

POWER MANAGEMENT

Description

The SC1417B is a fixed frequency, current mode step-up dc-dc converter. It operates over a wide input supply range of 1.5V to 12V, making it suitable for battery input and TFT-LCD applications. The 620kHz constant frequency oscillator minimizes the size of external components and allows simple filtering for noise sensitive environments. The integrated power NPN supports peak currents of up to 0.9A enabling the device to support 150mA at 15V from a 5V supply. The maximum switch duty cycle of 85% (typical) allows output to input voltage ratios as high as 6.5 in step-up configurations, thus allowing 2V to 12V boost operation.

The SC1417B features a low battery detector and a 200mV reference circuit which remains active during shut down. The part consumes less than 50µA in shutdown. The low battery detect output goes low when the input battery voltage has dropped below a user programmable level. Pulse-by-pulse current limit and thermal shutdown protect the converter during load faults.

The SC1417B is available in a MSOP-8 surface mount package.

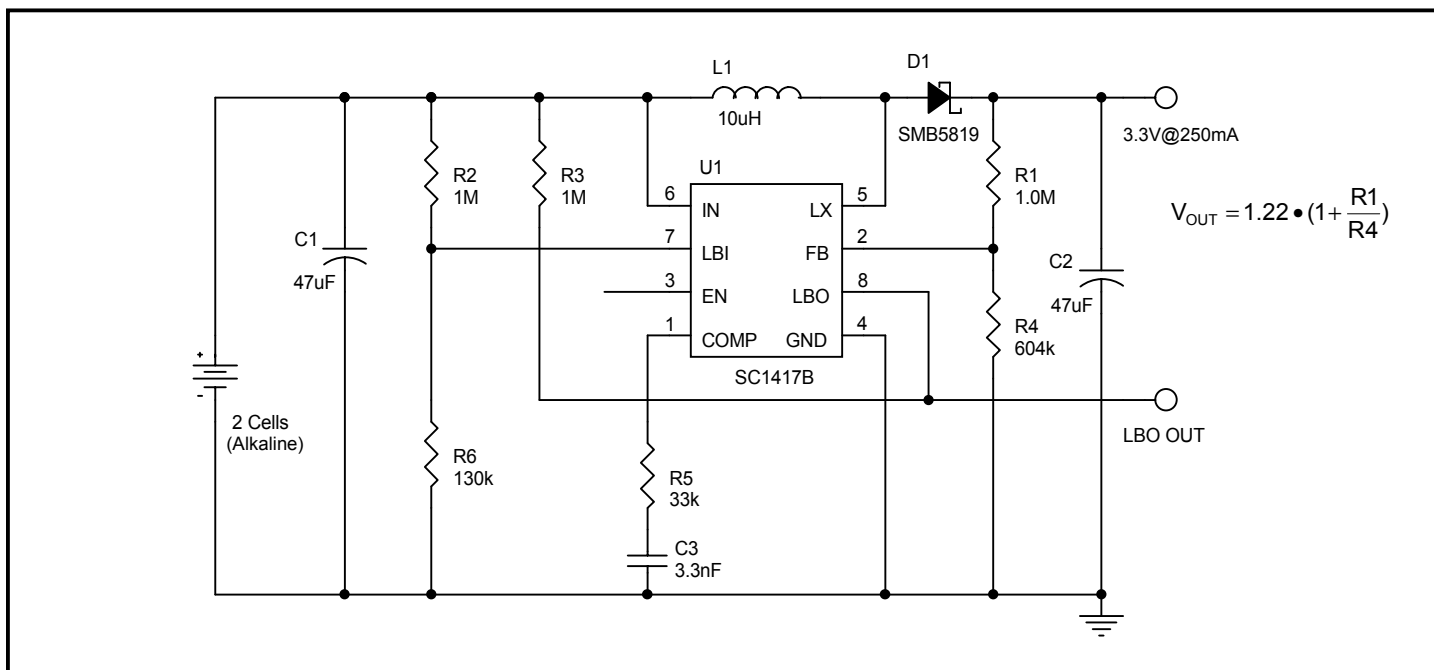
Features

- ◆ Operates from 1.5V to 12V supply voltage
- ◆ High efficiency >85%
- ◆ 150mA @ 15V from 5V input
- ◆ Internal switch peak current of 0.9A
- ◆ Programmable output voltage
- ◆ Powers up into full load
- ◆ Pulse-by-pulse current limit/thermal shutdown
- ◆ 620kHz fixed frequency current mode converter
- ◆ Low current shutdown mode extends battery life
- ◆ 18V output capability
- ◆ Low battery detector
- ◆ MSOP-8 package. Available in Lead-free package, fully WEEE and RoHS compliant
- ◆ Pin-for-pin compatible with LT1317B

Applications

- ◆ TFT-LCD Bias supplies
- ◆ Constant current LED bias supplies
- ◆ Pagers
- ◆ GPS receivers
- ◆ Battery backup
- ◆ SEPIC converters

Typical Application Circuit



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Absolute Maximum Ratings

Exceeding the specifications below may result in permanent damage to the device, or device malfunction. Operation outside of the parameters specified in the Electrical Characteristics section is not implied.

Parameter	Symbol	Maximum	Units
Input Supply Voltage	V_{IN}	15	V
LX Input	V_{LX}	-0.4 to 20	V
LBI Input	V_{LBI}	-0.3 to 6	V
EN Input	V_{EN}	-0.3 to 6	V
FB Input	V_{FB}	-0.3 to 6	V
LBO Output	V_{LBO}	-0.3 to 15	V
COMP Output	V_{COMP}	-0.3 to 6	V
Operating Ambient Temperature Range	T_A	-40 to 85	°C
Operating Junction Temperature Range	T_J	-40 to 125	°C
Thermal Impedance, Junction to Ambient	θ_{JA}	163	°C/W
Thermal Impedance, Junction to Case	θ_{JC}	63	°C/W
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering) 10 Sec.	T_{LEAD}	300	°C

Electrical Characteristics

Unless otherwise specified: $T_A = 25^\circ\text{C}$. Values in **bold** apply over full operating ambient temperature range. $V_{IN} = 2\text{V}$, $V_{EN} = 2\text{V}$. All voltages are with respect to ground, -ve indicates current is flowing out of the pin.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}	$V_{FB} = 1.22\text{V}$	1.5		12	V
			2.0		12	
Feedback Voltage	V_{FB}	$V_{COMP} = 600\text{mV}$, LX floating	1.16	1.22	1.28	V
Supply Current in Shutdown	$I_{Q(OFF)}$	$V_{EN} = 0\text{V}$, $V_{LBI} = 300\text{mV}$		40	55	μA
					65	
Supply Current in PWM Mode	I_Q	$I_{OUT} = 0\text{A}$, $V_{COMP} = 100\text{mV}$		4.3	5.8	mA
Feedback Input Current	I_{FB}	$V_{FB} = 1.22\text{V}$		15	60	nA
Error Amplifier Transconductance	Gm	$dI_{COMP} = 5\mu\text{A}$	70	140	240	μS

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Electrical Characteristics

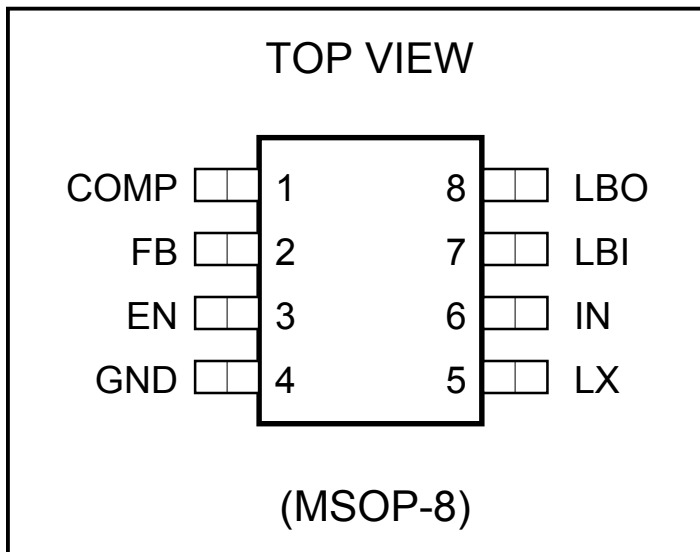
Unless otherwise specified: $T_A = 25^\circ\text{C}$. Values in **bold** apply over full operating ambient temperature range. $V_{IN} = 2\text{V}$, $V_{EN} = 2\text{V}$, All voltages are with respect to ground, -ve indicates current is flowing out of the pin.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Error Amplifier Voltage Gain ⁽¹⁾	$A_{V(E.A.)}$			700		V/V
Maximum Output Current, $L = 22\mu\text{H}$ ⁽¹⁾	I_{OUT}	$V_{OUT} = 5.0\text{V}$, $V_{IN} = 2.0\text{V}$	200			mA
		$V_{OUT} = 10\text{V}$, $V_{IN} = 5.0\text{V}$	250			mA
		$V_{OUT} = 15\text{V}$, $V_{IN} = 5.0\text{V}$	150			mA
Power Switch Voltage Drop ⁽¹⁾	$(V_{LX}-GND)$	$I_{LX} = 500\text{mA}$		150	250	mV
					500	
Power Switch Current Limit	I_{LIM}	$0^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	0.70	0.95	1.20	A
		$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	0.60			
Switch Leakage	I_{LX}	$V_{LX} = 5\text{V}$		0.01	3	μA
Internal Oscillator Frequency	f_{OSC}	LX, EN open	520	620	720	kHz
Maximum Duty Cycle	$\%_{DC}$		80	85		%
Low Battery Input Voltage Threshold	V_{LBI}		190	200	210	mV
			180		210	
LBI Input Current	I_{LBI}	$V_{LBI} = 100\text{mV}$		-5	-40	nA
Low Battery Output Low	$V_{LBO(L)}$	$I_{LBO} = 5\mu\text{A}$		75	250	mV
Low Battery Detector Gain ⁽¹⁾	A_V	$1\text{M}\Omega$ load		2000		V/V
Enable Inputs						
Enable Input Voltage	V_{IH}		1.4	0.6		V
	V_{IL}			0.60	0.25	V
Enable Pin Current	I_{IH}				300	nA
	I_{IL}	$V_{SHDN} = 0\text{V}$		-2.3	-6.0	μA

Notes:

(1) Guaranteed by design.

(2) This device is ESD sensitive. Use of standard ESD handling precautions is required.

POWER MANAGEMENT
Pin Configuration

Ordering Information

Part Number	Package
SC1417BIMSTR ⁽¹⁾	MSOP-8
SC1417BIMSTR ⁽¹⁾⁽²⁾	MSOP-8
SC1417BEVB	Evaluation Board

Note:

(1) Only available in tape and reel packaging. A reel contains 2500 devices.

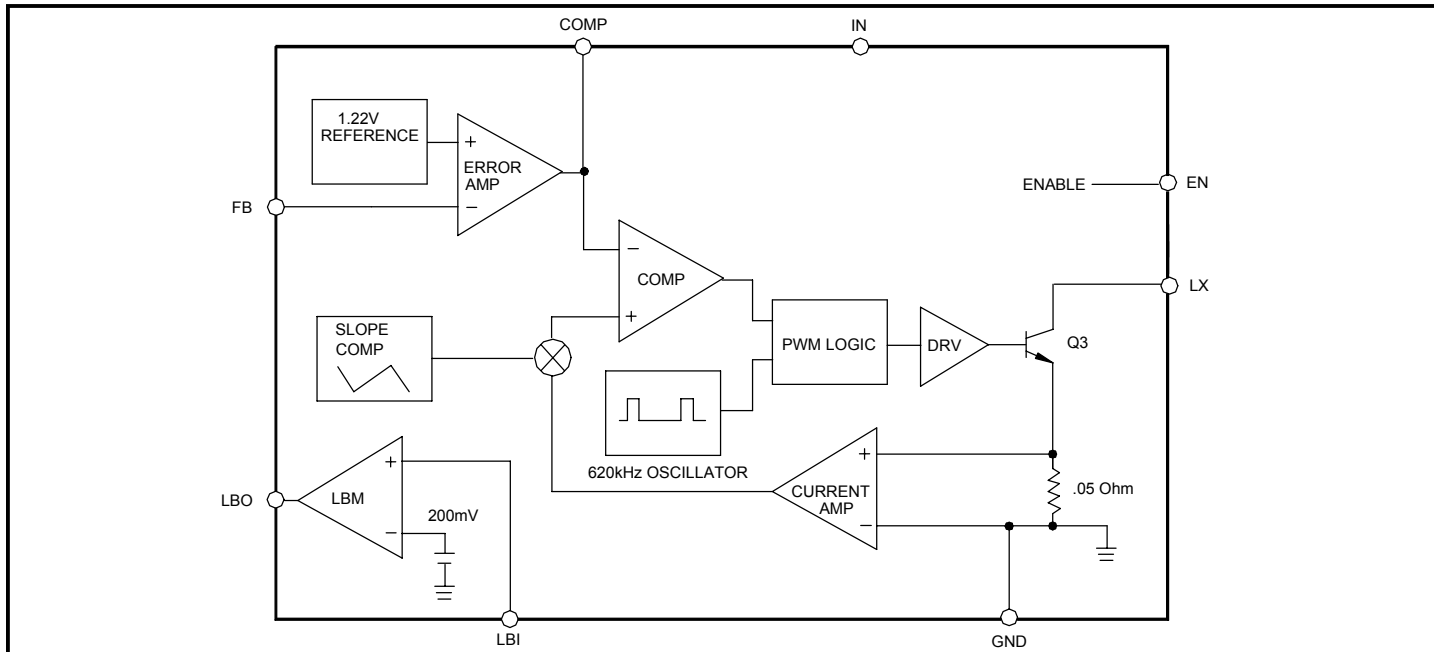
(2) Available in lead-free packaging only. This product is fully WEEE and RoHS compliant.

Pin Descriptions

Pin #	Pin Name	Pin Function
1	COMP	Compensation pin for error amplifier. Connect a series RC network from this pin to ground for frequency compensation. Typical values are 33kΩ/3.3nF. Placing a 100pF - 10nF capacitor from this pin to ground reduces the output and input capacitor values required for stability at the expense of slower transient response.
2	FB	Feedback pin. Connect to the output through a voltage divider to set output voltage. $V_{OUT} = 1.22 \cdot \left(1 + \frac{R1}{R4}\right)$
3	EN	Enable pin. Pull this pin low for shutdown mode. The device quiescent current reduces to 40μA (typ.). This pin can be left floating or pulled up to a voltage less than 6V to enable the device.
4	GND	Ground.
5	LX	Switch pin (the inductor and diode junction). Keep traces on this pin short and wide to minimize EMI.
6	IN	Supply pin. Bypass this pin to GND with a capacitor as close to pins 4 and 6 as possible.
7	LBI	Low battery detector input. Connect to IN through a voltage divider to set low battery indicator threshold. $V_{TH(LO)} = 0.2 \cdot \left(1 + \frac{R2}{R6}\right)$
8	LBO	Low battery detector open collector output. This pin pulls low when V_{LBI} is below 200mV (typ.). Pullup using a 1MΩ resistor.

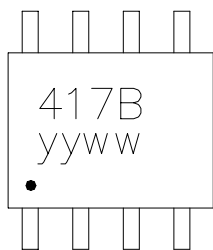
POWER MANAGEMENT

Block Diagram

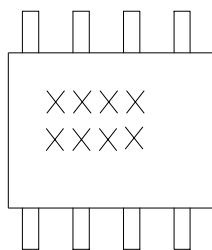


Marking Information

Marking for MSOP-8 package



TOP



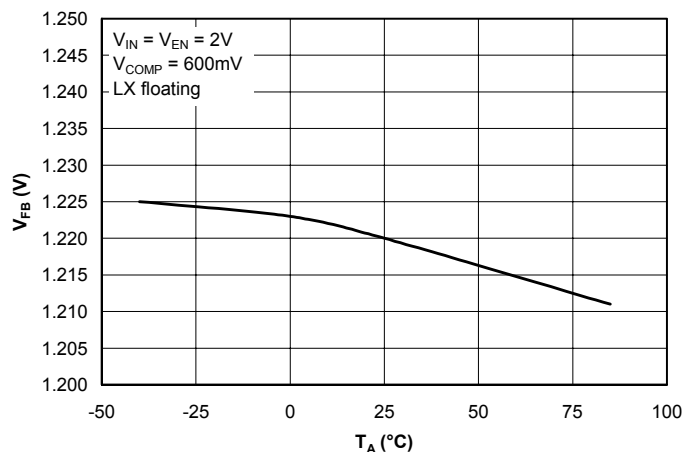
BOTTOM

yyww = Date Code (Example: 0012)

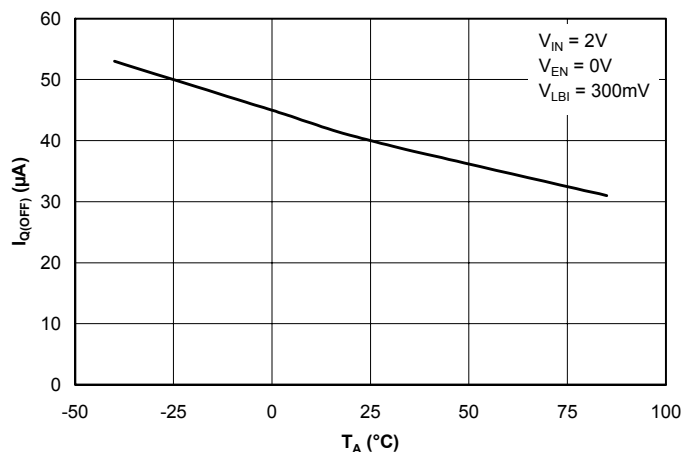
xxxxxxx = Semtech Lot No. (Example: E90101-1)

POWER MANAGEMENT
Typical Characteristics

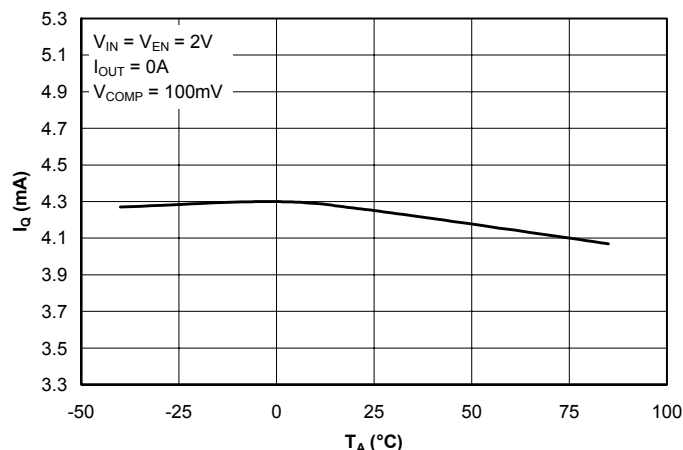
**Feedback Voltage
vs. Temperature**



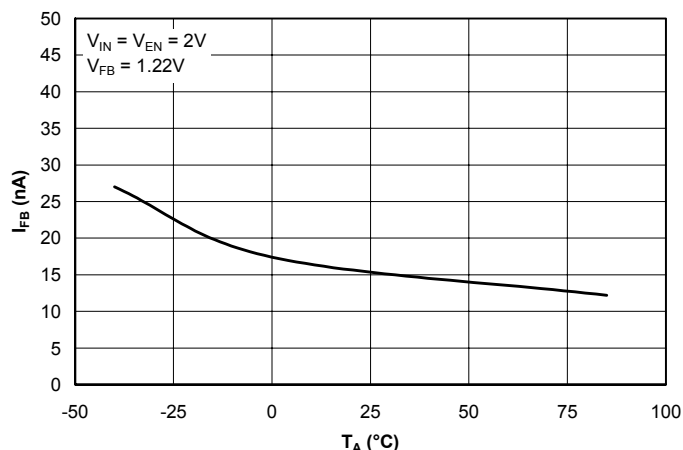
**Supply Current in Shutdown
vs. Temperature**



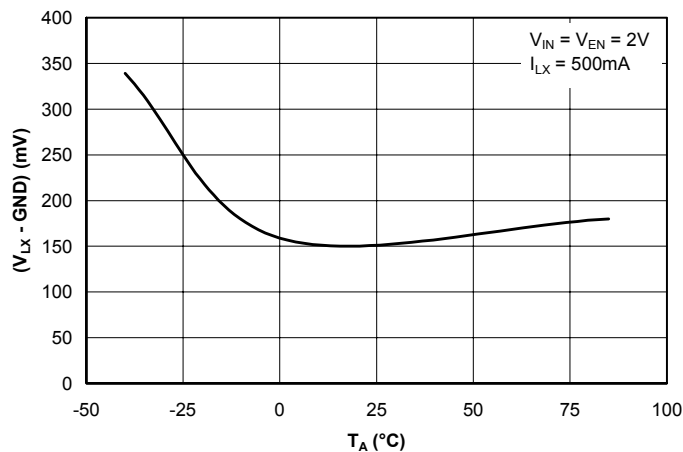
**Supply Current in PWM Mode
vs. Temperature**



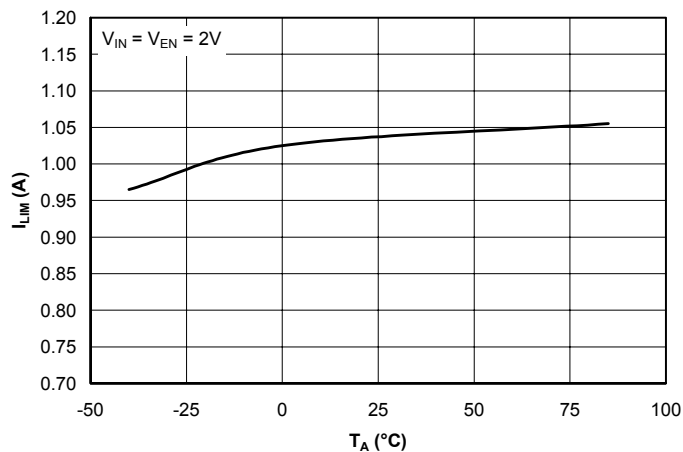
**Feedback Input Current
vs. Temperature**



**Power Switch Voltage Drop
vs. Temperature**

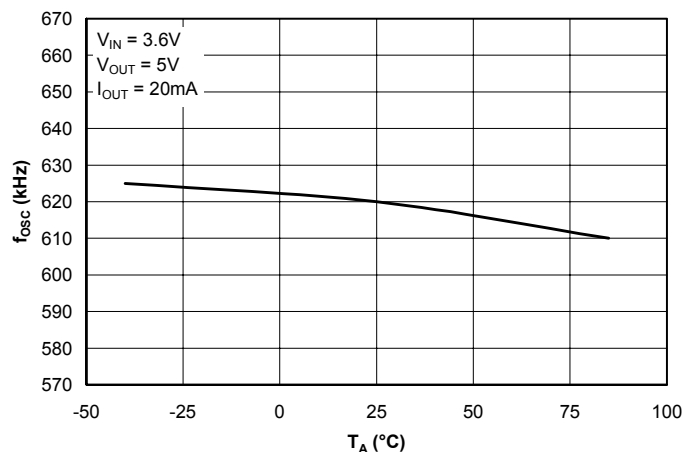


**Power Switch Current Limit
vs. Temperature**

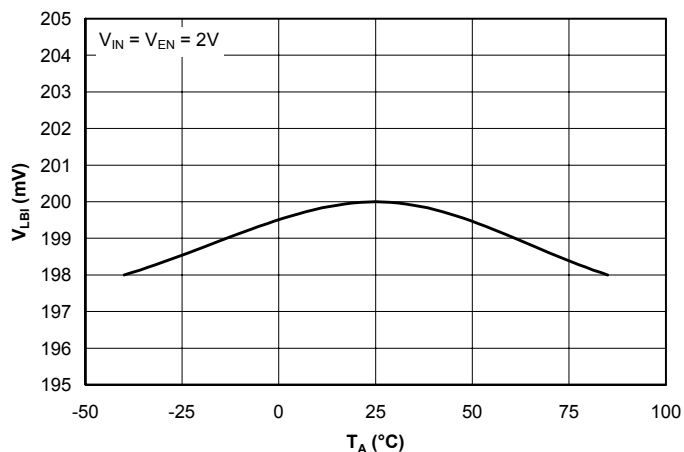


POWER MANAGEMENT
Typical Characteristics (Cont.)

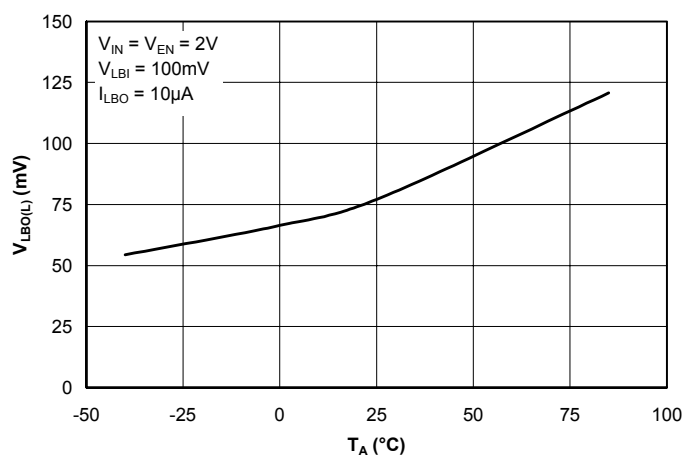
**Internal Oscillator Frequency
vs. Temperature**



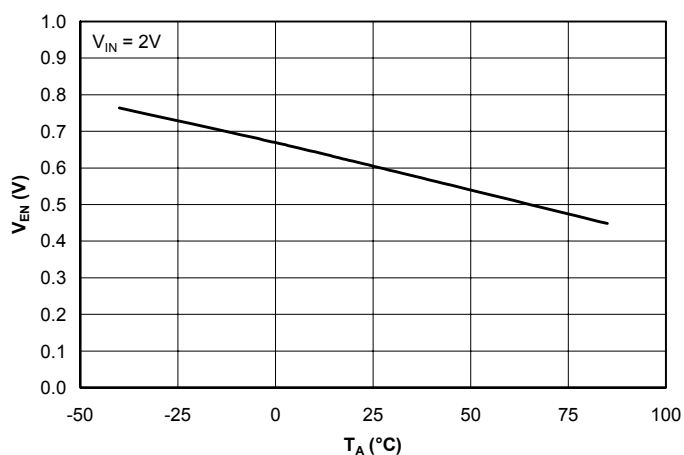
**Low Battery Input Voltage Threshold
vs. Temperature**



**Low Battery Output Low
vs. Temperature**

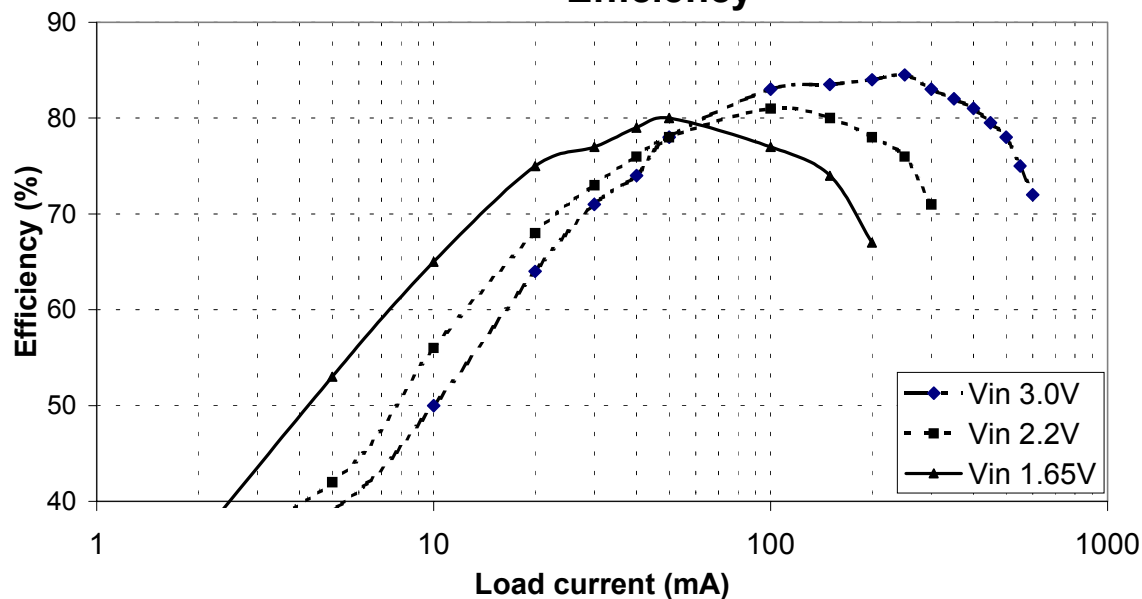


**Enable Voltage Threshold
vs. Temperature**

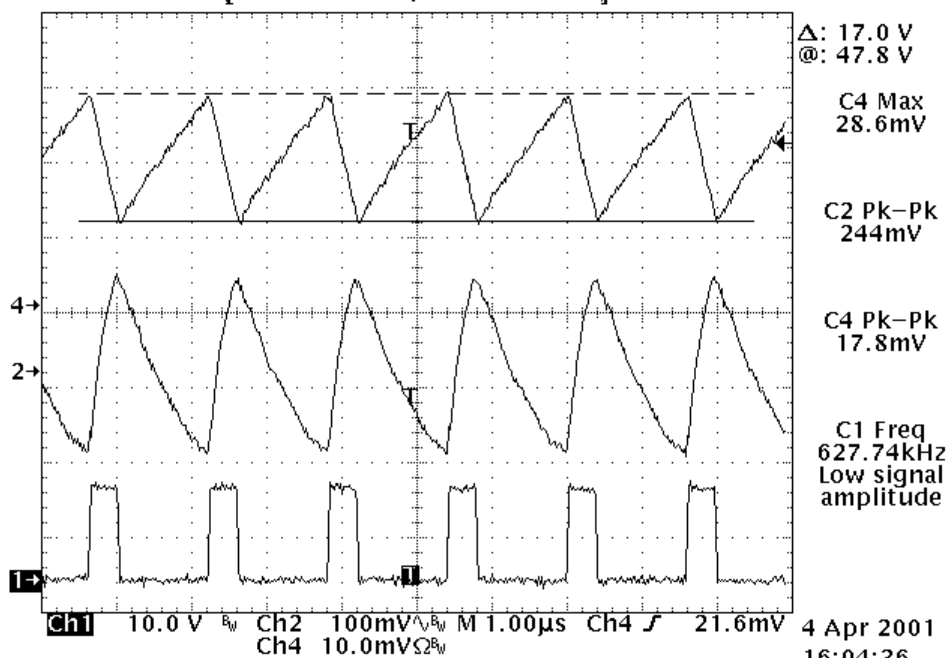


POWER MANAGEMENT
Typical Characteristics (Cont.)

2-Cell to 5V Converter Efficiency



Tek Run: 50.0MS/s Sample



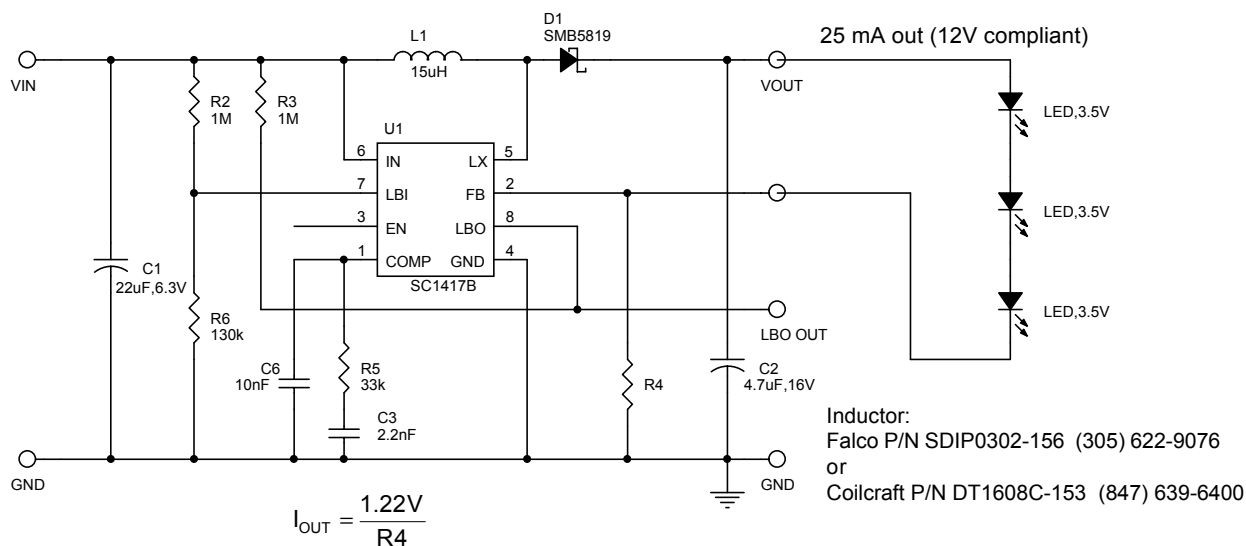
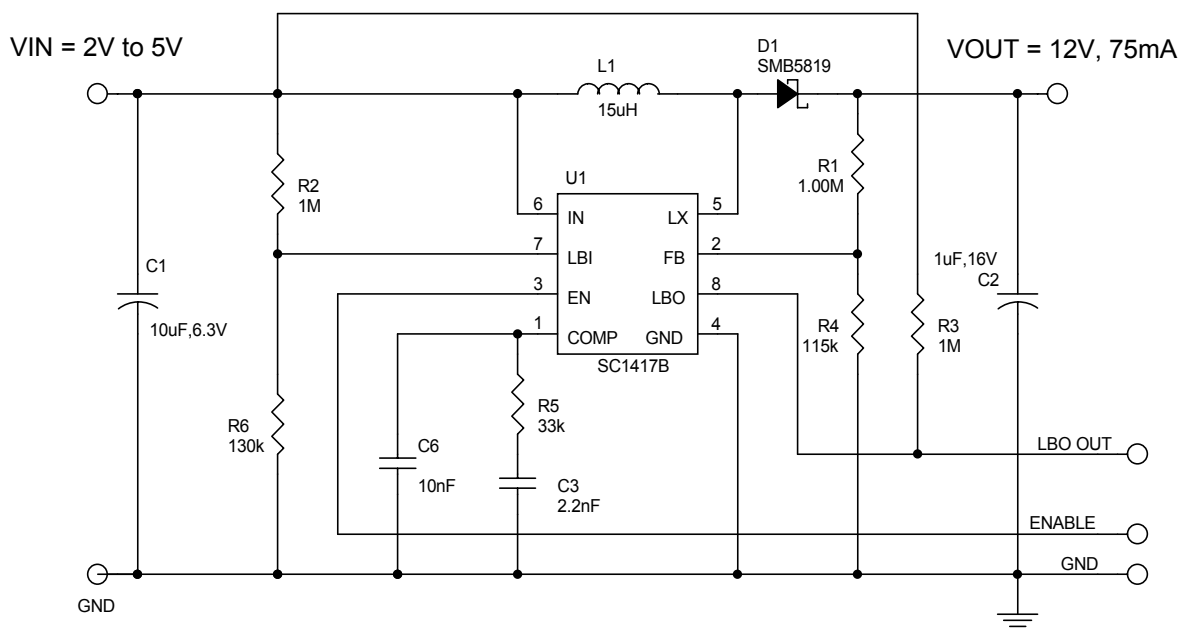
Scope plot of Boost Converter waveforms in Constant Brightness LED driver

Vin = 3V, Vout = 11.9V, Iout = 40mA, L = 15 μ H

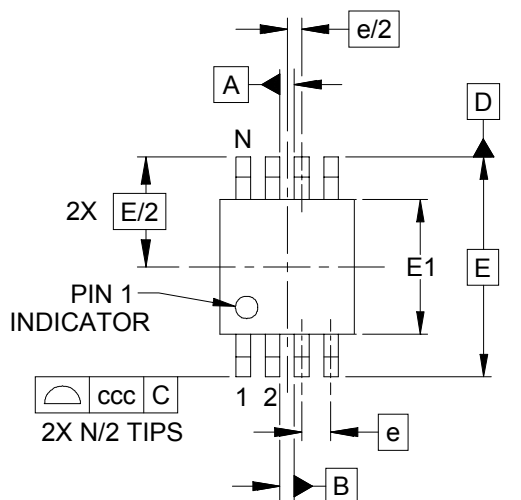
Cin = 10 μ F, 6.3V tant. Cout = 1 μ F, ceramic, (see above schematic for other components used)

Ch1: Switching Node, Ch2: Vout ripple, Ch4: Current in inductor, (100mA/div)

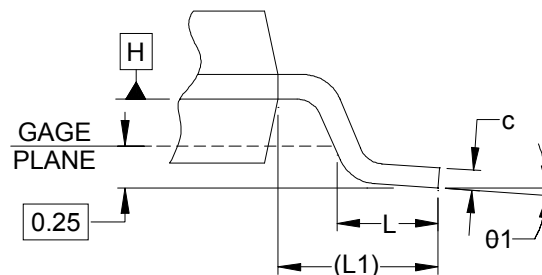
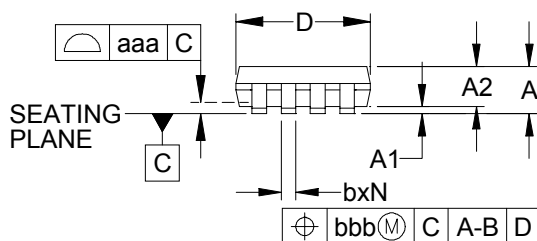
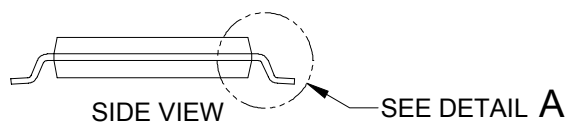
Inductor current ripple = 170mA pk-pk

POWER MANAGEMENT
Typical Application Circuits⁽¹⁾

Figure 1 - Constant Brightness LED driver with 12V compliance from 2-cells (constant current output)

Figure 2 - Minimum Capacitance Boost Converter
Note:

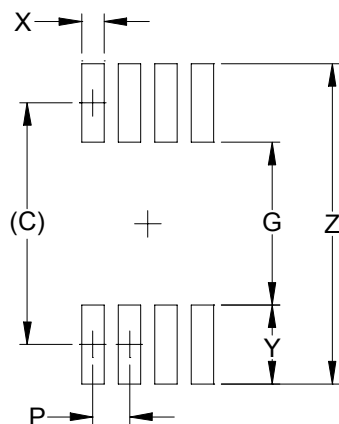
(1) Value of C1 depends on proximity of input source voltage and source impedance (use C1 > 47μF if the input supply is greater than two inches from the SC1417B).

POWER MANAGEMENT
Outline Drawing - MSOP-8


DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	.043	-	-	1.10
A1	.000	-	.006	0.00	-	0.15
A2	.030	-	.037	0.75	-	0.95
b	.009	-	.015	0.22	-	0.38
c	.003	-	.009	0.08	-	0.23
D	.114	.118	.122	2.90	3.00	3.10
E1	.114	.118	.122	2.90	3.00	3.10
E	.193 BSC			4.90 BSC		
e	.026 BSC			0.65 BSC		
L	.016	.024	.032	0.40	0.60	0.80
L1	(.037)			(.95)		
N	8			8		
θ1	0°	-	8°	0°	-	8°
aaa	.004			0.10		
bbb	.005			0.13		
ccc	.010			0.25		


DETAIL A

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DATUMS **-A-** AND **-B-** TO BE DETERMINED AT DATUM PLANE **-H-**
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. REFERENCE JEDEC STD MO-187, VARIATION AA.

POWER MANAGEMENT
Land Pattern - MSOP-8


DIMENSIONS		
DIM	INCHES	MILLIMETERS
C	(.161)	(4.10)
G	.098	2.50
P	.026	0.65
X	.016	0.40
Y	.063	1.60
Z	.224	5.70

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

Contact Information

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