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November 2009

FSUSB11 — Low-Power, Full-Speed (12Mbps) Switch

Features

- Space Saving MicroPak™ (1.6 x 2.1mm)
- USB 1.1 Signal Switching Compliant
- 3db Bandwidth: >350MHz
- Maximum 1.15Ω R_{ON} at 4.5V V_{CC} and 4Ω for 2.7V Supply
- 0.3Ω Maximum R_{ON} Flatness for +5V Supply
- Broad V_{CC} Operating Range: 1.65V to 5.5V
- Fast Turn-On and Turn-Off Time
- Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant, TTL-Compatible Control Input

Description

The FSUSB11 is a high-performance, dual Single-Pole Double-Throw (SPDT) switch designed for switching USB 1.1 signals. The device features ultra-low on resistance (R_{ON}) of 1.15 Ω maximum at 4.5V V_{CC} and 4.3 Ω at 2.7V supply. High bandwidth and ultra low (R_{ON}) make this switch able to pass both USB low- and full-speed signal with minimum signal distortion. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and designed for break-before-make operation. The select input is TTL-level compatible.

Applications

Cell Phones, PDAs, Digital Cameras, Notebook Computers

Ordering Information

Part Number	Operating Temperature Range	© Eco Status	Package	Packing Method
FSUSB11L10X	-40 to +85°C	RoHS	10-Lead, MicroPak™, JEDEC MO255,1.6 X 2.1mm	Tape and Reel
FSUSB11MTCX	-40 to +85°C	RoHS	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide	Tape and Reel

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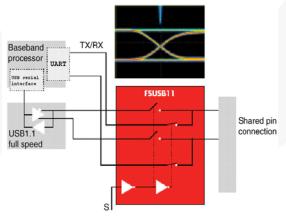
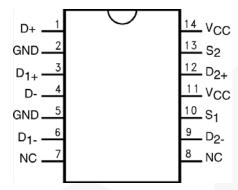
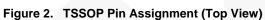


Figure 1. Block Diagram

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Pin Configuration





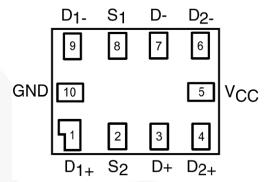


Figure 3. Micropak™ Pin Assignment (Top View)

Analog Symbol

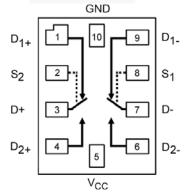


Figure 4. Analog Symbol

Pin Descriptions

TSSOP Pin #	MicroPak™ Pin #	Pin Names	Description
1, 3, 4, 6, 9, 12	1, 3, 4, 6, 7, 9	D+, D ₁₊ , D-, D ₁ -, D ₂₋ , D ₂ +	Data Ports
2, 5	10	GND	Ground
7, 8		NC	No Connect
10, 13	2, 8	S ₁ , S ₂	Control Input
11, 14	5	V _{CC}	Supply Voltage

Truth Table

Control Inputs	Function
Low Logic Level	D ₁ Connected to D+/D-
High Logic Level	D ₂ Connected to D+/D-

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
Vs	Switch Voltage	-0.5	V _{CC} + 0.5	V
V_{IN}	Input Voltage ⁽¹⁾	-0.5	6.0	V
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
TL	Lead Temperature (Soldering, 10 Seconds)		+260	°C
ESD	Human Body Model, JESD22-A114		8	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. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
V _{CC}	Power Supply	1.65	5.50	V
V _{IN}	Control Input Voltage ⁽²⁾	0	V_{CC}	V _{CC}
V _{SW}	V _{SW} Switch Input Voltage		V_{CC}	V _{CC}
T _A	Operating Temperature	-40	+85	°C

Note:

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

The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

DC Electrical Characteristics

Unless otherwise specified, typical values are at +25°C.

Symbol	Symbol Parameter		Conditions	V	_{cc} (V)	Т	_A =+25	°C		40 to 5°C	Units
						Min.	Тур.	Max.	Min.	Max.	
VIH	Input Voltage High			2.	7 to 3.6				2.0		V
VIH	Input Voltage High			4.	5 to 5.5				4.0		V
VIL	Input Voltage Low			2.	7 to 3.6						\
VIL	input voltage Low			4.	5 to 5.5						V
I _{IN}	Control Input Leaka	ane	V _{IN} =0V to V _{CC}	2.	7 to 3.6						μA
IIN	Control Input Leake	.gc	VIN-OV 10 VCC	4.	5 to 5.5						μπ
I _{NO(OFF)} , I _{NO(OFF)}	Off-Leakage Currer D ₁ and D ₂	nt of Port	A=1V, 4.5V, B ₀ or B ₁ =1V, 4.5V		5.5	-50		50	-100	100	nA
I _{A(ON)}	On-Leakage Currer Port D	nt of	A=1V, 4.5V, B ₀ or B ₁ =1V, 4.5V or Floating		5.5	50		50	-100	100	nA
	Switch On	Micropak	I _{OUT} = 100mA, D ₁ or D ₂ =1.5V		2.7		2.60	4.00		4.30	
R _{ON}		Switch On	I _{OUT} = 100mA, D ₁ or D ₂ =3.5V		4.5		0.95	1.15		1.30	Ω
NON	Resistance ⁽³⁾	TSSOP	I _{OUT} = 100mA, D ₁ or D ₂ =1.5V		2.7		2.80			4.50	22
		1330F	I _{OUT} = 100mA, D ₁ or D ₂ =3.5V		4.5		1.50			3.00	
	On Resistance	Micropak	I _{оит} = 100mA.				0.06	0.12		0.15	
ΔR_{ON}	Matching Between Channel (4)	TSSOP	D ₁ or D ₂ =3.5V		4.5		0.07			0.30	Ω
D	On Resistance Flatness ⁽⁵⁾		I _{OUT} =100mA, D ₁ or D ₂ =0V, 0.75V, 1.5V		2.7		1.4				
R _{FLAT(ON)}	On Resistance Flat	iiess	I _{OUT} =100mA, B ₀ or B ₁ =0V, 1V, 2V		4.5		0.2	0.3		0.4	Ω
Icc	Quiescent Supply C	Current	V _{IN} =0V or V _{CC} ,		3.6		0.1	0.5		1.0	μA
ICC	Quiescent Supply C	Juilell	I _{OUT} =0		5.5		0.1	0.5		1.0	μΛ

- 3. On resistance is determined by the voltage drop between D and Dn pins at the indicated current through the
- $\Delta R_{\text{ON}} = R_{\text{ONmax}}$ R_{ONmin} measured at identical V_{CC} , temperature, and voltage. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

AC Electrical Characteristics

Unless otherwise specified, typical values are at +25°C.

Symbol	Parameter	Conditions	V _{cc} (V)	7	Γ _A =+25	°C		40 to 5°C	Units	Figure
				Min.	Тур.	Max.	Min.	Max.		_
	Turn-on Time	D_1 or D_2 =1.5V, R_L =50 Ω , C_L =35pF	2.7 to 3.6			50		60	20	Figure 5
t _{ON}	S-to-Bus B	D_1 or D_2 =3.0V, R_L =50 Ω , C_L =35pF	4.5 to 5.5			35		30	ns	rigule 5
	Turn-off Time	D_1 or D_2 =1.5V, R_L =50 Ω , C_L =35pF	2.7 to 3.6			20		20	20	
LOFF	toff S-to-Bus B	D_1 or D_2 =3.0V, R_L =50 Ω , C_L =35pF	4.5 to 5.5			15			ns	Figure 5
tanu	. Break-Before-Make	D_1 or D_2 =1.5V, R_L =50 Ω , C_L =35pF	2.7 to 3.6				1		- ns	Figure 6
t _{ввм}	Time	D_1 or D_2 =3.0V, R_L =50 Ω , C_L =35pF	4.5 to 5.5		20		1			
		C _L =1.0nF,	2.7 to 3.6		20					Fi 0
Q	Charge Injection	V_{GEN} =0V, R_{GEN} =0 Ω	4.5 to 5.5		10				pC	Figure 8
O _{IRR}	Off Isolation	$f=1MHz$, $R_L=50Ω$	2.7 to 3.6		-70				dB	Figure 7
OIKK	on isolation	1 11/11/12, 11[-5052	4.5 to 5.5		-70				QD.	- iguic i
X _{TALK}	Non-Adjacent	f=1MHz, R_L =50 Ω	2.7 to 3.6		-75				dB	Figure 7
ZIALK	Channel Crosstalk	1 11VII 12, 1\[-3052	4.5 to 5.5		-75				QD.	
BW	-3dB Bandwidth	R _L =50Ω	2.7 to 3.6		350				MHz	Figure 10
	535 Barrawian	0022	4.5 to 5.5		350				111112	. 19470 10

USB Related AC Electrical Characteristics

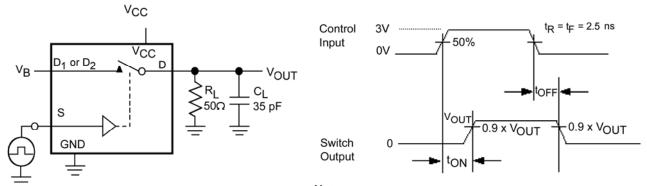
Unless otherwise specified, typical values are at 25°C.

Cumbal	Doromotor	Conditions	V 00	T _A =+25°C			Unita	Figure .
Symbol	Parameter	Conditions	V _{CC} (V)	Min.	Тур.	Max.	Units	Figure
	Skow	R _S =39, C _L =50pF, t _R =t _F =12ns	2.7 to 3.6		0.15		no	Figure 11
LSK(O)	t _{SK(O)} Skew	at 12Mbps	4.5 to 5.5		0.15		ns	
+	Rising/Fall Time	(Duty Cyclo=50%)	2.7 to 3.6		30		- ps	Figure 12
USK(P)	t _{SK(P)} Mismatch	(Duty Cycle=50%)	4.5 to 5.5		20			
т.	Total Jitter	R _S =39, C _L =50pF, t _R =t _F =12ns at	2.7 to 3.6		1.7		20	Figure 12
T _J Total Jitter	Total Jillei	Rs=39, C_L =50pF, t_R = t_F =12ns at 12Mbps (PRBS= 2^{15} 1)	4.5 to 5.5		1.6		ps	Figure 12

Capacitance

	_ ,		.,	T _A =+25°C				
Symbol	Parameter	Conditions	V _{CC} (V)	V _{CC} (V) Min.		Max.	Units	Figure
C _{IN}	Control Pin Input Capacitance	f=1MHz	0.0		3.5		pF	Figure 9
C _{OFF}	D _n Port Off Capacitance	f=1MHz	4.5		12.0		pF	Figure 9
Con	D Port On Capacitance	f=1MHz	4.5		40.0		pF	Figure 9

AC Loadings and Waveforms



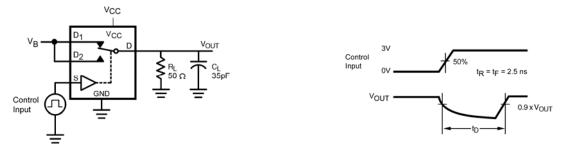
Note:

6. CL includes fixture and stray capacitance.

Note:

Logic input waveforms inverted for switches that have the opposite logic sense.

Figure 5. Turn On/ Turn Off Timing



Note:

8. C_L includes fixture and stray capacitance.

Figure 6. Break-Before-Make Timing

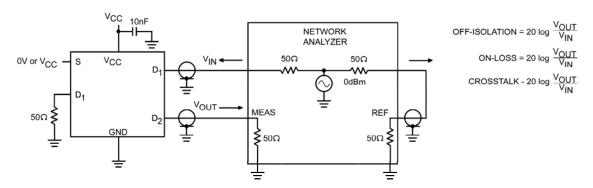


Figure 7. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

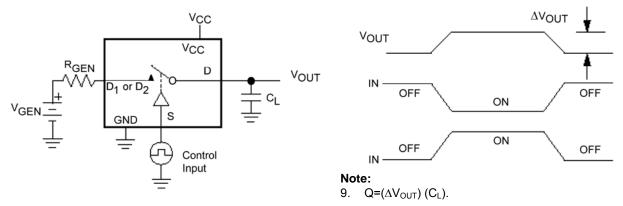


Figure 8. Charge Injection

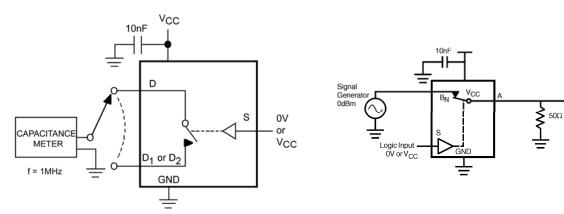


Figure 9. On/Off Capacitance Measurement Setup

Figure 10. Bandwidth

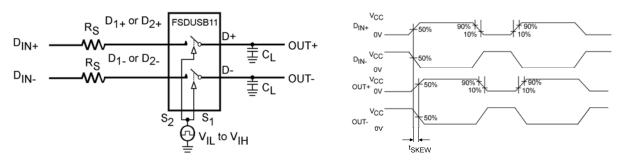


Figure 11. Skew Test

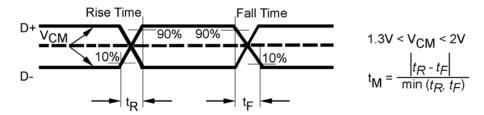


Figure 12. Rise/Fall Time Mismatch Test

Physical Dimensions

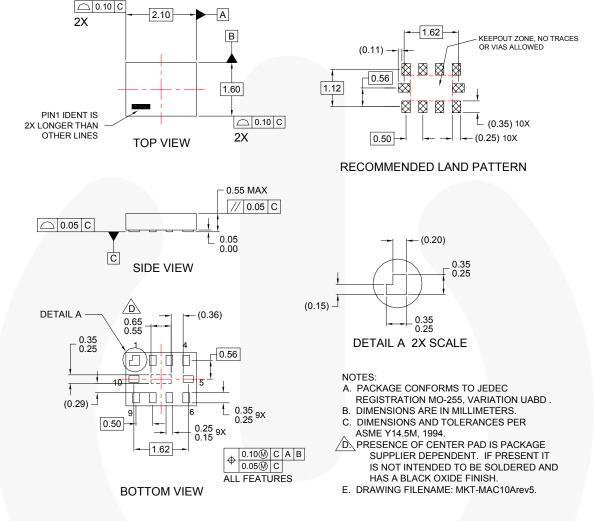


Figure 13. 10-Lead, MicroPak™, JEDEC MO255,1.6 X 2.1mm

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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
L10X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

Physical Dimensions

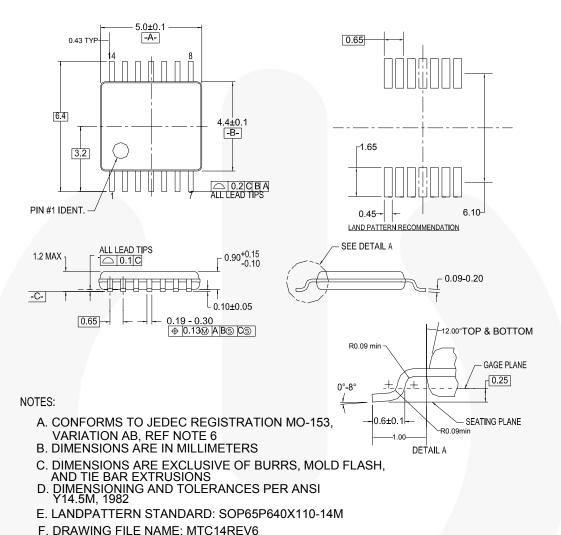


Figure 14. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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