



# Ultra low power converters



**High Voltage Converters**  

**Compact Bill of Materials**  

**Energy Saving Solutions**  

**High Voltage Systems**  

# VIPerPlus family of ultra low power converters

Integrated AC/DC SMPS Controller and High Voltage MOSFET

## Highlights

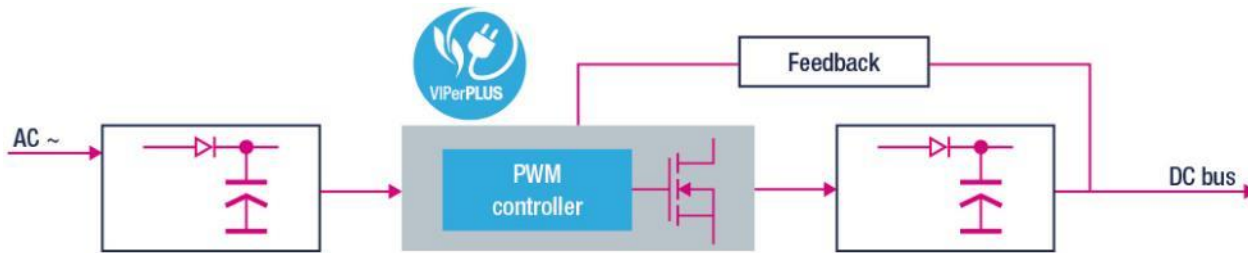
- Feature rich products for all applications
- Embedded 1050V, 800V, or 730V AR MOSFET
- A complete long term AC/DC solution





# VIPerPlus at a glance

## High Voltage Converter for AC-DC SMPS



## Bring a PLUS in your design

Low stand-by power as lower than 4 mW @ 265V<sub>AC</sub> in standby

Up to 1050 V AR MOS & protections

Versatile product family for nearly any application

Supports isolated and non-isolated topologies

Advanced controller for effective BoM

## Broad Application Experience



Home Appliances



Smart Meters



Home Automation



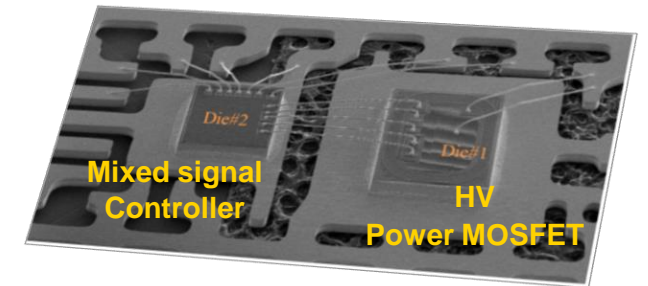
Lighting



Industrial



Power Adapter





# 730/800V/1050V to best fit your application

		Buck Converter		150 mA	200 mA	350 mA	
Buck & Fly-back	Zero Power Mode, 5V VCC Fixed Frequency, Jittering, E/A inside				VIPer0P		
	5V VCC, Input OVP/UVP, 10mW STB Fixed Frequency, Jittering, E/A inside	VIPer01	VIPer11				VIPer31*
	Fixed Frequency, Jittering 30mW STB, E/A inside	VIPer06	VIPer16			VIPer26 VIPer26K 1050V	
	Minimal BOM, Fixed Frequency, Jittering, E/A inside, 40 mW STB		VIPer12 730V		VIPer22 730V		
Fly-back	Quasi Resonant Brown-out, 30 mW STB					VIPer25	VIPer35
	Fixed Frequency, Jittering, Brown-out, 30mW STB		VIPer17			VIPer27	VIPer37
	Fixed Frequency, Jittering, Peak Power, 30mW STB					VIPer28	VIPer38
Fly-back Converter 85-265VAc		4 W	6 W	7 W	8 W	12 W	15 W



\* VIPer31 is under development, samples available





# A complete long term solution

## VIPerPLUS is more than a product



**SERVICE  
WITH  
QUALITY**

**12 Weeks average LT**  
**1Bu shipped YTD**  
**200+ Served Customers**  
**1 PPM in last 3Y**




**TECHNOLOGY**

**ROBUST MOSFET**  
800V & 1050V  
avalanche rugged


**SMART CONTROLLER**  
Integration allows  
minimized BoM

**SMALL PACKAGES**  
SMD and THD




**ECOSYSTEM**

**Design Tool**  
**Transformer Design**  
**Spice Models**  
**Application Notes**  
**>50 Evaluation Kits**



[st.com/viperplus](http://st.com/viperplus)



**BENEFITS**

**Robustness**  
**Efficiency**  
**Stand-by**  
**EMC Immunity**  
**Compactness**  
**Power Expertise**



# A compact bill of materials

## VIPer122 and VIPer 222 family for low power AC/DC converters

### Highlights

- Feature dense
- Optimized for low power AC/DC SMPS
- Small BOM for efficient designs





# Optimized for low power PSU

## Minimize BOM with VIPer122/222 family



- KEY FEATURES
  - 730 V AR integrated primary MOSFET
  - Embedded HV start up (730V)
  - PWM current mode controller
  - Fixed frequency (30 or 60kHz) with jittering
  - Embedded E/A for direct feedback
- KEY BENEFITS
  - Small EMI filter
  - Stand-by lower than 40mW @ 230VAC
  - Protections (short circuit & Thermal)
  - Few component counts and small PCB
  - Small package (SSO10)

Home Appliances



Smart Home

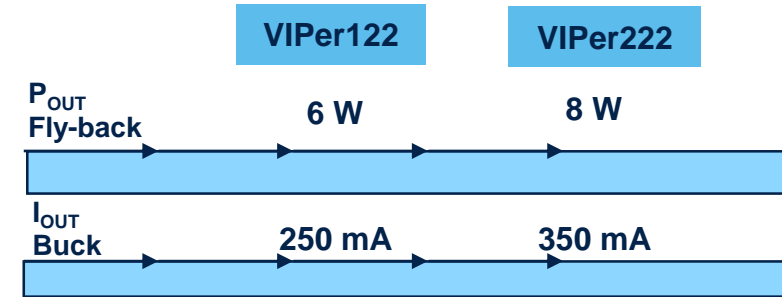
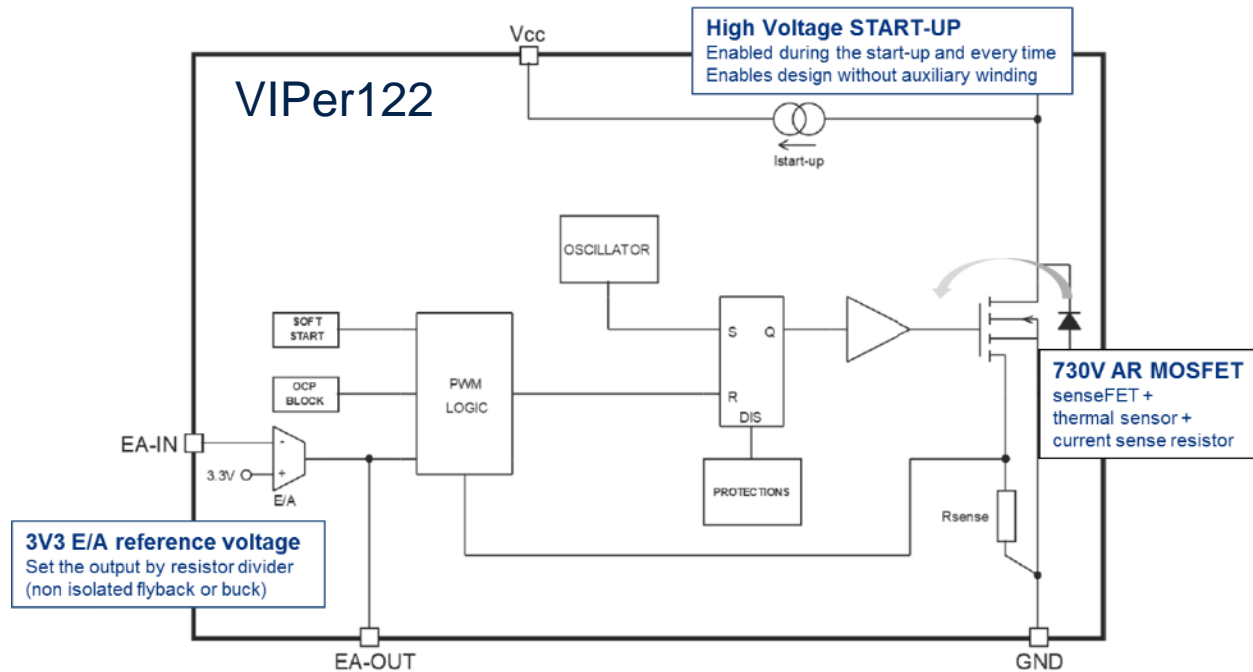
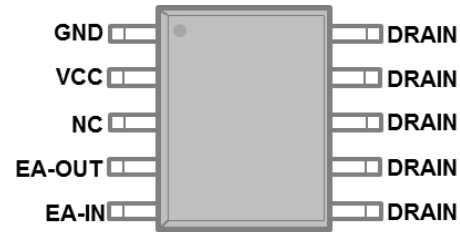


Smart Metering





# VIPer122 and VIPer222 low power AC/DC converters



Parameter	VIPer122	VIPer222
$B_{VDSS}$ [V]		730
Max $R_{DSon}$ [ $\Omega$ ]	27 max.	15 max.
$I_{LIM}$ [A]	0.45	0.62
$V_{CC}$ [V]	11.5 to 23.5	4.5 to 30
$V_{DRAIN\_START}$ [V]	45	26
$F_{OSC}$ [KHz]	30/60 $\pm$ 7% Jittering	30/60 $\pm$ 7% Jittering
E/A Reference Voltage [V]	3.3	1.2

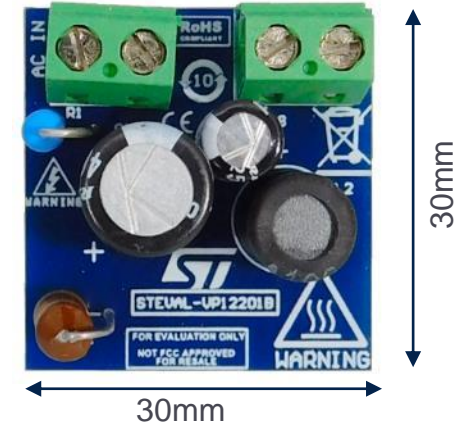
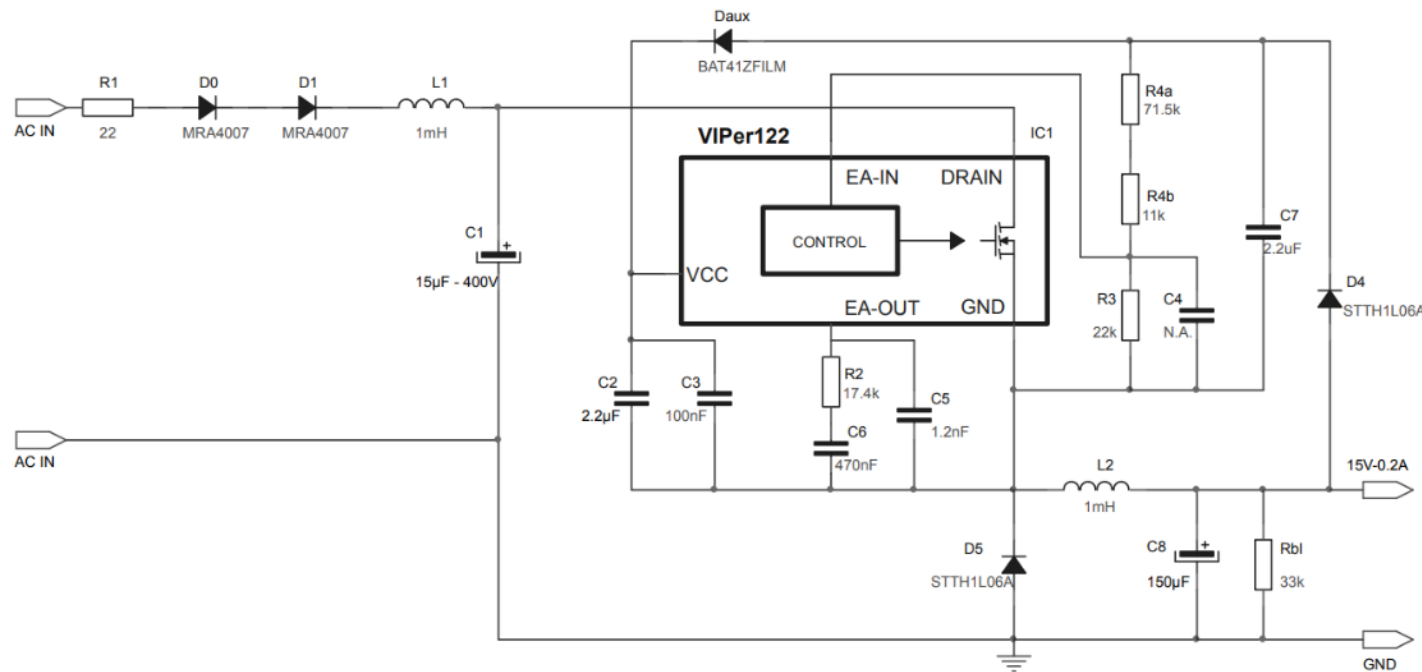






# Efficient design produces compact supplies

3W AC/DC power supply in just 9 cm<sup>2</sup>

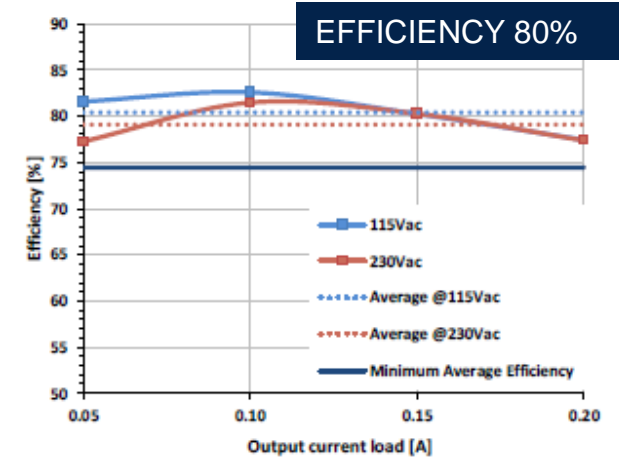
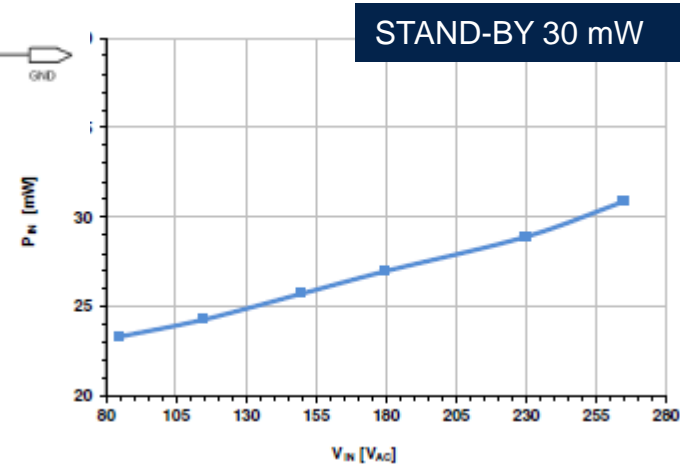
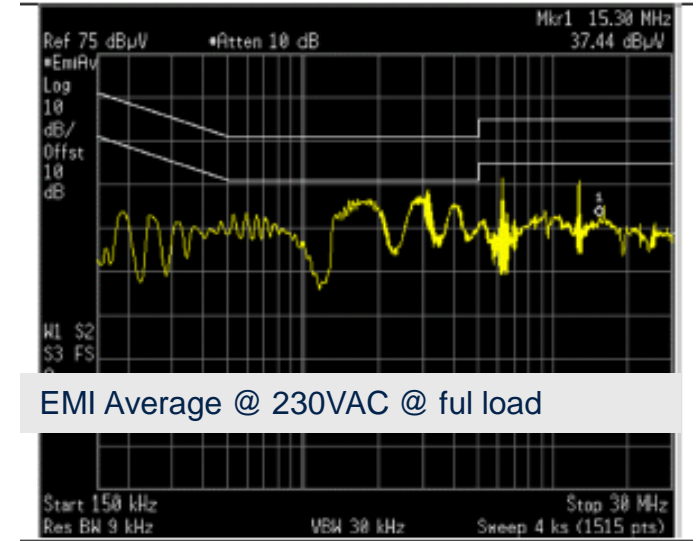
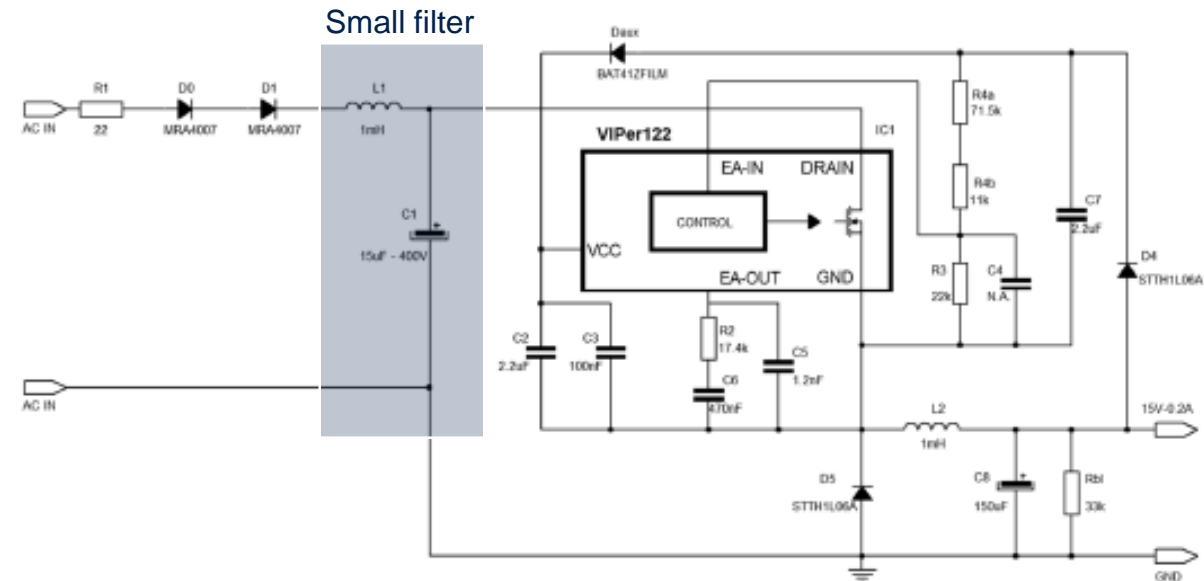


Parameter	STEVAL-VP12201B
Device	VIPER122
Input Voltage	85 – 265 V <sub>AC</sub>
Output Voltage	15V
Output Current	200mA
Average Efficiency	> 77%
Stand-by consumption	< 30mW @ 230VAC
EMI	IEC55022 Class B
Solution Size	30 x 30 mm



# Excellent EMI and efficiency with minimal components

STEVAL-V12201B 15V @ 200mA





# Energy saving SMPS solutions

**Minimize standby energy consumption with VIPerPlus**

## Highlights

- Less than 10mW standby power consumption
- Versatile devices for ultra-wide operating range
- Zero Power products lead the industry in savings



# VIPer01/11/31 family

**High efficiency to comply with the most stringent energy saving regulations**



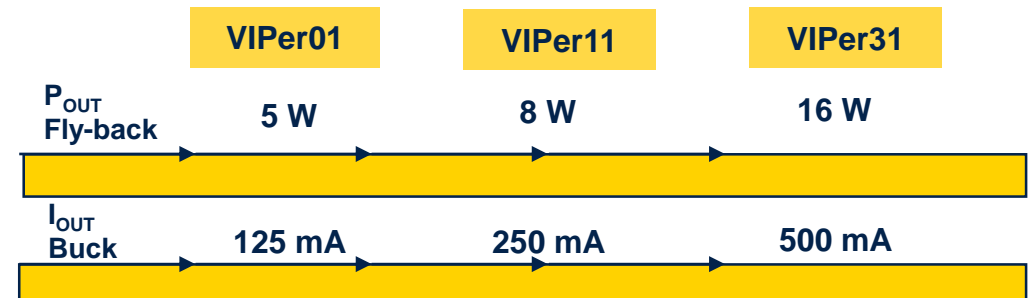
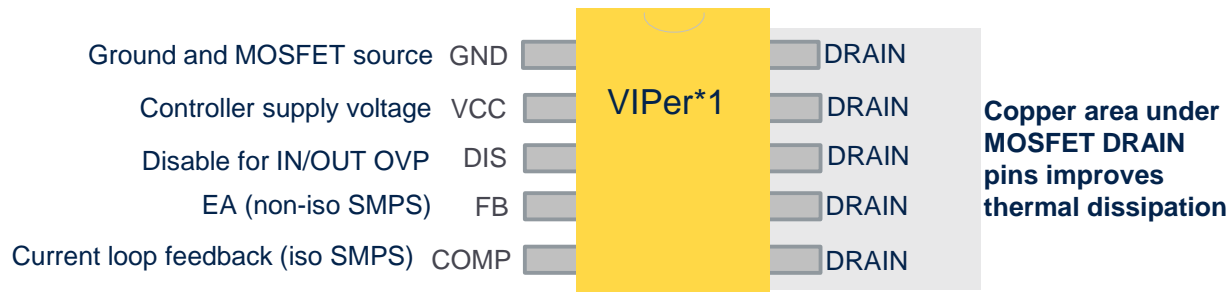
**Building Automation**  
**Home Appliances**  
**Auxiliary Industrial**  
**Metering**



- **KEY FEATURES**
  - Pulse frequency modulation
  - 800 V AR integrated primary MOSFET
  - Fixed frequency (30 or 60kHz) with jittering
  - Input over and undervoltage protection
  - Output over current protection
- **KEY BENEFITS**
  - Less than 10mW standby consumption
  - Integrated solution for reduced BoM
  - Small filter components and low EMI
  - Operation over varying conditions
  - High reliability for long SMPS lifetime



# Energy saving devices with wide operating range



Parameter	VIPer01	VIPer11	VIPer31
$B_{VDSS}$ [V]		800	
Max $R_{DSon}$ [ $\Omega$ ]	30	20	4.5
$V_{CC}$ [V]		4.5 - 30	
$V_{DRAIN\_START}$ [V]	18	25	30
$F_{OSC}$ [KHz] Three options	30/60/120 $\pm$ 7% Jittering		
$I_{Dlim}$ [mA] Three options	120 / 240 / 360	370 / 480 / 590	700 / 850 / 1000

## Tools

eDesign suite simulator on [st.com](http://st.com)

Spice Models available on [st.com](http://st.com)

Evaluation kits:

- STEVAL-ISA177V1 (flyback 4.25W VIPer01)
- STEVAL-ISA178V1 (buck 5V/200mA VIPer01)
- STEVAL-VP013B1B (buck 5V/100mA VIPer01B)
- STEVAL-ISA195V1 (buck 5V/350mA VIPer11)
- STEVAL-ISA196V1 (flyback non-iso 6W VIPer11)
- STEVAL-ISA197V1 (flyback iso 6W VIPer11)

# VIPer01-VIPer11-VIPer31 ecosystem

## Smart Designing with VIPerPlus

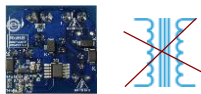
### Buck converters 5V- 350mA

**STEVAL-ISA195V1**

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 5V$  (non iso)
- $I_{OUT1} = 0.35 A$

**AN5081**

**VIPER115XS (30kHz)**



### Fly-back converters 12V 7.8W@85-265VAC

**STEVAL-ISA197V1**

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 12V$  (iso)
- $I_{OUT1} = 0.65 A$

**AN5057**

**VIPER114LS (60kHz)**



### 15V 18W@85-265VAC

**STEVAL-VP318L2F\***

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 15V$  (non-iso)
- $I_{OUT1} = 1.2 A$

**AN5057**

**VIPER318LS (60kHz)**



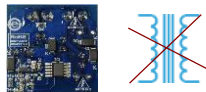
### 5V- 200mA

**STEVAL-ISA178V1**

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 5V$  (non iso)
- $I_{OUT1} = 0.200 A$
- $T_{AM} = 60^{\circ}C$

**AN4858**

**VIPER013XS (30kHz)**



### 5V-6W@85-265VAC

**STEVAL-ISA196V1**

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 5V$  (non iso)
- $I_{OUT1} = 1.2 A$

**AN5072**

**VIPER114LS (60kHz)**



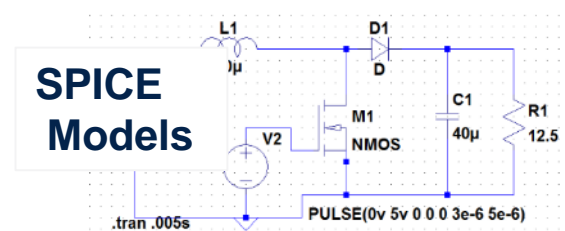
### 5V-6W@85-265VAC

**STEVAL-ISA177V1**

- $V_{IN} = 85 \sim 265 V_{AC}$
- $V_{OUT1} = 5V$  (non iso)
- $I_{OUT1} = 0.85 A$

**AN4855**

**VIPER013LS (60kHz)**





# Industry leading standby power with VIPer0P

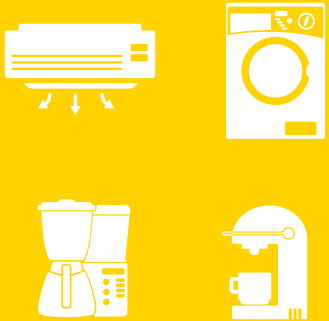
## Smart power management with Zero Power Mode



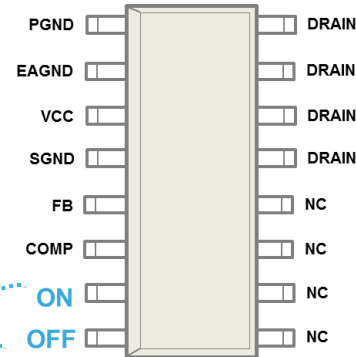
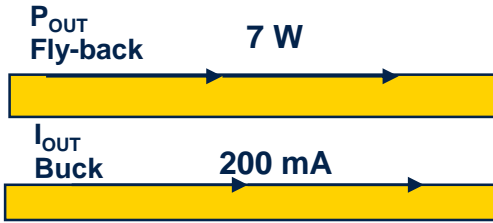
- Zero Power Mode
  - $< 5\text{mW}$  power consumption
  - Can be managed through MCU or buttons
  - Mechanical switch no longer required
- High Performance SMPS
  - 800V avalanche rugged power MOSFET
  - Wide input supply voltage
  - Integrated error amplifier
  - Precise



### Smart Appliances



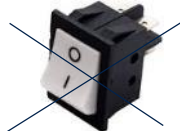
# VIPer zero power



Parameter	VIPer0P
$B_{VDSS}$ [V]	800
Max $R_{DSon}$ [ $\Omega$ ]	20
$V_{CC}$ [V]	4.5 - 30
$F_{OSC}$ [KHz] Two options	60/120 $\pm$ 7% Jittering
$I_{Dim}$ [mA]	400

## Smart SMPS Turn OFF & Turn ON

- OFF and ON pin driven by MCU
- No auxiliary voltages during the Zero Power Mode (OFF mode)
- MCU supplied by IC (ON pin) during the Zero Power Mode

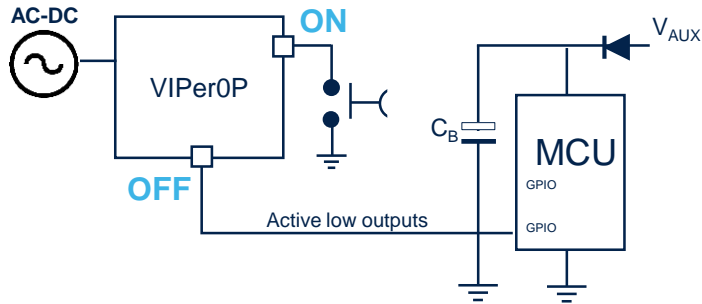


No need of HV Switch/Relay connected to the main line

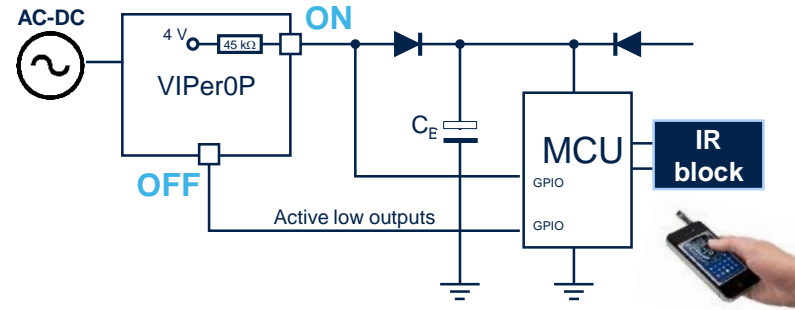


# Smart stand-by applications for VIPer0P

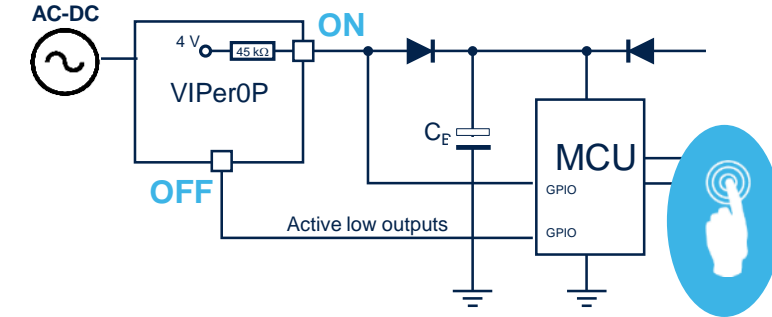
## Tactile Button



## Remote control



## Touch Panel



**STEVAL-ISA174V1  
AN4836**

VIPer 0P

### Fly-back converter:

- $V_{IN} = 85 \text{ to } 265 \text{ V}_{AC}$
- $P_{OUT} = 7 \text{ W}$
- $V_{OUT1} = -5 \text{ V}$
- $I_{OUT1} = 0.84 \text{ A}$
- $V_{OUT2} = 7 \text{ V}$
- $I_{OUT2} = 0.4 \text{ A}$



**STEVAL-ISA181V1  
AN4940**

VIPer 0P

### Fly-back converter:

- Isolated
- $V_{IN} = 85 \text{ to } 265 \text{ V}_{AC}$
- $P_{OUT} = 7.2 \text{ W}$
- $V_{OUT} = 12 \text{ V}$
- $I_{OUT} = 0.6 \text{ A}$



**STEVAL-ISA192V1  
AN4941**

VIPer 0P

### Flyback converter:

- $V_{IN} = 85 \text{ to } 265 \text{ V}_{AC}$
- $P_{OUT} = 7 \text{ W}$
- $V_{OUT1} = -5 \text{ V}$
- $I_{OUT1} = 0.8 \text{ A}$
- $V_{OUT2} = 7 \text{ V}$
- $I_{OUT2} = 0.4 \text{ A}$

**4 mW**

Overall consumption



**8 mW**

Overall consumption



**30 mW**

Overall consumption





# VIPer26K for high voltage systems

## 1050V High Voltage Converter

### Highlights

- Extremely wide input voltage range
- Reduces BOM of traditional HV approaches
- Industry compliance through robust design



# 1050V high voltage converter




## VIPer26K for high voltage systems



### KEY APPLICATIONS

- Power supply for 1 and 3-Phase Smart Energy Meters 

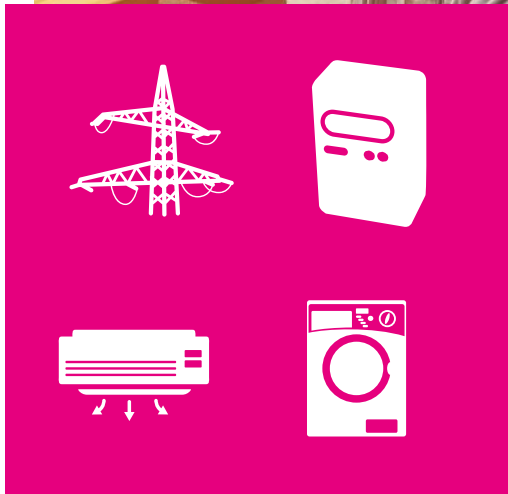
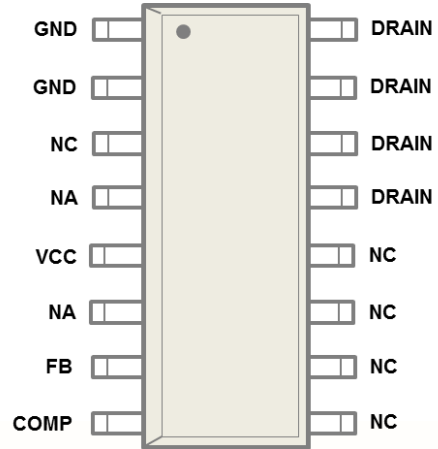
### Aux Power Supply for :

- 3-Phase Industrial Systems 
- Ultra wide voltage range High Power LED lighting 
- Air conditioning 

- High Voltage to comply with ULTRA WIDE VAC input range:
  - Jittered PWM controller plus 1050V avalanche rugged power MOSFET
  - Easy compliance with IEC 61000-4-2/4/5 immunity test ( 8kV Burst/ 2kV Surge, 20kV Air Elect. discharge, 10kV Contact discharge)
- High versatility fitting the most popular SMPS topologies
  - Isolated flyback, non-isolated flyback, buck and buck-boost converters
  - Up to 10W output power in wide input voltage range
  - High efficiency even at light load and 30mw input power at no load
- High integration for MINIMIZED BoM and compact PCB
  - 1050V BV integrated MOSFET allows to sustain 3-phase input voltage without the need of external stack FET and its driver circuitry
  - Fixed frequency (60kHz) with jittering reduces the EMI and allows small filters to be used
  - Embedded E/A for direct feedback using a resistor divider
  - Two current limit options (500mA or 700mA) to optimize the transformer size.



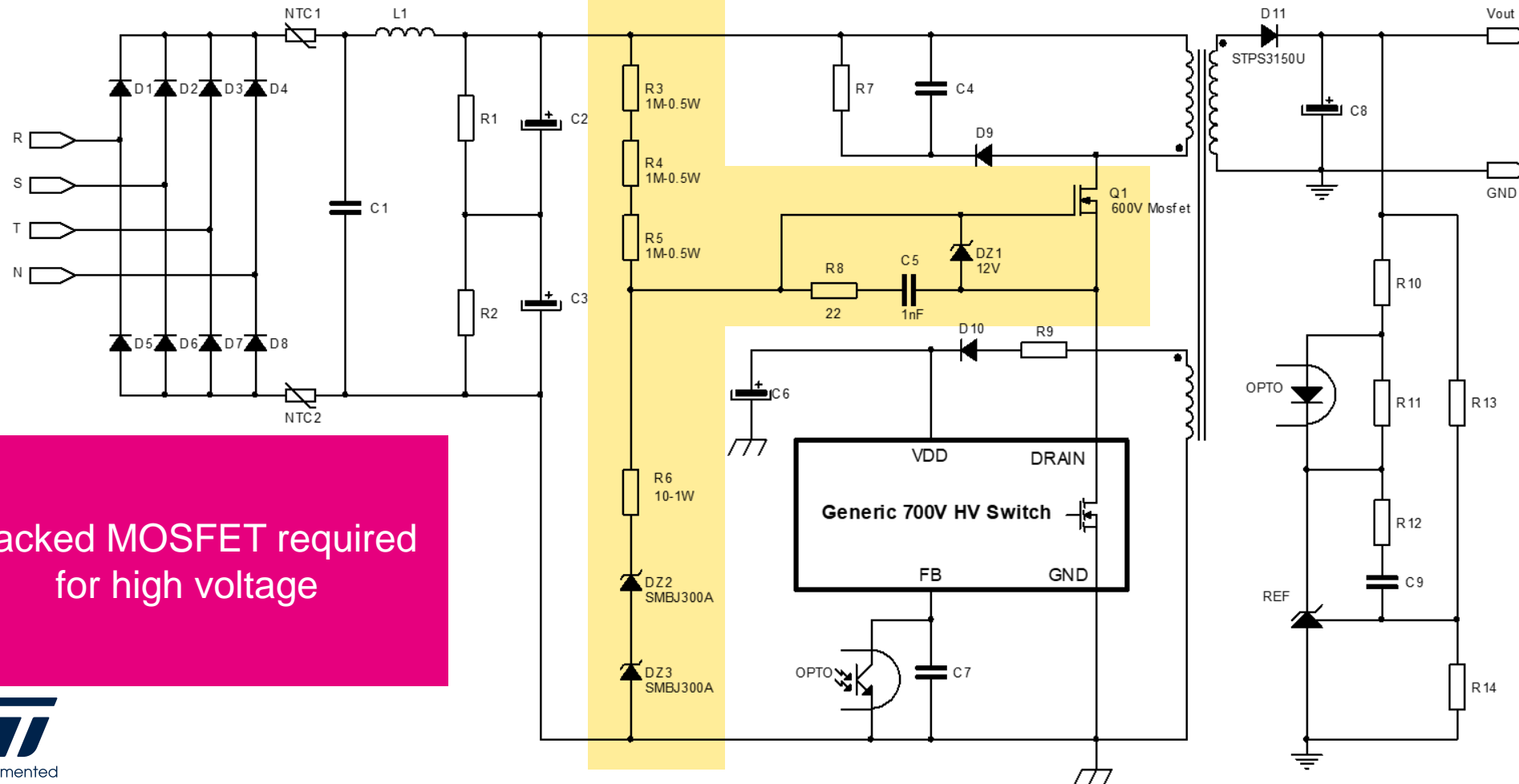
# VIPer26K power



	VIPer265K	VIPER267K
$P_{OUT}$ [W] Flyback		12W
$I_{OUT}$ [mA] Buck	250 mA	350 mA
$B_{VDSS}$ [V]		1050 V
$R_{DSon}$ [W]		8
$I_{DLIM}$ [mA]	500	700
$F_{OSC}$ [kHz] ± Jittering		60 kHz ±7%
$V_{CC}$		11.5V to 23.5V
$V_{DRAIN START}$	60V DC max	
Package	SO16N	

# Traditional high voltage solution for $> 900V$

## Stacked MOSFETs + 700V switcher

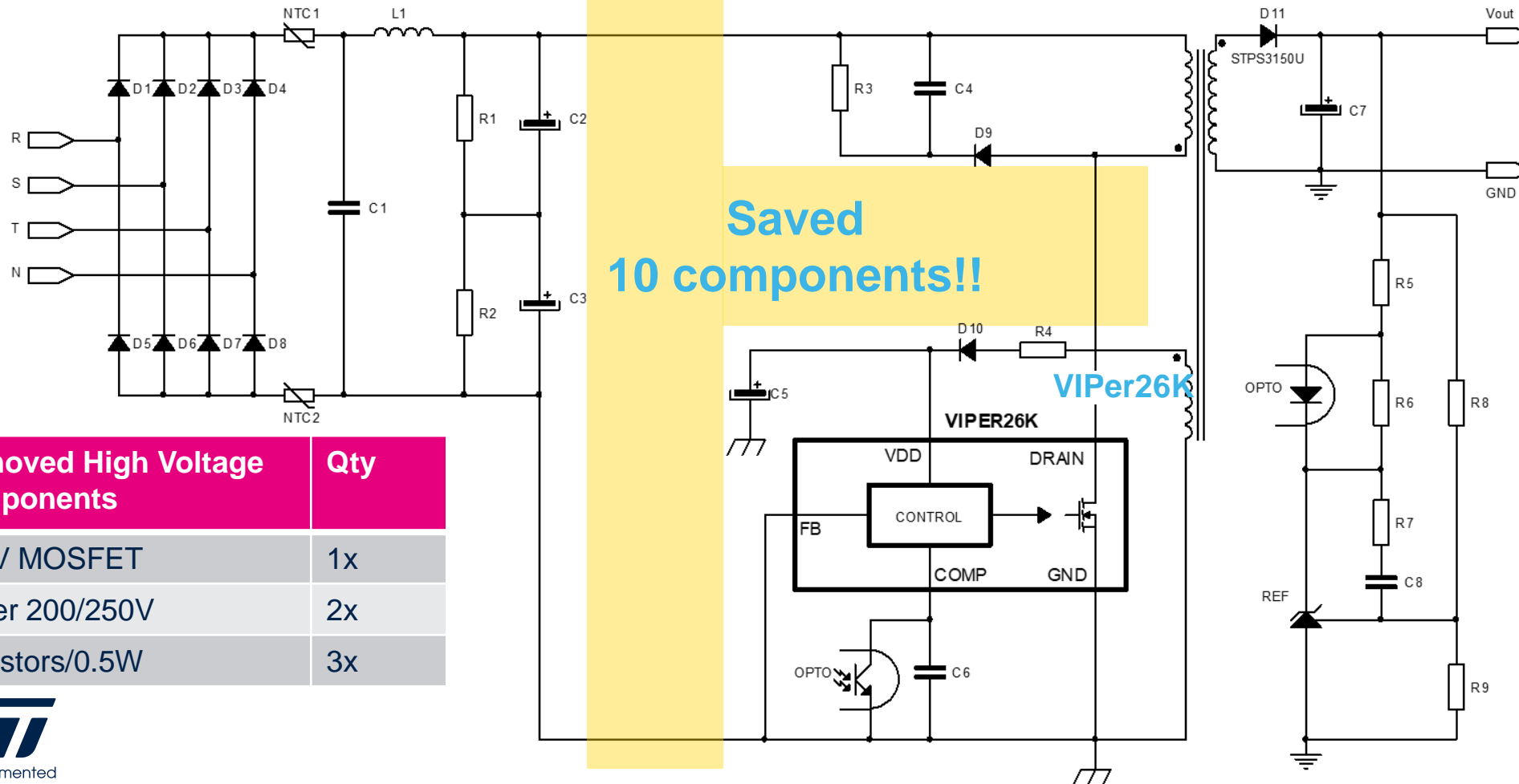


Stacked MOSFET required for high voltage



# VIPer26K eliminates the stacked MOSFET

1050V VIPerPlus reduces system size and cost



Removed High Voltage components	Qty
600V MOSFET	1x
Zener 200/250V	2x
Resistors/0.5W	3x





# Industry compliance through robust design

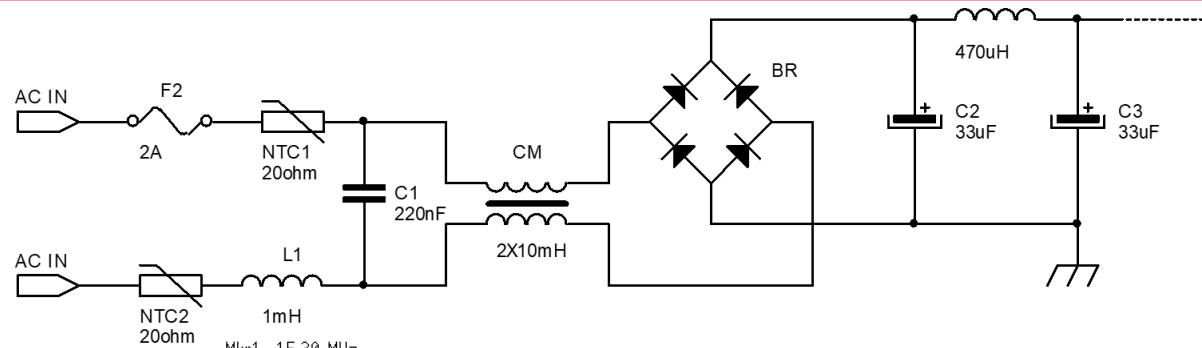
VIPER26k Results	Standard Tests		Non standard tests	
Electrostatic Discharge Immunity Test (EN/IEC 61000-4-2)	Air Discharge (*)	Contact Disc. (*)	Free ground plane discharge (**)	
	20 KV	12 KV	30 KV	
	Common Mode	Differential Mode	///	///
BURST SIMULATION (EN/IEC 61000-4-4)	8 KV	8 KV	///	///
SURGE SIMULATION (EN/IEC 61000-4-5)	5 KV	5 KV	///	///
LANGER TESTS (EFT)	///	///	B-field Probe	E-field Probe
			Max Level	Max Level

(\*) Test conditions (EN/IEC 61000-4-2):  
 Number of discharge: 10 +/-  
 Repetition rate: 1 Hz  
 Polarity: 10 +/-

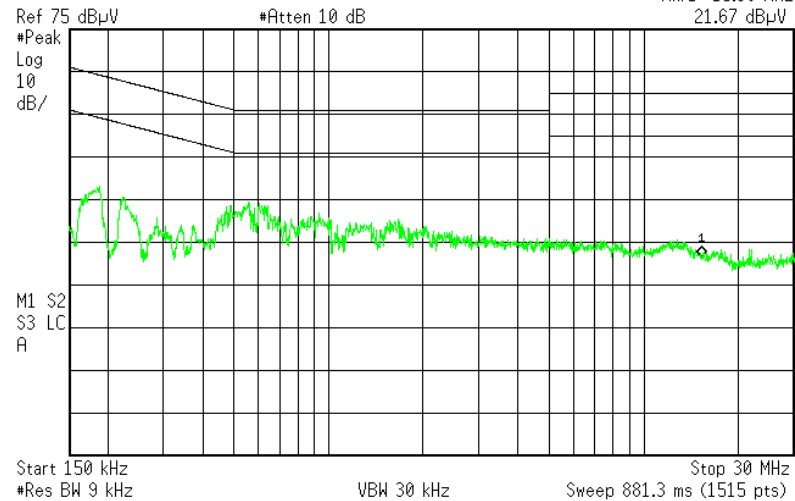
(\*\*) Test conditions:  
 Number of discharge: 9000 +/-  
 Repetition rate: 20 Hz  
 Polarity: 600 +/- both for 15 run



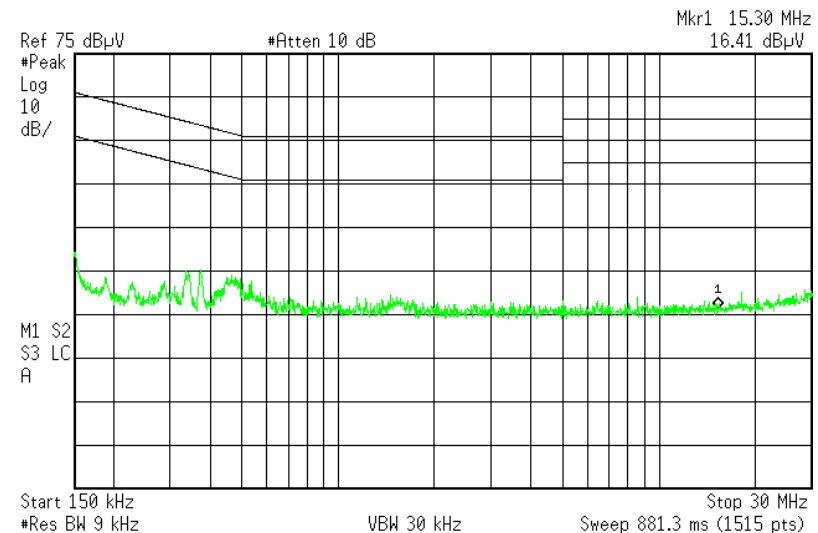
## EN55022 class B



## EN55022 class B



Line



Neutral



## High voltage converter for ultra-wide input voltage range

### 85-440VAC, 10W, fly-back



STEVAL-VP26K01F  
VIPER267KD

Available

#### Fly-back converter:

- $V_{IN} = 85 \sim 440 V_{AC}$
- $V_{OUT1} = 15V$
- $I_{OUT1} = 0.55 A$
- $V_{OUT2} = 5V$
- $I_{OUT2} = 0.1A$
- $V_{OUT3} = 3.3V$
- $I_{OUT3} = 0.2A$
- $T_{AM} = -40^{\circ}C, 85^{\circ}C$

### 3-ph SSR 9.5W fly-back



STEVAL-VP26K02F  
VIPER267KD

Under development

#### Fly-back converter:

- $V_{IN} = 85 \sim 290 V_{AC}$
- $V_{OUT1} = 12V$
- $I_{OUT1(RMS)} = 0.7A$
- $V_{OUT2} = 6V$
- $I_{OUT2} = 0.2 A$
- $I_{OUT1(PEAK)} = 1.0A$
- $T_{AM} = -40^{\circ}C, 85^{\circ}C$



### 3-ph PSR 9.5W fly-back



STEVAL-VP26K03F  
VIPER267KD

Under development

#### Fly-back converter:

- $V_{IN} = 85 \sim 290 V_{AC}$
- $V_{OUT1} = 12V$
- $I_{OUT1(RMS)} = 0.7A$
- $V_{OUT2} = 6V$
- $I_{OUT2} = 0.2 A$
- $I_{OUT1(PEAK)} = 1.0A$
- $T_{AM} = -40^{\circ}C, 85^{\circ}C$

### 60-870 VDC Buck Converter



STEVAL-VP26K01B  
VIPER265KD

Under development

#### Buck converter:

- $V_{IN} = 90 \sim 600 V_{AC}$   
or  $60 \sim 870 V_{DC}$
- $V_{OUT1} = 15V$
- $I_{OUT1} = 100mA$
- $T_{AM} = -40^{\circ}C, 85^{\circ}C$

SPICE  
Models

