CL320/CL325/CL330

3-Channel Linear LED Drivers

Features

- ±6% Current Accuracy when V_{OUT} is between 4V and 15V
- 90V Standoff Voltage
- Separate Enable Pins for each Channel for PWM Dimming
- Overtemperature Protection
- 8-Lead SOIC (with Heat Slug) Package

Applications

- LCD Backlighting
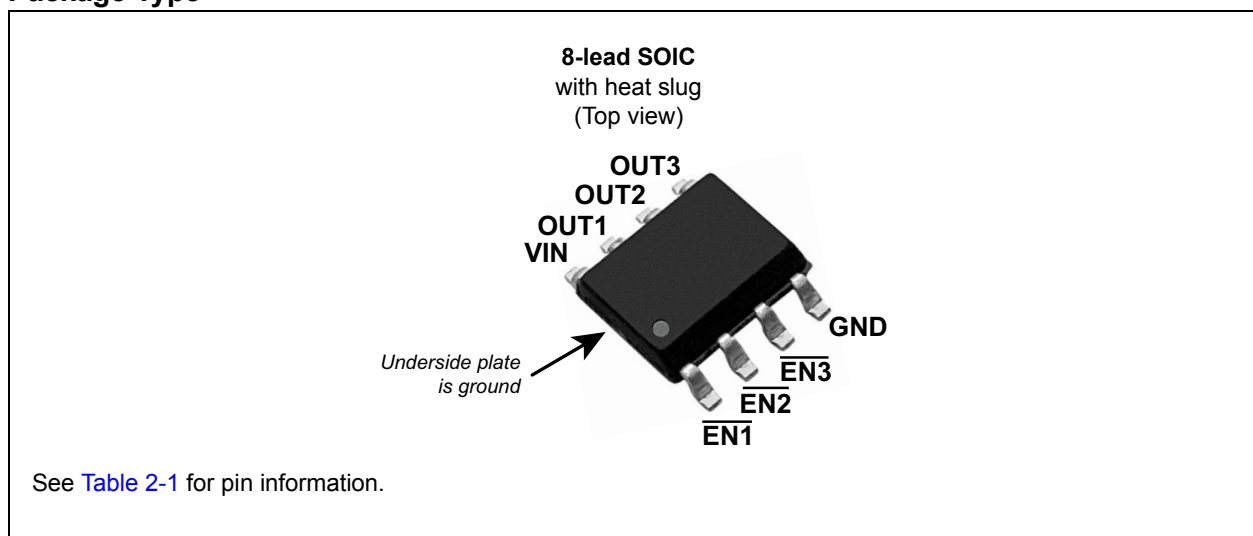- Indicator Lamps

General Description

The CL320/CL325/CL330 are designed to drive three strings of LEDs at a constant current of 20 mA, 25 mA and 30 mA, respectively.

The drive current is fixed, with a ±6% tolerance over a V_{OUT} range of 4V to 15V. Separate enable pins for each channel allow for PWM dimming, three-step linear dimming or individual disconnection of faulty LED strings.

Overtemperature protection circuitry shuts down all three channels when the nominal die temperature reaches 135°C. Normal operation resumes when the die temperature drops by 30°C.
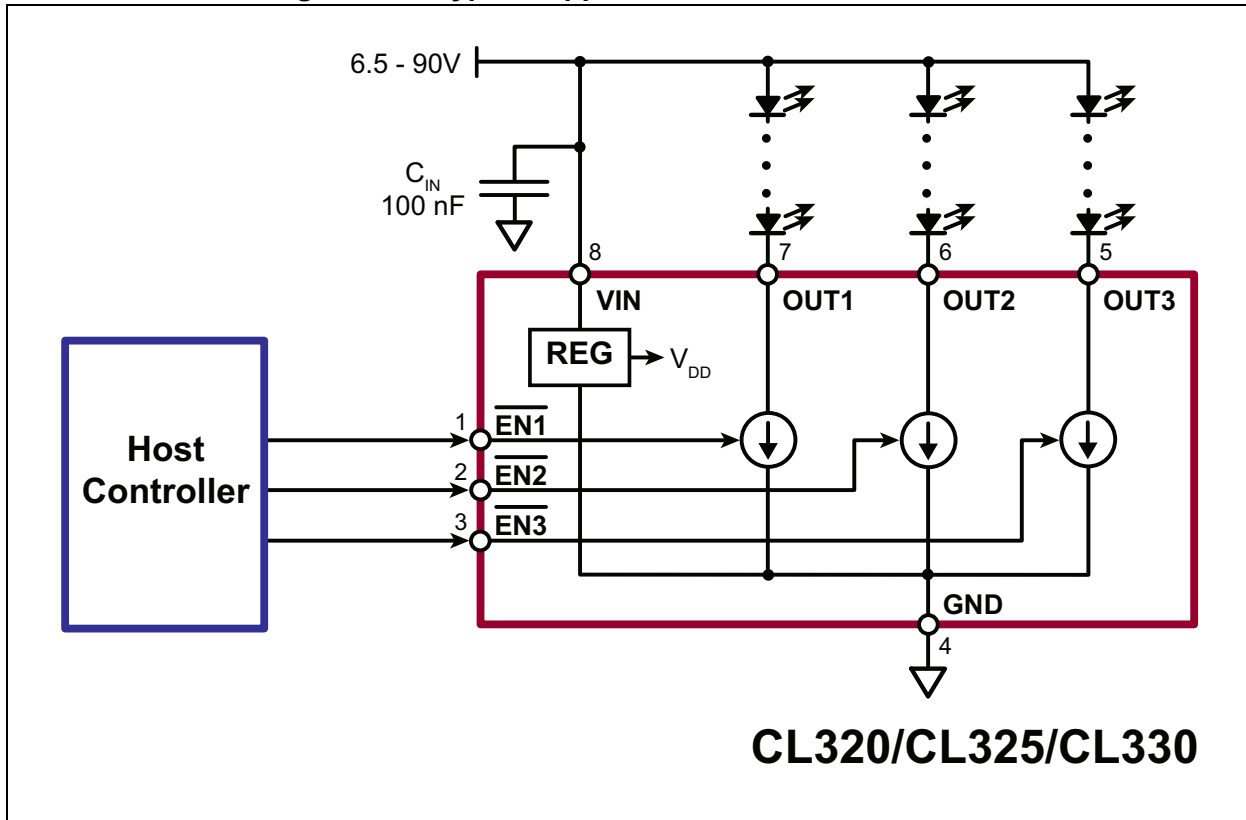
The CL320/CL325/CL330 are available in the 8-lead SOIC (with heat slug) package and require a single ceramic bypass capacitor which may be shared among several drivers.

Package Type

8-lead SOIC
with heat slug
(Top view)

OUT3
OUT2
OUT1
VIN

Underside plate is ground

GND
$\overline{EN3}$
$\overline{EN2}$
$\overline{EN1}$

See Table 2-1 for pin information.

CL320/CL325/CL330

Functional Block Diagram and Typical Application Circuit

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1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Supply Voltage, V_{IN} ....–0.5V to +100V
Output Voltage, V_{OUT} ....–0.5V to +100V
Enable Voltage, V_{EN}...–0.5V to +6.5V
Minimum Operating Junction Temperature, T_J (**Note 1**) ....–40°C
Storage Temperature, T_S ....–65°C to +150°C

> **† 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 sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

Note 1: Maximum junction temperature internally limited

RECOMMENDED OPERATING CONDITIONS

Electrical Specifications: All voltages with respect to GND pin

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	V_{IN}	6.5	—	90	V	
Output Voltage	V_{OUT}	4	—	15	V	$\overline{EN}$ = 0
				90		$\overline{EN}$ = 1
Enable Toggling Frequency	f_{EN}	0	—	100	kHz	
Operating Junction Temperature	T_J	–40	—	—	°C	
V_{IN} Capacitor	C_{IN}	—	100	—	nF	

ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over recommended operating conditions. T_A = 25°C unless otherwise noted.

Parameter		Sym.	Min.	Typ.	Max.	Unit	Conditions
V_{IN} Supply Current		I_{IN}	—	220	250	µA	$\overline{EN}_{1-3}$ = 1
			—	2.2	2.3	mA	$\overline{EN}_{1-3}$ = 0
Output Current, Off		$I_{OUT(OFF)}$	—	4	10	µA	$\overline{EN}_X$ = 1
Output Current, On	CL320	$I_{OUT(ON)}$	—	—	21.2	mA	$\overline{EN}_X$ = 0, V_{OUT} = 0V–4V
			18.8	20	21.2		$\overline{EN}_X$ = 0, V_{OUT} = 4V–15V
			18	20	22		$\overline{EN}_X$ = 0, V_{OUT} = 15V–90V
	CL325		—	—	26.5		$\overline{EN}_X$ = 0, V_{OUT} = 0V–4V
			23.5	25	26.5		$\overline{EN}_X$ = 0, V_{OUT} = 4V–15V
			22.5	25	27.5		$\overline{EN}_X$ = 0, V_{OUT} = 15V–90V
	CL330		—	—	31.8		$\overline{EN}_X$ = 0, V_{OUT} = 0V–4V
			28.2	30	31.8		$\overline{EN}_X$ = 0, V_{OUT} = 4V–15V
			27	30	33		$\overline{EN}_X$ = 0, V_{OUT} = 15V–90V
Enable Voltage, On		$V_{EN(ON)}$	—	—	0.8	V	
Enable Voltage, Off		$V_{EN(OFF)}$	2.4	—	—	V	
Enable Input Capacitance		C_{EN}	—	5	10	pF	

ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Specifications: Over recommended operating conditions. T_A = 25°C unless otherwise noted.

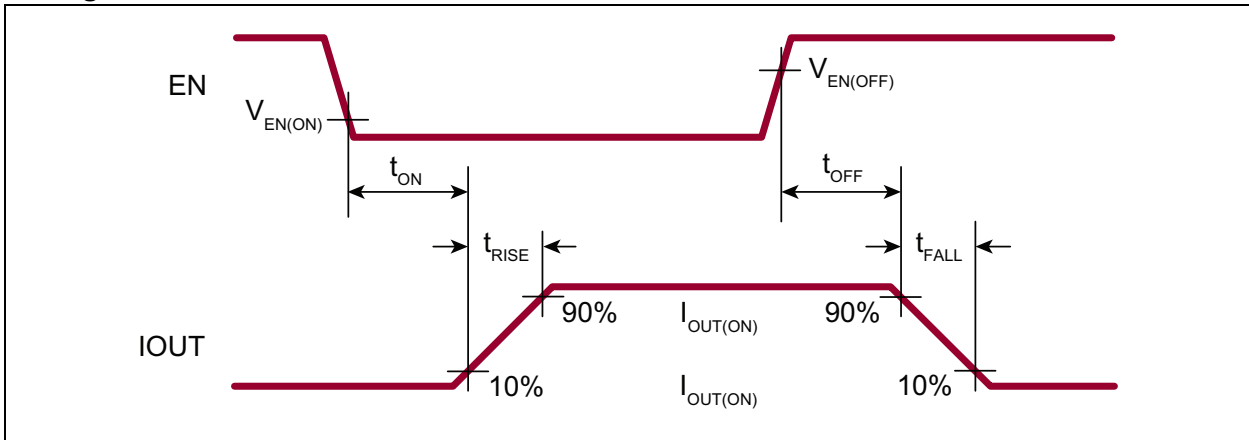| Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Enable Low Input Current	I_{ENL}	—	—	1	µA	V_{EN} = 0V
Enable High Input Current	I_{ENH}	—	—	1	µA	V_{EN} = 5V
Enable on Delay	t_{ON}	—	2	2.4	µs	
Output Current Rise Time	t_{RISE}	—	1	1.2	µs	
Enable Off Delay	t_{OFF}	—	440	800	ns	
Output Current Fall Time	t_{FALL}	—	170	250	ns	

TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TEMPERATURE RANGE						
Operating Junction Temperature	T_J	–40	—	—	°C	
Storage Temperature	T_S	–65	—	+150	°C	
Overtemperature Limit	T_{LIM}	+120	+135	+150	°C	
Overtemperature Hysteresis	T_{HYST}	—	30	—	°C	
PACKAGE THERMAL RESISTANCE						
8-lead SOIC (with heat slug)	θ_{JA}	—	84	—	°C/W	**Note 1**

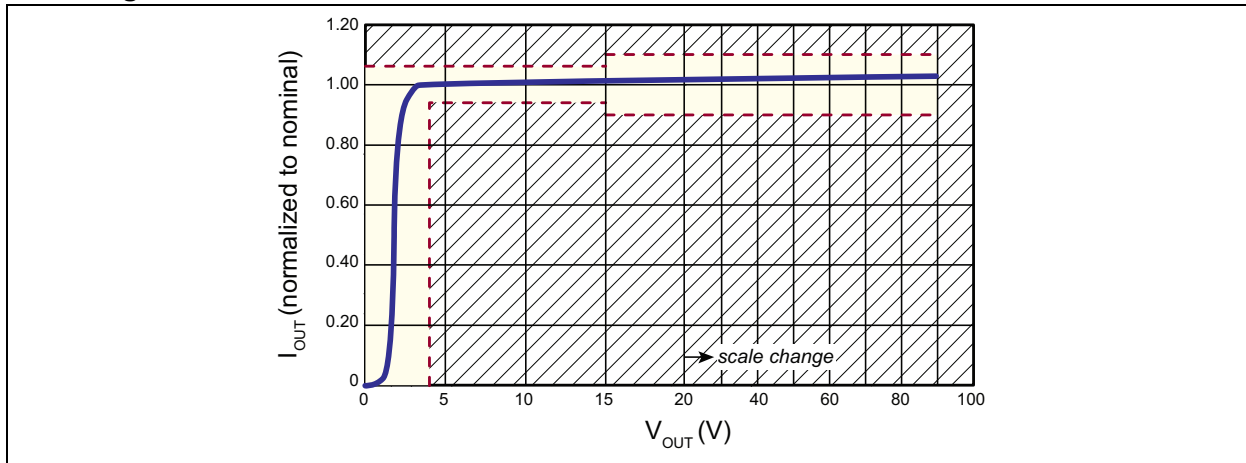**Note 1:** Mounted on JEDEC test PCB (2s 2p)
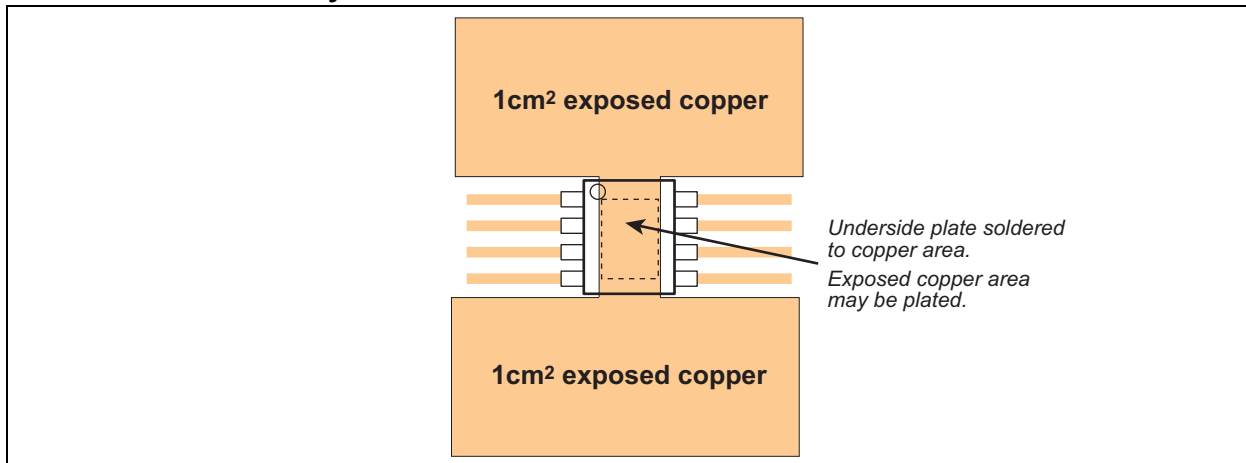
Timing Waveforms

Temperature Effects
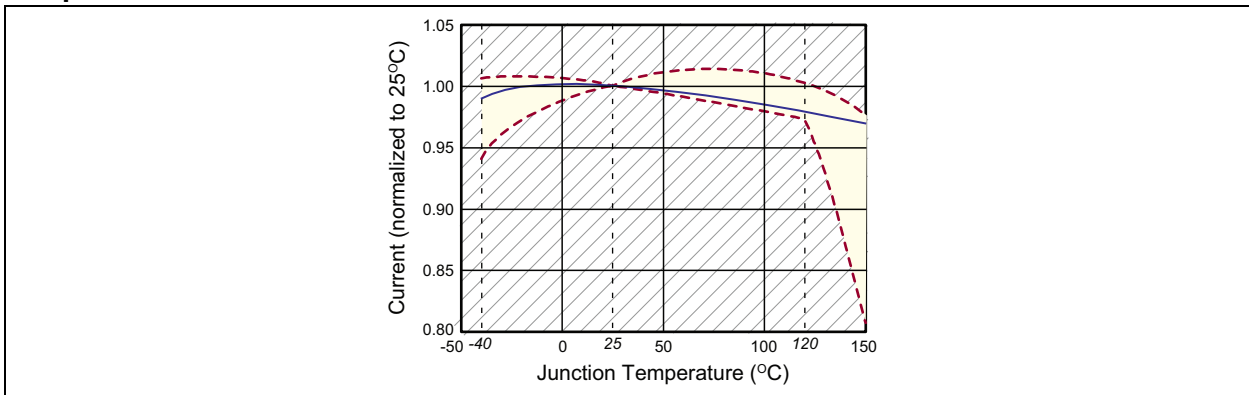
CL320/CL325/CL330

Load Regulation

Recommended PCB Layout

1cm² exposed copper

1cm² exposed copper

Underside plate soldered to copper area.
Exposed copper area may be plated.

2.0   PIN DESCRIPTION

The pin details of CL320/CL325/CL330 are listed on Table 2-1. Refer to **Package Type** for the location of the pins.

TABLE 2-1:   PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	$\overline{EN1}$	Output enable, active low
2	$\overline{EN2}$	
3	$\overline{EN3}$	
4	GND	Circuit common
5	OUT3	Constant current output (sinking). Connect the cathodes of the LEDs to these pins.
6	OUT2	
7	OUT1	
8	VIN	Supply voltage 6.5V to 90V. Bypass locally with a 100 nF capacitor to ground.
Underside Plate	GND	The exposed underside plate is internally connected to the GND pin. The plate may either be left floating or connected to ground. Solder the plate to an exposed copper area on the PCB for heatsinking purposes. (See **Recommended PCB Layout**.)

CL320/CL325/CL330

3.0   DETAILED DESCRIPTION

3.1   Higher LED Current

By paralleling outputs, higher LED currents can be achieved. In addition, linear dimming in three discrete steps may be obtained by enabling 1, 2 or 3 outputs.
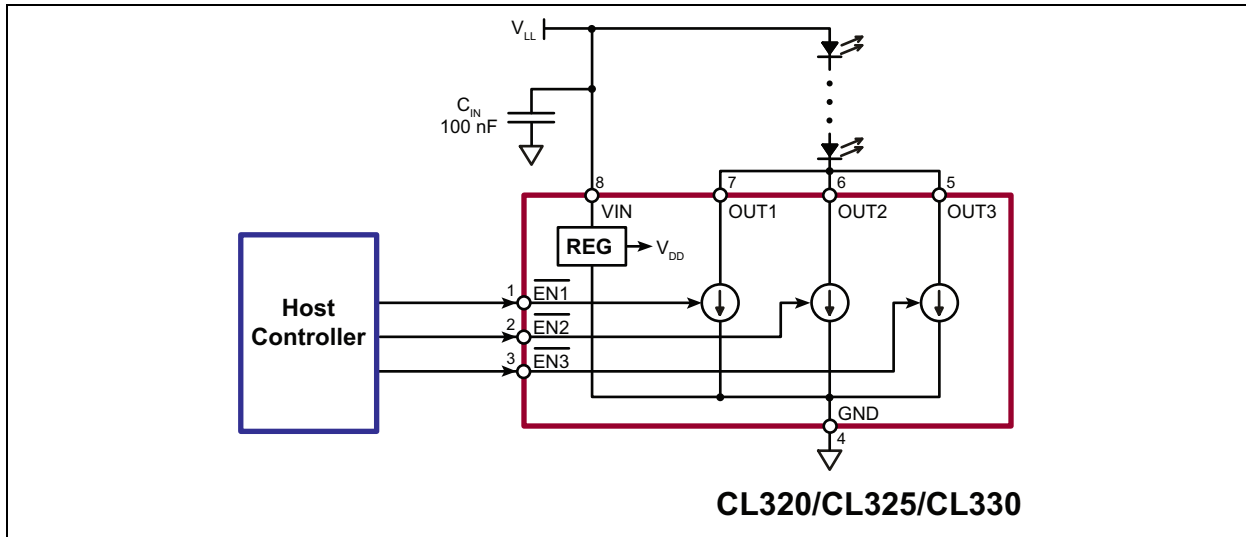
FIGURE 3-1:   *Paralleling Outputs of the CL320/CL325/CL330 LED Drivers.*
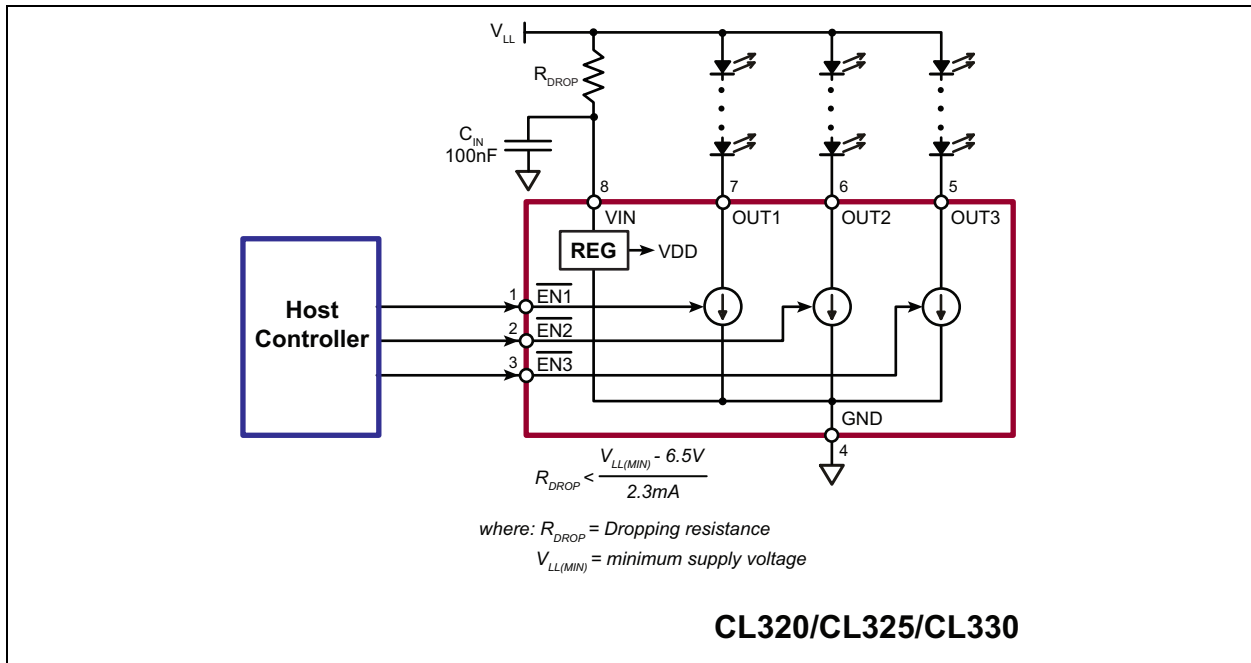
3.2   Lower Power Dissipation in the CL320/CL325/CL330

Power dissipation in the CL320/Cl325/Cl330 can be lowered in multiple ways. The following figures indicate some of the possible means to reduce power dissipation in the IC. Refer to Figure 3-2, Figure 3-3 and Figure 3-4.
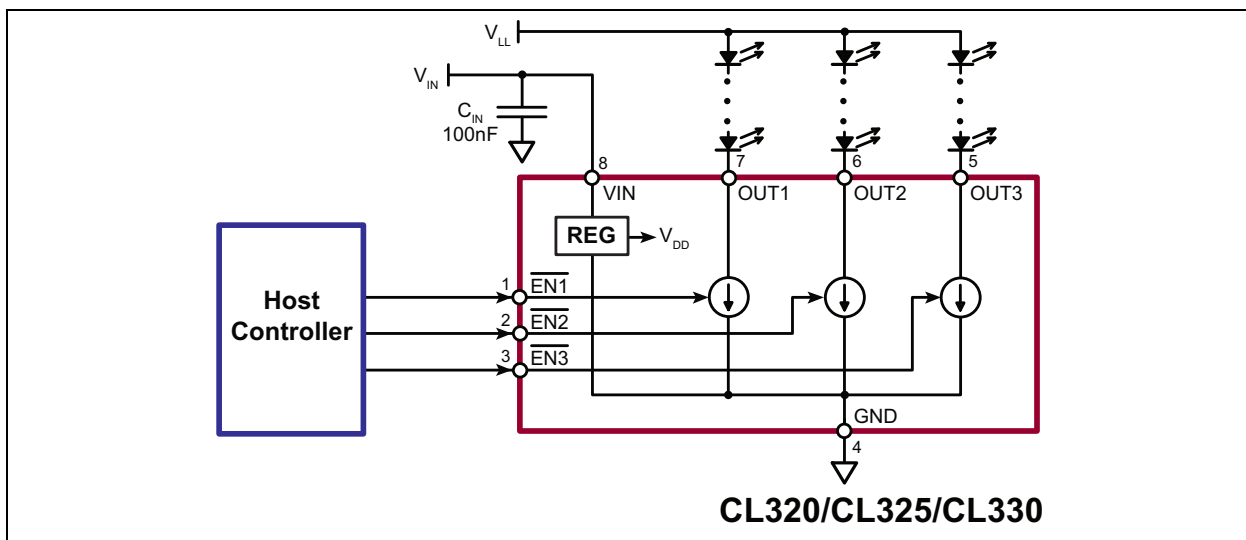
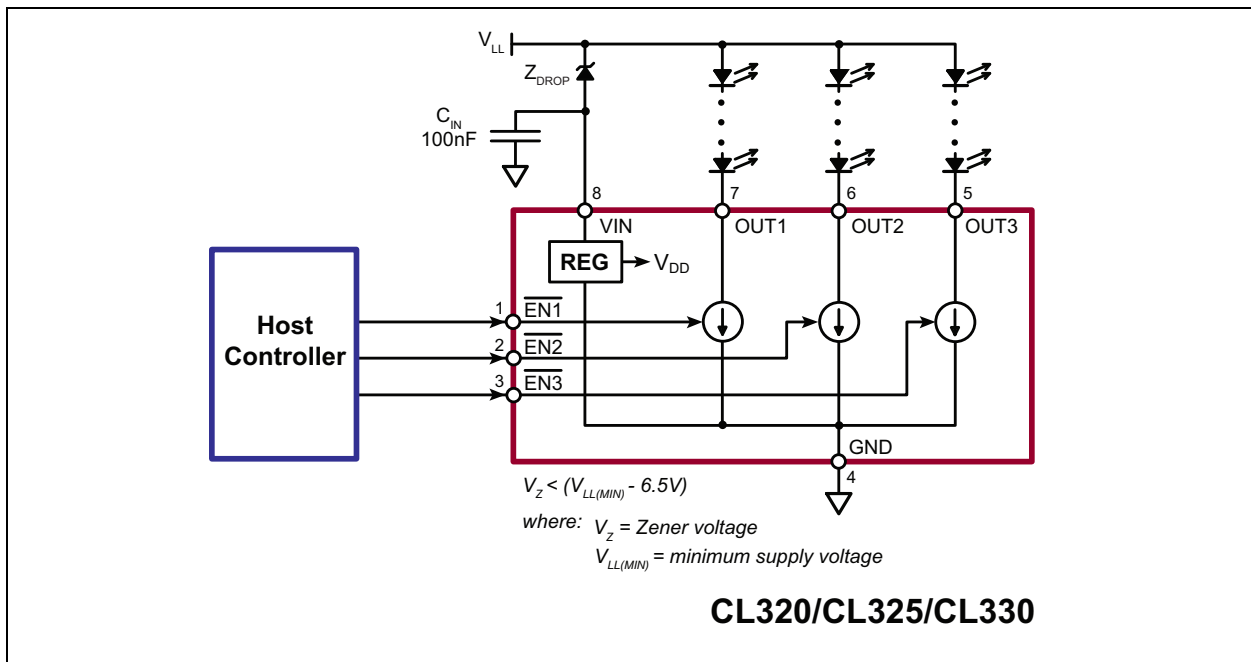**FIGURE 3-2:**   *Using a Separate Voltage Source for V_{IN} that is lower than V_{LL}.*

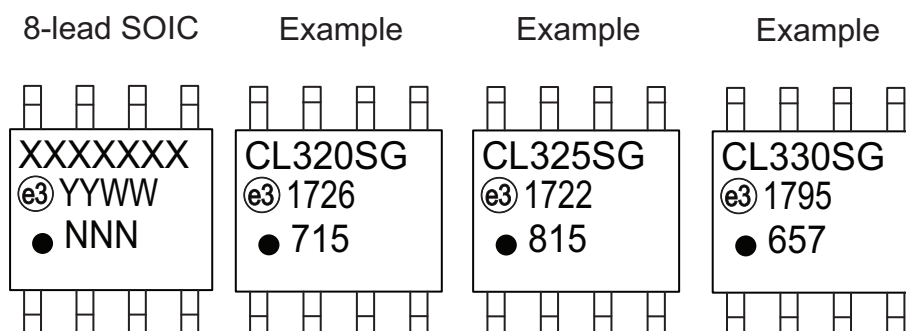**FIGURE 3-3:** *Using an External Resistor in Series with the V_{IN} pin.*

The circuit includes:

$$R_{DROP} < \frac{V_{LL(MIN)} - 6.5V}{2.3mA}$$

where: R_{DROP} = Dropping resistance
$V_{LL(MIN)}$ = minimum supply voltage

CL320/CL325/CL330

FIGURE 3-4: *Using an External Zener Diode in Series with the V_{IN} pin.*

$$V_Z < (V_{LL(MIN)} - 6.5V)$$

where: V_Z = Zener voltage
$V_{LL(MIN)}$ = minimum supply voltage

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4.0 PACKAGING INFORMATION

4.1 Package Marking Information

8-lead SOIC   Example   Example   Example

```
XXXXXXX       CL320SG       CL325SG       CL330SG
(e3) YYWW     (e3) 1726     (e3) 1722     (e3) 1795
  ● NNN         ● 715         ● 815         ● 657
```

Legend:	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.
Note:		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 product code or customer-specific information. Package may or not include the corporate logo.

8-Lead SOIC (Narrow Body w/Heat Slug) Package Outline (SG)
4.90x3.90mm body, 1.70mm height (max), 1.27mm pitch
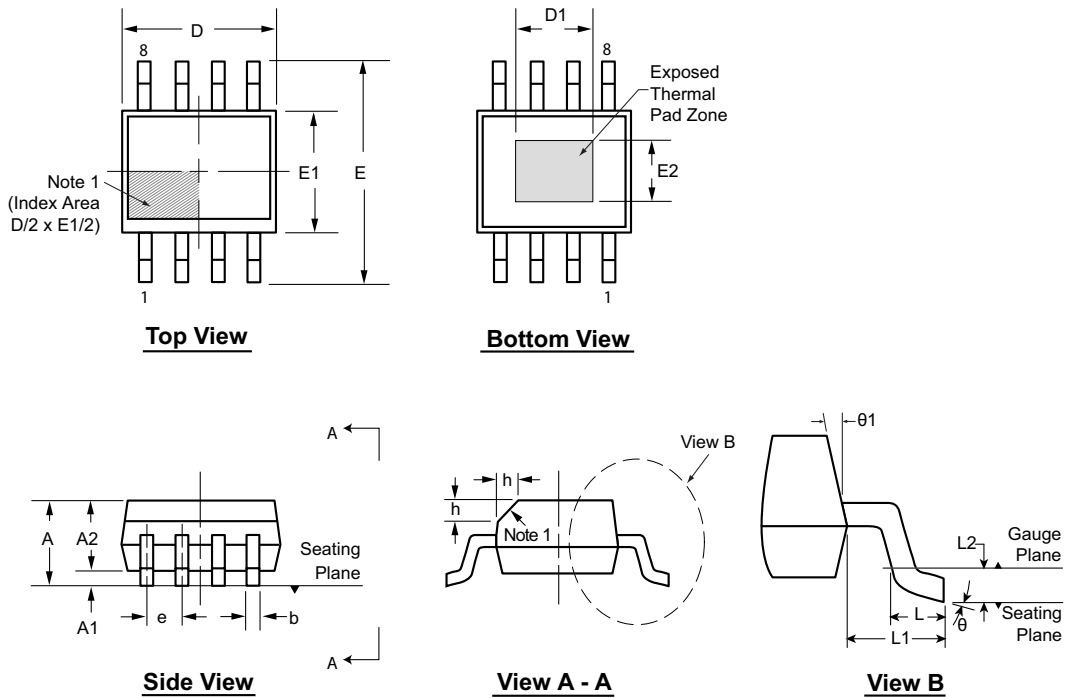
Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Note:
1. *If optional chamfer feature is not present, a Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/ identifier; an embedded metal marker; or a printed indicator.*

Symbol		A	A1	A2	b	D	D1	E	E1	E2	e	h	L	L1	L2	θ	θ1
Dimension (mm)	MIN	1.25*	0.00	1.25	0.31	4.80*	3.30†	5.80*	3.80*	2.29†	1.27 BSC	0.25	0.40	1.04 REF	0.25 BSC	0°	5°
	NOM	-	-	-	-	4.90	-	6.00	3.90	-		-	-			-	-
	MAX	1.70	0.15	1.55*	0.51	5.00*	3.81†	6.20*	4.00*	2.79†		0.50	1.27			8°	15°

JEDEC Registration MS-012, Variation BA, Issue E, Sept. 2005.
* This dimension is not specified in the JEDEC drawing.
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (May 2017)

- Consolidated and converted Supertex Doc# DSFP-CL320, Doc# DSFP-CL325 and Doc# DSFP-CL330 to Microchip DS20005599A
- Changed package marking format
- Changed the quantity of the SG package from 2500/Reel to 3300/Reel
- Made minor text changes throughout the document

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	XX	-	X	-	X
Device	Package Options		Environmental		Media Type

Devices:
CL320	=	3-Channel, 20 mA Linear LED Driver
CL325	=	3-Channel, 25 mA Linear LED Driver
CL330	=	3-Channel, 30 mA Linear LED Driver

Package: SG = 8-lead SOIC (with Heat Slug)

Environmental: G = Lead (Pb)-free/RoHS-compliant Package

Media Type: (blank) = 3300/Reel for an SG Package

Examples:

a) CL320SG-G: 3-Channel, 20 mA Linear LED Driver, 8-lead SOIC Package, 3300/Reel

b) CL325SG-G: 3-Channel, 25 mA Linear LED Driver, 8-lead SOIC Package, 3300/Reel

c) CL330SG-G: 3-Channel, 30 mA Linear LED Driver, 8-lead SOIC Package, 3300/Reel

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