WDE series PowerTap™
Evaluation Board Application Note

1. System Requirements

- Windows XP, Vista or 7
- Microsoft Office Excel version 2007 or above
- USB2+ port
- X86 Processor, Pentium 4 or above.
- 3Gb RAM
- Installation files require 10Mb disk space

2. Installation

For installation instructions please refer to "WDE Power Tap Quick Start Guide"

3. Scope

The evaluation board is intended to be used as a platform to enable users to quickly familiarize themselves with the capabilities of the WDE series power converters and the associated PowerTap™ software / configuration / monitoring and power management environment.

4. Evaluation Board Circuits Description - Analog

The evaluation board contains a number of circuit modules to reflect the end application and additional circuits for ease of operation and debug.

Input Filter / Suppressor

The Demo board contains an input PI filter which has different values fitted according to the operating input voltage range (i.e. 9.. 36Vin or 18 .. 75Vin). These values are noted on a table in the schematic.

There is also a transient voltage suppressor fitted which protects against accidental over-voltage and reverse voltages applied to the input terminals (+Vin, -Vin).

Current Measurement

For convenience the input current and output current may be measured across J2 and J3 where 1mR sense resistors are fitted. i.e. voltage sensed in mV = current in Amps.

Output ripple

The output section includes the recommended output capacitors from the datasheet for the particular model. Note that these values differ based on the output voltage of the model. The values are noted on the schematic. The output voltage ripple can be measured by inserting an Oscilloscope probe in the J16 'Probe Jack' position.

Output Voltage Sense Connection

In order to evaluate the output voltage accuracy / regulation, the simplest approach is connect a voltmeter to the +Vsense and –Vsense banana jacks provided. These connect directly to the sense pins of the unit and best reflect what the unit is actually regulating. It is recommended to make measurements at these terminals for evaluating efficiency, otherwise losses in the PCB traces and current sense resistor will degrade the measurement.

The jumper positions J24 and J24 allow the options of connecting the sense pins directly to the output of the unit or directly to the +Vo and –Vo metal banana jack power terminals.

Trim Options

The unit may be trimmed 'digitally' using the PMBus^{TM} interface in which case the analog trim features should not be used on the evaluation board as they will further modify the intended set-point.   While using the digital trim J12 & J13 jumpers and positions R6 & R10 should not be fitted.

For analog trim there are a number of options.

- J13 is used to set the voltage 'Pull-up' for trim down (as the voltage reference in the unit has to be pulled higher). When in the 3.3V-5.0V position the trim down voltage pull-up is the output voltage of the unit. When in the 12-48V position the pull-up voltage is established at c. 5.0V by the constant current (depletion mode MOSFET) Q2 in combination with the zener voltage CR2. This is to establish a more 'reasonable' 5.0V pull-up voltage for the trim down.

- Trim-up is accomplished by connecting the trim pin through a suitable resistor to –Vo.

- The trim-down fixed resistor position to –Vo is R10. The trim-up fixed resistor position to +Vo (or 5.0V reference described in the 12-48Vo case above) is R6.

- Additionally the trim resistor can be selected as either fixed resistor (R6 / R10) or potentiometer (R11) by selection with J12.

Auxiliary Power / Indicators

The evaluation board is designed to operate with no external power supplies except for the USB power (via a host computer) and the input power to the converter.

Note: It is strongly advised to have the USB power connected while evaluating as when un-powered, the USB / digital isolator circuits will drag down the PMBus lines to an undetermined state which could possibly cause erroneous data on the bus.

The USB host can provide enough auxiliary power to power the digital communications interface circuits but the option exists to power these circuits separately from a +5V auxiliary supply (J21, J22). To use an external auxiliary supply jumper J15 needs to be moved to the off position.

The USB serial MODEM is secondary side referenced so it should be noted that the host computer will be connected to the secondary side –Vo of the converter via the USB cable. Please consult the factory if the output of the converter is intended to be used in an application where the secondary output power is not intended to be ground referenced.

The auxiliary power for the primary side circuits is provided by the isolated single chip converter IC2 which converts the USB 3.3V secondary side to a primary side 3.3V rail (to power the primary side of the digital isolator).

The indicators 'Primary Power' and 'Sec. Comms Power' when lit show that USB power is present and converted across the isolation barrier to the primary side.

5. Evaluation Board Circuits Description – Digital

The evaluation board contains several circuit modules to provide isolation and ease of operation and debug.

Digital Isolator

The majority of the digital functionality (everything except setting the output voltage set-point) is referenced to the primary side of the converter. The functions of the converter are accessed with the PMBus™ industry standard protocol (www.pmbus.org) either through a host computer and GUI software provided or a bespoke system monitor microprocessor / firmware (not provided).

A digital isolator (IC1) is included, which bridges the serial communications between the primary and the secondary side of the converter, with the host computer connected to the secondary side –Vo via the USB cable.

Digital Communications Indicators

PMBus™, is an active low protocol and the indicator LEDs - PRI SCL, SDA and SEC SCL, SDA flash when these lines have instantaneously been pulled low. They include a pulse extension circuit to detect short transitions of the communications bus. They do not indicate the quality or success of the communications (which is better analyzed with the GUI flags). They indicate that communications are being attempted. A constant on-state of any of the indicators, or a constant off state when commands are being sent would likely indicate a hardware or software fault.

External Connection of PMBus™

Connectors J8 and J11 allow the connection of the communications bus to an external device. This could be used for example to connect to a unit fitted in a final application (customer product). This would be useful for late re-configuration / monitoring of unit in development / test or field environment. The GUI can also be used to download the fault history of a unit and therefore it is recommended to consider facilitating the option of a data connection to the unit in the customer product design.

As PMBus™ is a short distance protocol and susceptible to noise and bus loading it is recommended that such an external connection, where used should be shorter than 1M and have loosely twisted wires (low capacitive loading).

USB to serial MODEM

The FT2232H module bridges between the host computer and the serial PMBus™ SCL, SDA lines. The Calex provided drivers and DLL files configure the MODEM to communicate with the GUI.

Converter Sockets

The input and output power connections are raised to ensure that the supply rail is connected first (in particular the input supply for –Vin, GND). This is to avoid a situation where +Vin connects first and then a digital line (SCL, SDA) connects before –Vin connects. If this were to happen (no –Vin connection) the digital input could be stressed to approx the Vin voltage, potentially destroying the input. In a hot-plugging application it is essential that –Vin connects before the digital inputs (which is normal practice).

Graphical User Interface

The graphical user interface requires installation of Microsoft Excel version 2007 or later. It is regularly updated as new models are released in the PowerTap ^{TM} Product family. The www.calex.com/WDE location contains a training video to explain the functions and options available.

Watts	Vin Nominal	Vout	V in Range	I out (Amps)	Case size	Model Number	Evaluation Board Number
75	24	5	9.0 - 36.0	15	2.5" x 1.1" x 0.55"	24S5.15WDE	WDE24-1
75	24	12	9.0 - 36.0	6	2.5" x 1.1" x 0.55"	24S12.6WDE	WDE24-2
75	24	24	9.0 - 36.0	3	2.5" x 1.1" x 0.55"	24S24.3WDE	
75	24	28	9.0 - 36.0	2.5	2.5" x 1.1" x 0.55"	24S28.3WDE	
75	24	48	9.0 - 36.0	1.5	2.5" x 1.1" x 0.55"	24S48.1WDE	
75	48	24	18.0 – 75.0	3	2.5" x 1.1" x 0.55"	48S24.3WDE	WDE48-2
75	48	28	18.0 – 75.0	2.5	2.5" x 1.1" x 0.55"	48S28.3WDE	
75	48	48	18.0 – 75.0	1.5	2.5" x 1.1" x 0.55"	48S48.1WDE	

Contact Factory for Availability
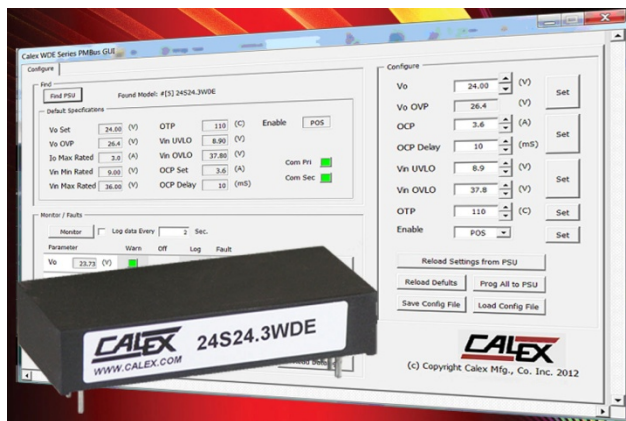
Evaluation Board Assembly Drawing
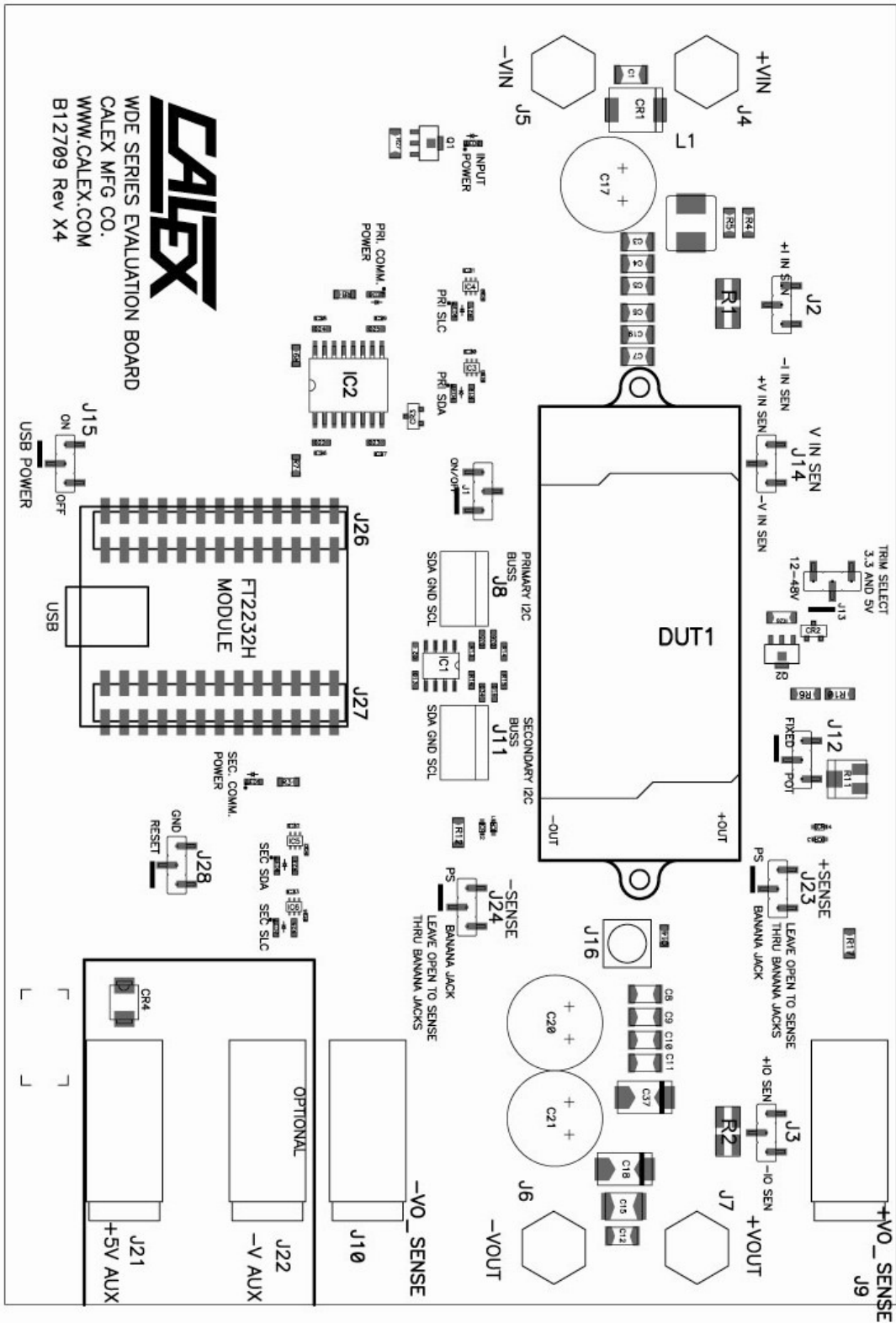
Evaluation Board Schematic Drawing