

# 17V, 3A, Forced PWM, High Efficiency Synchronous Step-Down Converter in SOT563

## DESCRIPTION

ETA1667 is a wide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 3A 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. The adaptive COT control also maintains a constant switching frequency across line and load. An OVP function protects the IC itself and its downstream system against input voltage surges. With this OVP function, the IC can stand off input voltage as high as 24V, making it an ideal solution for industrial applications such as LCD TV, Set Top Box, Portable TV, etc.

ETA1667 is available in SOT563 package.

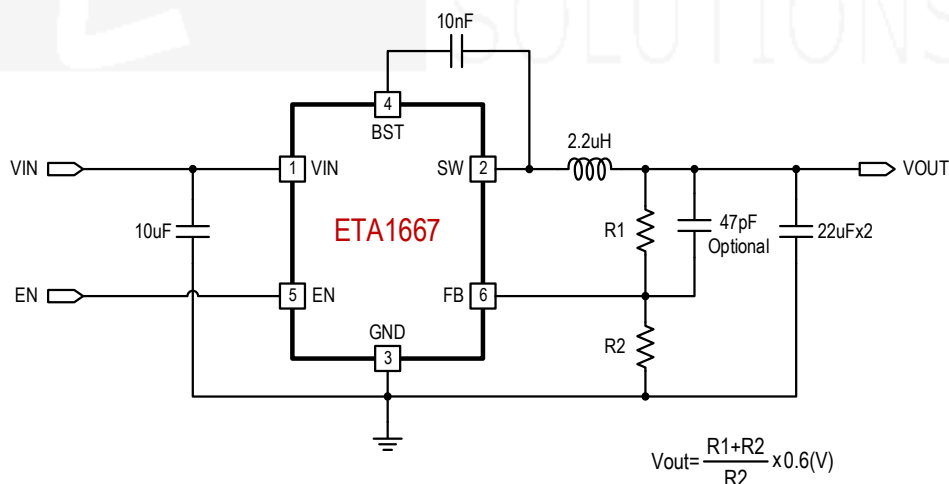
## FEATURES

- ◆ Wide Input Range: 4.2V-17V
- ◆ Adaptive COT Control
- ◆ Ultra-fast Load Transient Response
- ◆ Forced PWM Mode
- ◆ High Efficiency Synchronous Operation
- ◆ Low R<sub>dson</sub> Internal Power FETs
- ◆ Capable of Delivering 3A Output
- ◆ No External Compensation Needed
- ◆ Thermal Shutdown and UVLO
- ◆ Available in SOT563 Package
- ◆ RoHS Compliant

## APPLICATIONS

- ◆ LCD TV
- ◆ Set Top Box
- ◆ xDSL Modem

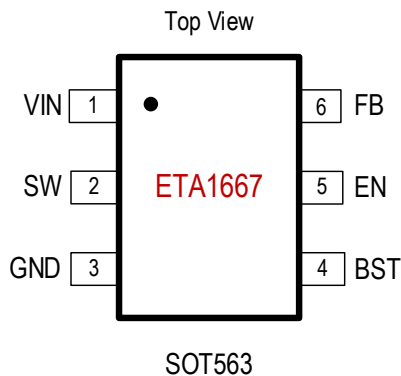
## TYPICAL APPLICATION



## ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1667FSG	SOT563	FgYW	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, EN, SW Voltage .....	-0.3V to 24V
BST Voltage .....	-0.3V to SW+6V
FB Voltage .....	-0.3V to 6V
Junction Temperature.....	150°C
Storage Temperature Range.....	-55°C to 150°C
Thermal Resistance	$\theta_{JA}$ $\theta_{JC}$
SOT563.....	120    50    °C/W
Lead Temperature (Soldering 10sec) .....	260°C
ESD HBM (Human Body Mode) .....	2KV
ESD CDM (Charged Device Mode) .....	1KV

## Recommended Operating Conditions

(Note: The device is not guaranteed to function outside its operating conditions.)

Ambient Temperature Range .....	-40°C to 85°C
Junction Temperature Range .....	-40°C to 125°C

## ELECTRICAL CHARACTERISTICS

(VIN = 12V, VOUT = 3.3V, unless otherwise specified. Typical values are at TA = 25°C.)

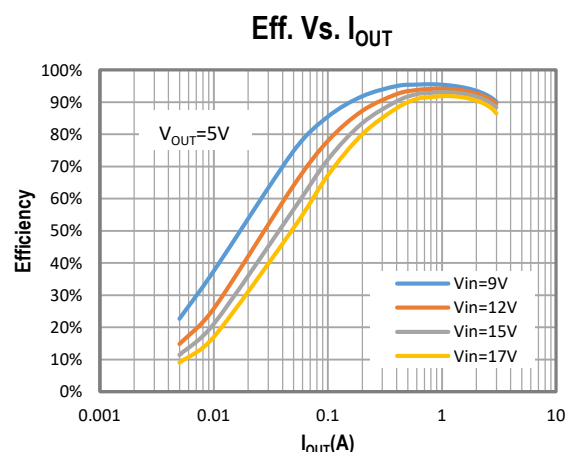
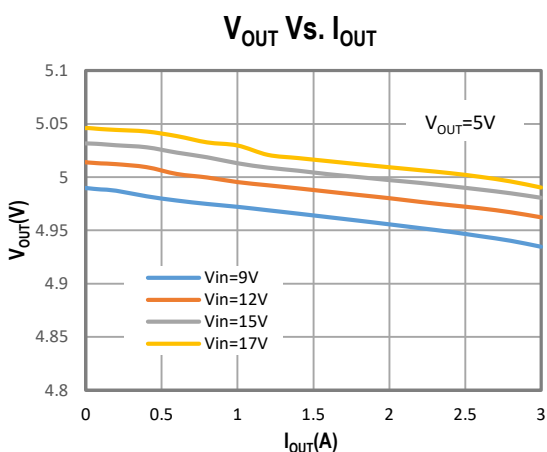
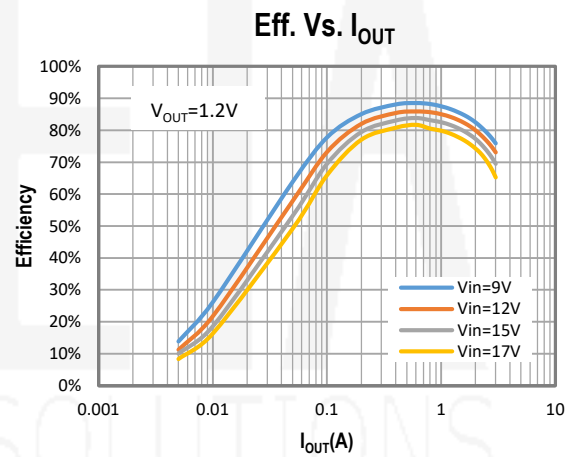
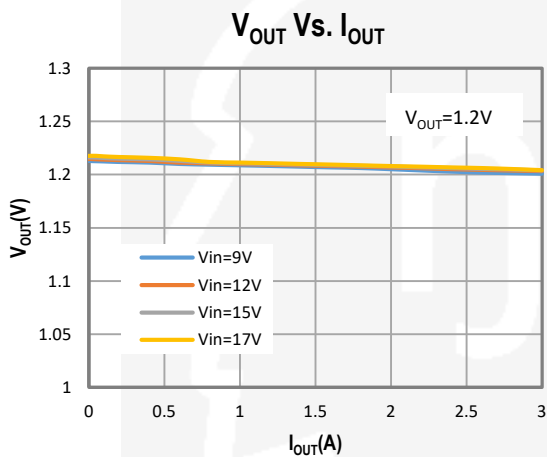
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		4.2		17	V
Input UVLO	Rising, Hysteresis=450mV		3.85		V
Input OVP	Rising, Hysteresis=0.9V		18.4		V
Input Supply Current	V <sub>FB</sub> =0.65V		200		µA
Input Shutdown Current			7	14	µA
FB Voltage		0.591	0.6	0.609	V
FB Input Current			0	0.1	µA
Switching Frequency		800	1000	1200	kHz
Minimum On Time	Ton_min		60		nS
Maximum Duty Cycle			87		%
Short Circuit Hiccup Time	On Time		1.4		mS
	Off Time		4.2		mS
FB Hiccup Threshold			0.3		V
High Side Switch On Resistance			110		mΩ
Low Side Switch On Resistance			50		mΩ
High Side Current Limit			4.9		A
SW Leakage Current	V <sub>IN</sub> =V <sub>SW</sub> =12V			10	µA
EN Rising Threshold	Hysteresis =0.1V	1.14	1.2	1.26	V
EN Input Current	V <sub>EN</sub> =2V		2	6	µA
Thermal Shutdown	Rising, Hysteresis =36°C		150		°C

## PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	VIN	Supply Voltage. Bypass with a 10 $\mu$ F ceramic capacitor to GND
2	SW	Inductor Connection. Connect an inductor between SW and the regulator output.
3	GND	Ground
4	BST	Bootstrap pin. Connect a 10nF capacitor from this pin to SW
5	EN	Enable pin for the IC. Drive this pin high to enable the part, low or floating to disable.
6	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set $V_{OUT}$

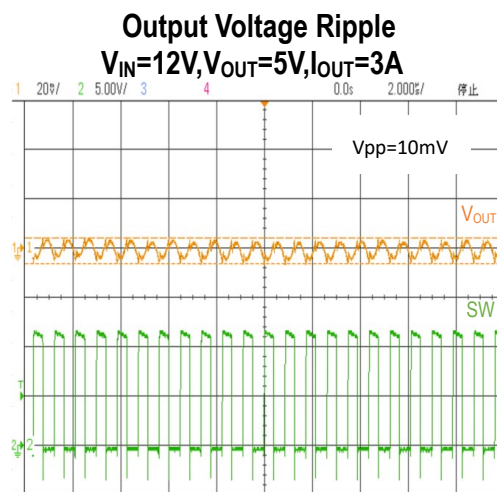
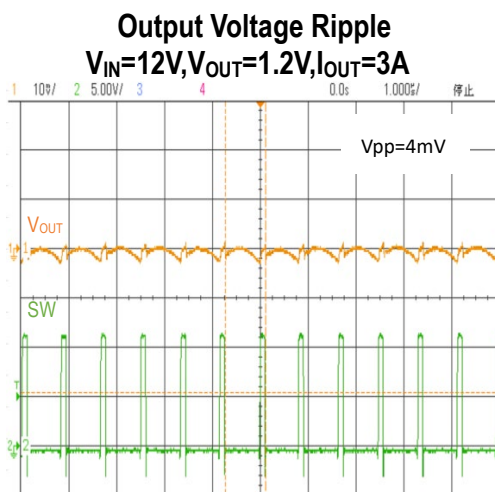
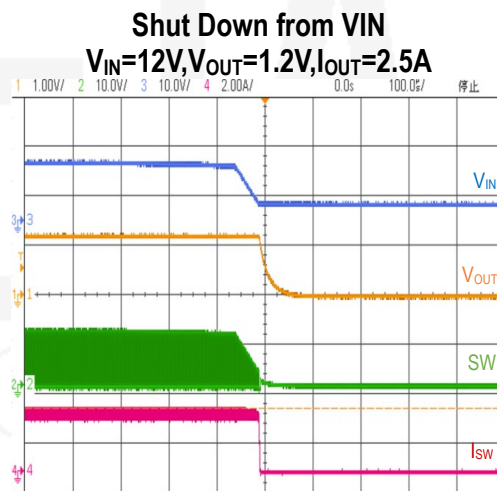
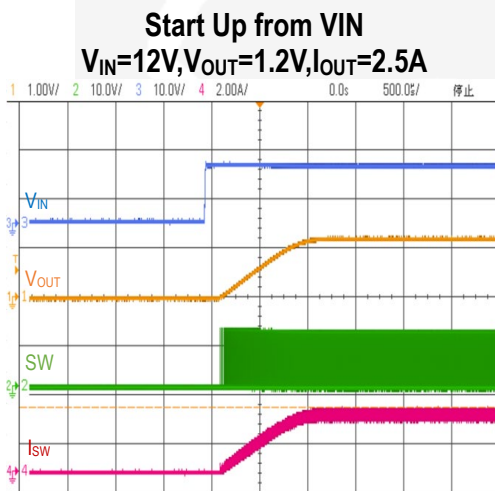
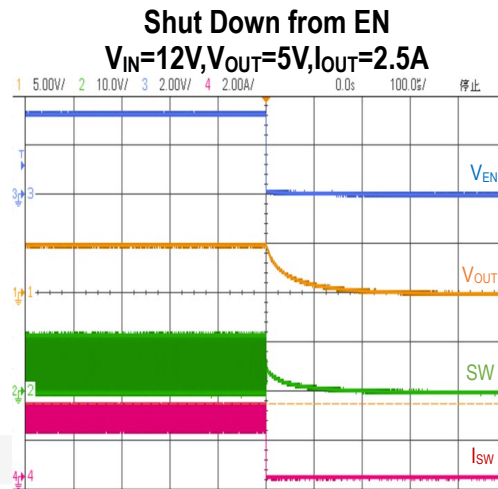
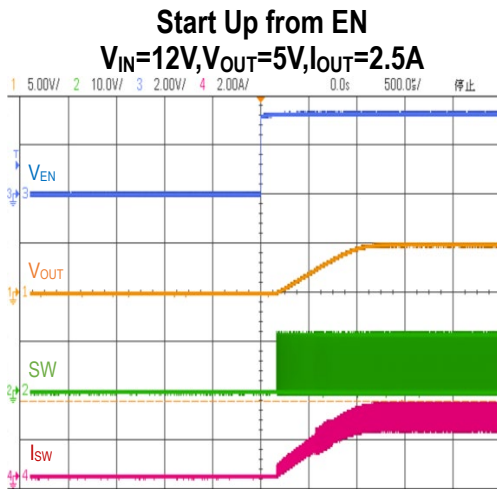
## TYPICAL CHARACTERISTICS

(Typical values are at  $V_{IN}=12V$   $T_A = 25^{\circ}C$  unless otherwise specified.)



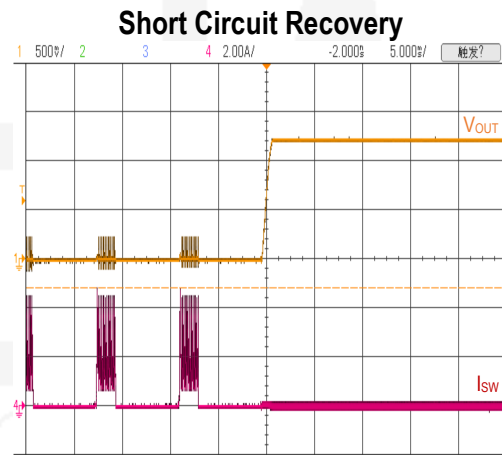
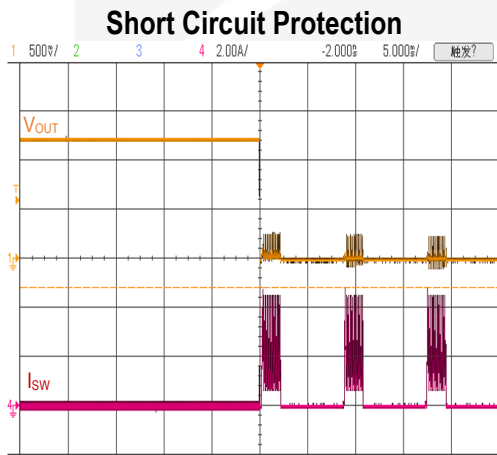
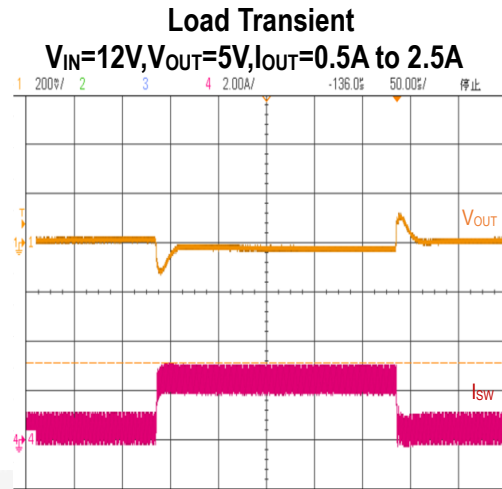
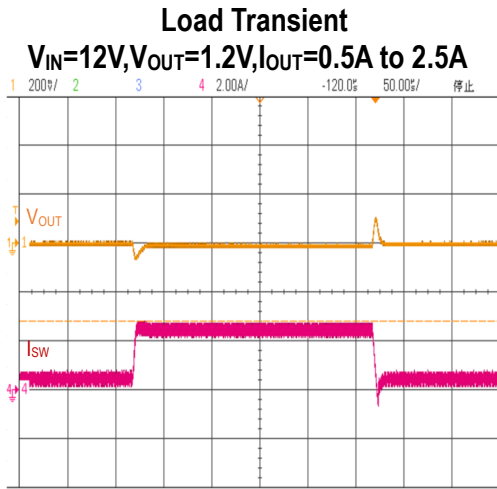
## TYPICAL CHARACTERISTICS Cont'd

(Typical values are at  $V_{IN}=12V$ ,  $T_A = 25^{\circ}C$  unless otherwise specified.)

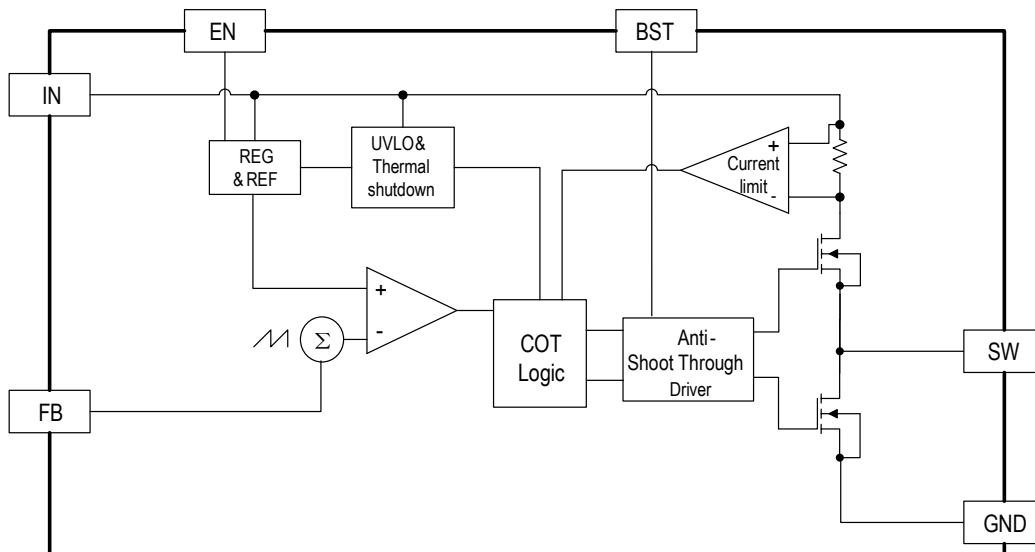


## TYPICAL CHARACTERISTICS Cont'd

(Typical values are at  $V_{IN}=12V$   $T_A = 25^{\circ}C$  unless otherwise specified.)



## FUNCTIONAL BLOCK DIAGRAM



## FUNCTIONAL DESCRIPTION

The ETA1667 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.

ETA1667 is a wide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 3A 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 Operation*

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.

### *Enable*

EN is a digital control pin that turns the ETA1667 on and off. Drive EN High to turn on the regulator, drive it Low to turn it off. An internal 1MΩ resistor from EN pin to GND allows EN to float to shut down the chip. Connecting the EN pin through a pull up resistor or shorted EN to VIN will automatically turn on the chip whenever plug in VIN.

### *Over Current Protection and Hiccup*

ETA1667 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 (0.3V), the ETA1667 will enter hiccup mode. It will turn off the chip immediately for 4.2mS. After that, it will try to re-starts as normal for 1.4mS. After 1.4mS, 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 114°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.

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## APPLICATION INFORMATION

### *External Output Voltage Setting*

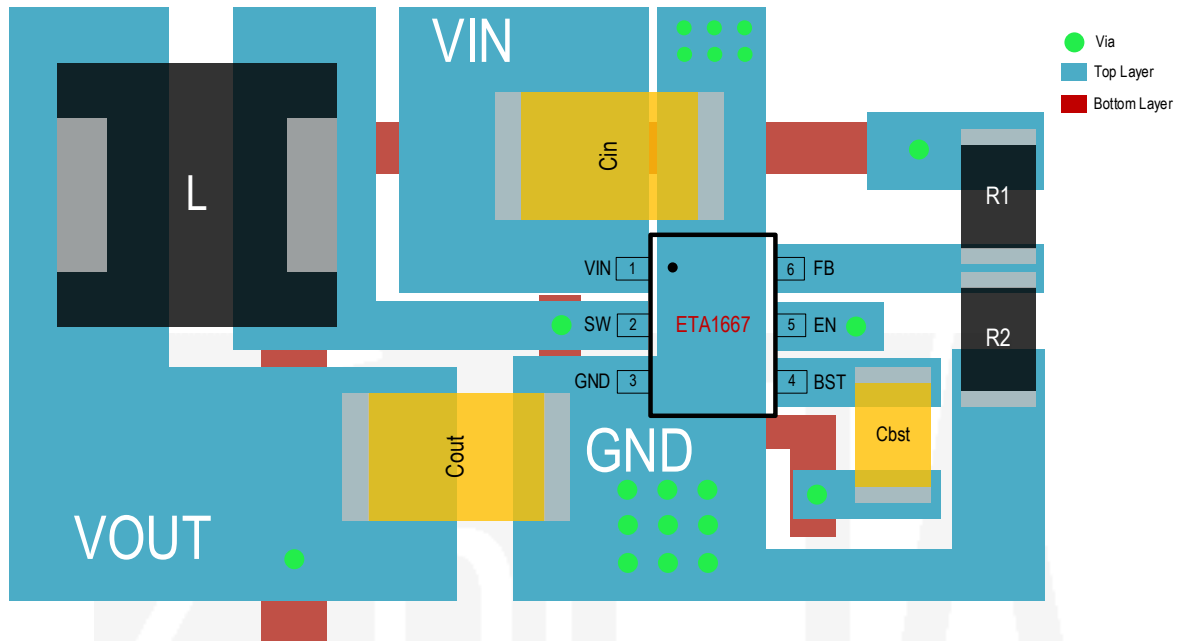
The output voltage of the ETA1667 regulator can be programmed by using an external resistor divider. The output voltage is calculated by using the below equation.

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

Where: VREF =0.6V typically (the internal reference voltage)

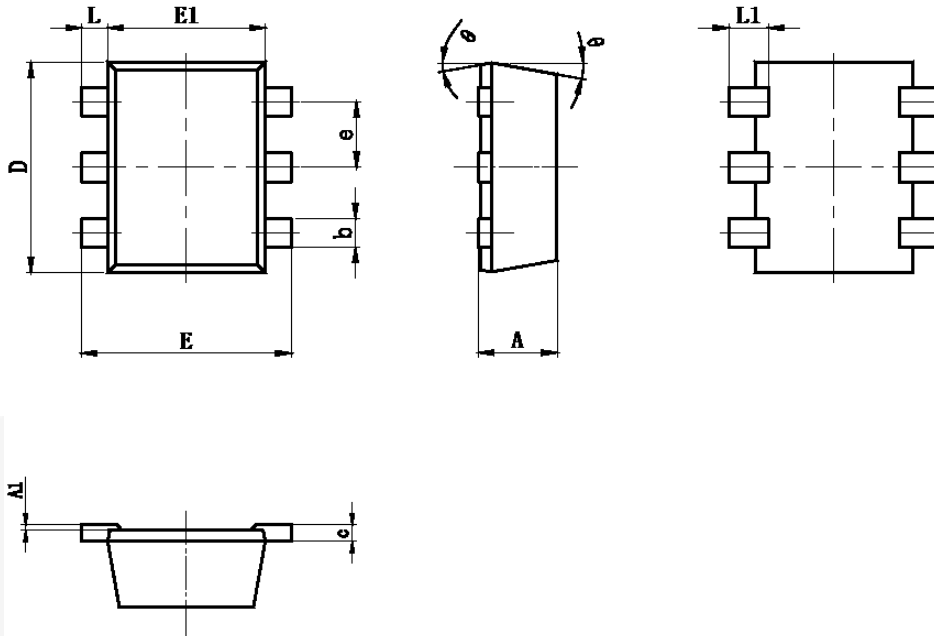
## PCB LAYOUT GUIDE

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

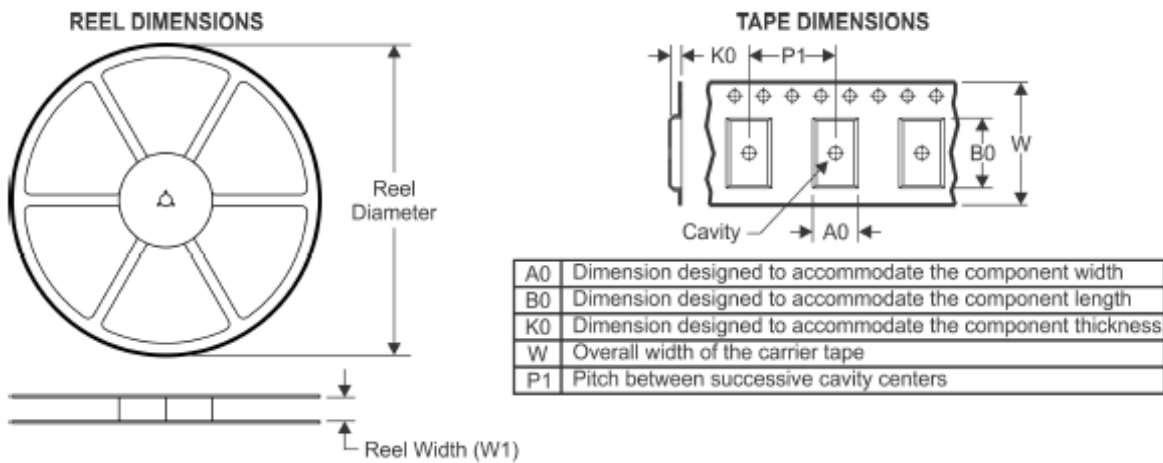
Package: SOT563



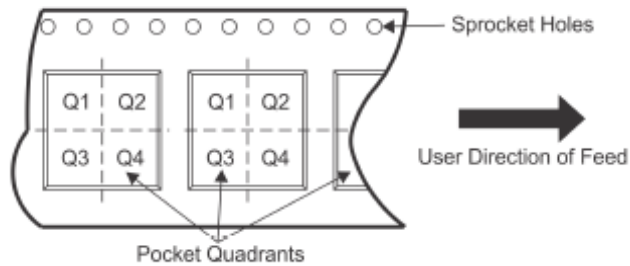
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
e	0.450	0.550	0.018	0.022
c	0.090	0.180	0.004	0.007
D	1.500	1.700	0.059	0.067
b	0.170	0.270	0.007	0.011
E1	1.100	1.300	0.043	0.051
E	1.500	1.700	0.059	0.067
L	0.100	0.300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



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
ETA1667FSG	SOT563	6	5000	178	9.5	1.78	1.78	0.69	4	8	Q3