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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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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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.

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.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Type/Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>DP</td>
<td>Analog</td>
<td>USB Mux Output</td>
</tr>
<tr>
<td>9</td>
<td>DM</td>
<td>Analog</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DP_1</td>
<td>Analog</td>
<td>USB Mux Input 1</td>
</tr>
<tr>
<td>1</td>
<td>DM_1</td>
<td>Analog</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DP_2</td>
<td>Analog</td>
<td>USB Mux Input 2</td>
</tr>
<tr>
<td>7</td>
<td>DM_2</td>
<td>Analog</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Analog</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>VDD</td>
<td>Analog</td>
<td>Power</td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td>Digital Input</td>
<td>Switch control. Refer to Table 4-1.</td>
</tr>
<tr>
<td>3</td>
<td>OE_N</td>
<td>Digital Input</td>
<td>Active low switch Output Enable. Refer to Table 4-1.</td>
</tr>
</tbody>
</table>
3.0 ELECTRICAL SPECIFICATIONS

3.1 Absolute Maximum Ratings

TABLE 3-1: ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Description</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD Voltage to GND</td>
<td>-0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>Any other pin to GND</td>
<td>-0.3 to VDD+0.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40 to +85</td>
<td>C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-55 to +150</td>
<td>C</td>
</tr>
<tr>
<td>ESD Rating</td>
<td>HBM</td>
<td>V</td>
</tr>
</tbody>
</table>

Stresses beyond the Absolute Maximum Ratings may damage the USB3740B.

3.2 Electrical Specifications

TABLE 3-2: ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD Recommended Operating Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>VDD</td>
<td>3.0</td>
<td>5.5</td>
<td>V</td>
<td></td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>Active/Standby</td>
<td>IDD</td>
<td>30</td>
<td>175</td>
<td>nA</td>
<td></td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>USB Mux Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>USB Mux On Resistance</td>
<td>RON_USB</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>ohm</td>
<td>0V &lt; Vin &lt; 3.3V</td>
</tr>
<tr>
<td>USB Mux Off Leakage</td>
<td>IOFF_USB</td>
<td>100</td>
<td>200</td>
<td>nA</td>
<td></td>
<td>0V &lt; Vin &lt; 3.3V</td>
</tr>
<tr>
<td>On Capacitance</td>
<td>CON_USB</td>
<td>5</td>
<td>7</td>
<td>pF</td>
<td></td>
<td>VDD = 3V</td>
</tr>
<tr>
<td>Off Capacitance</td>
<td>COFF_USB</td>
<td>3</td>
<td>4</td>
<td>pF</td>
<td></td>
<td>VDD = 3V</td>
</tr>
<tr>
<td>Off Isolation</td>
<td></td>
<td>-30</td>
<td>-32</td>
<td>-40</td>
<td>dB</td>
<td>R_L = 50 ohm, F = 250MHz</td>
</tr>
<tr>
<td>Crosstalk</td>
<td></td>
<td>-30</td>
<td>-45</td>
<td>-60</td>
<td>dB</td>
<td>R_L = 50 ohm, F = 250MHz</td>
</tr>
<tr>
<td>Bandwidth (-3dB)</td>
<td>BW</td>
<td>950</td>
<td>1000</td>
<td>1100</td>
<td>MHz</td>
<td>R_L = 50 ohm, C_L = 0pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>850</td>
<td>950</td>
<td>980</td>
<td></td>
<td>R_L = 50 ohm, C_L = 5pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>530</td>
<td>560</td>
<td>600</td>
<td></td>
<td>R_L = 50 ohm, C_L = 10pF</td>
</tr>
<tr>
<td>Control Signal Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>Input Logic High Threshold</td>
<td>V_IN_H</td>
<td>1.4</td>
<td></td>
<td></td>
<td>V</td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
<tr>
<td>Input Logic Low Threshold</td>
<td>V_IN_L</td>
<td></td>
<td>0.4</td>
<td></td>
<td>V</td>
<td>VDD = 5.0V, TA = -40C to 85C, all typical values at TA = 25C unless otherwise noted.</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>TABLE 4-1: USB3740B SWITCH STATES DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OE_N</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>
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.
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
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

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Terminals</td>
<td>N</td>
</tr>
<tr>
<td>Pitch</td>
<td>e</td>
</tr>
<tr>
<td>Overall Height</td>
<td>A</td>
</tr>
<tr>
<td>Standoff</td>
<td>A1</td>
</tr>
<tr>
<td>Terminal Thickness</td>
<td>A3</td>
</tr>
<tr>
<td>Overall Length</td>
<td>D</td>
</tr>
<tr>
<td>Overall Width</td>
<td>E</td>
</tr>
<tr>
<td>Terminal Width</td>
<td>b</td>
</tr>
<tr>
<td>Terminal Length</td>
<td>L</td>
</tr>
<tr>
<td>Terminal Length</td>
<td>L1</td>
</tr>
</tbody>
</table>

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 6-3: 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](http://www.microchip.com/packaging)

---

**RECOMMENDED LAND PATTERN**

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dimension Limits</td>
</tr>
<tr>
<td>Contact Pitch</td>
<td>E</td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C1</td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C2</td>
</tr>
<tr>
<td>Contact Pad Width (X10)</td>
<td>X</td>
</tr>
<tr>
<td>Contact Pad Length (X6)</td>
<td>Y1</td>
</tr>
<tr>
<td>Contact Pad Length (X4)</td>
<td>Y2</td>
</tr>
<tr>
<td>Contact Pad to Pad (X6)</td>
<td>G1</td>
</tr>
<tr>
<td>Contact Pad to Pad (X4)</td>
<td>G2</td>
</tr>
</tbody>
</table>

**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

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

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) - 1.6.x2.1 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

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
<th>Dimension Limits</th>
<th>MIN</th>
<th>NOM</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Pitch</td>
<td>E</td>
<td>0.50 BSC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C1</td>
<td>1.325</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C2</td>
<td>2.075</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Width (X10)</td>
<td>X1</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Length (X6)</td>
<td>Y1</td>
<td>0.825</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Length (X4)</td>
<td>Y2</td>
<td>1.075</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad to Center Pad (X6)</td>
<td>G1</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Revision</th>
<th>Section/Figure/Entry</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS00001725D (03-11-15)</td>
<td>Section 6.0, &quot;Package Outlines,&quot; on page 9</td>
<td>Updated 1.6x2.1 UQFN and 1.3x1.8 UQFN package drawings.</td>
</tr>
<tr>
<td>DS00001725C (12-11-14)</td>
<td>Cover</td>
<td>Added bullet: “Automotive option (1.6 x 2.1mm, 0.5mm pitch package only)”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added sub-bullet: “8kV HBM”</td>
</tr>
<tr>
<td></td>
<td>FIGURE 6-1: 10-pin, 1.3mm x 1.8mm QFN Package Outline on page 9 and FIGURE 6-4: 10-pin, 1.6mm x 2.1mm QFN Package Outline on page 12</td>
<td>Updated package drawings to latest revision C</td>
</tr>
<tr>
<td></td>
<td>Product Identification System</td>
<td>Added automotive ordering code information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added tape and reel quantity information.</td>
</tr>
<tr>
<td></td>
<td>Section 2.1, &quot;Pin Diagram,&quot; on page 5</td>
<td>Clarified which package is available for the automotive option.</td>
</tr>
<tr>
<td></td>
<td>All: Cover, Order Codes</td>
<td>Made operating temperature references generic “-40°C to +85°C”</td>
</tr>
<tr>
<td>DS00001725B (08-21-14)</td>
<td>Document is converted to Microchip template; Product Identification System page replaces Ordering Information.</td>
<td></td>
</tr>
<tr>
<td>DS00001725A replaces the previous SMSC version, Rev. 1.2</td>
<td></td>
<td>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”</td>
</tr>
<tr>
<td>Rev. 1.2 (07-30-12)</td>
<td>Table 3-1, “Absolute Maximum Ratings,” on page 6</td>
<td>Corrected “Any other pin to GND” row’s rating to “-0.3 to VDD+0.5V”</td>
</tr>
<tr>
<td>Rev. 1.1 (12-15-11)</td>
<td>Section 2.2, &quot;Ball/Pin Definitions&quot;</td>
<td>In Section 2.2, changed the description of Pin #8 as follows: “Ground”</td>
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<tr>
<td>Rev. 1.0 (08-03-11)</td>
<td>Data Sheet Release</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>PART NO.</th>
<th>XXX</th>
<th>[X]</th>
<th>Device</th>
<th>Package</th>
<th>Tape and Reel Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>USB3740B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AI2 = 10-pin QFN (1.3 x 1.8 x 0.55mm, 0.4mm pitch)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AI9 = 10-pin QFN (1.6 x 2.1 x 0.55mm, 0.5mm pitch)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Blank = Tray packaging</td>
<td>TR = Tape and Reel</td>
<td></td>
</tr>
</tbody>
</table>

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

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

Example:

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

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