0.28 Ω, CMOS, 1.65 V to 3.6 V, Single SPST Switch

Known Good Die

ADG841-KGD

FEATURES

Ultralow on resistance
0.28 Ω typical
0.48 Ω max at 125°C
Excellent audio performance, ultralow distortion
0.025 Ω typical
0.052 Ω max RON flatness
1.65 V to 3.6 V single supply
High current carrying capability
300 mA continuous current
500 mA peak current
Automotive temperature range: −40°C to +125°C
Rail-to-rail operation
Typical power consumption (<0.01 µW)
Known good die (KGD): these die are fully guaranteed to data sheet specifications

FUNCTIONAL BLOCK DIAGRAM

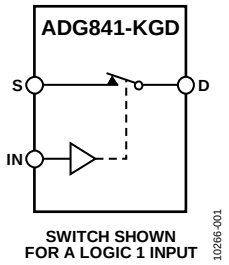

Figure 1.

APPLICATIONS

Handsets
PDAs
MP3 players
Power routing
Battery-powered systems
Communication systems
Modems
PCMCIA cards

GENERAL DESCRIPTION

The ADG841-KGD is a low voltage CMOS device containing a single-pole, single-throw (SPST) switch. The ADG841-KGD is closed for a Logic 1 input. The device offers ultralow on resistance of less than 0.48 Ω over the full temperature range. The ADG841-KGD is fully specified for 3.3 V, 2.5 V, and 1.8 V supply operation.

Each switch conducts equally well in both directions when on, and has an input signal range that extends to the supplies.

Additional application and technical information can be found in the ADG841 data sheet.

PRODUCT HIGHLIGHTS

1. <0.48 Ω over full temperature range of −40°C to +125°C.
2. Compatible with 1.8 V CMOS logic.
3. High current handling capability (300 mA continuous current at 3.3 V).
4. Low THD + N (0.02% typical).

Table 1. ADG841-KGD Truth Table

Logic (IN)	ADG841-KGD
0	Off
1	On

Rev. B **Document Feedback**

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11/11—Revision 0: Initial Version

SPECIFICATIONS—2.7 V TO 3.6 V

V_{DD} = 2.7 V to 3.6 V, GND = 0 V, unless otherwise noted. The temperature range is −40°C to +125°C.

Table 2.

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	V_{DD} = 2.7 V
On Resistance (R_{ON})	0.28			Ω typ	V_{DD} = 2.7 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
	0.37	0.43	0.48	Ω max	See Figure 3
On Resistance Flatness ($R_{FLAT (ON)}$)	0.025			Ω typ	V_{DD} = 2.7 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
	0.034	0.044	0.052	Ω max	
LEAKAGE CURRENTS					V_{DD} = 3.6 V
Source Off Leakage I_S (OFF)	±0.2			nA typ	V_S = 0.6 V/3.3 V, V_D = 3.3 V/0.6 V; see Figure 4
Channel On Leakage I_D, I_S (ON)	±0.2			nA typ	V_S = V_D = 0.6 V or 3.3 V; see Figure 5
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current, I_{INL} or I_{INH}	0.005			μA typ	V_{IN} = V_{INL} or V_{INH}
			±0.1	μA max	
Digital Input Capacitance, C_{IN}	3.2			pF typ	
DYNAMIC CHARACTERISTICS[1]					
t_{ON}	10.5			ns typ	R_L = 50 Ω, C_L = 35 pF
	14	15.5	16.5	ns max	V_S = 1.5 V; see Figure 8
t_{OFF}	6.5			ns typ	R_L = 50 Ω, C_L = 35 pF
	7.8	8	8.2	ns max	V_S = 1.5 V; see Figure 8
Charge Injection	200			pC typ	V_S = 1.5 V, R_S = 0 Ω, C_L = 1 nF; see Figure 9
Off Isolation	−54			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz; see Figure 6
Total Harmonic Distortion (THD + N)	0.012			%	R_L = 32 Ω, f = 20 Hz to 20 kHz, V_S = 3 V p-p
Insertion Loss	−0.02			dB typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
−3 dB Bandwidth	21			MHz typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
C_S (OFF)	160			pF typ	
C_D (OFF)	160			pF typ	
C_D, C_S (ON)	238			pF typ	
POWER REQUIREMENTS					V_{DD} = 3.6 V
I_{DD}	0.003			μA typ	Digital inputs = 0 V or 3.6 V
		1	4	μA max	

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

SPECIFICATIONS—2.5 V ± 0.2 V

V_{DD} = 2.5 V ± 0.2 V, GND = 0 V, unless otherwise noted. The temperature range is −40°C to +125°C.

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})	0.3			Ω typ	V_{DD} = 2.3 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
	0.35	0.4	0.45	Ω max	See Figure 3
On Resistance Flatness ($R_{FLAT (ON)}$)	0.025			Ω typ	V_{DD} = 2.3 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
	0.04	0.05	0.05	Ω max	
LEAKAGE CURRENTS					V_{DD} = 2.7 V
Source Off Leakage I_S (OFF)	±0.2			nA typ	V_S = 0.6 V/2.4 V, V_D = 2.4 V/0.6 V; see Figure 4
Channel On Leakage I_D, I_S (ON)	±0.2			nA typ	V_S = V_D = 0.6 V or 2.4 V; see Figure 5
DIGITAL INPUTS					
Input High Voltage, V_{INH}			1.7	V min	
Input Low Voltage, V_{INL}			0.7	V max	
Input Current, I_{INL} or I_{INH}	0.005			μA typ	V_{IN} = V_{INL} or V_{INH}
			±0.1	μA max	
Digital Input Capacitance, C_{IN}	3.2			pF typ	
DYNAMIC CHARACTERISTICS[1]					
t_{ON}	13			ns typ	R_L = 50 Ω, C_L = 35 pF
	16.5	18	19	ns max	V_S = 1.5 V; see Figure 8
t_{OFF}	7			ns typ	R_L = 50 Ω, C_L = 35 pF
	8.2	8.4	8.6	ns max	V_S = 1.5 V; see Figure 8
Charge Injection	150			pC typ	V_S = 1.25 V, R_S = 0 Ω, C_L = 1 nF; see Figure 9
Off Isolation	−54			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz; see Figure 6
Total Harmonic Distortion (THD + N)	0.022			%	R_L = 32 Ω, f = 20 Hz to 20 kHz, V_S = 1.5 V p-p
Insertion Loss	−0.02			dB typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
−3 dB Bandwidth	21			MHz typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
C_S (OFF)	170			pF typ	
C_D (OFF)	170			pF typ	
C_D, C_S (ON)	238			pF typ	
POWER REQUIREMENTS					V_{DD} = 2.7 V
I_{DD}	0.003			μA typ	Digital inputs = 0 V or 2.7 V
		1	4	μA max	

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

SPECIFICATIONS—1.65 V TO 1.95

V_{DD} = 1.65 V to1.95 V, GND = 0 V, unless otherwise noted. The temperature range is −40°C to +125°C.

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})	0.37			Ω typ	V_{DD} = 1.8 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
	0.4	0.84	0.84	Ω max	See Figure 3
	0.6	1.8	1.8	Ω max	V_{DD} = 1.65 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
On Resistance Flatness ($R_{FLAT (ON)}$)	0.17			Ω typ	V_{DD} = 1.65 V, V_S = 0 V to V_{DD}, I_{DS} = −100 mA
LEAKAGE CURRENTS					V_{DD} = 1.95 V
Source Off Leakage I_S (OFF)	±0.2			nA typ	V_S = 0.6 V/1.65 V, V_D = 1.65 V/0.6 V; see Figure 4
Channel On Leakage I_D, I_S (ON)	±0.2			nA typ	V_S = V_D = 0.6 V or 1.65 V; see Figure 5
DIGITAL INPUTS					
Input High Voltage, V_{INH}			0.65 V_{DD}	V min	
Input Low Voltage, V_{INL}			0.35 V_{DD}	V max	
Input Current, I_{INL} or I_{INH}	0.005			μA typ	V_{IN} = V_{INL} or V_{INH}
			±0.1	μA max	
Digital Input Capacitance, C_{IN}	4			pF typ	
DYNAMIC CHARACTERISTICS[1]					
t_{ON}	19			ns typ	R_L = 50 Ω, C_L = 35 pF
	26	28	30	ns max	V_S = 1.5 V; see Figure 8
t_{OFF}	8			ns typ	R_L = 50 Ω, C_L = 35 pF
	9.5	9.8	10	ns max	V_S = 1.5 V; see Figure 8
Charge Injection	100			pC typ	V_S = 1 V, R_S = 0 V, C_L = 1 nF; see Figure 9
Off Isolation	−54			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz; see Figure 6
Total Harmonic Distortion (THD + N)	0.14			%	R_L = 32 Ω, f = 20 Hz to 20 kHz, V_S = 1.2 V p-p
Insertion Loss	−0.02			dB typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
−3 dB Bandwidth	21			MHz typ	R_L = 50 Ω, C_L = 5 pF; see Figure 7
C_S (OFF)	178			pF typ	
C_D (OFF)	178			pF typ	
C_D, C_S (ON)	238			pF typ	
POWER REQUIREMENTS					V_{DD} = 1.95 V
I_{DD}	0.003			μA typ	Digital inputs = 0 V or 1.95 V
		1	4	μA max	

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

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 5.

Parameter	Rating
V_{DD} to GND	−0.3 V to +4.6 V
Analog Inputs[1]	−0.3 V to V_{DD} +0.3 V
Digital Inputs[1]	−0.3 V to 4.6 V or 10 mA, whichever occurs first
Peak Current, S or D	
3.3 V Operation	500 mA
2.5 V Operation	460 mA
1.8 V Operation	420 mA (pulsed at 1 ms, 10% duty cycle maximum)
Continuous Current, S or D	
3.3 V Operation	300 mA
2.5 V Operation	275 mA
1.8 V Operation	250 mA
Operating Temperature Range	−40°C to +125°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature	150°C

[1] Overvoltages at S or D are clamped by internal diodes. Current should be limited to the maximum ratings given.

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.

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 CONFIGURATION AND FUNCTION DESCRIPTIONS

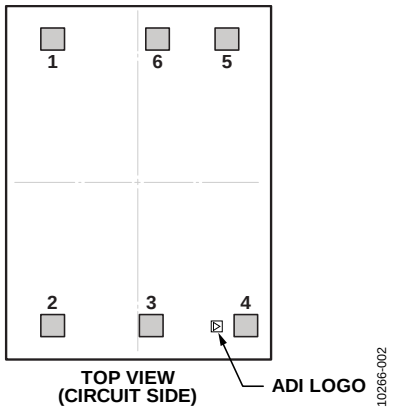

Figure 2. Pad Configuration

Table 6. Pad Function Descriptions

Pad No.	X-Axis (µm)	Y-Axis (µm)	Mnemonic	Pad Type	Description
1	−254	+401	V_{DD}	Single	Positive Power Supply Pad.
2	−254	−401	IN	Single	Logic Control Input Pad.
3	+6	−401	S	Single	Source Pad.
4	+306	−401	GND	Single	Ground Pad.
5	+249	+401	NC	Single	No Connect.
6	+39	+401	D	Single	Drain Pad.

TEST CIRCUITS

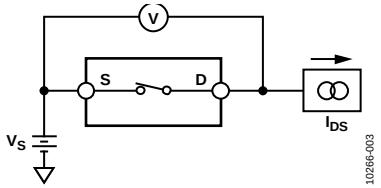

Figure 3. On Resistance

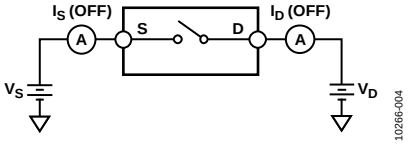

Figure 4. Off Leakage

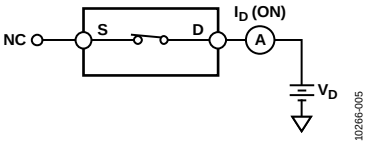

Figure 5. On Leakage

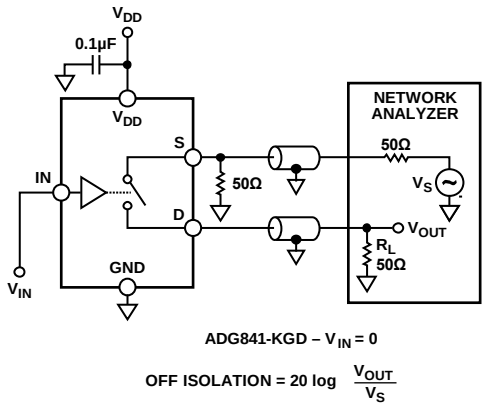

Figure 6. Off Isolation

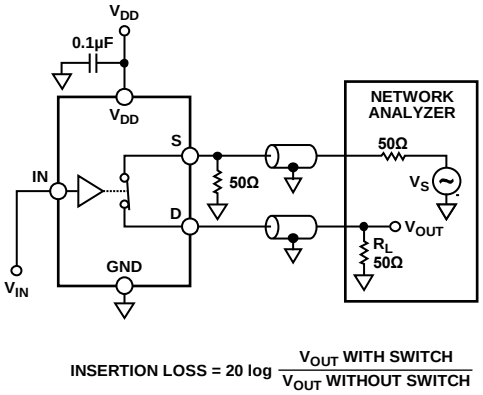

Figure 7. Bandwidth

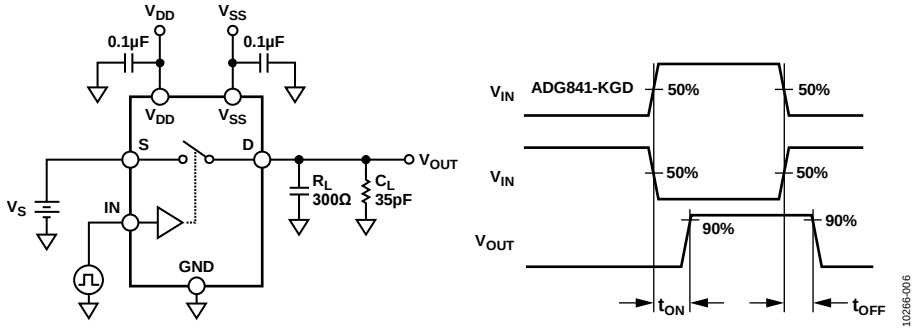

Figure 8. Switching Times, t_{ON}, t_{OFF}

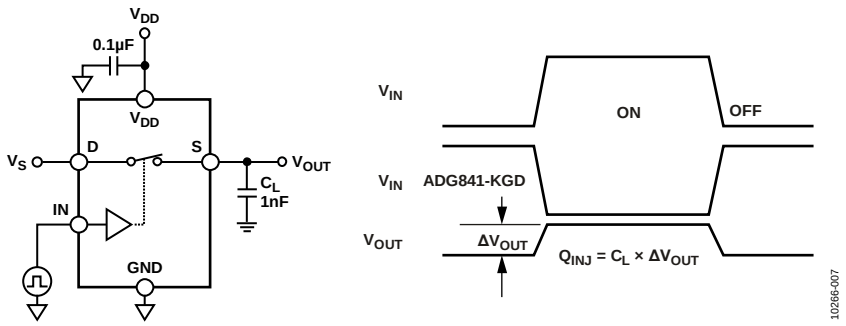

Figure 9. Charge Injection

OUTLINE DIMENSIONS

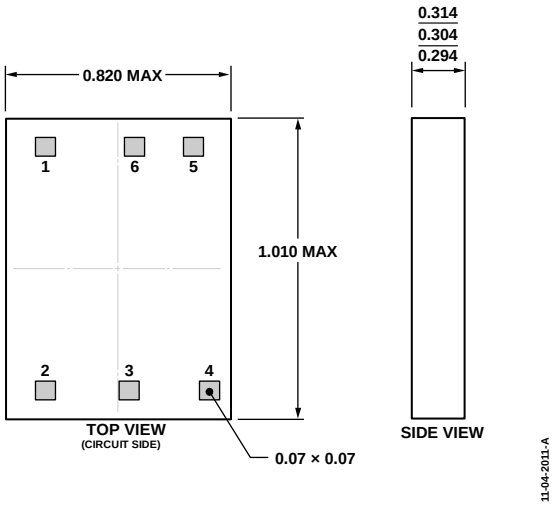

Figure 10. 6-Pad Bare Die [CHIP]
(C-6-3)
Dimensions shown in millimeters

DIE SPECIFICATIONS AND ASSEMBLY RECOMMENDATIONS

Table 7. Die Specifications

Parameter	Value	Unit
Chip Size	735 × 925	µm
Scribe Line Width	85 × 85	µm
Die Size	820 × 1010	µm (maximum)
Thickness	304 ± 10	µm
Bond Pad	70 × 70	µm (minimum)
Bond Pad Composition	99.5 Al, 0.5 Cu	%
Backside	Bare	Not Applicable
Passivation	Nitride	Not Applicable

Table 8. Assembly Recommendations

Assembly Component	Recommendation
Die Attach	Epoxy adhesive
Bonding Method	Gold ball or aluminum wedge
Bonding Sequence	Four first

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADG841-KGD-CHIPS	−40°C to +125°C	6-Pad Bare Die [CHIP]	C-6-3

D10266-0-12/14(B)