Fast Charging Physical Layer IC for USB Interfaces

Supports 7 fast charging standards: QC3.0/QC2.0, FCP, AFC, SFCP, Apple® 2.4A, BC1.2

1. Features

- Support several charging standards including : QC3.0/QC2.0, FCP, AFC, SFCP and Apple® 2.4A, Samsung® 2.0A, BC1.2
- Support QC3.0&QC2.0 Class A
  - Qualcomm® Certificate No.: 478786303-2
  - QC3.0 Class A: 3.6V~12 V (0.2V/step) output voltage
  - QC2.0 Class A: 5 V, 9 V, or 12 V
- Support Huawei® FCP of 5V and 9V
- Support Samsung® AFC of 5V and 9V
- Support Spreadtrum® SFCP of 12V, 9V and 5V
- Support Apple® 2.4A: DP=2.7V, DM=2.7V
- Support Samsung® 2.0A: DP=1.2V, DM=1.2V
- Support USB battery charging specification revision 1.2 compatible
- Support BC1.2: Automatic shorting D+ to D- line
- SEL configure the maximum voltage, allowed to applied for, as 12V or 9V or 5V
- Default 5 V mode operation
- Support auto-detect and auto-switching fast charging standards
- FB for voltage regulation
- Very low power consumption I_Q = 66uA(Typ.)
- Working voltage: 3V~5.5V
- Package: SOT23-6

2. Typical Applications

- USB power output ports for AC adapters, Power Banka, Car chargers
- Battery chargers for smart phones, tablets, netbooks, digital cameras, and Bluetooth accessories

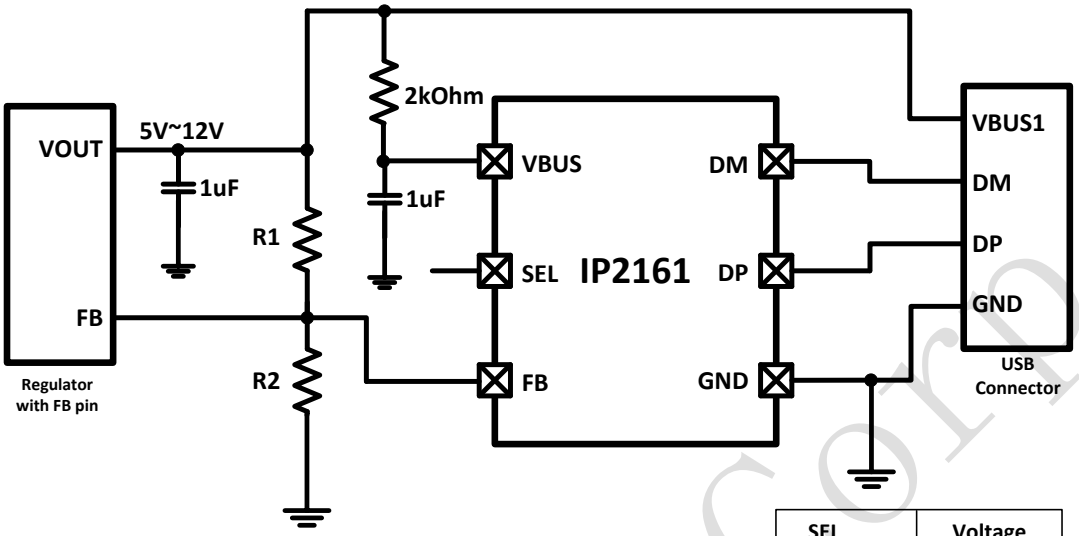
3. Description

IP2161 is a fast charging Physical Layer IC dedicated for USB ports, which supports several kinds of fast charging standards, including HVDCP QC3.0/QC2.0 (Quick Charge) Class A, FCP (Hisilicon® Fast Charge Protocol), AFC (Samsung® Adaptive Fast Charge), SFCP (Spreadtrum® Fast Charge Protocol), Apple® 2.4A, BC1.2 and Samsung® 2.0A.

IP2161 support automatically detecting the connected device's type and switching standards type to responding for fast charging requirements.

FB control line is integrated to source/sink current with precise 2uA/step in minimum, for accurate voltage regulation.

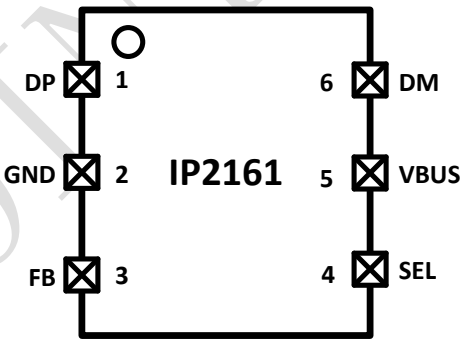
4. Typical Application Schematic



SEL	Voltage
High	12V
Float	9V
GND	5V

R1 recommend: 100kOhm (1% accuracy)
R2 value refer to the adopted Regulator

5. PIN Description



Pin name	Pin number	Pin description
DP	1	Connect to USB DP data line
GND	2	Ground
FB	3	Connect to the Regulator's FB line, current source/sink for voltage regulation
SEL	4	Configure the maximum voltage allowed to apply for: • V_{SELH} for 12V output • Floating for 9V output • GND for 5V output
VBUS	5	Power supply input, connect with 1uF capacitor to GND, a resistor of 2kOhm should be applied between VOUT and VBUS
DM	6	Connect to USB DM data line

6. IP Series Products List

USB Charging Port Control IC

IC Part No.	Channel Num	Standards Supported											Package
		BC1.2 & APPLE	QC3.0 & QC2.0	FCP	SCP	AFC	SFCP	MTK PE+ 2.0&1.1	Type-C	NTC	QC Certi-ficate	PD3.0	
IP2110	1	√	–	–	–	–	–	–	–	–	–	–	SOT23-5
IP2111	1	√	–	–	–	–	–	–	–	–	–	–	SOT23-6
IP2112	2	√	–	–	–	–	–	–	–	–	–	–	SOT23-6
IP2161	1	√	√	√	–	√	√	–	–	–	√	–	SOT23-6
IP2163	1	√	√	√	–	√	√	√	–	√	√	–	SOP8
IP2701	1	√	√	√	–	√	√	–	√	–	–	–	SOP8
IP2703	1	√	√	√	–	√	√	√	√	√	–	–	DFN10
IP2705	1	√	√	√	–	√	√	√	√	√	–	–	DFN12
IP2707	2	√	√	√	–	√	√	√	√	√	–	–	QFN16
IP2716	1	√	√	√	√	√	–	1. 1	√	–	√	√	QFN32

Power Bank IC

IC Part No.	Charge /Discharge		Features							Package	
	Charge	Dis-charge	LED Num	Lighting	Keys	I2C	DCP	Type-C	QC Certificate	Package	Compatibility
IP5303	1.0A	1.2A	1,2	√	√	–	–	–	–	eSOP8	PIN2PIN
IP5305	1.0A	1.2A	1,2,3,4	√	√	–	–	–	–	eSOP8	
IP5306	2.4A	2.1A	1,2,3,4	√	√	–	–	–	–	eSOP8	
IP5206	2A (Max)	1.5A	3,4,5	√	√	–	–	–	–	eSOP16	PIN2PIN
IP5108E	2.0A	1.0A	3,4,5	√	√	–	–	–	–	eSOP16	
IP5108	2.0A	2.0A	3,4,5	√	√	√	–	–	–	eSOP16	
IP5207	1.2A	1.2A	3,4,5	√	√	–	–	–	–	QFN24	PIN2PIN
IP5207T	1.2A	1.2A	1,2,3,4	√	√	√	√	–	–	QFN24	
IP5109	2.1A	2.1A	3,4,5	√	√	√	–	–	–	QFN24	
IP5209	2.4A	2.1A	3,4,5	√	√	√	√	–	–	QFN24	
IP5219	2.4A	2.1A	1,2,3,4	√	√	√	√	√	–	QFN24	
IP5310	3.1A	3.0A	1,2,3,4	√	√	√	√	√	–	QFN32	
IP5312	15W	3.6A	2,3,4,5	√	√	√	√	–	–	QFN32	
IP5318Q	18W	4.0A	2,3,4,5	√	√	√	√	–	√	QFN40	PIN2 PIN
IP5318	18W	4.0A	2,3,4,5	√	√	√	√	√	√	QFN40	
IP5322	18W	4.0A	1,2,3,4	√	√	√	√	–	√	QFN32	
IP5328	18W	4.0A	1,2,3,4	√	√	√	√	√	√	QFN40	

7. Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
VBUS Input Voltage Range	VBUS	-0.3 ~ 7	**V**
DP, DM Input Voltage Range	V_{DP}, V_{DM}	-0.3~11	**V**
Junction Temperature Range	T_J	-40 ~ 150	℃
Storage Temperature Range	Tstg	-60 ~ 150	℃
Ambient Temperature Range	T_A	-40~150	℃
Human Body Model (HBM)	ESD	4	**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	VBUS	3		5.5	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 ≤ VBUS ≤ 5.5V

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Quiescent Current	I_Q	No load, VBUS=5V	50	66	100	uA
Startup Time	Ts		8	10	12	ms
SEL Input High Voltage Range	V_{SELH}		3	5	5.5	V
SEL Default Output Voltage	V_{SELO}		1.35	1.5	1.65	V

10. Function Description

Charging Standards

IP2161 is a high-voltage, fast charging Physical Layer IC dedicated for charging applications where charging standards required to be negotiated between USB ports. IP2161 is needed at the host-side, when the attached portable client-side device negotiate the power allotment from the power source host-side, IP2161 can

auto-detect and respond to the those charging standards and may grant or deny the request based on the available voltage/current. IP2161 will inform the power source host-side to adjust the output voltage by FB line once charging request granted.

IP2161 support analysis several charging standards, including HVDCP QC3.0/QC2.0 (Quick Charge) Class A, FCP (Hisilicon® Fast Charge Protocol), AFC (Samsung® Adaptive Fast Charge), SFCP (Spreadtrum® Fast Charge Protocol), Apple® 2.4A, BC1.2 and Samsung® 2.0A.

IP2161 monitors the real-time voltage on DP line and DM line, when the attached device is not the fast charging type, IP2161 will change the voltage on the DP, DM line to fulfill the negotiation process. When fast charging client-side device connected, IP2161 auto-detect the type of charging standard and analysis the power requirements, source/sink current on FB line to grant the request voltage. When the output voltage is default 5V, FB line neither source nor sink current. IP2161 is not in control of the charging power loop, the actual charging loop and charging current is determined by the host-side power source and the client-side USB port device.

SEL

SEL line is used to configure the maximum voltage allotment that can be request, when SEL line is pull up to high-voltage of VSELH, the maximum voltage allotment is 12V; When SEL line is floating, the maximum voltage allotment is 9V; When SEL line is pull down to GND, IP2161 will not respond to any fast charging requirements and output default 5V.

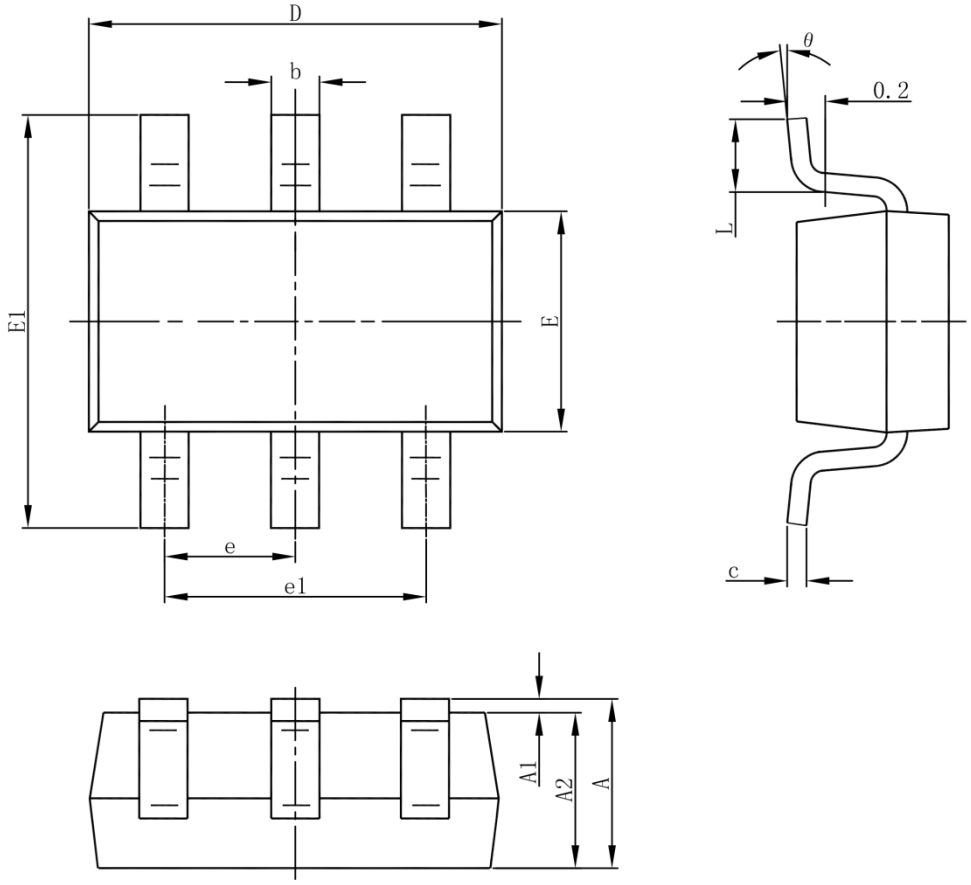
SEL	Voltage
High(V_{SELH})	12V
Floating	9V
GND	5V

FB

IP2161 integrated FB control line used for accurate voltage regulation by source/sink current with precise 2uA/step in minimum. FB source 40uA current for 9V output voltage; FB source 70uA current for 12V output voltage; When the output voltage is default 5V, FB neither source nor sink current.

In typical applications, IP2161 FB connects to the regulator's FB line, resistor (R1) between VOUT and FB should apply 100kOhm with high precision (1%), resistor (R2) value between FB and GND should refer to the regulator adopted, resistance of R2 can be calculated by equation: $VFB = \frac{VOUT}{R1+R2} * R2$

11.Package



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(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

12. Certificate Information

QUALCOMM® QUICK CHARGE™ 3.0 TECHNOLOGY

HIGH VOLTAGE DEDICATED CHARGING PORT VERIFICATION

ISSUED BY
UL TAIWAN CO., LTD.

CERTIFICATE NO	4787863030-2
SPECIFICATION	Qualcomm HVDCP Interface Specification Revision J
APPROVAL DATE	March 10, 2017
APPROVAL TYPE	ORIGINAL ASSESSMENT
CERTIFICATE HOLDER	INJOINIC TECHNOLOGY Room 101, 5th floor, East Science and Technology Building, Keyuan Road NO.16, Nanshan District, Shenzhen, Guangdong, 518000, China
TYPE OF EQUIPMENT	Chipset Reference Design
CLASS OF EQUIPMENT	CLASS A
TRADE NAME AND MODEL	INJOINIC TECHNOLOGY IP2161
	MEASUREMENT FACILITIES
LABORATORY NAME AND ADDRESS	UL Verification Services (Guangzhou) Co., Ltd., Song Shan Lake Branch Building 10, Innovation Technology Park, Song Shan Lake Hi-Tech Development Zone, Dongguan, 523808, China

Verification of equipment means only that the equipment has met the requirements of the above-noted specification. Trademark applications and agreements regarding the use of Quick Charge 3.0 Logo, are acted on accordingly by Qualcomm Technologies, Inc. This certificate is issued on condition that the holder complies and will continue to comply with the Quick Charge 3.0 program requirements established by Qualcomm Technologies, Inc. The equipment for which this certificate is issued shall not bear the Qualcomm Quick Charge 3.0 Logo unless the equipment complies with the applicable technical specifications and agreements issued by Qualcomm Technologies, Inc. as applicable to the Type Of Equipment and Class Of Equipment designated above.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.

ISSUED BY: Daniel Chiang

Daniel Chiang
Project Engineer, UL Taiwan Co., Ltd.

ISSUED ON:	March 10, 2017

Qualcomm Quick Charge 3.0

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