

5V, 8A, 550KHz High Efficiency Low Ripple Synchronous Step-Up Converter

Description

The FP6716 is a high efficiency, fixed frequency 550KHz, current mode PWM boost DC/DC converter which could operate battery such as input voltage down to 2.5V. The converter output voltage can be adjusted to a maximum of 5.25V by an external resistor divider. Besides the converter includes a 0.05Ω N-channel MOSFET switch and 0.08Ω P-channel synchronous rectifier. So no external Schottky diode is required and could get better efficiency near 90%.

The converter is based on a fixed frequency, current mode, pulse-width-modulation PWM controller that goes automatically into PSM mode at light load.

When converter operation into discontinuous mode, the internal anti-ringing switch will reduce interference and radiated electromagnetic energy.

The FP6716 is available in a space-saving SOP-8 (Exposed Pad) package for portable application.

Features

- High Efficiency up to 90%
- Low $R_{DS(ON)}$ Integrated Power MOSFET
- NMOS 50mΩ/PMOS 60mΩ
- Wide Input Voltage Range: 2.5V to 5.25V
- Fixed 550KHz Switching Frequency
- Low-Power Mode for Light Load Conditions
- $\pm 2.0\%$ Voltage Reference Accuracy
- Adjustable Current Limit
- PMOS Current Limit for Short Circuit Protection
- Low Quiescent Current
- Output Ripple under 200mV (Scope Full Bandwidth)
- Input Under Voltage Lockout
- Internal Compensation Function
- Built-In Soft Start Function
- Over-Temperature Protection with Auto Recovery
- Output Overvoltage Protection
- SOP-8 (Exposed Pad) Pb-Free Package

Applications

- Portable Power Bank
- Wireless Equipment
- Handheld Instrument
- GPS Receiver

Pin Assignments

SP Package (SOP-8 Exposed Pad)

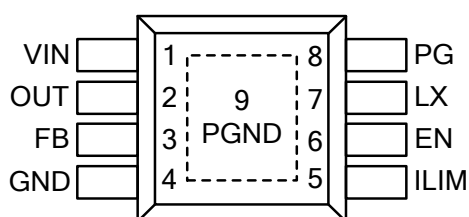
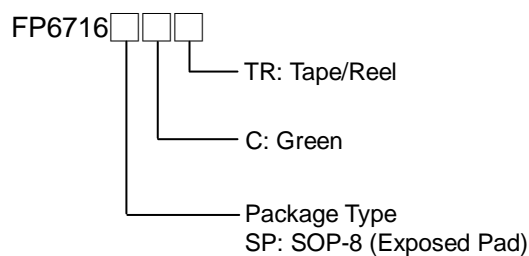
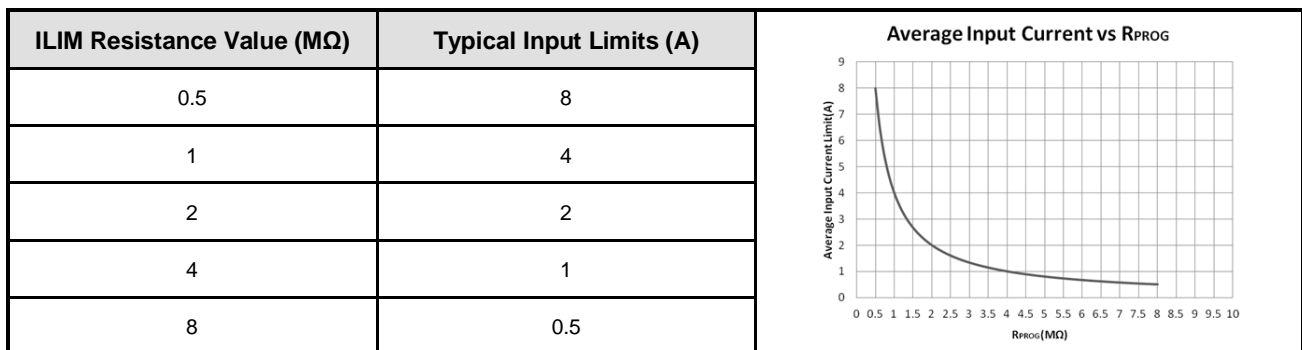
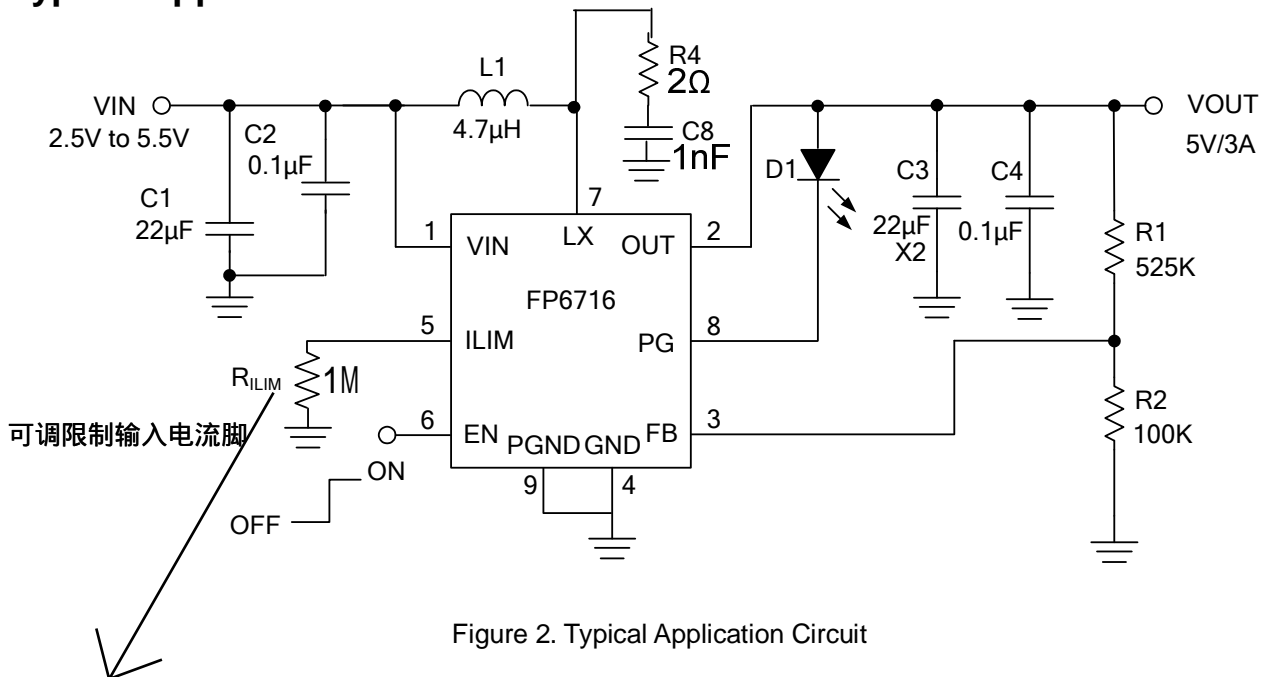


Figure 1. Pin Assignment of FP6716

Ordering Information



Typical Application Circuit



Functional Pin Description

Pin Name	Pin No.	Pin Function
VIN	1	Power Supply Input Pin.
OUT	2	Output of the Synchronous Rectifier.
FB	3	Voltage Feedback Input Pin.
GND	4	Ground Pin. Connect GND to exposed pad.
ILIM	5	Programming Input for Average Input Current.
EN	6	Logic Controlled Shutdown Input.
LX	7	Power Switching Connection. Connect LX to the inductor and output rectifier.
PG	8	Power Good Indication Open Drain Pin.
PGND	9	Power Ground Pin.

Block Diagram

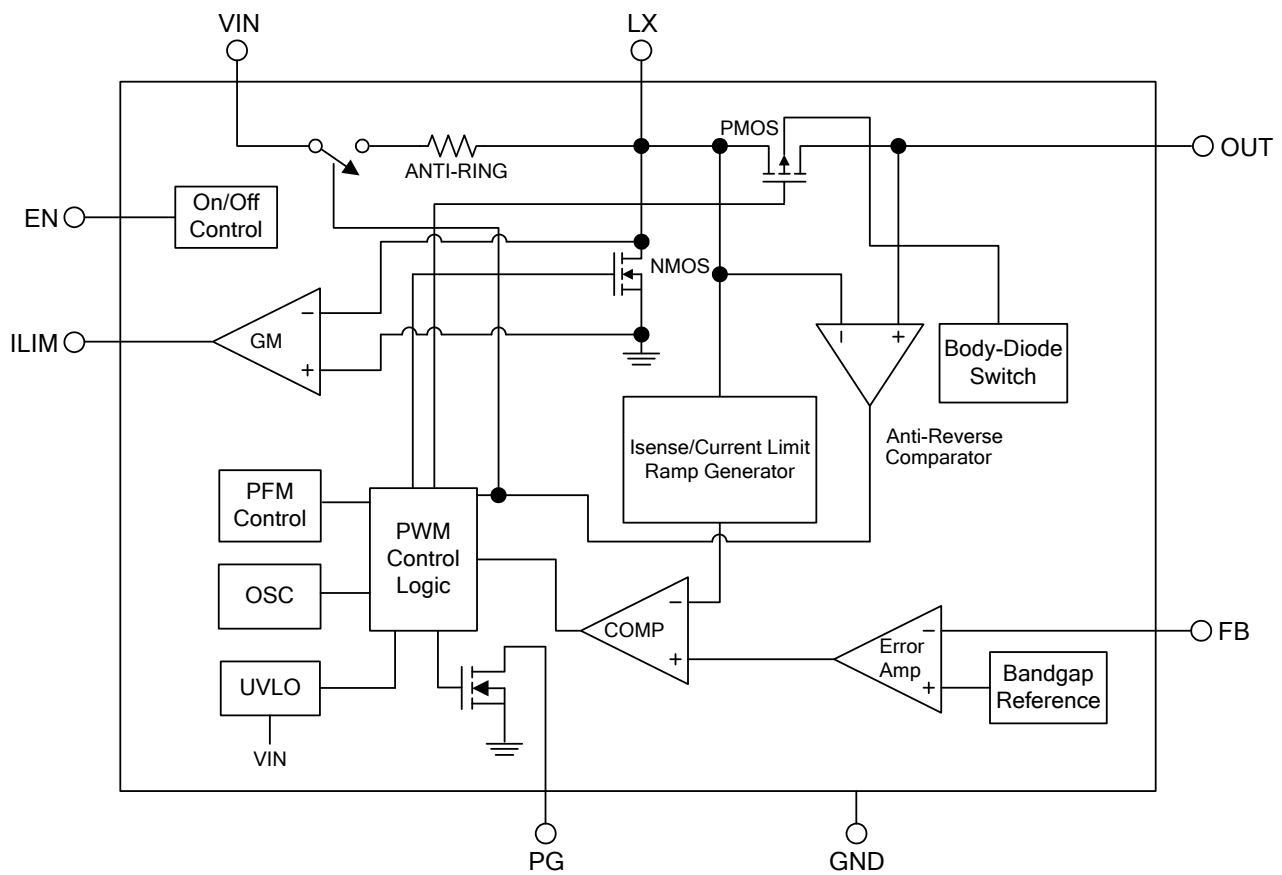


Figure 3. Block Diagram of FP6716

Absolute Maximum Ratings (Note 1)

- Supply Voltage V_{IN} ----- -0.3V to +6.5V
- LX Voltage V_{LX} ----- -0.3V to +6.5V
- All Other Pins Voltage ----- -0.3V to +6.5V
- Maximum Junction Temperature (T_J) ----- +150°C
- Storage Temperature (T_S) ----- -65°C to +150°C
- Lead Temperature (Soldering, 10sec.) ----- +260°C
- Package Thermal Resistance, (θ_{JA})
 SOP-8 (Exposed Pad) ----- 60°C/W
- Package Thermal Resistance, (θ_{JC})
 SOP-8 (Exposed Pad) ----- 15°C/W

Note 1 : Stresses beyond this listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Supply Voltage V_{IN} ----- +2.5V to +5.25V
- Output Voltage Range ----- up to +5.25V
- Operation Temperature Range ----- -40°C to +85°C

Electrical Characteristics

($V_{IN}=3.3V$, $T_A=25^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
VIN Input Supply Voltage	V_{IN}		2.5		5.25	V
VIN Supply Current (Switching)		$V_{IN}=3.3V$, $V_{FB}=0.7V$ Measure V_{IN}		300	500	μA
VIN Supply Current (No witching)		$V_{FB}=1V$		30		μA
Feedback Voltage	V_{FB}	$2.5V \leq V_{IN} \leq 5.5V$	0.784	0.8	0.816	V
High-Side PMOSFET $R_{DS(ON)}$				60		m Ω
Low-Side NMOSFET $R_{DS(ON)}$				50		m Ω
High-Side MOSFET Leakage Current	$I_{LX(leak)}$	$V_{LX}=5.5V$, $V_{OUT}=0V$			10	μA
Low-Side MOSFET Leakage Current		$V_{LX}=5.5V$			10	μA
Oscillation Frequency	F_{OSC}		450	550	650	KHz
Short Circuit Trip Point		Monitored FB voltage		0.3		V
Short Circuit Current Limit		$V_{IN} = 3.3V$		50		mA
Maximum Duty Cycle	D_{MAX}	$V_{IN}=3.3V$	90			%
ILIM Current				8		A
		$R_{ILIM}=500K$		8		A
ILIM Current Gain		$V_{IN}=3.3V$		8		M Ω -A/A
Line Regulation		$V_{IN}=2.5V$ to $5.5V$, $I_{OUT}=100mA$			1	%
Load Regulation		$I_{OUT}=0A$ to $1A$		0.5		%
Input UVLO Threshold	$V_{UVLO(VTH)}$	V_{IN} Rising		2.3		V
Under Voltage Lockout Threshold Hysteresis	$V_{UVLO(HYS)}$	V_{IN} Falling		300		mV
OVP Threshold Voltage on OUT Pin				6		V
OVP Threshold Hysteresis				500		mV
Internal Soft-Start Time				1	3	ms
Power Good Active		Monitored FB, with respect to V_{FB}		90		%
Power Good Hysteresis				5		%
PG Low Output		Sink 20mA			0.4	V
PG Leakage Current		PG=6.0V			1	μA
EN Input Low Voltage	$V_{EN(L)}$				0.4	V
EN Input High Voltage	$V_{EN(H)}$		1.4			V
EN Input Current	I_{EN}	$V_{IN}=3.3V$		2		μA

Electrical Characteristics (Continued)

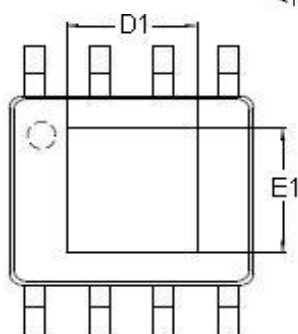
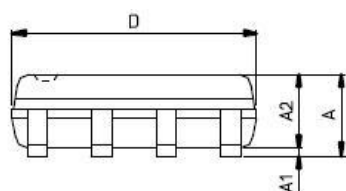
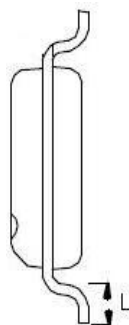
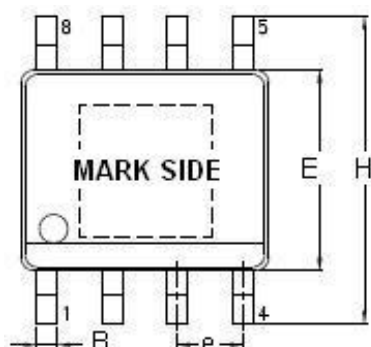
($V_{IN}=3.3V$, $T_A=25^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal Shutdown Threshold (Note 2)	T_{SD}			150		$^{\circ}C$
Thermal Shutdown Hysteresis				30		$^{\circ}C$

Note 2 : Not production tested.

Outline Information

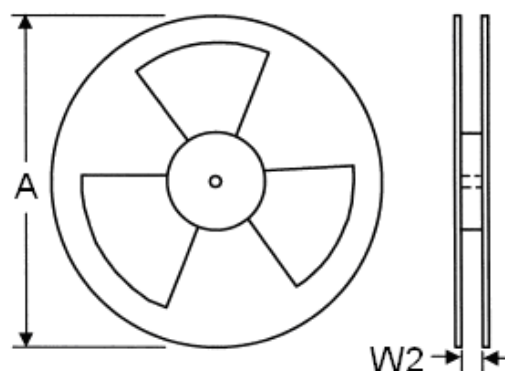
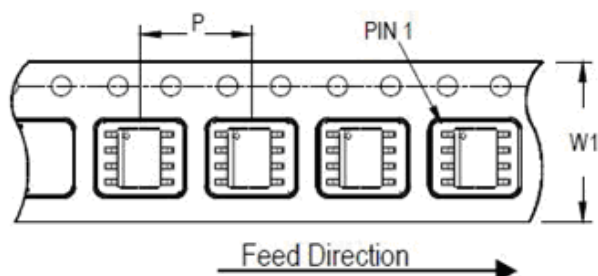
SOP-8 (Exposed Pad) Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.25	1.70
A1	0.00	0.15
A2	1.25	1.55
B	0.31	0.51
D	4.80	5.00
D1	3.04	3.50
E	3.80	4.00
E1	2.15	2.41
e	1.20	1.34
H	5.80	6.20
L	0.40	1.27

Note : Followed From JEDEC MO-012-E.

Carrier Dimensions



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
12	8	13	330	12.4	400~1000	2,500

Life Support Policy

Fitipower's products are not authorized for use as critical components in life support devices or other medical systems.

FP6716 IC特性

- 92%高效能同步升压转换器.
- 输入电压应用范围： 2.5V 至 5.25V.
- IC 在关断状态可完全隔离 输入端VIN 与输出端VOUT.
- 内置低内阻功率 MOSFET管.
NMOS 50mΩ / PMOS 80mΩ
- 550KHz 固定操作频率.
- PWM / PSM 双套式控制, 能自动切换到PSM 套式以提升轻载状态效能.
- ±2.0% 电压精确度.
- 可调电感峰值限流点，藉由ILIM 脚位电阻值.
- 输出端短路保护机制.
- IC静态电流低.
- 快速暂态反应
- 内置软启动功能及输入欠压锁定.
- IC过温保护及自动恢复侦测

外部元件选择及设定

FP6716/17 反馈电压 $V_{FB}=0.8V$ ，所以输出电压计算公式 $V_{out}=0.8V * (1+R1/R2)$, 分压电阻阻值 以 10KΩ or 100KΩ 为建议级距 .

Part Number	Output Voltage (V)	R1 (KΩ)	R2 (KΩ)	Note
FP6716 FP6717	5.0	525	100	Resistor accuracy is 1%
	5.1	645	120	
	5.25	584.1	105	

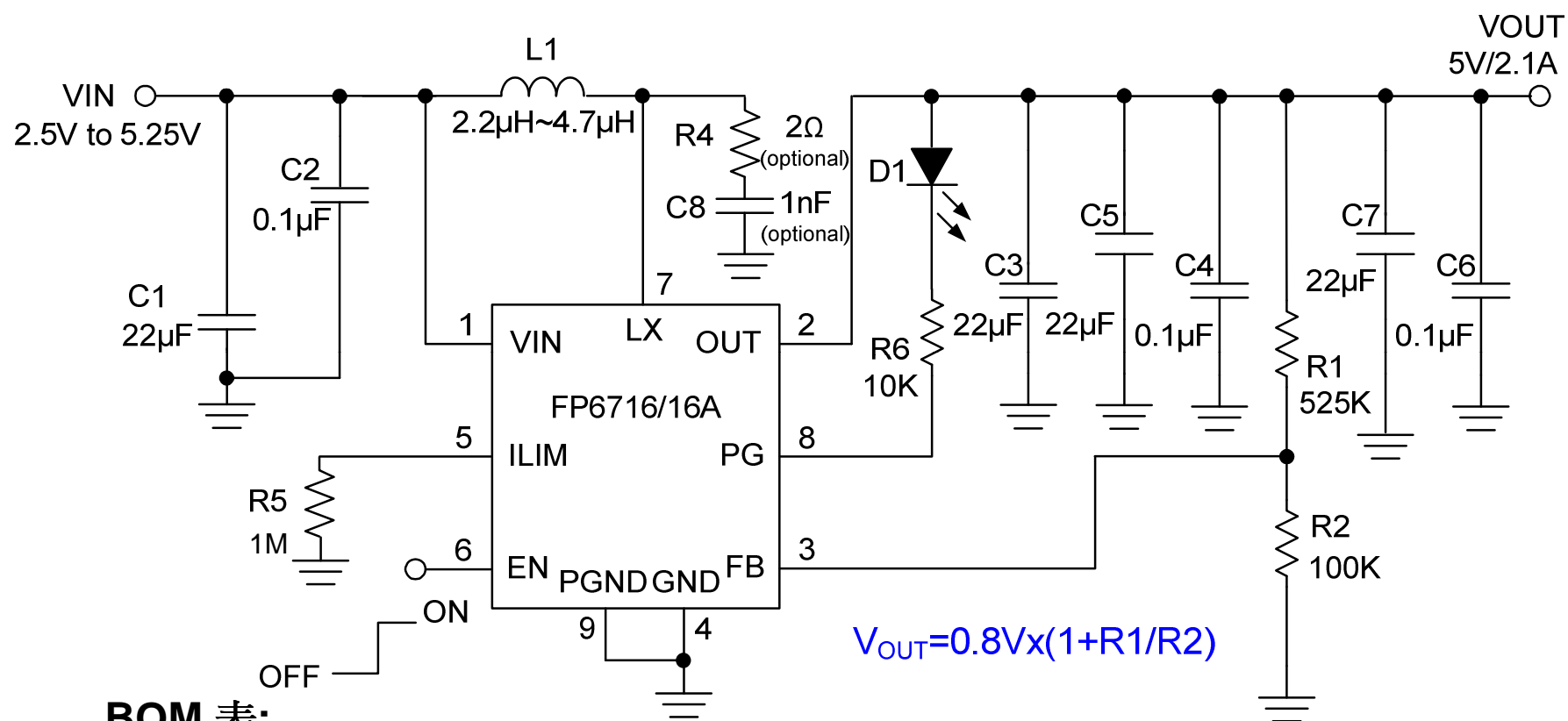
最大输出电压额定建议值为5.25V。上表为输出端反馈分压电阻设定值。

输入 / 输出电容 尺寸型式，电感电流额定会影响升压 IC 的稳定性及可靠度。

Part Number	Output Loading	C _{IN} (uF)	C _{OUT} (uF)	Inductor (uH)
FP6716SPCTR	5.0V/2.1A	22 (1206)	2x22(1206)	2.2~4.7 (6A current rating)

电感额定电流的计算公式为：{P_{OUT}/(V_{IN} * η)}* 1.3 倍。1.3倍的设定倍率是考量电感电流峰值涟波。
举例来说，{(5V * 2.1A)/ (3V* 0.85)}* 1.3= 5.35A, 所以使用者可挑选6A 额定电流的电感。.

FP6716/16A 典型应用电路

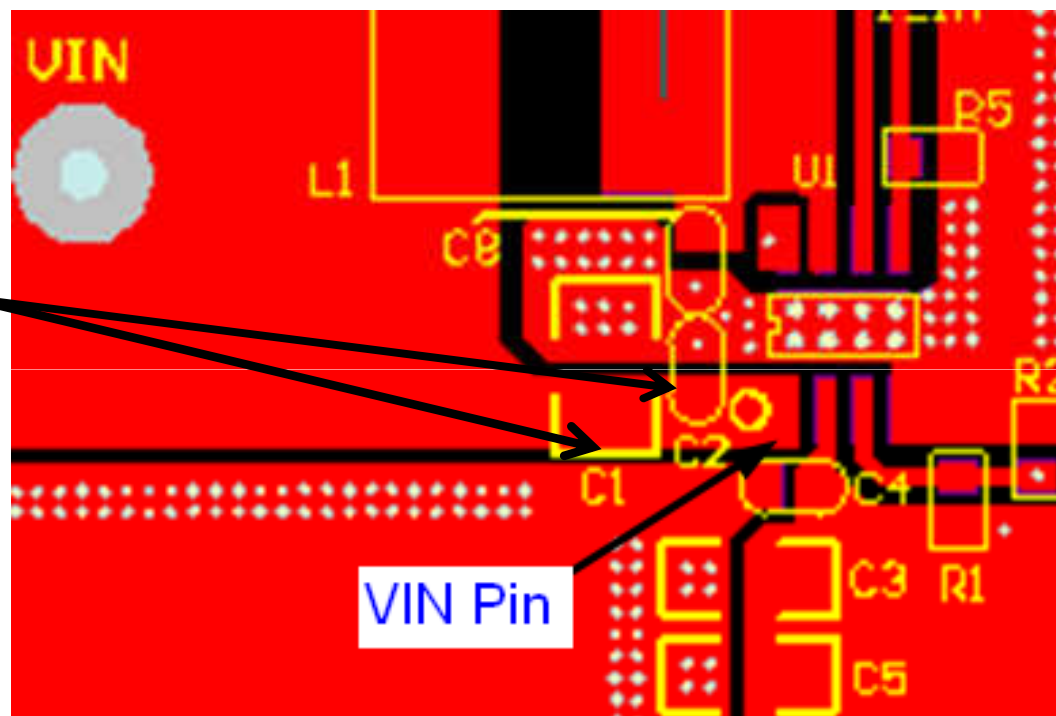
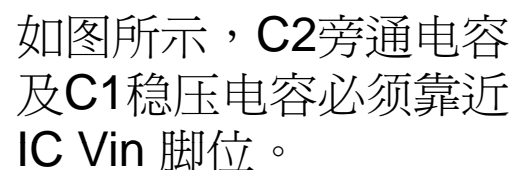


BOM 表:

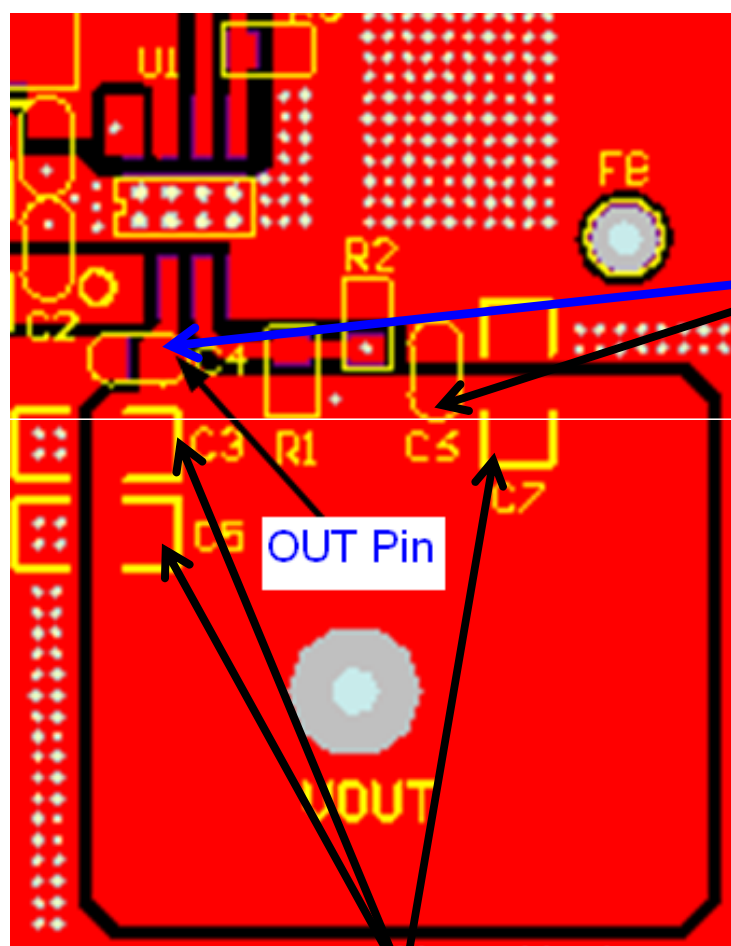
编号	元件类别	功能描述	附注
R1	贴片电阻	525KΩ 1/10W 1% 0603	
R2	贴片电阻	100KΩ 1/10W 1% 0603	
R4	贴片电阻	0805 2Ω 1/8W 5% 0805 (optional)	
R5	贴片电阻	1MΩ 1/10W 1% 0603	
R6	贴片电阻	10KΩ 1/10W 1% 0603	
C1	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C2	贴片电容	Ceramic Cap. 100nF 0603 type /50V	
C3	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C4	贴片电容	Ceramic Cap. 100nF 0603 type /50V	
C5	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C6	贴片电容	Ceramic Cap. 100nF 0603 type /50V	
C7	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C8	贴片电容	Ceramic Cap. 1nF 0603 type /50V (optional)	
D1	LED发光二极管	0805 SMD Green color LED	
L1	电感	4.7uH 6A	
U1	IC	FP6716/16A (SOP-8 EP)	
	PCB	公用板FP6716	

FP6716 佈局指南—输入电容C_{IN} (一)

输入旁通电容必须靠近Vin 脚位 (IC脚位 1)，为了提升IC PSRR 抗无用信息能力。



输出旁通电容必须靠近OUT 脚位 (IC脚位 2)，可抑制高频无用信息。



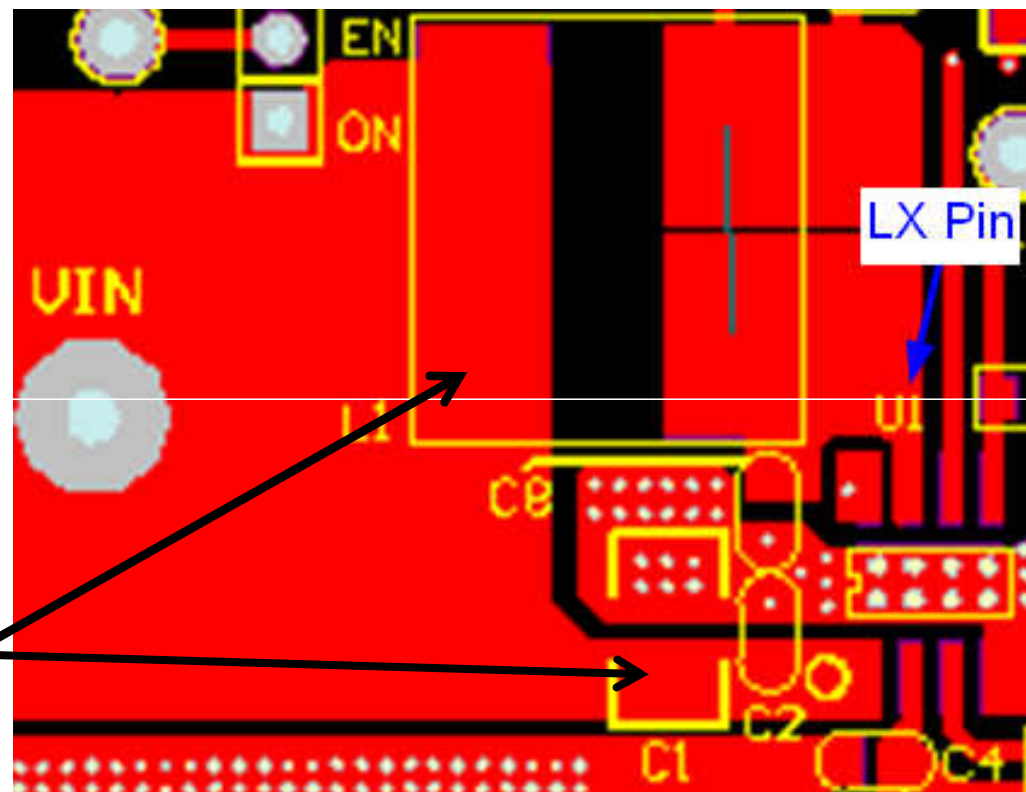
如图所示，C4 / C6 旁
通电容尽可能靠近IC 脚
位。

佈局指南—输出电容C_{OUT} (二)

C3/C5/C7 稳压电容也尽可能靠近OUT 脚位。

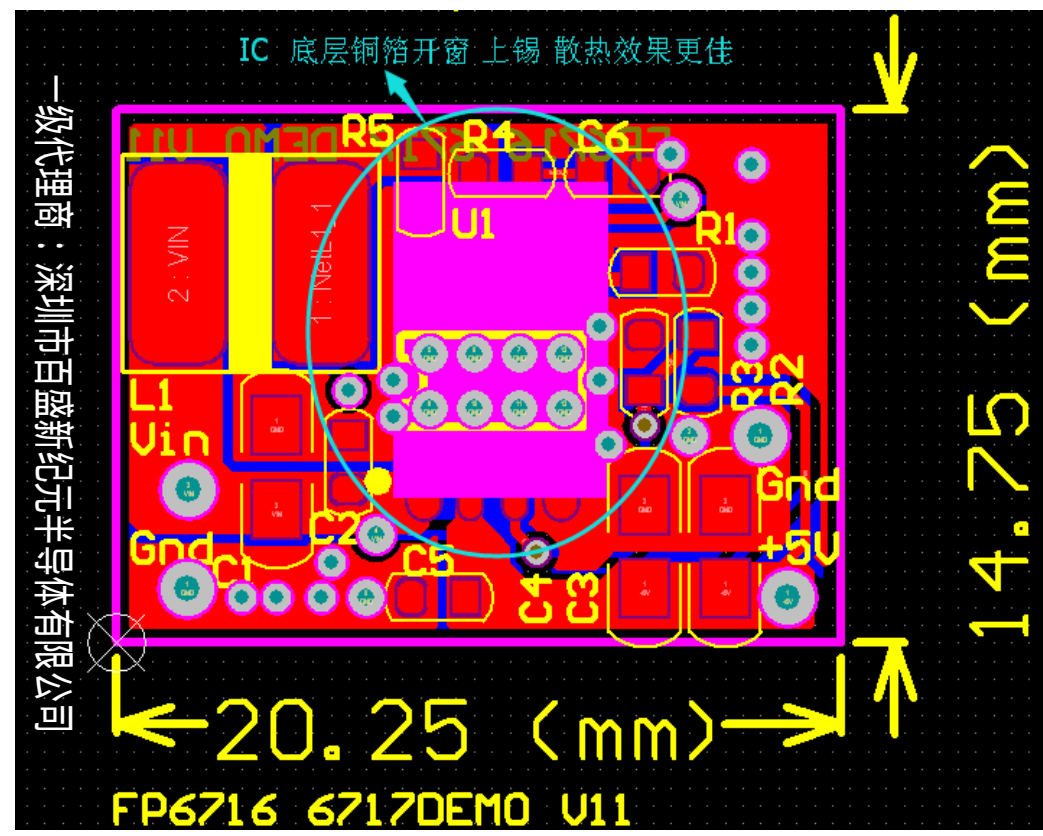
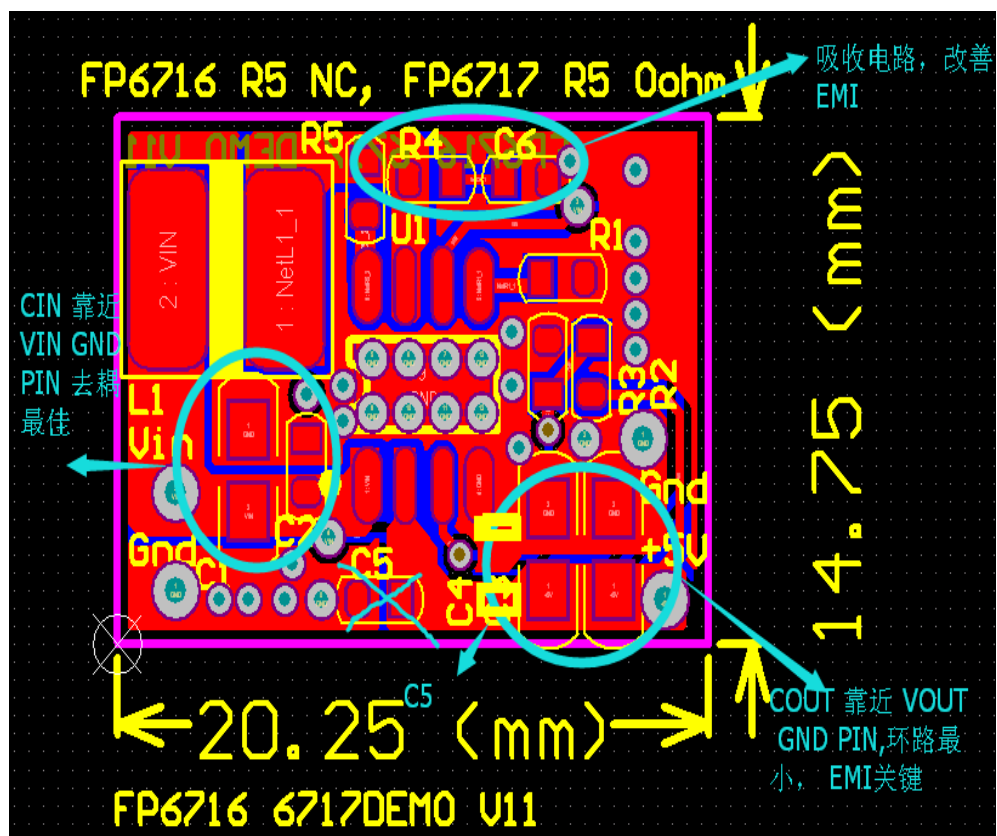
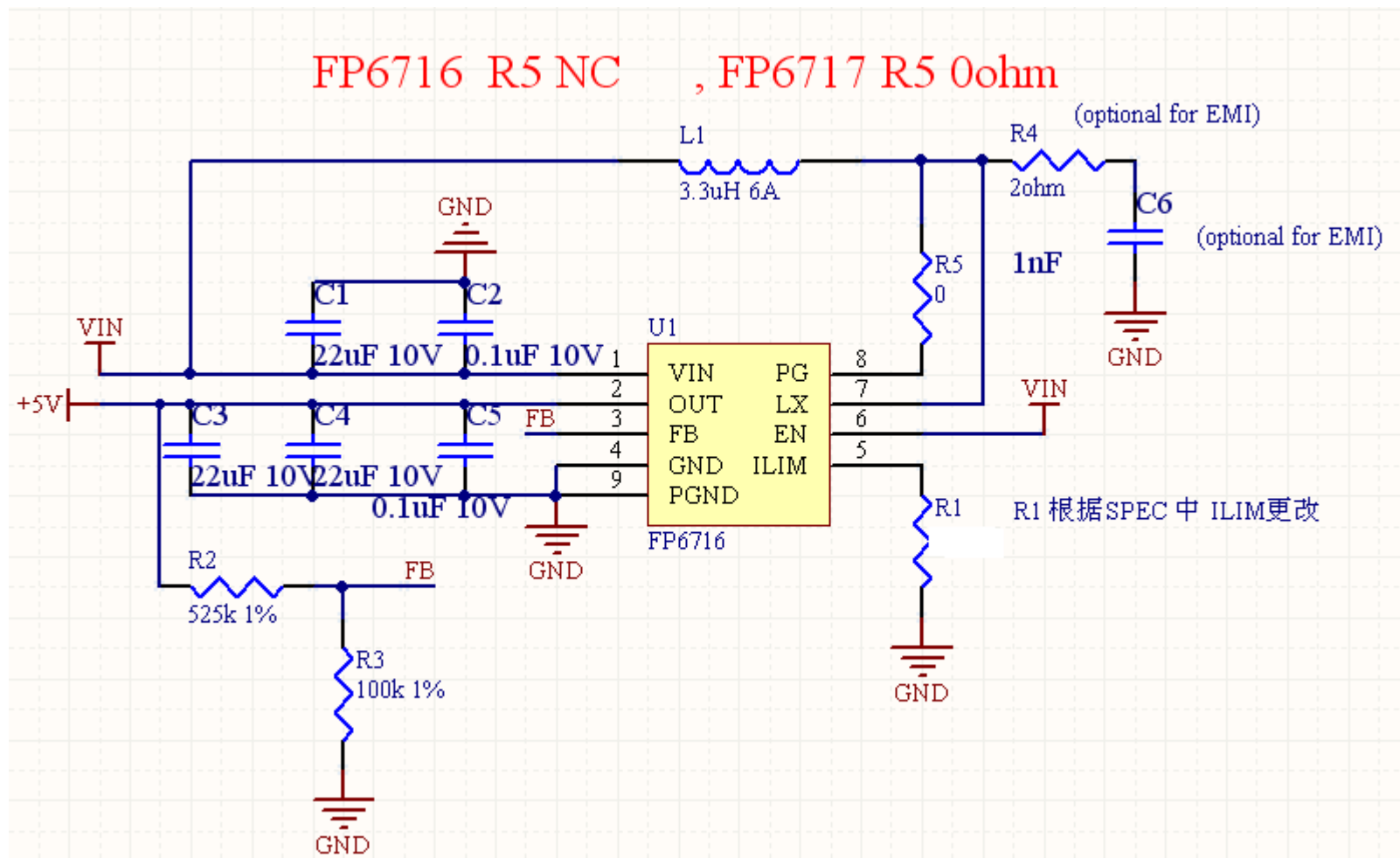
FP6716 佈局指南 —电感 L (三)

电感L走线铜箔必须宽且短，尽可能与IC在同一板面，因为IC 内部MOS管依据占空比执行切换动作，则LX脚位有较高能量的切换干扰无用信息。



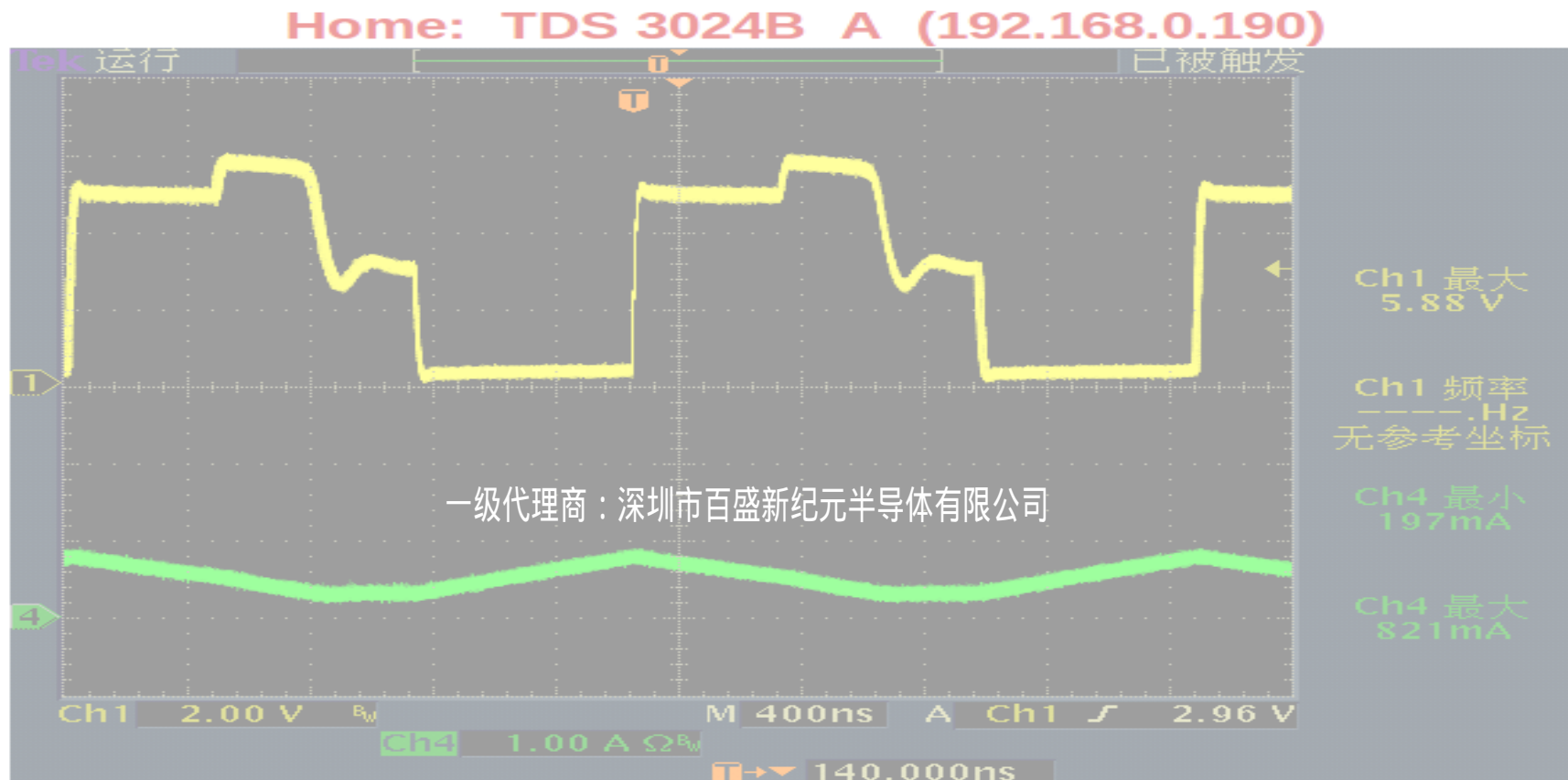
如图所示，电感L的位置必须在C1 电容之后，因为LX 脚位的切换无用信息能先被C1 电容抑制，避免直接干扰IC.

实际应用



注意事项

- 注意点：1、DCM 时，L电流未过零时，HS PMOS 切换至 body-diode，故出现如下波形，属正常波形。



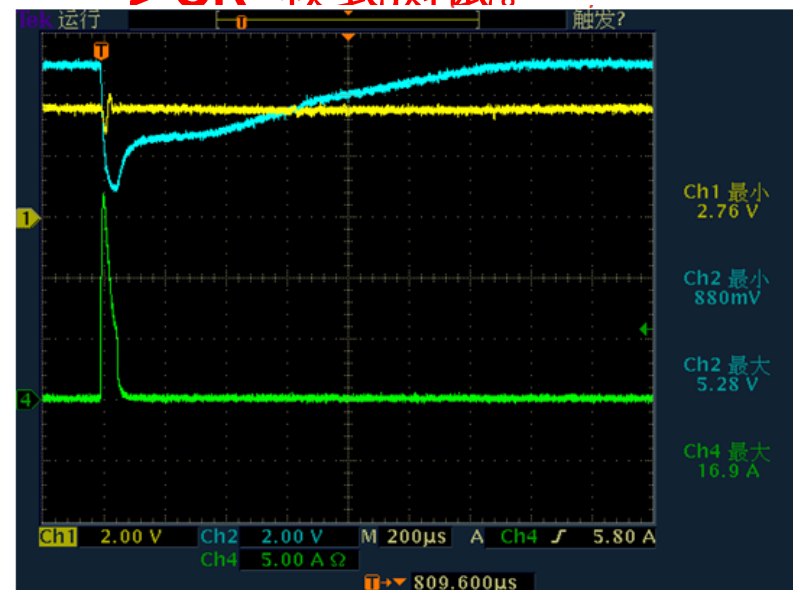
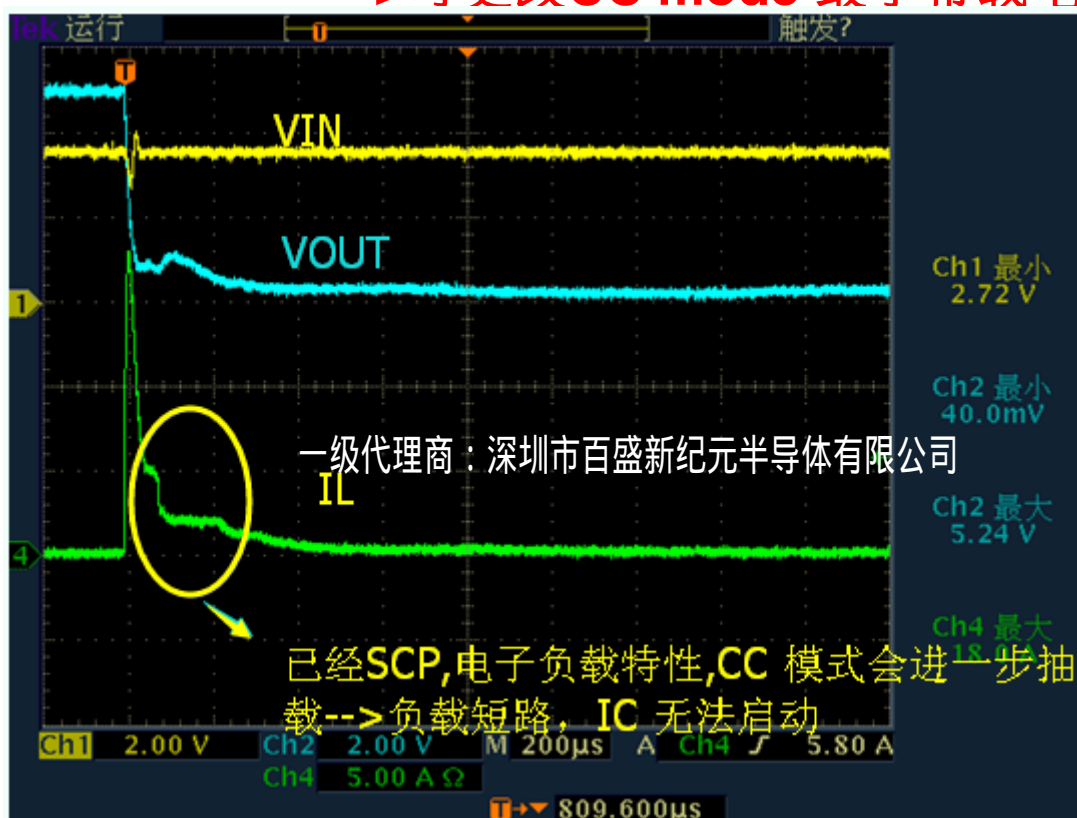
- 注意点2：负载用纯电阻做带载插拔测试，输出电压正常。
电子负载 CC 模式带载插拔会触发SCP,至输出无电压。

CONFIDENTIAL

---->可更改CC mode 最小带载电压，最小卸载电压（

Voff 3V,通常电池充电IC 工作电压都在4V 以上。）

----> CR 模式测试。



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