

1.5A 120KHz 80V Synchronous Buck DC to DC Converter

XL9713

Features

- Operation Voltage: 5V~72V
- Minimum Drop Out: 1.5V
- Feedback Voltage Accuracy $\pm 2\%$
- Fixed 120KHz Switching Frequency
- 1.5A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 94%
- Max. Output power up to 25W
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit protection function
- Built in output short protection function
- Device HBM ESD Classification Level Class3B
- Available in TO263-5L package

General Description

The XL9713 is a 120KHz fixed frequency PWM synchronous buck DC/DC converter, capable of driving a 1.5A load with high voltage, high efficiency, low ripple and excellent line and load regulation. XL9713 supports wide input operating voltage range of 5V~72V and a maximum duty cycle of 90% output. A built-in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space.

The XL9713 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

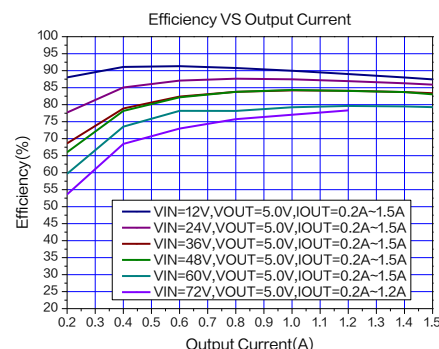
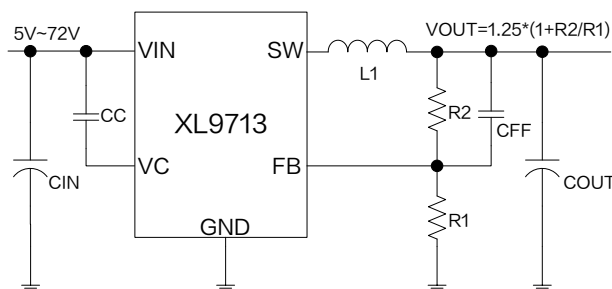


Figure1. XL9713 Typical application schematic and efficiency curve

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Pin Configurations

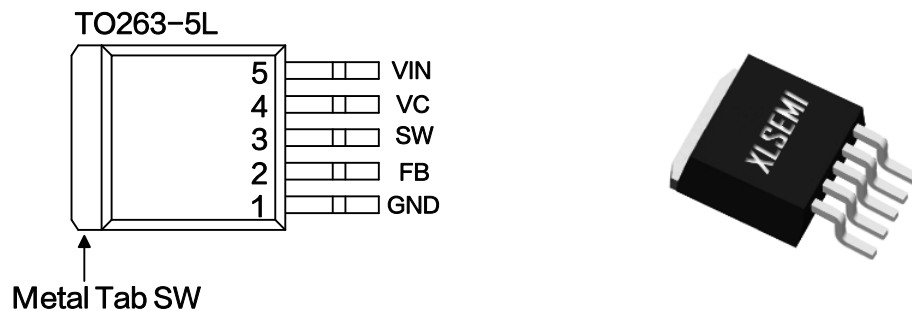


Figure2. Pin Configuration of XL9713

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. XL9713 operates from 5V to 72V 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
XL9713	XL9713	TO263-5L	RoHS & HF	800 Units on Reel

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Function Block

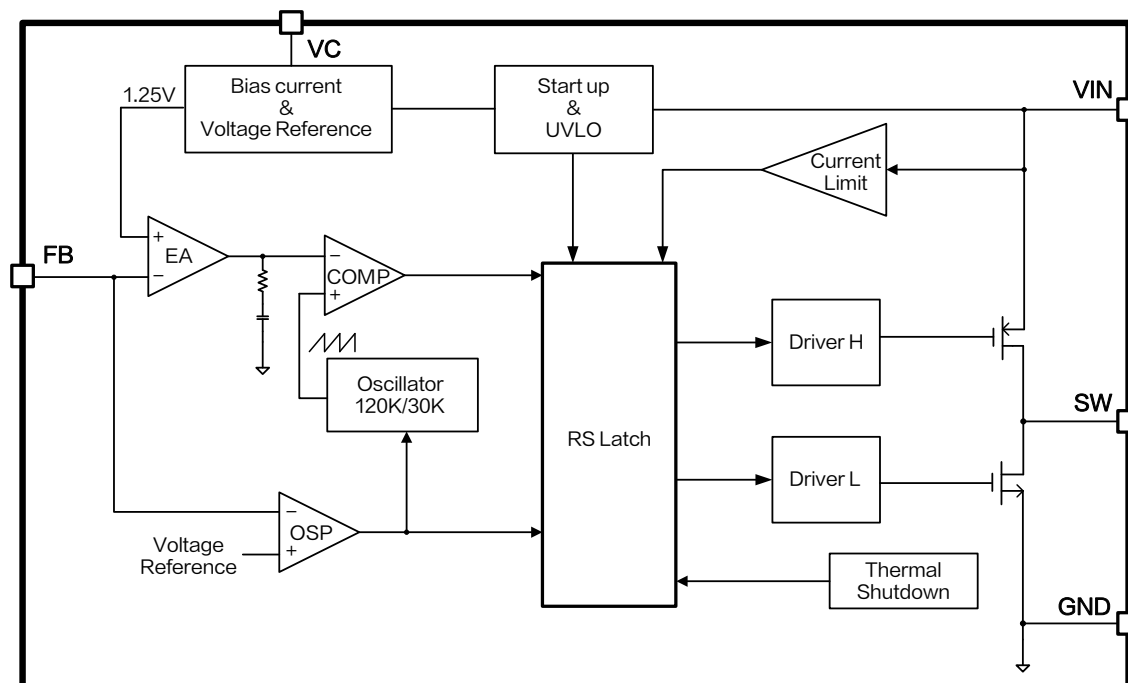


Figure3. Function Block Diagram of XL9713

Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3~80	V
Feedback Pin Voltage	V_{FB}	-0.3~7	V
Output Switch Pin Voltage	V_{SW}	-0.3~ V_{IN}	V
VC Pin Voltage	V_C	-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	-40~125	°C
Storage Temperature	T_{STG}	-65~150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		>8000	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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XL9713 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
η	Efficiency	$V_{IN}=12\text{V}$, $V_{OUT}=5.0\text{V}$ $I_{OUT}=1.0\text{A}$	–	89.7	–	%
η	Efficiency	$V_{IN}=12\text{V}$, $V_{OUT}=15\text{V}$ $I_{OUT}=1.0\text{A}$	–	94.7	–	%

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		72	V
Quiescent Supply Current	I_Q	$V_{FB}=2\text{V}$		3.5	5	mA
Oscillator Frequency	F_{OSC}		102	120	138	KHz
Switch Current Limit	I_L	$V_{FB}=0\text{V}$		2.0		A
High side MOS On-resistance	$R_{DS(ON)H}$			270		$\text{m}\Omega$
Low side MOS On-resistance	$R_{DS(ON)L}$			255		$\text{m}\Omega$
Thermal Shutdown Temperature	T_{SD}			140		$^{\circ}\text{C}$
Thermal Shutdown Hysteresis	T_D			60		$^{\circ}\text{C}$
Max. Duty Cycle	D_{MAX}	$V_{FB}=0\text{V}$		90		%

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Typical System Application Schematic ($V_{OUT}=3.3V$, $I_{OUT}=0\sim1.5A$)

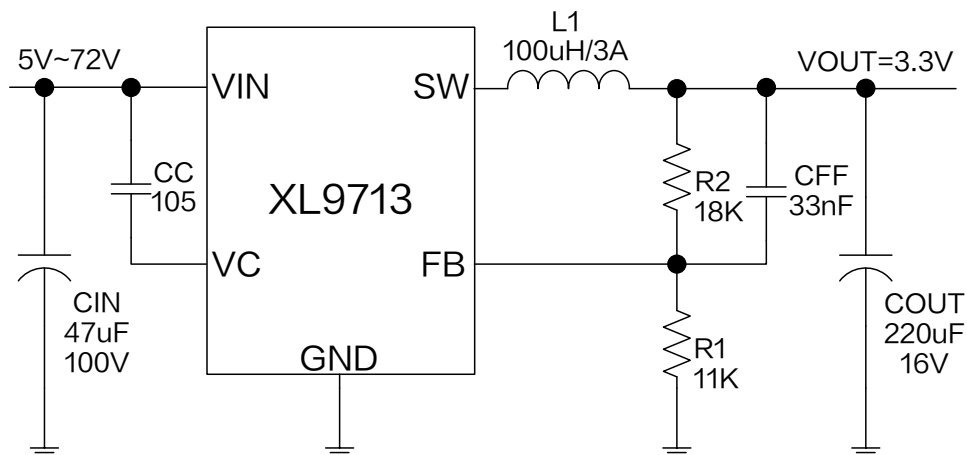


Figure4. XL9713 System Application ($V_{IN}=5V\sim72V$, $V_{OUT}=3.3V$, $I_{OUT}=0\sim1.5A$)

Typical System Application Transfer Efficiency

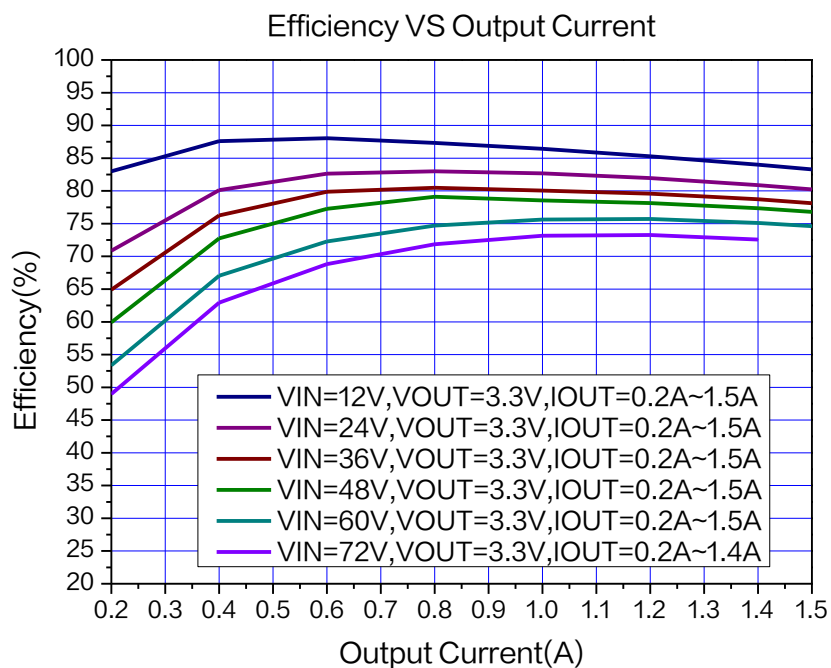


Figure5. XL9713 System Efficiency Curve($V_{OUT}=3.3V$)

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Typical System Application Schematic ($V_{OUT}=5.0V$, $I_{OUT}=0\sim1.5A$)

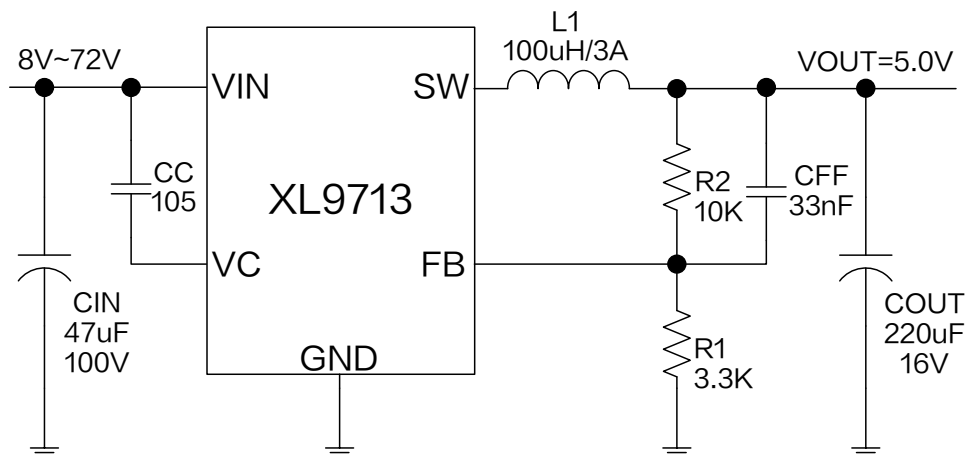


Figure6. XL9713 System Application ($V_{IN}=8V\sim72V$, $V_{OUT}=5.0V$, $I_{OUT}=0\sim1.5A$)

Typical System Application Transfer Efficiency

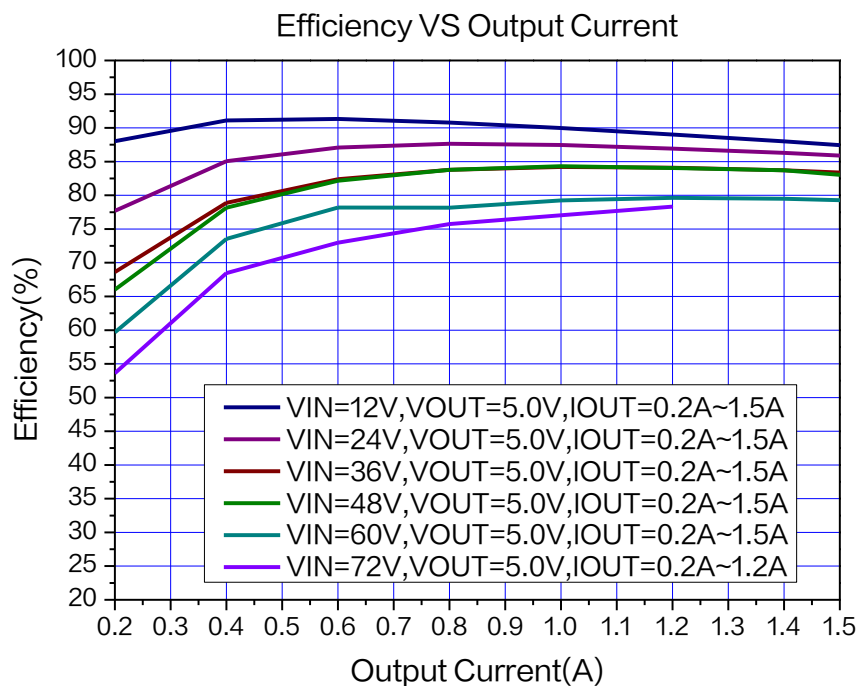


Figure7. XL9713 System Efficiency Curve ($V_{OUT}=5.0V$)

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Typical System Application Schematic ($V_{OUT}=15V$, $I_{OUT}=0\sim1.2A$)

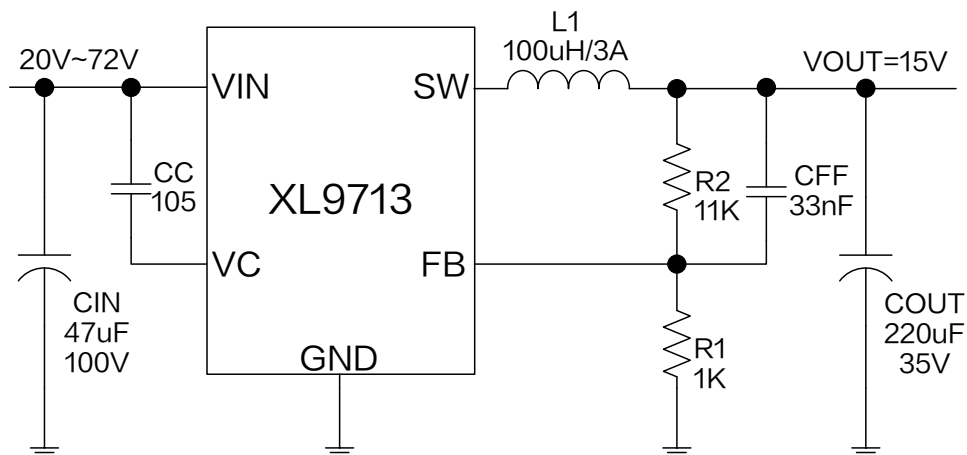


Figure8. XL9713 System Application ($V_{IN}=20V\sim72V$, $V_{OUT}=15V$, $I_{OUT}=0\sim1.2A$)

Typical System Application Transfer Efficiency

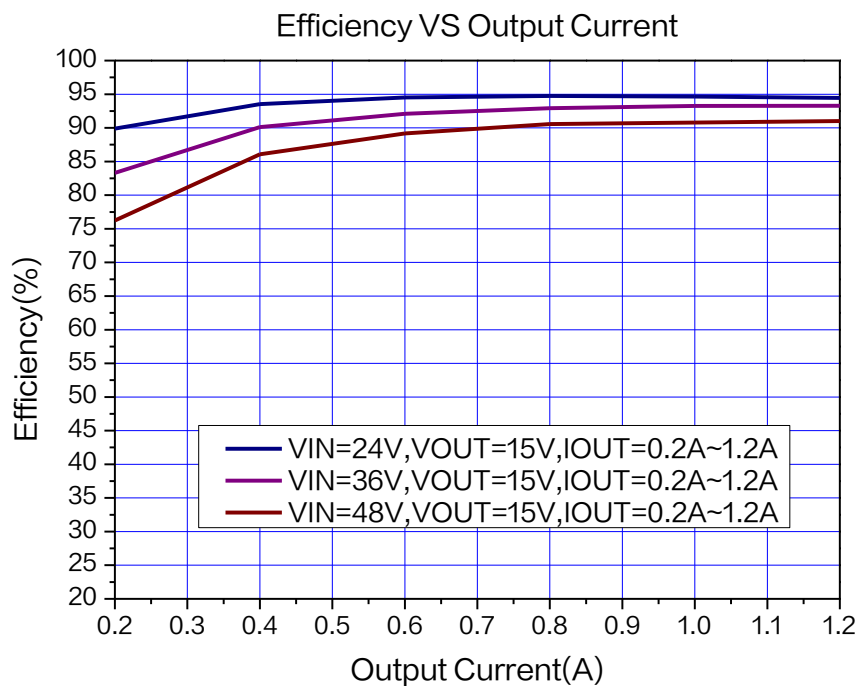


Figure9. XL9713 System Efficiency Curve ($V_{OUT}=15V$)

Typical Characteristics

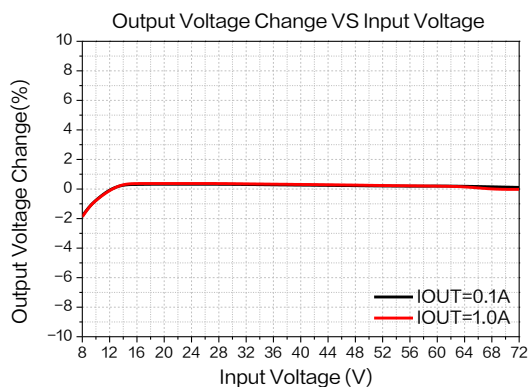


Figure 10.Line Regulation

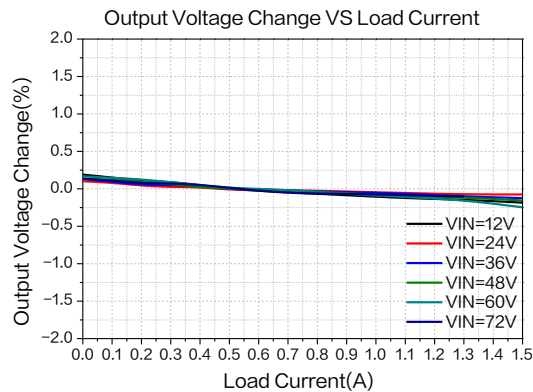


Figure 11.Load Regulation

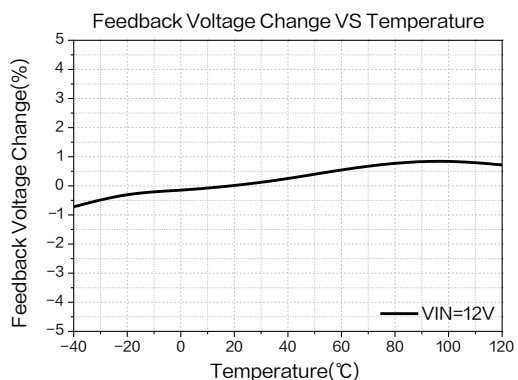


Figure 12.Feedback Voltage Regulation

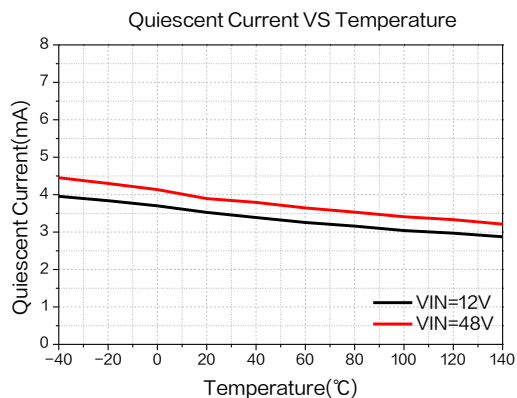


Figure 13.Quiescent Current

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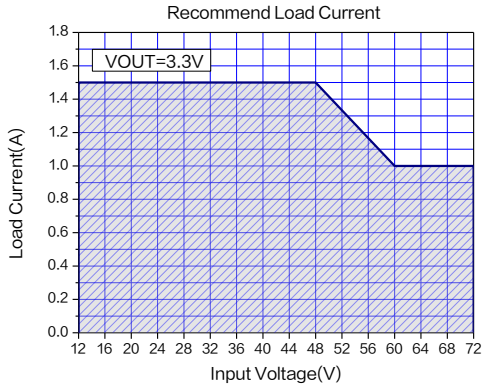


Figure 14.Max Output Current
($V_{OUT}=3.3V$, $T_A=25^{\circ}C$)

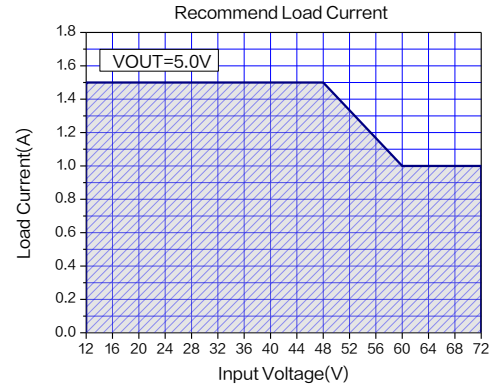


Figure 15.Max Output Current
($V_{OUT}=5.0V$, $T_A=25^{\circ}C$)

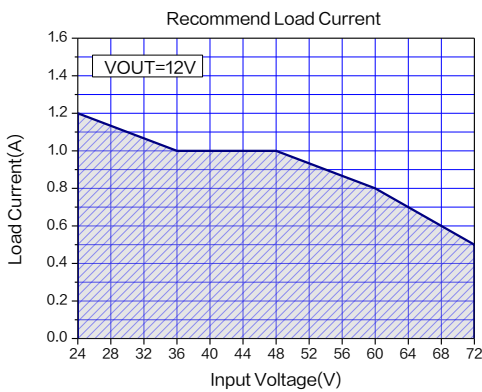


Figure 16.Max Output Current
($V_{OUT}=12V$, $T_A=25^{\circ}C$)

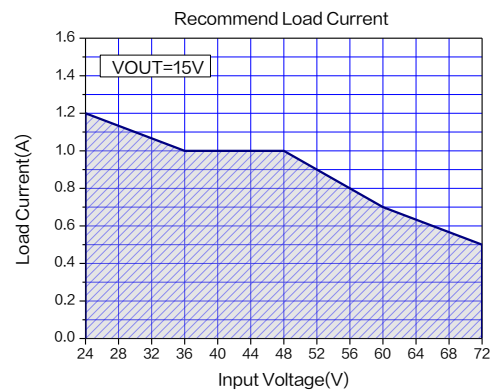


Figure 17.Max Output Current
($V_{OUT}=15V$, $T_A=25^{\circ}C$)

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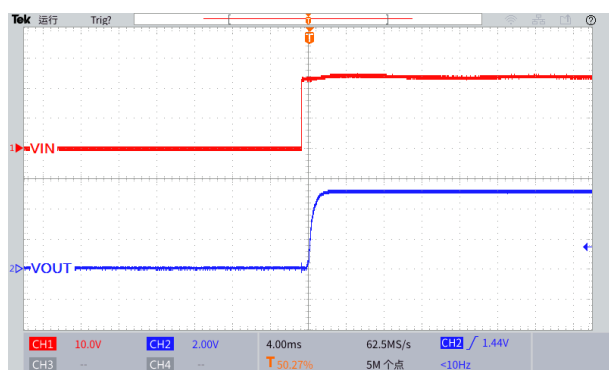


Figure 18. Start-Up Characteristic
($V_{IN}=24V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

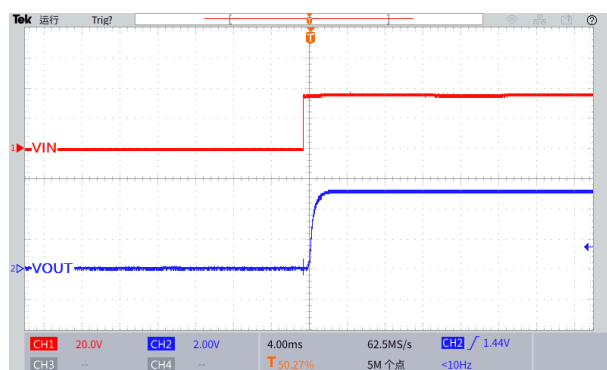


Figure 19. Start-Up Characteristic
($V_{IN}=36V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

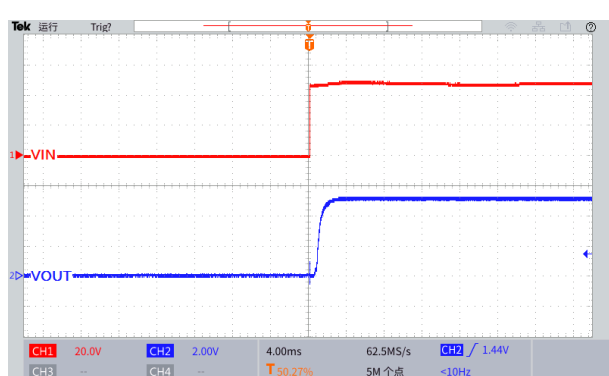


Figure 20. Start-Up Characteristic
($V_{IN}=48V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

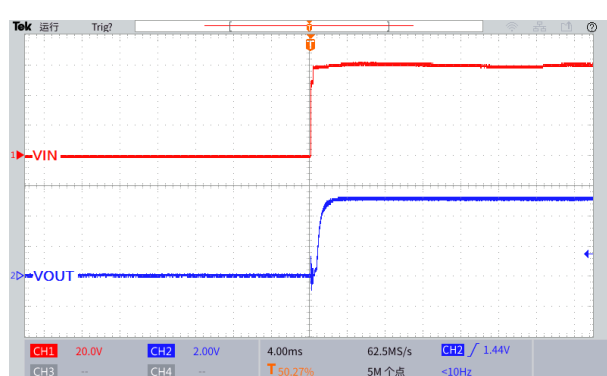


Figure 21. Start-Up Characteristic
($V_{IN}=60V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1A$)

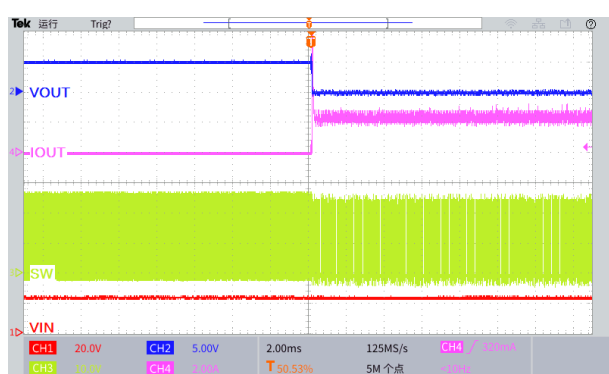


Figure 22. Output Short Circuit Waveform
($V_{IN}=24V$, $V_{OUT}=5.0V$)

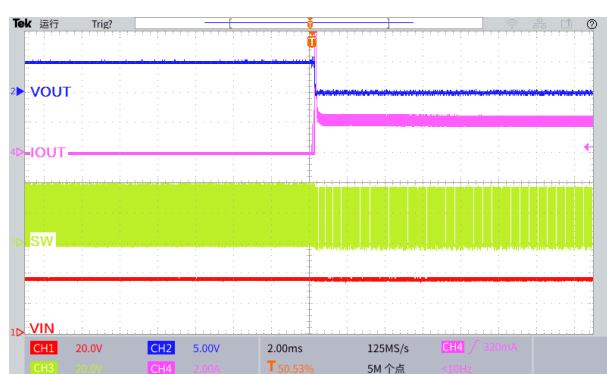


Figure 23. Output Short Circuit Waveform
($V_{IN}=36V$, $V_{OUT}=5.0V$)

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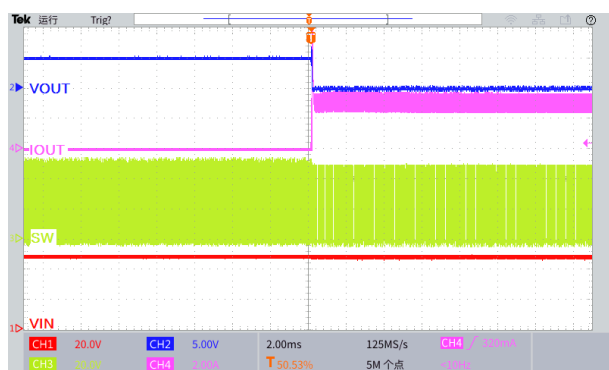


Figure 24. Output Short Circuit Waveform
($V_{IN}=48V$, $V_{OUT}=5.0V$)

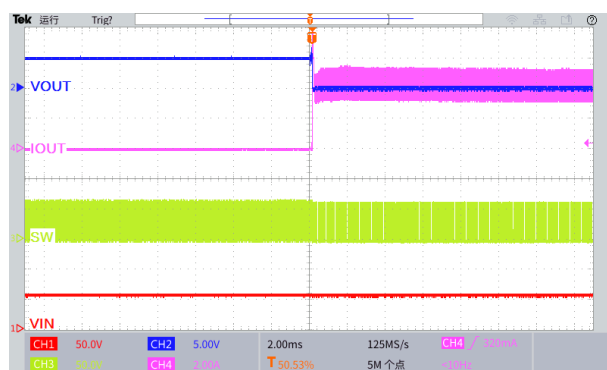


Figure 25. Output Short Circuit Waveform
($V_{IN}=60V$, $V_{OUT}=5.0V$)

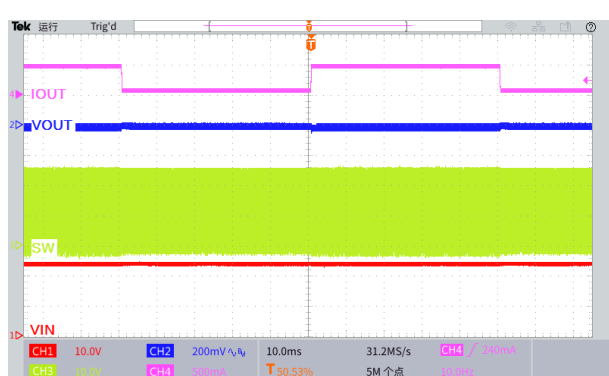


Figure 26. Load Transient Response
($V_{IN}=24V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1$ to $0.5A$)

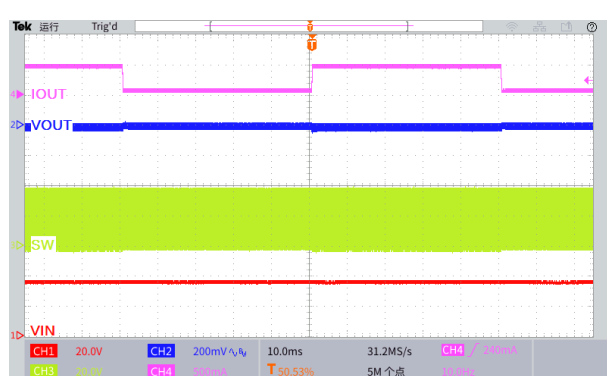


Figure 27. Load Transient Response
($V_{IN}=36V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1$ to $0.5A$)

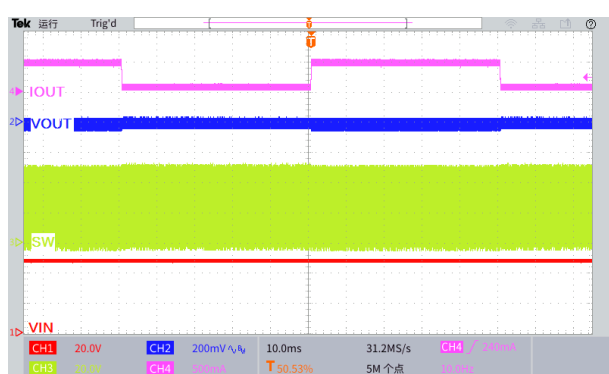


Figure 28. Load Transient Response
($V_{IN}=48V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1$ to $0.5A$)

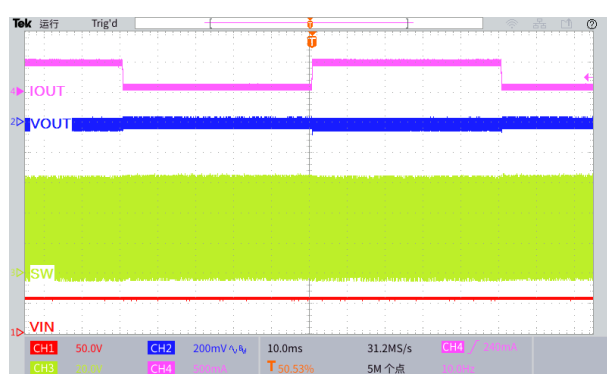


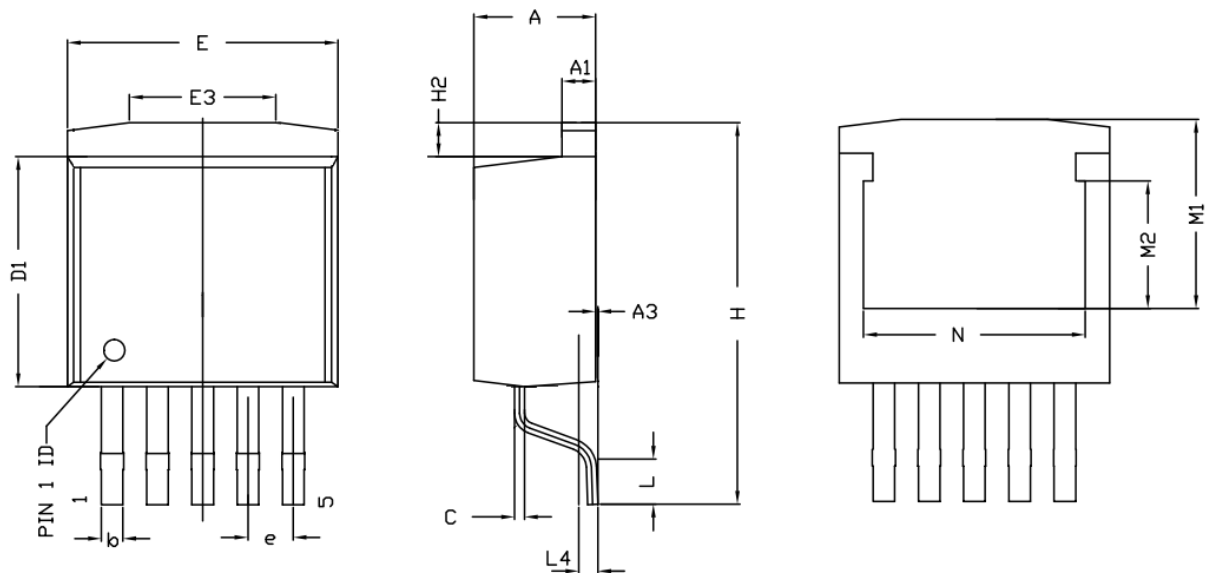
Figure 29. Load Transient Response
($V_{IN}=60V$, $V_{OUT}=5.0V$, $I_{OUT}=0.1$ to $0.5A$)

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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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