Microsemi
INTEGRATED PRODUCTS

LX7201-xx

EMI Filter & ESD Protection for Down Stream USB Ports

PRODUCTION DATA SHEET

DESCRIPTION

The LX7201 is an integrated Universal Serial Bus (USB) line termination device with an EMI filter and ESD protection diodes. This device offers a cost effective and compact solution for one USB downstream port. The USB specification requires line termination resistors on both the D+ and D- lines. These resistors ensure signal integrity by matching the cable impedance to that of the differential driver. The 15KΩ pull-down resistors identify the line as a downstream connection.

The 47 pF capacitor completes the high frequency filter and controls the edge rate of the USB signals. The LX7201 protects both D+ and D- data lines and the voltage bus from ESD. The TVS protection diodes exceed the requirements of IEC61000-4-2, level 4, 15kV (air discharge) and 8kV (contact discharge). The integrated configuration of the LX7201 minimizes board space and allows for ideal placement near the connector. The LX7201 is ideal for use in USB hubs, peripherals and portable appliances.

IMPORTANT: For the most current data, consult *MICROSEMI*'s website: **http://www.microsemi.com**

KEY FEATURES

- Bi-directional EMI/RFI Low-Pass Filter
- Line Termination with Integrated ESD Protection
- Low TVS Operating Voltage (5.25V)
- Low Leakage Current
- Integrated Single Die Construction
- Available With 15 or 22Ω Series Resistance
- Crosses from Semtech STF201

APPLICATIONS

- USB 1.1 and USB 2.0 Full Speed Compliant
- Peripherals
- Printers
- Monitors
- Servers, Desktops and Notebook Computers
- Digital Cameras

BENEFITS

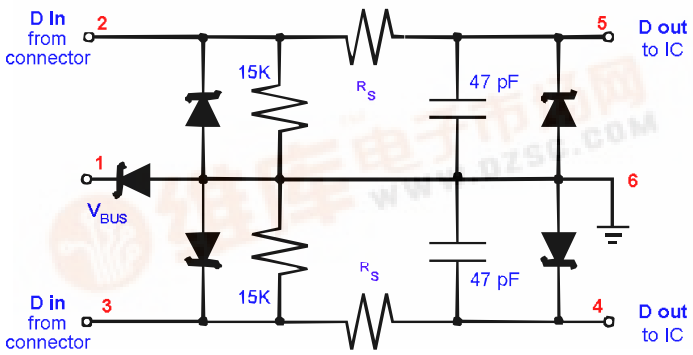
- Filter response characterized up to 6 GHz
- <2dB insertion loss in the pass band
- >20dB attenuation in the 800-900 MHz range
- >12dB attenuation in the WLAN frequencies of 2.4GHz and 5.0-6.0 GHz

PACKAGE ORDER INFO

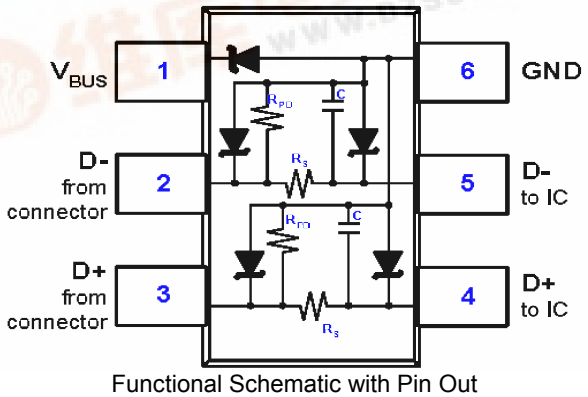
T_J (°C)	SF Plastic 6-Pin SOT23	Package Marking	Tape & Reel Quantity (Reel Size)
-40 to 125	LX7201-15ISF	115	3K (7inches)
-40 to 125	LX7201-22ISF	122	

Note: Append the letter "T" to the part number
For Tape & Reel Ordering

PRODUCT HIGHLIGHT



Circuit Diagram



Functional Schematic with Pin Out

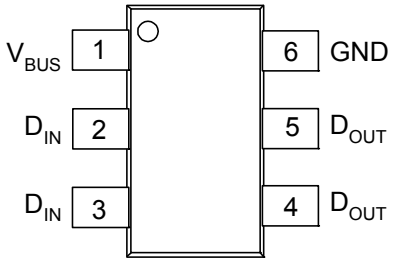
LX7201-XX

ABSOLUTE MAXIMUM RATINGS

Steady State Power 100mW
ESD Air Discharge per IEC61000-4-2 ..... 16kV
ESD Contact Discharge per IEC61000-4-2 ..... 10kV
Lead Soldering Temperature (10 Seconds) ..... 260°C
Operating Temperature ..... -40°C to +125°C
Storage Temperature Range ..... -55°C to +150°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

PACKAGE PIN OUT



SF PACKAGE
(Top View)

THERMAL DATA

SF **Plastic SOT23 6-Pin**

THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	62 °C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	96 °C/W

Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

FUNCTIONAL PIN DESCRIPTION

Name	Description
VBUS	Bus Voltage
DIN	Data In
GND	Ground
DOUT	Data Out

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, the following specifications apply over the operating ambient temperature -40°C ≤ T_A ≤ +125°C except where otherwise noted.

Parameter	Symbol	Test Conditions	LX7201-xx			Units
			Min	Typ	Max	
Stand-Off Voltage	VR_{WM}				5.25	V
Breakdown Voltage	V_{BR}	IR = 1mA	6			V
Leakage Current	I_R	VRWM = 5.25V, T = 25°C			1	µA
Series Resistance (-15)	R_S	Each Line	13.5	15	16.5	Ω
Series Resistance (-22)	R_S	Each Line	19.8	22	24.2	Ω
Temperature Coefficient of R_S	T_{COEFF}	Each Line		200		ppm
Pull Down Resistance	R_{PD}	Each Line	13.5	15	16.5	KΩ
Capacitor	C	Each Line		47		pF
Total Capacitance	C_{TOT}	Between I/O Pins and Ground, Each Device VR = 0V, f = 1MHz	54	60	66	pF

APPLICATION CIRCUITS

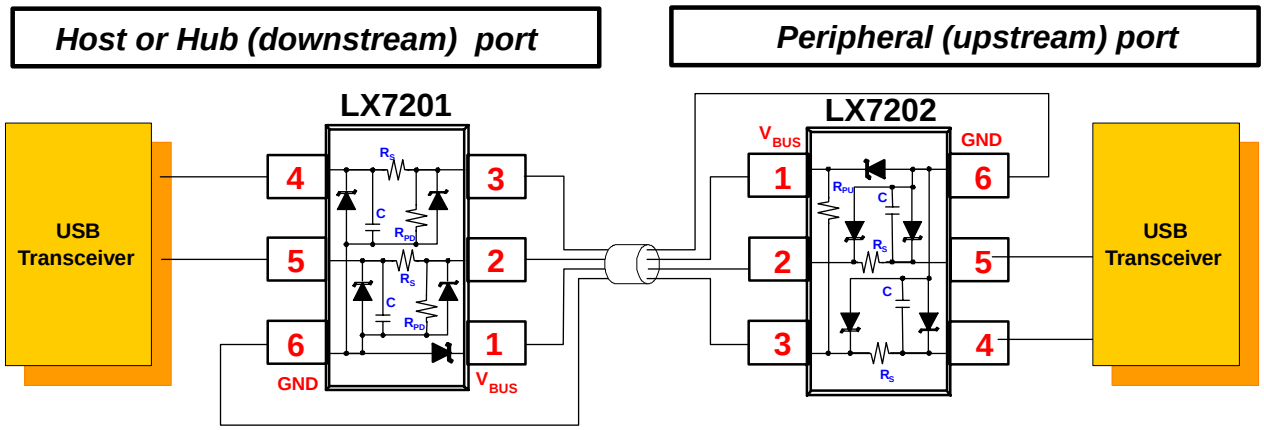


Figure 1 – Typical Application

APPLICATION INFORMATION

The LX7201 meets the requirements of the USB v1.1 and USB 2.0 Full Speed specification for device termination, EMI filtering and ESD protection. The R_S resistor provides the proper signal termination; the 47pF capacitor controls the signal rise and fall slew; the TVS diodes protect the IC from ESD damage; and the total capacitance and resistance creates a low pass filter eliminating the high frequency energy from the circuit.

Device Connection:

- Voltage Supply (V_{BUS}) is connected to Pin 1
- Ground is connected to Pin 6
- D+ from the connector is routed to Pin 2 and out of Pin 5.
- D- from the connector is routed to Pin 3 and out of Pin 4.

ELECTROMAGNETIC EMISSION AND SUSCEPTABILITY

FCC Part 15 sets limits for maximum allowable EM emission and susceptibility. There are two types of emissions. Conducted emissions with frequency of emission of 0.45 to 30 MHz and Radiated emissions with frequency of emission of 30 MHz to 40 GHz. All digital computing devices including the peripheral devices must comply. Examples of peripheral devices include terminals, printers, external floppy disk drives and other data storage devices, video monitors, keyboards, control cards, interface boards, external memory expansion cards and other input/output devices that may or may not contain digital circuitry. LX7201 is optimized to minimize the radiated EMI which is the primary concern in devices using USB. Refer to the typical filter response curve for the attenuation characteristics of LX7201 over the frequency range of 30KHz to 6GHz.

CHARACTERISTIC CURVES

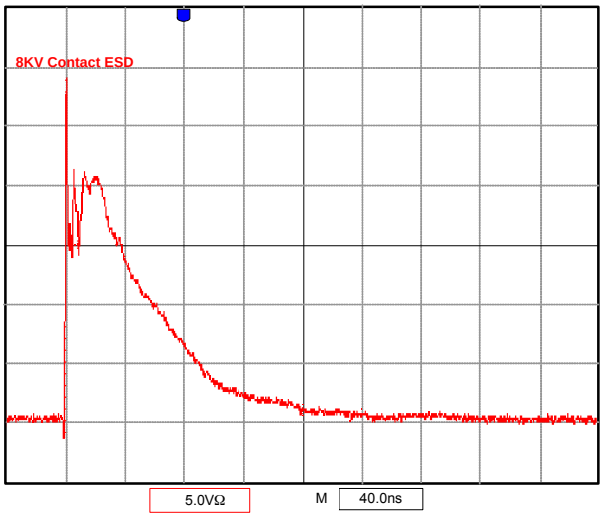


Figure 2 – 8KV ESD input pulse as per IEC61000-4-2. Vertical scale is equivalent to 5A/div.

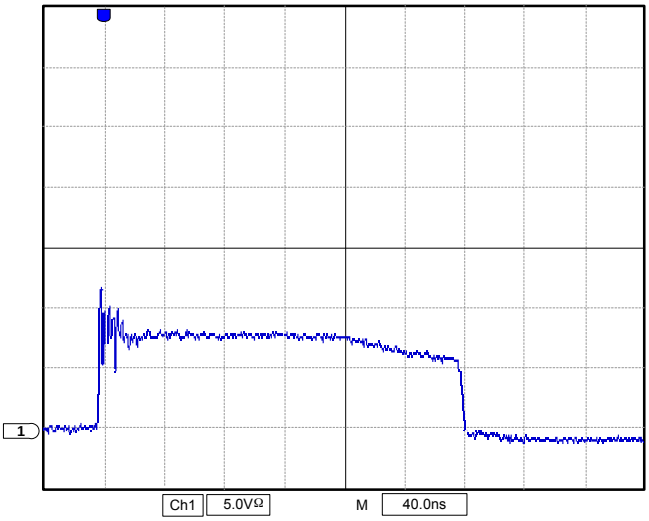


Figure 3 – Clamping Characteristics when device subjected to an 8 KV ESD pulse.

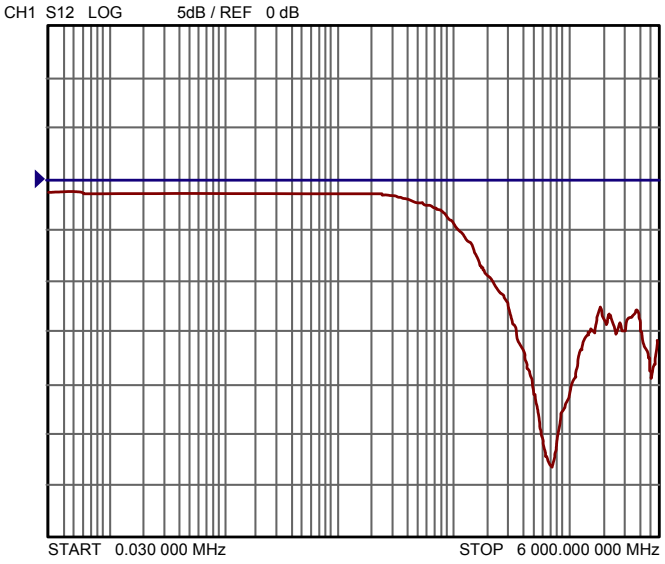


Figure 4 – Frequency response curve. Low insertion loss in the pass band and -20dB attenuation at 800-900 MHz. Better than -10dB attenuation at the WLAN frequencies of 2.4 and 5.0-6.0 GHz.

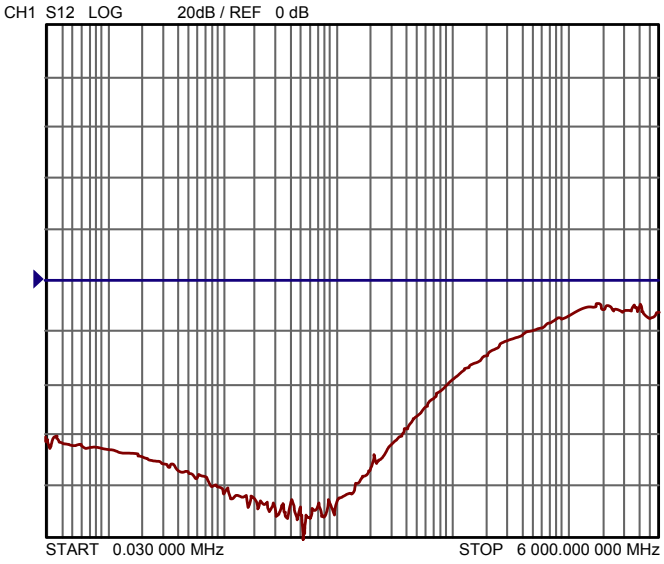
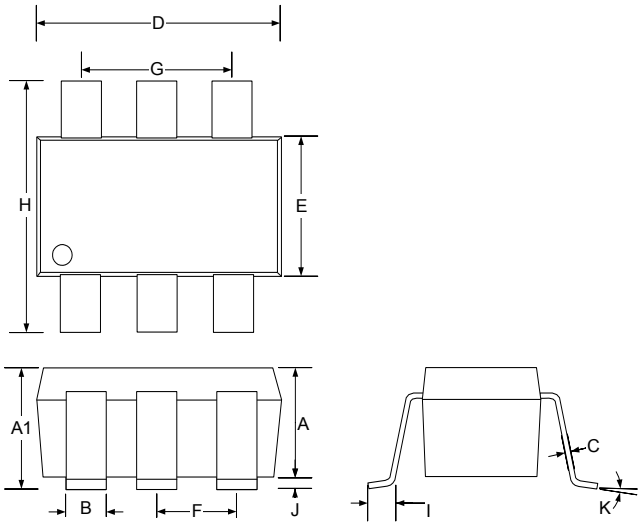


Figure 5 – Analog Crosstalk between the two datalines D- and D+

PACKAGE DIMENSIONS

SF 6-Pin SOT-23 Package

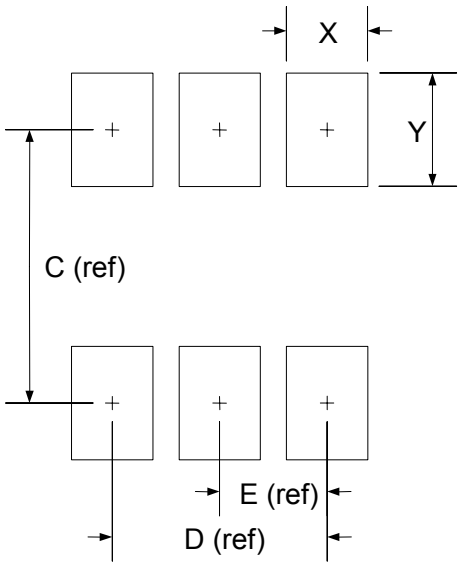


Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.30	0.035	0.051
A1	0.90	1.45	0.035	0.057
B	0.25	0.50	0.010	0.020
C	0.09	0.20	0.004	0.008
D	2.80	3.10	0.110	0.122
E	1.50	1.75	0.059	0.069
F	0.95 BSC		0.038 BSC	
G	1.90 BSC		0.075 BSC	
H	2.60	3.00	0.102	0.118
I	0.35	0.55	0.014	0.022
J	0.00	0.15	0.000	0.006
K	10° MAX		10° MAX	

Note:

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

Recommended Footprint



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
C	-	2.40	-	0.094
D	-	1.90	-	0.074
E	-	0.95	-	0.037
X	-	0.70	-	0.028
Y	-	1.00	-	0.039

NOTES