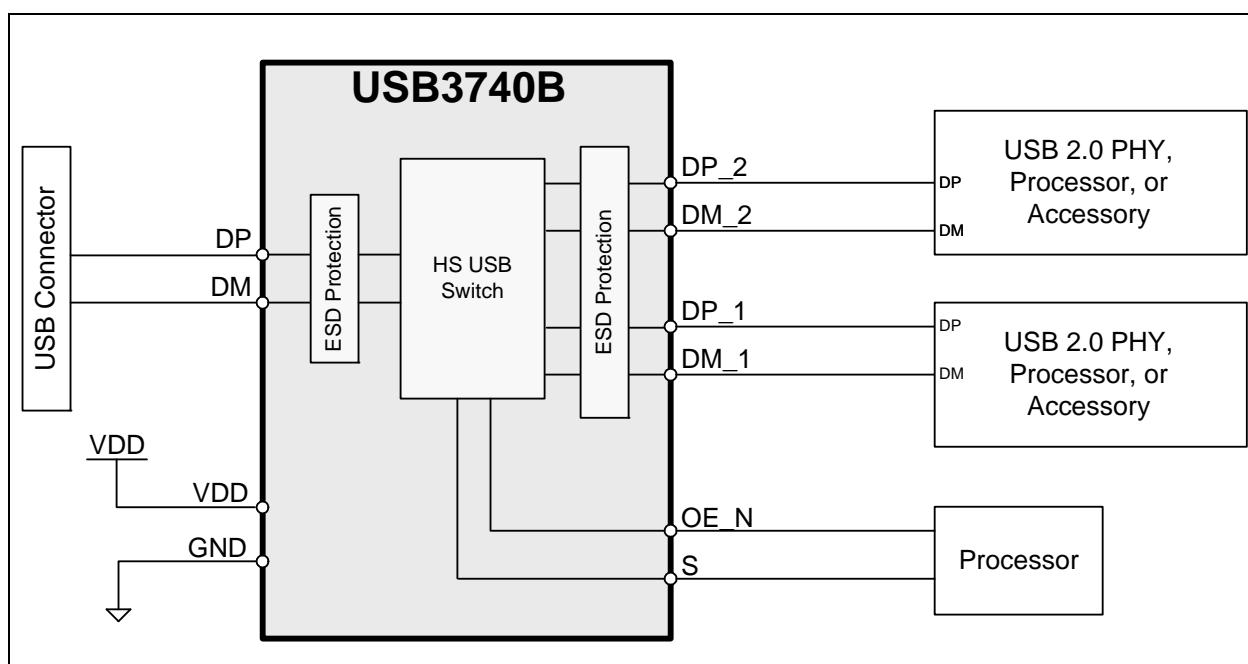


High Speed USB 2.0 Switch with ESD Protection and Low Standby Current

Features

- High Speed USB Mux for multiplexing the USB lanes between different functions
 - Switch the USB connector between two different functions
 - Up to 1GHz Bandwidth
- USB Port ESD Protection (DP/DM)
 - 8kV HBM
- flexPWR™ Technology
 - 30nA Active/Standby Current
 - Extremely low power design ideal for battery powered applications
- Control inputs accommodate 1.8V to 5V inputs
- DP/DM tolerate up to 5.5V
- -40°C to +85°C Operating Temperature
- 10-pin, QFN, RoHS compliant package; (1.3mm x 1.8mm x 0.55mm height, 0.4mm pitch)
- 10-pin, QFN, RoHS compliant package; (1.6mm x 2.1mm x 0.55mm height, 0.5mm pitch)
- Automotive option

Block Diagram



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Errata

An errata sheet, describing minor operational differences from the data sheet and recommended workarounds, may exist for current devices. As device/documentation issues become known to us, we will publish an errata sheet. The errata will specify the revision of silicon and revision of document to which it applies.

To determine if an errata sheet exists for a particular device, please check with one of the following:

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Table of Contents

1.0 General Description 4

2.0 Pin Layout 5

3.0 Electrical Specifications 6

4.0 General Operation 8

5.0 Application Notes 9

6.0 Package Outlines 10

The Microchip Web Site 17

Customer Change Notification Service 17

Customer Support 17

Product Identification System 18

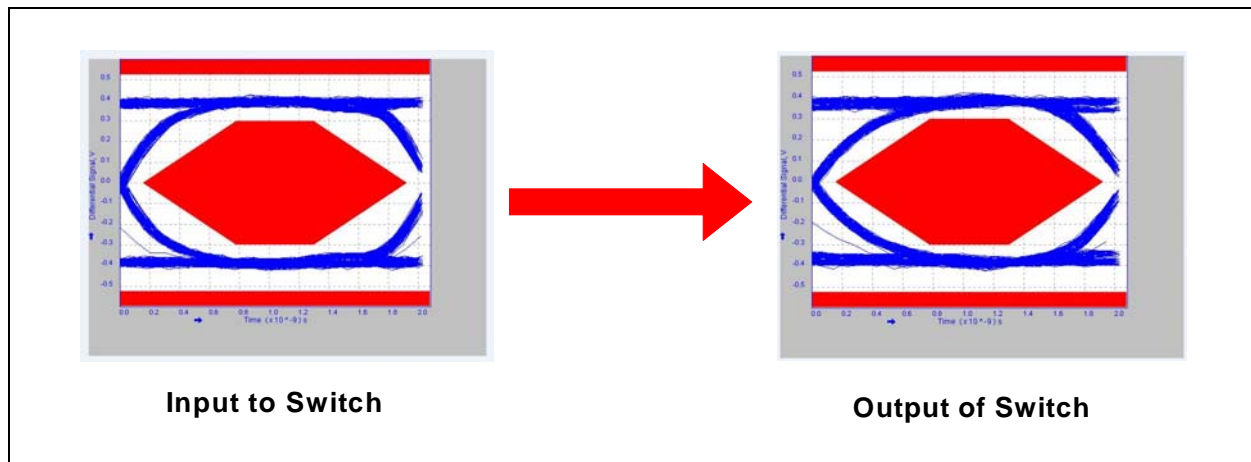
USB3740B

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

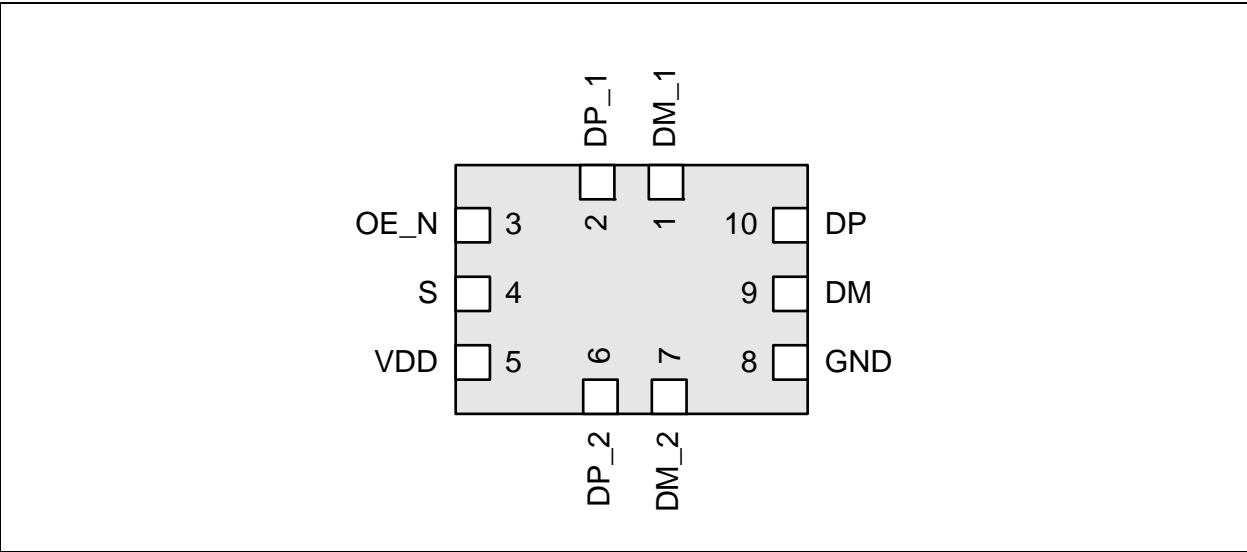
Universal Serial Bus Specification, Revision 2.0

2.0 PIN LAYOUT

2.1 Pin Diagram

The USB3740B is available in both a 0.4mm pitch QFN (1.3mm x 1.8mm x 0.55mm height) and 0.5mm pitch QFN (1.6mm x 2.1mm x 0.55mm height) package. The 0.5mm pitch package can be ordered in standard or automotive configurations. For additional ordering information, refer to the [Product Identification System](#) section.

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 .

USB3740B

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
Maximum Junction Temperature (Tjmax)		+125	C
ESD Rating	HBM	8,000	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	

3.3 Package Thermal Specifications

TABLE 3-3: PACKAGE THERMAL PARAMETERS

Parameter	Symbol	°C/W	Velocity (meters/s)
Thermal Resistance Junction to Ambient	Θ_{JA}	197.2	0
		190.4	1
Thermal Resistance Junction to Top of Case	Θ_{JC}	Note 3-1	
Thermal Resistance Junction to Bottom of Case	Ψ_{JT}	28.0	0
		29.2	1

Note 3-1 146.4 °C/W for 1.3mm x 1.8mm (0.4mm pitch) package, 135.6 °C/W for 1.6mm x 2.1mm (0.5mm pitch) package.

Note: Thermal parameters are measured or estimated for devices in a multi-layer 2S2P PCB per JESDN51.

USB3740B

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: <ul style="list-style-type: none">• 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](#).

USB3740B

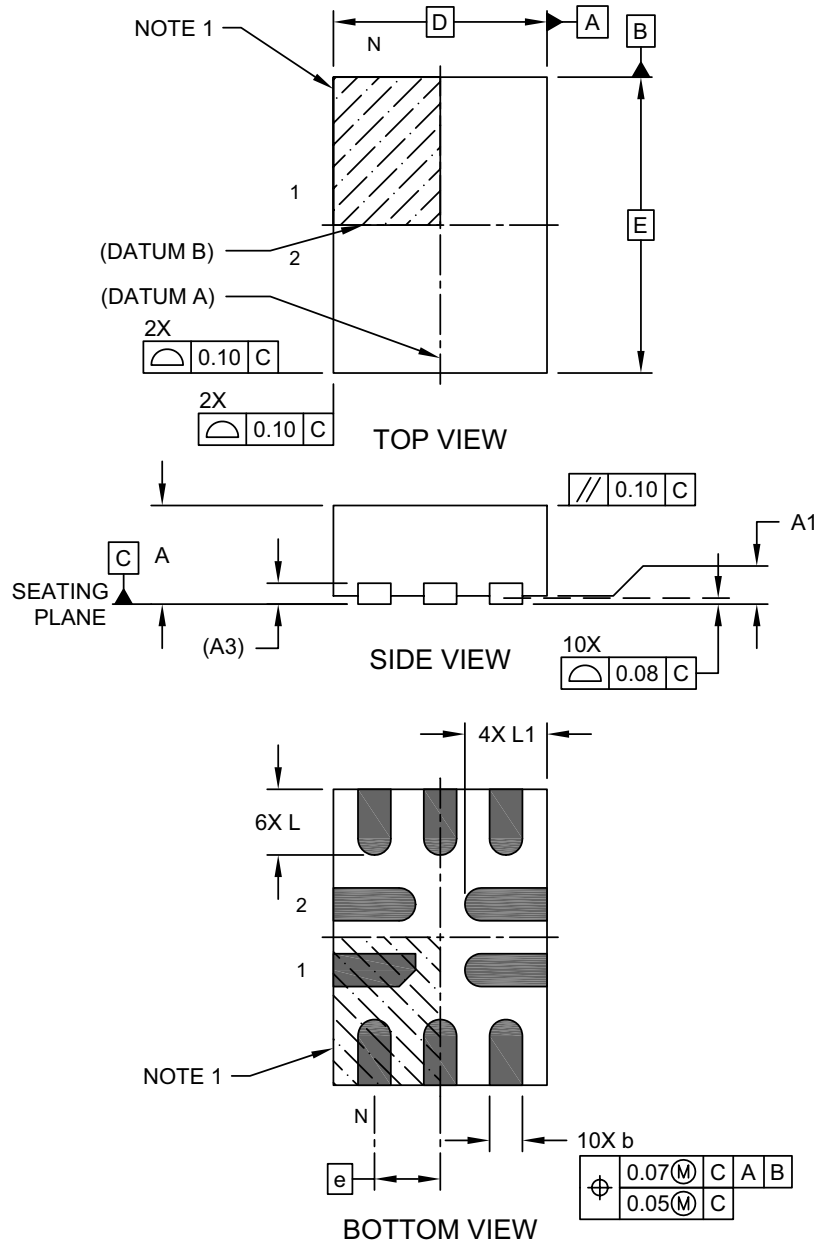
6.0 PACKAGE OUTLINES

6.1 1.3mm x 1.8mm QFN

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

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (2V) - 1.3x1.8x0.6 mm Body [UQFN] Chip-On-Lead

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

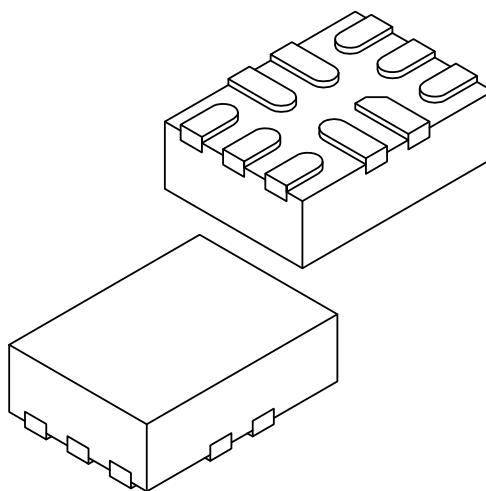


Microchip Technology Drawing C04-386A Sheet 1 of 2

FIGURE 6-2: 10-PIN, 1.3MM X 1.8MM QFN PACKAGE DIMENSIONS

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (2V) - 1.3x1.8x0.6 mm Body [UQFN] Chip-On-Lead

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	10		
Pitch	e	0.40 BSC		
Overall Height	A	0.50	0.55	0.60
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.127 REF		
Overall Length	D	1.30 BSC		
Overall Width	E	1.80 BSC		
Terminal Width	b	0.15	0.20	0.25
Terminal Length	L	0.35	0.40	0.45
Terminal Length	L1	0.45	0.50	0.55

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

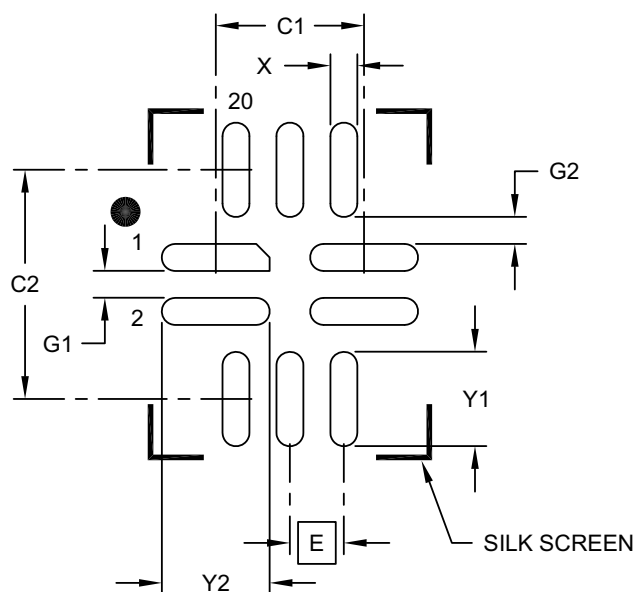
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-386A Sheet 2 of 2

FIGURE 6-3: 10-PIN, 1.3MM X 1.8MM QFN PACKAGE LAND PATTERN

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (2V) - 1.3x1.8x0.6 mm Body [UQFN] Chip-On-Lead

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.40 BSC		
Contact Pad Spacing	C1		1.10	
Contact Pad Spacing	C2		1.70	
Contact Pad Width (X10)	X			0.20
Contact Pad Length (X6)	Y1			0.70
Contact Pad Length (X4)	Y2			0.80
Contact Pad to Pad (X6)	G1	0.20		
Contact Pad to Pad (X4)	G2	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

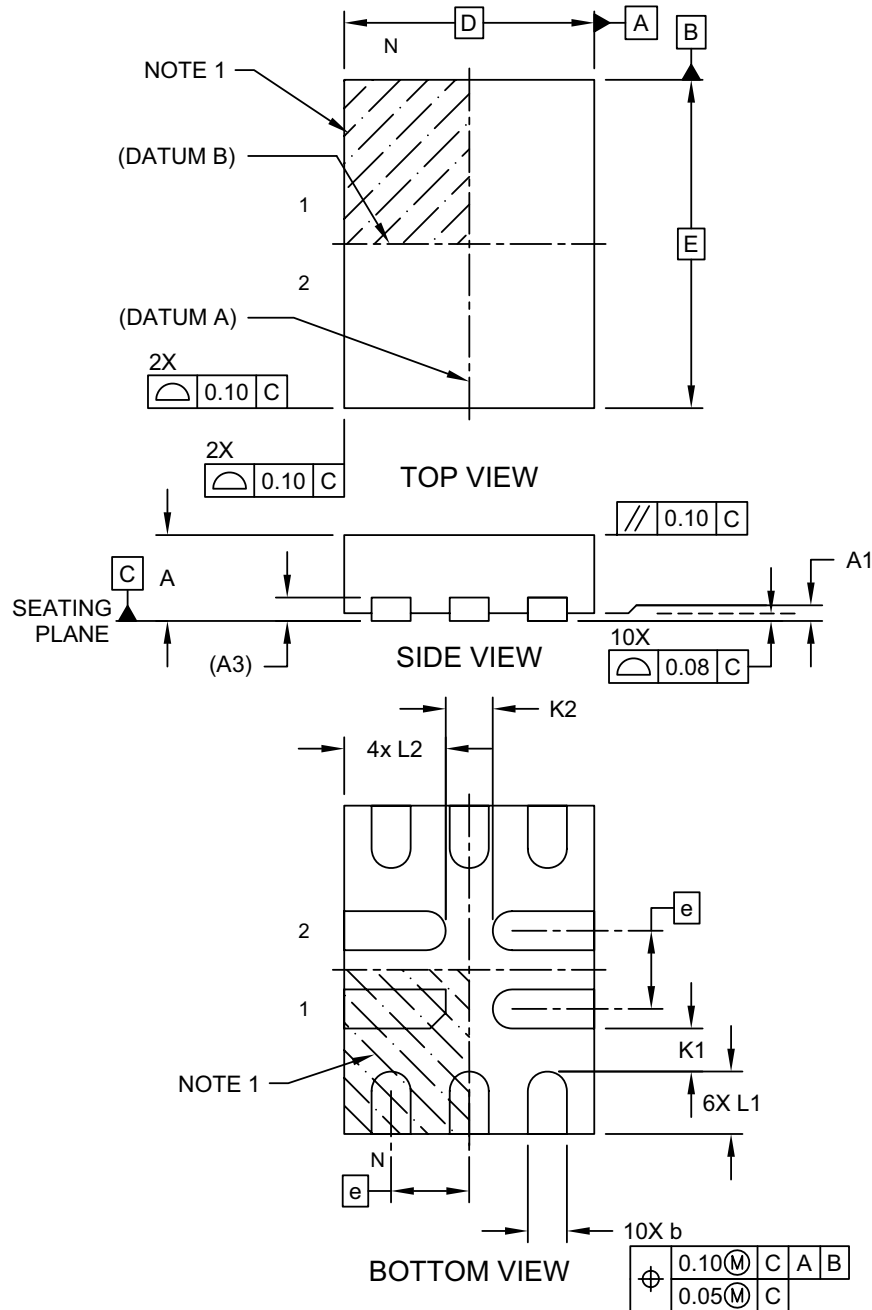
Microchip Technology Drawing C04-2386A

6.2 1.6mm x 2.1mm QFN

FIGURE 6-4: 10-PIN, 1.6MM X 2.1MM QFN PACKAGE OUTLINE

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (3V) - 1.6x2.1 mm Body [UQFN Chip-On-Lead

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

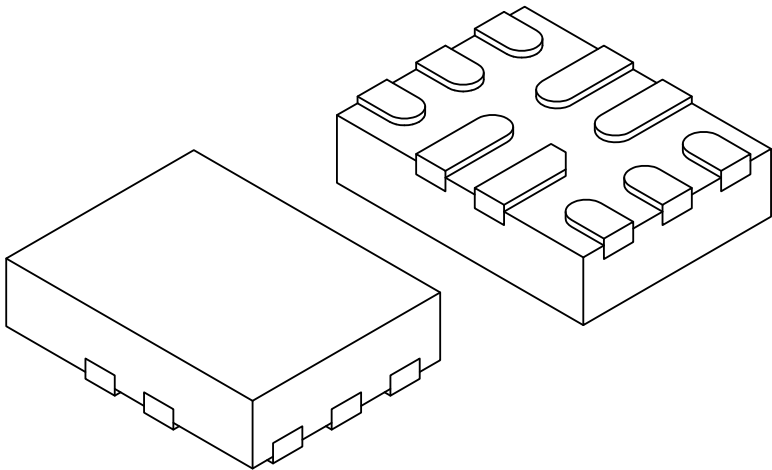


Microchip Technology Drawing C04-381A Sheet 1 of 2

FIGURE 6-5: 10-PIN, 1.6MM X 2.1MM QFN PACKAGE DIMENSIONS

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (3V) - 1.6x2.1 mm Body [UQFN] Chip-On-Lead

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	10		
Pitch	e	0.50 BSC		
Overall Height	A	0.50	0.55	0.60
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	(A3)	0.127 REF		
Overall Width	E	2.10 BSC		
Overall Length	D	1.60 BSC		
Terminal Width	b	0.20	0.25	0.30
Terminal Length	L1	0.35	0.40	0.45
Terminal Length	L2	0.60	0.65	0.70
Terminal Clearance	K1	0.20	-	-
Terminal Clearance	K2	0.20	-	-

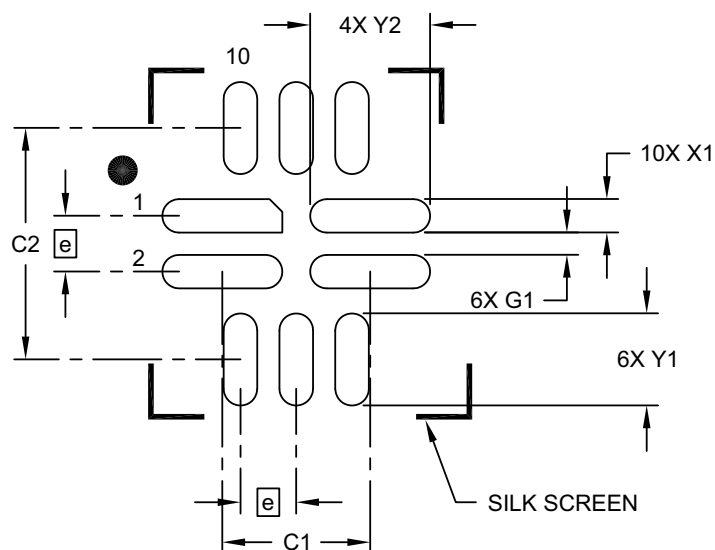
Notes:

- 1. Pin 1 visual index feature may vary, but must be located within the hatched area.
- 2. Package is saw singulated
- 3. Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.

FIGURE 6-6: 10-PIN, 1.6MM X 2.1MM QFN PACKAGE LAND PATTERN

10-Lead Ultra Thin Plastic Quad Flat, No Lead Package (3V) - 1.6x2.1 mm Body [UQFN Chip-On-Lead

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Contact Pad Spacing	C1		1.325	
Contact Pad Spacing	C2		2.075	
Contact Pad Width (X10)	X1			0.30
Contact Pad Length (X6)	Y1			0.825
Contact Pad Length (X4)	Y2			1.075
Contact Pad to Center Pad (X6)	G1	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2381A

APPENDIX A: DATA SHEET REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision	Section/Figure/Entry	Correction
DS00001725E (07-01-16)	Table 3-1, "Absolute Maximum Ratings," on page 6	Added maximum junction temperature (Tjmax) specification.
	Section 3.3, "Package Thermal Specifications," on page 7	Added new section with package thermal specifications.
DS00001725D (03-11-15)	Section 6.0, "Package Outlines," on page 10	Updated 1.6x2.1 UQFN and 1.3x1.8 UQFN package drawings.
DS00001725C (12-11-14)	Cover	Added bullet: "Automotive option (1.6 x 2.1mm, 0.5mm pitch package only)" Added sub-bullet: "8kV HBM"
	FIGURE 6-1: 10-pin, 1.3mm x 1.8mm QFN Package Outline on page 10 and FIGURE 6-4: 10-pin, 1.6mm x 2.1mm QFN Package Outline on page 13	Updated package drawings to latest revision C
	Product Identification System	Added automotive ordering code information. Added tape and reel quantity information.
	Section 2.1, "Pin Diagram," on page 5	Clarified which package is available for the automotive option.
	All: Cover, Order Codes	Made operating temperature references generic "-40°C to +85°C"
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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USB3740B

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To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

Standard Ordering Codes

<u>PART NO.</u>	-	<u>XXX</u>	-	<u>[X]</u> ⁽¹⁾
Device		Package		Tape and Reel Option
Device:		USB3740B		
Package:	AI2	= 10-pin QFN (1.3 x 1.8 x 0.55mm, 0.4mm pitch)		
	AI9	= 10-pin QFN (1.6 x 2.1 x 0.55mm, 0.5mm pitch)		
Tape and Reel Option:	Blank	= Tray packaging		
	TR	= Tape and Reel		

Examples:
a) USB3740B-AI2-TR
10-pin QFN RoHS Compliant package (1.3 x 1.8 x 0.55mm, 0.4mm pitch)
Tape & Reel
b) USB3740B-AI9-TR
10-pin QFN RoHS Compliant package (1.6 x 2.1 x 0.55mm, 0.5mm pitch)
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 3,000.

Automotive Ordering Code

<u>PART NO.</u>	<u>X</u> ⁽²⁾	-	<u>X</u>	/	<u>XX</u>	-	<u>XXX</u>
Device	Tape and Reel		Temp.		Package		Automotive Code
Device:					USB3740		
Tape and Reel:	T	=			Tape and Reel		
Temperature:	I	=			-40°C to +85°C		
Package:	ML	=			10-pin QFN (1.6mm x 2.1mm, 0.5mm pitch)		
Automotive Code:	V01	=			Automotive		

Example:
a) USB3740T-I/ML-V01
Tape & Reel
10-pin QFN RoHS Compliant package (1.6mm x 2.1mm, 0.5mm pitch),
Automotive

Note 2: 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 3,000.

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