

## GENERAL DESCRIPTION

The OB3375 is a high efficiency LED driver designed for white LEDs and for large LCDs backlight. OB3375 is built-in a quasi-resonant control method buck DC/DC converter. The controller implements a peak current mode control scheme and an internal transconductance amplifier to accurately control the output current over a wide input and load conditions. The transconductance amplifier reference is set by internal reference voltage and the duty cycle at HPWM pin. Low frequency LPWM dimming input that can accept an external control signal with a duty ratio of 1%-100%.

OB3375 offers comprehensive protection features to protect the system in various fault conditions such as Diode & Inductor short protection, CS open protection, MOS drain source short protection, LED+/LED- short protection, LED-/GND short circuit protection, LED open loop protection, Over temperature protection (OTP). The cycle-by-cycle current limit function limits the maximum current flowing through the external MOSFET.

OB3375 is offered in SOP8 package.

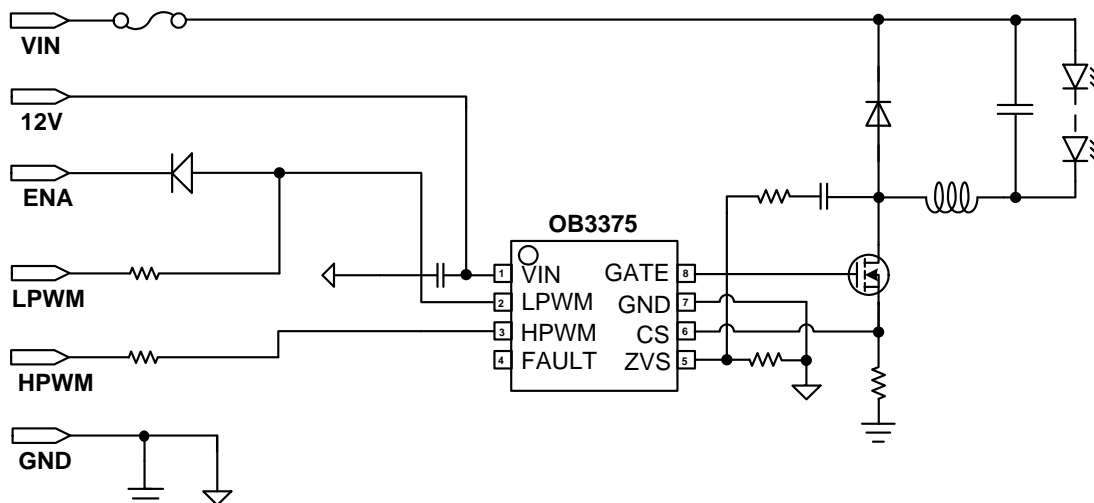
## FEATURES

- Low system cost and high efficiency
- Quasi-Resonant buck topology operation
- Programmable CC regulation
- PWM and PWM to analog combination dimming
- Zero voltage signal detected to improve efficiency and EMI performance
- LED+/LED- short circuit protection
- LED-/GND short circuit protection
- LED open loop protection
- Cycle-by-cycle current limiting
- Built-in leading edge blanking (LEB)
- VIN under voltage lockout with hysteresis
- Over temperature protection (OTP)
- Diode & Inductor short protection
- MOSFET drain source short protection
- CS open protection
- Low standby current

## APPLICATIONS

- LED backlight

## TYPICAL APPLICATION



## GENERAL INFORMATION

### Absolute Maximum Ratings

Parameter	Value
VIN, LPWM, HPWM, FAULT, ZVS, GATE to GND	-0.3V to 35V
CS to GND	-0.3V to 7V
Operating Ambient Temp. T <sub>A</sub>	-40°C ~ 85°C
Operating Junction Temp. T <sub>J</sub>	-40°C ~ 150°C
Min/Max Storage Temp. T <sub>stg</sub>	-55°C ~ 150°C
Lead Temp. (10 Sec)	260°C

**Note:** Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

### Recommended Operating Range

Parameter	Value
Vin Voltage	9V to 30V
LPWM Dimming Frequency	100Hz to 1KHz
HPWM Dimming Frequency	10KHz to 50KHz

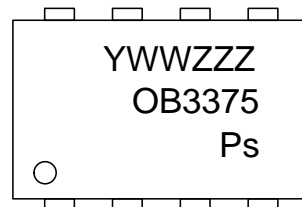
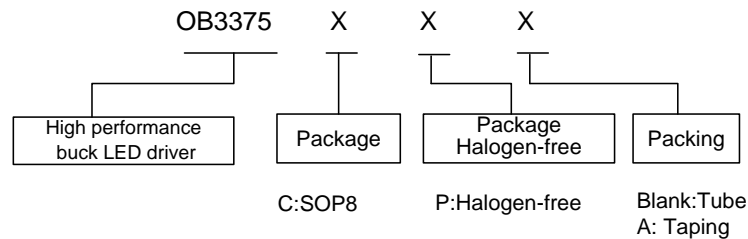
### Package Thermal Characteristics

Parameter	RθJA (°C/W)
SOP8	150

### Ordering Information

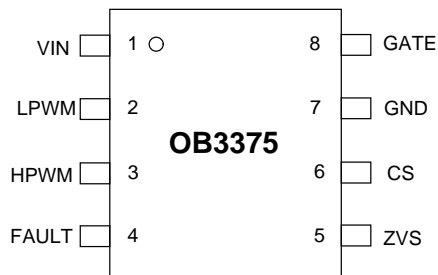
Part Number	Description
OB3375CP	SOP8, Halogen-free in tube
OB3375CPA	SOP8, Halogen-free in T&R

## Marking Information



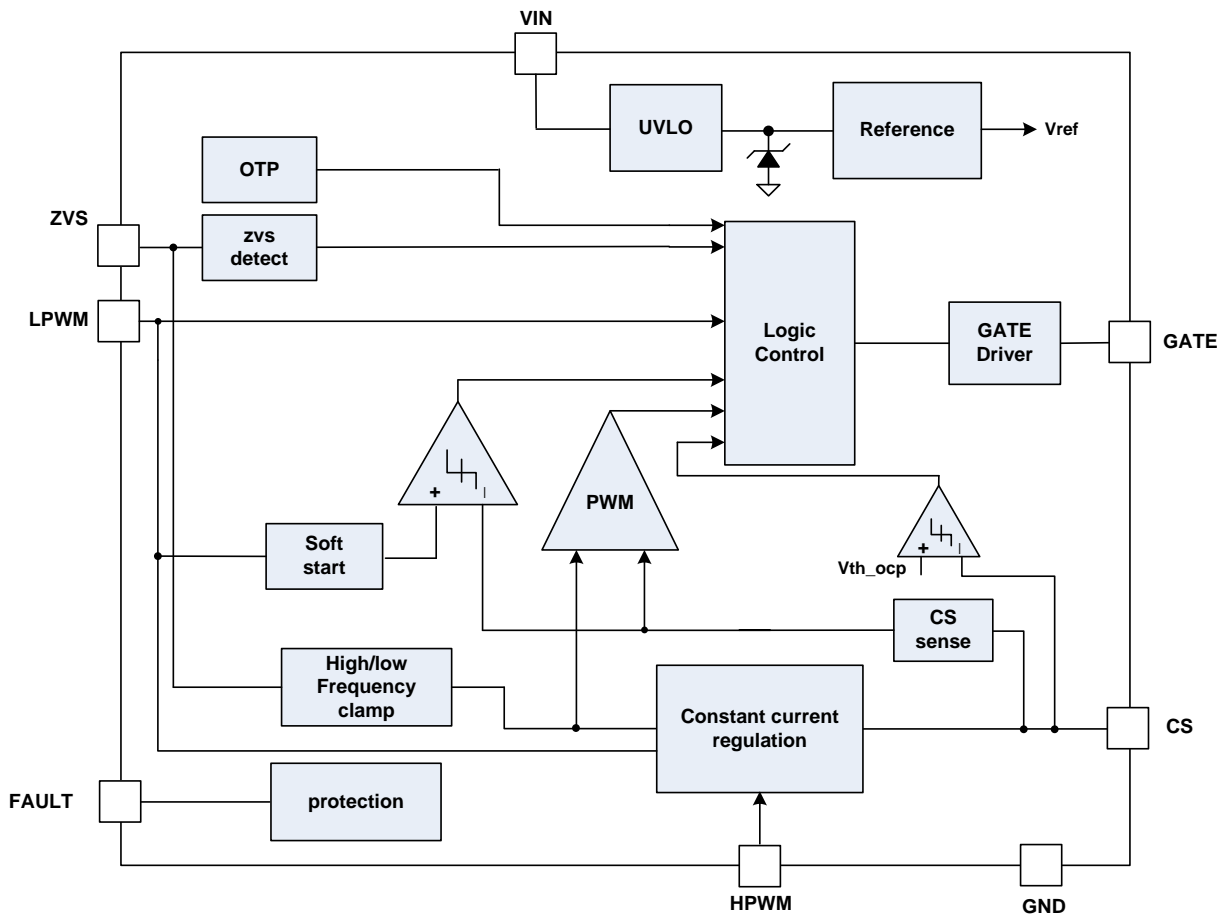
Y:Year Code  
 WW:Week Code(01-52)  
 ZZZ:Lot Code  
 P:Halogen-free Package  
 s:Internal Code(Optional)

### Terminal Assignments for SOP8 Package Parts



Pin Num	Pin Name	I/O	Description
1	VIN	P	Power supply input.
2	LPWM	I/O	LPWM signal input pin for PWM dimming control and enable pin for sleep mode control
3	HPWM	I/O	HPWM signal input pin for PWM to analog dimming control
4	FAULT	I/O	Fault signal for abnormal situation
5	ZVS	I/O	Quasi-Resonant signal
6	CS	I/O	Current sensing terminal.
7	GND	P	Power Ground.
8	GATE	I/O	Gate driver output

**BLOCK DIAGRAM**

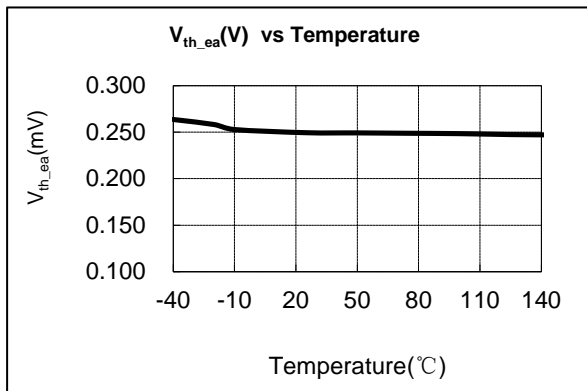
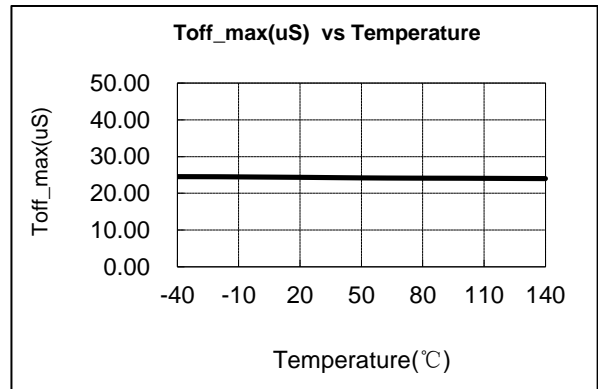
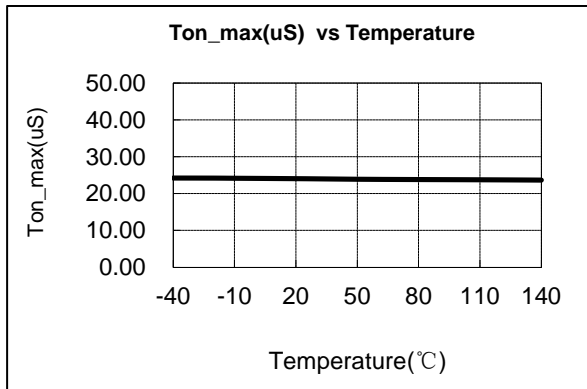
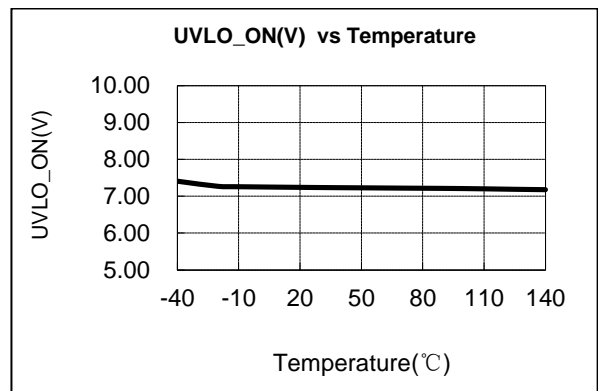
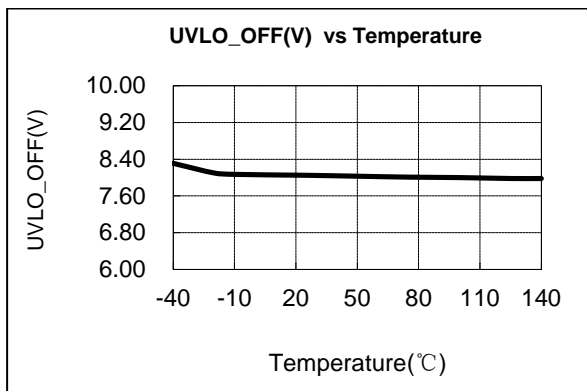
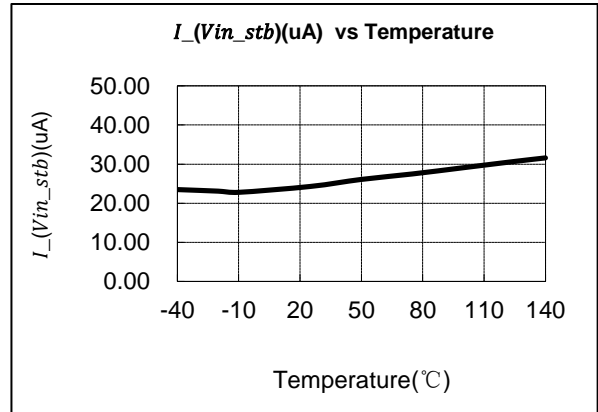
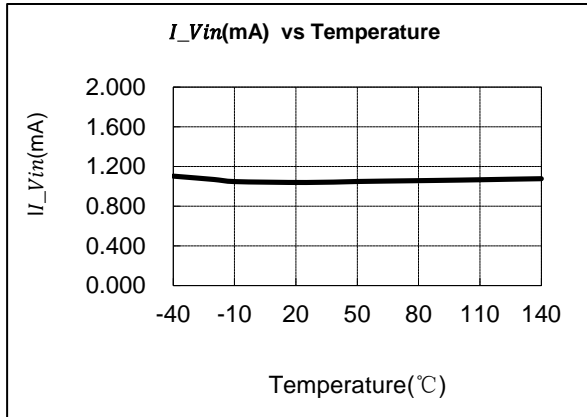


## ELECTRICAL CHARACTERISTICS

VIN=12V, LPWM=5V, T<sub>A</sub>=25°C, if not otherwise noted.

Parameter	Symbol	Conditions	Min	Typical	Max	Units
<b>Current Consumption</b>						
Input voltage range	V <sub>in</sub>		9	-	30	V
Operating supply current	I <sub>Vin</sub>	V <sub>in</sub> =12V, LPWM=5V no load	-	1.1	1.3	mA
Stand by current	I <sub>Vin_stb</sub>	LPWM low >50ms sleep mode	-	20	30	uA
<b>VIN UVLO</b>						
Vin under voltage lockout exit (recovery)	UVLO(OFF)		7	8	9	V
Vin under voltage lockout enter	UVLO(ON)		6.2	7.2	8.2	V
<b>HPWM Section</b>						
HPWM Logic input level	HPWM(high)	High Level	2			V
	HPWM(low)	Low Level			0.8	V
<b>LPWM Control</b>						
LPWM Input Threshold	LPWM(high)	High Level	2.5			V
	LPWM(low)	Low Level			1.3	V
Sleep mode time	T <sub>sleep</sub>			40		ms
<b>Current Sense Input Section</b>						
Time of leading edge blanking	T <sub>leb</sub>		250	350	450	ns
Threshold of over current protection	V <sub>th<sub>ocp</sub></sub>			0.8		V
<b>QR Section</b>						
Max frequency	F max		200	230	260	KHz
Max gate off time	T <sub>off max</sub>		20	25	30	us
Max gate on time	T <sub>on max</sub>		20	25	30	us
<b>Error Amplifier Section</b>						
Reference voltage of Error amplifier	V <sub>th<sub>ea</sub></sub>		0.245	0.25	0.255	V
<b>Protection</b>						
Threshold of diode & Inductor short protection	V <sub>th<sub>cs_high1</sub></sub>			1.5		V
Threshold of CS pin open protection	V <sub>th<sub>cs_high2</sub></sub>			2		V
Temperature of thermal shutdown	T <sub>OTP_ON</sub>			150		°C
Temperature of thermal recovery	T <sub>OTP_OFF</sub>			100		°C
<b>Gate Driver Output</b>						
Gate rise time	T <sub>rise</sub>	1nF load	-	150		ns
Gate fall time	T <sub>fall</sub>	1nF load		30		ns

**CHARACTERIZATION PLOTS**



## Function Description

### General Operation

The OB3375 is a high efficiency LED driver designed for white LEDs and for large LCDS backlight. OB3375 is built-in a quasi-resonant control method buck DC/DC converter. The controller implements a peak current mode control scheme and an internal transconductance amplifier to accurately control the output current over a wide input and load conditions. The transconductance amplifier reference is set by internal reference voltage and the duty cycle at HPWM pin.

Low frequency LPWM dimming input that can accept an external control signal with a duty ratio of 1%-100%.

OB3375 offers comprehensive protection features to protect the system in various fault conditions such as Diode & Inductor short protection, CS open protection, MOS DS short protection, LED+/LED- short protection, LED-/GND short circuit protection, over temperature protection (OTP). The cycle-by-cycle current limit function limits the maximum current flowing through the external MOSFET.

### Startup

OB3375 is enabled by applying a voltage of greater than approximately 2.5V to LPWM pin. An on-chip internal 3.8M ohm pull down resistor is inserted between LPWM pin and ground. When the first rising edge is applied to LPWM input, the OB3375 will power up immediately, and remains power up until the LPWM input is lower than 1.3V for 40mS (typical), at this time the chip will enter standby mode. At standby mode, the power of the OB3375 will be lower than 20uA (typical).

When LPWM is active high, The OB3375 will check faults (UVLO, CS high, MOS ds short, LED+/LED- short, LED-short to GND, OCP), if there is no fault, then the boost converter will boost up the output with the internal soft start.

### UVLO

An under-voltage lockout protection feature with a hysteresis of about 800mv is provided for VIN. When the voltage at this pin exceeds a threshold of approximately 8V (typ.), the IC starts normal operation. If the voltage at this pin drops below a threshold of approximately 7.2V (typ.) , the IC stops switching operation. The IC resumes switching operation when the voltage at pin VIN increases to a voltage above 8V (typical).

### LED Current Regulation

The LED current is sensed by current sense resistors connected between pin CS and GND

The sensed error signal is amplified and compared to the CS pin sensing current signal to determine the on-time of the switching MOSFET. The error amplifier sources or sinks the current to the internal COMP to adjust the required inductor current as the load changes.

The error amplifier reference is set by internal reference voltage and the duty cycle at HPWM pin.

The average LED current is approximated by the following equation;

$$I_{LED} [mA] = \frac{250 * DUTY_{HPWM} [mV]}{R_{CS} [\Omega]}$$

At light loading, the OB3375 automatically add off time to improve efficiency and prevent overcharging the output capacitor.

### Dimming Control

The LED brightness is controlled by the PWM signal at LPWM pin which has different duty cycle. OB3375 can accept an external PWM signal to LPWM pin in the range of 100Hz to 1 KHz with a swing voltage of 0V to a level greater than 2.5V.

### CS pin open Protection

OB3375 shuts down the output if CS pin is floating. In case of CS pin floating, OB3375 will pull up CS pin to internal 5V voltage. If the CS voltage is greater than 2V (typical) at gate off time, the gate output will be latched off for the safe propose.

This protection is latched and can be reset from VIN or LPWM.

### LED+/LED- short & LED-/GND short protection

When LED+/- short or LED- /GND short, IC can not detected demagnetization information , OB3375 will continuously work at max\_off state. After 60mS (typical), the gate output will be latched off for the safe propose.

This protection is latched and can be reset from VIN or LPWM.

### Diode & Inductor Short Protection

When the diode or the inductor shorts, the current of the power MOSFET increasing significantly. This state will cause the MOSFET permanent damage if the IC is continuously working. OB3375 will monitor the voltage on CS pin voltage cycle by cycle. If the voltage on CS pin is greater than 1.5V (typical) for continuous 16 cycles, the IC will latch shutdown the gate output to prevent the MOSFET from permanent damage.

This protection is latched and can be reset from VIN or LPWM.

**MOS drain source Short Protection**

The OB3375 has power MOS source drain short protection, when power MOS source drain short, the OB3375 will monitor the CS voltage greater than 2V at gate off time or CS voltage greater than 0.25V continuous 50uS. The gate output will be latched off for the safe propose.

This protection is latched and can be reset from VIN or LPWM.

**Thermal Shutdown**

The OB3375 includes a thermal protection circuit. When the junction temperature exceeds 150°C (typical), the controller and current sources shut down and do not restart until the junction temperature drops below 100°C (typical).

**Indication for FAULT Condition**

OB3375 builds an FAULT condition to output a

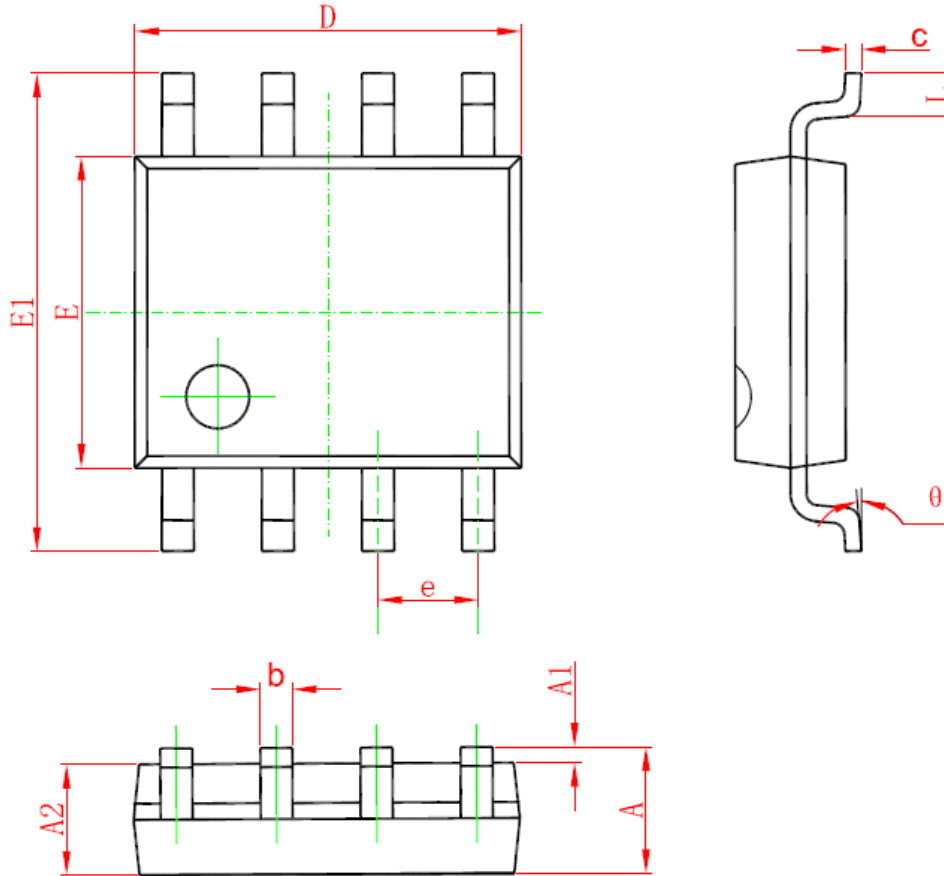
logic level signal at FAULT pin. The output stage of the FAULT pin adopts an open-drain NMOS structure. When OB3375 is operating normally, the voltage at FAULT pin is pulled-high through external circuits. When there is any error condition occurs, the voltage at FAULT pin is pulled-low. The FAULT pin indicates the following seven conditions:

- CS Open
- Diode & Inductor Short
- LED +/LED- short
- Power MOS drain source short
- LED-/ GND short
- LED open



**PACKAGE MECHANICAL DATA**

SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	4.700	5.150	0.185	0.203
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°

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