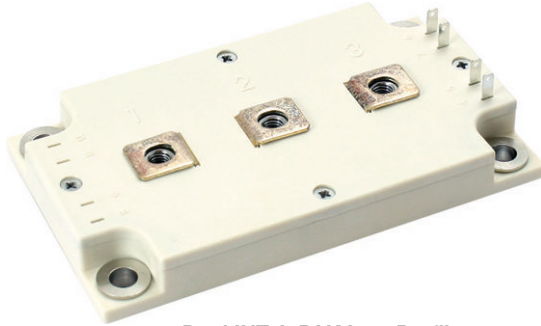


## Dual INT-A-PAK Low Profile “Half Bridge” (Standard Speed IGBT), 300 A



Dual INT-A-PAK Low Profile

### FEATURES

- TrenchStop IGBT technology
- Standard: optimized for hard switching speed
- Low  $V_{CE(on)}$
- Square RBSOA
- Gen 4 FRED Pt<sup>®</sup> dices technology
- 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](http://www.vishay.com/doc?99912)



### BENEFITS

- Increased operating efficiency
- Performance optimized as output inverter stage for TIG welding machines
- Direct mounting on heatsink
- Very low junction to case thermal resistance

PRIMARY CHARACTERISTICS	
$V_{CES}$	600 V
$I_C$ DC at $T_C = 100\text{ °C}$	300 A
$V_{CE(on)}$ (typical) at 300 A, 25 °C	1.15 V
Speed	DC to 1 kHz
Package	Dual INT-A-PAK low profile
Circuit configuration	Half bridge

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	$V_{CES}$		600	V
Continuous collector current	$I_C$ <sup>(1)</sup>	$T_C = 25\text{ °C}$	466	A
		$T_C = 80\text{ °C}$	349	
Pulsed collector current	$I_{CM}$	$T_C = 175\text{ °C}$ , $t_p = 6\text{ ms}$ , $V_{GE} = 15\text{ V}$	1500	
Clamped inductive load current	$I_{LM}$		700	
Diode continuous forward current	$I_F$	$T_C = 25\text{ °C}$	260	
		$T_C = 80\text{ °C}$	192	
Gate to emitter voltage	$V_{GE}$		± 20	V
Maximum power dissipation (IGBT)	$P_D$	$T_C = 25\text{ °C}$	882	W
		$T_C = 80\text{ °C}$	559	
Maximum power dissipation (diode)	$P_D$	$T_C = 25\text{ °C}$	441	W
		$T_C = 80\text{ °C}$	279	
RMS isolation voltage	$V_{ISOL}$	Any terminal to case ( $V_{RMS} t = 1\text{ s}$ , $T_J = 25\text{ °C}$ )	3500	V

#### Note

<sup>(1)</sup> Maximum continuous collector current must be limited to 500 A to do not exceed the maximum temperature of terminals



<b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}, I_C = 800\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 300\text{ A}$	-	1.15	1.47	
		$V_{GE} = 15\text{ V}, I_C = 300\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.16	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 4\text{ mA}$	3.8	5.0	6.3	
Collector to emitter leakage current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	1.2	200	$\mu\text{A}$
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	380	-	
Diode forward voltage drop	$V_{FM}$	$I_{FM} = 300\text{ A}$	-	1.56	2.02	V
		$I_{FM} = 300\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.45	-	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	$\pm 200$	nA

<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$I_C = 75\text{ A}, V_{CC} = 520\text{ V}, V_{GE} = 15\text{ V}$	-	1863	-	nC
Gate-to-emitter charge (turn-on)	$Q_{ge}$		-	296	-	
Gate-to-collector charge (turn-on)	$Q_{gc}$		-	540	-	
Turn-on switching loss	$E_{on}$	$I_C = 300\text{ A}, V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}, R_g = 1.5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	2.1	-	mJ
Turn-off switching loss	$E_{off}$		-	13.9	-	
Total switching loss	$E_{tot}$		-	16	-	
Turn-on switching loss	$E_{on}$		-	2	-	
Turn-off switching loss	$E_{off}$	$I_C = 300\text{ A}, V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}, R_g = 1.5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	20	-	ns
Total switching loss	$E_{tot}$		-	22	-	
Turn-on delay time	$t_{d(on)}$		-	19	-	
Rise time	$t_r$		-	75	-	
Turn-off delay time	$t_{d(off)}$		-	419	-	
Fall time	$t_f$	-	194	-		
Reverse bias safe operating area	RBSOA	$T_J = 175\text{ }^\circ\text{C}, I_C = 700\text{ A}, R_g = 1.5\text{ }\Omega, V_{GE} = +15\text{ V}/0\text{ V}, V_{CC} = 300\text{ V}, V_p = 600\text{ V}$	Fullsquare			
Diode reverse recovery time	$t_{rr}$	$I_F = 50\text{ A}, di_F/dt = 500\text{ A}/\mu\text{s}, V_{CC} = 200\text{ V}, T_J = 25\text{ }^\circ\text{C}$	-	152	-	ns
Diode peak reverse current	$I_{rr}$		-	24	-	A
Diode recovery charge	$Q_{rr}$		-	1.81	-	$\mu\text{C}$
Diode reverse recovery time	$t_{rr}$	$I_F = 50\text{ A}, di_F/dt = 500\text{ A}/\mu\text{s}, V_{CC} = 200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	201	-	ns
Diode peak reverse current	$I_{rr}$		-	39	-	A
Diode recovery charge	$Q_{rr}$		-	3.94	-	$\mu\text{C}$

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>						
PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating junction and storage temperature range		$T_J, T_{Stg}$	-40	-	175	$^\circ\text{C}$
Junction to case per leg	IGBT	$R_{thJC}$	-	-	0.17	$^\circ\text{C}/\text{W}$
	Diode		-	-	0.34	
Case to sink per module		$R_{thCS}$	-	0.05	-	
Mounting torque	case to heatsink: M6 screw		4	-	6	Nm
	case to terminal 1, 2, 3: M5 screw		2	-	5	
Weight			-	270	-	g

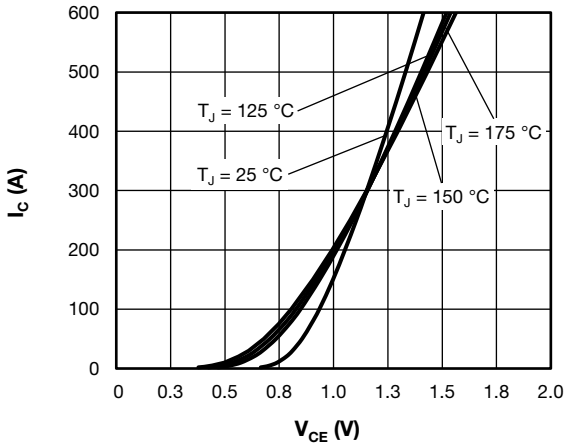


Fig. 1 - Typical Trench IGBT Output Characteristics,  $V_{GE} = 15\text{ V}$

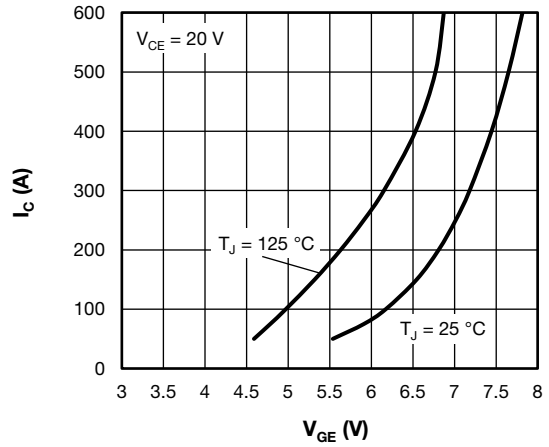


Fig. 4 - Typical Trench IGBT Transfer Characteristics

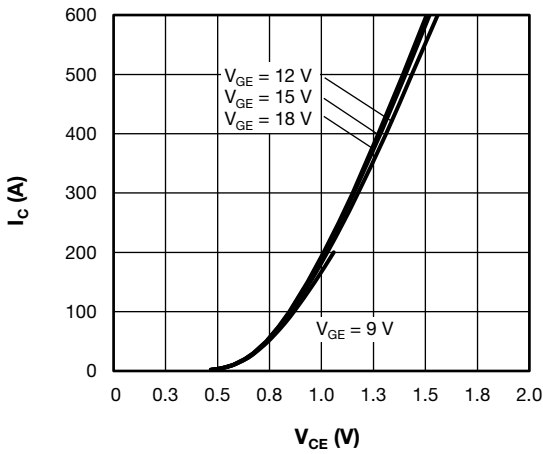


Fig. 2 - Typical Trench IGBT Output Characteristics,  $T_J = 125\text{ °C}$

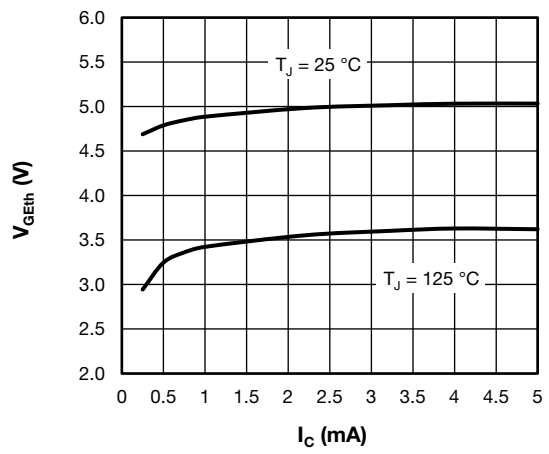


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

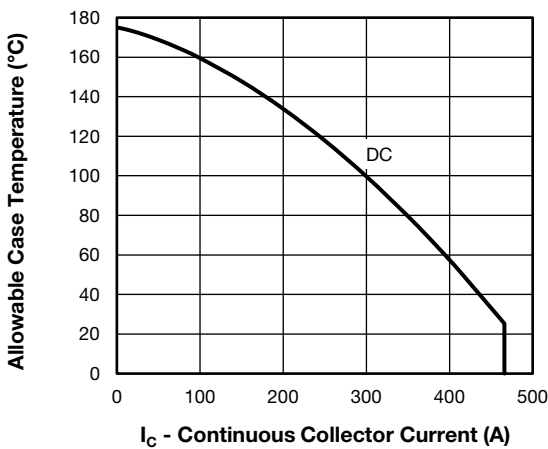


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

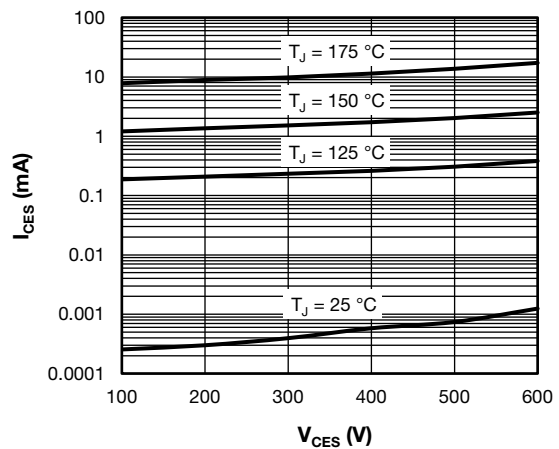


Fig. 6 - Typical trench IGBT Zero Gate Voltage Collector Current

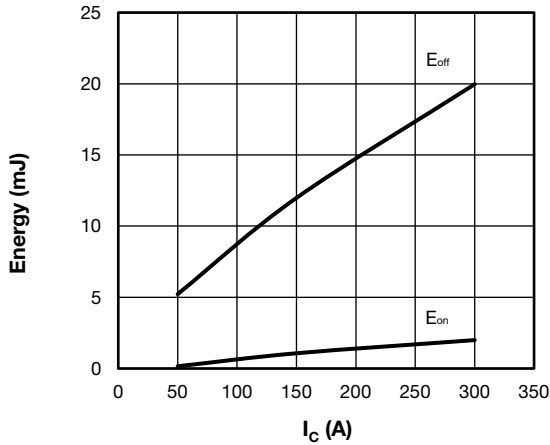


Fig. 7 - Typical Trench IGBT Energy Loss vs.  $I_C$ , (with Antiparallel Diode),  $T_J = 125^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $R_g = 1.5\ \Omega$ ,  $V_{GE} = +15\text{ V}/-15\text{ V}$ ,  $L = 500\ \mu\text{H}$

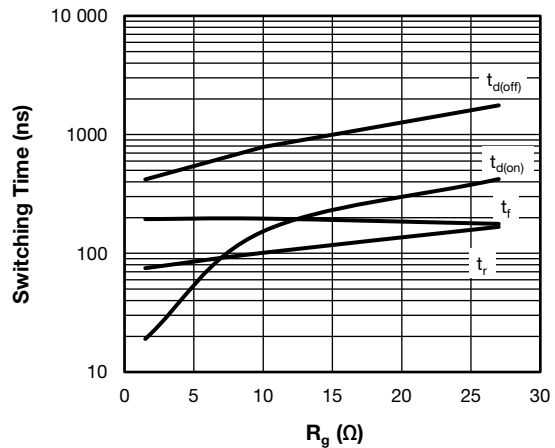


Fig. 10 - Typical Trench IGBT Switching Time vs.  $R_g$ , (with Antiparallel Diode),  $T_J = 125^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = +15\text{ V}/-15\text{ V}$ ,  $L = 500\ \mu\text{H}$

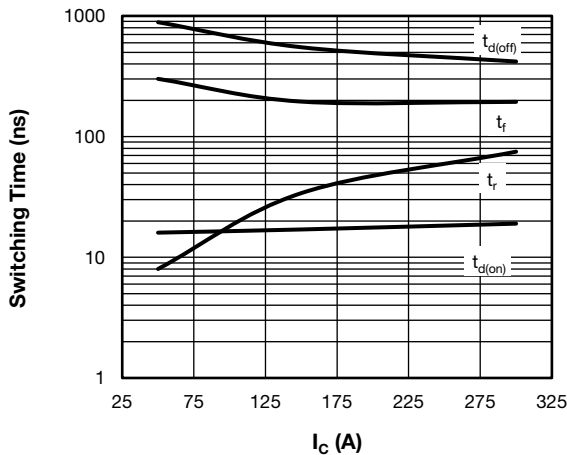


Fig. 8 - Typical Trench IGBT Switching Time vs.  $I_C$ , (with Antiparallel Diode),  $T_J = 125^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $R_g = 1.5\ \Omega$ ,  $V_{GE} = +15\text{ V}/-15\text{ V}$ ,  $L = 500\ \mu\text{H}$

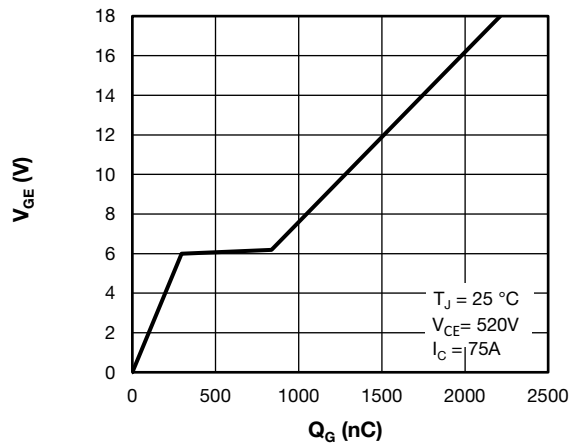


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

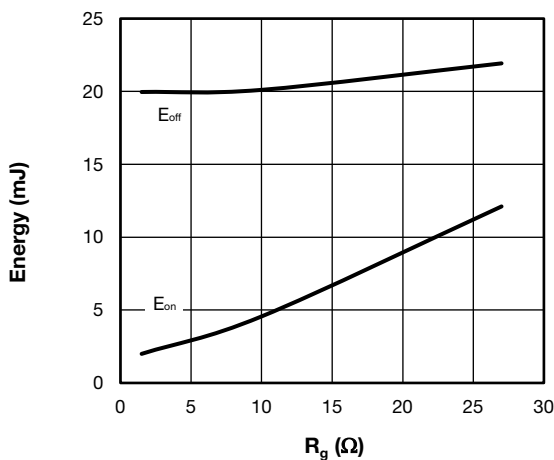


Fig. 9 - Typical Trench IGBT Energy Loss vs.  $R_g$ , (with Antiparallel Diode),  $T_J = 125^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = +15\text{ V}/-15\text{ V}$ ,  $L = 500\ \mu\text{H}$

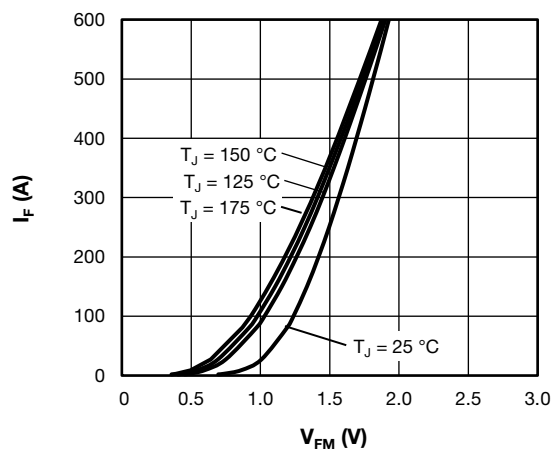


Fig. 12 - Typical Antiparallel Diode Forward Characteristics

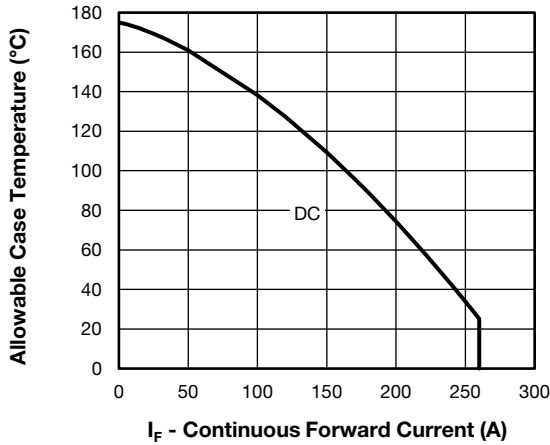


Fig. 13 - Maximum Antiparallel Diode Continuous Forward Current vs. Case Temperature

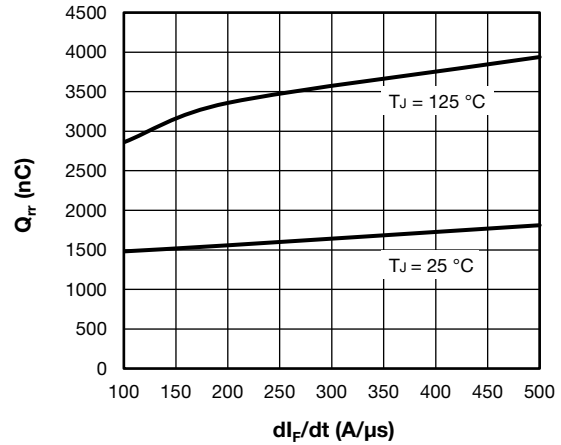


Fig. 16 - Typical Antiparallel Diode Reverse Recovery Charge vs.  $di_F/dt$ ,  $I_F = 50$  A,  $V_{CC} = 200$  V

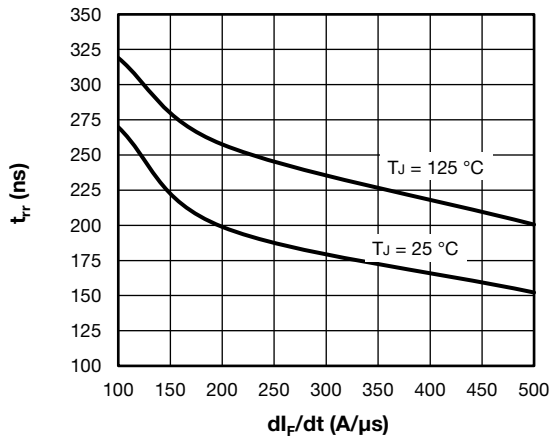


Fig. 14 - Typical Antiparallel Diode Reverse Recovery Time vs.  $di_F/dt$ ,  $I_F = 50$  A,  $V_{CC} = 200$  V

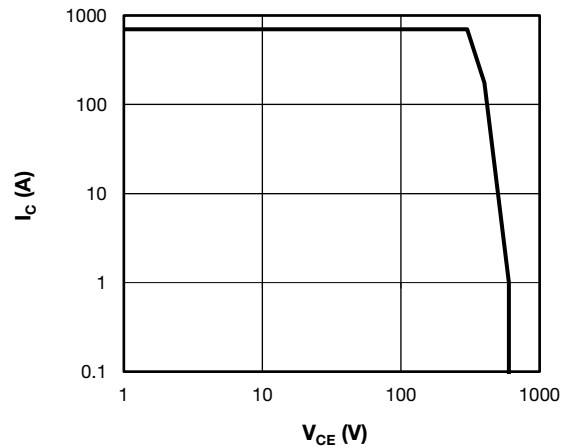


Fig. 17 - Trench IGBT Reverse BIAS SOA  
 $T_J = 175$  °C,  $I_C = 700$  A,  $R_{\theta} = 1.5$  Ω,  $V_{GE} = +15$  V/0 V,  $V_{CC} = 300$  V,  $V_p = 600$  V

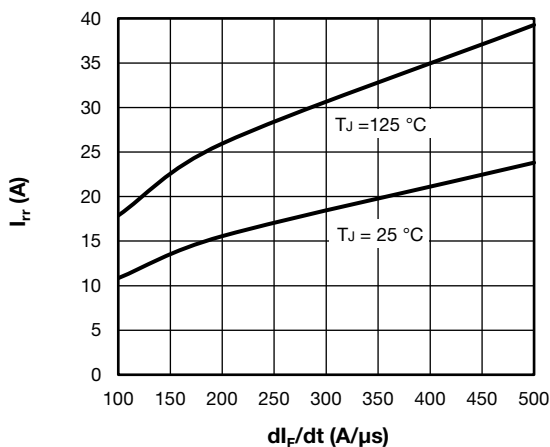


Fig. 15 - Typical Antiparallel Diode Reverse Recovery Current vs.  $di_F/dt$ ,  $I_F = 50$  A,  $V_{CC} = 200$  V

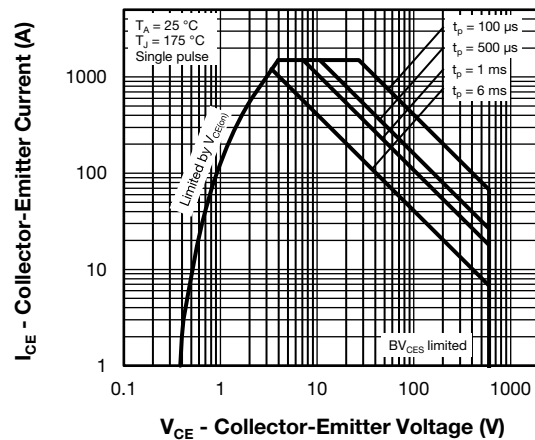


Fig. 18 - Trench IGBT Safe Operating Area

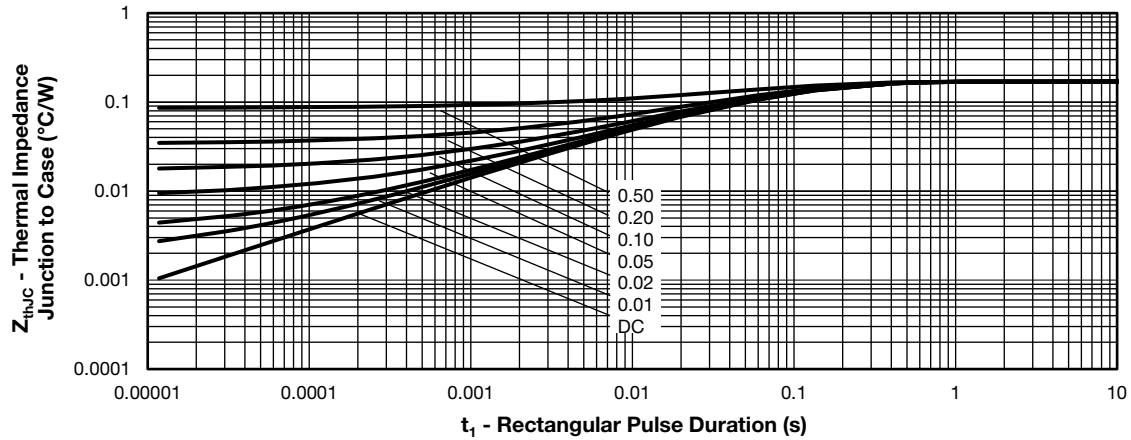


Fig. 19 - Maximum Trench IGBT Thermal Impedance  $Z_{thJC}$  Characteristics (IGBT)

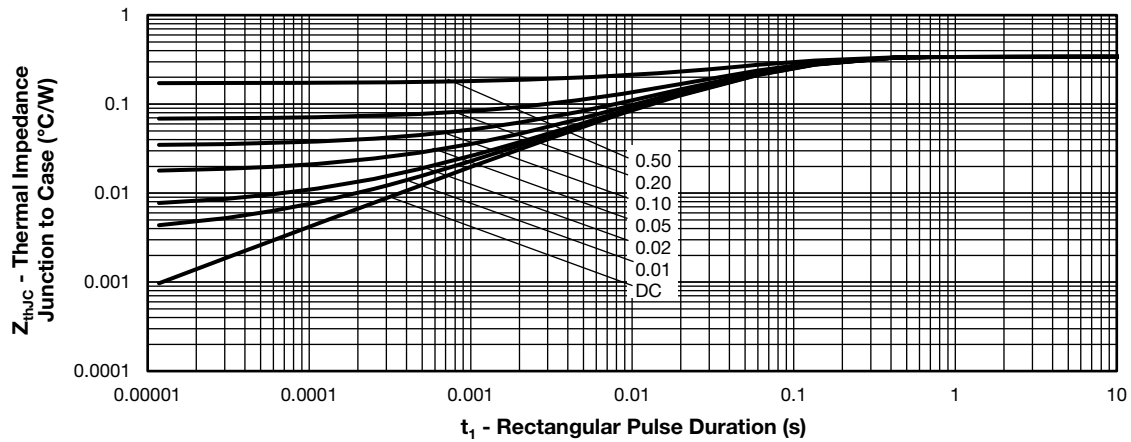


Fig. 20 - Maximum Antiparallel Diode Thermal Impedance  $Z_{thJC}$  Characteristics

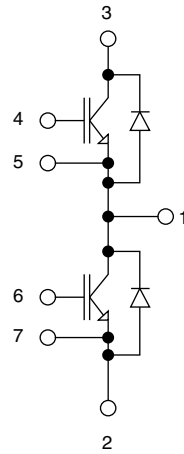
**ORDERING INFORMATION TABLE**

Device code	<b>G</b>	<b>T</b>	<b>300</b>	<b>T</b>	<b>D</b>	<b>60</b>	<b>S</b>
	①	②	③	④	⑤	⑥	⑦

- 1** - Insulated gate bipolar transistor (IGBT)
- 2** - T = Trench IGBT technology
- 3** - Current rating (300 = 300 A)
- 4** - Circuit configuration (T = half bridge)
- 5** - Package indicator (D = dual INT-A-PAK low profile)
- 6** - Voltage rating (60 = 600 V)
- 7** - Speed / type (S = standard speed IGBT)



**CIRCUIT CONFIGURATION**

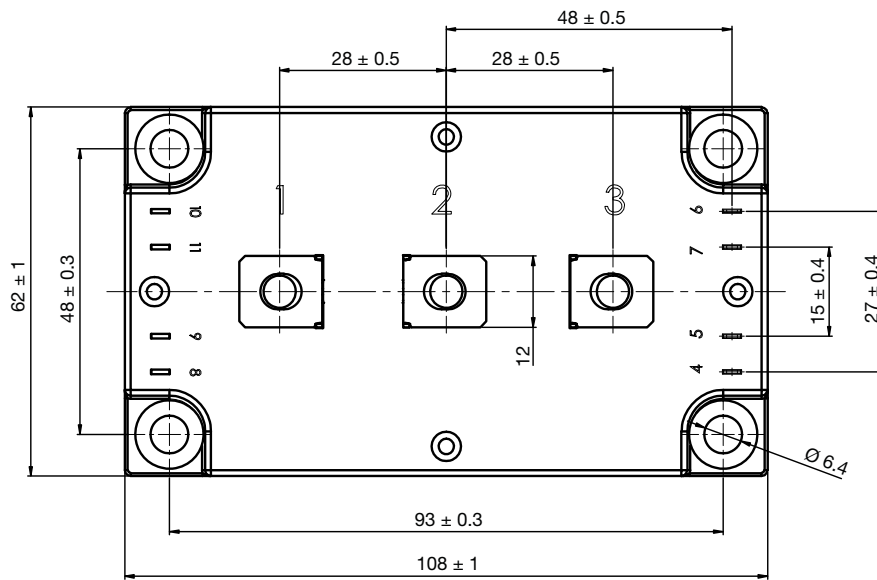
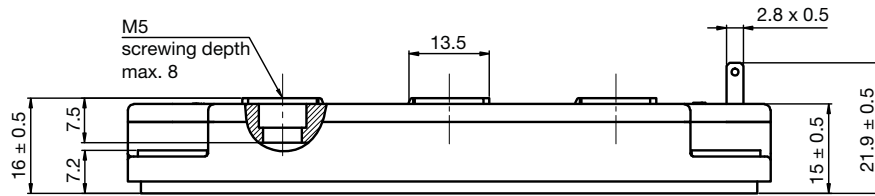


LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95435">www.vishay.com/doc?95435</a>



## Dual INT-A-PAK Low Profile

**DIMENSIONS** in millimeters







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