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## FSA2259 Low-Voltage, Dual-SPDT (0.8Ω) Analog Switch with 16kV ESD

### Features

- 0.8Ω Typical On Resistance ( $R_{ON}$ ) for +3.0V Supply
- 0.40Ω Maximum  $R_{ON}$  Flatness for +3.0V Supply
- -3db Bandwidth: > 50MHz
- Low  $I_{CCT}$  Current Over an Expanded Control Input Range
- Packaged in 10-Lead UMLP (1.4 x 1.8mm)
- Power-Off Protection on Common Ports
- Broad  $V_{CC}$  Operating Range: 1.65 to 4.4V
- ESD HBM JEDEC: JESD22-A114
  - I/O to GND: 8.5kV
  - Power to GND: 16.0kV

### Applications

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

### Description

The FSA2259 is a high-performance, dual, Single Pole Double Throw (SPDT) analog switch that features low  $R_{ON}$  of 0.8Ω (typical) at 3.0V  $V_{CC}$ . The FSA2259 operates over a wide  $V_{CC}$  range of 1.65V to 4.4V and is designed for break-before-make operation. The select input is TTL-level compatible.

The FSA2259 features very low quiescent current even when the control voltage is lower than the  $V_{CC}$  supply. This feature suits mobile handset applications by allowing direct interface with baseband processor general-purpose I/Os with minimal battery consumption.

### Related Resources

For additional information, please contact [analogswitch@fairchildsemi.com](mailto:analogswitch@fairchildsemi.com).

### Ordering Information

Part Number	Top Mark	Operating Temperature Range	Package
FSA2259UMX	JT	-40 to +85°C	10-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8mm

### Analog Symbol

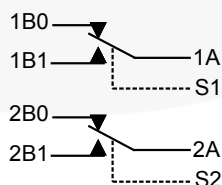


Figure 1. FSA2259

## Pin Configuration

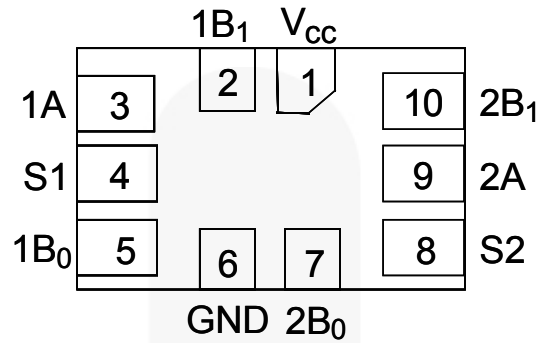


Figure 2. 10-Pin UMLP (Top Through View)

## Pin Description

Pin#	Name	Description
1	V <sub>CC</sub>	Supply Voltage
2	1B <sub>1</sub>	Data Ports
3	1A	Data Ports
4	S1	Switch Select Pins
5	1B <sub>0</sub>	Data Ports
6	GND	Ground
7	2B <sub>0</sub>	Data Ports
8	S2	Switch Select Pins
9	2A	Data Ports
10	2B <sub>1</sub>	Data Ports

## Truth Table

Control Input, S <sub>n</sub>	Function
LOW Logic Level	nB <sub>0</sub> Connected to nA
HIGH Logic Level	nB <sub>1</sub> Connected to nA

## 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
$V_{SW}$	Switch I/O Voltage <sup>(1)</sup>	1B0, 1B1, 2B0, 2B1, 1A, 2A Pins	-0.5	$V_{CC} + 0.3$	V
$V_{IN}$	Control Input Voltage <sup>(1)</sup>	S1, S2	-0.5	5.5	V
$I_{IK}$	Input Clamp Diode Current			-50	mA
$I_{SW}$	Switch I/O Current (Continuous)			350	mA
$I_{SWPEAK}$	Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle)			500	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	I/O to GND		8.5	kV
		Power to GND		16.0	
		All Other Pins		8.0	
	Charged Device Model, JEDEC: JESD22-C101			2.0	kV

### Note:

- 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	1.65	4.40	V
$V_{IN}$	Control Input Voltage	0	$V_{CC}$	V
$V_{SW}$	Switch I/O Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature	-40	+85	°C

## DC Electrical Characteristics

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

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	Control Input Voltage High		3.60 to 4.30				1.7		V
			2.70 to 3.60				1.5		
			2.30 to 2.70				1.4		
			1.65 to 1.95				0.9		
V <sub>IL</sub>	Control Input Voltage Low		3.60 to 4.30					0.7	V
			2.70 to 3.60					0.5	
			2.30 to 2.70					0.4	
			1.65 to 1.95					0.4	
I <sub>IN</sub>	Control Input Leakage (S1,S2)	V <sub>IN</sub> =0 to V <sub>CC</sub>	1.65 to 4.30				-0.5	0.5	μA
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Off Leakage Current of Port nB0 and nB1	nA=0.3V, V <sub>CC</sub> =0.3V nB0 or nB1=V <sub>CC</sub> -0.3V, 0.3V, or Floating Figure 4	1.95 to 4.30	-10		10	-50	50	nA
I <sub>A(ON)</sub>	On Leakage Current of Port nA	nA=0.3V, V <sub>CC</sub> =0.3V nB0 or nB1=V <sub>CC</sub> -0.3V, 0.3V, or Floating Figure 5	1.95 to 4.30	-20		20	-100	100	nA
I <sub>OFF</sub>	Power-Off Leakage Current (Common Port Only 1A, 2A)	Common Port (1A, 2A), V <sub>IN</sub> =0V to 4.3V, V <sub>CC</sub> =0V nB0, nB1=Floating	0V					±1	μA
R <sub>ON</sub>	Switch On Resistance <sup>(2,5)</sup>	I <sub>ON</sub> =100mA, nB0 or nB1=0.7V, 3.6V Figure 3	4.30		0.50			1.00	Ω
		I <sub>ON</sub> =100mA, nB0 or nB1=0.7V, 2.3V Figure 3	3.00		0.80			1.20	
		I <sub>ON</sub> =100mA, nB0 or nB1=0V, 0.7V, 1.6V, 2.3V Figure 3	2.30		1.10				
		I <sub>ON</sub> =100mA, nB0 or nB1=0V, 0.7V, 1.65V Figure 3	1.65		1.50				
ΔR <sub>ON</sub>	On Resistance Matching Between Channels <sup>(3,5)</sup>	I <sub>ON</sub> =100mA, nB0 or nB1=0.7V	4.30		0.08			0.25	Ω
			3.00		0.20			0.25	
			2.30		0.40				
			1.65		0.50				
R <sub>FLAT(ON)</sub>	On Resistance Flatness <sup>(4,5)</sup>	I <sub>OUT</sub> =100mA, nB0 or nB1=0V to V <sub>CC</sub>	4.30					0.4	Ω
			3.00					0.4	
			2.30		0.9				
			1.65		1.2				
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =0 or V <sub>CC</sub> , I <sub>OUT</sub> =0	4.30	-100		100	-500	500	nA
I <sub>CCT</sub>	Increase in I <sub>CC</sub> per Input	Input at 2.6V	4.30		3			7	μA
		Input at 1.8V			7			15	

### Notes:

- On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
- ΔR<sub>ON</sub>=R<sub>ON max</sub> - R<sub>ON min</sub> measured at identical V<sub>CC</sub>, temperature, and voltage.
- Flatness is defined as the difference between the maximum and minimum value of on resistance (R<sub>ON</sub>) over the specified range of conditions.
- Guaranteed by characterization, not production tested for V<sub>CC</sub>=1.65 - 3.0V.

## AC Electrical Characteristics

All typical value are for  $V_{CC}=3.3V$  at  $25^{\circ}C$  unless otherwise specified.

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A=+25^{\circ}C$			$T_A=-40$ to $+85^{\circ}C$		Unit	Figure
				Min.	Typ.	Max.	Min.	Max.		
$t_{ON}$	Turn-On Time	nB0 or nB1=1.5V, $R_L=50\Omega$ , $C_L=35pF$	3.60 to 4.30			55		60	ns	Figure 6 Figure 7
			2.70 to 3.60			60		65		
			2.30 to 2.70			65		70		
			1.65 to 1.95		70					
$t_{OFF}$	Turn-Off Time	nB0 or nB1=1.5V, $R_L=50\Omega$ , $C_L=35pF$	3.60 to 4.30			30	5	35	ns	Figure 8
			2.70 to 3.60			35	5	40		
			2.30 to 2.70			40	5	45		
			1.65 to 1.95		40					
$t_{BBM}$	Break-Before-Make Time <sup>(6)</sup>	nB0 or nB1=1.5V, $R_L=50\Omega$ , $C_L=35pF$	3.60 to 4.30		15		2		ns	Figure 8
			2.70 to 3.60		15		2			
			2.30 to 2.70		15		2			
			1.65 to 1.95		16		2			
Q	Charge Injection <sup>(6)</sup>	$C_L=1.0nF$ , $V_S=0V$ , $R_S=0\Omega$	1.65 to 4.30		25				pC	Figure 12
OIRR	Off Isolation <sup>(6)</sup>	$f=100kHz$ , $R_L=50\Omega$ , $C_L=0pF$	1.65 to 4.30		-80				dB	Figure 10
Xtalk	Crosstalk <sup>(6)</sup>	$f=100kHz$ , $R_L=50\Omega$ , $C_L=0pF$	1.65 to 4.30		-100				dB	Figure 11
BW	-3db Bandwidth <sup>(6)</sup>	$R_L=50\Omega$ , $C_L=0pF$	1.65 to 4.30		>50				MHz	Figure 9
THD+N	Total Harmonic Distortion + Noise <sup>(6)</sup>	$f=20Hz$ to $20kHz$ , $R_L=32\Omega$ , $V_{IN}=2V_{pp}$	1.65 to 4.30		.06				%	Figure 15

### Notes:

6. Guaranteed by characterization, not production tested

## Capacitance

All capacitance specifications are guaranteed by characterization and are not production tested.

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A=+25^{\circ}C$			Unit	Figure
				Min.	Typ.	Max.		
$C_{IN}$	Control Pin Input Capacitance	$f=1MHz$	0		1.5		pF	Figure 13
$C_{OFF}$	B Port Off Capacitance	$f=1MHz$	3.3		30		pF	Figure 13
$C_{ON}$	A Port On Capacitance	$f=1MHz$	3.3		50		pF	Figure 14

## Test Diagrams

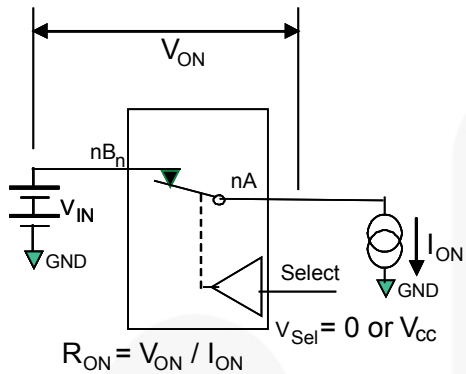
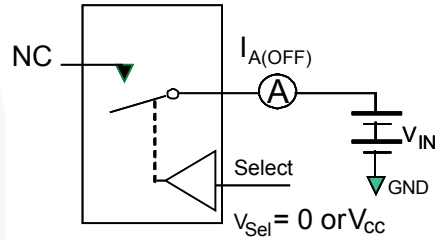


Figure 3. On Resistance



\*\*Each switch port is tested separately.

Figure 4. Off Leakage (Ports Tested Separately)

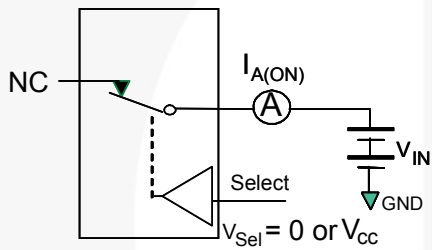


Figure 5. On Leakage

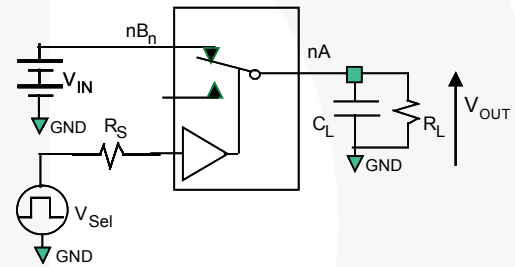


Figure 6. Test Circuit Load

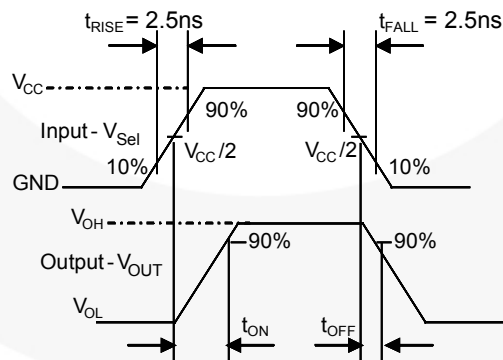
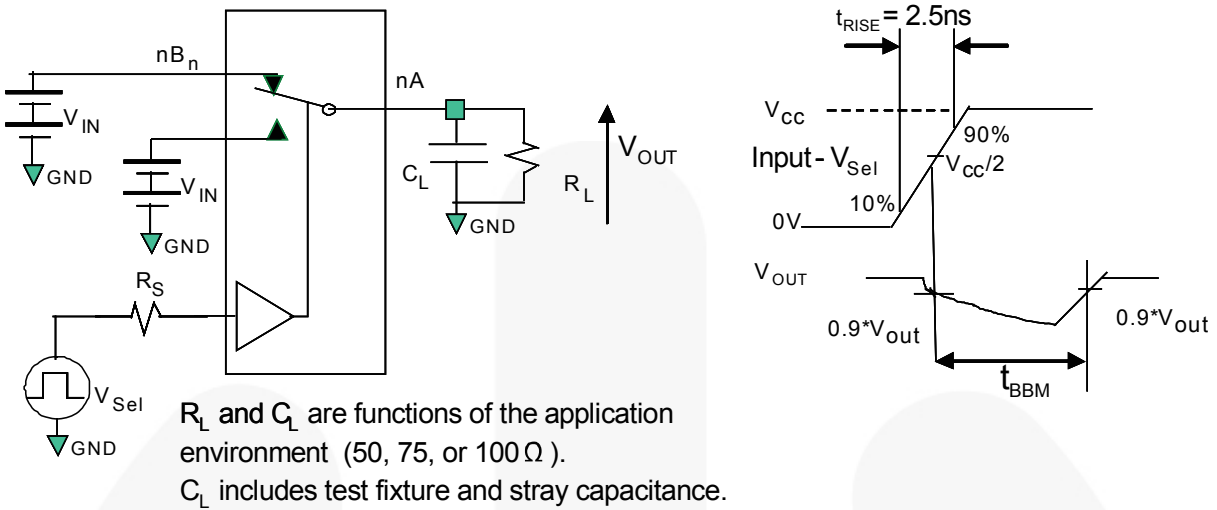
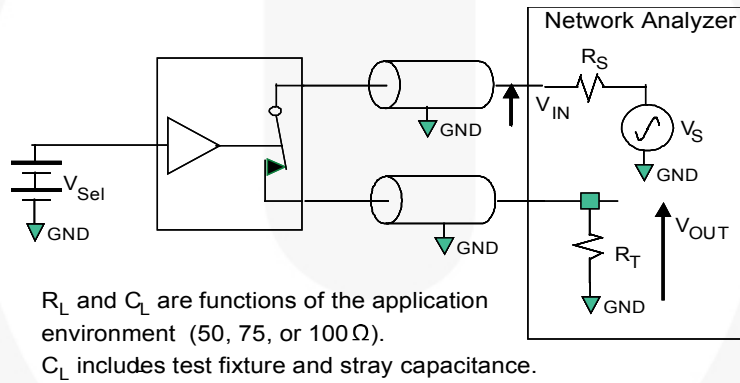


Figure 7. Turn-On / Turn-Off Waveforms

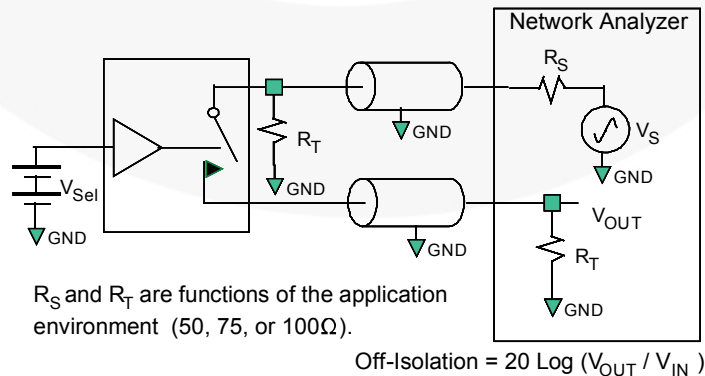
**Test Diagrams** (Continued)



**Figure 8. Break-Before-Make Interval Timing**



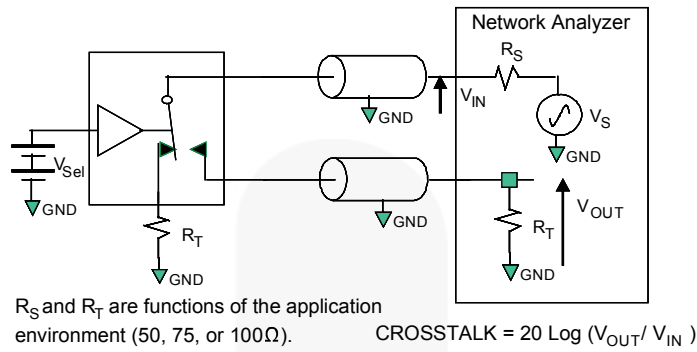
**Figure 9. Bandwidth**



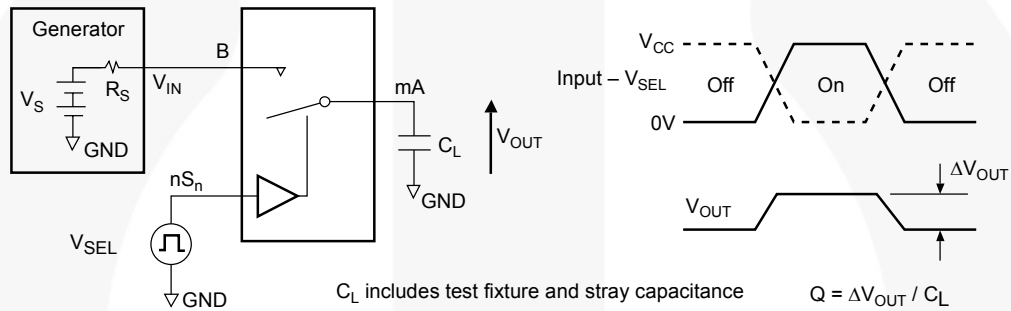
**Figure 10. Channel Off Isolation**



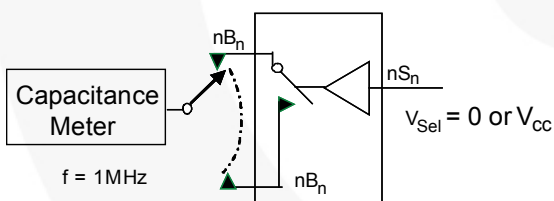
**Test Diagrams (Continued)**



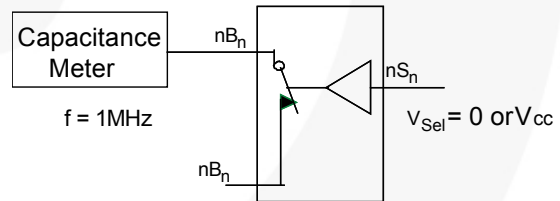
**Figure 11. Adjacent Channel Crosstalk**



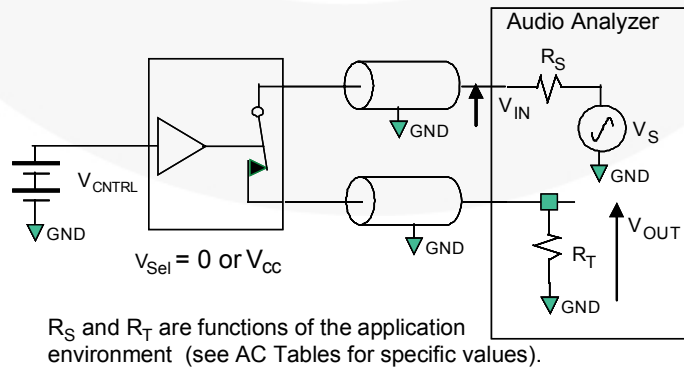
**Figure 12. Charge Injection Test**



**Figure 13. Channel Off Capacitance**

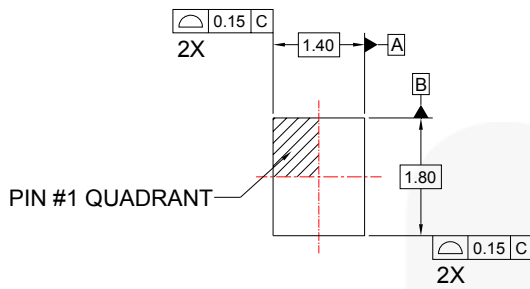


**Figure 14. Channel On Capacitance**

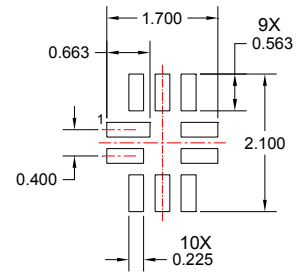


**Figure 15. Total Harmonic Distortion**

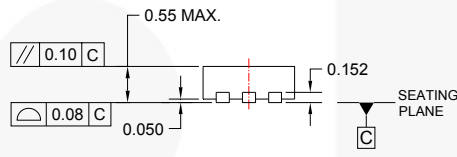
## Physical Dimensions



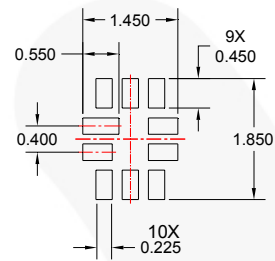
TOP VIEW



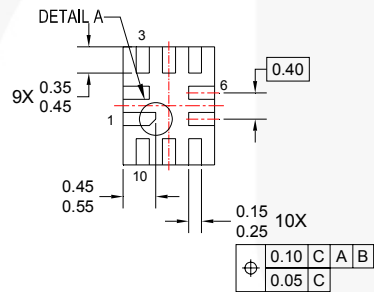
RECOMMENDED LAND PATTERN



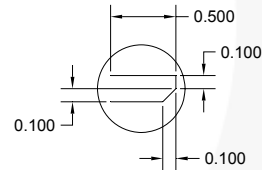
SIDE VIEW



OPTIONAL MINIMAL TOE LAND PATTERN



BOTTOM VIEW



DETAIL A  
PIN #1 TERMINAL  
SCALE: 2X

### NOTES:

- A. DIMENSIONS ARE IN MILLIMETERS.
- B. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- C. DRAWING FILENAME: UMLP10Arev2

**Figure 16. 10-Lead Quad Ultrathin Molded Leadless Package (UMLP)**

Click here for tape and reel specifications, available at:  
[http://www.fairchildsemi.com/products/analog/pdf/UMLP10\\_TNR.pdf](http://www.fairchildsemi.com/products/analog/pdf/UMLP10_TNR.pdf)


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| Build it Now™            | Global Power Resource™  | Programmable Active Droop™   | <b>the power franchise</b>   |
| CorePLUS™                | Green FPS™  | QFET®  | TinyBoost™   |
| CorePOWER™               | Green FPS™ e-Series™  | QST™   | TinyBuck™  |
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| CTL™                     | GTO™  | RapidConfigure™  | TinyLogic®   |
| Current Transfer Logic™  | IntelliMAX™   |  ™                | TINYOPTO™  |
| DEUXPEED®                | ISOPLANAR™  | Saving our world, 1mW/WkW at a time™   | TinyPower™   |
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| ESBC™                    | MicroPak™   | SPM®   | TRUECURRENT™*  |
| <b>F</b> ®               | MicroPak2™  | STEALTH™   | µSerDes™   |
| Fairchild®               | MillerDrive™  | SuperFET®  |  SerDes |
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| FAST®                    | OPTOLOGIC®  | SupreMOS®  | VCX™   |
| FastvCore™               | OPTOPLANAR®   | SyncFET™   | VisualMax™   |
| FETBench™                |  ™ | Sync-Lock™   | XS™  |
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**Definition of Terms**

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