2MHz, 2A, COT Synchronous Step-down Converter in SOT563

DESCRIPTION

The ETA3527 is a high-efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. The devices operate from an input voltage range of 2.5V to 6.0V and provide output voltages from 0.6V to VIN, making the ETA3527 ideal for low voltage power conversions. ETA3527 adopts an adaptive COT control scheme that enables very fast transient response and provides a very smooth transition when the output varies from light load to heavy load. The adaptive COT control also maintains a constant switching frequency across line and load. Running at a fixed frequency of 2MHz allows the use of small inductance value and low DCR inductors, thereby achieving a higher efficiency. Other external components, such as ceramic input and output caps, can also be small due to higher switching frequency, while maintaining exceptional low-noise output voltages. Internal soft-start control circuitry reduces inrush current. Short-circuit and thermal-overload protection improves design reliability

ETA3527 is available in a tiny SOT563 package.

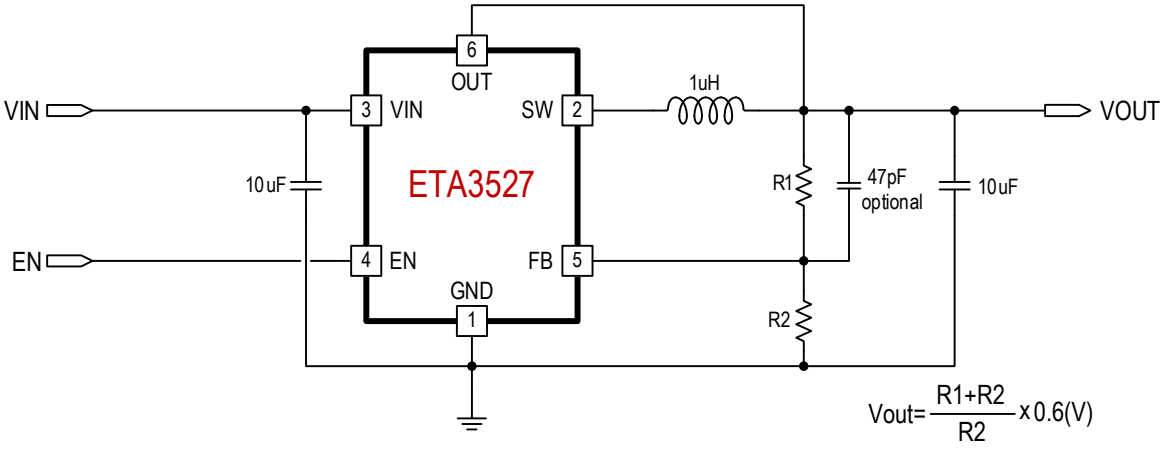
FEATURES

- Up to 95% Efficiency
- Up to 2A Max Output Current
- Adaptive COT Control
- Ultra-fast Load Transient Response
- Forced PWM Mode
- 2MHz Frequency
- 1% Feedback Accuracy
- Adjustable Output from 0.6V
- Cycle-by-cycle Over Current Protection
- Short Circuit Protection with Hiccup Mode
- Stable with Low-ESR Output Ceramic Capacitors
- Available in SOT563 Package

APPLICATIONS

- LCD TV
- Set Top Box
- IP CAM

TYPICAL APPLICATION

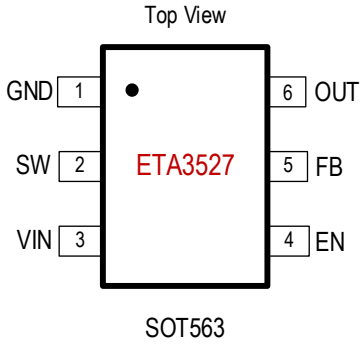


*R2 has to be between 1KOhm to 70KOhm

ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA3527FSG	SOT563	CTYW	5000

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, FB, EN, OUT, SW Voltage .....–0.3V to 6V
Operating Temperature Range .....–40°C to 85°C
Storage Temperature Range .....–55°C to 150°C

Thermal Resistance	Θ_{JA}	Θ_{JC}	
SOT563	80	50	°C/W

Lead Temperature (Soldering 10sec) .....260°C

ELECTRICAL CHARACTERISTICS

(V_{IN} = 5.0V, unless otherwise specified. Typical values are at T_A = 25°C.)

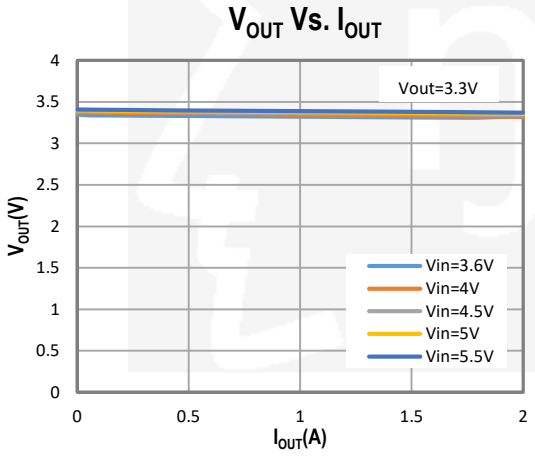
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		2.5		6.0	V
Input UVLO	Rising, Hysteresis=300mV	2.3	2.4	2.5	V
Input OVP	Rising, Hysteresis=0.25V	6.0	6.35	6.7	V
Input Supply Current	V_{FB}=0.65V, no switching		50	100	μA
Input Shutdown Current			0	1	μA
FB Voltage	2.5V≤V_{IN}≤6.0V	0.594	0.6	0.606	V
FB Input Current			0	1	μA
Output Voltage Range		0.6		VIN	V
Load Regulation			0.7		%/A
Line Regulation	V_{IN}=2.7V to 5.5V		0.2		%/V
Switching Frequency		1.5	2	2.5	MHz
Soft Start Time	V_{OUT} Rising from 10% to 90%		0.5		mS
Short Circuit Hiccup Time	On Time		0.5		mS
	Off Time		3.5		mS
FB Hiccup Threshold			0.2		V
High Side Switch On Resistance			100		mΩ
Low Side Switch On Resistance			80		mΩ
High Side Current Limit		3	3.6		A
Low Side Current Limit		2.2	2.8		A
SW Leakage Current	V_{OUT}=5.5V, V_{SW}=0 or 5.5V, EN= GND			10	μA
EN Logic High Threshold	Rising	1.2			V
EN Logic Low Threshold	Falling			0.4	V
EN Input Current	V_{EN}=2V			1	uA
Thermal Shutdown	Rising, Hysteresis =34°C		150		°C

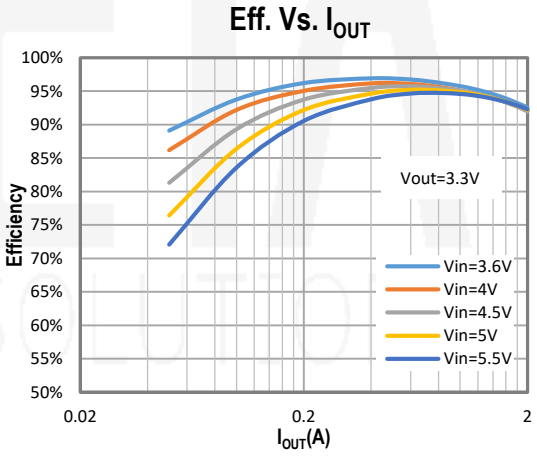
PIN DESCRIPTION

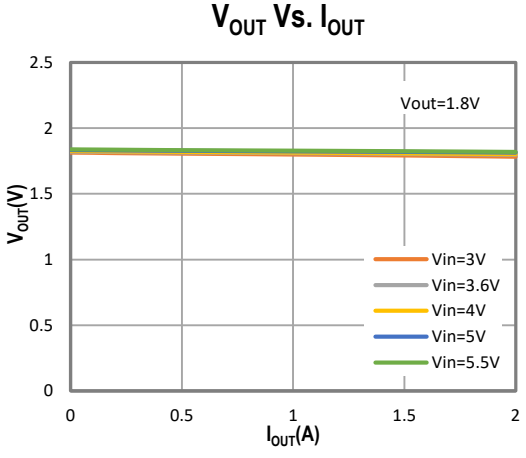
PIN #	NAME	DESCRIPTION
1	GND	Ground
2	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.
3	VIN	Supply Voltage. Bypass with a 10μF ceramic capacitor to GND
4	EN	Enable. EN is high voltage level to enable. For automatic start-up, connect EN pin to VIN pin with a pull-up resistor.
5	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}
6	OUT	Output pin. Bypass with a 10uF or larger ceramic capacitor closely between this pin and GND

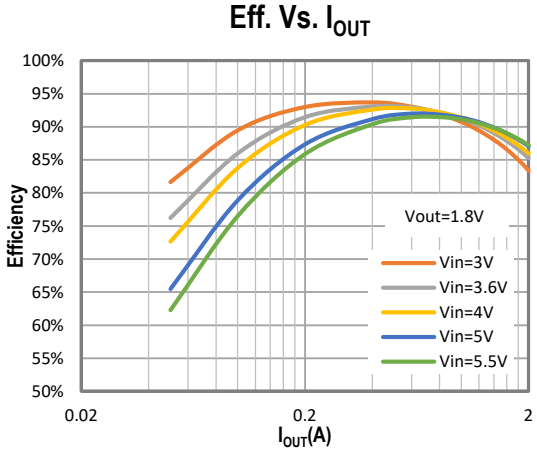
TYPICAL CHARACTERISTICS

(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)





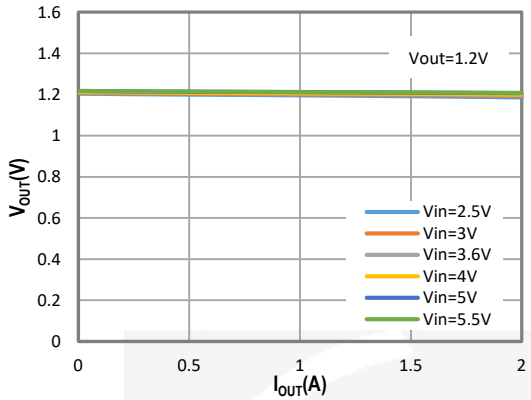




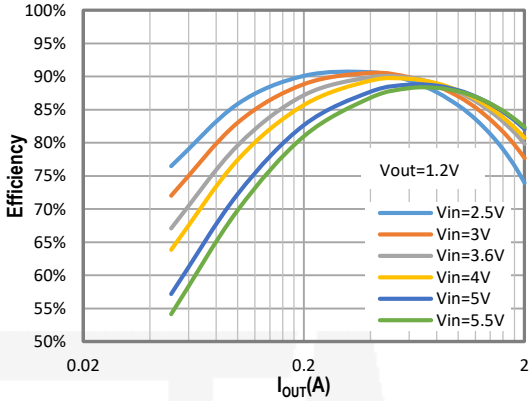
TYPICAL CHARACTERISTICS (cont')

(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

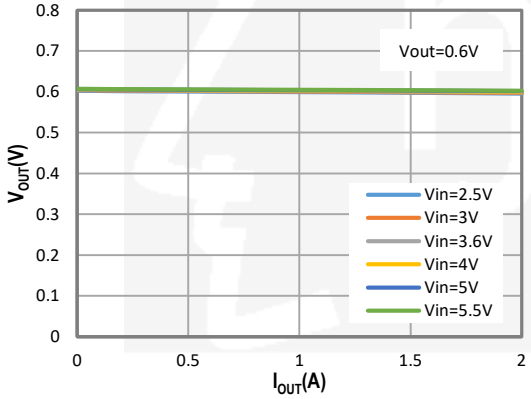
V_{OUT} Vs. I_{OUT}



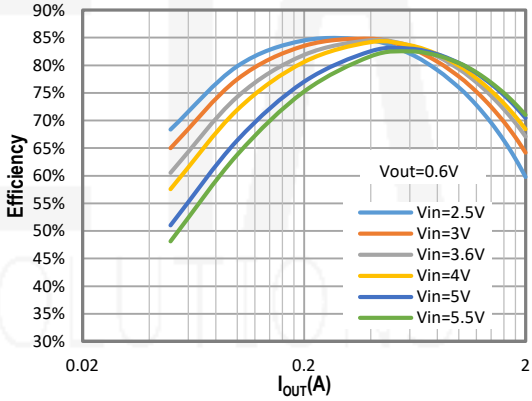
Eff. Vs. I_{OUT}



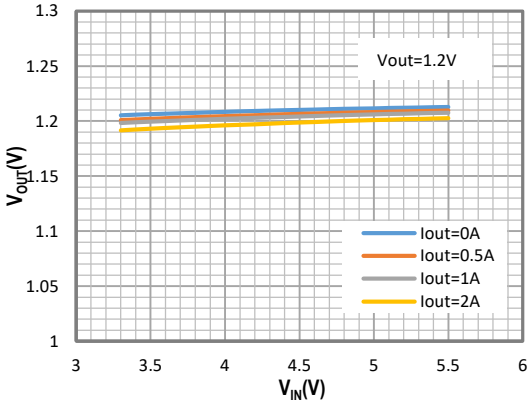
V_{OUT} Vs. I_{OUT}



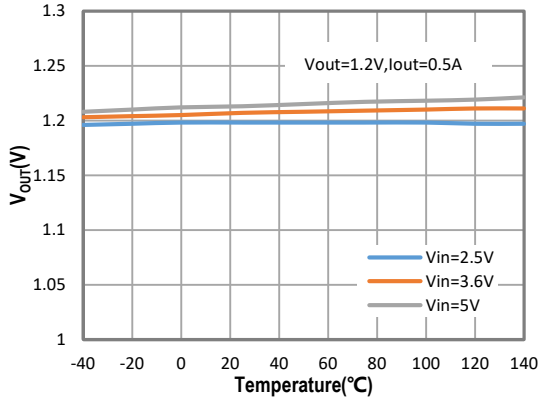
Eff. Vs. I_{OUT}



V_{OUT} Vs. V_{IN}



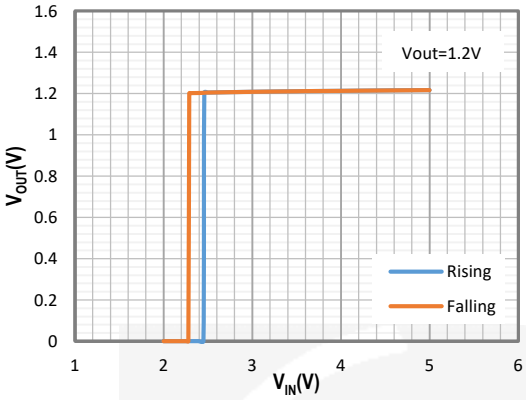
V_{OUT} Vs. Temp.



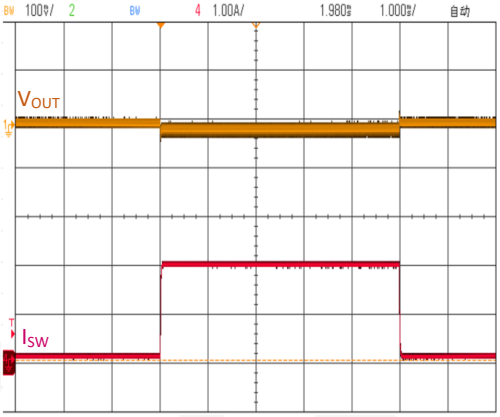
TYPICAL CHARACTERISTICS (cont')

(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

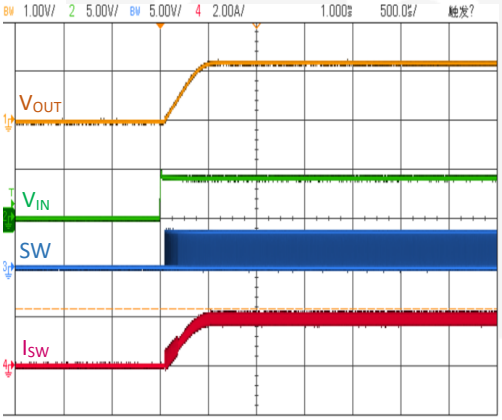
V_{IN} UVLO



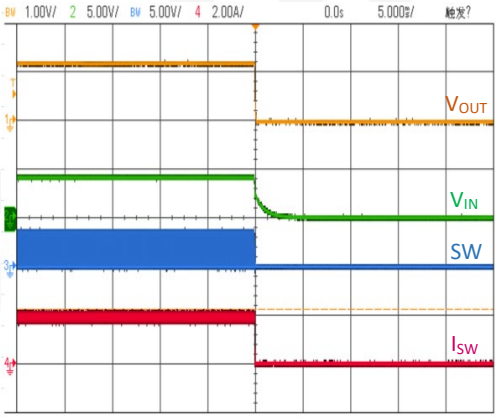
Load Transient
V_{IN}=3.3V, V_{OUT}=1.2V,I_{OUT}=0.1A-2A



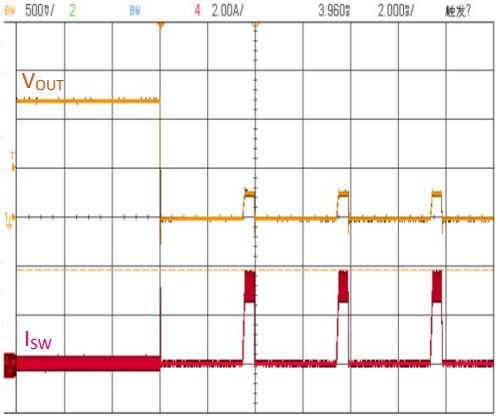
Start Up from VIN,
V_{IN}=4.2V, V_{OUT}=1.2V,I_{OUT}=2A



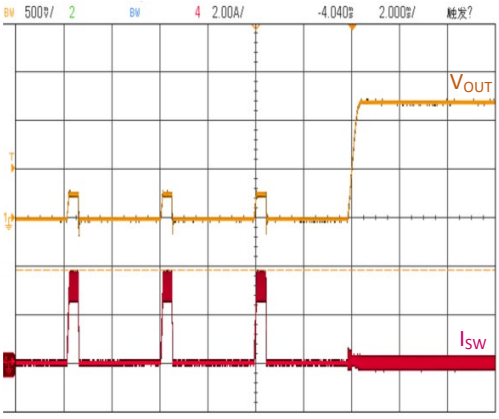
Shut Down from VIN,
V_{IN}=4.2V, V_{OUT}=1.2V,I_{OUT}=2A



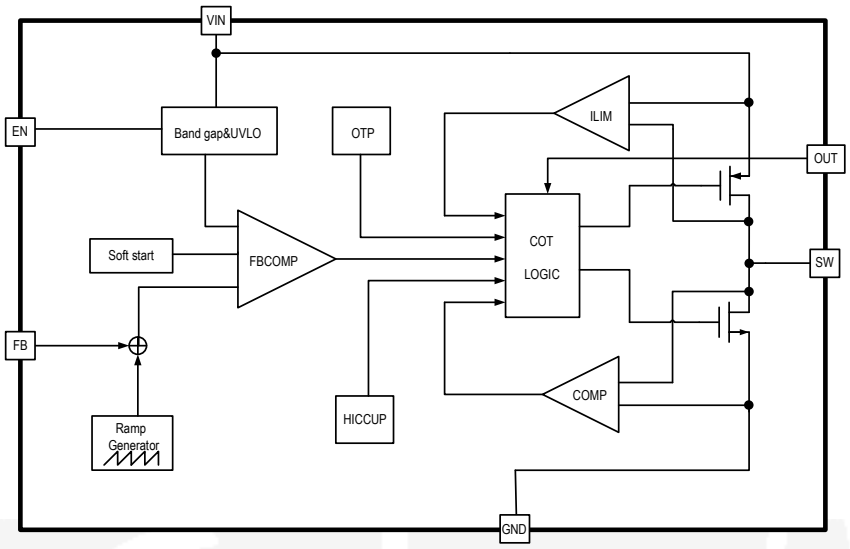
Short Circuit Protection



Short Circuit Recovery



FUNCTIONAL BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The ETA3527 is a synchronous buck regulator that integrates the adaptive COT control, top and bottom switches on the same die to minimize the switching transition loss and conduction loss.

ETA3527 is a high-efficiency and high-frequency DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. It adopts an adaptive COT control scheme that enables very fast transient response and provides a very smooth transition when the output varies from light load to heavy load. It compares the sum of the FB voltage and a ripple voltage that mimics the voltage due to the output ESR and capacitance. The constant-on-time timer varies with line to achieve relative constant switching frequency across line.

Forced PWM Mode

A forced PWM DC-DC regulator always switches at a fixed frequency when the output heavy load or light load. This is to ensure a minimum output voltage ripple over the full load range.

Over Current Protection and Hiccup

ETA3527 has a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UV threshold (0.2V), the ETA3527 will enter hiccup mode. It will turn off the chip immediately for 3.5mS. After that, it will try to re-starts as normal for 0.5mS. After 0.5mS, if FB is still below UV threshold, then the chip enters hiccup mode again. If FB is higher than UV threshold, it will enter the normal mode.

Over-Temperature Protection

Thermal protection disables the output when the junction temperature rises to approximately 150°C, allowing the device to cool down. When the junction temperature cools to approximately 115°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

External Output Voltage Setting

In external Output Voltage Setting Version selected, the ETA3527 regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

$$V_{OUT}=V_{REF}\times(1+\frac{R_1}{R_2})$$

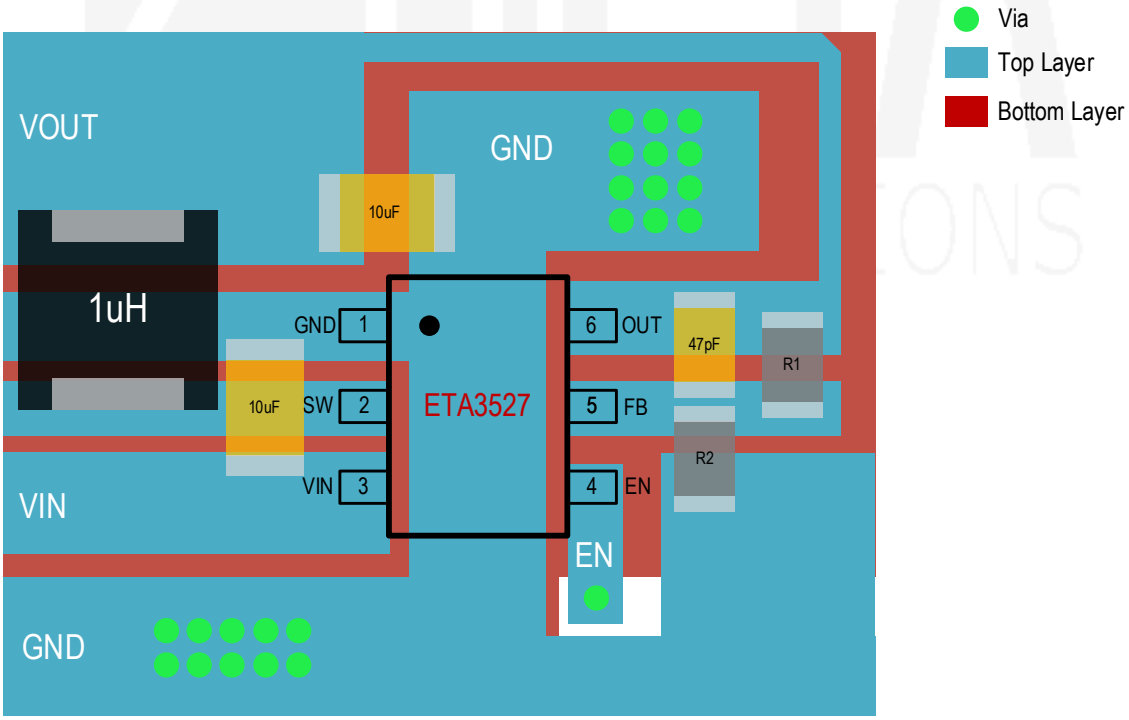
Where: V_{REF} =0.6V typically (the internal reference voltage)

Resistors R2 has to be between 1KOhm to 70KOhm and thus R1 is calculated by following equation.

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

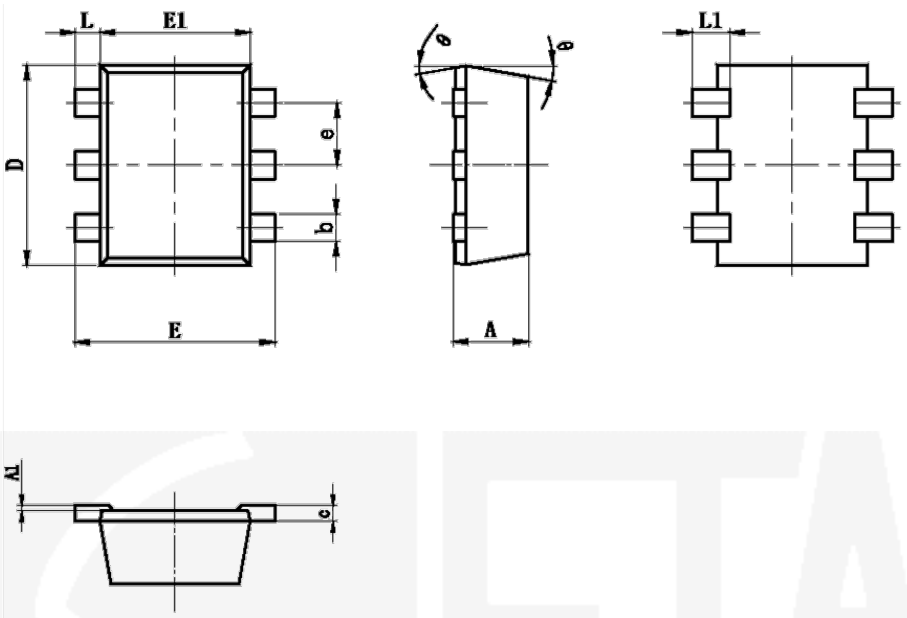
PCB LAYOUT GUIDE

Keep the power devices as close to the chip as possible to achieve the smallest power loop area, which leads to the best EMI performance; Cin is always placed nearest to Vin and GND



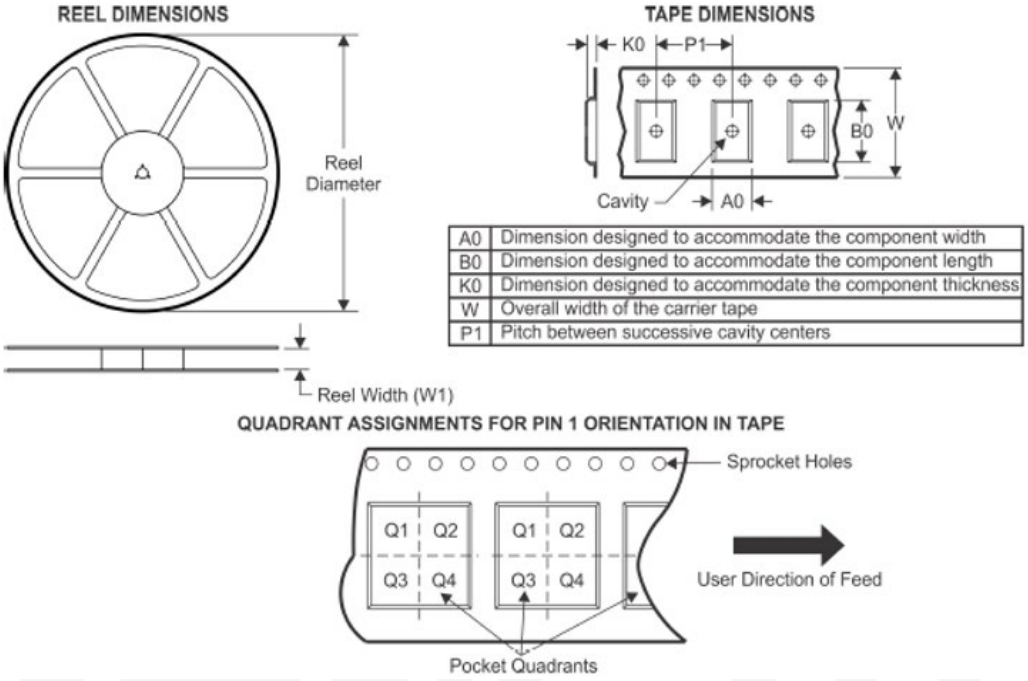
PACKAGE OUTLINE

Package: SOT563



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
e	0.450	0.550	0.018	0.022
c	0.090	0.180	0.004	0.007
D	1.500	1.700	0.059	0.067
b	0.170	0.270	0.007	0.011
E1	1.100	1.300	0.043	0.051
E	1.500	1.700	0.059	0.067
L	0.100	0.300	0.004	0.012
L1	0.200	0.400	0.008	0.016
θ	9° REF.		9° REF.	

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
ETA3527FSG	SOT563	6	5000	178	9.5	1.78	1.78	0.69	4	8	Q3