Features

Wide 4.5V to 40V Input Voltage Range
3.3V,5V,12V and adjustable versions
Output Adjustable from 1.23V to 37V
Maximum Duty Cycle 100%
Minimum Drop Out 1.5V
Fixed 52KHz Switching Frequency
3A Constant Output Current Capability
Internal Optimize Power Transistor
High efficiency
Excellent line and load regulation
TTL shutdown capability
ON/OFF pin with hysteresis function
Built in thermal shutdown function
Built in current limit function
Available in TO-220、TO-263 Packages

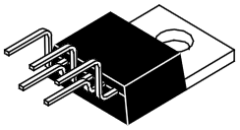
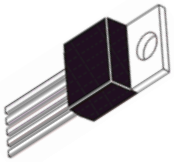
General Description

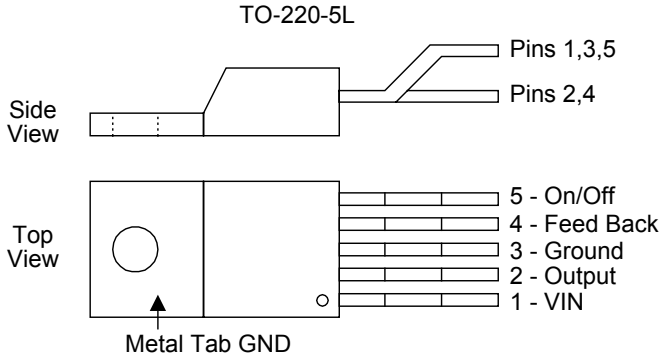
The HXL2596 is a 150KHz fixed frequency PWM buck （step-down）DC/DC converter, capable of driving a 3A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

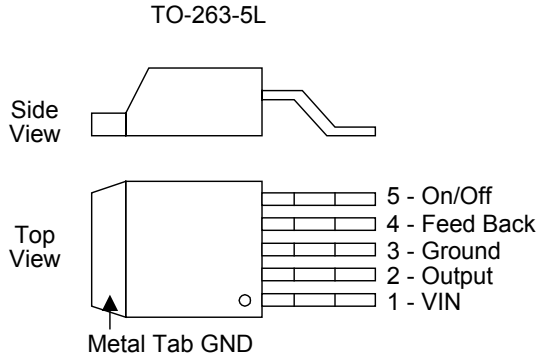
The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An enable function, an over current protection function is built inside. When second current limit function happens, the operation frequency will be reduced from 150KHz to 50KHz. An internal compensation block is built in to minimize external component count.

Applications

LCD Monitor and LCD TV
Digital Photo Frame
Set-up Box
ADSL Modem
Telecom / Networking Equipment

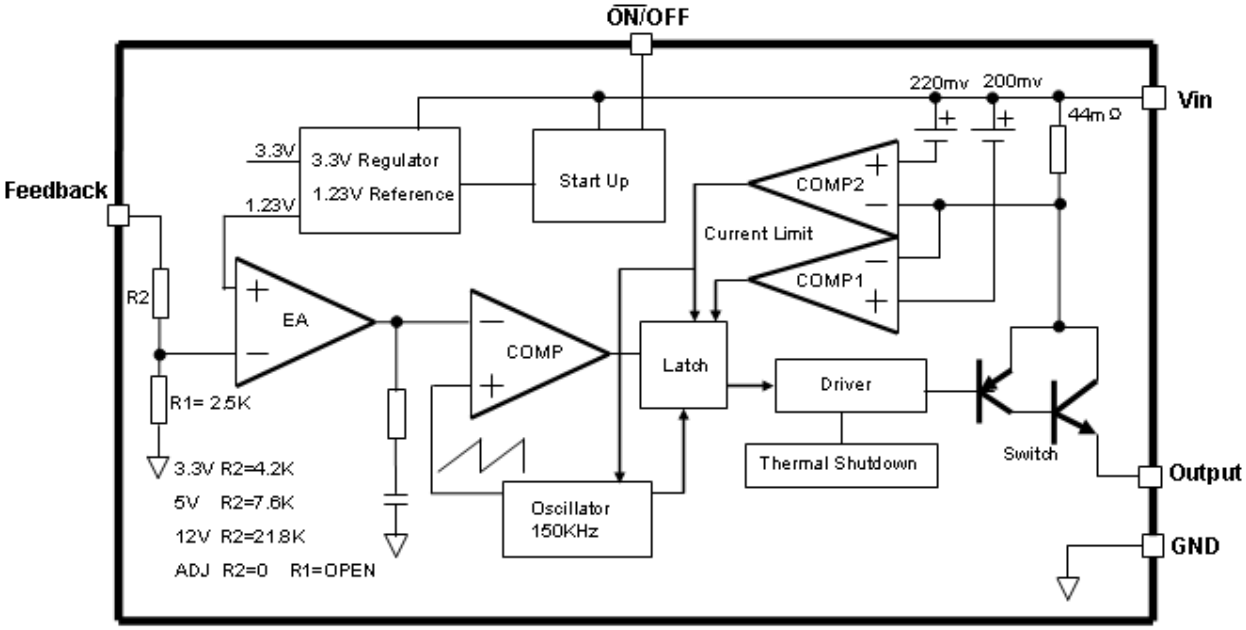
		
TO-220B-5L	TO-220-5L	TO-263-5L





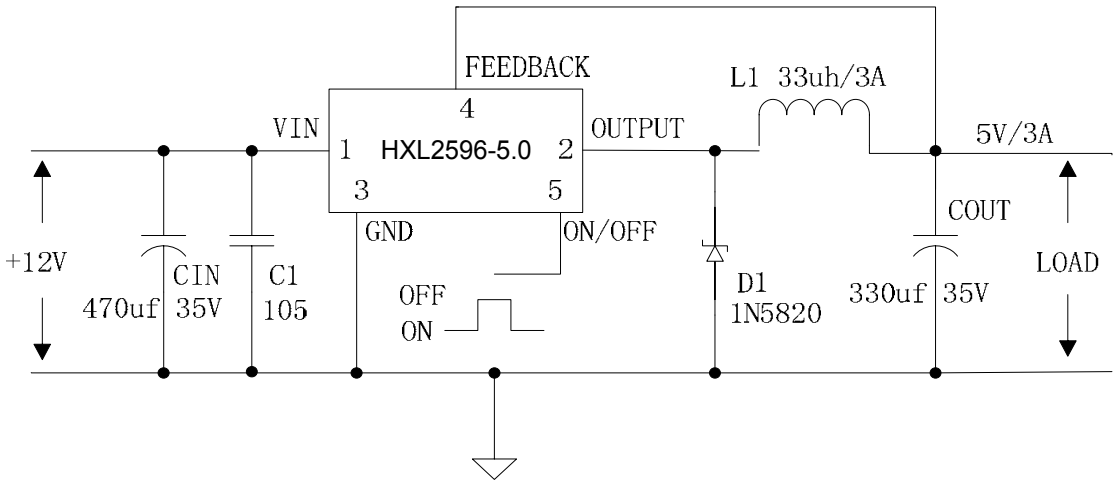
Pin	Pin Name	Description
1	VIN	Supply Voltage Input Pin. HXL2576 operates from a 4.5V to 40V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
2	OUTPUT	Power Switch Output Pin（SW）. Output is the switch node that supplies power to the output.
3	GND	Ground Pin. Care must be taken in layout. This pin should be placed outside of the Schottky Diode to output capacitor ground path to prevent switching current spikes from inducing voltage noise into HXL2576.
4	FEEDBACK	Feedback Pin（FB）. Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.23V.
5	ON/OFF	Enable Pin. Drive ON/OFF pin low to turn on the device, drive it high to turn it off. Floating is default low.

Function Block



Function Block Diagram of HXL2596

Typical Application Circuit



HXL2596 Typical Applic ation Circuit 12V-5V/3A

Ordering Information

HXL	2596	S	3.3	Blank	E1
HAOHAI	Circuit Type	S: TO263-5L T: TO220-5L TB: TO220B-5L	3.3=3.3V 5.0=5V 12=12V ADJ=Adjust	Packing Blank: Tube TR: Type and Reel	Lead Free

Package	Temperature Range	Part Number	Marking ID	Packing Type
		Lead Free	Lead Free	
TO-220-5L	-40℃~+85℃	HXL2596T-ADJE1	HXL2596T-ADJE1	Tube
		HXL2596T-3.3E1	HXL2596T-3.3E1	Tube
		HXL2596T-5.0E1	HXL2596T-5.0E1	Tube
		HXL2596T-12E1	HXL2596T-12E1	Tube
TO-220B-5L	-40℃~+85℃	HXL2596TB-ADJE1	HXL2596TB-ADJE1	Tube
		HXL2596TB-3.3E1	HXL2596TB-3.3E1	Tube
		HXL2596TB-5.0E1	HXL2596TB-5.0E1	Tube
		HXL2596TB-12E1	HXL2596TB-12E1	Tube
TO-263-5L	-40℃~+85℃	HXL2596S-ADJE1	HXL2596S-ADJE1	Tube
		HXL2596S-3.3E1	HXL2596S-3.3E1	Tube
		HXL2596S-5.0E1	HXL2596S-5.0E1	Tube
		HXL2596S-12E1	HXL2596S-12E1	Tube
		HXL2596S-ADJTRE1	HXL2596S-ADJE1	Tape & Reel
		HXL2596S-3.3TRE1	HXL2596S-3.3E1	Tape & Reel
		HXL2596S-5.0TRE1	HXL2596S-5.0E1	Tape & Reel
		HXL2596S-12TRE1	HXL2596S-12E1	Tape & Reel

Pb-free products, as designated with “E1” suffix in the par number, are RoHS compliant.

Absolute Maximum Ratings（Note1）

Parameter	Symbol	Value	Unit
Input Voltage	V_{in}	-0.3 to 45	V
Feedback Pin Voltage	V_{FB}	-0.3 to V_{in}	
ON/OFF Pin Voltage	$V_{ON/OFF}$	-0.3 to V_{in}	
Output Switch Pin Voltage	V_{Output}	-0.3 to V_{in}	
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (TO-220 & TO-263)（Junction to Ambient, No Heatsink, Free Air）	R_{JA}	50	℃/W
Operating Junction Temperature	T_J	-40 to +125	℃
Storage Temperature	T_{STG}	-65 to +150	
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	
ESD（HBM）		2000	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.

HXL2596-3.3 Electrical Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{in} = 4.75V to 40V，I_{load}=0.2A to 3A	3.168	3.3	3.432	V
Efficiency	η	V_{in}=12V，V_{out}=3.3V，I_{out}=3A	--	73	--	%

HXL2596-5.0 Electrical Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{in} = 7V to 40V，I_{load}=0.2A to 3A	4.8	5	5.2	V
Efficiency	η	V_{in}=12V，V_{out}=5.0V，I_{out}=3A	--	80	--	%

HXL2596-12 Electrical Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{in} = 15V to 40V，I_{load}=0.2A to 3A	11.52	12	12.48	V
Efficiency	η	V_{in}=25V，V_{out}=12V，I_{out}=3A	--	90	--	%

HXL2596-ADJ Electrical Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{in} = 4.5V to 40V，I_{load}=0.2A to 3A	1.193	1.23	1.267	V
Efficiency	η	V_{in}=12V，V_{out}=3.0V，I_{out}=3A	--	73	--	%

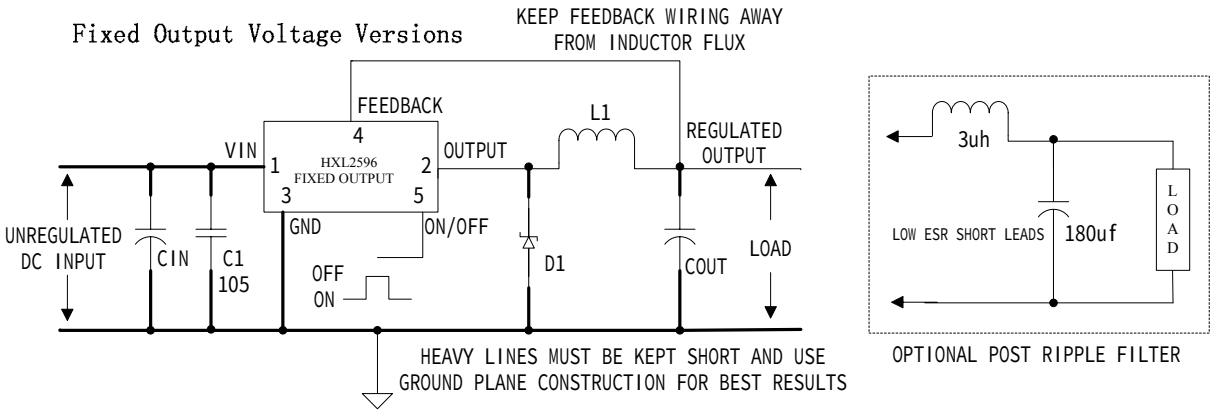
Ta=25℃;unless otherwise specified，System parameters test circuit figure5

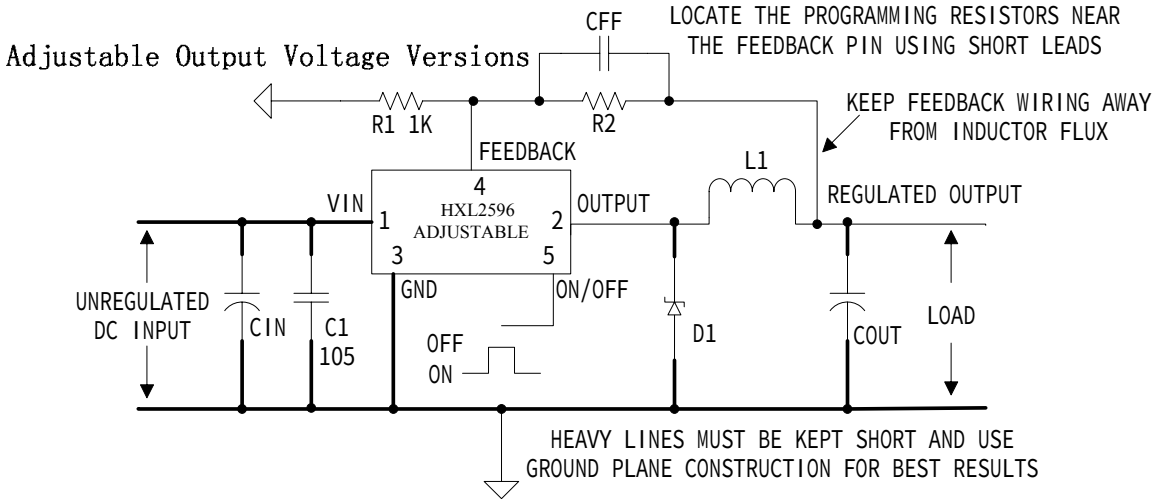
Electrical Characteristics（DC Parameters）

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V_{in}		4.5		40	V
Shutdown Supply Current	I_{STBY}	$V_{ON/OFF}$=5V		80	200	μA
Quiescent Supply Current	I_q	V_{ON}/O_{FF}=0V，V_{FB}=V_{in}		2	10	mA
Oscillator Frequency	F_{osc}		127	150	173	KHz
Switch Current Limit	I_L	V_{FB}=0	3.6	4.8	6.9	A
ON/OFF Pin Threshold	$V_{ON/OFF}$	High (Regulator OFF) Low (Regulator ON)		1.4 0.8		V
ON/OFF Pin Input Leakage Current	I_H	$V_{ON/OFF}$=2.5V（OFF）		5	15	μA
	I_L	$V_{ON/OFF}$=0.5V（ON）		0.2	5	
Output Saturation Voltage	V_{CE}	V_{FB}=0V，I_{out}=3A		1.3	1.5	V
Max. Duty Cycle	D_{MAX}	V_{FB}=0V		100		%

V_{in}=12V for the 3.3V，5V，and Adjustable Versions and V_{in}=24V for the 12V Version, G_{ND}=0V, V_{in} & G_{ND} parallel connect a 220uF/50V capacitor；I_{out}=500mA，T_a=25℃，the others floating unless otherwise specified.

Test Circuit and Layout guidelines





Standard Test Circuits and Layout Guides

Select R1 to be approximately 1KΩ，use a 1% Resistor for best stability. C1 and CFF are optional；in order to increase stability and reduce the input power line noise, CIN and C1 must be placed near to PIN1 and PIN3；For output voltages greater than approximately 10V，an additional capacitor CFF is required.

The compensation capacitor is typically between 100pF and 33nF，and is wired in parallel with the output voltage setting resistor, R2.

It provides additional stability for high output voltage，low input-output voltages，and/or very low ESR output capacitors，such as solid tantalum capacitors. CFF=1/（31×1000×R2）；

This capacitor type can be ceramic，plastic，silver mica，etc.（Because of the unstable characteristics of ceramic capacitors made with Z5U material，they are not recommended）

HXL2596 Series Buck Regulator Design Procedure（Fixed Output）

Conditions			Inductor（L1）	Output Capacitor（COUT）			
				Through Hole Electrolytic		Surface Mount Tantalum	
Output Voltage（V）	Load Current（A）	Max Input Voltage（V）	Inductance（uh）	Panasonic HFQ Series（uF/V）	Nichicon PL Series（uF/V）	AVX TPS Series（uF/V）	Sprague 595D Series（uF/V）
3.3V	3A	5	22	470/25	560/16	330/6.3	390/6.3
		7	22	560/35	560/35	330/6.3	390/6.3
		10	22	680/35	680/35	330/6.3	390/6.3
		40	33	560/35	470/35	330/6.3	390/6.3
	2A	6	22	470/25	470/35	330/6.3	390/6.3
		10	33	330/35	330/35	330/6.3	390/6.3
		40	47	330/35	270/50	220/10	330/10
5V	3A	8	22	470/25	560/16	220/10	330/10
		10	22	560/25	560/25	220/10	330/10
		15	33	330/35	330/35	220/10	330/10
		40	47	330/35	270/35	220/10	330/10
	2A	9	22	470/25	560/16	220/10	330/10
		20	68	180/35	180/35	100/10	270/10
		40	68	180/35	180/35	100/10	270/10
12V	3A	15	22	470/25	470/25	100/16	180/16
		18	33	330/25	330/25	100/16	180/16
		30	68	180/25	180/25	100/16	120/20
		40	68	180/35	180/25	100/16	120/20
	2A	15	33	330/25	330/25	100/16	180/16
		20	68	180/25	180/25	100/16	120/20
		40	150	82/25	82/25	68/20	68/25

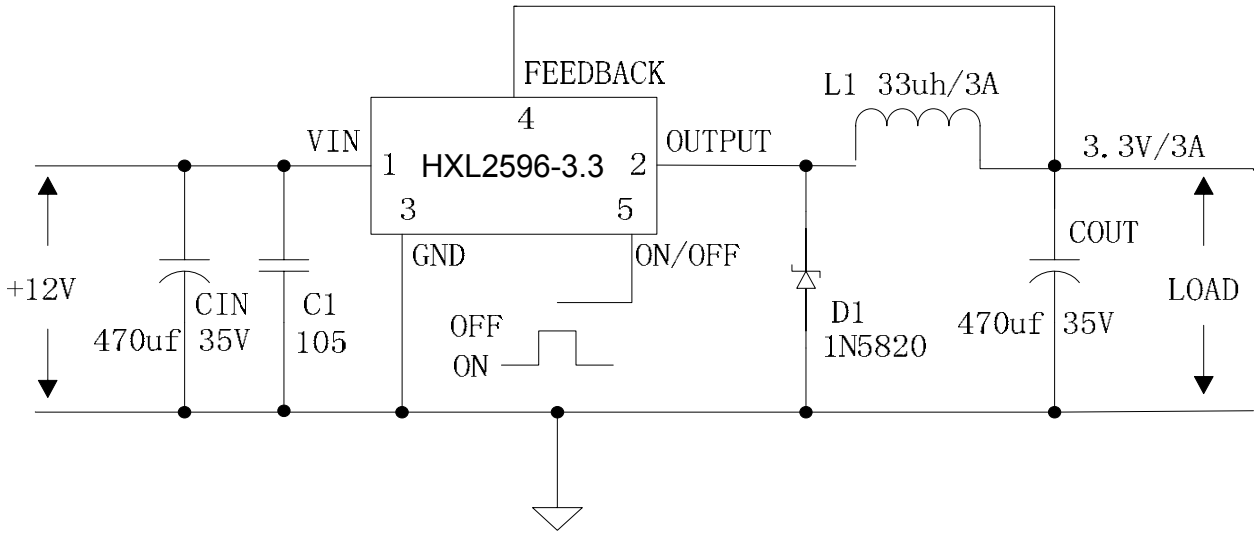
HXL2596 Series Buck Regulator Design Procedure（Adjustable Output）

Output Voltage（V）	Through Hole Output Electrolytic			Surface Mount Output Capacitor		
	Panasonic HFQ Series（uF/V）	Nichicon PL Series（uF/V）	Feedforward Capacitor	AVX TPS Series（uF/V）	Sprague 595D Series（uF/V）	Feedforward Capacitor
2	820/35	820/35	33nF	330/6.3	470/4	33nF
4	560/35	470/35	10nF	330/6.3	390/6.3	10nF
6	470/25	470/35	3.3nF	220/10	330/10	3.3nF
9	330/25	330/25	1.5nF	100/16	180/16	1.5nF
12	330/25	330/25	1nF	100/16	180/16	1nF
15	220/25	220/35	680pF	68/20	120/20	680pF
24	220/35	150/35	560pF	33/25	33/25	220pF
28	100/50	100/50	390pF	10/35	15/50	220pF

Schottky Diode Selection Table

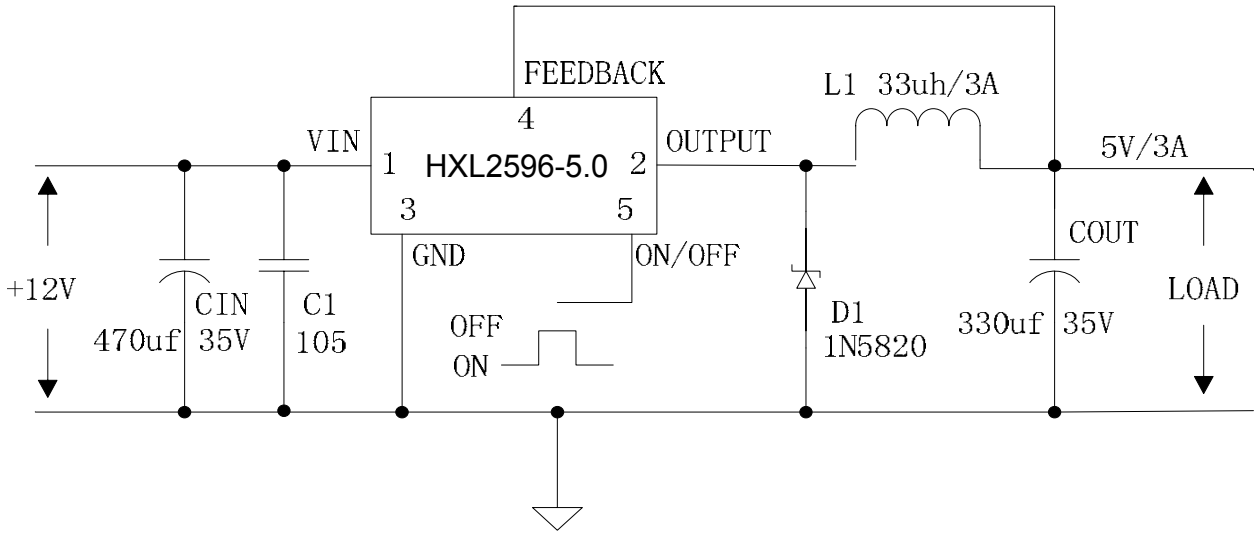
Current	Surface Mount	Through Hole	V_R（The same as system maximum input voltage）				
			20V	30V	40V	50V	60V
1A		√	1N5817	1N5818	1N5819		
3A		√	1n5820	1N5821	1N5822		
		√	MBR320	MBR330	MBR340	MBR350	MBR360
	√		SK32	SK33	SK34	SK35	SK36
	√			30WQ03	30WQ04	30WQ05	
		√		31DQ03	31DQ04	31DQ05	
		√	SR302	SR303	SR304	SR305	SR306
5A		√	1N5823	1N5824	1N5825		
		√	SR502	SR503	SR504	SR505	SR506
		√	SB520	SB530	SB540	SB550	SB560
	√			50WQ03	50WQ04	50WQ05	

Typical System Application for 3.3V Version



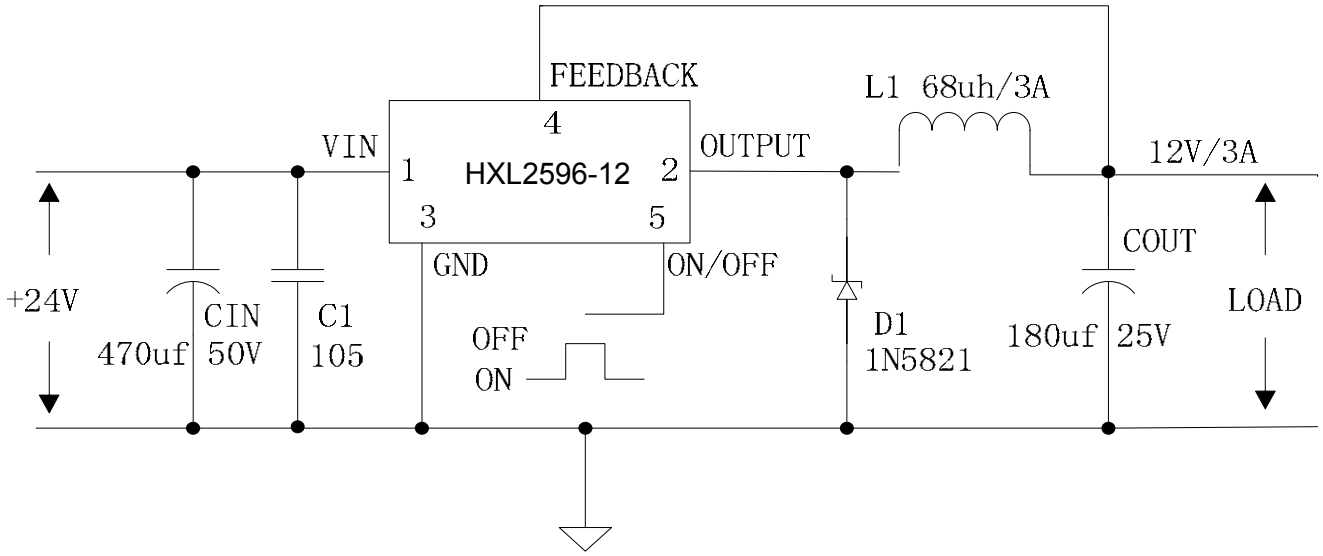
HXL2596-3.3 System Parameters Test Circuit

Typical System Application for 5V Version



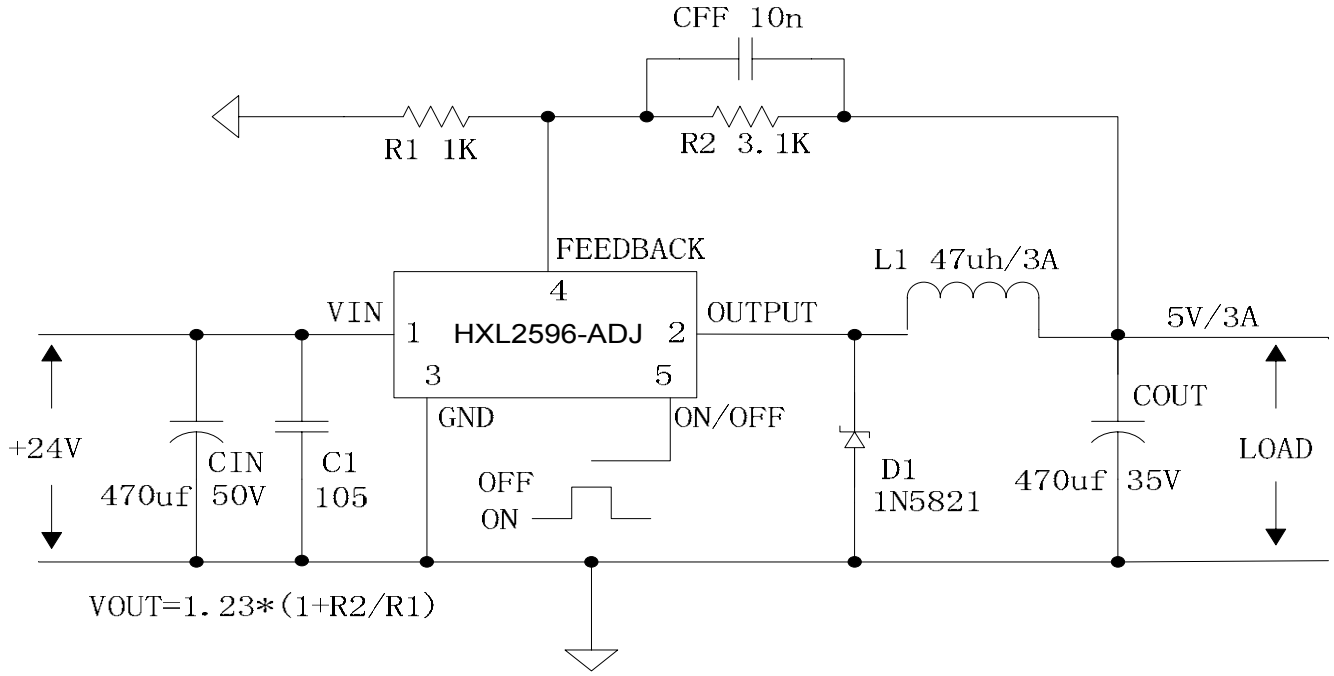
HXL2596-5.0 System Parameters Test Circuit

Typical System Application for 12V Version



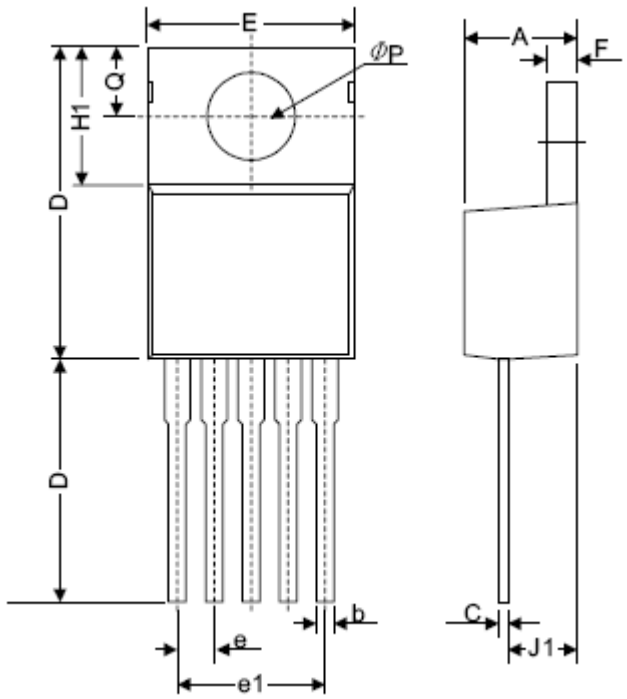
HXL2596-12 System Parameters Test Circuit

Typical System Application for ADJ Version



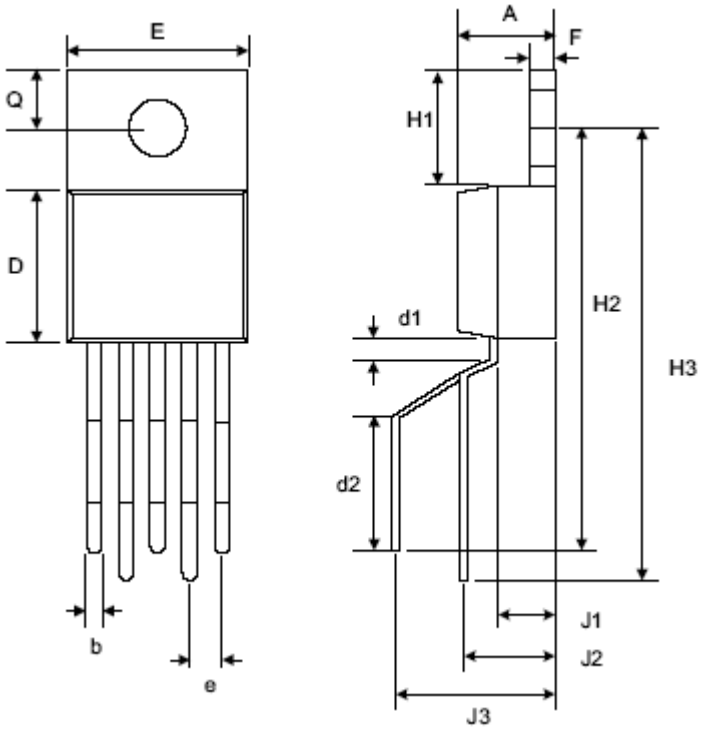
HXL2596-ADJ System Pa rameters Test Circuit

TO-220-5L　Package Information



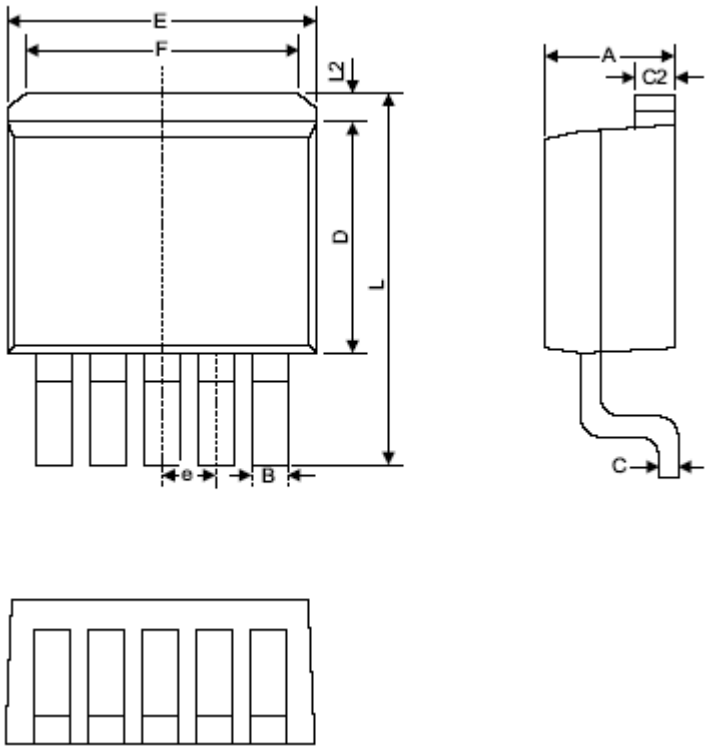
Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.16	0.19
b	0.76	1.02	0.03	0.04
C	0.36	0.64	0.014	0.025
D	14.22	15.49	0.56	0.61
E	9.78	10.54	0.385	0.415
e	1.57	1.85	0.062	0.073
e(1)	6.68	6.93	0.263	0.273
F	1.14	1.4	0.045	0.055
H(1)	5.46	6.86	0.215	0.27
J(1)	2.29	3.18	0.09	0.125
L	13.21	14.73	0.52	0.58
ΦP	3.68	3.94	0.145	0.155
Q	2.54	2.92	0.1	0.115

TO-220B-5L　Package Information



Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	0.44	0.17	0.175	0.185
b	0.07	0.09	0.027	0.037
D	0.84	0.89	0.33	0.35
d1	0.1		0.039	
d2	0.63		0.248	
E	9.91	10.41	0.39	0.41
e	0.16	0.18	0.062	0.072
F	0.12	0.13	0.048	0.052
H1	0.84		0.25	
H2	2.08	2.24	0.82	0.88
H3	2.38	2.55	0.942	1.002
J1	0.27		0.105	
J2	0.37	0.53	0.147	0.207
J3	0.84		0.331	
Q	0.25	0.3	0.1	0.12

TO-263-5L　Package Information



Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.16	0.19
B	0.76	1.02	0.03	0.04
C	0.36	0.64	0.014	0.025
C2	1.14	1.4	0.045	0.055
D	8.64	9.85	0.34	0.38
E	9.78	10.54	0.385	0.415
e	1.57	1.85	0.062	0.073
F	6.6	7.11	0.26	0.28
L	15.11	15.37	0.595	0.605
L2	--	1.4	--	0.065

Manufacturers version information
2012-01-01， HAOHAI ™ Product Data-1.0
2014-07-11， HAOHAI ™ Product Data-2.0
2021-05-11， HAOHAI ™ Product Data-2.1

深圳市浩海電子有限公司
SHENZHEN HAOHAI ELECTRONICS CO., LTD.

TEL: +86-755-29955080、29955081、29955082、29955083
FAX: +86-755-27801767　　E-mail:kkg@kkg.com.cn
http://www.szhhe.com　　http://www.kkg.com.cn