2A 150kHz 32V Buck DC to DC Converter XL1509S

Features

- Operating Voltage：4.5V to 32V
- 3.3V,5.0V,and adjustable version
- Maximum Duty Cycle 100%
- Minimum Drop Out 1.5V
- Fixed 150kHz Switching Frequency
- 2A Constant Output Current Capability
- Internal Optimize Power Transistor
- High efficiency
- Excellent line and load regulation
- TTL shutdown capability
- EN pin with hysteresis function
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in SOP8 package

General Description

The XL1509S is a 150 kHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 2A load with high efficiency, low ripple an excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%.An enable function, an over current protection function is built inside. When output short protection function happens, the operation frequency will be reduced from 150 kHz to 38kHz.An internal compensation block is built in to minimize external component count.

Applications

- Telecom/Networking Equipment
- Smart Terminal
- Industrial Control

Typical application schematic

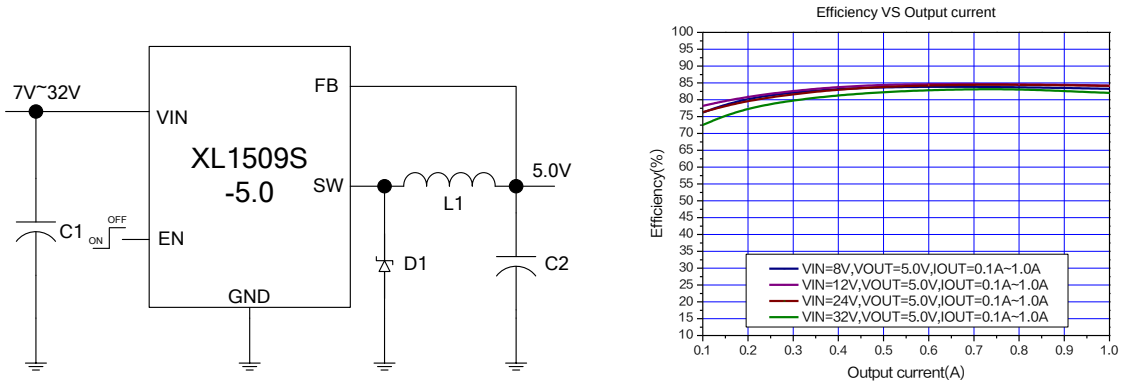


Figure1.XL1509S-5.0 Typical Application Schematic and Efficiency Curve

Pin Configurations

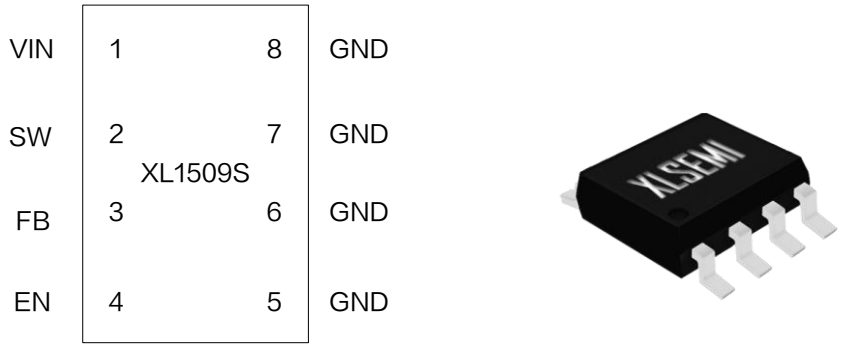


Figure2. Pin Configuration of XL1509S

Table1. Pin Description

Pin Number	Pin Name	Description
1	VIN	Supply Voltage Input Pin.XL1509S DC operating voltage range from a 4.5V to 32V.Bypass VIN to GND with a suitably large capacitor eliminate noise on the input.。
2	SW	Power Switch Output Pin (SW).
3	FB	Feedback Pin (FB). Through an external resistor divider network, detects the output voltage for adjustment, with an adjustable version reference voltage of 1.23V.
4	EN	Enable Pin. Driver EN pin low to turn on the device, drive it high to turn it off. Floating is default low.
5~8	GND	Ground Pin.

Ordering Information

Order Information	Marking ID	Package Type	Eco Plan	Packing Type Supplied As
XL1509S-ADJ	XL1509S-ADJ	SOP8	RoHS & HF	4000 Units on Reel
XL1509S-3.3	XL1509S-3.3	SOP8	RoHS & HF	4000 Units on Reel
XL1509S-5.0	XL1509S-5.0	SOP8	RoHS & HF	4000 Units on Reel

Function Block

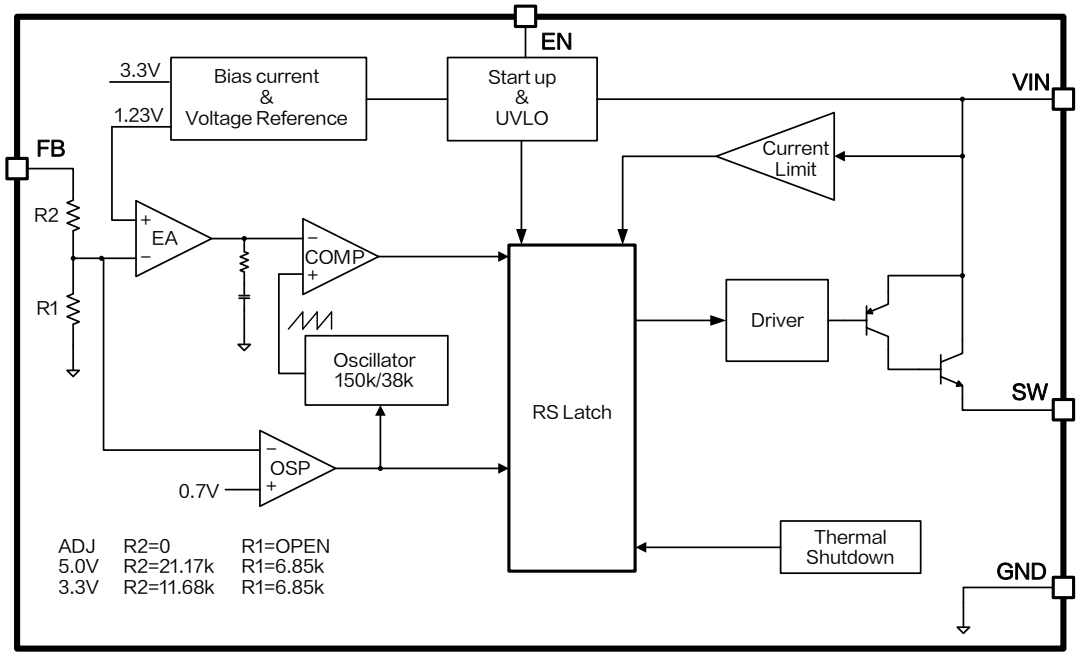


Figure3. Function Block Diagram of XL1509S

Absolute Maximum Ratings (Note1)

Parameter	符号	值	单位
Input Voltage	V_{IN}	−0.3~40	V
Feedback Pin Voltage	V_{FB}	−0.3~7	V
EN Pin Voltage	V_{EN}	−0.3~V_{IN}	V
Output Switch Pin Voltage	V_{SW}	−0.3~V_{IN}	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance(SOP8) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	100	°C /W
Operating Junction Temperature	T_J	−40~125	°C
Storage Temperature	T_{STG}	−65~150	°C
Lead Temperature(Soldering,10 sec)	T_{LEAD}	260	°C
ESD (HBM)		⩾3000	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.

XL1509S-ADJ Electrical Characteristics

T_A= 25°C；system parameters test circuit figure4，unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{FB}	Feedback Voltage	V_{IN}=12V ,V_{OUT}=5.0V I_{OUT}=0.5A	1.205	1.23	1.255	V
η	Efficiency	V_{IN}=12V ,V_{OUT}=5.0V I_{OUT}=0.5A	–	84.3	–	%

XL1509S-3.3 Electrical Characteristics

T_A = 25°C；system parameters test circuit figure6，unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN}=12V I_{OUT}=0.5A	3.201	3.3	3.399	V
η	Efficiency	V_{IN}=12V ,V_{OUT}=3.3V I_{OUT}=0.5A	–	80.3	–	%

XL1509S-5.0 Electrical Characteristics

T_A = 25°C；system parameters test circuit figure8，unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN}=12V I_{OUT}=0.5A	4.85	5.0	5.15	V
η	Efficiency	V_{IN}=12V ,V_{OUT}=5.0V I_{OUT}=0.5A	–	84.3	–	%

Electrical Characteristics (DC Parameters)

T_A = 25℃，V_{IN} = 12V，I_{OUT}=500mA; The others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V_{IN}		4.5		32	V
Shutdown Supply Current	I_S	V_{EN} =2V		70	200	μA
Quiescent Supply Current	I_Q	V_{FB} =6V		1.4		mA
Oscillator Frequency	F_{OSC}		120	150	180	kHz
Switch Current Limit	I_L	V_{FB} =0V		2.2		A
EN Pin Threshold	V_{EN_H}	High（Regulator OFF）		1.4		V
	V_{EN_L}	Low（Regulator ON）		0.8		V
EN Pin Current	I_{EN}	V_{EN} =2.5V		5		μA
Output Saturation Voltage	V_{CE}	V_{FB}=0V I_{OUT}=2A		1.3	1.5	V
Max. Duty Cycle	D_{MAX}	V_{FB}=0V		100		%

Typical System Application Schematic for ADJ Version

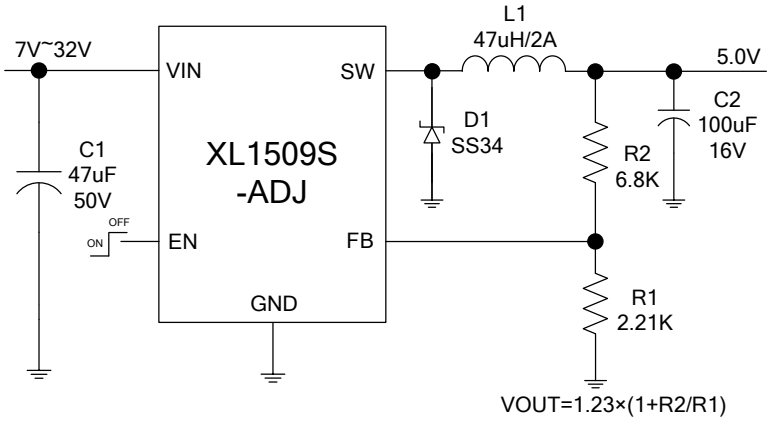


Figure4. XL1509S-ADJ System Parameters Test Circuit

Typical System Application Transfer Efficiency

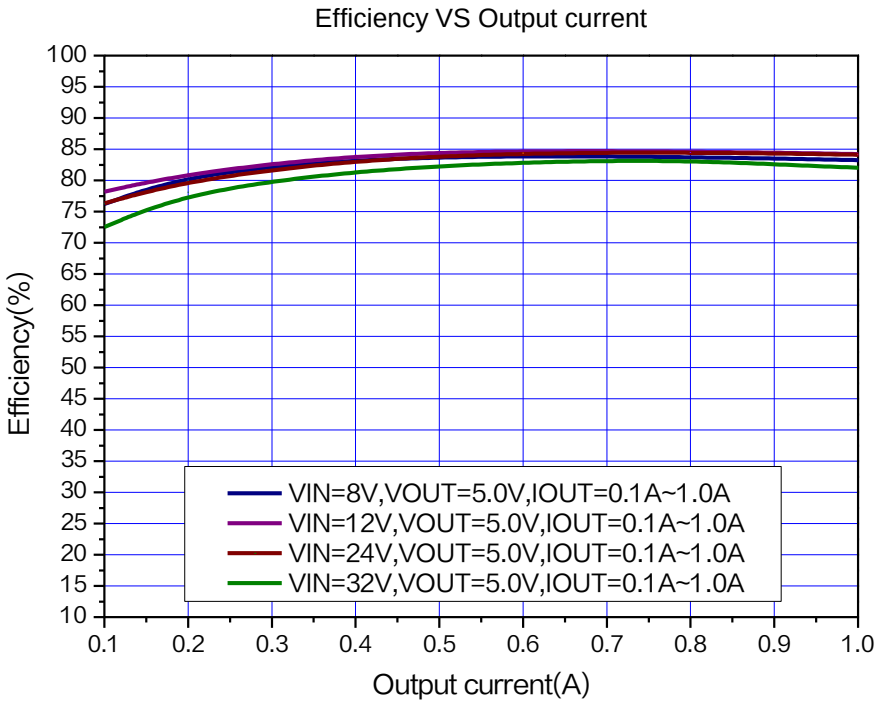


Figure5. XL1509S-ADJ System Efficiency Curve

Typical System Application Schematic for 3.3V Version

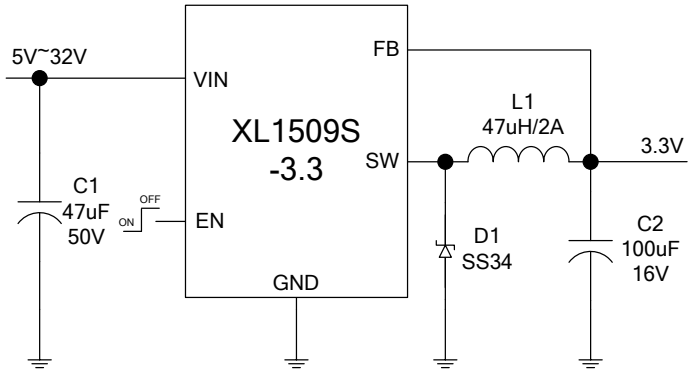


Figure6.XL1509S-3.3 System Parameters Test Circuit

Typical System Application Transfer Efficiency

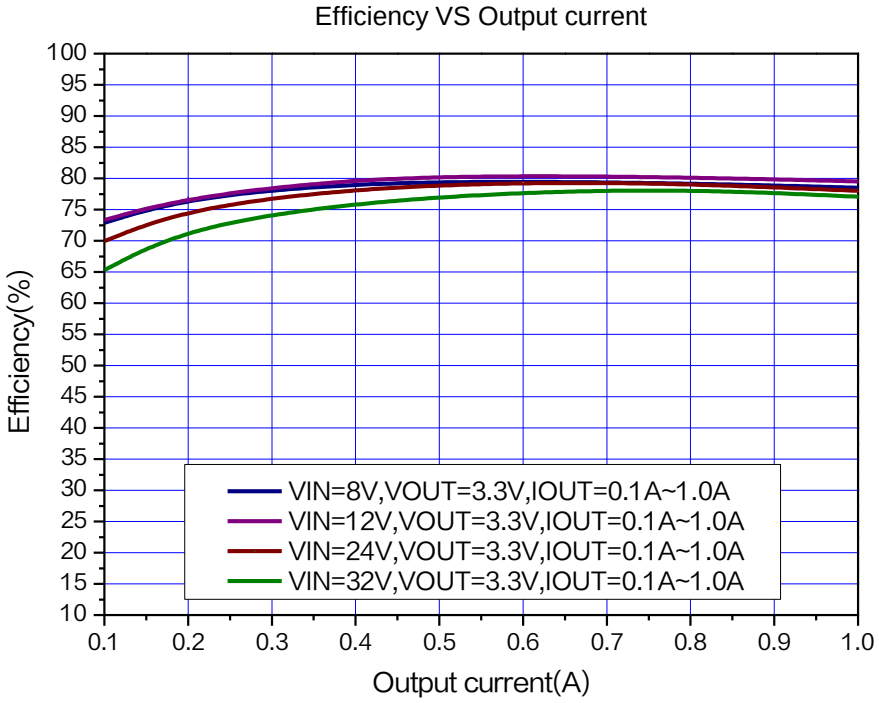


Figure7. XL1509S-3.3 System Efficiency Curve

Typical System Application Schematic for 5.0V Version

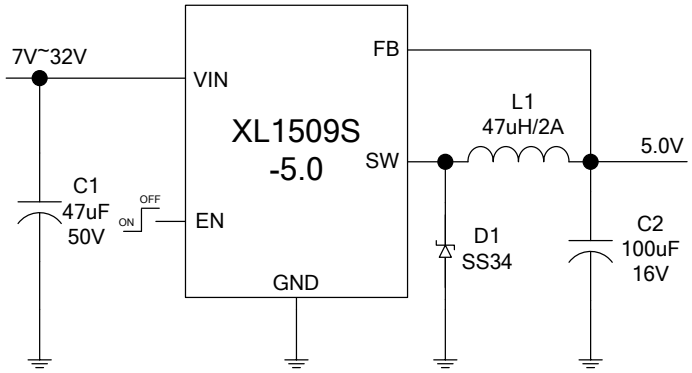


Figure8.XL1509S-5.0 System Parameters Test Circuit

Typical System Application Transfer Efficiency

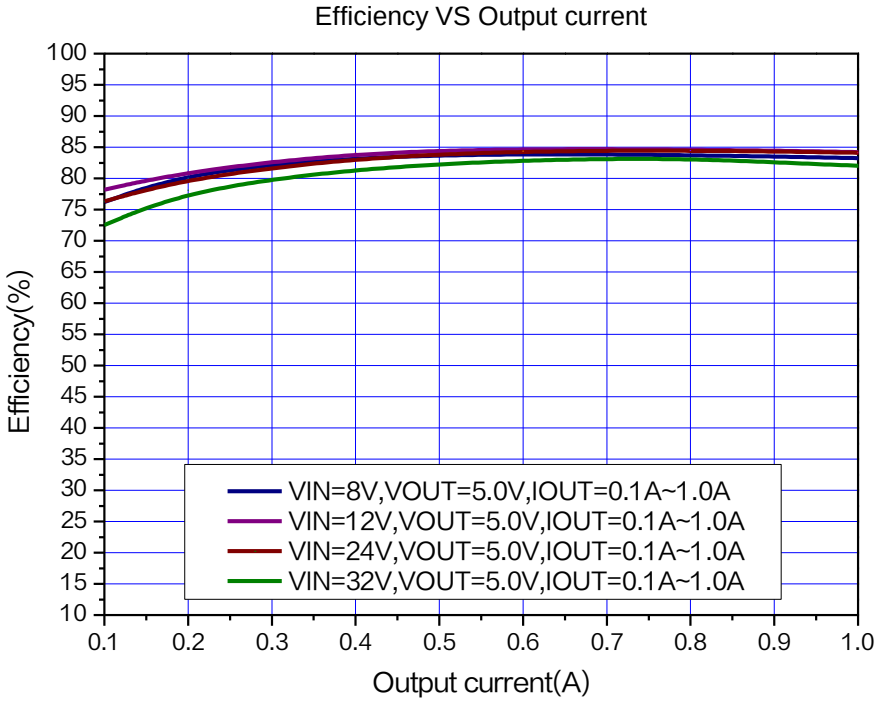


Figure9. XL1509S-5.0 System Efficiency Curve

Typical Characteristics

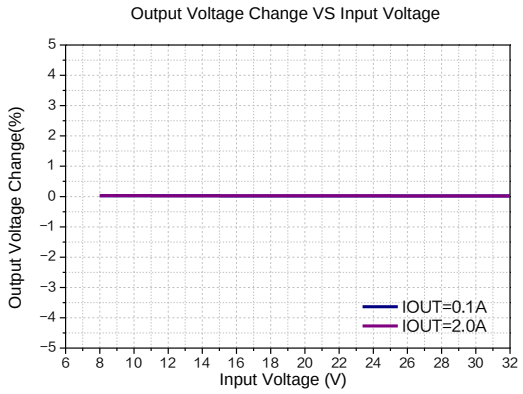


Figure10. Line Regulation

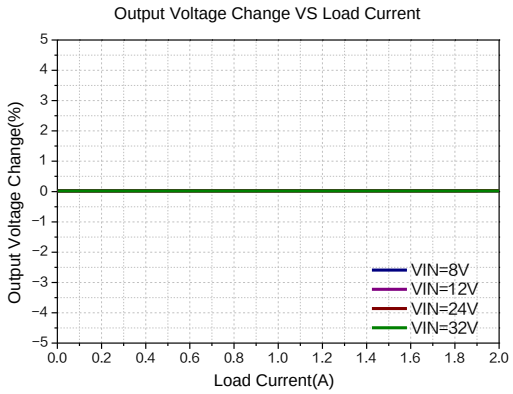


Figure11. Load Regulation

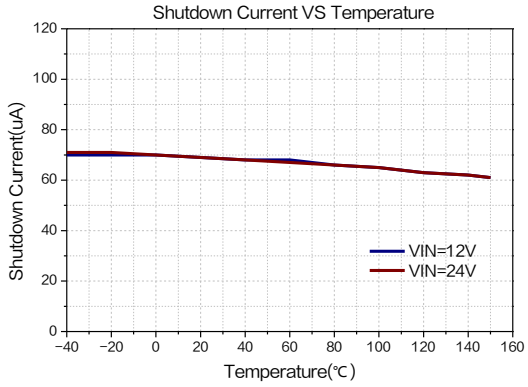


Figure12. Shutdown Current

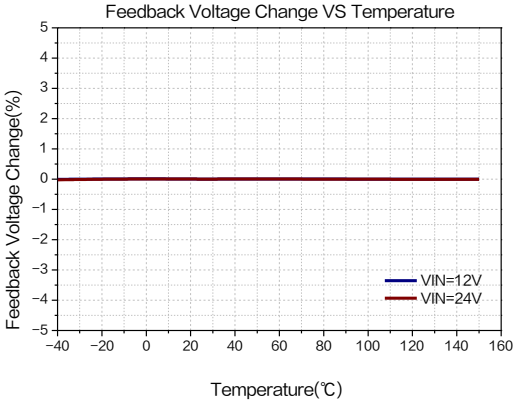


Figure13. Feedback Voltage Regulation

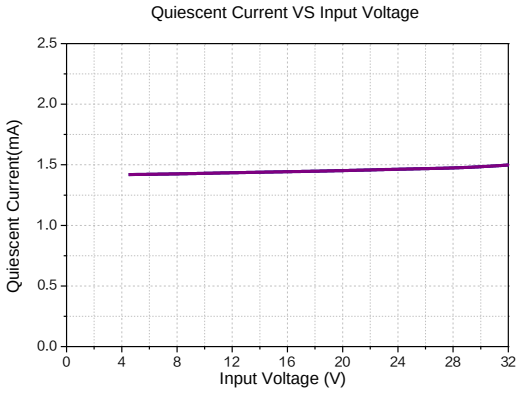


Figure14. Quiescent Current

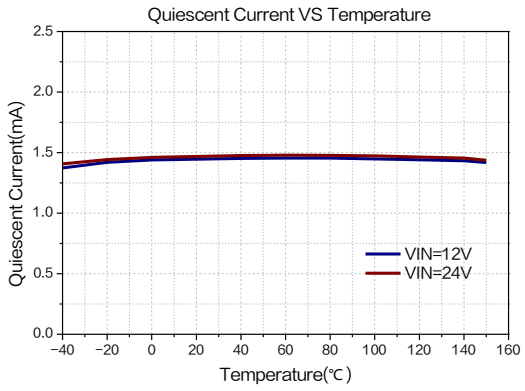


Figure15. Quiescent Current

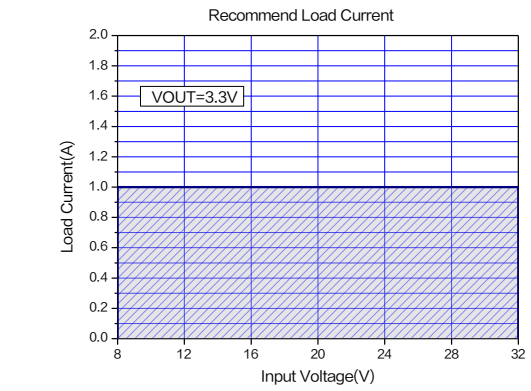


Figure16. Recommended Output Current
(V_{OUT}=3.3V，T_A=25℃)

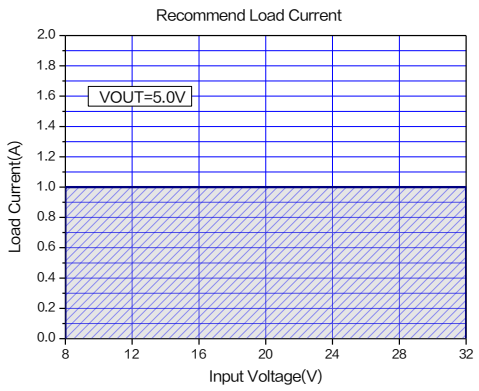


Figure17. Recommended Output Current
(V_{OUT}=5.0V，T_A=25℃)

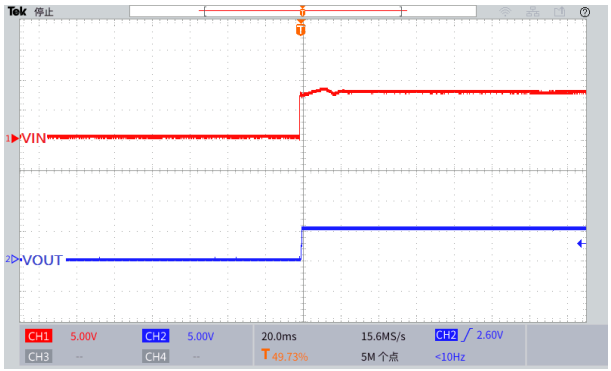


Figure18. Start-Up Characteristic
(V_{IN}=8V，V_{OUT}=5.0V，I_{OUT}=0.1A)

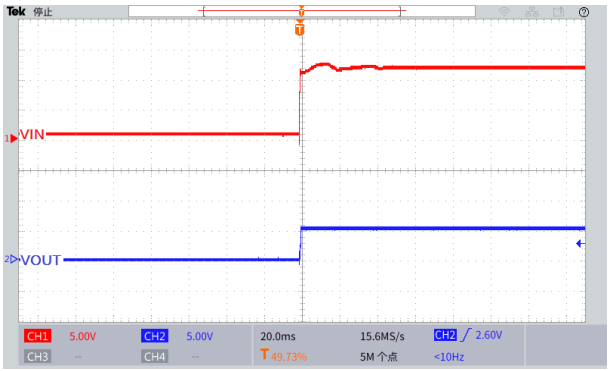


Figure19. Start-Up Characteristic
(V_{IN}=12V，V_{OUT}=5.0V，I_{OUT}=0.1A)

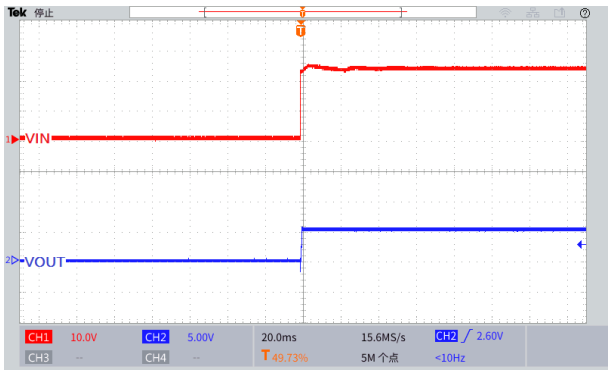


Figure20. Start-Up Characteristic
(V_{IN}=24V，V_{OUT}=5.0V，I_{OUT}=0.1A)

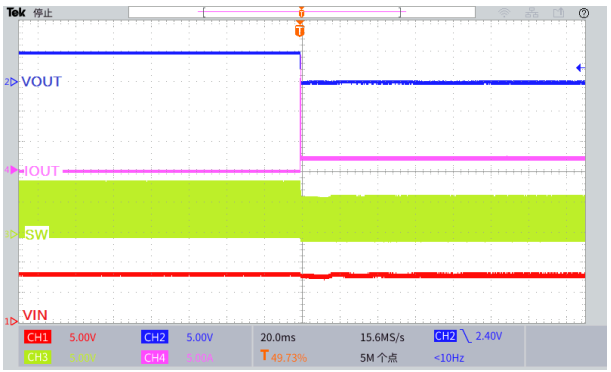


Figure21. Output Short Circuit Waveform
(V_{IN}=8V，V_{OUT}=5.0V)

Figure22. Output Short Circuit Waveform
(V_{IN}=12V，V_{OUT}=5.0V)

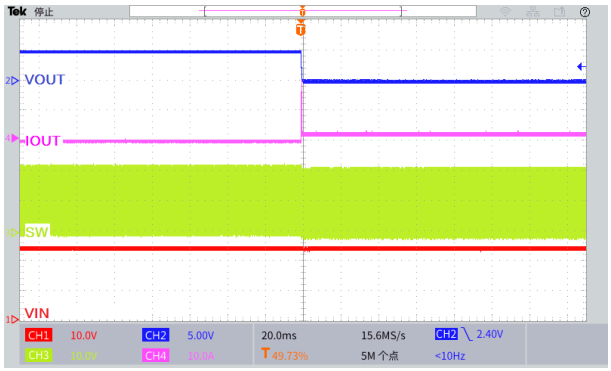


Figure23. Output Short Circuit Waveform
(V_{IN}=24V，V_{OUT}=5.0V)

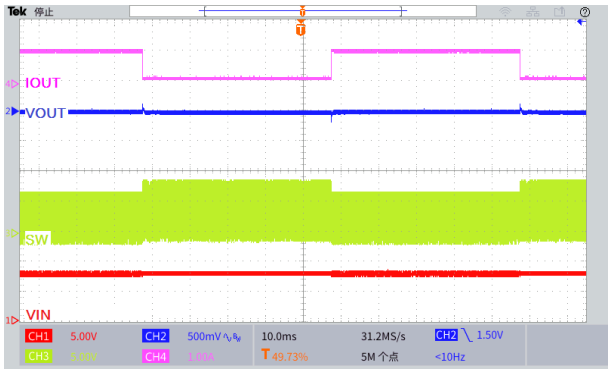


Figure24. Load Transient Response
(V_{IN}=8V，V_{OUT}=5.0V，I_{OUT}=0.1 to 1A)

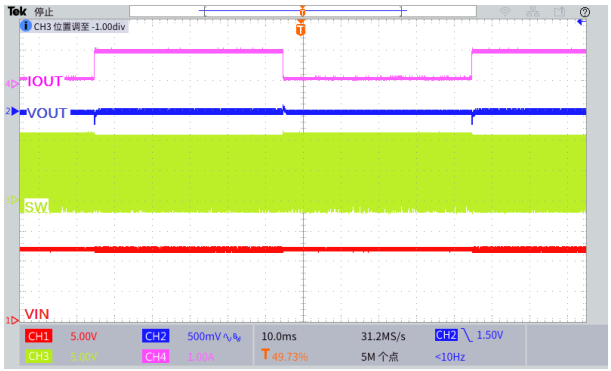


Figure25. Load Transient Response
(V_{IN}=12V，V_{OUT}=5.0V，I_{OUT}=0.1 to 1A)

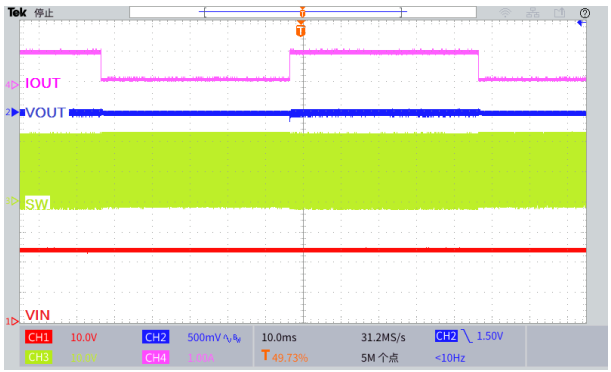


Figure26. Load Transient Response
(V_{IN}=24V，V_{OUT}=5.0V，I_{OUT}=0.1 to 1A)

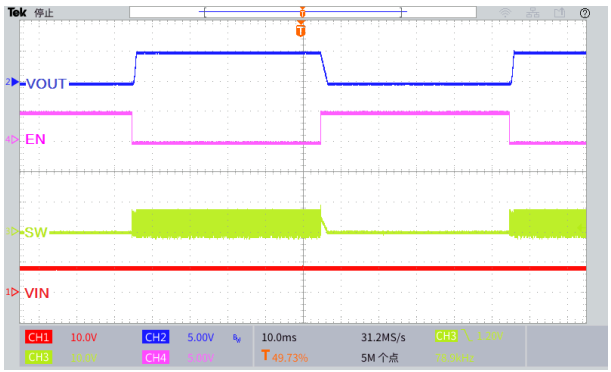


Figure27. Start or Shutdown Using EN Pin
(V_{IN}=8V，V_{OUT}=5.0V，I_{OUT}=0.5A)

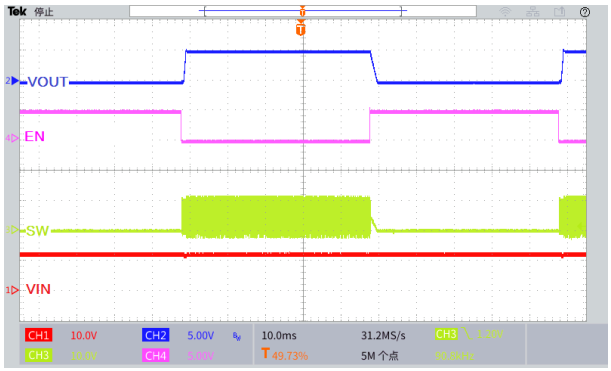


Figure28. Start or Shutdown Using EN Pin
(V_{IN}=12V，V_{OUT}=5.0V，I_{OUT}=0.5A)

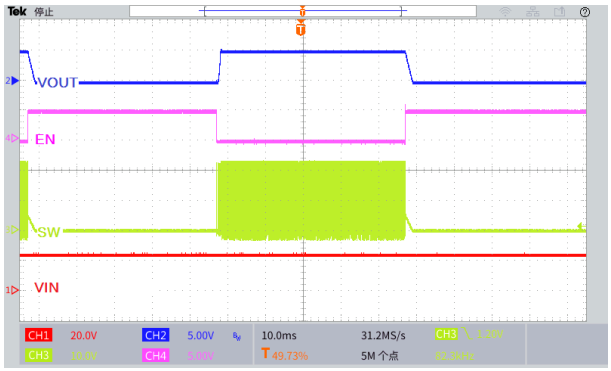
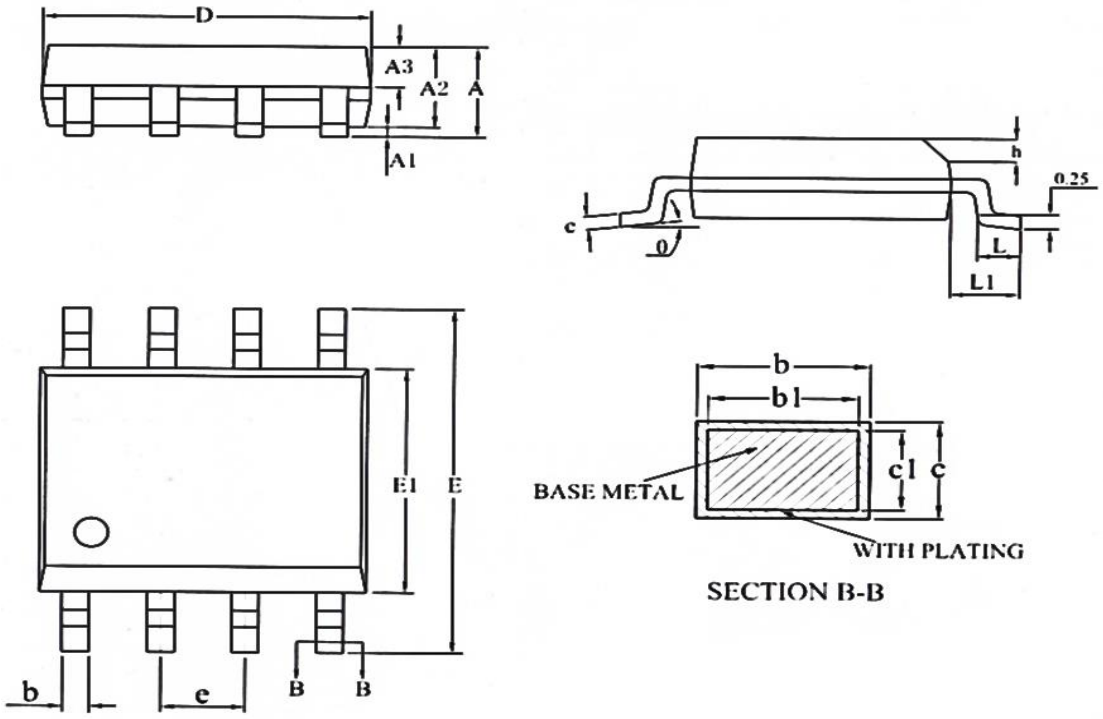


Figure29. Start or Shutdown Using EN Pin
(V_{IN}=24V，V_{OUT}=5.0V，I_{OUT}=0.5A)

Package Information

SOP8



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.05	–	0.25	0.002	–	0.010
A2	1.25	1.40	1.65	0.049	0.055	0.065
A3	0.50	0.60	0.70	0.019	0.024	0.028
b	0.30	–	0.51	0.012	–	0.020
b1	0.29	0.41	0.48	0.011	0.016	0.018
c	0.17	–	0.25	0.007	–	0.010
c1	0.17	0.20	0.23	0.007	0.008	0.009
D	4.70	4.90	5.10	0.185	0.193	0.200
E	5.80	6.00	6.20	0.228	0.236	0.244
	3.80	3.90	4.00	0.150	0.154	0.157
e	1.14	1.27	1.40	0.045	0.050	0.055
h	0.25	–	0.50	0.010	–	0.020
L	0.45	–	0.80	0.017	–	0.031
L1	0.82	1.03	1.23	0.032	0.040	0.048
θ	0	–	8°	0	–	8°

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