Industrial LIMITOR MODULE
LGDSI-50 : 50W POWER

Industrial Grade

Transient Limitor for 24V & 72V, 96V, 110V
1.8kV & 8.4kV Spike Suppressor
EN50155, RIA12
Metallic Case

- Spike suppressor module
  - EN50155 level 1.800V
  - RIA12 level 8.400V
- Transient suppressor module
  - EN50155
  - IEC 571
  - RIA12
- Input reverse polarity protection
- High efficiency (98%)
- Power range : from 4W to 50W
- Integrated EMI filter EN55022 class A
- Inhibition function
- RoHS process

1-General

The Gaïa Converter limitor LGDSI-50 Series designates an active power adaptor module designed to protect electronical systems against fast transient and high spike levels that can occur from an input bus line with no voltage stabilization devices.
The LGDSI-50 delivers an adapted output voltage compliant with Gaïa Converter DC/DC range of modules. This line of module is optimized to provide high efficiency up to 98% over the whole power range between 4W and 50W power.
The module includes also an EMI filter to provide compliance with EN55022 Class A together with GAIA Converter DC/DC modules.
The module is manufactured in a fully automated process to guarranty high quality. Each module is tested with a Gaïa Converter automated test equipment.
The LGDSI-50 features 2 modes of operations as follow :

- **Normal operation :**
  Normal operation occurs when input bus line is in steady state permanent range. The LGDSI-50 is then operating in steady transparency state providing an output with a typical 1,5V drop-out voltage.
- **Transient and spikes operation**
  The LGDSI-50 can sustain both :
  - transient during 1s and 20 ms according to RIA12 or EN50155 requirements,
  - high spike levels up to 1.8kV with 5 Ohms impedance and 8,4kV with 100 Ohms impedance to meet international input bus standards of EN50155, RIA12 or IEC 571.

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2-Product Selection

Single output model : LGDSI - 50 - *input* – *output*

Input Voltage Range	Output
Permanent J : 10-36 VDC Q : 36-154 VDC	K

3- Modes of Operation

3-1 LGDSI-50 Modes of Operation

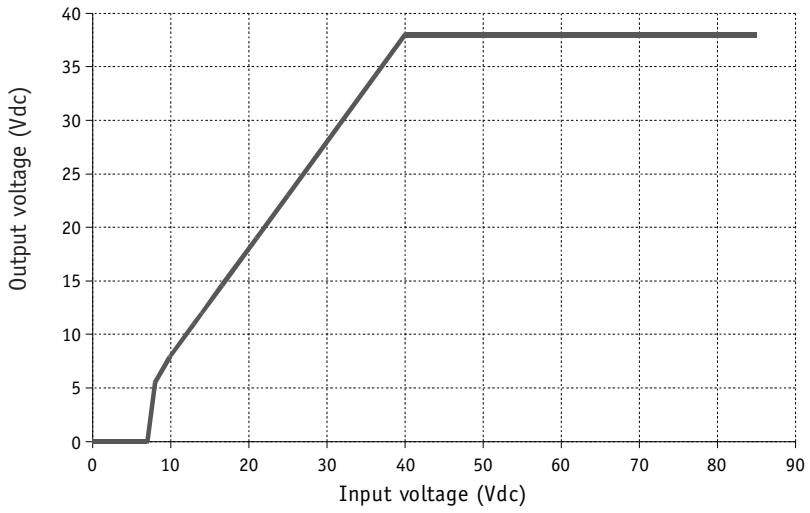
The LGDSI-50 series features 3 modes of operations detailed hereafter and illustrated by the 2 figures which depict the transfer fuctions for both models LGDSI-50-J-K and LGDSI-50-Q-K :

- **Power fail operation** :
An undervoltage lock-out stops operation for input voltage below the low line operation threshold (typically 10Vdc).

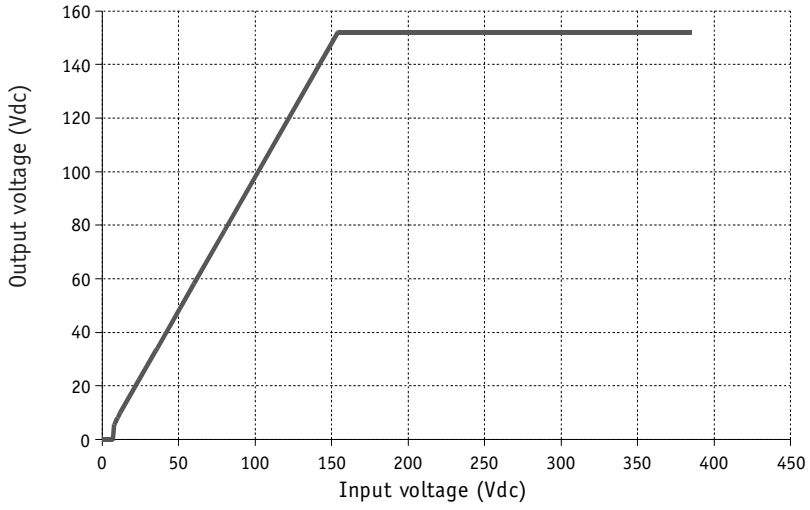
- **Normal operation :**
During normal operation the module is operating in steady transparency state.

- **Transient and spike operation :**
The LGDSI-50 series can sustain input transient and spike describe in section 4 by a clamping input system.

LGDSI-50-J-K Transfer Function



LGDSI-50-Q-K Transfer Function



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4- Electrical Specifications

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

Parameter	Conditions	Limit or typical	Units	LGDSI-50-J-K	LGDSI-50-Q-K
Input					
Compatible with nominal battery voltage	Full temperature range	Nominal	VDC	24	72 / 96 / 110
Limitor start up voltage	Full temperature range	Maximum	VDC	10	10
Permanent input voltage range	Full temperature range	Min. - Max.	VDC	10-36	36-154
Transient input voltage	Full temperature range Full load meet tandards EN50155, RIA12 Transient 1 sec. Transient 20 ms	 Maximum Maximum	 VDC/s VDC/ms	 40/1 85/20	 165/1 385/20
Spike input voltage limit (Direct spike and indirect coupled spike)	Full temperature range Full load meet standard				
	EN50155	Level A Level B	VDC VDC	1 800 8 400	(5/50µs, 5 Ohm or 100 Ohm) (0,05/0,1µs, 100 Ohm)
	RIA12	Level C Level D and H Level E and J Level F and K Level G and L*	VDC VDC VDC VDC VDC	960 1 800 3 600 4 800 8 400	(10/100µs, 5 Ohm) (5/50µs, 5 Ohm) (0,5/5µs, 100 Ohm) (0,1/1µs, 100 Ohm) (0,05/0,1µs, 100 Ohm)
Current in inhibit mode	No load to full load	Maximum	mA	10	10
Output					
Nominal output voltage in normal operation	In permanent input voltage mode	Maximum Minimum	VDC VDC	Ui - 0,5 Ui - 2	Ui - 1 Ui - 2
Output voltage in limitation operation	In transient input voltage mode	Maximum	VDC	38	152
Efficiency	At indicated nominal input Full load	Typical	%	95% at 24V input	96% at 72V input 98% at 110V input
Output power range	Full temperature range	Maximum	W	See figure section 4	50

Note* : see section 9-4

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4- Electrical Characteristics (continued)

Figure 1 : LGDSI-50-J-K 36V/1s RIA12 Transient Response

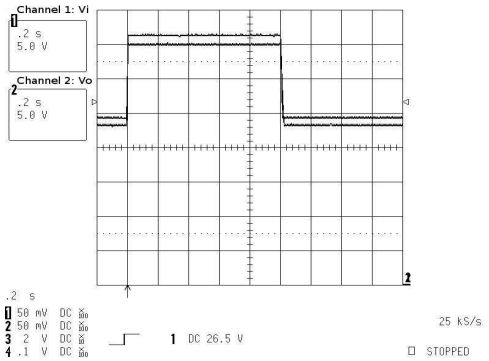


Figure 2 : LGDSI-50-Q-K 165V/1s RIA12 Transient Response

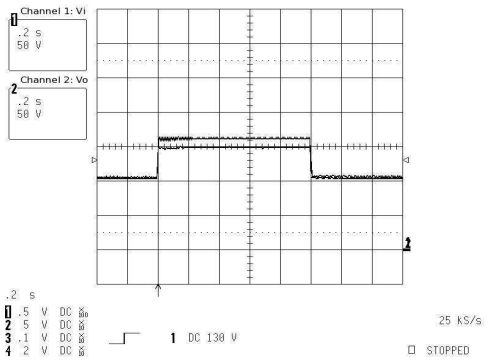


Figure 3 : LGDSI-50-J-K 85V/20ms RIA12 Transient Response

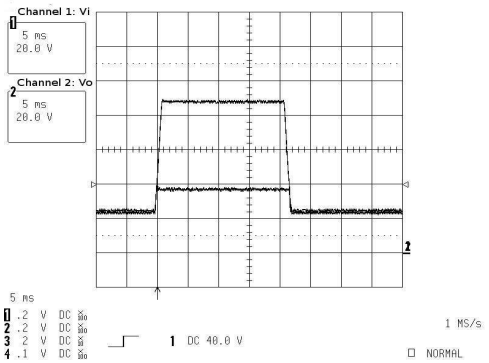


Figure 4 : LGDSI-50-Q-K 385V/20ms RIA12 Transient Response

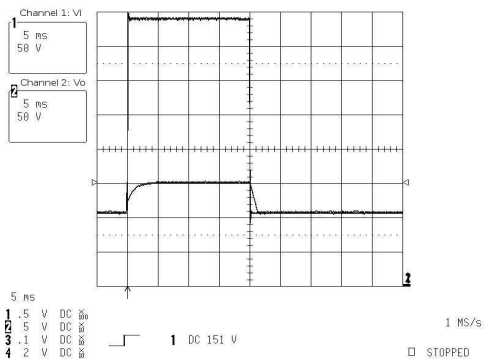


Figure 5 : LGDSI-50-J-K 1800V Spike Response

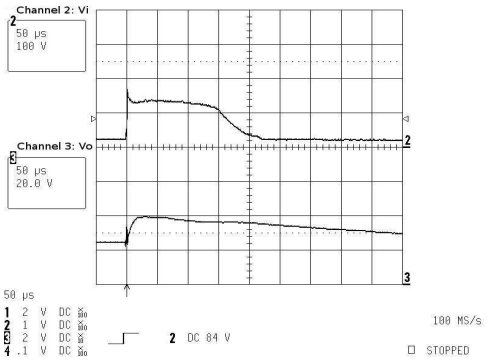


Figure 6 : LGDSI-50-Q-K 1800V Spike Response

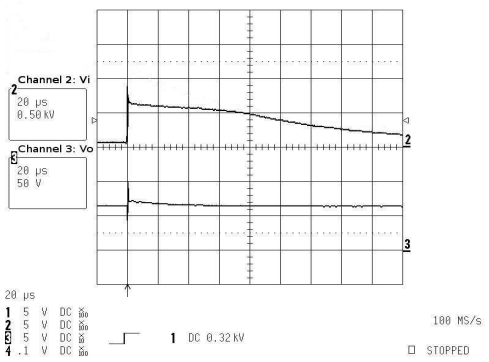
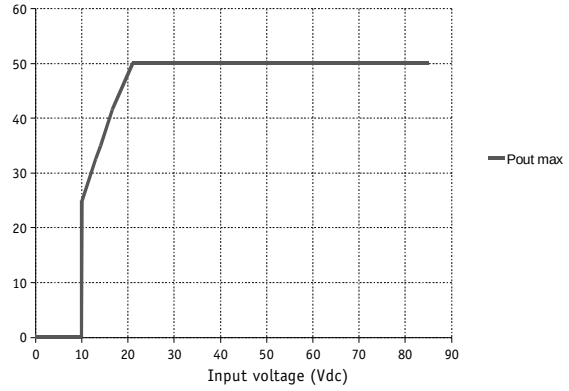


Figure 7 : LGDSI-50-J-K Output Power versus Input Voltage



5- Functional Characteristics

Characteristics	Conditions	Limit or typical	Performances
Isolation voltage	Between any pin	Typical	No isolation
Input reverse polarity protection	Reverse polarity	Maximum	Maximum permanent input voltage

6- Thermal Characteristics

Characteristics	Conditions	Limit or typical	Performances
Operating ambient temperature range	Ambient temperature *	Minimum Maximum	- 40°C + 71°C
Operating case temperature range	Case temperature	Minimum Maximum	- 40°C + 95°C
Storage temperature range	Non functionning	Minimum Maximum	- 40°C + 105°C

*Note * : The upper temperature range depends on configuration, the user must assure a max. case temperature of + 95°C (See Application Notes : Ambient versus case temperature).*

7- Reliability Characteristics

Characteristics	Conditions	Temperature	Performances
Mean Time Between Failure (MTBF) According to MIL-HDBK-217F	Ground fixed (Gf)	Case at 40°C Case at 70°C	2 500 000 Hrs 1 100 000 Hrs

8- Environmental and Electromagnetic Interference Qualifications

Characteristics	Conditions	Severity	Test procedure
Humidity	Damp heat Temperature	93 % H.R 56 Days 40°C	IEC 68-2-3
Vibration (Sinusoidal)	Number of cycle Frequency Amplitude /acceleration	10 cycles in each axis 10 to 60 Hz/ 60 to 2000 Hz 0.7 mm/10 g	IEC 68-2-6
Shock (Half sinus)	Number of shocks Peak acceleration Duration	3 shocks in each axis 100 g 6 ms	IEC 68-2-27
Bump (Half sinus)	Number of bumps Duration Peak acceleration	2 000 Bumps in each axis 6 ms 25 g	IEC 68-2-29
Conducted noise emission	Frequency range 150 KHz to 30 MHz	Class A compliance together with GAIA Converter DC/DC modules stand alone	EN55022
Radiated noise emission	Frequency range 30 MHz to 1.000 MHz	Class A compliance together with GAIA Converter DC/DC modules stand alone	EN55022
Electrical discharge susceptibility	Air discharge level +/-4 KV Contact discharge level +/- 2KV Air discharge level 8 KV Contact discharge level 4 KV	sanction A sanction A sanction B sanction B	EN55082-2 with : EN61000-4-2 IEC 801-2
Electrical field susceptibility	Antenna at 1 m Wave form : AM modulated 80 %, 1KHz Test : 26 KHz to 1 GHz	Value 10V/m	EN55082-2 with : EN61000-4-3 IEC801-3
Electrical fast transient susceptibility	Level 1 : 0.5 KV Level 3 : 2 KV	sanction A sanction B	EN55082-2 with : EN61000-4-4 IEC801-4
Surge Susceptibility	Level 4	See section 3	EN61000-4-5 EN50155, RIA12

9- Application Notes

9-1 Reverse Polarity Compatibility

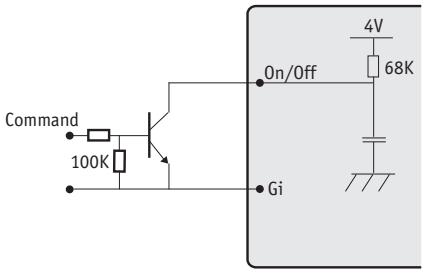
The LGDSI-50 integrates a reverse polarity protection connected directly on Vin (pin 1).

9-2 On/Off Function

The control pin 2 (On/Off) can be used for applications requiring On/Off operations. By using an open collector command with a transistor Q referrenced to the terminal Gin :

- A Level 1 on command disables the converter,
- A Level 0 an command or no connection / high impedance enables the converter.

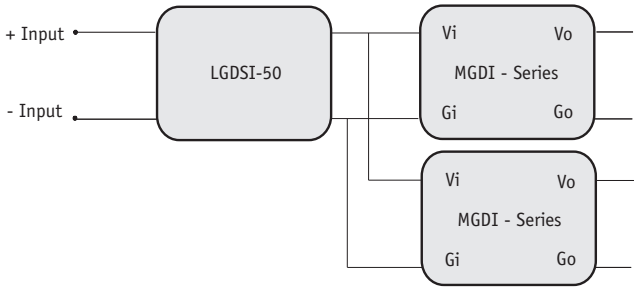
In off mode, the current consumption stays below 10mA.



9-3 Typical Schematic

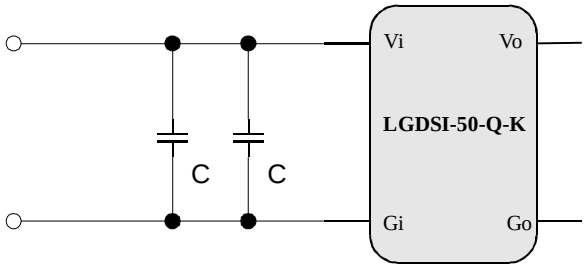
The LGDSI-50 Series are suitable to be used with several DC/DC GAIA converter modules in a parallel configuration as follow.

- The LGDSI-50-J-K works in conjunction with GAÏA Converter H input (9-36V) series or J input (16-40V) series.
- The LGDSI-50-Q-K works in conjunction with GAÏA Converter Q input (36-140V) series.



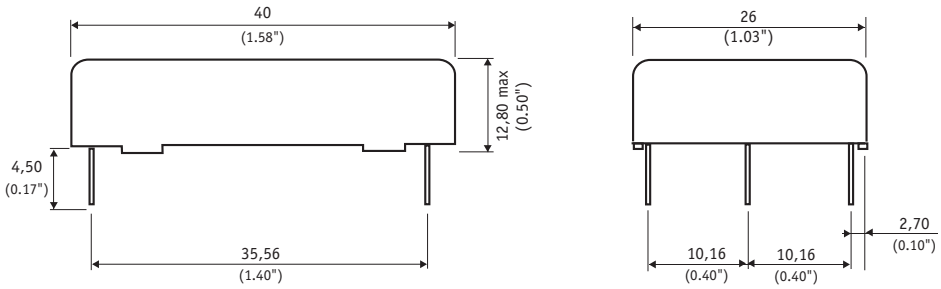
9-4 RIA12 Recommendation

To meet RIA12 requirements and in particular the waveform G, GAIA recommends to add some external parts to the LGDSI-50-Q-K as per schematic hereafter.
Suggested parts are ceramic capacitors X7R/4,7nF/1000V such as 1812AC472MAT1A (AVX). Alternative parts can be used provided they have similar caracteristics.
These components should be located close to the module and routed with short connections to minimize series inductance.



10- Dimensions

Dimension are given in mm (inches). Tolerance : +/- 0,2 mm (+/- 0.01 ") unless otherwise indicated.
Weight : 28 grams (1 Ozs) max.



Pin dimensions : Ø 0,73 mm (0.03 ")

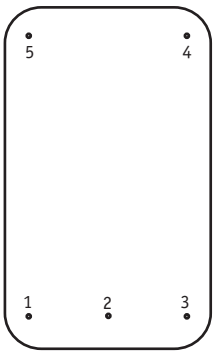
11- Materials

Case : Metallic black anodized coating.
Pins : Plated with pure matte tin over nickel underplate.

12- Product Marking

Upper face : Company logo, location of manufacturing.
Side face : Module reference, option, date code : year and week of manufacturing.

13- Connections



Bottom view

Pin	LGDSI-50
1	+ Input (Vi)
2	On / Off
3	- Input (Gi)
4	Common (Go)
5	Output (Vo)

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Printed in France by GAIA Converter Gaia Converter FC97-025.11/14 Revision M. Graphisme : Philippe Clicq