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Simple, 220V, 20mA, Temperature-Compensated, Constant-Current, LED Driver IC

Features

- 5.0 to 220V operating range (V_{A-B})
- 20mA $\pm 10\%$ at 5.0 - 160V
- 0.01% / °C typical temperature coefficient
- Packages Types:
 - TO-252 (D-PAK)
 - TO-220
- Can be paralleled for higher current

Applications

- Industrial lamp indicators
- Signage
- Accent lighting
- Constant current source
- Constant current sink

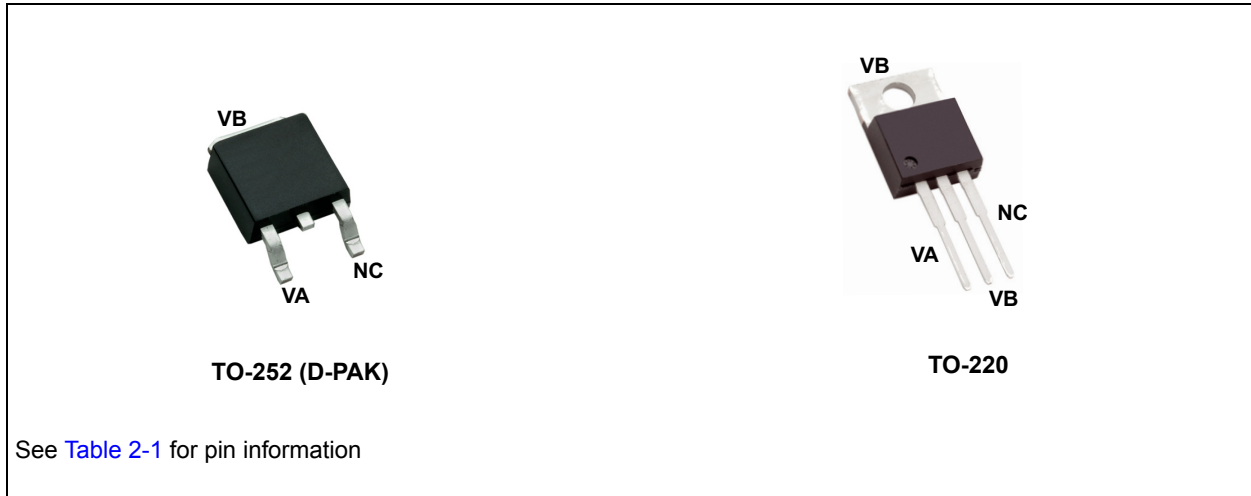
Description

CL220 is a high voltage, temperature-compensated, 20mA constant current regulator. The device operates at up to 220V, and is accurate to $\pm 10\%$ over a 5 - 160V range. The device can be used as a two-terminal, constant-current source or a constant-current sink.

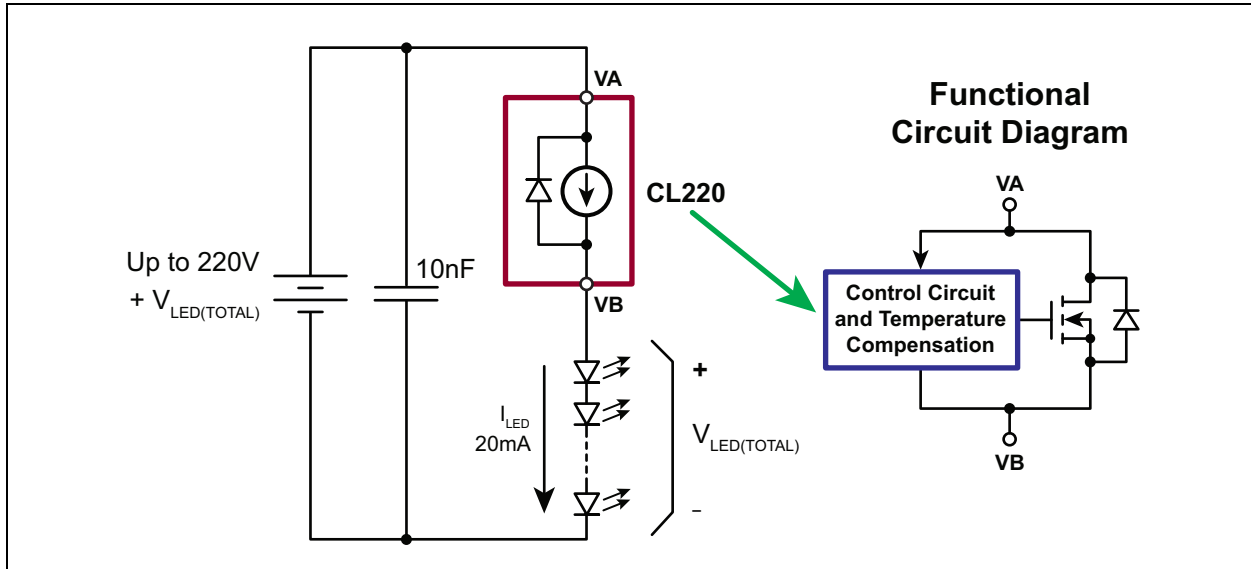
A typical application for CL220 is to drive LEDs with a constant current of 20mA. Multiple CL220s can also be used in parallel to provide higher currents such as 40mA, 60mA, 80mA, and so on. The device is available in the TO-252 (D-PAK) and TO-220 packages.

CL220

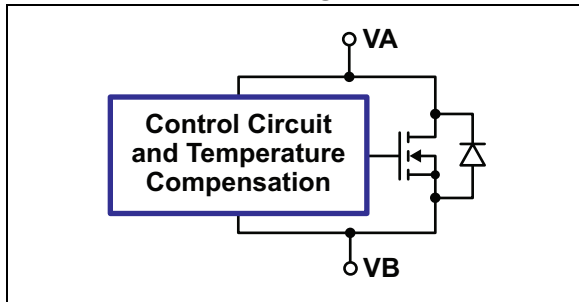
Package Type



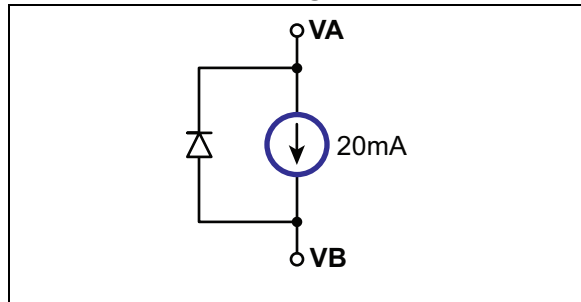
Typical Application Circuit



Functional Circuit Diagram



Equivalent Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS†

| | |
|---|-----------------|
| Operating voltage, V_{A-B} | 240V |
| Operating junction temperature, T_J | -40°C to +125°C |
| Storage temperature, T_S | -55°C 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.

TABLE 1-1: ELECTRICAL CHARACTERISTICS

| Electrical Specifications: Unless otherwise specified, for all specifications $T_J = +25^\circ\text{C}$ | | | | | | |
|---|-----------------------------------|-----|------|-----|---------------|--|
| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
| V_{A-B} | Operating voltage | 5.0 | - | 220 | V | |
| $\Delta I_{A-B}/\Delta T$ | I_{A-B} temperature coefficient | - | 0.01 | - | %/°C | $V_{A-B} = 45\text{V}$, $T_J = -40^\circ\text{C}$ to $+100^\circ\text{C}$ (Note 1) |
| R_{A-B} | Dynamic resistance | - | 300 | - | k Ω | |
| I_{AB} | Output current | 18 | 20 | 22 | mA | $V_{AB} = 4.0 - 160\text{V}$ |
| | | 18 | - | 25 | | $V_{AB} = 160 - 220\text{V}$ (Fig. 4) |
| | | - | - | 22 | | $V_{AB} = 0 - 4.0\text{V}$ |
| I_{OS} | Turn-on overshoot current | - | 25 | - | mA | $V_T = 45\text{V}$ (Fig. 5) (Note 1) |
| t_{OS} | Overshoot duration | - | 1 | - | μs | $V_T = 45\text{V}$ (Fig. 5) (Note 1) |
| t_{DLY} | Turn-on delay | - | 10 | - | μs | $V_T = 45\text{V}$ (Fig. 5) (Note 1) |
| t_{RISE} | Turn-on rise time | - | 200 | - | ns | $V_T = 45\text{V}$ (Fig. 5) (Note 1) |

Note 1: Obtained by Characterization; Not 100% tested in production.

TABLE 1-2: THERMAL RESISTANCE, JUNCTION TO AMBIENT

| Package | θ_{ja} | | | Units | Conditions |
|----------------|---------------|-----|-----|-------|---|
| | Min | Typ | Max | | |
| TO-252 (D-PAK) | - | 81 | - | °C/W | Soldered to 2.0 cm ² copper area exposed to free air (Note 1) |
| TO-220 | - | 29 | - | °C/W | |

Note 1: Obtained by Characterization; Not 100% tested in production.

2.0 PIN DESCRIPTION

The locations of the pins are shown in [Package Type](#) and [Packaging Information](#).

TABLE 2-1: PIN DESCRIPTION

| Pin # TO-252 | Pin # TO-220 | Function | Description |
|--------------|--------------|----------|-------------------------------|
| 1 | 1 | VA | Current flows into this pin |
| 4 | 2, 4 | VB | Current flows out of this pin |
| 3 | 3 | NC | No connection |

CL220

3.0 APPLICATION INFORMATION

Figures 3-1- 3-6 show the characteristics and timing for CL220.

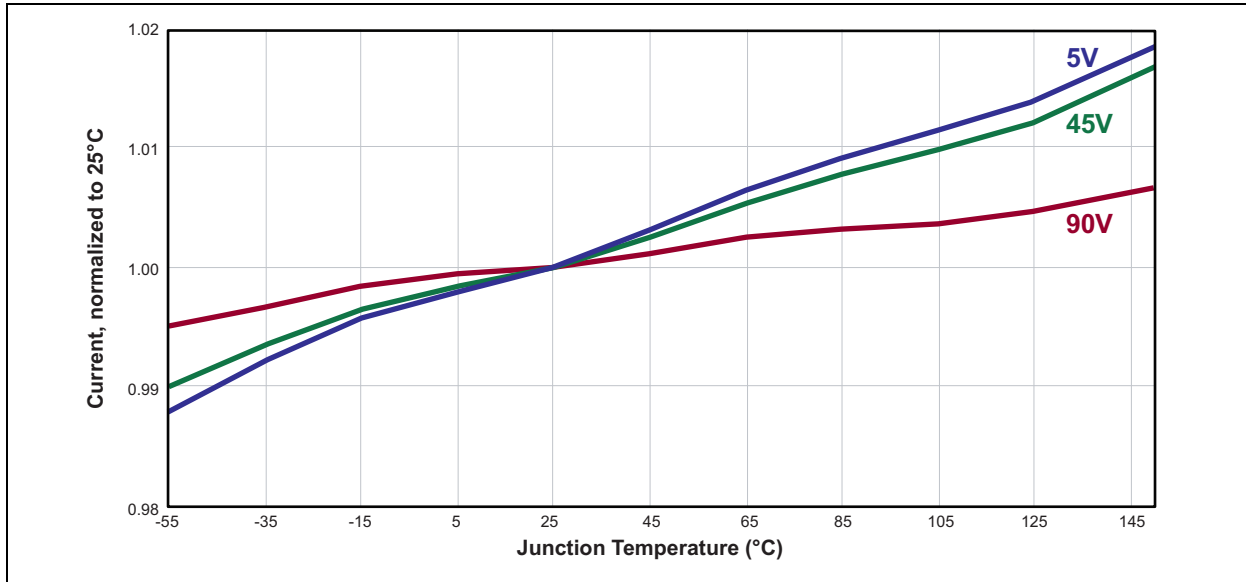


FIGURE 3-1: Temperature Characteristics

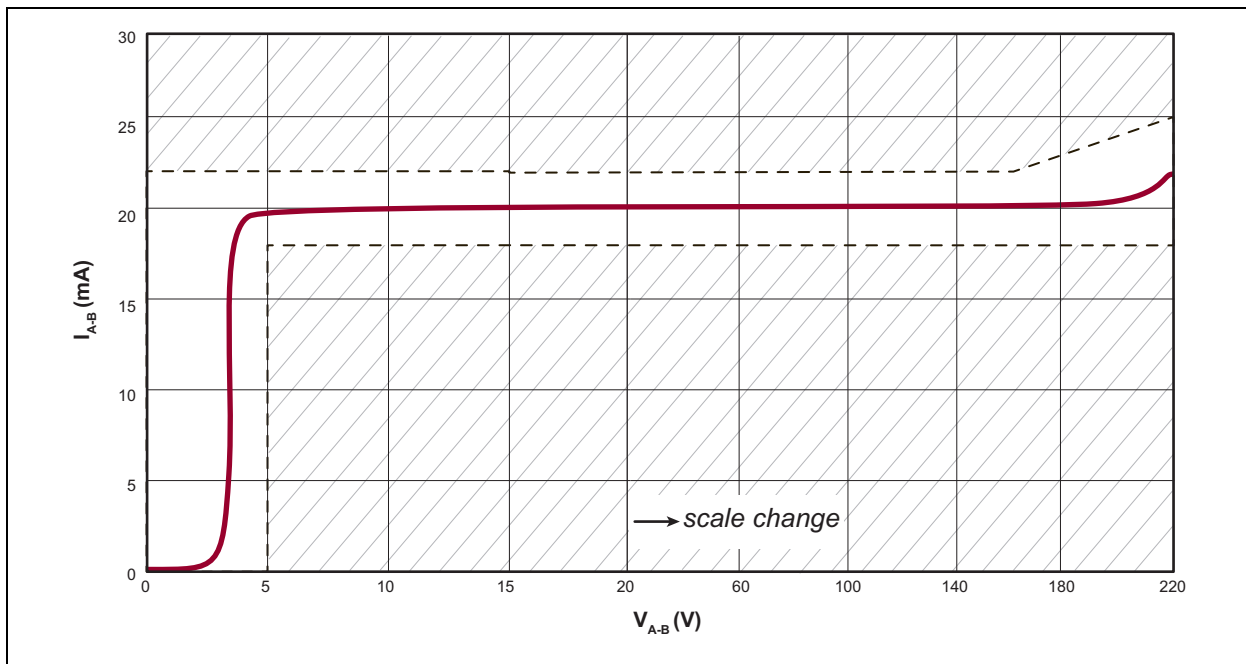


FIGURE 3-2: Output Characteristics

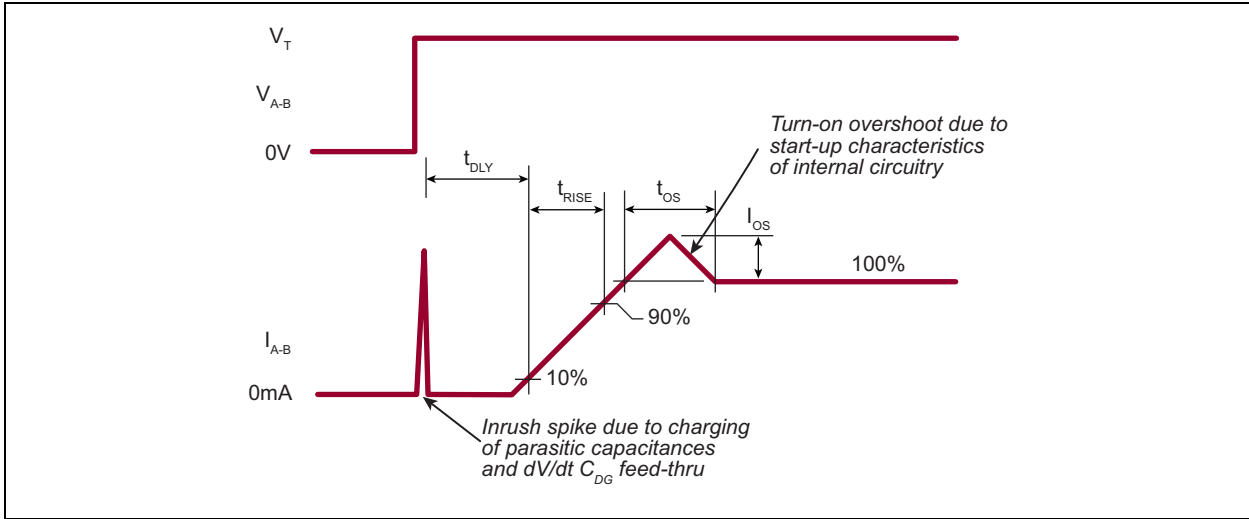


FIGURE 3-3: Timing Diagram

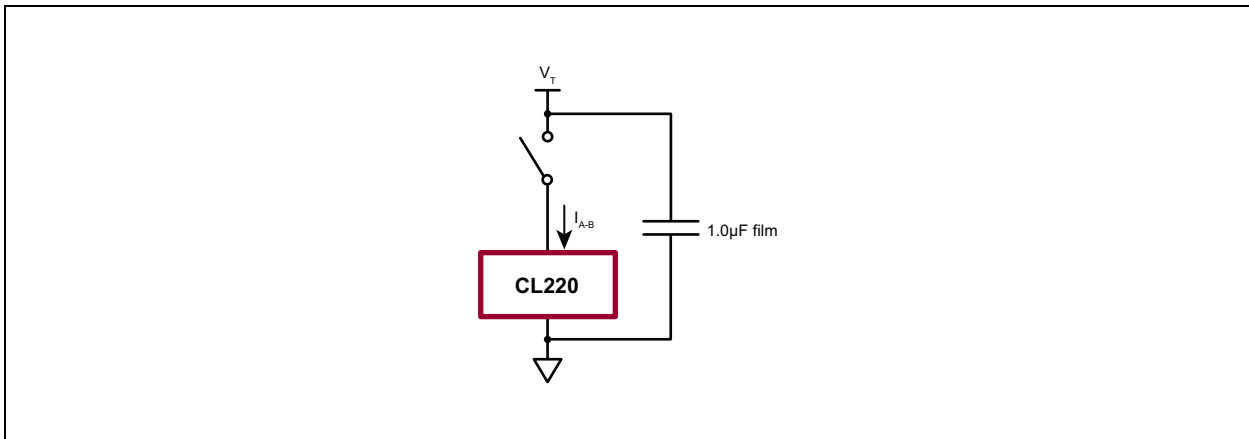


FIGURE 3-4: Timing Test Circuit

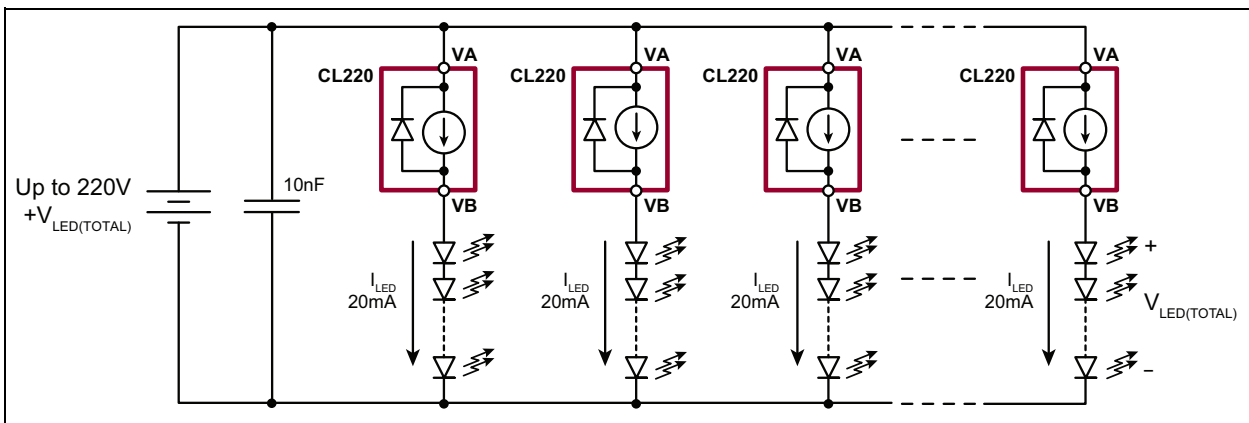


FIGURE 3-5: CL220 for Multiple LED Strings

CL220

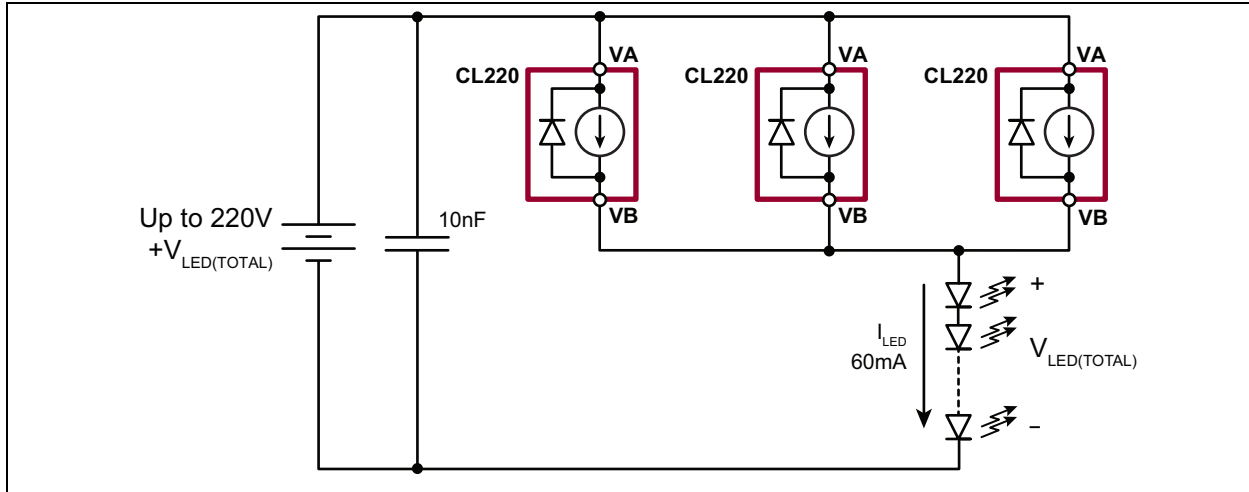


FIGURE 3-6: CL220 for Higher Current

3.1 Functional Circuit and Block Diagram

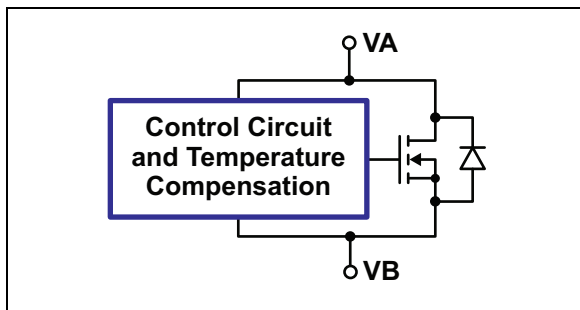


FIGURE 3-7: Functional Circuit Diagram

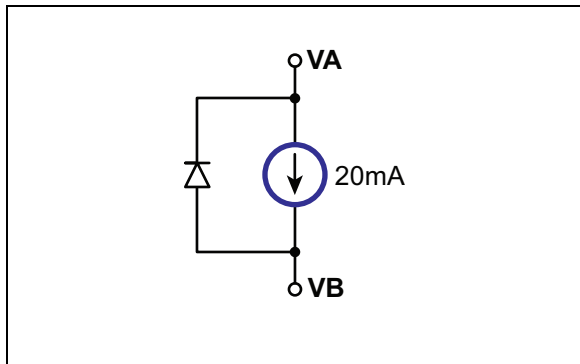
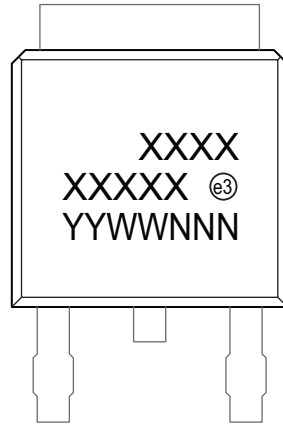


FIGURE 3-8: Block Diagram (Equivalent Functional Circuit)

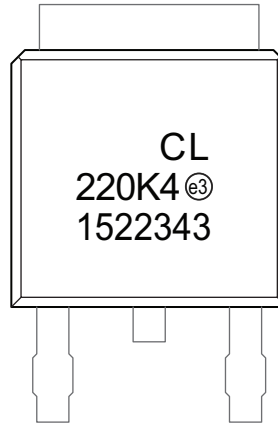
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

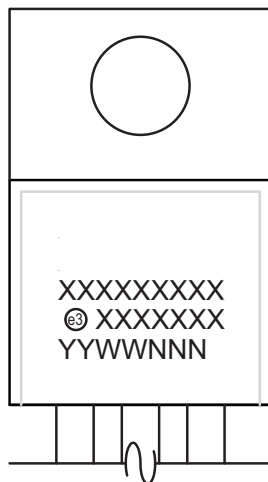
TO-252 (D-PAK)



Example



3-lead TO-220



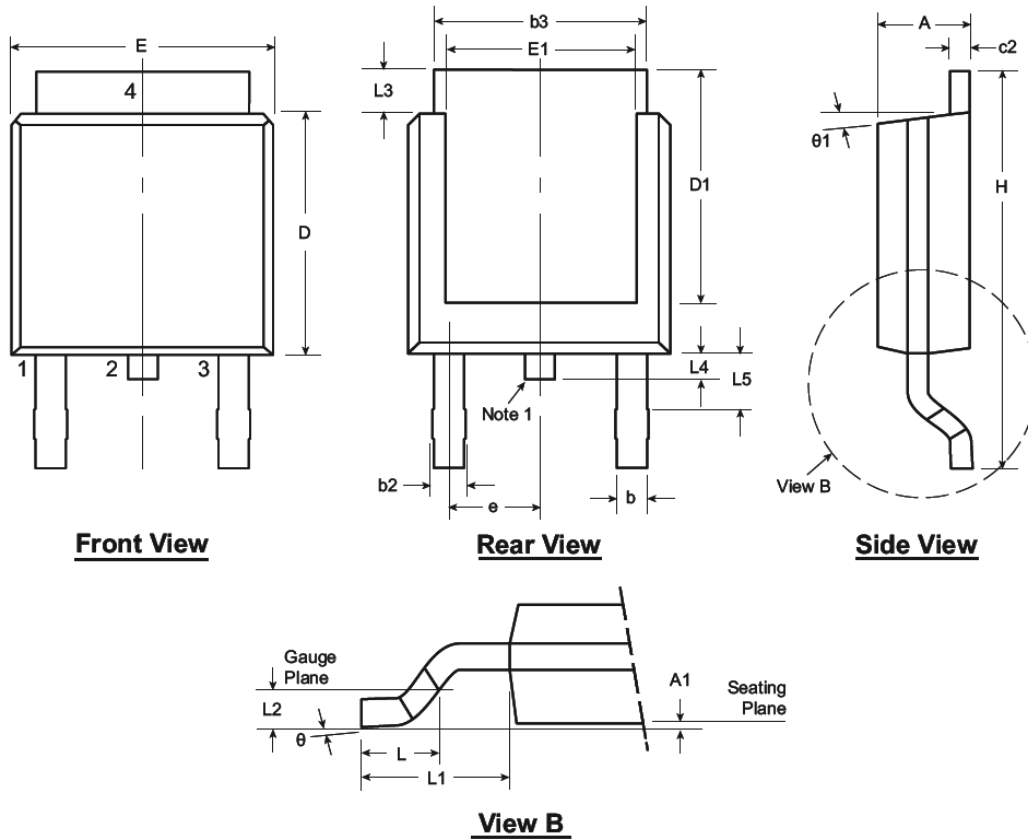
Example



| | | |
|----------------|--------|--|
| 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.

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.

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° | | |

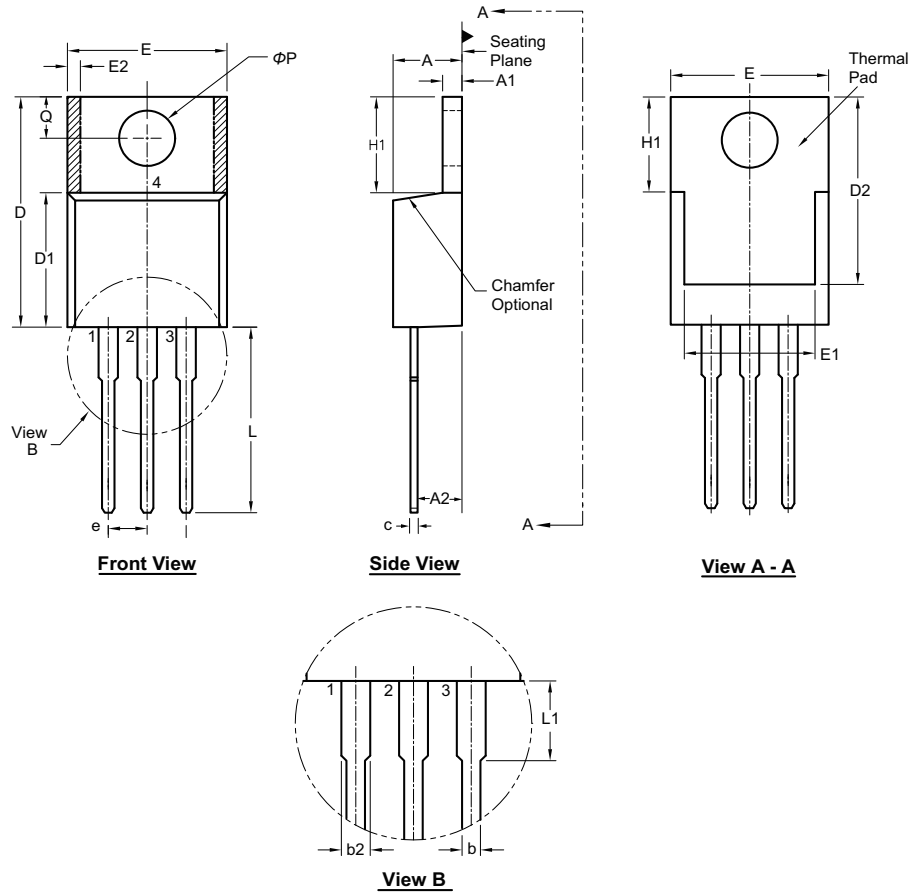
JEDEC Registration TO-252, Variation AA, Issue E, June 2004.

* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

3-Lead TO-220 Package Outline (N5)



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

| Symbol | A | A1 | A2 | b | b2 | c | D | D1 | D2 | E | E1 | E2 | e | H1 | L | L1 | Q | ϕP |
|--------------------|-----|------|------|-------|------|------|-------|------|-------|-------|------|------|----------|------|------|-------|------|----------|
| Dimension (inches) | MIN | .140 | .020 | .080 | .015 | .045 | .012† | .560 | .326† | .474† | .380 | .270 | 0.20* | .230 | .500 | .200* | .100 | .139 |
| | NOM | - | - | - | .027 | .057 | - | - | - | - | - | - | .100 BSC | - | - | - | - | - |
| | MAX | .190 | .055 | .120† | .040 | .070 | .024 | .650 | .361† | .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 (July 2015)

- Update file to new format

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>X</u> |
|-----------------|-----------------|---|--|---|------------|
| Device | Package Options | | Environmental | | Media Type |
| Device: | CL220 | = | Simple, 220V, 20 mA, temperature-compensated, constant-current LED driver IC | | |
| Package: | K4 | = | TO-252 (D-PAK) | | |
| | N5 | = | TO-220 | | |
| Environmental | G | = | Lead (Pb)-free/ROHS-compliant package | | |
| Media Type: | (blank) | = | 2000/Reel for TO-252 | | |
| | | = | 50/Tube for TO-220 | | |

Examples:

a) CL220K4-G TO-252 package, 2000/reel

b) CL220N5-G TO-220 package, 50/Tube

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