

IEC LEVEL 4 ESD-PROTECTED 0.75-Ω SPDT ANALOG SWITCH WITH 1.8-V COMPATIBLE INPUT LOGIC

Check for Samples: [TS5A12301E](#)

FEATURES

- Low ON-State Resistance (0.75 Ω)
- Low Charge Injection
- Excellent ON-State Resistance Matching
- Isolation in Power-Down Mode, $V_+ = 0$
- Specified Break-Before-Make Switching
- 2.25-V to 5.5-V Power Supply (V_+)
- 6-MΩ Input Pulldown Allows Control Input (IN) to Be Unconnected
- 1.8-V Compatible Control Input Threshold Independent of V_+
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
 - 3000-V Human-Body Model (A114-B, Class II)
 - 1000-V Charged-Device Model (C101)
- ESD Performance COM Port to GND
 - 8000-V Human-Body Model (A114-B, Class II)
 - ±8-kV Contact Discharge (IEC 61000-4-2)
 - ±15-kV Air-Gap Discharge (IEC 61000-4-2)

APPLICATIONS

- Cell Phones
- PDAs
- Portable Instrumentation
- MP3 Players
- Portable Media Players

YFP PACKAGE

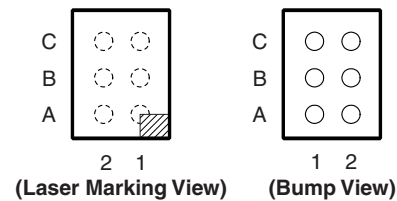


Table 1. TERMINAL ASSIGNMENTS

C	V_+	NC
B	COM	GND
A	IN	NO
	2	1

DESCRIPTION/ORDERING INFORMATION

The TS5A12301E is a single-pole double-throw (SPDT) analog switch that is designed to operate from 2.25 V to 5.5 V. The device offers a low ON-state resistance with an excellent channel-to-channel ON-state resistance matching, and the break-before-make feature to prevent signal distortion during the transferring of a signal from one path to another.

The device has excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications. The control input (IN) pin can be connected to low-voltage GPIOs, allowing it to be controlled by 1.8-V signals.

The TS5A12301E has ±15-kV Air-Gap Discharge and ±8-kV Contact Discharge ESD protection for the COM port to GND, which make it compliant with the IEC Level 4 ESD standard (IEC 61000-4-2).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Table 2. ORDERING INFORMATION⁽¹⁾

T_A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽³⁾
–40°C to 85°C	WCSP (DSBGA) 0.4-mm Pitch – YFP (Pb-free)	Tape and reel	TS5A12301EYFPR	— 3W —

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) YFP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

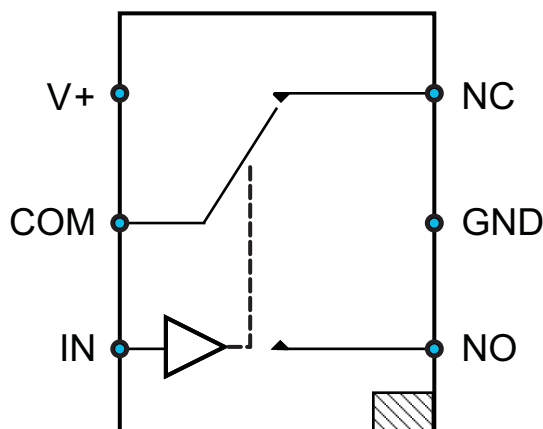
SUMMARY OF CHARACTERISTICS⁽¹⁾

Configuration	2:1 Multiplexer/Demultiplexer (1 × SPDT)
Number of channels	1
ON-state resistance (r_{on})	0.75 Ω max
ON-state resistance match (Δr_{on})	0.1 Ω max
ON-state resistance flatness ($r_{on(flat)}$)	0.1 Ω max
Turn-on/turn-off time (t_{ON}/t_{OFF})	110 ns/100 ns
Break-before-make time (t_{BBM})	10 ns
Charge injection (Q_C)	97 pC
Bandwidth (BW)	55 MHz
OFF isolation (O_{ISO})	–63 dB at 1 MHz
Crosstalk (X_{TALK})	–63 dB at 1 MHz
Total harmonic distortion (THD)	0.003%
Leakage current ($I_{NO(OFF)}/I_{NC(OFF)}$)	20 nA
Package option	6-pin WCSP, 0.4-mm pitch

(1) $V_+ = 5\text{ V}$, $T_A = 25^\circ\text{C}$

FUNCTION TABLE

IN	NC TO COM, COM TO NC	NO TO COM, COM TO NO
L or Open	ON	OFF
H	OFF	ON

**Figure 1. Logic Diagram**

ABSOLUTE MAXIMUM RATINGS^{(1) (2)}

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

			MIN	MAX	UNIT
V ₊	Supply voltage range ⁽³⁾		−0.5	6.5	V
V _{NC} V _{NO} V _{COM}	Analog voltage range ⁽³⁾ (4) (5)		−0.5	V ₊ + 0.5	V
I _{IK}	Analog port diode current	V ₊ < V _{NC} , V _{NO} , V _{COM} or V _{NC} , V _{NO} , V _{COM} < 0	−50	50	mA
I _{NC} I _{NO} I _{COM}	On-state switch current	V _{NC} , V _{NO} , V _{COM} = 0 to V ₊	−450	450	mA
	On-state peak switch current ⁽⁶⁾		−700	700	
V _I	Digital input voltage range ⁽³⁾ (4)		−0.5	6.5	V
I _{IK}	Digital input clamp current	V _I < 0	−50		mA
I ₊ I _{GND}	Continuous current through V ₊ or GND		−100	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, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) 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) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (5) This value is limited to 5.5 V maximum.
- (6) Pulse at 1-ms duration < 10% duty cycle

THERMAL IMPEDANCE RATINGS

				UNIT
θ_{JA}	Package thermal impedance ⁽¹⁾	YFP package	154.2	°C/W

- (1) The package thermal impedance is calculated in accordance with JESD 51-7.

ELECTRICAL CHARACTERISTICS FOR 5-V SUPPLY⁽¹⁾
 $V_+ = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T _A	V ₊	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V _{COM} , V _{NO} , V _{NO}					0		V ₊	V
ON-state resistance	r _{on}	V _{NO} or V _{NC} = 2.5 V, I _{COM} = −100 mA,	See Figure 15	25°C Full	4.5 V	0.5	0.75		Ω
ON-state resistance match between channels	Δr _{on}	V _{NO} or V _{NC} = 2.5 V, I _{COM} = −100 mA,	See Figure 15	25°C Full	4.5 V	0.05	0.1		Ω
ON-state resistance flatness	r _{on(flat)}	0 ≤ (V _{NO} or V _{NC}) ≤ V ₊ , I _{COM} = −100 mA,	See Figure 15	25°C	4.5 V	0.15			Ω
		V _{NO} or V _{NC} = 1 V, 1.5 V, 2.5 V, I _{COM} = −100 mA,	See Figure 15	25°C Full		0.1 0.25			
NO, NC OFF leakage current	I _{NO(OFF)} , I _{NC (OFF)}	V _{NO} = 1 V, 4.5 V, V _{COM} = 4.5 V, 1 V, V _{NC} = Open, or V _{NO} = 1 V, 4.5 V, V _{COM} = 4.5 V, 1 V, V _{NO} = Open,	See Figure 16	25°C	5.5 V	−20	2	20	nA
				Full		−100		100	
		I _{NO(PWROFF)} , I _{NC (PWROFF)}	V _{NO} or V _{NC} = 0 to 5.5 V, V _{COM} = 5.5V to 0		25°C Full	0 V	−10 −10		10 10
NC, NO ON leakage current	I _{NO(ON)}	V _{NO} = 1 V, 4.5 V, V _{COM} , V _{NC} = Open, or V _{NC} = 1 V, 4.5 V, V _{COM} , V _{NO} = Open,	See Figure 17	25°C	5.5 V	−20	2	20	nA
				Full		−200		200	
COM ON leakage current	I _{COM(ON)}	V _{COM} = 1 V, 4.5 V, V _{NO} and V _{NC} = Open, or V _{COM} = 1 V, 4.5 V, V _{NO} or V _{NC} = Open,	See Figure 17	25°C	5.5 V	−20	2	20	nA
				Full		−200		200	
COM OFF leakage current	I _{COM(PWROFF)}	V _{NO} or V _{NC} = 0 to 5.5 V, V _{COM} = 5.5V to 0	See Figure 16	25°C	0 V	−10		10	μA
				Full		−10		10	
Digital Control Input (IN)									
Input logic high	V _{IH}			Full	5.5 V	1.05		5.5	V
Input logic low	V _{IL}			Full	5.5 V	0		0.65	V
Input leakage current	I _{IH} , I _{IL}	V _I = 1.95 V or 0		Full	5.5 V	−0.05		0.5	μA
Input resistance	r _{IN}	V _I = 1.95 V		Full	5.5 V		6		MΩ

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

ELECTRICAL CHARACTERISTICS FOR 5-V SUPPLY⁽¹⁾ (continued)
 $V_+ = 4.5 \text{ V to } 5.5 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic								
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50 \Omega$, $C_L = 35 \text{ pF}$, See Figure 19	25°C	5 V		110	225	ns
			Full	4.5 V			250	
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50 \Omega$, $C_L = 35 \text{ pF}$, See Figure 19	25°C	5 V		100	215	ns
			Full	4.5 V			225	
Break-before-make time	t_{BBM}	$V_{COM} = V_+$, $R_L = 50 \Omega$, $C_L = 35 \text{ pF}$, See Figure 20	25°C	5 V	1	10	15	ns
			Full	4.5 V	1		20	
Charge injection	Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 1 \text{ nF}$, See Figure 24	25°C	5 V		97		pC
NO OFF capacitance	$C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF, See Figure 18	25°C	5 V		28		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON, See Figure 18	25°C	5 V		112		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON, See Figure 18	25°C	5 V		112		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND, See Figure 18	25°C	5 V		3		pF
Bandwidth	BW	$R_L = 50 \Omega$, Switch ON, See Figure 21	25°C	5 V		55		MHz
OFF isolation	O_{ISO}	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$, See Figure 22	25°C	5 V		–63		dB
Crosstalk	X_{TALK}	$R_L = 50 \Omega$, $f = 1 \text{ MHz}$, See Figure 23	25°C	5 V		–63		dB
Total harmonic distortion	THD	$R_L = 600 \Omega$, $C_L = 50 \text{ pF}$, $f = 20 \text{ Hz to } 20 \text{ kHz}$, See Figure 25	25°C	5 V		0.003		%
Supply								
Positive supply current	I_+	$V_I = V_+$ or GND	Full	5.5 V			10	μA

ELECTRICAL CHARACTERISTICS FOR 3.3-V SUPPLY⁽¹⁾
 $V_+ = 3\text{ V to }3.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T _A	V ₊	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V _{COM} , V _{NO}					0		V ₊	V
ON-state resistance	r _{on}	V _{NO} or V _{NC} = 2 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C Full	3 V	0.75	0.9		Ω
ON-state resistance match between channels	Δr _{on}	V _{NO} or V _{NC} = 2 V, 0.8 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C Full	3 V	0.1	0.15		Ω
ON-state resistance flatness	r _{on(flat)}	0 ≤ (V _{NO} or V _{NC}) ≤ V ₊ , I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C	3 V	0.2			Ω
		V _{NO} or V _{NC} = 0.8 V, 2 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C		0.1	0.2		
				Full			0.3		
NO, NC OFF leakage current	I _{NO(OFF)} , I _{NC (OFF)}	V _{NO} = 1 V, 3 V, V _{COM} = 3 V, 1 V, V _{NC} = Open, or V _{NC} = 1 V, 3 V, V _{COM} = 3 V, 1 V, V _{NO} = Open,	Switch OFF, See Figure 16	25°C	3.6 V	−20	2	20	nA
				Full		−50		50	
	I _{NO(PWROFF)} , I _{NC (PWROFF)}	V _{NO} or V _{NC} = 0 to 3.6 V, V _{COM} = 3.6V to 0		25°C	0 V	−10		10	μA
				Full		−10		10	
NC, NO ON leakage current	I _{NO(ON)}	V _{NO} = 1 V, 3 V, V _{NC} and V _{COM} = Open, or V _{NC} = 1 V, 3 V, V _{NO} and V _{COM} = Open,	Switch ON, See Figure 17	25°C	3.6 V	−20	2	20	nA
				Full		−100		100	
COM ON leakage current	I _{COM(ON)}	V _{COM} = 1 V, V _{NO} and V _{NC} = Open, or V _{COM} = 3 V, V _{NO} and V _{NC} = Open,	See Figure 17	25°C	3.6 V	−20	2	20	nA
				Full		−100		100	
COM OFF leakage current	I _{COM(PWROFF)}	V _{NO} or V _{NC} = 0 to 3.6 V, V _{COM} = 3.6 V to 0	See Figure 16	25°C	0 V	−10		10	μA
				Full		−10		10	
Digital Control Input (IN)									
Input logic high	V _{IH}			Full	3.6 V	1.05		5.5	V
Input logic low	V _{IL}			Full	3.6 V	0		0.65	V
Input leakage current	I _{IH} , I _{IL}	V _I = 1.95 V or 0		Full	3.6 V	−0.05		0.5	μA
Input resistance	r _{IN}	V _I = 1.95 V		Full	3.6 V		6		MΩ

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

ELECTRICAL CHARACTERISTICS FOR 3.3-V SUPPLY⁽¹⁾ (continued)
 $V_+ = 3\text{ V to }3.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic								
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 19	25°C	3.3 V	72	175	ns
				Full	3 V		185	
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 19	25°C	3.3 V	105	165	ns
				Full	3 V		170	
Break-before-make time	t_{BBM}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 20	25°C	3.3 V	1	16	ns
				Full	3 V	1	35	
Charge injection	Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$,	$C_L = 1\text{ nF}$, See Figure 24	25°C	3.3V	97		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_+$ or GND, Switch OFF,	See Figure 18	25°C	3.3 V	28		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 18	25°C	3.3 V	115		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 18	25°C	3.3 V	115		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 18	25°C	3.3 V	3		pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See Figure 21	25°C	3.3 V	54		MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See Figure 22	25°C	3.3 V	–63		dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	See Figure 23	25°C	3.3 V	–63		dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 20\text{ Hz to }20\text{ kHz}$, See Figure 25	25°C	3.3 V	0.004		%
Supply								
Positive supply current	I_+	$V_I = 1.95\text{ V or GND}$	25°C	3.6 V			10	μA

ELECTRICAL CHARACTERISTICS FOR 2.5-V SUPPLY⁽¹⁾
 $V_+ = 2.25 \text{ V to } 2.75 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T _A	V ₊	MIN	TYP	MAX	UNIT	
Analog Switch										
Analog signal range	V _{COM} , V _{NO}					0		V ₊	V	
ON-state resistance	r _{on}	V _{NO} or V _{NC} = 1.8 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C Full	2.25 V	1.1	1.3 1.6		Ω	
ON-state resistance match between channels	Δr _{on}	V _{NO} or V _{NC} = 1.8 V, 0.8 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C Full	2.25 V	0.15	0.2 0.2		Ω	
ON-state resistance flatness	r _{on(flat)}	0 ≤ (V _{NO} or V _{NC}) ≤ V ₊ , I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C	2.25 V	0.4			Ω	
		V _{NO} or V _{NC} = 0.8 V, 1 V, 1.8 V, I _{COM} = −100 mA,	Switch ON, See Figure 15	25°C		0.25				0.5
				Full						0.6
NO, NC OFF leakage current	I _{NO(OFF)} , I _{NC (OFF)}	V _{NO} = 0.5 V, 2.2 V, V _{COM} = 2.2 V, 0.5 V, V _{NC} = Open, or V _{NC} = 0.5 V, 2.2 V, V _{COM} = 2.2 V, 0.5 V, V _{NO} = Open,	Switch OFF, See Figure 16	25°C	2.75 V	−20	2	20	nA	
				Full		−50		50		
	I _{NO(PWROFF)} , I _{NC (PWROFF)}	V _{NO} or V _{NC} = 0 to 2.75 V, V _{COM} = 2.75 V to 0		0 V	−10		10	μA		
			Full		−10		10			
NC, NO ON leakage current	I _{NO(ON)}	V _{NO} = 0.5 V, 2.2 V, V _{NC} and V _{COM} = Open, or V _{NC} = 2.2 V, 0.5 V, V _{NO} and V _{COM} = Open,	Switch ON, See Figure 17	25°C	2.75 V	−20	2	20	nA	
				Full		−100		100		
COM ON leakage current	I _{COM(ON)}	V _{COM} = 0.5 V, V _{NO} and V _{NC} = Open, or V _{COM} = 2.2 V, V _{NO} and V _{NC} = Open,	Switch ON, See Figure 17	25°C	2.75 V	−20	2	20	nA	
				Full		−100		100		
COM OFF leakage current	I _{COM(PWROFF)}	V _{NO} or V _{NC} = 0 to 2.75 V, V _{COM} = 2.75 V to 0	See Figure 16	25°C	0 V	−10		10	μA	
				Full		−10		10		
Digital Control Input (IN)										
Input logic high	V _{IH}			Full	2.75 V	1.05		5.5	V	
Input logic low	V _{IL}			Full	2.75 V	0		0.65	V	
Input leakage current	I _{IH} , I _{IL}	V _I = 1.95 V or 0		Full	2.75 V	−0.05		0.5	μA	
Input resistance	r _{IN}	V _I = 1.95 V		Full	2.75 V	6			MΩ	

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

ELECTRICAL CHARACTERISTICS FOR 2.5-V SUPPLY⁽¹⁾ (continued)
 $V_+ = 2.25\text{ V to }2.75\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic								
Turn-on time	t_{ON}	$V_{COM} = V_+$ $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, See Figure 19	25°C	2.5 V		97	170	ns
			Full	2.25 V			175	
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, See Figure 19	25°C	2.5 V		80	155	ns
			Full	2.25 V			160	
Break-before-make time	t_{BBM}	$V_{COM} = V_+$ $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, See Figure 20	25°C	2.5 V	5	18	35	ns
			Full	2.25 V	5		40	
Charge injection	Q_C	$V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 1\text{ nF}$, See Figure 24	25°C	2.5 V		82		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_+$ or GND, Switch OFF, See Figure 18	25°C	2.5 V		29		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON, See Figure 18	25°C	2.5 V		116		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON, See Figure 18	25°C	2.5 V		116		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND, See Figure 18	25°C	2.5 V		3		pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON, See Figure 21	25°C	2.5 V		54		MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$, See Figure 22	25°C	2.5 V		-63		dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$, See Figure 23	25°C	2.5 V		-63		dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$, $f = 20\text{ Hz to }20\text{ kHz}$, See Figure 25	25°C	2.5 V		0.008		%
Supply								
Positive supply current	I_+	$V_I = 1.95\text{ V or GND}$	Full	2.75 V			10	μA

TYPICAL PERFORMANCE

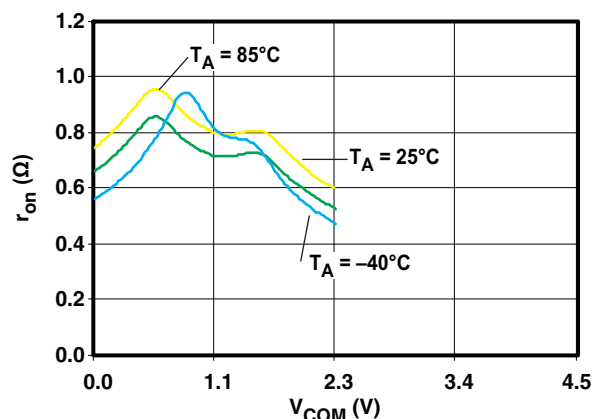
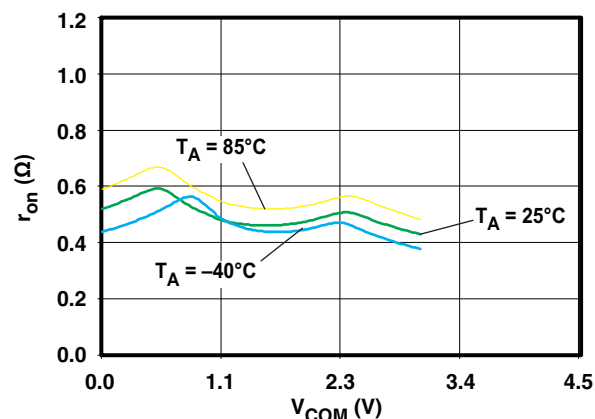
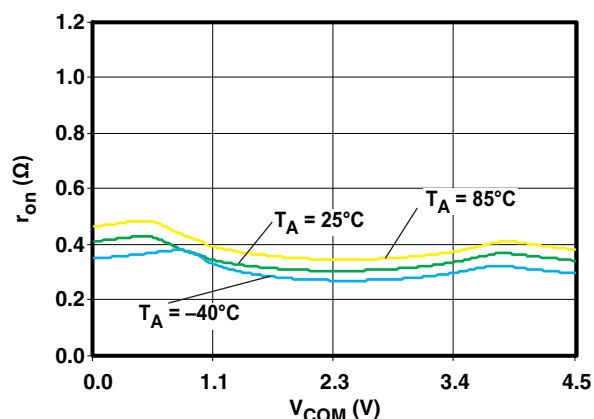
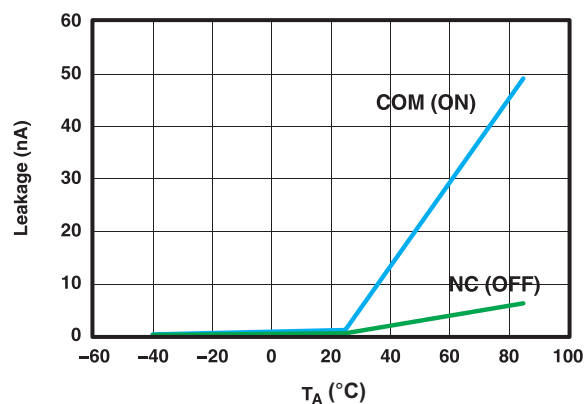
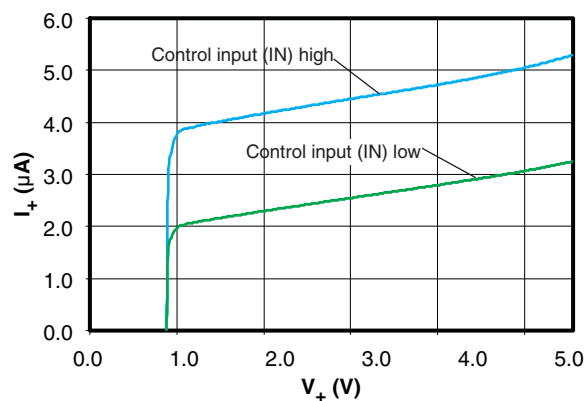
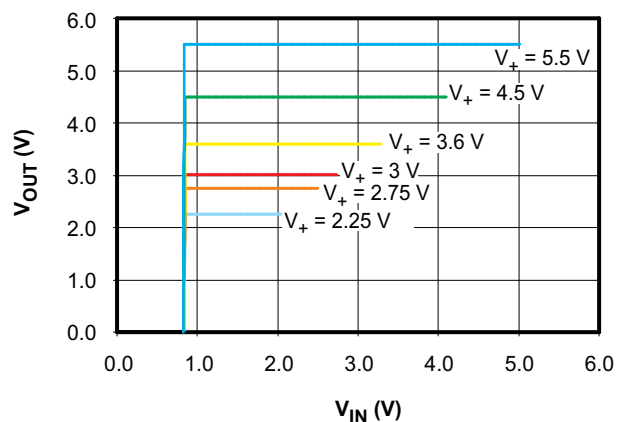
Figure 2. r_{on} vs V_{COM} ($V_+ = 2.25$ V)Figure 3. r_{on} vs V_{COM} ($V_+ = 3$ V)Figure 4. r_{on} vs V_{COM} ($V_+ = 4.5$ V)Figure 5. Leakage Current vs Temperature ($V_+ = 5$ V)Figure 6. I_+ vs V_+ ($T_A = 25^\circ\text{C}$)

Figure 7. Control Input Thresholds

TYPICAL PERFORMANCE (continued)

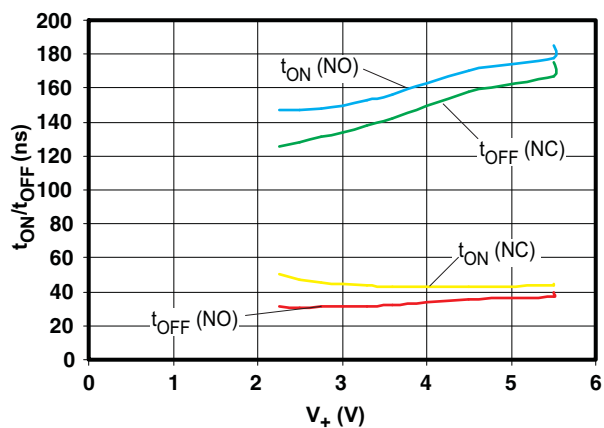


Figure 8. t_{ON}/t_{OFF} vs Supply Voltage

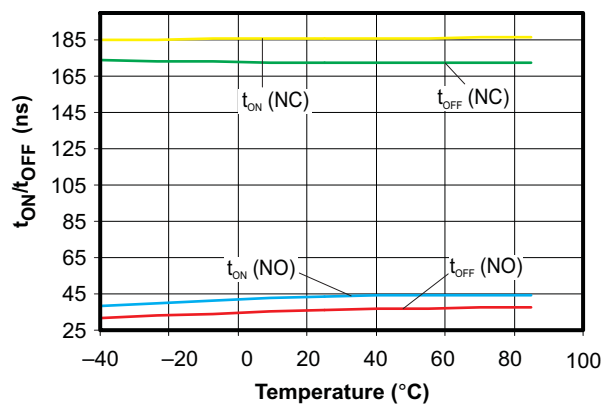


Figure 9. t_{ON}/t_{OFF} vs Temperature

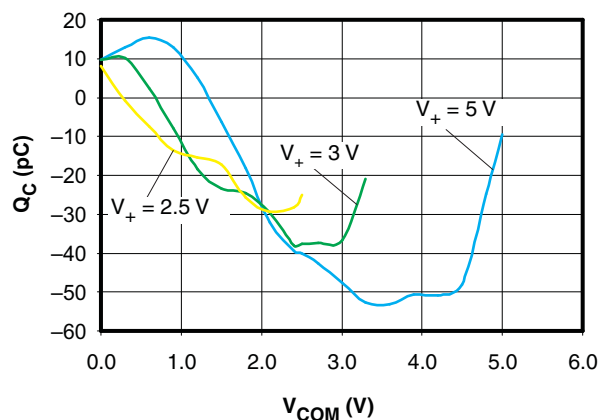


Figure 10. Charge Injection (Q_C) vs V_{COM}

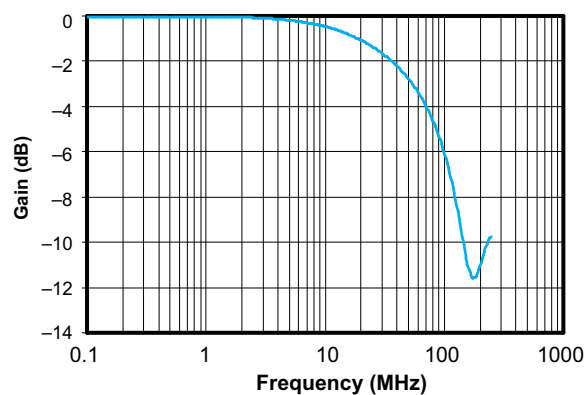


Figure 11. Gain vs Frequency

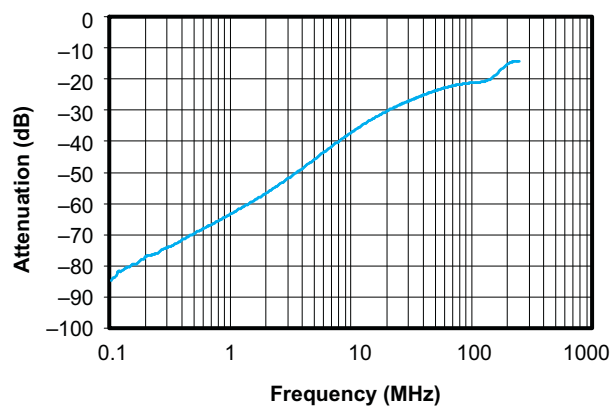


Figure 12. OFF Isolation vs Frequency

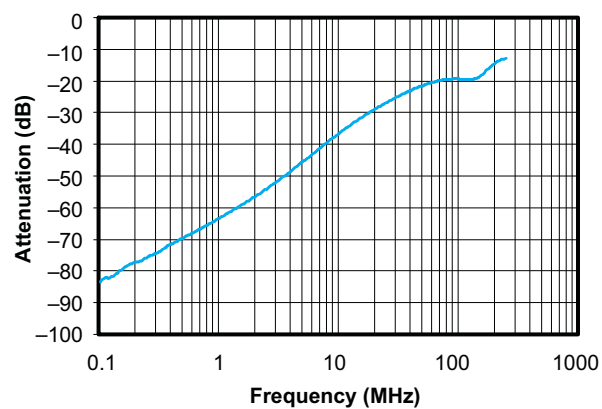
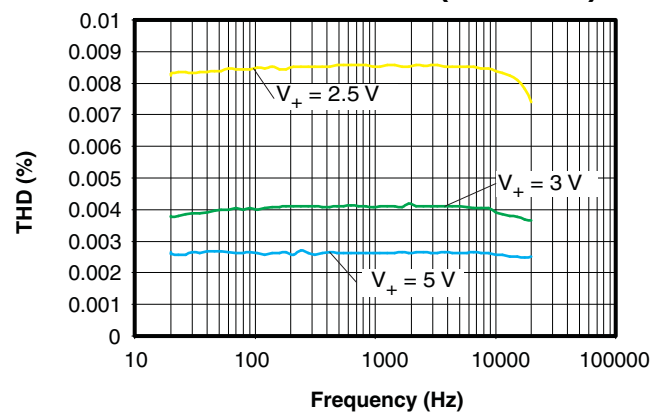


Figure 13. Crosstalk vs Frequency

TYPICAL PERFORMANCE (continued)**Figure 14. Total Harmonic Distortion (THD) vs Frequency**

PARAMETER MEASUREMENT INFORMATION

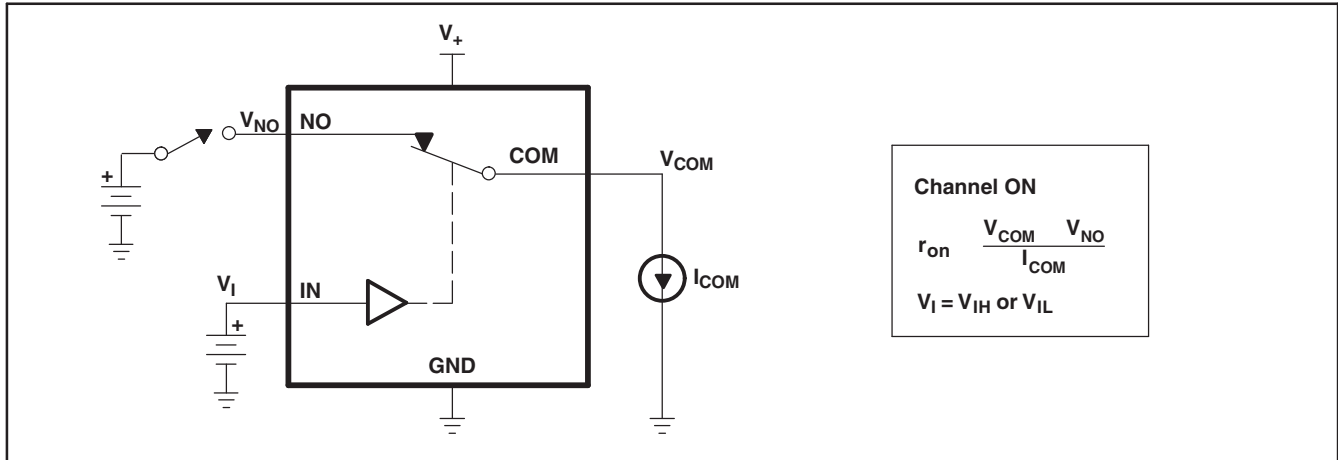


Figure 15. ON-State Resistance (r_{on})

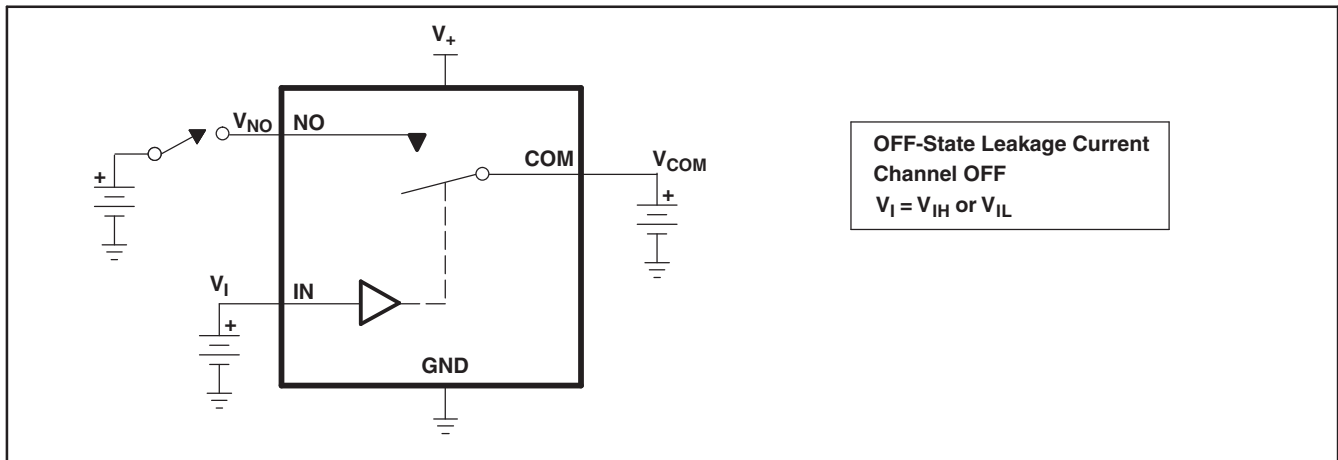


Figure 16. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NC(OFF)}$, $I_{COM(PWROFF)}$, $I_{NC(PWRFF)}$)

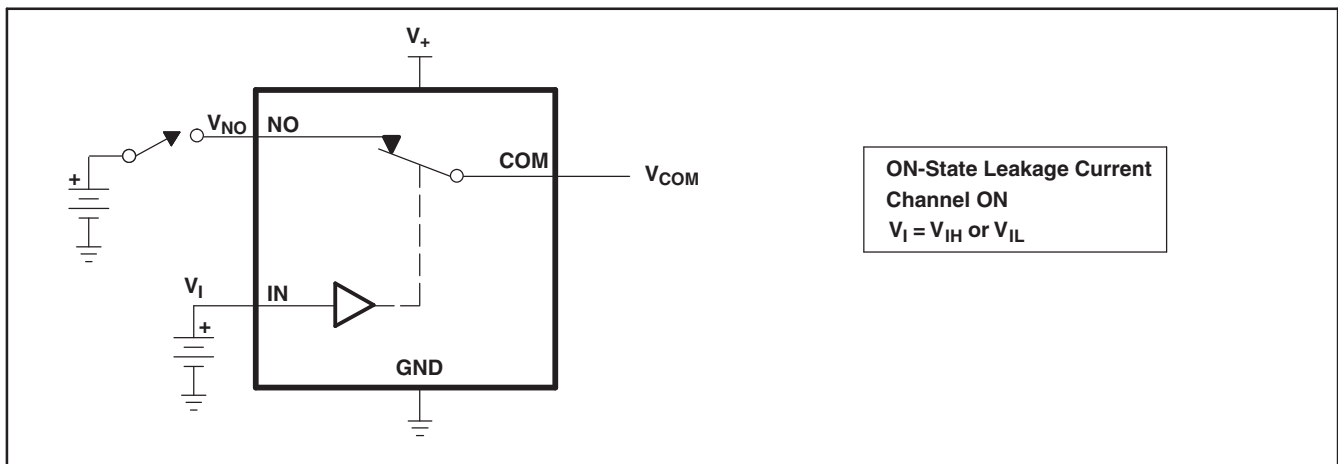


Figure 17. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

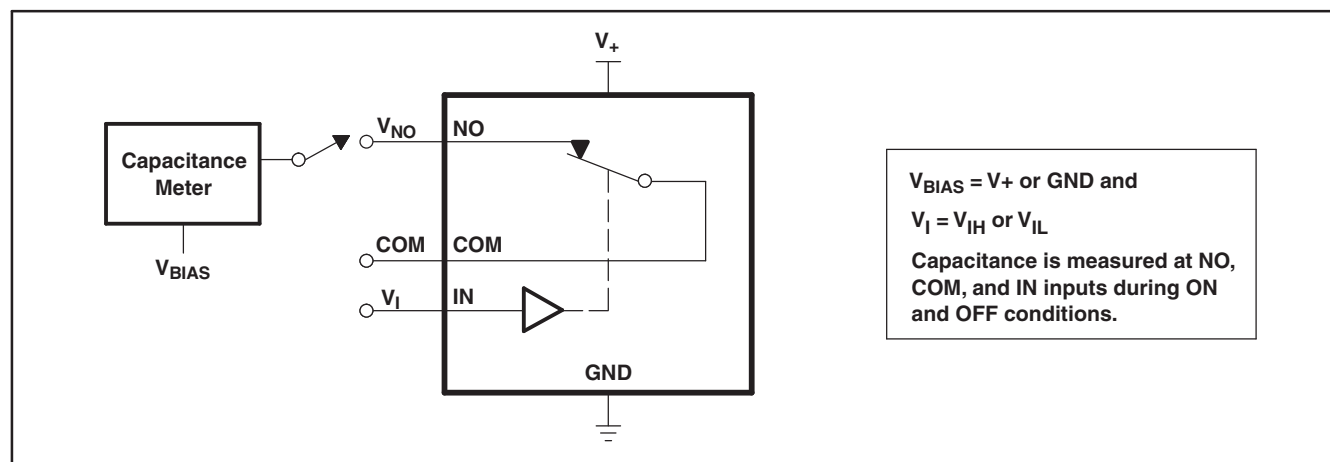
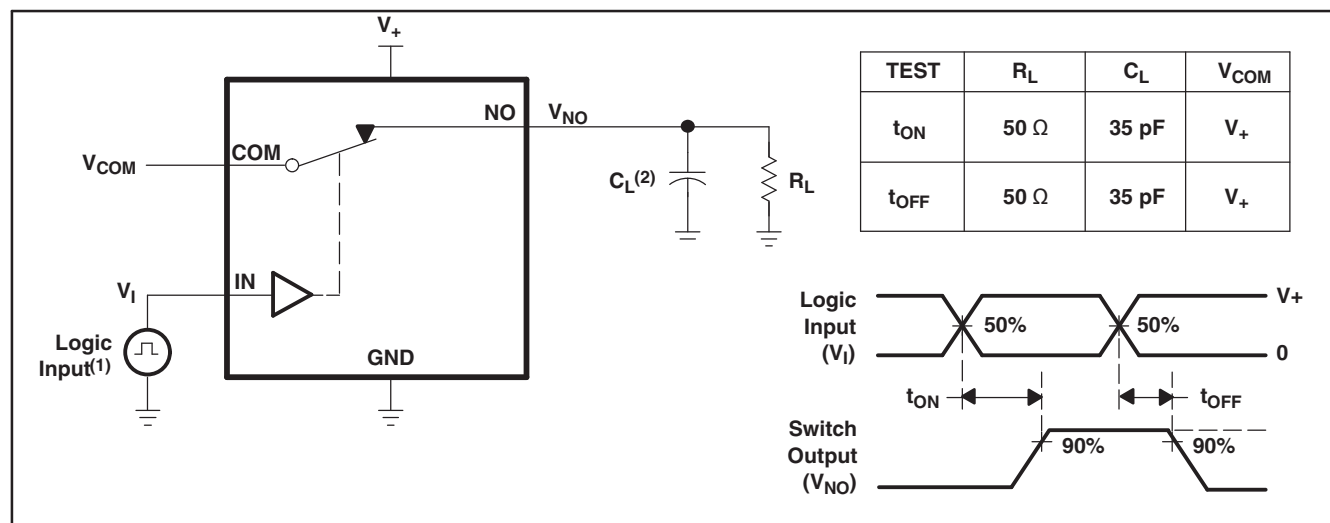


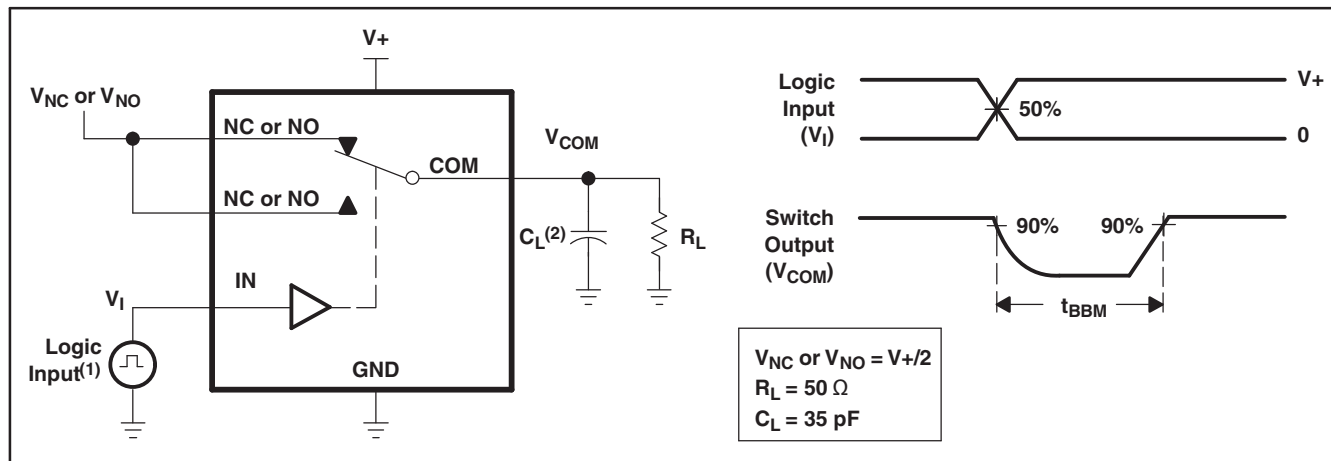
Figure 18. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$)



- A. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\ \text{MHz}$, $Z_O = 50\ \Omega$, $t_r < 5\ \text{ns}$, $t_f < 5\ \text{ns}$.
- B. C_L includes probe and jig capacitance.

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

PARAMETER MEASUREMENT INFORMATION (continued)



- All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r < 5 \text{ ns}$, $t_f < 5 \text{ ns}$.
- C_L includes probe and jig capacitance.

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

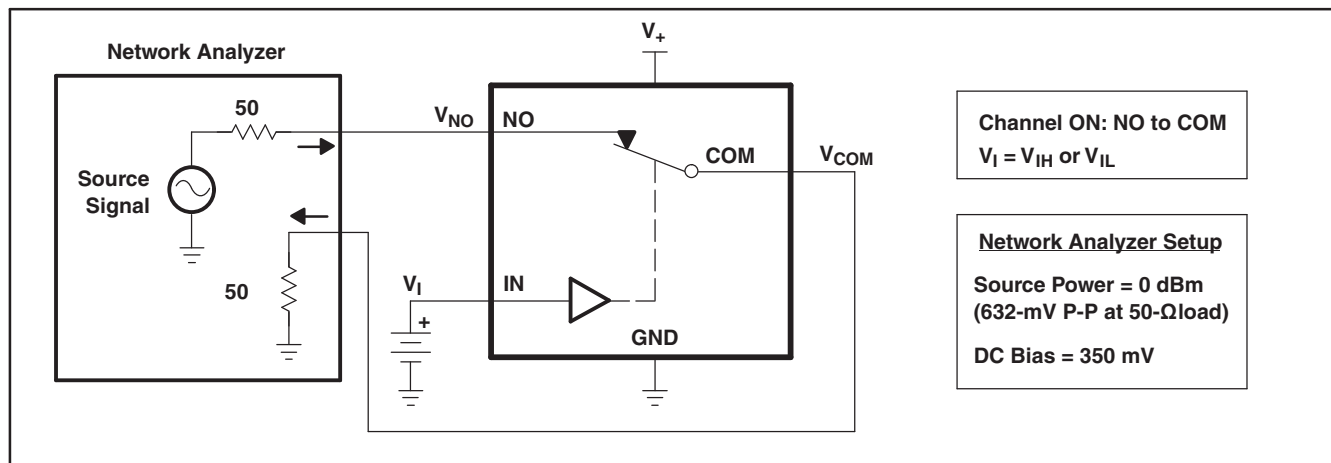


Figure 21. Bandwidth (BW)

PARAMETER MEASUREMENT INFORMATION (continued)

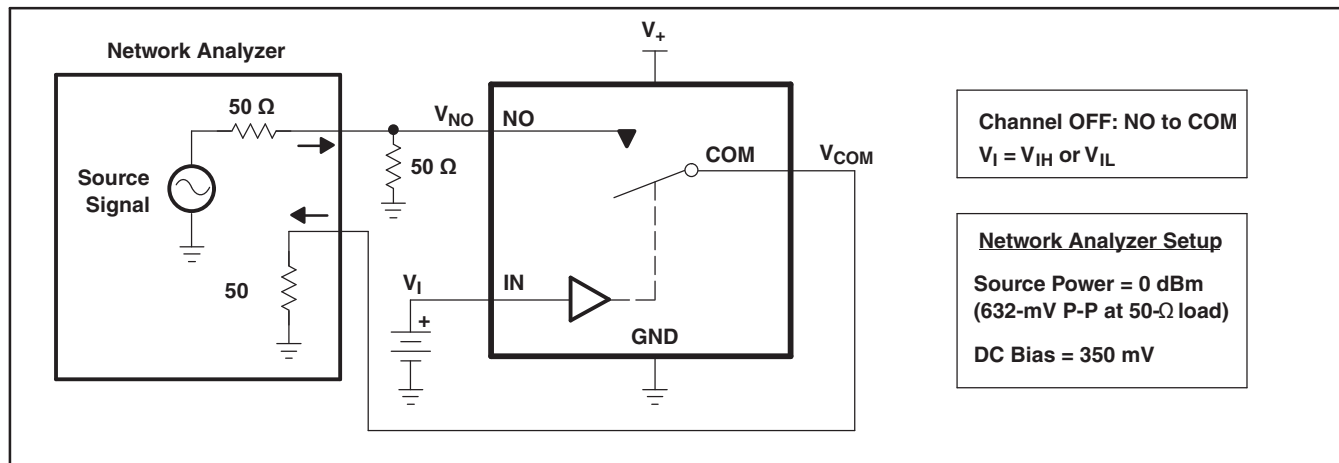


Figure 22. OFF Isolation (O_{ISO})

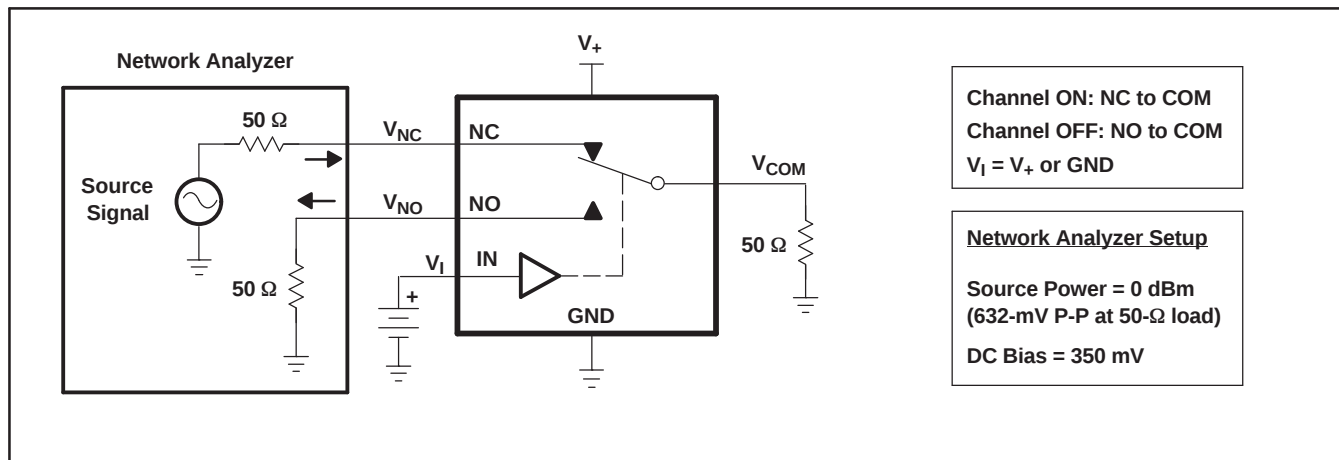
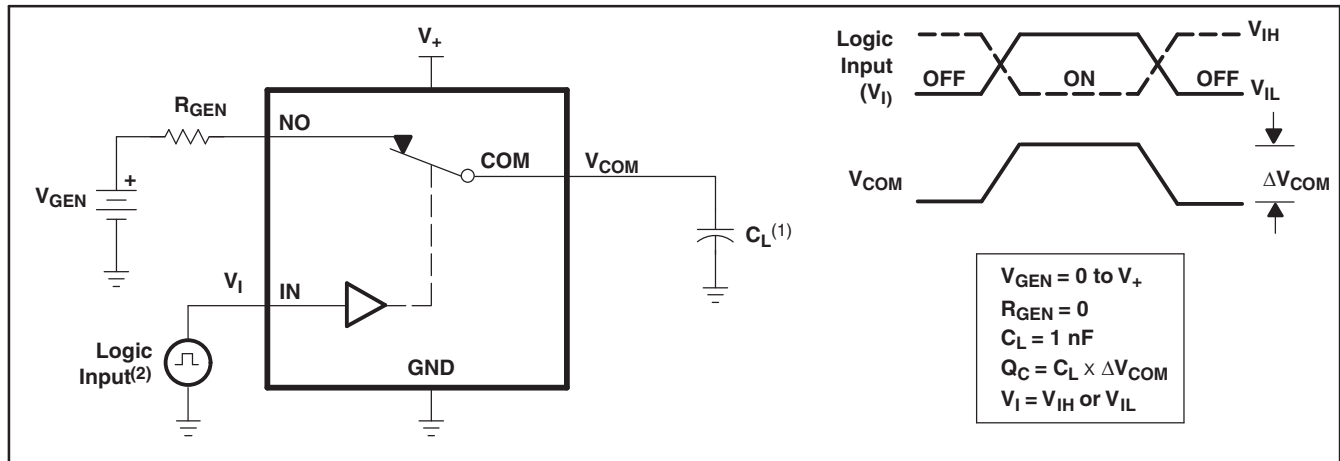


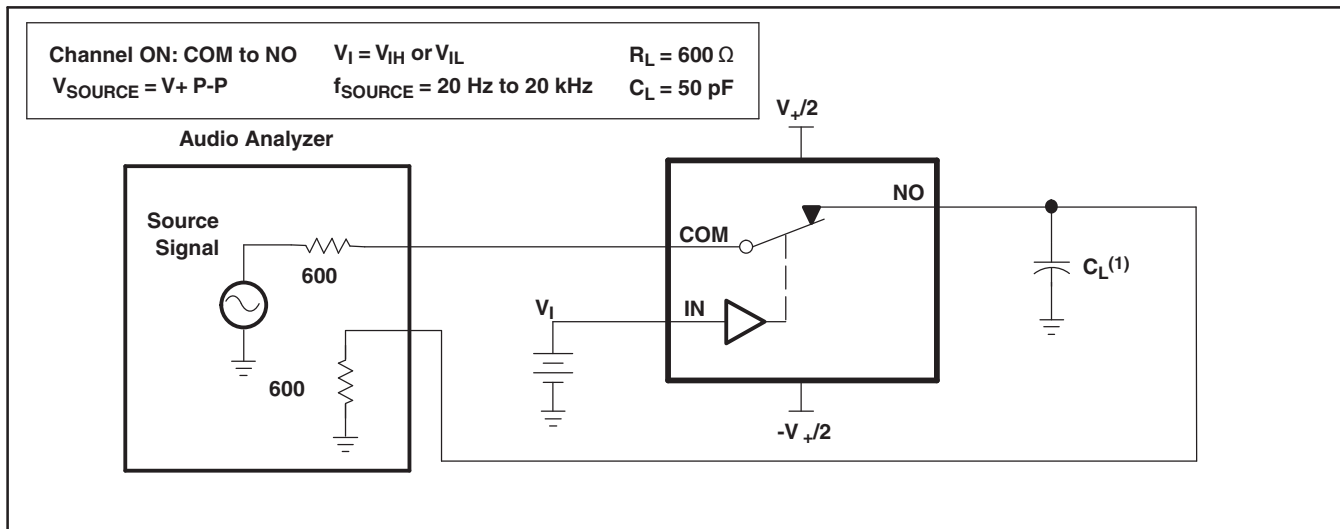
Figure 23. Crosstalk (X_{TALK})

PARAMETER MEASUREMENT INFORMATION (continued)



- A. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r < 5 \text{ ns}$, $t_f < 5 \text{ ns}$.
- B. C_L includes probe and jig capacitance.

Figure 24. Charge Injection (Q_C)



- A. C_L includes probe and jig capacitance.

Figure 25. Total Harmonic Distortion (THD)

REVISION HISTORY

Changes from Revision A (December 2009) to Revision B	Page
• Added Logic Diagram.	2

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5A12301EYFPR	ACTIVE	DSBGA	YFP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(3W2 ~ 3W7 ~ 3WN)	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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

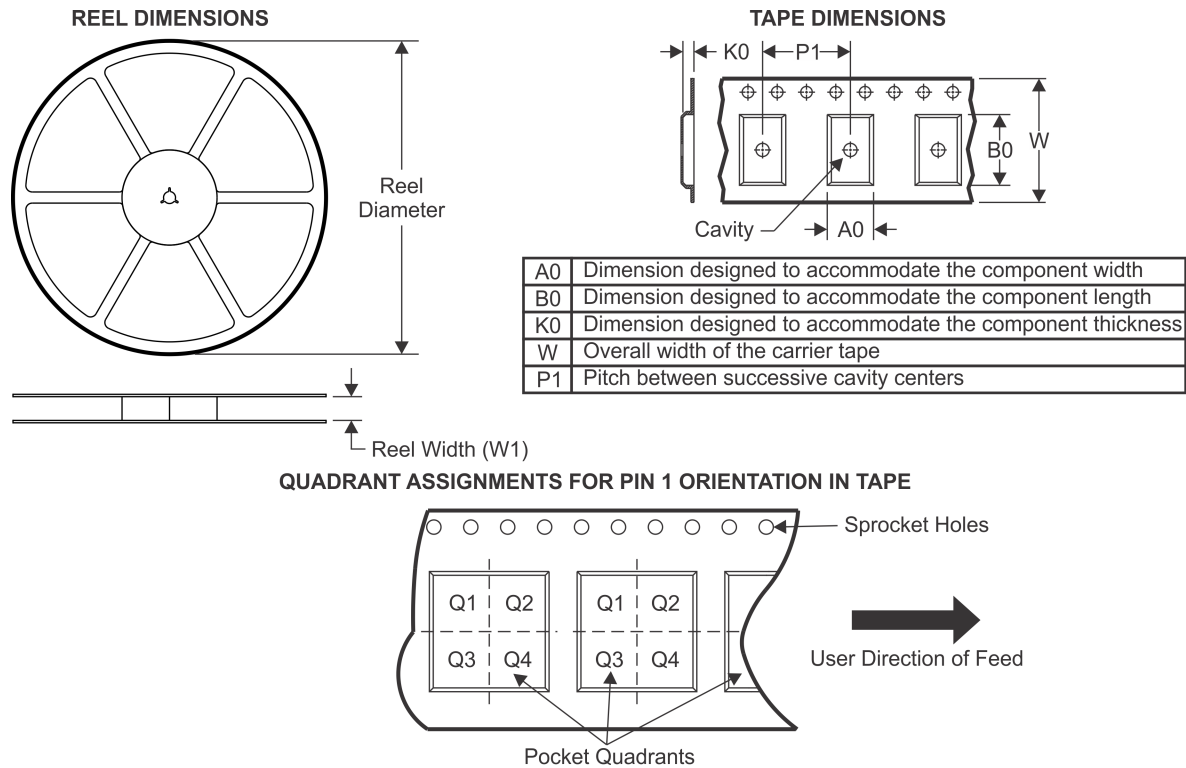
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

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.

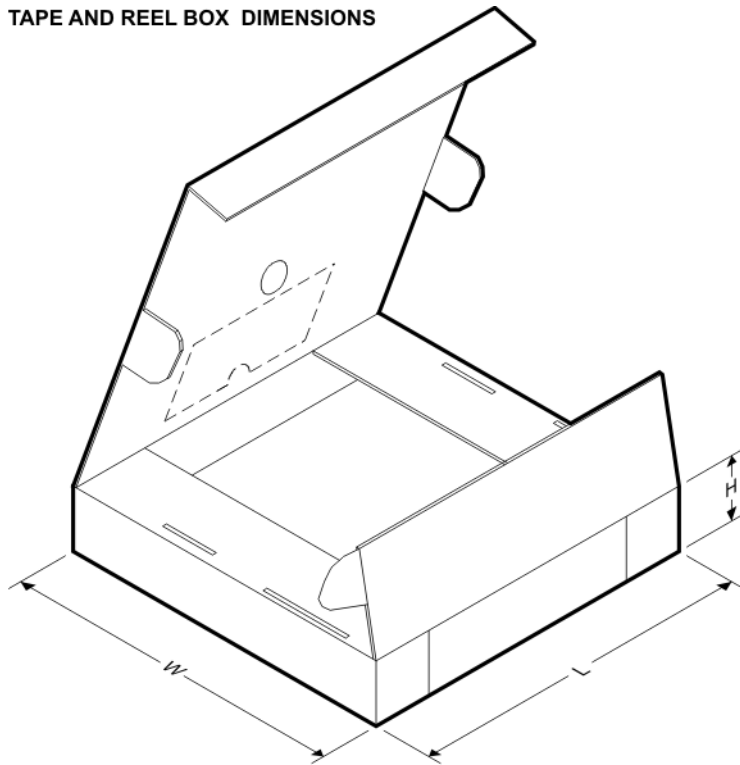
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION


*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
TS5A12301EYFPR	DSBGA	YFP	6	3000	180.0	8.4	0.89	1.29	0.62	4.0	8.0	Q1
TS5A12301EYFPR	DSBGA	YFP	6	3000	178.0	9.2	0.89	1.29	0.62	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A12301EYFPR	DSBGA	YFP	6	3000	220.0	220.0	34.0
TS5A12301EYFPR	DSBGA	YFP	6	3000	220.0	220.0	35.0

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com