

## Precision Wide Bandwidth Analog Switches

### Features

- Single-Supply Operation (+2V to +6V)
- Rail-to-Rail Analog Signal Dynamic Range
- Low On-Resistance (6Ω typ with 5V supply)  
Minimizes Distortion and Error Voltages
- On-Resistance Matching Channels, 0.8Ω typ
- On-Resistance Flatness, 3Ω typ
- Low Charge Injection Reduces Glitch Errors. Q = 4pC typ
- Replaces Mechanical Relays
- High Speed.  $t_{ON}$  = 10ns typ
- Low Off-Isolation: -72dB @ 1MHz
- Wide -3dB Bandwidth: 170 MHz
- High-Current Channel Capability: >100mA
- TTL/CMOS Logic Compatible
- Low Power Consumption (0.5μW typ)
- Pin-compatible with DG41X, MAX31X

### Applications

- Audio, Video Switching and Routing
- Battery-Powered Communication Systems
- Computer Peripherals
- Telecommunications
- Portable Instrumentation

### Description

The PI5A317A/381A/319A are analog switches designed for single-supply operation. These high-precision device is ideal for low-distortion audio, video, signal switching and routing.

The PI5A317A is a single-pole single-throw (SPST), normally closed (NC) switch. The PI5A318A has the same pinout but is a single-pole, single-throw (SPST, normally open (NO) function. The PI5A319A is a single-pole, double-throw (SPDT) switch

Each switch conducts current equally well in either direction when on. When off, they block voltages up to V<sub>CC</sub>.

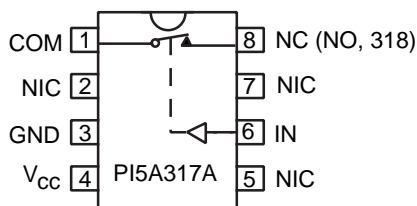
The PI5A317A/381A/319A are fully specified with +5V and +3.3V supplies. With +5V, they guarantee <10Ω on-resistance. On-resistance matching between channels is within 2Ω. On-resistance flatness is less than 5Ω over the specified range. This switch family also guarantees fast switching speeds ( $t_{ON}$  < 20ns).

These products are available in a 8-pin narrow body SOIC, and PDIP packages for operation over the industrial (-40°C to +85 °C) temperature range.

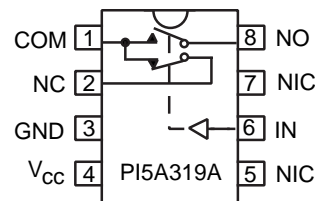
### Ordering Information

Part Number	Package
PI5A317AP	8-Pin PDIP
PI5A317AW	Narrow Body SOIC-8
PI5A318AP	8-Pin PDIP
PI5A318AW	Narrow Body SOIC-8
PI5A319AP	8-Pin PDIP
PI5A319AW	Narrow Body SOIC-8

### Functional Diagram, Pin Configuration and Truth Table



IN	PI5A317A	PI5A318A
0	ON	OFF
1	OFF	ON



IN	SW1	SW2
0	ON	OFF
1	OFF	ON

Switches shown for Logic "0" input  
 NC = Normally Open, NO = Normally Closed, NIC = Not Internally Connected

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### Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .....	-65°C to +150°C
Ambient Temperature with Power Applied .....	-40°C to +85°C
Supply Voltage to Ground Potential (Inputs & Vcc Only) .....	-0.5V to +7.0V
Supply Voltage to Ground Potential (Outputs & D/O Only) .....	-0.5V to +7.0V
DC Input Voltage .....	-0.5V to Vcc+0.5V
DC Output Current .....	120 mA
Power Dissipation .....	0.5W

**Note:**

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

### Single 5.0V Supply

**DC Electrical Characteristics** (Over the Operating Range, TA = -40°C to +85°C, VCC = 5V ±10%, GND = 0V)

Parameters	Description	Test Conditions <sup>(1)</sup>	Min.	Typ <sup>(2)</sup>	Max.	Units
VANALOG	Analog Signal Range <sup>(2)</sup>		0	—	5	V
RON	ON-Resistance	INC or NO = 10 mA to 30 mA	—	6	12	Ω
ΔRON	Match Between Channels	(319A)	—	0.8	2	Ω
RFLAT(ON)	RON Flatness <sup>(4)</sup>	ION = 1 mA, VNO, VNC = 0V to VCC	—	3	5	Ω
INO(OFF) INC(ON)	Off Leakage Current	VNO, VNC = 4.5V	-80	—	80	nA
ICOM(ON)	On Leakage Current	VNO, VNC = 4.5V	-30	—	30	nA
IO	Output Current	VNO, VNC or VCOM = 0V to VCC	100	—	—	mA
VIH	Input HIGH Voltage	Guaranteed Logic HIGH Level	2.0	—	—	V
VIL	Input LOW Voltage	Guaranteed Logic LOW Level	-0.5	—	0.8	V
IiH	Input HIGH Current	VCC = Max., VIN = VCC	—	—	±1	μA
IiL	Input LOW Current	VCC = Max., VIN = GND	—	—	±1	μA
ICC	Quiescent Supply Current	VCC = 5.5V, Vin = 0V or Vcc	—	—	1	μA

**Dynamic Electrical Characteristics** (Over the Operating Range, TA = -40°C to +85°C, VCC = 5V ±10%, GND = 0V)

Parameters	Description	Test Conditions <sup>(1)</sup>	Min.	Typ <sup>(2)</sup>	Max.	Units
tON	Turn-on Time	VCOM = 3.0V, see Figure 1	—	10	20	ns
tOFF	Turn-off Time	VCOM = 3.0V, see Figure 1	—	4	10	ns
Q	Charge Injection <sup>(2)</sup>	CL = 0.5 nF, VGen = 0V, see Figure 4	—	3	5	pC
C(OFF)	NC or NO Capacitance	f = 1 kHz	—	13	—	pF
CCOM(ON/OFF)	COM On Capacitance	f = 1 kHz (319A)	—	45	—	pF
CCOM(OFF)	COM Off Capacitance	f = 1 kHz (317A, 318A)	—	13	—	pF
OIRR	Off Isolation	RL = 100 Ω, f = 1 MHz, see Figure 2	—	-72	—	dB
BW	Bandwidth -3 dB	RL = 100 Ω (319A), see Figure 3 RL = 100 Ω (317A, 318A), see Figure 3	—	106 200	—	MHz MHz
D	Distortion RFLAT/RL	RL = 100 Ω	—	4	—	%

**Notes:**

1. For Max or Min. conditions, use appropriate value specified under Electrical Characteristics for applicable device type.
2. Guaranteed by design.

**Single 3.3V Supply**
**DC Electrical Characteristics** (Over the Operating Range,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ ,  $GND = 0\text{V}$ )

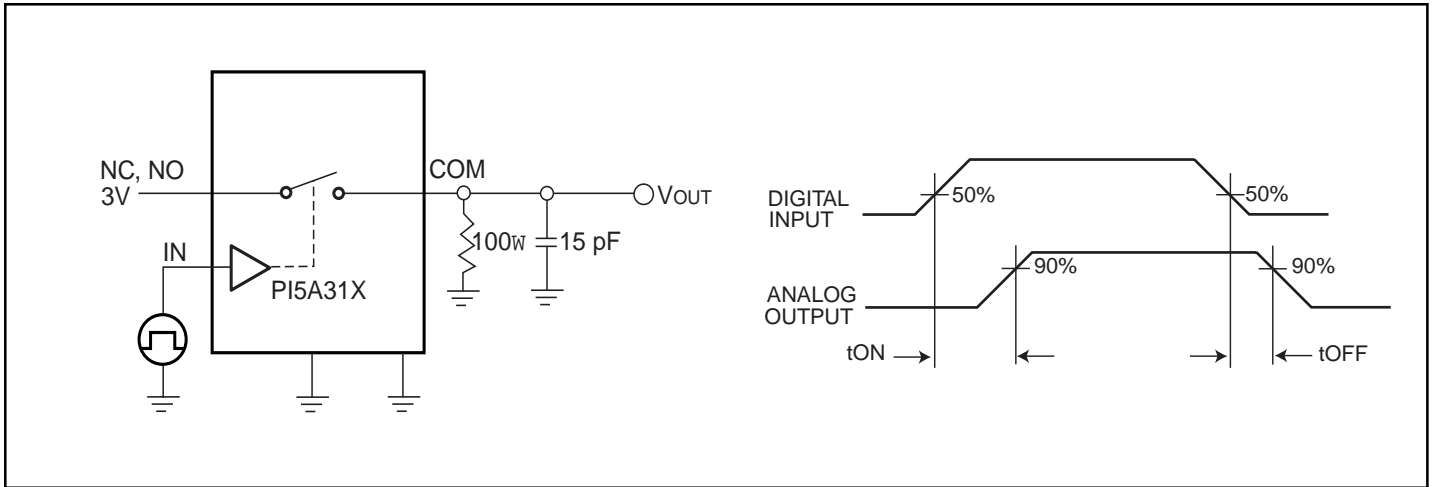
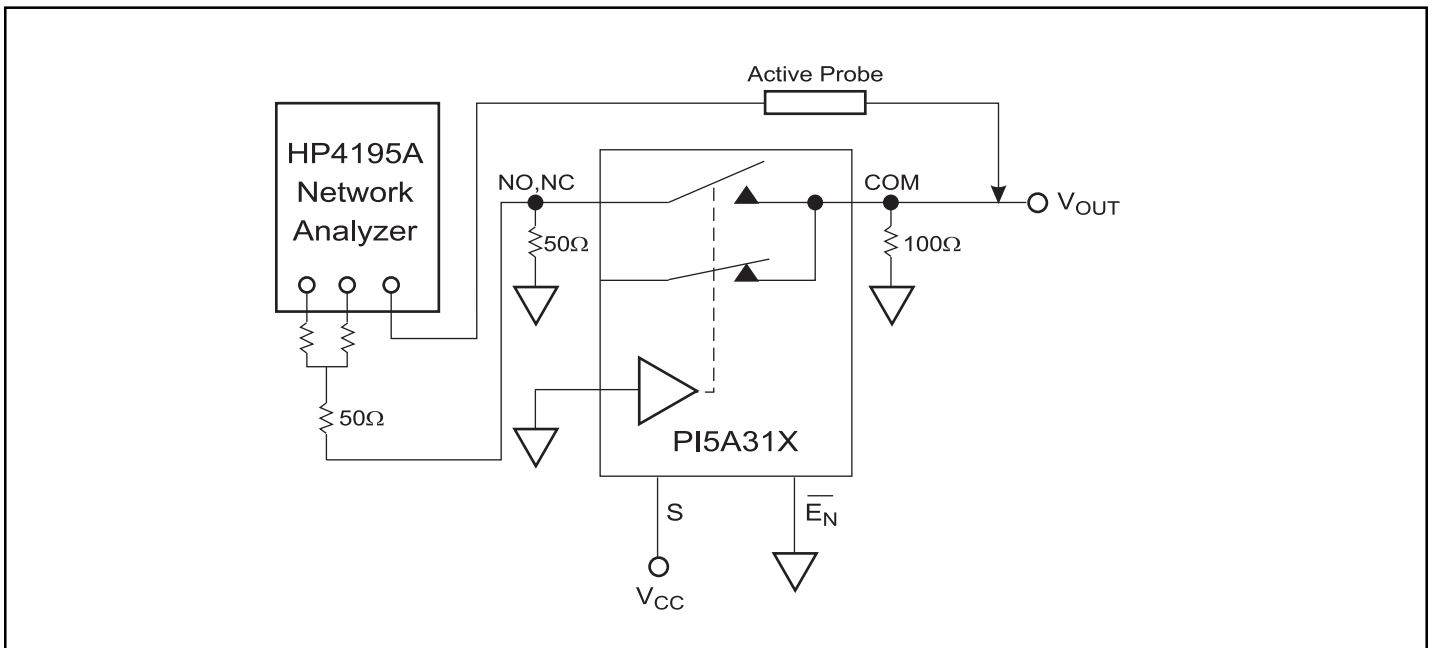
Parameters	Description	Test Conditions <sup>(1)</sup>	Min.	Typ <sup>(2)</sup>	Max.	Units
$V_{ANALOG}$	Analog Signal Range		0	—	$V_{CC}$	V
$R_{ON}$	ON-Resistance	$I_{ON} = 10\text{ mA to }30\text{ mA}$	—	18	22	$\Omega$
$\Delta R_{ON}^{(3)}$	Match Between Channels		—	1	3	
$R_{FLAT(ON)}$	$R_{ON}$ Flatness	$I_{ON} = 1\text{ mA}$ , $V_{NO}$ , $V_{NC} = 0\text{V to }V_{CC}$	—	8.7	12.5	
$I_{NO(OFF)}$ $I_{NC(ON)}$	Off Leakage Current	$V_{NO}$ , $V_{NC} = 3.0\text{V}$	-80	—	80	nA
$I_{COM(ON)}$	On Leakage Current	$V_{NO}$ , $V_{NC} = 3.0\text{V}$	-80	—	80	
$I_O$	Output Current	$V_{NO}$ , $V_{NC}$ or $V_{COM} = 0\text{V to }V_{CC}$	80	—	—	mA
$V_{IH}$	Input HIGH Voltage	Guaranteed Logic HIGH Level	2.0	—	—	V
$V_{IL}$	Input LOW Voltage	Guaranteed Logic LOW Level	-0.5	—	0.8	
$I_{IH}$	Input HIGH Current	$V_{CC} = \text{Max.}$ , $V_{IN} = V_{CC}$	—	—	$\pm 1$	$\mu\text{A}$
$I_{IL}$	Input LOW Current	$V_{CC} = \text{Max.}$ , $V_{IN} = GND$	—	—	$\pm 1$	
$I_{CC}$	Quiescent Supply Current	$V_{CC} = \text{Max.}$ , $V_{IN} = 0\text{V or }V_{CC}$	—	—	1	

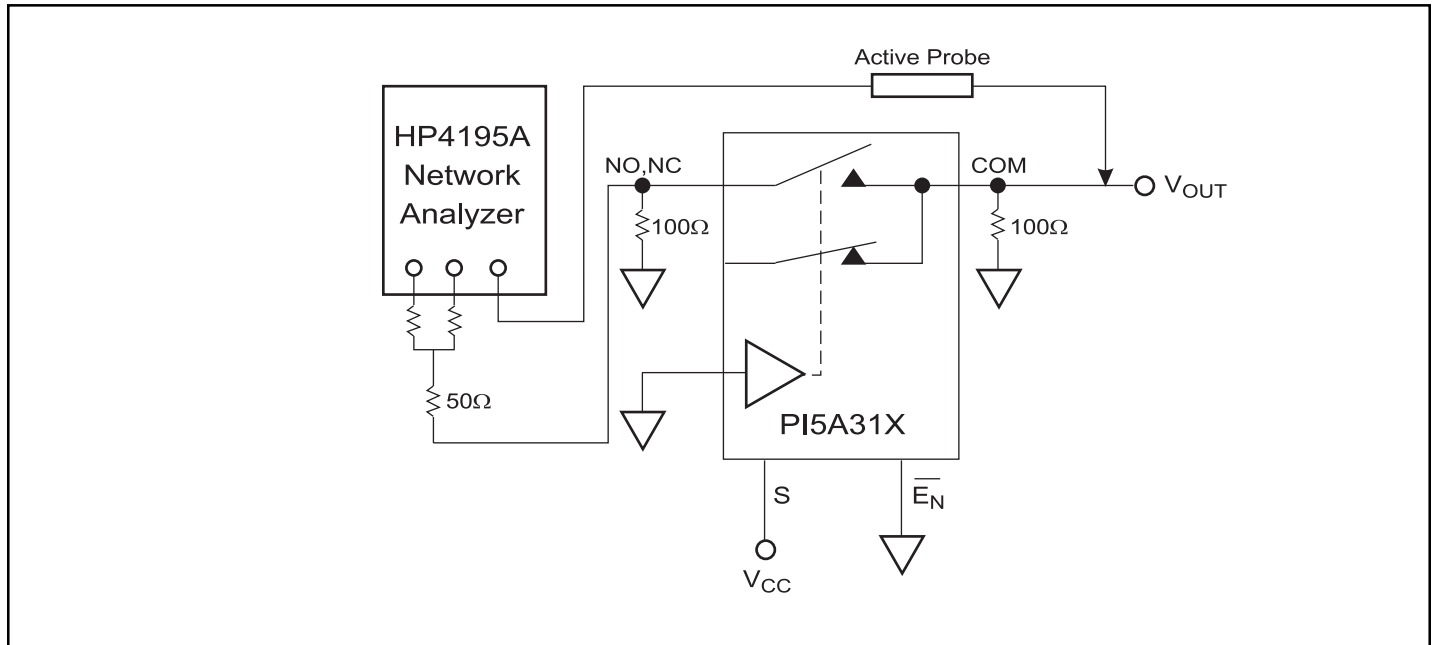
**Dynamic Electrical Characteristics** (Over the Operating Range,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ ,  $GND = 0\text{V}$ )

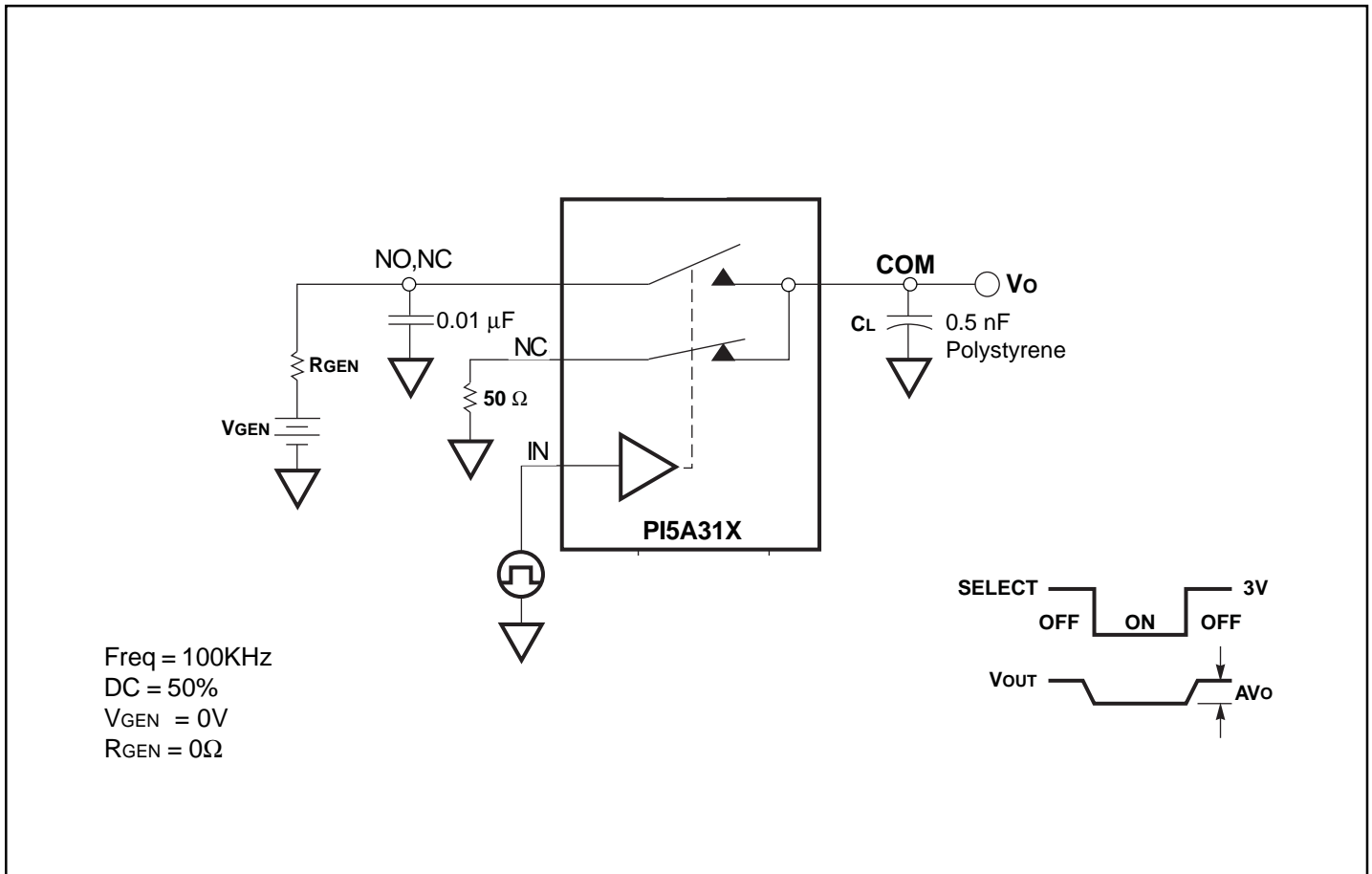
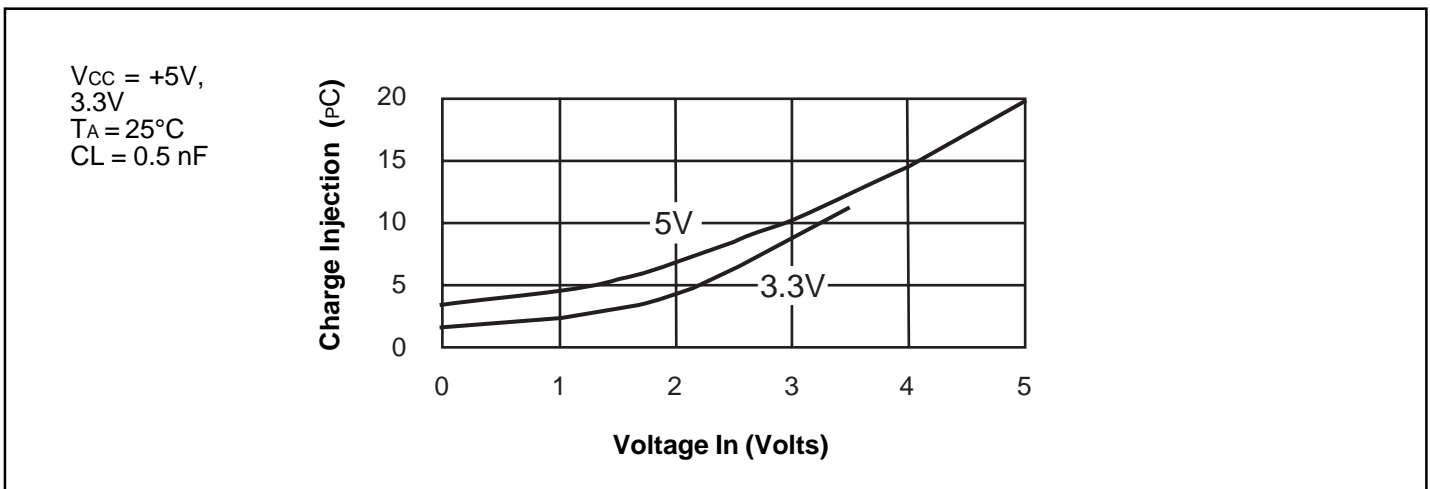
Parameters	Description	Test Conditions <sup>(1)</sup>	Min.	Typ <sup>(2)</sup>	Max.	Units
$t_{ON}$	Turn-on Time	$V_{COM} = 3.0\text{V}$ , see Figure 1	—	28	40	ns
$t_{OFF}$	Turn-off Time	$V_{COM} = 3.0\text{V}$ , see Figure 1	—	4	20	ns
Q	Charge Injection <sup>(2)</sup>	$C_L = 1.0\text{ nF}$ , $V_{Gen} = 0\text{V}$ , see Figure 4	—	3	5	pC
$C_{(OFF)}$	NC or NO Capacitance	$f = 1\text{ kHz}$	—	15	—	pF
$C_{COM(ON/OFF)}$	COM On/Off Capacitance	$f = 1\text{ kHz}$ (319)	—	50	—	pF
$C_{COM(OFF)}$	COM Off Capacitance	$f = 1\text{ kHz}$ (317, 318)	—	15	—	pF
OIRR	Off Isolation	$R_L = 100\ \Omega$ , $f = 1\text{ MHz}$ , see Figure 2	—	72	—	dB
BW	Bandwidth -3 dB	$R_L = 100\ \Omega$ (319), see Figure 3	—	90	—	MHz
		$R_L = 100\ \Omega$ (317, 318), see Figure 3	—	200	—	MHz
D	Distortion	$R_L = 100\ \Omega$	—	4	—	%

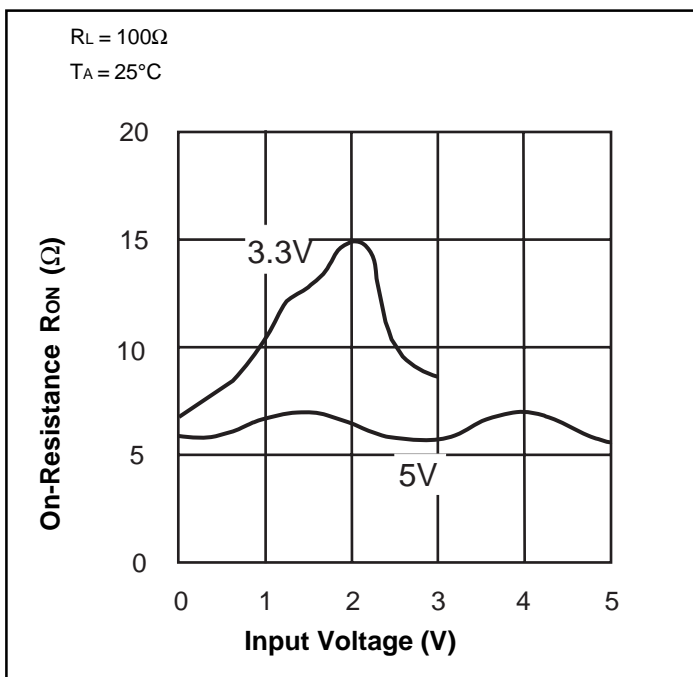
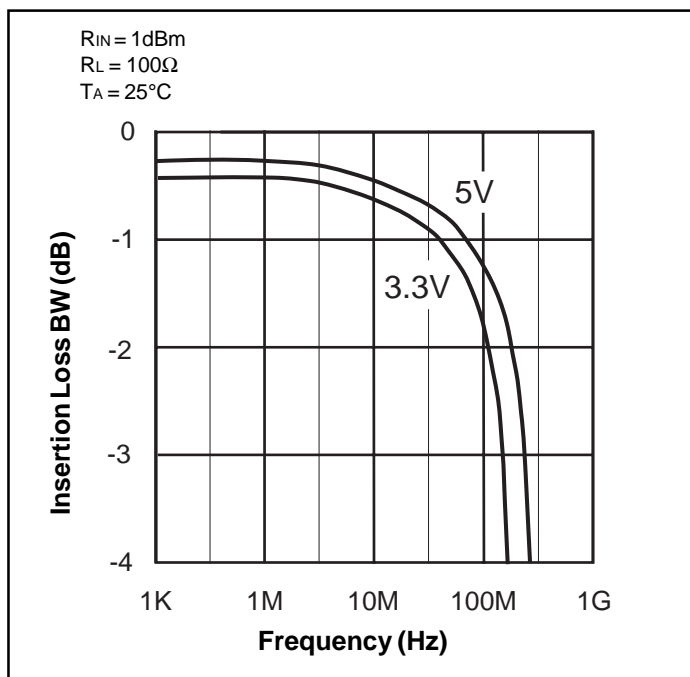
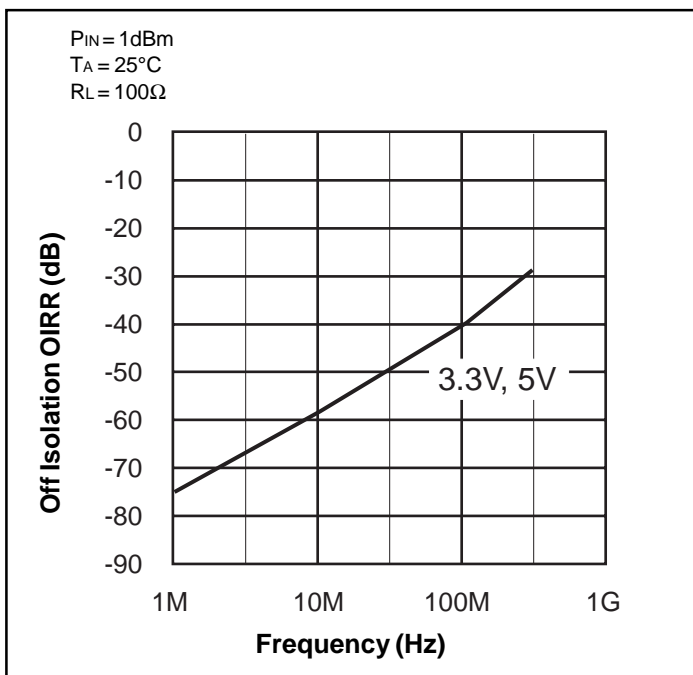
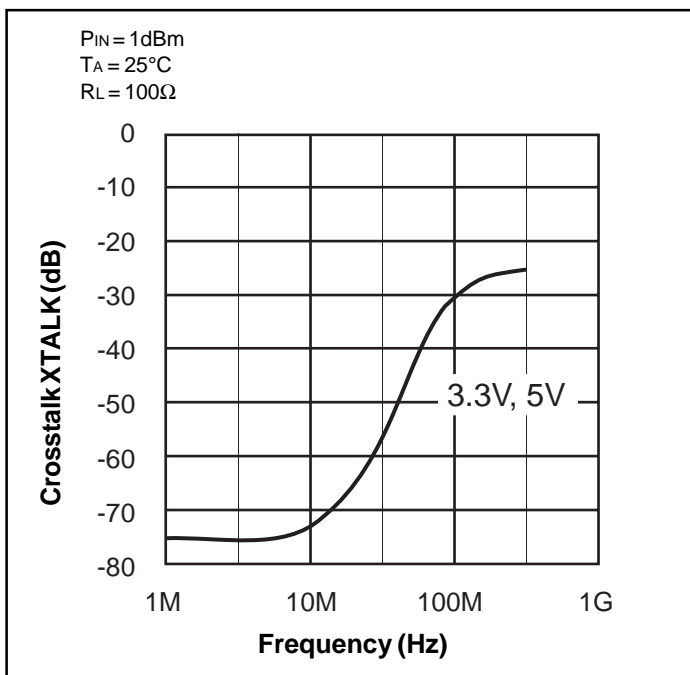
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**Test Circuits**

**Figure 1. Switching Time**

**Figure 2. Off Isolation**

**Typical Operating Characteristics**

**Figure 3. Bandwidth**


**Figure 5. Charge Injection**

**Figure 6. Charge Injection vs Analog Voltage**


**Figure 7. On-Resistance vs. Input Voltage**

**Figure 8. Insertion Loss vs. Frequency**

**Figure 9. Off Isolation vs. Frequency**

**Figure 10. Crosstalk vs Frequency**