

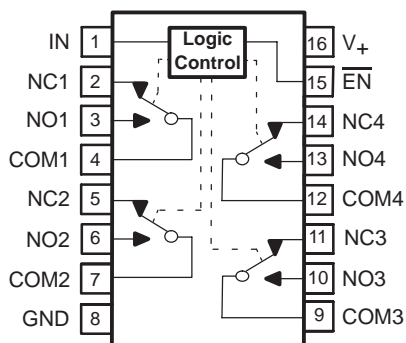
## Description

The TS3A5018 is a quad single-pole double-throw (SPDT) analog switch that is designed to operate from 2.3 V to 3.6 V. This device can handle both digital and analog signals, and signals up to  $V_+$  can be transmitted in either direction.

## Applications

- Sample-and-Hold Circuit
- Battery-Powered Equipment
- Audio and Video Signal Routing
- Communication Circuits

SOIC, SSOP, TSSOP, OR TVSOP PACKAGE  
(TOP VIEW)



FUNCTION TABLE

$\overline{\text{EN}}$	IN	NO TO COM, COM TO NO	NC TO COM, COM TO NC
L	L	OFF	ON
L	H	ON	OFF
H	X	OFF	OFF

## Features

- Low ON-State Resistance (10 Ω)
- Low Charge Injection
- Excellent ON-State Resistance Matching
- Low Total Harmonic Distortion (THD)
- 2.3-V to 3.6-V Single-Supply Operation
- Control Inputs are 5-V Tolerant
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)

## Summary of Characteristics

$V_+ = 3.3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$

Configuration	Quad Single Pole Double Throw (4 × SPDT)
Number of channels	4
ON-state resistance ( $r_{\text{ON}}$ )	7 Ω
ON-state resistance match ( $\Delta r_{\text{ON}}$ )	0.3 Ω
ON-state resistance flatness ( $r_{\text{ON(flat)}}$ )	5 Ω
Turn-on/turn-off time ( $t_{\text{ON}}/t_{\text{OFF}}$ )	3.5 ns/2 ns
Charge injection ( $Q_C$ )	2 pC
Bandwidth (BW)	300 MHz
OFF isolation ( $O_{\text{ISO}}$ )	–48 dB at 10 MHz
Crosstalk ( $X_{\text{TALK}}$ )	–48 dB at 10 MHz
Total harmonic distortion (THD)	0.2%
Leakage current ( $I_{\text{COM(OFF)}}$ )	±5 μA
Power-supply current ( $I_+$ )	2.5 μA
Package option	16-pin SOIC, SSOP, TSSOP, or TVSOP



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.

# TS3A5018

## 10-Ω QUAD SPDT ANALOG SWITCH

SCDS189 – JANUARY 2005

### ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC - D	Tube	TS3A5018D	TS3A5018
		Tape and reel	TS3A5018DR	
	SSOP (QSOP) - DBQ	Tape and reel	TS3A5018DBQR	YA018
	TSSOP - PW	Tube	TS3A5018PW	YA018
		Tape and reel	TS3A5018PWR	
	TVSOP - DGV	Tape and reel	TS3A5018DGVR	YA018

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

### Absolute Minimum and Maximum Ratings<sup>(1)(2)</sup>

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

			MIN	MAX	UNIT
V <sub>+</sub>	Supply voltage range <sup>(3)</sup>		−0.5	4.6	V
V <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub>	Analog voltage range <sup>(3)(4)</sup>		−0.5	7	V
I <sub>K</sub>	Analog port diode current	V <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub> < 0	−50		mA
I <sub>NC</sub> , I <sub>NO</sub> , I <sub>COM</sub>	On-state switch current	V <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub> = 0 to 7 V	−64	64	mA
V <sub>I</sub>	Digital input voltage range <sup>(3)(4)</sup>		−0.5	7	V
I <sub>IK</sub>	Digital input clamp current	V <sub>I</sub> < 0	−50		mA
I <sub>+</sub>	Continuous current through V <sub>+</sub>		−100	100	mA
I <sub>GND</sub>	Continuous current through GND		−100	100	mA
θ <sub>JA</sub>	Package thermal impedance <sup>(5)</sup>	D package		73	°C/W
		DBQ package		90	
		DGV package		120	
		PW package		108	
T <sub>sta</sub>	Storage temperature range		−65	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

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

## Electrical Characteristics for 3.3-V Supply<sup>(1)</sup>

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

PARAMETER	SYMBOL	TEST CONDITIONS	$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Analog Switch</b>								
Analog signal range	$V_{COM}, V_{NC}, V_{NO}$				0		$V_+$	V
ON-state resistance	$r_{on}$	$0 \leq (V_{NC} \text{ or } V_{NO}) \leq V_+$ , $I_{COM} = -32\text{ mA}$ , Switch ON, See Figure 13	25°C Full	3 V		7 10	12	Ω
ON-state resistance match between channels	$\Delta r_{on}$	$V_{NC} \text{ or } V_{NO} = 2.1\text{ V}$ , $I_{COM} = -32\text{ mA}$ , Switch ON, See Figure 13	25°C Full	3 V		0.3 0.8	1	Ω
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq (V_{NC} \text{ or } V_{NO}) \leq V_+$ , $I_{COM} = -32\text{ mA}$ , Switch ON, See Figure 13	25°C Full	3 V		5 7	8	Ω
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = 3\text{ V}$ , or $V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = 1\text{ V}$ , Switch OFF, See Figure 14	25°C Full	3.6 V	-0.1 -0.2	0.05	0.1 0.2	μA
		$V_{NC} \text{ or } V_{NO} = 0 \text{ to } 3.6\text{ V}$ , $V_{COM} = 3.6\text{ V to } 0$ , or $V_{NC} \text{ or } V_{NO} = 3.6\text{ V to } 0$ , $V_{COM} = 0 \text{ to } 3.6\text{ V}$ , Switch OFF, See Figure 14	25°C Full	0 V	-2 -10	0.05	2 10	
		$V_{COM} = 1\text{ V}, V_{NC} \text{ or } V_{NO} = 3\text{ V}$ , or $V_{COM} = 3\text{ V}, V_{NC} \text{ or } V_{NO} = 3\text{ V}$ , Switch OFF, See Figure 14	25°C Full	3.6 V	-0.1 -0.2	0.05	0.1 0.2	
		$V_{COM} = 0 \text{ to } 3.6\text{ V}, V_{NC} \text{ or } V_{NO} = 3.6\text{ V to } 0$ , or $V_{COM} = 3.6\text{ V to } 0, V_{NC} \text{ or } V_{NO} = 0 \text{ to } 3.6\text{ V}$ , Switch OFF, See Figure 14	25°C Full	0 V	-2 -10	0.05	2 10	
COM OFF leakage current	$I_{COM(OFF)}$	$V_{COM} = 1\text{ V}, V_{NC} \text{ or } V_{NO} = 3\text{ V}$ , or $V_{COM} = 3\text{ V}, V_{NC} \text{ or } V_{NO} = 3\text{ V}$ , Switch OFF, See Figure 14	25°C Full	3.6 V	-0.1 -0.2	0.05	0.1 0.2	μA
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = \text{Open}$ , or $V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = \text{Open}$ , Switch ON, See Figure 15	25°C Full	3.6 V	-0.1 -0.2	0.05	0.1 0.2	μA
COM ON leakage current	$I_{COM(ON)}$	$V_{COM} = 1\text{ V}, V_{NC} \text{ or } V_{NO} = \text{Open}$ , or $V_{COM} = 3\text{ V}, V_{NC} \text{ or } V_{NO} = \text{Open}$ , Switch ON, See Figure 15	25°C Full	3.6 V	-0.1 -0.2	0.05	0.1 0.2	μA
<b>Digital Control Inputs (<math>I_{IN}, \overline{EN}</math>)<sup>(2)</sup></b>								
Input logic high	$V_{IH}$		Full		2		$V_+$	V
Input logic low	$V_{IL}$		Full		0		0.8	V
Input leakage current	$I_{IH}, I_{IL}$	$V_I = 5.5\text{ V or } 0$	25°C	3.6 V	-1	0.05	1	μA
			Full		-1		1	

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

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

# TS3A5018

## 10-Ω QUAD SPDT ANALOG SWITCH

SCDS189 – JANUARY 2005

### Electrical Characteristics for 3.3-V Supply<sup>(1)</sup> (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
<b>Dynamic</b>								
Turn-on time	$t_{ON}$	$V_{COM} = 2\text{ V}$ , $R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ , See Figure 17	25°C	3.3 V	2.5	3.5	8	ns
			Full	3 V to 3.6 V	2.5		9	
Turn-off time	$t_{OFF}$	$V_{COM} = 2\text{ V}$ , $R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ , See Figure 17	25°C	3.3 V	0.5	2	6.5	ns
			Full	3 V to 3.6 V	0.5		7	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ $C_L = 0.1\text{ nF}$ , See Figure 22	25°C	3.3 V		2		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$ $C_{NO(OFF)}$	$V_{NC}$ or $V_{NO} = V_+$ or GND, Switch OFF, See Figure 16	25°C	3.3 V		4.5		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_+$ or GND, Switch OFF, See Figure 16	25°C	3.3 V		9		pF
NC, NO ON capacitance	$C_{NC(ON)}$ $C_{NO(ON)}$	$V_{NC}$ or $V_{NO} = V_+$ or GND, Switch ON, See Figure 16	25°C	3.3 V		16		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON, See Figure 16	25°C	3.3 V		16		pF
Digital input capacitance	$C_I$	$V_I = V_+$ or GND, See Figure 16	25°C	3.3 V		3		pF
Bandwidth	BW	$R_L = 50\ \Omega$ , Switch ON, See Figure 18	25°C	3.3 V		300		MHz
OFF isolation	$O_{ISO}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$ , Switch OFF, See Figure 19	25°C	3.3 V		-48		dB
Crosstalk	$X_{TALK}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$ , Switch ON, See Figure 20	25°C	3.3 V		-48		dB
Crosstalk Adjacent	$X_{TALK(ADJ)}$	$R_L = 50\ \Omega$ , $f = 10\text{ MHz}$ , Switch ON, See Figure 21	25°C	3.3 V		-81		dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$ , $C_L = 50\text{ pF}$ , $f = 20\text{ Hz to }20\text{ kHz}$ , See Figure 23	25°C	3.3 V		0.21		%
<b>Supply</b>								
Positive supply current	$I_+$	$V_I = V_+$ or GND, Switch ON or OFF	25°C	3.6 V		2.5	7	$\mu\text{A}$
			Full				10	

(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<sup>(1)</sup>

$V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T <sub>A</sub>	V <sub>+</sub>	MIN	TYP	MAX	UNIT		
Analog Switch											
Analog signal range	V <sub>COM</sub> , V <sub>NC</sub> , V <sub>NO</sub>					0		V <sub>+</sub>	V		
ON-state resistance	r <sub>on</sub>	0 ≤ (V <sub>NC</sub> or V <sub>NO</sub> ) ≤ V <sub>+</sub> , I <sub>COM</sub> = −24 mA,	Switch ON, See Figure 13	25°C Full	2.3 V	12 22		20	Ω		
ON-state resistance match between channels	Δr <sub>on</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 1.6 V, I <sub>COM</sub> = −24 mA,	Switch ON, See Figure 13	25°C Full	2.3 V	0.3		1 2	Ω		
ON-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ (V <sub>NC</sub> or V <sub>NO</sub> ) ≤ V <sub>+</sub> , I <sub>COM</sub> = −24 mA,	Switch ON, See Figure 13	25°C Full	2.3 V	14		18 20	Ω		
NC, NO OFF leakage current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 0.5 V, V <sub>COM</sub> = 2.2 V, or V <sub>NC</sub> or V <sub>NO</sub> = 2.2 V, V <sub>COM</sub> = 0.5 V,	Switch OFF, See Figure 14	25°C Full	2.7 V	−0.1 −0.2	0.05	0.1 0.2	μA		
		V <sub>NC</sub> or V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0, or V <sub>NC</sub> or V <sub>NO</sub> = 3.6 V to 0, V <sub>COM</sub> = 0 to 3.6 V,	Switch OFF, See Figure 14	25°C Full	0 V	−2 −10	0.05	2 10			
COM OFF leakage current	I <sub>COM(OFF)</sub>	V <sub>COM</sub> = 0.5 V, V <sub>NC</sub> or V <sub>NO</sub> = 2.2 V, or V <sub>COM</sub> = 2.2 V, V <sub>NC</sub> or V <sub>NO</sub> = 0.5 V,	Switch OFF, See Figure 14	25°C Full	2.7 V	−0.1 −0.2	0.05	0.1 0.2	μA		
		V <sub>COM</sub> = 0 to 3.6 V, V <sub>NC</sub> = 3.6 V to 0, or V <sub>COM</sub> = 3.6 V to 0, V <sub>NC</sub> = 0 to 3.6 V,	Switch OFF, See Figure 14	25°C Full	0 V	−2 −10	0.05	2 10			
NC, NO ON leakage current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 0.5 V, V <sub>COM</sub> = Open, or V <sub>NC</sub> or V <sub>NO</sub> = 2.2 V, V <sub>COM</sub> = Open,	Switch ON, See Figure 15	25°C Full	2.7 V	−0.1 −0.2	0.05	0.1 0.2	μA		
COM ON leakage current	I <sub>COM(ON)</sub>	V <sub>COM</sub> = 0.5 V, V <sub>NC</sub> or V <sub>NO</sub> = Open, or V <sub>COM</sub> = 2.2 V, V <sub>NC</sub> or V <sub>NO</sub> = Open,	Switch ON, See Figure 15	25°C Full	2.7 V	−0.1 −0.2	0.05	0.1 0.2	μA		
Digital Control Inputs (IN, EN)(2)											
Input logic high	V <sub>IH</sub>			Full		1.7		V <sub>+</sub>	V		
Input logic low	V <sub>IL</sub>			Full		0		0.7	V		
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0		25°C	2.7 V	−0.1	0.05	0.1	μA		
				Full		−1		1			

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

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

# TS3A5018

## 10-Ω QUAD SPDT ANALOG SWITCH

SCDS189 – JANUARY 2005

### Electrical Characteristics for 2.5-V Supply<sup>(1)</sup> (continued)

$V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>Dynamic</b>								
Turn-on time	$t_{ON}$	$V_{COM} = 1.5 \text{ V}$ , $R_L = 300 \Omega$ , $C_L = 35 \text{ pF}$ , See Figure 17	25°C	2.5 V	2.5	5	9.5	ns
			Full	2.3 V to 2.7 V	2.5		10.5	
Turn-off time	$t_{OFF}$	$V_{COM} = 1.5 \text{ V}$ , $R_L = 300 \Omega$ , $C_L = 35 \text{ pF}$ , See Figure 17	25°C	2.5 V	0.5	3	7.5	ns
			Full	2.3 V to 2.7 V	0.5		9	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ $C_L = 0.1 \text{ nF}$ , See Figure 22	25°C	2.5 V		1		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$ $C_{NO(OFF)}$	$V_{NC}$ or $V_{NO} = V_+$ or GND, Switch OFF, See Figure 16	25°C	2.5 V		3		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_+$ or GND, Switch OFF, See Figure 16	25°C	2.5 V		9		pF
NC, NO ON capacitance	$C_{NC(ON)}$ $C_{NO(ON)}$	$V_{NC}$ or $V_{NO} = V_+$ or GND, Switch ON, See Figure 16	25°C	2.5 V		16		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON, See Figure 16	25°C	2.5 V		16		pF
Digital input capacitance	$C_I$	$V_I = V_+$ or GND, See Figure 16	25°C	2.5 V		3		pF
Bandwidth	BW	$R_L = 50 \Omega$ , Switch ON, See Figure 18	25°C	2.5 V		300		MHz
OFF isolation	$O_{ISO}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$ , Switch OFF, See Figure 19	25°C	2.5 V		-48		dB
Crosstalk	$X_{TALK}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$ , Switch ON, See Figure 20	25°C	2.5 V		-48		dB
Crosstalk Adjacent	$X_{TALK(ADJ)}$	$R_L = 50 \Omega$ , $f = 10 \text{ MHz}$ , Switch ON, See Figure 21	25°C	3.3 V		-81		dB
Total harmonic distortion	THD	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $f = 20 \text{ Hz to } 20 \text{ kHz}$ , See Figure 23	25°C	2.5 V		0.33		%
<b>Supply</b>								
Positive supply current	$I_+$	$V_I = V_+$ or GND, Switch ON or OFF	25°C	2.7 V		2.5	7	$\mu\text{A}$
			Full				10	

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

# TYPICAL PERFORMANCE

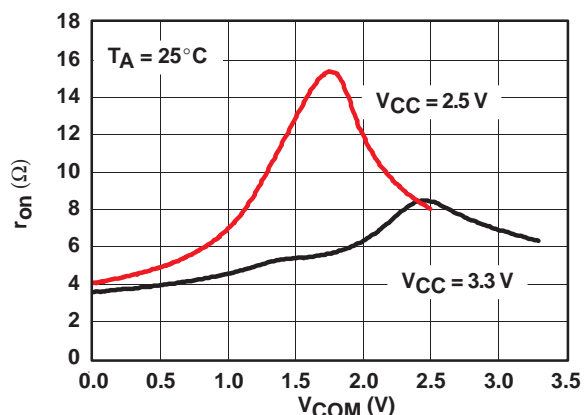


Figure 1.  $r_{on}$  vs  $V_{COM}$

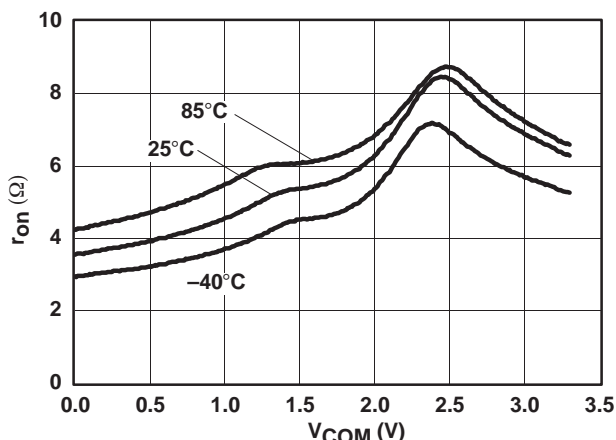


Figure 2.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3.3$  V)

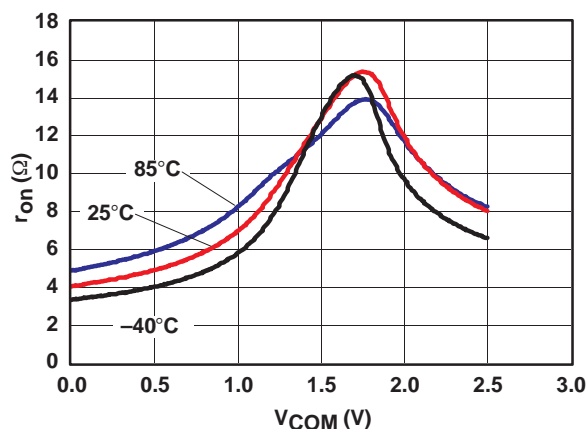


Figure 3.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3.3$  V)

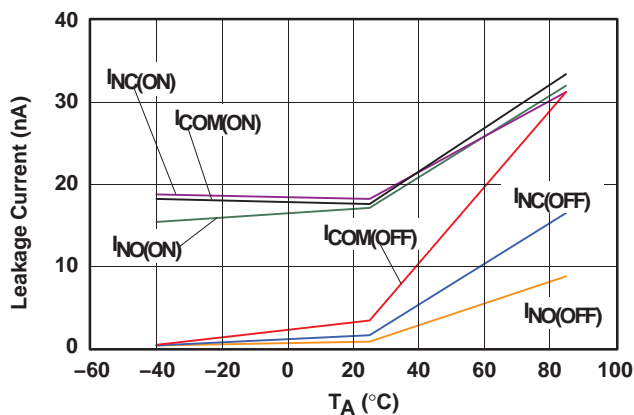


Figure 4. Leakage Current vs Temperature  
( $V_+ = 3.6$  V)

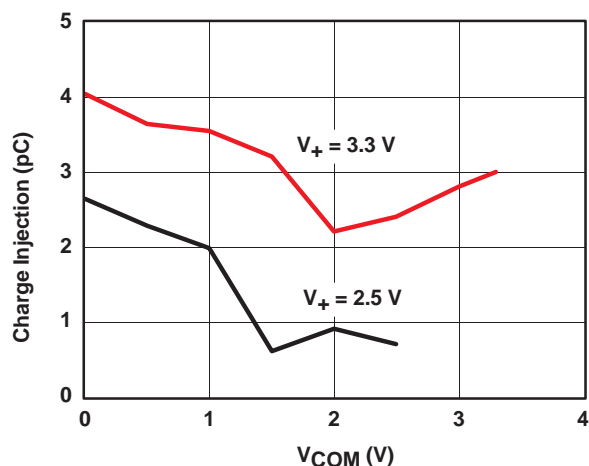


Figure 5. Charge-Injection ( $Q_C$ ) vs  $V_{COM}$

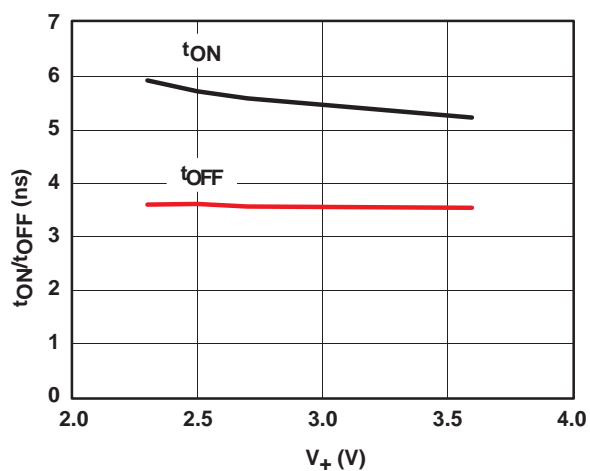


Figure 6.  $t_{ON}$  and  $t_{OFF}$  vs Supply Voltage

# TYPICAL PERFORMANCE

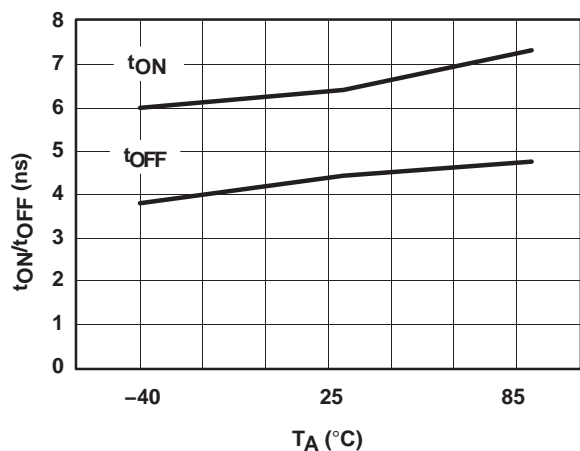


Figure 7.  $t_{ON}$  and  $t_{OFF}$  vs Temperature ( $V_+ = 5$  V)

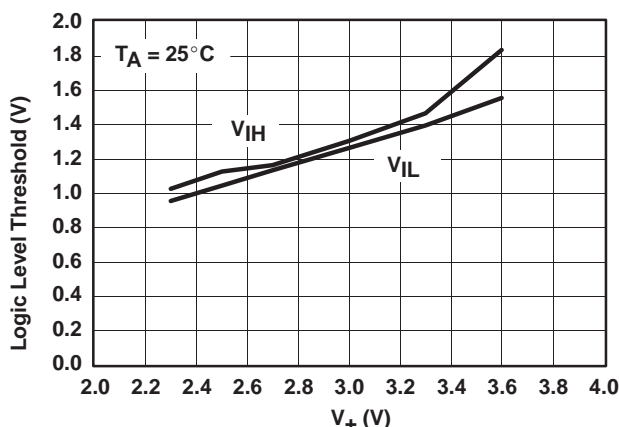


Figure 8. Logic-Level Threshold vs  $V_+$

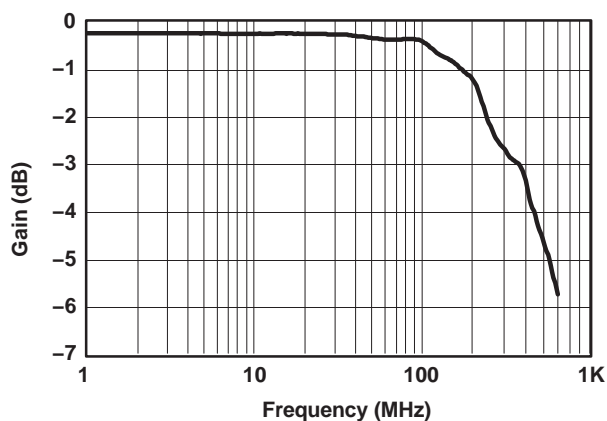


Figure 9. Gain vs Frequency Bandwidth ( $V_+ = 3.3$  V)

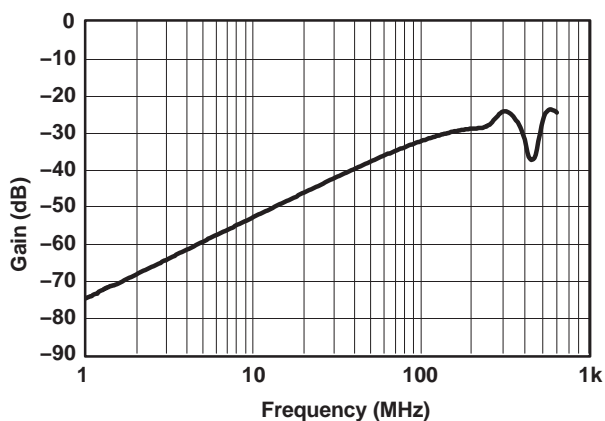


Figure 10. OFF Isolation vs Frequency ( $V_+ = 3.3$  V)

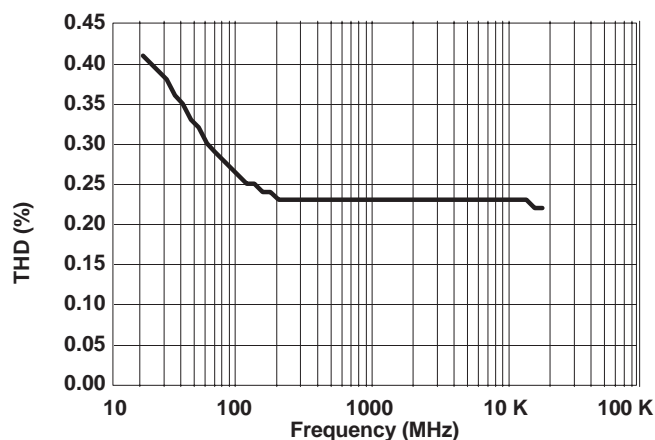


Figure 11. Total Harmonic Distortion vs Frequency

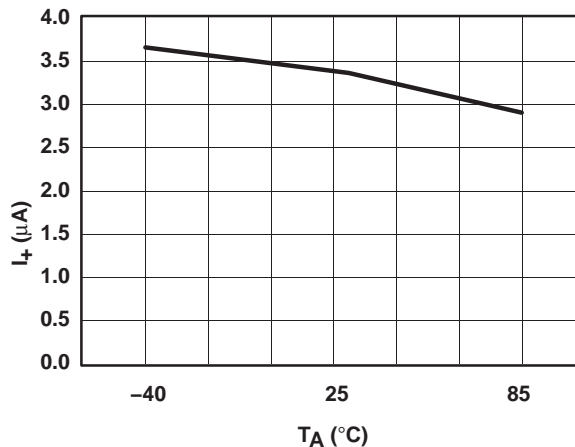


Figure 12. Power-Supply Current vs Temperature ( $V_+ = 3.3$  V)



**PIN DESCRIPTION**

PIN NUMBER	NAME	DESCRIPTION
1	IN	Digital control pin to select between NC and NO
2	NC1	Normally closed
3	NO1	Normally open
4	COM1	Common
5	NC2	Normally closed
6	NO2	Normally open
7	COM2	Common
8	GND	Digital ground
9	COM3	Common
10	NO3	Normally open
11	NC3	Normally closed
12	COM4	Common
13	NO4	Normally open
14	NC4	Normally closed
15	$\overline{\text{EN}}$	Chip Enable (active low)
16	V <sub>+</sub>	Power supply

**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
$\Delta r_{on}$	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 $\Delta V_{COM}$ 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

## PARAMETER MEASUREMENT INFORMATION

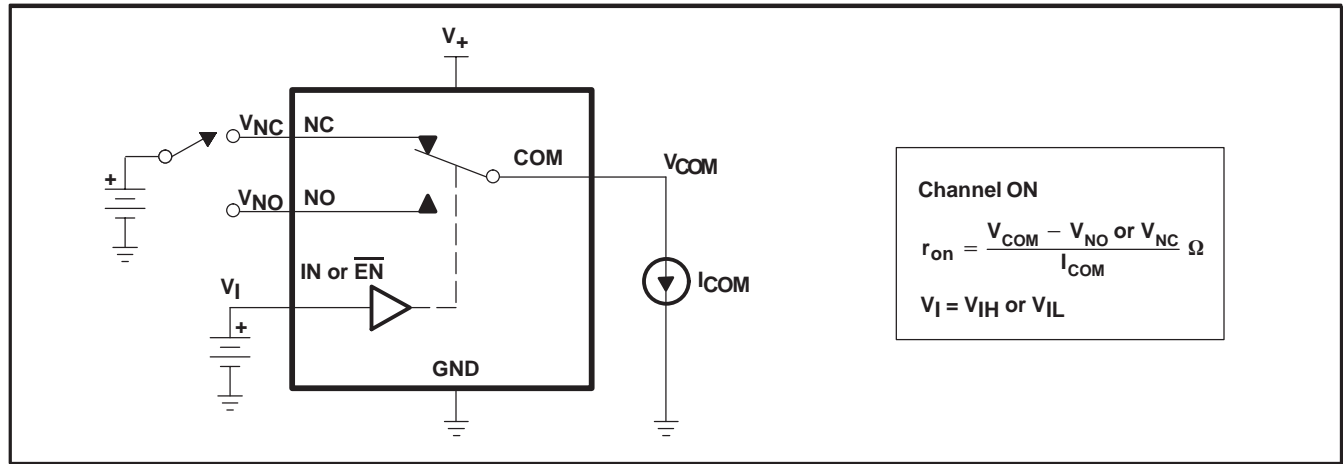


Figure 13. ON-State Resistance ( $r_{on}$ )

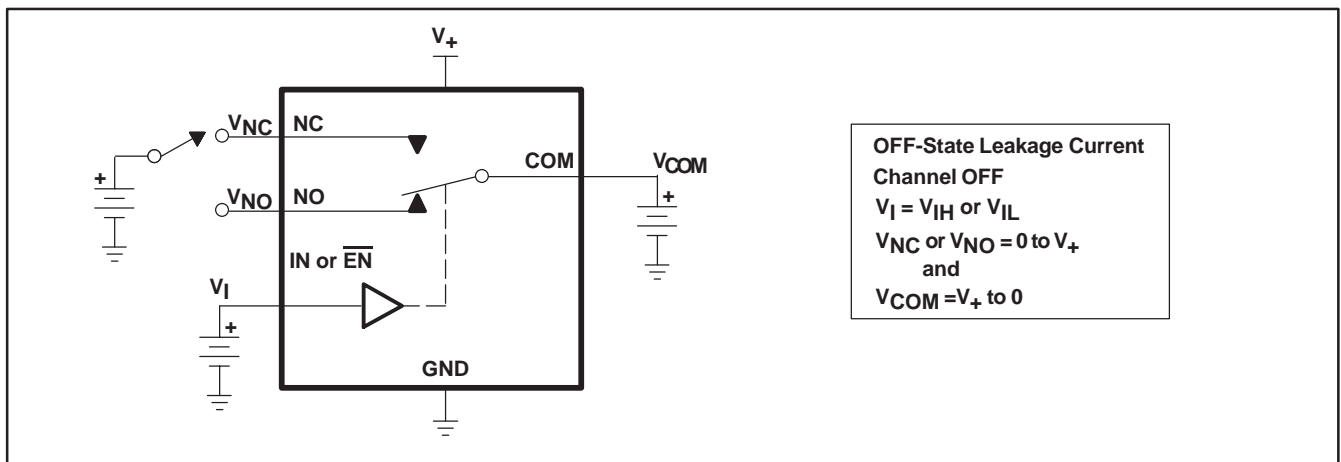


Figure 14. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NC(OFF)}$ ,  $I_{NO(OFF)}$ )

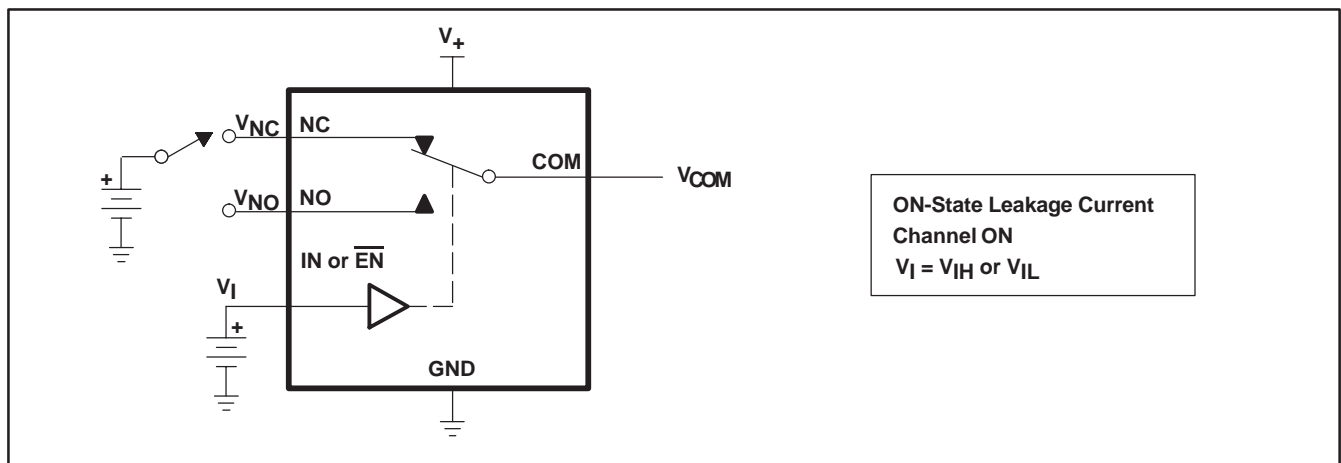
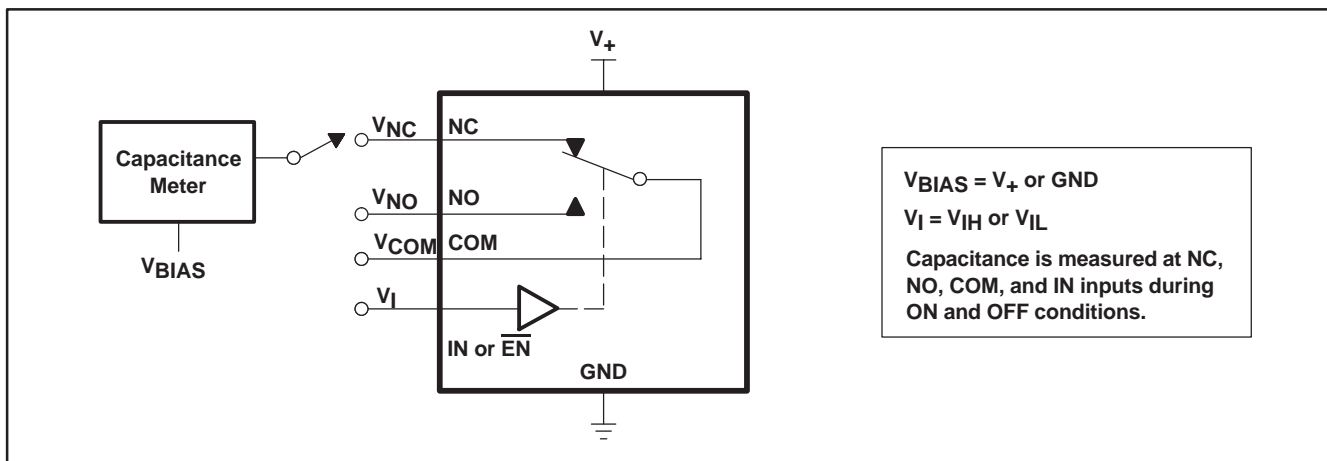
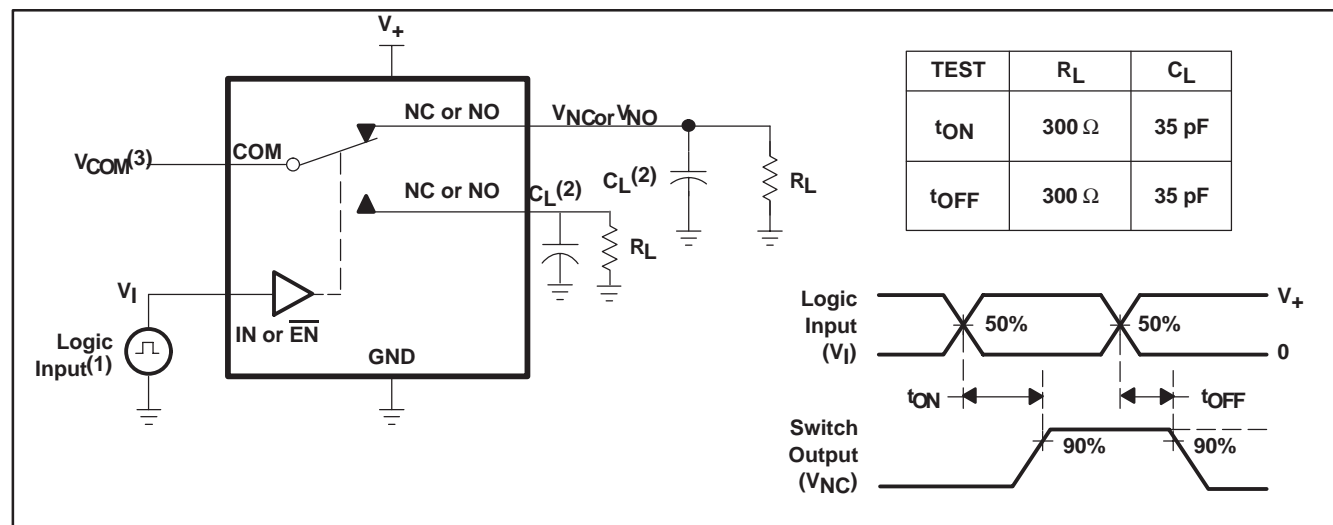


Figure 15. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NC(ON)}$ )

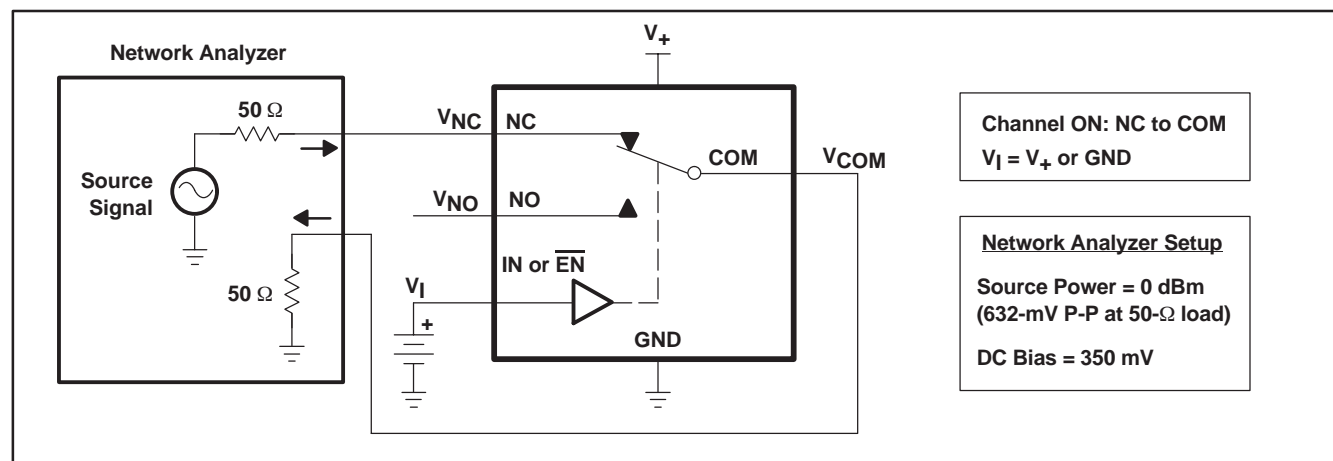


**Figure 16. Capacitance ( $C_I$ ,  $C_{\text{COM(OFF)}}$ ,  $C_{\text{COM(ON)}}$ ,  $C_{\text{NC(OFF)}}$ ,  $C_{\text{NC(ON)}}$ )**



- (1) All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.  
(2)  $C_L$  includes probe and jig capacitance.  
(3) See Electrical Characteristics for  $V_{\text{COM}}$ .

**Figure 17. Turn-On ( $t_{\text{ON}}$ ) and Turn-Off Time ( $t_{\text{OFF}}$ )**



**Figure 18. Bandwidth (BW)**

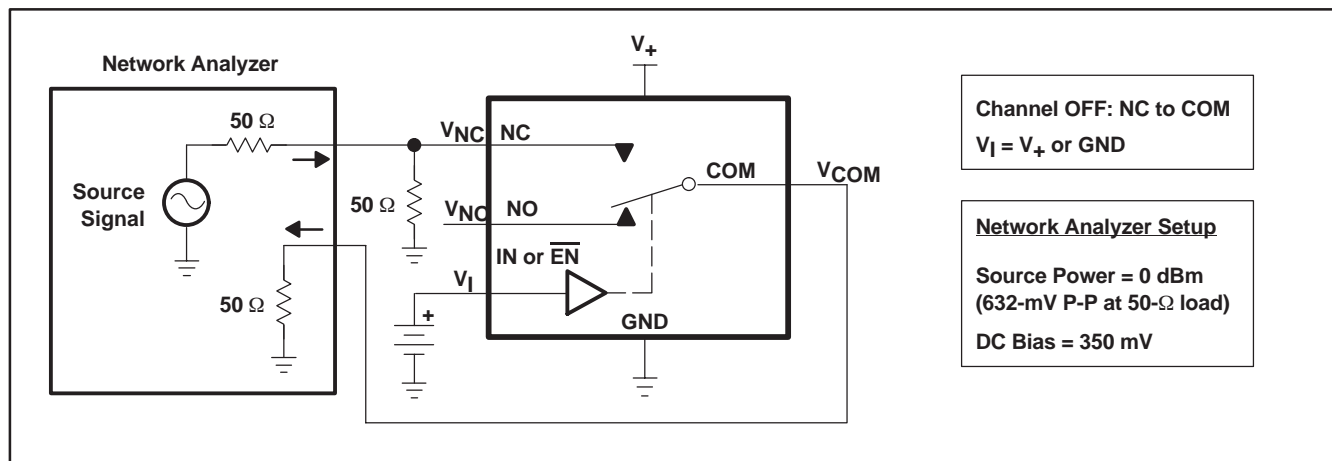


Figure 19. OFF Isolation ( $O_{ISO}$ )

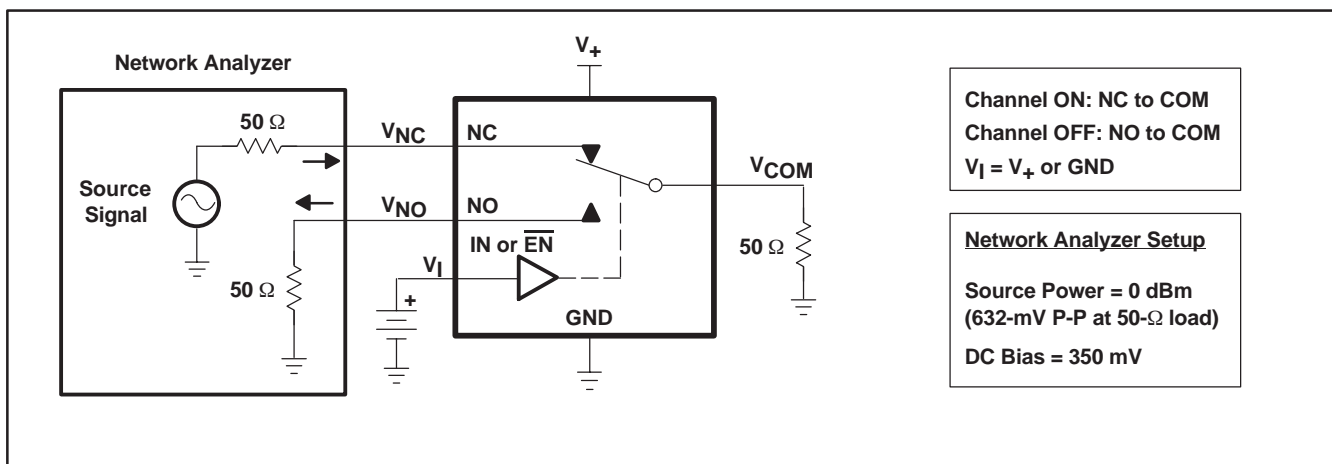


Figure 20. Crosstalk ( $X_{TALK}$ )

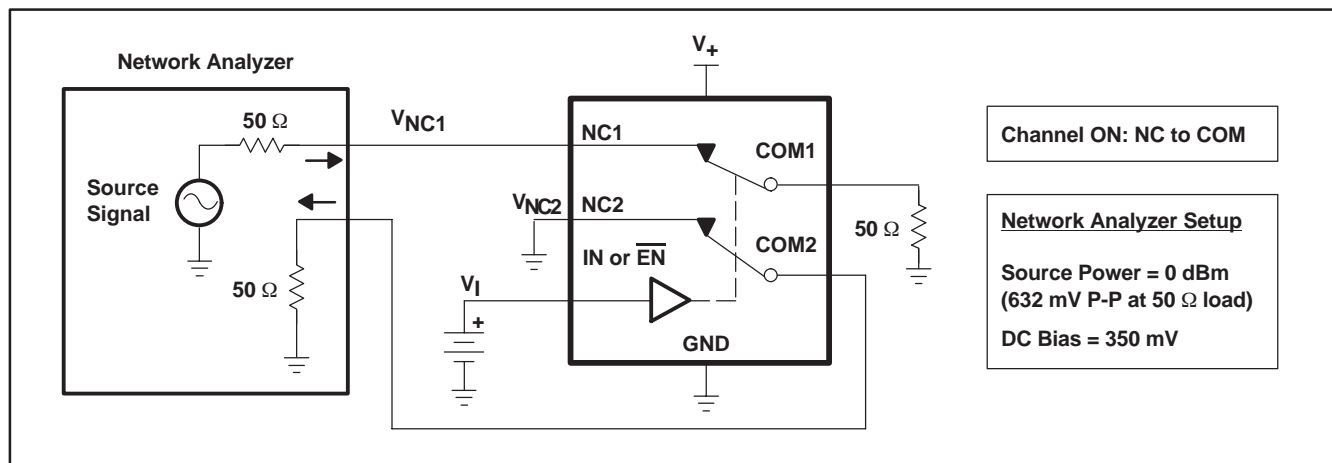
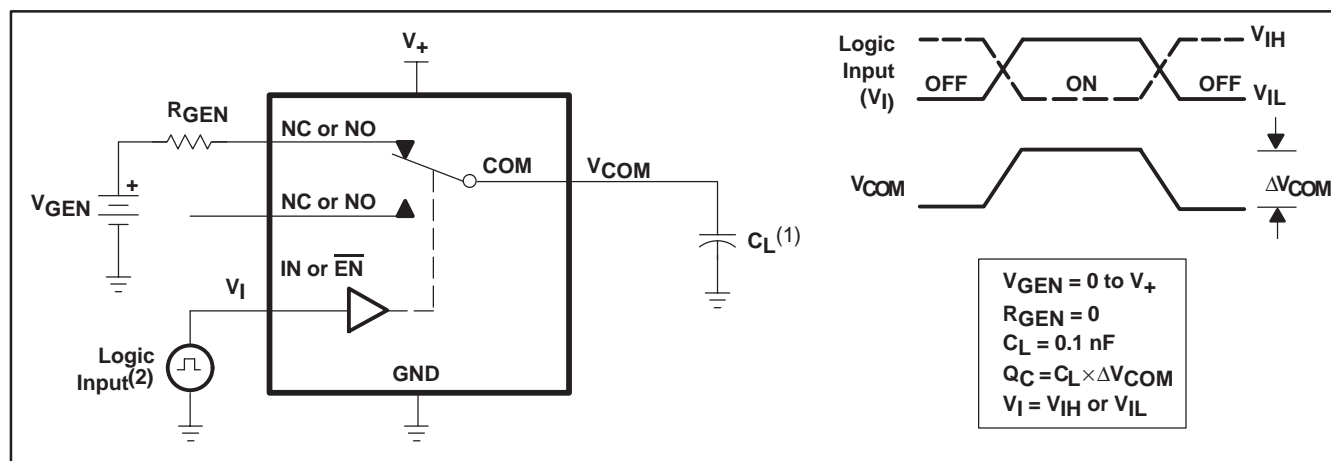


Figure 21. Crosstalk Adjacent

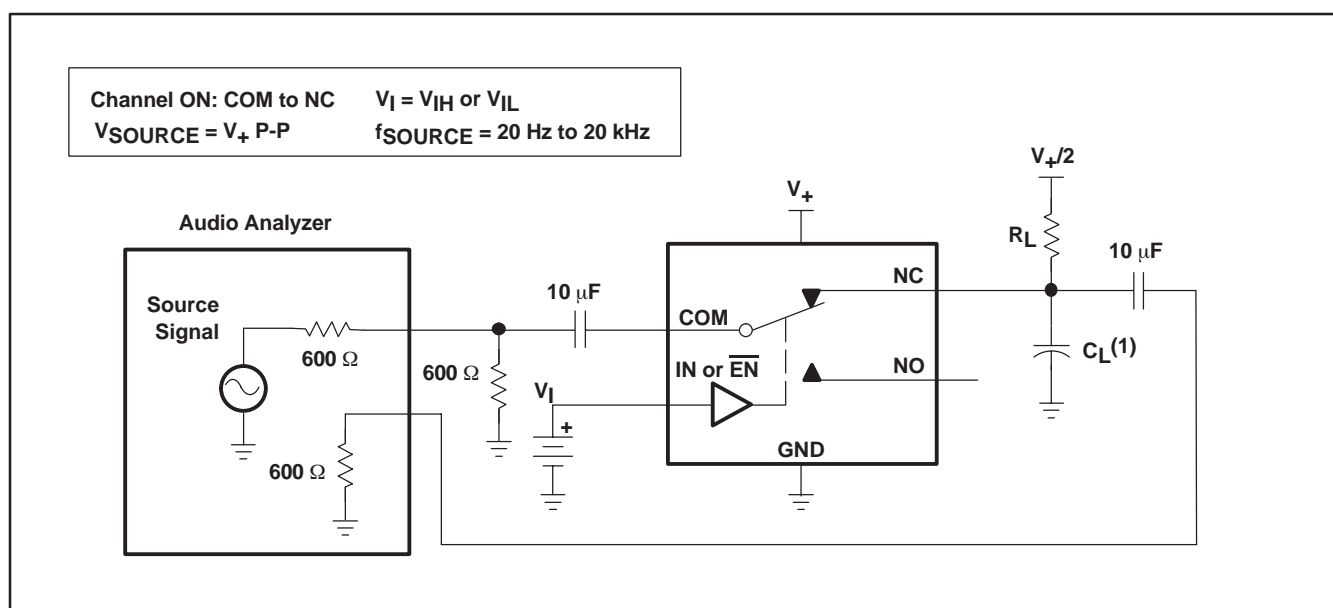
SCDS189 – JANUARY 2005



(1)  $C_L$  includes probe and jig capacitance.

(2) All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.

**Figure 22. Charge Injection ( $Q_C$ )**



(1)  $C_L$  includes probe and jig capacitance.

**Figure 23. Total Harmonic Distortion (THD)**

## PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TS3A5018D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018DBQR	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
TS3A5018DBQRE4	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
TS3A5018DBQRG4	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
TS3A5018DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018DGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS3A5018RGYR	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
TS3A5018RGYRG4	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

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## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

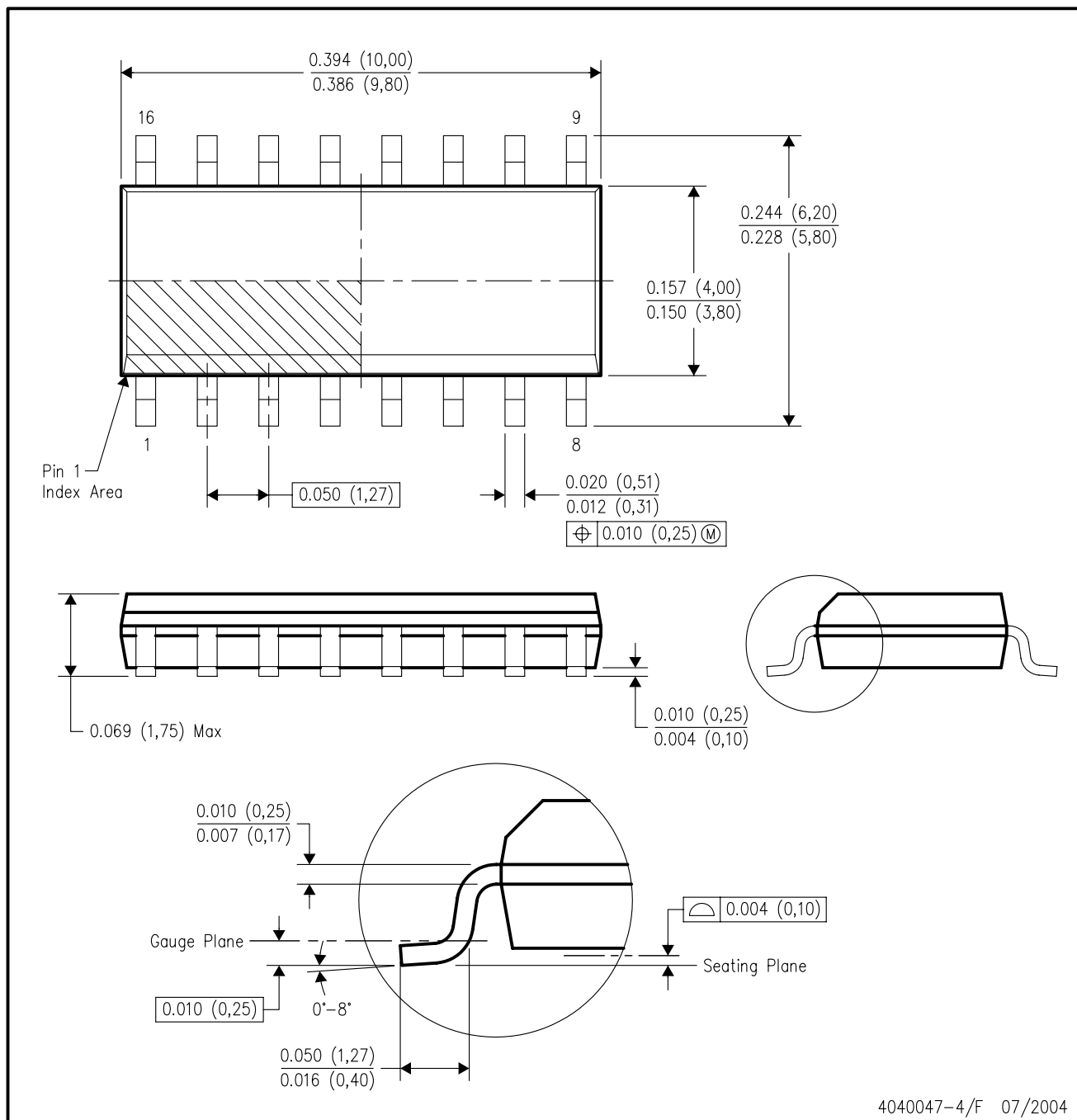
24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

## D (R-PDSO-G16)

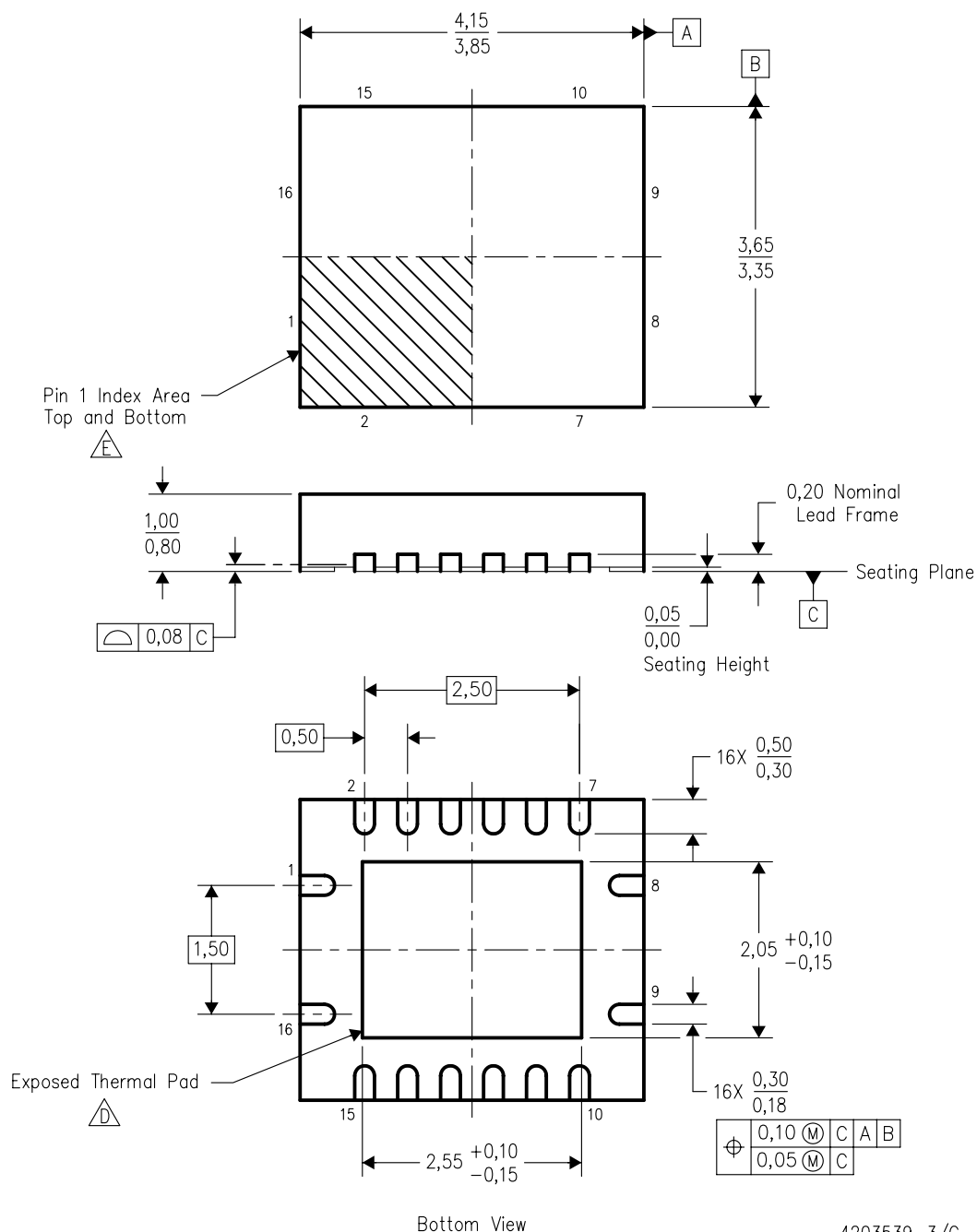
## PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-012 variation AC.

## RGY (R-PQFP-N16)

## PLASTIC QUAD FLATPACK



4203539-3/G 04/2005

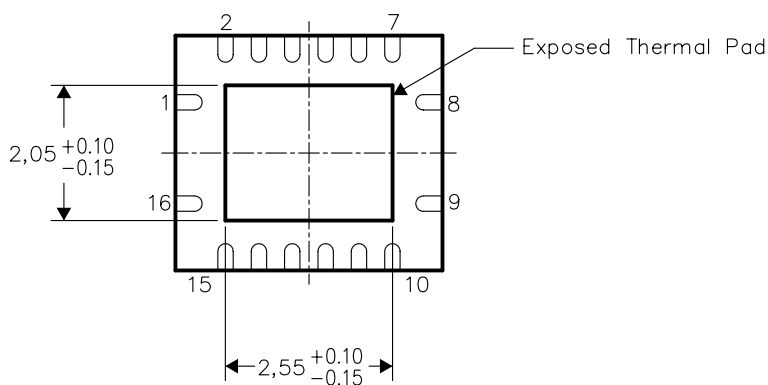
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical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

## THERMAL INFORMATION

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

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at [www.ti.com](http://www.ti.com).

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

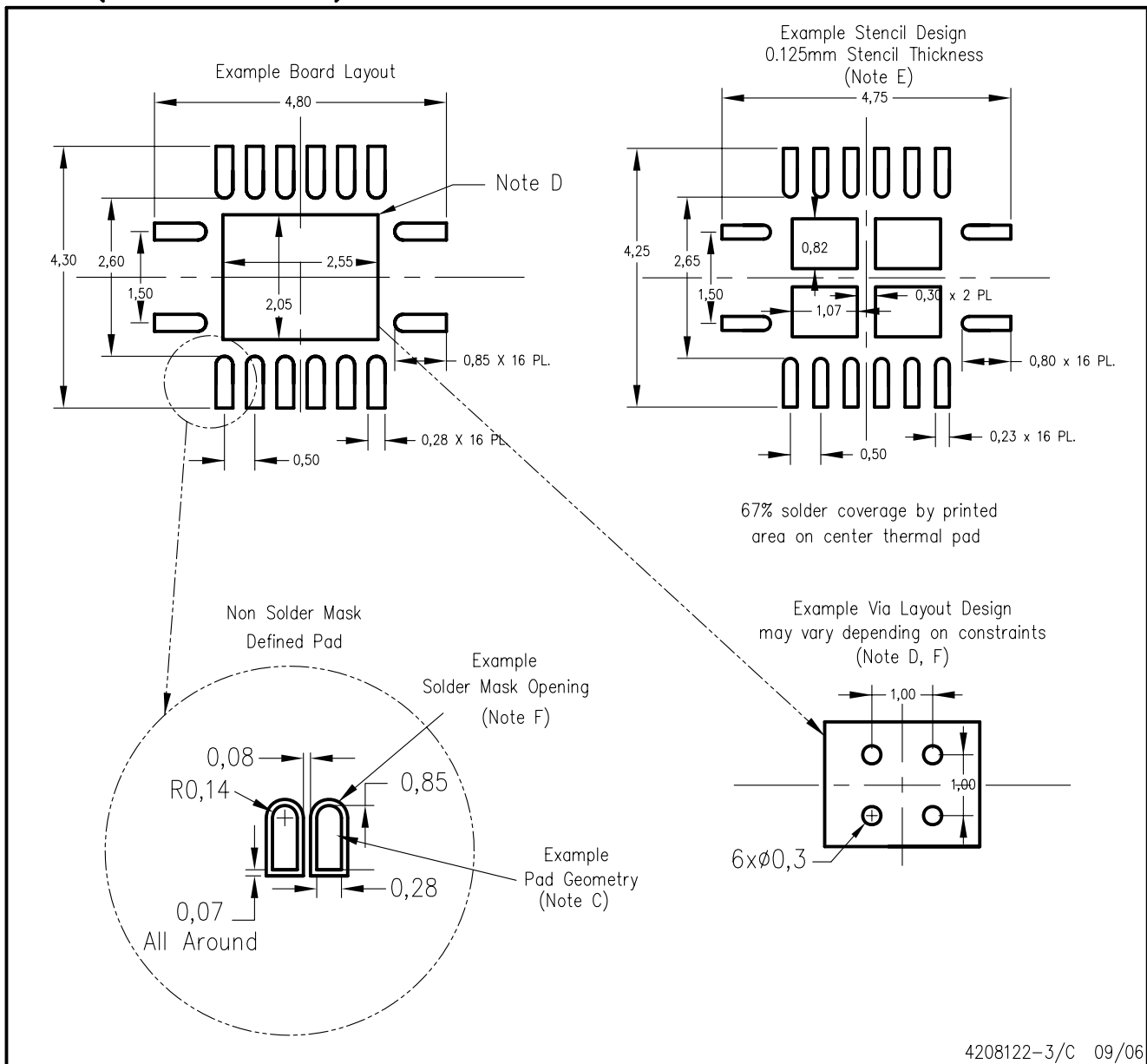


Bottom View

NOTE: All linear dimensions are in millimeters

## Exposed Thermal Pad Dimensions

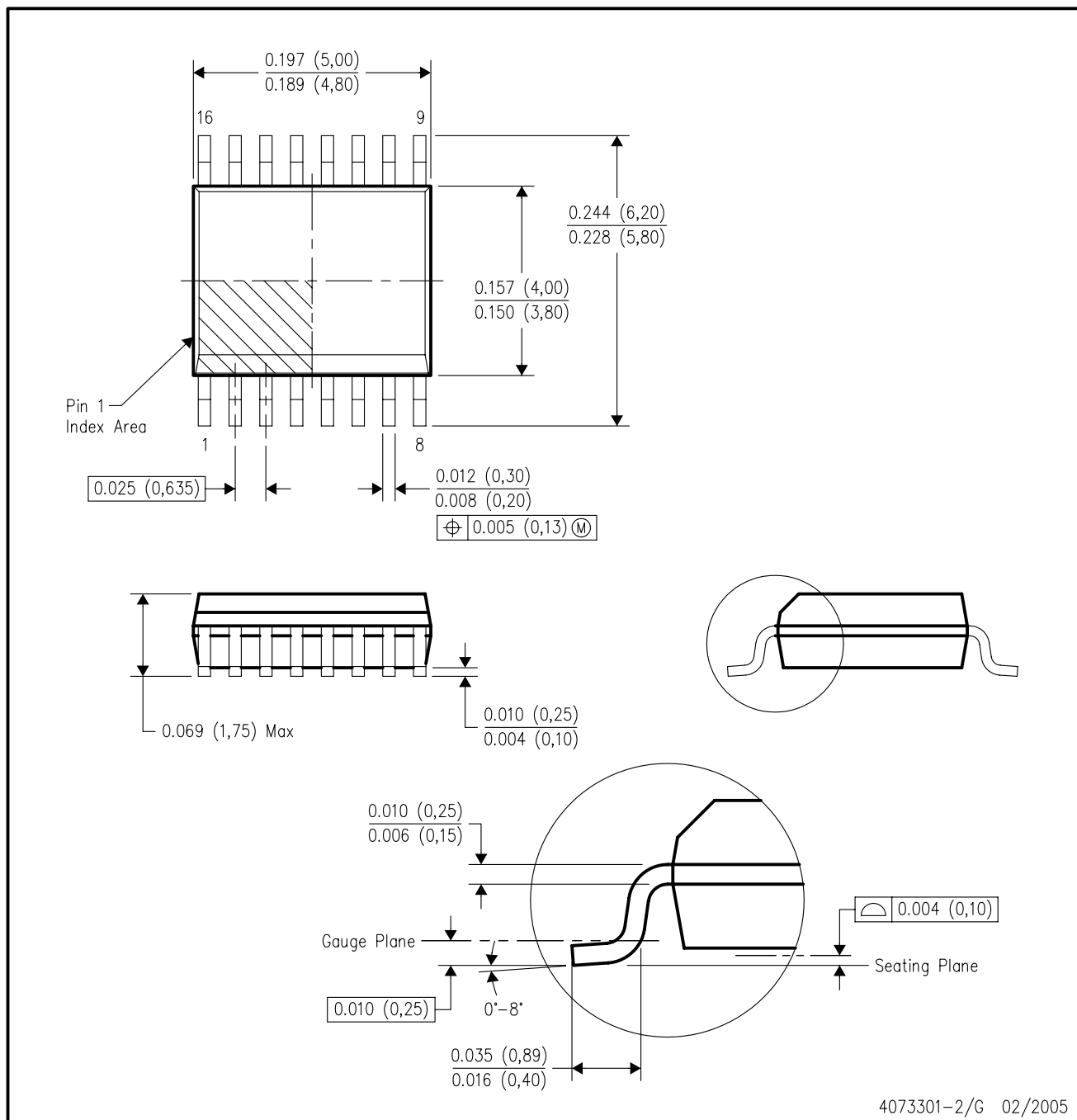
## RGY (R-PQFP-N16)



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SCBA017, SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

## DBQ (R-PDSO-G16)

## PLASTIC SMALL-OUTLINE PACKAGE

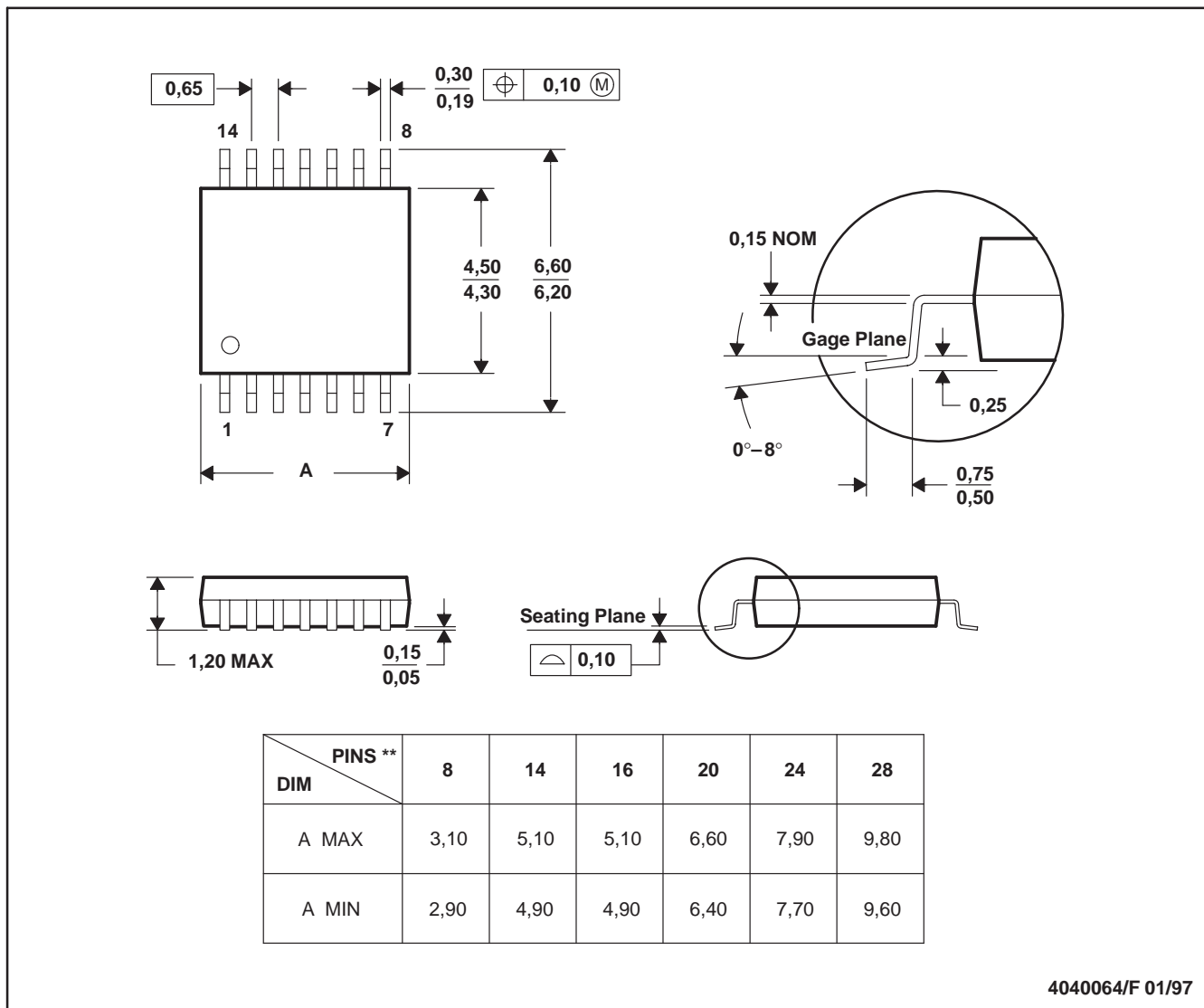


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
  - Falls within JEDEC MO-137 variation AB.

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
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