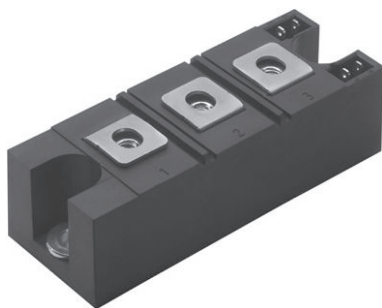


INT-A-PAK “Half-Bridge” (Ultrafast Speed IGBT), 138 A



INT-A-PAK

PRIMARY CHARACTERISTICS

V_{CES}	600 V
I_C DC	138 A
$V_{CE(on)}$ at 150 A, 25 °C	2.64 V
Speed	8 kHz to 30 kHz
Package	INT-A-PAK
Circuit configuration	Half bridge

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



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	$T_C = 25\text{ °C}$	138	A
		$T_C = 80\text{ °C}$	93	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
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	$T_C = 25\text{ °C}$	500	W
		$T_C = 80\text{ °C}$	280	
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	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	2.2	2.7	
		$V_{GE} = 15\text{ V}$, $I_C = 150\text{ A}$	-	2.64	3	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.68	3.11	
		$V_{GE} = 15\text{ V}$, $I_C = 150\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.25	3.79	
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}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	0.01	0.2	
Diode forward voltage drop	V_{FM}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	7.5	15	V
		$I_C = 100\text{ A}$	-	1.39	1.78	
		$I_C = 150\text{ A}$	-	1.52	1.91	
		$I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.31	1.72	
Gate to emitter leakage current	I_{GES}	$I_C = 150\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.49	2.05	nA
		$V_{GE} = \pm 20\text{ V}$	-	-	± 200	

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}	$I_C = 150\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 10\text{ }\Omega$, $L = 200\text{ }\mu\text{H}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	2.0	-	mJ
Turn-off switching loss	E_{off}		-	3.9	-	
Total switching loss	E_{tot}		-	5.9	-	
Turn-on switching loss	E_{on}	$I_C = 150\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 10\text{ }\Omega$, $L = 200\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.42	-	ns
Turn-off switching loss	E_{off}		-	4.2	-	
Total switching loss	E_{tot}		-	6.62	-	
Turn-on delay time	$t_{d(on)}$		-	390	-	
Rise time	t_r		-	100	-	
Turn-off delay time	$t_{d(off)}$		-	402	-	
Fall time	t_f		-	80	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 300\text{ A}$, $R_g = 10\text{ }\Omega$, $V_{GE} = 15\text{ V to }0$	Fullsquare			
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $V_{CC} = 400\text{ V}$, $V_P = 600\text{ V}$, $R_g = 10\text{ }\Omega$, $V_{GE} = 15\text{ V to }0$	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	R_{thJC}	-	0.17	0.25	$^{\circ}\text{C}/\text{W}$
IGBT		-	0.19	0.32	
Diode	R_{thCS}	-	0.1	-	
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

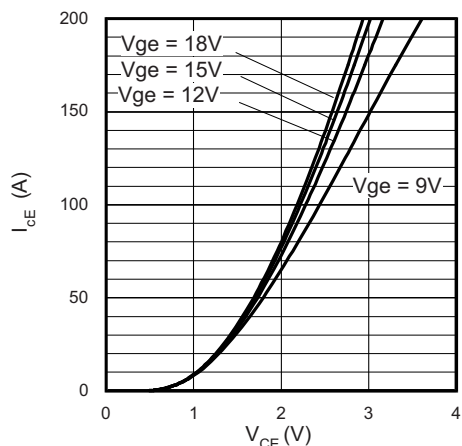


Fig. 1 - Typical IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$, $t_p = 500\ \mu\text{s}$

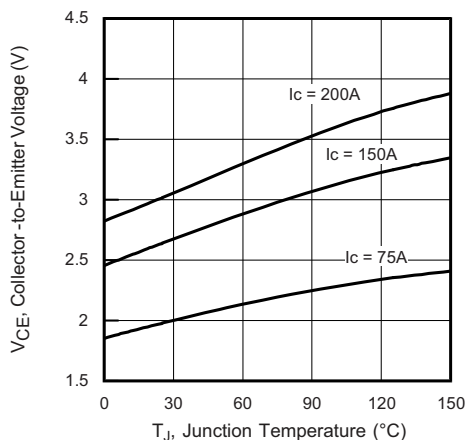


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature
 $V_{GE} = 15\ \text{V}$, $500\ \mu\text{s}$ pulse width

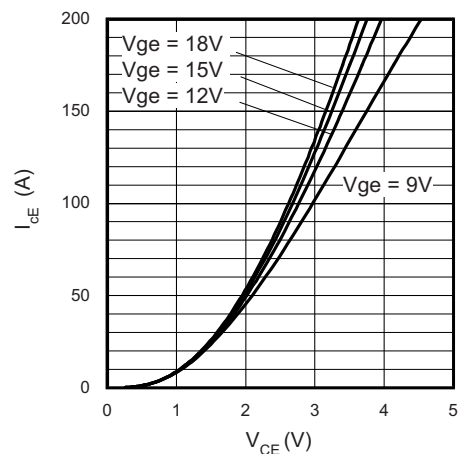


Fig. 2 - Typical IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$, $t_p = 500\ \mu\text{s}$

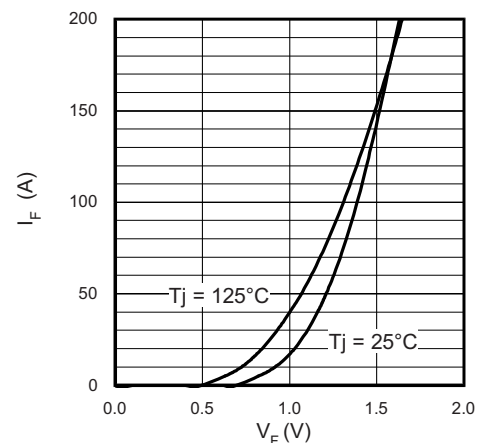


Fig. 5 - Diode Forward Characteristics, $t_p = 500\ \mu\text{s}$

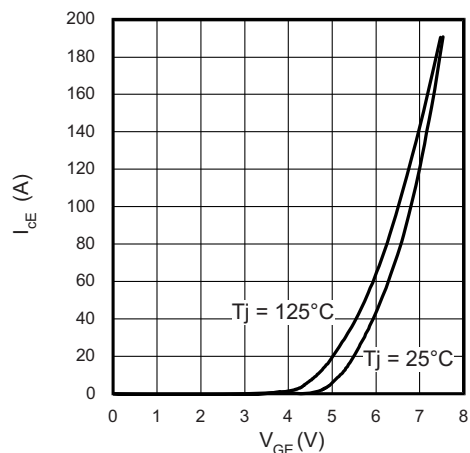


Fig. 3 - Typical Transfer Characteristics
 $V_{CE} = 20\ \text{V}$, $t_p = 500\ \mu\text{s}$

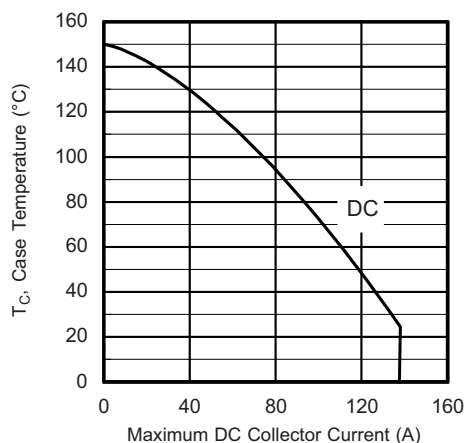


Fig. 6 - Maximum Collector Current vs. Case Temperature

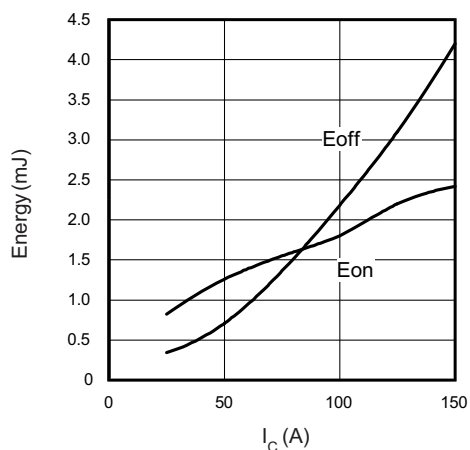


Fig. 7 - Typical Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $V_{CC} = 360\ \text{V}$,
 $R_g = 10\ \Omega$, $V_{GE} = 15\ \text{V}$

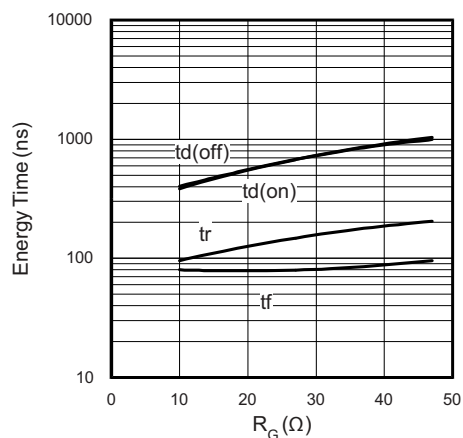


Fig. 10 - Typical Switching Time vs. R_g ,
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $V_{CC} = 360\ \text{V}$,
 $I_{CE} = 150\ \text{A}$, $V_{GE} = 15\ \text{V}$

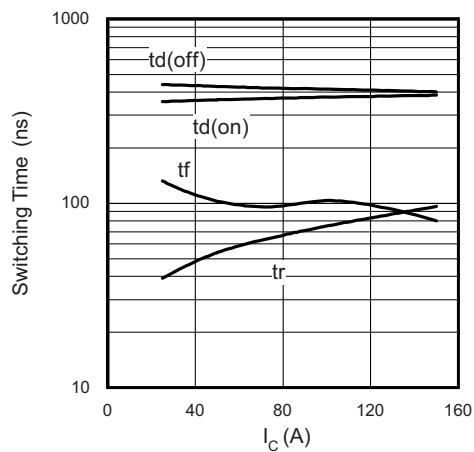


Fig. 8 - Typical Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $V_{CC} = 360\ \text{V}$,
 $R_g = 10\ \Omega$, $V_{GE} = 15\ \text{V}$

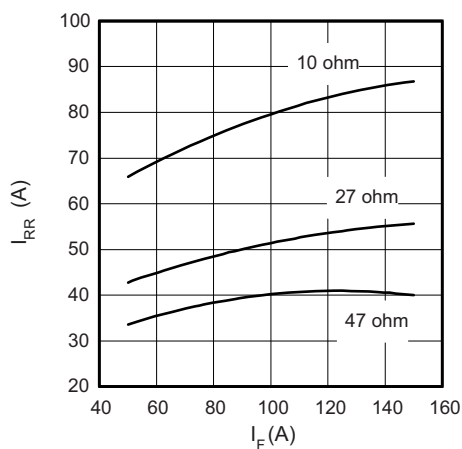


Fig. 11 - Typical Diode I_{rr} vs. I_F
 $T_J = 125^\circ\text{C}$

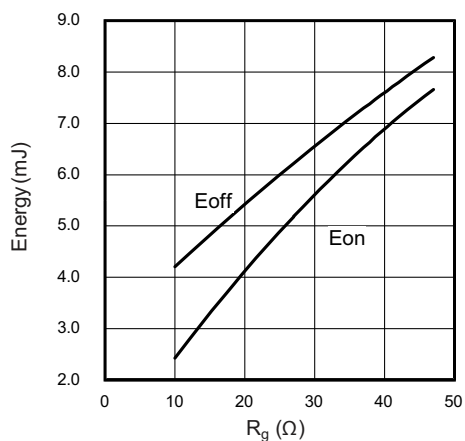


Fig. 9 - Typical Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $V_{CC} = 360\ \text{V}$,
 $I_{CE} = 150\ \text{A}$, $V_{GE} = 15\ \text{V}$

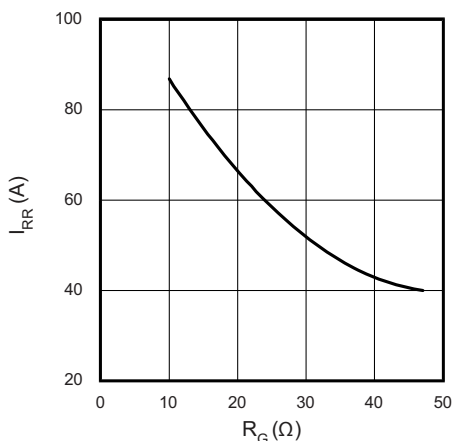


Fig. 12 - Typical Diode I_{rr} vs. R_g
 $T_J = 125^\circ\text{C}$, $I_F = 150\ \text{A}$

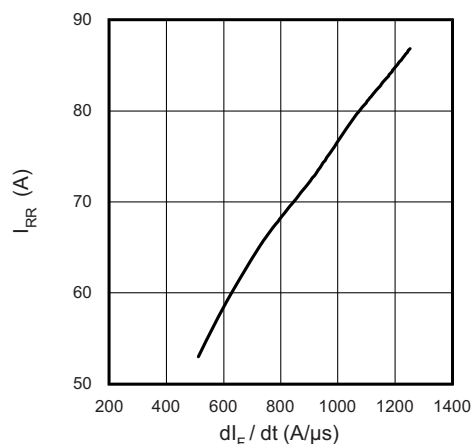


Fig. 13 - Typical Diode I_{RR} vs. dI_F/dt
 $T_J = 125^\circ\text{C}$, $V_{CC} = 360\text{ V}$, $I_F = 150\text{ A}$, $V_{GE} = 15\text{ V}$

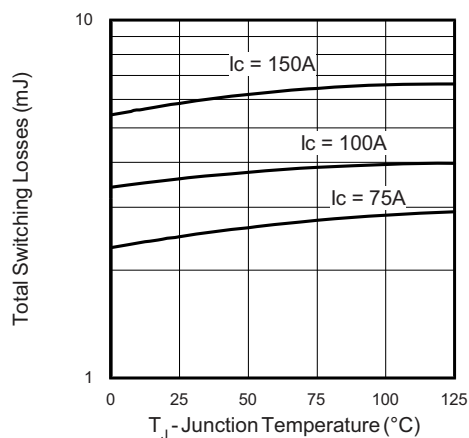


Fig. 15 - Typical Switching Losses vs. Junction Temperature;
 $L = 200\text{ }\mu\text{H}$, $R_g = 10\text{ }\Omega$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

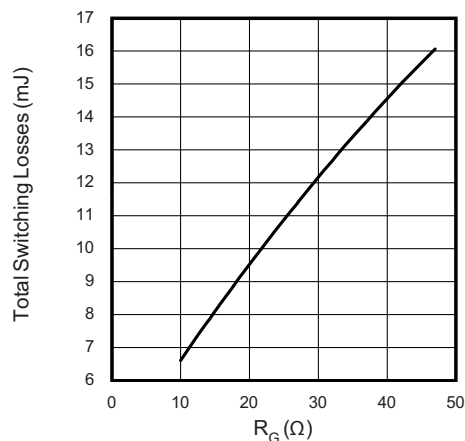


Fig. 14 - Typical Switching Losses vs. Gate Resistance,
 $T_J = 125^\circ\text{C}$, $L = 200\text{ }\mu\text{H}$, $R_g = 10\text{ }\Omega$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

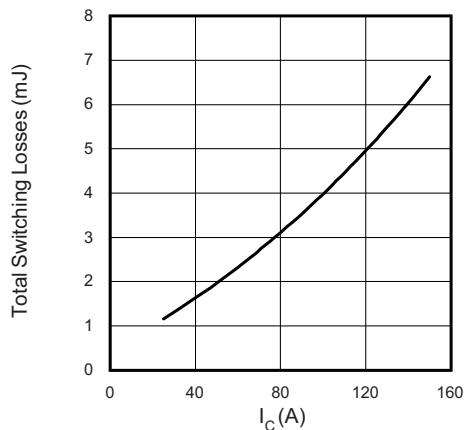


Fig. 16 - Typical Switching Losses vs. Collector to Emitter Current;
 $T_J = 125^\circ\text{C}$, $R_{g1} = 10\text{ }\Omega$, $R_{g2} = 0\text{ }\Omega$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

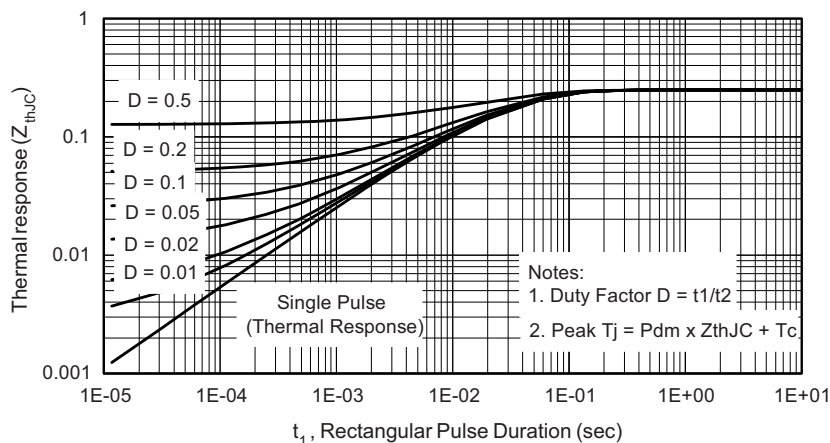


Fig. 17 - Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

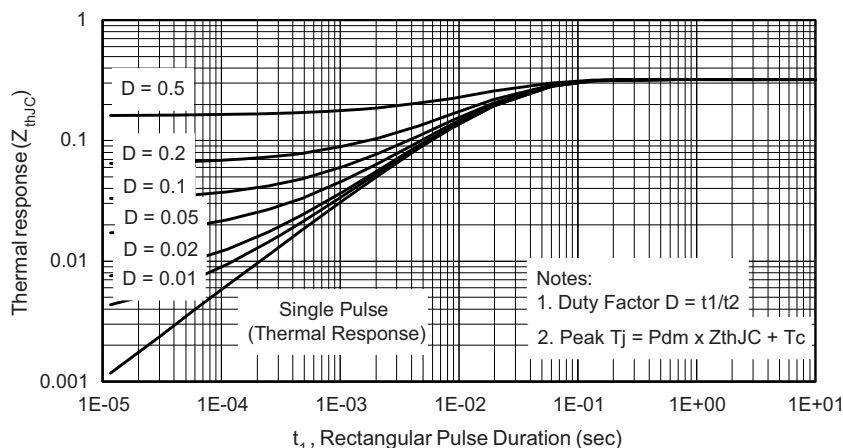


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

ORDERING INFORMATION TABLE

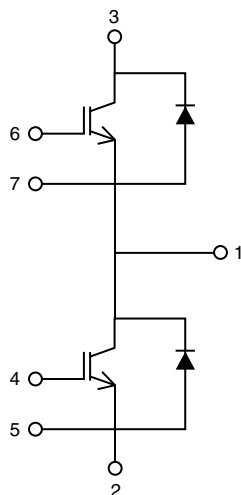
Device code

VS-	G	B	150	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 (150 = 150 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



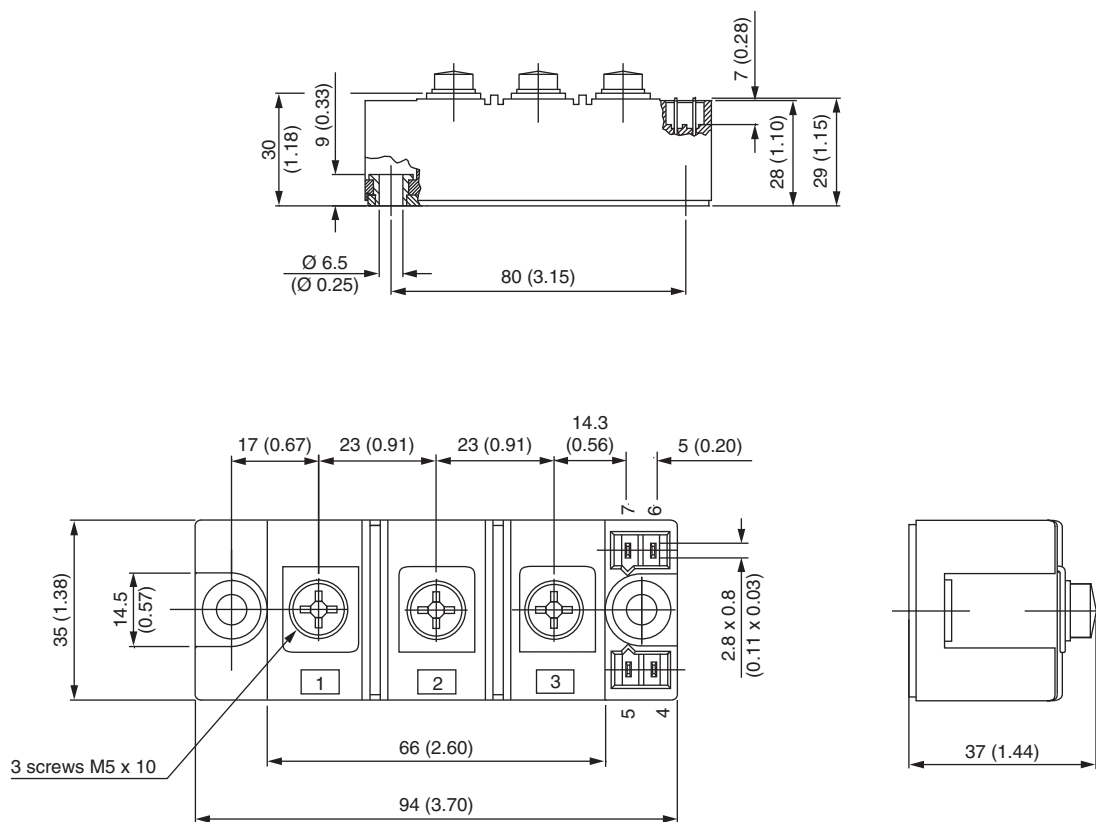
CIRCUIT CONFIGURATION



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

INT-A-PAK IGBT

DIMENSIONS in millimeters (inches)





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