

Product Specification

XBL2596

3A 150KHz 40V PWM Buck DC/DC Converter

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Descriptions

The XBL2596 is a 150 KHz 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.

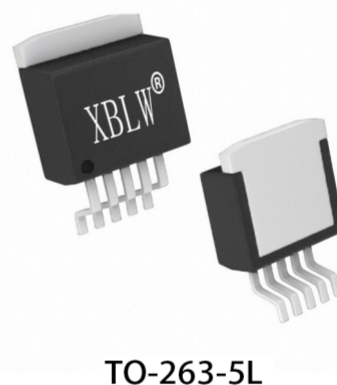
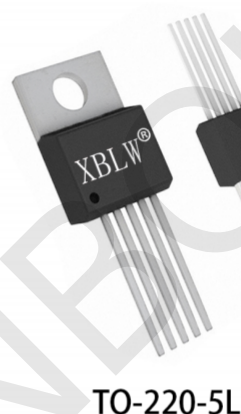
The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An enable function, an over current protection function is built inside. When second current limit function happens, the operation frequency will be reduced from 150KHz to 50KHz. An internal compensation block is built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

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 1.0V
- Fixed 150KHz Switching Frequency
- 3A Constant Output Current Capability
- Internal Optimize Power Transistor
- High efficiency
- TTL shutdown capability
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in TO220-5L/TO263-5L packages

Applications

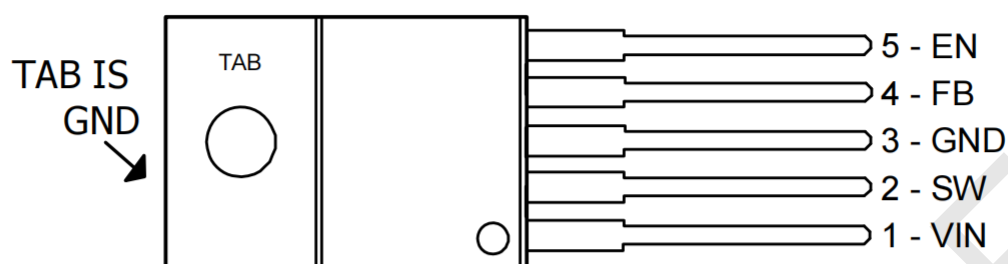
- Portable DVD
- LCD Monitor / TV
- Battery Charger
- ADSL Modem
- Telecom / Networking Equipment



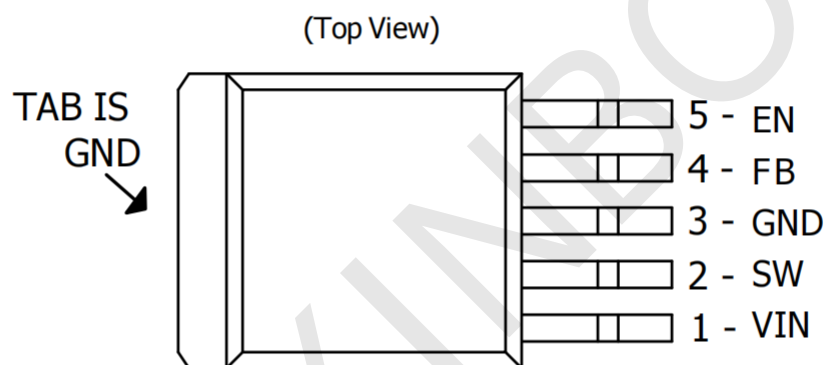
Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL2596T-3.3	TO-220-5L	XBL2596T-3.3	Tube	1000Pcs/Box
XBL2596T-5.0	TO-220-5L	XBL2596T-5.0	Tube	1000Pcs/Box
XBL2596T-12	TO-220-5L	XBL2596T-12	Tube	1000Pcs/Box
XBL2596T-ADJ	TO-220-5L	XBL2596T-ADJ	Tube	1000Pcs/Box
XBL2596S-3.3	TO-263-5L	XBL2596S-3.3	Tape	1000Pcs/Reel
XBL2596S-5.0	TO-263-5L	XBL2596S-5.0	Tape	1000Pcs/Reel
XBL2596S-12	TO-263-5L	XBL2596S-12	Tape	1000Pcs/Reel
XBL2596S-ADJ	TO-263-5L	XBL2596S-ADJ	Tape	1000Pcs/Reel

Pin Configurations



TO-220-5L



TO-263-5L

Figure 1 Pin Configuration of XBL2596 (Top View)

Pin Description

Pin Number	Pin Name	Description
1	VIN	Supply Voltage Input Pin. XBL2596 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	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
3	GND	Ground.
4	FB	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	EN	Enable Pin. Drive EN pin low to turn on the device, drive it high to turn it off. Floating is default low.
Tab	GND	Ground.

Function Block

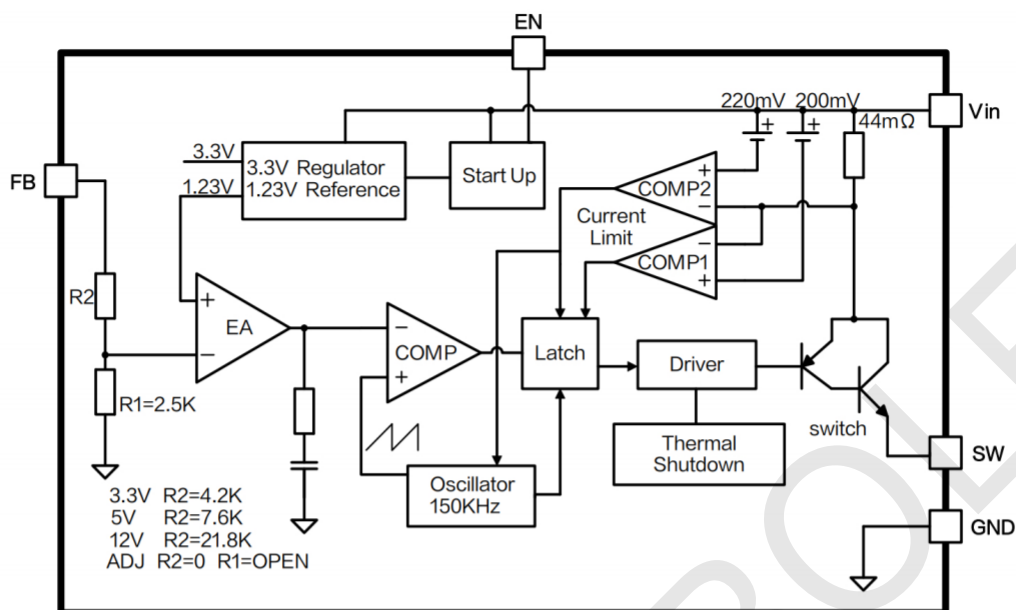


Figure 2 Function Block Diagram of XBL2596

Typical Application Circuit

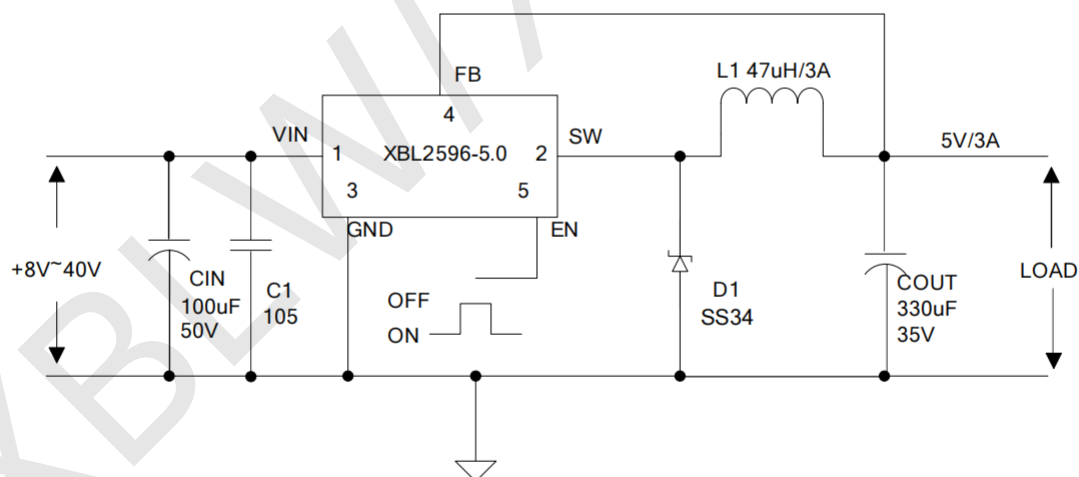


Figure 3. XBL2596 Typical Application Circuit (VIN=8V~40V, VOUT=5V/3A)

Absolute Maximum Ratings

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.

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 45	V
Feedback Pin Voltage	V_{FB}	-0.3 to V_{IN}	V
Enable Pin Voltage	V_{EN}	-0.3 to V_{IN}	V
Switch Pin Voltage	V_{SW}	-0.3 to V_{IN}	V
Power Dissipation	P_D	Internally limited	mW
Operating Junction Temperature	T_J	-40~125	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		2000	V
MSL		Level3	
Thermal Resistance-Junction to Ambient	$R_{\theta JA}$	85	°C / W
Thermal Resistance-Junction to Case	$R_{\theta JC}$	45	°C / W

Recommended Operating Conditions

Parameter Name	Symbol	Value	Unit
Supply Voltage	V_{IN}	4.5~40	V
Operating temperature range	T_{opr}	-40~+125	°C

XBL2596-3.3 Electrical Characteristics

$T_A = 25^{\circ}\text{C}$; unless otherwise specified. System parameters test circuit figure 5.

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

XBL2596-5.0 Electrical Characteristics

$T_A = 25^{\circ}\text{C}$; unless otherwise specified. System parameters test circuit figure 6.

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

XBL2596-12 Electrical Characteristics

T_A = 25°C; unless otherwise specified. System parameters test circuit figure 7.

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
η	Efficiency	V _{in} =25V, V _{out} =12V, I _{out} =3A	-	90	-	%

XBL2596-ADJ Electrical Characteristics

T_A = 25°C; unless otherwise specified. System parameters test circuit figure 8.

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
η	Efficiency	V _{in} =12V, V _{out} =3V, I _{out} =3A	-	73	-	%

Electrical Characteristics (DC Parameters)

V_{in} = 12V for the 3.3V, 5V, and Adjustable versions and V_{in}=24V for the 12V version, GND=0V, V_{in} & GND parallel connect a 220uF/50V capacitor; I_{out}=500mA, T_a = 25°C; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V _{in}		4.5		40	V
Shutdown Supply Current	I _S	V _{EN} =5V		50	200	uA
Quiescent Supply Current	I _q	V _{EN} = 0V, V _{FB} = V _{in}		4.5	10	mA
Oscillator Frequency	F _{osc}		127	150	173	KhZ
Switch Current Limit	I _L	V _{FB} = 0V	3.6	4.8	6.9	A
EN Pin Threshold	V _{EN}	High (Regulator OFF) Low (Regulator ON)		1.5 0.8		V
EN Pin Input Leakage Current	I _H	V _{EN} = 2.5V (OFF)		8	15	uA
	I _L	V _{EN} = 0.5V (ON)		0.5	5	uA
Output Saturation Voltage	V _{CE}	V _{FB} =0V I _{out} =3A		1.5	1.8	V
Max. Duty Cycle	D _{MAX}	V _{FB} =0V		100		%

Test Circuit and Layout guidelines

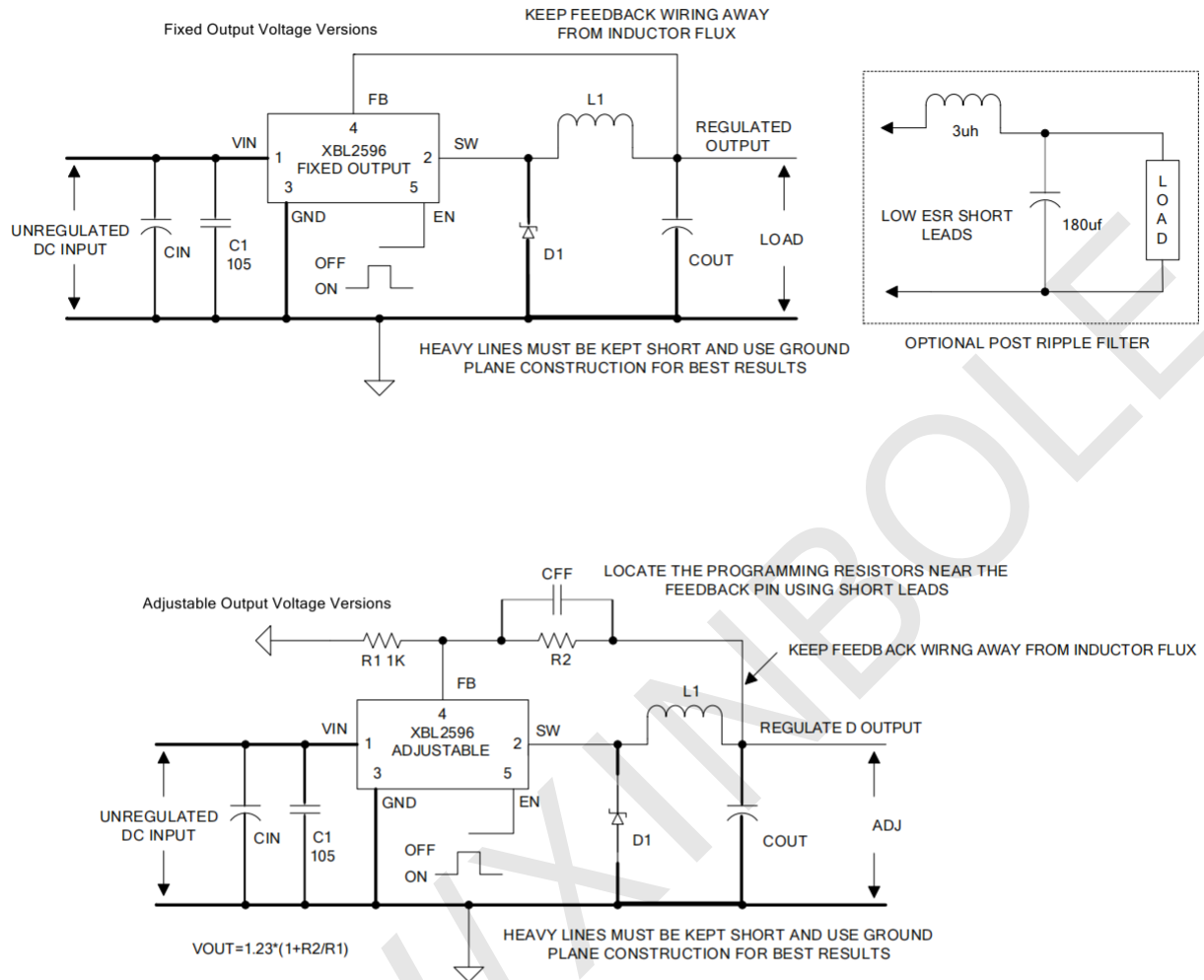


Figure 4. Standard Test Circuits and Layout Guides

Select R1 to be approximately 1K, use a 1% resistor for best stability.

C1 and CFF are optional; in order to increase stability and reduce the input power line noise, 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 100 pf and 33 nf , 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 . $CFF = 1 / (31 \cdot 1000 \cdot R2)$; 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.)

XBL2596 Series Buck Regulator Design Procedure (Fixed Output)

Conditions			Inductor (L1)	Output Capacitor (COU)			
				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)
3.3	3	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
	2	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
5	3	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
	2	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
12	3	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
	2	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

XBL2596 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	VR (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

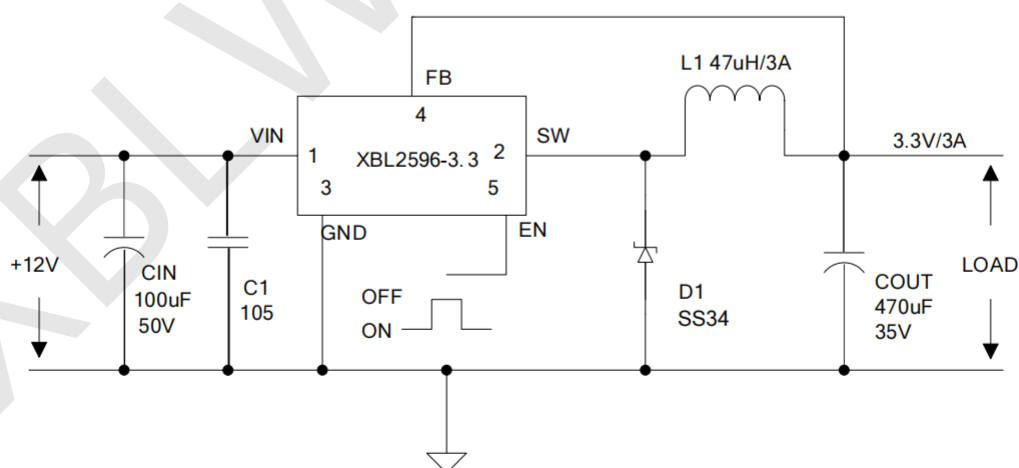


Figure 5. XBL2596-3.3 System Parameters Test Circuit

Typical System Application for 5V Version

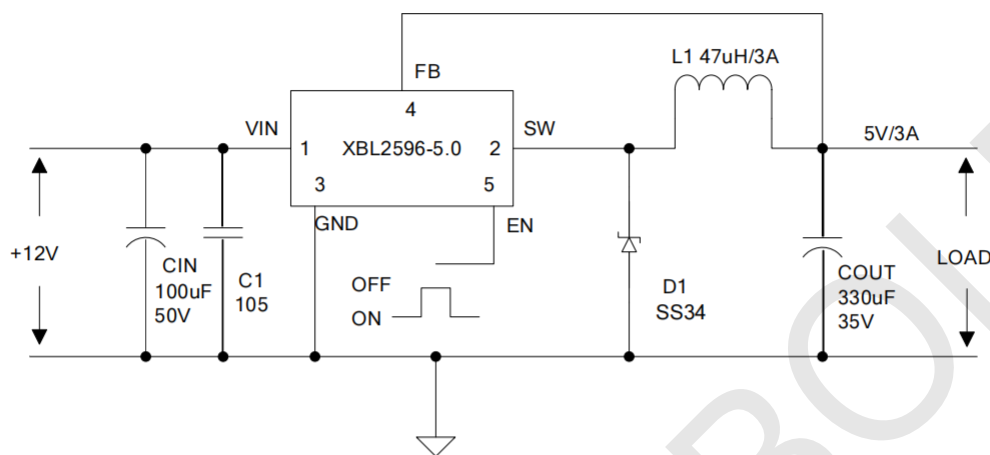


Figure 6. XBL2596-5.0 System Parameters Test Circuit

Typical System Application for 12V Version

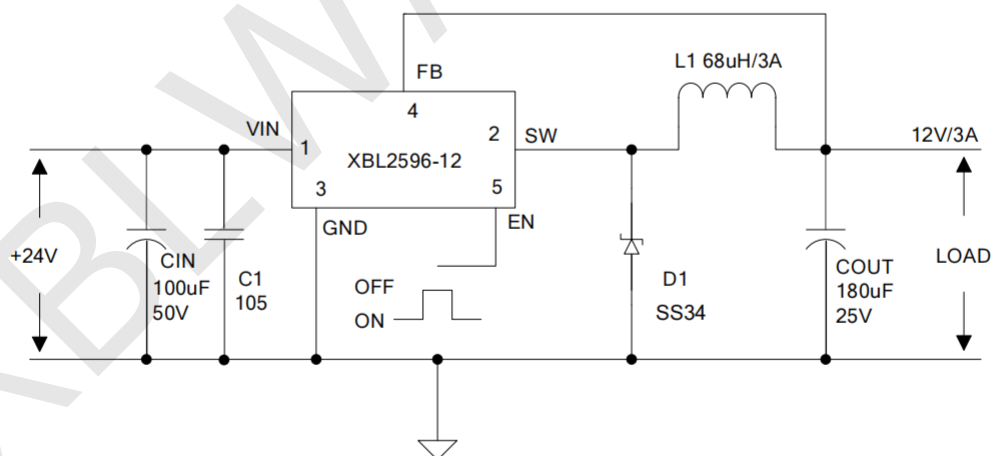


Figure 7. XBL2596-12 System Parameters Test Circuit

Typical System Application for ADJ Version

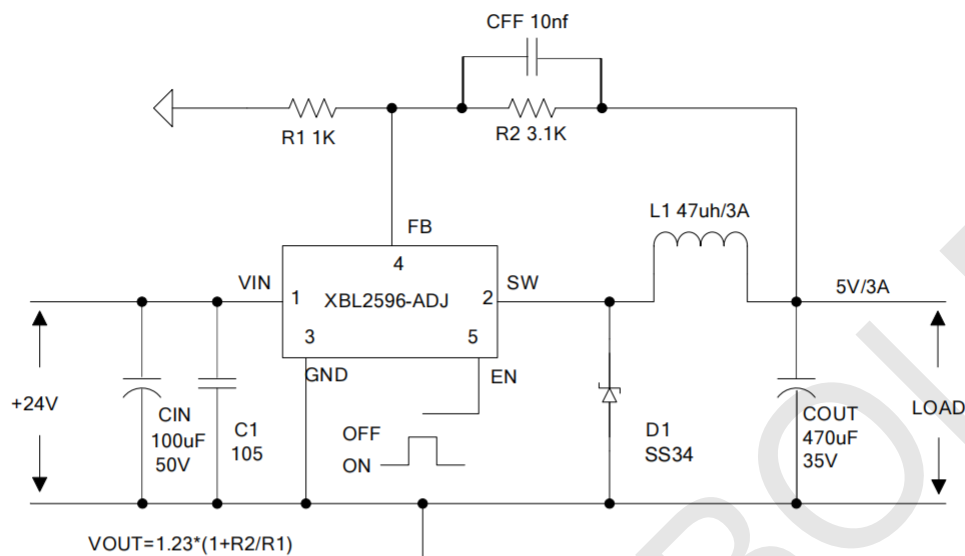


Figure 8. XBL2596-ADJ System Parameters Test Circuit

High Power Application Circuit

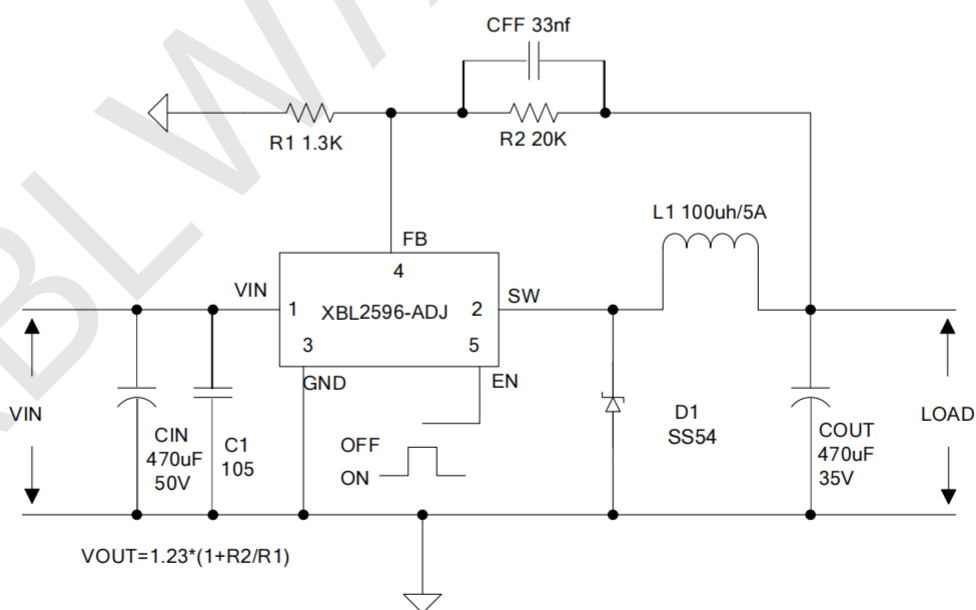
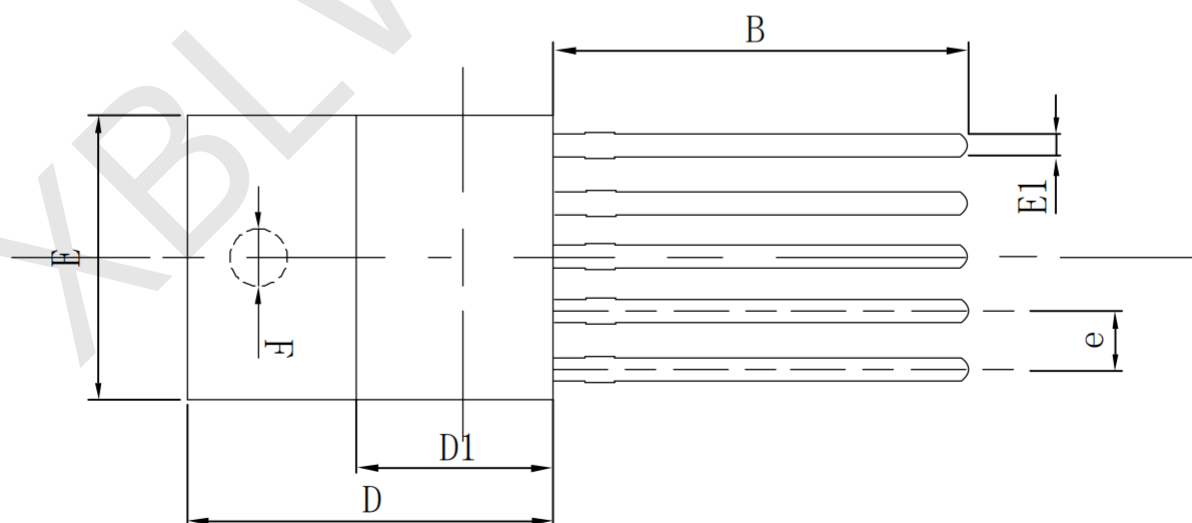
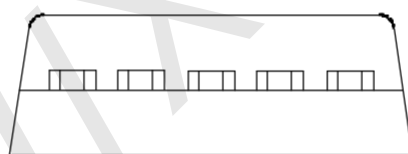
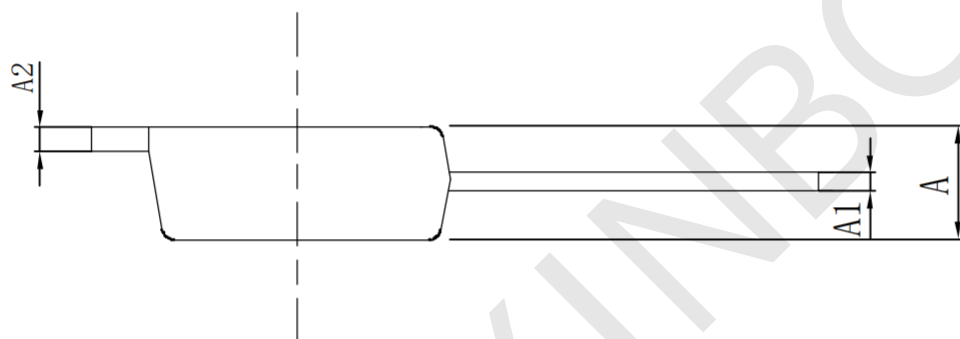


Figure 9. XBL2596-ADJ High Power Application Circuit ($V_{IN}=24V, V_{OUT}=20V, I_{OUT}=2.5A$)

Package Information

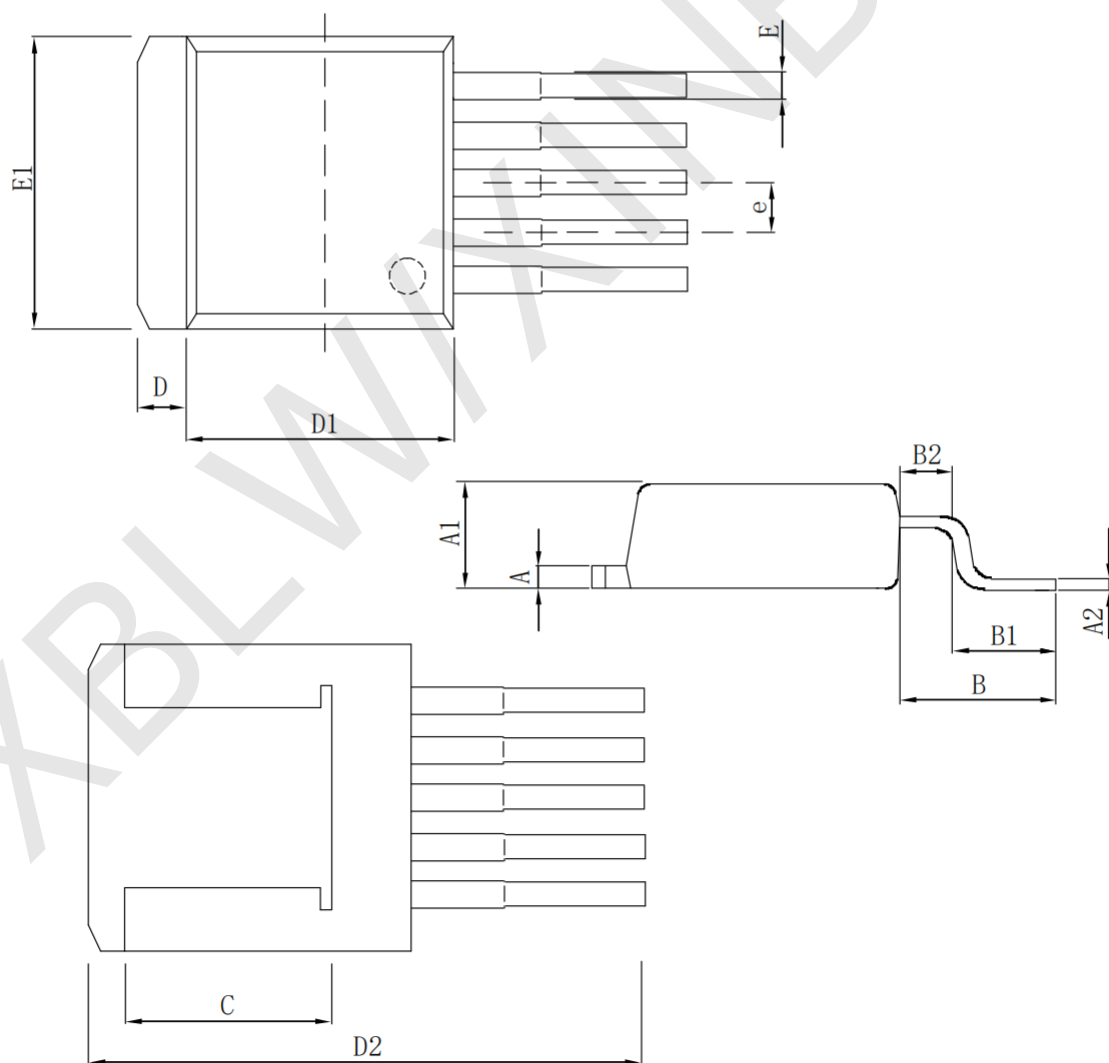
· T0-220-5L

Size Symbol	Dimensions In Millimeters		Size Symbol	Dimensions In Inches	
	Min (mm)	Max (mm)		Min (in)	Max (in)
A	4.300	4.700	A	0.169	0.185
A1	0.450	0.600	A1	0.017	0.023
A2	1.250	1.400	A2	0.049	0.055
B	12.88	13.38	B	0.507	0.527
D	15.50	15.90	D	0.610	0.626
D1	9.000	9.400	D1	0.354	0.370
E	9.700	10.10	E	0.381	0.398
E1	0.660	0.914	E1	0.025	0.036
e	1.702 (BSC)		e	0.670 (BSC)	
F	Φ3.500	Φ3.700	F	Φ0.137	Φ0.146



· T0-263-5L

Symbol	Size	Dimensions In Millimeters		Symbol	Size	Dimensions In Inches	
		Min (mm)	Max (mm)			Min (in)	Max (in)
A		1.270 (BSC)		A		0.050 (BSC)	
A1		4.570 (BSC)		A1		0.180 (BSC)	
A2		0.400 (BSC)		A2		0.0157 (BSC)	
B		3.870	4.270	B		0.152	0.168
B1		2.490	2.890	B1		0.098	0.114
B2		1.380 (BSC)		B2		0.0543 (BSC)	
C		6.900	7.200	C		0.272	0.283
D		1.740 (BSC)		D		0.0685 (BSC)	
D1		8.560	8.760	D1		0.337	0.345
D2		14.306	14.706	D2		0.563	0.579
E		0.810	0.910	E		0.0319	0.0358
E1		9.920	10.22	E1		0.391	0.402
e		1.700 (BSC)		e		0.0669 (BSC)	



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