FGDS-35A-50V : 35A CURRENT

Hi-Rel Grade

MIL-STD-461 EMI INPUT FILTER
9 to 50 Vdc Input Range
MIL-STD-461D/E/F/G & DO-160C/D/E/F/G Compliant

Features

- **MIL-STD-461D/E/F/G power leads:**
- CE 102 conducted emission : 10 Khz to 10 Mhz
- CS 101 Susceptibility : 30Hz to 150 Khz
- CS 114 Susceptibility : 10KHz to 400 MHz
- CS 115 Susceptibility : 10KHz to 400 MHz

- **DO-160CD/E/F/G power lines:**
- Conducted emission : 15 Khz to 152 Mhz
- Conducted Susceptibility : 10 Hz to 400 Mhz

- **Temperature range**
- Operating case temperature : -40°C/+105°C
- Storage case temperature : -55°C/+125°C

- **ROHS process**

Standards

- Mil-STD-461
- DO160
- Mil-STD-704
- Mil-STD-1275

Applications

- Mil-Aero
- Ground-borne
- Naval
- Civilian Avionic

Product Information

The GAIA Converter filter module FGDS-35A-50V provides a state-of-the-art product to fulfill ElectroMagnetic (EMI) for Aerospace and refence applications. The FGDS-35A-50V is a very compact and low loss solution for applications requiring up to 35A input current. The FGDS-35A-50V complies with major standards including :

• the US MIL-STD-461 rev D, to G
• the international DO-160 rev C to G

In particular, the filter module is compliant with the following requirements :

• **MIL-STD-461D/E/F/G requirements :**
• **Conducted Emission (CE)**
• CE102, power leads, emission over 10KHz to 10MHz, basic curve
• **Conducted Susceptibility (CS)**
• CS101, power leads, frequency 30Hz to 150KHz, curve#1
• CS114, bulk cable injection, frequency 10KHz to 400MHz,
• CS115, spikes, bulk cable injection calibrated spike
• CS116, damped sinusoidal transient
• **DO-160-C/D/E/F/G requirements :**
• **Conducted Emission (CE)**
• Section 21 power lines, emission over 15KHz to 152MHz, category B, AZ & LMH
• **Conducted Susceptibility (CS)**
• Section 20 power lines, frequency 10KHz to 400MHz

In addition, this filter withstands in a transparent state without damage the transient and spike requirements of :

MIL-STD-704A (80V 100ms)
MIL-STD-1275 (100V /50ms)
DO160 (80V 100ms)

The FGDS-35A-50V is suitable for all GAIA Converter DC/DC converters and DC architecture

• from 50W up to 300W output power
• up to 20A output current without cooling device
• up to 35A output current with cooling device
• up to 50V permanent input voltage.

Selection Guide

Part Number	Permanent Input Voltage (Vdc)	Output Current (Adc)	Standards
FGDS-35-A-50V	9-50	35	Mil STD461 / DO 160

Options :

Part Number /T : -55°C

Part Number /S : screening

1-ELECTRICAL SPECIFICATIONS

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

Parameter	Conditions	Limit	Units	FGDS35-A-50V
Input				
Nominal Input Voltage (Ui)	Full temperature range	Nominal	Vdc	28
Permanent Input Voltage range	Full temperature range	Min. Max	Vdc	9-50
Transient Input Voltage	Full temperature range	Maximum Maximum	Vdc/ms	80/100 100/50
Output				
Permanent Output current (see derating curve)	Ui min to Ui max -40 to 105°C case 90°C case		Adc	 30A 35A
Dissipated Power	At 35A output current	Maximum	W	8.4
Output Power Capability (at converter input side)	16Vdc min. per MIL-STD-704 18Vdc min. per DO160 28dc nominal	Maximum	W	560 630 980
Input to Output resistance (ESR)	Ui min to Ui max	max	mΩ	6.8
General				
Thermal resistance (Rthc-a)	Case to ambient Free air cooling	Typical	°C/W	15
Electrical strength test voltage	Case to pin GND to case	minimum	Vdc	500 500
MTBF according to Mil-HDBK-217F	Condition GF Condition AIC	40°C 85°C 40°C 85°C	Hours	27 000 000 7 000 000 13 000 000 3 500 000
EMI Compliance				
Conducted emission	Power leads Power lines Power lines	MIL-STD-461 D/E/F/G DO160C cat B& AZ DO160D/E/F/G cat B& LMH		CE102 Section 21 Section 21
Conducted susceptibility	50Ω impedance 10A 10khz to 400Mhz	MIL-STD-461 D/E/F/G DO160C/D/E/F/G		CS115/CS116 Section 20

2-ENVIRONEMENTAL

Characteristics	Conditions	Severity	Test procedure
Climatic Qualifications			
Life at high temperature	Duration Temperature / status of unit	Test D : 1 000 Hrs @ 125°C ambient, unit not operating	MIL-STD-202G Method 108A
Altitude	Altitude level C Duration Climb up Stabilization Status of unit	40 000 ft@-55°C 30 min. 1 000 ft/min to 70 000 ft@-55°C, 30 min. unit operating	MIL-STD-810G Method 500.5
Humidity cyclic	Number of cycle Cycle duration Relative humidity variation Temperature variation Status of unit	10 Cycle I : 24 Hrs 60 % to 88 % 31°C to 41°C unit not operating	MIL-STD-810G Method 507.5
Humidity steady	Damp heat Temperature Duration Status of unit	93 % relative humidity 40°C 56 days unit not operating	MIL-STD-202G Method 103B
Salt atmosphere	Temperature Concentration NaCl Duration Status of unit	35°C 5 % 48 Hrs unit not operating	MIL-STD-810G Method 509.5
Temperature cycling	Number of cycles Temperature change Transfer time Steady state time Status of unit	200 -40°C / +85°C 40 min. 20 min. unit operating	MIL-STD-202A Method 102A
Temperature shock	Number of shocks Temperature change Transfer time Steady state time Status of unit	100 -55°C / +105°C 10 sec. 20 min. unit not operating	MIL-STD-202G Method 107G
Mechanical Qualifications			
Vibration (Sinusoidal)	Number of cycles Frequency / amplitude Frequency / acceleration Duration Status of unit	10 cycles in each axis 10 to 60 Hz / 0.7 mm 60 to 2000 Hz / 10 g 2h 30 min. per axis unit not operating	MIL-STD-810G Method 514.6
Shock (Half sinus)	Number of shocks Peak acceleration Duration Shock form Status of unit	3 shocks in each axis 100 g 6 ms 1/2 sinusoidal unit not operating	MIL-STD-810G Method 516.6
Bump (Half sinus)	Number of bumps Peak acceleration Duration Status of unit	2 000 Bumps in each axis 40 g 6 ms unit not operating	MIL-STD-810G Method 516.6

3-THERMAL MANAGEMENT

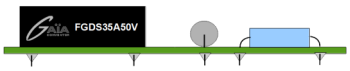
The filter thermal management can be achieved in 3 different ways:

Free air cooling : the filter thermal resistance (Rthc-a) allows operation without additional cooling device. Warning: this mode of cooling is reserved to low ambient temperature or very power conditions.

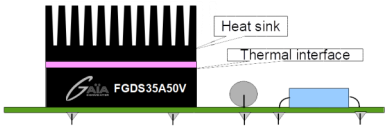
Cooling through an heat-sink : the heat-sink is applied to the converter top case through a thermal interface (gap-pad).This allows to reduce the total thermal resistance from case to ambient (Rth), resulting of the combination of case thermal resistance, gap-pad thermal resistance, and heat-sink thermal resistance. The max ambient temperature is given by:

$$Tamb = Tc - ESR * (\mathrm{I})^2 * Rth$$

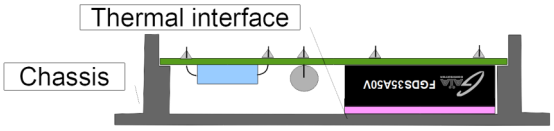
T_{amb} = max ambient temp.
T_c = max case temp.
I = DC current flowing through the filter
R_{th} = thermal resistance of the assembly: case(Rthc-a) + thermal pad + heat-sink to ambient



Free air cooling



Heat-sink usage



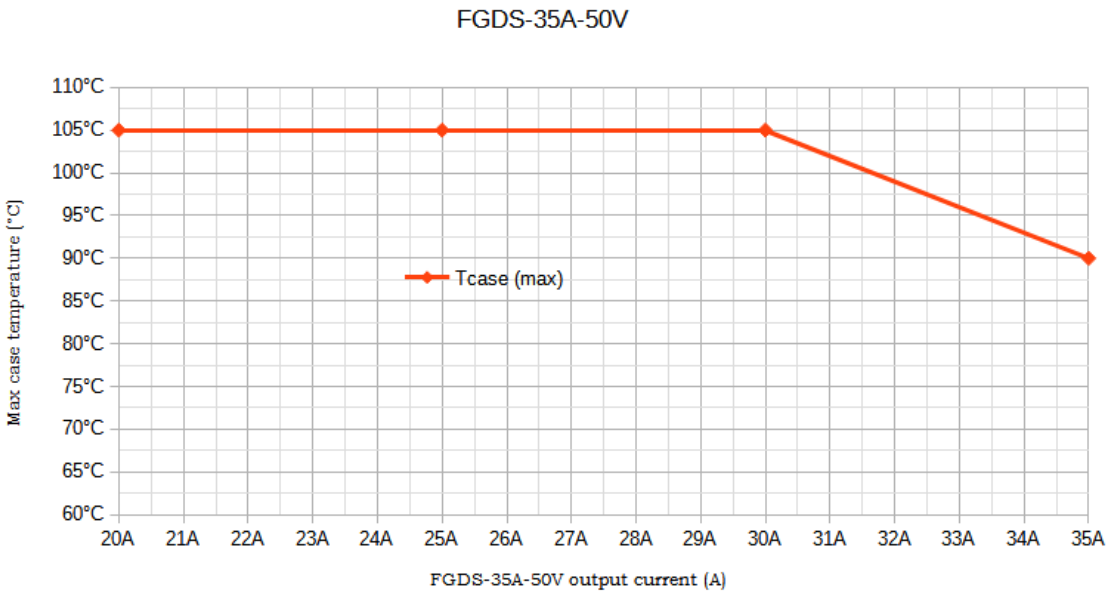
Chassis mount

Chassis mount: converter is applied to the chassis surface through a dedicate thermal interface (Gap-pad). The maximum ambient temperature operation will be given by the following formula :

$$Tamb = Tch - ESR * (\mathrm{I})^2 * Rth$$

T_{amb} = max ambient temp.
T_{ch} = max chassis temp.
I = DC current flowing through the filter
R_{th} = thermal resistance of the assembly case(Rthc-a) + thermal pad

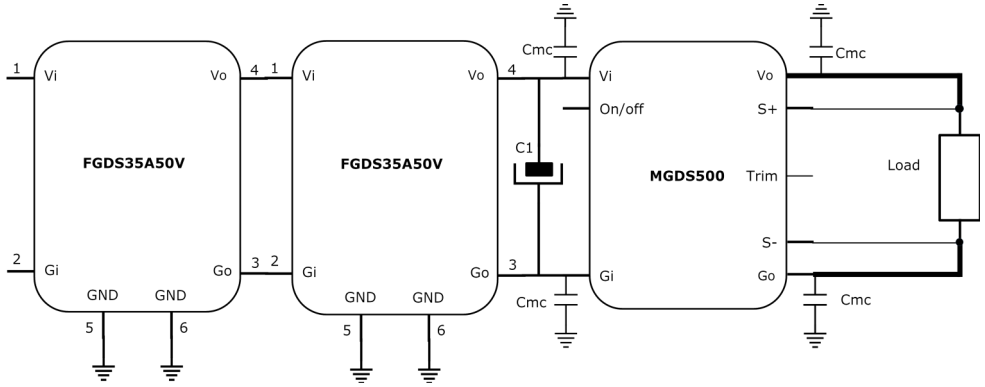
The diagram below shows the max case temperature according to current flowing through the filter

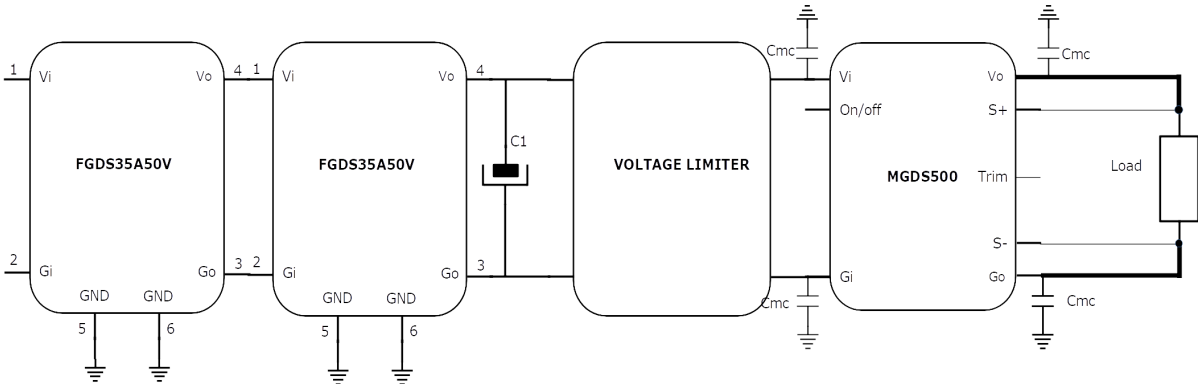


4-APPLICATION NOTE

4.1-500W architecture

The FGDS-35A-50V is ideally suited for filtering the conducted noise of MGDM500 MGDM250, MGDM205 series DC/DC converters. To comply with MIL-STD-461 and DO160 (all revisions) standards, regarding conducted noise. Two filter cells must be cascaded to achieve the correct filtering level. As shown on the diagrams below, the filter cells can be placed in front of the surge limiter, or directly at the DC/DC converter input. At low input voltage and high current, the AC impedance of the filter may become higher than the DC/DC input impedance, and trigger oscillations. The purpose of the capacitor C1 is to reduce the AC impedance of the source feeding the dc/dc converter. The proposed C1 values are shown in the table below, these values are obviously depending on the kind of dc/dc converters architecture that is supplied, and values can be adjusted accordingly. These C1 values are available for steady state input voltage above 12Vdc, and may require an increase in value for lower input voltage.





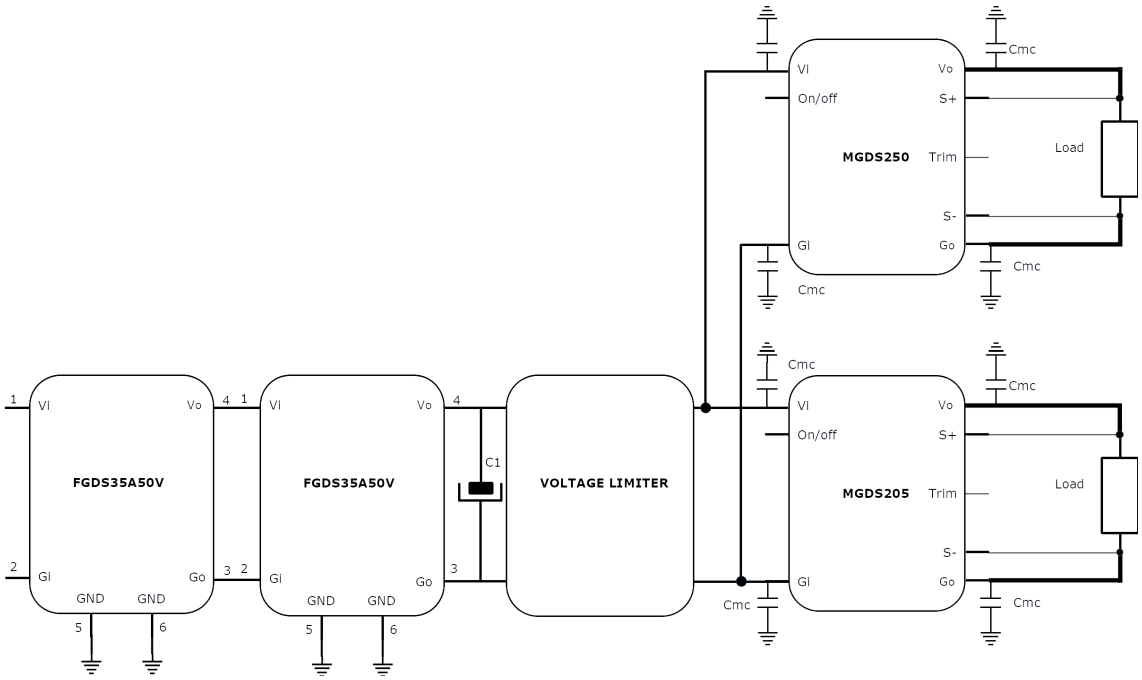
	DC/DC power level (W)		
Standard	100	300	500
MIL-STD-461	220µF	470µF	1000µF
DO-160	100µF	330µF	820µF

Proposed C1 capacitor values

4-APPLICATION NOTE

4.2-MULTIPLE OUTPUTS ARCHITECTURE

The FGDS-35A-50V is suitable for filtering complex architectures using several dc/dc converters. In this case the application diagram below can be uses.



4.3-HIGH POWER USAGE

To address high power needs (input current above FGDS-35A-50V limit) it is not possible to connect outputs of filter in parallel to create a single primary side bus. The correct wiring is shown in figure 2 with 2 buses in primary side. Since converter are isolated, their outputs can be combined in series or independent channels. (parallel connection can be achieved using external current sharing device.

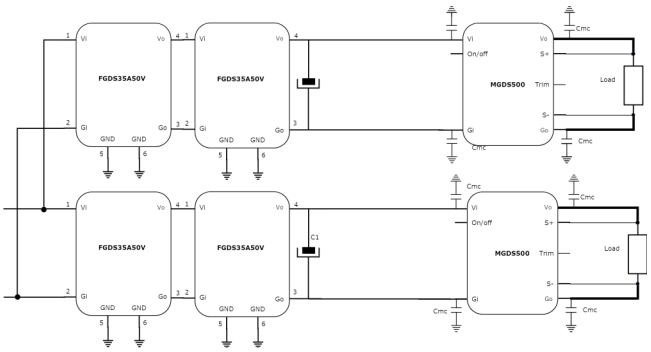
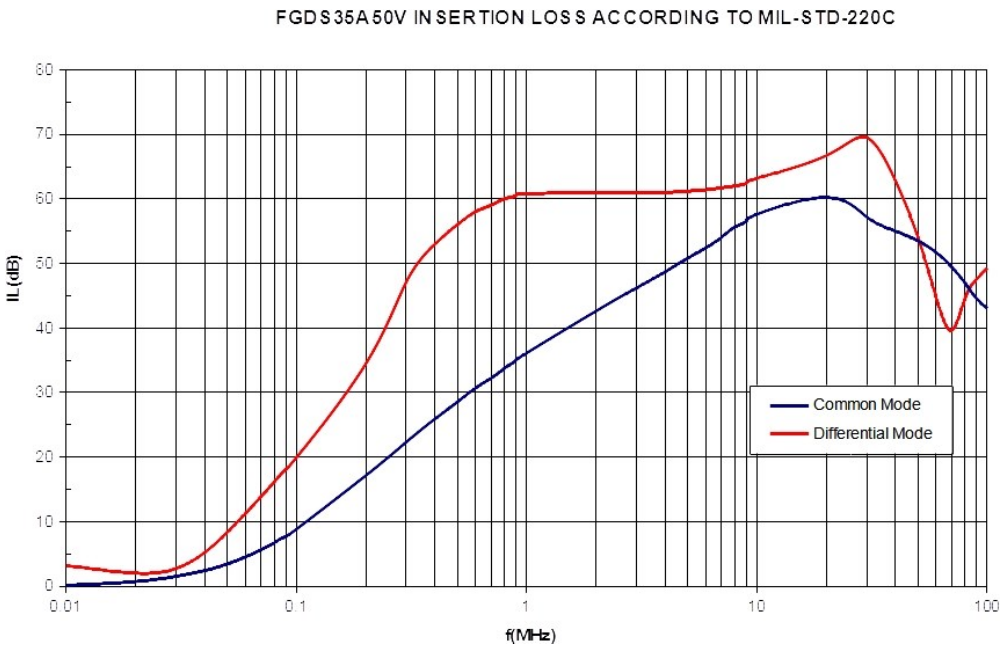


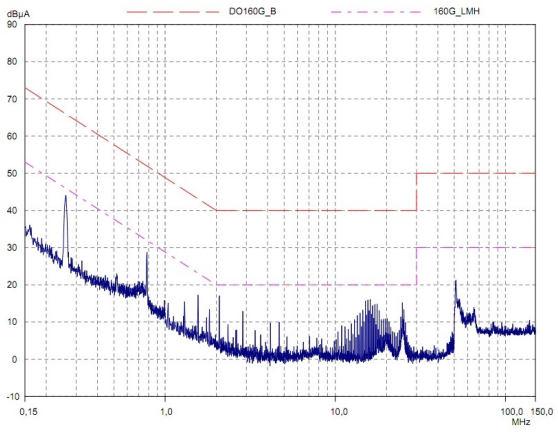
Figure 2

4-APPLICATION NOTE

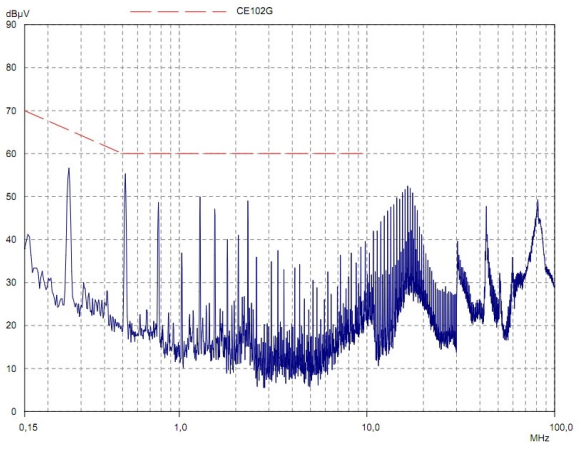
4.4-INSERTION LOSSES



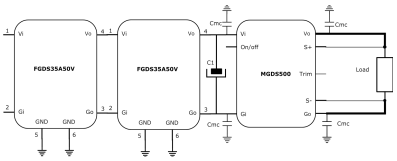
4.5-CONDUCTED NOISE PERFORMANCES



DO160 500W power

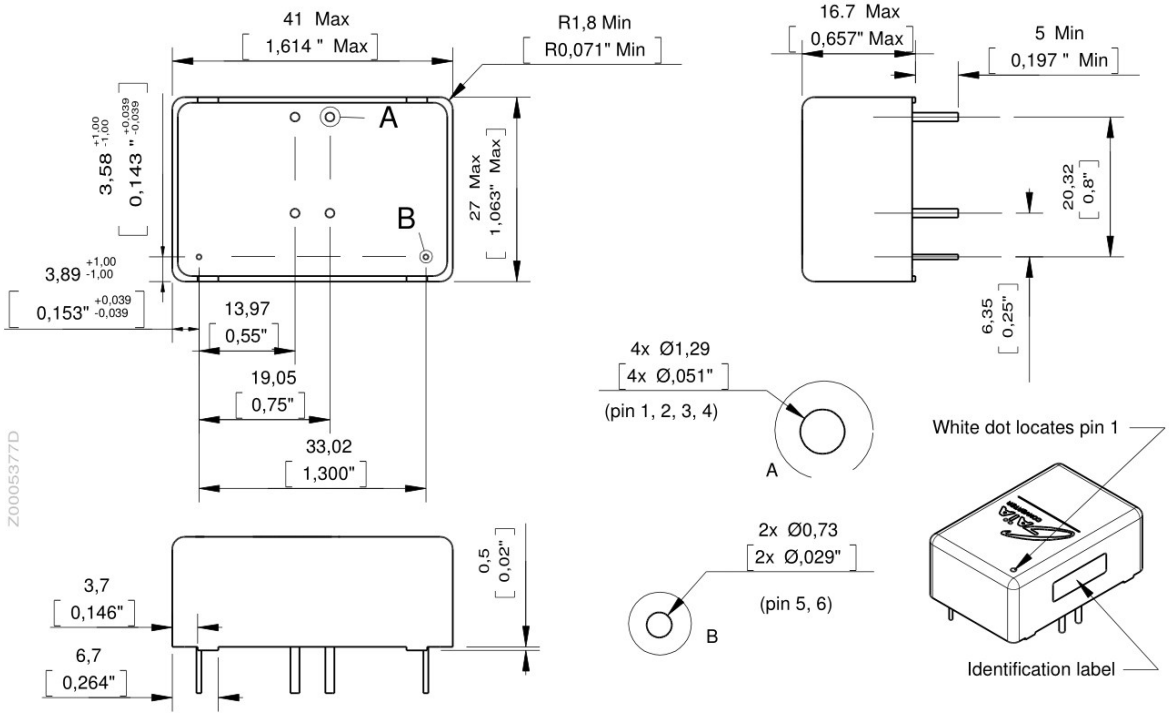


MIL-STD-461G CE102 500W power



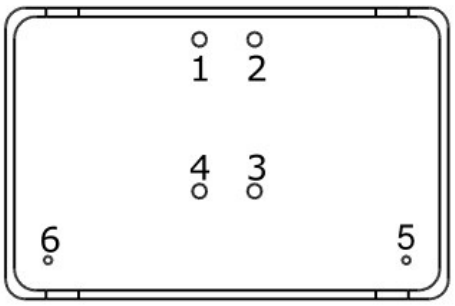
4-APPLICATION NOTE

4.6-MECHANICAL DRAWINGS



4.7-CONNECTION-PRODUCT MARKING

Product marking
Side face : Company logo.
: Module partnumber
: Date code : year and week of manufacturing, suffix, /option.
Product weight : 40 gr 1.5oz.
Case Material : Metallic case black anodized coating.
Pin Material : Solder plated pin.



Pin	Single
1	+ Input (Vi)
2	- Input (Gi)
3	- Output (Go)
4	+ Output (Vo)
5	Ground (Gnd)
6	Ground (Gnd)