

# CGD12HB00D

## 2-Channel Differential Transceiver

### Companion Tool to CGD12HBXMP & CGD15HB62LP

#### Technical Features

- Designed for use with Cree’s High-Performance [CGD12HBXMP](#) & [CGD15HB62LP](#)
- Single-Ended Inputs for Interfacing with 3.3 V or 5 V Microcontrollers
- Differential Outputs for Increased Noise Immunity
- High-Frequency, Ultra-Fast Switching Operation
- Fault Indicator LEDs
- Reverse Polarity & Overvoltage Protections
- Enables Retrofitting Single-Ended Systems for Differential Signals

#### Package



#### Maximum Ratings

Symbol	Parameter	Value	Unit
$V_{DC}$	Supply Voltage	-0.5 to 18	V
$V_I$	Logic Level Inputs	-0.5 to 5.5	
$T_{op}$	Ambient Operating Temperature	-50 to 70	°C
$T_{stg}$	Storage Temperature	-50 to 125	

#### Gate Driver Electrical Characterization

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{DC}$	Supply Voltage	9	12	18	V	Single-Ended Inputs
$V_{IH}$	High Level Logic Input Voltage	2.0		5.5		
$V_{IL}$	Low Level Logic Input Voltage	0		0.8		
$V_{IDCM}$	Differential Input Common Mode Range	-7		+12	mV	$V_{ID} = V_{Pos-Line} - V_{Neg-Line}$
$V_{IDTH}$	Differential Input Threshold Voltage	-200	-125	-50		
$V_{HYST}$	Differential Voltage Hysteresis	15	70			
$V_{ODH}$	Differential Output High Level	2.2	3.4		V	$I_{OD} = -20\text{ mA}$
$V_{ODL}$	Differential Output Low Level		0.2	0.4		$I_{OD} = 20\text{ mA}$
$V_{OD}$	Differential Output Magnitude	2	3.1			$R_L = 100\ \Omega$
$t_{PHL/PLH}$	Propagation Delay		15		ns	$C_L = 30\text{ pF}$
$f_c$	PWM Inputs First-Order Low-Pass Filter Cutoff Frequency		1		MHz	

## Input Connector Information

Pin Number	Parameter	Description
1	$V_{DC}$	Power Supply Input Pin
2	Common	Common
3	HS-PWM	High Side PWM Signal. 3.3 V or 5 V Logic Compatible. Active High.
4	Common	Common
5	LS-PWM	Low Side PWM Signal. 3.3 V or 5 V Logic Compatible. Active High.
6	Common	Common
7	$\overline{\text{FAULT}}$	5 V Fault Condition. <b>Caution for 3.3 V systems: this output is 5 V. Active Low.</b>
8	Common	Common
9	RTD	5 V Temperature Dependent Resistor Output. <b>Caution for 3.3 V systems: this output is 5 V. Duty cycle modulated.</b>
10	Common	Common
11	$\overline{\text{PS-Dis}}$	Pull Down to Disable Power Supply. Pull Up, or Leave Floating to Enable. Gate-Source will be Connected with 10 k $\Omega$ when disabled. <i>Straight pass-through to gate driver.</i>
12	Common	Common
13	PWM-EN	Pull Down to Disable PWM Input Logic. Pull Up/Leave floating to enable. Gate-source will be held low through gate resistor if power supplies are enabled. <i>Straight pass-through to gate driver.</i>
14	Common	Common
15	OC-EN (CGD15HB62LP)	Over-current Protection Enable. Pull down to disable detection of over-current fault. PWM and UVLO will continue to function. Pull up or leave floating to enable detection of over-current fault. <i>Straight pass-through to gate driver.</i>
	Reset (CGD12HBXMP)	Over-current Protection Reset. If a fault condition is detected, momentarily set the reset pin high to reactivate the gate driver. <i>Straight pass-through to gate driver.</i>
16	Common	Common



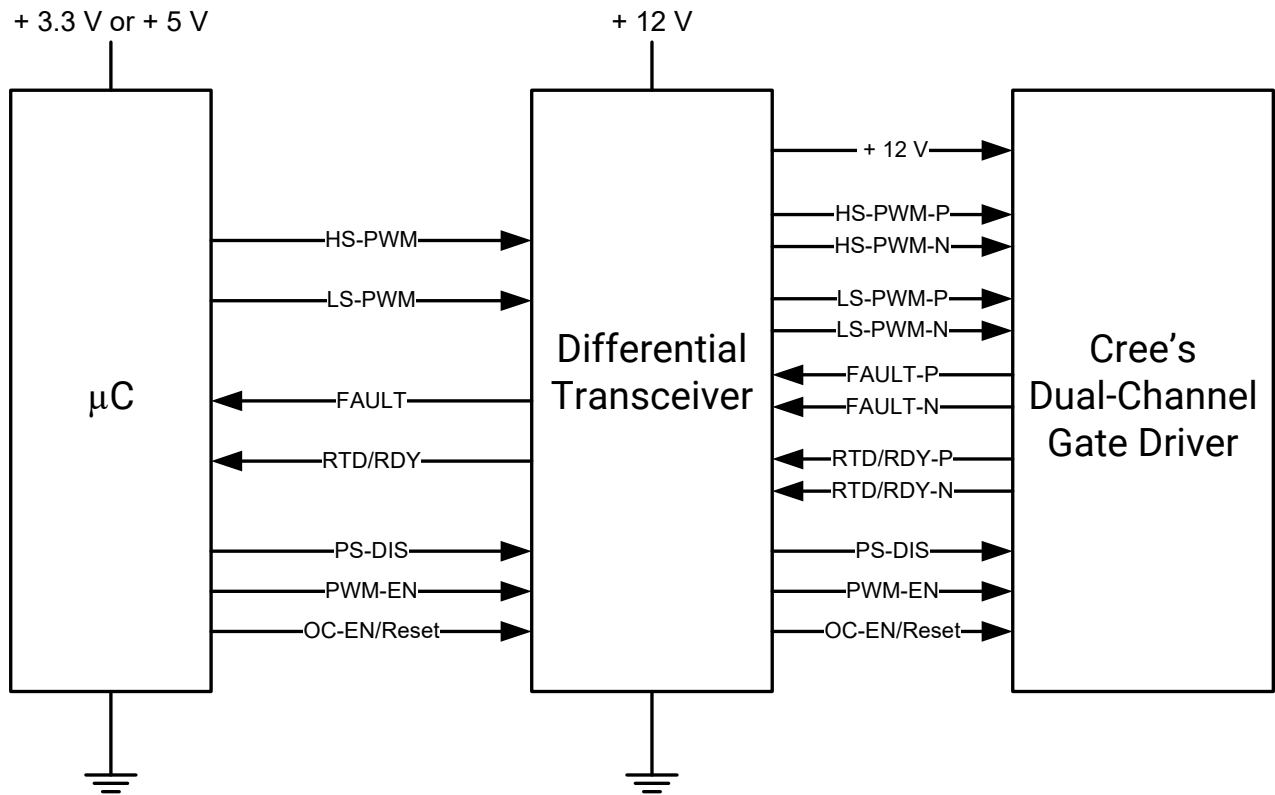
## Output Connector Information

Pin Number	Parameter	Description
1	$V_{DC}$	Power supply input pin
2	Common	Common
3	HS-P (*)	Positive Line of Differential High Side PWM Signal Pair.
4	HS-N (*)	Negative Line of Differential High Side PWM Signal Pair.
5	LS-P (*)	Positive Line of Differential Low Side PWM Signal Pair.
6	LS-N (*)	Negative Line of Differential Low Side PWM Signal Pair.
7	$\overline{\text{FAULT-P}}$ (*)	Positive Line of Differential Fault Condition Signal Pair. Drive Strength 20 mA.
8	$\overline{\text{FAULT-N}}$ (*)	Negative Line of Differential Fault Condition Signal Pair. Drive Strength 20 mA.
9	RTD-P (*)	Positive Line of Temperature Dependent Resistor Output Signal Pair.
10	RTD-N (*)	Negative Line of Temperature Dependent Resistor Output Signal Pair.
11	$\overline{\text{PS-Dis}}$	Low Logic Level Disables Power Supplies on Gate Driver. <i>Straight pass-through from single-ended input.</i>
12	Common	Common
13	PWM-EN	Low Logic Level Disables PWM Signals on the Gate Driver. <i>Straight pass-through from single-ended input.</i>
14	Common	Common
15	OC-EN (CGD15HB62LP)	Over-current Protection Enable. <i>Straight pass-through to gate driver.</i>
	Reset (CGD12HBXMP)	Over-current Protection Reset. <i>Straight pass-through to gate driver.</i>
16	Common	Common

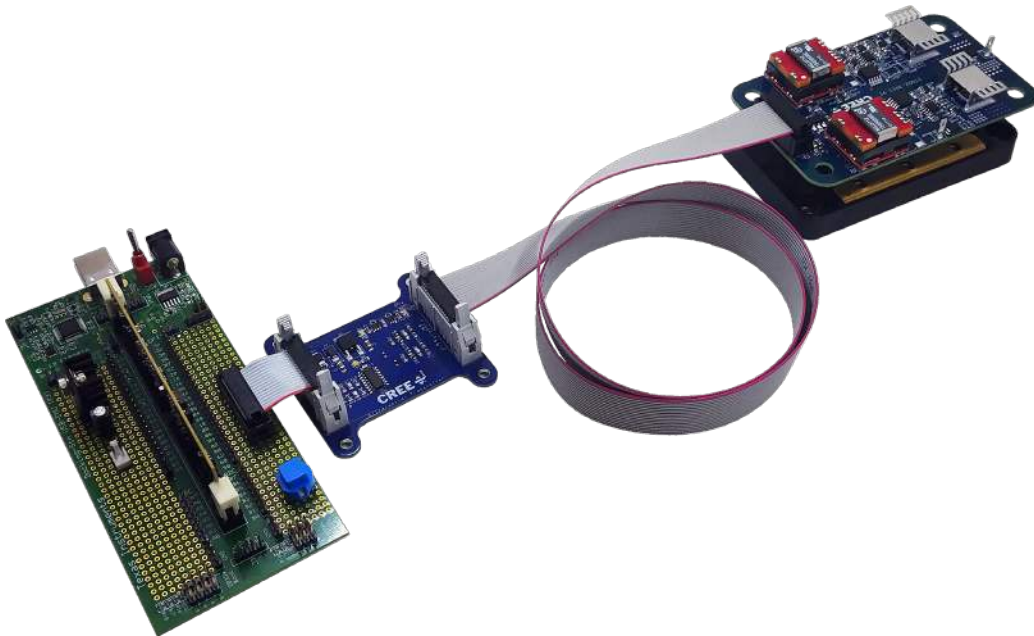
\* Inputs 3 - 10 are differential pairs.



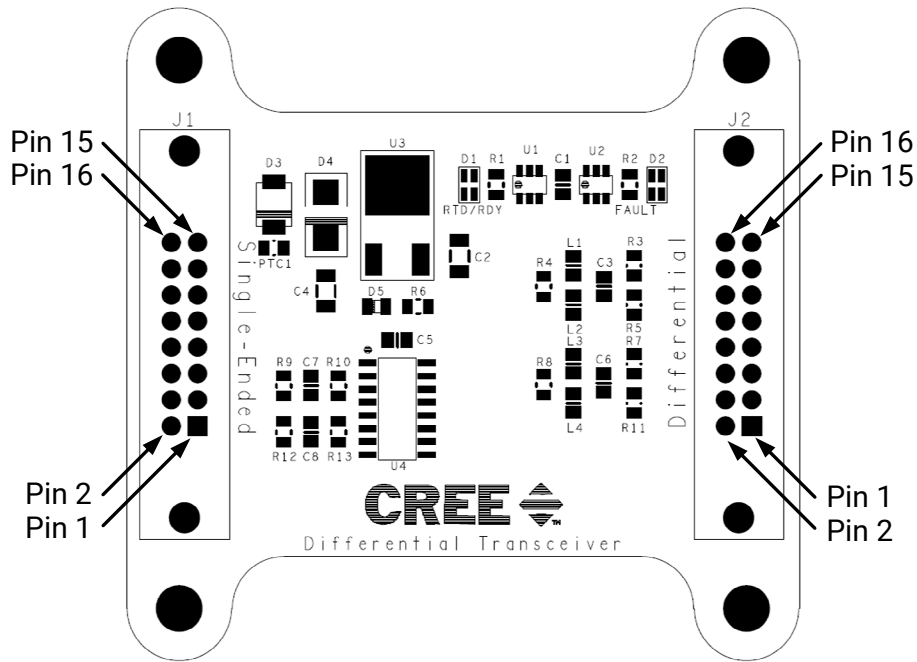
## Block Diagram



## Example Signal Chain



Board Interface



Connector	Name	Description
J1	Single-Ended	Signal Input (from microcontroller) <i>It is crucial to keep the single-ended connection as short as possible.</i>
J2	Differential	Signal Output (to Cree Dual-Channel Gate Driver)

Input Connector Information

- 71918-116LF - 16 Positions Header Connector 0.100" (2.54mm) Through Hole Gold

Suggested Mating Parts

- 71600-016LF - 16 Position Rectangular Receptacle Connector IDC Gold 28-30 AWG

Output Connector Information

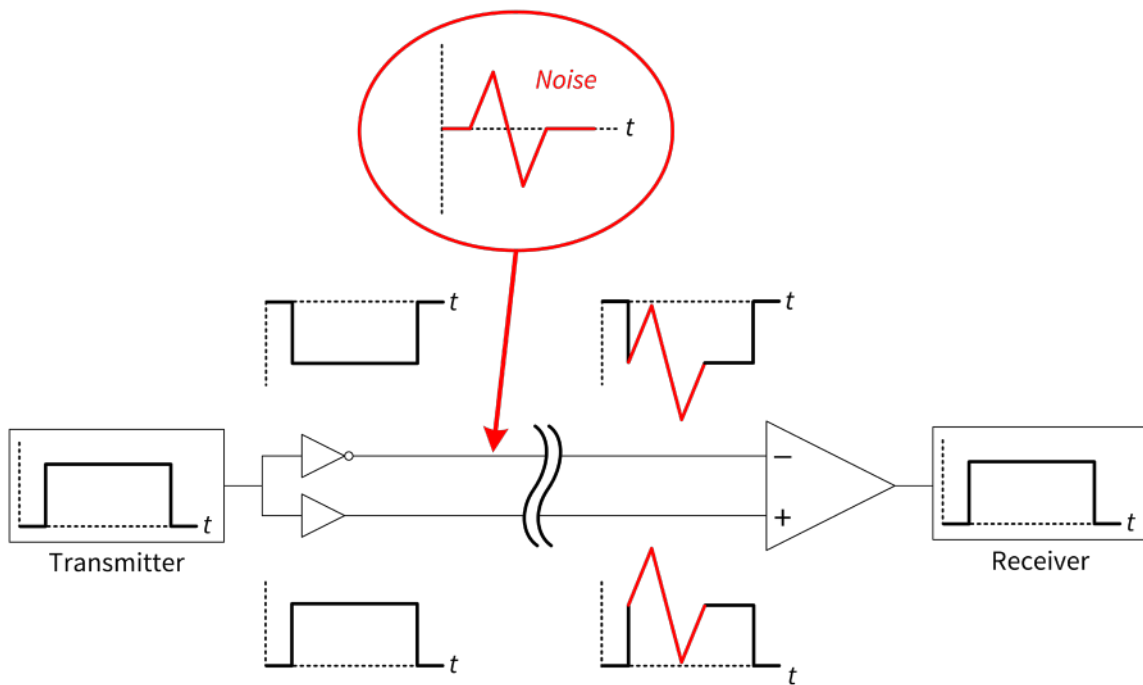
- HF365/16SF - Flat Ribbon Cable Gray 16 Conductors 0.050" (1.27mm) Flat Cable 10.0' (3.05m)
- 1700/16 100SF - Flat Ribbon Cable Multiple 16 (8 Pair Twisted) Conductors 0.050" (1.27mm) Flat Twisted Pair 10.0' (3.05m)



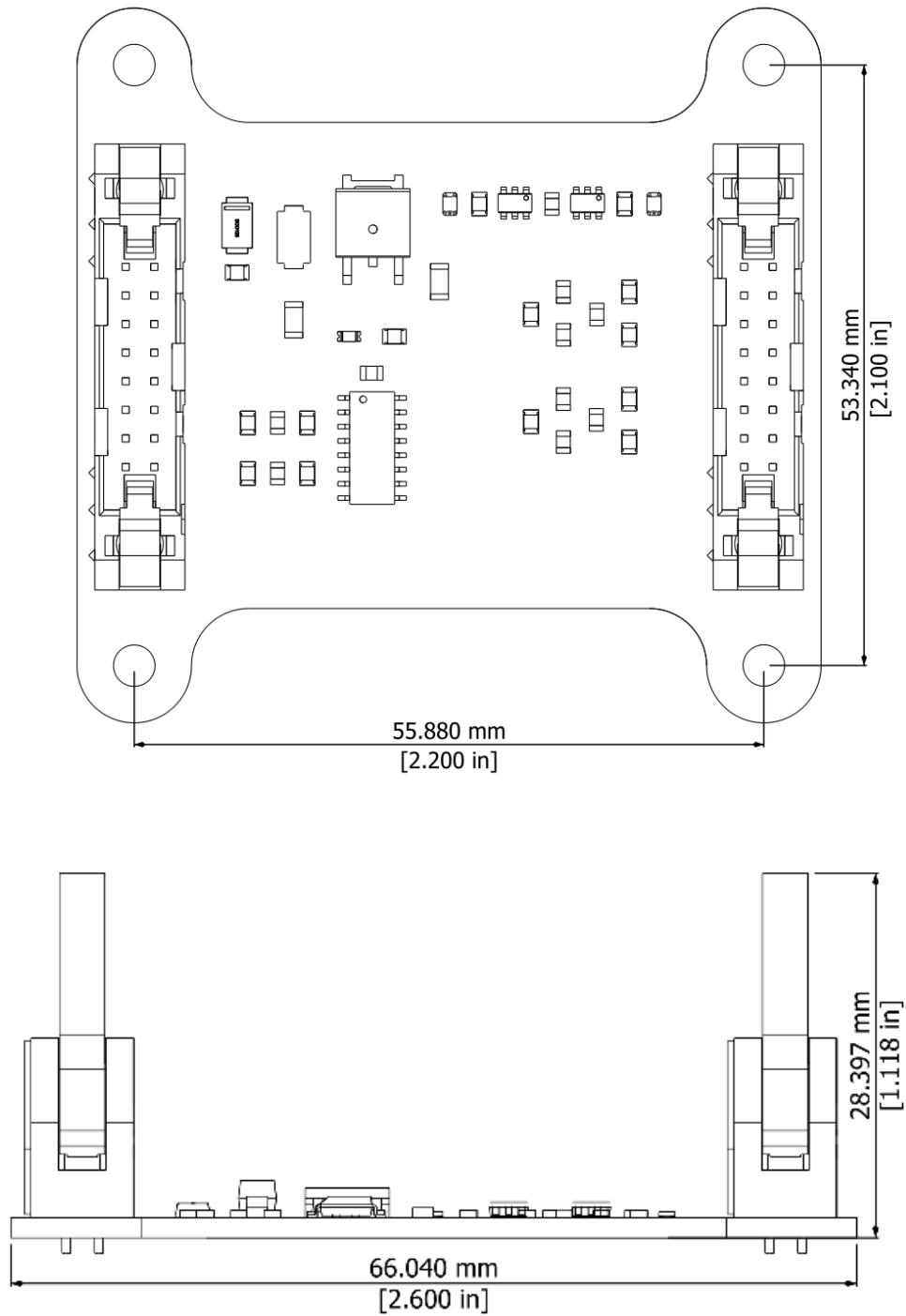
## Differential Signal Explanation

Signal integrity is of the utmost importance when controlling power devices with a gate driver. A gate driver that is susceptible to the powerful interference generated by power devices can induce a shoot-through condition in the module. The extremely fast turn-on and turn-off times during the switching events in a SiC power system create immense EMI that can easily couple onto the gate control signals. For this reason, differential signaling was chosen to replace standard, single-ended connections between the gate driver and control board.

Differential signaling significantly reduces the impact of radiated noise from the switching events of a power module. A single-ended signal can easily be converted to a differential signal by transmitting both the original signal and its complement in two closely coupled wires. At the receiver, the two signals are compared in order to reconstruct the original signal. The figure below illustrates this principle with an example of induced noise forced onto the cable somewhere between the transmitter and receiver. The noise affects both the original signal and the complement by the same magnitude assuming that the cables are consistently coupled. Thus, when the receiver compares the two signals, the difference is unaffected by the noise induced on the line and the intended original signal is created.



## Dimensions



## Supporting Links & Tools

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- [CAB450M12XM3: 1200 V, 450 A SiC Half-Bridge Module](#)
- [CGD12HBXMP: Gate Driver Evaluation Tool for the XM3 Module Platform](#)
- [CRD300DA12E-XM3: 300 kW Inverter Kit for Conduction-Optimized XM3 \(CPWR-AN30\)](#)
- [KIT-CRD-CIL12N-XM3: Dynamic Performance Evaluation Board for the XM3 Module \(CPWR-AN31\)](#)
- [CPWR-AN28: Module Mounting Application Note](#)
- [CPWR-AN29: Thermal Interface Material Application Note](#)

## Important Notes

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- This Cree-designed gate driver hardware for Cree components is meant to be used as an evaluation tool in a lab setting and to be handled and operated by highly qualified technicians or engineers. The hardware is not designed to meet any particular safety standards and the tool is not a production qualified assembly.
- Each part that is used in this gate driver and is manufactured by an entity other than Cree or one of Cree's affiliates is provided "as is" without warranty of any kind, including but not limited to any warranty of non-infringement, merchantability, or fitness for a particular purpose, whether express or implied. There is no representation that the operation of each such part will be uninterrupted or error free.
- This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, or air traffic control systems.
- The SiC MOSFET module switches at speeds beyond what is customarily associated with IGBT-based modules. Therefore, special precautions are required to realize optimal performance. The interconnection between the gate driver and module housing needs to be as short as possible. This will afford optimal switching time and avoid the potential for device oscillation. Also, great care is required to insure minimum inductance between the module and DC link capacitors to avoid excessive VDS overshoot.