

Digital Power Control – STNRG011



STNRG011
Features & Benefits

HW & FW
Details

System
Schematic

Ecosystem

STNRG011

Digital combo with all analog peripherals and integrated drivers for PFC and LLC converters

KEY FEATURES:

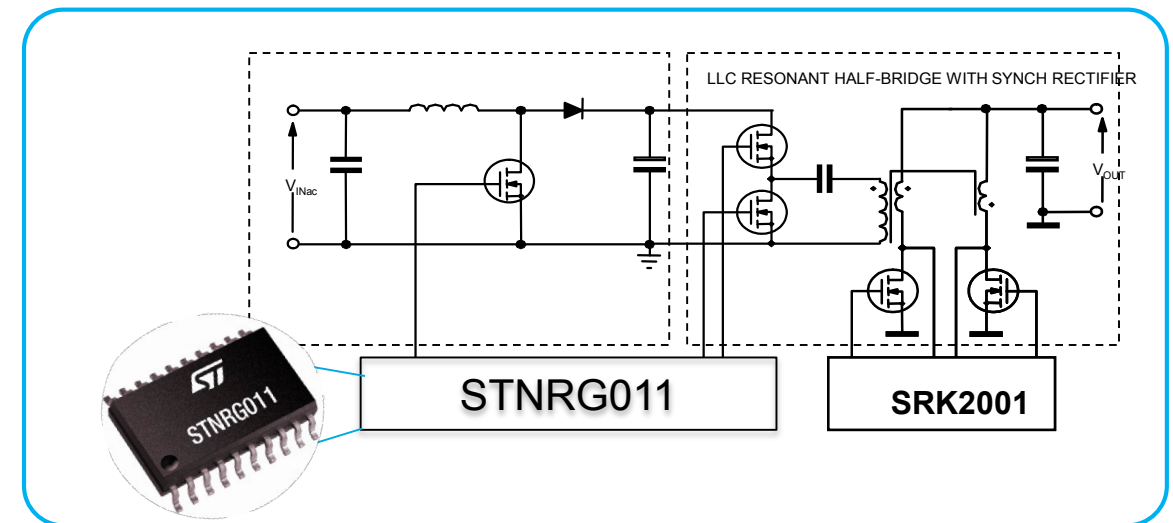
- 800V start-up circuit, line sense and Xcap discharge integration
- On chip HV Half Bridge and PFC drivers
- FTP memory for parameters customization
- Complete set of PFC and LLC protections
- UART interface for monitoring functions and black box recording
- Very low no load consumption (<100 mW)

PRODUCT CHARACTERISTICS:

- SO20 package
- Ramp Enhanced Constant-On-Time (RECOT) multimode PFC and Time Shift LLC controllers
- Enhanced burst mode

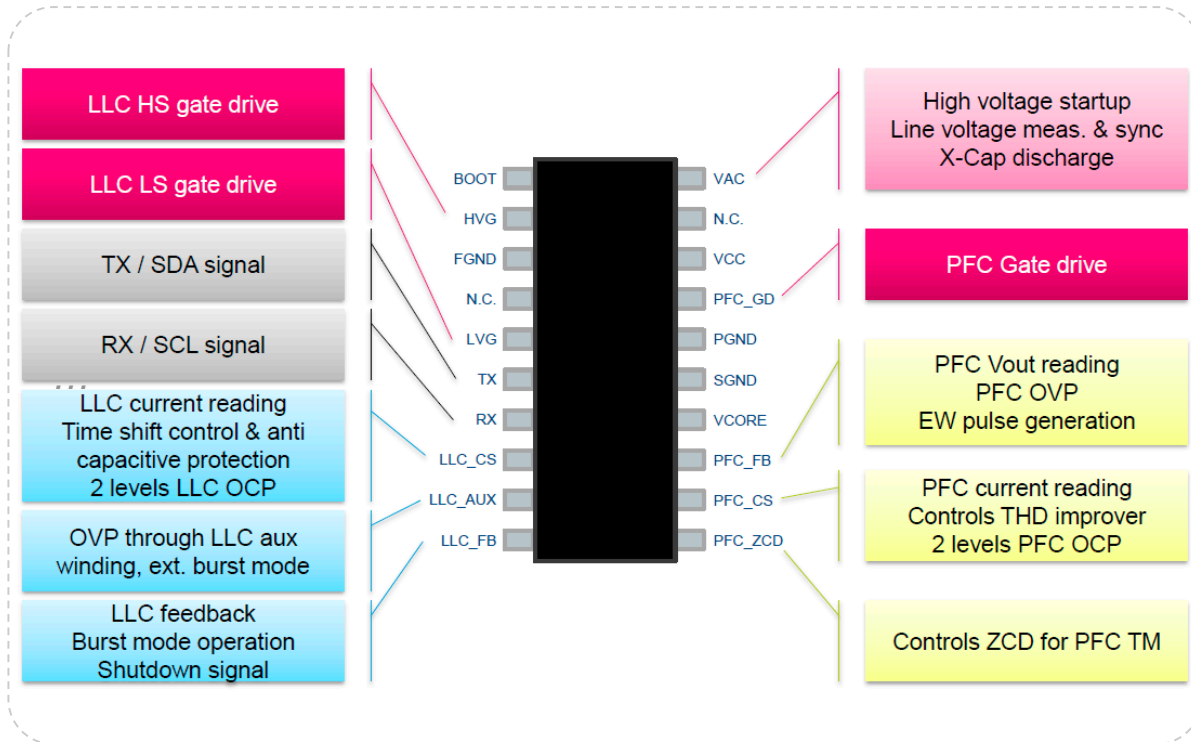
KEY BENEFITS:

- Flexible, ROM based solutions
- Smooth transition from analog to digital SMPS
- High efficiency, low BOM count
- Excellent no load consumption (<100 mW)



STNRG011 HW & FW Details

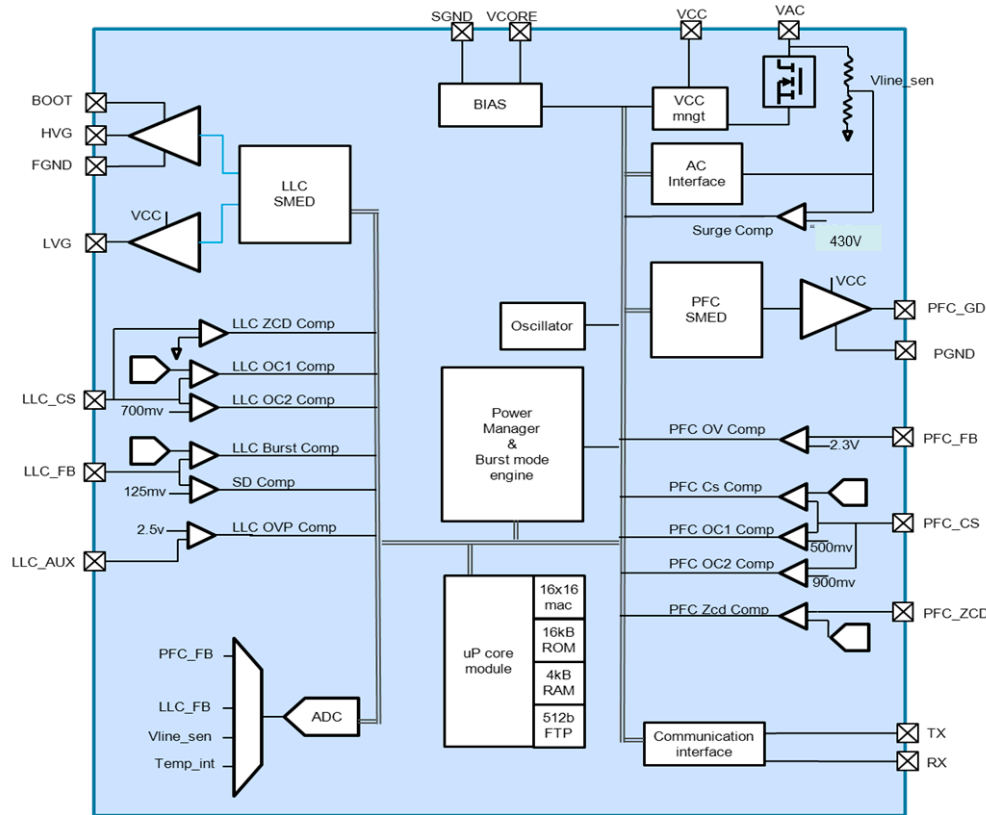
Highly Integrated Digital Combo Controller Ideal for 90W to 300W SMPSs



Device Inputs and Outputs

- On Chip HV&LV Drivers with 1A Peak Current
- 8 bit Core with 60MHz Clock
- 10 bit ADC with 15MHz clock, 1.5us Sampling Time
- Programmable State Machine for PWM Generation
- NVM Memory to Program Application Parameters
- UART&I2C Communication Interface

STNRG011 HW Details



ON-CHIP HV Half Bridge Driver

- Dedicated for LLC topology
- Up to 600V
- 1A Peak Current Drive Capability
- Matched Propagation Delays
- dv/dt immunity $\pm 50V/nsec$
- Integrated HV start up & AC line sense
- AC disconnection detection & Xcap discharge
- Brown out detection
- Surge detection

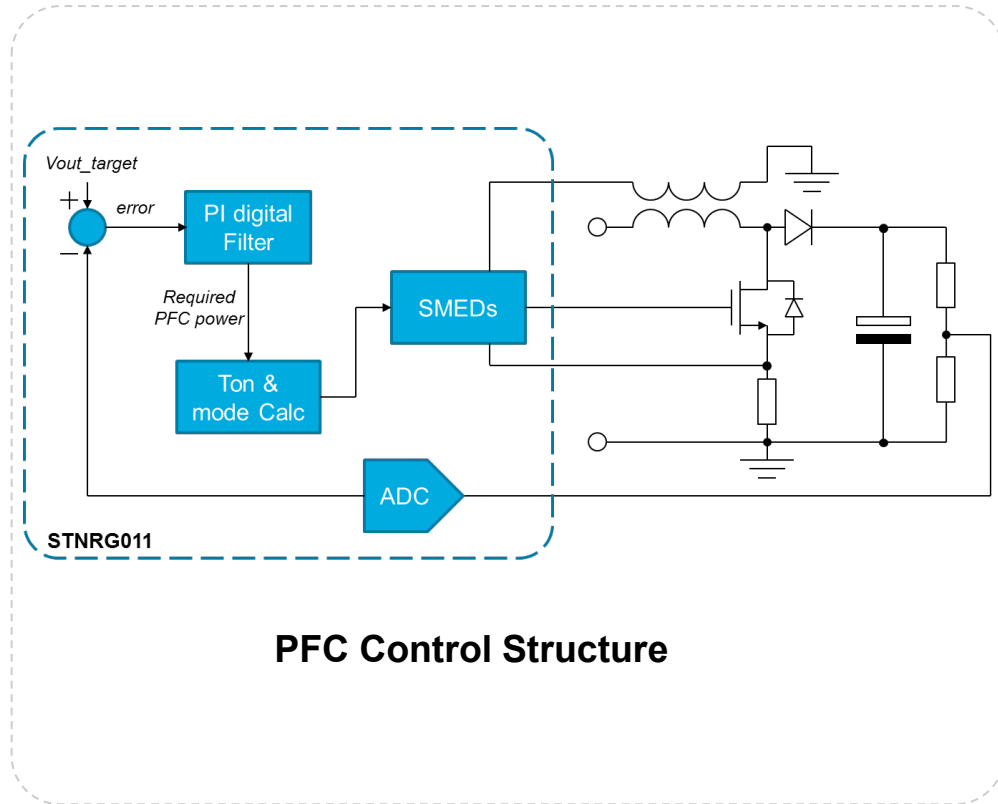
- Embedded μP
- 4 SMEDs (**S**tate **M**achine **E**vent **D**riven) for PWM generation
- Communication interfaces (UART & I2C)

ON-CHIP LV LS DRIVER

- PFC topology
- Up to 20V
- 1A Peak Current Drive Capability

STNRG011 FW Details: PFC Control

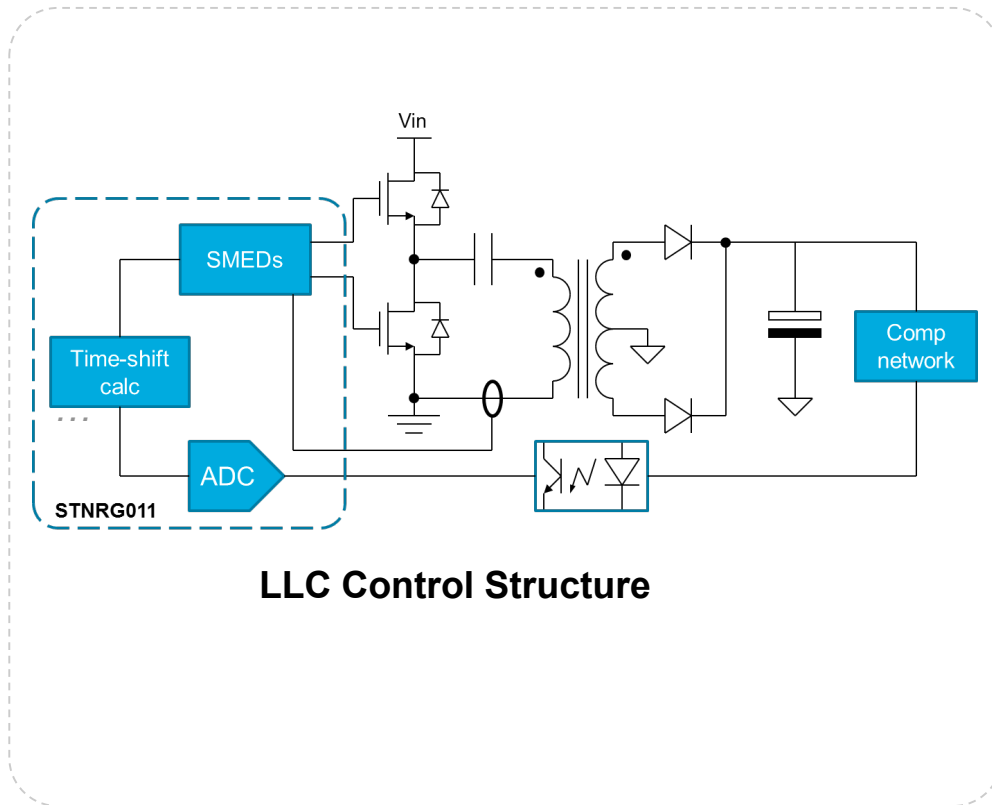
PFC Control Loop



- Digitally managed
 - V_{out} is converted through the ADC
 - Digital PI for voltage regulation
 - 2 coupled SMEDs generate the PWM signal
- Ramp Enhanced Constant On Time with 2 speed loop
 - Allows achieving very good PF & THD and dynamics
 - Ramp compensates input capacitive currents for high PF
- Multi mode operation
 - TM @ medium / high loads
 - TM, Valley skipping & skipping area @ low load
 - Burst mode @ very low load

STNRG011 FW Details: LLC Control

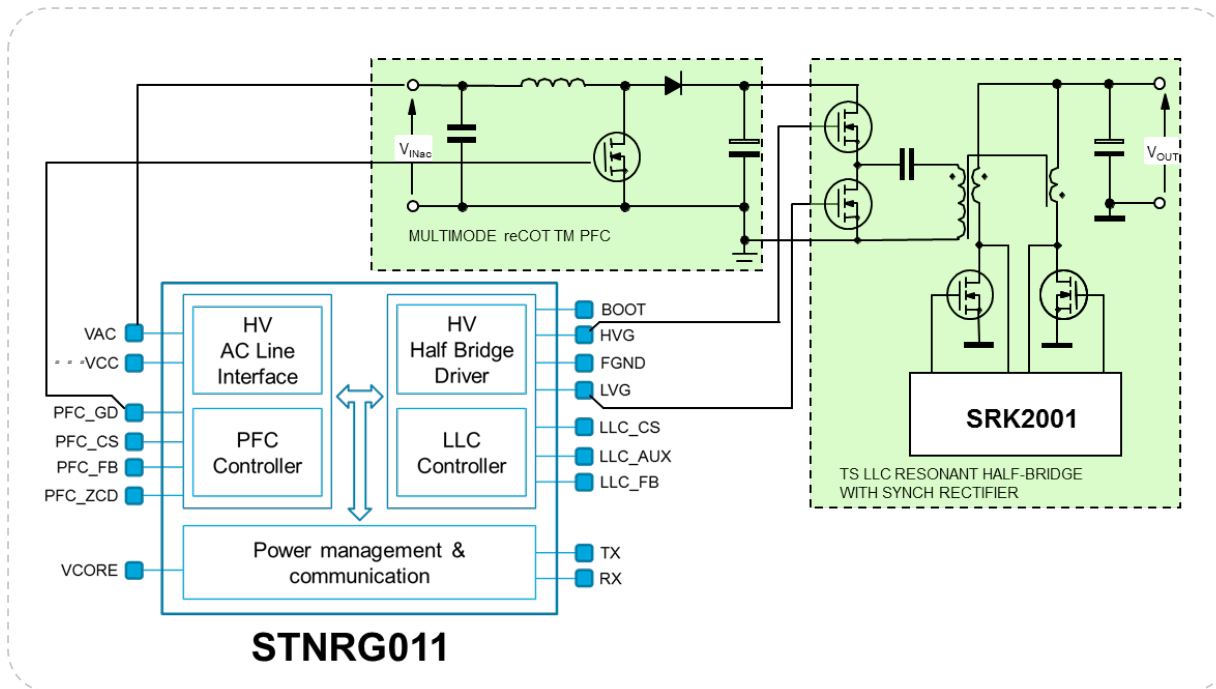
LLC Control Loop



- LLC Control managed in Mixed Mode
 - Compensation done on secondary side
 - ADC samples opto feedback
 - 2 coupled SMEDs generate the PWM signal
 - The internal ore calculates the Time Shift
 - SMEDs generate HS&LS gate signals
- Time Shift control
 - Improved dynamic performance
 - Easy compensation
 - Great input voltage ripple rejection (> 50dB)
- Advanced features & protections
 - Safe start
 - Anti Capacitive Protection
 - Over Current management
 - Burst Mode Operation driven by LLC

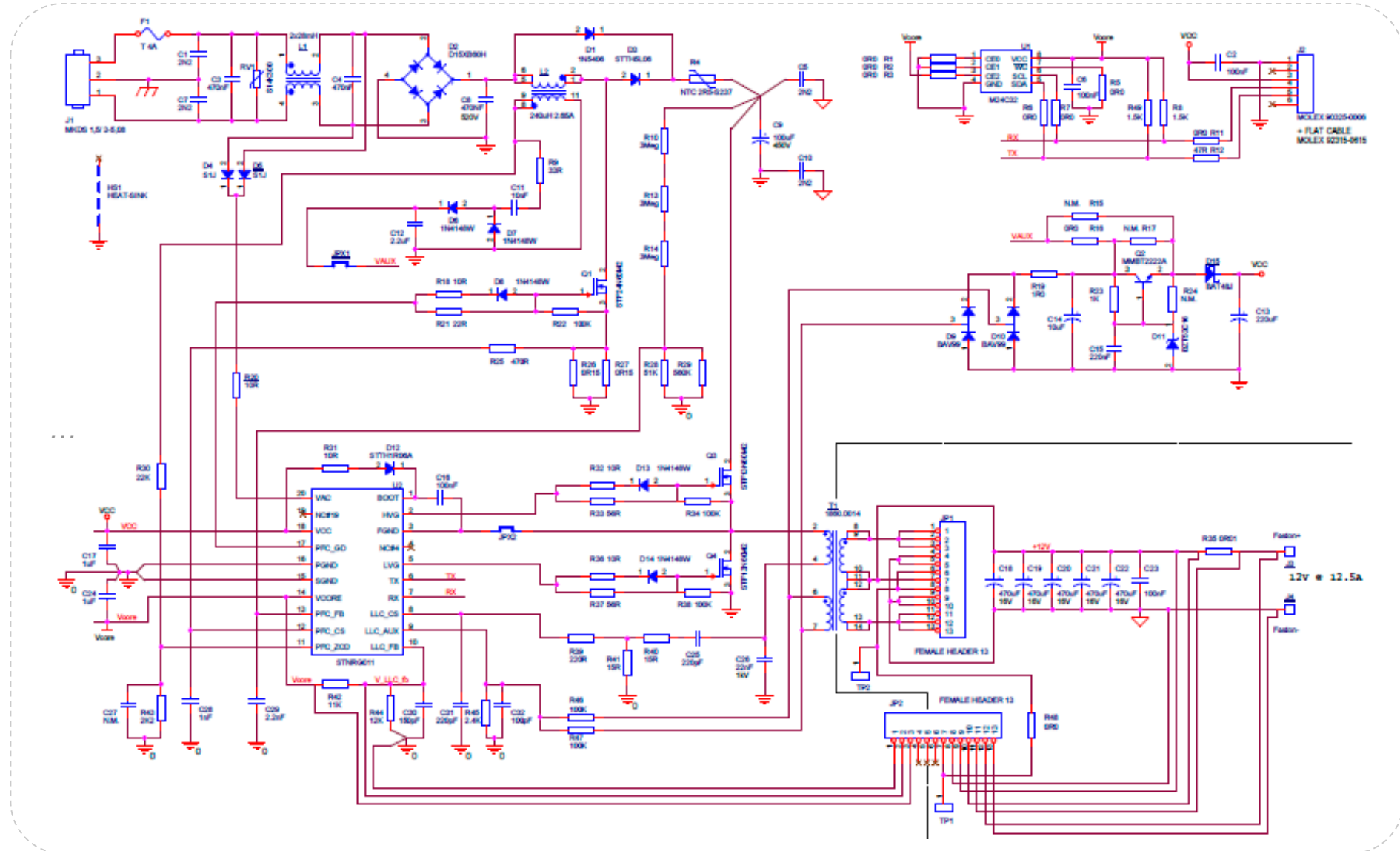
STNRG011 Schematic

High Performance and Low Components Count for Optimized BoM Cost



- Simplified Two Stage Digital SMPS Design
- High Efficiency Performance
- Low Components Count
- Less than 100mW Stand-by Power

150W-12V SMPS Schematic



150W SMPS Performance

115Vac	Vout	Iout	Pout	Pin	Eff	PF	THD
100mW	12.28	0.00887	0.108924	0.18	60.51%		
250mW	12.26	0.02082	0.255253	0.417	61.21%		
500mW	12.25	0.04178	0.511805	0.746	68.61%		
10%	12.03	1.2481	15.01464	17.95	83.65%		
20%	12.03	2.4975	30.04493	35.05	85.72%		
25%	12.03	3.1275	37.62383	43.11	87.27%		
50%	12.01	6.2418	74.96402	83.12	90.19%	0.984	6.10%
75%	11.99	9.3731	112.3835	122.99	91.38%		
100%	11.97	12.502	149.6489	163.66	91.44%	0.994	3.47%

No load	Pin
115 Vac	70 mW
230 Vac	93.4 mW

Excellent no load consumption!

4 points avg

90.03 %

230Vac	Vout	Iout	Pout	Pin	Eff	PF	THD
100mW	12.27	0.00887	0.108835	0.232	46.91%		
250mW	12.26	0.02087	0.255866	0.421	60.78%		
500mW	12.24	0.04179	0.51151	0.737	69.40%		
10%	12.02	1.2496	15.02019	17.48	85.93%		
20%	12.03	2.5125	30.22538	34.89	86.63%		
25%	12.03	3.1275	37.62383	42.44	88.65%		
50%	12.01	6.1237	73.54564	80.71	91.12%	0.933	8.55%
75%	11.99	9.3731	112.3835	121.47	92.52%		
100%	11.97	12.503	149.6609	161.07	92.92%	0.982	2.55%

4 points avg

91.30 %

150W SMPS Performance Check

Eu Coc 5 EPS Tier 2	Limits	Result 115Vac	Result 230Vac	Status
4 points avg	> 0.89	0.900	0.913	Pass
Eff @ 10%	> 0.79	0.836	0.859	Pass
No load	< 0.15 W	0.07	0.0934	Pass

Energy star 6.0 for computer	Limits	Result 115Vac	Result 230Vac	Status
Eff @ 20%	> 0.82	0.857	0.866	Pass
Eff @ 50%	> 0.85	0.902	0.911	Pass
Eff @ 100%	> 0.82	0.914	0.929	Pass
PF @ 100%	> 0.9	0.994	0.982	Pass

DOE – EISA 2007 (from 2016)	Limits	Result 115Vac	Result 230Vac	Status
4 points avg	> 0.88	0.900	0.913	Pass
No load	< 0.15 W	0.07	0.0934	Pass

ErP Lot 7	Limits	Result 115Vac	Result 230Vac	Status
4 points avg	> 0.87	0.900	0.913	Pass
No load	< 0.5 W	0.07	0.0934	Pass

STNRG011 Ecosystem

A Complete Set of Tools is Available to Ease Design and Testing



Maximum efficiency: state of the art algorithms for PCF & LLC

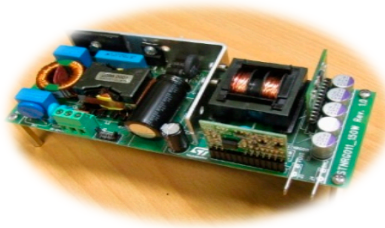


Communication: programmability and data monitoring



Fully Integrated solution: HV start-up & drivers

150W-12V adapter based on STNRG011 and SRK2001



GUI interface for easier configurability



STNRG011

Samples available

Board prototype available

Industrial PS



All-in-One



High power adapters



- 150W Wide Range, 12V/12.5A Evaluation Board:
EVLSTNRG011-150
- Interface Board for PC Connection
- PC GUI

