

This datasheet describes a 3300V single channel off-module gate drive. 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. Connection to the IGBT is made with a cable and small module interface card (MIC).

- High current drive into gate: 35A peak
- Wide input voltage range 14-30V
- 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
- 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	Notes	Units	Min	Typ	Max
Supply Voltage		V			30
DC link voltage	Limited by transient voltage suppressors (TVS)				2400

Power Supply Characteristics

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	14.0	24.0	27.6
Supply current	Without load, not switching, OFF (24V input)	mA		75	
	Operation at 3kHz into 1µF load with 330nF additional gate-emitter capacitance (24V input)	mA		185	

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		9.0	
Coupling capacitance	Primary to output	pF		5	8
Dielectric test voltage	50Hz AC for 10 seconds, primary to output	V _{rms}			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 limited by output resistors and MOSFETs not DC-DC converter.	W		5	19

General Electrical Characteristics (continued)

All data refers to +25 °C unless otherwise stated

Parameter	Notes	Units	Min	Typ	Max
Operating voltage (V _{peak})	Primary to secondary side	V			3300
Lower threshold for clamp	Voltage at which current flows in the TVS chain	V		2400	
Peak clamped V _{ce}		V	3200		

Physical Parameters

Parameter	Notes	Units	Min	Typ	Max
Length	All dimensions have a tolerance of +/- 0.5mm	mm			142.0
Width		mm			80.0
Height		mm			30.0
Length (MIC)		mm			77.0
Width (MIC)		mm			25.0
Height (MIC)		mm			5.0
Weight (total)		g			130.0
Screw torque	Maximum torque on gate, emitter and collector	Nm			2.0

Standards Compliance

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 gate drive.	
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	Compliant to EN 50155 Railways Applications	%		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				
Baseboard Creepage	Protective separation (Material Group 2)	mm	31.3		
	Functional isolation (Material Group 2)	mm	16.0		
Baseboard Clearance	Protective separation	mm	19.3		
	Functional isolation	mm	11.0		
MIC Creepage	Functional isolation (Material Group 3a)	mm	22.0		
MIC Clearance	Functional isolation	mm	11.0		

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

To observe the red LED flashing, set the fault lockout time to >1000ms.

Measured Parameters

Name	Comment	Units	Resolution
Gate drive temperature	On board temperature	°C	±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	YYMM	

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
di/dt Detection Filter	Filter out short pulses of high di/dt, e.g. when turning on
di/dt Detection Voltages	di/dt detection comparator voltages, three Vce monitors and one diode chain
Level mode	2 or 3-level mode operation

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	Not available on this gate drive due to simple module interface card and cabling
Number of switching cycles	Report of number of switching cycle count

Power Supply Interface

Manufacturer	Board Part Number	Cable Part Number	Pin Number	
Phoenix 2 Pos 5.08mm pitch	1955167 (Horizontal)	1925692	1	2

Fibre-optic Interface

Interface	Description	Manufacturer	Part Number	Encoding
Optical input (PWM)	Receiver (Black)	Firecomms	FR50MHIR	Light ON = IGBT ON
Optical output (ACK)	Transmitter (Grey)	Firecomms	FT10MHLR	Light ON = OK, OFF = Fault

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.

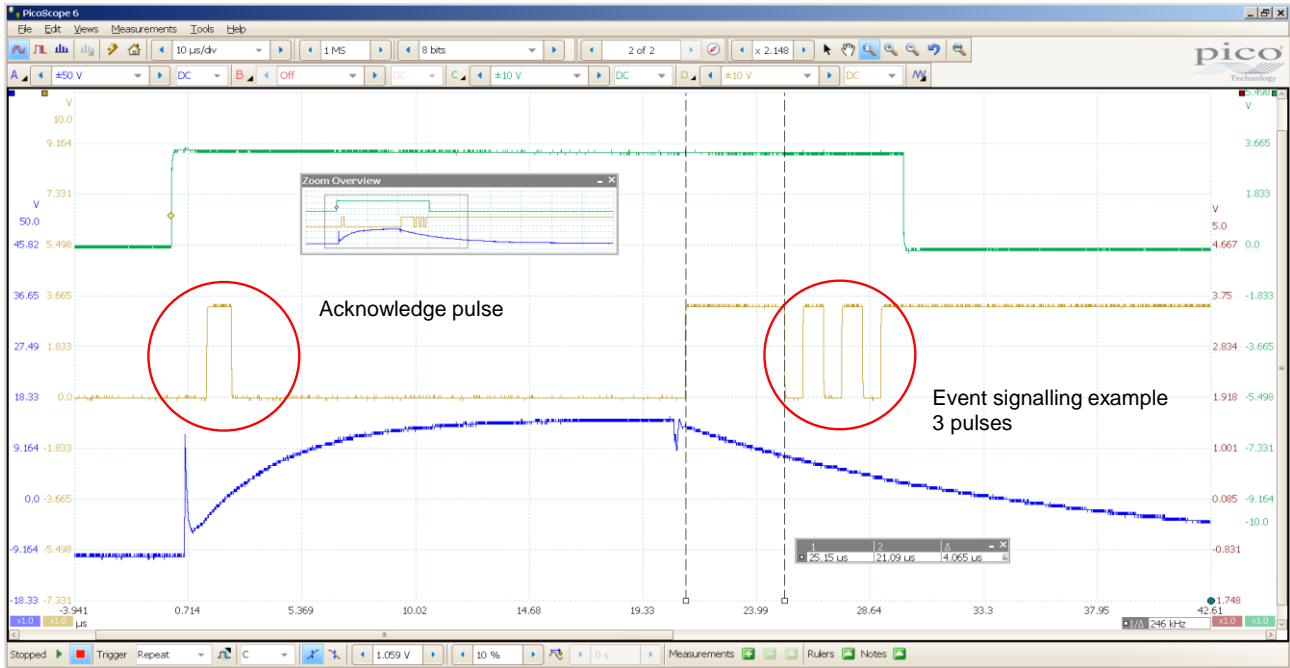
LED Drive Configuration	Units	LED Current	Comments
LED Drive Level 1	mA	1.82	Longest lifetime for LED
LED Drive Level 2	mA	2.73	
LED Drive Level 3	mA	3.64	
LED Drive Level 4	mA	4.55	
LED Drive Level 5	mA	6.37	

Effect of disconnected IGBT cables

Gate disconnected	IGBT will not turn on, gate drive may detect a desaturation fault.
Emitter disconnected	IGBT will not turn on, gate drive may detect a desaturation fault. If the power emitter is connected, the IGBT will turn on very slowly as the gate drive has a 12k resistor to ground. A gate fault will be detected.
Power emitter disconnected	The gate drive will not be able to detect a di/dt fault.
Collector disconnected	Desaturation fault will be detected as collector will be floating.

Warning: If the gate and/or emitter are not connected then the IGBT may turn-on at the wrong time and cause failure. The only mitigation for this is to connect the gate and emitter with a high value resistor (e.g. 10k) on the IGBT, but this may not guarantee to hold the IGBT off under all conditions (e.g. high dv/dt on the collector).

Event Signalling



# Pulses	Event type	Pulse measurement
1 pulse	di/dt fault	0.75µs, 4µs after light goes off (logic high on diagram)
2 pulses	Short-circuit type 2	0.75µs wide, 0.80µs spacing
3 pulses	not used	0.75µs wide, 0.80µs spacing
4 pulses	not used	0.75µs wide, 0.80µs spacing
5 pulses	Short-circuit type 1	0.75µs wide, 0.80µs spacing
6 pulses	Narrow off pulse	0.75µs wide, 0.80µs spacing
7 pulses	Gate voltage fault	0.75µs wide, 0.80µs spacing

Key	
█	PWM
█	FB/ACK (inverted)
█	Gate voltage

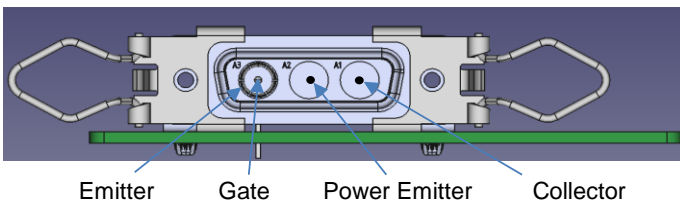
Mechanical Information

Please request a 3D model (STEP file) from Amantys.

Recommended Cable Specification for IGBT Module Connection

PCB mounted part

Part	Part Number	Qty
Connector	FM3W3S-1002	1
Coaxial Contact	FME008S102	1
High Voltage Contact	31D-0189-22	2
Spring Latch (Pair)	F1045-1	1



Position	Contact type	IGBT terminal
A3	Coaxial Contact	Gate/Emitter
A2	High Voltage Contact	Power Emitter
A1	High Voltage Contact	Collector

Cable mounted part

Part	Part Number	Qty	Notes
Connector	FM3W3S-1002	1	
Coaxial Contact	TBA	1	Cable RG58 C/U e.g. Huber & Suhner 85070085
High Voltage Contact	TBA	1	Cable 3600V insulation e.g. Huber & Suhner 1.5mm 12537829
Hood	TBA	2	Plastic, not metal coated
End Latch (Pair)	F1044-1	1	

Ordering Information

Part Number	AD33AA8P11Y-ZZZZ	Customer specific part number
Part Number	AD00XA8Y-ZZZZ	Generic part number

where X = no specific IGBT module, off-module so select appropriate MIC from table below
 Y = 0 (uncoated) or C (coated)
 ZZZZ = specific part number for each customer configuration

Compatible Module Interface Cards

Amantys Part Number	Description
XB000093-01	3300V 6kV isolation voltage HPM Module Interface Card
XC000075-01	3300V 6kV isolation voltage HPM Module Interface Card (with conformal coating)

Compatible Cable Assemblies

Amantys Part Number	Description
XS000058-01	500mm cable assembly fitted with FM3W3S DSUB connector and ring crimp terminals

Please discuss cable requirements with Amantys when ordering.

Legal Disclaimer

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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.