

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

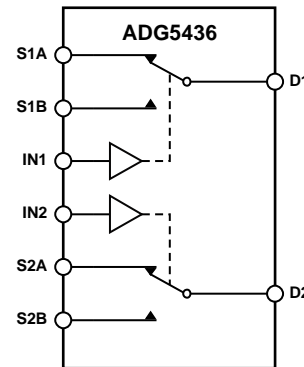
Relay replacement
Automatic test equipment
Data acquisition
Instrumentation
Avionics
Audio and video switching
Communication systems

GENERAL DESCRIPTION

The ADG5436 is a monolithic CMOS device containing two independently selectable single-pole/single-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.

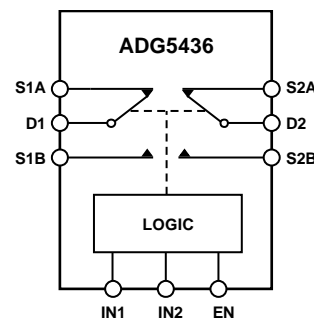
FUNCTIONAL BLOCK DIAGRAMS



SWITCHES SHOWN FOR A LOGIC 1 INPUT.

Figure 1. TSSOP Package

08204-001



SWITCHES SHOWN FOR A LOGIC 1 INPUT.

Figure 2. LFCSP Package

08204-002

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.

Rev. A

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REVISION HISTORY

6/11—Rev. 0 to Rev. A

| | |
|---|----|
| Added I _{SS} -40°C to +125°C Parameter | 5 |
| Updated Outline Dimensions | 19 |
| Changes to Ordering Guide | 19 |

7/10—Revision 0: Initial Version

SPECIFICATIONS

±15 V DUAL SUPPLY

$V_{DD} = +15\text{ V} \pm 10\%$, $V_{SS} = -15\text{ V} \pm 10\%$, 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 | $V_S = \pm 10\text{ V}$, $I_S = -10\text{ mA}$; see Figure 25 |
| | 11 | 14 | 16 | Ω max | $V_{DD} = +13.5\text{ V}$, $V_{SS} = -13.5\text{ V}$ |
| On-Resistance Match Between Channels, ΔR_{ON} | 0.35 | | | Ω typ | $V_S = \pm 10\text{ V}$, $I_S = -10\text{ mA}$ |
| On-Resistance Flatness, $R_{FLAT(ON)}$ | 0.7 | 0.9 | 1.1 | Ω max | |
| | 1.2 | | | Ω typ | $V_S = \pm 10\text{ V}$, $I_S = -10\text{ mA}$ |
| | 1.6 | 2 | 2.2 | Ω max | |
| LEAKAGE CURRENTS | | | | | |
| Source Off Leakage, I_S (Off) | ± 0.05 | | | nA typ | $V_{DD} = +16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ |
| | ± 0.25 | ± 0.75 | ± 3.5 | nA max | $V_S = \pm 10\text{ V}$, $V_D = \mp 10\text{ V}$; see Figure 28 |
| Drain Off Leakage, I_D (Off) | ± 0.1 | | | nA typ | $V_S = \pm 10\text{ V}$, $V_D = \mp 10\text{ V}$; see Figure 28 |
| | ± 0.4 | ± 2 | ± 12 | nA max | |
| Channel On Leakage, I_D (On), I_S (On) | ± 0.1 | | | nA typ | $V_S = V_D = \pm 10\text{ V}$; 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 CHARACTERISTICS¹ | | | | | |
| Transition Time, $t_{TRANSITION}$ | 170 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 235 | 285 | 316 | ns max | $V_S = 10\text{ V}$; see Figure 31 |
| t_{ON} | 173 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 230 | 280 | 351 | ns max | $V_S = 10\text{ V}$; see Figure 33 |
| t_{OFF} | 124 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 160 | 193 | 218 | ns max | $V_S = 10\text{ V}$; see Figure 33 |
| Break-Before-Make Time Delay, t_D | 55 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | | | 18 | ns min | $V_{S1} = V_{S2} = 10\text{ V}$; see Figure 32 |
| Charge Injection, Q_{INJ} | 200 | | | pC typ | $V_S = 0\text{ V}$, $R_S = 0\ \Omega$, $C_L = 1\text{ nF}$; see Figure 34 |
| Off Isolation | -78 | | | dB typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$; see Figure 27 |
| Channel-to-Channel Crosstalk | -58 | | | dB typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$; see Figure 26 |
| Total Harmonic Distortion + Noise | 0.009 | | | % typ | $R_L = 1\text{ k}\Omega$, 15 V p-p, $f = 20\text{ Hz}$ to 20 kHz; see Figure 29 |
| -3 dB Bandwidth | 102 | | | MHz typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$; see Figure 30 |
| Insertion Loss | -0.7 | | | dB typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$; see Figure 30 |
| C_S (Off) | 18 | | | pF typ | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ |
| C_D (Off) | 62 | | | pF typ | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ |
| C_D (On), C_S (On) | 83 | | | pF typ | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ |

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| Parameter | 25°C | -40°C to +85°C | -40°C to +125°C | Unit | Test Conditions/Comments |
|---------------------------|-------|----------------|-----------------|-------------------|---|
| POWER REQUIREMENTS | | | | | |
| I_{DD} | 45 | | | $\mu\text{A typ}$ | $V_{DD} = +16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Digital inputs = 0 V or V_{DD} |
| | 55 | | 70 | $\mu\text{A max}$ | |
| I_{SS} | 0.001 | | | $\mu\text{A typ}$ | Digital inputs = 0 V or V_{DD} |
| | | | 1 | $\mu\text{A max}$ | |
| V_{DD}/V_{SS} | | | $\pm 9/\pm 22$ | V min/V max | GND = 0 V |

¹ Guaranteed by design; not subject to production test.

±20 V DUAL SUPPLY

$V_{DD} = +20\text{ V} \pm 10\%$, $V_{SS} = -20\text{ V} \pm 10\%$, 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 | | | | | |
| Analogue Signal Range | | | V_{DD} to V_{SS} | V | |
| On Resistance, R_{ON} | 9 | | | Ω typ | $V_S = \pm 15\text{ V}$, $I_S = -10\text{ mA}$; see Figure 25 |
| | 10 | 13 | 15 | Ω max | $V_{DD} = +18\text{ V}$, $V_{SS} = -18\text{ V}$ |
| On-Resistance Match Between Channels, ΔR_{ON} | 0.35 | | | Ω typ | $V_S = \pm 15\text{ V}$, $I_S = -10\text{ mA}$ |
| | 0.7 | 0.9 | 1.1 | Ω max | |
| On-Resistance Flatness, $R_{FLAT(ON)}$ | 1.5 | | | Ω typ | $V_S = \pm 15\text{ V}$, $I_S = -10\text{ mA}$ |
| | 1.8 | 2.2 | 2.5 | Ω max | |
| LEAKAGE CURRENTS | | | | | |
| Source Off Leakage, I_S (Off) | ± 0.05 | | | nA typ | $V_{DD} = +22\text{ V}$, $V_{SS} = -22\text{ V}$ $V_S = \pm 15\text{ V}$, $V_D = \mp 15\text{ V}$; see Figure 28 |
| | ± 0.25 | ± 0.75 | ± 3.5 | nA max | |
| Drain Off Leakage, I_D (Off) | ± 0.1 | | | nA typ | $V_S = \pm 15\text{ V}$, $V_D = \mp 15\text{ V}$; see Figure 28 |
| | ± 0.4 | ± 2 | ± 12 | nA max | |
| Channel On Leakage, I_D (On), I_S (On) | ± 0.1 | | | nA typ | $V_S = V_D = \pm 15\text{ V}$; 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 | | | $\mu\text{A typ}$ | $V_{IN} = V_{GND}$ or V_{DD} |
| | | | ± 0.1 | $\mu\text{A max}$ | |
| Digital Input Capacitance, C_{IN} | 5 | | | pF typ | |
| DYNAMIC CHARACTERISTICS¹ | | | | | |
| Transition Time, $t_{TRANSITION}$ | 158 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 217 | 260 | 293 | ns max | $V_S = 10\text{ V}$; see Figure 31 |
| t_{ON} | 164 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 213 | 256 | 287 | ns max | $V_S = 10\text{ V}$; see Figure 33 |
| t_{OFF} | 110 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | 152 | 173 | 194 | ns max | $V_S = 10\text{ V}$; see Figure 33 |
| Break-Before-Make Time Delay, t_D | 50 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ |
| | | | 15 | ns min | $V_{S1} = V_{S2} = 10\text{ V}$; see Figure 32 |
| Charge Injection, Q_{INJ} | 250 | | | pC typ | $V_S = 0\text{ V}$, $R_S = 0\ \Omega$, $C_L = 1\text{ nF}$; see Figure 34 |
| Off Isolation | -78 | | | dB typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$; see Figure 27 |
| Channel-to-Channel Crosstalk | -58 | | | dB typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$; see Figure 26 |
| Total Harmonic Distortion + Noise | 0.007 | | | % typ | $R_L = 1\text{ k}\Omega$, 20 V p-p, $f = 20\text{ Hz}$ to 20 kHz; see Figure 29 |
| -3 dB Bandwidth | 100 | | | MHz typ | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$; 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 | $R_L = 50 \Omega$, $C_L = 5 \text{ pF}$, $f = 1 \text{ MHz}$; see Figure 30 |
| C_S (Off) | 18 | | | pF typ | $V_S = 0 \text{ V}$, $f = 1 \text{ MHz}$ |
| C_D (Off) | 63 | | | pF typ | $V_S = 0 \text{ V}$, $f = 1 \text{ MHz}$ |
| C_D (On), C_S (On) | 82 | | | pF typ | $V_S = 0 \text{ V}$, $f = 1 \text{ MHz}$ |
| POWER REQUIREMENTS | | | | | |
| I_{DD} | 50 | | | μA typ | $V_{DD} = +22 \text{ V}$, $V_{SS} = -22 \text{ V}$ 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} | | | $\pm 9/\pm 22$ | V min/V max | GND = 0 V |

¹ Guaranteed by design; not subject to production test.

12 V SINGLE SUPPLY

$V_{DD} = 12 \text{ V} \pm 10\%$, $V_{SS} = 0 \text{ V}$, 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 | $V_S = 0 \text{ V}$ to 10 V, $I_S = -10 \text{ mA}$; see Figure 25 |
| | 22 | 27 | 31 | Ω max | $V_{DD} = 10.8 \text{ V}$, $V_{SS} = 0 \text{ V}$ |
| On-Resistance Match Between Channels, ΔR_{ON} | 0.4 | | | Ω typ | $V_S = 0 \text{ V}$ to 10 V, $I_S = -10 \text{ mA}$ |
| | 0.8 | 1 | 1.2 | Ω max | |
| On-Resistance Flatness, $R_{FLAT(ON)}$ | 4.4 | | | Ω typ | $V_S = 0 \text{ V}$ to 10 V, $I_S = -10 \text{ mA}$ |
| | 5.5 | 6.5 | 7.5 | Ω max | |
| LEAKAGE CURRENTS | | | | | |
| Source Off Leakage, I_S (Off) | ± 0.05 | | | nA typ | $V_{DD} = 13.2 \text{ V}$, $V_{SS} = 0 \text{ V}$ $V_S = 1 \text{ V}/10 \text{ V}$, $V_D = 10 \text{ V}/1 \text{ V}$; see Figure 28 |
| | ± 0.25 | ± 0.75 | ± 3.5 | nA max | |
| Drain Off Leakage, I_D (Off) | ± 0.1 | | | nA typ | $V_S = 1 \text{ V}/10 \text{ V}$, $V_D = 10 \text{ V}/1 \text{ V}$; see Figure 28 |
| | ± 0.4 | ± 2 | ± 12 | nA max | |
| Channel On Leakage, I_D (On), I_S (On) | ± 0.1 | | | nA typ | $V_S = V_D = 1 \text{ V}/10 \text{ V}$; 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 CHARACTERISTICS¹ | | | | | |
| Transition Time, $t_{TRANSITION}$ | 250 | | | ns typ | $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ |
| | 346 | 437 | 501 | ns max | $V_S = 8 \text{ V}$; see Figure 31 |
| t_{ON} | 250 | | | ns typ | $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ |
| | 358 | 445 | 512 | ns max | $V_S = 8 \text{ V}$; see Figure 33 |
| t_{OFF} | 135 | | | ns typ | $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ |
| | 178 | 212 | 237 | ns max | $V_S = 8 \text{ V}$; see Figure 33 |
| Break-Before-Make Time Delay, t_D | 125 | | | ns typ | $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ |
| | | | 50 | ns min | $V_{S1} = V_{S2} = 8 \text{ V}$; see Figure 32 |
| Charge Injection, Q_{INJ} | 80 | | | pC typ | $V_S = 6 \text{ V}$, $R_S = 0 \Omega$, $C_L = 1 \text{ nF}$; see Figure 34 |

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

¹ Guaranteed by design; not subject to production test.

36 V SINGLE SUPPLY

$V_{DD} = 36\ \text{V} \pm 10\%$, $V_{SS} = 0\ \text{V}$, 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 | $V_S = 0\ \text{V}$ to 30 V, $I_S = -10\ \text{mA}$; see Figure 25 |
| On-Resistance Match Between Channels, ΔR_{ON} | 12 | 15 | 17 | Ω max | $V_{DD} = 32.4\ \text{V}$, $V_{SS} = 0\ \text{V}$ |
| On-Resistance Flatness, $R_{FLAT(ON)}$ | 0.35 | | | Ω typ | $V_S = 0\ \text{V}$ to 30 V, $I_S = -10\ \text{mA}$ |
| | 0.7 | 0.9 | 1.1 | Ω max | |
| | 2.7 | | | Ω typ | $V_S = 0\ \text{V}$ to 30 V, $I_S = -10\ \text{mA}$ |
| | 3.2 | 3.8 | 4.5 | Ω max | |
| LEAKAGE CURRENTS | | | | | |
| Source Off Leakage, I_S (Off) | ± 0.05 | | | nA typ | $V_{DD} = 39.6\ \text{V}$, $V_{SS} = 0\ \text{V}$ $V_S = 1\ \text{V}/30\ \text{V}$, $V_D = 30\ \text{V}/1\ \text{V}$; see Figure 28 |
| Drain Off Leakage, I_D (Off) | ± 0.25 | ± 0.75 | ± 3.5 | nA max | |
| | ± 0.1 | | | nA typ | $V_S = 1\ \text{V}/30\ \text{V}$, $V_D = 30\ \text{V}/1\ \text{V}$; see Figure 28 |
| Channel On Leakage, I_D (On), I_S (On) | ± 0.4 | ± 2 | ± 12 | nA max | |
| | ± 0.1 | | | nA typ | $V_S = V_D = 1\ \text{V}/30\ \text{V}$; 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 CHARACTERISTICS¹ | | | | | |
| Transition Time, $t_{TRANSITION}$ | 174 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\ \text{pF}$ |
| | 246 | 270 | 303 | ns max | $V_S = 18\ \text{V}$; see Figure 31 |
| t_{ON} | 180 | | | ns typ | $R_L = 300\ \Omega$, $C_L = 35\ \text{pF}$ |
| | 247 | 270 | 301 | ns max | $V_S = 18\ \text{V}$; see Figure 33 |

| Parameter | 25°C | -40°C to +85°C | -40°C to +125°C | Unit | Test Conditions/Comments |
|-------------------------------------|------|----------------|-----------------|-------------|---|
| 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 Ω , 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 | | | μ A typ | Digital inputs = 0 V or V_{DD} |
| | 100 | | 130 | μ A 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, S_x OR D_x

Table 5.

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

ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$, 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 | $V_{SS} - 0.3\text{ V}$ to $V_{DD} + 0.3\text{ V}$ or 30 mA, whichever occurs first |
| Digital Inputs ¹ | $V_{SS} - 0.3\text{ V}$ to $V_{DD} + 0.3\text{ V}$ 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 above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device 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

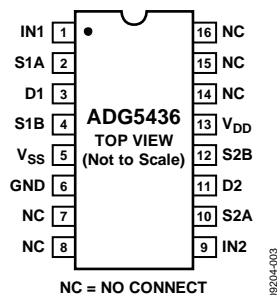
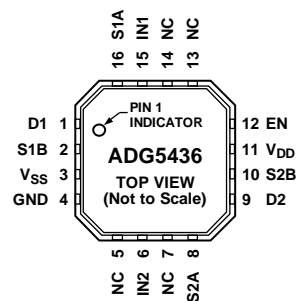


Figure 3. TSSOP Pin Configuration



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. |
| N/A | 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, IN_x logic inputs determine the on switches. |
| | EP | Exposed Pad | 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

| IN_x | S_xA | S_xB |
|--------|--------|--------|
| 0 | Off | On |
| 1 | On | Off |

Table 9. ADG5436 LFCSP Truth Table

| EN | IN_x | S_xA | S_xB |
|----|--------|--------|--------|
| 0 | X | Off | Off |
| 1 | 0 | Off | On |
| 1 | 1 | On | Off |

TYPICAL PERFORMANCE CHARACTERISTICS

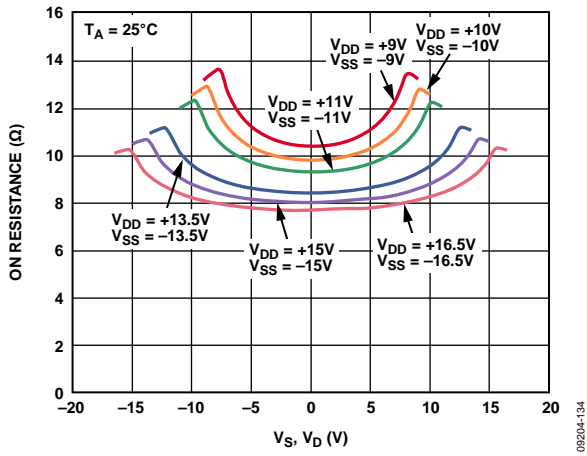


Figure 5. On Resistance vs. V_S , V_D (Dual Supply)

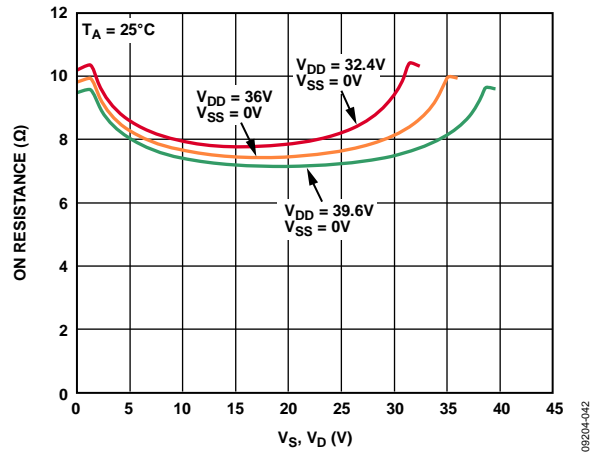


Figure 8. On Resistance vs. V_S , V_D (Single Supply)

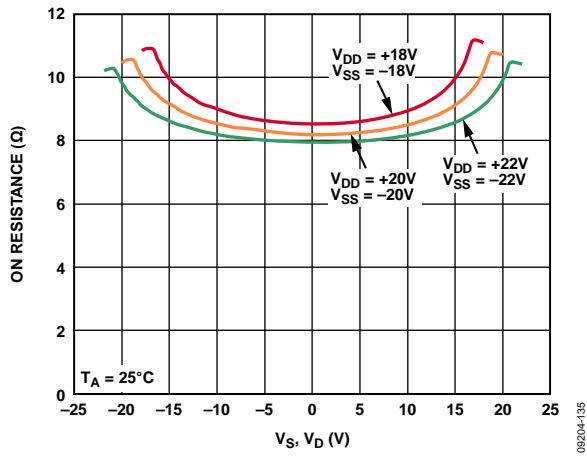


Figure 6. On Resistance vs. V_S , V_D (Dual Supply) Included

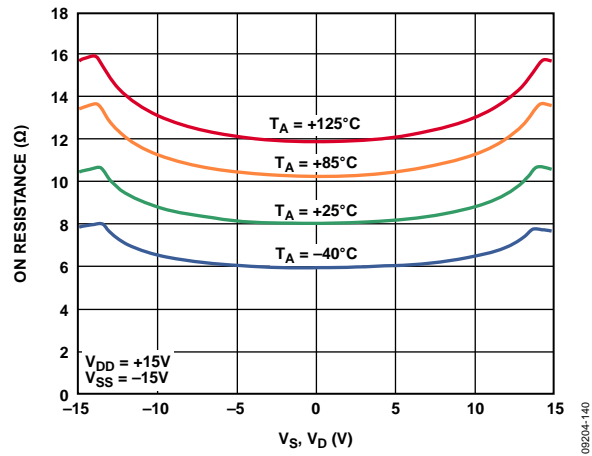


Figure 9. On Resistance vs. V_D or V_S for Different Temperatures, ± 15 V Dual Supply

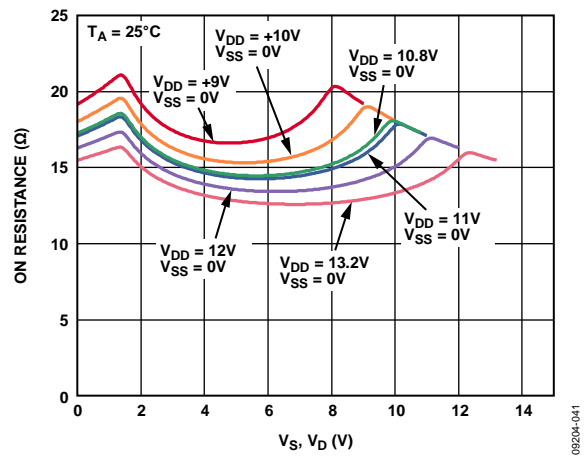


Figure 7. On Resistance vs. V_S , V_D (Single Supply)

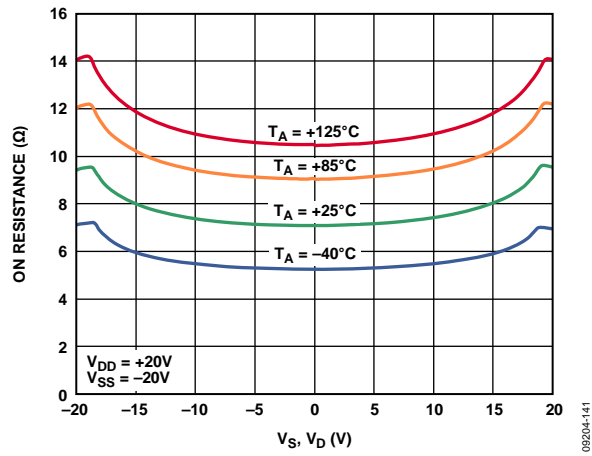


Figure 10. On Resistance vs. V_D or V_S for Different Temperatures, ± 20 V Dual Supply

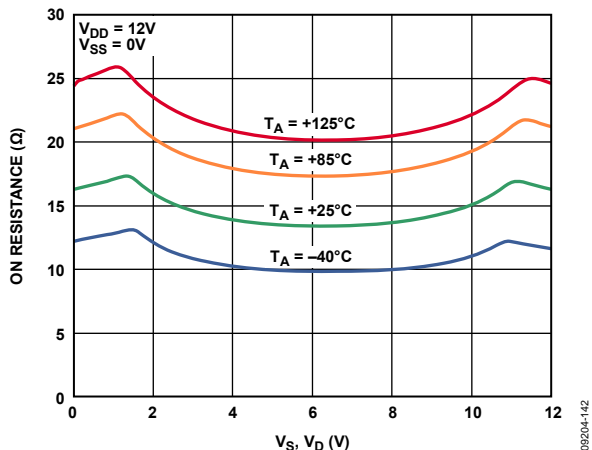


Figure 11. On Resistance vs. V_D or V_S for Different Temperatures, 12 V Single Supply

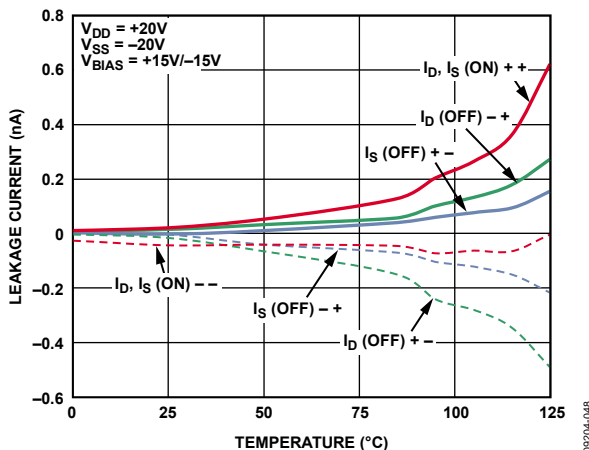


Figure 14. Leakage Currents vs. Temperature, ± 20 V Single Supply

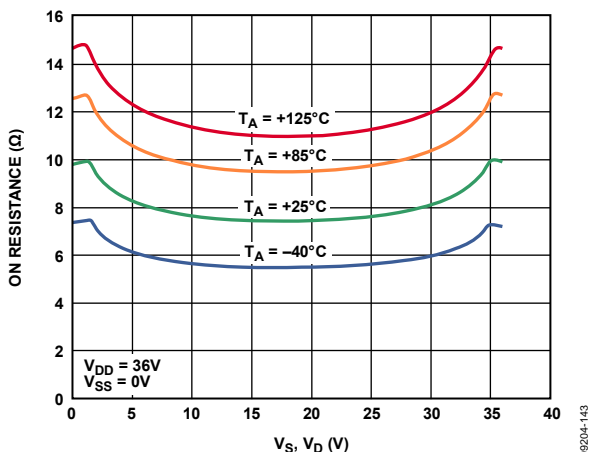


Figure 12. On Resistance vs. V_S (V_D) for Different Temperatures, 36 V Single Supply

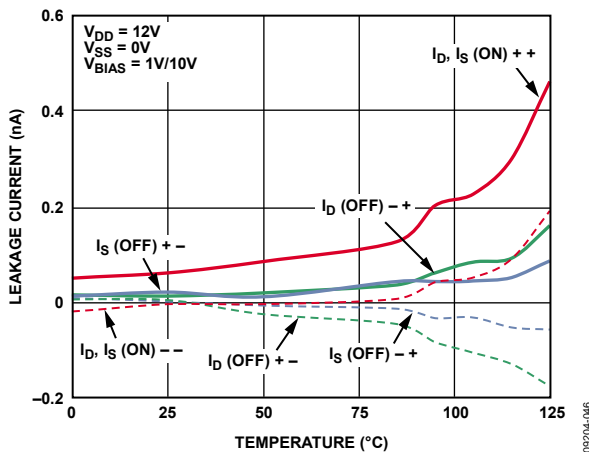


Figure 15. Leakage Currents vs. Temperature, 12 V Single Supply

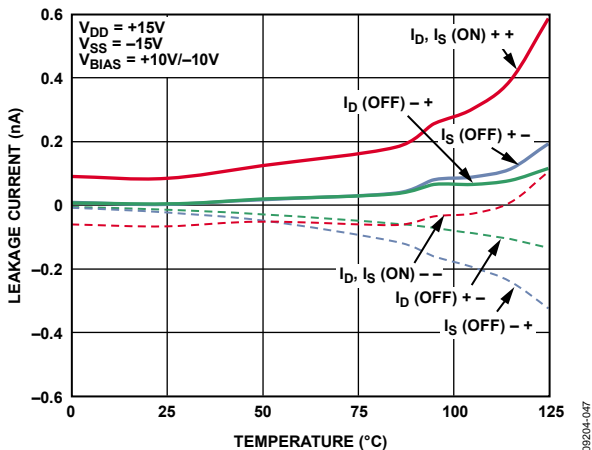


Figure 13. Leakage Currents vs. Temperature, ± 15 V Dual Supply

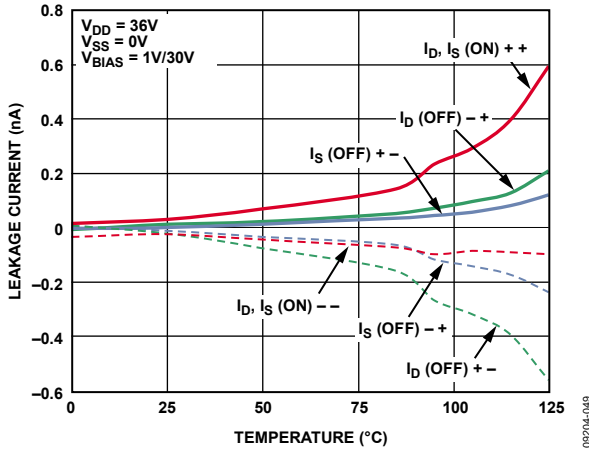


Figure 16. Leakage Currents vs. Temperature, 36 V Single Supply

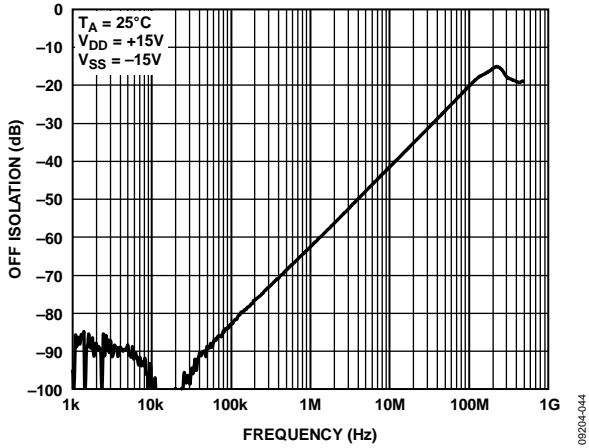


Figure 17. Off Isolation vs. Frequency

08204-044

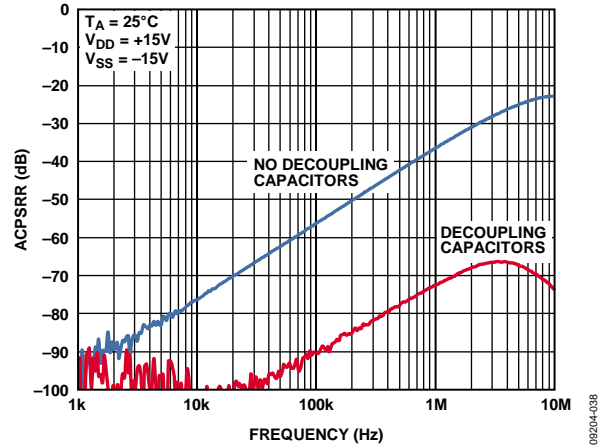


Figure 20. ACPSRR vs. Frequency

08204-038

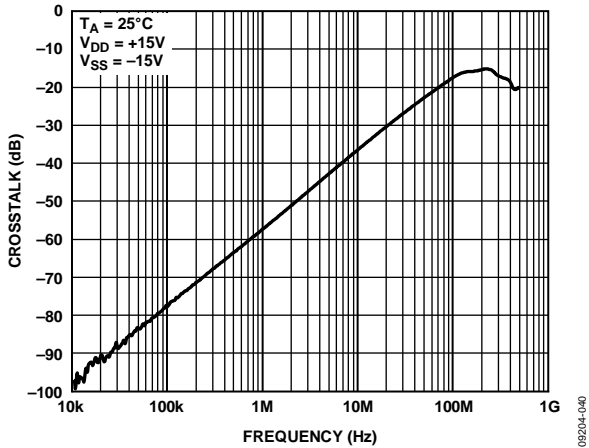


Figure 18. Crosstalk vs. Frequency

08204-040

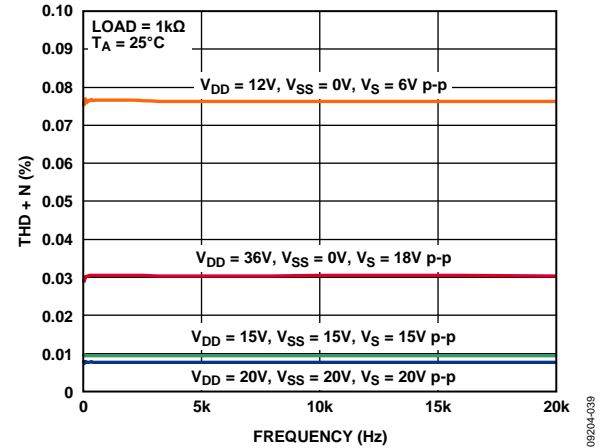


Figure 21. THD + N vs. Frequency

08204-039

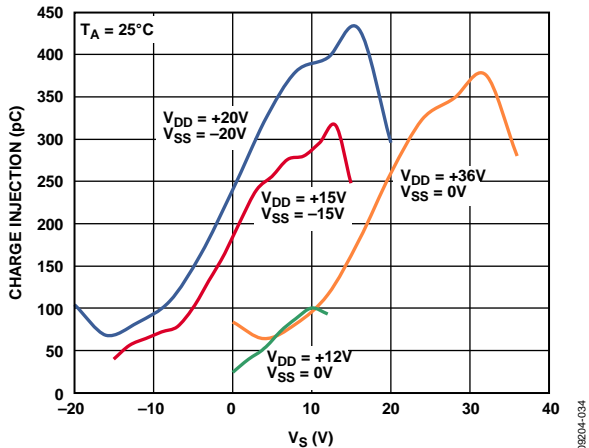


Figure 19. Charge Injection vs. Source Voltage

08204-034

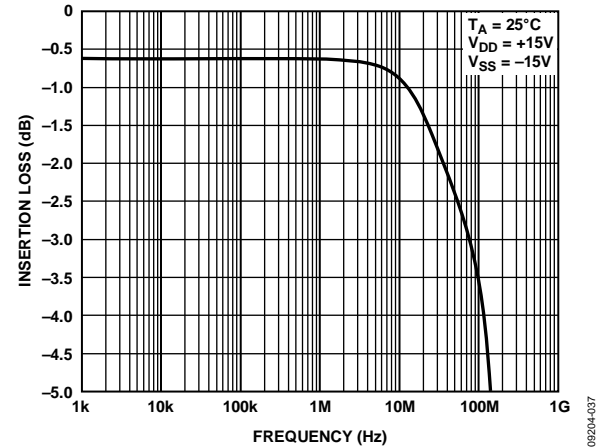


Figure 22. Bandwidth

08204-037

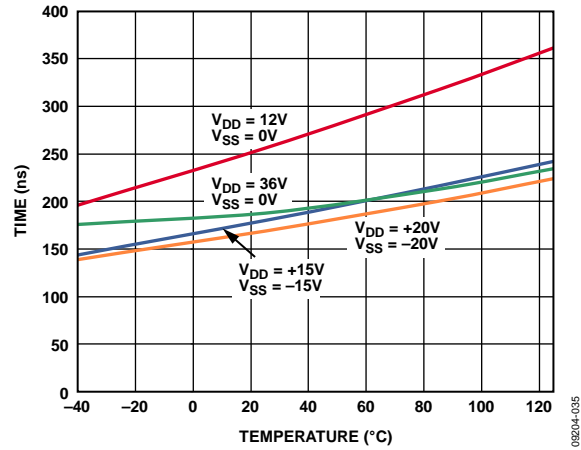


Figure 23. $t_{TRANSITION}$ Time vs. Temperature

TEST CIRCUITS

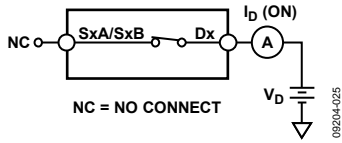


Figure 24. On Leakage

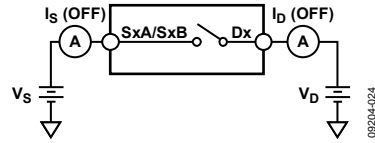


Figure 28. Off Leakage

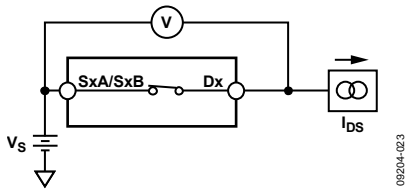


Figure 25. On Resistance

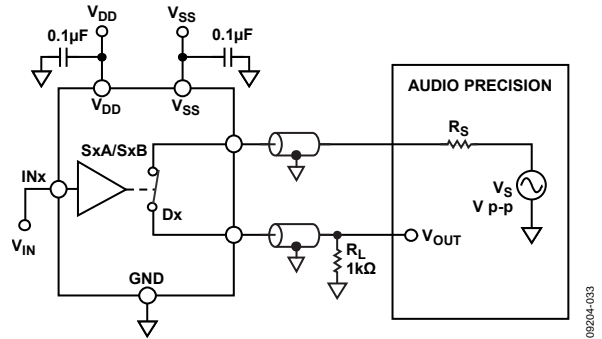
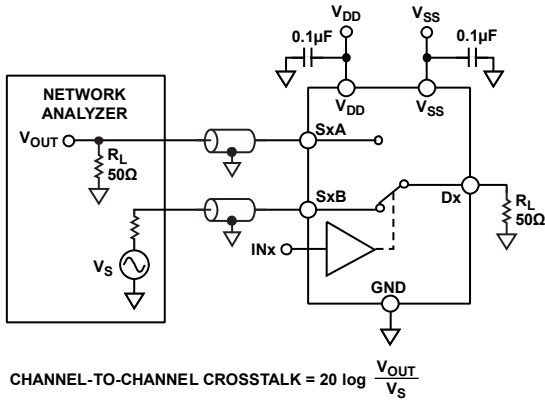
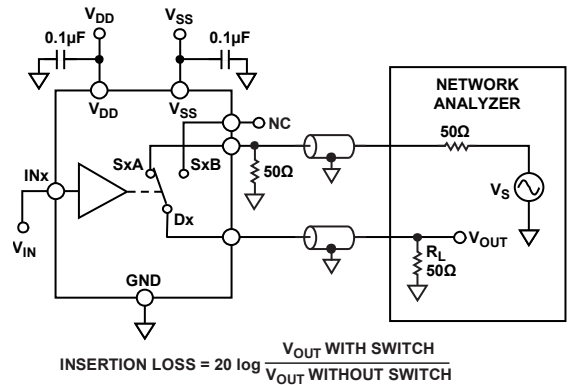


Figure 29. THD + Noise



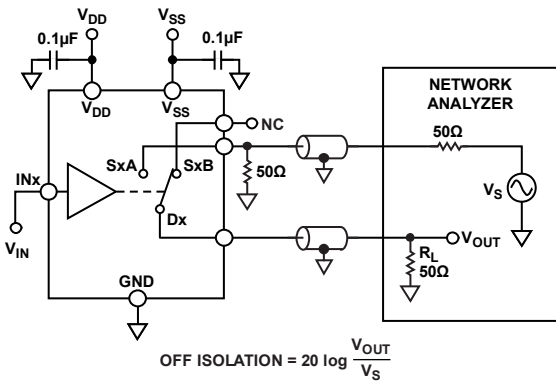
$$\text{CHANNEL-TO-CHANNEL CROSSTALK} = 20 \log \frac{V_{OUT}}{V_s}$$

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

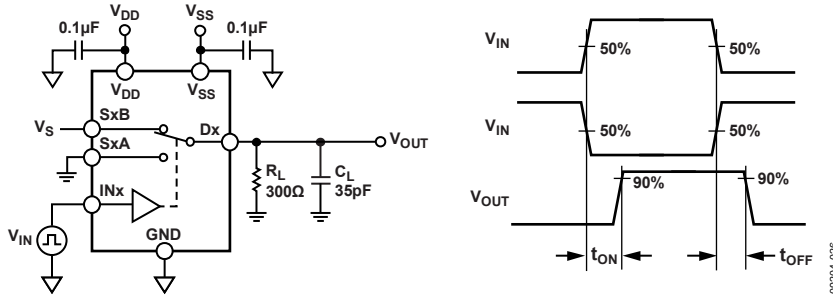


Figure 31. Switching Times

09204-026

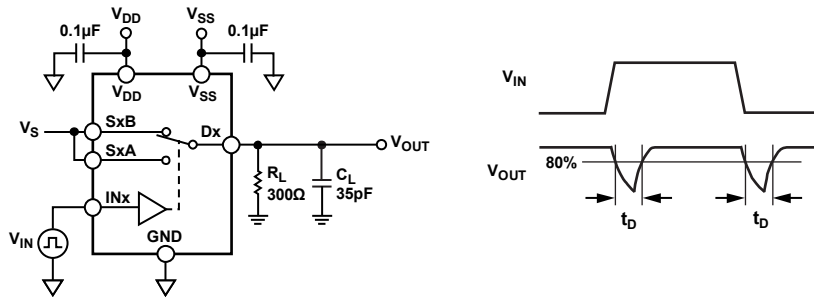


Figure 32. Break-Before-Make Time Delay t_d

09204-027

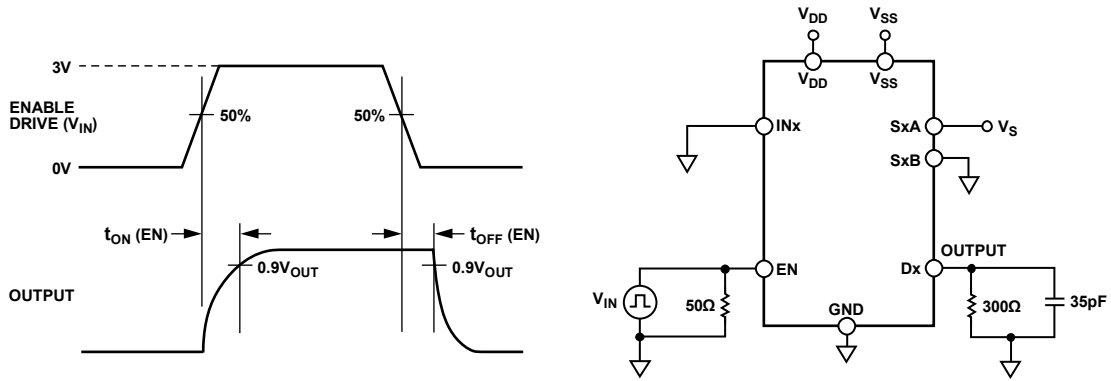


Figure 33. Enable Delay, $t_{ON}(EN)$, $t_{OFF}(EN)$

09204-028

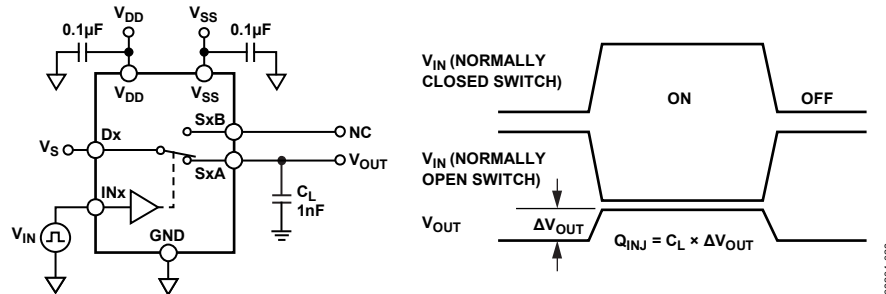


Figure 34. Charge Injection

09204-029

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.

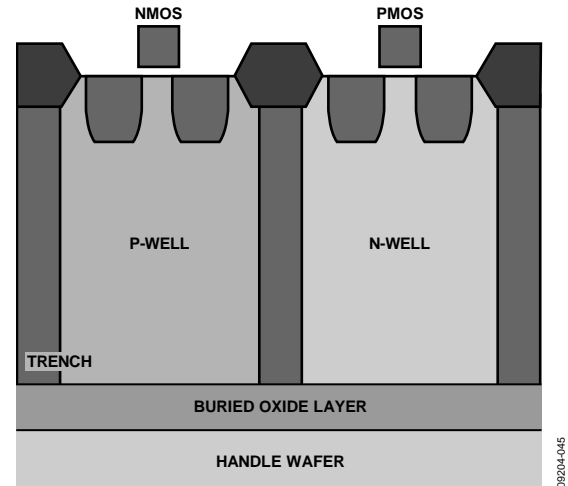


Figure 35. Trench Isolation

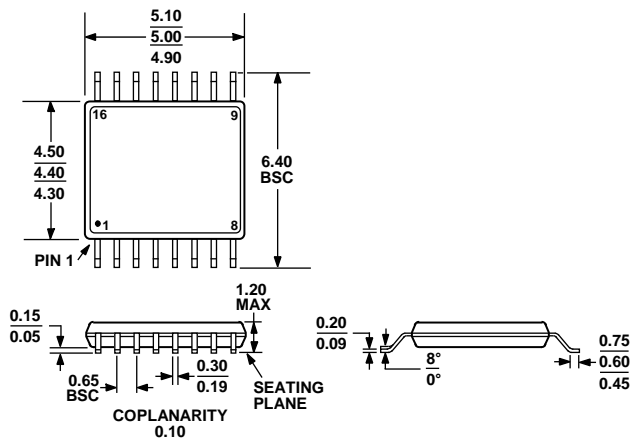
08204-045

APPLICATIONS INFORMATION

The ADG54xx 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.

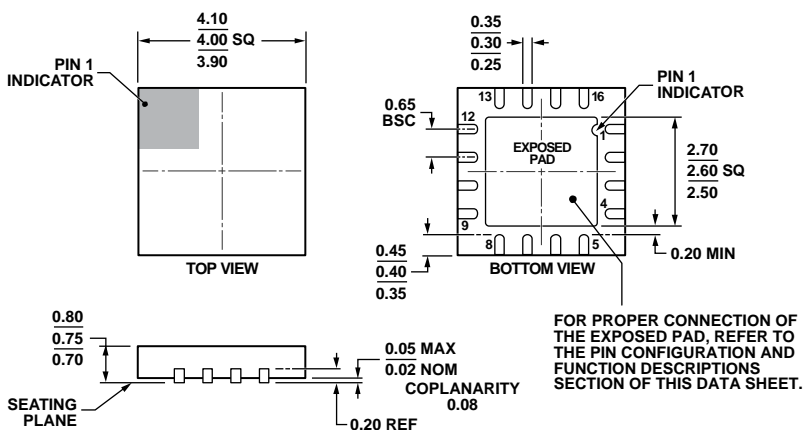
OUTLINE DIMENSIONS



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_WQ]

4 mm × 4 mm Body, Very Very Thin Quad

(CP-16-17)

Dimensions shown in millimeters

08-16-2010-C

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_WQ] | CP-16-17 |

¹ Z = RoHS Compliant Part.

ADG5436

NOTES