General Description

The EC8806 is a 300mA, low dropout and low noise linear regulator with high ripple rejection ratio and fast turn-on time. It has fixed and adjustable versions with output voltage ranging from 1.5V to 5V.

The EC8806 includes a reference voltage source, an error amplifier, driver transistors and an internal current limiter. The current limiter's holdback circuit operates as a short protection.

The EC8806 works well with low ESR ceramic capacitors, suitable for portable RF and wireless battery-powered applications with stringent space requirements and demanding performance. It also offers ultra low noise output and has low quiescent current.

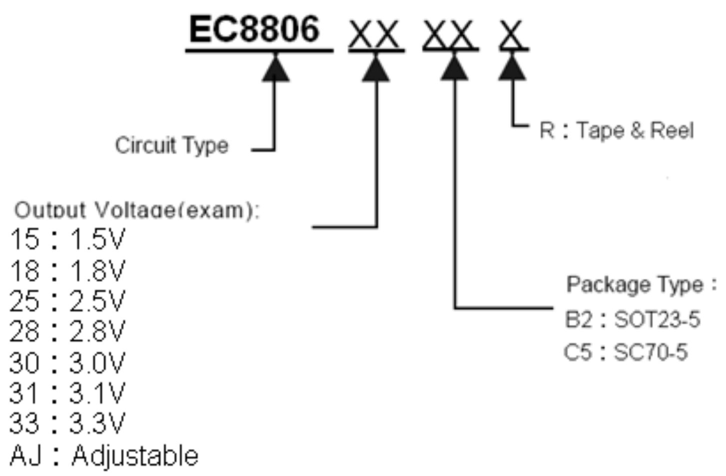
Features

- Ultra-Low-Noise Application
- Wide 2.5V to 6V Operating Range
- Quick Start-up
- Current Limiting Protection
- Thermal Shutdown Protection
- Low Dropout : 200mV @ 300mA
- High Ripple Rejection 70dB@1kHz
- Standby Current Less Than 0.1μA
- Seven Fixed Voltage Options Available

Applications

- Battery-Powered Equipment
- Portable Instruments
- Digital Camera
- WLAN Communication
- Hand-Held Instruments

Ordering Information



Marking Information

Device	Marking Information	Package Type	Remarks
EC8806VVB2R	8806 VVYW	SOT23-5	1. VV：Output Voltage(Ex：15：1.5V;33：3.3V) 2. Y：Year code(D=2013;E=2014;F=2015…) 3. W：Week Code(The big character of A~Z is for the week of 1~26, and small a~z is for the week of 27~52.)
EC8806VVC5R	6VVf	SC70-5	1. VV：Output Voltage(Ex：15：1.5V;33：3.3V) 2. Starting with underlined first-V, a bar is for production year 2012. The next bar is mark on top of second-V is for year 2013. The next bar is mark on bottom of second-V is for year 2014.The next bar is mark on top of f is year for 2015. The naming pattern continues with consecutive characters for later years. 3. f is the week of production. The big character of A~Z is for the week of 1~26, and small a~z is for the week of 27~52.

Typical Application Circuit

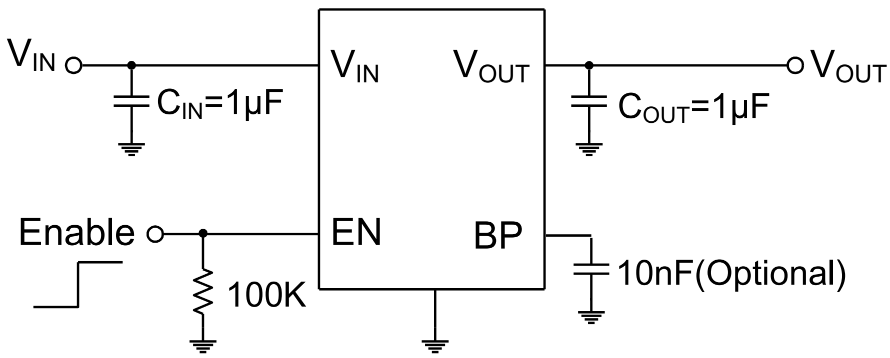
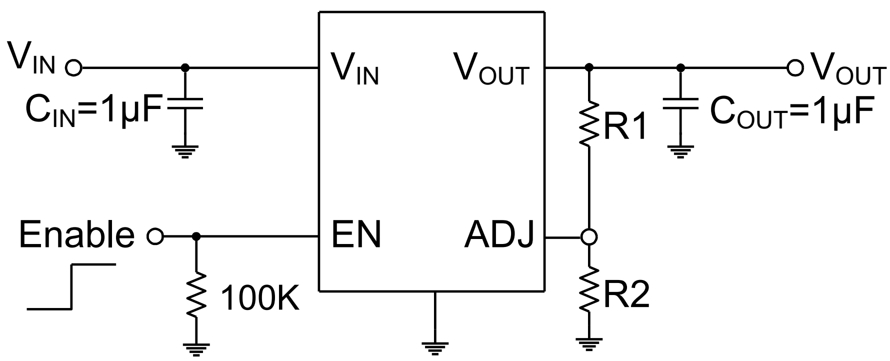


Figure 1. Fixed Voltage BP Version



$$VOUT = 1.2 \times (1 + \frac{R1}{R2}) \text{Volts}$$

Figure 2. Adjustable Voltage Version

Absolute Maximum Ratings (Note1)

Supply Voltage V_{IN}	6V
Power Dissipation, P_D @ T_A=25°C	
SC70-5	300mW
SOT23-5	400mW
Thermal Resistance, θja	
SC70-5	333°C/W
SOT23-5	250°C/W
Lead Temperature	260 °C
Storage Temperature	-65°C to 150°C

Recommended Operating Conditions

Input Voltage V_{IN}	2.5V to 6V
EN Input Voltage	0V to 6V
Junction Temperature	-40°C to 125°C
Ambient Operating Temperature	-40°C to 85°C

Electrical Characteristics (Unless otherwise specified V_{IN}=5V, T_A=25°C)

Parameters		Symbol	Condition		Min	Typ	Max	Units
Operating Voltage Range (Note 2)		V_{IN}					6	V
Standby Current		I_{SBY}	V_{EN} = GND,Shutdown			0.01	1	μA
Supply Current Limit		I_{LIMIT}	R_{LOAD} = 1Ω		360	450		mA
Dropout Voltage (Note 3)		V_{DROP}	I_{OUT} = 300mA	V_{OUT} = 1.2V		1300	2100	mV
				V_{OUT} = 1.8V		1100	1500	mV
				V_{OUT} = 2.5V		580	800	mV
				V_{OUT} = 2.8V		410	500	mV
				V_{OUT} = 3.0V		300	400	mV
				V_{OUT} = 3.1V		260	370	mV
				V_{OUT} = 3.3V		200	300	mV
EN input Bias Current		I_{IBSD}	V_{EN} = GND or V_{IN}			0	100	nA
Line Regulation		ΔV_{LINE}	V_{IN} = (V_{OUT} +1V) to 5.5V I_{OUT} = 1mA				10	mV/V
Load Regulation		ΔV_{LOAD}	1mA < I_{OUT} < 300mA			15	25	mV
Output Noise Voltage		eNO	10Hz to 100kHz I_{OUT} = 200mA C_{OUT} = 1μF			100		μV_{RMS}
Thermal Shutdown Temperature		T_{SD}				165		°C
Thermal Shutdown Temperature Hysteresis		ΔT_{SD}				30		°C
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT} =1mA		-2		+2	%
EN Threshold	Logic-Low V	V_{IL}	V_{IN} = 3V to 5.5V,Shutdown				0.4	V
	Logic-High V	V_{IH}	V_{IN} = 3V to 5.5V,Start-up		1.2			V
Power Supply Rejection Rate	f = 100Hz	PSRR	C_{OUT} = 1μF, I_{OUT} = 10mA			-70		dB
	f = 10KHz					-65		

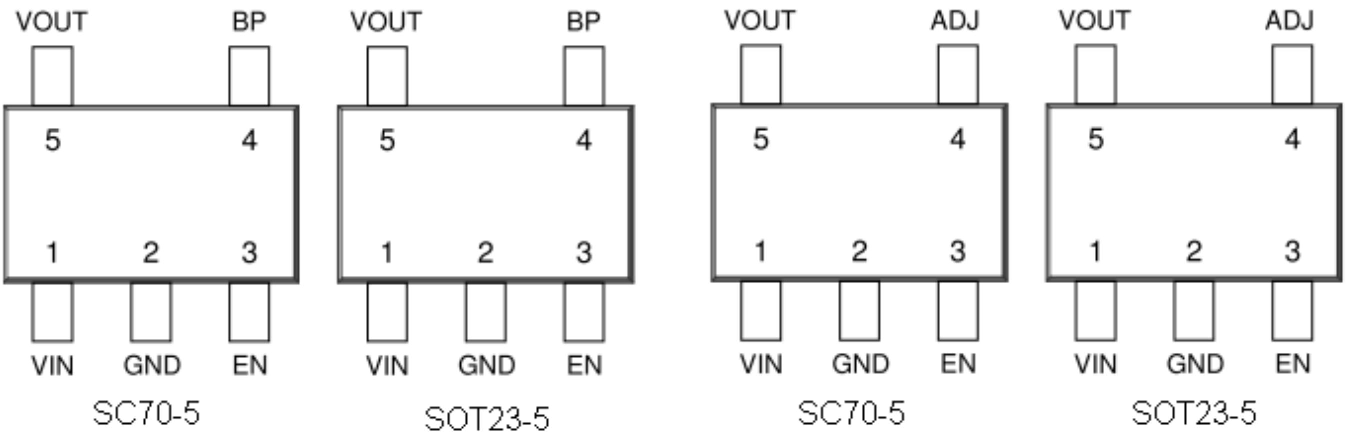
Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: $V_{IN\ (MIN)} = V_{OUT} + V_{DROPOUT}$

Note 3: The dropout voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} is 100mV below the target value of V_{OUT}.

Pin Configurations

(Top View)



Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
GND	Ground
VOUT	Output Voltage
VIN	Input Voltage
BP	Bypass Pin
ADJ	Feedback Input, this pin could not be floating.

Function Block Diagram

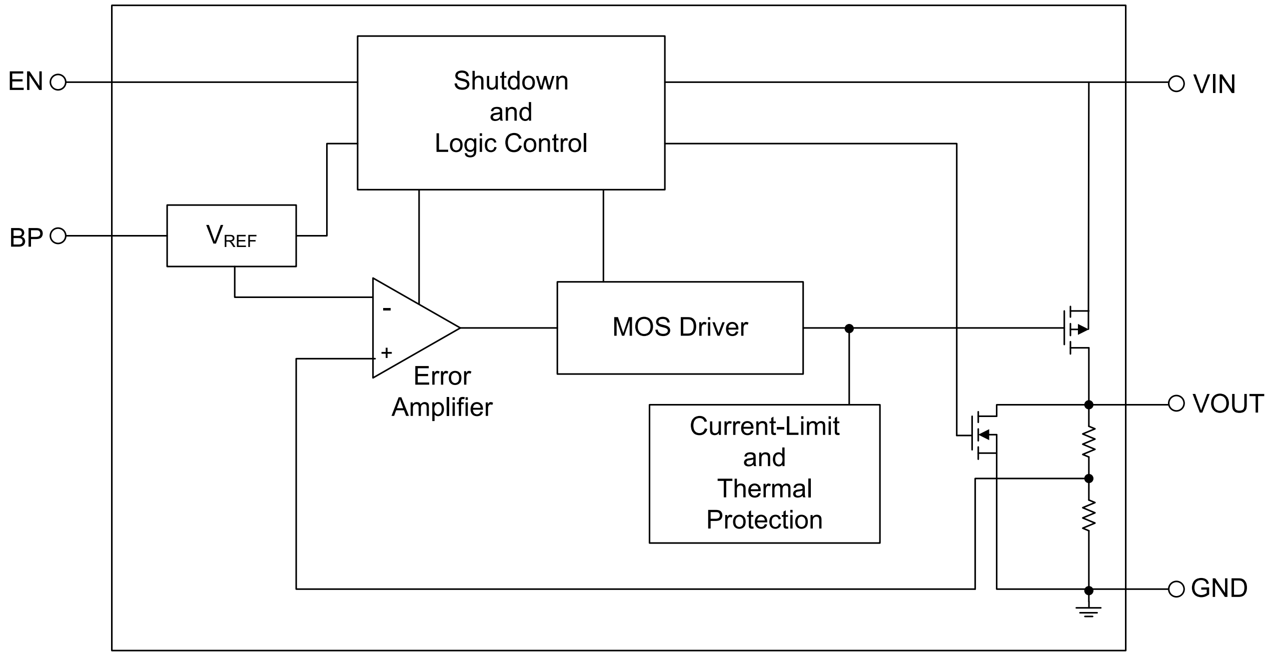


Figure3. BP Version

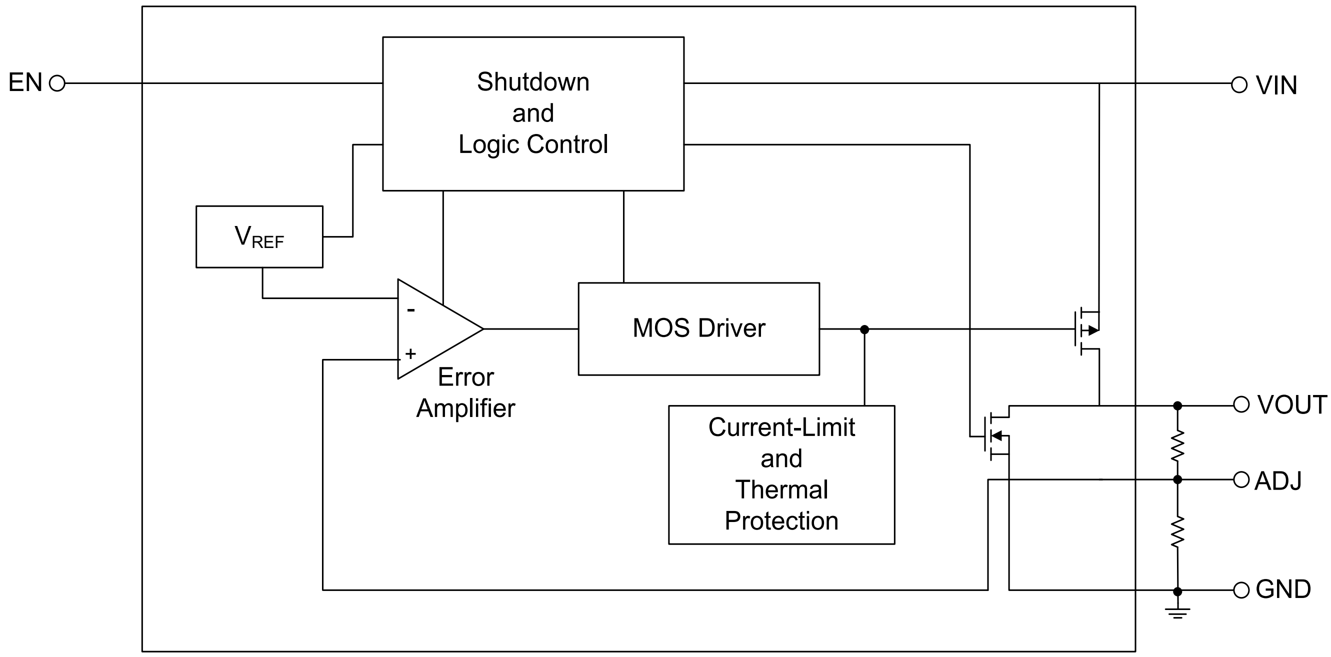


Figure4. ADJ Version

Typical Operating Characteristics

Quiescent Current vs. Input Voltage

Current Limit vs. Input Voltage

Dropout Voltage vs. Load Current

Shutdown Current vs. Input Voltage

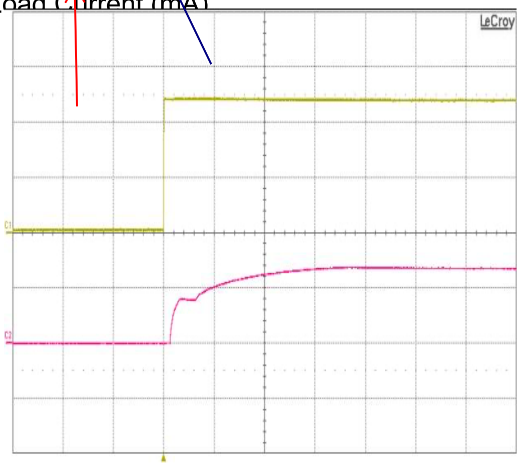
Load Regulation

Line Regulation

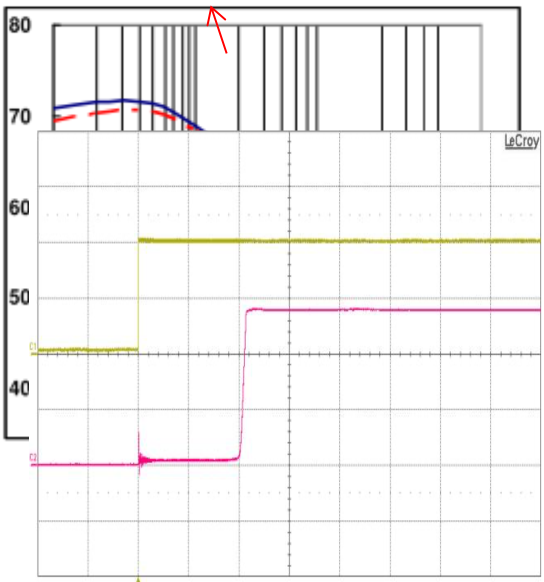
PSRR

PSRR

Start-up from EN

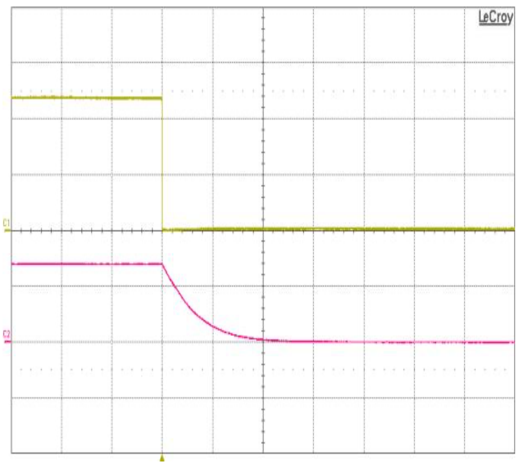


Time (20μs/Div)



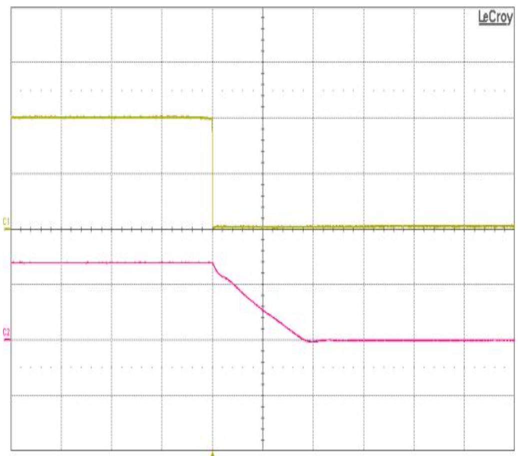
Time (200μs/Div)

Shutdown from EN



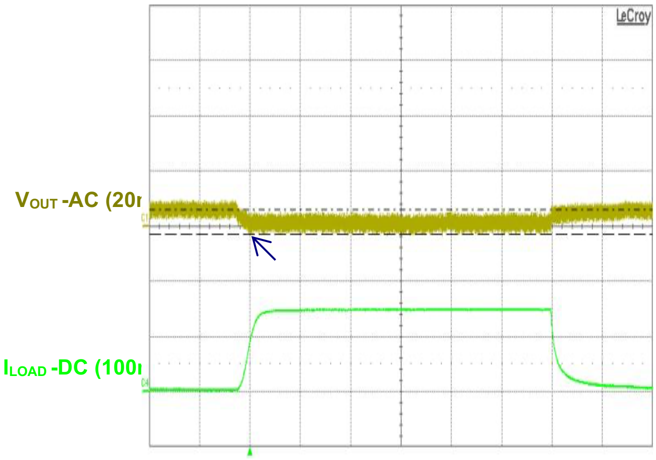
Time (100μs/Div)

Shutdown from EN



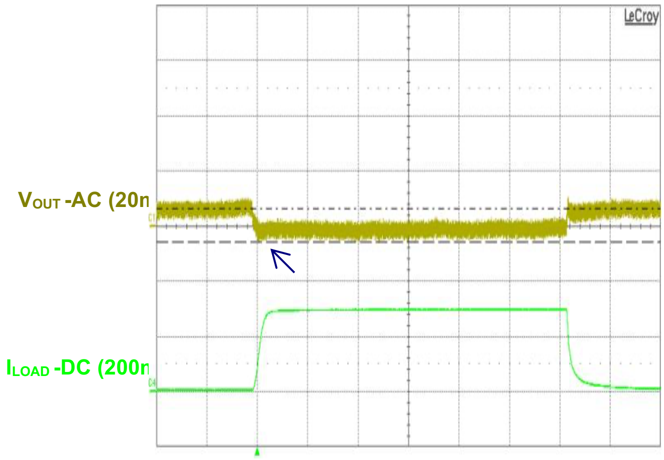
Time (10μs/Div)

Load Transient Response



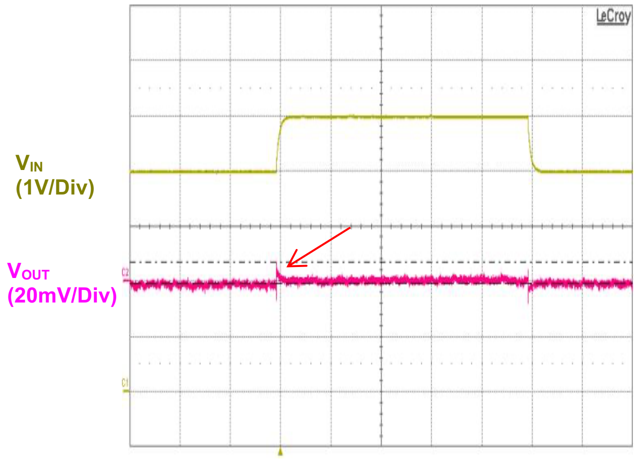
Time (200µs/Div)

Load Transient Response



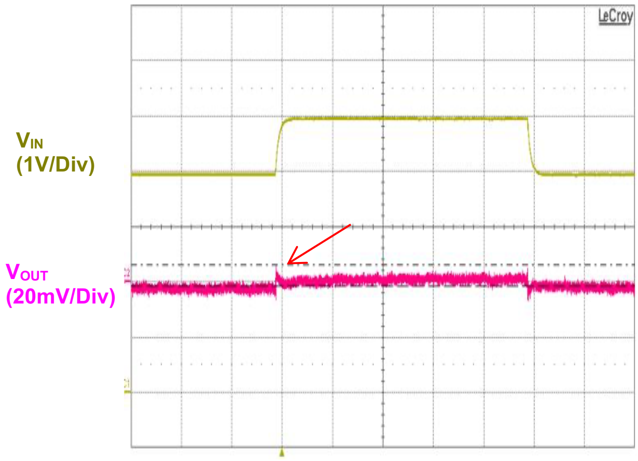
Time (200µs/Div)

Line Transient Response

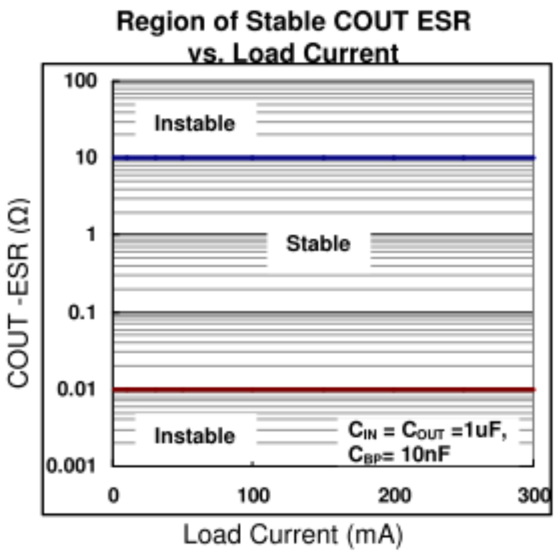


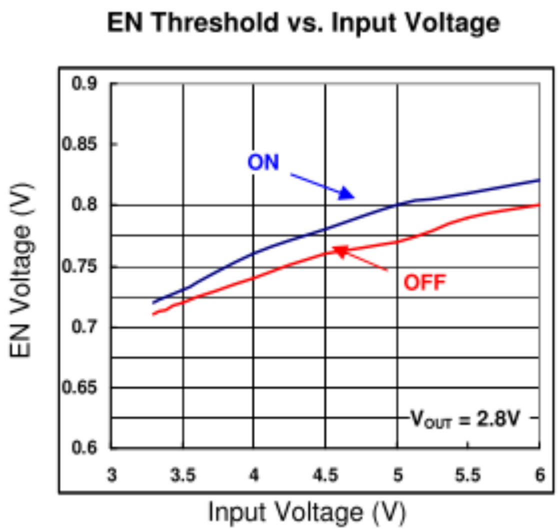
Time (1ms/Div)

Line Transient Response



Time (1ms/Div)





Application Information

Capacitor Selection and Regulator Stability

Input Capacitor

An input capacitance of 1μF is required between the device input pin and ground directly (the amount of the capacitance may be increased without limit). The input capacitor ***MUST*** be located less than 1 cm from the device to assure input stability (see PCB Layout Section). A lower ESR capacitor allows the use of less capacitance, while higher ESR type (like aluminum electrolytic) requires more capacitance. Capacitor types (aluminum, ceramic and tantalum) can be mixed in parallel, but the total equivalent input capacitance/ESR must be defined as above for stable operation. There are no requirements for the ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure the capacitance is 1μF over the entire operating range.

Output Capacitor

The EC8806 is designed specifically to work with very small ceramic output capacitors. The minimum capacitance recommended (temperature characteristics of X7R, X5R, Z5U or Y5V) is within the 1μF to 10μF range with 5mΩ to 50mΩ ESR range ceramic capacitor between LDO output and GND for transient stability, but it may be increased without limit. Higher capacitance values help to improve transient response. The output capacitor's ESR is critical because it forms a zero to provide phase lead which is required for loop stability.

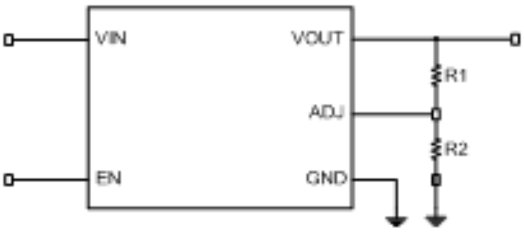
Enable Function

The EC8806 is shut down by pulling the EN pin low, and turned on by driving the input high. If the shutdown feature is not required, the EN pin should be tied to VIN to keep the regulator on at all times (the EN pin *MUST NOT* be left floating).

To assure proper operation, the signal source used to drive the EN pin must be able to swing above and below the specified turn-on/off voltage thresholds listed in the "Electrical Characteristics" under V_{IH} and V_{IL}. The ON/OFF signal may come from either CMOS output, or an open-collector output with pull-up resistor to the device input voltage or another logic supply. The high-level voltage may exceed the device input voltage, but must remain within the absolute maximum ratings for the EN pin.

Adjustable Operation

The adjustable version of the EC8806 has an output voltage ranging from 1.2V to 4.75V. The output voltage of the EC8806 adjustable regulator is programmed using an external resistor divider as shown in Figure 5. The output voltage can be calculated using:



$$VOUT = 1.2(1 + \frac{R1}{R2})$$

Fig. 5

Where:

V_{REF}= 1.2V TYP. (the internal reference voltage)

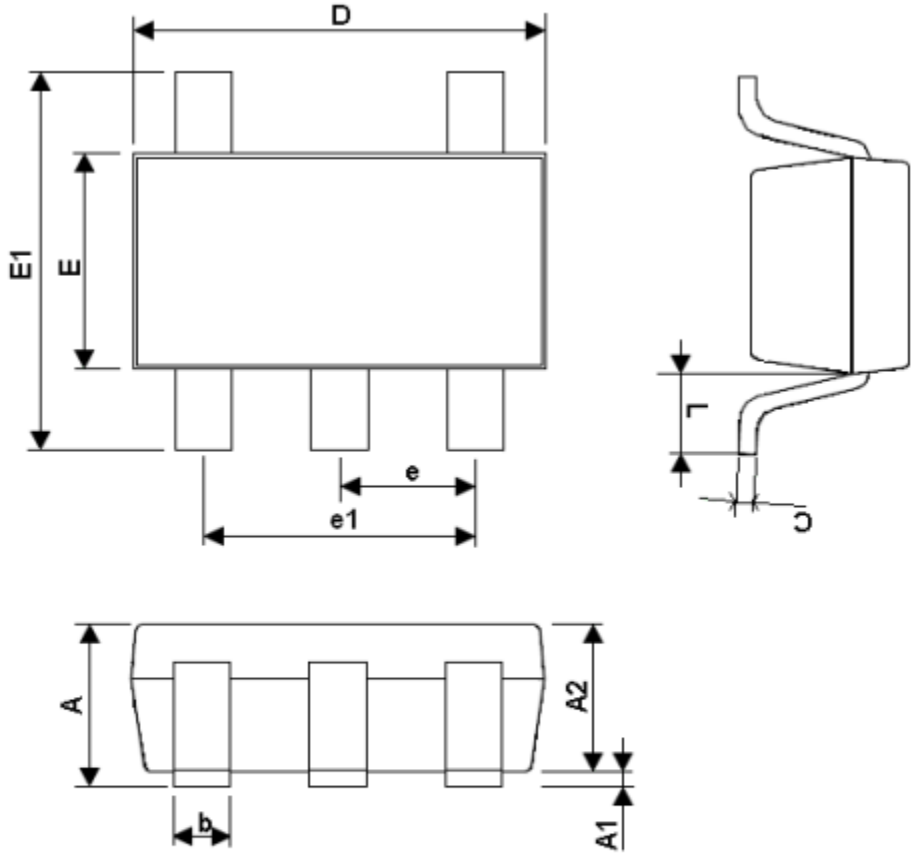
To enable default output voltage (pre-set), connect ADJ pin to ground. There is no external component needed to decide voltage.

Operating Region and Power Dissipation

Since the EC8806 is a linear regulator, its power dissipation is always given by P = I_{OUT} (V_{IN} – V_{OUT}). The maximum power dissipation is given by: $P_{D(MAX)}$ = (T_J–T_A) /θ_{JA} =(125°C -25°C)/250°C /W = 500mW Where (T_J–T_A) is the temperature difference the EC8806 die and the ambient air, θ_{JA} is the thermal resistance of the chosen package to the ambient air. For surface mount device, heat sinking is accomplished by using the heat spreading capabilities of the PC board and its copper traces. In the case of a SOT23-5 package, the thermal resistance is typically 240°C /Watt. Refer to Figure 6 & 7 for the EC8806 valid operating region (Safe Operating Area) and refer to Figure 8 for maximum power dissipation information of SOT23-5.

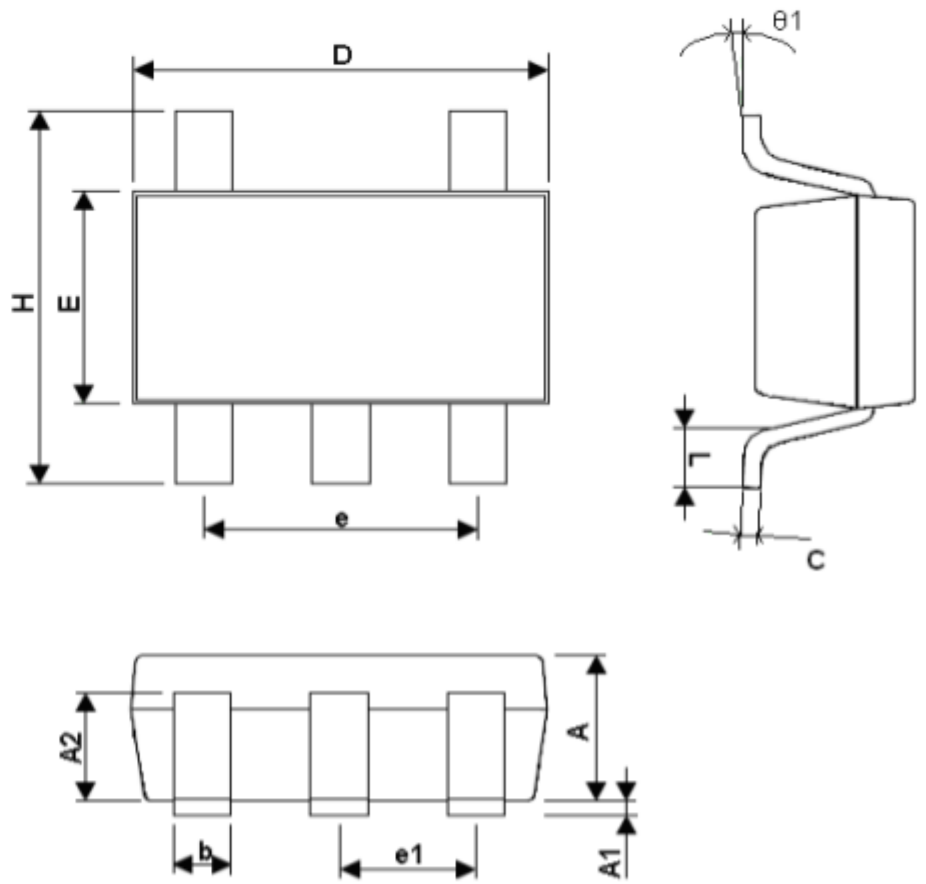
The die attachment area of the EC8806 lead frame is connected to pin 2, which is the GND pin. Therefore, the GND pin of EC8806 can dissipate the heat from the die very effectively. To improve the maximum power providing capability, connect the GND pin to ground using a large ground plane near the GND pin.

OUTLINE DRAWING SC70-5



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MAX	NOM	MAX
A	0.90	---	1.10	0.036	---	0.044
A1	0.025	---	0.10	0.001	---	0.004
A2	0.875	---	1.00	0.035	---	0.040
b	0.20	---	0.40	0.008	---	0.016
C	0.10	---	0.15	0.004	---	0.006
D	1.90	---	2.10	0.076	---	0.084
E	1.15	---	1.35	0.046	---	0.054
E1	2.00	---	2.20	0.080	---	0.088
e	0.65 BSC.			0.026 BSC.		
e1	1.30 BSC.			0.052 BSC.		
L	0.425 REF.			0.017 REF.		

OUTLINE DRAWING SOT23-5



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	---	0.10
A2	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.50	1.60	1.80
e	---	1.90(TYP)	---
H	2.60	2.80	3.00
L	0.37	---	---
θ1	1°	5°	9°
e1	---	0.95(TYP)	---