SY20718C

High Efficiency Bi-Directional Power Bank Regulator for Single-Cell Battery Power Banks

General Description

The SY20718C is a 5V controller featuring a bi-directional regulator capable of handling surges up to 18V. It is designed for single-cell Li-Ion battery power bank applications. The regulator employs advanced bi-directional energy flow control with automatic input power source detection, facilitating seamless switching between battery charging and power supply modes.

The SY20718C also integrates the discharging enable/disable control and LED status and fault indicator features.

Input overvoltage and overcurrent, battery overvoltage, boost short circuit, charging timeout and battery thermal protections are provided for reliable system operation.

The total solution can be easily configured using a few passive components and doesn't require the use of a microcontroller to supervise operation.

The SY20718C is available in a compact QFN 3mmx3mm package.

Features

- Maximum 18V Input Voltage Surge
- Input Voltage UVLO and OVP
- 4.2V/4.35V Selectable Battery Cell Voltage
- +/-0.5% Cell Voltage Accuracy
- 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
- Charge / Discharge / Fault Status Indicator
- Discharging Control Logic
- Programmable Input Current Limit
- Bad Adapter Detection
- Built-In Power Path NFETs and Power Switches
- Dynamic Power Management
- Cycle-by-Cycle Peak Current Limit
- Boost Output Short Circuit Protection
- Thermal Shutdown

Applications

- Single-Cell Power Banks
- Portable Devices with Single Cell Batteries

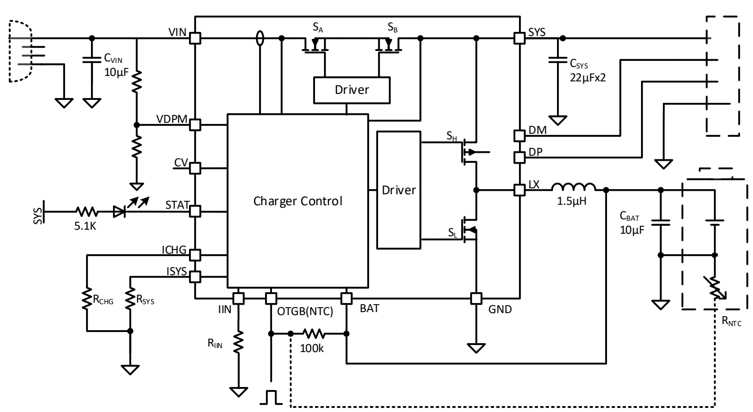


Figure 1. Schematic Diagram

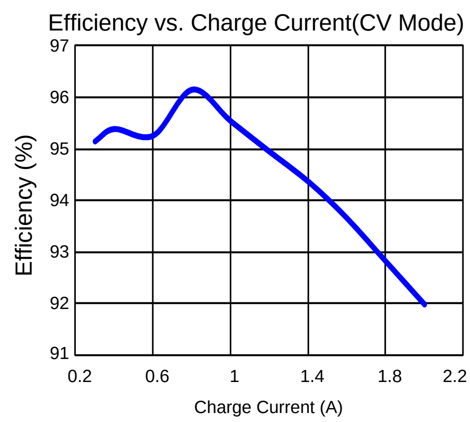


Figure 2. Efficiency vs. Charge Current

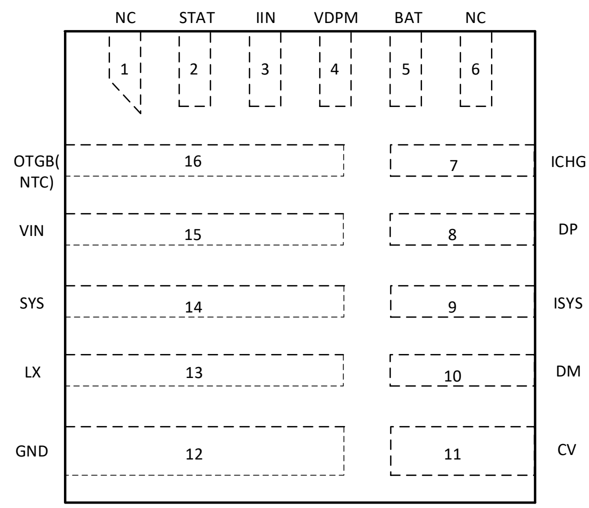
Ordering Information

Ordering Part Number	Package Type	Top Mark
SY20718CQDC	QFN3×3-16 RoHS Compliant and Halogen Free	**CFA*xyz***

Device code: **CFA**

x=year code, y=week code, z= lot number code

Pinout (Top View)



(QFN3x3)

Pin No	Pin Name	Pin Description
1	NC	Not connected.
2	STAT	Charge or discharge status indication pin. Open drain output. Pull high to the SYS node through an LED and current limiting resistor to indicate a charge or discharge in process. When charging is complete, the LED will turn off. This LED is also used as a fault indicator.
3	IIN	Connect a resistor to set the input current limit in buck mode.
4	VDPM	Voltage sense for input dynamic management. If the voltage drops to the internal 1.2V reference voltage, the VIN will be clamped to the configured value.
5	BAT	Battery voltage sense pin. It is used as battery constant voltage control and battery voltage protection.
6	NC	Not connected.
7	ICHG	Connect a resistor to set the charge current limit in buck mode.
8	DP	D+/D- output for USB port connection. It supports BC1.2 handshaking and supports Apple and Samsung protocols.
10	DM	
9	ISYS	Connect a resistor to set the SYS current limit in boost mode.
11	CV	Charge voltage termination selection pin. Open or pull it low for 4.2V, pull high for 4.35V.
12	GND	Power ground.
13	LX	Switch node pin. Connect to external inductor.
14	SYS	System connection point. Connect at least two 22µF multilayer ceramic capacitors (MLCC).
15	VIN	Power input pin. Connect a MLCC from this pin to the ground to decouple high frequency noise. This pin has OVP and UVLO functions to ensure the charger operates within a safe input voltage range.
16	OTGB(NTC)	Discharging enable/disable control or charging thermal sense pin. When the OTGB pin pulls LOW in discharging mode, it enables boost mode. When pulled HIGH, it disables boost mode. In charging mode, pull up to the BAT voltage with a resistor. Connect to the NTC pull-down resistor to achieve battery thermal protection—Disable thermal protection without a pull-down resistor.

Block Diagram

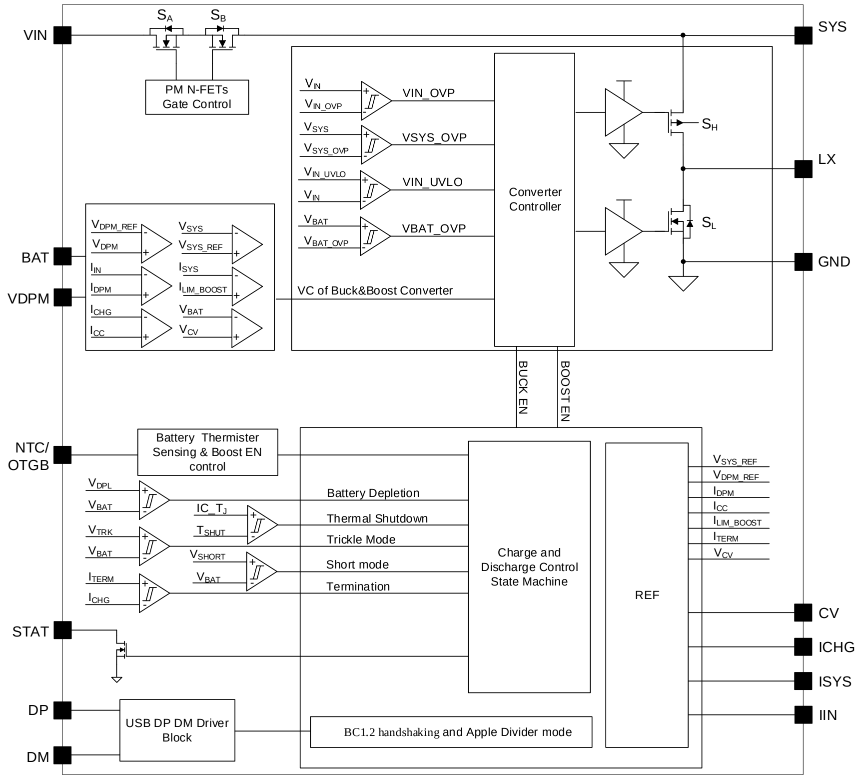


Figure 3. Block Diagram

Absolute Maximum Ratings (1)	Min	Max	Unit
VIN	-0.3	18	V
LX, SYS, STAT, IIN, VDPM, CV, ICHG, ISYS, DP, DM, BAT, OTGB(NTC)	-0.3	6	
VIN Pin Continuous Current		2.5	A
SYS Pin Continuous Current		3.5	
LX Pin Continuous Current		8	
Junction Temperature, Operating	-40	125	°C
Lead Temperature (Soldering,10sec.)		260	
Storage Temperature	-65	125	

Thermal Information (2)	Min	Max	Unit
θ_{JA} Junction-to-ambient Thermal Resistance		48	°C/W
θ_{JC} Junction-to-case Thermal Resistance		4	
P_D Power Dissipation T_A=25°C		2.1	W

Recommended Operating Conditions (3)	Min	Max	Unit
VIN	0	5.5	V
LX, SYS, STAT, IIN, VDPM, CV, ICHG, ISYS, DP, DM, BAT, OTGB(NTC)	0	5.5	
VIN Pin Continuous Current		2	A
SYS Pin Continuous Current		2.5	
LX Pin Continuous Current		6	
Junction Temperature, Operating	-20	100	°C
Junction Temperature	-40	85	

Electrical Characteristics
T_J=25°C, V_{IN}=5V, C_{IN}=10µF, C_{BAT}=10µF, C_{SYS}=44µF, L=1.5µH, unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Bias Supply (V_{IN})						
V_{IN}	Input Voltage Operation Range		4.5		5.35	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	5.65	5.8	5.95	V
ΔV_{OVP}	Input Overvoltage Protection Hysteresis	Falling edge		200		mV
V_{DPM}	Input Voltage REF for Adaptive Input Current Limit		1.17	1.2	1.23	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}= 4.35V	4.324	4.35	4.376	V
ΔV_{RCH}	CV Hysteresis for Recharge	V_{CV}= 4.35V	45	100	170	mV
V_{SYS}	Discharge Output Voltage at SYS	V_{BAT}=3.7V	5.05	5.15	5.25	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

Electrical Characteristics T_J=25°C, V_{IN}=5V, C_{IN}=10µF, C_{BAT}=10µF, C_{SYS}=44µF, L=1.5µH, unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
SYS Overurrent 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		°C
ΔT_{TSD}	Thermal Shutdown Hysteresis			30		°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.

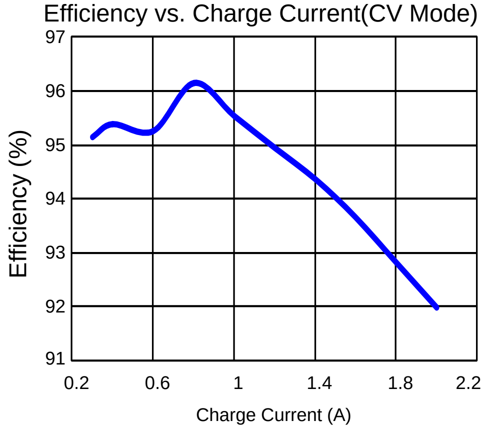
Note 2: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective four-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

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

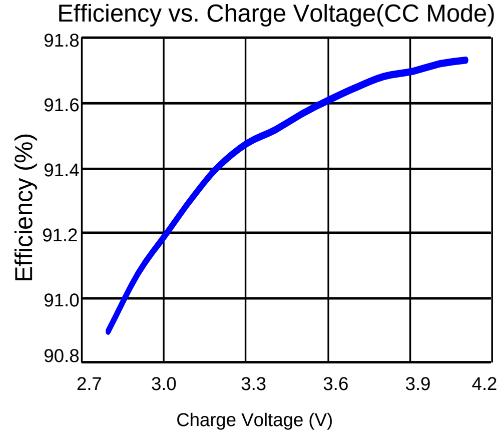
Typical Performance Characteristics

(T_A=25°C, V_{IN}=5V, R_{CHG}=2.55kΩ, R_{SYS}=2.2kΩ, single-cell battery, unless otherwise specified.)

Efficiency vs. Charge Current(CV Mode)

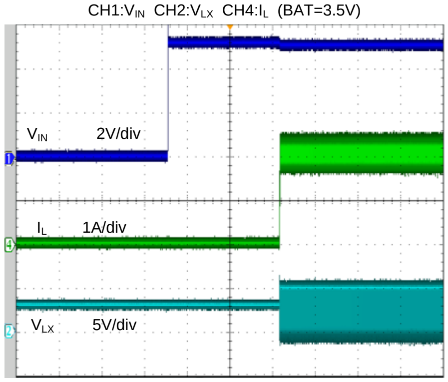


Efficiency vs. Charge Voltage(CC Mode)



Adapter Insert

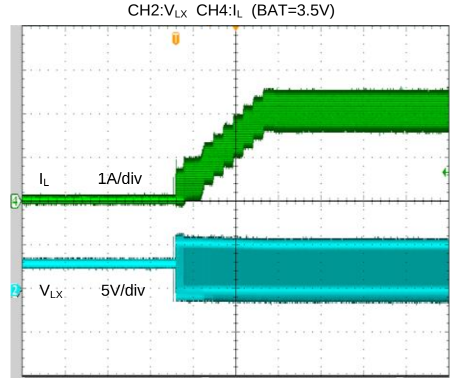
CH1:V_{IN} CH2:V_{LX} CH4:I_L (BAT=3.5V)



Time (200ms/div)

Current Soft Start

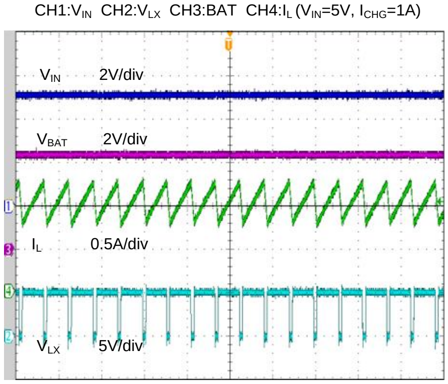
CH2:V_{LX} CH4:I_L (BAT=3.5V)



Time (2ms/div)

CV Mode Steady State

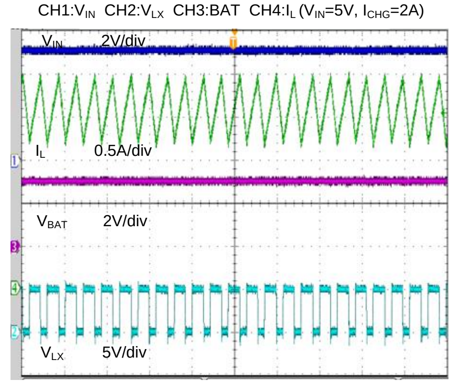
CH1:V_{IN} CH2:V_{LX} CH3:BAT CH4:I_L (V_{IN}=5V, I_{CHG}=1A)



Time (4μs/div)

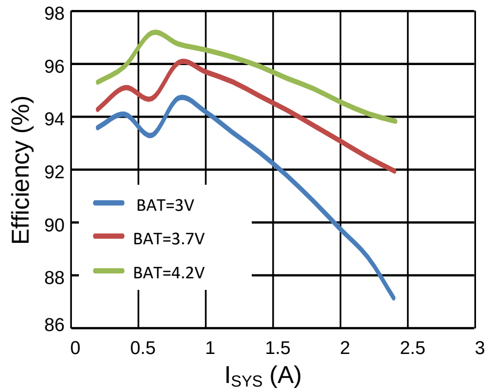
CC Mode Steady State

CH1:V_{IN} CH2:V_{LX} CH3:BAT CH4:I_L (V_{IN}=5V, I_{CHG}=2A)



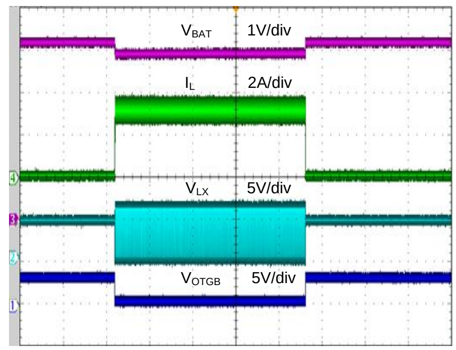
Time (4μs/div)

Efficiency vs. SYS Current



OTGB Enable and Disable Discharge

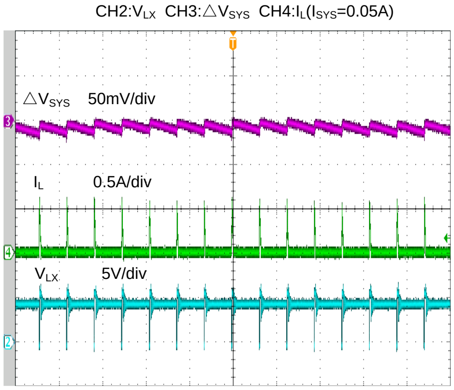
CH1:V_{OTGB} CH2:V_{LX} CH3:V_{BAT} CH4:I_L



Time (400ms/div)

Boost Mode Steady State

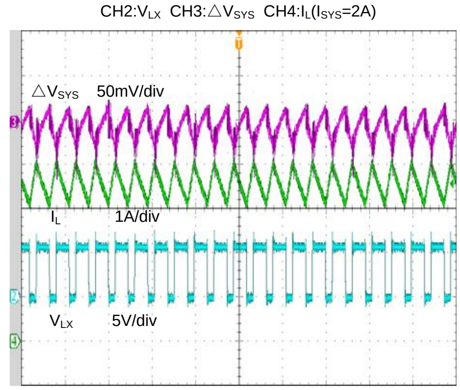
CH2:V_{LX} CH3:$\triangle V_{SYS}$ CH4:I_L(I_{SYS}=0.05A)



Time (40μs/div)

Boost Mode Steady State

CH2:V_{LX} CH3:$\triangle V_{SYS}$ CH4:I_L(I_{SYS}=2A)



Time (4μs/div)

Application Information

The SY20718C is a 5V converter featuring a bi-directional regulator capable of handling surges up to 18V. It is specifically designed for single-cell Li-Ion battery power bank applications. The regulator employs advanced bi-directional energy flow control with automatic input power source detection, facilitating seamless switching between battery charging and power supply modes.

If the external power supply is present, the SY20718C will run in battery charging mode with complete protection functions. If the external power supply is absent, the SY20718C will run in battery power supply mode with output current capability up to 2.5A.

The SY20718C integrates blocking MOSFETs to prevent current from leaking from the system or battery to the input side. The high-side switch protects the battery from high discharge current and short circuits at the SYS pin.

The SY20718C also provides OTGB control and LED status indication.

OTGB and NTC Function:

The OTGB pin can control the boost. Pull OTGB low to enable boost mode and high to disable boost mode.

The OTGB pin is also used as the battery NTC temperature sensing in charging mode if the voltage is lower than 90% of V_{BAT}. The device will shut down the charger and indicate the fault when the OTGB voltage is higher than V_{UTP} or lower than V_{OTP}.

LED Status Indication Description:

Connecting an LED to the STAT pin can indicate the charging status, the discharging status, and the fault mode as shown below:

- **Charging Mode:** When the adapter is present, the SY20718C operates in charging mode, even after the charging is complete. In charging mode, the LED ON indicates ongoing charging. LED OFF indicates charging is complete.
- **Discharging Mode:** When the adapter is removed, and the boost mode is enabled, the device will operate in discharging mode. In discharging mode, LED ON indicates ongoing discharging.
- **Fault Mode:** In the event of any fault (input OVP, battery OVP, SYS OVP, battery short, NTC faults, thermal shutdown, timeout, SYS short) the LED will flash at 2Hz.

LED status summary description:

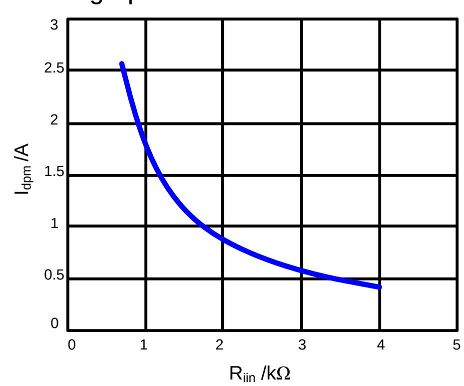
- Charging mode: STAT low
- Charging done: STAT high
- Discharging mode: STAT low
- Fault mode: 2Hz flash

Input Dynamic Power Management:

The SY20718C can effectively manage the input power limit. It has input VDPM and IDPM functions to protect the input source from high current conditions.

External components can be used to set the input source power capability in charging mode. The minimum input voltage limit can be set by connecting a resistor divider from the VIN to the VDPM pin. The resistor from the IIN pin to the GND determines the maximum input current limit.

The relationship between the input current limit and R_{IIN} is shown in the graph below:

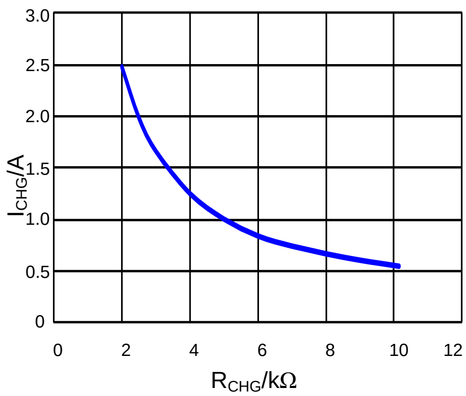


Test condition: V_{IN}=5V, V_{BAT}=3.7V

Charge Current Setting:

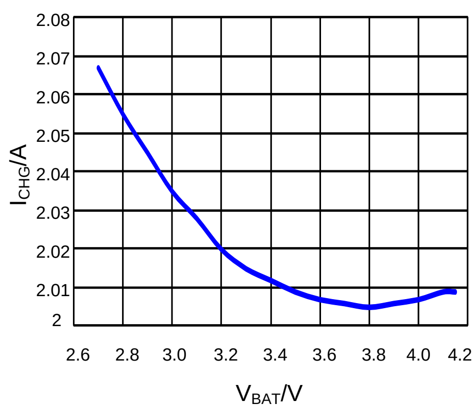
In charging mode, the SY20718C mirrors the current information to the ICHG pin, and the charge current is determined by the resistor connected between the ICHG and GND pins.

The relationship between the charging current and R_{CHG} is shown in the graph below:

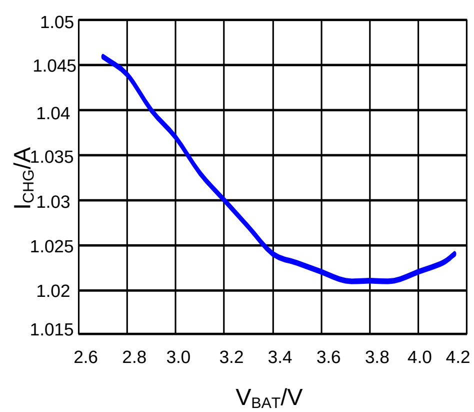


Test condition: V_{IN}=5V, V_{BAT}=3.7V

The SY20718C enables accurate I_{CHG} regulation performance over wide V_{IN} and V_{BAT} ranges. The relationship between the charging current and V_{BAT} voltage is shown in the graphs below:

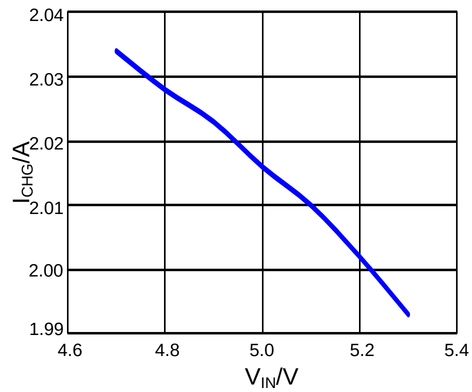


Test condition: V_{IN}=5V, R_{CHG}=2.5kΩ

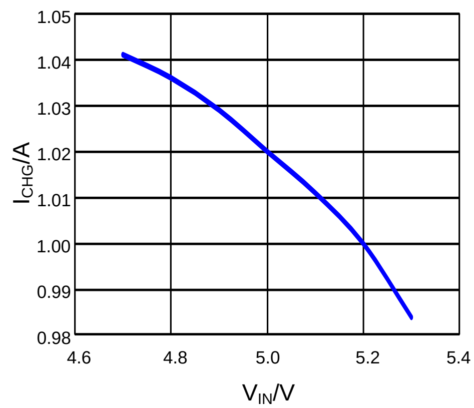


Test condition: V_{IN}=5V, R_{CHG}=5kΩ

The relationship between the charging current and V_{IN} is shown in the graph below:



Test condition: V_{BAT}=3.7V, R_{CHG}=2.5kΩ

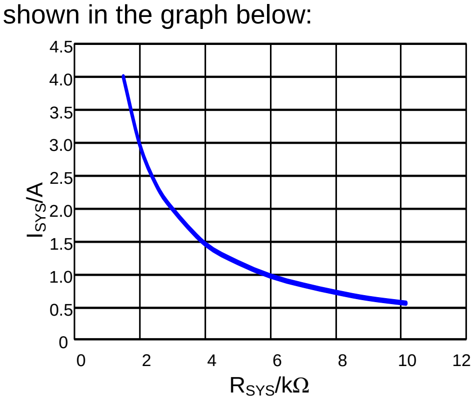


Test condition: V_{BAT}=3.7V, R_{CHG}=5kΩ

SYS Current Limit Setting:

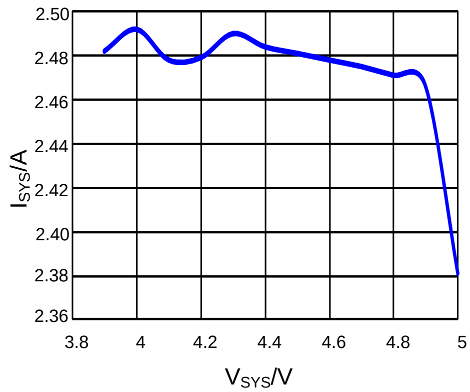
In discharge mode, the SY20718C mirrors the current information at the ISYS pin, and the resistor determines the discharge current limit from the ISYS pin to GND.

The relationship between the discharge current limit and R_{SYS} is shown in the graph below:



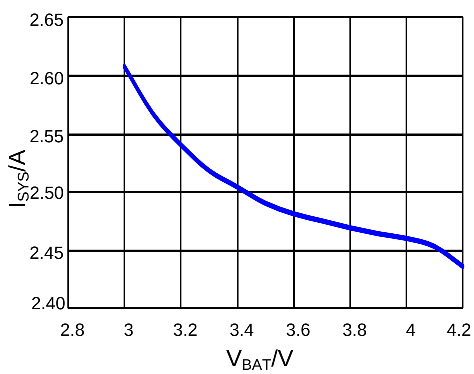
Test condition: V_{BAT}=3.7V, V_{SYS}=4.7V

The SY20718C enables accurate I_{SYS} regulation performance over wide V_{SYS} and V_{BAT} ranges. The relationship between the discharge current limit and V_{SYS} is shown in the curve below:



Test condition: V_{BAT}=3.7V, R_{SYS}=2.2kΩ

The relationship between the discharge current limit and V_{BAT} is shown in the curve below:

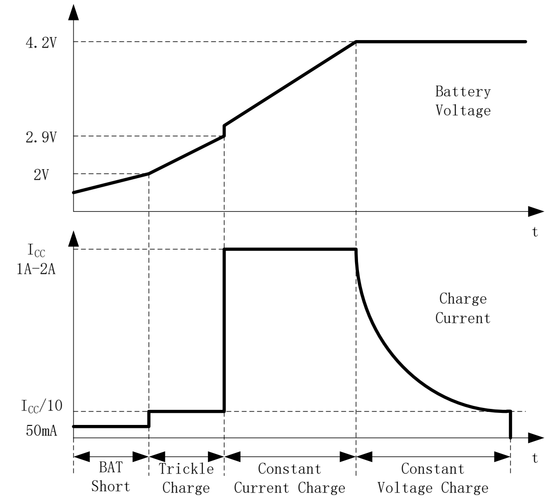


Test condition: V_{SYS}=4.7V, R_{SYS}=2.2kΩ

Buck Charger Basic Operation Description

When the adapter is present, the SY20718C will work as a synchronous buck mode battery charger. It utilizes a 500kHz switching frequency to minimize the solution size.

The charger will operate in battery short mode, trickle charge mode, constant current charge mode, and constant voltage charge mode according to the battery voltage. The charge current in every mode is shown in the graph below:



In charging mode, the SY20718C has complete protection features to protect the device and the battery:

- **Input Overvoltage Protection:** The SY20718C incorporates overvoltage protection for both VIN and SYS. In the event of input OVP, it deactivates the blocking MOSFETs and the switching charger. Normal operation resumes automatically upon removal of the fault.
- **Battery Overvoltage Protection:** Charging stops when BAT OVP is detected in the SY20718C. Normal operation resumes automatically upon removal of the fault.
- **Timeout Protection:** The charger is designed to identify a bad battery. If the charger operates in trickle mode for over 2 hours, it will stop charging and latch off. Recycling the input is necessary to return to normal operation.
- **Input Overcurrent Protection:** The SY20718C features hiccup mode input overcurrent protection, with a threshold of 25% higher than the I_{NDPM} value. During hiccup mode, the power path management N-channel MOSFETs (R_{SA} and R_{SB}) will turn off for 190 ms (typ.) and turn on for 5 ms (typ.) repeatedly until the overcurrent condition is removed.
- **Battery Thermal Protection:** Battery thermal protection is only available in charging mode. The charger will stop switching when the OTGB voltage is below the OTP threshold or exceeds the UTP threshold while remaining below 90% of BAT. Normal operation resumes automatically upon removal of the fault.

Boost Mode Basic Operation Description:

The battery can power the portable device connected to the SYS pin when the adapter is disconnected. Operating as a 500kHz synchronous boost, the converter can deliver up to 2.5A current to the load.

The boost function ensures a stable 5.15V output for the portable device, with the output current limited by RSYS.

While in boost mode, the SY20718C extends the following protections to the portable device, the battery, and itself:

- **SYS Overvoltage Protection:** If a SYS OVP event is detected, the SY20718C stops switching to prevent overvoltage. Normal operation resumes automatically upon removal of the fault.
- **BAT Depletion Protection:** In the event of BAT depletion, the SY20718C halts operation. To restore switching, the device must be re-enabled after the fault is removed.

Common Protection Features:

The SY20718C also provides the following protections:

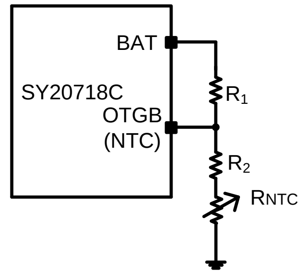
- **SYS Short Protection:** The SY20718C will stop switching and enter hiccup mode when a SYS short occurs.
- **Thermal Shutdown Protection:** The device will stop operation when the junction temperature is higher than T_{TSD} (150°C). The device will automatically return to normal operation when the temperature drops below T_{TSD} - ΔT_{TSD}.

Design Procedure

The SY20718C is a highly integrated device designed for power bank applications. The application circuits based on this regulator are straightforward. Only filter capacitors (C_{IN}, C_{BAT} and C_{SYS}), an inductor (L), NTC resistors (R_1, R_2), and current setting resistors (R_{CHG}, R_{SYS}) need to be selected for the target application specifications.

NTC Resistor:

The SY20718C monitors battery temperature by measuring the input voltage and NTC voltage. The controller will trigger the UTP or OTP when the rate K ($K= V_{NTC}/V_{BAT}$) reaches the threshold of UTP (K_{UT}) or OTP (K_{OT}). The temperature sensing network is shown below:



(Choose R_1 and R_2 to program the proper UTP and OTP points.)

The calculation steps are:

1. Define KUT; K_{UT} =65.7~69.7%
2. Define KOT; K_{OT} =29.9~33.9%
3. Assume the resistance of the battery NTC thermistor is R_{UT} at the UTP threshold and R_{OT} at the OTP threshold.
4. Calculate R_2:

$$R2 = \frac{KOT(1-KUT)RUT - KUT(1-KOT)ROT}{KUT - KOT}$$

5. Calculate R_1:

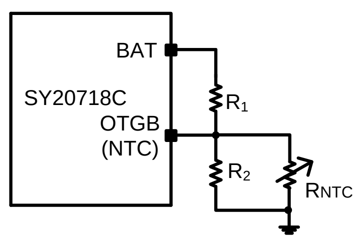
$$R1 = (1/KOT - 1)(R2 + ROT)$$

When typical values (K_{UT} =67.7% and K_{OT}=31.9%) are chosen, then:

$$R2 = 0.288RUT - 1.288ROT$$

$$R1 = 2.135(R2 + ROT)$$

The SY20718C accepts various NTC divider circuits. For the schematic below, R_1 and R_2 can be calculated by using the below equations:



$$R2 = \frac{ROTRUT(KUT-KOT)}{KOTKUT(RUT-ROT)+RUTKOT-ROTKUT} \quad R1 = \frac{R2RUT(1-KUT)}{KUT(R2+RUT)}$$

When typical values K_{UT} =67.7% and K_{OT}=31.9% are chosen, then:

$$R2 = \frac{0.358RUTROT}{0.103RUT - 0.461ROT}$$

$$R1 = \frac{0.477R2RUT}{RUT + R2}$$

Input Capacitor C_{IN}:

To handle the ripple current, X5R or X7R ceramic capacitors with greater than 10μF capacitance are recommended. The voltage rating of the capacitor should be higher than 16V.

Output Capacitor C_{BAT}:

The charger output capacitor is selected to handle the output ripple noise requirements. This ripple voltage is related to the capacitance and its equivalent series resistance (ESR). For the best performance, it is recommended to use an X5R or better grade low ESR ceramic capacitor. The voltage rating of the output capacitor should be higher than 10V.

A capacitance of greater than 10μF is recommended to design a smaller output ripple.

Output Capacitor C_{SYS}:

The boost output capacitor is selected to handle the output ripple noise and outload transient requirements. For the best performance, it is recommended to use an X5R or a better-grade, low-ESR ceramic capacitor. The voltage rating of the output capacitor should be higher than 10V.

For a compact solution, low output ripple and improved transient performance, using at least two capacitors with capacitance greater than 22μF is recommended.

Inductor L:

When selecting the inductor, consider the following factors:

1. Choose the inductance to achieve the desired ripple current. It is suggested that the ripple current be approximately 40% of the average input current. Given that the boost inductor current is more critical than the charger mode, base the inductor selection on the boost mode.
   The minimum inductance is calculated as follows:

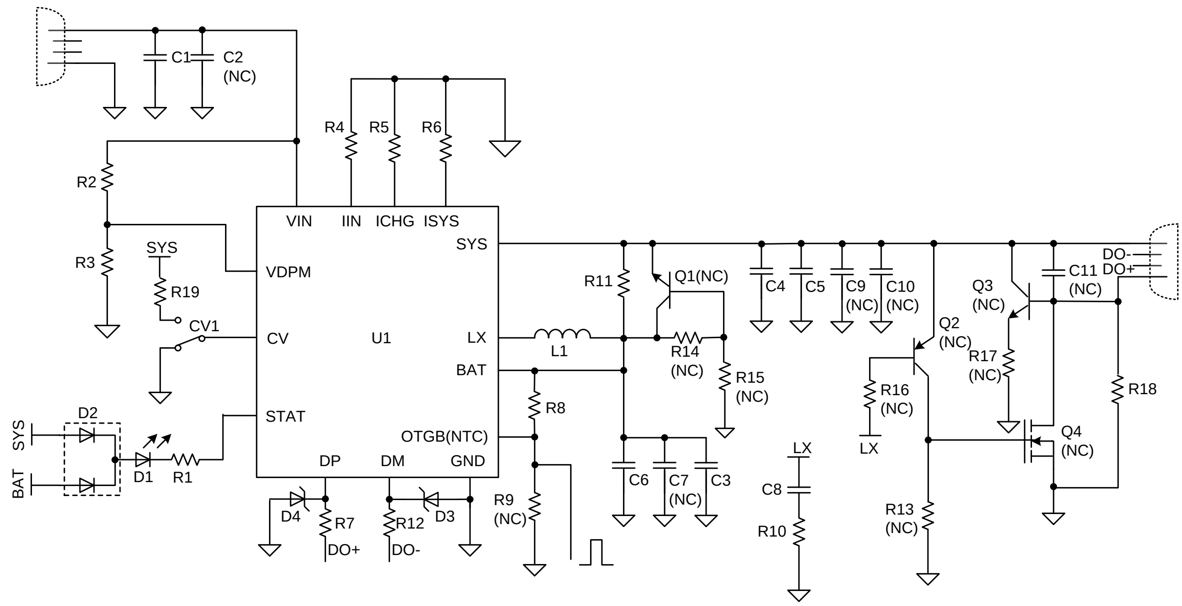
$$L = \left(\frac{VBAT}{VSYS}\right)^2 \frac{VSYS - VBAT}{ISYS \cdot FSW \cdot 40\%}$$

   (Where F_{SW} is the switching frequency, and I_{SYS} is the maximum discharge current.)
   The SY20718C exhibits tolerance to various ripple current amplitudes. Therefore, the final inductance selection can deviate slightly from the calculated value without significantly affecting performance. For most SY20718C applications, an inductance of 1.5μH is recommended.
2. The saturation current rating of the inductor must be selected to be greater than the peak inductor current under full load conditions.

$$ISAT > \frac{VSYS \cdot ISYS}{VBAT} + \left(\frac{VBAT}{VSYS}\right) \times \frac{VSYS - VBAT}{2 \cdot FSW \cdot L}$$

3. The DC resistance (DCR) of the inductor and the core loss at the switching frequency should be sufficiently low to meet the desired efficiency requirements. It is recommended to select an inductor with DCR < 10mΩ.

Application Schematic



BOM List

Designator	Description	Part Number	Manufacturer
U1	Highly Integrated Bi-Directional Power Regulator For Single-Cell Battery Power Bank Applications	SY20718CQDC	Silergy
L1	INDUCTOR 1.5µH	SPM6530T-1R5M	TDK
C1	16V/10µF	C3216X7R1C106K160AC	TDK
C3	16V/1µF	C1608X7R1C105K080AC	TDK
C4,C5	16V/22µF	C3216X5R1C226M160AB	TDK
C6	16V/10µF	C3216X7R1C106K160AC	TDK
C8	50V/10nF	C1608X5R1H103K080AA	TDK
C2, C7, C9,C10, C11	NC		
R1	5.1kΩ,0603, 5%		
R2	36kΩ, 0603, 5%		
R3	13kΩ, 0603, 5%		
R4	0.75kΩ, 0603, 1%		
R5	2.55kΩ, 0603, 1%		
R6	2.2kΩ, 0603, 1%		
R7,R12, R18	0Ω,0603,5%		
R8, R11	100kΩ, 0603, 5%		
R10	2.2Ω,0805, 5%		
R9, R13, R14, R15, R16, R17	NC		
R19	10kΩ, 0603, 5%		
Q1, Q2, Q3, Q4	NC		
D1	Chip LED 0603		
D2	BAT54C		
D3,D4	Zener, 5.1V		
CV1	Jumper		

PCB Layout Guide:

For best performance of the SY20718C, the following guidelines must be followed:

1. Enhance thermal and noise performance by maximizing the PCB copper area connected to the GND pin.
2. For the best efficiency and minimum noise problems, the following components should be placed close to the device: C_{IN}, L, C_{SYS}, and C_{SYS}.
3. The main MOSFET, rectifier MOSFET, and CSYS loop must be as small as possible.
4. Minimize the distance between the C_{IN} and the VIN and GND pins.
5. Minimize the PCB copper area connected to the LX pin to reduce EMI.
6. Place the small signal components R_{CHG} and R_{SYS} close to the device and not adjacent to the LX net on the PCB layout to minimize crosstalk.

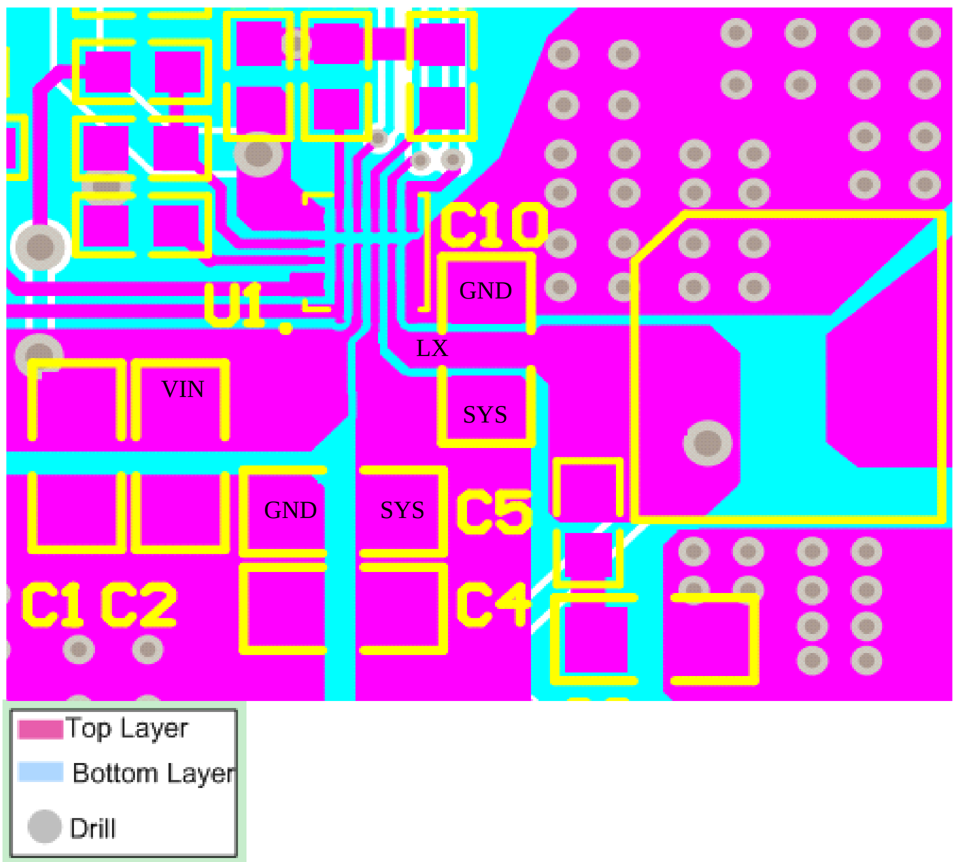
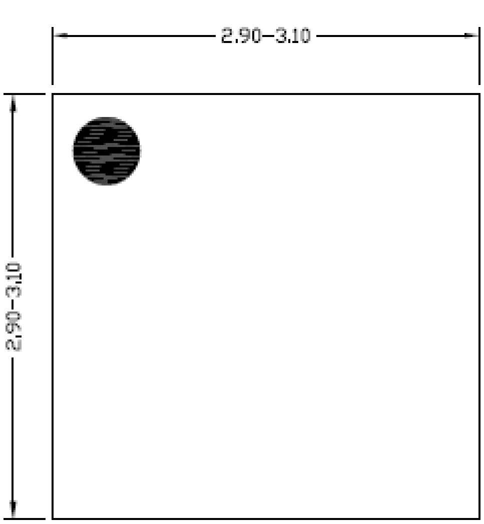
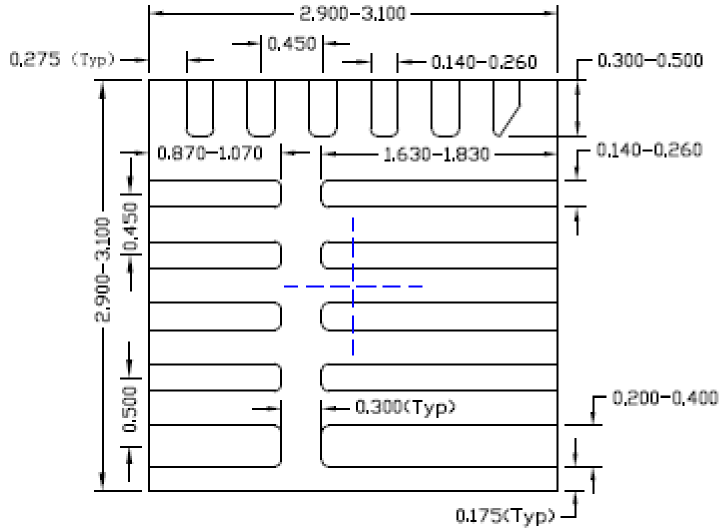


Figure 4. PCB Layout Suggestion

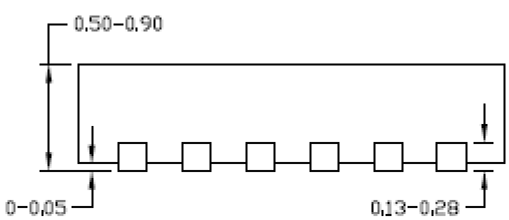
QFN3×3-16 Package Outline Drawing



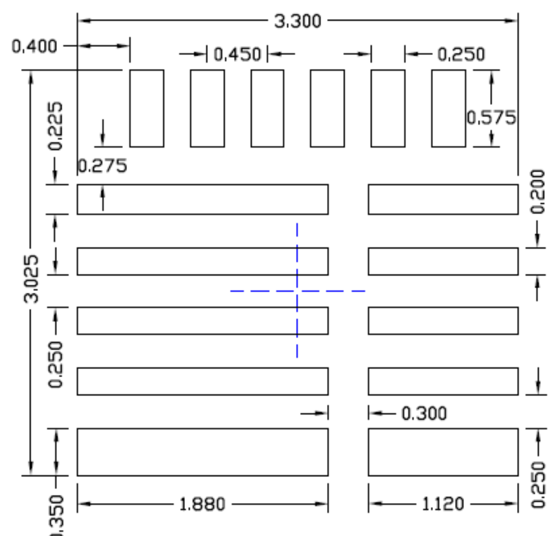
Top View



Bottom View



Side View

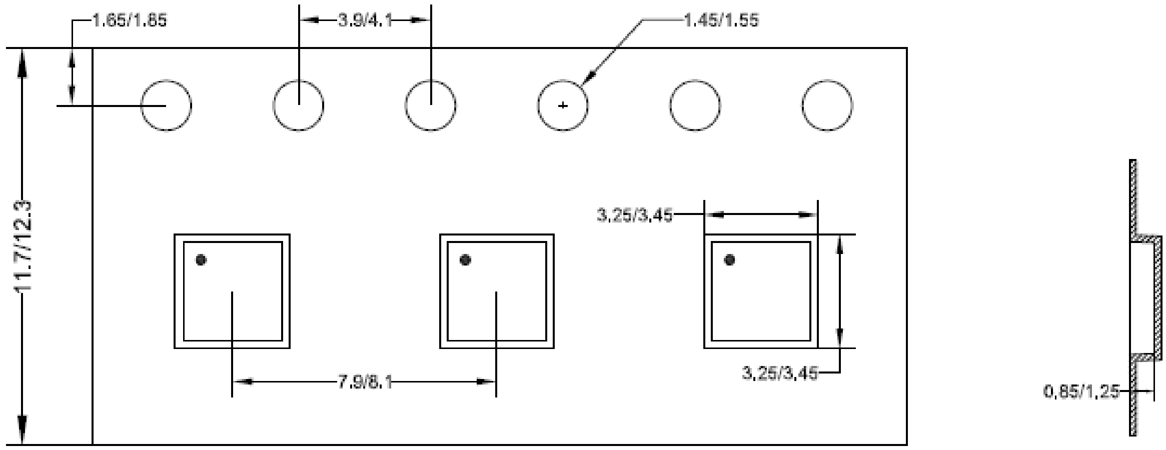


Recommended PCB Layout
(Reference Only)

Note: All dimensions are in millimeters and exclude mold flash and metal burr.

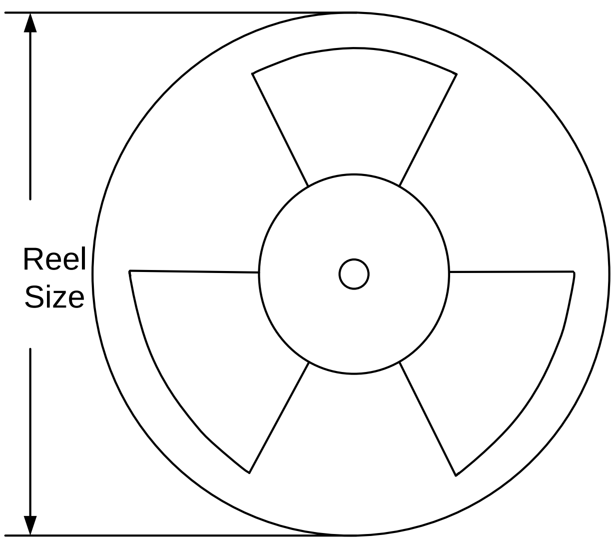
Taping & Reel Specification

Taping Orientation



Feeding direction →

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

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