

## USB Dedicated Fast-Charging Port Controller

### 1 FEATURES

- Support HiSilicon® Fast Charge Protocol(FCP)
- Support Samsung® Adaptive Fast Charging(AFC)
- Support Qualcomm® Quick Charging 3.0/2.0(QC3.0/QC2.0)™ Protocol
- Support USB DCP applying 2.7V on DP and DM line, output Current up to 2.4A for Apple® Device
- Meets Battery Charging Specification BC 1.2 for DCP
- Meets Chinese Telecommunication Industrial Standard YD/T 1591-2009
- Automatic Selection of D+/D- mode for an attached device
- Power Consumption below 1mW at 5V output
- SOT23-6 Package

- Adapter
- Car Charger
- USB Power Output Ports
- Power Bank

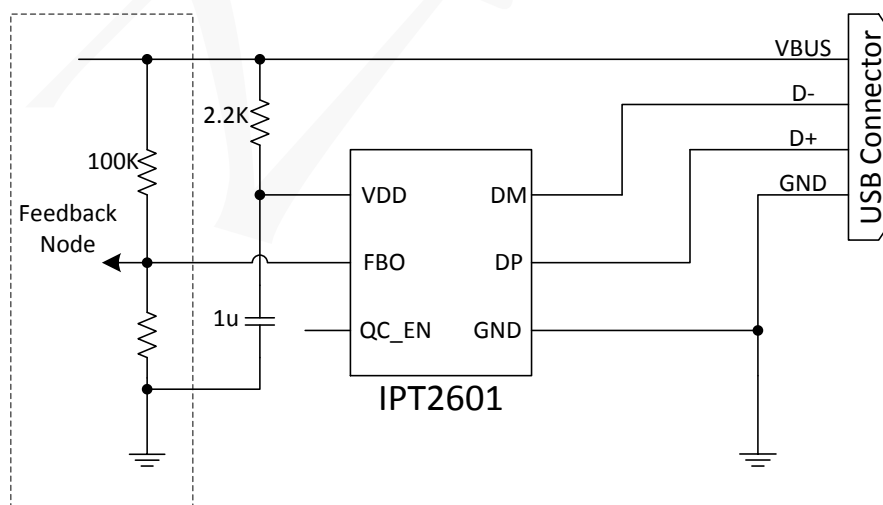
### 3 DESCRIPTION

IPT2601 is a low-cost USB Dedicated Fast Charging Port Controller which is fully compatible with BC1.2 and other non BC1.2 standards like YD/T 1591-2009 Apple® & Samsung® Charging Spec, HiSilicon® Fast Charge Protocol, Qualcomm® Quick Charging™ 3.0/2.0.

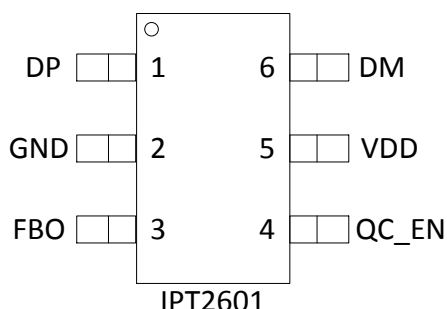
IPT2601 automatically detect whether a connected Power Device(PD) is Quick Charge 2.0/3.0 or FCP Capable before enabling output voltage adjustment. If a PD not compliant to Quick Charge 2.0/3.0 is detected the IPT2601 disables output voltage adjustment to ensure safe operation with legacy 5V only USB PDs. The IPT2601 is available in SOT23-6 package.

### 2 APPLICATIONS

### 4 Typical Application Schematic



## 5 PIN FUNCTIONS



| NO. | NAME  | TYPE | DESCRIPTION  |
|-----|-------|------|--|
| 1   | DP    | I/O  | USB positive data line.  |
| 2   | GND   | P    | Ground connection.   |
| 3   | FBO   | I/O  | Feedback output. Current source/sink output.                     |
| 4   | QC_EN | I    | FCP/QC function enable, H-z to enable FCP/QC and LOW to disable. |
| 5   | VDD   | P    | Power supply.  |
| 6   | DM    | I/O  | USB negative data line.  |

## 6 SPECIFICATIONS

### 6.1 ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

| PARAMETER                      |                  | MIN  | MAX | UNIT |
|--------------------------------|------------------|------|-----|------|
| Voltage Range (To PGND)        | VDD              | -0.3 | 6.5 | V    |
|                                | Others           | -0.3 | 6.5 | V    |
| Operating Junction Temperature | T <sub>J</sub>   | -40  | 150 | °C   |
| Storage Temperature Range      | T <sub>STG</sub> | -65  | 150 | °C   |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 6.2 ESD RATING

| SYMBOL           | PARAMETER              | VALUE | UNIT |
|------------------|------------------------|-------|------|
| V <sub>ESD</sub> | Human Body Model (HBM) | ±4000 | V    |

### 6.3 RECOMMENDED OPERATING CONDITIONS

| PARAMETER        |                             | MIN  | TYP | MAX | UNIT |
|------------------|-----------------------------|------|-----|-----|------|
| VDD              | Input Supply Voltage        | 3.2  | 5   | 6.4 | V    |
| C <sub>VDD</sub> | Input Capacitance           | 0.47 |     |     | μF   |
| T <sub>A</sub>   | Operation Temperature Range | -40  |     | 85  | °C   |

## 6.4 ELECTRICAL CHARACTERISTICS

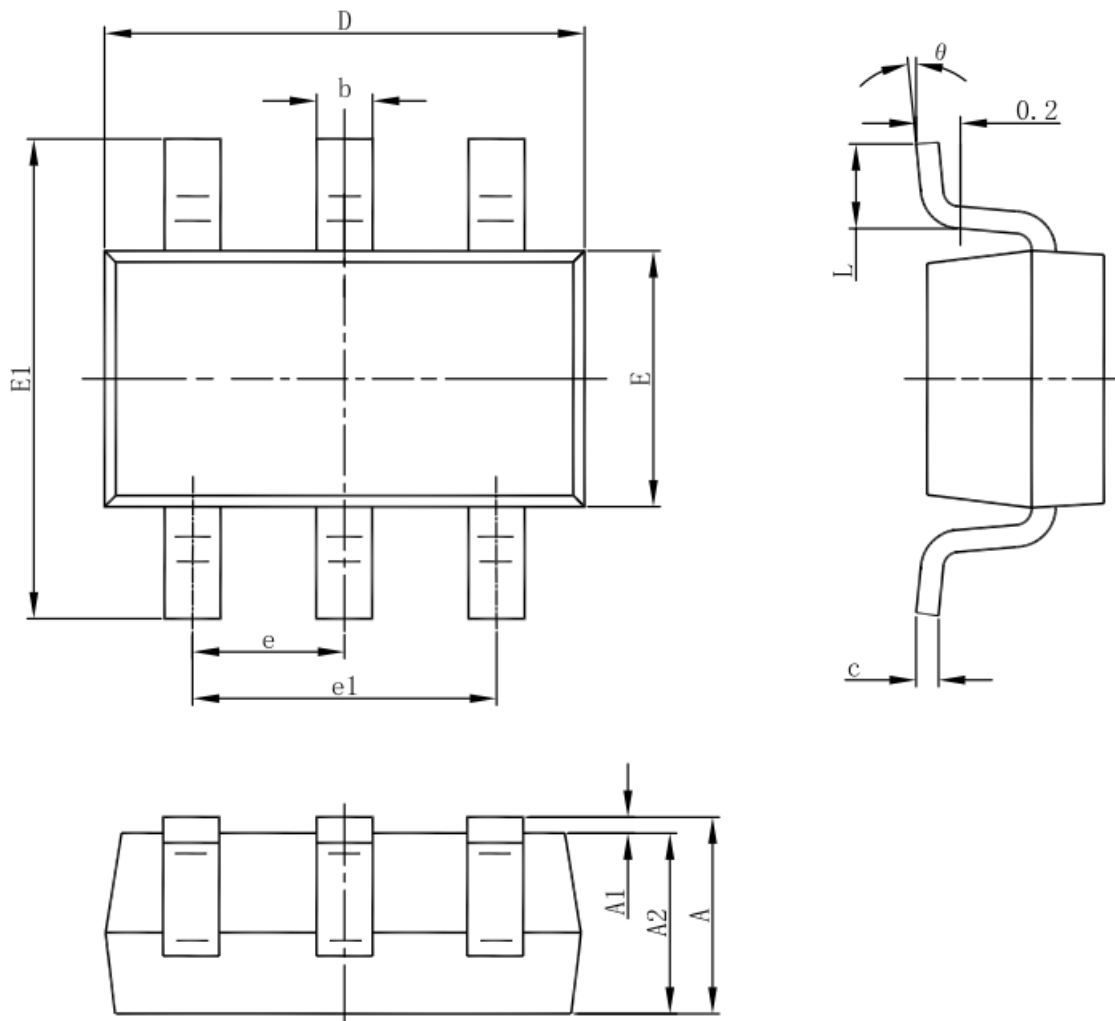
 Conditions are  $T_j = 25^{\circ}\text{C}$ ,  $V_{DD} = 5\text{V}$ .

| PARAMETER   |   | TEST CONDITIONS  | MIN  | TYP   | MAX  | UNIT             |
|---|---|--|------|-------|------|------------------|
| <b>INPUT POWER</b>                                  |   |  |      |       |      |                  |
| $V_{VDD}$   | VDD Input Voltage Range                               |  | 3.2  |       | 5.5  | V                |
| $I_{VDD}$   | VDD Supply Current                                    | $V_{DD}=5\text{V}$   |      | 200   |      | $\mu\text{A}$    |
| $V_{VDD(\text{SHUNT})}$                             | VDD Shunt Voltage                                     | $I_{VDD}=3.5\text{mA}$   |      | 4.75  |      | V                |
| <b>VDD UVLO Test</b>                                |   |  |      |       |      |                  |
| $V_{DD(\text{ON})}$                                 | VDD (turn on threshold voltage)                       | $V_{VDD}$ Rising   | 2.9  | 3.0   | 3.1  | V                |
| $V_{DD(\text{OFF})}$                                | VDD (turn off threshold voltage)                      | $V_{VDD}$ Falling  | 2.8  | 2.9   | 3.0  | V                |
| $\Delta V_{UVLO}$                                   | UVLO Hysteresis                                       | $V_{DD(\text{ON})} - V_{DD(\text{OFF})}$   |      | 0.1   |      | V                |
| <b>High Voltage Dedicated Charging Port (HVDCP)</b> |   |  |      |       |      |                  |
| $V_{\text{DAT}(\text{REF})}$                        | Data Detect Voltage                                   |  | 0.25 | 0.325 | 0.4  | V                |
| $V_{\text{SEL}(\text{REF})}$                        | Output voltage selection reference                    |  | 1.8  | 2     | 2.2  | V                |
| $T_{\text{GLITCH}(\text{DP})\text{HIGH}}$           | D+ High Glitch Filter Time                            |  | 1    | 1.25  | 1.5  | s                |
| $T_{\text{GLITCH}(\text{DM})\text{LOW}}$            | D- Low Glitch Filter Time                             |  |      | 1     |      | ms               |
| $T_{\text{GLITCH}(\text{V})\text{CHANGE}}$          | Output Voltage Glitch Filter Time                     |  | 20   | 40    | 60   | ms               |
| $T_{\text{GLITCH}(\text{CONT})\text{CHANGE}}$       | Continuous Mode Glitch Filter Time                    |  | 100  | 150   | 200  | $\mu\text{s}$    |
| $R_{\text{DAT}(\text{LKG})}$                        | D+ Leakage Resistance                                 | $V_{DD}=3.1\text{-}7\text{V}$ ,<br>$V(\text{D}+)=0.5\text{-}3.6\text{V}$ ,<br>Switch SW1=Off             | 300  | 500   | 800  | $\text{K}\Omega$ |
| $R_{\text{DM}(\text{DWN})}$                         | D- Pull-Down Resistance                               |  | 14.2 | 19.5  | 24.5 | $\text{K}\Omega$ |
| $R_{\text{ON}(\text{N1})}$                          | Switch SW1 on-resistance                              | $V_{DD}=3.1\text{-}7\text{V}$ ,<br>$V(\text{D}+)\leq 3.6\text{V}$ ,<br>$I_{\text{DRAIN}}=200\mu\text{A}$ |      | 20    | 40   | $\Omega$         |
| $C_{\text{DAT}}$                                    | Data Line Capacitance                                 |  |      |       | 1    | nF               |
| $V_{\text{TH}(\text{PD})}$                          | Output Device Connection Detection threshold          |  | 0.25 | 0.325 | 0.4  | V                |
| $T_{\text{DPD}}$                                    | Output Device connection Detection Glitch Filter Time |  | 120  | 160   | 200  | ms               |
| $\Delta I_{\text{T}(\text{UP})}$                    | Up Current Step                                       | $R_{\text{IREF}}=100\text{K}\Omega$  |      | 2     |      | $\mu\text{A}$    |
| $\Delta I_{\text{T}(\text{DO})}$                    | Down Current Step                                     | $R_{\text{IREF}}=100\text{K}\Omega$  |      | 2     |      | $\mu\text{A}$    |
| $T_{\text{DUR}(\text{step})}$                       | Duration for current step                             | QC3.0 mode   | 80   | 100   | 120  | $\mu\text{s}$    |
| <b>DCP 1.2V Mode</b>                                |   |  |      |       |      |                  |
| $V_{\text{DAT}(1.2\text{V})}$                       | D+ _1.2V/D- _1.2V line output voltage                 |  | 1.08 | 1.2   | 1.32 | V                |
| $R_{\text{DAT}(1.2\text{V})}$                       | D+ _1.2V/D- _1.2V line output Impedance               |  |      | 100   |      | $\text{K}\Omega$ |
| <b>Apple 2.4A Mode</b>                              |   |  |      |       |      |                  |



|                        |                             |                          |      |      |      |    |
|------------------------|-----------------------------|--------------------------|------|------|------|----|
| V <sub>DAT(2.7V)</sub> | D+/D- line output voltage   |                          | 2.57 | 2.7  | 2.84 | V  |
| R <sub>DAT(2.7V)</sub> | D+/D- line output Impedance |                          |      | 33.6 |      | KΩ |
| <b>FCP Mode</b>        |                             |                          |      |      |      |    |
| V <sub>TX-VOH</sub>    | D- FCP TX Valid High        |                          | 2.35 |      | 3.6  | V  |
| V <sub>TX-VOL</sub>    | D- FCP TX Valid Low         |                          |      |      | 0.3  | V  |
| V <sub>RX-VIH</sub>    | D- FCP RX Valid High        |                          | 1.5  |      | 3.6  | V  |
| V <sub>RX-VIL</sub>    | D- FCP RX Valid High        |                          |      |      | 1.0  | V  |
| R <sub>PD</sub>        | D- Pull-Down Resistance     |                          | 400  | 500  | 600  | Ω  |
| T <sub>UI</sub>        | Unit Interval for PHY       | F <sub>CLK</sub> =125KHz | 144  | 160  | 176  | us |
| T <sub>RISE</sub>      | FCP Pulse Rise Time         | 10% - 90%                |      | 1    | 2.5  | us |
| T <sub>FALL</sub>      | FCP Pulse Fall Time         | 90% - 10%                |      | 1    | 2.5  | us |

## 7 Outline Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.050                     | 1.150 | 0.041                | 0.045 |
| b        | 0.300                     | 0.500 | 0.012                | 0.020 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.020 | 0.111                | 0.119 |
| E        | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1       | 2.650                     | 2.950 | 0.104                | 0.116 |
| e        | 0.950                     |       | 0.037                |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

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