

80V Input, 1.5A Output, Non-synchronous Step-down Converter

Features

- 9V to 80V input voltage range
- 1.5A continuous output current
- 95% Peak Efficiency
- 400 μ A operating quiescent current
- 100V 400-m Ω high-side MOSFET
- Peak Current mode control
- 150 kHz Fixed Frequency
- Internal compensation for ease of use
- Up to 92% duty cycle
- 0.8V voltage reference
- 1 μ A shutdown current
- 3A cycle-by-cycle current limit
- 150ms Hiccup mode short circuit protection

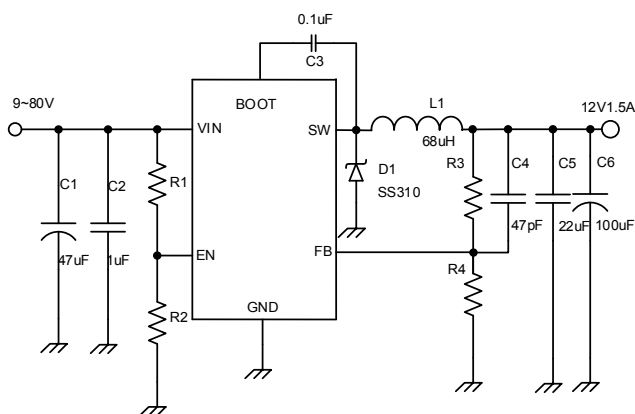
Function

- Thermal shutdown Function
- ESOP-8 package

Applications

- Charger in vehicle
- Battery Chargers
- Power adapter

Typical Application



Description

The HM3121 is a high voltage, non-synchronous step-down converter operates over a wide range input voltage 9V to 80V. The HM3121 integrates a 100-V 400-m Ω high-side MOSFET.

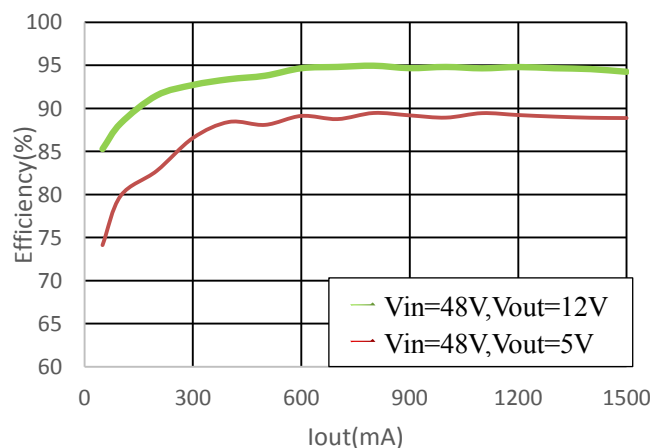
The HM3121 delivers 1.5A continuous load current with up to 95% efficiency. The HM3121 operates with fixed frequency peak current control with built-in compensation eliminates the need for external components.

Cycle-by-cycle current limit in high-side MOSFET protects the converter in an overload condition. Hiccup mode protection is triggered if the over-current condition has persisted for longer than the present time.

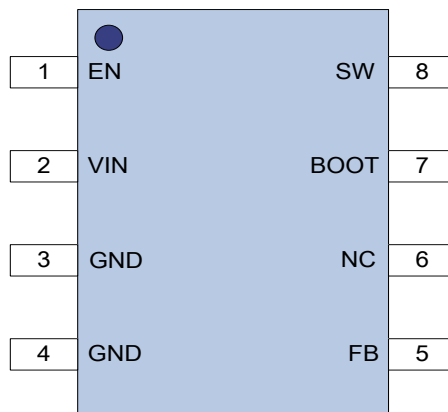
The HM3121 exhibits protection features that protect the load from faults like under-voltage, over-current and over-temperature.

The HM3121 is available in an ESOP-8 package.

Efficiency vs Output Current



Pin Configuration



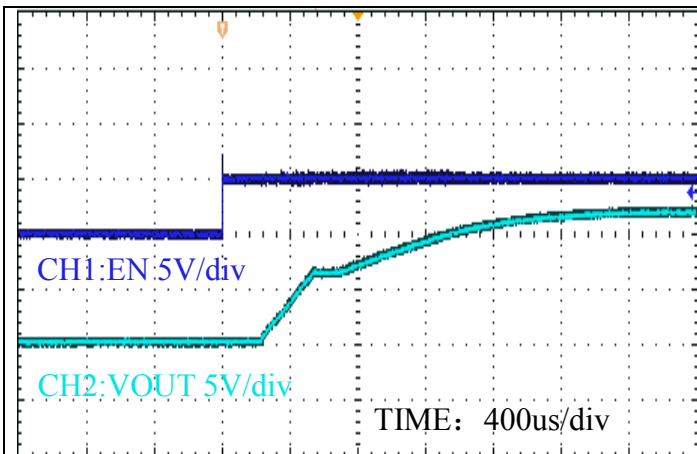
PIN	NAME	Description
1	EN	Enable input. Pull EN below the specified threshold to shut down the J O 5343. Pull EN above the specified threshold to enable the J O 5343.
2	VIN	Input supply. VIN supplies power to all of the internal control circuitries, both BOOT regulators, and the high-side switch.
3, 4	GND	Ground. GND should be placed as close to the output capacitor as possible to avoid the high-current switch paths. Connect the exposed pad to GND plane for optimal thermal performance.
5	FB	Feedback. FB is the input to the voltage hysteretic comparators. The average FB voltage is maintained at 800mV by loop regulation.
6	NC	No Connection
7	BOOT	Bootstrap. BOOT is the positive power supply for the internal, floating, high-side MOSFET driver. Connect a bypass capacitor between BOOT and SW.
8	SW	Switch node. SW is the output from the high-side switch. A low forward voltage Schottky rectifier to ground is required. The rectifier must be placed close to SW to reduce switching spikes.

Electrical Characteristics

(At $T_A=25^\circ\text{C}$, $V_{IN}=48\text{V}$, $V_{OUT}=12\text{V}$, Unless Otherwise Noted)

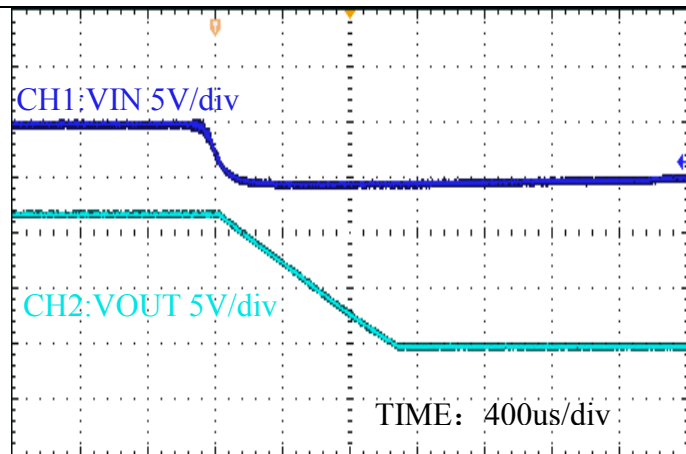
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VCC SUPPLY VOLTAGE						
Input Voltage	V_{IN}		9	-	80	V
UVLO	V_{STRAT}		-	8	-	V
UVLO Hysteresis	V_{UVLO1}		-	0.3	-	V
Shutdown supply current	I_{SHUT}	EN=0V	-	9	-	uA
Input Quiescent Current	I_Q	$V_{FB}=1\text{V}$	-	500	-	uA
ENABLE						
Enable threshold voltage	V_{EN}		-	2.2	-	V
Enable threshold voltage Hysteresis	V_{UVLO2}		-	0.2	-	V
FEEDBACK						
FB Reference Threshold	V_{FB}		-	0.8	-	V
Feedback short voltage	$V_{FB (short)}$		-	0.35	-	V
Feedback short voltage Hysteresis	V_{FB2}		-	0.42	-	V
OSCILLATOR						
Switching frequency	F	$I_{OUT}=500\text{mA}$	-	150	-	kHz
Maximum Duty Cycle	D_{MAX}	$V_{IN}=12\text{V}$	-	92	-	%
CURRENT LIMIT						
Current Limit Threshold	I_{PEAK}		-	3	-	A
HIGH-SIDE MOSFET						
On-resistance	$R_{DS(ON)}$	$V_{IN}=18\text{V}$	-	400	-	mΩ
THERMAL SHUTDOWN						
Thermal shutdown Temp	T_{SD}		-	150	-	°C
Thermal shutdown Temp Hysteresis	T_{SH}		-	30	-	°C

Typical Characteristics (At $T_A=25^\circ\text{C}$, $V_{IN}=48\text{V}$, $V_{OUT}=12\text{V}$, Unless Otherwise Noted)



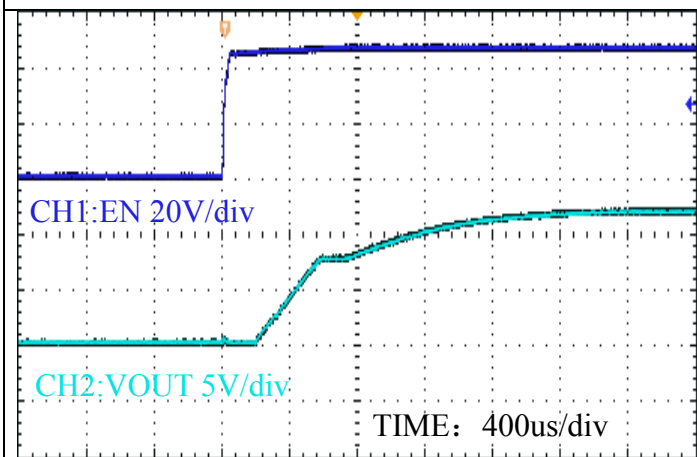
$V_{in}=48\text{V}$ $EN=5\text{V}$

Figure1 EN Start up



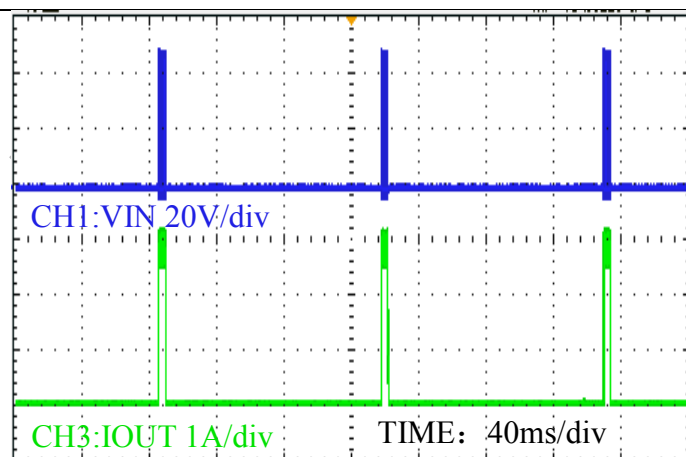
$V_{in}=48\text{V}$ $EN=5\text{V}$

Figure2 EN Turn off



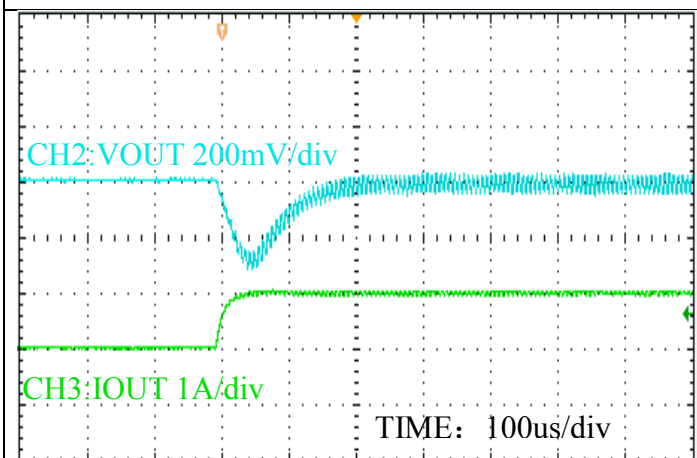
$V_{in}=48\text{V}$ $I_{out}=0\text{A}$

Figure3 Start up



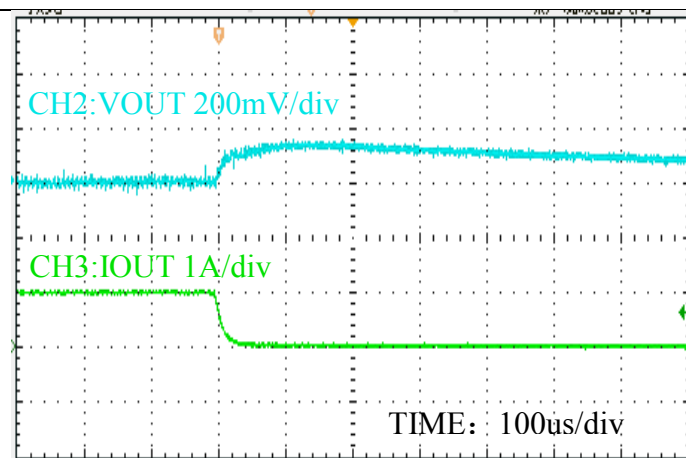
$V_{in}=48\text{V}$ $I_{out}=1\text{A}$

Figure4 Start up



$I_{out}=10\text{mA}\sim 1\text{A}$ $V_{in}=48\text{V}$

Figure5 Load Transient

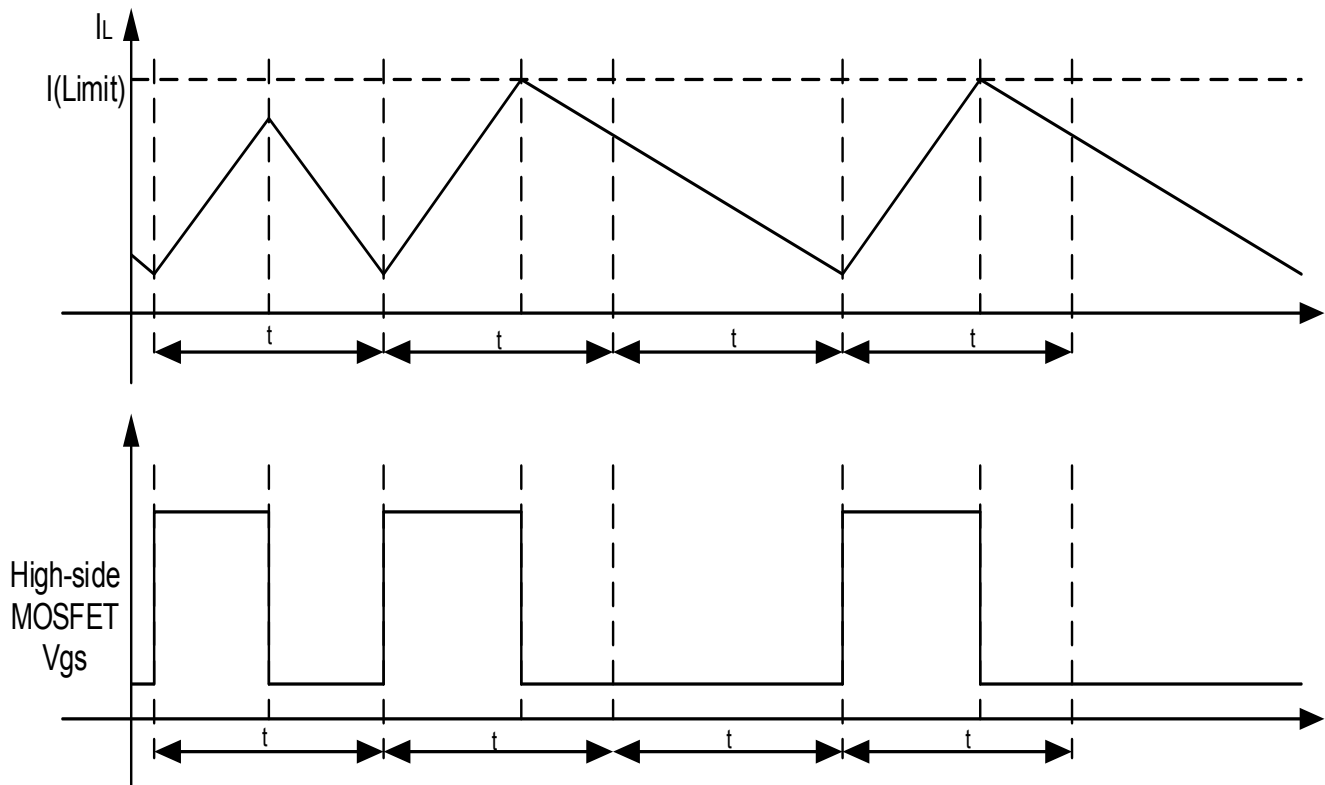


$I_{out}=1\text{A}\sim 10\text{mA}$ $V_{in}=48\text{V}$

Figure6 Load Transient

Applications Information

Overcurrent Protection: The J O 5343 implements current-mode control which uses the internal COMP voltage to control the turn on and the turnoff of the high-side MOSFET on a cycle-by-cycle basis. During each cycle, the switch current and the current reference generated by the internal COMP voltage are compared. When the peak switch current intersects the current reference the high-side switch turns off. Furthermore, if an output overload condition occurs for more than the hiccup wait time, which is programmed for 512 switching cycles, the device shuts down and restarts after the hiccup time of 16384 cycles. The hiccup mode helps to reduce the device power dissipation under severe overcurrent conditions.



C1: This capacitor's purpose is to supply most of the switch current during the on-time, and limit the voltage ripple at VIN. To allow for the capacitor's tolerance, temperature effects, and voltage effects, a 47 μ F capacitor is used.

C2:This capacitor helps avoid supply voltage transients and ringing due to long lead inductance at VIN. A low ESR, 1μF ceramic chip capacitor is recommended, located close to the HM3121.

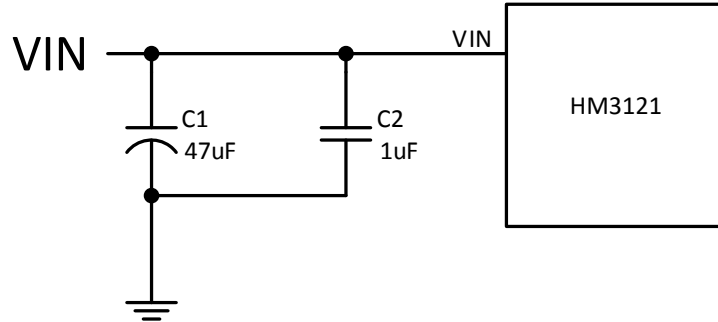


Figure7 The capacitor on the VIN

L1:The inductance is determined based on the switching frequency, load current, inductor ripple current, and the minimum and maximum input voltages designated VIN(min) and VIN(max), respectively. The peak inductor current during an overload condition is limited to 3 A nominal. Use the value of 68μH,5A to prevent saturation.

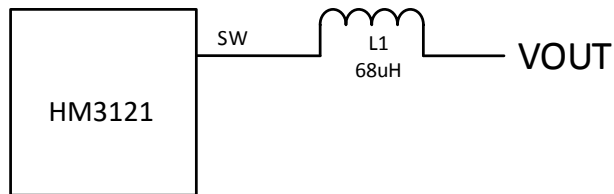


Figure8 The inductor on the choice

D1: A power Schottky diode is recommended. Ultra-fast recovery diodes are not recommended as the high speed transitions at the SW pin may inadvertently affect the IC's operation through external or internal EMI. The important parameters are reverse recovery time and forward voltage. The reverse recovery time determines how long the reverse current surge lasts with each turn-on of the internal buck switch. The forward voltage drop affects efficiency. The diode's reverse voltage rating must be at least as great as the maximum input voltage, plus ripple and transients, and its current rating must be at least as great as the maximum current limit specification.

C4/C5: The output capacitor filters the inductor ripple current and provides a source of charge for transient load conditions. The best performance is typically obtained using ceramic or polymer electrolytic type components. Typical tradeoffs are that the ceramic capacitor provides extremely low ESR to reduce the output ripple voltage and noise spikes. In order to meet output ripple specification, we should choose a ceramic capacitor of 22uF and a polymer electrolytic capacitor of 100uF.

R1/R2: The output voltage (VOUT) is programmed by two external resistors as shown in the Figure15. The regulation point can be calculated as follows:

$$V_{OUT} = 0.8 \times (R1 + R2) / R2$$

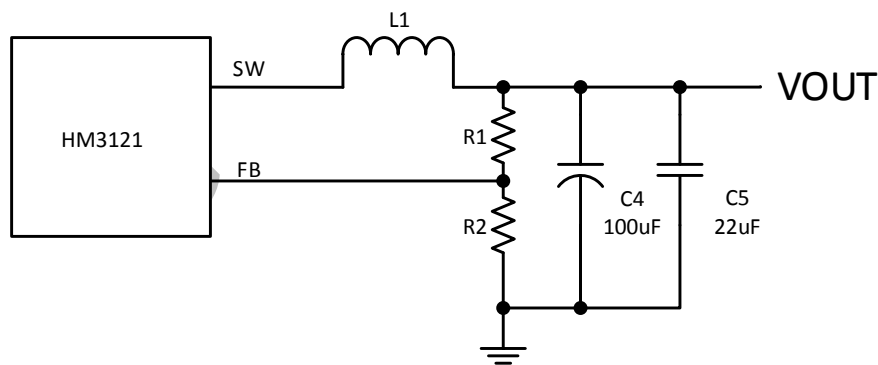


Figure9 Output Capacitors and Output Configuration

Layout

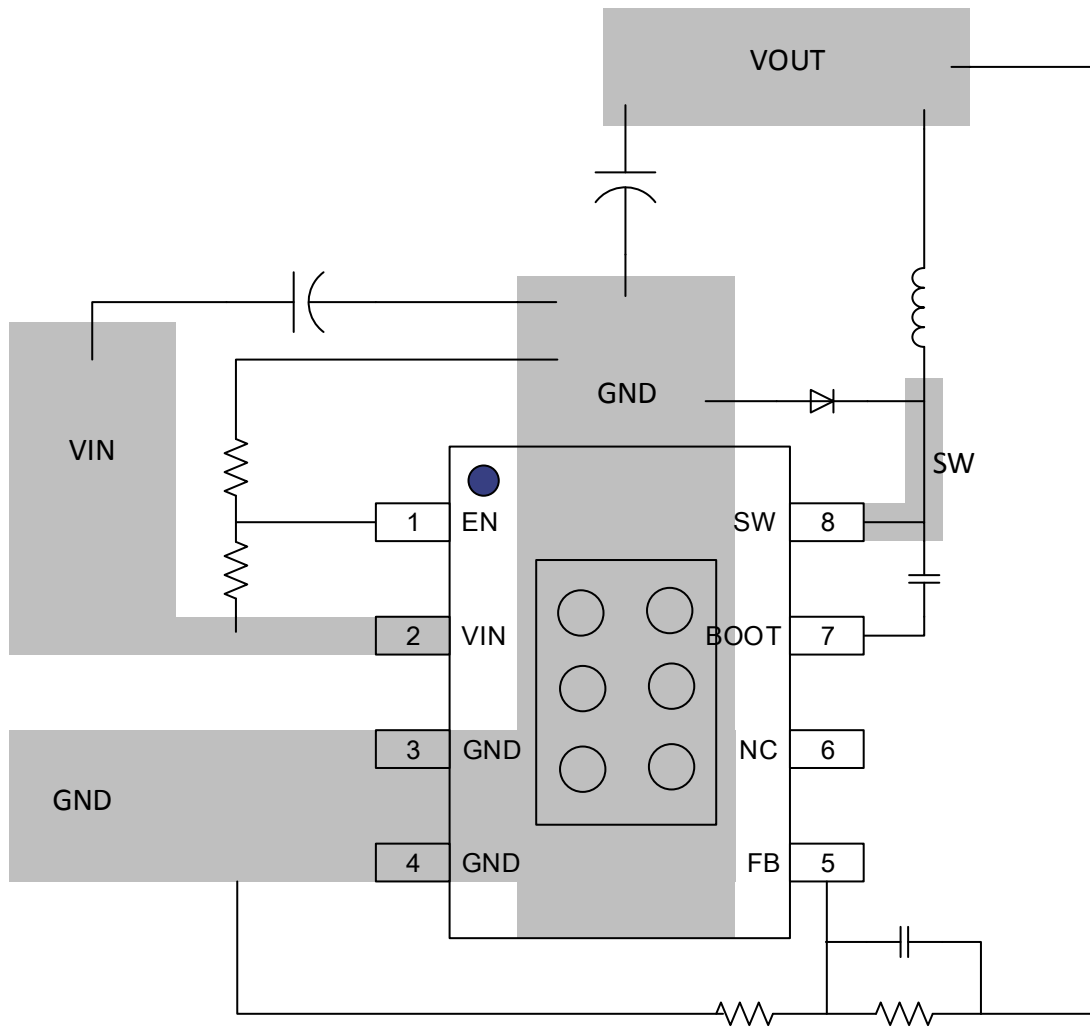
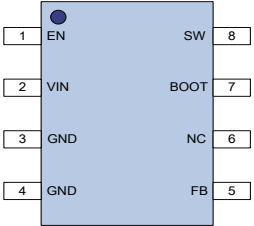
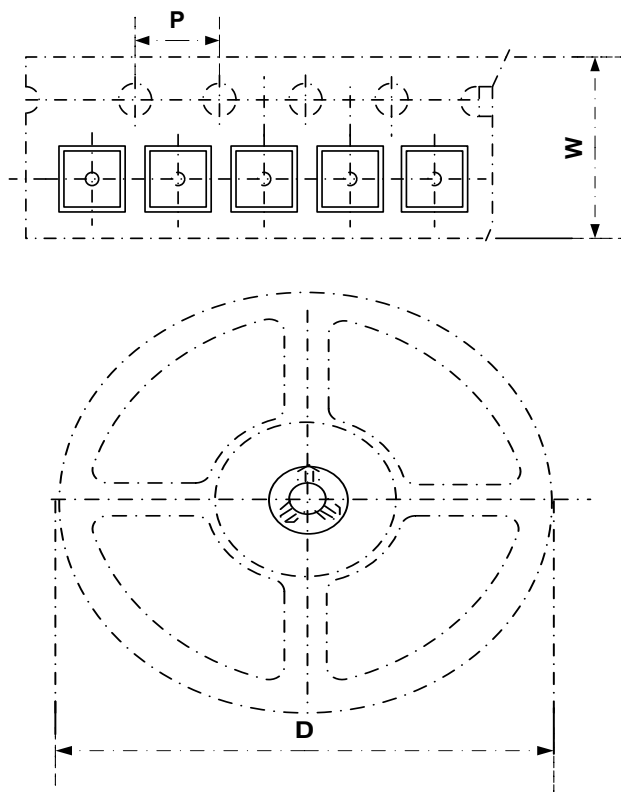


Figure10 PCB Layout Example

Ordering And Marking Information

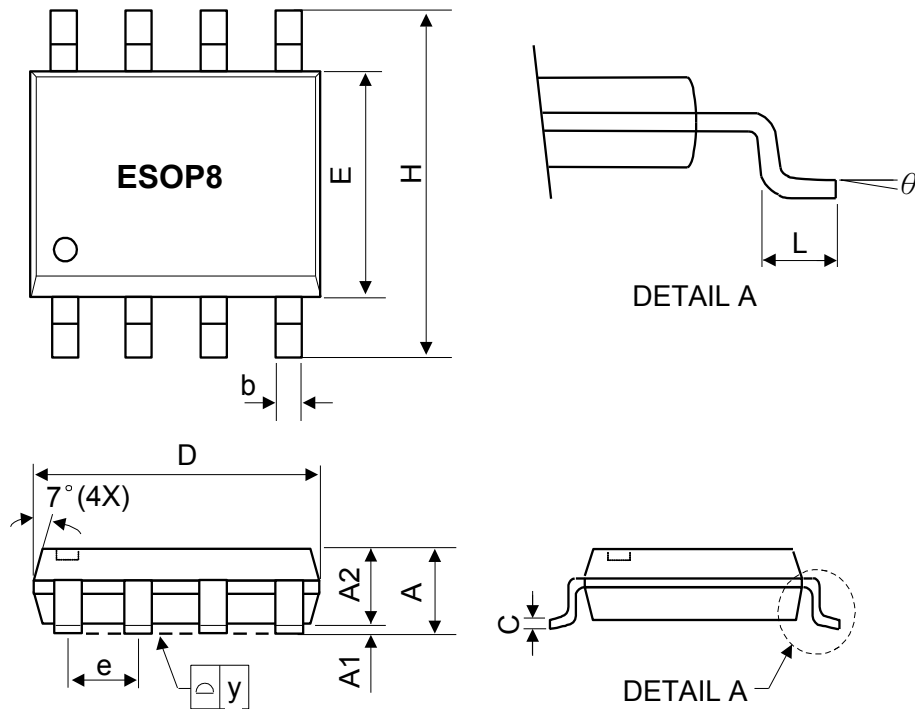
<p>Part Number</p> <p>HM 3121 ES</p> <p>Package Definition</p> <p>Product Name</p> <p>Company Name</p>	<p>Package Outline</p> 
	<p>Minimum Package</p> <p>ESOP8 2500pcs/Reel</p>
	<p>Marking</p> <p>HM 3121 ES</p> <p>XXXX</p> <p>ES: Package Definition</p> <p>3121: Product Name</p> <p>Lort Number</p> <p>HM: Company Name</p>

Packing Information



Type	W(mm)	P(mm)	D(mm)	Qty (pcs)
ESOP8	12.0±0.1 mm	8.0±0.1 mm	330±1 mm	2500pcs

Package Outline



Symbol	Millimetre			Inch		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°