

High Efficiency, Fast Response, 12A, 18V Input Synchronous Step Down Regulator

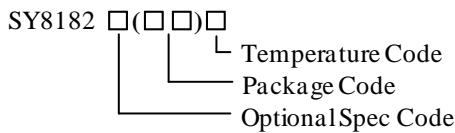
General Description

SY8182 develops a high efficiency synchronous Buck regulator capable of delivering 12A output current. The device operates over a wide input voltage range from 4.5V to 18V. SY8182 adopts instant PWM architecture to achieve fast transient response.

SY8182 features enable control, open drain power good indicator, cycle-by-cycle current limit, short circuit protection and thermal shutdown.

SY8182 provides compact solution for TCON power system. It is available in a QFN4x4-24 package.

Ordering Information



Ordering Number	Package type	Note
SY8182QCC	QFN4x4 -24	--

Features

- 4.5V to 18V Input Voltage Range
- 12A Synchronous Buck Regulator:
 - Low $R_{DS(ON)}$ For Internal Switches(Top FET/Bottom FET): 18mΩ/6mΩ
 - 12.0A Output Current Capability
 - Instant PWM Architecture to Achieve Fast Transient Responses
 - 200kHz~1MHz Programmable Switching Frequency
 - 0.6V+/-1% Feedback Reference Voltage
 - Enable Control
 - Power Good Indicator
 - Adjustable Soft-start Time
 - PFM/PWM Mode Selection
 - Cycle-by-Cycle Current Limit Protection
 - Output Short Circuit Protection
 - Output Over Voltage Protection
 - Hiccup Protection Mode
- Thermal Shutdown with Auto Recovery
- Input UVLO
- RoHS Compliant and Halogen Free
- Compact Package: QFN4x4-24

Applications

- TCON Power System
- FRC Power
- Mobile Handsets
- Portable Applications

Typical Applications

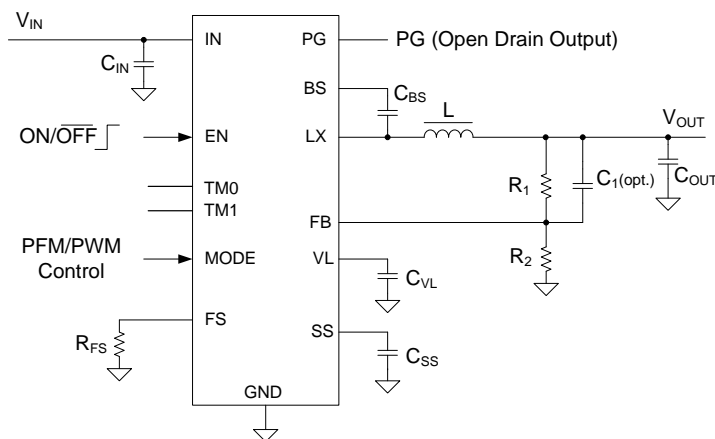


Figure1. Schematic Diagram

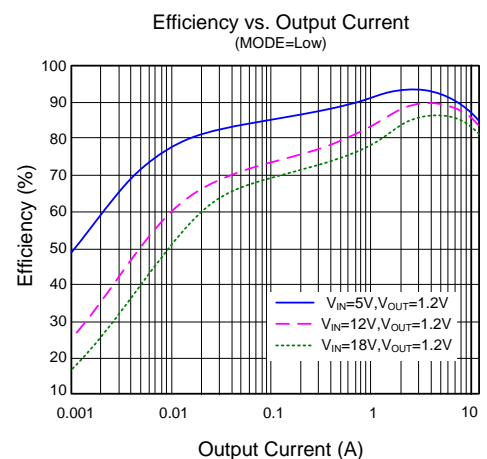
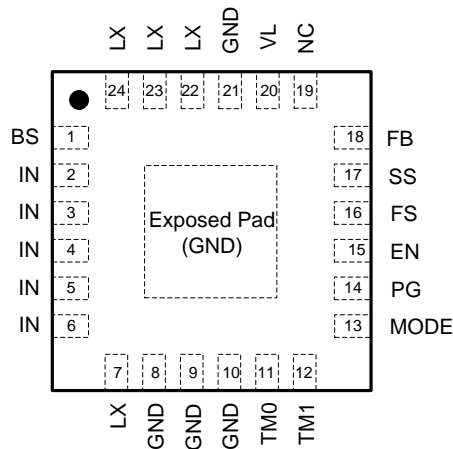


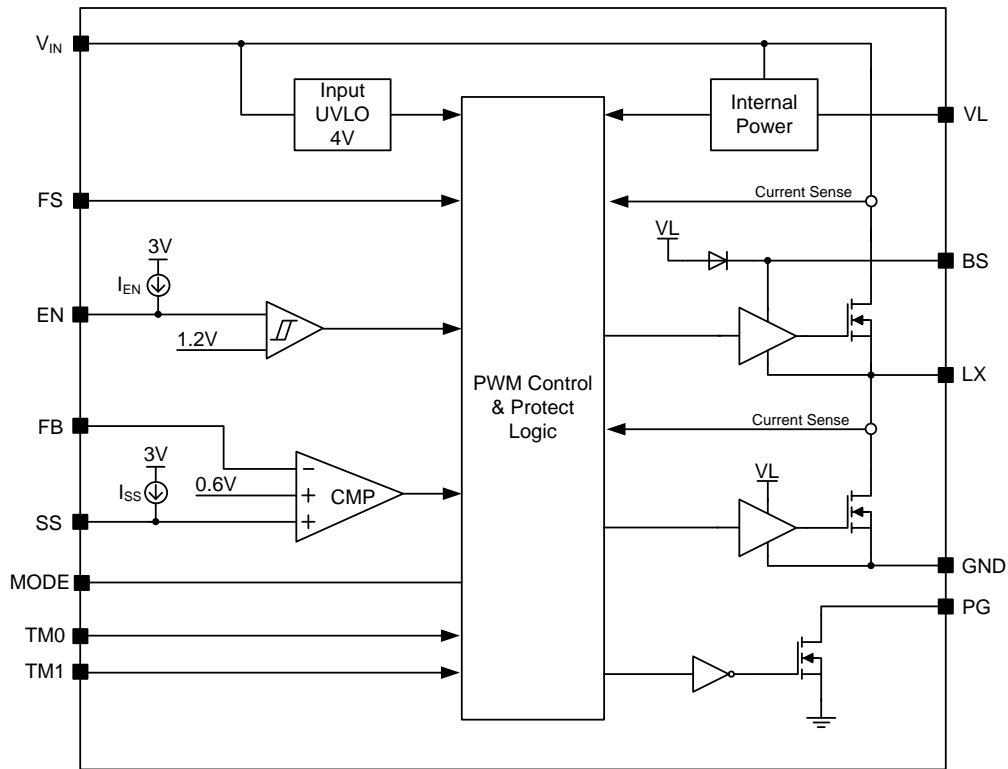
Figure2. Efficiency vs. Output Current

Pinout (top view)


(QFN4x4-24)

 Top Mark: BCV_{xyz}, (Device code: BCV, *x*=year code, *y*=week code, *z*=lot number code)

Pin Name	Pin Number	Pin Description
BS	1	Boot-strap pin. Decouple this pin to the LX pin with a 100nF capacitor.
IN	2,3,4,5,6	Power supply input. Decouple this pin to GND with at least a 10μF MLCC.
LX	7,22,23,24	Inductor pin. Connect this pin to the switching node of the inductor.
GND	8,9,10,21,EP	Ground pin.
TM0	11	TM0 and TM1 are for factory test use only. Connect these pins to GND or leave them floating in the application.
TM1	12	
MODE	13	Operating mode selection under light load. Pull this pin low for PFM operation and pull this pin high for PWM operation. Do not leave this pin floating.
PG	14	Open-drain power good indicator. Externally pull high when the output is in regulation range. Otherwise pull low.
EN	15	Enable control. Float to enable. This pin can also be used for adjusting input UVLO with resistor divider.
FS	16	Switching frequency setting pin. Connect a resistor from this pin to GND to adjust the switching frequency. $F_{sw}(kHz) = 44350/R_{FS}$, where R_{FS} is in kΩ.
SS	17	Soft-start input. Connect a capacitor from this pin to GND to program the soft-start time. A 5μA pull-up current source is connected to this pin. $t_{ss}(ms) = C_{SS}(nF) \times 0.6(V) / 5(\mu A)$
FB	18	Initial output voltage setting pin. Connect this pin to the resistor divider of the output.
NC	19	Not connected.
VL	20	Internal LDO output. Decouple this pin to GND with a 2.2μF ceramic capacitor.

Function Block

Figure3. Block Diagram
Absolute Maximum Ratings (Note 1)

IN, LX, EN, PG	-----	-0.3V to 20V
VL, BS-LX	-----	-0.3V to 4V
MODE	-----	-0.3V to 7V
All other pins	-----	-0.3V to 4V
Power Dissipation,		
P_D @ $T_A = 25^\circ\text{C}$ QFN4x4-24	-----	3.85W
Package Thermal Resistance (Note 2)		
θ_{JA} , QFN4x4-24	-----	26°C/W
θ_{JC} , QFN4x4-24	-----	4°C/W
Junction Temperature Range	-----	150°C
Lead Temperature (Soldering, 10 sec.)	-----	260°C
Storage Temperature Range	-----	-65°C to 150°C

Recommended Operating Conditions (Note 3)

IN	-----	4.5V to 18V
Junction Temperature Range	-----	-40°C to 125°C
Ambient Temperature Range	-----	-40°C to 85°C

Electrical Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		4.5		18	V
Output Voltage Range	$V_{OUT,RNG}$		0.6		5	
UVLO Rising Threshold	$V_{UVLO,RISING}$		3.7	4.0	4.3	V
UVLO Falling Threshold	$V_{UVLO,FALLING}$		3.3	3.6	3.9	V
Quiescent Current	I_Q	EN=High, FB=1V. Buck converters are not switching			500	μA
Shutdown Current	I_{SHUT}	EN =0			10	μA
Feedback Reference Voltage	V_{REF}		0.594	0.6	0.606	V
Switching Frequency Accuracy	F_{OSC}	$R_{FS}=88.7k\Omega$	420	500	580	kHz
Soft-start Charging Current	$I_{SS, CHG}$			5		μA
Power Good Threshold	V_{PG}	V_{FB} falling, PG from high to low		90		% V_{OUT}
		V_{FB} rising, PG from low to high		95		% V_{OUT}
		V_{FB} rising, PG from high to low		112		% V_{OUT}
		V_{FB} falling, PG from low to high		107		% V_{OUT}
Output UVP Threshold	V_{UVP}			65		% V_{OUT}
Output UVP Response Time	t_{UVP}	$F_S=500kHz$, Note 4		500		μs
Output UVP ON Time	$t_{ON, UVP}$	$F_S=500kHz$, Note 4		2.5		ms
Output UVP OFF Time	$t_{OFF, UVP}$	$F_S=500kHz$, Note 4		16		ms
Power Good Delay Time	$t_{PG, F}$	PG falling edge, Note 4		250		μs
	$t_{PG, R}$	PG rising edge, Note 4		2		ms
Power Good Low Voltage	$V_{PG, LOW}$	Sink 5mA to the PG pin, FB=0.6V			0.4	V
Enable Logic High Threshold	$V_{EN, HIGH}$	Rising		1.2	1.26	V
Enable Logic Low Threshold	$V_{EN, LOW}$	Falling	1.08	1.15		V
Enable Pull-up Current	I_{EN}	$V_{EN}=1V$		1.8		μA
		$V_{EN}=1.5V$		5		μA
Minimum ON Time	$T_{ON, MIN}$	Note 4		50		ns
Minimum OFF Time	$T_{OFF, MIN}$	Note 4		200		ns
Maximum Duty Cycle	D_{MAX}	$R_{FS}=88.7k\Omega$		90		%
Thermal Shutdown Temperature	T_{SD}			160		$^{\circ}C$
Thermal Shutdown Hysteresis	T_{HYS}			20		$^{\circ}C$
Top FET R_{ON}	$R_{DS(ON),N11}$			18		m Ω
Bottom FET R_{ON}	$R_{DS(ON),N12}$			6		m Ω
Top FET Current Limit	$I_{LIM, TOP1}$	Note 4		20		A
Bottom FET Valley Current Limit	$I_{LIM, BOT1}$		12			A
Bottom FET Reverse Current Limit	$I_{LIM, BOT2}$	Note 4		-5		A



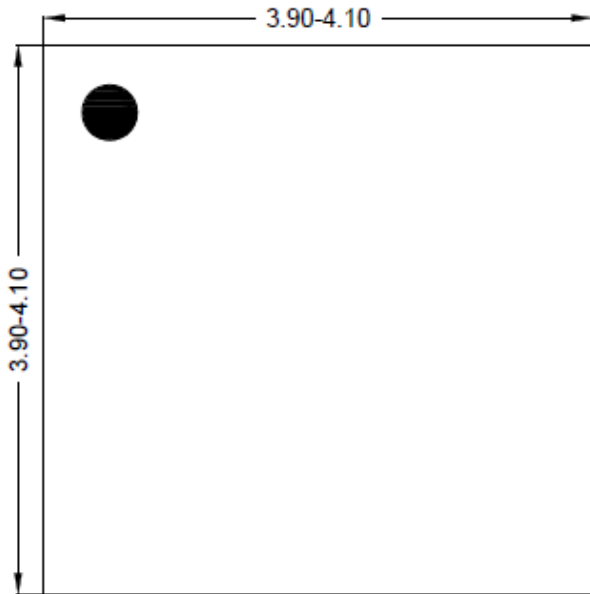
Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute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

Note 2: θ_{JA} is measured in the natural convection at $T_A = 25^\circ\text{C}$ on a low effective 4-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Paddle of QFN4x4 package is the case position for θ_{JC} measurement.

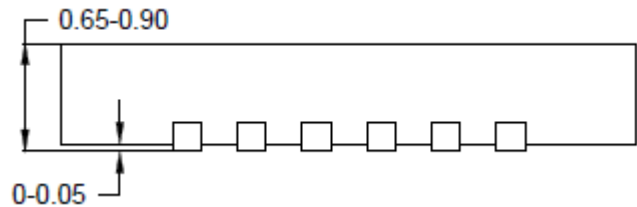
Note 3: The device is not guaranteed to function outside its operating conditions.

Note 4: Design Guarantee.

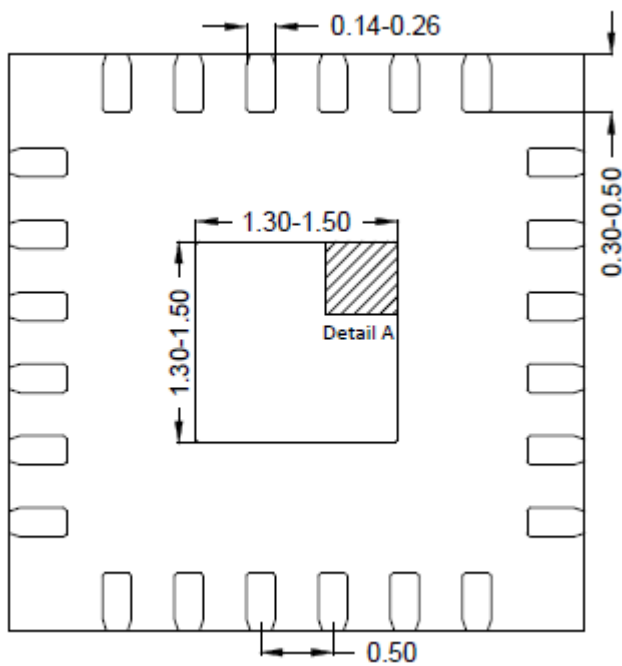
QFN4x4-24 Package Outline Drawing



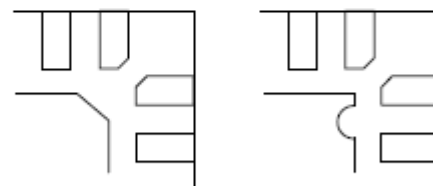
Top view



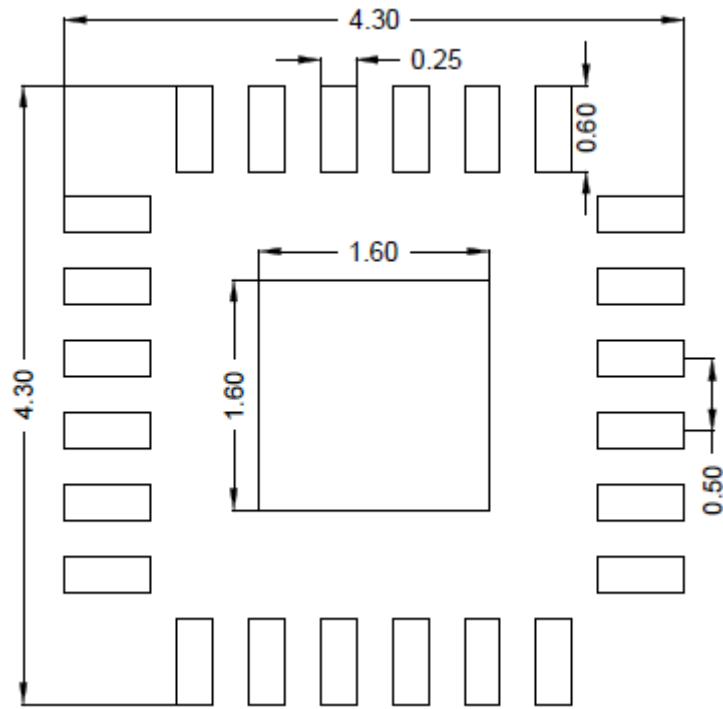
Side view



Bottom view



Detail A
Pin1 Identifier: two options



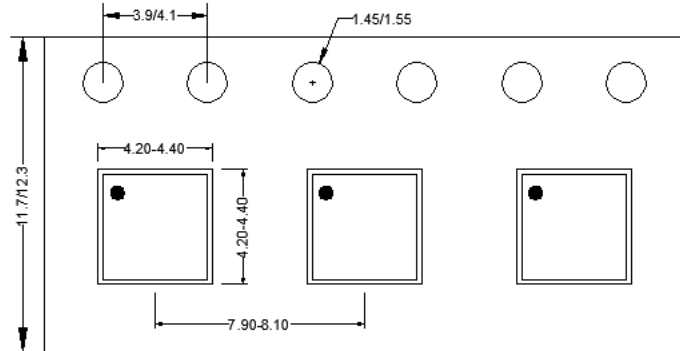
**Recommended PCB layout
(Reference only)**

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

Taping & Reel Specification

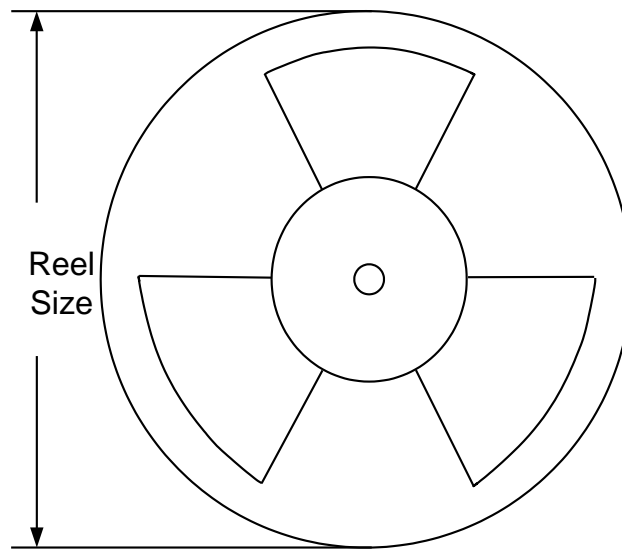
1. Taping orientation

QFN4x4



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)
QFN4x4	12	8	13"	400	400	5000

3. Others: NA