TMUXL27518 6-Channel (qSPI, eSPI), 1:2 Multiplexer and Demultiplexer with 1.2V Logic Compatible Control Inputs and Powered off Protection

1 Features

- 1.08V to 1.95V single-supply operation
- Isolation in power-down mode, V_{CC} = 0
- Low-capacitance switches, 12pF
- Bandwidth more than 500MHz
- Extended 1.2V logic compatible control inputs across supply
- 3.6V tolerant control inputs
- Powered-off Protection upto 3.6V Signals when VCC=0
- Bidirectional Signal Path
- -40°C to +125°C operating temperature

2 Applications

- qSPI , eSPI , SPI Muxing
- Flash Memory Sharing
- SD-SDIO and MMC two-port MUX
- PC VGA video MUX-video systems
- Audio and video signal routing
- Data Centers
- Hardware AI Accelerators
- PC & Notebooks

3 Description

The TMUXL27518 is a bidirectional, 6-channel, 1:2 multiplexer-demultiplexer designed to operate from 1.08V to 1.95V. This device can handle both digital and analog signals, and can transmit signals up to V_{CC} in either direction. The TMUXL27518 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 1.2V logic thresholds across supply voltage range of the device eliminating the need of external logic translation.

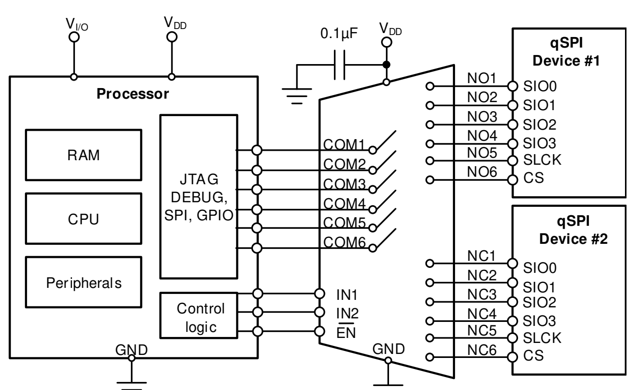
Powered-off Protection up to 1.95V on the signal path of the TMUXL27518 provides isolation when the supply voltage is removed (VDD = 0V). Without this protection feature, switches can back-power the supply rail through an internal ESD diode and cause potential damage to the system.

The TMUXL27518 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 supports upto 6-bit interfaces such a qSPI eSPI and SPI muxing. The TMUXL27518 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.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE
TMUXL27518	RTW (WQFN, 24)	4mm × 4mm

(1) For more information, see Section 11.



Typical Application

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4 Pin Configuration and Functions

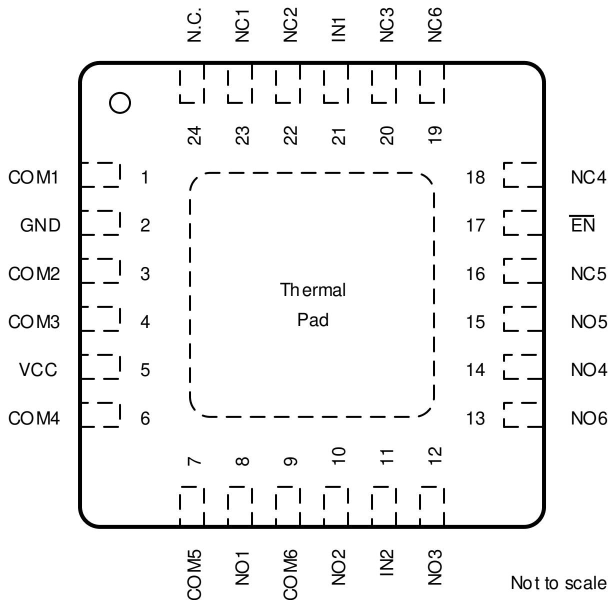


Figure 4-1. RTW Package
24-Pin WQFN
Top View

Table 4-1. Pin Functions

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

(1) I/O = input/output

5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage		-0.5	2.4	V
V_{NC}, V_{NO}, V_{COM}	Analog Voltage		-0.5	2.4	V
$I_{I/OK}$	Analog port diode current	V_{NC}, V_{NO}, V_{COM} < 0	-50	50	
$I_{I/OK}$	Analog port diode current	V_{NC}, V_{NO}, V_{COM} > V_{CC}	-50	50	mA
I_{NC}, I_{NO}, I_{COM}	ON-state switch current	V_{NC}, V_{NO}, V_{COM} = 0 to VCC	-50	50	mA
V_I	Digital input voltage		-0.5	3.6	V
I_{IK}	Digital input clamp current	V_I < 0	-50		mA
I_{CC} I_{GND}	Continuous current through V_{CC} or GND			100	mA
Storage temperature, T_{stg}			-65	150	ºC

(1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins[(1)]	±2000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins[(2)]	±1000	

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

5.3 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
VCC	Supply voltage		1.08		1.95	V
V_{NC} V_{NO} V_{COM}	Signal path voltage		0		1.95	V
V_{IN}	Digital Control Input		0		1.95	V
T_A	Operating free-air temperature		-40		125	°C

5.4 Thermal Information

THERMAL METRIC[1]		TMUXL27518 RTW(WQFN) 24 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	72.14	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	58.27	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	49.11	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	11.06	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	49.19	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	33.72	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application note.

5.5 Electrical Characteristics for 1.8V Supply

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
V_{COM},V_{NC},V_{NO}	Analog Signal Voltage					0			1.95	V
Analog Switch	R_{on}	ON-state resistance	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32mA,	Switch ON	25°C	1.65V		14	24	Ω
Analog Switch	R_{on}	ON-state resistance	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32mA,	Switch ON	Full	1.65V			25	Ω
Analog Switch	ΔR_{on}	ON-state resistance match between channels	V_{NC} or V_{NO} = 1.6V, I_{COM} = –32mA,	Switch ON	25°C	1.65V		0.45	1	Ω
Analog Switch	ΔR_{on}	ON-state resistance match between channels	V_{NC} or V_{NO} = 1.6V, I_{COM} = –32mA,	Switch ON	Full	1.65V			1.2	Ω
Analog Switch	$R_{on(flat)}$	ON-state resistance flatness	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32mA,	Switch ON	25°C	1.65V		7.5	14	Ω
Analog Switch	$R_{on(flat)}$	ON-state resistance flatness	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –32mA,	Switch ON	Full	1.65V			15	Ω
Analog Switch	$I_{NC(OFF)}$,$I_{NO(OFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0.3V, VCOM=1.65V Or VNC or VNO = 1.65V, VCOM=0.3V	Switch OFF	25°C	1.95V	-0.25	0.03	0.25	uA
Analog Switch	$I_{NC(OFF)}$,$I_{NO(OFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0.3V, VCOM=1.65V Or VNC or VNO = 1.65V, VCOM=0.3V	Switch OFF	Full	1.95	-5		5	uA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Analog Switch	$I_{NC(PWROFF)}$,$I_{NO(PWROFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0 to 1.95, VCOM=1.95 to 0 Or VNC or VNO = 1.95 to 0, VCOM=0 to 1.95	Switch OFF	25°C	0	-0.4	0.01	0.4	uA
Analog Switch	$I_{NC(PWROFF)}$,$I_{NO(PWROFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0 to 1.95, VCOM=1.95 to 0 Or VNC or VNO = 1.95 to 0, VCOM=0 to 1.95	Switch OFF	Full	0	-7.2		7.2	uA
Analog Switch	$I_{COM(OFF)}$	COM OFF Leakage Current	VNC or VNO = 0.3V, VCOM=1.65V Or VNC or VNO = 1.65V, VCOM=0.3V	Switch OFF	25°C	1.95	-0.4	0.02	0.4	uA
Analog Switch	$I_{COM(OFF)}$	COM OFF Leakage Current	VNC or VNO = 0.3V, VCOM=1.65V Or VNC or VNO = 1.65V, VCOM=0.3V	Switch OFF	Full	1.95	-0.9		0.9	uA
Analog Switch	$I_{COM(PWROFF)}$	COM OFF Leakage Current	VNC or VNO = 0 to 1.95, VCOM=1.95 to 0 Or VNC or VNO = 1.95 to 0, VCOM=0 to 1.95	Switch OFF	25°C	0	-0.4	0.02	0.4	uA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Analog Switch	$I_{COM(PWROFF)}$	COM OFF Leakage Current	VNC or VNO = 0 to 1.95, VCOM=1.95 to 0 Or VNC or VNO = 1.95 to 0, VCOM=0 to 1.95	Switch OFF	Full	0	-5		5	uA
Analog Switch	$I_{NC(ON)}$,$I_{NO(ON)}$	NC,NO ON Leakage Current	VNC or VNO = 0.3V, VCOM=Open Or VNC or VNO = 1.65V, VCOM=Open	Switch ON	25°C	1.95	-2	0.02	2	uA
Analog Switch	$I_{NC(ON)}$,$I_{NO(ON)}$	NC,NO ON Leakage Current	VNC or VNO = 0.3V, VCOM=Open Or VNC or VNO = 1.65V, VCOM=Open	Switch ON	Full	1.95	-5.2		5.2	uA
Analog Switch	$I_{COM(ON)}$	COM ON Leakage Current	VNC or VNO = Open, VCOM=1.65V Or VNC or VNO = Open, VCOM=0.3V	Switch ON	25°C	1.95	-2	0.02	2	uA
Analog Switch	$I_{COM(ON)}$	COM ON Leakage Current	VNC or VNO = Open, VCOM=1.65V Or VNC or VNO = Open, VCOM=0.3V	Switch ON	Full	1.95	-5.2		5.2	uA
Digital Control Inputs (IN)	V_{IH}	Input logic high			Full	1.95	0.77		3.6	V
Digital Control Inputs (IN)	V_{IL}	Input logic low			Full	1.95	0		0.39	V
Digital Control Inputs (IN)	I_{IH}, I_{IL}	Input leakage current	V_{IN} = V_{CC} or 0		25°C	1.95	-0.1	0.01	0.1	uA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Digital Control Inputs (IN)	I_{IH}, I_{IL}	Input leakage current	V_{IN} = V_{CC} or 0		Full	1.95	-2.1		2.1	uA
Dynamic	t_{ON}	Turnon time	V_{COM} = V_{CC}, R_L = 50Ω,	C_L=35pF	–40°C to 125°C	1.65 to 1.95		34	56	ns
Dynamic	t_{OFF}	Turnon time	V_{COM} = V_{CC}, R_L = 50Ω,	C_L=35pF	–40°C to 125°C	1.65 to 1.95		12	24	ns
Dynamic	t_{BBM}	Break-before-make time	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50Ω,	C_L=35pF	Full	1.65 to 1.95	11	20		ns
Dynamic	Q_C	Charge injection	V_{GEN} = 0, R_{GEN} = 0	C_L=0.1nF	25°C	1.8V		1.9		pC
Dynamic	$C_{COM(OFF)}$	COM OFF capacitance	V_{COM} = V_{CC} or GND, Switch OFF, f = 10MHz		25°C	1.8V		7.8		pF
Dynamic	$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NO} or V_{NC} = V_{CC} or GND, Switch OFF, f = 10MHz		25°C	1.8V		4.2		pF
Dynamic	$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_{CC} or GND, Switch ON, f = 10MHz		25°C	1.8V		12		pF
Dynamic	$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NO} or V_{NC} = V_{CC} or GND, Switch ON, f = 10MHz		25°C	1.8V		12		pF
Dynamic	C_I	Digital input capacitance	V_{IN} = V_{CC} or GND		25°C	1.8V		2		pF
Dynamic	BW	Bandwidth	R_L = 50Ω, –3dB		25°C	1.8V		600		MHz
Dynamic	O_{ISO}	OFF isolation	R_L = 50Ω	f = 10MHz	25°C	1.8V		-53		dB
Dynamic	X_{TALK}	Crosstalk	R_L = 50Ω	f = 10MHz	25°C	1.8V		-54		dB
Dynamic	$X_{TALK(ADJ)}$	Crosstalk	R_L = 50Ω	f = 10MHz	25°C	1.8V		-56		dB
Dynamic	THD	Total harmonic distortion	R_L = 600Ω, C_L = 50pF,	f = 20Hz to 20kHz	25°C	1.8V		0.1		%
Supply	I_{CC}	Positive supply current	V_{IN} = V_{CC} or GND, V_{NC} and V_{NO} = Floating	Switch ON or OFF	–40°C to 125°C	1.95V			6	μA

5.6 Electrical Characteristics for 1.2V Supply

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Analog Switch	V_{COM},V_{NC}, V_{NO}	Analog Signal Voltage					0		1.32	V
Analog Switch	R_{on}	ON-state resistance	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –12mA,	Switch ON	25°C	1.08V		47	81	Ω
Analog Switch	R_{on}	ON-state resistance	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –12mA,	Switch ON	Full	1.08V			85	Ω
Analog Switch	ΔR_{on}	ON-state resistance match between channels	V_{NC} or V_{NO} = 1.08V, I_{COM} = –12mA,	Switch ON	25°C	1.08V		0.45	1	Ω
Analog Switch	ΔR_{on}	ON-state resistance match between channels	V_{NC} or V_{NO} = 1.08V, I_{COM} = –12mA,	Switch ON	Full	1.08V			1.2	Ω
Analog Switch	$R_{on(flat)}$	ON-state resistance flatness	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –12mA,	Switch ON	25°C	1.08V		37	63	Ω
Analog Switch	$R_{on(flat)}$	ON-state resistance flatness	0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = –12mA,	Switch ON	Full	1.08V			70	Ω
Analog Switch	$I_{NC(OFF)}$,$I_{NO(OFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0.24V, VCOM=1.08V Or VNC or VNO = 1.08V, VCOM=0.24V	Switch OFF	25°C	1.32V	-0.25	0.03	0.25	uA
Analog Switch	$I_{NC(OFF)}$,$I_{NO(OFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0.24V, VCOM=1.08V Or VNC or VNO = 1.08V, VCOM=0.24V	Switch OFF	Full	1.32V	-5		5	uA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Analog Switch	$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0 to 1.32, VCOM=1.32 to 0 Or VNC or VNO = 1.32 to 0, VCOM=0 to 1.32	Switch OFF	25°C	0	-0.4	0.01	0.4	uA
Analog Switch	$I_{NC(PWROFF)}$, $I_{NO(PWROFF)}$	NC,NO OFF Leakage Current	VNC or VNO = 0 to 1.32, VCOM=1.32 to 0 Or VNC or VNO = 1.32 to 0, VCOM=0 to 1.32	Switch OFF	Full	0	-7.2		7.2	uA
Analog Switch	$I_{COM(OFF)}$	COM OFF Leakage Current	VNC or VNO = 0.24V, VCOM=1.08V Or VNC or VNO = 1.08V, VCOM=0.24V	Switch OFF	25°C	1.32V	-0.4	0.02	0.4	uA
Analog Switch	$I_{COM(OFF)}$	COM OFF Leakage Current	VNC or VNO = 0.24V, VCOM=1.08V Or VNC or VNO = 1.08V, VCOM=0.24V	Switch OFF	Full	1.32V	-0.9		0.9	uA
Analog Switch	$I_{COM(PWROFF)}$	COM OFF Leakage Current	VNC or VNO = 0 to 1.32, VCOM=1.32 to 0 Or VNC or VNO = 1.32 to 0, VCOM=0 to 1.32	Switch OFF	25°C	0	-0.4	0.02	0.4	uA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Analog Switch	$I_{COM(PWROFF)}$	COM OFF Leakage Current	VNC or VNO = 0 to 1.32, VCOM=1.32 to 0 Or VNC or VNO = 1.32 to 0, VCOM=0 to 1.32	Switch OFF	Full	0	-5		5	uA
Analog Switch	$I_{NC(ON)}$,$I_{NO(ON)}$	NC,NO ON Leakage Current	VNC or VNO = 0.24V, VCOM=Open Or VNC or VNO = 1.08V, VCOM=Open	Switch ON	25°C	1.32V	-2	0.02	2	uA
Analog Switch	$I_{NC(ON)}$,$I_{NO(ON)}$	NC,NO ON Leakage Current	VNC or VNO = 0.24V, VCOM=Open Or VNC or VNO = 1.08V, VCOM=Open	Switch ON	Full	1.32V	-5.2		5.2	uA
Analog Switch	$I_{COM(ON)}$	COM ON Leakage Current	VNC or VNO = Open, VCOM=1.08V Or VNC or VNO = Open, VCOM=0.24V	Switch ON	25°C	1.32V	-2	0.02	2	uA
Analog Switch	$I_{COM(ON)}$	COM ON Leakage Current	VNC or VNO = Open, VCOM=1.08V Or VNC or VNO = Open, VCOM=0.24V	Switch ON	Full	1.32V	-5.2		5.2	uA
Digital Control Inputs (IN)	V_{IH}	Input logic high			Full	1.32V	0.8		3.6	V
Digital Control Inputs (IN)	V_{IL}	Input logic low			Full	1.32V	0		0.39	V
Digital Control Inputs (IN)	I_{IH}, I_{IL}	Input leakage current	V_{IN} = V_{CC} or 0		25°C	1.32V	-0.1	0.01	0.1	nA

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Digital Control Inputs (IN)	^{I}IH, ^{I}IL	Input leakage current	V_{IN} = V_{CC} or 0		Full	1.32V	-2.1		2.1	nA
Dynamic	^{t}ON	Turnon time	^{V}COM = ^{V}CC, R_L = 50Ω,	C_L=35pF	–40°C to 125°C	1.08 to 1.32		60	165	ns
Dynamic	^{t}OFF	Turnon time	^{V}COM = ^{V}CC, R_L = 50Ω,	C_L=35pF	–40°C to 125°C	1.08 to 1.32		27	50	ns
Dynamic	^{t}BBM	Break-before-make time	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50Ω,	C_L=35pF	25°C	1.2	20	39		ns
Dynamic	^{t}BBM	Break-before-make time	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50Ω,	C_L=35pF	Full	1.08 to 1.32	17			ns
Dynamic	Q_C	Charge injection	V_{GEN} = 0, R_{GEN} = 0	C_L=0.1nF	25°C	1.2V		0.5		pC
Dynamic	$C_{COM(OFF)}$	COM OFF capacitance	V_{COM} = V_{CC} or GND, Switch OFF, f = 10MHz		25°C	1.2V		8		pF
Dynamic	$C_{NC(OFF)}$, $C_{NO(OFF)}$	NC, NO OFF capacitance	V_{NO} or V_{NC} = V_{CC} or GND, Switch OFF, f = 10MHz		25°C	1.2V		4		pF
Dynamic	$C_{COM(ON)}$	COM ON capacitance	V_{COM} = V_{CC} or GND, Switch ON, f = 10MHz		25°C	1.2V		12		pF
Dynamic	$C_{NC(ON)}$, $C_{NO(ON)}$	NC, NO ON capacitance	V_{NO} or V_{NC} = V_{CC} or GND, Switch ON, f = 10MHz		25°C	1.2V		12		pF
Dynamic	C_I	Digital input capacitance	V_{IN} = V_{CC} or GND		25°C	1.2V		2		pF
Dynamic	BW	Bandwidth	R_L = 50Ω, –3dB		25°C	1.2V		1000		MHz
Dynamic	^{O}ISO	OFF isolation	R_L = 50Ω	f = 10MHz,	25°C	1.2V		-51		dB
Dynamic	^{X}TALK	Crosstalk	R_L = 50Ω	f = 10MHz,	25°C	1.2V		-54		dB
Dynamic	^{X}TALK(ADJ)	Crosstalk	R_L = 50Ω	f = 10MHz,	25°C	1.2V		-57		dB

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

Section	Parameter		Test Conditions		T_A	V_{CC}	MIN	TYP	MAX	UNIT
Supply	ICC	Positive supply current	V_{IN} = V_{CC} or GND, V_{NC} and V_{NO} = Floating	Switch ON or OFF	–40°C to 125°C	1.32V			6	µA

5.7 Typical Characteristics

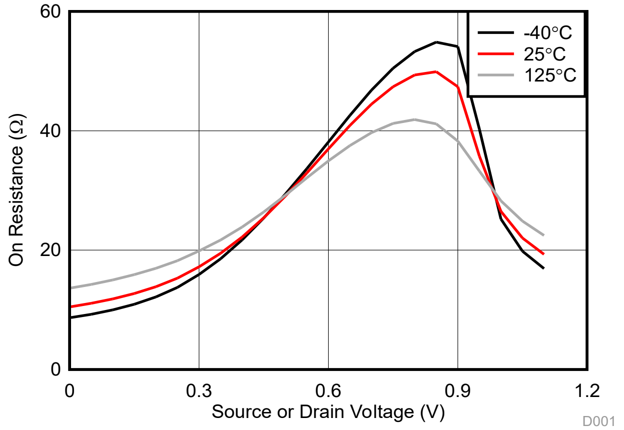


Figure 5-1. On-Resistance vs Source or Drain Voltage (VCC = 1.2V)

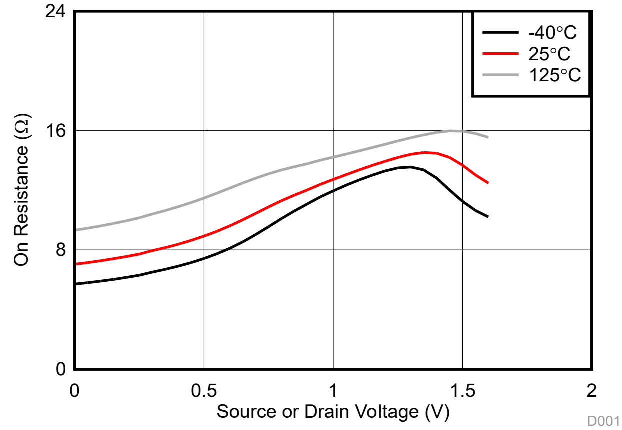


Figure 5-2. On-Resistance vs Source or Drain Voltage (VCC = 1.8V)

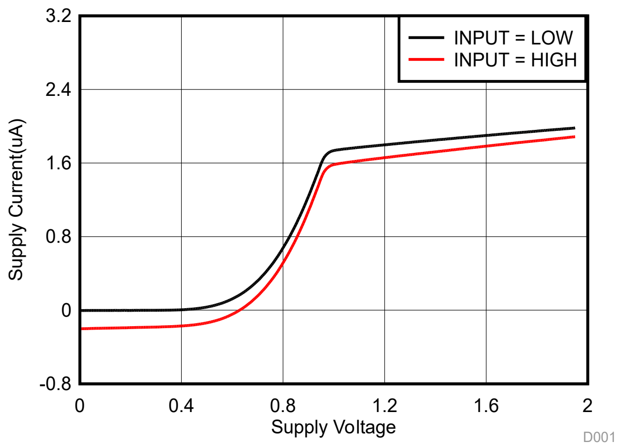


Figure 5-3. Supply Current vs Supply Voltage

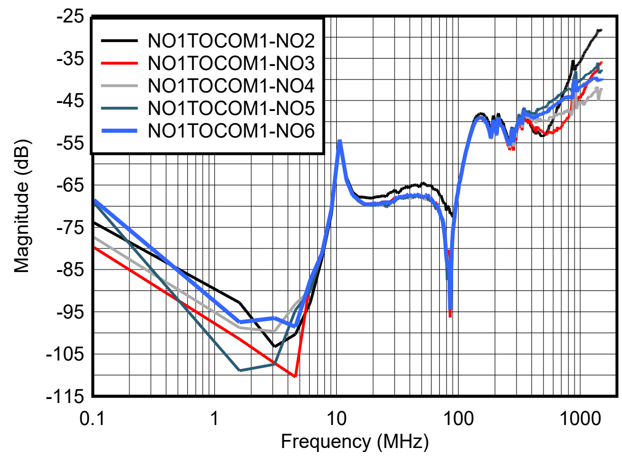


Figure 5-4. Crosstalk Adjacent

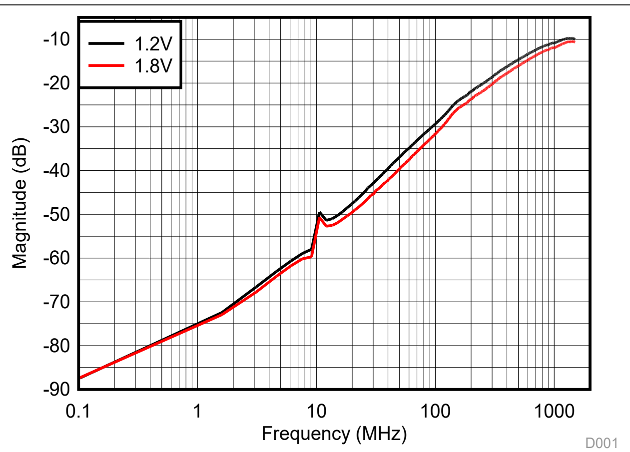


Figure 5-5. OFF Isolation

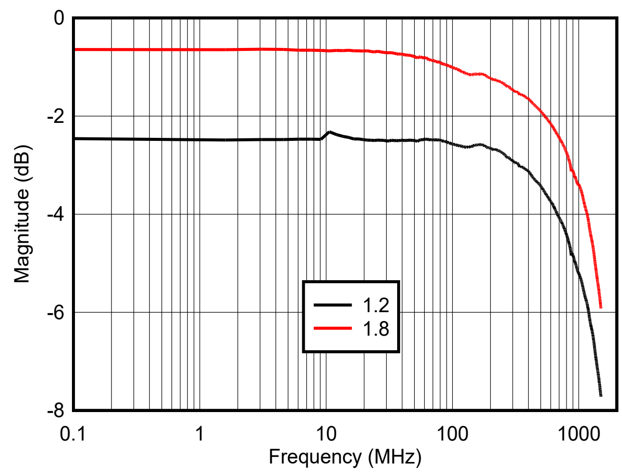


Figure 5-6. Insertion Loss

5.7 Typical Characteristics (continued)

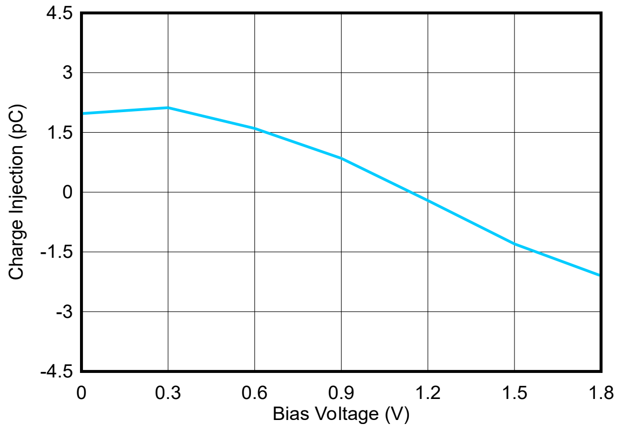


Figure 5-7. Charge Injection vs Bias Voltage (1.8V)

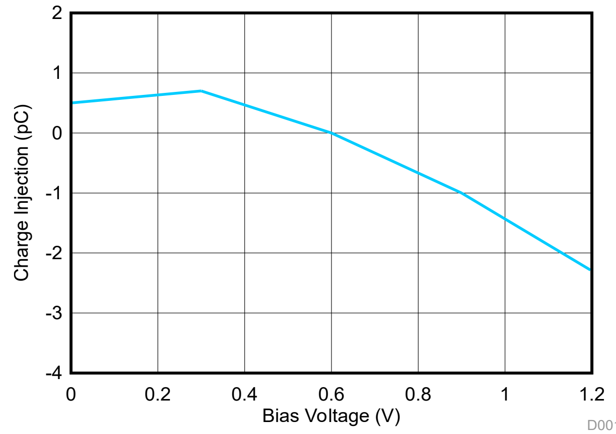


Figure 5-8. Charge Injection vs Bias Voltage (1.2V)

6 Parameter Measurement Information

Table 6-1. 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.

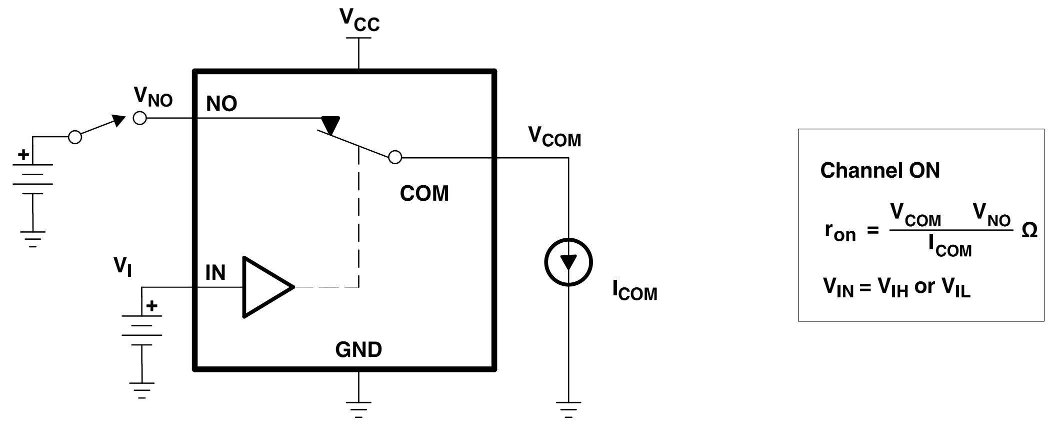


Figure 6-1. ON-State Resistance (r_{ON})

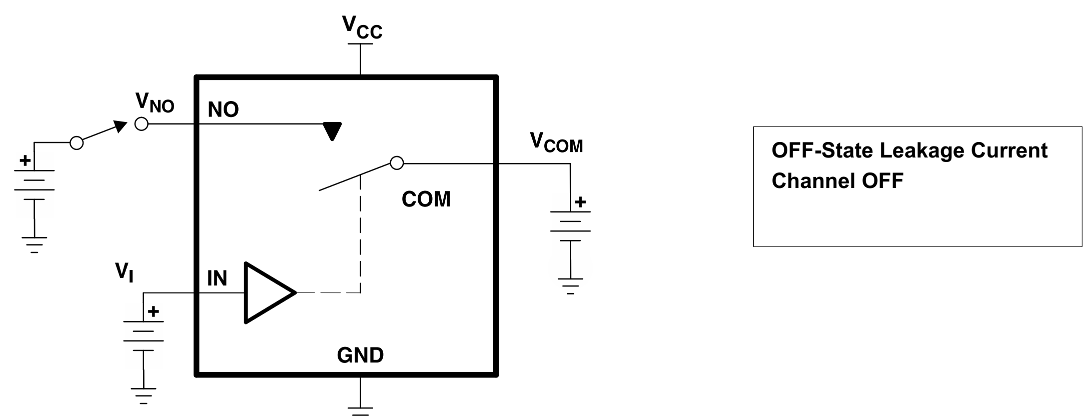


Figure 6-2. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NC(OFF)}$, $I_{COM(PWROFF)}$, $I_{NC(PWROFF)}$)

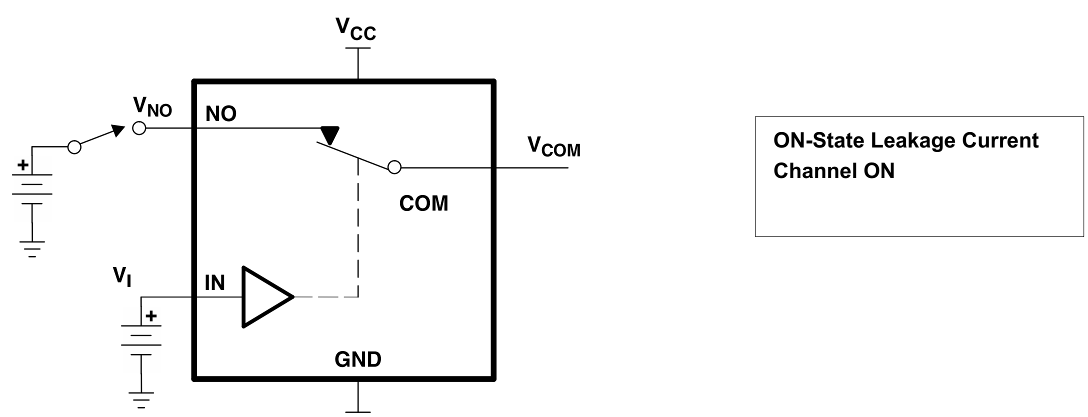


Figure 6-3. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$)

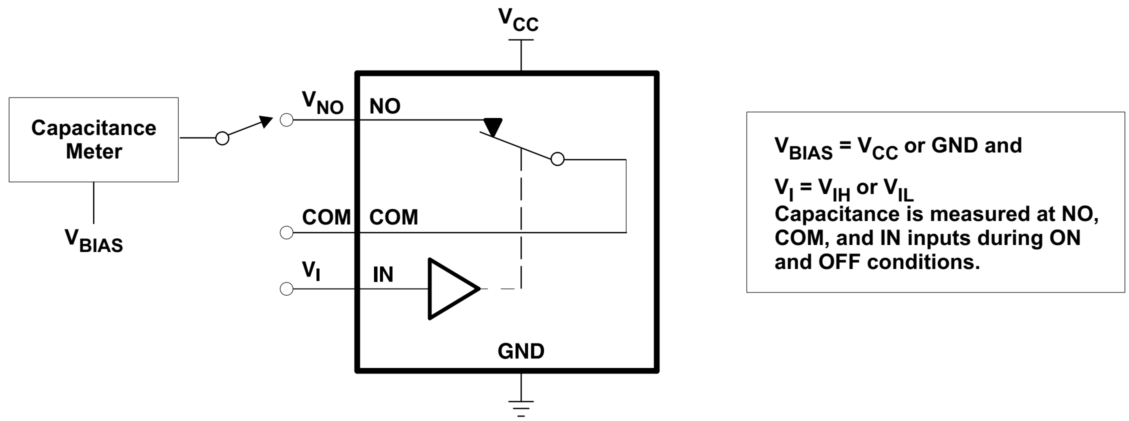
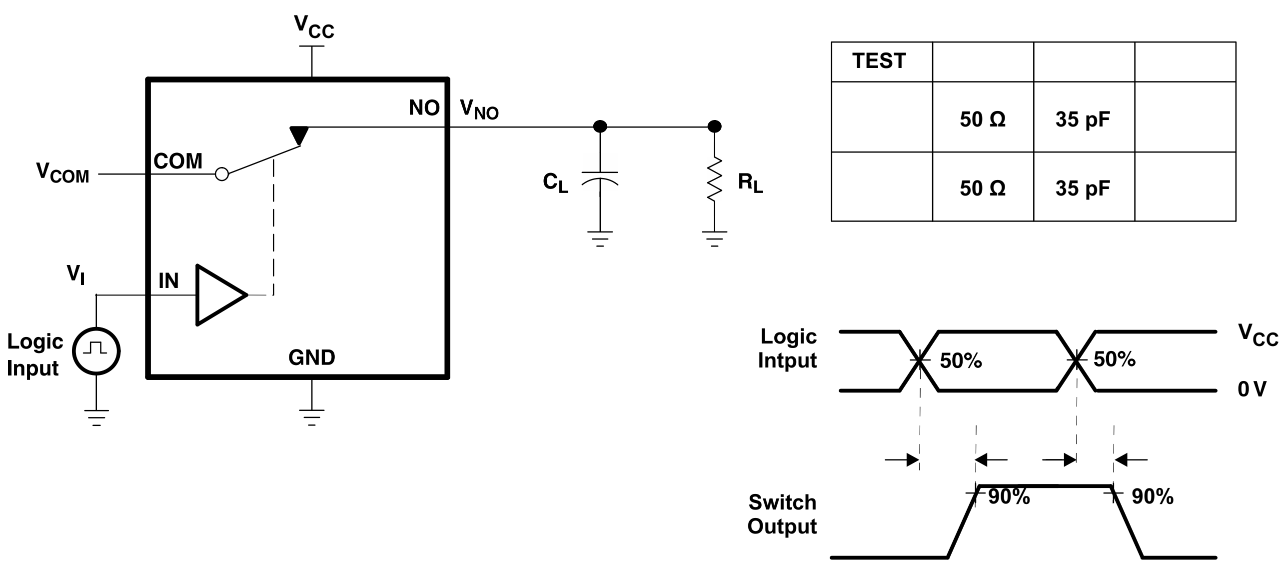


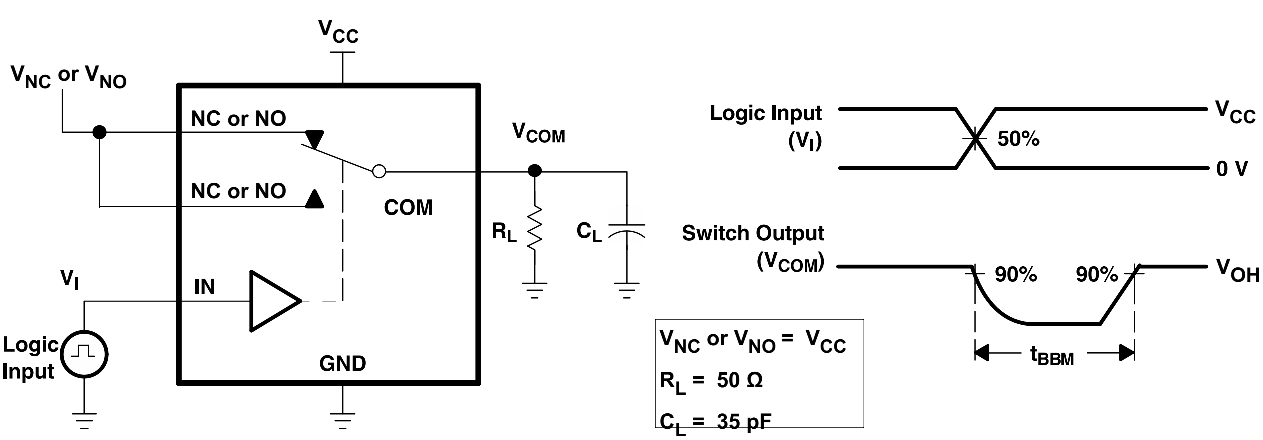
Figure 6-4. Capacitance (C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$)



TEST			
	50 Ω	35 pF	
	50 Ω	35 pF	

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

Figure 6-5. Turnon (t_{ON}) and Turnoff Time (t_{OFF})



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

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

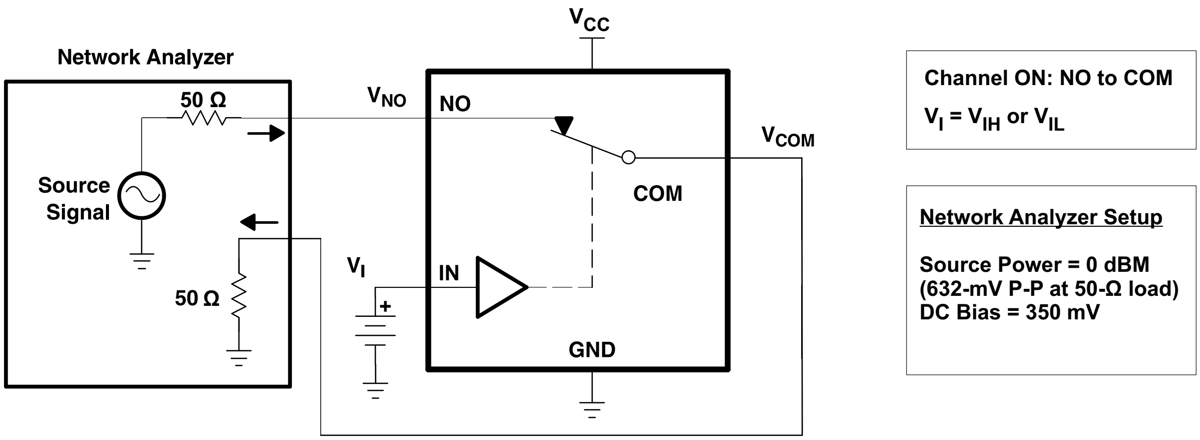


Figure 6-7. Bandwidth (BW)

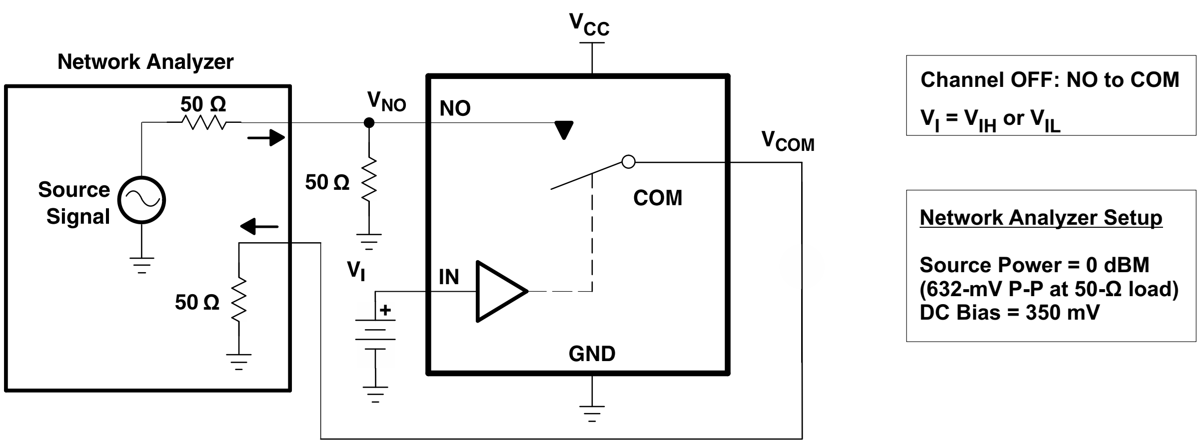


Figure 6-8. OFF Isolation (O_{ISO})

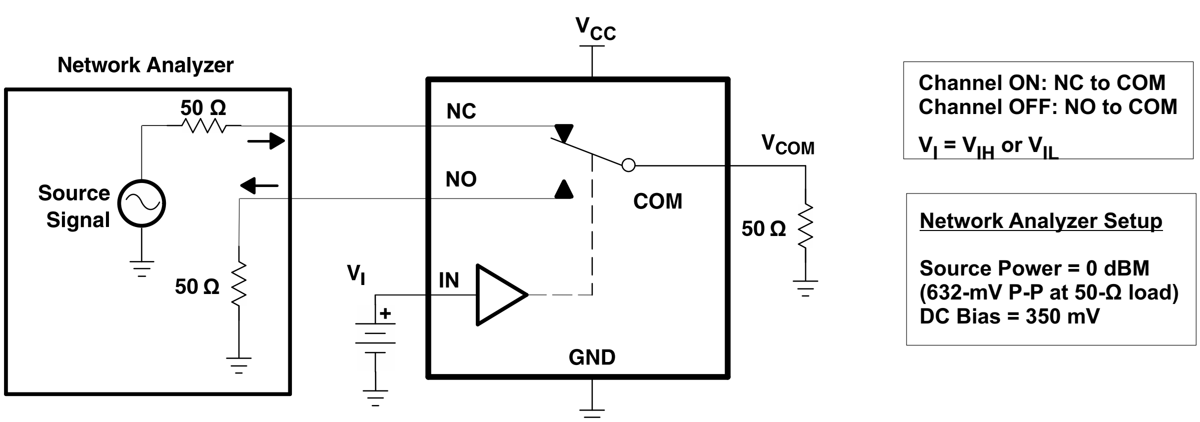
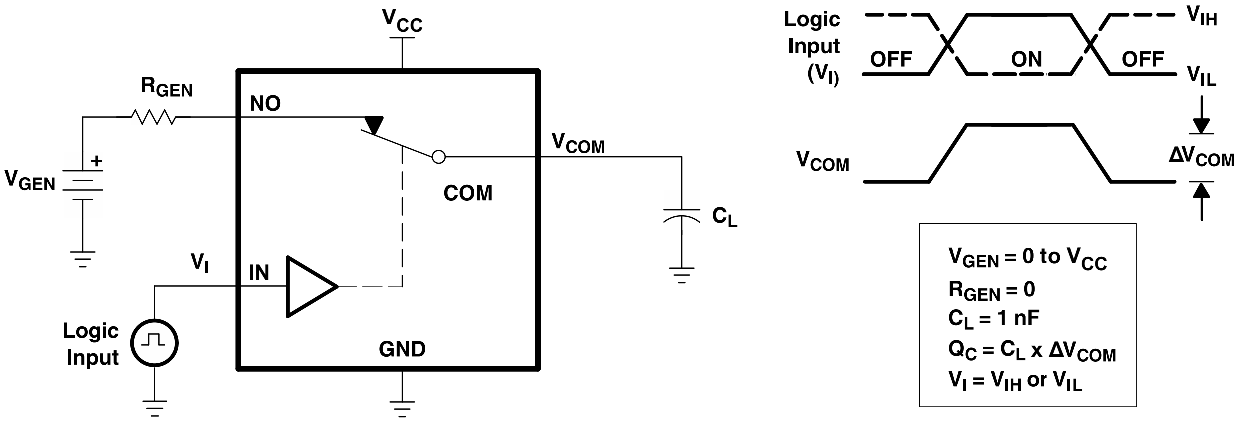
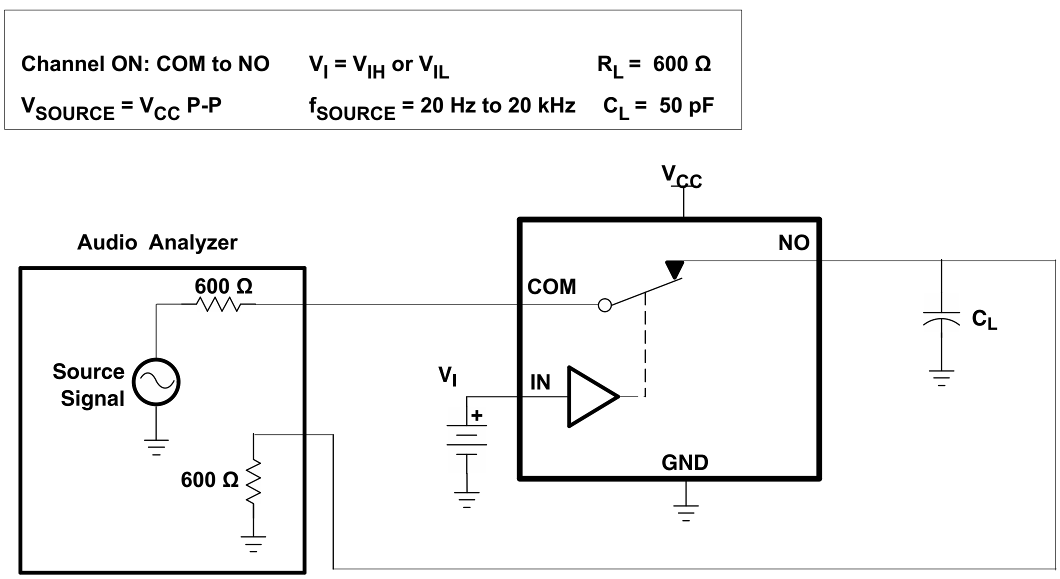


Figure 6-9. Crosstalk (X_{TALK})



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

Figure 6-10. Charge Injection (Q_C)



C_L includes probe and jig capacitance.

Figure 6-11. Total Harmonic Distortion (THD)

7 Detailed Description

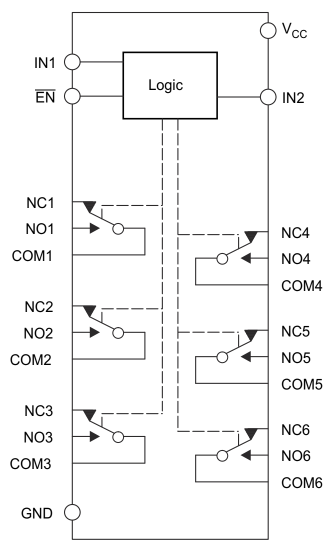
7.1 Overview

The TMUXL27518 is a bidirectional, 6-channel, 1:2 multiplexer-demultiplexer designed to operate from 1.08V to 1.95V. This device can handle both digital and analog signals, and can transmit signals up to V_{CC} in either direction. The TMUXL27518 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 1.2V logic thresholds across supply voltage range of the device eliminating the need of external logic translation.

Powered-off Protection up to 1.95V on the signal path of the TMUXL27518 provides isolation when the supply voltage is removed (VDD = 0 V). Without this protection feature, switches can back-power the supply rail through an internal ESD diode and cause potential damage to the system

The TMUXL27518 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 supports upto 6-bit interfaces such a qSPI eSPI and SPI muxing. The TMUXL27518 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.

7.2 Functional Block Diagram



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7.3 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 0V. When V_{CC} = 0 , there is no high leakage even when IO voltges go till 3.6V.

7.3.1 1.2V Compatible Logic Control

The TMUXL27518 has 1.2V logic compatible control inputs. Regardless of the VDD voltage, the control input thresholds remain fixed, allowing a 1.2V low nm processor IO to control the TMUXL27518 without the need for an external translator.

7.4 Device Functional Modes

The TMUXL27518 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 TMUXL27518 has an $\overline{EN}$ pin that when set to logic high, it places all channels into a high-impedance or HIGH-Z state. Table 7-1 lists the functions of TMUXL27518.

Table 7-1. 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

8 Application and Implementation

Note

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

8.1 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.

8.2 Typical Application

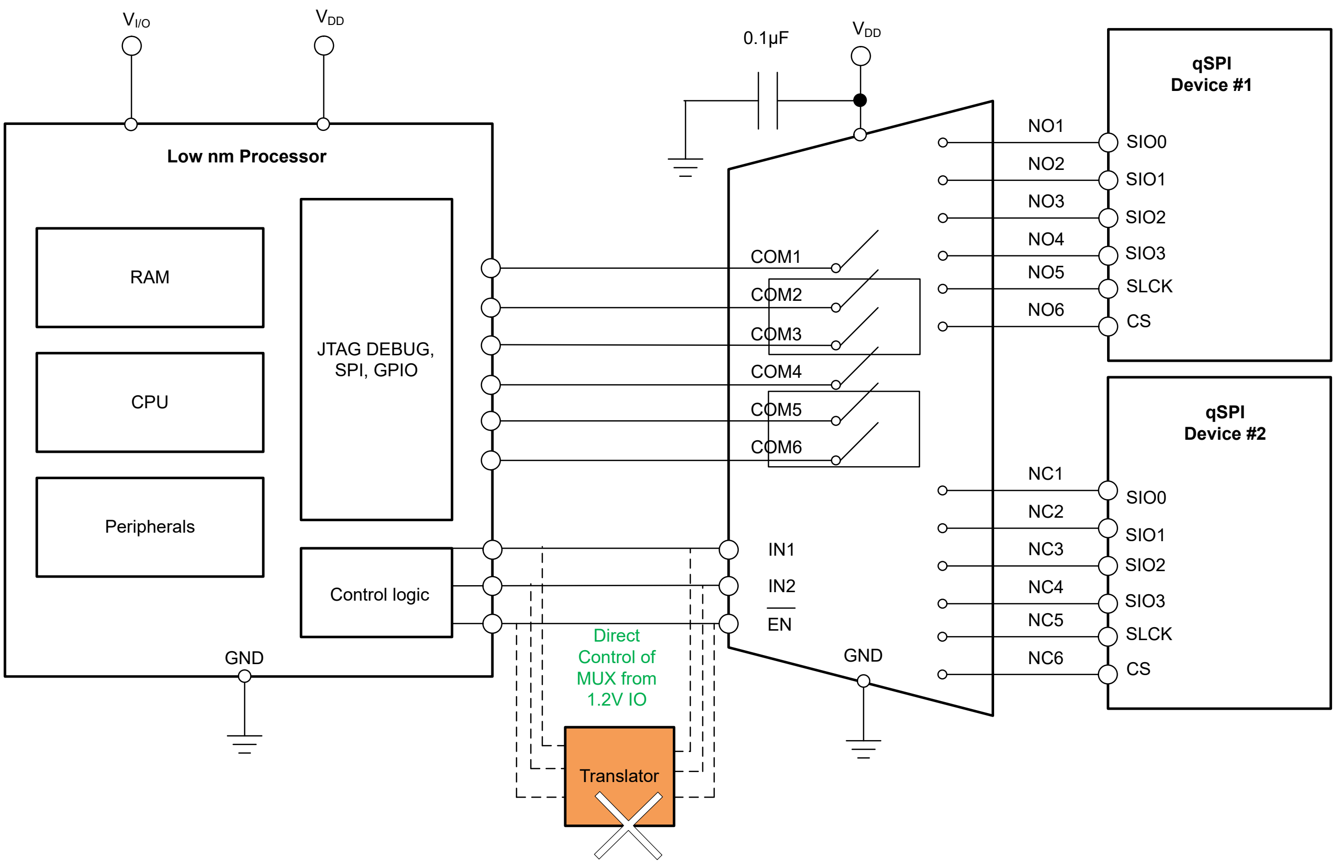

Figure 8-1. qSPI Expander Application Block Diagram

8.2.1 Design Requirement

Ensure that all of the signals passing through the switch are within the recommended operating ranges to ensure proper performance, see *Section 5.3*.

8.2.2 Detailed Design Procedure

The TMUXL27518 can be properly operated without any external components. However, TI recommends connecting unused pins to the ground through a 50Ω 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. Refer to the *Enabling SPI-Based Flash Memory Expansion by Using Multiplexers* application brief for more information on using switches and multiplexers for SPI protocol expansion.

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

8.3 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.

8.4 Layout

8.4.1 Layout Guidelines

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

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

8.4.2 Layout Example

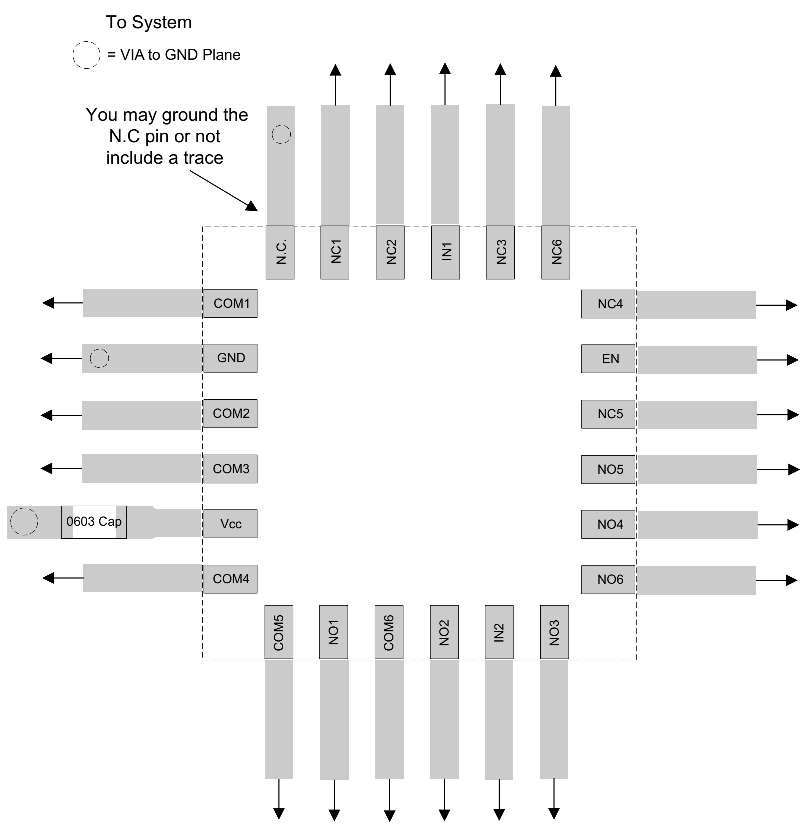

Figure 8-2. WQFN Layout Recommendation

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *Enabling SPI-Based Flash Memory Expansion by Using Multiplexers* application brief

9.2 Receiving Notification of Documentation Updates

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

9.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is 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.

9.4 Trademarks

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All trademarks are the property of their respective owners.

9.5 Electrostatic Discharge Caution

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

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

9.6 Glossary

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

10 Revision History

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

DATE	REVISION	NOTES
May 2026	*	Initial Release

11 Mechanical, Packaging, and Orderable Information

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

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TMUXL27518RTWR	Active	Production	WQFN (RTW) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	L27518

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

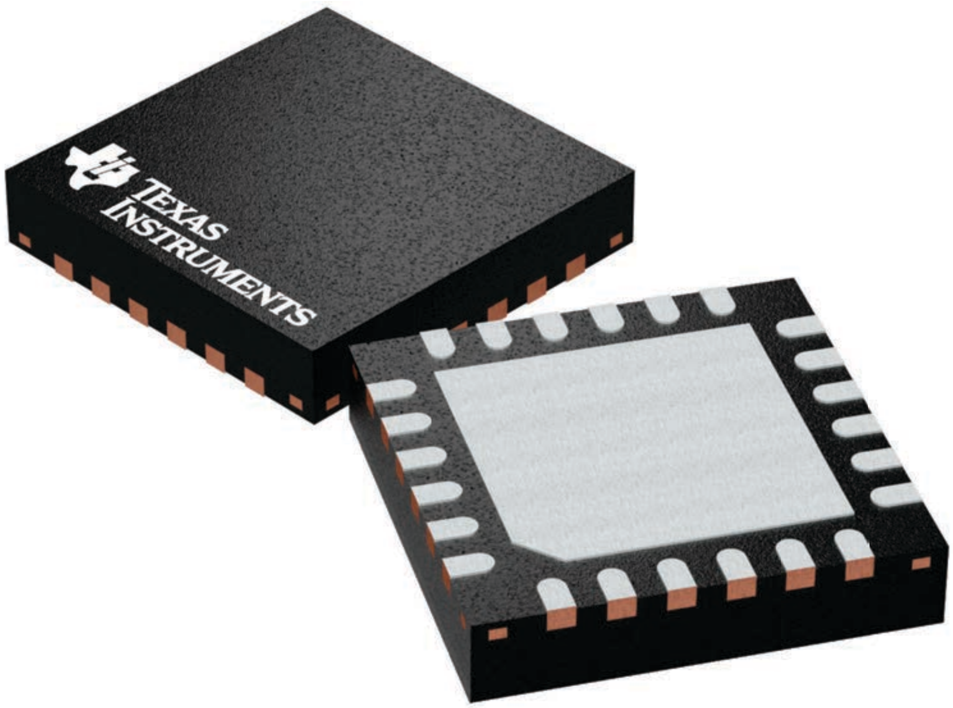
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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.

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



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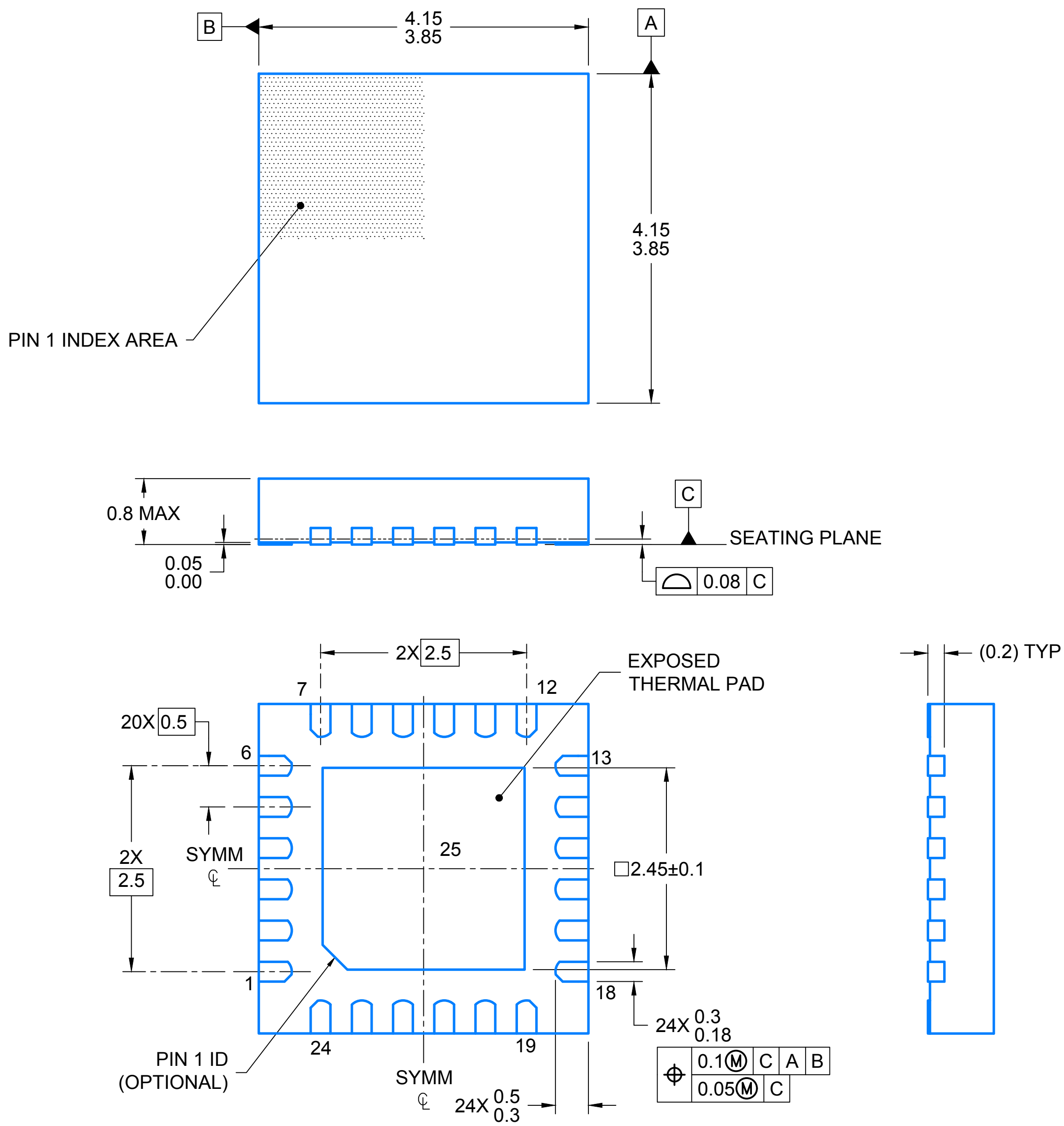
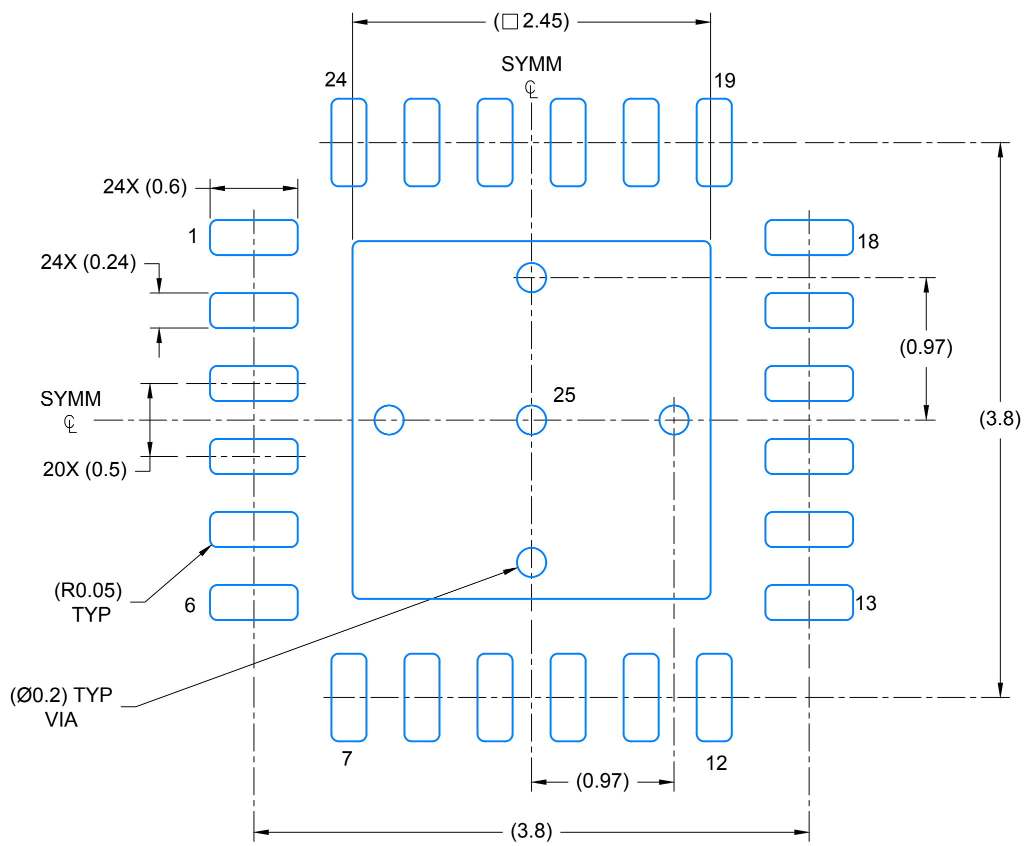


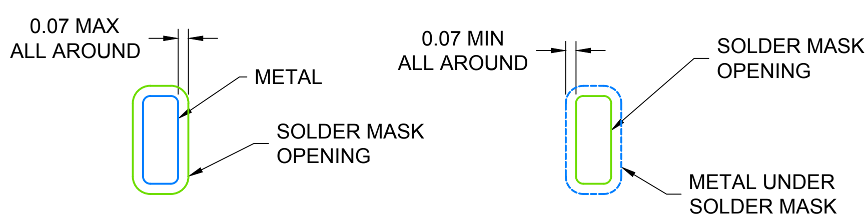
4219135/B 11/2016

NOTES:

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



LAND PATTERN EXAMPLE
SCALE: 20X



NON SOLDER MASK DEFINED (PREFERRED)

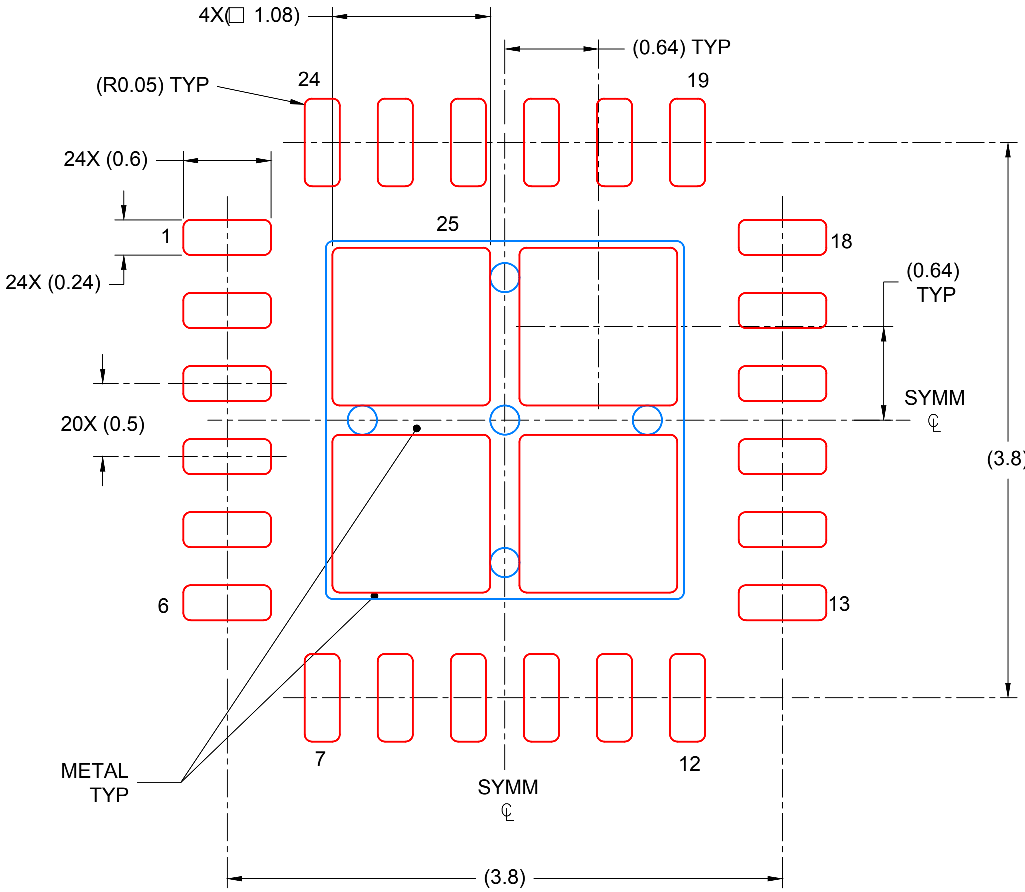
SOLDER MASK DEFINED

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.