

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

XL9025

Features

- Operation Voltage: 5V~40V
- Output Adjustable from 1.25V to 35V
- Maximum Duty Cycle up to 100%
- Feedback Voltage Accuracy $\pm 2\%$
- Fixed 120KHz Switching Frequency
- 4A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 96%
- Max. Output power up to 50W
- 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°C to 125°C
Ambient Operating Temperature Range
- Device HBM ESD Classification Level Class3A
- Available in TO263-5L package

General Description

The XL9025 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. XL9025 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 XL9025 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

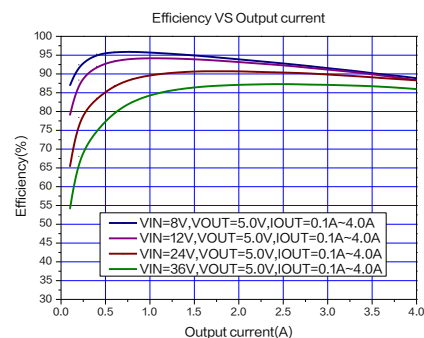
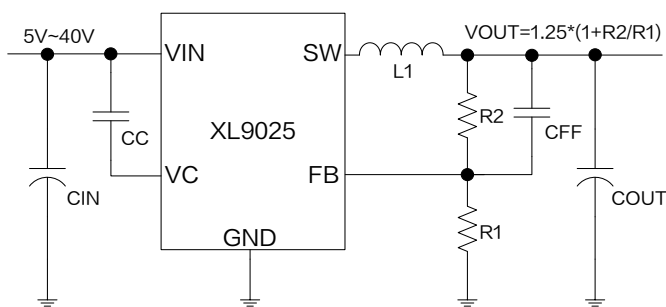


Figure1. XL9025 Typical application schematic and efficiency curve

Pin Configurations

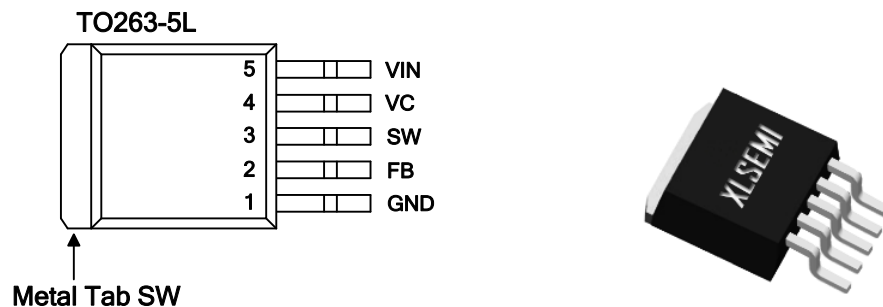


Figure2. Pin Configuration of XL9025

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. XL9025 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
XL9025	XL9025	TO263-5L	RoHS & HF	800 Units on Reel

Function Block

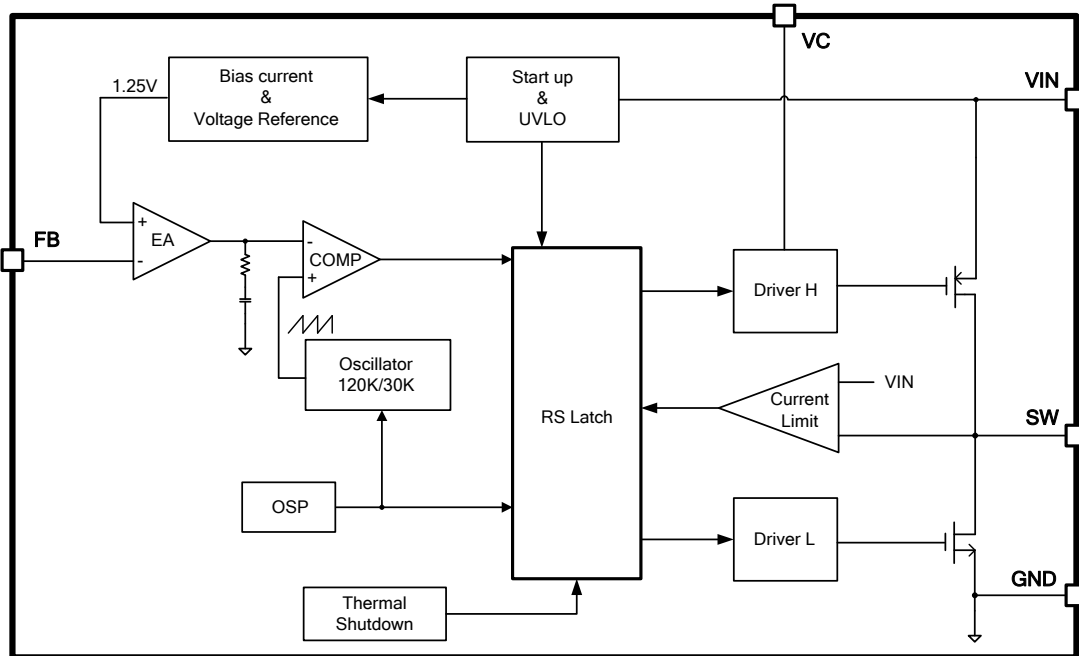


Figure3. Function Block Diagram of XL9025

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 (TO263-5L) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	30	°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.

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XL9025 Electrical Characteristics

T_A = 25°C; 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	-	94.2	-	%
η	Efficiency	V _{IN} =24V, V _{OUT} =12V I _{OUT} =1.5A	-	96.0	-	%

Electrical Characteristics (DC Parameters)

T_A=25°C, 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		°C
Thermal Shutdown Hysteresis	T _D			50		°C
Maximum Duty Cycle	D _{MAX}			100		%

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

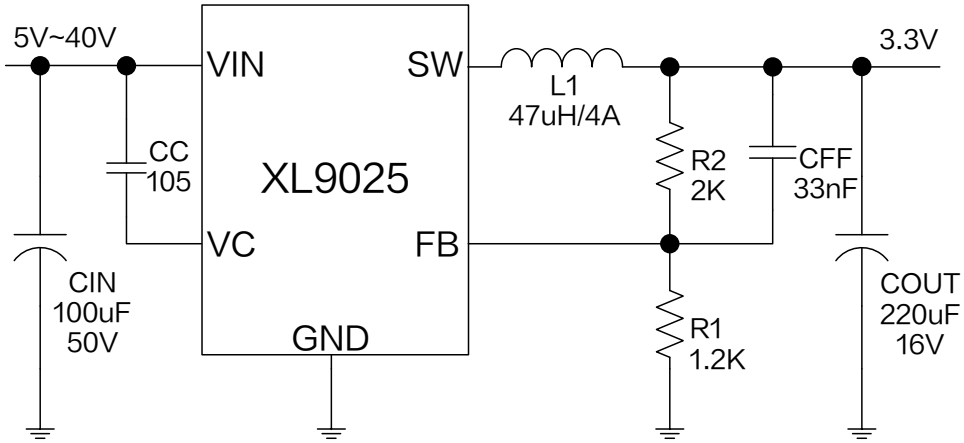


Figure4. XL9025 System Application ($V_{IN}=5V\sim 40V, V_{OUT}=3.3V, I_{OUT}=0\sim 4A$)

Typical System Application Transfer Efficiency

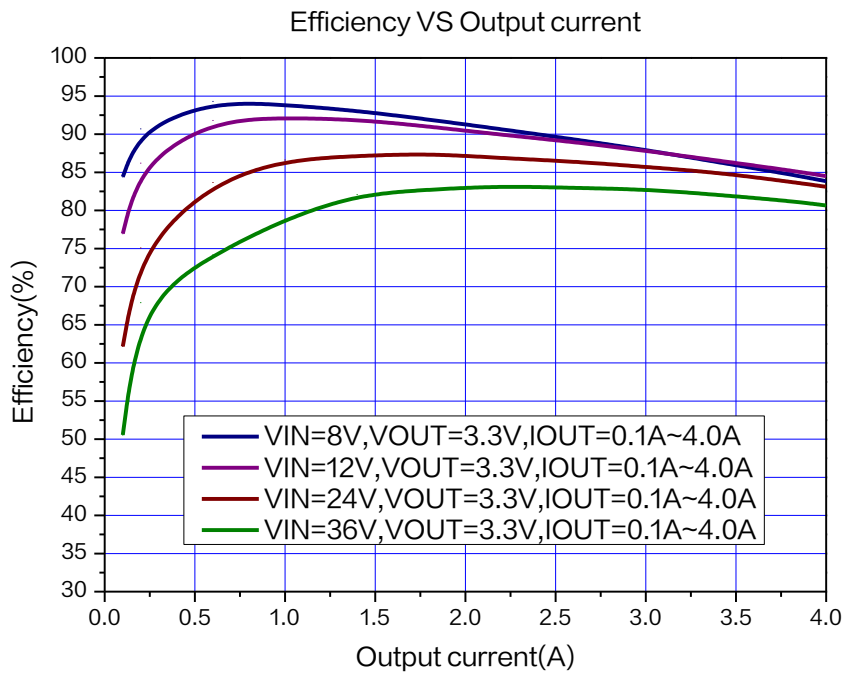


Figure5. XL9025 System Efficiency Curve ($V_{OUT}=3.3V$)

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

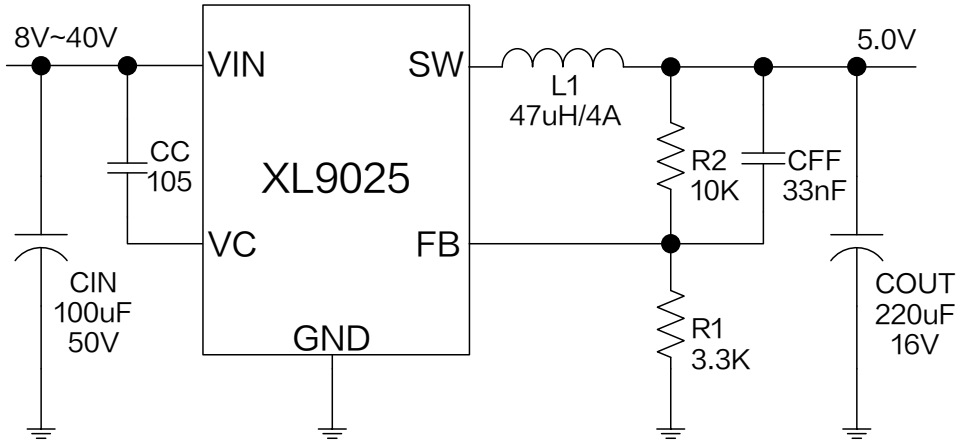


Figure6. XL9025 System Application ($V_{IN}=8V\sim 40V$, $V_{OUT}=5.0V$, $I_{OUT}=0\sim 4A$)

Typical System Application Transfer Efficiency

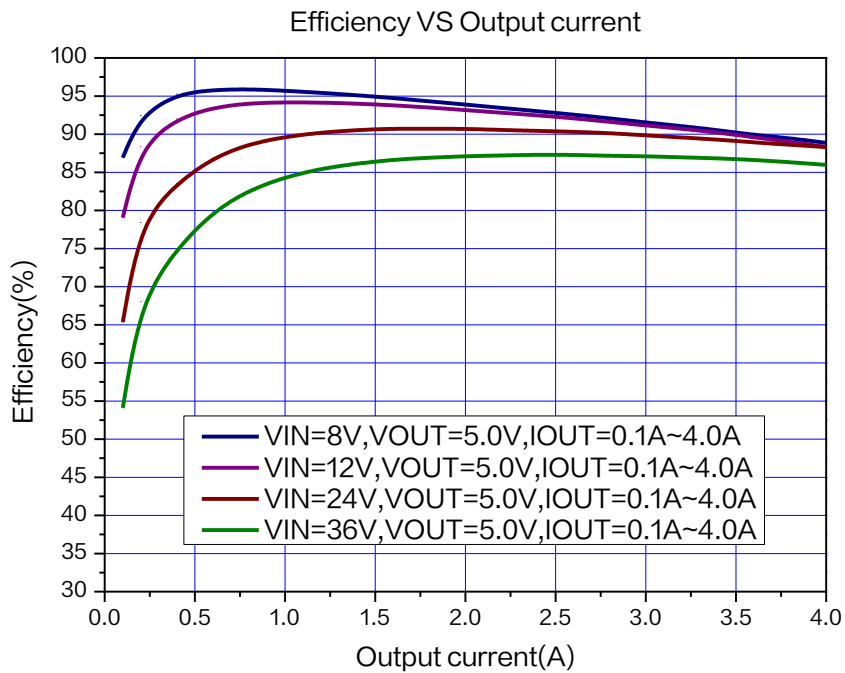


Figure7. XL9025 System Efficiency Curve ($V_{OUT}=5.0V$)

Typical System Application Schematic ($V_{OUT}=12V, I_{OUT}=0\sim 4A$)

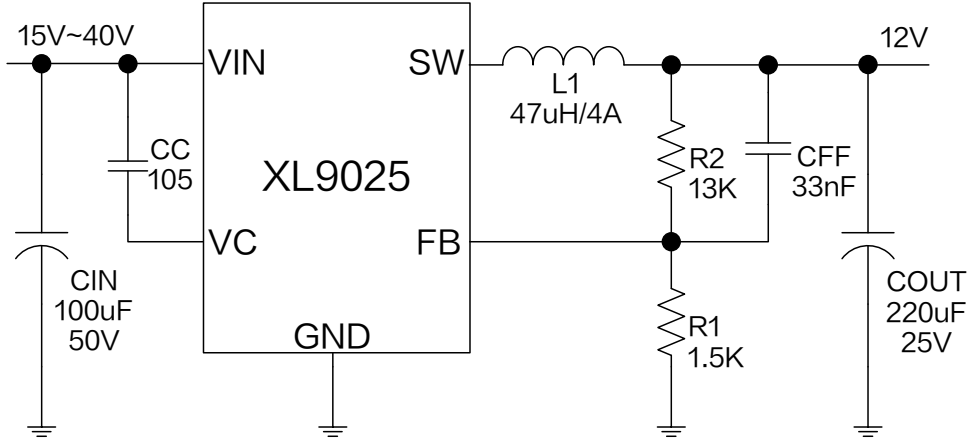


Figure8. XL9025 System Parameters Test Circuit ($V_{IN}=15V\sim 40V, V_{OUT}=12V, I_{OUT}=0\sim 4A$)

Typical System Application Transfer Efficiency

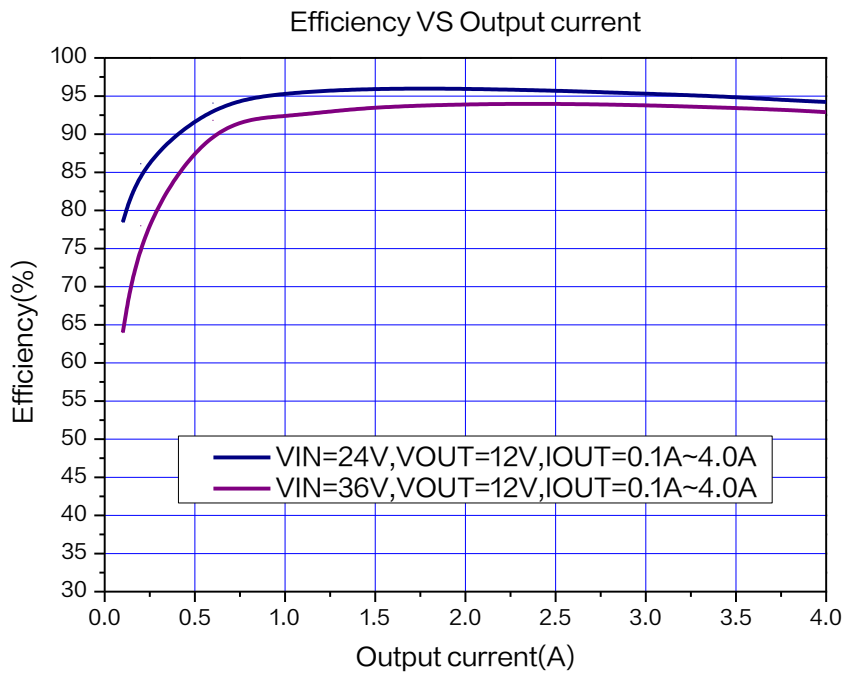


Figure9. XL9025 System Efficiency Curve ($V_{OUT}=12V$)

Typical System Application Schematic ($V_{OUT}=15V, I_{OUT}=0\sim 3.5A$)

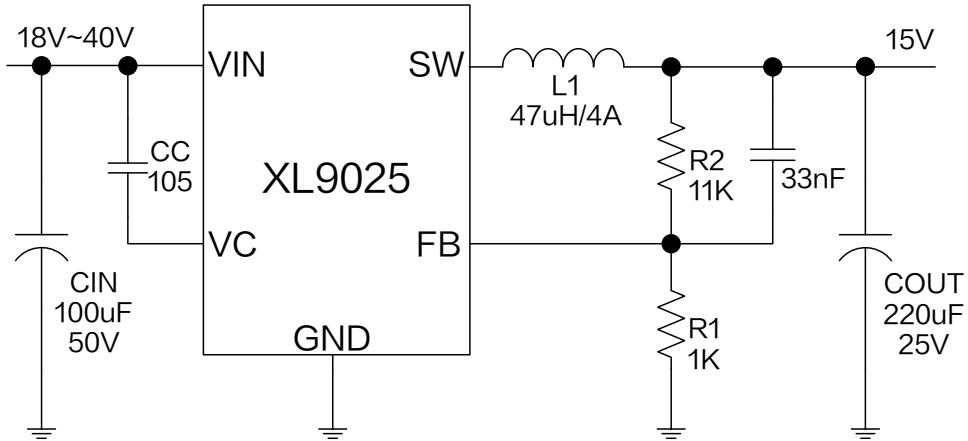


Figure10. XL9025 System Parameters Test Circuit ($V_{IN}=18V\sim 40V, V_{OUT}=15V, I_{OUT}=0\sim 3.5A$)

Typical System Application Transfer Efficiency

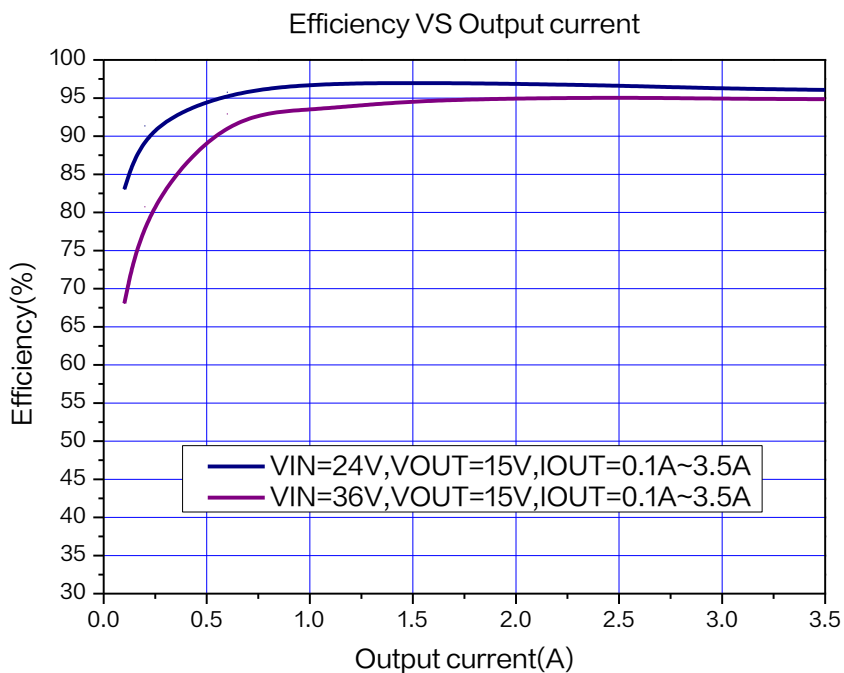


Figure11. XL9025 System Efficiency Curve ($V_{OUT}=15V$)

Typical Characteristics

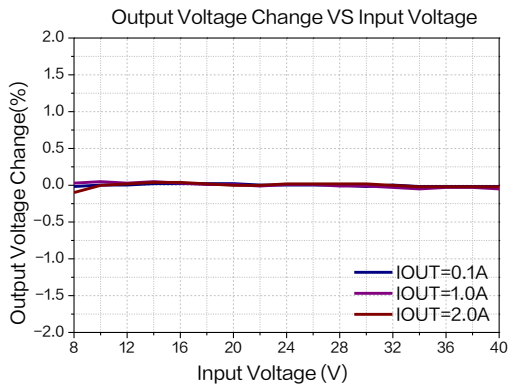


Figure12.Line Regulation

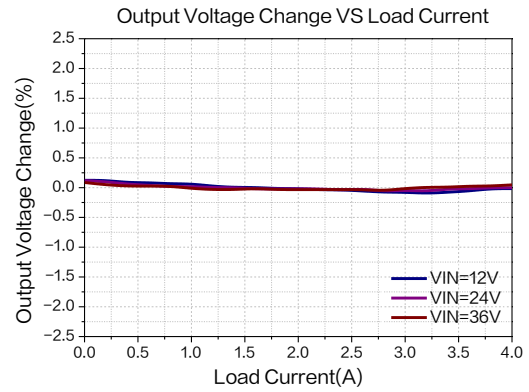


Figure13.Load Regulation

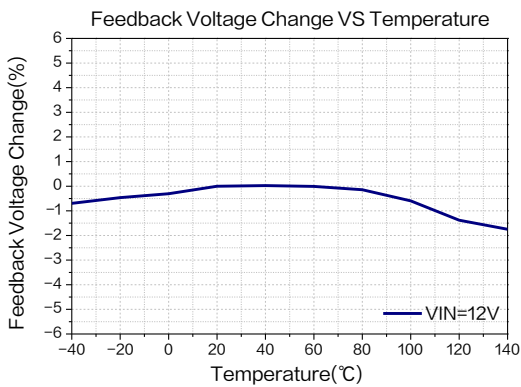


Figure14.Feedback Voltage Regulation

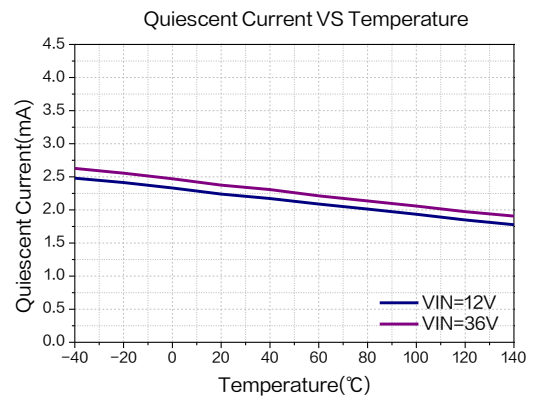


Figure15.Quiescent Current

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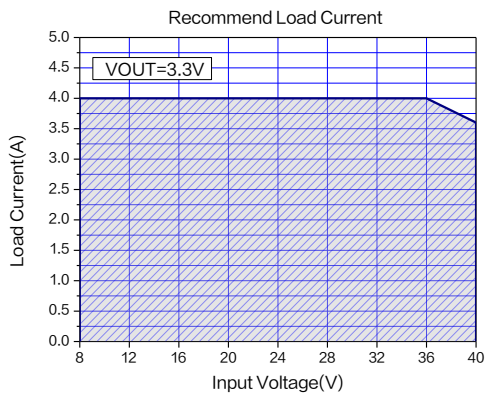


Figure 16.Max Output Current
($V_{OUT}=3.3V$, $T_A=25^{\circ}C$)

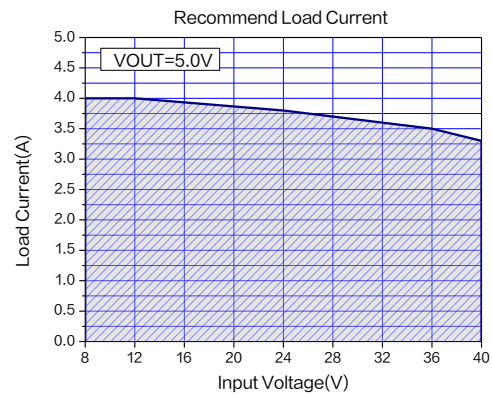


Figure 17.Max Output Current
($V_{OUT}=5.0V$, $T_A=25^{\circ}C$)

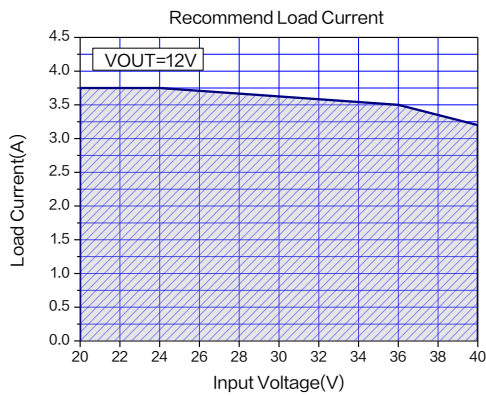


Figure 18.Max Output Current
($V_{OUT}=12V$, $T_A=25^{\circ}C$)

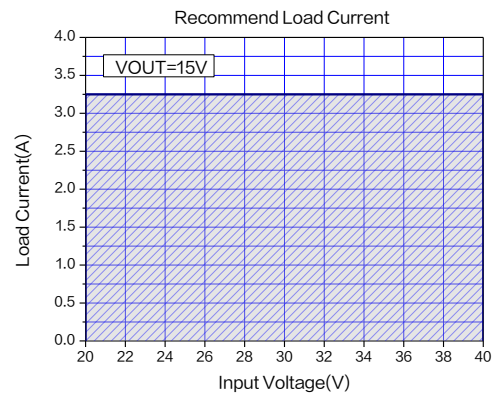


Figure 19.Max Output Current
($V_{OUT}=15V$, $T_A=25^{\circ}C$)

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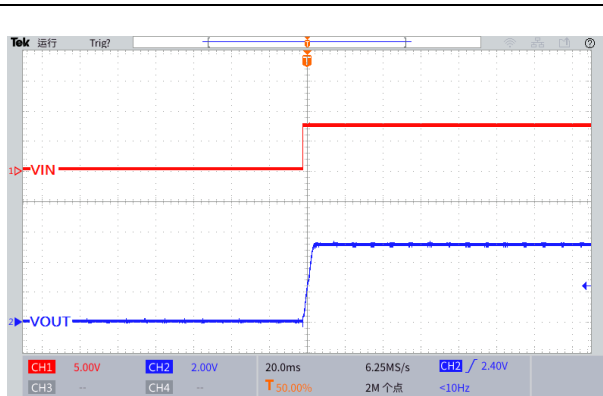


Figure 20. Start-Up Characteristic
($V_{IN}=8V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

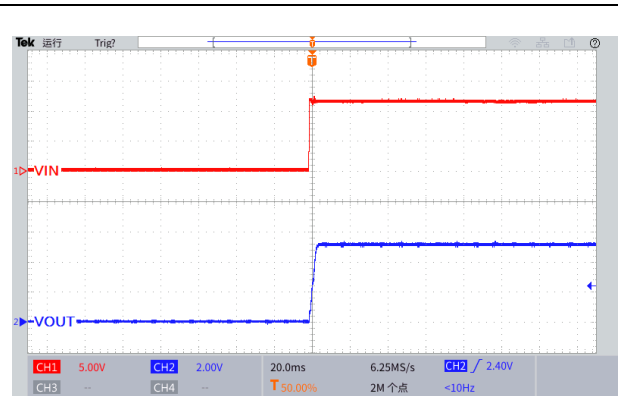


Figure 21. Start-Up Characteristic
($V_{IN}=12V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

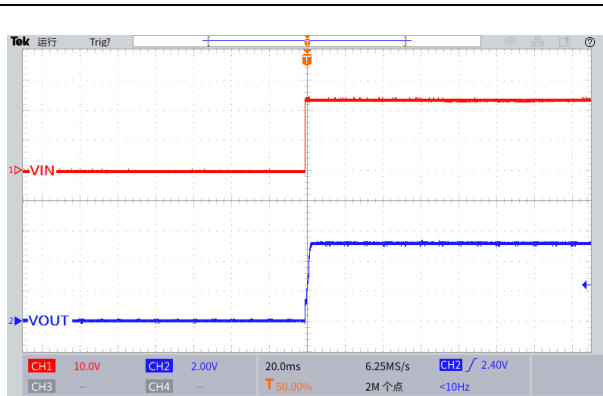


Figure 22. Start-Up Characteristic
($V_{IN}=24V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

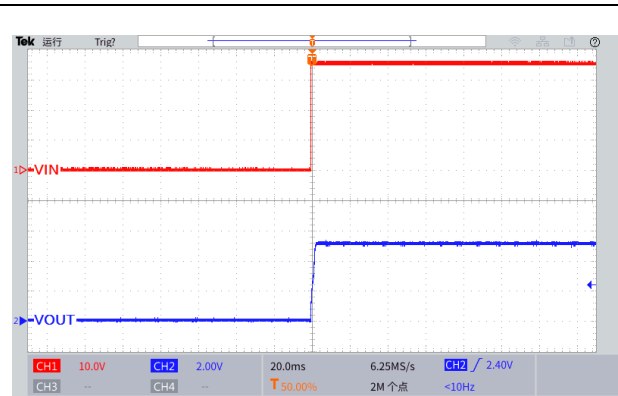


Figure 23. Start-Up Characteristic
($V_{IN}=36V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

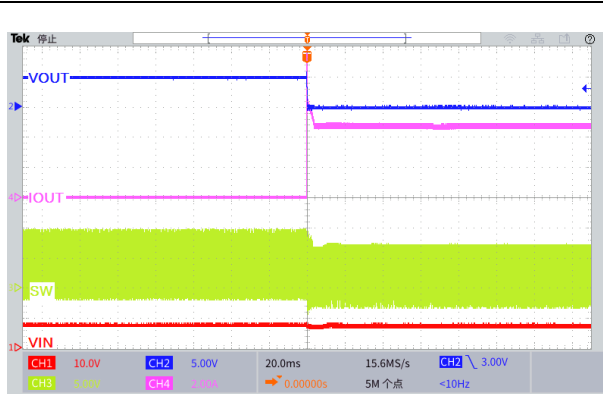


Figure 24. Output Short Circuit Waveform
($V_{IN}=8V$, $V_{OUT}=5.0V$)

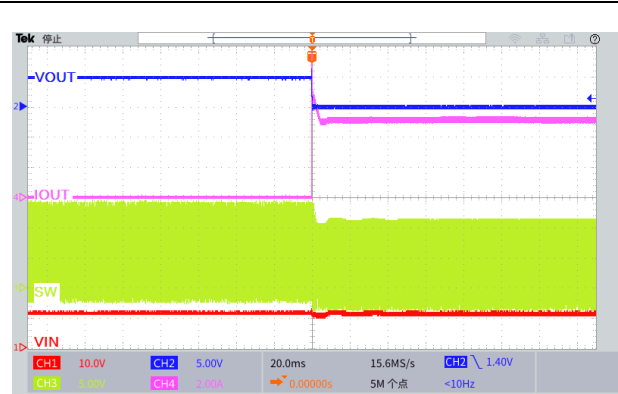


Figure 25. Output Short Circuit Waveform
($V_{IN}=12V$, $V_{OUT}=5.0V$)

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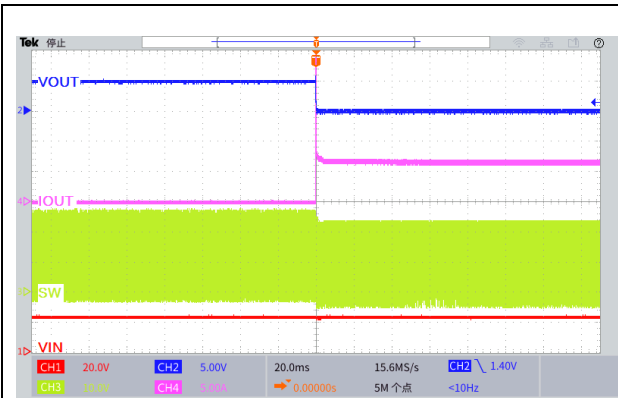


Figure 26. Output Short Circuit Waveform
($V_{IN}=24V$, $V_{OUT}=5.0V$)

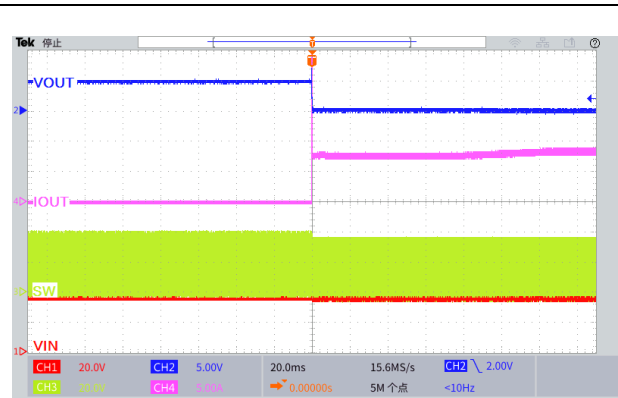


Figure 27. Output Short Circuit Waveform
($V_{IN}=36V$, $V_{OUT}=5.0V$)

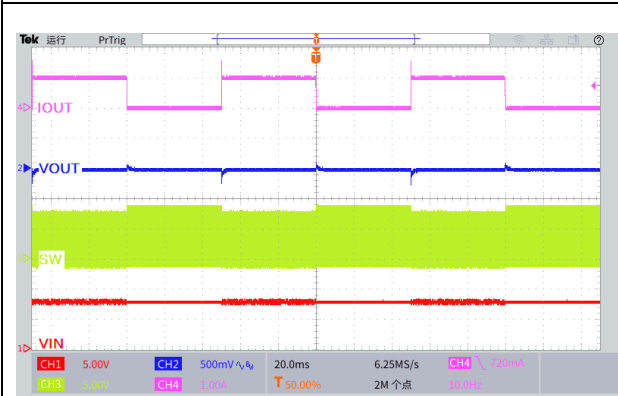


Figure 28. Load Transient Response
($V_{IN}=8V$, $V_{OUT}=5.0V$, $I_{OUT}=0$ to 1A)

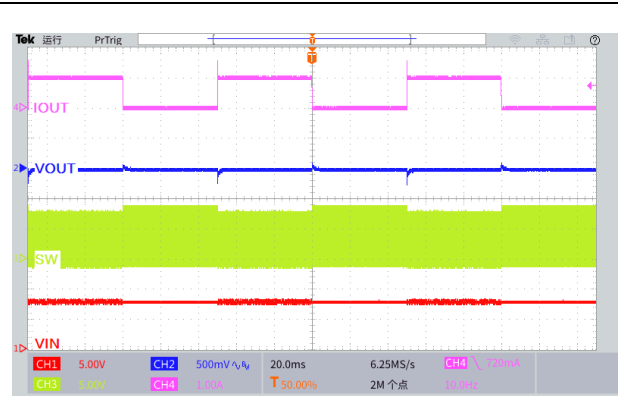


Figure 29. Load Transient Response
($V_{IN}=12V$, $V_{OUT}=5.0V$, $I_{OUT}=0$ to 1A)

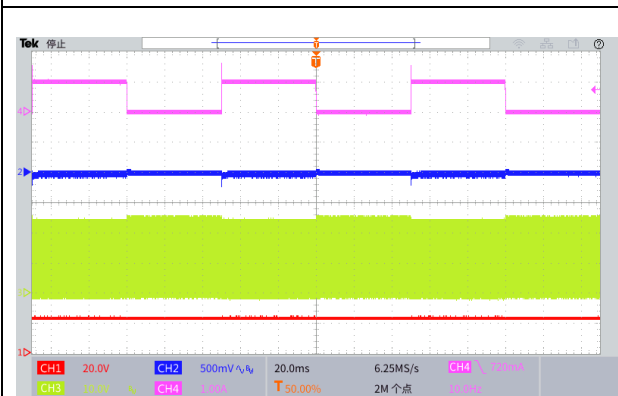


Figure 30. Load Transient Response
($V_{IN}=24V$, $V_{OUT}=5.0V$, $I_{OUT}=0$ to 1A)

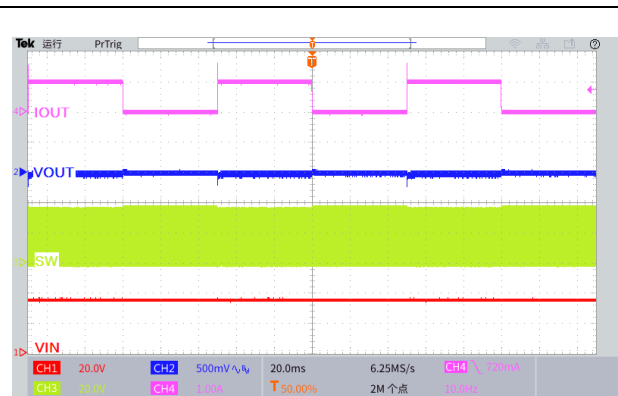
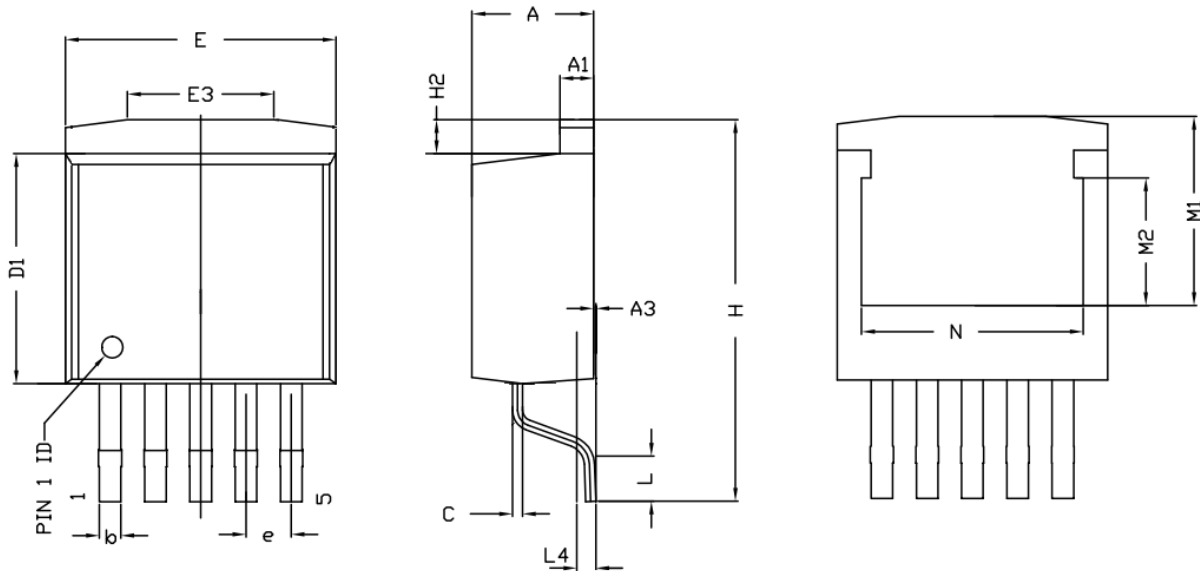


Figure 31. Load Transient Response
($V_{IN}=36V$, $V_{OUT}=5.0V$, $I_{OUT}=0$ to 1A)

Package Information

TO263-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.37	4.57	4.77	0.172	0.180	0.188
A1	1.17	1.27	1.42	0.046	0.050	0.056
A3	0.00	0.13	0.25	0.000	0.005	0.010
b	0.71	0.81	0.97	0.028	0.032	0.038
c	0.33	0.38	0.76	0.013	0.015	0.030
D1	8.38	8.70	9.00	0.330	0.343	0.354
E	9.90	10.16	10.39	0.390	0.400	0.410
E3	5.00	6.50	8.00	0.197	0.256	0.315
e	1.70 REF.			0.067 REF.		
H	13.00	13.85	14.35	0.511	0.545	0.565
H2	0.90	1.27	1.42	0.035	0.050	0.056
L	1.68	1.98	2.28	0.066	0.078	0.090
L4	0.56	0.76	0.96	0.022	0.030	0.038
M1	6.00	7.11	8.00	0.236	0.280	0.315
M2	-	4.80	-	-	0.189	-
N	7.30	8.33	9.30	0.287	0.328	0.366

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