4-Channel/8-Channel Fault-Protected Analog Multiplexers

ADG438F/ADG439F 4" to 8" Transfer Evaluation Report

ADG438F/ADG439F 4" TO 8" TRANSFER EVALUATION SUMMARY

This document highlights the performance differences between the 4" and 8" Transfer for the ADG438F and ADG439F Fault Protected Analog Multiplexers.

There was no significant specification changes due to this transfer but some subtle changes are covered in this document. Latch-up, ESD classification, Power supply sequencing and Absolute maximum ratings evaluation were carried out without any issue.

This document is divided into 3 sections:

1. Datasheet specification changes from 4" to 8" process transfer

   Table 1 outlines a datasheet specification comparison of 4" and 8" material.
2. ABSOLUTE MAXIMUM RATINGS

   Tables 2 & 3 outline a comparison of the absolute maximum ratings between 4" and 8" processes.
3. TYPICAL PERFORMANCE CHARACTERISTICS

   The TYPICAL PERFORMANCE CHARACTERISTICS section (Figures 1 to 24) compares typical plots of 4" and 8" material

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SPECIFICATION CHANGES FROM 4" TO 8" PROCESS TRANSFER

DUAL SUPPLY

4" Version : V_{DD} = +15 V, V_{SS} = −15 V, GND = 0 V, unless otherwise noted.

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

Table 1.

	4" Version			8" Version				
Parameter	**+25°C**	**−40°C to +85°C**	**−40°C to +105°C**	**+25°C**	**−40°C to +85°C**	**−40°C to +105°C**	**Unit**	**Test Conditions/Comments**
ANALOG SWITCH								
Analog Signal Range		V_{SS} + 1.2	V_{SS} + 1.2		V_{SS} + 1.4	V_{SS} + 1.4	V typ	Output open circuit
		V_{DD} − 0.8	V_{DD} − 0.8		V_{DD} − 1.4	V_{DD} − 1.4	V typ	
					V_{SS} + 2.2	V_{SS} + 2.2	V typ	Output loaded, 1 mA
					V_{DD} − 2.2	V_{DD} − 2.2	V typ	
R_{ON}				270			Ω typ	−10 V ≤ V_S ≤ +10 V, I_S = 1 mA;
		400	400		390	420	Ω max	V_{DD} = +15 V ± 10%, V_{SS} = −15 V ± 10%
ΔR_{ON}[1]				9			% typ	
		5	5					−5 V ≤ V_S ≤ +5 V, I_S = 1 mA;
				10	10	10	% max	−10 V ≤ V_S ≤ 10V, I_S = 1 mA;
R_{ON} Drift	0.6			0.5			%/°C typ	V_S = 0 V, I_S = 1 mA
R_{ON} Match	3	3	3	2	2	2	% max	V_S = ±10 V, I_S = 1 mA
LEAKAGE CURRENTS								
Source OFF Leakage I_S (OFF)	±0.01			±0.01			nA typ	V_D = ±10 V, V_S = ∓10 V;
	±0.5	±2	±5	±0.5	±1.5	±1.5	nA max	
Drain OFF Leakage I_D (OFF)	±0.01			±0.01			nA typ	V_D = ±10 V, V_S = ∓10 V;
ADG438F/ADG528F	±0.5	±5	±30	±0.5	±5	±5	nA max	
ADG439F	±0.5	±5	±15	±0.5	±5	±5	nA max	
Channel ON Leakage I_D, I_S (ON)	±0.01			±0.01			nA typ	V_S = V_D = ± 10 V;
ADG438F/ADG528F	±0.5	±5	±30	±0.5	±5	±5	nA max	
ADG439F	±0.5	±5	±15	±0.5	±5	±5	nA max	
FAULT								
Output Leakage Current	±0.02			±1			nA typ	V_S = ±33 V, or +50V, V_D = 0 V,
(With Overvoltage)	±1	±2	±10	±0.05	±0.1	±0.2	µA max	
Input Leakage Current	±0.005			±0.00005			µA typ	V_S = ±25 V, V_D = ∓10 V,
(With Overvoltage)	±1	±1	±2	±0.05	±0.1	±0.2	µA max	
Input Leakage Current	±0.001			±0.03			µA typ	V_S = ±25 V, V_D = V_{EN} = A0, A1, A2 = 0 V
(With Power Supplies OFF)	±1	±1	±4	±0.1	±0.2	±0.3	µA max	
DIGITAL INPUTS								
Input High Voltage, V_{INH}		2.4	2.4		2.0	2.0	V min	
Input Low Voltage, V_{INL}		0.8	0.8		0.8	0.8	V max	
Input Current, I_{INL} or I_{INH}		±1	±1		±1	±1	µA max	V_{IN} = 0 or V_{DD}
C_{IN}, Digital Input	5			5			pF typ	

Parameter	4" Version +25°C	4" Version −40°C to +85°C	4" Version −40°C to +105°C	8" Version +25°C	8" Version −40°C to +85°C	8" Version −40°C to +105°C	Unit	Test Conditions/Comments
Capacitance								
DYNAMIC CHARACTERISTICS[2]								
$t_{TRANSITION}$	170			175			ns typ	R_L = 1 MΩ, C_L = 35 pF;
	220	300	320	220	300	300	ns max	V_{S1} = ±10 V, V_{S8} = ∓10 V;
t_{OPEN}				90			ns typ	R_L = 1 kΩ, C_L = 35 pF;
	10	10	10	60	40	40	ns min	V_S = 5 V;
t_{ON} (EN)	200			180			ns typ	R_L = 1 kΩ, C_L = 35 pF;
	250	300	300	230	300	300	ns max	V_S = 5 V;
t_{OFF} (EN)	110			100			ns typ	R_L = 1 kΩ, C_L = 35 pF;
	150	180	180	130	150	150	ns max	V_S = 5 V;
t_{SETT}, Settling Time								
0.1%		0.5	0.5		1	1	µs typ	R_L = 1 kΩ, C_L = 35 pF;
0.01%		1.7	1.7		2.5	2.5	µs typ	V_S = 5 V
Charge Injection	4			15			pC typ	V_S = 0 V, R_S = 0 Ω, C_L = 1 nF;
OFF Isolation	80			93			dB typ	R_L = 1 kΩ, C_L = 15 pF, f = 100 kHz; V_S = 7 V rms;
Channel-to-Channel Crosstalk	85			93				R_L = 1 kΩ, C_L = 15 pF, f = 100 kHz; V_S = 7 V rms;
C_S (OFF)	5			3			pF typ	
C_D (OFF)								
ADG438F/ADG528F	50			22			pF typ	
ADG439F	25			12			pF typ	
POWER REQUIREMENTS								
I_{DD}	0.05			0.05			mA typ	V_{IN} = 0 V or 5 V
	0.15	0.25	0.25	0.1	0.2	0.2	mA max	
I_{SS}	0.01						mA typ	
	0.02	0.04	0.04	0.0001	0.001	0.001	mA max	

[1] ΔR_{ON} is measured in a +/-5V range on the 4" material test program and a +/-10V range for the8" material test program resulting in a specification difference.

ΔR_{ON} = RON variation due to a change in the analog input voltage with a constant load current.

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

ABSOLUTE MAXIMUM RATINGS

4" Material

T_A = +25°C unless otherwise noted.

Table 2.

Parameter	Rating
V_{DD} to V_{SS}	44 V
V_{DD} to GND	−0.3 V to +25 V
V_{SS} to GND	+0.3 V to −25 V
V_{EN}, V_A Digital Input	−0.3 V to V_{DD} + 2 V or 20 mA, whichever occurs first
V_S, Analog Input Overvoltage with Power On	V_{SS} − 25 V to V_{DD} + 40 V
V_S, Analog Input Overvoltage with Power Off	−40 V to +55 V
Continuous Current, S or D	20 mA
Peak Current, S or D	
(Pulsed at 1 ms, 10% Duty Cycle Max)	40 mA
Operating Temperature Range	
Industrial (B Version)	−40°C to +105°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature	150°C
Plastic Package	
θ_{JA}, Thermal Impedance	117°C/W
Lead Temperature, Soldering (10 sec)	260°C
SOIC Package	
θ_{JA}, Thermal Impedance	
Narrow Body	125°C/W
Wide Body	90°C/W
Lead Temperature, Soldering	
Vapor Phase (60 sec)	215°C
Infrared (15 sec)	220°C

8" Material

T_A = +25°C unless otherwise noted.

Table 3.

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
Digital Input, EN, Ax	−0.3 V to V_{DD} + 2 V or 20 mA, whichever occurs first
V_S, Analog Input Overvoltage with Power On	V_{SS} − 25 V to V_{DD} + 40 V
V_S, Analog Input Overvoltage with Power Off	−40 V to +55 V
Continuous Current, S or D	20 mA
Peak Current, S or D	
(Pulsed at 1 ms, 10% Duty Cycle Max)	40 mA
Operating Temperature Range	
Industrial (B Version)	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature	150°C
PDIP Package	
θ_{JA}, Thermal Impedance	117°C/W
SOIC Package	
θ_{JA}, Thermal Impedance	
Narrow Body	125°C/W
Wide Body	90°C/W

TYPICAL PERFORMANCE CHARACTERISTICS

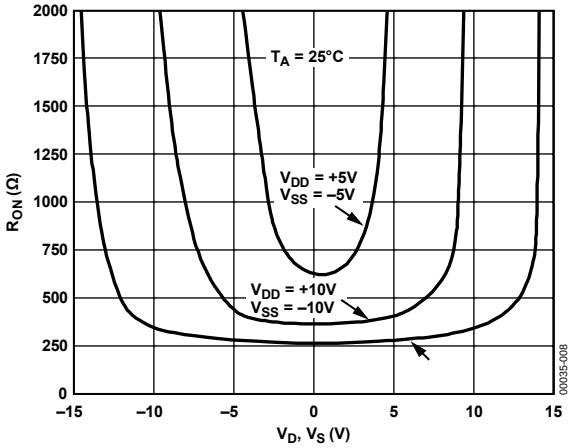

Figure 1. On Resistance as a Function of V_D (V_S) (4" Material)

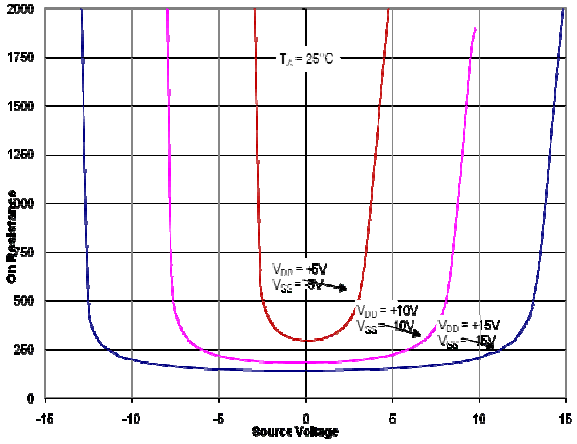

Figure 2. On Resistance as a Function of V_D (V_S) (8" Material)

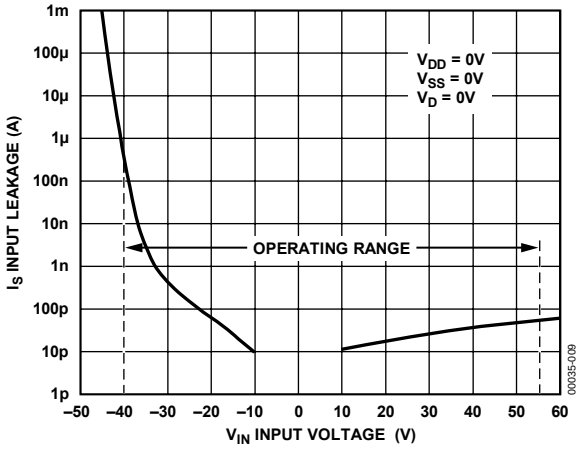

Figure 3. Input Leakage Current as a Function of V_S (Power Supplies Off) During Overvoltage Conditions (4" Material)

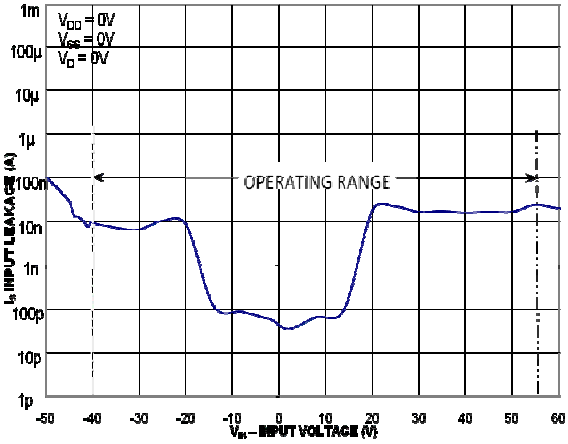

Figure 4. Input Leakage Current as a Function of V_S (Power Supplies Off) During Overvoltage Conditions (8" Material)

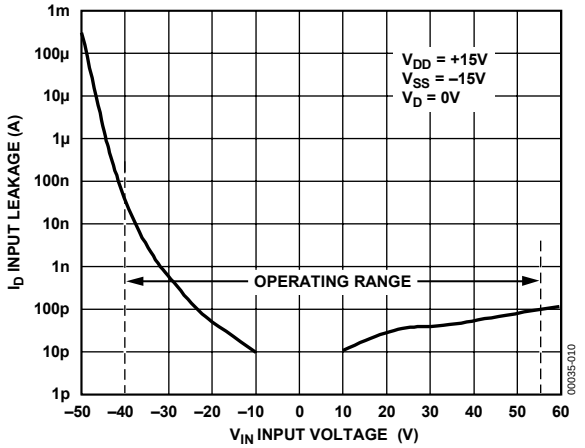

Figure 5. Output Leakage Current as a Function of V_S (Power Supplies On) During Overvoltage Conditions (4" Material)

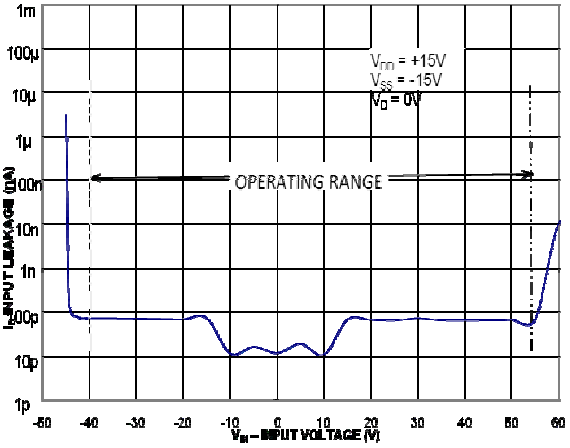

Figure 6. Output Leakage Current as a Function of V_S (Power Supplies On) During Overvoltage Conditions (8" Material)

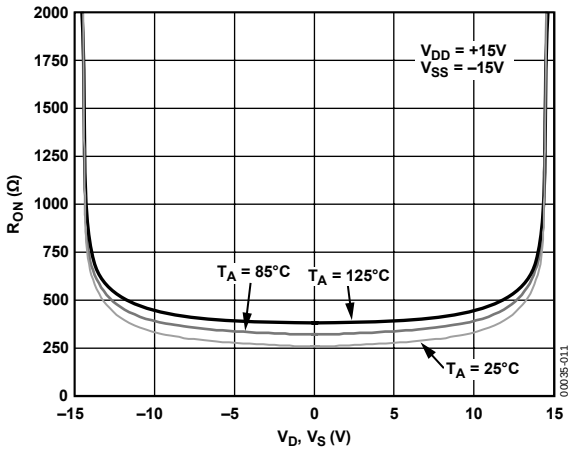

Figure 7. On Resistance as a Function of V_D (V_S) for Different Temperatures (4" Material)

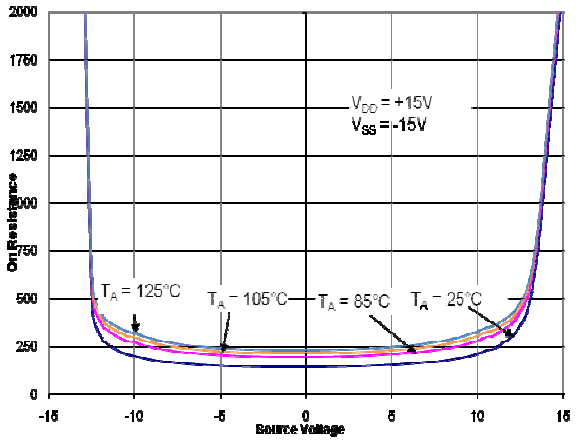

Figure 8. On Resistance as a Function of V_D (V_S) for Different Temperatures (8" Material)

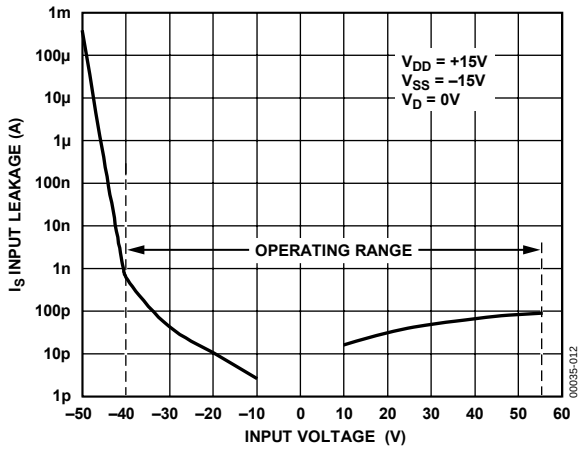

Figure 9. Input Leakage Current as a Function of V_S (Power Supplies On) During Overvoltage Conditions (4" Material)

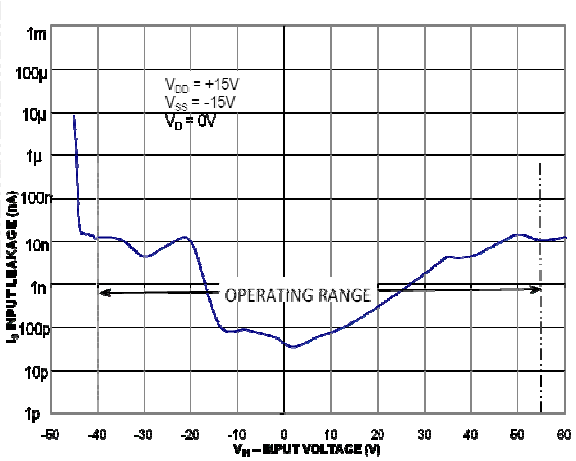

Figure 10. Input Leakage Current as a Function of V_S (Power Supplies On) During Overvoltage Conditions (8" Material)

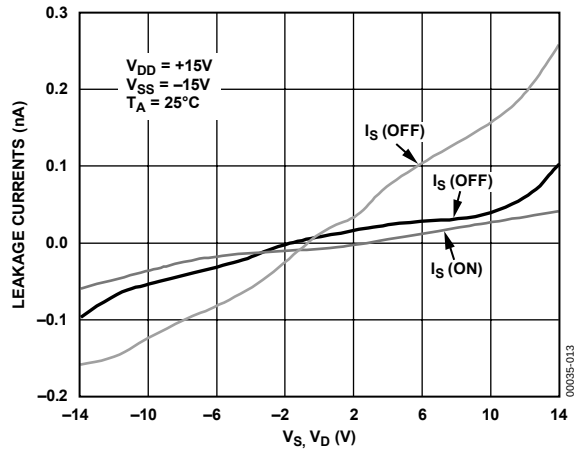

Figure 11. Leakage Currents as a Function of V_D (V_S) (4" Material)

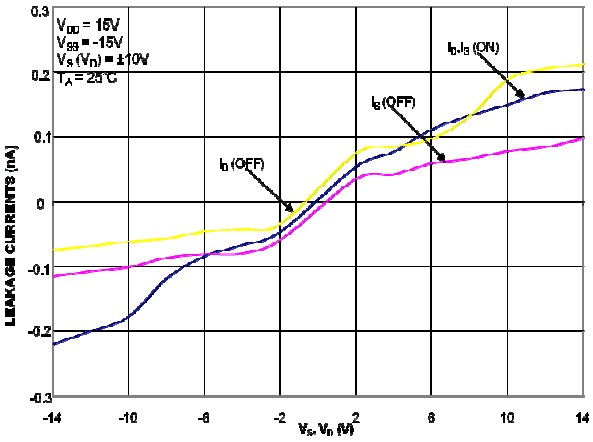

Figure 12. Leakage Currents as a Function of V_D (V_S) (8" Material)

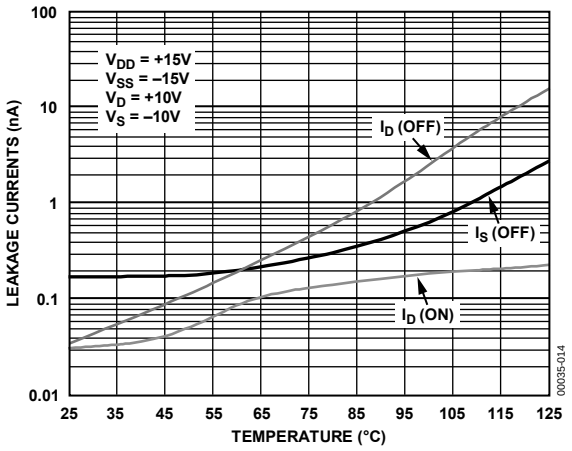

Figure 13. Leakage Currents as a Function of Temperature (4" Material)

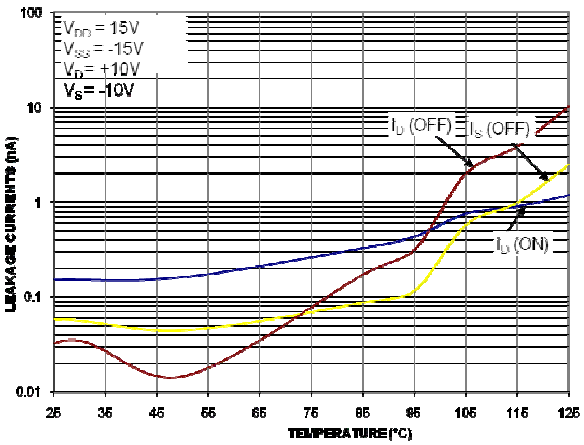

Figure 14. Leakage Currents as a Function of Temperature (8" Material)

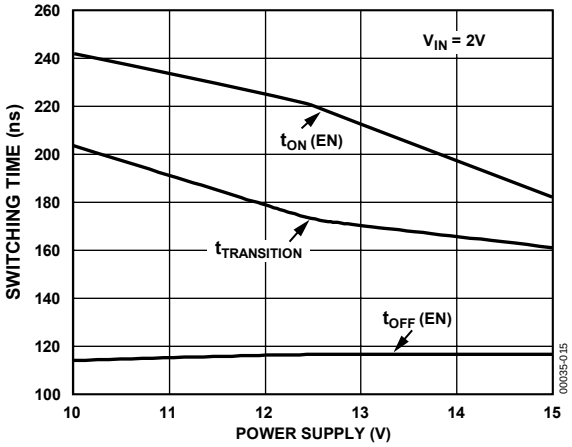

Figure 15. Switching Time vs. Dual Power Supply (4" Material)

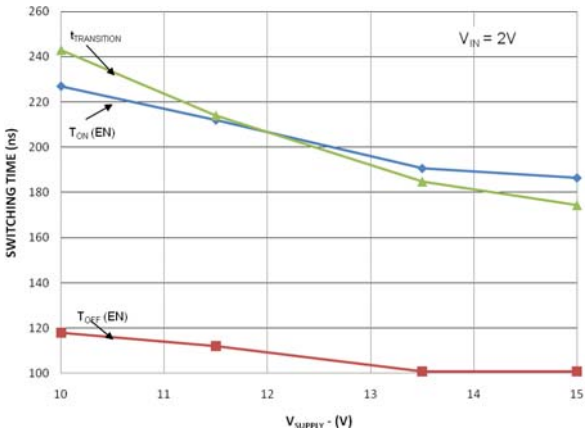

Figure 16. Switching Time vs. Dual Power Supply (8" Material)

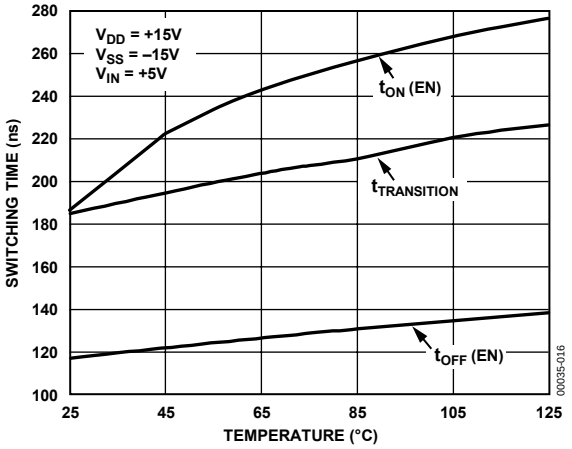

Figure 17. Switching Time vs. Temperature (4" Material)

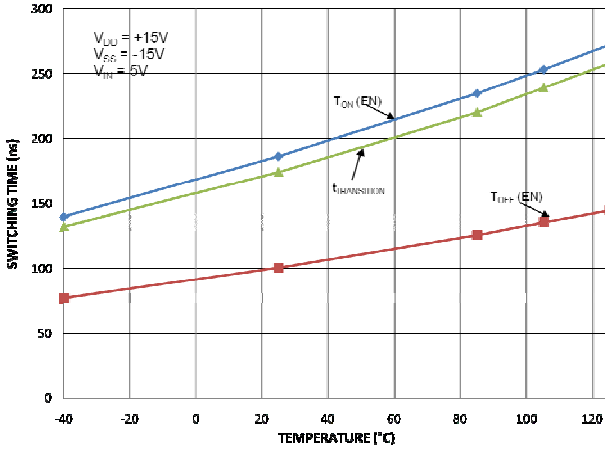

Figure 18. Switching Time vs. Temperature (8" Material)

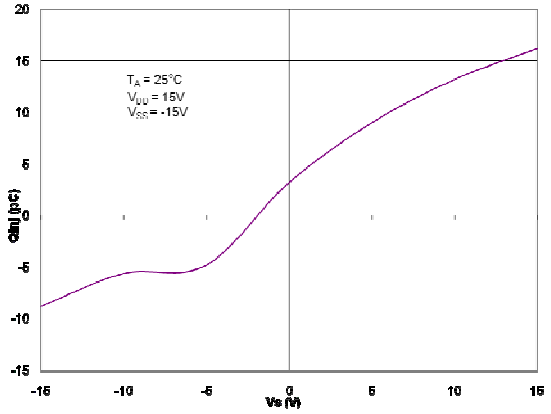

Figure 19. Charge injection *(4" Material)*

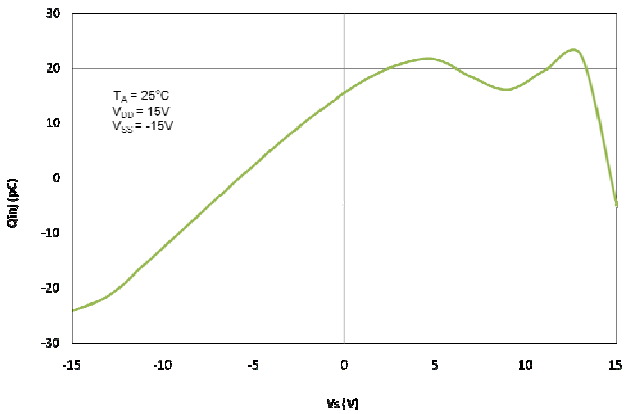

Figure 20. Charge Injection *(8" Material)*

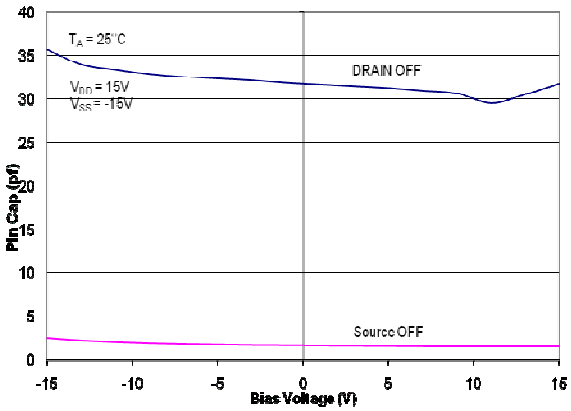

Figure 21. Capacitance Vs Source voltage *(4" Material)*

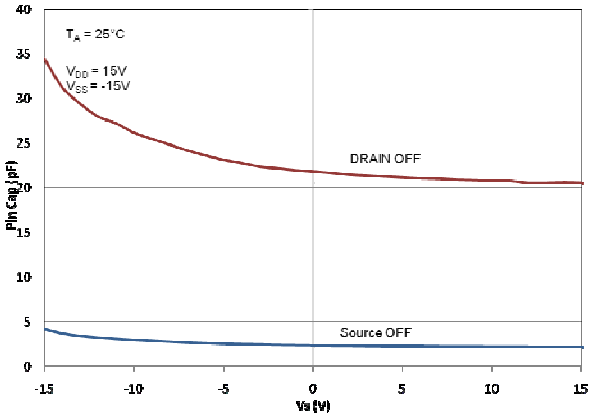

Figure 22. Capacitance Vs Source voltage *(8" Material)*

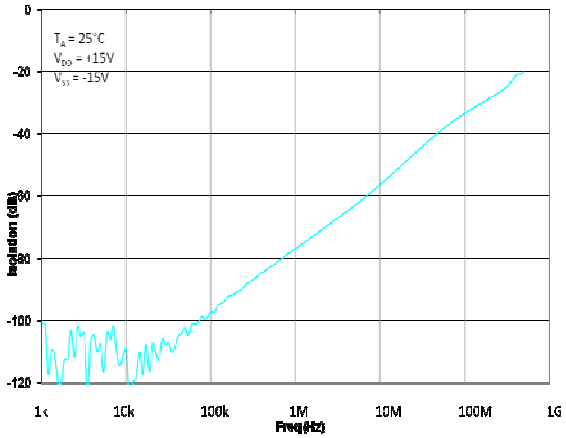

Figure 23. Off Isolation vs. Frequency *(4" Material)*

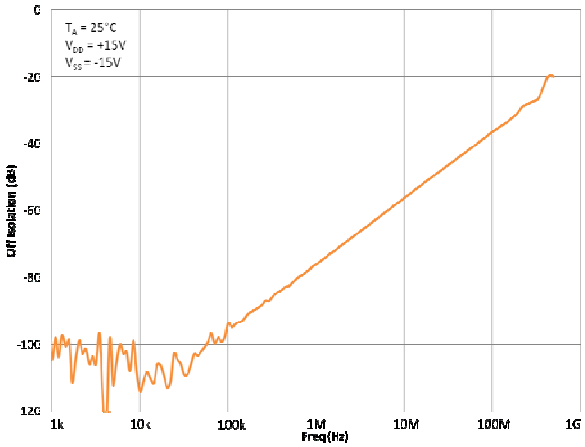

Figure 24. Off Isolation vs. Frequency *(8" Material)*