

USB Dedicated Charging Port Controller for Fast Charging Protocol and QC 2.0/3.0

FEATURES

- Supports HiSilicon Fast Charging Protocol (FCP) for Output Voltage and Current Communication Support Qualcomm Quick Charge2.0/3.0
- Class A : 3.6V up to 12V Output Voltage
- Automatic Selection FCP and QC2.0/3.0 Protocols
- Supports USB DCP Shorting D+ Line to D- Line per USB Battery Charging Specification Revision 1.2
- Meets Chinese Telecommunication Industrial Standard YD/T 1591-2009
- Supports USB DCP Applying 2.7V on D+ Line and 2.7V on D- Line
- Supports USB DCP Applying 1.2V on D+ and D- Lines
- SOT23-6 Package

APPLICATIONS

- Wall-Adapter, Smart Phones, Tablets, Netbooks
- Mobile / Tablet Power Bank
- Car Charger
- USB Power Output Ports

GENERAL DESCRIPTION

The TMI9290 is a fast charge protocol controller for HiSilicon Fast Charging Protocol (FCP) and Qualcomm Quick Charge2.0/3.0 (QC 2.0/3.0) USB interface. The device can fast charging FCP or QC 2.0/3.0 powered device (PD). The protocol feature monitors USB D+/D- data line voltage or D- data line transmission and automatically adjusts output voltage of power bank and wall adapter to optimize charge time.

TMI9290 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 not compliant to QC 2.0/3.0 or FCP is detected the TMI9290 disables output voltage adjustment to ensure safe operation with legacy 5 V only USB PDs.

The TMI9290 is available in a SOT23-6 package.

TYPICAL APPILICATION

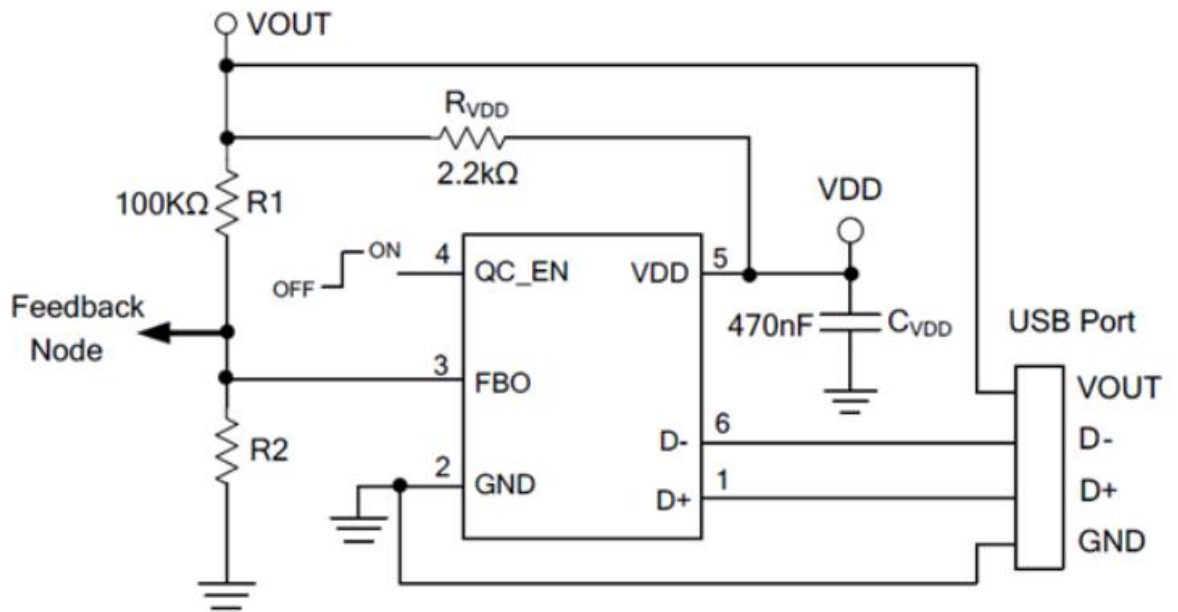


Figure 1. Basic Application Circuit

Output Voltage Lookup Table (QC2.0/3.0)

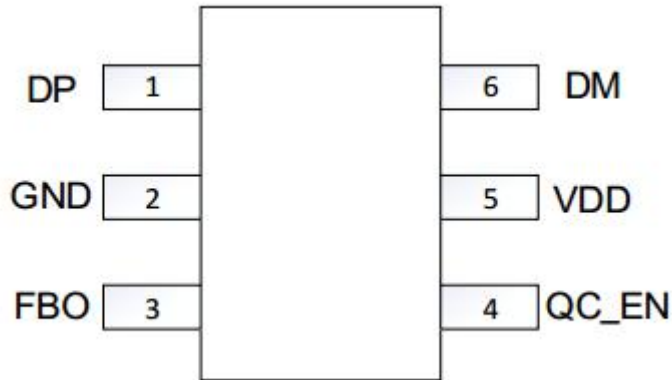
D+	D-	Output Voltage
0.6V	0.6V	12V
3.3V	0.6V	9V
0.6V	3.3V	Continuous mode
0.6V	High-Z	5V(Default)

ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit
VDD Voltage Range	-0.3~6.5	V
DP,DM,FBO,QC_EN voltage	-0.3~6.5	V
Junction Temperature	-40~+150	°C
Storage Temperature Range	-50~150	°C
Lead Temperature	260	°C
Power Dissipation	0.5	W
Package Thermal Resistance	110	°C/W

Over operating free-air temperature range (unless otherwise noted)

PIN CONFIGURATION



SOT23-6

Mark:T23XXX (T23:Device Code, XXX: Inside Code)

PartNumber	Package	Topmark	Quantity/ Reel
TMI9290	SOT23-6	T23XXX	3000

PIN FUNCTIONS

Pin	Name	Function
1	DP	USB D+ data line
2	GND	Ground Pin
3	FBO	Current Sink/Source FB Node
4	QC_EN	QC Enable
5	VDD	Power Supply
6	DM	USB D- data line

ESD RATINGS

Items	Description	Value	Unit
V _{ESD}	Human Body Model for all pins	±8000	V

JEDEC specification JS-001

RECOMMENDED OPERATING CONDITIONS

Items	Description	Min	Max	Unit
Voltage Range	VDD	3.2	6.4	V
TA	Operating Temperature Range	-40	85	°C

ELECTRICAL CHARACTERISTICS
(V_{DD}=5V , T_A = 25°C, unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VDD Input Voltage Range	V _{DD}		3.2		6.4	V
Input UVLO Threshold	V _{UVLO}	V _{DD} Fall	2.5		2.9	V
VDD Supply Current		V _{DD} =5V		200		uA
VDD Shunt Voltage	V _{DD} (SHUNT)	I _{VDD} =3mA	5.3	5.7	6.1	V
Data Detect Voltage	V _{DAT_REF}		0.25	0.325	0.4	V
Output Voltage selection reference	V _{SEL_REF}		1.8	2	2.2	V
D+ High Glitch Filter Time	T _{GLITCH_DP_H}			1250		mS
D- Low Glitch Filter Time	T _{GLITCH_DM_L}			1		mS
Output Voltage Glitch Filter Time	T _{GLITCH_CHANGE}			40		mS
D- Pull-Down Resistance	R _{DM}			20		Kohm
Continuous Mode Glitch Filter Time	T _{GLITCH_CONT_CHAN GE}			150		uS
D+ Leakage Resistance	R _{DP}			500		Kohm
Switch SW1 on-resistance	R _{DS_ON}				40	ohm
Up/Down Current Step	I _{UP/DOWN}			2		uA
D+ _1.2V/D- _1.2V line output voltage	V1.2V		1.08	1.2	1.32	V
D+ _1.2V/D- _1.2V line output Impedance				100		Kohm
D+ _2.7V/D- _2.7V line output voltage	V2.7V		2.56	2.7	2.84	V
D+ _2.7V/D- _2.7V line output Impedance				33.6		Kohm
D- FCP Tx Valid Output High	V _{TX_VOH}		2.55		3.6	V
D- FCP Tx Valid Output Low	V _{TX_VOL}				0.3	V
D- FCP Rx Valid Output High	V _{RX_VOH}		1.4		3.6	V
D- FCP Rx Valid Output Low	V _{RX_VOL}				1	V
D- Output Pull-Low Resistance (FCP)	R _{PD}			500		ohm
Unit Interval For FCP PHY communication	UI	F _{CLK} =125KHz	144	160	176	uS

FUNCTIONAL DESCRIPTION

The TMI9290 is a USB high voltage dedicated charging port interface IC for Qualcomm Quick Charge 2.0/3.0 class A, HiSilicon FCP specification.

The TMI9290 can fast charge most of the handheld devices. It can be like the original charging adapter.

The TMI9290 can support BC1.2, Apple, Samsung and HUAWEI. It also supports full output voltage range of QC 3.0 Class A(3.6V to 12V) or QC 2.0 Class A(5V,9V,12V)

Quick Charge 2.0/3.0 Interface

Power up D+/D- is supply 2.7V to Apple Device and then supply D+ short to D- into BC1.2. Set the output voltage level 5V. If D+ continuous above 0.325V and keep 1.25 seconds TMI9290 can automatic choose into Quick Charge 2.0/3.0, FCP operation mode.

When $V_{DAT}(REF) < D+ < V_{SEL_REF}$ and $D- > V_{SEL_REF}$, the TMI9290 enter continuous mode. Each step of D+ from 1V to 3V Pulse-width during 200us cause current sink 2uA by FBO. The maximum output sink current is 70uA for output voltage reach to 12V. Each step of D- from 3V to 1V Pulse-width during 200us cause current source 2uA by FBO. The minimum output source current is 14uA for output voltage reach to 3.6V.

If PD without QC 2.0 the device will keep output voltage level 5V guarantee safe operation for only 5V USB PD. When USB cable unplug the D+ voltage $< V_{DAT}(REF)$ and output voltage recovery default mode 5V.

Shunt Regulator

The wide power supply output voltage through external resistor from RVDD to VDD. The internal clamp VDD pin at 5.7V. Recommend $RVDD = 2.2k\Omega$ and $CVDD = 470nF$

QC_EN Function

QC_EN pin disables QC 2.0/3.0 and FCP function by connected to GND, Otherwise, it enables function by connected to VDD or floating. QC_EN signal need to be ready before TMI9290 starts detection. When TMI9290 already access QC2.0/3.0 or FCP mode, the mode won't be changed by setting QC_EN pin signal (High to Low)

FUNCTIONAL BLOCK DIAGRAM

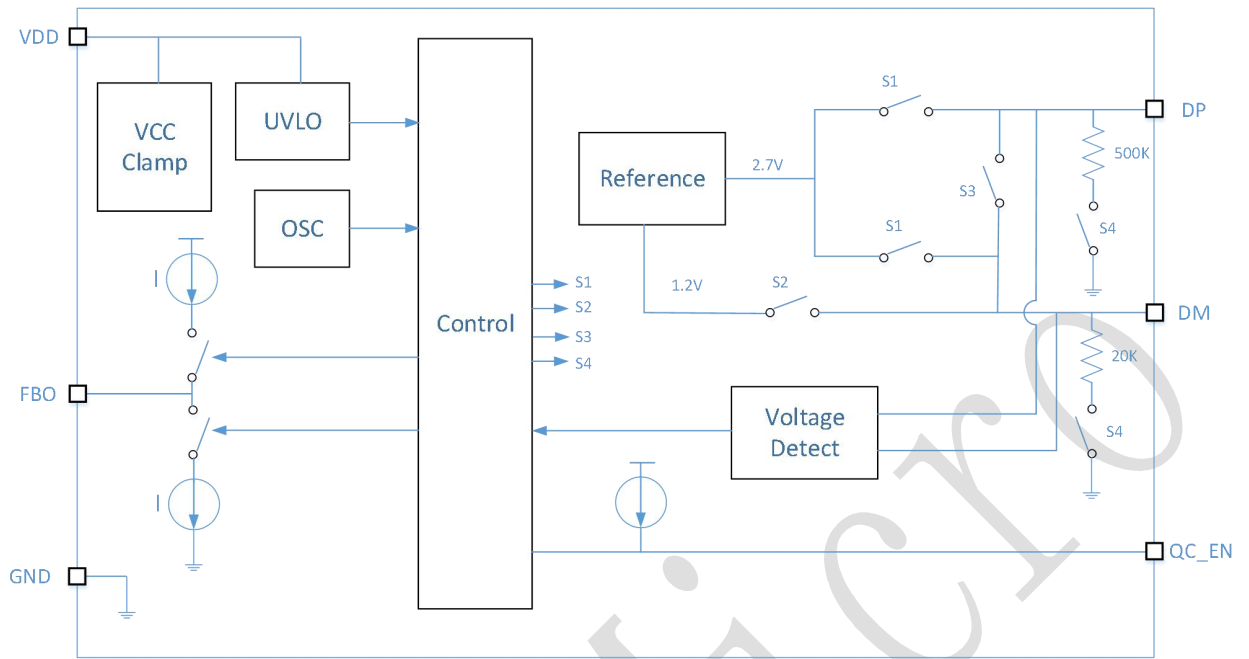
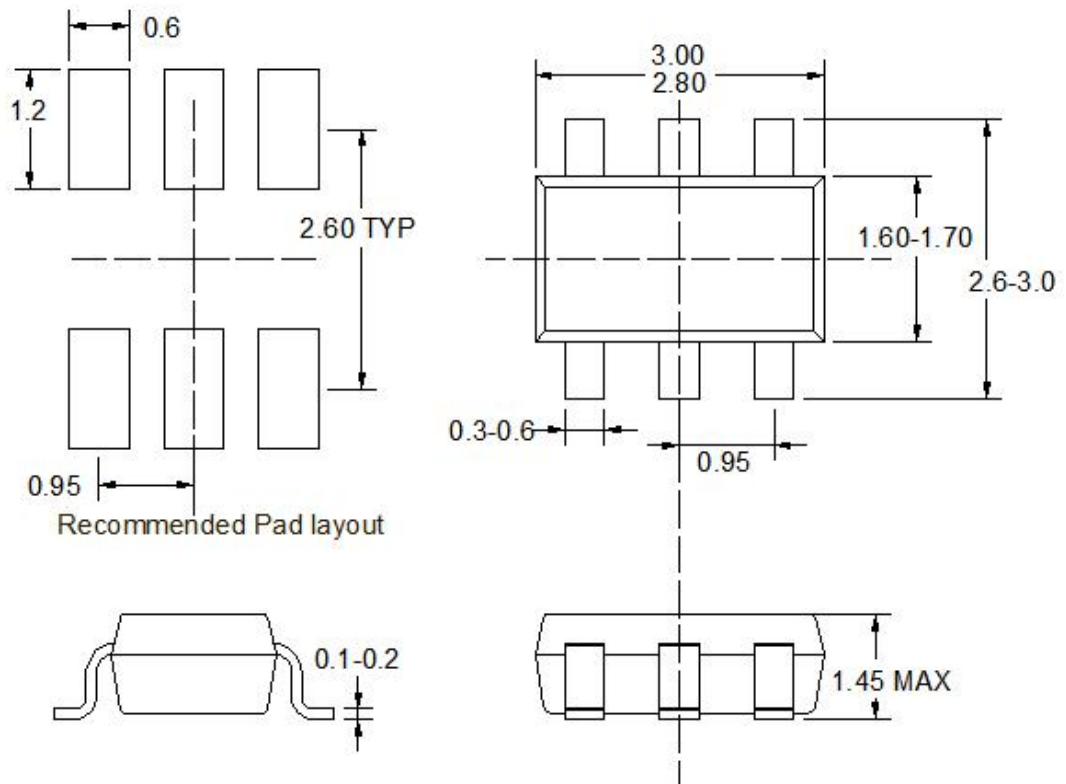


Figure2. TMI9290 Block Diagram

PACKAGE INFORMATION



SOT23-6