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FAIRCHILD SEMICONDUCTOR®

November 2013

FSA1256(A) / FSA1257(A) / FSA1258(A) Low-R_{ON} Low-Voltage, Dual SPST Analog Switch with Low-I_{CCT} "A" Option

Features

- FSA1256A, FSA1257A, FSA1258A Feature Low I_{CCT} when S Input is Lower than V_{CC}
- Maximum 1.1 Ω On Resistance (R_{ON}) for 4.5 V Supply
- 0.4 Ω Max. R_{ON} Flatness for 4.5 V Supply
- Space-Saving Pb-Free MicroPak™ Packaging
- Broad V_{CC} Operating Range:
  - FSA1256, FSA1257, FSA1258: 1.65 V to 5.5 V
  - FSA1256A, FSA1257A, FSA1258A: 2.7 V to 5.5 V
- Fast Turn-On and Turn-Off Times
- FSA1258, FSA1258A Feature Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Input

Applications

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

Description

The FSA1256, FSA1256A, FSA1257, FSA1257A, FSA1258, and FSA1258A are high performance dual Single-Pole / Single-Throw (SPST) analog switches. All devices feature ultra-low R_{ON} of 1.1 Ω maximum at 4.5 V V_{CC}. The FSA1256, FSA1257, and FSA1258 operate over a wide V_{CC} range of 1.65 V to 5.5 V. The FSA1256A, FSA1257A, and FSA1258A operation range is 2.7 V to 5.5 V. These devices are fabricated with sub-micron CMOS technology to achieve fast switching speeds and are designed for break-before-make operation. The select input is TTL level compatible. The FSA1256 and FSA1256A feature two Normally Open (NO) switches. The FSA1257 and FSA1257A feature two Normally Closed (NC) switches. The FSA1258 and FSA1258A have one NO switch and one NC switch.

IMPORTANT NOTE:

For additional performance information, please contact analogswitch@fairchildsemi.com.

Ordering Information

Part Number	Top Mark	Package Description	Packing Method
FSA1256L8X	EB	8-Lead, MicroPak™, 1.6 mm Wide	5000 Units Tape and Reel
FSA1256AL8X	FN	8-Lead, MicroPak, 1.6 mm Wide	5000 Units Tape and Reel
FSA1257L8X	EC	8-Lead, MicroPak, 1.6 mm Wide	5000 Units Tape and Reel
FSA1257AL8X	FP	8-Lead, MicroPak, 1.6 mm Wide	5000 Units Tape and Reel
FSA1258L8X	ED	8-Lead, MicroPak, 1.6 mm Wide	5000 Units Tape and Reel
FSA1258AL8X	FS	8-Lead, MicroPak, 1.6 mm Wide	5000 Units Tape and Reel

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

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Analog Symbols

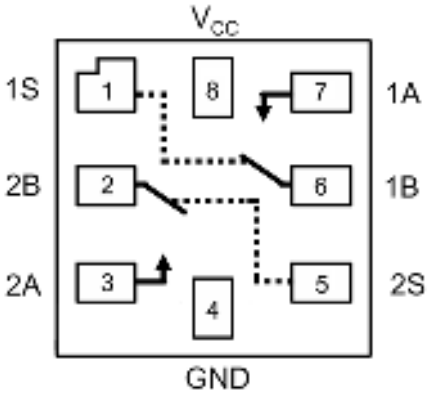


Figure 1. FSA1256, FSA1256A

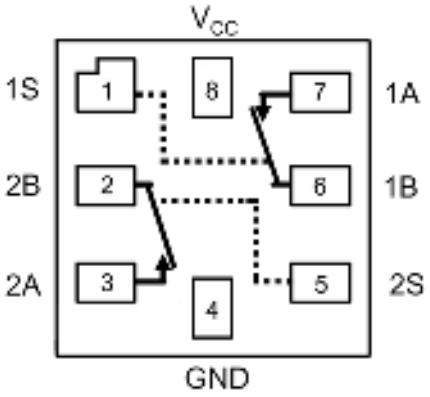


Figure 2. FSA1257, FSA1257A

Truth Tables

Control Input (s)	Function
LOW Logic Level	Disconnect
HIGH Logic Level	A Connected to B

Control Input (s)	Function
LOW Logic Level	A Connected to B
HIGH Logic Level	Disconnected

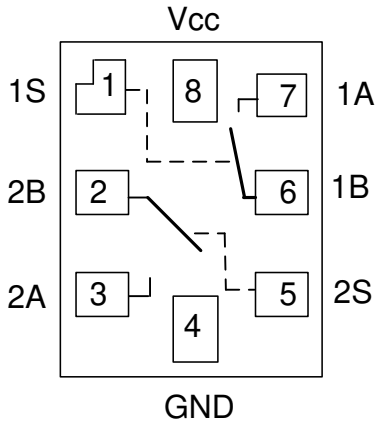


Figure 3. FSA1258, FSA1258A

Truth Table

Control Input, 1S	Function	Control Input 2S	Function
LOW Logic Level	1A Connected to 1B	LOW Logic Level	Disconnect
HIGH Logic Level	Disconnect	HIGH Logic Level	2A Connected to 2B

Pin Descriptions

Name	Description
A, B_0, B_1	Data Ports
S	Switch Select Pin

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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	6.0	V
V_S	Switch Voltage(1)		-0.5	V_{CC} +0.5	V
V_{in}	Input Voltage(1)		-0.5	6.0	V
	Power Dissipation at 85°C, MicroPak 8-Lead Package			180	mW
I_{IK}	Input Diode Current			-50	mA
I_{SW}	Switch Current			200	mA
I_{SWPEAK}	Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle)			400	mA
T_{STG}	Storage Temperature Range		-65	+150	°C
T_J	Maximum Junction Temperature			+150	°C
T_L	Lead Temperature (Soldering 10 Seconds)			+260	°C
ESD	Human Body Model (JEDEC: JESD22-A114)	FSA1256, FSA1257, FSA1258	5.5		kV
		FSA1256A, FSA1257A, FSA1258A	4.5		

Note:

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

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. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter		Min.	Max.	Units
V_{CC}	Supply Voltage	FSA1256, FSA1257, FSA1258	1.65	5.50	V
		FSA1256A, FSA1257A, FSA1258A	2.70	5.50	
V_{IN}	Control Input Voltage(2)		0	V_{CC}	V
V_{IN}	Switch Input Voltage		0	V_{CC}	V
Θ_{JA}	Thermal Resistance in Still Air, MicroPak 8L Package (Modeled)			224	°C/W
T_A	Operating Temperature		-40	+85	ºC

Note:

2. Unused inputs must be held HIGH or LOW. They must not float.

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DC Electrical Characteristics

All typical values are at 25ºC unless otherwise specified. The 1.65 V to 1.95 V range applies to FSA1256, FSA1257, and FSA1258 only.

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25°C			T_A=-40 to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
V_{IH}	Input Voltage High(3)		4.5 to 5.5				2.4		V
			2.7 to 3.6				2.0		
			1.65 to 1.95				0.9		
V_{IL}	Input Voltage Low(3)		4.5 to 5.5					0.8	V
		FSA1256A, FSA1257A, FSA1258A Only	2.7 to 3.6					0.4	
		FSA1256, FSA1257, FSA1258 Only	2.7 to 3.6					0.6	
			1.65 to 1.95					0.4	
I_{IN}	Control Input Leakage (S)	V_{IN}=0 to V_{CC}	1.95 to 5.5				-1	1	µA
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Off Leakage Current	A=1 V, 4.5 V 1B or 2B=1 V, 4.5 V	5.5		±2		-20	20	nA
R_{ON}	Switch On Resistance(3,4)	I_{OUT}=100 mA, 1B or 2B=3.5 V	4.5		0.95	1.15		1.30	Ω
		I_{OUT}=100 mA, 1B or 2B=1.5 V	2.7		2.6	4.0		4.3	
		I_{OUT}=100 mA, 1B or 2B=1.2 V	1.65		8.0	9.5		10.5	
ΔR_{ON}	On Resistance Matching Between Channels(3,5)	I_{OUT}=100 mA, 1B or 2B=3.5 V	4.5		0.06	0.12		0.15	Ω
$R_{FLAT(ON)}$	On Resistance Flatness(3,6)	I_{OUT}=100 mA, 1B or 2B=0 V, 1.0 V, 2.0 V	4.5		0.2	0.3		0.4	Ω
		I_{OUT}=100 mA, 1B or 2B=0 V, 0.75 V, 1.5 V	2.7		1.4				
		I_{OUT}=100 mA, 1B or 2B=0 V, 1.0 V, 1.2 V	1.65		1.8				
I_{CC}	Quiescent Supply Current	V_{IN}=0 V or V_{CC}, I_{OUT}=0 V	5.5		0.1	0.5		1.0	µA
			3.6		0.1	0.5		1.0	
I_{CCT}	Increase in I_{CC} per Input	One Input at 2.6 V, Others at V_{CC} or GND (FSA1256A, FSA1257A, FSA1258A Only)	4.3		0.2			10.0	µA

Notes:

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

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AC Electrical Characteristics

All typical values are at 25ºC unless otherwise specified. The 1.65 V to 1.95 V range applies to FSA1256, FSA1257, and FSA1258 only.

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25ºC			T_A=-40 to +85°C		Unit	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{ON}	Turn-On Time[7]	1B or 2B=3.0 V, R_L=50 Ω, C_L=35 pF	4.5 to 5.5		10	35		40	ns	Figure 8
		1B or 2B=1.5 V, R_L=50 Ω, C_L=35 pF	2.7 to 3.6		15	50		60		
		1B or 2B=1.0 V R_L=50 Ω, C_L=35 pF	1.65 to 1.95		35	110		120		
t_{OFF}	Turn-Off Time[7]	1B or 2B=3.0 V, R_L=50 Ω, C_L=35 pF	4.5 to 5.5		4	15		20	ns	Figure 8
		1B or 2B=1.5 V, R_L=50 Ω, C_L=35 pF	2.7 to 3.6		8	20		30		
		1B or 2B=1.0 V R_L=50 Ω, C_L=35 pF	1.65 to 1.95		10	30		40		
t_{BBM}	Break-Before-Make Time[7]	1B or 2B=3.0 V, R_L=50 Ω, C_L=35 pF	4.5 to 5.5		7				ns	Figure 9
		1B or 2B=1.5 V, R_L=50 Ω, C_L=35 pF	2.7 to 3.6		12					
Q	Charge Injection[7]	C_L=1.0 nF, V_{GEN}=0 V, R_{GEN}=0 Ω	4.5 to 5.5		20				pC	Figure 13
			2.7 to 3.6		10					
			1.65 to 1.95		5					
OIRR	Off Isolation[7]	f=1 MHz, R_L=50 Ω,	1.65 to 5.50		-70				dB	Figure 11
Xtalk	Crosstalk[7]	f=1 MHz, R_L=50 Ω,	1.65 to 4.30		-100				dB	Figure 12
BW	-3db Bandwidth[7]	R_L=50 Ω	1.65 to 4.30		300				MHz	Figure 10
THD	Total Harmonic Distortion[7]	f=20 Hz to 20 kHz, R_L=600 Ω, V_{IN}=0.5 V_{PP}	1.65 to 4.30		0.002				%	Figure 16

Notes:

7. Guaranteed, but not tested for V_{CC}=1.65 V.

Capacitance

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25ºC			Unit	Figure
				Min.	Typ.	Max.		
C_{IN}	Control Pin Input Capacitance	f=1 MHz	0		3.0		pF	Figure 15
C_{OFF}	B Port Off Capacitance	f=1 MHz	4.5		11.5		pF	Figure 14
C_{ON}	A Port On Capacitance	f=1 MHz	4.5		27.0		pF	Figure 15

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Test Diagrams

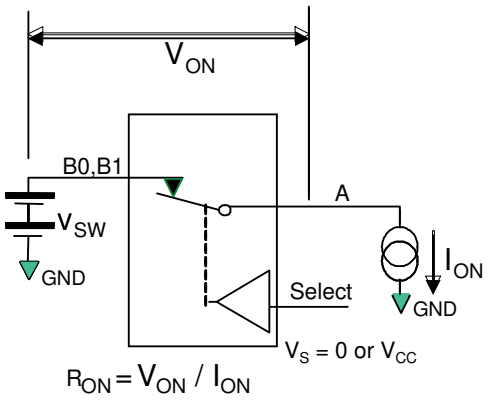


Figure 4. On Resistance

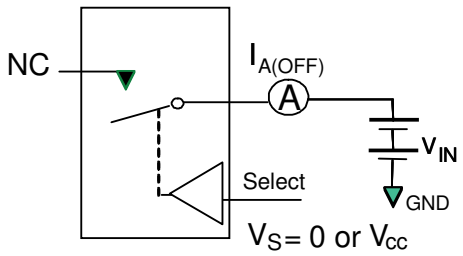


Figure 5. Off Leakage (Ports Tested Separately)

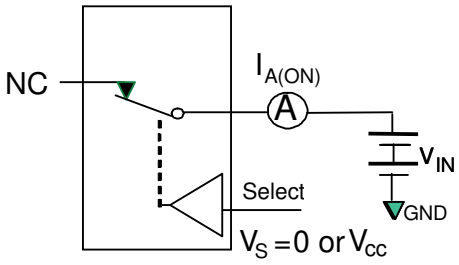


Figure 6. On Leakage

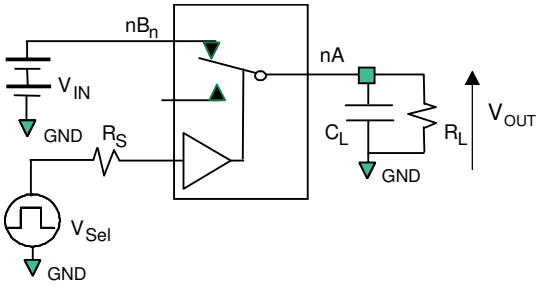


Figure 7. Test Circuit Load

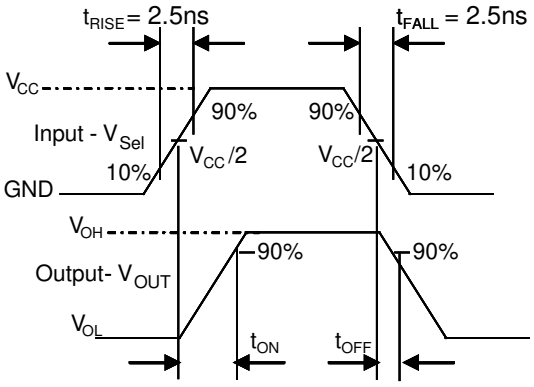
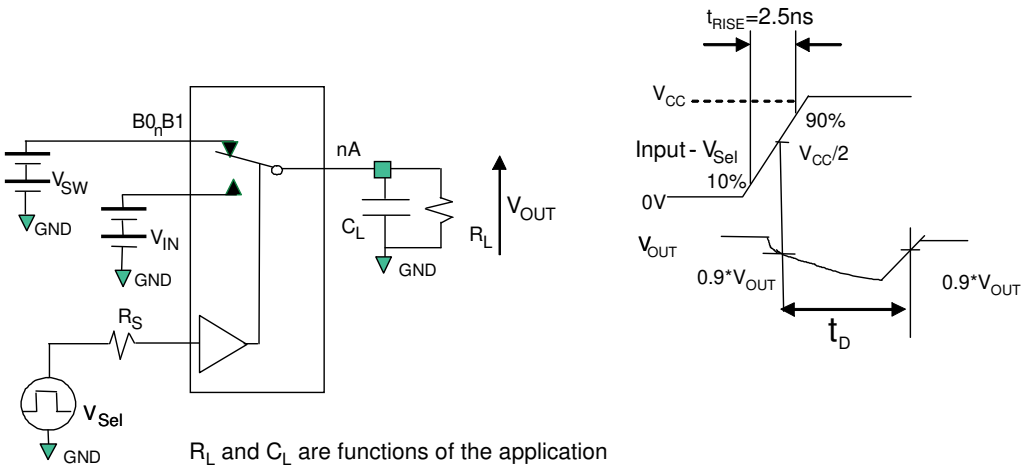


Figure 8. Turn-On / Turn-Off Waveforms

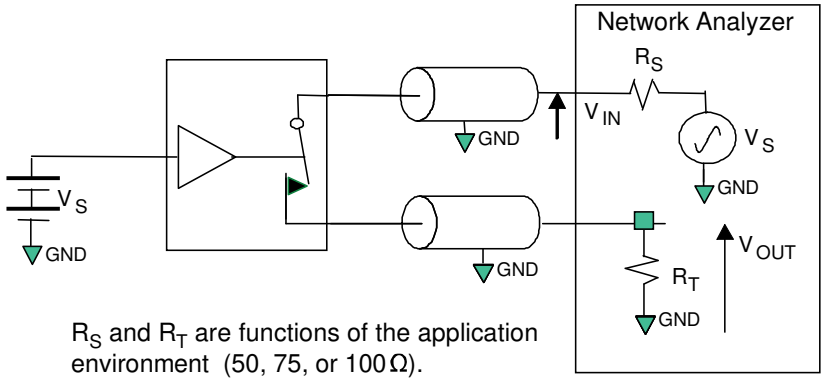
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Test Diagrams (Continued)



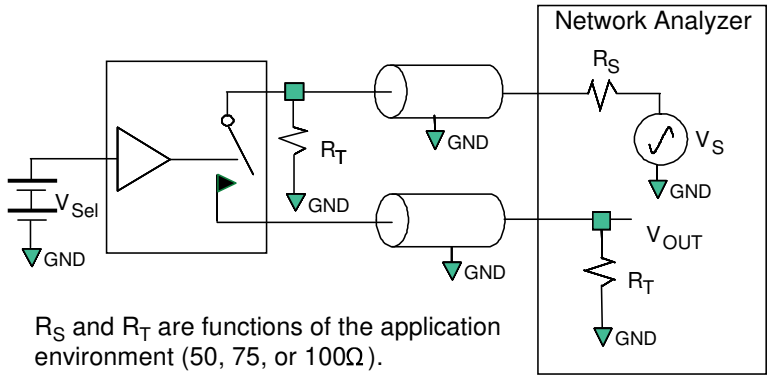
R_L and C_L are functions of the application environment (50, 75, or 100Ω).
C_L includes test fixture and stray capacitance.

Figure 9. Break-Before-Make Interval Timing



R_S and R_T are functions of the application environment (50, 75, or 100Ω).

Figure 10. Bandwidth

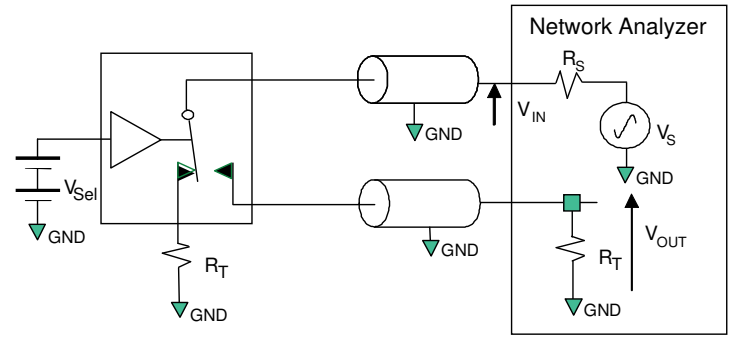


R_S and R_T are functions of the application environment (50, 75, or 100Ω).

Off Isolation= 20 Log (V_{OUT} / V_{IN})

Figure 11. Channel Off Isolation

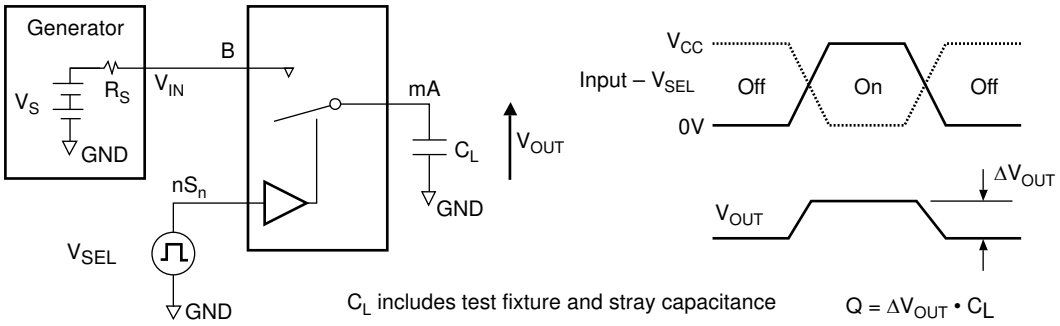
Test Diagrams (Continued)



R_S and R_T are functions of the application environment (50, 75, or 100Ω).

Crosstalk = 20 Log (V_{OUT} / V_{IN})

Figure 12. Adjacent Channel Crosstalk



C_L includes test fixture and stray capacitance

$Q = \Delta V_{OUT} \cdot C_L$

Figure 13. Charge Injection Test

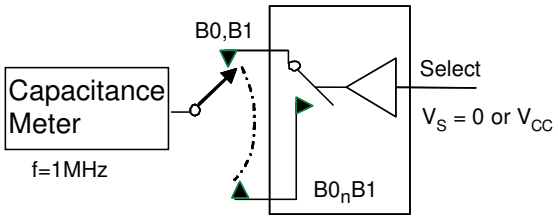


Figure 14. Channel Off Capacitance

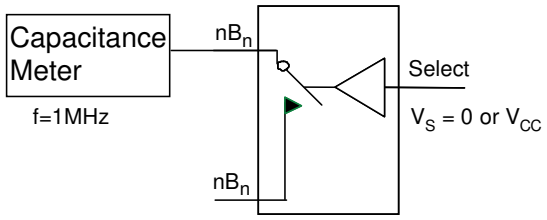
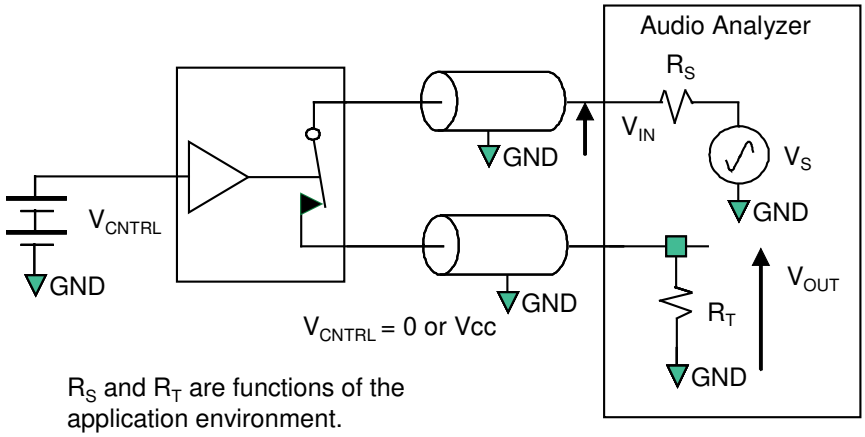


Figure 15. Channel On Capacitance

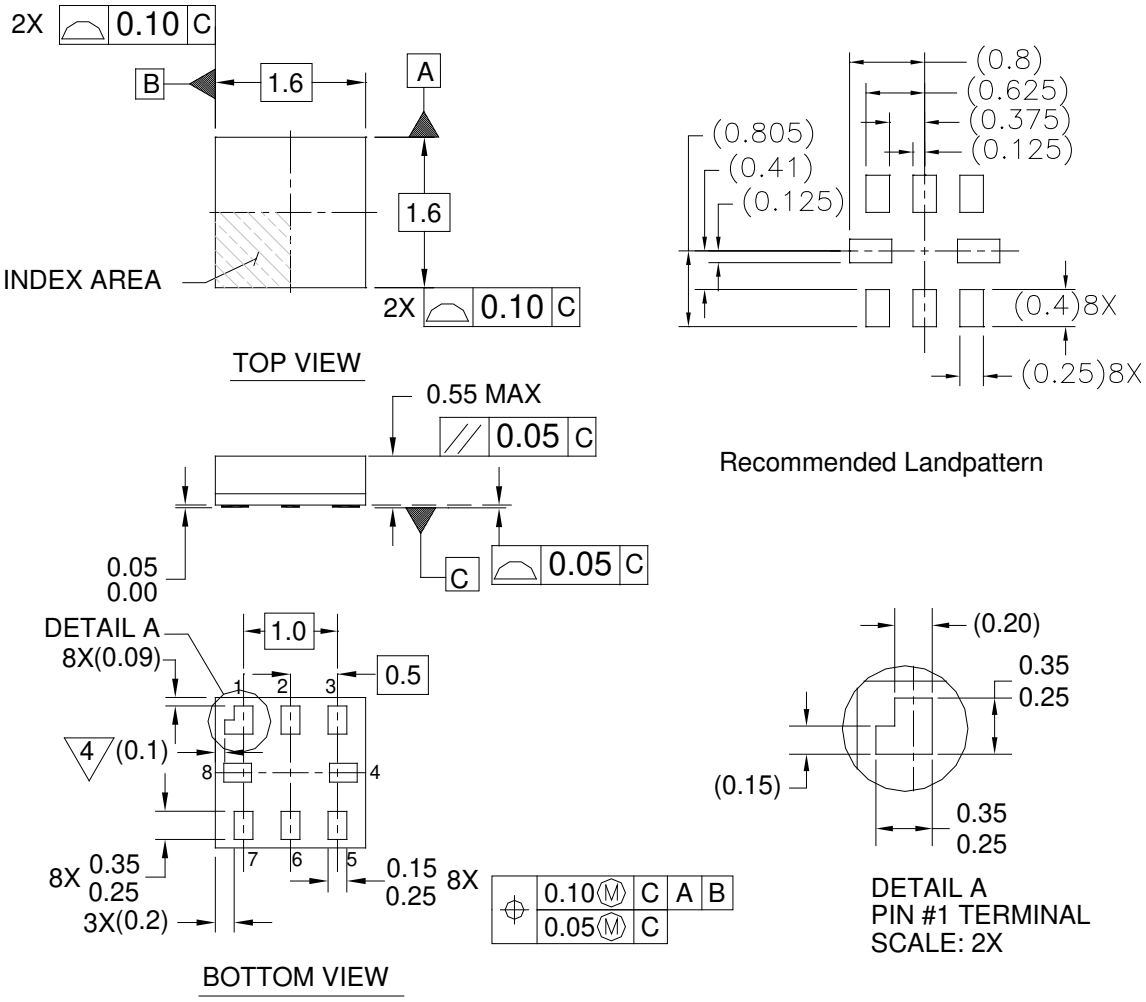


R_S and R_T are functions of the application environment.

Figure 16. Total Harmonic Distortion

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Physical Dimensions



Notes:

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

Figure 17. 8-Lead MicroPak™, 1.6 mm Wide

For tape and reel specifications for MicroPak, please visit:
http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf

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Definition of Terms

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