

## 1 $\mu$ A Ultra low IQ 1A Synchronous Boost in SOT23-6 and DFN2x2-6

### DESCRIPTION

ETA1061 is a high efficiency synchronous step-up converter with ultra-low quiescent current down to 1 $\mu$ A. It is capable of delivering at least 2W of power from a low voltage source, i.e. 0.4A at 5V output. It also features a true-shutoff function that disconnects the input from output, during shutdown and output short-circuit conditions. 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 1.4MHz 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. With the ultra-low IQ feature, ETA1061 is ideal for solution that requires low standby power and compact board size such as IoT applications.

ETA1061 is housed in a SOT23-6 and DFN2x2-6 package

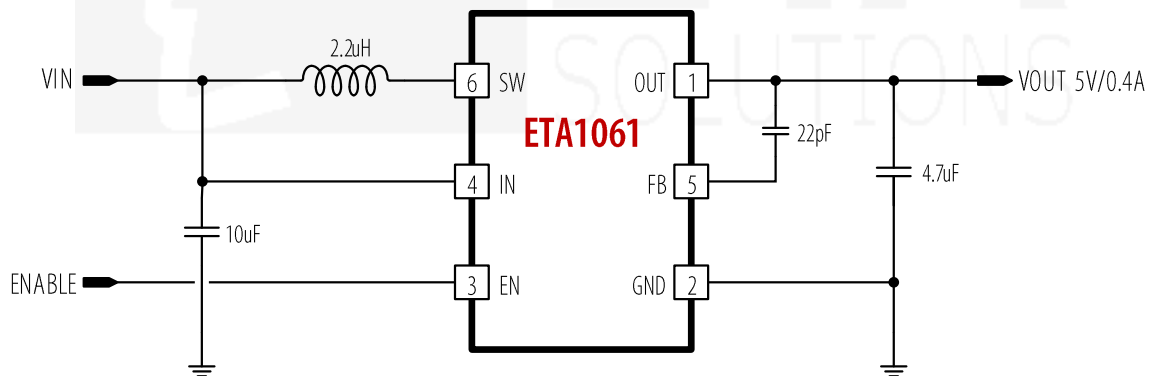
### FEATURES

- ◆ Ultra low IQ when No Switching :1 $\mu$ A
- ◆ Output Disconnect
- ◆ Short-circuit Protection
- ◆ 5V/0.4A Output Power
- ◆ Output to Input Reversed Current Protection
- ◆ Up to 94% Efficiency
- ◆ Internal Synchronous Rectifier
- ◆ Current Mode control
- ◆ Logic Control Shutdown and Thermal shutdown
- ◆ SOT23-6 & DFN2x2-6 Package

### APPLICATIONS

- ◆ Tablet, MID
- ◆ Smart Phone
- ◆ Power Bank

### TYPICAL APPLICATION



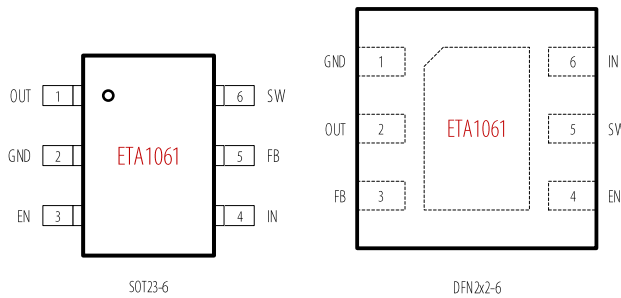
\*Pin number is just for SOT23-6 package

Fixed output voltage, 3.3V and 5V. Or setting output voltage thru FB pin with resistors costing extra 6 $\mu$ A current.

### ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1061V33S2G	SOT23-6	PLYW	3000
ETA1061V50S2G	SOT23-6	PVYW	3000
ETA1061V50D2G	DFN2x2-6	PwYW	3000

## PIN CONFIGURATION



## ABSOLUTE MAXIMUM RATINGS

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

IN OUT, SW, FB, EN 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 $\theta_{JA}$ $\theta_{JC}$	
SOT23-6.....	180.....90.....°C/W
DFN2x2-6.....	80.....30.....°C/W
Lead Temperature (Soldering 10ssec) .....	260°C
ESD HBM (Human Body Mode) .....	2KV
ESD MM (Machine Mode) .....	200V

## ELECTRICAL CHARACTERISTICS

( $V_{IN}=3.6V, V_{OUT}=5V$ , unless otherwise specified. Typical values are at  $T_A=25^\circ C$ .)

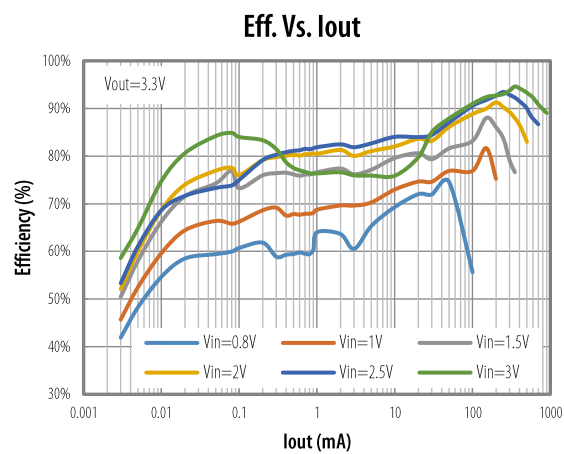
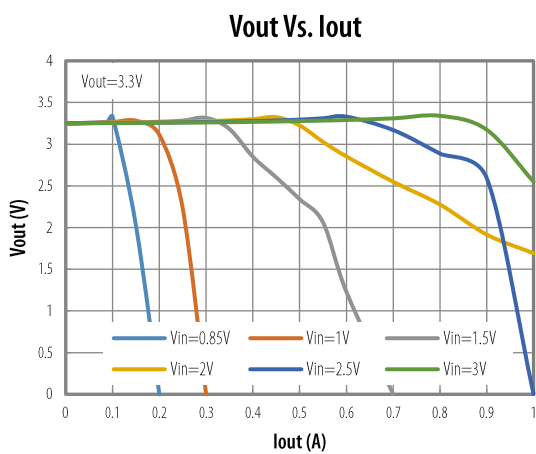
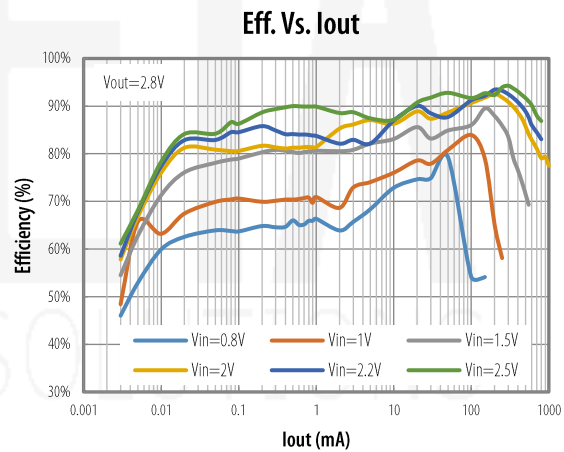
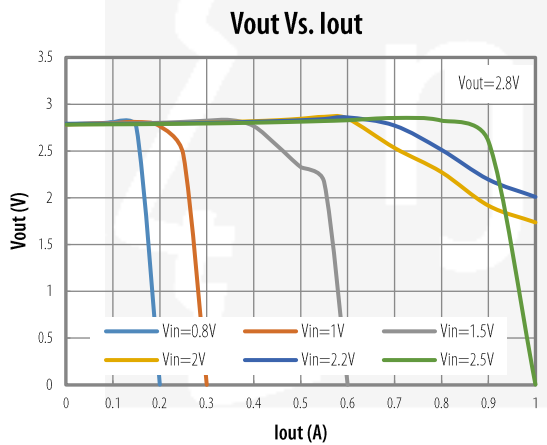
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Quiescent Current at OUT	$V_{EN}=IN$ , No load, Not switching		1.08		$\mu A$
Shutdown Supply Current at IN	$V_{EN}=GND$		0.32		$\mu A$
IN Startup Voltage	$I_{OUT}=1mA$		0.8		V
IN Operation Voltage	After Start-up	0.6		5	V
Output Voltage at 5V		4.85	5	5.15	V
Output Voltage at 3.3V		3.2	3.3	3.4	V
Feedback Voltage		1.076	1.11	1.144	V
Switching Frequency			1.4		MHz
NMOS Switch On Resistance	$I_{SW}=100mA$		220		m $\Omega$
PMOS Switch On Resistance	$I_{SW}=100mA$		160		m $\Omega$
SW Leakage Current	$V_{OUT}=5.2V, V_{EN}=GND, V_{SW}=5.2V$ or $V_{SW}=0V$			10	$\mu A$
NMOS Switch Current Limit			1		A
Start-up Current Limit			1		A
Short Circuit Hiccup time	ON		1.3		ms
	OFF		33		ms
EN Input Current	$V_{EN}=5V$ or $0V$	-1	0	1	$\mu A$
EN High Voltage	$V_{OUT}=5V$	1.2			V
EN low Voltage	$V_{OUT}=5V$			0.4	V
Thermal Shutdown	Rising, Hysteresis= $25^\circ C$		160		$^\circ C$

## PIN DESCRIPTION

SOT23-6 PIN #	DFN2x2-6 PIN #	NAME	DESCRIPTION
1	2	OUT	Output pin. Bypass with a 4.7 $\mu$ F or larger ceramic capacitor closely between this pin and GND
2	1	GND	Ground Pin
3	4	EN	Enable pin for the IC. Drive this pin high to enable the part, low to disable.
4	6	IN	Input Supply Voltage. Bypass with a 4.7 $\mu$ F ceramic capacitor to GND
5	3	FB	Feedback Input. Connect a 22pF from OUT to FB pin for fixed output voltage. And add an external resistor divider from the OUT to FB and GND to set VOUT for adjustable output voltage.
6	5	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.

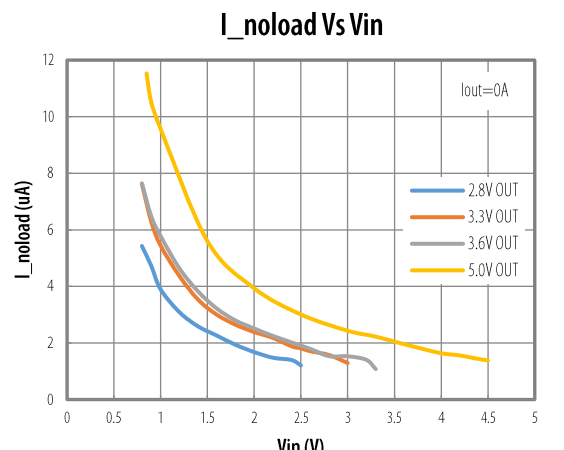
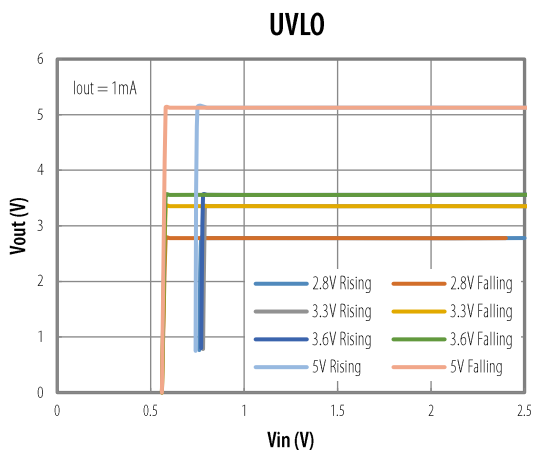
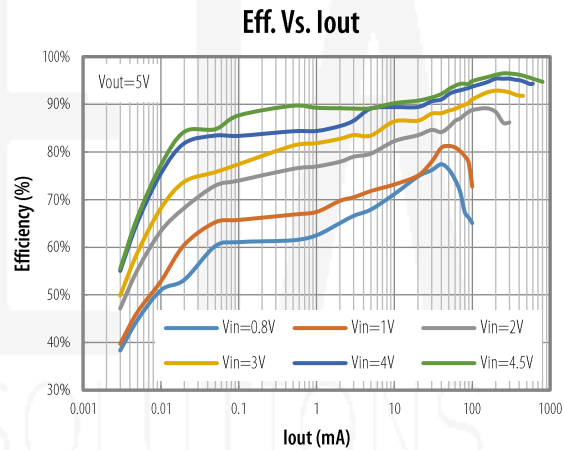
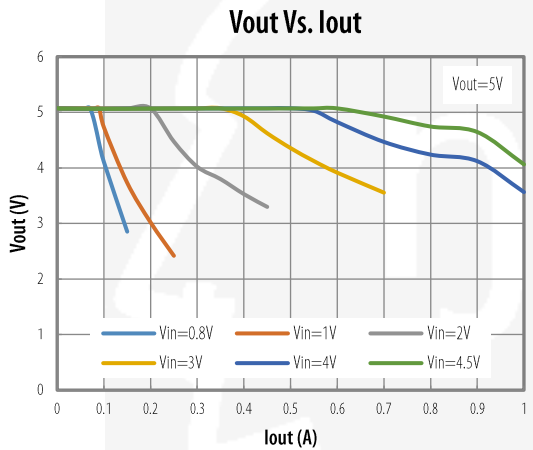
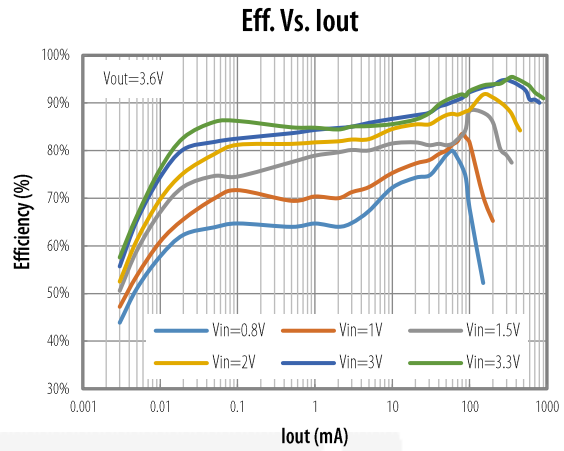
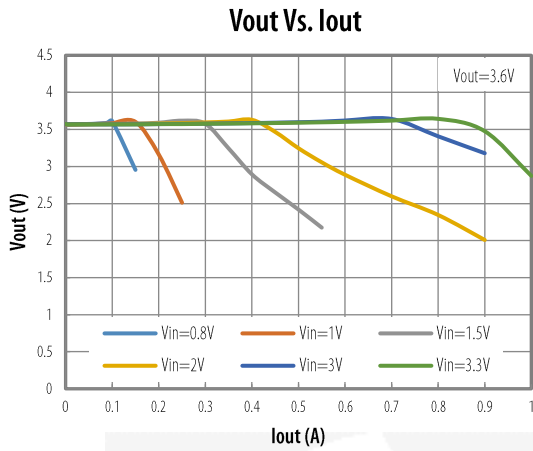
## TYPICAL CHARACTERISTICS

(Typical values are at  $T_A = 25^\circ\text{C}$  unless otherwise specified.)



TYPICAL CHARACTERISTICS cont'

(Typical values are at  $T_A = 25^\circ\text{C}$  unless otherwise specified.)



## APPLICATION INFORMATION

### Loop Operation

ETA1061 is a high efficiency synchronous step-up converter with ultra-low quiescent current down to 1 $\mu$ A. It integrates a 220m $\Omega$  Low Side Main MOSFET and 160m $\Omega$  synchronous MOSFET. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

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 1A. An internal temperature sensor prevents the device from getting overheated in case of excessive power dissipation.

### Ultra low current consumption at Light Load Operation

Traditionally, a fixed constant frequency PWM DC/DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite R<sub>DS(on)</sub>s of the MOSFETs and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ETA1061 employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power saving mode during light load and the no load quiescent current can be as low as 1 $\mu$ A.

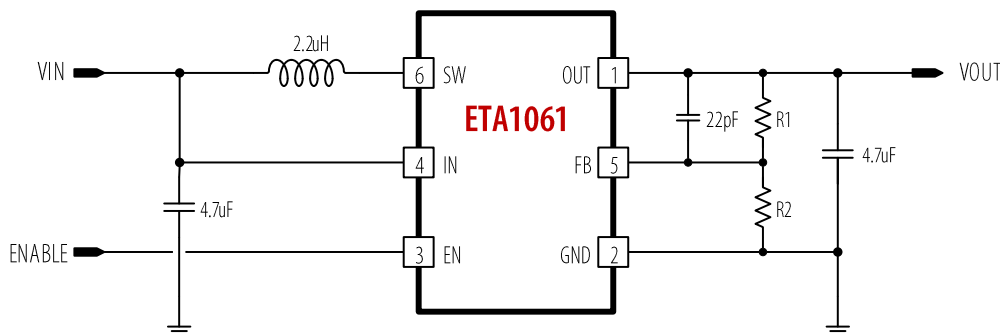
### Short-Circuit Protection

Unlike most step-up converters, the ETA1061 allows for short circuits on the output. In the event of a short circuit, the device first turns off the NMOS when the sensed current reaches the current limit. When OUT drops below IN, the device then enters a linear charge period with the current limited same as with the start-up period. In addition, the thermal shutdown circuits disable switching if the die temperature rises above 160 $^{\circ}$ C.

### Adjustable Output Voltage Setting with FB pin

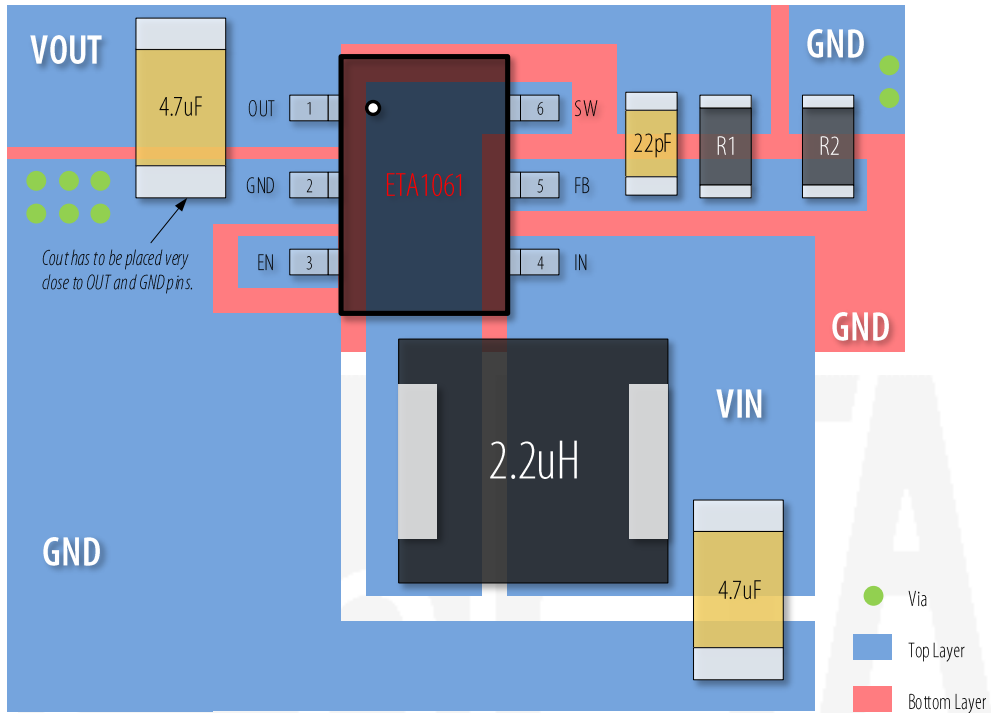
By adding a resistor divider at FB pin (R1 and R2 as shown in the circuit below), ETA1061 can be set to any voltage level less than 5V at output node. But as there is already a large internal resistor (about 20M $\Omega$ ) from FB to GND to set the fixed output voltage, the R2 is recommended to be 200K or less, which will add about 6 $\mu$ A or more at output. The output voltage is set by following equation:

$$V_{out} = \frac{R1+R2}{R2} \times 1.11V$$

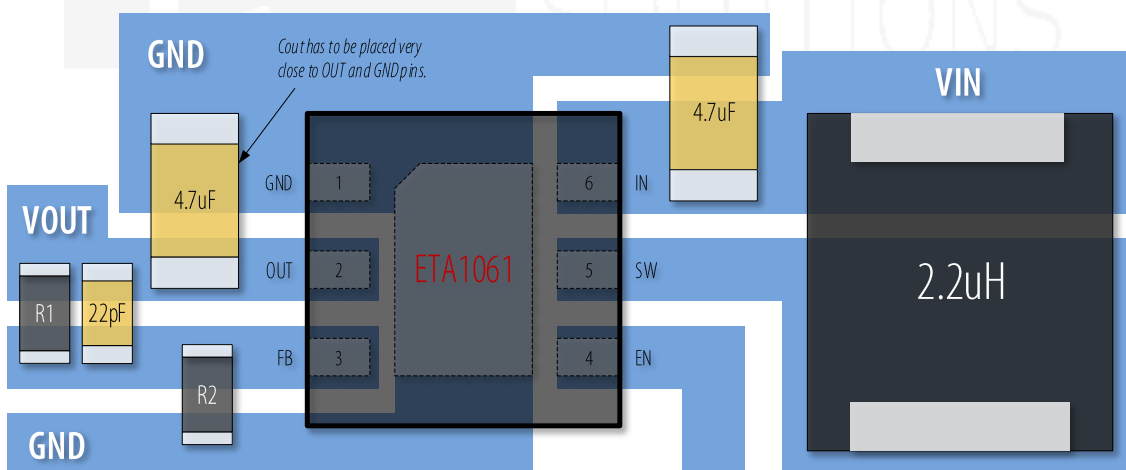


PCB GUIDELINES

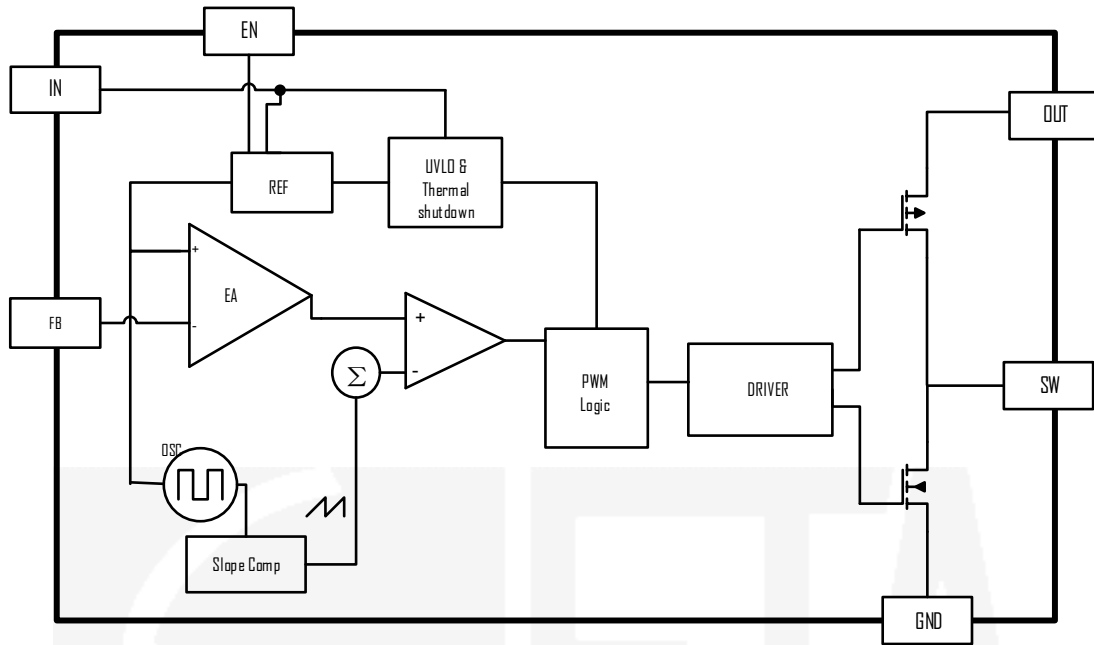
PCB layout example for SOT23-6 package



PCB layout example for DFN2x2-6 package

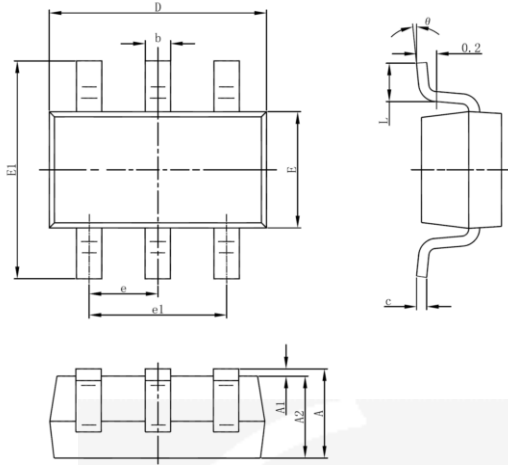


BLOCK DIAGRAM



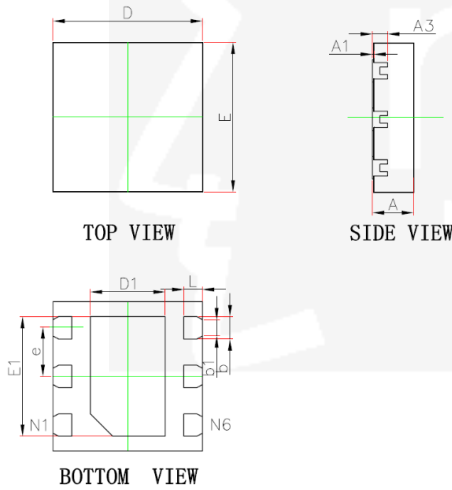
## PACKAGE OUTLINE

Package: 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°

Package: DFN2x2-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203 REF.		0.008 REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	1.500	1.700	0.059	0.067
b	0.250	0.350	0.010	0.014
b1	0.220 REF.		0.009 REF.	
e	0.650 BSC.		0.026 BSC.	
L	0.174	0.326	0.007	0.013