IGD1208W-15

Hybrid Integrated Isolated N-Channel IGBT Driver

Key Features:

- Internal DC/DC Converter
- Shielded OptoCoupler
- 30 kV/μS CMR
- V_{ISO} = 3,750V
- TTL Compatible Input
- Short Circuit Protected
- Fault Signal Output
- ±8A Output
- Switching Freq. to 20 kHz
- Compact SIP Package

A "User Manual" is also available for the IGD1208W. Go to the MPD website or call the factory for a copy

RoHS

Recommended For:

- 600V Series IGBT (up to 600A)
- 1200V Series IGBT (up to 400A)
- 1700V Series IGBT (up to 200A)

Electrical Specifications

Maximum Ratings, T_A = 25 °C, V_D = 15V unless otherwise noted.

Parameter		Conditions	Min.	Typ.	Max.	Units
Power Supply Input Voltage	V_D				16	VDC
Input Impulse High Level Current	I_{IH}				25	mA
Peak Driver Output Current	I_{GON}	Pulse Width 2 μS, Frequency ≦ 20 kHz			+8.0	A
	I_{GOFF}				-8.0	
Fault Output Current	I_{FO}				20	mA
Max Input Voltage To Fault Detection Pin	V_{R1}				50	VDC

Input Specifications, T_A = 25 °C

Parameter		Conditions	Min.	Typ.	Max.	Units
Power Supply, Input Voltage	V_D		14.5	15	15.5	VDC
Power Supply, Input Current	I_{IN}	f = 20 kHz, D = 0.5, Q = 0 uC		46		mA
		f = 20 kHz, D = 0.5, Q = 3 uC		165		
Input Impulse High Level Voltage	V_I		3.7		5.7	VDC
Input Impulse High Level Current	I_{IH}		10	16	20	mA
Input CMR				30		KV/μS

Output Specifications, T_A = 25 °C

Parameter		Conditions	Min.	Typ.	Max.	Units
Isolated Gate Supply Voltage	V_{CC}	f = 20 kHz, D = 0.5	14.5	16.0	18.0	VDC
	V_{EE}	f = 20 kHz, D = 0.5	-7.0	-8.5	-10.0	
Gate Resistance	R_G		2		5	Ω
Drive Output High Level Voltage	V_{OH}	f = 20 kHz, D = 0.5, Q = 3 uC	14.5	15.0		VDC
Drive Output Low Level Voltage	V_{OL}	f = 20 kHz, D = 0.5, Q = 3 uC	-7.0	-9.0		VDC
Drive Output Rise Time	T_R			0.3	1.0	μS
Drive Output Fall Time	T_f			0.3	1.0	μS
Drive Output Total Charge	Q	f = 20 kHz, D = 0.5			3.0	μC

General Specifications, T_A = 25 °C

Parameter		Conditions	Min.	Typ.	Max.	Units
Operating Frequency	f				20	kHz
Input Impulse/Drive Output Rise Time Delay	T_{PLH}	I_{IH} = 10 mA		0.5	1.0	μS
Input Impulse/Drive Output Fall Time Delay	T_{PHL}	I_{IH} = 10 mA		1.0	1.3	μS
Controlled Time Detect	T_{TRIP}			3.5	4.0	μS
Soft Turn-Off Time	T_{CF}	Pin 13 ≥15 VDC, Pin 14 Open		4.5		μS
Fault Reset Time	T_{TIMER}		1.0	1.4	2.0	mS
Fault Threshold Voltage	V_{OCP}			9.5		VDC
Fault Output Terminal Voltage	V_{FO}			-8.0		V
Isolation Voltage	V_{ISO}	Sine Wave 50 Hz/ 60 Hz , 1 Min	3,750			VAC
Operating Temperature	T_{OP}		-40		+71	°C
Storage Temperature	T_{ST}		-50		+125	°C
Mechanical Dimensions	See Mechanical Drawing on Page 4					
Weight	0.35 Oz (10g)					

Notes:
1. Exceeding Maximum Ratings may damage the module. These are not continuous operating ratings.
2. A user manual is available for this driver. For a copy, go to our website or call the factory.

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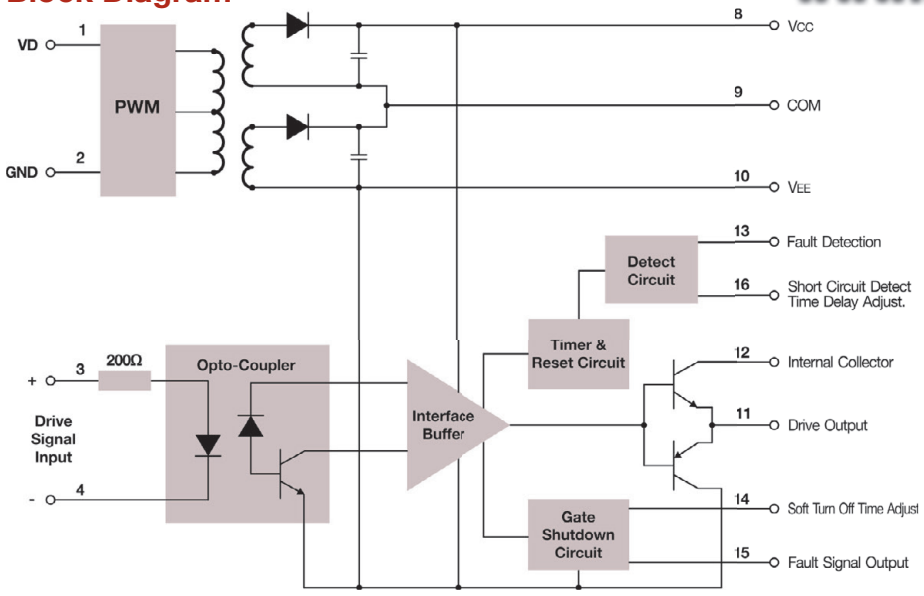
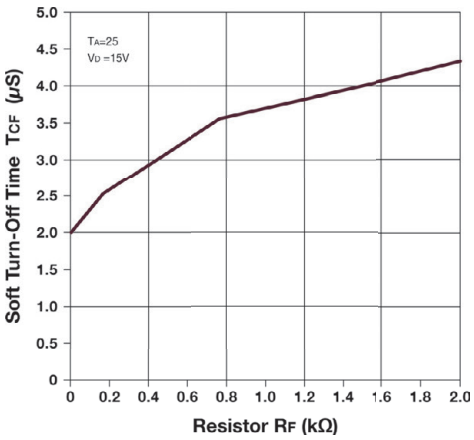
Block Diagram



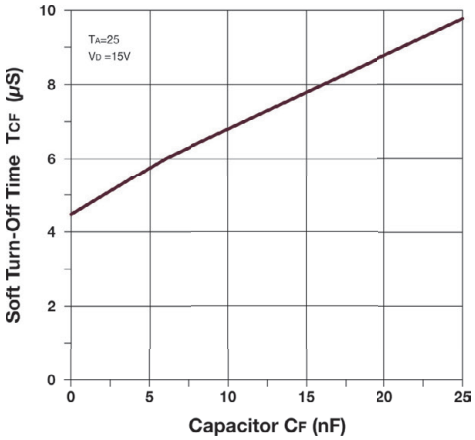
The **IGD1208W-15** is a hybrid integrated circuit designed to provide the isolated gate drive required for high power IGBT modules. It features an internal high speed opto-coupler, high transient immunity, short circuit protection and a fault signal output. It is packaged in a compact single-in-line (SIP) package (see Page 4) that minimizes the required printed circuit board space. The block diagram at left illustrates its' main components and features.

The **IGD1208W-15** converts logic level control signals into a fully isolated gate drive of +16V/-8.5V. Gate drive current is 8A peak. Gate drive power isolation is provided by an internal DC/DC converter. Control signal isolation is provided by an internal high speed optocoupler. Desaturation detection is used for short circuit protection.

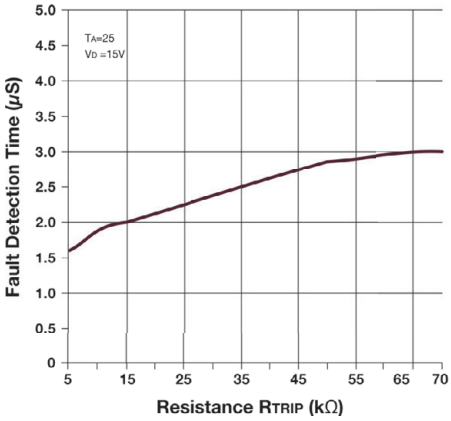
Soft Turn-Off Speed Vs RF



Soft Turn-Off Speed Vs CF



Fault Detection Speed Vs RTRIP



Soft Turn-Off Speed Vs RF

RF	TRF (µS)
---	4.5 µS
1.5 kΩ	4.0 µS
0.5 kΩ	3.5 µS
0.3 kΩ	3.0 µS
0.11 kΩ	2.5 µS

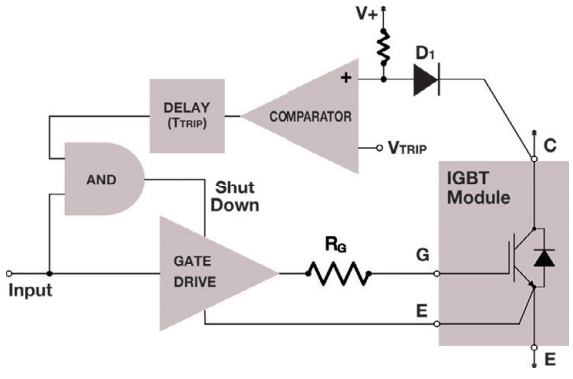
Soft Turn-Off Speed Vs CF

CF	TCF (µS)
---	4.5 µS
1.0 nF	4.9 µS
3.3 nF	5.3 µS
10 nF	6.5 µS
22 nF	9.3 µS

Soft Turn-Off Speed Vs RTrip

RTRIP	TTRIP (µS)
---	3.50 µS
68 kΩ	3.00 µS
51 kΩ	2.80 µS
30 kΩ	2.48 µS
20 kΩ	2.28 µS
15 kΩ	2.0 µS
10 kΩ	1.90 µS
5.1 kΩ	1.60 µS

Fault Detection Circuit



The **IDG1208W-15** provides short circuit protection by means of an on-state collector-emitter voltage sensing circuit. This type of protection is often called "Desaturation Detection". A block diagram of a typical desaturation detector is illustrated at left.

During a normal on-state condition, the comparator output will be low. During a normal off-state condition the comparator output will be high. If the IGBT turns on into a short circuit, the high current will cause it's collector-emitter voltage to rise above the level of VTRIP, even though the gate of the IGBT is being driven on.

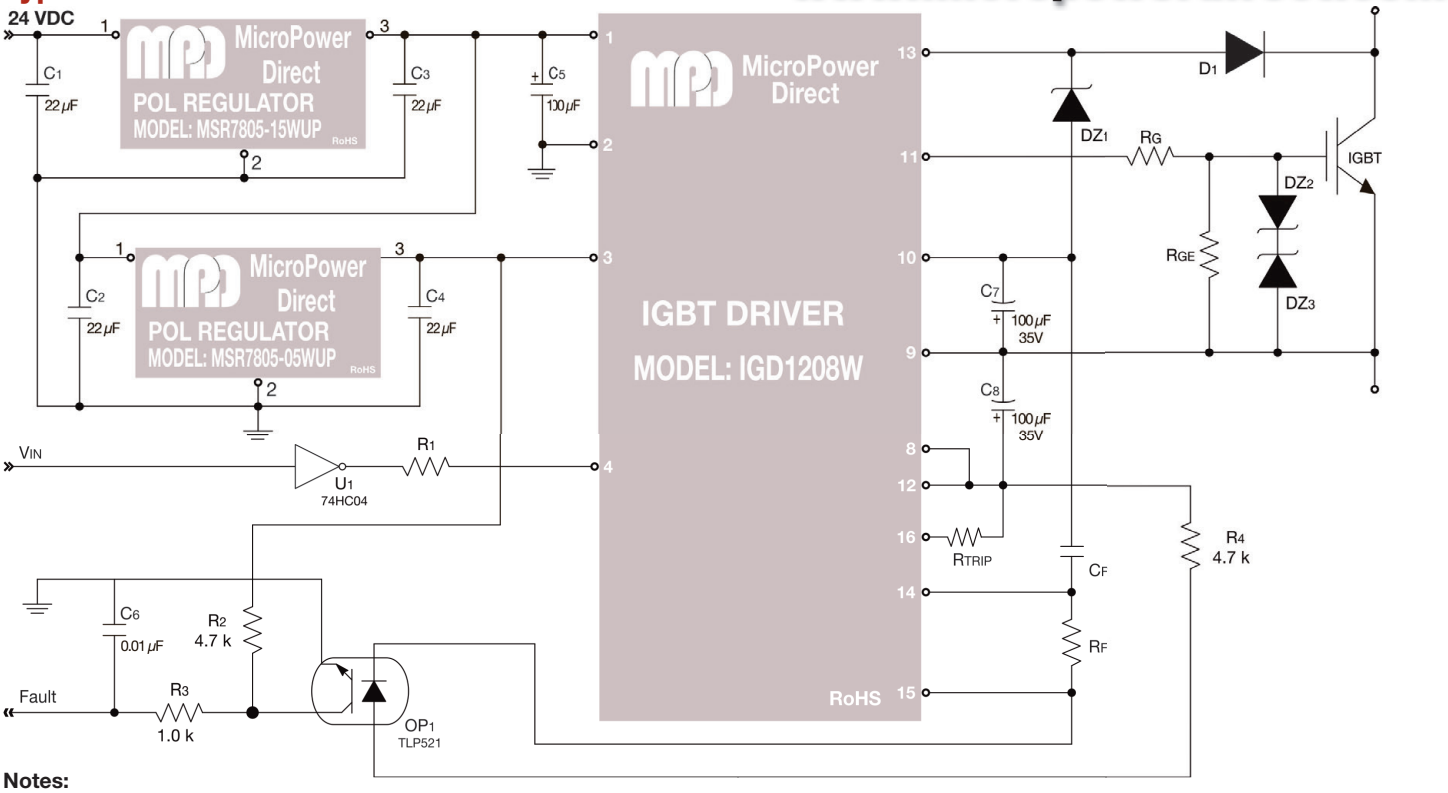
This condition (a high VCE when the IGBT is supposed to be on) is often called desaturation. Desaturation can be detected by a logical AND of the driver input signal and the comparator output. When the output of the AND goes high a short circuit is indicated. The output of the AND is then used to command the IGBT to shut down.

A delay (TTRIP) must be provided after the comparator output to allow for the normal turn-on time of the IGBT. This delay is to prevent erroneous desaturation detection. The default delay is 3.5 µs (the recommended maximum). For most applications this can be reduced to the minimum of 1.6 µs by connecting a 5.1 kΩ resistor (RTRIP) between pin 16 and pin 8.

When a short circuit is detected, the driver provides a soft shut down. This limits the transient voltage surge that occurs when large short circuit currents are interrupted. The default soft shutdown time is 4.5 µs. This setting will work for most applications.

In some applications it may be helpful to adjust the shut down time. The time can be raised by connecting capacitor (CF) between pins 14 and 10 or lowered by a resistor (RF) connected between pins 14 and 15. These adjustments are shown in the charts and graphs above. The recommended limits are a minimum of 2.5 µS and a maximum of 10 µS. The components CF & RF should not be connected at the same time.

Typical Connection



Notes:

To minimize the potential for problems (and/or failures) caused by induced noise, EMI interference and/or oscillation, the connection of the gate driver must be done with great care. Some recommendations would include:

1 The **IGD1208W-15** requires one 15 VDC, external supply (VD) to power its internal circuits. This supply is connected to the primary side of the hybrid gate driver's built in DC/DC converter at pins 1 & 2. Our typical connection uses the **MSR7805-15WUP** to convert a 24V bus to the 15V required by the driver. This low cost regulator has an input range of 19 to 36V and an output of 15V at 500 mA. For other bus voltages, contact the **MPD** technical sales staff for a recommendation. Capacitor C_1 is added to improve the stability of the regulator over time & temperature. Capacitor C_3 reduces the output ripple.

The external supply must be decoupled with a capacitor (C_5) mounted as close as possible to the driver's pins. The decoupling capacitor is necessary to provide a stable, well filtered voltage for the driver's built in DC/DC converter. The decoupling capacitor is a 100 µF low impedance electrolytic. This should be sufficient for most applications.

When selecting the input decoupling capacitor, it is important to ensure that it has a sufficiently high ripple current rating. Also, care must be taken not to exceed the capacitive load limit of the power supply or regulator used as an external supply. The max capacitive load specified for the **MSR7805-15WUP** is 680 µF. If the driver is lightly loaded, It may be possible to use a smaller capacitor.

2 Our circuit uses a second switching regulator (the **MSR7805-05ERUP**) to provide a stable 5V input signal voltage to the input (pin 3) of the **IGD1208W-15**. The input signal voltage cannot exceed 5.70V. The internal dissipation caused by the resultant increase in input current could damage the input optocoupler. A current limiting resistor (R_1) is used to help prevent this. The resistor value is calculated by the formula:

$$R_1 = \frac{V_{DR} - V_{OFD} - V_{OSD}}{I_{IH}} - 200\Omega$$

Where: V_{DR} = Required drive voltage
V_{OFD} = Forward voltage drop across Optocoupler diode
V_{OSD} = On state voltage drop across the driver
I_{IH} = Max Input Impulse High Level Current

3 The **IGD1208W-15** has a built in DC/DC converter that provides isolated gate driver voltage levels consisting of +16V (V_{CC}) at pin 8 and -8.5V (V_{EE}) at pin 10. The V_{CC} level is high enough to fully saturate the IGBT, minimizing on-state losses. At the same time it's low enough to limit short circuit current. These outputs share a common ground at pin 9. This allows the driver to provide a floating gate drive suitable for high or low side switching.

Low impedance electrolytic capacitors (C_6 and C_7) are used to decouple the internal supply outputs. It is important that these components be selected for low impedance and a maximum allowable ripple current that is sufficient for the application. Assuming the ripple current in the decoupling capacitors is about equal to the rms gate current, it can be estimated by the formula:

$$I_{RMS} = I_P \sqrt{\frac{T_P \times f}{3}}$$

Where: I_P = Peak current
T_P = Base width of pulse
f = Frequency

Capacitors C_6 and C_7 should be mounted as close to the driver as possible.

4 The gate wiring of the IGBT gate-emitter drive loop must be shorter than 1 meter.

5 Twisted pair wiring is recommended for the gate-emitter drive loop to minimize mutual induction.

6 If a large voltage spike is generated at the IGBT collector, the value of the gate resistor (R_G) should be increased. The range of acceptable values for R_G is 2Ω to 5Ω.

7 The peak reverse voltage rating of D_1 must be higher than the peak value of the IGBT collector voltage.

8 The voltage level at pin 13 could go "High" depending on the reverse recovery characteristics of D_1. A 30V zener diode DZ_1 is connected between pin 13 and pin 10 to prevent any problems caused by this.

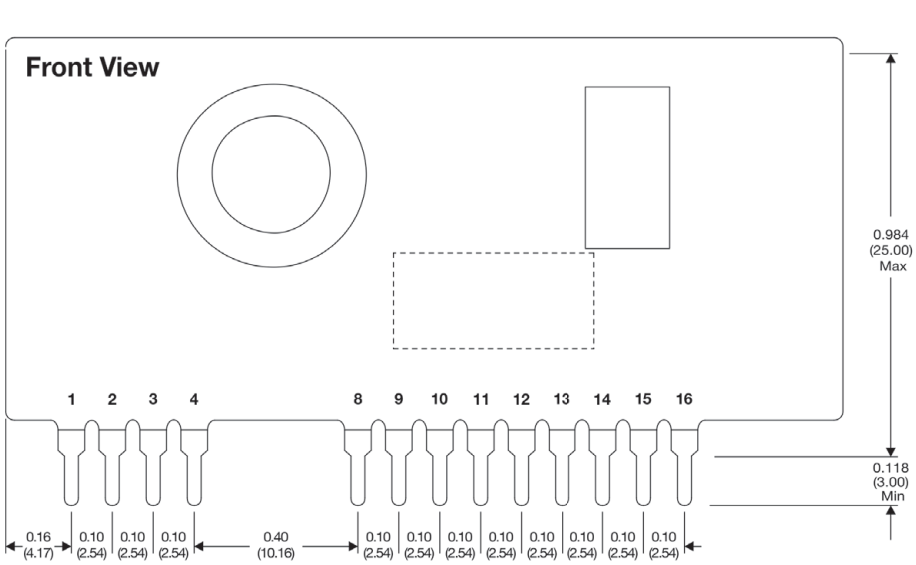
9 The driver has a short circuit detection time delay of 3.5 µS (4.0 µS max), For most applications this may be reduced to the minimum of 1.6 µS) by connecting a resistor (R_{TRIP}) between pins 16 & 8. See page 2 or contact the factory for details.

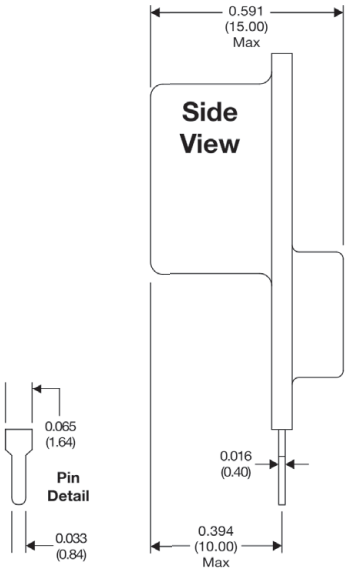
10 To help limit transient voltage surges that could occur if a short circuit is interrupted, a soft shutdown is provided by the driver. The default time is set to 4.5 µS, but it can be adjusted from 2.5 µS to 10 µS by using either C_F or R_F. See page 2 or contact the factory for details.

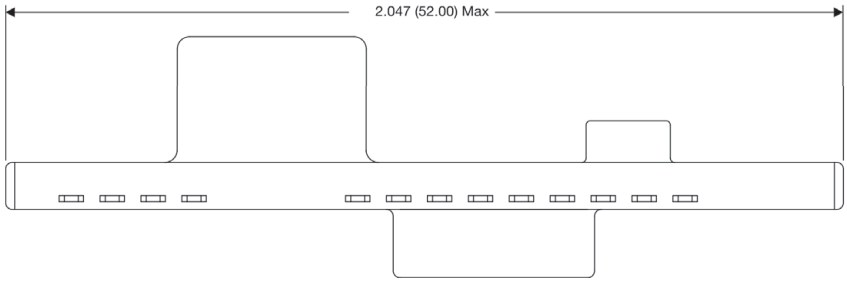
11 If the driver short circuit protection is activated, it will immediately shut down the gate drive and pull pin 15 low to indicate a fault (via OP_1). During normal operation, the collector of OP_1 is pulled high by R_2. In the event of a fault, the driver output is disabled and a fault signal is produced that lasts a minimum of 1 mS. The RC filter (C_6 and R_3) help provide noise immunity. If the short circuit protection circuit is not used, these components can be eliminated and pin 15 should be left open.

12 If the short circuit protection circuit is not used, a 4.7 kΩ should be connected between pin 9 and pin 13 (D_1 and DZ_1 are not required with this configuration).

Mechanical Dimensions







Pin	Function
1	+VDD (+ Power Supply)
2	-VDD (- Power Supply)
3	Drive Signal Input (+)
4	Drive Signal Input (-)
8	DC/DC Output (+)
9	DC/DC Output (Comm)
10	DC/DC Output (-)

Pin	Function
11	Drive Output
12	Internal Power Tube
13	Fault Detection
14	Soft Turn-Off Adj
15	Fault Signal Output
16	Control Pin (ForTTRIP)

Notes:
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.5)

More Literature:

Application Note

An in depth look at IGBT's, including their development, advantages & disadvantages, and usage.

Product Manual

In depth information on the use and performance of the **IGD1208W** IGBT Driver.

Product Datasheets

In depth specifications on the connection and performance of a full line of IGBT drivers and isolated DC/DC converters.

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