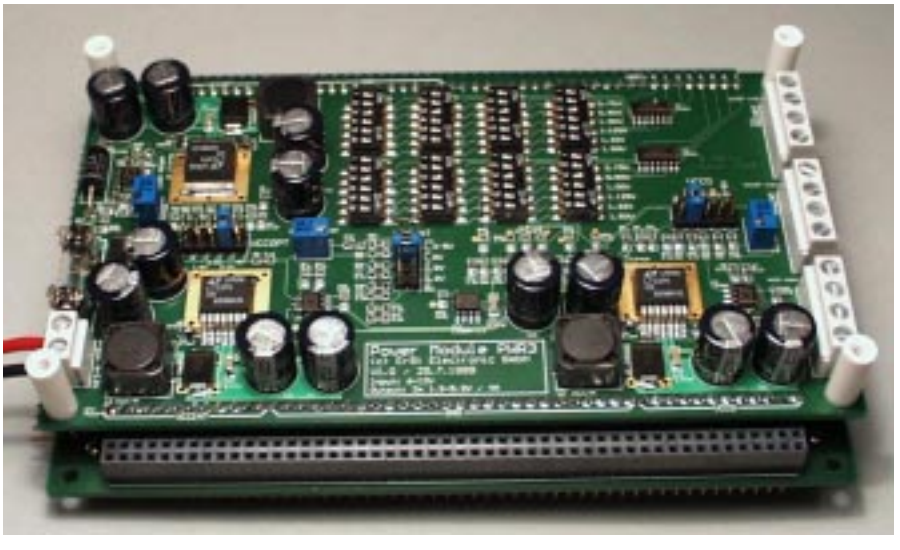
Power Module PWR3

User Manual



ErSt Electronic GmbH

Zürichstrasse 111
CH-8123 Ebmatingen

Phone +41 1 980 61 44
Fax +41 1 980 61 30

Internet http://www.erst.ch

Manual Version: PWR3 Version 1.0 July 1999

This manual describes the technical properties and the usage of the following products:

Power Module PWR3 Version 1.0 July 1999

Important Note:

The power module PWR3 has been designed and tested exclusively for the usage as a development tool. In particular, strong electromagnetic radiation may be produced. The ErSt Electronic GmbH does not undertake any liability for damages which may result from an improper use of this product.

Zürichstrasse 111
CH-8123 Ebmatingen
Phone +41 1 980 61 44
Fax +41 1 980 61 30
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1 Introduction

The ongoing miniaturisation of integrated circuits leads to lower supply voltages. This is due to two reasons. First, the dielectric streng of the insulator layers is limited. Second, the power dissipation can be minimised drastically (dynamic power dissipation is proportional to the square of the supply voltage).

The commonly used technologies work with 5V and 3.3V where the structure size goes down to 0.35µm. Already today, 0.25µm processes are state of the art and in the future the semiconductor manufacturers will be able to work with 0.18µm and 0.13µm structure sizes. The supply voltages will follow this trend and reach 2.5V, 1.8V and 1.3V.

Integrated circuits of different technologies with different supply voltages must work together in the same system. The implication of this is, that a single device can not longer work with a single supply voltage. Internal supplies and output driver supplies are separate from each other.

The power module PWR3 generates three regulated voltages in the range of 1.3 to 5V to ease the use of future digital integrated circuits. In addition, eight reference voltages for the support of multistandard I/Os are provided.

Information about new products and new developments can be found on the ErSt Electronic Website:

http://www.erst.ch

If you have questions you may write to the following email address:

info@erst.ch

We will answer as soon as possible, usually within one or two days.

2 Overview

2.1 Key Features

- Input power supply range 6-14V
- Switching regulator for VCCINT (1.8V/2.5V/3.3V/5V/U_{var})
- Switching regulator for VCCO (1.5V/2.5V/3.3V/5V/U_{var})
- Switching regulator for VCCOPT (1.8V/2.5V/3.3V/5V/U_{var})
- Output voltages selectable with jumper
- U_{var} is user adjustable in the range 1.3-5.2V
- Switching regulators are protected against short circuits and thermal overload
- Max. 4A load current for all output voltages
- All output voltages available on header connectors and power connectors
- Output power sufficient for up to three board modules
- 6 reference voltages (0.75V, 0.8V, 1V, 1.125V, 1.32V and 1.5V) for 8 I/O banks selectable with DIP switch matrix
- May be stacked with EVALXCV
- Board size 86mm x 150mm

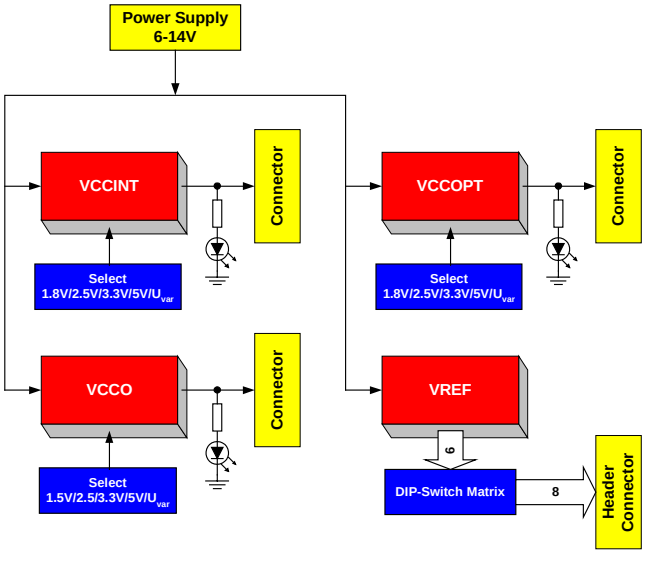

Figure 1: Block diagram of the power module PWR3

Absolute Maximum Ratings

Symbol	Description		Unit
V_{IN}	Input voltage [1)]	-0.3 ... 14	V
$I_{OUTVCCINT}$	Output current for VCCINT [2)]	4	A
$I_{OUTVCCO}$	Output current for VCCO [2)]	4	A
$I_{OUTVCCOPT}$	Output current for VCCOPT [2)]	4	A
$T_{SHORTOUT}$	Duration of output voltage short circuit against ground [3)]	Continuous	
$T_{SHORTREF}$	Duration of reference voltage short circuit against ground	Continuous	
T_{AMB}	Ambient temperature [4)]	0 ... 70	^oC

Note 1): The input is protected with an inverse diode and a transient suppressor diode. The inverse diode starts to conduct at voltages lower than –0.3V, the suppressor diode starts to conduct for voltages above 14V.

Note 2): This is the maximal output current of the switching regulator. The regulator circuit is thermally and short circuits protected.

Note 3): One output at a time.

Note 4): The maximal possible output current is reduced at high ambient temperatures.

Recommended Operating Conditions

Symbol	Description		Unit
V_{IN}	Input voltage	6 ... 12	V
$I_{OUTVCCINT}$	Output current for VCCINT [1)]	3	A
$I_{OUTVCCO}$	Output current for VCCO [1)]	3	A
$I_{OUTVCCOPT}$	Output current for VCCOPT [1)]	3	A
I_{OUTREF}	Output current of a reference voltage	10	mA
T_{AMB}	Ambient temperature	0 ... 40	^oC

Note 1): Continuous operation without additional cooling at 25 ^oC.

Typical Performance

V_{IN} = 10V, Ta = 25 ^oC unless otherwise noted

Description	Condition		Unit
Output ripple voltage (V_{p-p})	I_{OUT} = 4A	25	mV
Quiscent current		75	mA
Efficiency	V_{OUT} = 2.5V, I_{OUT} = 4A	75	%
Efficiency	V_{OUT} = 3.3V, I_{OUT} = 4A	78	%
Efficiency	V_{OUT} = 5V, I_{OUT} = 4A	83	%

2.2 Function Description

The power module PWR3 generates three regulated output voltages and eight reference voltages from a single unregulated power supply. The input supply voltage can be in the range from 6V to 14V. An inverse diode and a transient suppressor diode in conjunction with a fuse protect the module from inverted supply voltages and voltage transients.

The output voltages are generated with switching regulators working with 500kHz operating frequency and having an output current capability of 4A. They are thermally and short circuit protected. All output voltages are configureable with jumpers. Four settings (5V, 3.3V, 2.5V and 1.8V resp. 1.5V) are fix, a fifth setting is adjustable with a trim potentiometer. The three output voltages are available on header and power connectors. Each of the power connectors allows the connection of four wires, two for ground and two for output power.

Each of the eight reference voltages may be selected with DIP switches among six fixed voltages (0.75V, 0.8V, 1.0V, 1.125V, 1.32V and 1.5V). The reference voltages are also routed to the header connectors, buffered with a source follower.

Four LEDs show the state of the three output voltages and the power supply. The three LEDs which correspond to the three output voltages are driven by operational amplifiers connected to the voltage feedback input of the switching regulators. The reason for this is, that the output voltage may be well below the minimal forward voltage of an LED.

3 Technical Information

Figure 2 shows an overview of the placement of key components like input and output connectors, fuse, output voltage selection jumpers with adjustment potentiometers and DIP switches for reference voltage selection. A detailed description of each of these items is given in the following sections.

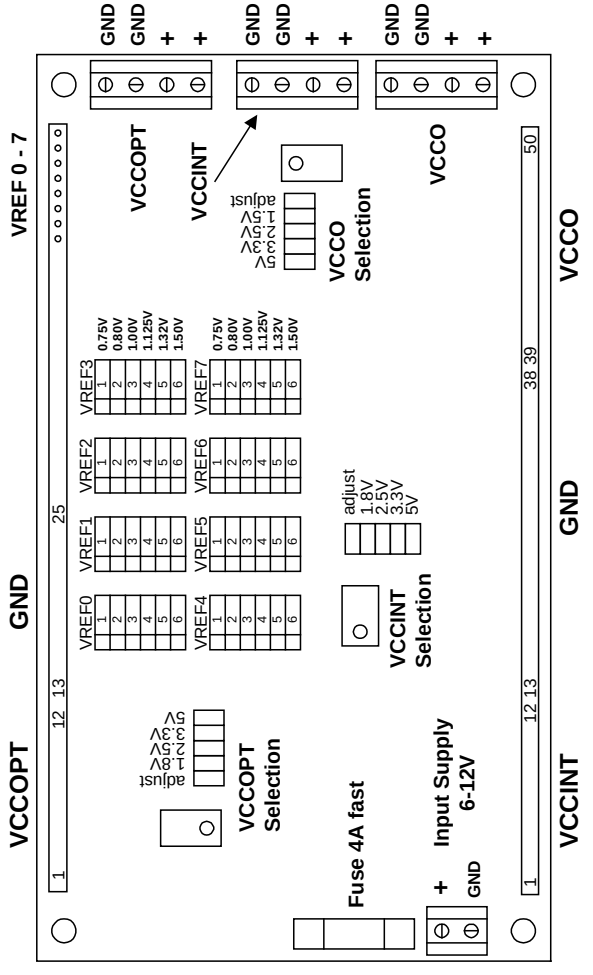

Figure 2: Component placement overview

3.1 Input Voltage

The input voltage of the power module may be choosen in the range of 6V to 14V and is connected to a two pole power connector. An inverse diode and a transient suppressor diode in conjunction with a fuse protect the module.

Caution: The fuse protects the module only in the case where the power supply can deliver enough current to blow the fuse immediately. Normally, inverse voltages or over voltages may be applied only for short durations to avoid damage to the module.

Due to the function principle of switching regulators the input current is higher at low input voltages than at higher input voltages. It may be necessary to adjust the value of the fuse for certain operating conditions.

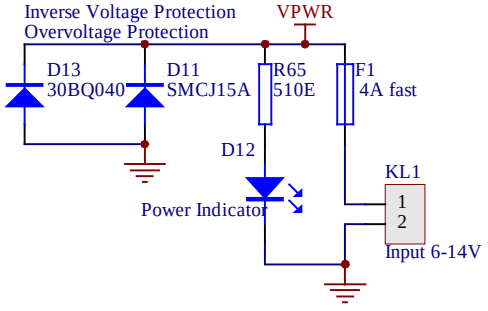

Figure 3: Input protection circuit

3.2 Output Voltages

The three ouput voltages are denoted with VCCINT, VCCO and VCCOPT. They are generated with switching regulators working at 500kHz. Each of the regulators is capable of delivering up to 4A and is thermally and short circuit protected.

The value of each of the output voltages is selectable by a jumper. *Table 1* shows the jumper settings and the resulting output voltage values. Only one jumper must be set at a time. During operation, the jumper settings may be changed without danger since the output voltage falls to 1.2V when all jumpers are removed.

Caution: Never insert more than one jumper at the same time since the output voltage may then rise well above 5V, limited by the input voltage level only.

Jumper	VCCINT
J6	5V
J7	3.3V
J8	2.5V
J9	1.8V
J10	variable

Jumper	VCCO
J11	5V
J12	3.3V
J13	2.5V
J14	1.5V
J15	variable

Jumper	VCCOPT
J1	5V
J2	3.3V
J3	2.5V
J4	1.8V
J5	variable

Table 1: Configuration of the output voltages

In the *variable* setting, the output voltages are adjustable with a trim potentiometer (see *Table 2*) in the range from 1.3V to 5.2V.

Note: The factory settings of the variable output voltages is undefined and must be adjusted to a reasonable value by the user before connecting anything to the output!

Potentiometer	Output voltage
R19	VCCINT
R18	VCCO
R17	VCCOPT

Table 2: Potentiometer for *variable* setting.

The output voltages are routed to power connectors and to header connectors. The naming and positioning of the signals on the header connectors corresponds with according connectors on board modules. *Table 3* shows the pins and signals on the header connectors. Also refer to *Figure 2.*

Connector	Pin Number	Signal Name
ST1	1 to 12	VCCOPT
	13 to 25	GND
	26 to 42	Reserved
	43	VREF0
	44	VREF1
	45	VREF2
	46	VREF3
	47	VREF4
	48	VREF5
	49	VREF6
	50	VREF7
ST2	1 to 12	VCCINT
	13 to 38	GND
	39 to 50	VCCO

Table 3: Pin numbers and signals on the header connectors

3.3 Reference Voltages

Figure 4 shows the circuit which generates the reference voltages. Eight reference voltages may be selected among six fixed voltages (0.75V, 0.8V, 1.0V, 1.125V, 1.32V und 1.5V) by means of DIP switches. All reference voltages are derived with resistive voltage dividers from a 2.5V reference.

Note: Only one switch of each six position switch should be in the *on* position. If two or more switches are in the *on* position, the voltage dividers are connected in parallel and the reference voltage assumes a wrong value.

The voltage dividers are buffered with an OpAmp (source follower). The output current of each reference voltage (VREF0 to VREF7) may be up to ca. 10mA.

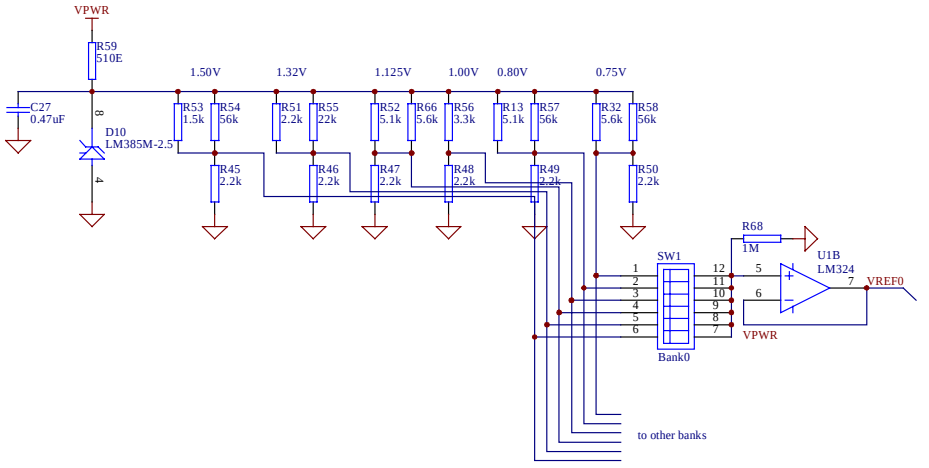

Figure 4: Reference voltage generation

3.4 Indicator LEDs

The three ouput voltages and the input voltage are equipped with indicator LEDs. The indicator LEDs of the output voltages are placed next to the appropriate power connector. As already mentioned in the function description, these LEDs are driven by an operational amplifier connected to the feedback voltage input of the switching regulator.
The indicator LED of the input voltage is placed between the fuse and the transient suppressor diode.