**Functional Description**

- Adjustable constant current output: 150 mA (default) to 350 mA
- 200 mA fixed current output option
- Current setting with external resistors
- Open & short circuit protection

**Mains Characteristics**

- Voltage range: 198 VAC – 264 VAC
  - Withstands max. 320 VAC [max. 1 hour]
- DC range: 176 VDC – 280 VDC
- Starting voltage: > 190 VDC
- Frequency: 0 / 50 Hz – 60 Hz
- THD at full power: < 10 %
- Leakage current to earth: < 0.3 mA
- Tested surge protection: 1 kV L-N, 2 kV L-GND (IEC 61000-4-5)
- Tested fast transient protection: 4 kV (IEC 61000-4-4)

**Insulation between circuits & driver case**

- Mains circuit - Output: Non-isolated
- Mains and output - Driver case: Basic insulation

**Load Output (non-isolated)**

- Output current ($I_{LED}$): 150 mA (default) – 350 mA
  - Accuracy: ± 5 %
  - Ripple: < 2 %* at ≤ 120 Hz
- $U_{LED\ max}$ (abnormal): 400 V

<table>
<thead>
<tr>
<th>$I_{LED}$</th>
<th>150 mA</th>
<th>200 mA</th>
<th>350 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{RATED}$</td>
<td>52.5 W</td>
<td>70 W</td>
<td>80 W</td>
</tr>
<tr>
<td>$U_{LED}$</td>
<td>150 – 350 V</td>
<td>120 – 350 V</td>
<td>120 – 228 V</td>
</tr>
<tr>
<td>PF (λ) at full load</td>
<td>0.98</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Efficiency (n) at full load</td>
<td>95 %</td>
<td>95 %</td>
<td>95 %</td>
</tr>
</tbody>
</table>
Operating window

![Operating window diagram]

**Driver performance**

![Driver performance graphs]

**Operating Conditions and Characteristics**

- **Highest allowed t<sub>c</sub> point temperature**: 85 °C
- **t<sub>c</sub> life (60 000 h) temperature**: 75 °C
- **Ambient temperature range**:
  - Independent use: –20 °C ... +40 °C
  - For other than independent use: –20 °C ... +50 °C
- **Storage temperature range**: –40 °C ... +80 °C
- **Maximum relative humidity**: No condensation
- **Lifetime (90 % survival rate)**:
  - 100 000 h, at t<sub>c</sub> = 65 °C
  - 60 000 h, at t<sub>c</sub> = 75 °C
  - 30 000 h, at t<sub>c</sub> = 85 °C

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**Quantity of drivers per miniature circuit breaker 16 A Type C**

<table>
<thead>
<tr>
<th>Based on I&lt;sub&gt;cont&lt;/sub&gt;</th>
<th>Based on inrush current I&lt;sub&gt;peak&lt;/sub&gt;</th>
<th>Typ. peak inrush current I&lt;sub&gt;peak&lt;/sub&gt;</th>
<th>1/2 value time, Δt</th>
<th>Calculated energy, I&lt;sub&gt;peak&lt;/sub&gt;²Δt</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 pcs.</td>
<td>36 pcs.</td>
<td>40 A</td>
<td>173 μs</td>
<td>0.198 A²s</td>
</tr>
</tbody>
</table>

**CONVERSION TABLE FOR OTHER TYPES OF MINIATURE CIRCUIT BREAKER**

<table>
<thead>
<tr>
<th>MCB type</th>
<th>Relative quantity of LED drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 10 A</td>
<td>37 %</td>
</tr>
<tr>
<td>B 16 A</td>
<td>60 %</td>
</tr>
<tr>
<td>B 20 A</td>
<td>75 %</td>
</tr>
<tr>
<td>C 10 A</td>
<td>62 %</td>
</tr>
<tr>
<td>C 16 A</td>
<td>100 % (see table above)</td>
</tr>
<tr>
<td>C 20 A</td>
<td>125 %</td>
</tr>
</tbody>
</table>

Type C MCB’s are strongly recommended to use with LED lighting. Please see more details in “MCB information” document in each driver product page in “downloads & links” section.
Connections and Mechanical Data

- **Wire size**: 0.5 mm² – 1.5 mm²
- **Wire type**: Solid core and fine-stranded
- **Wire insulation**: According to EN 60598
- **Maximum driver to LED wire length**: 5 m
- **Weight**: 170 g
- **IP rating**: IP20

Connections

- **Note:**
  - Not suitable for load side switching operation
  - Label may differ if the unit is preset to fixed current
  - Connect load between terminal (+) and (150mA / Iset) for resistor adjusted output currents

Dimensions (mm)

Output current can be set with the current setting resistor connected to the Rset terminal. Example current and resistor values across the range can be found in the following table. More information about the current setting resistor is given on page 4.

### Iset current setting resistor values

<table>
<thead>
<tr>
<th>R(Ω)</th>
<th>0</th>
<th>220</th>
<th>390</th>
<th>560</th>
<th>680</th>
<th>820</th>
<th>1k</th>
<th>1,5k</th>
<th>1,8k</th>
<th>2,2k</th>
<th>2,74k</th>
<th>3,3k</th>
<th>3,9k</th>
<th>4,7k</th>
<th>5,6k</th>
<th>8,2k</th>
<th>12k</th>
<th>18k</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{\text{out}}(mA)</td>
<td>350</td>
<td>330</td>
<td>320</td>
<td>310</td>
<td>300</td>
<td>290</td>
<td>280</td>
<td>270</td>
<td>260</td>
<td>250</td>
<td>240</td>
<td>230</td>
<td>220</td>
<td>210</td>
<td>200</td>
<td>190</td>
<td>180</td>
<td>170</td>
<td>150</td>
</tr>
</tbody>
</table>

| Order Code | T70000 | N/A | N/A | N/A | T70681 | T70821 | T70102 | T70152 | N/A | T70222 | T72741 | T70332 | T70392 | T70472 | T70562 | T70622 | T70123 | T70183 | N/A |

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Helvar | Helvar Oy Ab, Keilaranta 5 Fl-02150 Espoo, Finland. Data is subject to change without notice. www.helvar.com
LL1x23-80-E-CC LED driver is suited for built-in usage in luminaires. With LL1x2130-SR strain reliefs, independent use is possible too (see the LL1x2130-SR datasheet for details). In order to have safe and reliable LED driver operation, the LED luminaires will need to comply with the relevant standards and regulations (e.g. IEC/EN 60598-1). The LED luminaire shall be designed to adequately protect the LED driver from dust, moisture and pollution. The luminaire manufacturer is responsible for the correct choice and installation of the LED drivers according to the application and product datasheets. Operating conditions of the LED drivers may never exceed the specifications as per the product datasheet.

**Installation & operation**

**Maximum ambient and \( T_c \) temperature:**

- For built-in components inside luminaires, the \( T_a \) ambient temperature range is a guideline given for the optimum operating environment. However, integrator must always ensure proper thermal management (i.e. mounting base of the driver, air flow etc.) so that the \( T_c \) point temperature does not exceed the \( T_c \) maximum limit in any circumstance.
- Reliable operation and lifetime is only guaranteed if the maximum \( T_c \) point temperature is not exceeded under the conditions of use.

**Current setting resistor**

LL1x23-80-E-CC LED driver features a constant current output adjustable via current setting resistor.

- An external resistor can be inserted in to the current setting terminal, allowing the user to adjust the LED driver output current.
- When no external resistor is connected, then the LED drivers will operate at their default lowest current level.
- A standard through-hole resistor can be used for the current setting. To achieve the most accurate output current it is recommended to select a quality low tolerance resistor. Minimum diameter for resistor leg is 0.51mm.
- Always connect the current setting resistor only into the terminals marked with Rset on the LED driver label.
- For the resistor/current value selection, refer to the table on page 3.
- For drivers not providing isolation [non-isolated], current setting resistor must be insulated according safety regulations.

**LED driver earthing**

LL1x23-80-E-CC LED driver is a protective Class I device and designed for Class I luminaires.

- If used inside Class I luminaires, this LED driver must always have the protective earth cable connected for safety reasons.
- If used inside Class II luminaires, the safety of the luminaire shall be ensured through double/reinforced insulating of live parts. This LED driver is only basic insulated, and provided that luminaire insulation is done according to the latest standards (e.g. IEC/EN 60598-1), the earth terminal of the driver shall be left unconnected. However, the EMC performance of Class I LED drivers change when left unearthed, so it is always the responsibility of the integrator to take measures to ensure that the assembled luminaire complies with latest EMC standards.

**Miniature Circuit Breakers (MCB)**

- Type-C MCB’s with trip characteristics in according to EN 60898 are recommended.
- Please see more details in “MCB information” document in each driver product page in “downloads & links” section.

**Installation site**

- The general preferred installation position of LED drivers for independent use is to have the top cover facing upwards.

**Lamp failure functionality**

**No load**

When open load is detected, driver limits output voltage according to \( U_{out}(\text{max}) \) (abnormal).

**Overload**

Driver can withstand overload, however reliable operation is only guaranteed in specified voltage range.

**Underload**

Reliable operation of the driver is only guaranteed in specified voltage range.

**Short circuit**

Driver can withstand output short circuit.

**Conformity & standards**

<table>
<thead>
<tr>
<th>General and safety requirements</th>
<th>EN 61347-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particular safety requirements for DC or AC supplied electronic control gear for LED modules</td>
<td>EN 61347-2-13</td>
</tr>
<tr>
<td>Thermal protection class</td>
<td>EN 61347, C5e</td>
</tr>
<tr>
<td>Mains current harmonics</td>
<td>EN 61000-3-2</td>
</tr>
<tr>
<td>Limits for voltage fluctuations and flicker</td>
<td>EN 61000-3-3</td>
</tr>
<tr>
<td>Radio frequency interference</td>
<td>EN 55015</td>
</tr>
<tr>
<td>Immunity standard</td>
<td>EN 61547</td>
</tr>
<tr>
<td>Performance requirements</td>
<td>EN 62384</td>
</tr>
<tr>
<td>Compliant with relevant EU directives</td>
<td></td>
</tr>
<tr>
<td>RoHS/REACH compliant</td>
<td></td>
</tr>
<tr>
<td>ENEC and CE marked</td>
<td></td>
</tr>
</tbody>
</table>

**Label symbols**

Thermally controlled control gear, incorporating means of protection against overheating to prevent the case temperature under any conditions of use from exceeding 120 °C.