

Features

- Low ON-Resistance (35 ohms max.) Minimizes Distortion and Error Voltages
- 10pC Max. Charge Injection Reduces Step Error
- Dual-Supply Operation ($\pm 2.7V$ to $\pm 8V$)
- Single-Supply Operation (+2.7V to +15V)
- On-Resistance Matching Between Channels: < 6 ohms
- On-Resistance Flatness: 10 ohms (max.)
- TTL/CMOS Logic Compatible (with +5V or $\pm 5V$ supplies)
- Break-Before-Make Action Eliminates Momentary Crosstalk
- Rail-to-Rail Analog Signal Range
- Pin Compatible with MAX394
- Packaging: 20-pin SOIC (S)

Applications

- Data Acquisition Systems
- Audio Switching and Routing
- Test Equipment
- PBX, PABX
- Telecommunication Systems
- Battery-Powered Systems

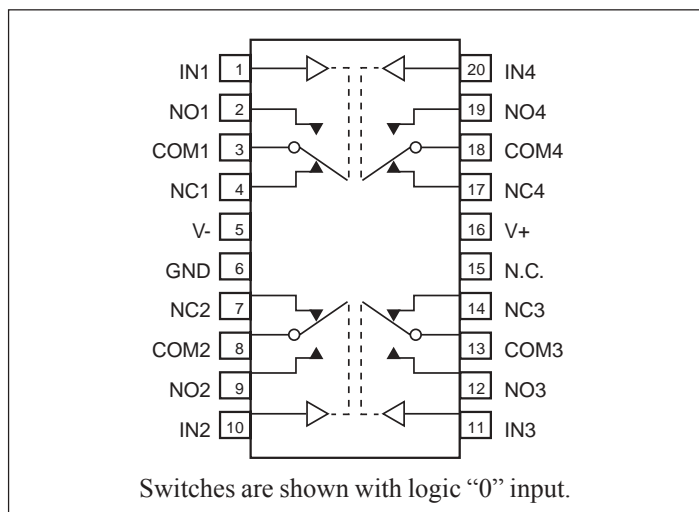
Description

The PS394 is a precision, low-voltage, quad, single-pole/double-throw (SPDT) analog switch. The four independent switches operate with bipolar supplies ranging from $\pm 2.7V$ to $\pm 8V$, or with a single supply of +2.7V to +15V. The PS394 offers low ON-resistance (less than 35 ohms), guaranteed to match within 6 ohms between channels and to remain flat over the analog signal range (10 ohms max.). It also offers break-before-make switching (10ns typical), with turn-off times less than 75ns and turn-on times less than 130ns. The PS394 is ideal for portable operation since quiescent current runs less than $1\mu A$ with all inputs high or low.

This monolithic, quad switch is fabricated using Pericom's 17V silicon-gate process. Design improvements guarantee extremely low charge injection and low power consumption ($10\mu W$).

Logic Inputs are TTL and CMOS compatible and guaranteed over a +0.8V to +2.4V range. Logic inputs and switched analog signals can range anywhere between the supply voltages without damage.

Pin Configuration



Pin Description

Name	Function
IN1 - IN4	Logic-Levels Inputs
NO1 - NO4	Normally Open Switches
COM1 - COM4	Common Switch Poles
NC1 - NC4	Normally Closed Switches
V-	Negative Power Supply
GND	Ground
N.C.	Not Internally Connected
V+	Positive Power Supply

Absolute Maximum Ratings

Voltages Referenced to GND

V+	.....	-0.3V to +17V
V-	.....	+0.3V to -17V
V+ to V-	.....	-0.3V to +17V
COM_, NO_, NC_, IN_ ⁽¹⁾	(V--2V) to (V++2V) or 30mA, whichever occurs first
Continuous Current, Any Pin	.....	30mA
Peak Current, Any Pin (pulsed at 1ms, 10% duty cycle max.)	.....	100mA

Continuous power Dissipation (T_A = +70°C)

Narrow SO (derate 8.70mW/°C above +70°C) 696mW

Operating Temperature Ranges

PS39_C_P 0°C to +70°C

PS39_E_P -40°C to +85°C

Storage Temperature Range -65°C to +150°C

Lead Temperature (soldering, 10s) +300°C

Note 1: Signals on NC, NO, COM, or IN exceeding V+ or V- are clamped by internal diodes. Limit forward diode current to maximum current rating.

CAUTION

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.

Electrical Characteristics—Dual Supplies

(V+ = 5V ± 10%, V- = -5V ± 10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

Parameter	Symbol	Conditions	Min. ⁽²⁾	Typ. ⁽²⁾	Max. ⁽²⁾	Units
Switch						
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}	(Note 3)	V-		V+	V
On-Resistance	R _{ON}	V+ = 4.5V, V- = -4.5V, V _{NC} or V _{NO} = ±3.5V, I _{COM} = 10mA, V _{INH} = 2.4V, V _{INL} = 0.8V	T _A = +25°C	20	35	Ω
			T _A = T _{MIN} to T _{MAX}		45	
On-Resistance Match Between Channels ⁽⁴⁾	ΔR _{ON}	V _{NC} or V _{NO} = ±3V, I _{COM} = 10mA, V+ = 5V, V- = -5V	T _A = +25°C		6	Ω
			T _A = T _{MIN} to T _{MAX}		8	
On-Resistance Flatness ⁽⁴⁾	R _{FLAT(ON)}	V _{NC} or V _{NO} = +3V, 0V, -3V; I _{COM} = 10mA, V+ = 5V; V- = -5V	T _A = +25°C		10	Ω
			T _A = T _{MIN} to T _{MAX}		13	
NC or NO Off Leakage Current ⁽⁵⁾	I _{NC(OFF)} or I _{NO(OFF)}	V _{COM} = ±4.5V, V _{NC} or V _{NO} = ±4.5V, V+ = 5.5V, V- = -5.5V	T _A = +25°C	-80	80	nA
			T _A = T _{MIN} to T _{MAX}	-100	100	
COM Leakage Current ⁽⁵⁾	I _{COM(ON)}	V _{COM} = ±4.5V, V _{NC} or V _{NO} = ±4.5V, V+ = 5.5V, V- = -5.5V	T _A = +25°C	-80	80	nA
			T _A = T _{MIN} to T _{MAX}	-100	100	
Digital Logic Input						
Input Current with Input Voltage High	I _{INH}	V _{IN} = 2.4V, all others = 0.8V	-1.0	0.005	1.0	μA
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V, all others = 2.4V	-1.0	0.005	1.0	μA
Logic High Input Voltage	V _{A_H}		2.4			V
Logic Low Input Voltage	V _{A_L}				0.8	V

Electrical Characteristics—Dual Supplies (continued)

($V_+ = 5V \pm 10\%$, $V_- = -5V \pm 10\%$, $GND = 0V$, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.)

Parameter	Symbol	Conditions	Min. ⁽²⁾	Typ. ⁽²⁾	Max. ⁽²⁾	Units	
Dynamic							
Turn-On-Time	t_{ON}	$V_{COM} = 3V$, Figure 2	$T_A = +25^\circ C$		82	130	ns
			$T_A = T_{MIN}$ to T_{MAX}			175	
Turn-off-Time	t_{OFF}	$V_{COM} = 3V$, Figure 2	$T_A = +25^\circ C$		57	75	ns
			$T_A = T_{MIN}$ to T_{MAX}			100	
Break-Before-Make Time Delay ⁽³⁾	t_D	Figure 5	$T_A = +25^\circ C$	2	10		ns
Charge Injection ⁽³⁾	V_{CTE}	$C_L = 1.0nF$, $V_{GEN} = 0V$, $R_{GEN} = 0$ ohm, Figure 6	$T_A = +25^\circ C$		5	10	pC
Off Isolation ⁽⁶⁾	V_{ISO}	$R_L = 50$ ohms, $C_L = 5pF$, $f = 1$ MHz, Figure 7	$T_A = +25^\circ C$		66		dB
Crosstalk ⁽⁷⁾	V_{CT}	$R_L = 50$ ohms, $C_L = 5pF$, $f = 1$ MHz, Figure 8	$T_A = +25^\circ C$		88		dB
Off Capacitance	C_{OFF}	$f = 1$ MHz, Figure 3	$T_A = +25^\circ C$		12		pF
COM Off Capacitance	$C_{COM(OFF)}$	$f = 1$ MHz, Figure 3	$T_A = +25^\circ C$		12		pF
Channel On Capacitance	$C_{COM(ON)}$	$f = 1$ MHz, Figure 4	$T_A = +25^\circ C$		39		pF
Supply							
Power-Supply Range				± 2.4		± 8	V
Positive Supply Current	I_+	All channels on or off, $V_+ = 5.5V$, $V_- = -5.5V$, $V_{IN} = 0V$ or V_+		-1.0	0.06	1.0	μA
Negative Supply Current	I_-	All channels on or off, $V_+ = 5.5V$, $V_- = -5.5V$, $V_{IN} = 0V$ or V_+		-1.0	-0.01	1.0	μA

Electrical Characteristics—Single+5V Supply

(V+ = 5V ± 10%, V- = 0V, GND = 0V, VINH = 2.4V, VINL = 0.8V, TA = TMIN to TMAX, unless otherwise noted.)

Parameter	Symbol	Conditions	Min. ⁽²⁾	Typ. ⁽²⁾	Max. ⁽²⁾	Units	
Switch							
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}	(Note 3)	0V		V+	V	
On-Resistance	R _{ON}	V+ = 5.0V, V- = 0V, V _{NC} or V _{NO} = 3.5V, I _{COM} = 1.0mA, V _{INH} = 2.4V, V _{INL} = 0.8V	T _A = +25°C	25	65	Ω	
			T _A = T _{MIN} to T _{MAX}		75		
On-Resistance Match Between Channels ⁽⁴⁾	ΔR _{ON}	V _{NC} or V _{NO} = 3V, I _{COM} = 1.0mA, V+ = 5V	T _A = +25°C		10	Ω	
			T _A = T _{MIN} to T _{MAX}		12		
On-Resistance Flatness ⁽⁴⁾	R _{FLAT(ON)}	V _{NC} or V _{NO} = 3V, 2V, 1V I _{COM} = 1.0mA; V+ = 5V, V- = 0V	T _A = +25°C		16	Ω	
			T _A = T _{MIN} to T _{MAX}		20		
NC or NO Off Leakage Current ⁽⁸⁾	I _{NC(OFF)} or I _{NO(OFF)}	V _{COM} = 0V, V _{NC} or V _{NO} = 4.5V, V+ = 5.5V, V- = 0V	T _A = +25°C	-80	80	nA	
			T _A = T _{MIN} to T _{MAX}	-100	100		
COM Leakage Current ⁽⁸⁾	I _{COM(ON)}	V _{COM} = 4.5V, V _{NC} or V _{NO} = 4.5V, V+ = 5.5V, V- = 0V	T _A = +25°C	-80	80	nA	
			T _A = T _{MIN} to T _{MAX}	-100	100		
Digital Logic Input							
Input Current with Input Voltage High	I _{INH}	V _{IN} = 2.4V, all others = 0.8V		-1.0	0.005	1.0	μA
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V, all others = 2.4V		-1.0	0.005	1.0	μA
Dynamic							
Turn-On-Time ⁽³⁾	t _{ON}	V _{COM} = 3V, Figure 2	T _A = +25°C		160	250	ns
			T _A = T _{MIN} to T _{MAX}			300	
Turn-off-Time ⁽³⁾	t _{OFF}	V _{COM} = 3V, Figure 2	T _A = +25°C		60	125	ns
			T _A = T _{MIN} to T _{MAX}			175	
Break-Before-Make Time Delay ⁽³⁾	t _D		T _A = +25°C	5	20		ns
Charge Injection ⁽³⁾	V _{CTE}	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0 ohm	T _A = +25°C		3	5	pC
Supply							
Power-Supply Range	V+			2.4		16	V
Positive Supply Current	I+	All channels on or off, V _{IN} = 0V or V+, V+ = 5.5V, V- = 0V		-1.0	0.01	1.0	μA
Negative Supply Current	I-	All channels on or off, V _{IN} = 0V or V+, V+ = 5.5V, V- = 0V		-1.0	-0.01	1.0	μA

Electrical Characteristics—Single+3.3V Supply

(V+ = 3.0V to 3.6V, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

Parameter	Symbol	Conditions	Min. ⁽²⁾	Typ. ⁽²⁾	Max. ⁽²⁾	Units
Switch						
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}	(Note 3)	0V		V+	V
On-Resistance	R _{ON}	V+ = 3V, V- = 0V, V _{NC} or V _{NO} = 1.5V, I _{COM} = 1.0mA, V _{INH} = 2.4V, V _{INL} = 0.8V	T _A = +25°C	75	185	Ω
			T _A = T _{MIN} to T _{MAX}		250	
NC or NO Off Leakage Current ⁽⁸⁾	I _{NC(OFF)} or I _{NO(OFF)}	V _{COM} = 0V, V _{NC} or V _{NO} = 3V, V+ = 3.6V, V- = 0V	T _A = +25°C	-80	80	nA
			T _A = T _{MIN} to T _{MAX}	-100	100	
COM Leakage Current ⁽⁸⁾	I _{COM(ON)}	V _{COM} = 3V, V _{NC} or V _{NO} = 3V, V+ = 3.6V, V- = 0V	T _A = +25°C	-80	80	nA
			T _A = T _{MIN} to T _{MAX}	-100	100	
Digital Logic Input						
Input Current with Input Voltage High	I _{INH}	V _{IN} = 2.4V, all others = 0.8V	-1.0	0.005	1.0	μA
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V, all others = 2.4V	-1.0	0.005	1.0	μA
Dynamic						
Turn-On-Time ⁽³⁾	t _{ON}	V _{COM} = 1.5V, Figure 2	T _A = +25°C		400	ns
Turn-off Time ⁽³⁾	t _{OFF}	V _{COM} = 1.5V, Figure 2	T _A = +25°C		150	ns
Break-Before-Make Time Delay ⁽³⁾	t _D	Figure 5	T _A = +25°C	5	20	ns
Charge Injection ⁽³⁾	V _{C_{TE}}	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0 ohm Figure 6	T _A = +25°C	1	5	pC
Supply						
Power-Supply Range	V+		2.7		16	V
Positive Supply Current	I+	All channels on or off, V _{IN} = 0V or V+, V+ = 3.6V, V- = 0V	-1.0	0.01	1.0	μA
Negative Supply Current	I-	All channels on or off, V _{IN} = 0V or V+, V+ = 3.6V, V- = 0V	-1.0	-0.01	1.0	μA

Notes:

2. The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.
3. Guaranteed by design
4. ΔR_{ON} = ΔR_{ON(MAX)}. On-resistance match between channels and flatness are guaranteed only with specified voltages. Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal range.
5. Leakage parameters are guaranteed by design.
6. See Figure 6. Off isolation = 20log₁₀ V_{COM}/V_{NC} or V_{NO}, V_{COM} = output, V_{NC} or V_{NO} = input to off switch
7. Between any two switches. See Figure 3.
8. Leakage testing at single supply is guaranteed by design with dual supplies.

Test Circuits/Timing Diagrams

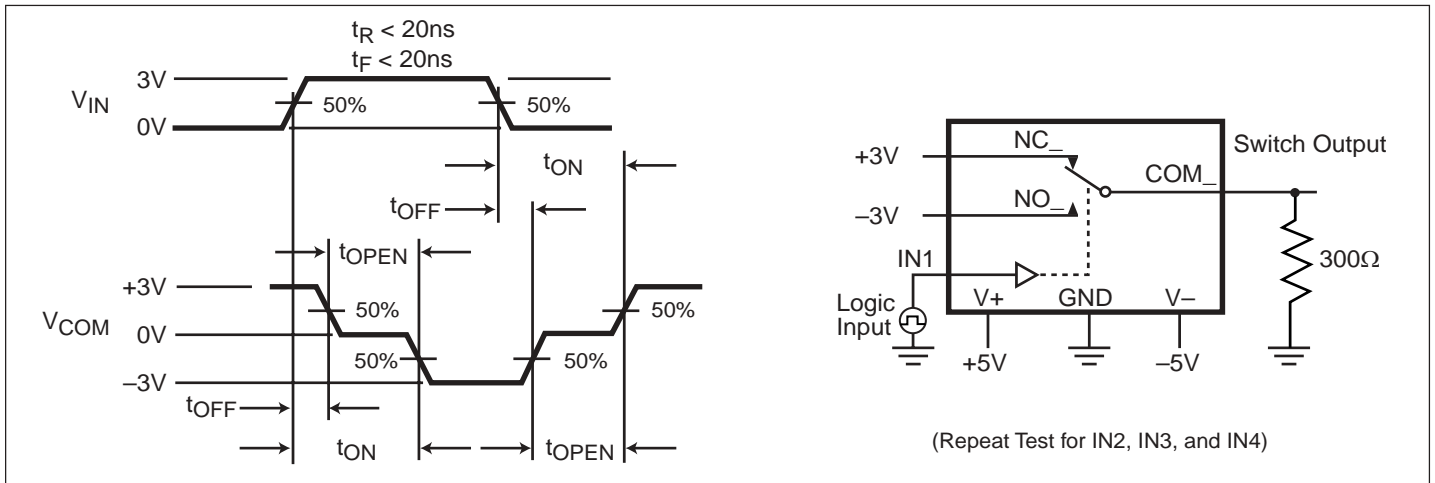


Figure 2. Switching-Time Circuit

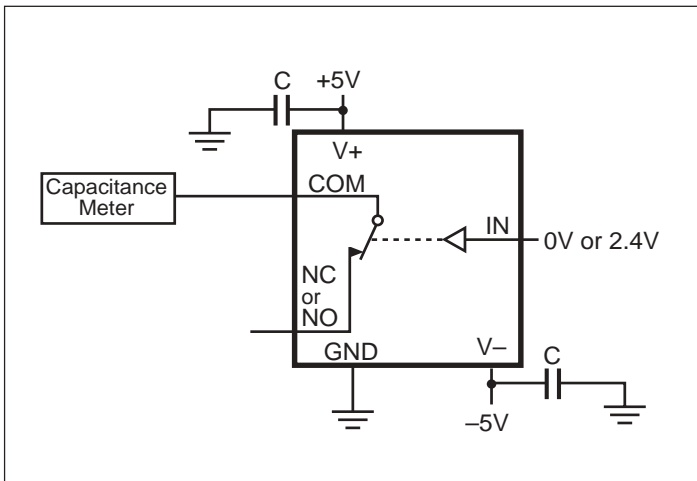


Figure 3. Channel Off Capacitance

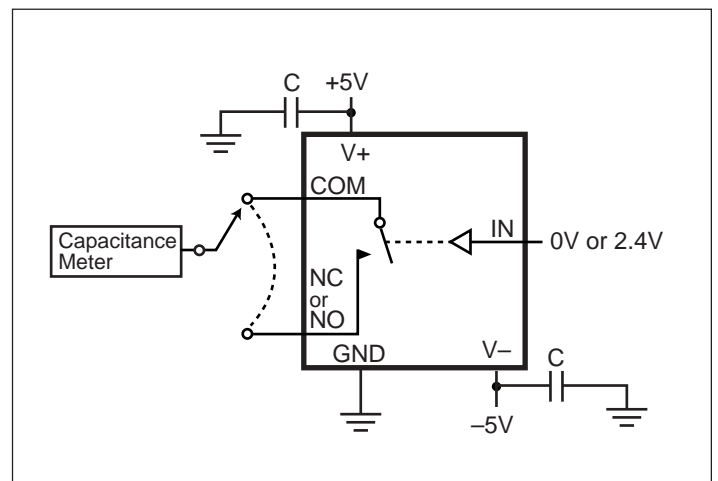


Figure 4. Channel On Capacitance

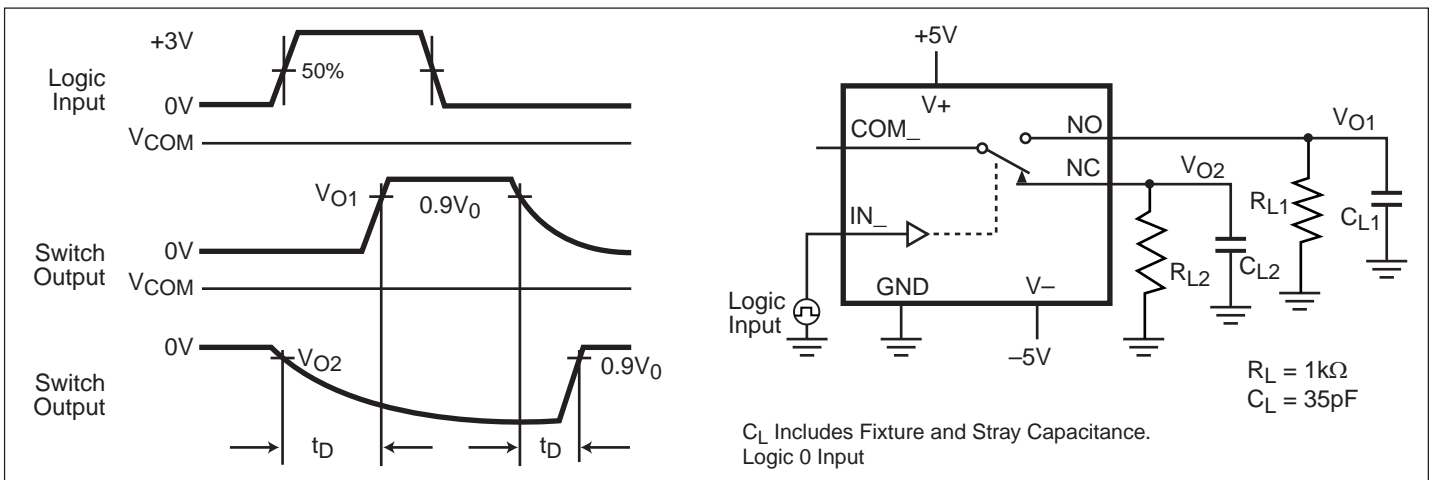


Figure 5. Break-Before-Make Delay

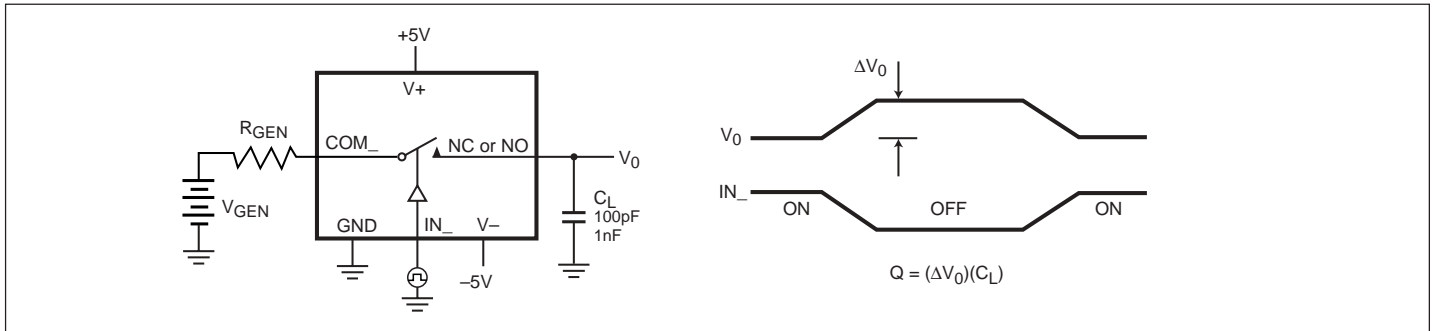


Figure 6. Charge Injection

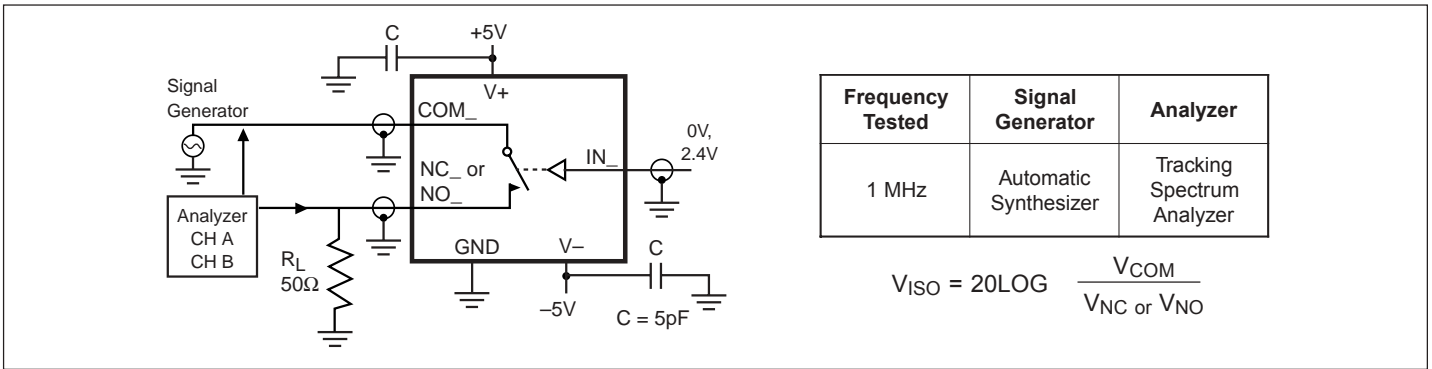


Figure 7. Off Isolation

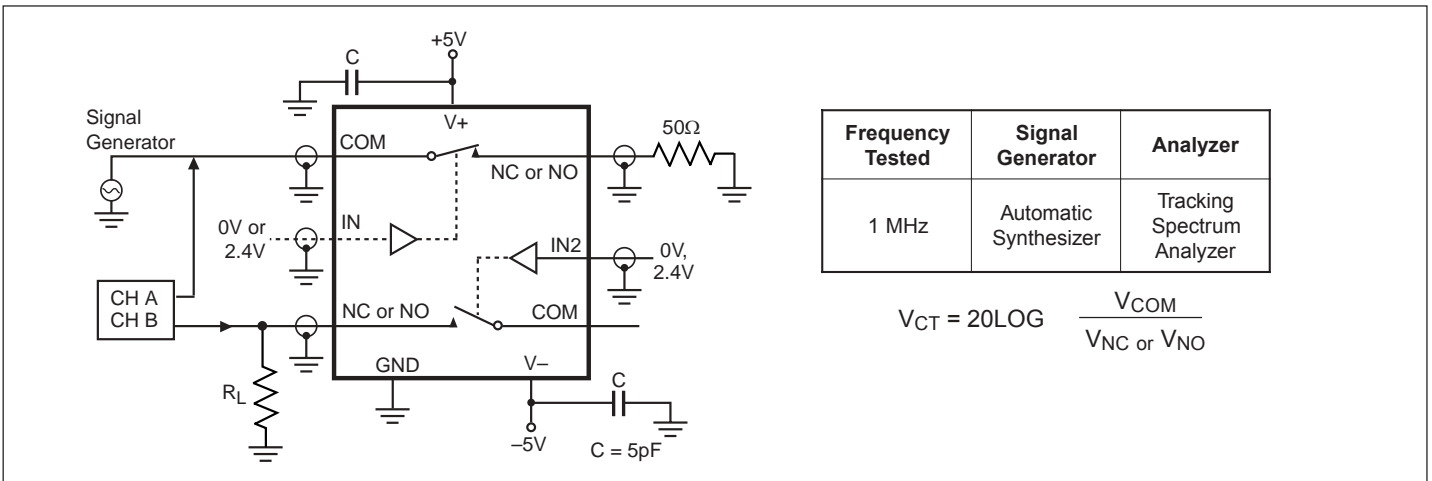
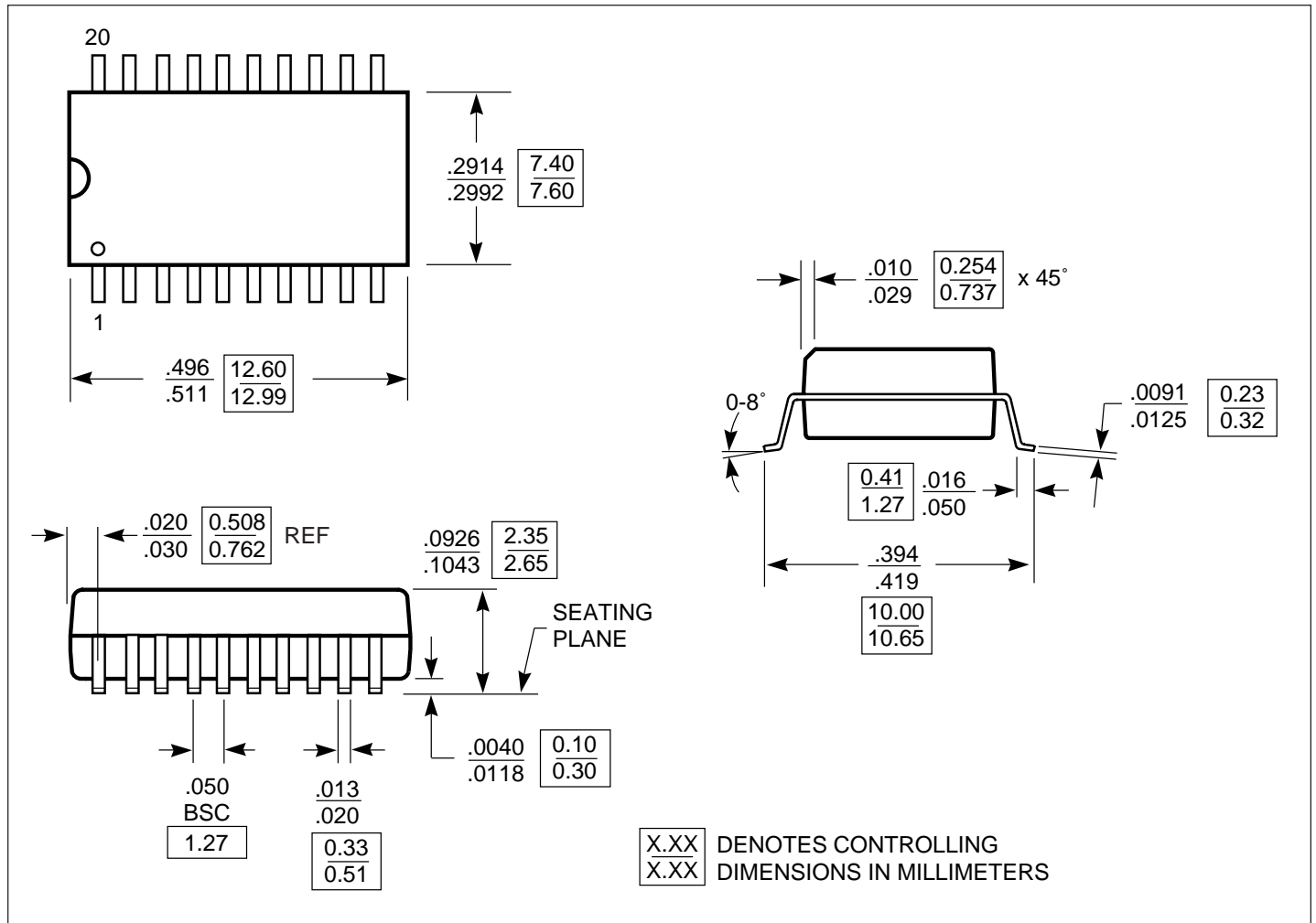


Figure 8. Crosstalk Test Circuit

Packaging Mechanical: 20-pin SOIC (package code S)



Ordering Information

Part Number	Temperature Range	Pin - Package
PS394CWP	0°C to +70°C	20-pin Wide SOIC
PS394EWP	-40°C to +85°C	20-pin Wide SOIC