

## Features

- Dim-to-off with Standby Power  $\leq 0.5$  W
- Always-on Auxiliary Power: 12Vdc, 200mA
- Thermal Sensing and Protection for LED Module
- Full Power at 70-100% Max. Current (Constant Power)
- Flicker-Free
- Dimmable to 5% by 0-10V/PWM/Timer (3 Timer Modes)
- Output Lumen Compensation
- 69,000 Hour Lifetime at 70°C Case Temperature
- Class II, SELV and Class 2
- Suitable for Built-in Use



## Description

The *LUD-060SxxxDS2* series is a 60W, constant-power, programmable IP20 LED driver that operates from 90-305Vac input with excellent power factor. Created for dimmable panel lights and linear lights, it provides good dimming accuracy down to 5% output, plus a dim-off mode with low standby power. The high efficiency of these drivers and slim metal case enables them to run cooler, significantly improving reliability and extending product life. To ensure trouble-free operation, protection is provided against over voltage, short circuit, and over temperature of both the driver and the external LED array.

## Models

| Output Current Range | Full-Power Current Range (1) | Default Output Current | Input Voltage Range(2)      | Output Voltage Range | Max. Output Power | Typical Efficiency (3) | Power Factor |        | Model Number                  |
|----------------------|------------------------------|------------------------|-----------------------------|----------------------|-------------------|------------------------|--------------|--------|-------------------------------|
|                      |                              |                        |                             |                      |                   |                        | 120Vac       | 220Vac |                               |
| 19.3-550mA           | 385-550 mA                   | 530mA                  | 90 ~ 305 Vac<br>127~300 Vdc | 31~156 Vdc           | 60 W              | 90.5%                  | 0.99         | 0.96   | LUD-060S055DS2                |
| 27.3-780mA           | 546-780 mA                   | 700mA                  | 90 ~ 305 Vac<br>127~300 Vdc | 22~110 Vdc           | 60 W              | 90.5%                  | 0.99         | 0.96   | LUD-060S078DS2 <sup>(4)</sup> |
| 38.5-1100mA          | 770-1100 mA                  | 1050mA                 | 90 ~ 305 Vac<br>127~300 Vdc | 16~78 Vdc            | 60 W              | 90.5%                  | 0.99         | 0.96   | LUD-060S110DS2 <sup>(4)</sup> |
| 52.5-1500mA          | 1050-1500mA                  | 1400mA                 | 90 ~ 305 Vac<br>127~300 Vdc | 12~57 Vdc            | 60 W              | 89.5%                  | 0.99         | 0.96   | LUD-060S150DS2 <sup>(5)</sup> |
| 73.5-2100mA          | 1470-2100mA                  | 2100mA                 | 90 ~ 305 Vac<br>127~300 Vdc | 8~40 Vdc             | 60 W              | 88.0%                  | 0.99         | 0.96   | LUD-060S210DS2 <sup>(5)</sup> |

**Notes:** (1) Output current range with constant power at 60W.

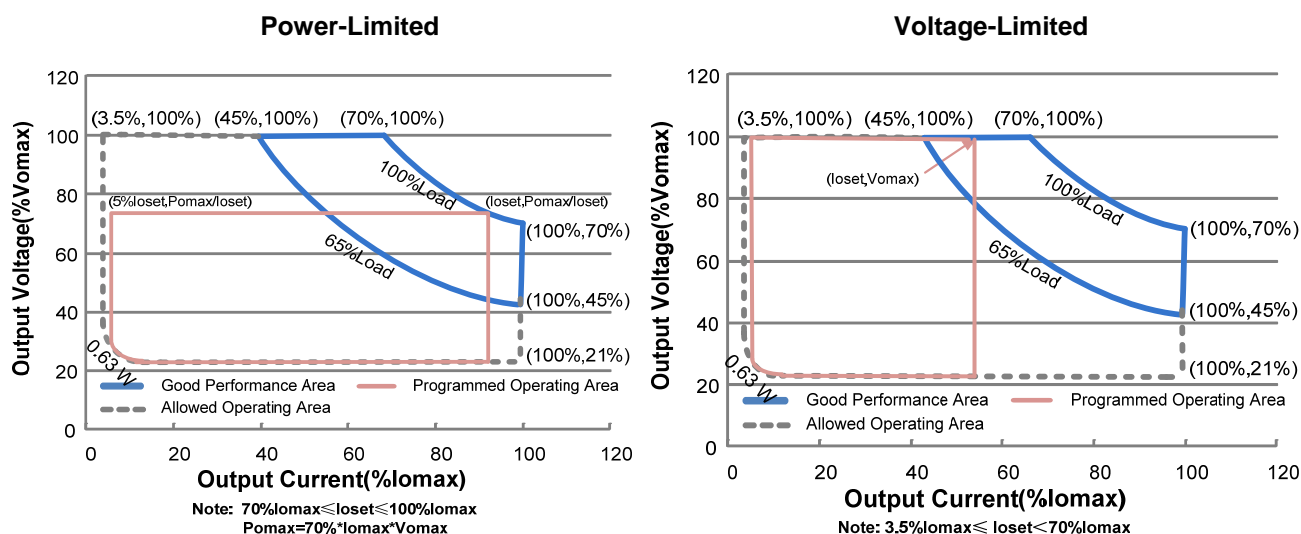
(2) Certified input voltage range: UL, FCC 100-277Vac or 127-300Vdc; otherwise 100-240Vac or 127-250Vdc.

(3) Measured at a 220Vac input with 70% maximum output current and 100% maximum output voltage.

(4) SELV output.

(5) Class 2 & SELV output.

## I-V Operating Area



## Input Specifications

| Parameter                | Min.  | Typ. | Max.                 | Notes  |
|--------------------------|-------|------|----------------------|--|
| Input Voltage            | 90 V  | -    | 305 V                | 127~300 Vdc  |
| Input Frequency          | 47 Hz | -    | 63 Hz                |  |
| Leakage Current          | -     | -    | 0.75 MIU             | UL8750; 277Vac/ 60Hz   |
|                          | -     | -    | 0.70 mA              | IEC60598-1; 240Vac/ 60Hz   |
| Input AC Current         | -     | -    | 0.8 A                | Measured at full load and 100 Vac input.   |
|                          | -     | -    | 0.36 A               | Measured at full load and 220 Vac input.   |
| Inrush Current( $I^2t$ ) | -     | -    | 0.9 A <sup>2</sup> s | At 220Vac input, 25°C Cold Start, Duration =560 $\mu$ S, 10%Ipk-10%Ipk. See Inrush Current Waveform for the details. |
| PF                       | 0.90  | -    | -                    | At 100-277Vac, 65%-100% load(39-60W)   |
| THD                      | -     | -    | 20%                  |  |

## Output Specifications

| Parameter  | Min.     | Typ.    | Max.      | Notes                             |
|--|----------|---------|-----------|-----------------------------------|
| Output Current Tolerance                         | -5%Ioset | -       | 5%Ioset   | At full load condition            |
| Output Current Setting (Ioset) Range             | 7%Iomax  | -       | 100%Iomax |                                   |
| Output Current Setting Range with Constant Power | 70%Iomax | -       | 100%Iomax |                                   |
| Total Output Current Ripple (pk-pk)              | -        | 5%Iomax | 10%Iomax  | At full load condition, 20 MHz BW |

## Output Specifications (Continued)

| Parameter                                     | Min.   | Typ.                | Max.                 | Notes   |
|---|--------|---------------------|----------------------|---|
| Output Current Ripple at<br>< 200 Hz (pk-pk)  | -      | 3%I <sub>omax</sub> | 5%I <sub>omax</sub>  | At full load condition. Only this component of ripple is associated with visible flicker. |
| Startup Overshoot Current                     | -      | -                   | 10%I <sub>omax</sub> | At full load condition  |
| No Load Output Voltage                        |        |                     |                      |   |
| LUD-060S055DS2                                | -      | -                   | 180 V                |   |
| LUD-060S078DS2                                | -      | -                   | 120 V                |   |
| LUD-060S110DS2                                | -      | -                   | 90 V                 |   |
| LUD-060S150DS2                                | -      | -                   | 59.5 V               |   |
| LUD-060S210DS2                                | -      | -                   | 50 V                 |   |
| Line Regulation                               | -      | -                   | ±0.5%                | Measured at full load   |
| Load Regulation                               | -      | -                   | ±1.5%                |   |
| Turn-on Delay Time                            | -      | 0.40 s              | 0.75 s               | Measured at 120Vac input, 65%-100% load.  |
|   | -      | -                   | 0.50 s               | Measured at 220Vac input, 65%-100% load.  |
| Temperature Coefficient of I <sub>o</sub> set | -      | 0.02%/°C            | -                    | Case temperature = 0°C ~T <sub>c</sub> max  |
| 12V Auxiliary Output Voltage                  | 10.8 V | 12 V                | 13.2 V               |   |
| 12V Auxiliary Output Source Current           | 0 mA   | -                   | 200 mA               | Return terminal is "Return-"  |

**Note:** All specifications are typical at 25°C unless otherwise stated.

## General Specifications

| Parameter                    | Min.  | Typ.  | Max. | Notes |
|------------------------------|-------|-------|------|-------|
| Efficiency at 120 Vac input: |       |       |      |       |
| LUD-060S055DS2               |       |       |      |       |
| I <sub>o</sub> =385 mA       | 86.5% | 88.5% | -    |       |
| I <sub>o</sub> =550 mA       | 86.5% | 88.5% | -    |       |
| LUD-060S078DS2               |       |       |      |       |
| I <sub>o</sub> =546 mA       | 86.5% | 88.5% | -    |       |
| I <sub>o</sub> =780 mA       | 86.5% | 88.5% | -    |       |
| LUD-060S110DS2               |       |       |      |       |
| I <sub>o</sub> =770 mA       | 86.5% | 88.5% | -    |       |
| I <sub>o</sub> =1100 mA      | 86.5% | 88.5% | -    |       |
| LUD-060S150DS2               |       |       |      |       |
| I <sub>o</sub> =1050 mA      | 85.5% | 87.5% | -    |       |
| I <sub>o</sub> =1500 mA      | 85.5% | 87.5% | -    |       |
| LUD-060S210DS2               |       |       |      |       |
| I <sub>o</sub> =1470 mA      | 84.0% | 86.0% | -    |       |
| I <sub>o</sub> =2100 mA      | 83.0% | 85.0% | -    |       |

Measured at full load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)

## General Specifications (Continued)

| Parameter   | Min.  | Typ.  | Max.                                      | Notes  |
|---|---|---|---|--|
| Efficiency at 220 Vac input:<br>LUD-060S055DS2<br>Io=385 mA<br>Io=550 mA<br>LUD-060S078DS2<br>Io=546 mA<br>Io=780 mA<br>LUD-060S110DS2<br>Io=770 mA<br>Io=1100 mA<br>LUD-060S150DS2<br>Io=1050 mA<br>Io=1500 mA<br>LUD-060S210DS2<br>Io=1470 mA<br>Io=2100 mA | 88.5%<br>88.5%<br>88.5%<br>88.5%<br>88.5%<br>87.5%<br>87.5%<br>86.0%<br>85.0% | 90.5%<br>90.5%<br>90.5%<br>90.5%<br>90.5%<br>89.5%<br>89.5%<br>88.0%<br>87.0% | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | Measured at full load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.) |
| Efficiency at 277 Vac input:<br>LUD-060S055DS2<br>Io=385 mA<br>Io=550 mA<br>LUD-060S078DS2<br>Io=546 mA<br>Io=780 mA<br>LUD-060S110DS2<br>Io=770 mA<br>Io=1100 mA<br>LUD-060S150DS2<br>Io=1050 mA<br>Io=1500 mA<br>LUD-060S210DS2<br>Io=1470 mA<br>Io=2100 mA | 88.5%<br>88.5%<br>88.5%<br>88.5%<br>88.5%<br>87.5%<br>87.5%<br>86.0%<br>85.0% | 90.5%<br>90.5%<br>90.5%<br>90.5%<br>90.5%<br>89.5%<br>89.5%<br>88.0%<br>87.0% | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | Measured at full load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.) |
| Standby Power   | -   | -   | 0.5 W                                     | Measured at 230Vac/50Hz; Dimming off   |
| MTBF  | -   | 217,000 Hours   | -   | Measured at 220Vac input, 80%Load and 25°C ambient temperature (MIL-HDBK-217F)   |
| Lifetime  | -   | 69,000 Hours  | -   | Measured at 120Vac input, 80%Load and 70°C case temperature; See lifetime vs. Tc curve for the details   |
| Operating Case Temperature for Safety Tc_s  | -30°C   | -   | +85°C                                     |  |
| Operating Case Temperature for Warranty Tc_w  | -30°C   | -   | +75°C                                     | Humidity: 10% RH to 90% RH<br>No condensation  |
| Storage Temperature   | -30°C   | -   | +85°C                                     | Humidity: 5% RH to 90% RH<br>No condensation   |
| Dimensions<br>Inches (L × W × H)<br>Millimeters (L × W × H)   | 14.88 × 1.18 × 0.83<br>378 × 30 × 21  |   |   |  |
| Net Weight  | -   | 370 g   | -   |  |

**Note:** All specifications are typical at 25°C unless otherwise stated.

## Dimming Specifications

| Parameter                                    | Min.      | Typ.   | Max.   | Notes                                    |
|--|-----------|--------|--------|--|
| Absolute Maximum Voltage on the Vdim (+) Pin | -20 V     | -      | 20 V   |  |
| Source Current on Vdim (+)Pin                | 200 uA    | 300 uA | 450 uA | Vdim(+) = 0 V                            |
| Dimming Output Range                         | 5%loset   | -      | loset  | 70%Iomax ≤ Ioset ≤ 100%Iomax             |
|  | 3.5%Iomax | -      | loset  | 3.5%Iomax ≤ Ioset < 70%Iomax             |
| Recommended Dimming Input Range              | 0 V       | -      | 10 V   | Default 0-10V dimming mode.              |
| Dim off Voltage                              | 0.35 V    | 0.5 V  | 0.65 V |  |
| Dim on Voltage                               | 0.55 V    | 0.7 V  | 0.85 V |  |
| Hysteresis                                   | -         | 0.2 V  | -      |  |
| PWM_in High Level                            | 3 V       | -      | 10 V   | Dimming mode set to PWM in PC interface. |
| PWM_in Low Level                             | -0.3 V    | -      | 0.6 V  |  |
| PWM_in Frequency Range                       | 200 Hz    | -      | 3 KHz  |  |
| PWM_in Duty Cycle                            | 1%        | -      | 99%    |  |
| PWM Dimming off (Positive Logic)             | 2%        | 5%     | 8%     |  |
| PWM Dimming on (Positive Logic)              | 4%        | 7%     | 10%    |  |
| PWM Dimming off ( Negative Logic)            | 92%       | 95%    | 98%    |  |
| PWM Dimming on ( Negative Logic)             | 90%       | 93%    | 96%    |  |
| Hysteresis                                   | -         | 2%     | -      |  |

**Note:** All specifications are typical at 25 °C unless stated otherwise.

## Safety & EMC Compliance

| Safety Category         | Standard  |
|-------------------------|---|
| UL/CUL                  | UL 8750,UL1310,CAN/CSA-C22.2 No. 250.13,CAN/CSA-C22.2 No. 223-M91 |
| CE                      | EN61347-1 <sup>(1)</sup> , EN61347-2-13                           |
| KS                      | KS C 7655   |
| EMI Standards           | Notes   |
| EN 55015 <sup>(2)</sup> | Conducted emission Test &Radiated emission Test                   |
| EN 61000-3-2            | Harmonic Current Emissions  |
| EN 61000-3-3            | Voltage Fluctuations & Flicker                                    |

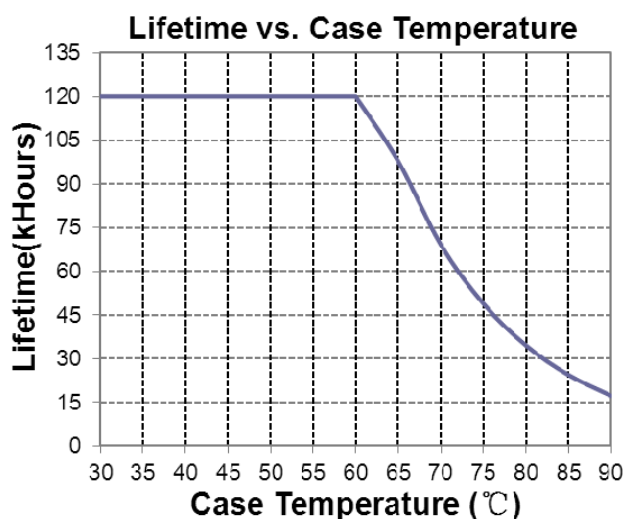
## Safety & EMC Compliance (Continued)

| EMI Standards              | Notes   |
|----------------------------|---|
| FCC Part 15 <sup>(2)</sup> | ANSI C63.4 Class B  |
|                            | This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: [1] this device may not cause harmful interference, and [2] this device must accept any interference received, including interference that may cause undesired operation. |
| EMS Standards              | Notes   |
| EN 61000-4-2               | Electrostatic Discharge(ESD): 8 kV air discharge, 4 kV contact discharge  |
| EN 61000-4-3               | Radio-Frequency Electromagnetic Field Susceptibility Test-RS  |
| EN 61000-4-4               | Electrical Fast Transient/Burst-EFT   |
| EN 61000-4-5               | Surge Immunity Test: AC Power Line: line to line 1 kV   |
| EN 61000-4-6               | Conducted Radio Frequency Disturbances Test-CS  |
| EN 61000-4-8               | Power Frequency Magnetic Field Test   |
| EN 61000-4-11              | Voltage Dips  |
| EN 61547                   | Electromagnetic Immunity Requirements Applies to Lighting Equipment   |

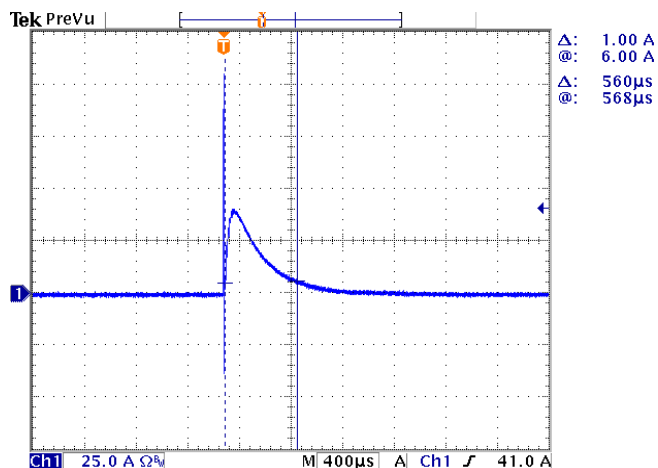
**Notes:** (1) This product meets all requirements for EN=61347-1, A2:2013 Annex O (Double insulation). When the driver is energized, the allowed leakage current is perceptible but harmless.

(2) This LED driver meets the EMI specifications above, but EMI performance of a luminaire that contains it depends also on the other devices connected to the driver and on the fixture itself.

## Lifetime vs. Case Temperature



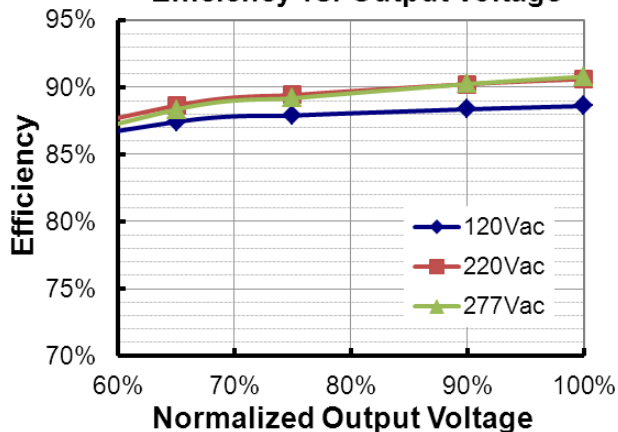
## Inrush Current Waveform



## Efficiency vs. Load

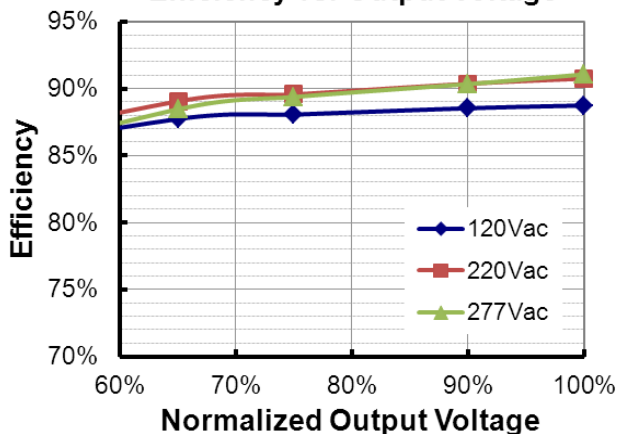
LUD-060S055DS2 (I<sub>o</sub>=385mA)

Efficiency vs. Output Voltage



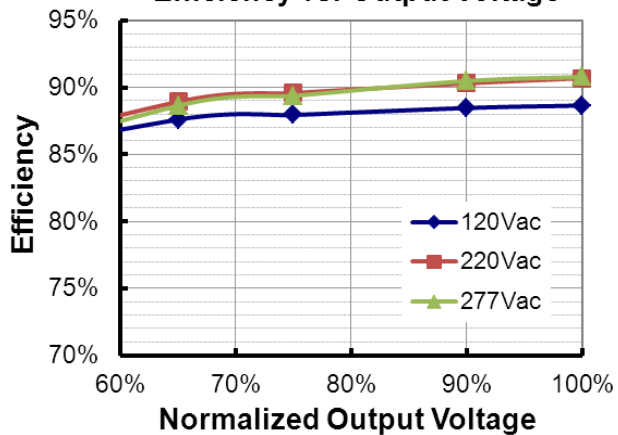
LUD-060S055DS2 (I<sub>o</sub>=550mA)

Efficiency vs. Output Voltage



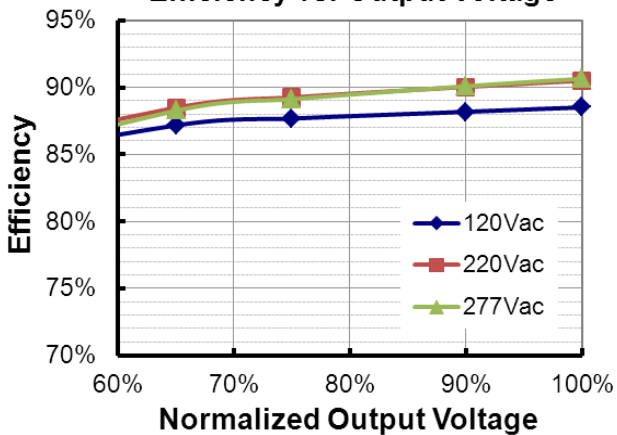
LUD-060S078DS2 (I<sub>o</sub>=546mA)

Efficiency vs. Output Voltage



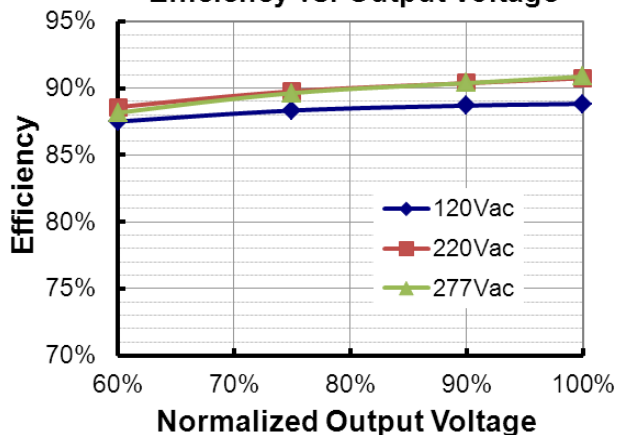
LUD-060S078DS2 (I<sub>o</sub>=780mA)

Efficiency vs. Output Voltage

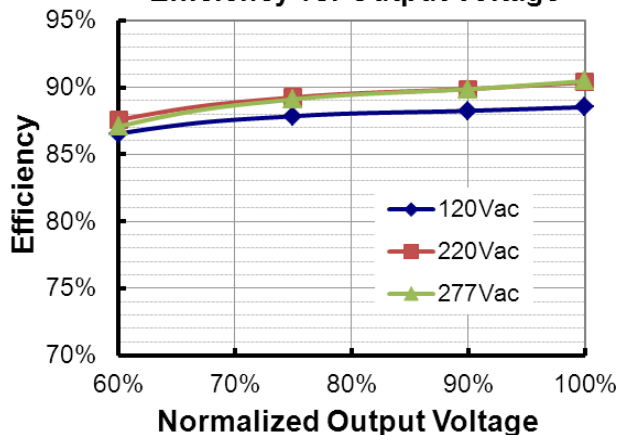




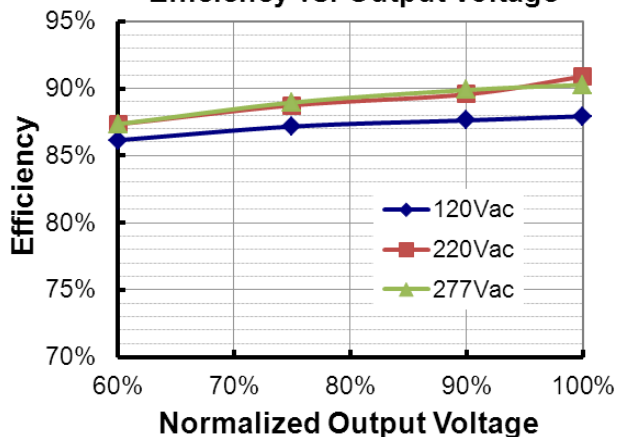
**LUD-060S110DS2 ( $I_o=770\text{mA}$ )**  
**Efficiency vs. Output Voltage**



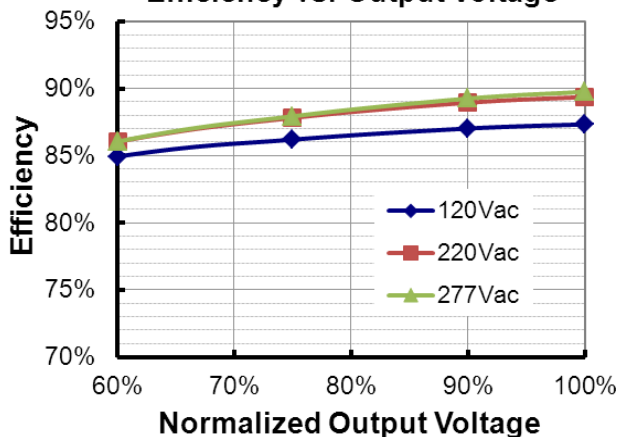
**LUD-060S110DS2 ( $I_o=1100\text{mA}$ )**  
**Efficiency vs. Output Voltage**



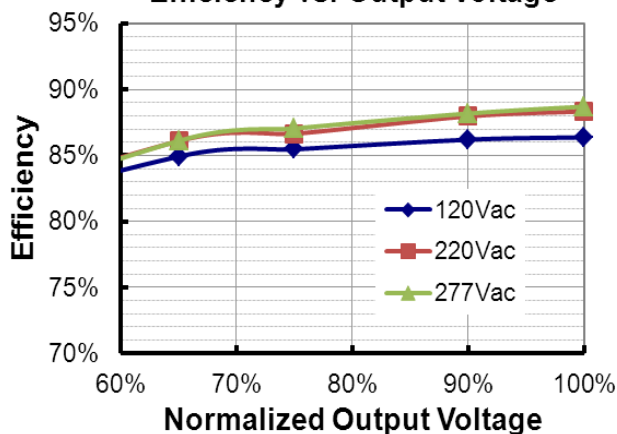
**LUD-060S150DS2 ( $I_o=1050\text{mA}$ )**  
**Efficiency vs. Output Voltage**



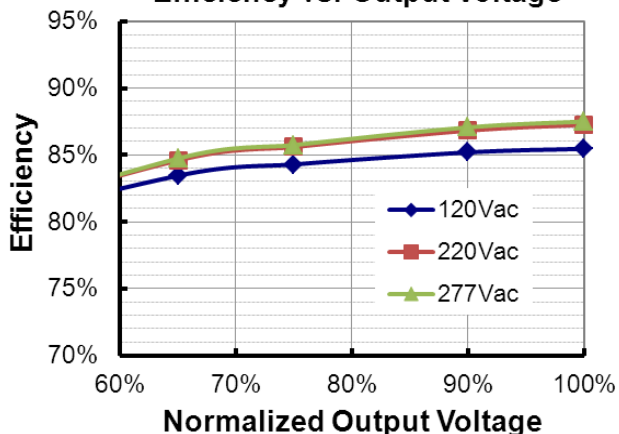
**LUD-060S150DS2 ( $I_o=1500\text{mA}$ )**  
**Efficiency vs. Output Voltage**



**LUD-060S210DS2 ( $I_o=1470\text{mA}$ )**  
**Efficiency vs. Output Voltage**

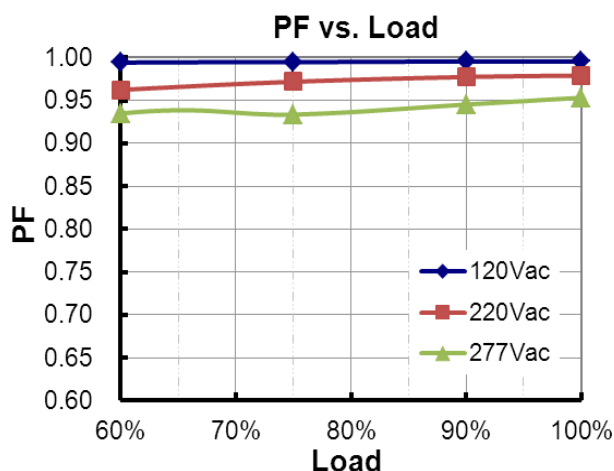


**LUD-060S210DS2 ( $I_o=2100\text{mA}$ )**  
**Efficiency vs. Output Voltage**

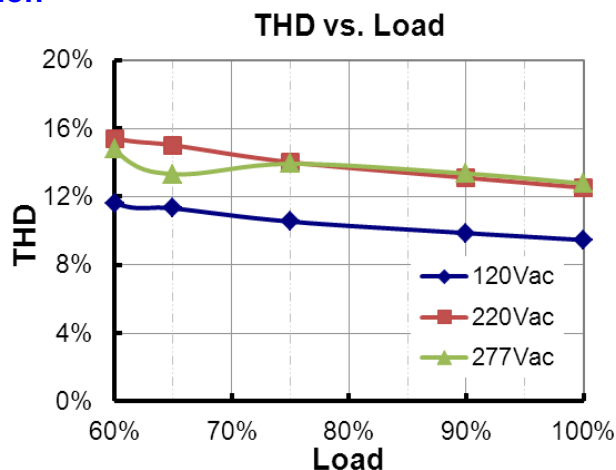




## Power Factor



## Total Harmonic Distortion



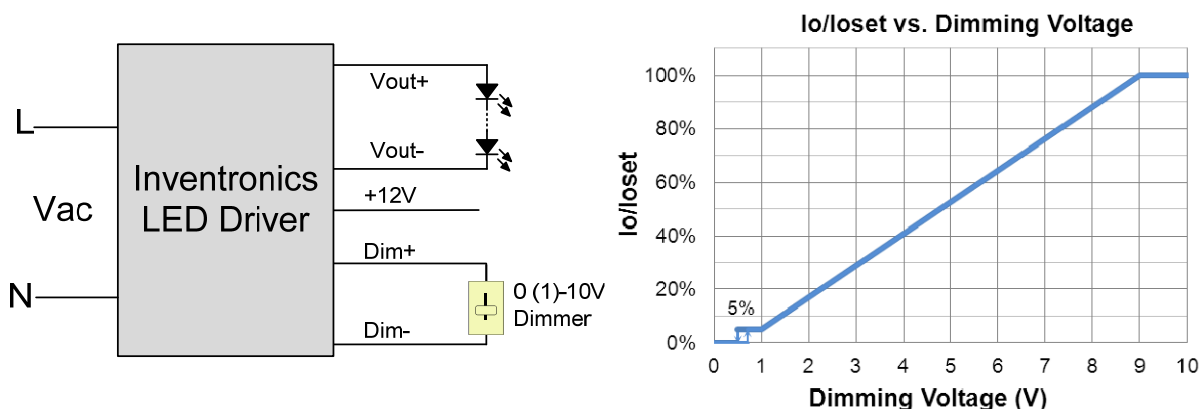
## Protection Functions

| Parameter                       |                          | Min.   | Typ.      | Max.      | Notes   |
|---------------------------------|--------------------------|--|-----------|-----------|---|
| Over Temperature Protection     |                          | Decreases output current. Returning to normal after over temperature is removed.   |           |           |   |
| Short Circuit Protection        |                          | Auto Recovery. No damage will occur when any output is short circuited. The output shall return to normal when the fault condition is removed. |           |           |   |
| Over Voltage Protection         |                          | Limits output voltage at no load and in case the normal voltage limit fails.   |           |           |   |
| External Thermal Protection NTC | R1                       | -  | 7.81 kOhm | -         | When R_NTC drops below R1, External Thermal Protection is triggered, reducing output current smoothly as a function of R_NTC. |
|                                 | R2                       | -  | 4.16 kOhm | -         | When R_NTC is less than R2, output current is held steady at the programmed "Protection Current Floor".                       |
|                                 | Protection Current Floor | 10%loset   | 60%loset  | 100%loset | 10%loset>lomin (default setting is 60%)   |
|                                 |                          | lomin  | 60%loset  | 100%loset | 10%loset≤lomin (default setting is 60%)   |

## Dimming

### ● 0-10V Dimming

The recommended implementation of the dimming control is provided below.

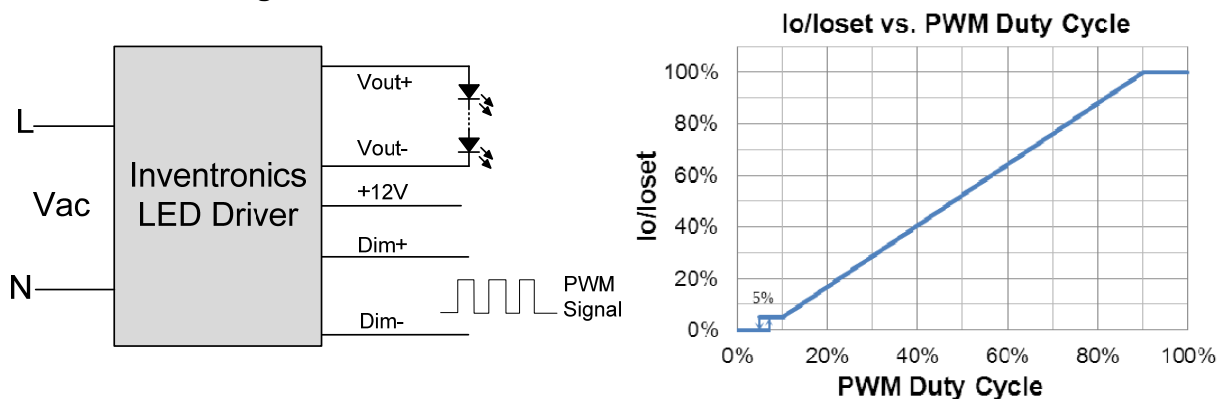


**Implementation 1: DC Input**

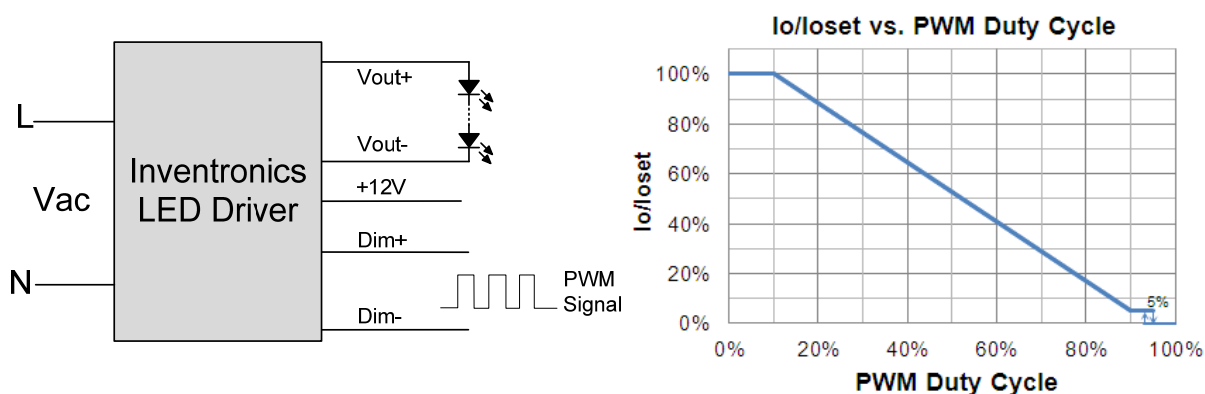
#### Notes:

1. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like resistors and zener.
2. Do not connect Dim- to the output V- or V+, otherwise the driver will not work properly.
3. If 0-10V dimming is not used, Dim + should be open.

### ● PWM Dimming



**Implementation 2: Positive logic**



## Implementation 3: Negative logic

### ● Timing Dimming

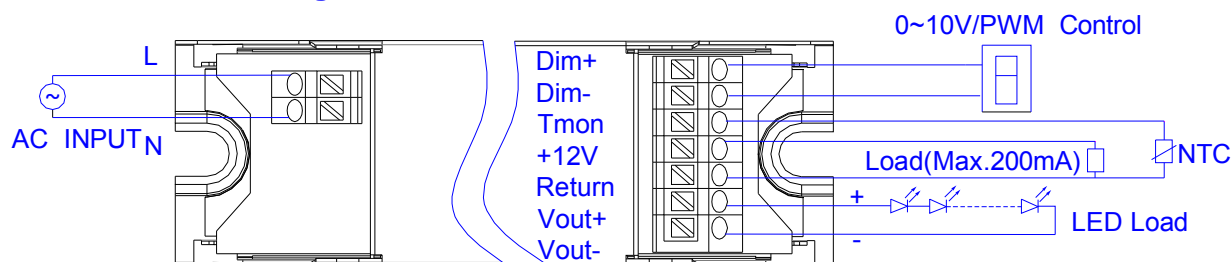
Time dimming control includes 3 kinds of modes, they are Self Adapting-Midnight, Self Adapting-Percentage and Traditional Timer.

- **Self Adapting-Midnight:** Automatically adjusts the dimming curve based on the on-time of past two days (if difference <15 minutes), assuming that the center point of the dimming curve is midnight local time.
- **Self Adapting-Percentage:** Automatically adjusts the on-time of each step by a constant percentage = (actual on-time for the past 2 days if difference <15 min) / (programmed on-time from the dimming curve).
- **Traditional Timer:** Follows the programmed timing curve after power on with no changes.

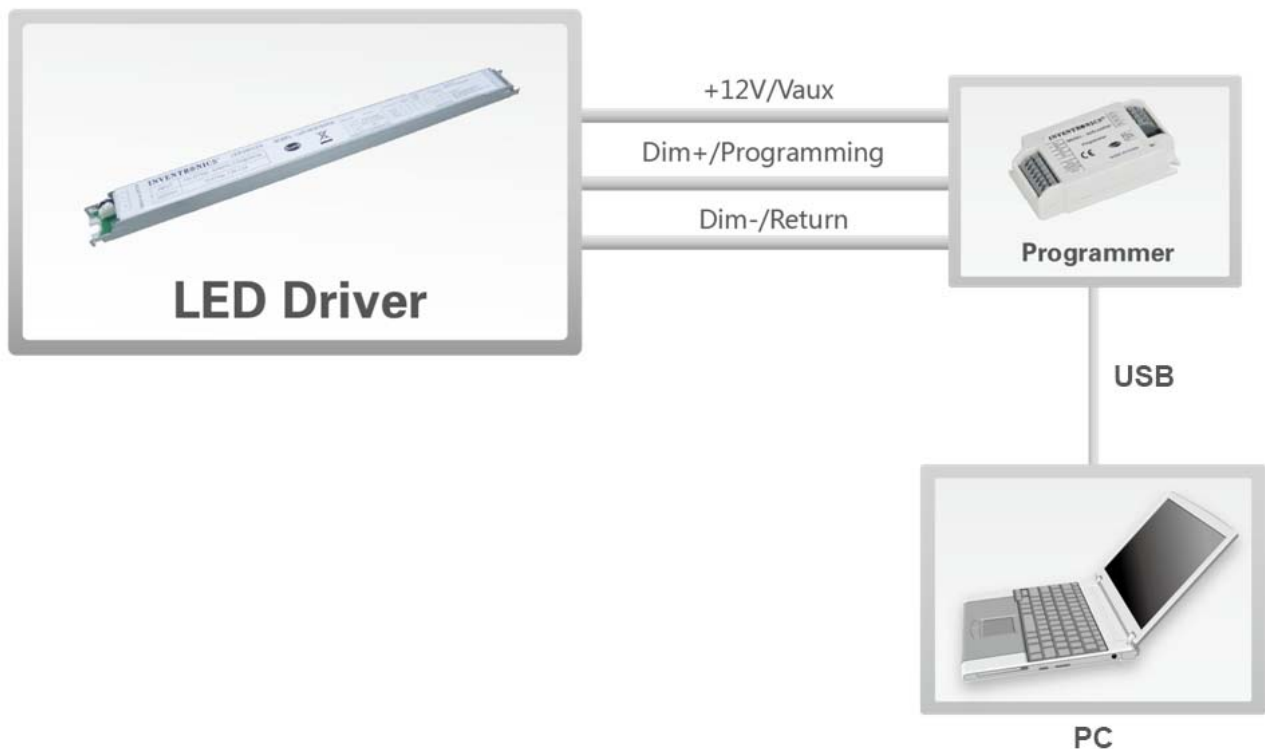
### ● Output Lumen Compensation

Output Lumen Compensation (OLC) may be used to maintain constant light output over the life of the LEDs by driving them at a reduced current when new, then gradually increasing the drive current over time to counteract LED lumen degradation.

## Wire Connection Diagram



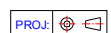
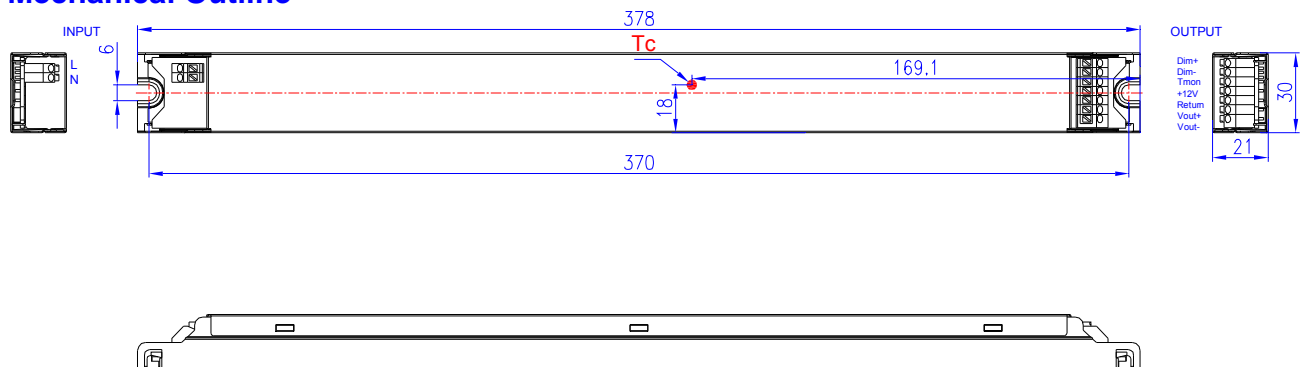
## Programming Connection Diagram



**Note:** The driver does not need to be powered on during the programming process.

- Please refer to [PRG-MUL2](#) (Programmer) datasheet for details.

## Mechanical Outline



Unspecified tolerance: ±1

## RoHS Compliance

Our products comply with the European Directive 2011/65/EC, calling for the elimination of lead and other hazardous substances from electronic products.

## Revision History

| Change Date | Rev. | Description of Change        |                               |                                |
|-------------|------|------------------------------|-------------------------------|--------------------------------|
|             |      | Item                         | From                          | To                             |
| 2015-12-07  | A    | Datasheets Release           | /                             | /                              |
| 2016-01-13  | B    | Lifetime                     | Min.=120,000Hours@<br>Tc=60°C | Typ.= 69,000 Hours@<br>Tc=70°C |
| 2016-02-25  | C    | KS Certificate Regulation    | /                             | Added                          |
|             |      | Notes of EMI Standard        | /                             | Updated                        |
| 2016-09-20  | D    | I-V Operating Area           | 3 W                           | 0.63 W                         |
| 2017-05-25  | E    | Turn-on Delay Time at 120Vac | Max.=1.2 s                    | Max.=0.75 s                    |