VIPer*6 family: The fast lane to SMPS design

* is used as a wildcard character for related part number
VIPer*6 family: content

VIPer*6 family

- Product features
- Applications
- Typical circuits
- Evaluation boards
- eDesignSuite
  (Software tool)
VIPer*6 family

Product features
- Applications
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The fast lane to design switch mode power supplies

VIPerPlus – high-voltage converter
Advanced controller with embedded 800 V power MOSFET

..directly from AC mains ~ voltage...

Input rectification and filtering

PWM Controller

Feedback

Output rectification and filtering

.. to +/- DC bus (3.3, 5, 12 V) to supply:
- Microcontroller
- PWM driver
- Relay

Robustness and reliability
800 V power MOSFET, thermal shutdown, soft start, OLP protection, auto-restart

Energy saving
Power consumption less than 30 mW at no load

High integration
Direct feedback, jittering, HV start-up

Flexibility
Power scalability up to 12 W, no aux winding, clampless design, no CM EMC filter
VIPer*6 family: block diagram

- **OCP comparator**
  - Overload protection ($I_{DUM}$) works in parallel with PWM comparator

- **Jittered oscillator**
  - Three frequency option: 30, 60 and 115 kHz with jittering +/-6%

- **High-voltage start-up**
  - Enabled during the start-up and every time $V_{DD}$ voltage is lower than 9.5 V (min).
  - Enables design without auxiliary winding

- **3.3 V reference voltage**
  - Embedded E/A for direct feedback with resistor from the output

- **E/A compensation**
  - and/or opto-coupler input only for isolated solution

- **PWM comparator**
  - For cycle-by-cycle turn-off

- **Short circuit protection**
  - In case of overload, alternate 50 ms on, 1 sec off

- **800 V AR power MOSFET**
  - senseFET + thermal sensor + current sense resistor

### Technical Specifications

<table>
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<th>VIPer*6 family</th>
<th>VIPer06</th>
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<th>VIPerA16</th>
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<td>6 W</td>
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VIPer*6 family

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VIPer*6 in applications

VIPer*6 family
Fixed-frequency AC-DC converters
VIPer06, VIPer16, VIPerA16, VIPer26

The best choice to power your microcontroller
VIPer*6 for metering

VIPer*6, key benefits for the application
- 30 kHz switching frequency to reduce noise in the communication band (only VIPer06)
- 800 V breakdown
- Op amp available for primary regulation

Aux SMPS market needs
- Non-isolated solution for single-phase meters
- Isolated solution for 3-phase meters
- Reduced noise in the communication band
- Robustness

VIPer*6 in smart-energy meters

VIPer*6 based AC-DC auxiliary power supply for
- microcontrollers
- transceivers
- metrology ICs

Flyback topology
Isolated with primary regulation

Inductor based topology
Buck
VIPer*6 for home appliances

VIPer*6 based
AC-DC auxiliary power supply for
- microcontrollers
- LEDs
- user interfaces
- motor driver ICs

Small home appliances
Major appliances

VIPer*6, key benefits for the application
- Frequency jittering
- VIPer*6 pin-to-pin compatible
- 800 V breakdown
- Self supply
- Op amp available for primary regulation or direct feedback

Inductor based topologies
- Buck common neutral
- Buck-boost negative output, common neutral

Smart flyback topologies
- Isolated
  - primary regulation
  - secondary regulation
- Non-isolated
  - direct feedback, positive/negative output, common neutral

Aux SMPS market needs

Small EMI input filter
Power scalability
Clampless
High efficiency
Reduced size
Powering MCU to drive Triac

Small home appliances
Major appliances

VIPer*6 in home appliances

Aux SMPS market needs

VIPer*6 key benefits and supported topologies

VIPer*6 based AC-DC auxiliary power supply for small home appliances and major appliances. Key benefits include:
- Frequency jittering
- VIPer*6 pin-to-pin compatible
- 800 V breakdown
- Self supply
- Op amp available for primary regulation or direct feedback

Inductor based topologies:
- Buck common neutral
- Buck-boost negative output, common neutral

Smart flyback topologies:
- Isolated
  - primary regulation
  - secondary regulation
- Non-isolated
  - direct feedback, positive/negative output, common neutral

Small EMI input filter
Power scalability
Clampless
High efficiency
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Powering MCU to drive Triac

VIPer*6 in home appliances

Aux SMPS market needs

VIPer*6 key benefits and supported topologies
VIPer*6 for home automation

VIPer*6 based
AC-DC auxiliary power supply for
- microcontrollers
- transceivers
- sensors
- motor driver ICs

VIPer*6 key benefits and supported topologies

- 30 mW @ no load
- Frequency jittering
- 800 V breakdown
- Self supply
- Op amp available for direct feedback

Inductor based topology
Buck

Smart flyback topologies
Non-isolated, direct feedback, positive/negative output, common neutral

VIPer*6 in home automation

Aux SMPS market needs

Low standby power
Small EMI input filter
Reliability
Cost saving
Cap SMPS replacement
Powering MCU to drive Triac

Cost saving Cap SMPS replacement

VIPer*6 based AC-DC auxiliary power supply for

- microcontrollers
- transceivers
- sensors
- motor driver ICs

VIPer*6, key benefits for the application

- 30 mW @ no load
- Frequency jittering
- 800 V breakdown
- Self supply
- Op amp available for direct feedback

Inductor based topology
Buck

Smart flyback topologies
Non-isolated, direct feedback, positive/negative output, common neutral
VIPer*6 for lighting

VIPer*6 in street lighting

VIPer*6 based AC-DC auxiliary power supply for
- microcontrollers
- transceivers
- lighting driver ICs

VIPer*6, key benefits for the application
- 30 mW @ no load
- Operating temperature: -25 to +125 °C
- 800 V breakdown
- Self supply
- Op amp available for primary regulation

Inductor based topology
- Buck

Smart flyback topologies
- Isolated with secondary regulation
- Isolated with primary regulation

Aux SMPS market needs

Robustness
Cost saving
Reduced size
High efficiency

Aux SMPS

VIPer*6, key benefits and supported topologies

High efficiency
Low standby power
Cost saving
Reduced size

Life augmented
VIPerA16 in automotive hybrid/EV control

Aux SMPS market needs

VIPerA16 – automotive grade 1, key benefits for the application
- AEQ100 compliant
- Operating temperature: -40 to +125 °C
- 800 V breakdown
- Op amp available for direct feedback

HV DC-DC aux SMPS based on VIPerA16 for
- Li-ion battery monitoring and cell balancing systems
- DC-DC conversion to generate 12/24 V needs to subsystems

14 to 15 V → 200 to 400 V
DC-DC conversion
12 to 15 V

Strong thermal robustness
Reliability

Smart flyback topologies
- Non-isolated direct feedback
- Isolated primary regulation
- Secondary regulation

Contact your ST office for further information on VIPerA16
VIPer*6: isolated flyback

**Primary regulation**

Perfect trade-off between isolation, cost and output regulation

**Secondary regulation**

- Standard topology without aux winding (VIPer self supply)
- Standard topology with the lowest standby consumption

**Isolated auxiliary SMPS**
VIPer*6: non-isolated flyback

Minimal component count

Direct feedback

Minimal component count with the lowest standby consumption ($V_{OUT} \geq 12$ V)

Non-isolated auxiliary SMPS
VIPer*6: non-isolated flyback

Configurations with positive and negative outputs

**Direct feedback**

- +7 V and -5 V: outputs referred to neutral with lowest standby consumption

**Secondary regulation**

- +12 V and -5 V: outputs referred to neutral with lowest standby consumption

Non-isolated auxiliary SMPS
VIPer*6: inductor based topologies

Buck

Simplicity and minimum size guaranteed

Buck-boost with negative output

Powering an MCU to drive a Triac

Non-isolated auxiliary SMPS
VIPer*6 family

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VIPer*6 family
VIPer*6 based solutions (1/3)

STEVAL-ISA130V1 (*)
1.7 W buck converter
based on VIPer06X
(output referred to neutral)

- $V_{IN} = 90$ to $265$ Vac
- $V_{OUT} = 12$ V
- $I_{OUT} = 140$ mA
- Efficiency = 82.6% @ 85 Vac (full load)

DN0009

STEVAL-ISA115V1 (*)
1.8 W buck converter
based on VIPer06XN
(output referred to neutral)

- $V_{IN} = 90$ to $265$ Vac
- $V_{OUT} = 12$ V
- $I_{OUT} = 150$ mA

AN4260 (*)

STEVAL-ISA010V1
1.8 W super wide range buck converter
based on VIPer16LN
(dual outputs referred to neutral)

- $V_{IN} = 85$ to $500$ Vac
- $V_{OUT1} = 12$ V
- $V_{OUT2} = 5$ V
- $I_{OUTtot} = 150$ mA
- Standby= 96 mW @ 230 Vac

AN2872

STEVAL-ISA096V1
2 W buck-boost converter
based on VIPer06XS
(negative output referred to neutral)

- $V_{IN} = 85$ to $264$ Vac
- $V_{OUT} = -12$ V
- $I_{OUT} = 150$ mA
- Efficiency = 80% @ 230 Vac (full load)
- Standby< 30 mW @ 264 Vac

UM1470

Solutions up to 2 W

(*) Available on request
VIPer*6 based solutions (2/3)

**STEVAL-ISA071V2**
4 W non-isolated flyback converter based on VIPer16L (direct feedback, dual outputs referred to neutral)

- $V_{IN} = 85$ to 264 Vac
- $V_{OUT1} = +7$ V
- $I_{OUT1} = 160$ mA
- $V_{OUT2} = -5$ V
- $I_{OUT2} = 400$ mA
- Standby: 35 mW @ 230 Vac

**STEVAL-ISA117V1 (**)**
4.2 W isolated flyback converter based on VIPer16LN (secondary regulation)

- $V_{IN} = 90$ to 265 Vac
- $V_{OUT} = 12$ V
- $I_{OUT} = 350$ mA

**STEVAL-ISA112V1 / STEVAL-ISA113V1**
4.2 W non-isolated flyback converter based on VIPer06HN / VIPer06HS (direct feedback)

- $V_{IN} = 90$ to 265 Vac
- $V_{OUT1} = +7$ V
- $I_{OUT1} = 160$ mA
- $V_{OUT2} = -5$ V
- $I_{OUT2} = 400$ mA
- Standby: 35 mW @ 230 Vac

**STEVAL-ISA118V1**
4.5 W non-isolated flyback converter based on VIPer16LN (direct feedback)

- $V_{IN} = 90$ to 265 Vac
- $V_{OUT} = 12$ V
- $I_{OUT} = 280$ mA
- Efficiency > 81% @ 230 Vac (full load)

Solutions up to 4.5 W

(*) Available on request
**VIPer*6 based solutions**

- **STEVAL-ISA116V1 (*)**
  - 5 W buck converter based on VIPer26LD
  - $V_{IN} = 90$ to $265\, \text{Vac}$
  - $V_{OUT} = 12\, \text{V}$
  - $I_{OUT} = 1\, \text{A}$
  - Average efficiency @ 115 Vac: $83.4\%$ (115 kHz), $87\%$ (60 kHz)

- **STEVAL-ISA110V1 (*)**
  - 12 W non-isolated flyback converter based on VIPer26LN (direct feedback; 60 kHz, 115 kHz versions)
  - $V_{IN} = 90$ to $265\, \text{Vac}$
  - $V_{OUT} = 12\, \text{V}$
  - $I_{OUT} = 1\, \text{A}$
  - Average efficiency @ 115 Vac: $83.4\%$ (115 kHz), $87\%$ (60 kHz)

- **STEVAL-ISA081V1**
  - 12 W isolated flyback converter based on VIPer16LND (primary regulation)
  - $V_{IN} = 85$ to $305\, \text{Vac}$
  - $V_{OUT1} = 12\, \text{V}$
  - $V_{OUT2} = 3.3\, \text{V}$
  - $I_{OUT1} = 900\, \text{mA}$
  - $I_{OUT2} = 100\, \text{mA}$
  - Efficiency = $84\%$ @ 230 Vac (full load)

**Solutions up to 12 W**

(*) Available on request
VIPer*6 family

- Product features
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- eDesignSuite
  (Software tool)
eDesignSuite enables VIPer*6 based design

**eDesignSuite**
The smart tool to design your application

- Login to www.st.com/edesignsuite (online registering is required)
- **or**
- Fill in eDesignSuite widget (visit VIPer*6 product pages on www.st.com)
- **or**
- Open eDesignSuite offline version (ask your ST sales office to get it)

1. Choose Power Supply application type and create your design
2. Insert your I/O specifications and select one of the proposed VIPer*6
3. The design is ready

A complete design in a few steps

www.st.com/edesign
eDesignSuite enables VIPer*6 based design

- The specifications view
- The actuals view
- A full set of analysis diagrams
- A full set of commands
- A fully interactive BOM
- A fully annotated and interactive schematic
- The user can customize the flyback transformer

www.st.com/edesign
For more information

www.st.com/viper