SY6885B

60V, 5A Full Protection Switch

General Description

The SY6885B is a current limit switch with programmable input over voltage protection and output voltage clamping. Extremely low $R_{DS(ON)}$ of the integrated protection N-channel FET helps to reduce power loss during normal operation. Programmable soft-start time controls the slew rate of the output voltage during start-up. Independent enable control allows the complicated system sequencing control. The device also integrates thermal shutdown protection. This device along with small QFN3×3-16 footprint provides small PCB area application.

Ordering Information

SY6885 □(□□)□

- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SY6885BQDC	QFN3×3-16	----

Features

- Wide Input Voltage Range from 4V to 48V with Surge up to 60V
- Low Bias Current: 100μA Typical
- Extremely Low $R_{DS(ON)}$ for the Integrated Protection Switch: 40mΩ
- Programmable Soft-start
- Programmable Current Limit
- OCP/TSD/OVP Protection: Auto-recovery
- Input Over Voltage Protection with Adjustable Threshold and Auto-recovery
- Programmable Output Voltage Clamping
- RoHS Compliant and Halogen Free
- Compact Package: QFN3×3-16

Applications

- Notebook PC
- Server
- Service PC

Typical Applications

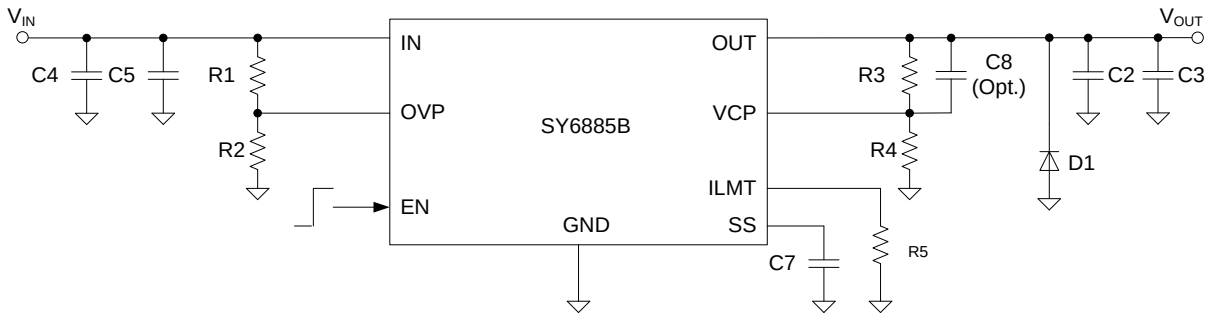
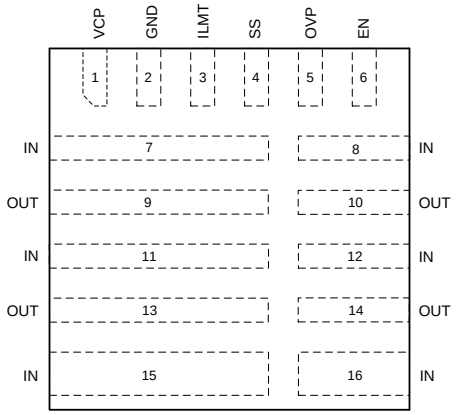


Figure 1. Schematic Diagram

Pinout (top view)



(QFN3×3-16)

Top Mark: BEO*xyz* (device code: BEO, ***x=year code, y=week code, z= lot number code)***

Pin Name	Pin Number	Pin Description
IN	7,8,11,12,15,16	Power input pin. Decouple high frequency noise by connecting at least 0.1μF MLCC to ground.
GND	2	Ground pin.
OVP	5	Over voltage protection input. Connect to the center of resistor divider. The protection voltage is: V_{OVP} = 1.2V× (R_1+R_2)/R_2.
ILMT	3	Current limit program pin. Connect a resistor from this pin to ground to program the current limit.
SS	4	Soft-start time program pin. Connect a capacitor to ground to program the soft-start time.
EN	6	Enable control input. Pull it high to enable the IC.
VCP	1	Output clamping voltage setting pin. The clamping voltage equals to V_{CLAMP}=1.2V× (R_3+R_4)/R_4.
OUT	9, 10, 13, 14	Power output pin.

Block Diagram

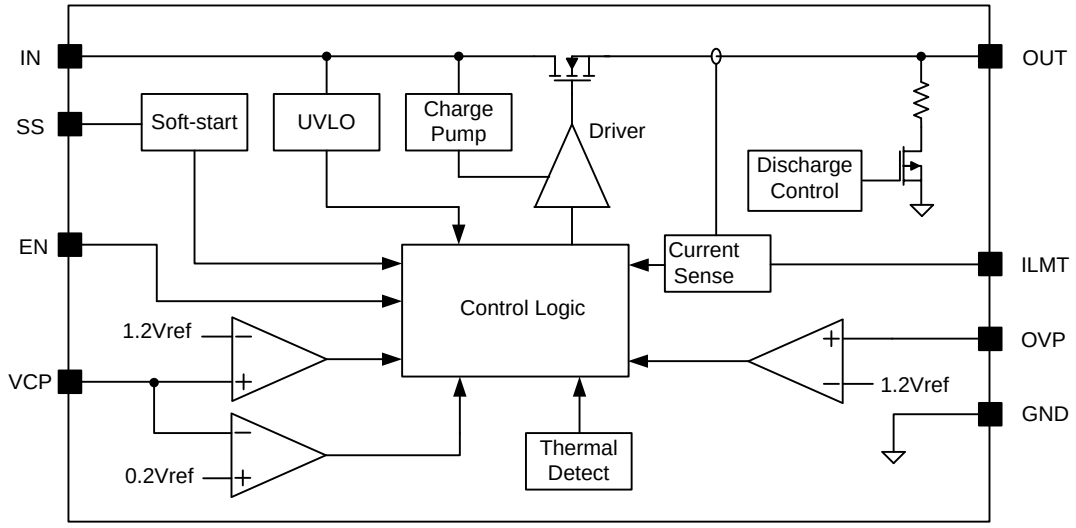


Figure 2. Block Diagram

Absolute Maximum Ratings (Note 1)

IN ---------- -0.3V to 60V
EN, OUT, OVP, VCP ---------- -0.3V to 60V
SS, ILMT ---------- -0.3V to 3.6V
Power Dissipation, P_D @ T_A = 25°C QFN3×3-16, ---------- 2.463W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 40.596°C/W
θ_{JC} ---------- 10.656°C/W
Junction Temperature Range ---------- -40°C to 125°C
Lead Temperature (Soldering, 10 sec.) ---------- 260°C
Storage Temperature Range ---------- -65°C to 150°C

Recommended Operating Conditions (Note 3)

IN ---------- 4V to 48V
EN, OUT, OVP, VCP ---------- 0V to 48V
SS, ILMT ---------- 0V to 3.3V
Junction Temperature Range ---------- -40°C to 125°C

Electrical Characteristics

(V_{IN} = 48V, C_{SST}=100nF, C_{IN} = 10µF, C_{OUT} = 10µF, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		4		48	V
Input UVLO Threshold	V_{UVLO}		3.5		3.9	V
UVLO Hysteresis	V_{HYS}			0.2		V
Bias Current	I_{BIAS}	V_{IN}=48V, EN=3V		100	150	µA
Shutdown Current	I_{SHDN}	V_{IN}=48V, EN=0		10		µA
Protection FET RON	$R_{DS(ON)}$	V_{IN}=5V, EN=3V		40	60	mΩ
Current Limit Program Range	I_{LMT}	(Note 5)	1		5	A
Current Limit Accuracy		I_{LMT} = 5A,V_{IN}=5V	-30%		30%	I_{LIM}
VCP Reference Voltage	V_{VCPREF}		1.176	1.2	1.224	V
OVP Reference Voltage	V_{OVPREF}		1.176	1.2	1.224	V
OVP Response Time	t_{OVP}			200		ns
OVP Recovery Hysteresis	$V_{OVP,HYS}$			120		mV
Soft-start Time	t_{SS}	(Note 4)C_{SST}=100nF,		23.2		ms
Soft-start Time Accuracy		V_{IN}=24V, R3/R4=200k/10k	-30%		30%	
EN Turn-on Threshold	V_{EN_ON}		2			V
EN Turn-off Threshold	V_{EN_OFF}				0.4	V
Output Discharge Resistor	R_{DIS}			13k		Ω
Thermal Shutdown Temperature	T_{SD}			150		°C
Thermal Shutdown Hysteresis	T_{HYS}			20		°C

Note 1: Stresses beyond the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

Note 2: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Pin1 of QFN3×3-16 packages is the case position for θ_{JC} measurement.

Note 3: The device is not guaranteed to function outside its operating conditions.

Note4: Recommended Current Soft-start Time Program Table

Condition: V_{IN}=24V, R3/R4=200k/10k				
SST cap (nF)	None	10	47	100
Rise (ms)	1.4	2.8	13.1	27.8

Recommended formula for C_{SS} & soft-start slew rate calculation:

$$\frac{dv}{dt}=\begin{cases}\frac{1}{T_{SS\_DLT}}\times\frac{R_{UP}+R_{LOW}}{R_{LOW}}, \text{No external } C_7\\ \frac{I_{INT}}{C_7}\times\frac{R_{UP}+R_{LOW}}{R_{LOW}}, t_{SS}\geq t_{SS\_DLT}\end{cases}$$ voltage loop soft-start.

$$\frac{di}{dt}=\begin{cases}\frac{1}{T_{SS\_DLT}}\times\frac{1}{R_{ILMT}\times 11}, \text{No external } C_7\\ \frac{I_{INT}}{C_7}\times\frac{1}{R_{ILMT}\times 11}, t_{SST}\geq t_{SS\_DLT}\end{cases}$$ current loop soft-start.

Where, T_{SS_DLT} is the internally fixed default soft-start time, about 1.4ms, which means there's no any external C_7; I_{INT} is the internal current source, about 4.1μA ; R_{UP} and R_{LOW} are the external resistors for output voltage OVP or Clamping setting; R_{ILMT} is current limit setting resistor.

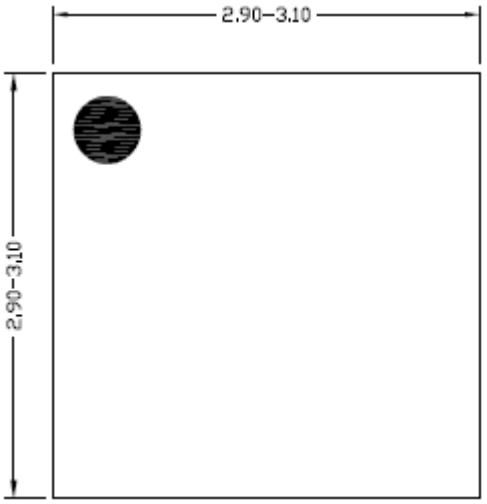
Note5: Recommended Current Limit Program Table

Current Limit Resistance (kΩ)	11	5.5	4.4	3.7	3.1	2.8	2.4	2.2
Current Limit (A)	1.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0

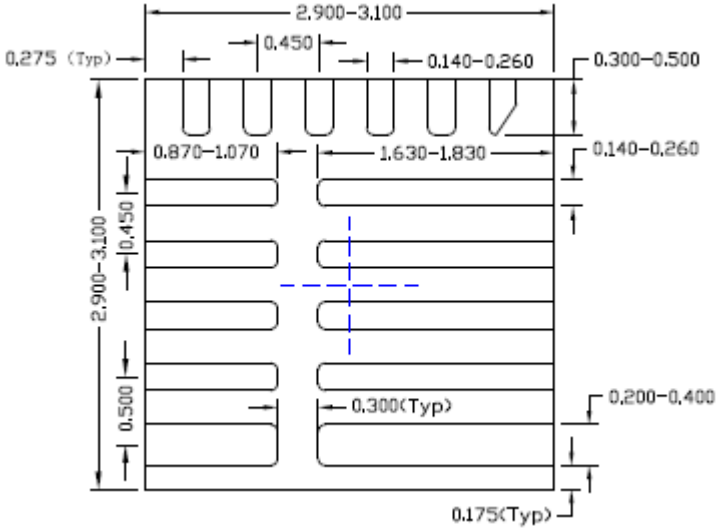
Recommended Formula for RLIM & Current Limit Calculation:

$$R_5=\frac{11K}{I_{LIM}}(\Omega)$$

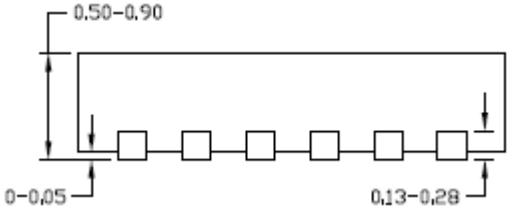
QFN3×3-16 Package Outline Drawing



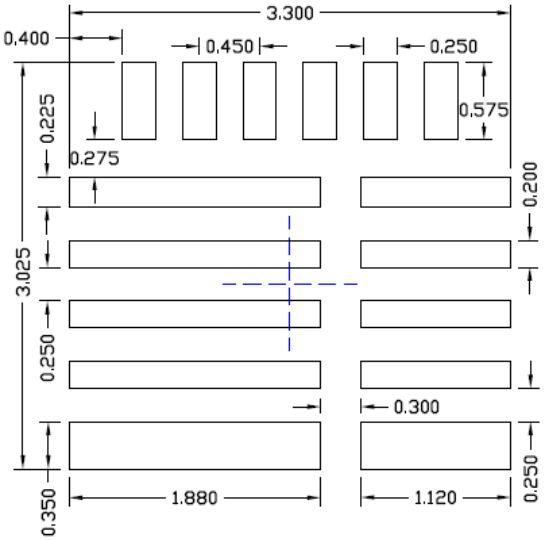
Top View



Bottom View



Side View



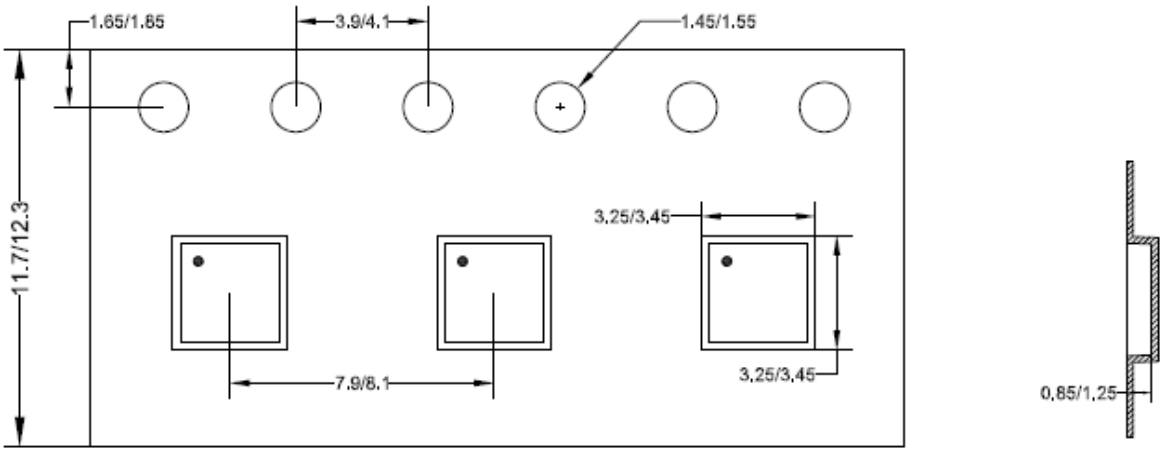
Recommended PCB layout
(Reference Only)

Notes: **All dimension in millimeter and exclude mold flash & metal burr.**

Taping & Reel Specification

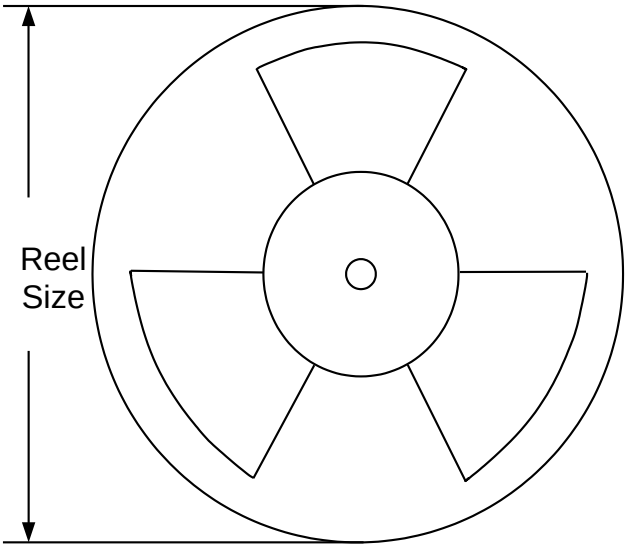
1. Taping orientation

QFN3×3



Feeding direction ⟶

2. Carrier Tape & Reel specification for packages



Package type	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel (pcs)
QFN3×3	12	8	13"	400	400	5000

3. Others: NA