



NXP Lighting Driver ICs

Public

Q1 2013 v1

Confidential



The smarter way
to energy efficiency

GreenChip Lighting Solutions

NXP LED Lighting Value Propositions

Offering turnkey solutions



Excellent customer support

Acting as solution provider

#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

Supply chain

In-house wafer fabs with High Volume production



(mains) dimming specialists

diversified portfolio, added-value

Offering the whole range

- LED controllers and drivers and conventional solutions CFL, TL, HID
- From 2W to 400W
- Offering DALI, DMX, KNX, ZigBee and PLC control solutions

Broad dimmer compatibility

- flicker-free, deep triac- and transistor dimming
- dimming via analogue or PWM signal, DALI, capacitive touch



LED Lighting Market Applications



hip

		segments	applications
lamps	Retrofit	<ul style="list-style-type: none"> GU10/PAR16 E14/C43 A19/A55/A60 PAR30 PAR38 Candle 	
	External, LED drivers	<ul style="list-style-type: none"> Multi-Purpose 	
	Outdoor lighting	<ul style="list-style-type: none"> Architectural Street, Area Lighting Industrial (hi-bay, low-bay) Tunnel Petrol Station 	
luminaires	Indoor lighting	<ul style="list-style-type: none"> Office (panel, linear lamps, downlights) Shop (HV track lighting) Hospitality (Pendants, Downlights, wall sconces, etc.) Residential (Floor Lamp, Pendants, desk lamps) 	
	Speciality Lighting	<ul style="list-style-type: none"> Stage and Studio Medical Horticultural 	

NXP Lighting driver IC Portfolio



▶ Non Dim SSL

- SSL1523/23A (EOL, LTB Sept 2013)
- SSL21081/81A/83/83A, SSL2109/09A
- SSL21101
- SSL21151/53

▶ Mains Dim SSL

- SSL2101/02/03
- SSL21082/82A/84/84A, SSL2129A

▶ High Power SSL

- SSL4101, SSL4120
- UBA3070 (EOL, LTB Sept 2013)

▶ Non Dim CFL

- UBA2021, UBA2024/24A/24B
- UBA2211A/B/C, UBA2213A/B/C
- UBA2212C (EOL SO package, LTB Jun 2013)

▶ Dim CFL

- UBA20270/60
- UBA20271/72/61/62
- UBA2028

▶ HF-TL

- UBA2014, UBA2015/15A/16A
- UBA2017/17A

▶ HID

- HID
- UBA2035, UBA2036/37
- UBA2080/80A/81

Black are focus products

NXP Lighting driver ICs SSL



SSL application		NXP Products			Power Factor
Non-dimmable	Non-isolated	SSL21151	BB	≤5W	0.6
		SSL21081/83(A)	B	5W (≤10W)	0.6 to >0.7
		SSL21153	BB	≤10W	0.6
		SSL1523(A)	B	≤15W	>0.9
		SSL21101	BB	≤15W	>0.9
	SSL2109A	B/TB/BB	5W to ≥25W	>0.9	
	Isolated	SSL21151	FB	5W	0.6
		SSL21153	FB	≤10W	0.6
		SSL1523(A)	FB	≤15W	>0.9
		SSL21101	FB	≤15W	>0.9
SSL2109A		FB	5W to ≥25W	>0.9	
Mains dimmable	Non-isolated	SSL21082A/84A	B	≤15W	>0.9
		SSL2101/02	B	≤15W	>0.9
		SSL2103	B	15W to ≥25W	>0.9
		SSL2129A	B/TB	15W to ≥25W	>0.9
	Isolated	SSL2101/02	FB	≤15W	>0.9
		SSL2103	FB	15W to ≥25W	>0.9
SSL2129A	FB	5W to ≥25W	>0.9		
Power supplies for high power lighting		SSL4101	FB	≤150W	>0.9
		SSL4120	R	≤350W	>0.9

Black are focus products








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B Buck, BB Buck Boost, FB Flyback
 TB Tapped Buck, TLD Tapped Linear Driver
 R Resonant









Non-dimmable SSL Product Positioning

NXP IC Drivers for Non-Dimmable SSL Retrofit Lamps

	Non-Dim / Non-Isolated		Non-Dim / Isolated	
Channels	For all regions, all channels (PF>0.7, P>5W)	For China Special bidding (PF>0.9)	For all regions, all channels (PF>0.7, P>5W)	For China Special bidding (PF>0.9)
Applications				
 5W GU10	SSL21081/83 <0.7 PF / INT FET	SSL21081/83 <0.7 PF / INT FET (High PF not needed for ≤ 5W)	SSL21151 <0.7 PF / INT FET	SSL21151 <0.7 PF / INT FET (High PF not needed for ≤ 5W)
 7W GU10	SSL21081/83 <0.7 PF / INT FET SSL21081/83 >0.7 PF / INT FET	SSL2109A >0.9 PF / CTRL	SSL2109A <0.7 PF / CTRL SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL
 9W A19	SSL21081/83 >0.7 PF / INT FET	SSL2109A >0.9 PF / CTRL	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL
 17W PAR30 18W T5/8	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL
 20W PAR38	SSL2109A >0.9 PF / CTRL (High PF required for All Consumer)	SSL2109A >0.9 PF / CTRL	SSL2109A >0.9 PF / CTRL (High PF required for All Consumer)	SSL2109A >0.9 PF / CTRL

NXP IC Drivers for Non-Dimmable SSL Retrofit Lamps

						
Product Name	SSL21151	SSL21081/3 PF<0.7	SSL21081/3 PF>0.7	SSL2109 PF<0.7	SSL2109 PF>0.7	SSL2109A PF>0.9
Power range	5W	10W	10W	Up to 25W	Up to 25W	Up to 25W
Switch	Integrated MOSFET	Integrated MOSFET	Integrated MOSFET	External MOSFET	External MOSFET	External MOSFET
Topology	Flyback	Buck	Buck	Buck / Flyback	Buck / Flyback	Buck / Flyback
Power Factor	<0.7	<0.7	>0.7	<0.7	>0.7	>0.9
THD	<30%	N.A.	N.A.	<35% / <30%	<35% / <30%	<35% / <30%
Efficiency	>85%	>90%	80%-90%	>90%	80%-90%	>90%
Line regulation	±5%	±3%	±3%	±3%	±3%	±3%
Load regulation	±5%	±3%	±3%	±3%	±3%	±3%
Current Accuracy	10%-15%	5%	5%	5%	5%	5%
Ripple	±30%, Base on E-cap size	<3%	<3%	<3%	<3%	<3%
Protection	Built-in short circuit, OTP, LED open, OCP	Built-in short circuit, OTP, external LED open	Built-in short circuit, OTP, external LED open	Built-in short circuit, OTP, external LED open	Built-in short circuit, OTP, external LED open	Built-in short circuit, OTP, external LED open
Component Count	37	14/16	15/17	16/18	17/19	32 / 29

NXP Lighting Portfolio

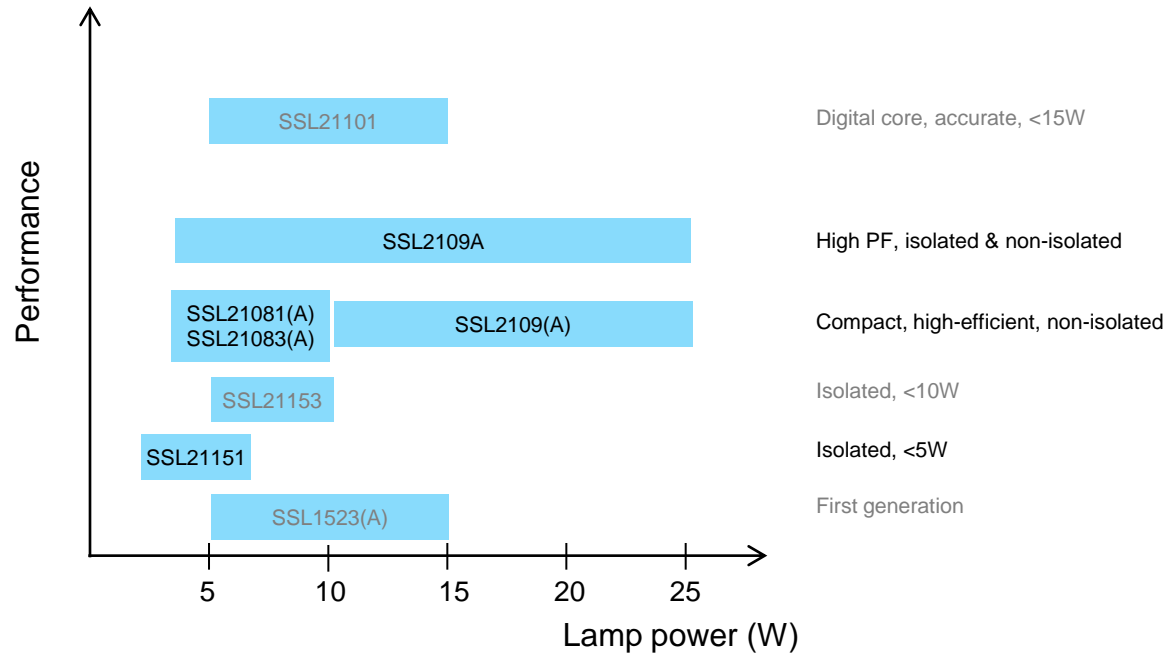
SSL non-dimmable (retro-fit)



Part name	Description	Package code	Mains Dim	Topology	Mains voltage	MOSFET	Power (W)	Value Proposition
SSL21151	Low-cost non-dimmable LED driver IC 230V/5W	SO7	N	Flyback / Buck Boost	100-230V	Internal	< 5	Low cost, compact, PSS, LR
SSL21153	Low-cost non-dimmable LED driver IC 230V/10W	SO7	N	Flyback / Buck Boost	100-230V	Internal	< 10	Low cost, compact, PSS, LR
SSL21081	Compact non-dimmable LED driver IC 120V/10W	SO8	N	Buck / Buck Boost	100-120V	Internal	< 10	Compact, high efficient, LR
SSL21081A	Compact non-dimmable LED driver IC 120V/10W w/o SWP	SO8	N	Buck / Buck Boost	100-120V	Internal	< 10	Same as SSL21081 w/o Short Winding Protection (SWP), Japan focus
SSL21083	Compact non-dimmable LED driver IC 230V/10W	SO8	N	Buck / Buck Boost	230V	Internal	< 10	Compact, high efficient, LR
SSL21083A	Compact non-dimmable LED driver IC 230V/10W w/o SWP	SO8	N	Buck / Buck Boost	230V	Internal	< 10	Same as SSL21083 w/o SWP, Japan focus
SSL1523	Non-dimmable LED driver IC 230V/15W	DIP8	N	Buck / Flyback	100-230V	Internal	< 15	First generation, HPF
SSL1523A	Non-dimmable LED driver IC 230V/15W w/o SWP	DIP8	N	Buck / Flyback	100-230V	Internal	< 15	First generation, HPF w/o SWP, Japan focus
SSL21101	Accurate non-dimmable LED driver IC 230V/15W	SO14	N	Flyback / Buck Boost	100-230V	Internal	< 15	Accurate, PSS, LR or HPF
SSL2109	Compact non-dimmable LED controller IC	SO8	N	Buck / BB / FB	100-230V	External	n.a.	Flexible, high efficient, LR
SSL2109A	Compact non-dimmable LED controller IC w/o SWP	SO8	N	Buck / BB / FB	100-230V	External	n.a.	Flexible, high efficient, LR , w/o SWP, supports high PF application solution

NXP Lighting Portfolio SSL

Non-dimmable / non-isolated



NXP Lighting Portfolio SSL

Full Non-dimmable / non-isolated Portfolio



▶ Products

- SSL21081/83(A) Internal MOSFET (B)
 - SSL2109(A) Controller-only (B/TB)
- (A) Is a version without the short winding protection

Compact, high efficient, LR
Flexible, high eff, LR or HPF

▶ Reference designs, eDemoboards

- SSL21081/83(A)
 - UM10482 SSL21081 100-120V / 6W buck
 - SSL21083 230V / 6W buck
- SSL2109(A)
 - UM10512 SSL2109 230V / 23W buck
 - UM10512 SSL2109 120V / 19W buck
 - SSL2109A 230V / 12W buck high PF
 - SSL2109A 230V / 18W buck T8 high PF



NXP Lighting Portfolio SSL

Full Non-dimmable / isolated Portfolio



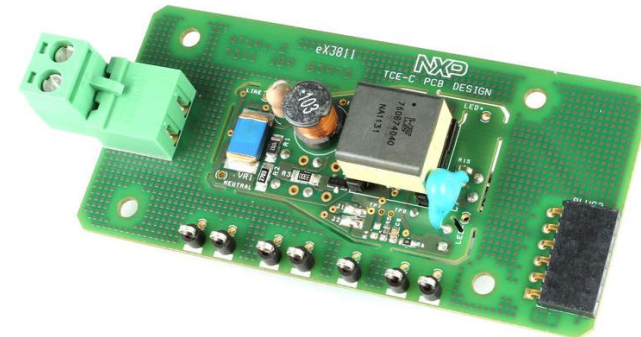
▶ Products

- SSL2109(A) Controller-only (FB)
 - SSL21151 Internal MOSFET (FB)
- (A) Is a version without the short winding protection

Flexible, high eff, LR or HPF
Low cost, compact, PSS, LR

▶ Reference designs, eDemoboards





- SSL21151
 - 230V / 5W flyback reference design
- SSL2109A
 - 230V / 12W flyback reference design







Mains-dimmable SSL Product Positioning

NXP IC Drivers for Dimmable SSL Retrofit Lamps

Socket	Dim / Non-Isolated	Dim / Isolated
 5W GU10	SSL2129A >0.9 PF / CTRL	SSL2129A >0.9 PF / CTRL
 7W GU10	SSL21082A/84A >0.9 PF / INT FET	SSL2129A >0.9 PF / CTRL
 9W A19	SSL21082A/84A >0.9 PF / INT FET	SSL2129A >0.9 PF / CTRL
 20W PAR38 17W PAR30	SSL2129A >0.9 PF / CTRL	SSL2129A >0.9 PF / CTRL

NXP IC Drivers for Dimmable SSL Retrofit Lamps

		
Product Name	SSL21082A/4A	SSL2129A
Power range	15W	5W (up to 25W)
Switch	Integrated FET	External FET
Topology	buck	Buck
Power Factor	>0.9	>0.9
THD	30%	30%
Efficiency	82%	80%
Line regulation	8% +3% with comp	8% +3% with comp
Load regulation	<±5%	<±5%
Current Accuracy	8%	8%
Ripple	±30%, Base on E-cap size	±30%, Base on E-cap size
Protection	Built-in short circuit, OTP, external LED	Built-in short circuit, OTP, external LED
Component Count	49	50

NXP Lighting Portfolio

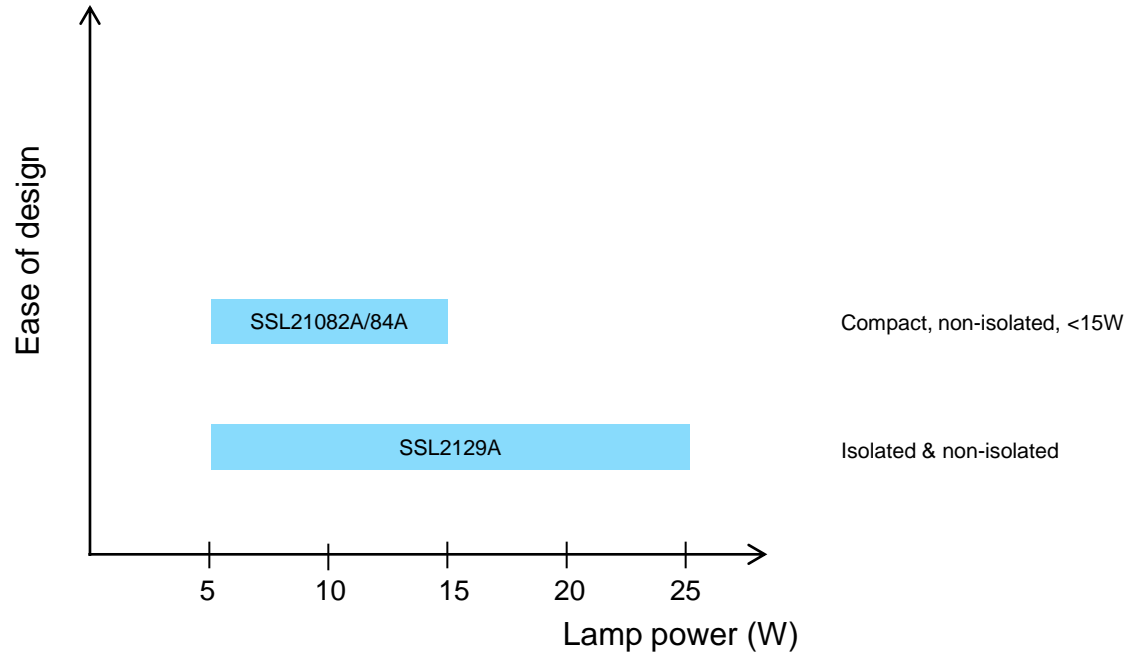
SSL dimmable (retro-fit)



Part name	Description	Package code	Mains Dim	Topology	Mains voltage	MOSFET	Power (W)	Value Proposition
SSL2101	Dimmable LED driver IC 230V/10W	SO16	Y	Buck / Flyback	100-230V	Internal	< 15	First generation dim SSL
SSL2102	Dimmable LED driver IC 230V/15W	SO20	Y	Buck / Flyback	100-230V	Internal	< 25	First generation dim SSL
SSL2103	Dimmable LED controller IC	SO14	Y	Buck / Flyback	100-230V	External	n.a.	First generation dim SSL, Flexible, higher power
SSL21082	Dimmable LED driver IC 120V/15W	SO12	Y	Buck / Buck Boost	100-120V	Internal	< 15	Ease of design, best dimming, HPF
SSL21082A	Dimmable LED driver IC w/o SWP 120V/15W	SO12	Y	Buck / Buck Boost	100-120V	Internal	< 15	Ease of design, best dimming, HPF, no SWP
SSL21084	Dimmable LED driver IC 230V/15W	SO12	Y	Buck / Buck Boost	230V	Internal	< 15	Ease of design, best dimming, HPF
SSL21084A	Dimmable LED driver IC w/o SWP 230V/15W	SO12	Y	Buck / Buck Boost	230V	Internal	< 15	Ease of design, best dimming, HPF, no SWP
SSL2129A	Dimmable LED controller IC	SO8	Y	Buck / BB / FB	100-230V	External	n.a.	Wide V_f LED range, best dim, HPF, no SWP

NXP Lighting Portfolio SSL

Dimmable / non-isolated



NXP Lighting Portfolio SSL

Full Dimmable / non-isolated Portfolio



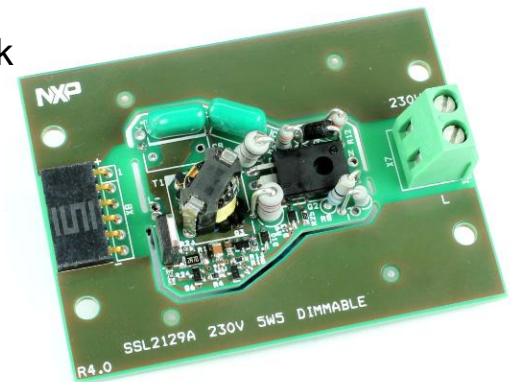
▶ Products

- SSL21082/84(A) Internal MOSFET (B)
 - SSL2129A Controller-only (TB)
- (A) Is a version without the short winding protection

Ease of design, best dimming
Wide V_f LED range, best dim

▶ Reference designs, eDemoboards

- SSL21082/84(A)
 - UM10577 SSL21084A 230V / 11W E27 buck
- SSL2129A
 - UM10576 SSL2129A 230V / 5.5W GU10 buck and tapped buck



NXP Lighting Portfolio SSL

Full Dimmable / isolated Portfolio



▶ Products

- SSL2129A Controller-only (FB)

(A) Is a version without the short winding protection

Full V_{LED} range, best dimming






▶ Reference designs, eDemoboards

- SSL2129A
 - 120V and 230V / 12W fly back E27



Fixtures SSL Product Positioning

NXP IC Drivers for Dim&Non-Dimmable SSL Fixtures

Channels Applications	Non-Dim / Q1 2013		Dim / Q1 2013	
	For US consumer, Europe and Asia (PF>0.7)	For US commercial & China Special bidding (PF>0.9)	For US consumer, Europe and Asia (PF>0.7)	For US commercial & China Special bidding (PF>0.9)
 3-10W Ceiling Spot	SSL21081/83 >0.7 PF / INT FET SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL	SSL21082A/84A >0.9 PF / INT FET	SSL21082A/84A >0.9 PF / INT FET
 10-18W Ceiling Spot	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL	SSL21082A/84A >0.9 PF / INT FET SSL2129A >0.9 PF / CTRL	SSL21082A/84A >0.9 PF / INT FET SSL2129A >0.9 PF / CTRL
 10-18W down light	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL	SSL21082A/84A >0.9 PF / INT FET SSL2129A >0.9 PF / CTRL	SSL21082A/84A >0.9 PF / INT FET SSL2129A >0.9 PF / CTRL
 18-30W Panel	SSL2109A >0.7 PF / CTRL	SSL2109A >0.9 PF / CTRL	SSL2129A >0.9 PF / CTRL	SSL2129A >0.9 PF / CTRL
 25-400W fixtures such as high bay, street lights...	SSL4101 SSL4120 >0.9 PF / CTRL	SSL4101 SSL4120 >0.9 PF / CTRL	SSL4101 SSL4120 >0.9 PF / CTRL	SSL4101 SSL4120 >0.9 PF / CTRL

The slide features a background with a light blue vertical bar on the left, a dark olive green triangular shape at the top-left, and a large yellow diamond shape pointing left towards the center. The text is centered within the yellow diamond.

SSL Part Nomenclature

NXP Lighting driver ICs

Part Nomenclature



Prefix	Technology / Topology	Dim / Non-dim	Generation	Power + Voltage
SSL	3 = MR16/12V LED controller/driver 4 = Customized part names (special versions) 5 = LED controller/driver 6 = LED direct to mains driver IC 7 = Bipolar LED controller/driver 8 = Power supplies controller for LED lighting	0 = Non-dim / Analog 1 = Non-dim / Digital core 2 = Dim Mains / Analog 3 = Dim Mains / Digital core 4 = Dim 12V Mains 5 = Dim control / Analog out 6 = Dim control / PWM out	0 = Gen1 1 = Gen2 2 = Gen3	1 = Controller-only 2 = 100-120V/Low Power 3 = 100-120V/Med Power 5 = 100-120V/High Power 6 = 230V/Low Power 7 = 230V/Med Power 8 = 230V/High Power

Products details

Non-dimmable SSL
SSL21081(A)/83(A)
SSL2109(A)

SSL21081(A)/83(A) and SSL2109(A)

High-eff. non-dim SSL drivers for (non)-isolated topologies



Description

These compact non-dimmable SSL drivers deliver excellent efficiency and reduce system cost.

Applications

- Retrofit LED lamps up to 25W
- Driver modules for LED lighting up to 25W

Features

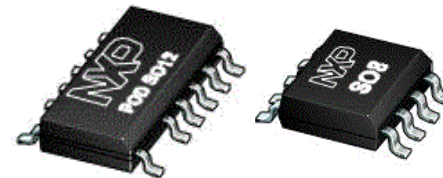
- High-efficiency buck-only LED driver ICs, non-isolated
 - With 300V INT FET SSL21081(A) 100VAC <10W
 - With 600V INT FET SSL21083(A) 230VAC <10W
- **Buck or Flyback controller-only IC**, (non)-isolated
 - Controller-only SSL2109(A) 100-230V <25W
- LED current regulation <3%

Benefits

- **High-efficient driver ICs up to 95%**
- Low bill of material (only 14 components)
- Small PCB area
- Easy to use, easy to manufacture
- A-version w/o short winding protection
- **SSL2109A supports high PF**

Ordering Information

- ✓ Datasheet
- ✓ Samples / demo boards
- ✓ Released

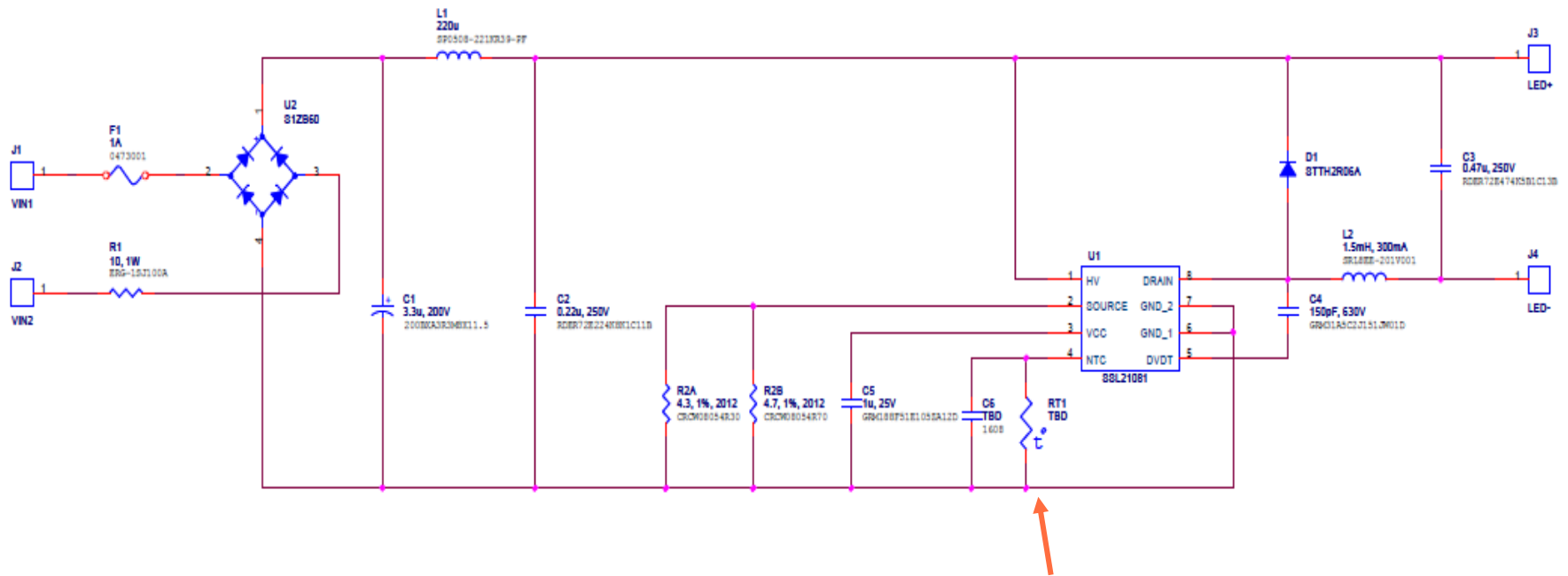


SSL21081

7W Retrofit Lamp



100V/60Hz Input
 70V/100mA Output
 Power Factor: 0.6
 Line regulation : <3%
 Efficiency: >92%

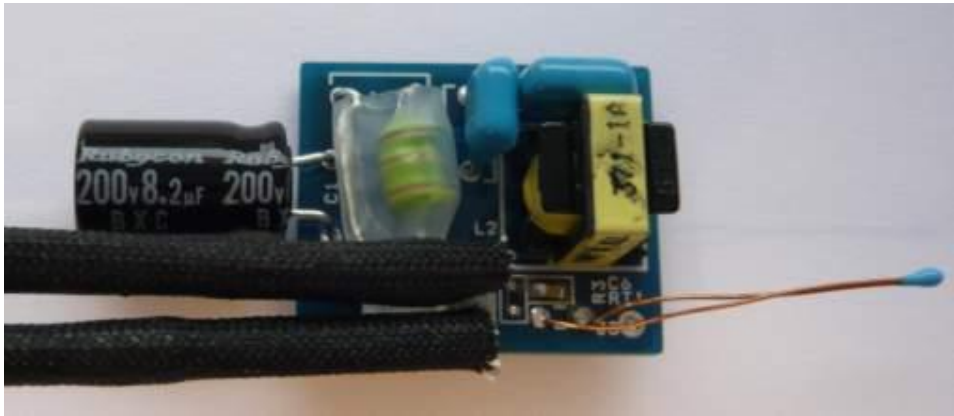
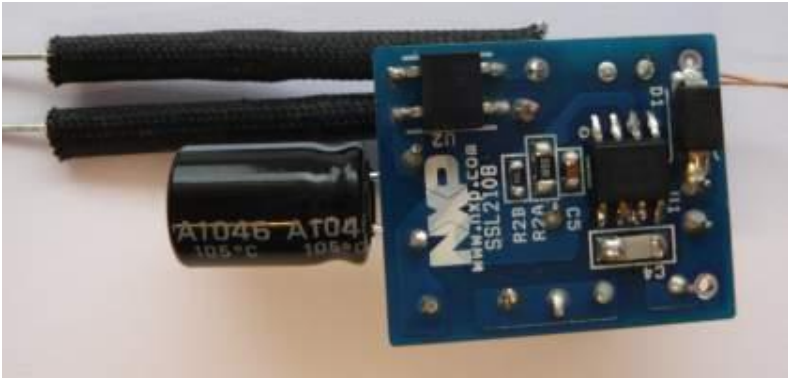
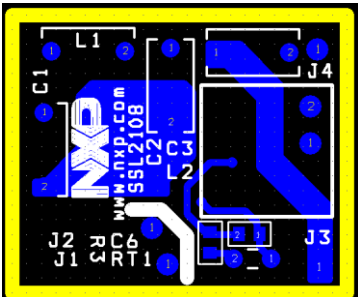
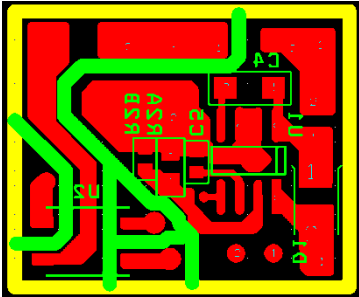


14 components
 (16 with optional NTC)

Optional NTC for Temperature protection

SSL21081

7W Retrofit Lamp



Board size is 18mm x 22mm for 100V buck solution

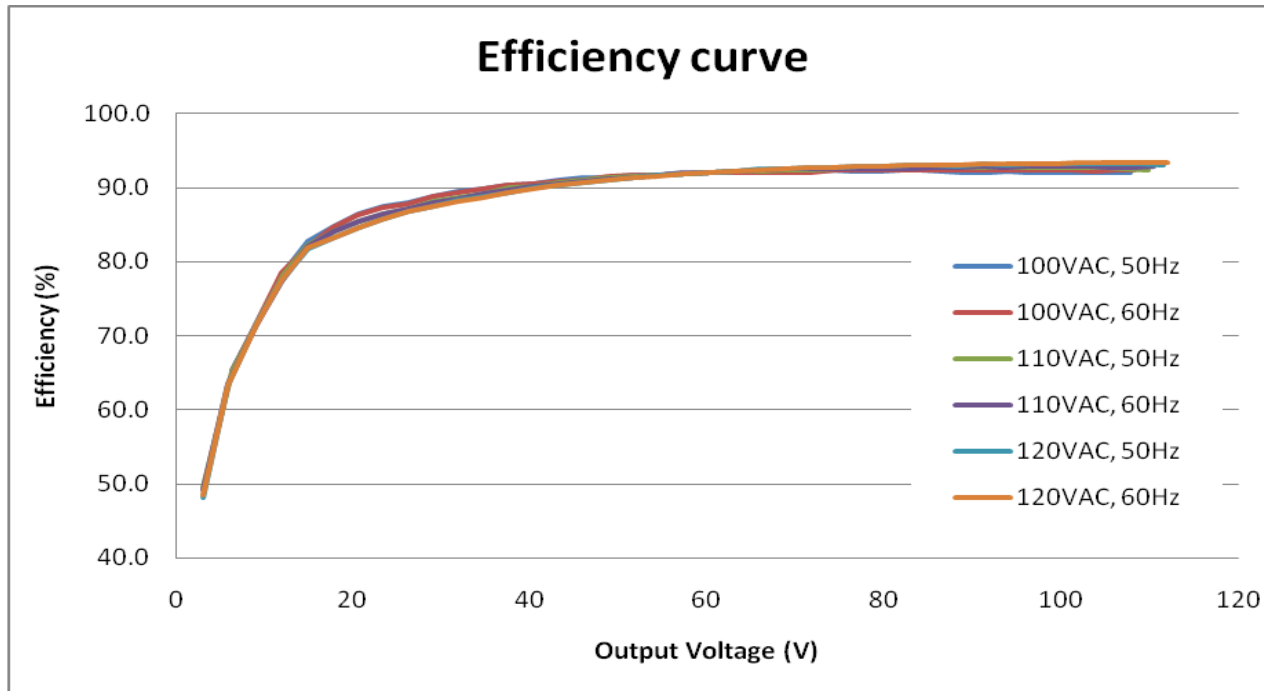


SSL21081

7W Retrofit Lamp



- ▶ Above 92% measured on SSL21081 reference board



**Non-dimmable SSL
SSL21151 Fly back**

SSL21151

Low-cost non-dimmable SSL drivers for isolated topologies



Description

The SSL21151 drives LEDs typically in flyback configurations. The device includes a high-voltage power switch and a circuit enabling start-up directly from the rectified mains voltage. It has a good controlled output current.

Applications

- Retrofit SSL
- LED Modules, LED Strings

Features

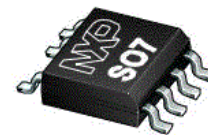
- 5W SSL21151
- Low output ripple <1%
- Power factor: 0.6 or ~0.9 (using valley-fill)
- Short/open-string protection, thermal protections
- Harmonics and EMC compatible
- 700V MOSFET inside

Benefits

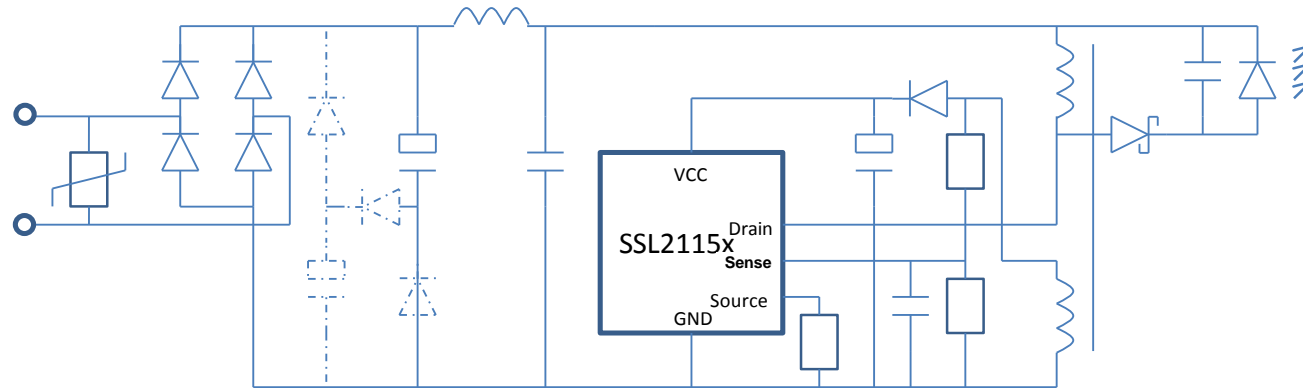
- Low cost SSL driver ICs up to 5W
- Primary sensing without opto coupler
- Option to connect PTC
- Frequency jitter
- Total solution fitting in GU10 casing

Ordering Information

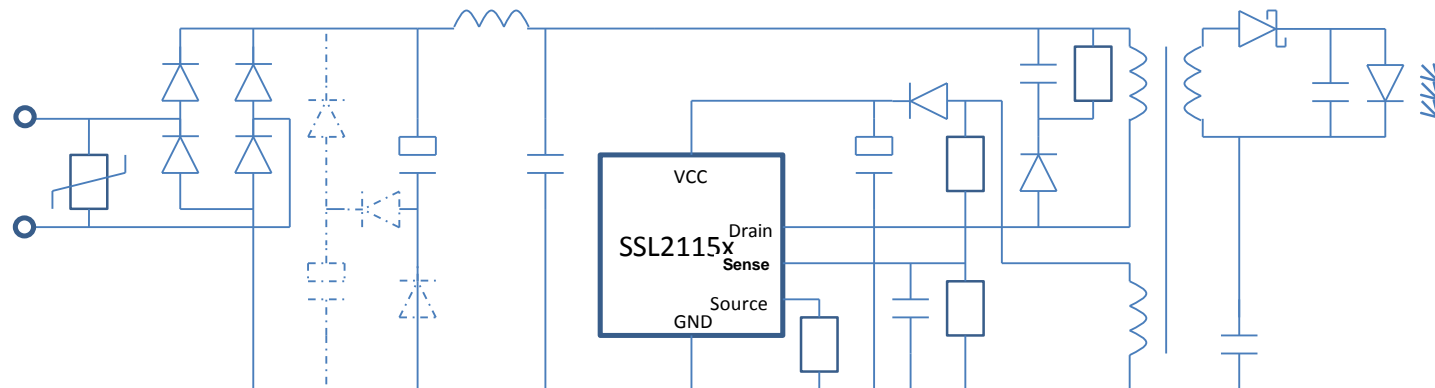
- ✓ Datasheet
- ✓ Samples
- ✓ Released



SSL2115x – Low Cost SSL Drivers



BuckBoost (non-isolated)



Flyback (isolated)

Mains Dimmable SSL

SSL21082A

SSL21084A

SSL2129A

SSL21082A/84A and SSL2129A

High-eff. dimnable SSL drivers for (non)-isolated topologies



Description

These compact best-in-class mains-dimmable SSL driver ICs deliver excellent efficiency and reduce system cost.

Applications

- Retrofit LED lamps
- Driver modules for LED lighting

Features

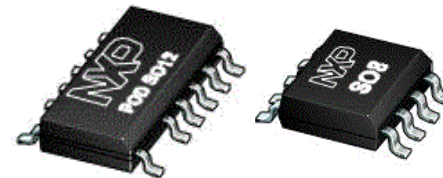
- Benchmark dimmer compatibility
- Buck LED driver ICs, non-isolated
 - 300V INT FET SSL21082A 120VAC <15W
 - 600V INT FET SSL21084A 230VAC <15W
- Buck or Flyback controller-only IC, (non)-isolated
 - Controller-only SSL2129A 100-230V <25W
- High Power Factor >0.9

Benefits

- **Benchmark dimmer compatibility**
- Low LED driver eBOM cost
- High-efficient
- Easy to use, easy to manufacture
- A-version w/o short winding protection

Ordering Information

- ✓ Datasheet
- ✓ Samples / demo boards
- ✓ Released



SSL21082A/84A/29A

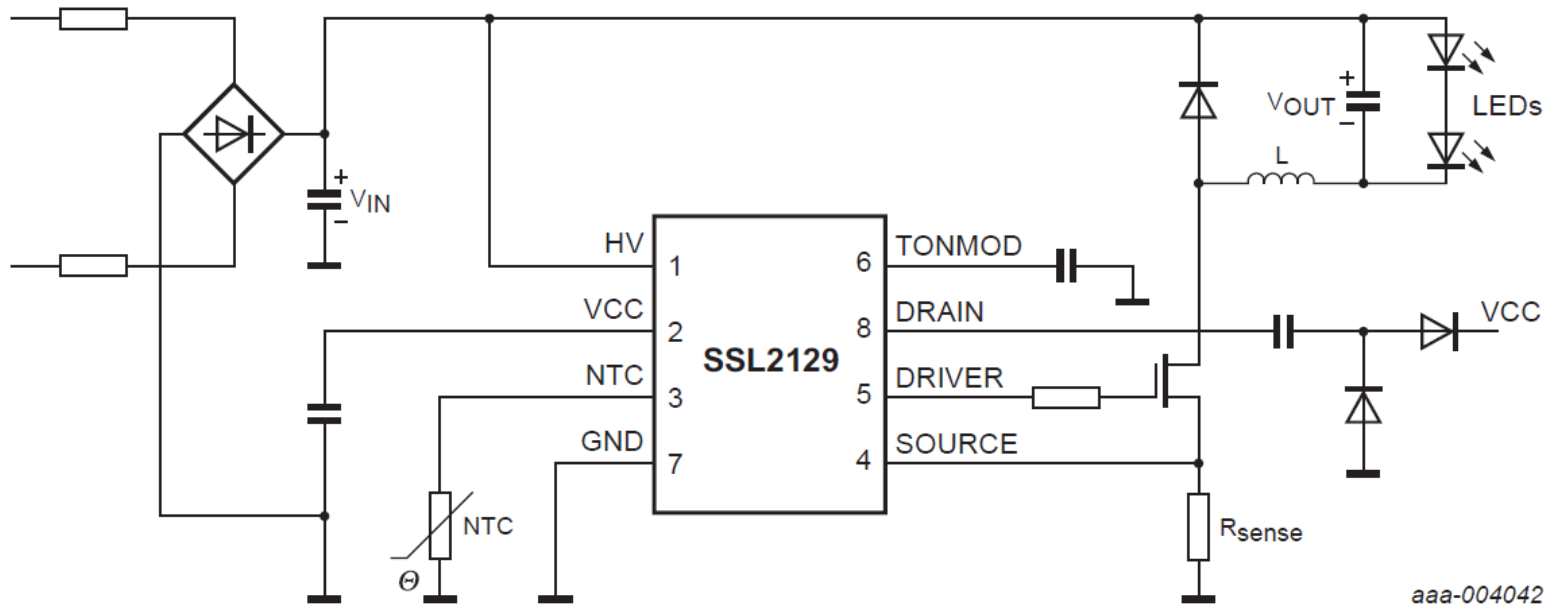
Compatibility per watt



- ▶ NXP determines lamp performance from the end-user perspective that results in a power merit factor that is based on these two conditions:
 - ▶ Stability - how well the lamp avoids visual disturbances like flicker, shimmer and flashing.
 - ▶ Controllability - how precisely the user can control and reduce the lamp's light output.
- ▶ LED driver applications based on NXP's dimmable SSL driver ICs show a great dimmer compatibility per watt at a very high power merit factor.
- ▶ Dimmer compatibility per watt not only depends on IC features, but also on the system implementation. NXP's application expertise, know-how and customer support are of crucial importance in designing a mains dimmable LED driver solution.

SSL2129A

Basic Applications Diagram



Dimmable SSL driver ICs

	Dimmer compatibility	System cost	Form factor	Accuracy	BOM count	Efficiency	Flexibility Topology	PF / THD
NXP SSL2101	Good enough	Good	Very good	Good	Good	Good	Good	Good
NXP SSL21082A/84A/29A	Good	Good	Good	Good enough	Good enough	Good	Good	Good
iWatt36xx single stage	Good enough	Good enough	Good	Very good	Good	Good	Good enough	Poor
iWatt36xx dual stage	Good	Poor	Poor	Very good	Poor	Good enough	Good enough	Good enough
Cirrus Logic dual stage CS1610/11/12/13	Very good	Poor	Poor	Very good	Poor	Good enough	Good	Good
Cirrus Logic single stage	Good	Good enough	Good enough	Good enough	Good enough	Good	Good enough	Good
TI/National LM3447	Good enough	Good enough	Good enough	Good enough	Good enough	Good	Good enough	Good
Fairchild FL7730	Good enough	Good enough	Good enough	Good	Good enough	Good	Good enough	Good
Marvell 88EM8183	Good enough	Good enough	Good	Good enough	Good	Good	Good	Good
OnSemi NLL30002	Good	Good enough	Good enough	Good enough	Good enough	Good	Good enough	Good
PI LNK40x/41x	Poor	Good enough	Good enough	Good enough	Good enough	Good	Good enough	Good
Monolithic Power Solutions MP4030	Poor	Good	Good	Good enough	Good	Good	Good enough	Good



Confidential

Legend

Very good	Good	Good enough	Poor
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Power supplies for High Power SSL
SSL4101
SSL4120

SSL4101

25 - 150W flyback controller with PFC for SSL Lighting



Description

The SSL4101 combines a controller for PFC and a high efficiency flyback controller for powers from 25 to 150 W. The PFC enables compliance for Class C harmonics regulations. Constant Current Mode (CCM) and Constant Voltage Mode (CVM) outputs are supported.

Applications

- Indoor and outdoor high power LED applications
- High-bay and low-bay lighting
- Parking garage and area lighting
- Street lighting

Features

- Integrated PFC and flyback controller
- Universal mains operation 90V to 305V
- High efficiency due to valley/zero voltage switching
- High level of integration
- Fully protected

Benefits

- Power supply solution for high power LED lighting
- High efficient >93%
- Low THD (<10%) and high PF (>0.97)
- Low external component count
- Robust cost-effective design

Ordering Information

- ✓ Datasheet
- ✓ Samples / demo boards
- ✓ Released





VALUE PROPOSITIONS

- ▶ Integrated PFC & Flyback controllers
 - Reduced PCB space
 - No interface issues, no additional hardware between the two controllers
 - Easily controlled startup behaviour
 - Easy Vcc management, only one Vcc electrolytic capacitor
- ▶ Best-in-class efficiency, power factor and THD
 - High voltage startup current source (5mA)
 - Flyback
 - QR/DCM operation with frequency limitation (125kHz) to reduce switching losses
 - Valley switching (NXP patented)
 - Cycle skipping at low and no load
 - PFC
 - QR/DCM operation with f_{max} 387kHz (better THD over dimming range and input voltage range)
 - Mains input voltage compensation for control loop (good transient response)
 - PFC is being switched off when low load is detected at Flyback output



GENERAL FEATURES

- ▶ True universal mains supply (90..305VAC)
- ▶ Flyback controller
 - soft start
- ▶ PFC
 - soft start and soft stop

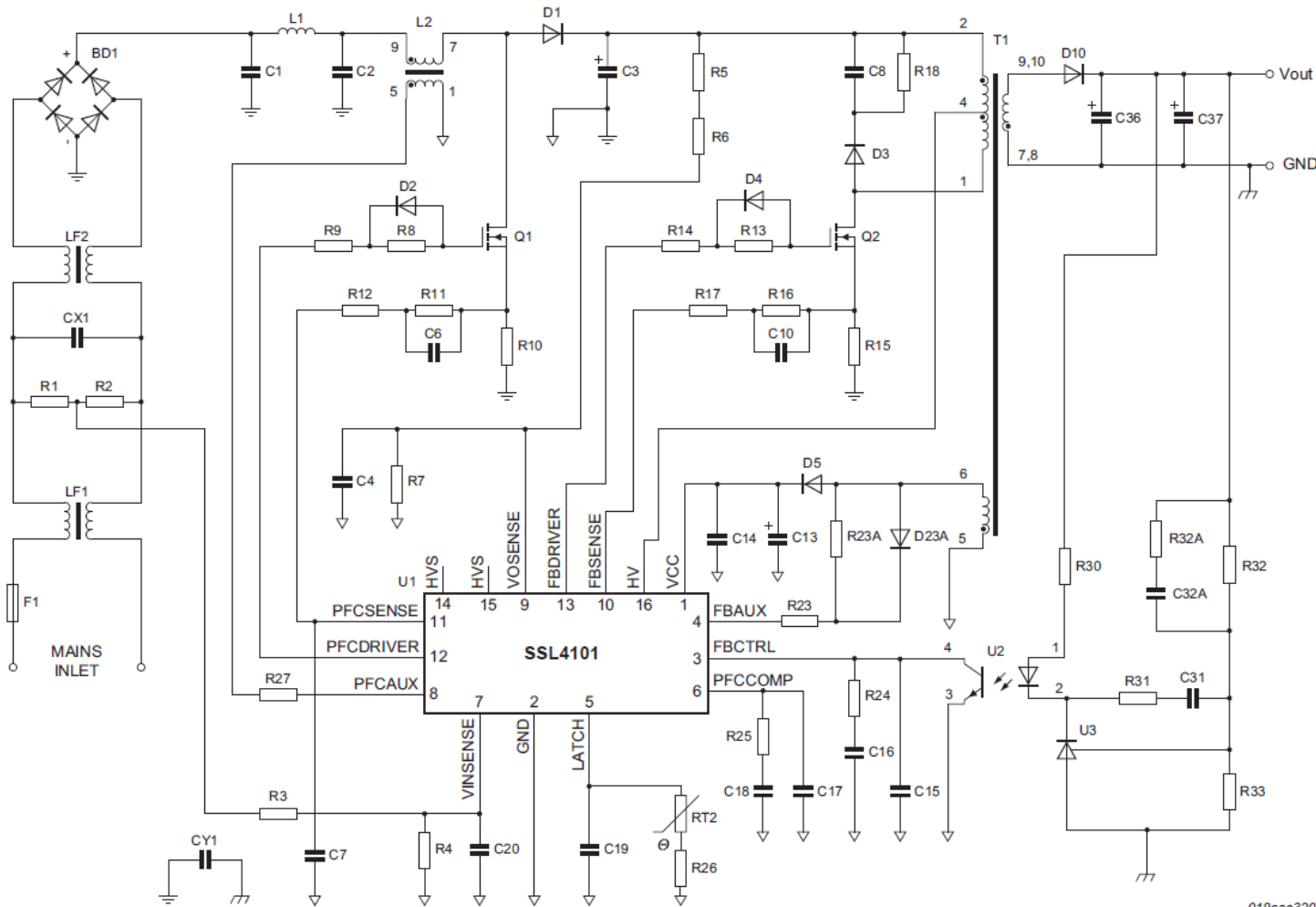


PROTECTION FEATURES

- ▶ Safe restart mode for system fault conditions
- ▶ Continuous mode protection by means of demagnetization detection for both converters (nxp patented)
- ▶ UnderVoltage Protection (UVP)
- ▶ Accurate overvoltage Protection (OVP) for both converters
- ▶ Open control loop protection for both converters
- ▶ IC overtemperature protection (OTP)
- ▶ Low and adjustable overcurrent protection (OCP) trip level for both converters
- ▶ General purpose input for latched protection, e.g. to be used for OTP

SSL4101

Typical PFC + Flyback application



SSL4101

Protections



▶ PFC

- Brown-out through pin Vi-sense
- Open pin detection @ pin Vi-sense and PFCaux
- Short and open pin detection @ pin Vo-sense, therefore external OVP circuit is not required
- OCP
- OVP through pin Vo-sense

▶ Flyback

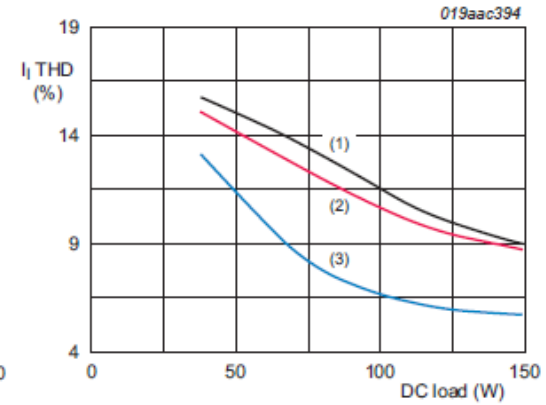
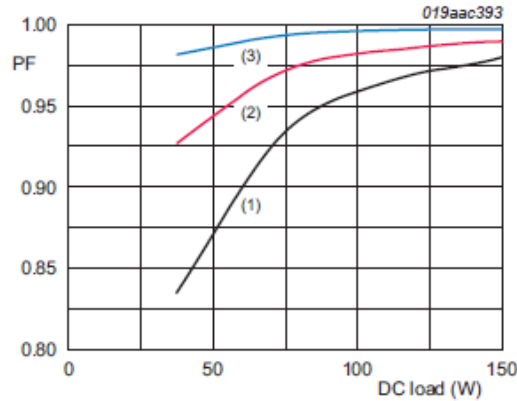
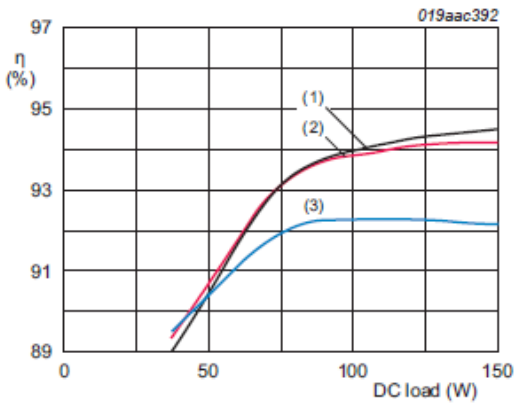
- Open pin detection @ pin FBctrl and Fbaux
- OCP
- OVP through FB aux winding (accurate)
- Time-out through pin FBctrl (auto restart)
- OPP - accurate Over Power Protection

▶ System

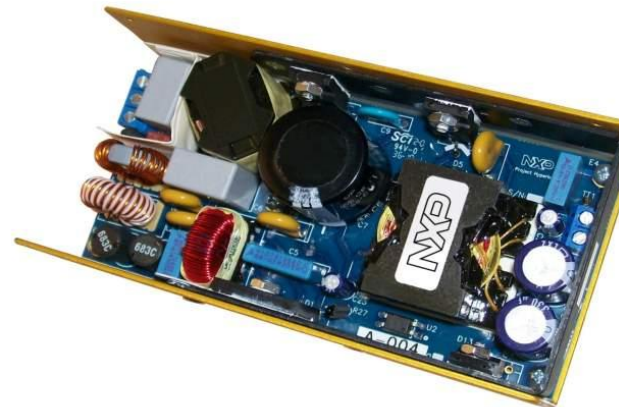
- Latch-pin with internal current-source
- Fast latch reset through pin Vi-sense
- Internal OTP at 140°C (typical value)
- Reduction of HV charge current after detection of protection to reduce input power in auto-restart mode

SSL4101

48 V/150 W demo board



- (1) 277 V (AC).
- (2) 230 V (AC).
- (3) 120 V (AC).



SSL4120

75 - 400W resonant controller with PFC for SSL Lighting



Description

The SSL4120 integrates a PFC and a Half-Bridge resonant Converter (HBC) controller for powers from 75 to 400 W. The PFC enables compliance for THD regulations. Constant Current Mode (CCM) and Constant Voltage Mode (CVM) outputs are supported.

Applications

- Indoor and outdoor high power LED applications
- High-bay and low-bay lighting
- Parking garage and area lighting
- Street lighting

Features

- Integrated PFC and HB controller
- Universal mains operation 90V to 305V
- PFC in boundary mode operation with on-time control
- High efficiency due to valley/zero voltage switching
- HBC burst mode switching
- Fully protected

Benefits

- Power supply for high power lighting applications
- High efficient >93%
- Low THD (<10%) and high PF (>0.97)
- Compact design
- Cost-effective

Ordering Information

- ✓ Datasheet
- ✓ Samples / demo boards
- ✓ Released





VALUE PROPOSITIONS

- ▶ Integrated PFC & controller For half bridge (HBC) resonant conversion
 - No external interface circuitry needed
 - Compact design
- ▶ High efficiency >93%, low THD <10% and high PF >0.97
- ▶ PFC
 - Boundary Mode Operation with on-time control
 - Valley/zero voltage switching for minimum switching losses
 - Frequency limiting to reduce switching losses
 - Accurate boost voltage regulation
 - Burst mode switching with soft start and soft stop
- ▶ HBC CONTROLLER
 - Integrated High-Voltage Level Shifter
 - Adjustable min and max frequency
 - Max. 500kHz HB switching frequ.
 - Adaptive non-overlap time
 - Burst mode switching



GENERAL FEATURES

- ▶ Universal mains supply operation (90V to 305VAC)
- ▶ Enable input (enable only PFC or both PFC and HBC controllers)
- ▶ On-chip High-Voltage start-up source
- ▶ Stand-alone operation of IC supplied from external DC source
- ▶ PFC frequency of 380kHz in compliance with THD regulations
- ▶ PFC in Boundary Conduction Mode with on-time control

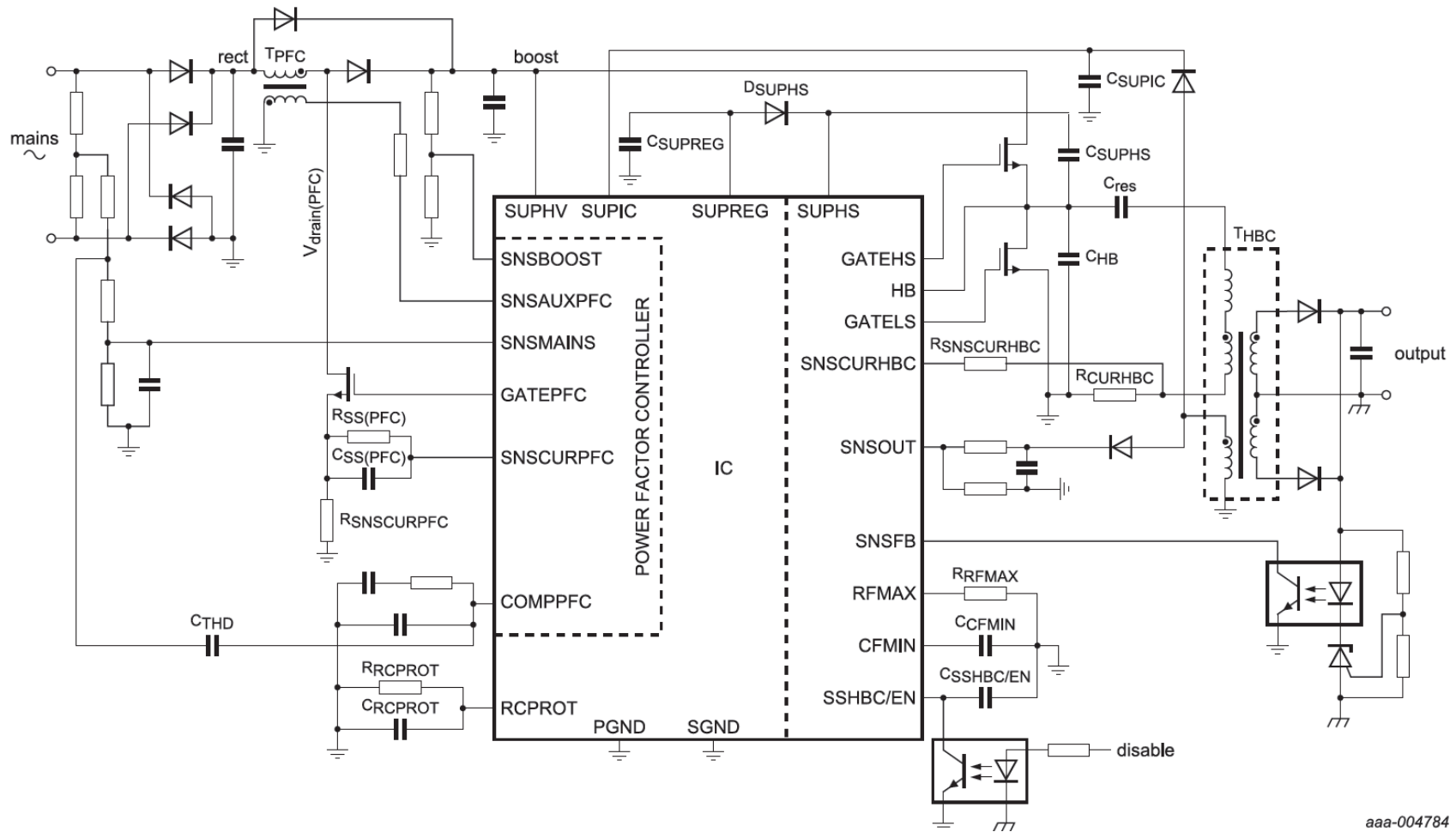


PROTECTION FEATURES

- ▶ Safe restart mode for system fault conditions
- ▶ General latched protection input for output overvoltage protection or external temperature protection
- ▶ Protection timer for time-out and restart
- ▶ OverTemperatureProtection (OTP)
- ▶ Soft (re)start for both controllers
- ▶ UnderVoltageProtection for mains (brownout), boost, IC supply and output voltage
- ▶ OverCurrent regulation and Protection (OCP) for both controllers
- ▶ Accurate OverVoltageProtection (OVP) for boost voltage
- ▶ Capacitive Mode Protection for HBC controller

SSL4120

Typical PFC + Resonant application



SSL4120

90 W demo board



Conditions	Efficiency (%)		
	$P_{O(min)}$	50 % $P_{O(nom)}$	100 % $P_{O(nom)}$
V_{mains}			
120 V; 60 Hz	51.5	90.3	90.9
230 V; 50 Hz	60	90.7	93.1
277 V; 50 Hz	61.5	90.4	93.2

Conditions	Power factor		
	$P_{O(min)}$	50 % $P_{O(nom)}$	100 % $P_{O(nom)}$
V_{mains}			
120 V; 60 Hz	0.3451	0.9643	0.9896
230 V; 50 Hz	0.1989	0.8993	0.9649
277 V; 50 Hz	0.1543	0.8027	0.9177

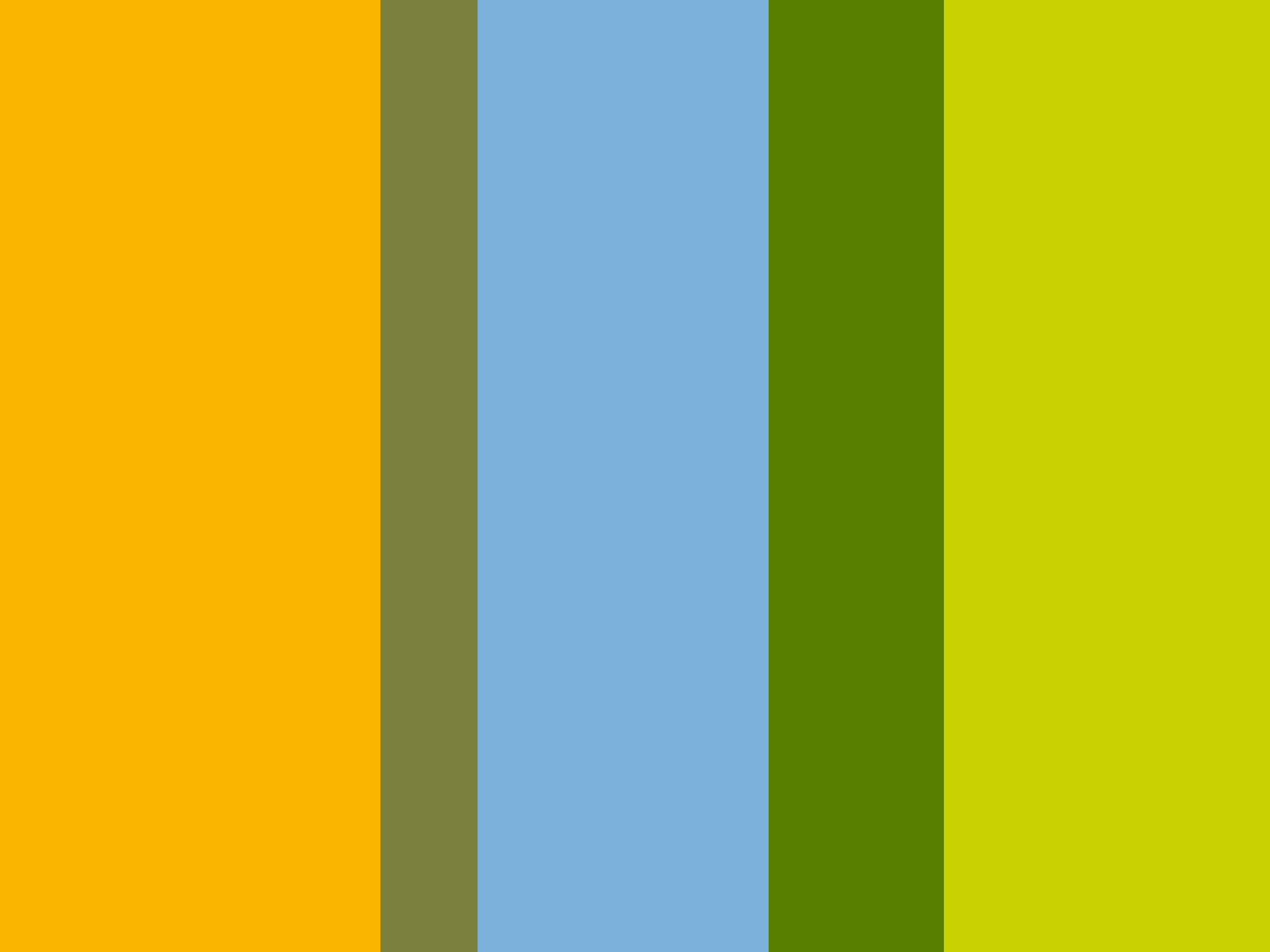
Conditions	ATHD (%)		
	$P_{O(min)}$	50 % $P_{O(nom)}$	100 % $P_{O(nom)}$
V_{mains}			
120 V; 60 Hz	52.95	9.95	5.76
230 V; 50 Hz	45.50	16.31	11.25
277 V; 50 Hz	37.21	24.35	17.72

SSL4101 & SSL4120

Comparison



	SSL4101	SSL4120
COMBI	PFC + Flyback	PFC + Half bridge resonant
PFC controller	Quasi resonant valley switching for universal mains	
Output controller	Flyback controller with quasi resonant valley switching	Resonant controller with zero voltage switching half bridge
Power range	25 - 150 W	75 - 400 W
Efficiency	High	Very high
Switches	PFC: 1 Flyback: 1 Output: 1	PFC: 1 Half bridge: 2 Output: 2
Package	SO16	SO24
Others	Low component count	Small; Thermal & EMI friendly



NXP Lighting driver IC Portfolio



- ▶ Non Dim SSL
 - SSL1523/23A
 - SSL21081/81A/83/83A, SSL2109/09A
 - SSL21101
 - SSL21151/53
- ▶ Mains Dim SSL
 - SSL2101/02/03
 - SSL21082/82A/84/84A, SSL2129A
- ▶ High Power SSL
 - SSL4101, SSL4120
 - UBA3070
- ▶ Non Dim CFL
 - UBA2021, UBA2024/24A/24B
 - UBA2211A/B/C, UBA2213A/B/C
 - UBA2212C
- ▶ Dim CFL
 - UBA20270/60
 - UBA20271/72/61/62
 - UBA2028
- ▶ HF-TL
 - UBA2014, UBA2015/15A/16A
 - UBA2017/17A
- ▶ HID
 - HID
 - UBA2035, UBA2036/37
 - UBA2080/80A/81

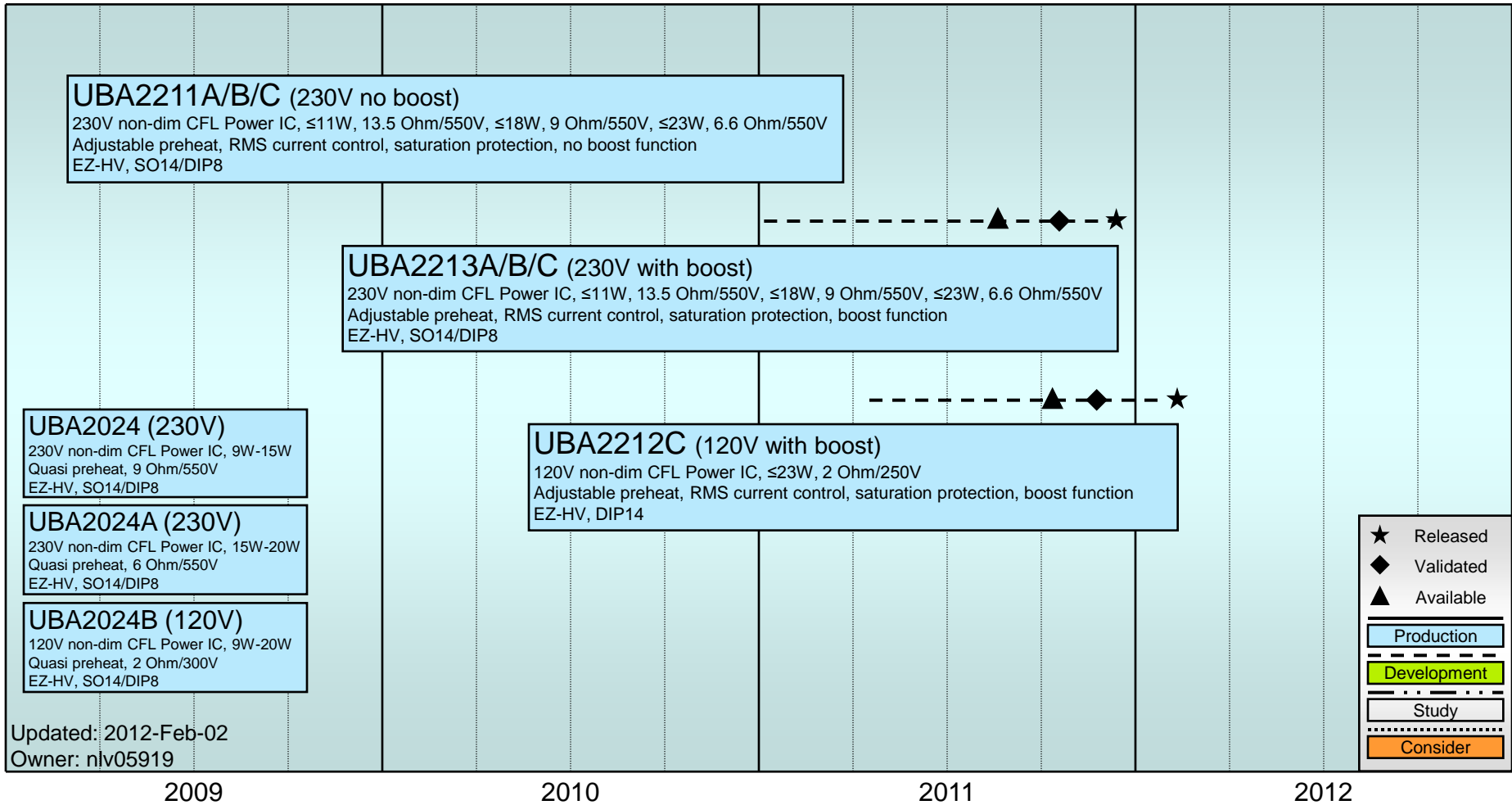
Black are focus products



Non-dimmable CFL

Non-dimmable CFL Power ICs

120V/230V versions with integrated MOSFETs



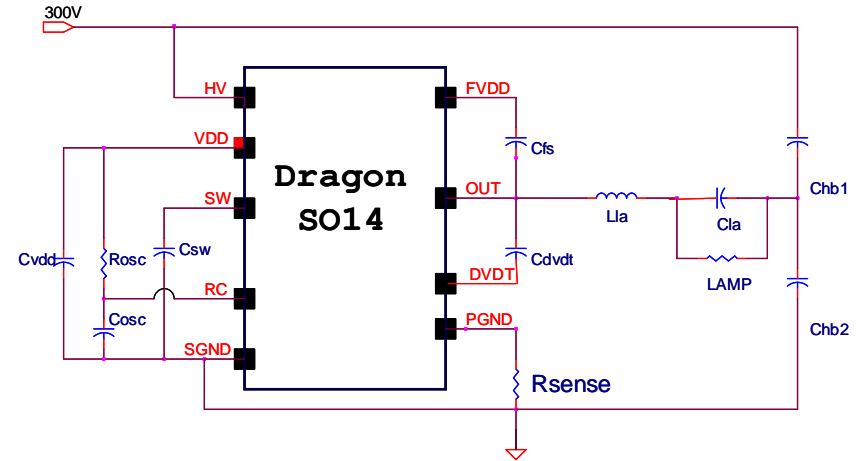
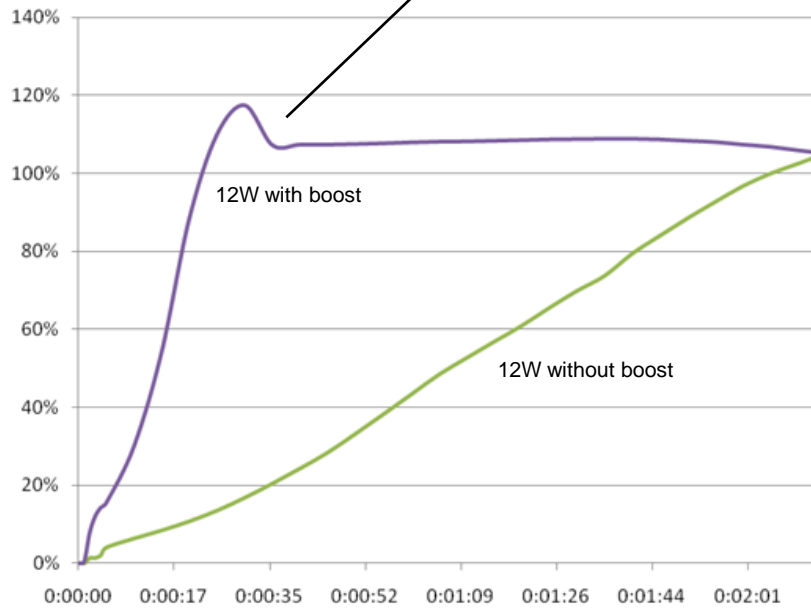
Value Propositions

Non-dimmable CFL



- ▶ **Maximized Number of Switching Cycles**
 - The current controlled preheat enables to maximize the switching cycles up to $> \times 50$ k.
- ▶ **Faster Light Output**
 - The boost function enables an, up to 5 times, shorter lamp warm-up time.
- ▶ **Shortest Switch-on Time**
 - The adjustable current controlled preheat enables a proper heating of the filaments in the shortest possible time ($\ll 1$ s).
- ▶ **Extended Lifetime and Reliability**
 - Due to the proper preheat, RMS current control and incorporated protections, a lifetime can be achieved up to 15 – 20 000 h.
- ▶ **Miniaturization**
 - Small form factor retrofit CFL lamps look like familiar incandescent bulbs, due to IC integration and coil saturation protection for smaller coils.

Boost Function



The run-up time becomes ~5 times faster due to the integrated boost function, which is important for (covered) amalgam CFLs.

Cost benefits IC based solutions



- ▶ BOM cost advantages compared to discrete solutions
 - No PTC for preheat
 - No auxiliary amalgam for shorter lamp warm-up time
 - Integration of components
 - Miniaturization of the lamp results in less materials
 - Power range with one PCB: A ($\leq 11\text{W}$), B ($\leq 18\text{W}$) and C ($\leq 23\text{W}$)
 - Pin-to-pin compatible IC family
- ▶ Less labor cost
 - For IC based solutions less resources are needed
- ▶ Less cost of non-quality
 - Suitable for mains variations and high ambient temperatures without failures, reduces e.g. the amount of field rejects within the warranty period
 - Improved line yield up to 10% with IC solution

Benefits (1/2)

IC based solutions



- ▶ Miniaturization
 - due to IC integration small CFL lamps can be developed.
- ▶ Innovation
 - an IC based solution radiates innovation, while using our GreenChip logo on the box of the lamps to reach the consumer's perception of high efficient & high tech products.
- ▶ Shorter Starting Time
 - the current controlled preheat enables a proper (maximized) heating of the filaments in the shortest time ($\ll 1$ s).
- ▶ Fast Light Out
 - a boost function results in a much faster warm-up time (depending on the boost ratio and burner specs approx. up to 5 times faster).
- ▶ Efficacy
 - Up to 10% more light output per watt

Benefits (2/2)

IC based solutions



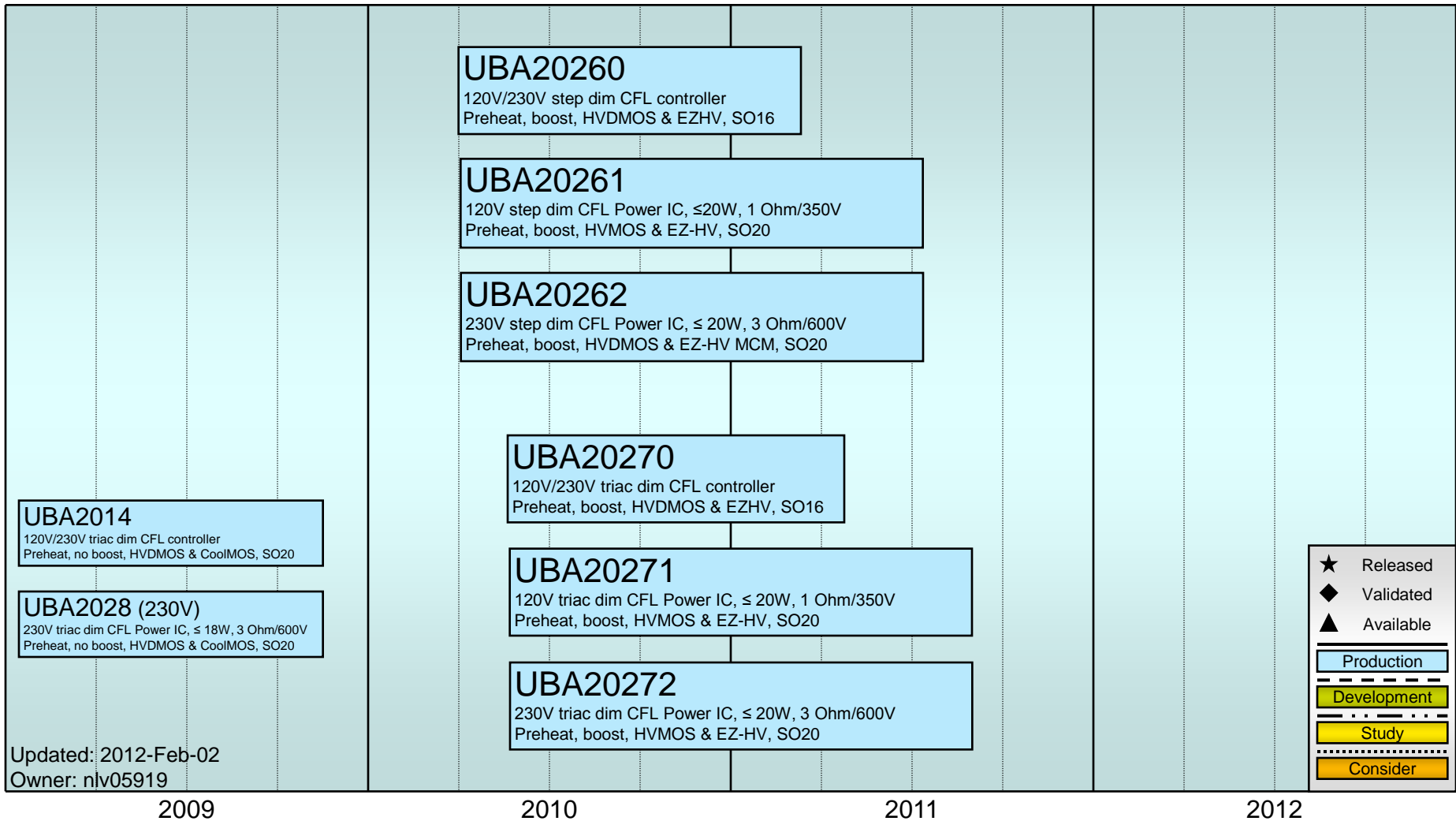
- ▶ Power Range
 - NXP offers a range of pin-compatible ICs with different power capabilities to enable a full range of CFL lamp powers, with limited SKUs.
- ▶ Extended Life Time
 - (1) the current controlled preheat enables to maximize the amount of switching cycles (>> 30k cycles).
 - (2) the RMS control loop drives the burner at its required preferred lamp power, independent of mains variations.
 - (3) there are fewer parts to go wrong, so bulbs last longer (approx. >15khours).
- ▶ First To Market
 - Close cooperation with NXP on releasing required new differentiating products together and developing the target lamps (in time) will enable our partner to be the first to the market.
- ▶ Regulations
 - NXP ICs enable compliance to EU directive, Energy Star and SuperCFL

The background features a light blue vertical bar on the left side. The rest of the page is divided into two main sections by a diagonal line: a dark green triangle in the top-left and bottom-left corners, and a large yellow area covering the top-right and bottom-right. The text 'Dimmable CFL' is centered in the yellow area.

Dimmable CFL

Step and Triac dimmable CFL ICs

120V/230V



- ★ Released
- ◆ Validated
- ▲ Available

Production
Development
Study
Consider



Value Propositions UBA2027x

Triac-dimmable CFL controller and Power IC family



- ▶ Deep dimming function (for standard phase cut dimmers)
 - ▶ Natural dimming curve by logarithmic correction, adjustable minimum dimming level
 - ▶ Deep dimming of lamp current (down to 2%)
- ▶ Boost function to get faster light out (shorter run-up time)
 - ▶ Fixed boost ratio of 1.5
 - ▶ Adjustable boost timing, dimmable during boost
- ▶ Preheat function to extend number of switching cycles
 - ▶ Adjustable preheat current and time
 - ▶ Fast and accurate current controlled heating of filaments
- ▶ Family approach
 - ▶ Power ICs for lamp powers up to 20W for 120V/230V
 - ▶ Controller-only version with external MOSFETs for more flexibility



Compliant with
Energy Star
**recommendations
for SuperCFL**

Value Propositions UBA2026x

Step-dimmable CFL controller and Power IC family



- ▶ Step dimming function (by standard ON/OFF switching)
 - ▶ 4 steps dimming (100%, 66%, 33% and MDL)
 - ▶ The Minimum Dimming Level is adjustable
- ▶ Boost function to get faster light out (shorter run-up time)
 - ▶ Fixed boost ratio of 1.5
 - ▶ Adjustable boost timing, dimmable during boost
- ▶ Preheat function to extend number of switching cycles
 - ▶ Adjustable preheat current and time
 - ▶ Fast and accurate current controlled heating of filaments
- ▶ Family approach
 - ▶ Power ICs for lamp powers up to 20W
 - ▶ Controller-only version with external MOSFETs for more flexibility



Compliant with
Energy Star

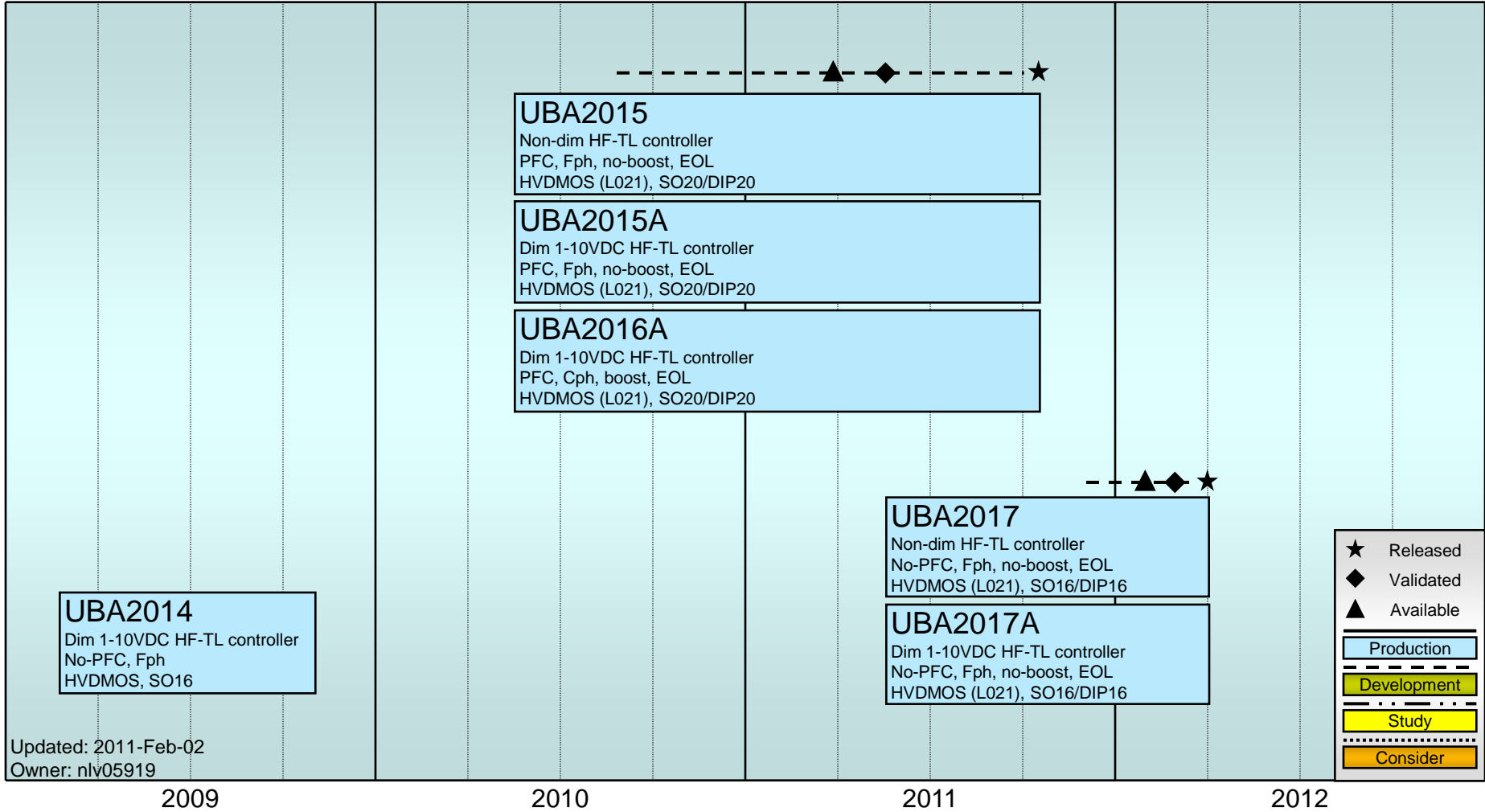
HF-TL UBA2015/16-family

Linear Fluorescent

Dimmable & non dimmable HF-TL controllers

Full Range

- With or without PFC
- Dimmable or non dimmable
- Frequency controlled or Current controlled Preheat
- Boost function and lamp current control
- End of Life protections



Value Propositions

HF-TL



- ▶ (Non-)dimmable HF-TL fluorescent lamp driver family with boost functionality
- ▶ PFC driver incorporated in UBA2015(A)/16A, but not included in UBA2017(A)
- ▶ Adjustable current controlled preheat to maximize the lamp life time
- ▶ Accurate lamp current control (+/- 1%)
- ▶ Protection mechanisms for safe operation of the fluorescent lamp under any abnormal operating conditions or lamp failure
- ▶ Cost-effective system solutions

Function and Feature Overview



Function / Feature	UBA2016A	UBA2015A	UBA2015	Advantage
Lamp boost	Yes			Reduced run-up time
Dimming	Yes	Yes		Energy harvesting and dimming
Lamp on detect	Yes	Yes		No flash at power on while dimmed
Current controlled preheat	Yes	Yes	Yes	Accurate lamp operation
Fixed frequency preheat		Yes	Yes	
Lamp current control	Yes	Yes	Yes	Accurate lamp operation without bus voltage ripple
Output to indicate burn state		Yes	Yes	Support switchable heater transformer circuit
Open/short protection on selected pins	Yes	Yes	Yes	Safety
Over temperature protection	Yes	Yes	Yes	Safety
SO and DIP package	Yes	Yes	Yes	More freedom in layout

UBA2016 Key Applications



- ▶ Supported ballast types:
 - Linear T4, T5, T8 and T12
 - Compact fluorescent
 - Dimmable fluorescent
 - Boost fluorescent
 - Multi lamp
 - Multi power
 - Lamp end-of-life (EOL) detection

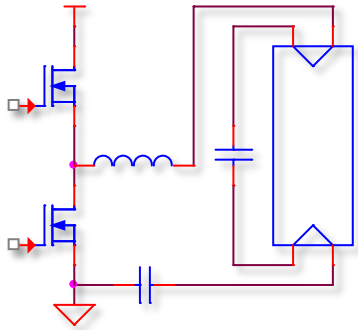


UBA2016 Application Landscape

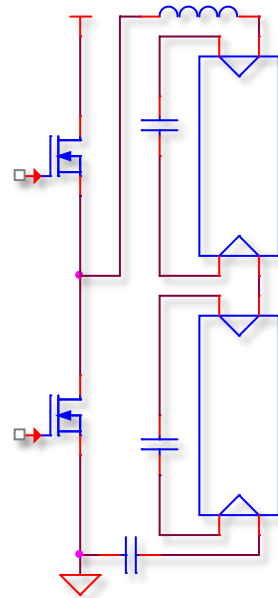


Supported lamp connections

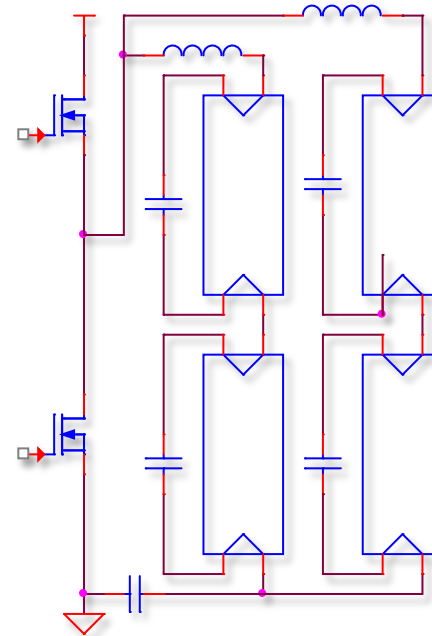
Single



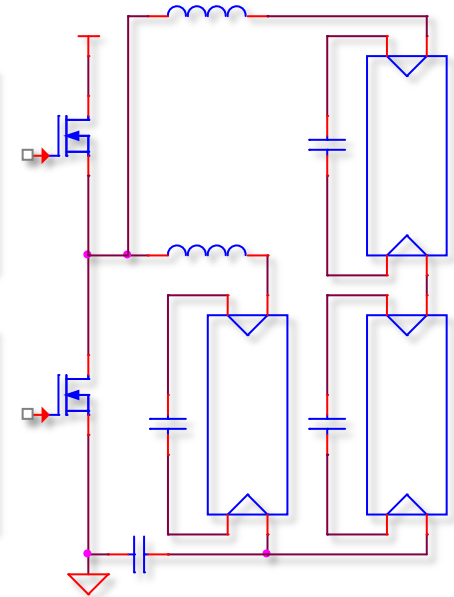
Series



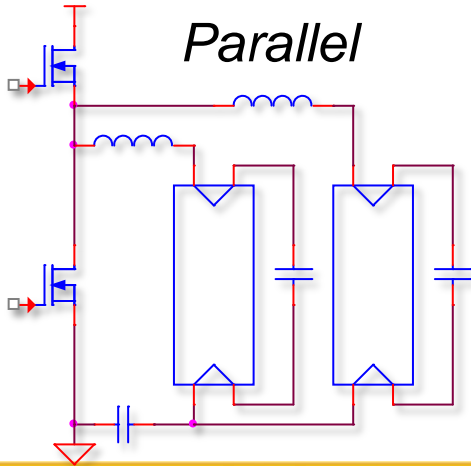
Series/parallel



Series/parallel



Parallel



Furthermore inductive heating (voltage mode) and "lamp to ground" is supported for all these topologies

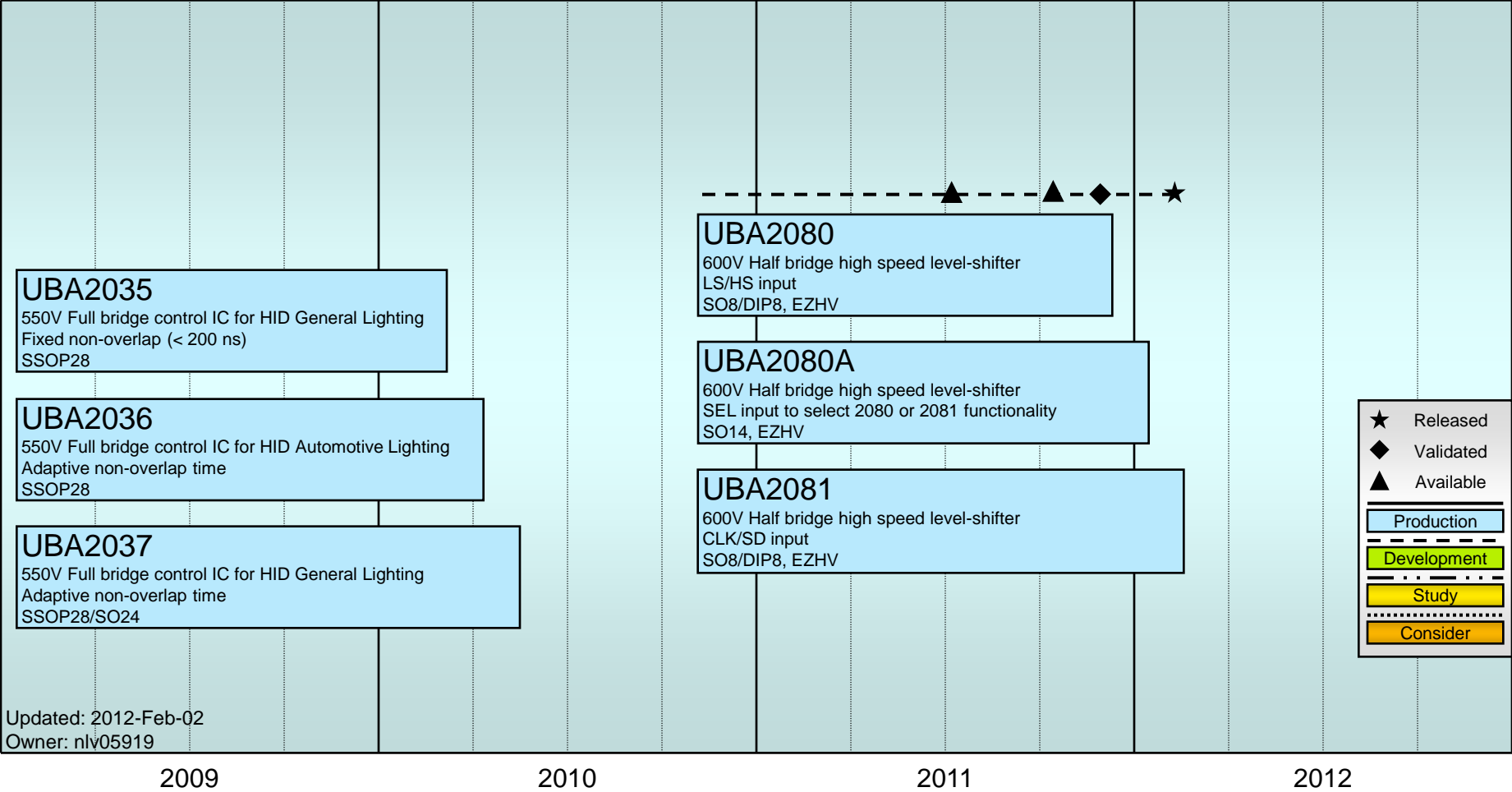


HID Drivers

- Full Bridge Drivers UBA2035/36/37
- Half Bridge Level Shifter UBA2080-family

HID / Level Shifters

Full bridge and half bridge drivers



Updated: 2012-Feb-02
Owner: nlv05919



Value Propositions

HID controllers



- ▶ High voltage monolithic ICs manufactured in a latch-up free High Voltage Silicon On Insulator (HVSOI) process.
- ▶ Integrated robust level shift function to drive HID lamps, even below ground level. These circuits are designed for driving MOSFETs.
- ▶ Full bridge HID driver family
 - UBA2035, non-overlap <200ns, 550V, projectors and general lighting, C&I
 - UBA2036, adaptive non-overlap, 550V, car headlights, automotive grade
 - UBA2037, adaptive non-overlap, 550V, projectors and general lighting, C&I
- ▶ Level Shifters, half bridge drivers
 - UBA2080(A), HS/LS input, fixed non-overlap time, 600V, SO8/SO14/DIP8
 - UBA2081, CLK/SD input, adjustable non-overlap time, 600V, SO8/DIP8

