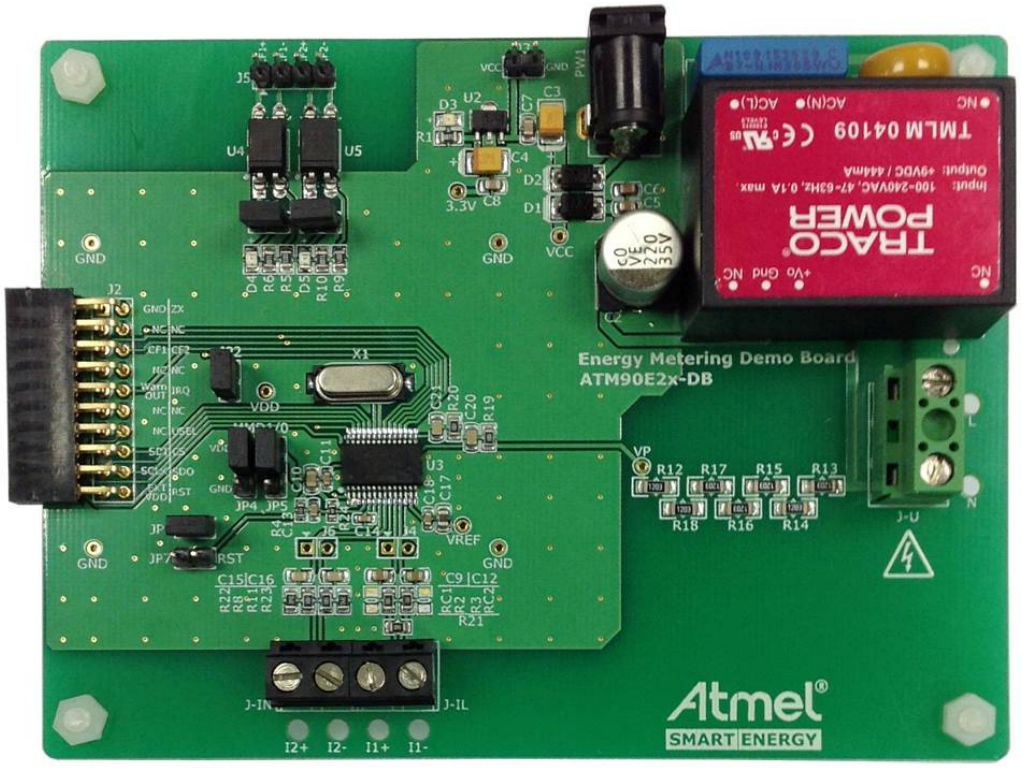
USER GUIDE

ATM90E2x Single-Phase Energy Metering Demo Board



Preface

ATM90E2x Single-Phase Energy Metering Demo Board (hereinafter referred to as ATM90E2x-DB) is used for the demo and testing of ATM90E2x (single-phase energy metering AFE chip of Atmel), which can sample single-phase voltage and current, meter active/reactive energy and output active/reactive energy pulses accordingly, as well as measure parameters such as voltage, current and power.

ATM90E2x-DB needs to access AC high voltage and could not be operated by non-professionals.

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1. Introduction

1.1 Features

- ATM90E26: single-phase energy metering AFE chip
- Voltage sampling: resistor divider network
- Current sampling
  - Shunt resistor or Current Transformer (CT) for L line current
  - Current Transformer (CT) for N line current
- Energy pulses
  - Active energy pulse indicator and isolated output
  - Reactive energy pulse indicator and isolated output
- One communication connector
- Crystal: 8.192MHz
- Power supply for demo board
  - AC 100V-240V line voltage input
  - DC 9V power input
  - External 3.3V input

1.2 Kit Overview

The whole demo kit contains two boards: the ATM90E2x-DB and the AFE Control Board. The ATM90E2x-DB is a single-phase energy metering board designed with Atmel's ATM90E2x chip. It communicates with the AFE Control Board through the extended communication connector (J2). For details of the AFE Control Board, please refer to the separate user guide.

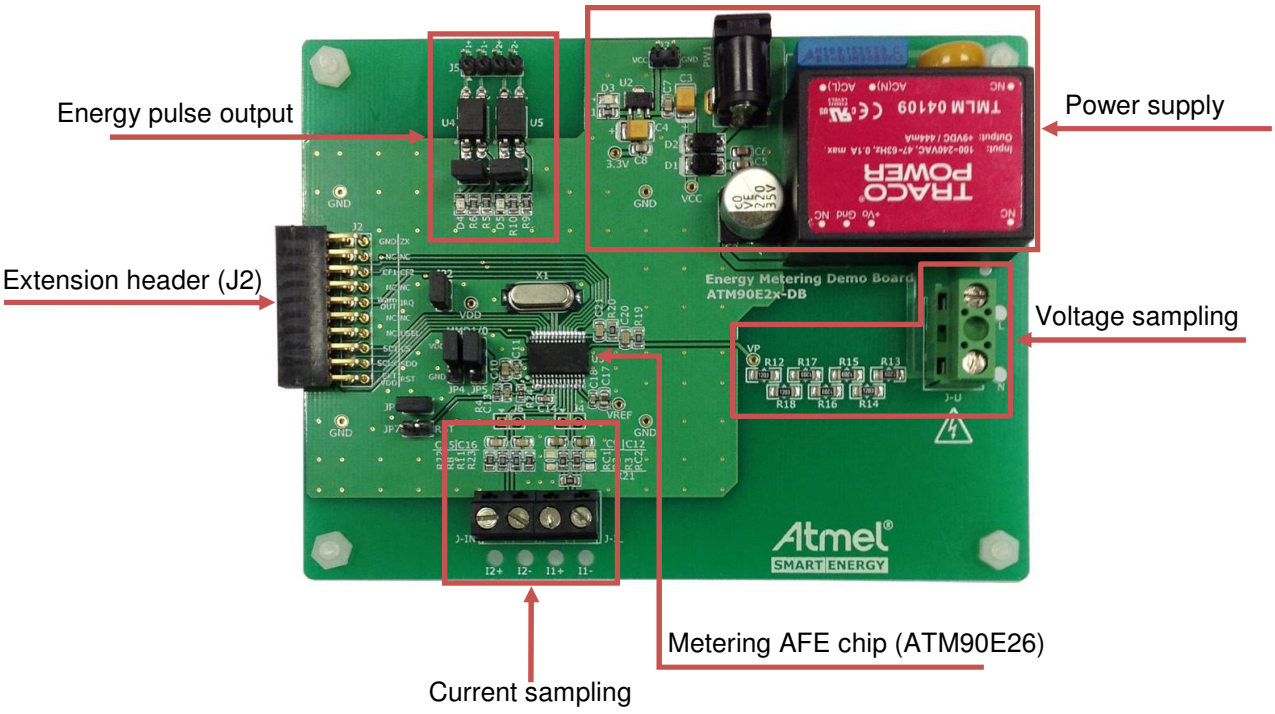


Figure 1-1 ATM90E2x-DB (Top View)

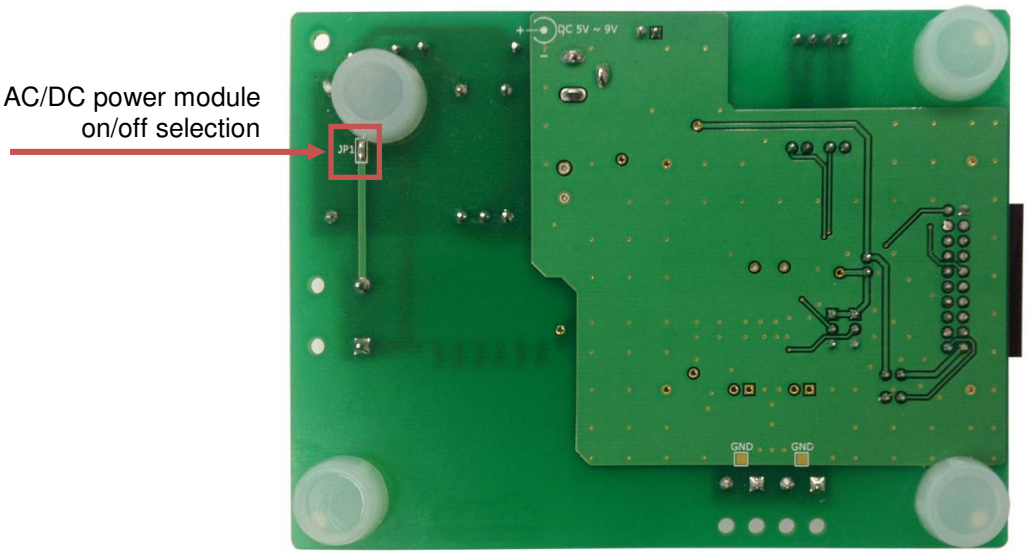


Figure 1-2 ATM90E2x-DB (Bottom View)

2. Getting Started

2.1 Connect ATM90E2x-DB to the AFE Control Board

The extension header J2 on the ATM90E2x-DB is used for communication with the AFE Control Board. Refer to Figure 1-3 for overview of the ATM90E2x-DB and the AFE Control Board after connection.

For details about J2 description, please refer to section 3.2.5.

When ATM90E2x-DB is powered on, LED D3 will be turned on, and the AFE Control Board will auto detect ATM90E2x-DB without any external program or debugger tool.

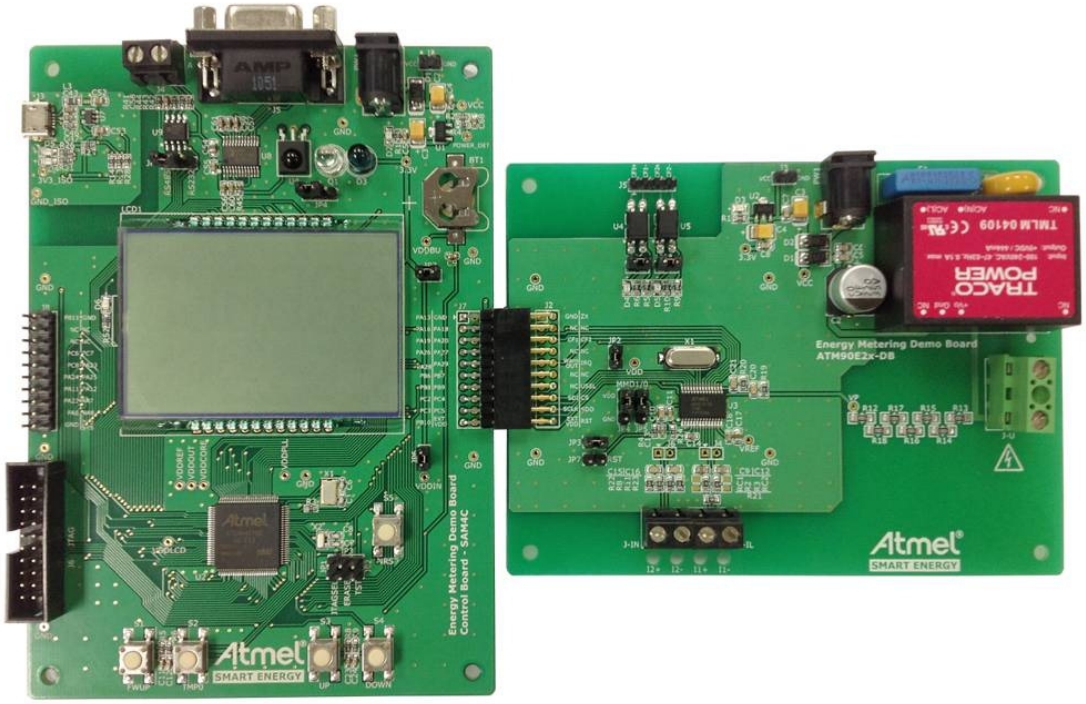


Figure 1-3 ATM90E2x-DB and AFE Control Board

2.2 Design Documentation and Related Links

The following is a list of the most relevant documents and software for the ATM90E2x-DB.

1. ATM90E26 Datasheet - Single-Phase High-Performance Wide-Span Energy Metering IC.
2. ATM90E26 Application Note - AN641: Single-Phase Energy Metering IC Application Note.
3. ATM90E2x-DB User Guide - PDF version of this user guide.
4. Atmel Software Framework (ASF) - Free Atmel Software Framework for development of C/C++ code for Atmel microcontrollers.

3. ATM90E2x-DB

3.1 Embedded Debugger

- ATM90E2x-DB uses extension header J2 for on-board debugging.
- Customers can use other MCU control board for debugging by connecting to J2.

3.2 Hardware User Guide

3.2.1 Power Supply

3.2.1.1 Board Power Supply

There are three possible sources for supplying board power. Detailed information is as shown in Table 3-1.

Table 3-1 Power Supply

Power Supply	Input Voltage	Description
External AC	AC 100V~240V	The power is from line voltage input that is connected to the screw terminal (J-U). The power input can be disabled by not soldering J1.
External DC	DC 9V	Plug a DC 9V power adapter to the power supply jacket (PW1).
External Board	DC 3.3V	The system power (3.3V) is got from the external board through the extension header J2.

3.2.1.2 Operating Voltage (VDD) Supply

When JP2 is connected, AFE chip is powered by 3.3V. User can measure power consumption by connecting to an ammeter serially.

When JP3 is connected, the on-board 3.3V power route is connected to external power through the EXT_VDD pin of the extension header J2. For details about J2 description, please refer to section 3.2.5.

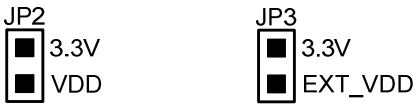


Figure 3-1 Power Selection

3.2.2 Voltage Sampling

There is one voltage channel on the ATM90E2x-DB. Line voltage (AC) is connected to the screw terminal (J-U) directly. Resistor divider network is used for voltage sampling. Please refer to Figure 3-2 for details.

Please note that the ground of single-phase energy meter is generally connected to the phase line (L line) of the single phase power supply.

Assume the line voltage is Un, the voltage sampling signal is as follows:

Vsample= (1/841K) x Un

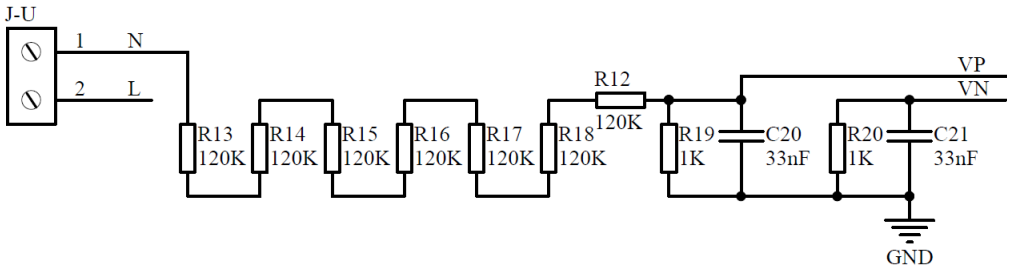
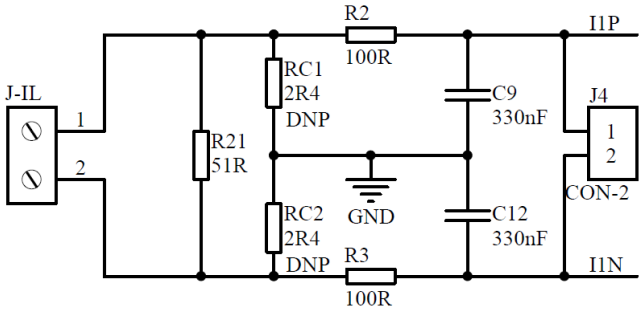


Figure 3-2 Voltage Sampling

3.2.3 Current sampling

There are two current channels (L line and N line) on the ATM90E2x-DB. Current is sampled over shunt resistor or Current Transformer (CT). Shunt and CT are external devices connecting to current terminals (J-IN or J-IL).

For L Line: either Shunt or CT can be selected for sampling, and different circuits are designed for shunt or CT. Please refer to Figure 3-3 for details.



	SHUNT	CT
RC1, RC2	NC	2R4

Figure 3-3 L line Current Sampling

When using Shunt for L line current sampling, the connection of the Shunt is as shown in Figure 3-4.

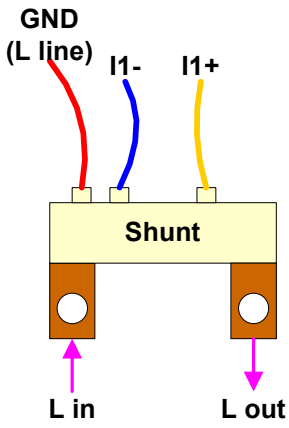


Figure 3-4 L Line Shunt Connection

For N Line: Only CT can be used in current sampling. Detailed application is as shown in Figure 3-5.

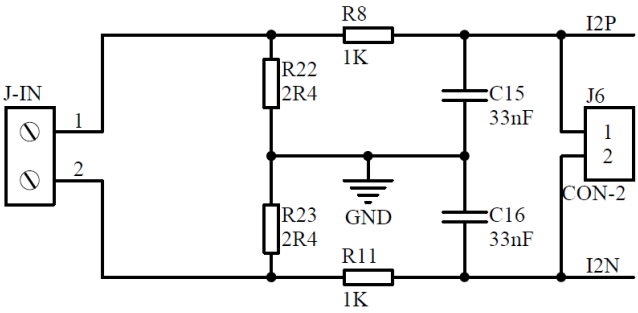


Figure 3-5 N line Current Sampling

3.2.4 Energy Pulse Output

ATM90E2x-DB can output energy pulses through the connector J5, including active energy and reactive energy indicated by LED D4 and LED D5 respectively. Table 3-2 shows the definition of J5.

Table 3-2 Definition of J5

Pin Number	Pin Name	Description
1	CF1+	Active energy pulse isolated output.
2	CF1-	The pulse is indicated by LED D4.
3	CF2+	Reactive energy pulse isolated output.
4	CF2-	The pulse is indicated by LED D5.

3.2.5 Headers and Connectors

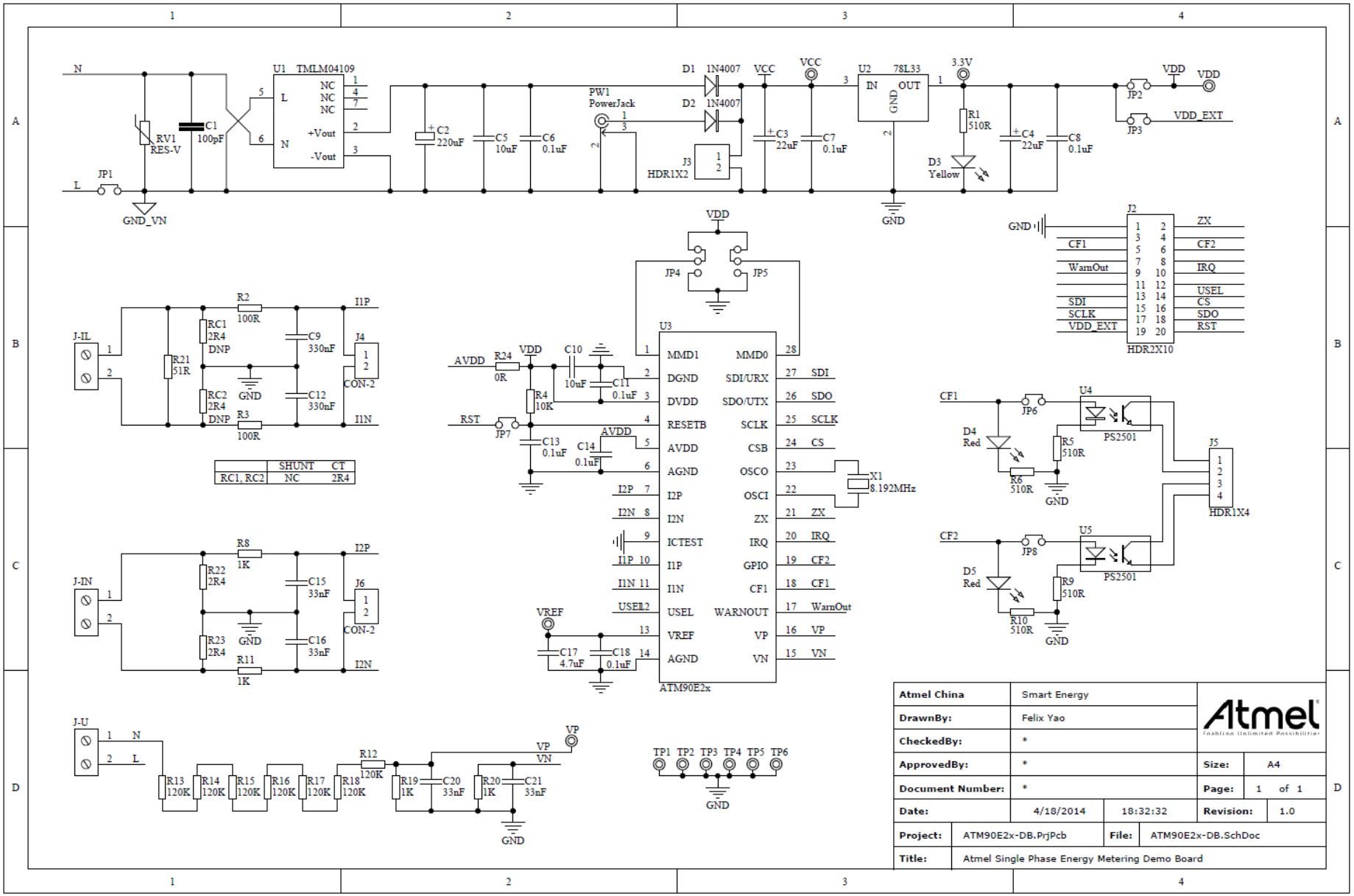
Extension Header J2 is a dual-row, 20-pin female connector. The AFE control board has the male counterparts.

J2 is an Xplained Pro Standard Extension Header. This header makes it possible to connect the AFE demo board to any Atmel's Xplained Pro MCU board. The pin assignment for J2 is shown in Table 3.2. Note that some pins are null.

Table 3.2 Extension Header (J2) Pin Assignment

Pin Number	Pin Name	Description
1	GND	Power Ground
2	ZX	Zero-crossing signal output
3	NC	Null
4	NC	Null
5	CF1	Active energy pulse output
6	CF2	Reactive energy pulse output
7	NC	Null
8	NC	Null
9	Warn Out	Warn out signal output
10	IRQ	Interrupt request signal output
11	NC	Null
12	NC	Null
13	NC	Null
14	USEL	SPI/UART select. USEL=1:SPI; USEL=0:UART
15	SDI	SPI Serial Data Input (MOSI)
16	CS	SPI Chip Select Input
17	SCLK	SPI Serial Clock Input
18	SDO	SPI Serial Data Output (MISO)
19	EXT_VDD	Power supply. Controlled by the Jumper J1. Please refer to 3.2.1.2 for J1 description.
20	RST	Chip Reset. Active Low

4. Demo Board Schematics



5. Revision History

Doc. Rev.	Date	Comments
1.0	09/09/2013	Initial release.
1.1	04/18/2014	Change P/N ATM90E25 to ATM90E26.

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