



Fuman Microelectronics Group Co., Ltd.

FINE MADE MICROELECTRONICS GROUP CO., LTD.

XPM52C(Document Number:S&CIC2197)

65W USB PDMulti-protocol buck chip

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characteristic

- Synchronous Switching Buck Converter
- Built-in power MOS
- Automatically identify input voltage and adjust output voltage
- Input operating voltage up to 31V
- Output voltage range: 3.3V to 21V, depending on fast charge
- Automatic adjustment of the protocol
- Maximum output power 65W
- Output voltage wired compensation function: 50mV/A, 100mV/A, 150mV/A
- Output has CV/CC characteristics
- Soft start function
- 3A start-up with load
- XP-LINK intelligent power reduction
- Supports USB Power Delivery (PD) 3.1 protocol
 - PD3.1 certified (TID: 7689)
 - FPDO configurable: 5V, 9V, 12V, 15V, 20V
 - APDO configurable: 5V Prog, 9V Prog, 15V Prog, 20V Prog
 - APDO adjusts voltage in 20mV steps
 - APDO current can support up to 5A

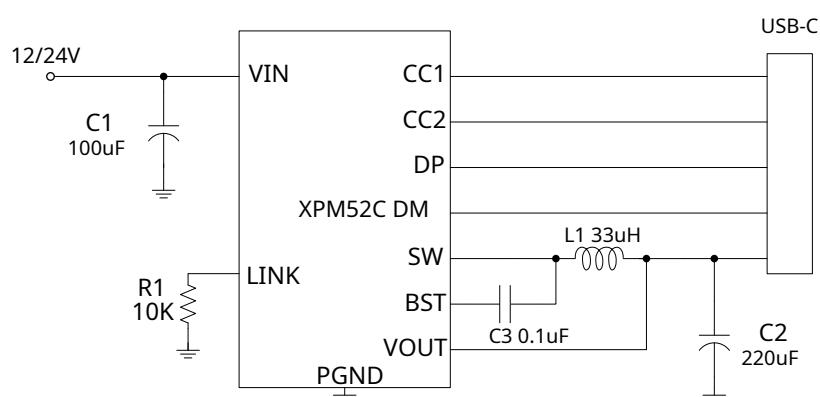
- Output fast charge
 - Support Quick Charge 2.0/3.0/3.0+ protocols
 - Support Xiaomi CHARGE TURBO 27W protocol
 - Support Huawei FCP/SCP/HVSCP protocols
 - Support Samsung AFC protocol
 - Support VOOC 2.0/4.0 protocol
 - Support MediaTek PE protocol
 - Support USB BC1.2 DCP
 - Support Apple 2.4A charging standard
- Support online upgrade
- Multiple protections, high reliability
 - Input over voltage and under voltage protection
 - Output short circuit, output overcurrent
 - Over temperature protection
- All pins ESD 4KV
- Package: QFN4x4-16L

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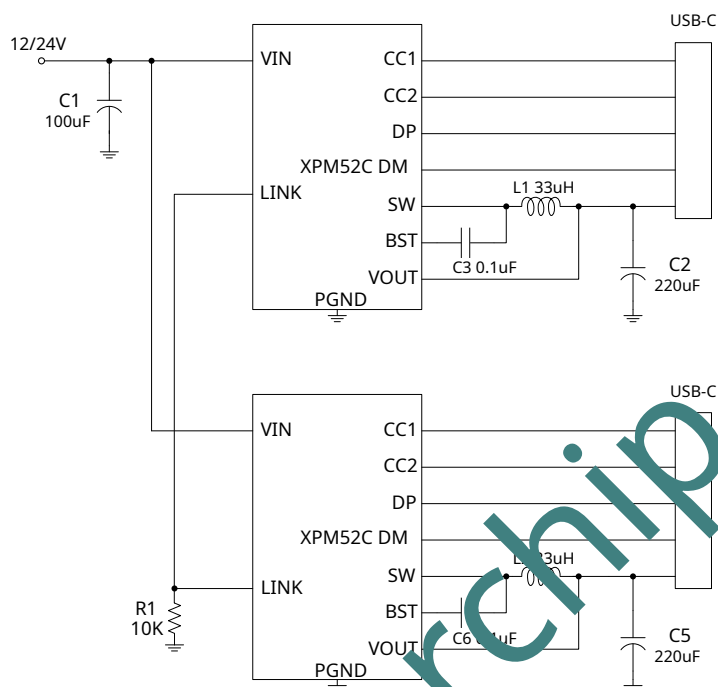
application

- USB Car Charger
- Portable charging equipment
- Universal High Voltage USB Charger
- General purpose high voltage DC/DC conversion applications
- Smart socket

3 Application Circuit Diagram



Application 1: Single C port operation



Application 2: Multi C port work



4 Overview

XPM52C It is a step-down converter with integrated synchronous switch, supporting multiple output fast charging protocols, USB Type-C and PDA and other fast charging protocols, including USB Type-C and PDA Protocol, Qualcomm QC2.0/3.0/3.0+, Huawei FCP/SCP/HVSCP, VOOC 2.0/4.0 Protocol, MediaTek PE, Samsung AFC, USB BC1.2 DCP and

Apple 2.4A Charging specifications provide complete

Complete solution.

XPM52C With automatic recognition VIN The function of input voltage is to adjust the output voltage according to the input voltage.

XPM52C Built-in power MOS, input operating voltage up to 31V, the output voltage range is 3.3V to 21V, can provide the maximum 65W. The output power can automatically adjust the output voltage and current according to the recognized fast charging protocol.

XPM52C The output has CV/CC characteristics, when the output current is less than the set value, the output CV mode, the output voltage is constant; when the output current is greater than the set value, the output CC mode, the output voltage decreases.

XPM52C The output voltage has a line compensation function. When the output current increases, the output voltage will increase accordingly to compensate for the voltage drop caused by the connection line impedance.

XPM52C Specially integrated XPD-LINK™ Patented Internet communication technology. XPD-LINK™ Interconnection function, XPM52C can be easily and flexibly applied in multiple Type-C port's charging scheme.

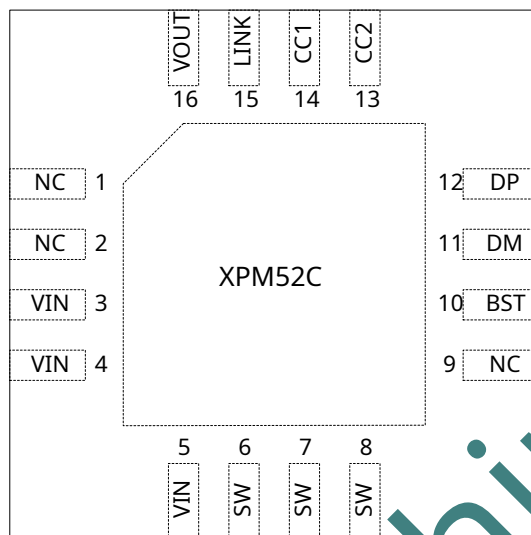
XPM52C Supports secondary burning and can realize online upgrade.

XPM52C There are multiple protection functions, including input overvoltage, under-voltage protection, output short circuit, overcurrent protection, and overtemperature protection.

XPM52C Use QFN4x4-16LEncapsulation.



5. Pin Definition



XPM52C Pin Diagram (Top View)

QFN16	name	Functional Description
1,2,9	NC	No connection.
3,4,5	VIN	Input voltage pin, close to IC, filter capacitors need to be placed, recommended 100uF.
6,7,8	SW	DPSwitching node, connect the inductor.
10	BST	Bootstrap circuit pin, close to the chipBSTPins andSWPin placement bootstrap capacitor0.1uF, providing voltage for the upper tube gate drive.
11	DM	USBFast charge identification signalDM.
12	DP	USBFast charge identification signalDP.
13	CC2	Type-CDetection pinCC2.
14	CC1	Type-CDetection pinCC1.
15	LINK	Smart power reduction output pin.
16	VOUT	Output Voltage Feedback Pin.
17	PGND	Power ground and heat dissipation ground.



6 Ordering Information

Part Number	USB Type-C port PDO and APDO Configuration	QC Configuration	Package
XPM52CD30A	High Power PDO: 5V/3A, 9V/3A, 12V/2.5A, 15V/2A, 20V/1.5A Low Power PDO : 5V/3A	Class B	QFN16 5K/plate
XPM52CD30	High Power PDO: 5V/3A, 9V/3A, 12V/2.5A, 15V/2A, 20V/1.5A Low Power PDO : 5V/3A, 9V/1.75A	Class A	
XPM52CDP30	High Power PDO: 5V/3A, 9V/3A, 12V/2.5A, 15V/2A, 20V/1.5A High Power APDO1 : 3.3-11V/3A High Power APDO2 : 3.3-16V/2A Low Power PDO : 5V/3A, 9V/1.75A	Class A	
XPM52CD35	PDO: 5V/3A, 9V/3A, 12V/2.92A, 15V/2.33A, 20V/1.75A	Class B	
XPM52CD3515	High Power PDO: 5V/3A, 9V/3A, 12V/2.92A, 15V/2.33A, 20V/1.75A Low Power PDO : 5V/3A, 9V/1.67A	Class A	
XPM52CD3518	High Power PDO: 5V/3A, 9V/3A, 12V/2.92A, 15V/2.33A, 20V/1.75A Low Power PDO : 5V/3A, 9V/2A, 12V/1.5A	Class A	
XPM52CD3518 B	High Power PDO: 5V/3A, 9V/3A, 15V/2.33A, 20V/1.75A Low Power PDO : 5V/3A, 9V/2A	/	
XPM52CD3520	High Power PDO: 5V/3A, 9V/3A, 12V/2.92A, 15V/2.33A, 20V/1.75A Low Power PDO : 5V/3A, 9V/2.22A, 12V/1.67A	Class A	
XPM52CD45	High Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/2.25A Low Power PDO : 5V/3A, 9V/2.5A, 12V/2A, 15V/1.5A	Class A	
XPM52CD65	High Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/3.25A Low Power PDO: 5V/3A, 9V/3A, 12V/2.5A, 15V/2A, 20V/1.5A	Class B	
XPM52CD65	High Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/3.25A High Power APDO1 : 3.3-16V/3.25A High Power APDO2 : 3.3-21V/3A Low Power PDO: 5V/3A, 9V/3A, 12V/2.5A, 15V/2A, 20V/1.5A Low Power APDO1 : 3.3-16V/2A Low Power APDO2 : 3.3-21V/1.5A	Class B	
XPM52CD6545	High Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/3.25A Low Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/2.25A	Class B	
XPM52CDP6545	High Power PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/3.25A High Power APDO1 : 3.3-16V/3.25A High Power APDO2 : 3.3-21V/3A	Class B	



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	Low PowerPDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/2.25A Low PowerAPDO1 : 3.3-16V/2.8A Low PowerAPDO2 : 3.3-21V/2.1A		
Customizable	Customizable		

Printing instructions:

First line,XPM52C: Chip model;

The second line,XXXXXX:Lot Number,X: Retain information.

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7 Specifications

7.1 Extreme operating parameters⁽¹⁾

parameter		Minimum	Maximum	unit
Pressure resistance	V _{IN}	- 0.3	38	V
	V _{SW}	- 0.3	V _{IN}	V
	V _{BST}	V _{SW} -0.3	V _{SW} +6	V
	DM/DP/CC1/CC2	- 0.3	6	V
Junction temperature	T _J	- 40	150	°C
Storage temperature	T _{STG}	- 65	150	°C

(1) Exceeding the operating limit range may cause permanent damage to the device. Long-term operation at the extreme ratings may affect the reliability of the device.

7.2 ESD Performance

symbol	parameter	value	unit
V _{ESD} HBM	Human Model (HBM)	±4000	V

ESD The test is based on the human body discharge model (HBM).

7.3 Recommended operating conditions

parameter		Minimum	Typical Value	Maximum	unit
V _{IN}			12/24		V
L			33		μH
C _{IN}			100		μF
C _{OUT}			220		μF
T _A		- 40		125	°C

7.4 Thermal Resistance

symbol	parameter	value	unit
R _{θJA}	Thermal resistance between junction temperature and ambient temperature ⁽¹⁾	25	°C/W

7.5 Electrical Characteristics

Unless otherwise specified, the following parameters are measured under this condition: V_{IN}=12V, V_{OUT}=5V, L=33μH, T_A=25°C

Parameters	Symbol	Condition	Min	Type	Max	Unit
Synchronous Switching Buck Converter						

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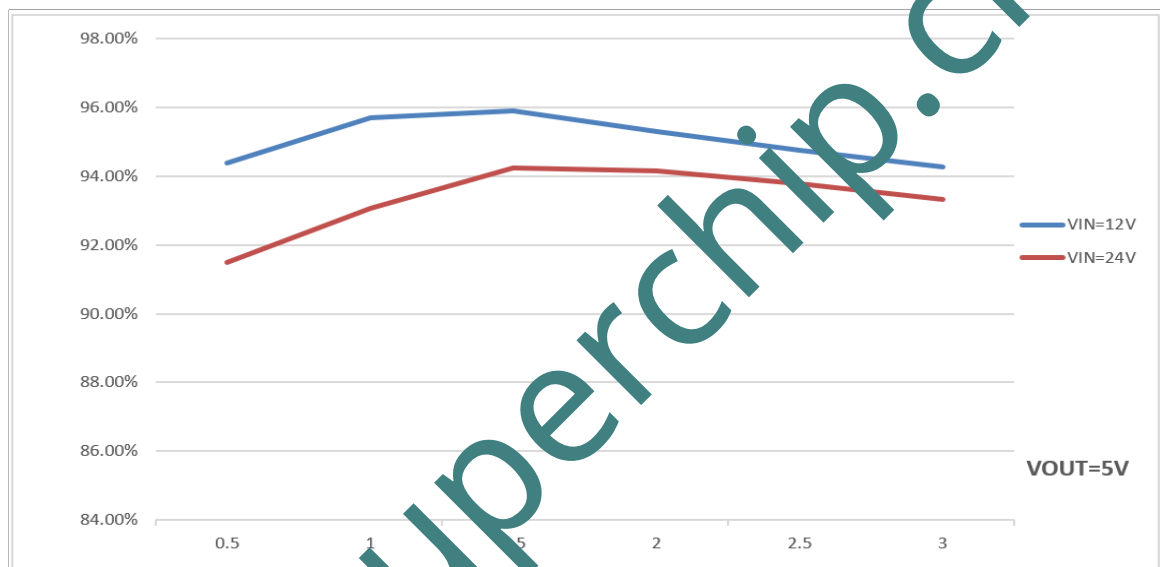
Parameters	Symbol	Condition	Min	Type	Max	Unit
VINUndervoltage current	IUVLO	VIN=6V		400		uA
Static operating current	INOSW	VIN=12V,VOUT=5V		600		uA
Input undervoltage lockout upper threshold	VUVLO_UP			7.3		V
Input undervoltage lockout lower threshold	VUVLO_DOWN			6.2		V
Input undervoltage lockout hysteresis	VUVLO_HYS			1.1		V
Input overvoltage protection	VINOVP			30.5		V
Input overvoltage protection hysteresis	VINOVP_HYS			3		V
Upper tube on-resistance	RDSO_H			30		mΩ
Lower tube on-resistance	RDSO_L			20		mΩ
No-load output voltage	VOUT	VIN=12/24V,VOUT=5V	5.00	5.05	5.10	V
		VIN=12/24V,VOUT=9V	9.00	9.09	9.18	V
		VIN=12,VOUT=12V		11.7		V
		VIN=24V,VOUT=12V	12.00	12.12	12.24	V
		VIN=24V,VOUT=15V	15.00	15.15	15.30	V
		VIN=24V,VOUT=20V	20.00	20.20	20.40	V
Operating frequency	FOSC			120		kHz
Maximum duty cycle	DMAX			97		%
Minimum on-time	TON			200		ns
Maximum output current in constant current mode	ICC	VIN=12V/24V, 3.3V≤VOUT≤8.8V		3		A
		VIN=12V/24V, 9V≤VOUT≤11.8V		3		A
		VIN=24V, 12V≤VOUT≤14.8V		3		A
		VIN=24V, 15V≤VOUT≤20V		2.25		A
Output line compensation voltage	VCOMP			50		mV/A
Over temperature shutdown temperature	TSD			150		°C
Over temperature shutdown hysteresis	TSD_HYS			15		°C



8 Functional Description

8.1 Conversion Efficiency

XPM52C Integrated dual low impedance NMOS, thus providing higher conversion efficiency. High-side NMOS Internal resistance is 72 mΩ, Low-side NMOS Internal resistance is 31 mΩ. At input access 100μF Electrolytic capacitor, output connection 220μF Electrolytic capacitors, 33μH Under the test conditions of inductance, XPM52C The conversion efficiency curve is shown in the figure below.



XPM52C Conversion efficiency curve

If further improvement is needed, XPM52C Conversion efficiency can be improved by taking the following measures:

1. Bundle 100μF Input electrolytic capacitor replaced 4 individual 22μF Chip ceramic capacitors;
2. Use low ESR Inductance;
3. Multilayer Board PCB.
4. Improve product thermal conductivity and speed up heat dissipation.

8.2 Layout Notes

1. Input filter capacitors, especially high-frequency decoupling capacitors, should be placed as close to the input pins as possible. VIN Placement to improve filtering effect.
2. Inductance L Should be close to SW pin to reduce electromagnetic noise.
3. Output Capacitor COUT Close to the inductor L place.
4. The ground connections of the input capacitor and the output capacitor should be connected to the system ground at one point as much as possible.



9 Package size

