

## 100 mA Fixed Constant-Current Linear LED Driver

### Features

- 100 mA  $\pm 5\%$  Constant-Current Driver
- Built-In Reverse Polarity Protection
- Dimmable via PWM Supply
- Overtemperature Protection
- Tab Ground allows Direct Heatsinking to Chassis
- 90V Maximum Rating for Transient Immunity

### Applications

- Flashlights
- Specialty Lighting
- Low-Voltage Signage
- Low-Voltage Lighting

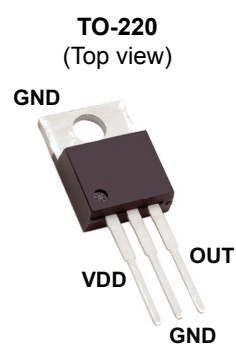
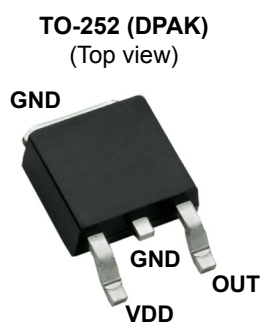
### General Description

The CL6 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 CL6 is offered in both TO-252 (D-PAK) and TO-220 packages. The tab on the TO-220 is ground, allowing heatsinking directly to a chassis without the need for electrically insulating spacers.

Overtemperature protection circuitry shuts off the LED current when the die temperature reaches 135°C (typical). Full LED current resumes when the die temperature falls below 105°C (typical).

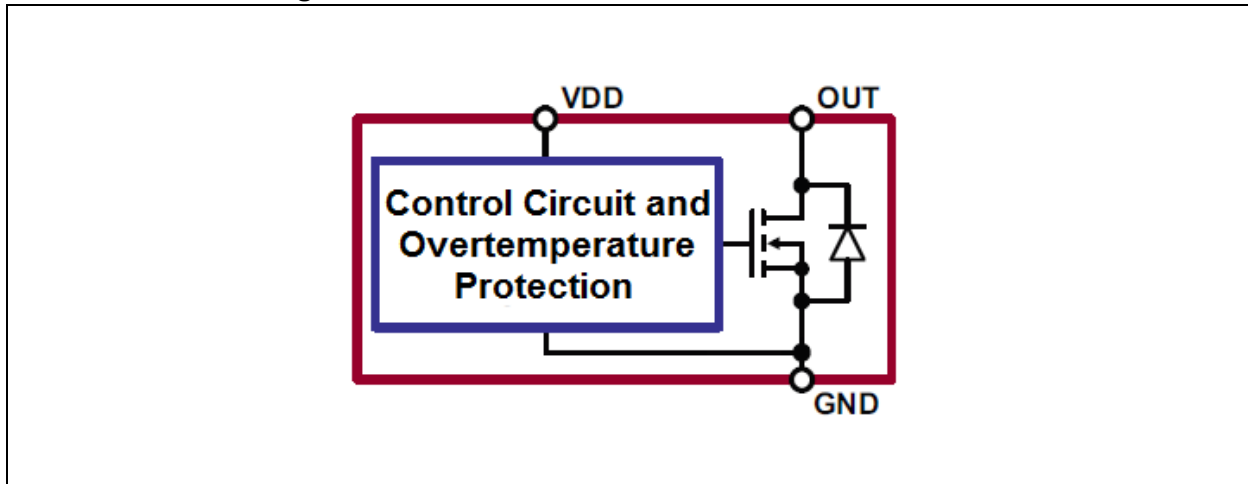
### Package Types



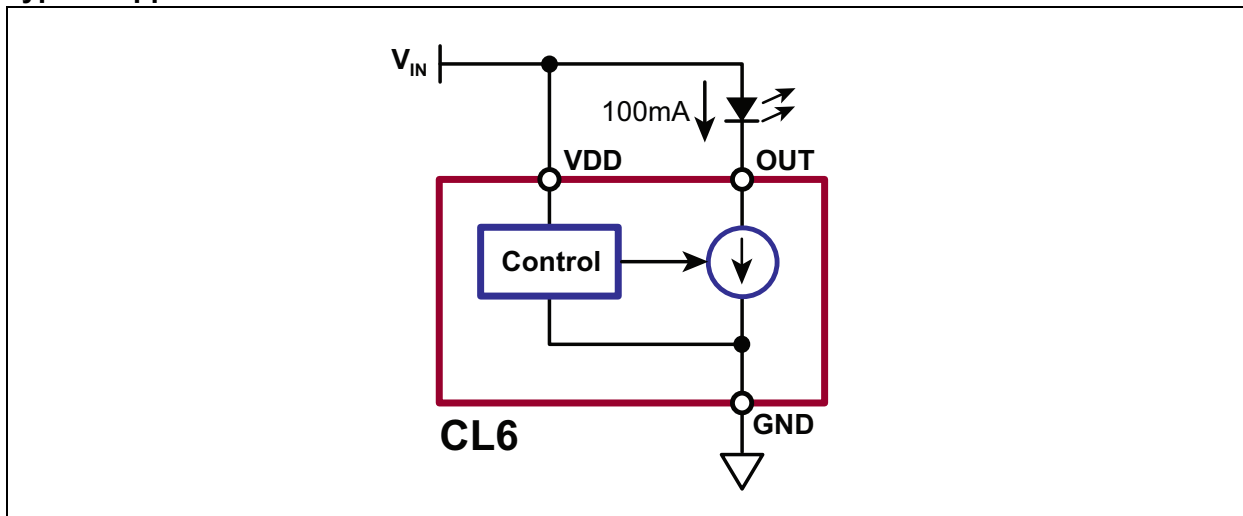
See [Table 2-1](#) and [Table 2-2](#) for pin information.

# CL6

## Functional Block Diagram



## Typical Application Circuit



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage, $V_{DD}$             | –25V to +100V   |
| Output Voltage, $V_{OUT}$            | –25V to +100V   |
| Junction Temperature, $T_J$ (Note 1) | –40°C to +135°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                 | $V_{DD}$  | 6.5  | —    | 28   | V    | Normal            |
|                                |           |      |      | 90   |      | Extended          |
| Voltage at Out Pin             | $V_{OUT}$ | 4    | —    | 28   | V    | Normal (Note 1)   |
|                                |           |      |      | 90   |      | Extended (Note 1) |
| Operating Junction Temperature | $T_J$     | –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

### DC ELECTRICAL CHARACTERISTICS

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

| Parameter                                   | Sym.           | Min. | Typ. | Max. | Unit | Conditions   |
|---|----------------|------|------|------|------|--|
| Current into $V_{DD}$ Pin                   | $I_{DD}$       | 3    | 5    | 10   | mA   |  |
| Current into OUT Pin                        | $I_{OUT}$      | 95   | 100  | 105  | mA   | Normal conditions, 25°C (Note 1)                                     |
|   |                | 90   | 100  | 110  |      | Normal conditions, full temperature (Note 1, Note 2)                 |
|   |                | 50   | —    | 120  |      | Extended conditions (See Recommended Operating Conditions.) (Note 1) |
| Current into OUT Pin with $V_{DD}$ Pin Open | $I_{OUT(OFF)}$ | —    | —    | 10   | μA   | $V_{DD}$ = open  |
| Voltage at $V_{DD}$ to Shut off LED Current | $V_{OFF}$      | —    | —    | 1    | V    | $I_{OUT} < 10 \mu A$   |
| $V_{DD}$ Applied On Delay                   | $t_{ON}$       | —    | —    | 100  | μs   |  |
| $V_{DD}$ Removed Off Delay                  | $t_{OFF}$      | —    | —    | 100  | μs   |  |

**Note 1:** Continuous operation at high  $V_{OUT}$  voltages may result in activation of overtemperature protection. Use appropriate heat sinking.

**2:** Limits obtained by characterization and not 100% tested in production.

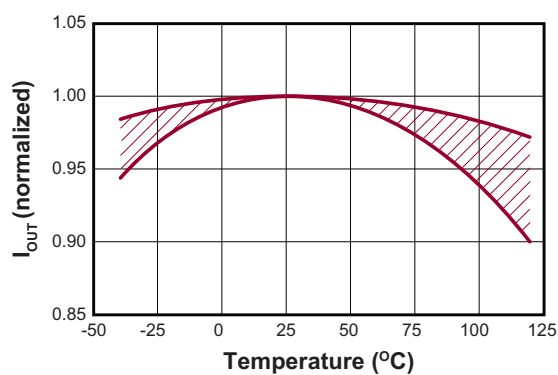
## TEMPERATURE SPECIFICATIONS

| Parameter                         | Sym.          | Min. | Typ. | Max. | Unit | Conditions |
|-----------------------------------|---------------|------|------|------|------|------------|
| <b>TEMPERATURE RANGE</b>          |               |      |      |      |      |            |
| Operating Junction Temperature    | $T_J$         | -40  | —    | 119  | °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     |
| <b>PACKAGE THERMAL RESISTANCE</b> |               |      |      |      |      |            |
| 3-lead TO-252 (D-PAK)             | $\theta_{JA}$ | —    | 81   | —    | °C/W | Note 2     |
| 3-lead TO-220                     | $\theta_{JA}$ | —    | 29   | —    | °C/W |            |

**Note 1:** For design guidance only

**Note 2:** Soldered to 2 cm<sup>2</sup> exposed copper area

## $I_{OUT}$ vs. Temperature



# CL6

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## 2.0 PIN DESCRIPTION

The details on the pins of CL6 are listed in [Table 2-1](#) and [Table 2-2](#). Refer to [Package Types](#) for the location of pins.

**TABLE 2-1: TO-252 (DPAK) PIN FUNCTION TABLE**

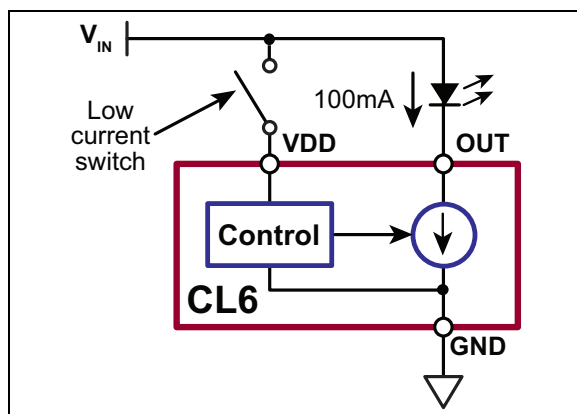
| Pin Number | Pin Name | Description   |
|------------|----------|---|
| 1          | VDD      | Supply voltage for the CL6  |
| 3          | OUT      | Constant-current sink. Connect the LED between this pin and the supply voltage. |
| 4          | GND      | Circuit common ground   |
| 2          | GND      | Circuit common ground (not for external connection)                             |

**TABLE 2-2: TO-220 PIN FUNCTION TABLE**

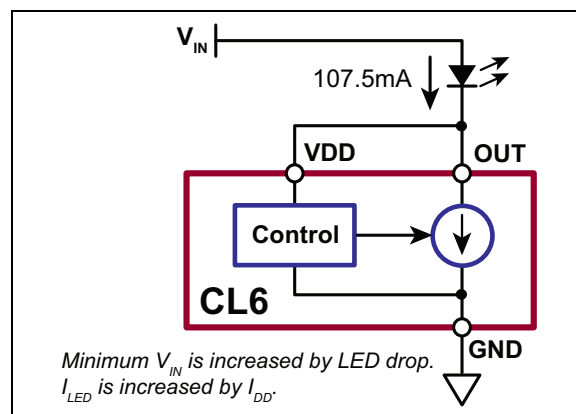
| Pin Number | Pin Name | Description   |
|------------|----------|---|
| 1          | VDD      | Supply voltage for CL6  |
| 2          | GND      | Circuit common ground   |
| 3          | OUT      | Constant current sink. Connect the LED between this pin and the supply voltage. |
| 4          | GND      | Circuit common ground (tab for mounting to external heatsink)                   |

### 3.0 APPLICATION INFORMATION

#### 3.1 Application Circuits



**FIGURE 3-1:** Low-Current On/Off Control.

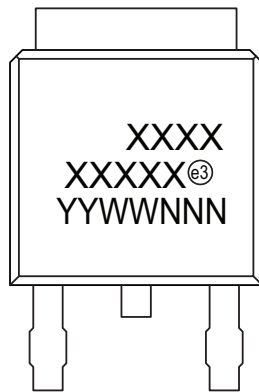


**FIGURE 3-2:** Two-Terminal Operation.

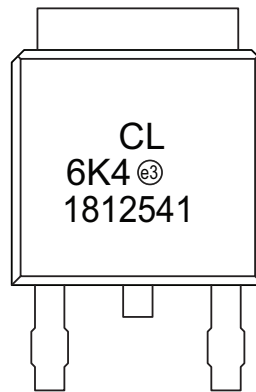
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

TO-252 (D-PAK)



Example



3-lead TO-220



Example

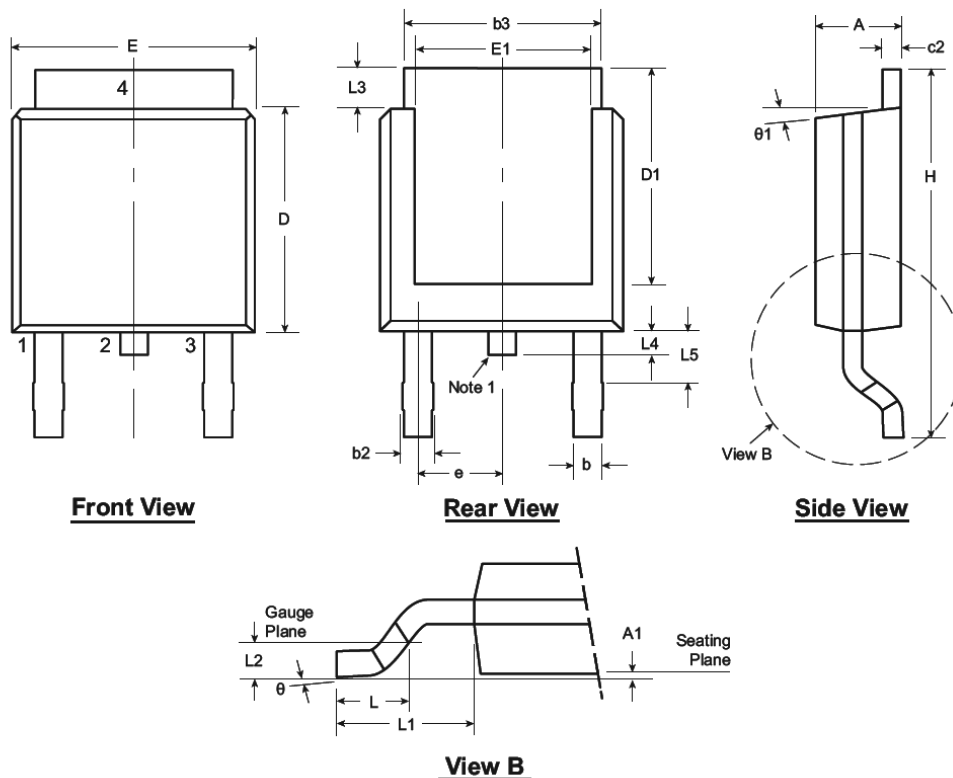


|                |        |  |
|----------------|--------|--|
| <b>Legend:</b> | XX...X | Product Code or Customer-specific information  |
|                | Y      | Year code (last digit of calendar year)  |
|                | YY     | Year code (last 2 digits of calendar year)   |
|                | WW     | Week code (week of January 1 is week '01')   |
|                | NNN    | Alphanumeric traceability code   |
|                | (e3)   | Pb-free JEDEC <sup>®</sup> 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.



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



Note: For the most current package drawings, see the Microchip Packaging Specification at [www.microchip.com/packaging](http://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    | $\theta$ | $\theta_1$ |
|-----------------------|-----|------|-------|------|------|------|------|------|-------|------|-------------|---|------|-------------|-------------|------|-------|-------|----------|------------|
| Dimension<br>(inches) | MIN | .086 | .000* | .025 | .030 | .195 | .018 | .235 | .205  | .250 | .170        |   | .370 | .055        |             | .035 | .025* | .035† | 0°       | 0°         |
|                       | NOM | -    | -     | -    | -    | -    | .240 | -    | -     | -    | .090<br>BSC | - | .060 | .108<br>REF | .020<br>BSC | -    | -     | -     | -        | -          |
|                       | MAX | .094 | .005  | .035 | .045 | .215 | .035 | .245 | .217* | .265 | .200*       |   | .410 | .070        |             | .050 | .040  | .060  | 10°      | 15°        |

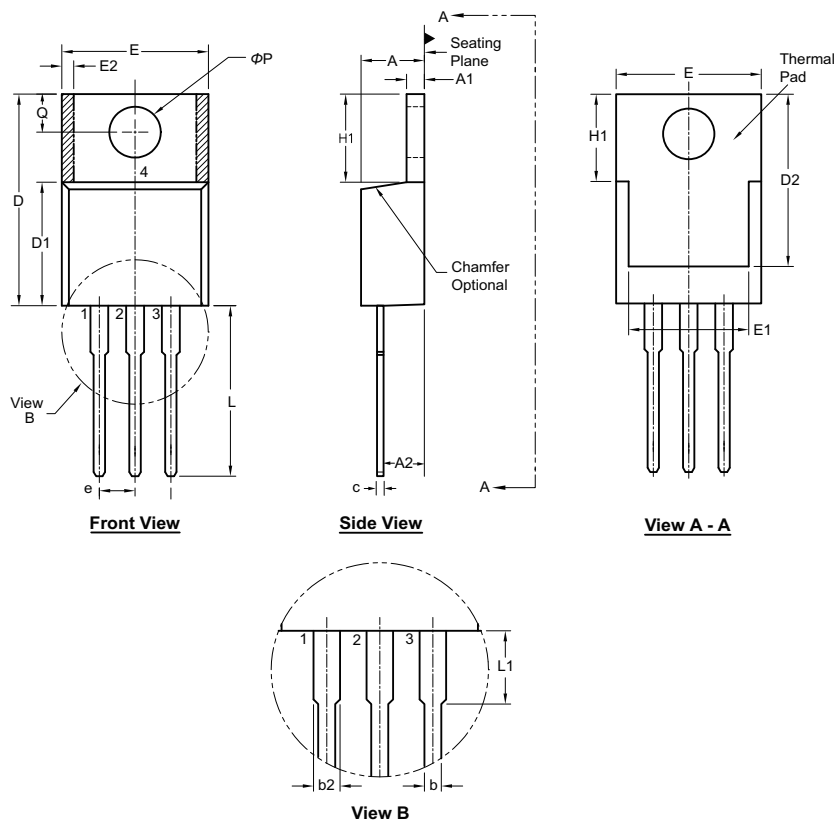
JEDEC Registration TO-252, Variation AA, Issue E, June 2004.

\* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

**Drawings not to scale.**

## 3-Lead TO-220 Package Outline (N5)



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

| Symbol                | A   | A1   | A2   | b                 | b2   | c    | D                 | D1   | D2                | E                 | E1   | E2   | e     | H1   | L    | L1    | Q    | $\Phi P$ |
|-----------------------|-----|------|------|-------------------|------|------|-------------------|------|-------------------|-------------------|------|------|-------|------|------|-------|------|----------|
| Dimension<br>(inches) | MIN | .140 | .020 | .080              | .015 | .045 | .012 <sup>†</sup> | .560 | .326 <sup>†</sup> | .474 <sup>†</sup> | .380 | .270 | 0.20* | .230 | .500 | .200* | .100 | .139     |
|                       | NOM | -    | -    | -                 | .027 | .057 | -                 | -    | -                 | -                 | -    | -    | .100  | -    | -    | -     | -    | -        |
|                       | MAX | .190 | .055 | .120 <sup>†</sup> | .040 | .070 | .024              | .650 | .361 <sup>†</sup> | .507              | .420 | .350 | .030  | .270 | .580 | .250  | .135 | .161     |

JEDEC Registration TO-220, Variation AB, Issue K, April 2002.

\* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

## APPENDIX A: REVISION HISTORY

### Revision A (November 2018)

- Converted Supertex Doc# DSFP-CL6 to Microchip DS20005809A
- Changed the maximum junction temperature from 150°C to 135°C in the Absolute Maximum Ratings section and added a maximum operating junction temperature of 119°C to the Temperature Specifications table
- Changed the package marking format
- Made new sections to comply with the standard Microchip document format.
- Made minor text changes throughout the document

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| PART NO.       |  | XX              |   | -   | X             | - | X          |
|----------------|--|-----------------|---|---|---------------|---|------------|
| Device         |  | Package Options |   |   | Environmental |   | Media Type |
| Device:        |  | CL6             | = | 100 mA Fixed Constant-Current Linear LED Driver |               |   |            |
| Packages:      |  | K4              | = | 3-lead TO-252 (D-PAK)                           |               |   |            |
|                |  | N5              | = | 3-lead TO-220                                   |               |   |            |
| Environmental: |  | G               | = | Lead (Pb)-free/RoHS-compliant Package           |               |   |            |
| Media Types:   |  | (blank)         | = | 2000/Reel for a TO-252 (D-PAK) Package          |               |   |            |
|                |  | (blank)         | = | 50/Tube for a TO-220 Package                    |               |   |            |

**Examples:**

a) CL6K4-G: 100 mA Fixed Constant-Current Linear LED Driver, 3-lead TO-252 (D-PAK) Package, 2000/Reel

b) CL6N5-G: 100 mA Fixed Constant-Current Linear LED Driver, 3-lead TO-220 Package, 50/Tube

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