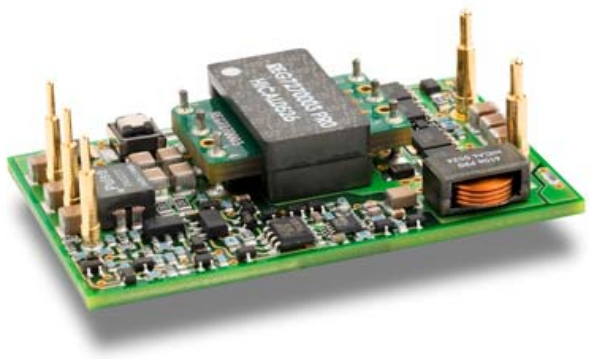
ERICSSON

Technical Specification

PKM 4303NF series Intermediate Bus Converters, Input 42-53 V, Output 25 A	EN/LZT 146 342 R1A February 2006

Key Features

- Industry standard Quarter-brick
  57.9 x 36.8 x 10.9mm (2.28 x 1.45 x 0.43in.)
- Single side design for low cost
- High efficiency, typ. 96 % at 12 Vout, 50% load & 48Vin
- 1500 Vdc input to output isolation
- Meets safety requirements according to IEC/EN/UL 60950
- More than 2.2 million hours MTBF



General Characteristics

- Input under voltage protection
- Input over voltage shutdown (OVP)
- Over temperature protection
- Output short-circuit protection
- Remote control
- Highly automated manufacturing ensures quality
- ISO 9001/14001 certified supplier

Safety Approvals

c UL us

Design for Environment

Pb RoHS compliant

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

Contents

Safety Specification

General information
Ericsson Power Modules DC/DC converters and DC/DC regulators are designed in accordance with safety standards IEC/EN/UL60950, *Safety of Information Technology Equipment*.

IEC/EN/UL60950 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 are defined as component power supplies. As components they cannot fully comply with the provisions of any Safety requirements without "Conditions of Acceptability". 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 Directives for the final product.

Component power supplies for general use should comply with the requirements in IEC60950, EN60950 and UL60950 *"Safety of information technology equipment".*

There are other more product related standards, e.g. EC61204-7 "Safety standard for power supplies", IEEE802.3af "Ethernet LAN/MAN Data terminal equipment power", and ETS300132-2 "Power supply interface at the input to telecommunications equipment; part 2: DC", but all of these standards are based on IEC/EN/UL60950 with regards to safety.

Ericsson Power Modules DC/DC converters and DC/DC regulators are UL60950 recognized and certified in accordance with EN60950.

The flammability rating for all construction parts of the products meets UL 94V-0.

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/UL60950.

Isolated DC/DC converters
It is recommended that a slow blow fuse with a rating twice the maximum input current per selected product 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 in the input filter or in the DC/DC converter that imposes a short circuit on the input source, this fuse will provide the following functions:

- Isolate the faulty DC/DC converter 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 for 60 seconds (refer to product specification).
Leakage current is less than 1 µA at nominal input voltage.

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 Ericsson Power Modules 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 TNV2 circuit and testing has demonstrated compliance with SELV limits and isolation requirements equivalent to Basic Insulation in accordance with IEC/EN/UL60950.

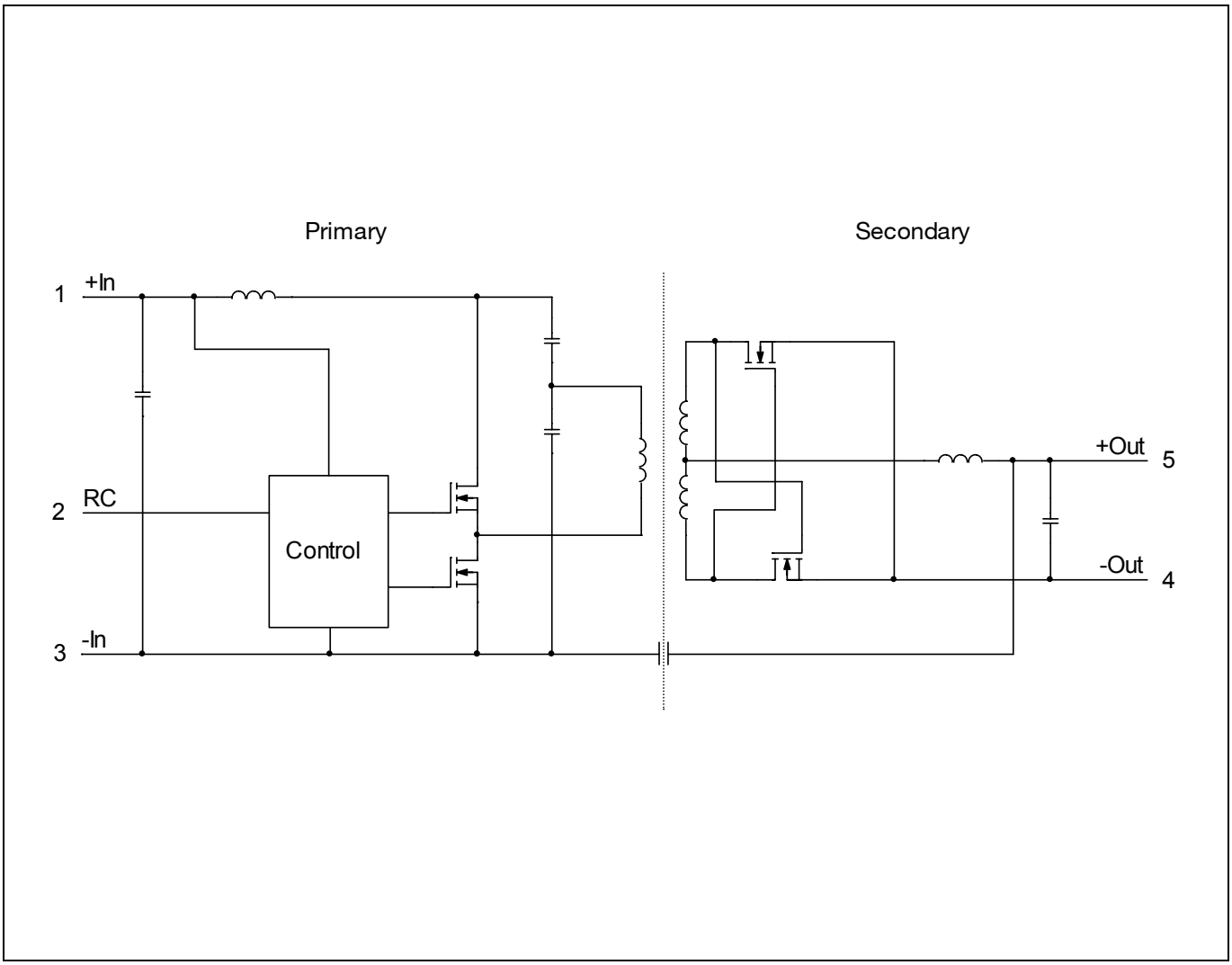
Non-isolated DC/DC regulators
The input voltage to the DC/DC regulator is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

Absolute Maximum Ratings

Characteristics			min	typ	max	Unit
T_{ref}	Operating Temperature (see Thermal Consideration section)		-40		+110	°C
T_S	Storage temperature		-55		+125	°C
V_I	Input voltage		-0.5		+60	V
V_{iso}	Isolation voltage (input to output test voltage)				1500	Vdc
V_{tr}	Input voltage transient (t_p 100 ms)				60	V
V_{RC}	Remote Control pin voltage (see Operating Information section)	Positive logic option	-0.5		11	V
		Negative logic option	-0.5		18	V

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 of Output data or Electrical Characteristics. If exposed to stress above these limits, function and performance may degrade in an unspecified manner.

Fundamental Circuit Diagram



12 V/25 A Electrical Specification — PKM 4303NF

T_{ref} = -40 to +90ºC, V_I = 42 to 53 V, unless otherwise specified under Conditions.
Typical values given at: T_{ref} = +25°C, V_I= 48 V, max I_O, unless otherwise specified under Conditions.

Characteristics		Conditions	min	typ	max	Unit
V_I	Input voltage range		42		53	V
V_{Ioff}	Turn-off input voltage	Decreasing input voltage	37	38.5	40.5	V
V_{Ion}	Turn-on input voltage	Increasing input voltage	38.5	40	41.5	V
C_I	Internal input capacitance			6.7		µF
P_O	Output power	V_I = 42 V	0		247	W
		V_I = 48 V	0		285	
		V_I = 53 V	0		316	
η	Efficiency	50 % of max I_O , V_I = 48 V		96.0		%
		max I_O , V_I = 48 V		95.4		
P_d	Power Dissipation	max I_O		14	16.5	W
P_{Ii}	Input idling power	I_O = 0 A, V_I = 48 V		3.5		W
P_{RC}	Input standby power	V_I = 48 V (turned off with RC)		0.2		W
f_s	Switching frequency	0-100 % of max I_O	150	170	188	kHz

V_{Oi}	Output voltage initial setting and accuracy	T_{ref} = +25°C, V_I = 48 V, I_O = 0 A	11.9	12	12.1	V
V_O	Output voltage tolerance band	0-100 % of max I_O	9.6		13.45	V
	Idling voltage	I_O = 0 A	10.05		13.45	V
	Line regulation	See Note 1		($V_I$max- $V_I$min)/4		V
	Load regulation	V_I = 48 V, 0-100 % of max I_O	0.45	0.60	0.75	V
V_{tr}	Load transient voltage deviation	V_I = 48 V, Load step 25-75-25 % of max I_O, di/dt = 1 A/µs		±750		mV
t_{tr}	Load transient recovery time			30		µs
t_r	Ramp-up time (from 10–90 % of V_{Oi})	0-100 % of max I_O	0.5	4	5	ms
t_s	Start-up time (from V_I connection to 90 % of V_{Oi})		1.5	5	6	ms
t_f	V_I shut-down fall time (from V_I off to 10 % of V_O)	max I_O		0.15		ms
t_{RC}	RC start-up time	max I_O		5		ms
	RC shut-down fall time (from RC off to 10 % of V_O)	max I_O		0.1		ms
I_O	Output current		0		25	A
I_{lim}	Current limit threshold	T_{ref} < max T_{ref}	27	30	34	A
I_{sc}	Short circuit current	See Note 2				
V_{Oac}	Output ripple & noise	See ripple & noise section, max I_O		90		mVp-p
OVP	Over voltage protection	See Note 3			15	V

Note 1: V_O = V_I/4-load regulation. Example: at V_I = 48 V and max I_O, V_O = 48/4-0.60 = 11.4 V.

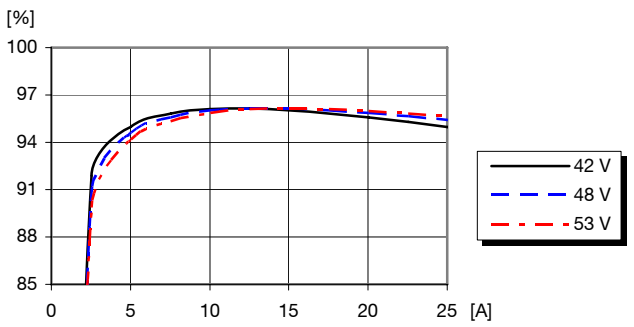
Note 2: See Operating Information section.

Note 3: See Operating Information section. The internal OVP circuit detects the input voltage and is activated at an input voltage between 54 to 60 V and typically at 56 V. The OVP limits the output voltage to max 15 V, this will occur at V_I = 60 V and I_O = 0 A, given by the formula: V_O = V_I/4-load regulation = 60/4-0 = 15 V.

12 V/25 A Typical Characteristics

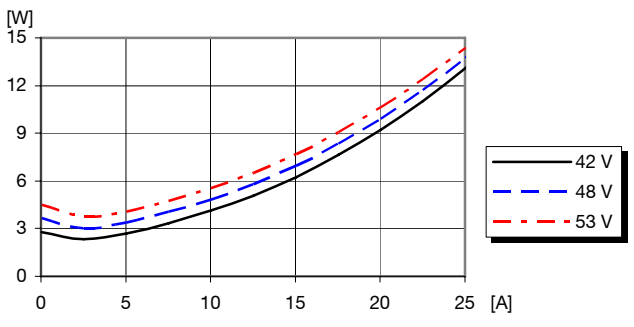
PKM 4303NF

Efficiency



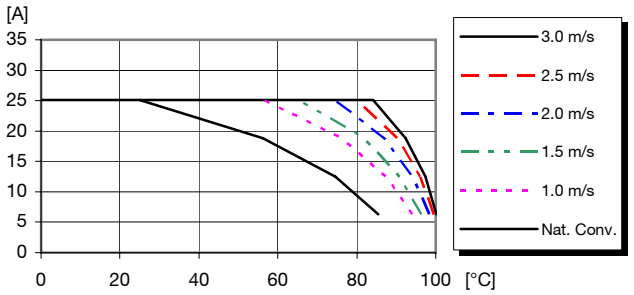
Efficiency vs. load current and input voltage at T_{ref} = +25°C

Power Dissipation



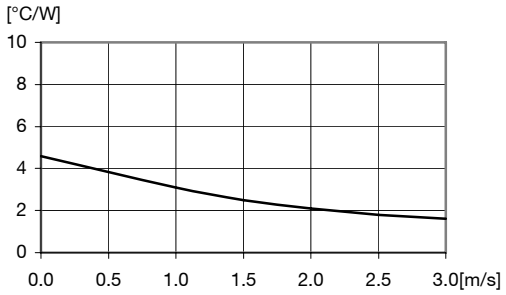
Dissipated power vs. load current and input voltage at T_{ref} = +25°C

Output Current Derating



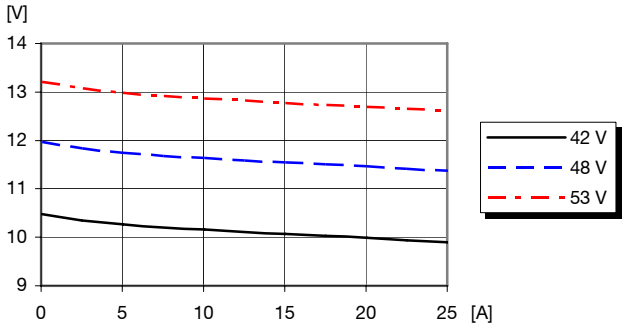
Available load current vs. ambient air temperature and airflow at V_I = 48 V. See Thermal Consideration section.

Thermal Resistance



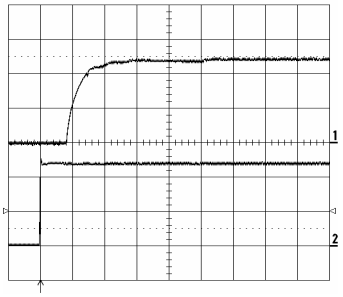
Thermal resistance vs. airspeed measured at the converter. Tested in wind tunnel with airflow and test conditions as per the Thermal consideration section.

Output Characteristics



Output voltage vs. load current at T_{ref} = +25°C

Start-up at no load



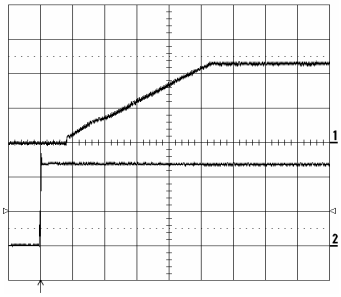
Start-up enabled by connecting V_I at:
T_{ref} = +25°C, V_I = 48 V,
I_O = 0 A.

Top trace: output voltage (5 V/div.).
Bottom trace: input voltage (20 V/div.).
Time scale: (1 ms/div.).

12 V/25 A Typical Characteristics

PKM 4303NF

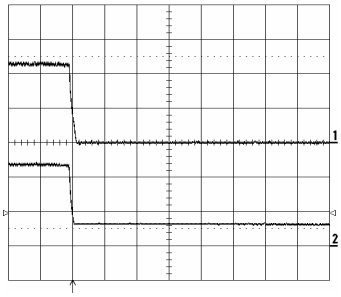
Start-up



Start-up enabled by connecting V_I at:
T_{ref} = +25°C, V_I = 48 V,
I_O = 25 A resistive load.

Top trace: output voltage (5 V/div.).
Bottom trace: input voltage (20 V/div.).
Time scale: (1 ms/div.).

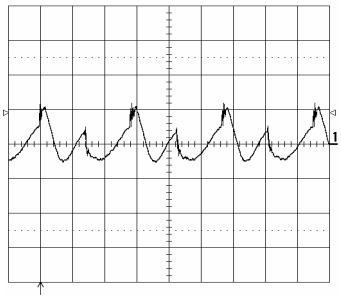
Shut-down



Shut-down enabled by disconnecting V_I at:
T_{ref} = +25°C, V_I = 48 V,
I_O = 25 A resistive load.

Top trace: output voltage (5 V/div.).
Bottom trace: input voltage (20 V/div.).
Time scale: (0.5 ms/div.).

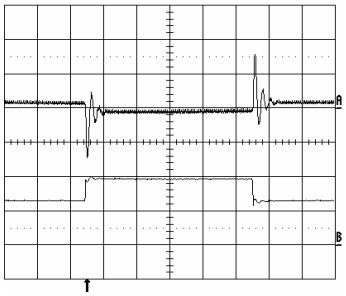
Output Ripple & Noise



Output voltage ripple at:
T_{ref} = +25°C, V_I = 48 V,
I_O = 25 A resistive load.

Trace: output voltage (50 mV/div.).
Time scale: (2 µs/div.).

Output Load Transient Response



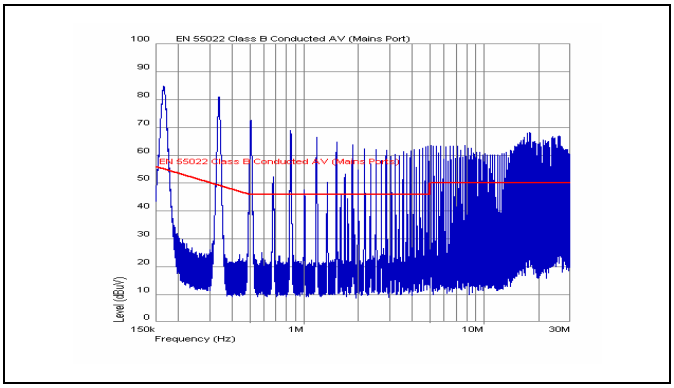
Output voltage response to load current step-change (12.5-18.8-12.5 A) at:
T_{ref} =+25°C, V_I = 48 V.

Top trace: output voltage (500 mV/div.).
Bottom trace: load current (10 A/div.).
Time scale: (0.1 ms/div.).

EMC Specification

Conducted EMI measured according to EN55022, CISPR 22 and FCC part 15J (see test set-up). See Design Note 009 for detailed information. The fundamental switching frequency is 170 kHz for PKM 4303NF @ V_I = 48 V, max I_O.

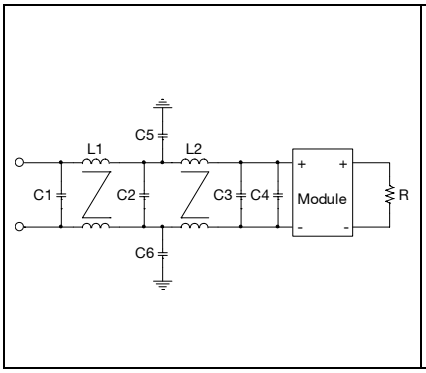
Conducted EMI Input terminal value (typ)



EMI without filter

External filter (class B)

Required external input filter in order to meet class B in EN 55022, CISPR 22 and FCC part 15J.

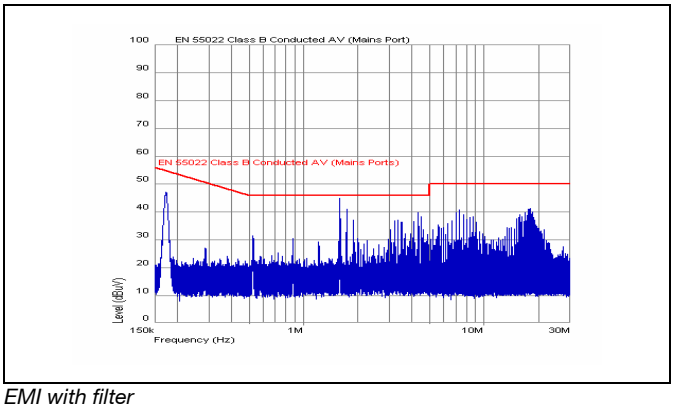


Filter components:
C1,2,3 = 2 µF/ 100 V Ceramic

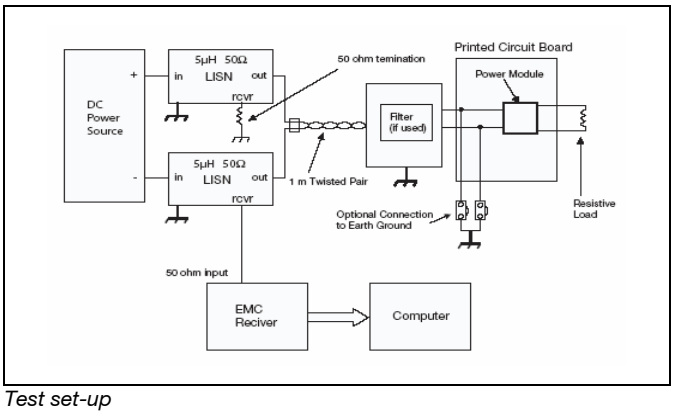
C4 = 33 µF/ 100 V Electrolytic

C5,6 = 2.2 nF/ 2 kV Ceramic

L1,2 = 0.809 µH
9.7 A, Common mode



EMI with filter



Test set-up

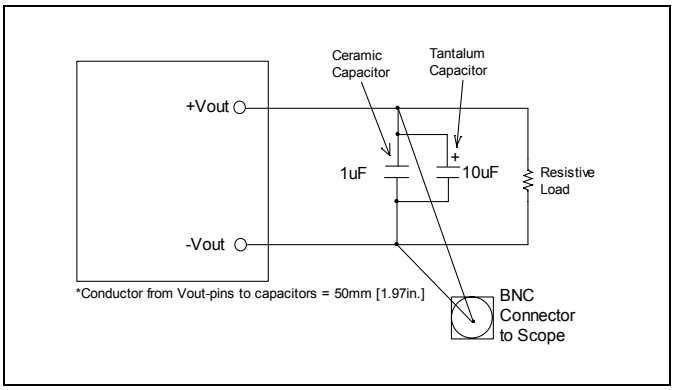
Layout recommendation

The radiated EMI performance of the DC/DC converter will depend on the PCB layout and ground layer design.
It is also important to consider the stand-off of the DC/DC converter.
If a ground layer is used, it should be connected to the output of the DC/DC converter and the equipment ground or chassis.

A ground layer will increase the stray capacitance in the PCB and improve the high frequency EMC performance.

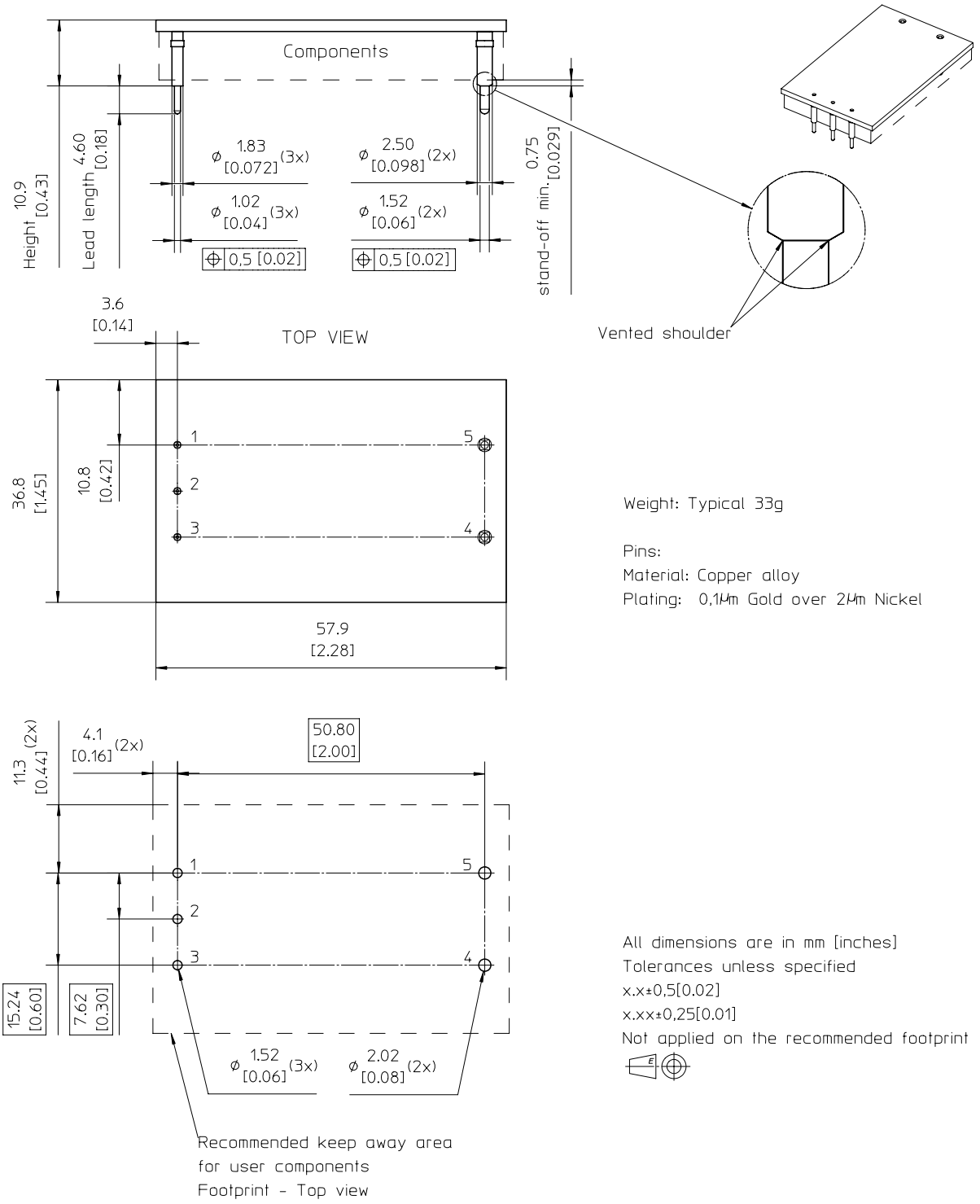
Output ripple and noise

Output ripple and noise measured according to figure below. See Design Note 022 for detailed information.



Output ripple and noise test setup

Mechanical Information



Weight: Typical 33g

Pins:
Material: Copper alloy
Plating: 0,1µm Gold over 2µm Nickel

All dimensions are in mm [inches]
Tolerances unless specified
x.x±0,5[0.02]
x.xx±0,25[0.01]
Not applied on the recommended footprint