chanhvinh.com

CL2

Simple 90V, 20mA, Temperature Compensated, Constant-Current LED Driver IC

Features

- 5.0 to 90V operating range (V_{A-B})
- 20 mA ±10% at 5.0 - 90V
- 0.01%/°C typical temperature coefficient
- Available in TO-243AA (SOT-89), TO-252(D-PAK), & TO-92 packages
- Can be paralleled for higher current

Applications

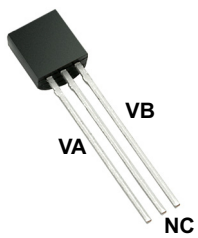
- LED driver
- Industrial lamp indicators
- Signage
- Accent lighting
- Automotive
- Constant current source
- Constant current sink

Description

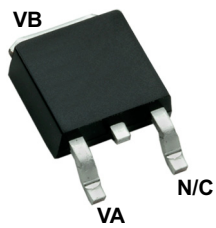
CL2 is a high voltage, temperature compensated, constant-current source. The device is trimmed to provide a constant current of 20 mA ±10% at an input voltage of 5–90V. The device can be used as a two-terminal, constant-current source or constant-current sink.

A typical application for the CL2 is to drive LEDs with a constant current of 20 mA. Multiple CL2s can also be used in parallel to provide higher currents such as 40 mA, 60 mA or 80 mA. The device is available in TO-243AA (SOT-89), TO-252 (D-PAK), and TO-92 packages.

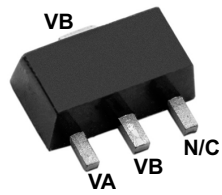
Package Type



TO-92



TO-252 (D-PAK)



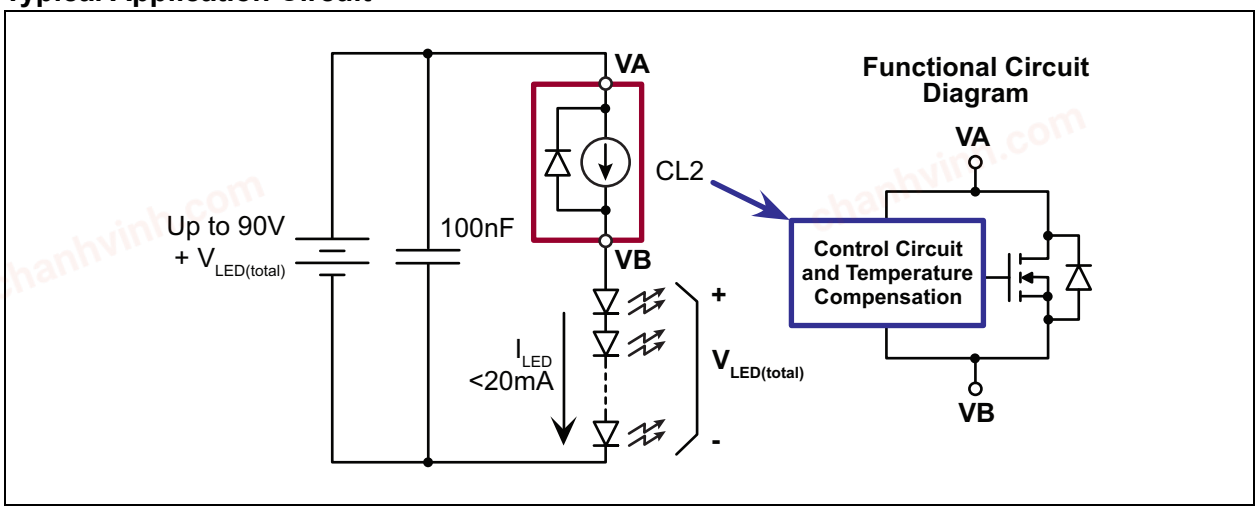
TO-243AA (SOT-89)

See Table 2-1 for pin information

chanhvinh.com

CL2

Typical Application Circuit



© 2015 Microchip Technology Inc.

chanhvinh.com

1.0 ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS†

Operating voltage, V_{A-B} 100V
Operating junction temperature, T_j ..... -40 to +125 °C
Storage Temperature, T_s ..... -55 to +150 °C

† Notice: Stresses above those listed under “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.

DC AND AC CHARACTERISTICS

Electrical Specifications: Unless otherwise specified, for all specifications T_A = +25°C						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Operating voltage	V_{A-B}	5.0	-	90	V	---
Current regulation	I_{A-B}	18.0	20	22	mA	V_{A-B}= 5.0V - 90V
I_{A-B} temperature coefficient	$\Delta I_{A-B}/\Delta T$	-	0.01	-	%/°C	V_{A-B}= 45V, T_j= -40°C to +100°C
Operating junction temperature	T_j	-40	-	125	°C	---
Dynamic resistance	R_{A-B}	-	300	-	kΩ	---

TEMPERATURE SPECIFICATIONS

Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Temperature Ranges						
Operating Junction Temperature	T_j	-40	–	125	°C	
Storage Temperature	T_s	-55	–	150	°C	
Package Thermal Resistances						
Thermal Resistance, TO-92	θ_{ja}	–	132	–	°C/W	
Thermal Resistance, TO-252	θ_{ja}	–	81	–	°C/W	Note 1
Thermal Resistance, TO-243AA	θ_{ja}	–	133	–	°C/W	Note 1

Note 1: Mounted on FR4 board, 25mm x 25mm x 1.57 mm

TABLE 1-1: THERMAL CHARACTERISTICS

Package	**Power Dissipation @T_A = 2.5°C (W)**	**Conditions**
TO-92	0.6	
TO-252	2.0	Note 1
TO-243AA	1.3	Note 1

Note 1: Mounted on FR4 board, 25mm x 25mm x 1.57 mm

© 2015 Microchip Technology Inc.

chanhvinh.com

2.0 PIN DESCRIPTION

The locations of the pins are listed in Package Type and Packaging Information.

TABLE 2-1: PIN DESCRIPTION

Pin # TO-92	Pin # TO-252	Pin # To-243AA	Symbol	Function
1	1	1	VA	Current in
2	3	3	NC	No connect
3	4	2,4	VB	Current out

© 2015 Microchip Technology Inc.

chanhvinh.com

3.0 FUNCTIONAL DESCRIPTION

Figure 3-1 provides the Functional Circuit diagram and its equivalent block diagram for CL2. Performance information is available in Figure 3-2 and Figure 3-3. Figure 3-4 and Figure 3-5 provide example schematics.

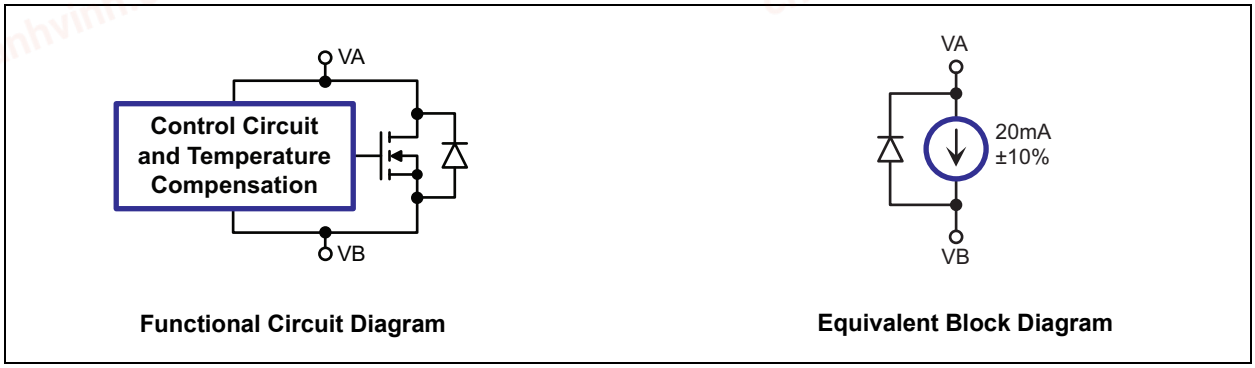


FIGURE 3-1: *Functional Circuit Diagram and Equivalent Block Diagram*

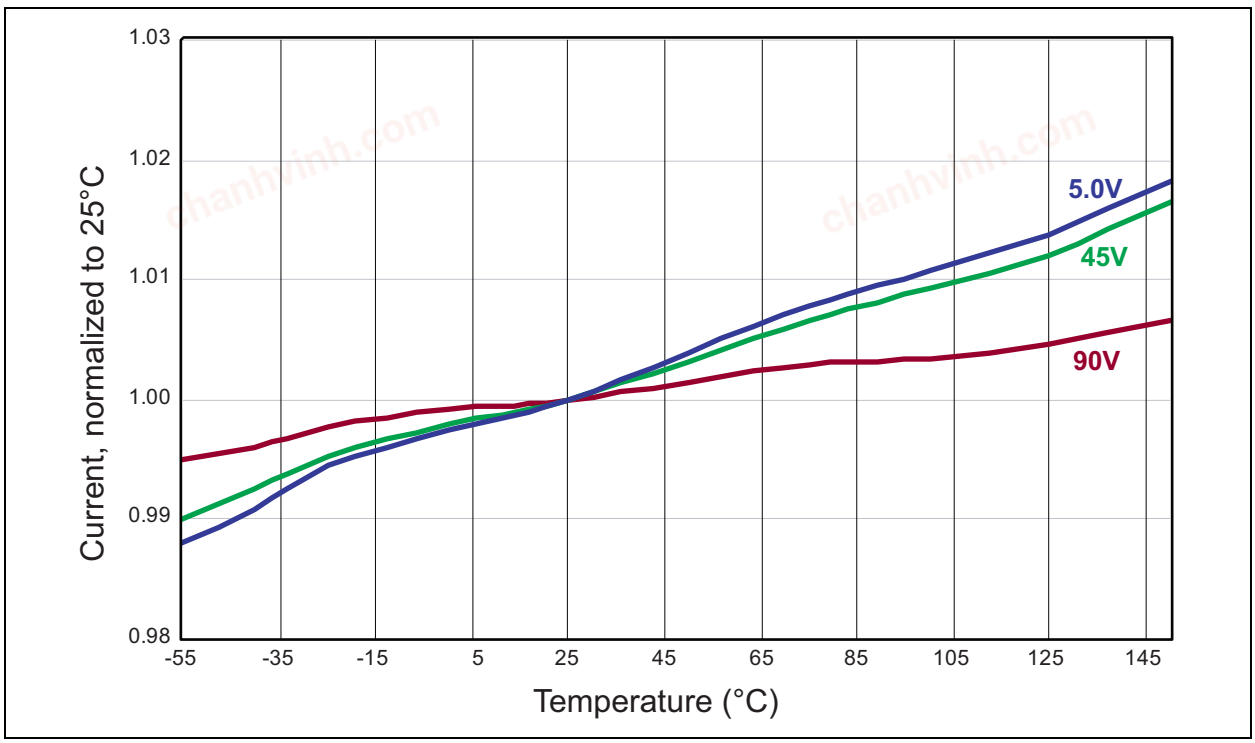


FIGURE 3-2: *Temperature Characteristics*

chanhvinh.com

CL2

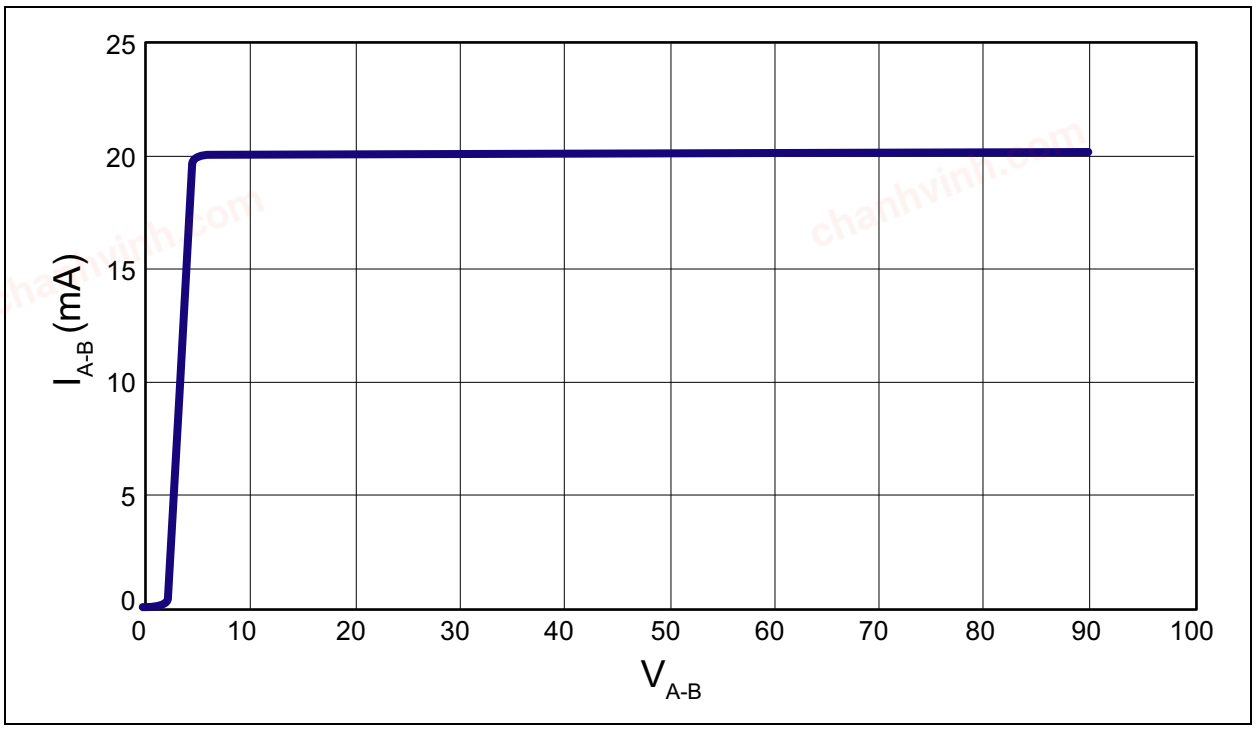


FIGURE 3-3: *Output Current vs Voltage*

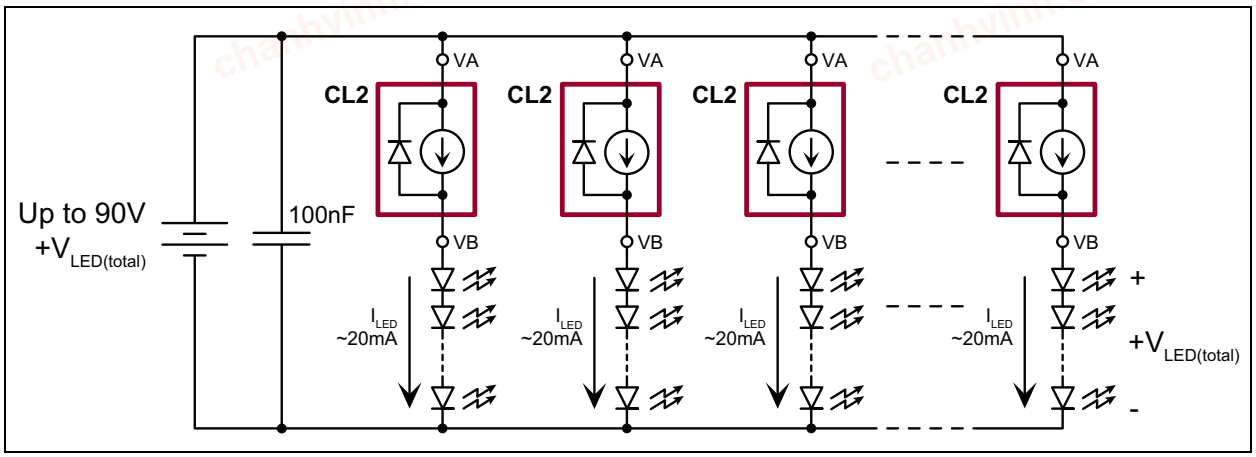


FIGURE 3-4: *CL2 for Multiple LED Strings*

© 2015 Microchip Technology Inc.

chanhvinh.com

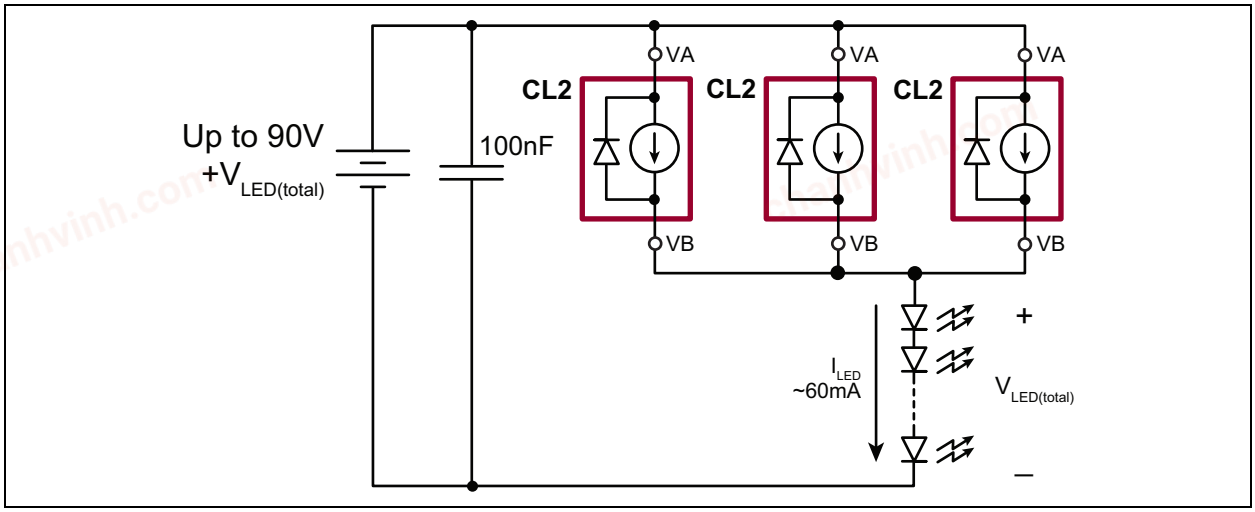


FIGURE 3-5: *CL2 for Higher Current*

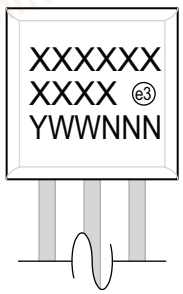
chanhvinh.com

chanhvinh.com

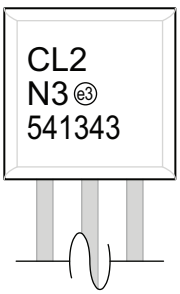
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

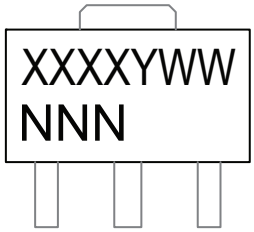
3-lead TO-92



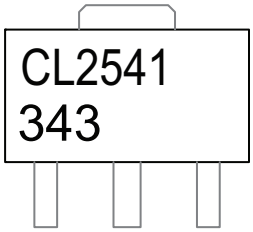
Example



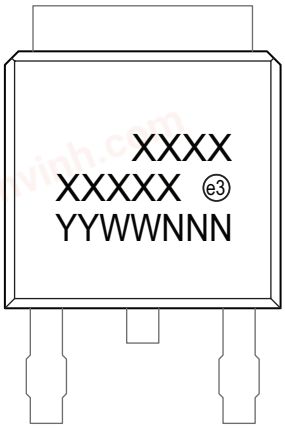
3-lead TO-243AA *
(SOT-89)



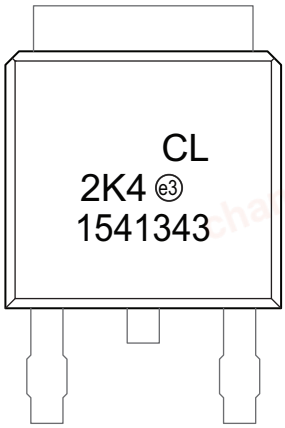
Example



TO-252 (D-PAK)



Example



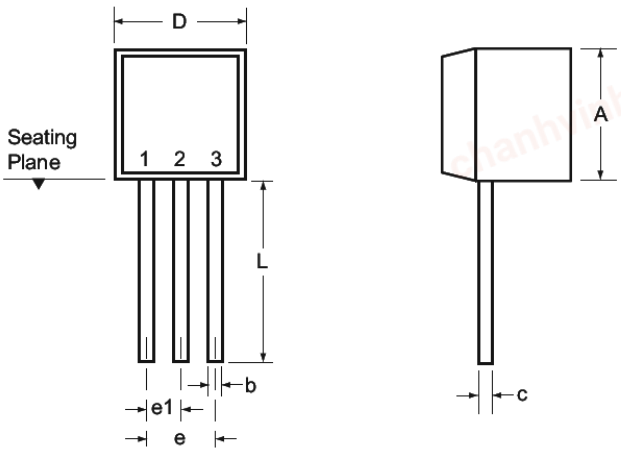
Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package 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.

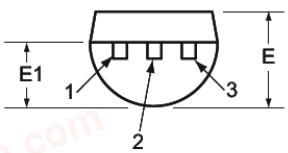
© 2015 Microchip Technology Inc.

chanhvinh.com

3-Lead TO-92 Package Outline (L/LL/N3)



Front View **Side View**



Bottom View

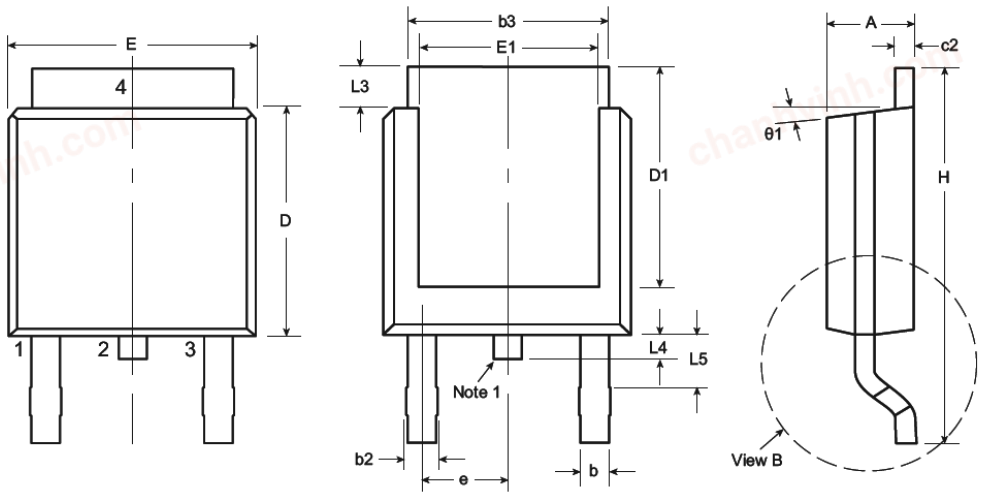
Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Symbol		A	b	c	D	E	E1	e	e1	L
Dimensions (inches)	MIN	.170	.014†	.014†	.175	.125	.080	.095	.045	.500
	NOM	-	-	-	-	-	-	-	-	-
	MAX	.210	.022†	.022†	.205	.165	.105	.105	.055	.610*

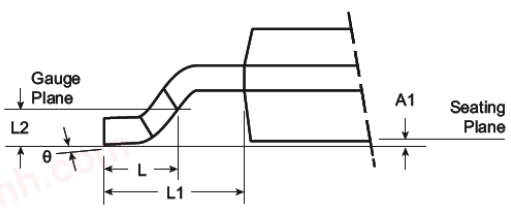
JEDEC Registration TO-92.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

chanhvinh.com

3-Lead TO-252 (D-PAK) Package Outline (K4)



Front View **Rear View** **Side View**



View B

Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Note:

1. Although 4 terminal locations are shown, only 3 are functional. Lead number 2 was removed.

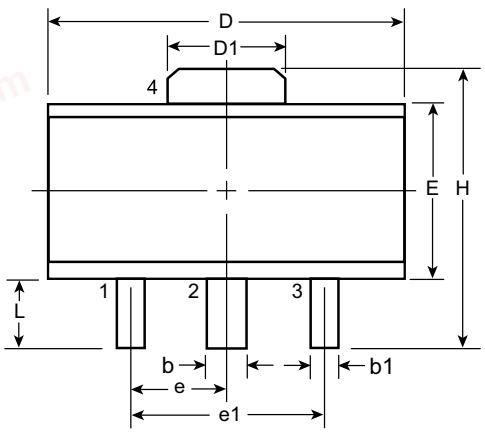
Symbol		A	A1	b	b2	b3	c2	D	D1	E	E1	e	H	L	L1	L2	L3	L4	L5	θ	θ1
Dimension (inches)	MIN	.086	.000*	.025	.030	.195	.018	.235	.205	.250	.170	.090 BSC	.370	.055	.108 REF	.020 BSC	.035	.025*	.035†	0°	0°
	NOM	-	-	-	-	-	-	.240	-	-	-		-	.060			-	-	-	-	-
	MAX	.094	.005	.035	.045	.215	.035	.245	.217*	.265	.200*		.410	.070			.050	.040	.060	10°	15°

JEDEC Registration TO-252, Variation AA, Issue E, June 2004.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

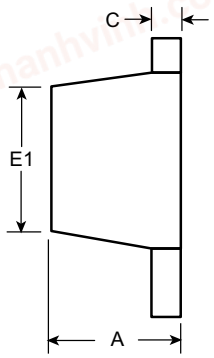
© 2015 Microchip Technology Inc.

chanhvinh.com

3-Lead TO-243AA (SOT-89) Package Outline (N8)



Top View



Side View

Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Symbol		A	b	b1	C	D	D1	E	E1	e	e1	H	L
Dimensions (mm)	MIN	1.40	0.44	0.36	0.35	4.40	1.62	2.29	2.00†	1.50 BSC	3.00 BSC	3.94	0.73†
	NOM	-	-	-	-	-	-	-	-			-	-
	MAX	1.60	0.56	0.48	0.44	4.60	1.83	2.60	2.29			4.25	1.20

JEDEC Registration TO-243, Variation AA, Issue C, July 1986.
† This dimension differs from the JEDEC drawing
Drawings not to scale.

chanhvinh.com

CL2

APPENDIX A: REVISION HISTORY

Revision A (November 2015)

- Updated file to Microchip format

chanhvinh.com

© 2015 Microchip Technology Inc.

chanhvinh.com

PRODUCT IDENTIFICATION SYSTEM

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

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

Device:	CL2	=	Simple 90V, 20 mA, Temperature-Compensated, Constant-Current LED Driver IC
Package:	N3	=	TO-92, 3-lead
	K4	=	TO-252 (D-PAK), 3-lead
	N8	=	TO-243AA (SOT-89), 3-lead
Environmental	G	=	Lead (Pb)-free/ROHS-compliant package
Media Type:	(blank)	=	1000/Bag for N3 packages
		=	2000/Reel for K4 packages
		=	2000/Reel for N8 packages
	P002	=	2000/Reel for N3

Examples:

a)	CL2N3-G	TO-92 package, 1000/Bag
b)	CL2K4-G	TO-252 package, 2000/Reel
c)	CL2N8-G	TO-243AA package, 2000/Reel
d)	CL2N3-G-P002	TO-92 package, 2000/Reel

chanhvinh.com

chanhvinh.com

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.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, flexPWR, JukeBlox, KEELOQ, KEELOQ logo, Kleer, LANCheck, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC32 logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

The Embedded Control Solutions Company and mTouch are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, ECAN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, KleerNet, KleerNet logo, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, RightTouch logo, REAL ICE, SQI, Serial Quad I/O, 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.

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.

© 2015, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-0014-1

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

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.

© 2015 Microchip Technology Inc.

chanhvinh.com

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

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

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

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110

Canada - Toronto
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

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

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

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 - 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: 86-21-5407-5533
Fax: 86-21-5407-5066

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
Fax: 65-6334-8850

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

Taiwan - Kaohsiung
Tel: 886-7-213-7828

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

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

Germany - Dusseldorf
Tel: 49-2129-3766400

Germany - Karlsruhe
Tel: 49-721-625370

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

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

Italy - Venice
Tel: 39-049-7625286

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

Poland - Warsaw
Tel: 48-22-3325737

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

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

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

07/14/15

© 2015 Microchip Technology Inc.