■ INTRODUCTION:

The CE6370 is designed for single-cell or dual-cell or triangle-cell alkaline, NiMH, or NiCd or single-cell lithium-ion battery powered application. It is a high efficiency boost converter with 600mV feedback voltage. A switching frequency of 1.0MHz minimizes solution footprint by allowing the use of tiny low profile inductors and ceramic capacitors. The current mode PWM design is internally compensated, and the device has a 0.9V start-up voltage with operation down to 0.65V. The CE6370 is rated over the -40°C to +85°C temperature range.

■ FEATURES:

- V_{IN} Operation Range: 0.65V to 6.0V
- 600mV Feedback Voltage
- Output Current 1.4A@VIN≧3.0V
- Up to 90% Efficiency
- Low Start-Up Voltage: 0.9V@Io=1mA
- Low Hold Voltage: 0.75V@Io=1mA
- 1.0MHz Fixed Switching Frequency
- PWM/PFM Auto Switching Maintains High Efficiency
- Over-Thermal and Over-Current Protection
- Low Shutdown Current: <1.0μA
- -40°C to +85°C Temperature Range

■ APPLICATIONS：

- Solar Battery Charger
- White LED Torch
- Backup Battery Charger
- Boost Application

■ ORDER INFORMATION:

CE6370①②③④

DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Standard, No Enable
	C	With Enable
②③	Integer	Output Voltage e.g.5.0V=②:5, ③:0 Adj=②:, ③:
④	M	Package：SOT-23-5
	E/EA	Package：SOT-23-6
	P	Package：SOT-89-3/5
	G	Package：SOT-223
	SM	Package：MSOP8
	ES	Package：SOP8-PP
	D	Package：DFN33-10

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■ **PIN CONFIGURATION:**
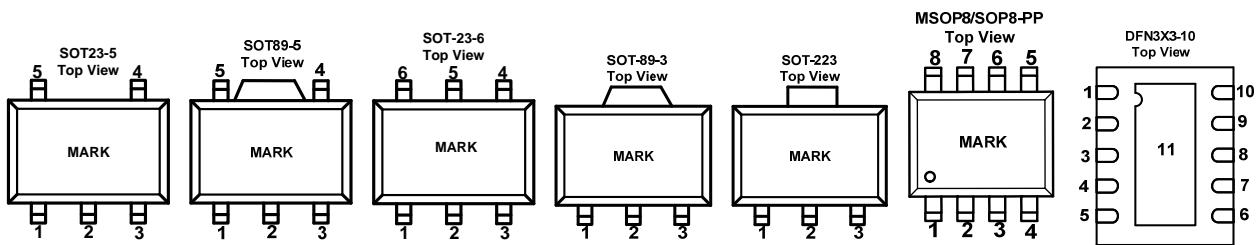
SOT23-5/SOT89-5

PIN NUMBER		PIN NAME	FUNCTION
SOT23-5	SOT89-5		
1	3	SW	Switch Pin. Connect inductor between SW and VIN
2	2	GND	Signal and Power Ground
3	1	FB	Feedback Input
4	5	CE	Chip Enable. High Active
5	4	VOUT	Chip Supply Voltage

SOT23-6

PIN NUMBER	PIN NAME		FUNCTION
	E	EA	
1	SW	SW	Switch Pin. Connect inductor between SW and VIN
2	GND	GND	Signal and Power Ground
3	FB	FB	Feedback Input
4	CE	——	Chip Enable. High Active
	——	NC	Not Connect
5	VOUT	VOUT	Chip Supply Voltage
6	NC	——	Not Connect
	——	VIN	Input Voltage

SOT89-3/SOT223

| PIN NUMBER	PIN NAME	FUNCTION
1	VOUT	Chip Supply Voltage and Feedback Input
2	GND	Signal and Power Ground
3	SW	Switch Pin. Connect inductor between SW and VIN

MSOP8/SOP8-PP

PIN NUMBER		PIN NAME	FUNCTION
MSOP8	SOP8-PP		
1/7/8	3/7	NC	Not Connect
2	2	FB	Feedback Input
3	8	CE	Chip Enable. High Active
4	1/5	GND	Signal and Power Ground
5	4	SW	Switch Pin. Connect inductor between SW and VIN
6	6	VOUT	Chip Supply Voltage

DFN3X3-10

PIN NUMBER	PIN NAME	FUNCTION
1/3/6/8/10	NC	Not Connect
2	FB	Feedback Input
4/5	SW	Switch Pin. Connect inductor between SW and VIN
7	VOUT	Chip Supply Voltage
9	CE	Chip Enable. High Active
11	GND	Signal and Power Ground

■ **BLOCK DIAGRAM**
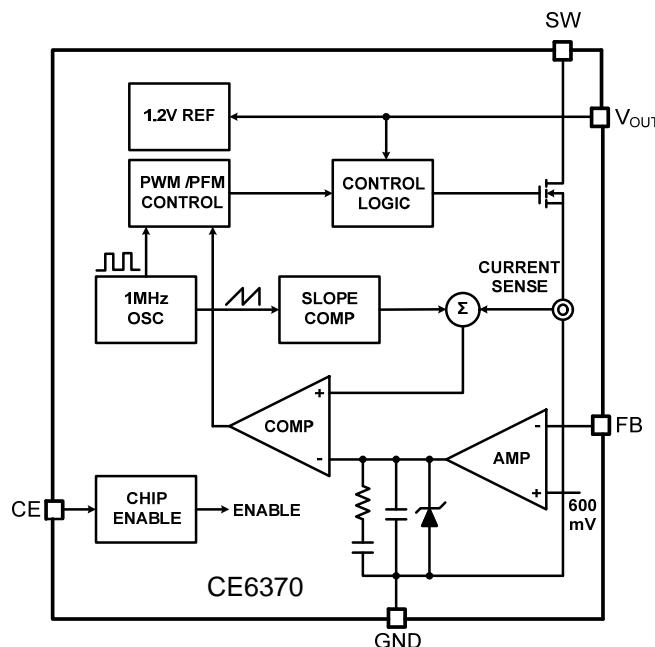
■ **ABSOLUTE MAXIMUM RATINGS**

(Unless otherwise specified, Ta=25°C)

PARAMETER		SYMBOL	RATINGS	UNITS
Voltage Output		V_{OUT}	$V_{SS}-0.3{\sim}V_{SS}+7$	V
CE,SW,FB,V_{OUT} Voltage			$V_{SS}-0.3{\sim}V_{OUT}+0.3$	V
Peak SW Sink and Source Current		I_{SWMAX}	3000	mA
Power Dissipation	SOT-23-5/6	P_d	300	mW
	SOT89-3/5	P_d	500	mW
	SOT-223	P_d	800	mW
	MSOP8	P_d	500	mW
	SOP8-PP	P_d	1000	mW
Operating Temperature		T_{opr}	-40~+85	℃
Junction Temperature		T_j	125	℃
Storage Temperature		T_{stg}	-40~+125	℃
Soldering Temperature & Time		T_{solder}	260℃, 10s	

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ELECTRICAL CHARACTERISTICS

CE6370 (V_{IN}= 3.6V, Ta=25℃, Test Circuit Figure1, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Feedback Voltage	V_{FB}		588	600	612	mV
Minimum Start-Up Voltage	V_{START}	V_{IN}:0V→3V, I_o =1mA		0.9		V
Minimum Hold Voltage	V_{HOLD}	V_{IN}:3V→0V, I_o =1mA		0.75		V
Minimum Operating Voltage	V_{IN}			0.65		V
Quiescent Current	I_{CC}	Measured On V_{OUT},V_{FB}=750mV, V_{OUT}=5.0V		130	300	µA
Max Duty Cycle		V_{FB} = GND	80	87		%
Oscillator Frequency	f_{osc}			1.0		MHz
NMOS Current Limit	I_{PK}			3.0		A
Switch On Resistance				70		mΩ
NMOS Switch Leakage		V_{CE}=0,V_{SW}=5.0V		±0.01	±1	µA
CE "High" Voltage[1]	$V_{CE“H”}$		1.0		V_{IN}	V
CE "Low" Voltage[2]	$V_{CE“L”}$				0.4	V
CE Leakage Current	I_{CE}	V_{CE}=5.0V		±0.1	±1	µA
Over Thermal Shutdown				140		℃
Over Thermal Hysteresis				20		℃

NOTE :

1. High Voltage：Forcing CE above 1.0V enables the part.

2. Low Voltage：Forcing CE below 0.4V shuts down the device. In shutdown, all functions are disabled drawing <1µA supply current. Do not leave CE floating.

■ **TYPICAL APPLICATION CIRCUITS**
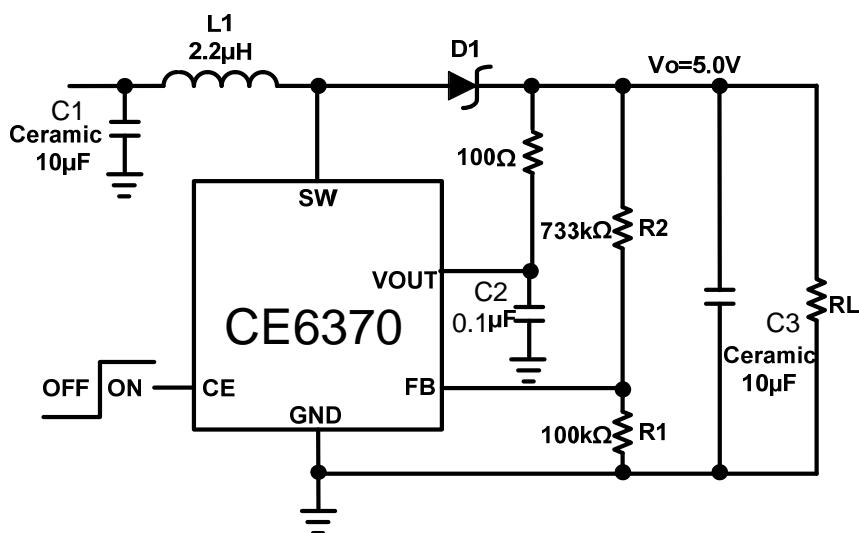
Figure1 Standard Application Circuit

■ TYPICAL PERFORMANCE CHARACTERISTICS
(V_{IN}=3.6,Ta=25℃，Test Figure1 above unless otherwise specified)

INPUT CURRENT vs. INPUT VOLTAGE
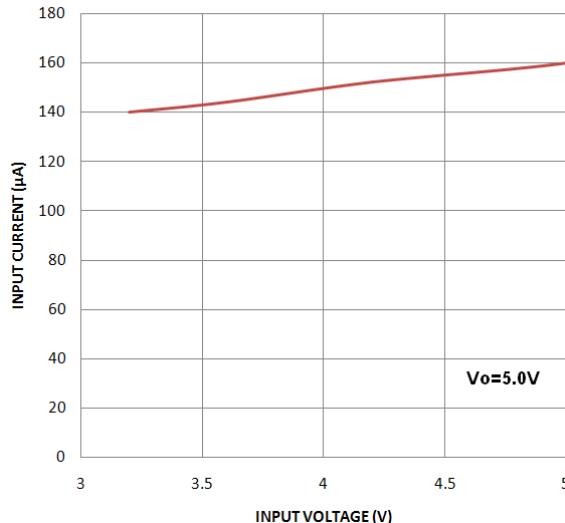
EFFICIENCY vs. OUTPUT CURRENT
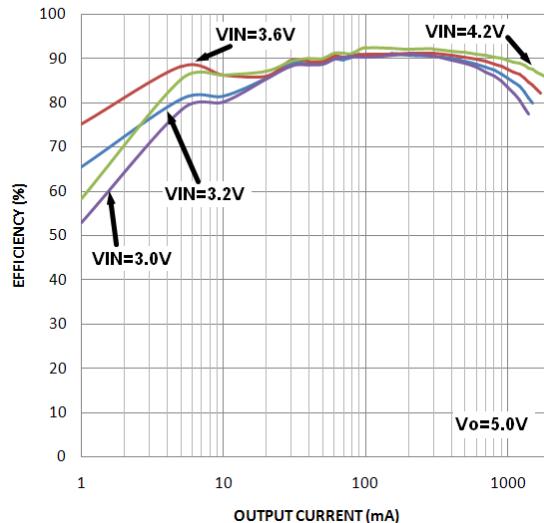
■ OPERATION

The CE6370 boost regulator is targeted for single-cell or dual-cell or triangle-cell alkaline, NiMH, and NiCd and single-cell lithium-ion battery applications. It has a 0.9V typical start-up voltage with operation after start-up to less than 0.65V. It can provide 1.4A output current when input voltage is larger than 3.0V.

The high 1.0MHz switching frequency of the CE6370 facilitates output filter component size reduction for improved power density and reduced overall footprint. It also provides greater bandwidth and improved transient response over other lower frequency step-up converters. With its low R_{DS}(ON) and 600mV feedback Voltage, the devices attain up to 90% efficiency.

SLOPE COMPENSATION

Slope compensation provides stability in constant frequency architecture by preventing sub-harmonic oscillations at high duty cycles. It is accomplished internally by adding a compensating ramp to the inductor current signal at duty cycles in excess of 50%. This slope compensated current mode PWM control provides stable switching and cycle-by-cycle current limit for excellent load and line response.

CURRENT SENSING

A signal representing NMOS switch current is summed with the slope compensator. The summed signal is compared to the error amplifier output to provide a peak current control command for the PWM. Peak switch current is limited to approximately 3A independent of input or output voltage. The current signal is blanked for 40ns to enhance noise rejection.

PWM/PFM AUTO SWITCHING

The CE6370 offers PWM/PFM automatic switching operation. The PWM operation is shifted to the PFM operation automatically at light load so that it maintains high efficiency over a wide range of load currents.

■ **APPLICATION   INFORMATION**

The basic CE6370 application circuits are shown in Figure 1. External component selection is driven by the load requirement and begins with the selection of L followed by C_{IN} and C_{OUT}.

OUTPUT AND INPUT CAPACITOR SELECTION

Surface mount X5R or X7R ceramic capacitors are suggested for both the output and the input. For the output capacitor (C2 in Figure 1) a 10µF, 10V, X5R ceramic capacitor is necessary for stability, transient response, and ripple performance.

The same 0805 sized capacitor is used for the input (C1 of Figure 1). If desired, a smaller, 0603 sized, 10µF, 6.3V, X5R ceramic capacitor can be substituted for the input capacitor (C1).

INDUCTOR SELECTION

The CE6370 is designed to operate with a 2.2µH inductor for all input/output voltage combinations. The inductor saturation current rating should be greater than the NMOS current limit specification listed in the Electrical Characteristics table. If necessary, the peak inductor current can exceed the saturation level by a small amount with no significant effect on performance.

Different core materials and shapes will change the size/current and price/current relationship of an inductor. The choice of which style inductor to use often depends more on the price vs. size requirements and any radiated field/EMI requirements than on what the CE6370 requires to operate. Table 7 shows some typical surface mount inductors that work well in CE6370 applications.

Table 7.Representative Surface Mount Inductors

PART NUMBER	VALUE (µH)	MAX DCR (mΩ)	MAX DC CURRENT (A)	SIZE W×L×H (mm^3)
Sumida CDRH 3D16	2.2	75	1.20	3.8×3.8×1.8
	3.3	110	1.10	
	4.7	162	0.90	
Sumida CR43	2.2	71.2	1.75	4.5×4.0×3.5
	3.3	86.2	1.44	
	4.7	108	1.15	
Sumida CDRH 4D18	2.2	75	1.32	4.7×4.7×2.0
	3.3	110	1.04	
	4.7	162	0.84	

OUTPUT DIODE

Use a schottky diode such as an MBR0520L, PMEG2010EA, 1N5819 or equivalent with rated current over 3A. Do not use ordinary rectifier diodes, since the slow recovery times will compromise efficiency.

PCB LAYOUT GUIDANCE

When laying out the printed circuit board, the following suggestions should be taken to ensure proper operation of the CE6370. These items are also illustrated graphically in Figure 2.

The power traces, including the GND trace, the SW trace and the V_{IN} trace should be kept short, direct and wide to allow large current flow. Put enough multiply-layer pads when they need to change the trace layer. Keep the switching node, SW, away from the sensitive FB node.

1. The FB pin should directly connect to the feedback resistors. The divider LED/R1 must be connected between the (+) plate of C_{OUT} and ground.

2. Connect the (+) plate of C_{IN} to the V_{IN} pin as

closely as possible.

3. Keep the (-) plate of C_{IN} and C_{OUT} as close as

possible.
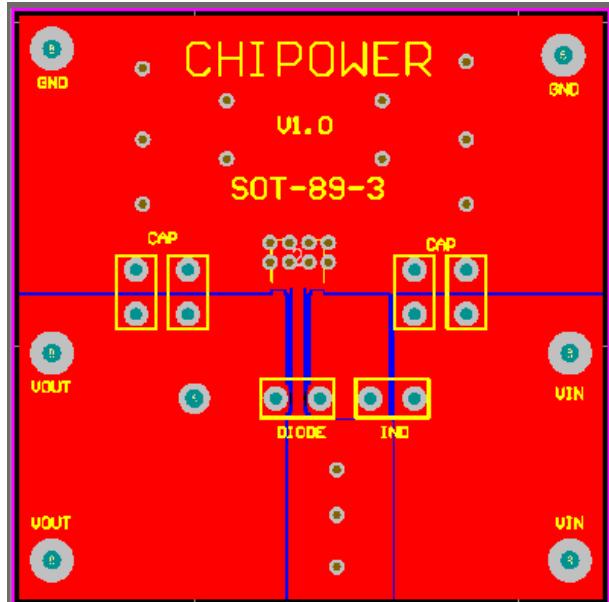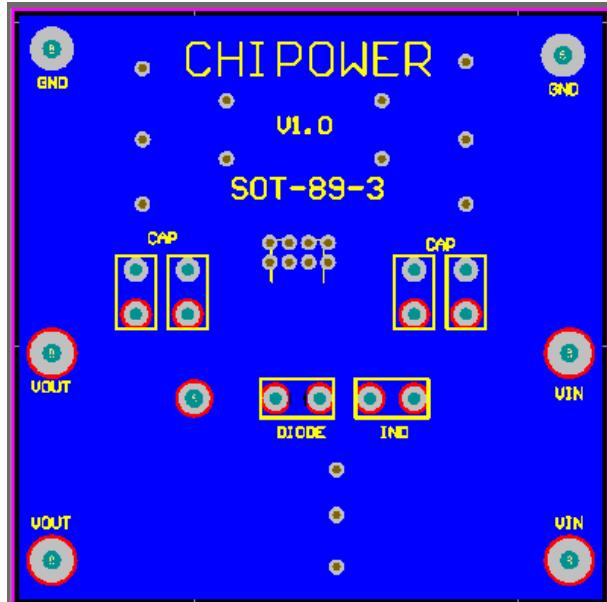

| Top View | Bottom View |

Figure 2 PCB Layout

■ **PACKAGING INFORMATION**

■ **SOT-23-5L Package Outline Dimensions**

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°

● **SOT89-5   Package Outline Dimensions**
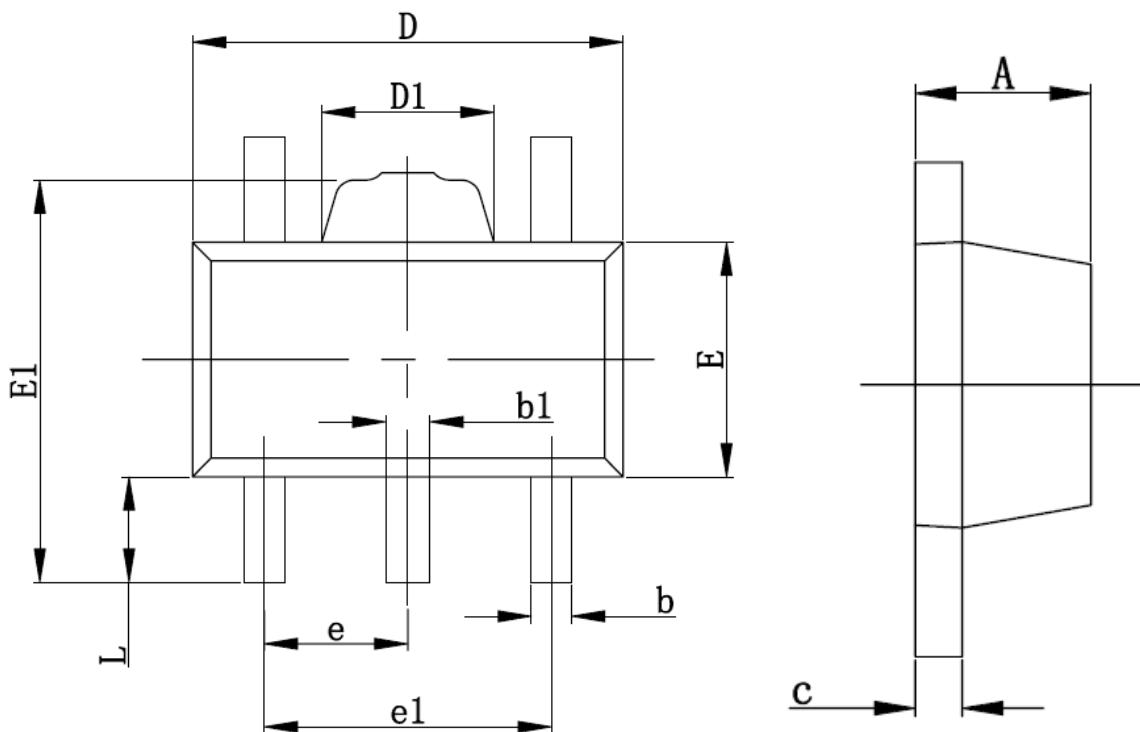
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0. 440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.200	0.035	0.047

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- **SOT-23-6L Package Outline Dimensions**

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°

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● **SOT89-3 Package Outline Dimensions**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0. 440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550REF		0.061REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	3.000TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

● **SOT223　Package Outline Dimensions**
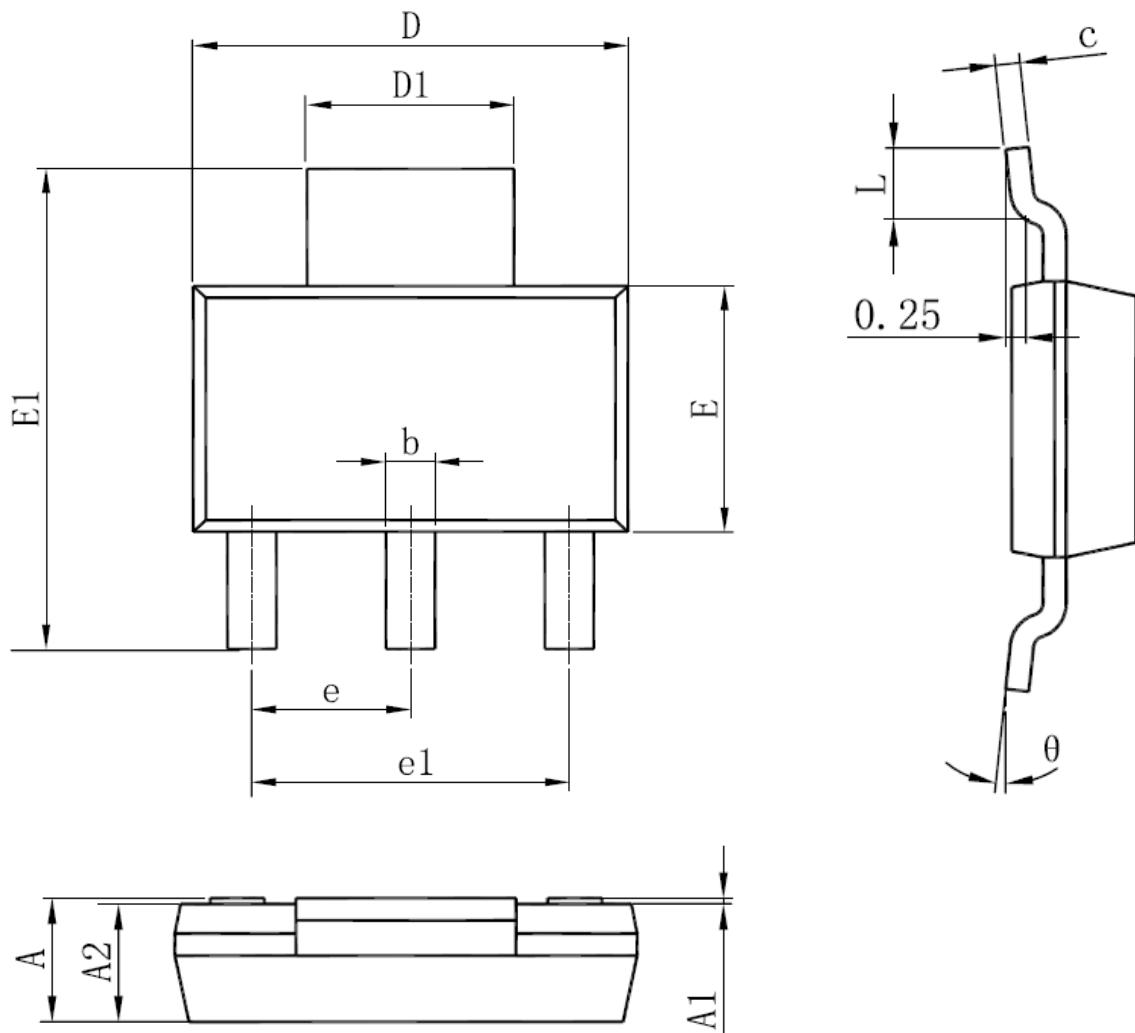
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0. 350	0.010	0.014
D	6.200	6.400	0.244	0.252
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BST)		0.091(BST)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0	10°	0	10°

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● **MSOP8 Package Outline Dimensions**
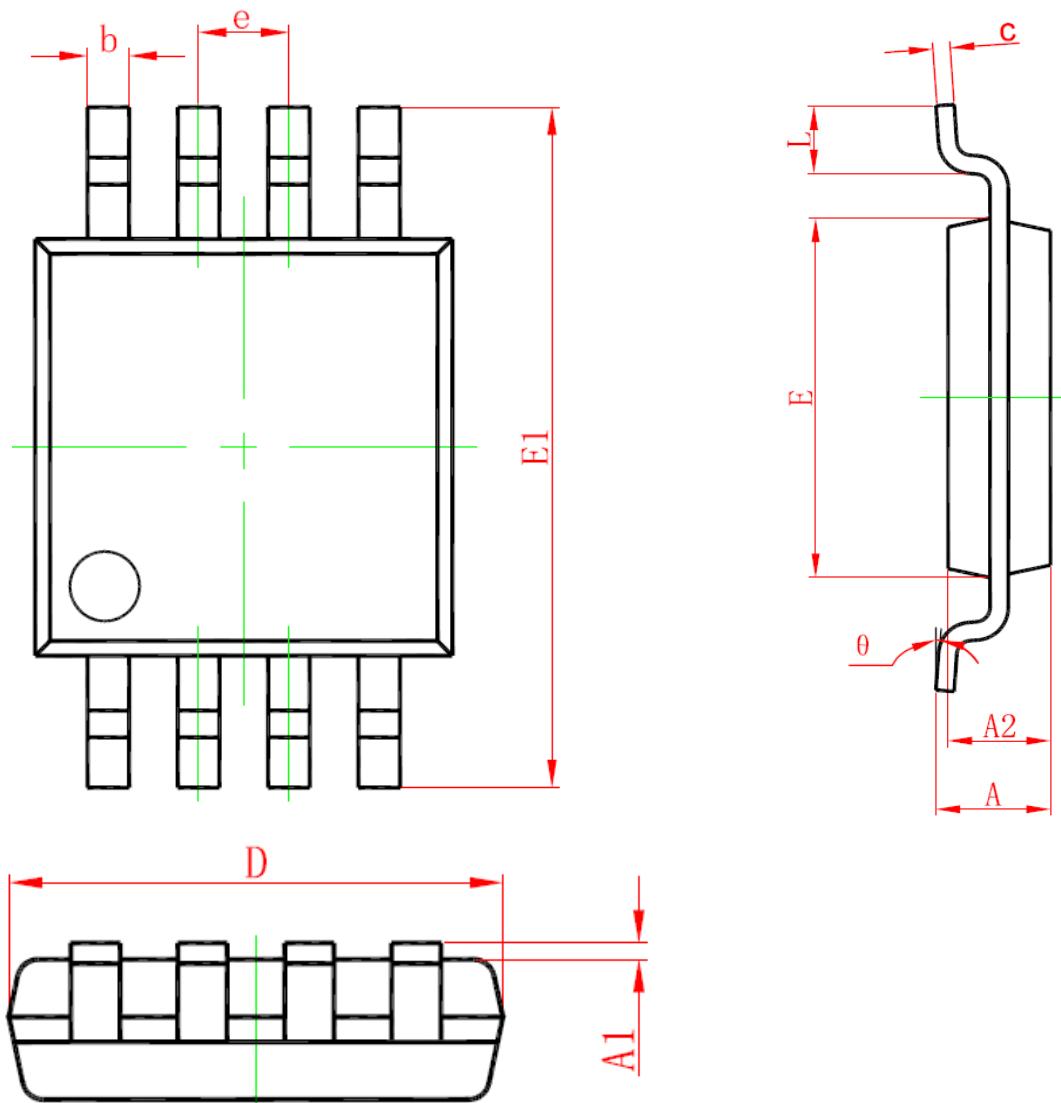
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0. 230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

● **SOP8-PP   Package Outline Dimensions**
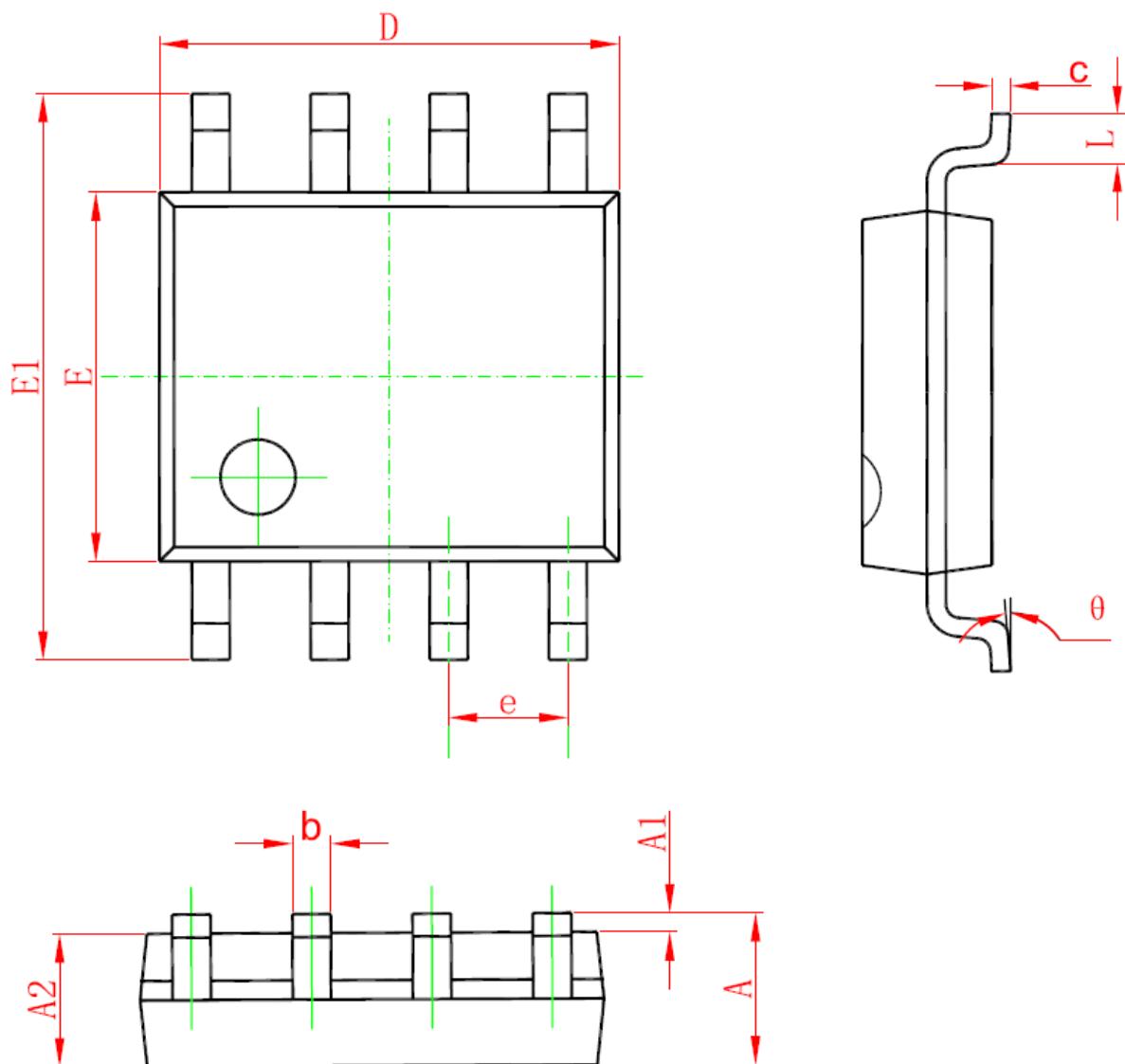
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0. 250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

● **DFN3x3-10   Package Outline Dimensions**
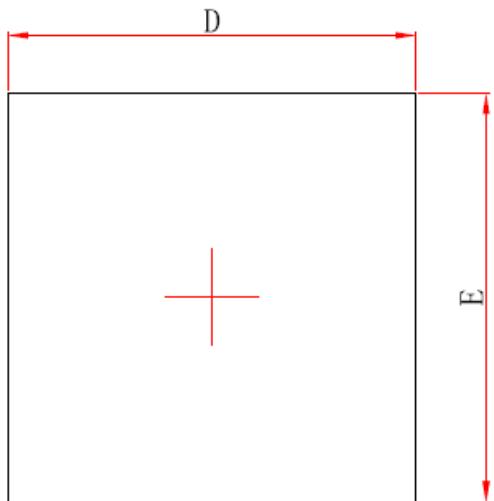
Top View
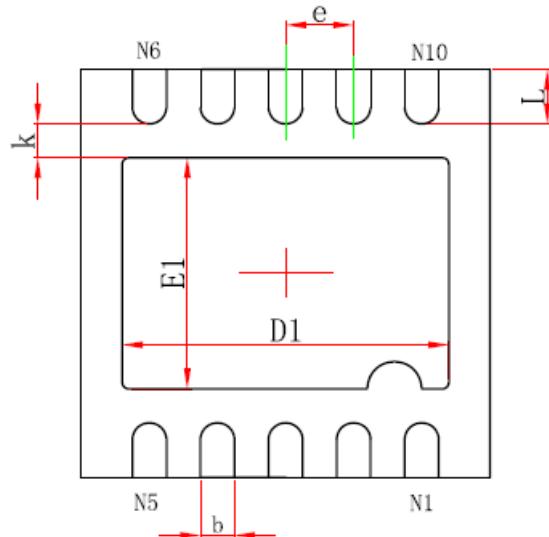
Bottom View
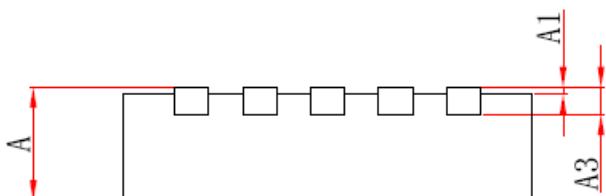
Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF		0.008REF	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN		0.008MIN	
b	0.180	0.300	0.007	0.012
e	0.500TYP		0.020TYP	
L	0.300	0.500	0.012	0.020