

## 24/28Vdc MIL LOW PROFILE POWER SUPPLY MIL-STD-1275/MIL-STD704 COMPATIBLE Configurable Dual Channel

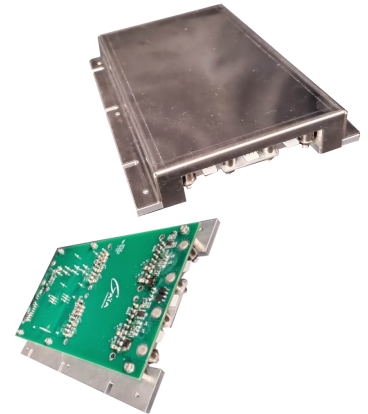
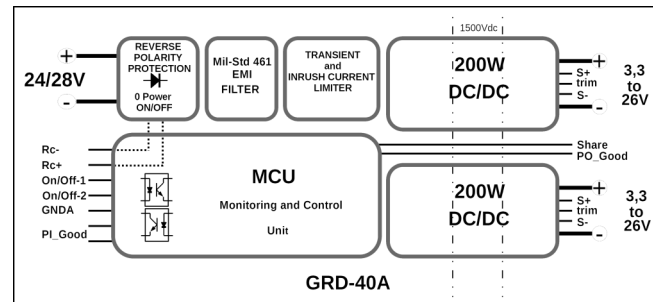
### Features

- 10-45/100 Vdc input.
- Power up to 400W
- Reverse Polarity protection
- Inrush current limiter
- Output 3.3 to 52Vdc
- Dual configurable channel
- Board Parallelizable
- Efficiency up to 88%
- Galvanic isolation 1500Vdc
- Output voltage trim
- -40 to 85°C base-plate
- Thermal protection
- EU RoHs process

### Product Information

The GRD40A designates a full family of 400W low profile military grade C.O.T.S power supplies. The board includes EMI filters, reverse polarity protection, inrush current limiter and input surge limiter in order to fully comply with usual mil input bus standard such as Mil-Std-1275, and Mil-Std-704. The internal limiter sustains input bus disturbances from 12 Vdc level given by MIL-STD1275 IES (initial engagement surge), to 100V dc surge level. Several fixed output voltages from 3.3Vdc to 48Vdc are available. The outputs can be trimmed from 10% to 110% of nominal value. A share function allows connection of several boards in parallel to boost output power. The power supply can be operated with a baseplate

temperature ranging from -40 to 85°C. The GRD40A comes with 2 independent and isolated 200W output channels that can be connected in series, parallel or with a common line, and +/- outputs. The power connections are made through 4 mm studs, the monitoring signals are available on standard low power connectors. With 180mm X 140mm X 28mm dimensions, the board can be ordered uncoated, coated, or with a metallic chassis hood. The GRD40A is particularly suitable for demanding projects in various fields of application like ground borne vehicle, or navy. Plug and play, the GRD40A is intended to speed up design processes reducing time to market.



mm: 190 x 140 x 28  
In : 7.5 x 5.5 x 1.09

### Standards

- Mil-STD -704
- Mil-STD-1275
- Mil-STD-461

### Selection Guide

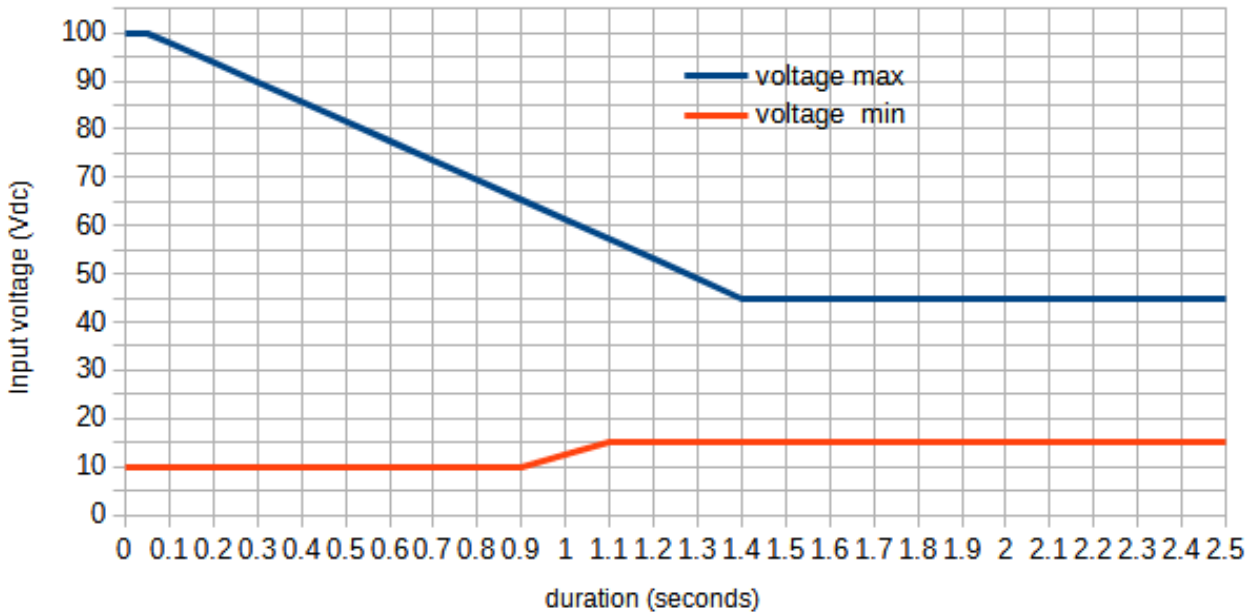
Part Number	Nominal Output Voltage (Vdc)	Output Current (A dc)	Output Power (W)	Part Number	Nominal Output Voltage (Vdc)	Output Current (A dc)	Output Power (W)
GRD40A-H-P	48	8.33	400	GRD40A-H-2E	+/-12	+/-33.3	200-200
GRD40A-H-J	28	13.3	373	GRD40A-H-2F	+/-15	+/-26.7	200-200
GRD40A-H-I	24	16.7	400	GRD40A-H-2I	+/-24	+/-16.7	200-200
GRD40A-H-F	15	26.7	400	GRD40A-H-IC	24-5	16.7-35	200-170
GRD40A-H-E	12	33.3	400	GRD40A-H-IE	24-12	16.7-33.3	200-200
GRD40A-H-C	5	70	350	GRD40A-H-IF	24-15	16.7-26.7	200-200
GRD40A-H-B	3.3	70	231	GRD40A-H-FB	24-3.3	16.7-35	200-115
GRD40A-H-CC	5-5	35-35	170-170	GRD40A-H-FC	15-5	26.7-35	200-170
GRD40A-H-EE	12-12	33.3-33.3	200-200	GRD40A-H-FE	15-12	26.7-33.3	200-200
GRD40A-H-FF	15-15	26.7-26.7	200-200	GRD40A-H-EB	12-3.3	33.3-35	200-115
GRD40A-H-II	24-24	16.7-16.7	200-200	GRD40A-H-EC	12-5	33.3-35	200-170
GRD40A-H-2C	+/-5	+/-35	+/-170	GRD40A-H-CB	5-3.3	35-35	170-115
Options :							
/C carter /S screen /T- 55°C /V Coating							

### Applications

- Mil-Ground-borne
- Embedded Avionic
- Naval

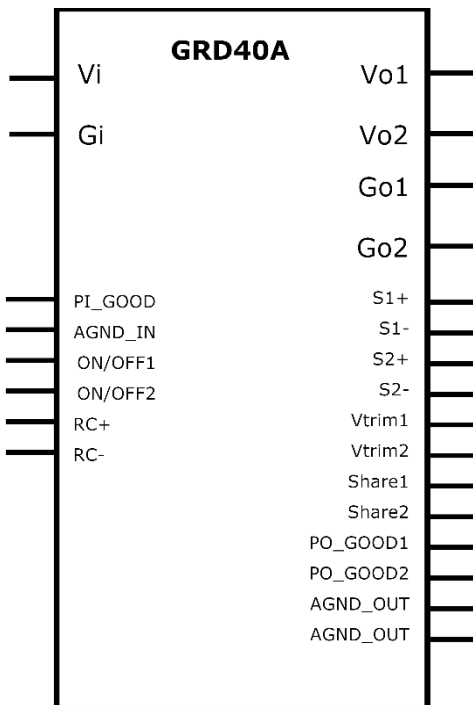
## 1-PRODUCT INTRODUCTION

GRD40A-H Transient operating input voltage



Max non operating input voltage = 202Vdc

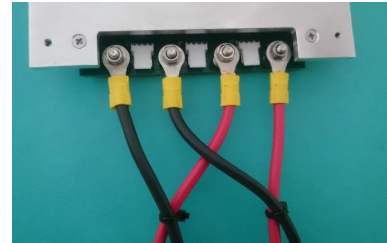
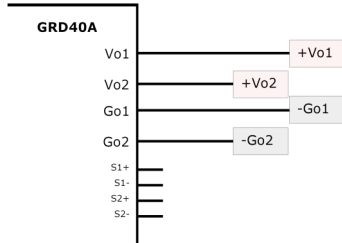
### TERMINALS FUNCTION



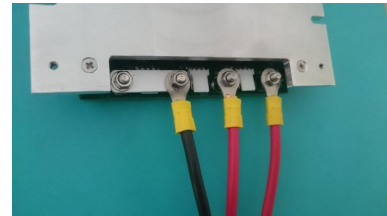
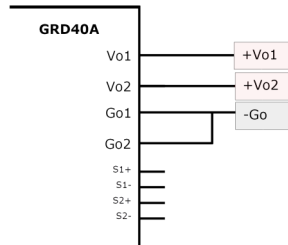
- Vi** : Positive input power connection.
- Gi** : Return input power connection.
- PI\_GOOD**: Input power-good, opto-isolated output signal that raises when input voltage reaches the expected value.
- AGND\_IN**: return for the PI\_GOOD, ON/OFF1, and ON/OFF1 signals.
- ON/OFF1** : Active low internal converter of channel 1 disable command.
- ON/OFF2** : Active low internal converter of channel 2 disable command.
- RC+ & RC-** : Remote control lines. When connected together, these 2 lines disable the complete board that switches to green power mode.
- Vo1, Vo2**: Positive output channel 1 & 2.
- Go1, Go2**: Return output channel 1&2.
- S1+, S2+**: Low current channel 1&2 positive sense.
- S1-, S2-**: Low current channel 1&2 negative sense.
- Vtrim1, Vtrim2**: Output voltage trim of channel 1&2.
- Share1, Share2**: When outputs of GRD40AN are configured in parallel, these pins are internally connected together, and can be used to connect in parallel 2 GRD40AN.
- PO\_GOOD1, PO\_GOOD2**: Power output good, opto-isolated output signal that raises when respectively output voltage of channel1 and output voltage of channel2 reaches the expected value.

## 1-PRODUCT INTRODUCTION

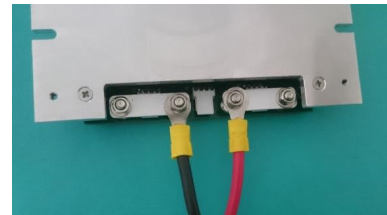
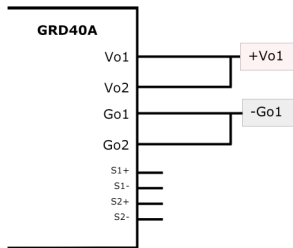
### OUTPUT CONFIGURATION :



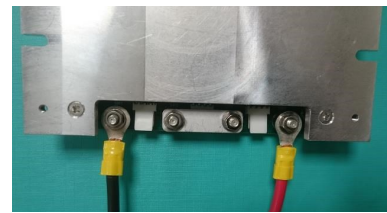
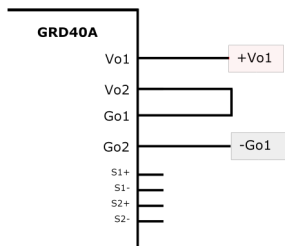
Output configuration **A** :2 isolated channels



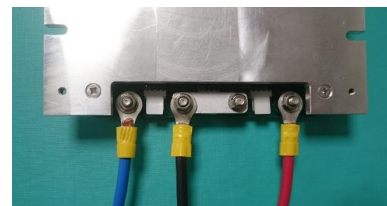
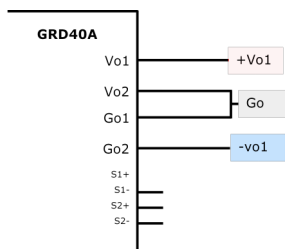
Output configuration **B** :2 independant channels common Go



Output configuration **C**: Parallel connection mode



Output configuration **D** :Series connection mode



Output configuration **E** : Symetrical mode 2 chan-

## 2-ELECTRICAL SPECIFICATIONS

Data are valid at +25°C, unless otherwise specified

Parameter	Conditions	Limit	Units	H input
<b>INPUT</b>				
<b>Nominal Input Voltage (Ui)</b>	Full temperature range	Nominal	Vdc	28
<b>Undervoltage lock-out (UVLO)</b>	Turn-on voltage turn-off voltage Pout 200W	Max. Min.	Vdc	11.1 9.1
<b>Start up time</b>	Ui Full load resistive load	Maximum	ms	30
<b>No load input Power</b>	Ui	Maximum	W	3.3
<b>Input power in inhibit mode</b>	Ui	Maximum	W	0.2
<b>Maximum input Current</b>	Full input voltage range	Maximum steady state	A	30
		Maximum Transient	A	(40)
<b>Maximum input ripple Current</b>	Ui Full load resistive load		Mil-Std-461 C0102 compliant	
<b>OUTPUT</b>				
<b>Set Point accuracy</b>	Ui 75% load	Maximum	%	+/- 2
<b>Output regulation</b> (Line+Load+Thermal)	Vi min. To Vi max 0% to full load	Maximum	%	+/- 1
<b>Output ripple voltage</b> B output (5V) C output (5V) E output (24V) F output (12V) I output (24V) P output (12V)	Vi min. To Vi max	Typical	mVpp	100 100 220 250 480 500
<b>Output voltage trim Range</b>	As function of nominal output voltage <b>Unchanged Max output current !</b>	Minimum	%	10
		Maximum	%	110
<b>Power Efficiency</b>	Ui 75% load	Typical	%	86
<b>Maximum capacitive load</b>	Ui	Maximum	μF	5000
<b>Switching Frequency</b>	Full input voltage range*	Min Max	Khz	280 210
<b>Isolation strength</b>	Input/Output		Vdc/mn.	1500
	Input/baseplate		Vdc/mn.	500
	Output/ baseplate		Vdc/mn.	500
	Output1 / Output2		Vdc/mn.	TBD
<b>Isolation strength</b>	Tested at 500Vdc		MΩ	500

\*Main apparent switching frequency tone may be close to 500kHz as result of 250khz internal biphas synchronization

## 2-ELECTRICAL SPECIFICATIONS

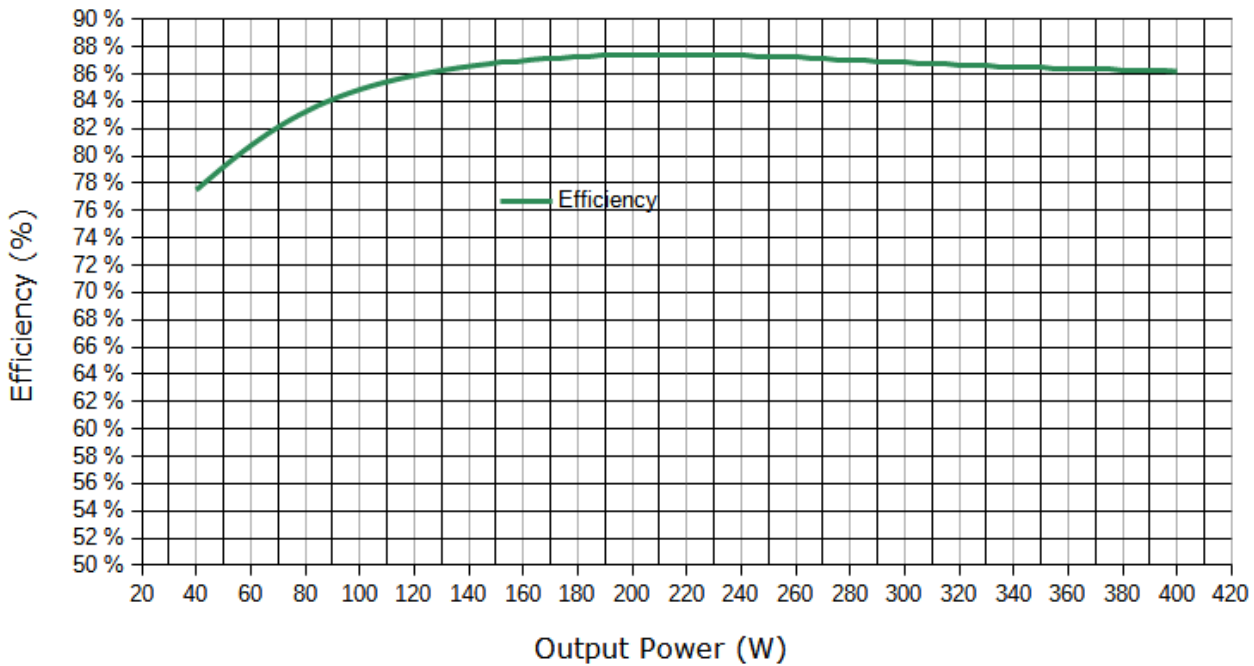
Data are valid at +25°C, unless otherwise specified

Parameter	Conditions	Limit	Units	H input
<b>PROTECTIONS &amp; CONTROLS</b>				
Refers to MGDM201 datasheet for complete output protection description				
<b>Over Current Protection (OCP) Protection mode</b>				FOLD BACK
<b>Over Temperature Protection Converters OTP level</b>	Thermostat with hysteresis cycle (Base plate Temperature)	Max./hyst	°C	115/10
<b>CONTROLS and MONITORING</b>				
<b>Start-up time</b>	Ui nom.	Maximum	ms	30
<b>On/Off module enable voltage</b>	Ui nom. 5mA max bias current	Minimum Maximum	Vdc Vdc	3,5 5,5
<b>On/Off module disable voltage</b>	Ui nom.	Maximum Minimum	Vdc Vdc	1 0
<b>Rc-Rc+ control dry contact impedance</b>	Ui nom. Disable mode	Maximum	Ohms	100
<b>RC-Rc+ max voltage</b>	Ui nom. Enable mode	Maximum	Vdc	15
<b>PI_GOOD trigger level</b>	Ui measured at input connector Pout = 100W	Minimum	Vdc	10.5
<b>PI_GOOD max Vce voltage PI_GOOD max sink current (Ic)</b>	For current < 2.5mA IC For voltage < 10 Vdc .	Maximum	Vdc mAdc	60V 15
<b>PO_GOOD(1)(2) trigger level</b>	Ui nom. As function of output voltage	Minimum	%	95%
<b>PO_GOOD max Vce voltage PO_GOOD max sink current (Ic)</b>	For current < 2.5mA For voltage < 10 Vdc .	Maximum	Vdc mAdc	60V 15
<b>THERMAL</b>				
<b>Operating temperature range</b>	Ui nominal Full power Base Plate temperature	Minimum Maximum	°C	-40 85
<b>Base Plate to Air thermal resistance</b>	Ui nom. Full Load	Typical	°C/W	3
<b>RELIABILITY</b>				
<b>Mean time between failures (MTBF)</b>				
<b>According to Mil HDBK 217F</b>	Ground fixed (Gf) 40°C Ground fixed (Gf) 85°C		Hours	TBD
<b>According to IEC-62380-TR</b>			Hours	TBD

## 3-PERFORMANCE

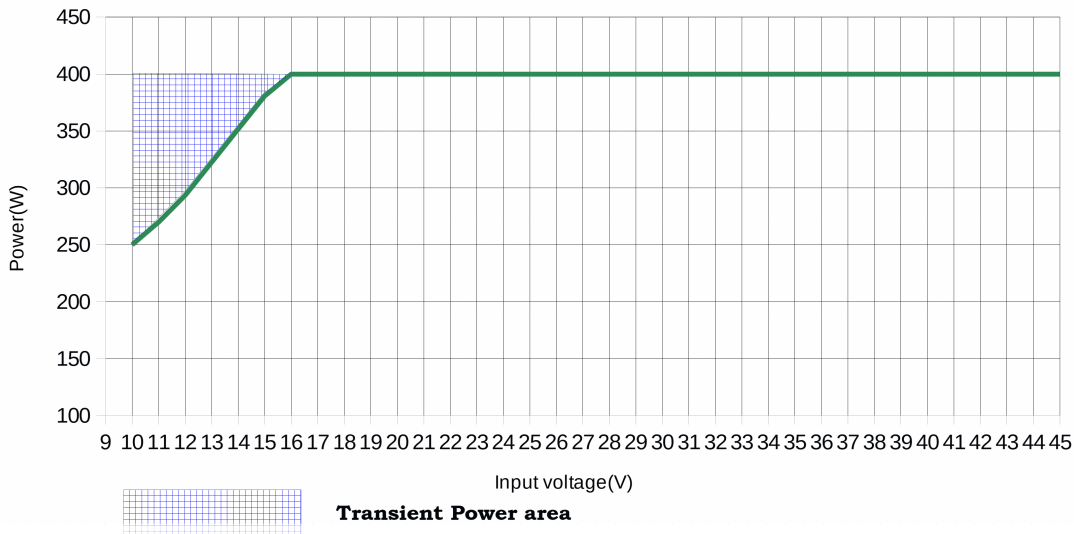
### Efficiency

Typical Efficiency GRD40A-H-I @ 25°C



### Power derating :

Output power derating



## 4-APPLICATION NOTE

### 4.1-THERMAL MANAGEMENT

The GRD40A thermal management can be achieved in 2 different ways:

**Air cooling :** Due to its high base-plate to air thermal resistance air cooling (with no heat-sink or cold plate) is possible for GRD40A-N only for low power or short duration operation. The max ambient temperature will be:

$$T_{amb} = BpT - P_o * \left( \frac{1}{eff} - 1 \right) * R_{th}$$

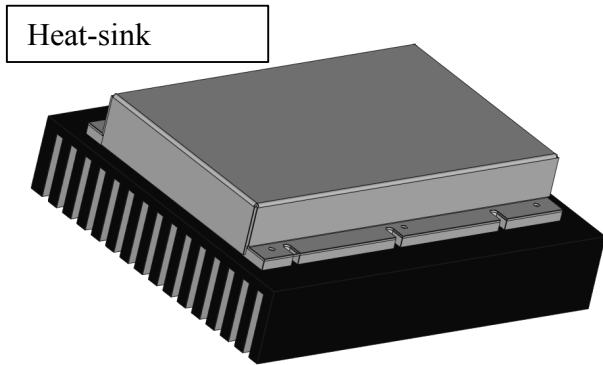
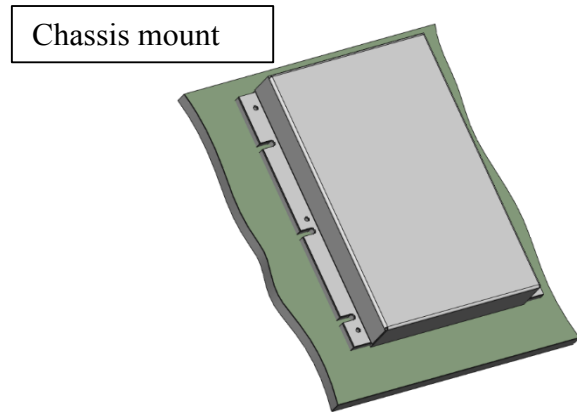
- T<sub>amb</sub> = max ambient temperature.
- BpT = max base plate temperature.
- eff = efficiency
- R<sub>th</sub> = baseplate to air thermal resistance

**Cooling through a heat-sink or chassis mount:**

The most common use of GRD40A is application where Board baseplate is screwed down to a heat-sink or the cold plate of a chassis. In this case The max ambient temperature will be:

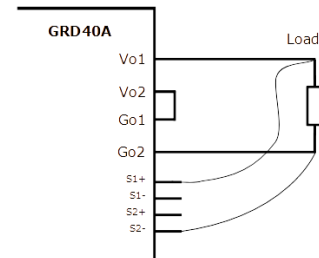
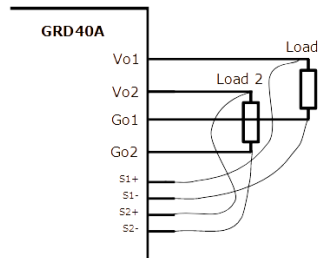
$$T_{amb} = BpT - P_o * \left( \frac{1}{eff} - 1 \right) * R_{th}$$

- T<sub>amb</sub> = max ambient temperature.
- BpT = max base plate temperature.
- eff = efficiency
- R<sub>th</sub> = heat-sink or chassis to air thermal resistance.



### 4.2-SENSE FUNCTION

Sense terminals can be connected to the load to compensate for possible output cables losses. Sense terminals can compensate up to 10% output voltage drop. If not used senses should not be connected. When outputs channels are connected in series and sense function is implemented, only Sense1+ and Sense2- must to be used.





## 4-APPLICATION NOTE

### 4.3-ON-OFF FUNCTION

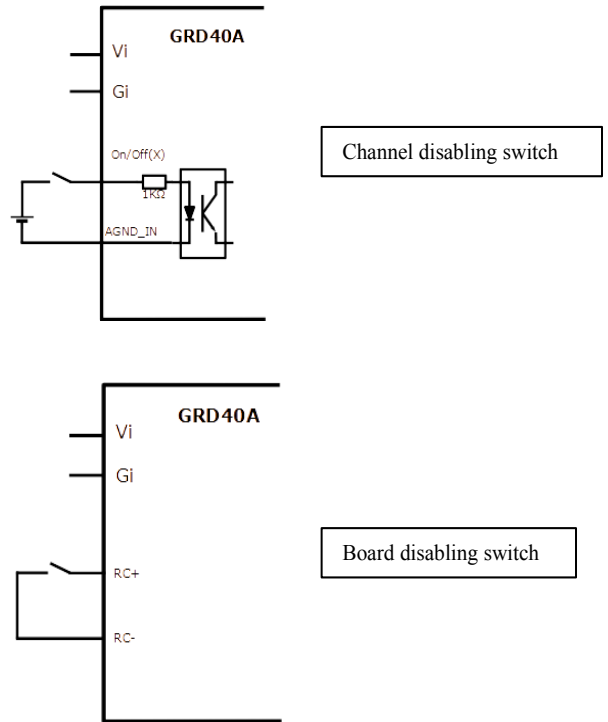
**On/Off1 , On/Off2 :** Each channel of the board can be disabled individually when output configuration is not “connected in series”. The channel is disabled when applying a voltage between On/off1 or On/off2 and AGND\_IN. See electrical specification for voltage and current values of On/off signal. The channels are enabled with On/off(x) unconnected. This On/off(X) control is galvanically isolated, from other parts of the board electrical circuit.

When the outputs are “connected in series” both the On/off(x) signal will disable the 2 channels.

When On/Off(x) are active only internal dc/dc converters are disabled, while the front-end of the board is still in operation.

**Rc+-Rc-:** when Rc+ and Rc- are connected together, the input stage of the board is no longer biased, and whole consumption is reduced to the minimum value. See electrical specification section for more details.

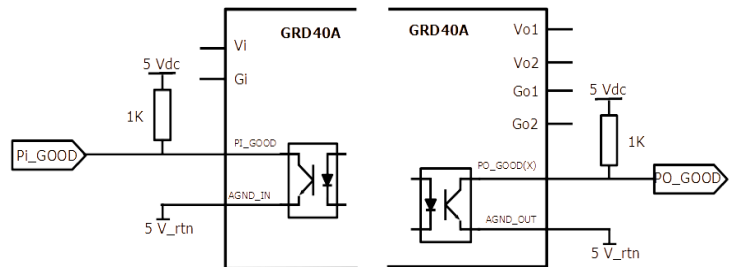
These Rc+ and Rc- are not galvanically isolated, from other parts of the board electrical circuit, therefore it is recommended to control those pins with a dry contact only.



### 4.4-POWER GOOD SIGNALS

The GRD40A provides user with input power good (PI\_GOOD) and output power good (PO\_GOOD1 , PO\_GOOD2) signals that are activated when respectively input voltage and outputs voltage reach their expected values. The signals are provided through transistor or opto-coupler that get saturated when board operate in nominal conditions, and transistor get open when an input or output voltage are not in their nominal values.

**Warning :** When an output voltage is trimmed, the corresponding PO\_GOOD will have threshold values changed. The opposite diagrams show a suggested circuit to use power good signals in a 0 -5V range.

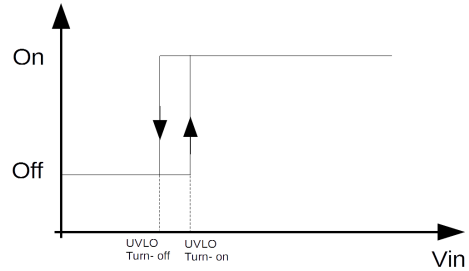




## 4-APPLICATION NOTE

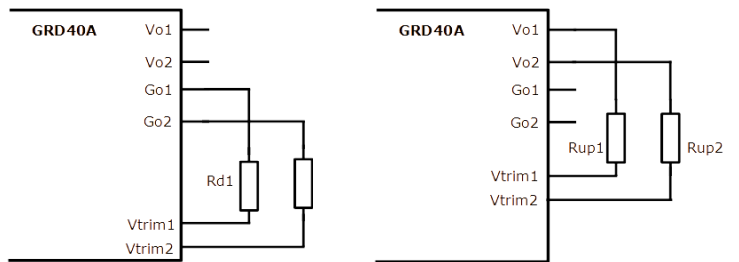
### 4.4-INPUT UNDERLOCKAGE VOLTAGE (UVLO)

An undervoltage protection is implemented to keep the converter off as long as the input voltage has not reached the UVLO turn-on threshold (see electrical specification for threshold value)



### 4.5-OUTPUT VOLTAGE TRIM

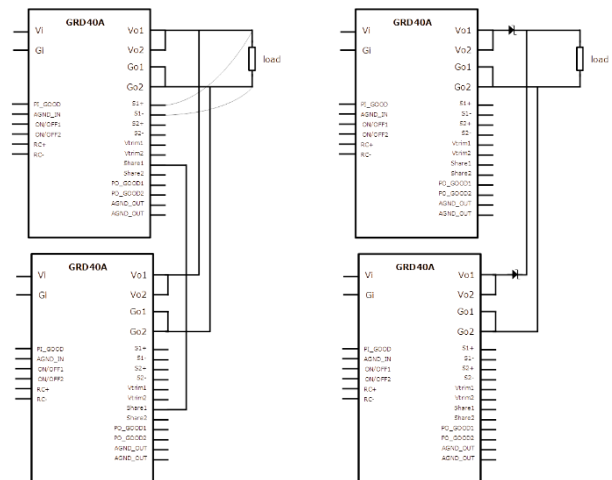
Outputs voltages of GRD40A can be trimmed up and down according to values specified in § electrical specifications. To trim outputs connect Rup(x) as described into opposite diagram. To trim down, connect Rd(x) as described into opposite diagram. Please refer to MGDM201 datasheet for Rup(x) or Rd(x) calculation. Each channel can have its output voltage trim independently, but when connected in series, the current into each channel being the same, it will define the channel output power.



### 4.6-PARALLELING And REDUNDANCY FUNCTION

Paralleling function: in order to boost the output power of a power supply, it is possible to connect outputs of several GRD40A in parallel, with current sharing activated. When the 2 channels off a GRD40A are connected in parallel, the Share1 and Share2 signals of this GRD40A are connected together, only one of them need to be used to parallel several GRD40A-N.

Redundancy function: Several GRD40A can be connected to the same load for redundancy purposes. In this case, Oring diodes must be used (their losses can be compensated using trim function) If GRD40A-N are connected in redundancy mode, the shares(X) pins and On/off 2 should be left unconnected.



## 4-APPLICATION NOTE

### 4.7-OUTPUT OVERVOLTAGE PROTECTION (OVP)

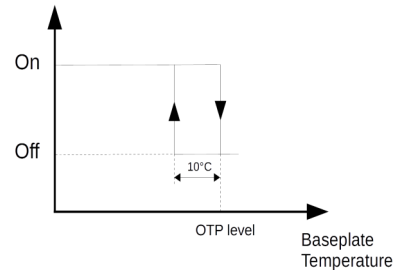
Please refer to MGDM201 datasheet for over voltage protection

### 4.8-OVER-CURRENT PROTECTION (OCP)

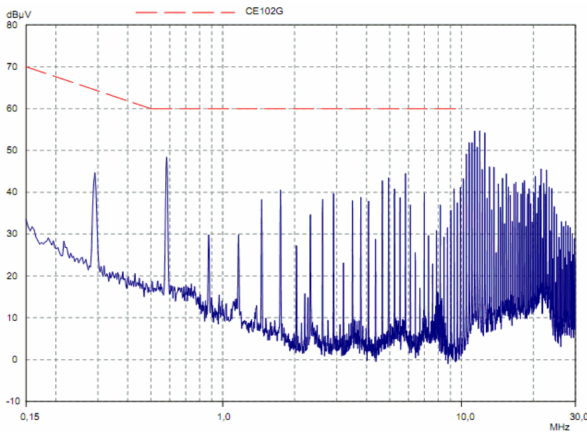
Please refer to MGDM201 datasheet for over current protection

### 4.9-OVER-TEMPERATURE PROTECTION

A thermal protection device adjusted at the OTP level (see characteristics) will inhibit the board as long as the overheat is present and will resume to normal operation automatically once the overheat is removed. The effectiveness of the OTP function is guaranteed only when the board is mounted on a heatsink.

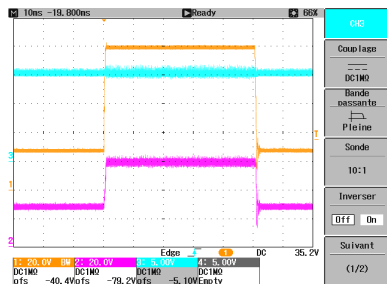


### 4.10-Mil STD 461 CONDUCTED EMI COMPLIANCE



GRD40A-H-I Vin= 28V Pout =400W

### 4.11-1275 SURGE COMPLIANCE



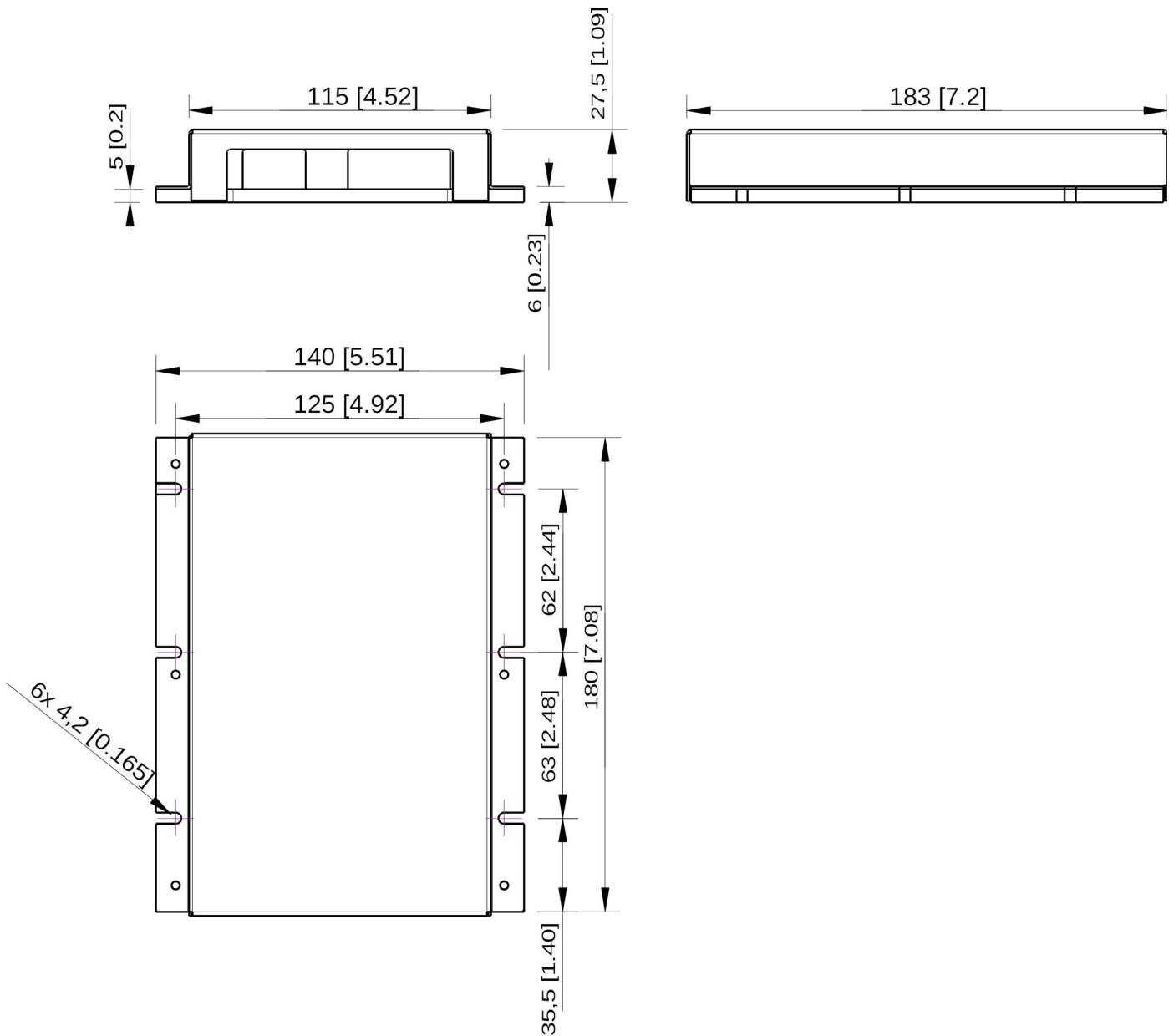
GRD40A-H-F Vin= Ch1, Vout =Ch3

\*Ch2 shows the internal voltage at MGDS201 input

## 4-APPLICATION NOTE

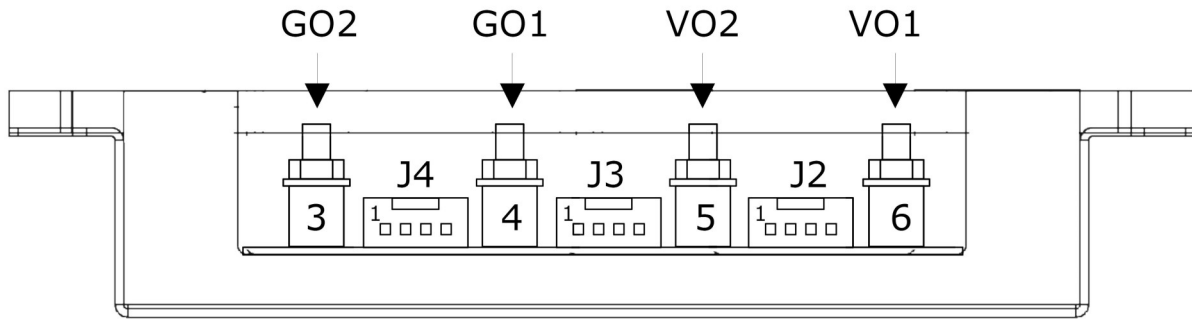
### 4.12-MECHANICAL DRAWINGS

**Material :**  
 baseplate : aluminium  
 Cover : Inox SUS 430 with Nickel plating  
 Cover : thickness 1mm

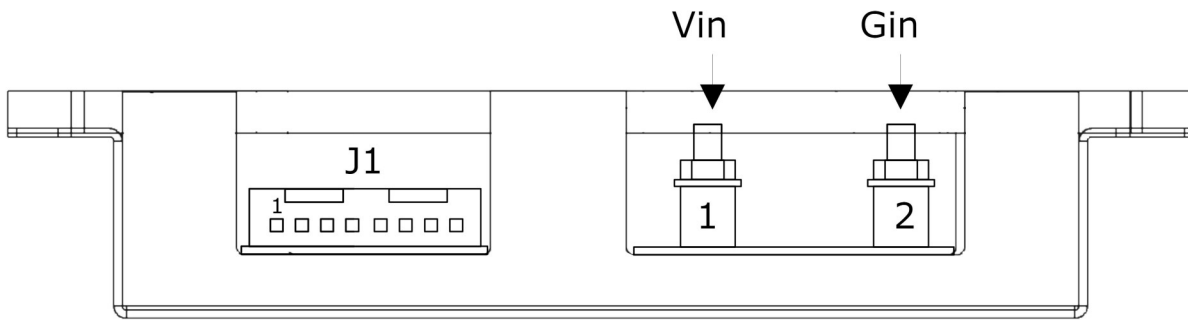


## 4-APPLICATION NOTE

### 4.13-CONNECTION, PRODUCT MARKING



Front side input connections



Back side output connections

Connector	Pin	Designation
Stud	1	+Input(Vin)
Stud	2	-Input(Gin)
Stud	3	-Output 2(Go2)
Stud	4	-Output 1(Go1)
Stud	5	+Output 2(Vo2)
Stud	6	+Output 1(Vo1)

Connector	Pin	Designation
J1	1	PI_GOOD
J1	2	AGND_IN
J1	3	On/Off1
J1	4	On/Off2
J1	5	DNC
J1	6	DNC
J1	7	RC+
J1	8	RC-

Connector	Pin	Designation
J2	1	S1+
J2	2	VTRIM1
J2	3	S1-
J2	4	SHARE1

Connector	Pin	Designation
J4	1	S2+
J4	2	VTRIM2
J4	3	S2-
J4	4	SHARE2

Connector	Pin	Designation
J3	1	AGND_OUT
J3	2	PO_GOOD2
J3	3	AGND_OUT
J3	4	PO_GOOD1



# GRD40A 400W POWER



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