EMI Filter & ESD Protection for Up Stream USB Ports

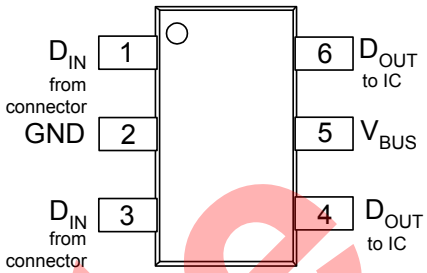
PRODUCTION DATA SHEET

ABSOLUTE MAXIMUM RATINGS

Steady State Power 100mW
ESD Air Discharge per IEC61000-4-2..... 16kV
ESD Contact Discharge per IEC61000-4-2 ..... 10kV
Peak Package Solder Reflow Temperature
(40 second maximum exposure) ..... 260°C (+0, -5)
Operating Temperature .....-40°C to +125°C
Storage Temperature Range.....-65°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



SM PACKAGE
(Top View)

RoHS / Pb-free 100% Matte Tin Lead Finish

THERMAL DATA

SM Plastic 6-Pin SC70

THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	119 °C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	122 °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	LX7203			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 Up Resistance	R_{PU}	Each Line	1.35	1.5	1.65	KΩ
Capacitor	C_{EDGE}	Each Line		47		pF
Total Capacitance	C_{TOT}	Between I/O Pins and Ground, Each Device VR = 0V, f = 1MHz	54	60	66	pF

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APPLICATION CIRCUITS

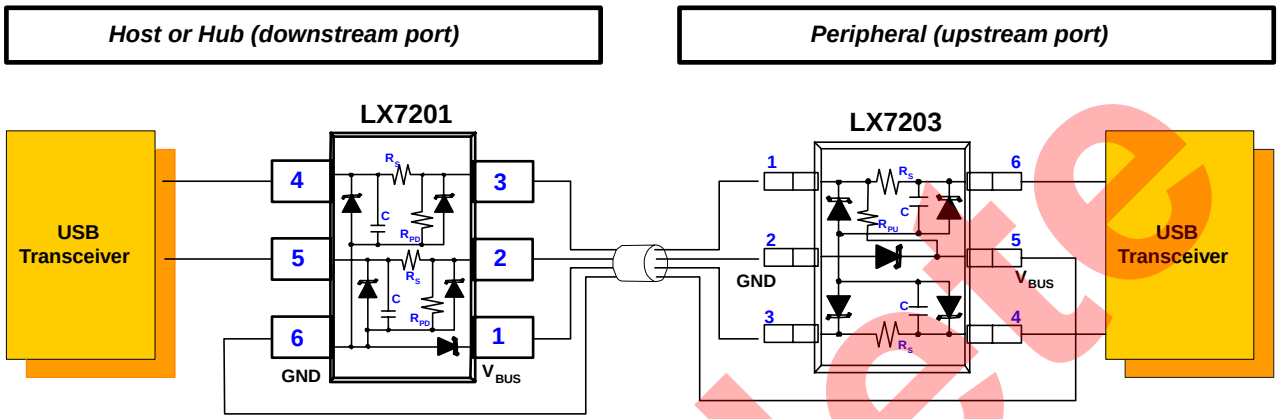

Figure 1 – Typical Application

APPLICATION INFORMATION

The LX7203 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 C_{EDGE} 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. The LX7203 can configure the upstream port for either Full-Speed or Low-Speed operation. The figures below show the proper connection in accordance with the USB specification.

FULL SPEED DEVICE (FIGURE 2)

The USB 2.0 specification offers a 12 Mbps data transfer rate known as Full-Speed which requires a 1.5 kΩ pull-up resistor to be connected to the D+ line. Slew rate control is accomplished with C_{EDGE} attached to the transceiver before the R_S.

- Voltage Supply (Vbus) is connected to Pin 5
- Ground is connected to Pin 2
- D+ from the connector is routed to Pin 1 (1.5 kΩ pull-up resistor) and Pin 6 to the D+ line of the USB Transceiver
- D- from the connector is routed to Pin 3 and Pin 4 to the D- line of the USB Transceiver

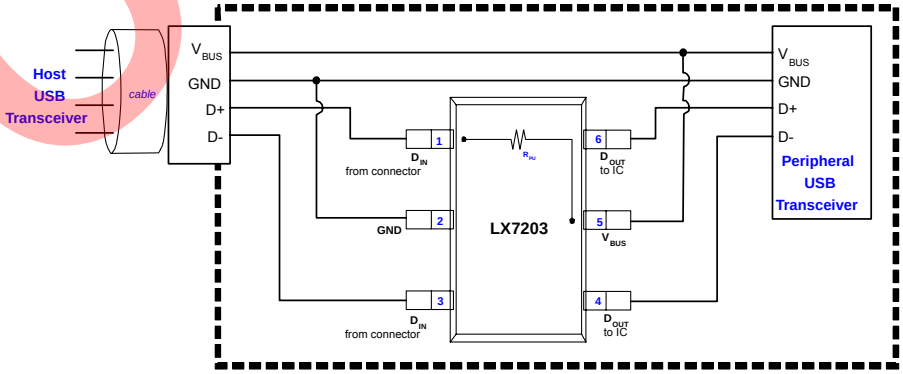

Figure 2 – Connection for Full Speed Operation

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APPLICATION INFORMATION (CONTINUED)

LOW SPEED DEVICE (FIGURE 3)

The USB v1.1 specification offers a 1.5 Mbps data transfer rate known as Low-Speed which requires a 1.5 kΩ pull-up resistor to be connected to the D- line. Slew rate control is accomplished with C_{EDGE} attached to the transceiver before the R_S.

- Voltage Supply (Vbus) is connected to Pin 5
- Ground is connected to Pin 2
- D+ from the connector is routed to Pin 3 and Pin 4 to the D+ line of the USB Transceiver
- D- from the connector is routed to Pin 1 (1.5 kΩ pull-up resistor) and Pin 6 to the D- line of the USB Transceiver

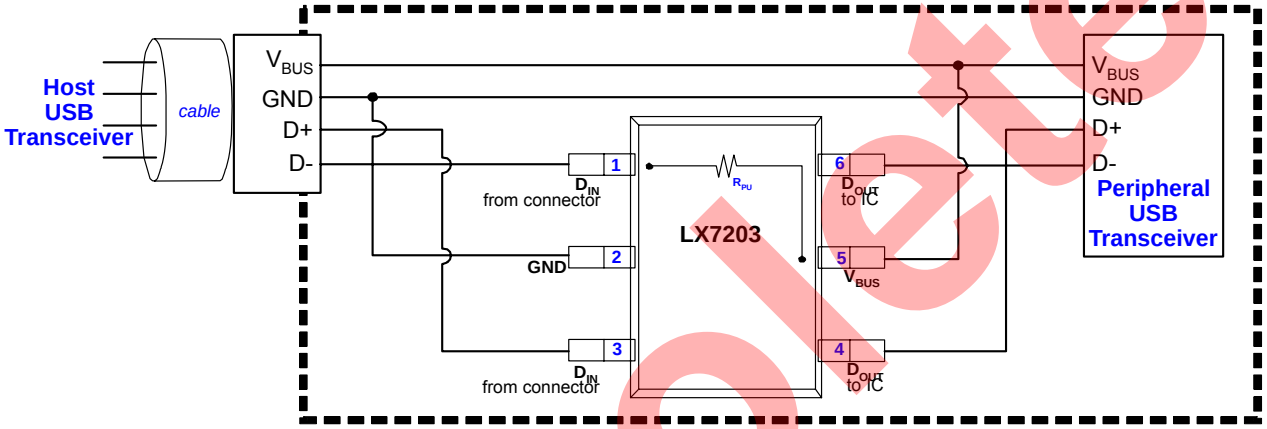


Figure 3 – Connection for Low Speed Operation

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. LX7203 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 LX7203 over the frequency range of 30kHz to 6GHz.

CHARACTERISTIC CURVES

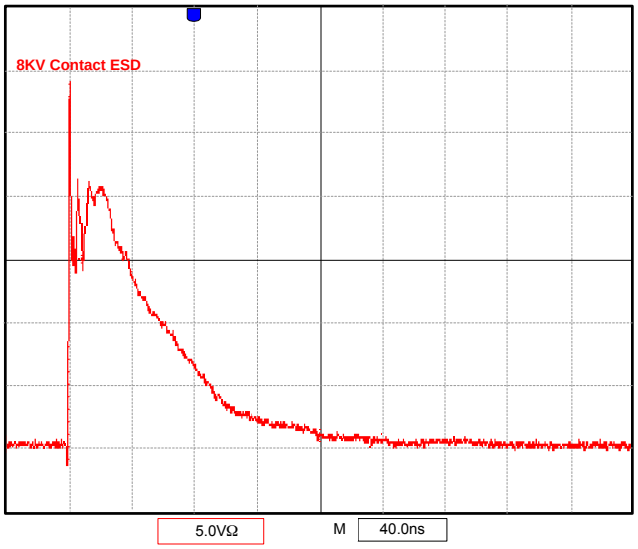


Figure 4 – 8KV ESD input pulse as per IEC61000-4-2. Vertical scale is equivalent to 5A/div.

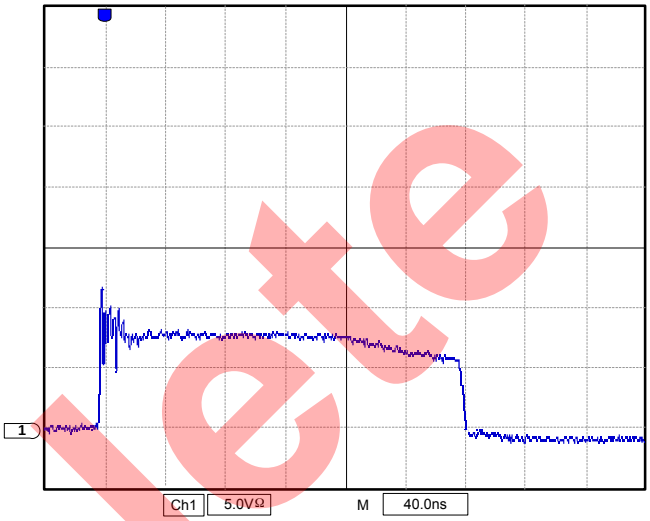


Figure 5 – Clamping Characteristics when device subjected to an 8 KV ESD pulse.

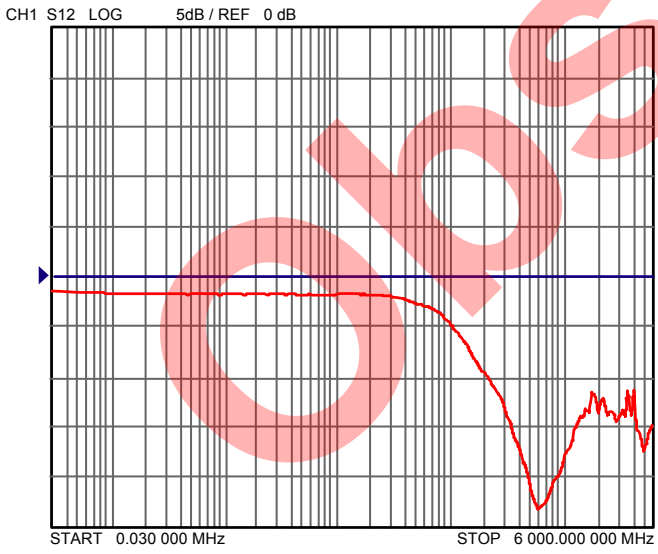


Figure 6 – Frequency response curve. Low insertion loss in the pass band and -20dB attenuation at 800-900 MHz. Better than -10dB attenuation at the WLAN frequencies of 2.4 and 5.0-6.0 GHz.

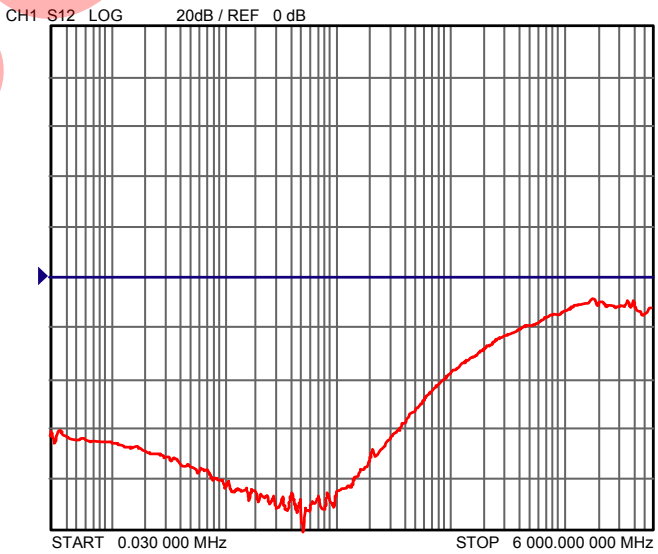
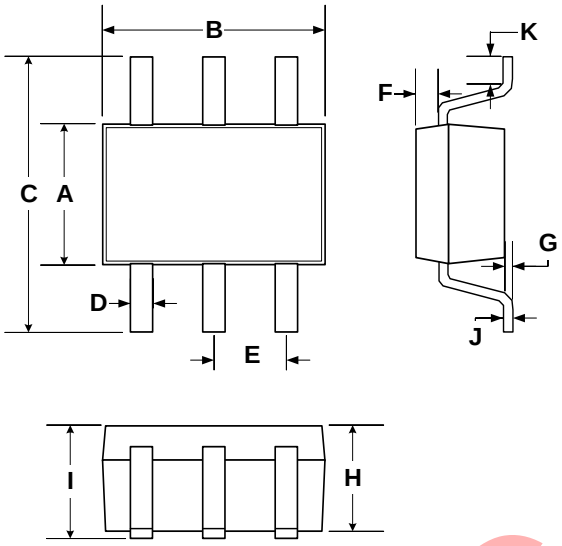


Figure 7 – Analog Crosstalk between the two datalines D- and D+

PACKAGE DIMENSIONS

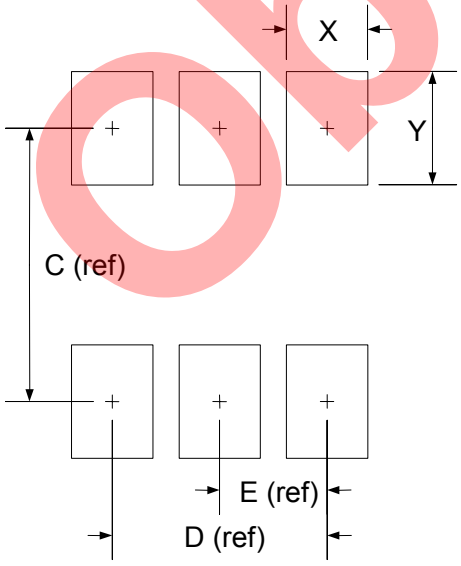
SM 6 Pin Plastic SC70



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.15	1.35	0.045	0.053
B	1.80	2.20	0.071	0.086
C	1.80	2.40	0.071	0.094
D	0.15	0.30	0.006	0.012
E	0.65 BSC		0.026 BSC	
F	0.10	0.40	0.004	0.016
G	0	0.10	0	0.004
H	0.80	1.00	0.032	0.039
I	0.80	1.10	0.032	0.043
J	0.10	0.18	0.004	0.007
K	0.10	0.30	0.004	0.012

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	-	1.60	-	0.063
D	-	1.30	-	0.052
E	-	0.65	-	0.026
X	-	0.35	-	0.014
Y	-	0.90	-	0.035

NOTES

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