TCPP01-M12

Data brief

USB type-C port protection for USB power delivery

Features

- ESD protection IEC 61000-4-2 level 4 for CC1, CC2 and VBUS (±8 kV contact discharge, ±15 kV air discharge)
- 22 V overvoltage protection on CC lines against short-to-VBUS overvoltage
- Externally programmable Over Voltage Protection on VBUS line
- Integrated VBUS gate driver for external N-MOSFET
- Over temperature protection
- Integrated “dead battery” management
- Open-drain fault reporting
- Low power mode for battery-operated SINK applications
- Operating junction temperature from -40°C to 85°C
- ECOPACK®2 compliant

Applications

Where current limitation is required in factory automation application:

- USB type-C power delivery, PPS compliant
- USB type-C used in sink configuration
- USB type-C used in source configuration
- USB type-C for UFP (upstream facing port) or DFP (downstream facing port) configuration
- USB type-C used in dual role port

Description

The TCPP01-M12 (type-C port protection) is a single chip solution for USB type-C port protection that facilitates the migration from USB legacy connectors type-A or type-B to USB type-C connectors. The TCPP01-M12 features 22 V tolerant ESD protection as per IEC61000-4-2 Level 4 on USB type-C connector communication channel (CC) and VBUS lines. To allow fast certification for USB power delivery, the TCPP01-M12 provides overvoltage protection on CC1 and CC2 pins when these pins are subjected to short circuit with the VBUS pin that may happen when removing the USB type-C cable from its receptacle. For sink applications, TCPP01-M12 triggers an externally programmable N-MOSFET overvoltage protection on VBUS pin when a defective power source applies a voltage higher than selected OVP threshold. Also, the TCPP01-M12 integrates a “dead battery” management logic that is compliant with the USB power delivery specification. The VBUS N-MOSFET load driver can also be used in source applications.
# Pinout and functions

## Table 1. Pinout and functions

<table>
<thead>
<tr>
<th>Name</th>
<th>Pin #</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC2</td>
<td>1</td>
<td>Input / Output</td>
<td>System-side for the CC2 OVP FET</td>
</tr>
<tr>
<td>GND</td>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>CC1</td>
<td>3</td>
<td>Input / Output</td>
<td>System-side for the CC1 OVP FET</td>
</tr>
<tr>
<td>Source</td>
<td>4</td>
<td>Power</td>
<td>VBUS load switch source</td>
</tr>
<tr>
<td>GATE</td>
<td>5</td>
<td>Output</td>
<td>VBUS load switch gate control</td>
</tr>
<tr>
<td>VBUS_CTRL</td>
<td>6</td>
<td>Input</td>
<td>Programmable VBUS OVP threshold (set by external resistor bridge)</td>
</tr>
<tr>
<td>CC1c</td>
<td>7</td>
<td>Input / Output</td>
<td>Connector side for CC1 OVP FET</td>
</tr>
<tr>
<td>IN_GD</td>
<td>8</td>
<td>Power</td>
<td>Connector side for VBUS</td>
</tr>
<tr>
<td>CC2c</td>
<td>9</td>
<td>Input / Output</td>
<td>Connector side for CC2 OVP FET</td>
</tr>
<tr>
<td>DB/</td>
<td>10</td>
<td>Input</td>
<td>Dead battery resistors management</td>
</tr>
<tr>
<td>FLT</td>
<td>11</td>
<td>Output</td>
<td>Fault reporting flag (open-drain)</td>
</tr>
<tr>
<td>VCC</td>
<td>12</td>
<td>Input</td>
<td>3.3 V power supply</td>
</tr>
<tr>
<td>Exposed pad</td>
<td>13</td>
<td>Ground</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Downloaded from Arrow.com.
TCPP01-M12 simplified internal block diagram

Figure 1. Block diagram

- IN_GD
- VBUS_CTRL
- VCC
- GND
- CC1c
- CC2c
- DBV
- IEC 61000-4-2 8 kV ESD PROTECTION
- OVER TEMPERATURE UVLO
- VBUS LOAD SWITCH DRIVER
- IEC 61000-4-2 8 kV ESD PROTECTION
- OVER VOLTAGE PROTECTION
- DEAD BATTERY MANAGEMENT LOGIC
- GATE
- SOURCE
- FLT
- CC1
- CC2
- VCC_OK
- 1.27V
- ALARME
- ENABLE
3 Typical sink application use-case

Figure 2. USB Type-C power delivery – SINK application with battery (3.3 V to 22 V)

Note: DB3846 - Rev 2

Figure 2 shows the USB Type-C power delivery configuration for a SINK application with a battery (3.3 V to 22 V). The figure illustrates the power management and voltage conversion process.

Note: DB/ is a pulled down TCPP01-M12 input: connect to 3,3V if not managed by MCU software. T1 reference used in this example is STL11N3LLH6.
4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

4.1 QFN 3X3-12L package information

Figure 3. QFN 3X3-12L package outline
# Ordering information

## Table 2. Ordering information

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<th>Order code</th>
<th>Marking</th>
<th>Package</th>
<th>Weight</th>
<th>Base qty.</th>
<th>Delivery mode</th>
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<tbody>
<tr>
<td>TCPP01-M12</td>
<td>TCPP</td>
<td>µQFN 3X3 – 12L</td>
<td>20 mg</td>
<td>3000</td>
<td>Tape and reel</td>
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## Revision history

### Table 3. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
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<tbody>
<tr>
<td>01-Mar-2019</td>
<td>1</td>
<td>Initial release.</td>
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<tr>
<td>05-Mar-2019</td>
<td>2</td>
<td>Updated Table 2. Ordering information.</td>
</tr>
</tbody>
</table>
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