1. NXP Lighting Value Propositions

- Offering industrializable turnkey solutions
- Acting as solution provider
- (mains) dimming specialists
- #1 IC supplier for lighting solutions
- Long-term lighting expertise, serving:
  - 4 out of the Top 5 lighting players
  - 8 out of the Top 10 lighting ODMs
- In-house wafer fabs with High Volume production
- Supply chain
- Broad dimmer compatibility:
  - flicker-free, deep triac- and transistor dimming
  - dimming via analogue or PWM signal, DALI, capacitive touch
- Diversified portfolio, added-value
- Offering the whole range:
  - LED controllers and drivers and conventional solutions CFL, TL, HID
  - From 1W to 300W
  - Offering DALI, DMX, KNX and PLC control solutions
# 2. Survey LED Lighting Market Applications

<table>
<thead>
<tr>
<th>segments</th>
<th>applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ballasts</strong></td>
<td></td>
</tr>
<tr>
<td>External, constant</td>
<td>Multi-Purpose</td>
</tr>
<tr>
<td>current LED drivers</td>
<td></td>
</tr>
<tr>
<td><strong>luminaires</strong></td>
<td></td>
</tr>
<tr>
<td>Outdoor lighting</td>
<td>Architectural&lt;br&gt;Street, Area Lighting&lt;br&gt;Industrial (hi-bay, low-bay)&lt;br&gt;Tunnel&lt;br&gt;Petrol Station</td>
</tr>
<tr>
<td>Indoor lighting</td>
<td>Office (louver luminaires, linear lamps, downlights)&lt;br&gt;Shop (HV track lighting)&lt;br&gt;Hospitality (Pendants, Downlights, wall sconces, etc.)&lt;br&gt;Residential (Floor Lamp, Pendants, desk lamps)</td>
</tr>
<tr>
<td>Speciality Lighting</td>
<td>Stage and Studio&lt;br&gt;Medical&lt;br&gt;Horticultural</td>
</tr>
<tr>
<td>lamps</td>
<td>GU10/PAR16&lt;br&gt;E14/C43&lt;br&gt;E27/A55/A60&lt;br&gt;PAR30&lt;br&gt;PAR38</td>
</tr>
<tr>
<td>retrofits</td>
<td></td>
</tr>
</tbody>
</table>
### 3. Survey LED Driver IC’s and its applications

<table>
<thead>
<tr>
<th>Power</th>
<th>Fixed/PWM Dim</th>
<th>Mains dimmable (triac/transistor)</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3 - 15W</strong></td>
<td><strong>SSL21101</strong>&lt;br&gt;- Flyback, primary side sensing&lt;br&gt;- efficiency up to 88%&lt;br&gt;- PF &gt; 0.95, THD &lt; 20% or low ripple&lt;br&gt;- integrated MOSFET</td>
<td><strong>SSL2101</strong>&lt;br&gt;- Buck or Flyback&lt;br&gt;- efficiency ~ 85%&lt;br&gt;- PF: ~ 0.9&lt;br&gt;- integrated MOSFET</td>
<td>LED bulb retrofits/light sources:&lt;br&gt;GU10/PAR16, E14/C43, E27/A50/55/60&lt;br&gt;&lt;br&gt;LED fixtures:&lt;br&gt;downlights, spots&lt;br&gt;High Voltage Track Lighting</td>
</tr>
<tr>
<td></td>
<td><strong>SSL21083</strong>&lt;br&gt;- Buck or Buck-Boost&lt;br&gt;- efficiency up to 95%&lt;br&gt;- integrated MOSFET</td>
<td><strong>SSL2102</strong> / <strong>SSL2103</strong>&lt;br&gt;- Buck or Flyback&lt;br&gt;- efficiency ~ 85%&lt;br&gt;- PF: ~ 0.9&lt;br&gt;- integrated MOSFET</td>
<td><strong>LED fixtures:</strong>&lt;br&gt;desk lamps, downlights, spots, wall sconces, bollards, etc.&lt;br&gt;High Voltage Track Lighting&lt;br&gt;&lt;br&gt;LED tube ballasts</td>
</tr>
<tr>
<td><strong>15 – 25W</strong></td>
<td><strong>TEA1733</strong>&lt;br&gt;(up to 75W) / soon: SSL2111&lt;br&gt;- Flyback&lt;br&gt;- efficiency ~90%&lt;br&gt;- external MOSFET</td>
<td><strong>SSL21084</strong>&lt;br&gt;- Buck or Buck-Boost, n ≤90%, ext. FET</td>
<td><strong>LED fixtures:</strong>&lt;br&gt;LED tube ballasts</td>
</tr>
<tr>
<td><strong>25 - 300W</strong></td>
<td><strong>SSL4101</strong>&lt;br&gt;(&amp; SR TEA1761)&lt;br&gt;- QR Flyback &amp; QR PFC&lt;br&gt;- efficiency typ. &gt; 90%&lt;br&gt;(up to 94% with SR)&lt;br&gt;- PF &gt; 0.9&lt;br&gt;- external MOSFET</td>
<td><strong>SSL2103</strong>&lt;br&gt;- Buck or Flyback&lt;br&gt;- efficiency ~ 85%&lt;br&gt;- PF: ~ 0.9&lt;br&gt;- external MOSFET</td>
<td><strong>LED fixtures:</strong>&lt;br&gt;street and area lighting,&lt;br&gt;high-bay/low-bay lighting, tunnel lighting, pendants,&lt;br&gt;architectural &amp; entertainment lighting&lt;br&gt;&lt;br&gt;High Voltage track lighting&lt;br&gt;LED tube ballasts</td>
</tr>
<tr>
<td><strong>&gt;50W</strong></td>
<td><strong>TEA1713/16</strong>&lt;br&gt;- LLC/Resonant &amp; PFC&lt;br&gt;- efficiency typ. 90%&lt;br&gt;- TEA1716 meeting EuP lot6&lt;br&gt;- external MOSFETs</td>
<td></td>
<td><strong>LED fixtures:</strong>&lt;br&gt;street lamps, tunnel lighting, high-bay/low-bay lighting,&lt;br&gt;&lt;br&gt;LED tube ballasts</td>
</tr>
<tr>
<td><strong>up to 300W</strong></td>
<td><strong>UBA3070</strong>&lt;br&gt;- DC/DC or AC/DC Buck&lt;br&gt;- Boundary Conduction Mode&lt;br&gt;- efficiency up to 99%&lt;br&gt;- (V_{in}): 12V..600VDC&lt;br&gt;- external MOSFETs</td>
<td></td>
<td><strong>LED fixtures:</strong>&lt;br&gt;louver luminaires, linear lighting, architectural &amp; entertainment lighting&lt;br&gt;constant current channels,&lt;br&gt;external LED drivers („bricks“),&lt;br&gt;LED backlights</td>
</tr>
</tbody>
</table>
1.a) General Lighting / Outdoor / Luminaires / Hi-Bay
   a) Application / SSL4101/TEA1761/(UBA3070)
1.b) GL / Outdoor / Luminaires / Street Lamps, Area Lighting

a) Application / SSL4101/TEA1761/(UBA3070)
1.c) GL / Outdoor / Luminaires / Tunnel Lighting

a) Application / SSL4101/TEA1761/(UBA3070)
1.d) GL / Outdoor / Luminaires / Fuel Station Lighting

a) Application / SSL4101/TEA1761/(UBA3070)
SSL4101 & TEA1761 (SR) & 4 x UBA3070 150W PSU

- PFC + Flyback + 4x Buck UBA3070
- Vin= 108-305VAC (Universal mains)
- Output current source: 4 x 1A @ 38V (max 150W)
- for up to 12 - 14 LEDs
- Efficiency > 90%
- PF >0.98, IEC61000-3-2 Class C
1. a-d) GL / Luminaires / Hi-Bay, Street, Tunnel, Fuel Station

b.ii) Measurements – 150W, 48VDC/3.125A design – best in class efficiency, PF and THD

SSL4101 & TEA1761 (SR) & 4 x UBA3070 150W PSU

**Efficiency**

**Power Factor**

**Total Harmonic Distortion**
1.a-d) GL / Luminaires / Hi-Bay, Street, Tunnel, Fuel Station

c) Schematics – 150W, 48VDC/3.125A design – best in class efficiency, PF and THD

- Minimize both the perimeters and the areas enclosed by the marked loops.
- Power GND and Signal GND should have ONLY one connection, between C22 ground pin and C7 minus pin.
- As shown in the schematic, connections for some capacitors MUST go directly to the point where the capacitor is soldered on the PCB and from that point continued to the next component.
- Components that are not part of the Power Loops, particularly the ICs and the filter capacitors MUST not be enclosed by the the Power Loops, and far away of those loops as physically possible.
Part Numbers: SSL4101T

PIP: http://www.nxp.com/products/lighting_driver_and_controller_ics/ac_powered_led_driver_ics/ac_powered_led_driver_ics_fixed_output/SSL4101T.html

Package: SO16

Product Family
- SSL4101T

General Features
- Integrated PFC & Flyback controller
- true universal mains supply (85V..305VAC)

Value Propositions
- Best-in-class efficiency, power factor and THD
  - 2-stage solution with active PFC
  - Valley switching for minimum switching losses
  - On-chip start-up source
  - Frequency limitation to reduce switching losses
  - PFC being switched off when low load is detected at Flyback output

- Ease and compactness of design
  - Reduced PCB space due to integrated PFC & Flyback controllers
  - No interface issues, no additional hardware between the two controllers

- Modular approach
  - Can be combined with x*UBA3070 constant current sources (dimmable)

Protection Features
- safe restart mode for system fault condition
- continuous mode protection via demagnetization detection
- UVP, OVP, OTP, OCP
- Open control loop protection
- general purpose input for latched protection
1.e) Specialty Lighting / Entertainment RGB
a) Application / SSL4101/TEA1761/x*UBA3070
1.f) Specialty Lighting / Medical / Surgical Lamps & P(D)T

a) Application / SSL4101/TEA1761/x*UBA3070
1.g) Specialty Lighting / Aircraft & Train Interior

a) Application / SSL4101/TEA1761/x*UBA3070
This universal mains power supply is based upon the High Performance SSL4101T Flyback controller including active PFC in one MCM (Multi-Chip-Module). It comes together with the TEA1761T controller IC for synchronous rectification on the 2nd side and features best-in-class efficiency, Power Factor and THD values. It offers one channel (CV or CC) from 100 – 280W or can be combined with the 4xUBA3070 DC/DC ref. board for 4 constant current channels.

**Controller:**
- outperforms typ. 8bit MCUs (up to 50 MHz)
- provides performance to integrate the different DALI system functions in one μC, leaving bandwith for customer applications
- enables industry leading low active power consumption (130 µA/MHz)
- power profiles allow best power consumption/performance ratio at run time

**Power Supply:**
- typ. 150W/48VDC output
  @230/277V efficiency: >94%, PF: >0.99, THD: 9%
- standby power <350mA
  (can be lowered with companion IC TEA1703)
- small footprint: 12.5 x 6.4 x 4.1cm
1.e-g) Specialty Lighting / Entertainment RGB
c) Block Diagram / SSL4101/TEA1761/x*UBA3070 & LPC1114

>90% system efficiency

SSL4101
Active PFC
Flyback Stage

UBA3070
Buck LED
Driver

UBA3070
Buck LED
Driver

UBA3070
Buck LED
Driver

UBA3070
Buck LED
Driver

PLM IC
TDA5051

LPC1114
Microcontroller
1.h) General Lighting / Shop / HV-Track-Lighting

a) Application / SSL2101, SSL2102, SSL2103
1.h) General Lighting / Shop / HV-Track-Lighting

b) Customer Application & Demo Board – SSL2102, SSL2103
SSL2103 22W Flyback Offline LED driver

- good dimmer compatibility
- Vin = 230VAC
- mains dimmable
- Vout=20V..63V
- Iout max = 800mA
- efficiency > 80%
- PF > 0.9
1.h) General Lighting / Shop / HV-Track-Lighting
c.i) Schematics – SSL2103
1.h) General Lighting / Shop / HV-Track-Lighting

b.ii) Demo Board – SSL2102

SSL2102 12W-230V Triac dimmable Flyback demo board (SSL2102DB)
1.h) General Lighting / Shop / HV-Track-Lighting

c.ii) Schematics – SSL2102

AC/DC Flyback converter

Bleeding circuit

Dimming Circuit

Feedback circuit
1.i) General Lighting / Indoor / Pendants, Floor Lamps
   a) Application – SSL2102, SSL2103
SSL2103 230V 50W dimmable Flyback design with passive PFC

- 230V mains
- Triac dimmable
- Fly-back
- 50W - Output 33V @ 1.5mA (30-36V)
- Output optimized 50W (60W max)
- PF > 0.95
- Eff >85%
1.h-i) General Lighting / Shop Lighting, Pendants
d) IC – SSL2101, SSL2102, SSL2103 – Mains dimmable Buck or Flyback controller/driver

Part Information
- Part Numbers: SSL2101T, SSL2102T, SSL2103T
- PIP: http://www.nxp.com/products/power_management_ics/lighting_driver_and_controller_ics/ac_powered_led_driver_ics/ac_powered_led_driver_ics_dimmable/SSL2101T.html#overview
- Package: SO16, SO20, SO14

Product Family
- SSL2101: 15W (integrated MOSFET and bleeder)
- SSL2102: 25W (integrated MOSFET and bleeder)
- SSL2103: up to 300W (external MOSFET and bleeder)

General Features
- offline AC/DC SMPS driver IC
- SSL2102/03: integrated 650V MOSFET
- built-in bleeders supporting various Triac and transistor dimmers
- logarithmic control of light output
- configurable as either Flyback (isolated) or Buck converter (unisolated)

Value Propositions
- Dimmability
  - Compatible to broad range of leading and trailing edge dimmers
  - 100% - 1% deep dimming
- Design for high efficiency (average n = 85%)
  - Valley switching minimizes switching losses
  - Demagnetization protection avoid continuous mode
- Cost-effective
  - Inherent power factor correction
  - Small form factor, low BOM count

Protection Features
- -40°C to +100°C operation (with built-in over-temp protection)
- undervoltage lockout
- short winding protection
- adjustable over-current protection
1.k) General Lighting / Indoor / Downlights, Spots
a) Application – SSL2101, SSL2102, SSL2103 – SSL21083/4 – SSL21101
1.k) General Lighting / Indoor / Downlights, Spots

b) Demo Board - mains dimmable SSL2101, SSL2103 - Schematics

SSL2101, 230V, 7W,
Non-Isolated Buck,
dimmable, GU10/A19

Key features:
• Triac dimmable
• Cost-effectiveness
• High power factor

SSL2103, 230V, 12W,
Non-Isolated Buck,
dimmable, E27

The circuit implements a Boundary Conduction Mode (BCM) buck converter using the SSL2103. It is mains dimmable for both leading edge (triac) and trailing edge (transistor) dimmers. It is designed for demonstrating high performance and high efficiency. It produces a 400 mA regulated output current to drive 10 LEDs at a 230 V (AC) input. Efficiencies of up to 85 % can be achieved.
1.k) General Lighting / Indoor / Downlights, Spots

b) Demo Board – non-mains dimmable, unisolated Buck SSL21083, SSL21084

User Manual UM10501,
Order Number (12nc): 9352 959 27598,
Board ID: SSL21083DB01

User Manual UM10502,
Order Number (12nc): 9352 959 29598,
Board ID: SSL21084DB01

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC line input voltage</td>
<td>170 V (AC) to 260 V (AC)</td>
<td>optimized for 230V(AC), 50Hz</td>
</tr>
<tr>
<td>Output voltage</td>
<td>20 V (DC) to 130 V (DC)</td>
<td></td>
</tr>
<tr>
<td>Output current</td>
<td>96 mA at Vo = 92 V (DC)</td>
<td>±4 % Vo = 60 V (DC) to 120 V (DC)</td>
</tr>
<tr>
<td>Maximum power in to LED load</td>
<td>12.5 W</td>
<td></td>
</tr>
<tr>
<td>Efficiency</td>
<td>&gt; 94%</td>
<td>96 mA</td>
</tr>
<tr>
<td>Power factor</td>
<td>0.6</td>
<td>At 10 W; 70 V; 96 mA</td>
</tr>
<tr>
<td></td>
<td>&gt;0.8</td>
<td>possible with lower efficiency</td>
</tr>
<tr>
<td>Board dimensions</td>
<td>17.5 x 53.5 x 17.5 mm</td>
<td>Length x width x height in mm</td>
</tr>
<tr>
<td>NTC threshold</td>
<td>60 °C</td>
<td>Adjustable depending on NTC and R3</td>
</tr>
<tr>
<td>IEC61000-3-2 compliant</td>
<td>Yes</td>
<td>P0 &gt; 8.5 W</td>
</tr>
<tr>
<td>IEC55015 compliant</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Top photos SSL21083; Lower photos SSL21084
Only inner part is needed for actual lamp
1.k) General Lighting / Indoor / Downlights, Spots

c) Schematics – non-mains dimmable, unisolated Buck SSL21083

15 components application !
(16 with optional NTC)
1.k) General Lighting / Indoor / Downlights, Spots

d) IC – SSL2108x – High Integration, non-mains dimmable Buck Driver Platform

Part Information

- **Part Numbers:** SSL2108x
- **PIP:**
- **Package:** SO8, SO14

Product Family

- **SSL21081:** 100-120V, 300V/2Ohms MOSFET, SO8
- **SSL21082:** 100-120V, 300V/2Ohms MOSFET, SO14
- **SSL21083:** 230V, 600V/5Ohms MOSFET, SO8
- **SSL21084:** 230V, 600V/5Ohms MOSFET, SO14
- **SSL2109:** 230V, external MOSFET

General Features

- **true current source,** Boundary Conduction Mode
- **primary side sensing**
- **Internal supply voltage generation enabling start-up from the rectified mains voltage**
- **External (Negative Temperature Coefficient (NTC)) overtemperature detection for LED current regulation**

Value Propositions

- **Dedicated LED driver device**
  - True current source behaviour, better than 3% current accuracy
- **Design for high efficiency**
  - 93% measured on reference board
- **Small form factor**
- **Cost-effective design**
  - **Total BOM cost ~ 1EUR**
- **PWM dimming**
  - Control from external source (e.g. micro controller)

Protection Features

- **output short protection**
- **built-in NTC input for temperature prot.**
1. General Lighting / Indoor / Downlights, Spots

b) Demo Board – non-mains dimmable, isolated Flyback SSL21101

7W GU10 Flyback

**Low Ripple Mode**
- up to 85% efficiency
- PF 0.6
- no 100Hz ripple
- with single elcap design
- line regulation +/- 1.2% vs. Mains

- small capacitor

7W GU10 Flyback

**High Power Factor, low THD Mode**
- up to 88% efficiency
- PF 0.96, THD ~ 10%

- big capacitor
1.k) General Lighting / Indoor / Downlights, Spots

c) Schematics – non-mains dimmable, isolated Flyback SSL21101
1.k) General Lighting / Indoor / Downlights, Spots

d) IC – non-mains dimmable, isolated Flyback driver SSL21101

Part Information
- **Part Numbers:** SSL21101T
- **PIP:** Will be released in June 2012
- **Package:** SO14

Product Family
- SSL21101: integrated MOSFET
- SSL21112: external MOSFET

General Features
- true current source
- primary side sensing
- Internal supply voltage generation enabling start-up from the rectified mains voltage
- External (Negative Temperature Coefficient (NTC)) overtemperature detection for LED current regulation

Value Propositions
- Dedicated LED driver device
  - True current source behaviour: LED current ind. of mains voltage, LED voltage, temperature and coil variations
  - High LED current accuracy (3% typ.)
  - Smart Digital Control, either
    - High PF (>0.95) and low THD (<20%)
    - Low ripple current with small electrolytic capacitors – compatible with exception clause IEC1000-3-2
- Design for high efficiency (n up to 88%)
- Cost-effective
  - Primary side sensing (no opto-coupler required)
  - Total BOM cost 1.5 EUR

Protection Features
- short winding protection
- internal OverTemperature Protection
- LED short
- LED open
- UnderVoltage Lockout
1.1) General Lighting / Indoor / Desk Lamps, Task Lights

a) Application – UBA3070
1.m) General Lighting / Indoor / Louver Luminaires, Troffer, Linear Lights

a) Application – UBA3070
1.1-m) General Lighting / Indoor / Desk Lamps, Louver

b.i, c.i) Demo Board, Schematics

UBA3070 DC/DC 67W Buck driver

Example typical efficiency:
- 10 LEDs, 350mA, 10W: 91%
- 32 LEDs, 350mA, 35W: 96%
- 80 LEDs, 300mA, 70W: 99%

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>output current</td>
<td>350 mA</td>
<td>selectable; see Ref. 2</td>
</tr>
<tr>
<td>supply voltage</td>
<td>12 V to 190 V</td>
<td>depends on maximum LED string length</td>
</tr>
<tr>
<td>AUX supply voltage</td>
<td>12 V</td>
<td>2 mA to 5 mA typical</td>
</tr>
<tr>
<td>switching frequency</td>
<td>30 kHz to 145 kHz</td>
<td>selectable; see Ref. 2</td>
</tr>
</tbody>
</table>
1.1-m) General Lighting / Indoor / Desk Lamps, Louver

c.ii) Schematics explained – UBA3070 Buck Application Circuit
1.1-m) General Lighting / Indoor / Desk Lamps, Louver

d) IC – UBA3070 – highly efficient switch mode AC/DC or DC/DC Buck converter

**Part Information**
- **Part Numbers:** UBA3070T
- **PIP:** http://www.nxp.com/products/power_management_ics/lighting_driver_and_controller_ics/led_back_lighting_driver_ics/UBA3070T.html
- **Package:** S08, DIP8

**Product Family**
- **Product Family:** UBA3070T

**General Features**
- Switch-Mode Buck converter capable of driving LED strings up to 600V
- PWM/analog dimming option
- Fast transient response through cycle-by-cycle current control

**Value Propositions**
- Dedicated LED driver device
  - Constant output current ensured by constant peak current control
  - No LED binning on forward voltage required
  - Allows use of a single, loosely controlled input voltage for multiple LED strings
- Design for high efficiency (up to 99%)
  - Boundary Conduction Mode:
    - No reverse recovery losses in freewheel diode
- Cost-effective
  - Minimal required inductance value and size

**Protection Features**
- Inherent overload/short circuit protection
- Overcurrent protection
- Overtemperature protection
- Undervoltage lockout
1.1) General Lighting / Indoor / Desk Lamps

b.ii) Demo Board – SSL21083, SSL21084

SSL21083 7W
- BUCK solution
- Small form factor
- Input: 230Vac
- Output: 70V @ 100mA

SSL21084 9W
- BUCK solution
- Small form factor
- Input: 230Vac
- Output: 70V @ 120mA
  - L: 2mH
  - Rsense: 2ohms

SSL21084 15W
- BUCK solution
- Small form factor
- Input: 230Vac
- Output: 70V @ 200mA
  - L: 3.3mH
  - Rsense: 1.2Ohms
2) separate LED Ballasts & constant current “bricks”
   a) Application – UBA3070
2) separate LED Ballasts & constant current “bricks”

b.i, c.i) Demo Board – SSL4101

SSL4101 15-75W LED, typical unit: 40W, 0.7A, 35-55VDC

HINT

30-50W,
60-90W,
100W turnkey solutions under development
2) separate LED Ballasts & constant current “bricks”

2.2) Schematics / Application Brief – UBA3070

Other Briefs include:

- 24V DC, 700mA dimmable LED driver
- 24V DC, 1000mA dimmable LED driver
- 48V DC, 350mA dimmable LED driver
- 48V DC, 700mA dimmable LED driver
- 48V DC, 1000mA dimmable LED driver
- 24V DC, 350mA 0-10V analog dimmable LED driver
- 24V DC, 700mA 0-10V analog dimmable LED driver
- 24V DC, 1000mA 0-10V analog dimmable LED driver
- 48V DC, 350mA 0-10V analog dimmable LED driver
- 48V DC, 700mA 0-10V analog dimmable LED driver
- 48V DC, 1000mA 0-10V analog dimmable LED driver
- Universal AC mains, isolated, 350mA non-dimmable LED driver
- Universal AC mains, isolated, 700mA non-dimmable LED driver
- Universal AC mains, isolated, 1000mA non-dimmable LED driver
- Universal AC mains, isolated, 350mA 0-10V analog dimmable LED driver
- Universal AC mains, isolated, 700mA 0-10V analog dimmable LED driver
- Universal AC mains, isolated, 1000mA 0-10V analog -dimmable LED driver

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Universal AC mains, isolated, 350mA non-dimmable LED driver

<table>
<thead>
<tr>
<th>Package</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO8</td>
<td>Electrolytic</td>
</tr>
<tr>
<td>SOT223</td>
<td>Double diode</td>
</tr>
<tr>
<td>SC8D23</td>
<td>Polyester</td>
</tr>
<tr>
<td>SOT25</td>
<td></td>
</tr>
</tbody>
</table>

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Operation and Performance
Principle operation is described in NXP application note AN10894.
2) separate LED Ballasts & constant current “bricks”
b.iii, c.iii) Demo Board, Schematics – TEA1733 15–25W

TEA1733 15-25W LED driver

Features and Specifications
- Input voltage: 86 – 264 Vrms 50Hz – 60Hz
- Switching Frequency 66.5kHz
- Output current: 700mA;
- Typical output voltage: 28V (drives up to 8 white LEDs in series)
- Very good current stability, near-independent of AC source voltage
- Dimming interface could be added using a program voltage or pwm
- High efficiency
- SMPS controller IC enabling low cost applications
- Overpower compensation (high/low line compensation)
- Fixed frequency with frequency jitter to reduce EMI
- Soft start
- Internal OTP

*TEA1733 IC features, see NXP SMPS presentation
3.a) LED retrofits / GU10 (-PAR16)
based on SSL2101 (mains-dimmable), SSL2108x, SSL21101 (non mains-dimmable)

SSL2101 7W Buck ref design
- Vin = 230VAC
- Triac dimmable
- Vout = 17V
- Iout = 420mA
- efficiency ~ 0.78
- PF: 0.9

SSL21101 8W Flyback demo board
- Vin = 230VAC
- non dimmable
- Vout ~30V
- Iout 225mA
- mains dependency +/- 3%
- efficiency ~ 86%
- PF 0.97, THD < 20%

SSL21083 6W Buck board
- Vin = 170V..260VAC
- Vout = 20V..130VDC
- Iout = 96mA@Vout = 92VDC
- efficiency >94%
- PF 0.6 (>0.8 possible with lower efficiency)
- IEC61000-3-2 compliant
- IEC55015 compliant

User Manual & Board via mailto:sebastian.huelck@nxp.com

User Manual: soon

User Manual UM10501, Order Number (12nc): 9352 959 27598, Board ID: SSL21083DB01
SSL21083 7W Buck demo board
- small form factor
- Vin = 230VAC
- Vout = 70V
- Iout = 100mA

3.b) LED retrofits / E14/C43 candelabra, E14 PAR
based on SSL2101 (mains-dimmable), SSL2108x, SSL21101 (non mains-dimmable)
3.c) LED retrofits / E27

e.g. based on SSL2103 (mains-dimmable), SSL2108x, SSL21101 (non mains-dimmable)

SSL2103 12W E26 Buck
- excellent dimmer compatibility
- Vin = 230VAC
- mains dimmable
- Vout = 30V
- Iout = 400mA
- efficiency = 85%
- PF ~ 0.8
3.d) LED retrofits / PAR30, PAR38
e.g. based on SSL2102, SSL2103 (mains-dimmable)

SSL2102 17W 230V Flyback PAR38
- Vin = 230VAC
- mains dimmable
- Vout = 24V
- Iout = 700mA (17-33V)
- output optimized for 17W (19W max.)
- efficiency 67-82%
- PF > 0.91

SSL2103 17W 230V Flyback PAR38
- Vin = 230VAC
- mains dimmable
- Vout = 30V (9 LEDs)
- Iout = 500mA
- efficiency 85%
- PF > 0.9
- active damping
- secondary current limit
3.e) LED retrofits / MR16
in Q1/2013

HINT

New IC versions

SSL3301 (µC version)
SSL3401 (integrated version)

under development
3.f.i) LED tubes/ T5, T8, T9
e.g. based on SSL2103 (mains-dimmable)

SSL2103 20W Flyback

- Vin = 230V
- mains dimmable
- Vout = 30V
- Iout = 600mA
- Output optimized for 20W (25W max)
- efficiency ~ 83%
- PF > 0.91

App: T8 LED Tube
3.f.ii) LED tubes/ T5, T8, T9
e.g. based on SSL21101 (non-mains dimmable, isolated Flyback)

SSL21101 15W design
- isolated AC/DC offline non-dimmable LED driver from 100V to 230VAC
- primary side sensing (no opto coupler needed)
- true current source behaviour, high LED current accuracy (typ. 3%)
- high efficiency (measured 88%)
- Smart Digital control (SDC) for either
  High Power Factor (>0.95) and low THD (<20%) or
  low form factor (low LED current ripple with small elcaps)

HINT
Needs to be adopted to requested LED tube form factor
3.f.iii) LED tubes/ T5, T8, T9

e.g. based on UBA3070 (non-mains dimmable, unisolated Buck)

HINT

Needs to be adapted to 230V
6. NXP Design Tools and Collateral

- **Level 1: Documentation**
  - All Data Sheets / User Manuals / Application Notes
    - [http://www.nxp.com/#/page/content=[f=/dynamic/datasheets/tid-53426/data.xml]]
    - [http://www.nxp.com/#/page/content=[f=/dynamic/usermanuals/tid-53426/data.xml]]
    - [http://www.nxp.com/#/page/content=[f=/dynamic/applicationnotes/tid-53426/data.xml]]

- **Lighting Driver and Controller Selection Guide**
  - [http://www.nxp.com/products/power_management_ics/lighting_driver_and_controller_ics/index.html#ps]

- **Training videos on YouTube**
  - NXP Lighting Solutions – Introduction
    - [http://www.youtube.com/watch?v=GBqu2B2dYE]
  - NXP Introduction to LED Lighting Solutions
    - [http://www.youtube.com/watch?v=Cmi_LFU1UMg]
  - NXP LED Drivers for Residential Lighting
    - [http://www.youtube.com/watch?v=JGznG9fnvDU]

- **PLS presentation package incl. FAE training and Application Briefs**
  - [https://nxp.box.com/s/hltgia4fp845j7v0ktf5]

- **Level 2: Online Design Tools**
  - [http://www.nxp.com/technical_support/designportal]

- **Level 3: Demoboards & Reference designs**
  - [http://extranet.nxp.com]

- **Level 4: Tailored circuits from spec over customized prototype to turnkey solutions**
  - [mailto: sebastian.huelck@nxp.com]