



Modification Record:

Date	New Ver	Old Ver	Who	Modification Contents
2019-01-15	1.0	NA	R&D	New Documentation
2019-04-25	1.1	1.0	R&D	Change PIN VCC, VDD
2019-10-29	1.2	1.1	Marketing	CS PIN CC control descriptions
2020-08-03	1.3	1.2	R&D	Application Circuit modifications
2022-07-19	1.4	1.3	R&D	Add typical efficiency comparison chart

Product Description

SE3837CS is a Synchronized PWM controller capable of working from a wide range of input voltages from 4.1V to 40V, while providing precision Constant Voltage (CV), and Constant Current (CC) output.

SE3837CS has all the compensation built-in for the complete full range of conditions including 100% duty-cycle applications, therefore eliminating external compensation RC networks and their adjustments, reducing overall application components.

Furthermore, the CV and CC control can be adjusted externally and consequently offer the customers the flexibility to optimize their application needs.

To minimize the effort in applications where EMC and EMI compliance is required, SE3837CS also has frequency-dither-function built-in. The oscillation frequency will automatically spread the energy over a wide range of frequencies, effectively reducing the frequency peaks to under EMI and EMC requirements.

For applications where high current output is needed, SE3837CS also has built-in Line-Compensation to compensate the IR line loss

SE3837CS is offered in SOP8 package for low cost considerations. For applications where overall product dimension is restricted,

Features

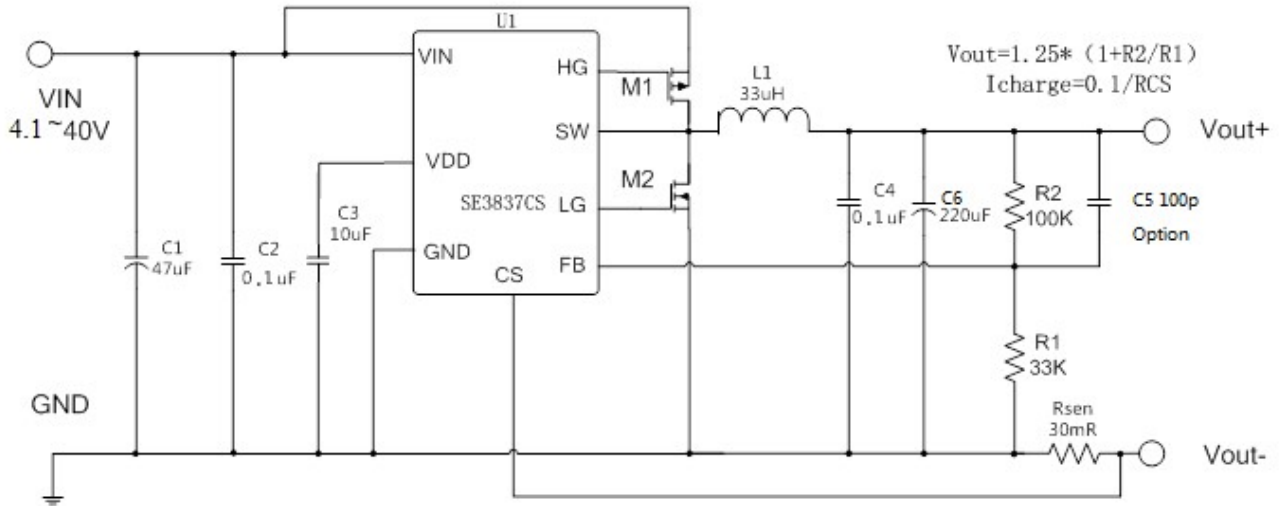
- Wide operating Input voltage 4.1~40V.
- No External compensations
- Adjustable CV and CC.
- 200KHz fixed operation frequency
- Internal frequency-dither for easy EMC test
- Short circuit protection, Over temperature protection, over voltage and under voltage protections
- Line compensation built-in to compensate output line IR drop up to 300mV.
- SOP8 package
- 100% duty cycle capable
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Applications

- Car-charger applications where QC and PD functions are required.
- USB Power Extension applications where QC and PD functions are required.
- Other low to mid-range output voltage applications from fixed 4.1-40V input voltages.

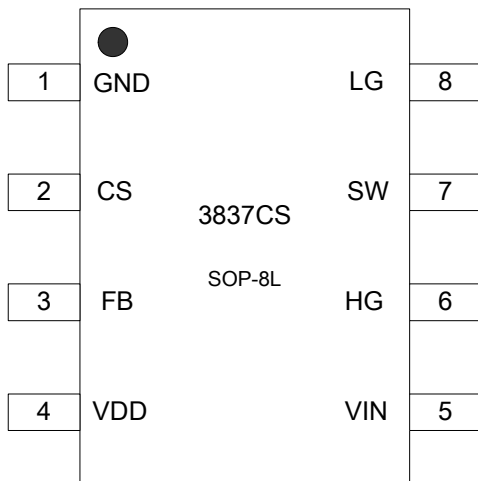


Typical Applications



Note: When VIN > 7V, C3 is optional

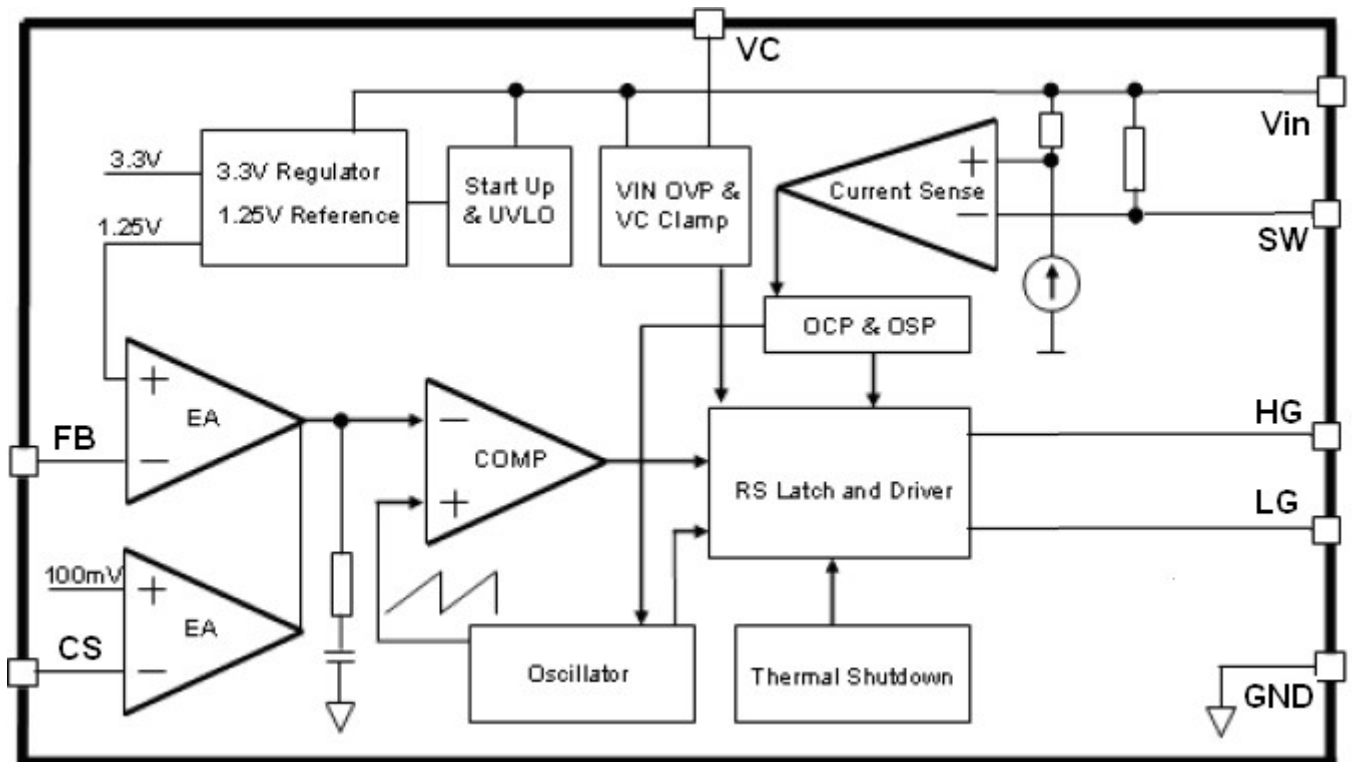
Pin Configuration



PIN Descriptions

NO.	Pin Name	Pin Function Description
1	GND	Ground
2	CS	Output current Sense PIN. (A: $I_{OUT}=0.105V/RCS$; B: $I_{OUT}=0.12V/RCS$; C: $I_{OUT}=0.14V/RCS$)
3	FB	Feedback PIN. Detect the output voltage. The internal reference is 1.25V
4	VDD	Internal power supply. A 10u ceramic capacitor is required between this PN and GND
5	Vin	Input Voltage. Supports $V_{in}=4.1V$ to 40V. A 10uF electrolytic capacitor is needed to reduce overall noise.
6	HG	High-side PMOS Drive
7	SW	Switching PIN
8	LG	Low-side NMOS drive

Simplified Internal Diagram





Ordering Information

Part Number	Marking Information	Package	Remarks
SE3837CS-HF	3837CS YYWW-HF	SOP8	Halogen Free. YY: year; WW: week CC options: A/B/C

Absolute Maximum

Symbol	Parameter	Maximum	Units
V _{in}	Input Voltage	40	V
V _{fb}	Feedback Voltage	6.5	V
V _{sw}	Switching Voltage	40	V
V _{dd}	Internal Voltage supply	6.5	V
V _{cs}	Current Sense Input	6.5	V
HG	High-Side PMOS drive voltage (V _{in} -HG)	6.5	V
LG	Low-Side NMOS drive voltage	6.5	V
T _j	Maximum junction temperature	150	°C



Parameters

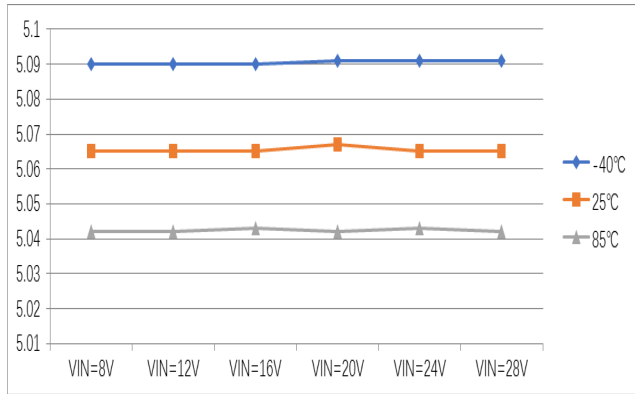
(V_{cc}=12V ; I_{out}=0mA ; T_j=25°C unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V _{in}		4.1V		40V	V
Vfb Reference	Vfb			1.25		V
Under Voltage Lockout	V _{in_uvlo}			4		V
Quiescent Current	I _q	Vfb=1.5V force driver of		3		mA
Operation Frequency	F _{osc}	I _{out} =100mA		200		KHZ
CC internal Voltage	V _{cs}	V _{out} - — Gnd		100		mV
Internal Line-Compensation	V _{smart}				300	mV
Over Temperature Protection	OTP	V _{out} =5V; I _{out} =100mA		130		°C
Over Current Protection	SCP	Vfb<0.3V		0.3		V
Max duty cycle	D _{MAX}		-	100	-	%
CC Accuracy	V _{sen}	VER.A	- 6%	105	+ 6%	mV
		VER.B	- 6%	120	+ 6%	
		VER.C	- 6%	140	+ 6%	

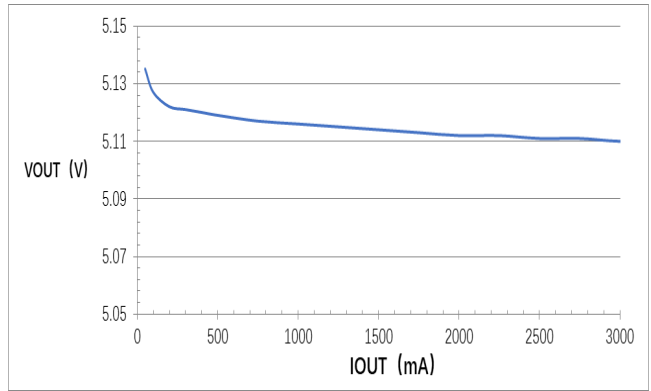


Typical performance characteristics

Output Voltage drifts over different Vin at different temperatures

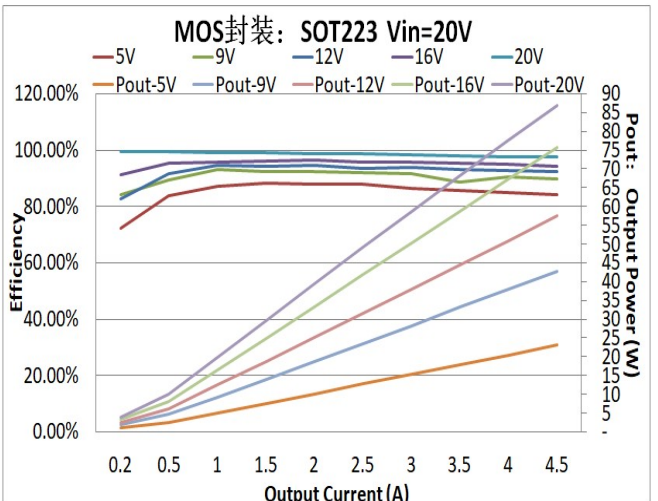
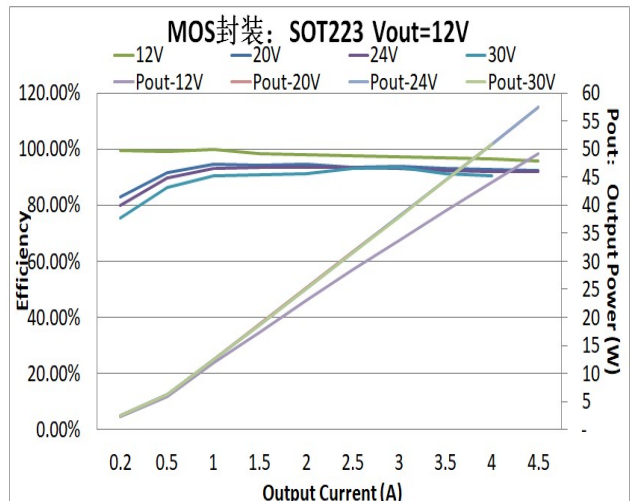
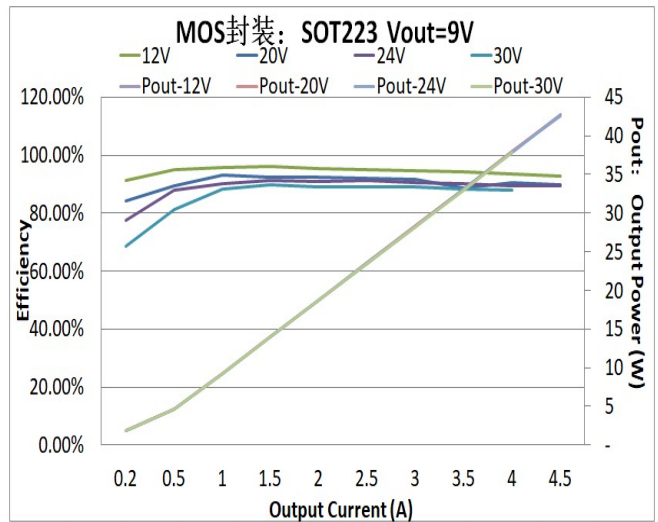
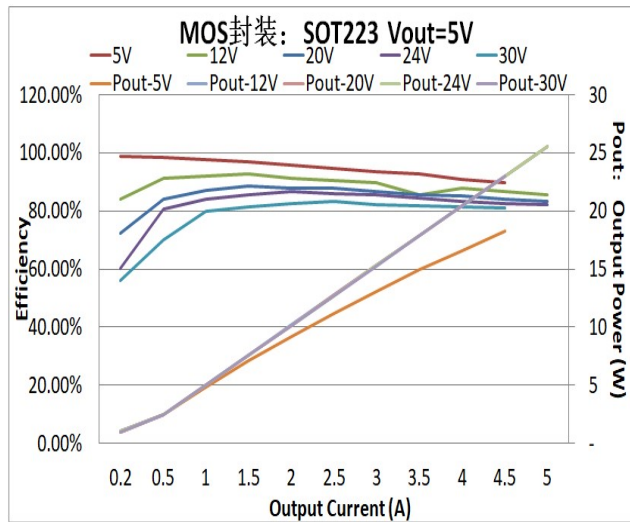


Load Regulation



Typical efficiency under different input and output combinations and different MOS packages

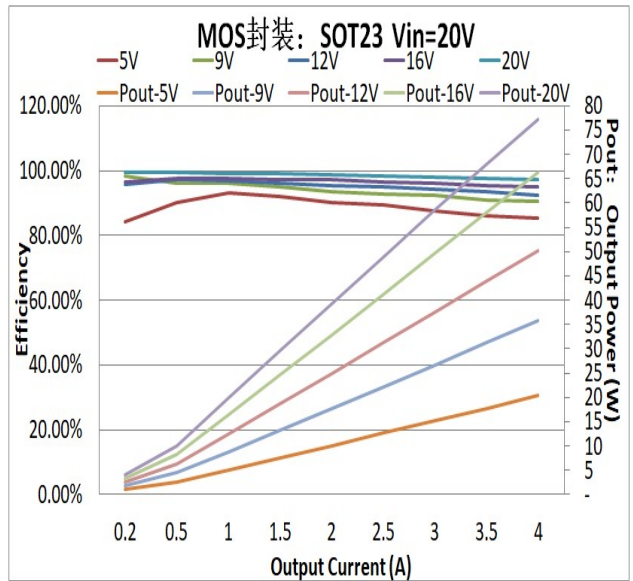
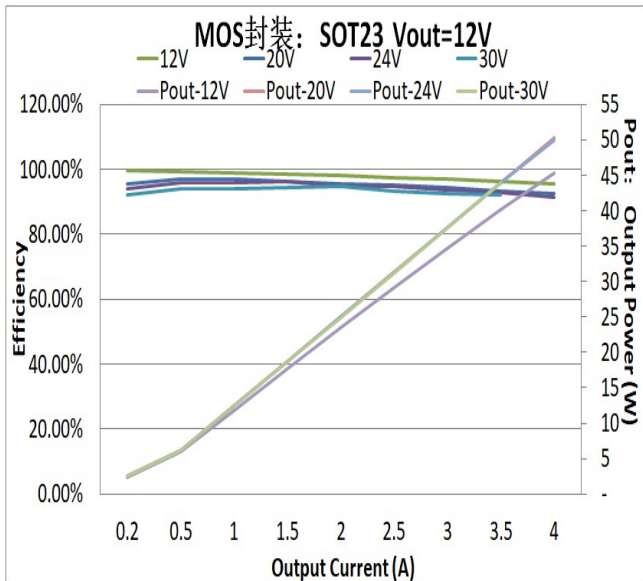
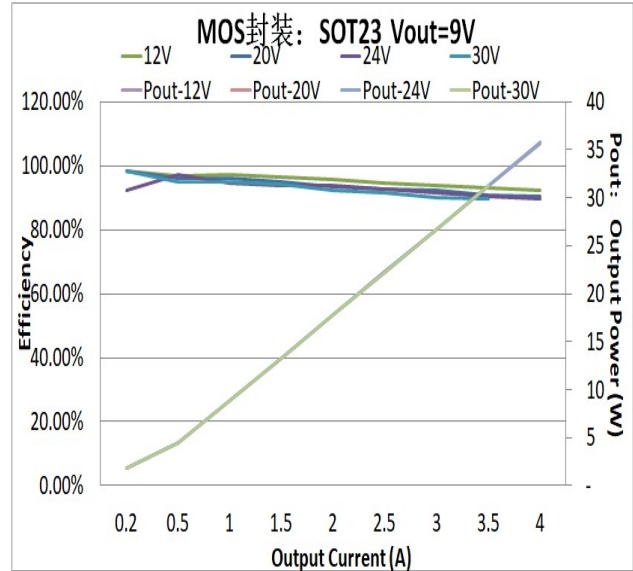
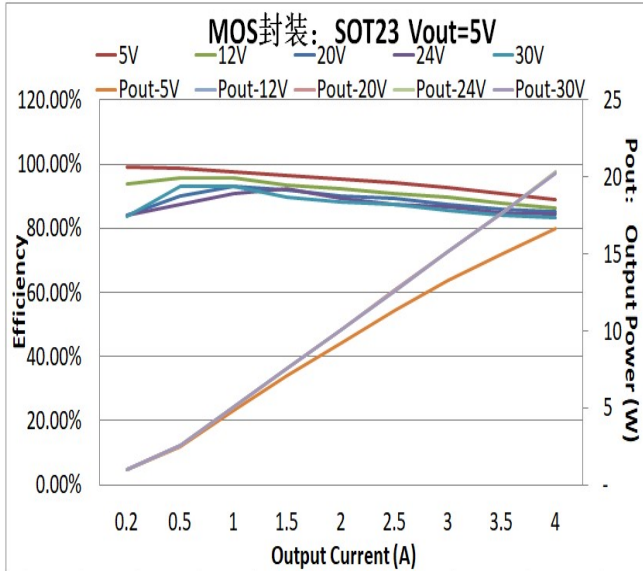
NMOS: STN4NF03, 60m@4.5V, CISS=330p
PMOS: VBJ2456, 60m@4.5V, CISS=970p





NMOS: IRLML0040, 78m@4.5V, CISS=266p

PMOS: WST3401, 64m@4.5V, CISS=580p





Functional Description

UVLO

SE3837CS VIN can take up to 40V, the operating range is from 4.1V to 40V. When Vin rises from 0V to 4.1V during power up, SE3837CS begins to deliver output voltage according to the user setup. When the input voltage drops below 4.1V, SE3837CS ceases to output voltage and current.

Soft-Start

During Power up, or after other abnormal conditions such as over-temperature protection, under voltage protection, short circuit protection, SE3837CS will provide a soft-start period of about 300us to minimize the current-shock to the Load and the overall system, and to minimize output overshoot.

Constant Voltage Output

SE3837CS output voltage can be adjusted through FB.

Constant Current Output

SE3837CS measures voltage on CS pin to monitor and control the output currents. Consequently, the output current can be adjusted through the resistors between CS and GND. Due to the application need and our production control, the following three(3) categories of IC's can be ordered, and current-adjusted through the following formulas:

The output current is adjusted by R_{sen} , as follows:

$$A: I_{out} = \frac{VER.A}{R_{sen}}$$

$$B: I_{out} = \frac{VER.B}{R_{sen}}$$

$$C: I_{out} = \frac{VER.C}{R_{sen}}$$

Short Circuit Protection

When the load is short-circuited, or too heavy a load for normal operations, the output voltage brings down Vfb to under 0.3V, SE3837CS enters Short-Circuit Protection mode. In short-circuit protection mode, SE3837CS lowers the operating frequency to 1/3 of the normal operations. Additionally, SE3837CS will monitor the output periodically to check if the short-circuit condition is removed. Once the short-circuit condition is removed,



SE3837CS will re-enter the normal operation, with the operating frequency goes back to normal.

Line Compensation

In most applications when heavy current is required, there will be associated with the Voltage drop (IR drops) on Power the Ground lines. For example, if the combined power lines and contact resistors are about 100mOhms which is quite normal, the Voltage drop will be around 300mV if 3A is passing through these lines. SE3837CS has a 300mV Line compensation built-in to cancel out these IR drops.

Frequency Hopping or Dithering

In applications where EMC compliance is required, SE3837CS already has Frequency Dithering built-in. SE3837CS operating frequency will dither 7% in 256 cycles. This is enough frequency energy spread to effectively lower frequency emission radiations, lower the maximum peak when EMC test is conducted.

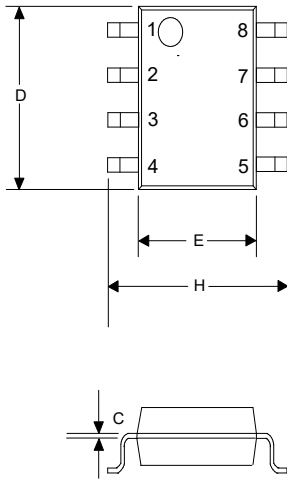
Due to the fast internal loop compensations with SE3837CS, this 7% frequency dithering will not impact the normal stable operations, and will not cause the overall system to malfunction.

Over Temperature Protection

When the junction temperature reaches 140C within SE3837CS, SE3837CS will cease operation to prevent overall system from malfunction, and wait for temperature to cool down. When the temperature cools down to 115C, SE3837CS will re-enter operation. The 30C gap is large enough to allow the IC to cool down considerably to re-start normal operation again.



OUTLINE DRAWING SOP8



DIMENSIONS				
DIM ^N	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.0532	0.0688	1.35	1.75
A1	0.0040	0.0098	0.10	0.25
B	0.0130	0.0200	0.33	0.51
B1	0.050 BSC		1.27 BSC	
C	0.0075	0.0098	0.19	0.25
D	0.1890	0.1968	4.80	5.00
H	0.2284	0.2440	5.80	6.20
E	0.1497	0.1574	3.80	4.00

Customer Support

Seaward Electronics Incorporated – China

Section B, 2nd Floor, ShangDi Scientific Office Complex, #22 XinXi Road
 Haidian District, Beijing 100085, China
 Tel: 86-10-8289-5700/01/05
 Fax: 86-10-8289-5706
 Email: sales@seawardinc.com.cn

Seaward Electronics Incorporated – North America

1512 Centre Pointe Dr.
 Milpitas, CA95035, USA
 Tel: 1-650-444-0713