

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Features

- Operation Voltage: 5V~45V
- Output Adjustable from 1.25V to 40V
- Feedback Voltage Accuracy  $\pm 2\%$
- Fixed 200KHz Switching Frequency
- 3.0A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 94%
- Max. Output power up to 15W
- Excellent line and load regulation
- EN PIN TTL ON/OFF capability
- Built in thermal shutdown function
- Built in current limit protection function
- Built in output short protection function
- Built in constant voltage loop and constant current loop
- Temperature Grade 1:  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  Ambient Operating Temperature Range
- Device HBM ESD Classification Level Class3A
- Available in SOP8-EP package

### General Description

The XL9010 is a 200KHz fixed frequency PWM synchronous buck DC/DC converter, capable of driving a 3.0A load with high efficiency, low ripple and excellent line and load regulation. XL9010 supports wide input operating voltage range of 5V ~ 45V and a maximum duty cycle of 100% output. Output supports constant voltage loop and constant current loop. A built-in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space. The XL9010 has built-in TTL ON/OFF capability, thermal shutdown, current limit protection and output short protection function and so on. When the output short protection function happens, the operation frequency will be reduced about from 200KHz to 50KHz.

### Applications

- Automotive Electronics
- Industrial Control
- Networking Equipment
- Internet of Things

### Typical application schematic

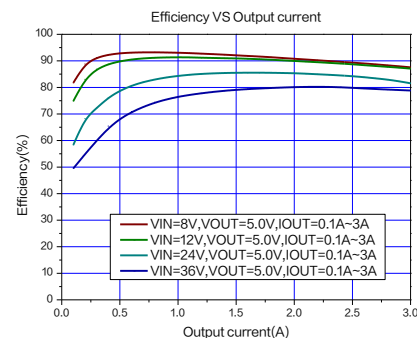
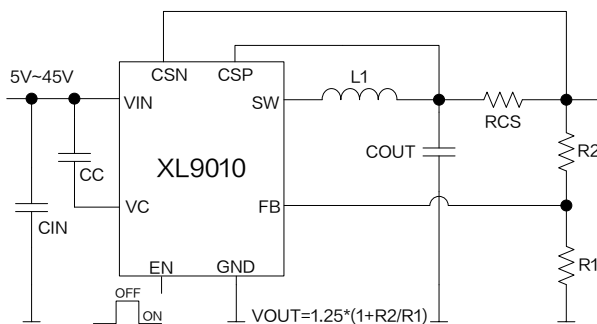


Figure1. XL9010 Typical application schematic and efficiency curve

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Pin Configurations

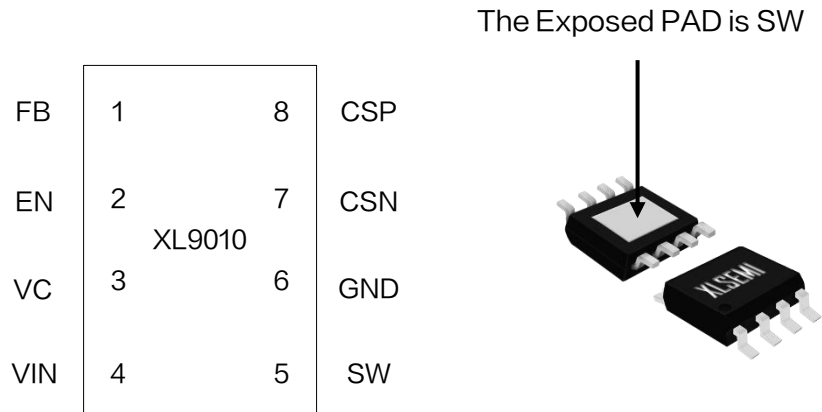


Figure2. Pin Configuration of XL9010

Table 1 Pin Description

Pin Number	Pin Name	Description
1	FB	Feedback Pin (FB). Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.25V.
2	EN	Enable Pin. Drive EN pin high to turn on the device, drive it low to turn it off. Floating is default high.
3	VC	Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uF capacitor to VIN.
4	VIN	Supply Voltage Input Pin. XL9010 operates from 5V to 45V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
6	GND	Ground Pin.
7	CSN	Current detection negative terminal pin.
8	CSP	Current detection positive terminal pin.

### Ordering Information

Order Information	Marking ID	Package Type	Eco Plan	Packing Type Supplied As
XL9010	XL9010	SOP8-EP	RoHS & HF	4000 Units on Reel

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Function Block

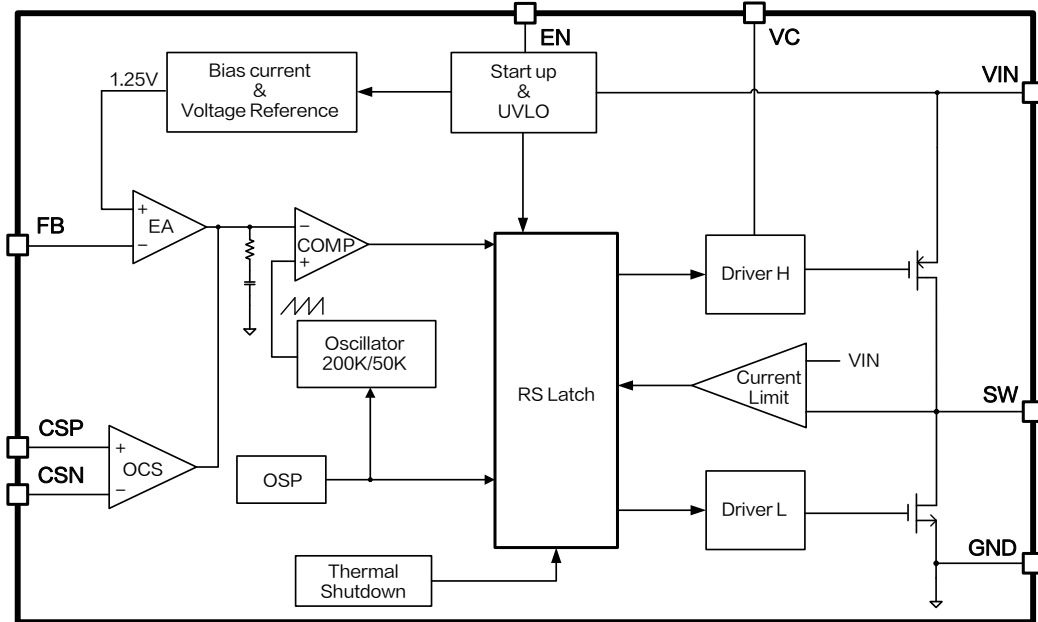


Figure3. Function Block Diagram of XL9010

### Absolute Maximum Ratings ( Note1 )

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	-0.3~50	V
EN Pin Voltage	$V_{EN}$	-0.3~7	V
Feedback Pin Voltage	$V_{FB}$	-0.3~7	V
Output Switch Pin Voltage	$V_{SW}$	-0.3~ $V_{IN}$	V
Internal Voltage Regulator Bypass Capacity	$V_C$	-0.3~ $V_{IN}$	V
CSP Pin Voltage	$V_{CSP}$	-0.3~ $V_{IN}$	V
CSN Pin Voltage	$V_{CSN}$	-0.3~ $V_{IN}$	V
Power Dissipation	$P_D$	Internally limited	mW
Thermal Resistance (SOP8-EP) (Junction to Ambient, No Heatsink, Free Air)	$R_{JA}$	60	°C/W
Operating Junction Temperature	$T_J$	-40~150	°C
Storage Temperature	$T_{STG}$	-65~150	°C
Lead Temperature (Soldering, 10 sec)	$T_{LEAD}$	260	°C
ESD (HBM)		>6000	V

**Note1:** Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### XL9010 Electrical Characteristics

$T_A = 25^\circ\text{C}$ ; system parameters test circuit figure6, unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{FB}$	Feedback Voltage	$V_{IN}=12\text{V}, V_{OUT}=5.0\text{V}$ $I_{OUT}=0.5\text{A}$	1.225	1.25	1.275	V
$\eta$	Efficiency	$V_{IN}=12\text{V}, V_{OUT}=5.0\text{V}$ $I_{OUT}=1.0\text{A}$	-	91.4	-	%
$\eta$	Efficiency	$V_{IN}=24\text{V}, V_{OUT}=12\text{V}$ $I_{OUT}=1.0\text{A}$	-	93.0	-	%
$\eta$	Efficiency	$V_{IN}=24\text{V}, V_{OUT}=15\text{V}$ $I_{OUT}=1.0\text{A}$	-	94.0	-	%

### Electrical Characteristics (DC Parameters)

$T_A=25^\circ\text{C}, V_{IN}=12\text{V}$ ; system parameters test circuit figure6, unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	$V_{IN}$		5		45	V
Shutdown Supply Current	$I_S$	$V_{EN}=2\text{V}$		35	100	$\mu\text{A}$
Quiescent Supply Current	$I_Q$	$V_{FB}=2\text{V}$		2.5	5	mA
Oscillator Frequency	$F_{OSC}$		170	200	230	KHz
Switch Current Limit	$I_L$	$V_{FB}=0$		3		A
EN Pin Threshold	$V_{EN\_H}$	High(OFF)	1.4			V
	$V_{EN\_L}$	Low(ON)			0.8	V
High side MOS On-resistance	$R_{DS(ON)H}$			68		$\text{m}\Omega$
Low side MOS On-resistance	$R_{DS(ON)L}$			50		$\text{m}\Omega$
Thermal Shutdown Temperature	$T_{SD}$			160		$^\circ\text{C}$
Thermal Shutdown Hysteresis	$T_D$			30		$^\circ\text{C}$
Maximum Duty Cycle	$D_{MAX}$	$V_{FB}=0$			100	%

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Typical System Application Schematic ( $V_{OUT}=3.3V, I_{OUT}=0\sim 3.0A$ )

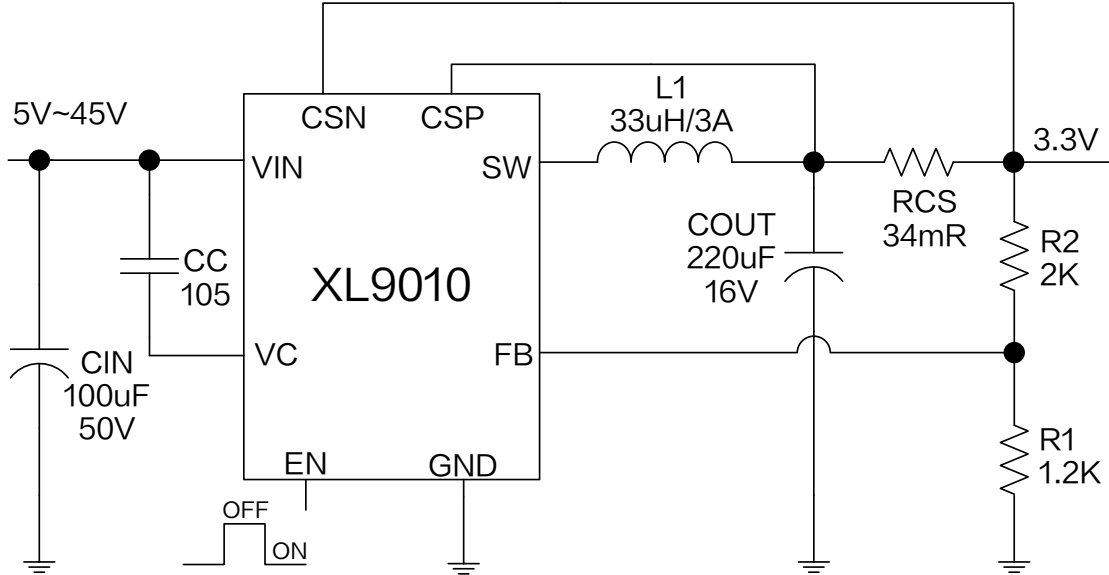


Figure4. XL9010 System Application ( $V_{IN}=5V\sim 45V, V_{OUT}=3.3V, I_{OUT}=0\sim 3.0A$ )

### Typical System Application Transfer Efficiency

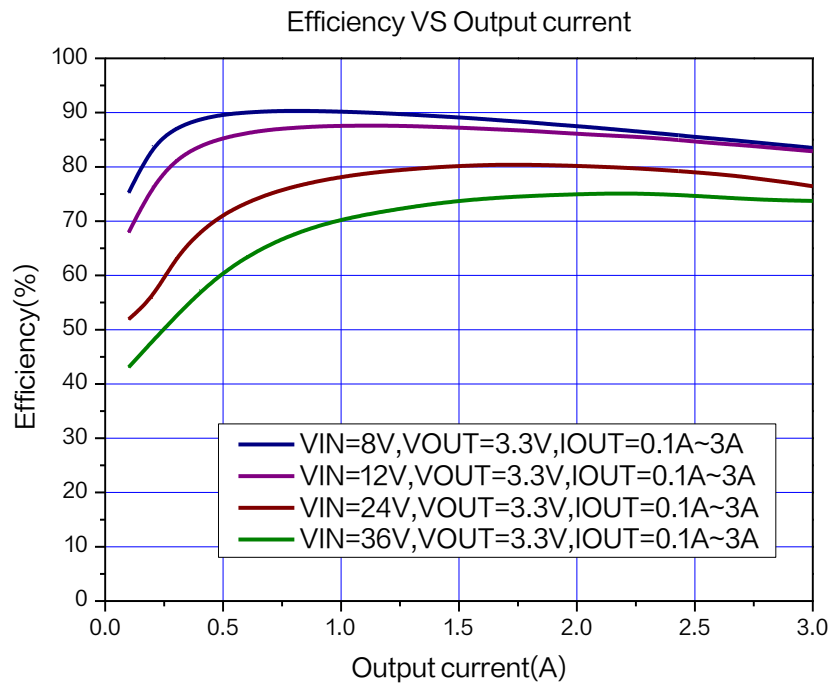


Figure5. XL9010 System Efficiency Curve ( $V_{OUT}=3.3V$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Typical System Application Schematic ( $V_{OUT}=5.0V$ , $I_{OUT}=0\sim 3.0A$ )

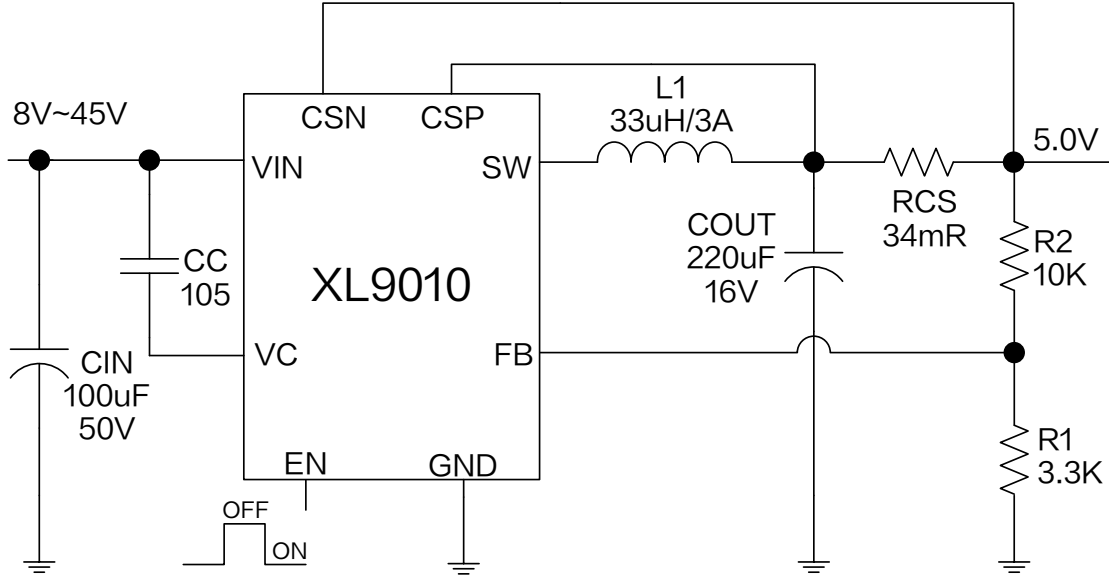


Figure6. XL9010 System Application ( $V_{IN}=8V\sim 45V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0\sim 3.0A$ )

### Typical System Application Transfer Efficiency

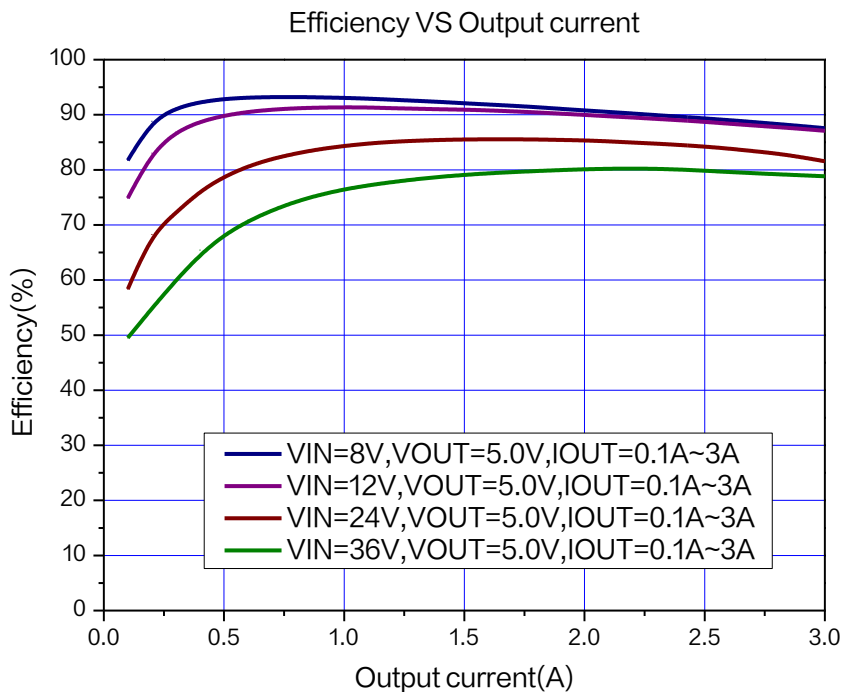


Figure7. XL9010 System Efficiency Curve ( $V_{OUT}=5.0V$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

Typical System Application Schematic ( $V_{OUT}=12V$ ,  $I_{OUT}=0\sim 1.2A$ )

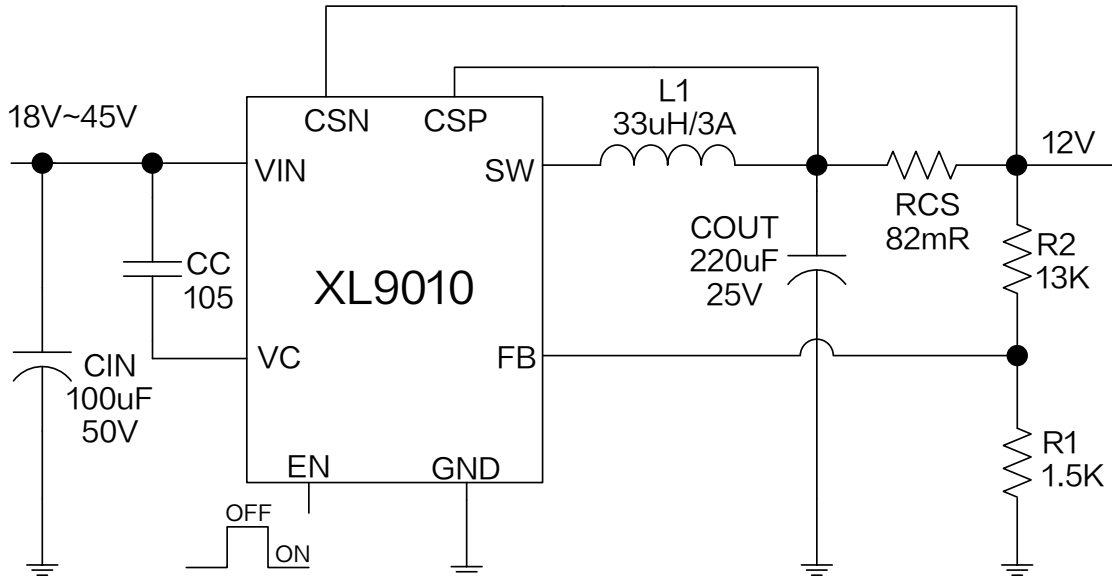


Figure8. XL9010 System Parameters Test Circuit ( $V_{IN}=18V\sim 45V$ ,  $V_{OUT}=12V$ ,  $I_{OUT}=0\sim 1.2A$ )

Typical System Application Transfer Efficiency

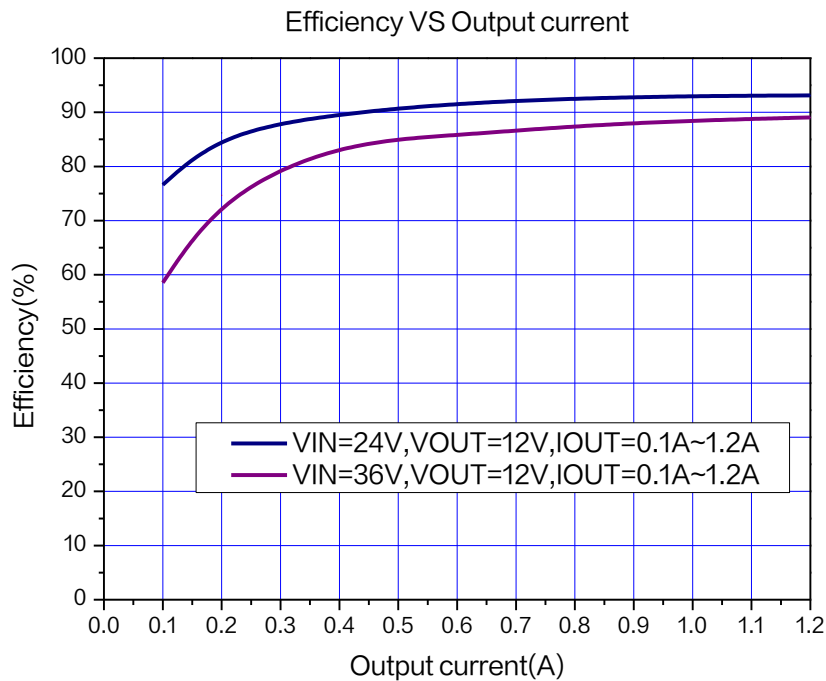
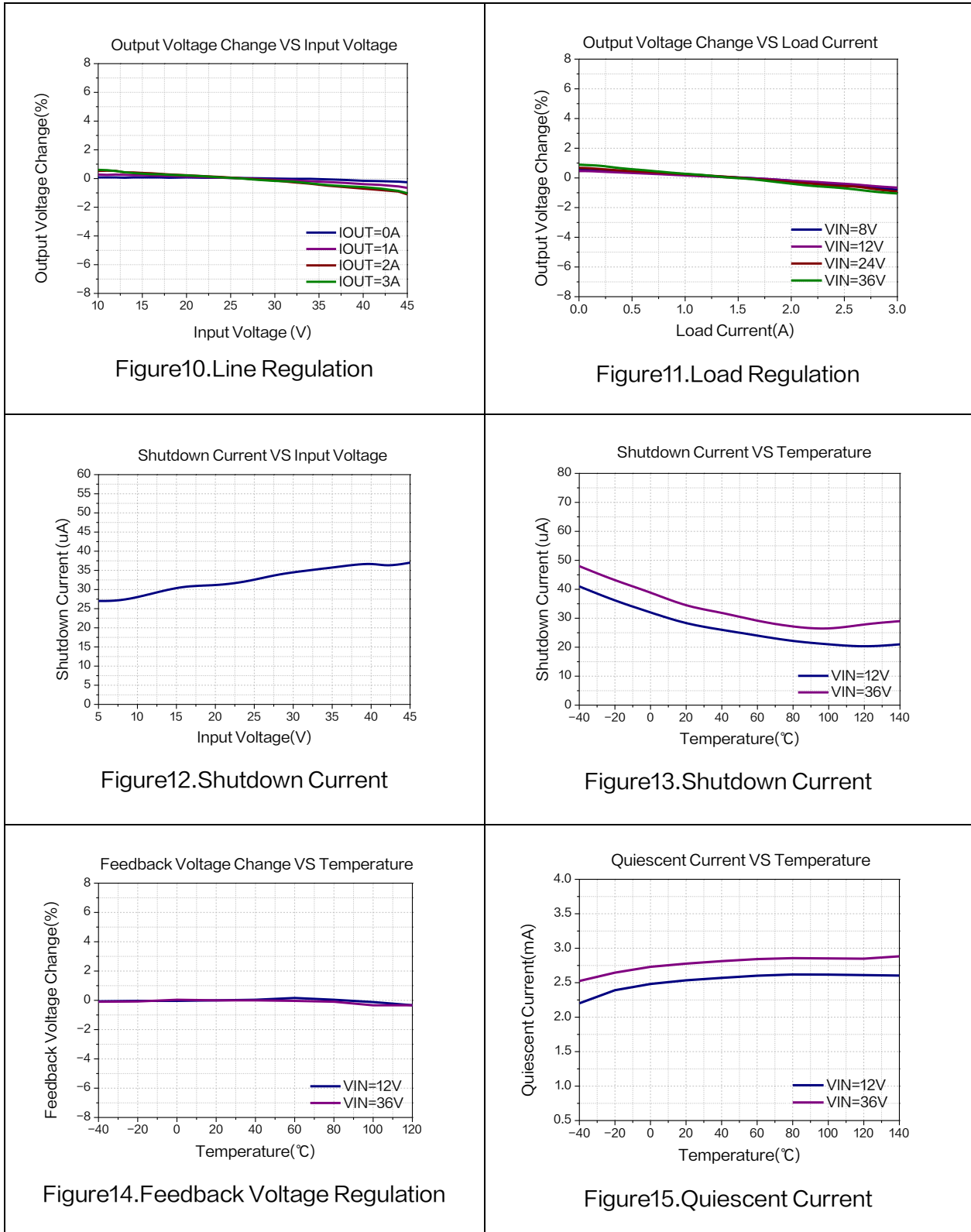


Figure9. XL9010 System Efficiency Curve ( $V_{OUT}=12V$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Typical Characteristics





## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

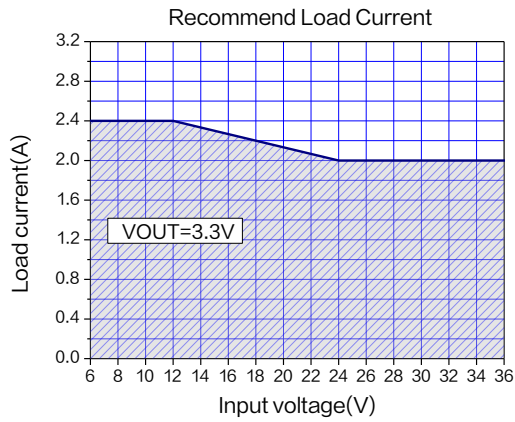


Figure 16. Max Output Current  
(V<sub>OUT</sub>=3.3V, T<sub>A</sub>=25°C)

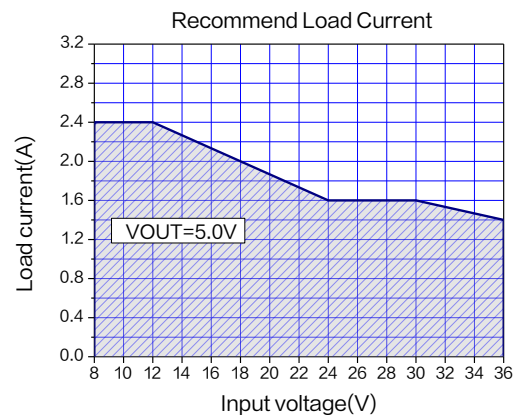


Figure 17. Max Output Current  
(V<sub>OUT</sub>=5.0V, T<sub>A</sub>=25°C)

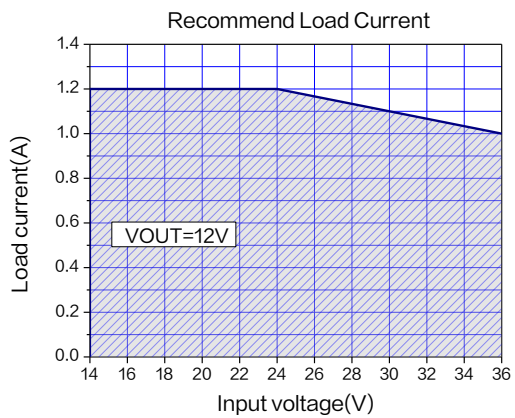


Figure 18. Max Output Current  
(V<sub>OUT</sub>=12V, T<sub>A</sub>=25°C)

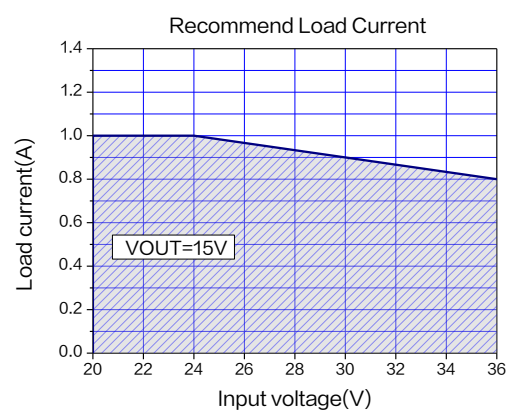


Figure 19. Max Output Current  
(V<sub>OUT</sub>=15V, T<sub>A</sub>=25°C)

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

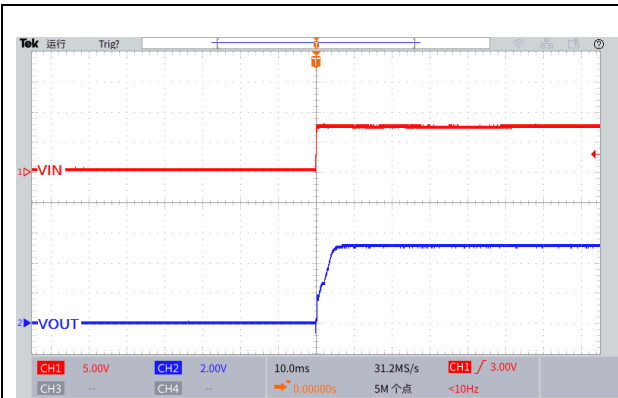


Figure 20. Start-Up Characteristic  
( $V_{IN}=8V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1A$ )

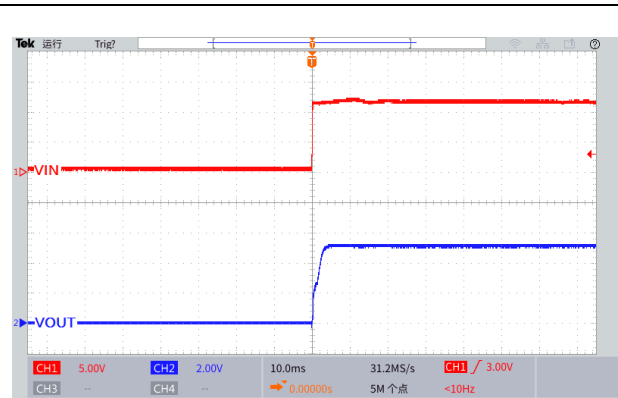


Figure 21. Start-Up Characteristic  
( $V_{IN}=12V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1A$ )

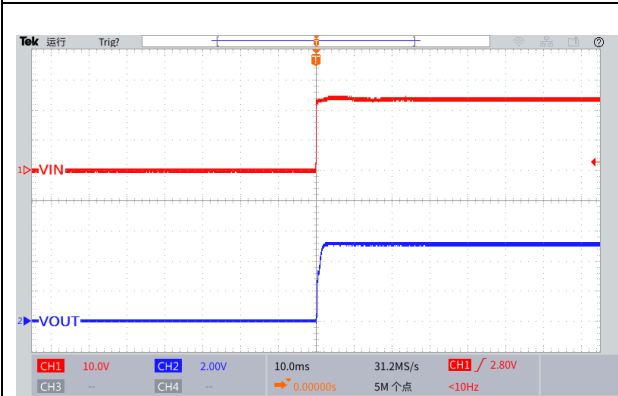


Figure 22. Start-Up Characteristic  
( $V_{IN}=24V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1A$ )

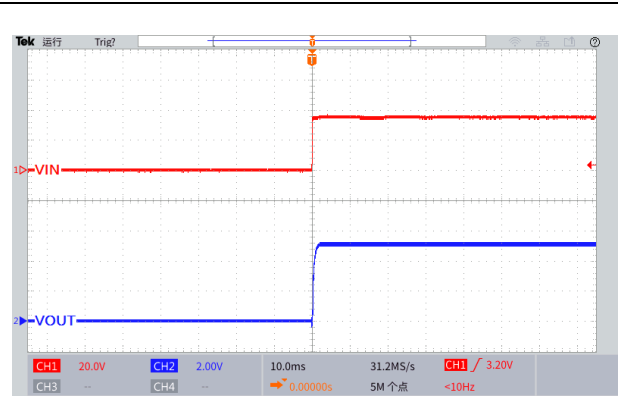


Figure 23. Start-Up Characteristic  
( $V_{IN}=36V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1A$ )

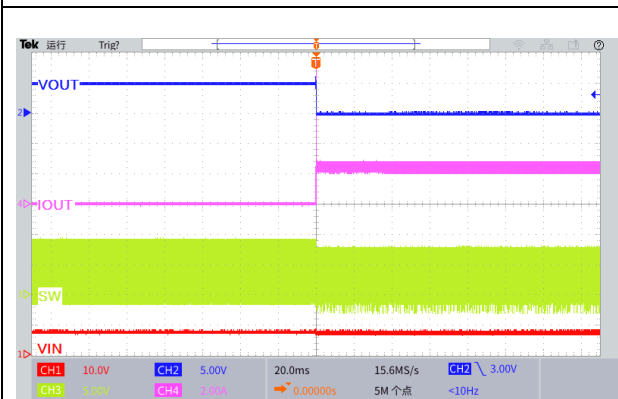


Figure 24. Output Short Circuit Waveform  
( $V_{IN}=8V$ ,  $V_{OUT}=5.0V$ )

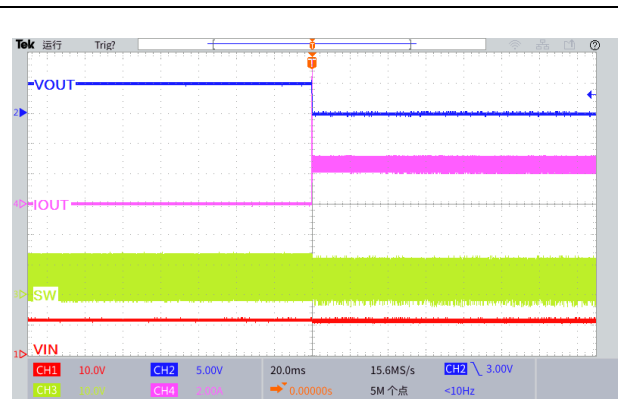


Figure 25. Output Short Circuit Waveform  
( $V_{IN}=12V$ ,  $V_{OUT}=5.0V$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

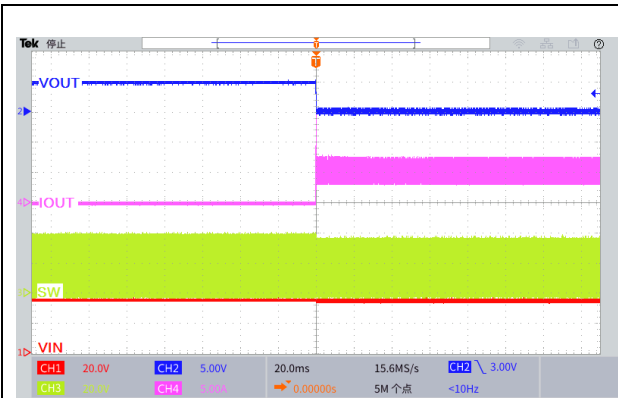


Figure 26. Output Short Circuit Waveform  
( $V_{IN}=24V$ ,  $V_{OUT}=5.0V$ )

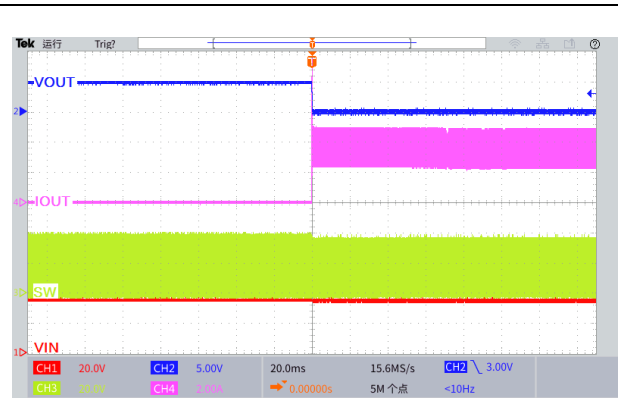


Figure 27. Output Short Circuit Waveform  
( $V_{IN}=36V$ ,  $V_{OUT}=5.0V$ )

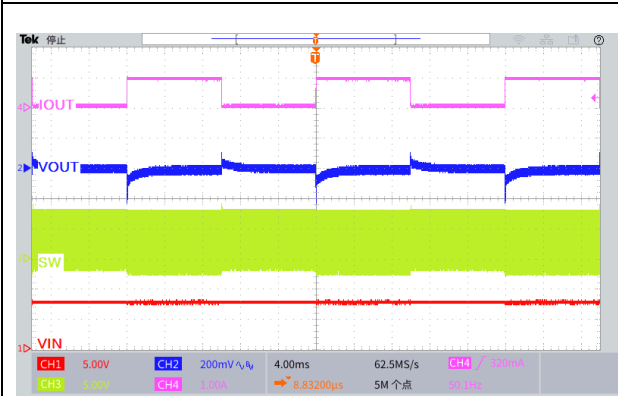


Figure 28. Load Transient Response  
( $V_{IN}=8V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1$  to  $1A$ )

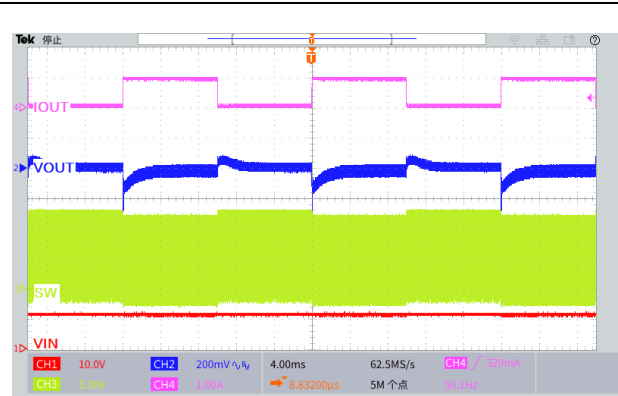


Figure 29. Load Transient Response  
( $V_{IN}=12V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1$  to  $1A$ )

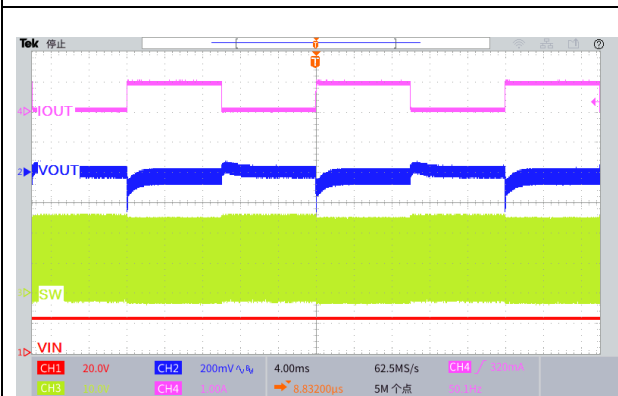


Figure 30. Load Transient Response  
( $V_{IN}=24V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1$  to  $1A$ )

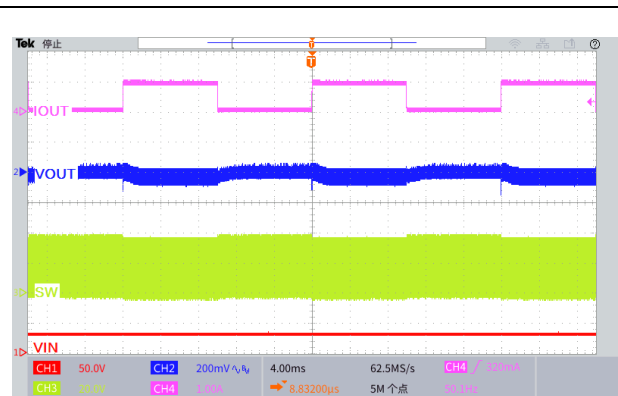


Figure 31. Load Transient Response  
( $V_{IN}=36V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.1$  to  $1A$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

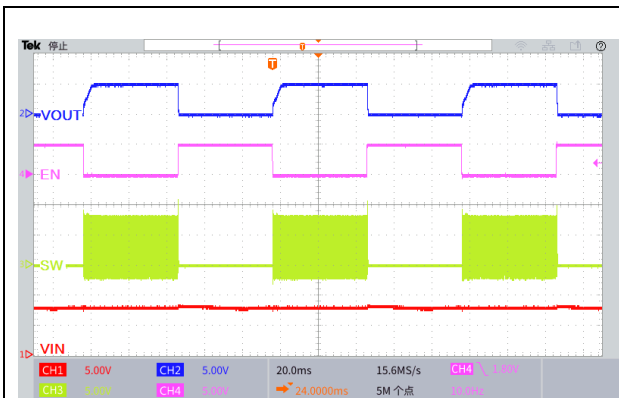


Figure32. Start or Shutdown Using EN Pin  
( $V_{IN}=8V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.5A$ )

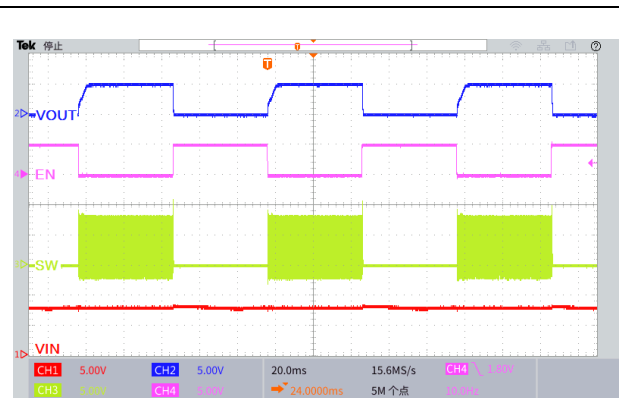


Figure33. Start or Shutdown Using EN Pin  
( $V_{IN}=12V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.5A$ )

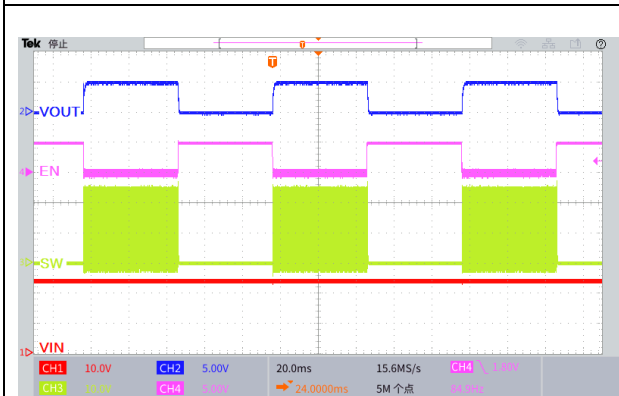


Figure34. Start or Shutdown Using EN Pin  
( $V_{IN}=24V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.5A$ )

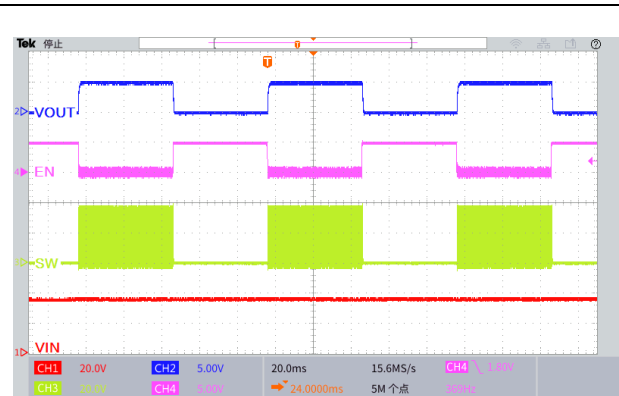
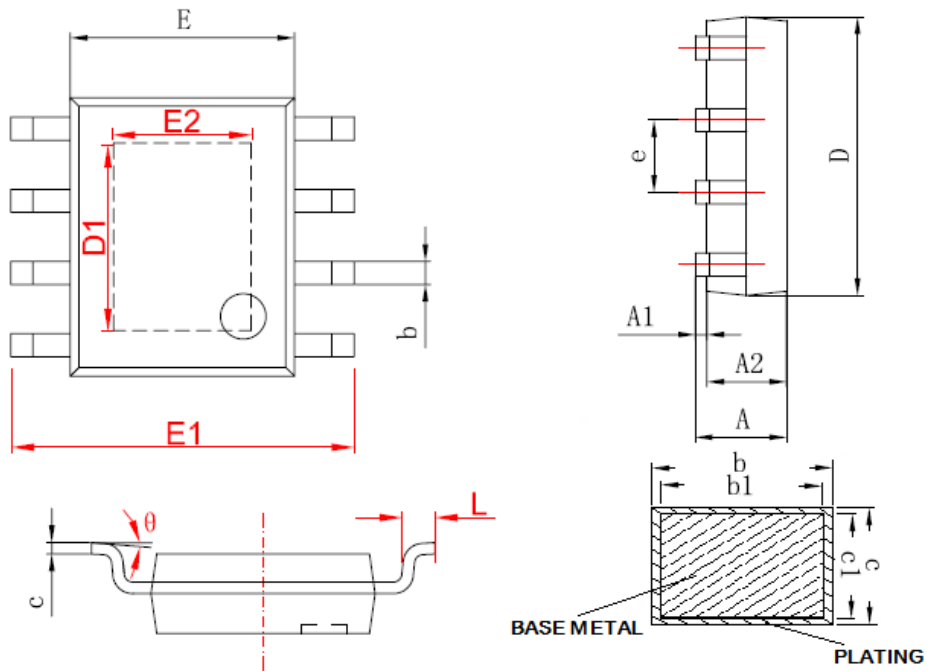


Figure35. Start or Shutdown Using EN Pin  
( $V_{IN}=36V$ ,  $V_{OUT}=5.0V$ ,  $I_{OUT}=0.5A$ )

## 3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010

### Package Information

#### SOP8-EP



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.000	0.150	0.000	0.006
A2	1.250	1.650	0.049	0.065
b	0.306	0.510	0.012	0.020
b1	0.296	0.480	0.011	0.019
c	0.170	0.250	0.006	0.010
c1	0.170	0.230	0.006	0.009
D	4.700	5.100	0.185	0.200
D1	2.650	3.467	0.104	0.136
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	1.930	2.534	0.076	0.100
e	1.140	1.400	0.045	0.055
L	0.450	0.800	0.017	0.031
θ	0°	8°	0°	8°

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**3.0A 200KHz 50V Synchronous Buck DC to DC Converter With CV/CC Loop XL9010**

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