

High Efficiency, 500kHz, 3A, 18V Input Synchronous Step Down Regulator

General Description

The SY8113D is a high efficiency 500kHz synchronous step-down DC/DC converter capable of delivering 3A current. The SY8113D operates over a wide input voltage range from 4.5V to 18V and integrates main switch and synchronous switch with very low $R_{DS(ON)}$ to minimize the conduction loss.

Low output voltage ripple and small external inductor and capacitor sizes are achieved with 500kHz switching frequency. It adopts the instant PWM architecture to achieve fast transient responses for high step down applications

Ordering Information

SY8113

└─ Temperature Code
└─ Package Code
└─ Optional Spec Code

Ordering Number	Package type	Note
SY8113DAIC	TSOT23-8	--

Features

- Low $R_{DS(ON)}$ for Internal Switches (Top/Bottom): 80mΩ/40mΩ
- 4.5-18V Input Voltage Range
- 3A Output Current Capability
- 500 kHz Switching Frequency
- Instant PWM Architecture to Achieve Fast Transient Responses
- Cycle-by-cycle Current Limitation
- Hiccup Mode Short Circuit Protection
- Power Good Indicator
- Programmable Soft-start Time to Limit the Inrush Current
- $\pm 1.5\%$ 0.6V Reference
- Thermal Shut Down With Auto-recovery
- RoHS Compliant and Halogen Free
- TSOT23-8 Package

Applications

- Set Top Box
- Portable TV
- Access Point Router
- DSL Modem
- LCD TV

Typical Applications

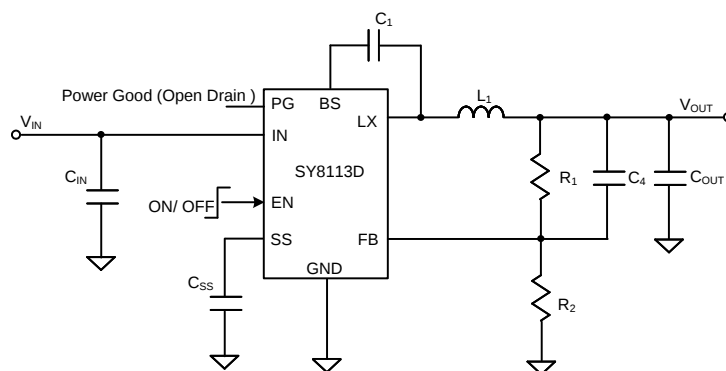


Figure1. Schematic Diagram

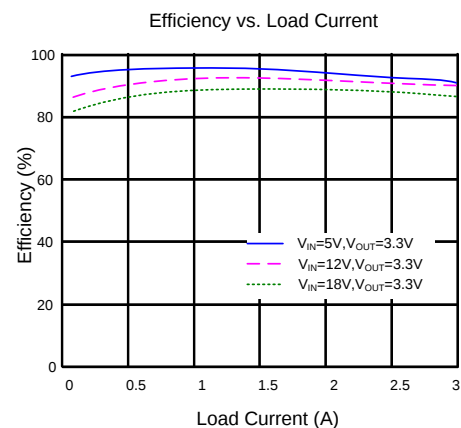
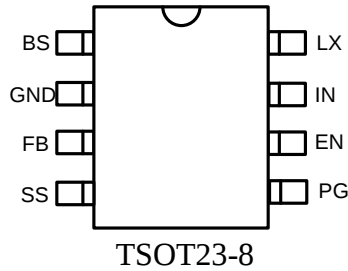


Figure2. Efficiency vs. Load Current

Pinout (top view)



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

Pin Name	Pin Number	Pin Description
BS	1	Boot-strap pin. Supply high side gate driver. Decouple this pin to the LX pin with a 0.1μF ceramic capacitor.
GND	2	Ground pin.
FB	3	Output feedback pin. Connect this pin to the center point of the output resistor divider (as shown in Figure1) to program the output voltage: $V_{OUT}=0.6 \times (1+R_1/R_2)$
SS	4	Soft-start programming pin. Connect a capacitor from this pin to the ground to program the soft-start time. $t_{SS}(ms)=C_{SS}(nF) \times 0.6V/4\mu A$. The typical soft-start time is 800μs.
PG	5	Power good Indicator. Low output if the output is within 90% of the regulation voltage; Open-drain output otherwise.
EN	6	Enable control. Pulled high to turn on. Do not leave it floating.
IN	7	Input pin. Decouple this pin to the GND pin with at least a 1μF ceramic capacitor.
LX	8	Inductor pin. Connect this pin to the switching node of the inductor.

Block Diagram

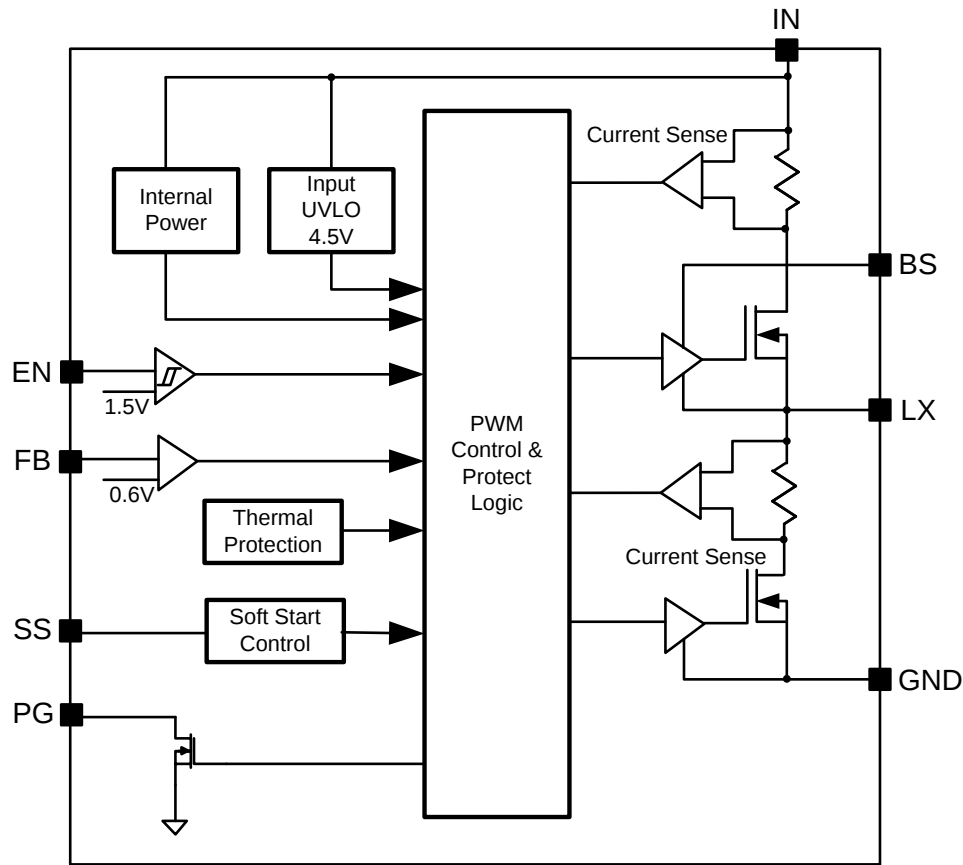


Figure3. Block Diagram

Absolute Maximum Ratings (Note 1)

IN, LX, PG, EN	19V
FB, SS, BS-LX	4V
Power Dissipation, P_D @ $T_A = 25^\circ\text{C}$, TSOT23-8	1.5W
Package Thermal Resistance (Note 2)	
θ_{JA}	66°C/W
θ_{JC}	15°C/W
Junction Temperature Range	150 °C
Lead Temperature (Soldering, 10 sec.)	260 °C
Storage Temperature Range	-65 °C to 150 °C
Dynamic LX voltage in 10ns duration	IN+3V to GND-4V

Recommended Operating Conditions (Note 3)

Supply Input Voltage	4.5V to 18V
Junction Temperature Range	-40 °C to 125 °C
Ambient Temperature Range	-40 °C to 85 °C

Electrical Characteristics

($V_{IN} = 12V$, $T_A = 25\text{ }^{\circ}C$, $I_{OUT} = 1A$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		4.5		18	V
Quiescent Current	I_Q	$I_{OUT}=0$, $V_{FB}=V_{REF} \times 105\%$		100		μA
Shutdown Current	I_{SHDN}	$EN=0$		5	10	μA
Feedback Reference Voltage	V_{REF}		0.591	0.6	0.609	V
FB Input Current	I_{FB}	$V_{FB}=3.3V$	-50		50	nA
Top FET RON	$R_{DS(ON)1}$			80	90	m Ω
Bottom FET RON	$R_{DS(ON)2}$			40	50	m Ω
Bottom FET Valley Current Limit	I_{LIM}		3.4	4.2	5	A
Top FET Peak Current Limit (Note 4)	$I_{LIM, TOP}$		4.5	6	7.5	A
EN Rising Threshold	V_{ENH}		1.5			V
EN Falling Threshold	V_{ENL}				0.4	V
Input UVLO Threshold	V_{UVLO}				4.5	V
UVLO Hysteresis	V_{HYS}			0.3		V
Min ON Time			50	80	120	ns
Min OFF Time			140	170	220	ns
Switching Frequency				500		kHz
Soft-start Charging Current	I_{SS}			4		μA
Soft-start Time	t_{SS}			800		μs
Power Good Threshold	V_{PG}	V_{FB} rising (Good)	88	90	92	$\%V_{REF}$
Power Good Hysteresis	$V_{PG, HYS}$			2		$\%V_{REF}$
Thermal Shutdown Temperature	T_{SD}			150		$^{\circ}C$
Thermal Shutdown Hysteresis	T_{HYS}			15		$^{\circ}C$

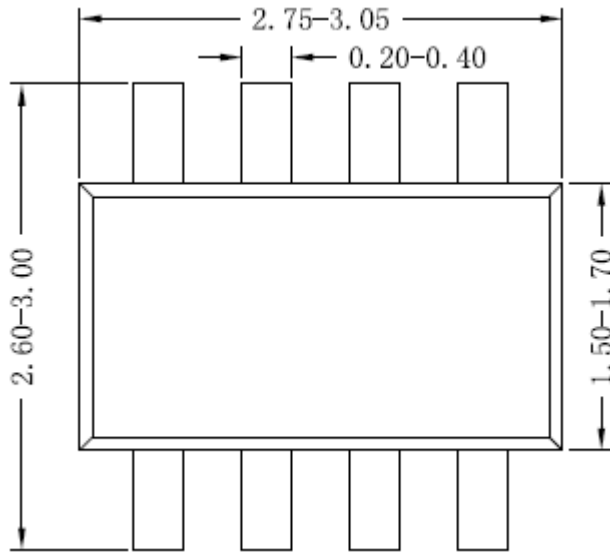
Note 1: Stresses beyond “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute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

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

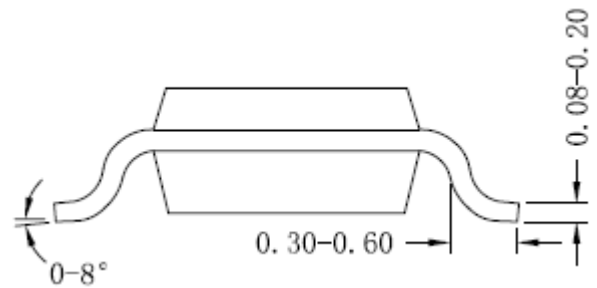
Note 3: The device is not guaranteed to function outside its operating conditions.

Note 4: The values are guaranteed by design.

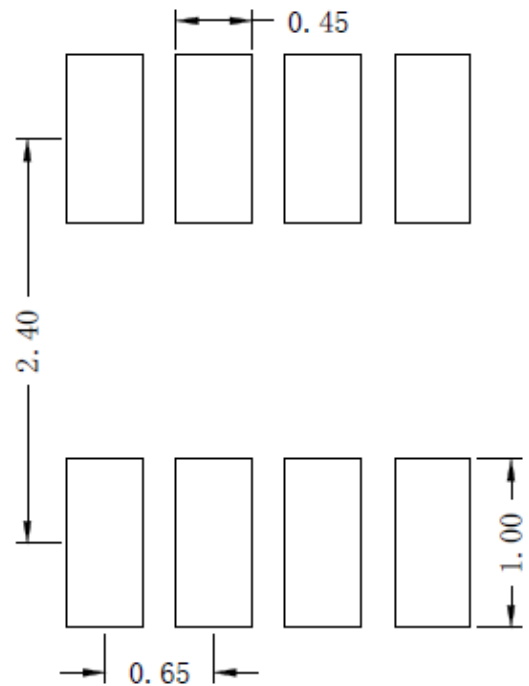
TSOT23-8 Package Outline Drawing



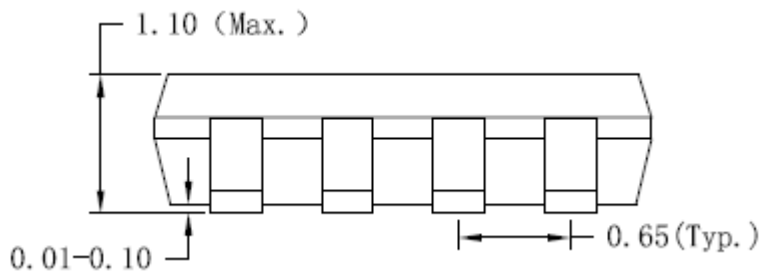
Top view



Side view A



**Recommended PCB layout
(Reference only)**

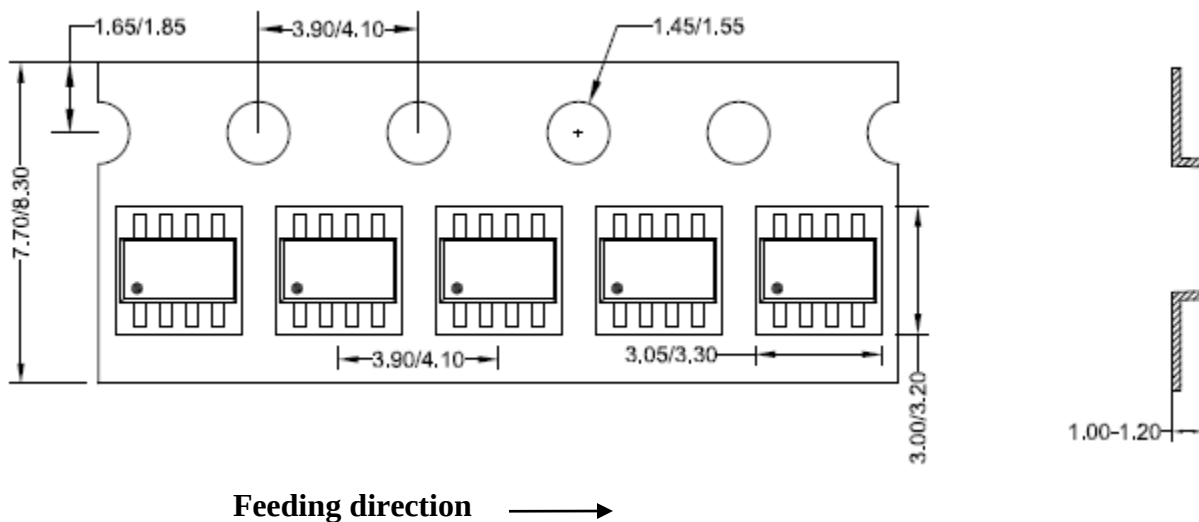


Side view B

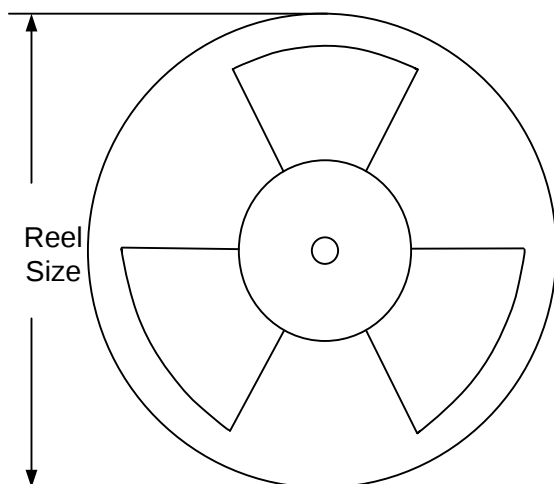
Notes: All dimension in millimeter and exclude mold flash & metal burr

Taping & Reel Specification

1. TSOT23-8 taping orientation



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
TSOT23-8	8	4	7	400	160	3000

3. Others: NA