DIO8269

Dimming Interface Converter Compatible with 0/1~10 V Dimming, Resistor Dimming and PWM Dimming

Description

The DIO8269 is a dimming interface converter that can recognize its input signal, which can be a 0/1~10 V dimming signal, resistor, or PWM signal. To achieve isolated dimming, the final output of the DIO8269, which is a PWM signal, is used to control a dimmable CC regulator or drive an opto-coupler. The frequency of the source current and output PWM signal to drive passive 0~10 V dimmer/resistor can be set by an external capacitor and resistor.

Features

- Compatible with 0/1~10 V dimming, resistor dimming, and PWM dimming
- Recognize different dimming signals automatically
- Integrate 60 V LDO module to simplify the external circuit
- The source current for passive 0/1~10 V dimmer can be set
- The frequency of output can be set
- Compact package: SOIC-8

Applications

- LED lighting

Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO8269CS8	DIOHB6J	Green	-65°C to 150°C	SOIC-8	Tape & Reel, 2500

Typical Application

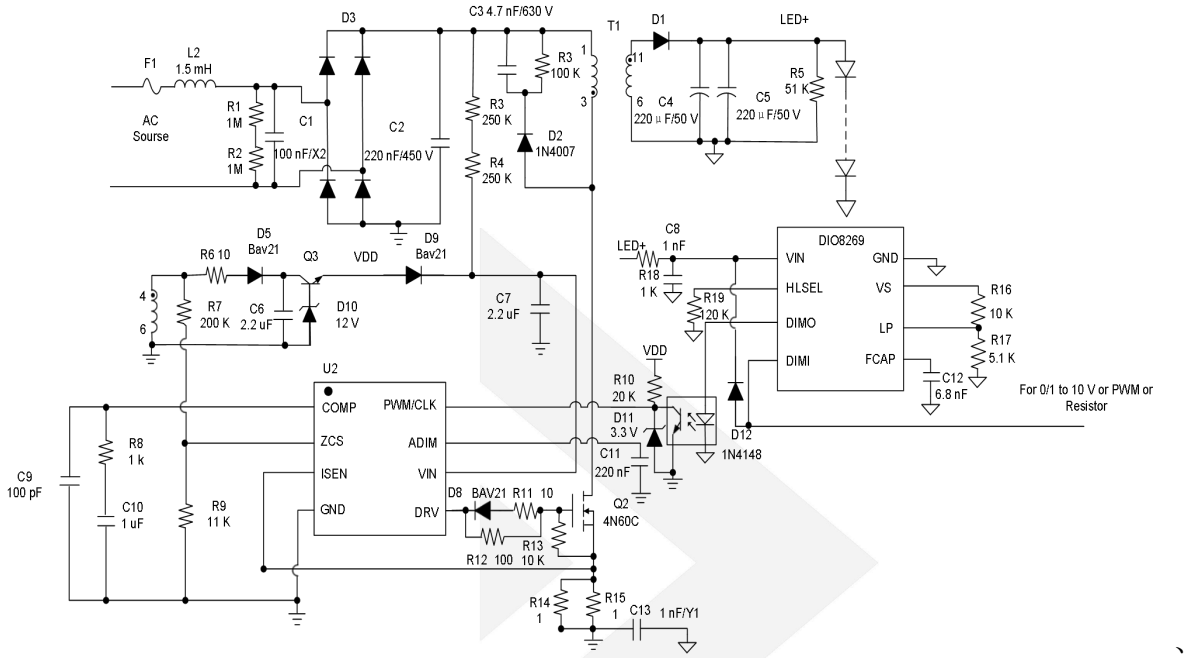

Figure 1. High clamp mode application

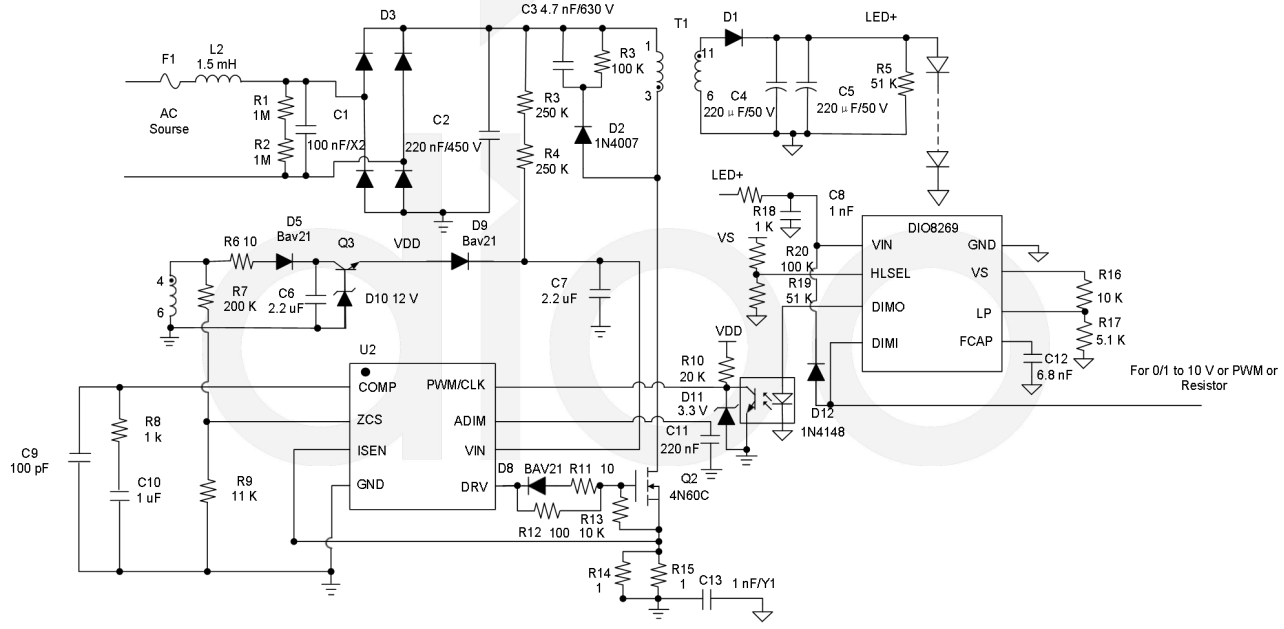

Figure 2. Low clamp mode application

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

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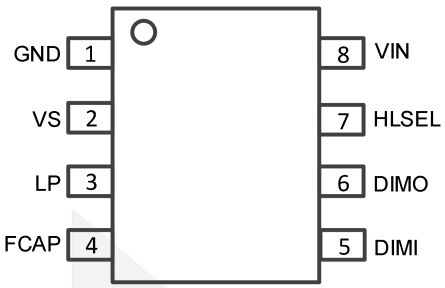


SOIC-8
Top view

Pin Number	Pin Name	Description
1	GND	Ground pin.
2	VS	Source current setting pin. V_{VS} is a 1.5 V voltage source. This pin is used to set the source current of DIMI pin for passive dimmer or resistor. $I_{DIMI} = \frac{5 \times 1.5}{R_{VS}}$
3	LP	The zero coordinate setting pin. This pin is used to set the lowest input voltage which corresponds to 0% duty. The real minimum 0~10 V input is $V_{LP1} = 1.5 \times k1 \times V_{LP} - k1 \times 0.926 + 0.2$ k1 = 1 ; (Low clamp mode) $k1 = \frac{14.58}{52.85 + 14.58} \times \frac{52.85 + (14.58 // R_{HLSELD})}{14.58 // R_{HLSELD}}$ (High clamp mode)
4	FCAP	Dimming frequency setting pin. This pin is used to set the frequency of DIMO pin. $f_{DIM} = \frac{30 \times 10^{-6}}{(6.6 - V_{LP}) \times C_{FCAP}}$
5	DIMI	Dimming input pin. Dimming signal is connected to this pin. It maybe is a 0/1~10 V analog signal, resistor or a PWM signal.
6	DIMO	Dimming output pin. This pin will output a PWM signal to driver opto-coupler for separation dimming.
7	HLSEL	High clamp and low clamp mode setting pin. If the voltage of HLSEL pin is larger than 100 mV during IC start-up, it enters into low clamp mode, else it works in high clamp mode.

		In low clamp mode, if V_{DIMI} is less than the setting value, it is clamped internally. $$V_{LSEL} = \frac{9.3}{2} \times (V_{HLSEL} - 0.2) + 0.2$$ In high clamp mode, the clamp voltage is 9.5 V fixedly, and the resistor connected to HLSEL is used to adjust the max duty. $$D_{MAX} = \frac{67.79 \times R_{HLSELD}}{67.43 \times R_{HLSELD} + 770.59}$$ For example R_{HSEL} = 510 kΩ. $$D_{MAX} = \frac{67.79 \cdot 510}{67.43 \cdot 510 + 770.59} = 98.3\%$$
8	VIN	Power supply pin. This pin provides power supply for IC.

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{IN}		-0.3 ~ 58	V
I_{IN}		10	mA
VS, FCAP, LP		-0.3~ 3.6	V
DIMI, DIMO		0.3~20	V
P_D	Power dissipation, at T_A = 25°C SOIC-8	0.8	W
T_J	Maximum junction temperature	125	°C
Lead temperature (soldering, 10 s)		260	°C
TSTG	Storage temperature range	-65 to 150	°C

3. Recommended Operating Condition

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{VIN}	VIN voltage range	$V_{VIN,ON}$ ~ 55	V
T_J	Junction temperature range	40 to 125	°C

4. Thermal Considerations

The thermal resistance determines the heat insulation property of a material. The higher the thermal resistance is, the lower the heat loss. Accumulation of heat energy degrades the performance of semiconductor components.

Symbol	Parameter	Value	Unit
θ_{JA}	Junction-to-ambient thermal resistance	88	°C/W
θ_{Jc}	Junction-to-case thermal resistance	45	°C/W

5. Electrical Characteristics

(V_{IN} = 15 V, T_A = 25°C unless otherwise specified.)

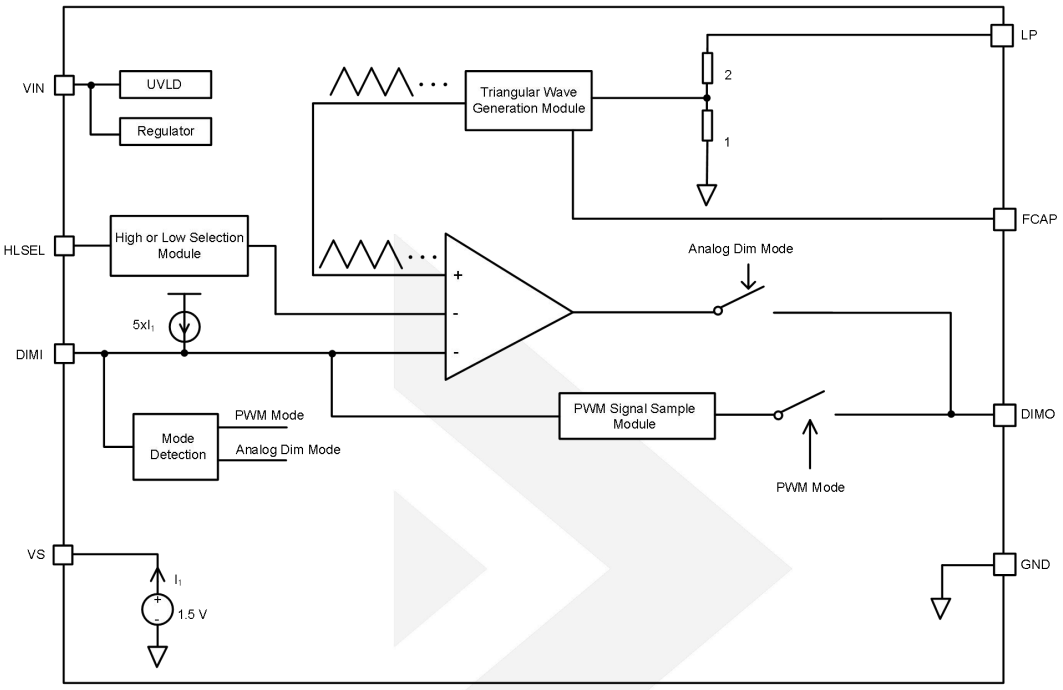
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Power supply section						
V_{VIN}	VIN voltage range		V_{VIN_ON}		55	V
V_{VIN_ON}	VIN turn-on threshold		8.4	9.2	10.2	V
V_{VIN_OFF}	VIN turn-off threshold			V_{IN_ON}-1.7		V
V_{VIN_OVP}	VIN over voltage protection		52	55	59	V
DIMI section						
V_{LP_Range}	Range of minimum dimming voltage		0		V_{VS}	V
V_{VS}	Reference voltage of VS		1.45	1.5	1.55	V
I_{SR_MAX}	MAX DIMI source current	VS = 3.75 K	1.85	2.0	2.15	mA
V_{HIGH}	Maximum dimming voltage		9.2	9.5	9.8	V
D_{PWM_MAX}	Max duty of PWM			99(1)		%
V_{PWM_ON}	PWM ON voltage threshold		2.3			V
V_{PWM_OFF}	PWM OFF voltage threshold				0.8	V
f_{PWM}	PWM frequency range		400		10 k	Hz
Thermal section						
T_{SD}	Thermal shut down temperature			145		°C

Note:

(1) Increase VIN pin voltage gradually higher than V_{VIN_ON} voltage then turn down to 12 V.

(2) Specifications subject to change without notice.

6. Block Diagram



7. Function Description

The DIO8269 is a dimming interface converter that can recognize its input signal, which can be a 0/1~10 V dimming signal, resistor, or PWM signal.

It will be converted into a PWM signal when the input signal is 0/1~10 V dimming signal to driver opto-coupler or dimmable IC.

When the input signal is a resistor, there is a current flowing out from DIMI pin to produce a voltage at the resistor. Then it works as same as 0/1~10 V dimming input.

The input signal is converted into a reverse PWM signal when it is a PWM signal.

There are two working modes：

To clamp the minimum duty cycle, use the low-clamp.

To clamp the maximum duty cycle, use the high-clamp.

More detailed information is discussed below.

8. Application Information

Important notice: Validation and testing are the most reliable ways to confirm system functionality. The application information is not part of the specification and is for reference purposes only.

8.1. Start up

Suppose DIMI is floating.

DIMO follows V_{IN} before V_{IN} reaches V_{IN_ON}. After reaching V_{IN_ON}, the IC begins to work and DIMO is regulated by DIMI.

Figure 3. Start up

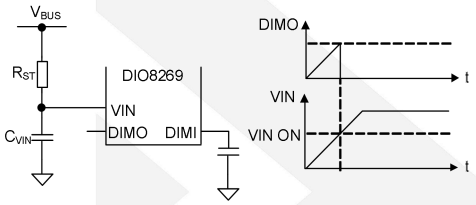
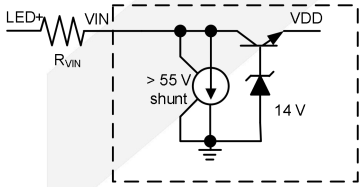


Figure 4. Internal LDO



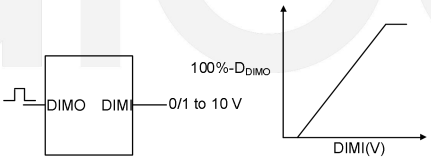
The IC integrates a 60 V LDO for simplifying peripheral device.

There is a shunt current if V_{IN} voltage is larger than 55 V, which helps protect the IC when the power voltage is higher than 55 V.

8.2. Dimming input

8.2.1. 0/1~10 V dimming

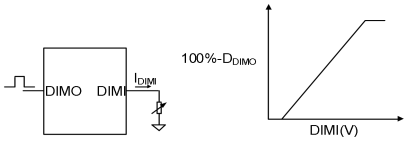
Figure 5. 0/1~10 V dimming



If the input signal of DIMI pin is 0/1~10 V, it is converted into reversed duty signal.

8.2.2. Resistor dimming

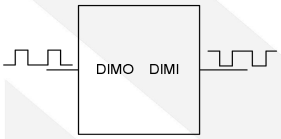
Figure 6. Resistor dimming



There is a current flow from DIMI pin to drive the resistor and produce a 0 ~ 10 V signal if DIMI is connected with a variable resistor. Also, the current exists in 0/1~10 V dimming application.

8.2.3. PWM Dimming

Figure 7. PWM dimming

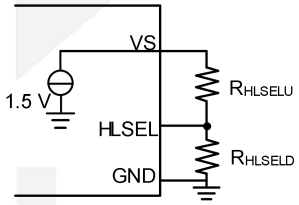


An IC converts an input dimming signal into a reversed PWM signal if it is PWM signal.

8.3. Working mode

8.3.1. High clamp mode

Figure 8. High clamp mode setting



The maximum duty is set by high clamp mode to regulate the full load current in some special applications.

The high clamp mode will be selected if the voltage of the HLSEL pin is less than V_{HLSEL_MODE} when V_{IN} first reaches V_{VIN_ON}. R_{HLSEL} should not be connected to ensure the IC enters into high clamp mode.

The turning point of DIMI is always 9.5 V, and the maximum duty can be calculated by the following formula.

$$D_{MAX} = \frac{1}{2.2-0.2} \times \left(\frac{(9.5-0.2) \times \frac{14.58-R_{HLSELD}}{14.58+R_{HLSELD}}}{\frac{14.58-R_{HLSELD}}{14.58+R_{HLSELD}} + 52.85} \right)$$

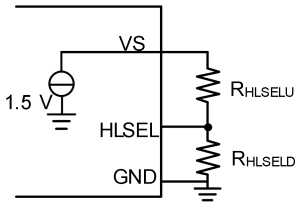
Or

$$D_{MAX} = \frac{67.79 \times R_{HLSELD}}{67.43 \times R_{HLSELD} + 770.59}$$

The maximum duty is changed with different R_{HLSELD}.

8.3.2. Low clamp mode

Figure 9. Low clamp mode setting



Low clamp mode is used to clamp the minimum duty.

When V_{IN} reaches V_{VIN_ON}, if the voltage of the HLSEL pin is larger than V_{HLSEL_MODE}, the low clamp mode is selected. To ensure the IC enters into low clamp mode, please ensure:

$$\frac{V_{VS} \times R_{HLSELD}}{R_{HLSELD} + R_{HLSELU}} > V_{HLSEL,MODE} + 0.1$$

The turning point of DIMI pin is set by

$$V_{LSEL} = \frac{9.3}{2} \times (V_{HLSEL} - 0.2) + 0.2 = \frac{9.3}{2} \times (\frac{V_{VS} \times R_{HLSELD}}{R_{HLSELU} + R_{HLSELD}} - 0.2) + 0.2$$

With different R_{HLSELU} and R_{HLSELD}, the minimum duty is set.

8.3.3. Special low clamp mode

If there is no need to work in high clamp mode or low clamp mode, it can be set by that:

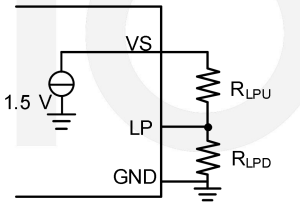
$$V_{LSEL} = 0.2$$

It means that:

$$\frac{V_{VS} \times R_{HLSELD}}{R_{HLSELU} + R_{HLSELD}} = 0.2$$

8.3.4. Zero coordinate setting

Figure 10. Zero coordinate setting



Adjust the zero cross point of the curve by setting the voltage of V_{LP}. The formula is shown below.

$$V_{LP1} = 1.55 \times k1 \times V_{LP} - K1 \times 0.926 + 0.2$$

K1 is compensation for high clamp mode. $k1 = 1$; (Low clamp mode)

$$k1 = \frac{14.58}{52.58 + 14.58} \times \frac{52.85 + (14.58 // R_{HLSELD})}{14.58 // R_{HLSELD}}$$; (High clamp mode)

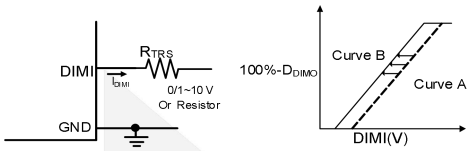
If V_{LP1} is less than 0.2 V, the duty is clamped when DIMI < 0.2 V.

And the V_{LP} is set by:

$$V_{LP} = \frac{V_{VS} \times R_{LPD}}{R_{LPU} + R_{LPD}}$$

8.3.5. Curve translation

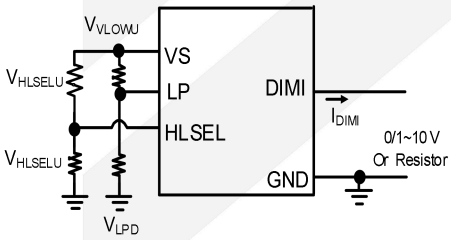
Figure 11. Curve translation setting



To translate the converted curve, R_{TRS} is set. With greater R_{TRS}, the converted curve is changed from A to B as shown above.

8.3.6. DIMI current set

Figure 12. DIMI current setting



There should be a drive current to power the dimmer if the dimmer is a passive device or a resistor.

The current is set by:

$$I_{DIMI} = \frac{5 \times 1.5}{R_{VS}}$$

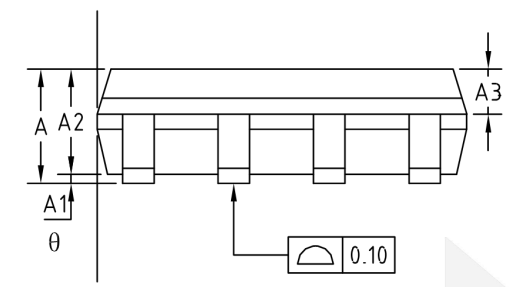
$$R_{VS} = (R_{HLSELU} + R_{HLSELD}) // (R_{LPU} + R_{LPD})$$

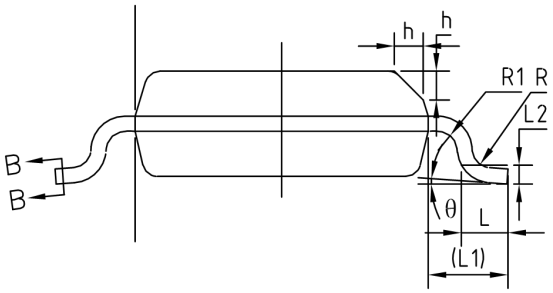
8.3.7. Frequency setting

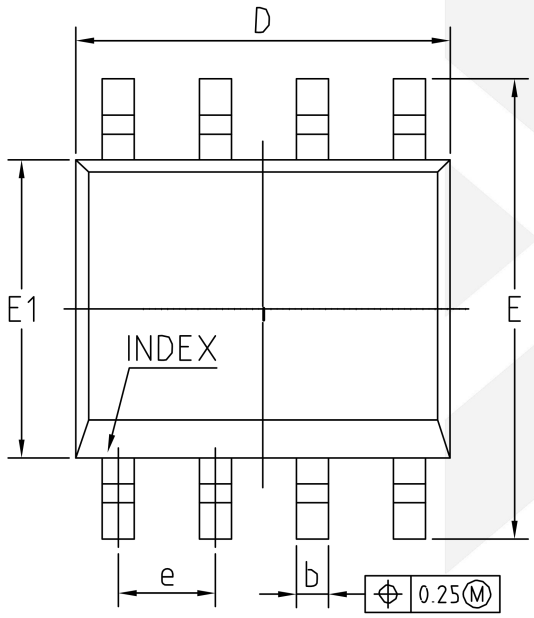
There is a 20 uA current charge or discharge FCAP capacitor to produce a reference triangle wave. The frequency is set by:

$$f_{DIM} = \frac{20u}{2 \times (2.2 - \frac{1}{3} \times V_{LP}) \times C_{FCAP}}$$

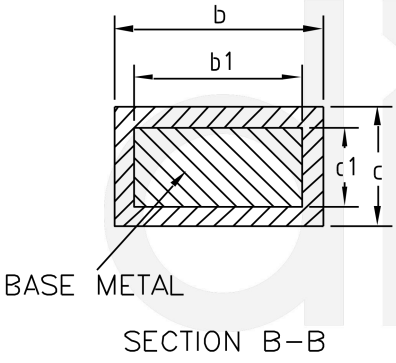
9. Physical Dimensions: SOIC-8







Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27 BSC	
L	0.45	0.60	0.80
L1		1.04 REF	
L2		0.25 BSC	
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
Θ	0°	-	8°



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