ERICSSON

Technical Specification

PIM 4000 series Power Interface Modules Input 36-75 V, Output up to 10 A / 390-540 W	EN/LZT 146 430 R1A February 2011
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Key Features

- Industry standard low profile Quarter-brick 57.9 x 36.8 x 13.7 mm (2.28 x 1.45 x 0.539 in)
- 400 W at 40 Vin, 480 W at 48 Vin, 540 W at 54 Vin
- High efficiency, typ. 99% at 300 W
- Low EMI design for CISPR Class B
- Surge pulse durability acc to IEC & ANSI standards
- 2250 Vdc input to output isolation
- Optimized for ATCA applications
- Functional isolation according to IEC/EN/UL 60950-1
- MTBF 1.8 Mh

General Characteristics

- Dual power feeds input and enable
- Input transient suppression
- Reverse polarity protection
- Input under voltage shutdown
- Over temperature protection
- Output current protection
- A/B Feed loss alarm
- Inrush protection and hot swap functionality
- Hold-up charge and management
- 12 W dual management power output
- Highly automated manufacturing ensures quality
- ISO 9001/14001 certified supplier

Safety Approvals

c US
UL EU

Design for Environment

Pb RoHS compatible

Meets requirements in high-temperature lead-free soldering processes.

Contents

PIM 4000 series Power Interface Modules Input 36-75 V, Output up to 10 A / 390-540 W	EN/LZT 146 430 R1A February 2011 © Ericsson AB

Ordering Information

Product program	Output
PIM 4328	10 A / 3.3 V, 3.6 A / 5 V, 0.15 A

Product number and Packaging

PIM 4XXX $n_1n_2n_3n_4$				
Options	n_1	n_2	n_3	n_4
Mounting	o			
Remote Control logic and function		o		
Lead length			o	
Delivery package information				o

Options	Description	
n_1	P	Through hole
n_2		Open collector *
n_3		5.33 mm *
	LA	3.69 mm
	LB	4.57 mm
n_4		Soft tray *

Example a through-hole mounted, open collector logic, standard pin product with tray packaging would be PIM 4328P.

* Standard variant (i.e. no option selected).

General Information

Reliability

The failure rate (λ) and mean time between failures (MTBF= 1/λ) is calculated at max output power and an operating ambient temperature (T_A) of +40°C. Ericsson Power Modules uses Telcordia SR-332 Issue 2 Method 1 to calculate the mean steady-state failure rate and standard deviation (σ).

Telcordia SR-332 Issue 2 also provides techniques to estimate the upper confidence levels of failure rates based on the mean and standard deviation.

Mean steady-state failure rate, λ	Std. deviation, σ
546 nFailures/h	47 nFailures/h

MTBF (mean value) for the PIM series = 1.83 Mh.
MTBF at 90% confidence level = 0.80 Mh

Compatibility with RoHS requirements

The products are compatible with the relevant clauses and requirements of the RoHS directive 2002/95/EC and have a maximum concentration value of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, PBB and PBDE and of 0.01% by weight in homogeneous materials for cadmium.

Exemptions in the RoHS directive utilized in Ericsson Power Modules products are found in the Statement of Compliance document.

Ericsson Power Modules fulfills and will continuously fulfill all its obligations under regulation (EC) No 1907/2006 concerning the registration, evaluation, authorization and restriction of chemicals (REACH) as they enter into force and is through product materials declarations preparing for the obligations to communicate information on substances in the products.

Quality Statement

The products are designed and manufactured in an industrial environment where quality systems and methods like ISO 9000, Six Sigma, and SPC are intensively in use to boost the continuous improvements strategy. Infant mortality or early failures in the products are screened out and they are subjected to an ATE-based final test. Conservative design rules, design reviews and product qualifications, plus the high competence of an engaged work force, contribute to the high quality of the products.

Warranty

Warranty period and conditions are defined in Ericsson Power Modules General Terms and Conditions of Sale.

Limitation of Liability

Ericsson Power Modules does not make any other warranties, expressed or implied including any warranty of merchantability or fitness for a particular purpose (including, but not limited to, use in life support applications, where malfunctions of product can cause injury to a person's health or life).

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Safety Specification

General information

Ericsson Power Modules DC/DC converters and DC/DC regulators are designed in accordance with safety standards IEC/EN/UL 60950-1 *Safety of Information Technology Equipment*.

IEC/EN/UL 60950-1 contains requirements to prevent injury or damage due to the following hazards:

- Electrical shock
- Energy hazards
- Fire
- Mechanical and heat hazards
- Radiation hazards
- Chemical hazards

On-board DC/DC converters and DC/DC regulators are defined as component power supplies. As components they cannot fully comply with the provisions of any safety requirements without "Conditions of Acceptability". Clearance between conductors and between conductive parts of the component power supply and conductors on the board in the final product must meet the applicable safety requirements. Certain conditions of acceptability apply for component power supplies with limited stand-off (see Mechanical Information for further information). It is the responsibility of the installer to ensure that the final product housing these components complies with the requirements of all applicable safety standards and regulations for the final product.

Component power supplies for general use should comply with the requirements in IEC 60950-1, EN 60950-1 and UL 60950-1 *Safety of Information Technology Equipment.* There are other more product related standards, e.g. IEEE 802.3 *CSMA/CD (Ethernet) Access Method*, and ETS-300132-2 *Power supply interface at the input to telecommunications equipment, operated by direct current (dc)*, but all of these standards are based on IEC/EN/UL 60950-1 with regards to safety.

Ericsson Power Modules DC/DC converters and DC/DC regulators are UL 60950-1 recognized and certified in accordance with EN 60950-1.

The flammability rating for all construction parts of the products meet requirements for V-0 class material according to IEC 60695-11-10, *Fire hazard testing, test flames* – 50 W horizontal and vertical flame test methods.

The products should be installed in the end-use equipment, in accordance with the requirements of the ultimate application. Normally the output of the DC/DC converter is considered as SELV (Safety Extra Low Voltage) and the input source must be isolated by minimum Double or Reinforced Insulation from the primary circuit (AC mains) in accordance with IEC/EN/UL 60950-1.

Isolated DC/DC converters

It is recommended that a slow blow fuse is to be used at the input of each DC/DC converter. If an input filter is used in the circuit the fuse should be placed in front of the input filter.
In the rare event of a component problem that imposes a short circuit on the input source, this fuse will provide the following functions:

- Isolate the fault from the input power source so as not to affect the operation of other parts of the system.
- Protect the distribution wiring from excessive current and power loss thus preventing hazardous overheating.

The galvanic isolation is verified in an electric strength test. The test voltage (V_{iso}) between input and output is 1500 Vdc or 2250 Vdc (refer to product specification).

24 V DC systems

The input voltage to the DC/DC converter is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

48 and 60 V DC systems

If the input voltage to the DC/DC converter is 75 Vdc or less, then the output remains SELV (Safety Extra Low Voltage) under normal and abnormal operating conditions.

Single fault testing in the input power supply circuit should be performed with the DC/DC converter connected to demonstrate that the input voltage does not exceed 75 Vdc.

If the input power source circuit is a DC power system, the source may be treated as a TNV-2 circuit and testing has demonstrated compliance with SELV limits in accordance with IEC/EN/UL60950-1.

Non-isolated DC/DC regulators

The input voltage to the DC/DC regulator is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

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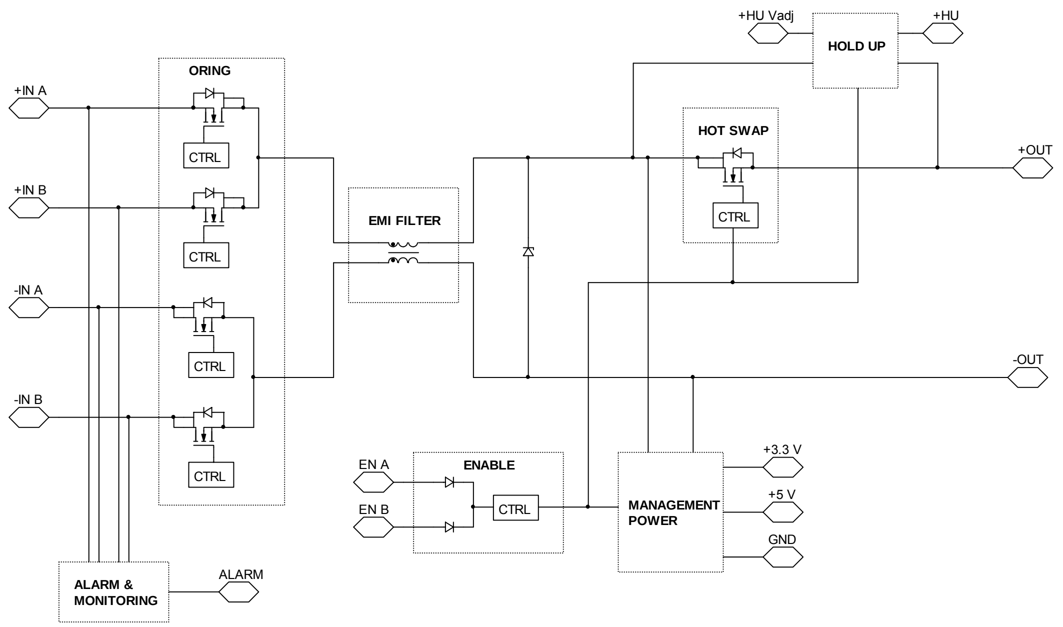
Absolute Maximum Ratings

Characteristics		min	typ	max	Unit
T_{P1}	Operating Temperature (see Thermal Consideration section)	-40		+110	°C
T_S	Storage temperature	-55		+125	°C
V_I	Input voltage	-0.5		75	V
V_I	Input voltage, reverse polarity			60	V
V_I	Input voltage transient ANSI T1.315-2001 (R2006)			100	V
V_I	Common mode surge pulses (1.2/50 µs) IEC 61000-4-5			500	V
V_{ISO}	Isolation voltage, shelf ground to input, management power and alarm			2250	Vdc
	Isolation voltage, management power and alarm to shelf ground and input			2250	
V_{HU}	Hold up capacitor voltage			100	V
C_{HU}	Hold up capacitor capacitance			3300	µF

Stress in excess of Absolute Maximum Ratings may cause permanent damage. Absolute Maximum Ratings, sometimes referred to as no destruction limits, are normally tested with one parameter at a time exceeding the limits in the Electrical Specification. If exposed to stress above these limits, function and performance may degrade in an unspecified manner.

Fundamental Circuit Diagram



PIM 4000 series Power Interface Modules Input 36-75 V, Output up to 10 A / 390-540 W	EN/LZT 146 430 R1A February 2011 © Ericsson AB

Main Unit, 36-72 V, 10 A, Electrical Specification — PIM 4328 P

T_{P1} = -40 to 90 ºC, V_I = 36 to 72 V.
Typical values given at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 10 A, I_{O2} = 3.6 A and I_{O3} = 0.15 A, unless otherwise specified under Conditions.

Characteristics		Conditions	min	typ	max	Unit
V_I	Input voltage range		36	53	72	V
$V_{EN\ A/B\ off}$	Enable turn-off threshold voltage	Decreasing feed A and B voltage	32	33		V
$V_{EN\ A/B\ on}$	Enable turn-on threshold voltage	Increasing feed A or B voltage		35	36	V
C_I	Internal input capacitance			10		µF
η	Efficiency	P_{O1} = 200 W, I_{O2} = 0 A, I_{O3} = 0 A		99.1		%
		P_{O1} = 300 W, I_{O2} = 0 A, I_{O3} = 0 A		99.1		
		I_{O1} = 10 A, I_{O2} = 0 A, I_{O3} = 0 A		98.7		
		I_{O1} = 10 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A		98.2		
P_d	Power Dissipation	I_{O1} = 10 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A		10	13	W
P_{li}	Input idling power	V_I = 53 V, I_{O1} = I_{O2} = I_{O3} = 0 A		1		W
P_{UVLO}	Input standby power	V_I < Enable turn off input voltage			0.4	W

t_r	Ramp-up time (from 10−90 % of V_{Oi})	V_I = 53 V, I_{O1} = I_{O2} = I_{O3} = 0 A, C_{O1} = 220 µF		1.4		ms
t_s	Start-up time (from V_I connection to 90 % of V_{Oi})			3.4		ms
I_{O1}	Output current	see Note 1	0		10	A
I_{lim}	Current limit threshold	T_{P1} < max T_{P1}	12.5	13.5	14.5	A
I_{sc}	Short circuit current	T_{P1} = 25 ºC, see Note 2		0.5		A
C_{O1}	Recommended Capacitive Load	T_{P1} = 25 ºC	Note 3			µF
I_{PK}	Inrush current transient	0.1-0.9 ms			40	A
		0.9-3.0 ms			40-18	

Note 1: No load allowed at start-up, see Hot Swap Functionality section
Note 2: RMS current, hiccup mode over current protection
Note 3: See Hold Up Event Voltage section

Hold up, Electrical Specification

T_{P1} = -40 to 90 ºC, V_I = 36 to 72 V.
Typical values given at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 10 A, I_{O2} = 3.6 A and I_{O3} = 0.15 A, unless otherwise specified under Conditions.

Characteristics		Conditions	min	typ	max	Unit
C_{HU}	Hold up capacitance		Note 4		3300	µF
f_{HU}	Hold up generator switching frequency			500		kHz
V_{HU}	Hold up capacitor voltage adjust range		40		95	V
t_{HU}	Hold up time, see Note 5	C_{HU} = 1200 µF, P_O = 300 W, V_{HU} = 75 V		8.7		ms
	Hold up event threshold voltage			36.8		V

Note 4: Ensure minimum 2 ms hold up time
Note 5: Time elapsed between output 1 reaches the hold up threshold voltage prior to and after the hold up event

Alarm, Electrical Specification

PIM 4328 P

T_{P1} = -40 to 90 °C, V_I = 36 to 72 V.
Typical values given at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 10 A, I_{O2} = 3.6 A and I_{O3} = 0.15 A, unless otherwise specified under Conditions.

Characteristics		Conditions	min	typ	max	Unit
V_I	Alarm turn on voltage	Decreasing input voltage		37		V
V_I	Alarm turn off voltage	Increasing input voltage		39		V
V_{ALARM}	Open drain voltage	Alarm off, feed A and B voltages above alarm turn on threshold			90	V
I_{ALARM}	Sink current	Alarm on, loss of feed A or B			135	mA

Management Power, 3.3 V, 3.6 A / 5.0 V, 0.15 A Electrical Specification

T_{P1} = -40 to 90 °C, V_I = 36 to 72 V, unless otherwise specified under Conditions.
Typical values given at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 10 A, I_{O2} = 3.6 A and I_{O3} = 0.15 A, unless otherwise specified under Conditions.

Characteristics		Conditions	min	typ	max	Unit
η	Efficiency	I_{O1} = 0 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A, see Note 6		75.6		%
P_d	Power Dissipation			4	6	W

			Output 2			**Output 3**			
			min	typ	max	min	typ	max	
V_{Oi}	Output voltage initial setting and accuracy	T_{P1} = +25 °C, V_I = 53 V, I_{O2} = 1.8 A, I_{O3} = 0.075 A		3.3			5.0		V
V_O	Output voltage tolerance band	10-100 % of max I_{O2}	3.2		3.4				V
		0-100 % of max I_{O3}				4.75		5.25	
	Idling voltage	I_{O2} = I_{O3} = 0 A		4	4.3		5.1	5.25	V
	Line regulation	I_{O2} = 3.6 A, I_{O3} = 0.15 A		50			2		mV
	Load regulation	V_I = 53 V, I_{O2} = 10-100% of max I_{O2}, I_{O3} = 0.15 A		30					mV
		V_I = 53 V, I_{O2} = 3.6 A, I_{O3} = 10-100 % of max I_{O3}					10		
V_{tr}	Load transient voltage deviation	V_I = 53 V, Load step I_{O2} = 25−75−25 % of max I_{O2}, I_{O3} = 0.15 A, C_{O2} = 360 µF, di/dt = 1 A/µs		±200			±40		mV
t_{tr}	Load transient recovery time			200			0		µs
t_r	Ramp-up time (from 10-90 % of V_{Oi})	I_{O2} = I_{O3} = 10-100 % of max I_O		2			0.2		ms
t_s	Start-up time (from V_I connection to 90 % of V_{Oi})			4			3		ms
I_O	Output current		0.36		3.6	0		0.15	A
I_{lim}	Current limit threshold	T_{P1} < max T_{P1}		4.5	5.5		0.2	0.5	A
I_{sc}	Short circuit current	T_{P1} = 25 °C, see Note 7		5.7			0.08		A
C_{O1}	Recommended Capacitive Load		0		10	0		10	mF
V_{Oac}	Output ripple & noise	See ripple & noise section, max I_O		30			20		mVp-p
f_s	Switching frequency	I_{O2} = I_{O3} = 10-100 % of max I_O		510			1500		kHz

Note 6: Idling losses in main unit is included

Note 7: Output 2 operates in constant current mode, output 3 operates in hiccup mode

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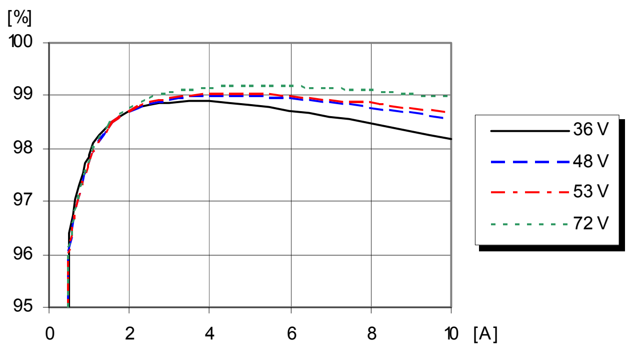
Main Unit, 36-72 V, 10 A, Typical Characteristics

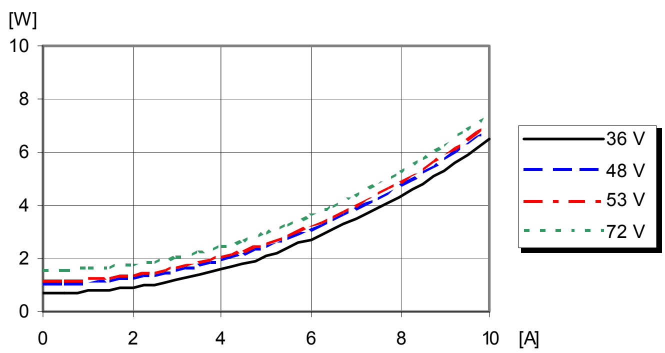
PIM 4328 P

Efficiency



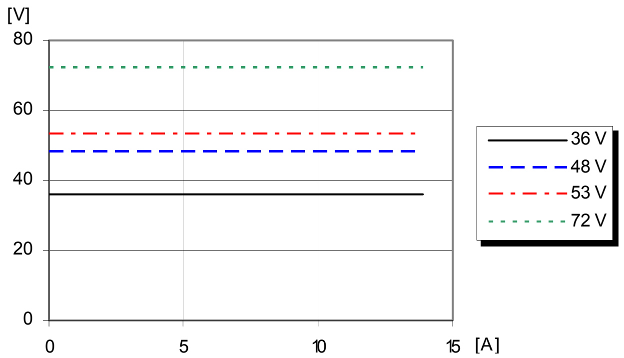
Efficiency vs. load current and input voltage at T_{P1} = +25 °C
I_{O2} = 0 A and I_{O3} = 0 A

Power Dissipation



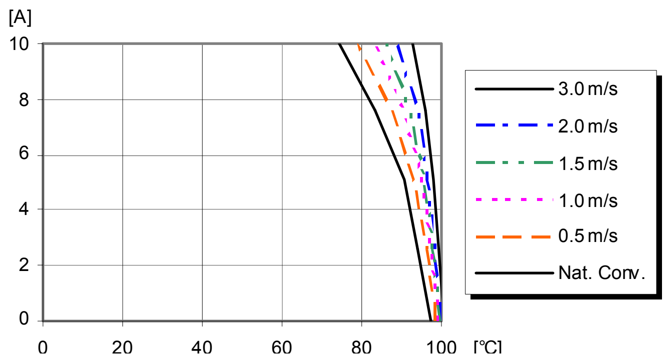
Dissipated power vs. load current and input voltage at
T_{P1} = +25 °C, I_{O2} = 0 A and I_{O3} = 0 A

Current Limit Characteristic



Output voltage vs. load current at I_{O1} > max I_{O1} , T_{P1} = +25 °C
I_{O2} = 0 A and I_{O3} = 0 A
Output 1 enters hiccup mode at current limit.

Output Current Derating

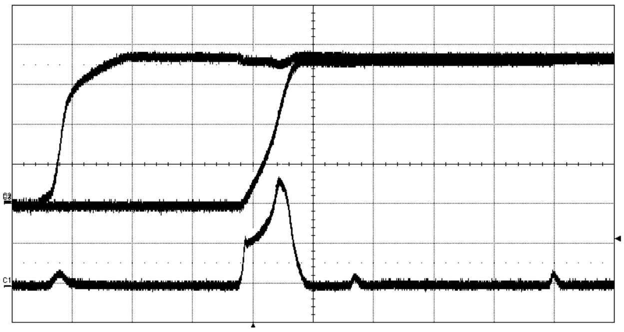


Available load current vs. ambient air temperature and airflow at
V_I = 53 V, I_{O2} = 1.5 A and I_{O3} = 0 A. See Thermal Consideration section.

Main Unit, 36-72 V, 10 A, Typical Characteristics

PIM 4328 P

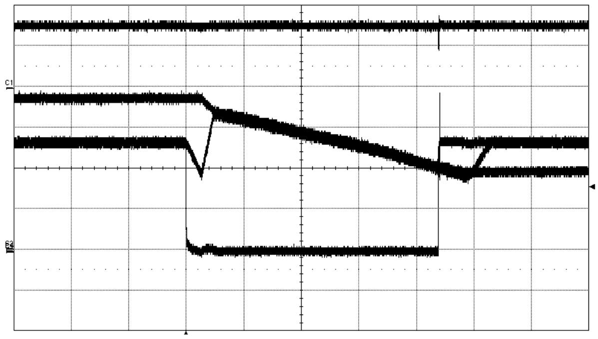
Start-up



Start-up enabled by connecting V_I at:
T_{P1} = +25 °C, V_I = 53 V, no load, output capacitance = 220 µF

Top trace: input voltage (10 V/div.).
Second trace: output 1 voltage (10 V/div.).
Bottom trace: input current (5 A/div.).
Time scale: (1 ms/div.).

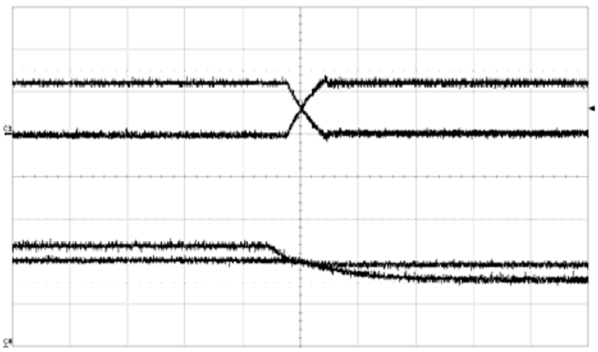
Hold up performance



Output voltage at loss of input power at:
hold up capacitance = 3 × 470 µF, hold up voltage = 75 V, T_{P1} = +25 °C, I_{O1} = 6.5 A (300 W DC/DC converter), I_{O2} = 3 A, I_{O3} = 0 A

Top trace: output 2 voltage (2 V/div.).
Second trace: Hold up voltage (20 V/div.).
Third trace: output 1 voltage (20 V/div.).
Bottom trace: input voltage (20 V/div.).
Time scale: (2 ms/div.).

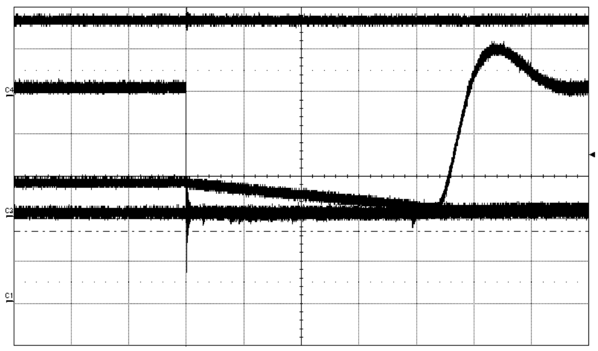
ORing



ORing at:
T_{P1} = +25 °C, V_{IA} = 54-52 V, V_{IB} = 53 V,
I_{O1} = 6 A electronic load,
I_{O2} = 0 A, I_{O3} = 0 A.

Top trace: input A current (5 A/div.).
Second trace: input B current (5 A/div.).
Third trace: input A voltage (2 V/div.).
Bottom trace: input B voltage (2 V/div.).
Time scale: (0.1 s/div.).

ORing functionality with one feed shorted



ORing functionality at:
T_{P1} = +25 °C, V_{IA} = 53 V, V_{IB} = 45 V, I_{O1} = 5.6 A, I_{O2} = 0 A, I_{O3} = 0 A.

Top trace: output 2 voltage (2 V/div.).
Second trace: input B current (2 A/div.).
Third trace: output 1 voltage (20 V/div.).
Bottom trace: input A current (2 A/div.).
Time scale: (0.1 ms/div.).

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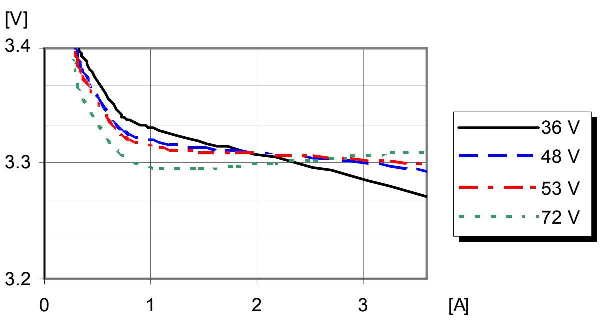
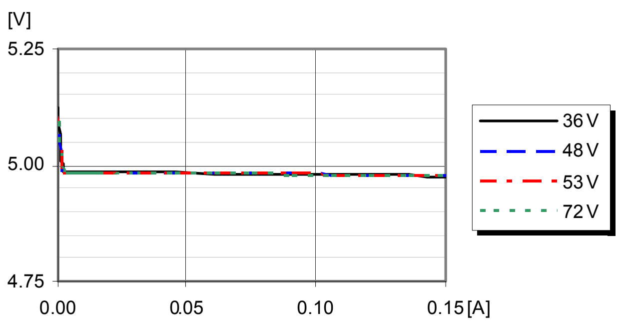
Management Power, 3.3 V, 3.6 A / 5 V, 0.15 A, Typical Characteristics — PIM 4328 P

Output 2 Characteristics



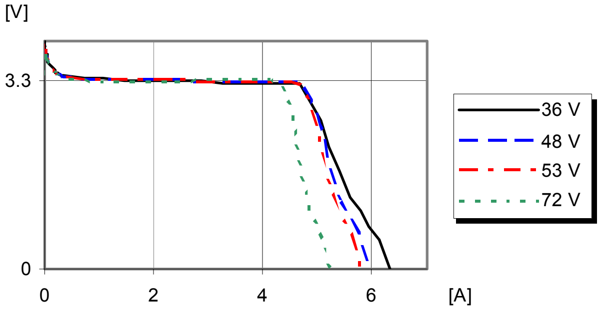
Output 2 voltage vs. load 2 current at:
T_{P1} = +25 °C. I_{O1} = 0 A, I_{O3} = 0 A

Output 3 Characteristics



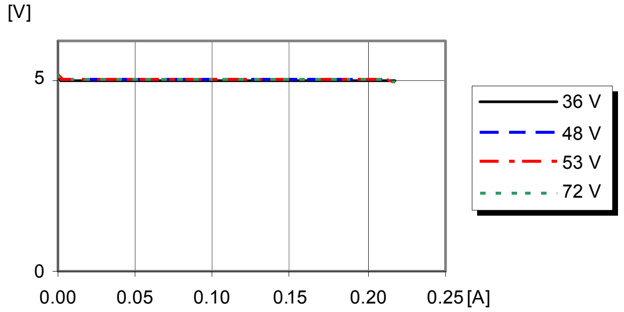
Output 3 voltage vs. load 3 current at:
T_{P1} = +25 °C. I_{O1} = 0 A, I_{O2} = 0 A

Output 2 Current Limit Characteristic



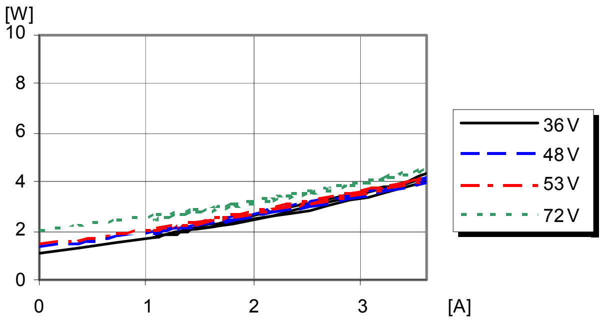
Output 2 voltage vs. load 2 current at:
T_{P1} = +25 °C, I_{O1} = 0 A, I_{O3} = 0 A

Output 3 Current Limit Characteristic



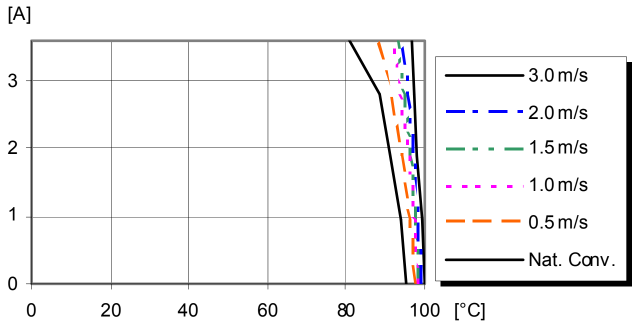
Output 3 voltage vs. load 3 current at:
T_{P1} = +25 °C, I_{O1} = 0 A, I_{O2} = 0 A
Output 3 enters hiccup mode at current limit.

Power Dissipation



Dissipated power vs. load 2 current and input voltage at
T_{P1} = +25 °C. I_{O1} = 0 A, I_{O3} = 0.15 A

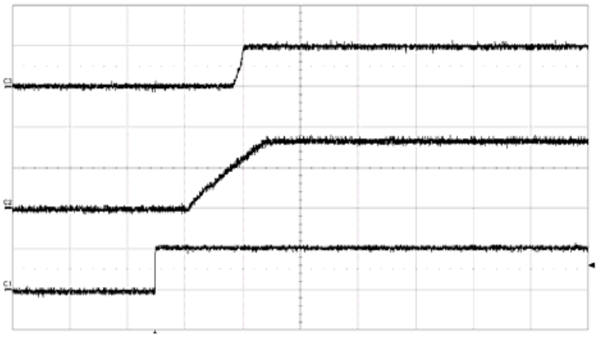
Output Current Derating



Available load current vs. ambient air temperature and airflow at
V_I = 53 V, I_{O1} = 4 A and I_{O3} = 0 A. See Thermal Consideration section.

Management Power, 3.3 V, 3.6 A / 5 V, 0.15 A, Typical Characteristics — PIM 4328 P

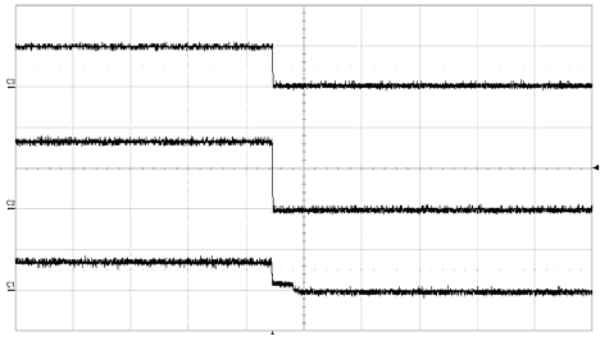
Start-up



Start-up enabled by connecting V_I at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 0 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A, resistive loads.

Top trace: output 3 voltage (5 V/div.).
Mid trace: output 2 voltage (2 V/div.).
Bottom trace: input voltage (50 V/div.).
Time scale: (2 ms/div.).

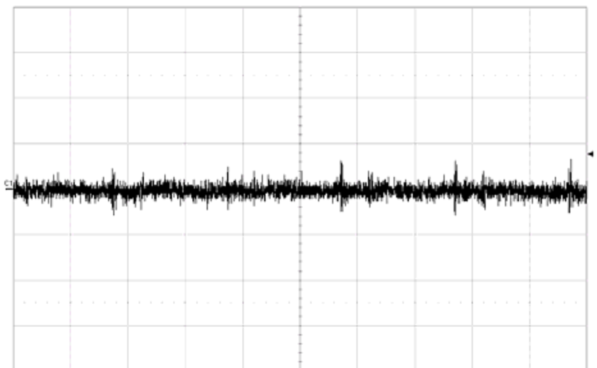
Shut-down



Shut-down enabled by disconnecting V_I at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 0 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A, resistive loads.

Top trace: output 3 voltage (5 V/div.).
Mid trace: output 2 voltage (2 V/div.).
Bottom trace: input voltage (50 V/div.).
Time scale: (20 ms/div.).

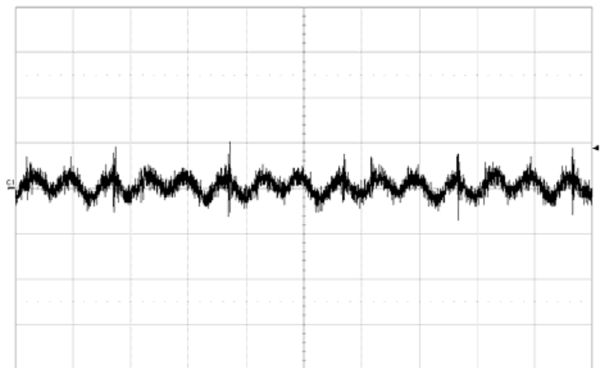
Output 2 Ripple & Noise



Output voltage ripple at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 0 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A, resistive loads.

Output 2 voltage (20 mV/div.).
Time scale: (1 µs/div.).

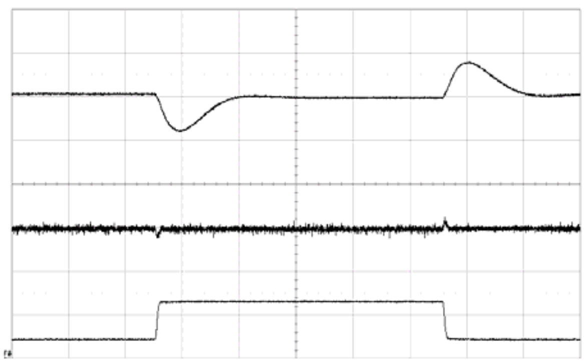
Output 3 Ripple & Noise



Output voltage ripple at: T_{P1} = +25 °C, V_I = 53 V, I_{O1} = 0 A, I_{O2} = 3.6 A, I_{O3} = 0.15 A, resistive loads.

Output 3 voltage (20 mV/div.).
Time scale: (1 µs/div.).

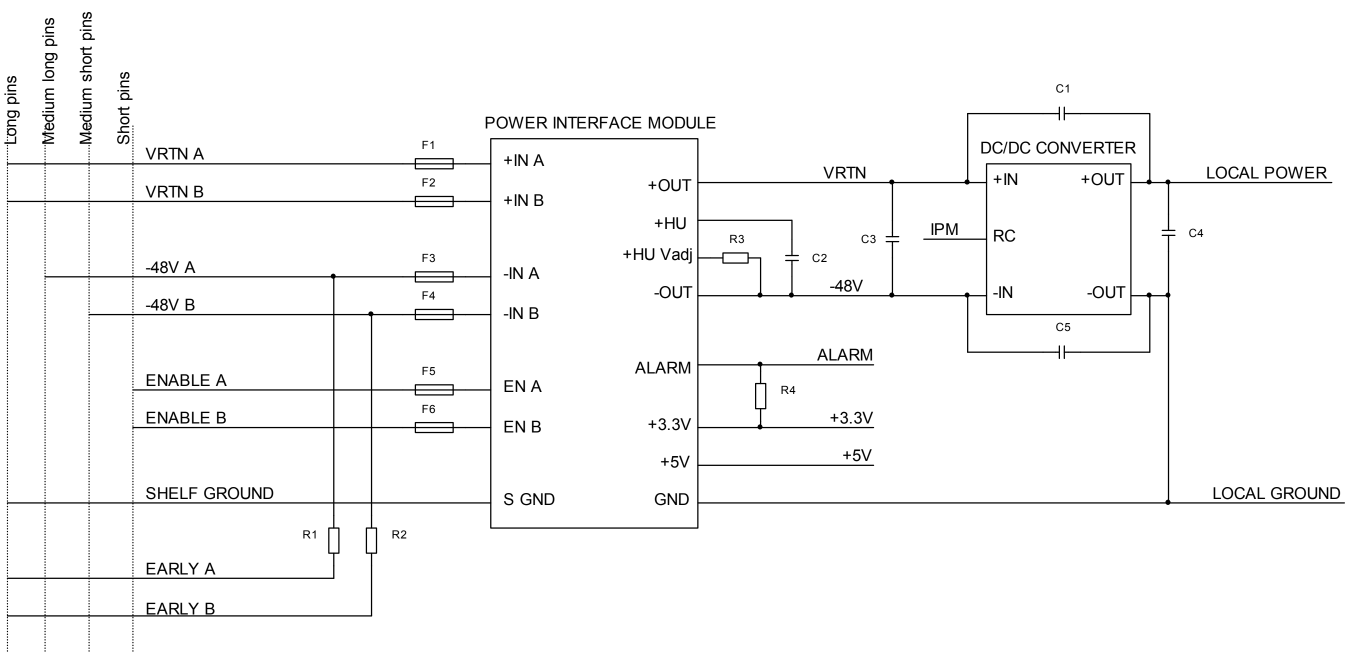
Output Load Transient Response



Output voltage response to load current step-change, output 2 (0.9-2.7-0.9 A) at: T_{P1} = +25 °C, V_I = 53 V I_{O1} = 0 A, I_{O3} = 0.15 A, resistive load, C_{O2} = 360 µF (ESR = 5 mΩ)

Top trace: output 2 voltage (0.2 V/div.).
Mid trace: output 3 voltage (0.2 V/div.).
Bottom trace: output 2 current (2 A/div.).
Time scale: (0.2 ms/div.).

Typical ATCA Application Circuit



External components

C1 = EMI suppression capacitor (recommended 3.3 nF)
C2 = hold up capacitor, C_{HU} (max 3300 µF)
C3 = DC/DC converter input capacitor, C_{O1} (see technical specification for the DC/DC converter)
C4 = DC/DC converter output capacitor (see technical specification for the DC/DC converter)
C5 = EMI suppression capacitor (recommended 3.3 nF)
F1 = fuse (recommended 15 A)
F2 = fuse (recommended 15 A)
F3 = fuse (recommended 15 A)
F4 = fuse (recommended 15 A)
F5 = fuse (recommended 0.5 A)
F6 = fuse (recommended 0.5 A)
R1 = pre-charge resistor, input A (recommended 100 Ω, max 0.5 A, max 0.1 s)
R2 = pre-charge resistor, input B (recommended 100 Ω, max 0.5 A, max 0.1 s)
R3 = hold up voltage adjust resistor, R_{HU} (see Hold Up Capacitor Charge section)
R4 = alarm pull-up resistor (recommended 3.3 kΩ)

(IPM = Intelligent Platform Management (see ATCA specification PICM 3.0))

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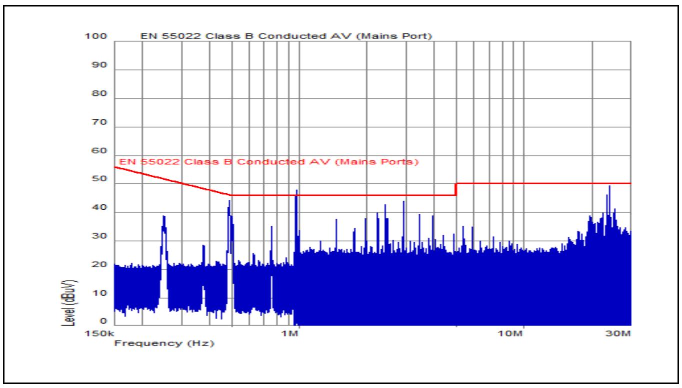
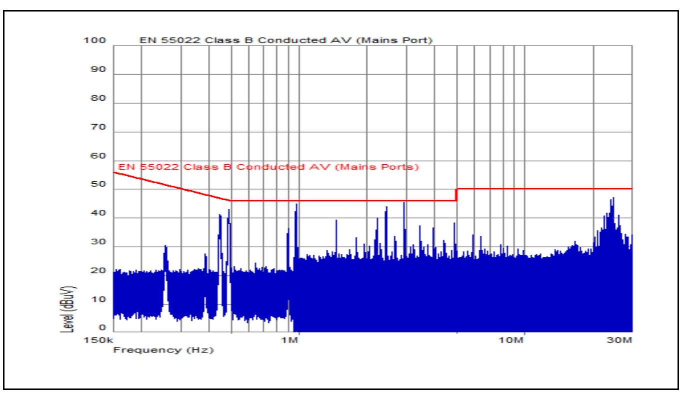
EMC Specification

The product contains an EMI filter which is designed to meet the requirements according to EN55022, CISPR 22 and FCC part 15J class B (see test set up), when used in conjunction with Ericsson PKM-B, PKB-B, PKM-NG, PKB-NG DC/DC converters loaded with max 300 W.

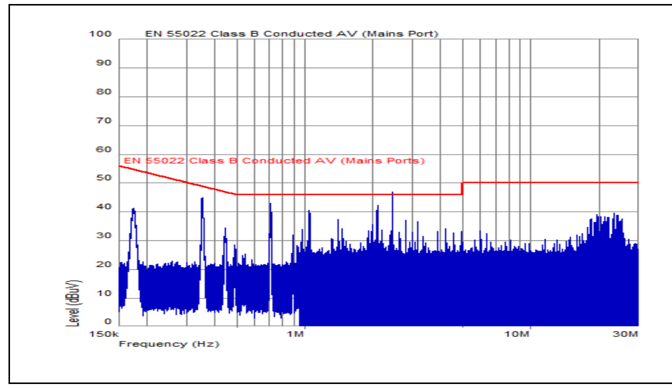
Conducted EMI Input terminal value (typ)



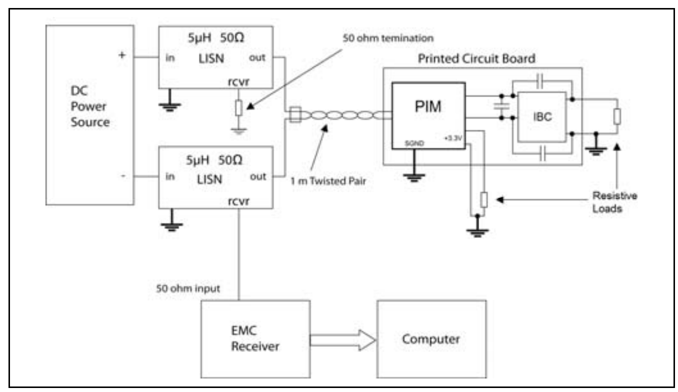
in combination with PKM 4304B
V_I = 48 V, C_{O1} = 220 µF, I_{O1} = 6.5 A ($I_{OPKM4304B}$ = 26.5 A), I_{O2} = 3.6 A, I_{O3} = 0 A
(peak value will increase max 5 dB at $I_{OPKM4304B}$ = 33 A)



in combination with PKM 4402NG
V_I = 48 V, C_{O1} = 220 µF, I_{O1} = 6.5 A ($P_{OPKM4402NG}$ = 300 W), I_{O2} = 3.6 A, I_{O3} = 0 A
(peak value will increase max 5 dB at $P_{OPKM4402NG}$ = 480 W)



in combination with PKB 4204B
V_I = 48 V, C_{O1} = 220 µF, I_{O1} = 5.1 A ($I_{OPKB4204B}$ = 18.2 A), I_{O2} = 3.6 A, I_{O3} = 0 A



Test set-up

Layout recommendations

The radiated EMI performance of the product will depend on the PCB layout and ground layer design. It is also important to consider the stand-off of the product. If a ground layer is used, it should be connected to shelf ground (S GND) of the product and the equipment ground or chassis.

A ground layer will increase the stray capacitance in the PCB and improve the high frequency EMC performance. For more information, see the technical specification for the downstream DC/DC converter.

Operating information

Input Voltage

The input voltage range 36 to 72 Vdc meets the requirements of the European Telecom Standard ETS 300 132-2 for normal input voltage range in –48 and –60 Vdc systems, -40.5 to -57.0 V and –50.0 to -72 V respectively.
At input voltages exceeding 72 V, the power loss will be higher than at normal input voltage and T_{P1} must be limited to absolute max 125 °C. The absolute maximum continuous input voltage is 75 Vdc.

Input Enable

The product has two Enable inputs which shall be connected to feed A and feed B supply of the backplane. The enable pins of the ATCA board are the last to be connected during board insertion and the first to be disconnected during board exertion. The product is switched off until one enable input is connected to the supply (EN A connected to +IN A or EN B connected to +IN B).

A/B Feed ORing

Two or four MOSFETs (depending on model) provide ORing of the input feeds. If a short is detected on one of the feeds a control circuit will detect reverse current and quickly turn the MOSFET off. This feature will also protect the product against reverse polarity of up to 60 V. At high load operation the MOSFETs are operated at a low Rdson condition and at zero load they are turned off.

A/B Feed Alarm

The input feeds A and B are monitored. In case of a feed loss the alarm pin will indicate a fault condition which is provided by an opto isolated signal. Under normal conditions the ALARM output goes open drain (high voltage with a pull-up) and in case of a feed loss the ALARM output goes low (low resistance to GND).

Management Power

The product provides two isolated DC outputs, 3.3 V and 5 V referred to GND. The management power is available as soon as the input voltage level is within 36 V to 72 V. The outputs are short circuit protected. In a short circuit condition the 3.3 V output will operate in a constant current mode and the 5 V output will operate in hiccup mode. A 2.2 µF ceramic capacitor and a 10 µF tantalum capacitor on the 3.3 V output is recommended to reduce switching noise and improve transient characteristics.
Management power will still be on for max 100 ms after enable A and B have dropped below enable turn-off threshold voltage.

Hot Swap Functionality

The hot swap function is designed to control the inrush current to the downstream DC/DC converter. The level and duration of the inrush current complies with the PICMG 3.0 ATCA base specification Inrush transient specifications.
Note: The hot swap circuit limits the output 1 current during start up. Hence, output 1 can not be loaded before its external filter capacitor has been charged.

Hold Up Capacitor Charge

An internal DC/DC converter charges the hold up capacitor to a voltage of 40 V – 95 V. The charge level is set by an external resistor.

Resistor connected between +HU Vadj and –OUT for hold up voltages from 50 to 95 V:

$$R_{HU} = \frac{500}{V_{HU} - 50} - 10 \quad [k\Omega]$$

where V_{HU} is the hold up voltage.

Resistor connected between +HU Vadj and +HU for hold up voltages from 40 to 50 V:

$$R_{HU} = \frac{200 \times V_{HU} - 500}{50 - V_{HU}} - 10 \quad [k\Omega]$$

where V_{HU} is the hold up voltage.

The hold up capacitor will be connected to the power train and provide energy to the system whenever the voltage on both A and B feeds has dropped below 36 V. When the voltage level on one or either feeds has returned the hold up capacitor will go off line and be recharged. The hold up capacitance is calculated by the following formula:

$$C_{HU} \geq \frac{2 \times P \times t_{HU}}{V_{HU}^{2} - V_{Th}^{2}} \quad [\mu F]$$

where P is the power of the downstream DC/DC converter, t_{HU} is the hold up time, V_{HU} is the hold up voltage and V_{Th} is the minimum voltage threshold of the downstream DC/DC converter.

When the enable inputs are disconnected the hold up and output capacitor will be discharged to less than 60 V within 1 s, conditions: V_{HU} = 75 V, V_I = 60 V, C_{O1} = 220 µF.

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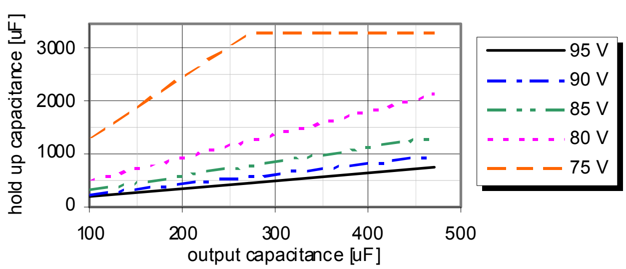
Hold Up Event Voltage

The resulting voltage across the output capacitor at a hold up event depends on the selected hold up voltage and the relation between hold up- and output capacitance. Maximum allowed hold up capacitance can be calculated using the following formula:

$$C_{HU} = \frac{(C_{O1} + 10) \times (VRTN - 36.8)}{V_{HU} - VRTN} \quad [\mu F]$$

where C_{HU} is the hold up capacitance, C_{O1} is the output capacitance [µF], VRTN is the input voltage for the down stream DC/DC converter and V_{HU} is the hold up voltage. Make sure that the resulting voltage is lower than maximum specified input voltage for the downstream DC/DC converter.



The chart shows output- and hold up capacitances at different hold up voltages for maximum 72 V peak input voltage to the downstream DC/DC converter.

Over Temperature Protection (OTP)

The products are protected from thermal overload by an internal over temperature shutdown circuit.
When T_{P1} as defined in thermal consideration section exceeds 115 °C the product will shut down. The product will make continuous attempts to start up (non-latching mode) and resume normal operation automatically when the temperature has dropped > 5 °C below the temperature threshold. In an over temperature situation the management power is still available.

Input Transient Over Voltage Protection

The product incorporates a transient voltage protector which will protect the product and the downstream DC/DC converter against over voltage transients exceeding 75 V. The transient voltage protector is rated for 1.5 kW peak pulse power with a breakdown voltage of 83 V. The product also handles transients of up to 100 V for 10 µs.

Over Current Protection (OCP)

The products include current limiting circuitry for protection at continuous overload. The output voltage will decrease towards zero for output currents in excess of max output current (max I_O). The product will resume normal operation after removal of the overload. The load distribution should be designed for the maximum output short circuit current specified.

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Thermal Consideration

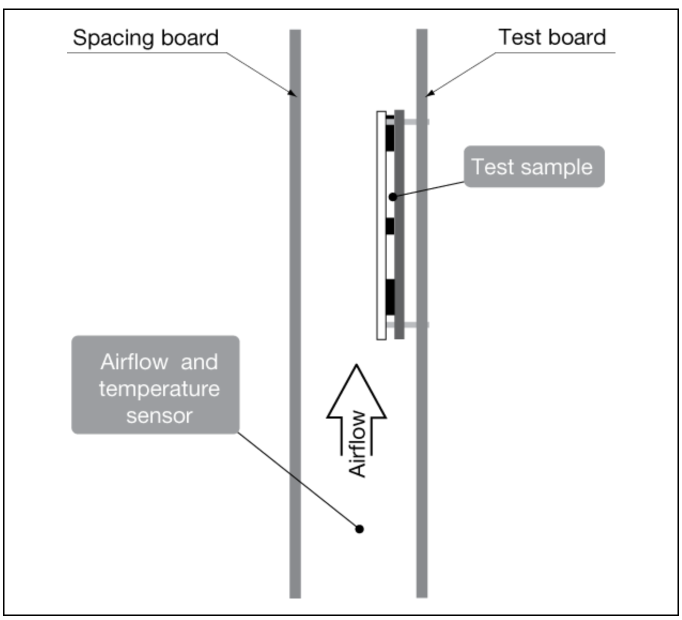
General

The products are designed to operate in different thermal environments and sufficient cooling must be provided to ensure reliable operation.

For products mounted on a PCB without a heat sink attached, cooling is achieved mainly by conduction, from the pins to the host board, and convection, which is dependant on the airflow across the product. Increased airflow enhances the cooling of the product. The Output Current Derating graph found in the Output section for each model provides the available output current vs. ambient air temperature and air velocity at V_I = 53 V.

A guard band of 5 °C is applied to the maximum recorded component temperatures when calculating output current derating curves.

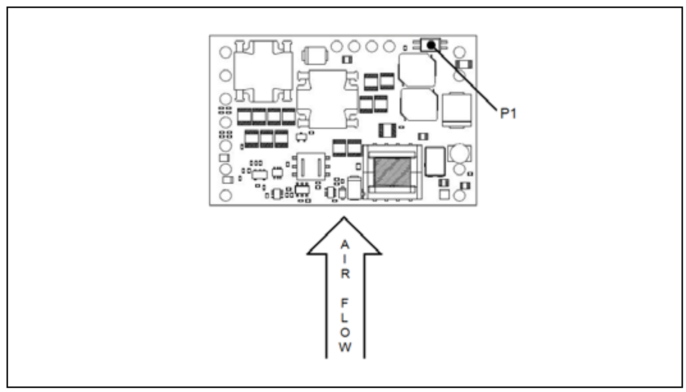
The product is tested on a 254 x 254 mm, 35 µm (1 oz), 16-layer test board mounted vertically in a wind tunnel with a cross-section of 608 x 203 mm.



Definition of product operating temperature

The product operating temperature is used to monitor the temperature of the product, and proper thermal conditions can be verified by measuring the temperature at position P1. The temperature at this position (T_{P1}) should not exceed the maximum temperature in the table below. Temperature above maximum T_{P1}, measured at the reference point P1 is not allowed and may cause permanent damage.

Position	Description	Max Temp.
P1	Opto coupler	T_{P1} = 110 ºC



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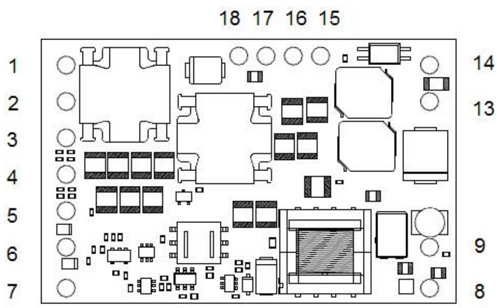
Connections



Top view

Pin	Designation	Function
1	-IN A	Input A negative feed
2	-IN B	Input B negative feed
3	+IN A	Input A positive feed
4	+IN B	Input B positive feed
5	A EN	Input A enable
6	B EN	Input B enable
7	S GND	Shelf ground
8	+5V	Management power, positive output 5 V
9	+3.3V	Management power, positive output 3.3 V
13	GND	Management power, negative output
14	ALARM	Feed loss alarm
15	-OUT	Main unit, negative output
16	+HU Vadj	Hold-up voltage adjust
17	+OUT	Main unit, positive output
18	+HU	Hold-up capacitor bank, positive side

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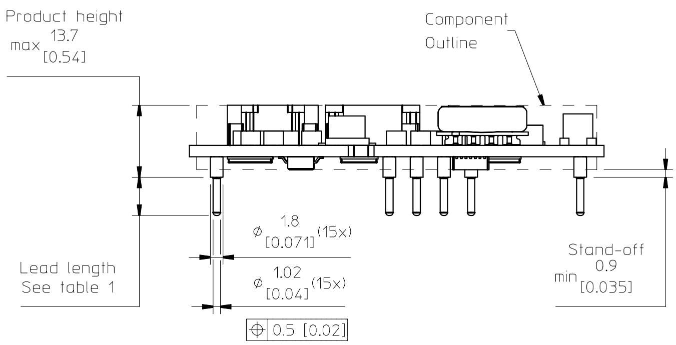
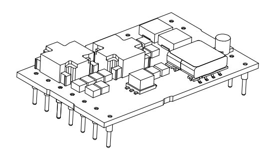
Mechanical Information





TOP VIEW
Pin positions according to recommended footprint

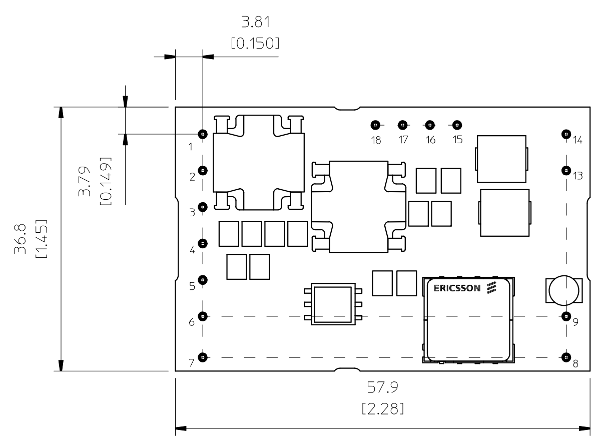
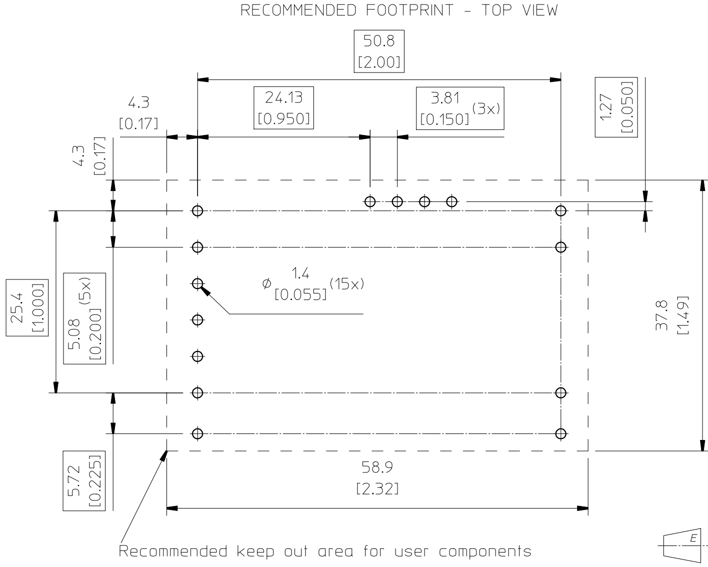


Table 1

Pin option	Lead length
Standard	5.33 [0.21]
LA	3.69 [0.145] cut
LB	4.57 [0.18] cut
LC	2.79 [0.11] cut

RECOMMENDED FOOTPRINT - TOP VIEW



Pins:
Material: Copper alloy
Plating: 10μm Matte Tin over 4μm Nickel

Weight: Typical 25 g
All dimensions in mm [inch].
Tolerances unless specified
x.x mm ±0.50 mm [0.02], x.xx mm ±0.25 mm [0.01]
(not applied on footprint or typical values)

All component placements – whether shown as physical components or symbolical outline – are for reference only and are subject to change throughout the product's life cycle, unless explicitly described and dimensioned in this drawing.

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Soldering Information - Hole Mounting

The hole mounted product is intended for plated through hole mounting by wave or manual soldering. The pin temperature is specified to maximum to 270°C for maximum 10 seconds.

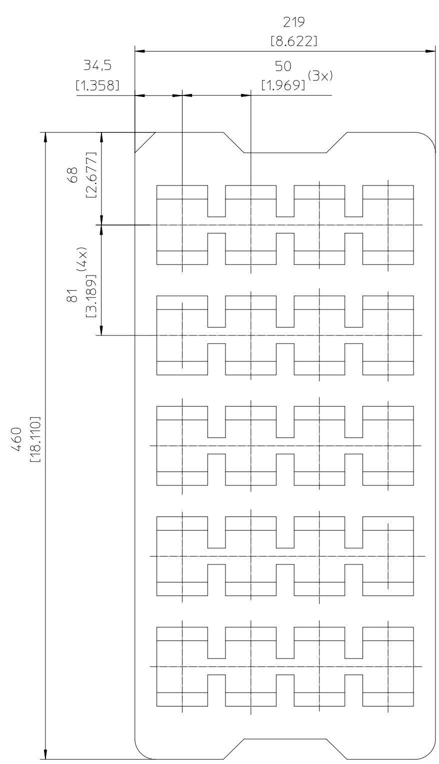
A maximum preheat rate of 4°C/s and maximum preheat temperature of 150°C is suggested. When soldering by hand, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

A no-clean flux is recommended to avoid entrapment of cleaning fluids in cavities inside the product or between the product and the host board. The cleaning residues may affect long time reliability and isolation voltage.

Delivery Package Information

The products are delivered in antistatic trays.

Tray Specifications	
Material	Antistatic PE foam
Surface resistance	10^5 < Ohm/square < 10^{12}
Bakeability	The trays are not bakeable
Tray thickness	26.0 mm [1.02 inch]
Box capacity	20 products (20 full trays/box)
Tray weight	140 g empty, 640 g full tray



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Product Qualification Specification

Characteristics			
External visual inspection	IPC-A-610		
Change of temperature (Temperature cycling)	IEC 60068-2-14 Na	Temperature range Number of cycles Dwell/transfer time	-40 to 100°C 1000 15 min/0-1 min
Cold (in operation)	IEC 60068-2-1 Ad	Temperature T_A Duration	-45°C 72 h
Damp heat	IEC 60068-2-67 Cy	Temperature Humidity Duration	85°C 85 % RH 1000 hours
Dry heat	IEC 60068-2-2 Bd	Temperature Duration	125°C 1000 h
Electrostatic discharge susceptibility	IEC 61340-3-1, JESD 22-A114 IEC 61340-3-2, JESD 22-A115	Human body model (HBM) Machine Model (MM)	Class 2, 2000 V Class 3, 200 V
Immersion in cleaning solvents	IEC 60068-2-45 XA, method 2	Water Glycol ether Isopropyl alcohol	55°C 35°C 35°C
Mechanical shock	IEC 60068-2-27 Ea	Peak acceleration Duration	100 g 6 ms
Moisture reflow sensitivity [1]	J-STD-020C	Level 1 (SnPb-eutectic) Level 3 (Pb Free)	225°C 260°C
Operational life test	MIL-STD-202G, method 108A	Duration	1000 h
Resistance to soldering heat [2]	IEC 60068-2-20 Tb, method 1A	Solder temperature Duration	270°C 10-13 s
Robustness of terminations	IEC 60068-2-21 Test Ua1 IEC 60068-2-21 Test Ue1	Through hole mount products Surface mount products	All leads All leads
Solderability	IEC 60068-2-58 test Td [1] IEC 60068-2-20 test Ta [2]	Preconditioning Temperature, SnPb Eutectic Temperature, Pb-free Preconditioning Temperature, SnPb Eutectic Temperature, Pb-free	150°C dry bake 16 h 215°C 235°C Steam ageing 235°C 245°C
Vibration, broad band random	IEC 60068-2-64 Fh, method 1	Frequency Spectral density Duration	10 to 500 Hz 0.07 g^2/Hz 10 min in each direction

Notes
[1] Only for products intended for reflow soldering (surface mount products)
[2] Only for products intended for wave soldering (plated through hole products)