5V, 3.1A, 550KHz High Efficiency Low Ripple Synchronous Step-Up Converter

Description

The FP6717 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 39mΩ N-channel MOSFET switch and 42mΩP-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 FP6717 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 39mΩ/PMOS 42mΩ
- Wide Input Voltage Range: 2.5V to 5.25V
- Fixed 550KHz Switching Frequency
- Low-Power Mode for Light Load Conditions
- ±2.0% Voltage Reference Accuracy
- Adjustable Current Limit
- PMOS Current Limit for Short Circuit Protection
- Low Quiescent Current
- 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)

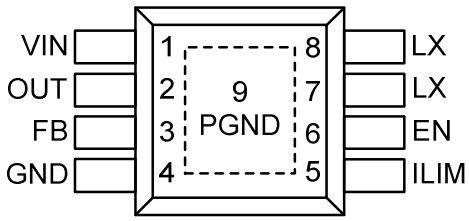
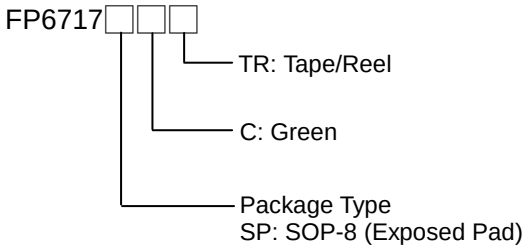
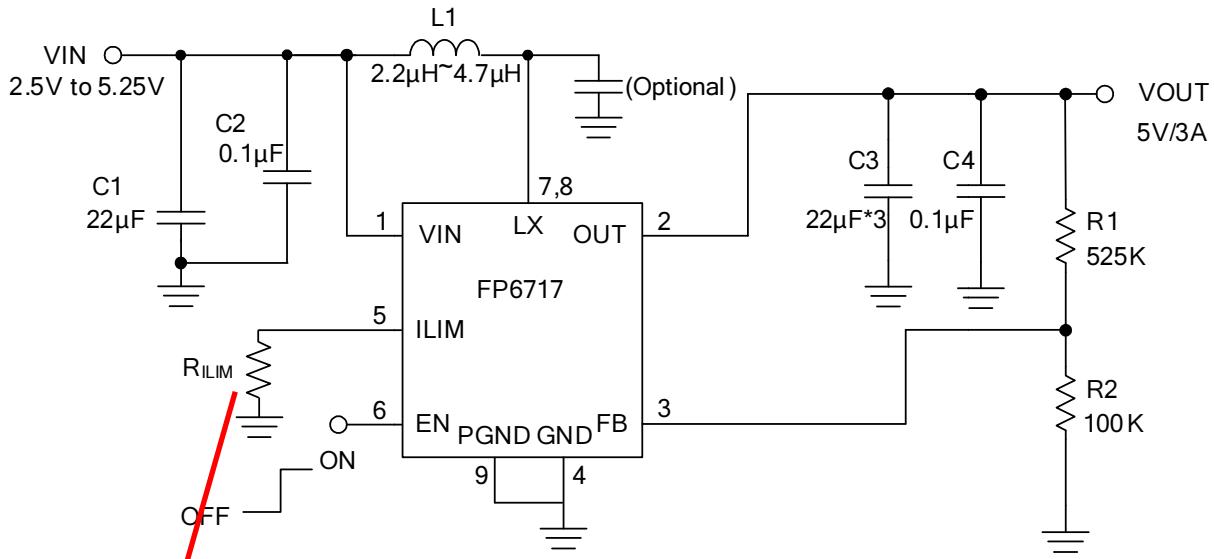


Figure 1. Pin Assignment of FP6717

Ordering Information



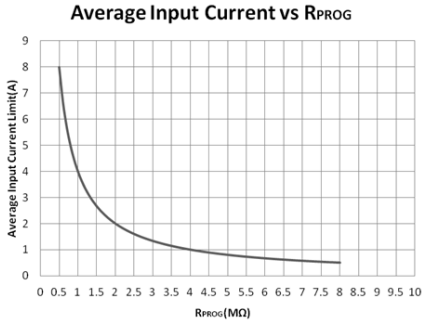
Typical Application Circuit



注意：IC第5脚是限流脚，限制的是输入端的电流。
输出电流2A时，建议阻值：1M

Figure 2. Typical Application Circuit

ILIM Resistance Value (MΩ)	Typical Input Limits (A)
0.5	8
1	4
2	2
4	1
8	0.5



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	7,8	Power Switching Connection. Connect LX to the inductor and output rectifier.
PGND	9	Power Ground Pin.

Block Diagram

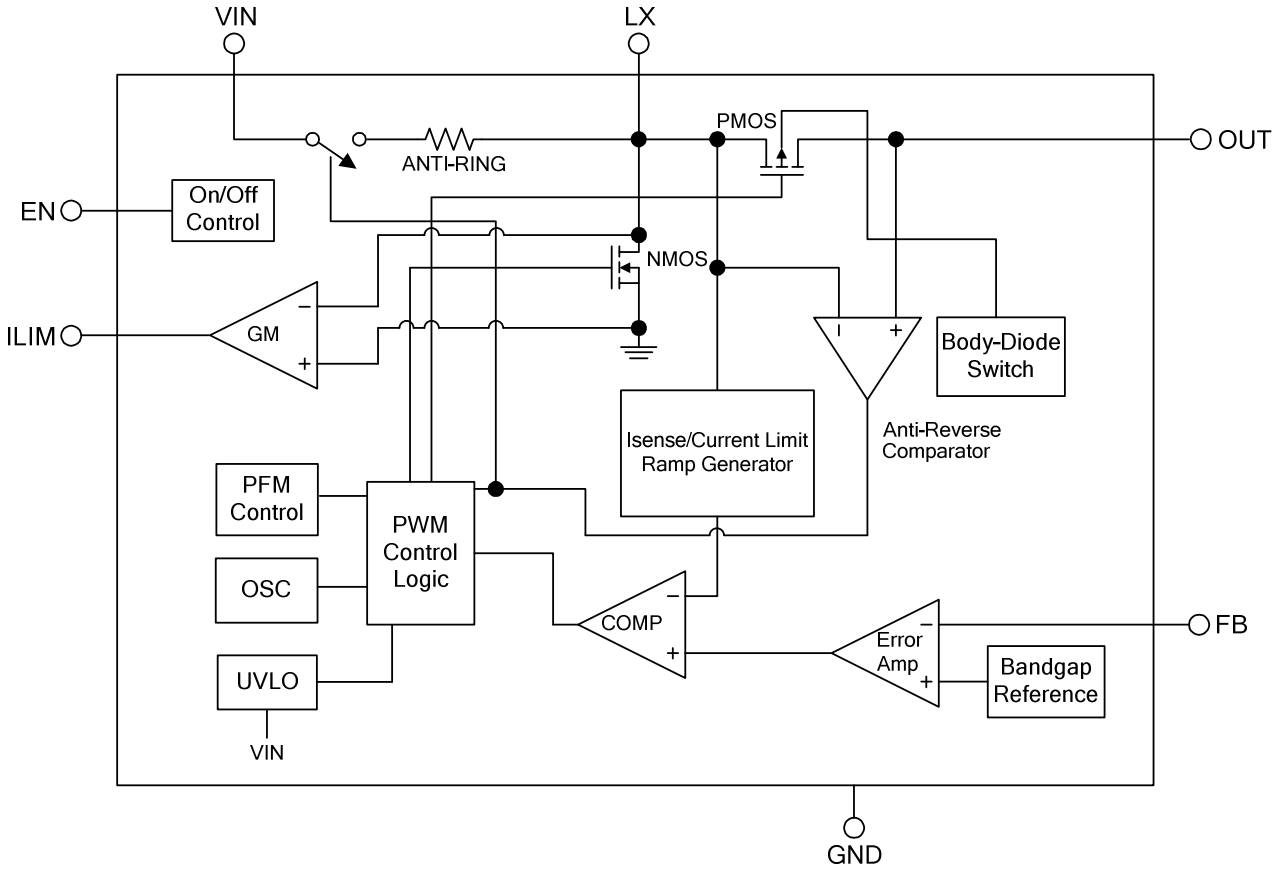


Figure 3. Block Diagram of FP6717

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℃
- Storage Temperature (T_S) ---------- -65℃ to +150℃
- Lead Temperature (Soldering, 10sec.) ---------- +260℃
- Package Thermal Resistance, (θ_{JA})

  SOP-8 (Exposed Pad) ---------- 60℃/W
- Package Thermal Resistance, (θ_{JC})

  SOP-8 (Exposed Pad) ---------- 15℃/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℃ to +85℃

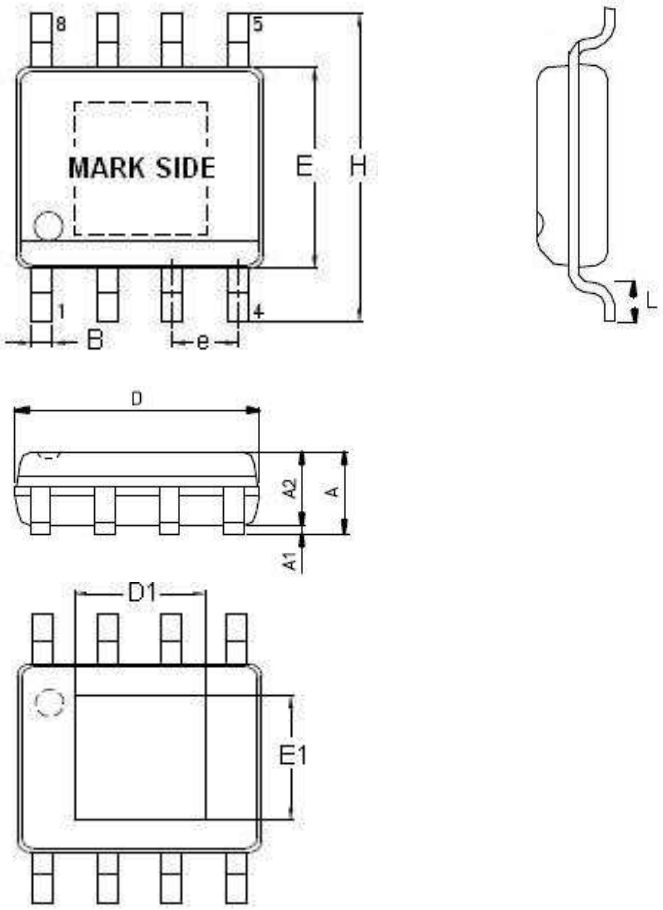
Electrical Characteristics

(V_{IN}=3.3V, T_A=25℃ , 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		45		μA
Feedback Voltage	V_{FB}	2.5V≦V_{IN}≦5.5V	0.784	0.8	0.816	V
High-Side PMOSFET R_{DS}(ON)				42		mΩ
Low-Side NMOSFET R_{DS}(ON)				39		mΩ
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		R_{ILIM}=500K		8		A
ILIM Current Gain		V_{IN}=3.3V		8		MΩ-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		250		mV
OVP Threshold Voltage on OUT Pin				5.7		V
OVP Threshold Hysteresis				350		mV
Internal Soft-Start Time				1	3	ms
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
Thermal Shutdown Threshold (Note 2)	TSD			150		℃
Thermal Shutdown Hysteresis				30		℃

Outline Information

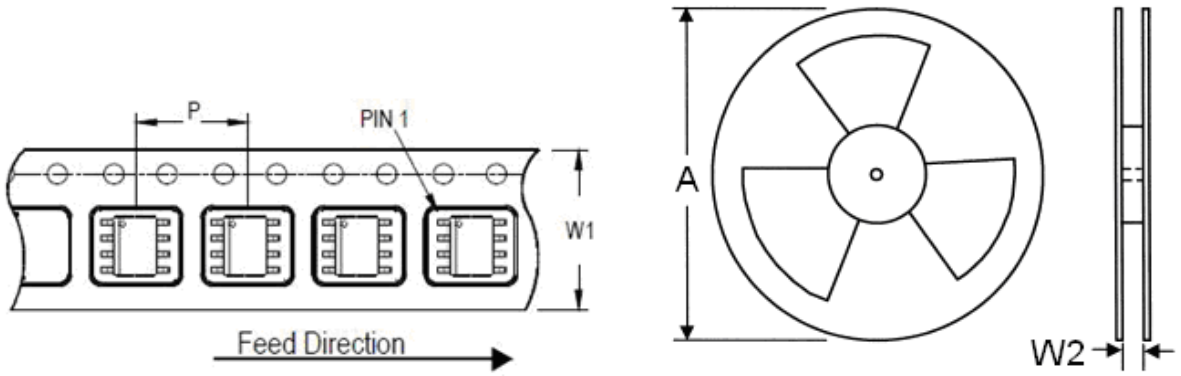
SOP-8 (Exposed Pad) Package (Unit: mm)



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.

FP6717 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 39mΩ / PMOS 42mΩ
- 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Vout=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	

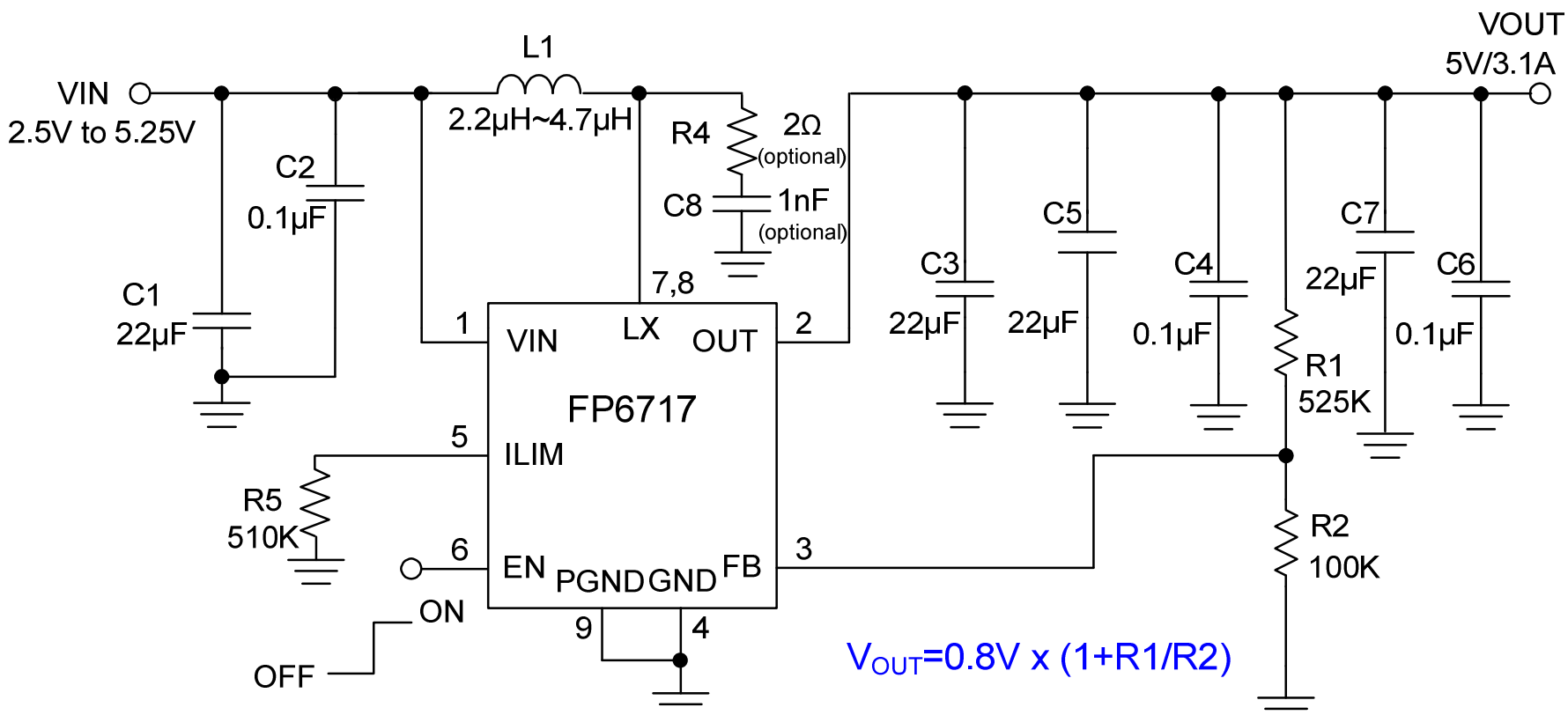
最大输出电压额定建议值为5.25V。上表为输出端反馈分压电阻设定值。

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： $\{P_{OUT}/(V_{IN} * \eta)\}$* 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。.

FP6717典型应用电路

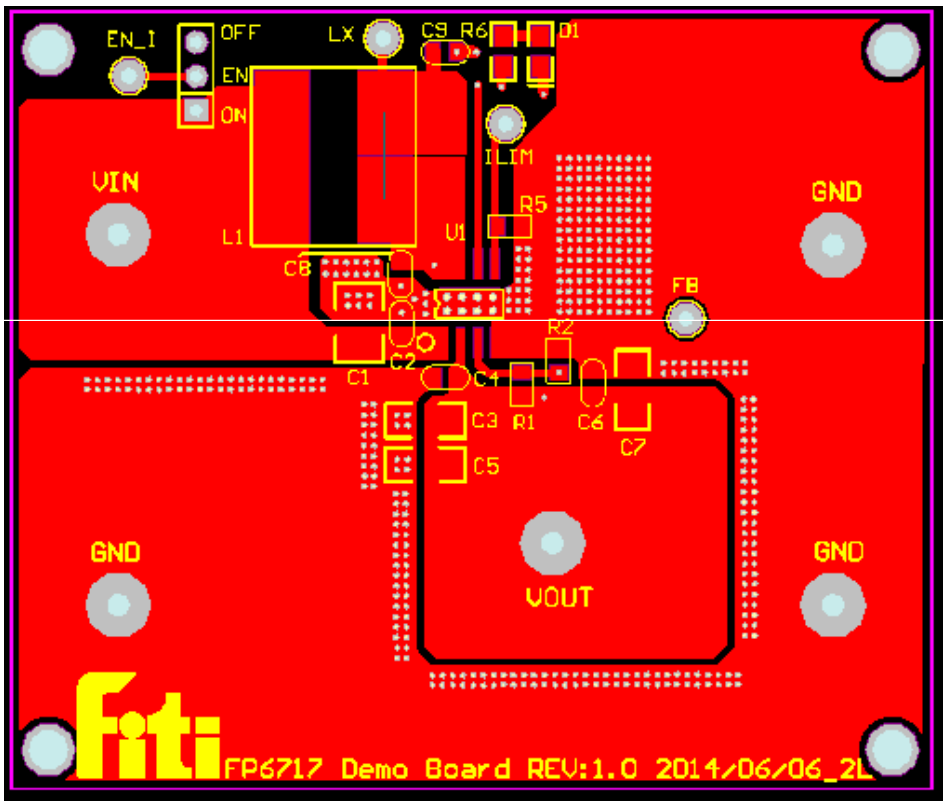


BOM 表:

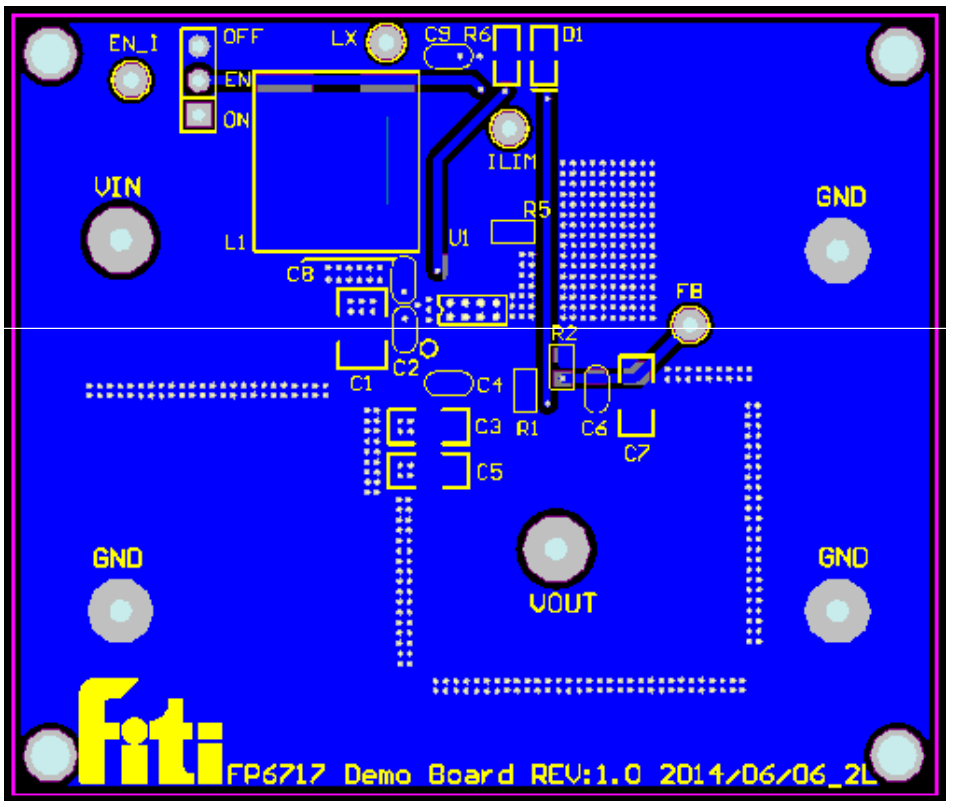
编号	元件类别	功能描述	附注
R1	贴片电阻	525KΩ 1/10W 1% 0603	
R2	贴片电阻	100KΩ 1/10W 1% 0603	
R4	贴片电阻	0805 2Ω 1/8W 5% 0805 (optional)	
R5	贴片电阻	510KΩ 1/10W 1% 0603	
R6	贴片电阻	10KΩ 1/10W 1% 0603	
C1	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C2	贴片电容	Ceramic Cap. 100nF 0603 type /50V	
C3	贴片电容	MLCC 22uF±10% X5R 1206 type /16V	
C4	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)	
L1	电感	4.7uH 8A	
U1	IC	FP6717 (SOP-8 EP)	
	PCB	公板FP6717	

FP6717 PCB 佈局指南

上视图



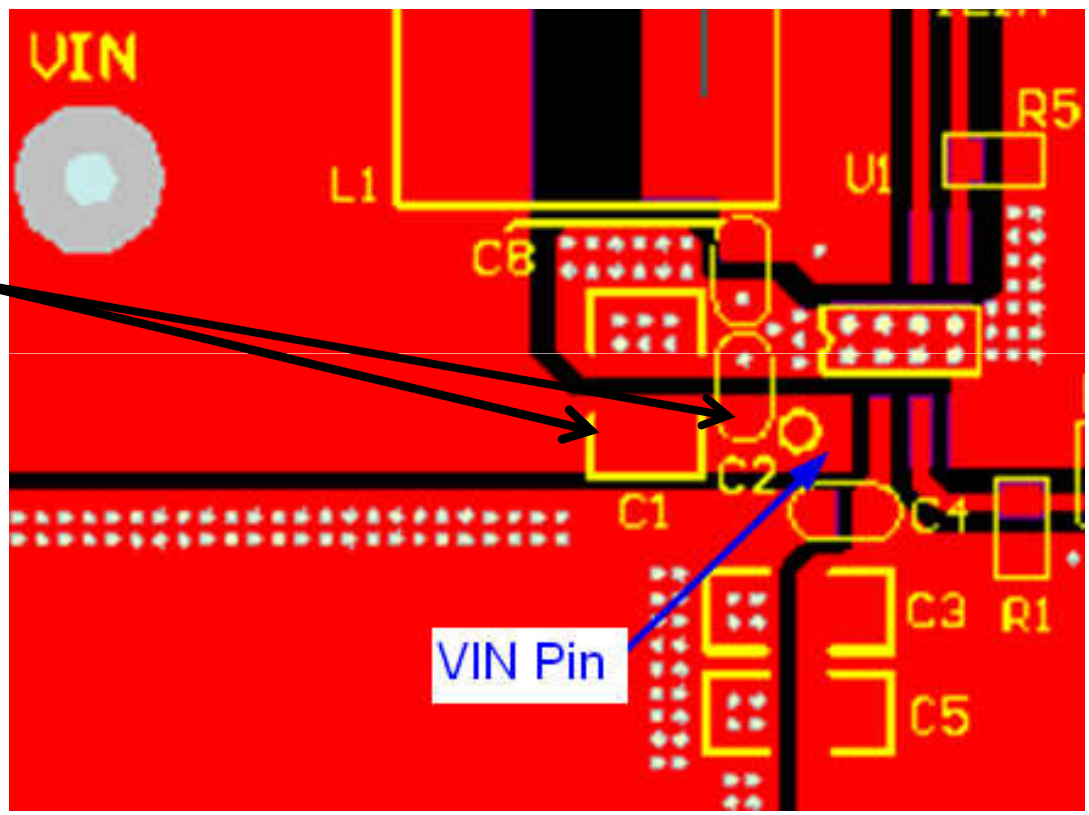
下视图



佈局指南—输入电容 C_{IN} (一)

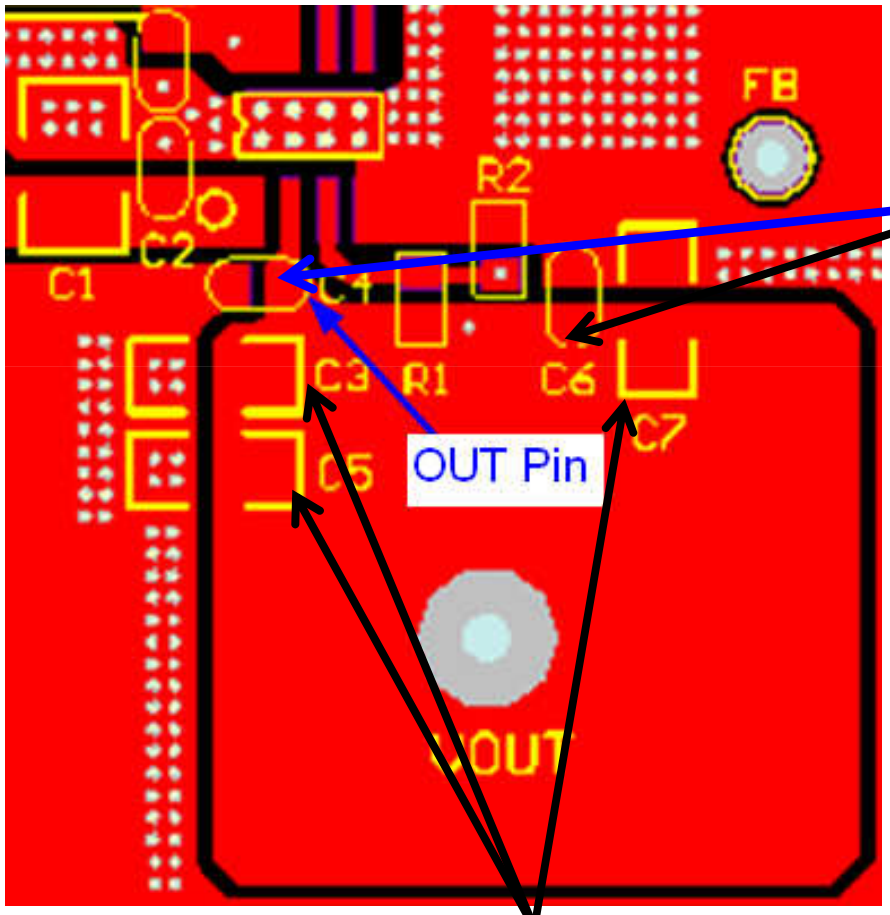
输入旁通电容必须靠近Vin 脚位 (IC脚位 1)，为了提升IC PSRR 抗无用信息能力。

如图所示，C2旁通电容及C1稳压电容必须靠近IC Vin 脚位。



佈局指南—输出电容C_{OUT}(二)

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。

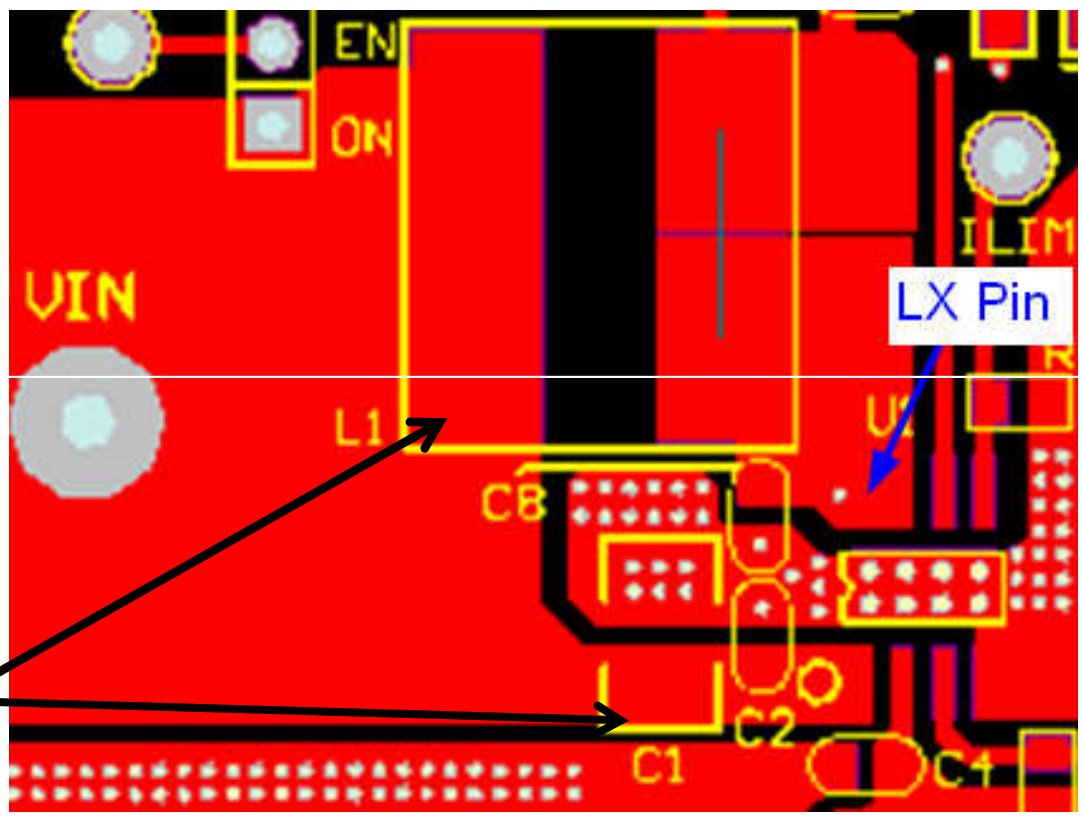


如图所示，C4 / C6 旁通电容尽可能靠近IC 脚位。

C3/C5/C7 稳压电容也尽可能靠近OUT 脚位。

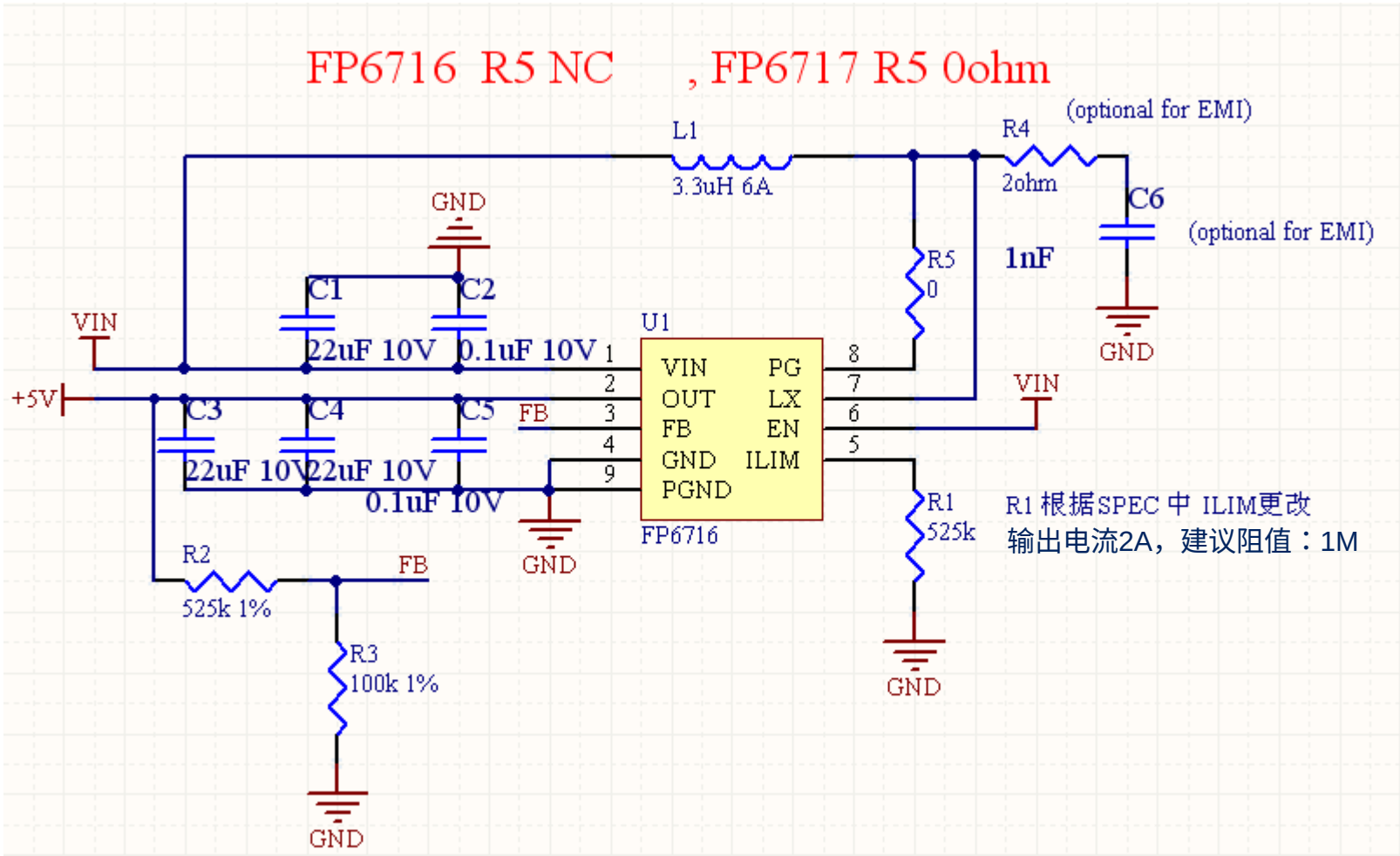
电感L走线铜箔必须宽且短，尽可能与IC在同一板面，因为IC 内部MOS管依据占空比执行切换动作，则LX脚位有较高能量的切换干扰无用信息。

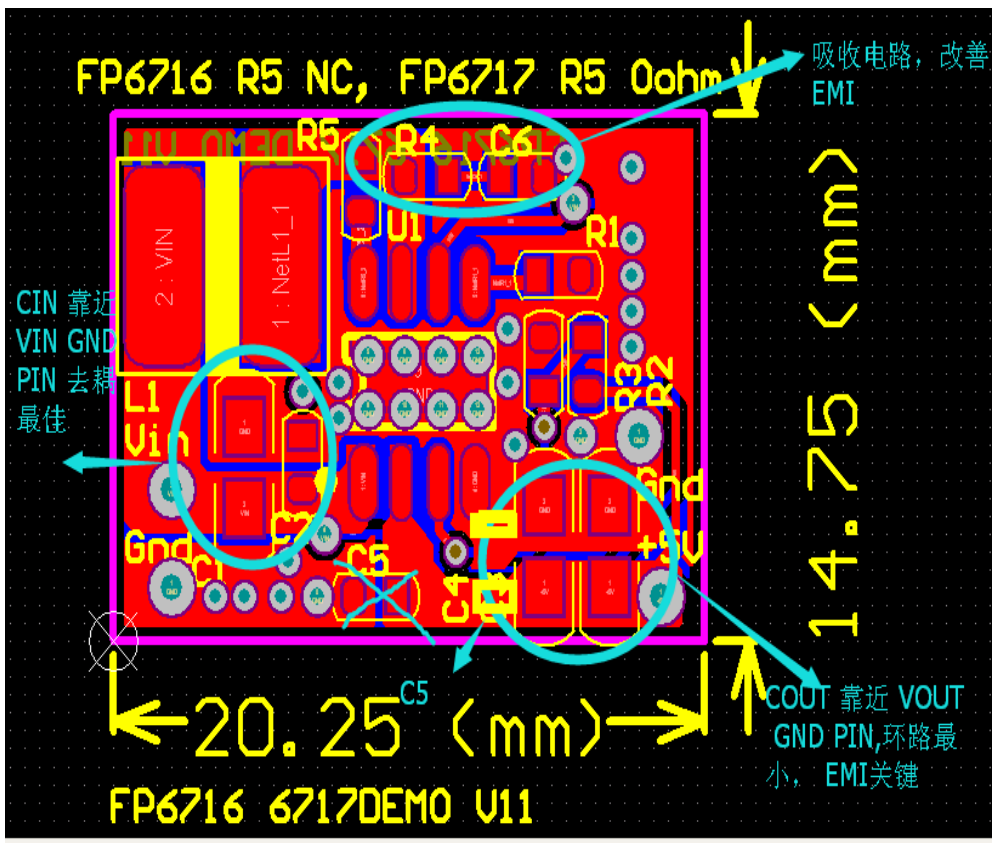
佈局指南—电感L (三)

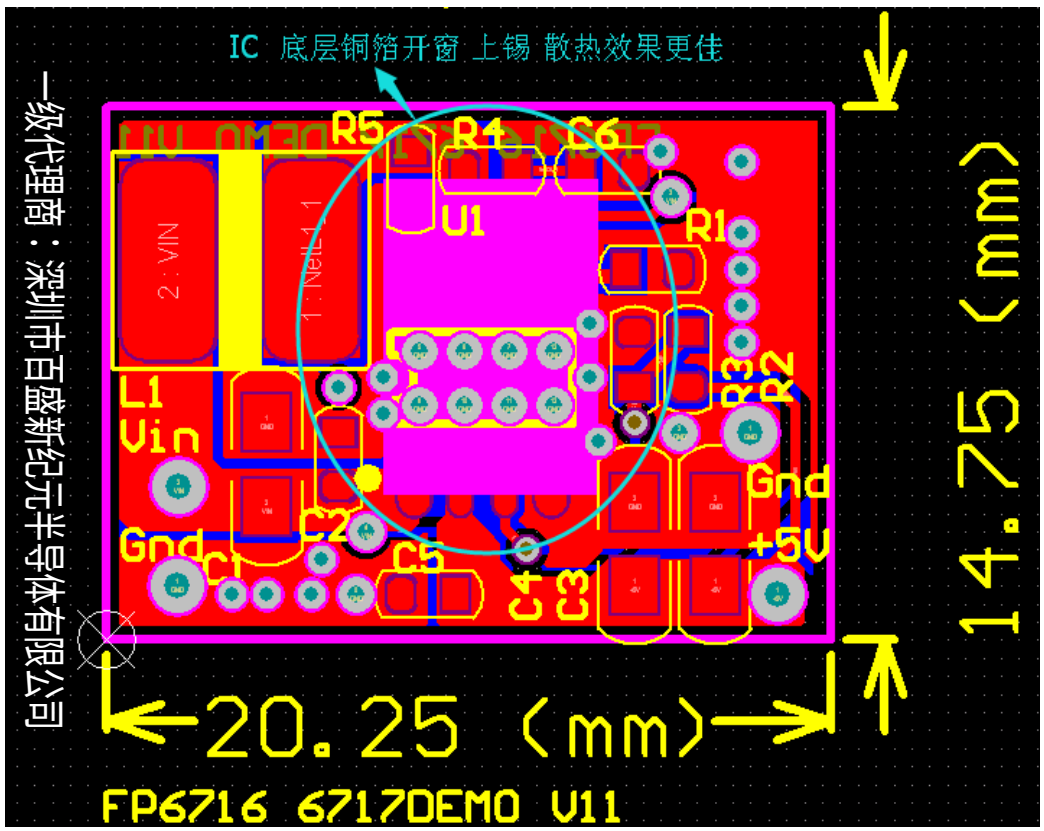


如图所示，电感L 的位置必须在C1 电容之后，因为LX 脚位的切换无用信息能先被C1 电容抑制，避免直接干扰IC.

实际应用

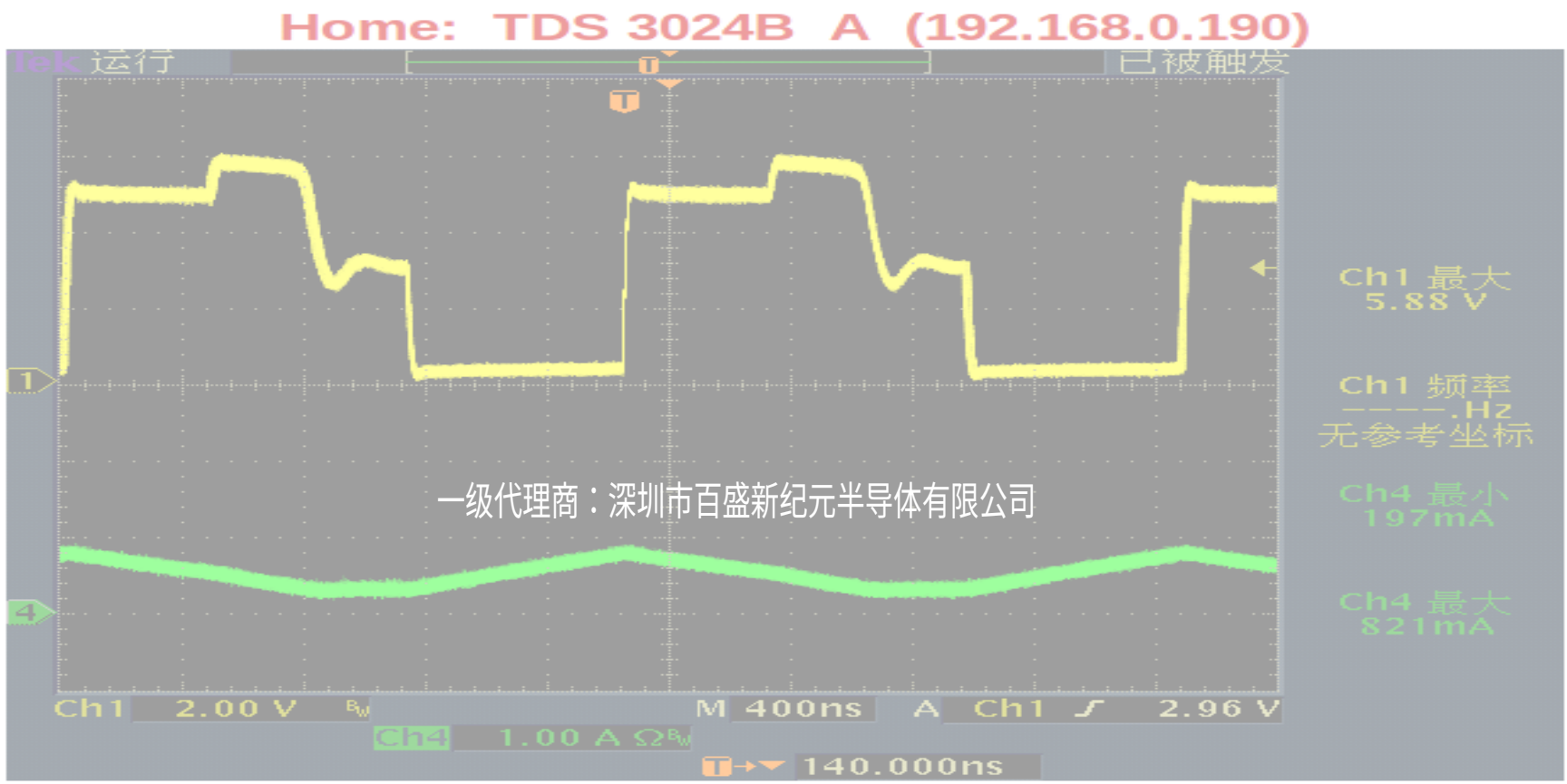

FP6716 R5 NC , FP6717 R5 0ohm
L1
3.3uH 6A
R4
2ohm
(optional for EMI)
C6
1nF
(optional for EMI)
GND
C1
C2
22uF 10V
0.1uF 10V
VIN
U1
R5
0
+5V
C3
C4
C5
22uF 10V
22uF 10V
0.1uF 10V
FB
VIN
OUT
FB
GND
PGND
PG
LX
EN
ILIM
FP6716
R1
525k
R1 根据SPEC 中 ILIM更改
输出电流2A，建议阻值：1M
R2
525k 1%
R3
100k 1%


FP6716 R5 NC, FP6717 R5 0ohm
吸收电路，改善EMI
CIN 靠近 VIN GND PIN 去耦最佳
COUT 靠近 VOUT GND PIN,环路最小，EMI关键
14.75（mm）
20.25（mm）
FP6716 6717DEMO V11


IC 底层铜箔开窗 上锡 散热效果更佳
一级代理商：深圳市百盛新纪元半导体有限公司
14.75（mm）
20.25（mm）
FP6716 6717DEMO V11

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。
  ---->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。