

## Wide range isolated flyback demonstration board, single output 12 V/4.2 W based on the VIPER16LN

Data brief



### Features

- Universal input mains range:
  - input voltage 90 - 264 V<sub>AC</sub>
  - frequency 45 - 65 Hz
- Single output voltage: 12 V at 0.35 A continuous operation
- Stand-by mains consumption: < 30 mW at 230 V<sub>AC</sub>
- Average efficiency: > 75 %
- Fully protected against faults (overload, feedback disconnection and overheating)
- EMI: according to EN55022-Class-B

### Description

This board implements a 4 W single-output wide range mains power supply set in flyback isolated topology, using the VIPER16LN, an off-line high voltage converter by STMicroelectronics.

The features include an 800 V avalanche rugged power section, PWM operation at 60 kHz with frequency jittering for lower EMI, current limiting with adjustable set point, on-board soft-start, a safe auto-restart after a fault condition and a low stand-by power.

The device does not require a biasing circuit to operate because the IC can be supplied by an internal current generator, therefore saving the cost of the transformers auxiliary winding. If the device is biased through an auxiliary winding, the demonstration board can reach very low standby consumption (< 30 mW at 230 V<sub>AC</sub>, with output load disconnected).

The IC implements several protections that considerably increase end-product safety and reliability: thermal shutdown with hysteresis, delayed overload protection, open loop failure protection (the last one available only if the device is biased through the auxiliary winding).

---

## Contents

<b>1</b>	<b>Adapter features .....</b>	<b>3</b>
<b>2</b>	<b>BOM and schematic .....</b>	<b>4</b>
<b>3</b>	<b>Layout .....</b>	<b>6</b>
<b>4</b>	<b>Transformer .....</b>	<b>7</b>
<b>5</b>	<b>Electrical performances .....</b>	<b>9</b>
<b>6</b>	<b>Revision history .....</b>	<b>12</b>

# 1 Adapter features

The electrical specifications of the demonstration board are listed below:

**Table 1: Electrical specification**

Parameter	Symbol	Value
Input voltage range	$V_{IN}$	[90V <sub>AC</sub> ; 265V <sub>AC</sub> ]
Output voltage	$V_{OUT}$	12V
Max output current	$I_{OUT}$	0.35A
Precision of output regulation	$\Delta V_{OUT\_LF}$	±5%
High frequency output voltage ripple	$\Delta V_{OUT\_HF}$	50mV
Max. ambient operating temperature	$T_{AMB}$	60 °C

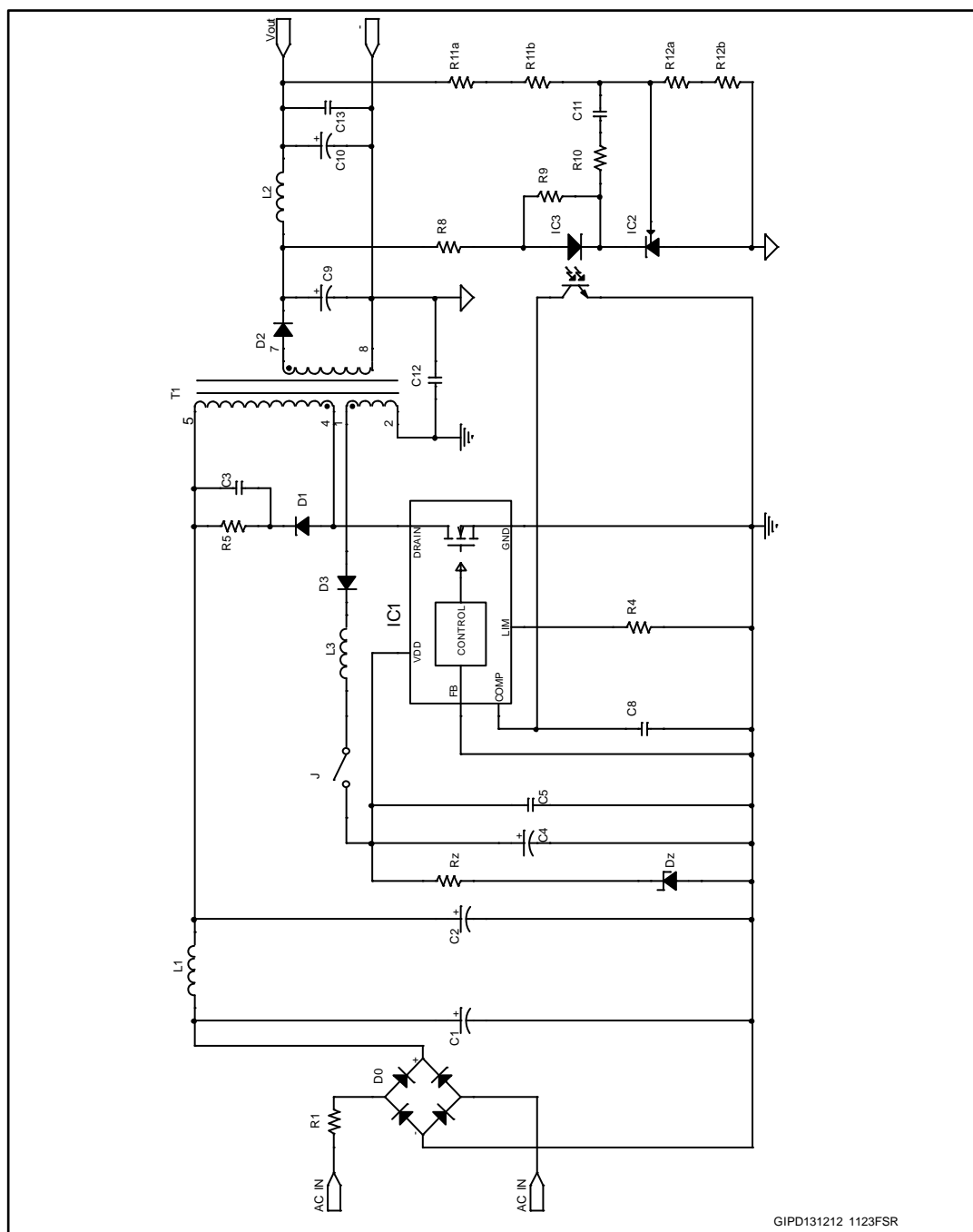
## 2 BOM and schematic

Table 2: Bill of material

Reference	Part	Description	Manufacturer
D0	DF06M	Diode bridge	VISHAY
C1, C2	4.7μF, 400V	Electrolytic capacitor, NHG series	PANASONIC
C3	Not mounted		
C4	10μF, 35V	Electrolytic capacitor, GA series	PANASONIC
C5	100nF, 50V	Ceramic capacitor, SR series	AVX
C8	3.3nF, 100V	Ceramic capacitor	
C9	470μF, 25V	Ultra-low ESR electrol. Cap., ZL serie	Rubycon
C10	Not mounted	Electrolytic capacitor	
C11	33nF, 50V	Ceramic capacitor B3798x serie	EPCOS
C12	2.2nF	Y1 capacitor 440L serie	VISHAY
C13	100nF, 50V	Ceramic capacitor, SR serie	AVX
D1	Not mounted	Clamp diode	
D2	STPS2H100	Output diode 2A, 100V	STMicroelectronics
D3	BAT46	Small signal diode	STMicroelectronics
Dz	18V	Zener diode	
Rz	6.8kΩ	1/4W resistor	
R1	4.7Ω	1W resistor	TYCO Electronics
R4	Not mounted	1/4W resistor	
R5	Not mounted	1/2W resistor	
R8	8.2kΩ	1/4 W resistor	
R9	15kΩ	1/4 W resistor	
R10	680kΩ	1/4W resistor	
R11a	120kΩ	1/4W resistor	
R11b	27kΩ	1/4W resistor	
R12a	15kΩ	1/4W resistor	
R12b	1.8kΩ	1/4W resistor	
IC1	VIPER16LN	PWM controller	STMicroelectronics
IC2	TS431	Voltage reference	STMicroelectronics
IC3	PC817	Optocoupler	
L1	1mH	Filter inductor BC type	EPCOS
L2	Short-circuit		
L3	1μH	Small signal inductor	

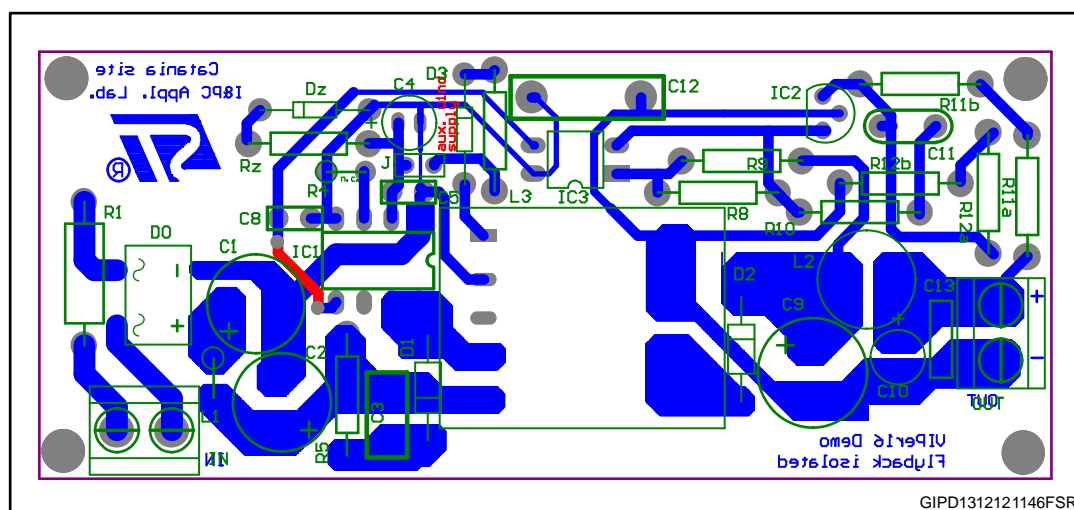
Reference	Part	Description	Manufacturer
T1	1335.0062	Transformer	MAGNETICA
J	Jumper		

**Figure 1: Application schematic**



### 3 Layout

Figure 2: Board layout



## 4 Transformer

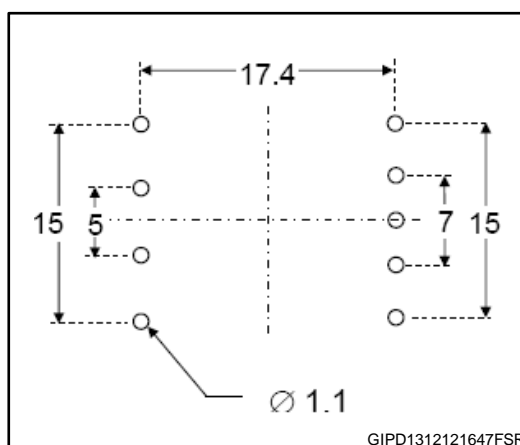
The transformer characteristics are listed in the table below.

**Table 3: Transformer characteristics**

Parameter	Value	Test conditions
Manufacturer	MAGNETICA	
Part number	1335.0062	
Primary inductance	1.2mH $\pm 15\%$	Measured at 1kHz 0.1V
Leakage inductance	2.9%	Measured at 10kHz 0.1V
Primary to secondary turn ratio (4 - 5)/(7, 8)	7.85 $\pm 5\%$	Measured at 10kHz 0.1V
Primary to auxiliary turn ratio (4 - 5)/(1 - 2)	7.33 $\pm 5\%$	Measured at 10kHz 0.1V

The following figures show size and pins distances (mm) of the transformers.

**Figure 3: Transformers pins distances**



**Figure 4: Transformer electrical diagram**

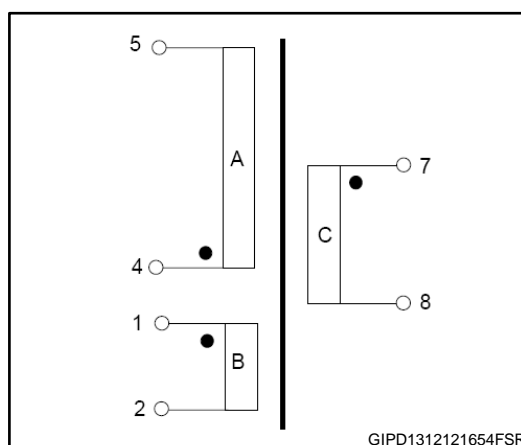


Figure 5: Transformer side view

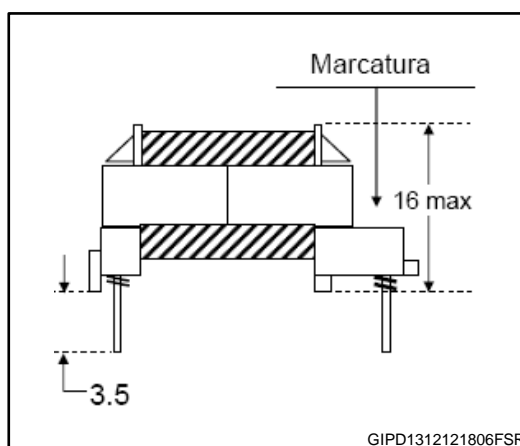
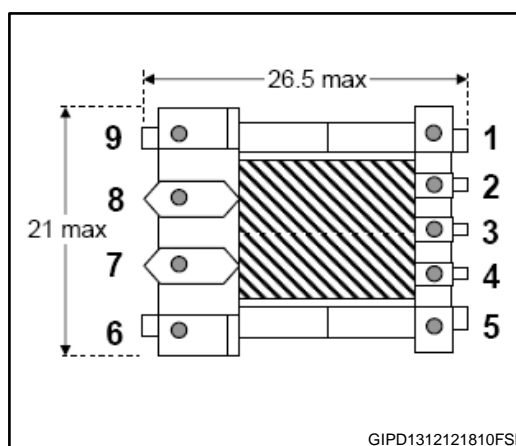


Figure 6: Transformer size and pin diagram





## 5 Electrical performances

Figure 7: Standby consumption at no/light load: IC externally biased (J selected)

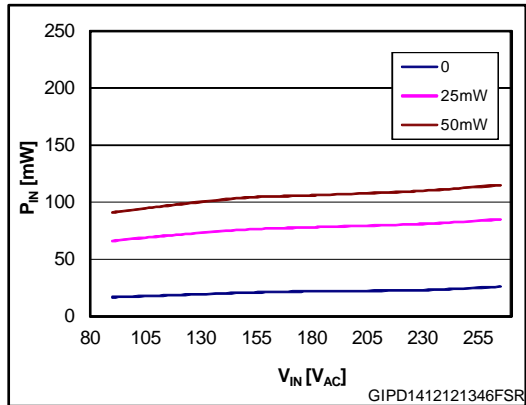


Figure 8: Standby consumption at no/light load: IC self biased (J not selected)

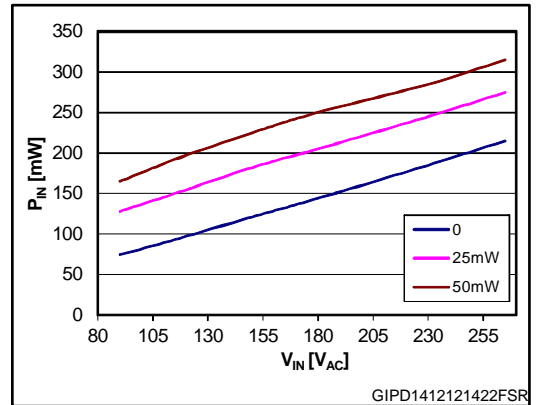


Figure 9: Line regulation

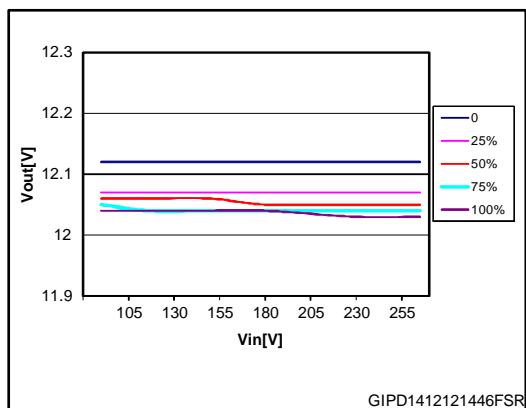
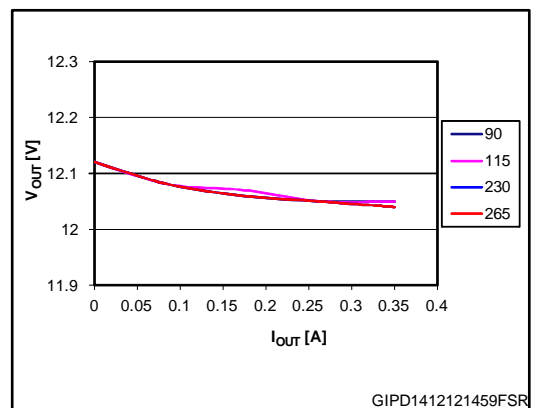


Figure 10: Load regulation



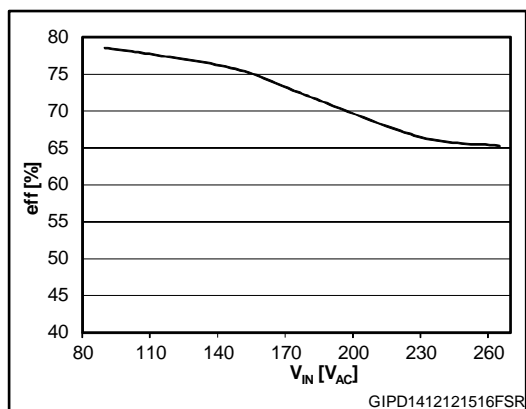
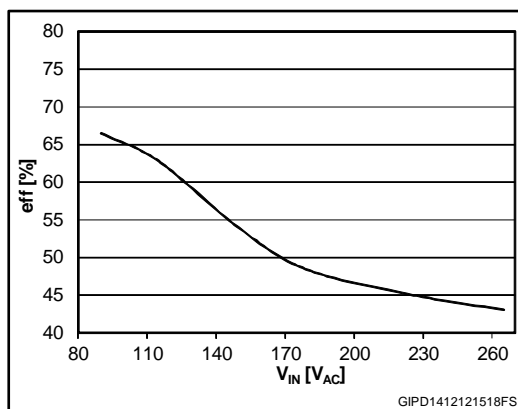
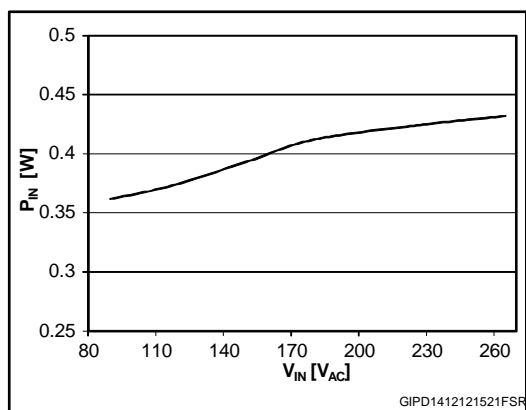
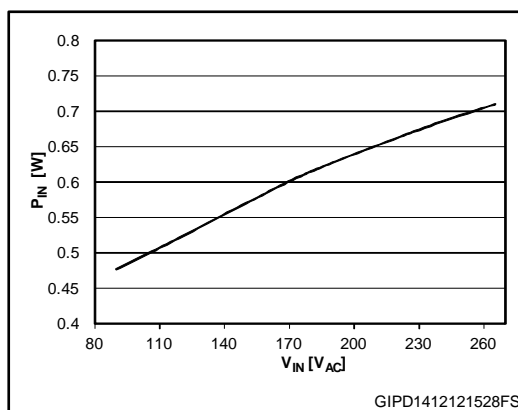
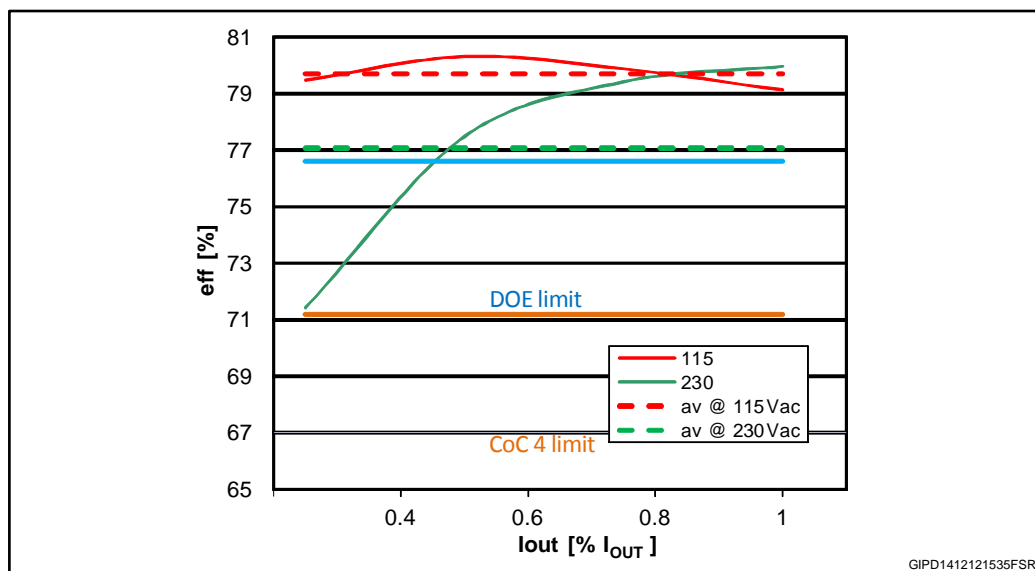
**Figure 11: Efficiency @  $P_{IN}$  = 1W, IC externally biased****Figure 12: Efficiency @  $P_{IN}$  = 1W, IC self biased****Figure 13:  $P_{IN}$  @  $P_{OUT}$  = 0.25W, IC externally biased****Figure 14:  $P_{IN}$  @  $P_{OUT}$  = 0.25W, IC self biased**

Figure 15: Active mode efficiency and comparison with energy efficiency standards (IC externally biased)



## 6 Revision history

Table 4: Document revision history

Date	Revision	Changes
21-May-2013	1	First release.

**Please Read Carefully**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy  
- Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United  
States of America

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

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[STEVAL-ISA117V1](#)