

100 mA Constant-Current Linear LED Driver with Enable Input

Features

- 100 mA ±5% Constant-current Driver
- · Built-in Reverse Polarity Protection
- · Logic-level Enable
- Dimmable via EN Pin
- · Overtemperature Protection
- · 90V Maximum Rating for Transient Immunity

Applications

- · Flashlights
- · Specialty Lighting
- · Low-voltage Signage
- · Low-voltage Lighting

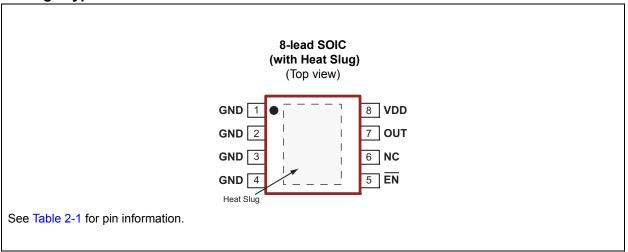
General Description

The CL7 is a fixed-current linear regulator designed for driving high-brightness LEDs at 100 mA from nominal 12V, 24V and 48V power supplies. With a maximum rating of 90V, it is able to withstand transients without the need for additional transient protection circuitry. The CL7 is offered in the 8-lead SOIC (with heat slug) package.

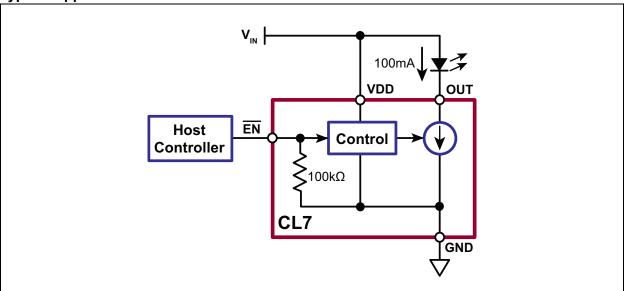
An active-low enable input (\overline{EN}) allows logic-level control of the LED for on/off control or PWM dimming. The enable input has 100 k Ω pull-down resistance. For applications not needing an enable input, refer to the CL6 data sheet.

Overtemperature protection circuitry shuts down all three channels when the nominal die temperature reaches 135°C. Normal operation resumes when the die temperature falls below 105 °C.

Package Type



Typical Application Circuit



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Supply Voltage, V _{DD}	–25V to +100V
Output Voltage, V _{OUT}	
Enable Voltage, V _{EN}	
Minimum Operating Junction Temperature, T _{.I} (Note 1)	
Storage Temperature, T _S	

† 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	6.5	_	28	V	Normal			
Supply Voltage	V_{DD}			90	V	Extended			
Voltage et OUT Die	V _{OUT}	4	_	28	V	Normal (Note 1)			
Voltage at OUT Pin				90	V	Extended (Note 1)			
Junction temperature	TJ	-40		119	°C	Note 2			

- **Note 1:** Continuous operation at high V_{OUT} voltages may result in activation of overtemperature protection. Use appropriate heat sinking.
 - 2: Maximum junction temperature internally limited

ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over normal recommended operating conditions unless otherwise specified. All voltages with respect to GND pin.

Parameter	Sym.	Min.	Тур.	Max.	Unit	Conditions				
Current into V _{DD} Pin	I _{DD}	3	5	10	mA					
		95	100	105		Normal conditions, 25°C (Note 1)				
Current into OUT Pin1	I _{OUT}	90	100	110	mA	Normal conditions, full temperature (Note 3)				
		50	_	120		Extended conditions (See Recommended Operating Conditions.)				
Current into OUT Pin with V _{DD} Pin Open or EN = 1	I _{OUT(OFF)}	1	_	10	μA	V _{DD} = open				
Enable Voltage, On	V _{EN(ON)}	_	_	0.8	V					
Enable Voltage, Off	V _{EN(OFF)}	2.4	_	_	V					
Enable Pull-down Resistance	R _{EN}	_	100		kΩ					

- **Note 1:** Continuous operation at high V_{OUT} voltages may result in activation of overtemperature protection. Use appropriate heat sinking.
 - 2: Maximum junction temperature internally limited
 - 3: Limits obtained by characterization and not 100% tested in production.
 - 4: For design guidance only

ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Specifications: Over normal recommended operating conditions unless otherwise specified. All voltages with respect to GND pin.

Parameter	Sym.	Min.	Тур.	Max.	Unit	Conditions
Voltage at V _{DD} to Shut off LED Current	V _{OFF}	_	_	1	٧	I _{OUT} < 10 μA
On Delay, EN to OUT	t _{ON}	_	3	_	μs	EN = 0V (Note 4)
Off Delay, EN to OUT	t _{OFF}	1	0.1	1	μs	EN = 5V (Note 4)
Current Rise Time, EN to OUT	t _{RISE}	_	4	_	μs	EN = 0V (Note 4)
Current Fall Time, EN to OUT	t _{FALL}	_	0.3	_	μs	EN = 5V (Note 4)

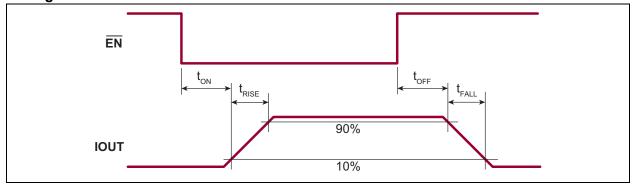
- **Note 1:** Continuous operation at high V_{OUT} voltages may result in activation of overtemperature protection. Use appropriate heat sinking.
 - 2: Maximum junction temperature internally limited
 - 3: Limits obtained by characterization and not 100% tested in production.
 - 4: For design guidance only

TEMPERATURE SPECIFICATIONS

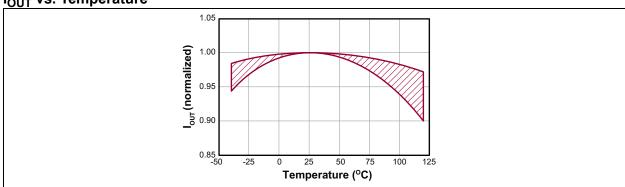
Parameter	Sym.	Min.	Тур.	Max.	Unit	Conditions
TEMPERATURE RANGE						
Operating Junction Temperature	TJ	-40	_	_	°C	
Storage Temperature	T _S	-65	_	+150	°C	
Overtemperature Limit	T _{LIM}	120	135	150	°C	Note 1
Overtemperature Hysteresis	T _{HYS}	_	30	_	°C	Note 1
PACKAGE THERMAL RESISTANCE						
8-lead SOIC (with Heat Slug)	θ_{JA}	_	84	_	°C/W	Note 2

- Note 1: For design guidance only
 - 2: Mounted on JEDEC test PCB (2s 2p)

Timing Waveforms



I_{OUT} vs. Temperature



2.0 PIN DESCRIPTION

The details on the pins of CL7 are listed on Table 2-1. Refer to **Package Type** for the location of pins.

TABLE 2-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1, 2, 3, 4	GND	Circuit common
5	EN	Active-low enable input. This input has an internal 100 kΩ pull-down resistance.
6	NC	No connection
7	OUT	Connect the LED between this pin and the supply voltage.
8	V_{DD}	Supply voltage for the CL7

3.0 APPLICATION INFORMATION

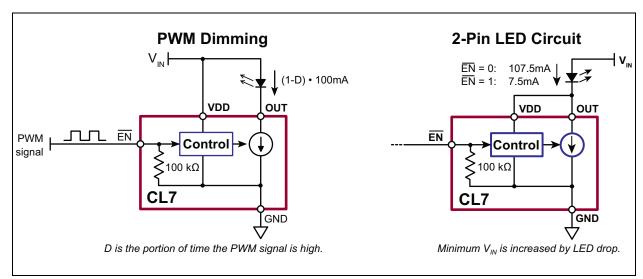
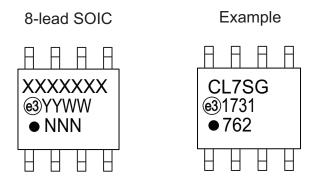


FIGURE 3-1: Application Circuits.

4.0 PACKAGING INFORMATION

4.1 Package Marking Information



Legend: XX...X Product Code or Customer-specific information Year code (last digit of calendar year)

YY 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

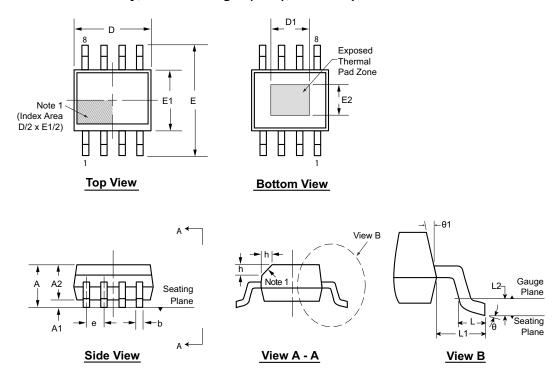
e3 Pb-free JEDEC® designator for Matte Tin (Sn)

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.

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.

Symbo	ol	Α	A1	A2	b	D	D1	E	E1	E2	е	h	L	L1	L2	θ	θ1
	MIN	1.25*	0.00	1.25	0.31	4.80*	3.30 [†]	5.80*	3.80*	2.29 [†]		0.25	0.40			0°	5°
Dimension (mm)	NOM	-	-	-	-	4.90	-	6.00	3.90	-	1.27 BSC	-	-	1.04 REF	0.25 BSC	-	-
()	MAX	1.70	0.15	1.55*	0.51	5.00*	3.81 [†]	6.20*	4.00*	2.79 [†]	200	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.

Drawings not to scale.

[†] This dimension differs from the JEDEC drawing.



NOTES:

APPENDIX A: REVISION HISTORY

Revision A (February 2017)

- Converted Supertex Doc# DSFP-CL7 to Microchip DS20005600A
- 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.	<u>xx</u>		. Y . Y	Exa	imple:	
Device	Package Options		Environmental Media Type	a)	CL7SG-G:	100 mA Constant-Current Linear LED Driver with Enable Input, 8-lead SOIC Package (with Heat Slug), 3300/Reel
Device:	CL7	=	100 mA Constant-Current Linear LED Driver with Enable Input			
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			

Note the following details of the code protection feature on Microchip devices:

- · Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our
 knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data
 Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM CERTIFIED BY DNV = ISO/TS 16949=

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KEELOQ, KEELOQ logo, Kleer, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, Anyln, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

 $\ensuremath{\mathsf{SQTP}}$ is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2017, Microchip Technology Incorporated, All Rights Reserved. ISBN: 978-1-5224-1392-9

© 2017 Microchip Technology Inc.

DS20005600A-page 13



Worldwide Sales and Service

AMERICAS

Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277

Technical Support: http://www.microchip.com/

support

Web Address: www.microchip.com

Atlanta
Duluth, GA

Tel: 678-957-9614 Fax: 678-957-1455

Austin, TX Tel: 512-257-3370

Boston

Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088

Chicago Itasca, IL

Tel: 630-285-0071 Fax: 630-285-0075

Dallas

Addison, TX Tel: 972-818-7423 Fax: 972-818-2924

Detroit Novi, MI

Tel: 248-848-4000

Houston, TX

Tel: 281-894-5983 Indianapolis

Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380

Los Angeles

Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800

Raleigh, NC Tel: 919-844-7510

New York, NY

Tel: 631-435-6000

San Jose, CA Tel: 408-735-9110 Tel: 408-436-4270

Canada - Toronto Tel: 905-695-1980 Fax: 905-695-2078

ASIA/PACIFIC

Asia Pacific Office Suites 3707-14, 37th Floor Tower 6, The Gateway

Hong Kong

Tel: 852-2943-5100 Fax: 852-2401-3431

Harbour City, Kowloon

Australia - Sydney Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

China - Beijing Tel: 86-10-8569-7000 Fax: 86-10-8528-2104

China - Chengdu Tel: 86-28-8665-5511 Fax: 86-28-8665-7889

China - Chongqing Tel: 86-23-8980-9588 Fax: 86-23-8980-9500

China - Dongguan Tel: 86-769-8702-9880

China - Guangzhou Tel: 86-20-8755-8029

China - Hangzhou Tel: 86-571-8792-8115 Fax: 86-571-8792-8116

China - Hong Kong SAR Tel: 852-2943-5100 Fax: 852-2401-3431

China - Nanjing Tel: 86-25-8473-2460 Fax: 86-25-8473-2470

China - Qingdao Tel: 86-532-8502-7355 Fax: 86-532-8502-7205

China - Shanghai Tel: 86-21-3326-8000 Fax: 86-21-3326-8021

China - Shenyang Tel: 86-24-2334-2829

Fax: 86-24-2334-2393
China - Shenzhen

Tel: 86-755-8864-2200 Fax: 86-755-8203-1760

China - Wuhan Tel: 86-27-5980-5300 Fax: 86-27-5980-5118

China - Xian Tel: 86-29-8833-7252 Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen Tel: 86-592-2388138 Fax: 86-592-2388130

China - Zhuhai Tel: 86-756-3210040 Fax: 86-756-3210049

India - Bangalore Tel: 91-80-3090-4444 Fax: 91-80-3090-4123

India - New Delhi Tel: 91-11-4160-8631 Fax: 91-11-4160-8632

India - Pune Tel: 91-20-3019-1500

Japan - Osaka Tel: 81-6-6152-7160 Fax: 81-6-6152-9310

Japan - Tokyo Tel: 81-3-6880- 3770 Fax: 81-3-6880-3771

Korea - Daegu Tel: 82-53-744-4301 Fax: 82-53-744-4302

Korea - Seoul Tel: 82-2-554-7200 Fax: 82-2-558-5932 or 82-2-558-5934

Malaysia - Kuala Lumpur Tel: 60-3-6201-9857 Fax: 60-3-6201-9859

Malaysia - Penang Tel: 60-4-227-8870 Fax: 60-4-227-4068

Philippines - Manila Tel: 63-2-634-9065 Fax: 63-2-634-9069

Singapore Tel: 65-6334-8870

Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan - Hsin Chu Tel: 886-3-5778-366 Fax: 886-3-5770-955

Taiwan - Kaohsiung Tel: 886-7-213-7830

Taiwan - Taipei Tel: 886-2-2508-8600 Fax: 886-2-2508-0102

Thailand - Bangkok Tel: 66-2-694-1351 Fax: 66-2-694-1350

EUROPE

Austria - Wels Tel: 43-7242-2244-39 Fax: 43-7242-2244-393

Denmark - Copenhagen Tel: 45-4450-2828 Fax: 45-4485-2829

Finland - Espoo Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

France - Saint Cloud Tel: 33-1-30-60-70-00

Germany - Garching Tel: 49-8931-9700 Germany - Haan

Tel: 49-2129-3766400 **Germany - Heilbronn** Tel: 49-7131-67-3636

Germany - Karlsruhe Tel: 49-721-625370

Germany - Munich Tel: 49-89-627-144-0 Fax: 49-89-627-144-44

Germany - Rosenheim Tel: 49-8031-354-560

Israel - Ra'anana Tel: 972-9-744-7705

Italy - Milan Tel: 39-0331-742611 Fax: 39-0331-466781

Italy - Padova Tel: 39-049-7625286

Netherlands - Drunen Tel: 31-416-690399 Fax: 31-416-690340

Norway - Trondheim Tel: 47-7289-7561

Poland - Warsaw Tel: 48-22-3325737

Romania - Bucharest Tel: 40-21-407-87-50

Spain - Madrid Tel: 34-91-708-08-90 Fax: 34-91-708-08-91

Sweden - Gothenberg Tel: 46-31-704-60-40

Sweden - Stockholm Tel: 46-8-5090-4654

UK - Wokingham Tel: 44-118-921-5800 Fax: 44-118-921-5820

Downloaded from Arrow.com.