# TYPEC/PD2.0/PD3.0 Physical Layer IC for USB TYPEC input Interfaces

## 1. Features

- **Support TYPEC/PD2.0/PD3.0 UFP mode for USB TYPEC input port**
  - Auto-detect USB connection condition
- **Integrate USB Power Delivery (PD2.0/PD3.0) protocol**
  - Integrate hardware bi-phase Mark Coding (BMC) over CC
  - Integrate physical layer
  - Hardware CRC protect data integrity
  - Integrate PD2.0/PD3.0 protocol UFP engine
  - Support hardreset
- **Integrate USB TYPEC protocol**
- **Power management**
  - VBUSG control the power rail by the external NMOS, depending on CC negotiation state
  - IP2721: SEL configure the maximum PD request voltage as 20V, 15V or 5V
  - IP2721_MAX12: SEL configure the maximum PD request voltage as 12V, 9V or 5V
- **Support VBUS soft start**
- **Working voltage: 3V~25V**
- **Package: TSSOP16**

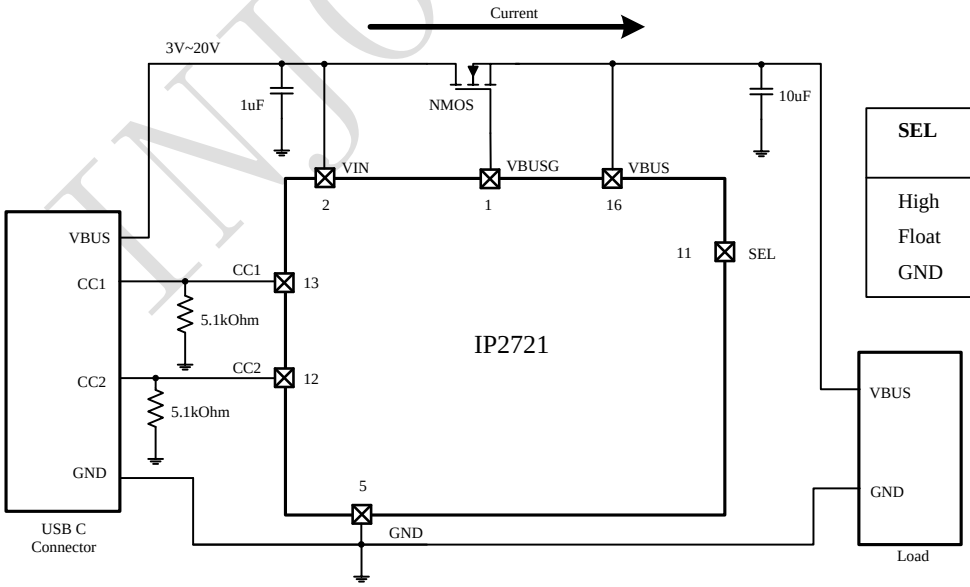
## 2. Description

**IP2721 is a USB TYPEC/PC2.0/PD3.0 physical layer protocol IC for USB TYPEC input port, support auto-detect USB port connection through CC1 and CC2. Integrate hardware PD protocol, analyze PD protocol to get source capabilities and request appropriate voltage accordingly.**

## 3. Typical Applications

- **USB TYPEC input port for Power Banka, cell phone, wireless charging dock, VR box and UAV etc.**

## 4. Typical Application Schematic

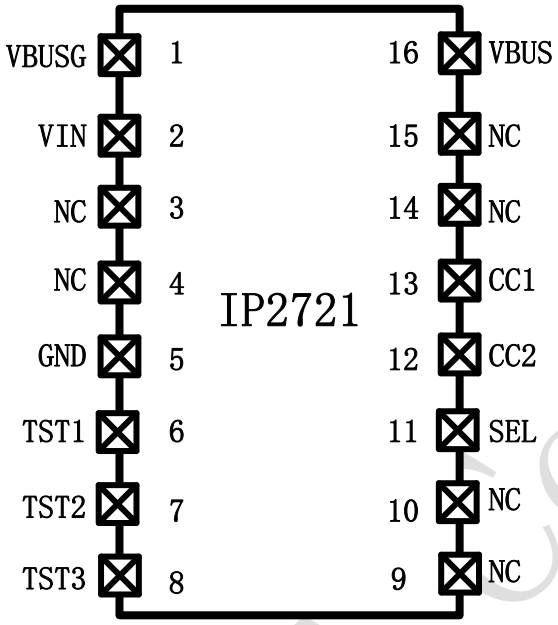



| SEL | Voltage (IP2721) | Voltage (IP2721_MAX12) |
|---|---|---|
| High | 20V | 12V |
| Float | 15V | 9V |
| GND | 5V | 5V |



## 5. PIN Description




TSSOP16

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | VBUSG | Connect to the gate of external NMOS, in control of the power rail. |
| 2 | VIN | Power input pin, apply 1uF capacitor to GND, connect to the Drain of the external NMOS. |
| 3,4 | NC | Keep floating |
| 5 | GND | Ground |
| 6,7,8 | TST1/TST2/TST2 | Reserved PIN, keep floating |
| 9,10 | NC | Keep floating |
| 11 | SEL | IP2721 / IP2721_MAX12<br>High: 20V / 12V<br>Floating: 15V / 9V<br>GND: 5V / 5V |
| 12 | CC2 | Connect to CC2 of USB Type-C port |
| 13 | CC1 | Connect to CC1 of USB Type-C port |
| 14,15 | NC | Keep floating |
| 16 | VBUS | Connect to the source of external NMOS |



## 6. IP Series Products List

### USB Charging Port Control IC

| IC Part No. | Channel | Standards supported | | | | | | | | | | Package | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BC1.2 & APPLE | QC3.0 & QC2.0 | FCP | SCP | AFC | SFCP | MTK PE+ 2.0&1.1 | TypeC | NTC | PD2.0/ PD3.0/PPS | Package | Compatibility |
| IP2110 | 1 | √ | - | - | - | - | - | - | - | - | - | SOT23-5 | |
| IP2111<br>IP2111A | 1 | √ | - | - | - | - | - | - | - | - | - | SOT23-6 | |
| IP2112<br>IP2112A | 2 | √ | - | - | - | - | - | - | - | - | - | SOT23-6 | |
| IP2161 | 1 | √ | √ | √ | - | √ | √ | - | - | - | - | SOT23-6 | |
| IP2163 | 1 | √ | √ | √ | - | √ | √ | √ | - | √ | - | SOP8 | PIN2 PIN |
| IP2183 | 1 | √ | √ | √ | √ | √ | √ | √ | - | - | - | SOP8 | |
| IP2701 | 1 | √ | √ | √ | - | √ | √ | - | √ | - | - | SOP8 | |
| IP2703 | 1 | √ | √ | √ | - | √ | √ | √ | √ | √ | - | DFN10 | |
| IP2705 | 1 | √ | √ | √ | - | √ | √ | √ | √ | √ | - | DFN12 | |
| IP2707 | 2 | √ | √ | √ | - | √ | √ | √ | √ | √ | - | QFN16 | |
| IP2712 | 1 | √ | √ | √ | √ | - | - | 1.1 | √ | - | √ | TSSOP20L | |
| IP2716 | 1 | √ | √ | √ | √ | √ | - | 1.1 | √ | - | √ | QFN32 | |
| IP2723 | 1 | √ | √ | √ | √ | √ | √ | √ | √ | - | √ | TSSOP16 | |
| IP2721 | 1 | - | - | - | - | - | - | - | - | - | √<br>SINK | TSSOP16 | |

## 7. Absolute Maximum Ratings

| Parameters | Symbol | Value | Unit |
|---|---|---|---|
| VIN input voltage range | VIN | -0.3 ~ 30 | V |
| CC1,CC2 input voltage range | $V_{CC1}$,$V_{CC2}$ | -0.3 ~ 30 | V |
| Other pins voltage range | | -0.3 ~ 10 | V |
| Junction temperature range | $T_J$ | -40 ~ 150 | ℃ |
| Storage temperature | Tstg | -60 ~ 150 | ℃ |
| Lead temperature (Soldering, 10sec.) | Ts | 260 | ℃ |
| Ambient temperature range | $T_A$ | -40~120 | ℃ |

| | | | |
|---|---|---|---|
| Package thermal resistance | $\theta_{JA}$ | 90 | ℃/W |
| Package thermal resistance | $\theta_{JC}$ | 39 | ℃/W |
| Human body model (HBM) | ESD | 2 | KV |

*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.

*Voltages are referenced to GND unless otherwise noted.

## 8. Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input voltage | VIN | 3 | | 25 | V |
| Ambient temperature | $T_A$ | -40 | | 85 | ℃ |

*Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

## 9. Electrical Characteristics

Unless otherwise specified, T A =25℃, 4.5V ≤ VCC1 ≤ 5.5V

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input voltage | VIN | Supplied directly | 3 | | 25 | V |
| Input UVLO threshold | UVLO | VIN Falling | 2.5 | | 2.9 | V |
| Quiescent current | $I_Q$ | CC floating | 120 | | 145 | uA |
| | | CC connected | 1 | | 1.5 | mA |
| Start time | Ts | | 20 | 37 | 50 | us |
| VBUS soft start time | Tv | | 3.5 | | 4.5 | ms |
| SEL input high voltage threshold | $V_{SELH}$ | | 2.5 | | | V |
| SEL input low voltage threshold | $V_{SELL}$ | | | | 0.3 | V |
| SEL default output voltage | $V_{SELO}$ | | 1.35 | 1.5 | 1.65 | V |
| CC1/CC2 connection detection threshold voltage | $V_{CC1\_TH}$/ $V_{CC2\_TH}$ | | 0.25 | | 2.04 | V |



# 10. Function Description

### USB TYPEC/PD protocol

IP2721 is an integrated USB TYPEC PD protocol IC for USB input port, support USB TYPEC/PD2.0/PD3.0 protocol. USB TYPEC device plug-in and plug-out is auto-detected based on CC1/CC2 pins. IP2721 integrated PD protocol analyzer to get the voltage capabilities and request the matched voltage.

- Port mode: sink (device)
- Auto-detect USB TYPEC device plug-in and plug-out
- Integrate hardware bi-phase Mark Coding (BMC) over CC
- Integrate physical layer
- Integrate PD protocol state machine
- Support PD hardreset

### SEL pin

SEL pin is used to configure the maximum voltage that IP2721 will request, when SEL is pulled to high voltage level $V_{SELH}$, the maximum request voltage is 20V; when SEL is floating, the maximum voltage that IP2721 request is 15V; when SEL pull down to GND, IP2721 only request 5V voltage.

If the maximum voltage SRC port supported is lower than IP2721 capable of, IP2721 will request the maximum voltage supported by the SRC port. If the maximum voltage SRC port supported is higher than IP2721 capable of , IP2721 will request its maximum voltage and supported by the SRC port as well. That is to say, IP2721 will request the maximum voltage supported by both IP2721 and SRC port.

The customized models of IP2721_MAX is configured switching the maximum request voltage among 12V, 9V and 5V by SEL. SEL pull 100kohm resistor to VIN is $V_{SELH}$. The switching of SEL voltage level is not supported after power up, it should be connected well before IP2721 power up.

| SEL | IP2721 Voltage | IP2721_MAX12 Voltage |
|---|---|---|
| $V_{SELH}$ | 20V | 12V |
| Floating | 15V | 9V |
| GND | 5V | 5V |

### Power path control

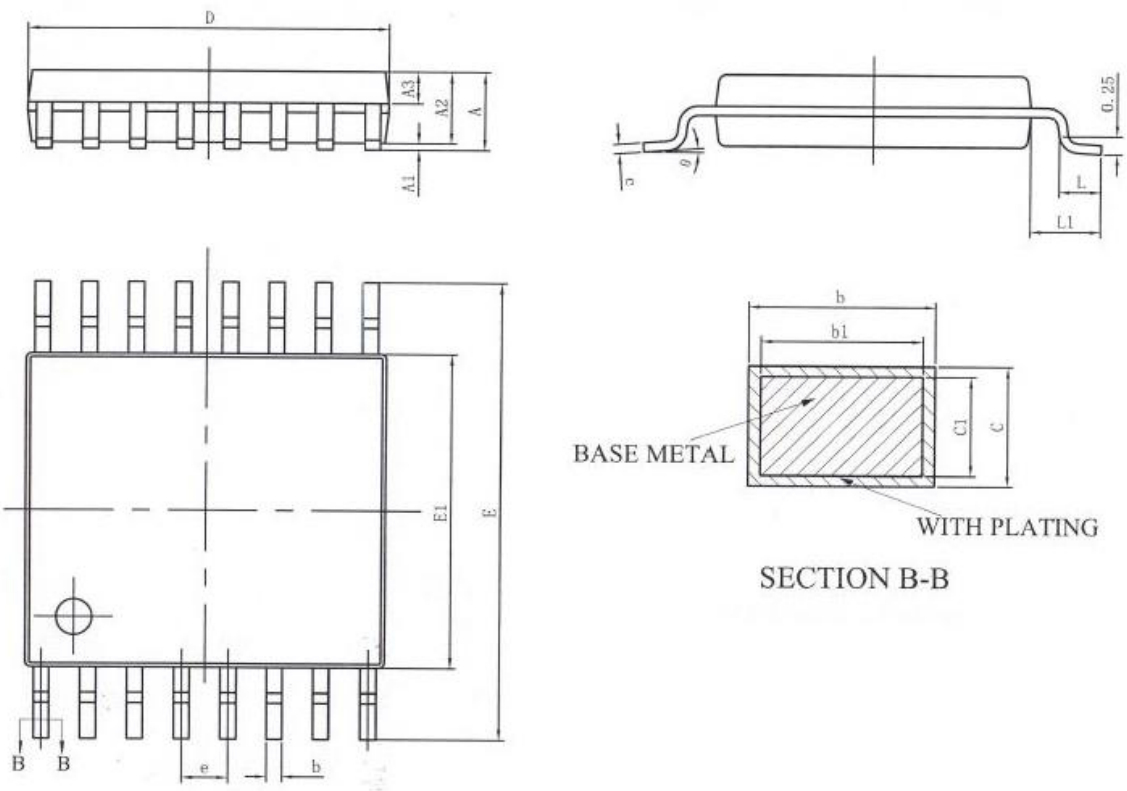
IP2721 support external NMOS for power path control, controlling the Gate of external NMOS by VBUSG pin. The NMOS will be turned on when CC connection is established, and turned off when CC disconnected.

*Power NMOS of Vds withstand voltage above 30V is recommended.



## 11. Package




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | — | — | 1.20 |
| A1 | 0.05 | — | 0.15 |
| A2 | 0.90 | 1.00 | 1.05 |
| A3 | 0.39 | 0.44 | 0.49 |
| b | 0.20 | — | 0.29 |
| b1 | 0.19 | 0.22 | 0.25 |
| c | 0.13 | — | 0.18 |
| c1 | 0.12 | 0.13 | 0.14 |
| D | 4.86 | 4.96 | 5.06 |
| E | 6.20 | 6.40 | 6.60 |
| E1 | 4.30 | 4.40 | 4.50 |
| e | 0.65BSC | | |
| L | 0.45 | 0.60 | 0.75 |
| L1 | 1.00BSC | | |
| θ | 0 | — | 8° |



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