



**THE DATASHEET OF
TS5A3159MDBVREP**



FEATURES

- **Controlled Baseline**
 - One Assembly/Test Site, One Fabrication Site
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree ⁽¹⁾**
- **Specified Break-Before-Make Switching**
- **Low ON-State Resistance (1 Ω)**
- **Control Inputs Are 5-V Tolerant**
- **Low Charge Injection**
- **Excellent ON-State Resistance Matching**

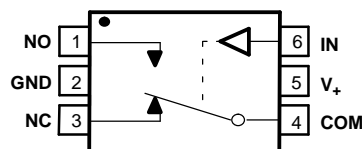
(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- **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)

APPLICATIONS

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

**SOT-23 PACKAGE
(TOP VIEW)**



DESCRIPTION/ORDERING INFORMATION

The TS5A3159-EP is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance and an excellent ON-state resistance matching with the break-before-make feature to prevent signal distortion during the transferring of a signal from one channel 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.

Summary of Characteristics⁽¹⁾

Configuration	2:1 Multiplexer/ Demultiplexer (1 × SPDT)
Number of channels	1
ON-state resistance (r_{on})	1.1 Ω
ON-state resistance match (Δr_{on})	0.1 Ω
ON-state resistance flatness ($r_{on(flat)}$)	0.15 Ω
Turn-on/turn-off time (t_{ON}/t_{OFF})	20 ns/15 ns
Break-before-make time (t_{BBM})	12 ns
Charge injection (Q_C)	36 pC
Bandwidth (BW)	100 MHz
OFF isolation (O_{ISO})	–65 dB at 1 MHz
Crosstalk (X_{TALK})	–66 dB at 1 MHz
Total harmonic distortion (THD)	0.01%
Leakage current ($I_{NO(OFF)}/I_{NC(OFF)}$)	±20 nA
Package option	6-pin DBV

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



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.

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–55°C to 125°C	SOT (SOT-23) – DBV	Tape and reel	TS5A3159MDBVREP	JA8R

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

FUNCTION TABLE

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

Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V ₊	Supply voltage range ⁽²⁾	–0.5	6.5	V
V _{NO} V _{COM}	Analog voltage range ⁽²⁾⁽³⁾⁽⁴⁾	–0.5	V ₊ + 0.5	V
I _{I/O} K	Analog port diode current	V _{NO} , V _{COM} < 0 or V _{NO} , V _{COM} > V ₊		±50 mA
I _{NO} I _{COM}	On-state switch current	V _{NO} , V _{COM} = 0 to V ₊		±200 mA
	On-state peak switch current ⁽⁵⁾		±400	mA
V _{IN}	Digital input voltage range ⁽²⁾⁽³⁾	–0.5	6.5	V
I _{IK}	Digital input clamp current	V _{IN} < 0		–50 mA
	Continuous current through V ₊ or GND		±100	mA
θ _{JA}	Package thermal impedance ⁽⁶⁾		165	°C/W
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 "Electrical Characteristics" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltages are with respect to ground, unless otherwise specified.
- (3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (4) This value is limited to 5.5 V maximum.
- (5) Pulse at 1-ms duration < 10% duty cycle.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.

Electrical Characteristics for 5-V Supply

$V_+ = 4.5\text{ V to }5.5\text{ V}$ (5 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NC}, V_{NO}					0		V_+	V
Peak ON resistance	r_{peak}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -30\text{ mA},$	Switch ON, See Figure 11	25°C	4.5 V	1		1.5	Ω
				Full				1.5	
ON-state resistance	r_{on}	$V_{NO} \text{ or } V_{NC} = 2.5\text{ V}, I_{COM} = -30\text{ mA},$	Switch ON, See Figure 11	25°C	4.5 V	0.75		1.1	Ω
				Full				1.3	
ON-state resistance match between channels	Δr_{on}	$V_{NO} \text{ or } V_{NC} = 2.5\text{ V}, I_{COM} = -30\text{ mA},$	Switch ON, See Figure 11	25°C	4.5 V	0.1			Ω
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -30\text{ mA}$	Switch ON, See Figure 11	25°C	4.5 V	0.233			Ω
		$V_{NO} \text{ or } V_{NC} = 1\text{ V}, 1.5\text{ V}, 2.5\text{ V}, I_{COM} = -30\text{ mA}$				0.15			
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 4.5\text{ V}, V_{COM} = 0,$	Switch OFF, See Figure 12	25°C	5.5 V	-6	0.2	4	nA
				Full				-20	
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 4.5\text{ V}, V_{COM} = \text{Open},$	Switch ON, See Figure 13	25°C	5.5 V	-6	2.8	4	nA
				Full				-40	
COM ON leakage current	$I_{COM(ON)}$	$V_{NC} \text{ or } V_{NO} = 4.5\text{ V or Open}, V_{COM} = 4.5\text{ V},$	Switch ON, See Figure 13	25°C	5.5 V	-4	0.47	7	nA
				Full				-40	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		2.4		5.5	V
Input logic low	V_{IL}			Full		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	$V_I = 5.5\text{ V or }0$		Full	5.5 V	-1		1	μA

(1) $T_A = 25^\circ\text{C}$

TS5A3159-EP
1-Ω SPDT ANALOG SWITCH

SCDS217B–DECEMBER 2005–REVISED JANUARY 2006

Electrical Characteristics for 5-V Supply (continued)

$V_+ = 4.5\text{ V to }5.5\text{ V}$ (5 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT	
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	4.5 V to 5.5 V	20	35	ns	
				Full			40		
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	4.5 V to 5.5 V	15	20	ns	
				Full			35		
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 16	25°C	4.5 V to 5.5 V	1	12	14.5	ns
				Full			1		
Charge injection	Q_C	$C_L = 1\text{ nF}$, $V_{GEN} = 0\text{ V}$,	See Figure 20	25°C	5 V	36		pC	
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	5 V	23		pF	
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 14	25°C	5 V	84		pF	
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 14	25°C	5 V	84		pF	
Digital input capacitance	C_{IN}	$V_{IN} = V_+$ or GND,	See Figure 14	25°C	5 V	2.1		pF	
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See Figure 17	25°C	5 V	100		MHz	
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch OFF, See Figure 18	25°C	5 V	-65		dB	
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch ON, See Figure 19	25°C	5 V	-65		dB	
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 600\text{ Hz to }20\text{ kHz}$, See Figure 21	25°C	5 V	0.01		%	
Supply									
Positive supply current	I_+	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	5.5 V	0.1		μA	

Electrical Characteristics for 3.3-V Supply

$V_+ = 3\text{ V to }3.6\text{ V}$ (3.3 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NC}, V_{NO}					0		V_+	V
Peak ON resistance	r_{peak}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -24\text{ mA},$	Switch ON, See Figure 11	25°C	3 V		1.35	2.15	Ω
				Full			2.15		
ON-state resistance	r_{on}	$V_{NO} \text{ or } V_{NC} = 2\text{ V}, I_{COM} = -24\text{ mA},$	Switch ON, See Figure 11	25°C	3 V		1.15	1.7	Ω
				Full			1.7		
ON-state resistance match between channels	Δr_{on}	$V_{NO} \text{ or } V_{NC} = 2\text{ V}, 0.8\text{ V}, I_{COM} = -24\text{ mA},$	Switch ON, See Figure 11	25°C	3 V		0.11		Ω
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -24\text{ mA}$	Switch ON, See Figure 11	25°C	3 V		0.225		Ω
		$V_{NO} \text{ or } V_{NC} = 2\text{ V}, 0.8\text{ V}, I_{COM} = -24\text{ mA}$					0.25		
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = 0,$	Switch OFF, See Figure 12	25°C	3.6 V		0.2		nA
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = \text{Open},$	Switch ON, See Figure 13	25°C	3.6 V		2.8		nA
COM ON leakage current	$I_{COM(ON)}$	$V_{NC} \text{ or } V_{NO} = 3\text{ V or Open}, V_{COM} = 3\text{ V},$	Switch ON, See Figure 13	25°C	3.6 V		0.47		nA
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		2		5.5	V
Input logic low	V_{IL}			Full		0	0.6		V
Input leakage current	I_{IH}, I_{IL}	$V_I = 5.5\text{ V or }0$		Full	3.6 V	-1		1	μA

(1) $T_A = 25^\circ\text{C}$

TS5A3159-EP

1-Ω SPDT ANALOG SWITCH

SCDS217B–DECEMBER 2005–REVISED JANUARY 2006

Electrical Characteristics for 3.3-V Supply (continued)

$V_+ = 3\text{ V to }3.6\text{ V}$ (3.3 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	3 V to 3.6 V	30	40	40	ns
				Full					
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	3 V to 3.6 V	20	25	25	ns
				Full					
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 16	25°C	3 V to 3.6 V	1	21	29	ns
				Full					
Charge injection	Q_C	$C_L = 1\text{ nF}$, $V_{GEN} = 0\text{ V}$,	See Figure 20	25°C	3.3 V	20			pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	3.3 V	23			pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 14	25°C	3.3 V	84			pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 14	25°C	3.3 V	84			pF
Digital input capacitance	C_{IN}	$V_{IN} = V_+$ or GND,	See Figure 14	25°C	3.3 V	2.1			pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See Figure 17	25°C	3.3 V	100			MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch OFF, See Figure 18	25°C	3.3 V	-65			dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch ON, See Figure 19	25°C	3.3 V	-65			dB
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 600\text{ Hz to }20\text{ kHz}$, See Figure 21	25°C	3.3 V	0.015			%
Supply									
Positive supply current	I_+	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	3.6 V	0.1			μA

Electrical Characteristics for 2.5-V Supply

$V_+ = 2.3 \text{ V to } 2.7 \text{ V}$ (2.5 V nominal), $T_A = -55^\circ\text{C to } 125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NC}, V_{NO}					0		V_+	V
Peak ON resistance	r_{peak}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -8 \text{ mA},$	Switch ON, See Figure 11	25°C	2.5 V		1.7	2.7	Ω
				Full			2.9		
ON-state resistance	r_{on}	$V_{NO} \text{ or } V_{NC} = 1.8 \text{ V}, I_{COM} = -8 \text{ mA},$	Switch ON, See Figure 11	25°C	2.5 V		1.45	2.3	Ω
				Full			2.5		
ON-state resistance match between channels	Δr_{on}	$V_{NO} \text{ or } V_{NC} = 0.8 \text{ V}, 1.8 \text{ V}, I_{COM} = -8 \text{ mA},$	Switch ON, See Figure 11	25°C	2.5 V		0.7		Ω
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -8 \text{ mA}$	Switch ON, See Figure 11	25°C	2.5 V		0.5		Ω
		$V_{NO} \text{ or } V_{NC} = 0.8 \text{ V}, 1.8 \text{ V}, I_{COM} = -8 \text{ mA}$					0.45		
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 2.3 \text{ V}, V_{COM} = 0,$	Switch OFF, See Figure 12	25°C	2.7 V		0.2		nA
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 2.3 \text{ V}, V_{COM} = \text{Open},$	Switch ON, See Figure 13	25°C	2.7 V		2.8		nA
COM ON leakage current	$I_{COM(ON)}$	$V_{NC} \text{ or } V_{NO} = 2.3 \text{ V or Open}, V_{COM} = 2.3 \text{ V},$	Switch ON, See Figure 13	25°C	2.7 V		0.47		nA
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		1.8		5.5	V
Input logic low	V_{IL}			Full		0	0.6		V
Input leakage current	I_{IH}, I_{IL}	$V_I = 5.5 \text{ V or } 0$		Full	2.7 V	-1		1	μA

(1) $T_A = 25^\circ\text{C}$

TS5A3159-EP

1-Ω SPDT ANALOG SWITCH

SCDS217B–DECEMBER 2005–REVISED JANUARY 2006

Electrical Characteristics for 2.5-V Supply (continued)

$V_+ = 2.3\text{ V to }2.7\text{ V}$ (2.5 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	2.3 V to 2.7 V	40	55	70	ns
				Full					
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	2.3 V to 2.7 V	30	40	55	ns
				Full					
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 16	25°C	2.3 V to 2.7 V	1	33	39	ns
				Full					
Charge injection	Q_C	$C_L = 1\text{ nF}$, $V_{GEN} = 0\text{ V}$,	See Figure 20	25°C	2.5 V	13		pC	
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	2.5 V	23		pF	
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 14	25°C	2.5 V	84		pF	
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 14	25°C	2.5 V	84		pF	
Digital input capacitance	C_{IN}	$V_{IN} = V_+$ or GND,	See Figure 14	25°C	2.5 V	2.1		pF	
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See Figure 17	25°C	2.5 V	100		MHz	
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch OFF, See Figure 18	25°C	2.5 V	-64		dB	
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch ON, See Figure 19	25°C	2.5 V	-64		dB	
Total harmonic distortion	THD	$R_L = 600\ \Omega$, $C_L = 50\text{ pF}$,	$f = 600\text{ Hz to }20\text{ kHz}$, See Figure 21	25°C	2.5 V	0.025		%	
Supply									
Positive supply current	I_+	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	2.7 V	0.1		μA	

Electrical Characteristics for 1.8-V Supply
 $V_+ = 1.65\text{ V to }1.95\text{ V (1.8 V nominal)}$, $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NC}, V_{NO}					0		V_+	V
Peak ON resistance	r_{peak}	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+$, $I_{COM} = -2\text{ mA}$,	Switch ON, See Figure 11	25°C	1.8 V		4	4.9	Ω
				Full					
ON-state resistance	r_{on}	$V_{NO} \text{ or } V_{NC} = 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, See Figure 11	25°C	1.8 V		1.7	3.2	Ω
				Full					
ON-state resistance match between channels	Δr_{on}	$V_{NO} \text{ or } V_{NC} = 0.6\text{ V, }1.5\text{ V}$, $I_{COM} = -2\text{ mA}$,	Switch ON, See Figure 11	25°C	1.8 V		0.7		Ω
				Full					
ON-state resistance flatness	$r_{on(Flat)}$	$0 \leq V_{NO} \text{ or } V_{NC} \leq V_+$, $I_{COM} = -2\text{ mA}$ $V_{NO} \text{ or } V_{NC} = 0.6\text{ V, }1.5\text{ V}$, $I_{COM} = -2\text{ mA}$	Switch ON, See Figure 11	25°C	1.8 V		1.85		Ω
				Full					
				25°C					
				Full					
NC, NO OFF leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NC} \text{ or } V_{NO} = 1.65\text{ V}$, $V_{COM} = 0$,	Switch OFF, See Figure 12	25°C	1.95 V		0.2		nA
NC, NO ON leakage current	$I_{NC(ON)}, I_{NO(ON)}$	$V_{NC} \text{ or } V_{NO} = 1.65\text{ V}$, $V_{COM} = \text{Open}$,	Switch ON, See Figure 13	25°C	1.95 V		2.8		nA
COM ON leakage current	$I_{COM(ON)}$	$V_{NC} \text{ or } V_{NO} = 1.65\text{ V or Open}$, $V_{COM} = 1.65\text{ V}$,	Switch ON, See Figure 13	25°C	1.95 V		0.47		nA
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		1.5		5.5	V
Input logic low	V_{IL}			Full		0	0.6		V
Input leakage current	I_{IH}, I_{IL}	$V_I = 5.5\text{ V or }0$		Full	1.95 V	-1		1	μA

 (1) $T_A = 25^\circ\text{C}$

TS5A3159-EP

1-Ω SPDT ANALOG SWITCH

SCDS217B–DECEMBER 2005–REVISED JANUARY 2006

Electrical Characteristics for 1.8-V Supply (continued)

$V_+ = 1.65\text{ V to }1.95\text{ V}$ (1.8 V nominal), $T_A = -55^\circ\text{C to }125^\circ\text{C}$ (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP ⁽¹⁾	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	1.65 V to 1.95 V	65	70	70	ns
				Full					
Turn-off time	t_{OFF}	$V_{COM} = V_+$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 15	25°C	1.65 V to 1.95 V	40	55	55	ns
				Full					
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, $R_L = 50\ \Omega$,	$C_L = 35\text{ pF}$, See Figure 16	25°C	1.65 V to 1.95 V	1	60	72	ns
				Full					
Charge injection	Q_C	$C_L = 1\text{ nF}$, $V_{GEN} = 0\text{ V}$,	See Figure 20	25°C	1.8 V	13			pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 14	25°C	1.8 V	23			pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 14	25°C	1.8 V	84			pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 14	25°C	1.8 V	84			pF
Digital input capacitance	C_{IN}	$V_{IN} = V_+$ or GND,	See Figure 14	25°C	1.8 V	2.1			pF
Bandwidth	BW	$R_L = 50\ \Omega$, Switch ON,	See Figure 17	25°C	1.8 V	100			MHz
OFF isolation	O_{ISO}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch OFF, See Figure 18	25°C	1.8 V	-63			dB
Crosstalk	X_{TALK}	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$,	Switch ON, See Figure 19	25°C	1.8 V	-63			dB
Supply									
Positive supply current	I_+	$V_{IN} = V_+$ or GND,	Switch ON or OFF	Full	1.95 V	0.1			μA

TYPICAL PERFORMANCE

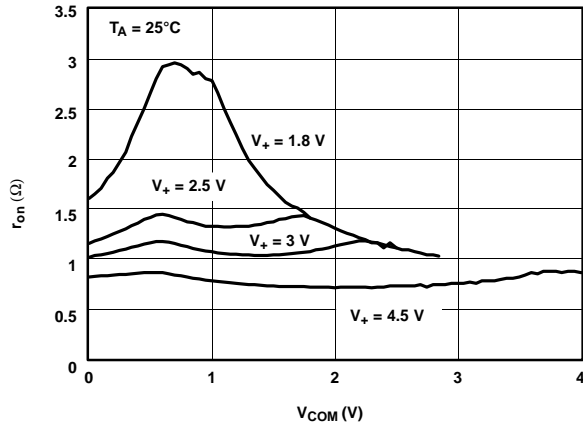


Figure 1. r_{on} vs V_{COM}

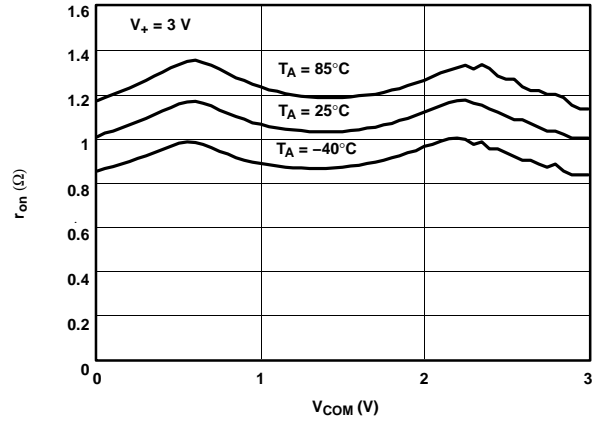


Figure 2. r_{on} vs V_{COM}

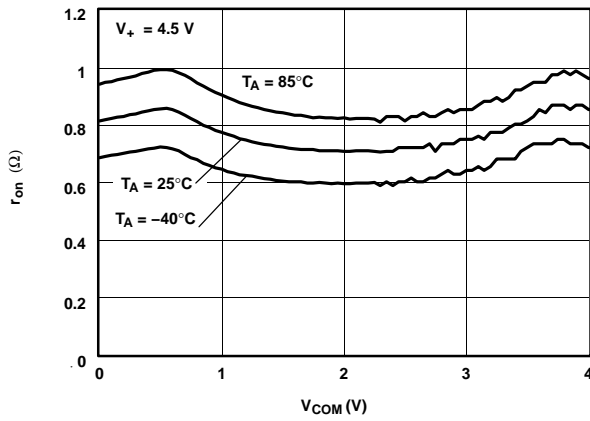


Figure 3. r_{on} vs V_{COM}

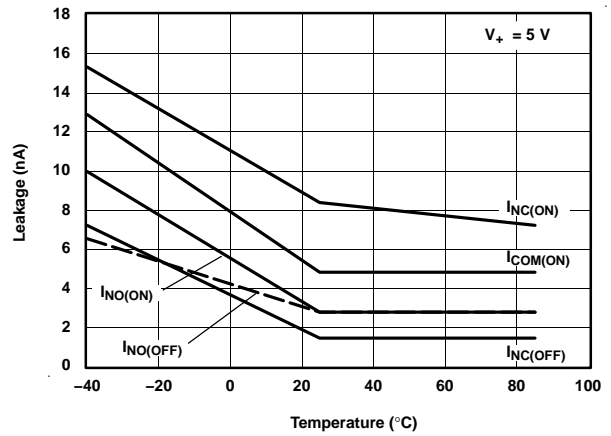


Figure 4. Leakage Current vs Temperature

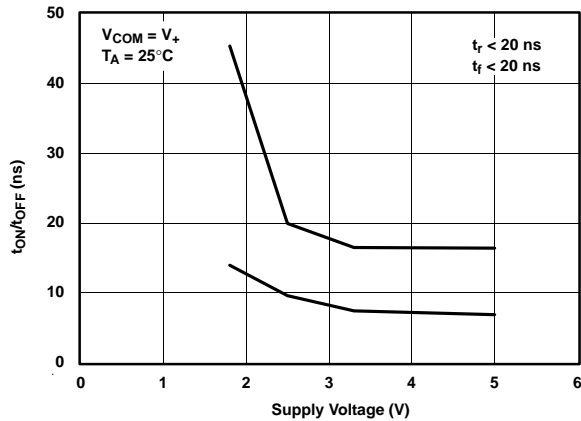


Figure 5. t_{ON}/t_{OFF} vs V_+

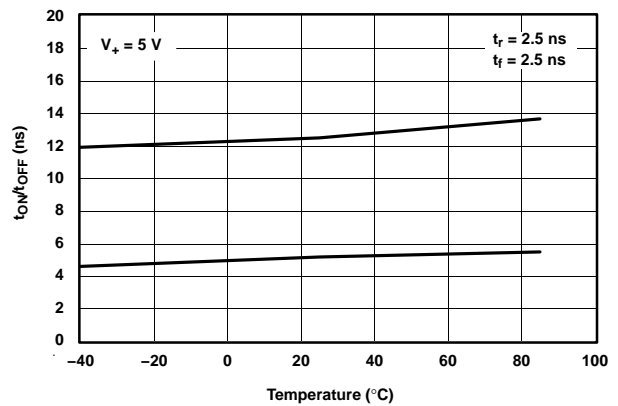


Figure 6. t_{ON}/t_{OFF} vs Temperature

TYPICAL PERFORMANCE (continued)

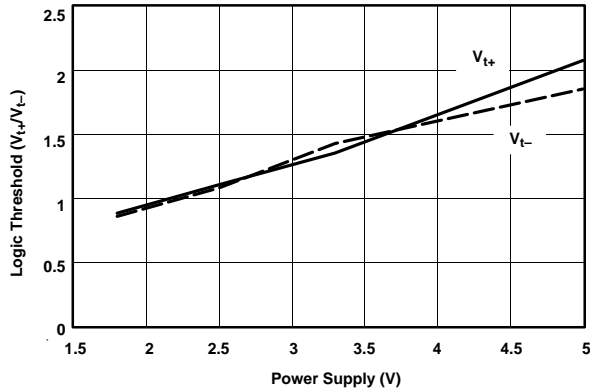


Figure 7. Logic Threshold vs Power Supply

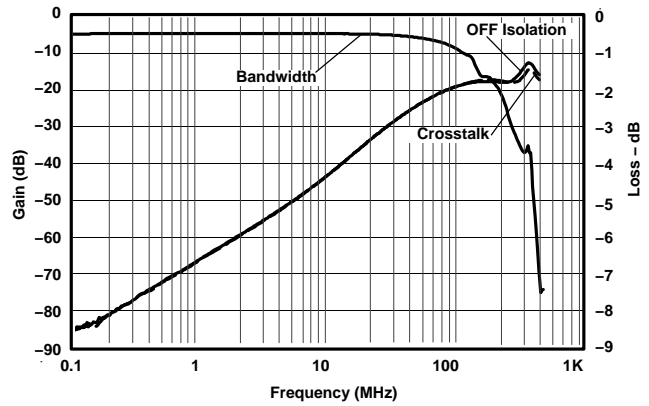


Figure 8. Frequency Response

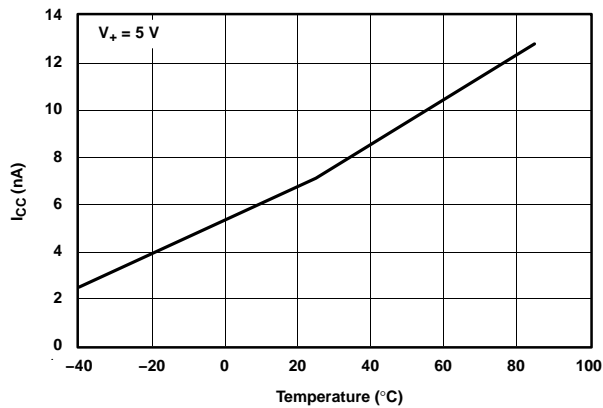


Figure 9. Power-Supply Current vs Temperature

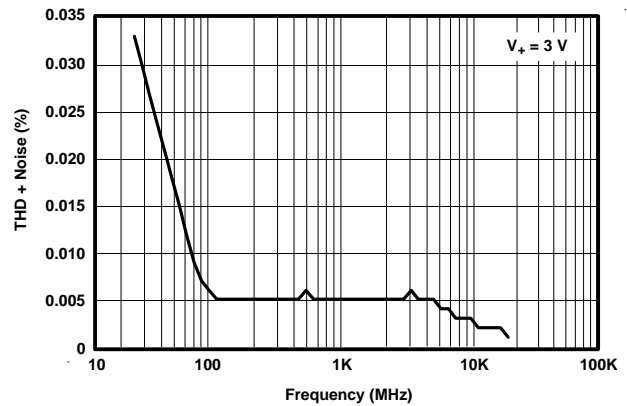


Figure 10. Total Harmonic Distortion (THD) vs Frequency

PIN DESCRIPTION

PIN NO.	NAME	DESCRIPTION
1	NO	Normally open
2	GND	Digital ground
3	NC	Normally closed
4	COM	Common
5	V ₊	Power supply
6	IN	Digital control to connect COM to NO or NC

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 NO ports when the channel is ON
r _{peak}	Peak on-state resistance over a specified voltage range
Δr _{on}	Difference of r _{on} between channels in a specific device
r _{on(flat)}	Difference between the maximum and minimum value of r _{on} in a channel over the specified range of conditions
I _{NC(OFF)}	Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state under worst-case input and output conditions
I _{NO(OFF)}	Leakage current measured at the NO port, with the corresponding channel (NO 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(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(ON)}	Leakage current measured at the COM port, with the corresponding channel (COM to NO) in the ON state and the output (NO) 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 IN
I _{IH} , I _{IL}	Leakage current measured at IN
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 (COM 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 (COM or 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 (NC and 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 × ΔV _{COM} , C _L is the load capacitance and ΔV _{COM} is the change in analog output voltage.
C _{NC(OFF)}	Capacitance at the NC port when the corresponding channel (NC to COM) is OFF
C _{NO(OFF)}	Capacitance at the NO port when the corresponding channel (NO to COM) is OFF
C _{NC(ON)}	Capacitance at the NC port when the corresponding channel (NC to COM) is ON
C _{NO(ON)}	Capacitance at the NO port when the corresponding channel (NO to COM) is ON
C _{COM(ON)}	Capacitance at the COM port when the corresponding channel (COM to NO) is ON
C _{IN}	Capacitance of IN
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 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.

TS5A3159-EP
1-Ω SPDT ANALOG SWITCH

SCDS217B–DECEMBER 2005–REVISED JANUARY 2006

PARAMETER DESCRIPTION (continued)

SYMBOL	DESCRIPTION
I_+	Static power-supply current with the control (IN) pin at V_+ or GND
ΔI_+	This is the increase in I_+ for each control (IN) input that is at the specified voltage, rather than at V_+ or GND.

PARAMETER MEASUREMENT INFORMATION

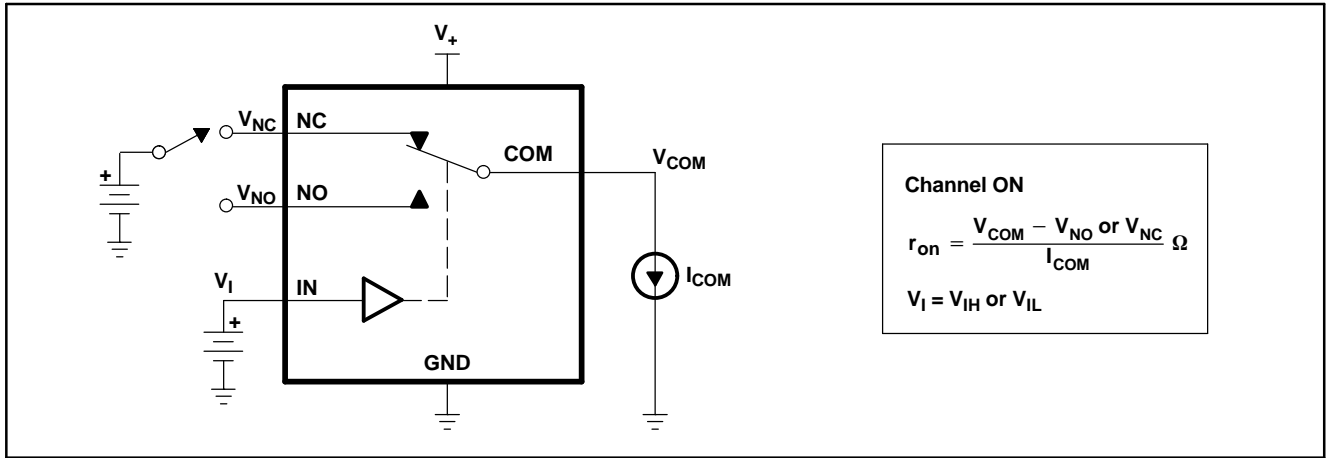


Figure 11. ON-State Resistance (r_{on})

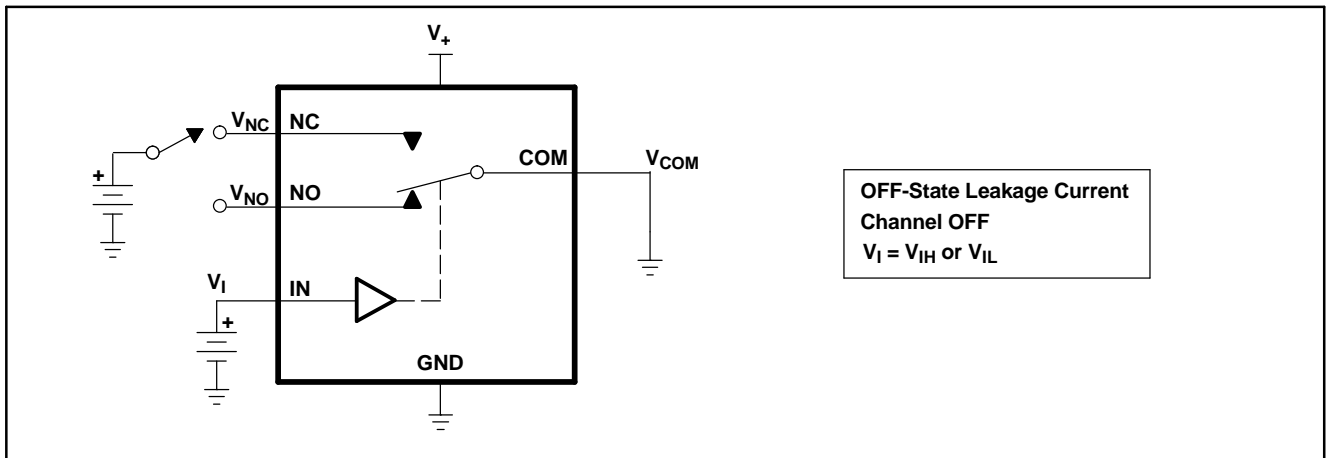


Figure 12. OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NO(OFF)}$)

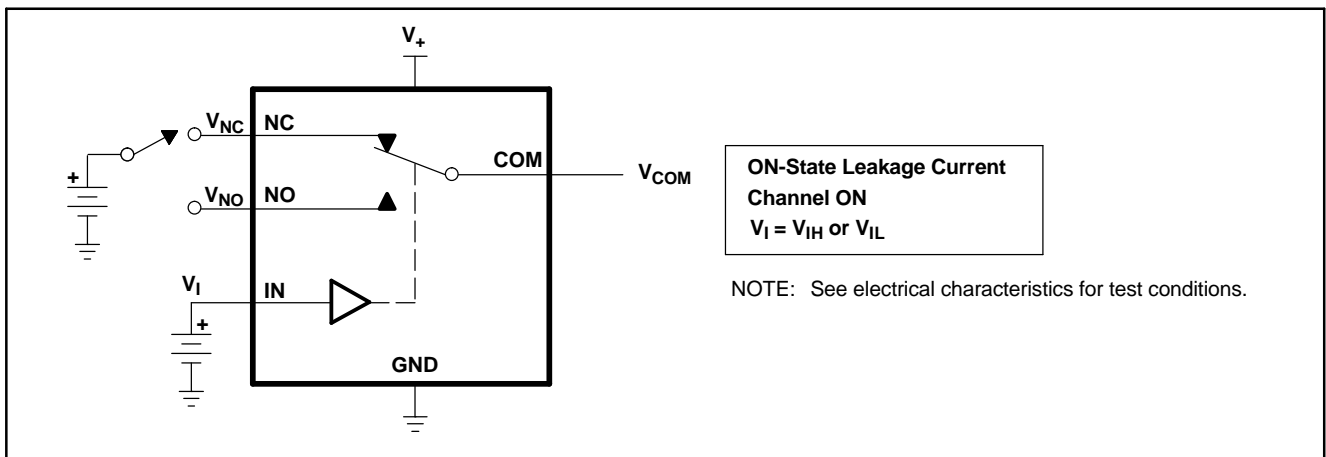


Figure 13. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

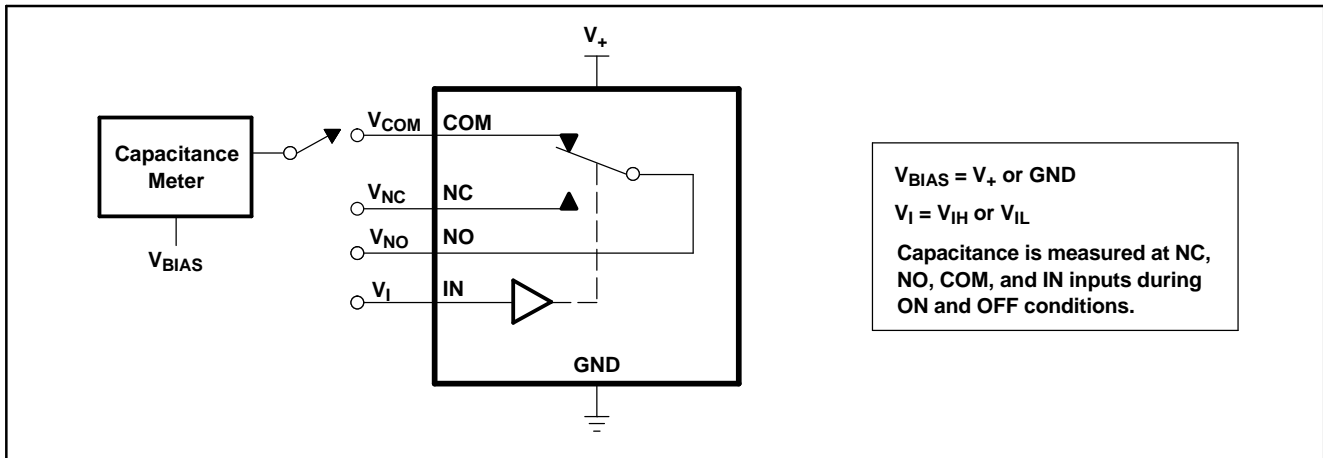
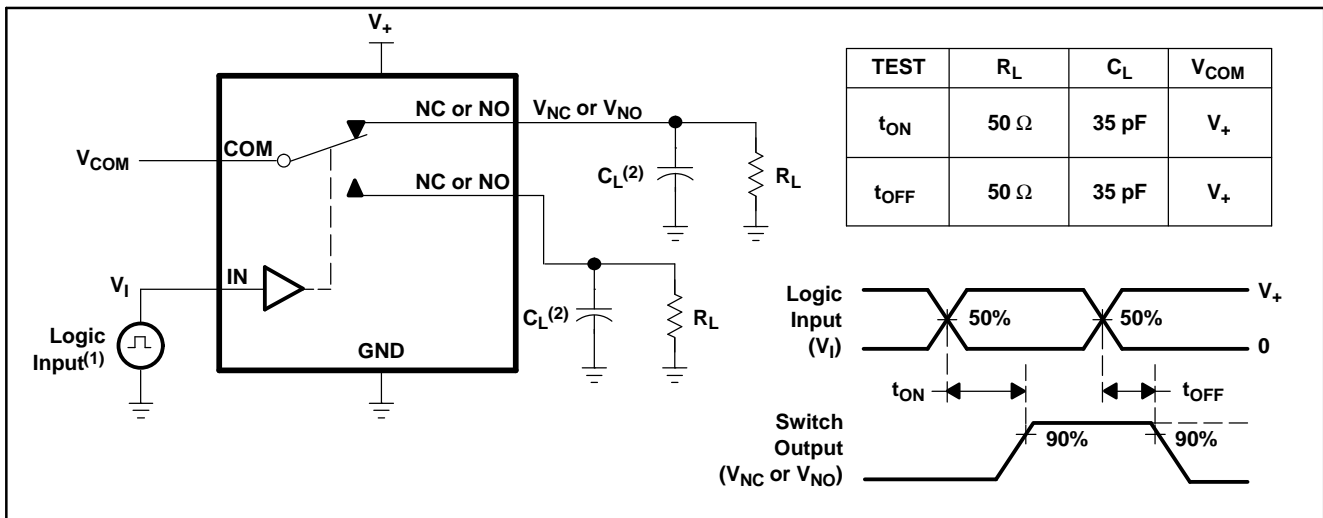


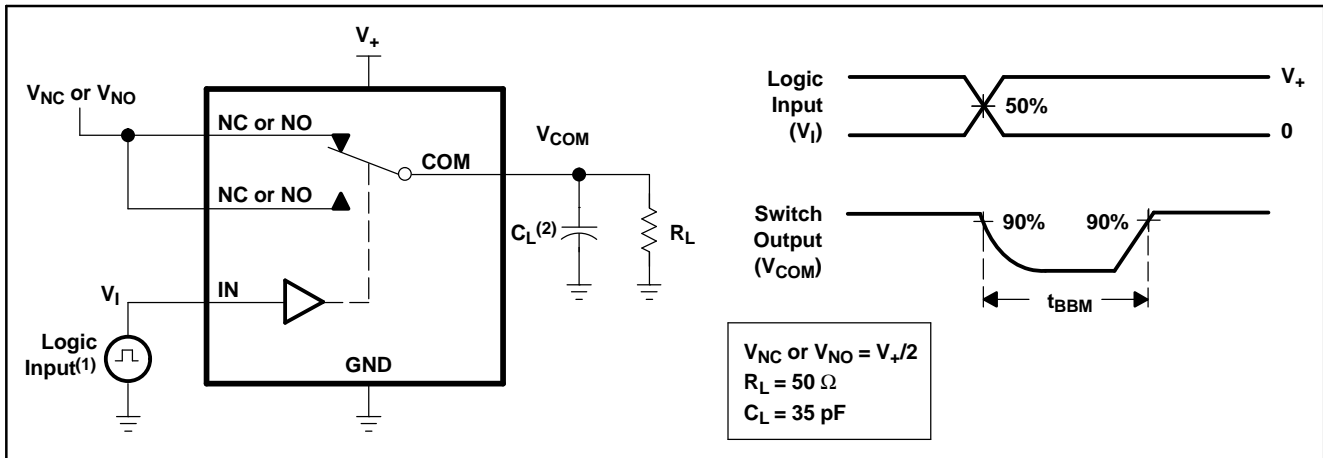
Figure 14. Capacitance (C_I , $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)



- (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.

Figure 15. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

PARAMETER MEASUREMENT INFORMATION (continued)



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

Figure 16. Break-Before-Make Time (t_{BBM})

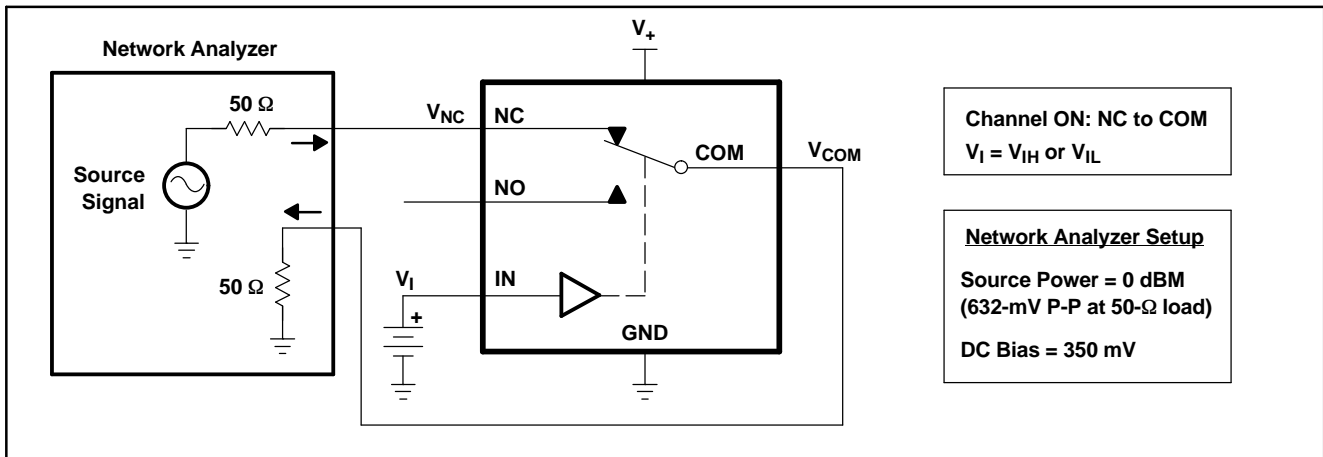


Figure 17. Bandwidth (BW)

PARAMETER MEASUREMENT INFORMATION (continued)

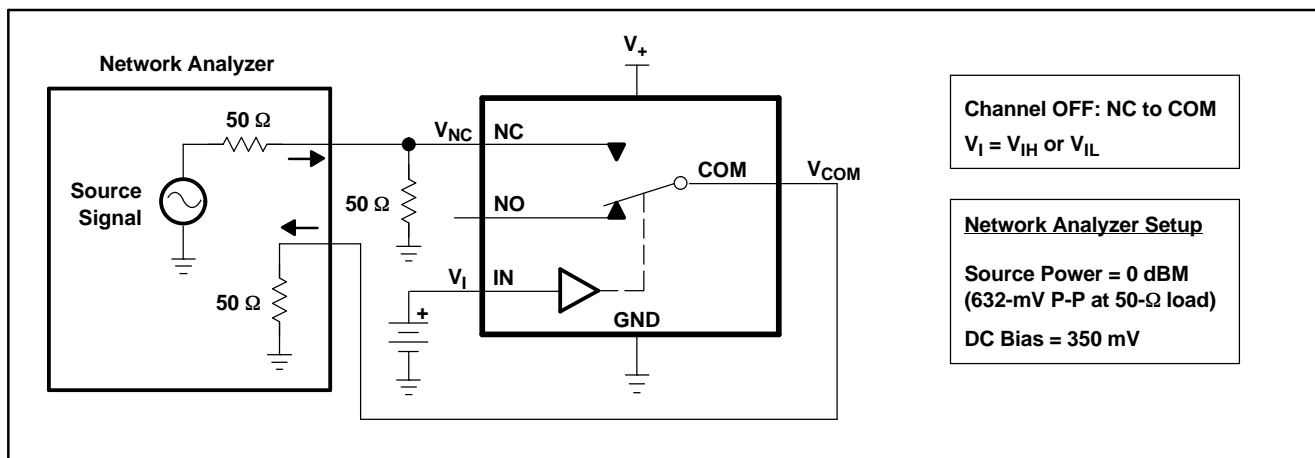


Figure 18. OFF Isolation (O_{ISO})

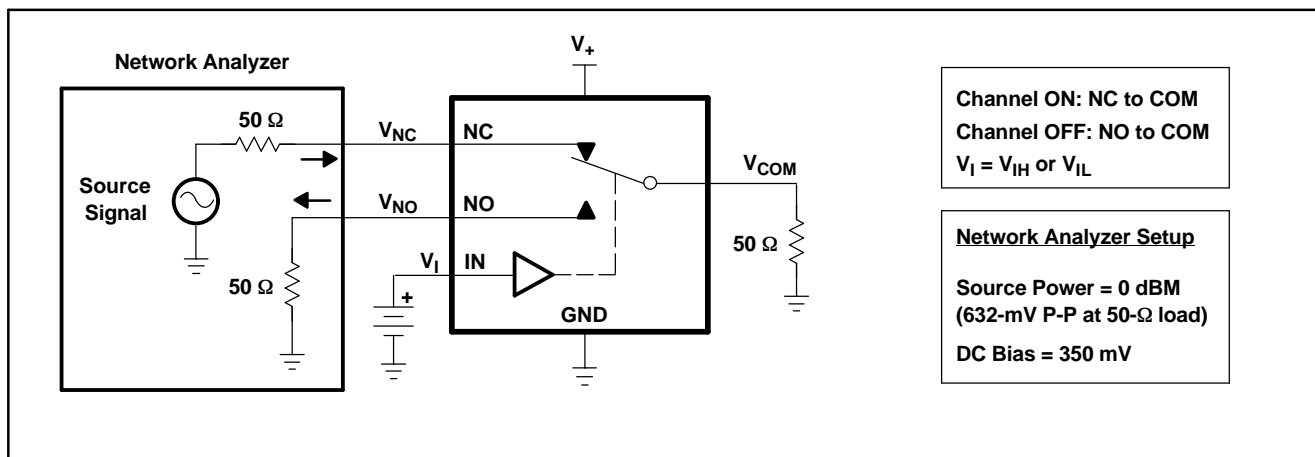
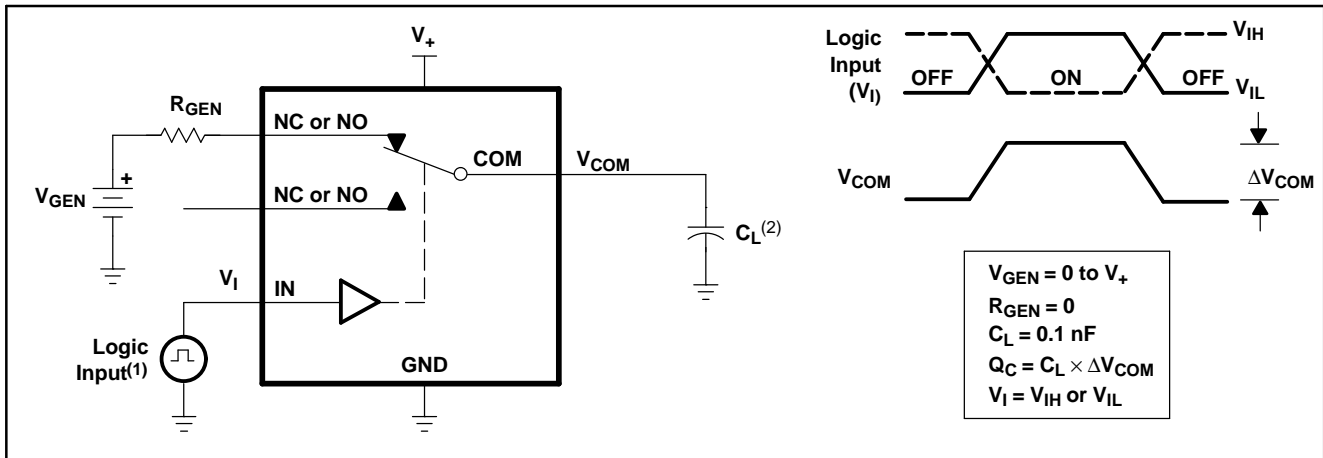


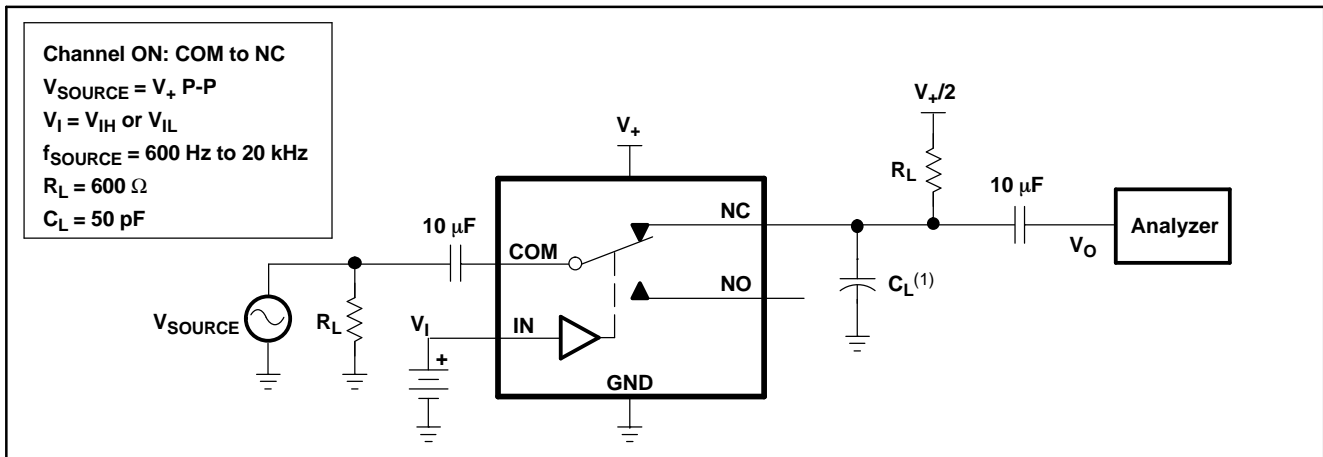
Figure 19. Crosstalk (X_{TALK})

PARAMETER MEASUREMENT INFORMATION (continued)



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

Figure 20. Charge Injection (Q_C)



- (1) C_L includes probe and jig capacitance.

Figure 21. 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)	Op Temp (°C)	Top-Side Markings (4)	Samples
TS5A3159MDBVREP	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	JA8R	Samples
V62/06613-01XE	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	JA8R	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) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side 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.

OTHER QUALIFIED VERSIONS OF TS5A3159-EP :

- Catalog: [TS5A3159](#)
- Automotive: [TS5A3159-Q1](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS5A3159MDBVREP	SOT-23	DBV	6	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A3159MDBVREP	SOT-23	DBV	6	3000	202.0	201.0	28.0

EXAMPLE BOARD LAYOUT

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214840/B 03/2018

NOTES: (continued)

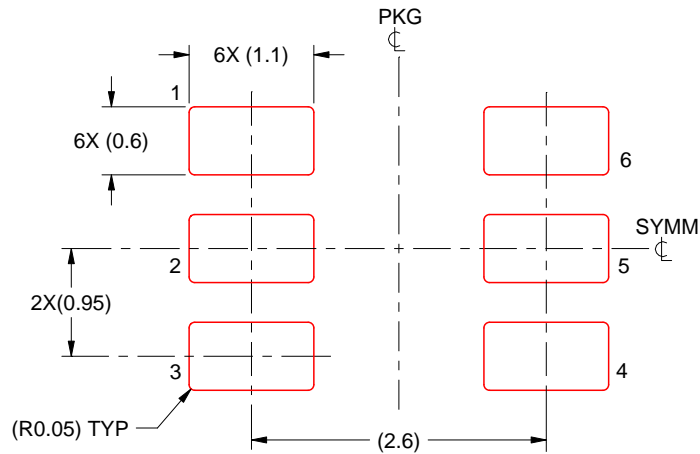
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214840/B 03/2018

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2019, Texas Instruments Incorporated

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View TS5A3159MDBVREP](#) on WIN SOURCE

 [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management