G5177A

Sync. Rectifier Step Up Converter

Features

- **Up to 93% Efficiency at V_{OUT} = 5V from 3.3V Input**
- **Low 50μA Quiescent Current**
- **Guaranteed 2.1A Output Current at V_{OUT} = 5V from 3.3V Input**
- **1MHz PWM Switching Frequency**
- **Synchronous and Embedded Power Mosfets; No Schottky Diode Required**
- **Internal Soft-Start to Limit Inrush Current**
- **Adjustable Output**
- **Adjustable Output Current Limit in TDFN3X3 package**
- **Output turn off true shutdown function**
- **Current Mode Operation with Internal Compensation for Excellent Line and Load Transient Response**
- **Overload/Short-Circuit Protection with hiccup control**
- **Shutdown Current <1μA**
- **Thermal Shutdown**
- **Compact 10-Pin, 3mm x 3mm TDFN Pacage and 8 pin,SOP8 (FD) package**

General Description

The G5177A is a compact, high-efficiency, synchronous step-up converter with power Mosfets embedded and with output turn off true shutdown function and adjustable output current limiting with foldback for a single-cell Li-ion/polymer battery. The G5177A uses only 50μA (typ) quiescent current and allows the converter to switch only when needed at no load and light loads, and when load is higher than 100mA, it uses fixed-frequency PWM technique at 1MHz. It features a current mode control for fast transient response with internal compensation. The G5177A includes cycle-by-cycle current limit to maximum inductor current and over-temperature protection circuit. The G5177A is suitable for iPad-like computers, smart phones and portable handheld devices.

The G5177A is available in a 3mm X 3mm TDFN package or SOP8 (FD) package. The operating temperature range is from -45°C to +85°C.

Application

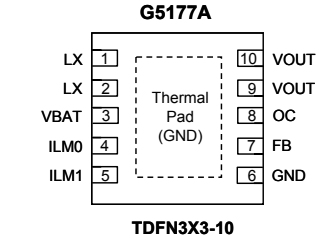
- **iPad-like computers, smart phones and portable handheld devices.**

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G5177ARE1U	5177A	0°C to +85°C	TDFN 3X3-10
G5177AF11U	G5177A	0°C to +85°C	SOP-8 (FD)

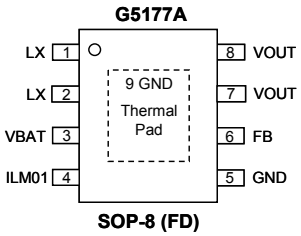
Note: RE: TDFN3X3-10 F1:SOP-8 (FD)
1: Bonding Code
U: Tape & Reel

Pin Configuration



TDFN3X3-10

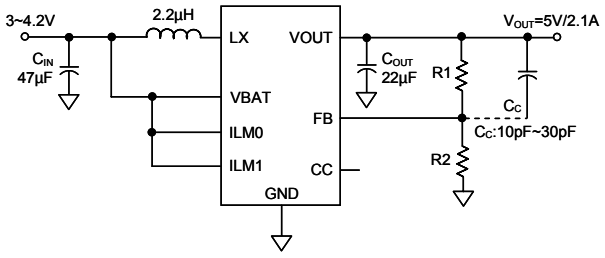
Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.



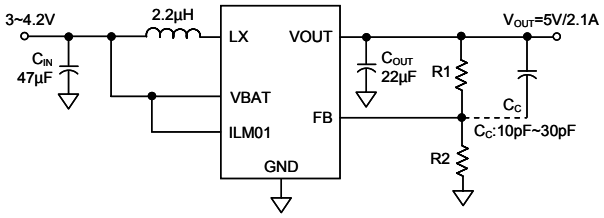
SOP-8 (FD)

Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Typical Application Circuit



VOUT=VREF*(1+R1/R2), where VREF typical is 1.23V



VOUT=VREF*(1+R1/R2), where VREF typical is 1.23V
SOP-8 (FD) Package application circuit

Absolute Maximum Ratings

VOUT to GND . . . . . -0.3V to 6V
LX to GND . . . . . -0.3V to 6V
ILIM0 to GND . . . . . -0.3V to 6V
ILIM1 to GND . . . . . -0.3V to 6V
FB to GND . . . . . -0.3V to 6V
BAT to GND . . . . . -0.3V to 6V
Thermal Resistance of Junction to Ambient (θ_{JA})
TDFN3X3-10 . . . . . 125°C/W

Continuous Power Dissipation (T_A = +25°C)
TDFN3X3-10 . . . . . TBD
Storage Temperature . . . . . -55~150°C
Operation Temperature. . . . . -40~85°C

Electrical Characteristics

(V_{OUT} = 5V, V_{BAT} = 3.6V, L = 2.2µH, C_{IN} = 47µF, C_{OUT} = 22µF, T_A = 25°C)

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

PARAMETER	Description	CONDITIONS	MIN	TYP	MAX	UNITS
General						
V_{BAT}	Input operation voltage		2.5	---	5.5	V
V_{OUT}	Output voltage	Line and Load Regulation in CCM (IL>100mA) V_{BAT}=2.5~4.5	4.925	5	5.075	V
I_{BAT}	Input Quiescent current	V_{BAT} =3.6 FB>1.3 No load, no switching (exclude input current from ILM0&ILM1,orILM01)	---	50	70	µA
I_{BAT}	Shutdown supply current	ILIM0=ILIM1=0 ,(ILM01=0 in SOP-8)	---	0.1	1	µA
Oscillator&Protection						
Fosc	Switching Frequency		0.75	1.0	1.25	MHz
SS	Soft-Start Interval		4	5	6	ms
V_{FB}	FB Regulation Voltage		1.208	1.227	1.246	V
I_{FB}	FB Input Current	FB=1.0V	---	---	100	nA
T_deglitch	OC De-Glitch	OC flag from 1 to 0 (in TDFN10 package)	---	7	---	ms
T_precharge+T_deglitch	Startup into a short-Circuit	OC flag from 1 to 0 (in TDFN10 package)	---	12	---	ms
T_scp_restart	Restart time in SCP	OC flagkeep 0 (in TDFN10 package)	---	70	---	ms
T_short_response	short-Circuit Response Time	V_{OUT} < V_{OUT} X25%,	---	Tosc	---	µs
T_oc_response	Current Limit Response Time		---	Tosc	---	µs
R_{ON}_OC	OC pin Pull low Resistance	(in SOP-8 without this function)	---	50	100	Ω
D_{max}	Maximum Duty Cycle	FB=0.95V	86	91	96	%
DC-DC Switches						
I_{PVOUT_LK}	VOUT Leakage Current	ILIM0=ILIM1=0,(ILM01=0 in SOP-8) V_{OUT}=5V	---	1	5	µA
I_{LX_LK}	LX Leakage Current	ILIM0=ILIM1=0, ,(ILM01=0 in SOP-8) V_{OUT}=5V	---	1	5	µA
R_{ON}-N	Switch ON Resistance		---	40	60	mΩ
R_{ON}-P			---	60	90	
I_LIM	Peak Current Limit (TDFN-10)	ILIM0=0, ILIM1=0	---	0	---	A
		ILIM0=1, ILIM1=0	---	1.8	---	
		ILIM0=0, ILIM1=1	---	3	---	
		ILIM0=1, LIMI1=1	4.4	5.2	6	
I_LIM	Peak Current Limit (SOP-8)	ILM01=1	4.4	5.2	6	A
	Efficiency	ILIM0=1, ILIM1=1, ,(ILM01=0 in SOP-8) V_{BAT}=3.3V, V_{OUT}=5V, I_{OUT}=1.8A	---	85	---	%

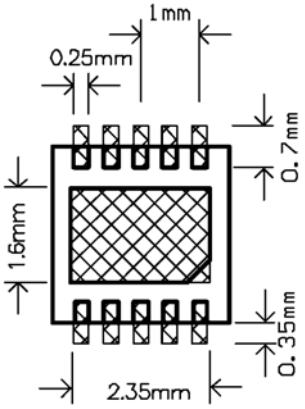
Electrical Characteristics (Continued)

PARAMETER	Description	CONDITIONS	MIN	TYP	MAX	UNITS
Protection Block						
V_{SCP}	VOUT Short-Circuit Threshold	Falling Edge	---	V_{OUT}(1- 0.27)	---	V
V_{SCP}	VOUT Short-Circuit Threshold	Ring Edge	---	V_{OUT}(1- 0.19)	---	V
V_{UVLO}	VBAT UVLO Threshold	Falling Edge	1.7	1.9	2.2	V
V_{UVLO}	VBAT UVLO Threshold	Rling Edge	2	2.2	2.5	V
	Thermal Shutdown Threshold	Rising Edge, 20°C hysteresis	---	150	---	°C
Control Block						
Vih_ilm	ILIM0, ILIM1,ILM01 Input High Level		1.5	---	5.5	V
Vil_ilm	ILIM0, ILIM1,ILM01 Input Low Level		0	---	0.5	V
Rin_ilm(TDFN-10)	ILIM0, ILIM1, Internal Pull-Low Resistance		400	500	600	KΩ
Rin_ilm(SOP-8)	ILIM01 Internal Pull-Low Resistance		200	250	300	KΩ

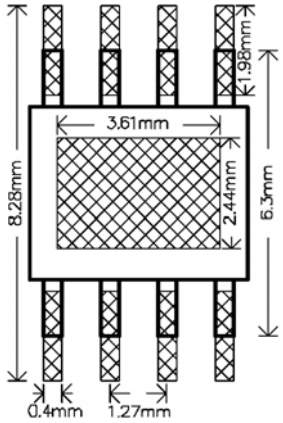
*note1:If ILIM0&ILIM1 connect to Vbat , It will consume current I_ilim= Vbat/500k
If ILM01 connect to Vbat,IT will consume current I_ilim01=Vbat/250k

Minimum Footprint PCB Layout Section

TDFN3X3-10

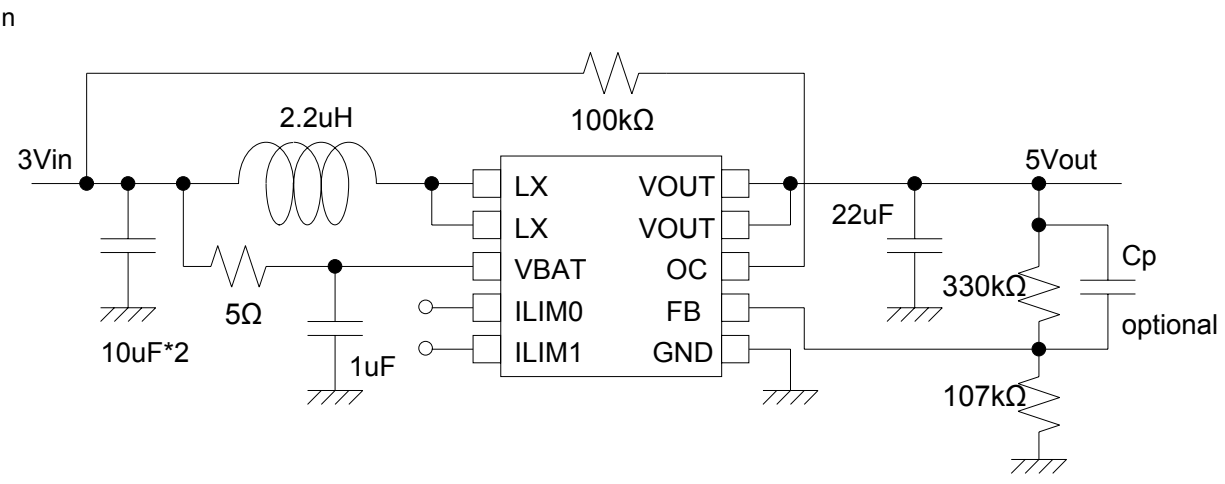


SOP-8 (FD)



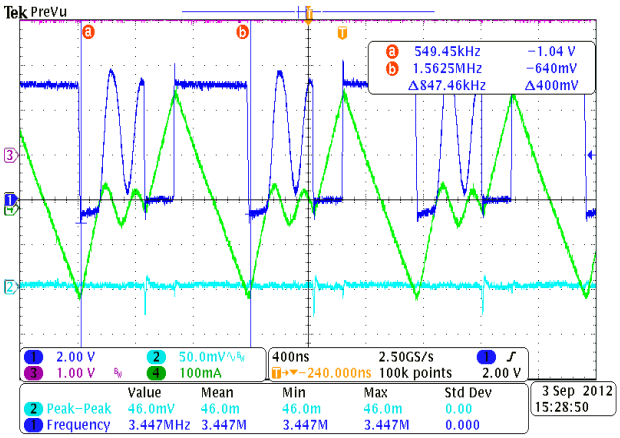
Typical performance Characteristics

Test Circuit：

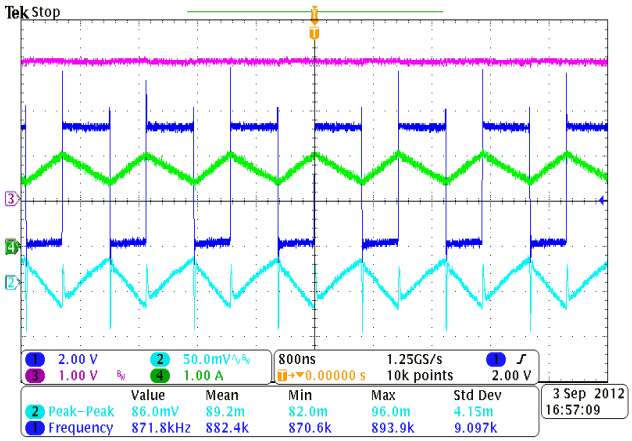


1. V_{IN} ,V_{OUT}, IL waveform

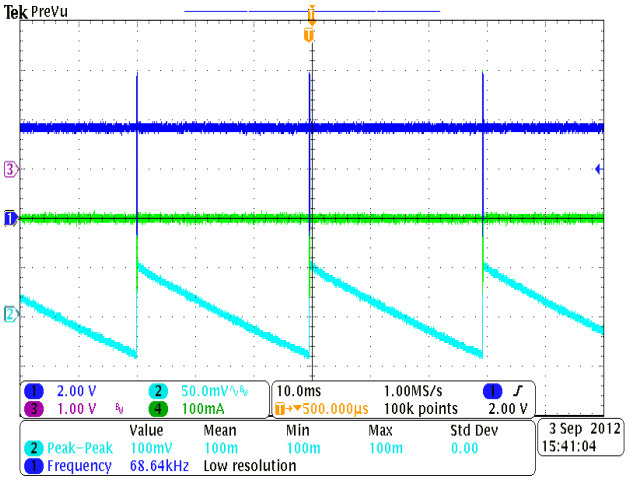
V_{IN}=3V I_{OUT}=0A



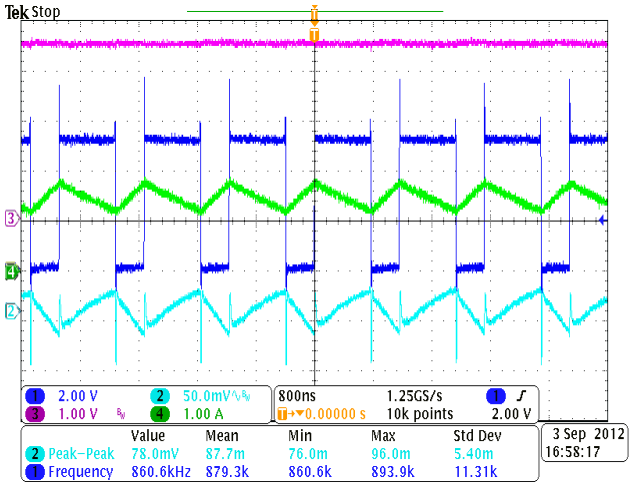
V_{IN}=3V I_{OUT}=1A



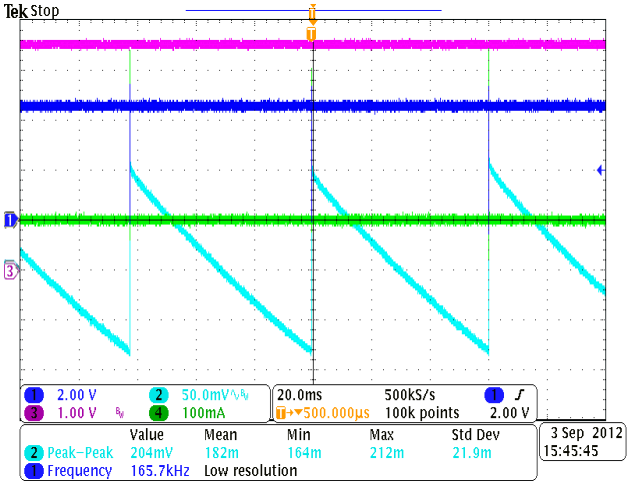
V_{IN}=3.5V I_{OUT}=0A



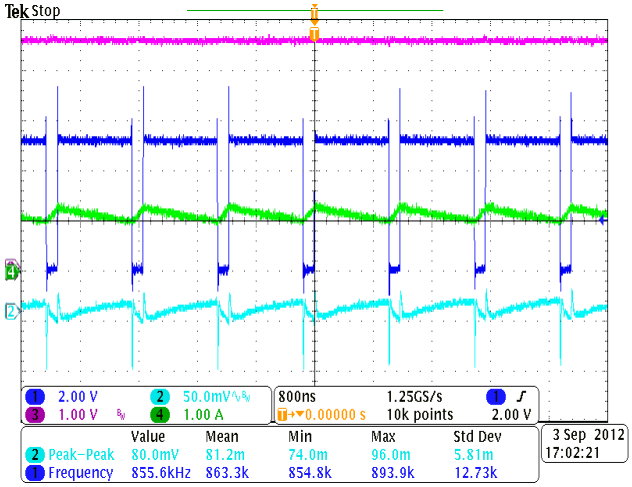
V_{IN}=3.5V I_{OUT}=1A



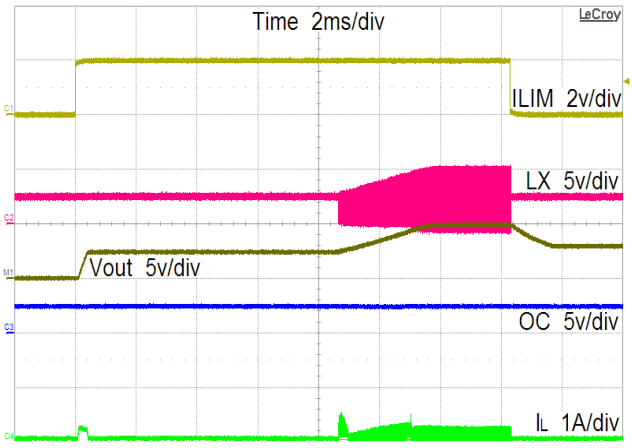
V_{IN}=4.5V I_{OUT}=0A

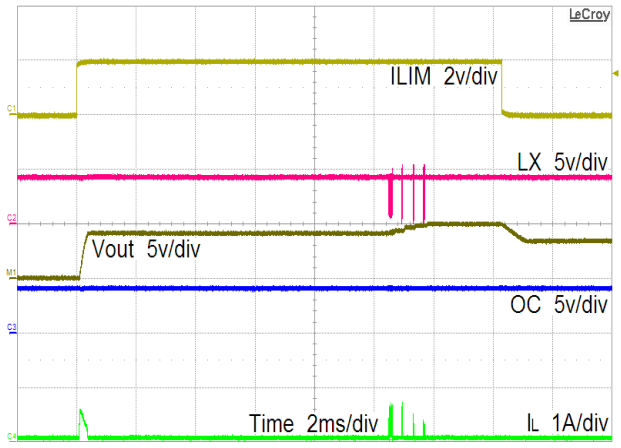


V_{IN}=4.5V I_{OUT}=1A

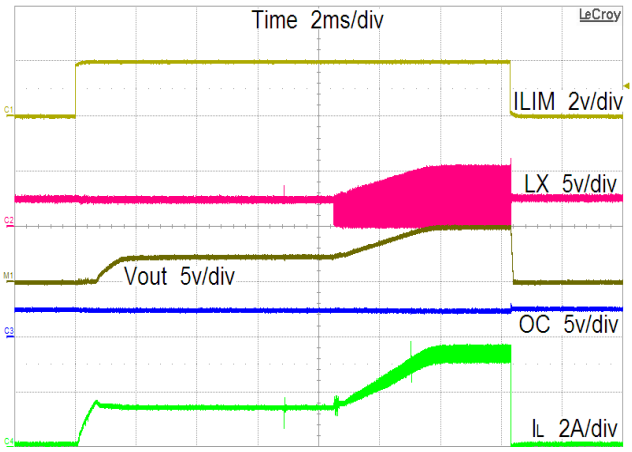


2. Start Up waveform (Left =2.5V_{IN}，Right =4.2V_{IN})

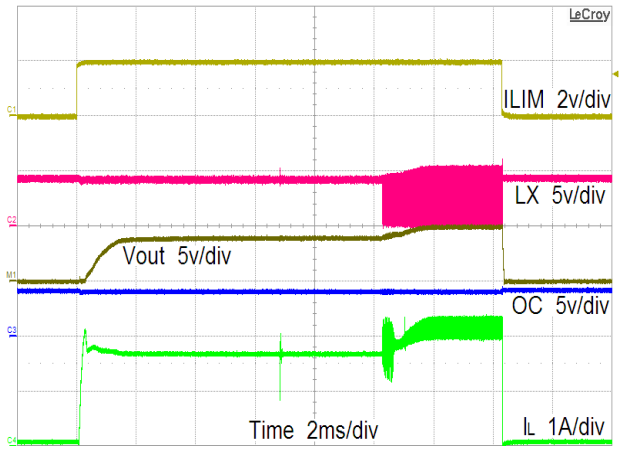




no load start up & shutdown quickly

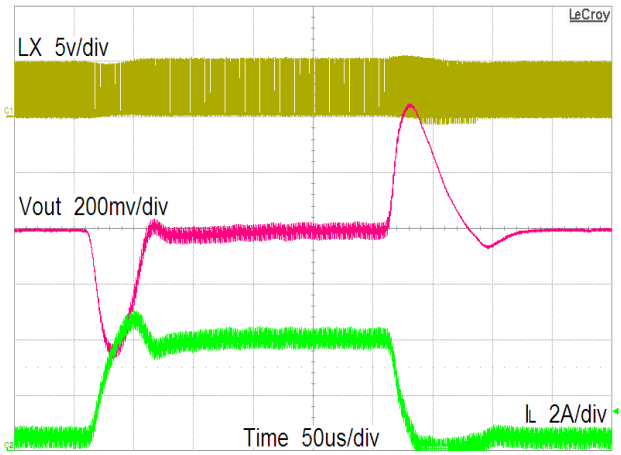


1.5A load start up & shutdown quickly

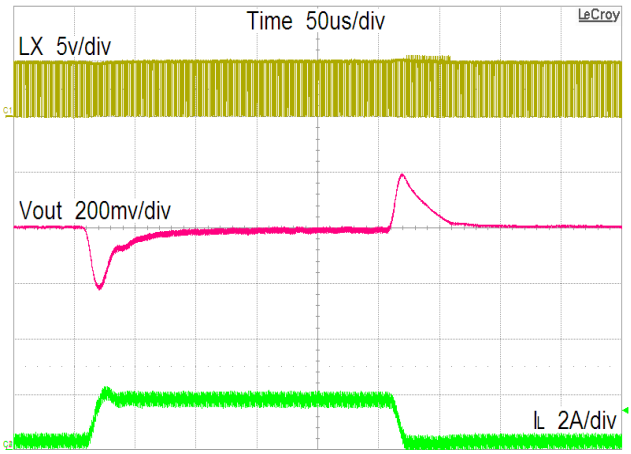


1.8 A load start up & shutdown quickly

3. 200mA ~ 1.5A Load Transient Waveform



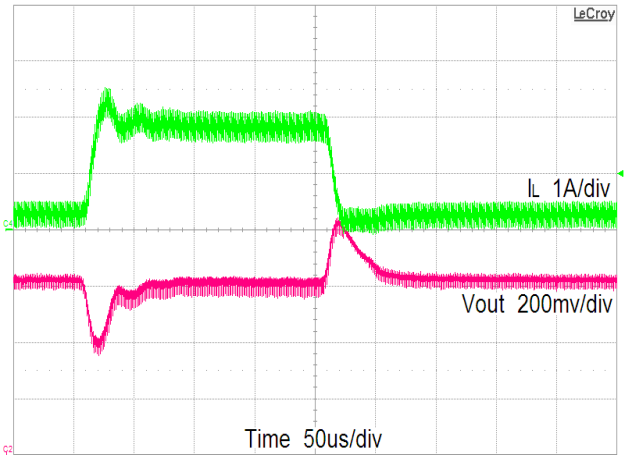
2.5Vin load transient test



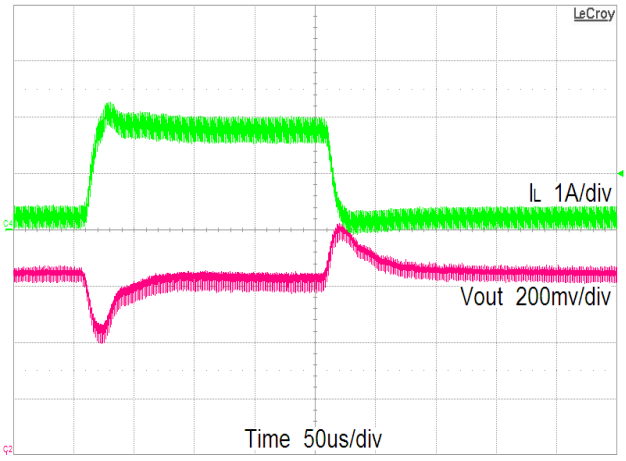
4.2Vin load transient test

CFB vs Load Transient

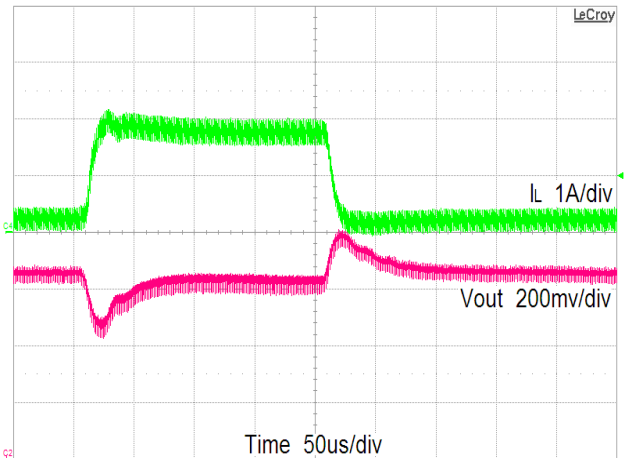
V_{IN} =4.2v, V_{OUT} =5V, 200mA~1.5A load transient



CFB=0pF

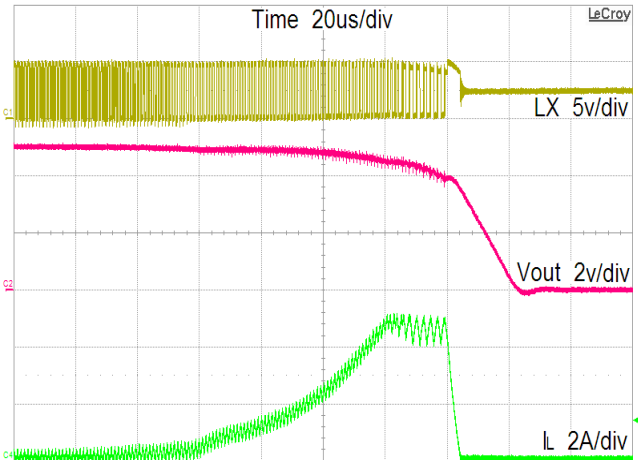


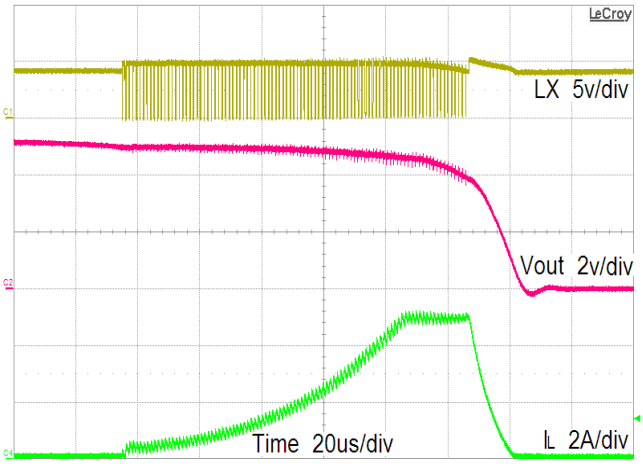
CFB=10pF



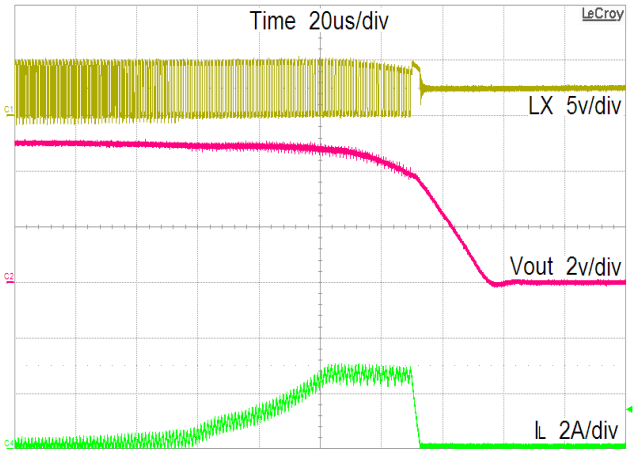
2.5Vin load transient test

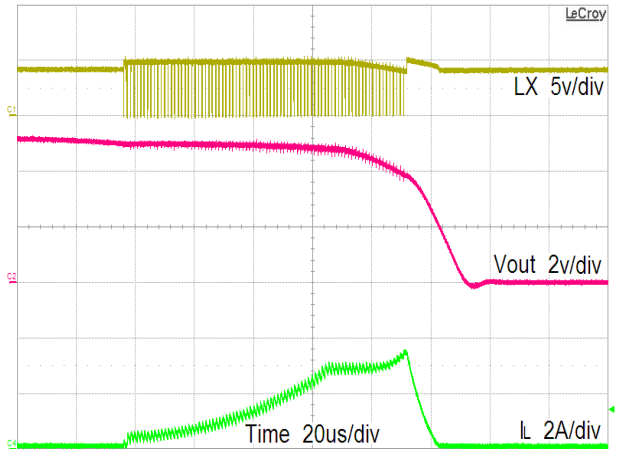
4. Over Current & Under Voltage Waveform (Left =2.5V_{IN}，Right = 4.2V_{IN})



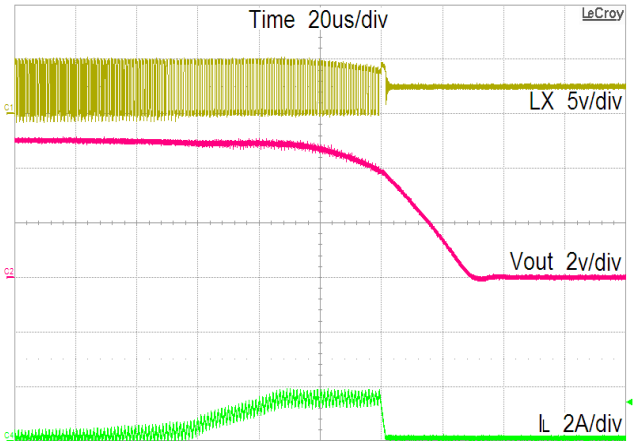


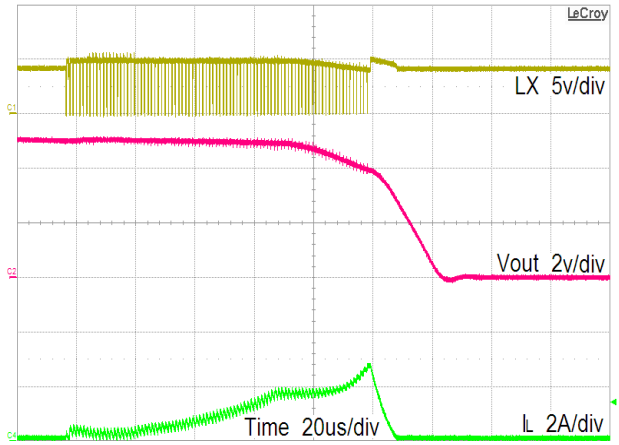
ILIM0=ILIM1=1, 6A current limit





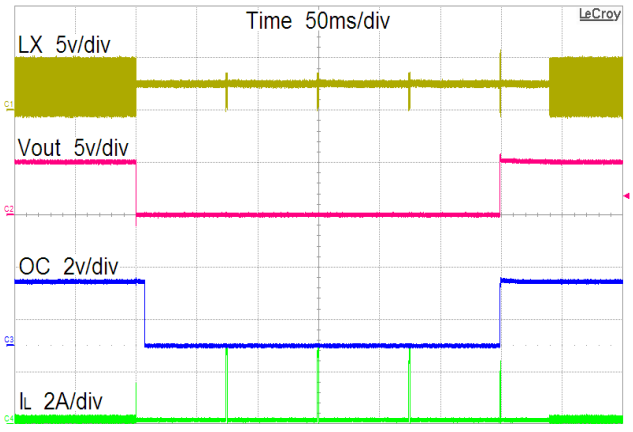
ILIM0=0, ILIM1=1, 3A current limit

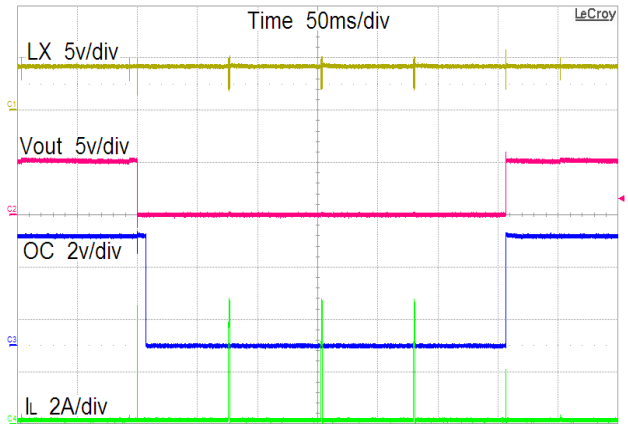




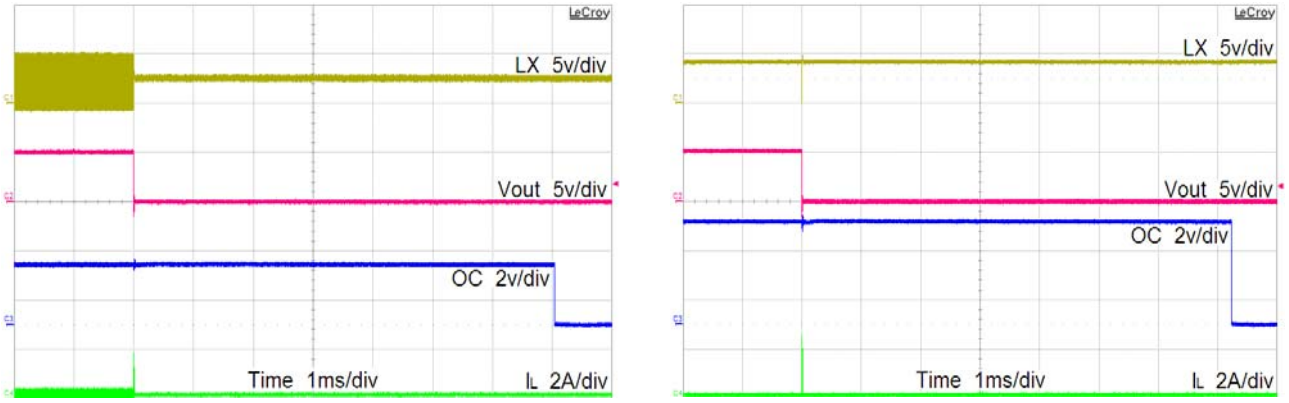
ILIM0=1, ILIM1=0, 2A current limit

5. Short Circuit waveform (Left = 2.5V_{IN}, Right = 4.2V_{IN})



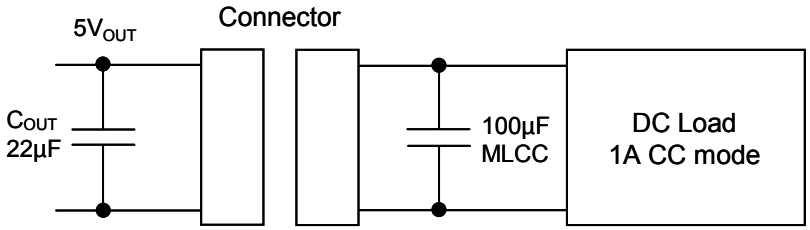


no load to short circuit test

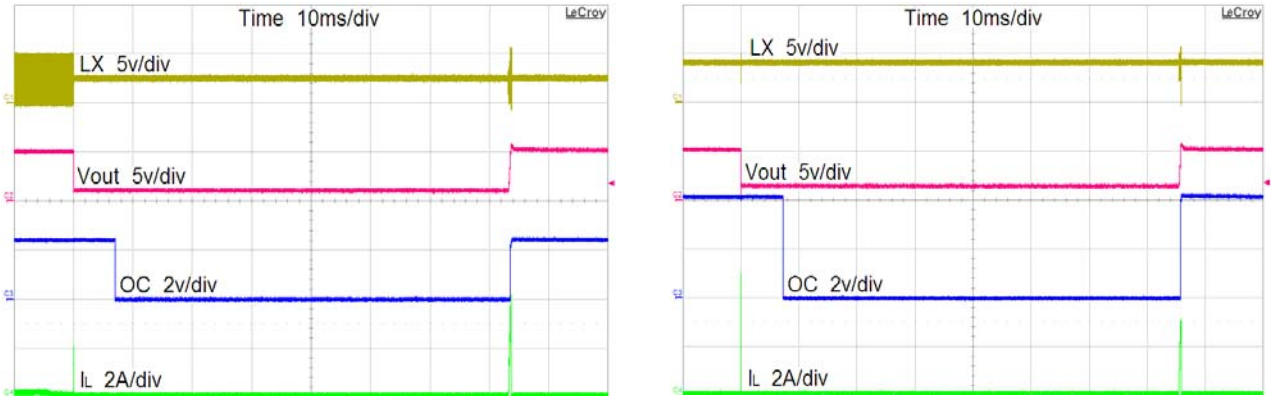


OC signal delay 7mS pull low

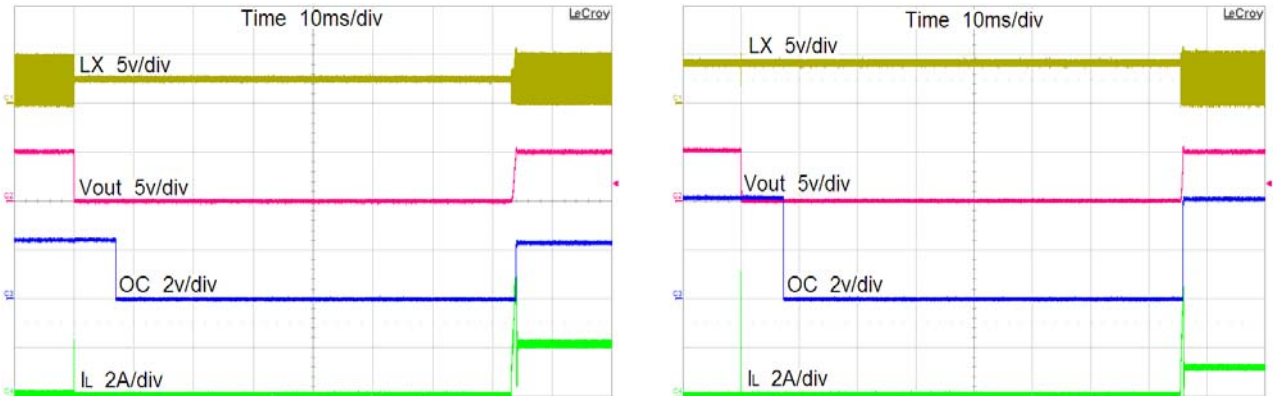
6. Hot Plug Test (Left = 2.5V_{IN}, Right = 4.2V_{IN})



test circuit



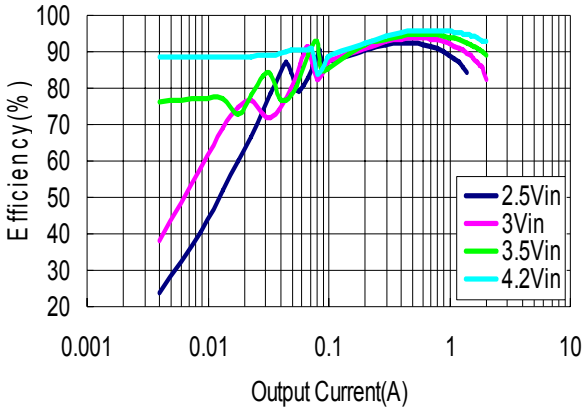
DC load no load



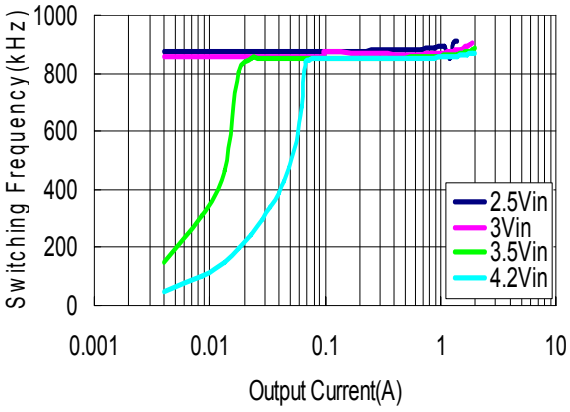
DC load 1A load

7.

I_{OUT} VS Efficiency



I_{OUT} vs Switching frequency



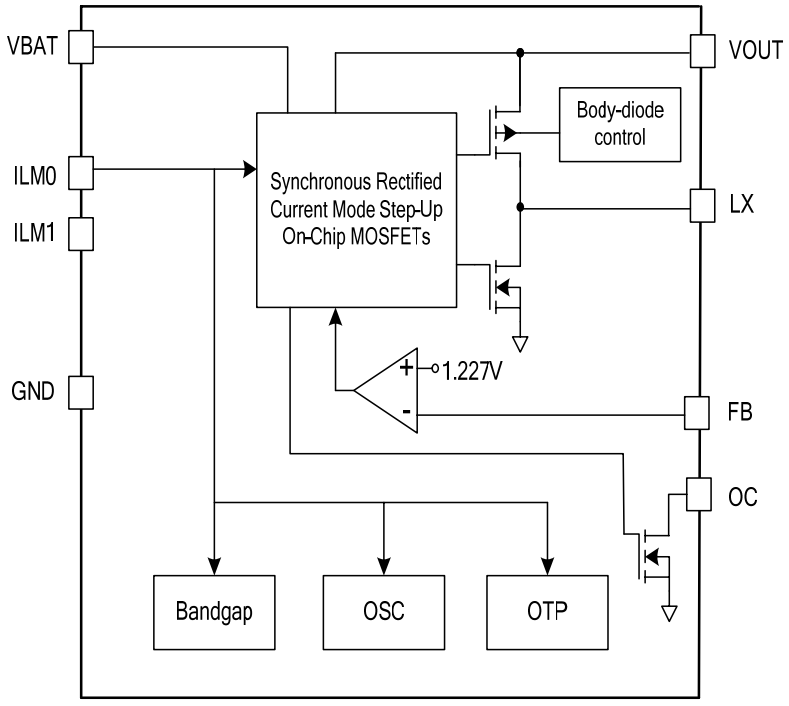
Pin Description For TDFN 3X3-10

PIN	NAME	FUNCTION
1,2	LX	Inductor Node.
3	VBAT	IC Power Supply Input.
4	ILIM0	Output Current Limit Setting, and On/Off Control.
5	ILIM1	Output Current Limit Setting, and On/Off Control.
6	GND	IC Analog Ground.
7	FB	Converter Feedback Input.
8	OC	Open-Drain Flag for Over-Current, Short-Circuit, or Thermal Shutdown; Active Low.
9,10	VOUT	Converter Output.
	EP	Exposed Paddle. Connect to the ground plane to optimize thermal performance. EP is internally connected to GND. EP must be connected to GND at a single point with a star ground connection.

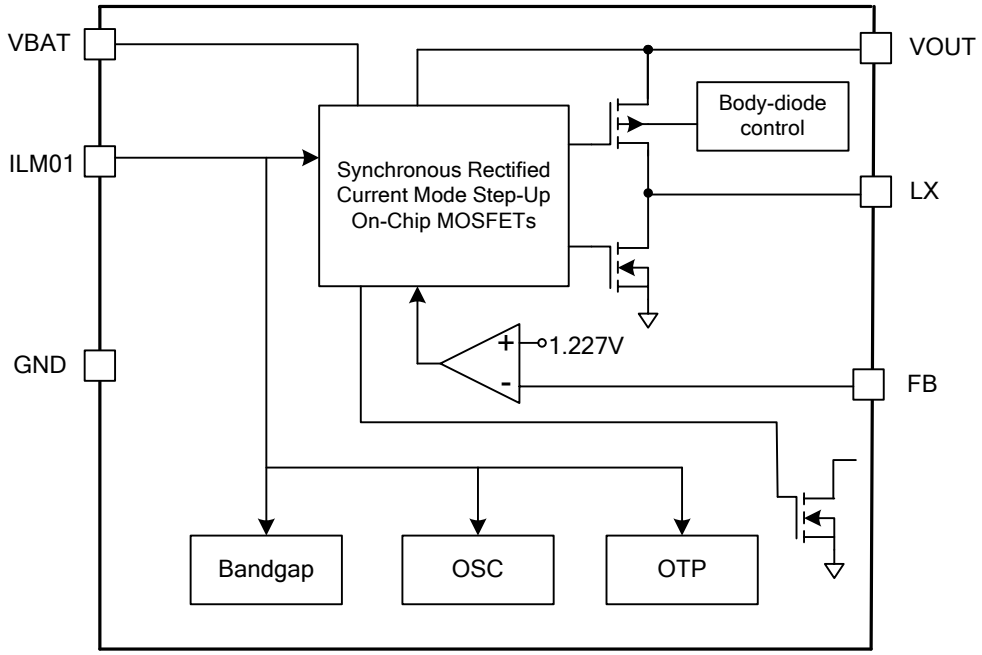
Pin Description For SOP-8 (FD)

PIN	NAME	FUNCTION
1,2	LX	Inductor Node.
3	VBAT	IC Power Supply Input.
4	ILIM01	Output Current Limit Setting, and On/Off Control.
5	GND	IC Analog Ground.
6	FB	Converter Feedback Input.
7,8	VOUT	Converter Output.
	EP	Exposed Paddle. Connect to the ground plane to optimize thermal performance. EP is internally connected to GND. EP must be connected to GND at a single point with a star ground connection.

Block Diagram (For TDFN 3X3-10)



Block Diagram (For SOP-8 (FD)



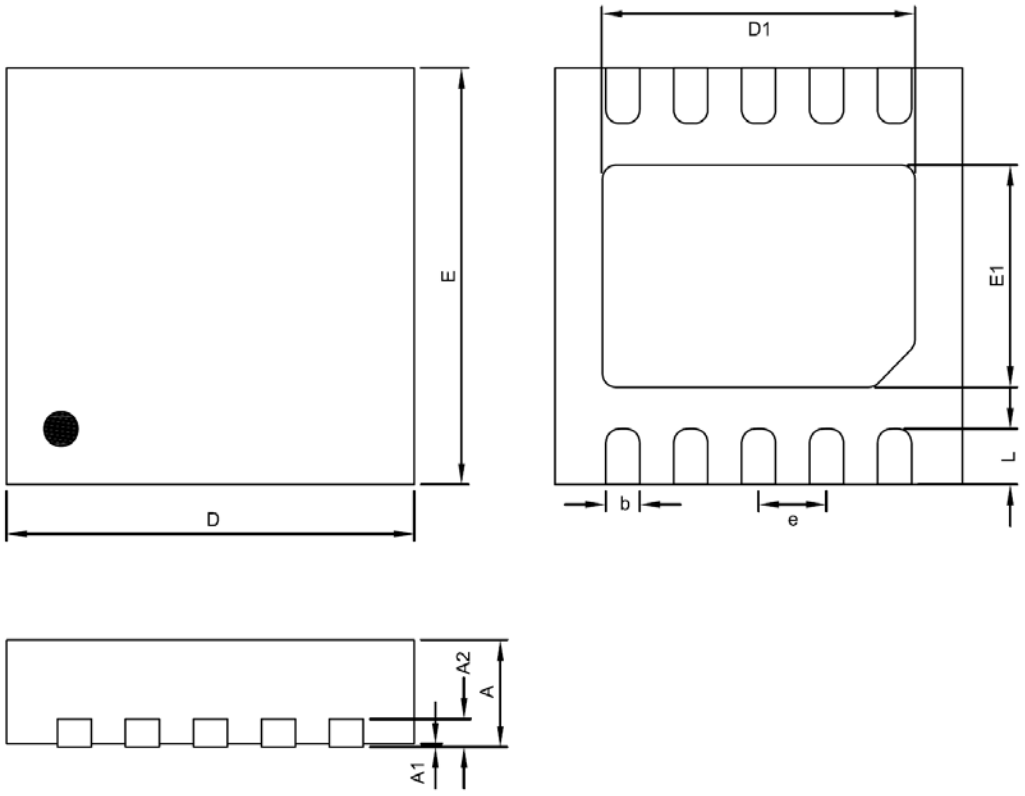
Function Description

The G5177A current-mode step-up DC-DC switching converter uses a fixed-frequency PWM architecture with output shutdown. In light-load mode, the converter switches when needed, consuming only 50μA of quiescent current. In heavy-load mode of higher than 100mA, the converter switches every cycle at a constant frequency as fixed-PWM, thus enabling noise filtering. The G5177A is highly efficient, with internal and synchronous switches. Shutdown reduces the quiescent current to less than 0.1μA. Low quiescent current and high efficiency make this device ideal for portable equipment.

The G5177A step-up DC-DC switching converter typically generates a 5V output voltage from a single-cell battery input voltage. The output peak current limit is adjustable to be set at 1.8A, 3A and 5.2A respectively by the preset pins of ILIM0 and ILIM1, as Table 1 in TDFN-3X3 package and the output peak current limit is fixed at 5.2A in SOP8-FD package. The OC pin (open-drain only available in TDFN 3X3 package) is asserted (active low) when an over-current, short-circuit or thermal shutdown condition is encountered after a 6-ms deglitch timeout. The OC pin remains asserted until the over-current or over-temperature condition is removed, and during the state of short-circuit after precharge is end, the converter will turn off 64ms first and then turn on 1ms cycle by cycle to protect converter under short circuit operation . Internal soft-start limits the inrush current to less than 500mA under no-load conditions during startup. The G5177A is adjustable by 2 external resistors with calculating the value for R1 as R1 = R2 (VOUT/VFB - 1).

The G5177A switches at a 1MHz frequency, allowing for tiny external components. The G5177A is optimized for use in iPad-like computers, smart phones, portable handheld devices and other applications requiring low quiescent current for maximum battery life.

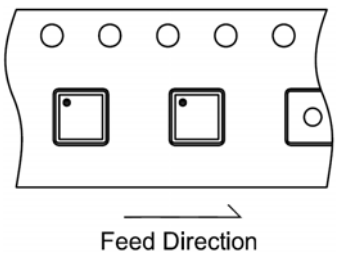
Package Information



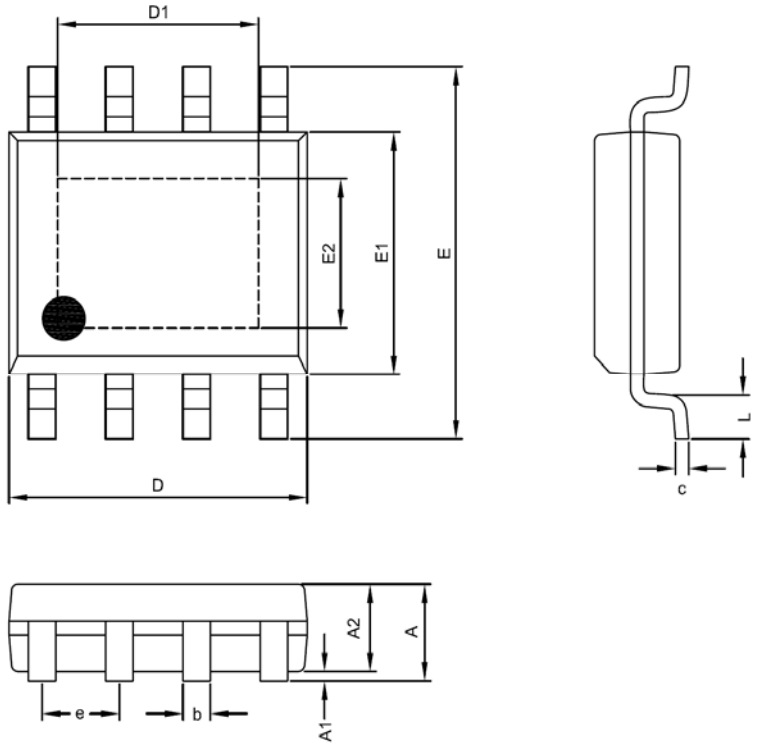
TDFN3X3-10 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.19	0.20	0.21	0.0075	0.0079	0.0083
D	2.95	3.00	3.05	0.1161	0.1181	0.1201
E	2.95	3.00	3.05	0.1161	0.1181	0.1201
D1	2.20	2.30	2.40	0.0866	0.0906	0.0945
E1	1.40	1.50	1.60	0.0551	0.0591	0.0630
b	0.18	0.25	0.30	0.0071	0.0098	0.0118
e	0.50 BSC			0.0197 BSC		
L	0.35	0.40	0.45	0.0138	0.0157	0.0177

Taping Specification



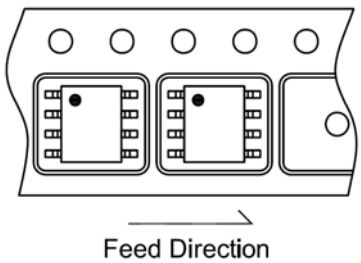
PACKAGE	Q'TY/REEL
TDFN3X3-10	3,000 ea



SOP- 8 (FD) Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.35	1.55	1.65	0.053	0.061	0.065
A1	0.00	---	0.15	0.000	---	0.006
A2	1.15	1.35	1.50	0.045	0.053	0.059
D	4.80	4.90	5.00	0.189	0.192	0.197
D1	2.29	---	3.71	0.090	---	0.146
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.153	0.157
E2	2.29	---	2.64	0.090	---	0.104
c	0.19	0.23	0.27	0.007	0.009	0.011
b	0.33	0.43	0.53	0.013	0.017	0.021
e	1.27 BSC			0.050 BSC		
L	0.40	0.70	1.00	0.016	0.028	0.039

Taping Specification



PACKAGE	Q'TY/REEL
SOP-8 (FD)	2,500 ea