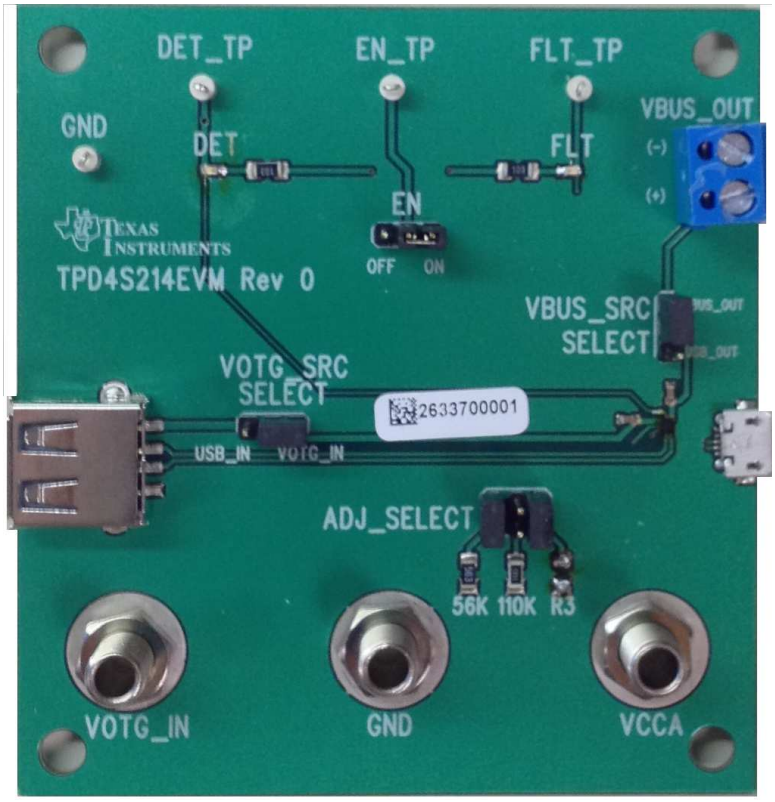
TPD4S214EVM

1 Introduction

The TPD4S214 is a single-chip protection solution for USB On-the-Go and other current limited USB applications. This device includes an integrated low $R_{DS(ON)}$ N-channel current limited switch for OTG current supply to peripheral devices. TPD4S214 offers low capacitance TVS ESD clamps for the D+, D–, and ID pins for both USB2.0 and USB3.0 applications. The VBUS pin can handle continuous voltage ranging from –2V to 30V. The over voltage lock-out (OVLO) at the VBUS pin ensures that if there is a fault condition at the VBUS line, the TPD4S214 is able to isolate it and protects the system from damage. Similarly, the under voltage lock out (UVLO) at the VOTG_IN pin ensures that there is no power drain from the internal OTG supply to external VBUS if VOTG_IN drops below safe operating level.

When EN is high, the OTG switch is activated and the $\overline{FLT}$ pin indicates whether there is a fault condition. The soft start feature waits 16 ms to turn on the OTG switch after all operating conditions are met. The $\overline{FLT}$ pin asserts low during any one of the following fault conditions: OVLO ($V_{BUS} > V_{OVLO}$), over temperature, over current, short circuit condition, or reverse-current-condition ($V_{BUS} > V_{OTG\_IN}$). The OTG switch is turned off during any fault condition; in addition, it is also turned off during UVLO condition ($V_{OTG\_IN} < V_{UVLO}$). Once the switch is turned off, the IC periodically rechecks the faults and UVLO internally. If the IC returns to normal operating conditions, the switch turns back on and $\overline{FLT}$ is reset to high.

There is also a VBUS detection feature for facilitating USB communication between USB host and peripheral device. Refer to Table 2 in data sheet for detection scheme. If this is not used, DET pin can be either floating or connected to ground.



2 Highlighted Features

- Input Voltage Protection at VBUS up to 30V
- Low RDS(ON) N-CH FET Switch for high efficiency
- Compliant with USB2.0 and USB3.0 OTG spec
- User Adjustable current limit from 250mA to beyond 900mA
- Built-in soft-start
- Reverse current blocking
- Over Voltage Lock Out for VBUS
- Under Voltage Lock Out for VOTG_IN
- Thermal shutdown and short circuit protection
- Auto retry on any fault; no latching off states
- Integrated V_{BUS} detection circuit
- Low Capacitance TVS ESD Clamp for USB2.0 High speed Data Rate
- Internal 16ms startup delay
- ESD Performance D+/D–/ID/V_{BUS} Pins:
  - ±15-kV Contact Discharge (IEC 61000-4-2)
  - ±15-kV Air Gap Discharge (IEC 61000-4-2)

Space Saving WCSP (12-YFF) Package

3 EVM Description

The TPD4S214EVM provides full functionality of TPD4S214. Dependent on the jumper configurations, VOTG_IN can be supplied through either the USB Type-A connector labeled USB_IN or the banana jack labeled VOTG_IN. VBUS can be output to either the Micro USB-B connector labeled USB_OUT or a two pin terminal block labeled VBUS_OUT. This configuration allows the device to be tested without the use of expensive breakout boards; yet one or two breakout boards can still be accommodated. D+/D– lines can only be characterized through the USB connectors.

Test points are provided for monitoring the DET, EN, and FLT logic pins.

VBUS current limiting adjustments are made by jumper selection of ADJ_SEL. R3 is left unpopulated to allow for a custom user preferred value.

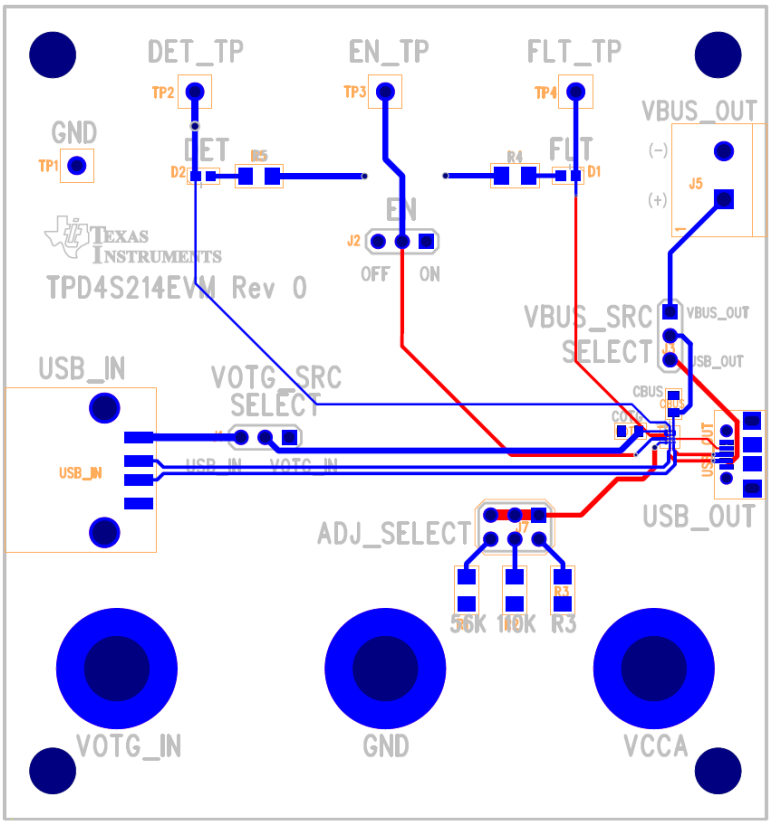


Table 1. Jumper Configurations

Jumper Configurations		
V_{OTG_IN} Source selection	USB_IN port	VOTG_IN banana connector
EN	Sets EN pin low	Sets EN pin high in reference to VCCA

Table 2. Jumper Configurations

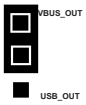
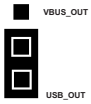
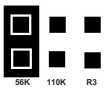
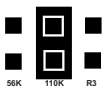
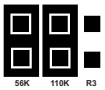
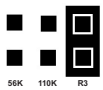
Jumper Configurations		
VBUS Source selection	VBUS_OUT Terminal block	USB_OUT connector

Table 3. Jumper Configurations

VBUS current limiter adjust				
ADJ_SELECT	~ 1A	~ 0.5A	~ 1.5A	User supplied

4 Bill of Materials

Table 4. Bill of Materials

Qty	RefDes	Size	Value	Description	Part Number	MFR
1	U1	0.051 inch x 0.067		IC, USB OTG COMPANION DEVICE	TPD4S214YFF	TI
1	CBUS	603	1uF	Capacitor, Ceramic Chip, 10V, ±10%	STD	STD
1	COTG	603	10uF	Capacitor, Ceramic Chip, 10V, ±10%	STD	STD
3	J4 J6 J8	0.300 inch dia		Connector, Banana Jack, Uninsulated	3267	Pomona
1	J5	0.354 inch x 0.628		Connector,15A, 300V Male 2 Pole, 5.08 mm	ED120/2DS	On Shore Technology Inc.
1	USB_OUT	0.201 inch x 0.295		Connector, SMT, Micro USB-B, flangeless	SD-105017-1001	Molex
1	USB_IN	0.596 inch x 0.618		CONN USB 2.0 R/A FMAL TYPE-A SMD	AU-Y1006-2-R	Assman WSW Components
2	D1-2	603	SML-LX0603GW-TR	Diode, LED, Red, 1.8, 2mA, 2.5 mcd	SML-311UTT86	Rohm Semiconductor
3	J1-3	0.10 inch x 0.30	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	PEC03SAAN	Sullins
1	J7	0.20 inch x 0.30	PEC03DAAN	Header, Male 2x3-pin, 100mil spacing	PEC03DAAN	Sullins
2	R4-5	1206	10K	Resistor, Metal Film, 1/4 watt, ±5%	STD	STD
1	R2	1206	110K	Resistor, Metal Film, 1/4 watt, ±5%	STD	STD
1	R1	1206	56K	Resistor, Metal Film, 1/4 watt, ±5%	STD	STD
4	TP1-4	0.100 inch dia.	5002	Test Point, White, Thru Hole Color Keyed	5002K-ND	Keystone

5 Schematic

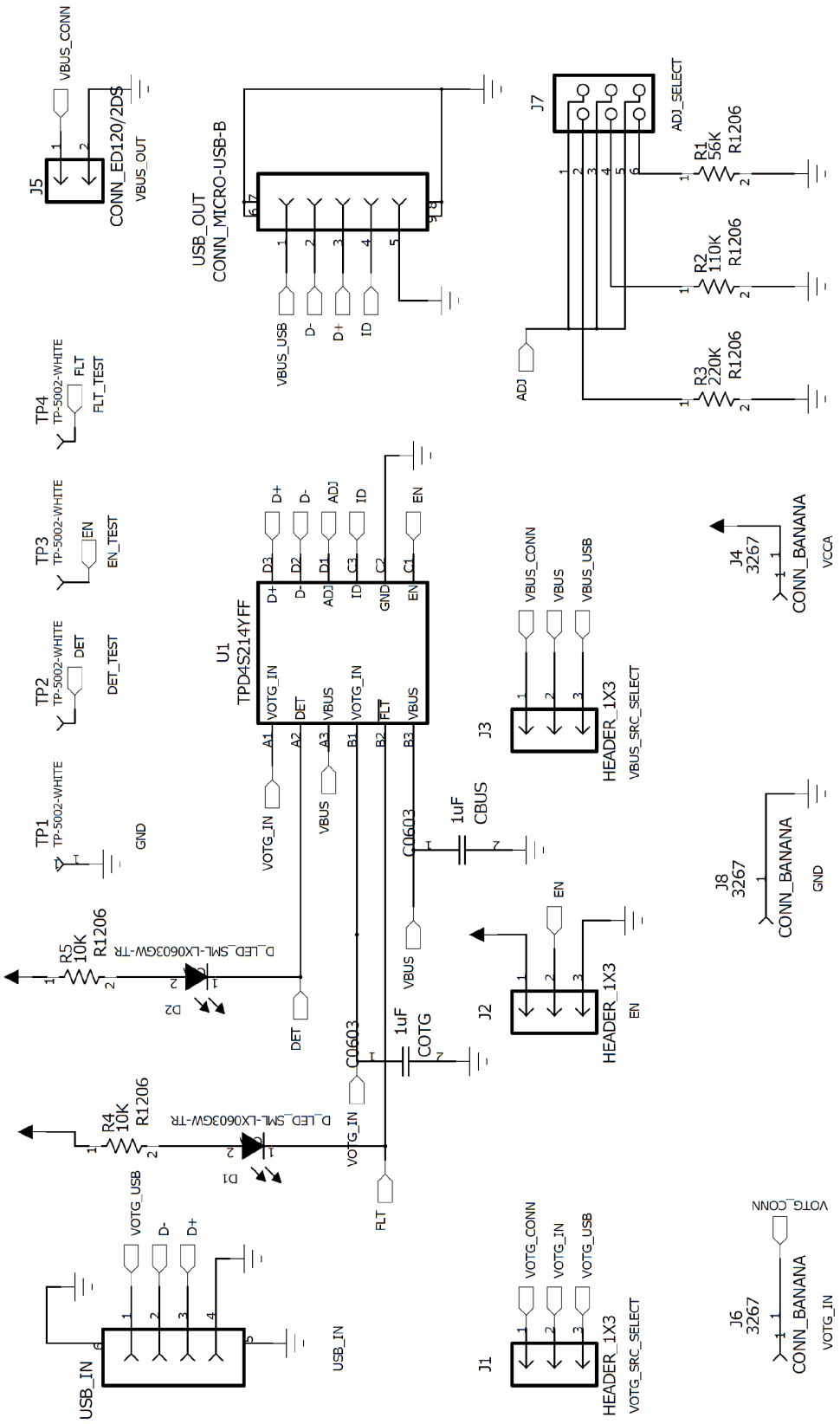


Figure 1. Schematic Drawing

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