ON Semiconductor

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ON Semiconductor

FSA2268 / FSA2268T Low-Voltage Dual-SPDT (0.4 Ω) Analog Switch with 16kV ESD

Features

- 0.4Ω Typical On Resistance (R_{ON}) for +3.0V Supply
- 0.25Ω Maximum R_{ON} Flatness for +3.0V Supply
- -3db Bandwidth: > 50MHz
- Low I_{CCT} Current Over an Expanded Control Input Range
- Packaged in Pb-free 10-Lead μMLP (1.4 x 1.8mm)
- Power-Off Protection on Common Ports
- Broad V_{CC} Operating Range: 1.65 to 4.3V
- HBM JEDEC: JESD22-A114
 - I/O to GND: 13.5kVPower to GND: 16.0kV
- Noise Immunity Termination Resistors in FSA2268T

Applications

- Cell Phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

Description

The FSA2268 is a high-performance, dual Single Pole Double Throw (SPDT) analog switch that features ultra-low R_{ON} of 0.4Ω (typical) at 3.0V V $_{CC}$. The FSA2268 operates over a wide V $_{CC}$ range of 1.65V to 4.3V and is designed for break-before-make operation. The select input is TTL-level compatible.

The FSA2268 features very low quiescent current even when the control voltage is lower than the $V_{\rm CC}$ supply. This feature suits mobile handset applications by allowing direct interface with baseband processor general-purpose I/Os with minimal battery consumption.

The FSA2268T includes termination resistors that improve noise immunity during overshoot excursions, off-isolation coupling, or "pop-minimization."

Ordering Information

Part Number	Top Mark	Package Description
FSA2268UMX	GF	10-Lead, Quad Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8mm, 0.4mm Pitch
FSA2268TUMX	GH	10-Lead, Quad Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8mm, 0.4mm Pitch
FSA2268L10X	GH	10-Lead, MicroPak™, 1.6mm Wide

Analog Symbols

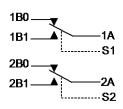


Figure 1. FSA2268

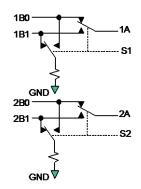
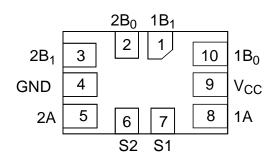


Figure 2. FSA2268T (with Noise Termination Resistors)

Pin Configuration



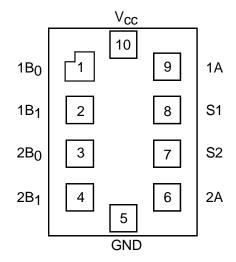


Figure 3. Pin Assignment 10-Pin UMLP (Top-Through View)

Figure 4. 10-Lead MicroPak™

Pin Descriptions

Pin # UMLP	Pin # MicroPak™	Name	Description
1	2	1B ₁	Data Ports
2	3	2B ₀	Data Ports
3	4	2B ₁	Data Ports
4	5	GND	Ground
5	6	2A	Data Ports
6	7	S2	Switch Select Pins
7	8	S1	Switch Select Pins
8	9	1A	Data Ports
9	10	V _{CC}	Supply Voltage
10	1	1B ₀	Data Ports

Truth Table

Control Input, Sn	Function
LOW Logic Level	nB0 connected to nA (FSA2268/2268T); nB1 terminated to GND (FSA2268T only)
HIGH Logic Level	nB1 connected to nA (FSA2268/2268T); nB0 terminated to GND (FSA2268T only)

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Units	
V _{CC}	Supply Voltage	-0.5	5.5	V		
V	Switch I/O Voltage ⁽¹⁾	1B0, 1B1, 2B0, 2B1, 1A, 2A Pins	-0.5	V _{CC} + 0.3	V	
V_{SW}	Switch i/O voltage	T Version nBn Pin Off	0	1.4]	
V_{IN}	Control Input Voltage ⁽¹⁾	S1, S2	-0.5	5.5	V	
l _{IK}	Input Clamp Diode Current		-50	mA		
I _{SW}	Switch I/O Current (Continu		350	mA		
ISWPEAK	Peak Switch Current (Pulse		500	mA		
T _{STG}	Storage Temperature Rang	ge	-65	+150	°C	
TJ	Maximum Junction Tempe	rature		+150	°C	
TL	Lead Temperature (Solder	ng, 10 seconds)		+260	°C	
MSL	Moisture Sensitivity Level (JEDEC J-STD-020A)		1	Level	
		I/O to GND		13.5		
	Human Body Model,	Power to GND		16.0	kV	
ESD	JEDEC: JESD22-A114	All Other Pins		9.0		
	Charged Device Model, JE		2.0	kV		

Note:

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. ON Semiconductor does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Units
Vcc	Supply Voltage	1.65	4.30	V
V _{IN}	Control Input Voltage	0	V_{CC}	V
V _{SW}	Switch I/O Voltage	0	Vcc	V
T _A	Operating Temperature	-40	+85	°C

^{1.} Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

DC Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Parameter Conditions		T _A =+25°C			T _A =-40 to +85°C		Unit
-			V _{CC} (V)	Min.	Тур.	Max.	Min.	Max.	
			3.6 to 4.3				1.7		
.,			2.7 to 3.6				1.5		
V_{IH}	Input Voltage High		2.3 to 2.7				1.4		V
			1.65 to 1.95				0.9		
			3.6 to 4.3					0.7	V
	Invest Malta na Laur		2.7 to 3.6					0.5	
V_{IL}	Input Voltage Low		2.3 to 2.7					0.4	V
			1.65 to 1.95					0.4	
I _{IN}	Control Input Leakage (S1,S2)	V _{IN} =0 to V _{CC}	1.65 to 4.30				-0.5	0.5	μΑ
I _{NO(0FF)} , I _{NC(OFF)} FSA2268	Off Leakage Current of Port nB0 and nB1	nA=0.3V, $V_{\rm CC}$ =0.3V nB0 or nB1= $V_{\rm CC}$ =0.3V, 0.3V, or Floating Figure 6	1.95 to 4.30	-10		10	-50	50	nA
I _{NC(OFF)} FSA2268T	Off Leakage Current of Port nB0 and nB1 (with Termination Resistors)	nA=0.3V, nB0 or nB1=0V or Floating Figure 6	1.95 to 4.30	-10		10	-50	50	μΑ
I _{A(ON)}	On Leakage Current of Port nA	nA=0.3V, V _{CC} -0.3V nB0 or nB1=V _{CC} -0.3V, 0.3V, or Floating Figure 7	1.95 to 4.30	-20		20	-100	100	nA
I _{OFF} FSA2268	Power-Off Leakage Current (Common Port Only 1A, 2A)	Common Port (1A, 2A), V _{IN} =0V to 4.3V, V _{CC} =0V nB0, nB1=Floating	0V					±1	μA
I _{OFF} FSA2268T	Power-Off Leakage Current (Common Port Only 1A, 2A)	Common Port (1A, 2A), $V_{\rm IN}$ =0V to 4.3V, $V_{\rm CC}$ =0V nB0, nB1=0V or Floating	0V					±40	μA
		I _{ON} =100mA, nB0 or nB1=0.7V, 3.6V Figure 5	4.30		0.30			0.50	
		I _{ON} =100mA, nB0 or nB1=0.7V, 2.3V Figure 5	3.00		0.40			0.55	
R _{ON}	Switch On Resistance ⁽²⁾⁽⁵⁾	I _{ON} =100mA, nB0 or nB1=0V, 0.7V, 1.6V, 2.3V Figure 5	2.30		0.52				Ω
		I _{ON} =100mA, nB0 or nB1=0V, 0.7V, 1.65V Figure 5	1.65		1.00				
			4.30		0.04			0.13	
۸D	On Resistance Matching	I _{ON} =100mA, nB0 or	3.00		0.06			0.13	_
ΔR_{ON}	Between Channels (3)(5)	nB1=0.7V	2.30		0.12				Ω
			1.65		1.00				

Continued on following page...

DC Electrical Characteristics (Continued)

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V _{cc} (V)	T _A =+25°C			T _A =	Unit		
				Min.	Тур.	Max.	Min.	Max.		
			4.30					0.25		
Ь	On Resistance Flatness ⁽⁴⁾⁽⁵⁾	I _{OUT} =100mA, nB0 or nB1=0V to V _{CC}	Begintenes Flatness (4)(5) I _{OUT} =100mA, nB0 or	3.00					0.25	Ω
R _{FLAT(ON)}	On Resistance Flatness		2.30		0.5				12	
			1.65		0.6					
R _{TERM}	Internal Termination Resistors ⁽⁶⁾				200				Ω	
Icc	Quiescent Supply Current	V _{IN} =0 or V _{CC} , I _{OUT} =0	4.30	-100		100	-500	500	nA	
		Input at 2.6V	4.30		3			7		
Ісст	Increase in I _{CC} per Input	Input at 1.8V			7			15	μA	

Notes:

- 2. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
- 3. $\Delta R_{ON} = R_{ON \text{ max}} R_{ON \text{ min}}$ measured at identical V_{CC} , temperature, and voltage.
- 4. Flatness is defined as the difference between the maximum and minimum value of on resistance (R_{ON}) over the specified range of conditions.
- 5. Guaranteed by characterization, not production tested, for V_{CC}=1.65-3.00V.
- 6. Guaranteed by characterization, not production tested.

AC Electrical Characteristics

All typical value are for V_{CC} =3.3V at 25°C unless otherwise specified.

Symbol	mbol Parameter Conditions		V _{cc} (V)	T _A =+25°C		°C	T _A =-40 to +85°C		Unit	Figure
				Min.	Тур.	Max.	Min.	Max.		
		nB0 or	3.6 to 4.3			55	15	60		
tou	Turn-On	nB1=1.5V,	2.7 to 3.6			60	15	65	ns	
t _{ON}	Time	$R_L=50\Omega$,	2.3 to 2.7			65	15	70	115	
		C _L =35pF	1.65 to 1.95		70					Figure 8
		nB0 or	3.6 to 4.3			30	5	35		Figure 9
+	Turn-Off	nB1=1.5V,	2.7 to 3.6			35	5	40	ne	
t _{OFF}	Time	$R_L=50\Omega$,	2.3 to 2.7			40	5	45	ns	
		C _L =35pF	1.65 to 1.95		40					
		nB0 or	3.6 to 4.3		15		2		ns	Figure 10
t	Break- Before-Make	-Make $\begin{array}{c} \text{nB1=1.5V,} \\ \text{R}_{L} = 50\Omega, \end{array}$	2.7 to 3.6		15		2			
t _{BBM}	Time		2.3 to 2.7		15		2			
	11110	C _L =35pF	1.65 to 1.95		16		2			
Q	Charge Injection	$C_L=1.0nF,$ $V_S=0V, R_S=0\Omega$	1.65 to 4.30		25				рС	Figure 14
OIRR	Off Isolation	$f=100kHz$, $R_L=50\Omega$, $C_L=0pF$	1.65 to 4.30		-70				dB	Figure 12
Xtalk	Crosstalk	$f=100kHz$, $R_L=50\Omega$, $C_L=0pF$	1.65 to 4.30		-70				dB	Figure 13
BW	-3db Bandwidth	R _L =50Ω, C _L =0pF	1.65 to 4.30		>50			_	MHz	Figure 11
THD	Total Harmonic Distortion		1.65 to 4.30		.06				%	Figure 17

Capacitance

Symbol	Doromotor	Canditions	V 00	T _A =+25°C			1110:4	F!
Symbol	Parameter	Conditions	V _{cc} (V)	Min.	Тур. Мах.		Unit	Figure
C _{IN}	Control Pin Input Capacitance	f=1MHz	0		1.5		pF	Figure 15
C _{OFF}	B Port Off Capacitance	f=1MHz	3.3		30		pF	Figure 15
Con	A Port On Capacitance	f=1MHz	3.3		120		рF	Figure 16

Test Diagrams

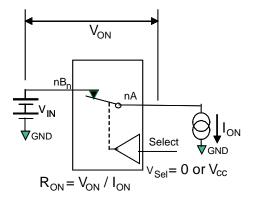
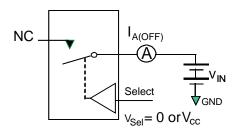


Figure 5. On Resistance



**Each switch port is tested separately.

Figure 6. Off Leakage (Ports tested separately)

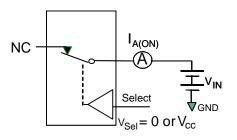


Figure 7. On Leakage

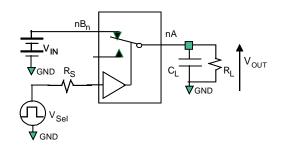
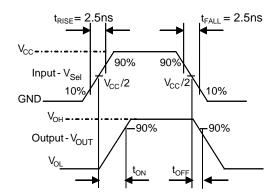


Figure 8. **Test Circuit Load**



Turn-On / Turn-Off Waveforms Figure 9.

Test Diagrams (Continued)

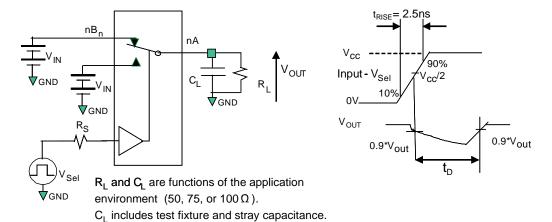


Figure 10. Break-Before-Make Interval Timing

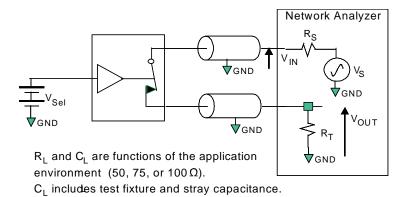


Figure 11. Bandwidth

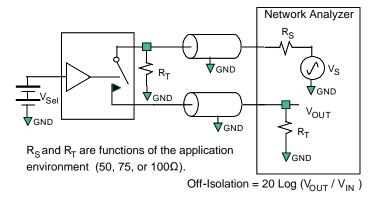


Figure 12. Channel Off Isolation

Test Diagrams (Continued)

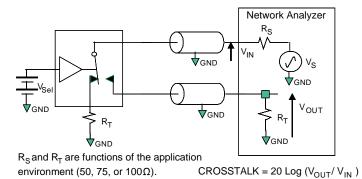


Figure 13. Adjacent Channel Crosstalk

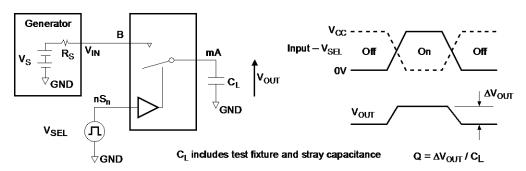


Figure 14. Charge Injection Test

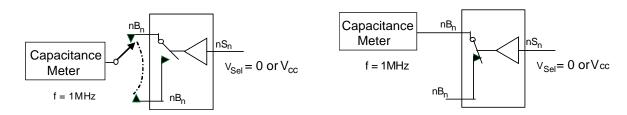


Figure 15. Channel Off Capacitance

Figure 16. Channel On Capacitance

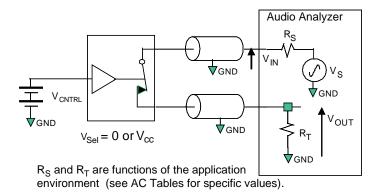
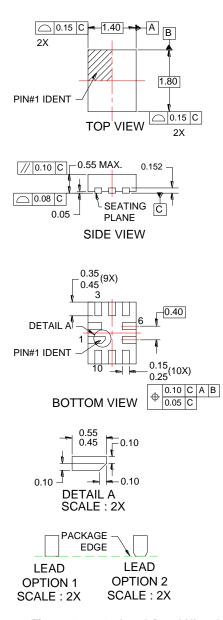
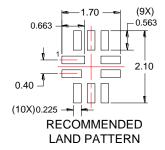
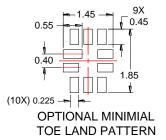


Figure 17. Total Harmonic Distortion

Physical Dimensions







NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.
- E. DRAWING FILENAME: MKT-UMLP10Arev3.

Figure 18. 10-Lead Quad Ultrathin Molded Leadless Package (UMLP)

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Physical Dimensions (Continued)

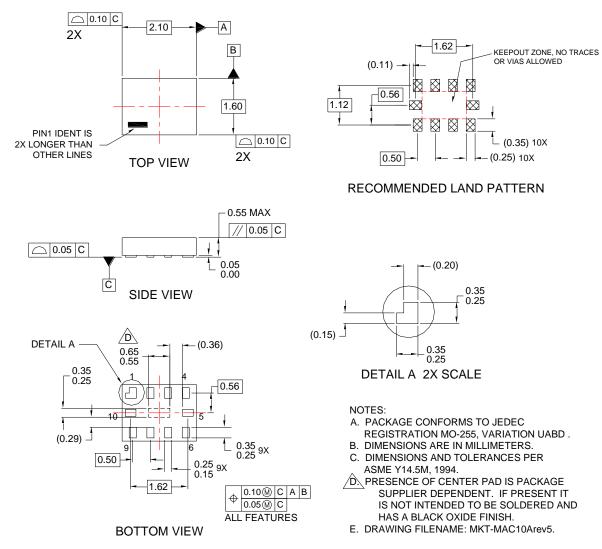


Figure 19. 10-Lead, MicroPak™, 1.6mm Wide

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DG2503DB-T2-GE1 TC4W53FU(TE12L,F) HV2201FG-G 74HC2G66DC.125 DG3257DN-T1-GE4 ADG619BRMZ-REEL
ADG1611BRUZ-REEL7 DG2535EDQ-T1-GE3 LTC201ACN#PBF 74LV4066DB,118 ISL43410IUZ FSA2275AUMX