带有集成型 IEC L-4 ESD 及 1.8V 逻辑兼容控制输入的 TS3A27518E-Q1 6 位、2 选 1 多路复用器/多路解复用器

1 特性

- 符合汽车应用 应用
- 具有符合 AEC-Q100 标准的下列结果：
  - 器件温度 2 级：-40°C 至 105°C 的环境运行温度范围
  - 器件人体放电模式 (HBM) 静电放电 (ESD) 分类等级 H2
  - 器件 CDM ESD 分类等级 C3B
- 1.65V 至 3.6V 单电源运行
- 关断保护（在处于断电模式时提供隔离，在 V_+ = 0 时处于高阻抗状态）
- 低电容开关，21.5pF（典型值）
- 可为高速轨至轨信号处理提供高达 240MHz 的带宽
- 串扰及断开隔离为 −62dB
- 用于控制输入的 1.8V 逻辑阈值兼容性
- 可耐受 3.6V 电压的控制输入
- ESD 性能：NC/NO 端口
  - ±6kV 接触放电 (IEC 61000-4-2)
- 24 引脚 TSSOP (7.8mm x 4.4mm) 和 24 引脚 QFN (4mm x 4mm) 封装

2 应用

- 安全数码卡 (SD) / 安全数码输入输出卡 (SDIO) 和多媒体卡 (MMC) 两端口多路复用器 (MUX)
- PC VGA 视频 MUX / 视频系统
- 音频和视频信号路由

3 说明

TS3A27518E-Q1 是一款 6 位、2 选 1 多路复用器/多路解复用器，其设计工作电压为 1.65V 至 3.6V。此器件可以处理数字信号和模拟信号，并允许向任意方向传输高达 V_+ 的信号。TS3A27518E-Q1 有两个控制引脚，每个引脚可同时控制三个 2 选 1 复用器，并且一个使能引脚可用于将所有输出置于高阻抗模式。这个控制引脚与 1.8V 逻辑阈值兼容并且也与 2.5V 和 3.3V 阈值向后兼容。

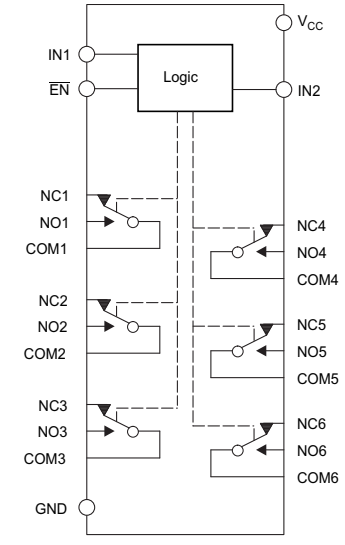
由于 SDIO 接口包含 6 位信号：即 CMD，CLK，和数据 [0:3] 信号，TS3A27518E-Q1 可实现任一 SD，SDIO，和多媒体卡主机控制器被扩展至多个卡或者外设。 TS3A27518E-Q1 有两个控制引脚，这两个引脚可为用户提供附加灵活性，例如复用两个设备中不同的音视频信号（诸如 LCD 电视、LCD 监视器、或者笔记本扩展坞）的功能。

器件信息(1)

器件型号	封装	封装尺寸（标称值）
TS3A27518E-Q1	RTW (WQFN)	4.00mm x 4.00mm
	PW (TSSOP)	7.80mm x 4.40mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

功能方框图



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本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。 有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。 TI 不保证翻译的准确性和有效性。 在实际设计之前，请务必参考最新版本的英文版本。

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4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Revision B (May 2012) to Revision C **Page**

- 添加了*器件信息* 表、*ESD 额定值* 表、*建议运行条件* 表、*特性 说明* 部分、*器件功能模式*、*应用和实施* 部分、*电源建议* 部分、*布局* 部分、*器件和文档支持* 部分以及*机械、封装和可订购信息* 部分 ... 1

Changes from Revision A (March 2012) to Revision B **Page**

- 将器件的温度等级从 1 更改为 2，删除了最大耐受电压信息，将 C3B2 更改为 C3B。 ... 1
- 在订购信息表中添加了额外一行。 ... 1
- Changed T_A = –40°C to 85°C to T_A = –40°C to 105°C ... 5
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C and limits -7.5 to 7.5 ... 5
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 68 ... 5
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- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 5 µA ... 6
- Changed T_A = –40°C to 85°C to T_A = –40°C to 105°C ... 7
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 38.4 ... 7
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 3 ... 8
- Changed T_A = –40°C to 85°C to T_A = –40°C to 105°C ... 9
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C and limits –5.8 to 5.8 ... 9
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 35.2 ... 9
- Changed Full to –40°C to 85°C and added extra row with 85°C to 105°C with limits 2.5 ... 10

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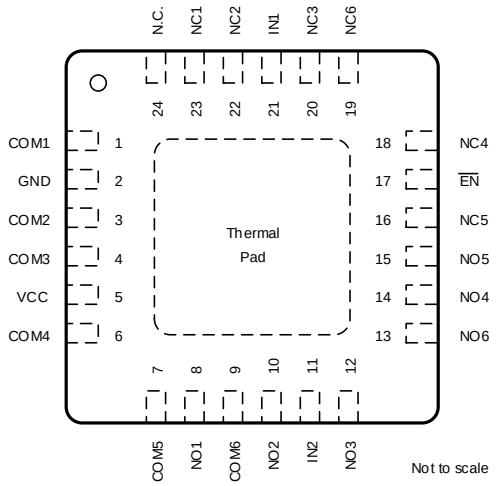
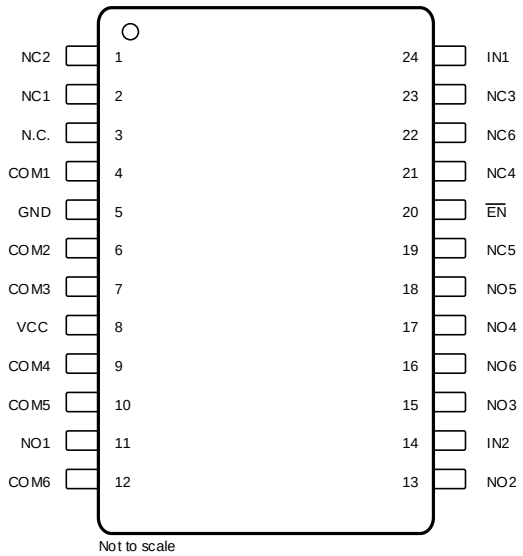
5 Pin Configuration and Functions

RTW Package
24-Pin WQFN
Top View



PW Package
24-Pin TSSOP
Top View



Pin Functions

PIN			I/O	DESCRIPTION
NAME	RTW	PW		
COM1	1	4	I/O	Common-signal path
COM2	3	6	I/O	Common-signal path
COM3	4	7	I/O	Common-signal path
COM4	6	9	I/O	Common-signal path
COM5	7	10	I/O	Common-signal path
COM6	9	12	I/O	Common-signal path
$\overline{EN}$	17	20	I	Digital control to enable or disable all signal paths
GND	2	5	—	Ground.
IN1	21	24	I	Digital control to connect COM to NC or NO
IN2	11	14	I	Digital control to connect COM to NC or NO
N.C.	24	3	—	Not connected
NC1	23	2	I/O	Normally closed-signal path
NC2	22	1	I/O	Normally closed-signal path
NC3	20	23	I/O	Normally closed-signal path
NC4	18	21	I/O	Normally closed-signal path
NC5	16	19	I/O	Normally closed-signal path
NC6	19	22	I/O	Normally closed-signal path
NO1	8	11	I/O	Normally open-signal path
NO2	10	13	I/O	Normally open-signal path
NO3	12	15	I/O	Normally open-signal path
NO4	14	17	I/O	Normally open-signal path
NO5	15	18	I/O	Normally open-signal path
NO6	13	16	I/O	Normally open-signal path
V_{CC}	5	8	—	Voltage supply

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6 Specifications

6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_+	Supply voltage range(2)		–0.5	4.6	V
V_{NC} V_{NO} V_{COM}	Analog voltage range(2) (3) (4)		–0.5	4.6	V
I_K	Analog port diode current(5)	$V_+ < V_{NC}$, V_{NO}, $V_{COM} < 0$	–50		mA
I_{NC} I_{NO} I_{COM}	ON-state switch current(6)	V_{NC}, V_{NO}, V_{COM} = 0 to V_+	–50	50	mA
V_I	Digital input voltage range(2) (3)		–0.5	4.6	V
I_{IK}	Digital input clamp current(2) (3)	$V_{IO} < V_I < 0$	–50		mA
I_+	Continuous current through V_+			100	mA
I_{GND}	Continuous current through GND		–100		mA
T_{stg}	Storage temperature range		–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) All voltages are with respect to ground, unless otherwise specified.
(3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(4) This value is limited to 5.5 V maximum.
(5) Requires clamp diodes on analog port to V_+.
(6) 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) AEC-Q100 Classification Level H2	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2) AEC-Q100 Classification Level C3B	±750	

(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)	
		24 PINS	24 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	104	40.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	51.6	42.9	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	57.5	19.2	°C/W
ψ_{JT}	Junction-to-top characterization parameter	9.9	1	°C/W
ψ_{JB}	Junction-to-board characterization parameter	57.1	19.3	°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.

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6.5 Electrical Characteristics for 3.3-V Supply(1)

V_+ = 3 V to 3.6 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
ON-state resistance	r_{on}	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	3 V		4.4	6.2	Ω
				Full				7.6	
ON-state resistance match between channels	Δr_{on}	V_{NC} or V_{NO} = 2.1 V, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	3 V		0.3	0.7	Ω
				Full				0.8	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 16	25°C	3 V		0.95	2.1	Ω
				Full				2.3	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 1 V, V_{COM} = 3 V, or V_{NC} or V_{NO} = 3 V, V_{COM} = 1 V,	Switch OFF, See Figure 16	25°C	3.6 V	–0.5	0.05	0.5	µA
				Full		–7		7	
	$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$	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,		25°C	0 V	–1	0.05	1	
				Full		–12		12	
COM OFF leakage current	$I_{COM(OFF)}$	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	25°C	3.6 V	–1	0.01	1	µA
				Full		–2		2	
	$I_{COM(PWROFF)}$	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,		25°C	0 V	–1	0.02	1	
				Full		–12		12	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	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	25°C	3.6 V	–2.5	0.04	2.2	µA
				–40°C to 85°C		–7		7	
				85°C to 105°C		–7.5		7.5	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 1 V, or V_{NC} or V_{NO} = Open, V_{COM} = 3 V,	Switch ON, See Figure 17	25°C	3.6 V	–2	0.03	2	µA
				Full		–7		7	
Digital Control Inputs (IN1, IN2, $\overline{EN}$)(2)									
Input logic high	V_{IH}			Full	3.6 V	1.2		3.6	V
Input logic low	V_{IL}			Full	3.6 V	0		0.65	V
Input leakage current	I_{IH}, I_{IL}	V_I = V_+ or 0		25°C	3.6 V	–0.1	0.05	0.1	µA
				Full		–2.5		2.5	
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	3.3 V		18.1	59	ns
				–40°C to 85°C	3 V to 3.6 V			60	
				85°C to 105°C				68	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	3.3 V		25.4	60.6	ns
				–40°C to 85°C	3 V to 3.6 V			61	
				85°C to 105°C				70	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 35 pF, See Figure 20	25°C	3.3 V	4	11.1	22.7	ns
				Full	3 V to 3.6 V			28	

(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_+ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

V_+ = 3 V to 3.6 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 24	25°C	3.3 V		0.81		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	3.3 V		13		pF
COM OFF capacitance	$C_{COM(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18		3.3 V		8.5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	3.3 V		21.5		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 18	25°C	3.3 V		21.5		pF
Digital input capacitance	C_I	V_I = V_+ or GND	See Figure 18	25°C	3.3 V		2		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON, See Figure 20	25°C	3.3 V		240		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 22	25°C	3.3 V		–62		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	3.3 V		–62		dB
Crosstalk adjacent	$X_{TALK(ADJ)}$	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	3.3 V		–71		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 25	25°C	3.3 V		0.05		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	3.6 V		0.04	0.3	µA
				–40°C to 85°C				3	
				85°C to 105°C				5	

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6.6 Electrical Characteristics for 2.5-V Supply(1)

V_+ = 2.3 V to 2.7 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
ON-state resistance	r_{on}	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	2.3 V		5.5	9.6	Ω
				Full				11.5	
ON-state resistance match between channels	Δr_{on}	V_{NC} or V_{NO} = 1.6 V, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	2.3 V		0.3	0.8	Ω
				Full				0.9	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 16	25°C	2.3 V		0.91	2.2	Ω
				Full				2.3	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	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	25°C	2.7 V	–0.3	0.04	0.3	µA
				Full		–6		6	
	$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$	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,		25°C	0 V	–0.6	0.02	0.6	
				Full		–10		10	
COM OFF leakage current	$I_{COM(OFF)}$	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	25°C	2.7 V	–0.7	0.02	0.7	µA
				Full		–1		1	
	$I_{COM(PWROFF)}$	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,		25°C	0 V	–0.7	0.02	0.7	
				Full		–7.2		7.2	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NC} or V_{NO} = 0.5 V or 2.3 V, V_{COM} = Open,	Switch ON, See Figure 17	25°C	2.7 V	–2.1	0.03	2.1	µA
				Full		–6		6	
COM ON leakage current	$I_{COM(ON)}$	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	25°C	2.7 V	–2	0.02	2	µA
				Full		–5.7		5.7	
Digital Control Inputs (IN1, IN2, $\overline{EN}$)(2)									
Input logic high	V_{IH}	V_I = V_+ or GND		Full	2.7 V	1.15		3.6	V
Input logic low	V_{IL}			Full	2.7 V	0		0.55	V
Input leakage current	I_{IH}, I_{IL}	V_I = V_+ or 0		25°C	2.7 V	-0.1	0.01	0.1	µA
				Full		–2.1		2.1	
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	2.5 V		17.2	36.8	ns
				Full	2.3 V to 2.7 V			42.5	
Turn-off time	t_{OFF}	V_{COM} = V+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	2.5 V		17.1	29.8	ns
				–40°C to 85°C	2.3 V to 2.7 V			34.4	
				85°C to 105°C				38.4	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 35 pF, See Figure 20	25°C	2.5 V	4.5	13	30	ns
				Full	2.3 V to 2.7 V			33.3	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 24	25°C	2.5 V		0.47		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	2.5 V		13.5		pF
COM OFF capacitance	$C_{COM(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18		2.5 V		9		pF

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

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

V_+ = 2.3 V to 2.7 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	2.5 V		22		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 18	25°C	2.5 V		22		pF
Digital input capacitance	C_I	V_I = V_+ or GND	See Figure 18	25°C	2.5 V		2		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON, See Figure 20	25°C	2.5 V		240		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 22	25°C	2.5 V		–62		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	2.5 V		–62		dB
Crosstalk adjacent	$X_{TALK(ADJ)}$	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	2.5 V		–71		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 25	25°C	2.5 V		0.06		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	2.7 V		0.01	0.1	µA
				–40°C to 85°C				2	
				85°C to 105°C				3	

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6.7 Electrical Characteristics for 1.8-V Supply(1)

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
ON-state resistance	r_{on}	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	1.65 V		7.1	14.4	Ω
				Full				16.3	
ON-state resistance match between channels	Δr_{on}	V_{NC} or V_{NO} = 1.5 V, I_{COM} = –32 mA,	Switch ON, See Figure 15	25°C	1.65 V		0.3	1	Ω
				Full				1.2	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NC} or V_{NO}) ≤ V_+, I_{COM} = –32 mA,	Switch ON, See Figure 16	25°C	1.65 V		2.7	5.5	Ω
				Full				7.3	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	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	25°C	1.95 V	–0.25	0.03	0.25	µA
				Full		–5		5	
	$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$	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,		25°C	0 V	–0.4	0.01	0.4	µA
				Full		–7.2		7.2	
COM OFF leakage current	$I_{COM(OFF)}$, $I_{COM(OFF)}$	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	25°C	1.95 V	–0.4	0.02	0.4	µA
				Full		–0.9		0.9	
	$I_{COM(PWROFF)}$, $I_{COM(PWROFF)}$	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,		25°C	0 V	–0.4	0.02	0.4	µA
				–40°C to 85°C		–5		5	
				85°C to 105°C		–5.8		5.8	
NC, NO ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	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	25°C	1.95 V	–2	0.02	2	µA
				Full		–5.2		5.2	
COM ON leakage current	$I_{COM(ON)}$	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	25°C	1.95 V	–2	0.02	2	µA
				Full		–5.2		5.2	
Digital Control Inputs (IN1, IN2, $\overline{EN}$)(2)									
Input logic high	V_{IH}	V_I = V_+ or GND		Full	1.95 V	1		3.6	V
Input logic low	V_{IL}			Full	1.95 V	0		0.4	V
Input leakage current	I_{IH}, I_{IL}	V_I = V_+ or 0		25°C	1.95 V	-0.1	0.01	0.1	µA
				Full		-2.1		2.1	
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	1.8 V		14.1	49.3	ns
				Full	1.65 V to 1.95 V			56.7	
Turn-off time	t_{OFF}	V_{COM} = V_+, R_L = 50 Ω,	C_L = 35 pF, See Figure 19	25°C	1.8 V		16.1	26.5	ns
				–40°C to 85°C	1.65 V to 1.95 V			31.2	
				85°C to 105°C				35.2	
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 35 pF, See Figure 20	25°C	1.8 V	5.3	18.4	58	ns
				Full	1.65 V to 1.95 V			58	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 1 nF, See Figure 24	25°C	1.8 V		0.21		pC

(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_+ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 105°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	1.8 V		9		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 18	25°C	1.8 V		22		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 18	25°C	1.8 V		22		pF
Digital input capacitance	C_I	V_I = V_+ or GND	See Figure 18	25°C	1.8 V		2		pF
Bandwidth	BW	R_L = 50 Ω,	Switch ON, See Figure 20	25°C	1.8 V		240		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 22	25°C	1.8 V		-60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	1.8 V		-60		dB
Crosstalk adjacent	$X_{TALK(ADJ)}$	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 23	25°C	1.8 V		-71		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 25	25°C	1.8 V		0.1		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	1.95 V		0.01	0.1	µA
				–40°C to 85°C				1.5	
				85°C to 105°C				2.5	

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6.8 Typical Characteristics

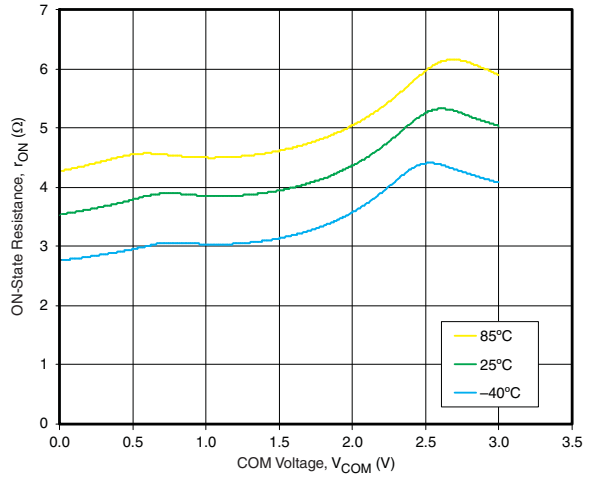

Figure 1. ON-State Resistance vs COM Voltage (V_{CC} = 3 V)

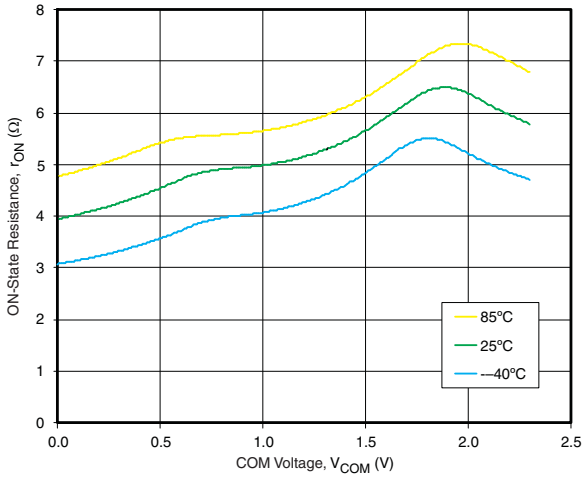

Figure 2. ON-State Resistance vs COM Voltage (V_{CC} = 2.3 V)

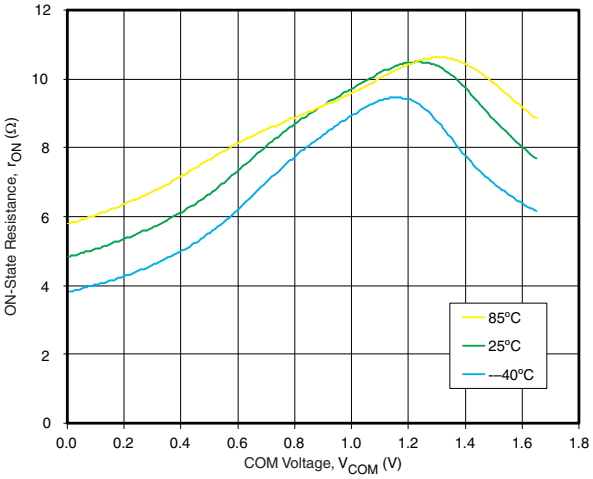

Figure 3. ON-State Resistance vs COM Voltage (V_{CC} = 1.65 V)

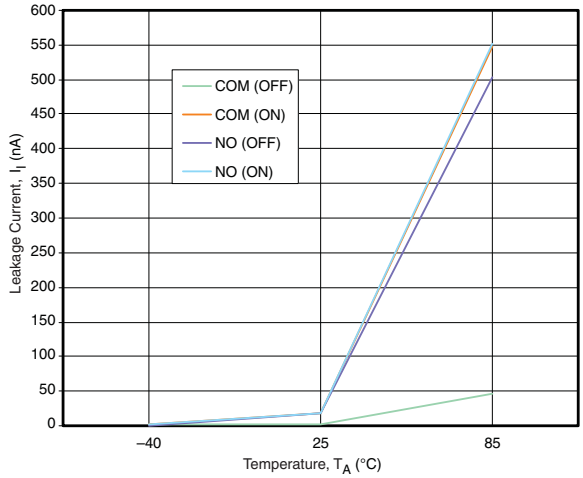

Figure 4. Leakage Current vs Temperature (V_{CC} = 3.3 V)

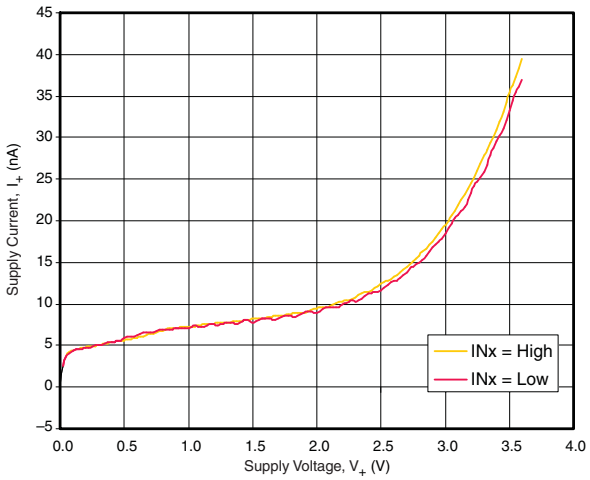

Figure 5. Supply Current vs Supply Voltage

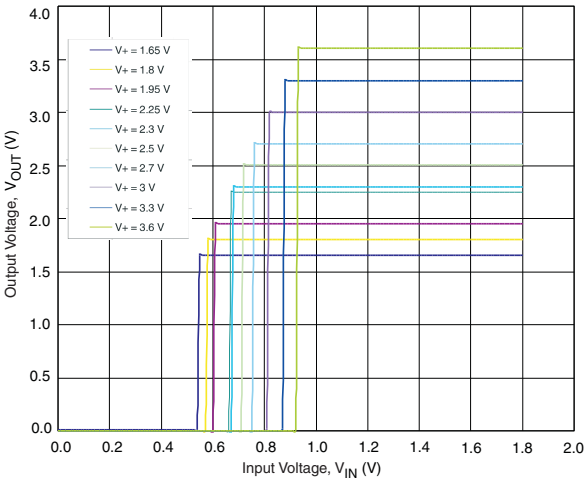

Figure 6. Control Input Thresholds (IN1, T_A = 25°C)

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Typical Characteristics (continued)

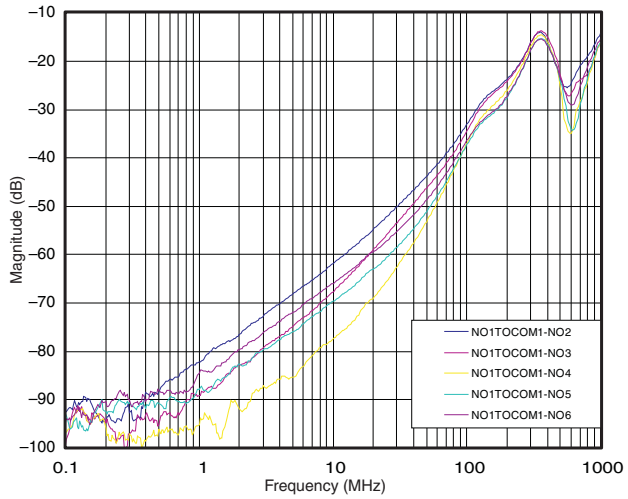

Figure 7. Crosstalk Adjacent

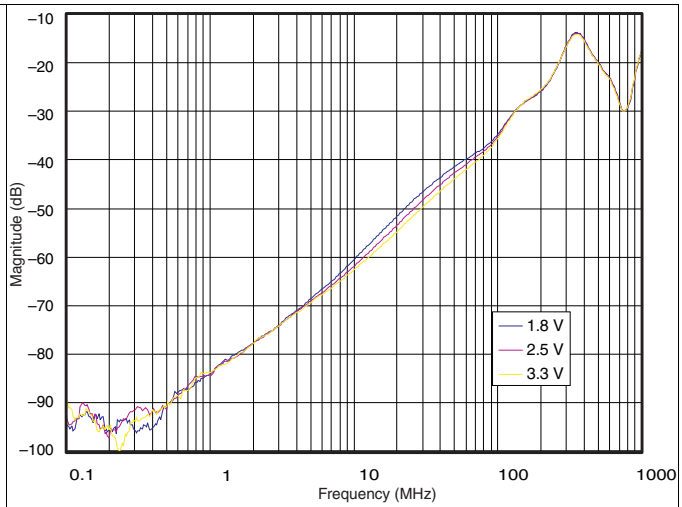

Figure 8. Crosstalk

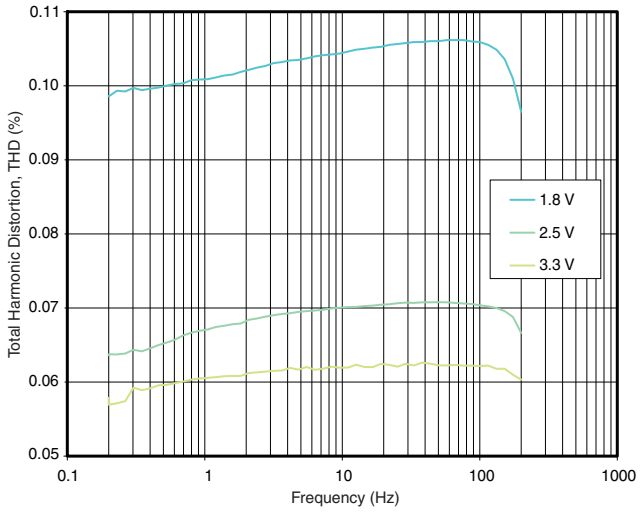

Figure 9. Total Harmonic Distortion vs Frequency

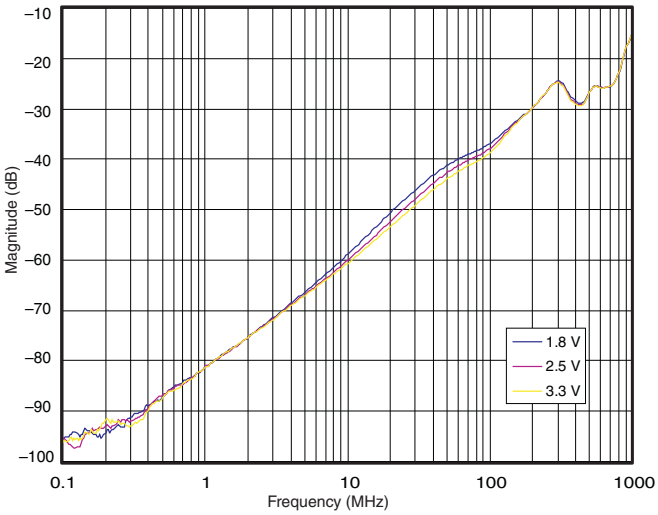

Figure 10. OFF Isolation

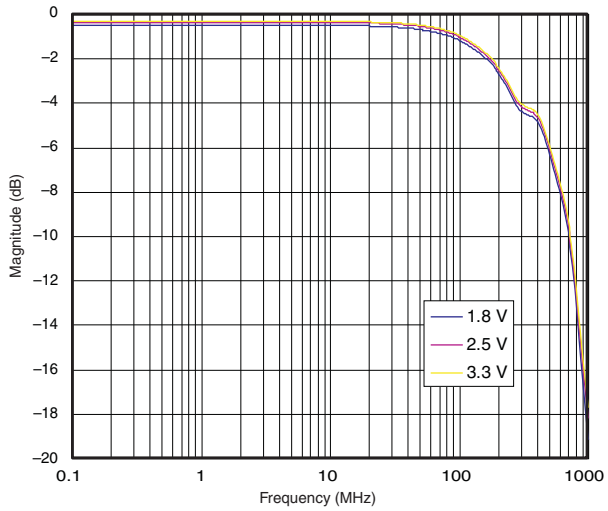

Figure 11. Insertion Loss

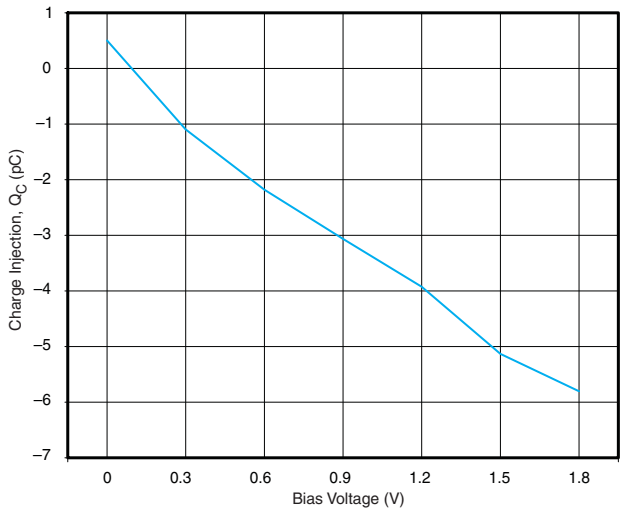

Figure 12. Charge Injection vs Bias Voltage (1.8 V)

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Typical Characteristics (continued)

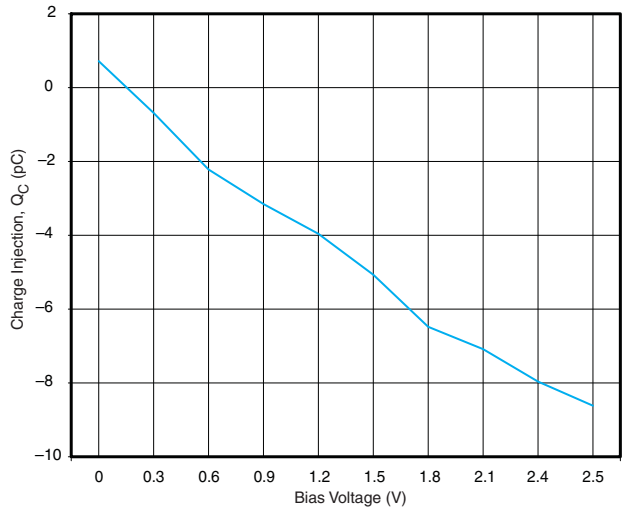

Figure 13. Charge Injection vs Bias Voltage (2.5 V)

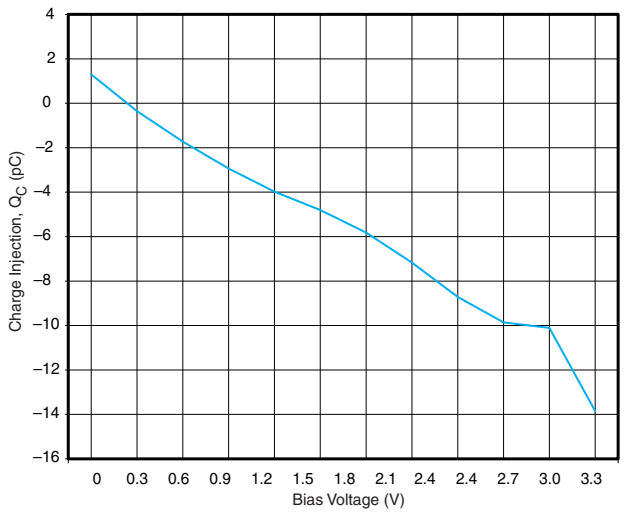

Figure 14. Charge Injection vs Bias Voltage (3.3 V)

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7 Parameter Measurement Information

Table 1. Parameter Description

SYMBOL	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}	Turn-on 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}	Turn-off 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_+	Static power-supply current with the control (IN) pin at V_+ or GND

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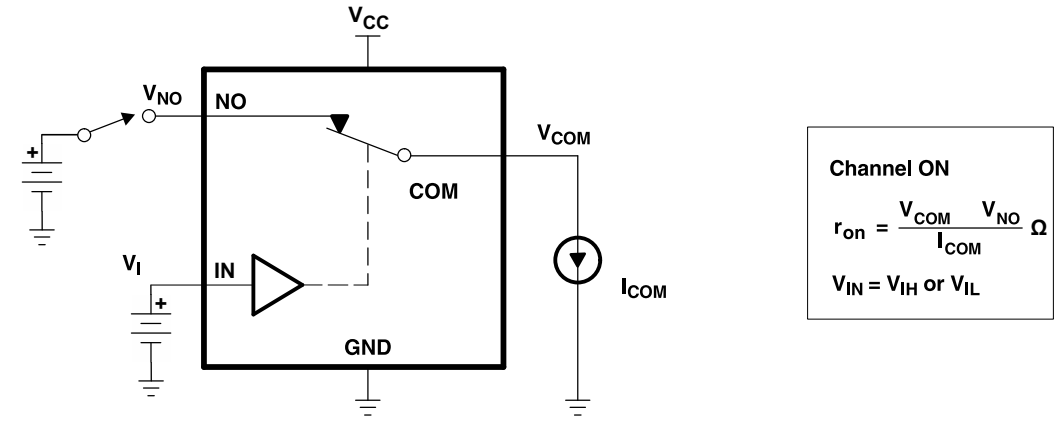

Figure 15. ON-state Resistance (r_{ON})

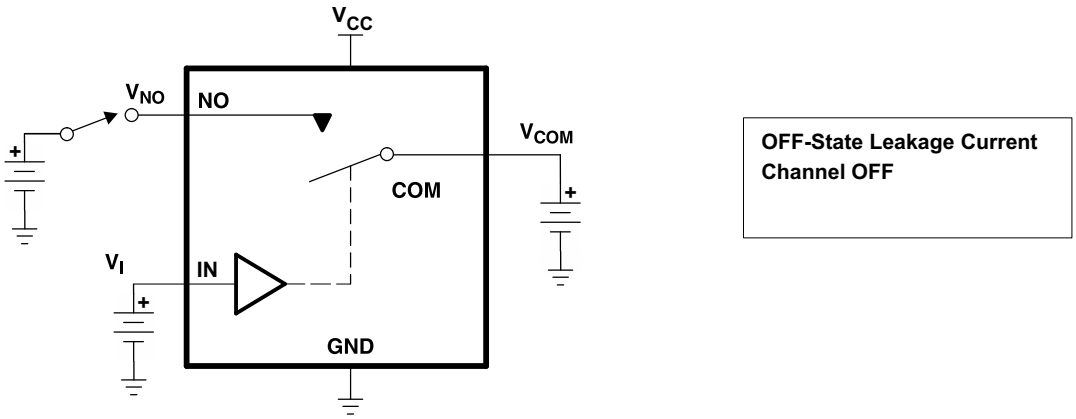

Figure 16. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NC(OFF)}$, $I_{COM(PWROFF)}$, $I_{NC(PWROFF)}$)

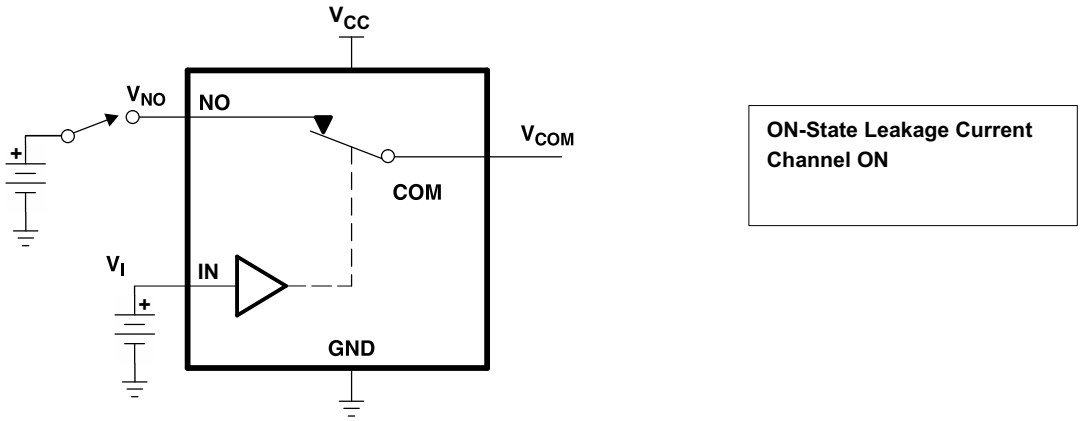

Figure 17. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$)

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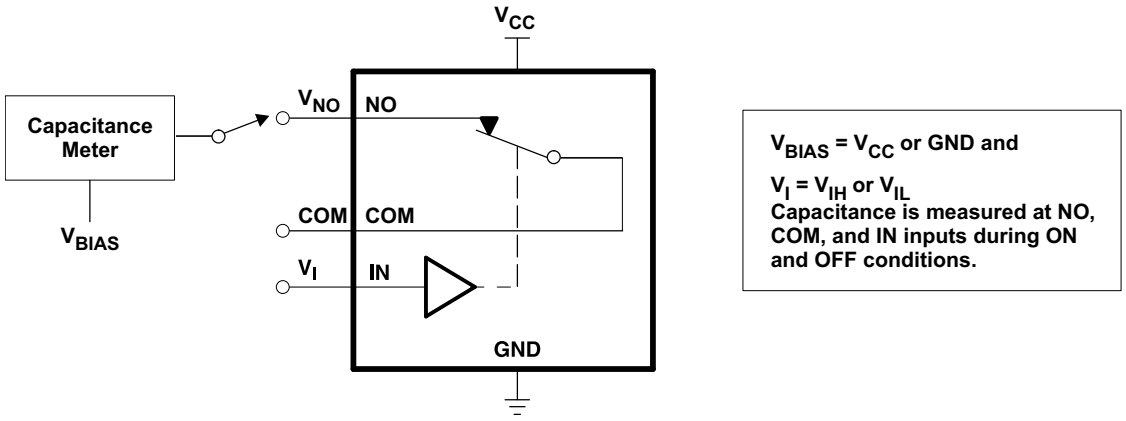
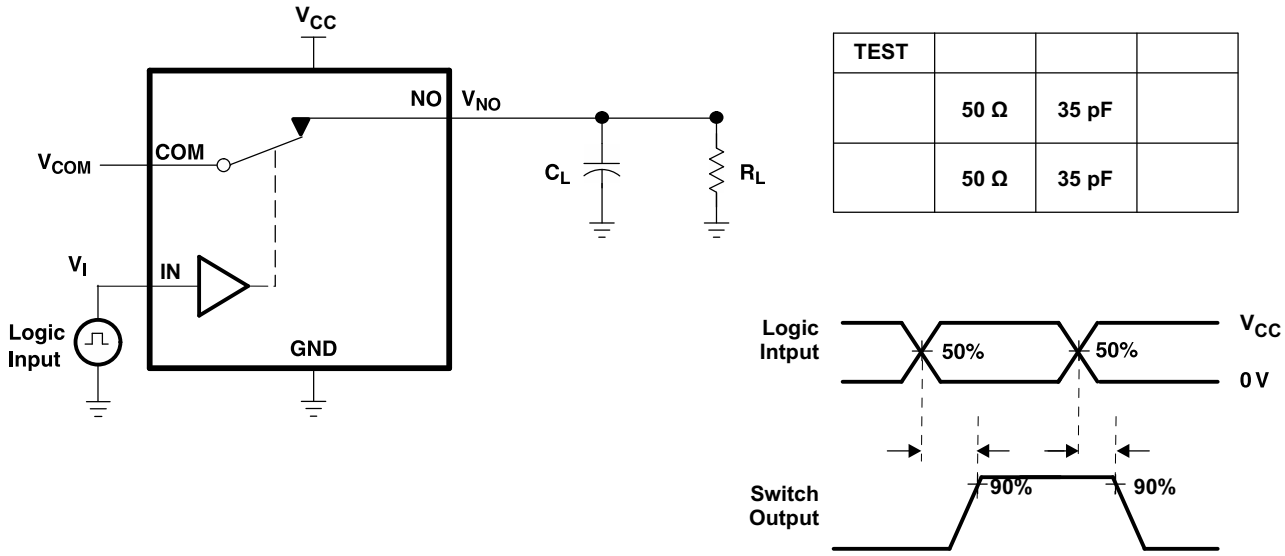


Figure 18. Capacitance
(C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$)



TEST			
	50 Ω	35 pF	
	50 Ω	35 pF	

A. 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.

B. C_L includes probe and jig capacitance.

Figure 19. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

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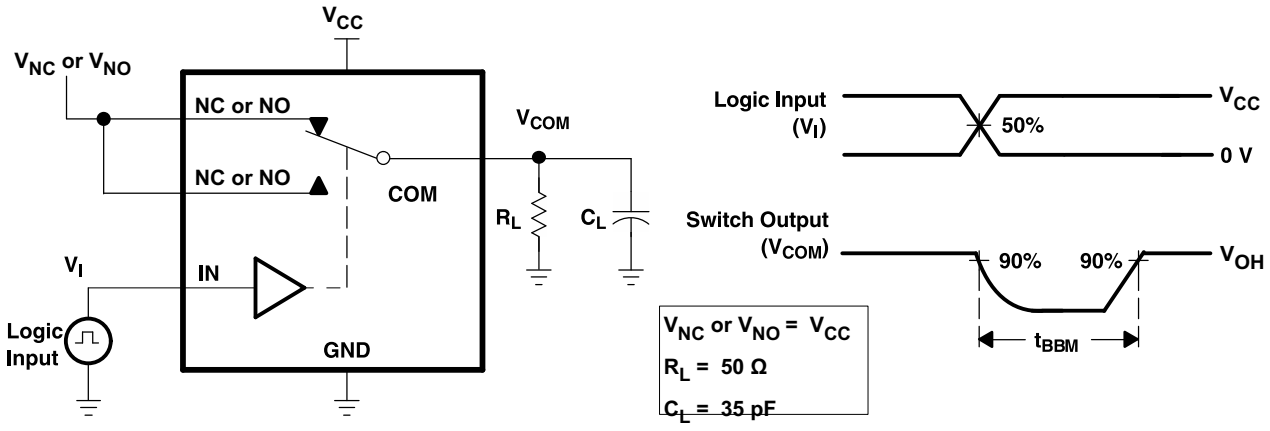


A. C_L includes probe and jig capacitance.

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

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

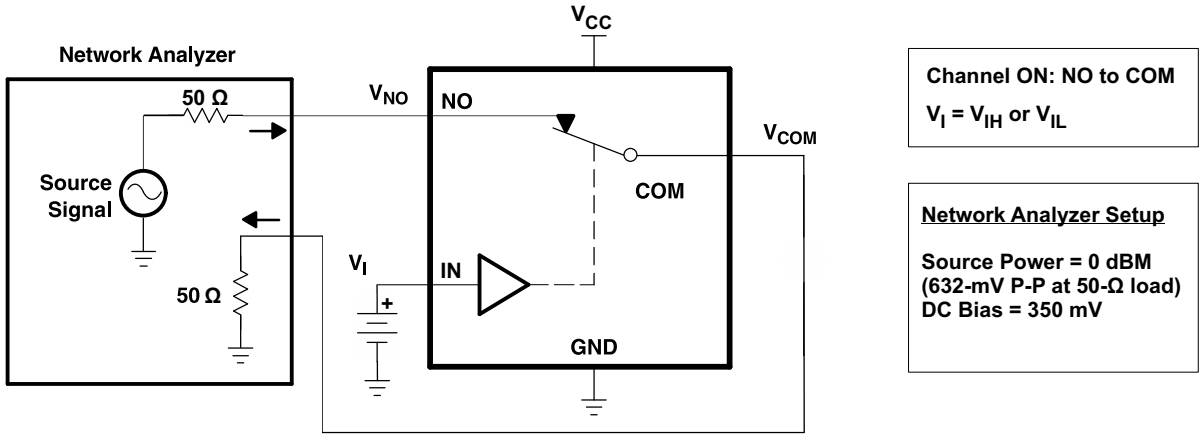


Figure 21. Bandwidth (BW)

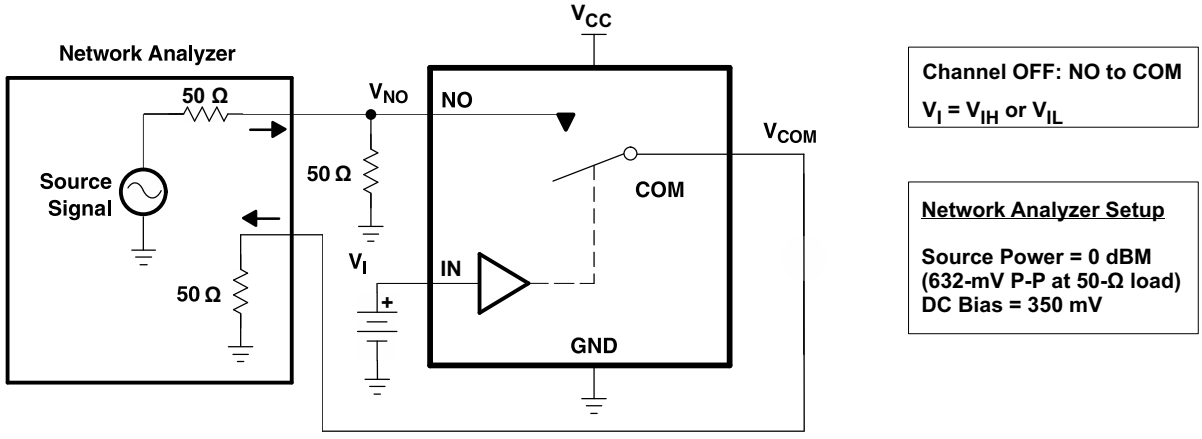


Figure 22. OFF Isolation (O_{ISO})

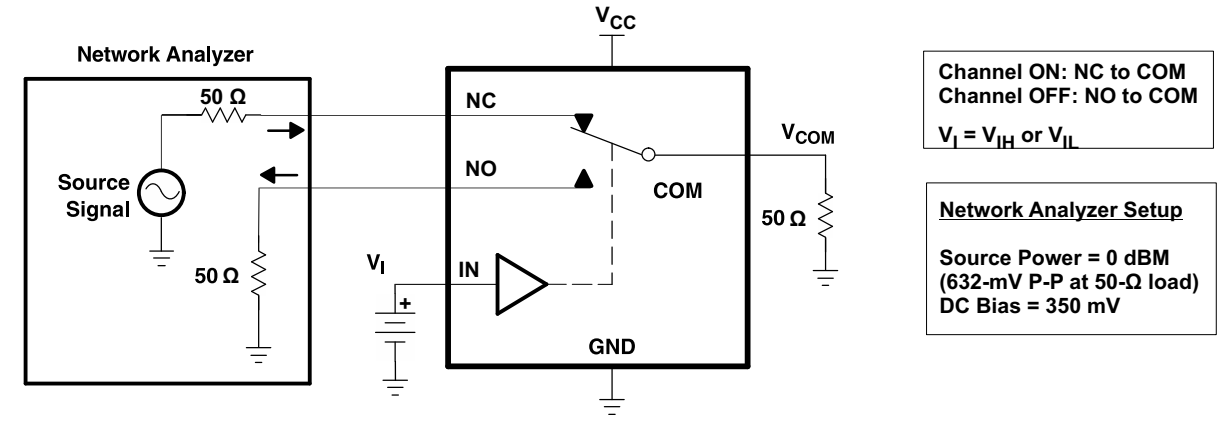
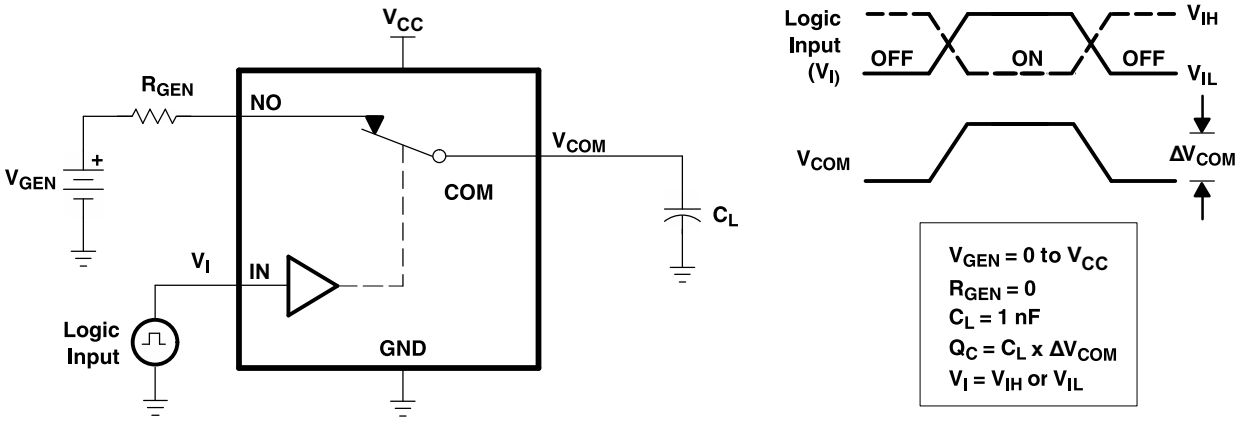


Figure 23. Crosstalk (X_{TALK})



A. 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.

B. C_L includes probe and jig capacitance.

Figure 24. Charge Injection (Q_C)

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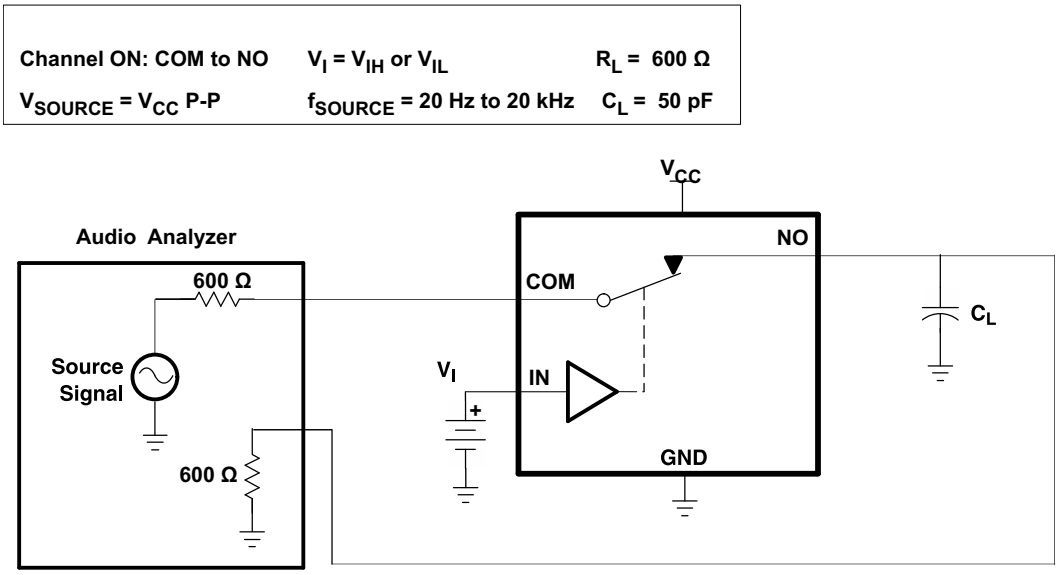


A. C_L includes probe and jig capacitance.

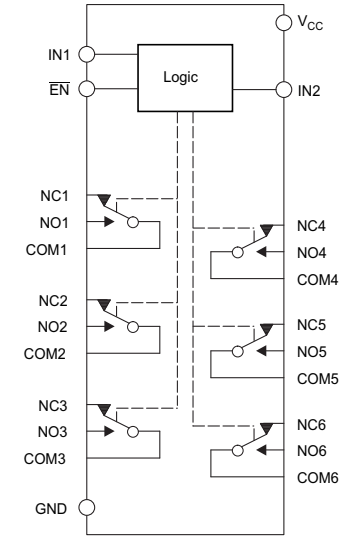
Figure 25. Total Harmonic Distortion (THD)

8 Detailed Description

8.1 Overview

The TS3A27518E-Q1 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-Q1 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



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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-Q1 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 TS3A27518E-Q1 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-Q1.

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

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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.

9.2 Typical Application

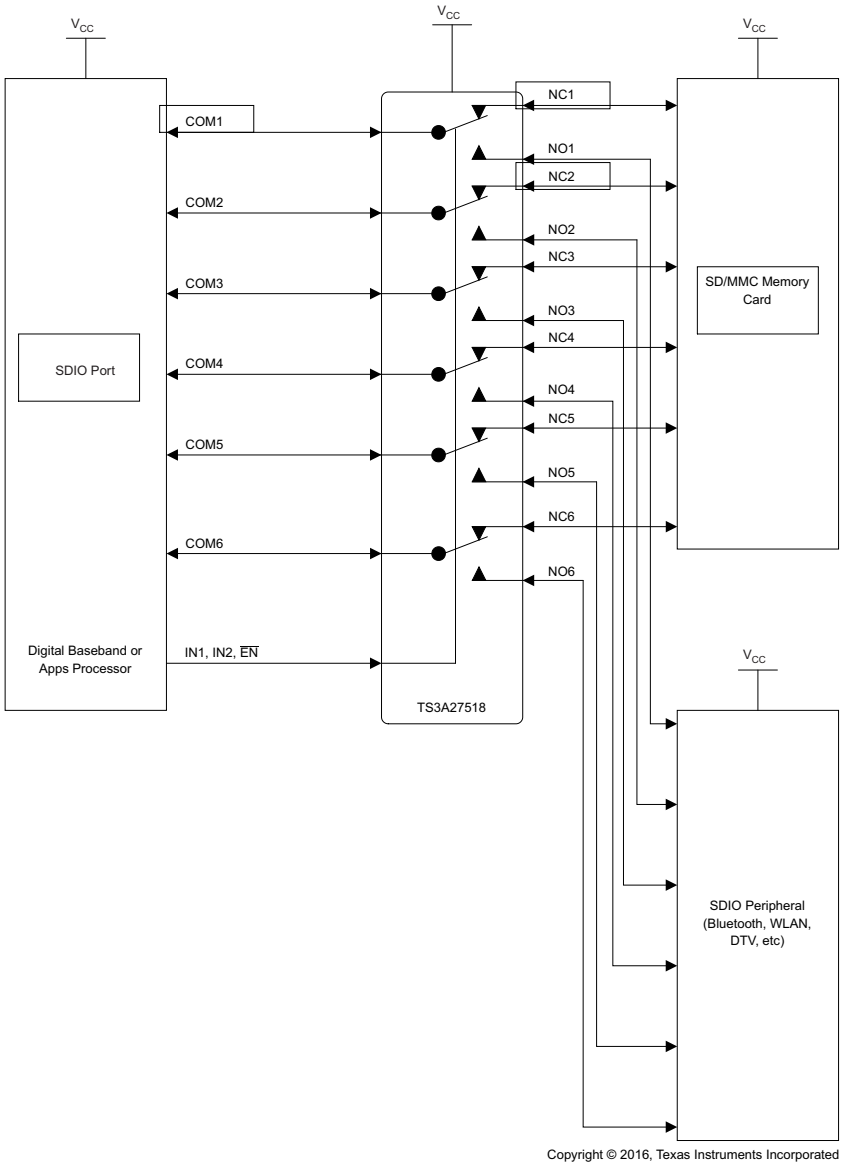

Figure 26. SDIO Expander Application Block Diagram

Typical Application (continued)

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-Q1 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

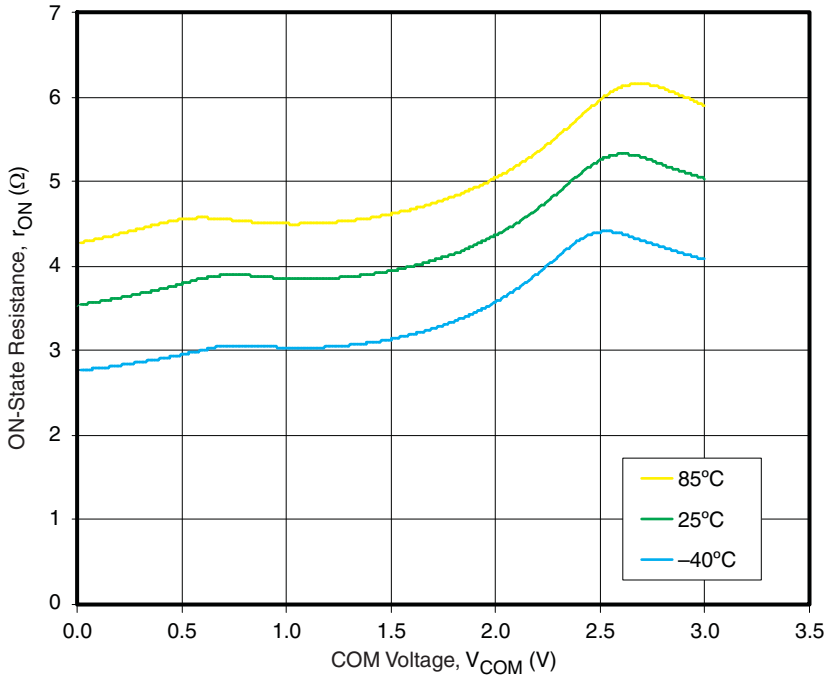

Figure 27. ON-State Resistance vs COM Voltage (V_{CC} = 3 V)

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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

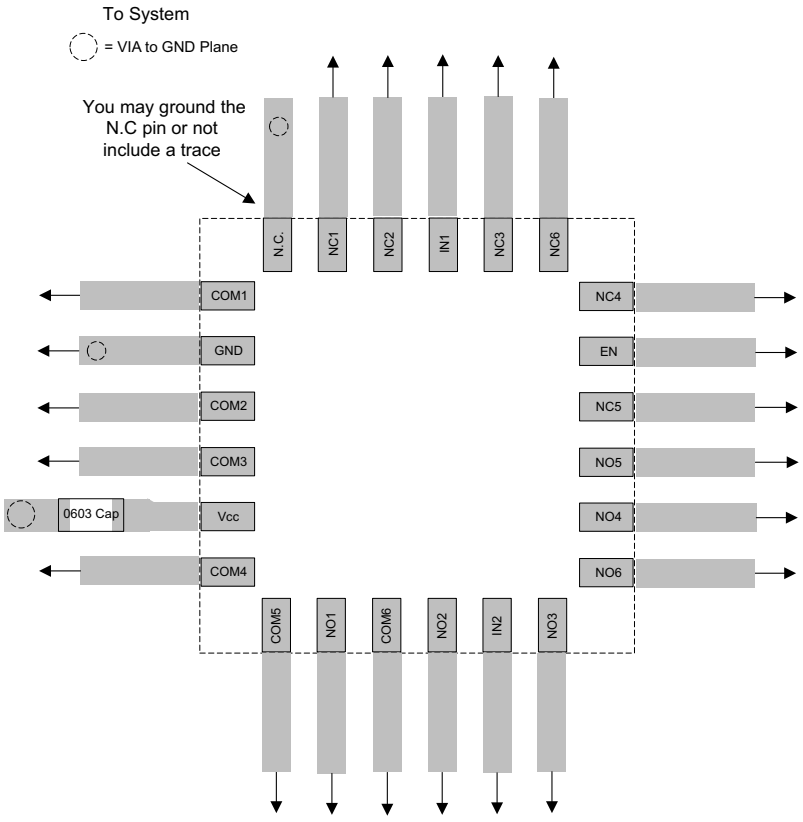

Figure 28. WQFN Layout Recommendation

12 器件和文档支持

12.1 接收文档更新通知

要接收文档更新通知，请导航至 TI.com.cn 上的器件产品文件夹。单击右上角的*通知我*进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.2 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。

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12.3 商标

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12.4 静电放电警告

ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。 精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.5 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、缩写和定义。

13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

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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
TS3A27518EIPWRQ1	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	YL518EQ1	Samples
TS3A27518EIRTWRQ1	ACTIVE	WQFN	RTW	24	3000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	27518EI	Samples
TS3A27518ETRTWRQ1	ACTIVE	WQFN	RTW	24	3000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 105	27518ET	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
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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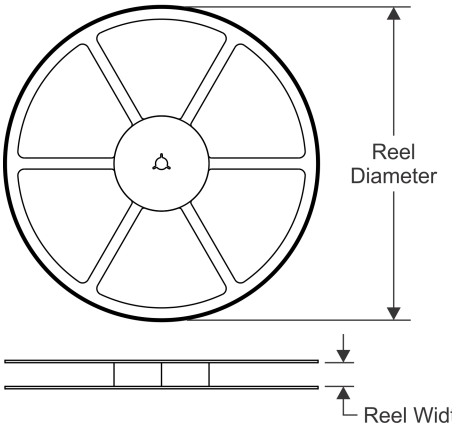
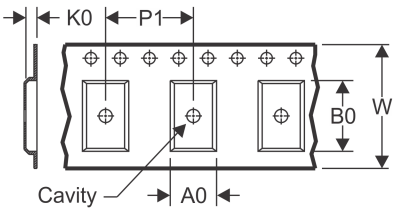
TAPE AND REEL INFORMATION

REEL DIMENSIONS

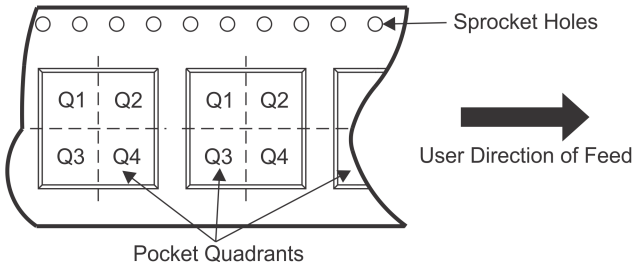


TAPE DIMENSIONS



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

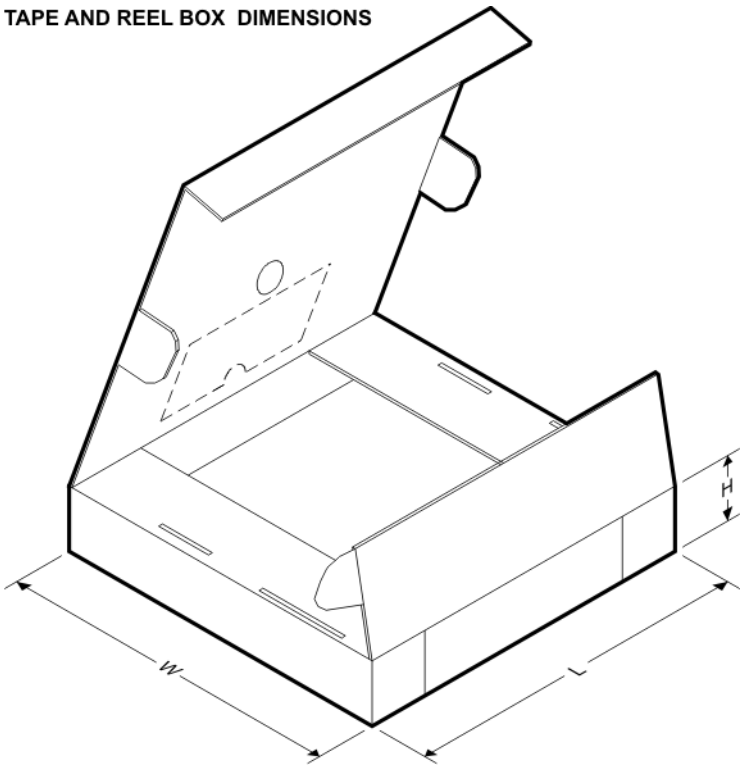
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TS3A27518EIPWRQ1	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1
TS3A27518EIRTWRQ1	WQFN	RTW	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
TS3A27518ETRTWRQ1	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

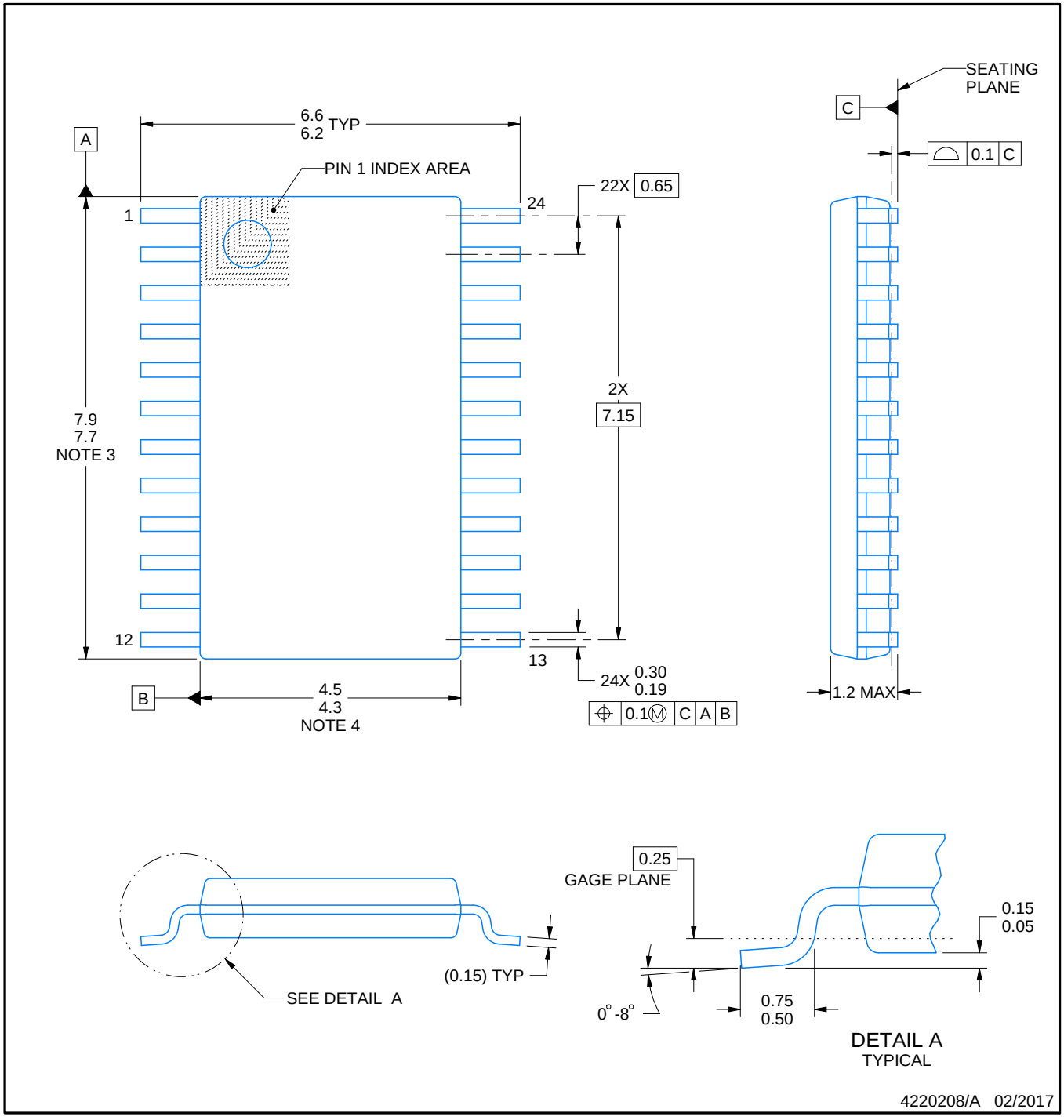
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A27518EIPWRQ1	TSSOP	PW	24	2000	853.0	449.0	35.0
TS3A27518EIRTWRQ1	WQFN	RTW	24	3000	853.0	449.0	35.0
TS3A27518ETRTWRQ1	WQFN	RTW	24	3000	853.0	449.0	35.0

PACKAGE OUTLINE

PW0024A

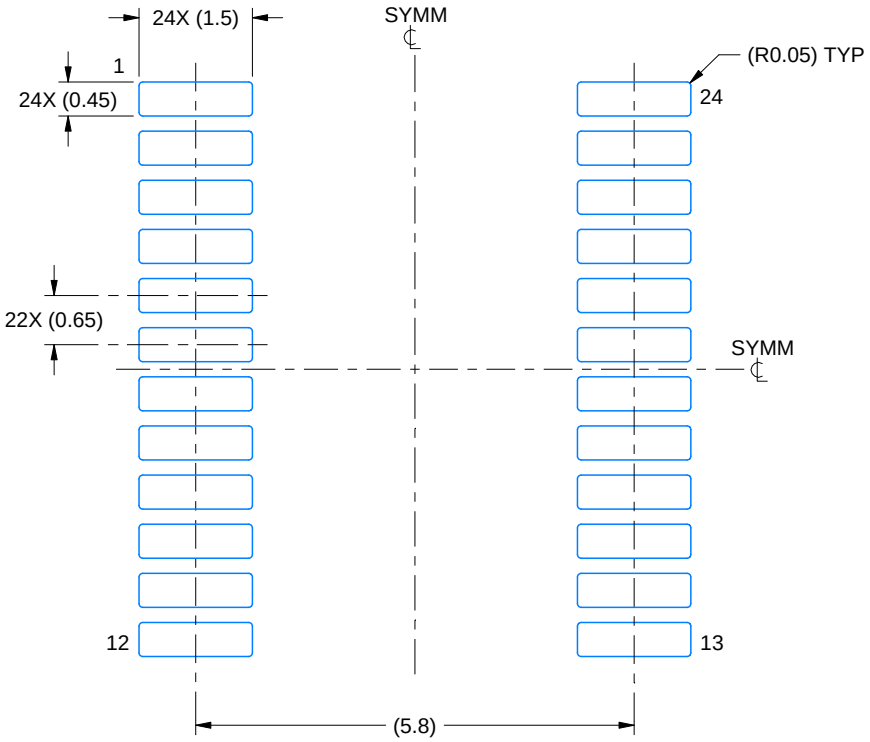
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

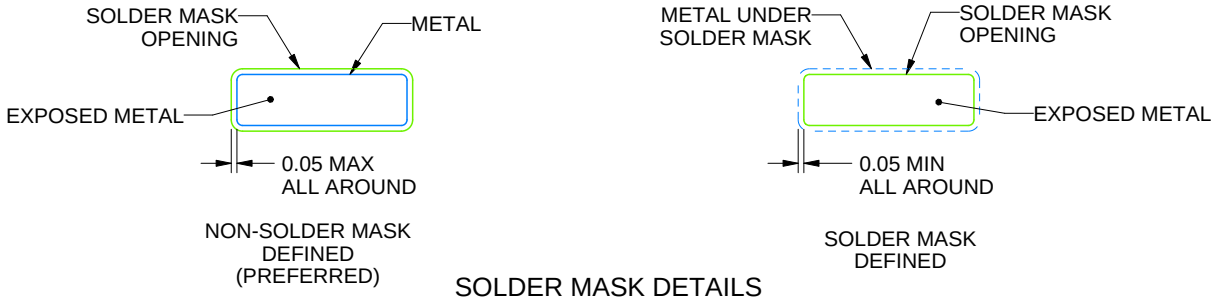


NOTES:

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

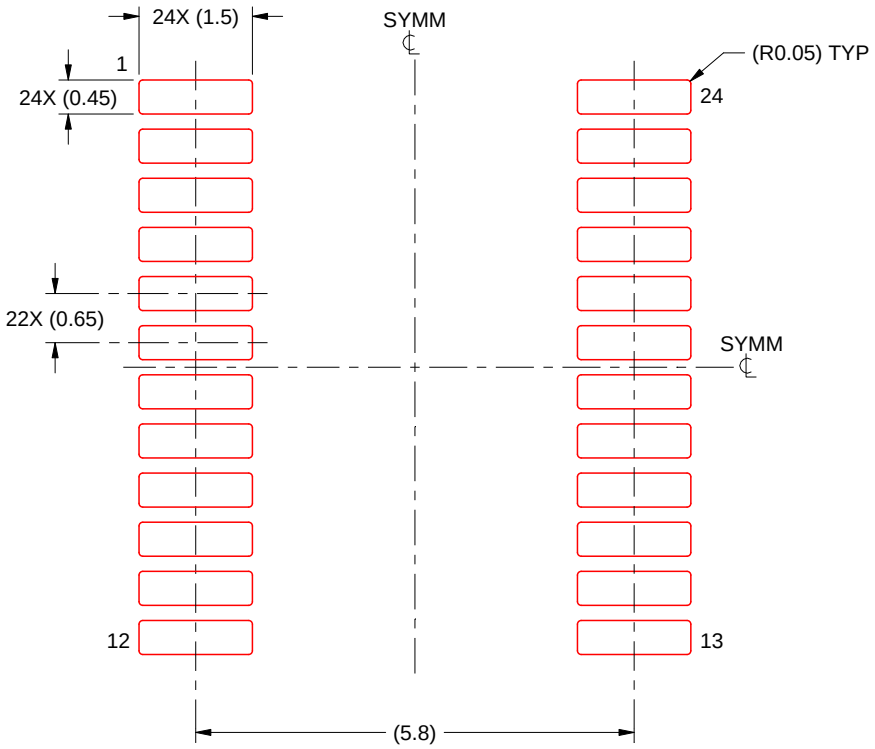


SOLDER MASK DETAILS

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.



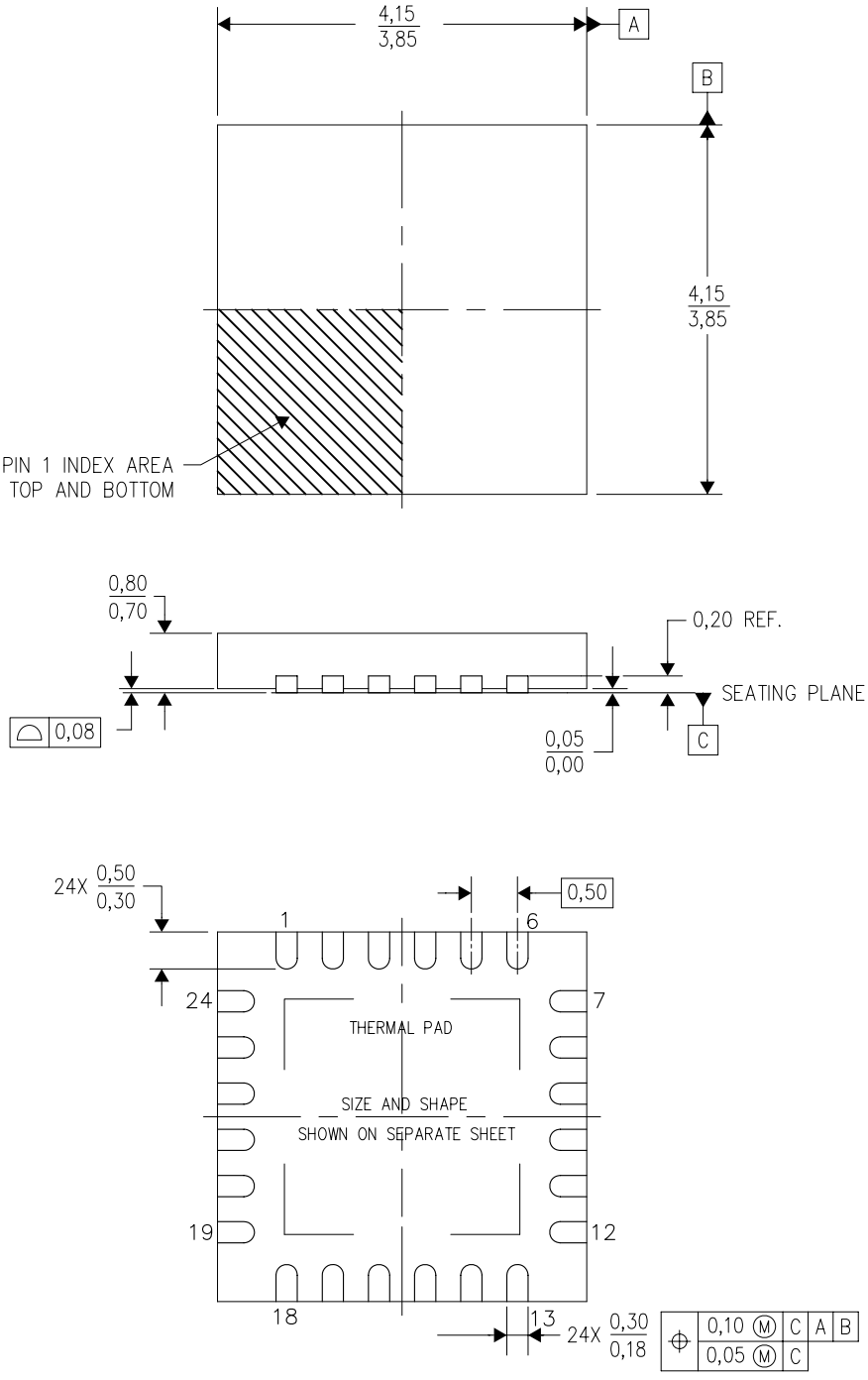
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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



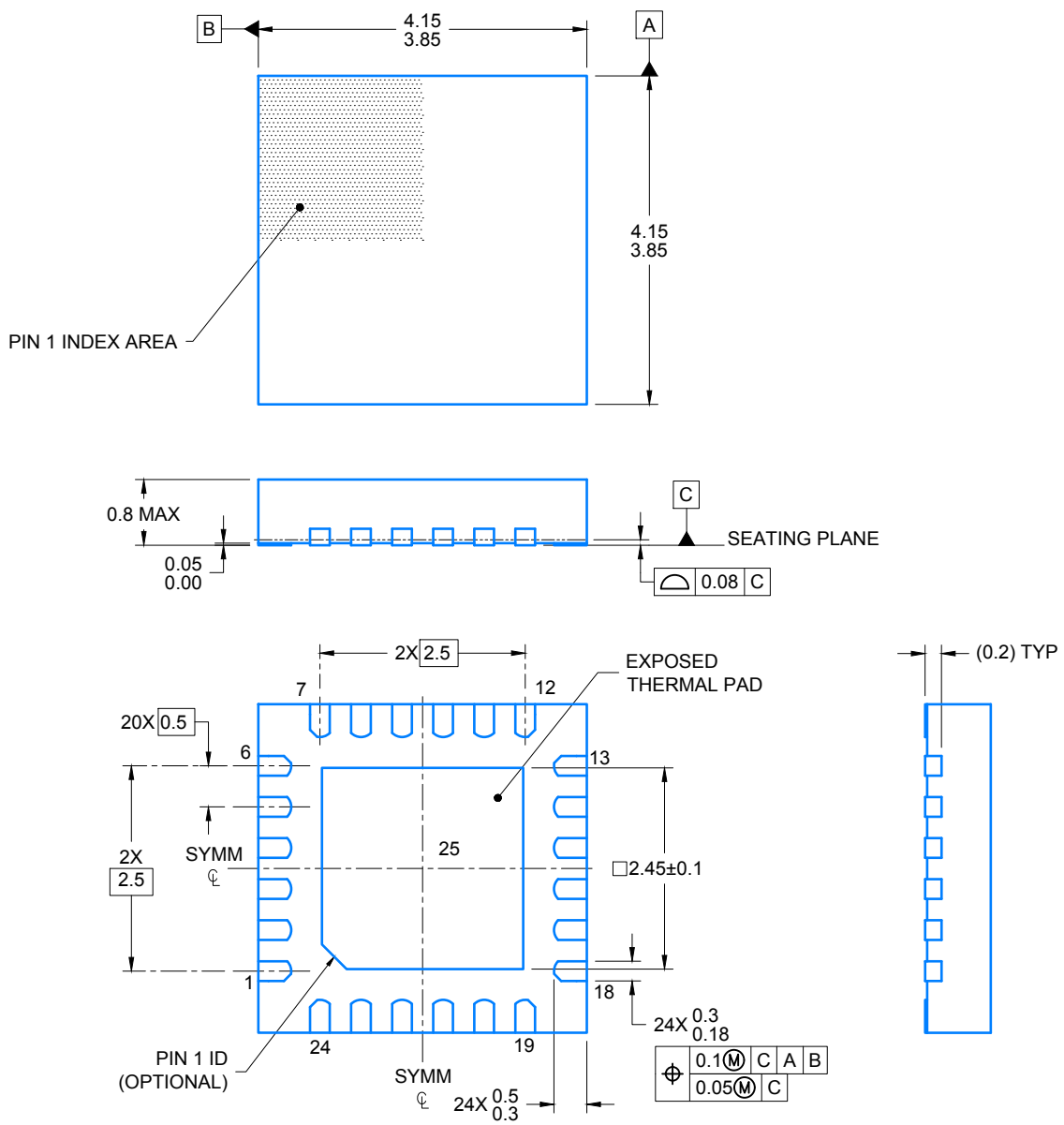
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Quad Flatpack, No–Leads (QFN) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
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

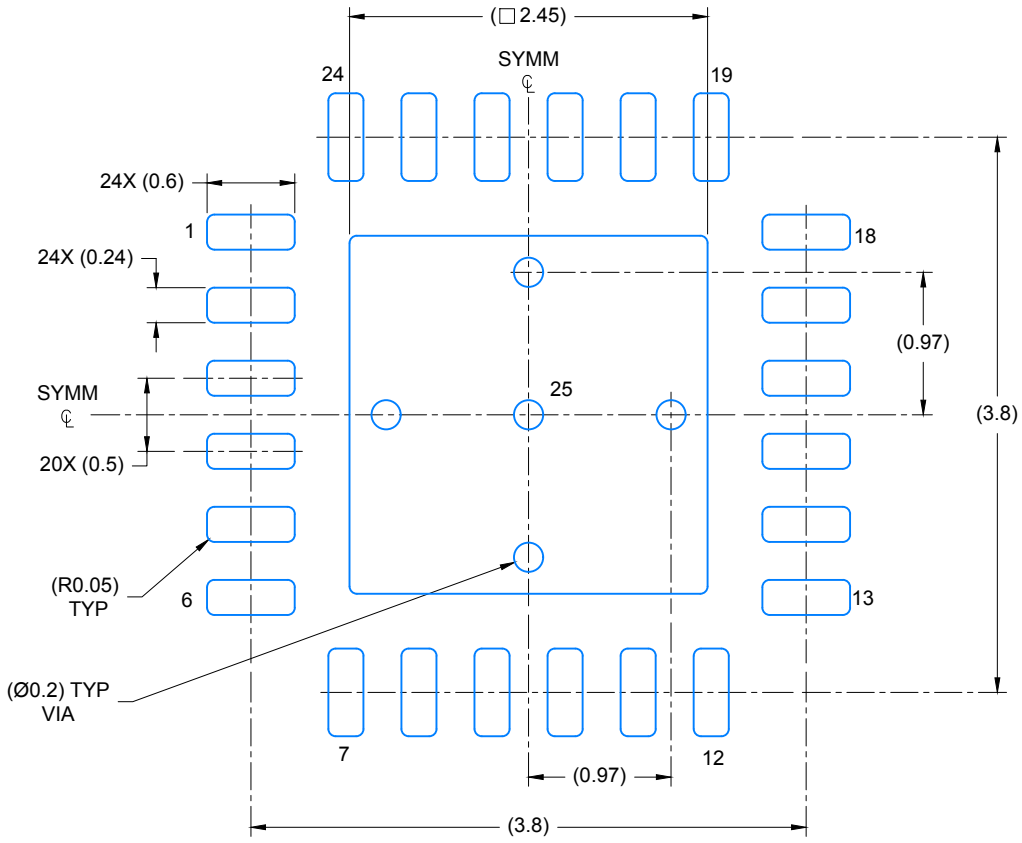
WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK-NO LEAD

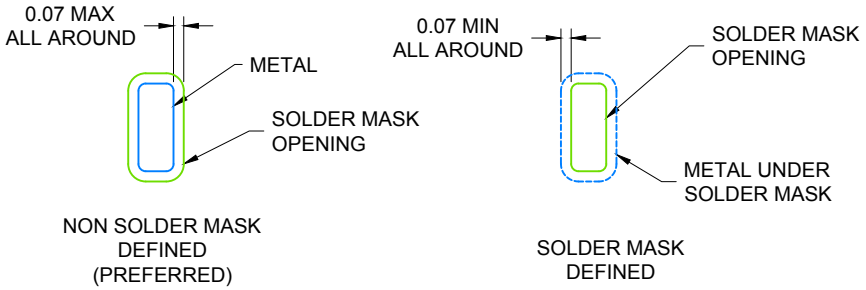


NOTES:

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

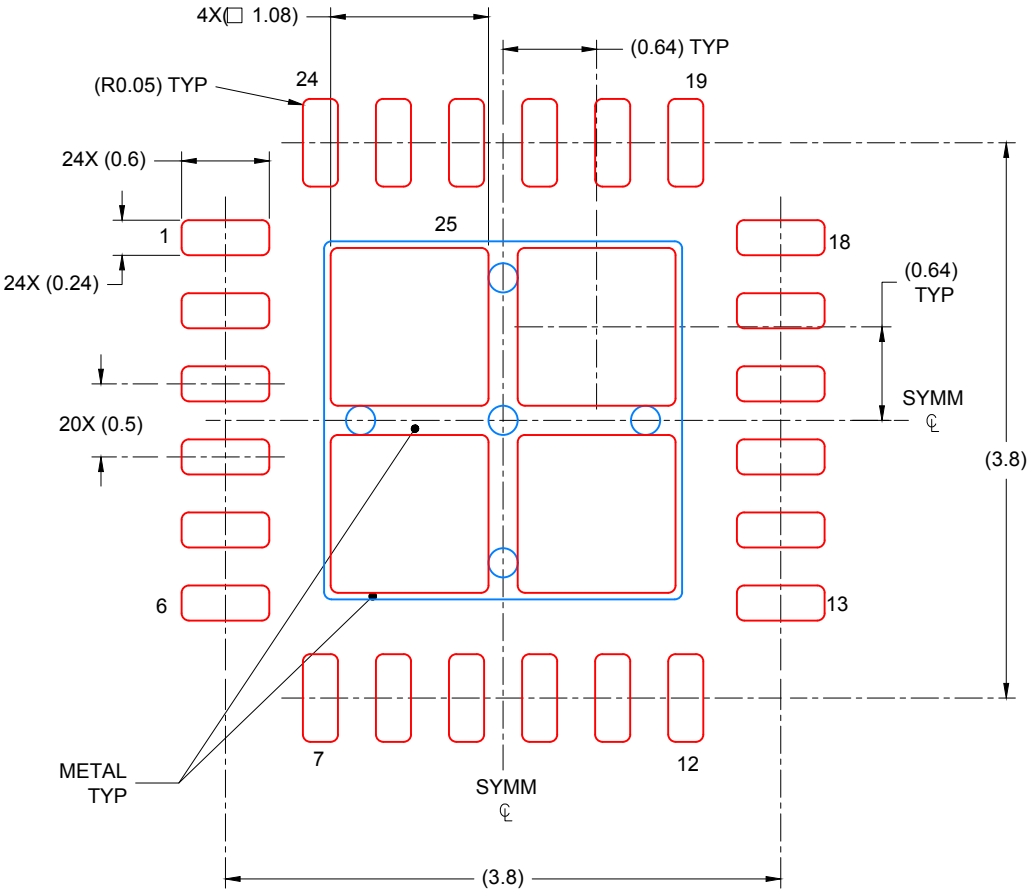


SOLDER MASK DETAILS

4219135/B 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/B 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.

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