


## "Half-Bridge" IGBT INT-A-PAK (Ultrafast Speed IGBT), 75 A



INT-A-PAK

### FEATURES

- Generation 4 IGBT technology
- Ultrafast: Optimized for high speed 8 kHz to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- HEXFRED® antiparallel diodes with ultrasoft recovery
- Industry standard package
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS**  
COMPLIANT

PRODUCT SUMMARY	
$V_{CES}$	1200 V
$I_C$ DC	110 A
$V_{CE(on)}$ at 75 A, 25 °C	2.5 V

### BENEFITS

- Increased operating efficiency
- Direct mounting to heatsink
- Performance optimized for power conversion: UPS, SMPS, welding
- Lower EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	$V_{CES}$		1200	V
Continuous collector current	$I_C$	$T_C = 25\text{ °C}$	110	A
		$T_C = 76\text{ °C}$	75	
Pulsed collector current	$I_{CM}$	Repetitive rating; $V_{GE} = 20\text{ V}$ , pulse width limited by maximum junction temperature	150	
Peak switching current See fig. 17	$I_{LM}$		150	
Peak diode forward current	$I_{FM}$		150	V
Gate to emitter voltage	$V_{GE}$		$\pm 20$	
RMS isolation voltage	$V_{ISOL}$	Any terminal to case, $t = 1\text{ minute}$	2500	W
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	390	
		$T_C = 85\text{ °C}$	200	
Operating junction temperature range	$T_J$		- 40 to + 150	°C
Storage temperature range	$T_{Stg}$		- 40 to + 125	

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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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 75\text{ A}$	-	2.5	3.7	
		$I_C = 75\text{ A}, V_{GE} = 15\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	2.25	3.3	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = 6.0\text{ V}, I_C = 750\text{ }\mu\text{A}$	3.0	4.5	6.0	mV/°C
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$		-	-14	-	
Forward transconductance	$g_{fe}$	$V_{CE} = 25\text{ V}, I_C = 75\text{ A}$ Pulse width 50 $\mu\text{s}$ , single shot	-	107	-	S
Collector to emitter leaking current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	0.03	1.0	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	4.3	10	
Diode forward voltage	$V_F$	$V_{GE} = 0\text{ V}, I_F = 75\text{ A}$	-	3	3.6	V
		$I_F = 75\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	2.83	3.3	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	250	nA

SWITCHING CHARACTERISTICS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$V_{CC} = 400\text{ V}$ $I_C = 85\text{ A}$	-	570	854	nC
Gate to emitter charge (turn-on)	$Q_{ge}$		-	96	144	
Gate to collector charge (turn-on)	$Q_{gc}$		-	189	283	
Turn-on delay time	$t_{d(on)}$	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$ $I_C = 75\text{ A}$	-	437	-	ns
Rise time	$t_r$		-	60	-	
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 720\text{ V}$ $V_{GE} = \pm 15\text{ V}$ Inductor load $T_J = 25\text{ }^\circ\text{C}$	-	395	-	
Fall time	$t_f$		-	245	-	
Turn-on switching energy	$E_{on}$	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$ $I_C = 75\text{ A}$ $V_{CC} = 720\text{ V}$ $V_{GE} = \pm 15\text{ V}$ Inductor load $T_J = 125\text{ }^\circ\text{C}$	-	5	-	mJ
Turn-off switching energy	$E_{off}^{(1)}$		-	3	-	
Total switching energy	$E_{ts}^{(1)}$		-	8	-	
Turn-on delay time	$t_{d(on)}$		-	453	-	ns
Rise time	$t_r$	-	70	-		
Turn-off delay time	$t_{d(off)}$	-	415	-		
Fall time	$t_f$	-	661	-		
Turn-on switching energy	$E_{on}$	$V_{CC} = 720\text{ V}$ $V_{GE} = \pm 15\text{ V}$ Inductor load $T_J = 125\text{ }^\circ\text{C}$	-	8	-	mJ
Turn-off switching energy	$E_{off}^{(1)}$		-	11	-	
Total switching energy	$E_{ts}^{(1)}$		-	19	32	
Input capacitance	$C_{ies}$		$V_{GE} = 0\text{ V}$	-	12 815	-
Output capacitance	$C_{oes}$	$V_{CC} = 30\text{ V}$	-	570	-	
Reverse transfer capacitance	$C_{res}$	$f = 1\text{ MHz}$	-	110	-	
Diode reverse recovery time	$t_{rr}$	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$ $I_C = 75\text{ A}$ $V_{CC} = 720\text{ V}$ $dI/dt = 1300\text{ A}/\mu\text{s}$	-	174	-	ns
Diode peak reverse current	$I_{rr}$		-	107	-	A
Diode recovery charge	$Q_{rr}$		-	9367	-	nC
Diode peak rate of fall of recovery during $t_b$	$dI_{(rec)M}/dt$		-	1491	-	A/ $\mu\text{s}$

## Note

(1) Repetitive rating;  $V_{GE} = 20\text{ V}$ , pulse width limited by maximum junction temperature

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	TYP.	MAX.	UNITS
Thermal resistance, junction to case	IGBT	$R_{thJC}$	-	0.32	°C/W
	Diode		-	0.35	
Thermal resistance, case to sink per module	$R_{thCS}$		0.1	-	
Mounting torque	case to heatsink	For screws M5 x 0.8	-	4.0	Nm
	case to terminal 1, 2 and 3		-	3.0	
Weight of module			200	-	g

# "Half-Bridge" IGBT INT-A-PAK Vishay High Power Products (Ultrafast Speed IGBT), 75 A

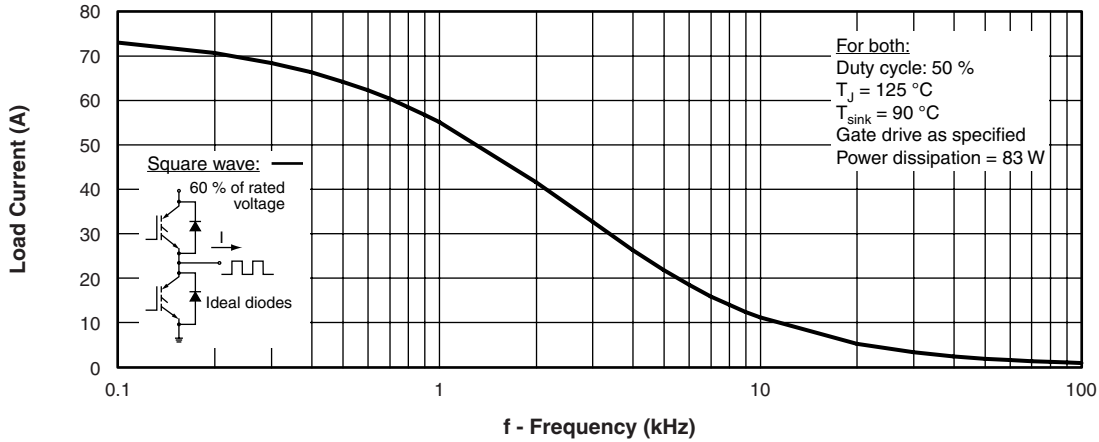


Fig. 1 - Typical Load Current vs. Frequency  
(Load Current =  $I_{RMS}$  of Fundamental)

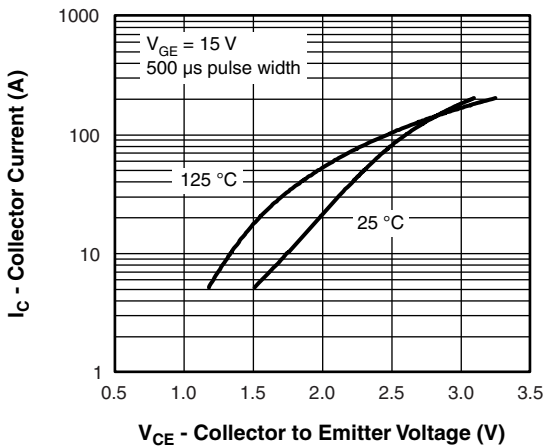


Fig. 2 - Typical Output Characteristics

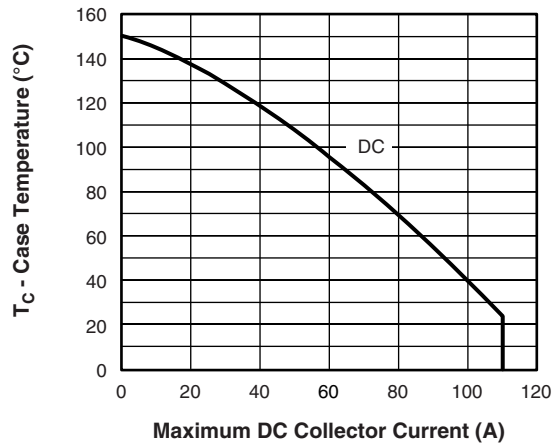


Fig. 4 - Case Temperature vs. Maximum Collector Current

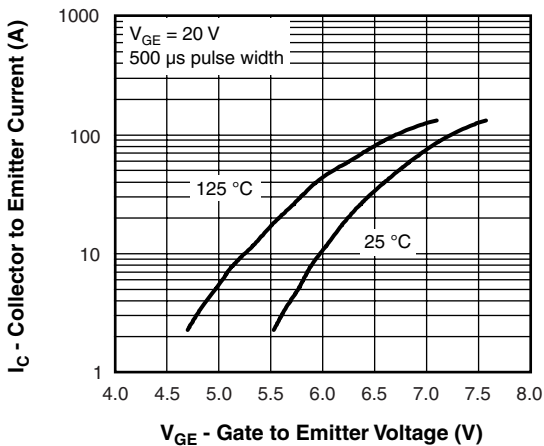


Fig. 3 - Typical Transfer Characteristics

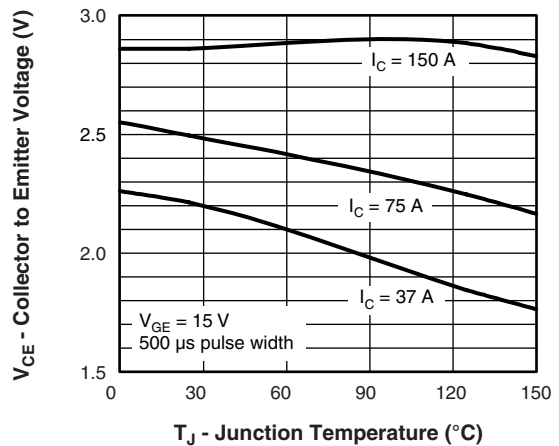


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

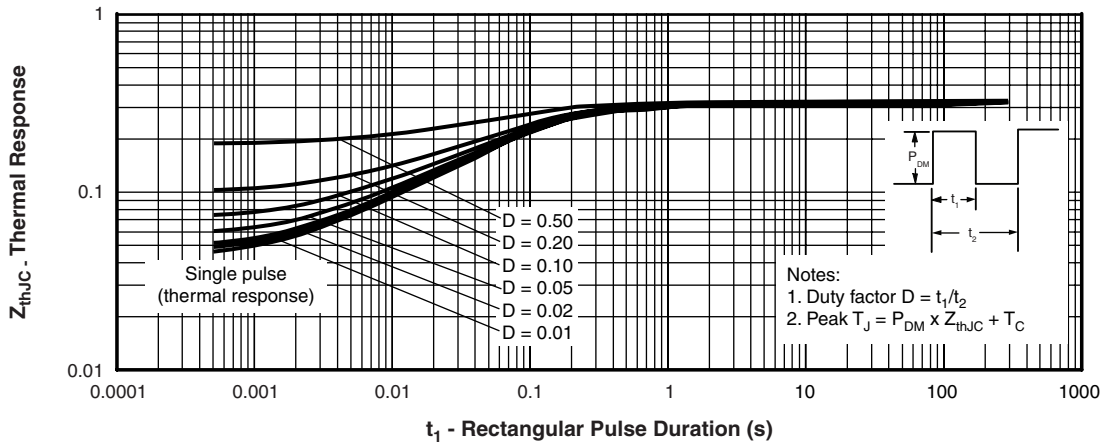


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

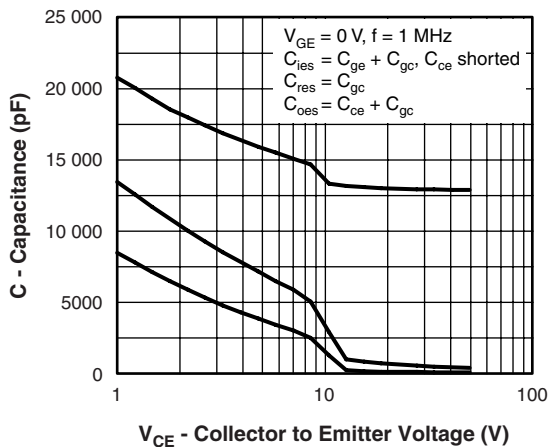


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

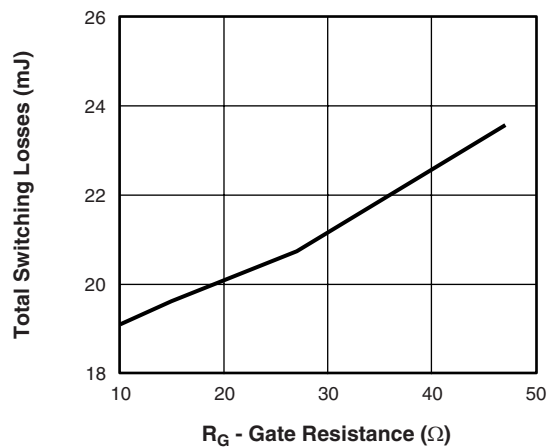


Fig. 9 - Typical Switching Losses vs. Gate Resistance

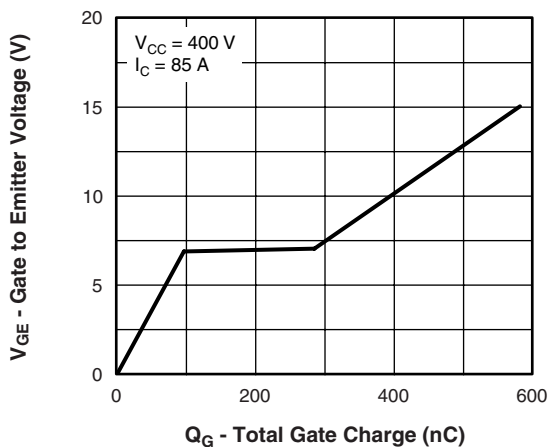


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

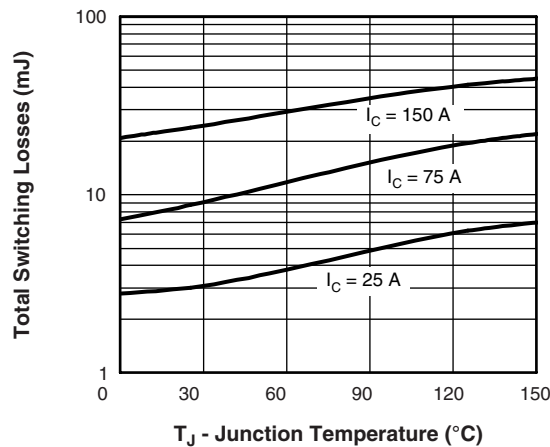


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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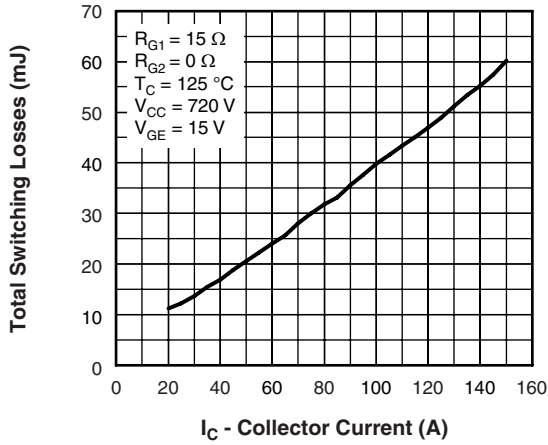


Fig. 11 - Typical Switching Losses vs. Collector to Emitter Current

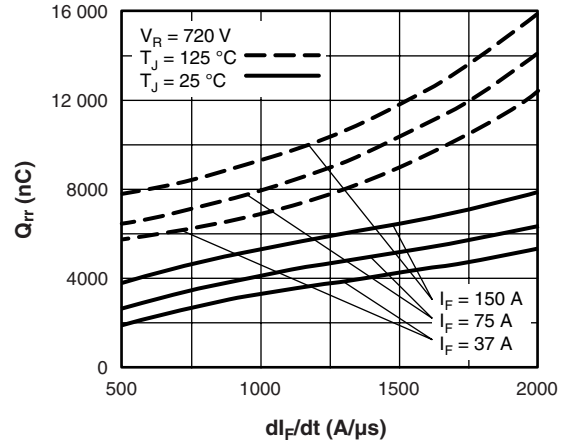


Fig. 14 - Typical Stored Charge vs.  $di_F/dt$

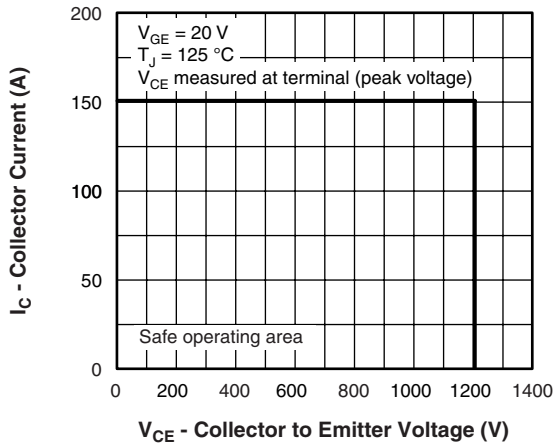


Fig. 12 - Reverse Bias SOA

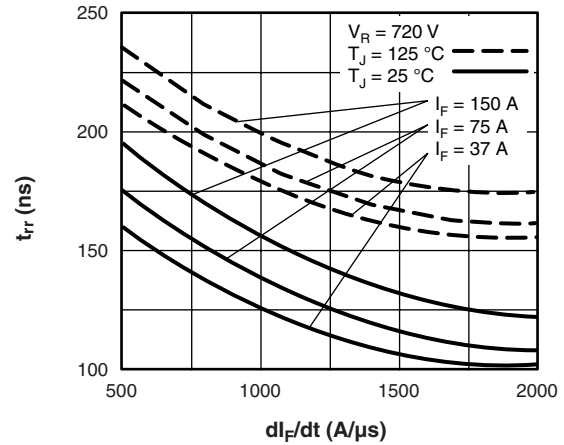


Fig. 15 - Typical Reverse Recovery Time vs.  $di_F/dt$

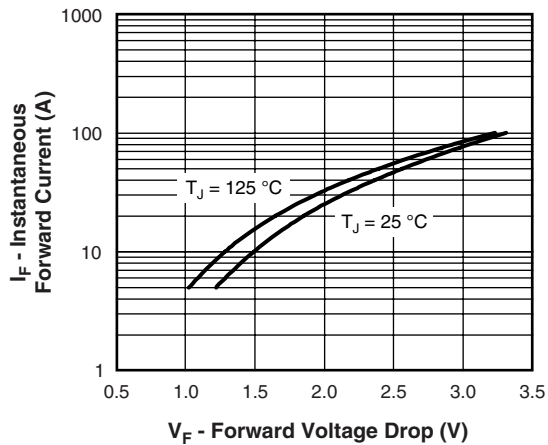


Fig. 13 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

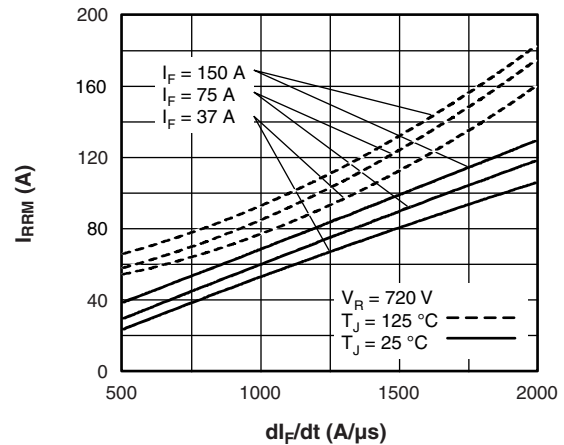


Fig. 16 - Typical Recovery Current vs.  $di_F/dt$

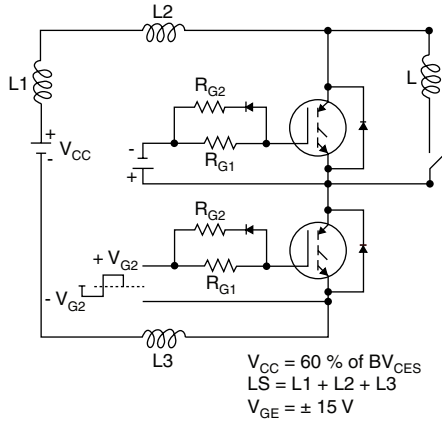


Fig. 17a - Test Circuit for Measurement of  $I_{LM}$ ,  $E_{on}$ ,  $E_{off}(\text{diode})$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$ ,  $t_{d(on)}$ ,  $t_r$ ,  $t_{d(off)}$ ,  $t_f$

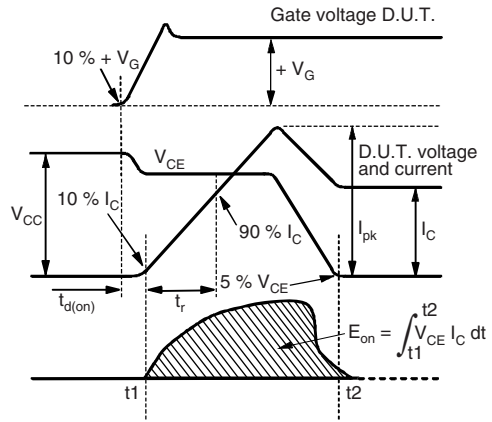


Fig. 17c - Test Waveforms for Circuit of Fig. 18a, Defining  $E_{on}$ ,  $t_{d(on)}$ ,  $t_r$

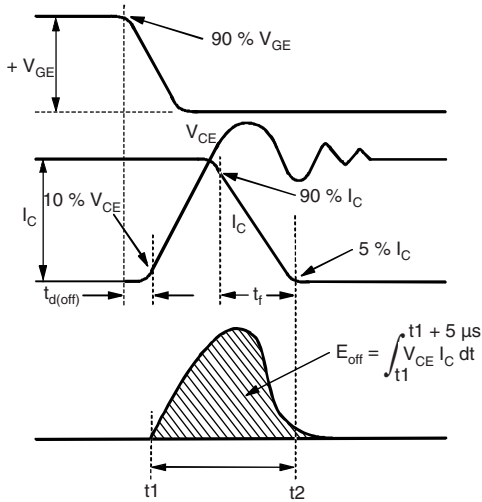


Fig. 17b - Test Waveforms for Circuit of Fig. 18a, Defining  $E_{off}$ ,  $t_{d(off)}$ ,  $t_f$

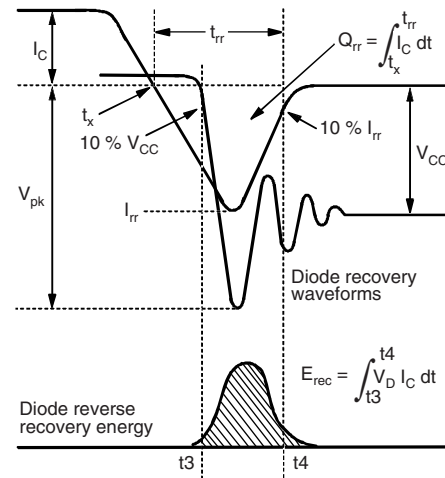


Fig. 17d - Test Waveforms for Circuit of Fig. 18a, Defining  $E_{rec}$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$

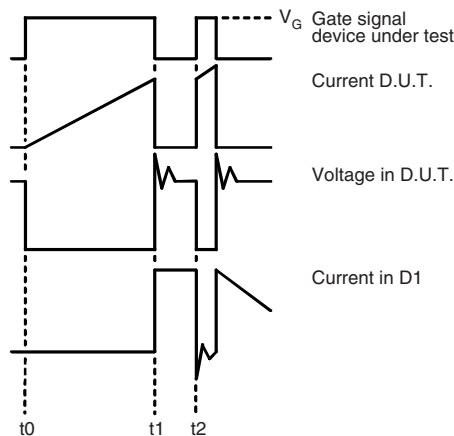
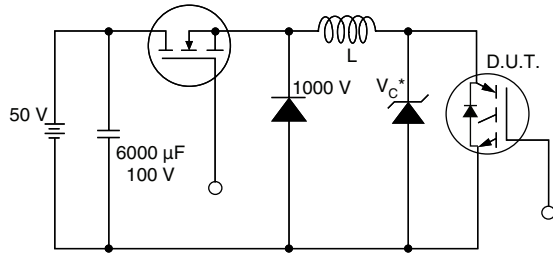


Fig. 17e - Macro Waveforms for Figure 18a's Test Circuit



\* Driver same type as D.U.T.;  $V_C = 80\%$  of  $V_{CE}$  (max)

**Note:** Due to the 50 V power supply, pulse width and inductor will increase to obtain rated  $I_d$

Fig. 18 - Clamped Inductive Load Test Circuit

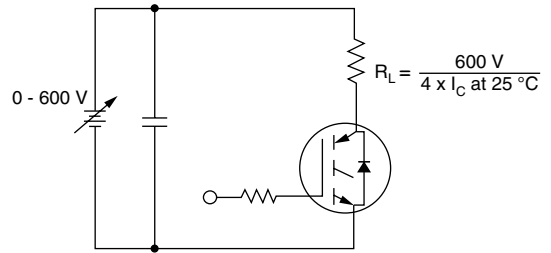


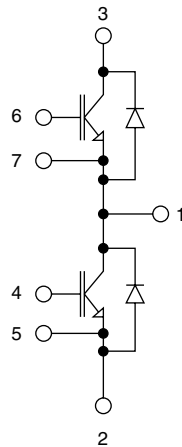
Fig. 19 - Pulsed Collector Current Test Circuit

### ORDERING INFORMATION TABLE

Device code	<b>G</b>	<b>A</b>	<b>75</b>	<b>T</b>	<b>S</b>	<b>120</b>	<b>U</b>	<b>PbF</b>
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Insulated gate bipolar transistor (IGBT)
- 2** - Generation 4, IGBT silicon, DBC construction
- 3** - Current rating (75 = 75 A)
- 4** - Circuit configuration (T = Half-bridge)
- 5** - Package indicator (INT-A-PAK)
- 6** - Voltage rating (120 = 1200 V)
- 7** - Speed/type (U = Ultrafast)
- 8** - PbF = Lead (Pb)-free

### CIRCUIT CONFIGURATION



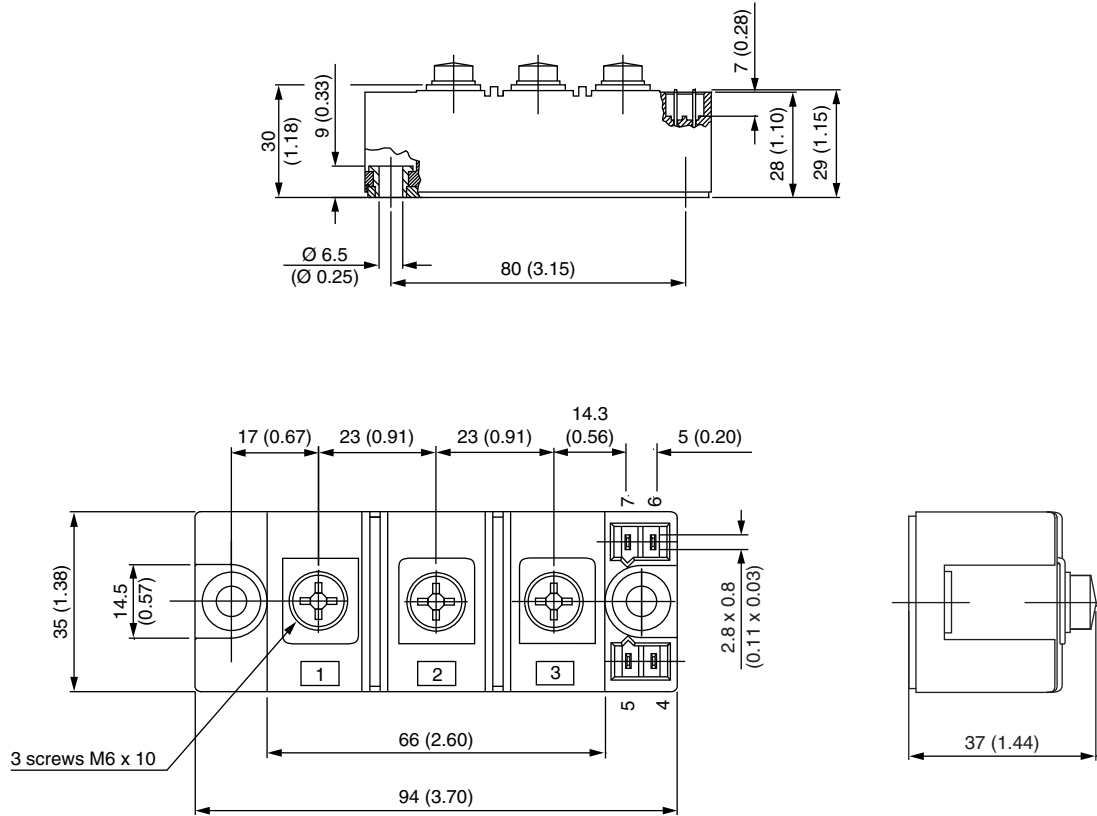
#### LINKS TO RELATED DOCUMENTS

Dimensions

[www.vishay.com/doc?95173](http://www.vishay.com/doc?95173)

## INT-A-PAK IGBT

**DIMENSIONS** in millimeters (inches)







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