

Type-A HVDCP Controller With Plug In/Out Auto Detection

Description

The FP6601A is a USB Type-A fast charging protocol controller with plug in/out auto detection for HiSilicon Fast Charging Protocol (FCP) and Qualcomm[®] Quick Charge[™] 2.0/3.0 (QC 2.0/3.0) USB interface. The FP6601A monitors USB DPx/DNx data line and automatically adjusts the output voltage depending on different portable device requirement. The charging time of portable device is therefore optimized by the FP6601A.

FP6601A can support not only USB BC compliant devices, but also Apple / Samsung / HUAWEI devices and automatically detects whether a connected powered device is QC-2.0/3.0 or FCP capable before enabling output voltage adjustment. If a PD is not compliant with QC 2.0/3.0 and FCP, the FP6601A will disable the adjustment of output voltage and keep the default 5V output voltage for safe operation.

Additionally, the FP6601A also monitors automatically adjust the output voltage depending on different device requirement. It is capable providing output voltage of 3.6V to 12V.

Features

- VDD Supply Voltage: 3.2V to 6.8V
- Supports HiSilicon Fast Charging Protocol (FCP)
- Supports Qualcomm[®] Quick Charge[™] 2.0/3.0 Class A
- Automatically Selects FCP and QC2.0/3.0 Protocols
- Supports USB DCP Shorting D+ Line to D- Line per USB Battery Charging Specification, Revision 1.2
- Supports USB DCP Applying 2.7V on D+ Line and 2.7V on D- Line
- USB Type-A Plug In/Out Detection
- Multi-Ports Control Application
- Over-Voltage Protection and VBUS Discharge Function
- Short-Circuit Protection
- Over-Current Protection
- UL Certification No. 4789032334-2

Applications

- Wall-Adapter
- Car Charger
- Power Strip
- USB Power Output Port

Pin Assignments

P5 Package CPC-16L

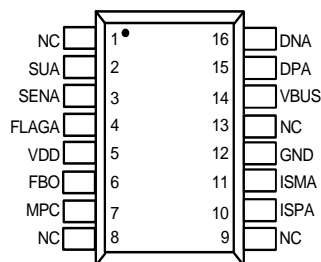
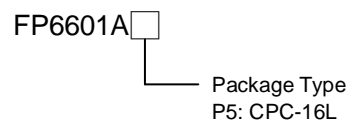


Figure1. Pin Assignment of FP6601A

Ordering Information



Typical Application Circuit

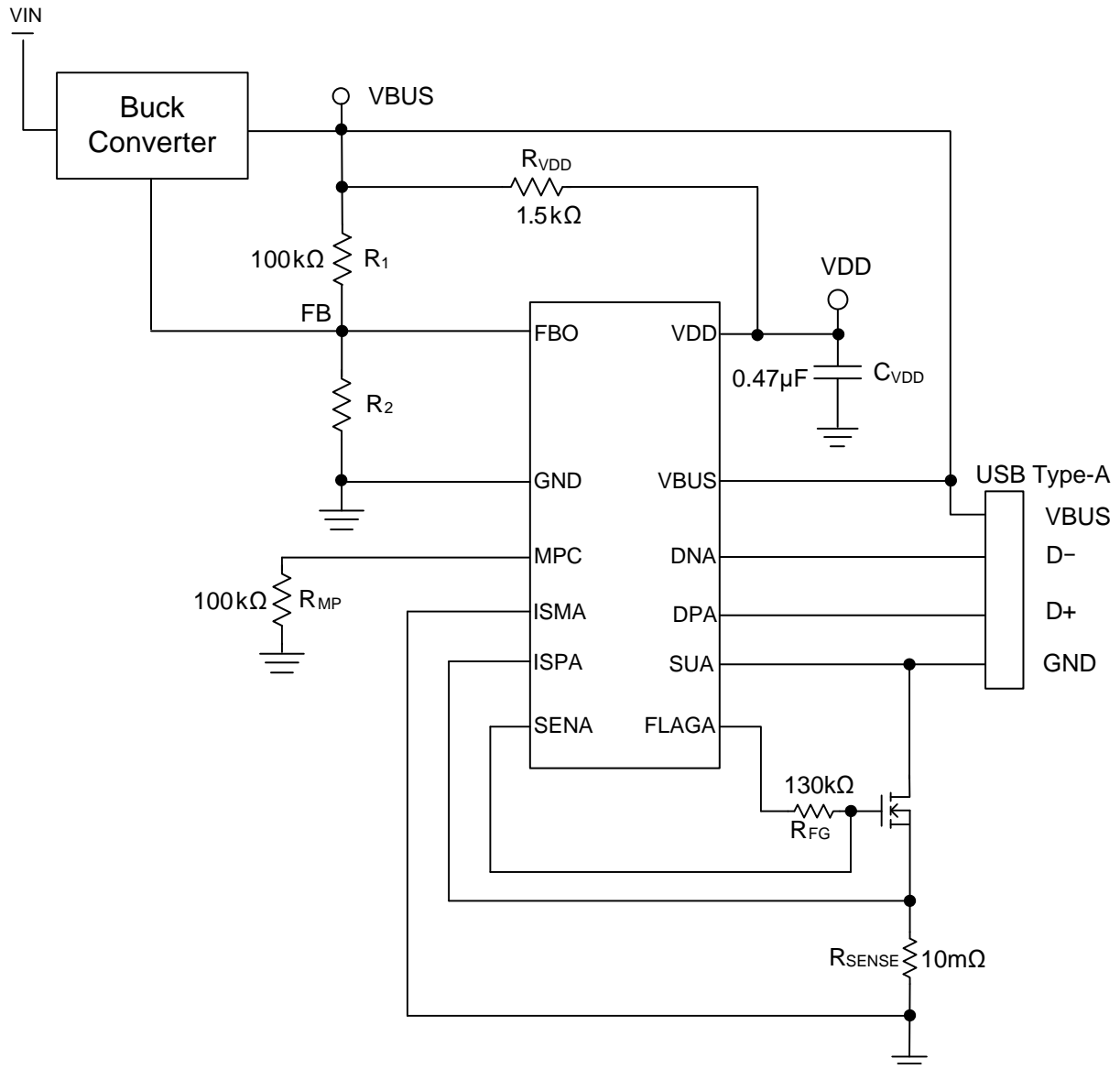


Figure2. FP6601A Single Port Typical Application Schematic

Typical Application Circuit (Continued)

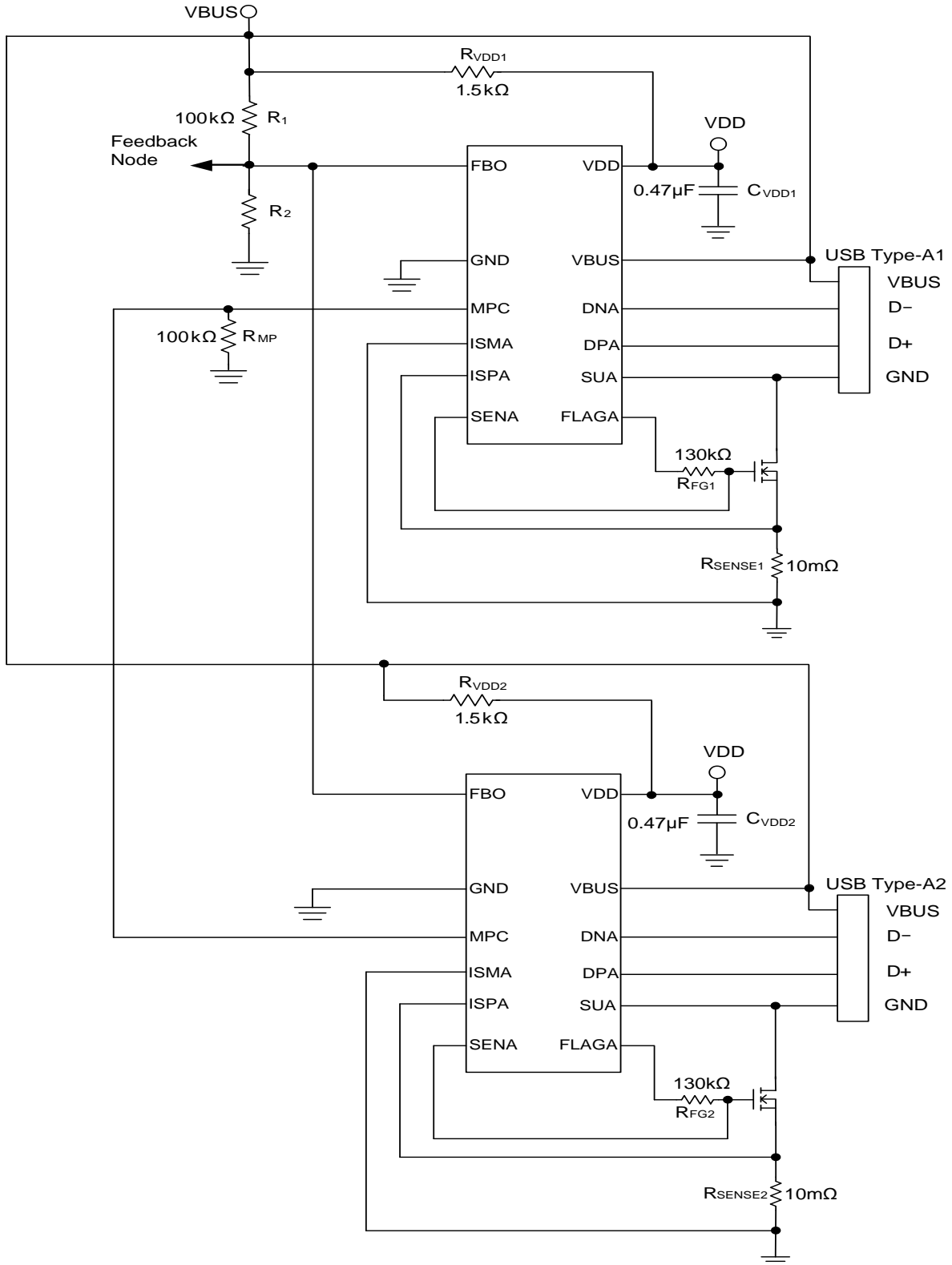


Figure3. FP6601A Multi-Ports Typical Application Schematic

Functional Pin Description

| Pin Name | Pin No. | Pin Function |
|----------|---------|---|
| NC | 1 | Unused pin, connect to ground. |
| SUA | 2 | Sense voltage of USB Type-A connector plug in. |
| SENA | 3 | Detection function pin. Detect USB Type-A whether is device existence. |
| FLAGA | 4 | N-MOSFET gate node control. When USB Type-A plug in, FLAGA function will be activated high, Type-A plug out, FLAGA pin will be activated low. |
| VDD | 5 | Power supply input pin. |
| FBO | 6 | Output voltage control pin. Current sink/source function for FB node. |
| MPC | 7 | Multi-ports control pin. Connect a 100kΩ resistor to GND. |
| NC | 8 | Unused pin, connect to ground. |
| NC | 9 | Unused pin, connect to ground. |
| ISPA | 10 | Positive input of current sense amplifier of USB Type-A. Connect to the current sense resistor on the VBUS power path. |
| ISMA | 11 | Negative input of current sense amplifier of USB Type-A. Connect to the current sense resistor on the VBUS power path. |
| GND | 12 | Ground pin. |
| NC | 13 | Unused pin, connect to ground. |
| VBUS | 14 | VBUS voltage detection and discharge. |
| DPA | 15 | USB D+ data line of Type-A. Recommended this pin connect without resistors(open) or with a resistor higher than 1MΩ connect to GND. |
| DNA | 16 | USB D- data line. |

Absolute Maximum Ratings ^(Note 1)

- Input Supply Voltage (VDD)----- -0.3V to +7V
- FBO, FLAGA----- -0.3V to +6.5V
- ISPA, ISMA, MPC----- -0.3V to +6.5V
- DPA, DNA----- -0.3V to +20V
- VBUS, SUA, SENA----- -0.3V to +20V
- Maximum Junction Temperature (T_J)----- +150°C
- Storage Temperature (T_S)----- -65°C to +150°C
- Lead Temperature (Soldering, 10sec.)----- +260°C
- Package Thermal Resistance, (θ_{JA}) ^(Note 2)
 - CPC-16L----- TBD
- Package Thermal Resistance, (θ_{JC})
 - CPC-16L----- TBD

Note 1: Stresses beyond this listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Note 2: θ_{JA} is measured at 25°C ambient with the component mounted on a high effective thermal conductivity test board of JEDEC-51-7.

Recommended Operating Conditions

- Input supply voltage (VDD)----- +3.2V to +6.8V
- Operating temperature range (T_A)----- -40°C to +125°C
- Junction temperature (T_J)----- -40°C to +125°C

Electrical Characteristics

(VDD=5V, T_A=25°C and the recommended supply voltage range, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|-------------------------------------|--|-------|-------|-------|------|
| Input Power | | | | | | |
| VDD Input Voltage Range | V _{DD} | | 3.2 | | 6.8 | V |
| Input UVLO Threshold | V _{DD_UVLO} | V _{DD} Rising | 3.1 | 3.3 | 3.5 | V |
| | V _{DD_HYS} | V _{DD} Falling | 2.45 | 2.6 | 2.75 | V |
| VDD Supply Current | I _{DD_SUP} | V _{DD} =5V, Nothing Attach | 20 | 33 | 45 | μA |
| VDD Shunt Voltage | V _{DD_SHUNT} | | 5.9 | 6.4 | 6.8 | V |
| VBUS | | | | | | |
| VBUS Over-Voltage Protection | | | 14.25 | 15 | 15.75 | V |
| VBUS Bleed Discharge Resistance | R _{Bleed} | | 8 | 10 | 12.5 | kΩ |
| VBUS Discharge Resistance | R _{DIS} | | | 400 | | Ω |
| USB Type-A | | | | | | |
| A_Plug in SUA Threshold | V _{TH-USBAIN} | | 0.57 | 0.83 | 1.02 | V |
| A_Plug in De-bounce Time | T _{USBAIN-DEB} | | | 20 | | μs |
| A_Plug out SUA Threshold | V _{TH-USBAOUT} | | | 80 | | mV |
| DPDN OV Threshold | V _{DPDNOV} | | | 4 | | V |
| High Voltage Dedicated Charging Port (HVDCP) | | | | | | |
| Data Detect Voltage | V _{DAT(REF)} | | 0.25 | 0.325 | 0.4 | V |
| Output Voltage Selection Reference | V _{SEL_REF} | | 1.8 | 2.0 | 2.2 | V |
| DPA High Glitch Filter Time | T _{GLITCH(BC)-DPA_H} | | 1000 | 1250 | 1500 | ms |
| DNA Low Glitch Filter Time | T _{GLITCH(BC)-DMA_L} | | | 1 | | ms |
| Output Voltage Glitch Filter Time | T _{GLITCH(V) CHANGE} | | 20 | 40 | 60 | ms |
| DNA Pull-Down Resistance | R _{DMA(DWN)} | | | 20 | | kΩ |
| Continuous Mode Glitch Filter Time | T _{GLITCH-CONT-CHANGE} | | 100 | | 200 | μs |
| DPA Leakage Resistance | R _{DAT-LKG} | V _{DD} =3.2 to 6.4V VDPA=0.6-3.6V Switch SW1=Off | 300 | 500 | 800 | kΩ |
| Switch SW1 On-Resistance | R _{DS_ON_N1} | V _{DD} =5V, SW1= 200μA | | | 40 | Ω |
| UP/Down Current Step | I _{UP} , I _{DOWN} | I _{UP} = 0μA (5V), 40μA (9V) 70μA (12V) I _{DOWN} = 14μA (3.6V) | | 2 | | μA |

Electrical Characteristics (Continued)

(VDD=5V, T_A=25°C and the recommended supply voltage range, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---------------------|-----------------------------------|------|------|------|------|
| DCP Charging Mode | | | | | | |
| DPX _{0.48V} / DNx _{0.48V} Line Output Voltage | | | 0.44 | 0.48 | 0.52 | V |
| DPX _{0.48V} / DNx _{0.48V} Line Output Impedance | | | | 900 | | kΩ |
| Apple Mode | | | | | | |
| DPX _{2.7V} / DNx _{2.7V} Line Output Voltage | | | 2.57 | 2.7 | 2.84 | V |
| DPX _{2.7V} / DNx _{2.7V} Line Output Impedance | | | | 33.6 | | kΩ |
| DNA Section (FCP) | | | | | | |
| DNA FCP Tx Valid Output High | V _{TX-VOH} | | 2.55 | | 3.6 | V |
| DNA FCP Tx Valid Output Low | V _{TX-VOL} | | | | 0.3 | V |
| DNA FCP Rx Valid Output High | V _{RX-VIH} | | 1.4 | | 3.6 | V |
| DNA FCP Rx Valid Output Low | V _{RX-VIL} | | | | 1.0 | V |
| DNA Output Pull-Low Resistance | R _{PD} | | 400 | 500 | 600 | Ω |
| Unit Interval for FCP PHY Communication | UI | F _{CLK} =125kHz | 144 | 160 | 180 | μs |
| Over-Current Protection | | | | | | |
| Over-Current Threshold | OCP | R _{sense} =10mΩ | | 4.2 | | A |
| Short-Circuit Protection | | | | | | |
| Short-Circuit Threshold | SCP | FLAGA pin turn on. Detection VBUS | | 3.6 | | V |

Application Information

Function Description

The FP6601A integrates both USB high voltage dedicated charging port interface IC for Qualcomm[®] Quick Charge[™] 2.0/3.0 class A and HiSilicon FCP specification.

The FP6601A can fast charge most of the handheld devices. It could be treated as the original charging adapter.

The FP6601A supports BC1.2, Samsung and HUAWEI devices. It also supports output voltage range of C 3.0 Class A (3.6V to 12V) or QC 2.0 Class A (5V, 9V, 12V).

Quick Charge 2.0/3.0 Interface

When the FP6601A is powered on, DPA and DNA pin are applied to 2.7V for Apple device. If handheld device has the function of QC 2.0/3.0, DPA pin will be forced between 0.325V and 2V. In the meanwhile, DPA pin will short to DNA pin through the switch SW1 for entering BC 1.2. If DPA is continuously applied to the voltage between 0.325V and 2V for 1.25 seconds, the FP6601A will enter QC 2.0/3.0 or FCP operation mode. The QC 2.0/3.0 could be classed as the following table.

| D+ | D- | Output Voltage |
|------|--------|-----------------|
| 0.6V | 0.6V | 12V |
| 3.3V | 0.6V | 9V |
| 0.6V | 3.3V | Continuous mode |
| 0.6V | High-Z | 5V (Default) |

When the voltage of DPA pin and DNA pin simultaneously satisfy these two inequalities $V_{DAT(REF)} < DPA < V_{SELREF}$ and $DNA > V_{SELREF}$, the FP6601A would enter continuous mode.

In the continuous mode, each voltage pulse on DPA pin generated by powered device is between 1V and 3V. In the meanwhile, the high level of pulse should be keep at least 200 μ s. If the specified conditions are satisfied, the FBO pin will sink 2uA per pulse. The maximum sink current is 70 μ A for output voltage 12V.

If the powered device doesn't support QC 2.0, the FP6601A will remain default output voltage 5V for safe operation. On the other hand, when USB cable is removed, the voltage of DPA pin is therefore lower than $V_{DAT(REF)}$ and the output default voltage 5V is also applied.

Shunt Regulator

The VDD of FP6601A is supplied by the wide output voltage through the external resistor RVDD. The internal Zener-Diode is utilized to clamp the VDD at 6.4V. The recommended value of RVDD and CVDD are 1.5k Ω and 0.47 μ F, respectively.

Multi-Ports Control

Use for single VBUS source and multi USB channel applications. Connect all MPC pins on different Fitipower USB ICs together and connect a 100k Ω resistor to GND. FP6601A will auto detect the attachments between all Fitipower USB ICs and will auto decide multi-ports operation is allowed or not.

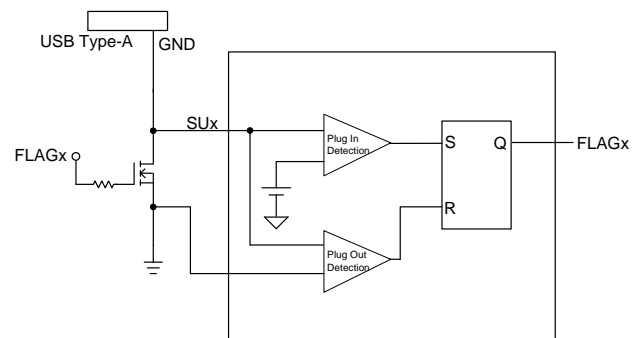
Data Line Protection

When DPA/DNA pin is touched by the external power in abnormal situation, the D+/D- pin of both sink device and source device may be damaged. In order to protect the DPA/DNA pin of the devices from damage in abnormal situation, the FP6601A will return the output voltage to default output voltage 5V when the voltage of DPA/DNA pin is higher than 7.5V.

Plug in/out Auto Detection

When device plugs in or out, the FP6601A can auto detect and into standby or operation mode:

1. Plug In detection is used for USB device plug in.
When device plug in, FLAGx pin alerts active high.
2. Plug Out detection is used for USB device plug out.
When plug out detected, FLAGx pin active low.



Application Information (Continued)

Over-Current Protection

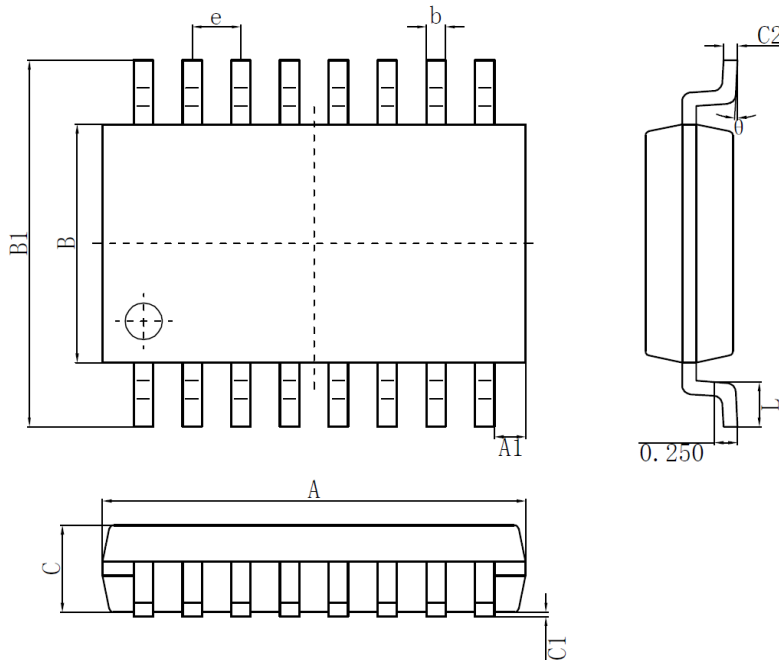
The FP6601A could detect the current value with current sense resistance($R_{SENSE}=10m\Omega$) to support the Over-Current Protection(OCP). If out current over 4.2A, The FP6601A will enable OCP function, then turn off N-MOSFET through FLAGA pin. Protection states is hiccup and auto recovery.

Short-Circuit Protection

The FP6601A monitor VBUS voltage and FLAGA pin states to provide Short-Circuit Protection (SCP). When USB Type-A connect side occur short-circuit status (VBUS to GND), VBUS voltage will drop. If the voltage drop down to 3.6V and FLAGA pin turn on, The FP6601A will enable SCP function, then turn off N-MOSFET through FLAGA pin. Protection states is hiccup and auto recovery.

Outline Information

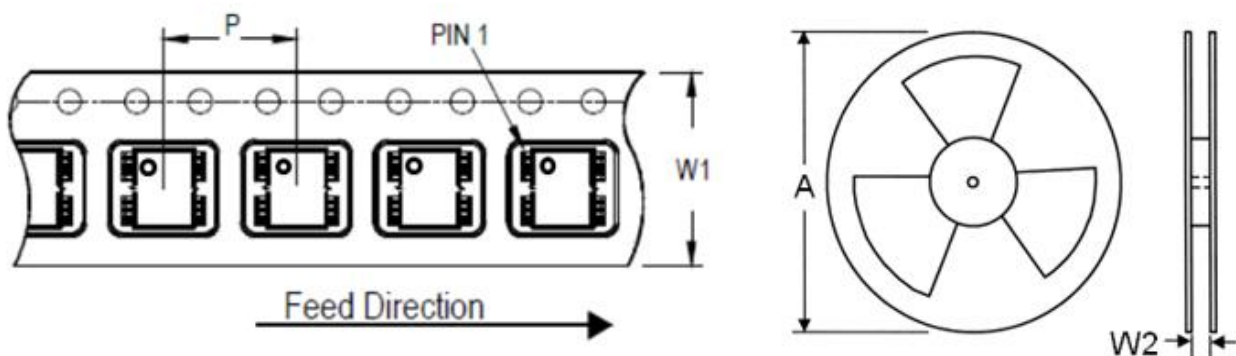
CPC-16L Package (Unit: mm)



| SYMBOLS UNIT | DIMENSION IN MILLIMETER | |
|-----------------|-------------------------|------|
| | MIN | MAX |
| A | 4.50 | 4.70 |
| A1 | 0.29 | 0.39 |
| B | 2.50 | 2.70 |
| B1 | 3.85 | 4.15 |
| C | 0.85 | 1.05 |
| C1 | 0.00 | 0.15 |
| C2 | 0.15 | 0.18 |
| e | 0.53 (BSC) | |
| b | 0.16 | 0.26 |
| L | 0.40 | 0.60 |

Note : Body dimensions do not include mold flash or protrusion.
Mold flash and protrusion shall not exceed 0.3mm

Carrier Dimensions



| Tape Size (W1)mm | Pocket Pitch (P)mm | Reel Size (A) | | Reel Width (W2)mm | Empty Cavity Length (mm) | Units per Reel |
|---------------------|-----------------------|---------------|------|----------------------|-----------------------------|----------------|
| | | (in) | (mm) | | | |
| 12 | 8 | 15 | 380 | 12.5 | 300~1000 | 6000 |

Life Support Policy

Jadard's products are not authorized for use as critical components in life support devices or other medical systems.