

General Description

The SY81105x high efficiency synchronous buck converter operates over a wide input voltage range of 4.5V to 18V, and can deliver an output current up to 5A. It integrates a top MOSFET and a bottom MOSFET with very low $R_{DS(ON)}$ to minimize conduction loss. The 400kHz pseudo-constant switching frequency enables using small external inductor and capacitor values.

The SY81105x uses constant on-time and ripple-based control strategy to achieve fast transient response for applications with high step-down ratios, and high efficiency at light loads. It also provides cycle-by-cycle current limit protection, output under voltage protection and over temperature protection.

Only the input and output capacitors, inductor, feedback resistor divider and feedforward capacitor need to be selected for the targeted application specifications.

The SY81105x is available in a compact TSOT23-6 package.

Part Number	Package	Frequency	Light Load Operation Mode
SY81105ADT	TSOT23-6	400kHz	PFM
SY81105EADT			FCCM

Features

- Low $R_{DS(ON)}$ for Internal MOSFETs: 29mΩ Top, 19mΩ Bottom
- Wide Input Voltage Range: 4.5V ~ 18V
- Up to 5A Output Current
- $\pm 1\%$ 0.6V Reference
- Pulse-Frequency Modulation (PFM) Mode Operation for SY81105
- Forced Continuous Conduction Mode (FCCM) Operation for SY81105E
- Internal Soft-Start Limits the Inrush Current
- Support Smooth Startup with Pre-Biased Output
- 400kHz Switching Frequency Minimizes the External Components
- Constant On-time and Ripple-Based Control to Achieve Fast Transient Responses
- Output Auto-Discharge Function
- Cycle-by-Cycle Valley and Peak Current Limit Protection
- Hic-Cup Mode Output Under Voltage Protection
- Auto-Recovery Mode Over Temperature Protection
- Input Under Voltage Lockout (UVLO)
- RoHS-Compliant and Halogen-Free
- Moisture Sensitivity Level (MSL): 1
- Compact Package: TSOT23-6

Applications

- Set-Top Box
- Portable TV
- DSL Modem
- LCD TV
- IP Camera
- Network

Typical Application

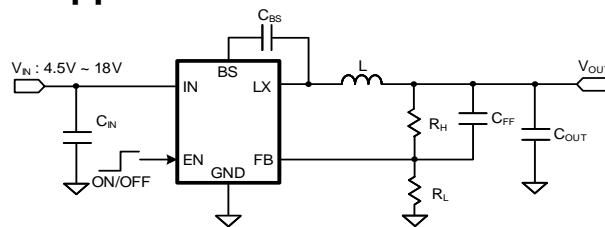


Figure 1. Schematic Diagram
Inductor and C_{OUT} Selectin Table

V _{OUT} [V]	L[μH]	C _{OUT} [μF]			
		10	22	32	44
1.2/1.8	1.5		√	√	√
	2.2		√	☆	√
3.3	3.3		√	☆	√
	4.7		√	√	√
5	3.3			√	√
	4.7			☆	√

Note: '☆' means recommended for most applications.

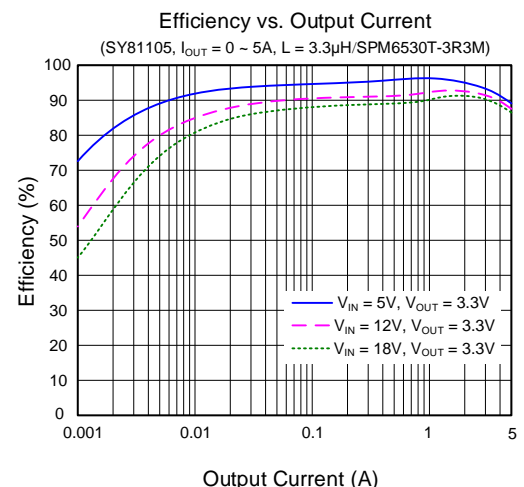


Figure 2. Efficiency vs. Output Current

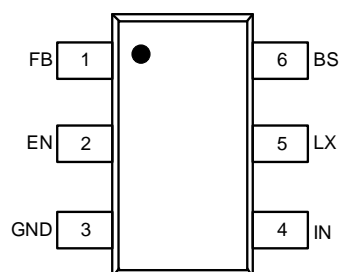


Ordering Information

Ordering Part Number	Package type	Top Mark
SY81105ADT	TSOT23-6	HYT xyz
SY81105EADT	RoHS Compliant and Halogen Free	KKY xyz

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

Pinout (top view)



SY81105xADT
TSOT23-6

Pin Description

Pin Name	Pin Number	Pin Description
FB	1	Output feedback pin. Connect this pin to the center point of the output resistor divider as shown in Figure 1. $V_{OUT} = 0.6V \times (1 + R_H/R_L)$.
EN	2	Enable control pin. Pull this pin higher than EN rising threshold to turn on the device and pull this pin lower than EN falling threshold to turn off the device. Do not leave this pin floating.
GND	3	Ground pin.
IN	4	Input pin. Decouple this pin to GND pin with at least a 10μF ceramic capacitor.
LX	5	Inductor pin. Connect this pin to the switching node of inductor.
BS	6	Bootstrap pin. Supply top FET gate driver. Connect a 0.1μF ceramic capacitor between BS and LX pin.



Block Diagram

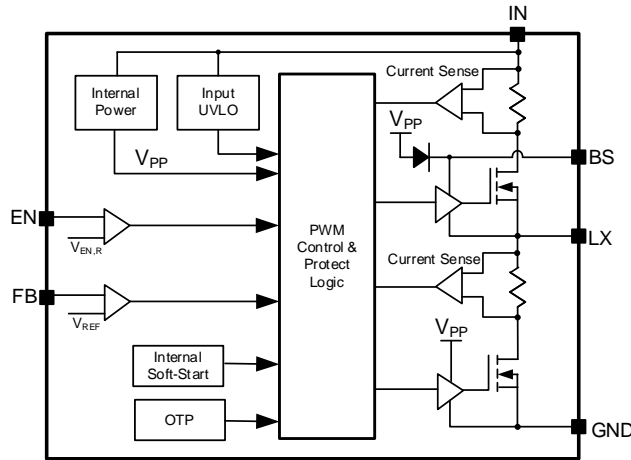


Figure3. Block Diagram

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN	-0.3	19	V
EN, LX	-0.3	IN + 0.3	
BS-LX, FB	-0.3	4	
LX, 10ns duration	- 5	IN + 3	
LX, 20ns duration	- 1	IN + 2	
Junction Temperature, Operating	-40	150	°C
Lead Temperature (Soldering, 10s)		260	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note 2)	Typ	Unit
θ_{JA} Junction-to-Ambient Thermal Resistance	40	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	5.5	
P_D Power Dissipation $T_A = 25^\circ\text{C}$	2.5	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
Input Voltage	4.5	18	V
Output Voltage	0.6	9.5	
Continuous Output Current		5	A
Ambient Temperature	-40	85	°C
Junction Temperature	-40	125	

Electrical Characteristics

($V_{IN} = 12V$, $V_{OUT} = 3.3V$, $L = 3.3\mu H$, $C_{OUT} = 32\mu F$, $T_J = 25^\circ C$, $I_{OUT} = 1A$ unless otherwise specified(Note 4))

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Input	Voltage Range	V_{IN}	4.5		18	V	
	UVLO Rising Threshold	$V_{IN,UVLO}$	V_{IN} rising		4.45		
	UVLO Hysteresis	$V_{IN,HYS}$		0.3			
	Quiescent Current	I_Q	$I_{OUT} = 0A$, $V_{FB} = V_{REF} \times 105\%$, only for SY81105		200	μA	
	Shutdown Current	I_{SHDN}	$V_{EN} = 0V$		5		10
Output	Voltage Range	V_{SET}	0.6		9.5	V	
	FB Reference Voltage	V_{REF}	594	600	606	mV	
	FB Input Current	I_{FB}	$V_{FB} = 1V$	-50		50	nA
	Discharge FET Resistance	R_{DIS}		42		Ω	
	Turn On Delay	$t_{ON,DLY}$	From EN high to LX starts switching (Note 5)		270		μs
	Soft-Start Time	t_{SS}	V_{OUT} from 0% to 100% V_{SET}		1.7		ms
	UVP Threshold	V_{UVP}			33		% V_{REF}
	UVP Delay	$t_{UVP,DLY}$			100		μs
	UVP Hiccup On-Time	$t_{HICCUP,ON}$			2.4		ms
	UVP Hiccup Off-Time	$t_{HICCUP,OFF}$			8.4		
Enable (EN)	Rising Threshold	$V_{EN,R}$	1.08	1.2	1.32	V	
	Falling Threshold	$V_{EN,F}$	0.9	1.0	1.1		
	De-Glitch Time	$t_{EN,DG}$	(Note 5)		4	μs	
	Input Current	I_{EN}	$V_{EN} = 0V \sim V_{IN}$		0	μA	
MOSFET	Top MOSFET $R_{DS(ON)}$	$R_{DS(ON),TOP}$		29		m Ω	
	Bottom MOSFET $R_{DS(ON)}$	$R_{DS(ON),BOT}$		19			
	Top MOSFET Current Limit Threshold	$I_{LMT,TOP}$		7		A	
	Bottom MOSFET Current Limit Threshold	$I_{LMT,BOT}$		5.5			
	Bottom FET Reverse Current Limit Threshold	$I_{LMT,RVS}$	Only for SY81105E	2.5			
Frequency	Switching Frequency	f_{SW}	$I_{OUT} = 1A$, CCM	400		kHz	
	Minimum On-Time	$t_{ON,MIN}$		50			
	Minimum Off-Time	$t_{OFF,MIN}$		150		ns	
OTP	Temperature	T_{OTP}	(Note 5)	150		$^\circ C$	
	Temperature Hysteresis	T_{HYS}	(Note 5)	15			

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 $T_A = 25^\circ C$ on a 6cmx6cm size, four-layer Silergy Evaluation Board with 2-oz copper. Case temperature θ_{JC} is measured at LX pin.

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



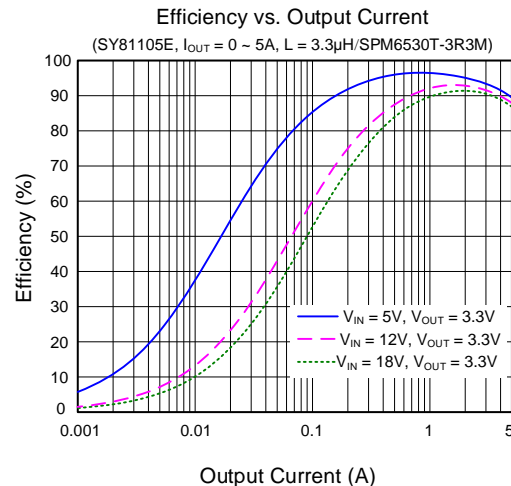
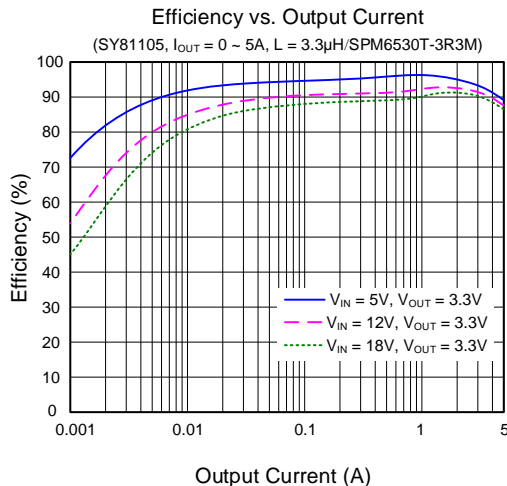
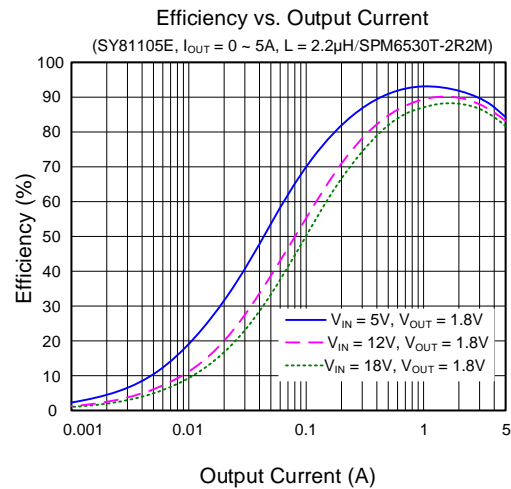
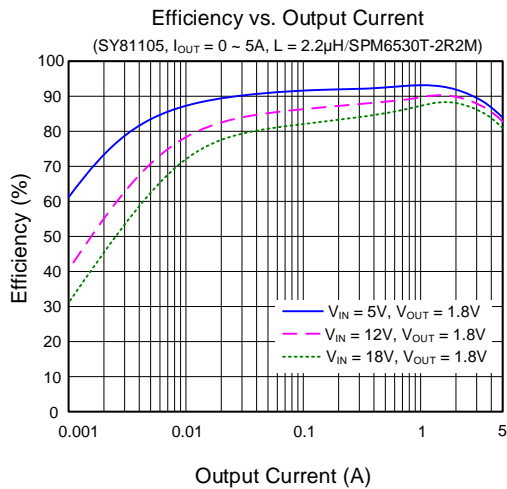
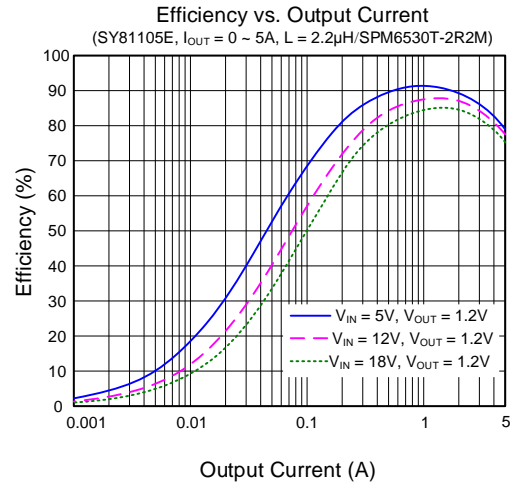
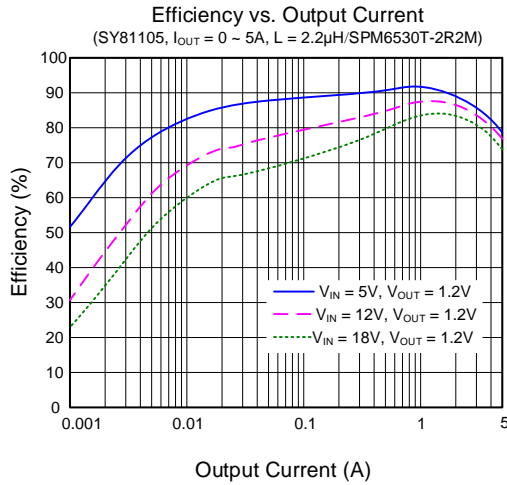
SY81105/SY81105E

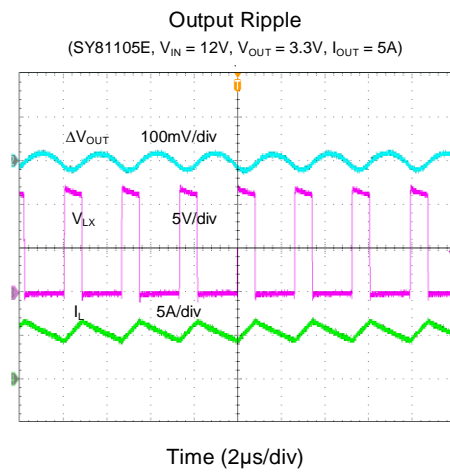
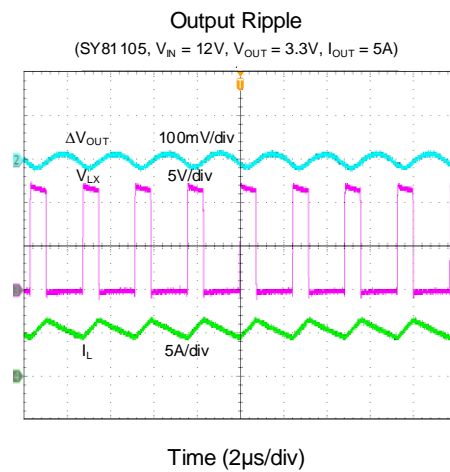
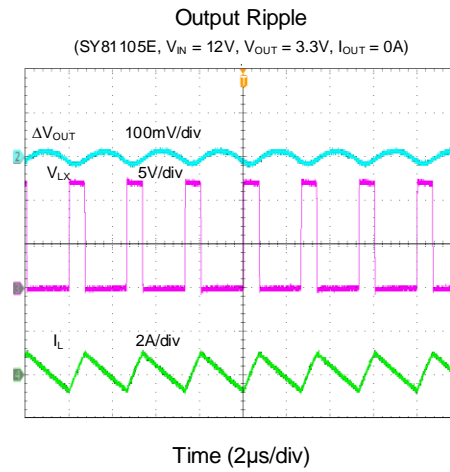
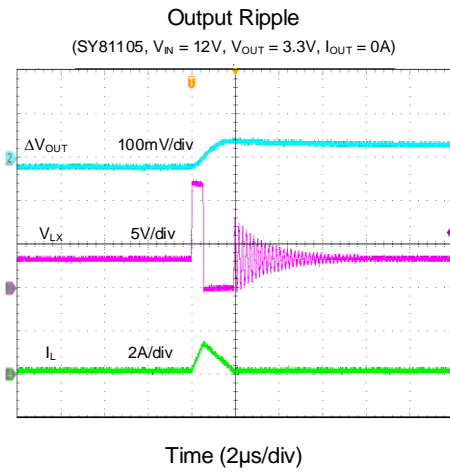
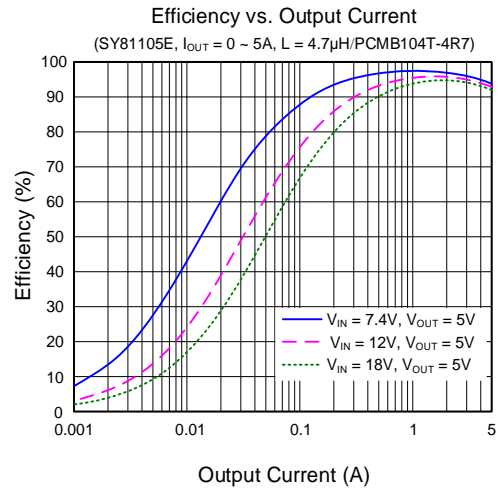
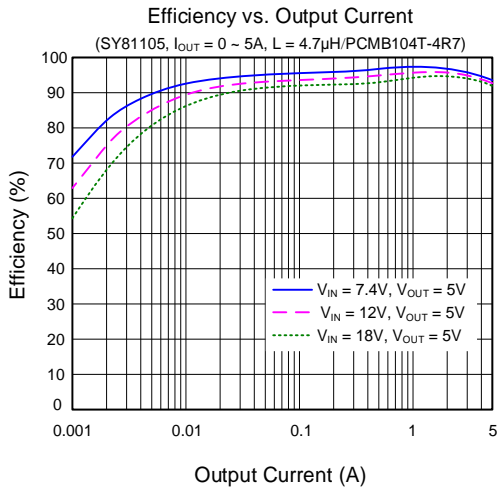
Note 4: Unless otherwise stated, limits are 100% production tested under pulsed load conditions such that $T_A \cong T_J = 25^\circ\text{C}$. Limits over the operating temperature range (See recommended operating conditions) and relevant voltage range(s) are guaranteed by design, test, or statistical correlation.

Note 5: Guaranteed by design or statistical correlation and not production tested.

Typical Performance Characteristics

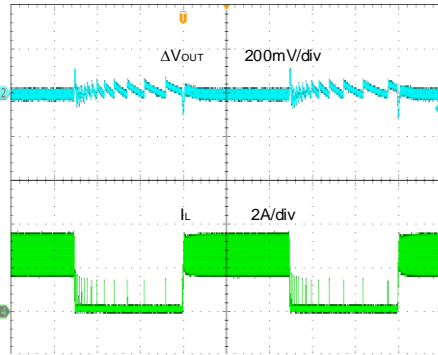
($T_A = 25^\circ\text{C}$, $V_{IN} = 12\text{V}$, $V_{OUT} = 3.3\text{V}$, $L = 3.3\mu\text{H}$, $C_{OUT} = 32\mu\text{F}$, unless otherwise noted)





Load Transient

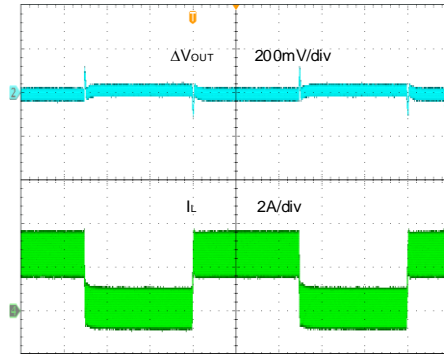
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 0A \sim 2.5A$)



Time (400μs/div)

Load Transient

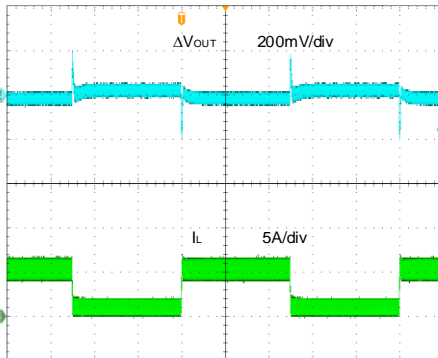
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Time (400μs/div)

Load Transient

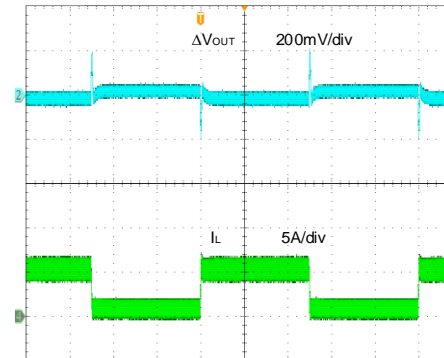
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 0.5A \sim 5A$)



Time (400μs/div)

Load Transient

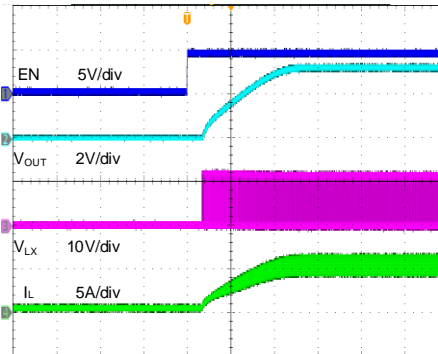
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 0.5A \sim 5A$)



Time (400μs/div)

Startup from Enable

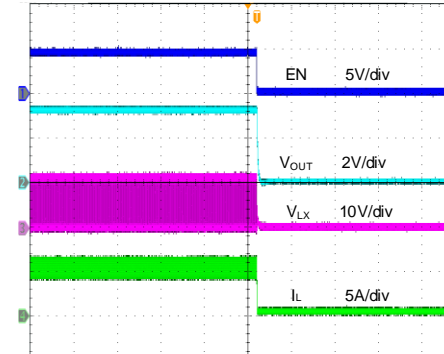
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (800μs/div)

Shutdown from Enable

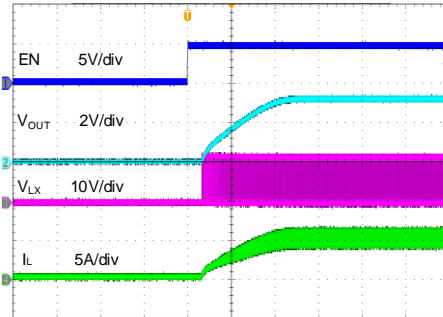
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (800μs/div)

Startup from Enable

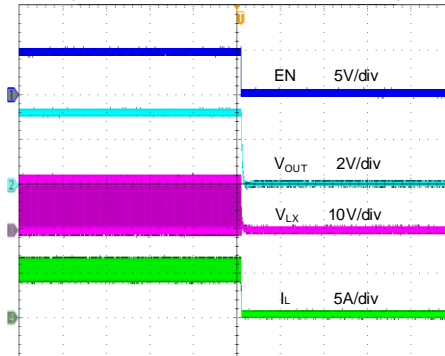
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (800 μ s/div)

Shutdown from Enable

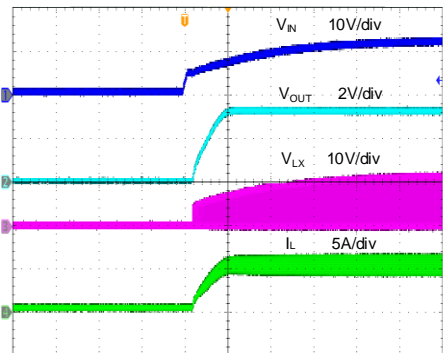
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (800 μ s/div)

Startup from V_{IN}

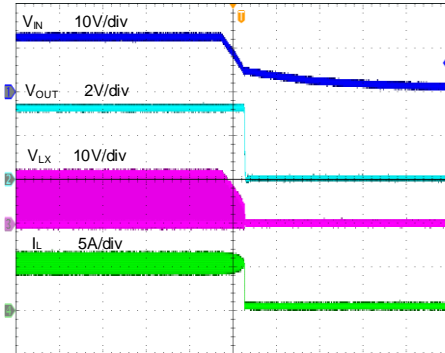
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (2ms/div)

Shutdown from V_{IN}

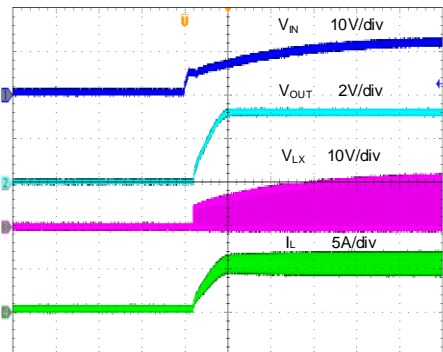
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (2ms/div)

Startup from V_{IN}

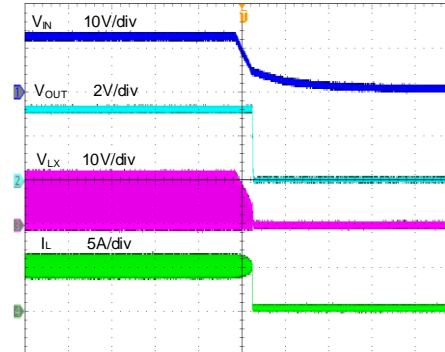
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (2ms/div)

Shutdown from V_{IN}

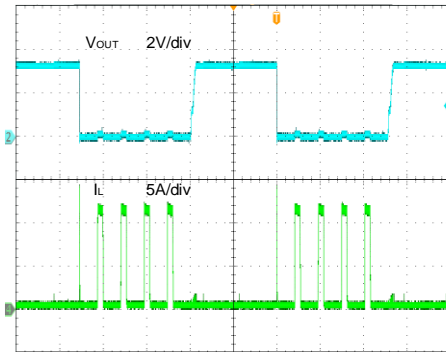
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A$)



Time (2ms/div)

Short Circuit Protection

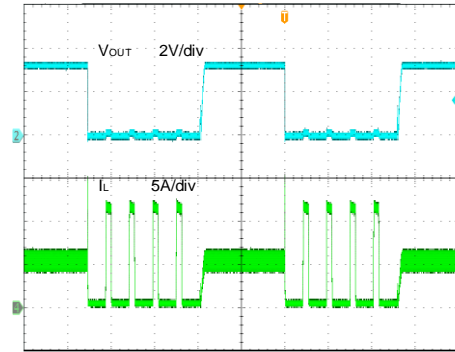
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Time (20ms/div)

Short Circuit Protection

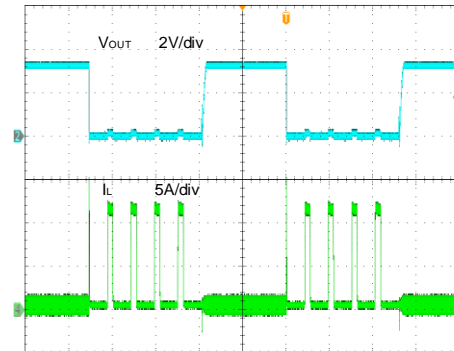
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A \sim \text{short}$)



Time (20ms/div)

Short Circuit Protection

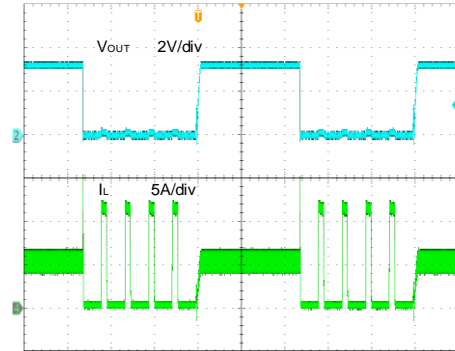
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 0A \sim \text{short}$)



Time (20ms/div)

Short Circuit Protection

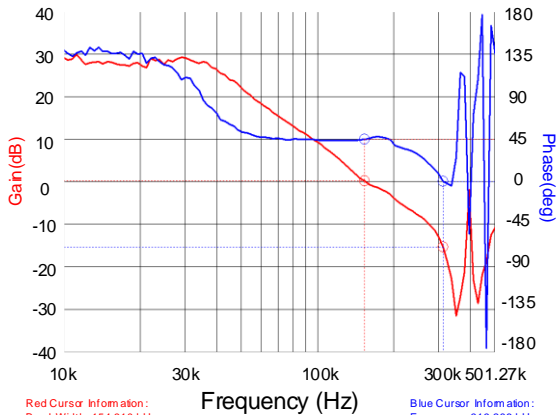
(SY81105E, $V_{IN} = 12V$, $V_{OUT} = 3.3V$, $I_{OUT} = 5A \sim \text{short}$)



Time (20ms/div)

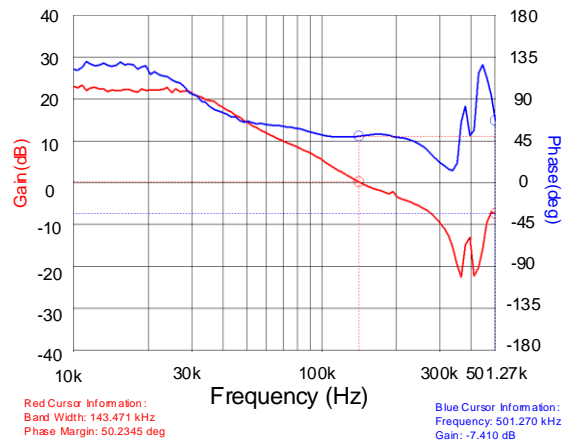
Bode Plot

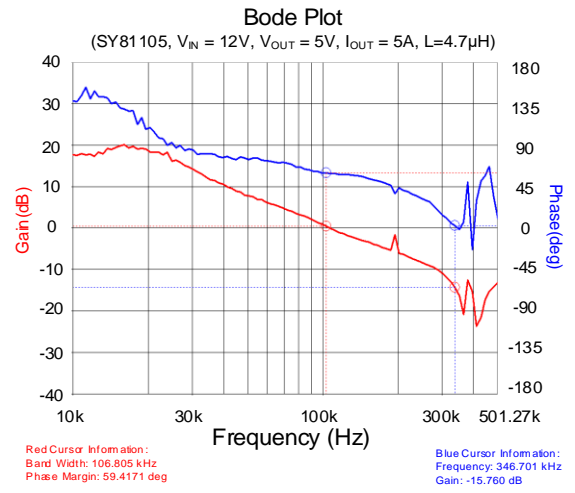
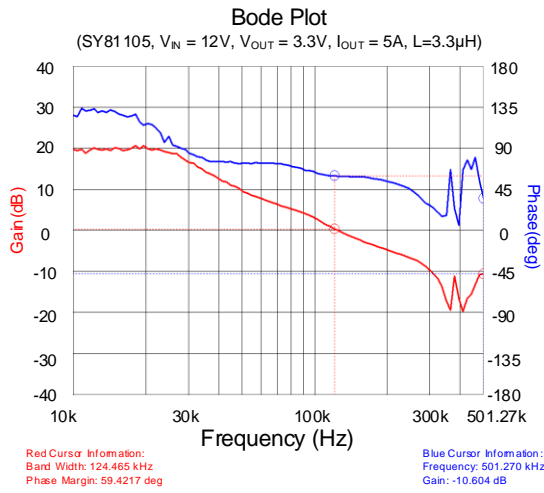
(SY81105, $V_{IN} = 12V$, $V_{OUT} = 1.2V$, $I_{OUT} = 5A$, $L=2.2\mu H$)



Bode Plot

(SY81105, $V_{IN} = 12V$, $V_{OUT} = 1.8V$, $I_{OUT} = 5A$, $L=2.2\mu H$)





Detailed Description

General Description

The SY81105x high efficiency synchronous buck converter operates over a wide input voltage range of 4.5V to 18V, and can deliver an output current up to 5A. It integrates a top MOSFET and a bottom MOSFET with very low $R_{DS(ON)}$ to minimize conduction loss. The 400kHz pseudo-constant switching frequency allows small external inductor and capacitor values.

The SY81105x also provides cycle-by-cycle current limit protection output under voltage protection and over temperature protection.

Constant On-Time and Ripple-Based Control Strategy

The device uses instant PWM architecture to achieve fast transient response for applications with high step-down ratios, and high efficiency at light loads. It uses a constant on-time and ripple-based control strategy in which a virtual replica of the inductor current signal is synthesized internally and combined with the feedback voltage. When the sum voltage is lower than the reference voltage, the bottom MOSFET turns off and the top MOSFET turns on for a fixed period of time (Constant t_{ON}). t_{ON} is internally calculated according to the input voltage, output voltage, and desired switching frequency (f_{SW}):

$$t_{ON} = \frac{V_{OUT}/V_{IN}}{f_{SW}}$$

The top MOSFET turns off after a period of t_{ON} .

Minimum Duty Cycle and Maximum Duty Cycle

In the COT architecture, there is no limitation for low duty cycle operation, because the switching frequency can be reduced as needed to always ensure proper operation when the on-time is close to the minimum on time.

The SY81105 and SY81105E can support a maximum duty cycle of up to 80% across the entire operating temperature range of $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$.

PFM Light Load Operation

The SY81105 use pulse-frequency modulation (PFM) operation mode under light load condition for high efficiency. Under light load conditions, typically when the load satisfies the following equation,

$$I_{OUT_CTL} = \frac{\Delta I_L}{2} = \frac{V_{OUT} \times (1 - D)}{2 \times f_{SW} \times L} \quad (1)$$

the current through the bottom MOSFET will ramp to near zero before the next t_{ON} time. When this occurs, the bottom MOSFET turns off, preventing recirculation current that can seriously reduce efficiency under these light load conditions. As load current is further reduced, the combined feedback and ramp signals remain much higher than the reference voltage, the instant-PWM control loop will not

trigger another t_{ON} until needed, and the apparent operating switching frequency will correspondingly drop, improving efficiency. Continuous conduction mode (CCM) resumes smoothly as soon as the load current increases sufficiently for the inductor current to remain above zero at the time of the next t_{ON} cycle. The buck converter enters CCM once the load current exceeds the threshold shown in (1). Above the threshold, the switching frequency stays fairly constant over the output current range.

While in PFM mode, the output of the device doesn't require over voltage protection because the device stops switching as soon as the voltage at the FB node increases above V_{REF} , preventing the output voltage from increasing further.

FCCM Light Load Operation

SY81105E and use forced continuous conduction mode (FCCM) under light load condition. Under light load conditions, the bottom MOSFET still turns on even when the inductor current crosses zero. Current flow will continue until the next t_{ON} cycle. The device always operates under continuous conditions mode and keeps fairly constant switching frequency over all the output current range.

Input Under Voltage Lockout (UVLO)

To prevent operation before all internal circuitry is ready and to ensure that the top MOSFET and bottom MOSFET can be correctly biased, the device incorporates input under voltage lockout protection. The device remains in a low current state and all LX node switching actions are inhibited until V_{IN} exceeds its rising threshold. At that time, if EN is enabled, the device will startup. If V_{IN} falls below $V_{IN,UVLO}$ less than the input UVLO hysteresis, the LX node switching actions will again be suppressed.

Precise EN Threshold

The EN pin uses precise rising and falling thresholds to provide programmable ON/OFF control. The device will be turned on when the EN pin voltage exceeds the rising threshold. The device will be turned off while the EN pin voltage falls below the falling threshold. Increasing the UVLO startup voltage threshold is possible using an external resistor divider as shown below:

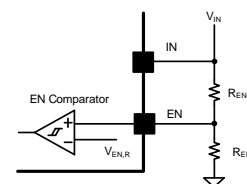


Figure4. EN Control

It is not recommended to connect EN pin to the V_{IN} or another voltage source directly. A resistor with a value between $1\text{k}\Omega$ and $1\text{M}\Omega$ is recommended if the EN pin is pulled high.

Soft-Start and Startup with Pre-Biased Output

The device incorporates an internal soft-start circuit to ramp the output to the desired voltage whenever the device is enabled. Internally, the soft-start circuit clamps the output at a low voltage and then allows the output to rise to the desired voltage over approximately 1.7ms, which avoids high current flow and transients during startup.

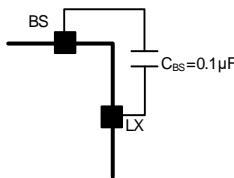
The device supports startup with pre-biased output. If the output is pre-biased to a certain voltage before startup, the buck converter disables the switching of both the top MOSFET and the bottom MOSFET until the internal soft-start voltage V_{SS} exceeds the sensed output voltage at the FB node. The first pulse on-time is internally calculated based the input voltage and pre-biased output voltage.

Output Auto-Discharge Function

The device discharges the output voltage when the buck converter shuts down due to low V_{IN} or EN, or caused by over temperature protection, so that the output voltage can be discharged in a minimal time, even if the buck output load current is zero. The discharge MOSFET in parallel with the bottom MOSFET turns on after the bottom MOSFET turns off when the shutdown logic is enabled. The output discharge MOSFET resistance is 42Ω. The discharge MOSFET is not active outside of these shutdown conditions.

External Bootstrap Capacitor

The external bootstrap capacitor provides the gate driver voltage for the N-channel top MOSFET. A 0.1μF low ESR ceramic capacitor connected between the BS pin and the LX pin is recommended.



Fault Protection Modes

Cycle-by-Cycle Current Limit Protection

If the top MOSFET current exceeds the top current limit threshold, it will turn off and the bottom MOSFET will turn on. If the bottom MOSFET current exceeds the bottom current limit threshold, it will stay on until the current decreases below its current limit threshold. As a result, both inductor peak and valley currents are limited.

Output Under Voltage Protection (UVP)

With output current increasing, as soon as the bottom MOSFET current exceeds its current limit threshold, the top MOSFET will not be allowed to turn on any more. If the load current continues to increase, the output voltage will drop. When the output voltage falls below 33% of the regulated level, the output under voltage protection will be activated

and the device will operate in hiccup mode. The hiccup on-time is 2.4ms, and the hiccup off-time is 8.4ms. If the hard short condition is removed, the device will return to normal operation.

Over Temperature Protection (OTP)

The device includes over temperature protection (OTP) circuitry to prevent overheating due to excessive power dissipation. This will shut down the device when the junction temperature exceeds 150°C. When the junction temperature is reduced by approximately 15°C, the device will resume normal operation after a complete soft-start cycle. For continuous operation, provide adequate thermal dissipation so that the junction temperature does not exceed the OTP threshold.

Application Information

The following paragraphs provide information on the selection of the external components needed to meet the targeted application specifications.

Feedback Resistor Divider R_H and R_L

Choose R_H and R_L to program the proper output voltage. A value between 1kΩ and 1MΩ is recommended for both resistors to minimize power consumption under light loads. As an example, if $V_{OUT} = 5V$ and R_H selected value is 100kΩ, R_L can be calculated as follows:

$$R_L = \frac{0.6}{V_{OUT} - 0.6V} \times R_H$$

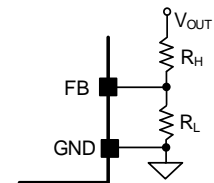


Figure6. Feedback Resistor Divider

With a calculated value of 13.7kΩ for R_L , a standard 1% 13.7kΩ resistor is selected.

Input Capacitor C_{IN}

For the best performance, select a typical X5R or better grade ceramic capacitor with a 50V rating, and at least 10μF capacitance. The capacitor should be placed as close as possible to the device, while also minimizing the loop area formed by C_{IN} and the IN/GND pins.

When selecting an input capacitor, ensure that its voltage rating is at least 20% greater than the maximum voltage of the input supply. X5R or X7R dielectric types are the most often selected due to their small size, low cost, surge current capability, and high RMS current rating over a wide temperature and voltage range.

In situations where the input rail is supplied through long wires, it is recommended to add some bulk capacitance like electrolytic, tantalum or polymer type capacitors to reduce

the overshoot and ringing caused by the added parasitic inductance.

Consider the RMS current rating of the input capacitor, paralleling additional capacitors if required to meet thecalculated RMS ripple current.

$$I_{CIN_RMS} = I_{OUT} \times \sqrt{D \times (1 - D)}$$

The worst-case condition occurs at D = 0.5, then

$$I_{CIN_RMS,MAX} = \frac{I_{OUT}}{2}$$

For simplicity, use an input capacitor with an RMS current rating greater than 50% of the maximum load current. The input capacitor value determines the input voltage ripple of the converter. If there is a voltage ripple requirement in the system, choose an appropriate input capacitor that meets the specification.

Given the very low ESR and ESL of ceramic capacitors, the input voltage ripple can be estimated using the formula:

$$V_{CIN_RIPPLE,CAP} = \frac{I_{OUT}}{f_{SW} \times C_{IN}} \times D \times (1 - D)$$

The worst-case condition occurs at D = 0.5, then

$$V_{CIN_RIPPLE,CAP,MAX} = \frac{I_{OUT}}{4 \times f_{SW} \times C_{IN}}$$

The capacitance value is less important than the RMS current rating. A single 10μF X5R capacitor is sufficient for most applications.

Output Inductor L

Consider the following when choosing this inductor:

- 1) Choose the inductance to provide a ripple current that is approximately 40% of the maximum output current. The recommended inductance is calculated as:

$$L = \frac{V_{OUT}(1 - V_{OUT} / V_{IN,MAX})}{f_{sw} \times I_{OUT,MAX} \times 0.4}$$

where f_{sw} is the switching frequency and $I_{OUT,MAX}$ is the maximum load current.

The device has high tolerance for ripple current amplitude variation. As a result, the final choice of inductance can vary slightly from the calculated value with no significant performance impact.

- 2) For buck converter using FCCM light load operation mode, make sure the inductance value is high enough to avoid reverse current limit threshold is been triggered just under steady state if the load current is zero.
- 3) The inductor's saturation current rating must be greater than the peak inductor current under full load:

$$I_{SAT,MIN} > I_{OUT,MAX} + \frac{V_{OUT}(1 - V_{OUT}/V_{IN,MAX})}{2 \times f_{SW} \times L}$$

- 4) The DCR of the inductor and the core loss at the switching frequency must be low enough to achieve the desired efficiency requirement. Use an inductor with DCR less than 20mΩ to achieve good overall efficiency.

Output Capacitor C_{OUT}

Select the output capacitor C_{OUT} to handle the output ripple requirements. Both steady state ripple and transient requirements must be taken into consideration when selecting C_{OUT}. For the best performance, use a X5R or better grade ceramic capacitor with a 16V rating, and capacitance of at least 22μF.

For applications where the design must meet stringent ripple requirements, the following considerations must be followed.

The output voltage ripple at the switching frequency is caused by the inductor current ripple (ΔI_L) on the output capacitor's ESR (ESR ripple), as well as the stored charge (capacitive ripple). When calculating total ripple, consider both.

$$V_{RIPPLE,ESR} = \Delta I_L \times ESR$$

$$V_{RIPPLE,CAP} = \frac{\Delta I_L}{8 \times C_{OUT} \times f_{SW}}$$

The measured capacitive ripple might be higher than the theoretical value because the effective capacitance for ceramic capacitors decreases with the voltage across its terminals. The voltage derating is usually included as a chart in the capacitor datasheet, and the ripple can be recalculated after taking the target output voltage into account.

Feedforward Capacitor C_{FF}

The device integrates the compensation components to achieve good stability and fast transient responses. In some applications, adding a ceramic capacitor (feedforward capacitor C_{FF}) in parallel with R_H may further speed up the load transient response. Note that when the output LC parameter is large, the feedforward capacitor can be increased for providing sufficient ripple to FB for small output ripple and good transient behavior.

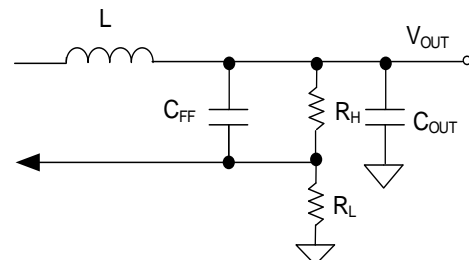
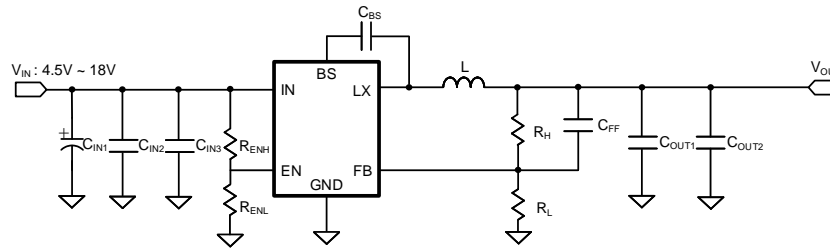


Figure7. Feedforward Network

Application Schematic (SY81105/SY81105E, $V_{OUT} = 3.3V$)



SY81105ADT/SY81105EADT

Figure8. Schematic Diagram

BOM List

Reference Designator	Description	Part Number	Manufacturer
CIN1	47 μ F/50V Electrolytic Capacitor		
CIN2	10 μ F/50V/X5R, 1206	GRM31CR61H106KA12L	m μ Rata
CIN3, CBS	0.1 μ F/50V/X5R, 0603	GRM188R61H104KA93D	m μ Rata
COUT1	22 μ F/16V/X5R, 1206	GRM31CR61C226ME15L	m μ Rata
COUT2	10 μ F/16V/X5R, 1206	GRM319R61C106KE15D	m μ Rata
CFF	47pF/50V/C0G, 0603	GRM1885C1H470JA01D	m μ Rata
L	3.3 μ H/inductor, 7.3A	SPM6530T-3R3M	TDK
RH, R _{PG}	100k Ω , 1%, 0603		
RL	22.1k Ω , 1%, 0603		
RENH	10k Ω , 1%, 0603		
RENL	1M Ω , 1%, 0603		

Recommend Component Values for Typical Applications

$V_{OUT}(V)$	$R_H(k\Omega)$	$R_L(k\Omega)$	$C_{FF}(pF)$	L/Part Number	C_{OUT}
1.2	100	100	10	2.2 μ H/SPM6530T-2R2M	1 \times 22 μ F/16V/X5R, 1206 1 \times 10 μ F/16V/X5R, 1206
1.8	100	49.9	22	2.2 μ H/SPM6530T-2R2M	1 \times 22 μ F/16V/X5R, 1206 1 \times 10 μ F/16V/X5R, 1206
3.3	100	22.1	47	3.3 μ H/SPM6530T-3R3M	1 \times 22 μ F/16V/X5R, 1206 1 \times 10 μ F/16V/X5R, 1206
5	100	13.7	100	4.7 μ H/PCMB104T-4R7	1 \times 22 μ F/16V/X5R, 1206 1 \times 10 μ F/16V/X5R, 1206

Layout Design

Follow these PCB layout guidelines for optimal performance and thermal dissipation:

Input Capacitors: Place the input capacitors very close to IN and GND pins, minimizing the loop formed by these connections. The input capacitor should be connected to the IN and GND pins using a wide copper area.

Output Capacitors: Connect the C_{OUT} negative terminal to the GND pin using wide copper traces instead of vias, in order to achieve better accuracy and stability of the output voltage.

Feedback Network: Place the feedback components (R_H, R_L and C_{FF}) as close to the FB pin as possible. Avoid routing the feedback line near LX, or other high-frequency signals as it is noise-sensitive. Use a Kelvin connection to connect with C_{OUT} rather than the inductor output terminal.

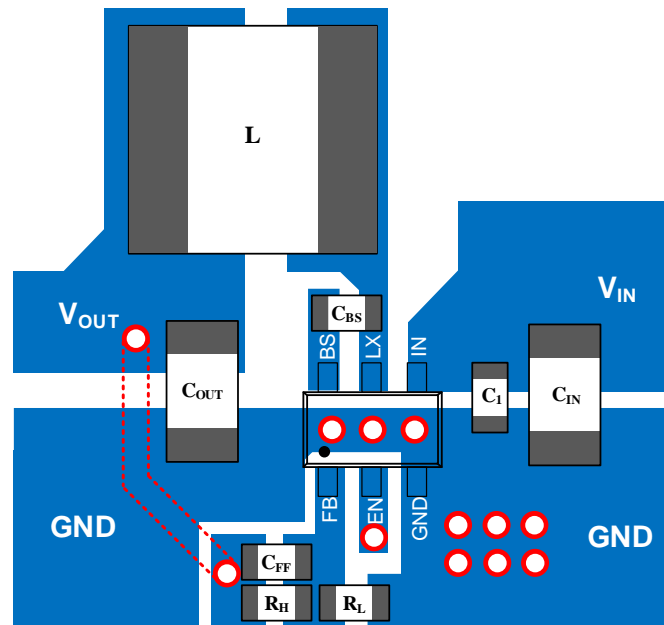
LX Connection: Keep the LX area small to prevent excessive EMI, while providing a wide copper trace to minimize parasitic resistance and inductance.

BS Capacitor: Place the BS capacitor on the **same** layer as the device, keep the BS voltage path (BS, LX and C_{BS}) as short as possible.

EN Signal: It is not recommended to connect EN pin directly to V_{IN} or another voltage source. A resistor in a range of 1kΩ to 1MΩ should be used if EN pin is pulled high.

GND Vias: Place an adequate number of vias on the GND layer around the device for better thermal performance. The exposed GND pad should be connected to a copper area larger than its size. Place multiple GND vias on it for heat dissipation.

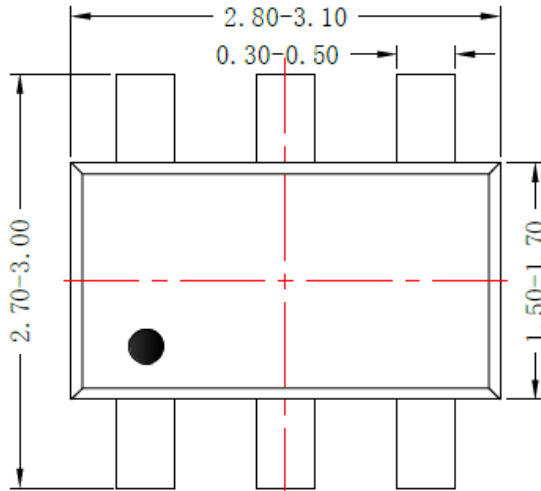
PCB Board: To achieve the best thermal and noise performance, maximize the PCB copper area connecting to the GND pin. A ground plane is highly recommended if possible. Connect the ground pad to a large copper area to enhance thermal performance.



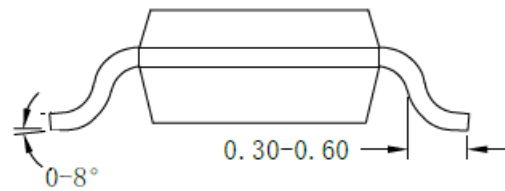
SY81105xADT

Figure9. Suggested PCB Layout

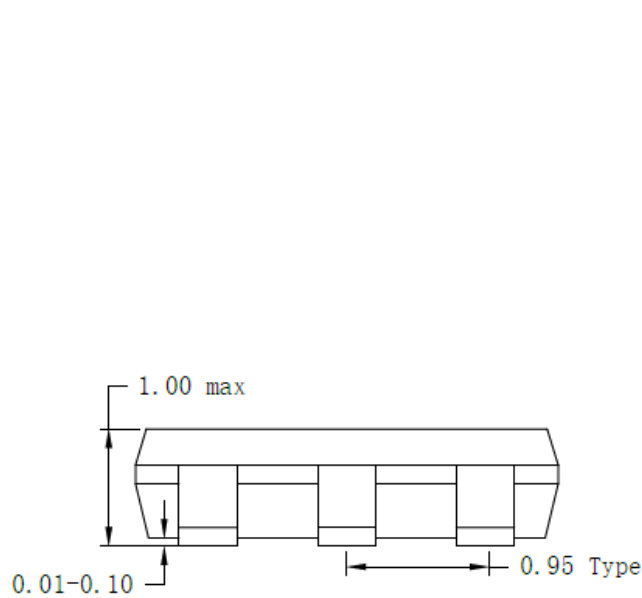
TSOT23-6 Package Outline & PCB Layout



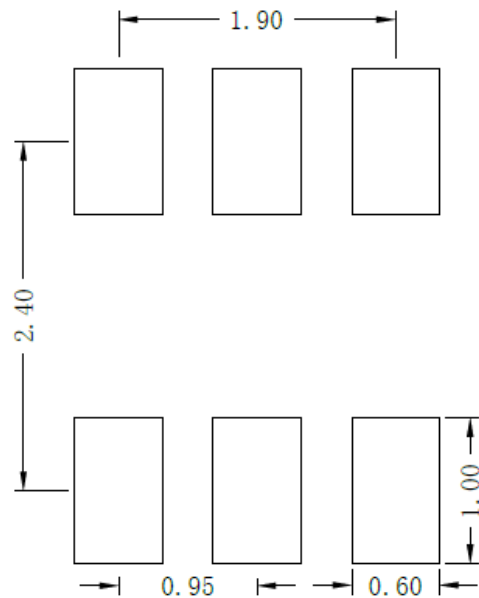
Top view



Side view



Front view

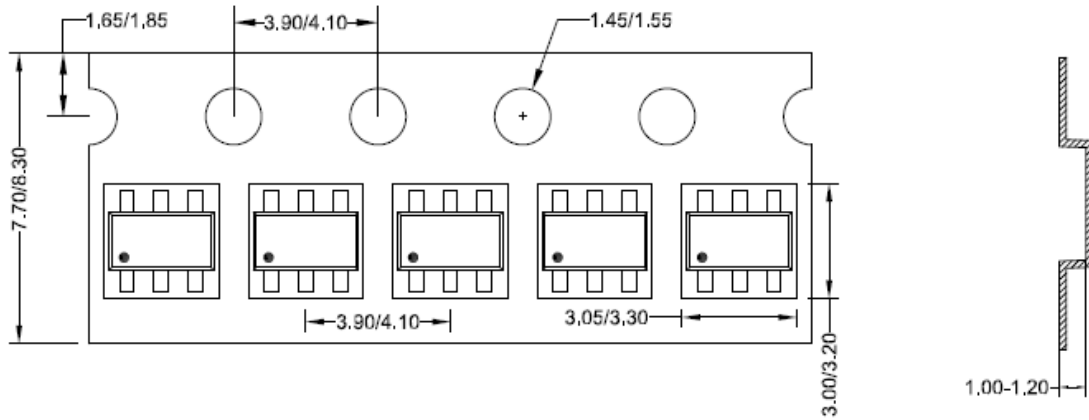


Recommended Pad Layout

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

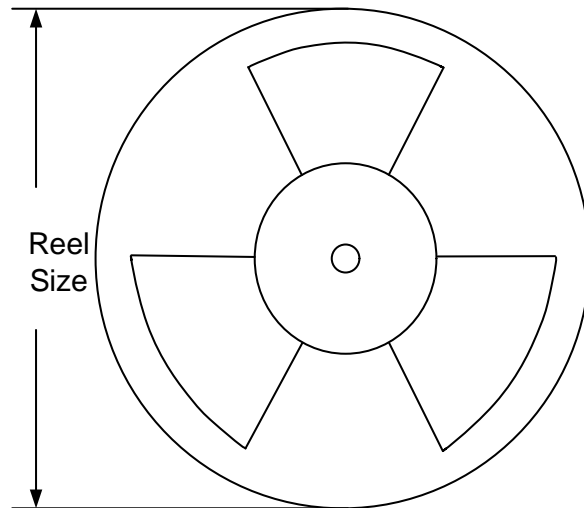
Tape and Reel Information

1. Tape Dimensions and Pin1 Orientation



Feeding direction →

2. Reel Dimensions



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel
TSOT23-6	8	4	7	400	160	3000



Revision History

The revision history provided is for informational purpose only and is believed to be accurate, however, not warranted. Please make sure that you have the latest revision.

Date	Revision	Change	Pages changed
Apr.16, 2025	1.0	Initial Release	-



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