

# Rectifiers and ASD™ for power conversion applications



# Contents

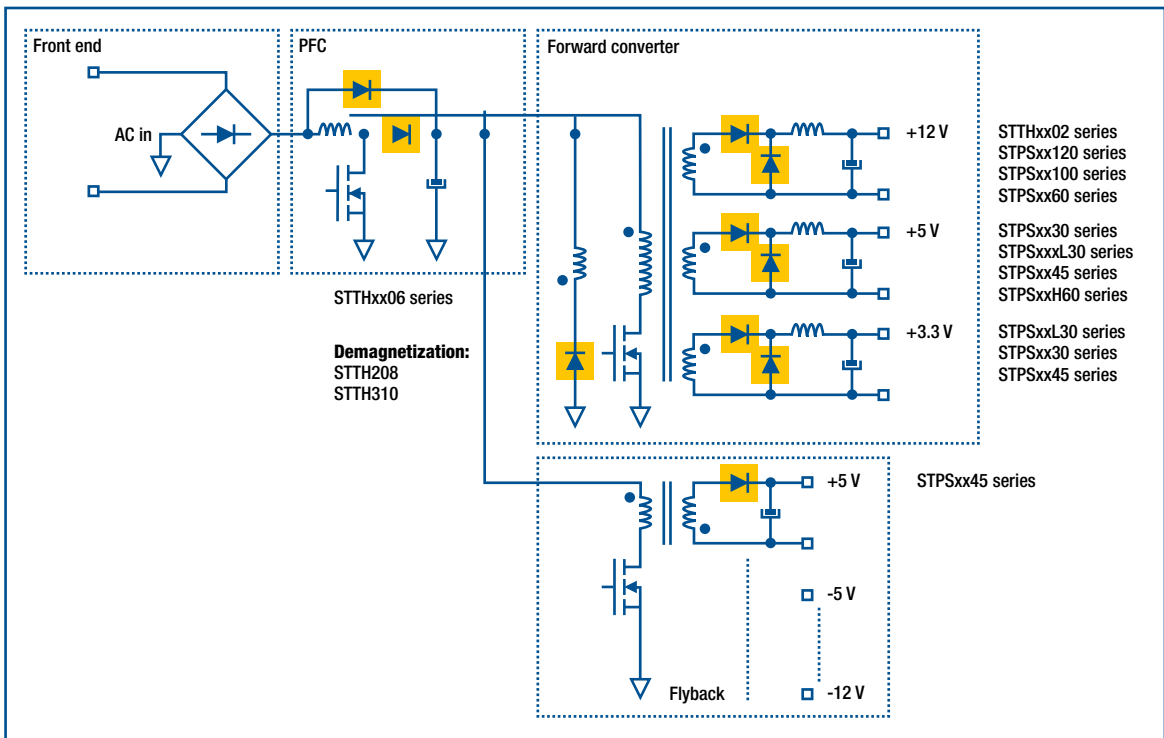
<b>Meeting today's industrial power-conversion requirements</b>	<b>3</b>
<b>1.0 Computers</b>	<b>3</b>
1.1 Desktop PCs	3
1.2 File servers	4
<b>2.0 Computers and consumer goods</b>	<b>5</b>
2.1 Notebooks, game stations, audio players, and similar applications	5
<b>3.0 Consumer goods</b>	<b>6</b>
3.1 LCD TVs	6
3.2 Plasma TVs	7
3.3 Set-top-boxes	8
<b>4.0 Telecom</b>	<b>9</b>
4.1 Base stations: AC-DC converters	9
4.2 Mobile phones: battery chargers	9
<b>5.0 Industrial supplies</b>	<b>11</b>
5.1 Welding	11
5.2 Three-phase motor control	11
<b>6.0 Automotive supplies</b>	<b>12</b>
6.1 Reverse polarity protection	12
6.2 Engine motor control	12
6.3 High Intensity Discharge (HID)	13
6.4 DC-DC converters	13
6.5 Injection	14
<b>7.0 General-purpose supplies</b>	<b>15</b>
7.1 Embedded DC-DC converters	15
<b>8.0 Focus on the Power Schottky avalanche diode specification</b>	<b>17</b>
8.1 2% savings with specified Power Schottky avalanche diodes	17
8.2 Key steps	17
8.3 Key benefits: choose between efficiency and cost savings	17
<b>9.0 Ordering scheme</b>	<b>18</b>
9.1 Signal Schottky series	18
9.2 Power Schottky series	18
9.3 SiC diodes	19
9.4 Ultrafast series	19

# Meeting today's industrial power-conversion requirements

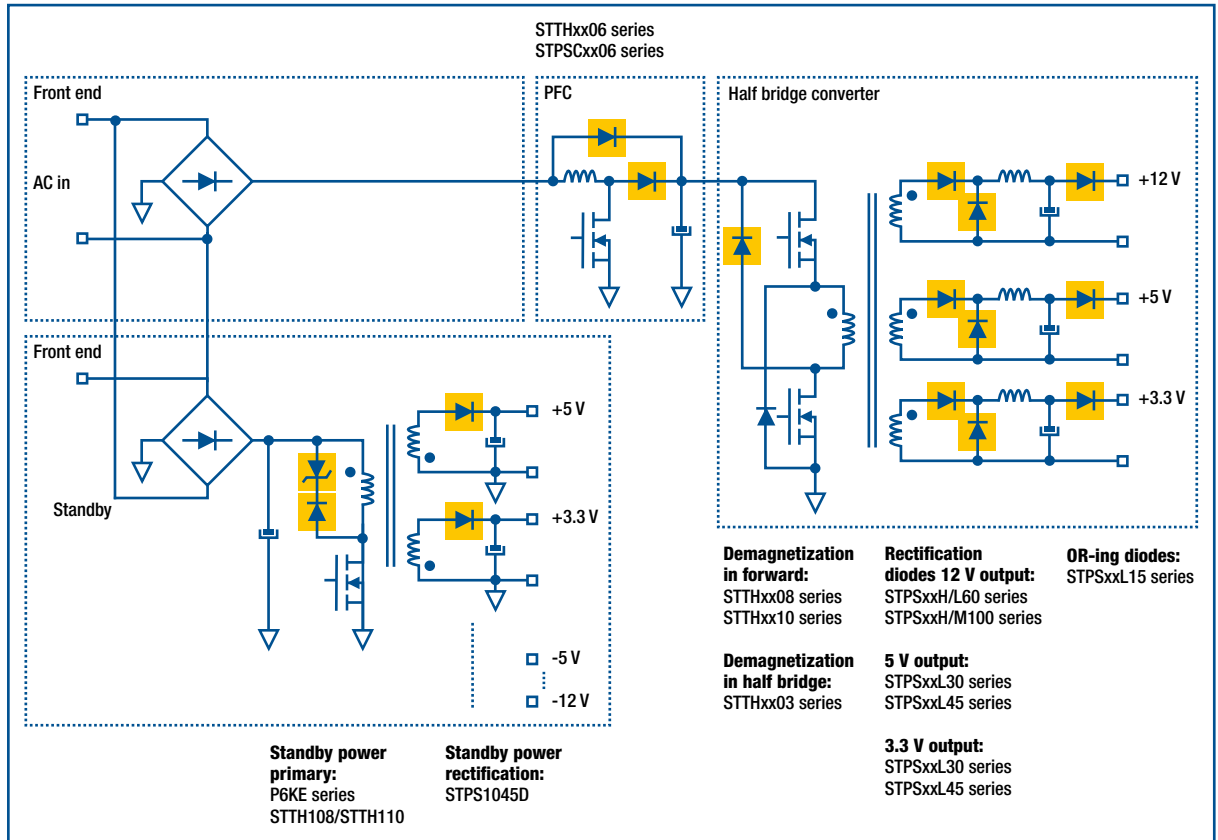
The following diagrams are intended to help you when designing an SMPS (switch-mode power supply) to select the most suitable discrete components from the ST portfolio. An extensive list of ST references is provided for each application, as well as for each function within the application. For more information, please contact your local ST sales office.

## 1.0 Computers

### 1.1 Desktop PCs



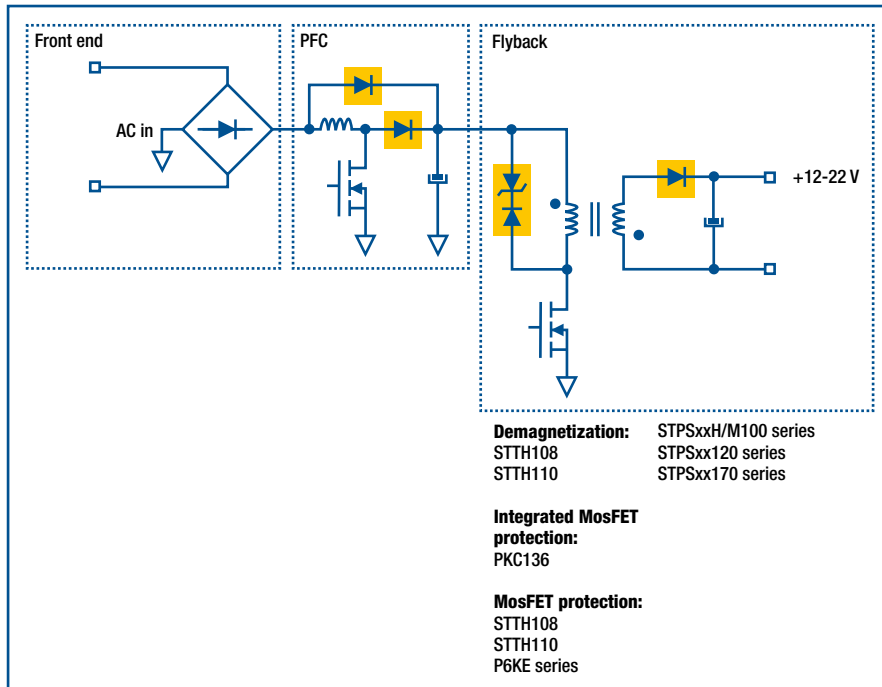
## 1.2 File servers



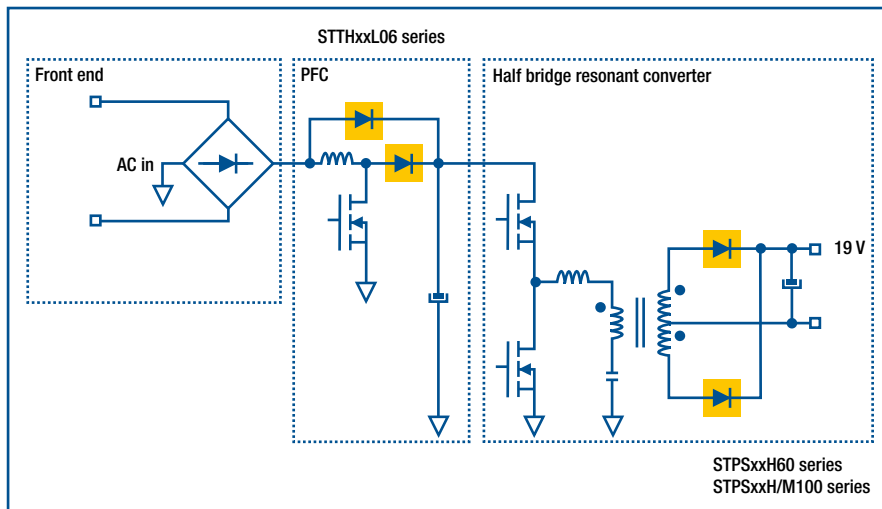
# 2.0 Computers and consumer goods

## 2.1 Notebooks, game stations, audio players, and similar applications

### Adapter converter (1)



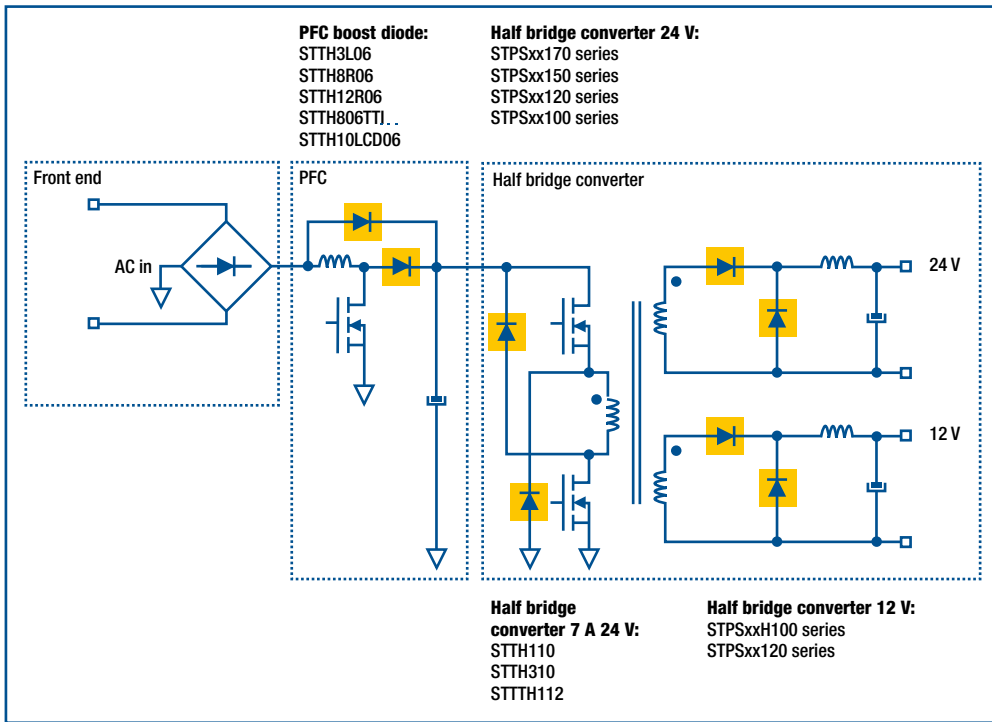
### Adapter converter (2)



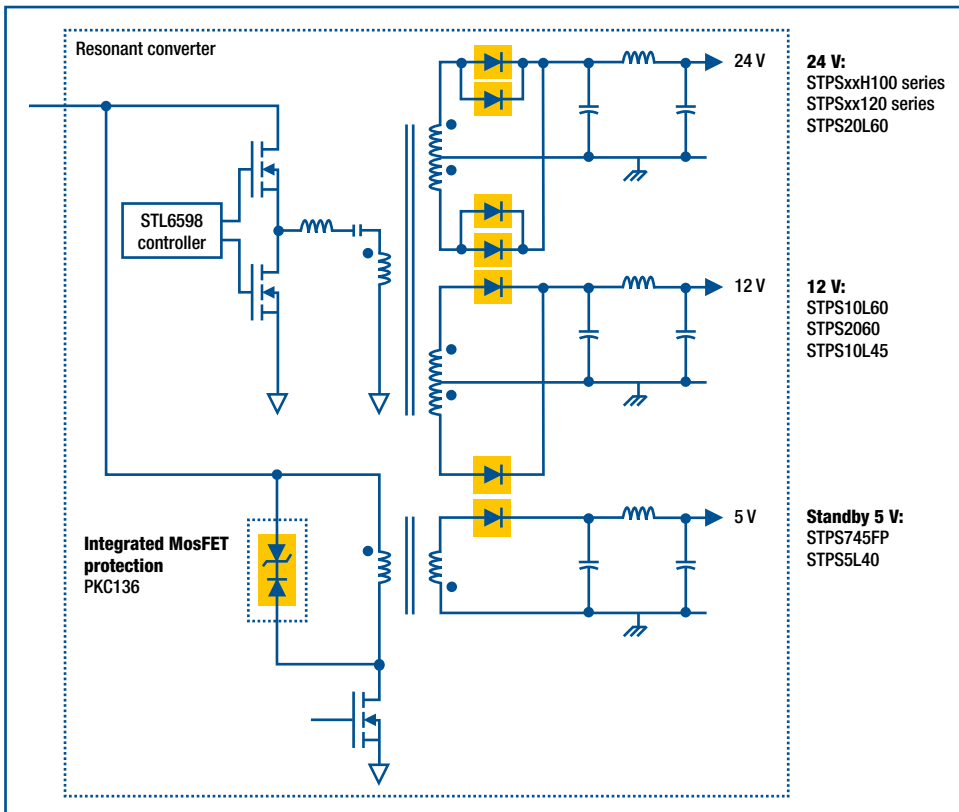
# 3.0 Consumer goods

## 3.1 LCD TVs

### AC-DC converter (1)

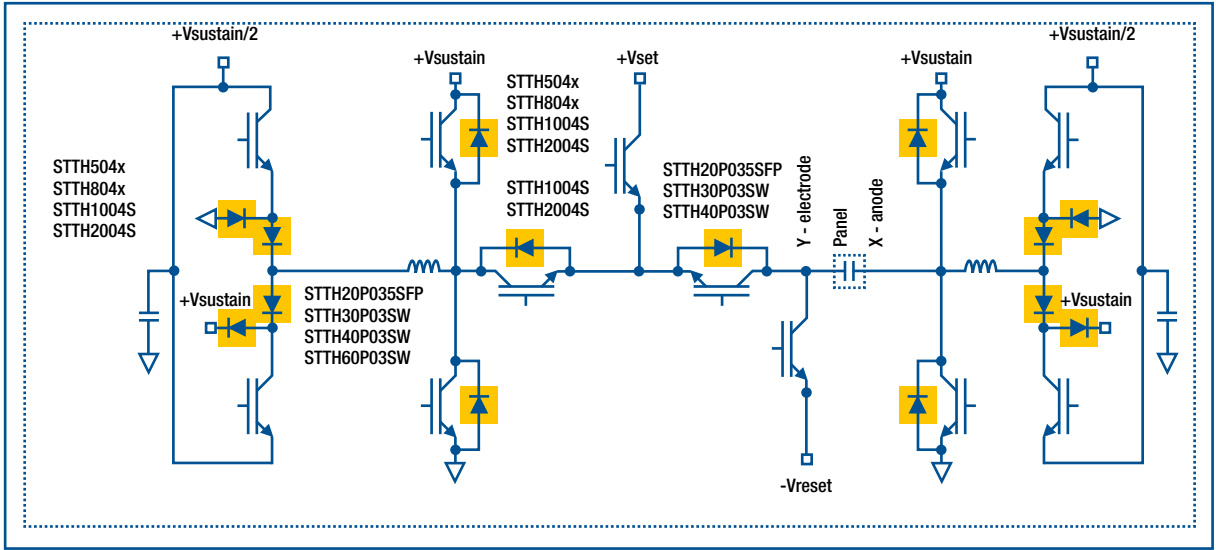


### AC-DC converter (2): LLC topology

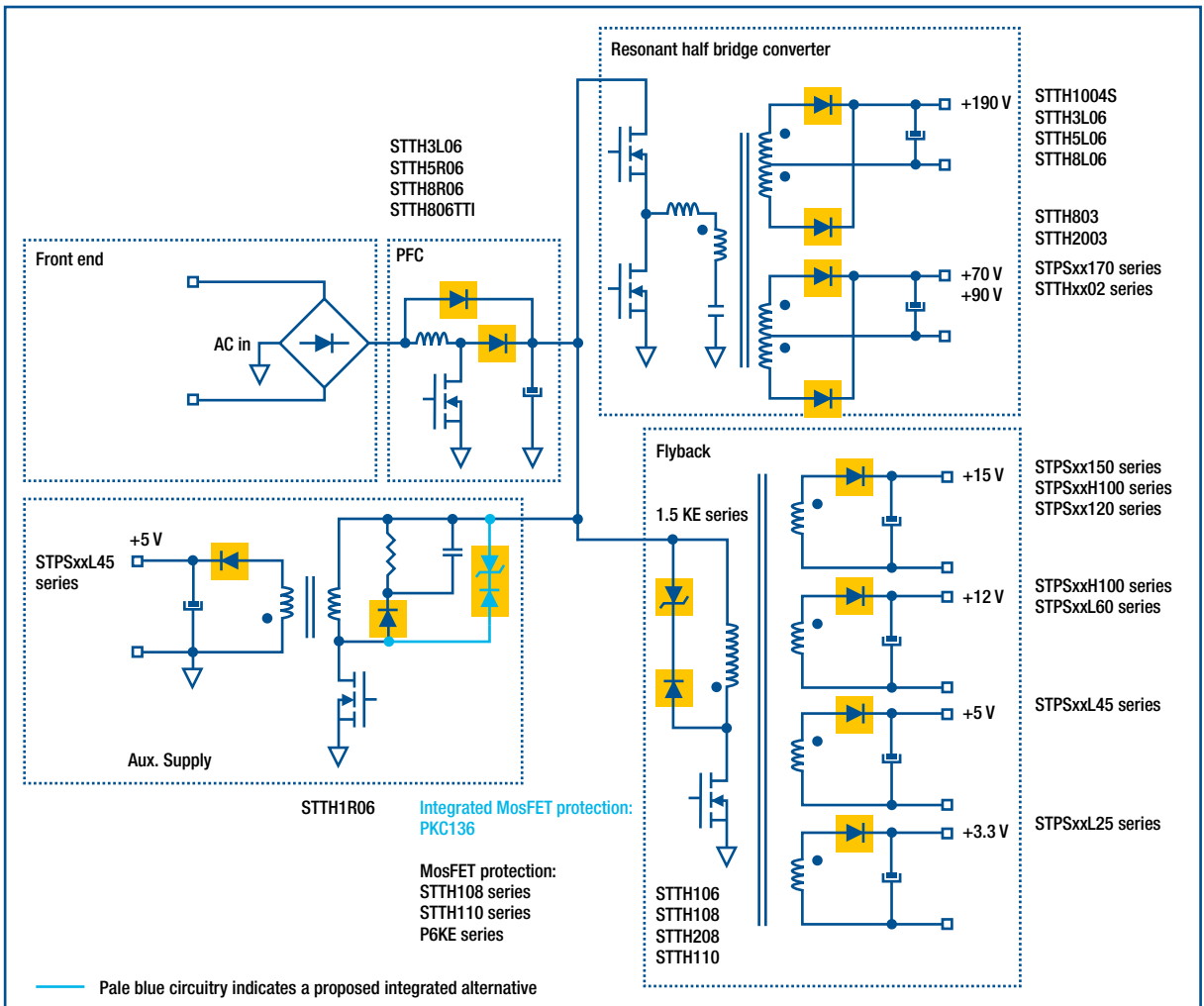


### 3.2 Plasma TVs

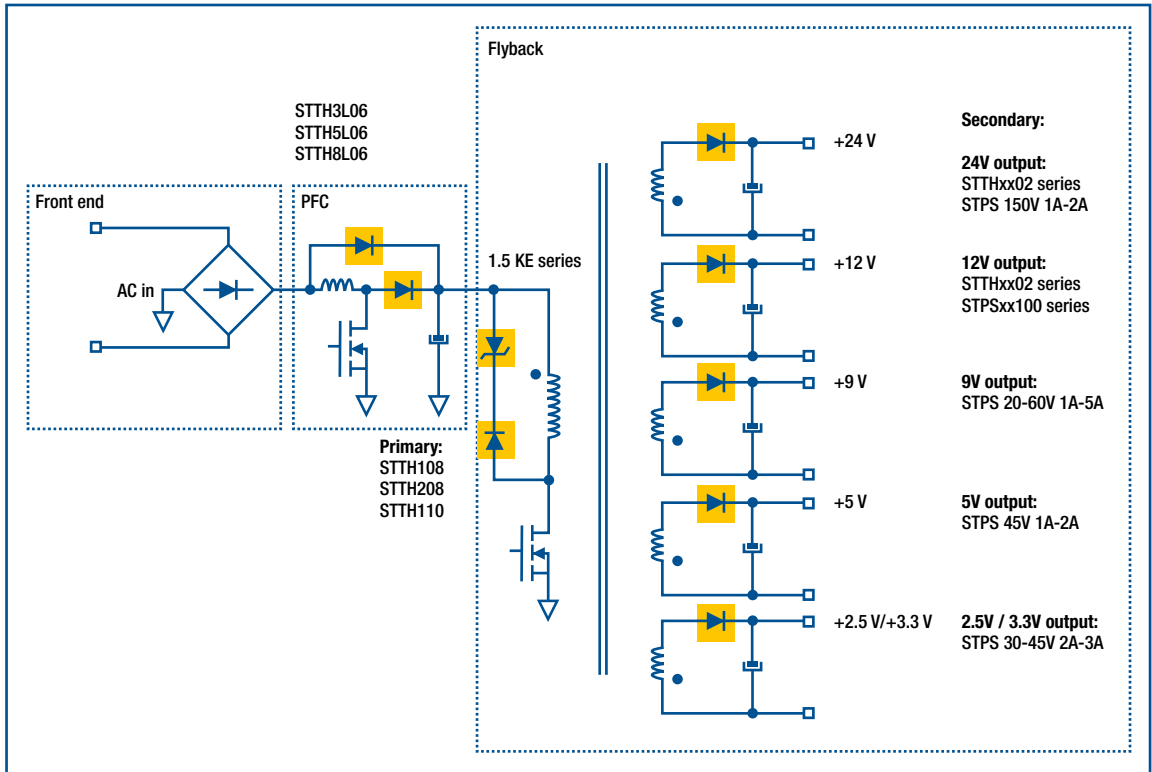
#### Plasma display panel: energy recovery circuit



#### Plasma TV: AC-DC converter



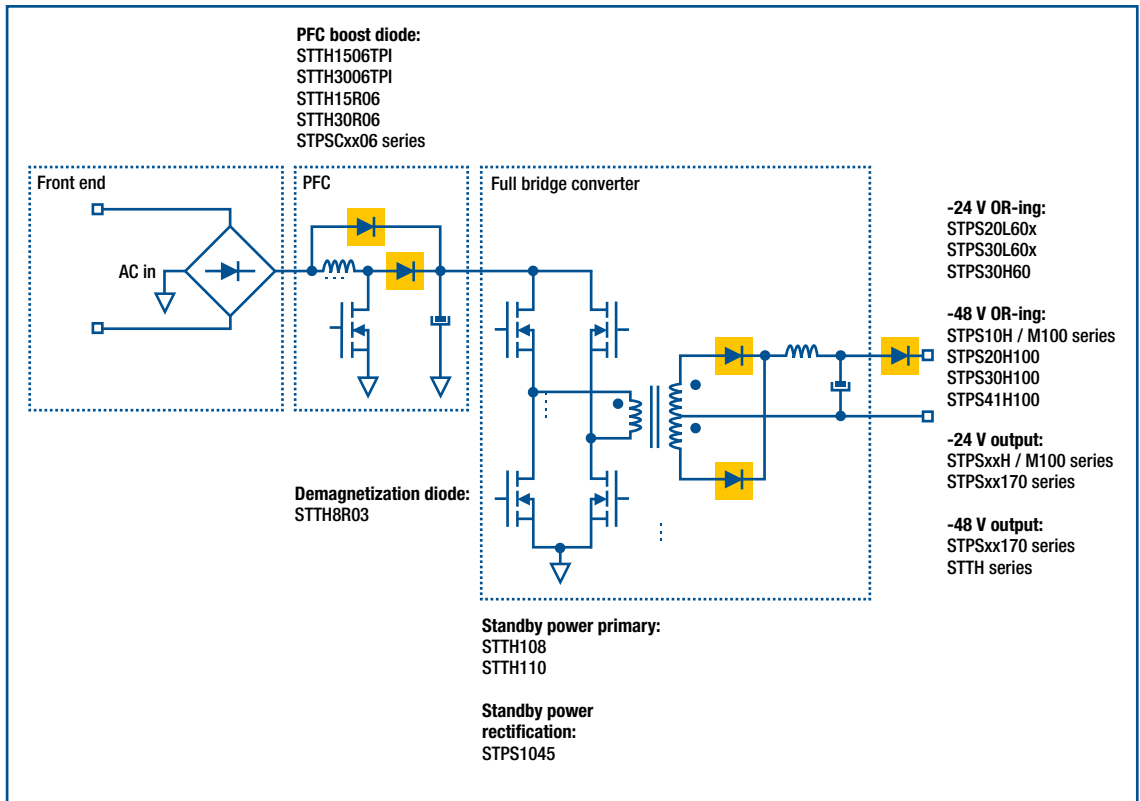
### 3.3 Set-top boxes





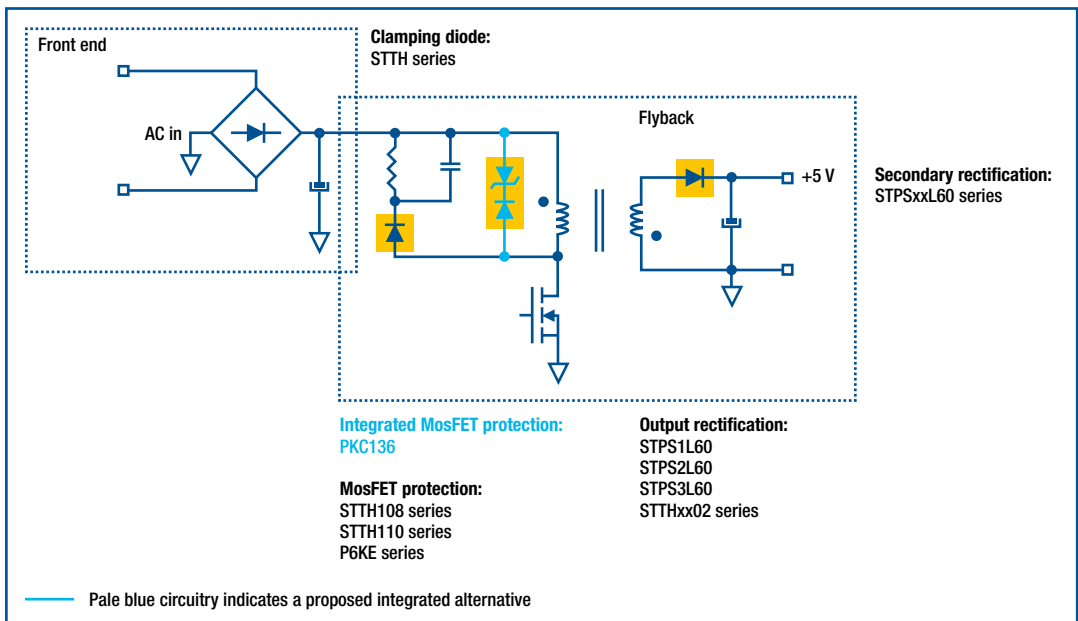
# 4.0 Telecom

## 4.1 Base stations: AC-DC converter

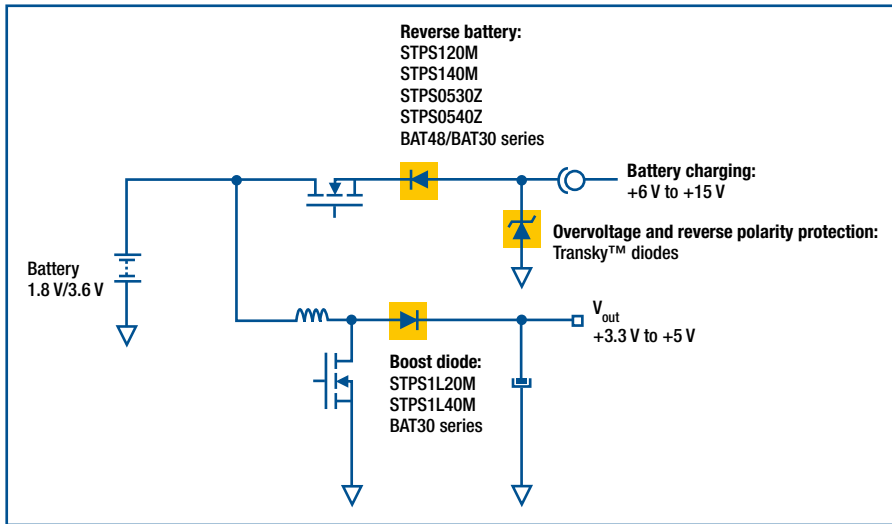


## 4.2 Mobile phones: battery chargers

### Battery charger (1)

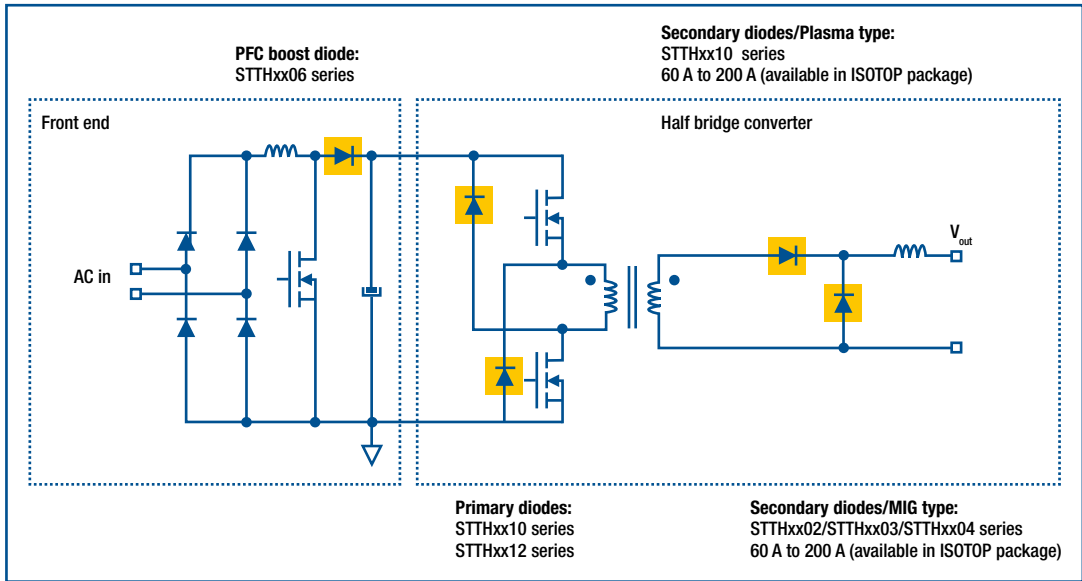


## Battery charger (2)

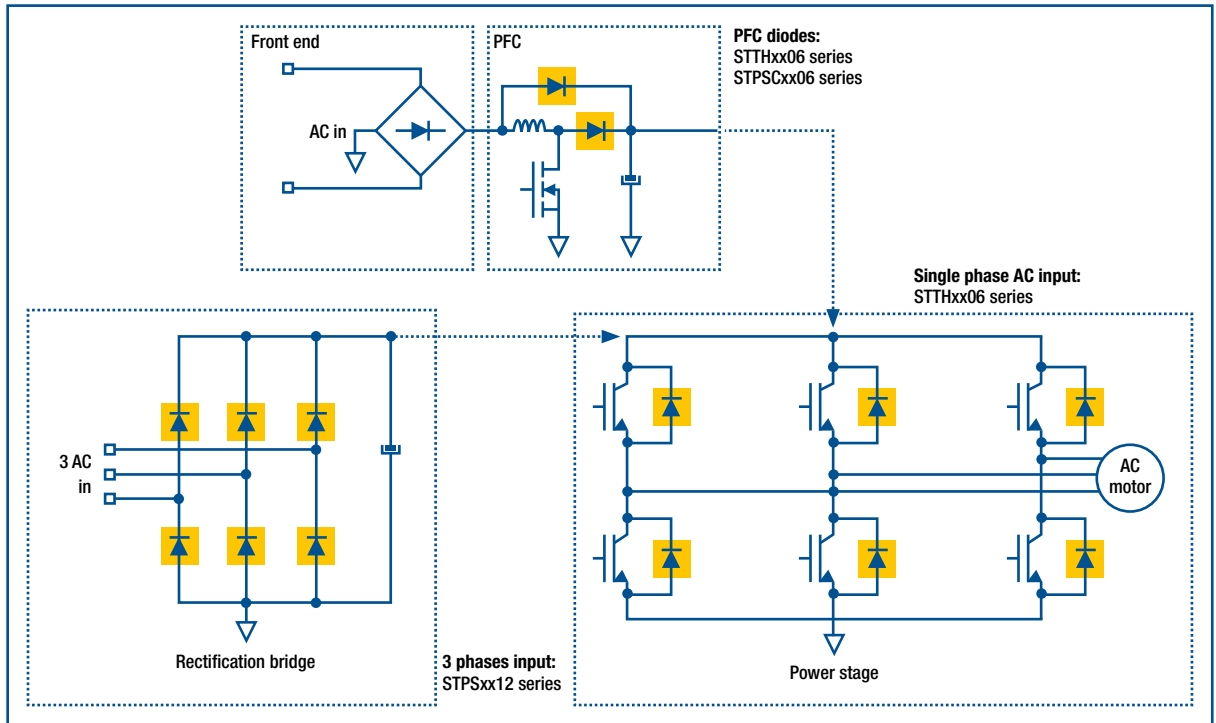


# 5.0 Industrial supplies

## 5.1 Welding

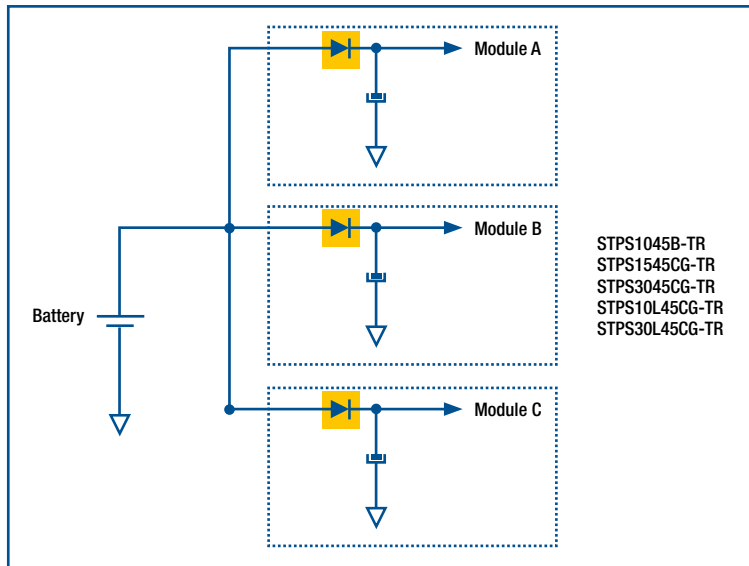


## 5.2 Three-phase motor control

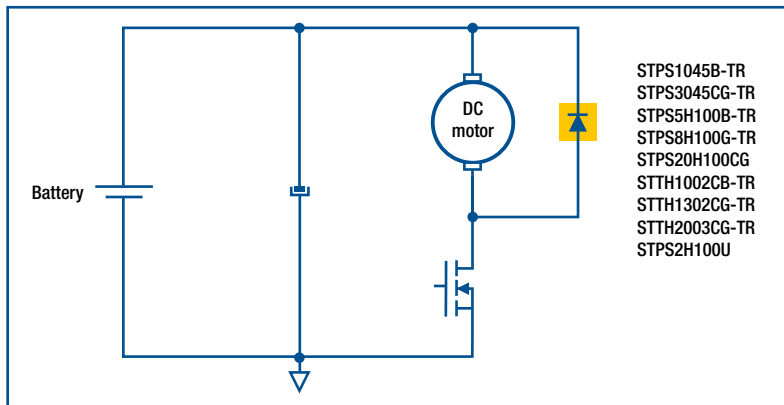


# 6.0 Automotive supplies

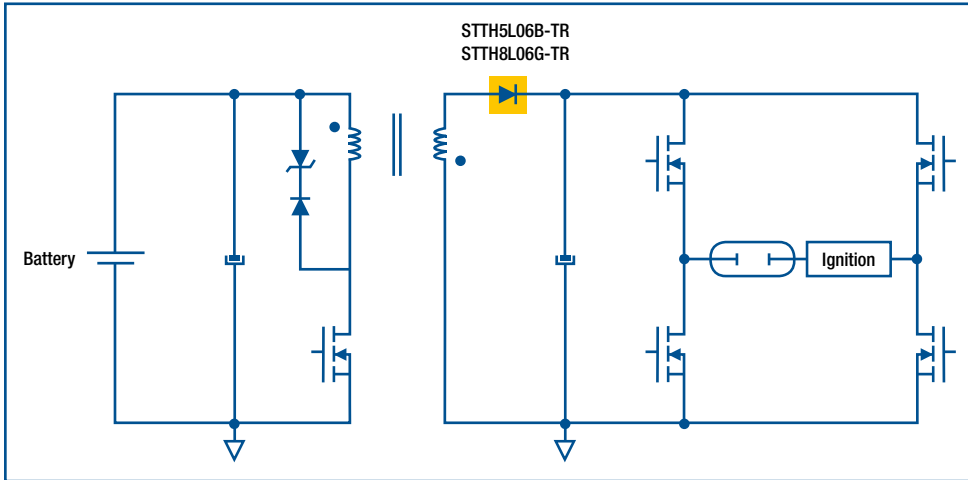
## 6.1 Reverse polarity protection



## 6.2 Engine motor control

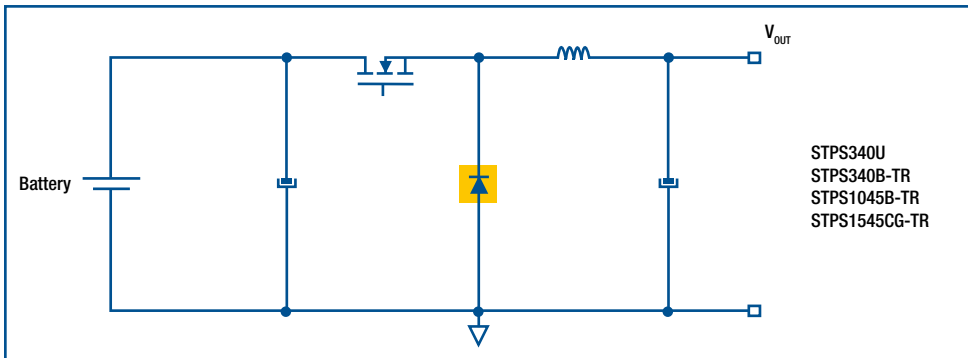


### 6.3 High Intensity Discharge (HID)

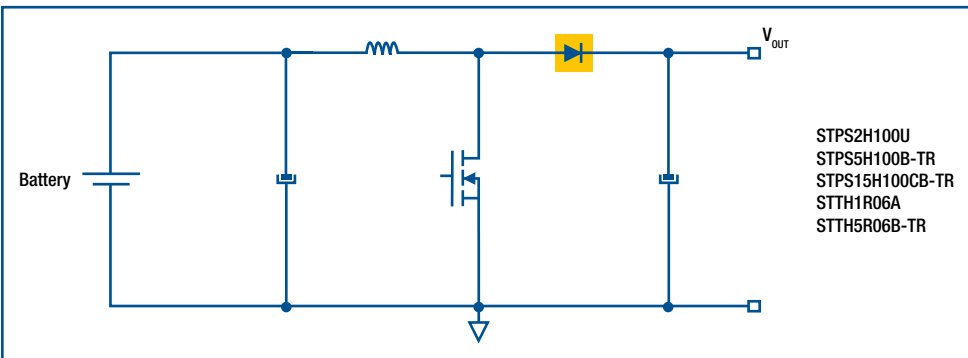


### 6.4 DC-DC converters

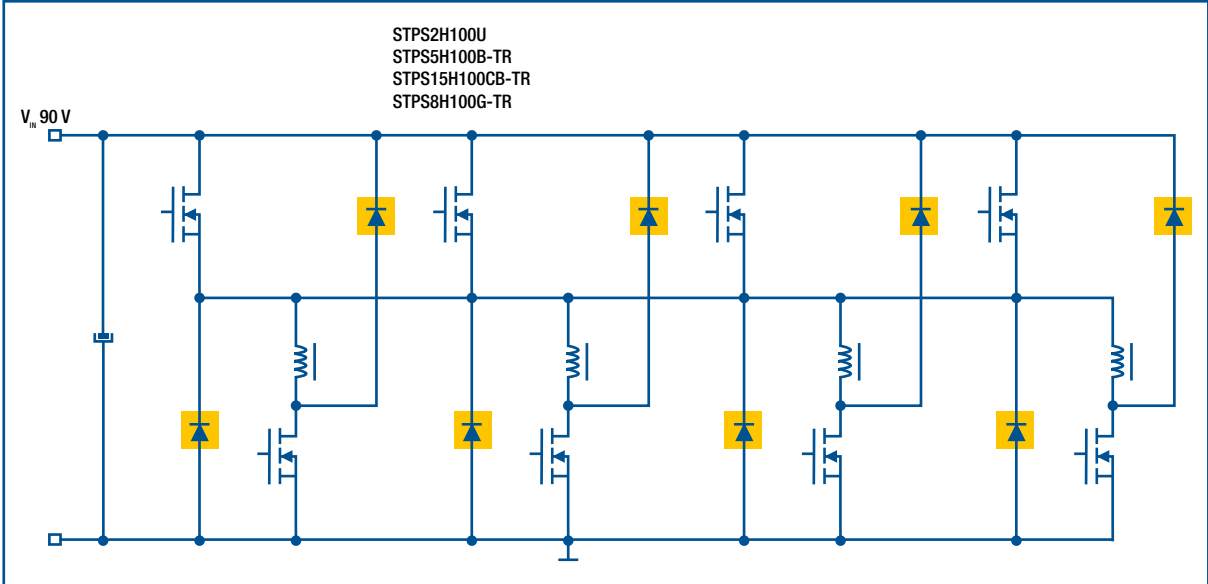
#### Buck topology



#### Boost topology



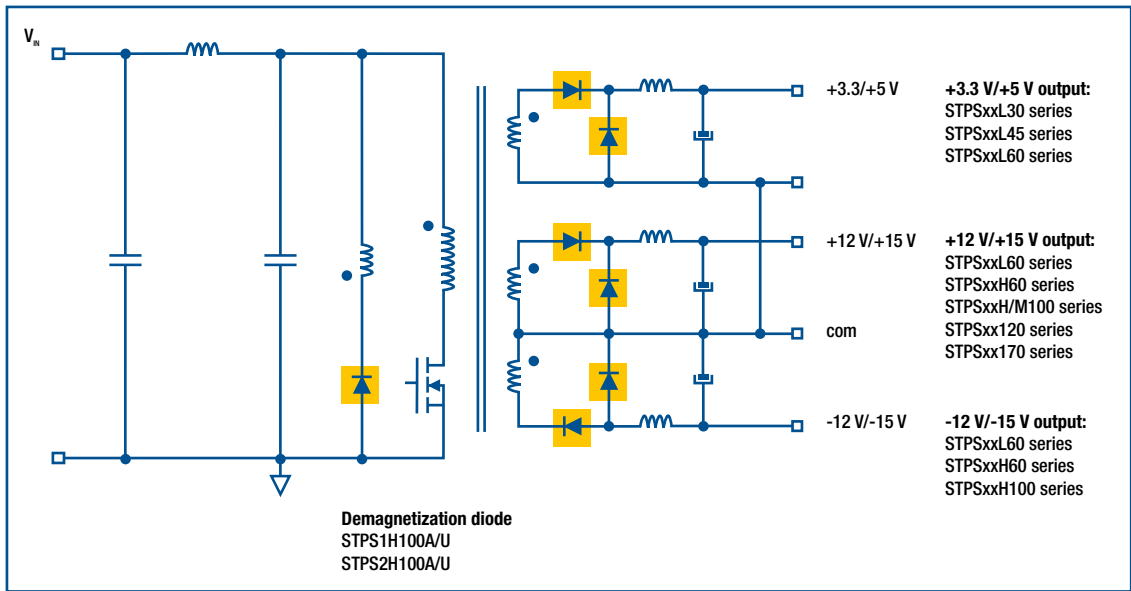
# 6.5 Injection



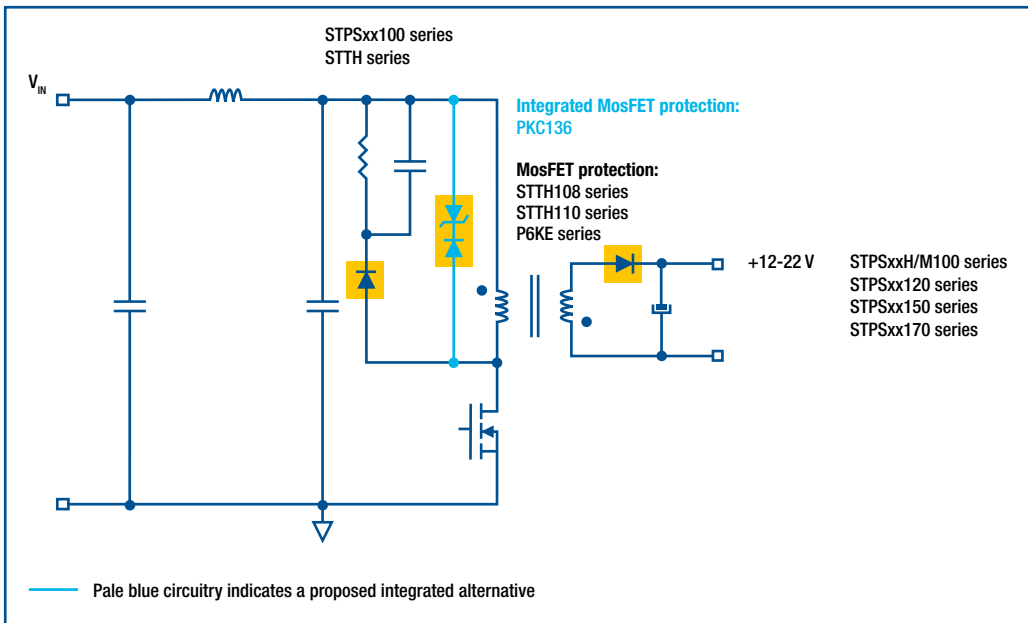
# 7.0 General-purpose supplies

## 7.1 Embedded DC-DC converters

### Forward converter

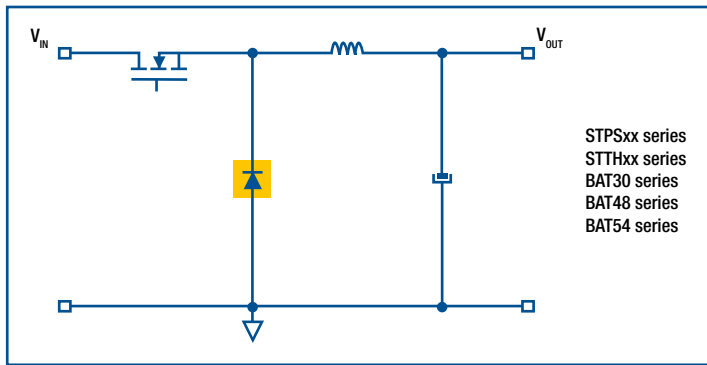


### Flyback converter

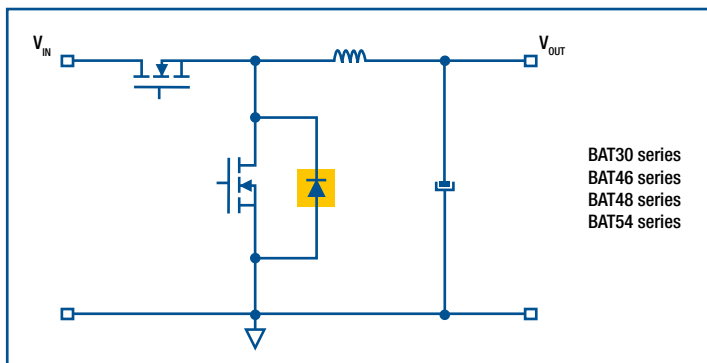


## Buck converter

Diode rectification



Synchronous rectification





# 8.0 Focus on the Power Schottky avalanche diode specification

## 8.1 2% savings with specified Power Schottky avalanche diodes!

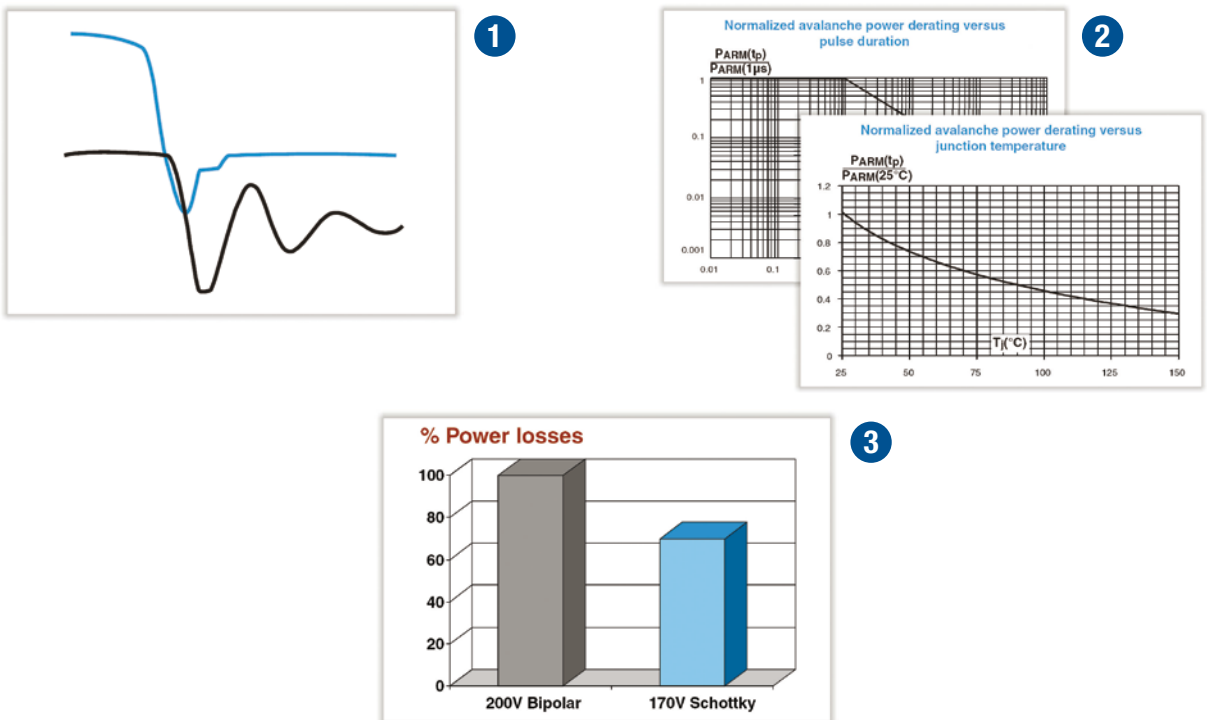
Rectifier devices usually represent from 10 to 15 % of the cost of an SMPS bill of material. This means that with a 20 % savings on the rectifiers when using the avalanche specification of STMicroelectronics diodes, you save 2 % or more on the total SMPS BOM.

As a result of exhaustive characterization, reliability and R&D validation, ST offers the best solution by rating the avalanche for each of its Power Schottky diodes. The avalanche rating temperature and pulse width derating curves ensure a precise match between the power converter voltage spikes and the capability of the diodes.

This key information provides the designer with the opportunity to choose between upgrading the efficiency by 2 % and reducing the BOM cost by 2 %.

## 8.2 Key steps

1. Spike measurement and avalanche power calculation in applications ( $P_p$ )
2. Comparison with the diode capability specified in the datasheet ( $P_p < P_{ARM}$ )
3. Power-loss budget verification

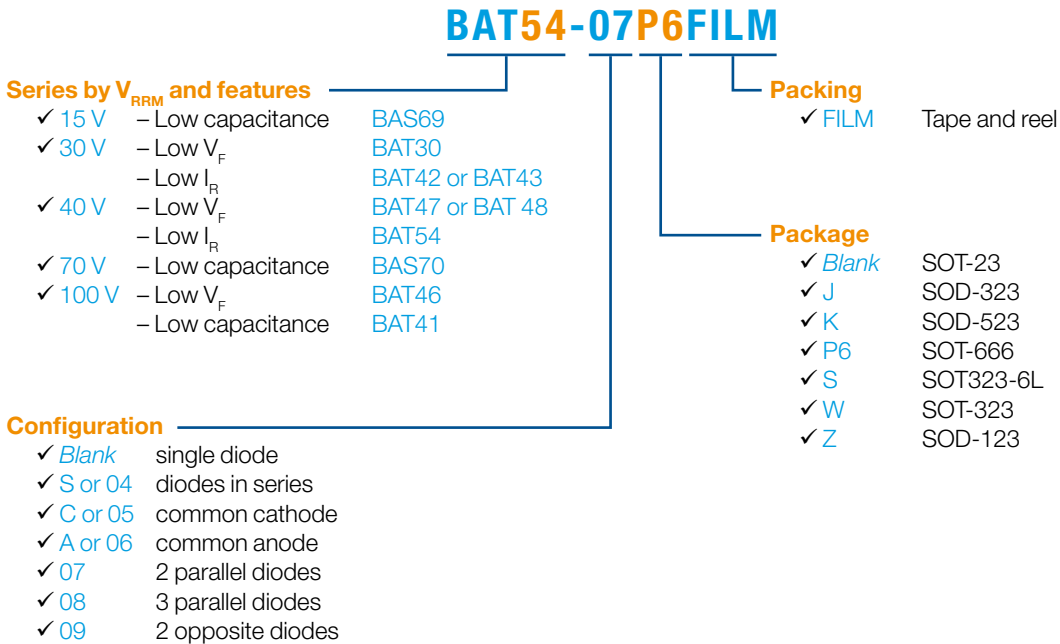


## 8.3 Key benefits: choose between efficiency and cost savings

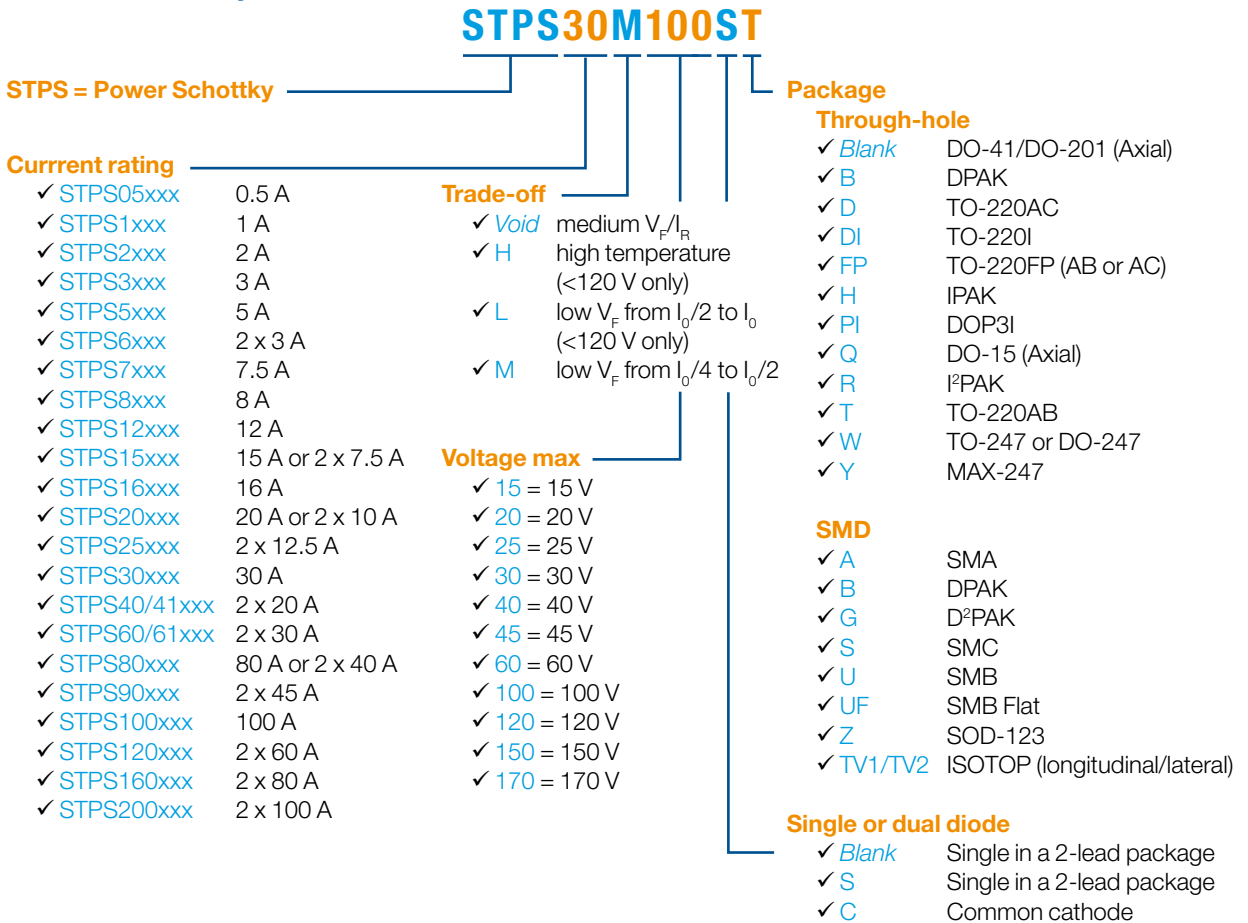
280 W SMPS	Application improvement examples with avalanche diodes		
	Reference design	Efficiency improvement	Cost saving
3.3 V/10 A	STPS3045CT	STPS3030CT	STPS2030CT
5.0 V/25 A	STPS6045CW	STPS6030CW	STPS3030CT
12 V/10 A	STPS20H100CT	STPS20L60CT	STPS10L60CT
<b>Efficiency</b>	Nominal	+2 %	Unchanged
<b>Diode cost</b>	Nominal	Unchanged	From -15 % to -25 %
<b>SMPS cost</b>	Nominal	Unchanged	-2 %

# 9.0 Ordering scheme

## 9.1 Signal Schottky series



## 9.2 Power Schottky series



### 9.3 SiC diodes

## STPSC1006D

- Power Schottky structure**
- Silicon carbide**
- Current rating**
  - ✓ STPSC08xxx 8 A
  - ✓ STPSC10xxx 10 A

- Package**
  - ✓ D TO-220AC
- Voltage max**
  - ✓ 06 x 100 V = 600 V

### 9.4 Ultrafast series

## STTH16R04CFP

- STTH = Ultrafast**
- Current rating**
  - ✓ STTH1xxx 1 A
  - ✓ STTH3xxx 3 A
  - ✓ STTH5xxx 5 A
  - ✓ STTH8xxx 8 A
  - ✓ STTH12xxx 12 A
  - ✓ STTH15xxx 15 A
  - ✓ STTH16xxx 2 x 8 A
  - ✓ STTH20xxx 20 A
  - ✓ STTH30xxx 30 A
  - ✓ STTH60/61xxx 2 x 30 A
  - ✓ STTH60xxx 60 A
  - ✓ STTH80xxx 80 A
  - ✓ STTH90xxx 2 x 45 A
  - ✓ STTH100xxx 100A
  - ✓ STTH120xxx 2 x 60 A
  - ✓ STTH200xxx 2 x 100 A

- Trade-off**
  - ✓ *Void* low  $V_F$  (600 V mainly)
  - ✓ *L* medium  $V_F$  &  $Q_{RR}$
  - ✓ *R* low  $Q_{RR}$  recovery

*Note: R trade-off mainly used for 400 V and 600 V*

- Voltage max**
  - ✓ 02 x 100 V = 200 V
  - ✓ 04 x 100 V = 400 V
  - ✓ 06 x 100 V = 600 V
  - ✓ 08 x 100 V = 800 V
  - ✓ 10 x 100 V = 1000 V
  - ✓ 12 x 100 V = 1200 V

- Package Through-hole**
  - ✓ *Blank* Axial: DO-41, DO-15, DO-201
  - ✓ D TO-220AC
  - ✓ DI TO-220I
  - ✓ T TO-220AB
  - ✓ FP TO-220FPAB
  - ✓ PI DOP3I
  - ✓ R I<sup>2</sup>PAK
  - ✓ W TO-247 or DO-247
- SMD**
  - ✓ A SMA
  - ✓ U SMB
  - ✓ S SMC
  - ✓ B DPAK
  - ✓ G D<sup>2</sup>PAK
  - ✓ TV1/TV2 ISOTOP (longitudinal/lateral)
- For dual diode – ONLY**
  - ✓ C Common cathode



© STMicroelectronics - May 2008 - Printed in Italy - All rights reserved

The STMicroelectronics corporate logo is a registered trademark of the STMicroelectronics group of companies. ASD is a trademark of STMicroelectronics.  
All other names are the property of their respective owners.

**For selected STMicroelectronics sales offices fax:**

China +86 21 34054689; France +33 1 55489569; Germany +49 89 4605454; Italy +39 02 8250449; Japan +81 3 57838216; Singapore +65 6481 7771;  
Sweden +46 8 58774411; Switzerland +41 22 9292900; United Kingdom and Eire +44 1628 890391; USA +1 781 861 2678

**Full product information at [www.st.com](http://www.st.com)**

Order code: BRECT0408

