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

$$V_{OUT} = 1.22 \cdot (1 + \frac{R1}{R4})$$
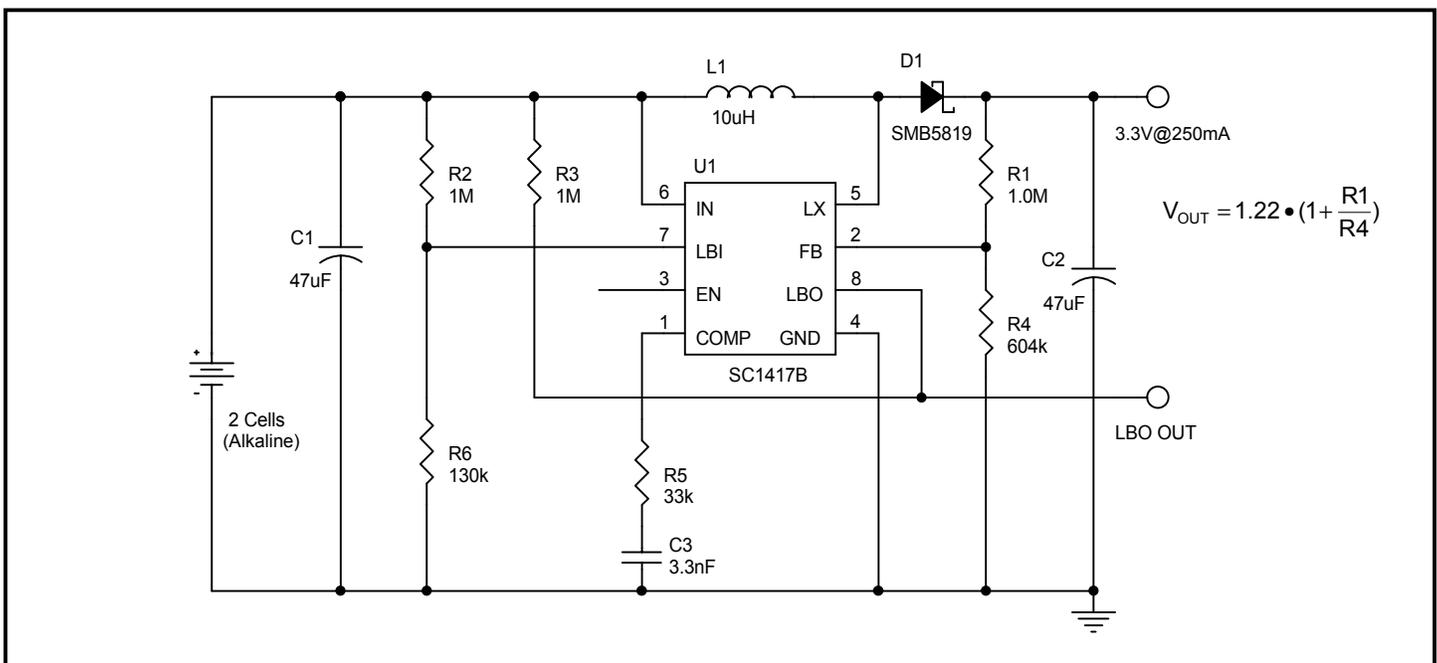
POWER MANAGEMENT

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°C. Values in **bold** apply over full operating ambient temperature range. V_{IN} = 2V, V_{EN} = 2V, 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} = 1.22V	1.5		12	V
			2.0		**12**	
Feedback Voltage	V_{FB}	V_{COMP} = 600mV, LX floating	**1.16**	1.22	**1.28**	V
Supply Current in Shutdown	$I_{Q(OFF)}$	V_{EN} = 0V, V_{LBI} = 300mV		40	55	µA
					65	
Supply Current in PWM Mode	I_Q	I_{OUT} = 0A, V_{COMP} = 100mV		4.3	**5.8**	mA
Feedback Input Current	I_{FB}	V_{FB} = 1.22V		15	**60**	nA
Error Amplifier Transconductance	Gm	dI_{COMP} = 5µA	**70**	140	**240**	µS

POWER MANAGEMENT

Electrical Characteristics

Unless otherwise specified: T_A = 25°C. Values in **bold** apply over full operating ambient temperature range. V_{IN} = 2V, V_{EN} = 2V, 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 = 22uH [1]	I_{OUT}	V_{OUT} = 5.0V, V_{IN} = 2.0V	200			mA
		V_{OUT} = 10V, V_{IN} = 5.0V	250			mA
		V_{OUT} = 15V, V_{IN} = 5.0V	150			mA
Power Switch Voltage Drop [1]	$(V_{LX}\text{-GND})$	I_{LX} = 500mA		150	250	mV
					500	
Power Switch Current Limit	I_{LIM}	0°C $\leq T_A \leq$ 85°C	**0.70**	0.95	**1.20**	A
		-40°C $\leq T_A \leq$ 85°C	**0.60**			
Switch Leakage	I_{LX}	V_{LX} = 5V		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} = 100mV		-5	**-40**	nA
Low Battery Output Low	$V_{LBO(L)}$	I_{LBO} = 5µA		75	**250**	mV
Low Battery Detector Gain [1]	A_V	1MΩ 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} = 0V		-2.3	**-6.0**	µA

Notes:
(1) Guaranteed by design.
(2) This device is ESD sensitive. Use of standard ESD handling precautions is required.

SEMTECH

Pin Configuration

TOP VIEW

COMP	1	8	LBO
FB	2	7	LBI
EN	3	6	IN
GND	4	5	LX
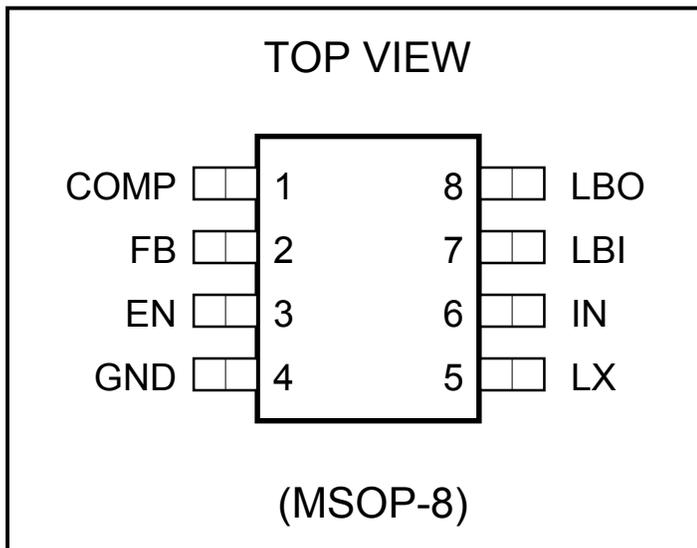
(MSOP-8)

Ordering Information

Part Number	Package
SC1417BIMSTR[1]	MSOP-8
SC1417BIMSTRT[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. $V_{OUT} = 1.22 \bullet (1 + \dfrac{R1}{R4})$
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 then 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. $V_{TH(LO)} = 0.2 \bullet (1 + \dfrac{R2}{R6})$
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
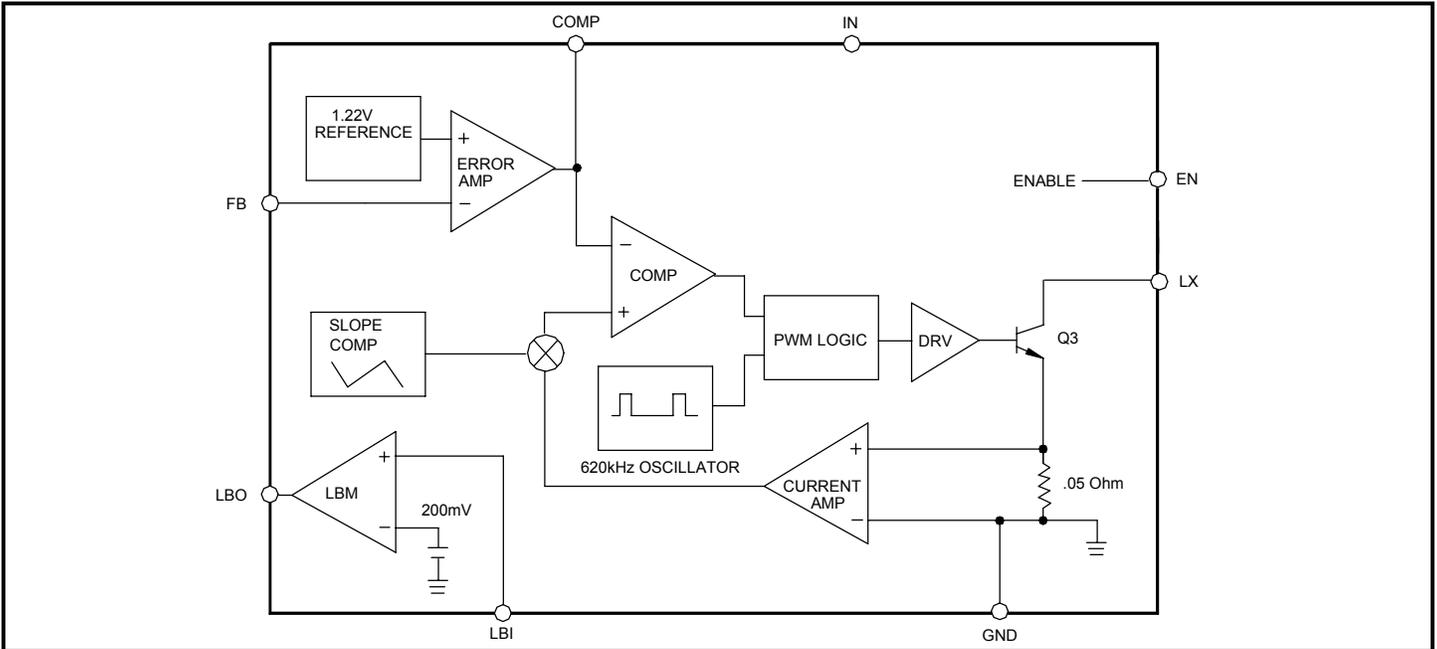
Marking Information

Marking for MSOP-8 package

417B
yyww

TOP

XXXX
XXXX

BOTTOM
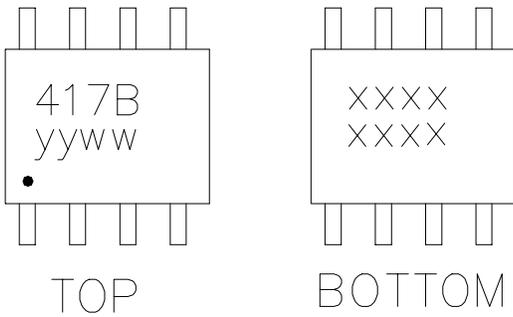
yyww = Date Code (Example: 0012)
xxxxxxxx = Semtech Lot No. (Example: E90101-1)

SEMTECH

Feedback Voltage
vs. Temperature

$V_{IN} = V_{EN} = 2V$
$V_{COMP} = 600mV$
LX floating
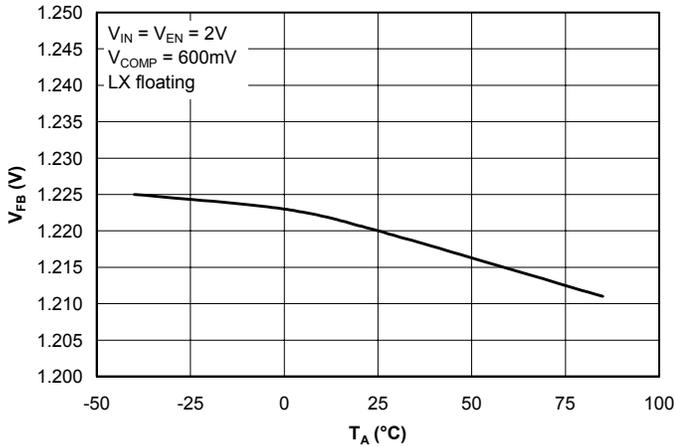
Supply Current in Shutdown
vs. Temperature

$V_{IN} = 2V$
$V_{EN} = 0V$
$V_{LBI} = 300mV$
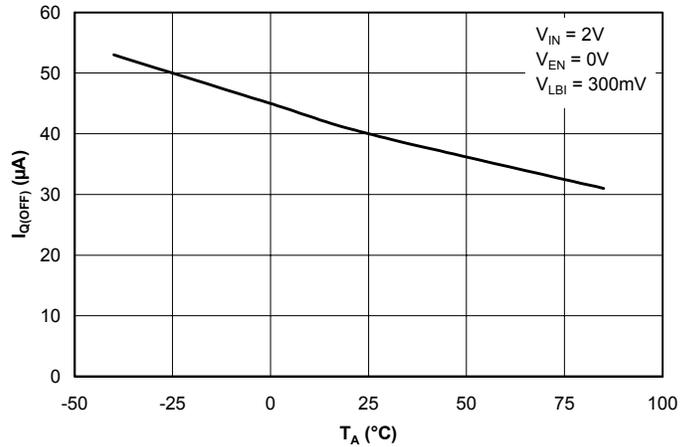
Supply Current in PWM Mode
vs. Temperature

$V_{IN} = V_{EN} = 2V$
$I_{OUT} = 0A$
$V_{COMP} = 100mV$
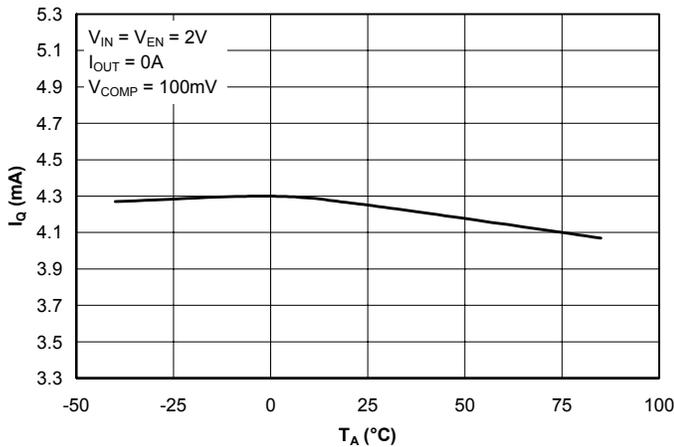
Feedback Input Current
vs. Temperature

$V_{IN} = V_{EN} = 2V$
$V_{FB} = 1.22V$
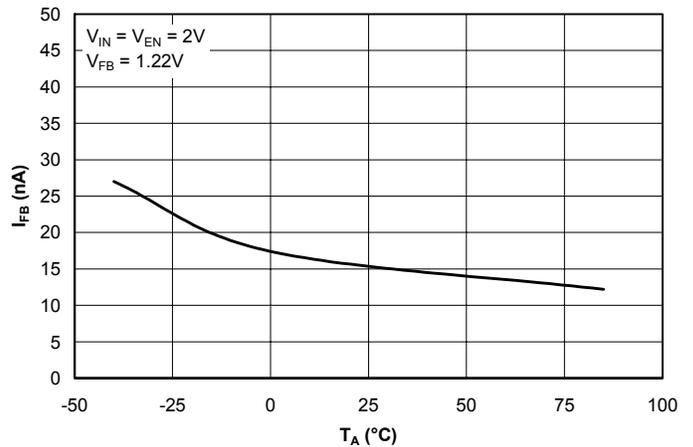
Power Switch Voltage Drop
vs. Temperature

$V_{IN} = V_{EN} = 2V$
$I_{LX} = 500mA$
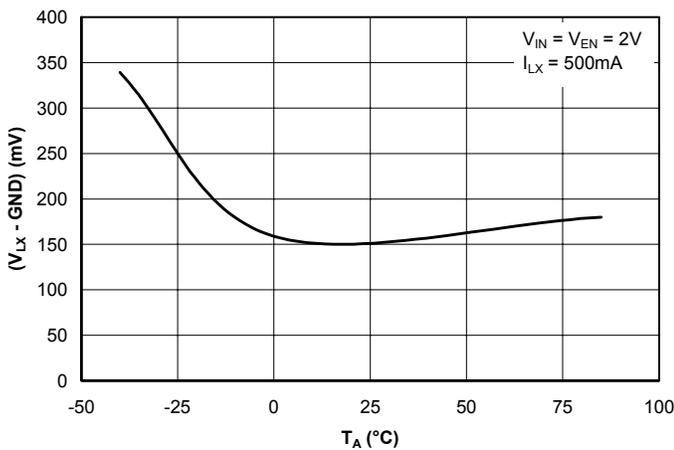
Power Switch Current Limit
vs. Temperature

$V_{IN} = V_{EN} = 2V$

SEMTECH

Internal Oscillator Frequency

vs. Temperature

$V_{IN} = 3.6V$
$V_{OUT} = 5V$
$I_{OUT} = 20mA$

f$_{OSC}$ (kHz) vs. T$_A$ (°C)

Low Battery Input Voltage Threshold

vs. Temperature

$V_{IN} = V_{EN} = 2V$

V$_{LBI}$ (mV) vs. T$_A$ (°C)
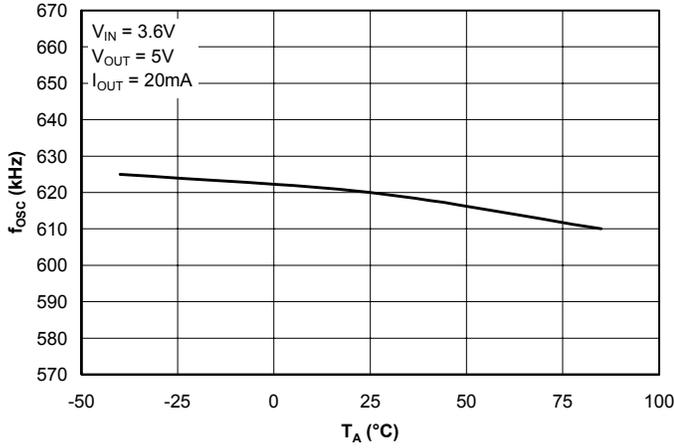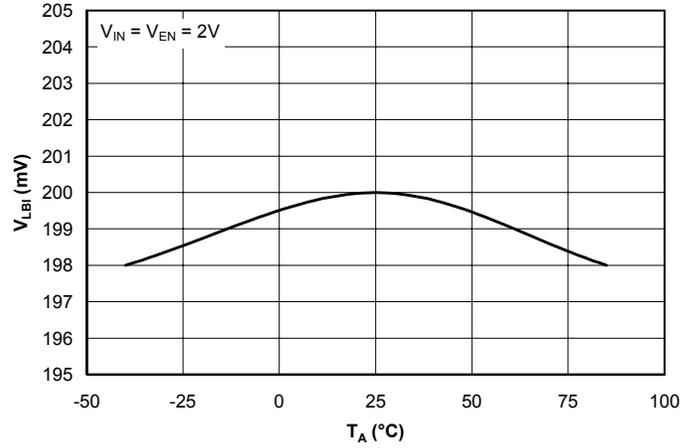
Low Battery Output Low

vs. Temperature

$V_{IN} = V_{EN} = 2V$
$V_{LBI} = 100mV$
$I_{LBO} = 10\mu A$

V$_{LBO(L)}$ (mV) vs. T$_A$ (°C)
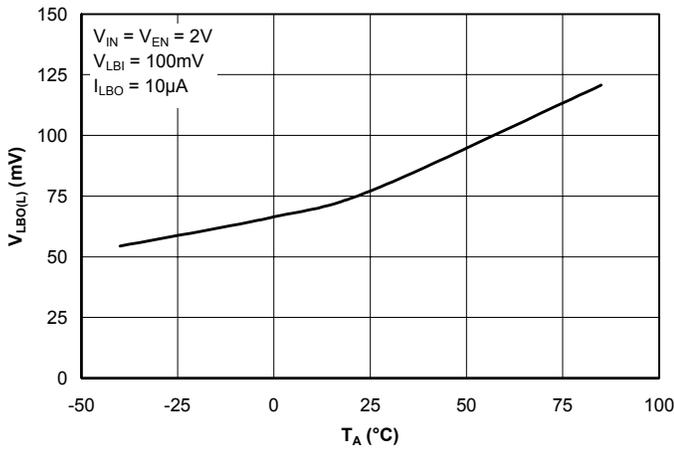
Enable Voltage Threshold

vs. Temperature

$V_{IN} = 2V$

V$_{EN}$ (V) vs. T$_A$ (°C)

2-Cell to 5V Converter
Efficiency

Legend: Vin 3.0V, Vin 2.2V, Vin 1.65V
X-axis: Load current (mA)
Y-axis: Efficiency (%)

Tek Run: 50.0MS/s   Sample

Δ: 17.0 V
@: 47.8 V

C4 Max
28.6mV

C2 Pk-Pk
244mV

C4 Pk-Pk
17.8mV

C1 Freq
627.74kHz
Low signal
amplitude

Ch1 10.0 V ᴮw Ch2 100mV ᴺᵥᴮw M 1.00µs Ch4 ʃ 21.6mV
Ch4 10.0mVΩᴮw

4 Apr 2001
16:04:36

Scope plot of Boost Converter waveforms in Constant Brightness LED driver
Vin = 3V, Vout = 11.9V, Iout = 40mA, L = 15uH
Cin = 10uF, 6.3V tant. Cout = 1uF, 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

www.semtech.com

![Semtech logo] SEMTECH

POWER MANAGEMENT

Typical Application Circuits[(1)]

$$I_{OUT} = \frac{1.22V}{R4}$$

Inductor:
Falco P/N SDIP0302-156 (305) 622-9076
or
Coilcraft P/N DT1608C-153 (847) 639-6400
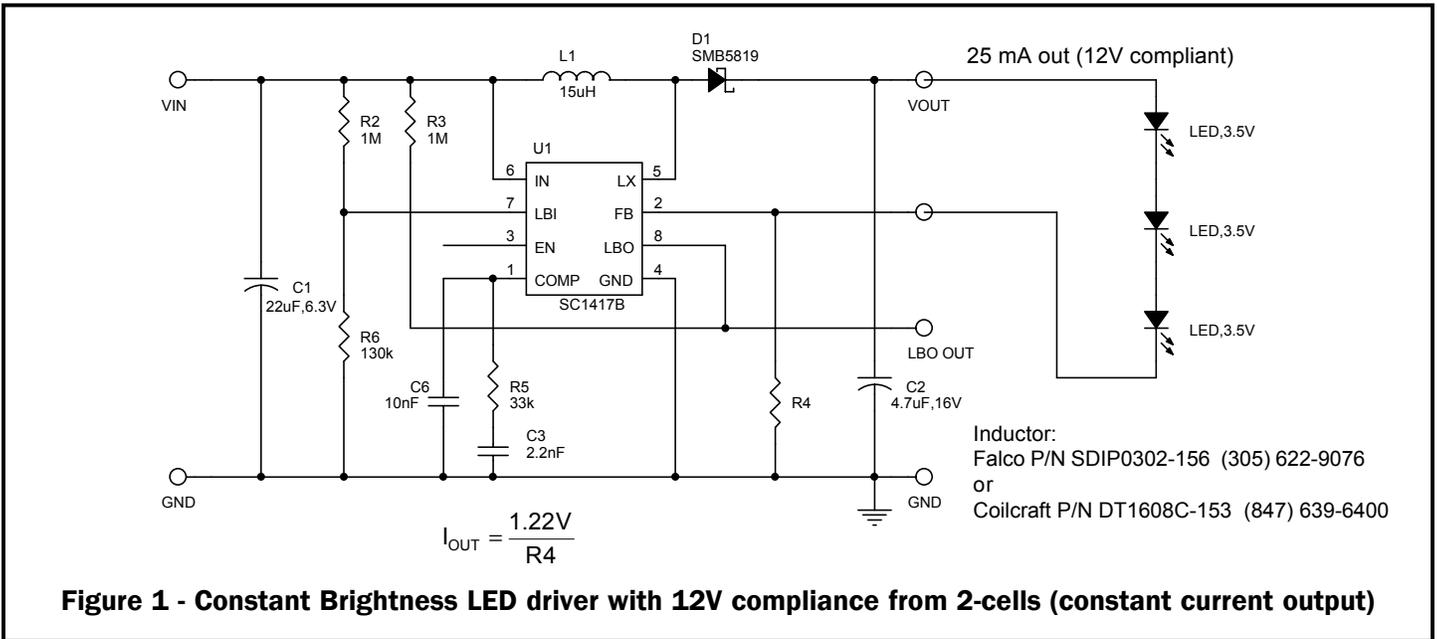
**Figure 1 - Constant Brightness LED driver with 12V compliance from 2-cells (constant current output)**
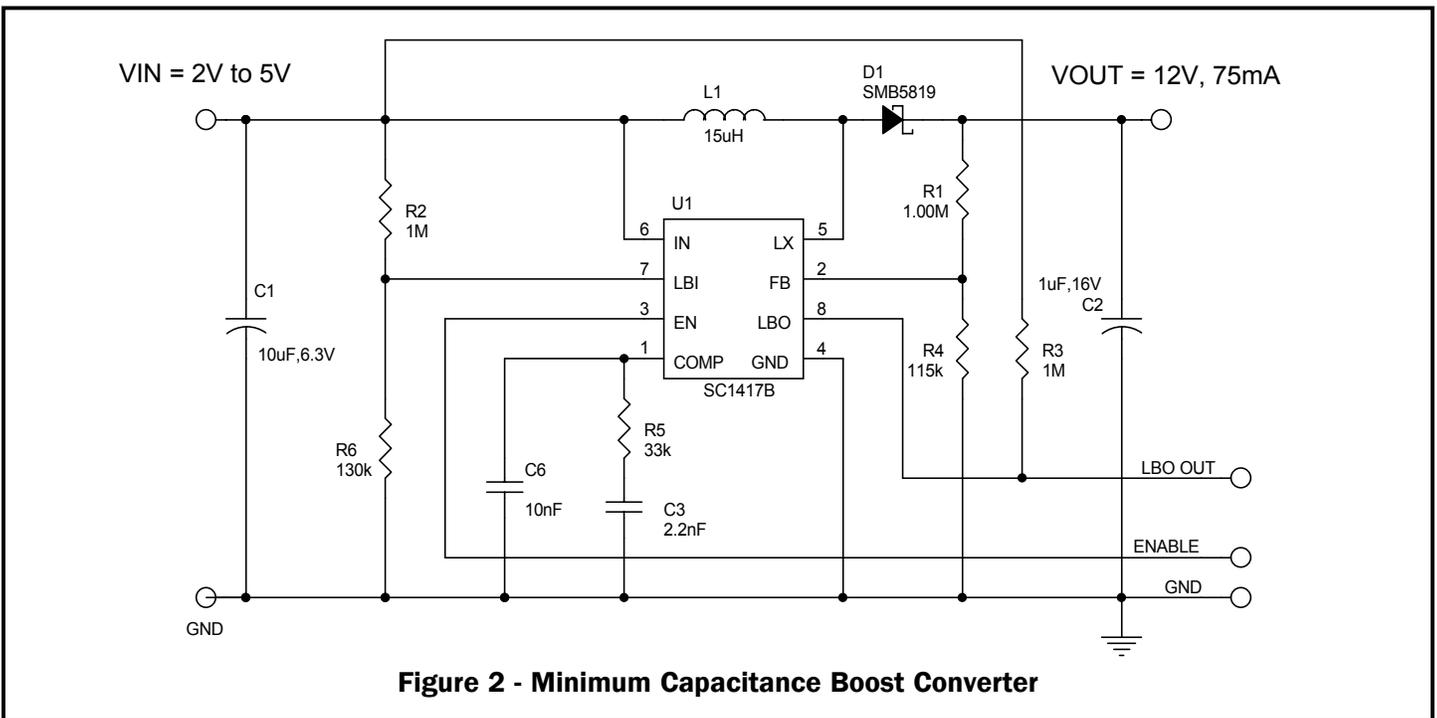
Figure 2 - Minimum Capacitance Boost Converter

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
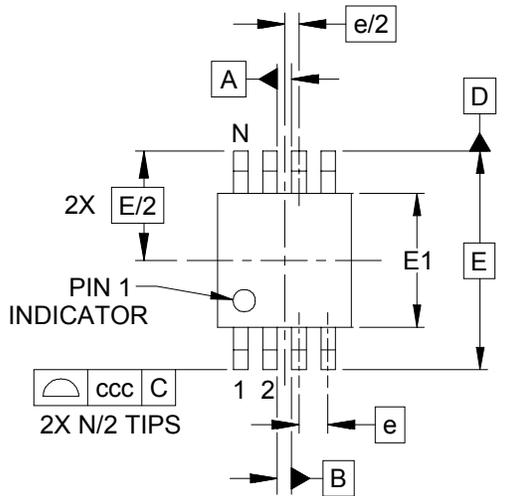
DIMENSIONS						
DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	.043	-	-	1.10
A1	.000	-	.006	0.00	-	0.15
A2	.030	-	.037	0.75	-	0.95
b	.009	-	.015	0.22	-	0.38
c	.003	-	.009	0.08	-	0.23
D	.114	.118	.122	2.90	3.00	3.10
E1	.114	.118	.122	2.90	3.00	3.10
E	.193 BSC			4.90 BSC		
e	.026 BSC			0.65 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

SIDE VIEW   SEE DETAIL A
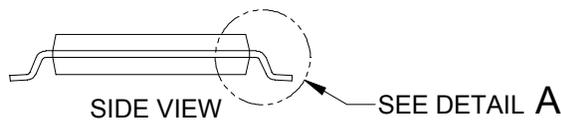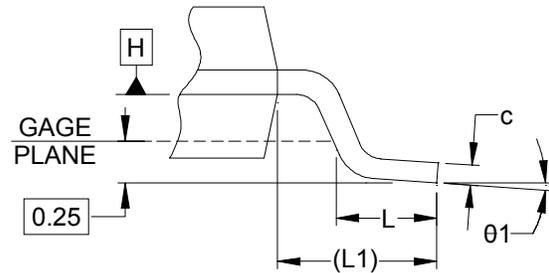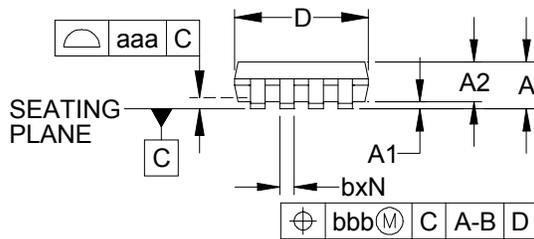
NOTES:

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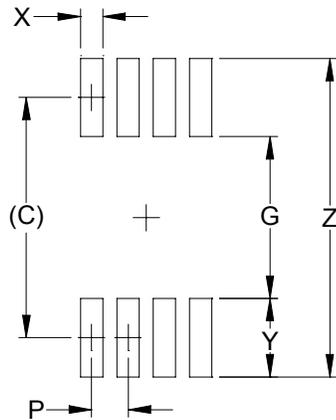
DIMENSIONS		
DIM	INCHES	MILLIMETERS
C	(.161)	(4.10)
G	.098	2.50
P	.026	0.65
X	.016	0.40
Y	.063	1.60
Z	.224	5.70

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

Semtech Corporation
Power Management Products Division
200 Flynn Road, Camarillo, CA 93012
Phone: (805) 498-2111 FAX (805)498-3804

Visit us at: www.semtech.com