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

INT-A-PAK

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	209 A
$V_{CE(on)}$ at 200 A, 25 °C	2.6 V
Speed	8 kHz to 30 kHz
Package	INT-A-PAK
Circuit	Half bridge with SMD gate resistor

FEATURES

- Generation 5 Non Punch Through (NPT) technology
- Ultrafast: optimized for hard switching speed
- Low $V_{CE(on)}$
- 10 μs 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

Pb-free
RoHS COMPLIANT

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 °C	209	A
		T_C = 80 °C	142	
Pulsed collector current	I_{CM}		400	
Clamped inductive load current	I_{LM}		400	
Diode continuous forward current	I_F	T_C = 25 °C	178	
		T_C = 80 °C	121	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation	P_D	T_C = 25 °C	781	W
		T_C = 80 °C	438	
Isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	V
Operating junction temperature range	T_J		-40 to +150	°C

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

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Turn-on switching loss	E_{on}	I_C = 200 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 10 Ω, L = 200 μH, T_J = 25 °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 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 10 Ω, L = 200 μH, T_J = 125 °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 °C, I_C = 400 A, R_g = 27 Ω, V_{GE} = 15 V to 0	Fullsquare			
Short circuit safe operating area	SCSOA	T_J = 150 °C, V_{CC} = 400 V, V_P = 600 V, R_g = 27 Ω, V_{GE} = 15 V to 0	10	-	-	
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_{CC} = 400 V, T_J = 25 °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 A, dI_F/dt = 200 A/μs, V_{CC} = 400 V, T_J = 125 °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	°C
Junction to case per leg	IGBT	R_{thJC}	-	0.13	0.16	°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

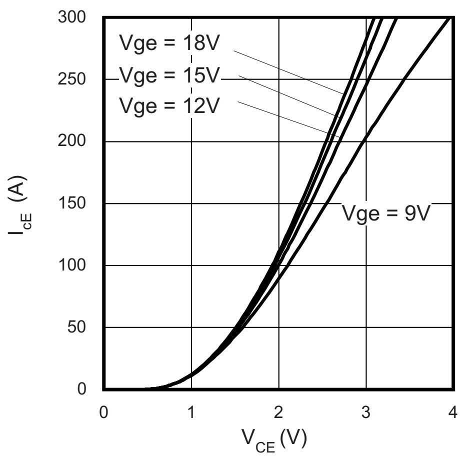


Fig. 1 - Typical IGBT Output Characteristics
T_J = 25 °C, t_p = 500 μs

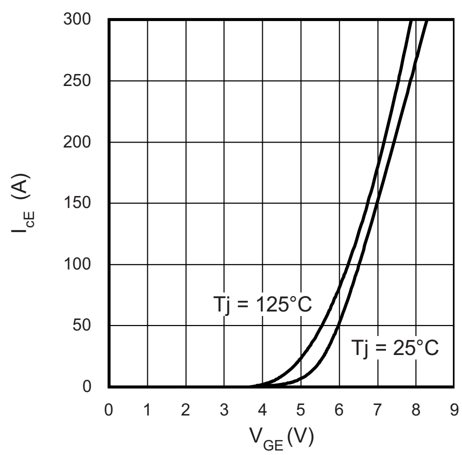


Fig. 3 - Typical Transfer Characteristics
V_{CE} = 20 V, t_p = 500 μs

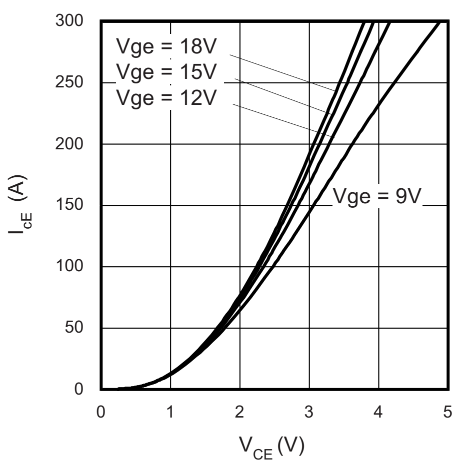


Fig. 2 - Typical IGBT Output Characteristics
T_J = 125 °C, t_p = 500 μs

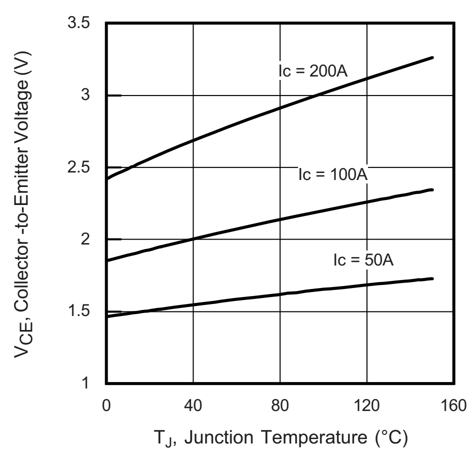


Fig. 4 - Typical Collector to Emitter Voltage vs.
Junction Temperature

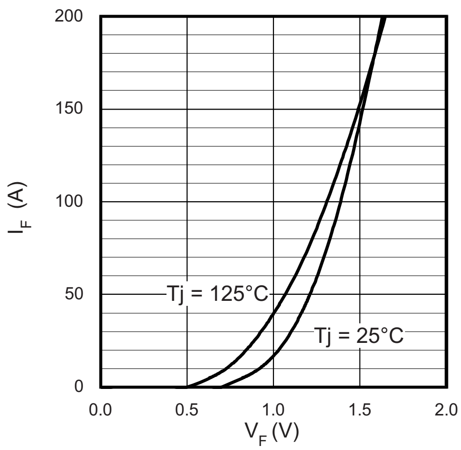


Fig. 5 - Diode Forward Characteristics, t_p = 500 μs

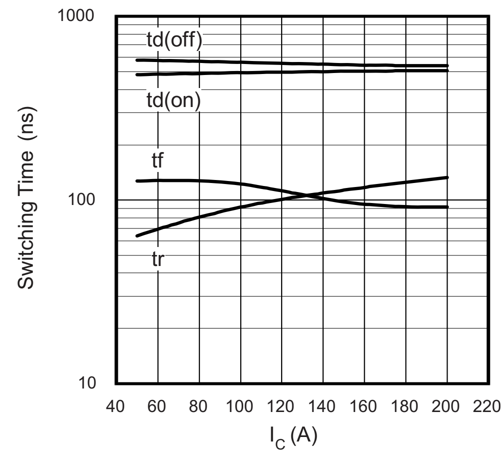


Fig. 8 - Typical Switching Time vs. I_C
T_J = 125 °C, L = 200 μH, V_{CC} = 360 V, R_g = 10 Ω, V_{GE} = 15 V

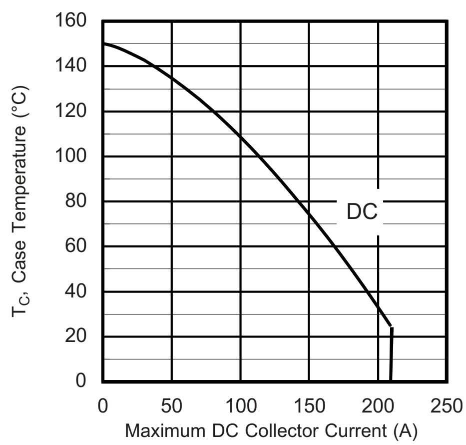


Fig. 6 - Maximum Collector Current vs. Case Temperature

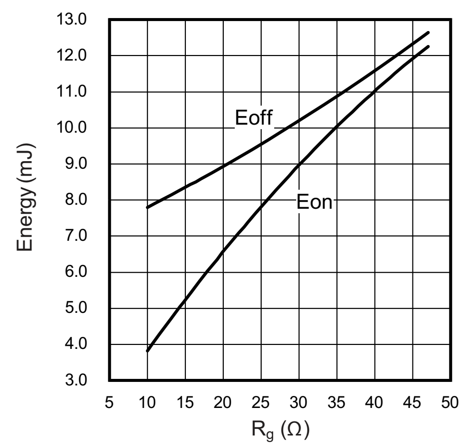


Fig. 9 - Typical Energy Loss vs. R_g
T_J = 125 °C, L = 200 μH, V_{CC} = 360 V, I_{CE} = 200 A, V_{GE} = 15 V

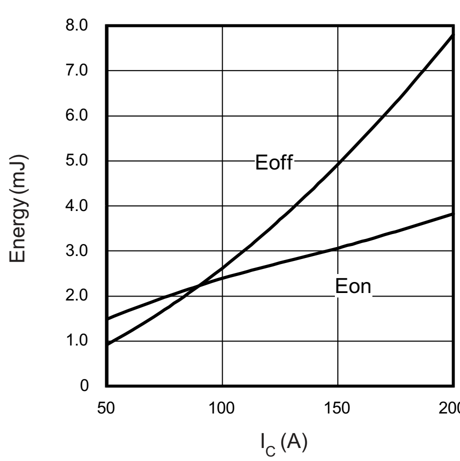


Fig. 7 - Typical Energy Loss vs. I_C
T_J = 125 °C, L = 200 μH, V_{CC} = 360 V, R_g = 10 Ω, V_{GE} = 15 V

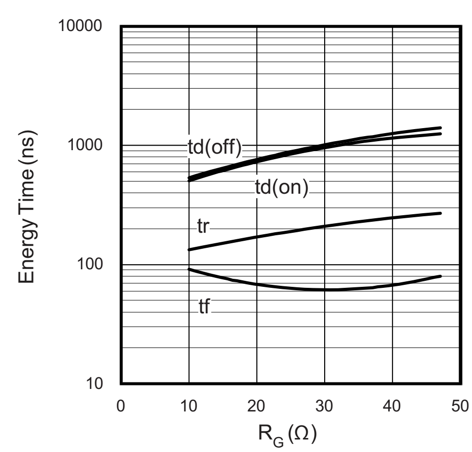


Fig. 10 - Typical Switching Time vs. R_g
T_J = 125 °C, L = 200 μH, V_{CC} = 360 V, I_{CE} = 200 A, V_{GE} = 15 V

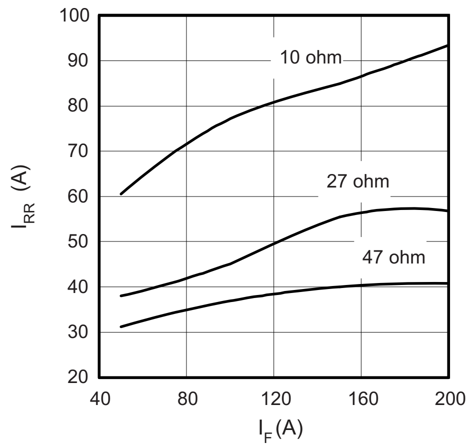


Fig. 11 - Typical Diode I_{rr} vs. I_F
T_J = 125 °C

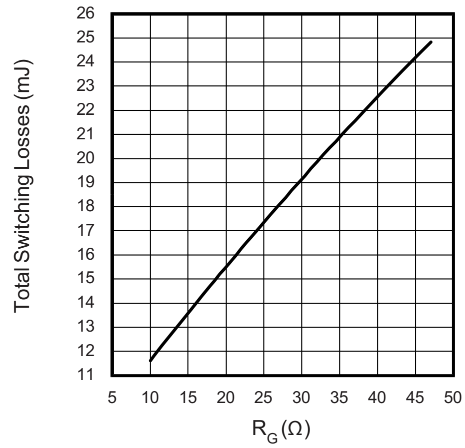


Fig. 14 - Typical Switching Losses vs. Gate Resistance
T_J = 125 °C, L = 200 µH, R_g = 10 Ω,
V_{CC} = 360 V, V_{GE} = 15 V

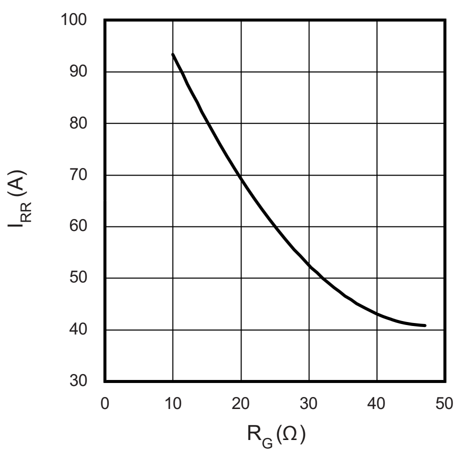


Fig. 12 - Typical Diode I_{rr} vs. R_g
T_J = 125 °C, I_F = 200 A

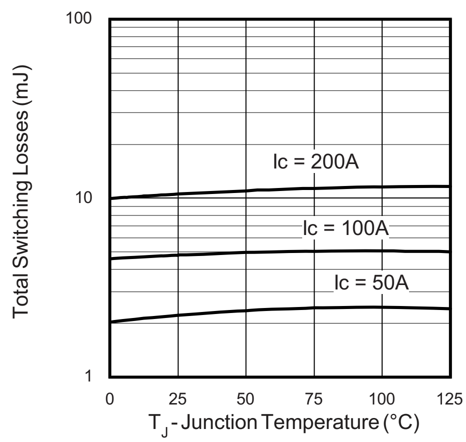


Fig. 15 - Typical Switching Losses vs.
Junction Temperature;
L = 200 µH, R_g = 10 Ω, V_{CC} = 360 V, V_{GE} = 15 V

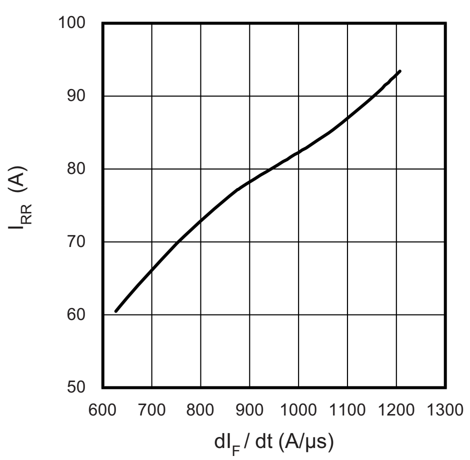


Fig. 13 - Typical Diode I_{rr} vs. dI_F/dt
T_J = 125 °C, V_{CC} = 360 V, I_F = 200 A, V_{GE} = 15 V

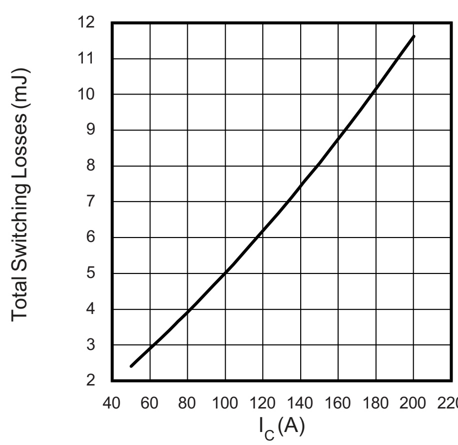


Fig. 16 - Typical Switching Losses vs.
Collector to Emitter Current;
T_J = 125 °C,R_{g1} = 10 Ω, R_{g2} = 0 Ω, V_{CC} = 360 V, V_{GE} = 15 V

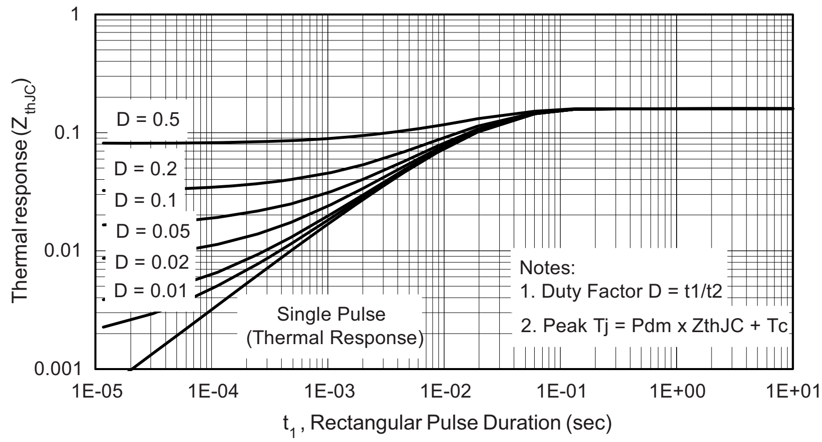


Fig. 17 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

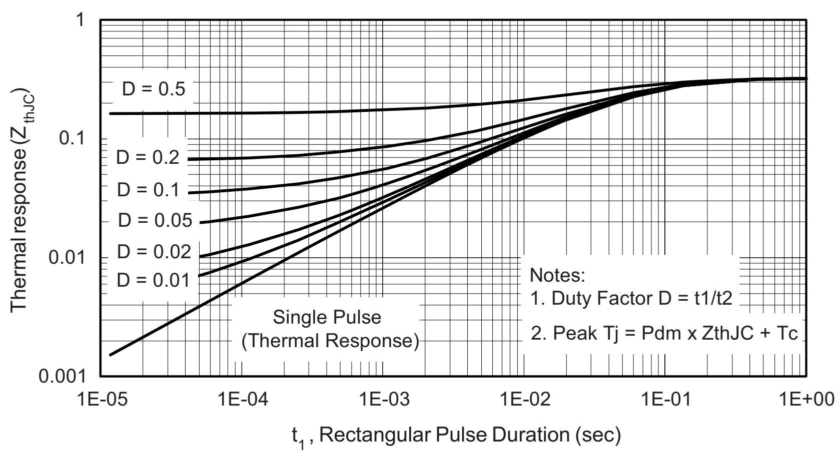


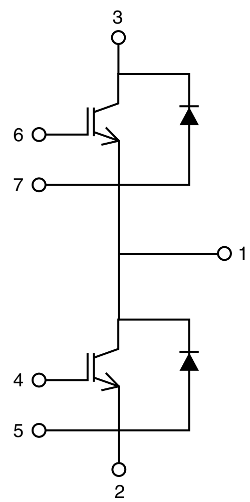
Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

ORDERING INFORMATION TABLE

Device code	VS-	G	B	200	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 Generation 5 NPT
4 - Current rating (200 = 200 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

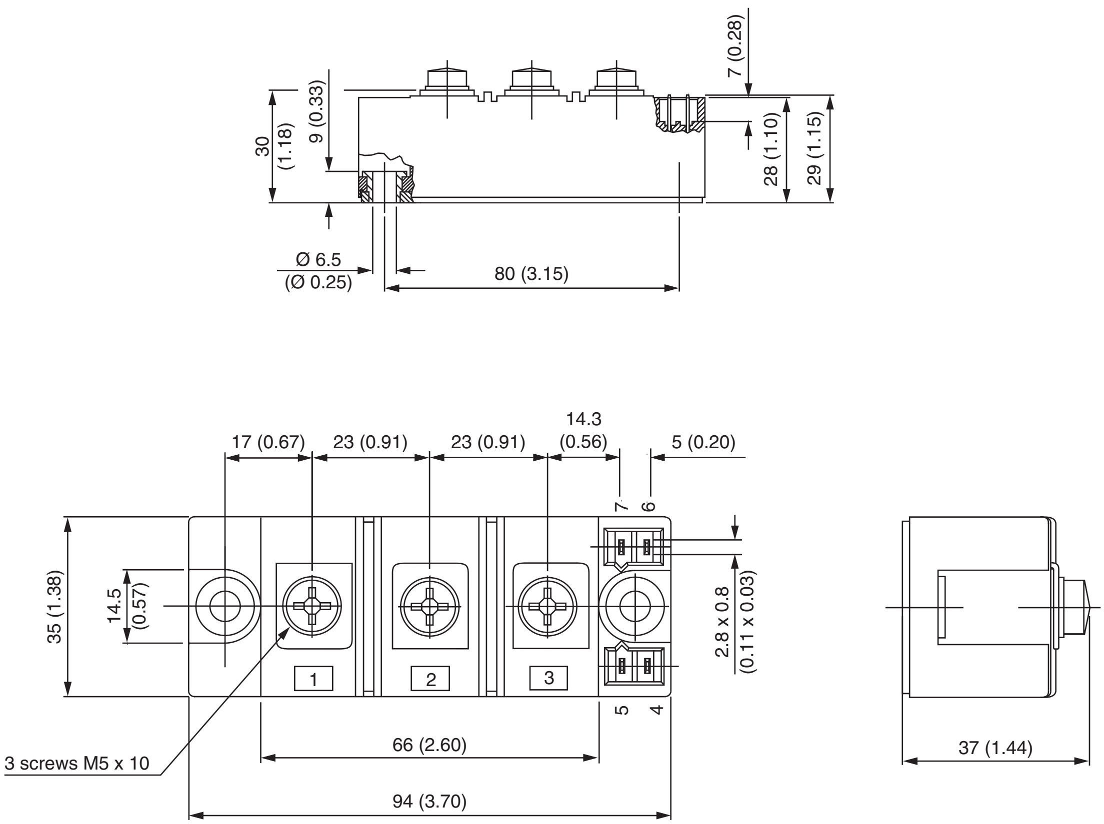
CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95543

INT-A-PAK IGBT

DIMENSIONS in millimeters (inches)



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