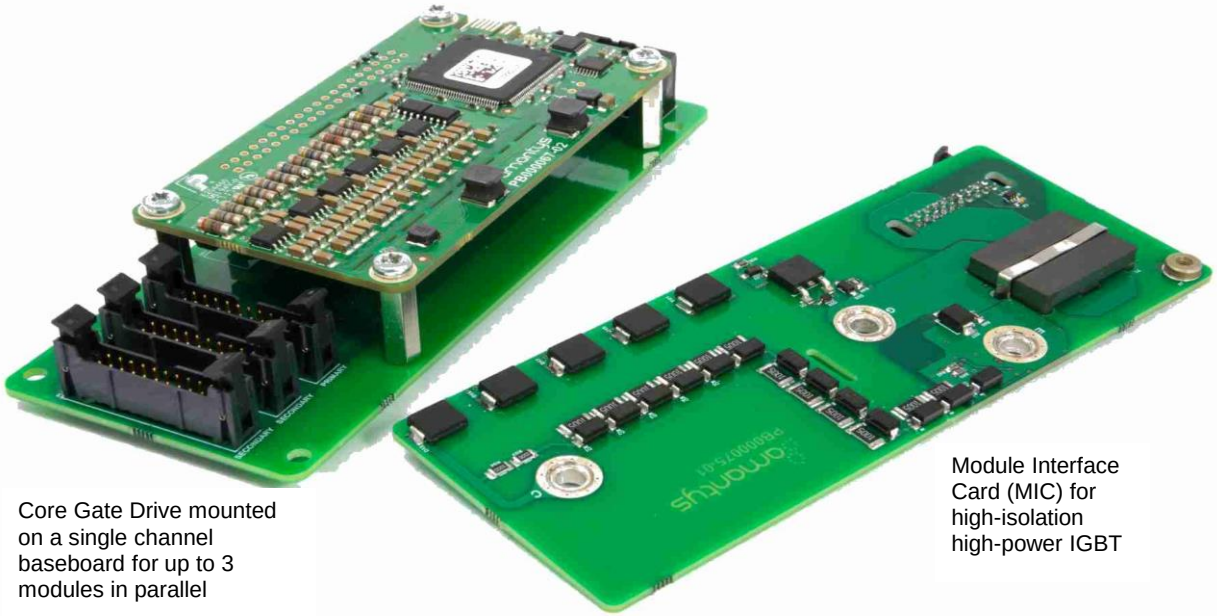


Core Gate Drive mounted on a single channel baseboard for up to 3 modules in parallel

Module Interface Card (MIC) for high-isolation high-power IGBT

This datasheet describes a gate drive for 4500V and 6500V IGBT modules using the Amantys Core Gate Drive, a single-channel baseboard containing fibre-optic transceivers, and one or more module interface cards (MIC) connected to the IGBT modules. The gate drive incorporates protection features for the IGBT and can be configured by the user for optimised operation in the power stack of the end application. The baseboard does not include an isolateed DC-DC converter which must be provided separately. Up to three IGBT modules can be connected in parallel. This datasheet refers to the Amantys Isolated DC-DC Converter (AS00D), See datasheet with document code P100112 for details.

The AP00J has a fixed gate voltage of +15/-10V. The AP01J has variable gate voltage.

- High current drive into gate: 35A peak
- DC-DC converter (AS00D) input voltage 15V or 24V
- Operating temperature range: -40°C to +85°C
- Type I and type II short circuit protection
- Power supply undervoltage protection
- User configurable
- Logging of fault events
- LED status indication
- Designed to EN 50155 for railway applications (Requires conformal coating)
- IEC 61800-5-1 compliant for variable speed drives
- Thermal shock and vibration to IEC 61373
- EMC compliant to EN 50121-3-2, EN 50121-5, IEC 61800-3
- Lead free design, RoHS compliant
- 12 months warranty

Absolute Maximum Ratings
Permanent damage may occur if the Absolute Maximum Ratings are exceeded.

Parameter (per channel)	Notes	Units	Value
Supply Voltage		V	36.0
Continuous DC link voltage (with clamping disabled)	Limited by transient voltage supressors (TVS)		
	Configured for 4500V IGBT modules	V	3385*
	Configured for 6500V IGBT modules	V	4815*

*this is 300V above the TVS datasheet minimum voltage at 1mA

Power Supply Characteristics
All data refers to +25 °C unless otherwise stated

Parameter (per channel)	Notes	Units	Min	Typ	Max
Nominal Supply Voltage (V_{DC}) for baseboard	A current limited supply (<2.0A) is recommended	V	18.0	28.0	36.0
Supply power for DC-DC converter, baseboard, core gate drive and MIC	Without load, not switching, OFF	W		1.3	1.7
	Operation at 3kHz into 1µF load with 330nF additional gate-emitter capacitance from 15V	W		4.7	6.1

Note: The power supply input on the baseboard is not isolated. Use with an isolated DC-DC Converter. The supply power measurements above were taken with the gate drive fed from this converter with the input at 15V.

General Electrical Characteristics

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Under-voltage lockout threshold on 15V supply	Internal power supply of gate drive	V		12.9	
Gate voltage (IGBT on)	AP00J fixed gate voltage	V	14.5	15.0	15.5
Gate voltage (IGBT off)	AP00J fixed gate voltage	V	-10.5	-10.0	-9.5
Gate voltage (IGBT on)	AP01J variable.gate voltage	V	14.5	15.0	22.0
Gate voltage (IGBT off)	AP01J variable gate voltage	V	-10.5	-10.0	-4.0
Gate peak current	Limited by gate output FETs.	A			35

Gate drive configured for 4500V operation

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
TVS datasheet 1mA	Clamp enabled	V	3085		
TVS datasheet 1mA	Clamp disabled	V	3385		
Max DC link	For short periods of time (< 5 minutes)	V	3400*		
Max DC link	For short periods of time (<1 second)	V	3685		

*design target, to be confirmed

Gate drive configured for 6500V operation

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
TVS datasheet 1mA	Clamp enabled	V	4515		
TVS datasheet 1mA	Clamp disabled	V	4815		
Max DC link	For short periods of time (< 5 minutes)	V	4800*		
Max DC link	For short periods of time (< 1 second)	V	5115		

*design target, to be confirmed

Physical Parameters (Baseboard and Core Gate Drive)

Parameter	Notes	Units	Min	Typ	Max
Length	All dimensions have a tolerance of +/- 0.5mm	mm	132.0		
Width		mm			53.0
Height		mm			30.0
Weight		g		26	

Physical Parameters (Module Interface Card)

Parameter	Notes	Units	Min	Typ	Max
Length	All dimensions have a tolerance of +/- 0.5mm	mm			98.0
Width		mm			62.0
Height		mm			10.0
Weight		g		68	
Screw torque	Maximum torque on gate, emitter and collector	Nm			2.0

Standards Compliance

Test	Notes	Test Standard
Impulse test	Refer to Isolated DC-DC Converter Datasheet	Type test
Dielectric test	Refer to Isolated DC-DC Converter Datasheet	Type test
Partial discharge	Refer to Isolated DC-DC Converter Datasheet	Type test and production test
EMC Immunity		EN 50121-3-2 Rolling Stock
		EN 50121-5 Trackside
		IEC 61800-3 Variable Speed Drives
Electrostatic discharge	Air ±8 kV, contact ±6 kV, Perf Criterion B	IEC 61000-4-2
	ESD precations must be taken when handling the core.	
Radiated immunity	10 V/m 80-2000 MHz, Perf Criterion A	IEC 61000-4-3
Fast burst immunity	±4 kV, Perf Criterion A	IEC 61000-4-4
Surge immunity	±2 kV, Perf Criterion B	IEC 61000-4-5
Conducted immunity	10 Vrms, Perf Criterion A	IEC 61000-4-6
Magnetic field immunity	100 A/m AC, 300 A/m DC, Perf Criterion A	IEC 61000-4-8
Damped osc. voltage	2.5 kV line-earth, Perf Criterion B	IEC 61000-4-12
Radiated emissions (E-field)	20-230/230-1000 MHz, 50/57 dBµV/m q-pk, 3 m	EN 55011 class A, group 1
Conducted emissions	0.15-0.5/0.5-30 MHz 99/93 dBµV/m quasi-pk	EN 55016-2-1

General Specifications

Parameter	Notes	Units	Min	Typ	Max
Operating temperature		°C	-40		85
Storage temperature		°C	-40		85
Humidity	With conformal coating compliant to EN 50155 Railways Applications Electronic Equipment Used on Rolling Stock	%		85	95
Material flammability rating	UL94V-0 rated				
Pollution degree	Class 2				
Maximum altitude	Derate above this: Amantys to advise	m			2000
Environmental compliance	REACH compliant				
	RoHS compliant				
Creepage	Functional isolation (MIC Mat. Grp. 2)	mm	27.0		
Clearance	Functional isolation (MIC Mat. Grp 2)	mm	22.0		

Power Supply Interface

Manufacturer	Manufacturers Part Number	Amantys Part Number
METZ Connect	SP06502VBNF	EC000875
Pheonix Contact	FKC 2,5/ 2-STF-5.08	EC000875

Pin Number	
1	2
VDC	GND

Picture shows board mount part. It is vertically mounted.
Many different mating options are available, Amantys ships one of the two listed.
Please observe polarity marked on the PCB.

Fibre-optic Interface

Interface	Description	Manufacturer	Part Number
Optical input (PWM)	Receiver	Avago	AFBR-2529Z
Optical output (ACK)	Transmitter	Avago	AFBR-1529Z

Gate Drive Transmit LED Drive Current

Note: the drive current of the transmit (ACK) LED on the gate drive can be driven with different drive currents that are configurable by the user. The lifetime of the transmit LED can be prolonged by driving with a lower current.

LED Drive Configuration	Units	LED Current	Comments
LED Drive Level 1	mA	1.82	Longest lifetime for LED
LED Drive Level 2	mA	2.73	
LED Drive Level 3	mA	3.64	
LED Drive Level 4	mA	4.55	
LED Drive Level 5	mA	6.37	Only use to extend operational time

LED Status Indication

Note: The gate drive has two status LEDs that communicate the status of the gate drive

LED	Behaviour	Status
Green	Lit continuously	Supply OK
Green	Flashing 1Hz	Gate drive receiving PWM input
Red	Lit continuously	Power supply below minimum voltage
Red	Flashing intermittently	Short circuit gate-emitter or power supply fault
Red	Flashing 1Hz	Short circuit condition in converter
Green/Red	Both lit continuously	PLD not programmed (LEDs will be dimly lit)
Green/Red	Flashing simultaneously	PLD programmed with test design
Green/Red	Both off	No supply or LEDs are broken

Measured Parameters

Name	Comment	Units	Resolution
Gate drive temperature	On board temperature	°C	±1.0
+15V supply rail	Secondary side voltage	V	±0.01
Vge On	Vge when the power device is turned on	V	±0.01
Vge Off	Vge when the power device is turned off	V	±0.01
Vce On	Vce when the power device is turned on; i.e. the saturation voltage	V	±0.01
Vce Off	Vce when the power device is turned off	V	±1.0
Product Code		String	
Serial Number		String	
Software Part Numbers [0 - 9]	Part number strings for up to 10 software components included in this product	String	
Build Date	Date of configuration	YYYMM	

Configurable Parameters

Note:The gate drive can be configured by using a Power Insight Adapter and the Power Insight Configurator Software

Name	Comment
Gate On Resistor	Turn-on resistor value
Gate Off Resistor	Turn-off resistor value
High Vce Gate Off Resistor	Turn-off resistor value when Vce above threshold
Gate Soft Turn Off	Turn-off resistor value under fault condition
Gate-Emitter Capacitor	Capacitance between gate and emitter
Fault Lock out time	After fault time before gate drive can be switched
Desaturation Detection Times	Four time windows are defined during which the Vce comparators are checked
Desaturation Detection Voltages	Desaturation detection comparator voltages, three Vce monitors and one diode chain
Level mode	2 or 3-level mode operation
Gate voltage when ON	AP01J only, variable typically +15V to +22V. AP00J fixed at +15V.
Gate voltage when OFF	AP01J only, variable typically -10V to -5V. AP00J fixed at -10V.

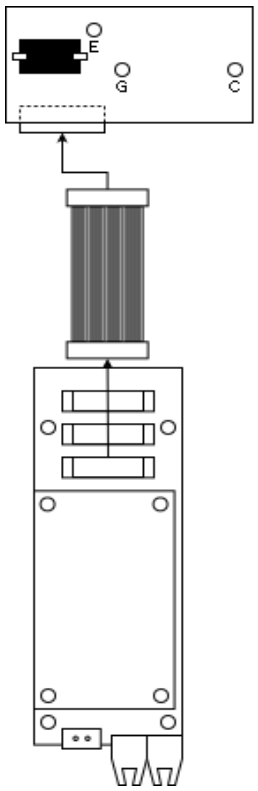
Refer to the Power Insight Configurator for values and the Gate Drive Technical Manual for further details.

Event Counters

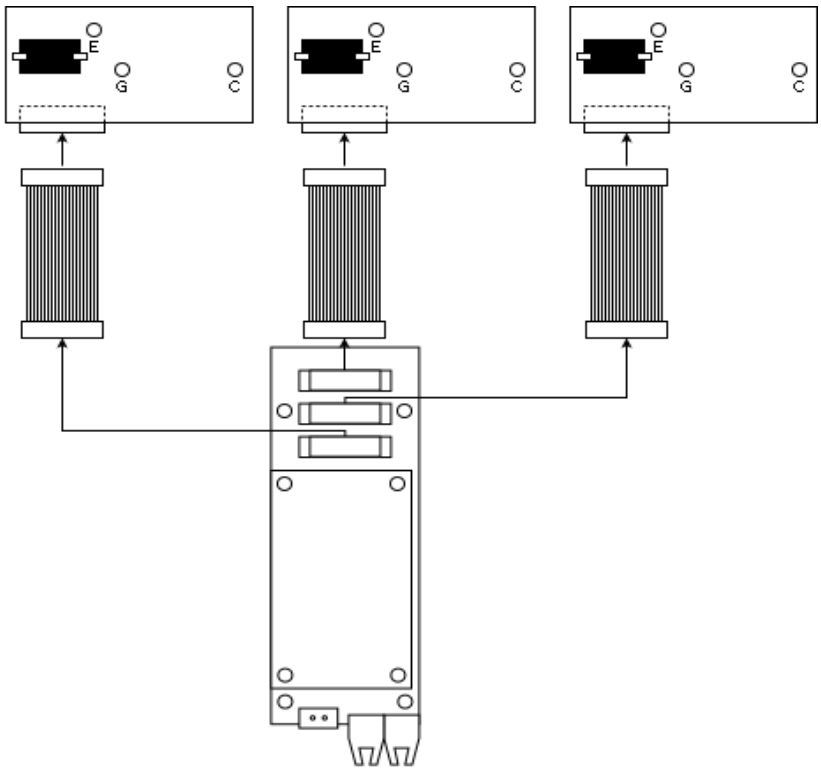
The gate drive records the events below on board the gate drive. The event counters can be viewed using a Power Insight Adapter and the Power Insight Configurator.

Event	Description
Type I short circuit	Report of type I short circuit count
Type II short circuit	Report of type II short circuit count
Undervoltage lockout	Report of undervoltage lockout protection count
Overvoltage clamp activation	Report of overvoltage clamp activation count
Number of switching cycles	Report of number of switching cycle count

Connection Diagram



Connection to single module



Three in parallel

Cable Specification

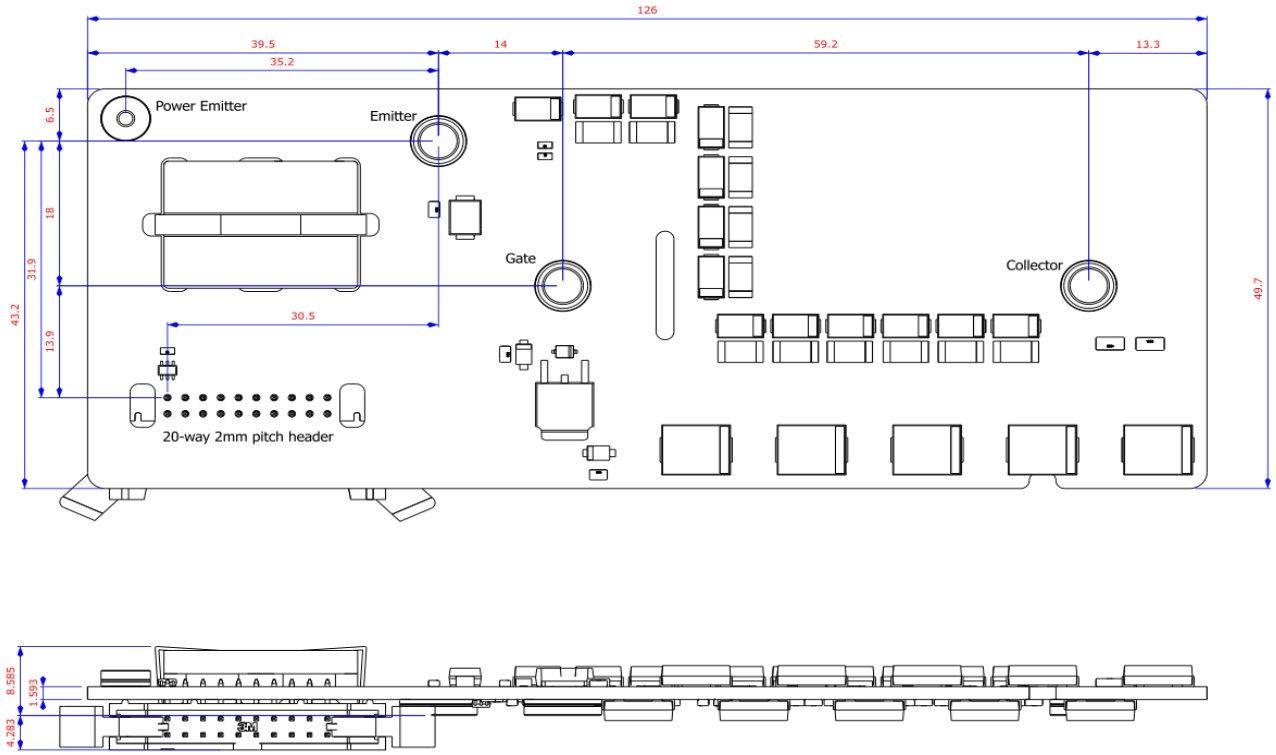
Cable is 1mm (0.039") pitch 20-way ribbon cable, for example 3M Series HF625 (Digi-key HF20S-10-ND)
Connectors compatible with latching headers on the baseboard and the pin header on the MIC are 3M 2mm Latch/Eject Header Series 1522. Manufacturer part number 152220-0113-GB. (Digi-key MTE20A-ND)

Note: The cable must be further insulated or routed to maintain sufficient separation from other cables and parts of the converter at earth potential.

Refer to the ordering information for details of module interface cards and cable assemblies.

Physical Dimensions

Module Interface Card (MIC)



Check dimensions carefully when using with 140x130mm modules or when modules are mounted close together.

Ordering Information

Compatible Module Inferface Cards

Amantys Part Number	Description
XC000042-02	4500V 10.2kV isolation HV High Power Module (HPM) Module Interface Card
XC000040-02	6500V 10.2kV isolation HV High Power Module (HPM) Module Interface Card

Compatible Cable Assemblies

Amantys Part Number	Description
XS000035-01	180mm 20-way ribbon cable with 2mm pitch connectors on the same side of the cable
XS000037-01	180mm 20-way ribbon cable with 2mm pitch connectors on opposite sides of the cable

Please discuss cable requirements with Amantys when ordering.

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Important Information

The data contained herein is intended exclusively for qualified engineers who are experienced with, and trained in, working with high voltage apparatus which involves risk to life. Strict compliance with all relevant safety regulations for the target application is essential. Any handling of electronic devices is subject to the general specifications for protecting electrostatic sensitive devices according to international standard IEC 747-1, Chapter IX or European standard EN 100015 (i.e. the workplace, tool, operating environment, etc. must comply with these standards). Failure to comply may lead to the product becoming damaged.