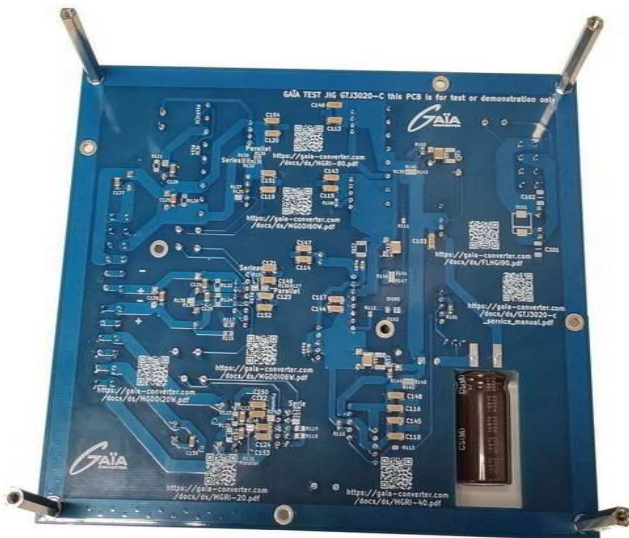
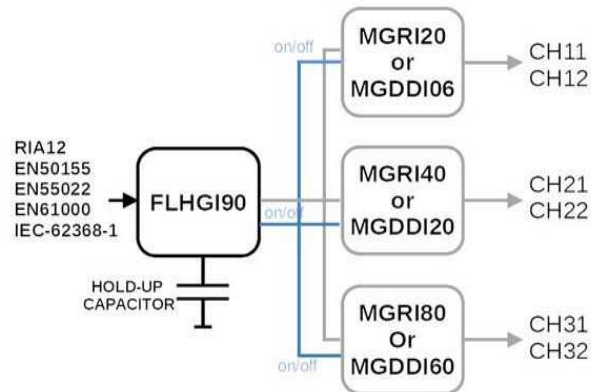


GTJ3000 : GAIA TEST JIG

GTJ 3020-C SERVICE MANUAL JIG for FLHGI90, MGRI, MGDDI series



Multiple Outputs Power Architecture
Multi Standard Compliant



GTJ3000 : GAIA TEST JIG

GTJ 3020 service manual content

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1. GTJ3000 Series Information

The GTJ3020-C is a test jig that can be used to evaluate the performances off DC/DC converters from MGRI or MGDDI series, along with the FLHGI-90 input bus conditioner.

GTJ3020-C contains 3 channels who can be tested separately with configuration strap (see table page 6).

The board is equipped with all component positions to configure UVLO , TRIM function or on/off, in order to ease full product functions evaluation excepted the high insulation voltage. The converters outputs can be configured in parallel or in series connection depending of the configuration jumper (table page 6).

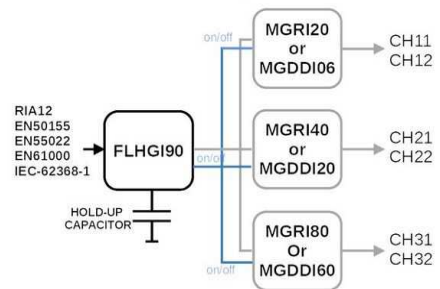
Sockets can be populated on the board in order to plug converters and use the GTJ3020-C like a real test jig.

The board silk-screen contains Qrcodes that give a fast access to allusefull documentation of MGRI, MGDDI series, and FLHG-I-90 as well as access to the GTJ3020-C service manual.

Testing can be performed against Users standards EN55022, EN50155, EN61000 and RIA12 .

**This board is for evaluation purpose only.
Only bare PCB without components is available**

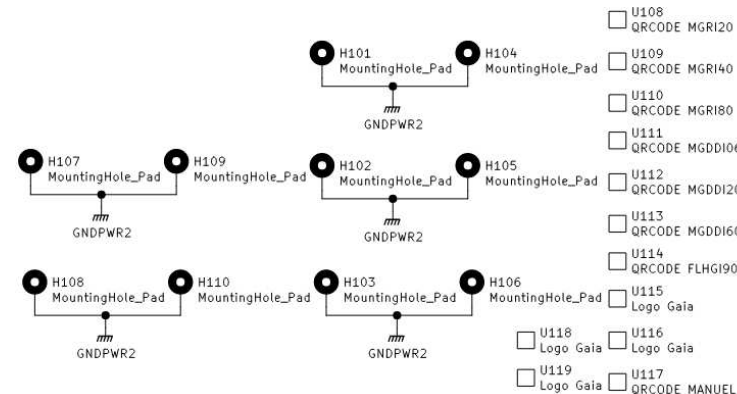
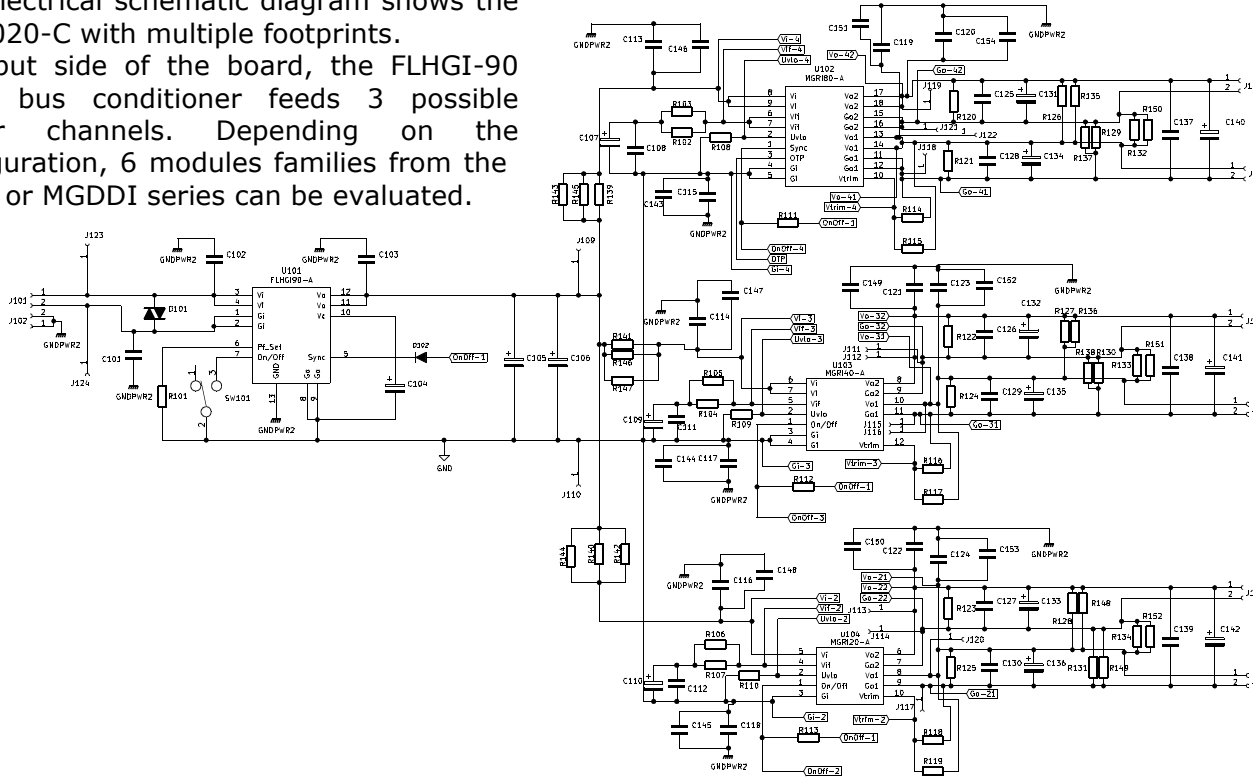
Multiple Outputs Power Architecture
Multi Standard Compliant



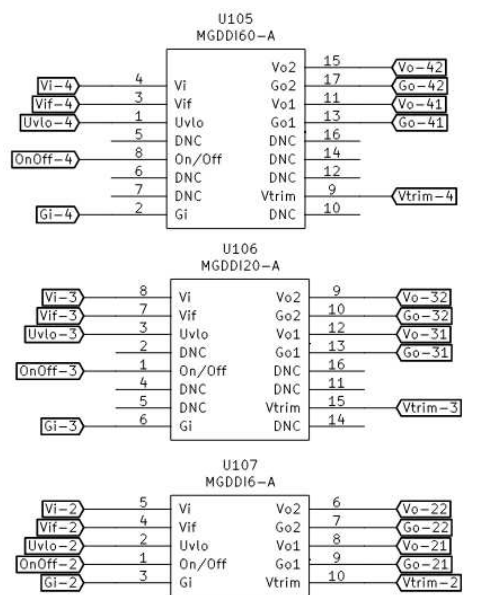
GTJ3000 : GAIA TEST JIG

2. Schematic Diagram

The electrical schematic diagram shows the GTJ3020-C with multiple footprints. At input side of the board, the FLHGI-90 input bus conditioner feeds 3 possible power channels. Depending on the configuration, 6 modules families from the MGRI or MGDDI series can be evaluated.



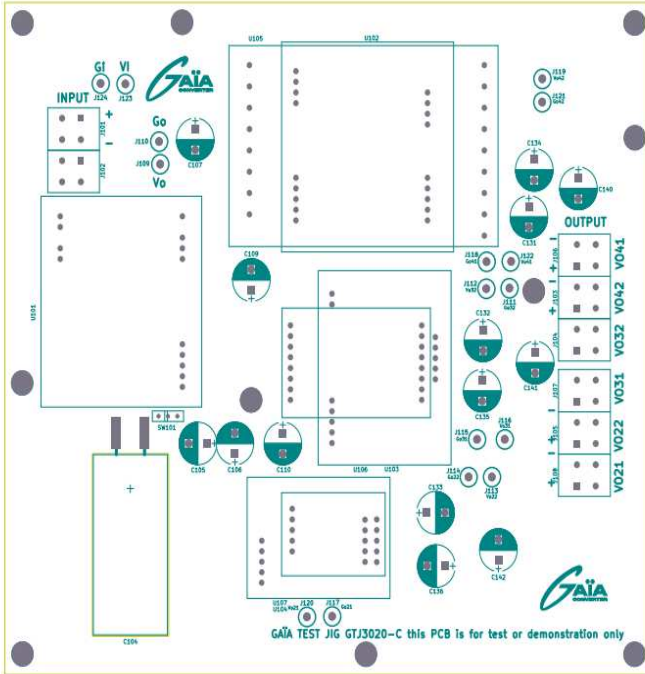
Holes, QRcode and Gaia logo



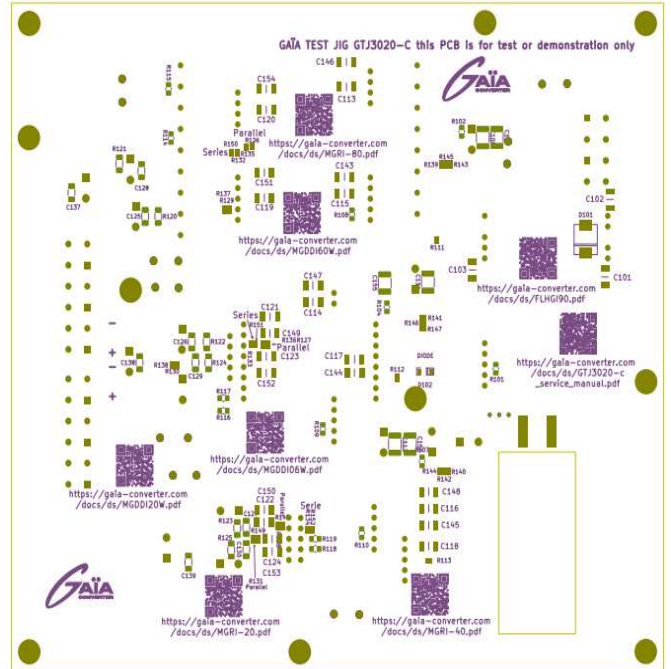
Implantation of the MGDDI series

GTJ3000 : GAIA TEST JIG

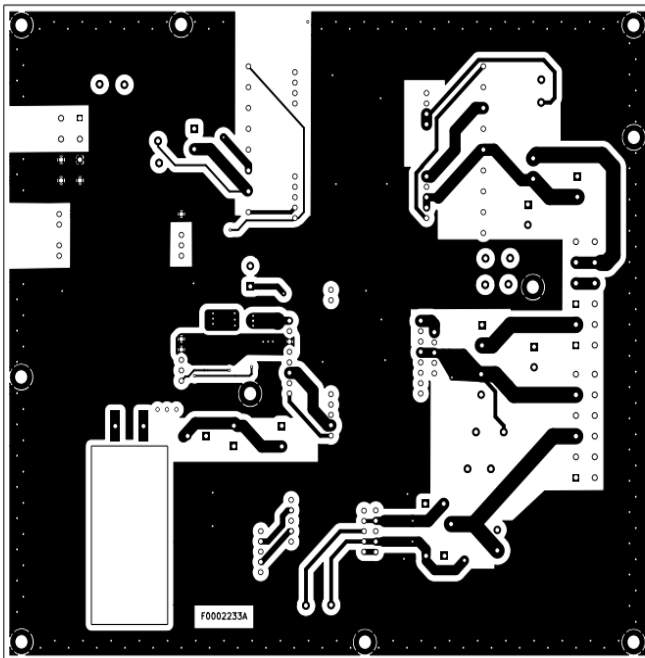
3. Board Drawings



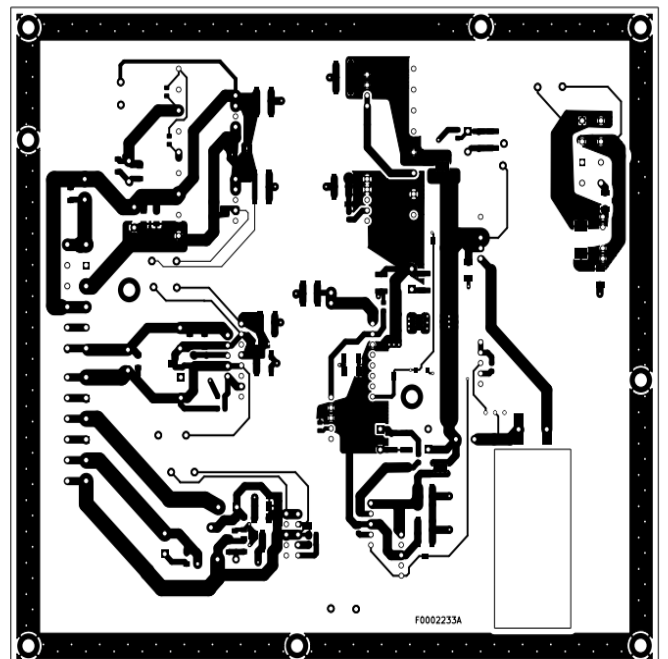
Top view



Bottom view

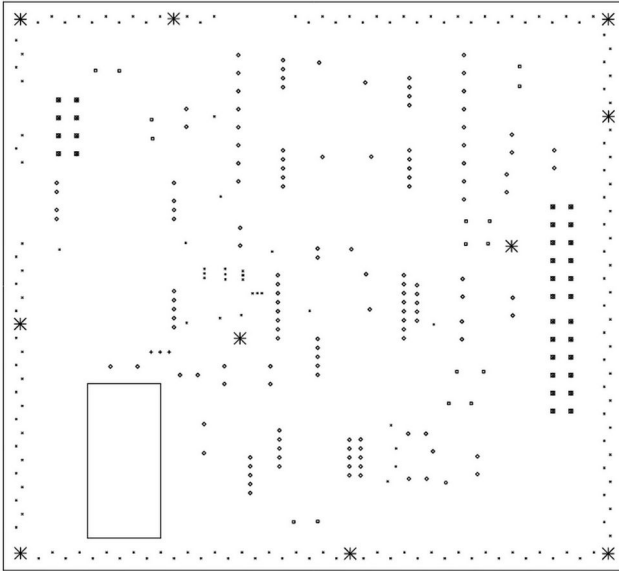


Top view



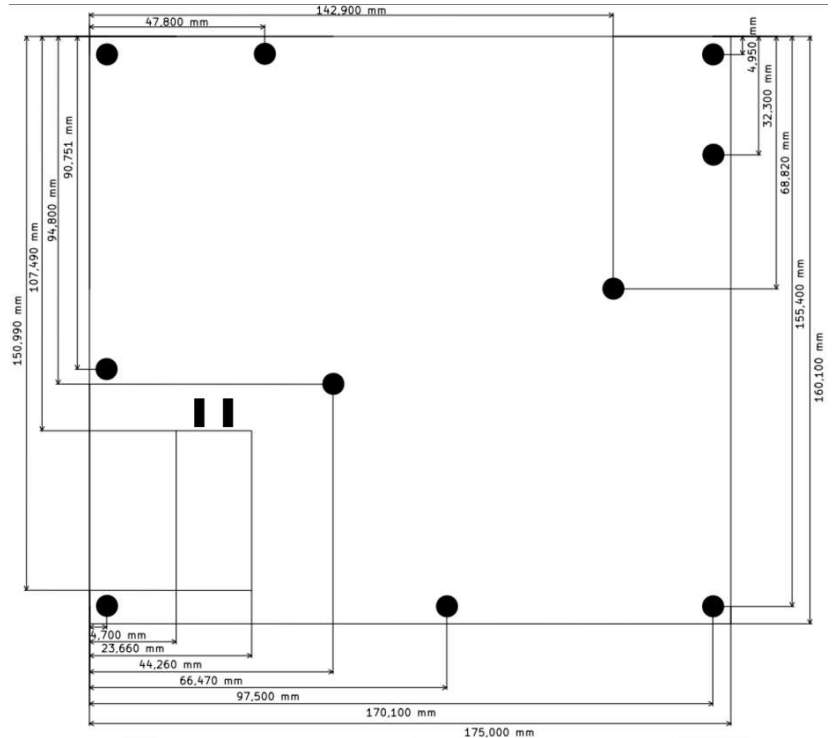
Bottom view

GTJ3000 : GAIA TEST JIG



Drill Map:

- 0.400mm / 0.0157" (169 holes)
- 0.750mm / 0.0295" (1 hole)
- 0.800mm / 0.0315" (3 holes)
- 0.991mm / 0.0390" (16 holes)
- 1.000mm / 0.0394" (136 holes)
- 1.100mm / 0.0433" (32 holes)
- * 3.200mm / 0.1260" (10 holes)



4. Bill Of Materials (BOM)

The table below includes all components that can be used on the GTJ3020-C. Those components are suggested part-numbers that can be replaced by compatible parts.

Designator	Description	Quantity	Possible part-number	Supplier	Comment
C101, C102	DNP	2	302R29W102KV4E	Johanson Dielectrics	
C103, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C123, C124, C143, C144, C145, C146, C147, C148, C149, C150, C151, C152, C153, C154	1nF/2500V	25	302R29W102KF4E-SC	Johanson Dielectrics	
C104	330µF/200V	1	LGU2D331MELA	Nichicon	
C105, C106	22µF/200V	2	200PX22MEFCT810X16	Rubycon	
C107, C109, C110	33µF/250V	3	2220Y5000564JX	Syfer	
C108, C111, C112	560nF/500V	3	2220Y5000564JX	Syfer	
C125, C126, C127, C128, C129, C130, C137, C138, C139	10µF/50V	9	12065Z106KAT2A	AVX	
C131, C132, C133, C134, C135, C136, C140, C141, C142	100µF/50V	9	222204858101	Vishay	

GTJ3000 : GAIA TEST JIG

Designator	Description	Quantity	Possible part-number	Supplier	Comment
D101	Diode	1	ES3D	Vishay	
D102	Diode	1	ES2B	Onsemi	
J101, J102, J103, J104, J105, J106, J107, J108	Conn_01x02_Female	8	236-404	Wago	
J109, J110, J111, J112, J113, J114, J115, J116, J117, J118, J119, J120, J121, J122, J123, J125	Testpoint	16	Test-1 (Bk)	Multicomp	
R101	1K Ω	1	CR21-FL series	ASJ	
R102, R104, R107, R108, R109, R110	3,3K Ω	6	CR21-FL series	ASJ	
R103, R105, R106, R111, R112, R113, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152	DNP	39			Configuration jumper
R114, R115, R116, R117, R118, R119	DNP	6			
SW101	SWITCH_INV_short_pin	1	450301014042	Wurth electronic	
U101	Input bus conditioner	1	FLHGI90RR	GAIA-CONVERTER	
U102	80W reinforced iso DC/DC	1	MGRI80R	GAIA-CONVERTER	
U103	40W reinforced iso DC/DC	1	MGRI40R	GAIA-CONVERTER	
U104	20W reinforced iso DC/DC	1	MGRI20R	GAIA-CONVERTER	
U105	20W wide input DC/DC	1	MGDI20R	GAIA-CONVERTER	
U106	60W wide input DC/DC	1	MGDDI60R	GAIA-CONVERTER	
U107	6W wide input DC/DC	1	MGDDI06R	GAIA-CONVERTER	

DNP = Do Not Populate,

5. Compatible Products

Compatibles Modules	Comment
FLHGI-90-R-R	Input bus conditioner
MGRI-80	80W reinforced iso DC/DC
MGRI-40	40W reinforced iso DC/DC
MGRI-20	20W reinforced iso DC/DC
MGDDI-06	6W wide input DC/DC
MGDDI-20	20W wide input DC/DC
MGDDI-60	60W wide input DC/DC

The table opposite shows all modules families that can be tested with the GTJ3020-C.

GTJ3000 : GAIA TEST JIG

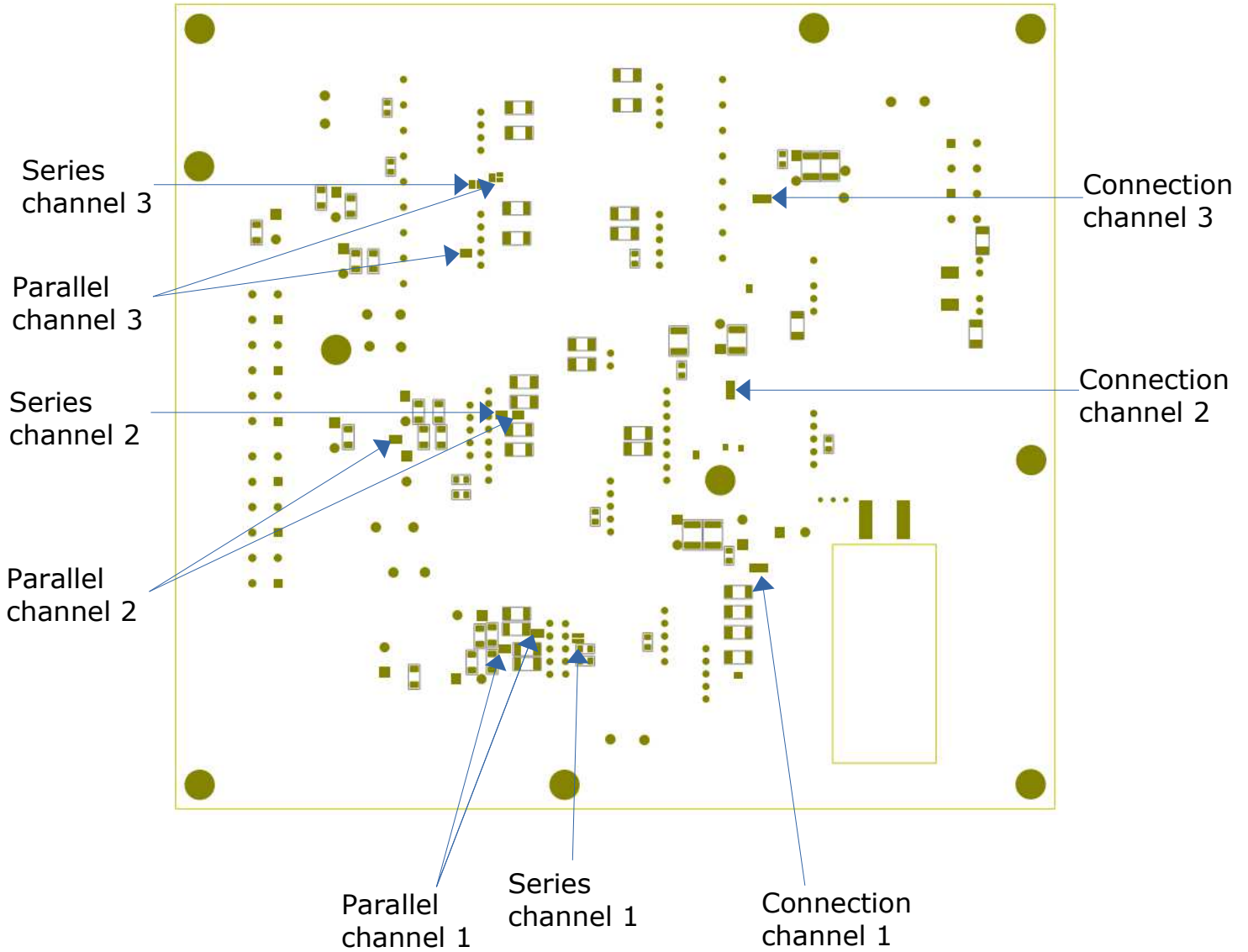
6. Connectors Pinout

Designator	Pin#	Function	Model	Designator	Pin#	Function	Model
J101	1	Vi	Terminal	J109	1	Vo	Testpoint
J101	2	Gi	Terminal	J110	1	Go	Testpoint
J102	1	GNDPWR	Terminal	J111	1	Go-32	Testpoint
J102	2	GNDPWR	Terminal	J112	1	Vo-32	Testpoint
J103	1	Vo-42	Terminal	J113	1	Vo-22	Testpoint
J103	2	Go-42	Terminal	J114	1	Go-22	Testpoint
J104	1	Vo-32	Terminal	J115	1	Go-31	Testpoint
J104	2	Go-32	Terminal	J116	1	Vo-31	Testpoint
J105	1	Vo-22	Terminal	J117	1	Go-21	Testpoint
J105	2	Go-22	Terminal	J118	1	Go-41	Testpoint
J106	1	Vo-41	Terminal	J119	1	Vo-42	Testpoint
J106	2	Go-41	Terminal	J120	1	Vo-21	Testpoint
J107	1	Vo-31	Terminal	J121	1	Go-42	Testpoint
J107	2	Go-31	Terminal	J122	1	Vo-41	Testpoint
J108	1	Vo-21	Terminal	J123	1	Vi	Testpoint
J108	2	Go-21	Terminal	J124	1	Gi	Testpoint

7. Configuration Table

Conf. item	Section	Function	Set Connections	Section	Function	Connections	Comment
1	Channel 1	Input bus conditioner connection	R140, R142, R144	Series	Channel 1 output in series	R134, R152	The jumpers Rxx in this table Just need weld the copper tracks together without resistance.
2	Channel 1	Input bus conditioner connection	R140, R142, R144	PARALLEL	Channel 1 output in parallel	R128, R148, R131, R149	
3	Channel 2	Input bus conditioner connection	R141, R146, R147	Series	Channel 2 output in serie	R133, R151	
4	Channel 2	Input bus conditioner connection	R141, R146, R147	PARALLEL	Channel 2 output in parallel	R127, R136, R130, R138	
5	Channel 3	Input bus conditioner connection	R139, R143, R145	Series	Channel 3 output in series	R132, R150	
6	Channel 3	Input bus conditioner connection	R139, R143, R145	PARALLEL	Channel 3 output in parallel	R126, R135, R129, R137	

GTJ3000 : GAIA TEST JIG



GTJ3000 : GAIA TEST JIG

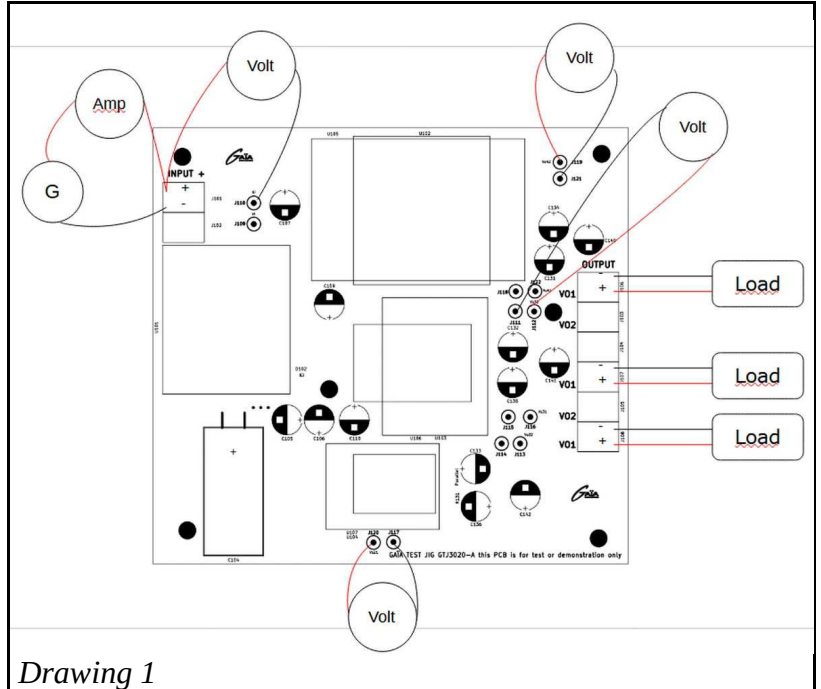
8. Assembly & Operation

Board assembly : Start by populating smallest components (SMD resistors and SMD capacitors) on the bottom side of the PCB, and then on top side. Populate configuration resistors according to the desired output configuration (see table on section 7).

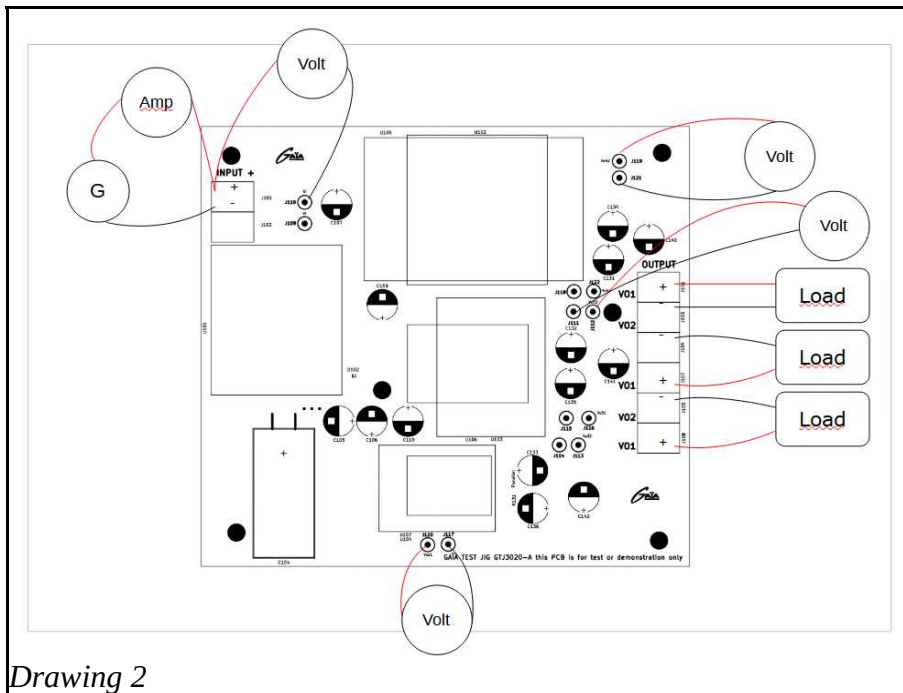
Board operation :

Drawing 1 : (parallel) the performance can be evaluated using the following connections of each devices. Results are viewable page 8.

Testpoints (VO/GO)	Module	Output
J120/J117 or J113/J114	MGRI20/MGDDI06	Channel 1
J116/J115 or J112/J111	MGRI40/MGDDI20	Channel 2
J122/J118 or J119/J121	MGRI80/MGDDI60	Channel 3



Drawing 1



Drawing 2

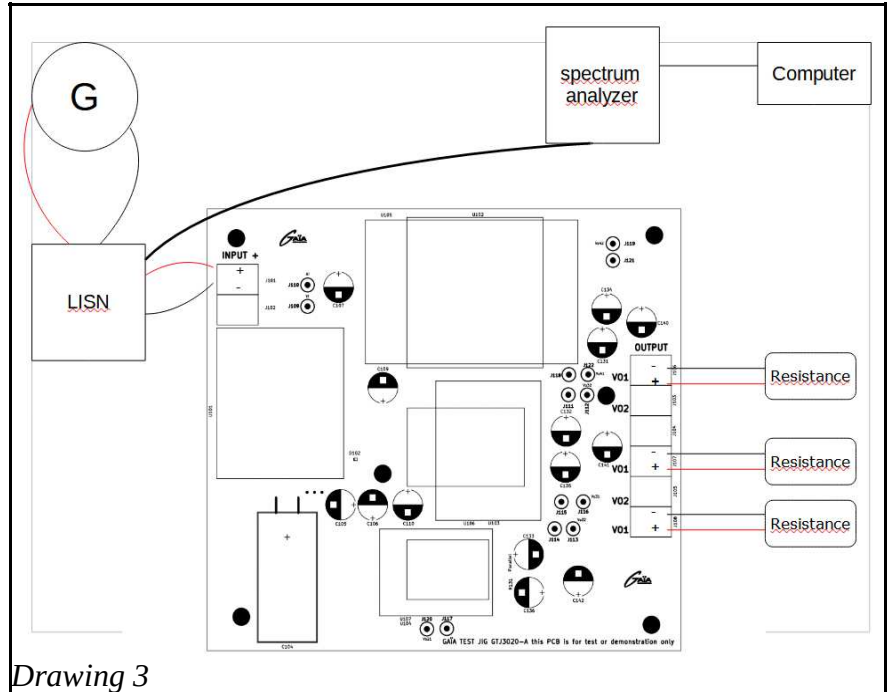
Drawing 2 : In this configuration (serie) the performance can be evaluated using the following schematic for each channel.

Testpoints	Module	Output
J120/J117	MGRI20/MGDDI06	Vo21 (CH11)
J113/J114	MGRI20/MGDDI06	Vo22 (CH12)
J116/J115	MGRI40/MGDDI20	Vo31 (CH21)
J112/J111	MGRI40/MGDDI20	Vo32 (CH22)
J122/J118	MGRI80/MGDDI60	Vo41 (CH31)
J119/J121	MGRI80/MGDDI60	Vo42 (CH32)

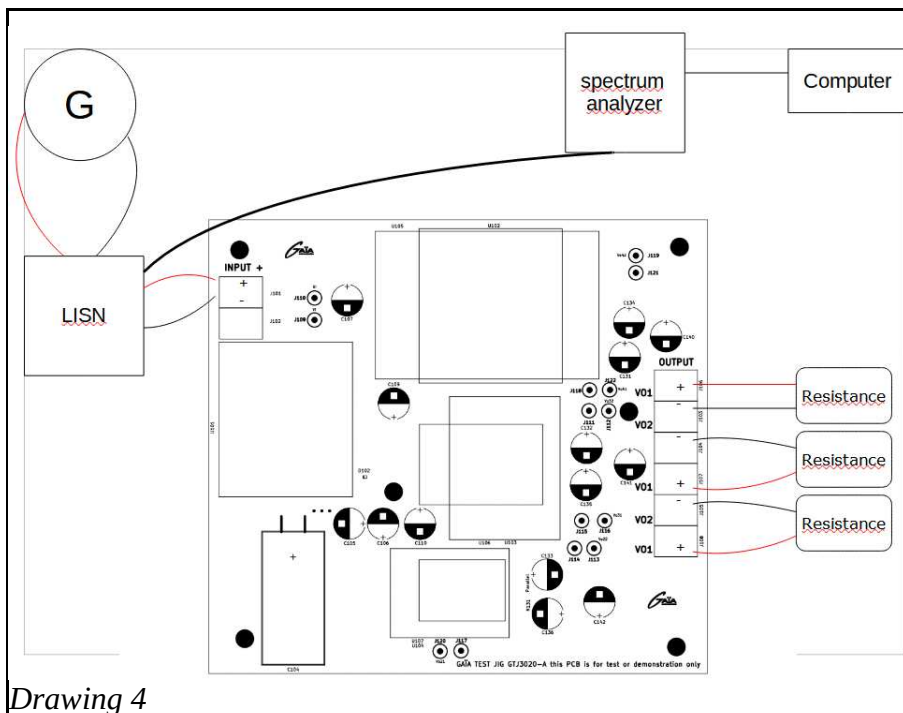
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Drawing 3 : In this configuration (parallel) the conducted EMI can be evaluated using the following schematic for each channel, results are in section 9.2.

Module	Output
MGRI20/MGDDI06	Channel 1
MGRI40/MGDDI20	Channel 2
MGRI80/MGDDI60	Channel 3



Drawing 3



Drawing 4

Drawing 4 : In this configuration (series) the conducted EMI can be evaluated using the following schematic for each channel. Results are in section 9.2.

GTJ3000 : GAIA TEST JIG

9. Performances

9.1. Efficiencies

Stand alone Converters efficiency :

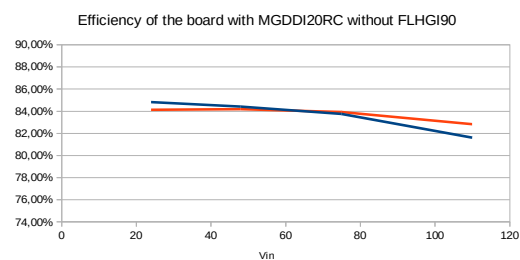
In this section , the FLHGI-90 is by-passed, and converters stand alone are tested

Board with MGDDI20RC without FLHGI90	
Vin (V)	Performance (%)
24	84,82%
48	84,39%
75	83,73%
110	81,60%

Performance at 75% of load

Board with MGDDI20RC without FLHGI90	
Vin (V)	Performance (%)
24	84,10%
48	84,18%
75	83,90%
110	82,83%

Performance at 100% of load

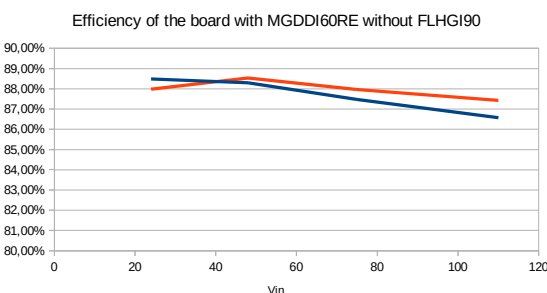


Board with MGDDI60RE without FLHGI90	
Vin (V)	Performance (%)
24	88,48%
48	88,30%
75	87,47%
110	86,57%

Performance at 75% of load

Board with MGDDI60RE without FLHGI90	
Vin (V)	Performance (%)
24	87,98%
48	88,52%
75	87,95%
110	87,42%

Performance at 100% of load



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Full line-up channels efficiency :

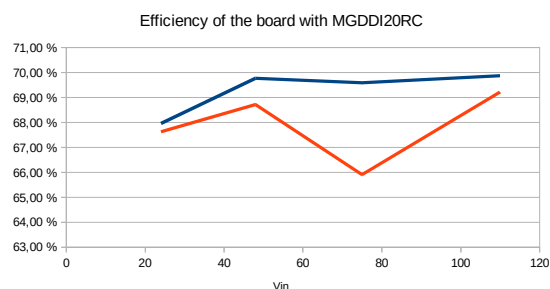
MGDDI series

Board with MGDDI20RC	
Vin (V)	Performance (%)
24	67,96 %
48	69,77 %
75	69,59 %
110	69,86 %

Performance at 75% of load

Board with MGDDI20RC	
Vin (V)	Performance (%)
24	67,63 %
48	68,71 %
75	65,91 %
110	69,21 %

Performance at 100% of load

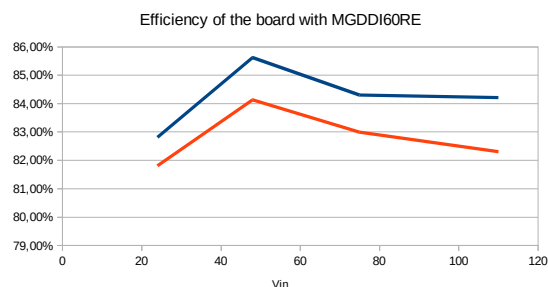


Board with MGDDI60RE	
Vin (V)	Performance (%)
24	78,95 %
48	82,69 %
75	82,18 %
110	81,31 %

Performance at 75% of load

Board with MGDDI60RE	
Vin (V)	Performance (%)
24	79,84 %
48	81,96 %
75	80,86 %
110	82,69 %

Performance at 100% of load



The blue curves show the performance at 75% load and orange's ones are the performance at 100% load.

All the modules were tested with output in parallel (drawing 1).

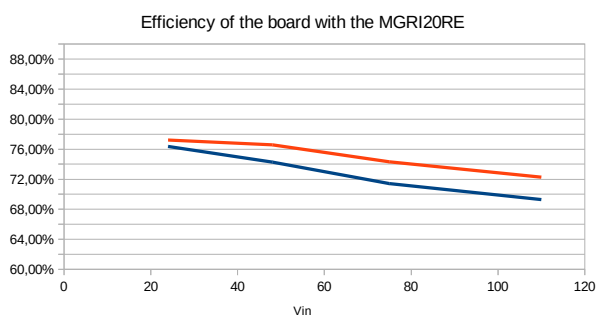
MGRI serie

Board with MGRI20RE	
Vin (V)	Performance (%)
24	76,37%
48	74,25%
75	71,41%
110	69,26%

Performance at 75% of load

Board with MGRI20RE	
Vin (V)	Performance (%)
24	77,21%
48	76,54%
75	74,30%
110	72,24%

Performance at 100% of load

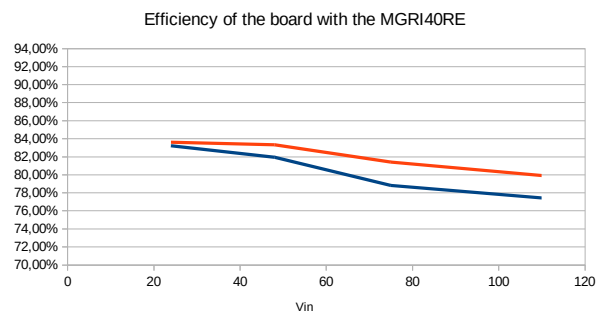


Board with MGRI40RE	
Vin (V)	Performance (%)
24	83,21%
48	81,94%
75	78,80%
110	77,44%

Performance at 75% of load

Board with MGRI40RE	
Vin (V)	Performance (%)
24	83,61%
48	83,31%
75	81,40%
110	79,90%

Performance at 100% of load



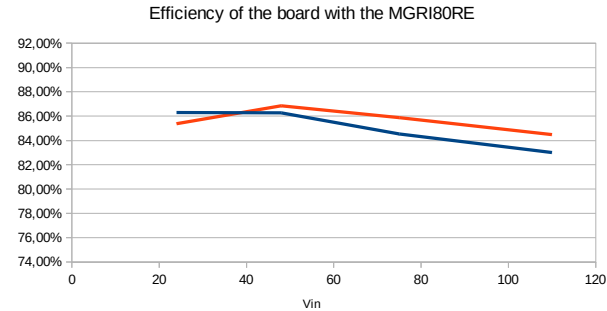
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Board with MGRI80RE	
Vin (V)	Performance (%)
24	86,29%
48	86,25%
75	84,53%
110	83,00%

Performance at 75% of load

Board with MGRI80RE	
Vin (V)	Performance (%)
24	85,36%
48	86,84%
75	85,87%
110	84,46%

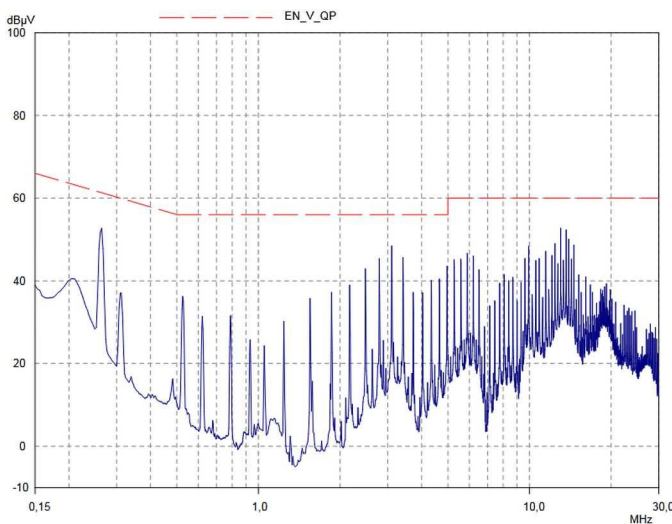
Performance at 100% of load



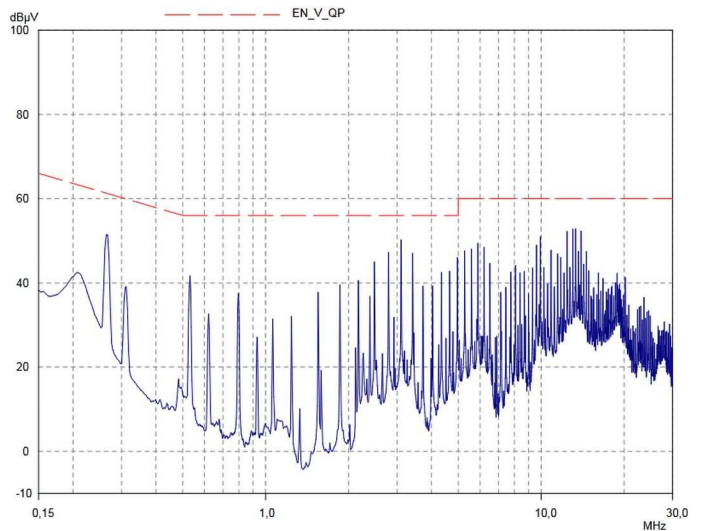
The blue curves show the performance at 75% load and orange's ones are the performance at 100% load. All the modules were tested with output in parallel (drawing 1).

9.2. EMI compliance

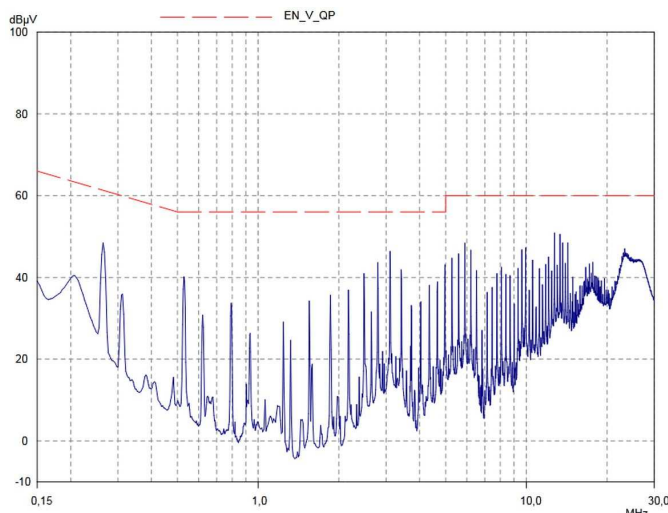
EN55022 EMI



Test with MGRI20



Test with MGRI40



Test with MGRI80

Frequency range MHz	Limits dB(µV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

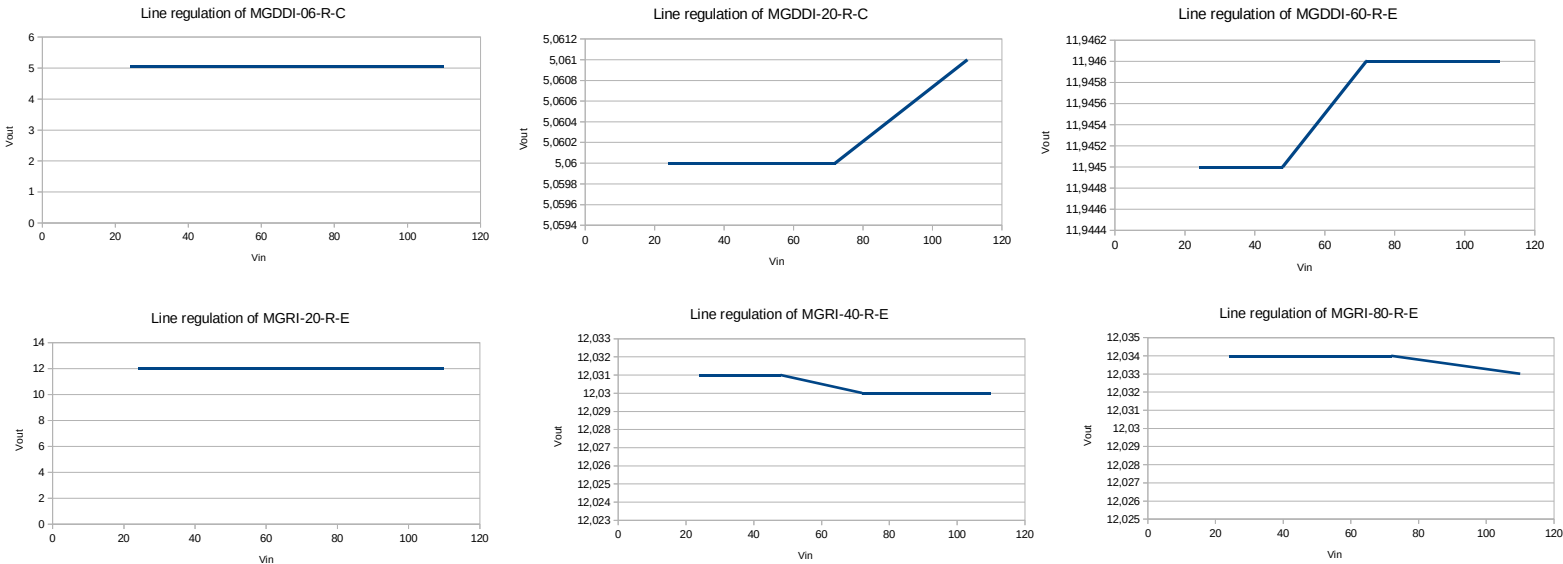
Values of the EMI standards EN55022

The FLHGI-90-R-R and converters were tested at 48Vdc input, with output load at 75% of nominal power.

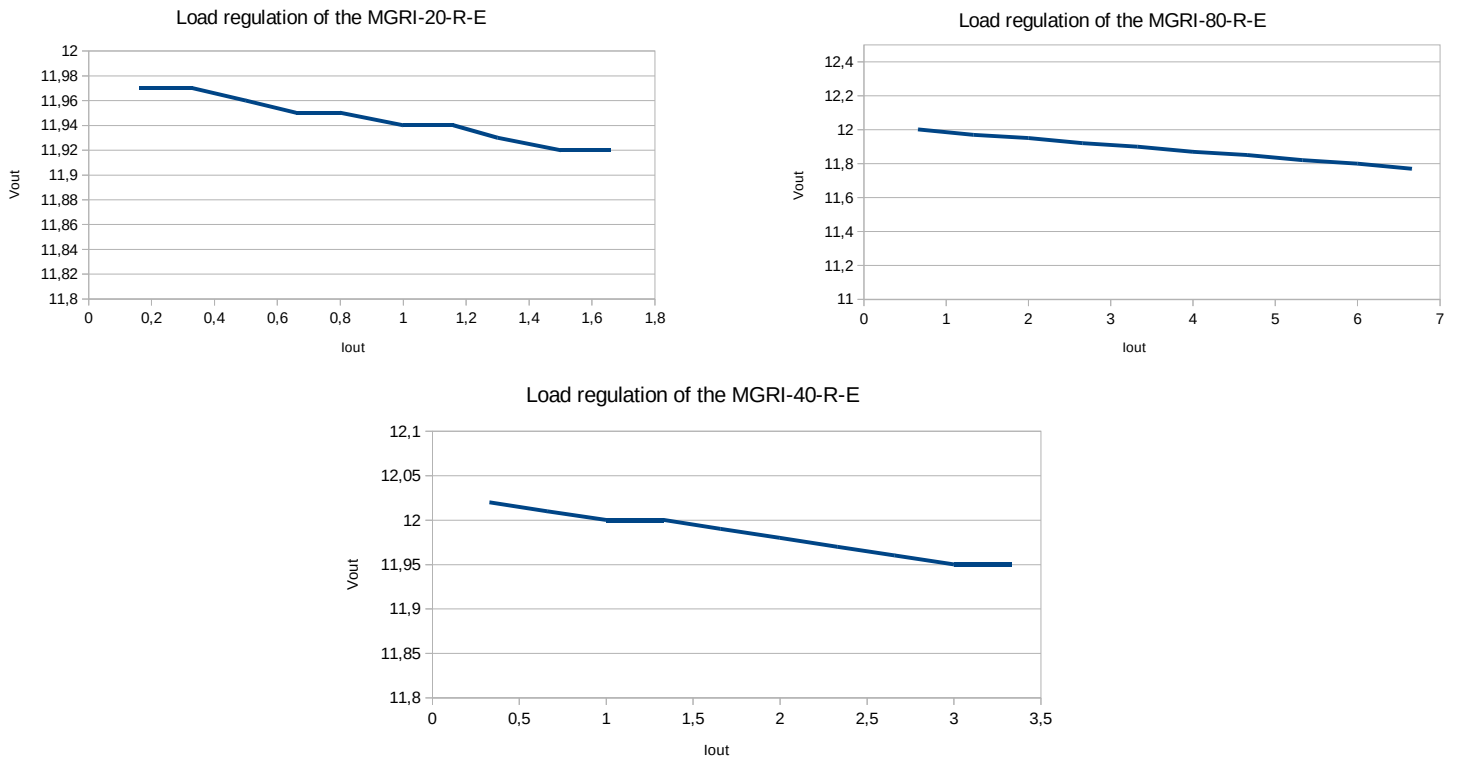
GTJ3000 : GAIA TEST JIG

9.3. Line and load regulation

The plots below show the line regulation (24V to 110V) of the MGDDI and MGRI series at 75% load.



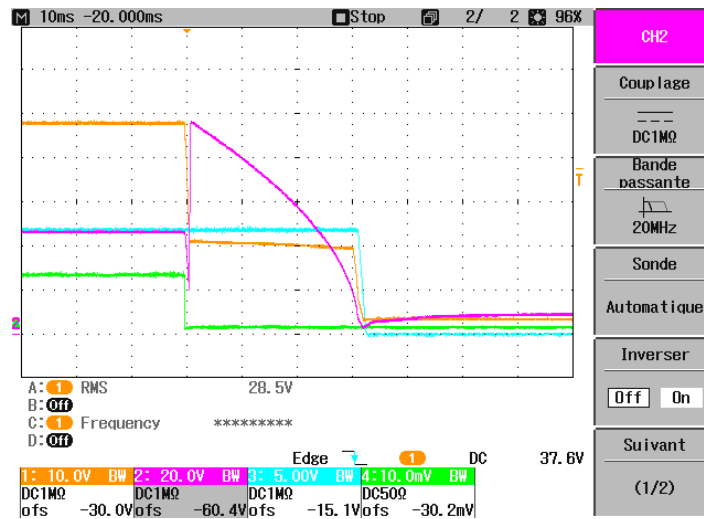
The plots below show the load regulation (48V in) of the MGRI series.



GTJ3000 : GAIA TEST JIG

9.4. Hold-up

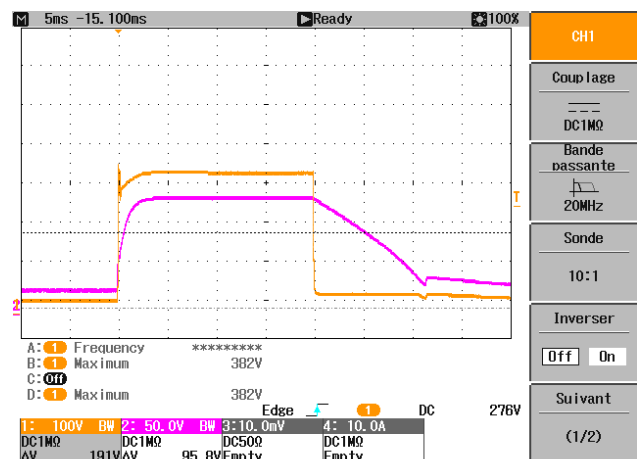
The plot below shows the GTJ3020-C hold-up function testing with a MGDDI60 at 60% of load.



Plots definition : Input voltage at 48V (ch1), the FLHGI-90-R-R output voltage (ch2), the output of the MGDDI-60 (ch3) and the current at the input of the board (1A/div) (ch4).

9.5. 385 Vdc transient Voltage test.

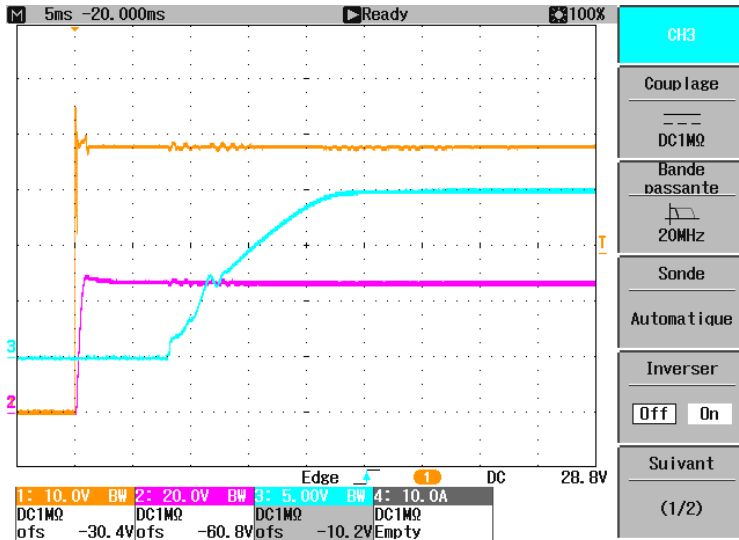
The GTJ3020-C equipped with the FLHGI-90-R-R sustain 385Vdc /20 ms of the RIA12 standard. The plot opposite shows FLHGI-90-R-R output voltage (CH2) that remains at 110V max during surge application (Ch1).



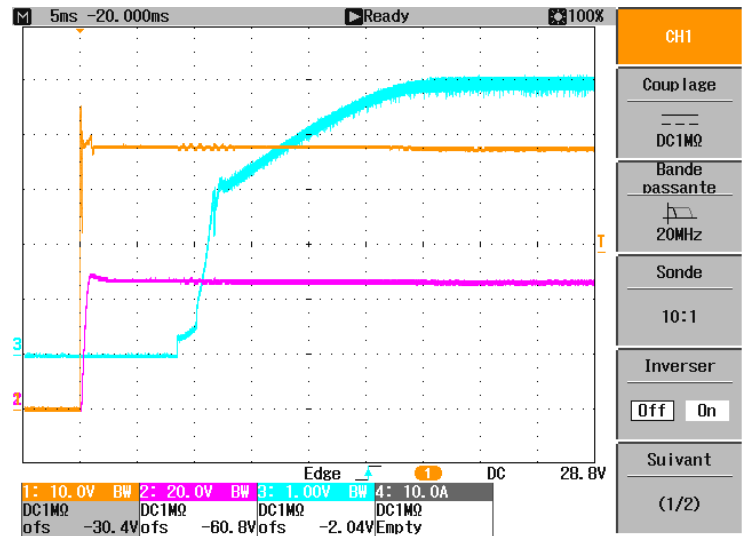
GTJ3000 : GAIA TEST JIG

9.6. Soft Start

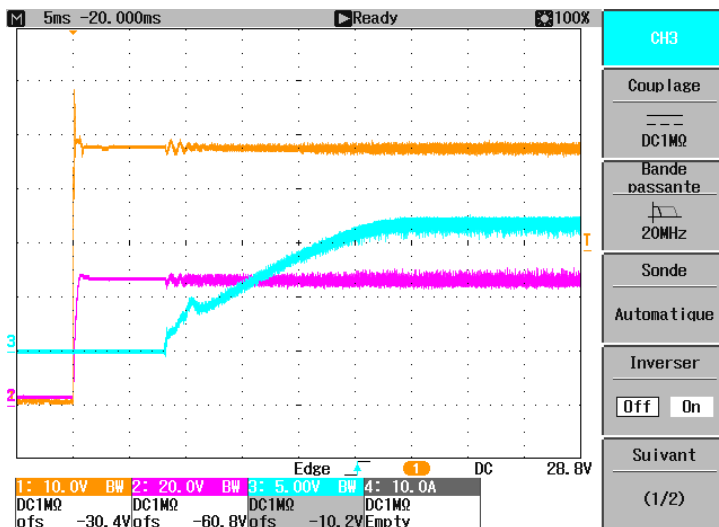
The graphics shows the different time period of the startup of the board. The input at the channel 1, the output of the bus conditioner at the channel 2 and the output of the modules at the channel 3.



Start-up with the MGR20RF



Start-up with the MGR40RC



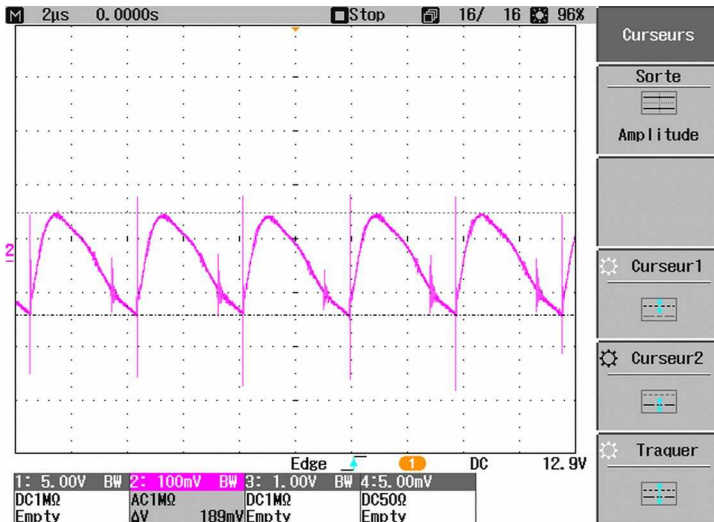
Start-up with the MGR80RE

The graphics represent the soft start sequence of the GTJ3020-C with various converters:

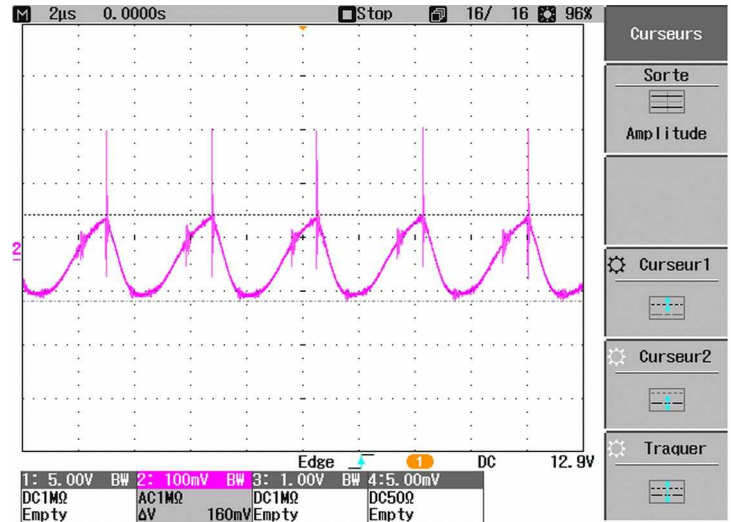
- Ch1 : board input voltage
 - Ch2 : FLHGI-90-R-R output voltage
 - Ch3 : converter Output voltage
- The converters were tested at 48V in input, full load

GTJ3000 : GAIA TEST JIG

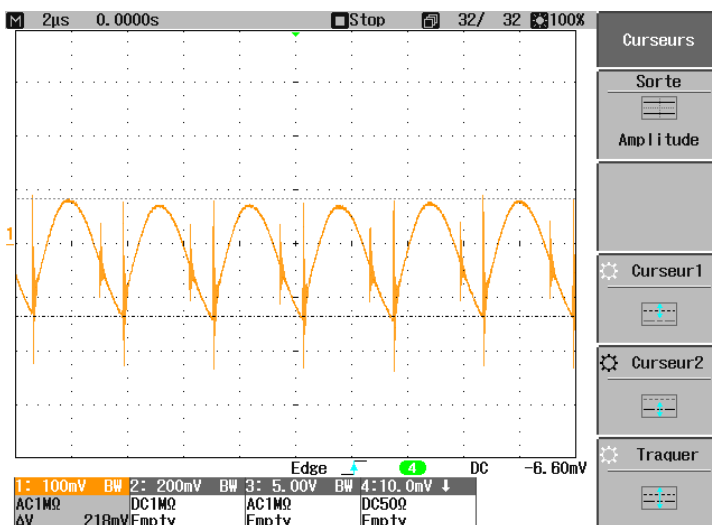
9.7. Ripple



Ripple of the MGRI20RE



Ripple of the MGRI40RE



Ripple of the MGRI80RE

The plots show some output ripple of the MGRI series with 3 capacitors of 100 μ F in parallel and 3 ceramics capacitors of 10 μ F also in parallel for each module.

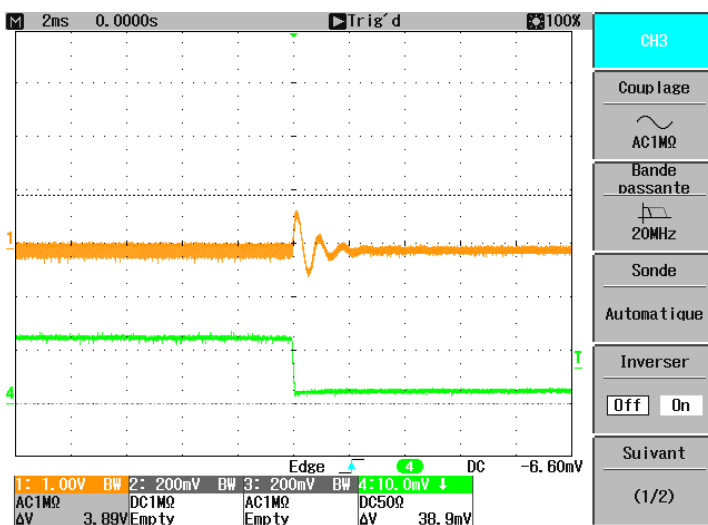
The converters were tested at 75% of load and at 48V in input.

GTJ3000 : GAIA TEST JIG

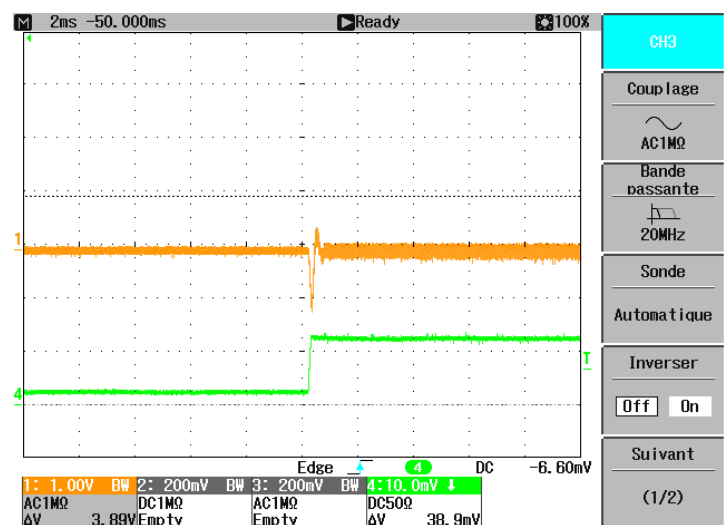
9.8. Load step

Load step testing is intended to demonstrate the converter feedback loop stability. It is performed with changing load from 25% to 100% of nominal converter output power, with a 0.1ms rising/falling time. The converter under test got the 2 channels in parallel connection with a 300 μ F output capacitor.

The plots below show the voltage at the 12 Vdc output of the module (ch1) and the load current (ch4).



[MGRDI80RE @ 48V in](#)



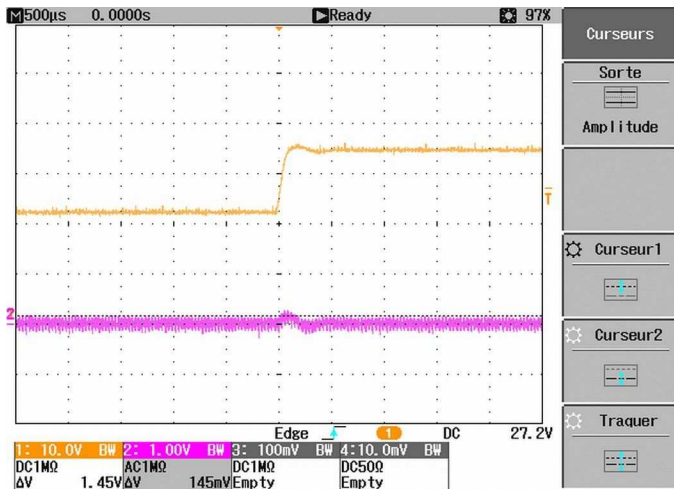
[MGRDI80RE@ 48V in](#)

9.9 Input bus disturbance

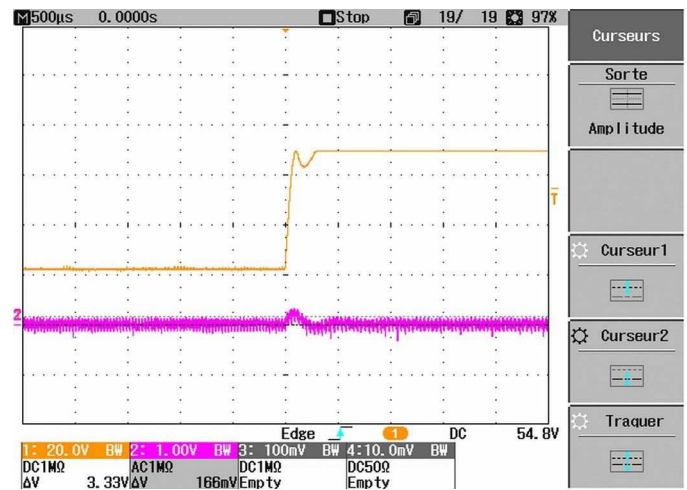
This test is intended to show the converter immunity to input bus disturbance such as fast input bus voltage changes, spikes and burst. The converters from MGRI series are implementing current control feedback loop that insures a good output voltage stability against input disturbance.

The channel 1 is the board input voltage and the channel 2 is the voltage disturbance at the output of MGRI-80-R-E converter 60% load charged, that remains stable.

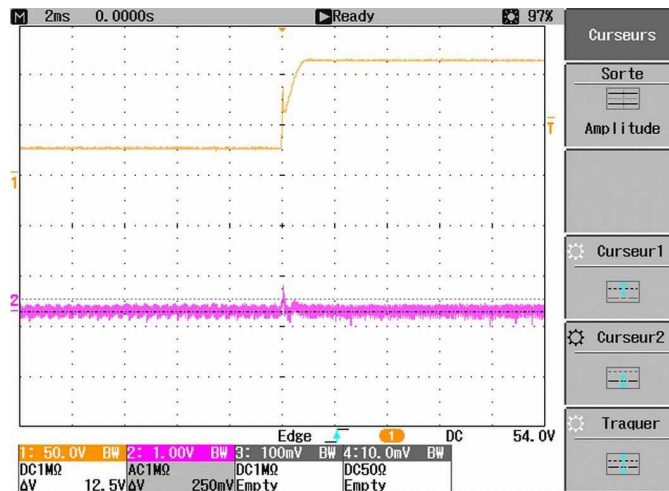
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24V to 36V



24V to 75V



24V to 110V