

Dual-Channel CC/CV Mode

Synchronous Step-Down Controller

DESCRIPTION

The EUP3468B is a dual-channel synchronous step-down controller capable of driving 5A continuous load with excellent line and load regulation. The EUP3468B operates in either CC (Constant Current) mode or CV (Constant Voltage) mode with an input voltage range from 8V to 36V. The EUP3468B can be configured as single output or dual outputs with independent programmable CC threshold for current limitation. The EUP3468B provides programmable cable compensation by adjusting external resistor divider. External shutdown function can be controlled by pulling COMP pin to a level below 0.14V. The EUP3468B stops switching when the output reaches over voltage threshold which is set by internal resistor divider.

Fault protection includes secondary cycle-by-cycle current limit, short circuit protection and thermal shutdown. Internal soft-start minimizes the inrush supply current and the output overshoot at initial startup.

The EUP3468B is available in MSOP-10 package.

FEATURES

- 8V to 36V Wide Input Operating Range
- 40V Input Voltage Surge
- 80kHz~800kHz Switching Frequency Selection
- Dual Channel CC/CV Mode Control
- Up to 5A Output Current
- +/- 1% Voltage Reference Accuracy
- +/- 4% Constant Current Accuracy
- Programmable Cable Compensation
- Internal Soft Start
- Single Pin to External Compensation and Shutdown Control
- Output Over Voltage Protection
- Hiccup Short Circuit Protection
- Secondary Cycle-by-Cycle Current Limit
- Thermal Shutdown
- Available in MSOP-10 Package
- RoHS Compliant and 100% Lead(Pb)-Free Halogen-Free

APPLICATIONS

- Car Charger
- Portable charger applications
- DC/DC converters with current limited

Typical Application Circuit

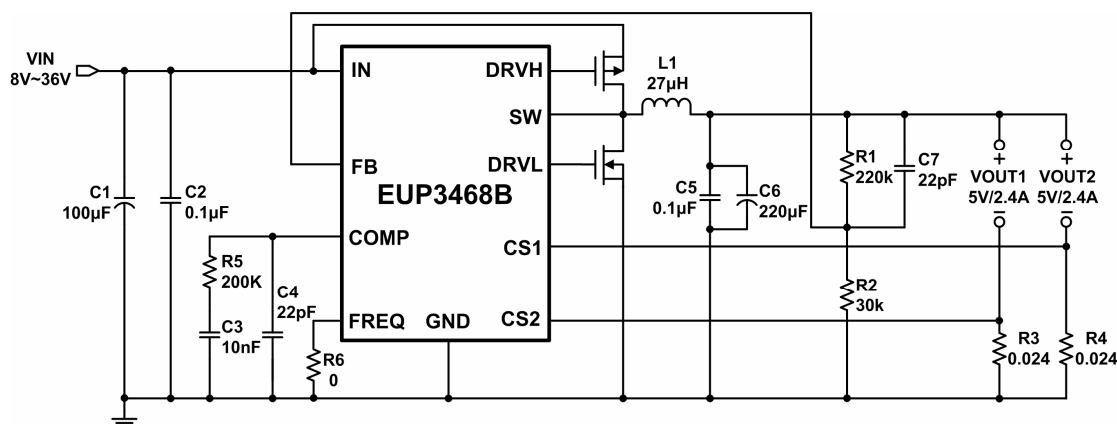


Figure 1. Application Circuit

Block Diagram

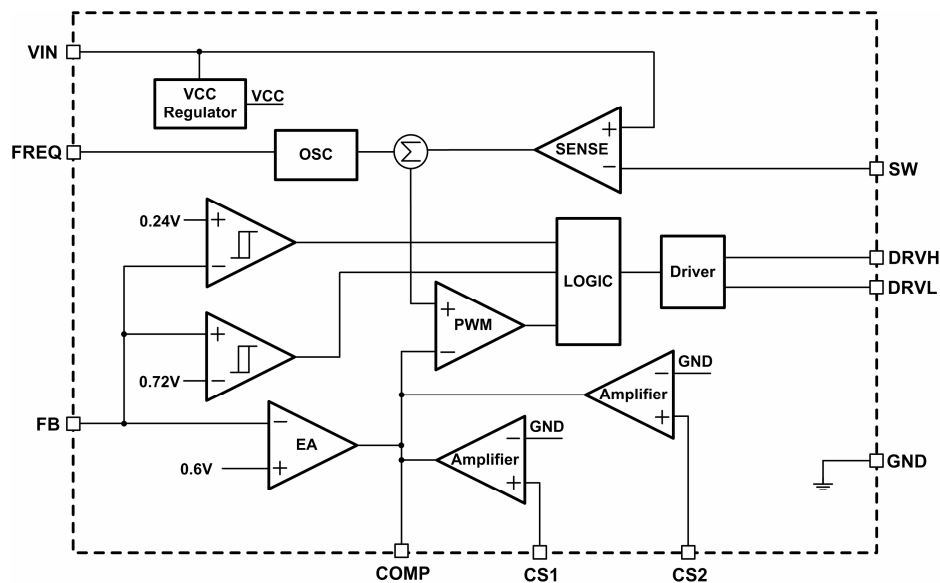


Figure 2. Functional Block Diagram

Pin Configurations

Package Type	Pin Configurations
MSOP-10	<p>(TOP VIEW)</p>

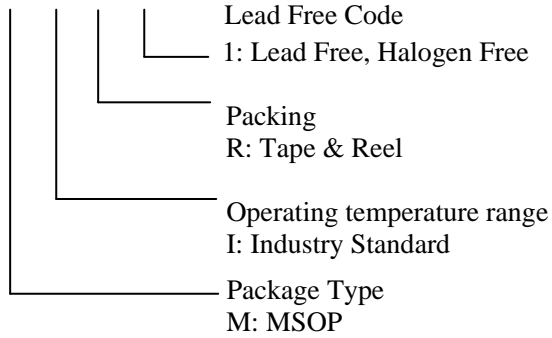
Pin Description

Pin Name	MSOP-10	DESCRIPTION
DRVL	1	Low-side switch drive pin.
SW	2	Power switch pin.
DRVH	3	High-side switch drive pin.
VIN	4	Input Supply Pin.
GND	5	Ground.
COMP	6	Loop compensation pin. Drive COMP voltage logic low to turn off the converter.
FB	7	Output Feedback Input.
CS1	8	Channel 1 current sense input pin.
CS2	9	Channel 2 current sense input pin.
FREQ	10	Frequency select pin.

Ordering Information

Order Number	Package Type	Marking	Quantity per Reel	Operating Temperature Range
EUP3468BMIR1	MSOP-10	XXXXX 3468B	2500	-40°C to +85°C

EUP3468B □ □ □ □



Absolute Maximum Ratings (1)

■ Input Voltage (V_{IN}), DRVH -----	-0.3V to 40V
■ Switch Voltage (V_{SW}) -----	-1V to $V_{IN} + 0.3V$
■ CS1, CS2, DRVL -----	-0.3V to 13V
■ All Other Pins -----	-0.3V to 6V
■ Junction Temperature -----	150°C
■ Storage Temperature -----	-65°C to +150°C
■ Lead Temp(Soldering, 10sec) -----	260°C
■ Thermal Resistance θ_{JA} (MSOP-10) -----	140°C /W

Recommend Operating Conditions (2)

■ Supply Voltage (V_{IN}) -----	8V to 36V
■ Operating Temperature Range -----	-40°C to +85°C

Note (1): Stress beyond those listed under “Absolute Maximum Ratings” may damage the device.

Note (2): The device is not guaranteed to function outside the recommended operating conditions.

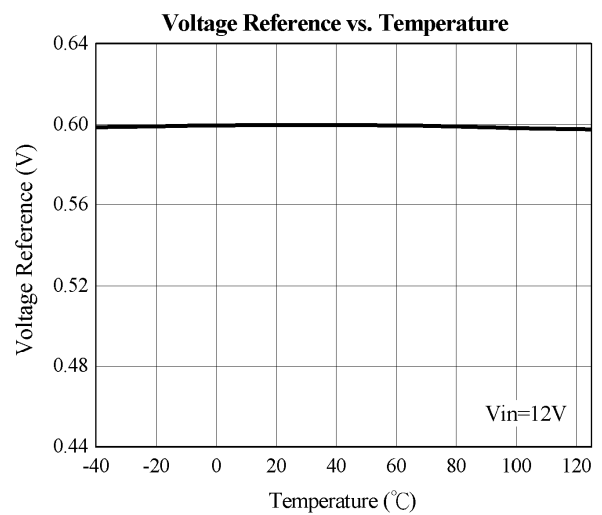
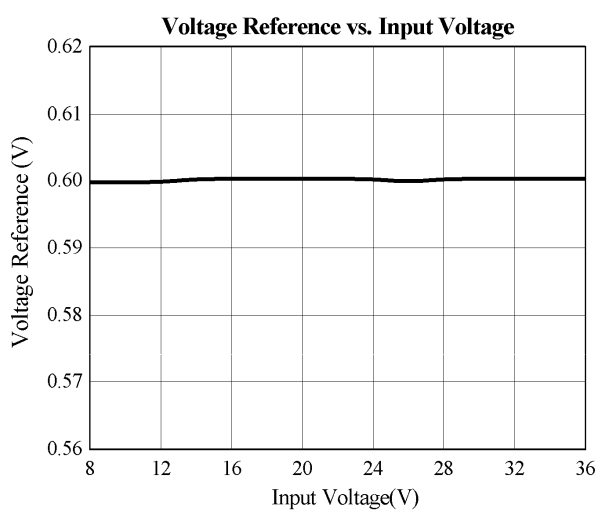
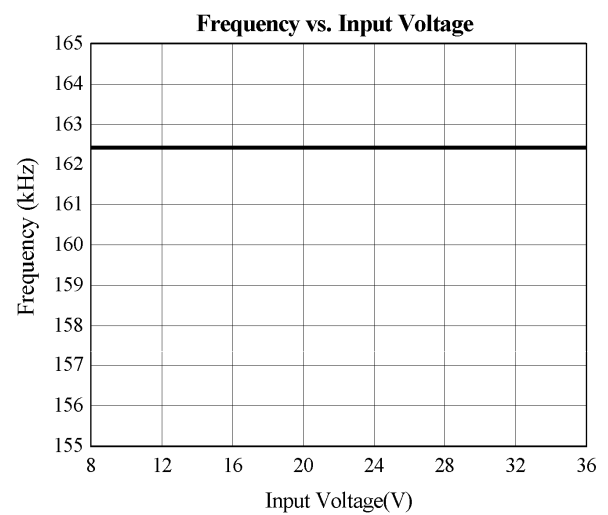
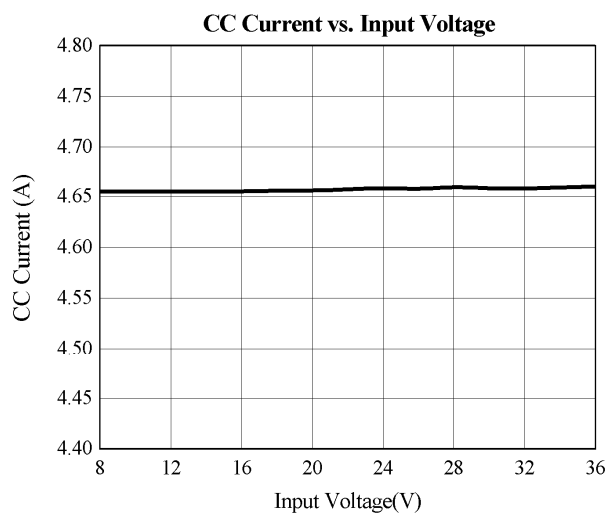
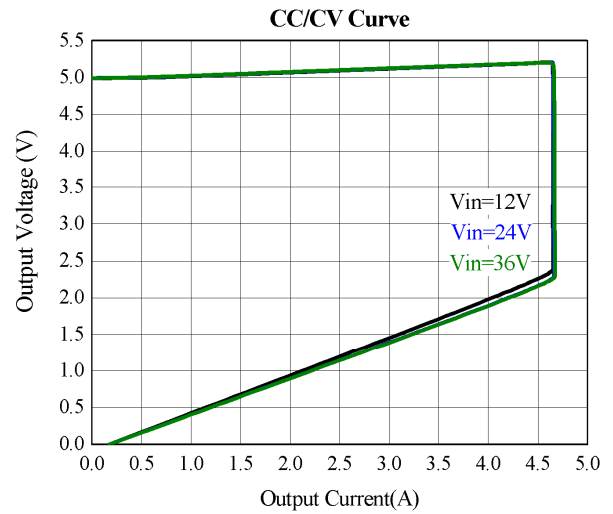
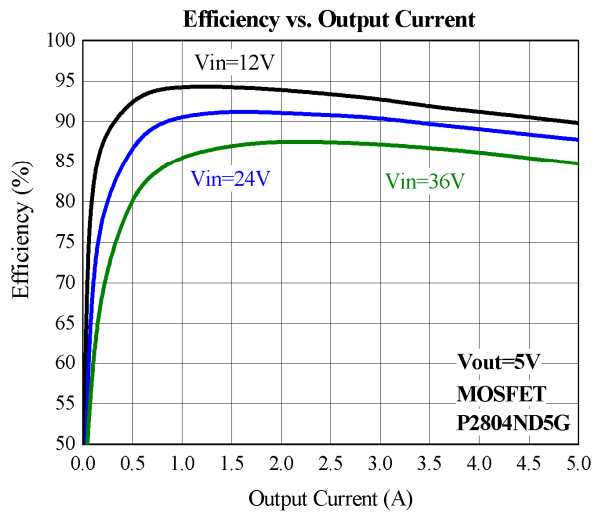
Electrical Characteristics

($V_{IN}=12V$, $T_A=+25^\circ C$, $I_{OUT}=2.0A$, unless otherwise specified)

Parameter		Conditions	EUP3468B			Unit
			Min.	Typ.	Max.	
Input voltage			8		36	V
Input No Load Current		I _{OUT} =0A			10	mA
Quiescent Current		V _{FB} =0.7V		1		mA
Shutdown Current		V _{COMP} =0V		380		μA
Input Under Voltage Lockout Threshold Rising			6.2	6.7	7.2	V
Input Under Voltage Lockout Threshold Hysteresis				1		V
Current Limit				7.5		A
Operating frequency	R6=0Ω		144	160	176	kHz
		T _J = -25°C to 125°C	136		184	kHz
Maximum Duty Cycle					100	%
Minimum On-Time				400		ns
Reference Voltage of the Voltage Error Amplifier			0.594	0.6	0.606	V
		T _J = -25°C to 125°C	0.587		0.613	V
CS1/CS2 Reference Voltage			57.4	60	62.6	mV
		T _J = -25°C to 125°C	56.4		63.6	mV
Transconductance of Error Amplifier				75		μA/V
Reference Voltage of the Over Voltage Comparator			0.698	0.72	0.742	V
		T _J = -25°C to 125°C	0.691		0.749	V
Reference Voltage of the Short Circuit Foldback Comparator				0.24		V
COMP Enable Threshold Rising				0.14		V
COMP Enable Threshold Hysteresis				40		mV
Thermal Shut-down Temperature		Temperature Rising		150		°C
		Temperature Falling		100		°C

Typical Operating Characteristics

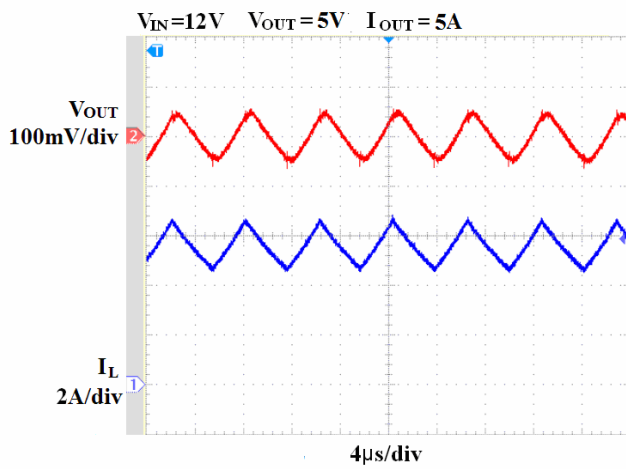
$V_{IN}=12V$, $V_{OUT}=5V$, $T_A=25^{\circ}C$, unless otherwise noted.



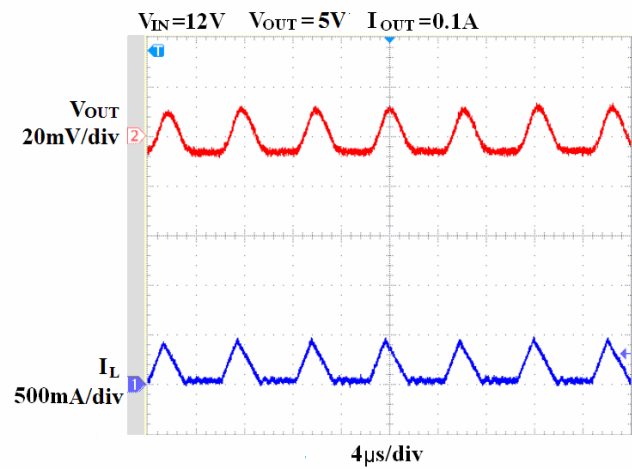
Typical Operating Characteristics (continued)

$V_{IN}=12V$, $V_{OUT}=5V$, $T_A=25^\circ C$, unless otherwise noted.

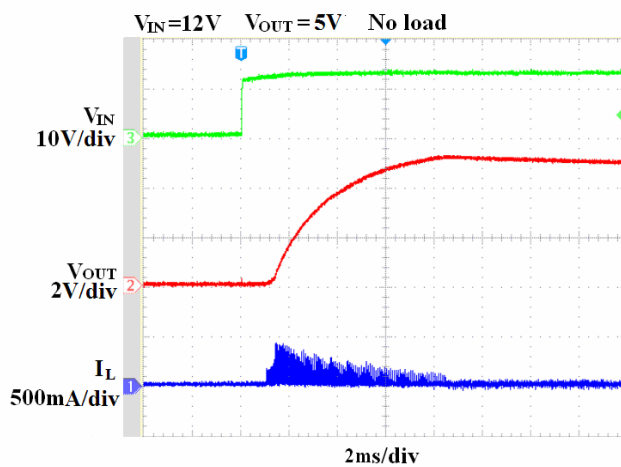
Steady State



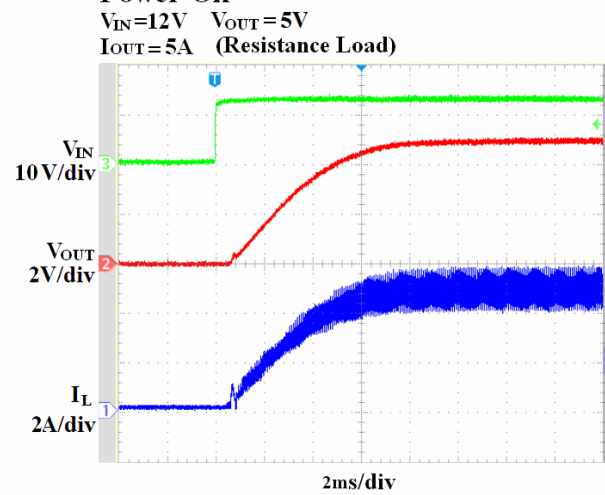
Steady State



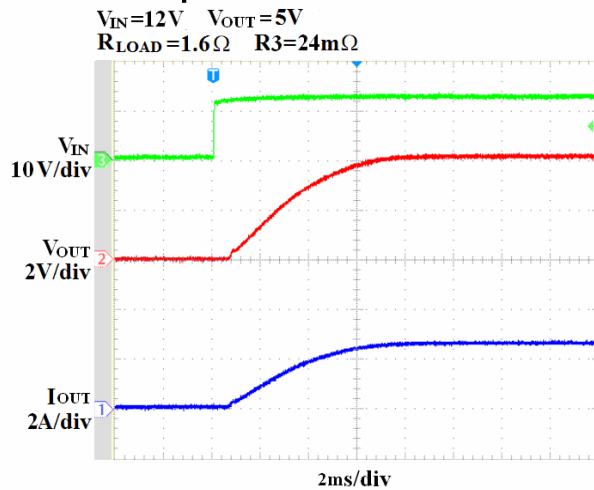
Power On



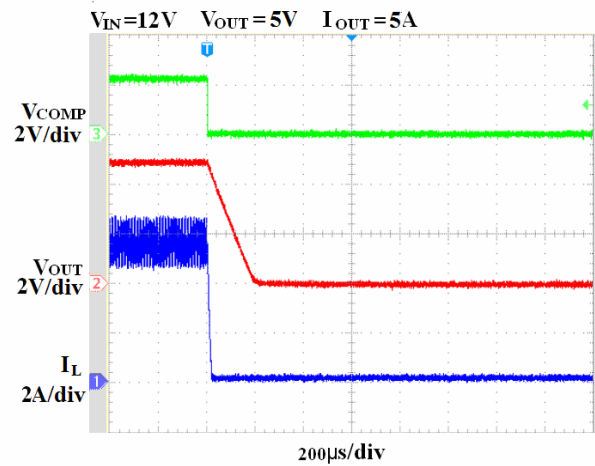
Power On



Startup into CC mode



Shutdown

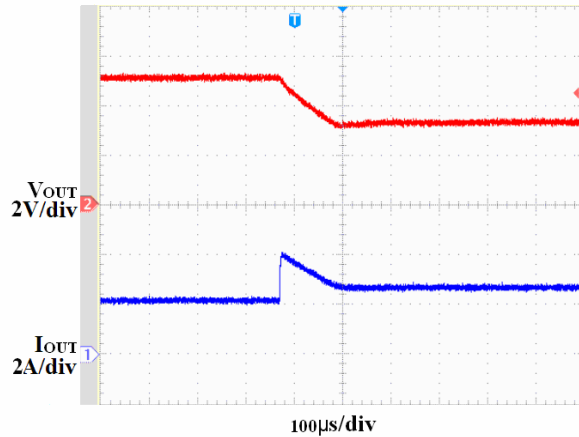


Typical Operating Characteristics (continued)

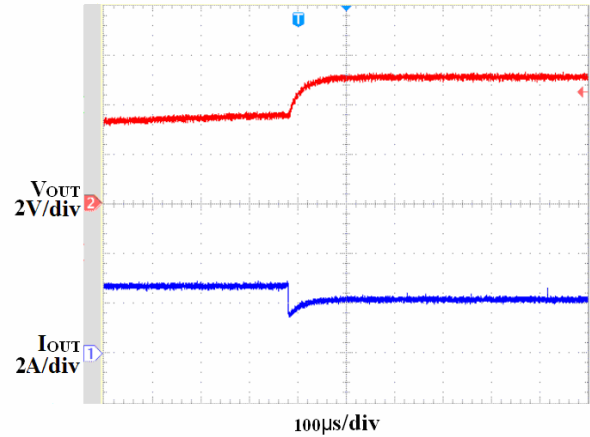
$V_{IN}=12V$, $V_{OUT}=5V$, $T_A=25^{\circ}C$, unless otherwise noted.

CV mode to CC mode

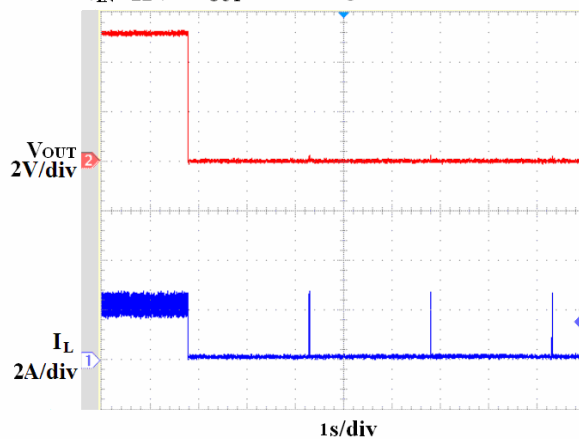
$V_{IN}=12V$ $V_{OUT}=5V$ $R_3=24m\Omega$
 $R_{LOAD}=2.5\Omega$ to 1.25Ω

**CC mode to CV mode**

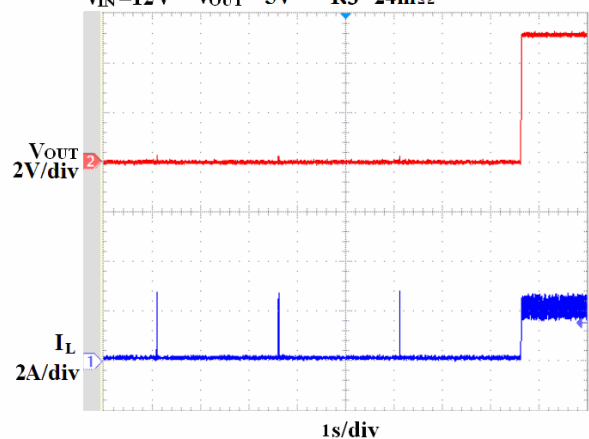
$V_{IN}=12V$ $V_{OUT}=5V$ $R_3=24m\Omega$
 $R_{LOAD}=1.25\Omega$ to 2.5Ω

**Short Circuit**

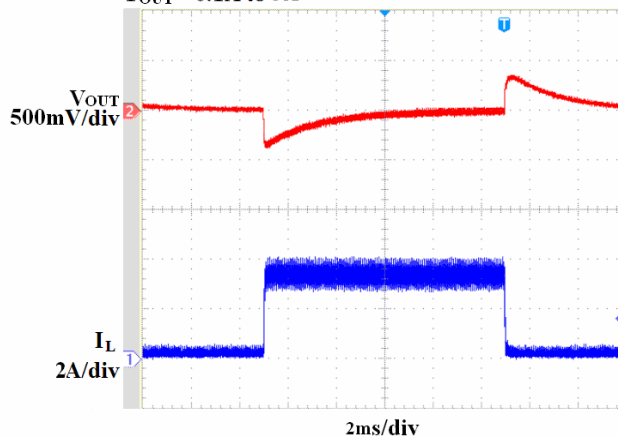
$V_{IN}=12V$ $V_{OUT}=5V$ $R_3=24m\Omega$

**Short Circuit Recovery**

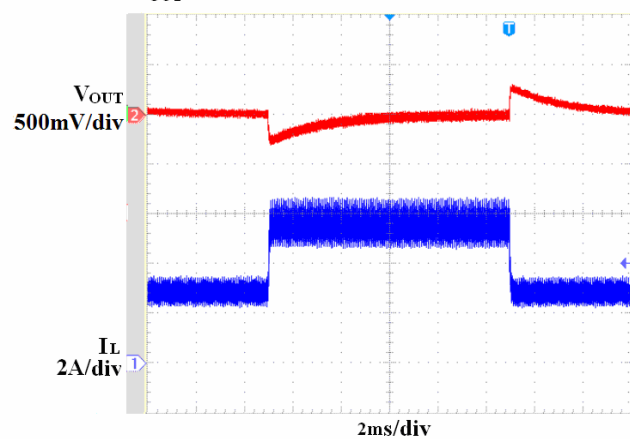
$V_{IN}=12V$ $V_{OUT}=5V$ $R_3=24m\Omega$

**Load Transient**

$V_{IN}=12V$ $V_{OUT}=5V$
 $I_{OUT}=0.1A$ to $3A$

**Load Transient**

$V_{IN}=12V$ $V_{OUT}=5V$
 $I_{OUT}=2.5A$ to $5A$



Functional Description

The EUP3468B is a current-mode synchronous step-down controller with 8V to 36V input power supply. The device can provide up to 5A continuous current to the output. The EUP3468B uses current-mode architecture to control the regulator loop. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal error amplifier. The output current of the transconductance error amplifier is presented at COMP pin where a RC network compensates the regulator loop. Slope compensation is internally added to eliminate subharmonic oscillation at high duty cycle. The slope compensation adds voltage ramp to the inductor current signal which reduces maximum inductor peak current at high duty cycles.

CC/CV mode control

The EUP3468B operates in either CC mode or CV mode. The CV mode regulates the output voltage. When output current reaches the CC threshold, the device enters CC mode to limit the output current.

Programmable cable compensation

The EUP3468B provides programmable cable compensation by adjusting the external resistor divider to compensate resistive voltage drop across the charger's output cable.

Internal soft-start

Internal soft-start minimizes the inrush supply current and the output overshoot at initial startup.

Over voltage protection

OVP (over voltage protection) function with fixed OV (over voltage) threshold set by the internal resistor divider is provided. When output over voltage occurs, the device shuts down and returns to normal operation automatically when the output over voltage is released.

Short circuit protection

The EUP3468B provides the output short circuit protection function to prevent large output short circuit current from damaging the device. When output short happens, the device shuts down and returns to normal operation automatically when the short circuit condition is released.

Thermal Shutdown

The EUP3468B stops switching when its junction temperature exceeds 150°C and resumes when the temperature has dropped by 50°C to protect the device.

Application Information

The output voltage is set through a resistive voltage divider and can be expressed by the equation as follows

$$V_{OUT} = 0.6V \times (R1 + R2) / R2$$

Setting the CC current

EUP3468B channel 1 constant current value is set by the resistor R3 connected between the CS1 and GND pins. Channel 2 constant current value is set by the resistor R4 connected between the CS2 and GND pins. The CC current is determined by the equation as follows

$$I_{CS1} = 0.06V / R3$$

$$I_{CS2} = 0.06V / R4$$

Setting the switching frequency

The switching frequency is set by the resistor R6 connected between the FREQ and GND pins and can be expressed by the equation as follows

$$f_{SW} = 10^{11} / R6$$

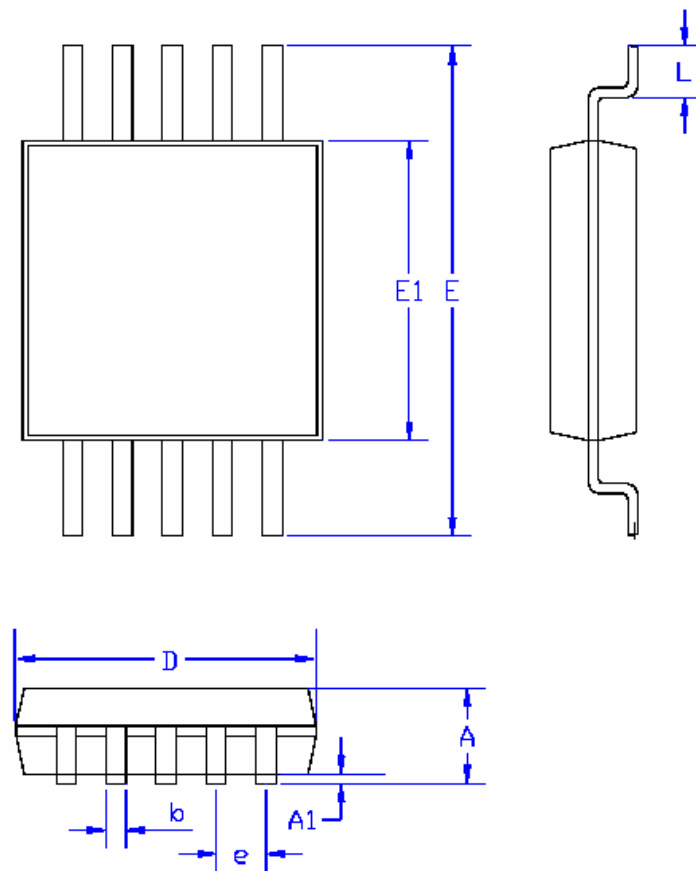
The switching frequency is 160kHz when R6=0Ω.

Setting the cable compensation

The EUP3468B provides programmable cable voltage drop compensation using the impedance at the FB pin to compensate voltage drop across the charger's output cable. The cable compensation voltage can be expressed as

$$\Delta V_{OUT} = 15.35\mu \times (I_{OUT1} \times R3 + I_{OUT2} \times R4) \times R1$$

By adjust the value of R1, the cable compensation voltage can be programmed.

Packaging Information**MSOP-10**

SYMBOLS	MILLIMETERS			INCHES		
	MIN.	Normal	MAX.	MIN.	Normal	MAX.
A	-	-	1.22	-	-	0.048
A1	0.00	-	0.15	0.000	-	0.006
D	2.90	3.00	3.10	0.114	0.118	0.122
E1	2.90	3.00	3.10	0.114	0.118	0.122
E	4.70	4.90	5.10	0.185	0.193	0.201
L	0.40	0.60	0.80	0.016	0.024	0.031
b	0.15	-	0.33	0.006	-	0.013
e	0.50 REF			0.020 REF		