0.58 Ω CMOS, 1.8 V to 5.5 V, Quad SPDT/2:1 Mux in Mini LFCSP

Data Sheet **ADG858**

FEATURES

0.58 Ω typical on resistance
0.82 Ω maximum on resistance at 85°C
1.8 V to 5.5 V single supply
High current carrying capability: 250 mA continuous
Rail-to-rail switching operation
Fast-switching times: <20 ns
Typical power consumption: <0.1 µW
2.1 mm × 2.1 mm mini LFCSP

APPLICATIONS

Cellular phones
PDAs
MP3 players
Power routing
Battery-powered systems
PCMCIA cards
Modems
Audio and video signal routing
Communication systems

FUNCTIONAL BLOCK DIAGRAM

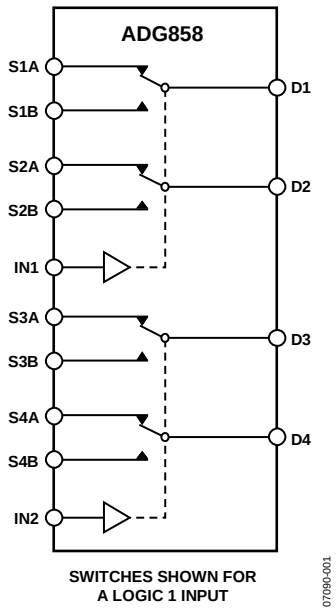


Figure 1.

GENERAL DESCRIPTION

The ADG858 is a low voltage CMOS device containing four single-pole, double-throw (SPDT) switches. This device offers ultralow on resistance of less than 0.82 Ω over the full temperature range. The ADG858 is fully specified for 4.2 V to 5.5 V and 2.7 V to 3.6 V supply operation.

Each switch conducts equally well in both directions when on and has an input signal range that extends to the supplies. The ADG858 exhibits break-before-make switching action.

The ADG858 is available in a 2.1 mm × 2.1 mm, 16-lead mini LFCSP. This tiny package makes the device ideal for space-constrained applications, such as handsets, PDAs, and MP3s.

PRODUCT HIGHLIGHTS

1. <0.82 Ω over the full temperature range of −40°C to +85°C.
2. Single 1.8 V to 5.5 V operation.
3. Compatible with 1.8 V CMOS logic.
4. High current handling capability (250 mA continuous current per channel).
5. Low THD + N: 0.06% typical.
6. 2.1 mm × 2.1 mm, 16-lead mini LFCSP.

Rev. B **Document Feedback**
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REVISION HISTORY

4/16—Rev. A to Rev. B

Changes to Table 4 ... 6
Updated Outline Dimensions ... 13
Changes to Ordering Guide ... 13

8/08—Rev. 0 to Rev. A

Changes to Features Section ... 1

8/08—Revision 0: Initial Version

SPECIFICATIONS

V_{DD} = 4.2 V to 5.5 V, GND = 0 V, unless otherwise noted.

Table 1.

Parameter	+25°C	−40°C to +85°C	Unit	Test Conditions/Comments
ANALOG SWITCH				
Analog Signal Range		0 to V_{DD}	V	
On Resistance, R_{ON}	0.58		Ω typ	V_{DD} = 4.2 V, V_S = 0 V to V_{DD}, I_S = 100 mA, see Figure 16
	0.72	0.82	Ω max	
On-Resistance Match Between Channels, ΔR_{ON}	0.04		Ω typ	V_{DD} = 4.2 V, V_S = 2 V, I_S = 100 mA
		0.14	Ω max	
On-Resistance Flatness, $R_{FLAT (ON)}$	0.12		Ω typ	V_{DD} = 4.2 V, V_S = 0 V to V_{DD}
		0.26	Ω max	I_S = 100 mA
LEAKAGE CURRENTS				V_{DD} = 5.5 V
Source Off Leakage, I_S (Off)	±10		pA typ	V_S = 0.6 V/4.2 V, V_D = 4.2 V/0.6 V, see Figure 17
Channel On Leakage, I_D, I_S (On)	±10		pA typ	V_S = V_D = 0.6 V or 4.2 V, see Figure 18
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}	0.004		μA typ	V_{IN} = V_{GND} or V_{DD}
		0.05	μA max	
Digital Input Capacitance, C_{IN}	2		pF typ	
DYNAMIC CHARACTERISTICS[1]				
t_{ON}	20		ns typ	R_L = 50 Ω, C_L = 35 pF
	27	36	ns max	V_S = 3 V/0 V, see Figure 19
t_{OFF}	8		ns typ	R_L = 50 Ω, C_L = 35 pF
	12	13	ns max	V_S = 3 V, see Figure 19
Break-Before-Make Time Delay, t_{BBM}	14		ns typ	R_L = 50 Ω, C_L = 35 pF
		9	ns min	V_{S1} = V_{S2} = 1.5 V, see Figure 20
Charge Injection	45		pC typ	V_S = 1.5 V, R_S = 0 Ω, C_L = 1 nF, see Figure 21
Off Isolation	−67		dB typ	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 22
Channel-to-Channel Crosstalk	−85		dB typ	S1A to S2A/S1B to S2B/S3A to S4A/S3B to S4B, R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 25
	−67		dB typ	S1A to S1B/S2A to S2B/S3A to S3B/S4A to S4B, R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 24
Total Harmonic Distortion, THD + N	0.06		%	R_L = 32 Ω, f = 20 Hz to 20 kHz, V_S = 2 V p-p
Insertion Loss	−0.05		dB typ	R_L = 50 Ω, C_L = 5 pF, see Figure 23
−3 dB Bandwidth	70		MHz typ	R_L = 50 Ω, C_L = 5 pF, see Figure 23
C_S (Off)	25		pF typ	
C_D, C_S (On)	75		pF typ	
POWER REQUIREMENTS				V_{DD} = 5.5 V
I_{DD}	0.003		μA typ	Digital inputs = 0 V or 5.5 V
		1	μA max	

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

V_{DD} = 2.7 V to 3.6 V, GND = 0 V, unless otherwise noted.

Table 2.

Parameter	+25°C	−40°C to +85°C	Unit	Test Conditions/Comments
ANALOG SWITCH				
Analog Signal Range		0 to V_{DD}	V	
On Resistance, R_{ON}	1		Ω typ	V_{DD} = 2.7 V, V_S = 0 V to V_{DD}, I_S = 100 mA, see Figure 16
	1.35	1.5	Ω max	
On-Resistance Match Between Channels, ΔR_{ON}	0.05		Ω typ	V_{DD} = 2.7 V, V_S = 0.7 V, I_S = 100 mA
		0.15	Ω max	
On-Resistance Flatness, $R_{FLAT (ON)}$	0.35		Ω typ	V_{DD} = 2.7 V, V_S = 0 V to V_{DD}, I_S = 100 mA
		0.79	Ω max	
LEAKAGE CURRENTS				V_{DD} = 3.6 V
Source Off Leakage I_S (Off)	±10		pA typ	V_S = 0.6 V/3.3 V, V_D = 3.3 V/0.6 V, see Figure 17
Channel On Leakage I_D, I_S (On)	±10		pA typ	V_S = V_D = 0.6 V or 3.3 V, see Figure 18
DIGITAL INPUTS				
Input High Voltage, V_{INH}		1.35	V min	
Input Low Voltage, V_{INL}		0.8	V max	
Input Current				
I_{INL} or I_{INH}	0.004		μA typ	V_{IN} = V_{GND} or V_{DD}
		0.05	μA max	
Digital Input Capacitance, C_{IN}	2		pF typ	
DYNAMIC CHARACTERISTICS[1]				
t_{ON}	30		ns typ	R_L = 50 Ω, C_L = 35 pF
	50	59	ns max	V_S = 1.5 V/0 V, see Figure 19
t_{OFF}	9		ns typ	R_L = 50 Ω, C_L = 35 pF
	14	15	ns max	V_S = 1.5 V, see Figure 19
Break-Before-Make Time Delay, t_{BBM}	25		ns typ	R_L = 50 Ω, C_L = 35 pF
		11	ns min	V_{S1} = V_{S2} = 1.5 V, see Figure 20
Charge Injection	35		pC typ	V_S = 1.5 V, R_S = 0 Ω, C_L = 1 nF, see Figure 21
Off Isolation	−67		dB typ	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 22
Channel-to-Channel Crosstalk	−85		dB typ	S1A to S2A/S1B to S2B/S3A to S4A/S3B to S4B, R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 25
	−67		dB typ	S1A to S1B/S2A to S2B/S3A to S3B/S4A to S4B, R_L = 50 Ω, C_L = 5 pF, f = 100 kHz, see Figure 24
Total Harmonic Distortion, THD + N	0.1		%	R_L = 32 Ω, f = 20 Hz to 20 kHz, V_S = 1.5 V p-p
Insertion Loss	−0.06		dB typ	R_L = 50 Ω, C_L = 5 pF, see Figure 23
−3 dB Bandwidth	70		MHz typ	R_L = 50 Ω, C_L = 5 pF, see Figure 23
C_S (Off)	25		pF typ	
C_D, C_S (On)	75		pF typ	
POWER REQUIREMENTS				V_{DD} = 3.6 V
I_{DD}	0.003		μA typ	Digital inputs = 0 V or 3.6 V
		1	μA max	

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

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 3.

Parameter	Rating
V_{DD} to GND	−0.3 V to +6 V
Analog Inputs[1]	−0.3 V to V_{DD} + 0.3 V
Digital Inputs[1]	−0.3 V to V_{DD} or 10 mA, whichever occurs first
Peak Current, S or D	500 mA (pulsed at 1 ms, 10% duty cycle max)
Continuous Current, S or D	250 mA
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature	150°C
16-Lead Mini LFCSP	
θ_{JA} Thermal Impedance, 3-Layer Board	84.9°C/W
Reflow Soldering, Pb-Free	
Peak Temperature	260(+0/−5)°C
Time at Peak Temperature	10 sec to 40 sec

[1] Overvoltages at IN, S, or D are clamped by internal diodes. Current must 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.

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 CONFIGURATION AND FUNCTION DESCRIPTIONS

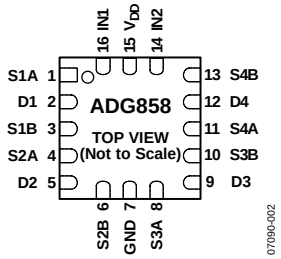


Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 3, 4, 6, 8, 10, 11, 13	S1A, S1B, S2A, S2B, S3A, S3B, S4A, S4B	Source Terminal. Can be an input or output.
2, 5, 9, 12	D1, D2, D3, D4	Drain Terminal. Can be an input or output.
7	GND	Ground (0 V) Reference.
14, 16	IN2, IN1	Logic Control Input.
15	V_{DD}	Most Positive Power Supply Potential.

Table 5. ADG858 Truth Table

Logic (IN1/IN2)	Switch A (S1A/S2A/S3A/S4A)	Switch B (S1B/S2B/S3B/S4B)
0	Off	On
1	On	Off

TYPICAL PERFORMANCE CHARACTERISTICS

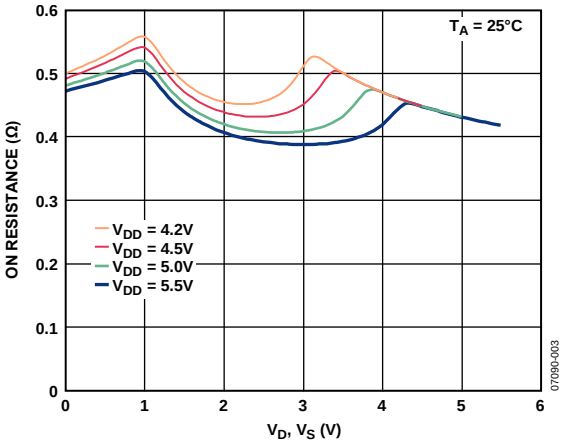


Figure 3. On Resistance vs. V_D (V_S), V_{DD} = 4.2 V to 5.5 V

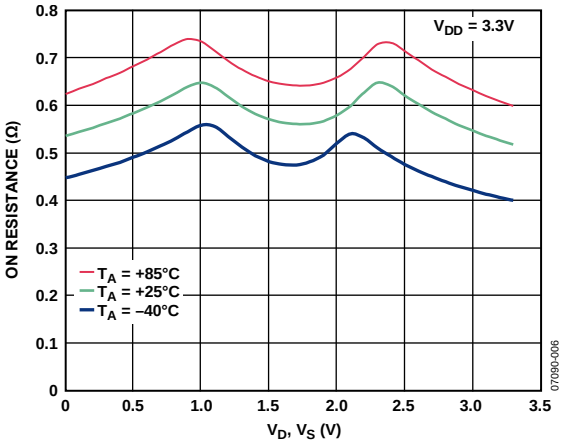


Figure 6. On Resistance vs. V_D (V_S) for Different Temperatures, V_{DD} = 3.3 V

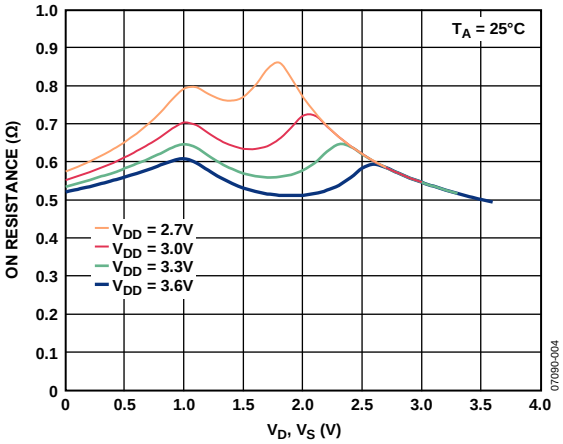


Figure 4. On Resistance vs. V_D (V_S), V_{DD} = 2.7 V to 3.6 V

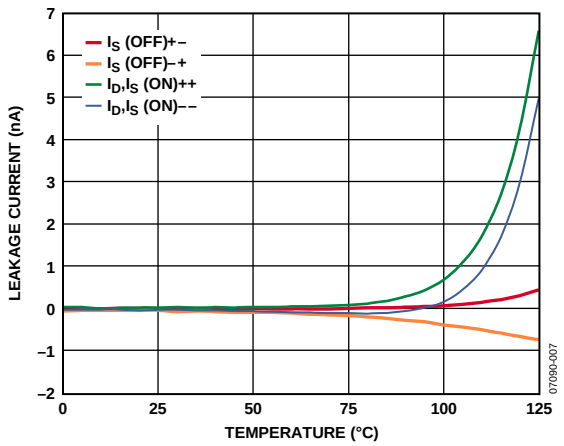


Figure 7. Leakage Current vs. Temperature, V_{DD} = 5 V

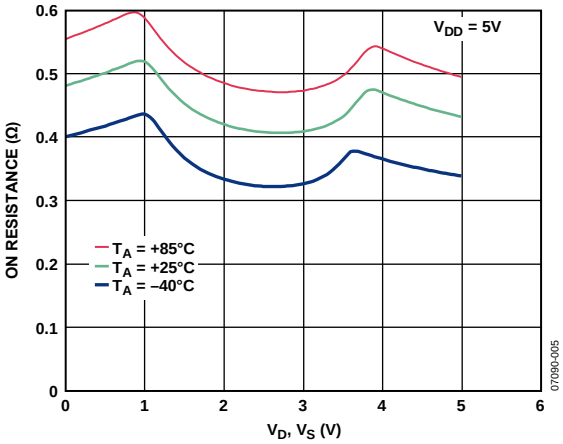


Figure 5. On Resistance vs. V_D (V_S) for Different Temperatures, V_{DD} = 5 V

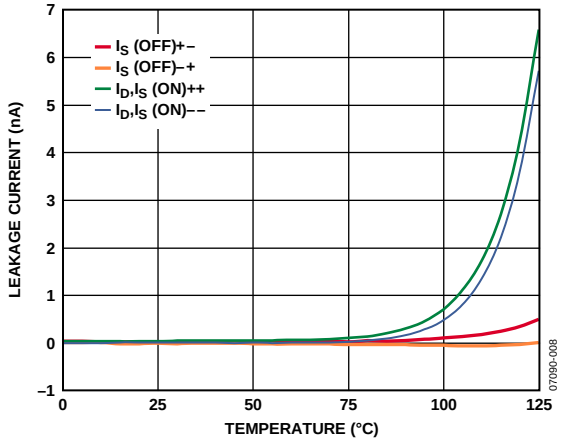


Figure 8. Leakage Current vs. Temperature, V_{DD} = 3.3 V

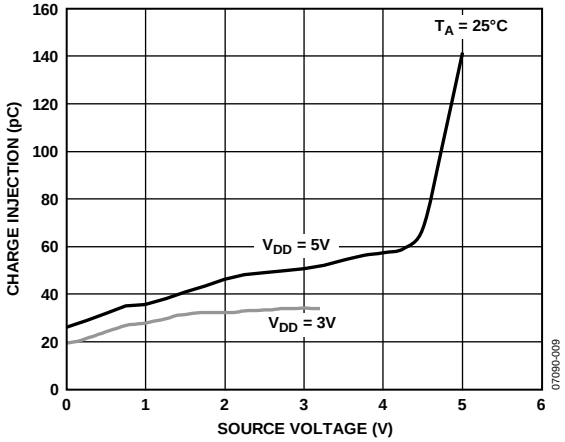


Figure 9. Charge Injection vs. Source Voltage

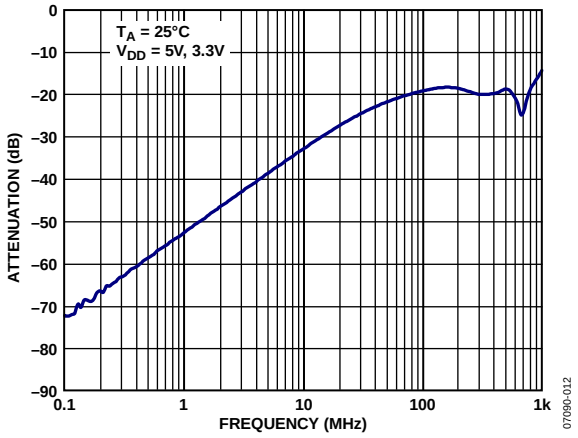


Figure 12. Off Isolation vs. Frequency

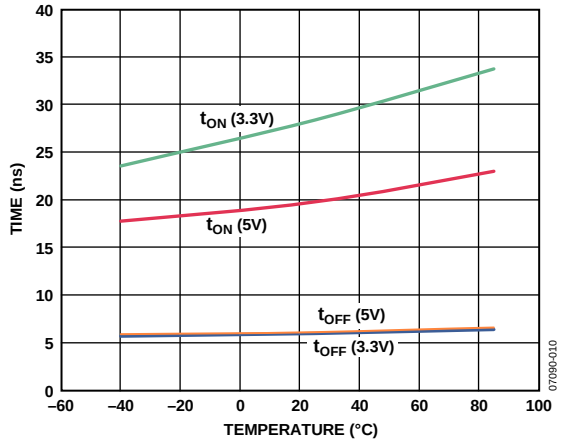


Figure 10. t_{ON}/t_{OFF} Times vs. Temperature

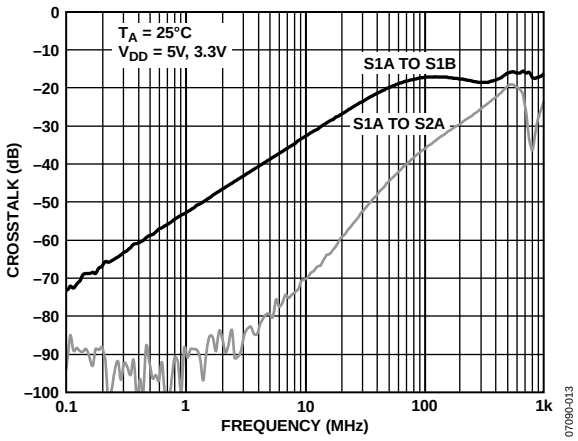


Figure 13. Crosstalk vs. Frequency

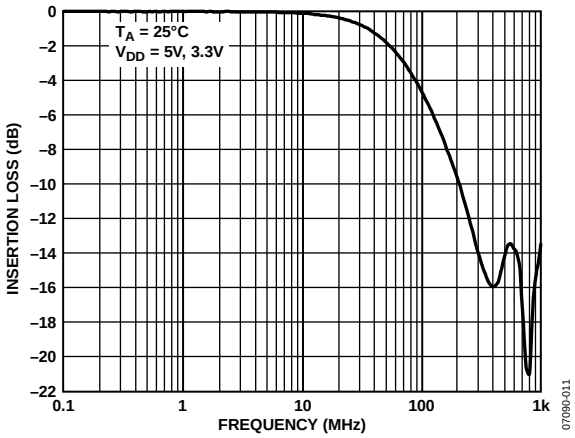


Figure 11. Bandwidth

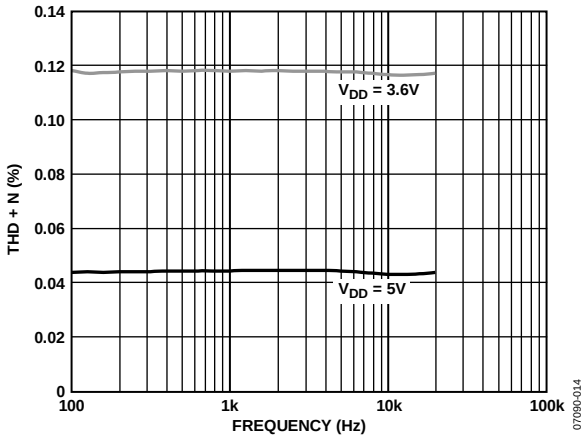


Figure 14. Total Harmonic Distortion + Noise (THD + N) vs. Frequency

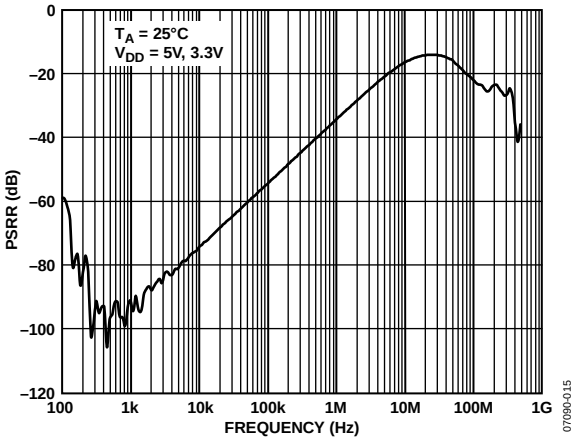


Figure 15. PSRR vs. Frequency

TEST CIRCUITS

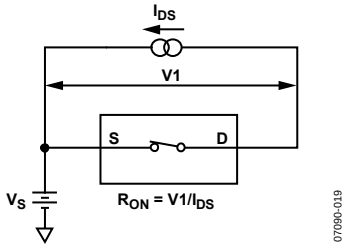


Figure 16. On Resistance

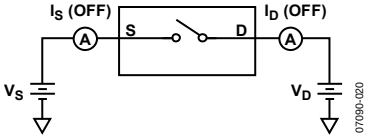


Figure 17. Off Leakage

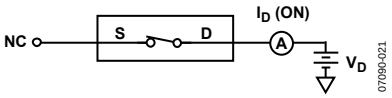


Figure 18. On Leakage

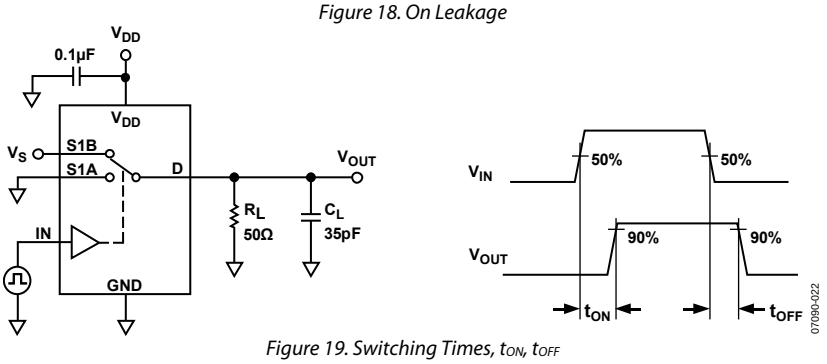


Figure 19. Switching Times, t_{ON}, t_{OFF}

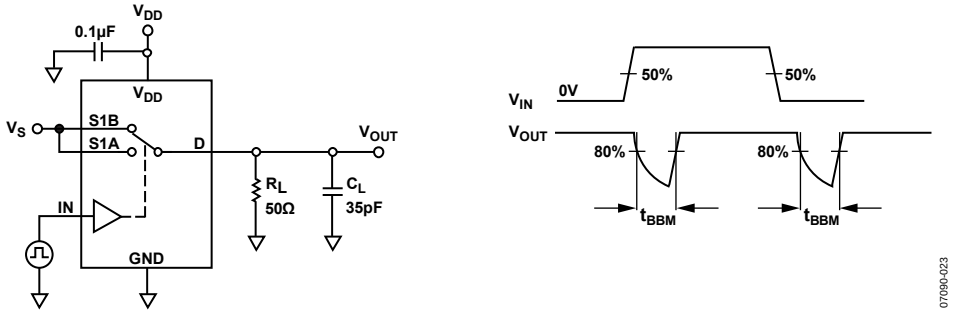


Figure 20. Break-Before-Make Time Delay, t_{BBM}

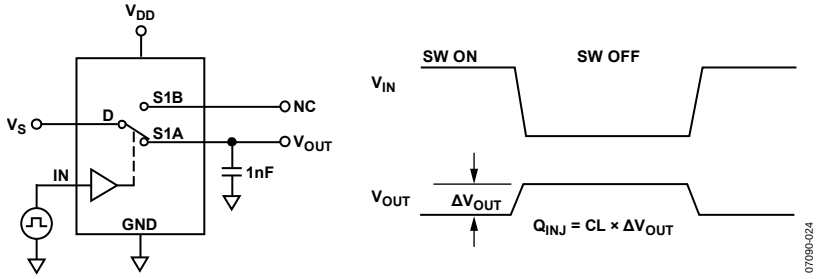


Figure 21. Charge Injection

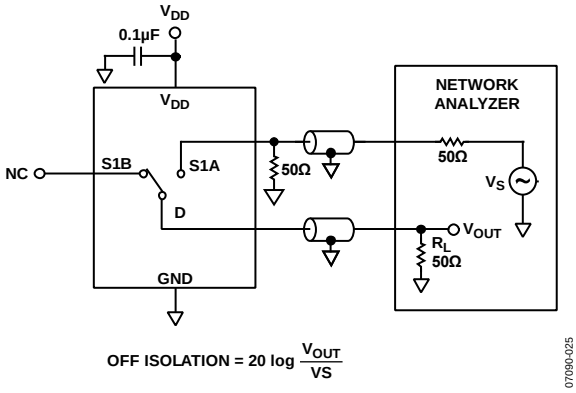


Figure 22. Off Isolation

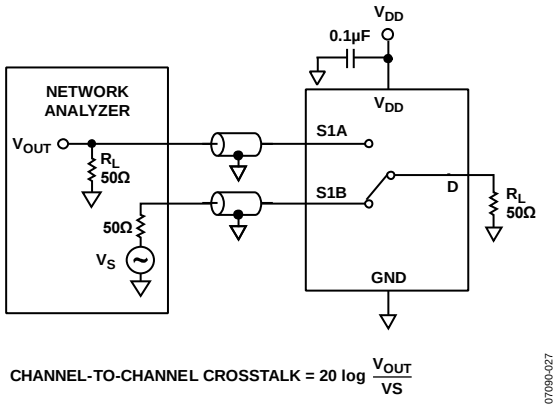


Figure 24. Channel-to-Channel Crosstalk (S1A to S1B)

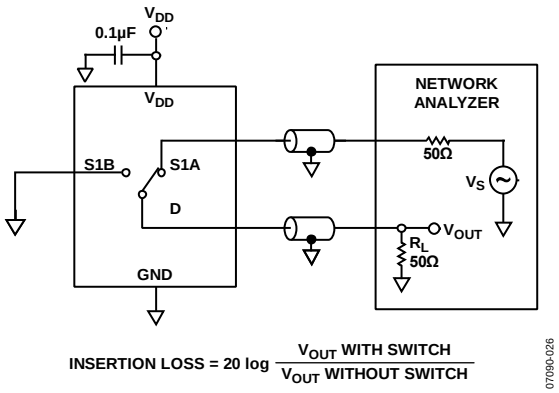


Figure 23. Bandwidth

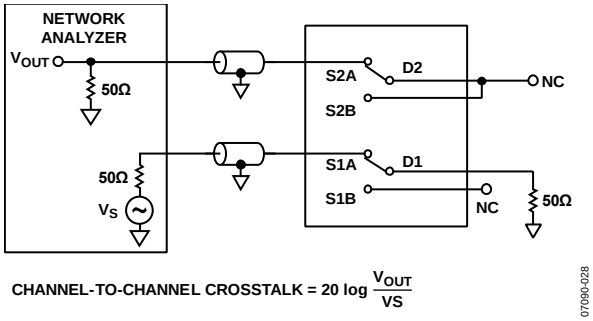


Figure 25. Channel-to-Channel Crosstalk (S1A to S2A)

TERMINOLOGY

I_{DD}
Positive supply current.

V_D (V_S)
Analog voltage on Terminal D and Terminal S.

R_{ON}
Ohmic resistance between Terminal D and Terminal S.

$R_{FLAT (ON)}$
The difference between the maximum and minimum values of on resistance as measured on the switch.

ΔR_{ON}
On resistance match between any two channels.

I_S (Off)
Source leakage current with the switch off.

I_D (Off)
Drain leakage current with the switch off.

I_D, I_S (On)
Channel leakage current with the switch on.

V_{INL}
Maximum input voltage for Logic 0.

V_{INH}
Minimum input voltage for Logic 1.

I_{INL} (I_{INH})
Input current of the digital input.

C_S (Off)
Off switch source capacitance. Measured with reference to ground.

C_D (Off)
Off switch drain capacitance. Measured with reference to ground.

C_D, C_S (On)
On switch capacitance. Measured with reference to ground.

C_{IN}
Digital input capacitance.

t_{ON}
Delay time between the 50% and 90% points of the digital input and switch on condition.

t_{OFF}
Delay time between the 50% and 90% points of the digital input and switch off condition.

t_{BBM}
On or off time measured between the 80% points of both switches when switching from one to another.

Charge Injection
Measure of the glitch impulse transferred from the digital input to the analog output during on/off switching.

Off Isolation
Measure of unwanted signal coupling through an off switch.

Crosstalk
Measure of unwanted signal that is coupled from one channel to another because of parasitic capacitance.

−3 dB Bandwidth
Frequency at which the output is attenuated by 3 dB.

On Response
Frequency response of the on switch.

Insertion Loss
The loss due to the on resistance of the switch.

THD + N
Ratio of the harmonics amplitude plus noise of a signal to the fundamental.

OUTLINE DIMENSIONS

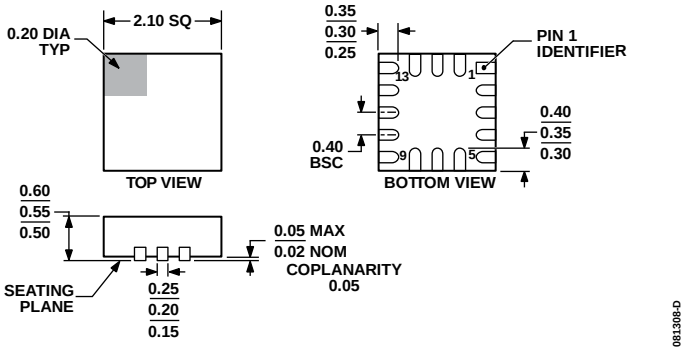


Figure 26. 16-Lead Lead Frame Chip Scale Package [LFCSP_UQ]
2.10 mm × 2.10 mm Body, Ultra Thin Quad
(CP-16-15)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding
ADG858BCPZ-REEL7[1]	−40°C to +85°C	16-Lead Lead Frame Chip Scale Package [LFCSP_UQ]	CP-16-15	11

[1] Z = RoHS Compliant Part.

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