High Voltage Latch-Up Proof, Dual SPDT Switches

Data Sheet

ADG5436

FEATURES

Latch-up proof
8 kV HBM ESD rating
Low on resistance (<10 Ω)
±9 V to ±22 V dual-supply operation
9 V to 40 V single-supply operation
48 V supply maximum ratings
Fully specified at ±15 V, ±20 V, +12 V, and +36 V
V_{SS} to V_{DD} analog signal range

APPLICATIONS

Relay replacement
Automatic test equipment
Data acquisition
Instrumentation
Avionics
Audio and video switching
Communication systems

FUNCTIONAL BLOCK DIAGRAMS
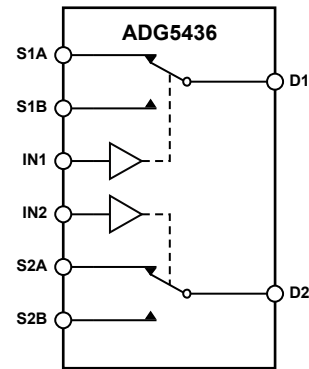
SWITCHES SHOWN FOR A LOGIC 1 INPUT.

Figure 1. TSSOP Package

SWITCHES SHOWN FOR A LOGIC 1 INPUT.

Figure 2. LFCSP Package

GENERAL DESCRIPTION

The ADG5436 is a monolithic CMOS device containing two independently selectable single-pole/double-throw (SPDT) switches. An EN input on the LFCSP package enables or disables the device. When disabled, all channels switch off. Each switch conducts equally well in both directions when on and has an input signal range that extends to the supplies. In the off condition, signal levels up to the supplies are blocked. Both switches exhibit break-before-make switching action for use in multiplexer applications.

The on-resistance profile is very flat over the full analog input range, ensuring excellent linearity and low distortion when switching audio signals.
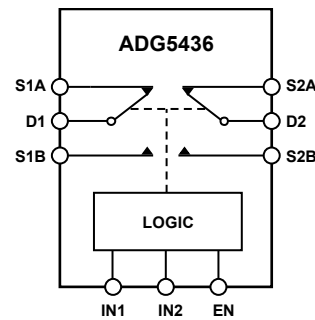
PRODUCT HIGHLIGHTS

1. Trench isolation guards against latch-up. A dielectric trench separates the P and N channel transistors thereby preventing latch-up even under severe overvoltage conditions.
2. Low R_{ON}.
3. Dual-supply operation. For applications where the analog signal is bipolar, the ADG5436 can be operated from dual supplies up to ±22 V.
4. Single-supply operation. For applications where the analog signal is unipolar, the ADG5436 can be operated from a single-rail power supply up to 40 V.
5. 3 V logic compatible digital inputs: V_{INH} = 2.0 V, V_{INL} = 0.8 V.
6. No V_L logic power supply required.

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REVISION HISTORY

SPECIFICATIONS

±15 V DUAL SUPPLY

V_{DD} = +15 V ± 10%, V_{SS} = −15 V ± 10%, GND = 0 V, unless otherwise noted.

Table 1.

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			V_{DD} to V_{SS}	V	
On Resistance, R_{ON}	9.8			Ω typ	V_S = ±10 V, I_S = −10 mA; see Figure 25
	11	14	16	Ω max	V_{DD} = +13.5 V, V_{SS} = −13.5 V
On-Resistance Match Between Channels, ΔR_{ON}	0.35			Ω typ	V_S = ±10 V , I_S = −10 mA
	0.7	0.9	1.1	Ω max	
On-Resistance Flatness, $R_{FLAT (ON)}$	1.2			Ω typ	V_S = ±10 V, I_S = −10 mA
	1.6	2	2.2	Ω max	
LEAKAGE CURRENTS					V_{DD} = +16.5 V, V_{SS} = −16.5 V
Source Off Leakage, I_S (Off)	±0.05			nA typ	V_S = ±10 V, V_D = ∓ 10 V; see Figure 28
	±0.25	±0.75	±6	nA max	
Drain Off Leakage, I_D (Off)	±0.1			nA typ	V_S = ±10 V, V_D = ∓ 10 V; see Figure 28
	±0.4	±2	±12	nA max	
Channel On Leakage, I_D (On), I_S (On)	±0.1			nA typ	V_S = V_D = ±10 V; see Figure 24
	±0.4	±2	±12	nA max	
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2.0	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current, I_{INL} or I_{INH}	0.002			µA typ	V_{IN} = V_{GND} or V_{DD}
			±0.1	µA max	
Digital Input Capacitance, C_{IN}	5			pF typ	
DYNAMIC CHARACTERISTICS[1]					
Transition Time, $t_{TRANSITION}$	170			ns typ	R_L = 300 Ω, C_L = 35 pF
	235	285	316	ns max	V_S = 10 V; see Figure 31
t_{ON}	173			ns typ	R_L = 300 Ω, C_L = 35 pF
	230	280	351	ns max	V_S = 10 V; see Figure 33
t_{OFF}	124			ns typ	R_L = 300 Ω, C_L = 35 pF
	160	193	218	ns max	V_S = 10 V; see Figure 33
Break-Before-Make Time Delay, t_D	55			ns typ	R_L = 300 Ω, C_L = 35 pF
			18	ns min	V_{S1} = V_{S2} = 10 V; see Figure 32
Charge Injection, Q_{INJ}	200			pC typ	V_S = 0 V, R_S = 0 Ω, C_L = 1 nF; see Figure 34
Off Isolation	−78			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; see Figure 27
Channel-to-Channel Crosstalk	−58			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; see Figure 26
Total Harmonic Distortion + Noise	0.009			% typ	R_L = 1 kΩ, 15 V p-p, f = 20 Hz to 20 kHz; see Figure 29
−3 dB Bandwidth	102			MHz typ	R_L = 50 Ω, C_L = 5 pF; see Figure 30
Insertion Loss	−0.7			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; see Figure 30
C_S (Off)	18			pF typ	V_S = 0 V, f = 1 MHz
C_D (Off)	62			pF typ	V_S = 0 V, f = 1 MHz
C_D (On), C_S (On)	83			pF typ	V_S = 0 V, f = 1 MHz

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
POWER REQUIREMENTS					V_{DD} = +16.5 V, V_{SS} = −16.5 V
I_{DD}	45			µA typ	Digital inputs = 0 V or V_{DD}
	55		70	µA max	
I_{SS}	0.001			µA typ	Digital inputs = 0 V or V_{DD}
			1	µA max	
V_{DD}/V_{SS}			±9/±22	V min/V max	GND = 0 V

[1] Guaranteed by design; not subject to production test.

±20 V DUAL SUPPLY

V_{DD} = +20 V ± 10%, V_{SS} = −20 V ± 10%, GND = 0 V, unless otherwise noted.

Table 2.

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			V_{DD} to V_{SS}	V	
On Resistance, R_{ON}	9			Ω typ	V_S = ±15 V, I_S = −10 mA; see Figure 25
	10	13	15	Ω max	V_{DD} = +18 V, V_{SS} = −18 V
On-Resistance Match Between Channels, ΔR_{ON}	0.35			Ω typ	V_S = ±15 V , I_S = −10 mA
	0.7	0.9	1.1	Ω max	
On-Resistance Flatness, $R_{FLAT (ON)}$	1.5			Ω typ	V_S = ±15 V, I_S = −10 mA
	1.8	2.2	2.5	Ω max	
LEAKAGE CURRENTS					V_{DD} = +22 V, V_{SS} = −22 V
Source Off Leakage, I_S (Off)	±0.05			nA typ	V_S = ±15 V, V_D = ∓15 V; see Figure 28
	±0.25	±0.75	±6	nA max	
Drain Off Leakage, I_D (Off)	±0.1			nA typ	V_S = ±15 V, V_D = ∓15 V; see Figure 28
	±0.4	±2	±12	nA max	
Channel On Leakage, I_D (On), I_S (On)	±0.1			nA typ	V_S = V_D = ±15 V; see Figure 24
	±0.4	±2	±12	nA max	
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2.0	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current, I_{INL} or I_{INH}	0.002			µA typ	V_{IN} = V_{GND} or V_{DD}
			±0.1	µA max	
Digital Input Capacitance, C_{IN}	5			pF typ	
DYNAMIC CHARACTERISTICS[1]					
Transition Time, $t_{TRANSITION}$	158			ns typ	R_L = 300 Ω, C_L = 35 pF
	217	260	293	ns max	V_S = 10 V; see Figure 31
t_{ON}	164			ns typ	R_L = 300 Ω, C_L = 35 pF
	213	256	287	ns max	V_S = 10 V; see Figure 33
t_{OFF}	110			ns typ	R_L = 300 Ω, C_L = 35 pF
	152	173	194	ns max	V_S = 10 V; see Figure 33
Break-Before-Make Time Delay, t_D	50			ns typ	R_L = 300 Ω, C_L = 35 pF
			15	ns min	V_{S1} = V_{S2} = 10 V; see Figure 32
Charge Injection, Q_{INJ}	250			pC typ	V_S = 0 V, R_S = 0 Ω, C_L = 1 nF; see Figure 34
Off Isolation	−78			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; see Figure 27
Channel-to-Channel Crosstalk	−58			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; see Figure 26
Total Harmonic Distortion + Noise	0.007			% typ	R_L = 1 kΩ, 20 V p-p, f = 20 Hz to 20 kHz; see Figure 29
−3 dB Bandwidth	100			MHz typ	R_L = 50 Ω, C_L = 5 pF; see Figure 30

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
Insertion Loss	−0.6			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 30
C_S (Off)	18			pF typ	$V_S = 0$ V, f = 1 MHz
C_D (Off)	63			pF typ	$V_S = 0$ V, f = 1 MHz
C_D (On), C_S (On)	82			pF typ	$V_S = 0$ V, f = 1 MHz
POWER REQUIREMENTS					$V_{DD} = +22$ V, $V_{SS} = −22$ V
I_{DD}	50			µA typ	Digital inputs = 0 V or V_{DD}
	70		110	µA max	
I_{SS}	0.001			µA typ	Digital inputs = 0 V or V_{DD}
			1	µA max	
V_{DD}/V_{SS}			±9/±22	V min/V max	GND = 0 V

[1] Guaranteed by design; not subject to production test.

12 V SINGLE SUPPLY

$V_{DD} = 12$ V ± 10%, $V_{SS} = 0$ V, GND = 0 V, unless otherwise noted.

Table 3.

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V_{DD}	V	
On Resistance, R_{ON}	19			Ω typ	$V_S = 0$ V to 10 V, $I_S = −10$ mA; see Figure 25
	22	27	31	Ω max	$V_{DD} = 10.8$ V, $V_{SS} = 0$ V
On-Resistance Match Between Channels, ΔR_{ON}	0.4			Ω typ	$V_S = 0$ V to 10 V, $I_S = −10$ mA
	0.8	1	1.2	Ω max	
On-Resistance Flatness, $R_{FLAT\ (ON)}$	4.4			Ω typ	$V_S = 0$ V to 10 V, $I_S = −10$ mA
	5.5	6.5	7.5	Ω max	
LEAKAGE CURRENTS					$V_{DD} = 13.2$ V, $V_{SS} = 0$ V
Source Off Leakage, I_S (Off)	±0.05			nA typ	$V_S = 1$ V/10 V, $V_D = 10$ V/1 V; see Figure 28
	±0.25	±0.75	±6	nA max	
Drain Off Leakage, I_D (Off)	±0.1			nA typ	$V_S = 1$ V/10 V, $V_D = 10$ V/1 V; see Figure 28
	±0.4	±2	±12	nA max	
Channel On Leakage, I_D (On), I_S (On)	±0.1			nA typ	$V_S = V_D = 1$ V/10 V; see Figure 24
	±0.4	±2	±12	nA max	
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2.0	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current, I_{INL} or I_{INH}	0.002			µA typ	$V_{IN} = V_{GND}$ or V_{DD}
			±0.1	µA max	
Digital Input Capacitance, C_{IN}	5			pF typ	
DYNAMIC CHARACTERISTICS[1]					
Transition Time, $t_{TRANSITION}$	250			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	346	437	501	ns max	$V_S = 8$ V; see Figure 31
t_{ON}	250			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	358	445	512	ns max	$V_S = 8$ V; see Figure 33
t_{OFF}	135			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	178	212	237	ns max	$V_S = 8$ V; see Figure 33
Break-Before-Make Time Delay, t_D	125			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
			50	ns min	$V_{S1} = V_{S2} = 8$ V; see Figure 32
Charge Injection, Q_{INJ}	80			pC typ	$V_S = 6$ V, $R_S = 0\ \Omega$, $C_L = 1$ nF; see Figure 34

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
Off Isolation	−78			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 27
Channel-to-Channel Crosstalk	−58			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 26
Total Harmonic Distortion + Noise	0.075			% typ	$R_L = 1\ k\Omega$, 6 V p-p, f = 20 Hz to 20 kHz; see Figure 29
−3 dB Bandwidth	106			MHz typ	$R_L = 50\ \Omega$, $C_L = 5$ pF; see Figure 30
Insertion Loss	−1.3			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 30
C_S (Off)	22			pF typ	$V_S = 6$ V, f = 1 MHz
C_D (Off)	67			pF typ	$V_S = 6$ V, f = 1 MHz
C_D (On), C_S (On)	85			pF typ	$V_S = 6$ V, f = 1 MHz
POWER REQUIREMENTS					$V_{DD} = 13.2$ V
I_{DD}	40			µA typ	Digital inputs = 0 V or V_{DD}
	50		65	µA max	
V_{DD}			9/40	V min/V max	GND = 0 V, $V_{SS} = 0$ V

[1] Guaranteed by design; not subject to production test.

36 V SINGLE SUPPLY

$V_{DD} = 36$ V ± 10%, $V_{SS} = 0$ V, GND = 0 V, unless otherwise noted.

Table 4.

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V_{DD}	V	
On Resistance, R_{ON}	10.6			Ω typ	$V_S = 0$ V to 30 V, $I_S = -10$ mA; see Figure 25
	12	15	17	Ω max	$V_{DD} = 32.4$ V, $V_{SS} = 0$ V
On-Resistance Match Between Channels, ΔR_{ON}	0.35			Ω typ	$V_S = 0$ V to 30 V, $I_S = -10$ mA
	0.7	0.9	1.1	Ω max	
On-Resistance Flatness, $R_{FLAT(ON)}$	2.7			Ω typ	$V_S = 0$ V to 30 V, $I_S = -10$ mA
	3.2	3.8	4.5	Ω max	
LEAKAGE CURRENTS					$V_{DD} = 39.6$ V, $V_{SS} = 0$ V
Source Off Leakage, I_S (Off)	±0.05			nA typ	$V_S = 1$ V/30 V, $V_D = 30$ V/1 V; see Figure 28
	±0.25	±0.75	±6	nA max	
Drain Off Leakage, I_D (Off)	±0.1			nA typ	$V_S = 1$ V/30 V, $V_D = 30$ V/1 V; see Figure 28
	±0.4	±2	±12	nA max	
Channel On Leakage, I_D (On), I_S (On)	±0.1			nA typ	$V_S = V_D = 1$ V/30 V; see Figure 24
	±0.4	±2	±12	nA max	
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2.0	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current, I_{INL} or I_{INH}	0.002			µA typ	$V_{IN} = V_{GND}$ or V_{DD}
			±0.1	µA max	
Digital Input Capacitance, C_{IN}	5			pF typ	

Parameter	25°C	−40°C to +85°C	−40°C to +125°C	Unit	Test Conditions/Comments
DYNAMIC CHARACTERISTICS[1]					
Transition Time, $t_{TRANSITION}$	174			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	246	270	303	ns max	$V_S = 18$ V; see Figure 31
t_{ON}	180			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	247	270	301	ns max	$V_S = 18$ V; see Figure 33
t_{OFF}	127			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
	179	193	215	ns max	$V_S = 18$ V; see Figure 33
Break-Before-Make Time Delay, t_D	55			ns typ	$R_L = 300\ \Omega$, $C_L = 35$ pF
			18	ns min	$V_{S1} = V_{S2} = 18$ V; see Figure 32
Charge Injection, Q_{INJ}	250			pC typ	$V_S = 18$ V, $R_S = 0\ \Omega$, $C_L = 1$ nF; see Figure 34
Off Isolation	−78			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 27
Channel-to-Channel Crosstalk	−58			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 26
Total Harmonic Distortion + Noise	0.03			% typ	$R_L = 1\ k\Omega$, 18 V p-p, f = 20 Hz to 20 kHz; see Figure 29
−3 dB Bandwidth	98			MHz typ	$R_L = 50\ \Omega$, $C_L = 5$ pF; see Figure 30
Insertion Loss	−0.8			dB typ	$R_L = 50\ \Omega$, $C_L = 5$ pF, f = 1 MHz; see Figure 30
C_S (Off)	19			pF typ	$V_S = 18$ V, f = 1 MHz
C_D (Off)	40			pF typ	$V_S = 18$ V, f = 1 MHz
C_D (On), C_S (On)	78			pF typ	$V_S = 18$ V, f = 1 MHz
POWER REQUIREMENTS					$V_{DD} = 39.6$ V
I_{DD}	80			µA typ	Digital inputs = 0 V or V_{DD}
	100		130	µA max	
V_{DD}			9/40	V min/V max	GND = 0 V, $V_{SS} = 0$ V

[1] Guaranteed by design; not subject to production test.

CONTINUOUS CURRENT PER CHANNEL, Sx OR Dx

Table 5.

Parameter	25°C	85°C	125°C	Unit
CONTINUOUS CURRENT, Sx OR Dx				
$V_{DD} = +15$ V, $V_{SS} = −15$ V				
TSSOP ($\theta_{JA} = 112.6$°C/W)	122	77	44	mA maximum
LFCSP ($\theta_{JA} = 30.4$°C/W)	217	116	53	mA maximum
$V_{DD} = +20$ V, $V_{SS} = −20$ V				
TSSOP ($\theta_{JA} = 112.6$°C/W)	130	80	45	mA maximum
LFCSP ($\theta_{JA} = 30.4$°C/W)	229	121	54	mA maximum
$V_{DD} = 12$ V, $V_{SS} = 0$ V				
TSSOP ($\theta_{JA} = 112.6$°C/W)	84	56	36	mA maximum
LFCSP ($\theta_{JA} = 30.4$°C/W)	150	90	48	mA maximum
$V_{DD} = 36$ V, $V_{SS} = 0$ V				
TSSOP ($\theta_{JA} = 112.6$°C/W)	110	70	42	mA maximum
LFCSP ($\theta_{JA} = 30.4$°C/W)	196	109	52	mA maximum

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 6.

Parameter	Rating
V_{DD} to V_{SS}	48 V
V_{DD} to GND	−0.3 V to +48 V
V_{SS} to GND	+0.3 V to −48 V
Analog Inputs[1]	V_{SS} − 0.3 V to V_{DD} + 0.3 V or 30 mA, whichever occurs first
Digital Inputs[1]	V_{SS} − 0.3 V to V_{DD} + 0.3 V or 30 mA, whichever occurs first
Peak Current, Sx or Dx Pins	375 mA (pulsed at 1 ms, 10% duty cycle maximum)
Continuous Current, Sx or Dx[2]	Data + 15%
Temperature Range	
Operating	−40°C to +125°C
Storage	−65°C to +150°C
Junction Temperature	150°C
Thermal Impedance, θ_{JA}	
16-Lead TSSOP (4-Layer Board)	112°C/W
16-Lead LFCSP	30.4°C/W
Reflow Soldering Peak Temperature, Pb Free	260(+0/−5)°C

[1] Overvoltages at the INx, Sx, and Dx pins are clamped by internal diodes. Current should be limited to the maximum ratings given.
[2] See Table 5.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

Only one absolute maximum rating can be applied at any one time.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS
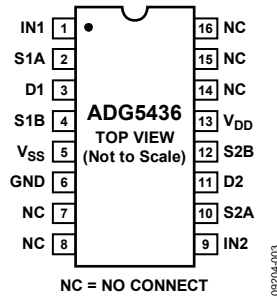
Figure 3. TSSOP Pin Configuration
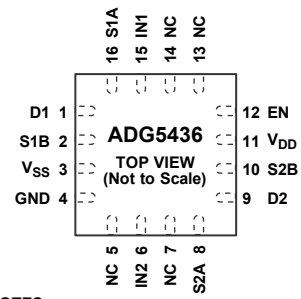
NOTES
1. EXPOSED PAD TIED TO SUBSTRATE, V_SS.
2. NC = NO CONNECT.

Figure 4. LFCSP Pin Configuration

Table 7. Pin Function Descriptions

Pin No.		Mnemonic	Function
TSSOP	**LFCSP**		
1	15	IN1	Logic Control Input 1.
2	16	S1A	Source Terminal 1A. This pin can be an input or output.
3	1	D1	Drain Terminal 1. This pin can be an input or output.
4	2	S1B	Source Terminal 1B. This pin can be an input or output.
5	3	V_SS	Most Negative Power Supply Potential.
6	4	GND	Ground (0 V) Reference.
7, 8, 14 to 16	5, 7, 13, 14	NC	No Connect.
9	6	IN2	Logic Control Input 2.
10	8	S2A	Source Terminal 2A. This pin can be an input or output.
11	9	D2	Drain Terminal 2. This pin can be an input or output.
12	10	S2B	Source Terminal 2B. This pin can be an input or output.
13	11	V_DD	Most Positive Power Supply Potential.
Not applicable	12	EN	Active High Digital Input. When this pin is low, the device is disabled and all switches are off. When this pin is high, INx logic inputs determine the on switches.
Not applicable		EPAD	The exposed pad is connected internally. For increased reliability of the solder joints and maximum thermal capability, it is recommended that the pad be soldered to the substrate, V_SS.

TRUTH TABLE FOR SWITCHES

Table 8. ADG5436 TSSOP Truth Table

INx	SxA	SxB
0	Off	On
1	On	Off

Table 9. ADG5436 LFCSP Truth Table

EN	INx	SxA	SxB
0	X[1]	Off	Off
1	0	Off	On
1	1	On	Off

[1] X is don't care.

TYPICAL PERFORMANCE CHARACTERISTICS
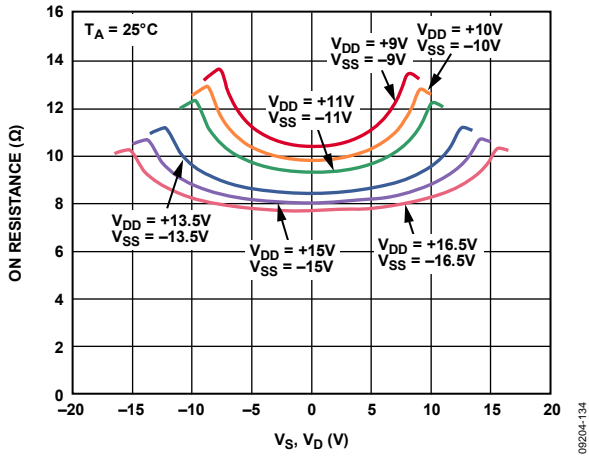
Figure 5. On Resistance vs. V_S, V_D (Dual Supply)
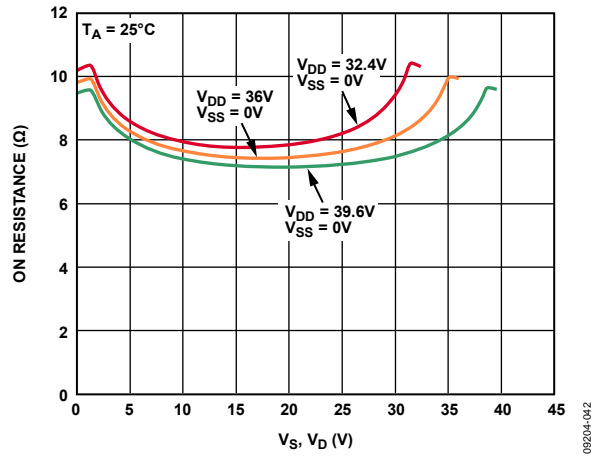
Figure 8. On Resistance vs. V_S, V_D (Single Supply)
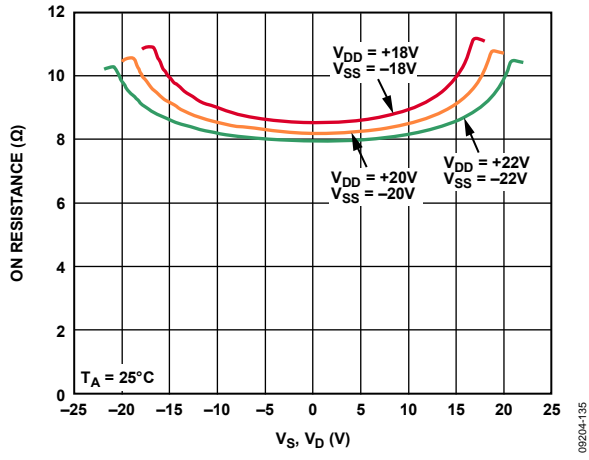
Figure 6. On Resistance vs. V_S, V_D (Dual Supply) Included
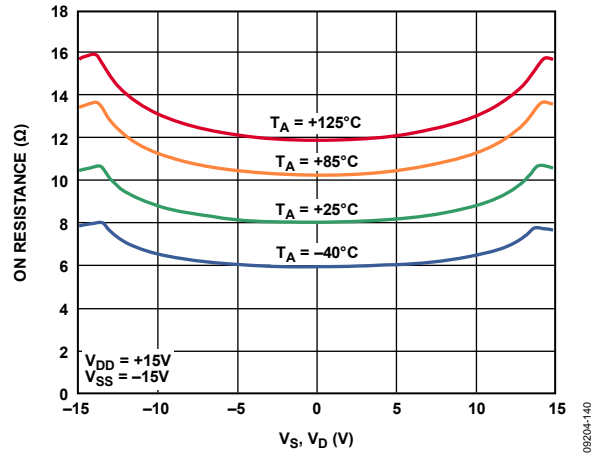
Figure 9. On Resistance vs. V_D or V_S for Different Temperatures, ±15 V Dual Supply
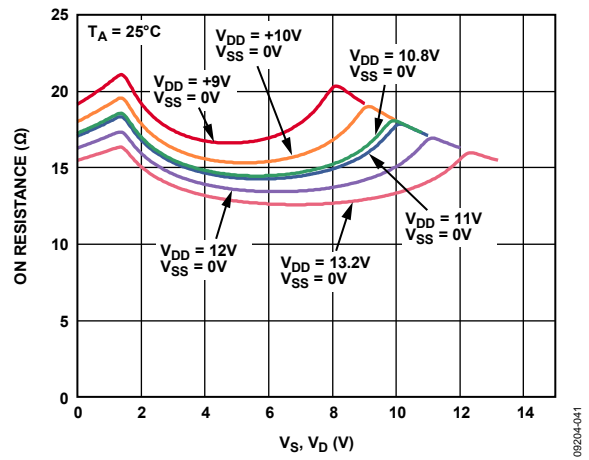
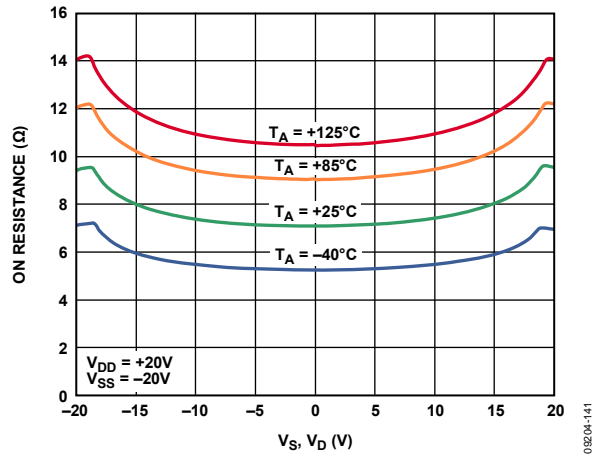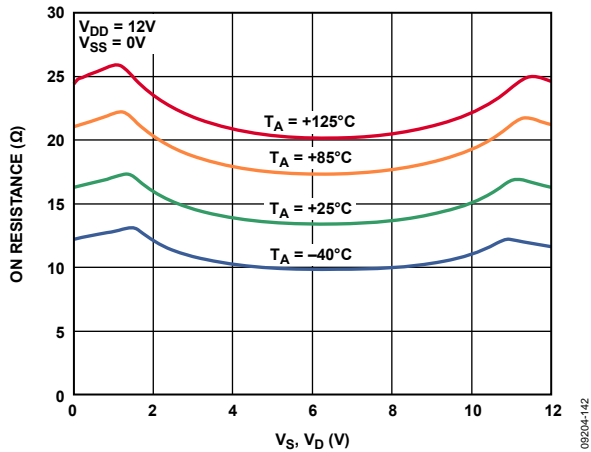

Figure 7. On Resistance vs. V_S, V_D (Single Supply)

Figure 10. On Resistance vs. V_D or V_S for Different Temperatures, ±20 V Dual Supply

Figure 11. On Resistance vs. V_D or V_S for Different Temperatures, 12 V Single Supply
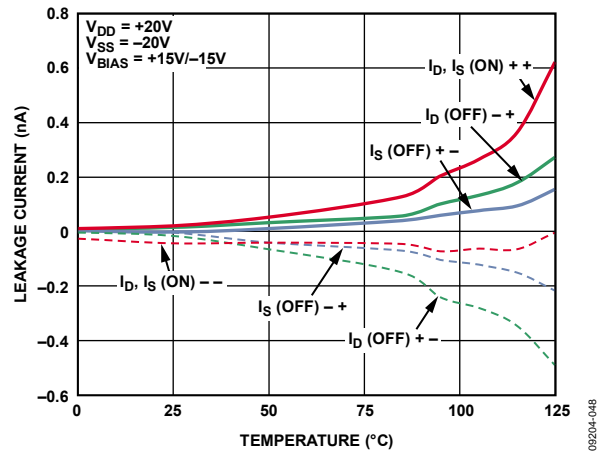
Figure 14. Leakage Currents vs. Temperature, ±20 V Single Supply
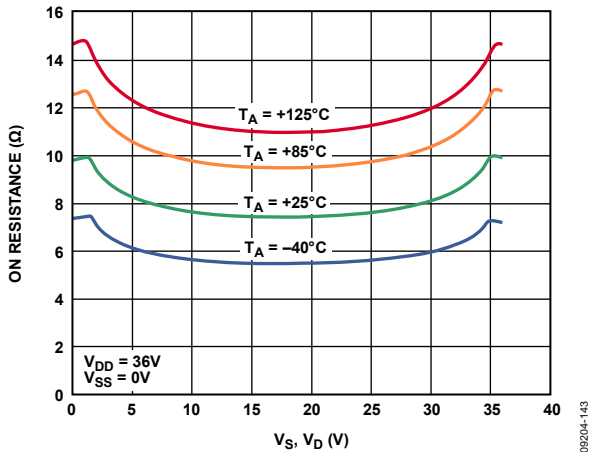
Figure 12. On Resistance vs. V_S (V_D) for Different Temperatures, 36 V Single Supply
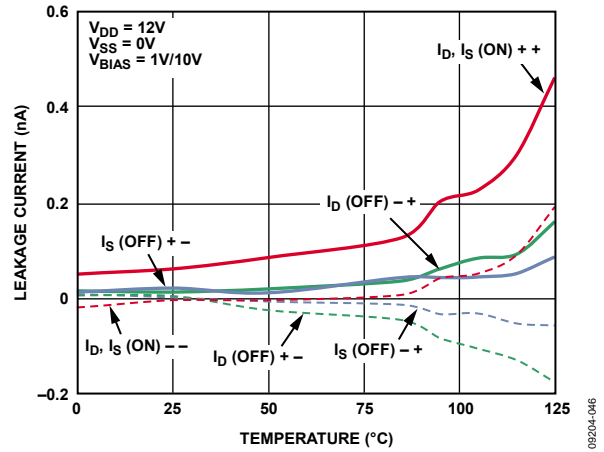
Figure 15. Leakage Currents vs. Temperature, 12 V Single Supply
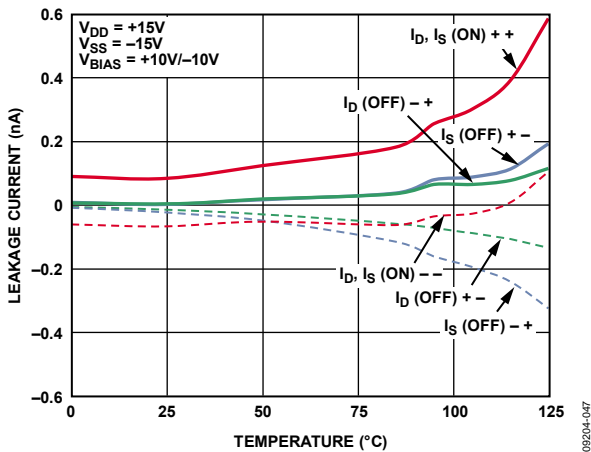
Figure 13. Leakage Currents vs. Temperature, ±15 V Dual Supply
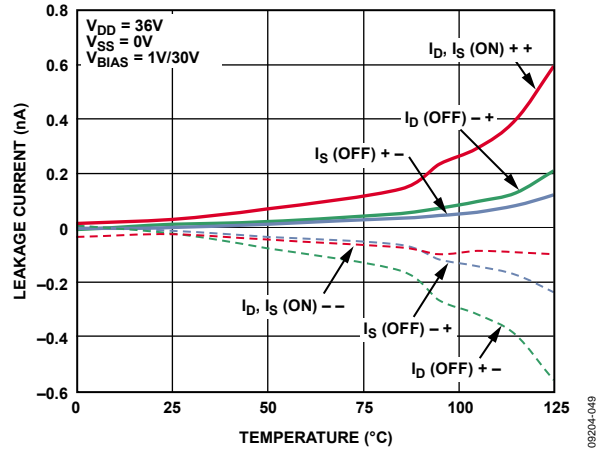
Figure 16. Leakage Currents vs. Temperature, 36 V Single Supply
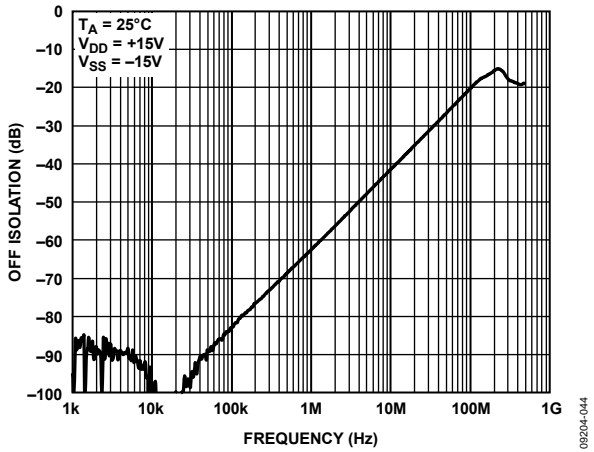
Figure 17. Off Isolation vs. Frequency

Figure 18. Crosstalk vs. Frequency

Figure 19. Charge Injection vs. Source Voltage

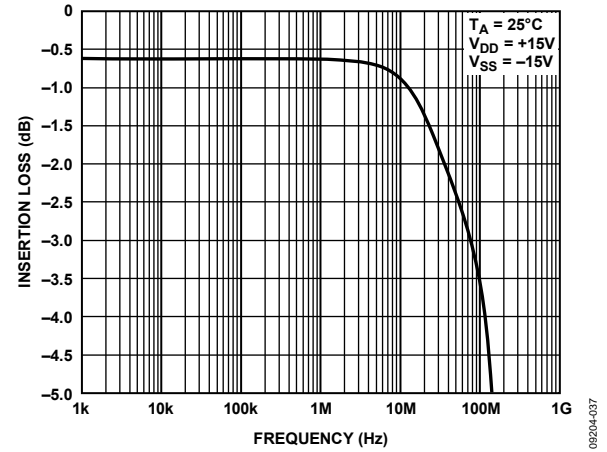Figure 20. ACPSRR vs. Frequency

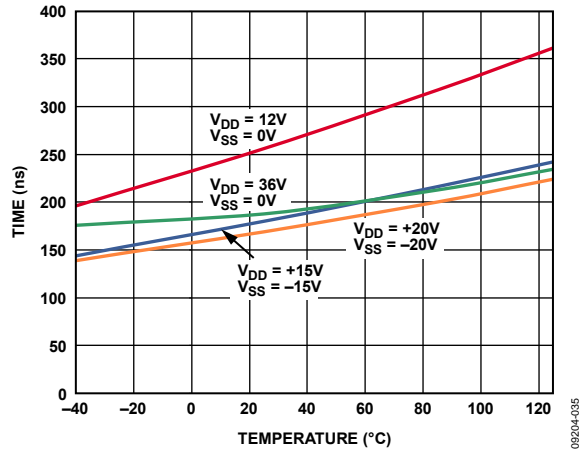Figure 21. THD + N vs. Frequency

Figure 22. Bandwidth

Figure 23. t$_{TRANSITION}$ Time vs. Temperature
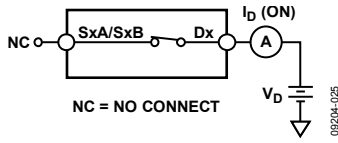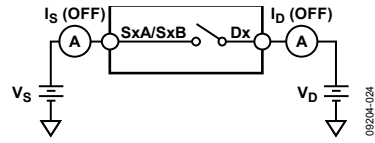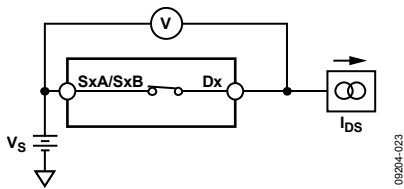
TEST CIRCUITS

Figure 24. On Leakage

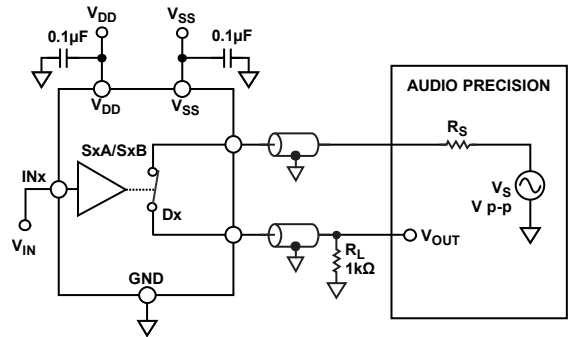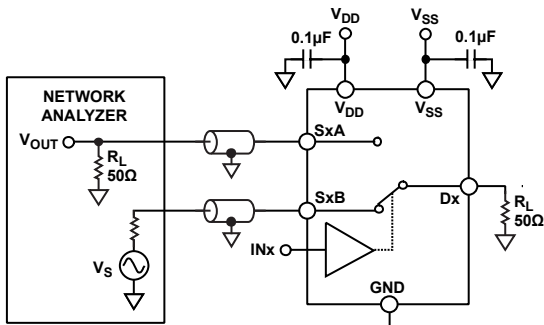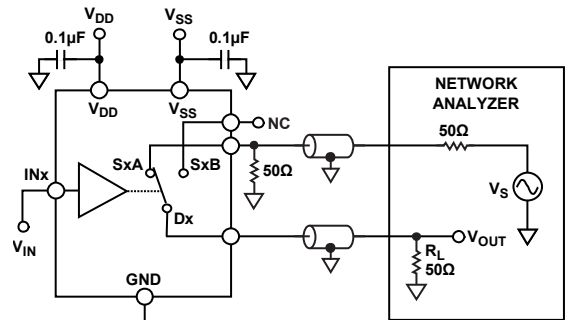Figure 28. Off Leakage

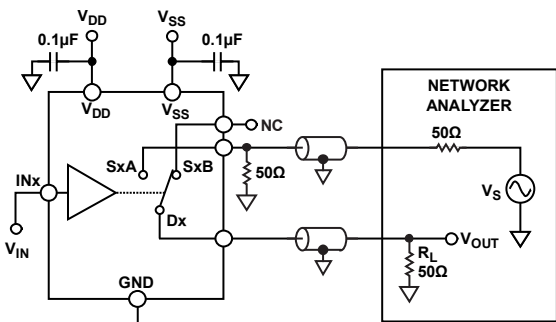Figure 25. On Resistance

Figure 29. THD + Noise

$$\text{CHANNEL-TO-CHANNEL CROSSTALK} = 20 \log \frac{V_{OUT}}{V_S}$$

Figure 26. Channel-to-Channel Crosstalk

$$\text{INSERTION LOSS} = 20 \log \frac{V_{OUT} \text{ WITH SWITCH}}{V_{OUT} \text{ WITHOUT SWITCH}}$$

Figure 30. Bandwidth

$$\text{OFF ISOLATION} = 20 \log \frac{V_{OUT}}{V_S}$$
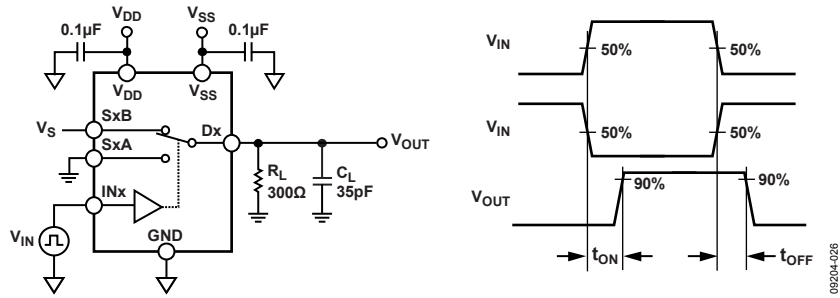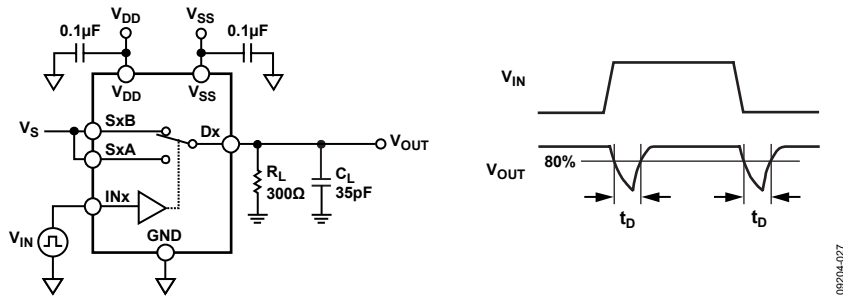
Figure 27. Off Isolation

Figure 31. Switching Times
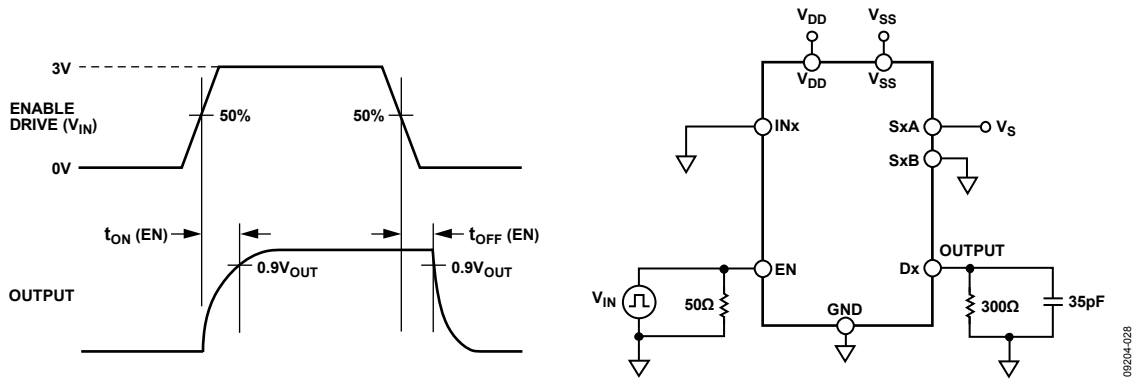

Figure 32. Break-Before-Make Time Delay t_D

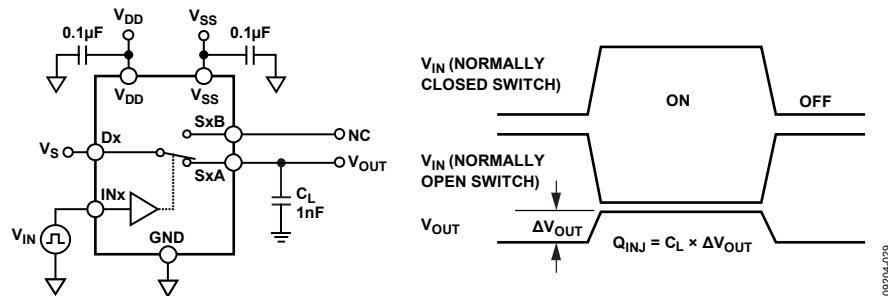Figure 33. Enable Delay, t_{ON} (EN), t_{OFF} (EN)

Figure 34. Charge Injection

TERMINOLOGY

I$_{DD}$

I$_{DD}$ represents the positive supply current.

I$_{SS}$

I$_{SS}$ represents the negative supply current.

V$_D$, V$_S$

V$_D$ and V$_S$ represent the analog voltage on Terminal D and Terminal S, respectively.

R$_{ON}$

R$_{ON}$ represents the ohmic resistance between Terminal D and Terminal S.

ΔR$_{ON}$

ΔR$_{ON}$ represents the difference between the R$_{ON}$ of any two channels.

R$_{FLAT (ON)}$

Flatness that is defined as the difference between the maximum and minimum value of on resistance measured over the specified analog signal range is represented by R$_{FLAT (ON)}$.

I$_S$ (Off)

I$_S$ (Off) is the source leakage current with the switch off.

I$_D$ (Off)

I$_D$ (Off) is the drain leakage current with the switch off.

I$_D$ (On), I$_S$ (On)

I$_D$ (On) and I$_S$ (On) represent the channel leakage currents with the switch on.

V$_{INL}$

V$_{INL}$ is the maximum input voltage for Logic 0.

V$_{INH}$

V$_{INH}$ is the minimum input voltage for Logic 1.

I$_{INL}$, I$_{INH}$

I$_{INL}$ and I$_{INH}$ represent the low and high input currents of the digital inputs.

C$_D$ (Off)

C$_D$ (Off) represents the off switch drain capacitance, which is measured with reference to ground.

C$_S$ (Off)

C$_S$ (Off) represents the off switch source capacitance, which is measured with reference to ground.

C$_D$ (On), C$_S$ (On)

C$_D$ (On) and C$_S$ (On) represent on switch capacitances, which are measured with reference to ground.

C$_{IN}$

C$_{IN}$ is the digital input capacitance.

t$_{ON}$

t$_{ON}$ represents the delay between applying the digital control input and the output switching on.

t$_{OFF}$

t$_{OFF}$ represents the delay between applying the digital control input and the output switching off.

t$_D$

t$_D$ represents the off time measured between the 80% point of both switches when switching from one address state to another.

Off Isolation

Off isolation is a measure of unwanted signal coupling through an off switch.

Charge Injection

Charge injection is a measure of the glitch impulse transferred from the digital input to the analog output during switching.

Crosstalk

Crosstalk is a measure of unwanted signal that is coupled through from one channel to another as a result of parasitic capacitance.

Bandwidth

Bandwidth is the frequency at which the output is attenuated by 3 dB.

On Response

On response is the frequency response of the on switch.

Insertion Loss

Insertion loss is the loss due to the on resistance of the switch.

Total Harmonic Distortion + Noise (THD + N)

The ratio of the harmonic amplitude plus noise of the signal to the fundamental is represented by THD + N.

AC Power Supply Rejection Ratio (ACPSRR)

ACPSRR is the ratio of the amplitude of signal on the output to the amplitude of the modulation. This is a measure of the ability of the part to avoid coupling noise and spurious signals that appear on the supply voltage pin to the output of the switch. The dc voltage on the device is modulated by a sine wave of 0.62 V p-p.

TRENCH ISOLATION

In the ADG5436, an insulating oxide layer (trench) is placed between the NMOS and the PMOS transistors of each CMOS switch. Parasitic junctions, which occur between the transistors in junction isolated switches, are eliminated, and the result is a completely latch-up proof switch.

In junction isolation, the N and P wells of the PMOS and NMOS transistors form a diode that is reverse-biased under normal operation. However, during overvoltage conditions, this diode can become forward-biased. A silicon controlled rectifier (SCR) type circuit is formed by the two transistors causing a significant amplification of the current that, in turn, leads to latch-up. With trench isolation, this diode is removed, and the result is a latch-up proof switch.
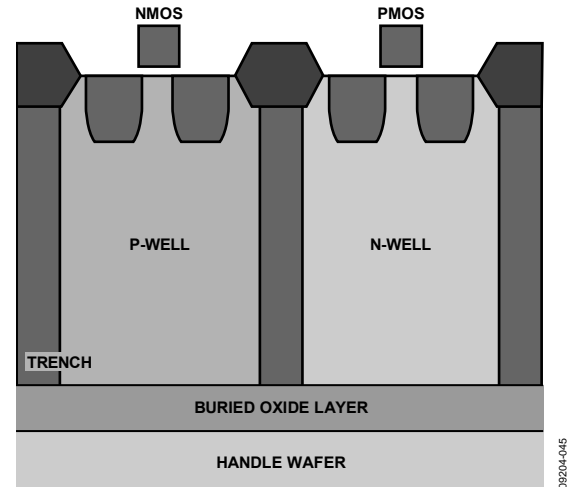

Figure 35. Trench Isolation

APPLICATIONS INFORMATION

The Analog Devices, Inc., family of switches and multiplexers provide a robust solution for instrumentation, industrial, automotive, aerospace and other harsh environments that are prone to latch-up, which is an undesirable high current state that can lead to device failure and persist until the power supply is turned off. The ADG5436 high voltage switches allow single-supply operation from +9 V to +40 V and dual-supply operation from ±9 V to ±22 V. The ADG5436 (as well as other select devices within this family) achieves an 8 kV human body model ESD rating, which provides a robust solution eliminating the need for separate protect circuitry designs in some applications.
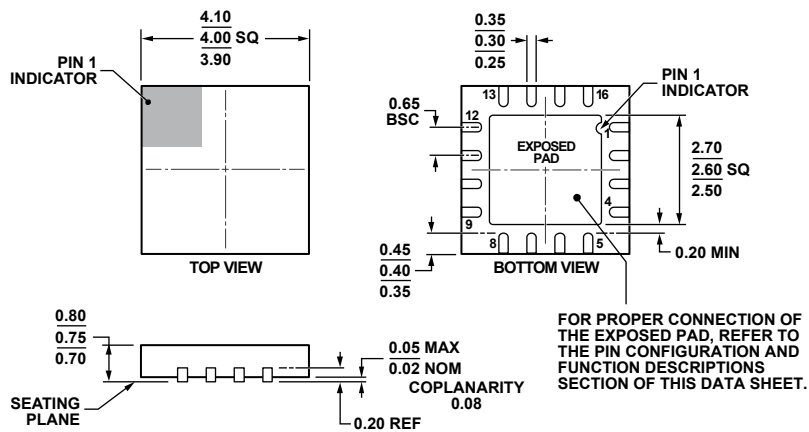
OUTLINE DIMENSIONS
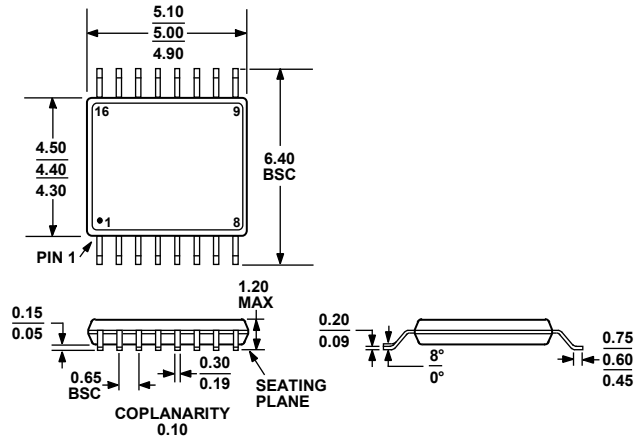
COMPLIANT TO JEDEC STANDARDS MO-153-AB

Figure 36. 16-Lead Thin Shrink Small Outline Package [TSSOP]
(RU-16)
Dimensions shown in millimeters

COMPLIANT TO JEDEC STANDARDS MO-220-WGGC.

Figure 37. 16-Lead Lead Frame Chip Scale Package [LFCSP]
4 mm × 4 mm Body and 0.75 mm Package Height
(CP-16-17)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
ADG5436BRUZ	−40°C to +125°C	16-Lead Thin Shrink Small Outline Package [TSSOP]	RU-16
ADG5436BRUZ-REEL7	−40°C to +125°C	16-Lead Thin Shrink Small Outline Package [TSSOP]	RU-16
ADG5436BCPZ-REEL7	−40°C to +125°C	16-Lead Lead Frame Chip Scale Package [LFCSP]	CP-16-17

[1] Z = RoHS Compliant Part.

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