



Dual channel Core Gate Drive Baseboard



Module Interface Card (XHP3 version shown)

This datasheet describes a dual-channel off-module Gate Drive. This is suitable for use with the latest half-bridge IGBT and SiC modules, single and dual switch high-power modules (HPM) through use of a cable connections and module interface cards (MIC). Up to three parallel connected modules can be driven per channel. The gate drive incorporates protection features for the IGBT module and can be configured by the user for optimised operation in the power stack of the end application. AP01BA8 supports variable gate voltage for SiC devices.

- Compatible with many different IGBT and SiC modules
- High current drive into gate: 35A peak
- 15V input voltage (24V option available on request)
- 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
- EN 50155 compliant 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

When ordering please specify the Module Interface Card and cable length you require. See p5 for details. Ask Amantys for availability if box is greyed out.

#### Absolute Maximum Ratings

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

Parameter	Notes	Units	Min	Typ	Max
Supply Voltage	Configured for 24V input voltage	V			28
	Configured for 15V input voltage	V			16.5
DC link voltage	Limited by transient voltage suppressors (TVS) between gate and emitter				
Note: TVS are mounted on the module interface card (MIC)	Configured for 1200V IGBT modules	V			950
	Configured for 1700V IGBT modules	V			1420
	Configured for 3300V IGBT modules	V			2600

#### Power Supply Characteristics (15 V input variant)

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Nominal Supply Voltage	A current limited supply (<2.0A) is recommended	V	14.5	15.0	15.5
Supply current	Without load, not switching, OFF	mA		250	300
	Operation at 3kHz into 1µF load with 330nF additional gate-emitter capacitance	mA		600	1000

#### Power Supply Characteristics (24V input variant)

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Nominal Supply Voltage	A current limited supply (<2.0A) is recommended	V	21.6	24.0	26.4
Supply current	Without load, not switching, OFF	mA		160	200
	Operation at 3kHz into 1µF load with 330nF gate-emitter capacitance	mA		400	600

### 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	
Coupling capacitance	Primary to output	pF		10	15
Dielectric test voltage	50Hz AC for 10 seconds, primary to output	V <sub>rms</sub>			7400
Gate voltage (IGBT on)		V	15.0		
Gate voltage (IGBT off)		V			-10
Gate peak current	Limited by gate output FETs.	A			35
DC-DC Converter Peak Power	Continuous operation with 24V input voltage	W			5
	Continuous operation with 15V input voltage	W			3

### Gate drive configured for 1200V operation

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Operating voltage (V <sub>peak</sub> )		V			1200
Lower threshold for clamp		V		800	
Peak clamped V <sub>ce</sub>		V	1150		

### Gate drive configured for 1700V operation

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Operating voltage (V <sub>peak</sub> )		V			1700
Lower threshold for clamp		V		1200	
Peak clamped V <sub>ce</sub>		V	1650		

### Gate drive configured for 3300V operation

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Operating voltage (V <sub>peak</sub> )		V			3300
Lower threshold for clamp		V		2600	
Peak clamped V <sub>ce</sub>		V	3200		

### Physical Parameters

Parameter	Notes	Units	Min	Typ	Max
Length (baseboard)	All dimensions have a tolerance of +/- 0.5mm	mm			175
Width (baseboard)		mm			116
Height (baseboard + core)		mm			35
Weight (baseboard + 2x core)		g		168	
Screw torque	Maximum torque on gate, emitter and collector	Nm			2.0

### Standards Compliance

All data refers to +25°C unless otherwise stated

Test	Notes	Test Standard
Impulse test	18 kV 1.2/50 μs primary to output	Type test
Dielectric test	7.4 kVrms primary to output, 50 Hz, 60 sec	Type test
Partial discharge	≥2.6 kV rms extinction, <10 pC, input to output	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 precautions 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**

All data refers to +25°C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Operating temperature		°C	-40		85
Storage temperature		°C	-40		85
Humidity	Compliant to EN 50155 Railways Applications Electronic Equipment Used on Rolling Stock with conformal coating	%		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	Protective separation (Baseboard Mat. Grp. 3a)	mm	44		
	Functional isolation (MIC Mat. Grp. 2)	mm	16		
Clearance	Protective separation (Baseboard Mat. Grp. 3a)	mm	20		
	Functional isolation (MIC Mat. Grp 2)	mm	10.5		

**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

**LED Status Indication**

Note: The gate drive has two 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	YYYYMM	

### 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	AP01BA8 only, variable typically +15V to +22V. AP00BA8 fixed at +15V
Gate voltage when OFF	AP01BA8 only, variable typically -10V to -5V. AP00BA8 fixed at -10V

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

### 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  Only use to extend operational time
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	

### Event Counters

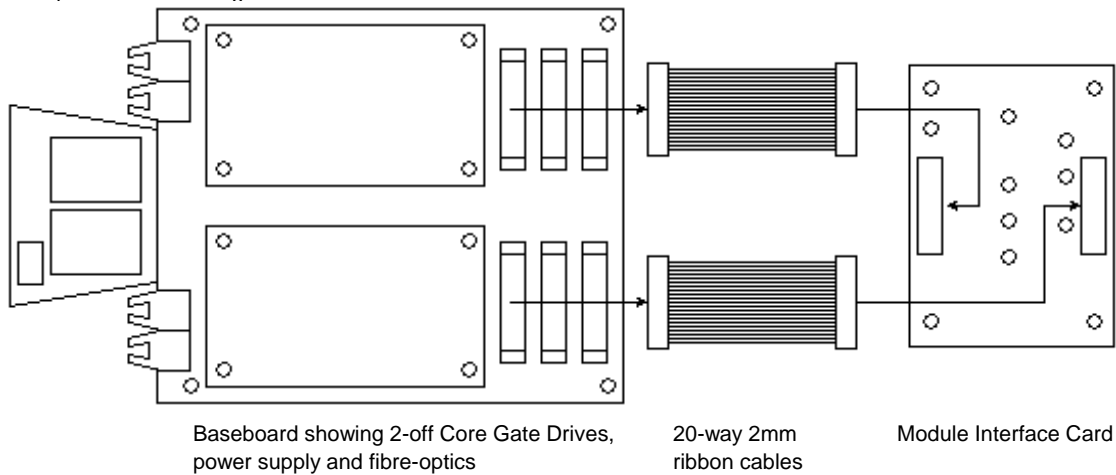
The gate drive records the events below on board the gate drive. The event counters can be viewed using a Power Insight Adapter and the Power Insight Configurator.

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
Oversvoltage clamp activation	Report of oversvoltage clamp activation count
Number of switching cycles	Report of number of switching cycle count

### Mechanical Drawing

Please ask Amantys for 3D model when planning converter layout.

Example shown with single nHPD2 MIC



Note: The ribbon cable must be connected to the 20-way header marked "PRIMARY" nearest the driver core on the baseboard. The other connectors are for parallel connected IGBTs.

### Ordering Information

#### Compatible Module Interface Cards

Amantys Part Number	Description
XC000026-04	3300V nHPD2/LinPak Module Interface Card
XC000070-04	1700V nHPD2/LinPak Module Interface Card
XC000071-01	3300V LV100/XHP2/Semitrans 20 Module Interface Card
XC000072-01	1700V LV100/XHP2/Semitrans 20 Module Interface Card
XB000097-01	3300V XHP3 Module Interface Card (not suitable for 4500/6500V)
XC000042-02	4500V 10.2kV isolation voltage HPM Module Interface Card
XC000040-02	6500V 10.2kV isolation voltage HPM Module Interface Card
under consideration	3300V 6kV isolation voltage 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.