

“Half Bridge” IGBT INT-A-PAK, (Trench PT IGBT), 100 A

Proprietary Vishay IGBT Silicon “L Series”



INT-A-PAK

PRIMARY CHARACTERISTICS	
V_{CES}	600 V
I_C DC, $T_C = 130\text{ }^{\circ}\text{C}$	100 A
$V_{CE(on)}$ at 100 A, $25\text{ }^{\circ}\text{C}$	1.16 V
Speed	DC to 1 kHz
Package	INT-A-PAK
Circuit configuration	Half bridge

FEATURES

- Trench PT IGBT technology
- FRED Pt[®] anti-parallel diodes with fast recovery
- Very low conduction losses
- Al_2O_3 DBC
- UL pending
- Designed for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

BENEFITS

- Optimized for high current inverter stages (AC TIG welding machines)
- Direct mounting to heatsink
- Very low junction to case thermal resistance
- Low EMI

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ }^{\circ}\text{C}$	337	A
		$T_C = 80\text{ }^{\circ}\text{C}$	235	
Pulsed collector current	I_{CM}		440	
Peak switching current	I_{LM}		440	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ min}$	2500	
Maximum power dissipation	P_D	$T_C = 25\text{ }^{\circ}\text{C}$	781	W
		$T_C = 100\text{ }^{\circ}\text{C}$	312	
Operating junction temperature range	T_J		-40 to +150	$^{\circ}\text{C}$
Storage temperature range	T_{Stg}		-40 to +125	

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	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	1.16	1.34	
		$V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$	-	1.37	-	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.08	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 3.2\text{ mA}$	4.9	5.8	8.8	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 3.2\text{ mA}$, ($25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)	-	-27	-	mV/ $^{\circ}\text{C}$
Forward transconductance	g_{fe}	$V_{CE} = 20\text{ V}$, $I_C = 50\text{ A}$	-	93	-	S
Transfer characteristics	V_{GE}	$V_{CE} = 20\text{ V}$, $I_C = 100\text{ A}$	-	10.2	-	V
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	1.0	150	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	300	-	
Diode forward voltage drop	V_{FM}	$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$	-	1.36	1.96	V
		$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.17	-	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 500	nA

**SWITCHING CHARACTERISTICS** ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge	Q_g	$I_C = 100\text{ A}$, $V_{CC} = 400\text{ V}$	-	942	-	nC
Gate to emitter charge	Q_{ge}		-	295	-	
Gate to collector charge	Q_{gc}		-	802	-	
Turn-on switching energy	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 300\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 500\text{ }\mu\text{H}$ $R_g = 3.3\text{ }\Omega$, $T_J = 25\text{ }^{\circ}\text{C}$	-	1.0	-	mJ
Turn-off switching energy	E_{off}		-	7.9	-	
Total switching energy	E_{ts}		-	8.9	-	
Turn-on delay time	$t_{d(on)}$		-	242	-	ns
Rise time	t_r		-	66	-	
Turn-off delay time	$t_{d(off)}$		-	453	-	
Fall time	t_f		-	460	-	
Turn-on switching energy	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 300\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 500\text{ }\mu\text{H}$ $R_g = 3.3\text{ }\Omega$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.0	-	mJ
Turn-off switching energy	E_{off}		-	15.3	-	
Total switching energy	E_{ts}		-	17.3	-	
Turn-on delay time	$t_{d(on)}$		-	257	-	ns
Rise time	t_r		-	68	-	
Turn-off delay time	$t_{d(off)}$		-	716	-	
Fall time	t_f		-	868	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 440\text{ A}$, $V_{CC} = 300\text{ V}$, $V_p = 600\text{ V}$, $R_g = 3.3\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0 V , $L = 500\text{ }\mu\text{H}$	Fullsquare			
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{rr} = 200\text{ V}$	-	115	-	ns
Diode peak reverse current	I_{rr}		-	11	-	A
Diode recovery charge	Q_{rr}		-	638	-	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{rr} = 200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	210	-	ns
Diode peak reverse current	I_{rr}		-	21.4	-	A
Diode recovery charge	Q_{rr}		-	2251	-	nC

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J	-40	-	150	$^{\circ}\text{C}$
Storage temperature range	T_{Stg}	-40	-	125	
Junction to case	R_{thJC}	-	-	0.16	$^{\circ}\text{C}/\text{W}$
per switch		-	-	0.48	
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

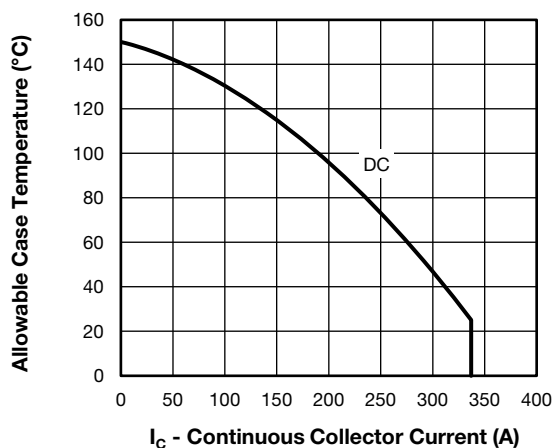


Fig. 1 - Maximum IGBT Continuous Collector Current vs. Case Temperature

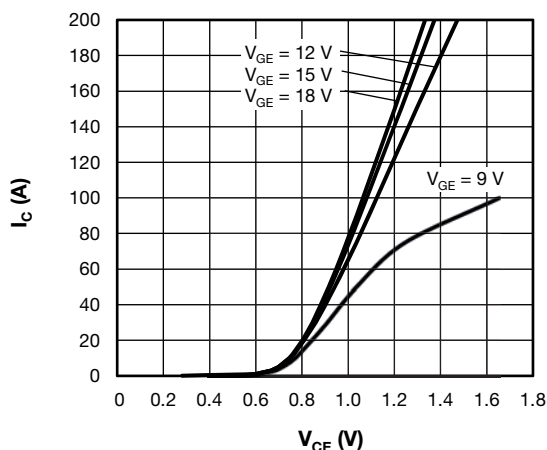


Fig. 4 - Typical IGBT Output Characteristics, $T_J = 125^\circ\text{C}$

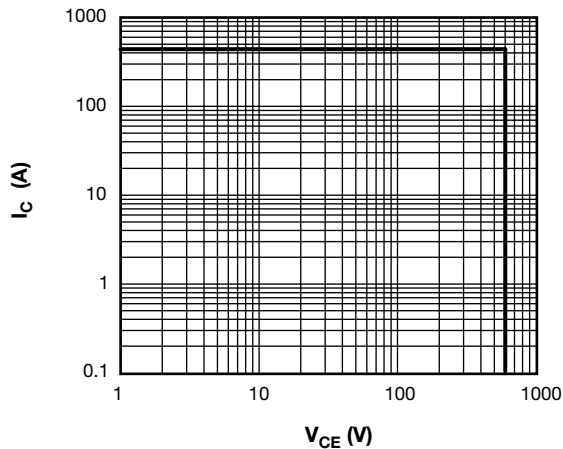


Fig. 2 - IGBT Reverse BIAS SOA $T_J = 150^\circ\text{C}$, $V_{GE} = 15\text{ V}$

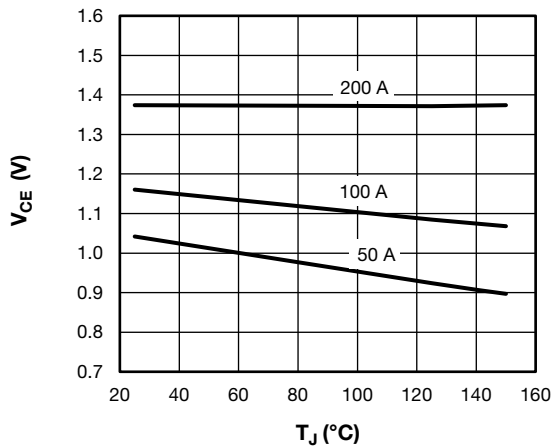


Fig. 5 - Collector to Emitter Voltage vs. Junction Temperature

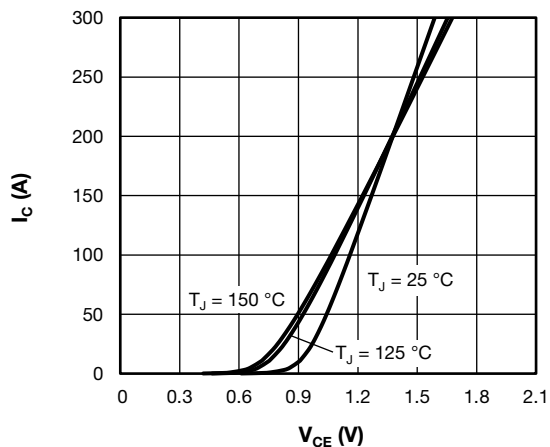


Fig. 3 - Typical IGBT Output Characteristics, $V_{GE} = 15\text{ V}$

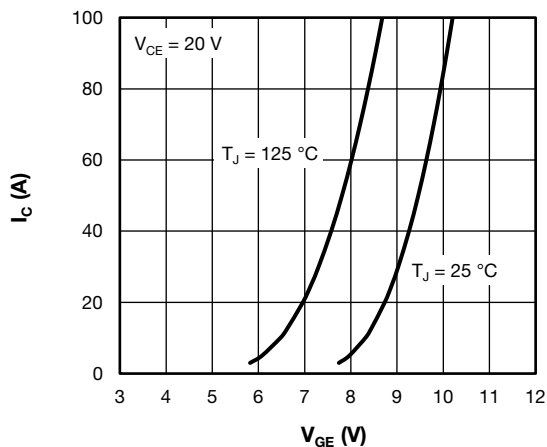


Fig. 6 - Typical IGBT Transfer Characteristics

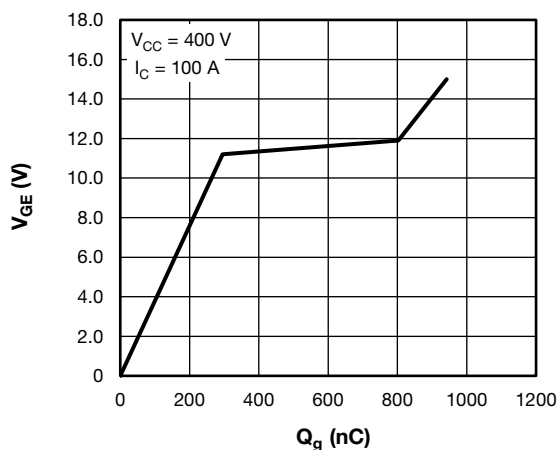


Fig. 7 - Typical Total Gate Charge vs. Gate to Emitter Voltage

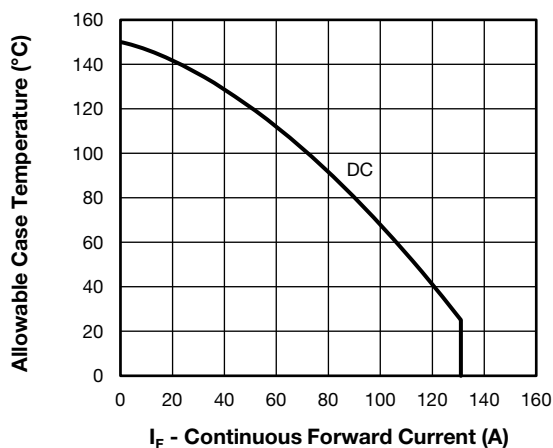


Fig. 10 - Maximum Diode Continuous Forward Current vs. Case Temperature

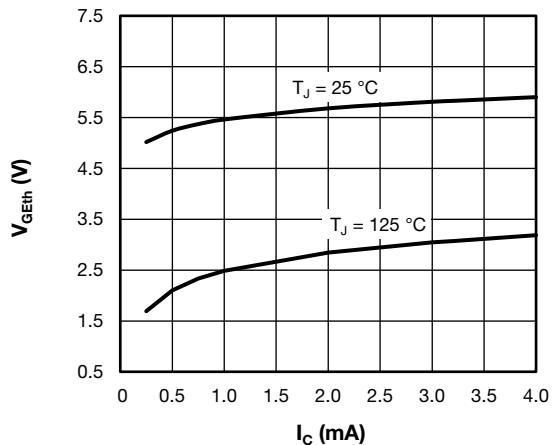


Fig. 8 - Typical IGBT Gate Threshold Voltage

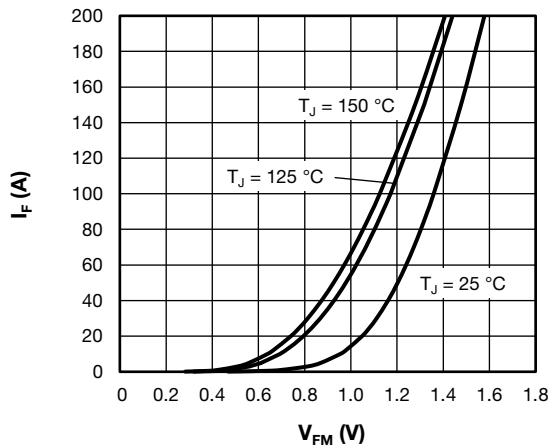


Fig. 11 - Typical Diode Forward Characteristics

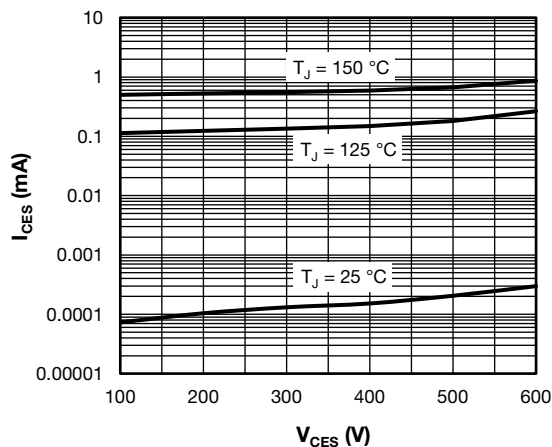
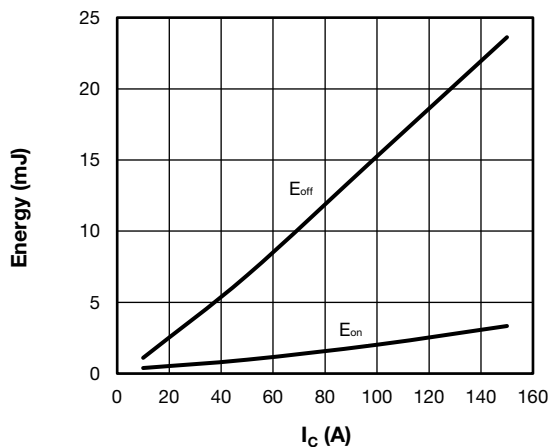


Fig. 9 - Typical IGBT Zero Gate Voltage Collector Current


Fig. 12 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125$ $^{\circ}$ C, $V_{CC} = 300$ V, $R_g = 3.3$ Ω , $V_{GE} = 15$ V, $L = 500$ μ H

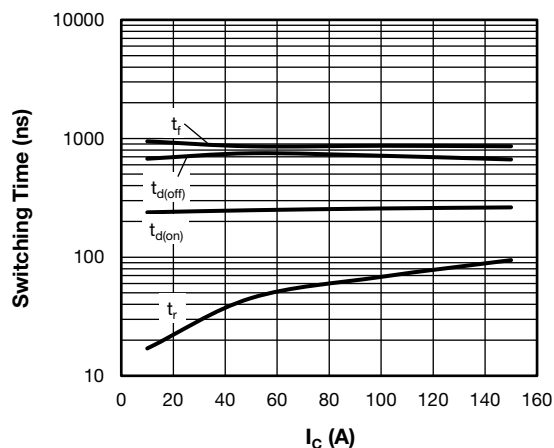


Fig. 13 - Typical IGBT Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

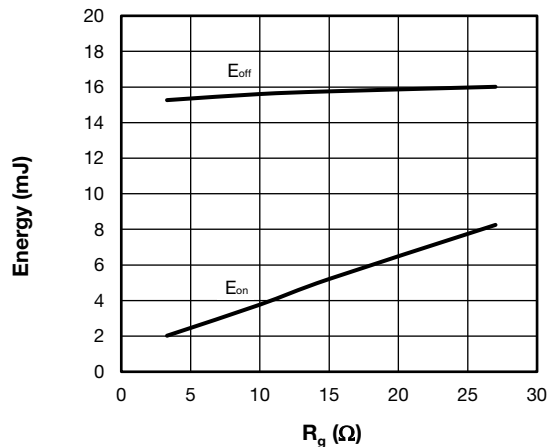


Fig. 14 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

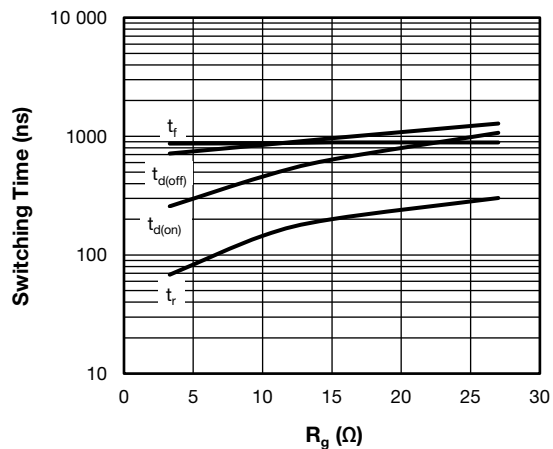


Fig. 15 - Typical IGBT Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

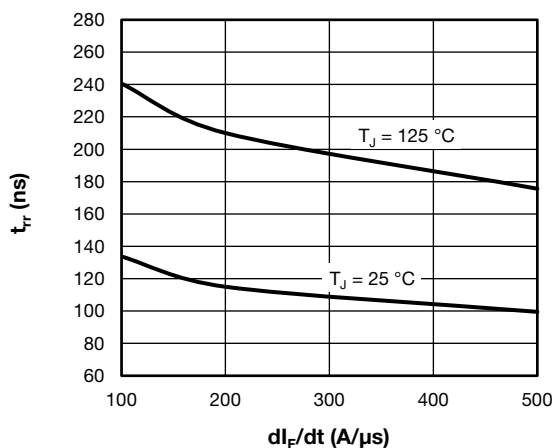


Fig. 16 - Typical Diode Reverse Recovery Time vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$

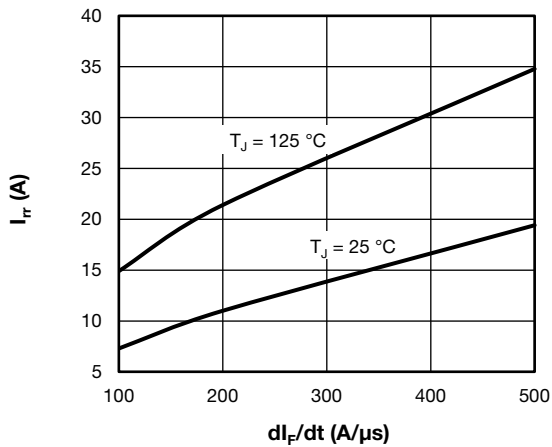


Fig. 17 - Typical Diode Reverse Recovery Current vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$

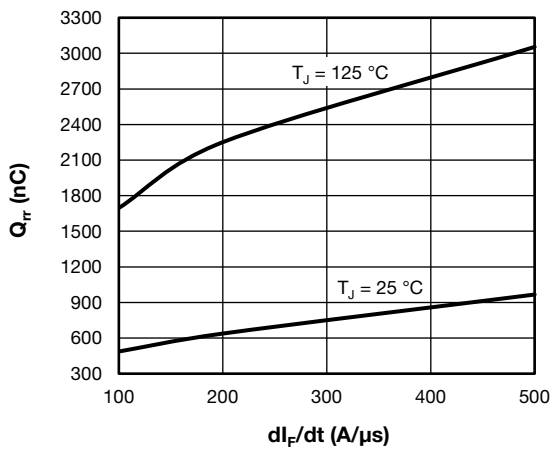
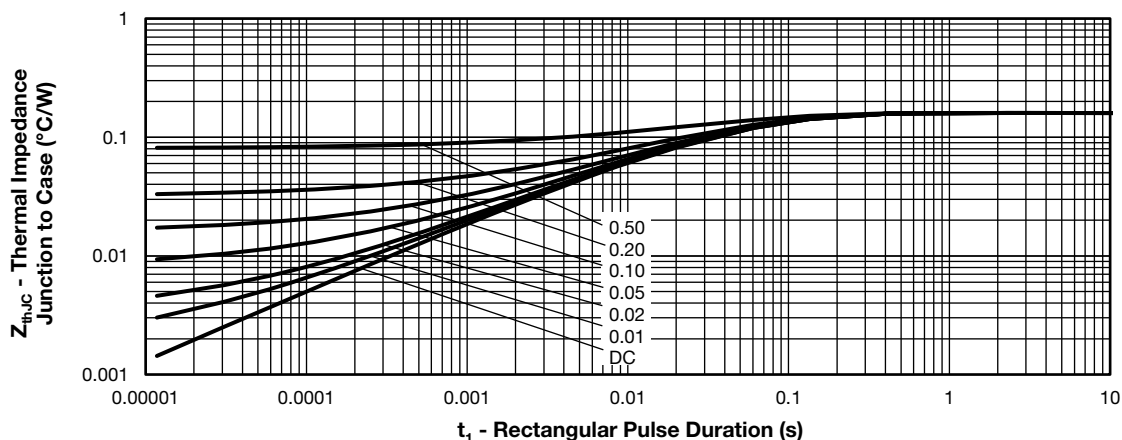
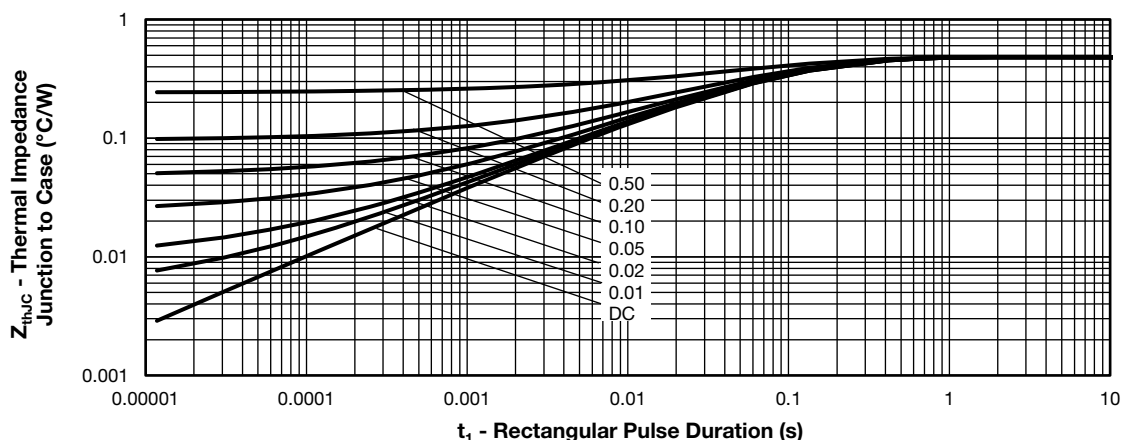


Fig. 18 - Typical Diode Reverse Recovery Charge vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (IGBT)

Fig. 20 - Maximum Thermal Impedance Z_{thJC} Characteristics - (Diode)

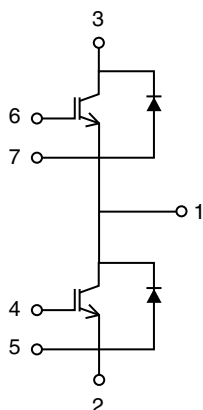
ORDERING INFORMATION TABLE

Device code	VS-	GP	100	T	S	60	S	F	PbF
	1	2	3	4	5	6	7	8	9

- 1** - Vishay Semiconductors product
- 2** - IGBT die technology (GP = trench PT)
- 3** - Current rating (100 = 100 A)
- 4** - Circuit configuration (T = half bridge)
- 5** - Package indicator (S = INT-A-PAK)
- 6** - Voltage code (60 = 600 V)
- 7** - Speed/type (S = standard speed IGBT)
- 8** - Diode type
- 9** - None = standard production; PbF = Lead (Pb)-free



CIRCUIT CONFIGURATION

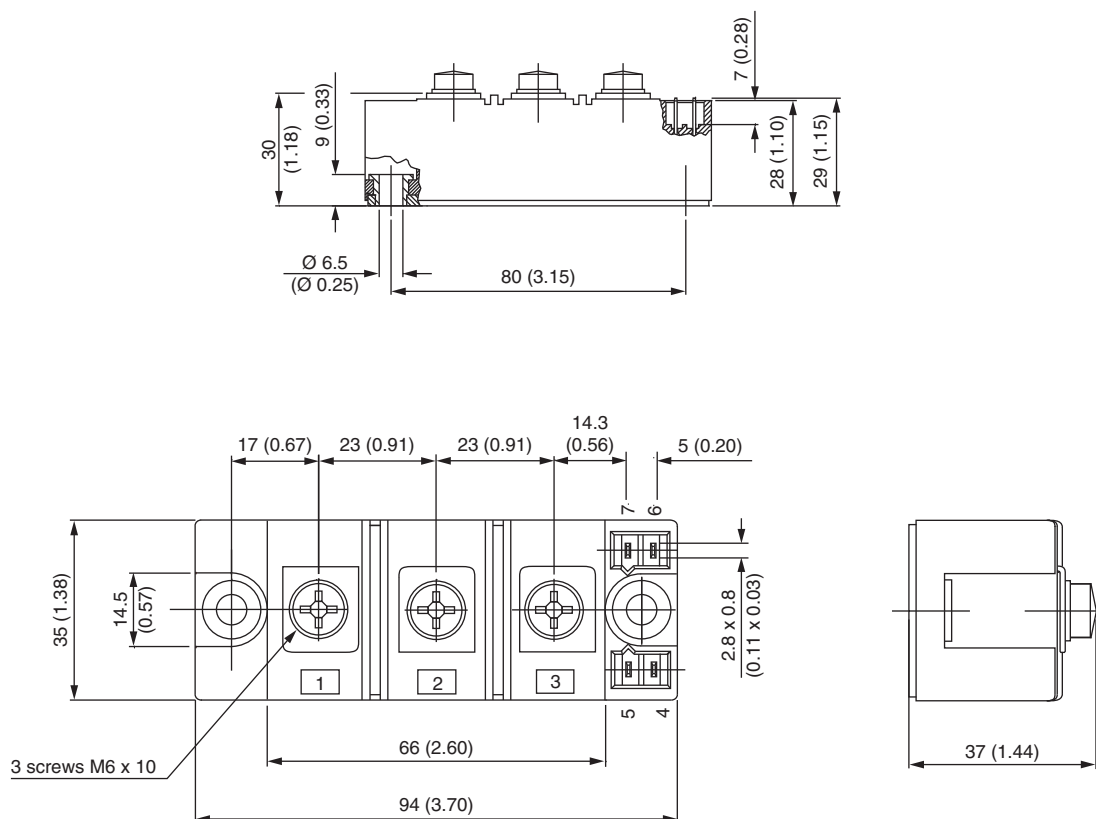


LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95173
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INT-A-PAK IGBT

DIMENSIONS in millimeters (inches)





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