SY20751

High Integrated Bi-Direction Power Regulator For Single-Cell Battery Power Bank Application

General Description

The SY20751 is a 4.5-5.7V input 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 charge mode and battery power supply mode alternately. If the external power supply is present, the SY20751 will run in battery charge mode with fully protection function. If the external power supply is absent, the SY20751 will run in battery power supply mode with output current capability up to 3A.

The SY20751 has integrated reverse blocking switches to prevent current leaking from the system side or battery side to the input side. The high side switch protects the battery from high discharge current and short circuits at SYS point.

The SY20751 also provides the KEY control and LEDs status indication.

The SY20751 is available in QFN4x4 package to minimize the PCB layout size.

Ordering Information

SY20751 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SY20751TYC	QFN4×4-26	

Features

- Maximum 18V Input Voltage Rating
- Build in Low R_{dson} Power Path NFETs and Power Switches
- Programmable Boost Switching Frequency
- Maximum 3A Charge Current
- Maximum 3A Boost Output Current
- 4.2V/4.35V/4.4V Selectable Cell Voltage
- +/-0.5% Battery Cell Voltage Tolerance
- 4 LEDs Battery Level Indicator
- Trickle Current / Constant Current / Constant Voltage Charge Mode
- Adaptive Input Current Limit
- Input Voltage UVLO and OVP
- Output Divider Mode, DCP Mode Handshaking
- Boost Auto Start When Portable Device Inserts
- Boost Auto Shutdown with Light Load
- Boost Cycle-by-cycle Peak Current Limit
- Boost Programmable Output Current Limit
  Boost Output Short Circuit Protection
- Thermal Shutdown Protection
- Compact Package: QFN4×4-26

Applications

- Power Bank
- Portable Device with 1-Cell Battery

Typical Application

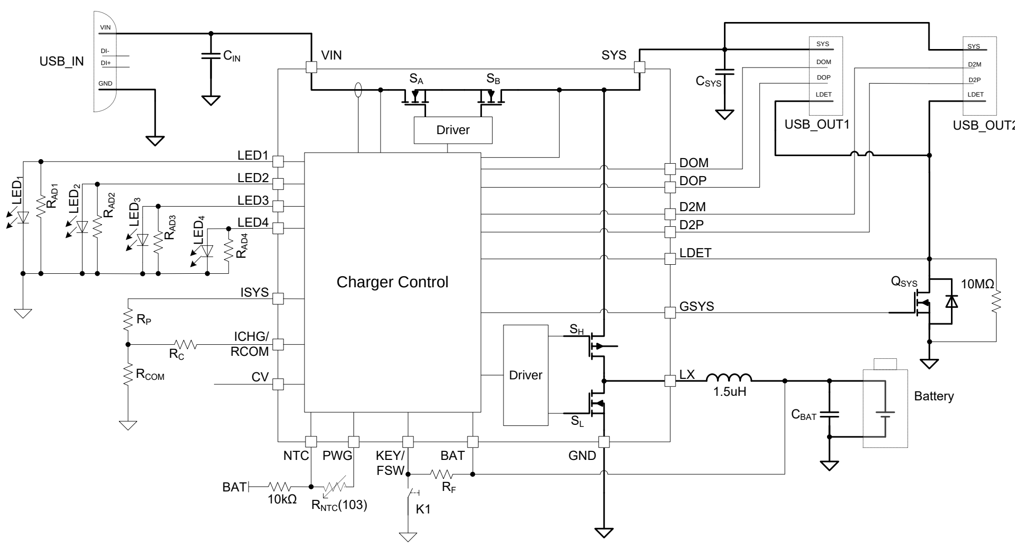
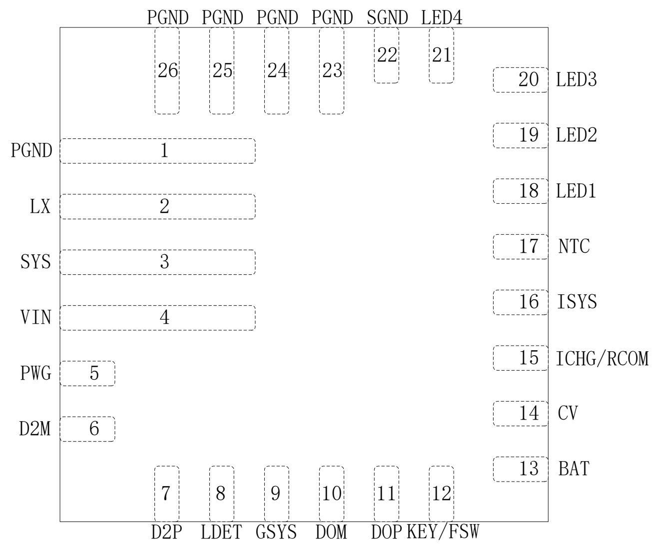


Figure 1. Typical Application Circuits

Pinout (top view)



QFN4x4-26

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

Name	No	Description
PGND	1, 23-26	Power ground.
LX	2	Switch node pin. Connect to external inductor.
SYS	3	System connection point. Add at least 2pcs of 22µF MLCC here.
VIN	4	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.
PWG	5	Negative connection point to the NTC resistor network.
D2M, D2P	6, 7	Data pins for system output port2.
LDET	8	Load inserted detection pin.
GSYS	9	Gate driver for external system power MOSFET.
DOM,DOP	10,11	Data pins for system output port1.
KEY/FSW	12	Connect a press KEY from this pin to ground. Pressing KEY can restart Boost and GSYS. This pin is also used for programming the Boost switching frequency by connecting a resistor to BAT pin.
BAT	13	Battery voltage sense pin.
CV	14	Battery cell voltage setting. Float to set 4.2V, pull low to set 4.35V and pull high to set 4.4V.
ICHG/ RCOM	15	Connect a resistor to set the maximum charge current in charge mode. This pin is also used as battery internal-resistance compensation for battery level indication in Boost mode.
ISYS	16	Connect a resistor to set the maximum system current in Boost mode.
NTC	17	Battery thermal sense pin for thermal protection. Connect the pull-up resistor between NTC and BAT pins. Connect the pull-down resistor between NTC and PWG pins.
LED1-4	18-21	LED driver for battery level indicator. They are also used as battery level indication threshold adjustment pins, both in Buck and Boost mode.
SGND	22	Analog ground.

Absolute Maximum Ratings (Note 1)

VIN	-0.3 to 18V
Others	-0.3 to 6V
Power Dissipation, P_D @ T_A = 25°C	2.5W
Package Thermal Resistance	
θ_{JA}	41.6°C/W
θ_{JC}	28.3°C/W
Junction Temperature Range	-40°C to 150°C
Lead Temperature (Soldering, 10 sec.)	260°C
Storage Temperature Range	-65°C to 150°C

Recommended Operating Conditions

VIN, others	0 to 5.5V
Junction Temperature Range	-40°C to 125°C
Ambient Temperature Range	-40°C to 85°C

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Bias Supply (V_{IN})						
V_{IN}	Supply Voltage		4.5		5.7	V
V_{UVLO}	V_{IN} under Voltage Lockout Threshold	V_{IN} rising and measured from VIN to SGND			4.5	V
ΔV_{UVLO}	V_{IN} under Voltage Lockout Hysteresis	Measured from VIN to SGND		150		mV
V_{OVP}	Input Overvoltage Protection	V_{IN} rising and measured from VIN to SGND	5.72	5.9	6.03	V
ΔV_{OVP}	Input Overvoltage Protection Hysteresis	Measured from VIN to SGND		100		mV
V_{DPM}	The Regulated SYS Voltage When VDPM Loop Works	Measured from SYS to SGND, GSYS turns on	4.69	4.77	4.85	V
Quiescent Current						
I_{BAT}	Battery Discharge Current	Disable Boost			20	uA
I_{IN}	Input Quiescent Current	Disable Buck			1.5	mA
Oscillator and PWM						
f_{OSC_BOOST}	Oscillator Frequency of Boost	R_F=50kΩ		350		kHz
f_{OSC_BUCK}	Oscillator Frequency of Buck			350		kHz
Power MOSFET						
R_{HIGH}	$R_{DS(ON)}$ of High Side P-FET	R_{SH}		30		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-FETs	R_{SA}+R_{SB}		90		mΩ
I_{CHG_PEAK}	Peak Current of Switching FETs on Charge Mode			6		A
I_{BST_PEAK}	Peak Current of Switching FETs on Discharge Mode			11		A
Voltage Threshold and Regulation						
V_{CV}	Cell Charge Voltage Tolerance	V_{CV}=4.2V	-0.5		0.5	%
ΔV_{RCH}	CV Hysteresis for Recharge	V_{CV}=4.2V	50	100	150	mV
V_{SYS}	Discharge Output Voltage at SYS	V_{BAT}=3.7V, I_{SYS}=1A, R_{ISYS}=1.5kΩ	5.05	5.15	5.25	V
		V_{BAT}=3.7V, I_{SYS}=1.8A, R_{ISYS}=1.5kΩ	5.15	5.25	5.35	V
Current Regulation						
I_{CC}	Internal Charge Current Accuracy for Constant Current Mode	I_{CC}=3A, R_{CHG}=1.8kΩ	-8		8	%
		I_{CC}=1A, R_{CHG}=5.4kΩ	-10		10	%
I_{TC}	Internal Charge Current Accuracy for Trickle Current Mode	I_{TC}=1/8 I_{CC}, I_{CC}=3A	-30		30	%
		I_{TC}=1/8 I_{CC}, I_{CC}=1A	-50		50	%
I_{TERM}	Termination Current Accuracy	I_{TERM}=1/20 I_{CC}, I_{CC}=3A	-30		30	%
		I_{TERM}=1/20 I_{CC}, I_{CC}=1A	-60		50	%
I_{INMAX}	Internal Maximum Input Current Limit When Charger is Switching	I_{CHG}=1A	2.7		3.3	A
I_{INMIN}	Internal Minimum Input Current Limit When Charger is Switching	I_{CHG}=500mA			500	mA
I_{SYS_LL}	SYS Current with Light Load for Boost Auto Shutdown	V_{BAT}=3.7V, R_{ISYS}=1.5kΩ	30	50	70	mA
System and BAT OVP						

V_{SYS_OVP}	SYS Voltage OVP Threshold	Rising edge	102%	104%	106%	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 Voltage Threshold						
V_{DPL}	Battery Depletion Threshold Accuracy in Boost Mode	Falling edge, R_{AD1}=50kΩ	2.65	2.75	2.85	V
		Falling edge, R_{AD1}=100kΩ	2.9	3.0	3.1	V
ΔV_{DPL}	Battery Depletion Hysteresis	Rising edge		450		mV
V_{TRK}	Battery Trickle Charge Threshold	Falling edge	2.45	2.6	2.7	V
ΔV_{TRK}	Battery Trickle Charge Hysteresis	Rising edge		250		mV
BAT Short Protection						
V_{SHORT}	Output Short Protection Threshold	V_{BAT} falling edge	1.9	2.0	2.1	V
SYS Current Limit						
I_{SYSMAX}	Maximum SYS Current Limit on Boost Mode	V_{BAT} =3.7V, R_{ISYS}=1.5kΩ	2.7	3	3.3	A
Timing						
T_{TC}	Trickle Current Charge Timeout			2		hour
T_{SYS_LL}	Boost Shutdown Deglitch Time with Light-load		22	27	32	s
Battery NTC Thermal Protection in Charge mode						
V_{T1}	V_{COLD}, Cold (0°C) Threshold	Rising edge	72.6	73.4	74.2	%V_{BAT}
	Cold Hysteresis	Falling edge		2		
V_{T2}	V_{COOL}, Cool (15°C) Threshold	Rising edge	58.6	59.6	60.4	
	Cool Hysteresis	Falling edge		2		
V_{T3}	V_{WARM}, Warm (40°C) Threshold	Falling edge	36.1	36.8	37.5	
	Warm Hysteresis	Rising edge		2		
V_{T4}	V_{HOT}, Hot (45°C) Threshold	Falling edge	32.2	32.9	33.6	
	Hot Hysteresis	Rising edge		2		
Battery NTC Thermal Protection in Boost Mode						
V_{COLD}	Cold (-20°C) Threshold	Rising edge	87.1	87.6	88.1	%V_{BAT}
	Cold Hysteresis	Falling edge		2		
V_{HOT}	Hot (60°C) Threshold	Falling edge	22.6	23.15	23.7	
	Hot Hysteresis	Rising edge		2		
KEY Active Voltage						
V_{KEY}	KEY Active Low Voltage	Falling edge			0.4	V

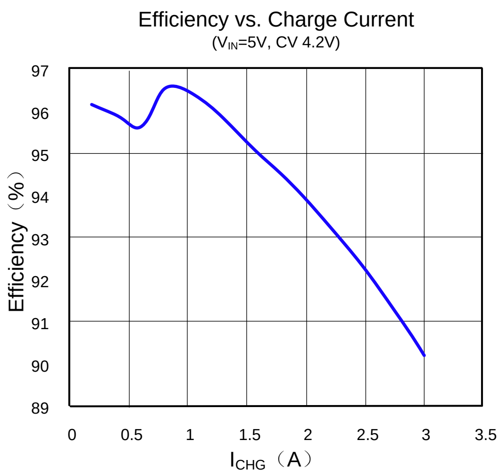
Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

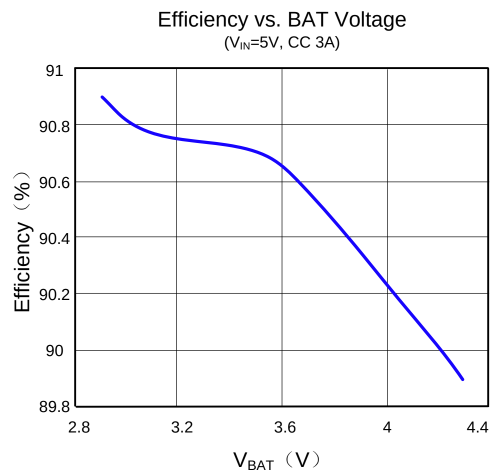
Note 2: Θ_{JA} is measured in the natural convection at T_A= 25°C on a low effective four-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

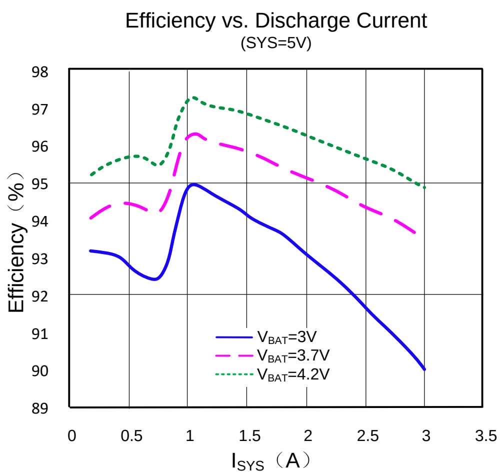
Note 3: The device is not guaranteed to function outside its operating conditions.

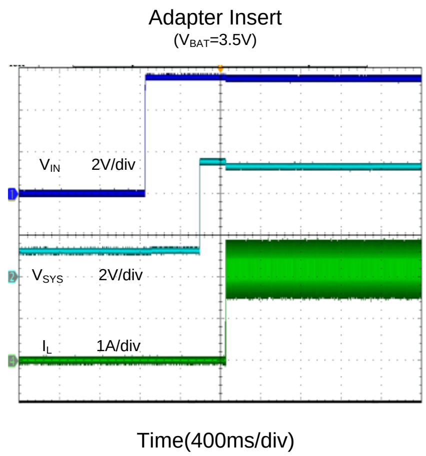
Typical Performance Characteristics

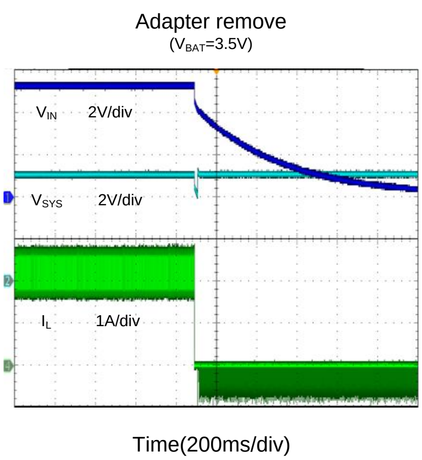
T_A=25°C, V_{IN}=5V, R_{CHG}=1.8kΩ, R_{ISYS}=1.5kΩ, 1cell battery, unless otherwise specified.

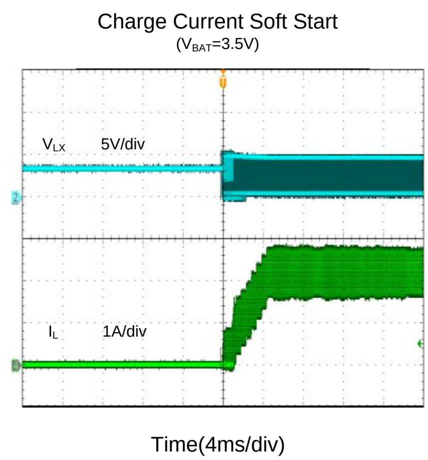




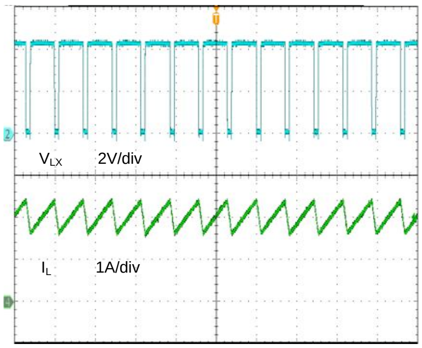






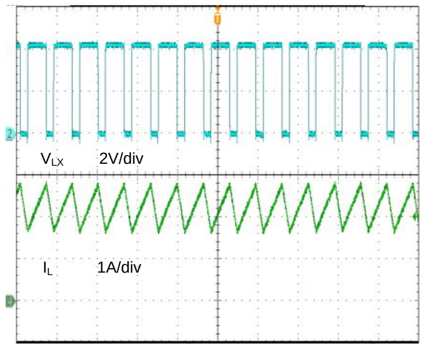


CV Mode Steady State
(V_{BAT}=4.2V)



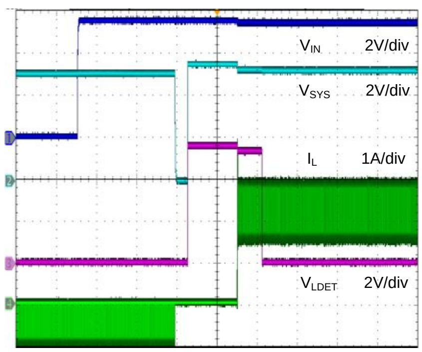
Time(4µs/div)

CC Mode Steady State
(V_{BAT}=3.5V)



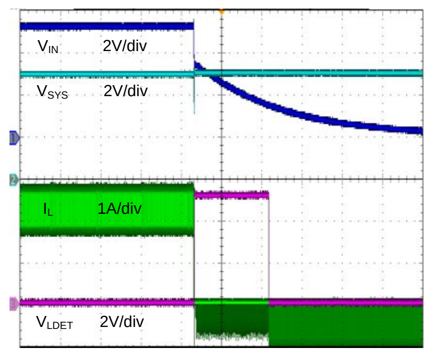
Time(4µs/div)

Boost To Buck Transition
(I_{SYS}=0.1A)



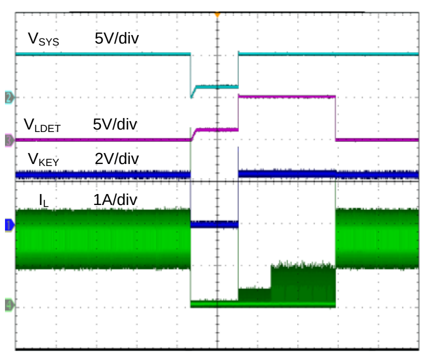
Time(200ms/div)

Buck To Boost Transition
(I_{SYS}=0.1A)



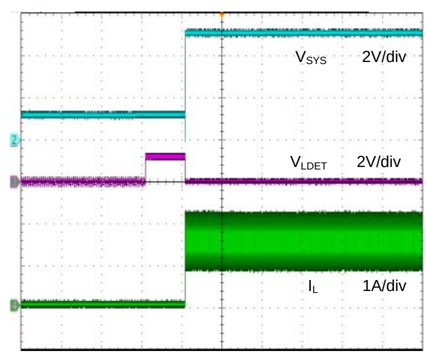
Time(200ms/div)

Press Key to Reset Boost



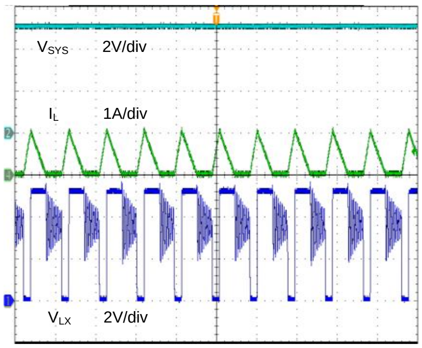
Time(400ms/div)

Load Insert To Enable Boost



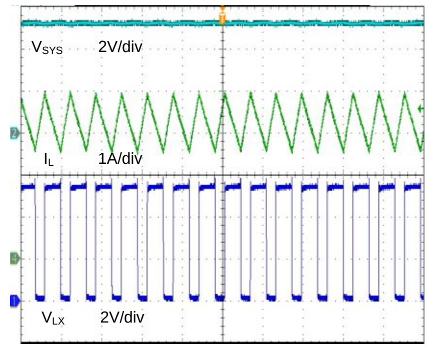
Time(400ms/div)

Boost Mode Steady State
(I_{SYS}=0.1A)



Time(4μs/div)

Boost Mode Steady State
(I_{SYS}=2A)



Time(4μs/div)

General Function Description

The SY20751 is a 4.5-5.7V input 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 charge mode and battery power supply mode alternately. If the external power supply is present, The SY20751 will run in battery charge mode with fully protection function. If the external power supply is absent, The SY20751 will run in battery power supply mode with output current capability up to 3A.

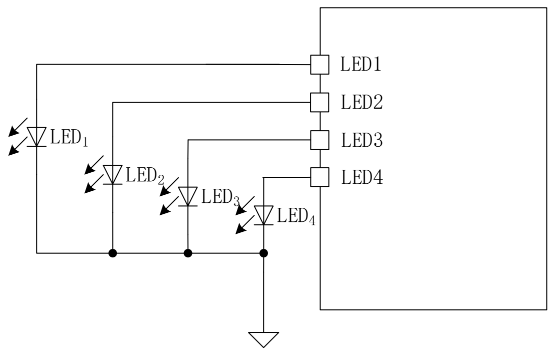
Press Key Function

The SY20751 supports 2 modes of KEY actions. 1 click will reset the IC in either Buck or Boost mode and 2 clicks within 300ms will disable the light-load detection function within 2 hours and automatically enable it after this timer is expired.

KEY pin is also used for programming the switching frequency of Boost mode, by connecting a resistor to BAT pin.

LEDs Status Indication Description

The SY20751 can indicate the battery level and converter status through 4 LEDs as below circuit. The LED pins can provide maximum 5mA current each.



1. Charge mode - When the adapter is present, the SY20751 will work in charge mode even when the charging is done. In charge mode, the LEDs will indicate the battery level as below table.
2. Discharge mode - When the adapter is removed, and the Boost is enabled, the IC will work in discharge mode. In discharge mode, the LEDs indicate the battery level as below table.
3. Fault Mode – When any fault (Input OVP, Battery OVP, SYS OVP, NTC faults, timeout, SYS short) occurs in charge mode, the LEDs flickers.

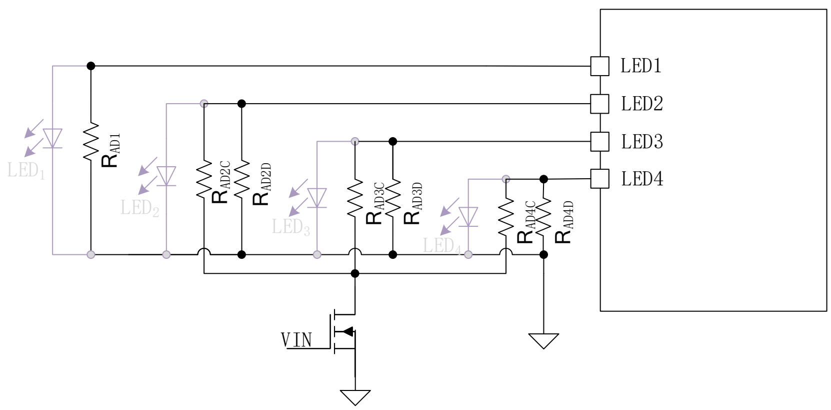
Operation	**Level**	**V_{BAT}**	**LED1**	**LED2**	**LED3**	**LED4**
Charging	0-25%	$< V_{TH1}$	Flicker	OFF	OFF	OFF
	25-50%	V_{TH1}~ V_{TH2}	ON	Flicker	OFF	OFF
	50-75%	V_{TH2}~ V_{TH3}	ON	ON	Flicker	OFF
	75-100%	V_{TH3}~V_{CV}	ON	ON	ON	Flicker
	100%	$=V_{CV}$	ON	ON	ON	ON
Discharging	0-25%	$< V_{TH1}$	ON	OFF	OFF	OFF
	25-50%	V_{TH1}~ V_{TH2}	ON	ON	OFF	OFF
	50-75%	V_{TH2}~ V_{TH3}	ON	ON	ON	OFF
	75-100%	$\geq V_{TH3}$	ON	ON	ON	ON

Flicker—ON 640ms, OFF 640ms.

The thresholds (V_{TH1}, V_{TH2}, V_{TH3}) can be heightened by the adjustment resistors (R_{AD1}, R_{AD2}, R_{AD3}, R_{AD4}) connecting to LED1~LED4 pins.

	Charge mode	Discharge mode
V_{TH1}	$83\%*V_{CV}+0.5R_{AD2}/R_{AD1}$	$80\%*V_{CV}+0.5R_{AD2}/R_{AD1}$
V_{TH2}	$88\%*V_{CV}+0.5R_{AD3}/R_{AD1}$	$85\%*V_{CV}+0.5R_{AD3}/R_{AD1}$
V_{TH3}	$93\%*V_{CV}+0.5R_{AD4}/R_{AD1}$	$90\%*V_{CV}+0.5R_{AD4}/R_{AD1}$

Changing the adjustment resistors by an external switch can get different battery level thresholds for charge and discharge modes.



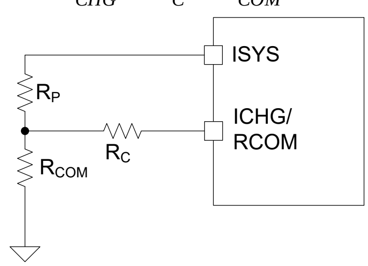
Input Dynamic Power Management

The SY20751 can manage the input power limit very well. It has input VDPM and IDPM function. The IC can detect the input source power capability and protect it from over-load automatically.

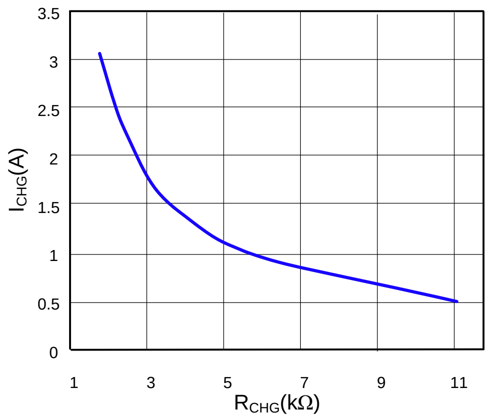
Charge Current Setting

In the charge mode, the SY20751 mirrors the current information to the ICHG pin and the charge current is determined by the equivalent resistance from the ICHG pin to SGND. The equivalent resistance R_{CHG} can be calculate as following:

$$R_{CHG} = R_C + R_{COM}$$

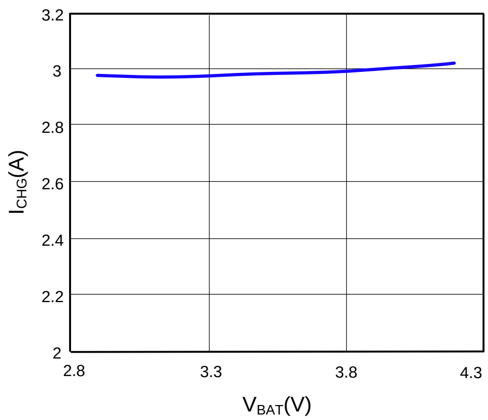


The relationship between the charging current and R_{CHG} is showed in below curve.



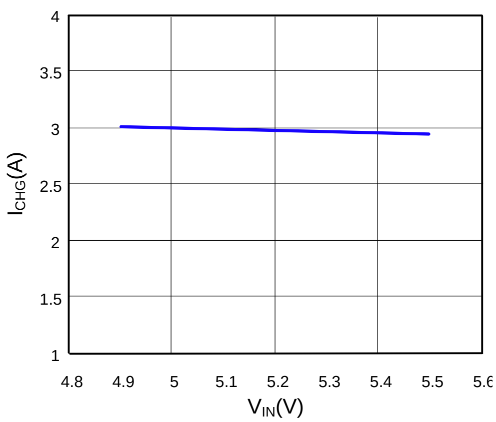
Test condition: V_{IN}=5V, V_{BAT}=3.7V

The SY20751 has good I_{CHG} regulation performance even in wide V_{IN} and V_{BAT} range. The relationship between the charging current and V_{BAT} is showed in below curve.



Test condition: V_{IN}=5V, R_{CHG}=1.8kΩ

The relationship between the charging current and V_{IN} is showed in below curve.

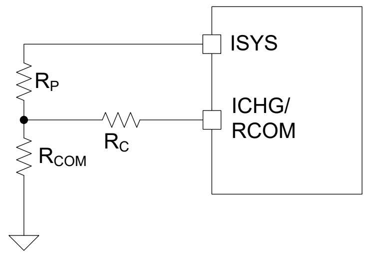


Test condition: V_{BAT}=3.7V, R_{CHG}=1.8kΩ

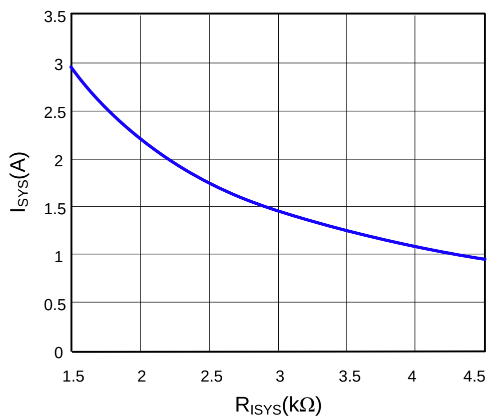
SYS Current Limit Setting

In discharge mode, the SY20751 mirrors the system output current information to the ISYS pin and the system output current limit is determined by the resistance from the ISYS pin to SGND.

$$R_{ISYS} = R_P + R_{COM}$$

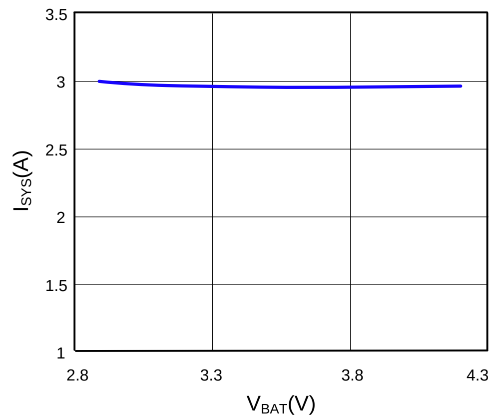


The relationship between the system output current limit and R_{ISYS} is showed in below curve.



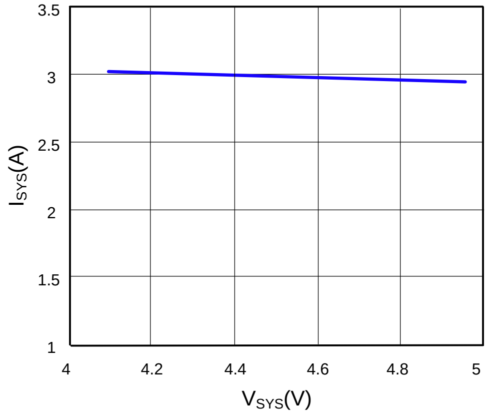
Test condition: V_{BAT}=3.7V, V_{SYS}=4.7V

The SY20751 has good I_{SYS} regulation performance even in wide V_{SYS} and V_{BAT} range. The relationship between the system output current limit and V_{BAT} is showed in below curve.



Test condition: V_{SYS}=4.7V, R_{ISYS}=1.5kΩ

The relationship between the system output current limit and V_{SYS} is showed in below curve.



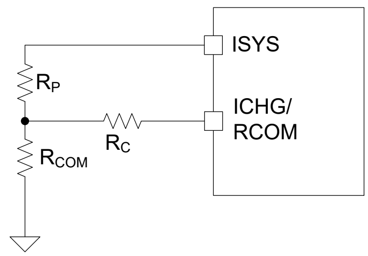
Test condition: V_{BAT}=3.7V, R_{ISYS}=1.5kΩ

Battery Internal Resistance Compensation

In Boost mode, the SY20751 will use the RCOM pin to compensate the battery internal resistance R_{BAT}. The sensed voltage will be added to the battery voltage on BAT pin as the actual battery voltage, which is used for LEDs indicating.

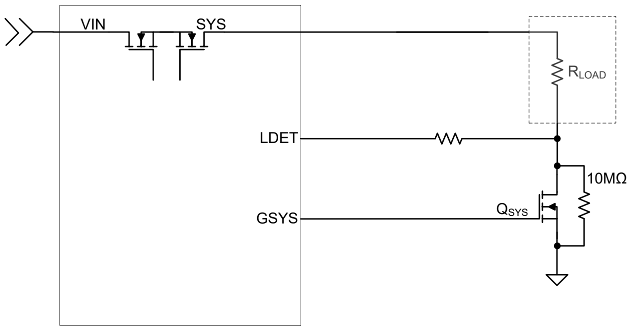
The compensation resistor R_{COM} is determined with the equation:

$$R_{COM} = \frac{R_{BAT}}{90\mu}$$



Portable Device Insert Detection

The SY20751 can detect the inserted phone when LDET is pulled high. Its load-inserted detection can be adopted in two ports application.



GSYS Control

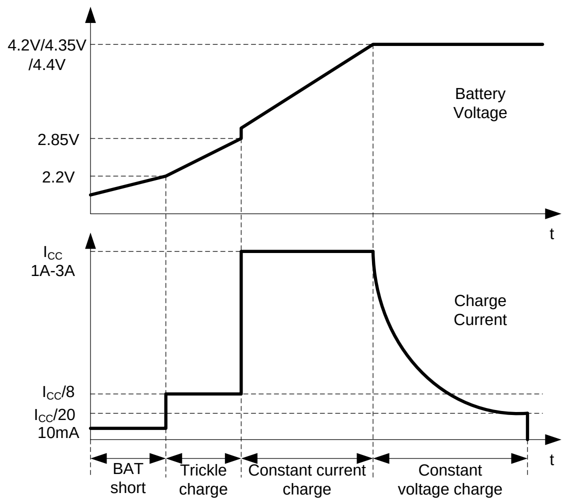
In charge mode, when adapter is present, GSYS will turn on after load insertion detected on SYS port.

In Boost mode, GSYS turns on after load insertion detected on SYS and turns off after Boost shuts down.

Buck Charger Basic Operation Description

The SY20751 will work as a synchronous Buck mode battery charger when the adapter is present. It utilizes about 350kHz switching frequency to minimize the PCB design.

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 showed in below charge curve.



In charge mode, the SY20751 has full protection to protect the IC and the battery.

Input Over Voltage Protection – The SY20751 has both VIN and SYS over voltage protection. It will turn off the blocking FETs and switching charger when input OVP occurs. IC will auto recover normal operation when fault removes.

BAT Over Voltage Protection – The SY20751 will stop charging when BAT OVP occurs. IC will auto recover normal operation when fault removes.

BAT Short Protection –The SY20751 will limit the charge current until the fault removed.

Input Over Current Protection- The SY20751 will turns off the blocking FETs to avoid SYS over-load.

Timeout Protection – It will stop charge and latch off when the charger works over 2 hours in trickle mode. Only recycling the input can release this fault.

Boost Mode Basic Operation Description

The battery can supply the portable device connecting to SYS pin when the adapter is removed. The converter works as a programmable synchronous Boost which can deliver up to 3A current to the load.

In Boost mode, the SY20751 provides full protections for the portable device, the battery and itself.

SYS over Voltage Protection –The SY20751 will stop switching when SYS OVP occurs.

BAT Depletion Protection –The SY20751 will stop operation when BAT depletion occurs.

Boost Switching Frequency Control

The Boost switching frequency of SY20751 can be programmed by the pull-up resistor R_F between KEY/FSW and BAT pins.

The frequency is determined by the resistor with the equation:

$$F_{SW} = \frac{1.75 \times 10^{7}}{R_F}(kHz)$$

Common Protection Description

The SY20751 also provides some common protections to prevent all the related devices.

SYS short Protection –The SY20751 will turn off system output when SYS short occurs.

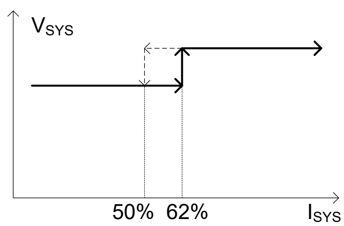
Battery Thermal Protection – When NTC voltage is lower than V_{HOT} threshold or higher than V_{COLD} threshold, the converter will stop switching. IC will auto recovery when fault removes in charge mode.

Thermal Shutdown Protection – The IC will stop operation when the junction temperature is higher than 150°C. It will auto recover normal when fault removes.

Boost Mode Basic Operation Description

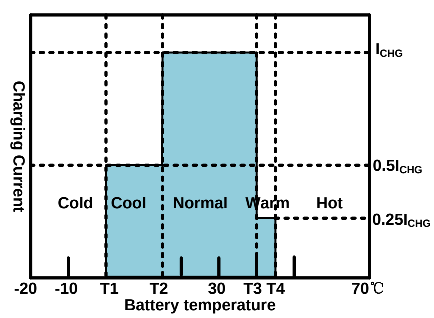
The battery can supply the portable device connecting to SYS pin when the adapter is removed. The converter works as a programmable synchronous Boost which can deliver up to 3A current to the load.

The Boost regulated voltage will be adjusted according to the system current as below picture. IC will heighten the SYS regulated voltage 100mV to compensate the cable voltage drop when the load current increase.



Charging NTC Guideline

The SY20751 provides flexibility charge current settings. The current setting at cool temperature (T1–T2) can be reduced to 50% of fast charge current, and current setting at warm temperature (T3 - T4) can be reduced to 25% of fast charge current.

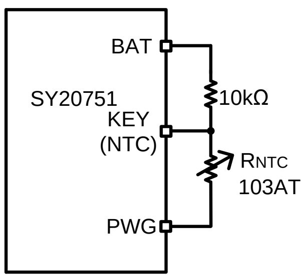


Applications Information

The SY20751 is a very high integration IC for power bank application. The application circuit based on this regulator IC is rather simple. Only filter capacitors (C_{IN}, C_{BAT} and C_{SYS}), inductor L, NTC resistors R1, R2 and current setting resistors (R_{CHG}, R_{ISYS}) need to be selected for the targeted application specifications.

NTC Resistor

The SY20751 monitors battery temperature by measuring the BAT voltage and NTC voltage. The temperature sensing network is showed as below, with a 103-AT type thermistor used.



Input Capacitor C_{IN}

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

Output Capacitor C_{BAT}

The charger output capacitor is selected to handle the output ripple noise requirement. This ripple voltage is related to the capacitance and its equivalent series resistance (ESR). For the best performance, it is recommended to use X5R or better grade low ESR ceramic capacitor.

To design a smaller output ripple, larger than 10μF capacitance is recommended.

Output Capacitor C_{SYS}

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

To design a smaller output ripple and better transient performance, greater than 2pcs of 22μF capacitors are recommended for lower than 2A SYS current and 3pcs of 22μF capacitors are recommended for higher than 2A application.

Inductor L

There are several considerations in choosing this inductor.

1) Choose the inductance to provide the desired ripple current. It is suggested to choose the ripple current to be about 40% of the average input current. The Boost inductor current is worse than in the charge mode, so the inductor is choose based on Boost mode. The inductance is calculated as:

$$L = \left(\frac{V_{BAT}}{V_{SYS}}\right)^2 \frac{V_{SYS} - V_{BAT}}{I_{SYS} \cdot F_{SW} \cdot 40\%}$$

Where F_{SW} is the switching frequency.

The SY20751 is quite tolerant of different ripple current amplitude. Consequently, the final choice of inductance can be slightly off the calculation value without significantly impacting the performance.

Recommend 1.5μH inductance in the SY20751 applications.

2) The saturation current rating of the inductor must be selected to be larger than the peak inductor current under full load conditions.

$$I_{SAT} > \frac{V_{SYS} \cdot I_{SYS}}{V_{BAT}} + \left(\frac{V_{BAT}}{V_{SYS}}\right)^2 \frac{V_{SYS} - V_{BAT}}{2 \cdot F_{SW} \cdot L}$$

3) The DCR of the inductor and the core loss at the switching frequency must be low enough to achieve the desired efficiency requirement. It is desirable to choose an inductor with DCR<10mohm to achieve a good overall efficiency.

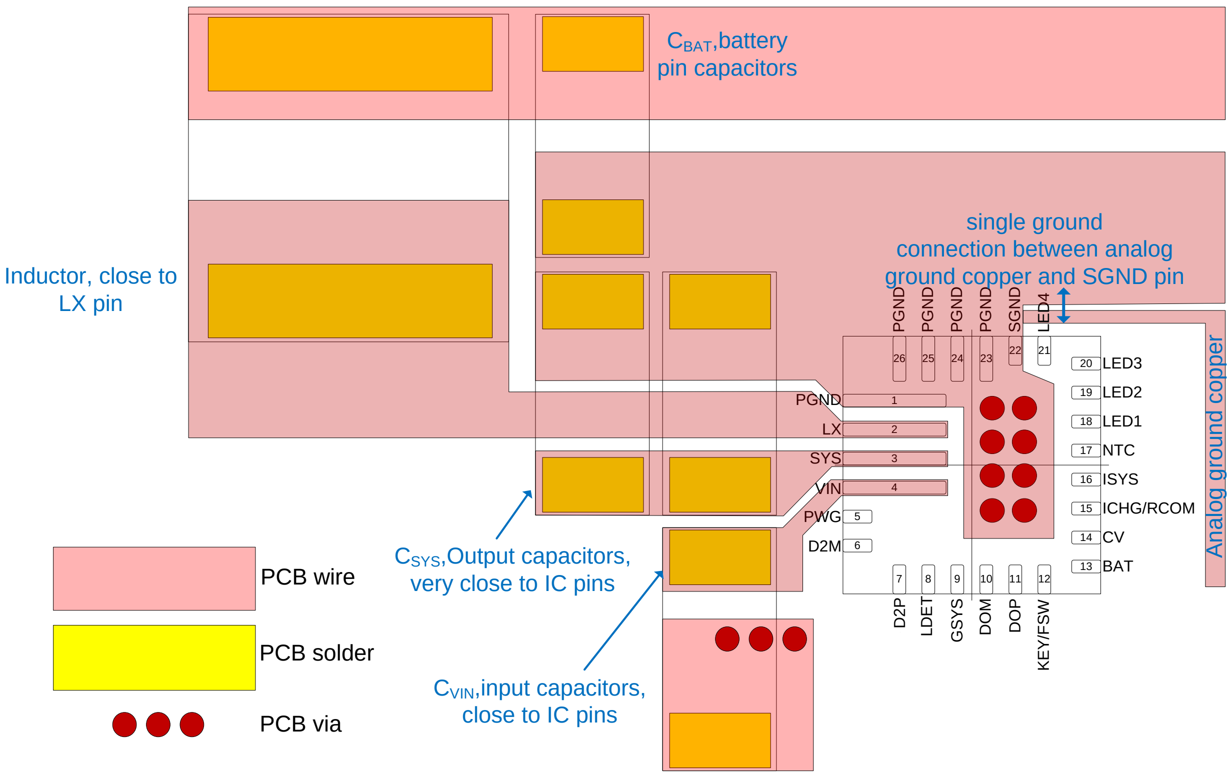
Layout Design

The layout design of the SY20751 regulator is relatively simple. For the best efficiency and minimum noise problems, the following components should be placed close to the IC: C_{IN}, L, C_{SYS}, especially C_{SYS}.

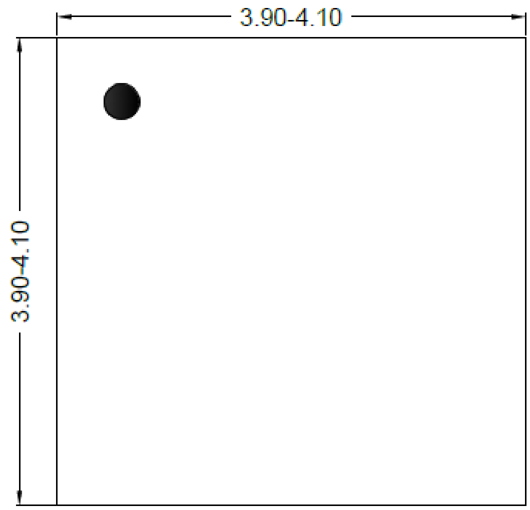
1) The loop of main MOSFET, rectifier MOSFET, and C_{SYS} must be as short as possible.
2) Place inductor input terminal to LX pin as close as possible.

3) It is desirable to maximize the PCB copper area connecting to PGND pin to achieve the best thermal and noise performance.

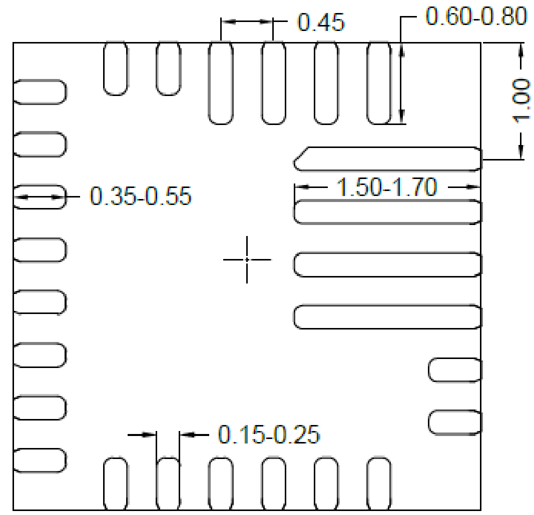
4) Route analog ground separately from power ground. The ground of the small signal component R_{CHG}, R_{ISYS}, LED1~LED4 must be connected to the analog ground copper.



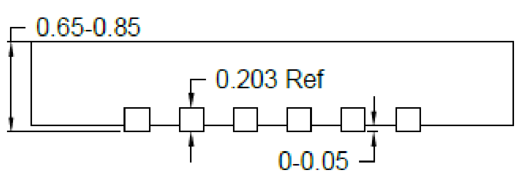
QFN4×4-26 Package Outline Drawing



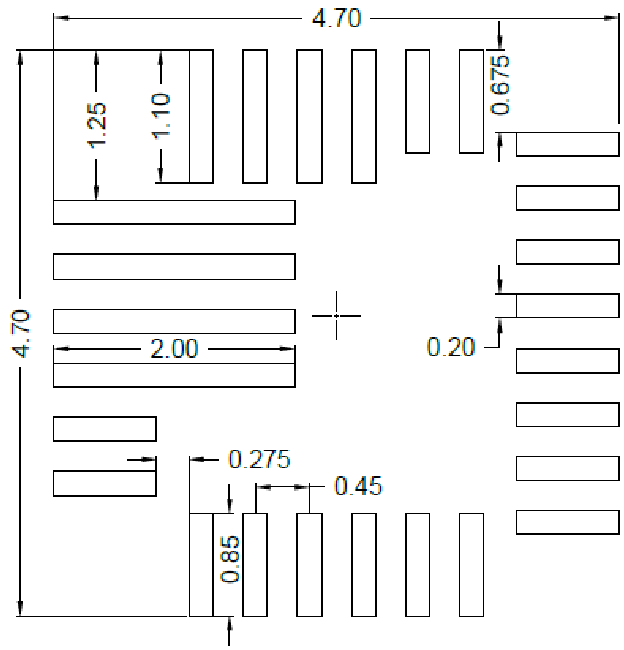
Top View



Bottom View



Side View

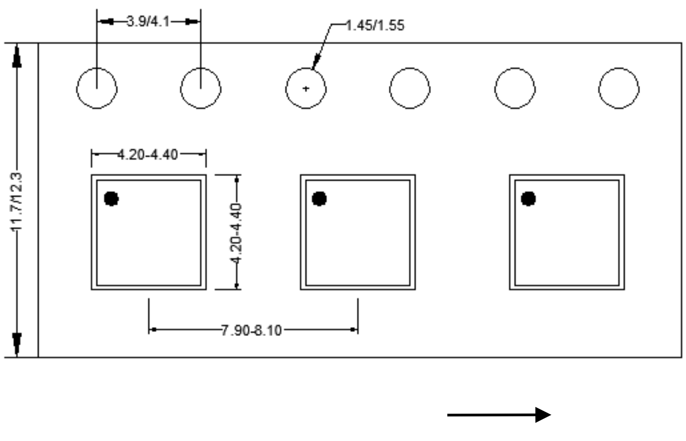


Recommended PCB (Reference only)

Notes: 1, All dimension in millimeter and exclude mold flash & metal burr.
2, center line refers chip body center

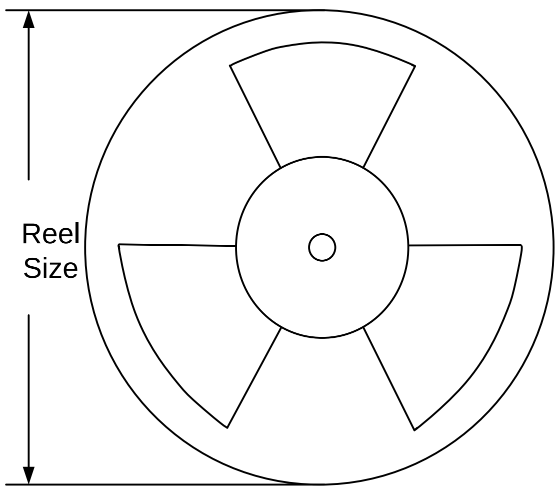
Taping & Reel Specification

1. QFN4x4 taping orientation



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 (pcs)
QFN4x4	12	8	13"	400	400	5000

3. Others: NA

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