**Fixed Constant-Current Linear LED Driver**

**Features**
- 20 mA ±10% Constant-Current Driver for CL520
- 25 mA ±10% Constant-Current Driver for CL525
- 1V Dropout
- 4.75V to 90V Supply Range
- 90V Maximum Rating for Transient Immunity
- Temperature Compensated

**Applications**
- Specialty Lighting
- Low-Voltage Signage

**General Description**
The CL520 and CL525 are fixed-current linear regulators designed for driving LEDs at 20 mA and 25 mA, respectively. With a maximum rating of 90V, these devices are able to withstand transients without the need for additional transient protection circuitry. The CL520/CL525 are ideally suited for applications employing single or multiple LEDs.

The devices’ minimum dropout voltage of 1V accommodates extra LEDs, permits lower supply voltages and provides more efficient operation.

The CL520/CL525 are offered in TO-252 (D-PAK) and TO-92 packages.

---

**Package Types**

See Table 2-1 and Table 2-2 for pin information.
Functional Block Diagram
CL520/CL525

Typical Application Circuit

- Control
- VIN: 4.75 – 90V
- OUT
- GND
- VDD
- 100nF
- IOUT
1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Supply Voltage, V_{DD} ........................................................... –0.5V to +100V
Output Voltage, V_{OUT} .............................................................. –0.5V to +100V
Junction Temperature, T_J ......................................................... –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.

RECOMMENDED OPERATING CONDITIONS

Electrical Specifications: All voltages with respect to GND pin

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V_{DD}</td>
<td>4.75</td>
<td>—</td>
<td>90</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Voltage at OUT Pin</td>
<td>V_{OUT}</td>
<td>1</td>
<td>—</td>
<td>90</td>
<td>V</td>
<td>Note 1</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>T_J</td>
<td>–40</td>
<td>—</td>
<td>+125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>V_{DD} Bypass Capacitor</td>
<td>C_{DD}</td>
<td>100</td>
<td>—</td>
<td>—</td>
<td>nF</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Thermal considerations may limit voltage to less than 90V.

DC ELECTRICAL CHARACTERISTICS

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current into V_{DD} Pin</td>
<td>I_{DD}</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Current into OUT Pin</td>
<td>I_{OUT}</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>mA</td>
<td>1V &lt; V_{OUT} &lt; 90V</td>
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<tr>
<td>CL520</td>
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<td>—</td>
<td>—</td>
<td>22</td>
<td>mA</td>
<td>V_{OUT} &lt; 1V</td>
</tr>
<tr>
<td>CL525</td>
<td></td>
<td>22.5</td>
<td>25</td>
<td>27.5</td>
<td>mA</td>
<td>1V &lt; V_{OUT} &lt; 90V</td>
</tr>
<tr>
<td>Current into OUT Pin with V_{DD} Pin Open</td>
<td>I_{OUT(OFF)}</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>μA</td>
<td>V_{DD} = open</td>
</tr>
<tr>
<td>Voltage at V_{DD} to Shut Off LED Current</td>
<td>V_{DD(OFF)}</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>μA</td>
<td>I_{OUT} &lt; 10 μA</td>
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<tr>
<td>V_{DD} Applied On-Time</td>
<td>t_{ON}</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>V_{DD} Removed Off-Time</td>
<td>t_{OFF}</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>μs</td>
<td></td>
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</table>
TEMPERATURE SPECIFICATIONS

<table>
<thead>
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<th>Parameter</th>
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<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
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<tr>
<td>TEMPERATURE RANGE</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>T_J</td>
<td>-40</td>
<td>—</td>
<td>125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>T_J(ABS MAX)</td>
<td>—</td>
<td>—</td>
<td>+135</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_S</td>
<td>-65</td>
<td>—</td>
<td>+150</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

| PACKAGE THERMAL RESISTANCE         |      |      |      |      |      |            |
| 3-lead TO-252 (D-PAK)              | θ_JA | —    | 81   | —    | °C/W | Note 1    |
| 3-lead TO-92                       | θ_JA | —    | 132  | —    | °C/W | Note 1    |

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

I<sub>OUT</sub> vs. Temperature

![Graph showing I<sub>OUT</sub> vs. Junction Temperature](image)
2.0 PIN DESCRIPTION

The pin details of CL520/CL525 3-lead TO-252 (D-PAK) and 3-lead TO-92 are listed in Table 2-1 and Table 2-2, respectively. Refer to Package Types for the location of pins.

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

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Supply voltage. Bypass locally with a 100 nF capacitor to ground.</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Circuit common (not for external connection)</td>
</tr>
<tr>
<td>3</td>
<td>OUT</td>
<td>Constant-current output (sink)</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Circuit common</td>
</tr>
</tbody>
</table>

**TABLE 2-2: TO-92 PIN FUNCTION TABLE**

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Supply voltage. Bypass locally with a 100 nF capacitor to ground.</td>
</tr>
<tr>
<td>2</td>
<td>OUT</td>
<td>Constant-current output (sink)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Circuit common</td>
</tr>
</tbody>
</table>
3.0 APPLICATION INFORMATION

3.1 CL520 Application Circuits

**FIGURE 3-1:** CL520 Switched LED.

**FIGURE 3-2:** CL520 Separate LED Supply ($V_{\text{OUT}}$ may be higher or lower than $V_{\text{DD}}$).

**FIGURE 3-3:** CL520 Ground-Referenced LEDs.

---

**Note 1:** Single or multiple LED(s) depend on the $V_{\text{IN}}$ supply voltage.

**Note 2:** Limit to pulse operation with suitable duty cycle at high voltages across OUT and GND pins to keep the device power dissipation and junction temperature below the maximum limit. E.g., 10% duty cycle pulse operation when the voltage across OUT and GND pins is 90V.

$V_{\text{IN}} = 4.75\text{ - }90\text{V}$

$100\text{nF}$

$I_{\text{OUT}} = 20\text{mA}$

$V_{\text{DD}}$

$\text{Control}$

$\text{GND}$

$I_{\text{OUT}}$ (Note 1)

$V_{\text{IN}}$

$\text{VDD}$

$\text{OUT}$ (Note 2)

$\text{Control}$

$\text{GND}$

$\text{VDD}$

$\text{OUT}$ (Note 2)

$\text{Control}$

$\text{GND}$

$\text{VDD}$

$\text{OUT}$ (Note 2)

$\text{Control}$

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$\text{OUT}$ (Note 2)

$\text{Control}$

$\text{GND}$

$\text{VDD}$

$\text{OUT}$ (Note 2)

$\text{Control}$

$\text{GND}$

$\text{VDD}$

$\text{OUT}$ (Note 2)
3.2 CL525 Application Circuits

**FIGURE 3-4:** CL525 Switched LED.

**FIGURE 3-5:** CL525 Separate LED Supply ($V_{OUT}$ may be higher or lower than $V_{DD}$).

**FIGURE 3-6:** CL525 Ground-Referenced LEDs.

---

**Note 1:** Single or multiple LED(s) depend on the $V_{IN}$ supply voltage.

**Note 2:** Limit to pulse operation with suitable duty cycle at high voltages across OUT and GND pins to keep the device power dissipation and junction temperature below the maximum limit, e.g., 10% duty cycle pulse operation when the voltage across OUT and GND pins is 90V.

$V_{IN}$ 4.75 – 90V

![Diagram](image1)

$V_{DD}$ 100nF

$I_{OUT}$ 25mA

$V_{LED(TOTAL)} + 4.75V \leq V_{IN} \leq V_{LED(TOTAL)} + 90V$

$I_{LED} = I_{OUT} + I_{DD}$

---

$V_{IN}$ 4.75 – 90V

![Diagram](image2)

$V_{DD}$ 100nF

$I_{OUT}$ 25mA

$V_{LED(TOTAL)} + 4.75V \leq V_{IN} \leq V_{LED(TOTAL)} + 90V$

$I_{LED} = I_{OUT} + I_{DD}$

---

$V_{IN}$ 4.75 – 90V

![Diagram](image3)

$V_{DD}$ 100nF

$I_{OUT}$ 25mA

$V_{LED(TOTAL)} + 4.75V \leq V_{IN} \leq V_{LED(TOTAL)} + 90V$

$I_{LED} = I_{OUT} + I_{DD}$

---

$V_{IN}$ 4.75 – 90V

![Diagram](image4)

$V_{DD}$ 100nF

$I_{OUT}$ 25mA

$V_{LED(TOTAL)} + 4.75V \leq V_{IN} \leq V_{LED(TOTAL)} + 90V$

$I_{LED} = I_{OUT} + I_{DD}$

---

**Note 1:** Single or multiple LED(s) depend on the $V_{IN}$ supply voltage.

**Note 2:** Limit to pulse operation with suitable duty cycle at high voltages across OUT and GND pins to keep the device power dissipation and junction temperature below the maximum limit, e.g., 10% duty cycle pulse operation when the voltage across OUT and GND pins is 90V.
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

**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
- @  Pb-free JEDEC® designator for Matte Tin (Sn)
- *  This package is Pb-free. The Pb-free JEDEC designator (@) 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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>A</th>
<th>A1</th>
<th>b</th>
<th>b2</th>
<th>b3</th>
<th>c2</th>
<th>D</th>
<th>D1</th>
<th>E</th>
<th>E1</th>
<th>e</th>
<th>H</th>
<th>L</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
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<td>MAX</td>
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<td>.365</td>
<td>.200°</td>
<td>.410</td>
<td>.070</td>
<td>.050</td>
<td>.040</td>
<td>.060</td>
<td>10°</td>
<td>15°</td>
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</table>

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>A</th>
<th>b</th>
<th>c</th>
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<th>E</th>
<th>E1</th>
<th>e</th>
<th>e1</th>
<th>L</th>
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<tbody>
<tr>
<td>MIN</td>
<td>.170</td>
<td>.014(^1)</td>
<td>.014(^1)</td>
<td>.175</td>
<td>.125</td>
<td>.080</td>
<td>.095</td>
<td>.045</td>
<td>.500</td>
</tr>
<tr>
<td>NOM</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MAX</td>
<td>.210</td>
<td>.022(^2)</td>
<td>.022(^2)</td>
<td>.205</td>
<td>.165</td>
<td>.105</td>
<td>.105</td>
<td>.055</td>
<td>.610(^*)</td>
</tr>
</tbody>
</table>

JEDEC Registration TO-92

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

\(^1\) This dimension differs from the JEDEC drawing.

Drawings not to scale.
APPENDIX A: REVISION HISTORY

Revision A (December 2018)

• Converted Supertex Doc# DSFP-CL520/CL525 to Microchip DS20005805A
• Changed the maximum junction temperature in the Absolute Maximum Ratings from 150°C to 135°C
• Changed the package marking format
• 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.

<table>
<thead>
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<th>PART NO.</th>
<th>Device</th>
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<th>Environmental</th>
<th>Media Type</th>
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<td>Devices:</td>
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<td>=</td>
<td>Fixed Constant-Current Linear LED Driver</td>
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<tr>
<td></td>
<td>CL525</td>
<td>=</td>
<td>Fixed Constant-Current Linear LED Driver</td>
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<td></td>
</tr>
<tr>
<td>Packages:</td>
<td>K4</td>
<td>=</td>
<td>3-lead TO-252 (DPAK)</td>
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</tr>
<tr>
<td></td>
<td>N3</td>
<td>=</td>
<td>3-lead TO-92</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Environmental:</td>
<td>G =</td>
<td>Lead (Pb)-free/RoHS-compliant Package</td>
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<td></td>
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<tr>
<td>Media Types:</td>
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<td>2000/Reel for a K4 Package</td>
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<tr>
<td></td>
<td>(blank) =</td>
<td>1000/Bag for an N3 Package</td>
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</tr>
</tbody>
</table>

**Examples:**

a) CL520K4-G: Fixed Constant-Current Linear LED Driver, 3-lead TO-252 (DPAK) Package, 2000/Reel

b) CL520N3-G: Fixed Constant-Current Linear LED Driver, 3-lead TO-92 Package, 1000/Bag

c) CL525K4-G: Fixed Constant-Current Linear LED Driver, 3-lead TO-252 (DPAK) Package, 2000/Reel

d) CL525N3-G: Fixed Constant-Current Linear LED Driver, 3-lead TO-92 Package, 1000/Bag
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