



## Product Change Notification / SYST-20AQQO462

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### Date:

21-Jul-2022

### Product Category:

General Purpose LED Drivers

### PCN Type:

Document Change

### Notification Subject:

Data Sheet - HV9910C - Universal High-Brightness LED Driver

### Affected CPNs:

[SYST-20AQQO462\\_Affected\\_CPN\\_07212022.pdf](#)

[SYST-20AQQO462\\_Affected\\_CPN\\_07212022.csv](#)

### Notification Text:

SYST-20AQQO462

Microchip has released a new Datasheet for the HV9910C - Universal High-Brightness LED Driver of devices. If you are using one of these devices please read the document located at [HV9910C - Universal High-Brightness LED Driver](#).

**Notification Status:** Final

#### Description of Change:

1. Modified values in sections Internal Regulator and Current Sense Comparator in Table 1-1.
2. Updated Section 4.0 "Packaging Information" with the latest package markings and drawings.
3. Minor text and format changes throughout.

**Impacts to Data Sheet:** See above details.

**Reason for Change:** To Improve Productivity

**Change Implementation Status:** Complete

**Date Document Changes Effective:** 21 Jul 2022

**NOTE:** Please be advised that this is a change to the document only the product has not been changed.

Markings to Distinguish Revised from Unrevised Devices::N/A

## Attachments:

HV9910C - Universal High-Brightness LED Driver

Please contact your local [Microchip sales office](#) with questions or concerns regarding this notification.

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Affected Catalog Part Numbers (CPN)

HV9910CNG-G

HV9910CLG-G

HV9910CNG-G-M934

HV9910CSG-G

## Universal High-Brightness LED Driver

### Features

- Switch Mode Controller for Single Switch LED Drivers
- Enhanced Drop-In Replacement to the HV9910B
- Open Loop Peak Current Controller
- Internal 15 to 450V Linear Regulator
- Constant Frequency or Constant Off-Time Operation
- Linear and PWM Dimming Capability
- Requires Few External Components for Operation
- Over-Temperature Protection

### Applications

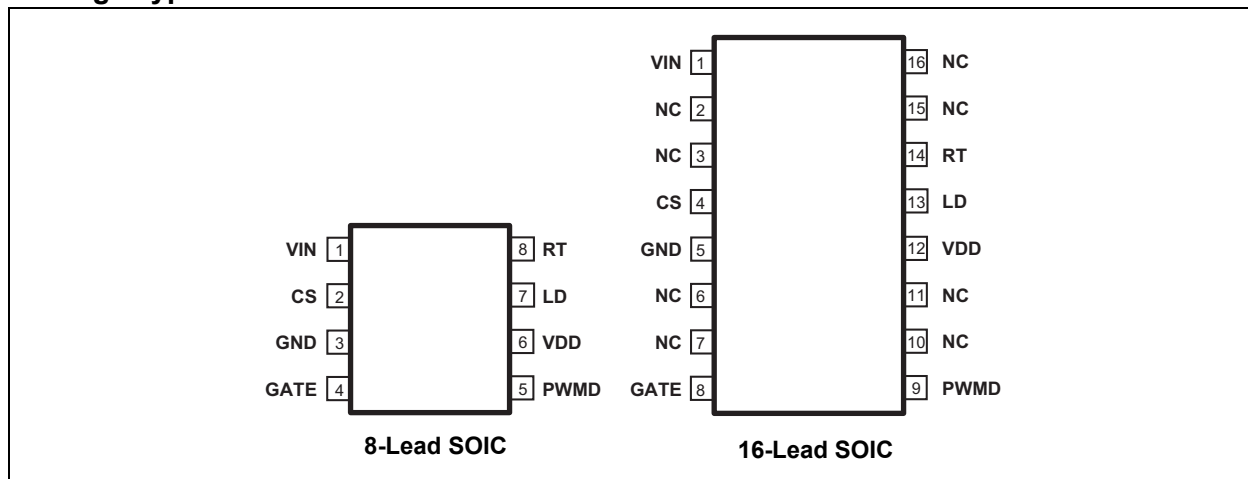
- DC/DC or AC/DC LED Driver Applications
- RGB Back-Lighting LED Driver
- Back Lighting of Flat Panel Displays
- General Purpose Constant Current Source
- Signage and Decorative LED Lighting
- Chargers

### Description

HV9910C is an open-loop, current-mode control, LED driver IC. This IC can be programmed to operate in either a constant frequency or constant off-time mode. It includes a 15-450V linear regulator which allows it to work with a wide range of input voltages without the need for an external low voltage supply. HV9910C includes a TTL-compatible, PWM-dimming input that can accept an external control signal with a duty ratio of 0-100% and a frequency of up to a few kilohertz. It also includes a 0-250 mV linear-dimming input which can be used for linear dimming of the LED current. Unlike the HV9910B, the HV9910C is equipped with built-in thermal-shutdown protection.

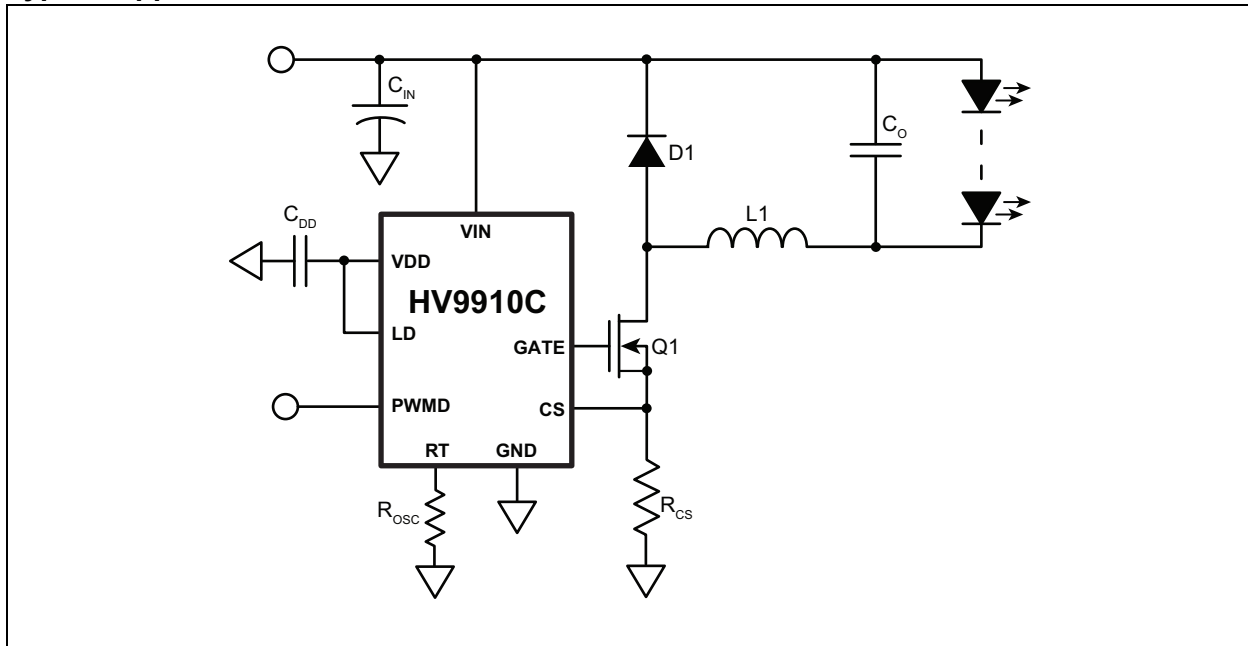
HV9910C is ideally suited for buck LED drivers. Since the HV9910C operates in open-loop current mode control, the controller achieves good output current regulation without the need for any loop compensation. Also, being an open-loop controller, PWM-dimming response is limited only by the rate of rise of the inductor current, enabling a very fast rise and fall times of the LED current. HV9910C requires only three external components (apart from the power stage) to produce a controlled LED current. This makes HV9910C an ideal solution for low-cost LED drivers.

### Package Types

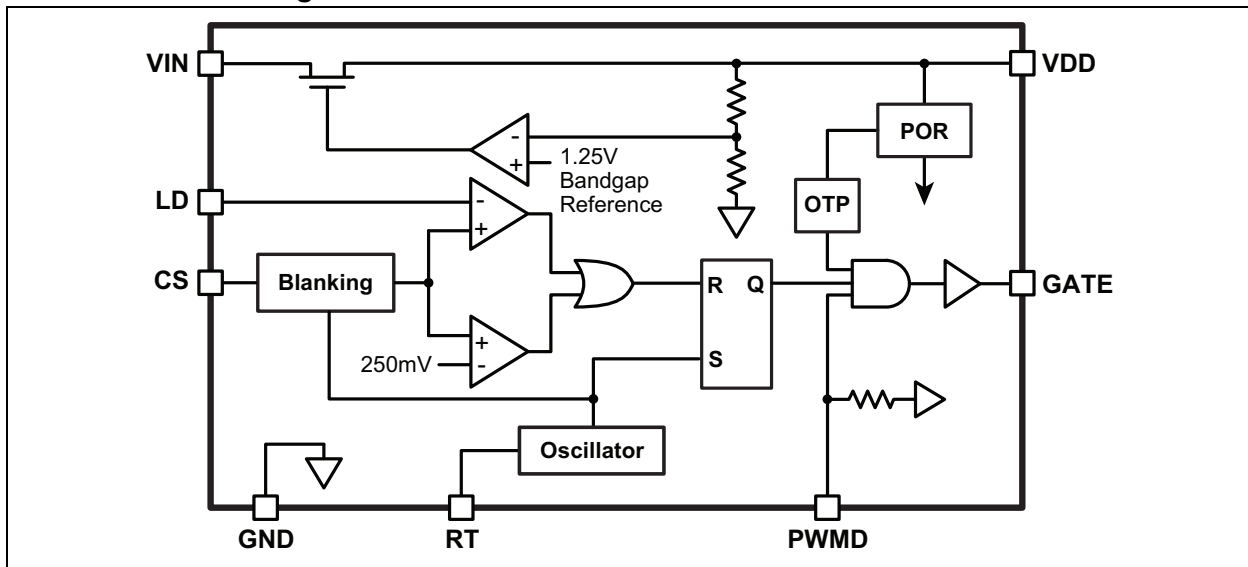


# HV9910C

## Typical Application Circuit



## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### ABSOLUTE MAXIMUM RATINGS<sup>†</sup>

$V_{IN}$ to GND.....	-0.5V to +470V
$V_{DD}$ to GND.....	12V
CS, LD, PWMD, GATE.....	-0.3V to ( $V_{DD} + 0.3V$ )
Junction temperature .....	-40°C to +125°C
Storage temperature .....	-65°C to +150°C
Continuous power dissipation ( $T_A = +25^\circ\text{C}$ )	
8-lead SOIC .....	650 mW
16-lead SOIC.....	1300 mW
8-lead SOIC with heat slug.....	1300 mW

**† Notice:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions, above those indicated in the operational listings of this specification, is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### 1.1 ELECTRICAL SPECIFICATIONS

**TABLE 1-1: ELECTRICAL CHARACTERISTICS (Note 1)**

Parameter	Symbol	Min	Typ	Max	Units	Conditions
<b>Input</b>						
Input DC Supply Voltage Range, (Note 2)	$V_{INDC}$	15	—	450	V	DC input voltage, (Note 3)
Supply Current	$I_{IN(MAX)}$	—	0.8	1.5	mA	Pin PWMD to $V_{DD}$ , no capacitance at GATE
Shut-down Mode Supply Current	$I_{INSD}$	—	0.5	1.0	mA	Pin PWMD to GND
<b>Internal Regulator</b>						
Internally Regulated Voltage	$V_{DD}$	7.20	7.50	7.75	V	$V_{IN} = 15V$ , $I_{DD(ext)} = 0$ , PWMD = $V_{DD}$ , 500 pF at GATE; $R_{OSC} = 249\text{ k}\Omega$
Line Regulation of $V_{DD}$	$\Delta V_{DD, \text{line}}$	0	—	1.0	V	$V_{IN} = 15 - 450V$ , $I_{DD(ext)} = 0$ , PWMD = $V_{DD}$ , 500 pF at GATE; $R_{OSC} = 249\text{ k}\Omega$
Load Regulation of $V_{DD}$	$\Delta V_{DD, \text{load}}$	0	—	0.1	V	$I_{DD(ext)} = 0 - 1.0\text{ mA}$ , PWMD = $V_{DD}$ , 500 pF at GATE; $R_{OSC} = 249\text{ k}\Omega$
$V_{DD}$ Under Voltage Lockout Threshold	UVLO	6.45	6.70	6.95	V	$V_{DD}$ rising, (Note 3)
$V_{DD}$ Under Voltage Lockout Hysteresis	$\Delta UVLO$	—	500	—	mV	$V_{DD}$ falling
Maximum Regulator Current	$I_{IN(MAX)}$	5.0	—	—	mA	$V_{DD} = UVLO - \Delta UVLO$ , (Note 4)
<b>PWM Dimming</b>						
PWMD Input Low Voltage	$V_{EN(lo)}$	—	—	1.0	V	$V_{IN} = 15 - 450V$ , (Note 3)
PWMD Input High Voltage	$V_{EN(hi)}$	2.4	—	—	V	$V_{IN} = 15 - 450V$ , (Note 3)
Internal Pull-down Resistance at PWMD	$R_{EN}$	50	100	150	k $\Omega$	$V_{PWMD} = 5.0V$
<b>Current Sense Comparator</b>						
Current Sense Pull-in Threshold Voltage	$V_{CST}$	217	250	275	mV	-40°C < $T_A$ < +125°C
Offset Voltage for LD Comparator	$V_{OFFSET}$	-20	—	+20	mV	Note 3

**Note 1:** Specifications apply at  $T_A = 25^\circ\text{C}$ ,  $V_{IN} = 15V$  unless otherwise noted.

**2:** Also limited by package-power dissipation limit; Whichever is lower.

**3:** Applies over the full operating ambient temperature range of -40°C <  $T_A$  < +125°C.

**4:** For design guidance only.

**TABLE 1-1: ELECTRICAL CHARACTERISTICS (Note 1) (CONTINUED)**

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Current Sense Blanking Interval	$T_{\text{BLANK}}$	175	215	317	ns	$0^{\circ}\text{C} < T_{\text{A}} < +85^{\circ}\text{C}$ , $V_{\text{LD}} = V_{\text{DD}}$ , $V_{\text{CS}} = V_{\text{CS,TH}} + 50\text{ mV}$ after $T_{\text{BLANK}}$
		175	215	350		$-40^{\circ}\text{C} < T_{\text{A}} < +125^{\circ}\text{C}$ , $V_{\text{LD}} = V_{\text{DD}}$ , $V_{\text{CS}} = V_{\text{CS,TH}} + 50\text{ mV}$ after $T_{\text{BLANK}}$
Delay to Output	$t_{\text{DELAY}}$	—	80	150	ns	$V_{\text{IN}} = 15\text{V}$ , $V_{\text{LD}} = 0.15\text{V}$ , $V_{\text{CS}} = 0\text{V}$ to $0.22\text{V}$ after $t_{\text{BLANK}}$
Oscillator						
Oscillator Frequency	$f_{\text{OSC}}$	20	25	30	kHz	$R_{\text{OSC}} = 1.00\text{ M}\Omega$
		80	100	120		$R_{\text{OSC}} = 249\text{ k}\Omega$
Gate Driver						
Maximum GATE Sourcing Current	$I_{\text{SOURCE}}$	0.165	—	—	A	$V_{\text{GATE}} = 0\text{V}$
Maximum GATE Sinking Current	$I_{\text{SINK}}$	0.165	—	—	A	$V_{\text{GATE}} = V_{\text{DD}}$
GATE Output Rise Time	$t_{\text{RISE}}$	—	30	50	ns	$C_{\text{GATE}} = 500\text{ pF}$ , (Note 4)
GATE Output Fall Time	$t_{\text{FALL}}$	—	30	50	ns	$C_{\text{GATE}} = 500\text{ pF}$ , (Note 4)
Over-Temperature Protection						
Shut-down Temperature	$T_{\text{SD}}$	128	—	150	$^{\circ}\text{C}$	
Hysteresis	$\Delta T_{\text{SD}}$	10	—	30	$^{\circ}\text{C}$	
$T_{\text{SD}}$ -mode $V_{\text{IN}}$ Current	$I_{\text{SD}}$	—	—	350	$\mu\text{A}$	

- Note 1:** Specifications apply at  $T_A = 25^{\circ}\text{C}$ ,  $V_{IN} = 15\text{V}$  unless otherwise noted.  
**2:** Also limited by package-power dissipation limit; Whichever is lower.  
**3:** Applies over the full operating ambient temperature range of  $-40^{\circ}\text{C} < T_A < +125^{\circ}\text{C}$ .  
**4:** For design guidance only.

**TABLE 1-2: THERMAL RESISTANCE**

Package	Symbol	Min	Typ	Max	Units	Conditions
8-Lead SOIC	$\theta_{JA}$	—	101	—	$^{\circ}\text{C}/\text{W}$	
16-Lead SOIC	$\theta_{JA}$	—	83	—	$^{\circ}\text{C}/\text{W}$	
8-Lead SOIC (with heat slug)	$\theta_{JA}$	—	84	—	$^{\circ}\text{C}/\text{W}$	

## 2.0 PIN DESCRIPTION

The descriptions of the pins are listed in [Table 2-1](#).

**TABLE 2-1: PIN DESCRIPTION**

Pin #		Function	Description
8-Lead SOIC	16-Lead SOIC		
1	1	VIN	Input of an 15-450V linear regulator.
2	4	CS	Current sense pin used to sense the FET current by means of an external sense resistor. When this pin exceeds the lower of either the internal 250 mV or the voltage at the LD pin, the GATE output goes low.
3	5	GND	Ground return for all internal circuitry. Must be electrically connected to the power ground.
4	8	GATE	Output GATE driver for an external N-channel power MOSFET.
5	9	PWMD	TTL-compatible, PWM-dimming input of the IC. When this pin is pulled to GND or left open, the GATE driver is turned off. When the pin is pulled high, the GATE driver operates normally.
6	12	VDD	Power supply pin for all internal circuits. It must be bypassed with a low-ESR capacitor to GND ( $\geq 0.1 \mu\text{F}$ ).
7	13	LD	Linear-dimming input and sets the current sense threshold as long as the voltage at the pin is less than 250 mV (typ).
8	14	RT	Sets the oscillator frequency. When a resistor is connected between RT and GND, the HV9910C operates in constant frequency mode. When the resistor is connected between RT and GATE, the IC operates in constant off-time mode.
—	2, 3, 6, 7, 10, 11, 15, 16	NC	No connection



## 3.0 APPLICATION INFORMATION

HV9910C is optimized to drive buck LED drivers using open-loop, peak-current mode control. This method of control enables fairly accurate LED current control without the need for high side current sensing or the design of any closed loop controllers. The IC uses very few external components and enables both Linear and PWM-dimming of the LED current.

A resistor connected to the RT pin programs the frequency of operation (or the off-time). The oscillator produces pulses at regular intervals. These pulses set the SR flip-flop in the HV9910C which causes the GATE driver to turn on. The same pulses also start the blanking timer, which inhibits the reset input of the SR flip flop and prevents false turn-offs due to the turn-on spike. When the FET turns on, the current through the inductor starts ramping up. This current flows through the external sense resistor,  $R_{CS}$ , and produces a ramp voltage at the CS pin. The comparators are constantly comparing the CS pin voltage to both the voltage at the LD pin and the internal 250 mV. Once the blanking timer is complete, the output of these comparators is allowed to reset the flip-flop. When the output of either one of the two comparators goes high, the flip-flop is reset and the GATE output goes low. The GATE goes low until the SR flip-flop is set by the oscillator. Assuming a 30% ripple in the inductor, the current sense resistor  $R_{CS}$  can be set using:

$$R_{CS} = \frac{0.25V(or V_{LD})}{1.15 \cdot I_{LED}}$$

Constant frequency peak current mode control has an inherent disadvantage – at duty cycles greater than 0.5, the control scheme goes into subharmonic oscillations. To prevent this, an artificial slope is typically added to the current sense waveform. This slope compensation scheme will affect the accuracy of the LED current in the present form. However, a constant off-time peak current control scheme does not have this problem and can easily operate at duty cycles greater than 0.5. This control scheme also gives inherent input voltage rejection, making the LED current almost insensitive to input voltage variations. However, this scheme leads to variable frequency operation and the frequency range depends greatly on the input and output voltage variation. Using HV9910C, it is easy to switch between the two modes of operation by changing one connection (see [Section 3.3 “Oscillator”](#)).

### 3.1 Input Voltage Regulator

HV9910C can be powered directly from its  $V_{IN}$  pin and can work from 15-450 VDC at its  $V_{IN}$  pin. When a voltage is applied at the  $V_{IN}$  pin, HV9910C maintains a constant 7.5V at the  $V_{DD}$  pin. This voltage is used to power the IC and any external-resistor dividers needed

to control the IC. The  $V_{DD}$  pin must be bypassed by a low-ESR capacitor to provide a low impedance path for the high frequency current of the output GATE driver.

HV9910C can also be operated by supplying a voltage at the  $V_{DD}$  pin greater than the internally regulated voltage. This will turn off the internal linear regulator of the IC and the HV9910C will operate directly off the voltage supplied at the  $V_{DD}$  pin. This external voltage at the  $V_{DD}$  pin should not exceed 12V.

Although the  $V_{IN}$  pin of the HV9910C is rated up to 450V, the actual maximum voltage that can be applied is limited by the power dissipation in the IC. For example, if an 8-lead SOIC HV9910C (junction to ambient thermal resistance  $R_{\theta ja} = 101^{\circ}\text{C/W}$ ) draws about  $I_{IN} = 2.0$  mA from the  $V_{IN}$  pin, and has a maximum allowable temperature rise of the junction temperature limited to  $\Delta T = 75^{\circ}\text{C}$ , the maximum voltage at the  $V_{IN}$  pin would be:

$$\begin{aligned} V_{IN(MAX)} &= \frac{\Delta T}{R_{\theta ja}} \cdot \frac{1}{I_{IN}} \\ &= \frac{75^{\circ}\text{C}}{101^{\circ}\text{C/W}} \cdot \frac{1}{2\text{mA}} \\ &= 371\text{V} \end{aligned}$$

In these cases, to operate HV9910C from higher input voltages, a Zener diode can be added in series with the  $V_{IN}$  pin to divert some of the power loss from HV9910C to the Zener diode. In the above example, using a 100V Zener diode will allow the circuit to easily work up to 450V.

**Note:** The Zener diode will increase the minimum input voltage required to turn on the HV9910C to 115V.

The input current drawn from the  $V_{IN}$  pin is a sum of the 1.5 mA (maximum) current drawn by the internal circuit and the current drawn by the GATE driver. The GATE driver depends on the switching frequency and the GATE charge of the external FET.

$$I_{IN} = 1.5\text{mA} + Q_g \cdot f_s$$

In the above equation,  $f_s$  is the switching frequency and  $Q_g$  is the GATE charge of the external FET, which can be obtained from the data sheet of the FET.

### 3.2 Current Sense

The current sense input of HV9910C goes to the non-inverting inputs of two comparators. The inverting terminal of one comparator is tied to an internal 250 mV reference, whereas the inverting terminal of the other comparator is connected to the LD pin. The outputs of both these comparators are fed into an OR GATE and the output of the OR GATE is fed into the reset pin of

the flip-flop. Thus, the comparator which has the lowest voltage at the inverting terminal determines when the GATE output is turned off.

The outputs of the comparators also include a 150-280 ns blanking time which prevents spurious turn-offs of the external FET due to the turn-on spike normally present in peak-current mode control. In rare cases, this internal blanking might not be enough to filter out the turn-on spike. In these instances, an external RC filter needs to be added between the external sense resistor (RCS) and the CS pin.

Please note that the comparators are fast (with a typical 80 ns response time). A proper layout minimizing external inductances will prevent false triggering of these comparators.

### 3.3 Oscillator

The oscillator in HV9910C is controlled by a single resistor connected at the RT pin. The equation governing the oscillator time period  $T_{OSC}$  is given by:

$$T_{OSC}(\mu s) = \frac{R_{OSC}(k\Omega)}{25}$$

If the resistor is connected between RT and GND, HV9910C operates in a constant frequency mode and the above equation determines the time period. If the resistor is connected between RT and GATE, HV9910C operates in a constant off-time mode and the above equation determines the off-time.

### 3.4 Gate Output

The gate output of the HV9910C is used to drive an external FET. It is recommended that the GATE charge of the external FET be less than 25 nC for switching frequencies  $\leq 100$  kHz and less than 15 nC for switching frequencies  $> 100$  kHz.

### 3.5 Linear Dimming

The Linear Dimming pin is used to control the LED current. There are two cases when it may be necessary to use the Linear Dimming pin.

1. In some cases, when using the internal 250 mV, it may not be possible to find the exact  $R_{CS}$  value required to obtain the LED current. In these cases, an external voltage divider from the  $V_{DD}$  pin can be connected to the LD pin to obtain a voltage (less than 250 mV) corresponding to the desired voltage across  $R_{CS}$ .
2. Linear dimming may be desired to adjust the current level to reduce the intensity of the LEDs. In these cases, an external 0-250 mV voltage can be connected to the LD pin to adjust the LED current during operation.

To use the internal 250 mV, the LD pin can be connected to  $V_{DD}$ .

**Note:** Although the LD pin can be pulled to GND, the output current will not go to zero. This is due to the presence of a minimum on-time, which is equal to the sum of the blanking time and the delay to output time, or about 450 ns. This minimum on-time causes the FET to be on for a minimum of 450 ns, and thus the LED current when LD = GND is not zero. This current is also dependent on the input voltage, inductance value, forward voltage of the LEDs, and circuit parasitics. To get zero LED current, the PWMD pin has to be used.

### 3.6 PWM Dimming

PWM Dimming can be achieved by driving the PWMD pin with a low frequency square wave signal. When the PWM signal is zero, the GATE driver is turned off; when the PWMD signal is high, the GATE driver is enabled. The PWMD signal does not turn off the other parts of the IC, therefore, the response of HV9910C to the PWMD signal is almost instantaneous. The rate of rise and fall of the LED current is thus determined solely by the rise and fall times of the inductor current.

To disable PWM Dimming and enable the HV9910C permanently, connect the PWMD pin to  $V_{DD}$ .

### 3.7 Over-Temperature Protection

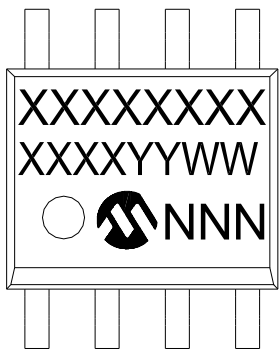
The auto-recoverable thermal shutdown at 140°C (typ.) junction temperature with 20°C hysteresis is featured to avoid thermal runaway. When the junction temperature reaches  $T_{SD} = 140^\circ\text{C}$  (typ.), HV9910C enters a low power consumption shut-down mode with  $I_{IN} < 350 \mu\text{A}$ .

# HV9910C

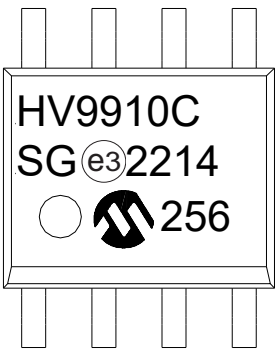
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

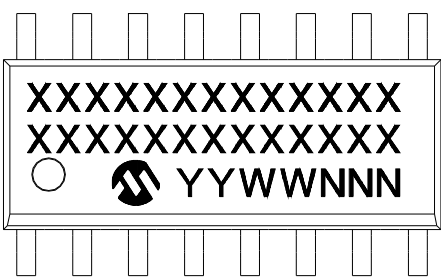
8-Lead SOIC



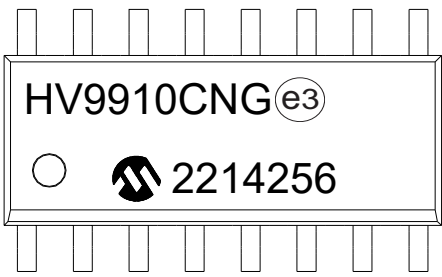
Example



16-Lead SOIC



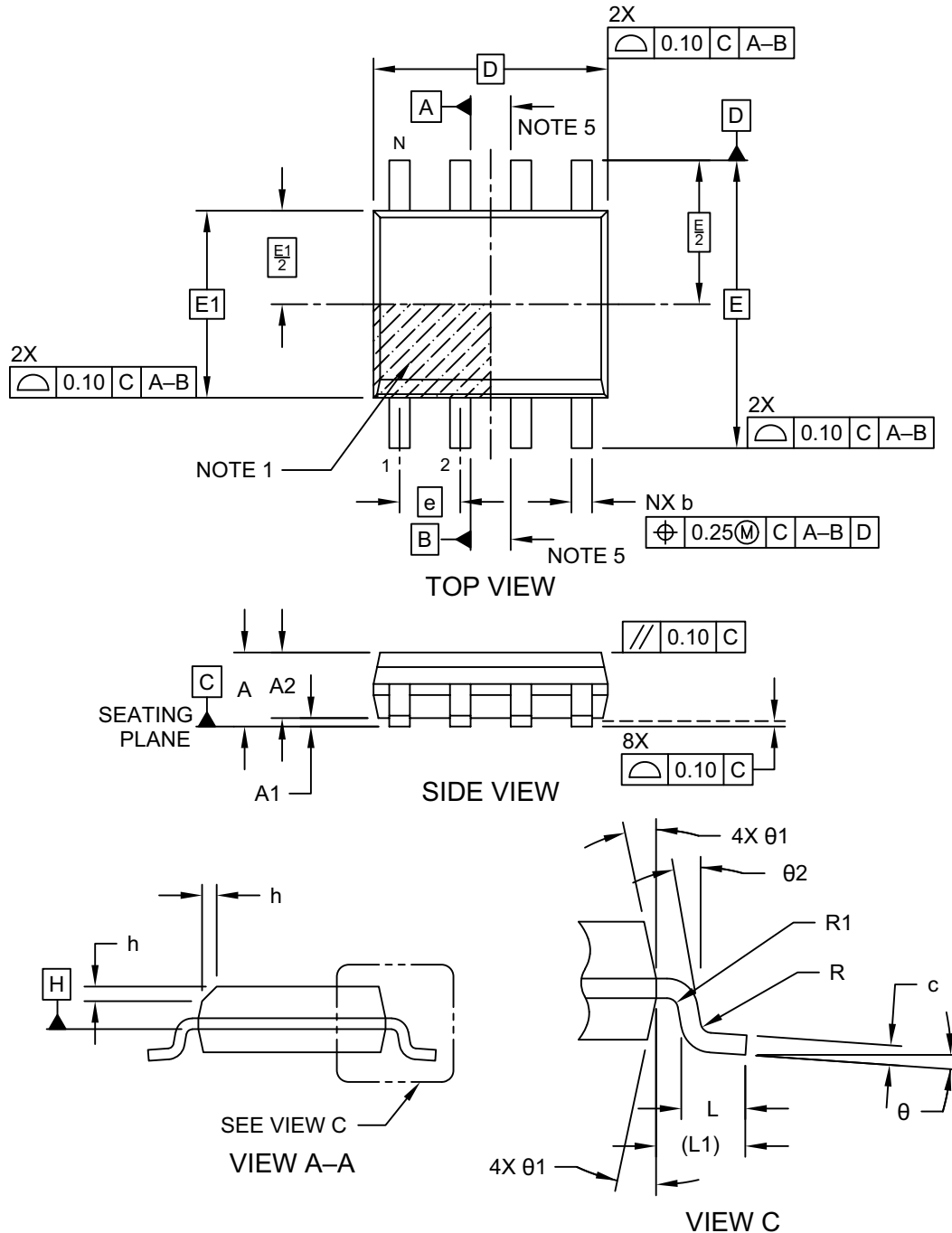
Example



<b>Legend:</b>	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	e3	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package.
	•, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).
<b>Note:</b>	In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.	
	Underbar ( _ ) and/or Overbar ( ¯ ) symbol may not be to scale.	

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

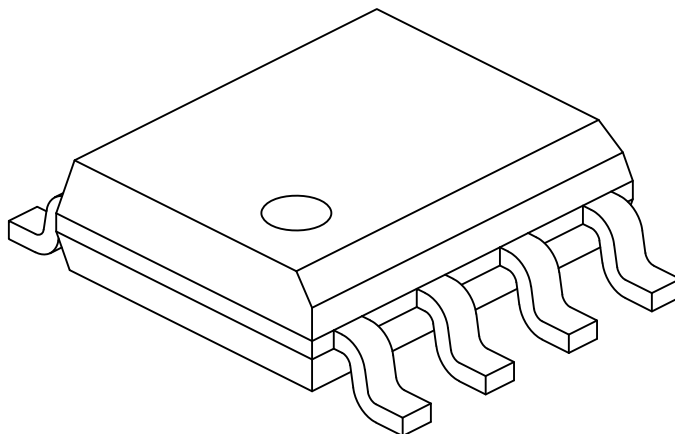
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing No. C04-057-SN Rev J Sheet 1 of 2

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



		Units	MILLIMETERS		
Dimension Limits			MIN	NOM	MAX
Number of Pins	N		8		
Pitch	e		1.27 BSC		
Overall Height	A		–	–	1.75
Molded Package Thickness	A2		1.25	–	–
Standoff §	A1		0.10	–	0.25
Overall Width	E		6.00 BSC		
Molded Package Width	E1		3.90 BSC		
Overall Length	D		4.90 BSC		
Chamfer (Optional)	h		0.25	–	0.50
Foot Length	L		0.40	–	1.27
Footprint	L1		1.04 REF		
Lead Thickness	c		0.17	–	0.25
Lead Width	b		0.31	–	0.51
Lead Bend Radius	R		0.07	–	–
Lead Bend Radius	R1		0.07	–	–
Foot Angle	θ		0°	–	8°
Mold Draft Angle	θ1		5°	–	15°
Lead Angle	θ2		0°	–	8°

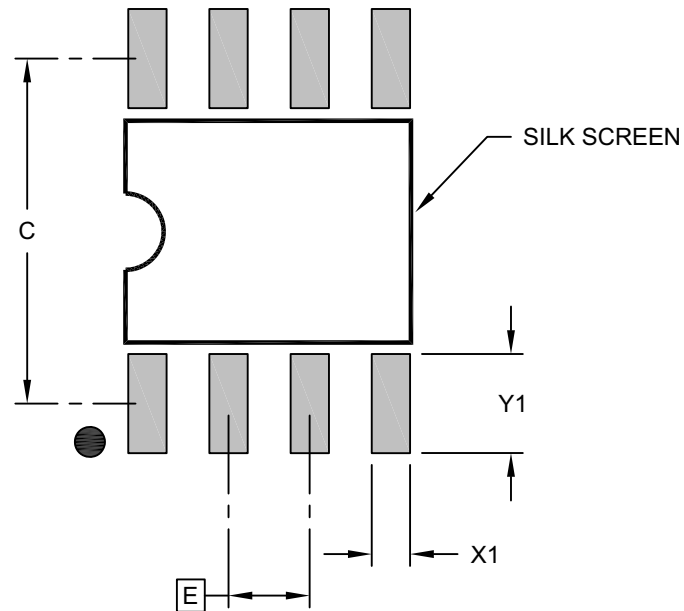
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.
- Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-057-SN Rev J Sheet 2 of 2

## 8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	1.27 BSC		
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

**Notes:**

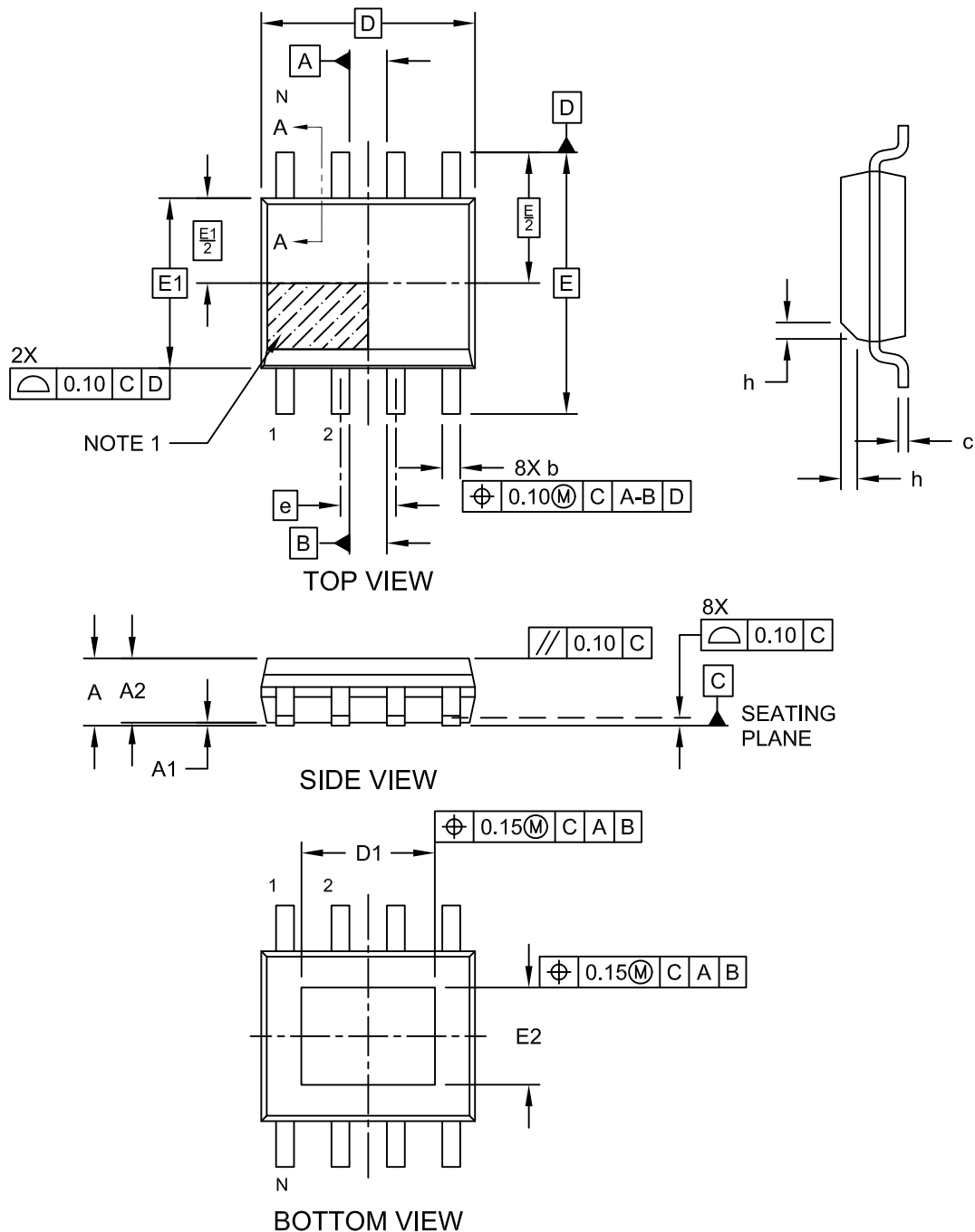
1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2057-SN Rev J

## 8-Lead Thermally Enhanced Plastic Small Outline (SE) - Narrow, 3.90 mm Body [SOIC] With 2.2 x 3.0 mm Exposed Pad

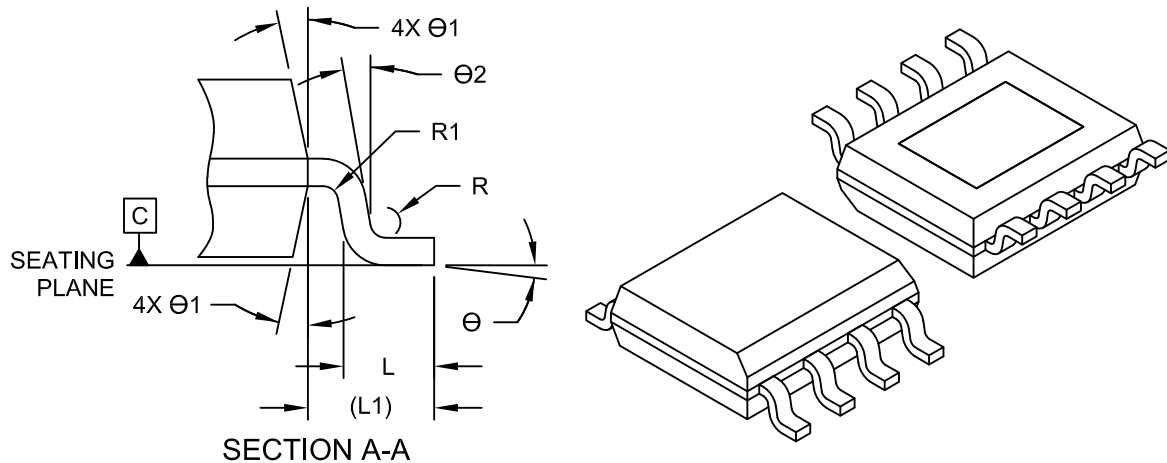
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-162-SE Rev D Sheet 1 of 2

## 8-Lead Thermally Enhanced Plastic Small Outline (SE) - Narrow, 3.90 mm Body [SOIC] With 2.2 x 3.0 mm Exposed Pad

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	1.27 BSC		
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.00	-	0.15
Overall Width	E	6.00 BSC		
Molded Package Width	E1	3.90 BSC		
Overall Length	D	4.90 BSC		
Exposed Pad Width	E2	2.05	2.23	2.41
Exposed Pad Length	D1	2.81	3.06	3.30
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1	1.04 REF		
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Lead Bend Radius	R	0.07	-	-
Lead Bend Radius	R1	0.07	-	-
Foot Angle	$\Theta$	0°	-	8°
Lead Angle	$\Theta 2$	0°	-	-
Mold Draft Angle Top and Bottom	$\Theta 1$	5°	-	15°

### Notes:

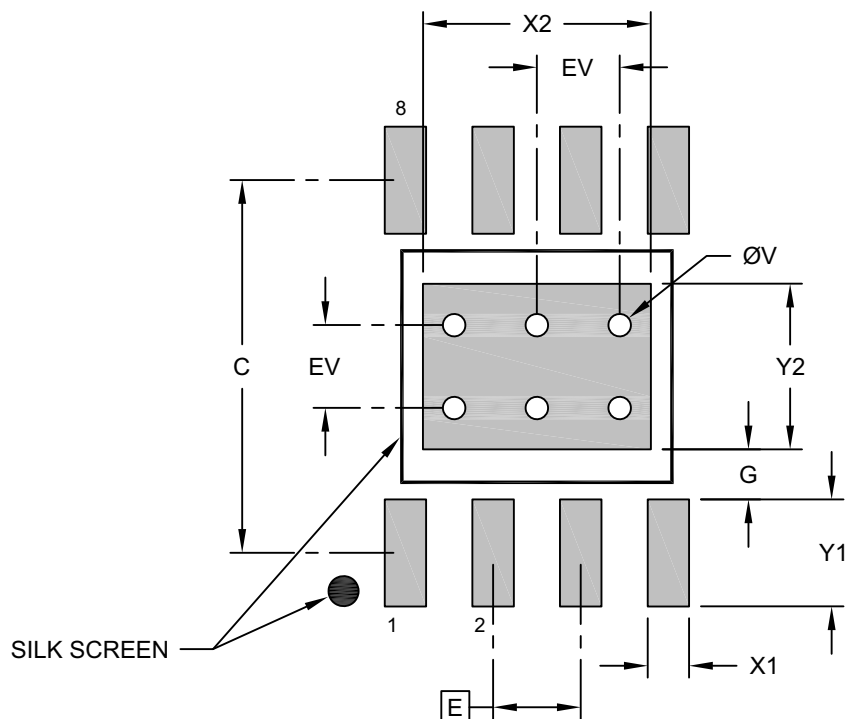
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M
  - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
  - REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-162-SE Rev D Sheet 2 of 2



## 8-Lead Thermally Enhanced Plastic Small Outline (SE) - Narrow, 3.90 mm Body [SOIC] With 2.2 x 3.0 mm Exposed Pad

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	1.27 BSC		
Center Pad Width	X2			3.30
Center Pad Length	Y2			2.40
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55
Contact Pad to Center Pad (X8)	G	0.20		
Thermal Via Diameter	V		0.33	
Thermal Via Pitch	EV		1.20	

#### Notes:

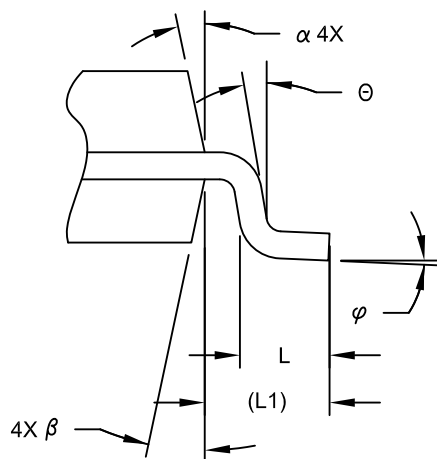
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing No. C04-2162-SE Rev D

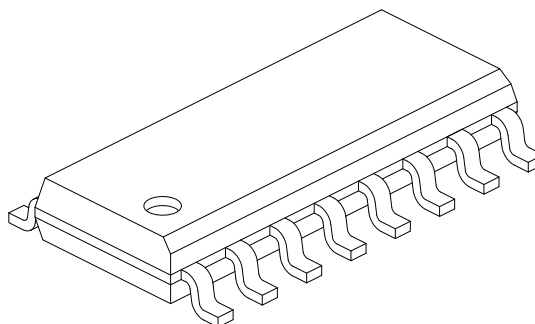


## 16-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



VIEW C



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	16		
Pitch	e	1.27 BSC		
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.10	-	0.25
Overall Width	E	6.00 BSC		
Molded Package Width	E1	3.90 BSC		
Overall Length	D	9.90 BSC		
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1	1.04 REF		
Lead Angle	$\theta$	0°	-	-
Foot Angle	$\phi$	0°	-	8°
Lead Thickness	c	0.10	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	$\alpha$	5°	-	15°
Mold Draft Angle Bottom	$\beta$	5°	-	15°

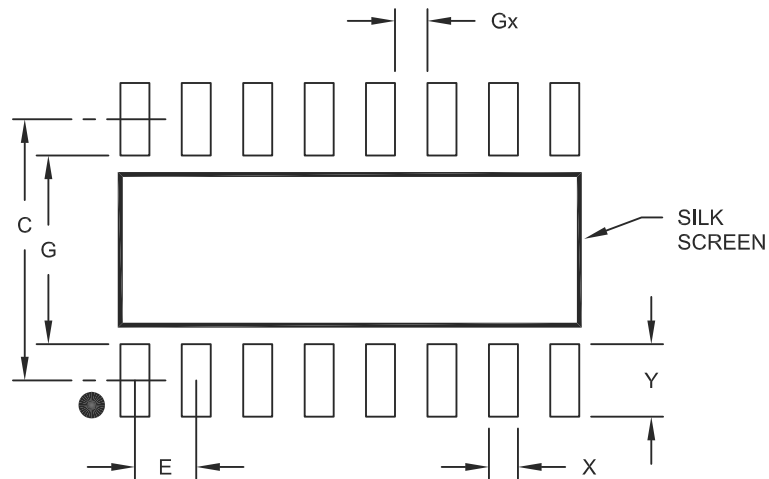
### Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimension D does not include mold flash, protrusions or gate burrs, which shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion, which shall not exceed 0.25 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M
  - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
  - REF: Reference Dimension, usually without tolerance, for information purposes only.
- Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-108C Sheet 2 of 2

## 16-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	1.27 BSC		
Contact Pad Spacing	C		5.40	
Contact Pad Width	X			0.60
Contact Pad Length	Y			1.50
Distance Between Pads	Gx	0.67		
Distance Between Pads	G	3.90		

#### Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2108A

## APPENDIX A: REVISION HISTORY

### Revision B (July 2022)

- Modified values in sections [Internal Regulator](#) and [Current Sense Comparator](#) in [Table 1-1](#).
- Updated [Section 4.0 “Packaging Information”](#) with the latest package markings and drawings.
- Minor text and format changes throughout.

### Revision A (August 2014)

- Original Release of this Document.

# HV9910C

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>PART NO.</u>	<u>XX</u>	<u>-X</u>	<u>-XXXX<sup>1</sup></u>	<b>Examples:</b>
Device	Package Options	Environmental	Reel	
<div><div>Device:</div><div>HV9910C= Universal High-Brightness LED Driver</div><div>Package:</div><div><div>LG</div><div>= 8-Lead SOIC</div><div>NG</div><div>= 16-Lead SOIC</div><div>SG</div><div>= 8-Lead SOIC with heat slug</div></div><div>Environmental:</div><div><div>G</div><div>= Lead (Pb)-free/RoHS-compliant package</div></div><div>Reel:</div><div><div>Blank</div><div>= Reel for LG and SG packages, Tube for NG package</div><div>M934</div><div>= Reel for NG package</div></div></div>				<div>a) HV9910CLG-G: 8-Lead SOIC package, Lead (Pb)-free, RoHS-compliant, 3300/Reel.</div> <div>b) HV9910CNG-G: 16-Lead SOIC package, Lead (Pb)-free, RoHS-compliant, 45/Tube</div> <div>c) HV9910CNG-G-M934: 16-Lead SOIC package, Lead (Pb)-free, RoHS-compliant, 2600/Reel.</div> <div>d) HV9910CSG-G: 8-Lead SOIC package with heat slug, Lead (Pb)-free, RoHS-compliant, 3300/Reel.</div>
<div><div>Note 1:</div><div>Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.</div></div>				

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