2.8A/20V Boost Converter with Output Voltage Programmable by PWM Signal

DESCRIPTION

The ETA1621 is a high efficiency step-up converter with an internally integrated 20V/2.8A low side power MOSEFT. It runs with an optimal 1MHz frequency that enables the use of small external components while still providing the best efficiency. Given the 2.8A power FET, ETA1621 is suitable for delivering 0.15-2A output current depending on the Vout/Vin ratio. The incorporated true PWM-Diming feature through EN pin enable one further digitally program the output voltage lower. For maximum protection, the ETA1621 has an OVP protection feature that prevents the output voltage exceeding the maximum rating of the ETA1621 and the output cap during open conditions.

ETA1621 is available in a space-saving SOT23-6 package.

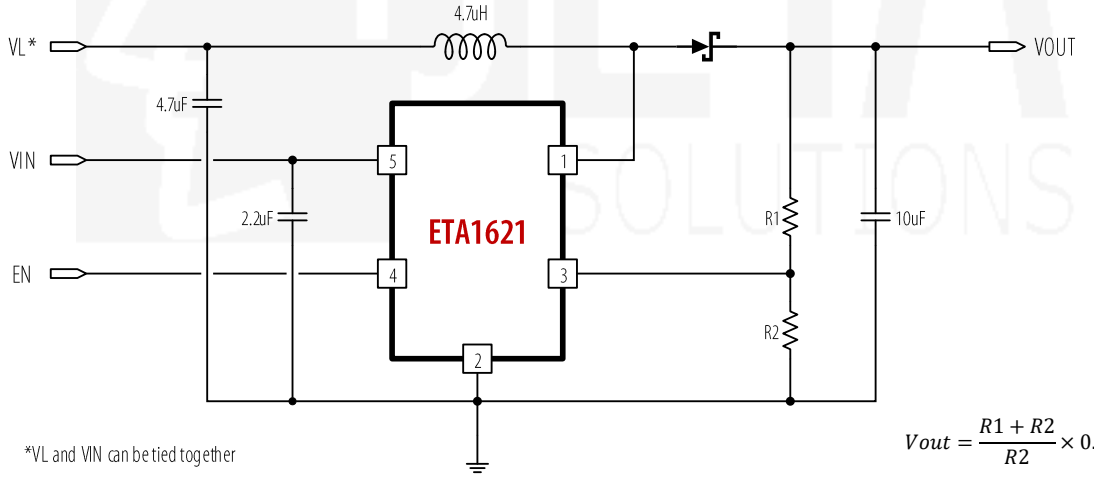
FEATURES

- Up to 95% Efficiency
- 22V OVP protection
- True PWM Vfb Control
- 600mV Feedback Voltage
- 2.8A current limit
- SOT23-6 Package

APPLICATIONS

- PLC module
- Power Bank
- Bluetooth Speaker

TYPICAL APPLICATION CIRCUIT



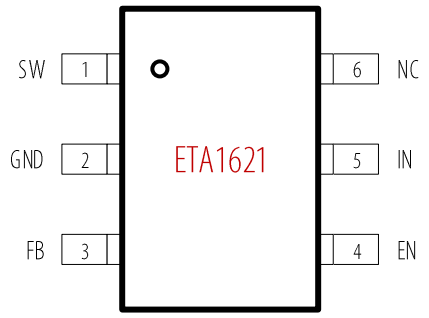
*VL and VIN can be tied together

$$Vout = \frac{R1 + R2}{R2} \times 0.6V$$

ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1621S2G	SOT23-6	GjYW	3000

PIN CONFIGURATION



SOT23-6

ABSOLUTEMAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

SW Voltage.....–0.3V to 22V
All Other Pin Voltage.....–0.3V to 6V
SW to PGND current.....Internally limited
Operating Temperature Range .....–40°C to 85°C
Storage Temperature Range .....–55°C to 150°C

Thermal Resistance	θ_{JA}	θ_{JC}	
SOT23-6	134	50	°C/W

Lead Temperature (Soldering, 10ssec) .....260°C
ESD HBM (Human Body Mode) 2KV
ESD MM (Machine Mode) 200V

ELECTRICAL CHACRACTERISTICS

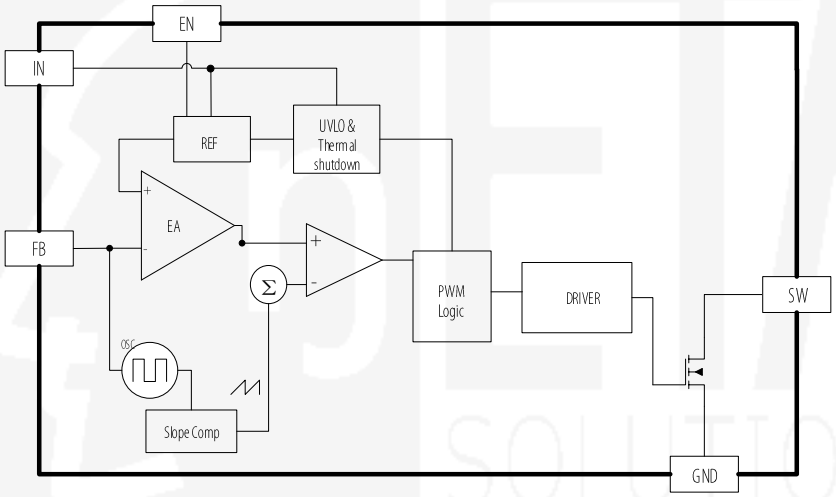
(V_{IN} =3.6V, unless otherwise specified. Typical values are at T_A = 25°C.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		2.5		6	V
Input UVLO	Rising	1.85	2.15	2.45	V
UVLO HYS			140		mV
FB Feedback Voltage	V_{IN} = V_{EN} =3.6V	582	600	618	mV
FB Input Current				50	nA
Quiescent Current at IN	Switching at Iout=0		1.8		mA
	No Switching		0.25		mA
Shutdown Supply Current at IN	V_{EN}=GND		0	5	μA
Switching Frequency	V_{IN}<4.3V	0.8	1	1.2	MHz
Maximum Duty Cycle		90			%
NMOS Switch On Resistance	I_{SW} =100mA		0.1		Ω
NMOS Switch Current Limit			2.8		A
SW Leakage Current	V_{SW}=0 or 20V, V_{EN}=GND			10	μA
EN Input Low Voltage				0.6	V
EN Input High Voltage		1.2			V
Thermal Shutdown	Rising, Hysteresis=10°C		150		°C

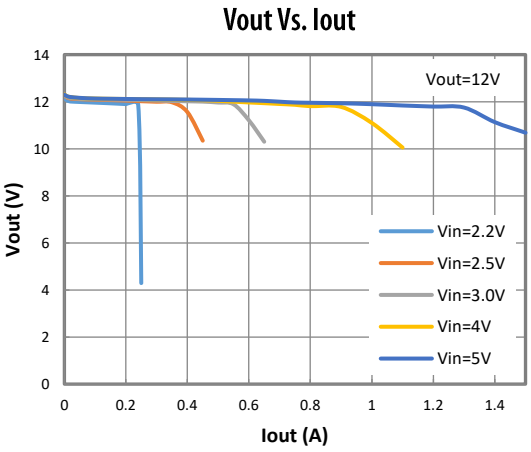
PIN DESCRIPTION

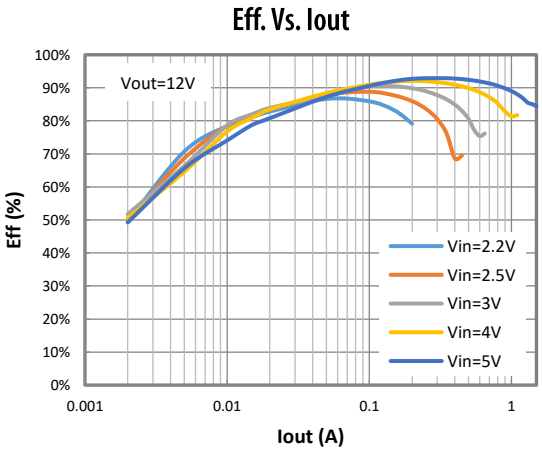
PIN #	PIN NAME	DESCRIPTION
1	SW	Inductor Connection. Connect an inductor Between SW and IN.
2	GND	Ground Pin
3	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set VOUT
4	EN	Control pin for the IC. It is a multi-functional pin for enable control, PWM dimming. If the pin is floating will disable the IC.
5	IN	Input Supply pin. Bypass with a 4.7μF or larger ceramic capacitor to GND
6	NC	Not connected, leave this PIN floating

FUNCTIONAL BLOCK DIAGRAM



TYPICAL PERFORMANCE CHARATERISTICS





FUNCTION DESCRIPTION

The ETA1621 is a high efficiency, high output voltage boost converter in a small package size. The device is ideal for delivering 1-2A current when boosting up the output voltage. The device integrates 22V/2.8A switch FET and operates in pulse width modulation (PWM) with 1MHz fixed switching frequency. For operation details, please check the block diagram at the "Block Diagram" chapter. The duty cycle of the converter is set by the error amplifier output and the current signal applied to the PWM control comparator.

Output Open Circuit Protection

Output open circuit protection circuitry prevents IC damage as the result of output open circuit. The ETA1621 monitors the voltage at the SW pin and FB pin during each switching cycle. The circuitry turns off the switch FET and shuts down the IC when both of the following conditions persist for 8 switching clock cycles: (1) the SW voltage exceeds the VOVP threshold, which is 22V and (2) the FB voltage is less than half of regulation voltage. As a result, the output voltage falls to the level of the input supply. The device remains in shutdown mode until it is enabled by toggling the EN pin logic. The output voltage plus the 200mV reference voltage cannot exceed the minimum OVP threshold or OUTPUT VOLTAGE + 200 mV≤ VOVP(MIN).

Shutdown

The ETA1621 enters shutdown mode when the EN voltage is logic low for more than 2.5ms. During shutdown, the input supply current for the device is less than 1μA (max). Although the internal FET does not switch in shutdown, there is still a DC current path between the input and the output through the inductor and Schottky diode.

Output Voltage Setting

The FB voltage is regulated by a low 0.6V reference voltage. The output voltage is set externally by using a resistor divider. The value of the R1/R2 divider is calculated using Equation 1.1:

$$Vout = \frac{R1+R2}{R2} \times 0.6V \quad (1.1)$$

Where,

VOUT = output voltage, R2 = resistance between FB and GND, R1 = resistance between OUT and FB.

The output current tolerance depends on the FB accuracy and the current sensor resistor accuracy.

PWM Dimming Control or Output Voltage Programming

When the EN pin is constantly high, the FB voltage is regulated to 600mV typically. However, the EN pin allows a PWM signal to reduce this regulation voltage; therefore, it achieves LED brightness dimming or output voltage programming (only to make output voltage lower). The relationship between the duty cycle and FB voltage is given by Equation 1.2:

VFB =Duty x 600 mV (1.2)

Where

Duty = duty cycle of the PWM signal, 600 mV = internal reference voltage

This PWM dimming eliminates the audible noise which often occurs when the output current is pulsed in replica of the frequency and duty cycle of PWM control. Unlike other scheme which filters the PWM signal for analog dimming, ETA1621 regulation voltage is independent of the PWM logic voltage level which often has large variations for optimum performance, use the PWM dimming frequency in the range of 25kHz to 100kHz.

APPLICATION INFORMATION

Inductor Selection

Using an inductor with a smaller inductance value forces discontinuous PWM when the inductor current ramps down to zero before the end of each switching cycle. This reduces the boost converter's maximum output current, causes large input voltage ripple and reduces efficiency. Large inductance value provides much more output current and higher conversion efficiency. For these reasons, a 4.7μH inductor value range is recommended and optimized the efficiency for most application while maintaining low inductor peak to peak ripple. Below table lists the recommended inductor for the ETA1621.

Recommended Inductors for ETA1621

Part #	L(μH)	Saturation Curent (mA)	Vendor
SWRH3D16S	4.7	>2500	Sunlord

Schottky Diode Selection

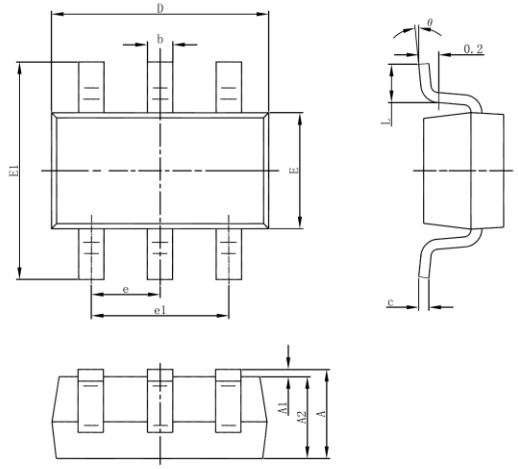
A high-speed rectifying Schottky is recommended for ETA1621 for maximum efficiency due to its high switching frequency. The diode average and peak current rating must be larger than the average output current and peak inductor current to ensure reliability. In addition, the diode's reverse breakdown voltage must exceed the open LED protection voltage.

Input and Output Capacitor Selection

The output capacitor is mainly selected to meet the requirements for the output ripple and loop stability. The output requires a capacitor in the range of 10μF to 22μF.

PACKAGE OUTLINE

SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°