TS5A3357
SINGLE 5-Ω SP3T ANALOG SWITCH
5-V/3.3-V 3:1 ANALOG MULTIPLEXER/DEMULTIPLEXER

SCDS177 – OCTOBER 2004

DESCRIPTION

The TS5A3357 is a high-performance, single-pole triple throw (SP3T) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance and low input/output capacitance and, thus, causes a very low signal distortion. The break-before-make feature allows transferring of a signal from one port to another, with a minimal signal distortion. This device also offers a low charge injection which makes this device suitable for high-performance audio and data acquisition systems.

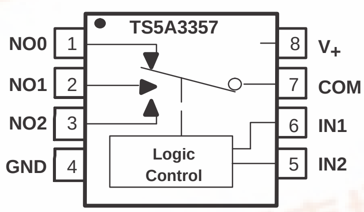
APPLICATIONS

- **Cell Phones**
- **PDAs**
- **Portable Instrumentation**

FEATURES

- **Specified Break-Before-Make Switching**
- **Low ON-State Resistance**
- **High Bandwidth**
- **Control Inputs are 5.5-V Tolerant**
- **Low Charge-Injection**
- **Excellent ON-State Resistance Matching**
- **Low Total Harmonic Distortion**
- **1.65-V to 5.5-V Single-Supply Operation**
- **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)**

SSOP OR VSSOP PACKAGE
(TOP VIEW)



FUNCTION TABLE

IN1	IN2	COM TO NO0	COM TO NO1	COM TO NO2
L	L	OFF	OFF	OFF
H	L	ON	OFF	OFF
L	H	OFF	ON	OFF
H	H	OFF	OFF	ON

SUMMARY OF CHARACTERISTICS

(V_+ = 5 V AND T_A = 25 °C)

Configuration	3:1 Multiplexer/Demultiplexer (1 × SP3T)
Number of Channels	1
r_{on}	5 Ω
Δr_{on}	0.1 Ω
$r_{on(flat)}$	6.5 Ω
t_{ON}/t_{OFF}	6.5 ns/3.7 ns
t_{BBM}	0.5 ns
Charge-Injection	3.4 pC
Bandwidth	334 MHz
Off-Isolation	−82 dB at 10 MHz
Crosstalk	−62 dB at 10 MHz
Total Harmonic Distortion	0.05%
$I_{COM(OFF)}$	±1 μA
Package Option	8 Pin DCT (SM8) or DCU (US8)

ORDERING INFORMATION

T_A	PACKAGE[1]		ORDERABLE PART NUMBER	TOP-SIDE MARKING[2]
−40°C to 85°C	SSOP − DCT	Tape and reel	TS5A3357DCTR	JA9_ _ _
	VSSOP − DCU	Tape and reel	TS5A3357DCUR	JA9_

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) DCT: The actual top-side marking has three additional characters that designate the year, month, and assembly/test site.
DCU: The actual top-side marking has one additional character that designates the assembly/test site.
YEP/YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

Absolute Minimum and 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_{NO} V_{COM}	Analog voltage range[3][4][5]		−0.5	$V_+ + 0.5$	V
I_K	Analog port diode current	V_{NO}, $V_{COM} < 0$ or V_{NO}, $V_{COM} > V_+$	−50	50	mA
I_{NO} I_{COM}	On-state switch current	V_{NO}, V_{COM} = 0 to V_+	−100	100	mA
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
θ_{JA}	Package thermal impedance[6]			165	°C/W
T_{stg}	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) This value is limited to 5.5 V maximum.
(6) The package thermal impedance is calculated in accordance with JESD 51-7.

ELECTRICAL CHARACTERISTICS FOR 5 V SUPPLY

(V_+ = 4.5 V TO 5.5 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
ANALOG SWITCH									
Analog Signal Range	V_{COM}, V_{NO}					0		V_+	V
Peak On-Resistance	r_{peak}	$0 \le V_{NO} \le V_+$, I_{COM} = −30 mA,	Switch ON, see Figure 12	Full	4.5 V			15	Ω
On-Resistance	r_{on}	V_{NO} = 0, I_{COM} = 30 mA	Switch ON, see Figure 12	25 °C	4.5 V		5	7	Ω
				Full				7	
		V_{NO} = 2.4 V, I_{COM} = −30 mA		25 °C			6	12	
				Full				12	
		V_{NO} = 4.5 V, I_{COM} = −30 mA		25 °C			7	15	
				Full				15	
On-Resistance match between channels	Δr_{on}	V_{NO} = 3.15 V, I_{COM} = −30 mA,	Switch ON, see Figure 12	25 °C	4.5 V		0.1		Ω
On-Resistance flatness	$r_{on(flat)}$	$0 \le V_{NO} \le V_+$, I_{COM} = −30 mA	Switch ON, see Figure 12	25 °C	5 V		6.5		Ω
NO Off-Leakage Current	$I_{NO(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	5.5 V	−0.1		0.1	µA
				Full		−1		1	
COM Off-Leakage Current	$I_{COM(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	5.5 V	−0.1		0.1	µA
				Full		−1		1	
NO On-Leakage Current	$I_{NO(ON)}$	V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, see Figure 13	25 °C	5.5 V	−0.1		0.1	µA
				Full		−1		1	
COM On-Leakage Current	$I_{COM(ON)}$	V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, see Figure 13	25 °C	5.5 V	−0.1		0.1	µA
				Full		−1		1	
DIGITAL INPUTS (IN1, IN2)(2)									
Input Logic High	V_{IH}			Full		$0.7 \times V_+$		5.5	V
Input Logic Low	V_{IL}			Full		0		$0.3 \times V_+$	V
Input Leakage Current	I_{IH}, I_{IL}	V_{IN} = 5.5 V or 0		25 °C	5.5 V			0.1	µA
				Full				1	

(1) All typical values are at V_+ = 5 V, T_A = 25°C.

(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.

Electrical Characteristics for 5 V Supply (continued)

(V_+ = 4.5 V TO 5.5 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
DYNAMIC									
Turn-On Time	t_{ON}	$V_{NO} = V_+$ or GND, R_L = 500 Ω,	C_L = 35 pF, see Figure 15	25 °C	4.5 V to 5.5 V	1.5		6.5	ns
				Full		1.5		7	
Turn-Off Time	t_{OFF}	$V_{NO} = V_+$ or GND, R_L = 500 Ω,	C_L = 35 pF, see Figure 15	25 °C	4.5 V to 5.5 V	0.8		3.7	ns
				Full		0.8		7	
Break-Before-Make Time	t_{BBM}	$V_{NO} = V_+$, R_L = 500 Ω,	C_L = 35 pF, see Figure 16	25 °C	4.5 V to 5.5 V	0.5			ns
				Full		0.5			
Charge Injection	Q_C	C_L = 0.1 nF, V_{GEN} = 0 V,	see Figure 20	25 °C	5 V		3.4		pC
NO Off-Capacitance	$C_{NO(OFF)}$	$V_{NO} = V_+$ or GND, Switch OFF,	see Figure 14	25 °C	5 V		4.5		pF
COM Off-Capacitance	$C_{COM(OFF)}$	$V_{NO} = V_+$ or GND, Switch OFF,	see Figure 14	25 °C	5 V		10.5		pF
NO On-Capacitance	$C_{NO(ON)}$	$V_{NO} = V_+$ or GND, Switch ON,	see Figure 14	25 °C	5 V		17		pF
COM On-Capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	see Figure 14	25 °C	5 V		17		pF
Digital Input Capacitance	C_{IN}	$V_{IN} = V_+$ or GND,	see Figure 14	25 °C	5 V		3		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	see Figure 17	25 °C	4.5 V to 5.5 V		334		MHz
Off-Isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, see Figure 18	25 °C	4.5 V to 5.5 V		−82		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, see Figure 19	25 °C	4.5 V to 5.5 V		−62		dB
Total Harmonic Distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, see Figure 21	25 °C	5 V		0.05		%
SUPPLY									
Positive Supply Current	I_+	$V_{IN} = V_+$ or GND,	Switch ON or OFF	25 °C	5.5 V			1	µA
				Full				10	

(1) All typical values are at V_+ = 5 V, T_A = 25°C.

Electrical Characteristics for 3.3 V Supply

(V_+ = 3 V TO 3.6 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP[1]	MAX	UNIT
ANALOG SWITCH									
Analog Signal Range	V_{COM}, V_{NO}					0		V_+	V
Peak On-Resistance	r_{peak}	$0 \le V_{NO} \le V_+$, I_{COM} = −24 mA,	Switch ON, see Figure 12	Full	3 V			25	Ω
On-Resistance	r_{on}	V_{NO} = 0 V, I_{COM} = 24 mA	Switch ON, see Figure 12	25 °C	3 V		6.5	9	Ω
				Full				9	
		V_{NO} = 3 V, I_{COM} = −24 mA		25 °C			9	20	
				Full				20	
On-Resistance match between channels	Δr_{on}	V_{NO} = 2.1 V, I_{COM} = −24 mA,	Switch ON, see Figure 12	25 °C	3 V		0.1		Ω
On-Resistance flatness	$r_{on(flat)}$	$0 \le V_{NO} \le V_+$, I_{COM} = −24 mA,	Switch ON, see Figure 12	25 °C	3.3 V		13.5		Ω
NO Off-Leakage Current	$I_{NO(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	3.6 V	−0.1		0.1	μA
				Full		−1		1	
COM Off-Leakage Current	$I_{COM(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	3.6 V	−0.1		0.1	μA
				Full		−1		1	
NO On-Leakage Current	$I_{NO(ON)}$	V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, see Figure 13	25 °C	3.6 V	−0.1		0.1	μA
				Full		−1		1	
COM On-Leakage Current	$I_{COM(ON)}$	V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, see Figure 13	25 °C	3.6 V	−0.1		0.1	μA
				Full		−1		1	
DIGITAL INPUTS (IN1, IN2)[2]									
Input Logic High	V_{IH}			Full		$0.7 \times V_+$		5.5	V
Input Logic Low	V_{IL}			Full		0		$0.3 \times V_+$	V
Input Leakage Current	I_{IH}, I_{IL}	V_{IN} = 5.5 V or 0		25 °C	3.6 V	−1		0.1	μA
				Full				1	

(1) All typical values are at V_+ = 3.3 V, T_A = 25°C.
(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.

Electrical Characteristics for 3.3 V Supply (continued)

(V_+ = 3 V TO 3.6 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP[1]	MAX	UNIT
DYNAMIC									
Turn-On Time	t_{ON}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	3 V to 3.6 V	2		9.5	ns
				Full		2		11	
Turn-Off Time	t_{OFF}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	3 V to 3.6 V	1.3		5.1	ns
				Full		1.5		5.5	
Break-Before-Make Time	t_{BBM}	V_{NO} = V_+, R_L = 500 Ω,	C_L = 35 pF, see Figure 16	25 °C	3 V to 3.6 V	0.5			ns
				Full		0.5			
Charge Injection	Q_C	C_L = 0.1 nF, V_{GEN} = 0 V,	see Figure 20	25 °C	3.3 V		1.75		pC
NO Off-Capacitance	$C_{NO(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	3.3 V		4.5		pF
COM Off-Capacitance	$C_{COM(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	3.3 V		10.5		pF
NO On-Capacitance	$C_{NO(ON)}$	V_{NO} = V_+ or GND, Switch ON,	see Figure 14	25 °C	3.3V		17		pF
COM On-Capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	see Figure 14	25 °C	3.3 V		17		pF
Digital Input Capacitance	C_{IN}	V_{IN} = V_+ or GND,	see Figure 14	25 °C	3.3 V		3		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	see Figure 17	25 °C	3 V to 3.6 V		327		MHz
Off-Isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, see Figure 18	25 °C	3 V to 3.6 V		−82		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, see Figure 19	25 °C	3 V to 3.6 V		−62		dB
SUPPLY									
Positive Supply Current	I_+	V_{IN} = V_+ or GND,	Switch ON or OFF	25 °C	3.6 V			1	µA
				Full				10	

(1) All typical values are at V_+ = 3.3 V, T_A = 25°C.

Electrical Characteristics for 2.5 V Supply

(V_+ = 2.3 V TO 2.7 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP[1]	MAX	UNIT
ANALOG SWITCH									
Analog Signal Range	V_{COM}, V_{NO}					0		V_+	V
Peak On-Resistance	r_{peak}	$0 \le V_{NO} \le V_+$, I_{COM} = −8 mA,	Switch ON, see Figure 12	Full	2.3 V			50	Ω
On-Resistance	r_{on}	V_{NO} = 0 V, I_{COM} = 8 mA	Switch ON, see Figure 12	25 °C	2.3 V		8	12	Ω
				Full				12	
		V_{NO} = 2.3 V, I_{COM} = −8 mA		25 °C			11	30	
				Full				30	
On-Resistance match between channels	Δr_{on}	V_{NO} = 1.6 V, I_{COM} = −8 mA,	Switch ON, see Figure 12	25 °C	2.3 V		0.3		Ω
On-Resistance flatness	$r_{on(flat)}$	$0 \le V_{NO} \le V_+$, I_{COM} = −8 mA,	Switch ON, see Figure 12	25 °C	2.5 V		39		Ω
NO Off-Leakage Current	$I_{NO(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	2.7 V	−0.1		0.1	µA
				Full		−1		1	
COM Off-Leakage Current	$I_{COM(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	2.7 V	−0.1		0.1	µA
				Full		−1		1	
NO On-Leakage Current	$I_{NO(ON)}$	V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, see Figure 13	25 °C	2.7 V	−0.1		0.1	µA
				Full		−1		1	
COM On-Leakage Current	$I_{COM(ON)}$	V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, see Figure 13	25 °C	2.7 V	−0.1		0.1	µA
				Full		−1		1	
DIGITAL INPUTS (IN1, IN2)[2]									
Input Logic High	V_{IH}			Full		$0.75 \times V_+$		5.5	V
Input Logic Low	V_{IL}			Full		0		$0.25 \times V_+$	V
Input Leakage Current	I_{IH}, I_{IL}	V_{IN} = 5.5 V or 0		25 °C	2.3 V			0.1	µA
				Full				1	

(1) All typical values are at V_+ = 2.5 V, T_A = 25°C.
(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.

Electrical Characteristics for 2.5 V Supply (continued)

(V_+ = 2.3 V TO 2.7 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP[1]	MAX	UNIT
DYNAMIC									
Turn-On Time	t_{ON}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	2.3 V to 2.7 V	3		15	ns
				Full		3		16.5	
Turn-Off Time	t_{OFF}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	2.3 V to 2.7 V	2		7.2	ns
				Full		2		7.8	
Break-Before-Make Time	t_{BBM}	V_{NO} = V_+, R_L = 500 Ω,	C_L = 35 pF, see Figure 16	25 °C	2.3 V to 2.7 V	0.5			ns
				Full		0.5			
Charge Injection	Q_C	C_L = 0.1 nF, V_{GEN} = 0 V,	see Figure 20	25 °C	2.5 V		1.15		pC
NO Off-Capacitance	$C_{NO(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	2.5 V		4.5		pF
COM Off-Capacitance	$C_{COM(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	2.5 V		10.5		pF
NO On-Capacitance	$C_{NO(ON)}$	V_{NO} = V_+ or GND, Switch ON,	see Figure 14	25 °C	2.5V		17		pF
COM On-Capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	see Figure 14	25 °C	2.5 V		17		pF
Digital Input Capacitance	C_{IN}	V_{IN} = V_+ or GND,	see Figure 14	25 °C	2.5 V		3		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	see Figure 17	25 °C	2.3 V to 2.7 V		320		MHz
Off-Isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, see Figure 18	25 °C	2.3 V to 2.7 V		−81		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, see Figure 19	25 °C	2.3 V to 2.7 V		−61		dB
SUPPLY									
Positive Supply Current	I_+	V_{IN} = V_+ or GND,	Switch ON or OFF	25 °C	2.7 V			1	µA
				Full				10	

(1) All typical values are at V_+ = 2.5 V, T_A = 25°C.

Electrical Characteristics for 1.8 V Supply

(V_+ = 1.65 V TO 1.95 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP(1)	MAX	UNIT
ANALOG SWITCH									
Analog Signal Range	V_{COM}, V_{NO}					0		V_+	V
Peak On-Resistance	r_{peak}	$0 \le V_{NO} \le V_+$, I_{COM} = −4 mA,	Switch ON, see Figure 12	Full	1.65 V			150	Ω
On-Resistance	r_{on}	V_{NO} = 0 V, I_{COM} = 4 mA	Switch ON, see Figure 12	25 °C	1.65 V		10	20	Ω
				Full				20	
		V_{NO} = 1.8 V, I_{COM} = −4 mA		25 °C			17	50	
				Full				50	
On-Resistance match between channels	Δr_{on}	V_{NO} = 1.15 V, I_{COM} = −4 mA,	Switch ON, see Figure 12	25 °C	1.65 V		0.3		Ω
On-Resistance flatness	$r_{on(flat)}$	$0 \le V_{NO} \le V_+$, I_{COM} = −4 mA,	Switch ON, see Figure 12	25 °C	1.8 V		140		Ω
NO Off-Leakage Current	$I_{NO(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	1.95 V	−0.1		0.1	µA
				Full		−1		1	
COM Off-Leakage Current	$I_{COM(OFF)}$	V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, see Figure 13	25 °C	1.95 V	−0.1		0.1	µA
				Full		−1		1	
NO On-Leakage Current	$I_{NO(ON)}$	V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, see Figure 13	25 °C	1.95 V	−0.1		0.1	µA
				Full		−1		1	
COM On-Leakage Current	$I_{COM(ON)}$	V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, see Figure 13	25 °C	1.95 V	−0.1		0.1	µA
				Full		−1		1	
DIGITAL INPUTS (IN1, IN2)(2)									
Input Logic High	V_{IH}			Full		$0.75 \times V_+$		5.5	V
Input Logic Low	V_{IL}			Full		0		$0.25 \times V_+$	V
Input Leakage Current	I_{IH}, I_{IL}	V_{IN} = 5.5 V or 0		25 °C	1.95 V			0.1	µA
				Full				1	

(1) All typical values are at V_+ = 1.8 V, T_A = 25°C.

(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.

Electrical Characteristics for 1.8 V Supply (continued)

(V_+ = 1.65 V TO 1.95 V AND T_A = −40 °C TO 85 °C) (UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP[(1)]	MAX	UNIT
DYNAMIC									
Turn-On Time	t_{ON}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	1.65 V to 1.95 V	5		32	ns
				Full		5		34	
Turn-Off Time	t_{OFF}	V_{NO} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, see Figure 15	25 °C	1.65 V to 1.95 V	3		14	ns
				Full		3		14.5	
Break-Before-Make Time	t_{BBM}	V_{NO} = V_+, R_L = 500 Ω,	C_L = 35 pF, see Figure 16	25 °C	1.65 V to 1.95 V	0.5			ns
				Full		0.5			
Charge Injection	Q_C	C_L = 0.1 nF, V_{GEN} = 0 V,	see Figure 20	25 °C	1.8 V		0.3		pC
NO Off-Capacitance	$C_{NO(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	1.8 V		4.5		pF
COM Off-Capacitance	$C_{COM(OFF)}$	V_{NO} = V_+ or GND, Switch OFF,	see Figure 14	25 °C	1.8 V		10.5		pF
NO On-Capacitance	$C_{NO(ON)}$	V_{NO} = V_+ or GND, Switch ON,	see Figure 14	25 °C	1.8V		17		pF
COM On-Capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	see Figure 14	25 °C	1.8 V		17		pF
Digital Input Capacitance	C_{IN}	V_{IN} = V_+ or GND,	see Figure 14	25 °C	1.8 V		3		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	see Figure 17	25 °C	1.65 V to 1.95 V		341		MHz
Off-Isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, see Figure 18	25 °C	1.65 V to 1.95 V		−81		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, see Figure 19	25 °C	1.65 V to 1.95 V		−61		dB
SUPPLY									
Positive Supply Current	I_+	V_{IN} = V_+ or GND,	Switch ON or OFF	25 °C	1.95 V			1	µA
				Full				10	

(1) All typical values are at V_+ = 1.8 V, T_A = 25°C.

TYPICAL PERFORMANCE

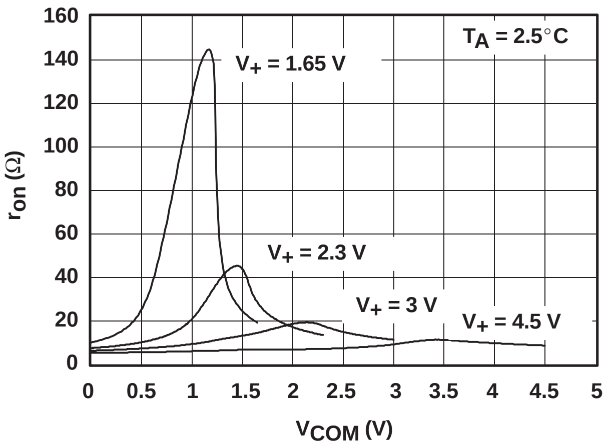


Figure 1. r_{on} vs V_{COM}

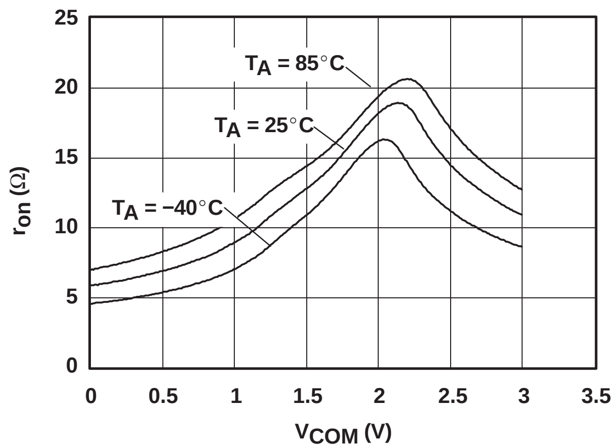


Figure 2. r_{on} vs V_{COM} (V_+ = 3 V)

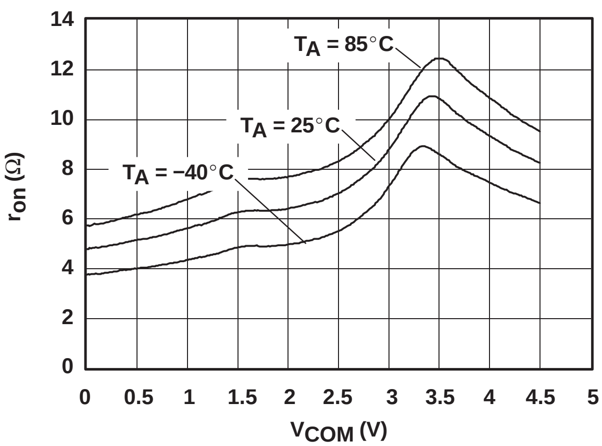


Figure 3. r_{on} vs V_{COM} (V_+ = 4.5 V)

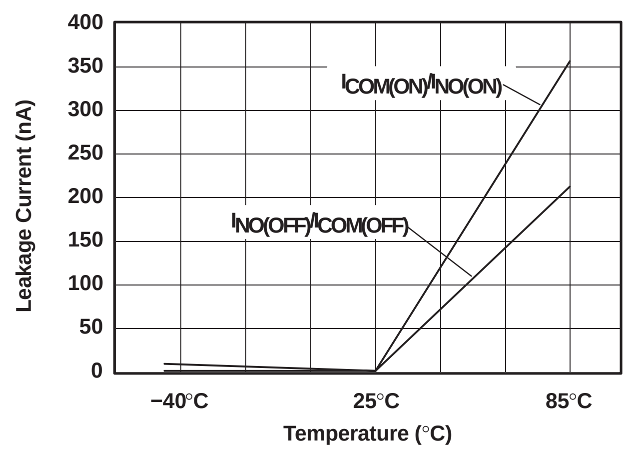


Figure 4. Leakage Current vs Temperature (V_+ = 5 V)

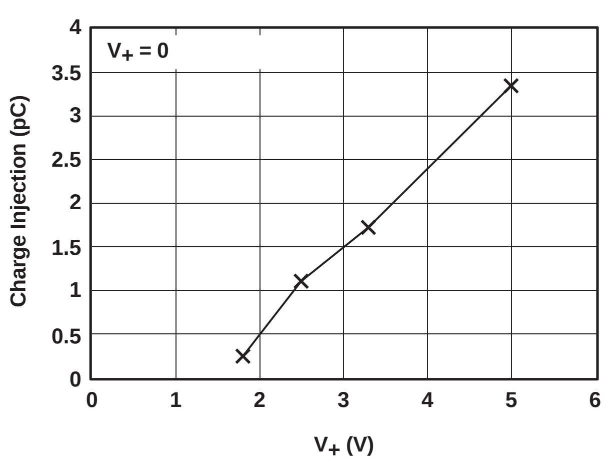


Figure 5. Charge Injection Current vs V_+

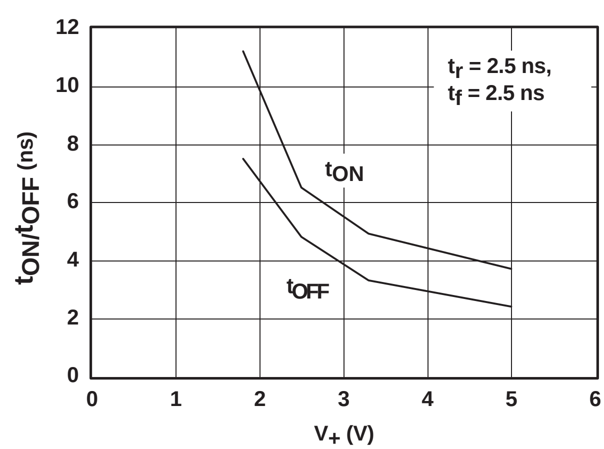


Figure 6. t_{ON} and t_{OFF} vs V_+

TYPICAL PERFORMANCE (continued)

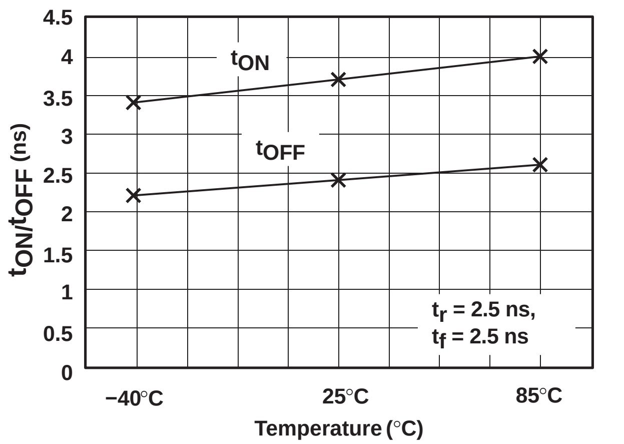


Figure 7. t_{ON} and t_{OFF} vs Temperature ($V_+ = 5$ V)

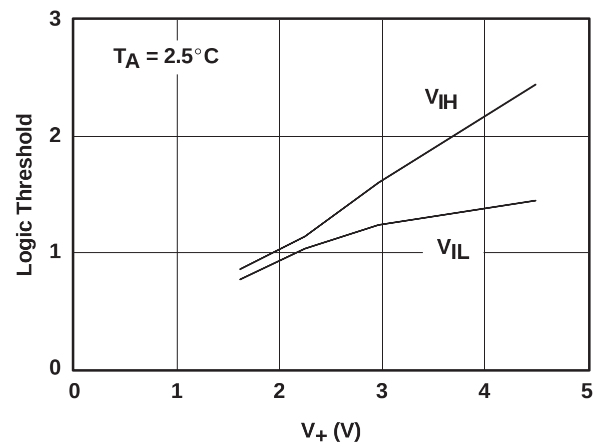


Figure 8. Logic Threshold vs V_+

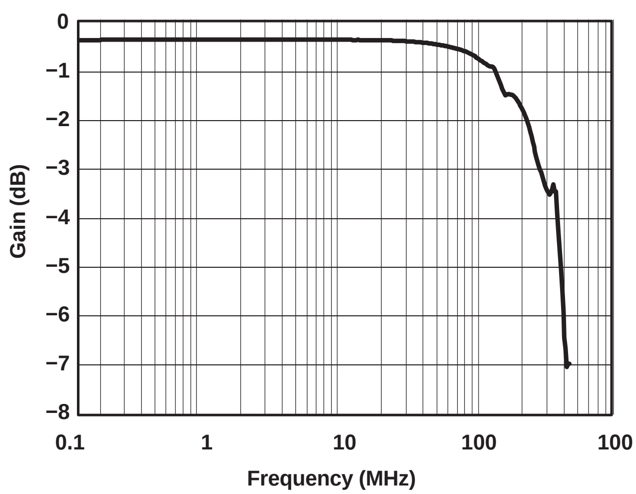


Figure 9. Frequency Response ($V_+ = 3$ V)

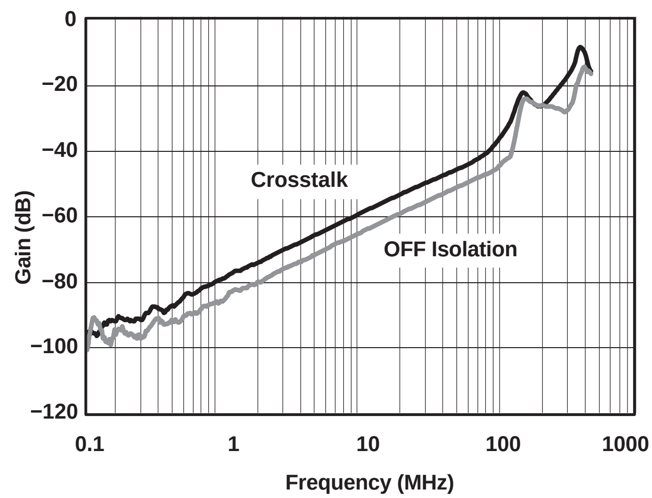


Figure 10. OFF Isolation and Crosstalk vs Frequency ($V_+ = 3$ V)

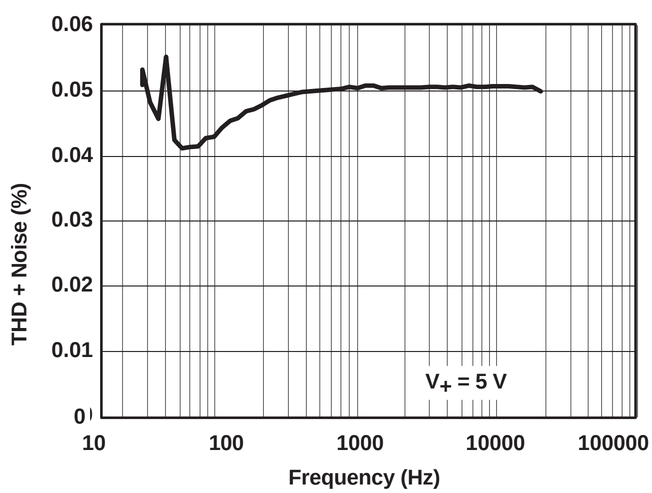


Figure 11. Total Harmonic Distortion vs Frequency ($V_+ = 5$ V)

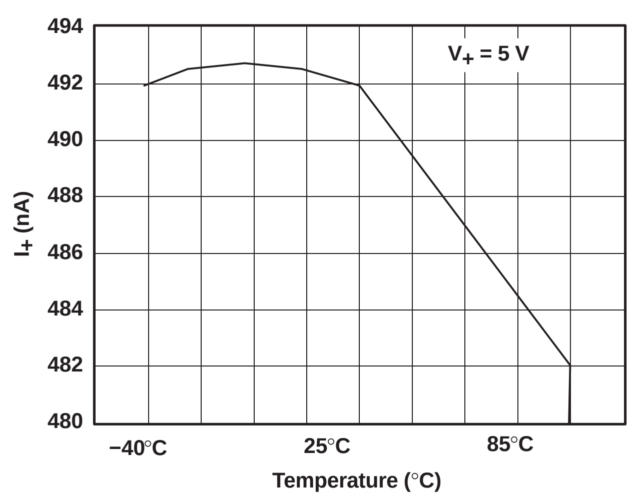


Figure 12. Power Supply Current vs Temperature ($V_+ = 5$ V)

PIN DESCRIPTION

PIN NUMBER	NAME	DESCRIPTION
1	NO0	Normally-open terminal
2	NO1	Normally-open terminal
3	NO2	Normally-open terminal
4	GND	Digital ground
5	IN2	Digital control pin to connect the COM terminal to the NO terminals
6	IN1	Digital control pin to connect the COM terminal to the NO terminals
7	COM	Common terminal
8	V_+	Power supply

PARAMETER DESCRIPTION

SYMBOL	DESCRIPTION
V_{COM}	Voltage at the COM pin.
V_{NO}	Voltage at the NO pin.
r_{on}	Resistance between COM and NO ports, when the channel is ON.
Δr_{on}	Difference of r_{on} between channels.
$r_{on(flat)}$	Difference between the maximum and minimum value of r_{on} in a channel over the specified range of conditions.
$I_{NO(OFF)}$	Leakage current measured at the NO port with the corresponding channel (NO to COM) in the OFF-state under worst case input and output conditions.
$I_{NO(ON)}$	Leakage current measured at the NO port with the corresponding channel (NO to COM) in the ON-state and the output (COM) being open.
$I_{COM(OFF)}$	Leakage current measured at the COM port with the corresponding channel (COM to NO) in the OFF-state under worst case input and output conditions.
$I_{COM(ON)}$	Leakage current measured at the COM port with the corresponding channel (COM to NO) in the ON-state and the output (NO) being open.
V_{IH}	Minimum input voltage for logic high for the control input (IN)
V_{IL}	Maximum input voltage for logic low for the control input (IN)
V_{IN}	Voltage at the IN pin.
I_{IH}, I_{IL}	Leakage current measured at the IN pin.
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 outputs (COM/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 outputs (COM/NO) signal, when the switch is turning OFF.
t_{BBM}	Break-Before-Make time. This parameter is measured under the specified range of conditions and by the propagation delay between the output of two adjacent analog channels (NO), when the control signal changes state.
Q_C	Charge-injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NO or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge-injection, $Q_C = C_L \times \Delta V_O$, C_L is the load capacitance and ΔV_O is the change in analog output voltage.
$C_{NO(OFF)}$	Capacitance at the NO port when the corresponding channel (NO to COM) is OFF.
$C_{NO(ON)}$	Capacitance at the NO port when the corresponding channel (NO to COM) is ON.
$C_{COM(OFF)}$	Capacitance at the COM port when the corresponding channel (COM to NO) is OFF.
$C_{COM(ON)}$	Capacitance at the COM port when the corresponding channel (COM to NO) is ON.
C_{IN}	Capacitance of the IN input.

PARAMETER DESCRIPTION (continued)

SYMBOL	DESCRIPTION
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 (NO to COM) in the OFF state.
X_{TALK}	Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel. This is measured in a specific frequency and in dB.
BW	Bandwidth of the switch. This is the frequency where the gain of an ON channel is −3 dB below the DC gain.
I_+	Static power supply current with the control (IN) pin at V_+ or GND.

PARAMETER MEASUREMENT INFORMATION

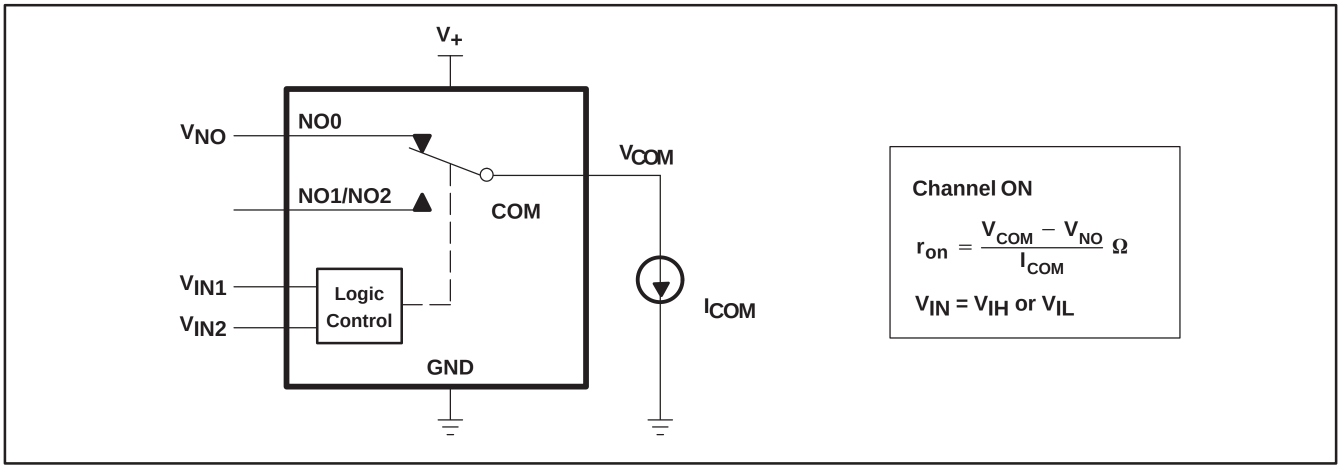


Figure 13. ON-State Resistance (r_{on})

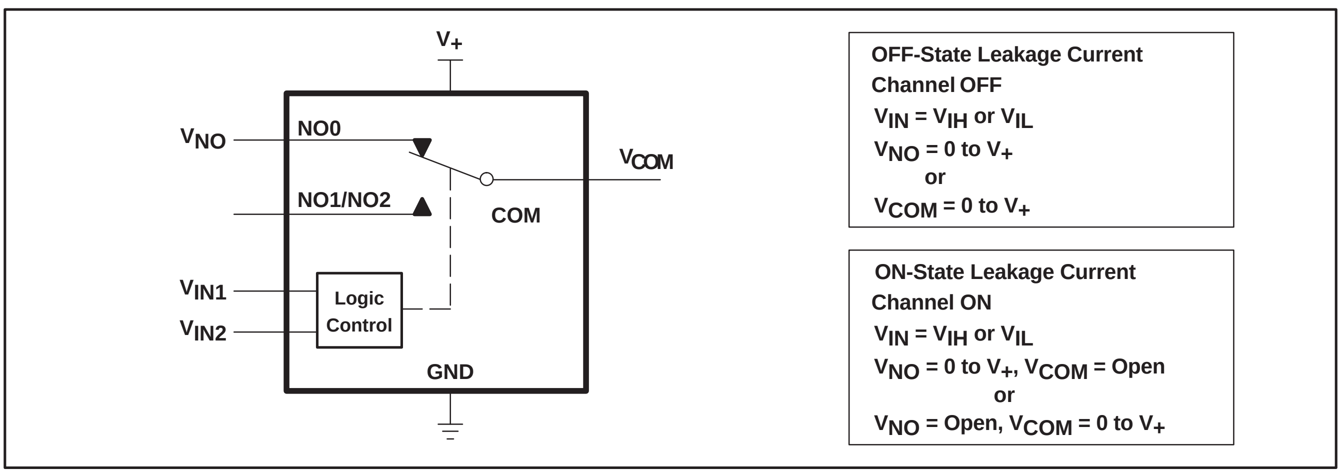


Figure 14. ON and OFF State Leakage Current ($I_{COM(ON)}$, $I_{COM(OFF)}$, $I_{NO(OFF)}$, $I_{NO(ON)}$)

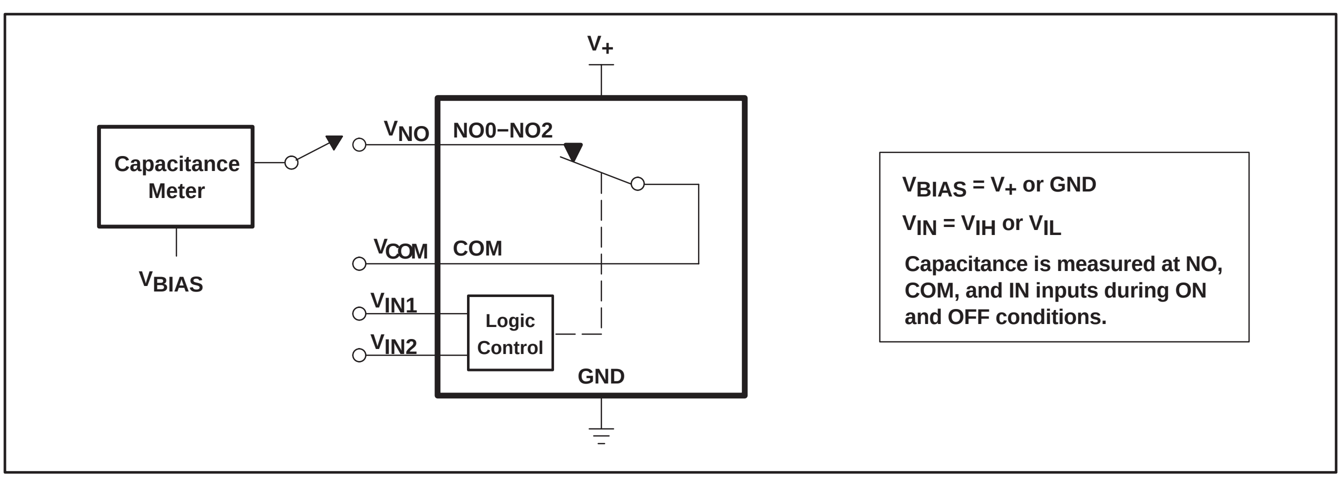
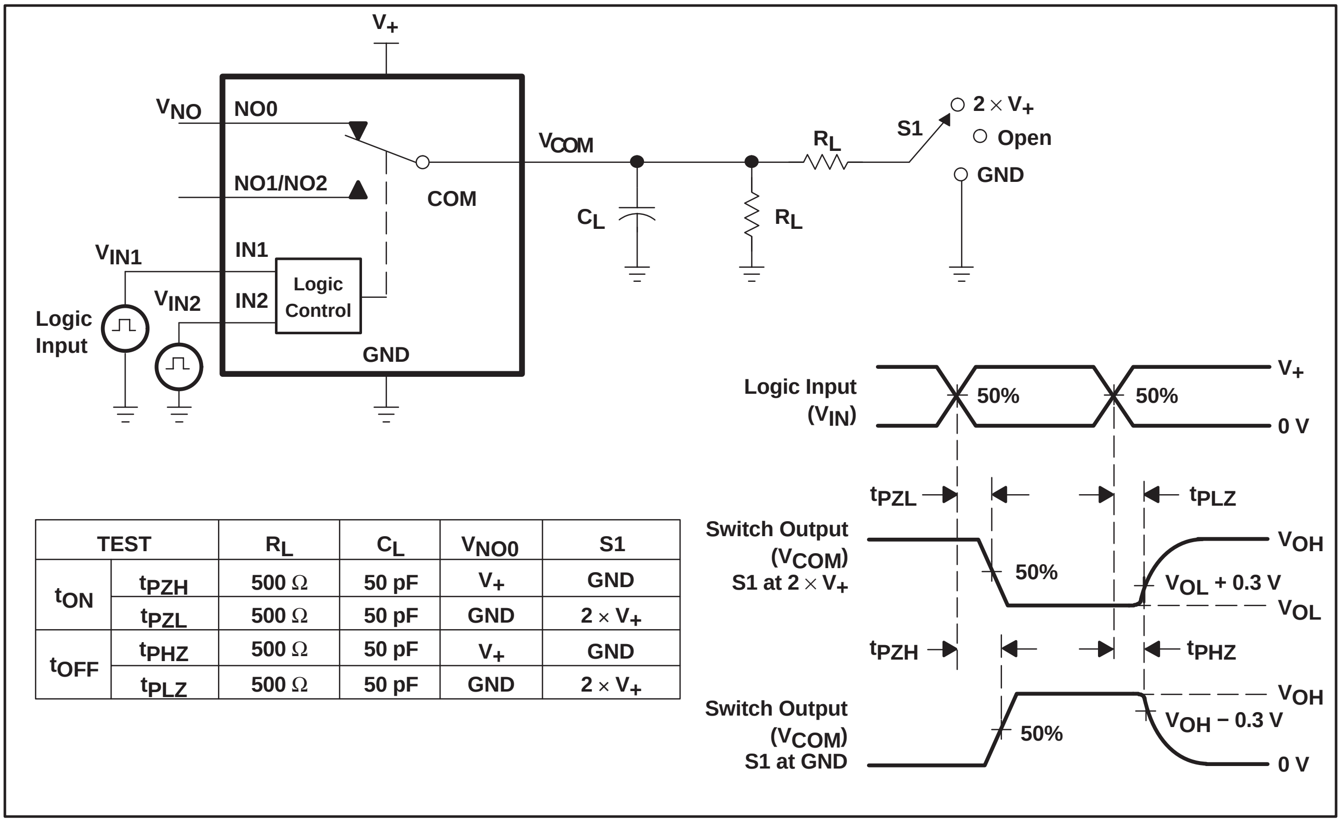


Figure 15. Capacitance (C_{IN}, $C_{COM(ON)}$, $C_{COM(OFF)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)



TEST		R_L	C_L	V_{NO0}	S1
t_{ON}	t_{PZH}	500 Ω	50 pF	V+	GND
	t_{PZL}	500 Ω	50 pF	GND	2 × V+
t_{OFF}	t_{PHZ}	500 Ω	50 pF	V+	GND
	t_{PLZ}	500 Ω	50 pF	GND	2 × V+

Figure 16. Turn-ON (t_{ON}) and Turn-OFF (t_{OFF}) Time

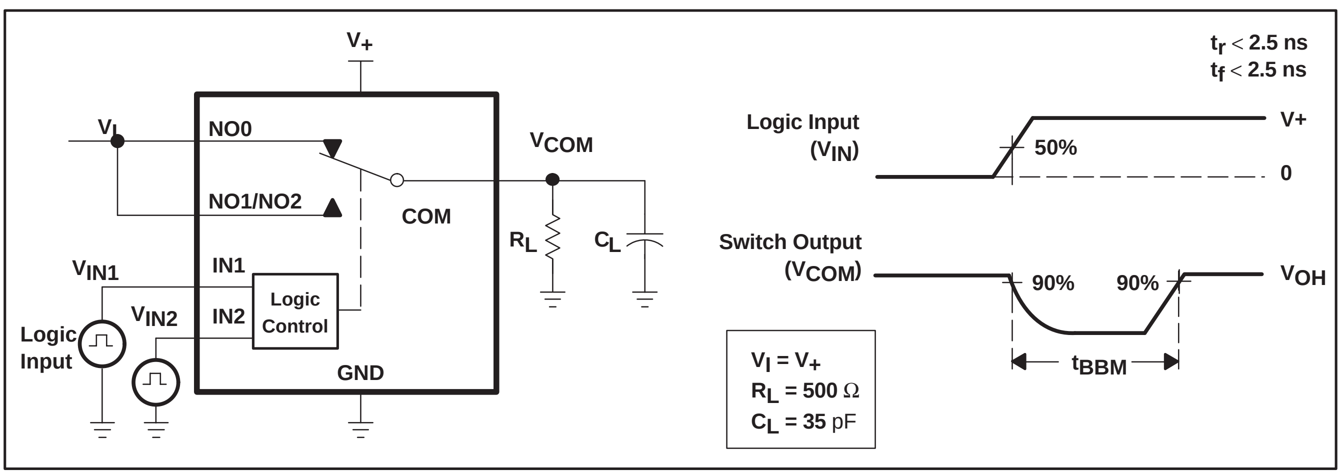


Figure 17. Break-Before-Make (t_{BBM}) Time

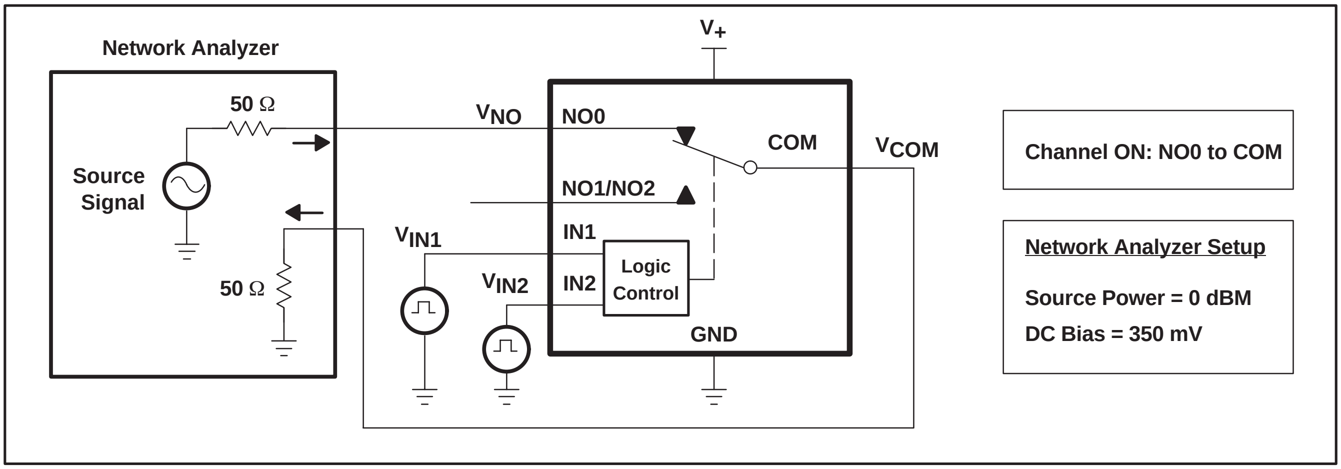


Figure 18. Frequency Response (BW)

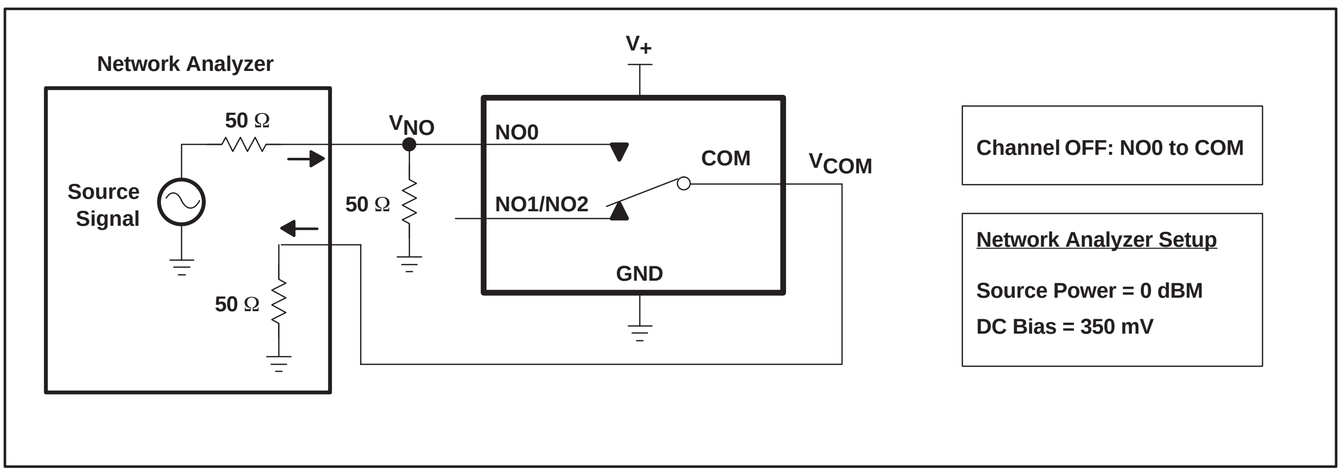


Figure 19. Off-Isolation (O_{ISO})

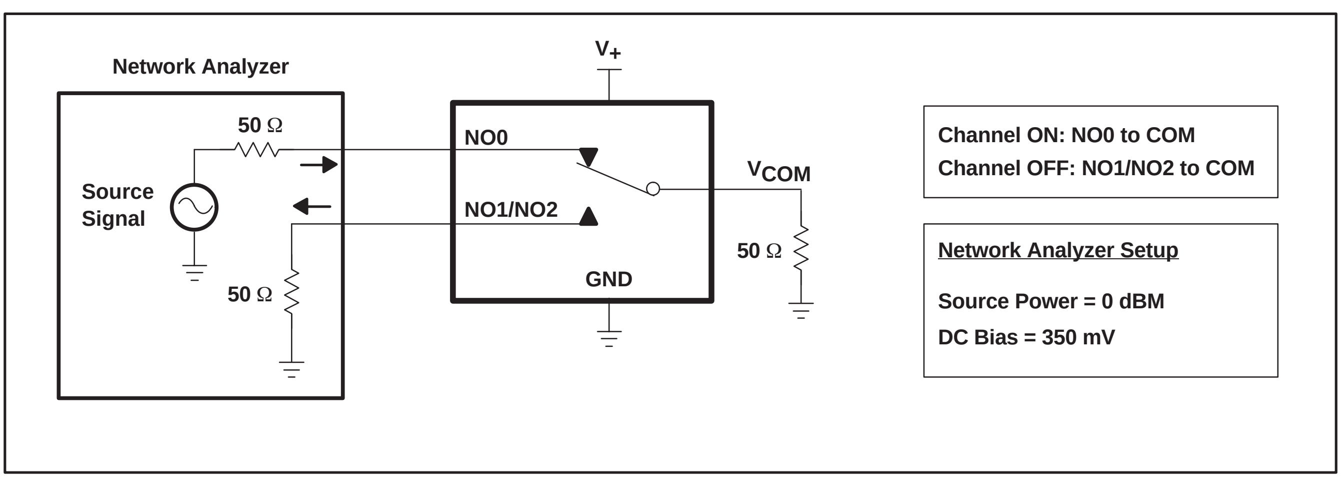


Figure 20. Crosstalk (X_{TALK})

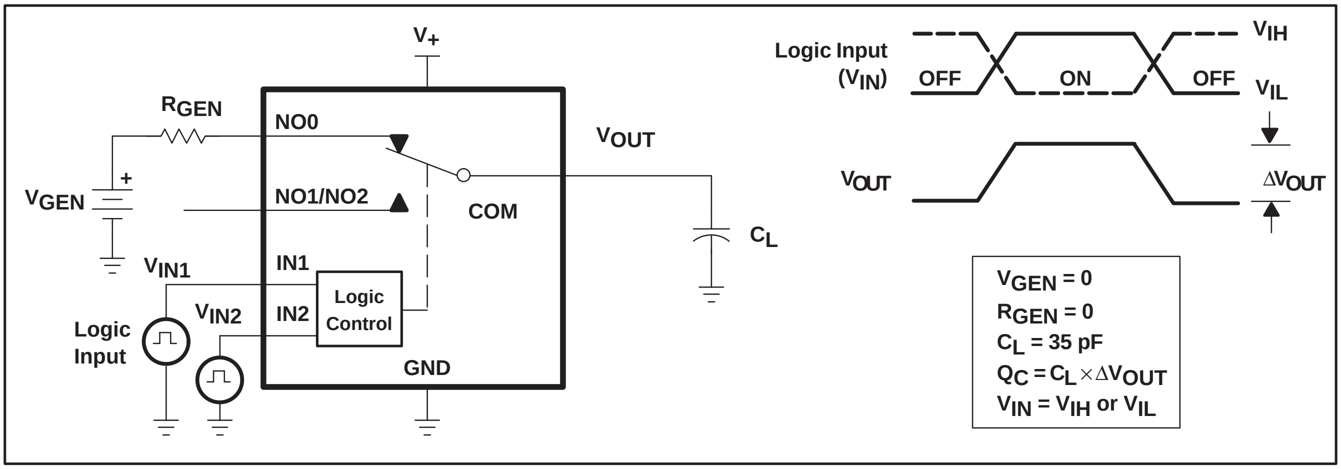
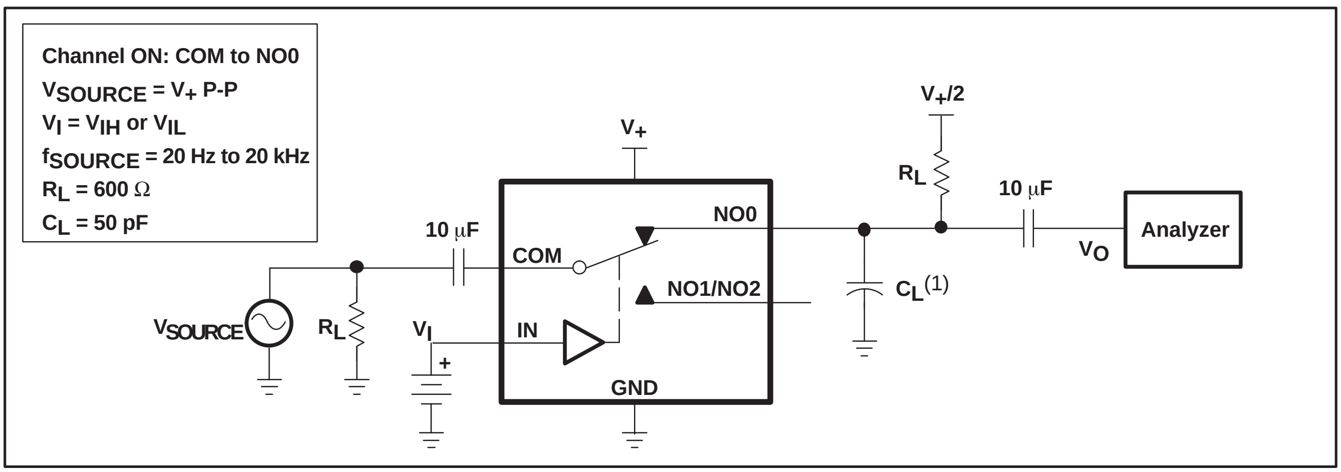


Figure 21. Charge-Injection (Q_C)



(1) C_L includes probe and jig capacitance.

Figure 22. Total Harmonic Distortion (THD)

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TS5A3357DCTR	PREVIEW	SM8	DCT	8	3000	TBD	Call TI	Call TI
TS5A3357DCUR	ACTIVE	US8	DCU	8	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
TS5A3357DCURE4	ACTIVE	US8	DCU	8	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
TS5A3357DCUT	ACTIVE	US8	DCU	8	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
TS5A3357DCUTE4	ACTIVE	US8	DCU	8	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM

(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) 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.
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.

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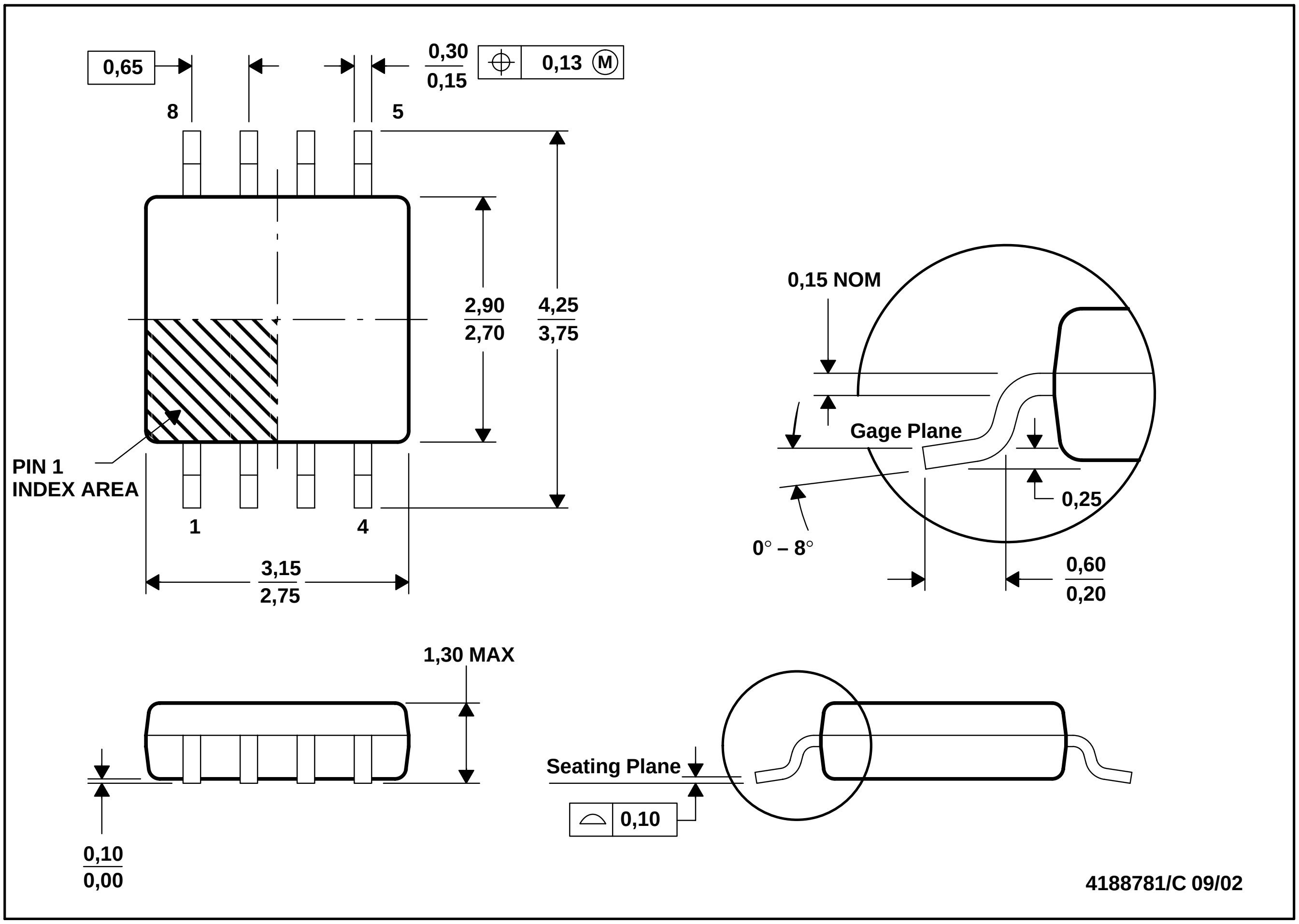
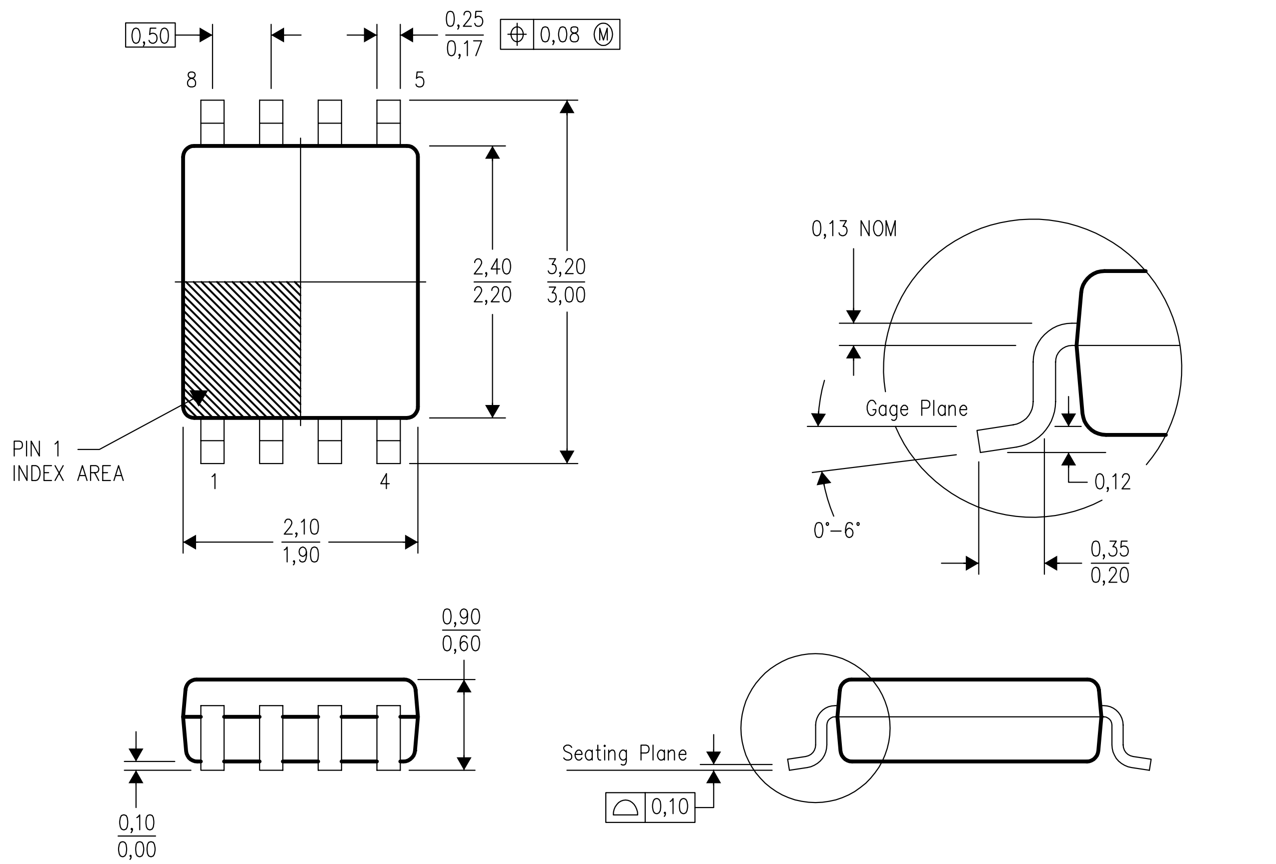


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion
D. Falls within JEDEC MO-187 variation DA.

DCU (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE (DIE DOWN)



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NOTES:
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B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–187 variation CA.

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