DIO8269

High-Performance, Three-in-One, Dimming Interface Converter

Description

The DIO8269 is a dimming interface converter that can recognize its input signal, which can be a 0/1~10 V dimming, 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
- Recognizes different dimming signals automatically
- Integrates an HV LDO module to simplify the external circuit
- Programmable source current for the passive 0/1~10 V dimmer
- Programmable frequency output
- Compact package: SOIC-8

Applications

- Smart LED lighting
- Business lighting

Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO8269CS8	DIOHB6J	Green	-40°C to 125°C	SOIC-8	Tape & Reel, 2500

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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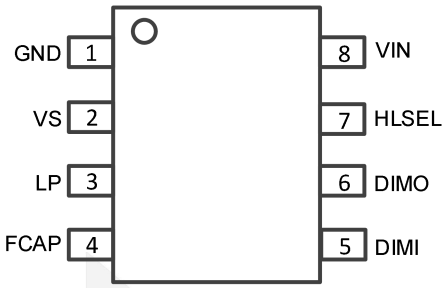


SOIC-8
Top view

Pin No.	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.
4	FCAP	Dimming frequency setting pin. This pin is used to set the frequency of DIMO pin.
5	DIMI	Dimming input pin. Dimming signal is connected to this pin. It can be 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. Otherwise, it works in high clamp mode.
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_{VIN}	Power supply voltage	-0.3 ~ 60	V
I_{VIN}	Input current	10	mA
	VS, FCAP, LP	-0.3 ~ 5	V
	DIMI, DIMO	0.3 ~ 24	V
P_D	Power dissipation, at T_A = 25°C, SOIC-8	0.8	W
T_J	Maximum junction temperature	125	°C
T_L	Lead temperature (soldering, 10 s)	260	°C
T_{STG}	Storage temperature range	-40 ~ 125	°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}	Power supply voltage	$V_{VIN,ON}$ ~ 55	V
T_J	Junction temperature range	-40 ~ 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
$R_{\theta JA}$	Junction-to-ambient thermal resistance	100	°C/W
$R_{\theta Jc}$	Junction-to-case thermal resistance	50	°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						
V_{VIN}	VIN voltage		V_{VIN_ON}		55	V
V_{VIN_ON}	VIN turn-on threshold		8.4	9.3	10.2	V
V_{VIN_OFF}	VIN turn-off threshold			V_{IN_ON} - 1.7		V
V_{VIN_OVP}	VIN overvoltage protection		52	55	59	V
I_{VINQ}	VIN quiescent current				100	μA
DIMI						
V_{LP_Range}	Range of minimum dimming		0		V_{VS}	V
V_{VS}	Reference voltage of VS		1.45	1.5	1.55	V
I_{SR_MAX}	MAX DIMI source current	R_{VS} = 3.75 kΩ	1.86	2.0	2.14	mA
V_{HIGH}	Maximum dimming voltage		9.2	9.5	9.8	V
D_{PWM_MAX}	Max duty of PWM			99(1)(2)		%
V_{PWM_ON}	PWM ON voltage threshold		2.3			V
V_{PWM_OFF}	PWM OFF voltage threshold				0.8	V
f_{PWM}	PWM frequency		400		10k	Hz
Thermal						
T_{SD}	Thermal shutdown temperature			145		°C

Note:

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

(2) Guaranteed by design.

(3) Specifications subject to change without notice.

6. Typical Performance Characteristics

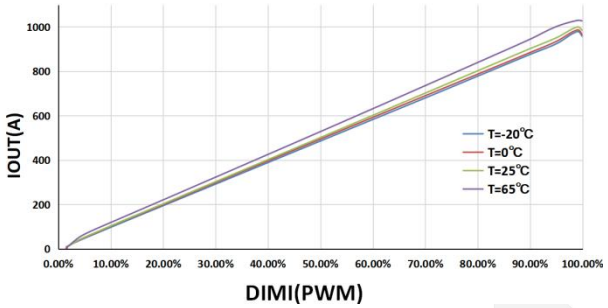


Figure 1. Dimming at various temperatures

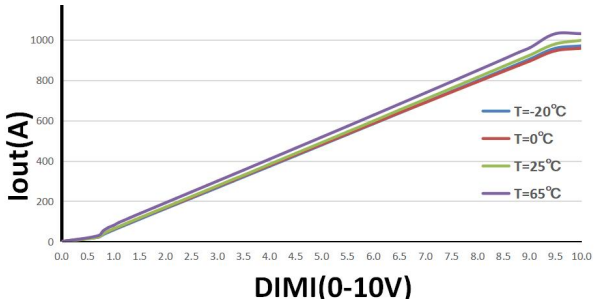
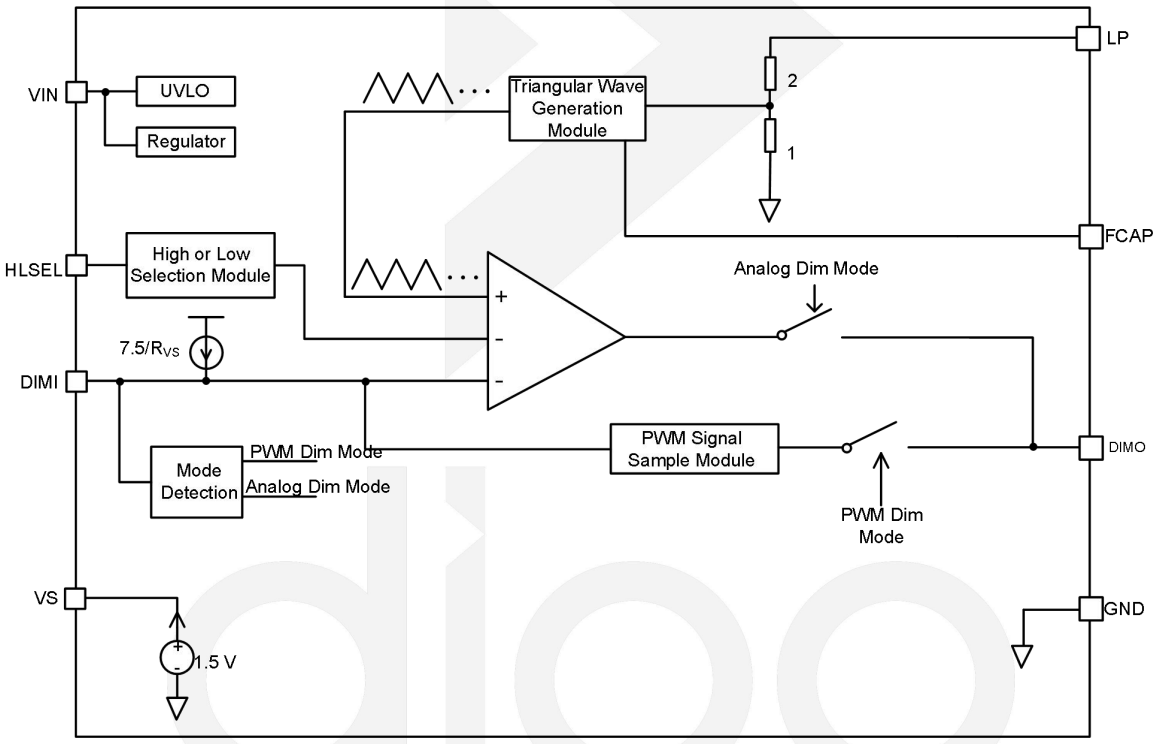


Figure 2. Dimming at 0 ~ 10 V

7. Block Diagram



8. Function Description

The DIO8269 is a dimming interface converter which change or convert different types of dimming signals into a specific type of signal that is compatible with other components in a lighting system. The DIO8269 can recognize its input signal, which can be a 0/1~10 V dimming signal, resistor, or PWM signal.

For an input of 0/1~10 V dimming signal, it will be converted into a PWM signal to drive the opto-coupler or dimmable IC. For an input signal from the resistor, a current flows from the DIMI pin to drive the resistor and produce a voltage at the resistor. The device will then treat the signal as a 0/1~10V dimming signal. The DIO8269 converts a PWM signal into a reverse PWM signal.

There are two working modes: the low-clamp mode clamps the minimum duty cycle and the high-clamp mode clamps the maximum duty cycle.

9. 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.

9.1. Application examples

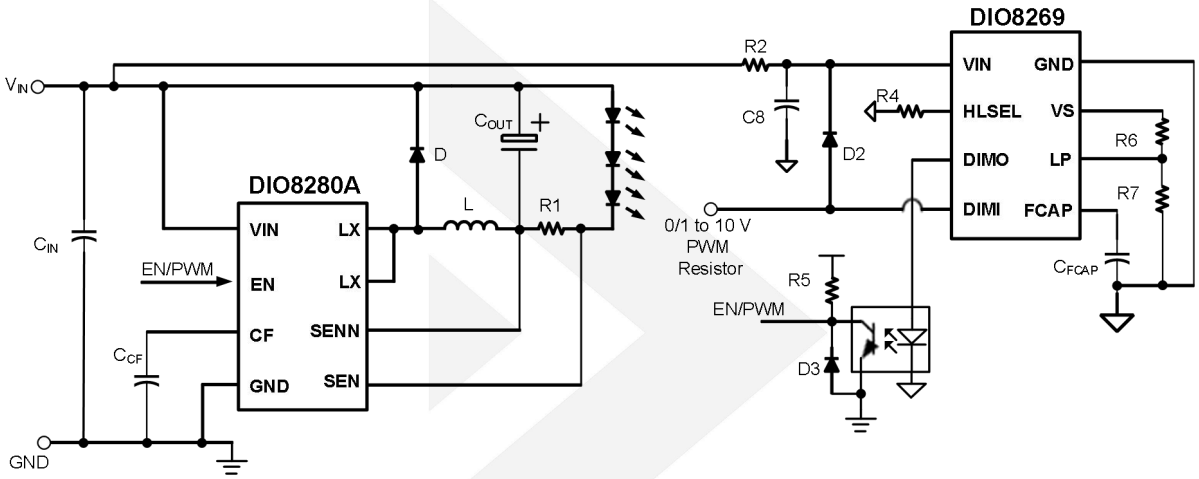


Figure 3. High clamp mode application

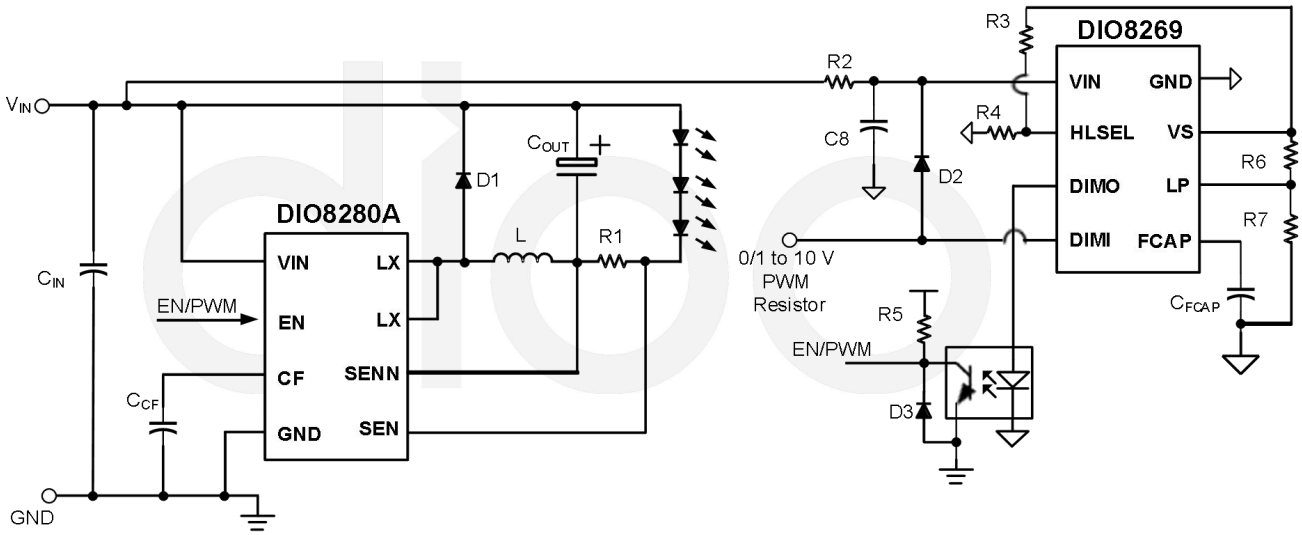


Figure 4. Low clamp mode application

9.2. Start up

Supposing DIMI is floating. The DIMO of the IC is regulated by VIN until it reaches V_{IN_ON}. As soon as V_{IN_ON} is reached, the IC starts functioning and the regulation of DIMO shifts to DIMI.

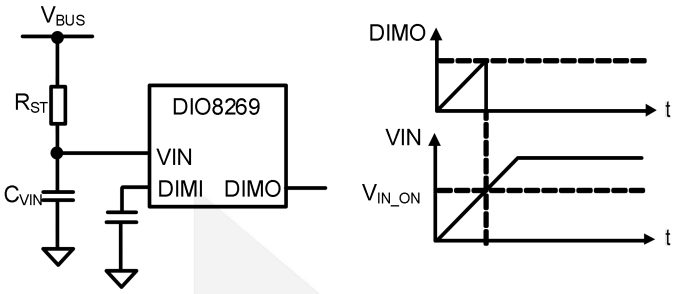


Figure 5. Start up

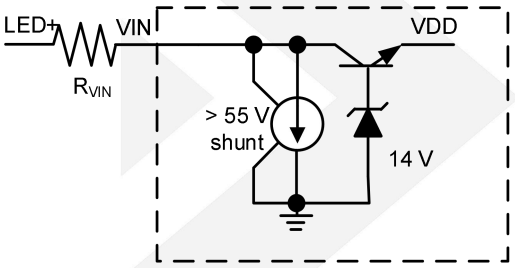


Figure 6. Internal LDO

The IC integrates an HV LDO for simplifying peripheral devices. A shunt current helps protect the IC when the power voltage exceeds 55 V.

9.3. Dimming input

9.3.1. 0/1~10 V dimming

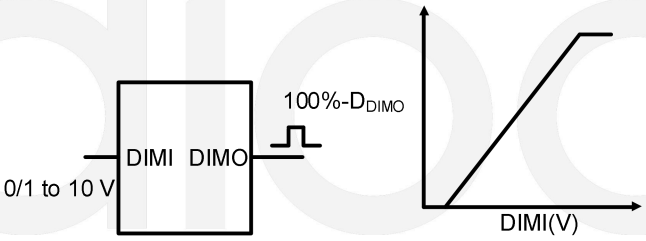


Figure 7. 0/1~10 V dimming

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

9.3.2. Resistor dimming

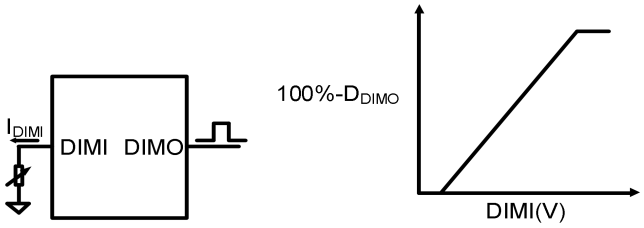


Figure 8. Resistor dimming

A current flows 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.

9.3.3. PWM Dimming

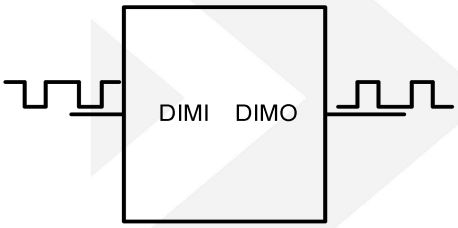


Figure 9. PWM dimming

The IC converts PWM signal into a reversed PWM signal.

9.4. Working mode

9.4.1. High clamp mode

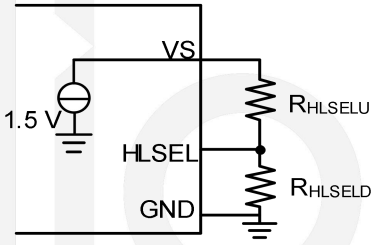


Figure 10. High clamp mode setting

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 the threshold voltage when V_{IN} first reaches V_{VIN_ON}. To ensure the IC enters into high clamp mode, leave the R_{HLSEL} disconnected. The turning point of DIMI is a constant 9.5 V, and the maximum duty can be calculated by the following formula.

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

Or

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

For R_{HLSELD} = 510 kΩ,

$$D_{MAX} = \frac{67.79 \times 510}{67.43 \times 510 + 770.59} = 98.3\%$$

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

9.4.2. Low clamp mode

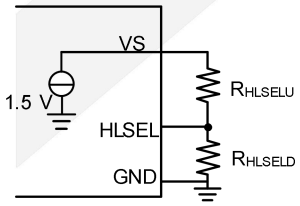


Figure 11. Low clamp mode setting

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 the threshold voltage, 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 Equation 3.

$$V_{LSEL} = \frac{9.3}{2} \times (V_{HLSEL} - 0.2) + 0.2 = \frac{9.3}{2} \times \left(\frac{V_{VS} \times R_{HLSELD}}{R_{HLSELU} + R_{HLSELD}} - 0.2 \right) + 0.2 \quad (3)$$

The minimum duty cycle is established by varying the values of R_{HLSELU} and R_{HLSELD}.

9.4.3. Special low clamp mode

Utilize special slow mode if operation in high or low clamp mode is unnecessary. Set V_{LSEL} to 0.2.

It means that:

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

9.4.4. Zero coordinate setting

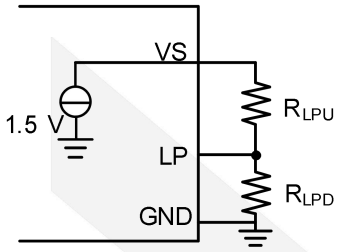


Figure 12. Zero coordinate setting

Adjust the zero cross point of the dimming curve by setting the voltage of V_{LP} as in Equation 4..

$$V_{LP1} = 1.55 \times k1 \times V_{LP} - k1 \times 0.926 + 0.2 \quad (4)$$

where

- $k1$ is a 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 below 0.2 V, the duty is clamped when DIMI < 0.2 V. And the V_{LP} is set by Equation 5.

$$V_{LP} = \frac{V_{VS} \times R_{LPD}}{R_{LPU} + R_{LPD}} \quad (5)$$

9.4.5. Curve translation

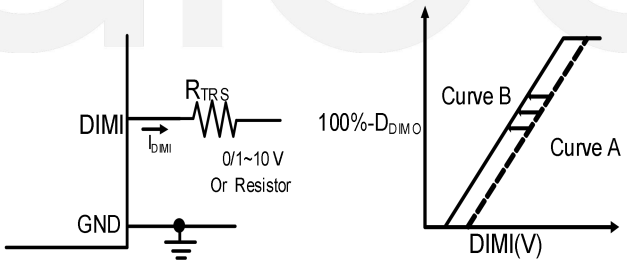


Figure 13. Curve translation setting

Use R_{TRS} to translate the converted curve. With greater R_{TRS}, the converted curve is changed from A to B as shown in Figure 11.

9.4.6. DIMI current setting

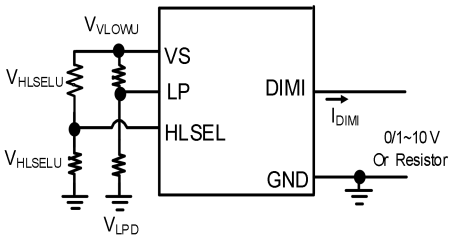


Figure 14. DIMI current setting

A drive current can power the dimmer if the dimmer is a passive device or a resistor.

The current is set by Equation 6.

$$I_{DIMI} = \frac{5 \times 1.5}{R_{VS}} \quad (6)$$

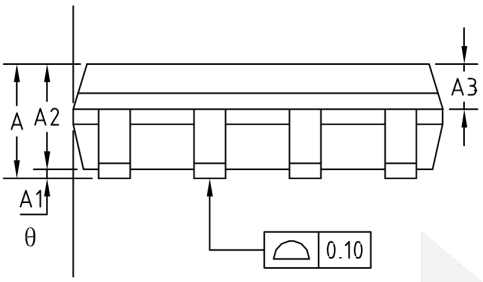
$$R_{VS} = (R_{HLSELU} + R_{HLSELD}) // (R_{LPU} + R_{LPD})$$

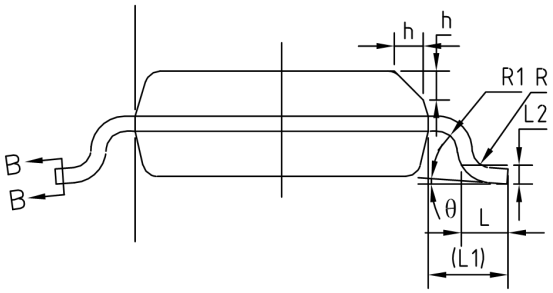
9.4.7. Frequency setting

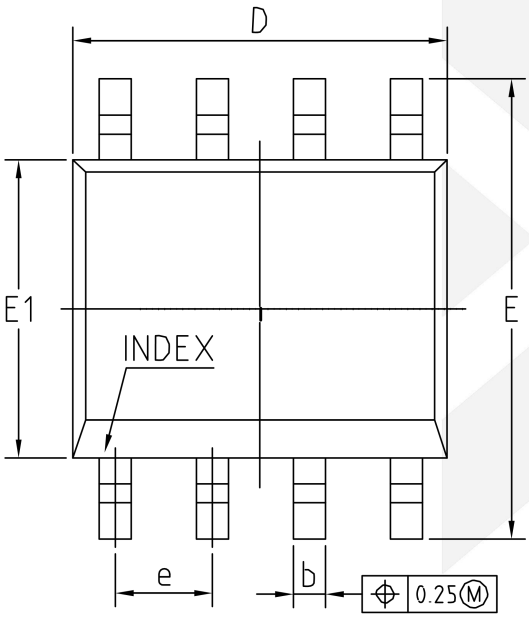
A 20 μA current charge or discharge FCAP capacitor can produce a reference triangle wave. The frequency is set by Equation 7.

$$f_{DIM} = \frac{20u}{2 \times (2.2 - \frac{1}{3} \times V_{LP}) \times C_{FCAP}} \quad (7)$$

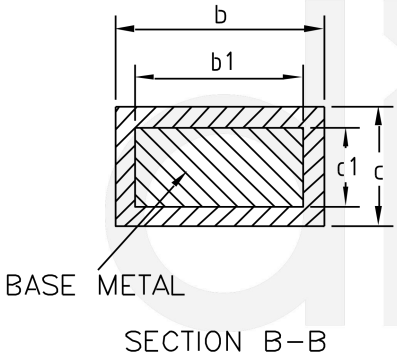
10. Physical Dimensions: SOIC-8







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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