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Product Specification

XBL2594

1.5A 150KHz 40V PWM Buck DC/DC Converter

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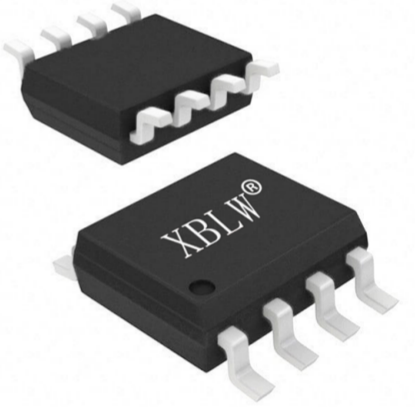
Descriptions

The XBL2594 regulator is monolithic integrated circuit ideally suited for easy and convenient design of a step−down switching regulator(buck converter). It is capable of driving a 1.5A load with excellentline and load regulation. This device is available in adjustable outputversion. It is internally compensated to minimize the number ofexternal components to simplify the power supply design.Since XBL2594 converter is a switch−mode ower supply, itsefficiency is significantly higher in comparison with popularthree−terminal linear regulators, especially with higher input voltages.The XBL2594 operates at a switching frequency of 150 kHz thusallowing smaller sized filter components than what would be neededwith lower frequency switching regulators.
Available in a standard SOP8 Surface Mount packages.The other features include a guaranteed ±4% tolerance on outputvoltage with in specified input voltages and output load conditions, and┐ 15% on the oscillator frequency. External shutdown is included,featuring 50 μA (typical) standby current. Self protection featuresinclude switch cycle−by−cycle current limit for the output switch, as well as thermal shutdown for complete protection under fault conditions.

Features

- Adjustable Output Voltage Range 1.23V-37V
- 3.3V,5V,12V, and adjustable versions
- Guaranteed 1.5A Output Load CurrentWide
- Input Voltage Range up to 40 V
- 150 kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability Low Power Standby Mode, typ 50 μA
- Thermal Shutdown and Current Limit Protection
- Internal Loop Compensation
- These are Pb-Free Devices



SOP-8

Figure 1. Package Types of XBL2594

Applications

- Simple High-Efficiency Step-Down (Buck) Regulator
- Efficient Pre-Regulator for Linear Regulators
- On-Card Switching Regulators
- Positive to Negative Converter (Buck-Boost)
- Negative Step-Up Converters
- Power Supply for Battery Chargers

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL2594M-3.3	SOP-8	XBL2594M-3.3	Tape	4000Pcs/Reel
XBL2594M-5.0	SOP-8	XBL2594M-5.0	Tape	4000Pcs/Reel
XBL2594M-12	SOP-8	XBL2594M-3.3	Tape	4000Pcs/Reel
XBL2594M-ADJ	SOP-8	XBL2594M-ADJ	Tape	4000Pcs/Reel

Pin Configurations

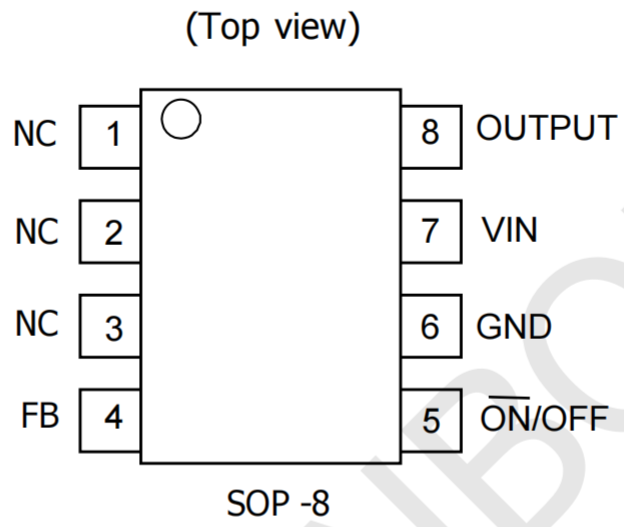


Figure 2 Pin Configuration of XBL2594 (Top View)

Pin Description

Pin Number	Pin Name	Description
1/2/3	NC	Not Connected
4	FB	This pin is the direct input of the error amplifier and the resistor network R2, R1 is connected externally toallow programming of the output voltage.
5	$\overline{\text{ON/OFF}}$	Allows the switching regulator circuit to be shut down using logic levels, thus dropping the total input supply current to approximately 50 μA. The threshold voltage is typical. 1.6 V. Applying a voltage above this value (up to VIN) shuts the regulator off. If the voltage applied to this pin is lower than 1.6 V or if this pin is left open,the regulator will be in the "on" condition.
6	GND	Circuit ground pin. See the information about the printed circuit board layout.
7	VIN	Positive input supply for XBL2594 step-down switching regulator. In order to minimize voltage transients and to supply the switching currents needed by the regulator, a suitable input bypass capacitor must be present
8	OUTPUT	Emitter of the internal switch. The saturation voltage Vsat of the output switch is typically 1 V. It should be kept in mind that PCB area connected to this pin should be kept to a minimum in order to minimize coupling to sensitive circuitry

Function Block

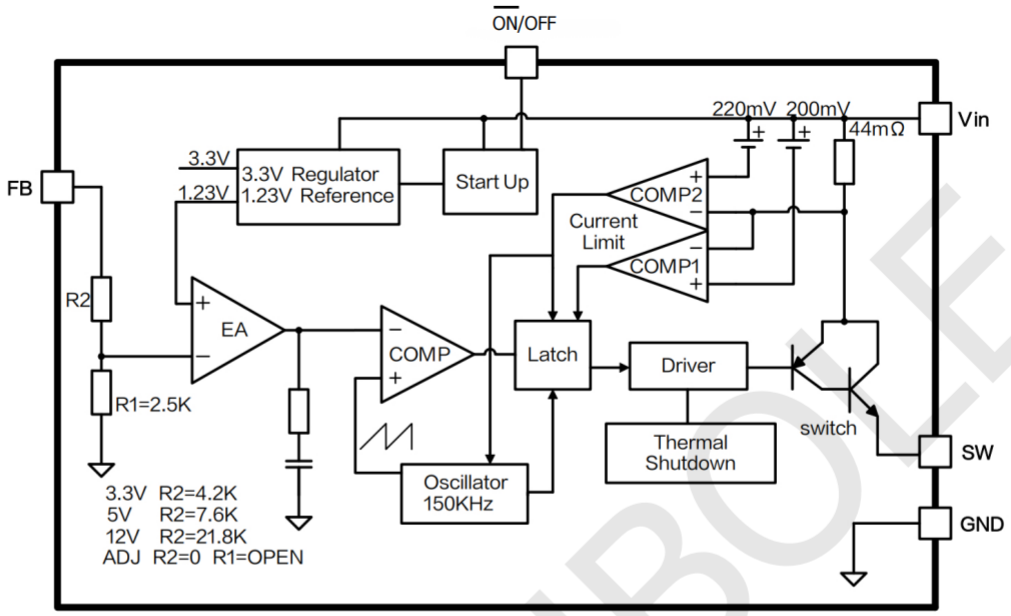


Figure 3 Function Block Diagram of XBL2594

Typical Application Circuit

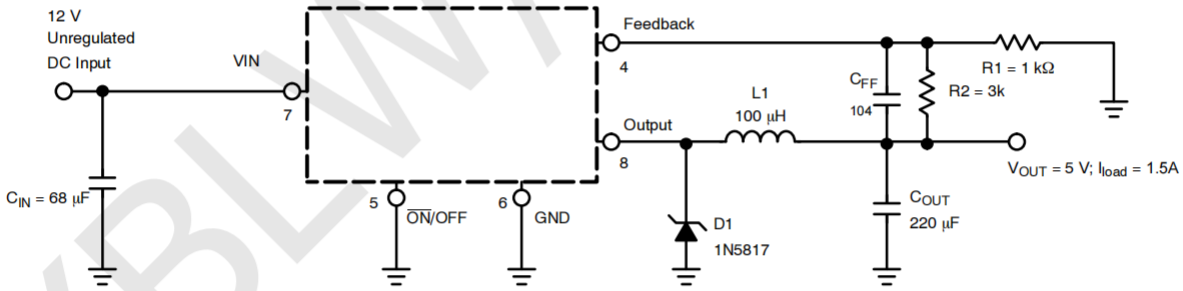


Figure4. XBL2594-ADJ Typical Application Circuit (VIN=8V~40V, VOUT=5V/1.5A)

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 VIN	V
Enable Pin Voltage	V_{EN}	-0.3 to VIN	V
Switch Pin Voltage	V_{SW}	-0.3 to VIN	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	RθJA	85	°C / W
Thermal Resistance-Junction to Case	RθJC	45	°C / W

XBL2594M-3.3 Electrical Characteristics

T_a = 25℃;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure6						
VOUT	Output Voltage	Vin = 8V to 40V Iload=0.1A to 1.5A	3.168	3.3	3.432	V
η	Efficiency	Vin=12V ,Vout=3.3V Iout=1.5A	-	78	-	%

XBL2594M-5.0 Electrical Characteristics

T_a = 25℃;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure7						
VOUT	Output Voltage	Vin = 8V to 40V Iload=0.1A to 1.5A	4.8	5	5.2	V
η	Efficiency	Vin=12V ,Vout=5V, Iout=1.5A	-	83	-	%

XBL2594M-12 Electrical Characteristics

T_a = 25℃;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure8						
VOUT	Output Voltage	Vin = 15V to 40V , Iload=0.1A to 1.5A	11.52	12	12.48	V
η	Efficiency	Vin=25V ,Vout=12V Iout=1.5A	-	85	-	%

XBL2594M-ADJ Electrical Characteristics

T_a = 25℃;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure9						
VOUT	Output Voltage	Vin = 8V to 40V Iload=0.1A to 1.5A	1.193	1.23	1.267	V
η	Efficiency	Vin=12V ,Vout=5V, Iout=1.5A	-	83	-	%

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°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} =Vin		4.5	10	mA
Oscillator Frequency	Fosc		127	150	173	Khz
Switch Current Limit	I_L	V_{FB} =0V		4.0		A
EN Pin Threshold	V_{EN}	High (Regulator OFF) Low (Regulator ON)		1.4 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}=2A		1.2	1.5	V
Max. Duty Cycle	D_{MAX}	V_{FB}=0V		95		%

Test Circuit and Layout guidelines

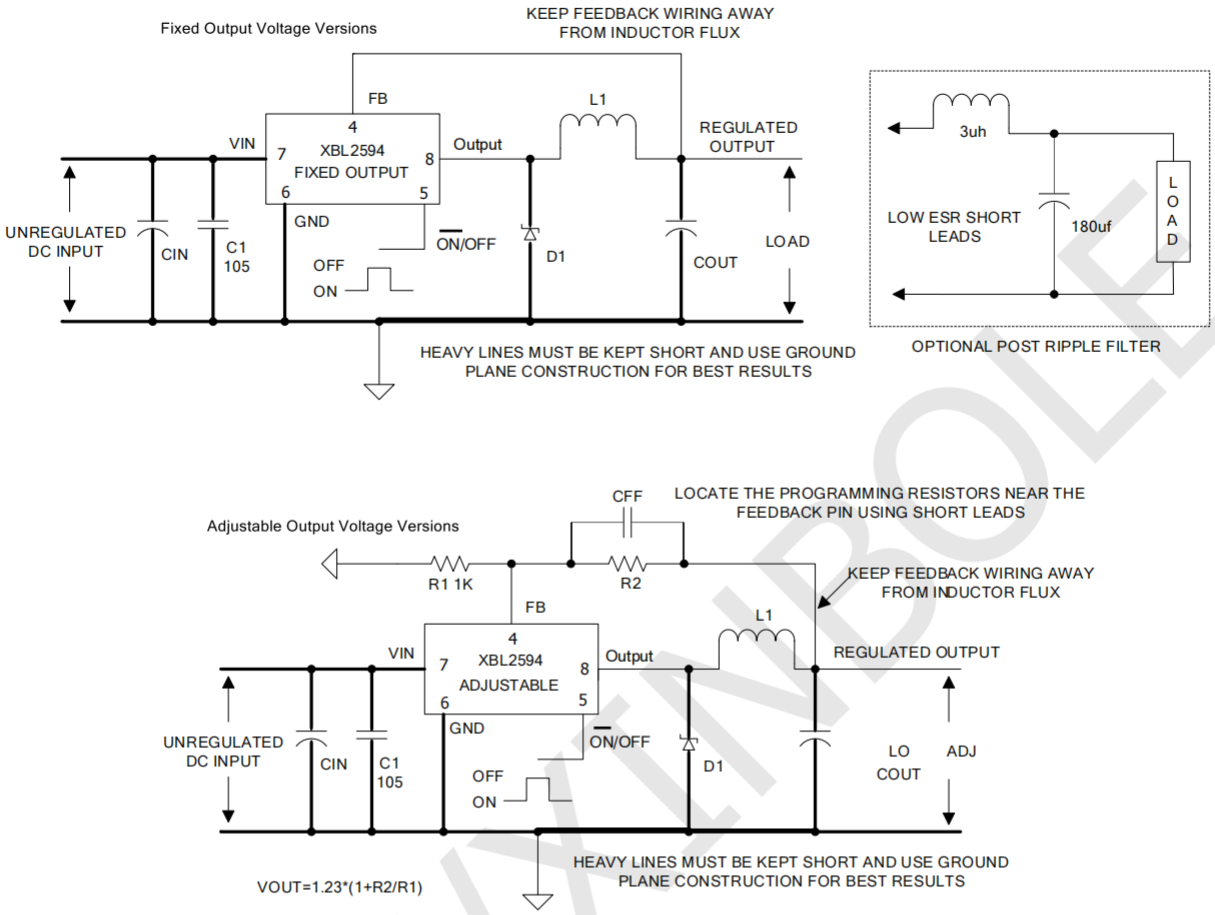


Figure4. Standard Test Circuits and Layout Guides

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*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.)

XBL2594 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)
3.3	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	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	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

XBL2594 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		
2A		√	1N5820	1N5821	1N5822		
		√	MBR320	MBR330	MBR340	MBR350	MBR360
	√		SS32	SS33	SS34	SS35	SS36
	√			30WQ03	30WQ04	30WQ05	
		√		31DQ03	31DQ04	31DQ05	
		√	SR302	SR303	SR304	SR305	SR306

Typical System Application for 3.3V Version

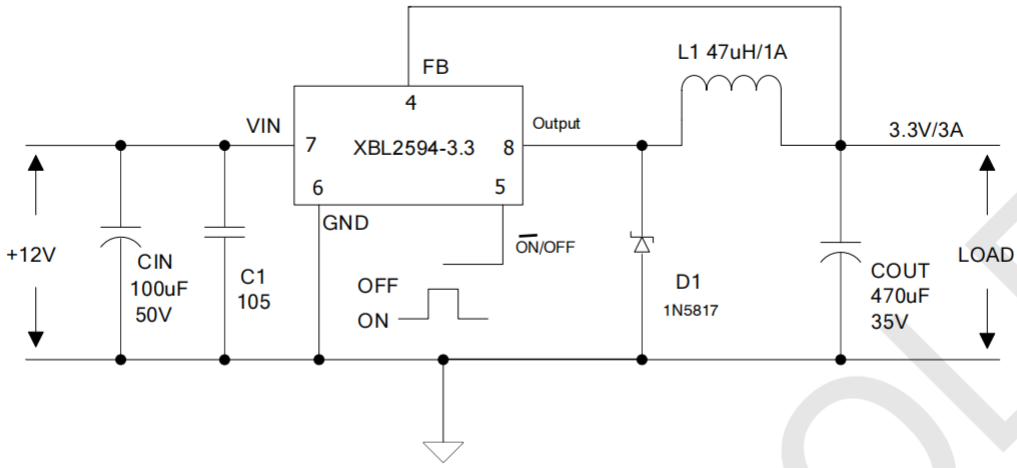


Figure5. XBL2594-3.3 System Parameters Test Circuit

Typical System Application for 5V Version

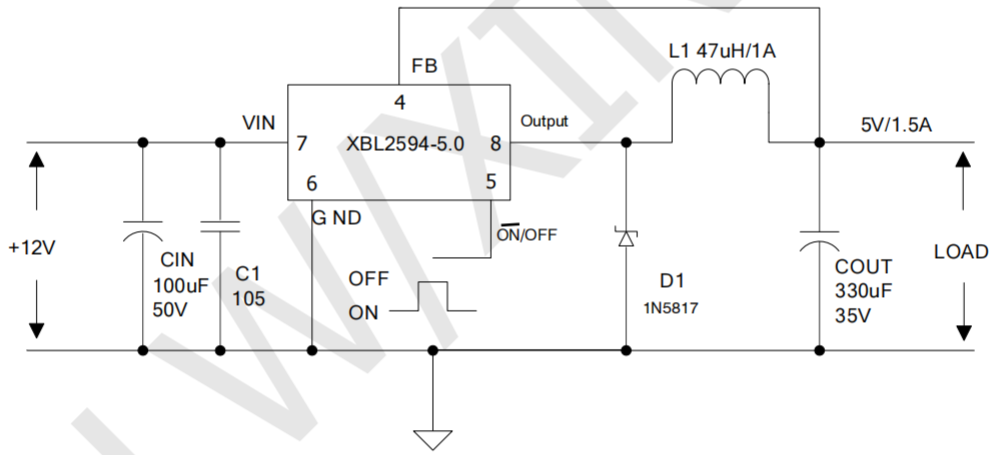


Figure6. XBL2594-5.0 System Parameters Test Circuit

Typical System Application for 12V Version

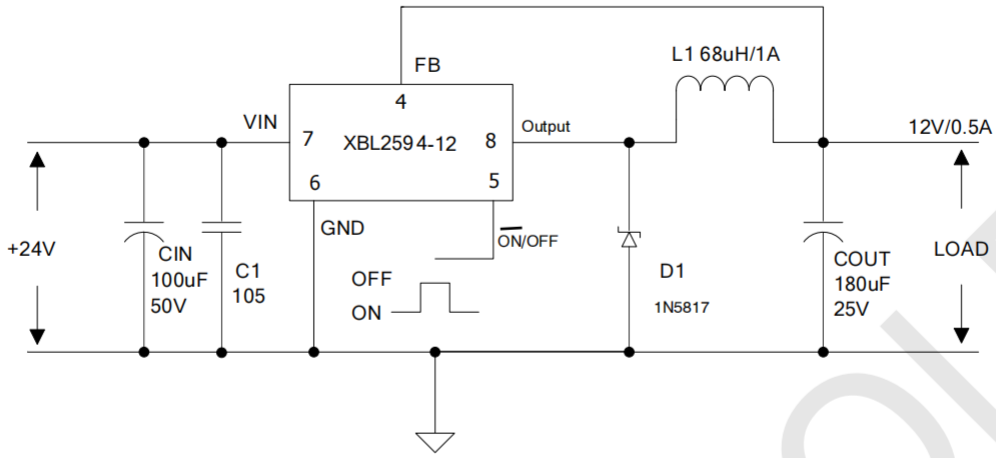


Figure 7. XBL2594-12 System Parameters Test Circuit

Typical System Application for ADJ Version

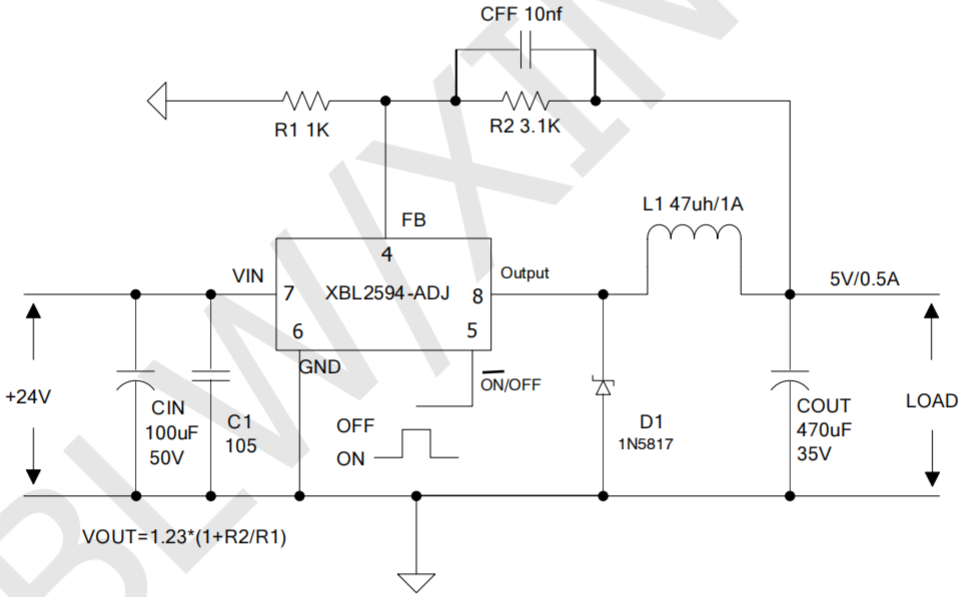
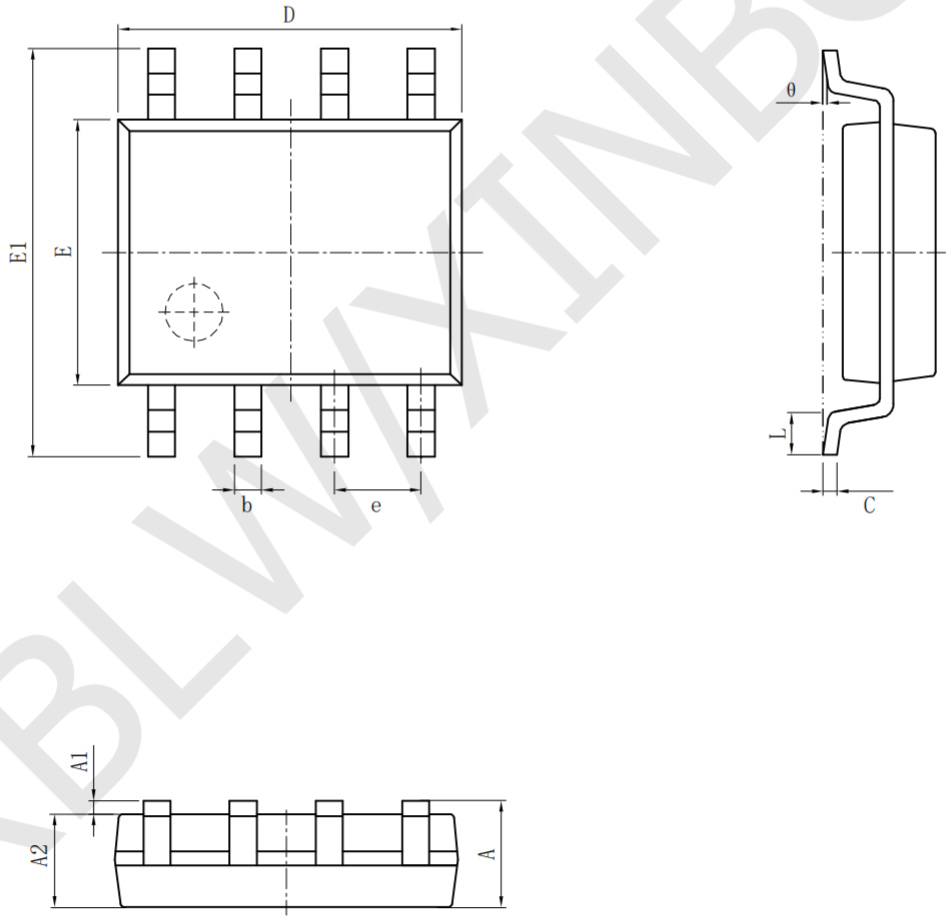


Figure 8. XBL2594-ADJ System Parameters Test Circuit

Package Information

- SOP-8

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	1.350	1.750	A	0.053	0.069
A1	0.100	0.250	A1	0.004	0.010
A2	1.350	1.550	A2	0.053	0.061
b	0.330	0.510	b	0.013	0.020
c	0.170	0.250	c	0.006	0.010
D	4.700	5.100	D	0.185	0.200
E	3.800	4.000	E	0.150	0.157
E1	5.800	6.200	E1	0.228	0.224
e	1.270(BSC)		e	0.050(BSC)	
L	0.400	1.270	L	0.016	0.050
θ	0°	8°	θ	0°	8°



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