

TECHNICAL DATA  
DATASHEET 4099, REV D

**Three-Phase IGBT BRIDGE, With Gate Driver and Optical Isolation**

**DESCRIPTION:** A 1200 VOLT, 80 AMP, THREE PHASE IGBT BRIDGE

ELECTRICAL CHARACTERISTICS PER IGBT DEVICE

(T<sub>j</sub>=25°C UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
<b>IGBT SPECIFICATIONS</b>					
Collector to Emitter Breakdown Voltage I <sub>C</sub> = 250 μA, V <sub>GE</sub> = 0V	BV <sub>CES</sub>	1200	-	-	V
Continuous Collector Current T <sub>C</sub> = 25 °C T <sub>C</sub> = 90 °C	I <sub>C</sub>	-	-	80 70	A
Pulsed Collector Current, 1mS	I <sub>CM</sub>	-	-	200	A
Gate to Emitter Voltage	V <sub>GE</sub>	-	-	+/-20	V
Gate-Emitter Leakage Current , V <sub>GE</sub> = +/-20V	I <sub>GES</sub>	-	-	+/- 100	nA
Gate Threshold Voltage, I <sub>C</sub> =2mA	V <sub>GE(TH)</sub>	3.0	-	6.0	V
Zero Gate Voltage Collector Current V <sub>CE</sub> = 1200 V, V <sub>GE</sub> =0V T <sub>i</sub> =25°C V <sub>CE</sub> = 900 V, V <sub>GE</sub> =0V T <sub>i</sub> =125°C	I <sub>CES</sub>	-	-	1 10	mA mA
Collector to Emitter Saturation Voltage, I <sub>C</sub> = 60A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 25 °C	V <sub>CE(SAT)</sub>	-	2.5	2.8	V
Maximum Thermal Resistance	R <sub>θJC</sub>	-	-	0.3	°C/W
<b>Brake IGBT SPECIFICATIONS</b>					
Continuous Collector Current T <sub>C</sub> = 25 °C T <sub>C</sub> = 90 °C	I <sub>C</sub>	-	-	40 25	A
Pulsed Collector Current, 0.5mS	I <sub>CM</sub>	-	-	120	A

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<b>OVER-TEMPERATURE SHUTDOWN</b>					
Over-Temperature Shutdown	Tsd	100	110	120	°C
Over-Temperature Shutdown Hysteresis			20		°C
Over-Temperature Output	Tco		10		10mV/°C
<b>ULTRAFAST DIODES RATING AND CHARACTERISTICS</b>					
Diode Peak Inverse Voltage	PIV	1200	-	-	V
Continuous Forward Current, T <sub>C</sub> = 90 °C	I <sub>F</sub>	-	-	60	A
Forward Surge Current, t <sub>p</sub> = 10 msec	I <sub>FSM</sub>	-	-	250	A
Diode Forward Voltage, I <sub>F</sub> = 70A	V <sub>F</sub>	-	2.0	2.3	V
Diode Reverse Recovery Time (I <sub>F</sub> =60A, V <sub>RR</sub> =600V, di/dt=200 A/μs)	t <sub>rr</sub>	-	180	250	nsec
Maximum Thermal Resistance	R <sub>θJC</sub>	-	-	0.55	°C/W
<b>GATE DRIVER</b>					
Supply Voltage	VCC	10	15	20	V
Input On Current	HIN, LIN	2		5.0	mA
Opto-Isolator Logic High Input Threshold	I <sub>th</sub>	-	1.6	-	mA
Input Reverse Breakdown Voltage	BV <sub>in</sub>	5.0	-	-	V
Input Forward Voltage @ I <sub>in</sub> = 5mC	V <sub>F</sub>	-	1.5	1.7	V
Under Voltage Lockout	VCCUV	11.5	-	12.5	V
ITRIP Reference Voltage <sup>(1)</sup>	Itrip-ref	2.9	3.0	3.1	V
Desaturation Over-Current Protection Blanking time <sup>(2)</sup>	t <sub>bl</sub>	3	5	TBD	μsec
Logic Inputs Fault, Fault Clr, SD Logic "1" Input Voltage		2.0	-	-	V
Logic Inputs Fault, Fault Clr, SD Logic "0" Input Voltage		-	-	0.8	V
Input-to-Output Turn On Delay	t <sub>ond</sub>	-		800	nsec
Output Turn On Rise Time	t <sub>r</sub>	-		100	
Input-to-Output Turn Off Delay	t <sub>offd</sub>	-		1000	
Output Turn Off Fall Time	t <sub>f</sub>	-		100	
At VCC=300V, IC=50A, T <sub>C</sub> = 25					
Input-Output Isolation Voltage	-	1000	-	-	V

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Maximum operating Junction Temperature	$T_{jmax}$	-40	-	150	°C
Maximum Storage Junction Temperature	$T_{jmax}$	-55	-	150	°C

## Pin Description

Pin Number	Function	Pin Number	Function
1	Isolated Input for Low-side IGBT of Phase A	17	+15V Rtn (Signal Ground)
2	Return for Input at 1	18	Fault Output <sup>(3)</sup>
3	Isolated Input for High-side IGBT of Phase A	19	Fault Clear Input <sup>(3)</sup>
4	Return for Input at 3	20	+5V Output
5	Isolated Input for Low -side IGBT of Phase B	21	Over-Current Trip Set point <sup>(3)</sup>
6	Return for Input at 5	22	DC Bus Current Output with Total Gain of 0.0365 V/A
7	Isolated Input for High-side IGBT of Phase B	23	Case Temperature Output with a gain of 0.010 V/°C
8	Return for Input at 7	24	Brake IGBT Gate Input
9	Isolated Input for Low-side IGBT of Phase C	25	Brake IGBT Emitter Input. This input is internally connected to Signal Ground
10	Return for Input at 9	26 to 30	DC Bus return
11	Isolated Input for High-side IGBT of Phase C	31 , 32	Brake Resistor Terminal. Brake Resistor Shall be Connected Between These Terminals and +VDC
12	Return for Input at 11	33 to 37	DC Bus "+VDC" input
13	NC	38 to 42	Phase C output
14	NC	43 to 47	Phase B output
15	SD <sup>(3)</sup>	48 to 52	Phase A output
16	+15V Input	Case	Isolated

- (1) ITRIP Cycle-by cycle current limit is internally set to 70A peak. The set point can be lowered by connecting a resistor between Itrip-ref and Gnd. The set point can be increased by connecting a resistor between Itrip-ref and +5V ref
- (2) Desaturation blanking maximum time is TBD and is only provided at the low-side IGBTs.
- (3) See application notes on page 6.



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**Application Notes:****a- Shutdown Feature:**

- 1- SD is a dual function input/output, active low input. It is internally pulled high. As a low input shuts down all IGBTs regardless of the Hin and Lin signals.
- 2- SD is also internally activated by the over-temperature shutdown, over-current limit, under-voltage shutdown, and desaturation protection.
- 3- Over-temperature shutdown and over-current limit are not latching features.
- 4- Under-voltage shutdown is automatically reset after 300 msec once the VCC rises above the threshold limit.
- 5- Desaturation shutdown is a latching feature and internally reset after 300 msec.
- 6- When any of the internal protection features is activated, SD is pulled down.
- 7- SD can be used to shutdown all IGBTs except the brake IGBT by an external command. An open collector switch shall be used to pull down SD externally.
- 8- Also, SD can be used as a fault condition output. Low output at SD indicates a fault situation.

**b- Fault Output Feature:**

- 1- Pin 18 Flt is a dual function pin. It is internally pulled high. If pulled down, it will freeze the status of all the six IGBTs regardless of the Hin and Lin signals
- 2- Pin 18 as an output reports desaturation protection activation. When desaturation protection is activated a low output for about 9  $\mu$ sec is reported.
- 3- If any other protection feature is activated, it will not be reported by Pin 18.

**c- Fault Clear Output:**

- 1- Pin 19 is a fault clear input. It can be used to reset a latching fault condition, due to desaturation protection.
- 2- Pin 19 is internally pulled down. A latching fault due to desaturation can be cleared by pulling high this input.
- 3- An internal fault clear is activated after 300 msec delay. If desired to clear the fault earlier, this input can be used.

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