SY6918E

High Efficiency Bi-direction Power Bank Regulator for Single-cell Battery Power Bank

General Description

The SY6918E is a 5V adapter input with up to 18V surge bi-directional regulator which is designed for single cell Li-Ion battery power bank application. Advanced bi-directional energy flow control with automatic input power source detection is adopted to achieve battery charging mode and battery power supply mode alternately.

The SY6918E also integrates the discharging enable/disable control and LED status indication.

The SY6918E is available in QFN3x3 package to minimize the PCB layout size for wide portable applications.

Ordering Information

SY6918 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SY6918EQDC	QFN3x3-16	

Features

- Maximum 18V Input Voltage Surge
- Bad Adapter Detection
- Build in Power Path NFETs and Power Switches
- 500kHz Switching Frequency Operation
- Trickle Current / Constant Current / Constant Voltage Charge Mode with Internal Compensation
- Maximum 2A Constant Charge Current
- Maximum 2.5A Boost Output Current
- 4.25V/4.4V Selectable Battery Cell Voltage
- +/-0.5% Cell Voltage Accuracy
- Charge/Discharge/Fault Status Indicator
- Discharging Control Logic
- Programmable Input Current Limit
- Dynamic Power Management
- Cycle-by-cycle Peak Current Limitation
- Input Voltage UVLO and OVP
- Boost Output Short Circuit Protection
- Thermal Shutdown

Applications

- Single Cell Power Bank
- Portable Device with Single Cell Battery

Typical Applications

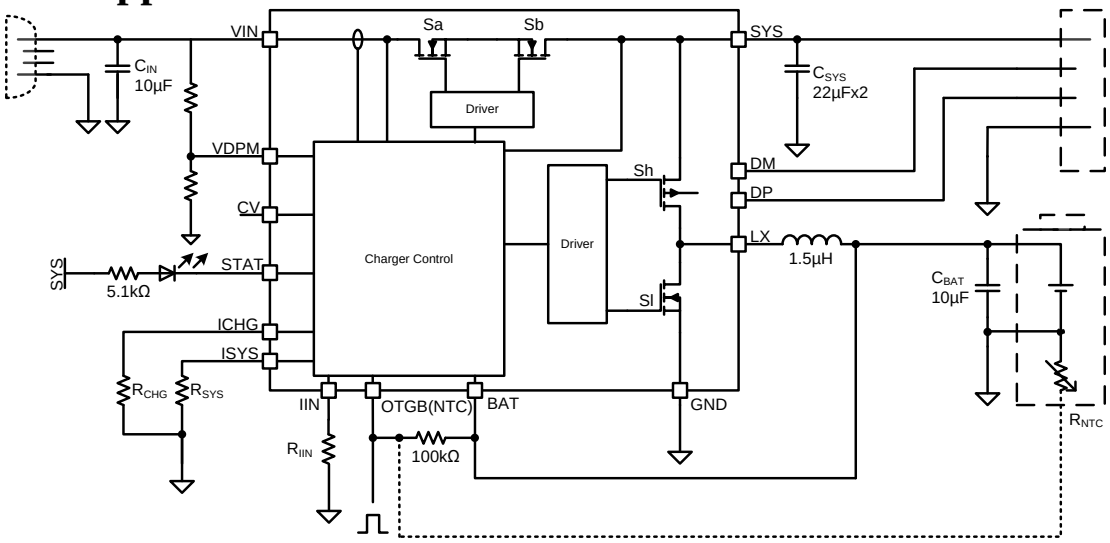
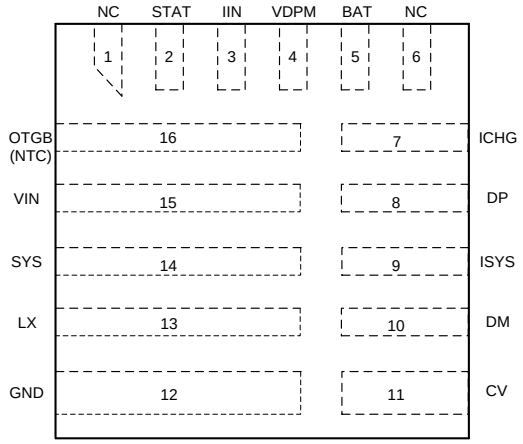


Figure 1. Schematic Diagram

Pinout (top view)



(QFN3x3-16)

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

Name	Number	Description
NC	1	Not connected.
STAT	2	Charge or discharge status indication pin. Open drain output. Pull high to SYS through a LED to indicate the charge or discharge in process. When the charge is done, the LED will be off. This LED is also used as a fault indicator.
IIN	3	Connect a resistor to set the input current limit in Buck mode.
VDPM	4	Voltage sense for input dynamic management. If the voltage drops to the internal 1.225V reference voltage, the VIN will be clamped to the setting value.
BAT	5	Battery voltage sense pin. It is used as battery constant voltage control and battery voltage protections.
NC	6	Not connected.
ICHG	7	Connect a resistor to set charge current limit in Buck mode.
DP	8	D+/D- output for USB port connection. It supports BC1.2 handshaking, and also supports Apple and Samsung portable device.
DM	10	
ISYS	9	Connect a resistor to set SYS current limit in Boost mode.
CV	11	Charge voltage selection pin. Open or pull it low for 4.25V. Pull it high for 4.4V.
GND	12	Power ground.
LX	13	Switch node pin. Connect it to the external inductor.
SYS	14	System connection point. Add at least 2pcs of 22μF MLCC here.
VIN	15	Power input pin. Connect a MLCC from this pin to ground to decouple high harmonic noise. This pin has OVP and UVLO function to make the charger operate within safe input voltage range.
OTGB(NTC)	16	Discharging enable/disable control or charging thermal sense pin. In discharging mode, OTGB pin LOW enables Boost, HIGH disables Boost. In charging mode, pull up to BAT with a resistor. Connect to the NTC pull-down resistor to achieve battery thermal protection. Disable thermal protection without pull-down resistor.

Absolute Maximum Ratings

VIN ---------- -0.3~18V
LX, SYS, STAT, IIN, VDPM, CV, ICHG, ISYS, DP, DM, BAT, OTGB(NTC)---------- -0.3~6V
VIN Pin Continuous Current ---------- 2.5A
SYS Pin Continuous Current ---------- 3.5A
LX Pin Continuous Current ---------- 8A
Power Dissipation, P_D @ T_A = 25℃, QFN3x3---------- 2.1W
Package Thermal Resistance
θ_{JA} ---------- 48℃/W
θ_{JC} ---------- 4℃/W
Junction Temperature Range ---------- -40℃ to +125℃
Lead Temperature (Soldering, 10 sec.) ---------- 260℃
Storage Temperature Range ---------- -65℃ to 125℃

Recommended Operating Conditions

VIN ---------- 0~5.5V
LX, SYS, STAT, IIN, VDPM, CV, ICHG, ISYS, DP, DM, BAT, OTGB(NTC) ---------- 0~5.5V
VIN Pin Continuous Current ---------- 2.0A
SYS Pin Continuous Current ---------- 2.5A
LX Pin Continuous Current ---------- 6A
Junction Temperature Range ---------- -20℃ to 100℃
Ambient Temperature Range ---------- -40℃ to 85℃

Electrical Characteristics

T_J=25 ℃, V_{IN}=5V, C_{IN}=10 μF, C_{BAT}=10 μF, C_{SYS}=44 μF, L=1.5 μH, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Bias Supply (V_{IN})						
V_{IN}	Input Voltage Operation Range		4.7		5.5	V
V_{INOK}	Adapter OK Voltage	Rising edge	4.35	4.5	4.65	V
ΔV_{INOK}	Adapter OK Voltage Hysteresis	Falling edge		200		mV
V_{OVP}	Input Overvoltage Protection	Rising edge	5.7	5.85	6.0	V
ΔV_{OVP}	Input Overvoltage Protection Hysteresis	Falling edge		200		mV
V_{DPM}	Input Voltage REF for Adaptive Input Current Limit		1.2	1.225	1.25	V
Quiescent Current						
I_{BAT}	Battery Discharge Current	Boost shutdown, $V_{OTGB}=V_{BAT}$			20	μA
I_{IN}	Input Quiescent Current	Disable Charge			1.5	mA
Oscillator and PWM						
f_{OSC}	Switching Frequency			500		kHz
Power MOSFET						
R_{HIGH}	$R_{DS(ON)}$ of High Side P-FET	R_{SH}		35		mΩ
R_{LOW}	$R_{DS(ON)}$ of Low Side N-FET	R_{SL}		20		mΩ
R_{PM}	$R_{DS(ON)}$ of Power Path Management N-FET	$R_{SA}+R_{SB}$		80		mΩ
I_{CHG_MAX}	Peak Current of Switching FETs in Charge Mode			4.5		A
I_{DIS_MAX}	Peak Current of Switching FETs in Discharge Mode			8		A
Voltage Threshold and Regulation						
V_{CV}	Cell Voltage Tolerance	V_{CV}= 4.4V	4.378	4.4	4.422	V
ΔV_{RCH}	CV Hysteresis for Recharge	V_{CV}= 4.4V	45	100	170	mV
V_{SYS}	Discharge Output Voltage at SYS	V_{BAT}=3.7V	5.1	5.2	5.3	V
Current Regulation						
I_{CC}	Internal Charge Current Accuracy for Constant Current Mode	R_{CHG}=2.55kΩ (I_{CC}=2A)	-10		10	%
I_{TC}	Internal Charge Current for Trickle Current Mode	R_{CHG}=2.55kΩ (I_{CC}=2A)		0.1		I_{CC}
I_{TERM}	Termination Current	R_{CHG}=2.55kΩ (I_{CC}=2A)		0.1		I_{CC}
I_{INDPM}	Maximum Input Current Limit When Charger is Switching.	R_{IIN}=0.75kΩ, I_{CHG}=1A	2.25	2.5	2.75	A
System and BAT OVP						
V_{SYS_OVP}	SYS Voltage OVP Threshold	Rising edge	103%	105%	107%	V_{SYS}
ΔV_{SYS_OVP}	SYS Voltage OVP Hysteresis	Falling edge		2%		V_{SYS}
V_{BAT_OVP}	BAT Voltage OVP Threshold	Rising edge	103%	105%	107%	V_{CV}
ΔV_{BAT_OVP}	BAT Voltage OVP Hysteresis	Falling edge		2%		V_{CV}
Battery Weak						
V_{DPL}	Battery Depletion Threshold	Falling edge		2.5		V
ΔV_{DPL}	Battery Depletion Hysteresis	Rising edge		300		mV
V_{TRK}	Battery Trickle Charge Threshold	Falling edge	2.5	2.6	2.7	V
ΔV_{TRK}	Battery Trickle Charge Hysteresis	Rising edge		200		mV
BAT Short Protection						
V_{SHORT}	Output Short Protection Threshold	V_{BAT} falling edge	1.9	2.0	2.1	V

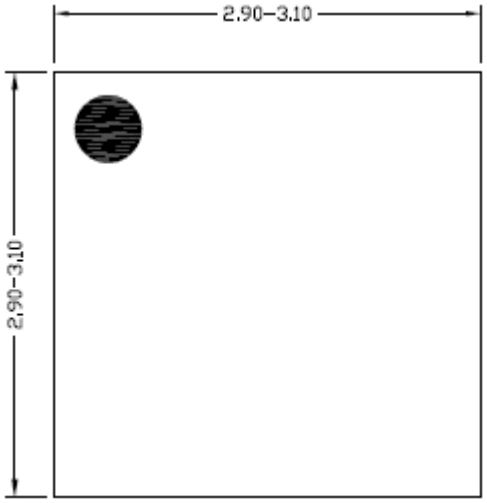
SYS Over Current Protection						
I_{SYSMAX}	SYS Current Limit on Boost Mode	V_{BAT}=3.7V, R_{SYS}=2.2kΩ	2.25	2.5	2.75	A
Timing						
t_{TC}	Trickle Current Charge Timeout			2		hour
t_{OC}	ACOC Deglitch Time			600		μs
Battery Thermal Protection						
V_{UTP}	UTP Threshold	Rising edge	65.7%	67.7%	69.7%	V_{BAT}
	UTP Hysteresis	Falling edge		3.5%		V_{BAT}
V_{OTP}	OTP Threshold	Falling edge	29.9%	31.9%	33.9%	V_{BAT}
	OTP Hysteresis	Rising edge		2%		V_{BAT}
$V_{NTCHIGH}$	High Voltage to Disable NTC Function	Rising edge		90%		V_{BAT}
V_{OTGB}	OTGB Active Low Voltage	Falling edge		0.35		V
Thermal Regulation and Thermal Shutdown						
T_{TSD}	Thermal Shutdown Threshold			150		℃
ΔT_{TSD}	Thermal Shutdown Hysteresis			30		℃

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.

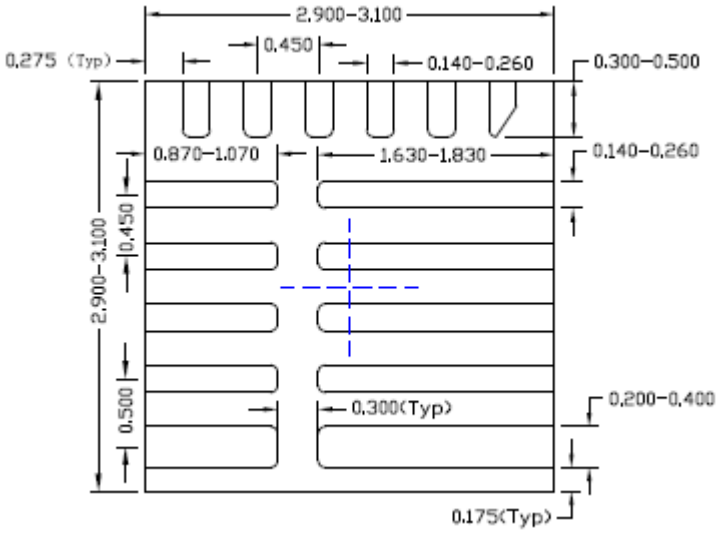
Note 2: θ_{JA} is measured in the natural convection at T_A = 25℃ on a low effective four-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

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

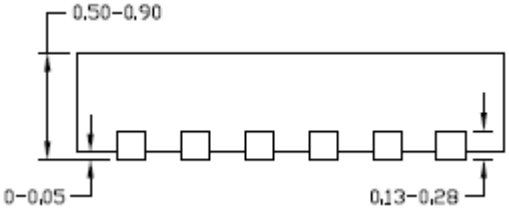
QFN3x3-16 Package Outline Drawing



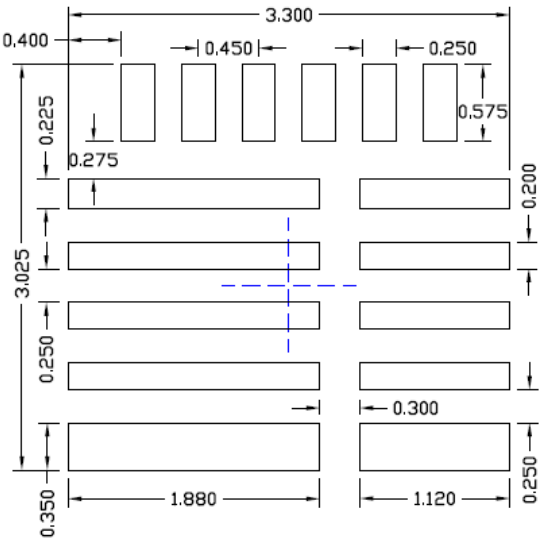
Top View



Bottom View



Side View



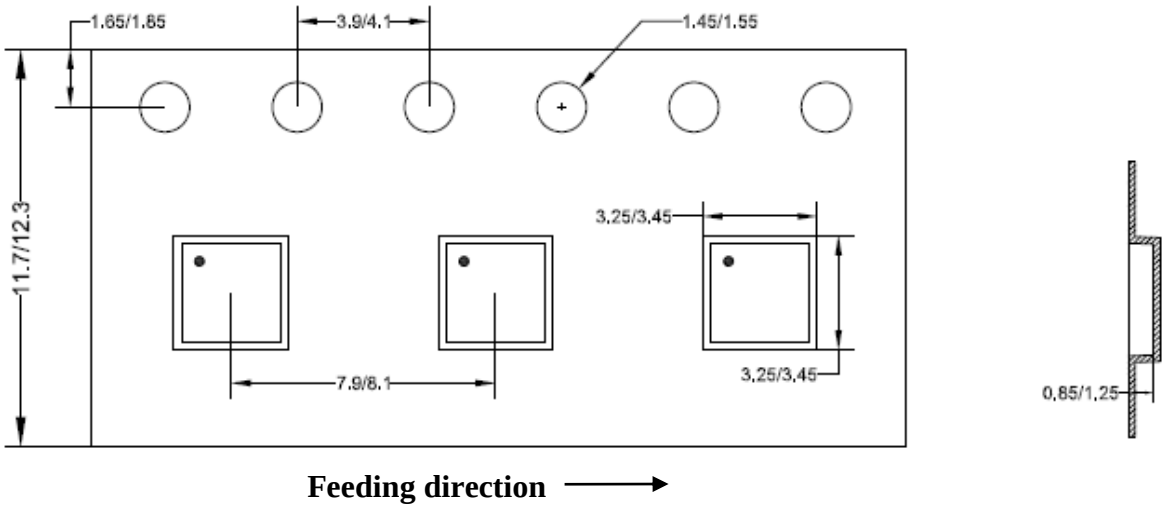
Recommended PCB layout
(Reference Only)

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

Taping & Reel Specification

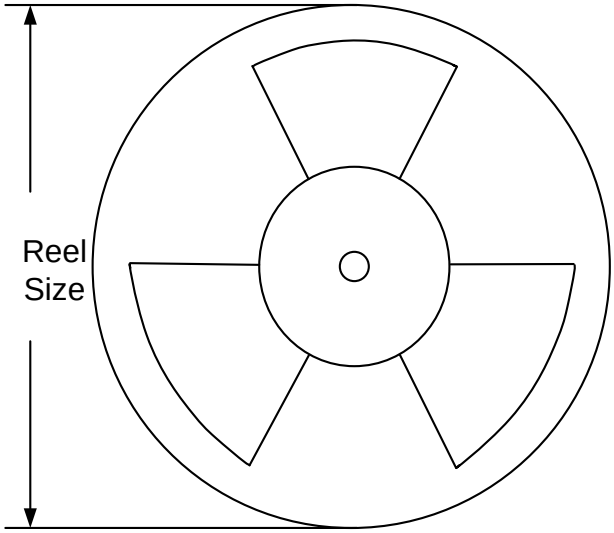
1. Taping orientation

QFN3x3



Feeding direction ⟶

2. Carrier Tape & Reel specification for packages



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel
QFN3x3	12	8	13"	400	400	5000

3. Others: NA