March 2013

FSA2380 — Low R_{ON} (0.75Ω) 3:1 Negative Swing Audio Source Switch

Features

- 10µA Maximum I_{CCT} Current Over An Expanded Control Voltage Range (V_{IN}=2.6V, V_{CC}=4.3V)
- C_{ON} Capacitance 70pF Typical
- 0.75Ω Typical On Resistance (R_{ON})
- 1Bn, 2Bn Ports Support Negative Swing Audio to -2V
- -3db Bandwidth: > 120 MHz
- Low Power Consumption (1µA maximum)
- Power-Off Feature for 1A/2A Pin (I_{IN} < 2µA)
- Packaged in Pb-Free 14-Pin TSSOP and DQFN

Applications

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

Description

The FSA2380 is a Double-Pole, Triple Throw (DP3T) multiplexer that routes three dual-channel sources of data or audio under the control of a single pair of select pins. The FSA2380 has special circuitry on the 1A/2A pins to allow a power-off feature. With the V_{CC} supply removed and voltage on the 1A/2A pins, there is minimal leakage current into the 1A/2A data pins. The FSA2380 also features very low quiescent current and a power-off feature to extend battery life. The low quiescent current feature allows mobile handset applications direct interface with the baseband processor general-purpose I/Os. Typical applications involve switching in portables and consumer applications, such as cell phones, digital cameras, and notebooks with hubs or controllers.

IMPORTANT NOTE:

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

Ordering Information

Part Number	Top Mark	Eco Status	Packing Description
FSA2380BQX	2380	Green	14-Terminal Depopulated very thin Quad Flat-pack No leads (DQFN) 2.5 x 3.0mm, JEDEC MO-241
FSA2380MTCX	FSA2380	RoHS	14-Lead Thin Shrink Small Outline Package (TSSOP) 4.4mm wide, JEDEC MO-153

For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Analog Symbol

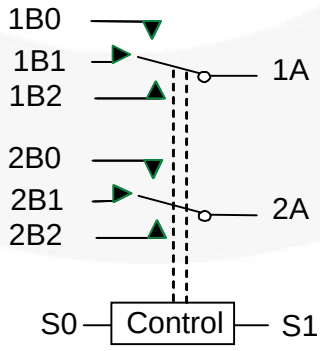


Figure 1. FSA2380 Analog Symbol

Pin Assignments

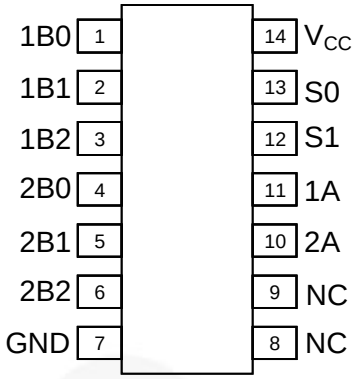


Figure 2. TSSOP-14 (Top Through View)

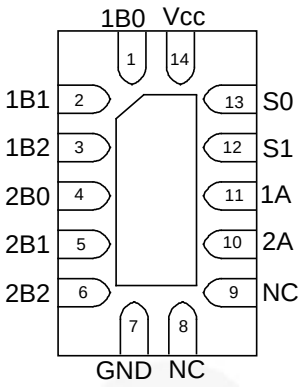


Figure 3. DQFN-14 (Top Through View)

Pin Descriptions

Name	Description
S0, S1	Switch Control Selects
1A, 2A	A Data Bus (Common)
1Bn, 2Bn	Multiplexed Source inputs

Truth Table

S1	S0	Function
LOW Logic Level	LOW Logic Level	Disconnected (Hi-Z)
LOW Logic Level	HIGH Logic Level	1B0 = 1A; 2B0 = 2A
HIGH Logic Level	LOW Logic Level	1B1 = 1A; 2B1 = 2A
HIGH Logic Level	HIGH Logic Level	1B2 = 1A; 2B2 = 2A

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.	Unit
V_{CC}	Supply Voltage		-0.5	6.0	V
V_{SW}	Switch I/O Voltage[1]	1Bn, 2Bn Pins	V_{CC}-5.5	V_{CC}+0.3	V
		1A, 2A Pins	V_{CC}-5.5	V_{CC}+0.3	V
V_{CNTRL}	Control Input Voltage[1] S0, S1 Pins		-0.5	6.0	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
P_D	Power Dissipation at 85°C	DQFN-14		2.5	µW
		TSSOP-14		2.5	µW
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)	All Pins		5500	kV
		I/O to GND		8000	
		VCC to GND		8000	
	Charged Device Model (JEDEC-JESD22-C101)			2000	kV

Note:

1. The input and output negative ratings may be exceeded if the 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.	Unit
V_{CC}	Supply Voltage		2.7	5.0	V
V_{CNTRL}	Control Input Voltage ($V_{S0:S1}$)		0	V_{CC}	V
V_{SW}	Switch I/O Voltage		V_{CC} -5.5	V_{CC}	
T_A	Operating Temperature		-40	+85	°C
θ_{JA}	Thermal Resistance (free air)	DQFN-14		145	°C/W
		TSSOP-14			

DC Electrical Characteristics

All typical values are at 25ºC unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = - 40°C to +85°C			Unit
				Min.	Typ.	Max.	
	Analog Signal Range			V_{CC} - 5.5		V_{CC}	V
V_{IK}	Clamp Diode Voltage					1.2	V
V_{IH}	Control Input Voltage HIGH		2.7 to 3.6	1.2			V
			3.6 to 4.3	1.5			
V_{IL}	Control Input Voltage LOW		2.7 to 3.6			0.5	
			3.6 to 4.3			0.7	
I_{IN}	Control Input Leakage	V_{IN} = 0 to V_{CC}	4.3			±1	µA
I_{OFF}	Power Off Leakage Current (Common Port Only 1A, 2A)	Common Port (1A, 2A) V_{SW} = 0 to 4.3V V_{CC} = 0V	0V			±10	µA
$I_{NO(0FF)}$	Off-Leakage Current of Port (1Bn, 2Bn)	1Bn, 2Bn or 1A, 2A = 0.3V, V_{CC} -0.5V, or Floating	4.3	-50	10	50	nA
$I_{NC(0N)}$	On-Leakage Current of Port 1Bn, 2Bn	1Bn, 2Bn or 1A, 2A = 0.3V, V_{CC} -0.5V, or Floating	4.3	-50	10	50	nA
R_{ON}	Switch On Resistance[2]	1Bn or 2Bn = 0V, 0.7V, 2.0V, 2.7V; I_{ON} = -100mA See Figure 7, Figure 8	2.70		0.75	2.00	Ω
ΔR_{ON}	Delta On Resistance[3]	1Bn or 2Bn = 0.7V, V_{CC}, I_{ON} = -100mA	2.70		0.50		Ω
$R_{FLAT(ON)}$	On Resistance Flatness[4]	1Bn or 2Bn = 0V, 0.7V, 2.0V, 2.7V; I_{ON} = -100mA See Figure 7, Figure 8	2.7 to 4.3		0.23	0.40	Ω
I_{CC}	Quiescent Supply Current	V_{SW} = 0 or V_{CC}-0.3 I_{OUT} = 0	4.3		22	500	nA
I_{CCT}	Increate in Quiescent Supply Current per Control Voltage and V_{CC}	V_{CNTRL} = 2.6V	4.3		2.0	10.0	µA
		V_{CNTRL} = 1.8V			6.5	15.0	

Notes:

2. R_{ON} measured by the voltage drop between 1Bn (2Bn) and 1A (2A) pins at identical current through the switch. R_{ON} is determined by the lower of the voltage on the two pins.
3. Guaranteed by characterization, not production tested.
4. Flatness is defined as the difference between the maximum and minimum values of on resistance over the specified range of conditions.

AC Electrical Characteristics

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

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = - 40°C to +85°C			Unit
				Min.	Typ.	Max.	
t_{ON}	Turn-On Time S[0:1] to Output	V_{Bn} = 1.5V, R_L = 50Ω, C_L = 35pF **Error! Reference source not found.**, Figure 12	2.7 to 4.3		30	60	ns
t_{OFF}	Turn-Off Time S[0:1] to Output	V_{Bn} = 1.5V, R_L = 50Ω, C_L = 35pF **Error! Reference source not found.**, Figure 12	2.7 to 4.3		22	45	ns
t_{PD}	Propagation Delay(5)	R_L = 50Ω, C_L = 5pF Figure 13	3.3		0.25		ns
t_{BBM}	Break-Before-Make(5)	R_L = 50Ω, C_L = 5pF V_{IN1} = V_{IN2} = V_{IN3} = 1.5V **Error! Reference source not found.**	2.7 to 4.3	1	6		ns
Q	Charge Injection	R_{GEN} = 0Ω, C_L = 100pF, R_L = OPEN Figure 14	2.7 to 4.3		9		pC
O_{IRR}	Off-Isolation	f = 100kHz, R_L = 50Ω Figure 4, Figure 16	2.7 to 4.3		-68		dB
Xtalk	Non-Adjacent Channel Crosstalk	f = 100kHz, R_L = 50Ω Figure 5, Figure 17	2.7 to 4.3		-60		dB
THD	Total Harmonic Distortion	f = 20Hz to 20kHz, R_L = 600Ω,V_{SW} = 0.5V_{pp} Figure 20	2.7 to 4.3		0.01		%
BW	-3db Bandwidth	R_L = 50Ω, C_L = 0, 5pF Figure 6, Figure 15	2.7 to 4.3		120		MHz

Note:

5. Guaranteed by characterization, not production tested.

Capacitance

Symbol	Parameter	Conditions	T_A = - 40°C to +85°C	Unit
			Typical	
C_{IN}	Control Pin Input Capacitance	V_{CC} = 0V	2.75	pF
C_{ON}	A/B On Capacitance	V_{CC} = 3.3V; S[0:1] = 01, 10, 11; f = 1MHz Figure 19	70	pF
C_{OFFA}	Port 1A, 2A Off Capacitance	V_{CC} = 3.3V, S[0:1] = 00 Figure 18	42	pF
C_{OFFB}	Port 1Bn, 2Bn Off Capacitance	V_{CC} = 3.3V, S[0:1] = 00 Figure 18	20	pF

Typical Characteristics

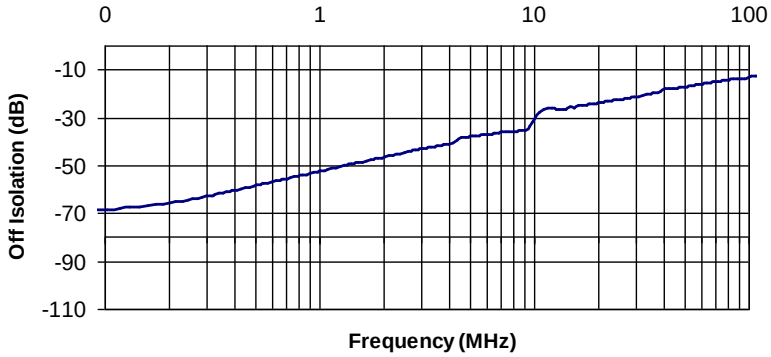


Figure 4. Off Isolation V_{CC} = 3.3V,C_L = 0pF

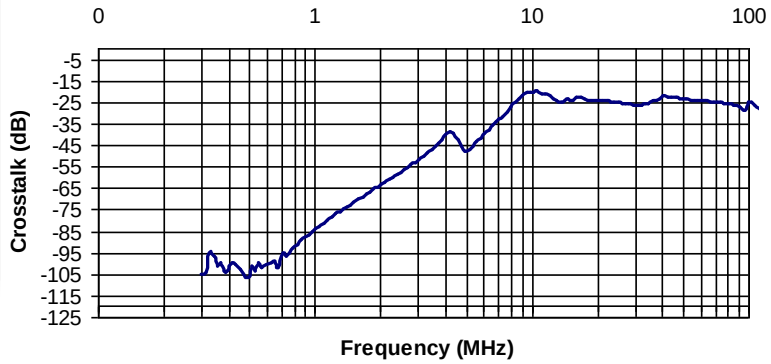


Figure 5. Non-Adjacent Crosstalk V_{CC} = 3.3V,C_L = 0pF

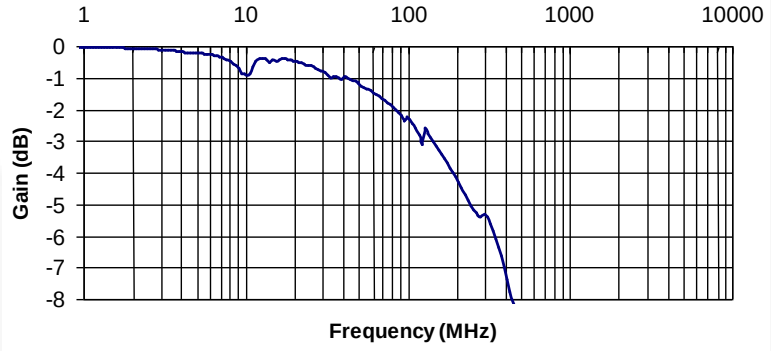


Figure 6. Bandwidth V_{CC} = 3.3V,C_L = 0pF

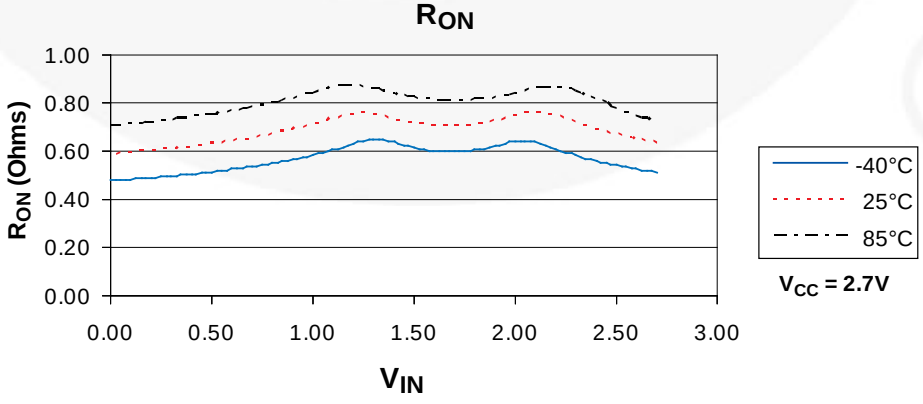


Figure 7. Switch On Resistance, R_{ON} V_{CC} = 2.7V

Test Diagrams

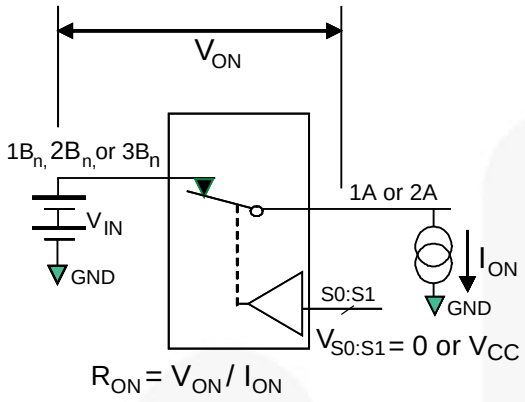
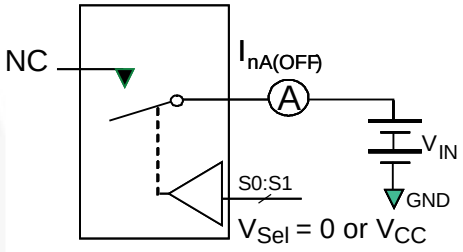
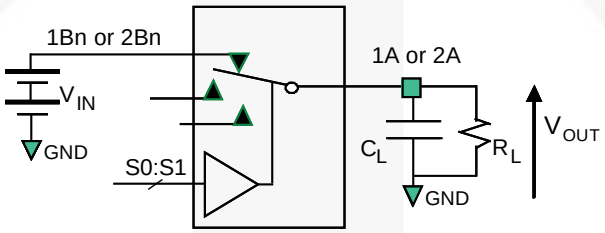


Figure 8. On Resistance



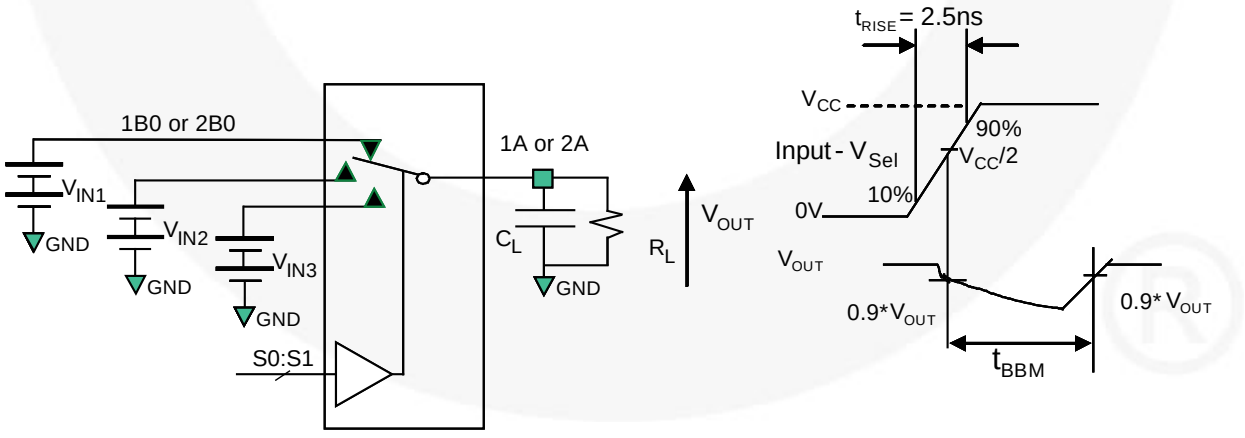
**Each switch port is tested separately

Figure 9. Off Leakage



R_L and C_L are functions of the application environment (see AC Tables for specific values)
C_L includes test fixture and stray capacitance

Figure 10. AC Test Circuit Load



R_L and C_L are functions of the application environment (see AC Tables for specific values)
C_L includes test fixture and stray capacitance

Figure 11. Break-Before-Make Timing

Test Diagrams (Continued)

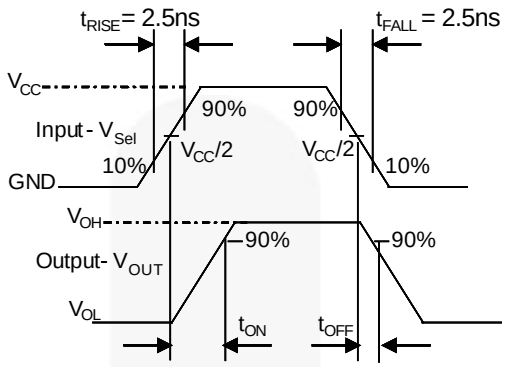


Figure 12. Turn-On / Turn-Off Waveforms

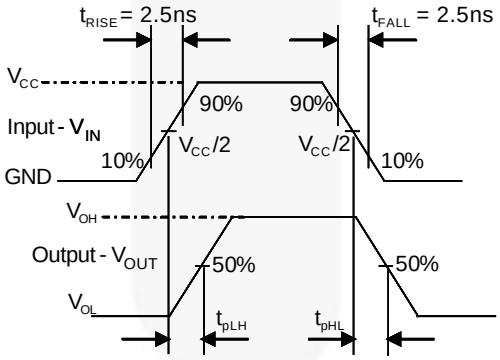


Figure 13. Switch Propagation Delay Waveforms

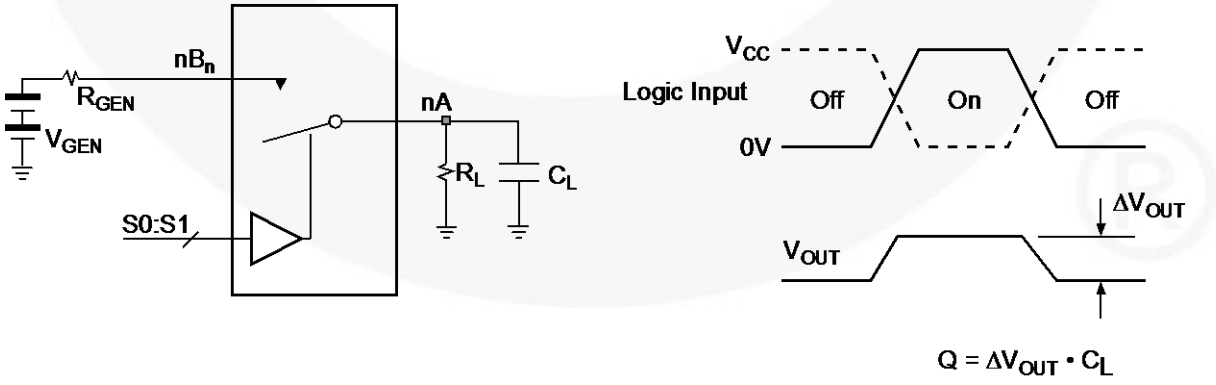
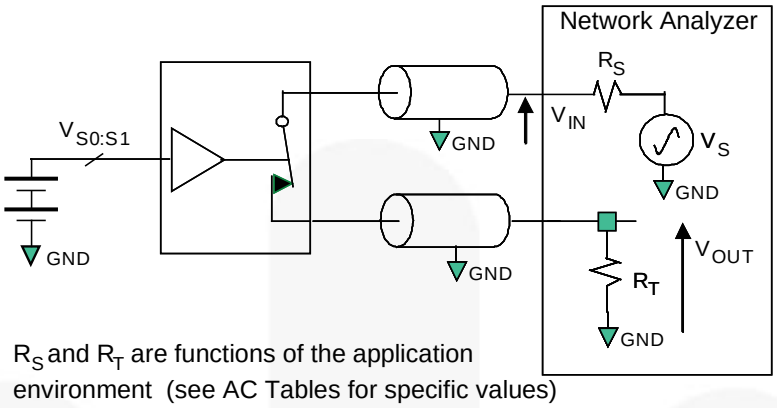


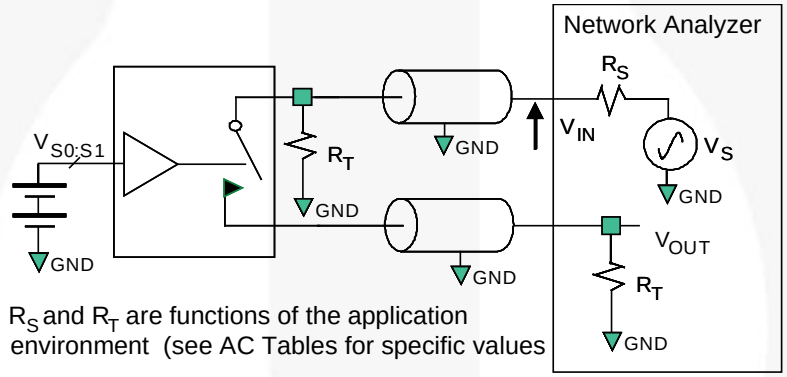
Figure 14. Charge Injection Test

Test Diagrams (Continued)



R_S and R_T are functions of the application environment (see AC Tables for specific values)

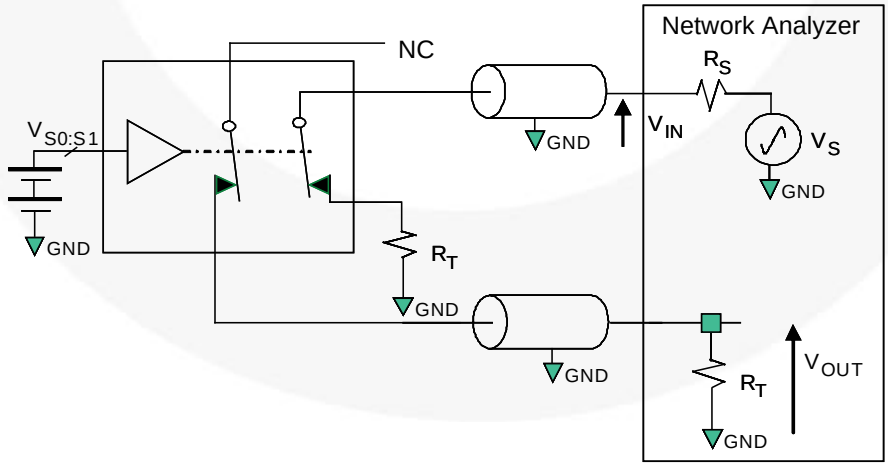
Figure 15. Bandwidth



R_S and R_T are functions of the application environment (see AC Tables for specific values

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

Figure 16. Channel Off Isolation



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

Figure 17. Non-Adjacent Channel-to-Channel Crosstalk

Test Diagrams (Continued)

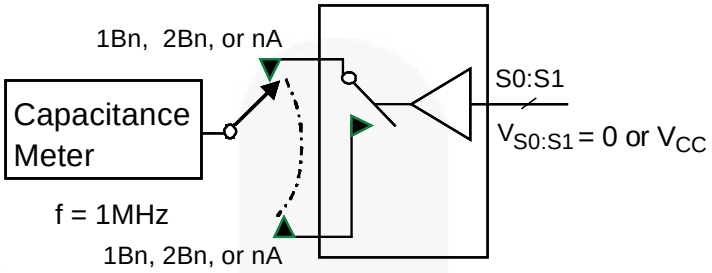


Figure 18. Channel Off Capacitance

Figure 19. Channel On Capacitance

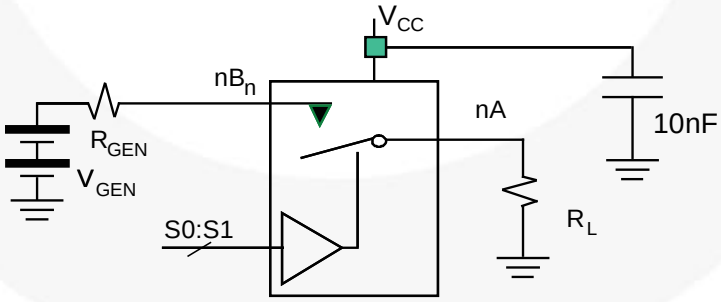
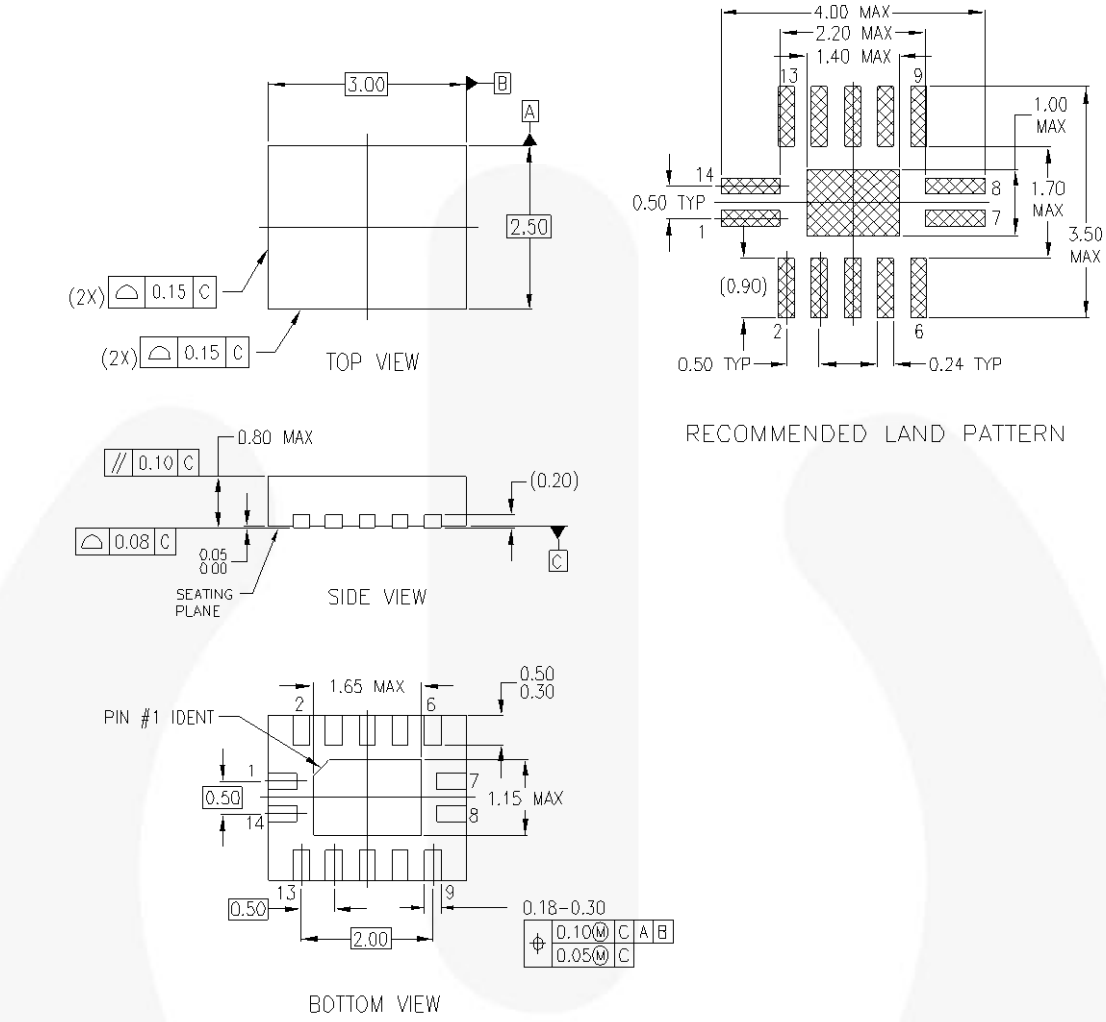


Figure 20. Total Harmonic Distortion

Physical Dimensions



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP14ArevA

Figure 21. 14-Terminal Depopulated, Very Thin Quad Flat-pack, No leads (DQFN)

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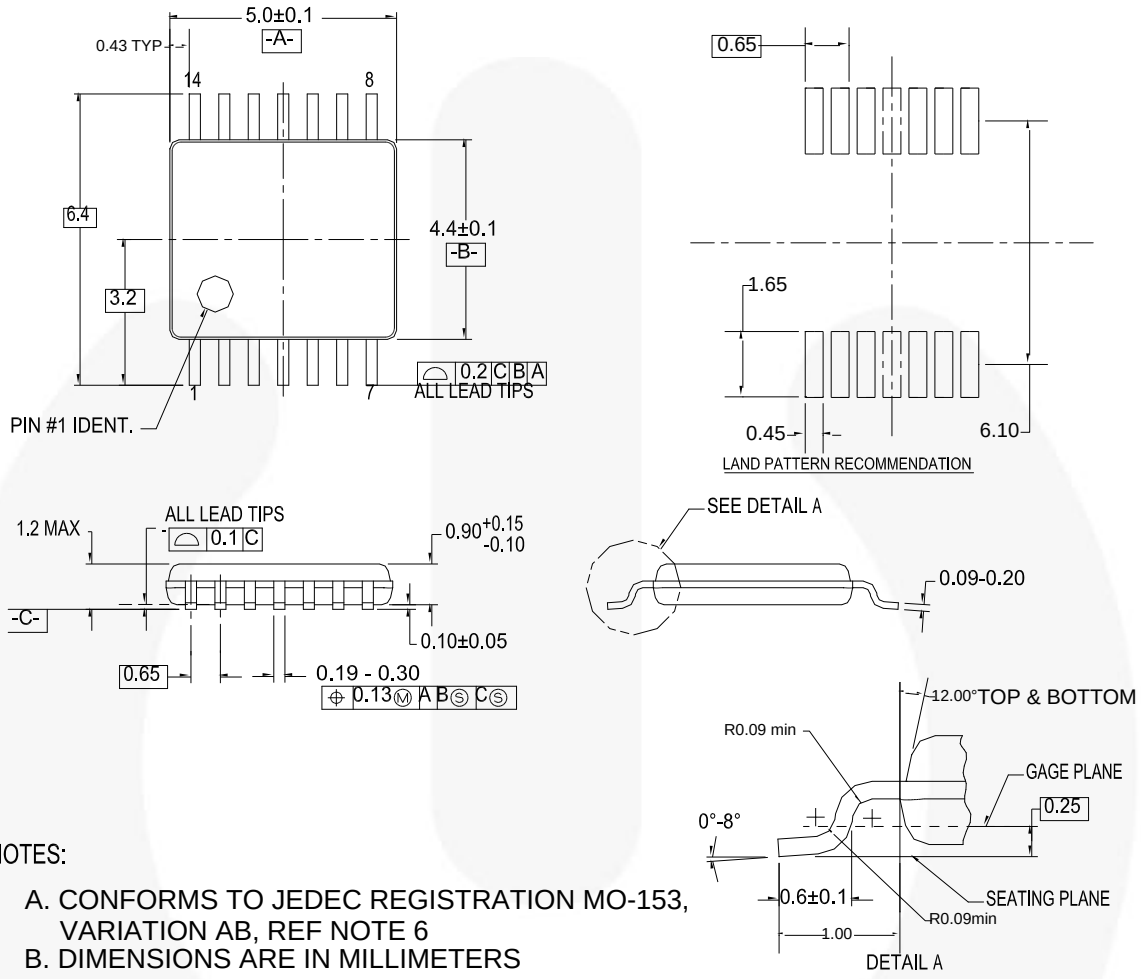
Physical Dimensions



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6

B. DIMENSIONS ARE IN MILLIMETERS

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS

D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

E. LANDPATTERN STANDARD: SOP65P640X110-14M

F. DRAWING FILE NAME: MTC14REV6

Figure 22. 14-Lead Thin Shrink Small Outline Package (TSSOP)

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™
Saving our world, 1mW/W/kW at a time™
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SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
Sync-Lock™
SYSTEM ®* GENERAL
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TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
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TRUECURRENT™*
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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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