

35V/3A Synchronous Step-Down Converter in ESOP8

DESCRIPTION

The ETA2808 is a high-efficiency DC-to-DC step-down switching regulator that is capable of delivering up to 3A of output current. The device operates with wide input voltage range from 4.6V to 35V, making it ideal for high voltage USB charging applications.

The ETA2808 uses a constant current mode architecture. It includes constant current(CC)/ constant voltage(CV) output regulation and output load compensation. It also includes external programmable switching frequency for EMI optimization and external adjustable CC current limit setting, making it a perfect solution for car charger application.

ETA2808 is available in ESOP8 package.

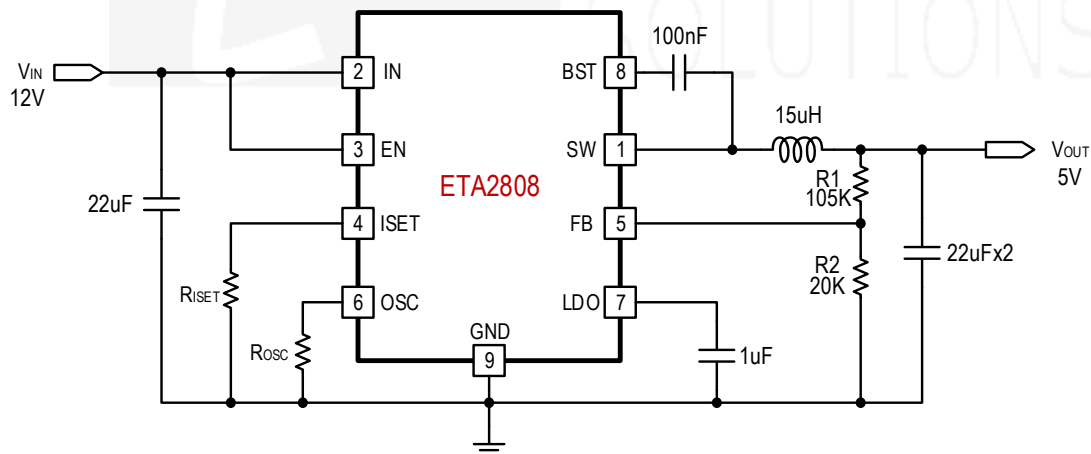
FEATURES

- ◆ Wide Input Voltage Range: 4.6V-35V
- ◆ 40V Input Standoff Voltage
- ◆ High Efficiency PFM Mode at Light Load
- ◆ Capable of Delivering 3A Output Current
- ◆ 100% Duty Cycle
- ◆ Support CC/CV Output
- ◆ Load Compensation Function
- ◆ Adjustable Switching Frequency
- ◆ Adjustable Output Current Limit
- ◆ Current Mode Control
- ◆ Logic Control Shutdown
- ◆ Thermal Shutdown and UVLO
- ◆ Available in ESOP8 Package
- ◆ RoHS Compliant

APPLICATIONS

- ◆ Car Chargers
- ◆ Industrial Applications
- ◆ Automotive Applications

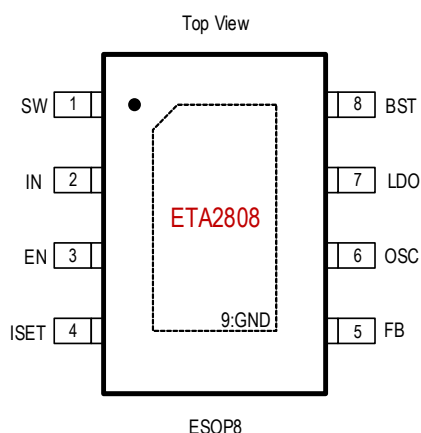
TYPICAL APPLICATION



ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA2808E8A	ESOP-8	ETA2808 YWWXL	4000

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.)

IN Pin Voltage.....	-0.3V to 40V
EN Pin Voltage.....	-0.3V to VIN+0.3V
SW Pin Voltage.....	-0.3V(-3V for 10ns) to VIN+0.3V(49V for 10ns)
BST Voltage.....	-0.3V to SW+6V
FB, LDO, OSC, ISET Pin Voltage.....	-0.3V to 6V
SW Pin to ground 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}
ESOP8.....	10.....50 °C /W
Lead Temperature (Soldering, 10sec)	260°C

ELECTRICAL CHARACTERISTICS

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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range ⁽¹⁾		4.6		35	V
Input UVLO	Rising, Hysteresis=320mV		4.57		V
Input Supply Current	V _{FB} =0.9V, no switching		500		µA
Input Shutdown Current			8		µA
VLDO Internal Voltage			5.3		V
FB Voltage		0.784	0.8	0.816	V
FB Cord Compensation Current ⁽¹⁾	I _{OUT} =2A, I _{CORR} (A)=I _{OUT} (A)/2000000		1		µA
Switching Frequency	R _{OSC} open		250		KHz
	R _{OSC} =68K, F _{OSC} (KHz)=20000/R _{OSC} (KOhm)		300		KHz
	R _{OSC} =0		500		KHz
Switching Frequency Range		120		1100	KHz
OSC Voltage			0.6		V
Maximum Duty Cycle	F _{OSC} =300KHz			100	%
Soft Start Time			300		µs
Short Circuit Hiccup Time ⁽¹⁾	On Time, F _{OSC} =300KHz, V _{FB} =0		6		ms
	Off Time, F _{OSC} =300KHz, V _{FB} =0		300		ms
FB_Hiccup Falling Threshold			32		%V _{FB}
FB_Hiccup Rising Threshold			40		%V _{FB}
FB_OVP Falling Threshold			107		%V _{FB}
FB_OVP Rising Threshold			109		%V _{FB}

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Foldback Frequency	V _{OUT} =0, R _{OSC} =68K		75		KHz
CC Current Limit Threshold	R _{ISET} =50K, I _{CC} (A)=160/R _{ISET} (KOhm)		3.2		A
	R _{ISET} open		3.5		A
	R _{ISET} =0		4.5		A
ISET Pin Voltage	R _{ISET} =50K		0.6		V
High Side Switch On Resistance ⁽¹⁾	I _{SW} =500mA		56		mΩ
Low Side Switch On Resistance ⁽¹⁾	I _{SW} =500mA		29		mΩ
High Side Current Limit ⁽¹⁾			6		A
Low Side Zero Crossing Current ⁽¹⁾			120		mA
EN Logic High Threshold	Rising		1.3		V
EN Logic Low Threshold	Falling		1.1		V
EN Pull Up Current	V _{EN} =0		1		μA
Thermal Shutdown ⁽²⁾			150		°C
Thermal Shutdown Hysteresis ⁽²⁾			20		°C

Notes:

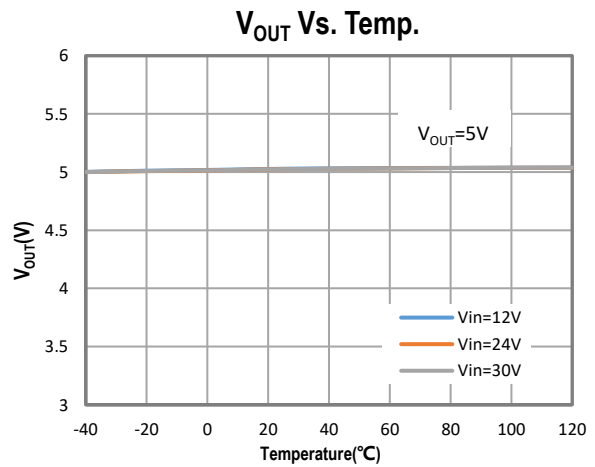
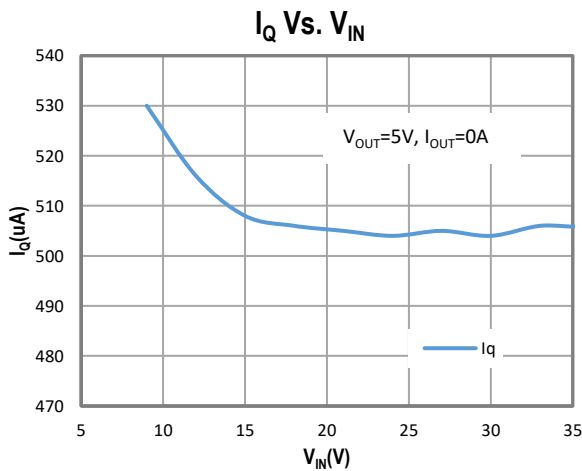
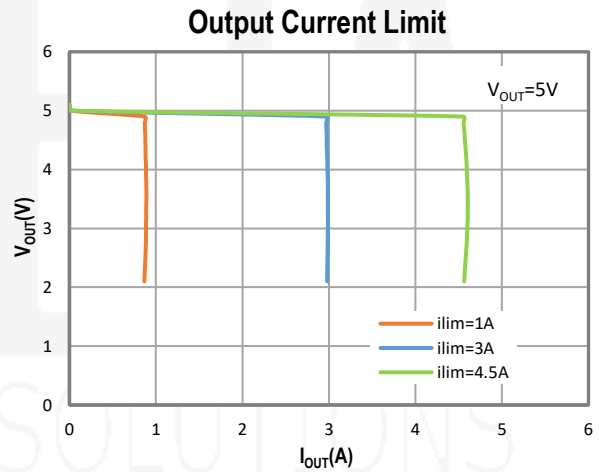
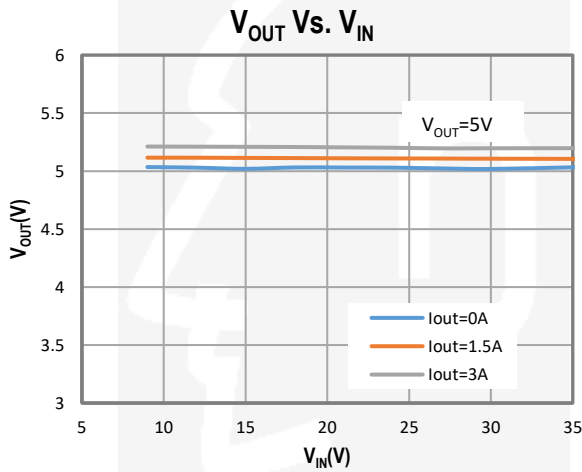
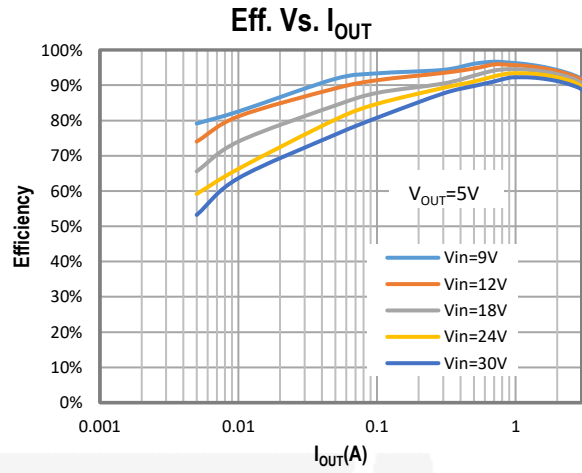
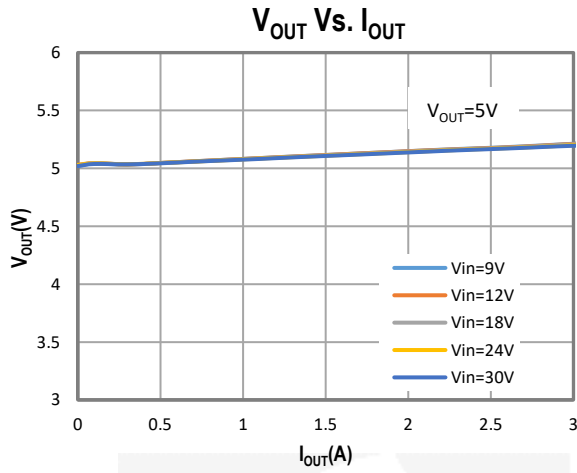
- 1) Guaranteed by Design
- 2) Guaranteed by Engineering Characterization

PIN DESCRIPTION

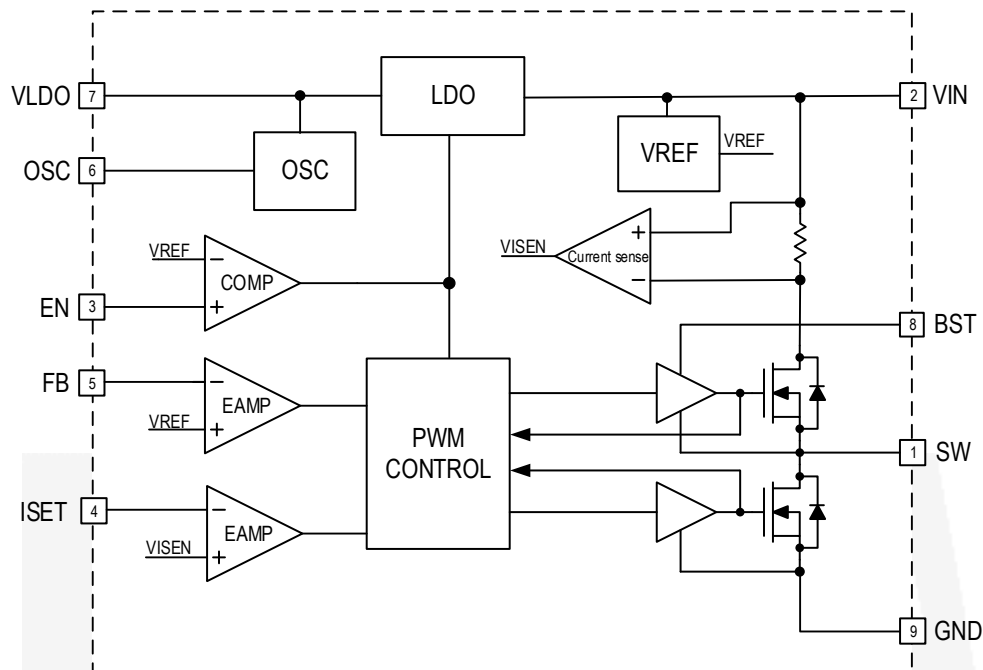
PIN #	NAME	DESCRIPTION
1	SW	Inductor connection. Connect an inductor between SW and the regulator output.
2	IN	Supply voltage. Bypass with a 22μF ceramic capacitor to GND.
3	EN	Enable pin for the IC. Drive this pin high to enable the IC, low to disable.
4	ISET	External current limit setting pin. Connect a resistor at this pin to GND to set the output current limit: $I_{CC} = \frac{160}{R_{ISET}(KOhm)} (A)$
5	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V _{OUT} .
6	OSC	External switching frequency setting pin. Connect a resistor at this pin to GND to set the switching frequency: $F_{osc} = \frac{20000}{R_{osc}(KOhm)} (KHz)$
7	LDO	Power supply pin for internal circuit. Bypass with a 1uF ceramic capacitor to GND.
8	BST	Bootstrap pin. Connect a 100nF capacitor from this pin to SW.
Exposed Pad	GND	Ground pin.

TYPICAL CHARACTERISTICS

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



FUNCTIONAL BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The 2808 is a wide input range, high-efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 3A of output current, integrated with a 56mΩ high side MOSFET. It uses a PWM current-mode control scheme. An error amplifier integrates the error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

Light Load Operation

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFET, power is lost due to the finite $R_{ds(on)}$ of the MOSFET and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ETA2808 goes into a power save mode during light load, thereby extending the range of high efficiency operation.

Enable

EN is a digital control pin that turns the ETA2808 on and off. Drive EN High to turn on the regulator, drive it Low to turn it off. Connecting the EN pin through a pull up resistor or shorted EN to IN will automatically turn on the chip whenever plug in IN.

CC Current Setting

We can set the CC current for ETA2808 by connecting a resistor from ISET pin to GND, the CC current is determined by the equation below.

$$I_{CC} = \frac{160}{R_{ISET}(\text{KOhm})} (\text{A})$$

If R_{ISET} is bigger than 300K or float the ISET pin, it will work with internal current setting, which is 3.5A. If R_{ISET} is smaller than 30K, the CC current will be 4.5A. If $30\text{K} < R_{ISET} < 300\text{K}$, the CC current can be set by the equation.

External Frequency Setting

We can set the switching frequency for ETA2808 by connecting a resistor from OSC pin to GND, the frequency is determined by the equation below.

$$F_{osc} = \frac{20000}{R_{osc}(KOhm)} (KHz)$$

If R_{osc} is bigger than 170K or float the OSC pin, it will work with internal frequency setting, which is 250KHz. If R_{osc} is smaller than 15K, the frequency will be 500KHz. If $15K < R_{osc} < 170K$, the frequency can be set by the equation.

External Output Voltage Setting

The output voltage of the ETA2808 regulator can be programmed by using an external resistor divider. The output voltage is calculated by the equation below.

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

Where: $V_{REF} = 0.8$ typically (the internal reference voltage)

R_2 has to be between 10KOhm to 100KOhm and thus R_1 is calculated by the following equation.

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

Cord Compensation Function

ETA2808 has a cord compensation feature to compensate the voltage drop due to cord resistance. The sink current at FB pin for cord compensation is I_{CORD} when output current is I_{OUT} .

The output voltage is calculated by the equation below.

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

The V_{CORD_COMP} can be calculated by the equation below.

$$I_{CORD} = \frac{I_{OUT}(A)}{2000000} (A), V_{CORD_COMP} = I_{CORD} \times R_1 (Ohm)$$

Over Current Protection and Hiccup

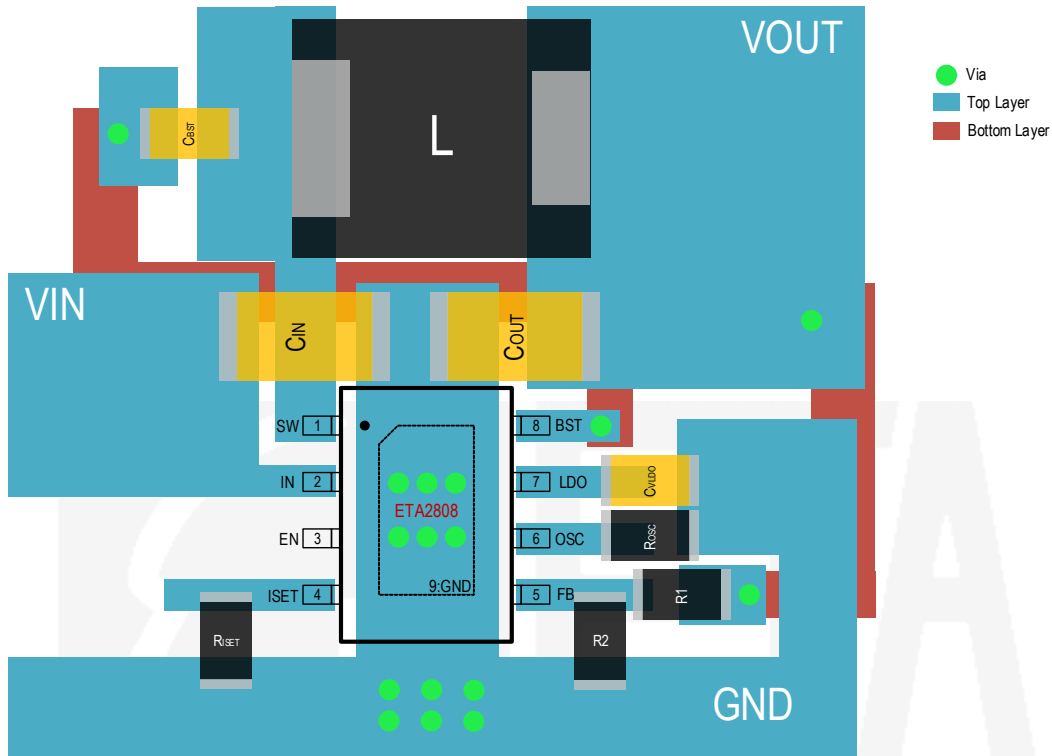
ETA2808 has a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UV threshold (0.3V), the ETA2808 will enter hiccup mode. It will turn off the chip immediately for 300mS. After that, it will try to re-starts as normal for 6mS. After 6mS, 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 130°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.

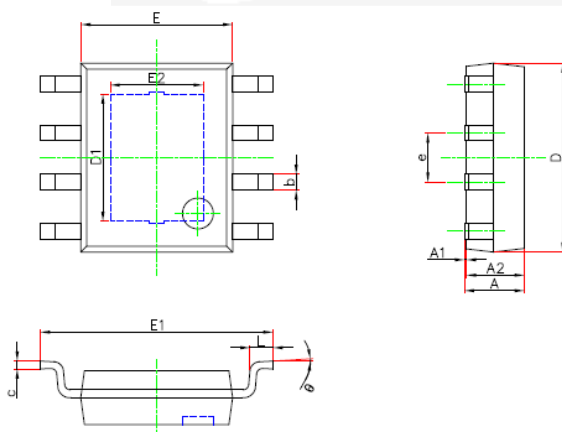
PCB GUIDELINES

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; C_{IN} is always placed nearest to V_{IN} and GND



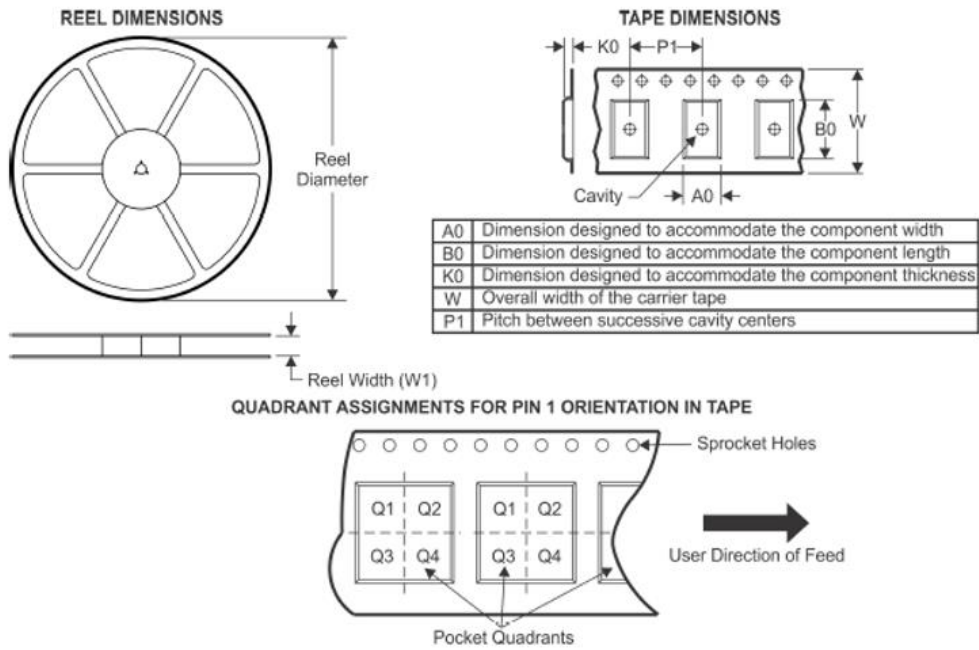
PACKAGE OUTLINE

Package: ESOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.300	1.700	0.051	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°		8°	

TAPE AND REEL INFORMATION



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA2808E8A	ESOP8	8	4000	330	12.7	6.6	5.4	2.05	8	12	Q1