

1 Amp Current Limited Load Switch

DESCRIPTION

The EUP3510/3511 are Current Limited P-channel MOSFET power switches designed for high-side load-switching applications. The internal current-limiting circuit protects the input supply against large output short circuit current which may cause the supply to fall out of regulation. The current limit threshold is programmed with an external resistor from SET Pin to ground. The quiescent supply current is typically 8 μ A, making the device ideal for portable battery-operated equipment. In shutdown mode, the supply current decreases to less than 0.1 μ A.

Additional features include thermal shutdown to prevent catastrophic switch failure from high current loads, under-voltage lockout (UVLO) to ensure that the device remains off unless there is a valid input voltage present.

The EUP3510/3511 are available in 5 pin SOT-23 packages.

FEATURES

- 2.4V to 5.5V Input voltage range
- Programmable Over Current Threshold
- Fast Transient Response:
- Low Quiescent Current
 - 8 μ A Normal Operation
 - 1 μ A Max in Shutdown
- 115m Ω typical $R_{DS(ON)}$
- Only 1.8V needed for ON/OFF Control
 - EUP3510 ENB Active Low
 - EUP3511 EN Active High
- Under-Voltage Lockout
- Thermal Shutdown
- 4kV ESD Protection
- Available in SOT23-5 Package
- RoHS Compliant and 100% Lead(Pb)-Free

APPLICATIONS

- Peripheral ports
- Notebook computers
- Personal communication devices
- Hot swap supplies

Typical Application Circuit

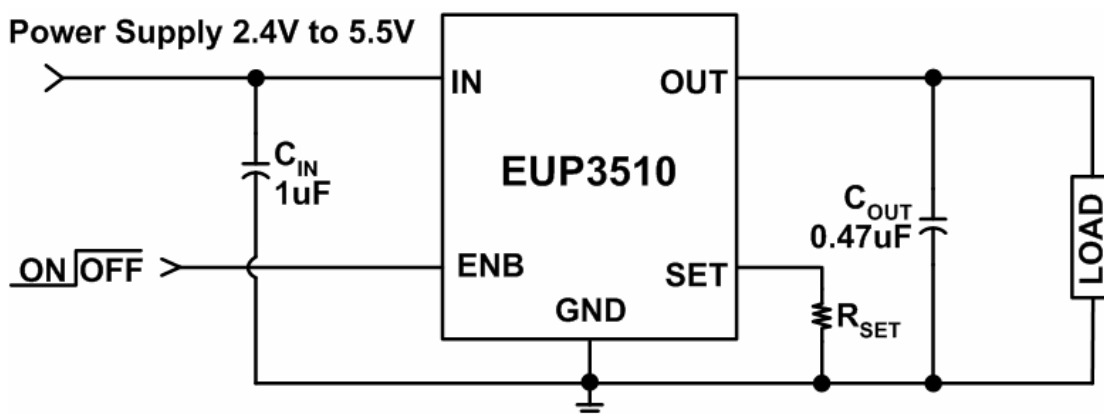


Figure 1.

Typical Application Circuit (continued)

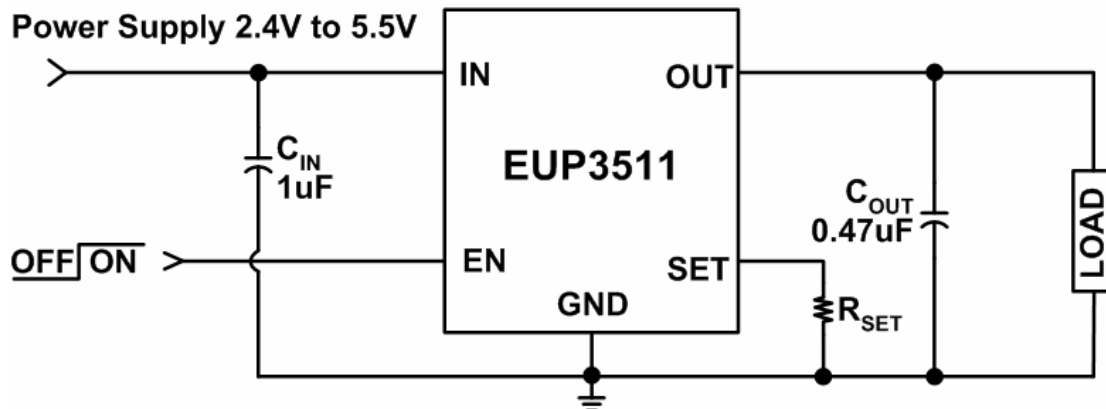


Figure 2.

Block Diagram

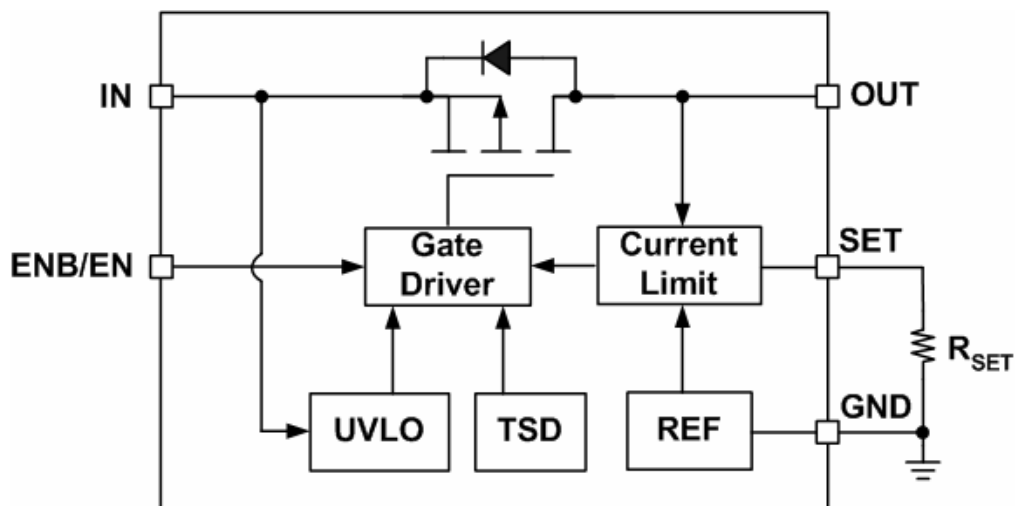


Figure 3.

Pin Configurations

Package Type	Pin Configurations
SOT23-5	(Top View)

Pin Description

PIN	NAME	DESCRIPTION
1	OUT	Output Terminal. Connect a 0.47uF capacitor from V_{OUT} to Ground
2	GND	Ground Connection.
3	SET	Current-Limit Set Input. Connect a resistor R_{SET} from SET to ground to set the current limit for the switch.
4	ENB	Enable input. EUP3510 ENB Active low. Set logic low to enable the device, and set logic high to disable the device.
	EN	Enable input. EUP3511 EN Active high. Set logic high to enable the device, and set logic low to disable the device.
5	IN	Input supply connection. Connect a 1uF capacitor from V_{IN} to Ground

Ordering Information

Order Number	Package Type	Marking	Operating Temperature Range
EUP3510VIR1	SOT23-5	40xxxx	-40 °C to +85°C
EUP3511VIR1	SOT23-5	xxxxx AG00	-40 °C to +85°C

EUP3510/3511 □ □ □ □

- Lead Free Code
1: Lead Free 0: Lead
- Packing
R: Tape & Reel
- Operating temperature range
I: Industry Standard
- Package Type
V:SOT23

Absolute Maximum Ratings (1)

- IN to GND ----- -0.3V to 6V
- Other pins to GND----- -0.3V to $V_{IN}+0.3V$
- Storage Temperature ----- -65°C to 150°C
- Reflow Temperature (soldering,10sec) ----- 260°C
- Thermal Resistance θ_{JA} (SOT23-5) ----- 220°C/W
- ESD Rating
Human Body Model ----- 4kV

Recommend Operating Conditions (2)

- Supply Voltage (V_{IN}) ----- 2.4V to 5.5V
- Operating Temperature (T_A) ----- -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.

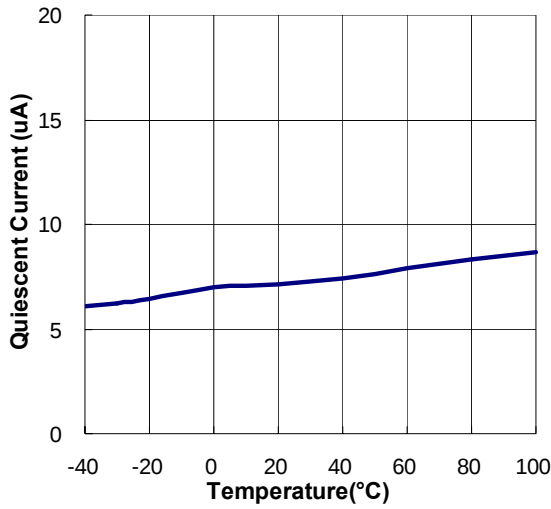
Electrical Characteristics

Unless otherwise specified, $V_{IN} = 5V$, $C_{IN}=1\mu F$, $C_{OUT}=0.47\mu F$, $T_A=-40 \sim +85$.

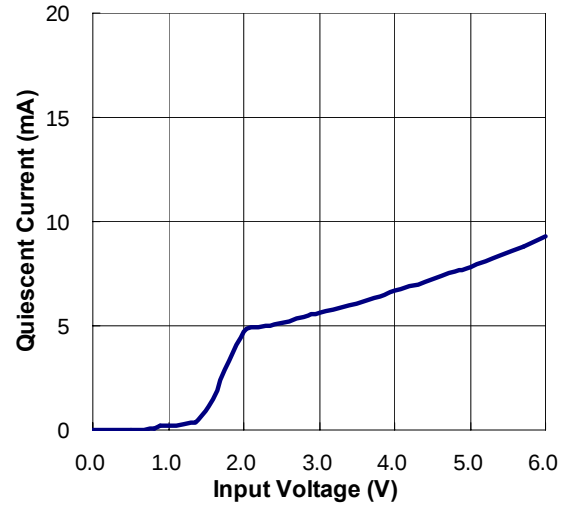
Symbol	Description	Conditions	EUP3510/3511			UNITS
			Min.	Typ.	Max.	
V_{IN}	Input Voltage Range		2.4		5.5	V
I_Q	Quiescent Current	$V_{IN}=5V$, EN/ENB=active, $I_{OUT}=0$		7.5	9.5	μA
$I_{Q(OFF)}$	Off Supply Current	EN/ENB =inactive, $V_{IN}=5.5V$		0.1	1	μA
$I_{SD(OFF)}$	Off Switch Current	EN/ENB =inactive, $V_{IN}=5.5V, V_{OUT}=0$		0.1	1	μA
V_{UVLO}	Under Voltage Lockout	Rising edge, 300mV hysteresis		1.57		V
$R_{DS(ON)}$	$R_{DS(ON)}$	$V_{IN}=5V, T_A=25$		115		m Ω
		$V_{IN}=4.5V, T_A=25$		120		
		$V_{IN}=3V, T_A=25$		140		
I_{LIM}	Current Limit	$R_{SET}=6.8K\Omega$	750	968	1250	mA
$I_{LIM(MIN)}$	Minimum Current Limit			170		mA
$V_{ON(L)}$	Input Logic Low Voltage	$V_{IN}=2.7V$ to 5.5V			1.1	V
$V_{ON(H)}$	Input Logic High Voltage	$V_{IN}=2.7V$ to 5V	1.6			V
$I_{ON(SINK)}$	EN/ENB Input leakage	$V_{ON}=5.5V$		0.1	1	μA
T_{RESP}	Current Limit Response Time	$V_{IN}=5V$		1.5		μs
T_{OFF}	Turn-Off Time	$V_{IN}=5V, R_L=10\Omega$		5	20	μs
T_{ON}	Turn-On Time	$V_{IN}=5V, R_L=10\Omega$		50	200	μs
T_{SD}	Thermal Shutdown	$V_{IN}=5V$		135		
$T_{SD(HYS)}$	Thermal Shutdown Hysteresis	$V_{IN}=5V$		20		

Typical Operating Characteristics (See Figure 1 and Figure 2, unless otherwise noted, $V_{IN}=5V$, $T_A=+25^{\circ}C$.)

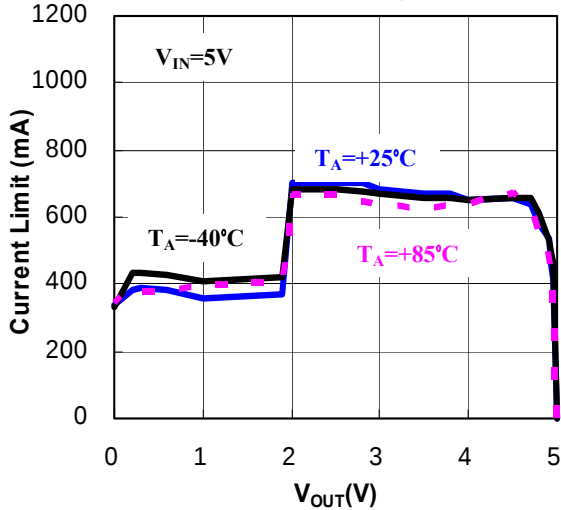
Quiescent Current vs. Temperature



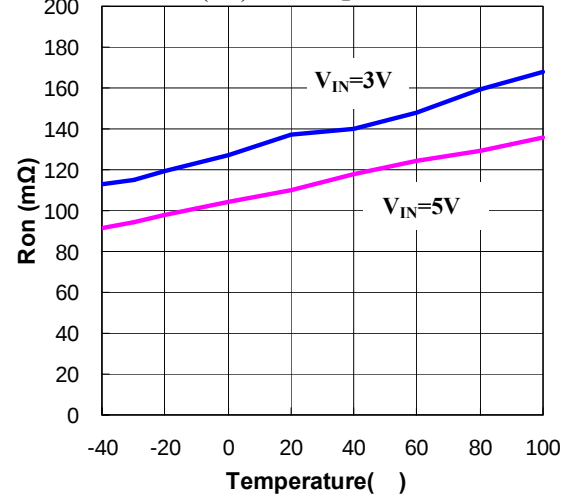
Quiescent Current vs. Input Voltage



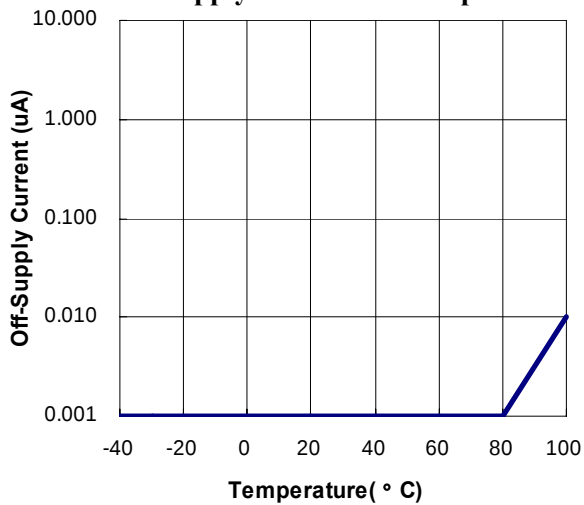
Current Limit vs. V_{OUT} ($R_{SET}=10.5k\Omega$)



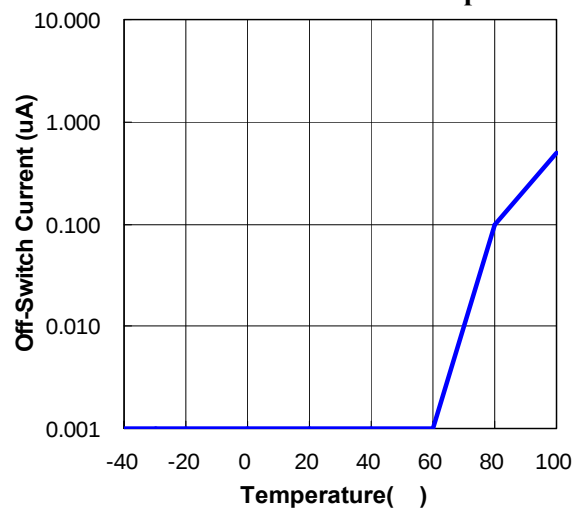
$R_{(ON)}$ vs. Temperature



Off-Supply Current vs. Temperature

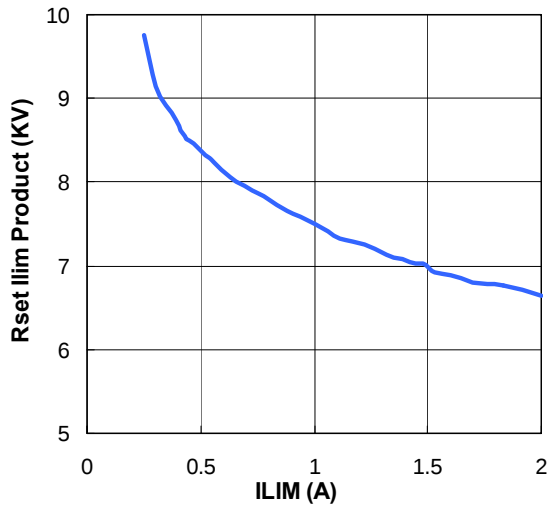


Off-Switch Current vs. Temperature

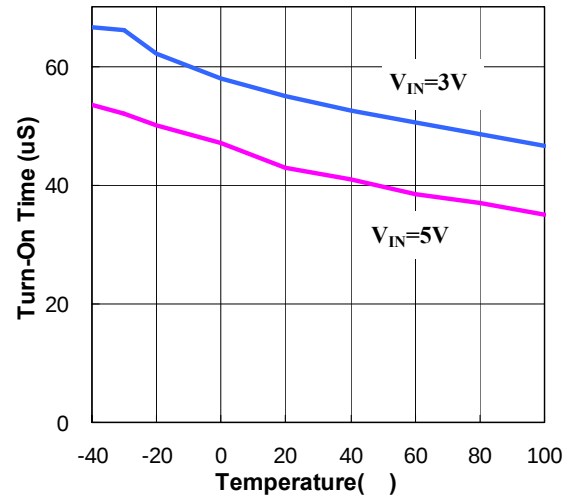


Typical Operating Characteristics (See Figure 1 and Figure 2, unless otherwise noted, $V_{IN}=5V$, $T_A=+25^{\circ}C$.)

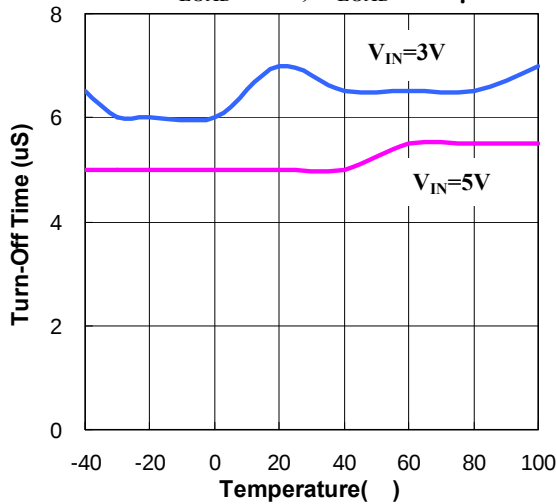
R_{SET} Coefficient vs. ILIM



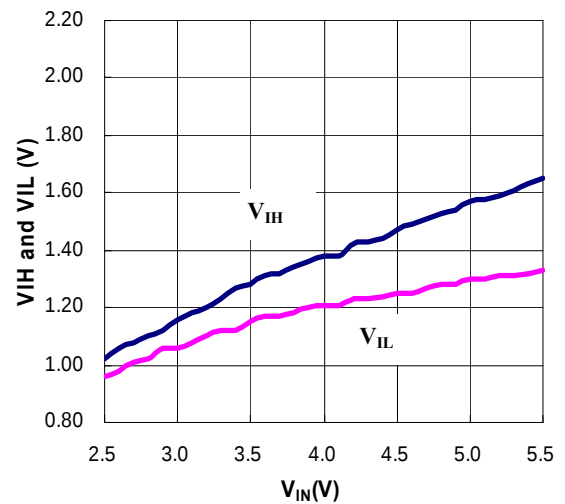
Turn-On vs. Temperature
 $R_{LOAD}=10\Omega$, $C_{LOAD}=0.47\mu F$



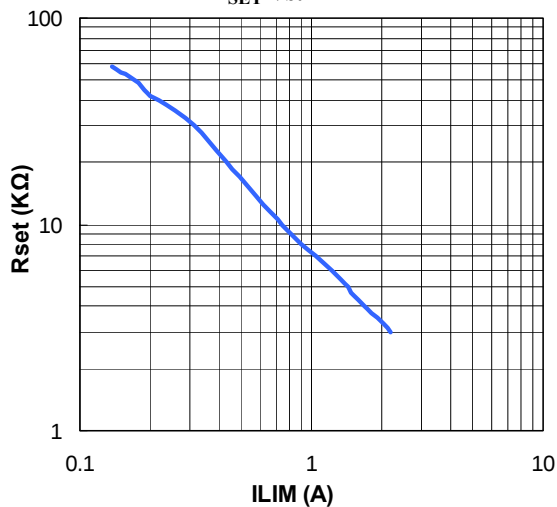
Turn-Off vs. Temperature
 $R_{LOAD}=10\Omega$, $C_{LOAD}=0.47\mu F$



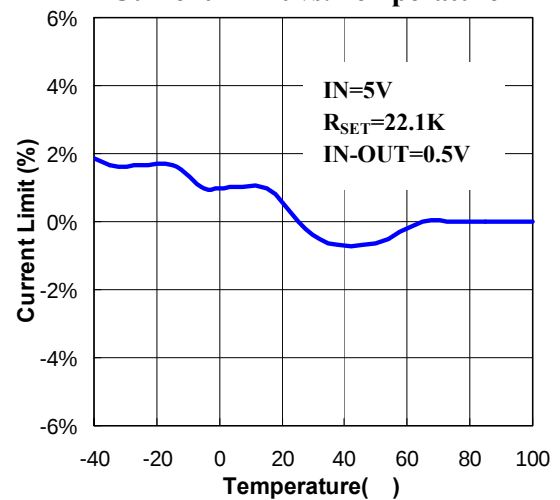
ENABLE Threshold V_{IH} and V_{IL} vs. V_{IN}



R_{SET} vs. ILIM

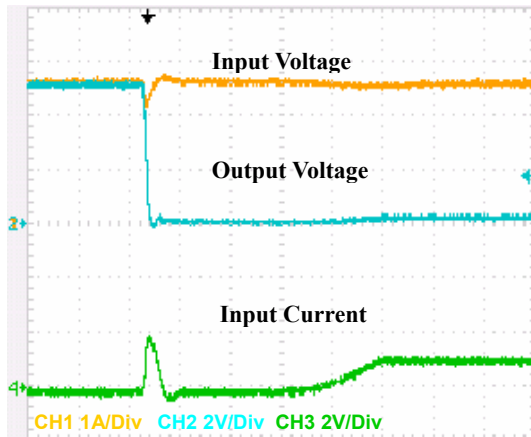


Current Limit vs. Temperature

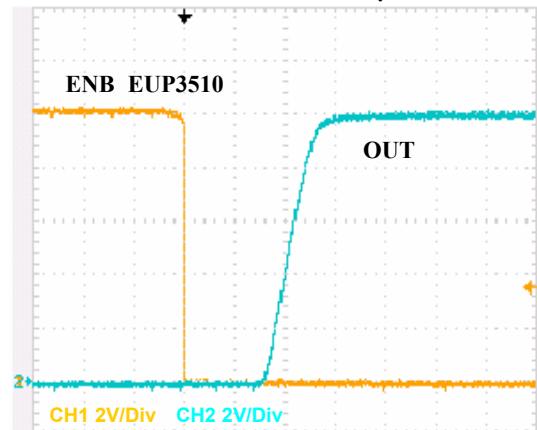


Typical Operating Characteristics (unless otherwise noted, $V_{IN}=5V$, $T_A=+25^{\circ}C$.)

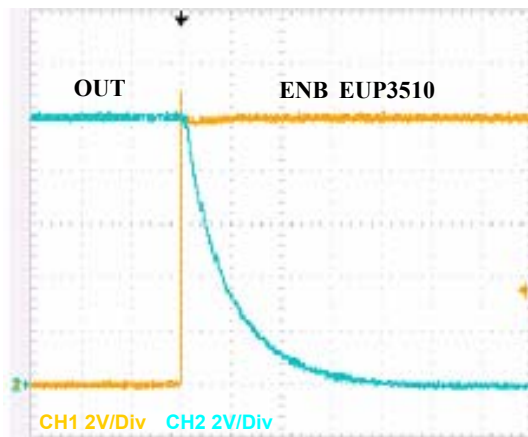
Short Circuit through 0.3Ω



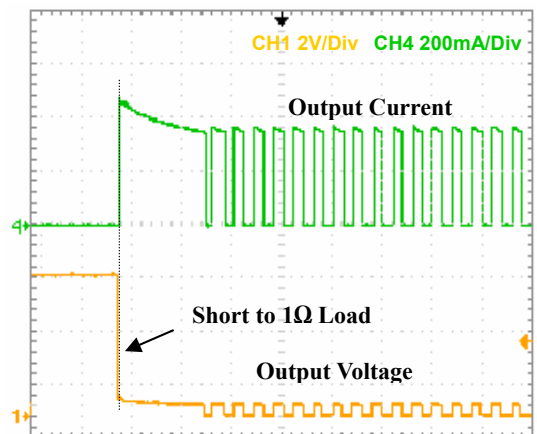
Turn-On
 $R_L=10\Omega$, $C_L=0.47\mu F$



Turn-Off
 $R_L=10\Omega$, $C_L=0.47\mu F$



Short-Circuit Thermal Protection



Detailed Description**Setting the Current Limit Level**

Setting the current limit level on the EUP3510/3511 requires some care to ensure the maximum current required by the load will not trigger the current limit circuitry. The minimum current limit threshold should be determined by taking the maximum current required by the load, I_{LOAD} , and adding 25 % margin. The EUP3510/3511 has a current limit tolerance is around 25 %, which results from process variations from part to part, and also temperature and V_{IN}/V_{OUT} variances.

To determine R_{SET} start with the maximum current drawn by the load, and multiply it by 1.33. (typical_ILIM=minum_ILIM/0.75). Refer to the “RSET vs. ILIM” table and find the R_{SET} that corresponds to the typical current limit value.

Current Limit R_{SET} Values

Rset(kΩ)	Minimum Current Limit (mA)	Current limit typ(mA)	Maximum Current Limit (mA)
40.2	138	184	230
30.9	177	236	295
24.9	219	292	365
22.1	245	326	408
19.6	272	362	453
17.8	298	397	496
16.2	321	428	535
14.7	353	470	588
13	398	530	663
10.5	480	640	800
8.87	569	758	948
7.5	663	884	1105
6.81	722	962	1203
6.04	803	1070	1338
5.49	876	1168	1460
4.99	950	1266	1583
4.64	1011	1348	1685

Operating in Current Limit

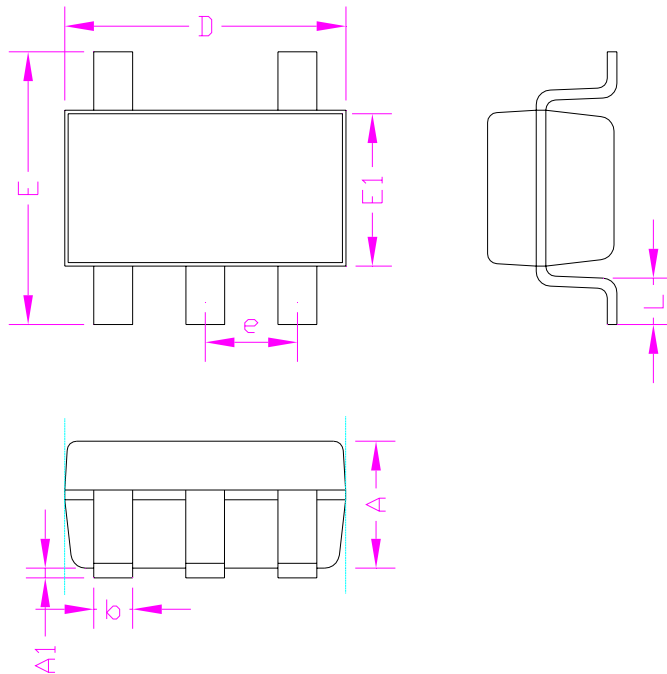
When a heavy load is applied to the output of the EUP3510/3511, the load current is limited to the value of ILIM determined by R_{SET} . See the figure “Overload Operation”. Since the load demands more current than I_{LIM} , the voltage at the output drops. EUP3510/3511 dissipate larger amount of power, and cause its die temperature to increase. When the die temperature exceeds an over temperature limit, the EUP3510/3511 will shut down until it cools sufficiently, at which point it will startup again. The EUP3510/3511 will continue to cycle on and off until the heavy load is removed or power is removed, or the device is disabled.

Reverse Voltage

The EUP3510/3511 control current flowing from IN to OUT. If OUT voltage is greater than the input voltage on IN, large current will flow from OUT to IN and damage the device permanently.

Packaging Information

SOT23-5



SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.30	-	0.052
A1	0.00	0.15	0.000	0.006
D	2.90		0.114	
E1	1.60		0.063	
E	2.60	3.00	0.102	0.118
L	0.30	0.60	0.012	0.024
b	0.30	0.50	0.012	0.020
e	0.95		0.037	