3A 150KHz 40V Buck DC to DC Converter XL2596

Features

- Wide 3.6 to 40V Input Voltage Range
- 3.3V,5V,12V, and adjustable versions
- Output Adjustable from 1.23V to 38V
- Maximum Duty Cycle 100%
- Minimum Drop Out 1.3V
- Fixed 150KHz Switching Frequency
- 3A Constant Output Current Capability
- Internal Optimize Power Transistor
- Up to 90% Efficiency
- Excellent line and load regulation
- TTL shutdown capability
- Built in Frequency Compensation
- Built in Soft Start Function
- Built in Thermal Shutdown Function
- Built in Current Limit Function
- Built in Short Protection Function
- Available in TO-220,TO-263 packages

Applications

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

General Description

The XL2596 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 and a short circuit protection function are built inside. When OCP or SCP happens, the operation frequency will be reduced from 150KHz to 30KHz. An internal compensation block is built in to minimize external component count.

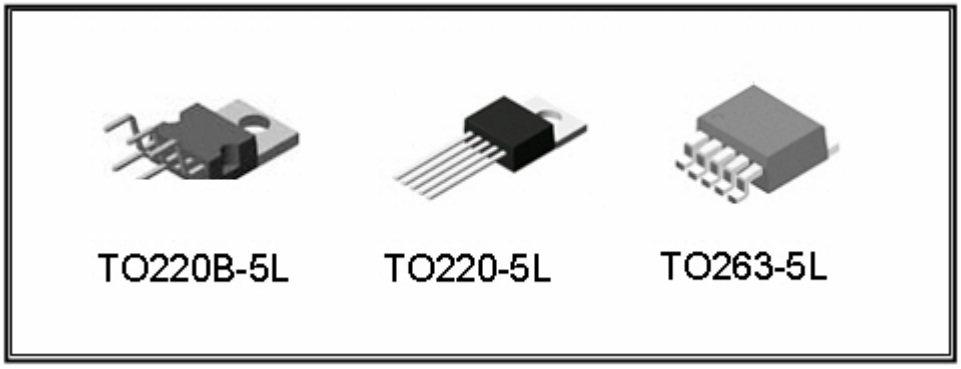


Figure1. Package Type of XL2596

Pin Configurations

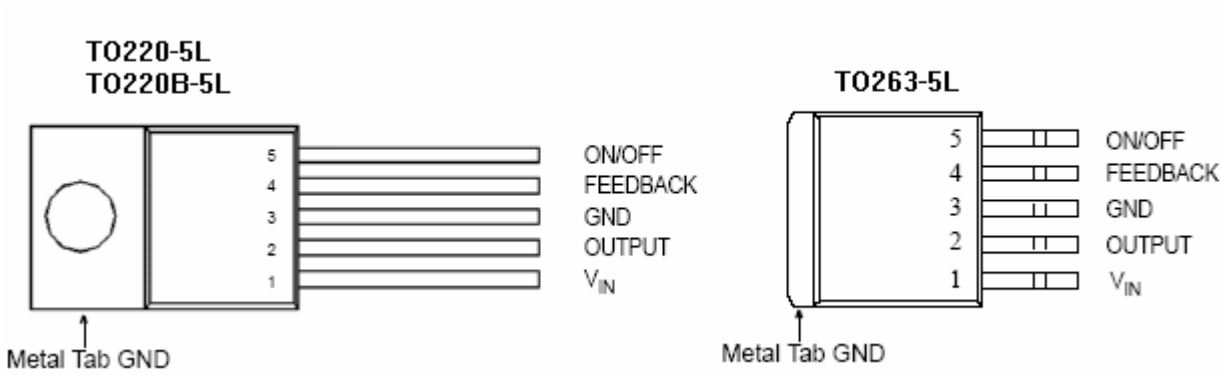


Figure2. Pin Configuration of XL2596 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	Vin	Supply Voltage Input Pin. XL2596 operates from a 3.6V 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 XL2596.
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

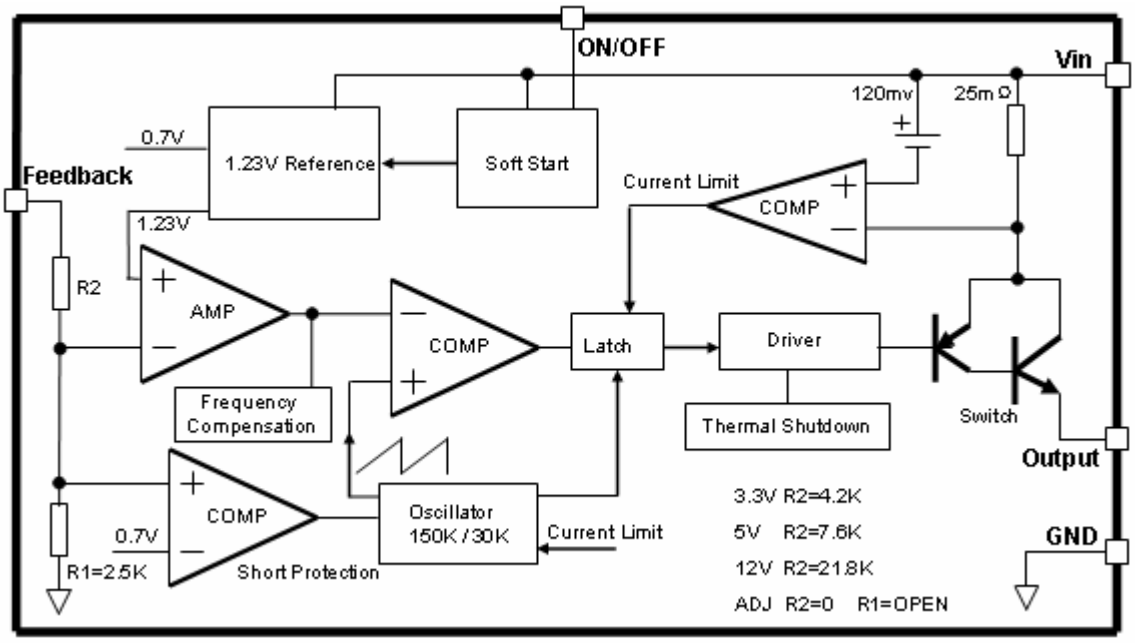


Figure3. Function Block Diagram of XL2596

Typical Application Circuit

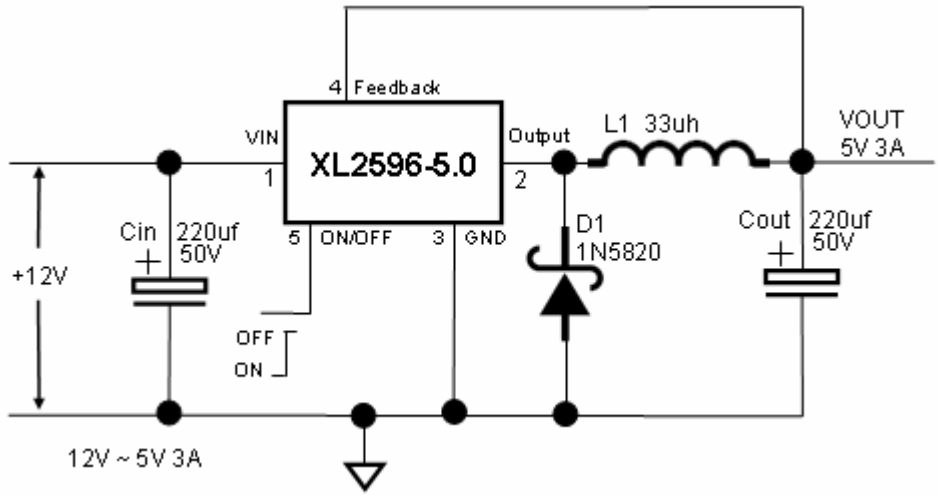
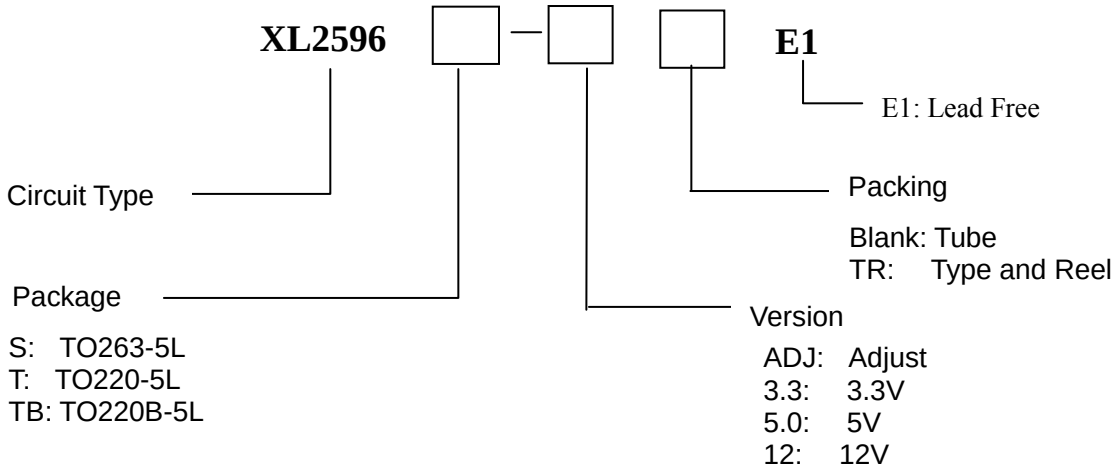


Fig4. XL2596 Typical Application Circuit 12V-5V/3A

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
		Lead Free	Lead Free	
TO220-5L	-40°C ~ 85°C	XL2596T-ADJE1	XL2596T-ADJE1	Tube
		XL2596T-3.3E1	XL2596T-3.3E1	Tube
		XL2596T-5.0E1	XL2596T-5.0E1	Tube
		XL2596T-12E1	XL2596T-12E1	Tube
TO220B-5L	-40°C ~ 85°C	XL2596TB-ADJE1	XL2596TB-ADJE1	Tube
		XL2596TB-3.3E1	XL2596TB-3.3E1	Tube
		XL2596TB-5.0E1	XL2596TB-5.0E1	Tube
		XL2596TB-12E1	XL2596TB-12E1	Tube
TO263-5L	-40°C ~ 85°C	XL2596S-ADJE1	XL2596S-ADJE1	Tube
		XL2596S-3.3E1	XL2596S-3.3E1	Tube
		XL2596S-5.0E1	XL2596S-5.0E1	Tube
		XL2596S-12E1	XL2596S-12E1	Tube
		XL2596S-ADJTRE1	XL2596S-ADJTRE1	Tape & Reel
		XL2596S-3.3TRE1	XL2596S-3.3TRE1	Tape & Reel
		XL2596S-5.0TRE1	XL2596S-5.0TRE1	Tape & Reel
		XL2596S-12TRE1	XL2596S-12TRE1	Tape & Reel

XLSEMI 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	Vin	-0.3 to 45	V
Feedback Pin Voltage	V_{FB}	-0.3 to Vin	V
ON/OFF Pin Voltage	$V_{ON/OFF}$	-0.3 to Vin	V
Output Switch Pin Voltage	V_{Output}	-0.3 to Vin	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (TO220 & TO263) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	50	ºC/W
Operating Junction Temperature	T_J	-40 to 125	ºC
Storage Temperature	T_{STG}	-65 to 150	ºC
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	ºC
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.

Electrical Characteristics (DC Parameters)

Vin = 12V for the 3.3V,5V,and Adjustable versions and Vin=24V for the 12V version, GND=0V, Vin & GND parallel connect a 220uf/50V capacitor; Iout=500mA, T_a = 25℃; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	Vin		3.6		40	V
Shutdown Supply Current	I_{STBY}	$V_{ON/OFF}$=5V		100	200	uA
Quiescent Supply Current	I_q	$V_{ON/OFF}$ =Gnd, V_{FB} =Vin		3	10	mA
Feedback Bias Current	I_{FB}	V_{FB}=1.3V		0.1	1	uA
Switch Current Limit	I_L	V_{FB} =0	3.6	4.8	6.9	A
ON/OFF Pin Threshold	$V_{ON/OFF}$	V_{FB} =0V, $V_{ON/OFF}$ from 0.5V~1.5V	2	1.3	0.6	V
ON/OFF Pin Input Leakage Current	I_H	$V_{ON/OFF}$ =2.5V (OFF)		5	15	uA
	I_L	$V_{ON/OFF}$ =0.5V (ON)		0.2	5	uA
Output Saturation Voltage	V_{CE}	V_{FB}=0V I_{out}=3A		1.3	1.6	V
Max. Duty Cycle	D_{MAX}	V_{FB}=0V		100		%
Thermal Shutdown	T_{OTSD}	V_{FB}=0V		165		ºC
Thermal Shutdown Hysteresis	T_{HYS}	V_{FB}=0V		20		ºC

Electrical Characteristics (System Parameters 3.3V Version)

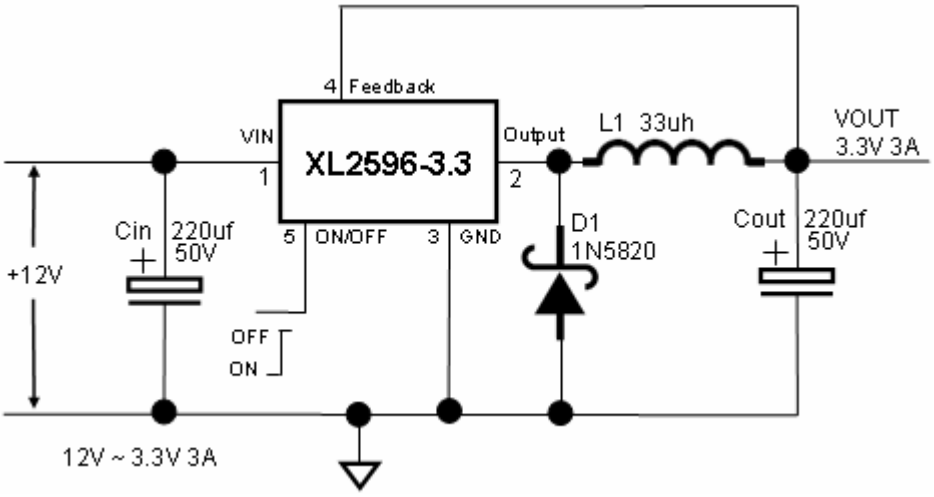


Fig5. XL2596 System Parameters Test Circuit

T_a = 25℃;unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	V_{FB}	Vin = 5V to 36V Vout=3.3V, Iout=0.5A	3.168	3.3	3.432	V
VOUT Line Regulation	R_{LINE}	Vin = 5V to 36V Vout=3.3V, Iout=0.5A		0.5	2	%
VOUT Load Regulation	R_{LOAD}	Vin=12V, Vout=3.3V Iout=0.5 to 3A		0.8	2	%
Switching Frequency	F_{output}	Vin=12V, Vout=3.3V Iout=0.5A	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	Vin=12V, Vout=Short V_{FB}<1.9V		30		KHz
Efficiency(12V~3.3V)	ŋ	Vin=12V ,Vout=3.3V Iout=3A	-	75	-	%

Electrical Characteristics (System Parameters 5V Version)

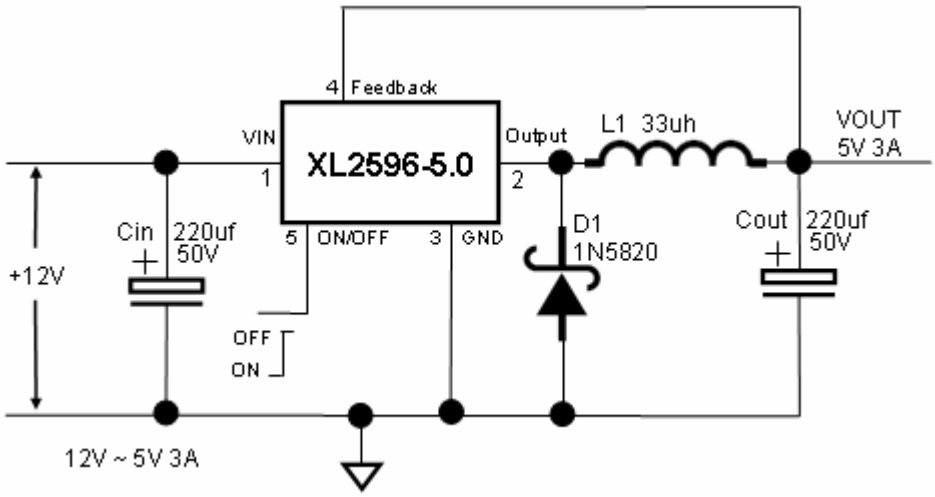


Fig6. XL2596 System Parameters Test Circuit

T_a = 25℃;unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	V_{FB}	Vin = 7V to 36V Vout=5V, Iout=0.5A	4.8	5	5.2	V
VOUT Line Regulation	R_{LINE}	Vin = 7V to 36V Vout=5V, Iout=0.5A		0.5	2	%
VOUT Load Regulation	R_{LOAD}	Vin=12V, Vout=5V Iout=0.5 to 3A		0.8	2	%
Switching Frequency	F_{output}	Vin=12V, Vout=5V Iout=0.5A	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	Vin=12V, Vout=Short V_{FB}<2.8V		30		KHz
Efficiency(12V~5V)	ŋ	Vin=12V ,Vout=5V Iout=3A	-	81	-	%

Electrical Characteristics (System Parameters 12V Version)

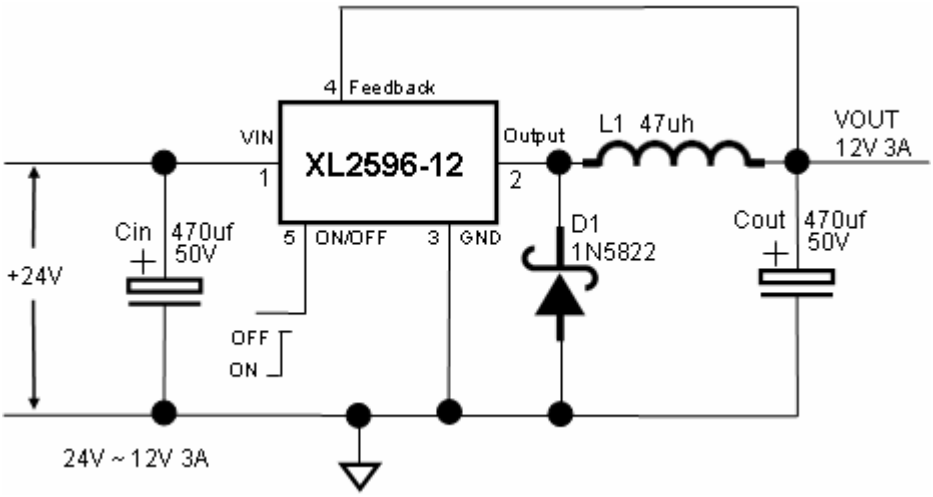


Fig7. XL2596 System Parameters Test Circuit

T_a = 25℃;unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	V_{FB}	Vin = 15V to 36V Vout=12V, Iout=0.5A	11.52	12	12.48	V
VOUT Line Regulation	R_{LINE}	Vin = 15V to 36V Vout=12V, Iout=0.5A		0.6	2	%
VOUT Load Regulation	R_{LOAD}	Vin=24V, Vout=12V Iout=0.5 to 3A		0.8	2	%
Switching Frequency	F_{output}	Vin=24V, Vout=12V Iout=0.5A	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	Vin=24V, Vout=Short V_{FB}<6.8V		30		KHz
Efficiency(24V~12V)	ŋ	Vin=24V ,Vout=12V Iout=3A	-	90	-	%

Electrical Characteristics (System Parameters ADJ Version)

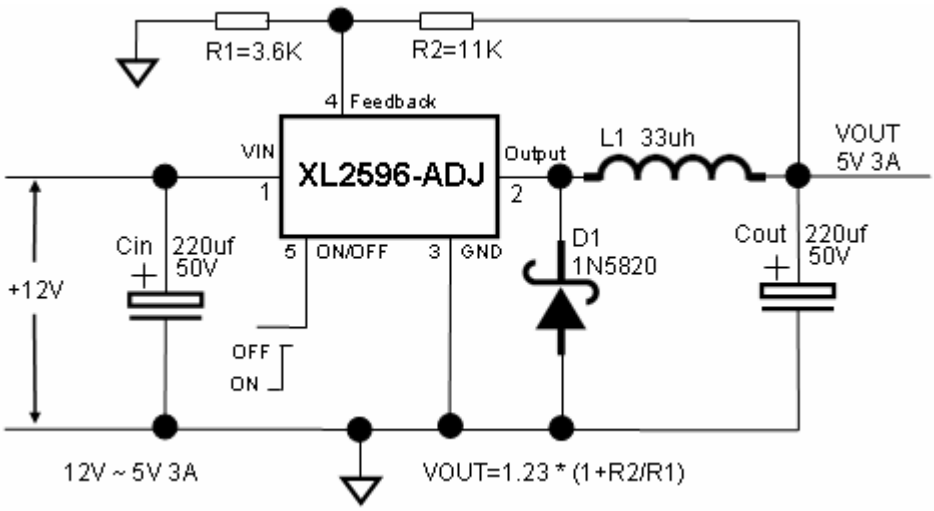
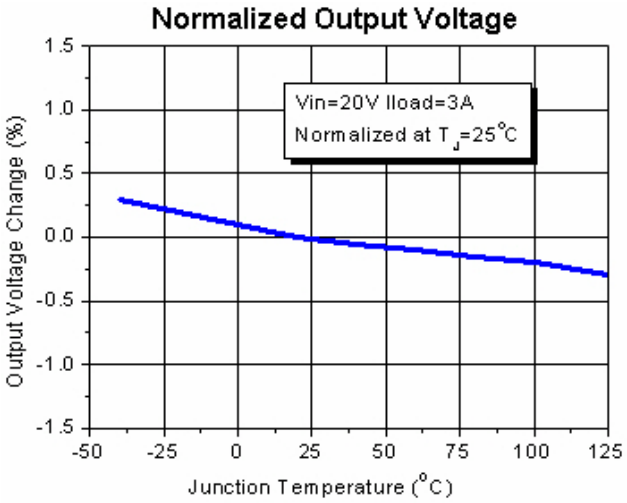


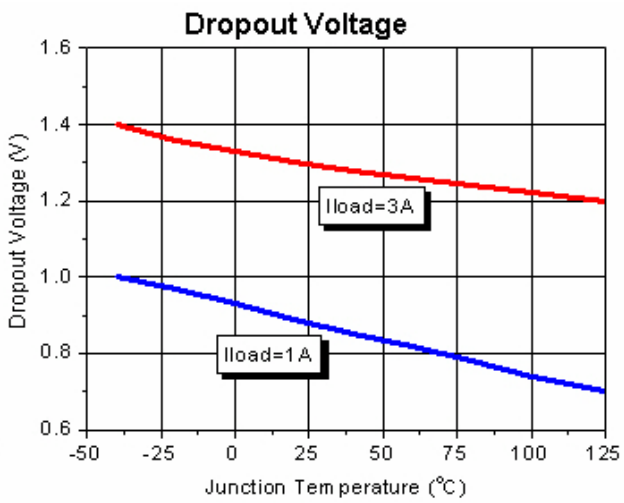
Fig8. XL2596 System Parameters Test Circuit

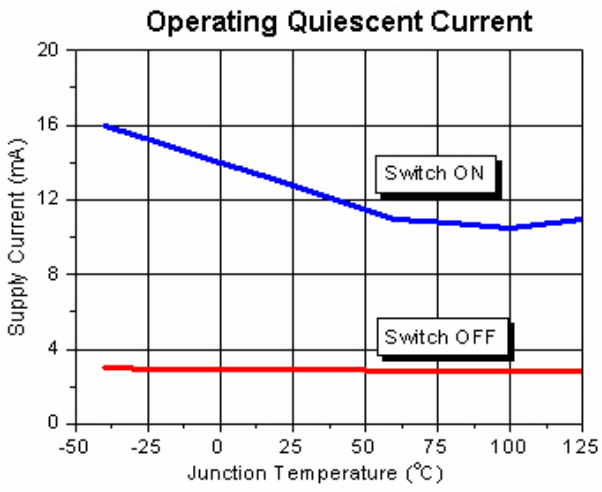
T_a = 25℃;unless otherwise specified.

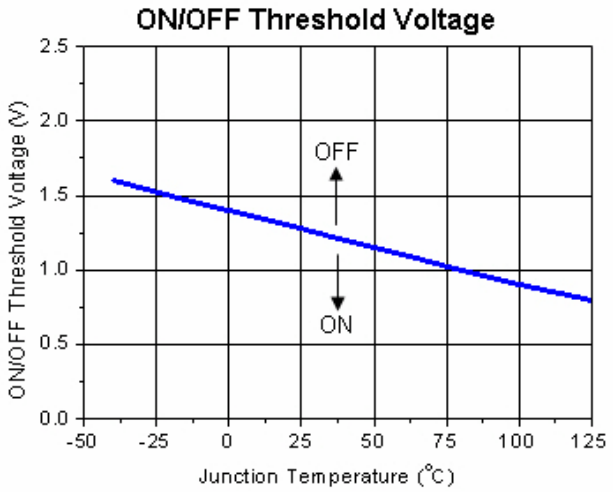
Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	V_{FB}	Vin = 7V to 36V Vout=5V, Iout=0.5A	1.193	1.23	1.267	V
VOUT Line Regulation	R_{LINE}	Vin = 7V to 36V Vout=5V, Iout=0.5A		0.5	2	%
VOUT Load Regulation	R_{LOAD}	Vin=12V, Vout=5V Iout=0.5 to 3A		0.8	2	%
Switching Frequency	F_{output}	Vin=12V, Vout=5V Iout=0.5A	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	Vin=12V, Vout=Short V_{FB}<0.7V		30		KHz
Efficiency(12V~5V)	ŋ	Vin=12V ,Vout=5V Iout=3A	-	81	-	%

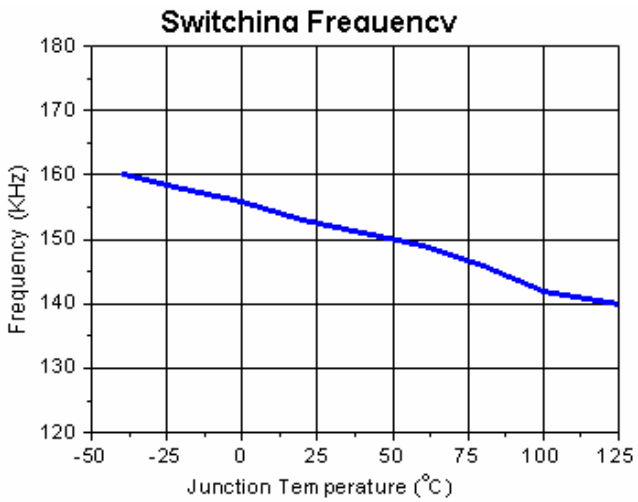
Typical Performance Characteristics (Circuit of Figure 8)

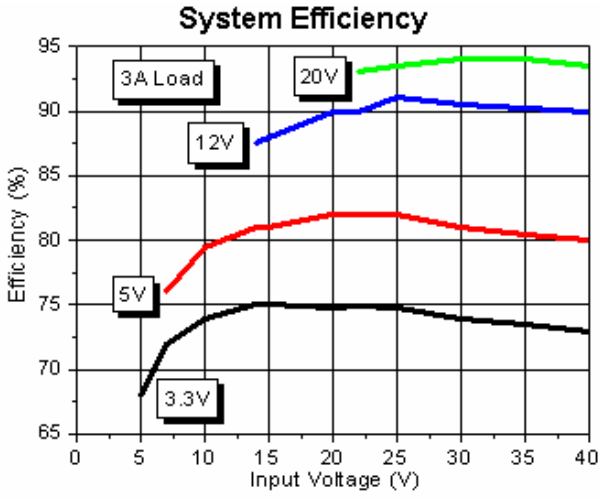






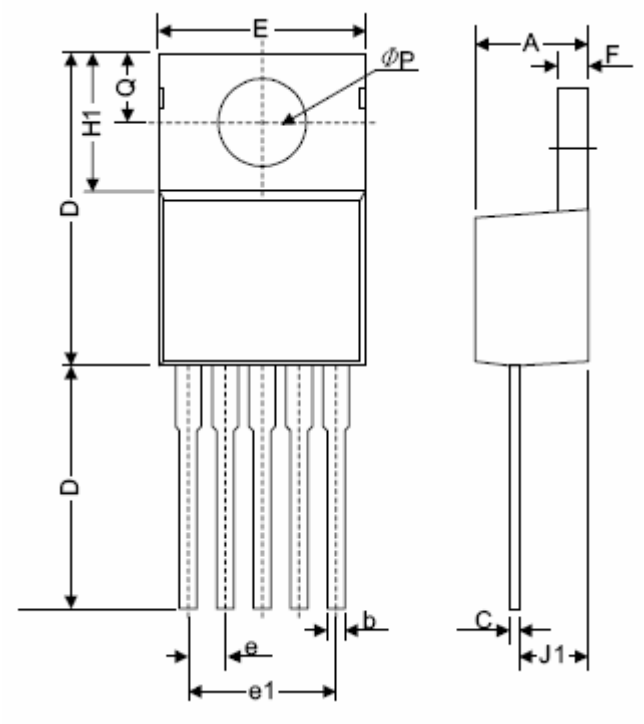






Package Information

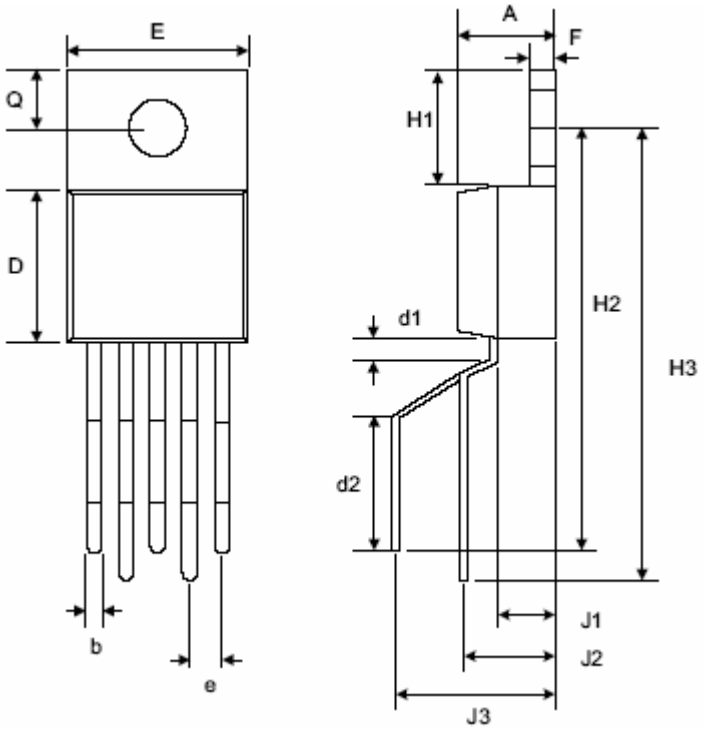
(1) TO220-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
b	0.76	1.02	0.030	0.040
C	0.36	0.64	0.014	0.025
D	14.22	15.49	0.560	0.610
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	1.40	0.045	0.055
H(1)	5.46	6.86	0.215	0.270
J(1)	2.29	3.18	0.090	0.125
L	13.21	14.73	0.520	0.580
ΦP	3.68	3.94	0.145	0.155
Q	2.54	2.92	0.100	0.115

Package Information

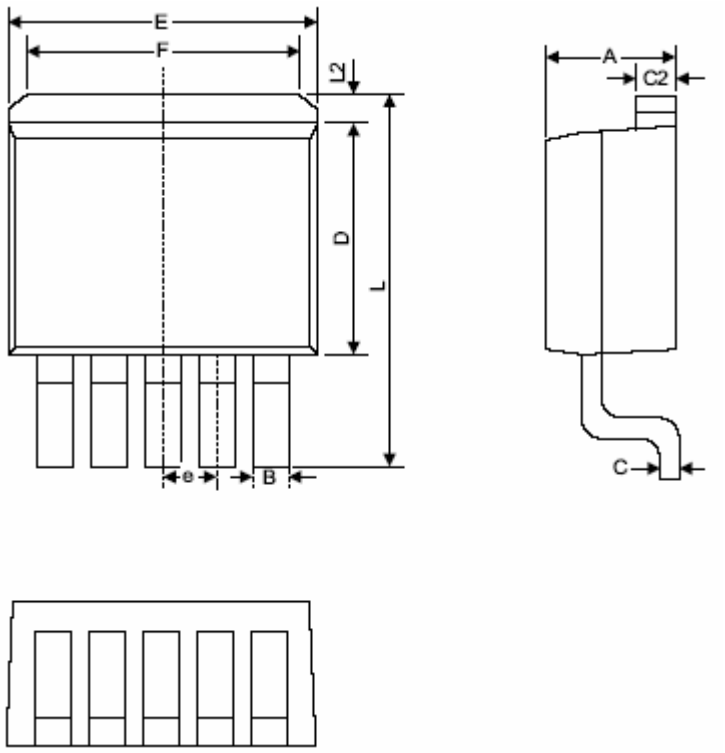
(2) TO220B-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.44	0.47	0.175	0.185
b	0.07	0.09	0.027	0.037
D	0.84	0.89	0.330	0.350
d1	0.10		0.039	
d2	0.63		0.248	
E	9.91	10.41	0.390	0.410
e	0.16	0.18	0.062	0.072
F	0.12	0.13	0.048	0.052
H1	0.64		0.250	
H2	2.08	2.24	0.820	0.880
H3	2.39	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	0.30	0.100	0.120

Package Information

(3) TO263-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
B	0.76	1.02	0.030	0.040
C	0.36	0.64	0.014	0.025
C2	1.14	1.40	0.045	0.055
D	8.64	9.65	0.340	0.380
E	9.78	10.54	0.385	0.415
e	1.57	1.85	0.062	0.073
F	6.60	7.11	0.260	0.280
L	15.11	15.37	0.595	0.605
L2	-	1.40	-	0.055