14V Synchronous Boost with True Shutoff with Selectable CV and CC Output

DESCRIPTION

The ETA1043 is a high efficiency synchronous step-up converter that can provide at least 100mA to a boosted output up to 14V from a low voltage source. Unlike most step-up converter, it incorporates circuits that disconnect the input from output, during shutdown, short-circuit, output current overloading, or other events when output is higher than the input. This eliminates the need for an external MOSFET and its control circuitry to disconnect the input from output, and provides robust output overload protection.

A switching frequency of 1.2MHZ minimizes solution footprint by allowing the use of tiny and low profile inductors and ceramic capacitors. An internal synchronous MOSFET provides highest efficiency and with a current mode control that is internally compensated, external parts count is reduced to minimal.

ETA1043 is in a tiny DFN2x2-8L package.

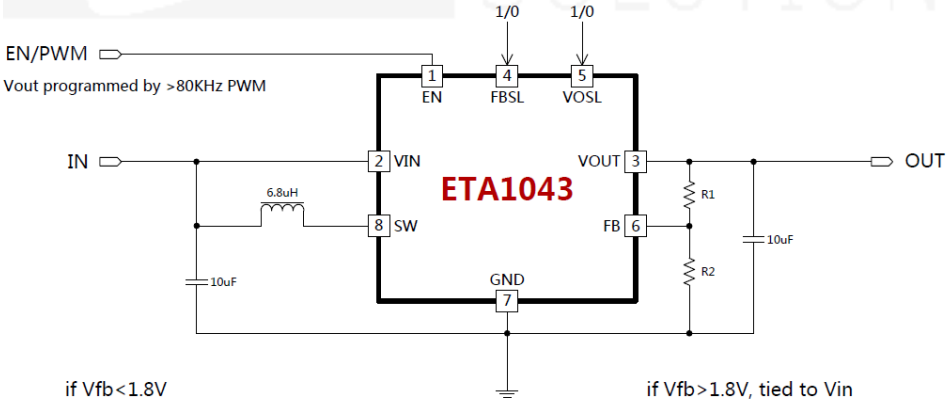
FEATURES

- 14V Max output voltage
- Wide input range 2.5V to 6.5V
- Output Disconnect
- Short-circuit Protection
- At least 14V/100mA Output
- 0.8A input current limit
- Output to Input Reversed Current Protection
- Up to 96% Efficiency
- 70μA No load I_Q and light load PFM Mode
- Internal Synchronous Rectifier
- Current Mode control
- Logic Control Shutdown and Thermal shutdown
- DFN2x2-8L Package

APPLICATIONS

- Wearable
- OLED driver
- 2-4 LEDs backlight driver for small TFT LCD

TYPICAL APPLICATION



if Vfb<1.8V

Vout = $\frac{R1 + R2}{R2}$ x 0.8 (V) if FBSL=1 for CV output

Vfb = 0.2 (V) if FBSL=0 for CC output like LED backlight

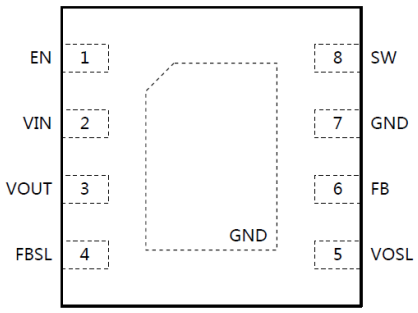
if Vfb>1.8V, tied to Vin

Vout = 12V if FBSL=0 VOSL=0
Vout = 10V if FBSL=0 VOSL=1
Vout = 12.5V if FBSL=1 VOSL=0
Vout = 13.5V if FBSL=1 VOSL=1

ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1043D2I	DFN2x2-8	ECYW	3000

PIN CONFIGURATION



ABSOLUTEMAXIMUM RATINGS

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

OUT,SW Voltage .....–0.3V to 18V
All Other Pin Voltage .....–0.3V to 6.5V
SW to ground 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}	
DFN2x2-8	62	12	°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 TA = 25oC.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Range		2.5		6.5	V
Input UVLO or Startup Voltage	Rising, Hysteresis=0.18V		2.42		V
FB Feedback Voltage	V_{FBSL} =0		200		mV
	V_{FBSL} =V_{IN}		0.8		V
FB Input Current				50	nA
Output Voltage Range		3		14	V
Output OVP voltage			16		V
Internally Set Output Voltage	See output selection table				
Quiescent Current at IN	V_{FB}=1.3V		40		μA
Shutdown Supply Current at IN	V_{EN}=GND		0.3	2	μA
Switching Frequency		0.9	1.2	1.5	MHz
Maximum Duty Cycle		95			%
NMOS Switch On Resistance	I_{SW} =100mA		0.2	0.40	Ω
PMOS Switch On Resistance	I_{SW} =100mA		0.5	1.0	Ω
NMOS Switch Current Limit	I_{SW}		0.8		A
Start-up and Output Short Current Limit	I_{OUT},V_{IN}=3.6V		0.08		A
Output to Input Reverse Leakage Current	V_{EN}=GND, Measure at IN pin		0.5	3	μA
SW Leakage Current	V_{SW}=0 or 12V, V_{EN}=GND			10	μA
Logic Input EN, FBSL, VOSL					
Input Current			0.1	1	μA
Input Low Voltage				0.4	V

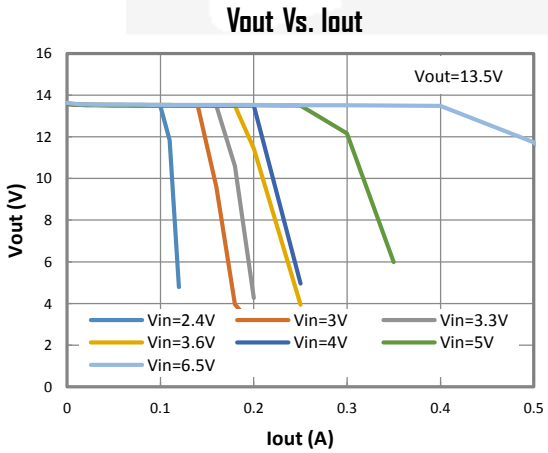
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input High Voltage		1.1			V
PWM Diming Frequency		20		100	KHz
Minimum Dimming duty at 20KHZ			5		%
Off time EN remained low to shutdown			2		mS
Thermal Shutdown	Rising, Hysteresis=10°C		165		°C

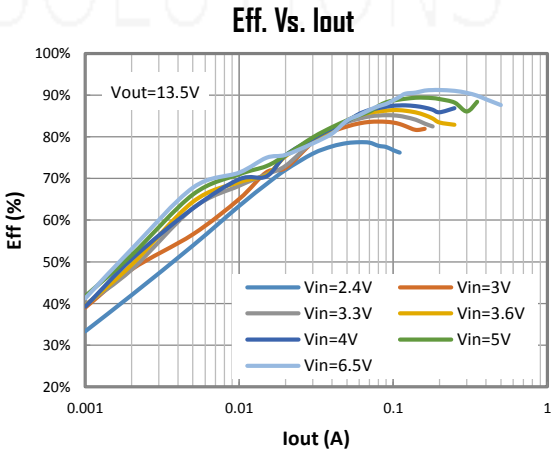
PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	EN	It is a multi-functional pin for enable control, PWM dimming, tie low more than 2ms to disable the BOOST.
2	VIN	Input pin. Bypass with a 10uF capacitor to GND.
3	VOUT	Output pin. Bypass with a 10uF capacitor to GND, a 2.2uF capacitor is OK in LED mode.
4	FBSL	Feedback voltage select pin.
5	VOSL	Output Voltage select pin.
6	FB	Feedback Pin. Feedback Input for Current in LED mode, connect an external resistor FB to GND to set I_{OUT}; or Connect an external resistor divider from the output to FB and GND to set V_{OUT}.
7	GND	Ground Pin.
8	SW	Switching node of the Switching Regulator. Connect a 2.2~6.8μH inductor from this pin to VIN.

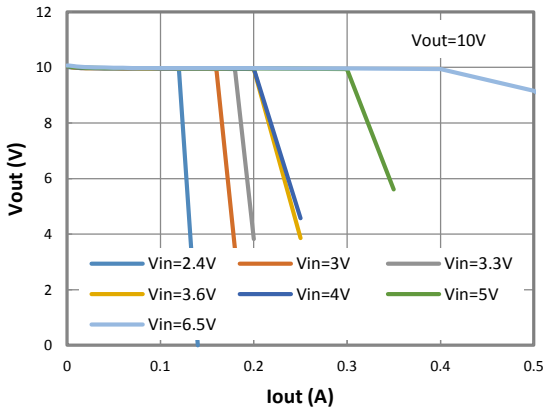
TYPICAL CHARACTERISTICS

(Typical values are at T_A = 25°C unless otherwise specified.)

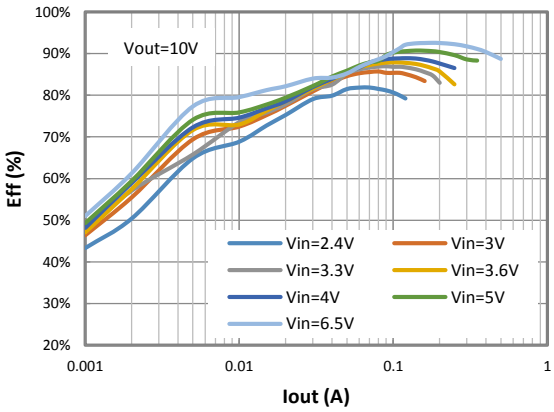




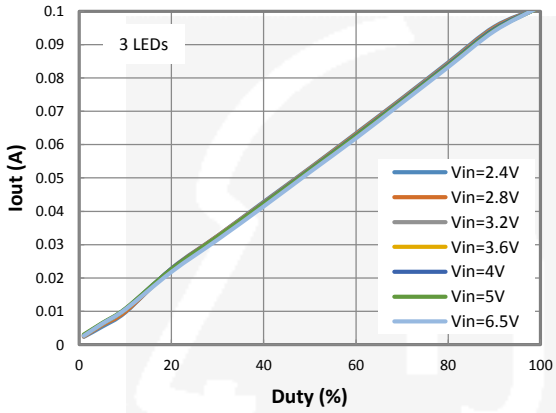
Vout Vs. Iout



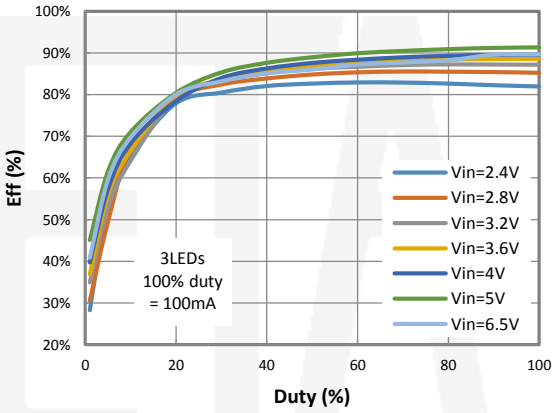
Eff. Vs. Iout



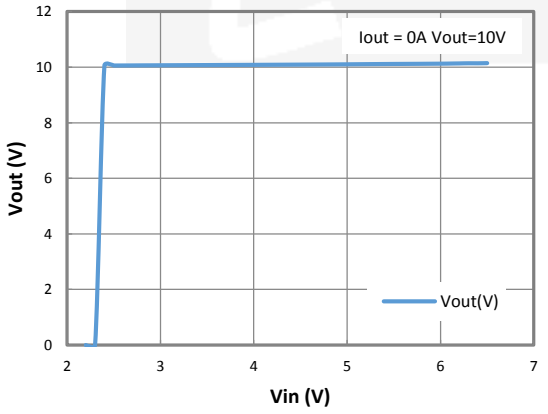
Iout Vs. Duty



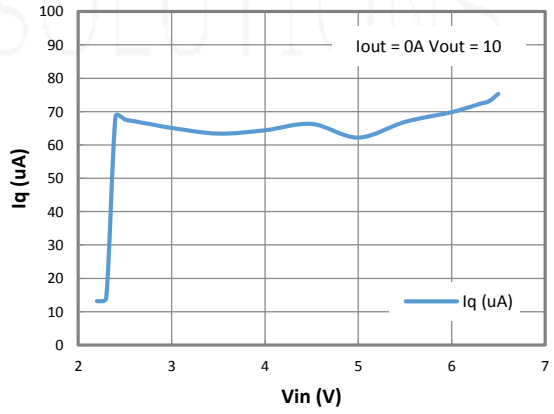
Eff. Vs. Duty



Vout Vs. Vin



Iq Vs. Vin



APPLICATION INFORMATION

Peripheral Capacitor and Inductor Selection

Inductor Selection

Large inductance value provides much more output current and higher conversion efficiency. For these reasons, a 2.2μH to 6.8μH inductor value range is recommended. A 6.8μH inductor optimized the efficiency for most application while maintaining low inductor peak to peak ripple.

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 with 10uF for CV application and 2.2uF for CC application (e.g. LED backlight driving).

Output Voltage Setting for Constant Voltage Output

As ETA1043 is designed for application in wearable devices, output voltage can be set by a digital way to save the PCB space for resistors, as well as the conventional way with a resistor divider.
When Vfb is smaller than 1.8V and FBSL is set high, the output voltage is set by a resistor divider, and the output voltage is defined by

$$Vout = \frac{R1 + R2}{R2} \times 0.8V$$

If Vfb is pulled higher than then 1.8V, the output voltage setting is changed to a digital mode as defined by following table

FBSL	VOSL	Vout (V)
0	0	12
0	1	10
1	0	12.5
1	1	13.5

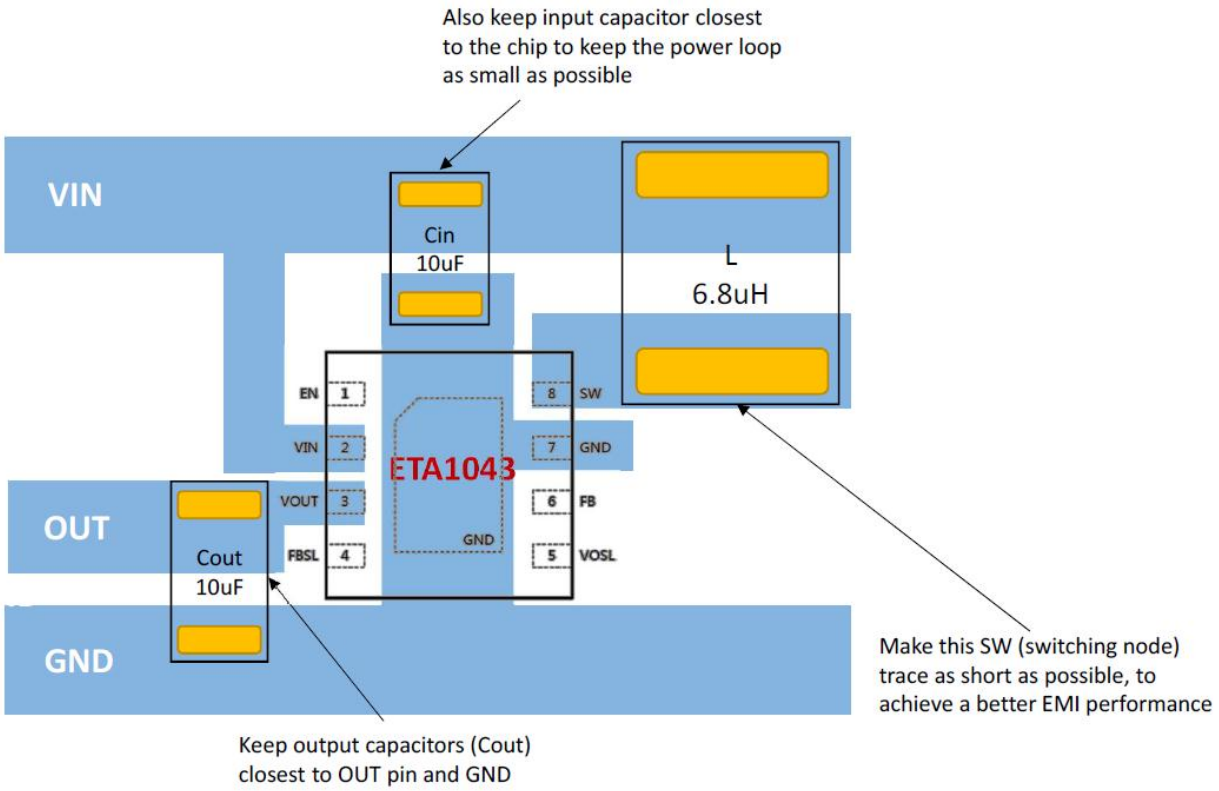
Output Voltage further programmed by PWM signal at EN pin

The output voltage can be further programmed by sending PWM signal with frequency larger than 80KHz to the EN pin. Because the internal feedback voltage will be proportional to the duty cycle of the PWM signal, output voltage is then proportional to the duty cycle too.

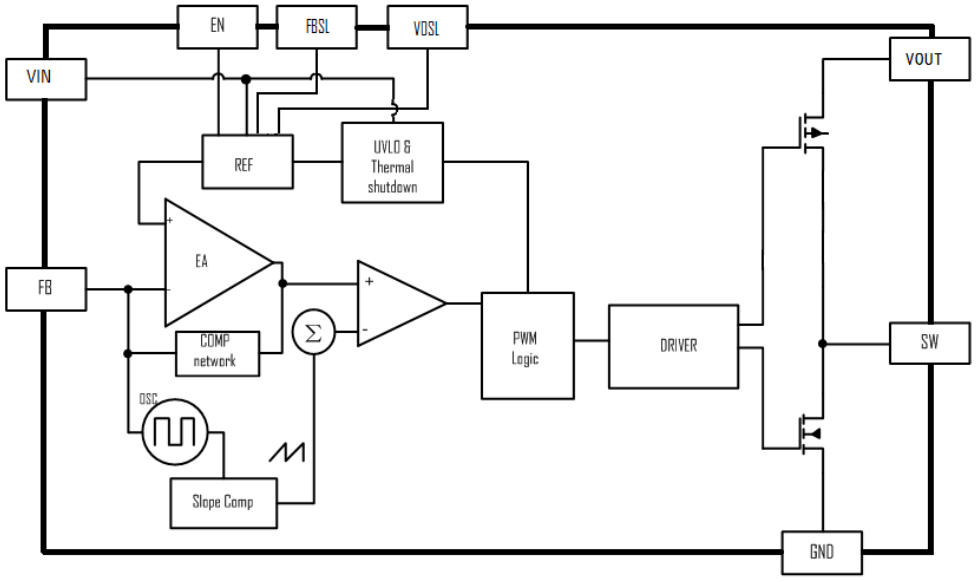
Setting Feedback Voltage to 0.2V for Constant Current Output

When FB is less than 1.8V, pulling FBSL low will set FB voltage at 0.2V, which is normally the current sense voltage for constant current output, like backlight LED driver for TFT LCD screen.

PCB GUIDELINES

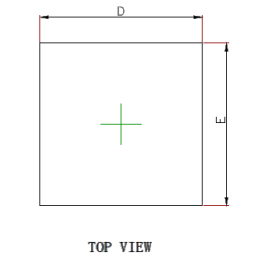


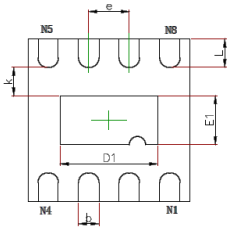
BLOCK DIAGRAM

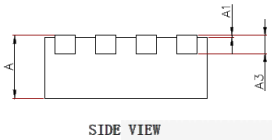


PACKAGE OUTLINE

Package: DFN2x2-8







Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	1.100	1.300	0.043	0.051
E1	0.500	0.700	0.020	0.028
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.274	0.426	0.011	0.017