

Channel ON: COM to NO	$V_I = V_{IH}$ or V_{IL}	R_L = 600 Ω
$V_{SOURCE} = V_{CC}$ P-P	f_{SOURCE} = 20 Hz to 20 kHz	C_L = 50 pF

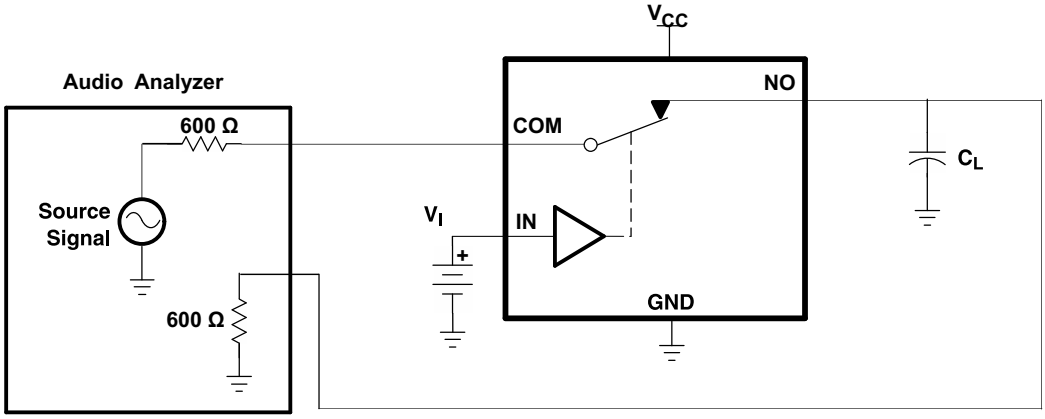


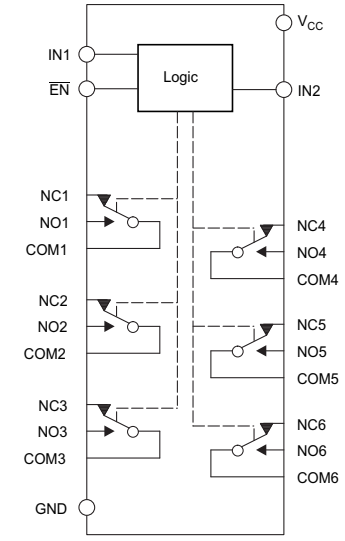
Figure 25. Total Harmonic Distortion (THD)

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



Copyright © 2016, Texas Instruments Incorporated

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. Table 2 lists the functions of TS3A27518E

Table 2. Function Table

$\overline{EN}$	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

Copyright © 2009–2019, Texas Instruments Incorporated

9 Application and Implementation

NOTE

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

9.1 Application Information

The 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 inferfaces such as SD, SDIO, GPIO, MMC and qSPI.

9.2 Typical Application

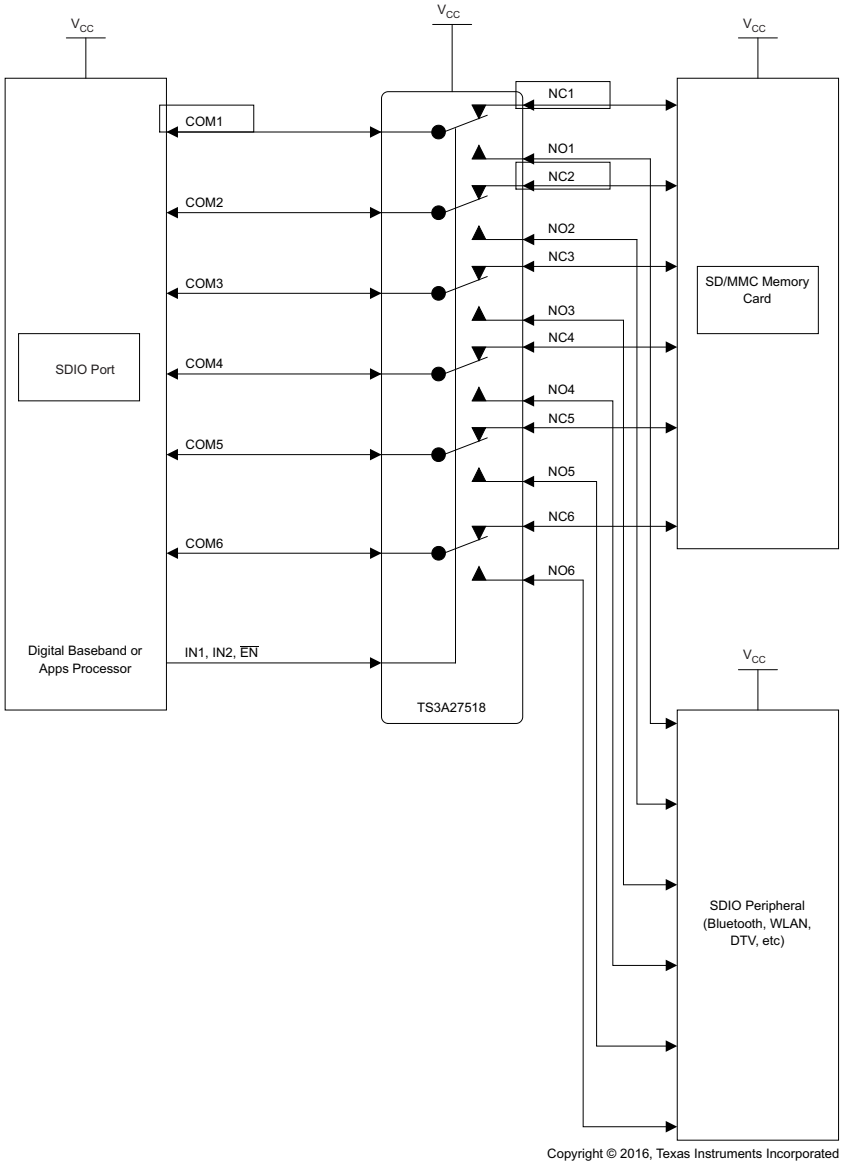


Figure 26. SDIO Expander Application Block Diagram

Typical Application (continued)

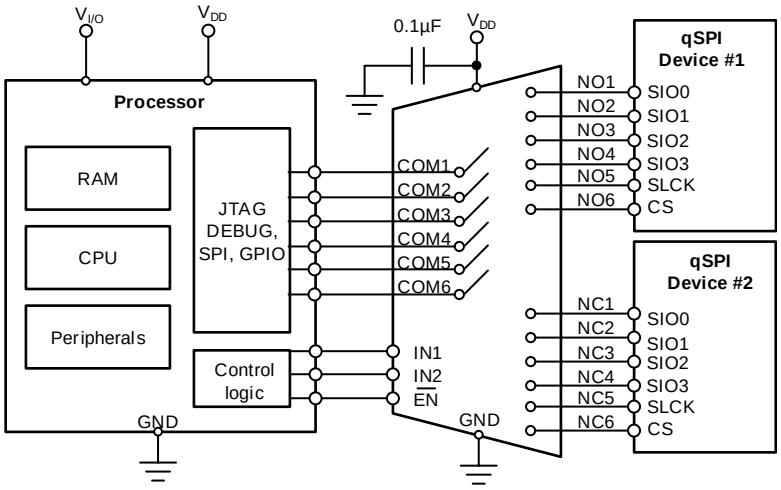


Figure 27. qSPI Expander Application Block Diagram

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 *Recommended Operating Conditions*.

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_{CC} or down to GND to avoid undesired switch positions that could result from the floating pin.

For the RTW package connect the thermal pad to ground.

9.2.3 Application Curve

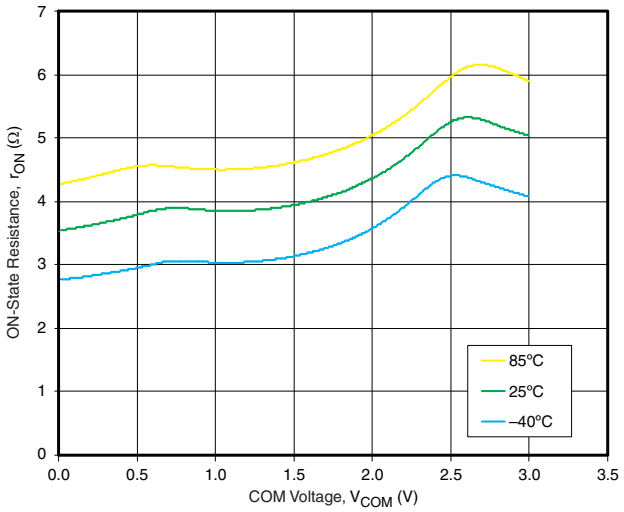


Figure 28. ON-State Resistance vs COM Voltage (V_{CC} = 3 V)

Copyright © 2009–2019, Texas Instruments Incorporated

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-μF 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

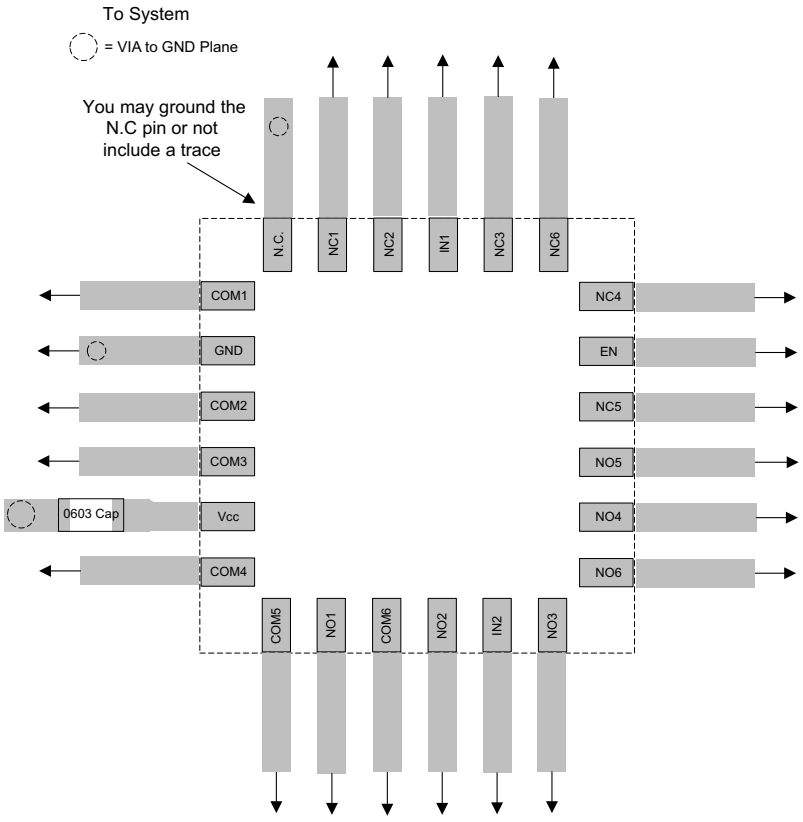


Figure 29. WQFN Layout Recommendation

12 Device and Documentation Support

12.1 Community Resources

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, 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.

12.2 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

12.3 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

12.4 Glossary

SLYZ022 — *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.

Copyright © 2009–2019, Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS3A27518EPWR	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	YL518E	Samples
TS3A27518ERTWR	ACTIVE	WQFN	RTW	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YL518E	Samples
TS3A27518EZQSR	LIFEBUY	BGA MICROSTAR JUNIOR	ZQS	24	2500	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	YL518E	

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish 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.

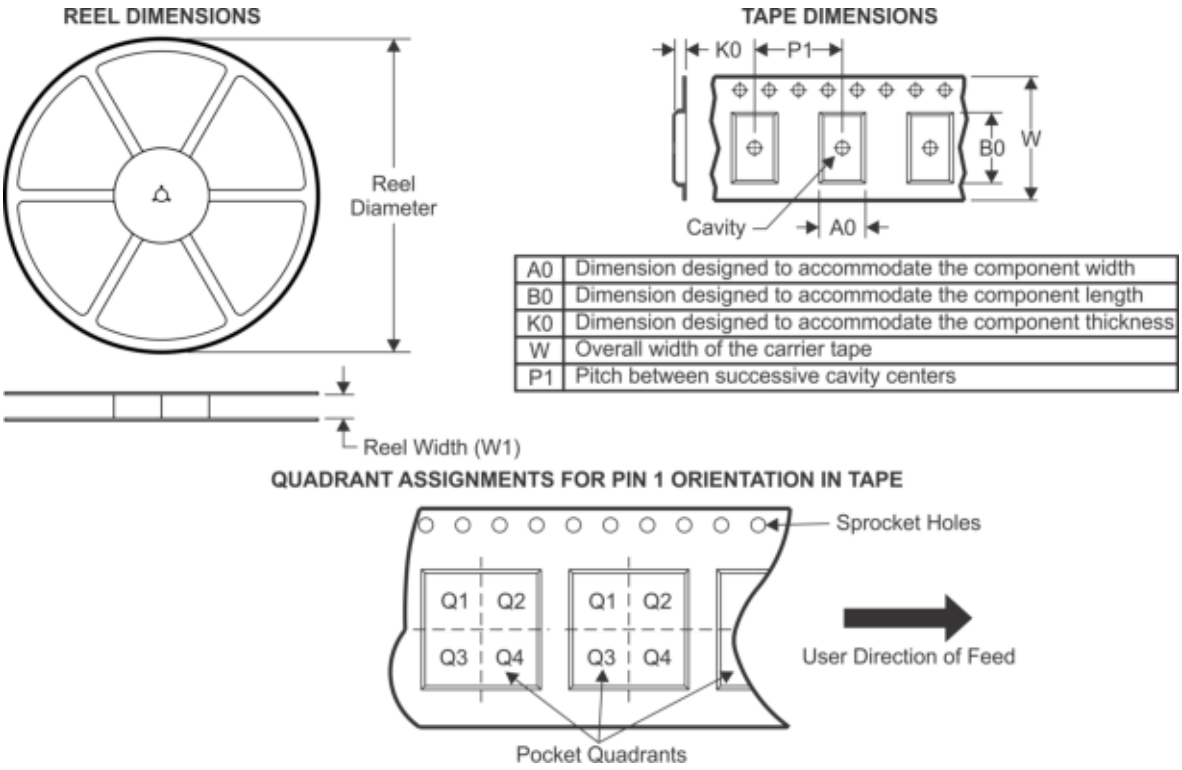
OTHER QUALIFIED VERSIONS OF TS3A27518E :

- Automotive: TS3A27518E-Q1

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION

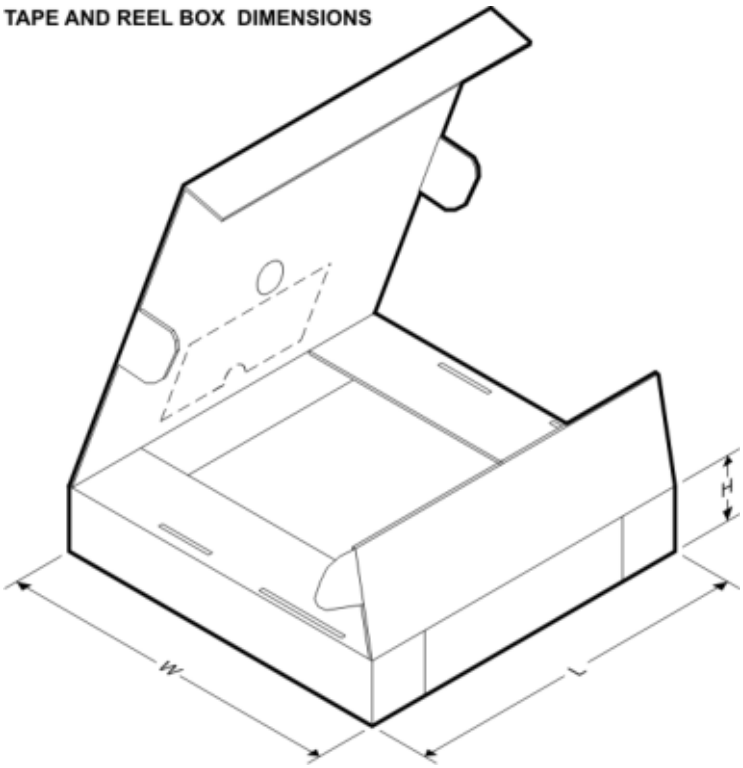


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

*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
TS3A27518EZQSR	BGA MICROSTAR JUNIOR	ZQS	24	2500	330.0	12.4	3.3	3.3	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

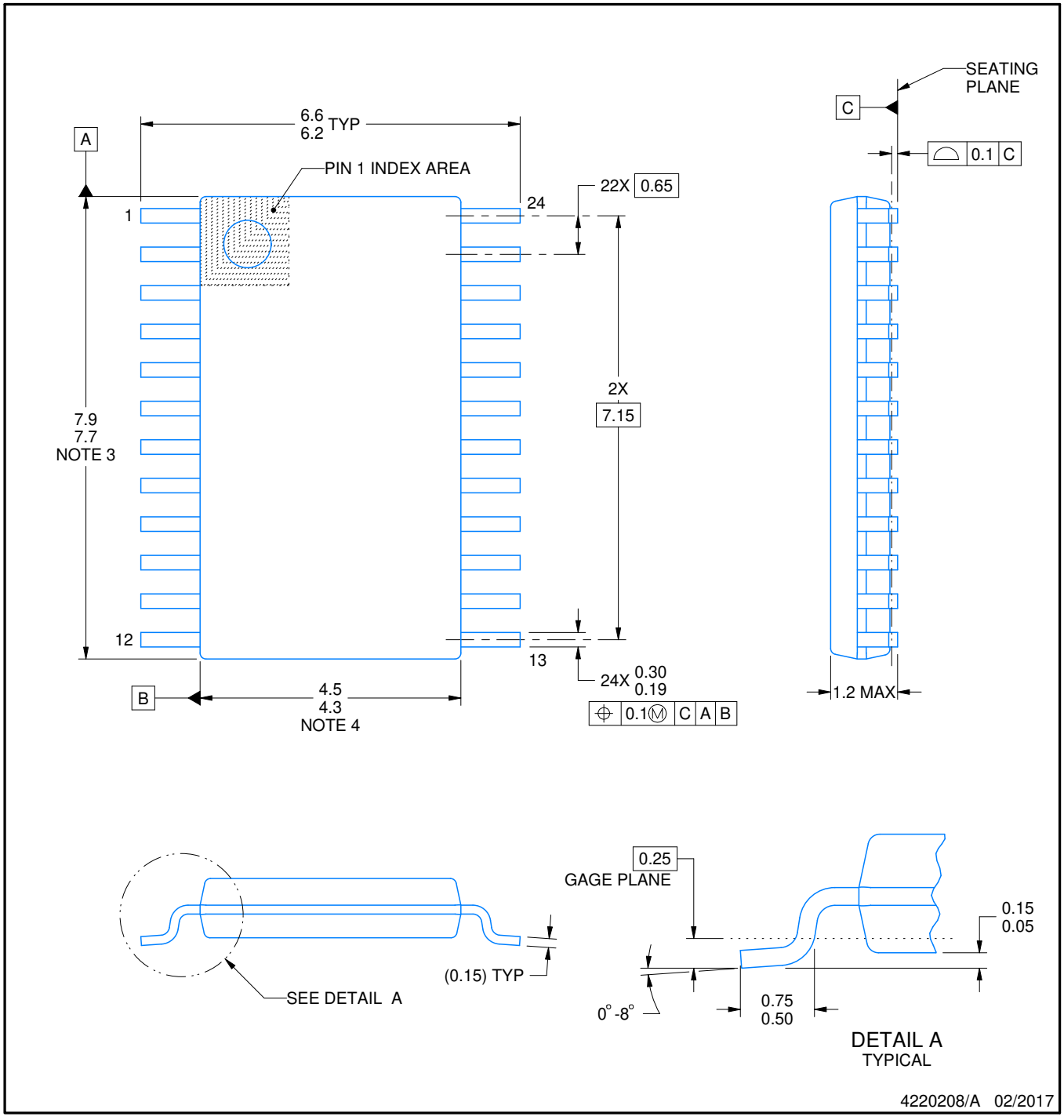
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A27518EPWR	TSSOP	PW	24	2000	367.0	367.0	38.0
TS3A27518ERTWR	WQFN	RTW	24	3000	367.0	367.0	35.0
TS3A27518EZQSR	BGA MICROSTAR JUNIOR	ZQS	24	2500	350.0	350.0	43.0

PACKAGE OUTLINE

PW0024A

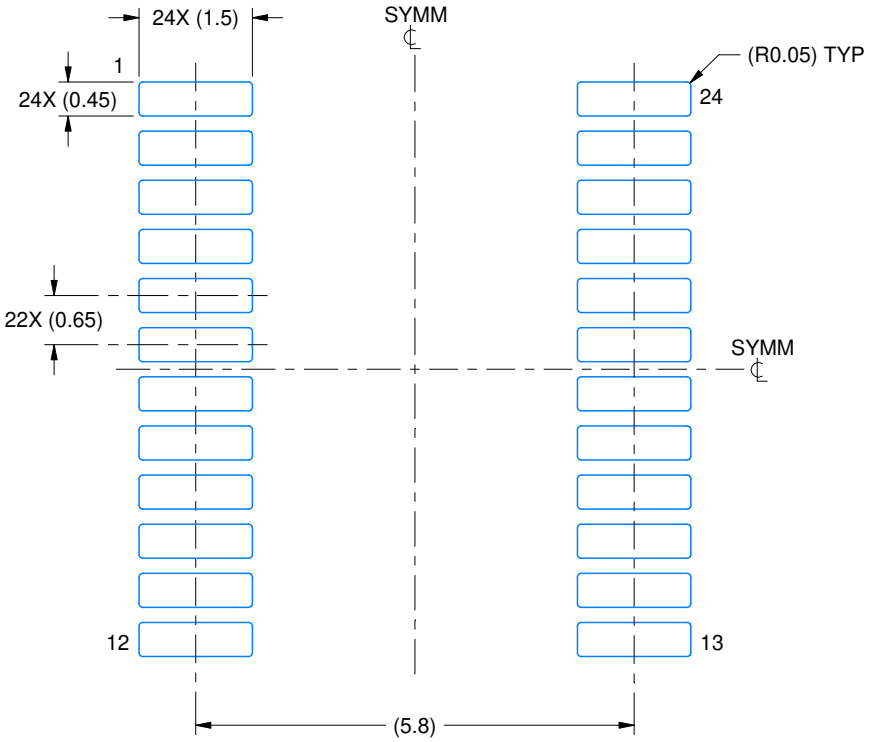
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

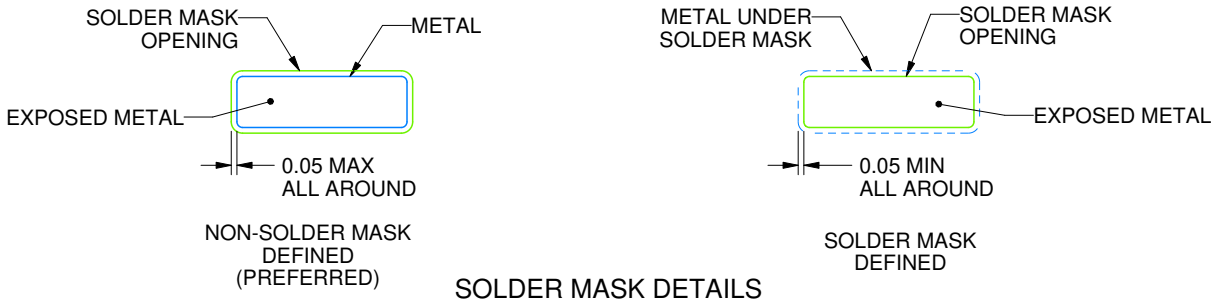


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

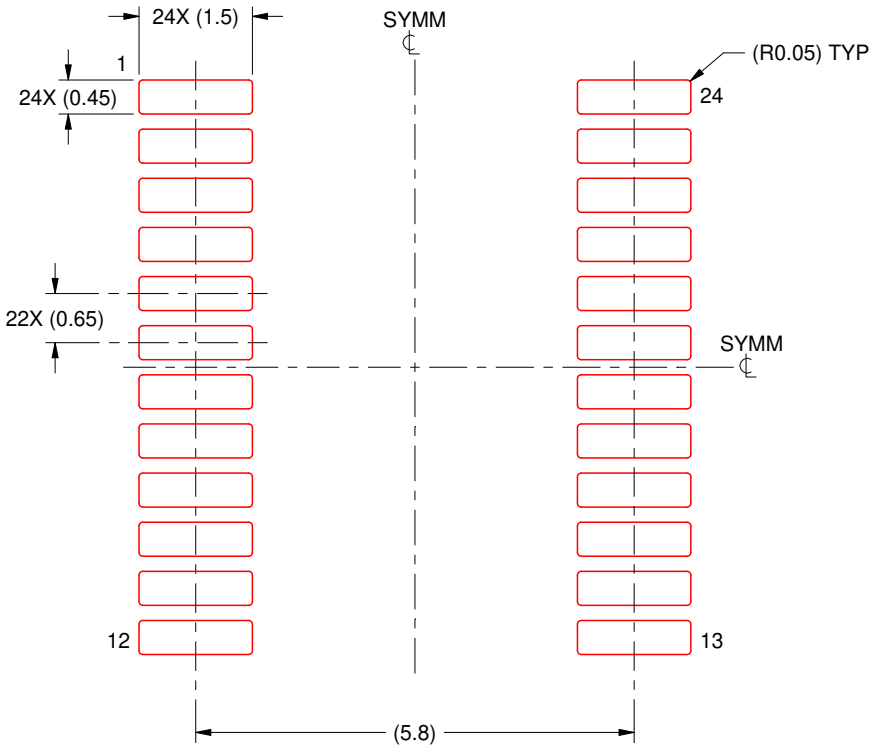


SOLDER MASK DETAILS

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.



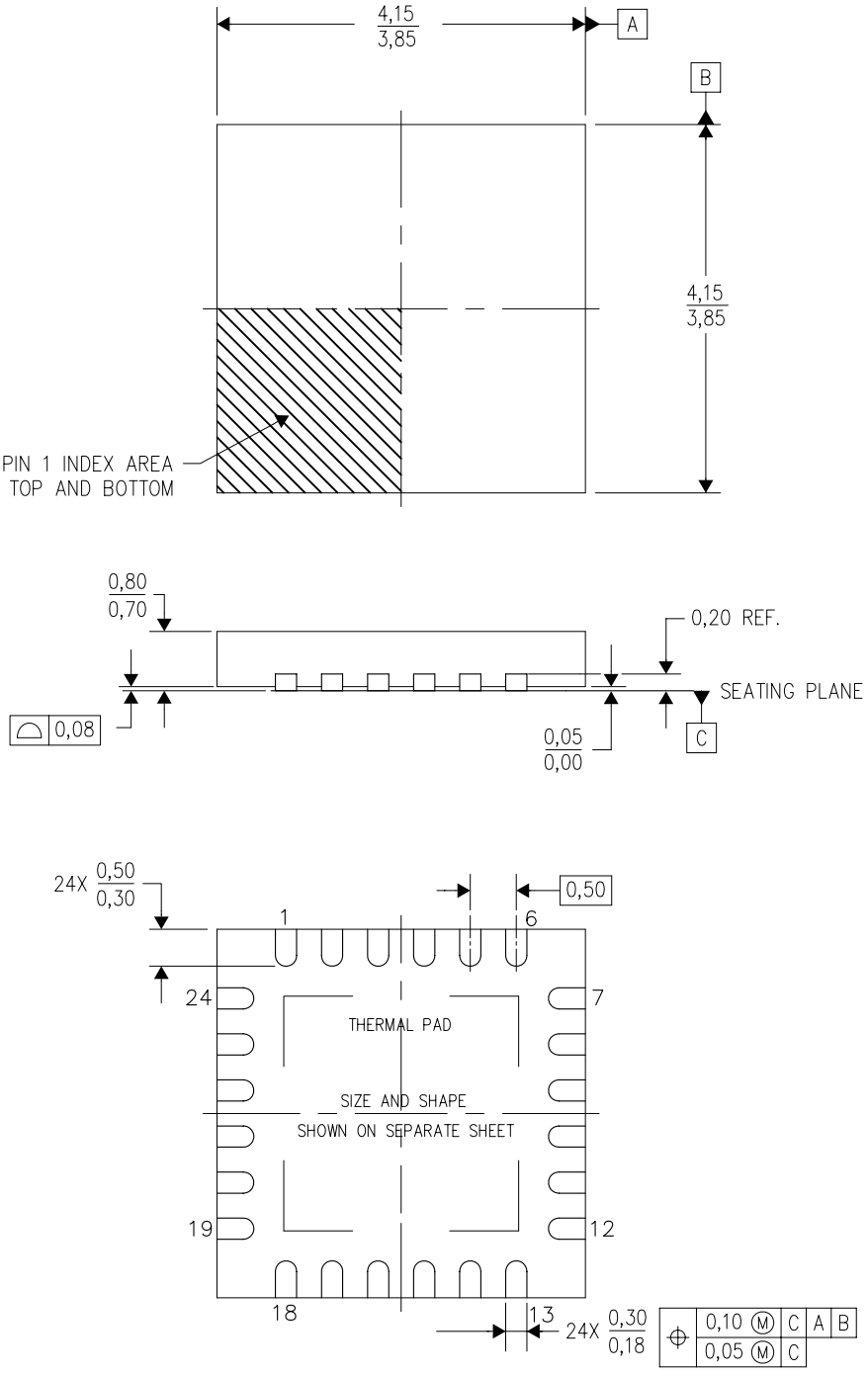
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220208/A 02/2017

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.

RTW (S–PWQFN–N24) PLASTIC QUAD FLATPACK NO–LEAD



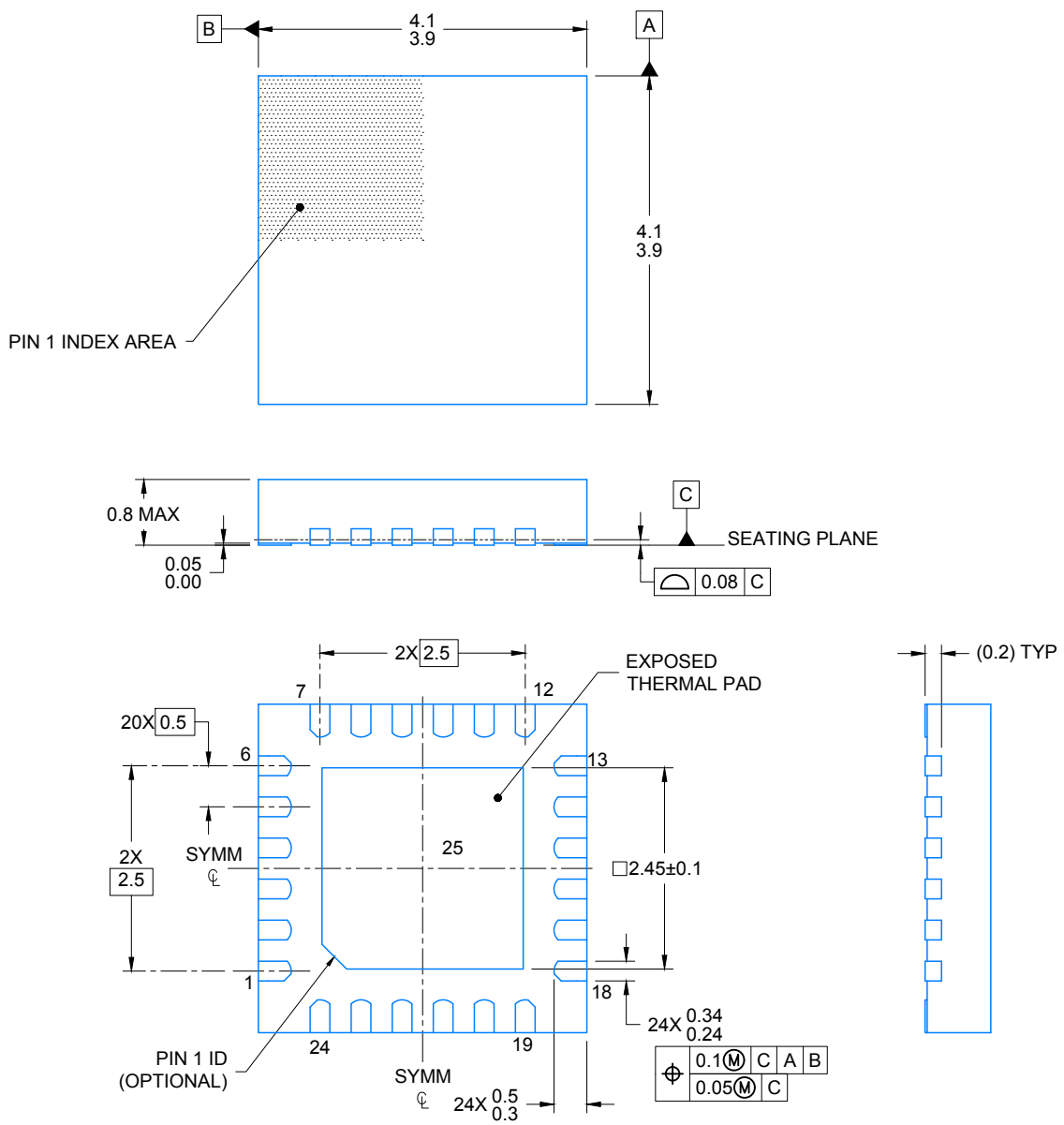
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Quad Flatpack, No–Leads (QFN) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Falls within JEDEC MO–220.

PACKAGE OUTLINE

RTW0024B

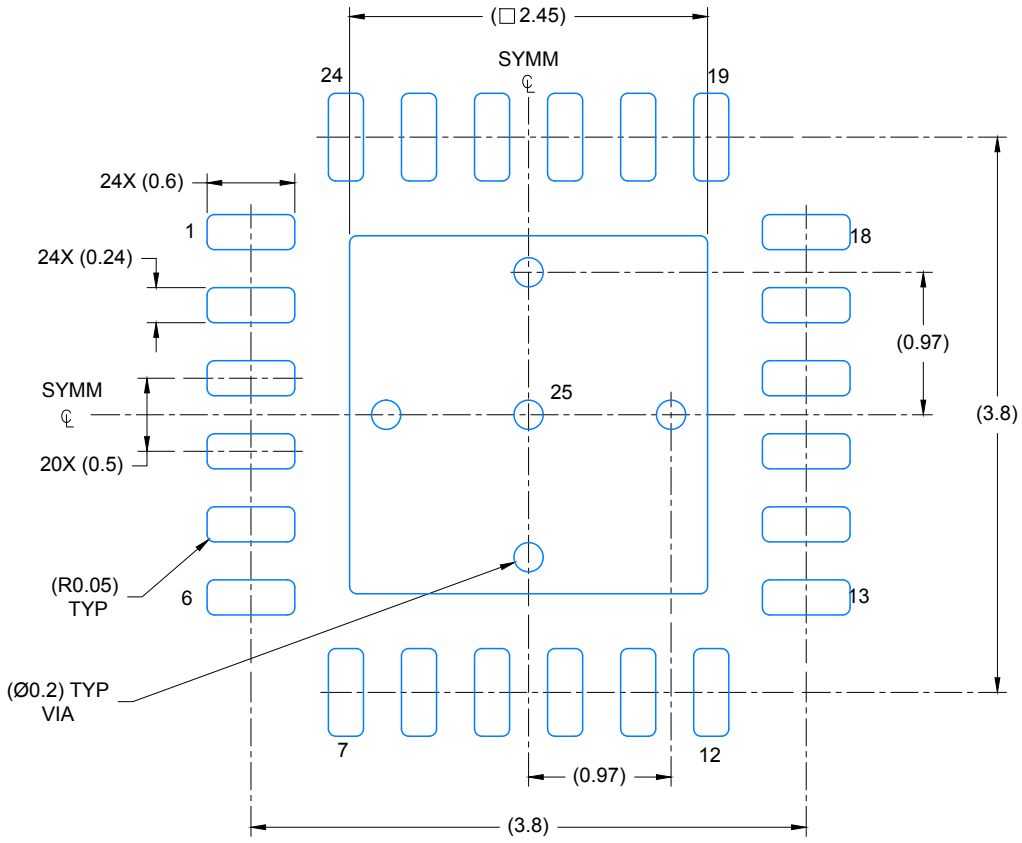
WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK-NO LEAD

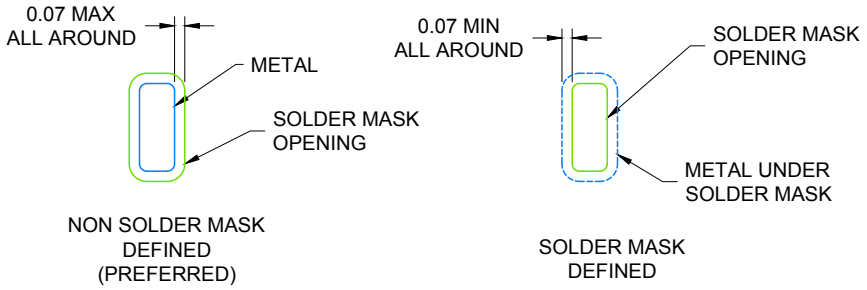


NOTES:

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

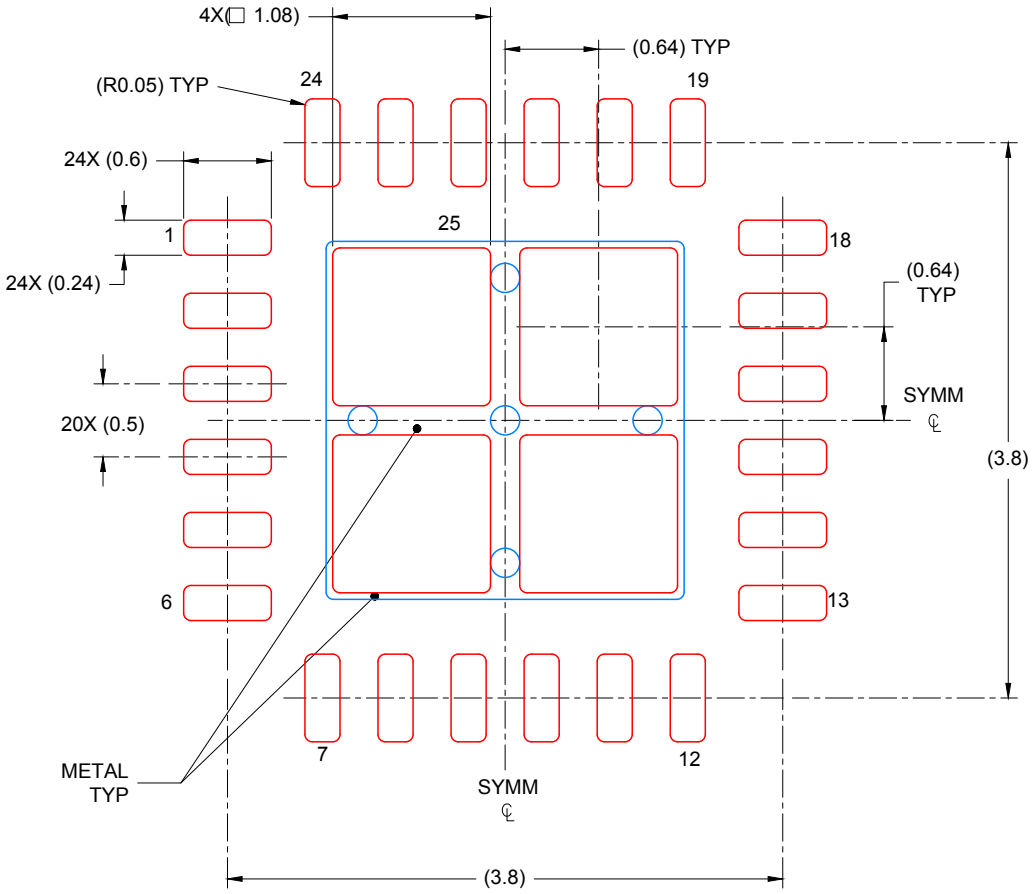


SOLDER MASK DETAILS

4219135/A 11/2016

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271) .



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

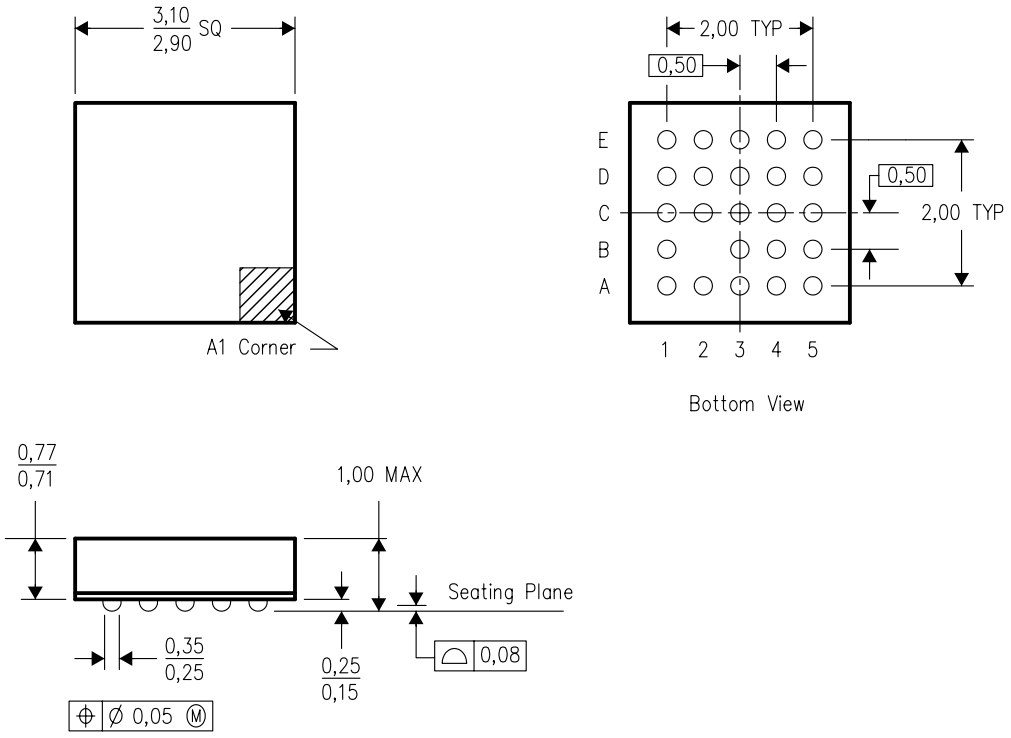
EXPOSED PAD 25:
78% PRINTED COVERAGE BY AREA UNDER PACKAGE
SCALE: 20X

4219135/A 11/2016

NOTES: (continued)

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

ZQS (S–PBGA–N24) PLASTIC BALL GRID ARRAY



4206374/A 09/04

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–225
D. This package is lead–free.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2019, Texas Instruments Incorporated