

High Efficiency, 28V Input Single Inductor Synchronous Step Up/Down Regulator Advanced Design Specification

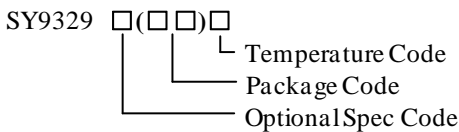
General Description

The SY9329C is a high voltage synchronous buck-boost converter. The device operates over a wide input voltage range from 3.5V to 28V with 10A maximum average inductor current capability. The four-integrated low $R_{DS(ON)}$ switches minimize the conduction loss.

The SY9329C includes full protection features, such as output over current/short circuit protection, over voltage protection and thermal shutdown for reliable operating.

The device is available in compact QFN4×4-32 package.

Ordering Information



Ordering Number	Package Type	Note
SY9329CQFC	QFN4×4-32	--

Features

- 3.5V to 28V Wide Input Voltage Range
- Low $R_{DS(ON)}$ for Internal Switches: 25mΩ
- Internal Soft-start Limits the Inrush Current
- Hiccup Mode Output Over Current, Short Circuit and Over Voltage Protection
- Thermal Shutdown with Auto Recovery
- 250kHz/500kHz Selectable Switching Frequency
- 6A/10A Selectable Average Inductor Current Limitation
- $1.0V \pm 1.5\%$ Reference Voltage Accuracy
- Programmable Output Current Limitation with External Sensing Resistor
- Compact package: QFN4×4-32

Applications

- Docking Station
- Laptop
- High-End Power Bank
- Monitor
- Car Charger
- USB PD

Typical Applications

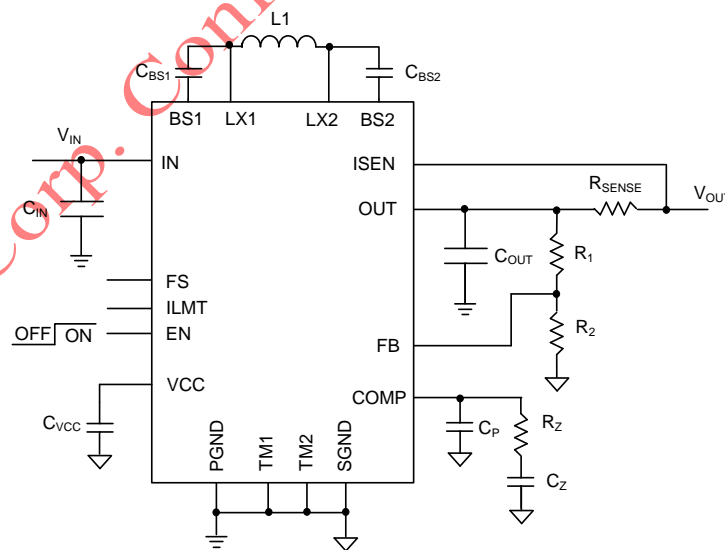
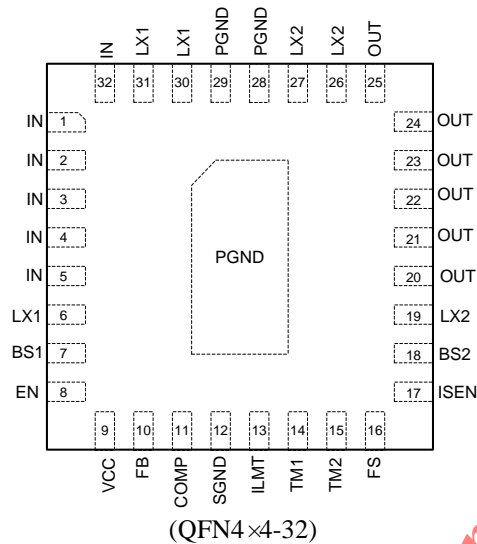


Figure1. Schematic Diagram

Pinout (top view)



Top Mark: BXXxyz (Device code: BXX; x=year code, y=week code, z=lot number code)

Pin Name	Pin Number	Description
IN	1,2,3,4,5,32	Power input pin, decouple this pin to PGND with at least 10μF ceramic capacitor.
LX1	6,30,31	Switching node 1
BS1	7	Boot-Strap pin. Supply high side gate driver. Connect a 0.1μF ceramic capacitor between BS1 and LX1 pin.
EN	8	IC Enable control pin, logic high enable. This pin is internally pulled high by 400nA pull-up current.
VCC	9	3.3V LDO output, power supply for internal driver and control circuits. Decouple this pin to SGND with a minimum of 2.2μF ceramic capacitor.
FB	10	Output feedback pin. Connect this pin to the center point of the output resistor divider to program the output voltage: $V_{OUT} = 1V \times (R_1 + R_2) / R_2$.
COMP	11	Compensation pin. Connect RC network between this pin and ground.
SGND	12	Signal ground.
ILMT	13	Average inductor current limitation threshold select pin. Connect this pin to VCC for 10A threshold, and connect this pin to SGND for 6A threshold.
TM1	14	Test pin. For factory use only. Connect this pin to SGND in application.
TM2	15	Test pin. For factory use only. Connect this pin to SGND in application.
FS	16	Switching frequency select pin. Connect this pin to VCC for 500kHz switching frequency, and connect this pin to SGND for 250kHz switching frequency.
ISEN	17	Current sense pin. Connect a resistor R_{SENSE} between OUT and ISEN set the output current limitation threshold. $I_{OUT,LMT} = 30m/R_{SENSE}$.
BS2	18	Boot-strap pin. Supply high side gate driver. Connect a 0.1μF ceramic capacitor between BS2 and LX2 pin.
LX2	19,26,27	Switching node 2.
PGND	28,29, Exposed Pad	Power ground.

OUT	20,21,22,23, 24,25	Power output pin, decouple this pin to PGND with at least a 10 μ F ceramic capacitor.
-----	--------------------	---

Block Diagram

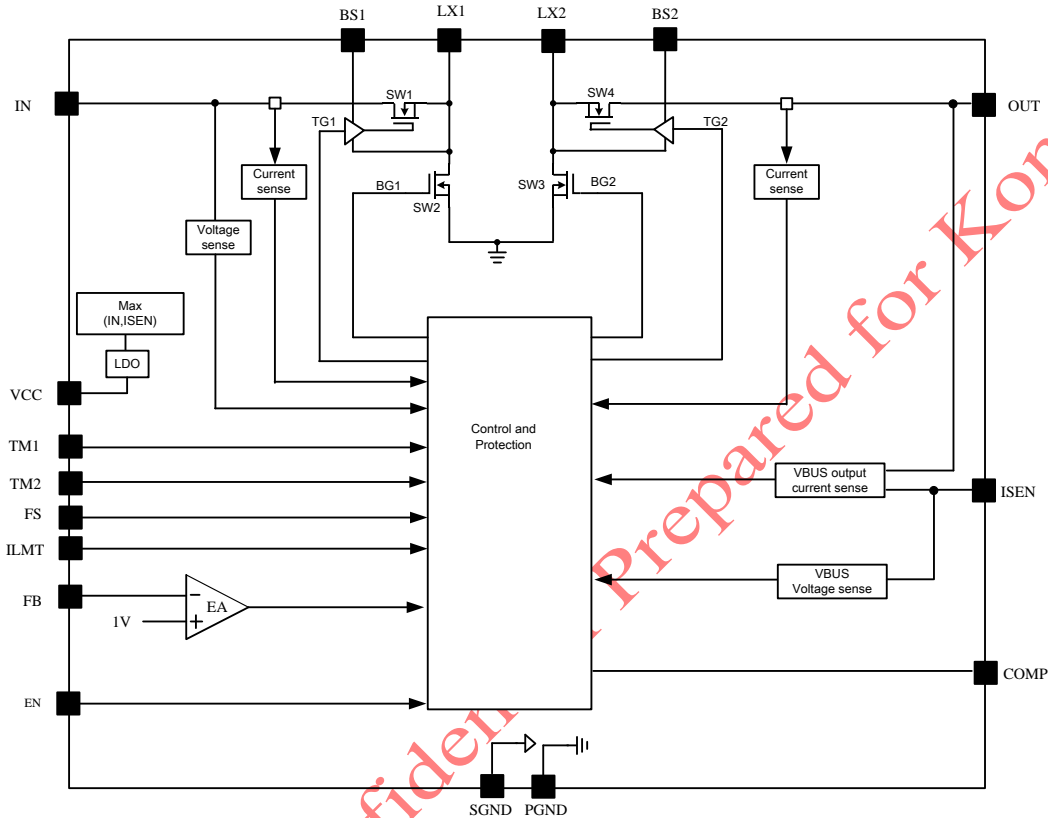


Figure2. Block Diagram

Absolute Maximum Ratings (Note 1)

IN, LX1, LX2, OUT, ISEN, EN, FB, COMP	-----	-0.3V to 30V
BS-LX, VCC	-----	-0.3V to 4V
FS, ILMT	-----	-0.3V to 4V
Power Dissipation, Pd @ TA = 25 °C QFN4×4-32	-----	4W
Package Thermal Resistance (Note 2)		
θ_{JA}	-----	28 °C/W
θ_{JC}	-----	2.8 °C/W
Junction Temperature	-----	150 °C
Lead Temperature (Soldering, 10 sec.)	-----	260 °C
Storage Temperature Range	-----	-65 °C to 150 °C

Recommended Operating Conditions (Note 3)

Input Voltage Range	-----	-3.5V to 28V
Junction Temperature Range	-----	-40 °C to 125 °C
Ambient Temperature Range	-----	-40 °C to 85 °C

Electrical Characteristics

($V_{IN} = 12V$, $V_{OUT} = 12V$, $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified)

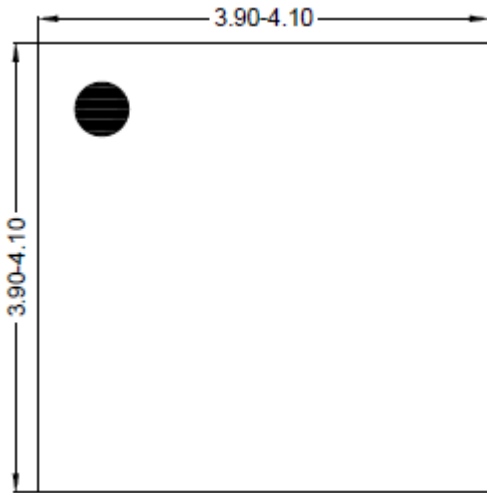
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		3.5		28	V
Input UVLO Threshold	$V_{IN,UVLO}$		3.0		3.5	V
UVLO Hysteresis	$V_{UVLO,HYS}$			0.2		V
VCC LDO Voltage	VCC	$I_{LDO} = 10\text{mA}$	3.12	3.3	3.37	V
Quiescent Current	I_Q	EN=High, no switching			200	μA
Shutdown Current	I_{SD}	EN=Low			10	μA
Feedback Reference Voltage	V_{REF}		0.985	1	1.015	V
FB Input Current	I_{FB}		-50		50	nA
OUT Pin Over Voltage Protection	$V_{OUT,OV P}$		25		28	V
Output OVP Threshold	$V_{FB,OV P}$	FB voltage rising		120		$\% V_{REF}$
Output OVP Delay Time	$t_{OV P,DLY}$			10		μs
Output UVP Threshold	$V_{FB,UV P}$	FB voltage falling		50		$\% V_{REF}$
Output UVP Delay Time	$t_{UV P,DLY}$			200		μs
Internal Power MOSFET $R_{DS(ON)}$	$R_{DS(ON)}$			25		m Ω
Inductor Average Current Limit	I_{AVG}	ILMT connect to SGND		6		A
		ILMT connect to VCC		10		A
Inductor Peak Current Limit	I_{PK}	ILMT connect to SGND	6.8	8.8	11.1	A
		ILMT connect to VCC	11	13	15	A
EN Input Logic High	V_{ENH}		1.5			V
EN Input Logic Low	V_{ENL}				0.5	V
Output Current Limit Voltage Threshold	$V_{IOUT,LIM}$		27	30	33	mV
Oscillator Frequency	F_{OSC}	FS connect to VCC	425	500	575	kHz
		FS connect to SGND	210	250	290	kHz
Min On Time	$t_{ON,MIN}$			150		ns
Thermal Shutdown Temperature	T_{SD}			150		$^\circ\text{C}$
Thermal Shutdown Hysteresis	T_{HYS}			15		$^\circ\text{C}$
Soft-Start Time	T_{SS}			1.5		ms

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.

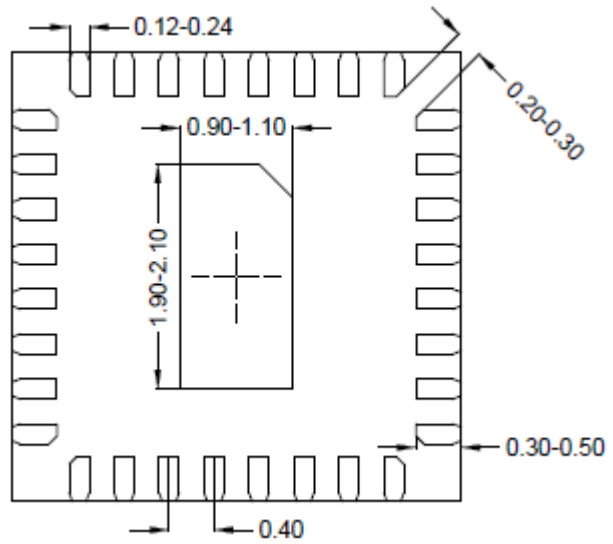
Note 2: θ_{JA} is measured in the natural convection at $T_A = 25\text{ }^\circ\text{C}$ on a four-layer Silergy Evaluation Board.

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

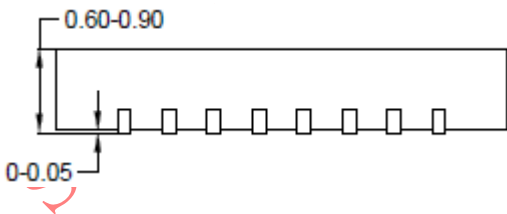
QFN4×4-32 Package Outline Drawing



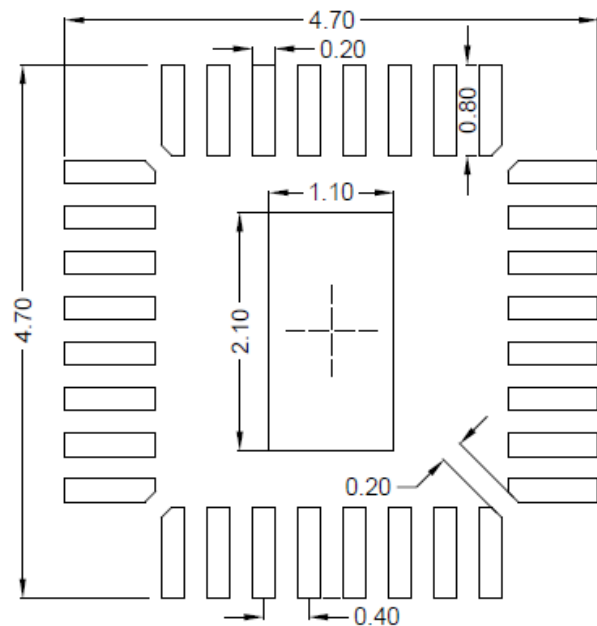
Top View



Bottom View



Side View



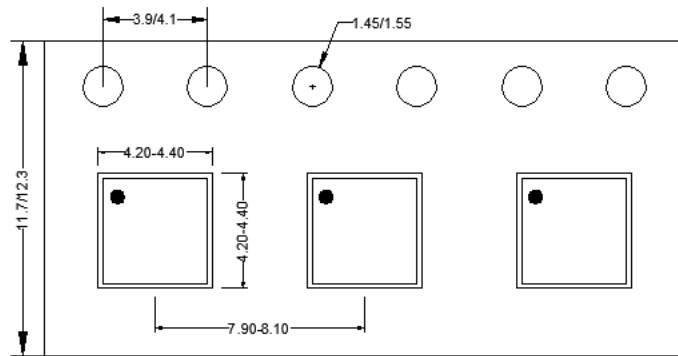
**Recommended PCB layout
(Reference only)**

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

Taping & Reel Specification

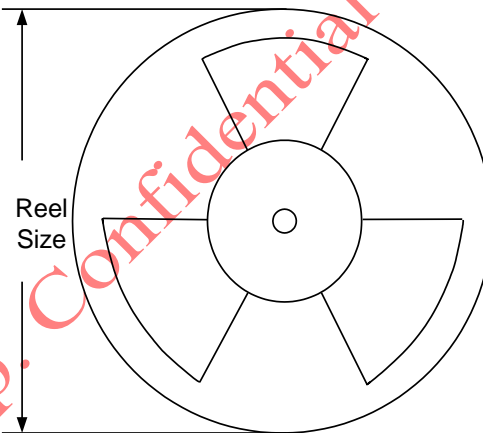
1. Taping orientation

QFN4×4



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)
QFN4×4	12	8	13"	400	400	5000