Programmable Current Limit Switch with Input Ripple Removal

DESCRIPTION

ETA6030 is a current limit switch that provides protection to systems and loads which may encounter large current conditions. It has the function of filtering out the input ripple and providing a low noise stable output voltage. The current limit of the switch can be externally programmed by a resistor.

ETA6030 can stand off input voltage as high as 32V. The device also includes short circuit protection, thermal shutdown and UVLO.

ETA6030 is available in SOT23-6 package.

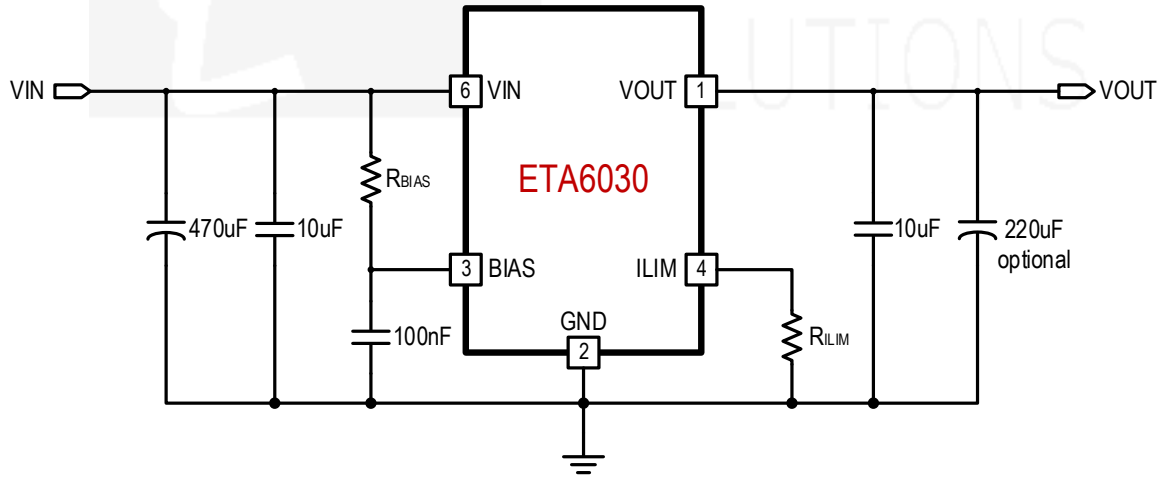
FEATURES

- Input Ripple Removal
- 32V Input Standoff Voltage
- Programmable Current Limit
- UVLO and Thermal Shutdown
- SOT23-6 Package

APPLICATIONS

- Power Meter
- Power Meter Module
- USB Ports and Hubs
- Set-Top Boxes

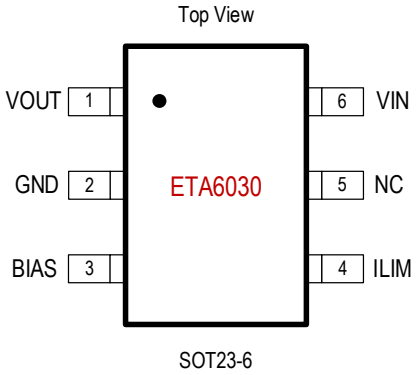
TYPICAL APPLICATION



ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA6030S2G	SOT23-6	IRYW	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.)

VIN, VOUT, BIAS to GND.....–0.3V to 32V
ILIM to GND.....–0.3V to 6.5V
VOUT to GND current.....Internally limited
Operating Temperature Range.....–40°C to 85°C
Storage Temperature Range.....–55°C to 150°C

Thermal Resistance	θ_{JC}	θ_{JA}
SOT23-6	90	180	°C/W

Lead Temperature (Soldering, 10sec)..... 260°C
ESD HBM (Human Body Mode)..... 2KV
ESD CDM (Charged Device Mode).....1KV

ELECTRICAL CHARACTERISTICS

(V_{IN} = 12V, unless otherwise specified. Typical values are at TA = 25°C.)

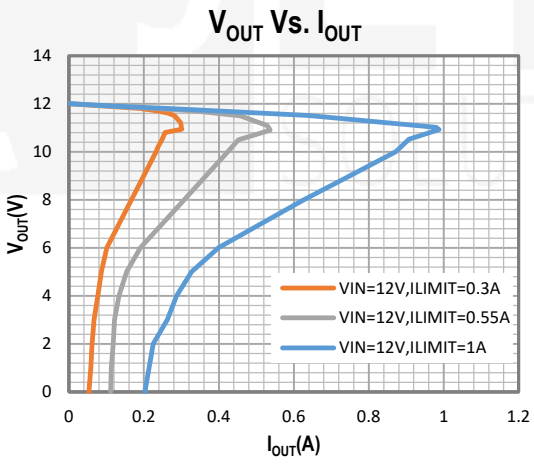
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Standoff Voltage	VIN_MAX		32			V
Input Voltage Range	VIN_RANGE		8.5		24	V
Input Under Look Out Voltage	UVLO	Rising, Hysteresis=500mV	7.6	8.0	8.4	V
Input Supply Current	IQ	V_{IN} = 7V		100		μA
		V_{IN} = 12V		180		μA
		V_{IN} = 24V		200		μA
Power Switch On Resistance	RON	I_{SW} = 500mA, -40°C≤T_J≤120°C		500	900	mΩ
Current Limit Range	ILIM		0.2		1.2	A
Current Limit Threshold	ILIM_0P6	R_{ILIM}=30K	0.55	0.6	0.65	A
	ILIM_0P3	R_{ILIM}=60K	0.25	0.3	0.35	
	ILIM_INT	R_{ILIM}<4K	0.6	0.65	0.7	
Foldback Current Limit Reduction Ratio	IFLDBCK	I_{OUT_CC} / (V_{IN}–VFLDBCK –V_{OUT})		10		%ILIM/V
Current Limit Foldback Start Threshold	VFLDBCK	V_{IN}-V_{OUT}		2.5		V
Forward Regulation Voltage	VFWD	I_{OUT} = 10mA		300		mV
Bias Pin Voltage	VBIAS			300		mV
Bias Pin Resistance	RBIAS	From VIN to BIAS internally		450		kΩ
Thermal Shutdown	TSD	Rising, Hys=15°C		135		°C

PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	VOUT	Output pin of the current limit switch. Bypass with a 10uF capacitor to GND. A 220uF or larger electrolytic capacitor can be also placed at the output.
2	GND	Ground
3	BIAS	Bias RC filter pin. Connect a resistor from VIN to this pin and a 100nF capacitor from this pin to GND.
4	ILIM	Current limit setting pin for the current limit switch. Connect a resistor from this pin to GND. When this pin is shorted to GND, the current limit is 650mA by default.
5	NC	None connection
6	VIN	Input pin. Bypass with a 10uF capacitor to GND. A 470uF or larger electrolytic capacitor can be also placed at the input.

TYPICAL CHARACTERISTICS

(VIN = 12V, TA=25°C, unless otherwise specified)



FUNCTION DESCRIPTION

Enable and Disable

Current Limit Switch is enabled if all of following conditions occur:

- VIN is greater than UVLO
- Junction temperature of IC does not exceed TSD

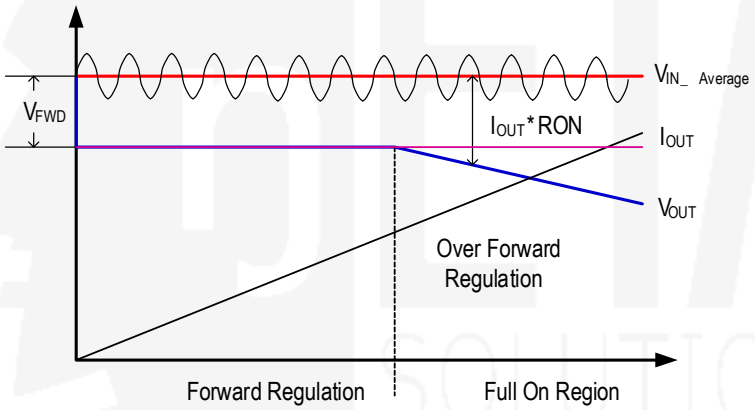
Current Limit Switch is disable if one of above conditions do not occur.

Current Limit Switch

The ETA6030 is equipped with a current limit switch which can configure the current limit from 200mA to 1200mA. If ILIM pin is shorted to GND or RILIM<4kΩ, the current limit is set to 650mA by default.

The ETA6030 Current Limit Switch is enhanced by having a feature that can remove the ripple from the input, and provide a more stable voltage at the output.

Ripple Remove Function



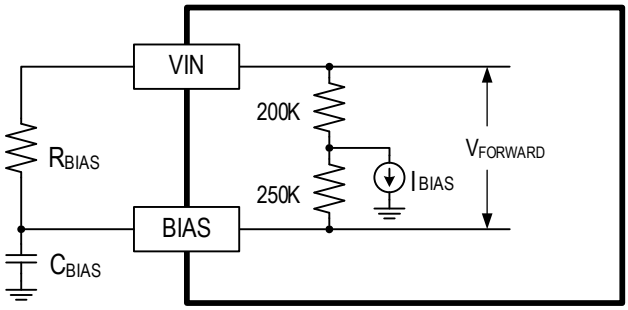
The forward regulation voltage for the ripple remover is 300mV. When the difference between VOUT and $V_{IN\_Average}$ is less than 300mV, the ripple remove function will work to filter out the input ripple, so that IC can provide a stable output voltage.

Thermal Shutdown

Thermal protection disables the output when the junction temperature rises to approximately 135°C, allowing the device to cool down. When the junction temperature cools to approximately 120°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as a result of overheating.

APPLICATION INFORMATION

Forward Regulation Voltage



ETA6030 is allowed to adjust ripple remove threshold by adding an external resistor R_{BIAS}. New threshold will be given by following equation ($V_{FORWARD\_BASE}$ is 300mV):

$$V_{FORWARD\_NEW} = V_{FORWARD\_BASE} \times \frac{R_{BIAS}}{450k\Omega + R_{BIAS}}$$

BIAS Capacitor Selection

The total resistance from VIN to BIAS and the capacitor from BIAS to GND are exactly in a "Low Pass Filter" to generate reference voltage for output voltage regulation. And the filter bandwidth is given by:

$$F_{BIAS\_FILTER} = \frac{1}{2 \times \pi \times C_{BIAS} \times R_{BIAS}}$$

where R_{BIAS} is the total resistance from VIN to BIAS, and C_{BIAS} is the capacitor from BIAS to GND.

It is better to select C_{BIAS} that F_{BIAS_FILTER} is 4 times higher than the maximum input ripple frequency. Then C_{BIAS} is selected by:

$$C_{BIAS} = \frac{1}{8 \times \pi \times R_{BIAS} \times F_{RIPPLE\_MAX}}$$

Switch Current Limit Setting

Switch current limit is given by following equation:

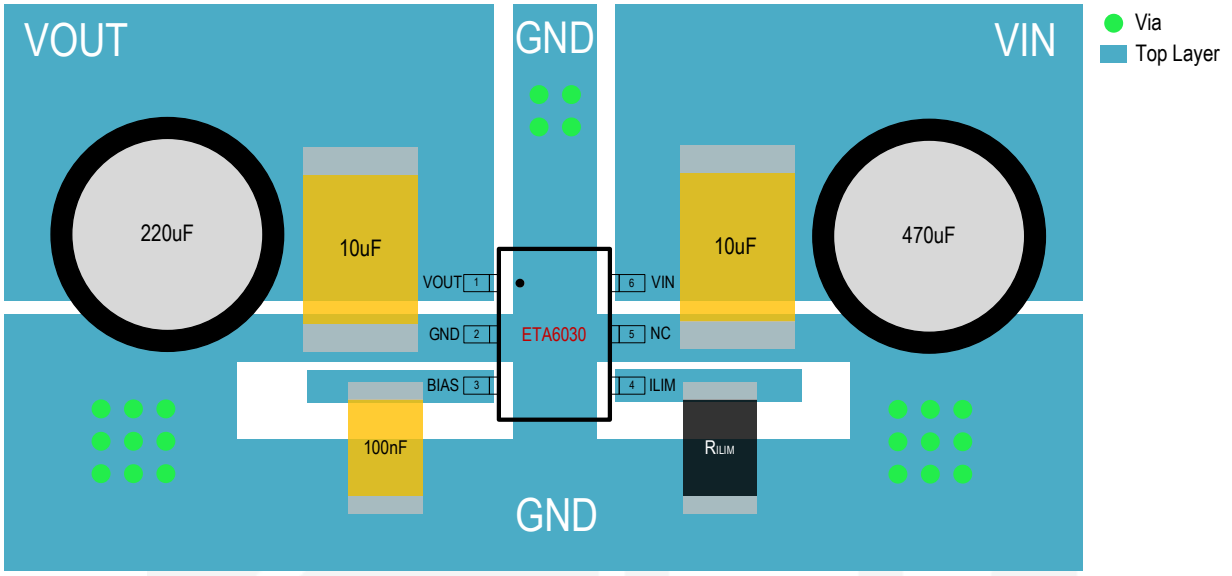
$$ILIM(mA) = \frac{18000}{R_{ILIM}(k\Omega)}$$

Switch current limit is recommended in following table:

R_{ILIM} (kΩ)	ILIM (mA)	R_{ILIM} (kΩ)	ILIM (mA)
15	1200	30	600
18	1000	40	450
20	900	50	360
25	720	90	200

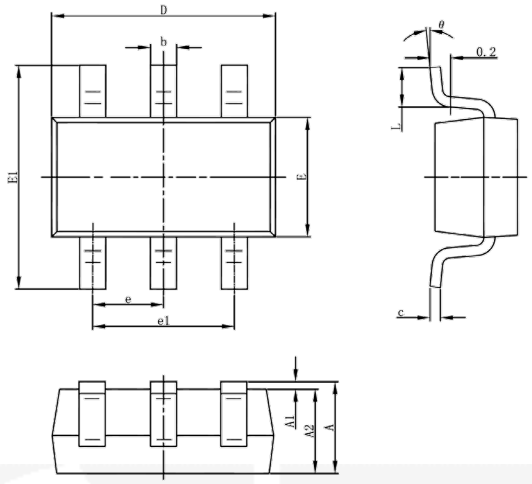
If ILIM pin is shorted to GND or R_{ILIM} <4kΩ, the current limit is set to 650mA by default.

PCB GUIDELINES



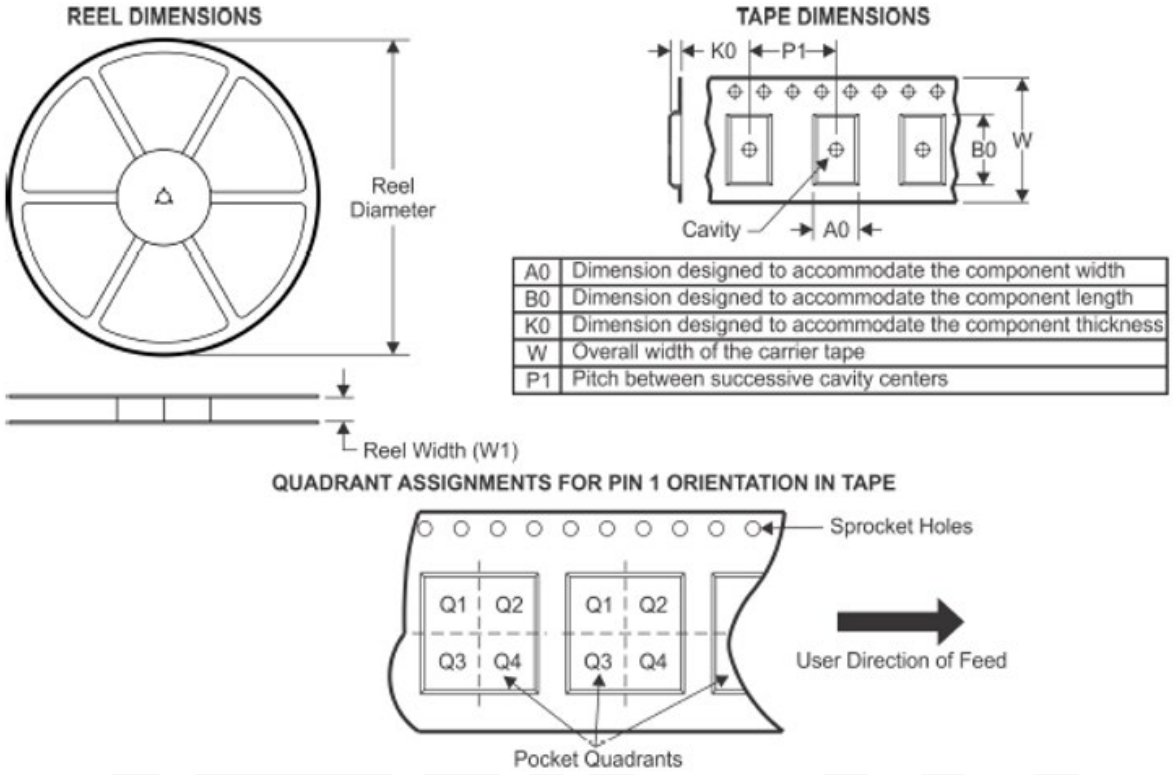
PACKAGE OUTLINE

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°

TAPE AND REEL INFORMATION



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA6030S2G	SOT23-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3