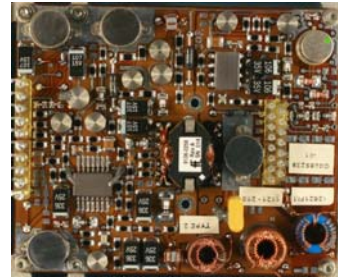


**HIGH RELIABILITY  
RADIATION HARDENED  
QUAD OUTPUT  
DC-DC CONVERTER**

**MAH1000503R30812Q**  
100V Input, Quad Output



**Description**

The MAH-Series of isolated DC-DC converters for space applications are low to medium power radiation hardened high reliability devices designed for hostile radiation environments such as those encountered by geostationary earth orbit satellites, deep space probes and communication systems. Features include small size, high efficiency, low weight, and a good tolerance to total ionizing dose, single event effects, and environmental stresses such as temperature extremes, mechanical shock, and vibration. All components are fully derated to meet the requirements of EEE-INST-002 (NASA) and ECSS-Q-ST-30-11 (ESA). Extensive documentation including worst case analysis, radiation susceptibility, thermal analysis, stress analysis, and reliability analysis are available.

The MAH-Series converter has four outputs – three positive and one negative - each is independently regulated via linear post regulators. The outputs are sequenced during turn-on and turn-off such that the negative output comes up first at turn-on and stays up at turn-off until the positive outputs have decreased. The MAH-Series converters incorporate a fixed frequency flyback power converter and internal EMI filter that meets the requirements for most major satellite power buses. The converter includes input under voltage shut-down functionality.

Due to the linear post regulation of the outputs, the MAH-Series is well suited for use in RF-applications where low noise, high output voltage accuracy, and high CS attenuation is required.

Each converter is provided as a complete board assembly for installation into the host equipment chassis. The board is conformal coated (except for mating surfaces) and is mounted in the host chassis using screws. The board outline is L x W x H: (85mm x 71mm x 18mm). The weight is less than 90 grams.

Non-flight versions of the MAH-Series converters are available for system development purposes. Variations in electrical specifications and screening to meet custom requirements can be accommodated

[www.irf.com](http://www.irf.com)

**Features**

- Total Dose > 100 krad(Si)
- SEE > 82 MeV.cm<sup>2</sup>/mg
- Low Weight < 90 grams
- 70V to 103V DC Input Range
- O/P 1: +5.0V (up to 630mA)
- O/P 2: +5.0V (up to 530mA)
- O/P 3: -8.0V (up to 40mA)
- O/P 4: +12V (up to 60mA)
- Output Ripple: < 1mVrms (100Hz - 50MHz)
- CS Rejection Input to Outputs: > 90dB (50Hz - 1.0MHz)
- 10MΩ @ 100VDC Isolation
- Input Under-Voltage Protection
- Meets Conducted Emission Limits:  
30Hz - 60kHz: 65dBuArms  
60kHz - 3.4MHz: -20dB/decade  
3.4MHz - 100MHz: 30dBuArms
- Short Circuit and Overload Protection
- Meets Derating Requirements of EEE-INST 002 and ECSS-Q-ST-30-11
- Output Status Telemetry (Bi-Level)
- Temperature Telemetry (Thermistor)
- Workmanship Per IPC-A610 Class 3
- Board is Coated with ARATHANE-5750

**Applications**

- Low to Medium Power RF Systems (like Receivers, Beacons, Frequency Up and Down Converters) On-board Satellites

**MAH1000503R30812Q  
(100V Input, Quad Output)**

International  
**IRF** Rectifier

**Circuit Description**

The MAH-Series converters utilize two-stage regulation with a flyback topology with a switching frequency of 100kHz for primary regulation and linear post regulation for each of the outputs.

The Output power is limited under any load fault condition to approximately 120% of rated output (12V 60mA more like 145%). An overload condition on positive outputs 2 and 4 causes the converter output to behave like a constant current source with the output voltage dropping below nominal. An overload condition at the negative output causes the positive outputs to shut-down in order to protect RF-transistors in the load. An overload on the positive output 1 result in hick-up operation of the positive outputs but sequencing with the negative output is respected. The converter will resume normal operation when the load current is reduced below the current limit point.

An under-voltage protection circuit prohibits the converter from operating when the line voltage is too low for safe operation. In case of an under voltage event the converter will start when the input voltage returns to its nominal level (automatic re-start).

For further information please refer to the MAH-Series generic description available at [www.irf.com](http://www.irf.com).

**Design Methodology**

The MAH-Series is developed using a proven conservative design methodology, which includes selecting radiation tolerant, and established reliability components and full derating to the requirements of EEE-INST-002 and ECSS-Q-ST-30-11.

**Specifications**

Absolute Maximum Ratings		Recommended Operating Conditions	
Input voltage range	-0.5Vdc to +120Vdc	Input voltage range (Note 9)	+70Vdc to +103Vdc
Output power	Internally limited	Output power	0 to Max. Rated
Operating mounting point temperature (Note 10)	-55°C to +100°C	Operating mounting point temperature (Note 9)	-40°C to +75°C *
Storage temperature	-55°C to +125°C	Cold start temperature	-55°C

\* Meets full derating

**Electrical Performance Characteristics**

Parameter	Condition	Conditions -40°C ≤ T <sub>C</sub> ≤ +75°C V <sub>IN</sub> = 100V DC ± 5%, C <sub>L</sub> = 0 unless otherwise specified	Limits			Unit
			Min.	Nom.	Max.	
Primary Input Voltage			70	100	103	V
Output Voltage ( V <sub>OUT</sub> ) ( O/P 1, O/P 2, O/P 3, O/P 4 )		Note 1				
+5.0V	1	0% ≤ I <sub>OUT</sub> ≤ 100% rated load	+4.975	+5.00	+5.025	V
+3.3V	1		+3.284	+3.30	+3.317	
-8.0V	1		-7.960	-8.00	-8.040	
+12V	1		+11.940	+12.00	+12.060	
+5.0V	2	0% ≤ I <sub>OUT</sub> ≤ 100% rated load	+4.925		+5.075	V
+3.3V	2		+3.267		+3.333	
-8.0V	2		-7.880		-8.200	
+12V	2		+11.820		+12.180	
+5.0V	3	0% ≤ I <sub>OUT</sub> ≤ 100% rated load	+4.900		+5.100	V
+3.3V	3		+3.234		+3.366	
-8.0V	3		-7.840		-8.160	
+12V	3		+11.760		+12.240	
Output Power ( P <sub>OUT</sub> ) ( O/P 1, O/P 2, O/P 3, O/P 4 )						
+5.0V	1,2,3	V <sub>IN</sub> = 70V, 100V, 103V Either Output			3.25	W
+3.3V					2.54	
-8.0V					0.32	
+12V					0.72	
Output Current ( I <sub>OUT</sub> ) ( O/P 1, O/P 2, O/P 3, O/P 4 )						
+5.0V	1,2,3	V <sub>IN</sub> = 70V, 100V, 103V Either Output	0		650	mA
+3.3V			0		770	
-8.0V			0		80	
+12V			0		60	

For Notes to Specifications, refer to page 6

**Electrical Performance Characteristics (continued)**

Parameter	Condition	Conditions $-40^{\circ}\text{C} \leq T_C \leq +75^{\circ}\text{C}$ $V_{IN} = 100\text{V DC} \pm 5\%$ , $C_L = 0$ unless otherwise specified	Limits			Unit
			Min.	Nom.	Max.	
Line Regulation ( $VR_{LINE}$ ) ( O/P 1, O/P 2, O/P 3, O/P 4 )	1,2,3	$V_{IN} = 70\text{V}, 100\text{V}, 103\text{V}$ $I_{OUT} = 10\%, 50\%, 100\%$ rated	-1.0		1.0	mV
Load Regulation ( $VR_{LOAD}$ ) ( O/P 1, O/P 2, O/P 3, O/P 4 )	1,2,3	$V_{IN} = 70\text{V}, 100\text{V}, 103\text{V}$ $I_{OUT} = 10\%, 50\%, 100\%$ rated	-1.0		1.0	mV
Cross Regulation ( $VR_{CROSS}$ )	1,2,3	$V_{IN} = 70\text{V}, 100\text{V}, 103\text{V}$ , Note 1			5.0	mV
Input Current	1,2,3	$I_{OUT} = 0$ , Commanded On		10	15	mA
Switching Frequency ( $F_S$ )	1,2,3	Notes 1, 7	90	100	110	kHz
Input Under-Voltage Trig Level	1,2,3	$0\% \leq I_{OUT} \leq 100\%$ rated load	60		68	V
Output Sequencing Turn-on Delay O/P 3 to OP 2 Turn-off Delay O/P 2 to O/P 3	1,2,3	$I_{OUT} > 20\%$ for Output 2 On is $> 90\%$ Off is $< 10\%$	2.0 1.0		12 8.0	ms
Output Ripple ( $V_{RIP}$ ) ( O/P 1, O/P 2, O/P 3, O/P 4 ) +5.0V +3.3V -8.0V +12V	1	$V_{IN} = 70\text{V}, 100\text{V}, 103\text{V}$ $I_{OUT} = 100\%$ rated load Frequency Domain 100Hz - 50MHz Note 1			1.0 1.0 1.0 1.0	mV <sub>RMS</sub>
+5.0V +3.3V -8.0V +12V	1,2	Time Domain 100Hz - 50MHz Notes 1, 2			30 30 30 30	mV <sub>PP</sub>
Efficiency ( $E_{FF}$ ) For combined Output Power of 1.43W 3.57W 7.15W	1,2,3	$I_{OUT} = 20\%$ rated load $I_{OUT} = 50\%$ rated load $I_{OUT} = 100\%$ rated load	40 54 59	42 56 61		%

For Notes to Specifications, refer to page 6

**Electrical Performance Characteristics (continued)**

Parameter	Condition	Conditions -40°C ≤ T <sub>C</sub> ≤ +75°C V <sub>IN</sub> = 100V DC ± 5%, C <sub>L</sub> = 0 unless otherwise specified	Limits			Unit
			Min.	Nom.	Max.	
Telemetry Converter On Converter Off	1,2,3		4.50 -0.1	4.62	4.75 0.1	V
Current Limit Point ( O/P 1, O/P 2, O/P 3, O/P 4 ) +5.0V +3.3V -8.0V +12V	1,2,3	V <sub>OUT</sub> = 100mV below Nominal Note 11	650 770 120 60		1700 900 150 86	mA
Output Response to Step Load changes ( V <sub>TLD</sub> ) +5.0V +3.3V -8.0V +12V	1,2,3	20% To/From Full Load, Note 3	-200 -150 -80 -300		200 150 80 300	mV <sub>PK</sub>
Turn-on Response Overshoot ( V <sub>OS</sub> ) +5.0V +3.3V -8.0V +12V Turn-on Delay ( T <sub>DLY</sub> )	1,2,3	10% Load, Full Load Note 5			200 150 80 300 10	mV ms
Capacitive Load ( C <sub>L</sub> ) +5.0V +3.3V -8.0V +12V	1,2,3	I <sub>OUT</sub> = 100% rated load No effect on DC performance Notes 1, 6 Each Output			500 250 100 100	μF

For Notes to Specifications, refer to page 6

**Electrical Performance Characteristics (continued)**

Parameter	Condition	Conditions $-40^{\circ}\text{C} \leq T_C \leq +75^{\circ}\text{C}$ $V_{IN} = 100\text{V DC} \pm 5\%$ , $C_L = 0$ unless otherwise specified	Limits			Unit
			Min.	Nom.	Max.	
EMC conducted susceptibility (Line Rejection)	1	$I_{OUT} = 100\%$ rated load Primary power sine wave injection of $3V_{P-P}$ , 100Hz to 1.0MHz, Note 1	90	100		dB
Electromagnetic Interference (EMI), Conducted Emission (CE)	1	$I_{OUT} = 100\%$ rated load Notes 1, 7	Limits per Fig. 2			
Isolation	1	Input to Output, any potential to telecommand input and any potential to telemetry output, test @ 100VDC	10			MΩ
Device Weight					90	g
Failure Rate		MIL-HDBK-217F2, SF, 35°C, Note 8			100	FITs

**Notes: Specification and Electrical Performance Characteristics Tables**

- Parameter is tested as part of design characterization or after design changes. Thereafter, parameter shall be guaranteed to the limits specified.
- Guaranteed for a D.C. to 50MHz bandwidth. Tested using a 10.7MHz bandwidth.
- Load current step transition time  $\geq 10 \mu\text{s}$ .
- Recovery time is measured from the initiation of the transient to where  $V_{OUT}$  has returned to within  $\pm 1\%$  of its steady state value.
- Turn-on delay time from application of telecommand pulse to the point where Output 3 = 90% of nominal output voltage.
- Capacitive load may be any value from 0 to the maximum limit without compromising the output sequencing performance. A capacitive load in excess of the maximum limit may influence the output sequencing performance and start-up time, converter operation and dc performance will remain intact.
- The switching frequency and 1st and 2nd harmonic of the input ripple is tested on every unit.
- MIL-HDBK-217F2 stress-dependent method is used with 2 exceptions: For soldering a fixed failure rate at 0.035FIT is used and for power MOSFETs the dissipated power (instead of rated power) is used for the Pr parameter. 1 FIT is 1 failure in  $10^9$  hours.
- The converter meets full derating per EEE-INST-002 and ECSS-Q-30-11A with the following exception: For Schottky diode JANS1N5819 a maximum derated junction temperature of  $+110^{\circ}\text{C}$ . For EEE-INST-002 it is required that ceramic capacitors with a voltage stress below 10V shall be rated for minimum 100V - in the product such capacitors is rated for 50V minimum.
- Although operation temperatures between  $-55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$  and  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$  is guaranteed, no parameter limits are specified.
- The +12V output is only protected against hard short circuit up to an interface temperature of  $+40^{\circ}\text{C}$

**Electrical Performance Characteristics - Definition of Conditions**

Condition	Definition	Comment
1	BOL @ $+25^{\circ}\text{C}$ interface temperature	Initial setting
2	BOL @ $-40^{\circ}\text{C}$ to $+75^{\circ}\text{C}$ interface temperature	Initial setting and worst case temperature variation
3	EOL @ $-40^{\circ}\text{C}$ to $+75^{\circ}\text{C}$ interface temperature	Worst case performance including initial setting, temperature variation, aging and radiation degradation

## Model Definition and Test Plans

### Model Definition

Model	Description	Build Standard
EBB	<p>The EBB is an electrical representative model.</p> <p>The EBB is intended to be used by customers in their proto type at equipment level.</p> <p>EBB models are built at IR's Danish Design Center.</p>	<p>The PCB will be had soldered by the engineering group (certified operator). No staking and conformal coating is foreseen.</p> <p>Preferably same type of EEE parts as intended for flight, but lower grade will be used for convenience. For resistors and capacitors different types with same basic characteristics may be used</p>
EQM	<p>The EQM is an electrical and mechanical representative model.</p> <p>The EQM is intended to be used by customer in their EQM at equipment level.</p>	<p>Flight standard for processes.</p> <p>Same type of EEE parts as intended for flight, but lower grade may be used for convenience.</p>
FM	Flight standard models.	Full flight standard

### Test Plan - EBB

The EBB must pass the following tests:			
Test No.	Type of Test	Location*	Remarks
1	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRD	Acceptance Test Procedure
2	Electrical performance test in temperature (Q-level)	IRD	Acceptance Test Procedure
3	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRD	Acceptance Test Procedure
4	Final Inspection	IRD	General inspection Procedure

**Test Plan - EQM**

<b>The EQM must pass the following tests:</b>			
<b>Test No.</b>	<b>Type of Test</b>	<b>Location*</b>	<b>Remarks</b>
1	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRSJ	Acceptance Test Procedure
2	Thermal cycling with electrical monitoring of input and outputs (Q-level)	IRSJ	Acceptance Test Procedure 10 cycles
3	Electrical performance test in temperature (Q-level)	IRSJ	Acceptance Test Procedure
4	Random Vibration test in (Q-level)	External test house	Vibration Test Procedure
5	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRSJ	Acceptance Test Procedure
6	Mechanical Measurements	IRSJ	Acceptance Test Procedure
7	Final Inspection	IRSJ	General inspection Procedure

**Test Plan - FM**

<b>The FM must pass the following tests:</b>			
<b>Test No.</b>	<b>Type of Test</b>	<b>Location*</b>	<b>Remarks</b>
1	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRSJ	Acceptance test procedure
2	Electrical performance test in temperature (A-levels)	IRSJ	Acceptance test procedure
3	Electrical performance test, room temperature incl. Limited EMC test (CE 50kHz-1MHz)	IRSJ	Acceptance test procedure
4	Electrical performance test, room temperature	IRSJ	Acceptance Test Procedure
5	Mechanical Measurements	IRSJ	Acceptance test procedure
6	Final Inspection	IRSJ	General inspection procedure

**Note:**

Location\* - IRD: IR's Danish Design Center, Skovlunde, Denmark  
 - IRSJ: IR's Site in San Jose, California, USA



## Radiation Performance

### TID

The TID radiation performance is guaranteed by worst case analysis with radiation degradation data for each radiation sensitive component used in the DC-DC converter. For TID radiation verification testing (RVT) for each wafer lot for all sensitive components is part of the EEE parts requirements per table below.

**TID RVT Plan Table**

Component Type	RVT Plan (applicable to all flight lots)
JANS2N2222A	LDRS 0.01 to 0.1 rad/s up to 200kRad per IR RVT plan
JANS2N2907A	LDRS 0.01 to 0.1 rad/s up to 200kRad per IR RVT plan
JANS2N5153	LDRS 0.01 to 0.1 rad/s up to 200kRad per IR RVT plan
JANS2N5154	LDRS 0.01 to 0.1 rad/s up to 200kRad per IR RVT plan
JANSR2N7492T2	RVT by Manufacturer (HDR)
IRHF57214SESCS	RVT by Manufacturer (HDR)
JANSR2N7616UB	RVT by Manufacturer (HDR)
JANSR2N7626UB	RVT by Manufacturer (HDR)
LM124AWR	RVT by Manufacturer (ELDRS)
IS2-1009RH	RVT by Manufacturer (HDR) LDRS 0.01 to 0.1 rad/s up to 100kRad per IR RVT plan
UC1845A	LDRS 0.01 to 0.1 rad/s up to 100kRad per IR RVT plan

### SEE

The SEE radiation performance is guaranteed by a combination of derating and mitigation at circuit level. For mitigation at circuit level both theoretical analysis and testing with imposed SEE effects are performed. The applicable SEE and mitigation concept is presented in table below.

The maximum output perturbation is 5% of the nominal output voltage during any SEE.

Component Type	Applicable SEE	Mitigation Concept
RH MOSFET	SEGR	Vds derating in combination with SEE SOA curves from manufacturer data sheet
Op-Amp	SET, 15us perturbation to rail	Mitigation at circuit level (filtering)
Voltage reference	SET, 10us perturbation to rail	Mitigation at circuit level (filtering)
PWM	SET, 15us perturbation to rail	Mitigation at circuit level (filtering)
	Double Pulses	Mitigation at circuit level (filtering, no saturation of magnetic parts)
	Missing Pulses	Mitigation at circuit level (filtering, no saturation of magnetic parts)

**EEE Parts Technical Standard**

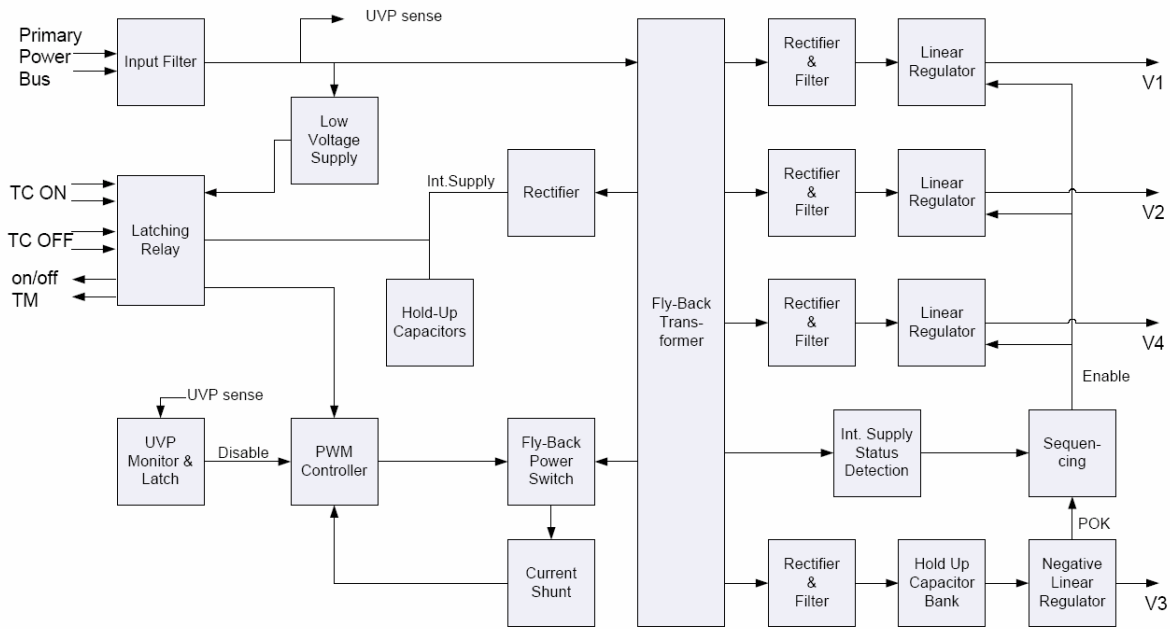
For component screening and DPA rules, refer to the generic MAH-Series data sheet with PD-97814.

**Random Vibration**

Axis	Frequency Range (Hz)	Level	PSD Level (g <sub>rms</sub> )	Duration (S)
X, Y, Z	20-100	+6 dB/oct	29.9	180
	100-1600	0.5 SQR(g)/Hz		
	1600-2000	-12 dB/oct		

First Eigen frequency for the MAH-Series is placed at approx 1150 Hz.

**Fig 1- Block Diagram**

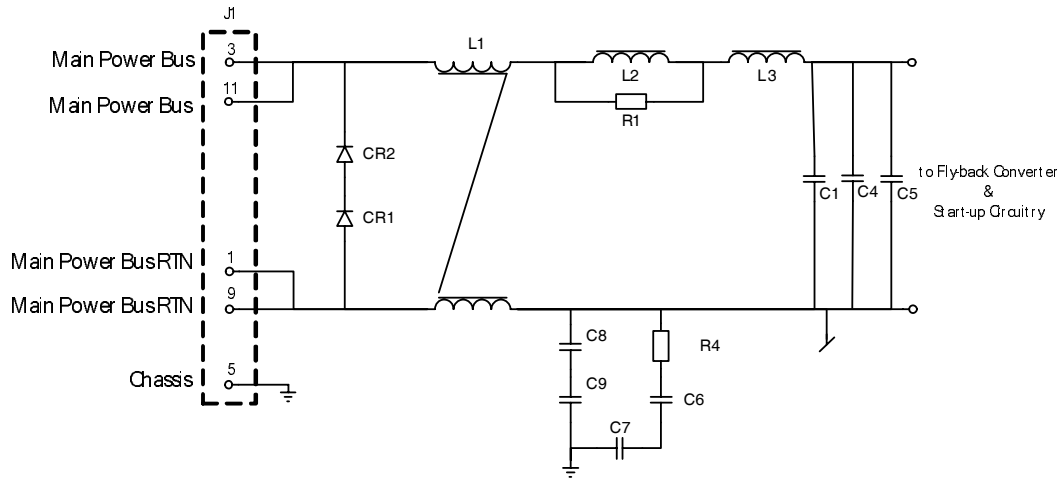


**Grounding and Isolation Scheme**

Parameter	Grounding & Isolation Performance
Isolation: Primary to secondary: O/P Status TM:	>10Mohm // < 50nF Referenced to secondary return
Grounding:	Secondary Return bound to chassis via multiple screw connections.

## Interface Schematics

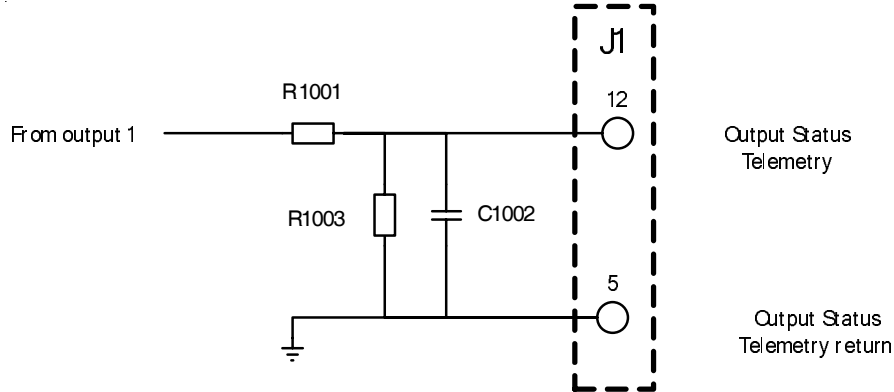
Fig 2 - Power Input:



Component	Component Type	Package	Value	Voltage (V)
C1	BR40 II	RADIAL	0.56 $\mu$ F	200
C4	BR40 II	RADIAL	0.56 $\mu$ F	200
C5	BR40 II	RADIAL	0.56 $\mu$ F	200
C6	CDR33BX	SMD 1210	27nF	100
C7	CDR33BX	SMD 1210	27nF	100
C8	CDR33BX	SMD 1210	15nF	100
C9	CDR33BX	SMD 1210	15nF	100
CR1	1N5806US	A- MFLF	2.5A	150
CR1	1N5806US	A- MFLF	2.5A	150
L1	R10	TOROID	2 X600 $\mu$ H	
L2	HIGH FLUX	TOROID	1600 $\mu$ H	
L3	HIGH FLUX	TOROID	400 $\mu$ H	
R1	RWR81S	RWR	16.2 Ohms	500
R4	RM1206B	SMD 1206	100 Ohms	100

Final Component values may change.

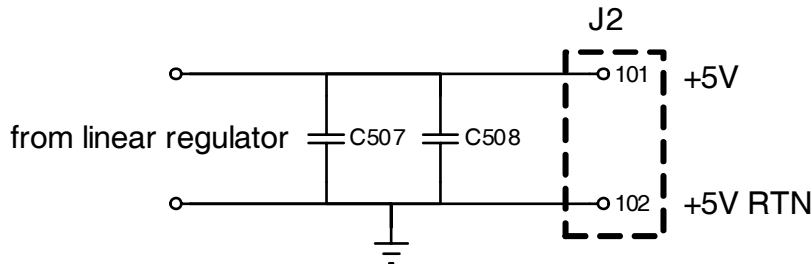
Fig 3 - O/P Status Telemetry Interface:



Component	Component Type	Package	Value	Voltage
R1001	RM1005B	SMD 1005	909 Ohms	40V
R1003	RM1005B	SMD 1005	11 kOhms	40V
C1001	CDR31BX	SMD 0805	82pF	100V

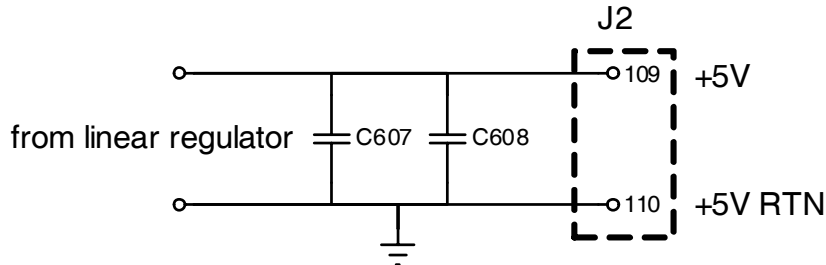
Final Component values may change.

Fig 4 - O/P 1 (+5V) Interface:



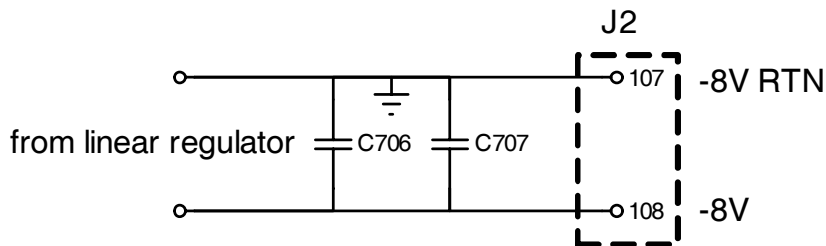
Component	Component Type	Package	Value	Voltage
C507	CWR29	SMD H	100 $\mu$ F	15V
C508	CWR29	SMD H	100 $\mu$ F	15V

Fig 5 - O/P 2 (+3.3V) Interface:



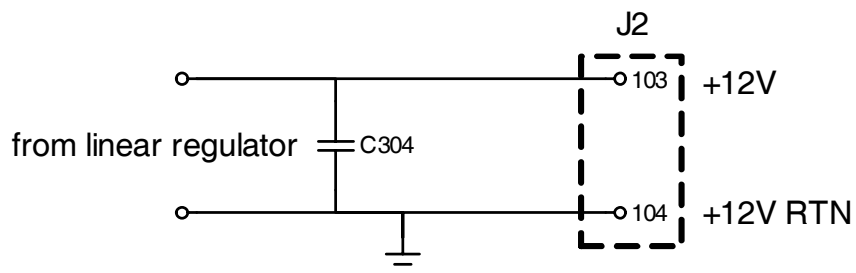
Component	Component Type	Package	Value	Voltage
C607	CWR29	SMD H	220 $\mu$ F	10V
C608	CWR29	SMD H	220 $\mu$ F	10V

Fig 6 - O/P 3 (-8V) Interface:



Component	Component Type	Package	Value	Voltage
C706	CWR29	SMD H	47 $\mu$ F	20V
C707	CWR29	SMD H	47 $\mu$ F	20V

Fig 7 - O/P 4 (+12V) Interface:



Component	Component Type	Package	Value	Voltage
C304	CWR29	SMD H	4.7 $\mu$ F	50V

EMI Performance

Fig 8 - Typical Conducted Emission Performance at Power Input  
(Limit shown based on 5%pp of max steady-state input current to 60kHz-  
20dB/dec above 60kHz with min level at 30dBuArms)

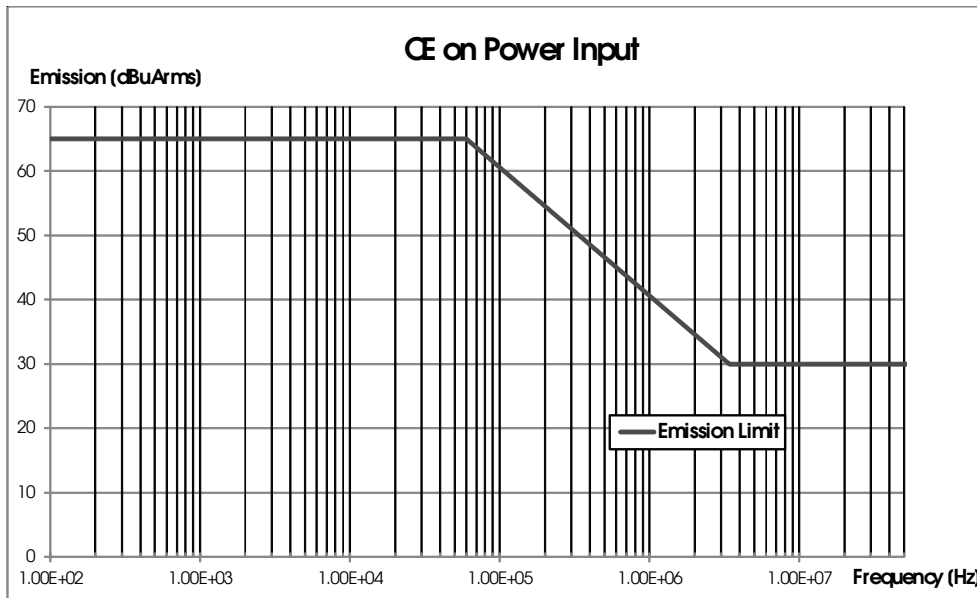
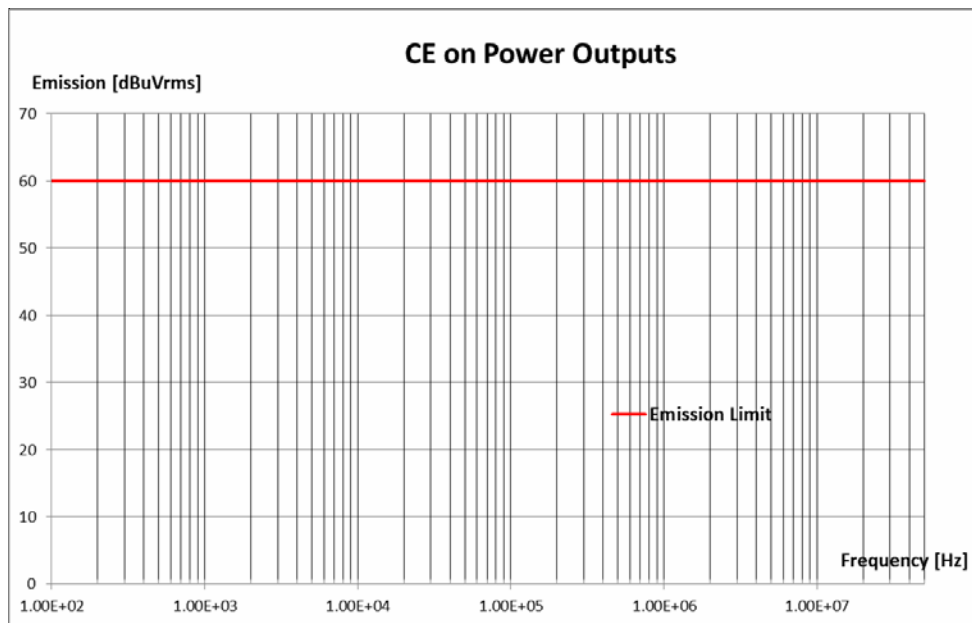
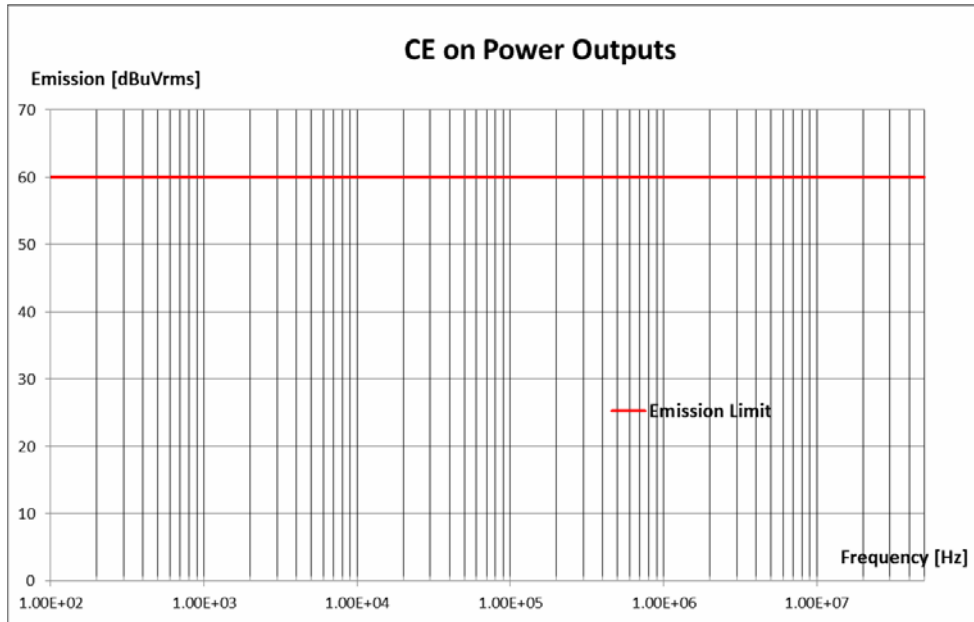


Fig 9 - Typical Conducted Emission Performance at Output 1  
(Only limit shown - actual data to be added when available)



**Fig 10 - Typical Conducted Emission Performance at Output 2**  
(Only limit shown - actual data to be added when available)



**Fig 11 - Typical Conducted Emission Performance at Output 3**  
(Only limit shown - actual data to be added when available)

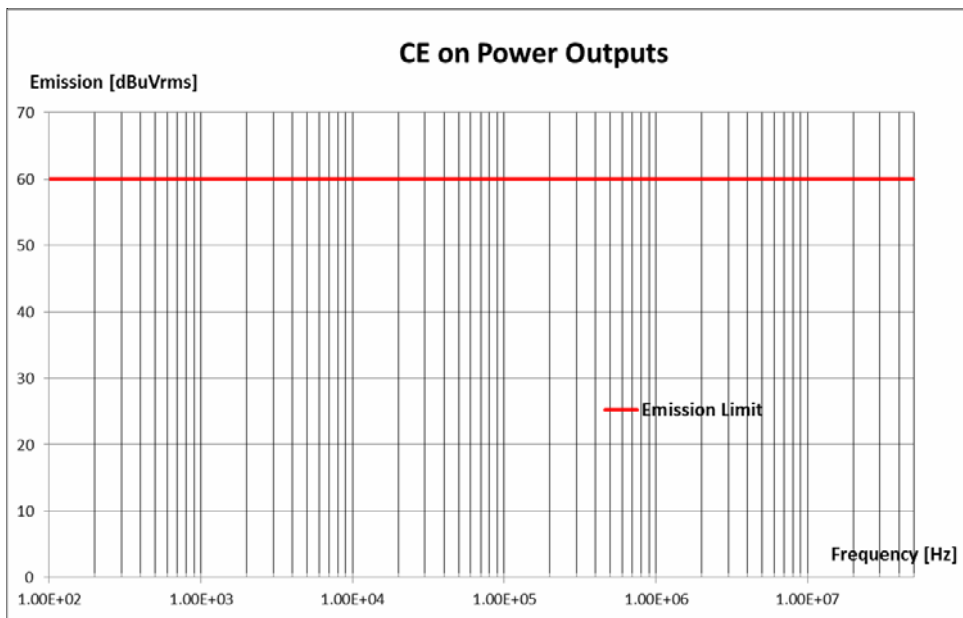
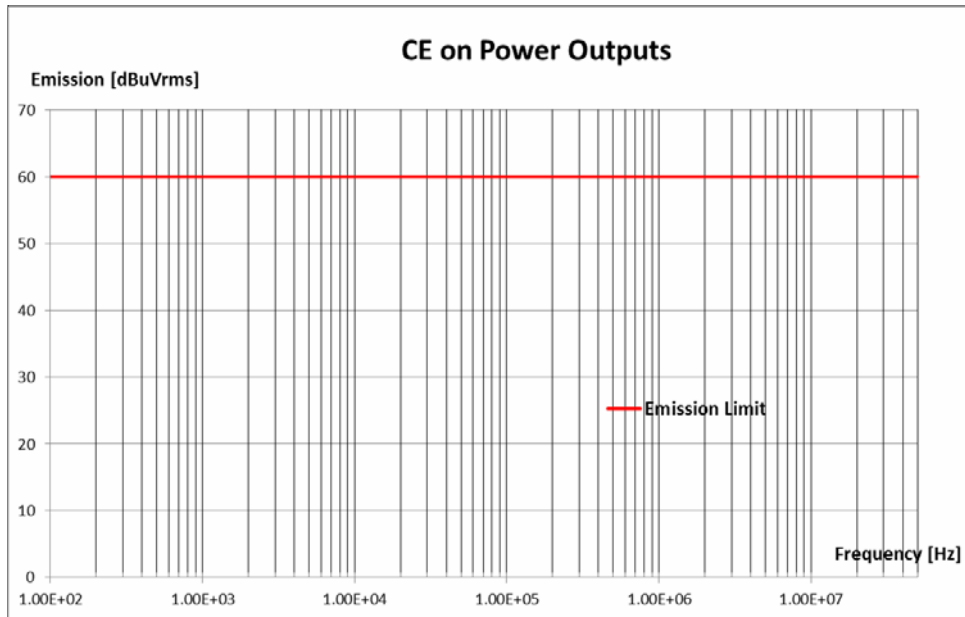
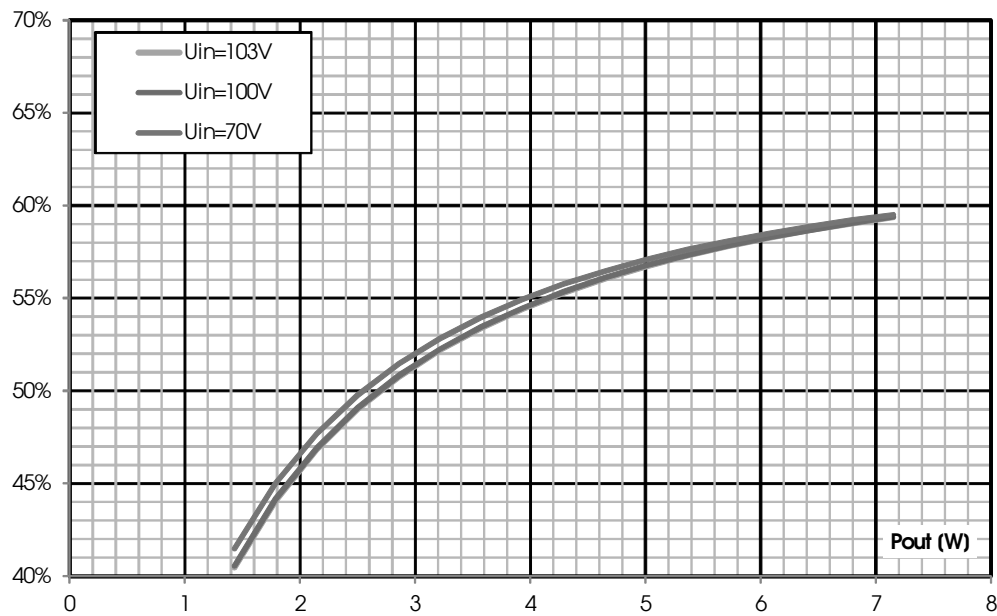


Fig 12 - Typical Conducted Emission Performance at Output 4  
(Only limit shown - actual data to be added when available)



### Power Conversion Efficiency

Fig 13 - Worst Case EOL. Power Conversion Efficiency Vs Output Power  
(All outputs at same relative level)

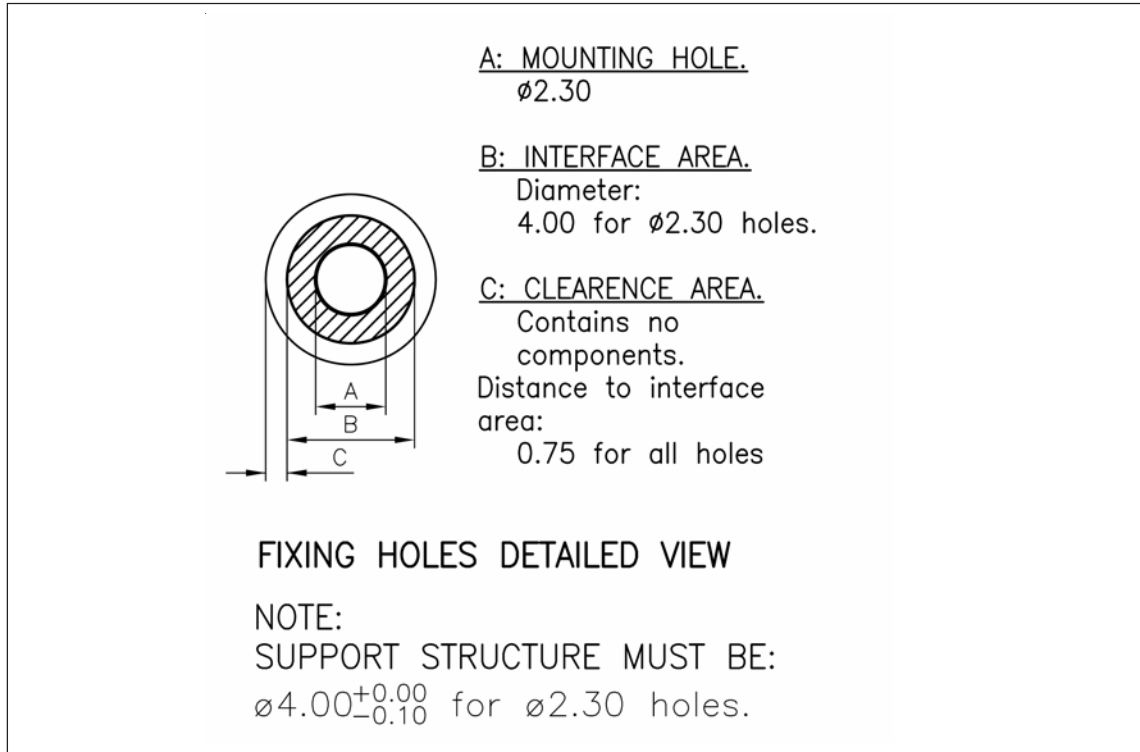




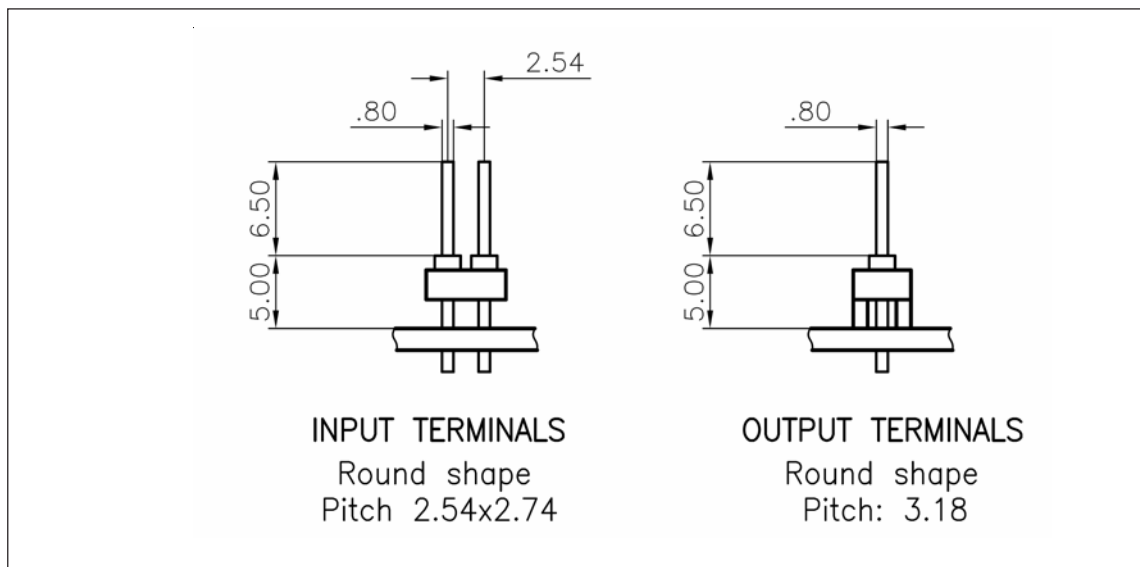
### Recommended Mounting Stud Design

It is foreseen with a mounting stud design with circular mounting studs made out of aluminum with a diameter of 4.0mm and a treaded hole support mounting with M2 screws.

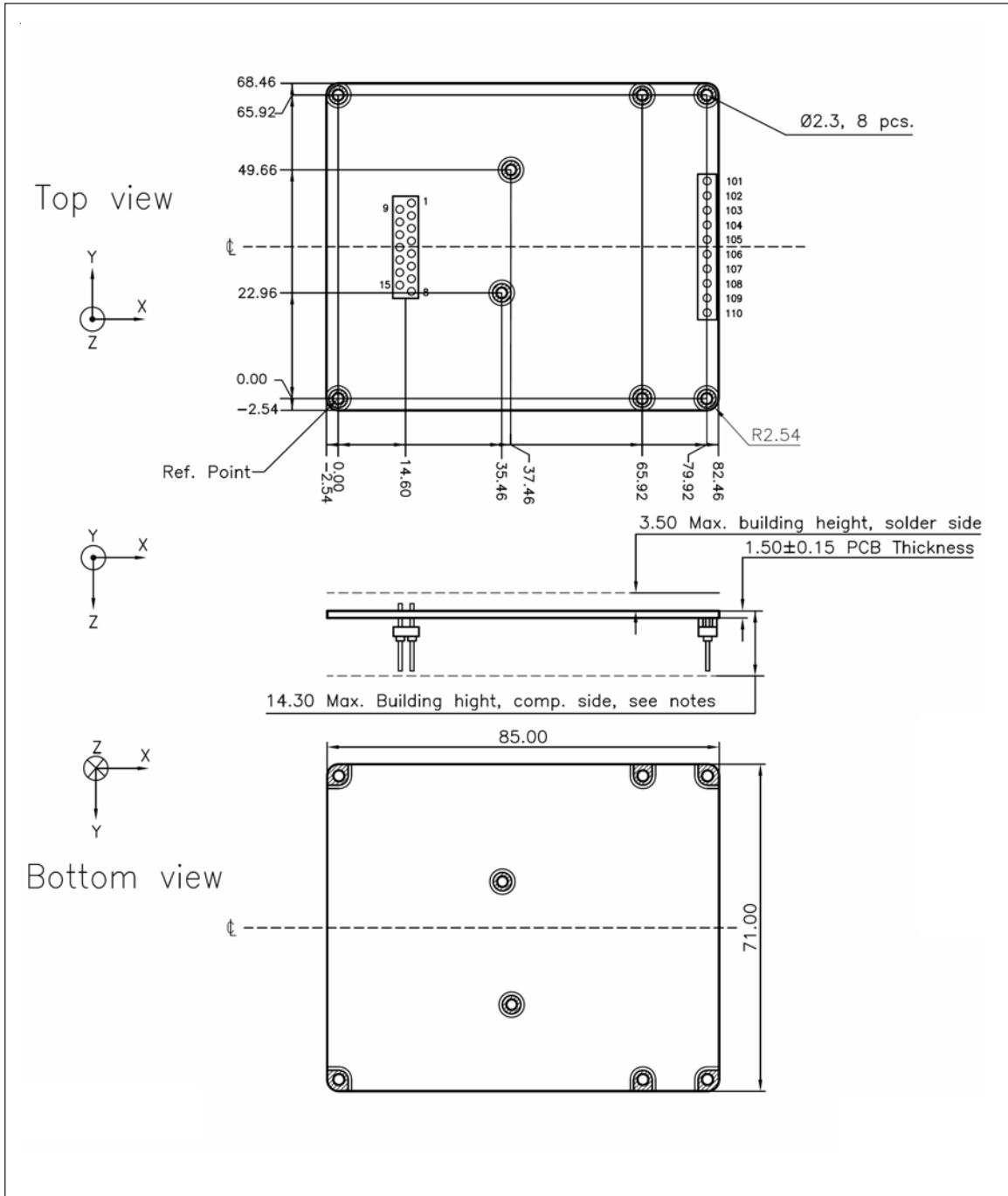
5pcs M2 screws are used for mounting the board. Mounting torque shall be 30Ncm ± 5.0Ncm.



### Electrical Terminal Design



**Mechanical Diagram**



### Pin Designation Tables

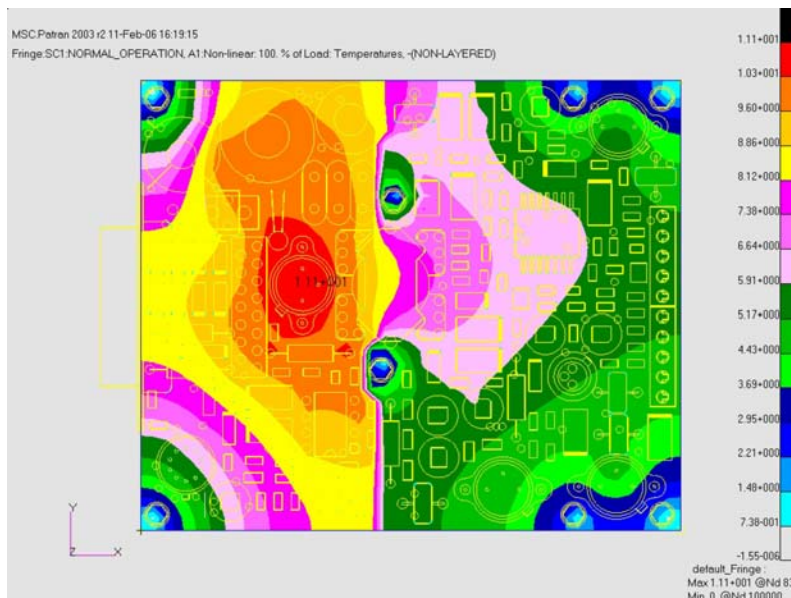
Input Terminals Assignment List		
Indent: Input Terminals (Solder, Pins, Straight)		
Pin #	Pin #	Function
	1	Main Bus Return
9		Main Bus Return
	2	Reserved
10		Reserved
	3	Main Bus
11		Main Bus
	4	Chasis (Ground)
12		TM Voltage
	5	TM Voltage Return
13		Reserved
	6	Reserved
14		Reserved
	7	Reserved
15		Reserved
	8	Reserved

Output Terminals Assignment List	
Indent: Output Terminals (Solder, Pins, Straight)	
Pin #	Function
101	V1 (Positive)
102	V1 Return
103	V4 (Positive)
104	V4 Return
105	Voltage Telemetry
106	Voltage Telemetry Return
107	V3 Return
108	V3 (Negative)
109	V2 Return
110	V2 (Positive)

### Thermal Design Information

The thermal design for the MAH-Series is solely based on heat conduction through the mounting interfaces/mounting screws into the host equipment chassis.

The maximum power loss during normal operation is 4.6W. The temperature profile for the board based on all screw mounting points kept at isothermal level is given below.

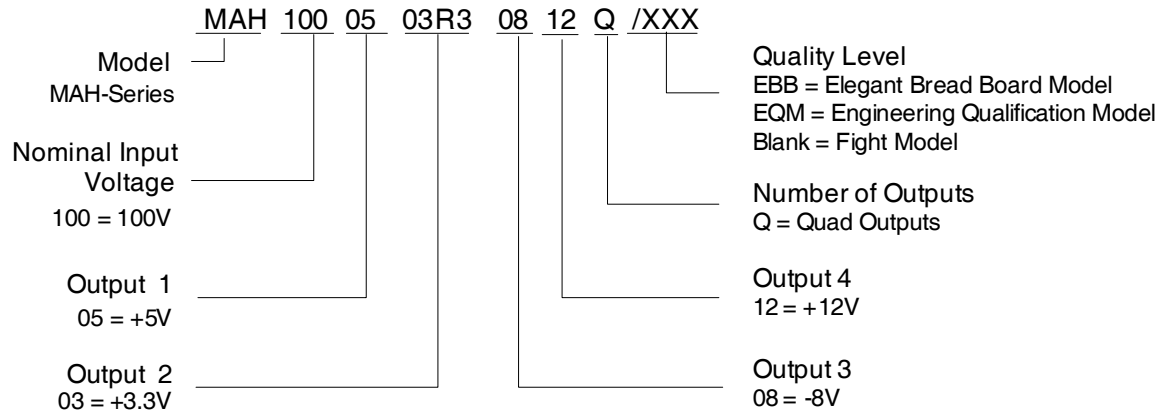


Thermal plot worst case power dissipation during normal operation (Data from similar unit – to be updated when actual data is available)

**MAH1000503R30812Q**  
**(100V Input, Quad Output)**

International  
**IR** Rectifier

**Part Numbering**



**Application Information**

**Standard Documentation**

Each converter is delivered with The following documentation.

- Interface Control Drawing
- Users's Manual
- End Item Data Package with Coc, Applicable Configuration, MIP Photo and Test Results

**Design Justification Documentation**

The following documentation can be made available upon request:

- Worst Case Analysis
- Parts Stress Analysis
- Thermal Analysis
- Mechanical Analysis
- FMECA
- Reliability Assessment
- Declared Components List
- Declared Materials List
- Declared Process List

International  
**IR** Rectifier

**WORLD HEADQUARTERS:** 101 N, Sepulveda Blvd., El Segundo, California 90245, USA Tel: (310) 252-7105

**IR SAN JOSE:** 2520 Junction Avenue, San Jose, California 95134, USA Tel: (408) 434-5000

**IR DENMARK:** Literbuen10C, DK-2740 Skovlunde, Denmark, Tel: +45 4457 5010

Visit us at [www.irf.com](http://www.irf.com) for sales contact information.

*Data and specifications subject to change without notice. 10/2013*