Features

- 9V to 100V input voltage range
- 10A continuous output current
- 96% Peak Efficiency
- 600μA operating quiescent current
- Peak Current mode control
- 150 kHz Fixed Frequency
- Internal compensation for ease of use
- Up to 91% duty cycle
- 0.8V voltage reference
- 1μA shutdown current
- 150ms Hiccup mode short circuit protection Function
- Thermal shutdown Function
- SOP-14 package

Applications

- Charger in vehicle
- Battery Chargers
- Power adapter

Description

The MX10010S is a high voltage, synchronous step-down controller operates over a wide range input voltage 9V to 100V.
The MX10010S delivers 10A continuous load current with up to 96% efficiency.

The MX10010S 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.

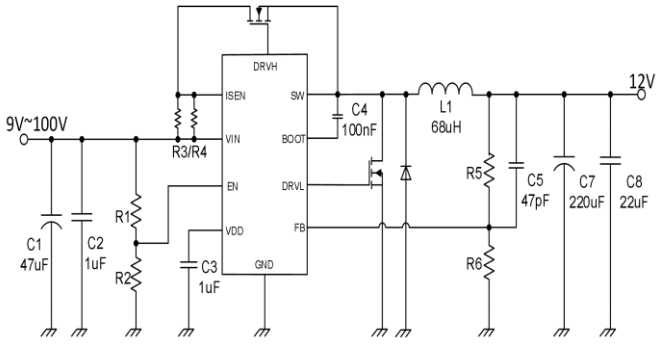
The MX10010S exhibits protection features

that protect the load from faults like under-voltage, over-current and over-temperature. The MX10010S is available in an SOP-14.

Device Information

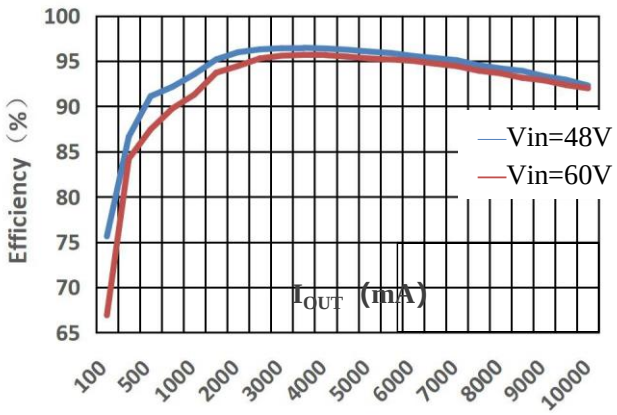
PART NUMBER	PACKAGE	BODY SIZE
MX10010S	SOP14	8.5mm*5.8m

Typical Application

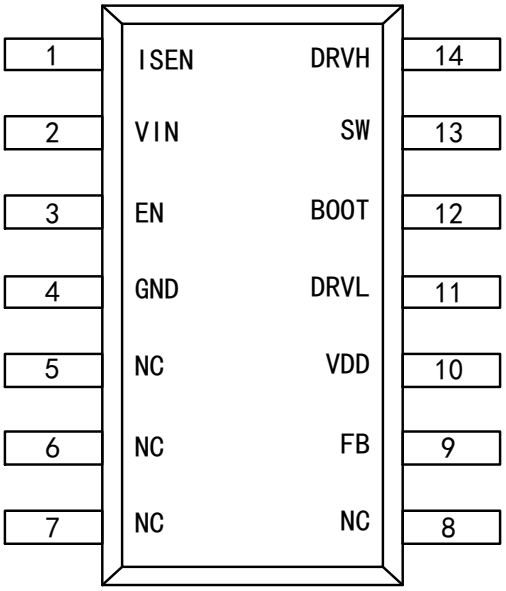


Efficiency vs Output Current

V_{OUT} = 12V

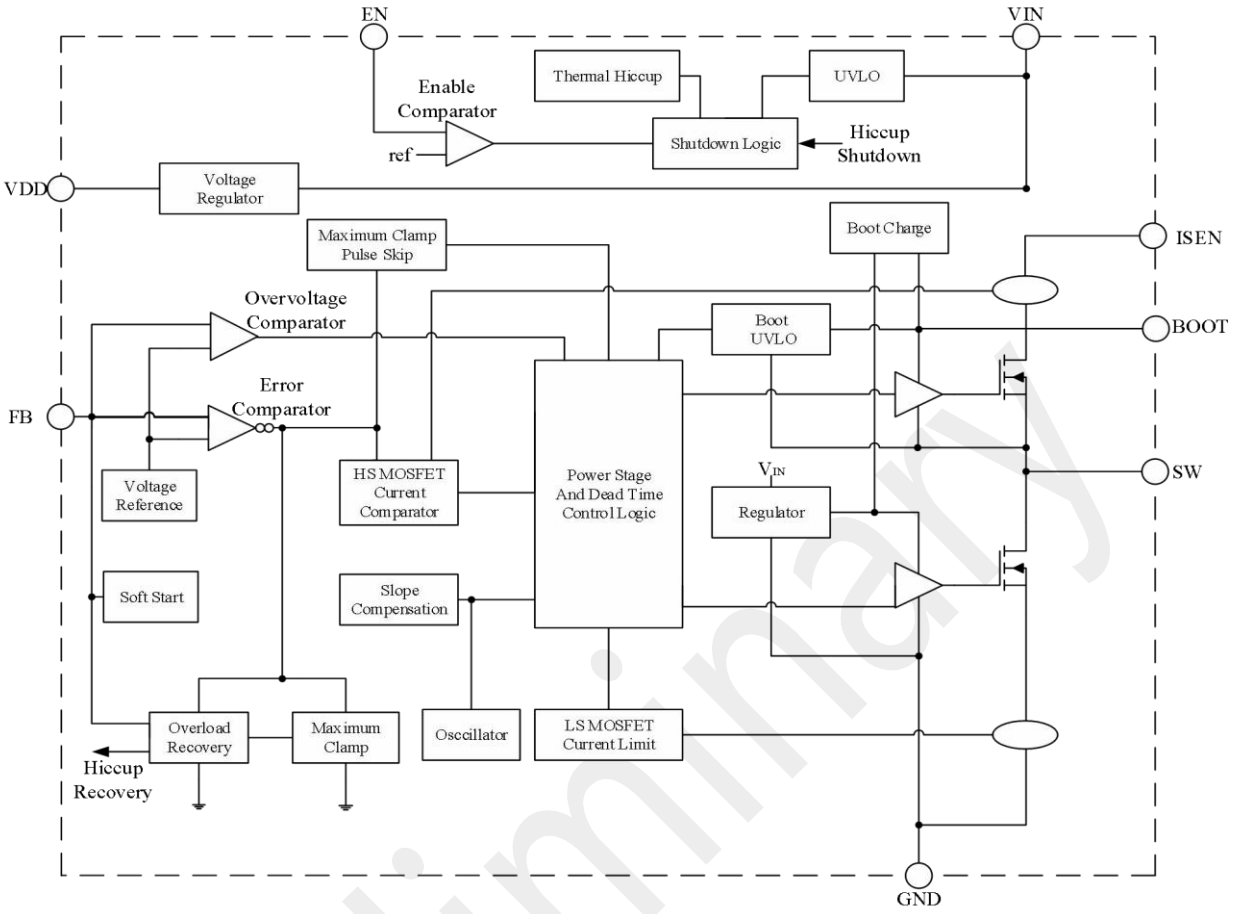


Pin Configuration



PIN	NAME	Descripti
1	I_{SEN}	Connecting a resistance from I_{SEN} to V_{IN} sets the output short circuit detection threshold.
2	V_{IN}	**Input supply.** V_{IN} supplies power to all of the internal control circuitries, both BOOT regulators, and the high-side switch.
3	EN	**Enable input.** Pull EN below the specified threshold to shut down the MX10010S. Pull EN above the specified threshold or leave EN floating to enable the MX10010S.
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.
5,6,7,8	NC	No Connection
9	FB	**Feedback.** FB is the input to the voltage hysteretic comparators. The average FB voltage is maintained at 800mV by loop regulation.
10	V_{DD}	Power input to the controller.
11	DRVL	**Low Drive.** Bootstrapped output for driving the gate of the low side N channel FET.
12	BOOT	**Bootstrap.** BOOT is the positive power supply for the internal, floating, high-side MOSFET driver. Connect a bypass capacitor between BOOT and SW.
13	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.
14	DRVH	**High Drive.** Bootstrapped output for driving the gate of the high side N channel FET.

Block Diagram



Absolute Maximum Ratings

Item	Description	Range	Unit
V_{SW}, V_{EN}, V_{IN}, V_{ISEN}	SW, EN, V_{IN}, I_{SEN} Voltage	-0.3 ~ +105	V
V_{FB}, V_{DD}	V_{DD}, FB Voltage	-0.3 ~ +7	V
V_{BOOT}	BOOT Voltage	VSW-0.3 ~ VSW+7	V
Tstg	Storage Junction Temperature	-55 ~ 150	℃
Tsolder	Lead Tempe	260	℃
ESD	Human Body Model	2	kV

Note: exceeding the range specified by the rated parameters will cause damage to the chip, and the working state of the chip beyond the range of rated parameters cannot be guaranteed. Exposure outside the rated parameter range will affect the reliability of the chip.

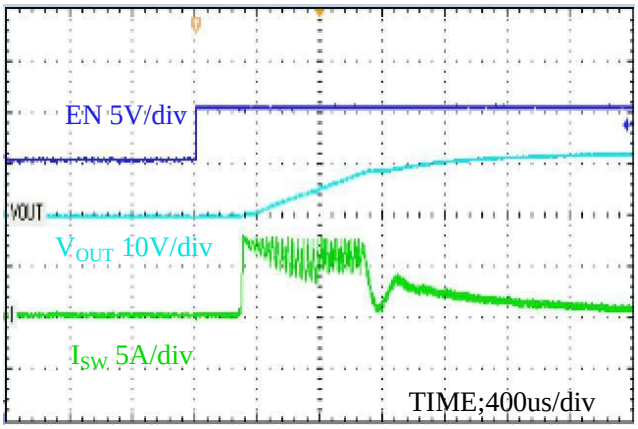
Electrical Characteristics

(At TA=25℃, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VCC SUPPLY VOLTAGE						
Input Voltage	V_{IN}		9	-	100	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}=1V	-	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}=500mA	-	150	-	kHz
Maximum Duty Cycle	D_{MAX}	V_{IN}=12V	-	91	-	%
V_{DD}						
V_{DD} Voltage	V_{DD}			5.4		V
CURRENT LIMIT						
Cycle-by-cycle sense voltage	V_{SEN}		-	300	-	mV
THERMAL SHUTDOWN						
Thermal shutdown Temp	T_{SD}		-	117	-	℃
Thermal shutdown Temp Hysteresis	T_{SH}		-	85	-	℃

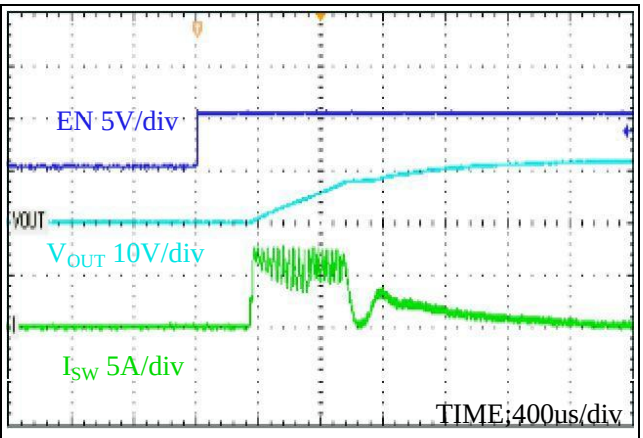
Typical Characteristics

(At TA=25°C, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted



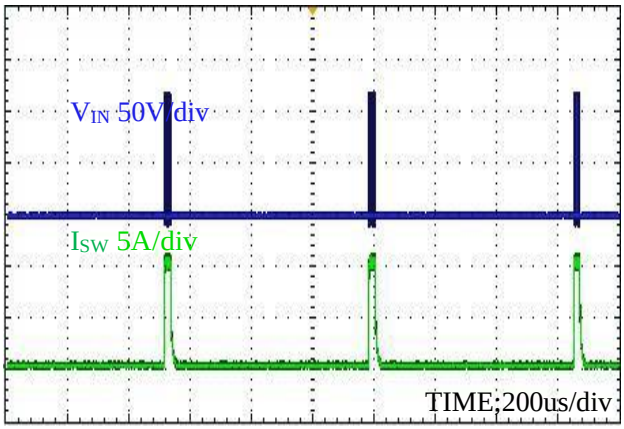
V_{IN}=48V EN=5V I_{OUT}=1A

Figure1 EN Start up



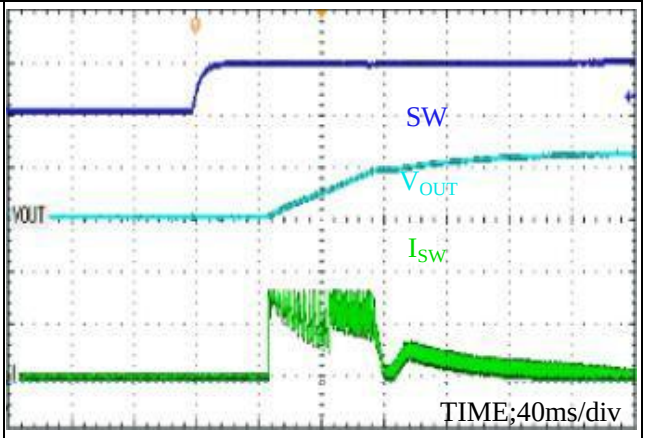
V_{IN}=48V EN=5V I_{OUT}=0A

Figure2 EN Start up



V_{IN}=48V Iout=0A

Figure3 Start up



V_{IN}=48V

Figure4 Short

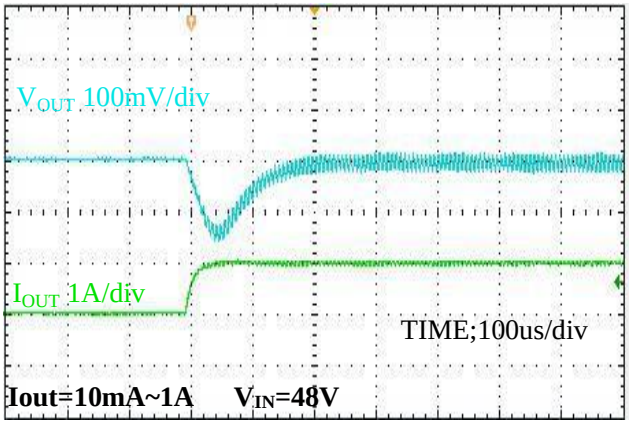


Figure5 Load Transient

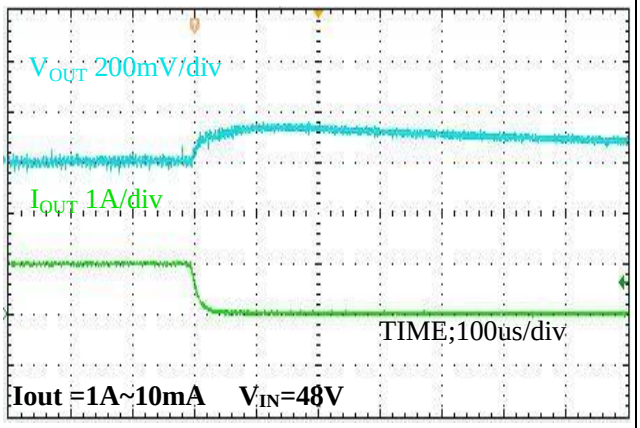
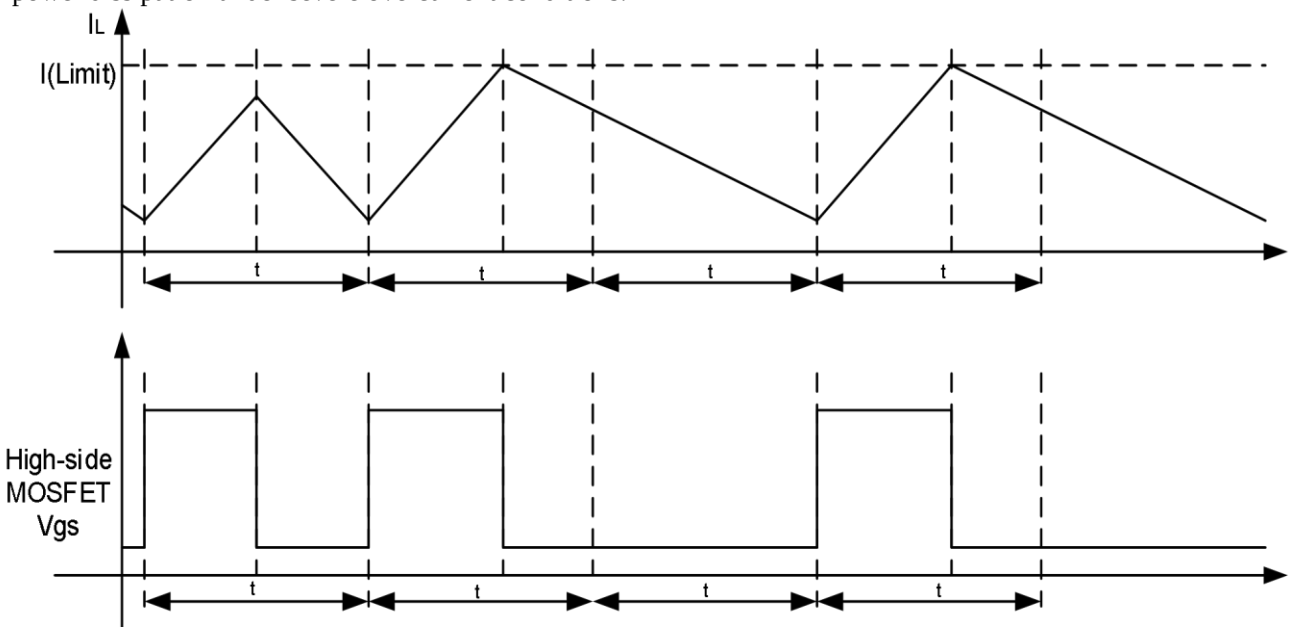


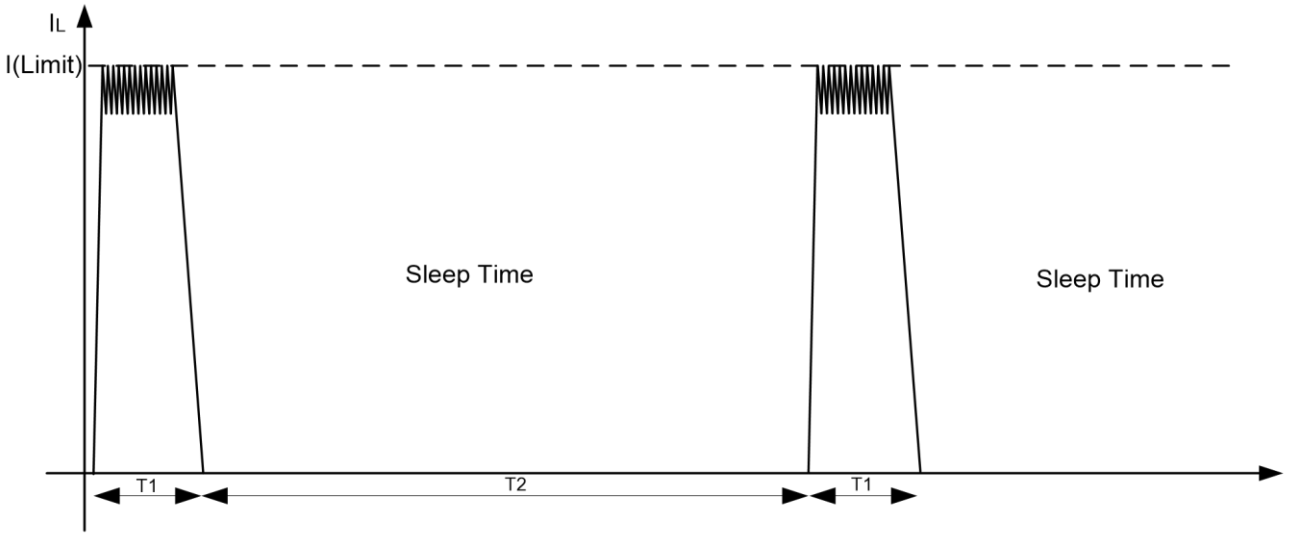
Figure6 Load Transient

Applications Information

Overcurrent Protection: The MX10010S 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.



Hiccup mode: If an output overload condition occurs for more than the hiccup wait time, which is programmed for 512 switching cycles(T1), the device shuts down and restarts after the hiccup time of 16384 cycles(T2). The hiccup mode helps to reduce the device power dissipation under severe over-current conditions.



F

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

C2: This capacitor helps avoid supply voltage transients and ringing due to long lead inductance at V_{IN}. A low ESR, 1μF ceramic chip capacitor is recommended, located close to the MX10010S.

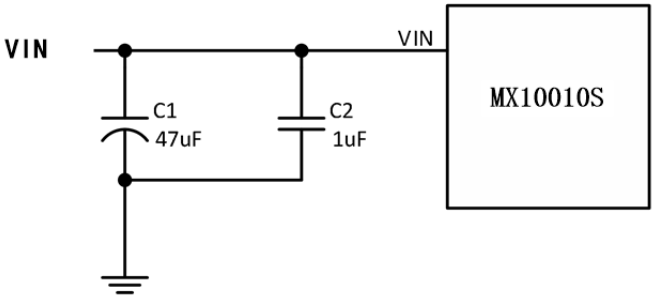


Figure7 The capacitor on the V_{IN}

L1: The inductance is determined based on the switching frequency, load current, inductor ripple current, and the minimum and maximum input voltages designated $V_{IN(min)}$ and $V_{IN(max)}$, respectively. The peak inductor current during an overload condition is limited to 10 A nominal. Use the value of 47μH,15A to prevent saturation.

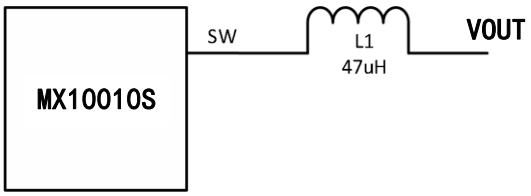


Figure8 The inductor on the choice

L1: 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 (V_{OUT}) is programmed by two external resistors as shown in the Figure9. The regulation point can be calculated as follows:

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

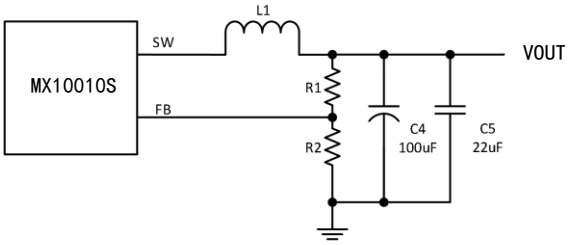
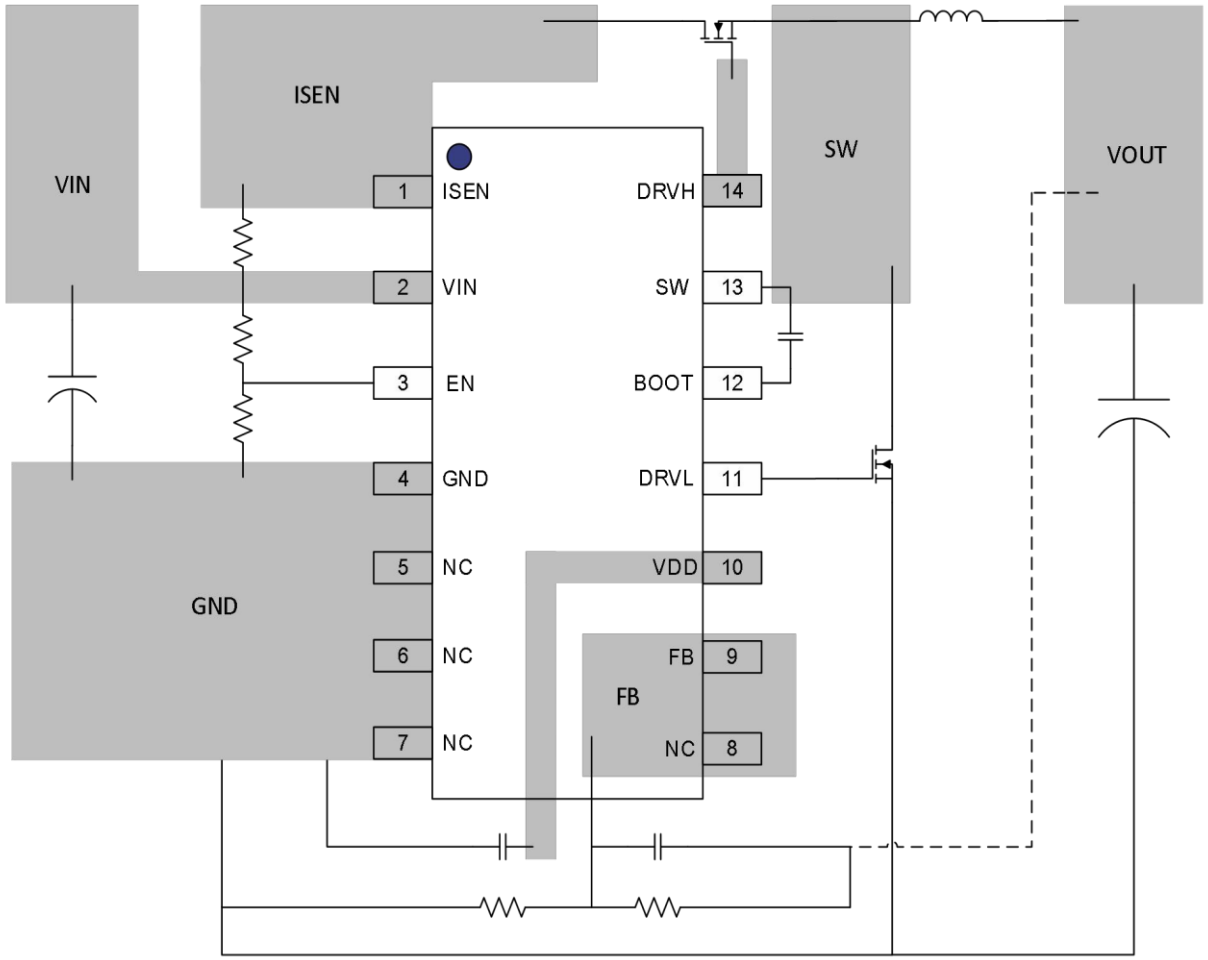
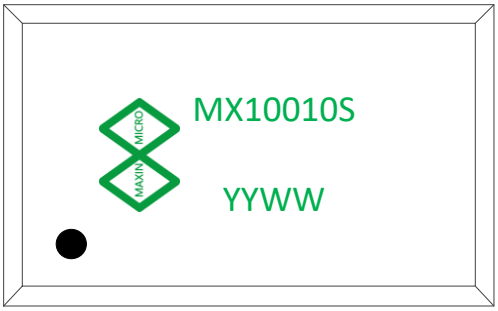


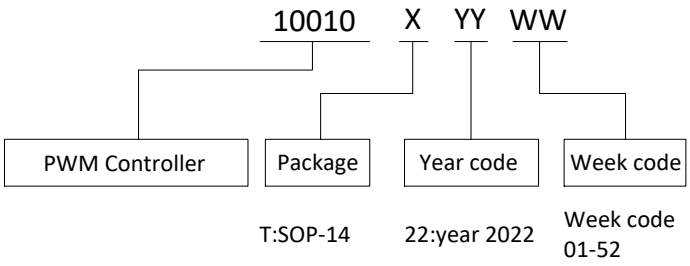
Figure9 Output Capacitors and Output Configuration

Layout



Marking Information



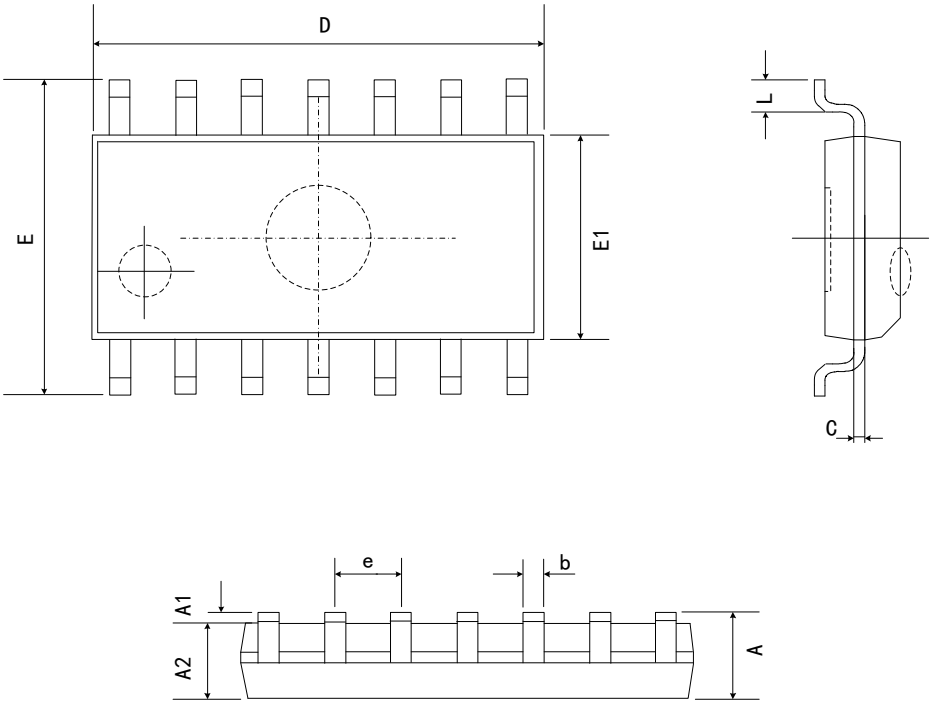


Packing Information

Type	W(mm)	D(mm)	Qty (pcs)
SOP14	16.0±0.1	330±1	2500

Figure10 PCB Layout Example

Package Outline



Symbol	Millimeter			Inch		
	Min	Typ	Max	Min	Typ	Max
A	——	1.750	——	0.069	A	——
A1	0.100	0.250	0.004	0.010	A1	0.100
A2	1.250	——	0.049	——	A2	1.250
b	0.310	0.510	0.012	0.020	b	0.310
c	0.100	0.250	0.004	0.010	c	0.100
D	8.450	8.850	0.333	0.348	D	8.450
E	5.800	6.200	0.228	0.244	E	5.800
E1	3.800	4.000	0.150	0.157	E1	3.800
e	1.270(BSC)			0.050(BSC)		
L	0.400	1.270	0.016	0.050	L	0.400
θ	0°	8°	0°	8°	θ	0°

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