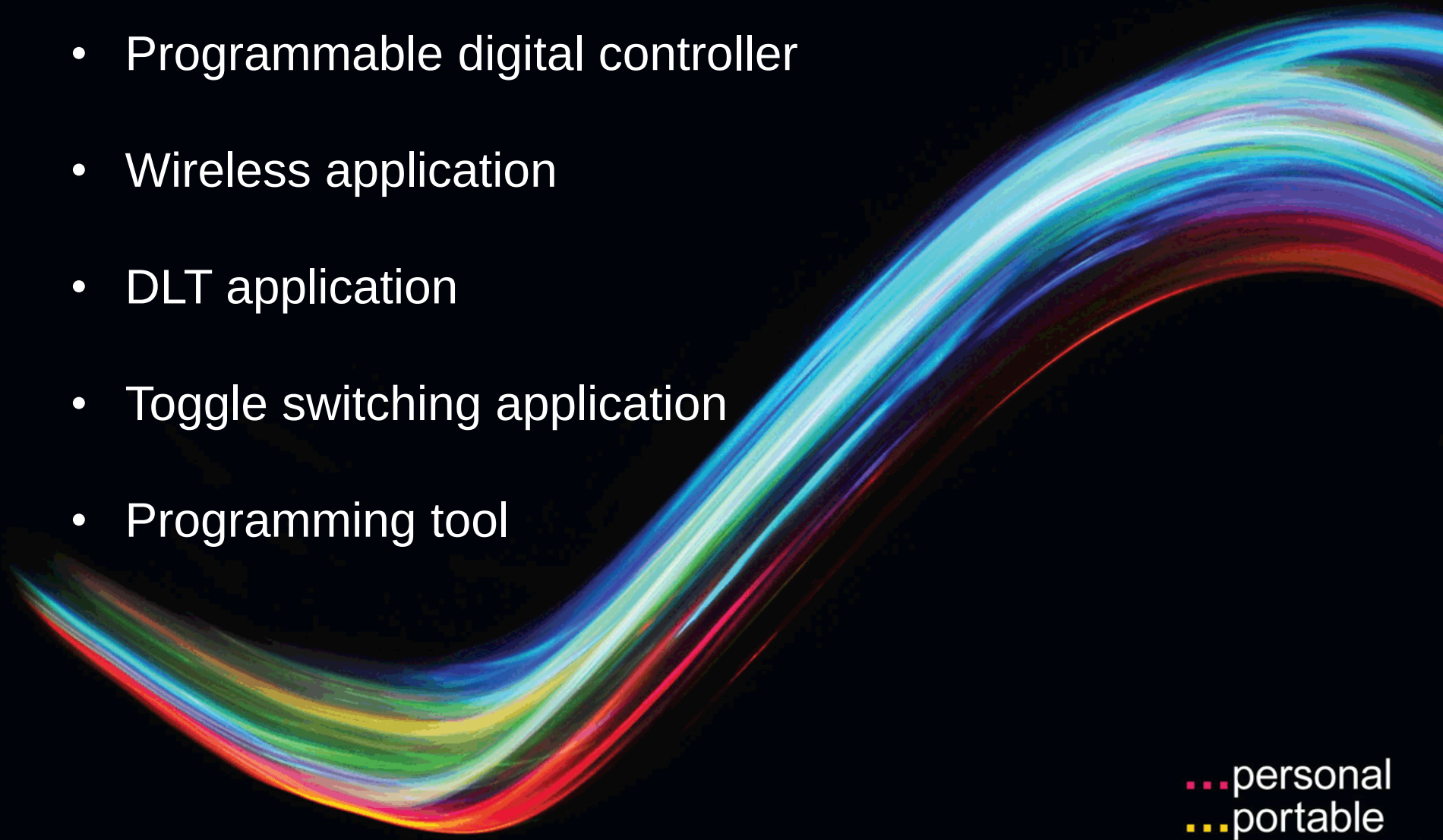
iW6401 smarteXite™
Digital LED power processor

November 2014

...personal
...portable
...connected

Agenda

- Programmable digital controller
- Wireless application
- DLT application
- Toggle switching application
- Programming tool



...personal
...portable
...connected

iW6401
Redefining LED Retrofit Lighting Control

- **<u>Fully programmable</u> digital LED controller chip**
  - Big reductions in R&D time
  - Bringing products to market faster

- Flexible to change
  - Old way: family of inflexible controller chips (spec change = HW change)
  - smarteXite™ way: **single chip controller** providing **programmable LED bulbs**

What others do in hardware, SmarteXite does in software!

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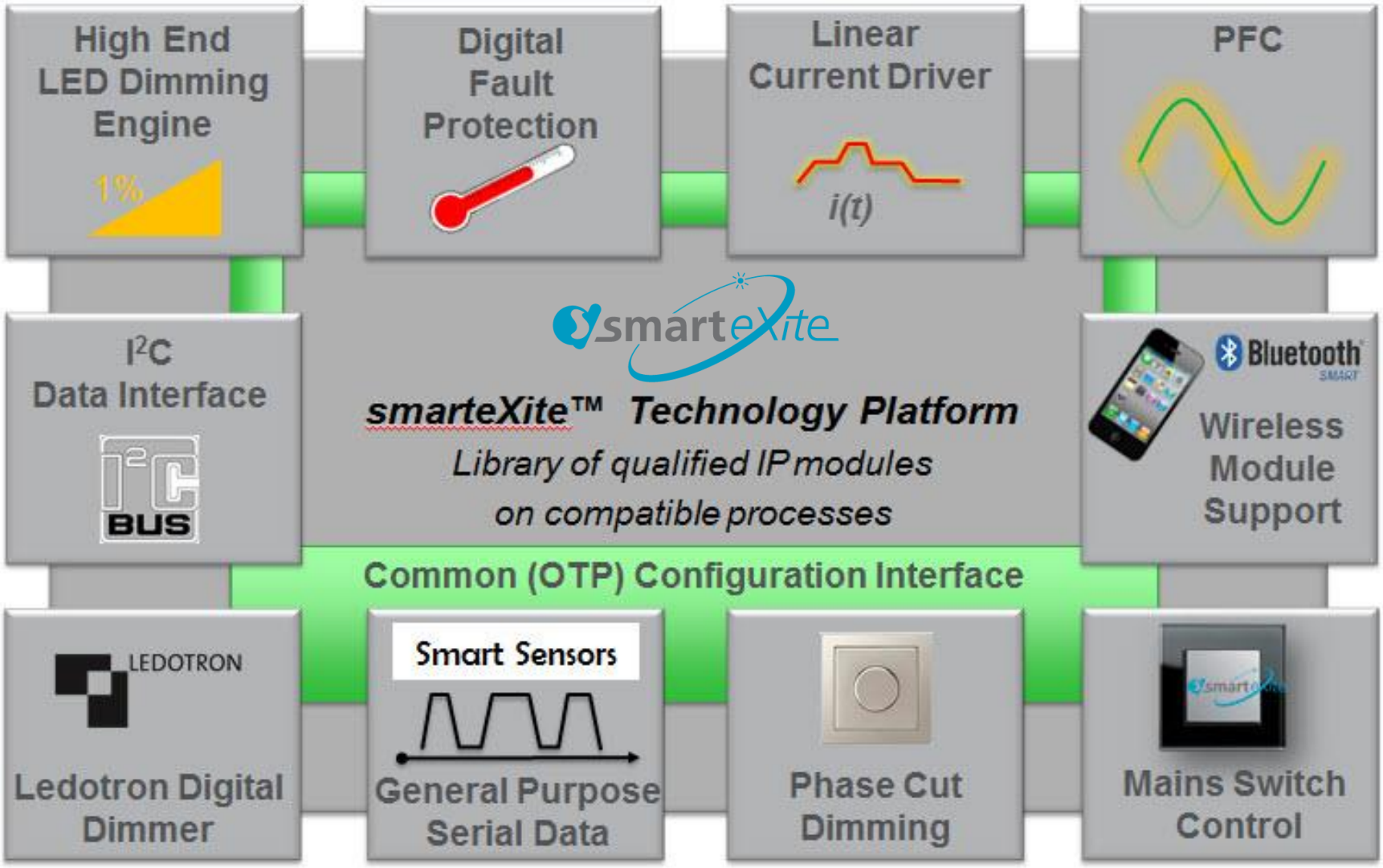
smarteXite™ Offering Ultimate Flexibility



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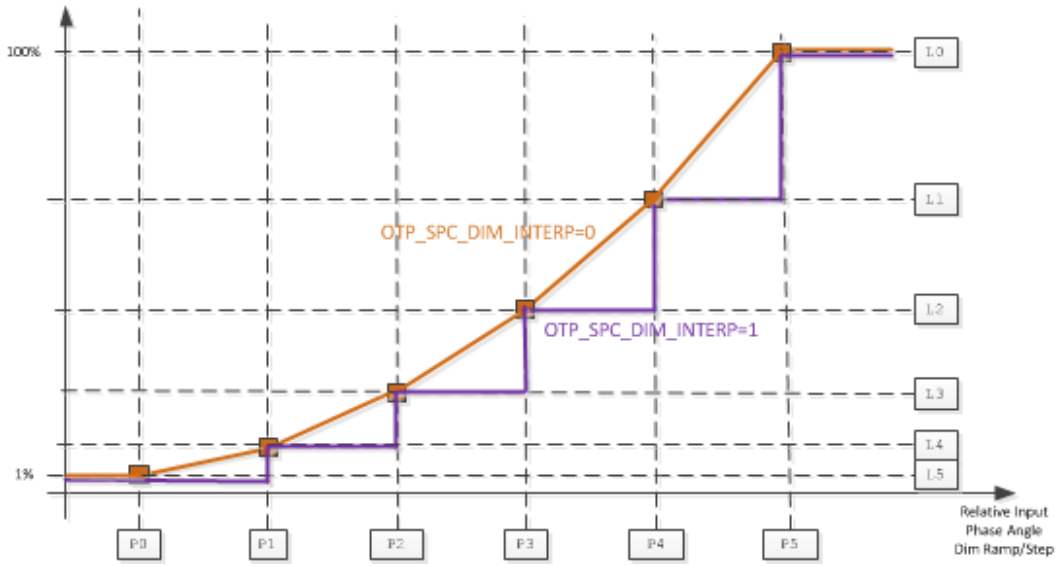
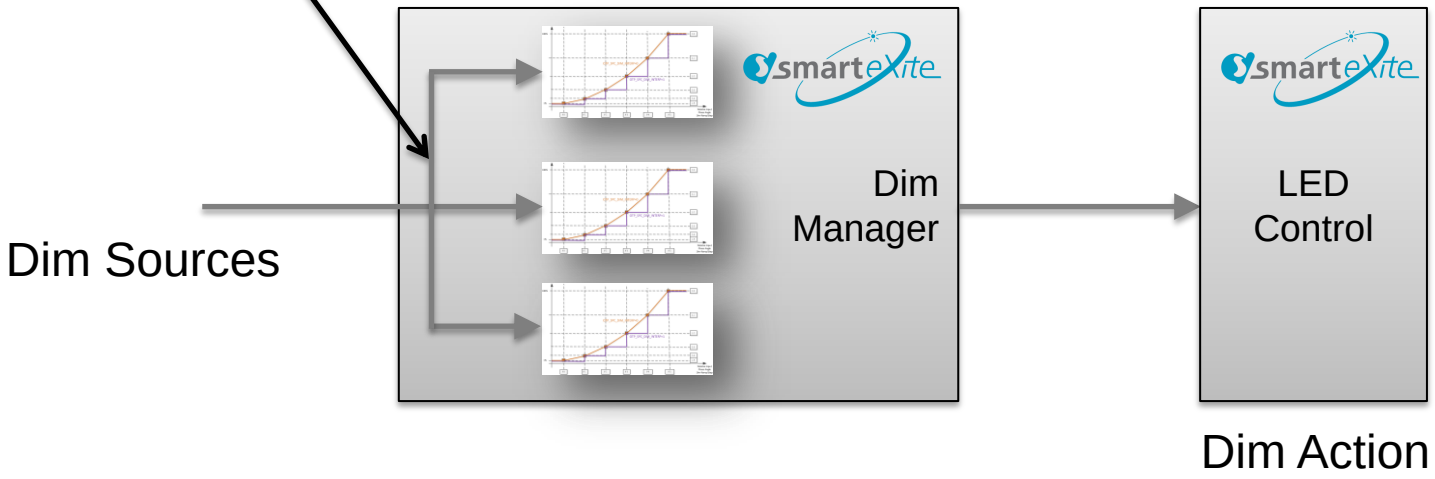
smarteXite™ Dimming Curve Programming

Multiple lookup tables for easy trimming of dim curves for optimized user experience.





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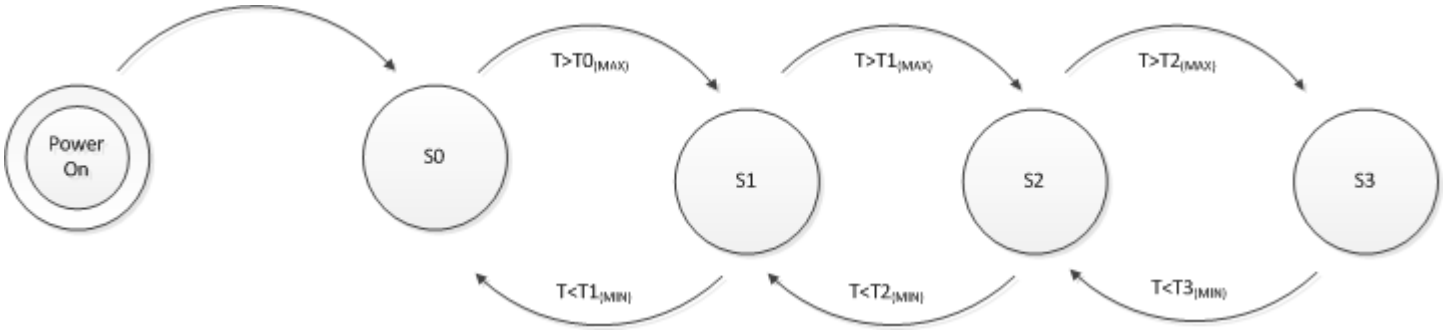
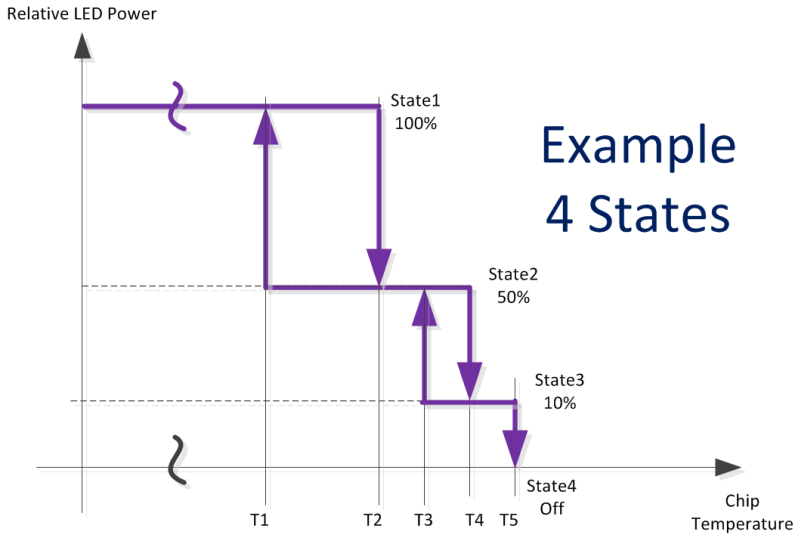
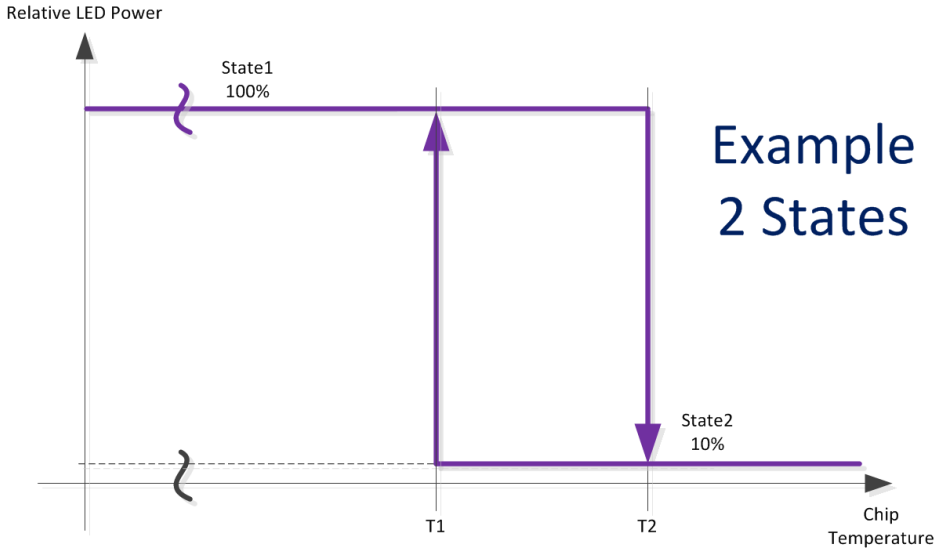
Optimized Thermal Management with Dynamic Temperature States



For each state Tmin, Tmax, and Lout are set in OTP.



Example
4 States



Example
2 States

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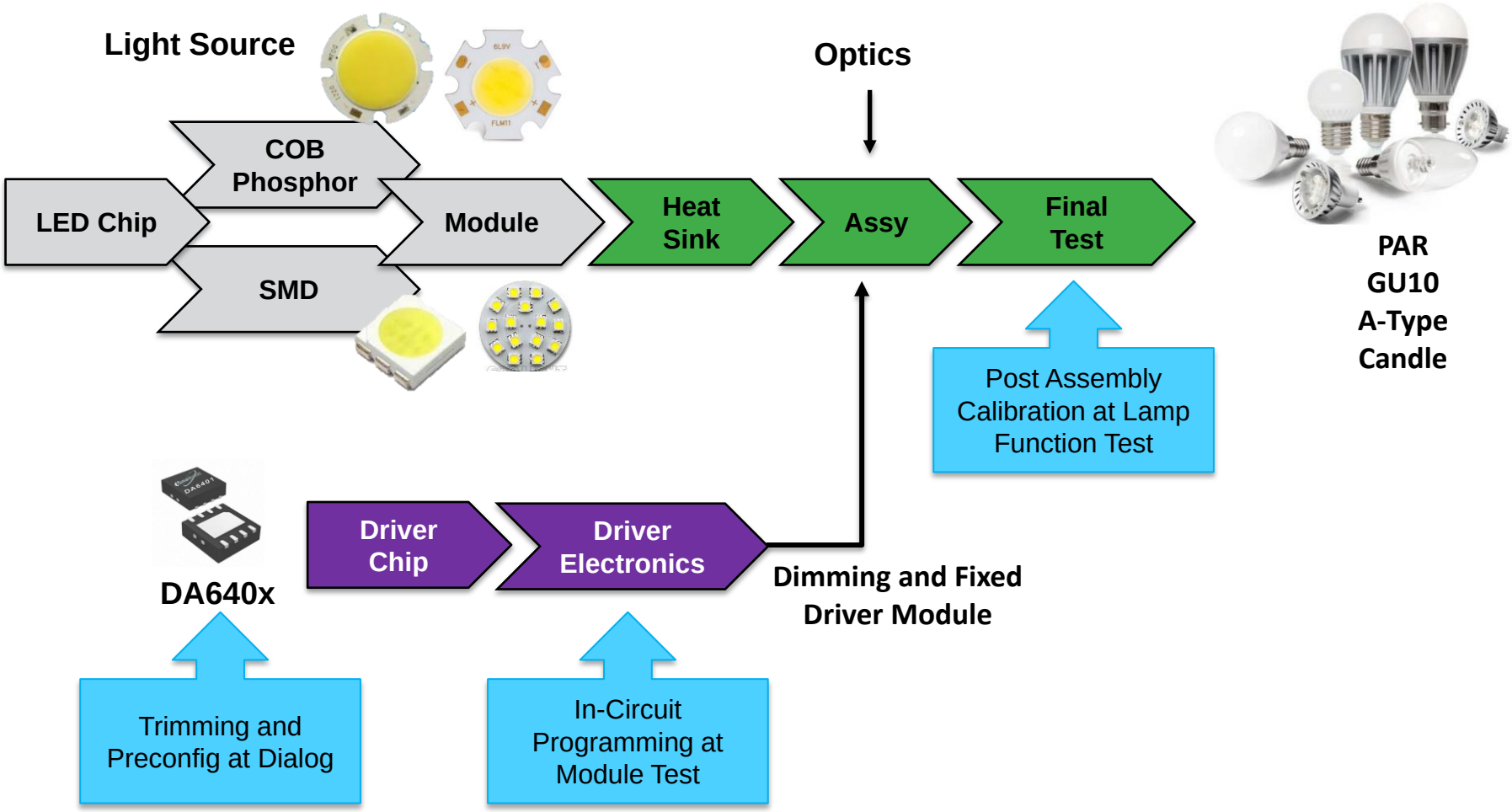
OTP Programming Possible at Different Stages of Value Chain



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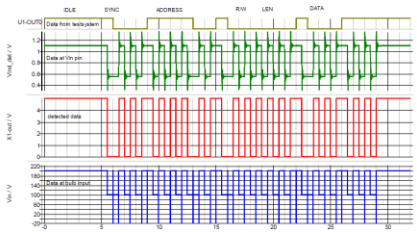
Post Assembly Calibration and Diagnostics

Calibration data is only received if no phase cut dimmer is present and data reception is not locked out.

200V Serial Bitstream



smartpulse

Wi Fi

Light Sensor TSL2581

I²C Fast
SDA/SCL
3V3

110/230V AC

150V AC or 200V DC

Dialog Calibration Supply Reference Design

smarteXite

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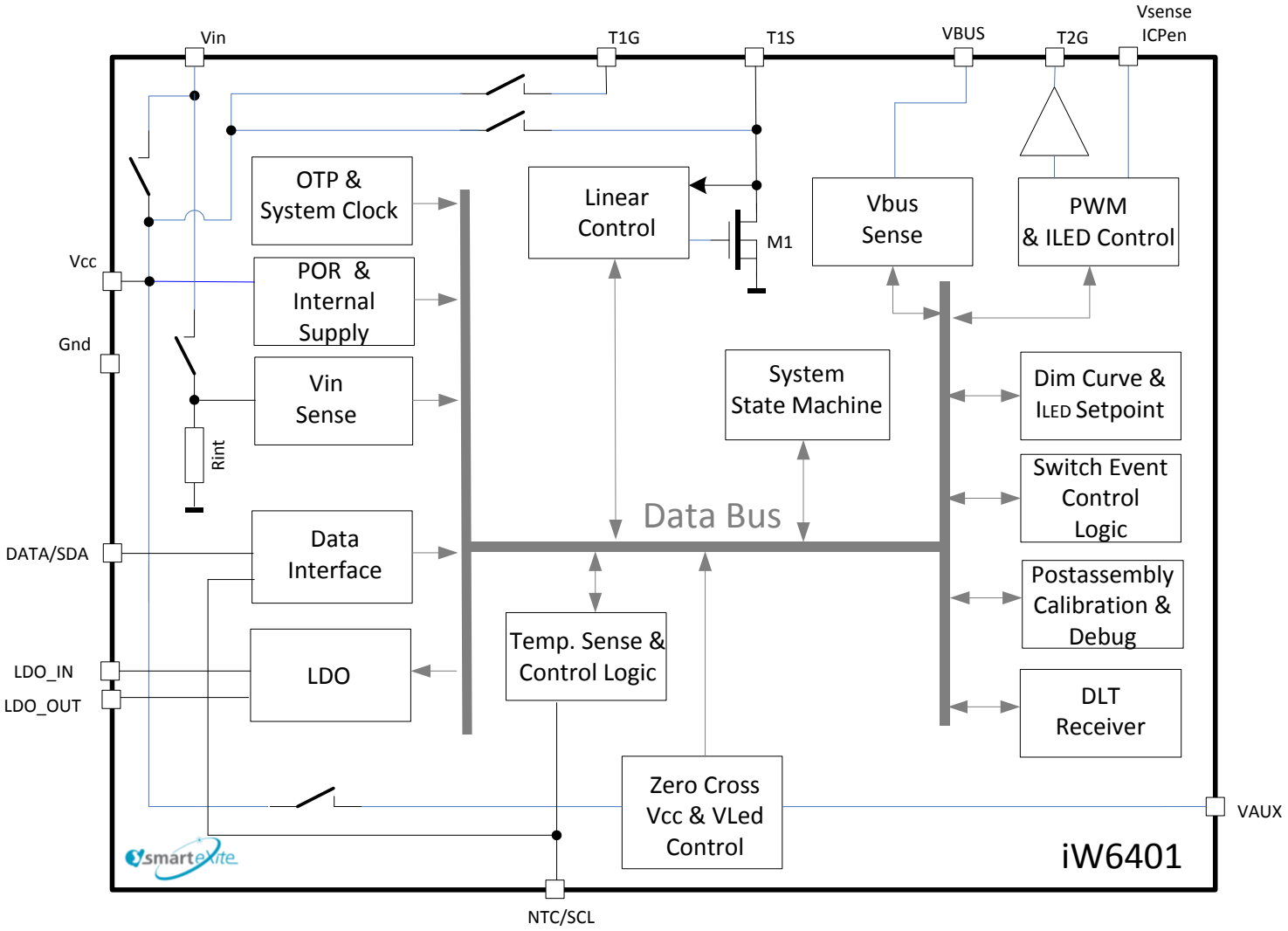
smarteXite™ iW6401 Block Diagram



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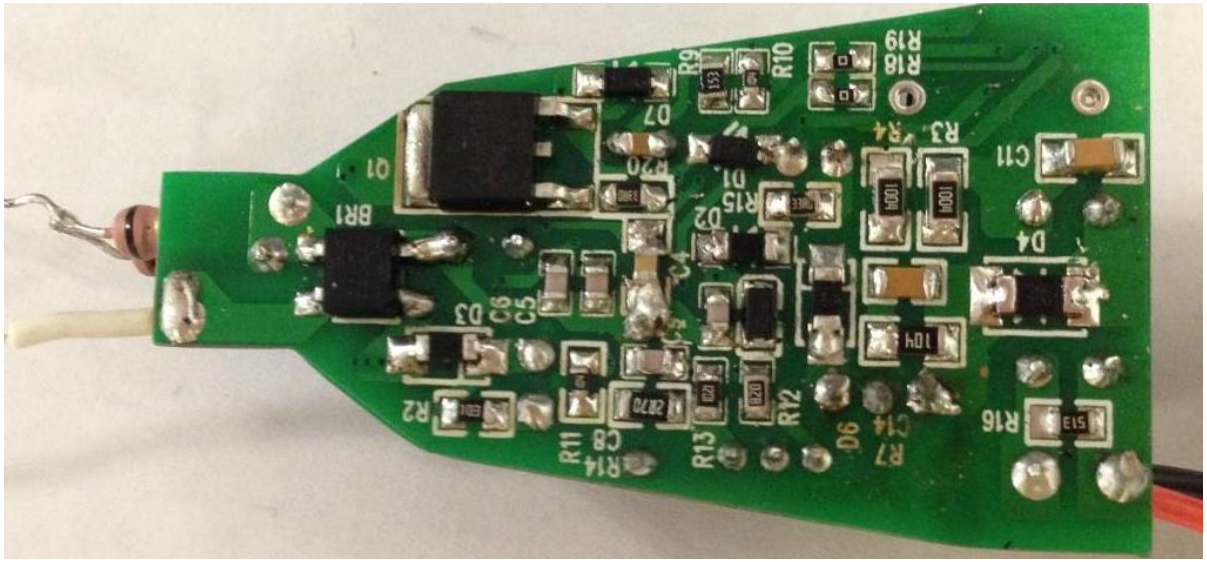
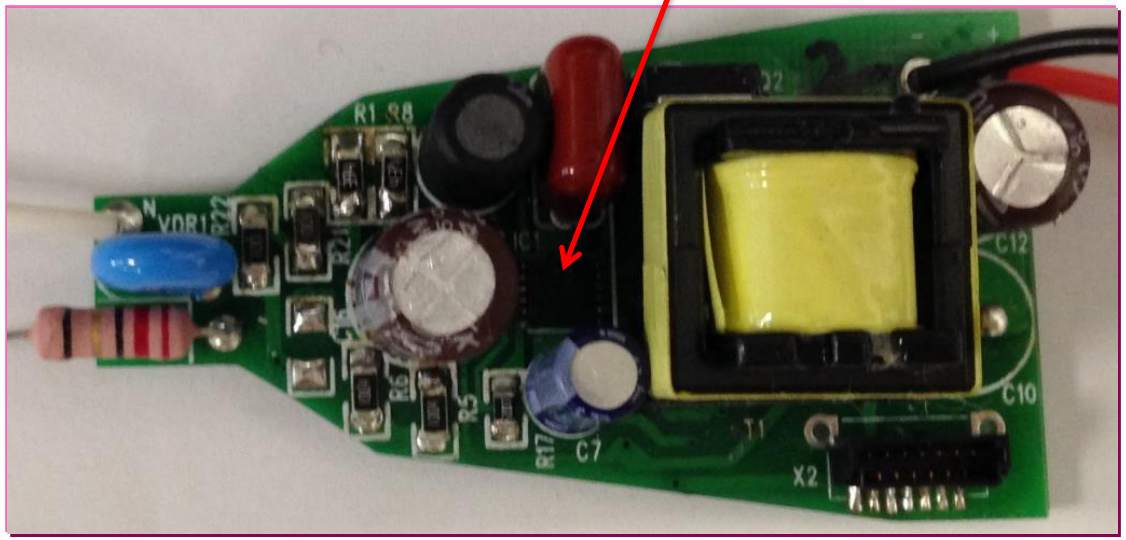
smarteXite™ iW6401 Demo Board



iW6401



iW6401: Multiple Application Options

Bluetooth SMART

ULE UltraLowEnergy

AC Mains

- Phase Cut Dimming
- Mains Switch Controlled Dimming
- Power Line Communication

Modular approach for highest flexibility

DLT IEC62756

IEC

- Open Protocol
- Simple & Robust
- IEC Standardization Ongoing
- Low Cost Implementation
- Addressable
- Multi-Channel (Color, Tunable White)
- Improved Electrical Efficiency
- Simple Replacement of Dimmers
- Plug and Play
- Perfect Room Controller
- Perfect Gateway to Bridge the Last Mile

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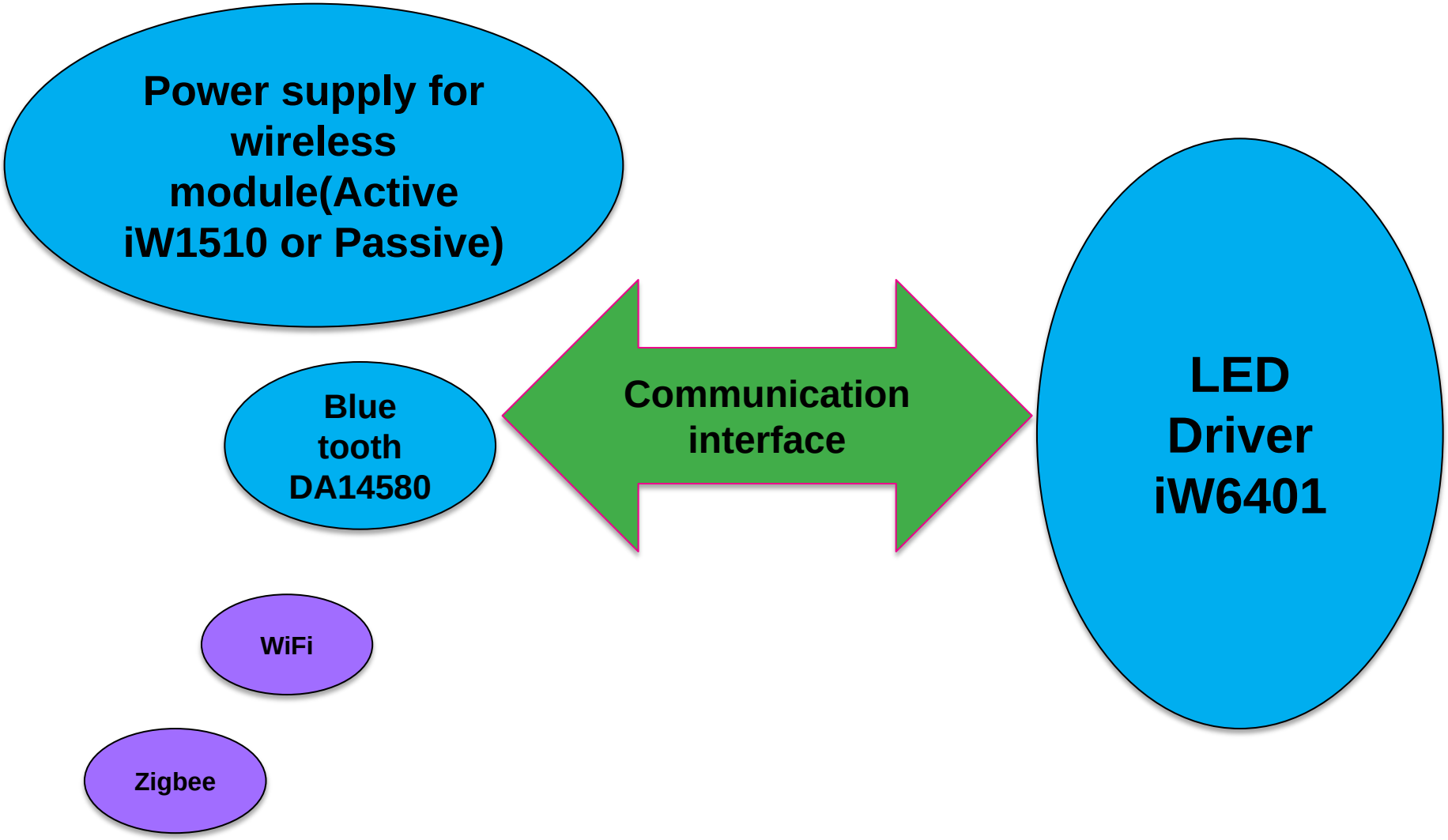
Wireless Lighting Control



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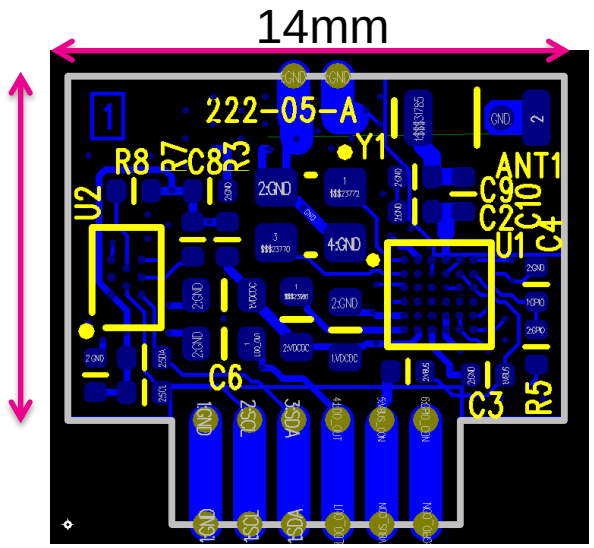
Wireless Lighting Control to the Smartphone

- iW6401 and DA14580 “ready to go” Bluetooth® LED driver solution
- Compatible with every Bluetooth 4.0 enabled smartphone
- Lowest power consumption 5ma RX/TX, 5nA sleep
- 0dBm output RF power (at antenna), -93dBm sensitivity for reliable communication in Bulb / Fixture assembly
- Precise control of LED operation using high speed I^2C data link between LED driver and BT transceiver

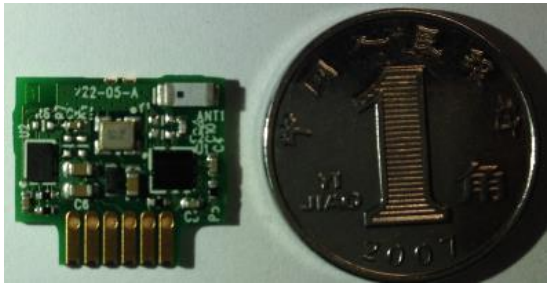
Bluetooth® SMART

Dialog Provided BT Communication Module



DEMO HW

DA14580 Radio Chip and Antenna



- BT module with header connection to driver PCB
- Optimized RF performance
- FCC & CE certification
- Minimum design-in effort
- Range up to 20m

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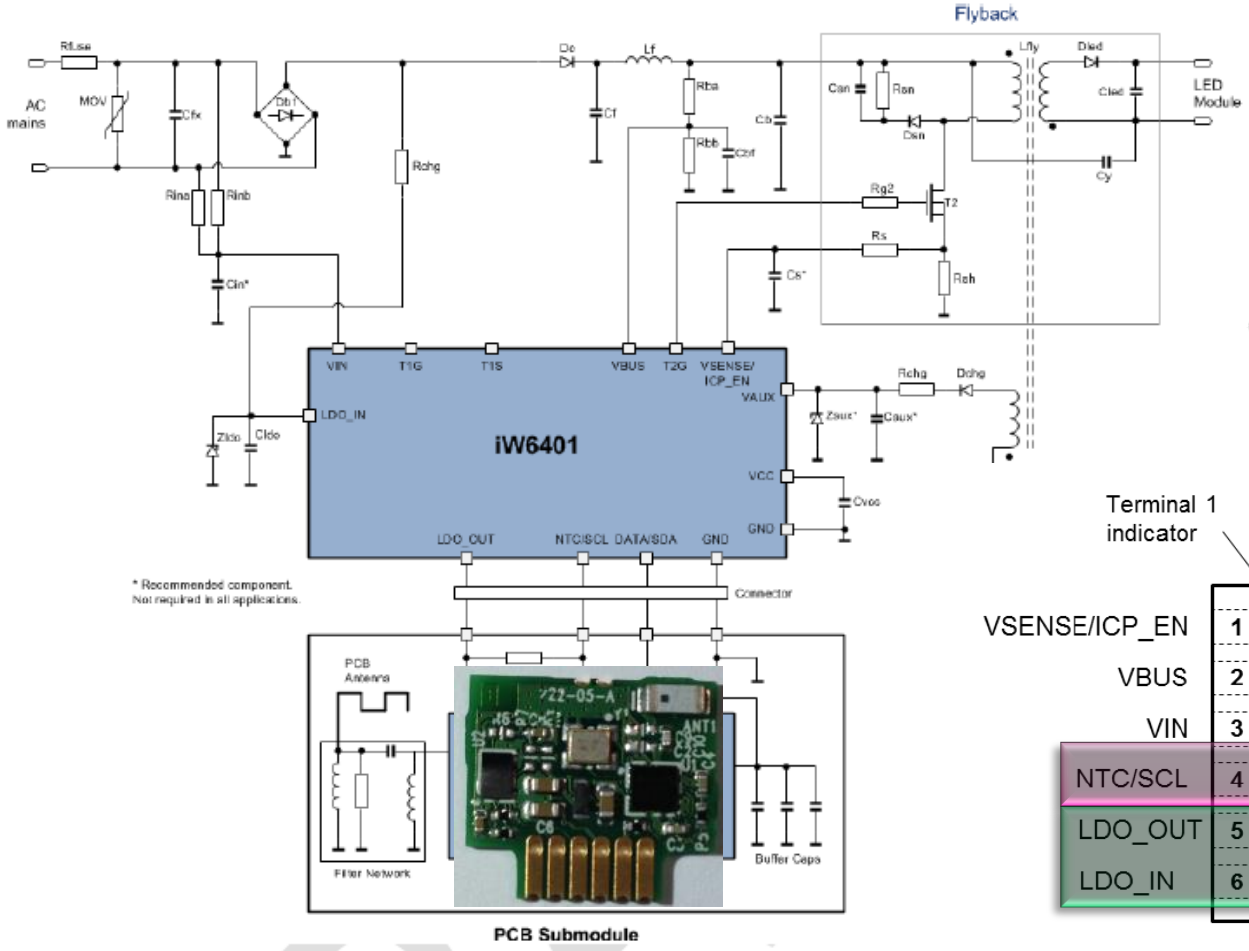
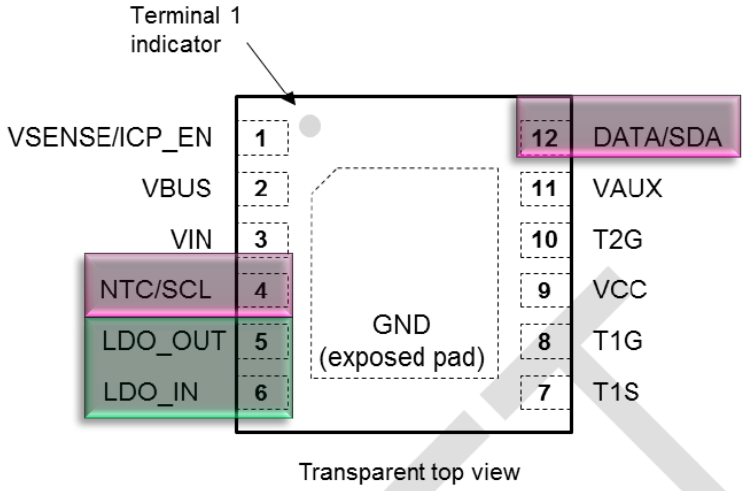
iWatt

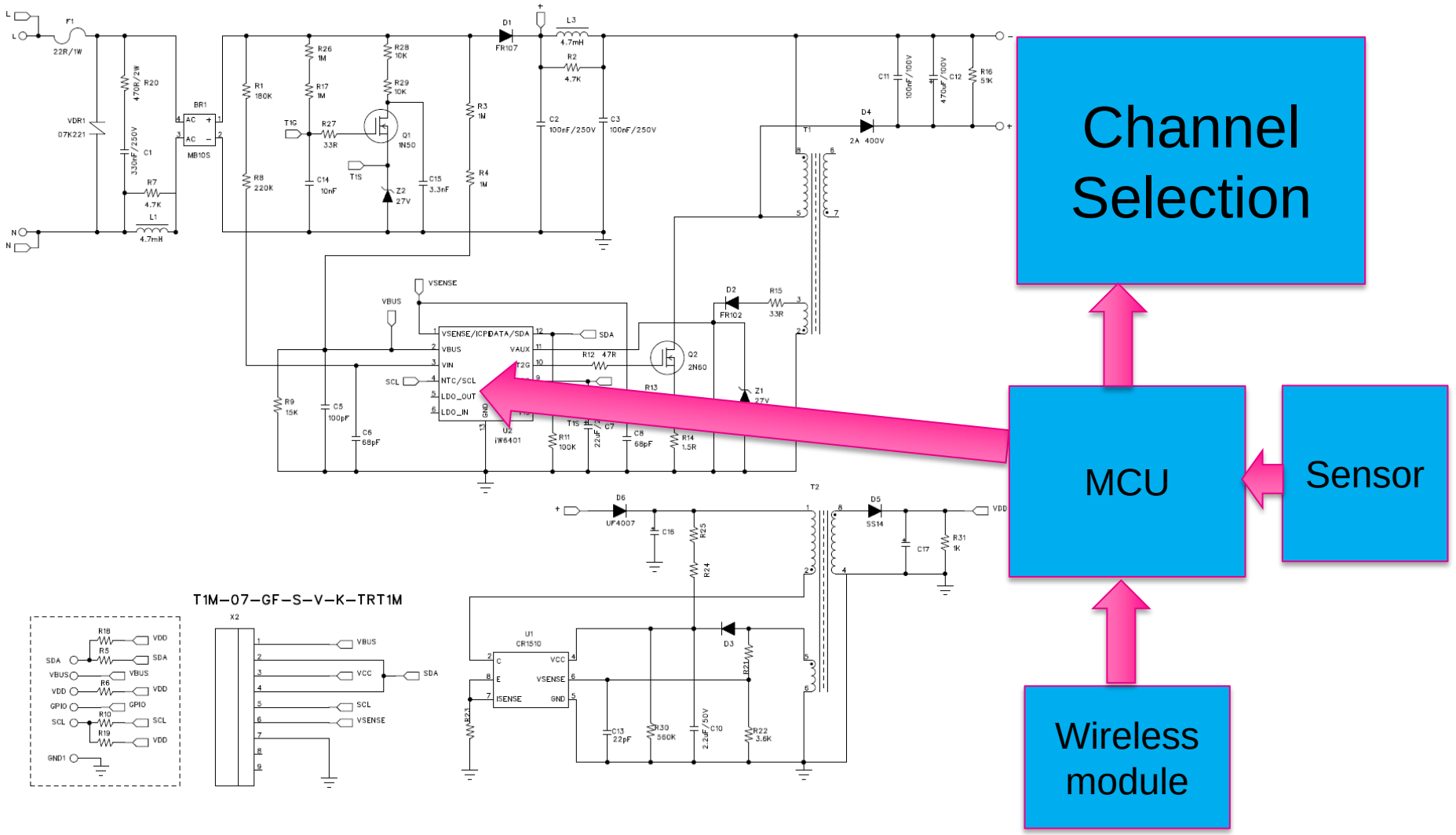
Wireless Dimming_BlueTooth Application



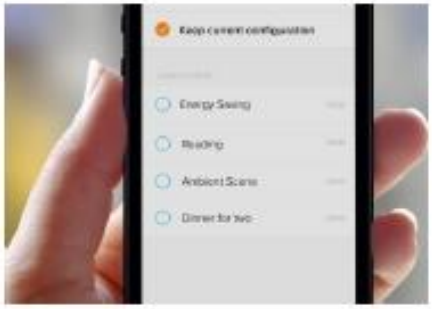
Bluetooth® SMART

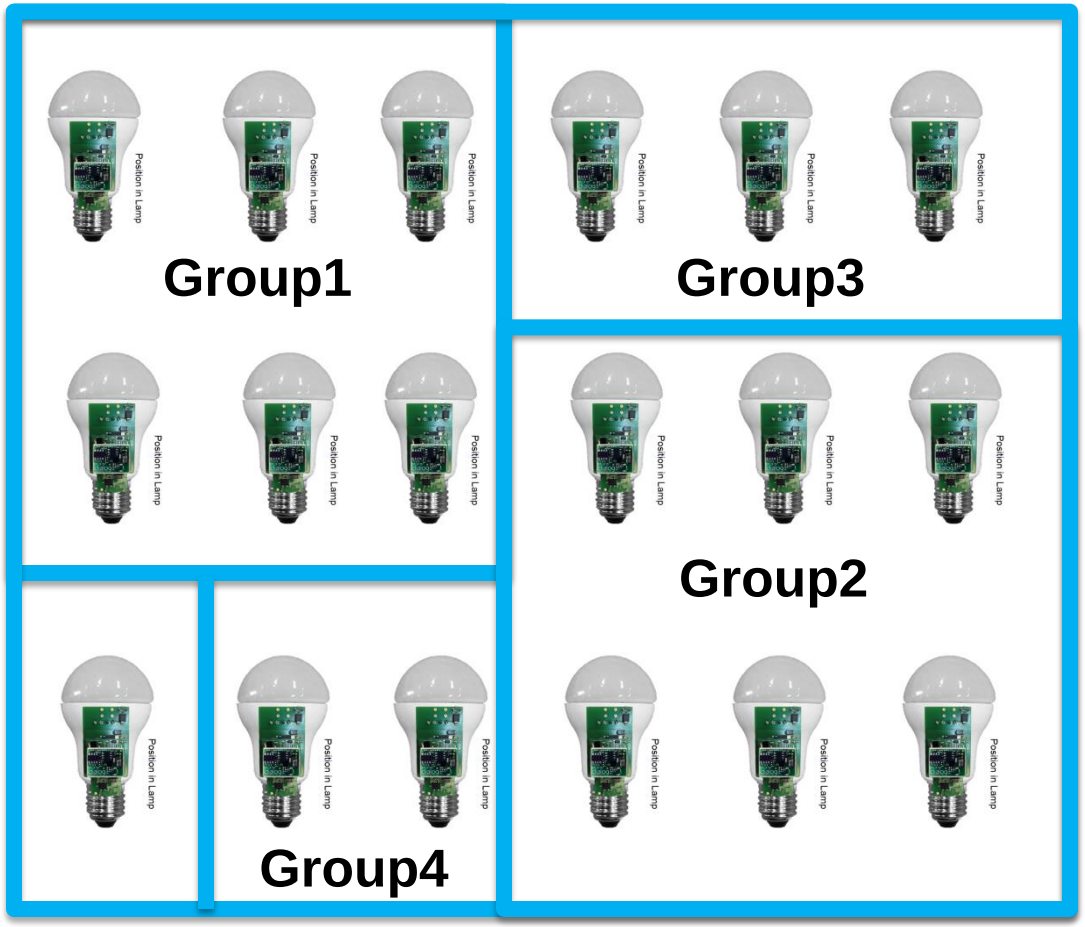


Tunable white and color change solution

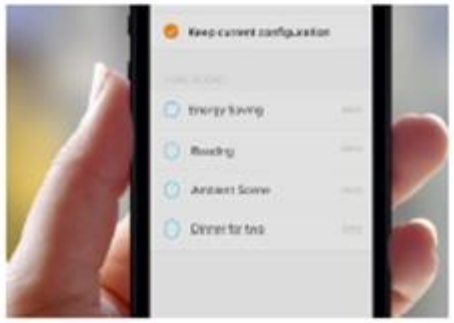


Blue Tooth Control





Open API



- Easy-to-use GUI
- Protected against foreign access
- Designed by HMI experts
  (human machine interface)

- Hierarchical structure room/group/lamp
- Continuous dim
- On/Off control
- Scene set and recall

- Wizards guide through system config
- Easy replacement and modification

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Bluetooth SMART in General

PROS

- Minimal power consumption
- Small size
- Direct interface to smartphone
- Profiles ensure interoperability
- Applicable to all markets
- Low cost
- Secure data transmission

CONS

- No direct cloud access
- No mesh networking

Bluetooth® SMART

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DLT Digital Dimming Technology

- Ledotron is a brand name from OSRAM/INSTA for a new digital dimmer technology referred to as DLT “Digital Loadside Transmission”
- DLT is a new dimming control technology developed by OSRAM to **replace and extend phase cut dimming**
- **DLT resolves all problems** with phase cut dimmers
- **It is a digital** addressable multi-channel protocol. It supports group adressing as well as tunable white and color control
- DLT is fully **retrofitable**
- Standardized in **IEC62756. Open Standard, no licenses required**
- Perfect digital link for the **“last mile”** to connect to home and building automation

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Benefits of DLT Dimming Technology

- Resolves all compatibility problems with phase cut dimmers
- Applicable worldwide
- Small driver size fits for GU-10
- Better electrical performance (no bleeder losses)
- No audible noise, No reliability issues, No light flicker or shimmer
- Up to 100m cable between dimmer and light source
- Any number of lamps, limited only by total power
- Much better electrical efficiency of the LED driver over traiditonal phase cut dimmers

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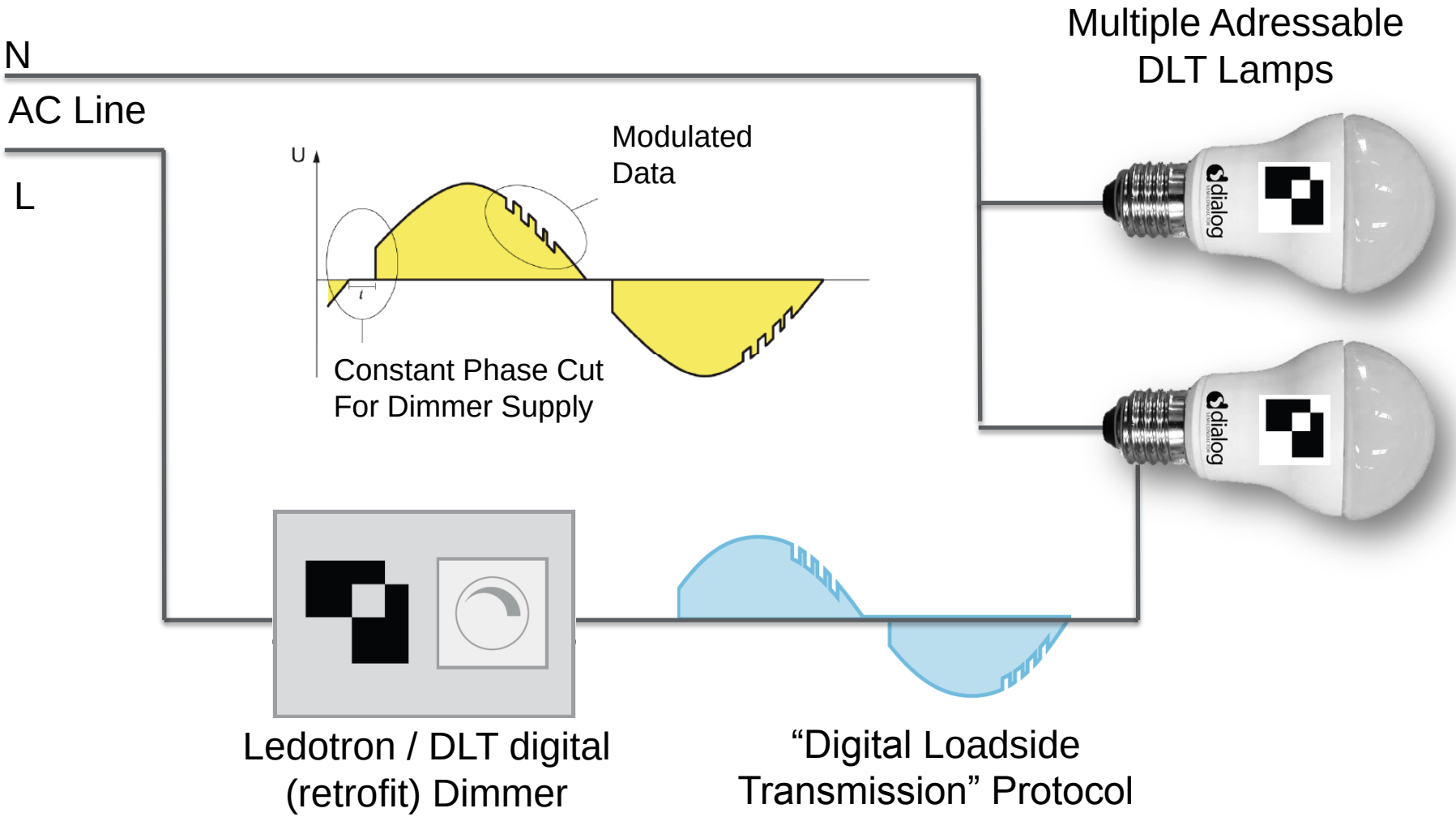
DLT Digital Retrofit Dimming

Digital Dimmer for a Digital Light Source



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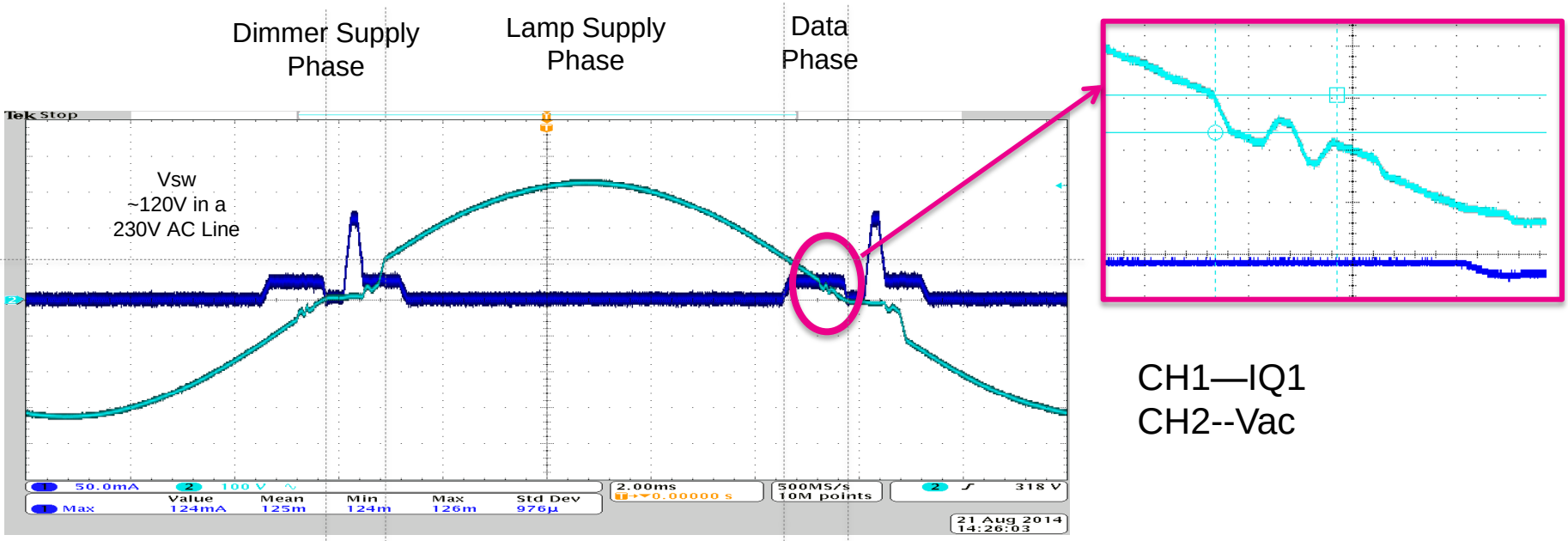
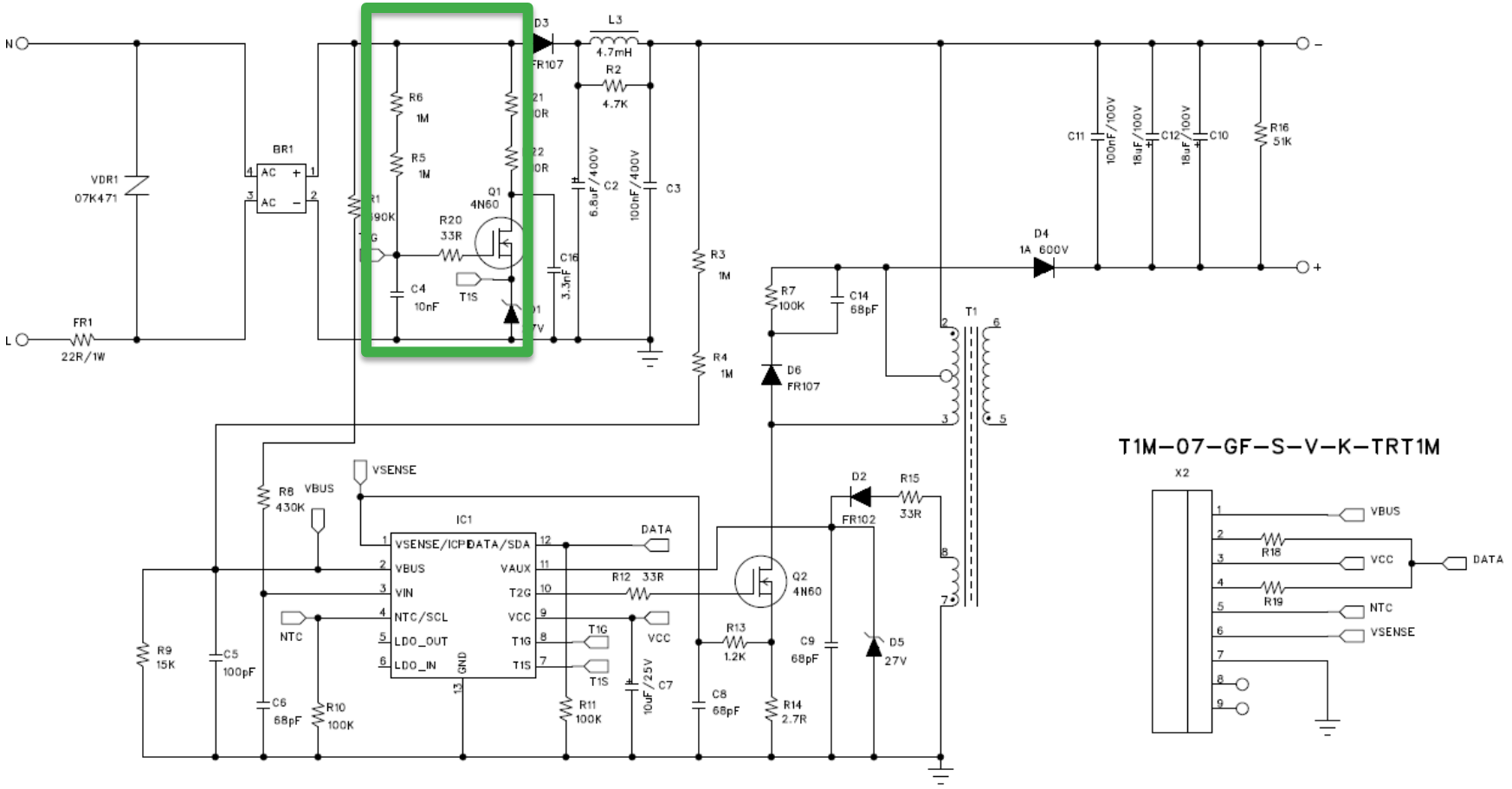
DLT bypass circuit operating with dimmer connection



- During dimmer supply phase the lamp shall provide current sink capability and the mains voltage will be low, similar to leading edge case
- During Lamps Supply phase the full mains AC line voltage is applied to the lamp regardless of dim level. This allows for perfect dimming between 100% and below 1%
- During Data phase the lamp shall provide a low current sink capability and Data Bits are modulated on top of the AC line voltage
- 2 Data Bits are transmitted per half wave, 16 Bits in total per frame this makes a data rate of 200Byte/sec in a 50Hz Domain

iW6401 DLT Single-Chip Solution

Bypass circuit



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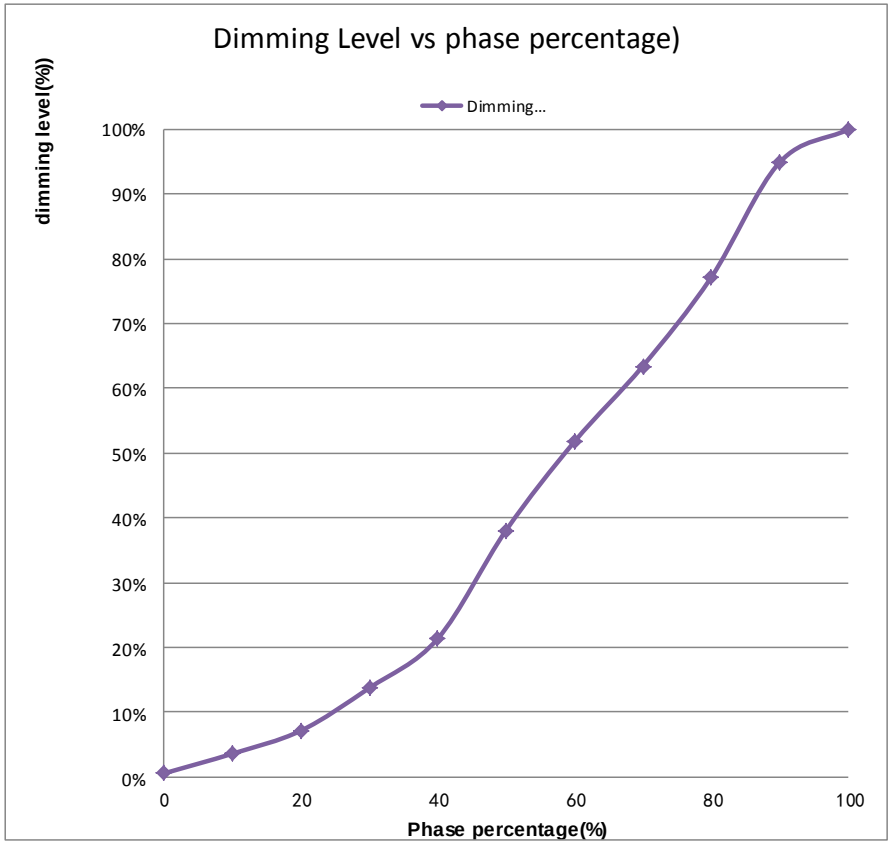
Dimming Curve _ LEDOTRON Dimmer



Dimmer Scale	Iout (mA)	Dimming Level(%)
0	1.0	1%
10	7.0	4%
20	14.0	7%
30	27.0	14%
40	42.0	21%
50	75.0	38%
60	102.0	52%
70	125.0	63%
80	152.0	77%
90	187.0	95%
100	197.0	100%

Dimmer type：INSTA 51191002

Manual Toggle Switch Control

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Manual Toggle Switch Control for Intuitive Smart Lighting Experience

- Coexistence of manual and assisted control is a must have requirement for smart lighting technologies
- Even without the use of wireless or digital dimming the smarteXite technology makes every lamp dimmable without the presence of dimmers
- Toggle switch operating mode can differ between lamp models ranging from simple 2 level control to more advanced linear dim ramp approach
- Using the unique smarteXite multi stage programming model the toggle switch operating mode can be set on chip-level, at driver assembly or in the final product

smarteXite

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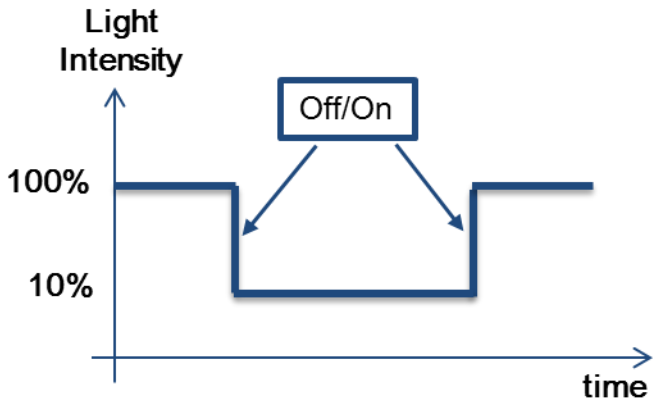
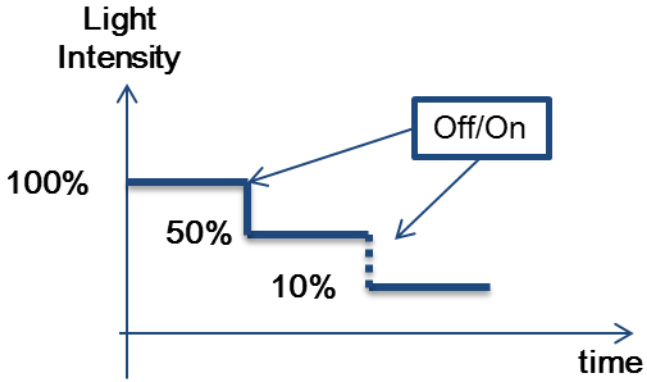
Manual Toggle Switch Control for Intuitive Smart Lighting Experience

On — Switch is steady on

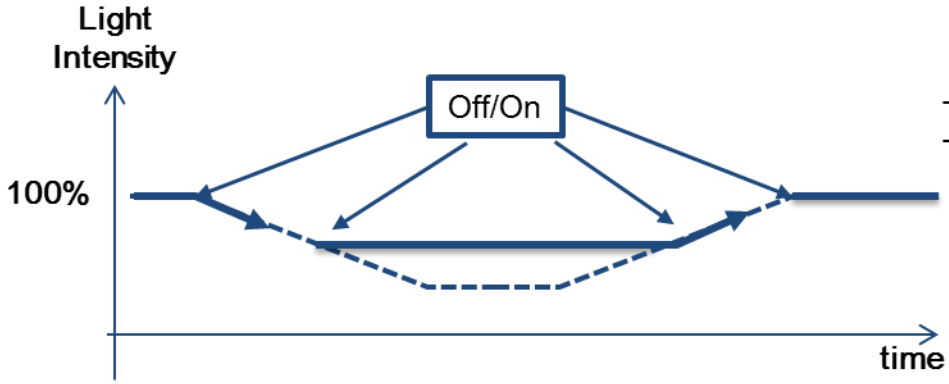
Off — Switch is steady off

Off/On — Switch is turned off/on within 1-2sec





Toggle to move between illumination states



Toggle to trigger dimming ramp
Toggle again to hold most recent value

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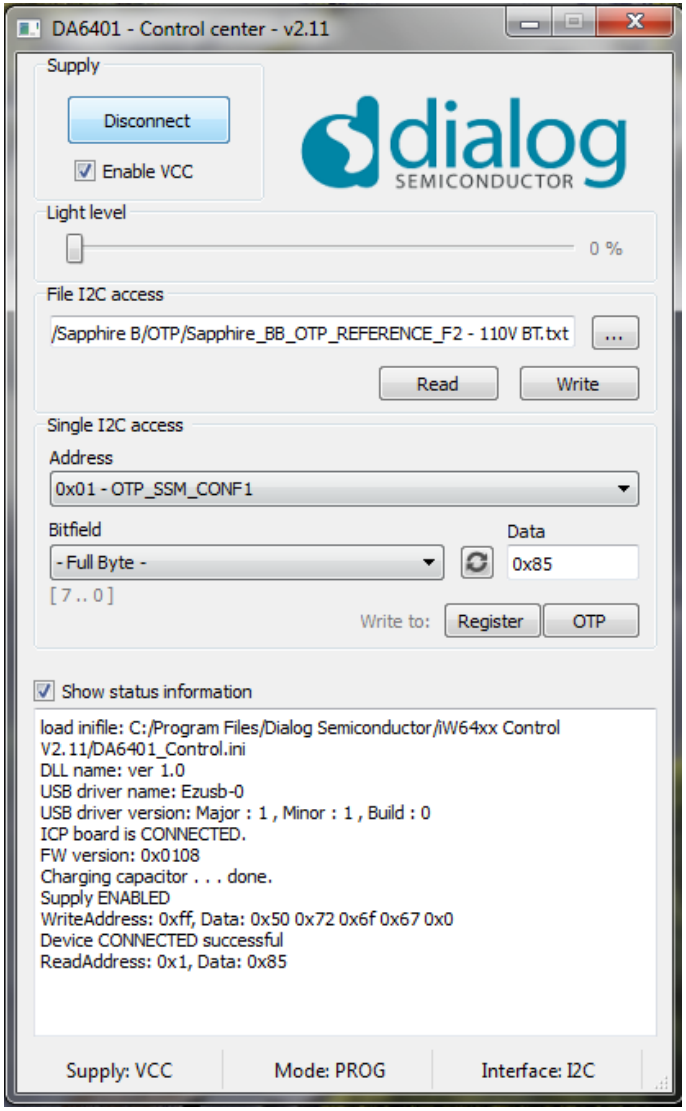
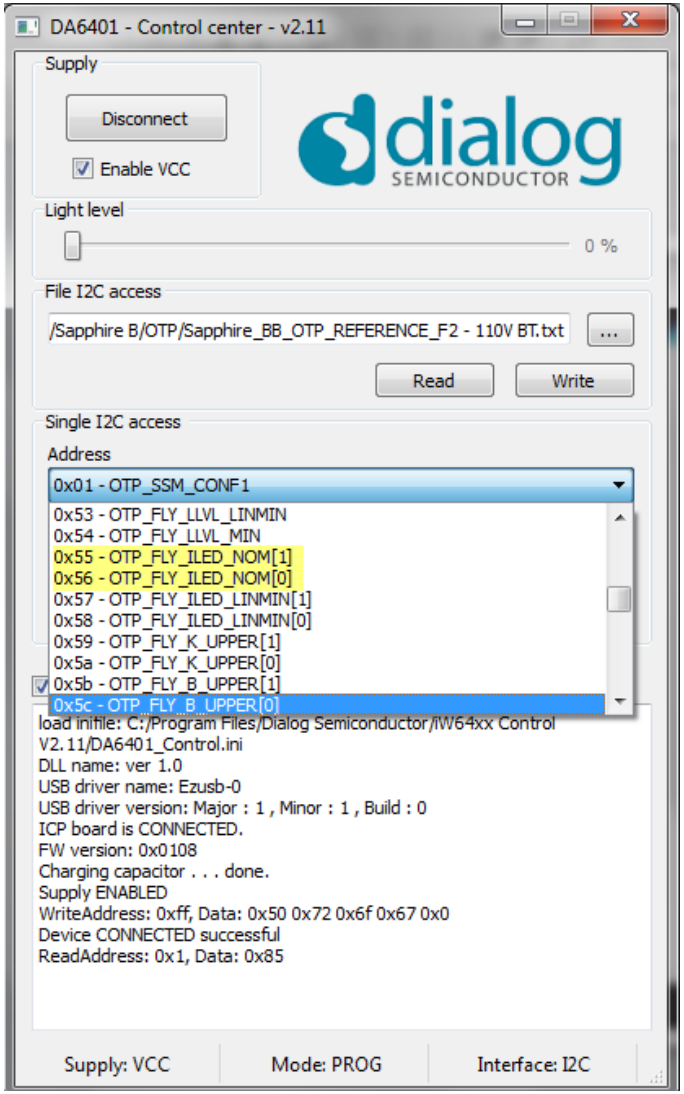
Programming Tool

Programming Tool



Programming _Register configuration



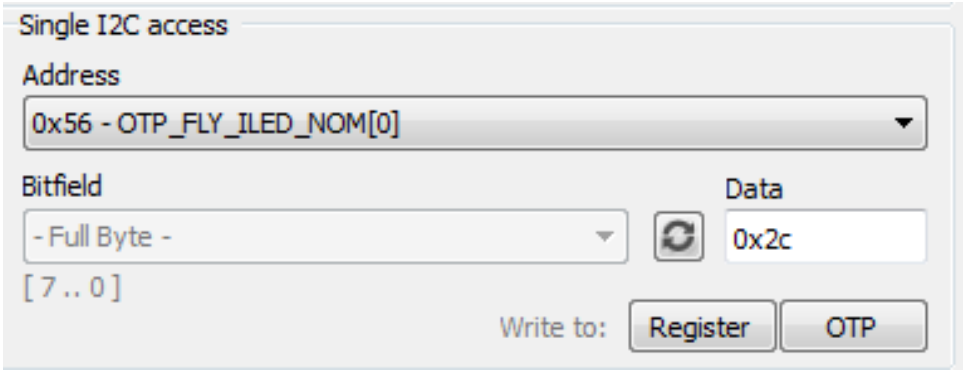


Table 58: OTP_FLY_ILED_NOM (0x56 to 0x55)

Bit	Mode	Symbol	Description	Reset
15:0	R/W	OTP_FLY_ILED_NOM	Nominal LED current at 100 % light level. Unit: 1 mA. Range: 0 mA to 1023 mA (0x000 to 0x3FF). **Note:** Register OTP_FLY_KN must be set correctly.	0x012C

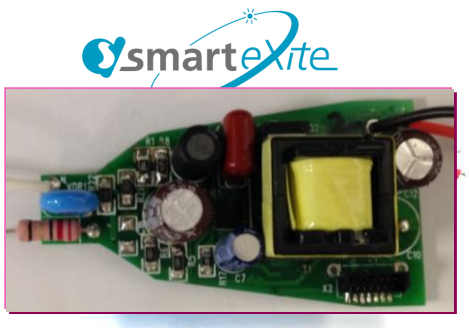
Programming _Flyback register configuration

Addr	Addr	Sect.	Dec default value	Hex Default value
74	FLY_BLANK_OC	Blanking time for the flyback shunt current overcurrent sense after positive edge of gate on signal	88	58
75	FLY_T_MIN	Minimum flyback periode time. Used for valley mode switching skip cycles. From 100kHz - 250kHz	50	32
76	FLY_TON_MAX	Maximum on time of the flyback	100	64
77	FLY_TOFF_MAX	Maximum off time of the flyback	255	FF
78	FLY_TON_MIN_LOW	Flyback on time in ton_min mode. Used when Vcc is discharging or when Vcc regulation mode is disabled.	5	05
79	FLY_TON_MIN_HIGH	Flyback on time in ton_min mode. Used when flyback is charging Vcc; Vcc regulation mode must be enabled.	15	0F
7A	FLY_TOFF_MIN	Flyback off time in ton_min mode	127	7F
7B	FLY_TOFF_RAMP	Fixed off time of the flyback during ramp mode.	100	64
7C	FLY_VSENSE_OC_THRES	Threhold level for vsense Over current comparator	255	FF
7D	FLY_PWM_PHASE	Centre point for flyback modulation. Point is set relative to the timebase phase count.	238	EE
7E	FLY_PWM_MIN	Minimum duty cycle of flyback modulation		

iW6401 – Fully Data-Defined LED Driver Platform

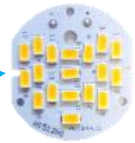
Driver Configuration Data

LED Current & Voltage
Controller Dynamics
Transformer Design
Safety Thresholds
Signal Timing
Thermal Control
Dim Curves
Enable/Disable Feature Set



Converter Hardware Module

Multiple LED Sources



Change LED Modules for a Given Hardware Topology in Minutes

- Reduced complexity
  - Simplified supply chain - one chip fits all
- Ultimate flexibility
  - High future proofing; low design risk
  - Single chip supports different LEDs, wattages, feature sets
- Driving down cost

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iW6401 smarteXite LED Driver Summary

- Fully configurable platform solution
  - Fastest time to market---don't have to change hardware for modify design
  - Optimized system cost
  - Maximize economy of scale
- Disruptive **digital dimming technology** for future-proof compatibility
  - Industry first support of Ledotron / DLT digital dimming technology
  - Parallel support of phase cut dimmers
  - Configurable toggle-switch based dimming
- Full **connectivity** to high level communication
  - Connects to any wireless communication
  - Connects to any microprocessor with simple low cost 1 wire digital interface
- Industry first **"end of line" programming** feature
  - Ultimate accuracy of light output with calibration at final manufacturing state
  - Full manufacturing process control with diagnostics feature
- Programmed safety and lifetime with **configurable thermal control** logic

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dialog SEMICONDUCTOR

The power to be...

...personal
...portable
...connected