4A 120KHz 45V Synchronous Buck DC to DC Converter XL9023

Features

- Operation Voltage：5V~40V
- Output Adjustable from 1.25V to 35V
- Maximum Duty Cycle up to 100%
- Feedback Voltage Accuracy ±2%
- Fixed 120KHz Switching Frequency
- 4A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 95%
- Max. Output power up to 30W
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit protection function
- Built in output short protection function
- Temperature Grade 1: −40℃ to 125℃ Ambient Operating Temperature Range
- Device HBM ESD Classification Level Class3A
- Available in TO252−5L package

General Description

The XL9023 is a 120KHz fixed frequency PWM synchronous buck DC/DC converter, capable of driving a 4A load with high efficiency, low ripple and excellent line and load regulation. XL9023 supports wide input operating voltage range of 5V ~ 40V and a maximum duty cycle of 100% output. A built−in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space.

The XL9023 has built−in 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 120KHz to 30KHz.

Applications

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

Typical application schematic

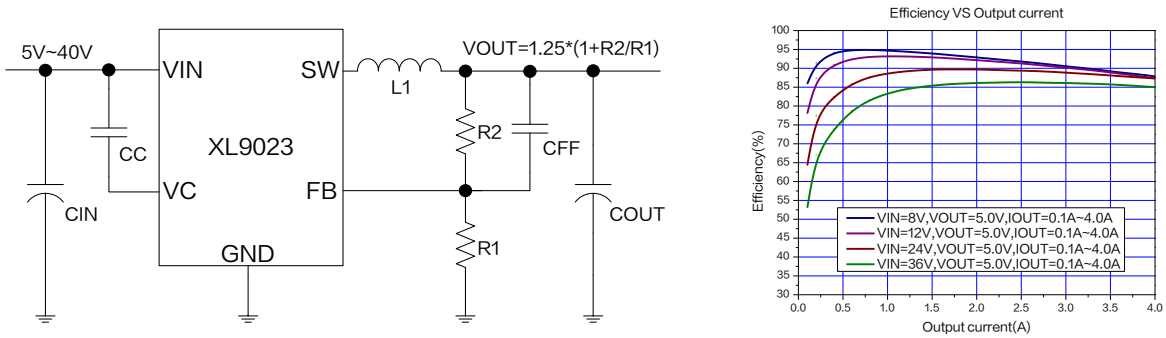


Figure1. XL9023 Typical application schematic and efficiency curve

Pin Configurations

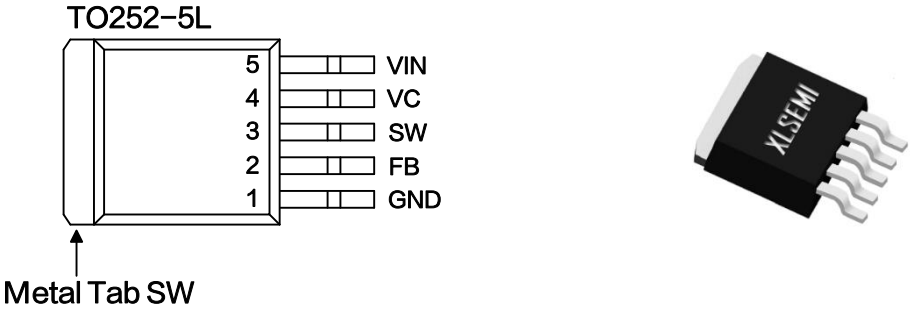


Figure2. Pin Configuration of XL9023

Table 1 Pin Description

Pin Number	Pin Name	Description
1	GND	Ground Pin.
2	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.
3	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
4	VC	Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uF capacitor to VIN.
5	VIN	Supply Voltage Input Pin. XL9023 operates from 5V to 40V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.

Ordering Information

Order Information	Marking ID	Package Type	Eco Plan	Packing Type Supplied As
XL9023	XL9023	TO252-5L	RoHS & HF	2500 Units on Reel

Function Block

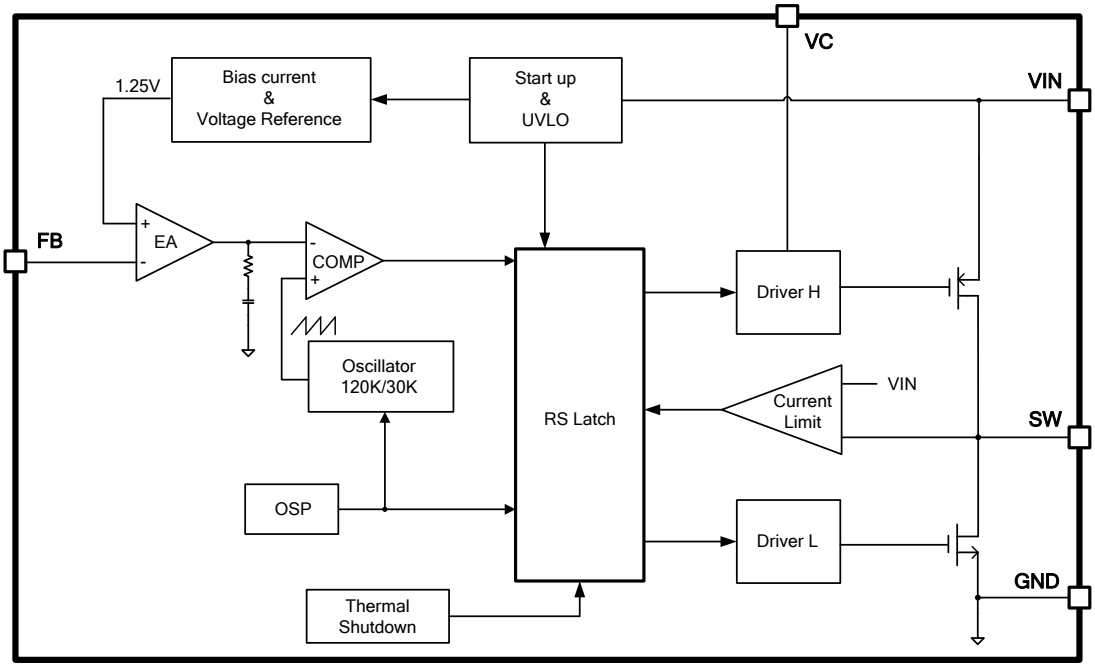


Figure3. Function Block Diagram of XL9023

Absolute Maximum Ratings（Note1）

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	−0.3~45	V
Internal Voltage Regulator Bypass Capacity.	V_C	−0.3~V_{IN}	V
Feedback Pin Voltage	V_{FB}	−0.3~7	V
Output Switch Pin Voltage	V_{SW}	−0.3~V_{IN}	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (TO252−5L) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	50	℃/W
Operating Junction Temperature	T_J	−40~150	℃
Storage Temperature	T_{STG}	−65~150	℃
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	℃
ESD (HBM)		>4000	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.

XL9023 Electrical Characteristics

T_A = 25℃; system parameters test circuit figure6, 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	1.225	1.25	1.275	V
η	Efficiency	V_{IN} =12V, V_{OUT} =5.0V I_{OUT} =1.0A	–	93.0	–	%
η	Efficiency	V_{IN} =24V, V_{OUT} =12V I_{OUT} =1.5A	–	95.0	–	%

Electrical Characteristics (DC Parameters)

T_A=25℃,V_{IN}=12V;system parameters test circuit figure6, unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V_{IN}		5		40	V
Quiescent Supply Current	I_Q	V_{FB} =2V		2.3	5	mA
Oscillator Frequency	F_{OSC}		96	120	144	KHz
Switch Current Limit	I_L	V_{FB}=0		4.2		A
High side MOS On-resistance	$R_{DS(ON)H}$			68		mΩ
Low side MOS On-resistance	$R_{DS(ON)L}$			50		mΩ
Thermal Shutdown Temperature	T_{SD}			170		℃
Thermal Shutdown Hysteresis	T_D			50		℃
Maximum Duty Cycle	D_{MAX}			100		%

Typical System Application Schematic (V_{OUT}=3.3V, I_{OUT}=0~4A)

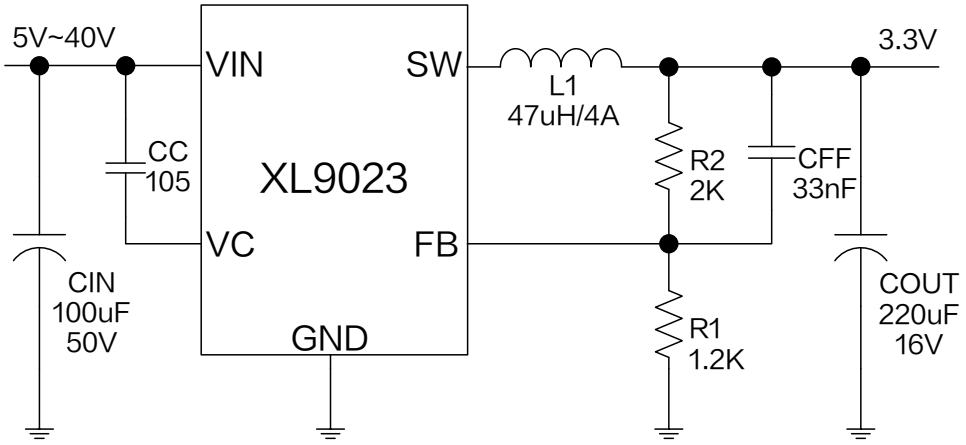


Figure4. XL9023 System Application (V_{IN}=5V~40V, V_{OUT}=3.3V, I_{OUT}=0~4A)

Typical System Application Transfer Efficiency

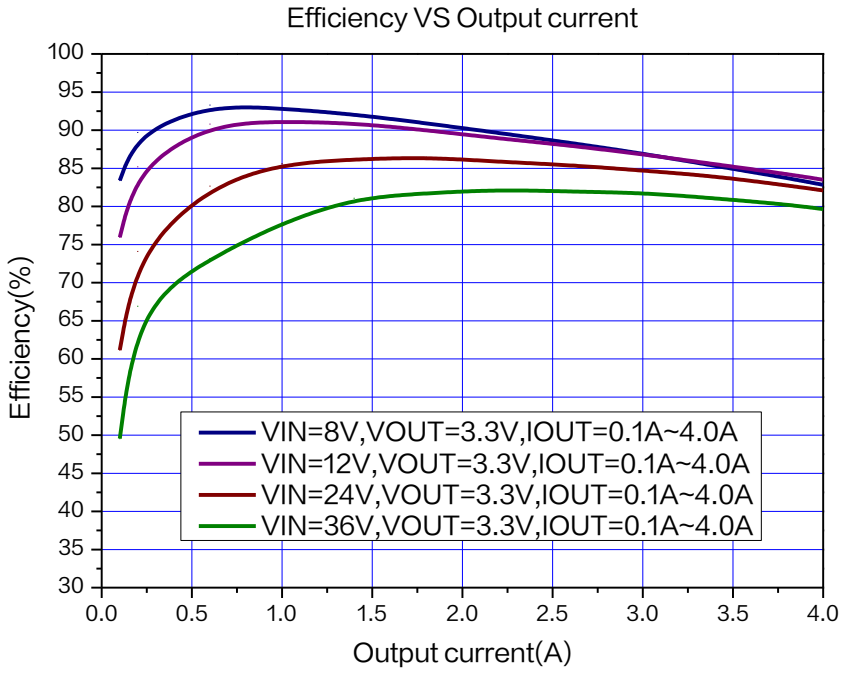


Figure5. XL9023 System Efficiency Curve(V_{OUT}=3.3V)

Typical System Application Schematic (V_{OUT}=5.0V, I_{OUT}=0~4A)

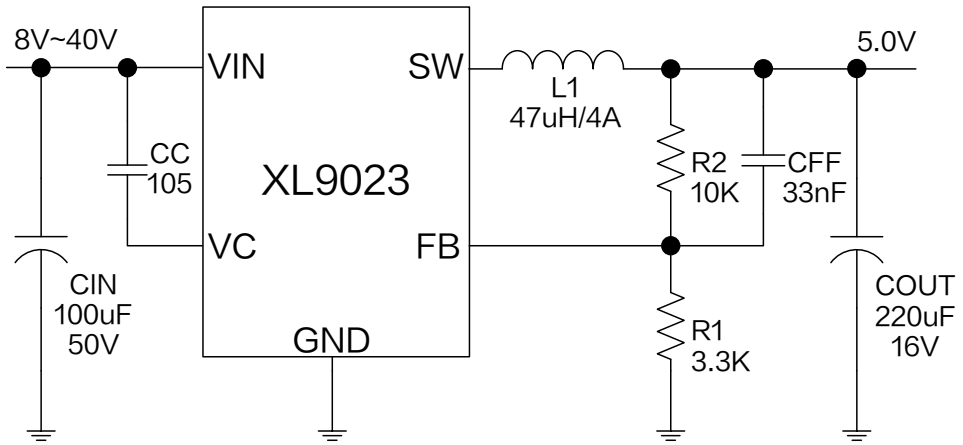


Figure6. XL9023 System Application (V_{IN}=8V~40V, V_{OUT}=5.0V, I_{OUT}=0~4A)

Typical System Application Transfer Efficiency

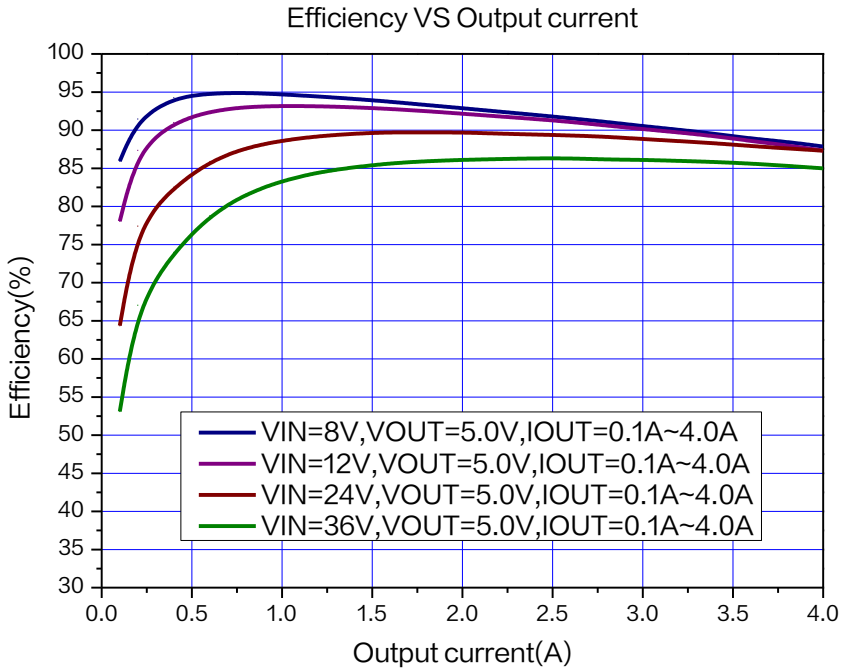


Figure7. XL9023 System Efficiency Curve(V_{OUT}=5.0V)

Typical System Application Schematic (V_{OUT}=12V, I_{OUT}=0~2.5A)

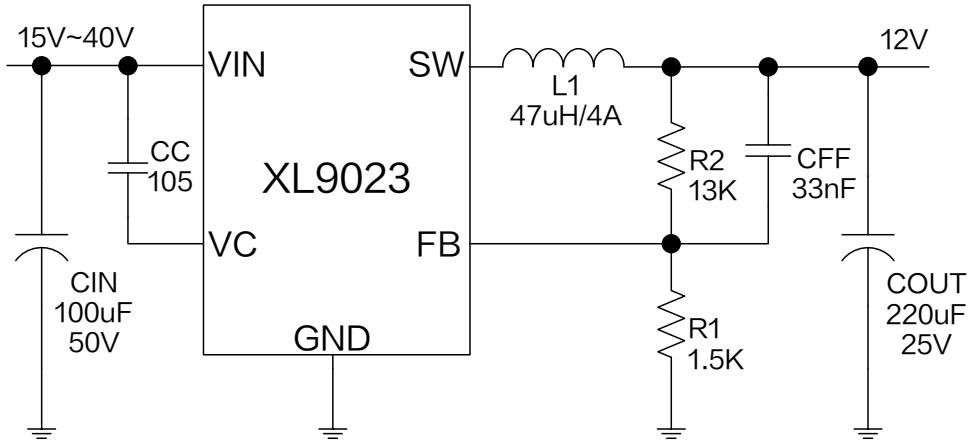


Figure8. XL9023 System Parameters Test Circuit (V_{IN}=15V~40V, V_{OUT}=12V, I_{OUT}=0-2.5A)

Typical System Application Transfer Efficiency

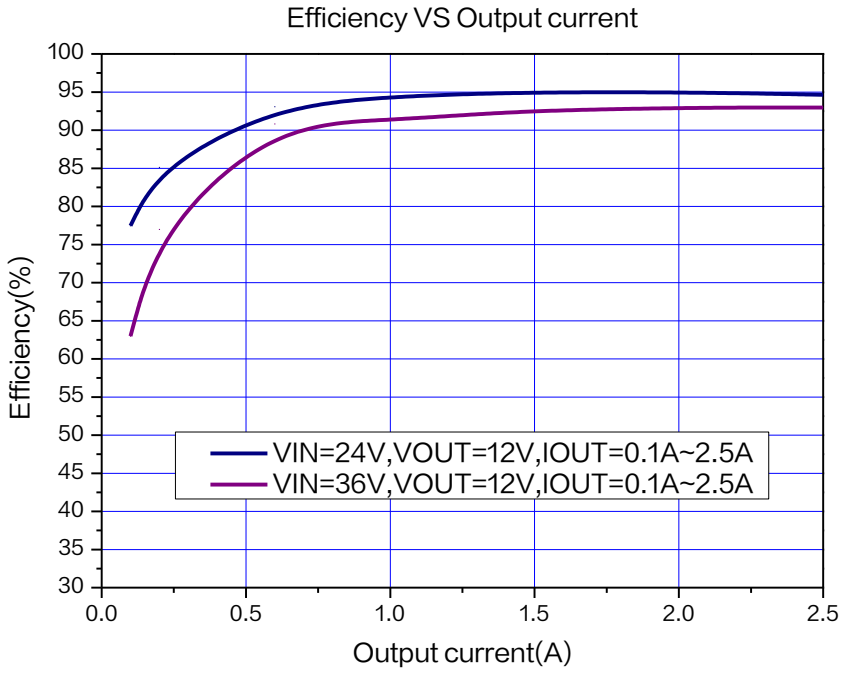


Figure9. XL9023 System Efficiency Curve(V_{OUT}=12V)

Typical System Application Schematic (V_{OUT}=15V, I_{OUT}=0~2A)

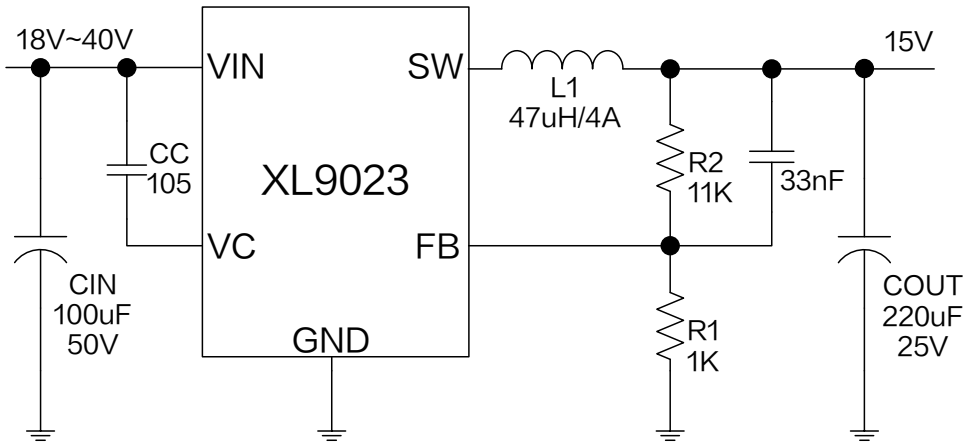


Figure10. XL9023 System Parameters Test Circuit (V_{IN}=18V~40V, V_{OUT}=15V, I_{OUT}=0-2A)

Typical System Application Transfer Efficiency

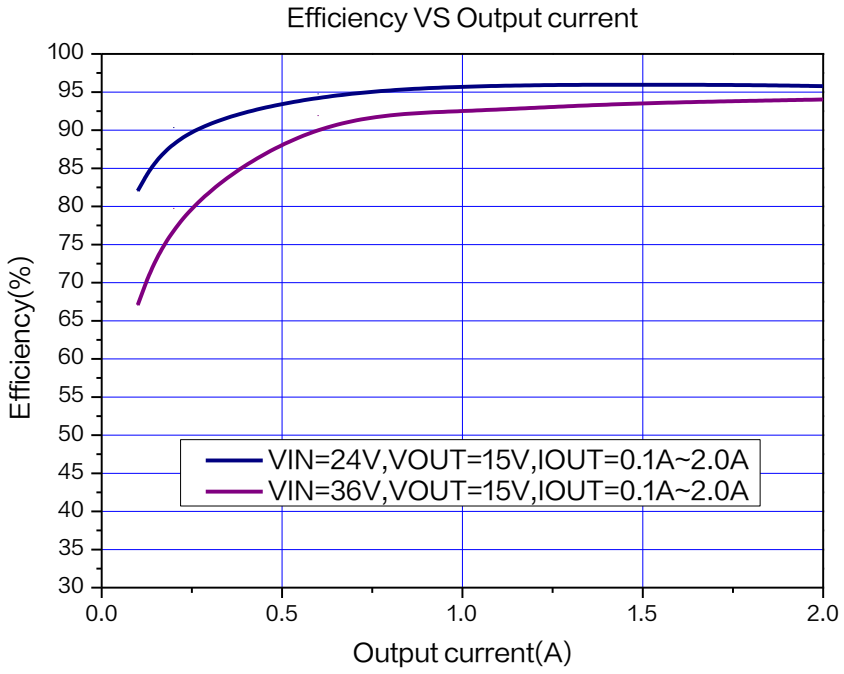


Figure11. XL9023 System Efficiency Curve(V_{OUT}=15V)

Typical Characteristics

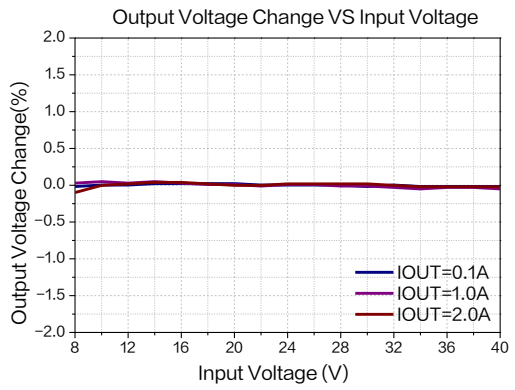


Figure12.Line Regulation

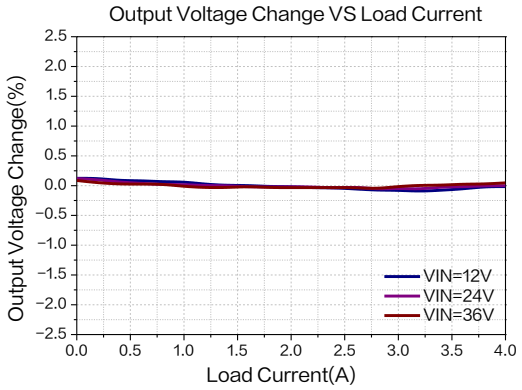


Figure13.Load Regulation

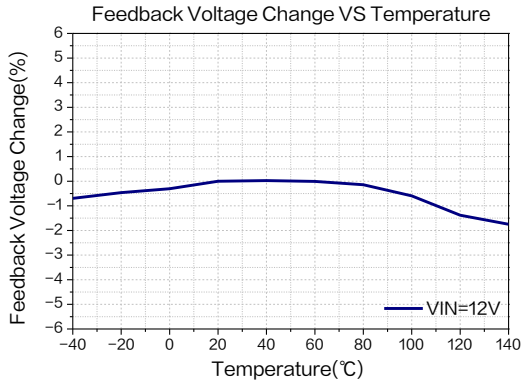


Figure14.Feedback Voltage Regulation

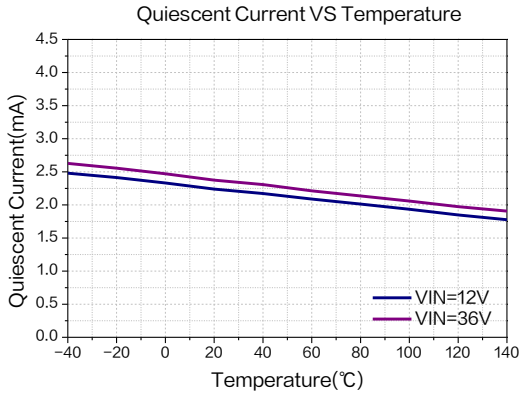


Figure15.Quiescent Current

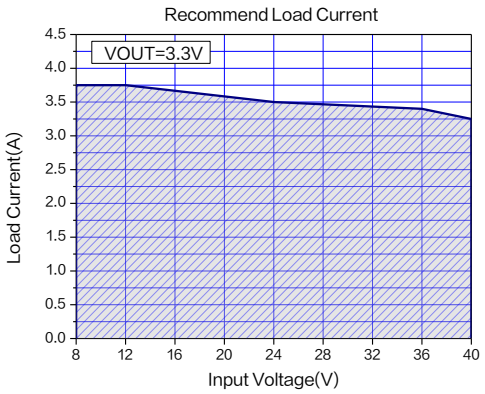


Figure 16.Max Output Current
(V_{OUT}=3.3V，T_A=25℃)

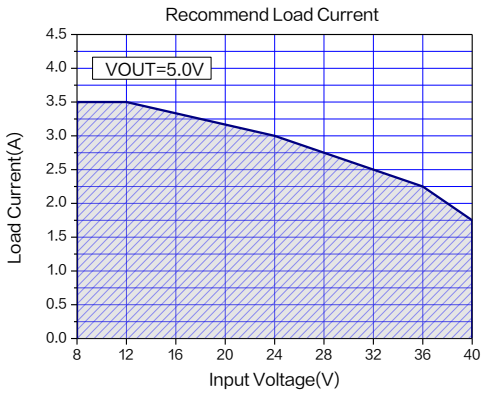


Figure 17.Max Output Current
(V_{OUT}=5.0V，T_A=25℃)

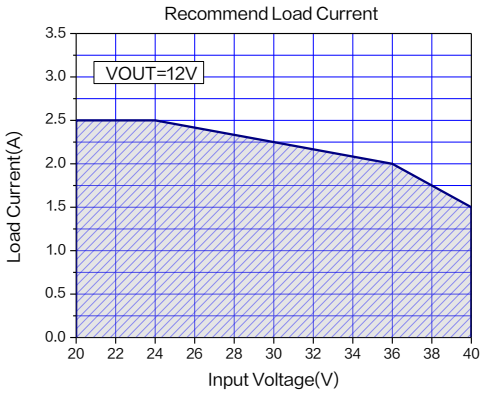


Figure 18.Max Output Current
(V_{OUT}=12V，T_A=25℃)

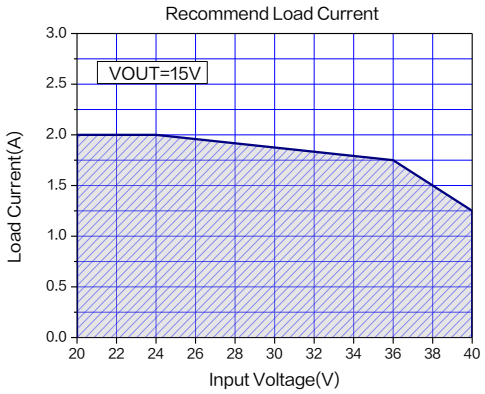


Figure 19.Max Output Current
(V_{OUT}=15V，T_A=25℃)

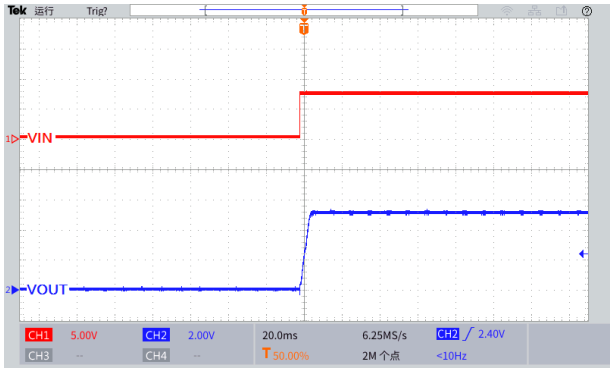


Figure 20. Start-Up Characteristic
(V_{IN}=8V，V_{OUT}=5.0V，I_{OUT}=0.1A)

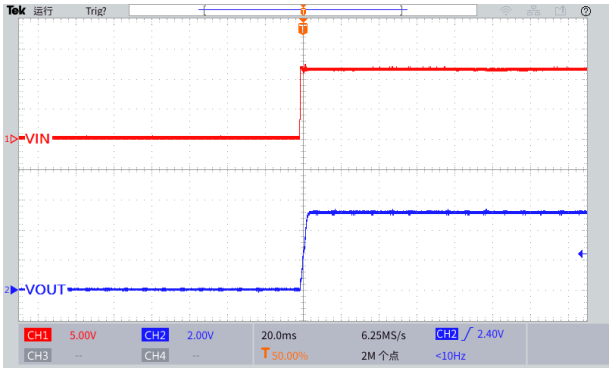


Figure 21. Start-Up Characteristic
(V_{IN}=12V，V_{OUT}=5.0V，I_{OUT}=0.1A)

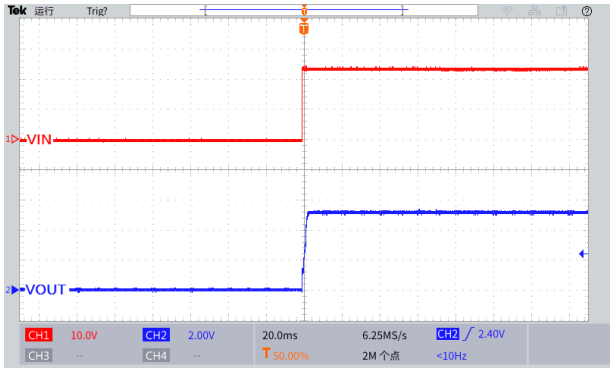


Figure 22. Start-Up Characteristic
(V_{IN}=24V，V_{OUT}=5.0V，I_{OUT}=0.1A)

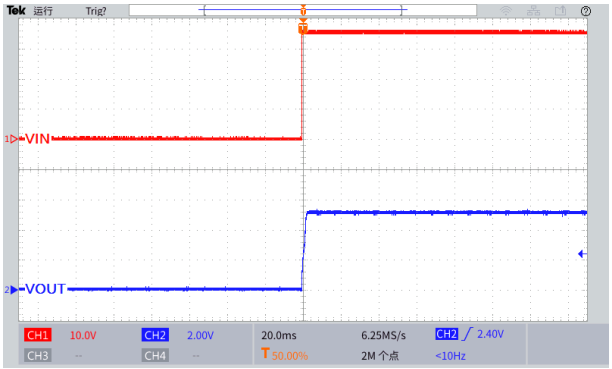


Figure 23. Start-Up Characteristic
(V_{IN}=36V，V_{OUT}=5.0V，I_{OUT}=0.1A)

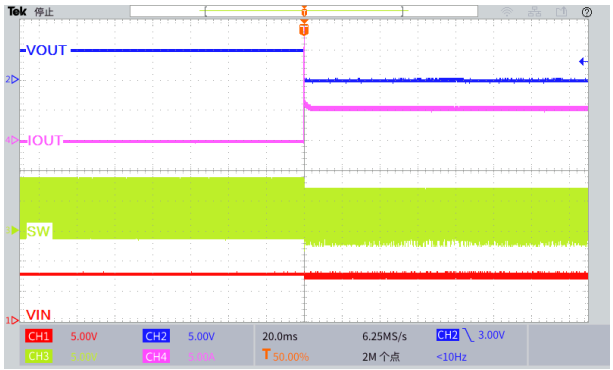


Figure 24. Output Short Circuit Waveform
(V_{IN}=8V，V_{OUT}=5.0V)

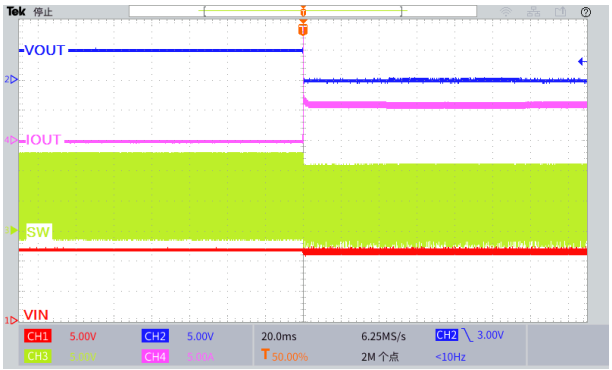


Figure 25. Output Short Circuit Waveform
(V_{IN}=12V，V_{OUT}=5.0V)

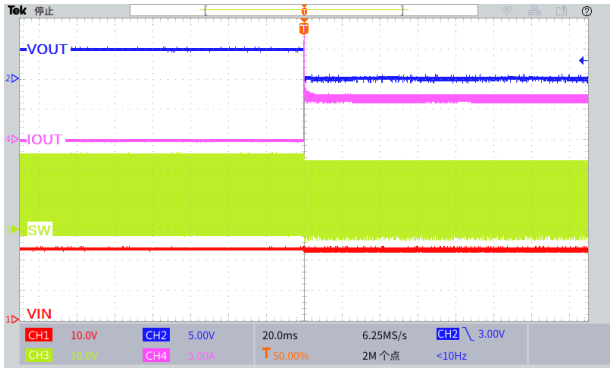


Figure 26. Output Short Circuit Waveform
(V_{IN}=24V，V_{OUT}=5.0V)

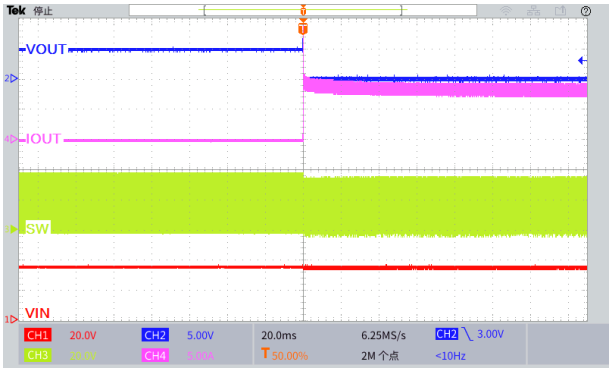


Figure 27. Output Short Circuit Waveform
(V_{IN}=36V，V_{OUT}=5.0V)

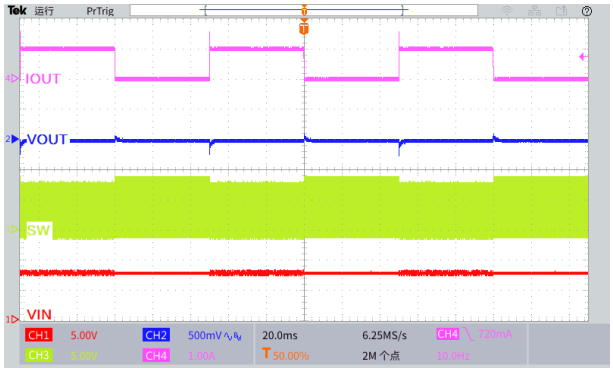


Figure28. Load Transient Response
(V_{IN}=8V，V_{OUT}=5.0V，I_{OUT}=0 to 1A)

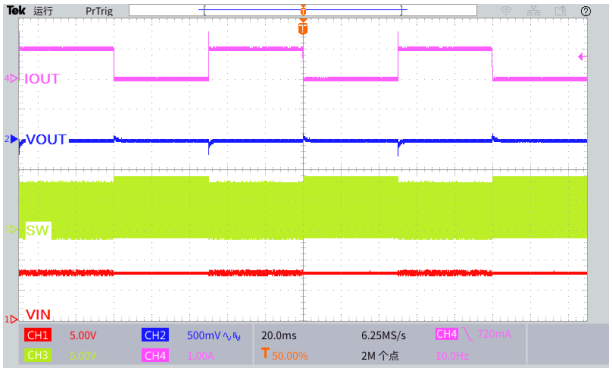


Figure29. Load Transient Response
(V_{IN}=12V，V_{OUT}=5.0V，I_{OUT}=0 to 1A)

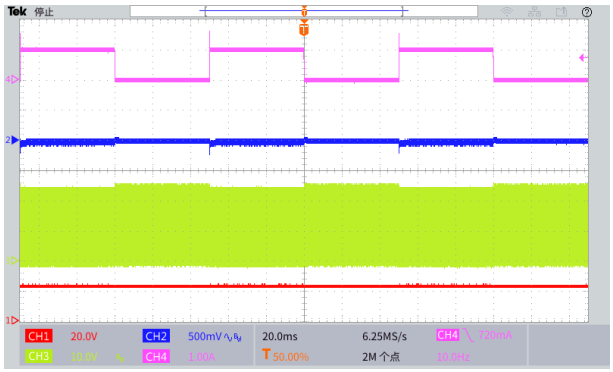


Figure30. Load Transient Response
(V_{IN}=24V，V_{OUT}=5.0V，I_{OUT}=0 to 1A)

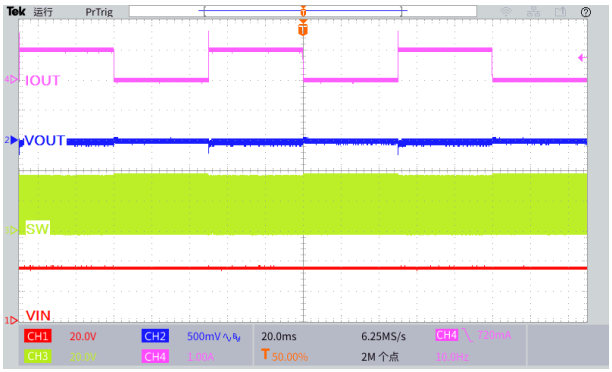
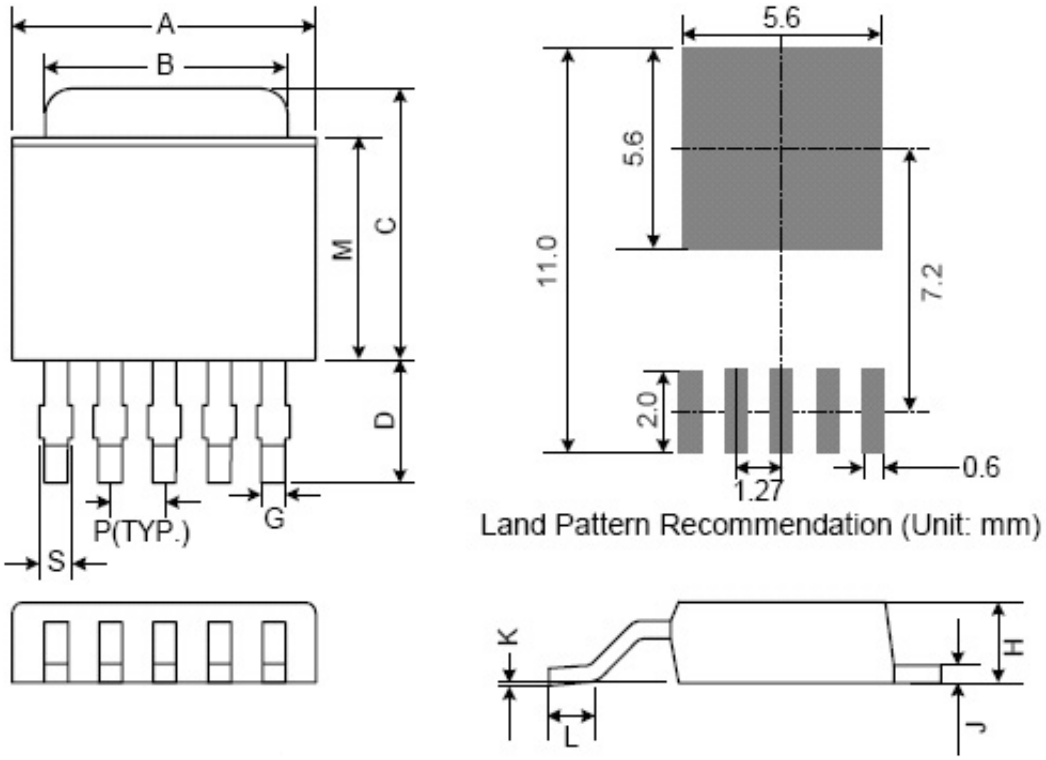


Figure31. Load Transient Response
(V_{IN}=36V，V_{OUT}=5.0V，I_{OUT}=0 to 1A)

Package Information

TO252-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	6.35	6.60	6.85	0.250	0.260	0.270
B	5.20	5.35	5.50	0.205	0.211	0.217
C	6.80	7.00	7.30	0.268	0.276	0.287
D	2.40	2.80	3.20	0.094	0.110	0.126
P	1.27 REF.			0.05 REF.		
S	0.50	0.65	0.80	0.020	0.026	0.031
G	0.40	0.50	0.63	0.016	0.020	0.025
H	2.20	2.30	2.40	0.087	0.091	0.094
J	0.45	0.52	0.58	0.018	0.020	0.023
K	0.00	0.08	0.15	0.000	0.003	0.006
L	0.90	1.20	1.77	0.035	0.047	0.064
M	5.40	5.80	6.20	0.213	0.228	0.244

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