LED Lighting Driver Solution
Why LED Lighting?

- 20% of Global Energy is used for Electricity Generation
- Over 25% of a Building Energy Consumption is used for Lighting
- With LED Lighting adoption can save 40% of lighting electricity in 2030
# LED Lighting App./Market

<table>
<thead>
<tr>
<th>Segments</th>
<th>Non-Phase-Cut Dimming</th>
<th>Non Dimming</th>
<th>Phase-Cut Dimming</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Power</strong></td>
<td><img src="image" alt="High Power" /></td>
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<td><img src="image" alt="Phase-Cut Dimming" /></td>
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<tr>
<td>Troffers</td>
<td>60W</td>
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<tr>
<td>Street light</td>
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<td>Flood light</td>
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<td>Outdoors</td>
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<td><strong>Mid Power</strong></td>
<td><img src="image" alt="Mid Power" /></td>
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<tr>
<td>Down light</td>
<td>25W</td>
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<tr>
<td>Flat light</td>
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<td>Ceiling light</td>
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<td>Down light</td>
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Public Information
LED Lighting Power Topology Solution

**Segments**

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<td>• Tubes</td>
<td>• Down light</td>
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</tbody>
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**Non-Phase-Cut Dimming**

- **60W**

**Non Dimming**

**Phase-Cut Dimming**

**Multiple stage isolated Topology**

**Single Stage Isolated Topology**

**Direct AC LED Driver**

**Single Stage Non-Isolated Topology**

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**Public Information**
Direct AC LED Driver Solution

NCL30170 Power scalable/Wide Dimmable AC LED driver IC

Key Features
- Accurate LED CC regulation: <±1%
- Workable for Constant Power regulation
- Selectable LED Channel counts
- High PF & Low THD: >0.99 / <10%
- Proprietary Active PC Dimmer Control Tech.
- Wide Analog Dimming range: 5~100%
- HV Startup Current Source
- Protections
  - Input Over Voltage Protection
  - R_{CS} Short Protection
  - Thermal Shutdown

Benefits
- Excellent Light Uniformity
- High Design Flexibility
- Easy Power Scalability 5~300 W
- Overpass global standard
- Excellent Phase-cut dimmer Compatibility
- Flexible Smart Lighting Design
- Fast start up & Low eBOM
- High System Reliability

Market & Applications
- LED Light - PAR, Down, Tube, Flat, Ceiling, Flood, High Bay, Street Light
  - Non-Dimming, Phase-Cut Dimming
  - Analog Dimming (0-10)

Ordering & Package Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>VDIM</th>
<th>Package</th>
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<tr>
<td>NCL30170ADR2G</td>
<td>0 - 3V</td>
<td>10 SOIC</td>
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<tr>
<td>NCL30170BDR2G</td>
<td>0 - 1.5V</td>
<td>10 SOIC</td>
</tr>
</tbody>
</table>

Public Information
Phase-Cut Dimming Solution

FL7734 Universal Input Phase-Cut Dimming Single Stage PSR Controller

**Key Features**
- Universal Input Φ-cut Dim.
- Controllable lIN min.
- Controllable Dimming curve
- <± 1% Line regulation PSR Control
- RCS short and open protec.

**Benefits**
- Universal input design
- Meet SSL7A & EnergyStar
- Good light uniformity and Low BOM
- High system liability

**Other Features**
- High PF, Low THD : >0.9 / <20
- Fast < 0.3 s Start-up (@ Small phase angle)
- LED Short Protection (SCP)
- LED Open Protection (OVP-VS, OVP-VDD)
- Output Diode Short Protection (OCP)
- Over Temperature Protection (TSD)

**Market & Applications**
- Phase-Cut Dimming LED Light
  - A19, PAR30/38, Down Light
  - Indoor Flat, Ceiling light

**Ordering & Package Information**

<table>
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<tr>
<th>Ordering Part Number</th>
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</thead>
<tbody>
<tr>
<td>FL7734MX</td>
<td>16SOIC</td>
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</table>

Evaluation Boards and Design Tools Available
Step Dimming Driver with Mechanical Wall Switch

NCL30185 Step Dimmable QR PSR Current Mode Controller for LED Lighting

Key Features
- Precise current regulation accuracy (±2% typical)
- Quasi-resonant control
- Adjustable thermal foldback
- 3 Step Dimmable (70/25/5%)
- Programmable OVP

Benefits
- Avoids over specifying LEDs to achieve lumen output
- Higher efficiency
- Improved driver reliability
- Triac Dimmer Not Required
- User can set over voltage protection level

Other Features
- Current control insensitive to normal transformer variation
- Wide Vcc range (9.4-26 Vdc) to support extend VF range
- Output diode and shorted winding protection
- Cycle-by-cycle current limiting
- Open LED and shorted output protection
- Built-in Vcc overvoltage protection

Market & Applications
- LED Bulbs and tubes
- LED Drivers
- LED Luminaires

Ordering & Package Information

<table>
<thead>
<tr>
<th>Ordering Part Number</th>
<th>Protections</th>
<th>Package</th>
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<tbody>
<tr>
<td>NCL30185ADR2G</td>
<td>Latched Fault</td>
<td>8 SOIC</td>
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<tr>
<td>NCL30188BDR2G</td>
<td>Auto Recoverable</td>
<td>8 SOIC</td>
</tr>
</tbody>
</table>
Non-Phase-Cut Dimming Single Stage Solution

NCL30486 Smart-Dimmable CC/CV PSR Controller

**Key Features**

- Integrated 700 V HV Startup
- Precise current regulation accuracy (<±2% typical)
- Precise voltage regulation accuracy (<±1% typical)
- PF(>0.95)/THD(<10%) @ Univ.
- Quasi-resonant control
- Standby Mode
- Optional PSR/SSR mode
- Excellent Dimming features
  - Dimming curve: Linear/Quadratic
  - ADIM: Analog I\textsubscript{OUT} with V\textsubscript{DC}
  - PWM I\textsubscript{OUT} with V\textsubscript{PWM}
  - PDIM: Analog I\textsubscript{OUT} with V\textsubscript{PWM}
  - Optional Min. Dim. Clamping(0/1/5/8%)
  - DIM CV Mode
- Protections
  - BO/ Line OVP/ V\textsubscript{CC} OVP
  - LED Open/ short protection
  - Winding / Diode short protection
  - TSD

**Benefits**

- Fast startup, low Pstdby
- Constant brightness
- Aux. power supply for MCU & cold start up
- Exceeds global standards
- Higher efficiency
- P\textsubscript{IN}: < 150 mW
- Design flexibility

- Design flexibility
- Supports “Smart” Lighting
- Use opto. Instead of pulse trans.
- Deep dimming features
- Vcc supply for Smart lighting MCU
- High system reliability

**Market & Applications**

- Analog/PWM Dimmable LED Driver

**Ordering Part Number**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Features</th>
<th>Package</th>
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</thead>
<tbody>
<tr>
<td>NCL30486A2DR2G</td>
<td>1% Dim clamp</td>
<td>9 SOIC</td>
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</tbody>
</table>

Public Information
Non-Dimming Single Stage Solution

NCL30488 Single Stage CC/CV PSR controller

**Key Features**
- Integrated 700 V HV Startup
- Precise current regulation accuracy (<±2% typical)
- Precise voltage regulation accuracy (<±2% typical)
- PF(>0.95)/THD(<10%) @ Univ.
- Quasi-resonant control
- Standby Mode
- Optional PSR/SSR mode
- Protections
  - BO/Line OVP/ V$_{CC}$ OVP
  - LED Open/short protection
  - Winding/Diode short protection
  - TSD

**Benefits**
- Fast startup, low Pstdby
- Constant brightness
- Aux. power supply for MCU & cold start up
- Exceeds global standards
- Higher efficiency
- $P_{IN}$: < 150 mW
- Design flexibility
- High system reliability

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<tr>
<td>NCL30488A2DR2G</td>
<td>BO: 138 V</td>
<td>7 SOIC</td>
</tr>
<tr>
<td>NCL30488A3DR2G</td>
<td>BO: 108 V</td>
<td>7 SOIC</td>
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</tbody>
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**Market & Applications**
- Non Dimming LED Light
LED Panel Lighting Solution

NCL30125 2SW forward controller for low Vout/ high Iout LED load

**Key Features**
- Adjustable frequency upto 300KHz
- Internal 700 V high side gate driver
- +0.9/-1.2 A high & low side gate driver
- Internal 700 V HV startup current source
- Dynamic Self Supply (DSS)
- Skip cycle mode
- Jittering function

**Benefits**
- 2 Switch Forward optimal design
- Save external pulse transformer
- High power driving capability
- Fast startup & Low standby power
- Stable operation in transient & no load.
- Real no load operation
- Good EMI performance

**Other Features**
- Design Flexibility
  - 35 V wide \( V_{CC} \) operation
  - Adjustable operating frequency & soft start duration
  - Optional features (Skip threshold, BO level, OCP timer & etc.)
  - Auto-recovery or Latch option
- Robust system operation
  - Brown-out, OCP(SCP/OLP), \( V_{CC} \) OVP, TSD,
  - Dedicated Fault pin for OVP or OTP detection

**Market & Applications**
- Lighting Advertisement power board - 2SW Forward converter
- Power Supplies for Power tool charger, PC Silver Boxes, Games Adapter

**Ordering & Package Information**

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<tbody>
<tr>
<td>NCL30125A2DR2G</td>
<td>Latch</td>
<td>14 SOIC</td>
</tr>
<tr>
<td>NCL30125B2DR2G</td>
<td>AR</td>
<td>14 SOIC</td>
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Public Information
Multiple Power Stage Solution – Flyback+Buck

FL7740 (Single Stage CV PSR PWM IC) + FL7760 (Wide ADIM Buck PWM IC)

- **FL7740 Single Stage CV PSR Controller**
  - Precise CV regulation: $\pm 2\%$.
  - Fast line/load transient response: $\pm 10\%$.
  - Low Standby Power consumption: <0.15W at no-load.
  - >0.9 PF at Half load & 305V$_{AC}$ condition

- **FL7760 70 V CCM Dimmable Buck Controller**
  - Input voltage range: 8 V$_{DC}$ ~ 60V$_{DC}$
  - Wide Dimming Range
    - Analog: 5~100%.
    - PWM: 1~100% (@2KHz)

- **Market & Applications**
  - Smart Luminaries
  - Low profile Power Supply

50 W – 2Ch. Buck EVB Available
Multiple Power Stage Solution – Boost PFC + LLC HB

NCL2801 (Ultra low THD CrM Boost) + NCP13992 (Current Mode LLC controller)

• **NCL2801 CrM PFC Controller**
  - Valley Count Frequency Foldback for high efficiency
  - Dynamic Response Enhancer for lower undershoot
  - Soft/Fast OVP for lower overshoot
  - THD Enhancer for < 10% THD

• **NCP13992 Current Mode LLC half bridge controller**
  - Built-in 600V/1A H/B driver
  - High Frequency 50 KHz to 750 KHz
  - Light Load Mode for standby power
    - < 30 mW off-mode
    - < 100 mW No Load
  - Quiet Skip Mode for less audible noise

• **Market & Applications**
  - Smart Luminaries
  - Non-Dimmable LED driver

150 W EVB