

## Molding Type Module IGBT, 2-in-1 Package, 600 V and 400 A



Double INT-A-PAK

### FEATURES

- Low  $V_{CE(on)}$  trench IGBT technology
- Low switching losses
- 5  $\mu$ s short circuit capability
- $V_{CE(on)}$  with positive temperature coefficient
- Maximum junction temperature 175 °C
- Low inductance case
- Fast and soft reverse recovery antiparallel FWD
- Isolated copper baseplate using DCB (Direct Copper Bonding) technology
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

$V_{CES}$	600 V
$I_C$ at $T_C = 80\text{ °C}$	400 A
$V_{CE(on)}$ (typical) at $I_C = 400\text{ A}$ , $25\text{ °C}$	1.60 V
Speed	8 kHz to 30 kHz
Package	Double INT-A-PAK
Circuit	Half bridge

### TYPICAL APPLICATIONS

- UPS
- Switching mode power supplies
- Electronic welders

### DESCRIPTION

Vishay's IGBT power module provides ultralow conduction loss as well as short circuit ruggedness. It is designed for applications such as UPS and SMPS.

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ °C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	$V_{CES}$		600	V
Gate to emitter voltage	$V_{GES}$		$\pm 20$	
Collector current	$I_C$	$T_C = 25\text{ °C}$	530	A
		$T_C = 80\text{ °C}$	400	
Pulsed collector current	$I_{CM}^{(1)}$	$t_p = 1\text{ ms}$	800	
Diode continuous forward current	$I_F$		400	
Diode maximum forward current	$I_{FM}$		800	
Maximum power dissipation	$P_D$	$T_J = 175\text{ °C}$	1600	W
Short circuit withstand time	$t_{SC}$	$T_J = 125\text{ °C}$	5	$\mu$ s
$I^2t$ -value, diode	$I^2t$	$V_R = 0\text{ V}$ , $t = 10\text{ ms}$ , $T_J = 125\text{ °C}$	10 900	A <sup>2</sup> s
RMS isolation voltage	$V_{ISOL}$	$f = 50\text{ Hz}$ , $t = 1\text{ min}$	2500	V

#### Note

<sup>(1)</sup> Repetitive rating: pulse width limited by maximum junction temperature.

**IGBT ELECTRICAL SPECIFICATIONS** ( $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$ , $I_C = 2\text{ mA}$ , $T_J = 25\text{ }^{\circ}\text{C}$	600	-	-	V
Collector to emitter saturation voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$ , $I_C = 400\text{ A}$ , $T_J = 25\text{ }^{\circ}\text{C}$	-	1.6	2.05	
		$V_{GE} = 15\text{ V}$ , $I_C = 400\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$	-	2.0	-	
Gate to emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$ , $I_C = 4\text{ mA}$ , $T_J = 25\text{ }^{\circ}\text{C}$	4.0	-	6.5	
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0\text{ V}$ , $T_J = 25\text{ }^{\circ}\text{C}$	-	-	5.0	mA
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = V_{GES}$ , $V_{CE} = 0\text{ V}$ , $T_J = 25\text{ }^{\circ}\text{C}$	-	-	400	nA

**SWITCHING CHARACTERISTICS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400\text{ V}$ , $I_C = 400\text{ A}$ , $R_g = 1.3\text{ }\Omega$ , $V_{GE} = \pm 15\text{ V}$ , $T_J = 25\text{ }^{\circ}\text{C}$	-	35	-	ns
Rise time	$t_r$		-	70	-	
Turn-off delay time	$t_{d(off)}$		-	180	-	
Fall time	$t_f$		-	75	-	
Turn-on switching loss	$E_{on}$	$V_{CC} = 400\text{ V}$ , $I_C = 400\text{ A}$ , $R_g = 1.3\text{ }\Omega$ , $V_{GE} = \pm 15\text{ V}$ , $T_J = 175\text{ }^{\circ}\text{C}$	-	14.1	-	mJ
Turn-off switching loss	$E_{off}$		-	10.0	-	
Turn-on delay time	$t_{d(on)}$		-	37	-	ns
Rise time	$t_r$		-	72	-	
Turn-off delay time	$t_{d(off)}$		-	220	-	
Fall time	$t_f$		-	84	-	
Turn-on switching loss	$E_{on}$	$V_{GE} = 0\text{ V}$ , $V_{CE} = 30\text{ V}$ , $f = 1.0\text{ MHz}$	-	23.2	-	mJ
Turn-off switching loss	$E_{off}$		-	16.8	-	
Input capacitance	$C_{ies}$		-	30.8	-	nF
Output capacitance	$C_{oes}$		-	2.12	-	
Reverse transfer capacitance	$C_{res}$		-	0.92	-	
SC data	$I_{SC}$	$t_{sc} \leq 5\text{ }\mu\text{s}$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$ , $V_{CC} = 360\text{ V}$ , $V_{CEM} \leq 600\text{ V}$	-	TBD	-	A
Internal gate resistance	$R_{gint}$		-	1.3	-	$\Omega$
Stray inductance	$L_{CE}$		-	-	20	nH
Module lead resistance, terminal to chip	$R_{CC'+EE'}$	$T_C = 25\text{ }^{\circ}\text{C}$	-	0.35	-	m $\Omega$

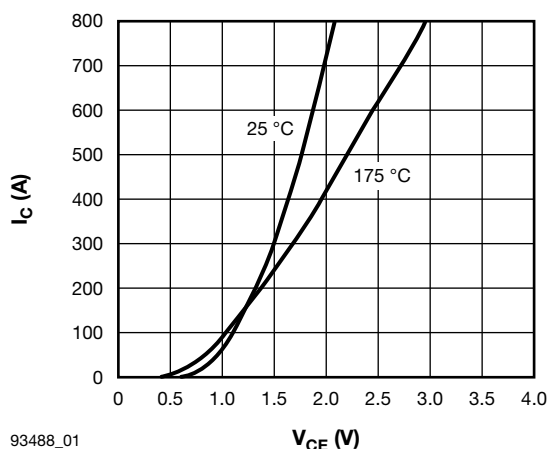
**DIODE ELECTRICAL SPECIFICATIONS** ( $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Diode forward voltage	V <sub>F</sub>	I <sub>F</sub> = 400 A	T <sub>J</sub> = 25 °C	-	1.38	1.80	V
			T <sub>J</sub> = 125 °C	-	1.41	-	
Diode reverse recovery charge	Q <sub>rr</sub>	I <sub>F</sub> = 400 A, V <sub>R</sub> = 300 V, dI/dt = -7000 A/μs, V <sub>GE</sub> = -15 V	T <sub>J</sub> = 25 °C	-	15.5	-	μC
			T <sub>J</sub> = 125 °C	-	28.5	-	
Diode peak reverse recovery current	I <sub>rr</sub>		T <sub>J</sub> = 25 °C	-	265	-	A
			T <sub>J</sub> = 125 °C	-	335	-	
Diode reverse recovery energy	E <sub>rec</sub>		T <sub>J</sub> = 25 °C	-	3.5	-	mJ
			T <sub>J</sub> = 125 °C	-	7.5	-	



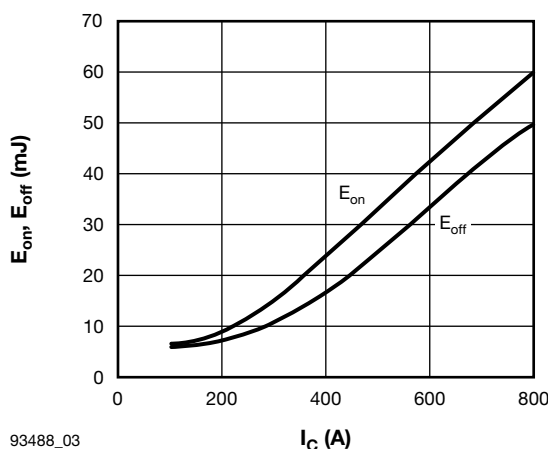
## THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T <sub>J</sub>		-	-	175	°C
Storage temperature range	T <sub>Stg</sub>		-40	-	125	
Junction to case per ½ module	IGBT Diode R <sub>thJC</sub>		-	-	0.094	K/W
			-	-	0.158	
Case to sink	R <sub>thCS</sub>	Conductive grease applied	-	0.035	-	
Mounting torque		Power terminal screw: M6	2.5 to 5.0			Nm
		Mounting screw: M6	3.0 to 5.0			
Weight			300			g



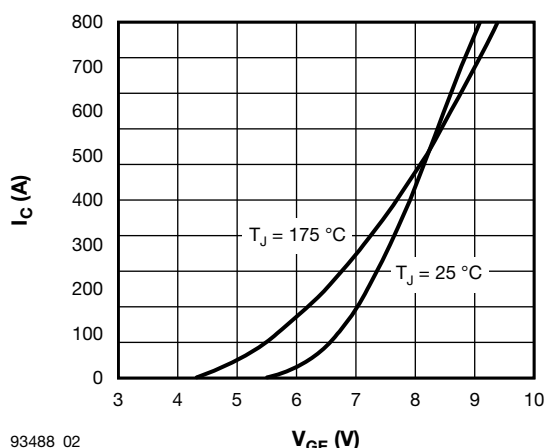
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Fig. 1 - IGBT Typical Output Characteristics  
 $V_{GE} = 15 \text{ V}$



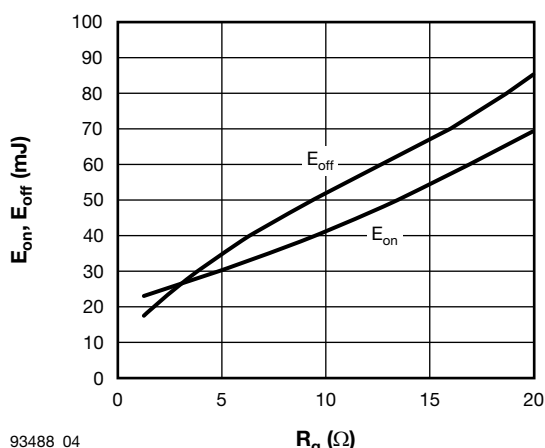
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Fig. 3 - IGBT Switching Loss vs. Collector Current  
 $V_{CC} = 600 \text{ V}$ ,  $R_g = 1.3 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_J = 175 \text{ °C}$



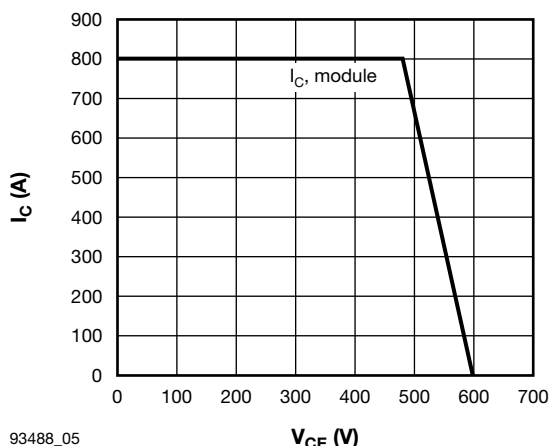
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Fig. 2 - IGBT Typical Transfer Characteristics  
 $V_{CE} = 20 \text{ V}$



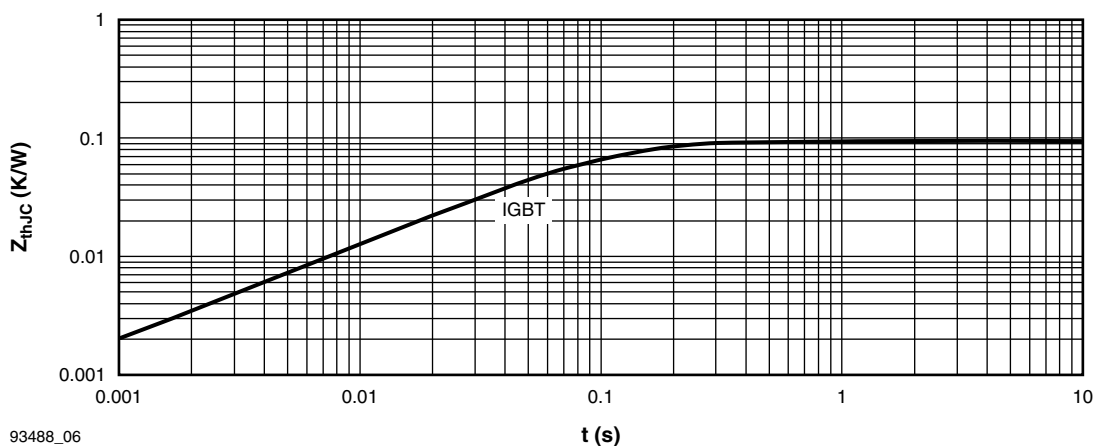
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Fig. 4 - Switching Loss vs. Gate Resistor  
 $V_{CE} = 600 \text{ V}$ ,  $I_C = 400 \text{ A}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_J = 175 \text{ °C}$



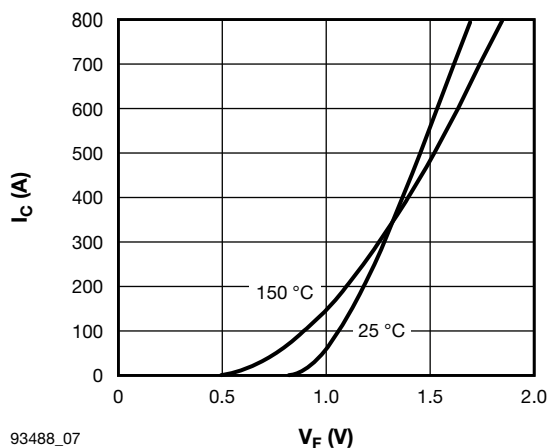
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Fig. 5 - RBSOA  
 $R_g = 1.3 \, \Omega$ ,  $V_{GE} = \pm 15 \, \text{V}$ ,  $T_J = 175 \, ^\circ\text{C}$



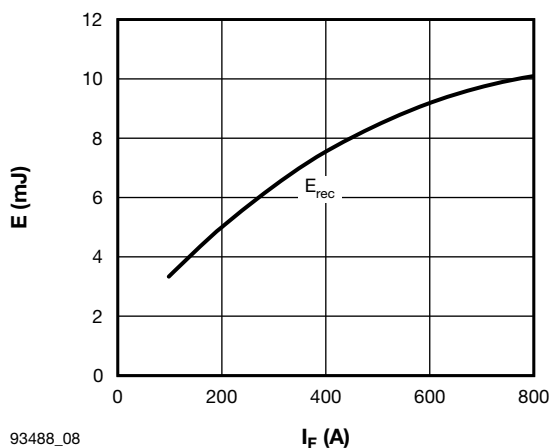
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Fig. 6 - IGBT Transient Thermal Impedance



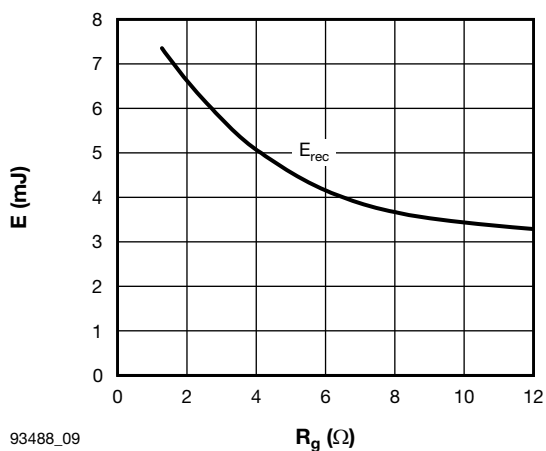
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Fig. 7 - Forward Characteristics of Diode



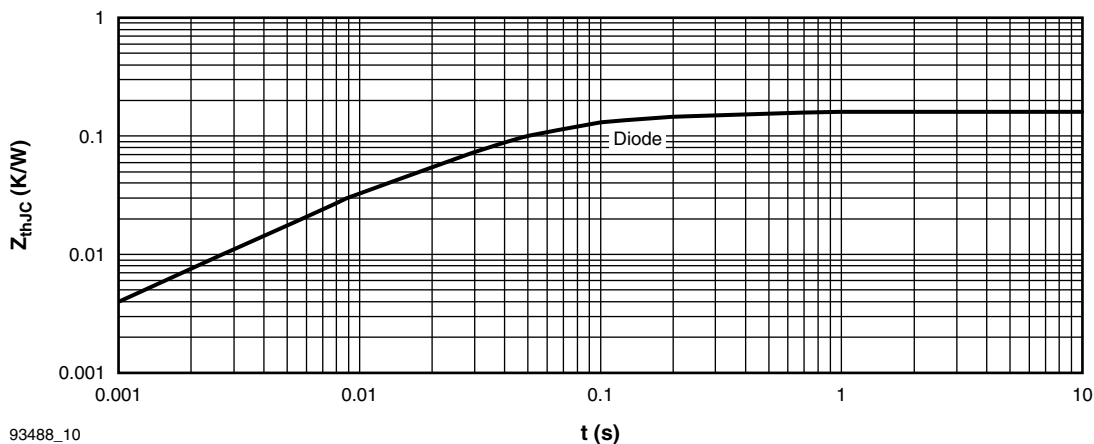
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Fig. 8 - Diode Switching Loss vs.  $I_F$   
 $V_{CC} = 600 \, \text{V}$ ,  $R_g = 1.3 \, \Omega$ ,  $V_{GE} = -15 \, \text{V}$ ,  $T_J = 125 \, ^\circ\text{C}$



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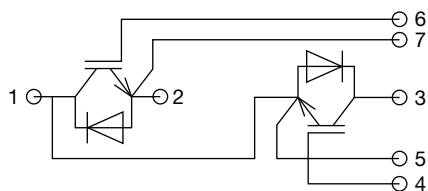
Fig. 9 - Diode Switching Loss vs. Gate Resistance  
 $V_{CC} = 600$  V,  $I_C = 400$  A,  $V_{GE} = -15$  V,  $T_J = 125$  °C



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Fig. 10 - Diode Transient Thermal Impedance

## CIRCUIT CONFIGURATION

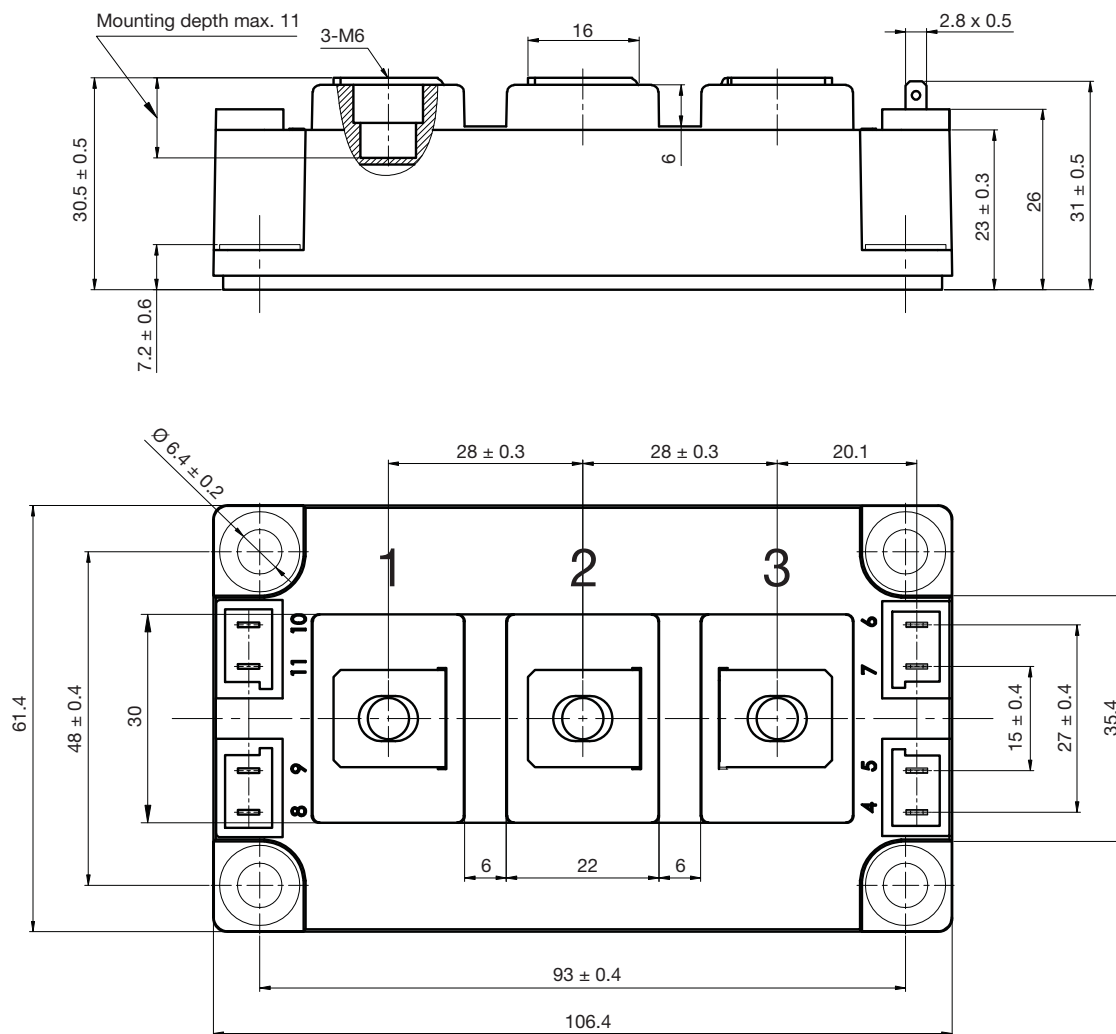


LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95525">www.vishay.com/doc?95525</a>



## Double INT-A-PAK

**DIMENSIONS** in millimeters (inches)





## Disclaimer

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