UM1059
User manual

STPMC1, STPMS2 demonstration kit

Introduction

The STEVAL-IPE014V1 is a demonstration board designed for the STPMS2L chip. It is designed to work along with the STEVAL-IPE010V1 demonstration board, for a ready-to-use energy meter application.

The STEVAL-IPE010V1 demonstration board is for the STPMC1 device, while the IPE014 package contains only the daughterboard with the STPMS2L companion chip.

These demonstration boards can be used in two ways:

- For demonstration purposes. Connecting the reference design to an AC power source and changing all the settings parameters through the GUI interface and the parallel hardware programmer/reader
- For user application demonstration and development

Note: The boards come not programmed and not calibrated.

Figure 1. STEVAL-IPE010V1 demonstration board

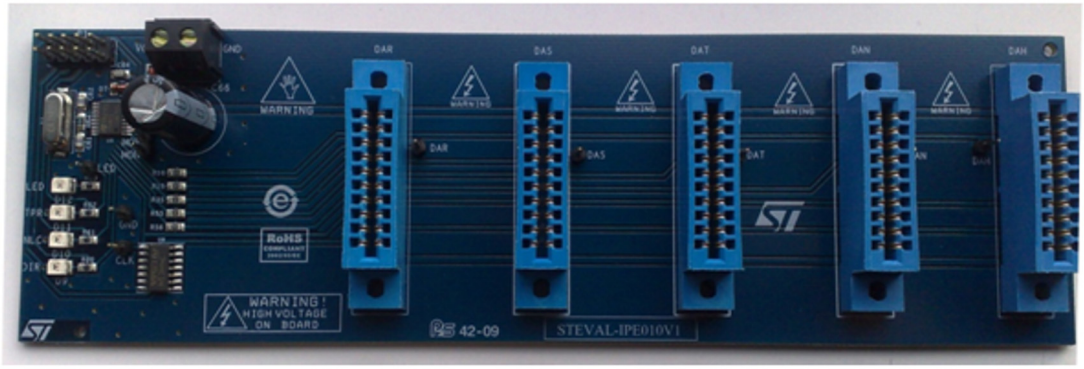
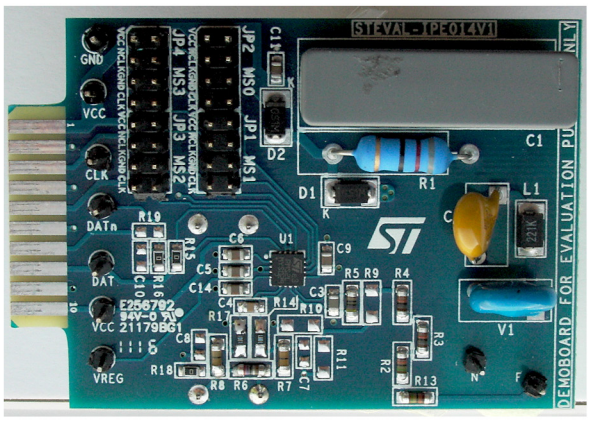


Figure 2. STEVAL-IPE014V1 demonstration board



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1 Overview

1.1 Safety rules

This board can be connected to mains voltage (220 V/110 V). In the case of improper use, wrong installation or malfunction, there is a danger of serious personal injury and damage to property. All operations such as transport, installation, and commissioning, as well as maintenance, should be carried out only by skilled technical personnel (national accident prevention rules must be observed).

Due to the risk of death when using this prototype on mains voltage (220 V/110 V), only “skilled technical personnel” who are familiar with installation, mounting, commissioning, and operating with power electronic systems, and have the qualifications needed to perform these functions, may use this prototype.

1.2 Operating conditions

Table 1. Operating conditions

Condition	Value	Unit
V_{NOM}	230	V_{RMS}
I_{NOM}	CT: I_{NOM} = 1	A_{RMS}
I_{MAX}	CT: I_{MAX} = 30	A_{RMS}
f_{LIN}	50/60 ± 10%	Hz
T_{OP}	-40 / +85	°C

1.3 Features

- Modularity
- Programmability
- Supports:
  - 3-phase, 4-wire RSTN, 4-system RSTN (tamper); extra module is needed
  - 3-phase, 4-wire RSTN, 3-system RST
  - 3-phase, 3-wire RST_, 3-system RST_ (tamper)
  - 3-phase, 3-wire RST_, 2-system R_T_ (Aron)
  - 2-phase, 3-wire _STN, 2-system _ST_ (America)
  - 1-phase, 2-wire __TN, 2-system _ST_ (tamper)
  - 1-phase, 2-wire __TN, 1-system __T_.
- 4 LEDs showing:
  - Power
  - No load condition
  - Tamper detection
  - Reverse current direction
- Embedded capacitive power supply
- Isolation of current channel

1.4 Recommended reading

This document describes how to use and set up a basic test session with a GUI interface. Additional information can be found in the following documents:

- STPMC1 datasheet
- STPMS2L/H datasheet
- Components datasheet
- AN2299 application note
- Schematics

1.5 Getting technical support

Technical assistance is provided free to all customers. For technical assistance, documentation, information, and product upgrades and services, please refer to your local ST distributor/office.

ST microelectronics offers its customers a free technical support service at online support in the www.st.com web site. Before contacting us, we recommend checking that you are working with the latest version of software/firmware. Upgrades are available free of charge at http://www.st.com/metering.

2 STEVAL-IPE014V1 components

2.1 Package content

The package contains:

- n.1 STEVAL-IPE014V1
- Promotional CD

2.2 STEVAL-IPE014V1

This board is a daughterboard. Each module serves one single phase, converting the voltage and current information, multiplexing them together, and sending the stream to the STPMC1.

Each of the boards must be connected to the voltage source of the relative phase and to the load.

Test points available are:

- GND
- VCC (stepper counter display connector)
- CLK
- DAT
- VREG
- F, N

The board should be plugged into the motherboard by the edge connector. Voltage inputs are pin F (hot wire) and N (neutral wire).

Current input (load wire) should be passed through the current transformer placed on the non-component side of the module.

2.2.1 Jumper settings

The onboard jumpers JP1, JP2, JP3, and JP4 allow the setting of the STPMS2L device according to *Table 2*, *3*, *4* and *5* below:

Table 2. Modes of operation

JP1	MS0	Description
1	GND	LPR, amplifier GAIN selection g3 = 16
2	CLK	LPR, amplifier GAIN selection g0 = 2
3	NCLK	HPR, amplifier GAIN selection g0 = 2
4(1)	VCC	HPR, amplifier GAIN selection g3 = 16

1. Default value

Table 3. Changing of BandGap voltage reference

JP2	MS1	Description
1	GND	TC = 60 ppm/°C
2(1)	CLK	Flattest TC = +30 ppm/°C
3	NCLK	TC = +160 ppm/°C
4	VCC	TC = -160 ppm/°C

1. Default value

Table 4. Changing of BandGap voltage reference

JP3	MS2	Description
1(1)	GND	Voltage channel ON, DATn = ~(DAT =(CLK) ? bsV: bsC))
2	CLK	Voltage channel OFF, DATn = bsCn, DAT = bsC
3	NCLK	Voltage channel OFF, DATn = bsCn, DAT = bsC
4	VCC	Voltage channel ON, DATn = bsC, DAT = bsV

1. Default value

Table 5. Changing of BandGap voltage reference

JP4	MS3	Description
1(1)	GND	Hard mode, BIST mode OFF
2	CLK	Soft mode
3	NCLK	Reserved
4	VCC	Hard mode, BIST mode ON

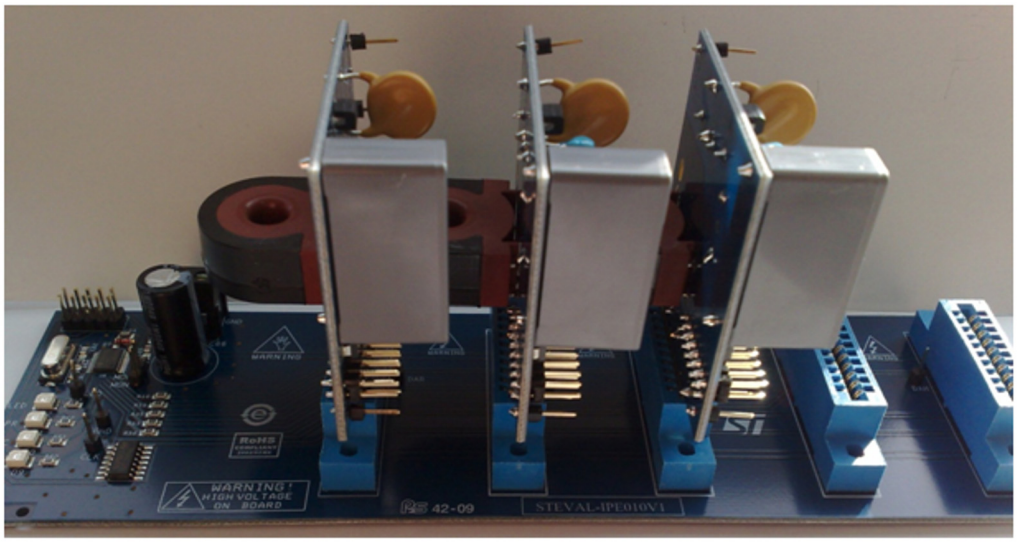
1. Default value

3 Getting started

3.1 Board assembly

Assemble the board as described in *Figure 3*:

Figure 3. STEVAL-IPE010V1 board assembly



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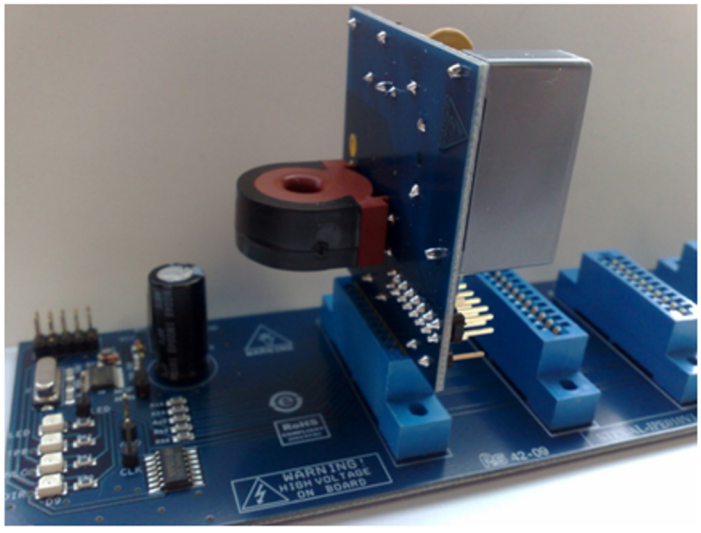
3.2 Board connection

Plug in the daughterboard as shown in *Figure 4*:

Figure 4. STEVAL-IPE010V1 daughterboard assembly



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Use the connectors DAR, DAS, DAT, and DAN (optional for 4-wire with tamper systems) as shown in *Figure 5*:

Figure 5. STEVAL-IPE010V1 DAR, DAS, AND DAT connectors

3.3 System configuration

Once one or more STPMS2 boards are plugged into the STPMC1 board and powered on, the system must be programmed and configured through the STPMC1 GUI.

The basic STPMC1 configuration bits to be set are the following:

TCS = 1: current transformer sensor selected

PM = 1: STPMS2 device selected for precision mode

HSA = 1: high speed clock output for STPMS2 device

To calibrate the system, first set the calibrators value to the middle of their range, setting CVX7 = 1 and CIX7 = 1 (where X stands for R, S, T, or N according to the phase the STPMS2 board is plugged into).

To complete calibration, it is recommended to use the STPMC1 GUI and follow the procedure described in AN2299.

4 Bill of material

4.1 Bill of material of the STEVAL-IPE014V1

Table 6. Bill of material

Ref.	Part/value	Toll. %	Voltage current	Watt	Technology information	Package-footprint	Manufacturer	Manuf. code	RS/distrelec/ other code	More info
C1	470 nF		275 Vac	-	Metallized polyester X2 capacitor	TH 11.5x31.5, lead spacing 27.5	Evox Rifa	PHE820EF 6470MR06 L2	Distrelec: 821891 / or equivalent	
C2	1 nF	10%	400/250 Vac	-	Ceramic capacitor X1/Y2	TH 8.5 X 6 mm	Vishay	S102M33Z 5US6TK7R	RS: 683-2181	
C3	10 nF	10%	25 V	-	X7R ceramic capacitor	SMD 0805				
C4	22 nF	10%	25 V	-	X7R ceramic capacitor	SMD 0805				
C5,C6, C9, C11,C14	1 µH	10%	25 V	-	X7R ceramic capacitor	SMD 0805				
C10	1 µH	10%	25 V	-	X7R ceramic capacitor	SMD 0805		Not mounted		Not mounted
C7,C8	4.7 nF	10%	25 V	-	X7R ceramic capacitor	SMD 0805				Not mounted
D1,D2			600 V / 1 A	-	Diode rectifier SMD*600 V 1 A	SMD SMA			RS: 700-1255 or equivalent	
JP1,JP2 ,JP3, JP4	Morsetti_4x2			-	8-way 2-row stripline connector	TH			Elcart:5/7643 or equivalent	+ n. 4 jumper

Table 6. Bill of material (continued)

Ref.	Part/value	Toll. %	Voltage current	Watt	Technology information	Package-footprint	Manufacturer	Manuf. code	RS/distrelec/ other code	More info
L1	220 µH	10%	100 mA		Wirewound chip inductor 220 µH/100 mA	SMD 1812	Bourns	CM453232-221KL	RS: 692-7780	
R1	82	5%		2 W	Wire resistor SFR_KRAH type	TH	ITALOHM www.italohm.com	SFR_KRAH		
R2,R13	150 kΩ	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713126	
R3,R4	180 kΩ	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713128	
R5	470 Ω	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713066	
R5	2.7 Ω	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713012	
R7,R8	0	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713000	
R14,R17	1 kΩ	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713074	
R9	43 kΩ	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713113	Not mounted
R10	2.2 MΩ	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713154	Not mounted
R11	100 Ω	1%			Mini Melf resistor	SMD Mini Melf 0204	Vishay	MMA0204	Distrelec: 713050	Not mounted
R15,R16 ,R18	0				Metal film resistor	SMD 0805				
R19	0	Not mounted			Metal film resistor	SMD 0805				Not mounted

Table 6. Bill of material (continued)

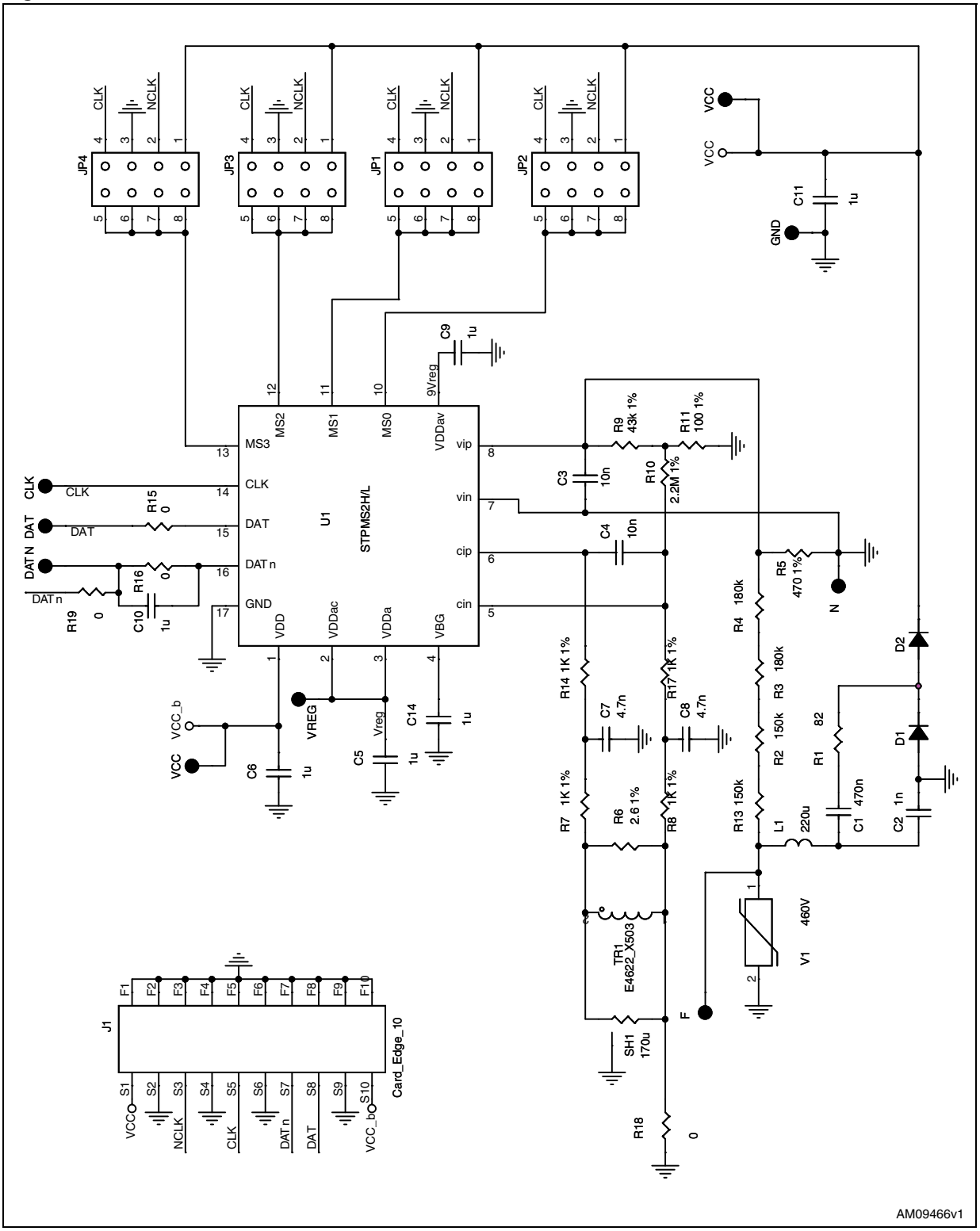
Ref.	Part/value	Toll. %	Voltage current	Watt	Technology information	Package-footprint	Manufacturer	Manuf. code	RS/distrelec/ other code	More info
TR1	E4622_ X503				VAC_e4622_x503	TH	VAC www.vacuumschmelze.de	T60404-E4622-X503		Bottom side mounted
U1	STPMS2L				Smart sensor II dual-channel second-order sigma-delta modulator with embedded PGA	SMD QFN16	STMicroelectronics	STPMS2L-PUR		
V1	420 V		320 Vac / 420 Vdc	Varistor S10K320	TH	Epcos	B72210S0321K101	RS: 289-7749		
W1	F				TEST_POINT - single stripline connector	TH				
W2	N				TEST_POINT - single stripline connector	TH				
W3	DAT				TEST_POINT - single stripline connector	TH				
W4	VREG				TEST_POINT - single stripline connector	TH				
W5,W8	VCC				TEST_POINT - single stripline connector	TH				
W6	GND				TEST_POINT - single stripline connector	TH				

Table 6. Bill of material (continued)

Ref.	Part/value	Toll. %	Voltage current	Watt	Technology information	Package-footprint	Manufacturer	Manuf. code	RS/distrelec/ other code	More info
W7	CLK				TEST_POINT - single stripline connector	TH				
W9	DATN				TEST_POINT - single stripline connector	TH				

5 Schematic

Figure 6. STEVAL-IPE014V1 schematic



6 Revision history

Table 7. Document revision history

Date	Revision	Changes
25-Aug-2011	1	Initial release.

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