

INT-A-PAK “Half-Bridge” (Ultrafast Speed IGBT), 108 A


INT-A-PAK

FEATURES

- Gen 5 non punch through (NPT) technology
- Ultrafast: optimized for hard switching speed
- 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
- Designed for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

PRIMARY CHARACTERISTICS

V_{CES}	600 V
I_C DC	108 A
$V_{CE(on)}$ at 100 A, 25 °C	2.6 V
Speed	8 kHz to 30 kHz
Package	INT-A-PAK
Circuit configuration	Half bridge

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	$T_C = 25\text{ °C}$	108	A
		$T_C = 80\text{ °C}$	74	
Pulsed collector current	I_{CM}		200	
Clamped inductive load current	I_{LM}		200	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	106	
		$T_C = 80\text{ °C}$	69	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	390	W
		$T_C = 80\text{ °C}$	219	
Isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ min}$	2500	V
Operating junction temperature range	T_J		-40 to +150	°C
Storage temperature range	T_{Stg}		-40 to +150	



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	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$	-	1.95	2.1	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	2.6	2.85	
		$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2.21	2.44	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.05	3.38	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 500\text{ }\mu\text{A}$	3	4.6	6	
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	0.01	0.1	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	3.7	10	
Diode forward voltage drop	V_{FM}	$I_C = 50\text{ A}$	-	1.35	1.66	V
		$I_C = 100\text{ A}$	-	1.57	1.96	
		$I_C = 50\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.27	1.50	
		$I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.57	1.89	
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}	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 4.7\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	0.6	-	mJ
Turn-off switching loss	E_{off}		-	1.1	-	
Total switching loss	E_{tot}		-	1.7	-	
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 4.7\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	0.8	-	
Turn-off switching loss	E_{off}		-	1.3	-	
Total switching loss	E_{tot}		-	2.1	-	
Turn-on delay time	$t_{d(on)}$		-	197	-	ns
Rise time	t_r		-	50	-	
Turn-off delay time	$t_{d(off)}$		-	225	-	
Fall time	t_f	-	72	-		
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 200\text{ A}, R_g = 27\text{ }\Omega, V_{GE} = 15\text{ V to }0$	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}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 25\text{ }^\circ\text{C}$	-	116	140	ns
Diode peak reverse current	I_{rr}		-	11	15	A
Diode recovery charge	Q_{rr}		-	600	1050	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	152	190	ns
Diode peak reverse current	I_{rr}		-	16	20	A
Diode recovery charge	Q_{rr}		-	1215	1900	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	-	0.23	0.32	$^\circ\text{C}/\text{W}$	
	Diode	-	0.38	0.64		
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	

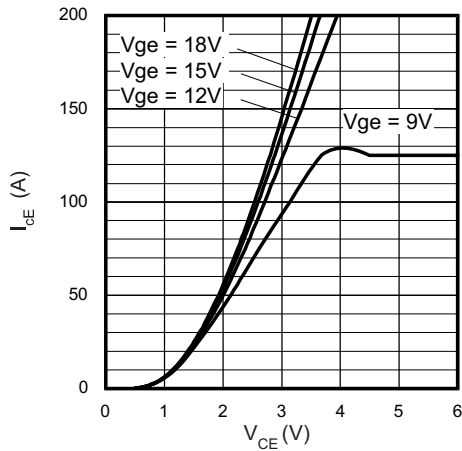


Fig. 1 - Typical IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$, $t_p = 500 \mu\text{s}$

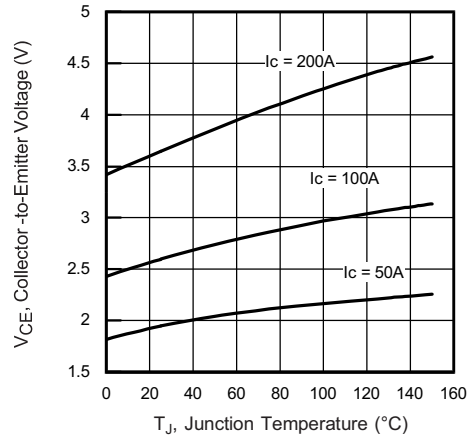


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature,
 $V_{GE} = 15 \text{ V}$, $500 \mu\text{s}$ pulse width

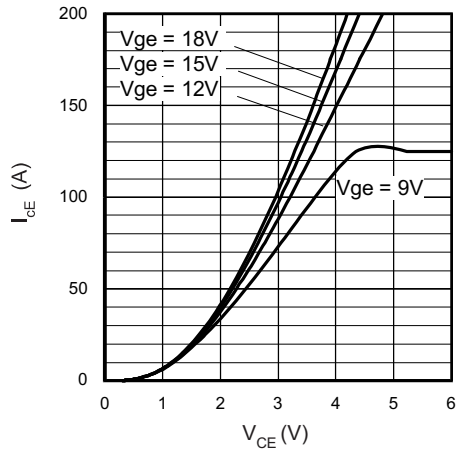


Fig. 2 - Typical IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$, $t_p = 500 \mu\text{s}$

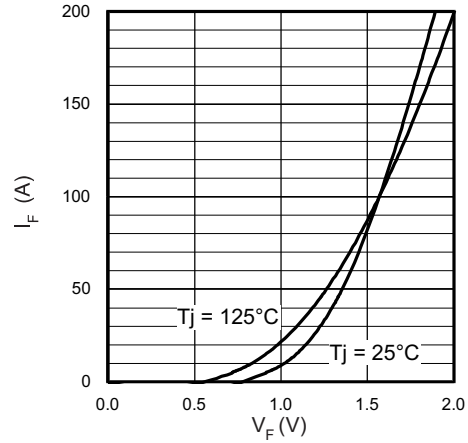


Fig. 5 - Diode Forward Characteristics, $t_p = 500 \mu\text{s}$

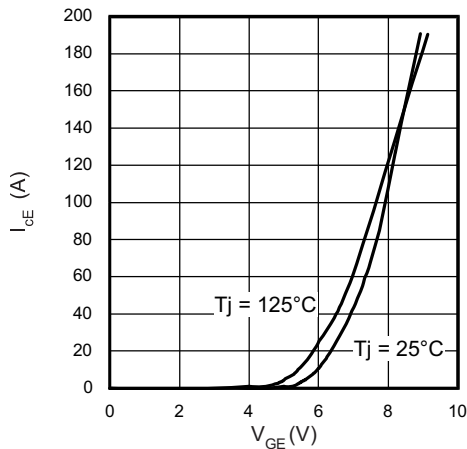


Fig. 3 - Typical Transfer Characteristics
 $V_{CE} = 20 \text{ V}$, $t_p = 500 \mu\text{s}$

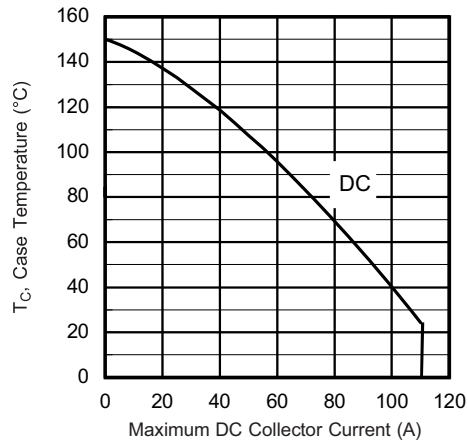


Fig. 6 - Maximum Collector Current vs. Case Temperature

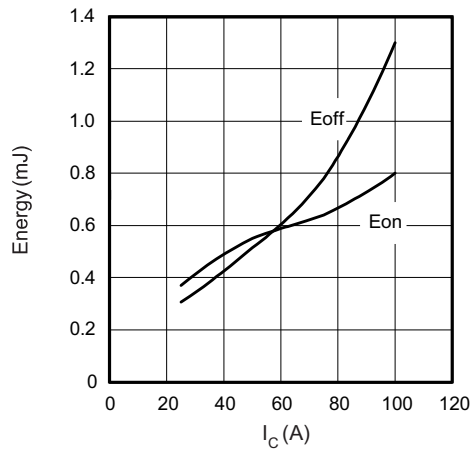


Fig. 7 - Typical Energy Loss vs. I_C , $T_J = 125\text{ }^\circ\text{C}$, $L = 200\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$, $R_g = 4.7\text{ }\Omega$, $V_{GE} = 15\text{ V}$

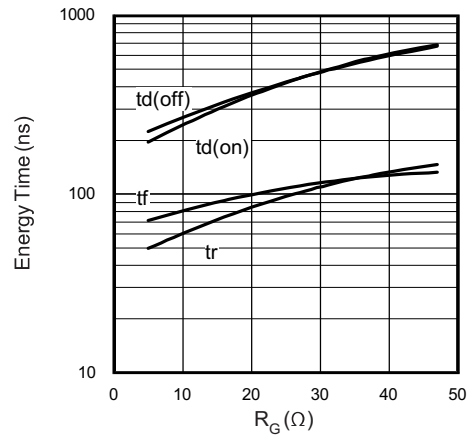


Fig. 10 - Typical Switching Time vs. R_g , $T_J = 125\text{ }^\circ\text{C}$, $L = 200\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$, $I_{CE} = 100\text{ A}$, $V_{GE} = 15\text{ V}$

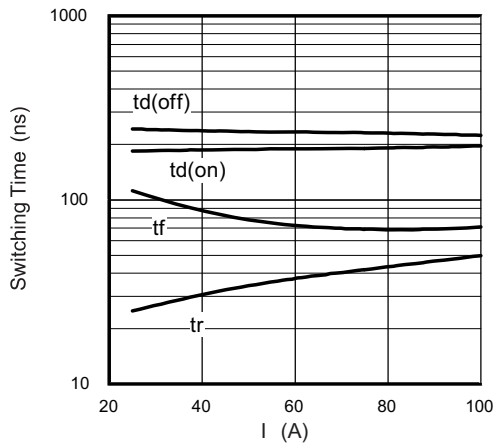


Fig. 8 - Typical Switching Time vs. I_C , $T_J = 125\text{ }^\circ\text{C}$, $L = 200\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$, $R_g = 4.7\text{ }\Omega$, $V_{GE} = 15\text{ V}$

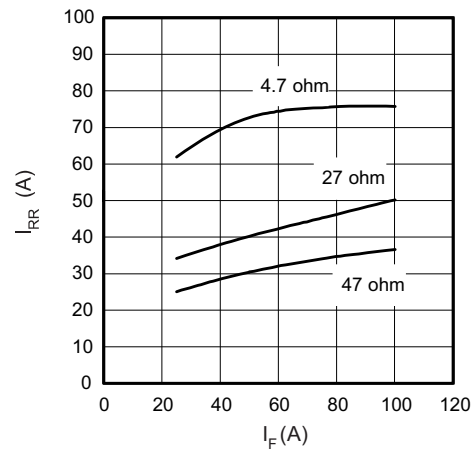


Fig. 11 - Typical Diode I_{rr} vs. I_F , $T_J = 125\text{ }^\circ\text{C}$

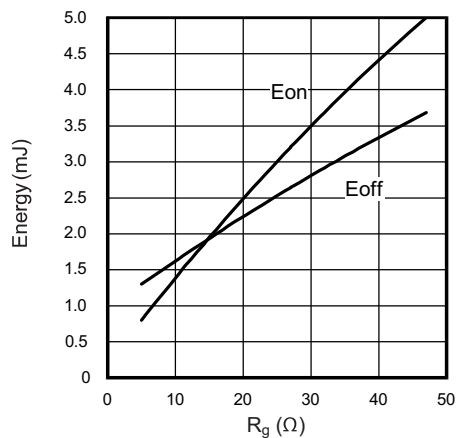


Fig. 9 - Typical Energy Loss vs. R_g , $T_J = 125\text{ }^\circ\text{C}$, $L = 200\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$, $I_{CE} = 100\text{ A}$, $V_{GE} = 15\text{ V}$

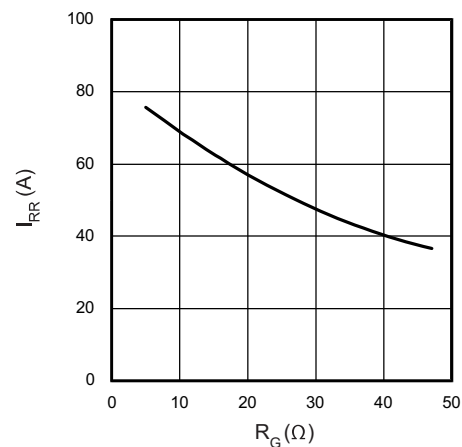


Fig. 12 - Typical Diode I_{rr} vs. R_g , $T_J = 125\text{ }^\circ\text{C}$, $I_F = 100\text{ A}$

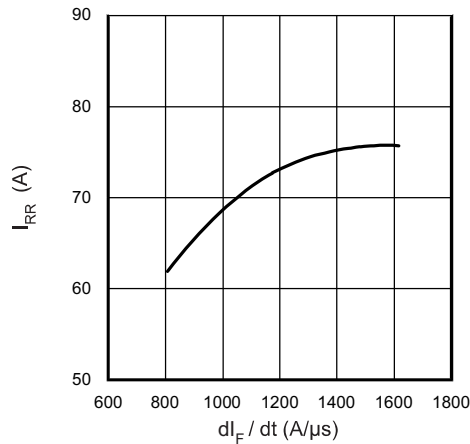


Fig. 13 - Typical Diode I_{RR} vs. dI_F/dt ,
 $T_J = 125^\circ\text{C}$, $V_{CC} = 360\text{ V}$, $I_F = 150\text{ A}$, $V_{GE} = 15\text{ V}$

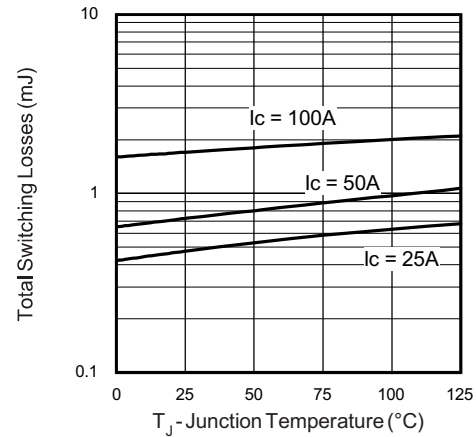


Fig. 15 - Typical Switching Losses vs. Junction Temperature,
 $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

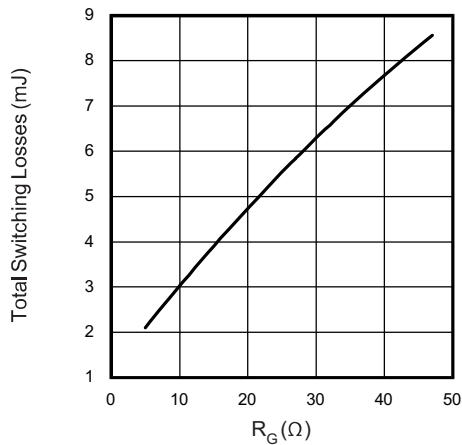


Fig. 14 - Typical Switching Losses vs. Gate Resistance,
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$,
 $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

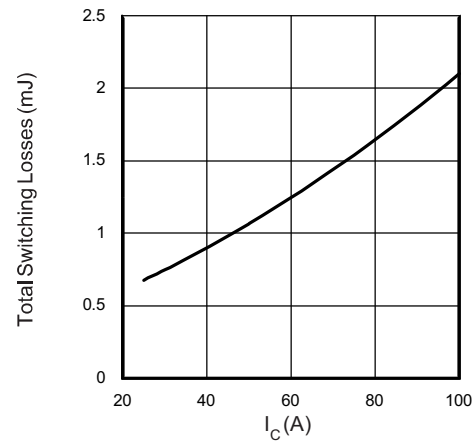


Fig. 16 - Typical Switching Losses vs. Collector to Emitter Current,
 $T_J = 125^\circ\text{C}$, $R_{g1} = 4.7\ \Omega$, $R_{g2} = 0\ \Omega$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

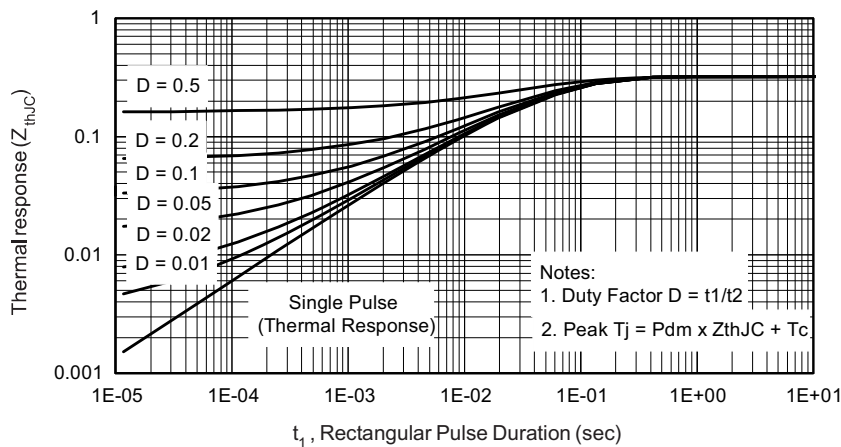


Fig. 17 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

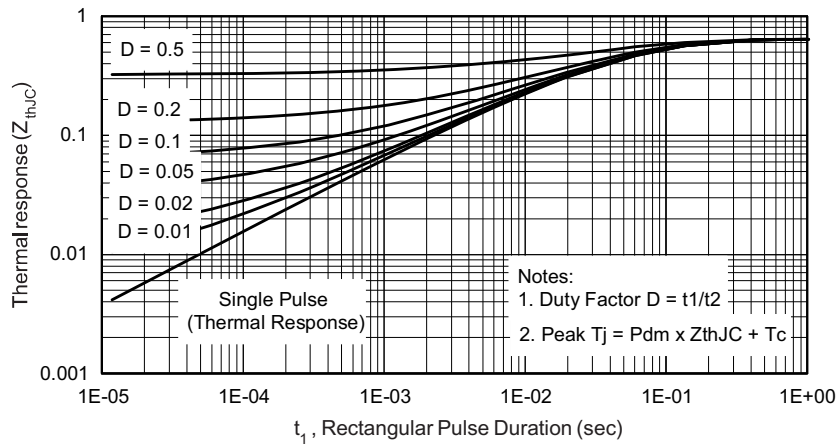
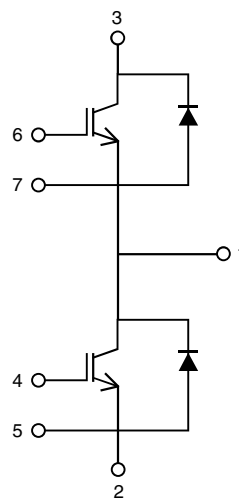


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

ORDERING INFORMATION TABLE

Device code	VS-	G	B	100	T	S	60	N	PbF
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- 1** - Vishay Semiconductors product
- 2** - Insulated gate bipolar transistor (IGBT)
- 3** - B = IGBT Gen 5 NPT
- 4** - Current rating (100 = 100 A)
- 5** - Circuit configuration (T = half bridge)
- 6** - Package indicator (S = INT-A-PAK)
- 7** - Voltage rating (60 = 600 V)
- 8** - Speed / type (N = ultrafast IGBT)
- 9** - Lead (Pb)-free

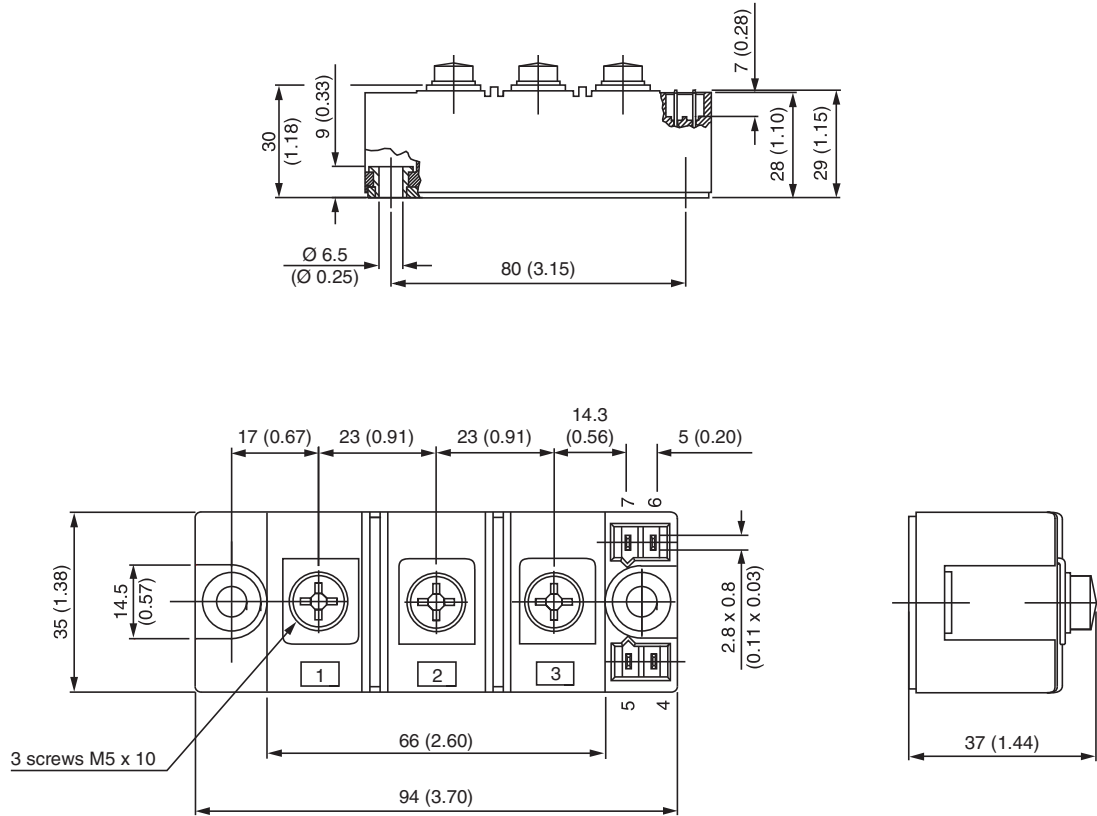
CIRCUIT CONFIGURATION

LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95543
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INT-A-PAK IGBT

DIMENSIONS in millimeters (inches)





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