

PMU with 24V Current Limit Switch and 200mA Linear Regulator

DESCRIPTION

ETA5197 is a power management unit (PMU) consisting of a 24V current limit switch and a 200mA LDO linear regulator. The input operating voltage can be as high as 24V and input standoff voltage is up to 32V.

The current limit of the switch can be externally programmed by a resistor. The LDO is capable of delivering up to 200mA current with a linear foldback current limit.

ETA5197 is available in SOT23-6 package.

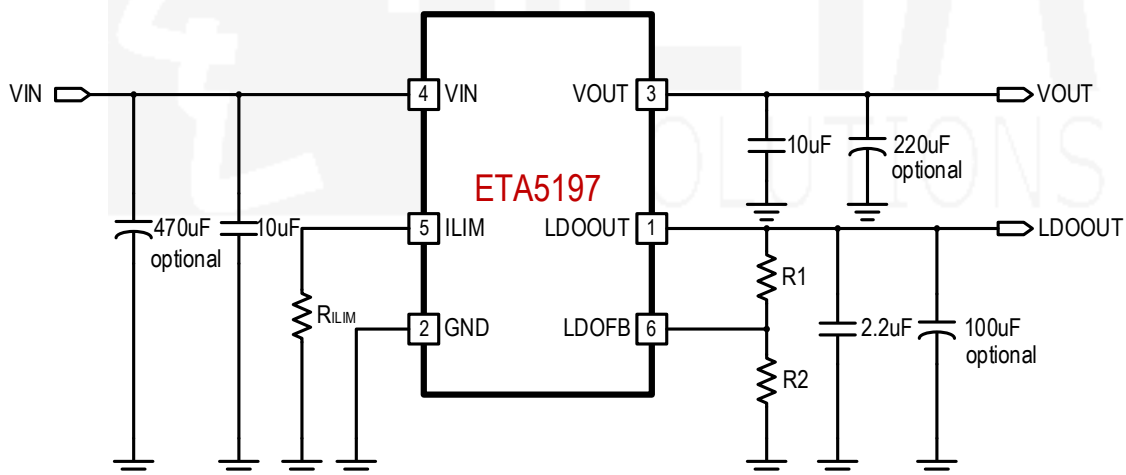
FEATURES

- ◆ Stable with Wide Range of Output Capacitor
- ◆ Wide Input Voltage Range: 3.8V-24V
- ◆ Wide Output Voltage Range of LDO: 1.1-12V
- ◆ 32V Input Standoff Voltage
- ◆ Programmable Current Limit
- ◆ Dual Thermal Shutdown
- ◆ SOT23-6 Package

APPLICATIONS

- ◆ Power Meter
- ◆ Power Meter Module

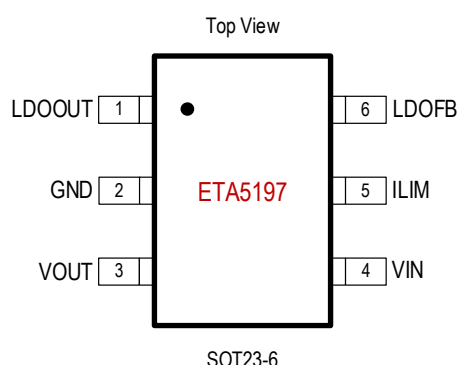
TYPICAL APPLICATION



ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA5197S2G	SOT23-6	IHYW	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, LDOOUT Voltage.....	-0.3V to 32V
LDOFB, ILIM Voltage.....	-0.3V to 6.5V
VOUT, LDOOUT 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

(VIN = 12V, VLDOOUT=5V, 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		3.8		24	V
Input UVLO for System	SYS_UVLO	Rising, Hysteresis=200mV	3.4	3.5	3.65	V
Input Supply Current	IQ	VIN = 7V		100		µA
		VIN = 12V		180		µA
		VIN = 24V		200		µA
Thermal Shutdown for System	SYS_TSD	Rising, Hys=15°C		155		°C

CURRENT LIMIT SWITCH

Input UVLO For Current Limit Switch	SW_UVLO	Rising, Hysteresis=500mV	7.6	8.0	8.4	V
Thermal Shutdown for Switch	SW_TSD	Rising, Hys=15°C		135		°C
Power Switch On Resistance	RON	ISW = 500mA, -40°C ≤ TJ ≤ 120°C		500	900	mΩ
Current Limit Range	SW_ILIM		0.2		1.2	A
Current Limit Threshold	SW_ILIM_OP6	RILIM=30K	0.55	0.6	0.65	mA
	SW_ILIM_OP3	RILIM=60K	0.25	0.3	0.35	
	SW_ILIM_INT	RILIM<4K	0.6	0.65	0.7	
Foldback Current Limit Reduction Ratio	SW_IFLDBCK	IOUT_CC / (VIN - SW_VFLDBCK - VOUT)		10		%ILIM/ V

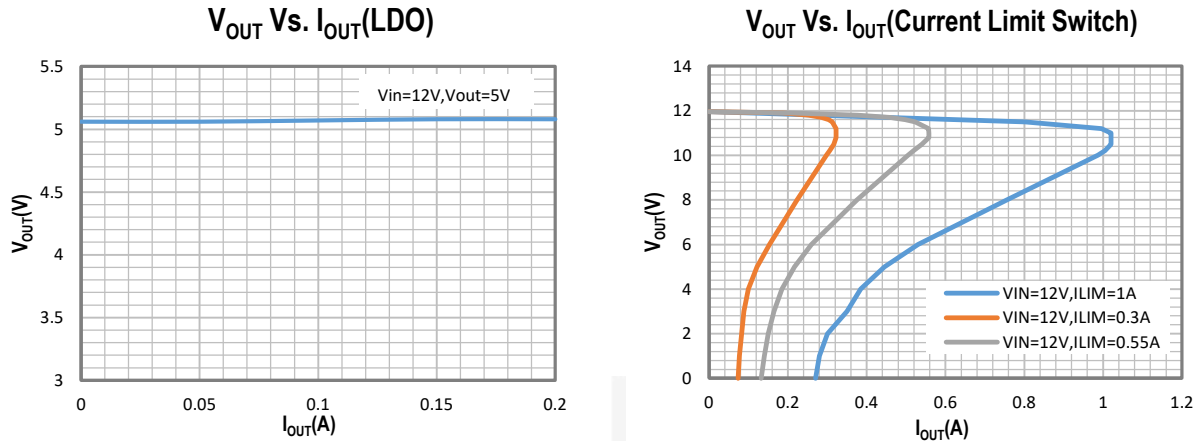
Current Limit Foldback Start Threshold	SW_VFLDBCK	$V_{IN}-V_{OUT}$		2.5		V
Forward Regulation Voltage	VFWD	$I_{OUT} = 10\text{mA}$		75		mV
LOW DROP-OUT REGULATOR LDO						
Dropout Voltage	VDROPOUT	$I_{LDOOUT}=100\text{mA}$		1.5		V
LDOFB Threshold	VREF	$-40^{\circ}\text{C}\leq T_J\leq 120^{\circ}\text{C}$	1.067	1.1	1.133	V
LDOFB Input Leakage	IFB				0.01	μA
Maximum Continuous Output Current	IOUT				200	mA
LDO Current Limit	LDO_ILIM	$V_{LDOFB} = 1.05\text{V}$	250		350	mA
LDO Current Limit at Foldback	LDO_IFLDBCK	$V_{LDOOUT} < 0.25\text{V}$	70	90		mA
LDO Current Limit Foldback Start threshold	LDO_VFLDBCK	LDOFB pin Voltage		0.9		V

PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	LDOOUT	Output pin of the LDO. Bypass with a 2.2 μF capacitor to GND. A 100 μF or larger electrolytic capacitor can be also placed at the output.
2	GND	Ground
3	VOUT	Output pin of the current limit switch. Bypass with a 10 μF capacitor to GND. A 220 μF or larger electrolytic capacitor can be also placed at the output.
4	VIN	Input pin. Bypass with a 10 μF capacitor to GND. A 470 μF or larger electrolytic capacitor can be also placed at the input.
5	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.
6	LDOFB	Feedback pin of the LDO

TYPICAL CHARACTERISTICS

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



FUNCTION DESCRIPTION

Enable and Disable

LDO is enabled if all of following conditions occur:

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

LDO is disable if one of above conditions do not occur.

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

- VIN is greater than SW_UVLO
- Junction temperature of IC does not exceed SW_TSD

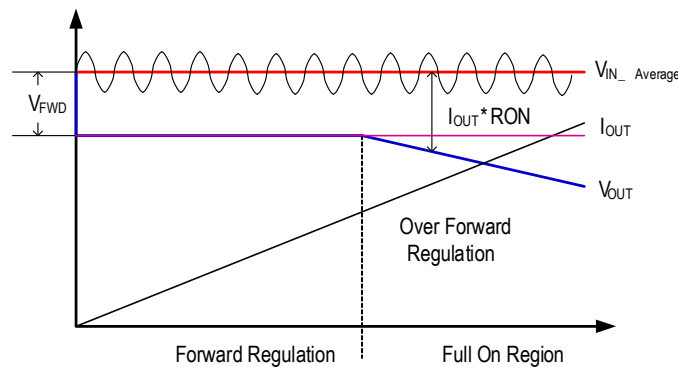
Current Limit Switch is disable if one of above conditions do not occur.

Current Limit Switch

The ETA5197 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 $R_{ILIM} < 4k\Omega$, the current limit is set to 650mA by default.

The ETA5197 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 75mV. When the difference between V_{OUT} and $V_{IN_Average}$ is less than 75mV, the ripple remove function will work to filter out the input ripple, so that IC can provide a stable output voltage.

Low Dropout (LDO) Regulator

The ETA5197 is equipped with a low dropout regulator which can configure the output voltage from 1.1V to 12V. The LDO can provide up to 200mA current for the output device.

To inhibit the heat generation of LDO, ETA5197 reduces the LDO current limit. In the foldback condition, the current is reduced linearly when LDO_FB pin voltage falls below 0.9V and get the minimum of 90mA when LDO_FB pin voltage reach 0.2V.

Thermal Shutdown

ETA5197 is integrated with dual independent thermal shutdown activities. When the temperature of IC exceeds SW_TSD (135°C typically), the part shutdowns Current Limit Switch. LDO is still maintained as long as the IC temperature is still under SYS_TSD (155°C typically)

APPLICATION INFORMATION

LDO Output Voltage Setting

The output voltage of the ETA5197 LDO regulator can be programmed by using an external resistor divider. The output voltage is calculated by the equation below.

$$V_{LDOOUT} = V_{REF} \times \left(1 + \frac{R_2}{R_1} \right)$$

Where: $V_{REF} = 1.1V$ typically (the internal reference voltage)

To minimize feedback resistor current which is determined by V_{REF} and R_1 , R_1 has to be from 22kΩ to 220kΩ and thus R_2 is calculated by the following equation:

$$R_2 = \left(\frac{V_{LDOOUT}}{V_{REF}} - 1 \right) \times R_1$$

LDO output voltage configuration is recommended in following table:

$R_1 = 22k\Omega$ ($I_{FB} = 50\mu A$)		$R_1 = 33k\Omega$ ($I_{FB} = 33\mu A$)		$R_1 = 44k\Omega$ ($I_{FB} = 25\mu A$)		$R_1 = 66k\Omega$ ($I_{FB} = 16.67\mu A$)	
R_2 (k Ω)	V_{OUT} (V)	R_2 (k Ω)	V_{OUT} (V)	R_2 (k Ω)	V_{OUT} (V)	R_2 (k Ω)	V_{OUT} (V)
11	1.2	3	1.2	4	1.2	6	1.2
14	1.8	21	1.8	28	1.8	42	1.8
28	2.5	42	2.5	56	2.5	84	2.5
44	3.3	66	3.3	88	3.3	132	3.3
58	4	87	4	116	4	174	4
78	5	117	5	156	5	234	5
98	6	147	6	196	6	294	6
118	7	177	7	236	7	354	7
138	8	207	8	276	8	414	8
158	9	237	9	316	9	474	9
178	10	267	10	356	10	534	10
2	1.2	3	1.2	4	1.2	6	1.2
14	1.8	21	1.8	28	1.8	42	1.8
28	2.5	42	2.5	56	2.5	84	2.5

LDO Output Capacitor Selection

By using ETA Solutions architecture, LDO output can be stable with any capacitor type ranging from 1 μ F to 100 μ F. To maximize LDO performance, it is strong recommended to select output capacitor with some below tips:

- If need to use huge capacitor, It will be no problem to use a 1 μ F ceramic capacitor in parallel with a huge electrolytic capacitor. Or it can even be a single electrolytic capacitor.
- Use the capacitor bigger than 2.2 μ F for the setting of LDOOUT lower than 1.5V for better transient.

Switch Current Limit Setting

Switch current limit is given by the following equation:

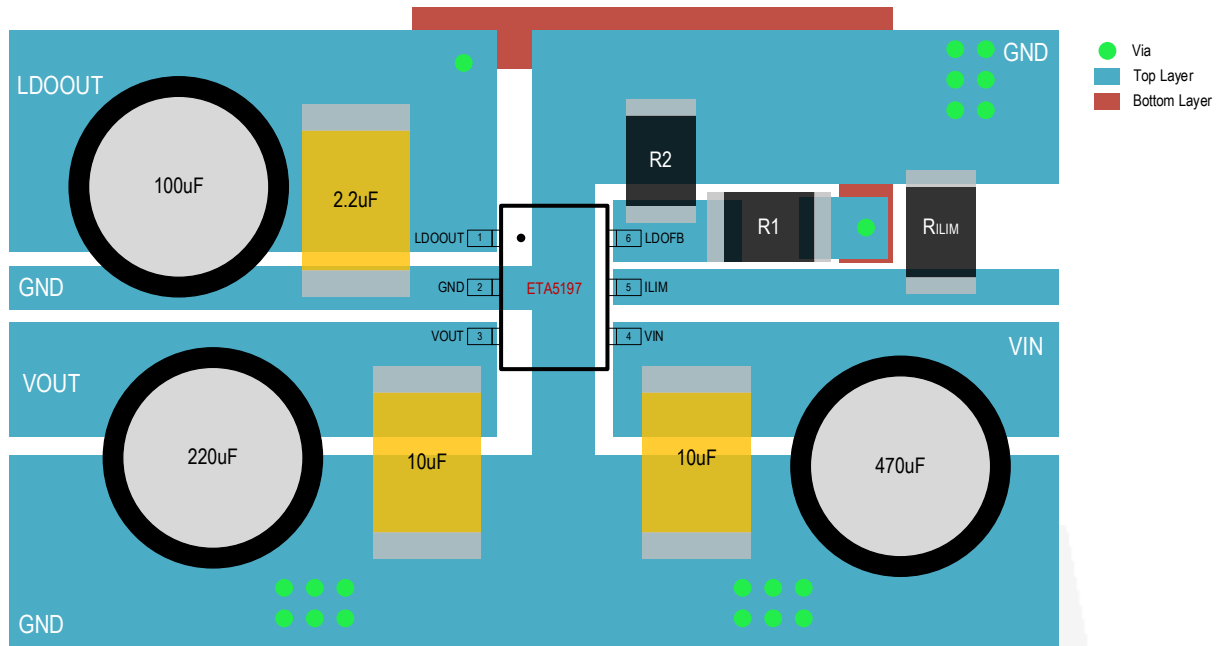
$$I_{LIM}(\text{mA}) = \frac{18000}{R_{LIM}(\text{k}\Omega)}$$

Switch current limit is recommended in the following table:

R_{LIM} (k Ω)	I_{LIM} (mA)	R_{LIM} (k Ω)	I_{LIM} (mA)
15	1200	30	600
18	1000	40	450
20	900	50	360
25	720	90	200

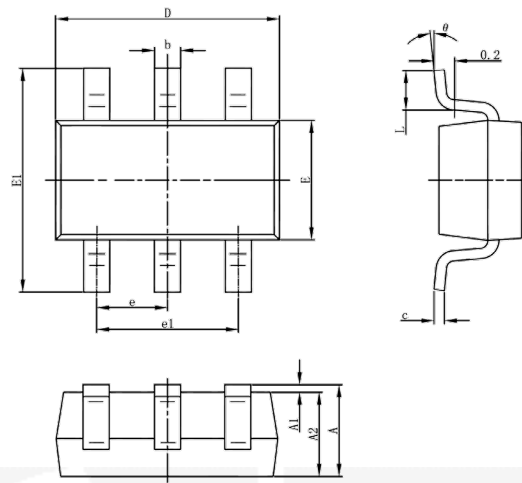
If I_{LIM} pin is shorted to GND or $R_{LIM} < 4k\Omega$, the current limit is set to 650mA by default.

PCB GUIDELINES



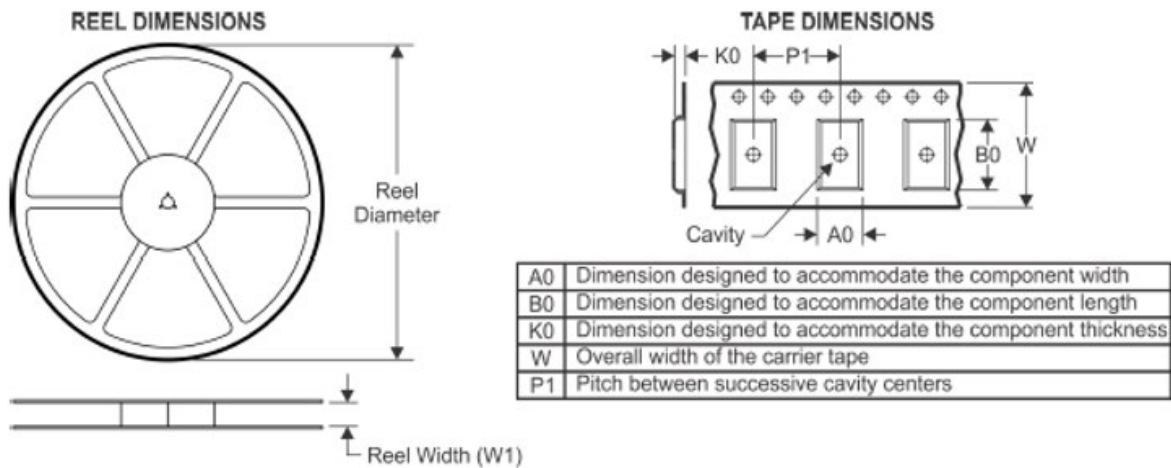
PACKAGE OUTLINE

Package: SOT23-6

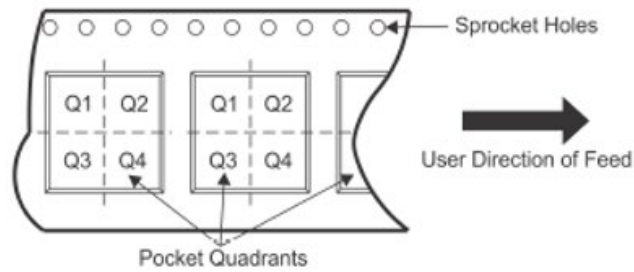


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
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



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA5197S2G	SOT23-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3