

INT-A-PAK "Half-Bridge" (Ultrafast Speed IGBT), 209 A



INT-A-PAK

FEATURES

- Generation 5 Non Punch Through (NPT) technology
- Ultrafast: Optimized for hard switching speed 8 kHz to 60 kHz
- Low $V_{CE(on)}$
- 10 μ s short circuit capability
- Square RBSOA
- Positive $V_{CE(on)}$ temperature coefficient
- HEXFRED® antiparallel diode with ultrasoft reverse recovery characteristics
- Industry standard package
- Al_2O_3 DBC
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed for industrial level



RoHS
COMPLIANT

PRODUCT SUMMARY

V_{CES}	600 V
I_C DC	209 A
$V_{CE(on)}$ at 200 A, 25 °C	2.6 V

BENEFITS

- Benchmark efficiency for UPS and welding application
- Rugged transient performance
- Direct mounting on heatsink
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	209	A
		$T_C = 80\text{ °C}$	142	
Pulsed collector current	I_{CM}		400	
Clamped inductive load current	I_{LM}		400	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	178	
		$T_C = 80\text{ °C}$	121	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	781	W
		$T_C = 80\text{ °C}$	438	
Isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ minute	2500	V

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CE)}$	$V_{GE} = 0\text{ V}$, $I_C = 500\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	1.95	2.1	
		$V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$	-	2.6	2.84	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.28	2.5	
		$V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.14	3.48	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 500\text{ }\mu\text{A}$	3	4.2	6	mA
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	0.005	0.2	
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	0.01	15	V
Diode forward voltage drop	V_{FM}	$I_C = 100\text{ A}$	-	1.39	1.78	
		$I_C = 200\text{ A}$	-	1.64	2.2	
		$I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.32	1.69	
		$I_C = 200\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.67	2.30	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 200	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on switching loss	E_{on}	$I_C = 200\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 10\text{ }\Omega$, $L = 200\text{ }\mu\text{H}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	3.65	-	mJ
Turn-off switching loss	E_{off}		-	6.9	-	
Total switching loss	E_{tot}		-	10.55	-	
Turn-on switching loss	E_{on}	$I_C = 200\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 10\text{ }\Omega$, $L = 200\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.8	-	
Turn-off switching loss	E_{off}		-	7.8	-	
Total switching loss	E_{tot}		-	11.6	-	
Turn-on delay time	$t_{d(on)}$		-	507	-	ns
Rise time	t_r		-	133	-	
Turn-off delay time	$t_{d(off)}$		-	538	-	
Fall time	t_f		-	92	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 400\text{ A}$, $R_g = 27\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0	Fullsquare			
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $V_{CC} = 400\text{ V}$, $V_P = 600\text{ V}$, $R_g = 27\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0	10	-	-	
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{CC} = 400\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	226	260	ns
Diode peak reverse current	I_{rr}		-	17	20	A
Diode recovery charge	Q_{rr}		-	1900	2600	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{CC} = 400\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	290	330	ns
Diode peak reverse current	I_{rr}		-	25	30	A
Diode recovery charge	Q_{rr}		-	3600	5000	nC

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating junction and storage temperature range	T_J, T_{Stg}	- 40	-	150	$^{\circ}\text{C}$
Junction to case per leg	IGBT	-	0.13	0.16	$^{\circ}\text{C/W}$
	Diode	-	0.19	0.32	
Case to sink per module	R_{thCS}	-	0.1	-	
Mounting torque	case to heatsink	-	-	4	Nm
	case to terminal 1, 2, 3	-	-	3	
Weight		-	185	-	g

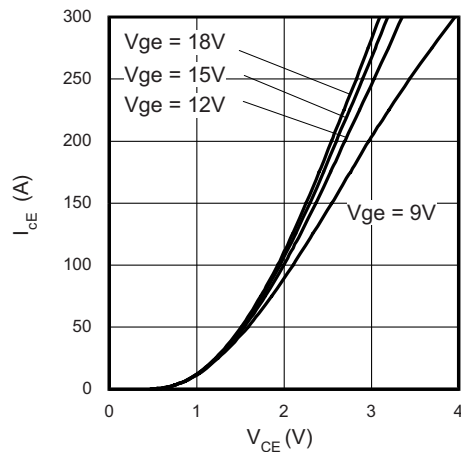


Fig. 1 - Typical IGBT Output Characteristics
 $T_J = 25^{\circ}\text{C}$, $t_p = 500 \mu\text{s}$

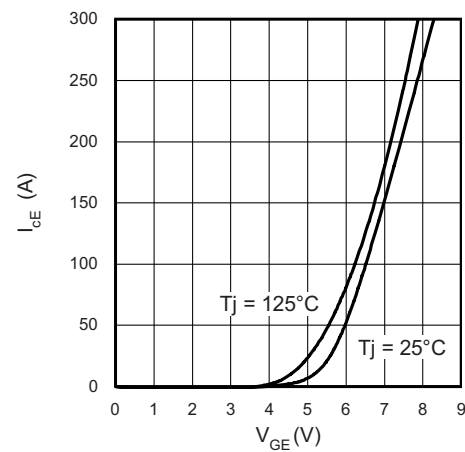


Fig. 3 - Typical Transfer Characteristics
 $V_{CE} = 20 \text{ V}$, $t_p = 500 \mu\text{s}$

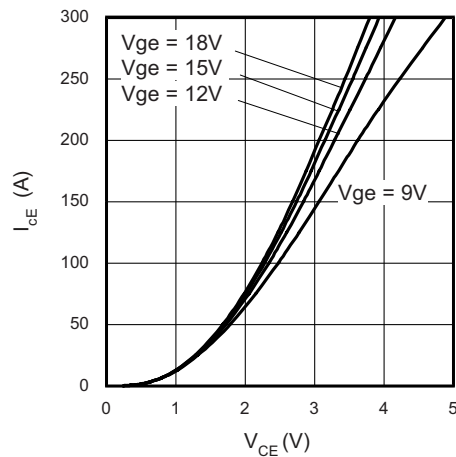


Fig. 2 - Typical IGBT Output Characteristics
 $T_J = 125^{\circ}\text{C}$, $t_p = 500 \mu\text{s}$

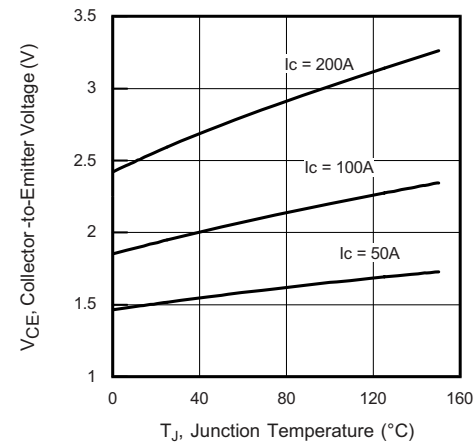


Fig. 4 - Typical Collector to Emitter Voltage vs.
Junction Temperature

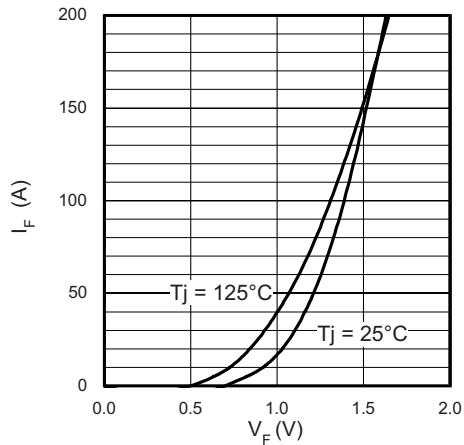


Fig. 5 - Diode Forward Characteristics,
 $t_p = 500 \mu s$

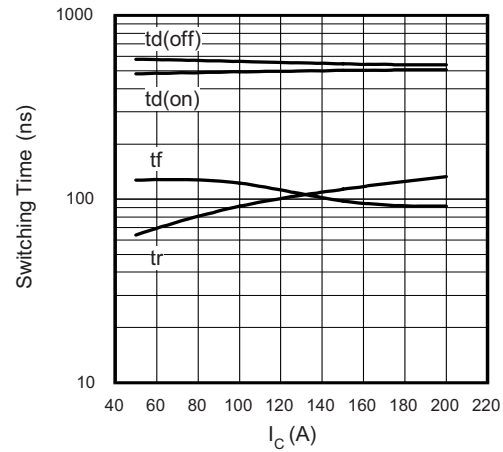


Fig. 8 - Typical Switching Time vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

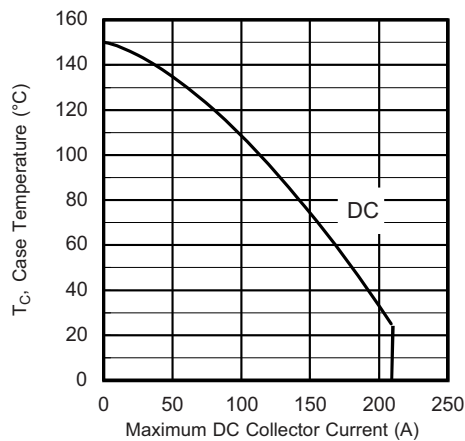


Fig. 6 - Maximum Collector Current vs.
Case Temperature

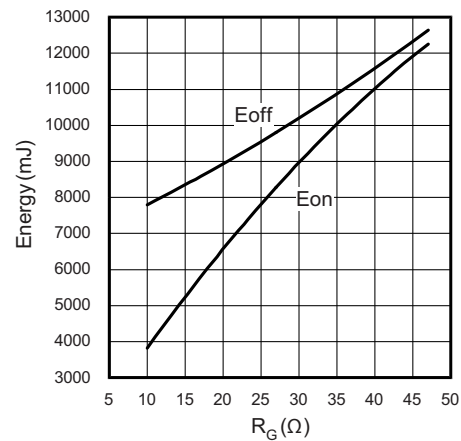


Fig. 9 - Typical Energy Loss vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

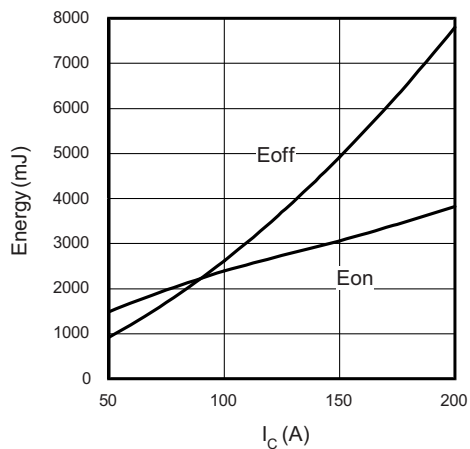


Fig. 7 - Typical Energy Loss vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

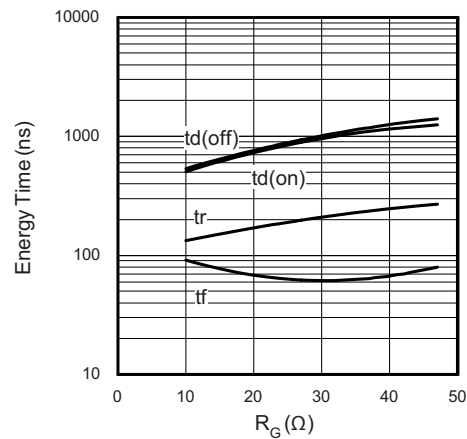


Fig. 10 - Typical Switching Time vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

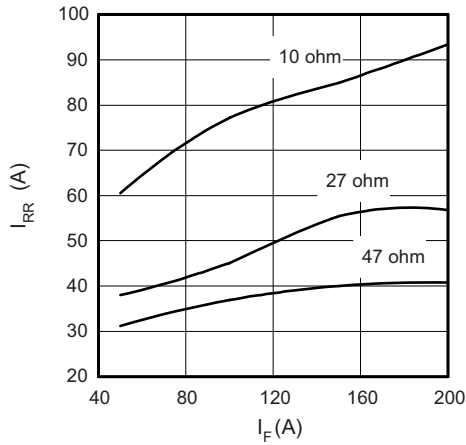


Fig. 11 - Typical Diode I_{rr} vs. I_F
 $T_J = 125^\circ\text{C}$

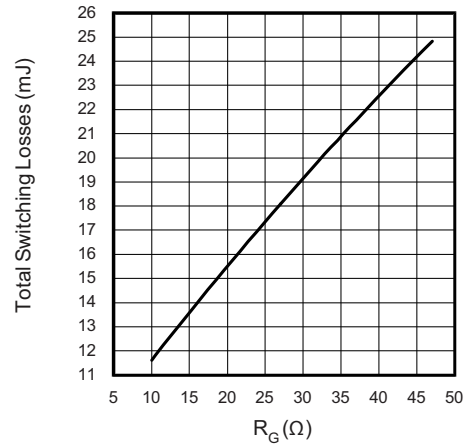


Fig. 14 - Typical Switching Losses vs. Gate Resistance
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$,
 $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

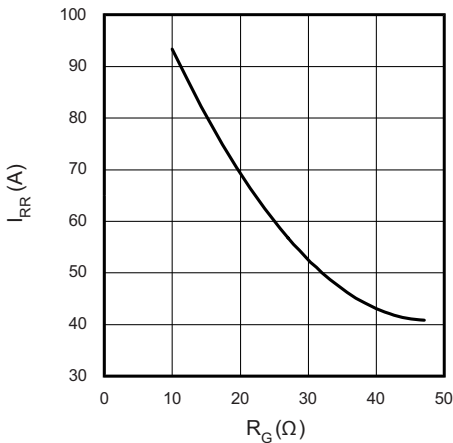


Fig. 12 - Typical Diode I_{rr} vs. R_g
 $T_J = 125^\circ\text{C}$, $I_F = 200\ \text{A}$

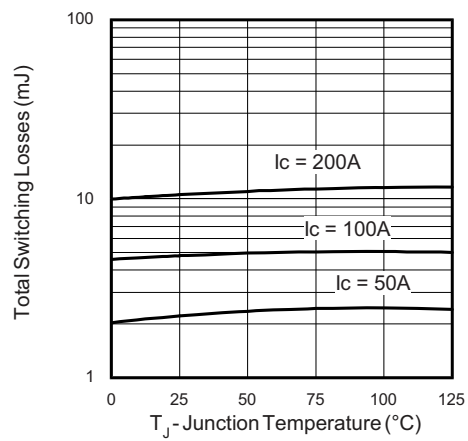


Fig. 15 - Typical Switching Losses vs.
Junction Temperature;
 $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

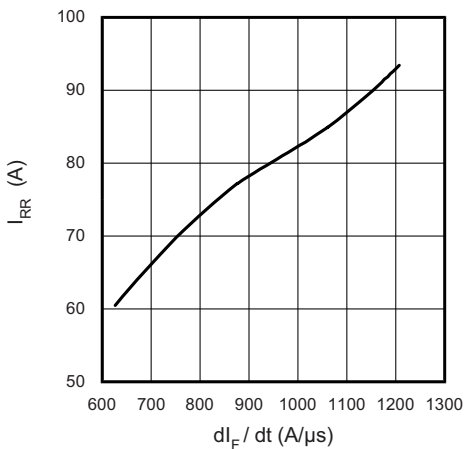


Fig. 13 - Typical Diode I_{rr} vs. di_F/dt
 $T_J = 125^\circ\text{C}$, $V_{CC} = 360\ \text{V}$, $I_F = 200\ \text{A}$, $V_{GE} = 15\ \text{V}$

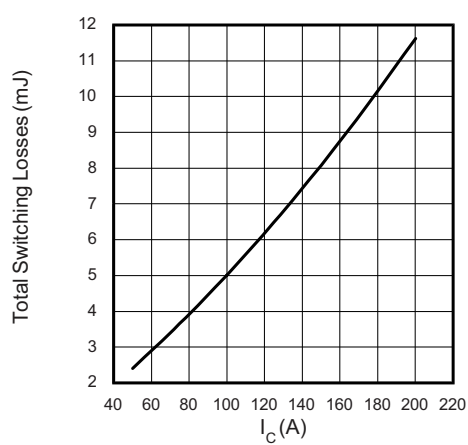


Fig. 16 - Typical Switching Losses vs.
Collector to Emitter Current;
 $T_J = 125^\circ\text{C}$, $R_{g1} = 10\ \Omega$, $R_{g2} = 0\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

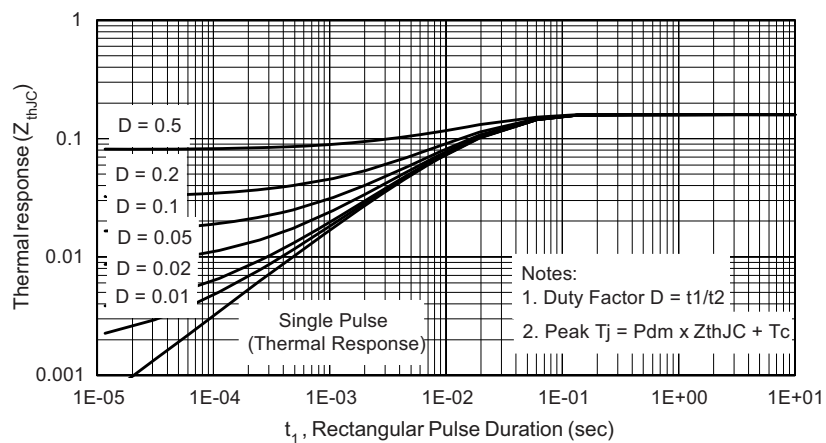


Fig. 17 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

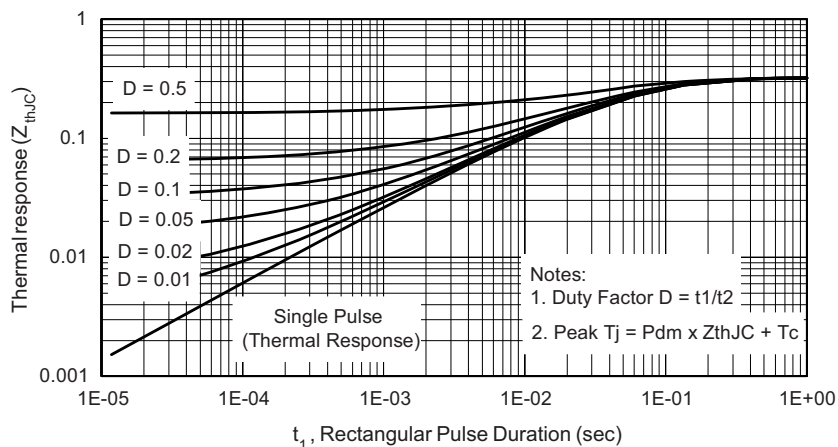
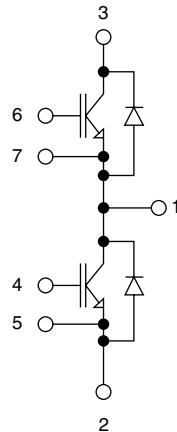


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

**ORDERING INFORMATION TABLE**

Device code	G	B	200	T	S	60	N	PbF
	①	②	③	④	⑤	⑥	⑦	⑧

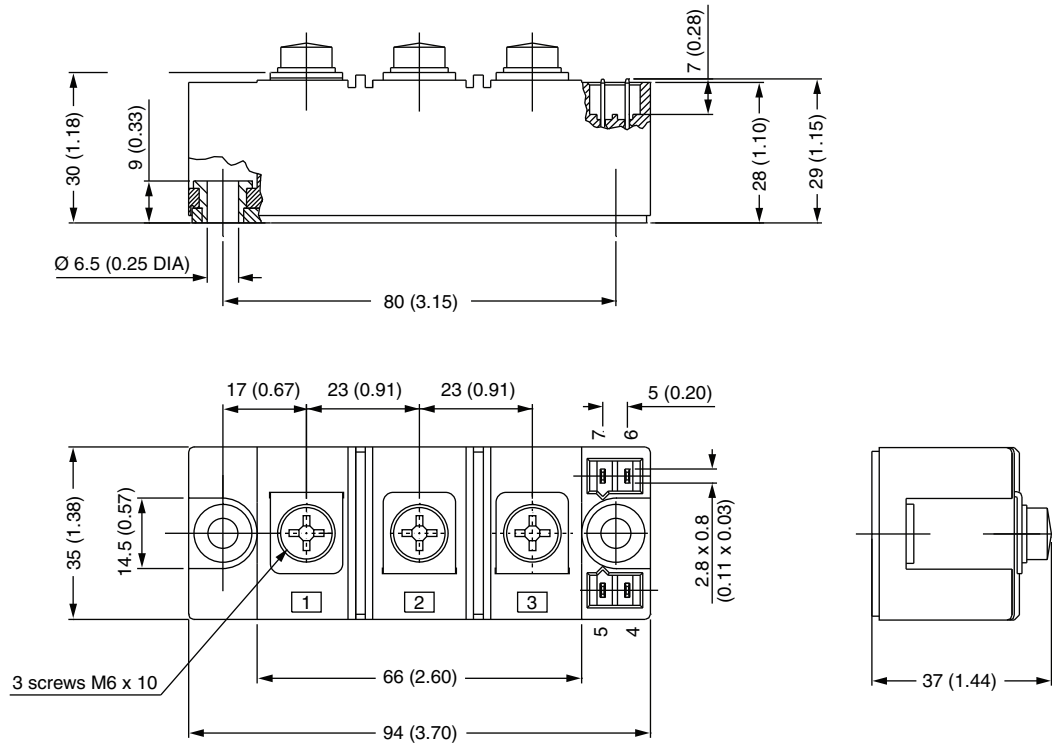
- | | | |
|----------|---|--|
| 1 | - | Insulated Gate Bipolar Transistor (IGBT) |
| 2 | - | B = IGBT Generation 5 NPT |
| 3 | - | Current rating (200 = 200 A) |
| 4 | - | Circuit configuration (T = Half-bridge) |
| 5 | - | Package indicator (S = INT-A-PAK) |
| 6 | - | Voltage rating (60 = 600 V) |
| 7 | - | Speed/type (N = Ultrafast IGBT) |
| 8 | - | Lead (Pb)-free |

CIRCUIT CONFIGURATION

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95173

INT-A-PAK IGBT/Thyristor

DIMENSIONS in millimeters (inches)





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