

# GS5421

## 28V, 2A, Forced PWM Synchronous Step-Down Converter

### Product Description

The GS5421 is a high-frequency, Synchronous, Rectified, Step down, Switch-mode converter with internal power MOSFETs. It offers a very compact solution to achieve a 2A continuous output current over a wide input supply range, with excellent load and line regulator.

The GS5421 has synchronous-mode operation for higher efficiency over the output current-load range. Current-mode operation provides fast transient response and eases loop stabilization. Protection features include over-current protection and over-temperature protection .

The GS5421 requires a minimal number of readily available, standard external components and is available in space-saving SOT23-6L package.

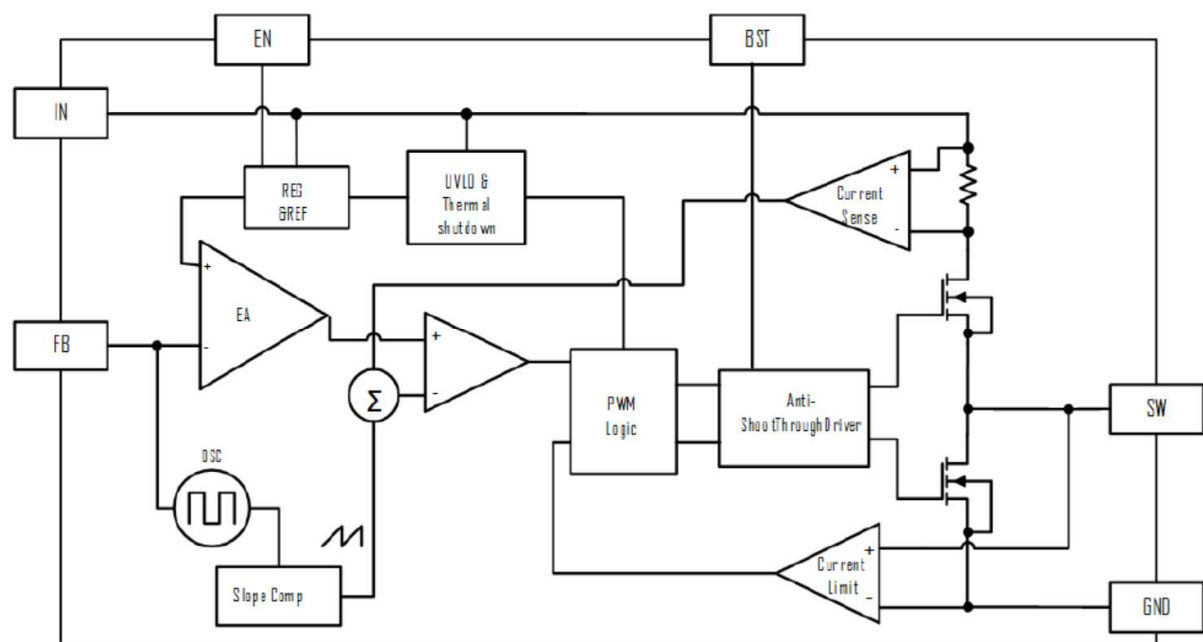
### Features

- Wide 4.2V-to-28V Operating Input Range
- Forced PWM Control
- 1MHz Switching Frequency.
- Capable of Delivering 2A
- No External Compensation Needed
- Current Mode Control
- Thermal Shutdown and UVLO
- Excellent Load and Line Transient Response
- Available in SOT23-6L Package

### Applications

- Surveillance Camera
- LCD TV
- Portable Devices
- Set Top Boxes

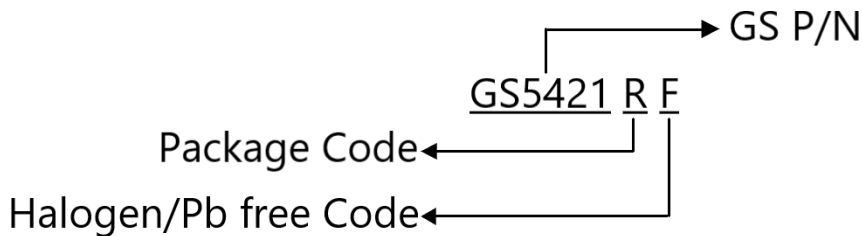
### Functional Block Diagram



## Packages & Pin Assignments

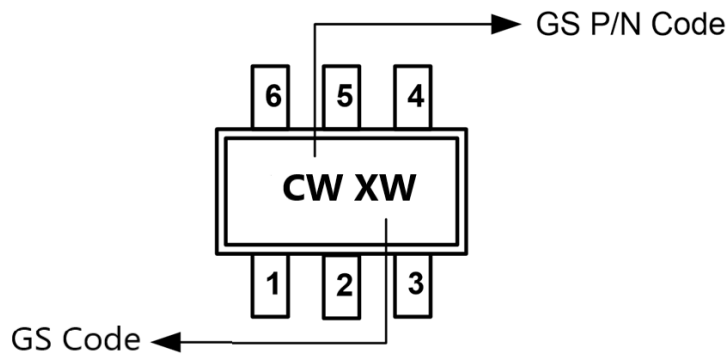
GS5421RF (SOT23-6L)	
<p style="text-align: center;">(Top View)</p>	
Pin Name	Description
GND	System Ground. Reference ground of the regulated output voltage, requires extra care during PCB layout.
SW	Switch Output. Connect using wide a PCB trace.
V <sub>IN</sub>	Supply Voltage. The GS5421 operates from a 4.2V to 28V input rail.
FB	Feedback Voltage.
EN	Enable pin for the IC. Drive this pin high to enable the part, Low to disable.
BS	Bootstrap pin. Connect a 10nF capacitor form this pin to SW.

## Ordering Information



Part Number	Package	Quantity
GS5421RF	SOT23-6L	3000 PCS

## Marking Information



## Absolute Maximum Rating

Symbol	Parameter	Maximum	Unit	
$V_{IN}, V_{EN}, V_{SW}$	Input , Enable and SW Pin Voltage	-0.3 to 30	V	
$V_{BS}$	Boost Pin Voltage	-0.3 to $V_{SW}+6$	V	
$V_{FB}$	Feedback Pin Voltage	-0.3 to 6	V	
$T_A$	Operating temperature Range	-40 to 85	°C	
$T_{STG}$	Storage temperature Range	-55 to 150	°C	
$T_{LEAD}$	Lead temperature (Soldering 10S)	260	°C	
ESD	HBM (Human Body Mode)	2000	V	
	MM (Machine Mode)	200	V	
$\theta_{JA}$	Thermal Resistance Junction to Ambient	SOT23-6L	180	°C/W

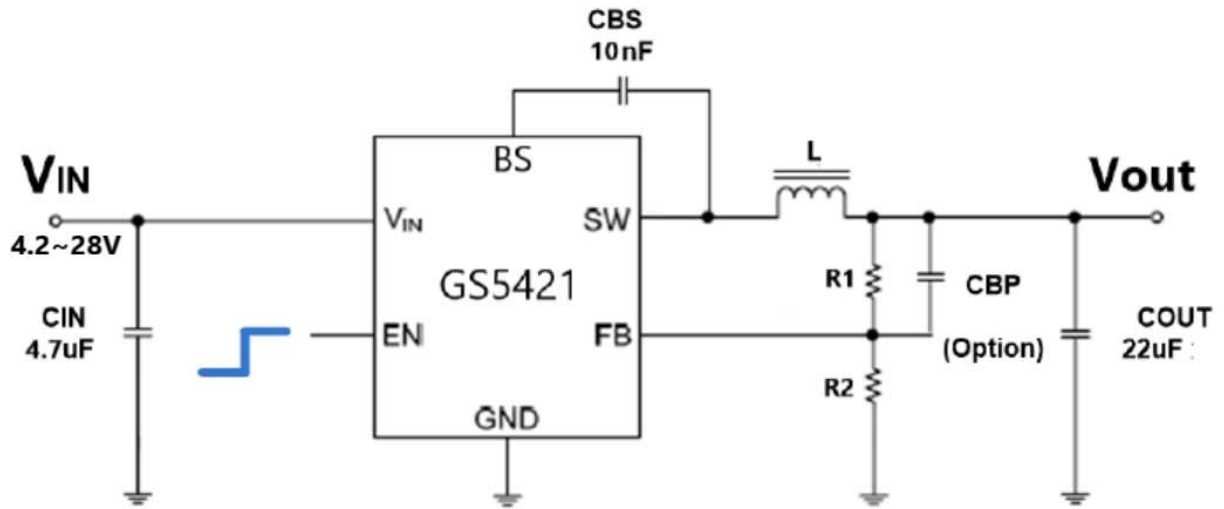
(Note : Exceeding these limits may damage the device. Exposure to absolute maximum ratings conditions for long periods may affect device reliability.)

## Electrical Characteristics

(Typical values  $V_{IN}=12V$ ,  $V_{OUT}=3.3V$  with typical  $T_A=25^\circ C$ , unless otherwise specified)

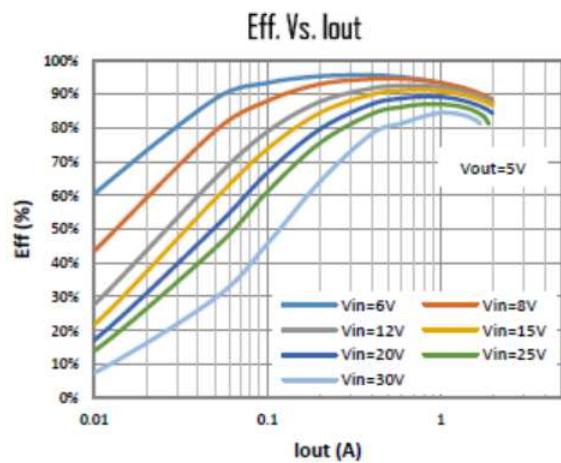
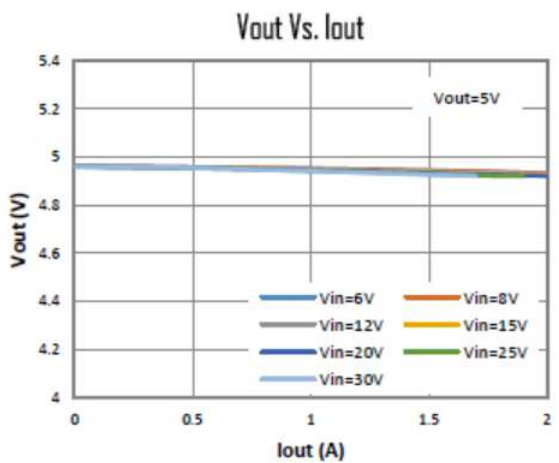
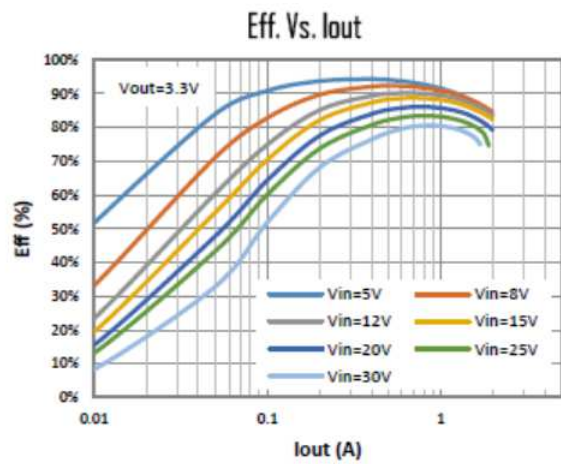
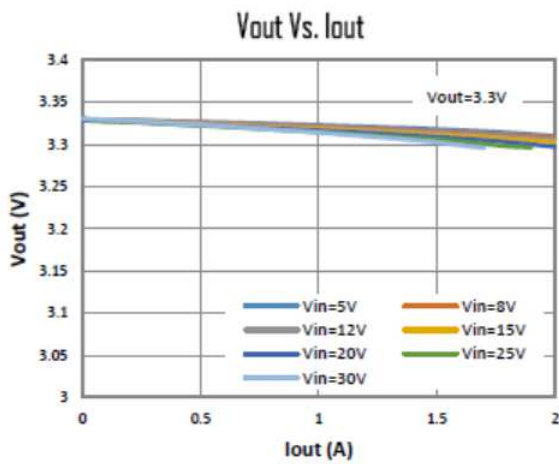
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{IN}$	Input Voltage Range	-	4.2	-	28	V
$V_{UVLO}$	UVLO Threshold	Rising, Hysteresis=340mV	-	4.2	-	V
$I_Q$	Supply Current	$V_{in}=12V$ , $V_{FB}=0.85V$ , $I_{out}=0A$ , No Switching	-	750	-	$\mu A$
$I_{SHDN}$	Shutdown Current	-	-	7	14	$\mu A$
$V_{FB}$	Feedback Voltage	-	0.784	0.8	0.816	V
$V_{FBH}$	FB Hiccup Threshold	-	-	0.2	-	V
$I_{FB}$	Feedback Current	-	-	0	1	$\mu A$
$R_{DS(ON)H}$	High-Side Switch on Resistance	-	-	160	-	m $\Omega$
$R_{DS(ON)L}$	Low-Side Switch on Resistance	-	-	95	-	m $\Omega$
$T_{SCH}$	Short Circuit Hiccup Time	On time	-	2	-	mS
		Off time	-	6	-	mS
$I_{SW}$	Switch Leakage Current	$V_{in}=V_{sw}=12V$	-	-	20	$\mu A$
$F_{OSC}$	Oscillation Frequency	-	-	1000	-	KHz
$I_{LIMIT}$	High-Side Current Limit	-	-	3.5	-	A
$D_{MAX}$	Maximum Duty Cycle	-	-	99	-	%
$V_{ENH}$	EN Rising Threshold	-	1.48	1.58	1.68	V
$V_{ENL}$	EN Falling Threshold	-	1.315	1.4	1.485	V
$I_{EN}$	EN Input Current	$V_{EN}=2V$	-	1	-	$\mu A$
$T_{SD}$	Thermal Shutdown	Rising, Hysteresis=40°C	-	150	-	°C

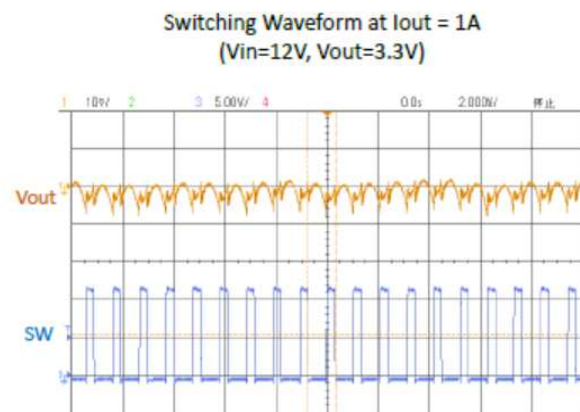
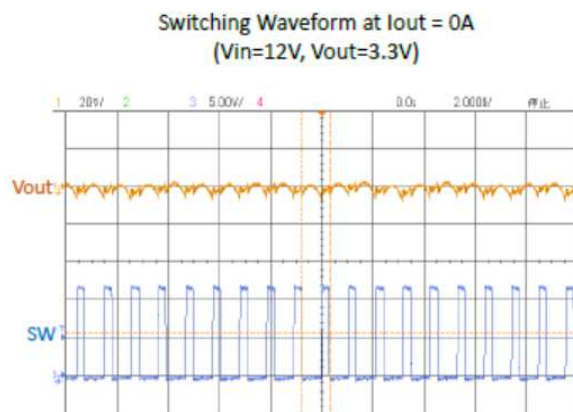
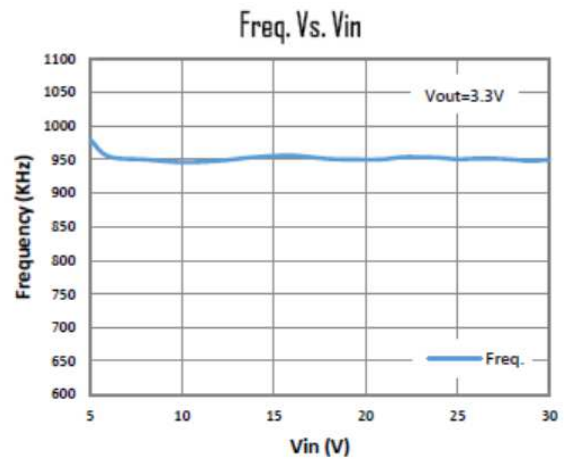
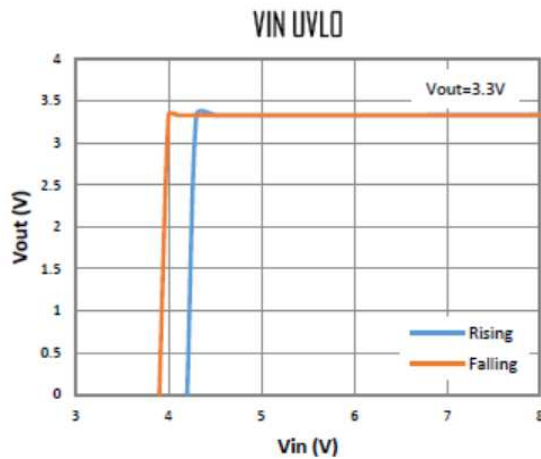
## Typical Application Circuit



## Typical Characteristics

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





## Function Description

The GS5421 is a wide input range, high efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current, integrated with a 160mΩ high side and 95mΩ low side MOSFET. It uses PWM current-mode control scheme. An error amplifier integrates 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 MOSFET to achieve regulation for output voltage.

## Forced PWM Operation

A forced PWM DC-DC regulator always switches at a fixed frequency even when the output load is small. This is to ensure a minimum output voltage ripple over the full load range. It may induce a relatively large (about 10mA when Vin=12V) input current when load is zero.

## Enable

EN is a digital control pin that turns the GS5421 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 shutdown 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

GS5421 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 GS5421 will enter hiccup mode. It will turn off the chip immediately for 6mS. After that, it will try to re-starts as normal for 2mS. After 2mS, 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 cooldown. When the junction temperature cools to approximately 110°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.

## Applications Information

### Setting the Output Voltage

The external resistor divider is used to set the output voltage (see Typical Application on page 4).

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

Resistors R2 has to be between 1kOhm to 12KOhm.

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

### Inductor

A 2.2 $\mu H$  to 4.7 $\mu H$  inductor with a DC current rating of at least 25% percent higher than the maximum load current is recommended for most applications. For highest efficiency, the inductor DC resistance should be less than 15m $\Omega$  . For most designs, the inductance value can be derived from the following equation.

$V_{out} \geq 3.3V$ ,  $2.2\mu H \leq L \leq 4.7\mu H$ .

$V_{out} < 3.3V$ ,  $L = 2.2\mu H$ .

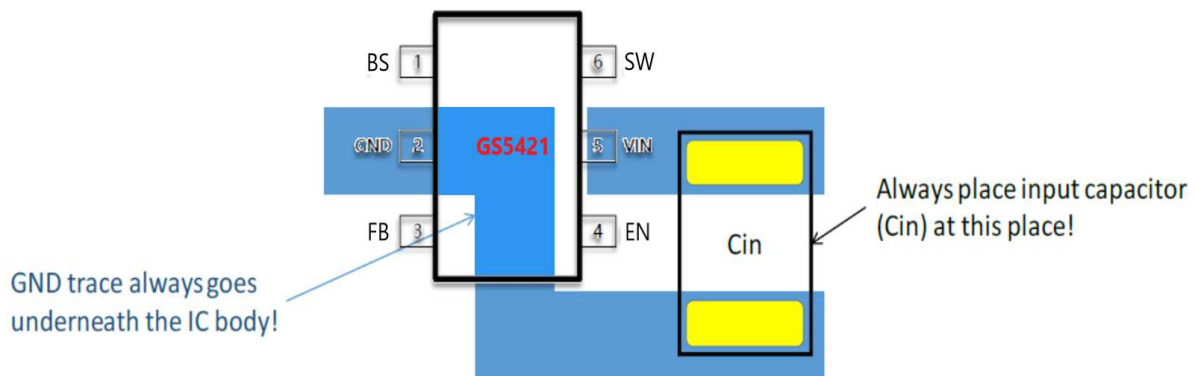
$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L + f_{osc}}$$

Where  $\Delta I_L$  is the inductor ripple current. Choose inductor ripple current to be approximately 30% if the maximum load current 2A. The maximum inductor peak current is:

$$I_{L(MAX)} = I_{LOAD} + \frac{\Delta I_L}{2}$$

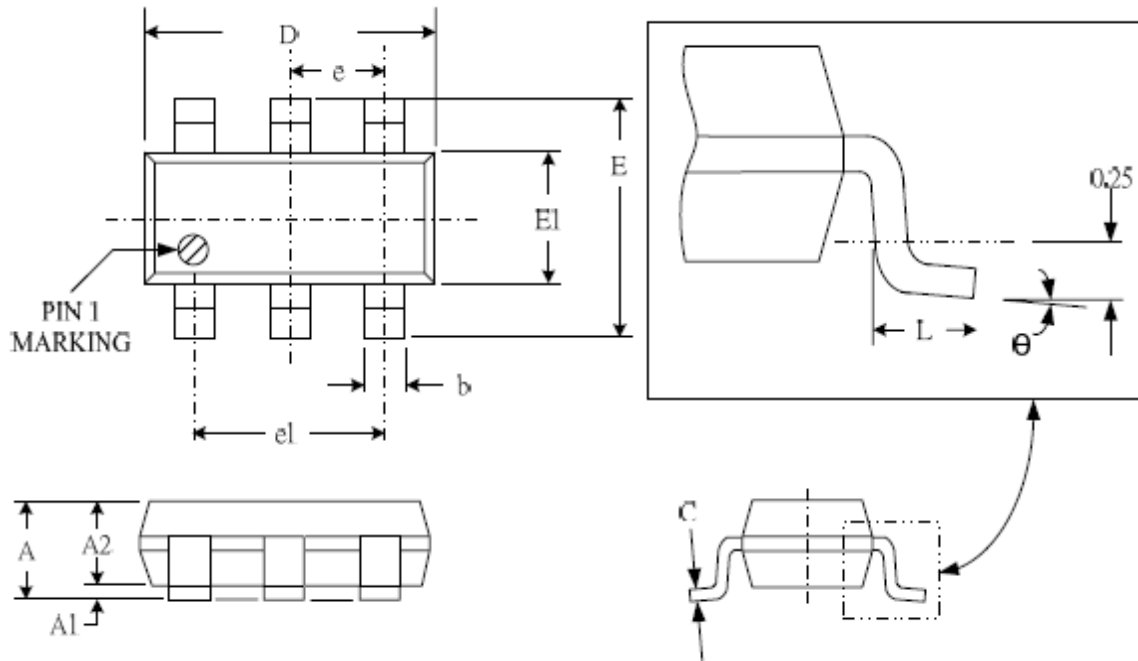
### PCB LAYOUT GUIDE

For any high voltage buck, it is always crucial to have input capacitor placed as close to the chip's IN and GND pin without any via, because the input capacitor is to keep the chip's real input voltage from dropping too much when large switching current is drawn from the input node. A simple illustration of how to place input capacitor and draw the trace to the chip's IN and GND pins is shown below, and it is highly recommended to strictly follow this guide.



## Package Dimension

### SOT23-6L PLASTIC PACKAGE









Dimensions				
SYMBOL	Millimeters		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
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.95 (BSC)		0.037 (BSC)	
e1	1.90 (BSC)		0.075 (BSC)	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

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