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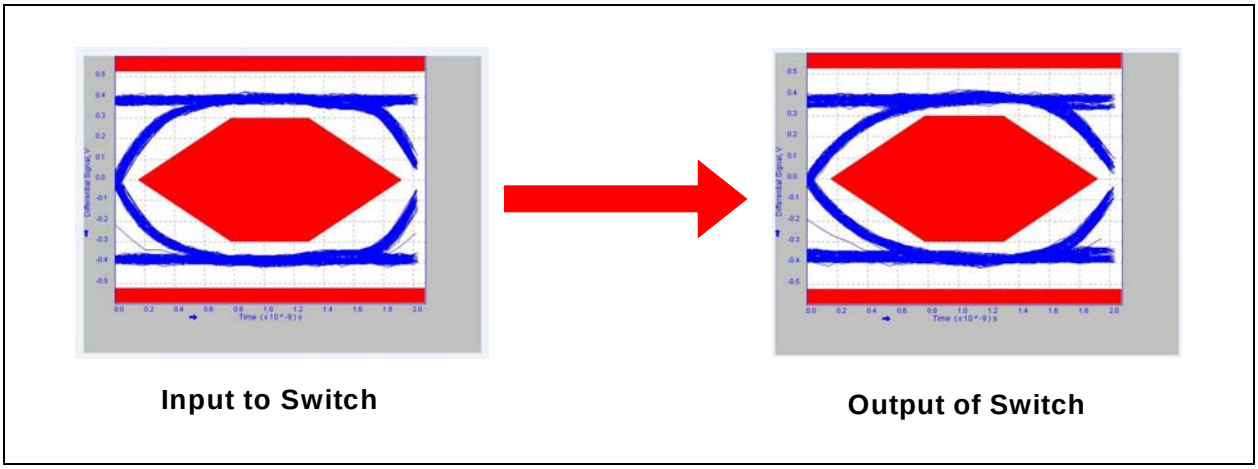
Table of Contents

1.0 GENERAL DESCRIPTION

The USB3740B is a USB 2.0 compliant High Speed switch that provides robust ESD protection to the interface in an extremely small package. Outstanding ESD robustness eliminates the need for external ESD protection devices to save eBOM cost and PCB area.

The high bandwidth capabilities of the USB3740B enable extremely low high frequency loss and an exceptionally clean USB 2.0 High Speed eye diagram.

FIGURE 1-1: USB3740B USB 2.0 HIGH SPEED EYE DIAGRAM



1.1 Reference Document

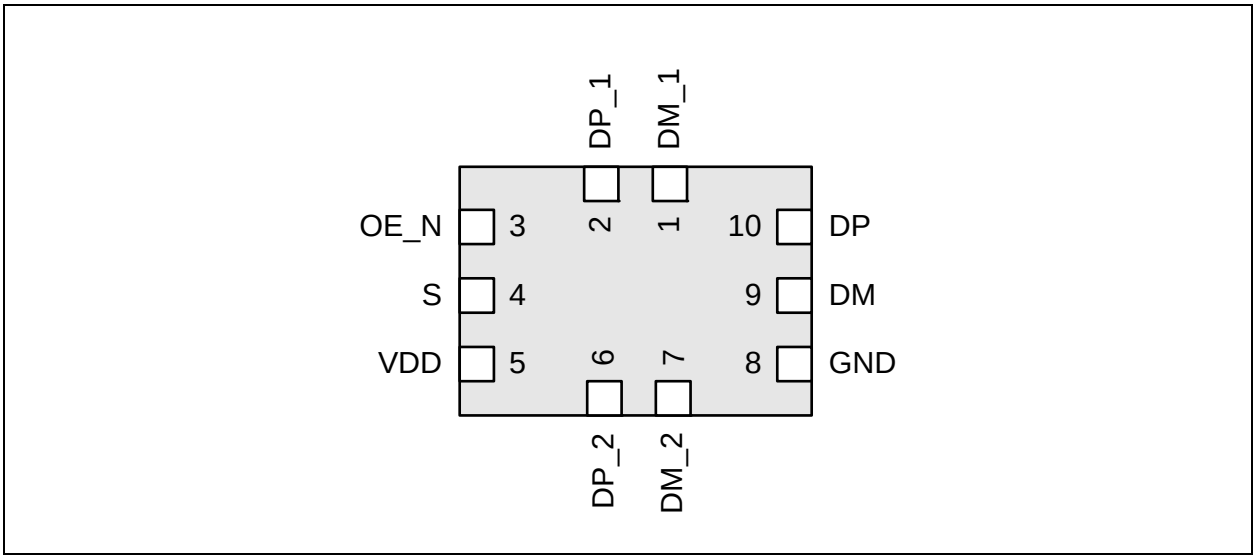
Universal Serial Bus Specification, Revision 2.0

2.0 PIN LAYOUT

2.1 Pin Diagram

The USB3740B is available in both a 0.4mm pitch QFN (1.3mm x 1.8mm) and 0.5mm pitch QFN (1.55mm x 2.05mm) package.

FIGURE 2-1: USB3740B PACKAGE DIAGRAM



2.2 Ball/Pin Definitions

The following table details the ball/pin definitions for the package diagram above.

Pin	Name	Type/ Direction	Description
10	**DP**	Analog	USB Mux Output
9	**DM**	Analog	
2	**DP_1**	Analog	USB Mux Input 1
1	**DM_1**	Analog	
6	**DP_2**	Analog	USB Mux Input 2
7	**DM_2**	Analog	
8	**GND**	Analog	Ground
5	**VDD**	Analog	Power
4	**S**	Digital Input	Switch control. Refer to Table 4-1.
3	**OE_N**	Digital Input	Active low switch Output Enable. Refer to Table 4-1.

3.0 ELECTRICAL SPECIFICATIONS

3.1 Absolute Maximum Ratings

TABLE 3-1: ABSOLUTE MAXIMUM RATINGS

Description		Rating	Unit
VDD Voltage to **GND**		-0.3 to 6.0	V
Any other pin to **GND**		-0.3 to VDD+0.5	V
Operating Temperature Range		-40 to +85	C
Storage Temperature Range		-55 to +150	C
ESD Rating	HBM (JESD 22)	8,000	V
	HBM (Pin to Ground)	8,000	V
	IEC-61000-4-2	15,000 (Air) 15,000 (Contact)	V

Stresses beyond the Absolute Maximum Ratings may damage the USB3740B.

3.2 Electrical Specifications

TABLE 3-2: ELECTRICAL SPECIFICATIONS

Characteristic	Symbol	MIN	TYP	MAX	Units	Conditions
V_{DD} = 5.0V, T_A = -40C to 85C, all typical values at T_A = 25C unless otherwise noted.						
VDD Recommended Operating Conditions						
Input Voltage	V_{DD}	3.0		5.5	V	
Active/Standby	I_{DD}		30	175	nA	
USB Mux Characteristics						
USB Mux On Resistance	R_{ON_USB}	1	2	5	ohm	0V < Vin < 3.3V
		1	2	2.5		0V < Vin < 0.4V
USB Mux Off Leakage	I_{OFF_USB}		100	200	nA	0V < Vin < 3.3V
On Capacitance	C_{ON_USB}		5	7	pF	V_{DD} = 3V
Off Capacitance	C_{OFF_USB}		3	4	pF	V_{DD} = 3V
Off Isolation		-30	-32	-40	dB	R_L = 50 ohm, F = 250MHz
Crosstalk		-30	-45	-60	dB	R_L = 50 ohm, F = 250MHz
Bandwidth (-3dB)	BW	950	1000	1100	MHz	R_L = 50 ohm, C_L = 0pF
		850	950	980		R_L = 50 ohm, C_L = 5pF
		530	560	600		R_L = 50 ohm, C_L = 10pF
Control Signal Characteristics						
Input Logic High Threshold	V_{IN_H}	1.4			V	
Input Logic Low Threshold	V_{IN_L}			0.4	V	

4.0 GENERAL OPERATION

The USB3740B is a high bandwidth switch suitable for many applications, including High Speed USB. The mux allows high speed signals to pass through and still meet HS USB signaling requirements.

The USB3740B will protect the system from ESD stress events on all **DP** and **DM** pins. The USB3740B provides ESD protection to the IEC-61000 ESD specification.

The USB mux is designed to pass High Speed USB signals to the USB connector, and allows for two USB inputs to be multiplexed into one USB output.

The USB Mux is designed to pass USB signals from 0 to **VDD**. It is not designed to pass signals that go above **VDD** or below ground.

The USB3740B switches are controlled by the digital signals OE_N and S, as shown in Table 4-1.

TABLE 4-1: USB3740B SWITCH STATES DEFINITION

OE_N	S	Switch State
1	X	STANDBY: • Both switch paths disconnected. • Lowest power state
0	0	DP = DP1, DM = DM1:
0	1	DP = DP2, DM = DM2:

5.0 APPLICATION NOTES

5.1 ESD Performance

The USB3740B is protected from ESD strikes. By eliminating the requirement for external ESD protection devices, board space is conserved, and the board manufacturer is enabled to reduce cost. The advanced ESD structures integrated into the USB3740B protect the device whether or not it is powered up.

5.1.1 HUMAN BODY MODEL (HBM) PERFORMANCE

HBM testing verifies the ability to withstand the ESD strikes like those that occur during handling and manufacturing, and is done without power applied to the IC. To pass the test, the device must have no change in operation or performance due to the event. The USB3740B HBM performance is detailed in Table 3-1.

5.1.2 EN/IEC 61000-4-2 PERFORMANCE

The EN/IEC 61000-4-2 ESD specification is an international standard that addresses system-level immunity to ESD strikes while the end equipment is operational. In contrast, the HBM ESD tests are performed at the device level with the device powered down.

Microchip contracts with Independent laboratories to test the USB3740B to EN/IEC 61000-4-2 in a working system. Reports are available upon request. Please contact your Microchip representative, and request information on 3rd party ESD test results. The reports show that systems designed with the USB3740B can safely provide the ESD performance shown in Table 3-1 without additional board level protection.

In addition to defining the ESD tests, EN/IEC 61000-4-2 also categorizes the impact to equipment operation when the strike occurs (ESD Result Classification). The USB3740B maintains an ESD Result Classification 1 or 2 when subjected to an EN/IEC 61000-4-2 (level 4) ESD strike.

Both air discharge and contact discharge test techniques for applying stress conditions are defined by the EN/IEC 61000-4-2 ESD document.

5.1.2.1 Air Discharge

To perform this test, a charged electrode is moved close to the system being tested until a spark is generated. This test is difficult to reproduce because the discharge is influenced by such factors as humidity, the speed of approach of the electrode, and construction of the test equipment.

5.1.2.2 Contact Discharge

The uncharged electrode first contacts the USB connector to prepare this test, and then the probe tip is energized. This yields more repeatable results, and is the preferred test method. The independent test laboratories contracted by Microchip provide test results for both types of discharge methods.

6.0 PACKAGE OUTLINES

Note: For the most current package drawings, see the Microchip Packaging Specification at http://www.microchip.com/packaging.

FIGURE 6-1: 10 PIN, 1.3MM X 1.8MM QFN PACKAGE OUTLINE

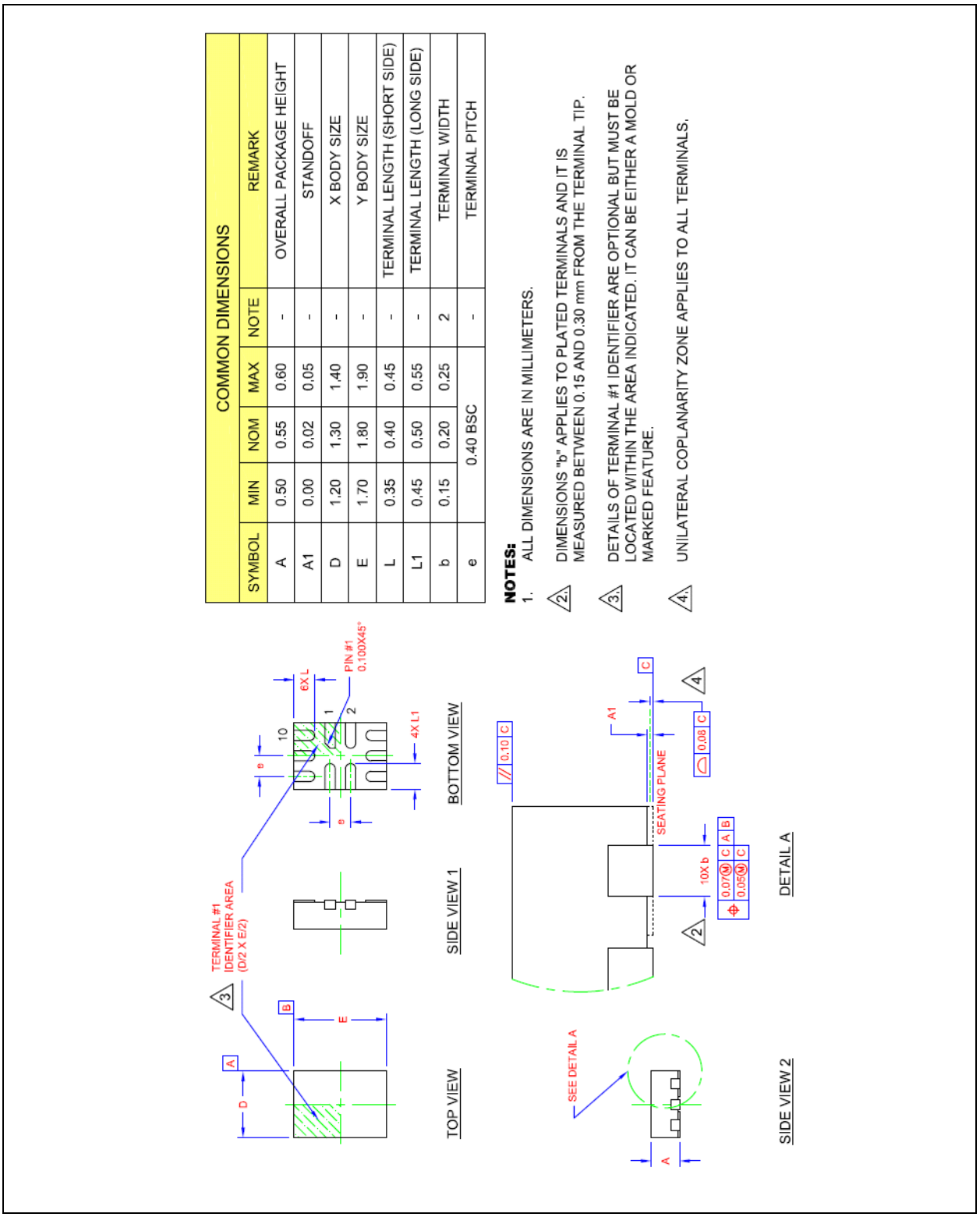
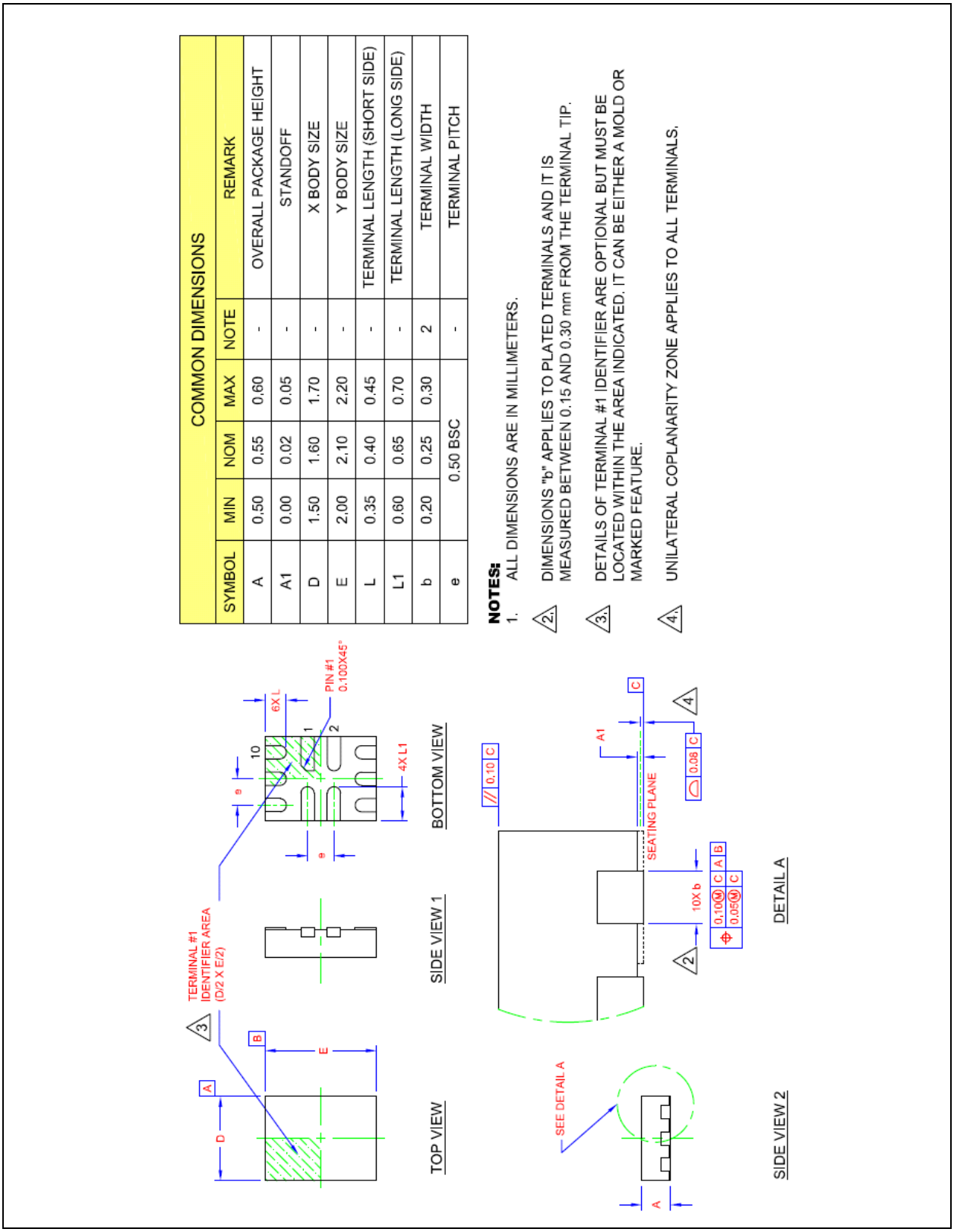


FIGURE 6-2: 10 PIN, 1.6MM X 2.1MM QFN PACKAGE OUTLINE



COMMON DIMENSIONS					
SYMBOL	MIN	NOM	MAX	NOTE	REMARK
A	0.50	0.55	0.60	-	OVERALL PACKAGE HEIGHT
A1	0.00	0.02	0.05	-	STANDOFF
D	1.50	1.60	1.70	-	X BODY SIZE
E	2.00	2.10	2.20	-	Y BODY SIZE
L	0.35	0.40	0.45	-	TERMINAL LENGTH (SHORT SIDE)
L1	0.60	0.65	0.70	-	TERMINAL LENGTH (LONG SIDE)
b	0.20	0.25	0,30	2	TERMINAL WIDTH
e	0.50 BSC			-	TERMINAL PITCH

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS "b" APPLIES TO PLATED TERMINALS AND IT IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
3. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL BUT MUST BE LOCATED WITHIN THE AREA INDICATED. IT CAN BE EITHER A MOLD OR MARKED FEATURE.
4. UNILATERAL COPLANARITY ZONE APPLIES TO ALL TERMINALS.

APPENDIX A: DATA SHEET REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision	Section/Figure/Entry	Correction
DS00001725B (08-21-14)	Document is converted to Microchip template; Product Identification System page replaces Ordering Information.	
DS00001725A replaces the previous SMSC version, Rev. 1.2		Title changed from “High Speed Switch for Mobile and Portable Applications” to “High Speed USB 2.0 Switch with ESD Protection and Low Standby Current”
Rev. 1.2 (07-30-12)	Table 3-1, “Absolute Maximum Ratings,” on page 6	Corrected “Any other pin to GND” row’s rating to “-0.3 to VDD+0.5V”
Rev. 1.1 (12-15-11)	Section 2.2, "Ball/Pin Definitions"	In Section 2.2, changed the description of Pin #8 as follows: “Ground”
Rev. 1.0 (08-03-11)	Data Sheet Release	

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PART NO.	-	XXX	-	[X](1)
Device		Package		Tape and Reel Option

Device:	USB3740B	
Package:	AI2 =	10-pin QFN (1.3mm x 1.8mm)
	AI9 =	10-pin QFN (1.6mm x 2.1mm)
Tape and Reel Option:	Blank =	Tray packaging
	TR =	Tape and Reel

Examples:

a) USB3740B-AI2-TR
10-pin QFN RoHS Compliant package
(1.3mm x 1.8mm)
Tape & Reel

b) USB3740B-AI9-TR
10-pin QFN RoHS Compliant package
(1.6mm x 2.1mm)
Tape & Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option. Reel size is 4,000.

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