3.3V~5V Input 24W Output Step-up DC/DC Converter

GENERAL DESCRIPTION

The XR2981 is a high frequency, high efficiency DC to DC converter with an integrated 12A, 25mΩ power switch capable of providing an output voltage up to 24V. The fixed 600KHz allows the use of small external inductions and capacitors and provides fast transient response. It integrates Soft start, Comp,. Only need few components outside.

It can output 6V 3.5A, 9V 2A when 3.3V Battery input and output 6V 4.5A, 9V 3A when 3.6V Battery input at good heat dissipation condition.

FEATURES

- 2.7V to 5.5V input voltage Range
- Efficiency up to 96%
- 24V Boost converter with 12A switch current Limit
- 600KHz fixed Switching Frequency
- Integrated soft-start
- Thermal Shutdown
- Under voltage Lockout
- Support external LDO auxiliary power supply
- 8-Pin SOP-PP Package

APPLICATIONS

Portable Audio Amplifier Power Supply
Power Bank
QC 2.0/Type C
Wireless Charger
POS Printer Power Supply
Small Motor Power Supply

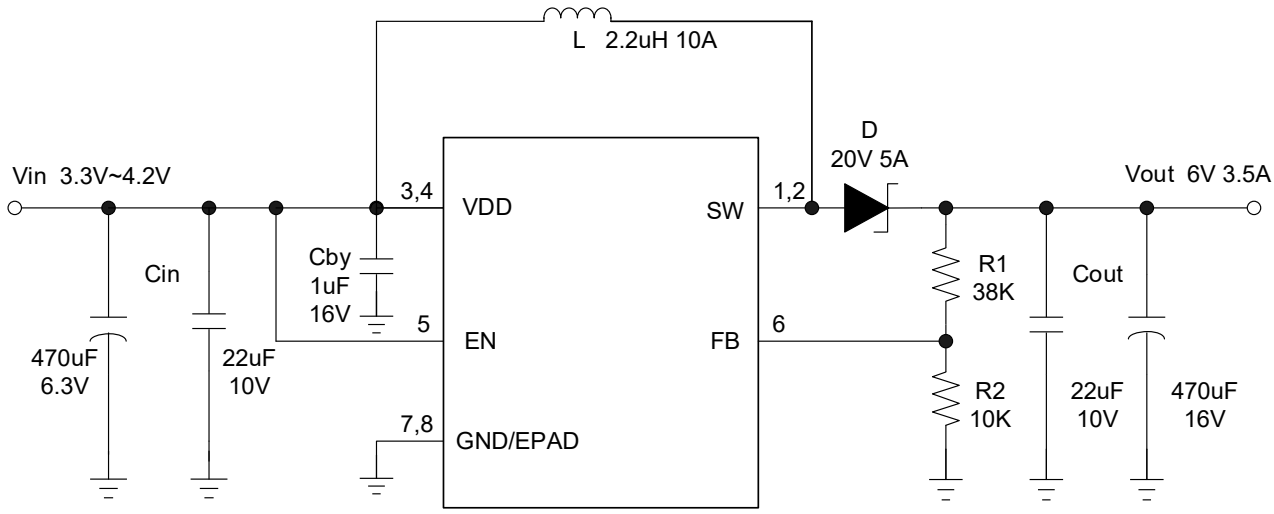


Figure 1. Typical Application Circuit1

（For Single Cell Li-Battery）

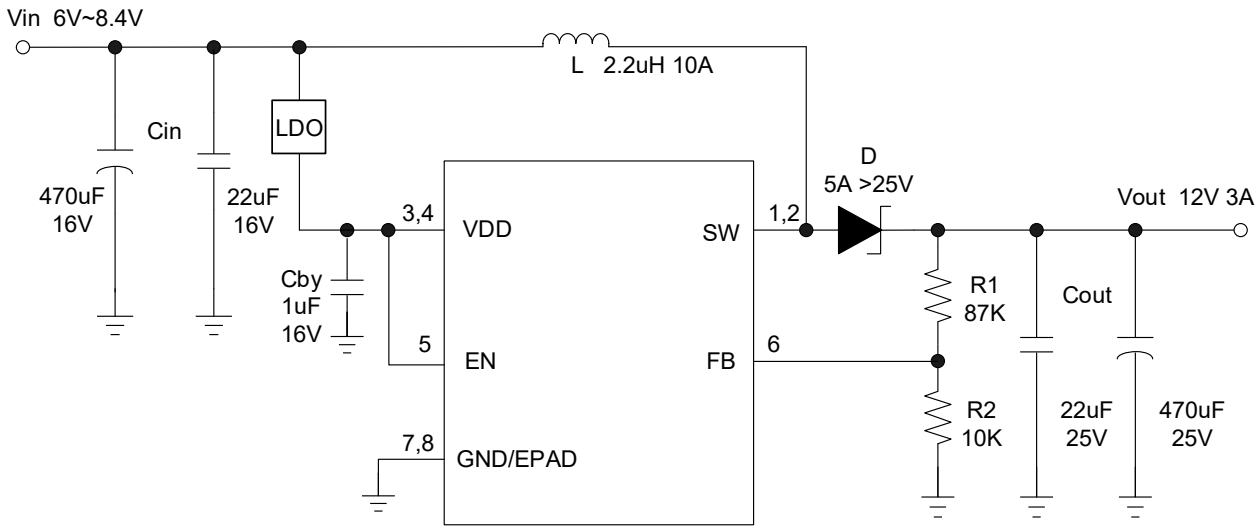


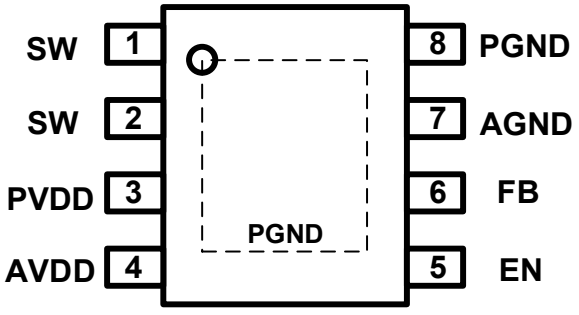
Figure 2 Typical Application Circuit2

（For Dual Cell Li-Battery）

ORDERING INFORMATION

PART NUMBER	TEMP RANGE	SWITCHING FREQUENCY	OUTPUT VOLTAGE(V)	ILIM(A)	PACKAGE
XR2981	-40℃~85℃	600KHZ	ADJ	12	SOP8-PP

PIN CONFIGURATION



TOP VIEW

Figure 3. PIN Configuration

PIN DESCRIPTION

XR2981 PIN NUMBER	PIN NAME	PIN DESCRIPTION
1,2	SW	Switch pin
3	PVDD	Input power supply pin, please connect to Cin as close as possible
4	AVDD	Boost IC Logic power supply pin, if far from Cin, please add one 1uF MLCC as close as possible
5	EN	Shutdown control input. Connect this pin to logic high level to enable the device
6	FB	Feedback pin
7	AGND	Analog ground
8	PGND	Power ground
EPAD	PGND	Please connect with PGND & AGND by mass metal for low Rdson, high efficiency and good heat dissipation

ABSOLUTE MAXIMUM RATINGS

(NOTE: DO NOT EXCEED THESE LIMITS TO PREVENT DAMAGE TO THE DEVICE. EXPOSURE TO ABSOLUTE MAXIMUM RATING CONDITIONS FOR LONG PERIODS MAY AFFECT DEVICE RELIABIL-

PARAMETER	VALUE	UNIT
Supply Voltage VIN	-0.3 to 6.5	V
FB, EN Voltage	-0.3 to 6.5	V
SW Voltage	-0.3 to 26V	V
Operating Ambient Temperature	-40 to 85	°C
Maximum Junction Temperature	150	°C
Storage Temperature	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)	300	°C

ELECTRICAL CHARACTERISTICS

Typical and limits appearing in normal type apply for V_{IN}=3.6V, TA = 25˚C, unless otherwise specified.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range	V_{IN}		2.7		5.5	V
Boost output voltage range	V_{OUT}				24	V
UVLO Low Threshold	V_{UVLOL}			2.6		V
UVLO High Threshold	V_{UVLOH}			3.2		V
Operating Supply Current	I_{SUPPLY}	V_{FB}=1.5V, EN=Vin, I_{Load} =0		140		μA
Shutdown Supply Current		V_{EN} =0V, V_{IN} =3.6V			1	μA
Regulated Feedback Voltage	V_{FB}		1.21	1.24	1.27	V
Peak Inductor Current limit	I_{PEAK}			12		A
Oscillator Frequency	F_{OSC}		400	600	800	KHz
Rds(ON) of N-channel FET		I_{SW} =1A		25		mΩ
Enable OFF Threshold		V_{EN} Falling			0.3	V
Enable ON Threshold		V_{EN} Rising	1.5			V
Enable Leakage Current			-0.1		0.1	μA
SW Leakage Current		V_{EN} = 0V, V_{SW} = 0V or 5V, V_{IN} = 5V			1	μA

FUNCTIONAL BLOCK DIAGRAM

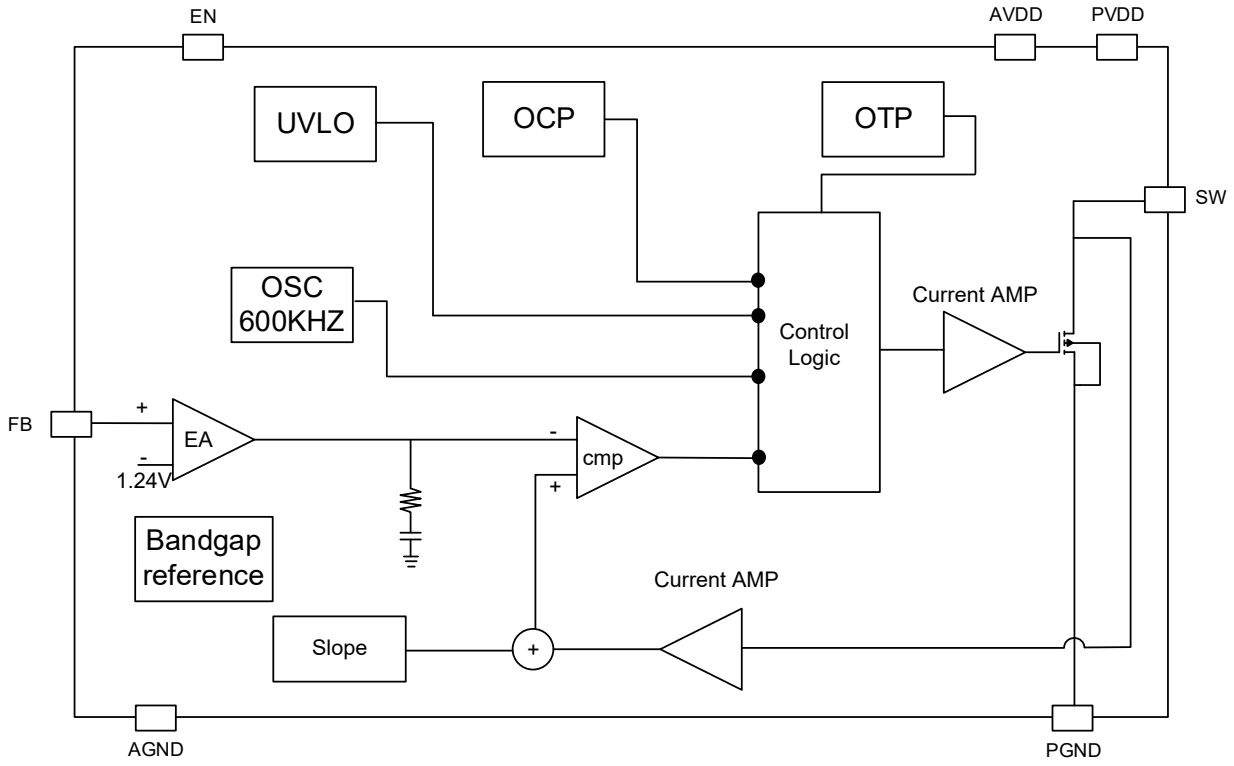


Figure 4. Functional Block Diagram

FUNCTIONAL DESCRIPTION

Normal operating mode

The boost converter is designed for output voltage up to 24V with a 12A/24V power MOSFET. The low Rds(on) of the internal power switches enables better power efficiency. The chip, which operates in a current mode scheme with constant frequency 600KHz. It operates with Pulse With Modulation (PWM). To avoid the inrush current during power up, soft start circuit is integrated in the chip.

The controller circuit of the device is based on a fixed frequency multiple feedback controller topology. Input voltage, output voltage, and voltage drop on the NMOS switch are monitored and feedback to the regulator. So changes in the operating conditions of the converter directly affect the duty cycle and must not take the indirect and slow way through the control loop and the error amplifier. The control loop, determined by the error amplifier, only has to handle small signal errors. The input for it is the feedback voltage on the FB pin, the voltage on the internal resistor divider. It is compared with the internal reference voltage to generate an accurate and stable output voltage.

Cycle by cycle current limit

The peak current of the NMOS switch is also sensed to limit the maximum current flowing through the switch and the inductor. The typical peak current limit is set to reach 12A.

Undervoltage lockout (UVLO)

Under voltage lockout prevents operation of the device at input voltages below typical 2.6V when the input voltage is falling. When the input voltage is below the under voltage threshold, the device is shut down and the internal switch FETs are turned off. If the raised input voltage reaches under-voltage lockout hysteresis(3.2V), the IC restarts.

Thermal shutdown

A thermal shutdown is implemented to prevent damages due to excessive heat and power dissipation. Typically the thermal shutdown threshold is 150˚C. When the thermal shutdown is triggered the device stops switching until the temperature falls below typically 136˚C.Then the device starts switching again.

APPLICATION INFORMATION

INDUCTOR SELECTION

In normal operation, the inductor maintains continuous current to the output. The inductor current has a ripple that is dependent on the inductance value. The high inductance reduces the ripple current.

Selected inductor by actual application:

Manufacturer	*Part Number*	*Inductance (uH)*	*DRC max (mOhms)*	*Dimensions L*W*H(mm3)*	*Id*	*Isat*
WURTH	74439358022	2.2	3.7	8.8*8.3*7.8	13A	30A
	74437368022	2.2	6.5	11*10*3.8	10A	28A
	7443330220	2.2	4.6	10.9*10*9.3	16.5A	22A
	74437349022	2.2	11.2	7.3*6.6*4.8	7.5A	14A
	744311220	2.2	11.4	6.9*7.0*3.8	9A	13A
TDK	SPM6530T	2.2	17	7.1*6.5*3	8.4A	
	VLP6045LT	2.2	20	6*6*4.5	6.4A	

Table 1. Recommend Surface Mount Inductors

Notes: Please select inductor according to I in. The IL need to be 1.5~2*I in. For getting higher efficiency, need to use low DRC inductors.

INPUT CAPACITOR SELECTION

The input capacitor reduces input voltage ripple to the converter, low ESR ceramic capacitor is highly recommended. For audio amplifier applications, A 22uF ceramic capacitor & 470uF E-cap is needed. low ESR tantalum capacitor is recommended for good ripple performance & dynamic response. The input capacitor should be placed as close as possible to VIN and GND.

OUTPUT CAPACITOR SELECTION

A low ESR output capacitor is required in order to maintain low output voltage ripple. In the case of ceramic output capacitors, capacitor ESR is very small and does not contribute to the ripple, so a lower capacitance value is acceptable when ceramic capacitors are used. For audio amplifier applications, A 22uF ceramic capacitor & 470uF E-cap is needed. low ESR tantalum capacitor is recommended for good ripple performance & dynamic response.

OUTPUT VOLTAGE PROGRAMMING

In the adjustable version, the output voltage is set by a resistive divider according to the following equation:

$$R_1 = R_2 \times \left(\frac{V_{OUT}}{1.24} - 1\right)$$

DIODE SELECTION

According to max Iout and max Vout, you can select suitable diode.

Normally we select diode If=(1.5~2)*Ioutmax and VR=(1.5~2)*Voutmax. For high efficiency, suggest that you select low Vf Schottky diode.

For example, 3.3V~4.2Vin 6V 3.5Aout, you can select SS12P31.

For common application, you can select SS34 or SS54 according to Ioutmax

LDO Selection

For Typical Application Circuit2, you need to select LDO--Input voltage range 4V~15V(or higher). Iout>=100mA. Output voltage is preferred to set 4.2V~4.5V.

LDO need enough input & output capacity, please select suitable external parts and layout them according to LDO's datasheet.

LAYOUT CONSIDERATIONS

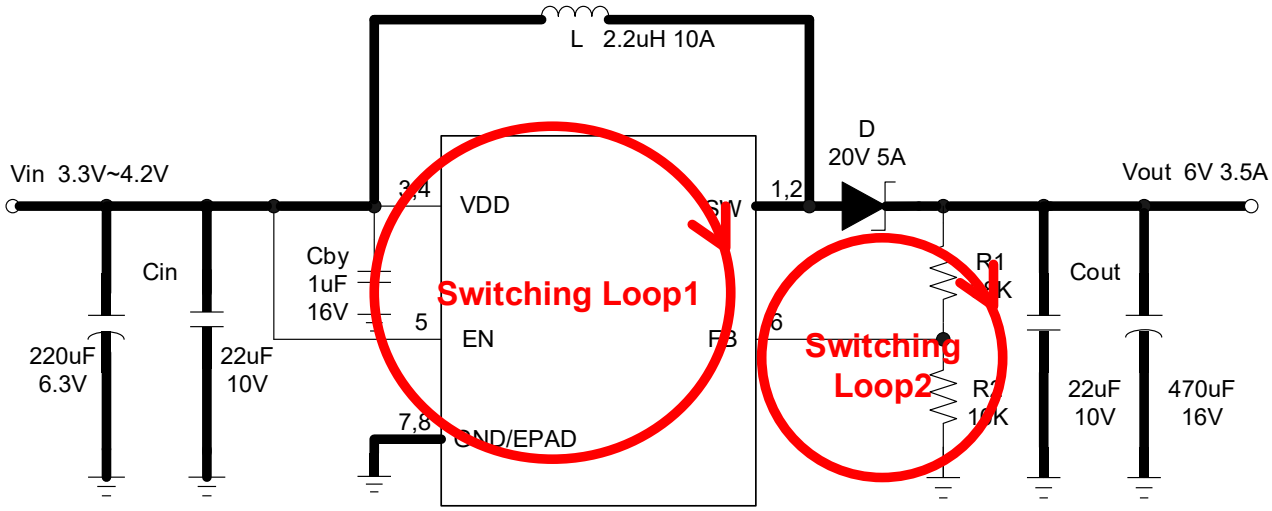
1.The input capacitor, output capacitor, and the inductor should be placed as close as possible to the IC to keep resistance very low and the switching loop very small for EMI performance.

2.The FB pin connection should be made as close to the load as possible so that the voltage at the load is the expected regulated value. And place FB network far from Switching node.

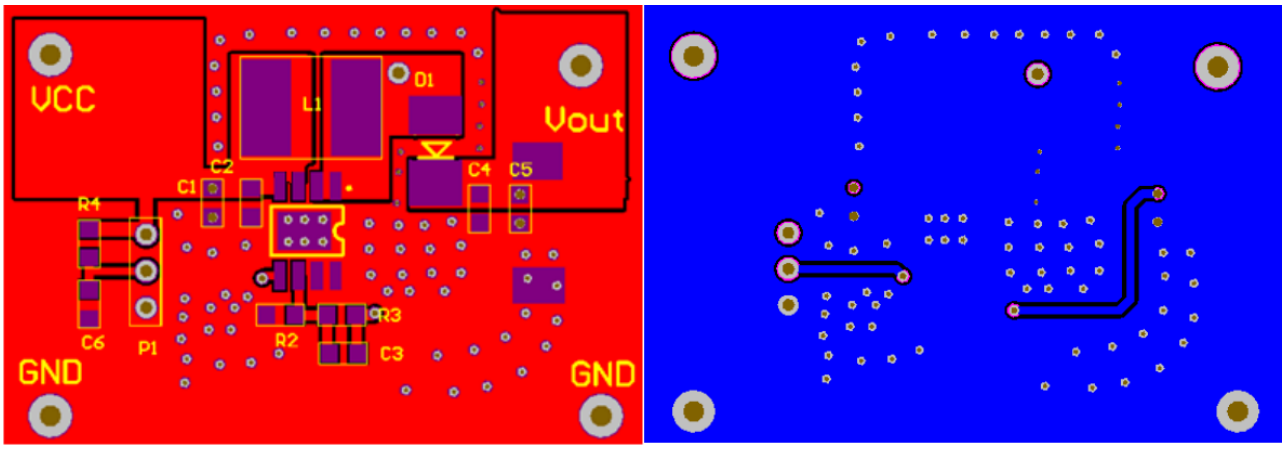
3.Please make sure that the big current circuits are board and short to reduce the circuit Rds(on), all ground connection must be tied together. Use a broad ground plane to establish the lowest resistance possible between all connections to achieve the best thermal and noise performance.

4.The switch node connection should be low resistance to reduce power losses.

5.The heavy copper board in big current output is recommended for high efficiency and good heat dissipation.



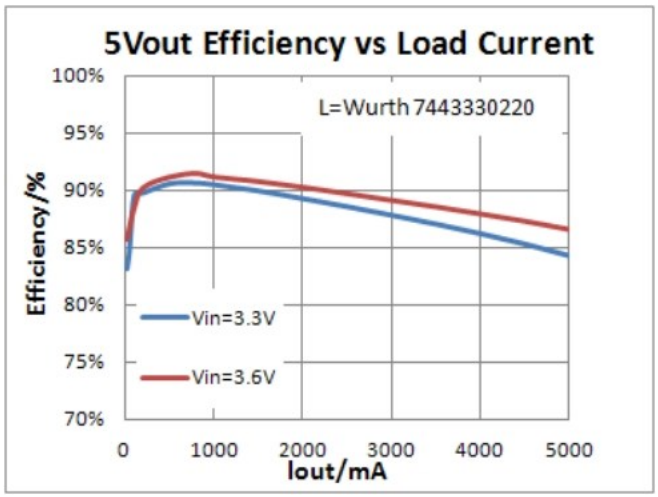
PCB LAYOUT GUIDE

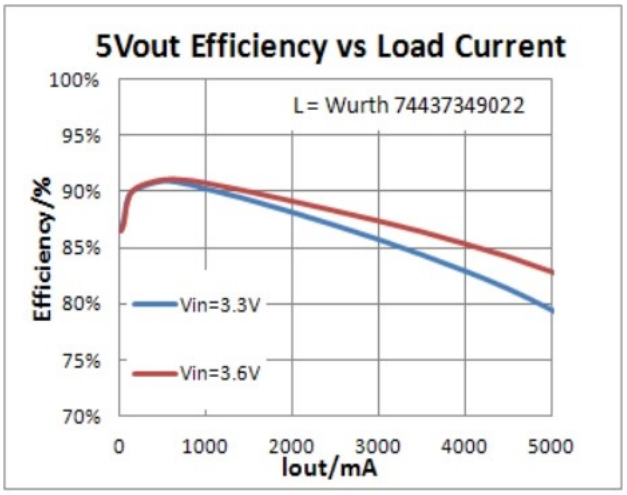


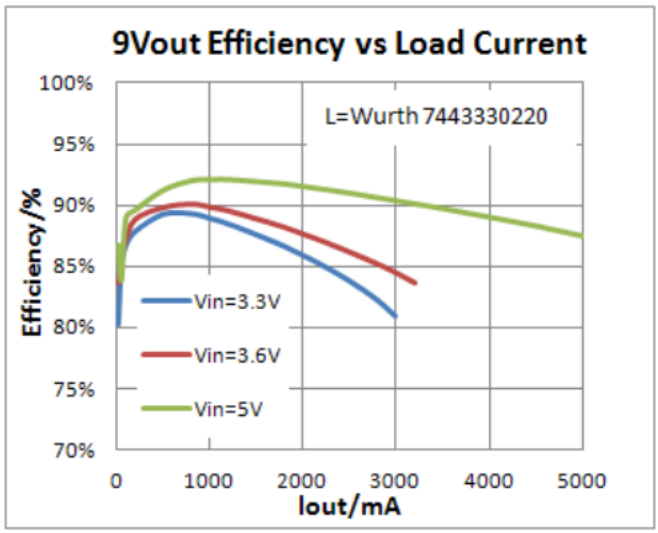
TOP LAYER BOTTOM LAYER

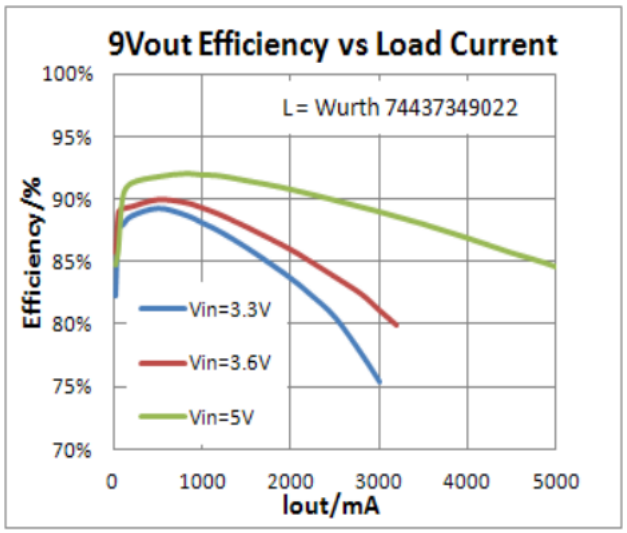
TYPICAL PERFORMANCE CHARACTERISTICS

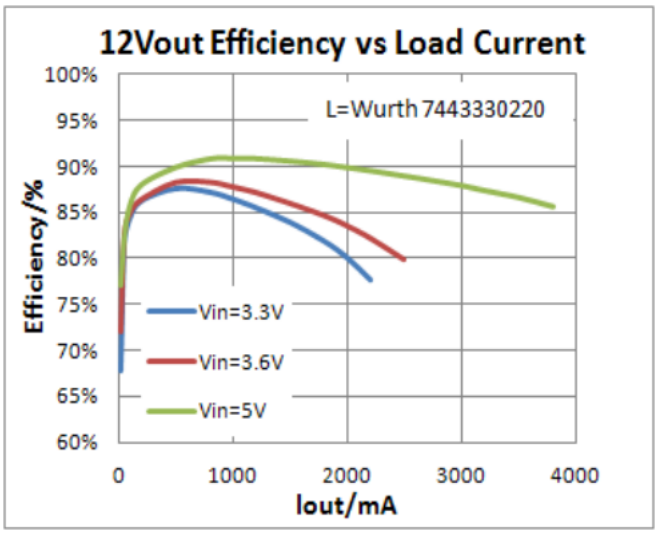
L=2.2uH-Wurth, Cin or Cout=22uF, MLCC+220uF Ecap, D=SS12P31, if not mentioned

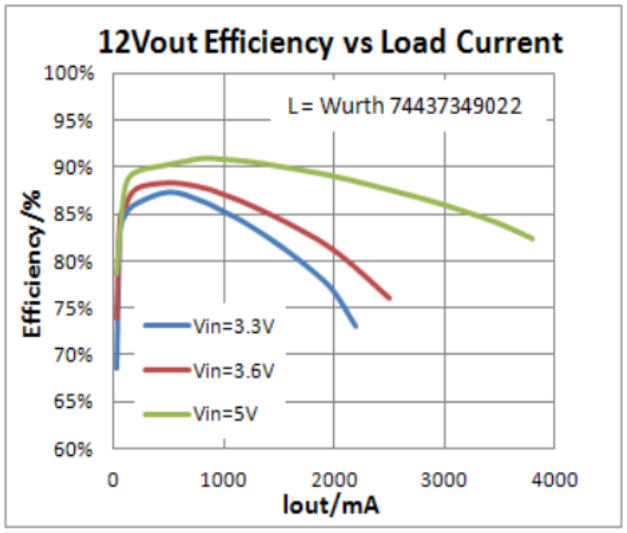


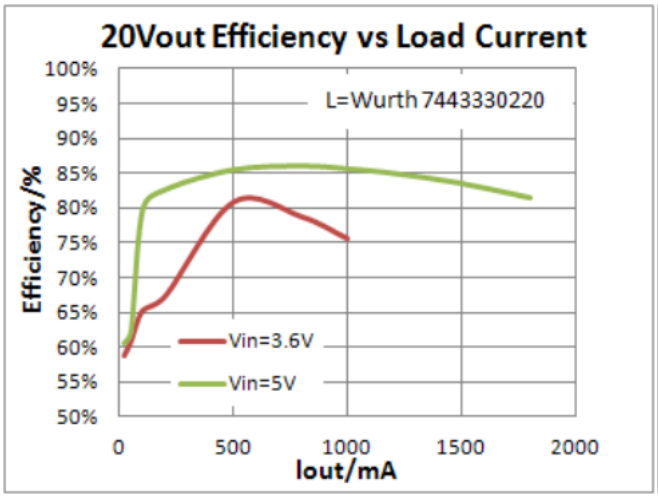


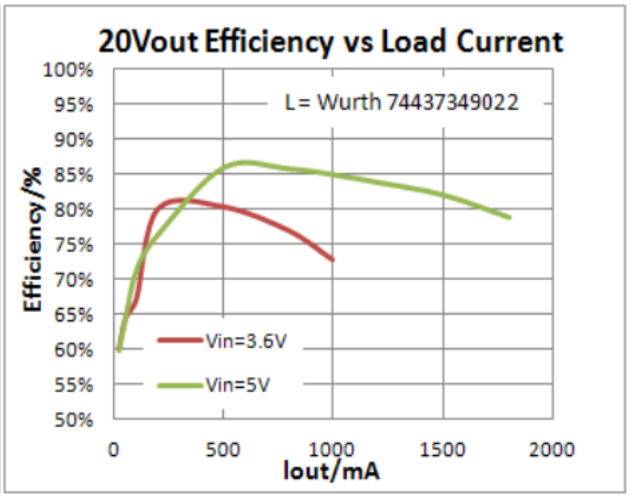






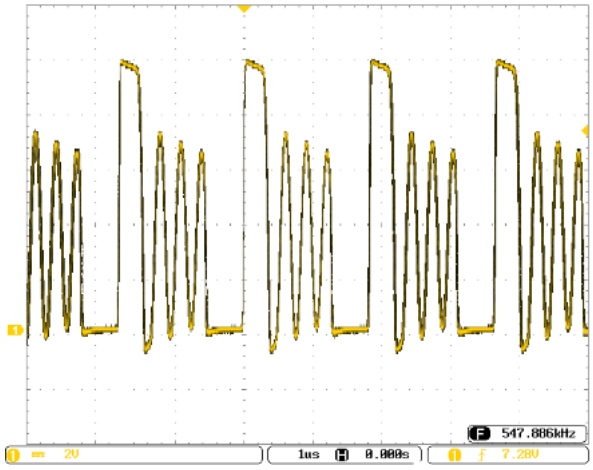




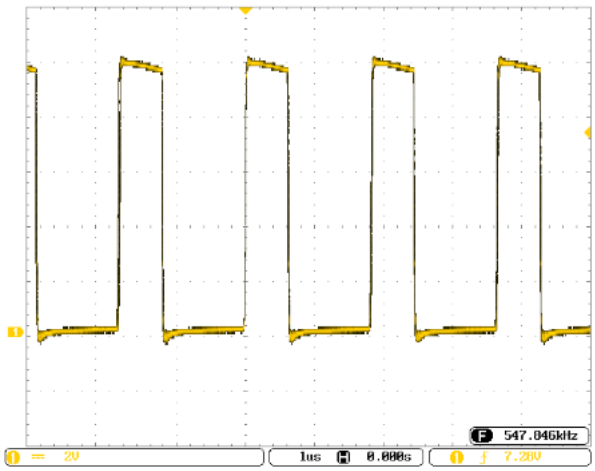


Note: Efficiency data is based on demo test at 20℃. If work at big current for long time, maybe thermal shutdown. its load capacity is related with heat dissipation conditions.

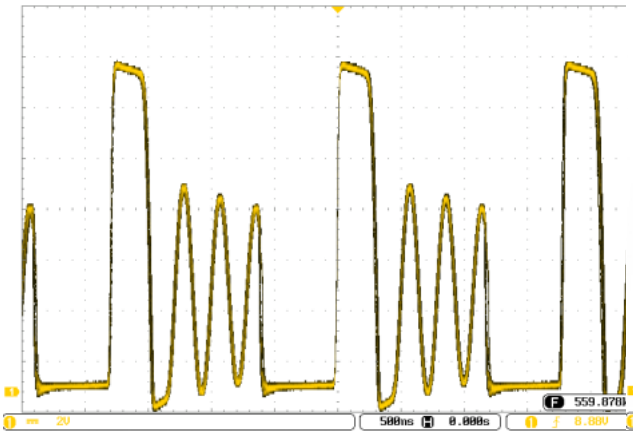
3.6Vin 9Vout 50mA Switching



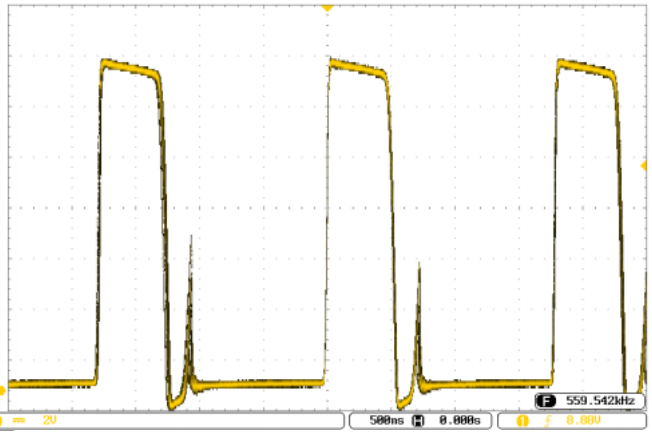
3.6Vin 9Vout 1A Switching



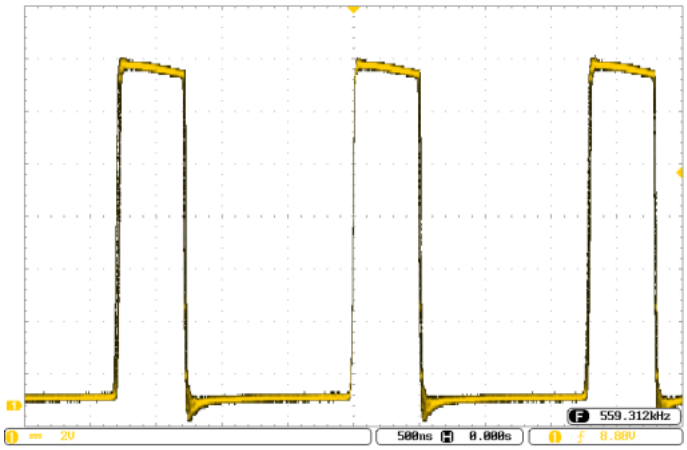
3.6Vin 12Vout 50mA Switching



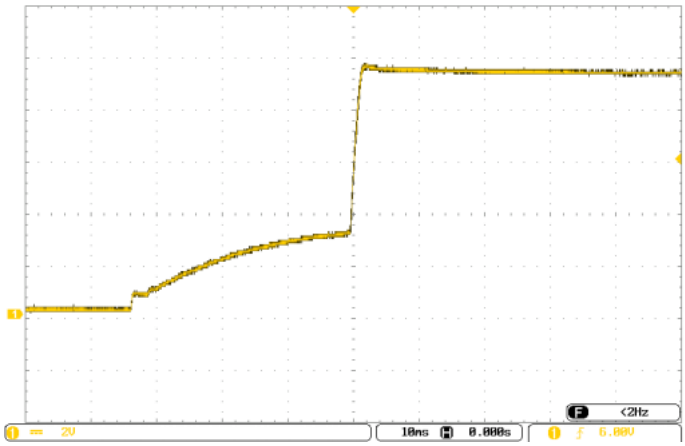
3.6Vin 12Vout 200mA Switching



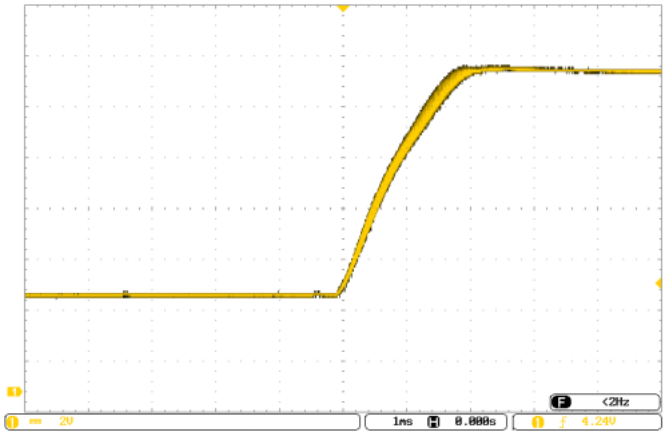
3.6Vin 12Vout 1A Switching



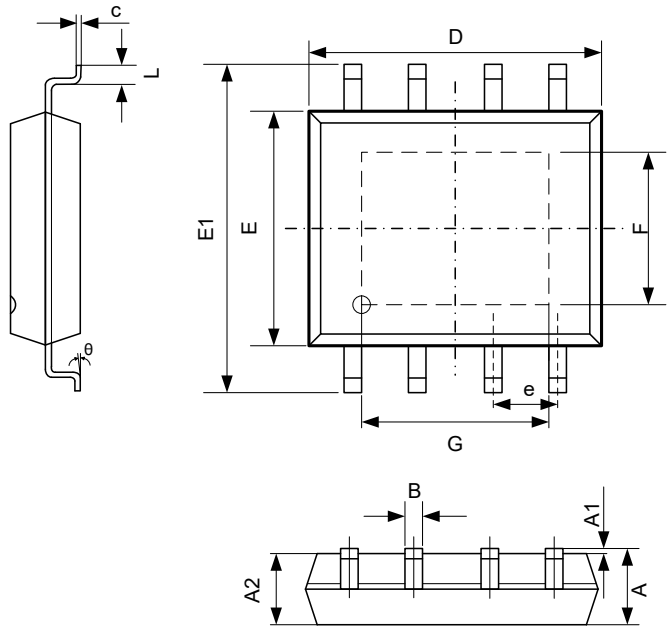
9Vout Startup from Vin



9Vout Startup from EN



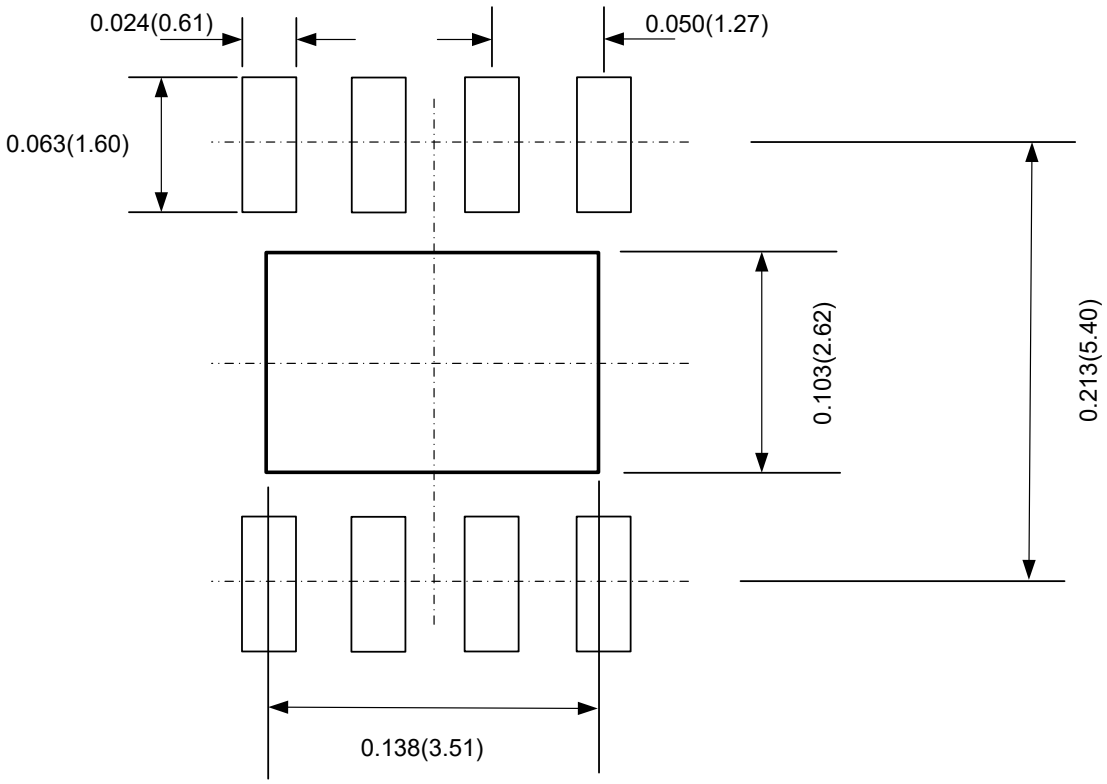
PACKAGE OUTLINE(SOP8-PP)



Symbol	Dimensions In Millimetres		Dimensions In Inches	
	Min	Max	Min	Max
A	1.30	1.75	0.051	0.069
A1	0.000	0.250	0.000	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.27TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°
F	2.26	2.56	0.089	0.101
G	3.15	3.45	0.124	0.136

PACKAGE OUTLINE(SOP8-PP)

In order to increase the driver current capability of XR2981 and improve the temperature of package, Please ensure Epad and enough ground PCB to release energy.



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