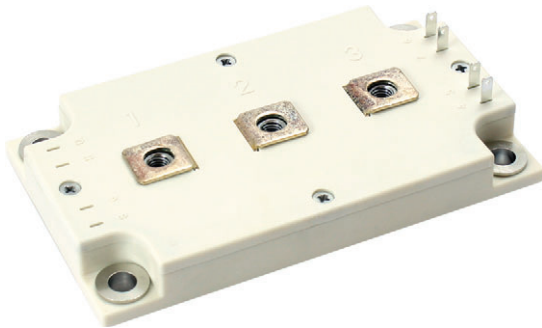





# Dual INT-A-PAK Low Profile “Half Bridge” (Trench PT IGBT), 300 A

Proprietary Vishay IGBT Silicon “L Series”



Dual INT-A-PAK Low Profile

### FEATURES

- Trench PT IGBT technology
- Low  $V_{CE(on)}$
- Square RBSOA
- 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](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

PRODUCT SUMMARY	
$V_{CES}$	600 V
$I_C$ DC at $T_C = 104\text{ }^\circ\text{C}$	300 A
$V_{CE(on)}$ (typical) at 300 A, 25 °C	1.30 V
Speed	DC to 1 kHz
Package	DIAP low profile
Circuit	Half bridge

### 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

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>	$T_C = 25\text{ }^\circ\text{C}$	580	A
		$T_C = 80\text{ }^\circ\text{C}$	400	
Pulsed collector current	$I_{CM}$		800	
Clamped inductive load current	$I_{LM}$		800	
Diode continuous forward current	$I_F$	$T_C = 25\text{ }^\circ\text{C}$	219	
		$T_C = 80\text{ }^\circ\text{C}$	145	
Gate to emitter voltage	$V_{GE}$		$\pm 20$	V
Maximum power dissipation (IGBT)	$P_D$	$T_C = 25\text{ }^\circ\text{C}$	1136	W
		$T_C = 80\text{ }^\circ\text{C}$	636	
RMS isolation voltage	$V_{ISOL}$	Any terminal to case ( $V_{RMS} t = 1\text{ s}$ , $T_J = 25\text{ }^\circ\text{C}$ )	3500	V
Operating junction and storage temperature range	$T_J, T_{Stg}$		-40 to +150	$^\circ\text{C}$

### 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	$V_{BR(CEs)}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 150\text{ A}$	-	1.12	1.21	
		$V_{GE} = 15\text{ V}, I_C = 300\text{ A}$	-	1.30	1.45	
		$V_{GE} = 15\text{ V}, I_C = 150\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.03	-	
		$V_{GE} = 15\text{ V}, I_C = 300\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.26	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 6.4\text{ mA}$	4.9	6.0	8.8	
		$V_{CE} = V_{GE}, I_C = 6.4\text{ mA}, T_J = 125\text{ }^\circ\text{C}$	-	3.4	-	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T$	$V_{CE} = V_{GE}, I_C = 6.4\text{ mA}, (25\text{ }^\circ\text{C to } 125\text{ }^\circ\text{C})$	-	-26	-	mV/ $^\circ\text{C}$
Forward transconductance	$g_{fe}$	$V_{CE} = 20\text{ V}, I_C = 50\text{ A}$	-	67	-	S
Transfer characteristics	$V_{GE}$	$V_{CE} = 20\text{ V}, I_C = 300\text{ A}$	-	11.4	-	V
Collector to emitter leakage current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	4.0	150	$\mu\text{A}$
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	100	-	
Diode forward voltage drop	$V_{FM}$	$I_{FM} = 150\text{ A}$	-	1.31	1.41	V
		$I_{FM} = 300\text{ A}$	-	1.56	1.75	
		$I_{FM} = 150\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.28	-	
		$I_{FM} = 300\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.63	-	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	$\pm 500$	nA

<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on switching energy	$E_{on}$	$I_C = 300\text{ A}, V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}, R_g = 1.5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	6.0	-	mJ
Turn-off switching energy	$E_{off}$		-	33	-	
Total switching energy	$E_{tot}$		-	39	-	
Turn-on delay time	$t_{d(on)}$	$I_C = 300\text{ A}, V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}, R_g = 1.5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	503	-	ns
Rise time	$t_r$		-	214	-	
Turn-off delay time	$t_{d(off)}$		-	600	-	
Fall time	$t_f$		-	547	-	
Turn-on switching loss	$E_{on}$		-	7.2	-	
Turn-off switching loss	$E_{off}$	-	55.2	-		
Total switching loss	$E_{tot}$	-	62.4	-		
Turn-on delay time	$t_{d(on)}$	$I_C = 300\text{ A}, V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}, R_g = 1.5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	476	-	ns
Rise time	$t_r$		-	209	-	
Turn-off delay time	$t_{d(off)}$		-	807	-	
Fall time	$t_f$		-	918	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 800\text{ A}, V_{CC} = 300\text{ V}, V_P = 600\text{ V}, R_g = 1.5\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}, L = 500\text{ }\mu\text{H}$	Fullsquare			
Diode reverse recovery time	$t_{rr}$	$I_F = 300\text{ A}, R_g = 1.5\text{ }\Omega, V_{CC} = 300\text{ V}, T_J = 25\text{ }^\circ\text{C}$	-	119	-	ns
Diode peak reverse current	$I_{rr}$		-	99	-	A
Diode recovery charge	$Q_{rr}$		-	7.3	-	$\mu\text{C}$
Diode reverse recovery time	$t_{rr}$	$I_F = 300\text{ A}, R_g = 1.5\text{ }\Omega, V_{CC} = 300\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	165	-	ns
Diode peak reverse current	$I_{rr}$		-	127	-	A
Diode recovery charge	$Q_{rr}$		-	13	-	$\mu\text{C}$



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	-	-	0.11	°C/W
	diode	-	-	0.4	
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	-	4	
Weight		-	270	-	g

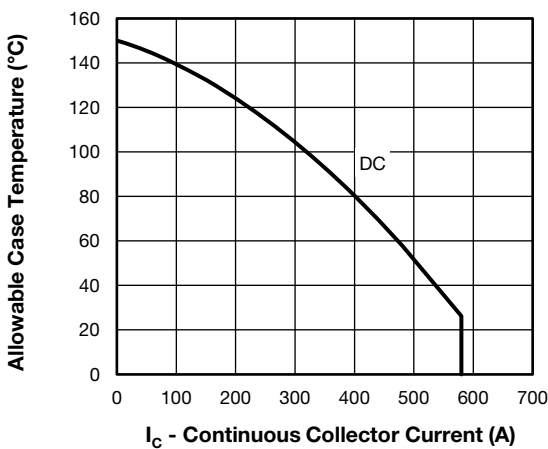


Fig. 1 - Maximum IGBT Continuous Collector Current vs. Case Temperature

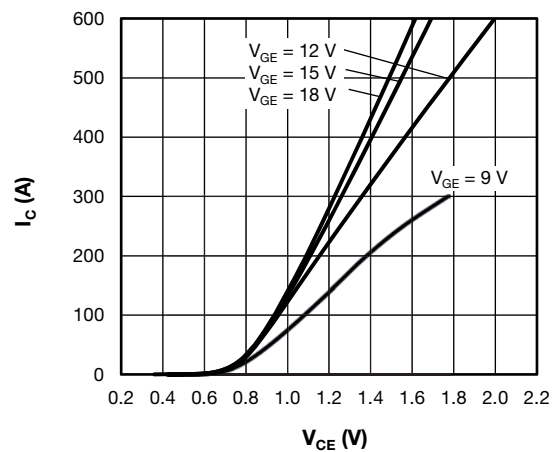


Fig. 3 - Typical IGBT Output Characteristics,  $T_J = 125$  °C

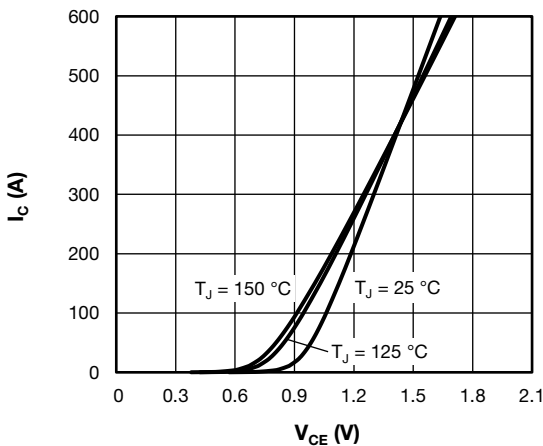


Fig. 2 - Typical IGBT Output Characteristics,  $V_{GE} = 15$  V

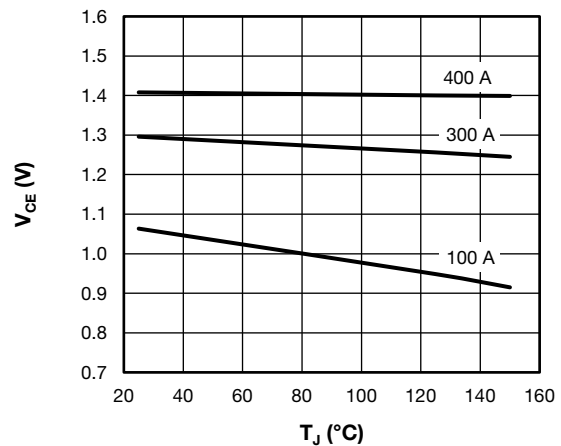


Fig. 4 - Collector to Emitter Voltage vs. Junction Temperature

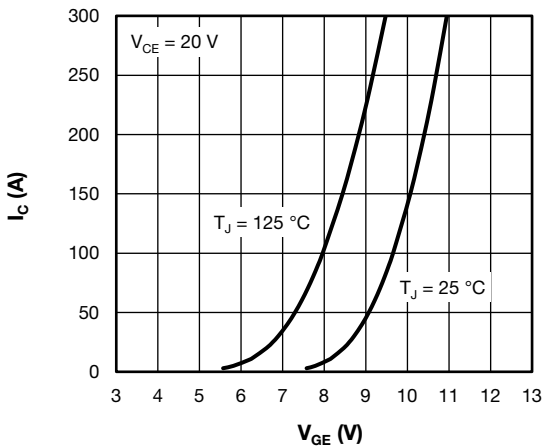


Fig. 5 - Typical IGBT Transfer Characteristics

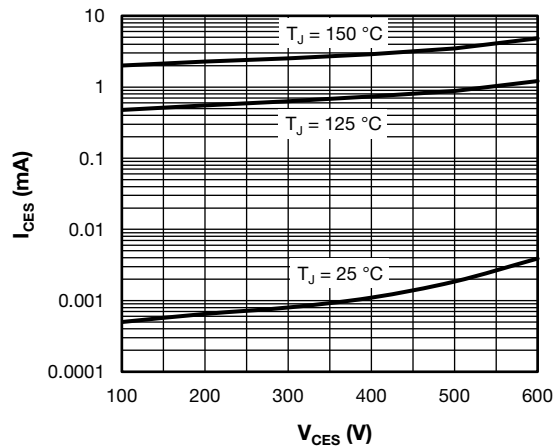


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

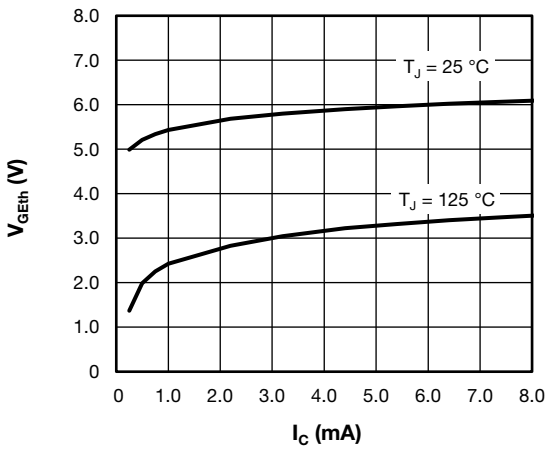


Fig. 6 - Typical IGBT Gate Threshold Voltage

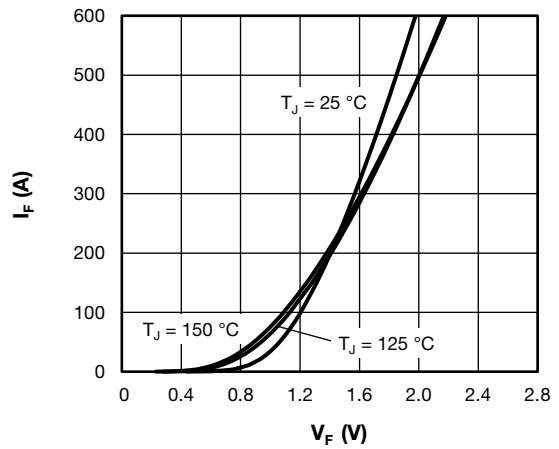


Fig. 9 - Typical Diode Forward Characteristics

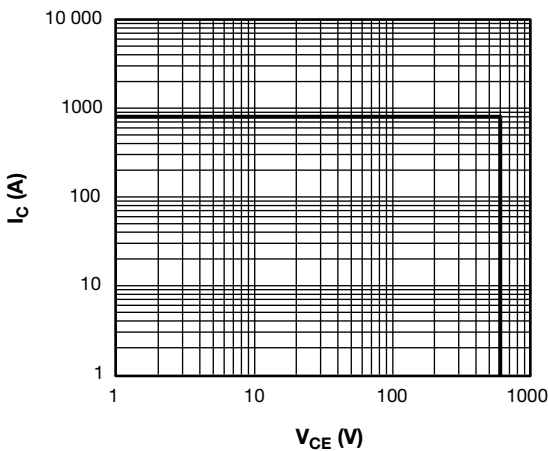


Fig. 7 - IGBT Reverse BIAS SOA  $T_J = 150\text{ }^\circ\text{C}$ ,  $V_{GE} = 15\text{V}$

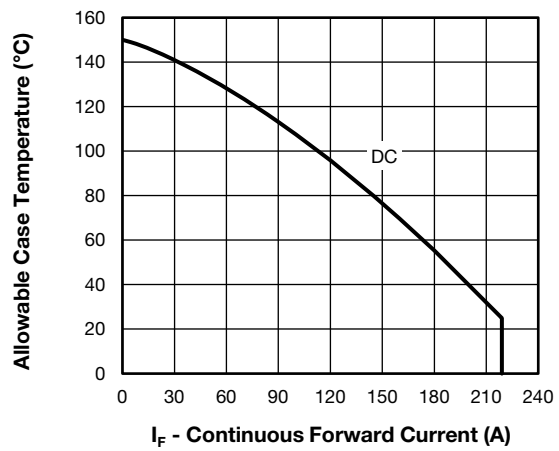


Fig. 10 - Maximum Diode Continuous Forward Current vs. Case Temperature

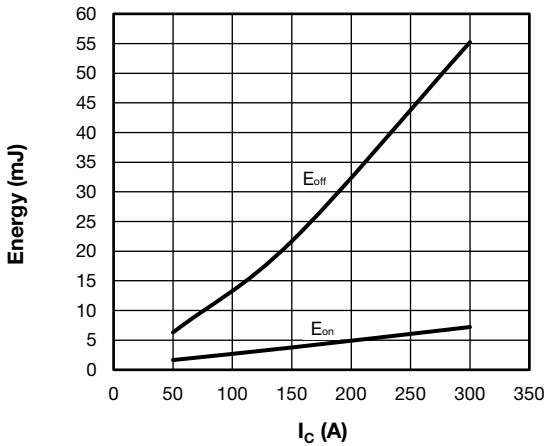


Fig. 11 - Typical IGBT Energy Loss vs.  $I_C$   
 $T_J = 125\text{ }^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $R_g = 1.5\ \Omega$ ,  $V_{GE} = 15\text{ V}$ ,  $L = 500\ \mu\text{H}$

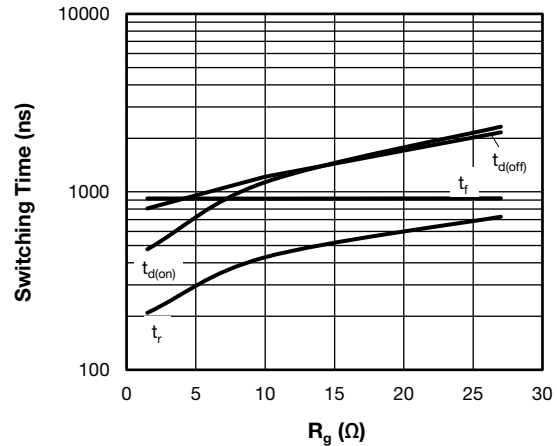


Fig. 14 - Typical IGBT Switching Time vs.  $R_g$   
 $T_J = 125\text{ }^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = 15\text{ V}$ ,  $L = 500\ \mu\text{H}$

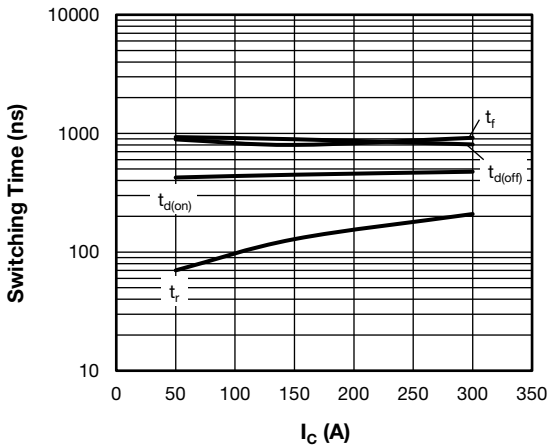


Fig. 12 - Typical IGBT Switching Time vs.  $I_C$   
 $T_J = 125\text{ }^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $R_g = 1.5\ \Omega$ ,  $V_{GE} = 15\text{ V}$ ,  $L = 500\ \mu\text{H}$

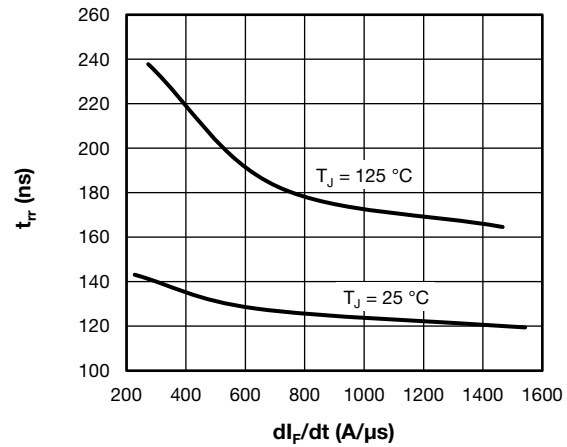


Fig. 15 - Typical Diode Reverse Recovery Time vs.  $dI_F/dt$   
 $V_{CC} = 300\text{ V}$ ,  $I_F = 300\text{ A}$

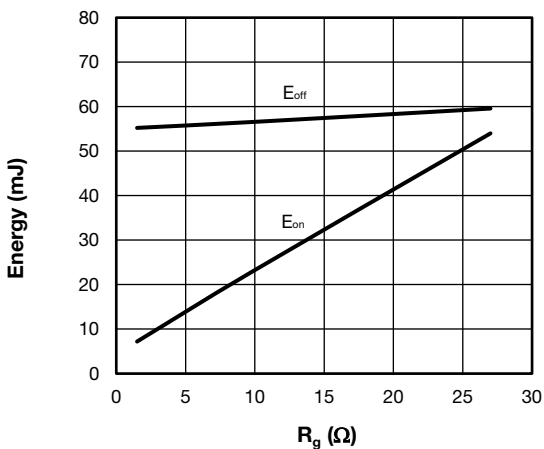


Fig. 13 - Typical IGBT Energy Loss vs.  $R_g$   
 $T_J = 125\text{ }^\circ\text{C}$ ,  $V_{CC} = 300\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = 15\text{ V}$ ,  $L = 500\ \mu\text{H}$

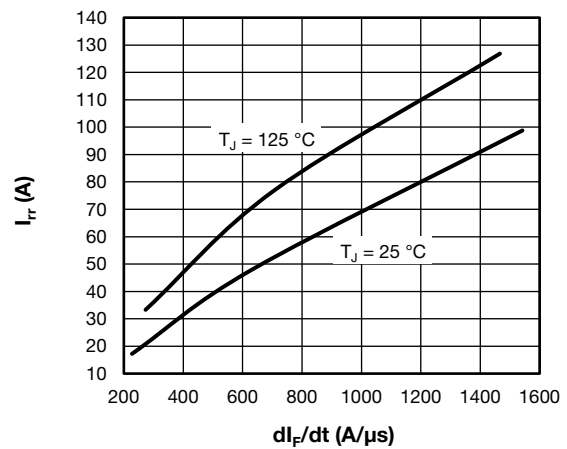


Fig. 16 - Typical Diode Reverse Recovery Current vs.  $dI_F/dt$   
 $V_{CC} = 300\text{ V}$ ,  $I_F = 300\text{ A}$

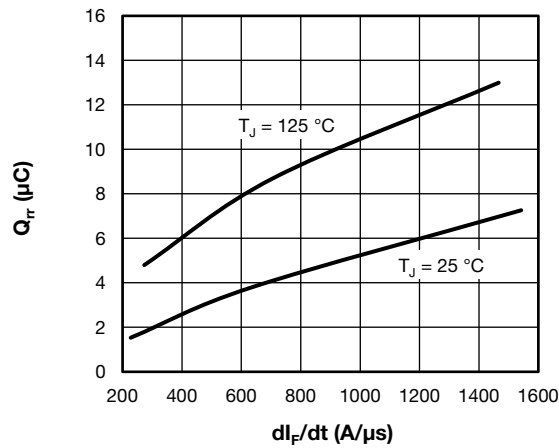


Fig. 17 - Typical Diode Reverse Recovery Charge vs.  $di_F/dt$   
 $V_{CC} = 300\text{ V}$ ,  $I_F = 300\text{ A}$

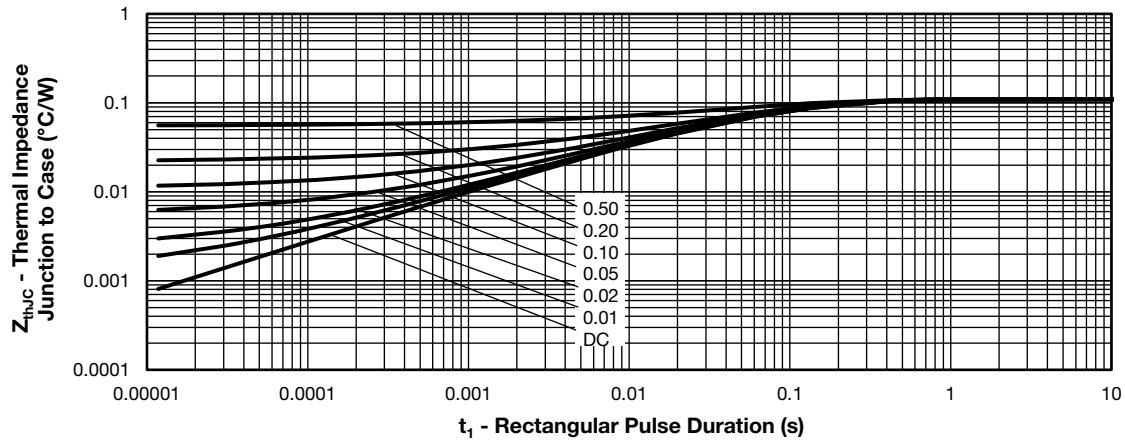


Fig. 18 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics - (IGBT)

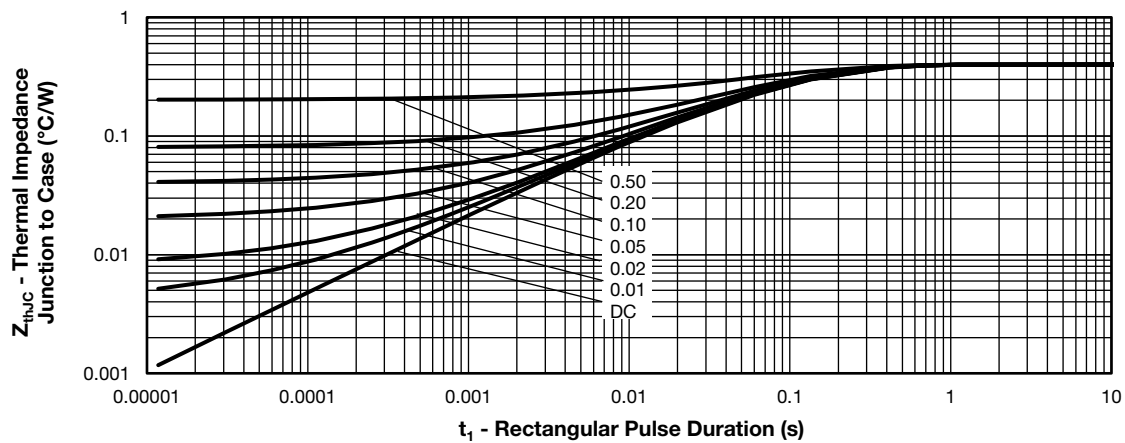


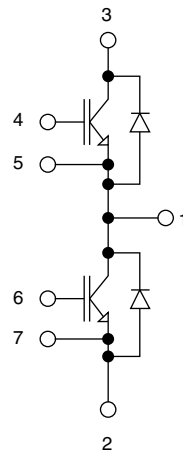
Fig. 19 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics - (Diode)

## ORDERING INFORMATION TABLE

Device code	<b>VS-</b>	<b>G</b>	<b>P</b>	<b>300</b>	<b>T</b>	<b>D</b>	<b>60</b>	<b>S</b>
	①	②	③	④	⑤	⑥	⑦	⑧

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

## CIRCUIT CONFIGURATION



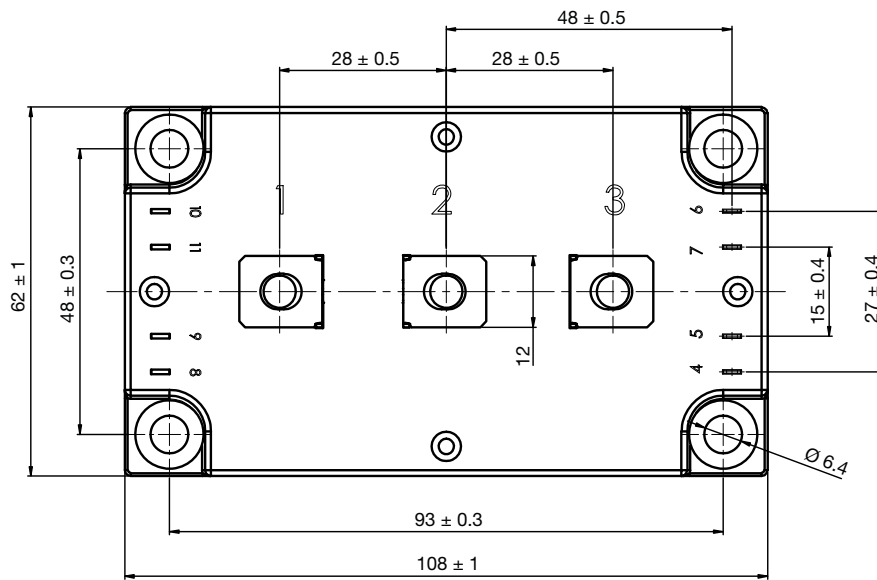
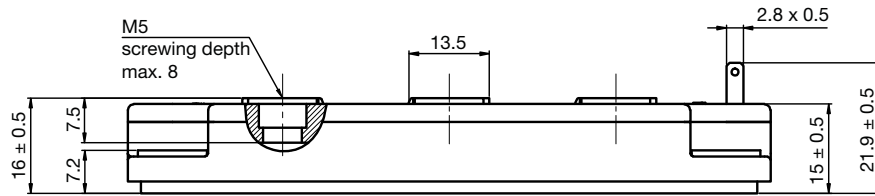
### LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?95435">www.vishay.com/doc?95435</a>
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## Dual INT-A-PAK Low Profile

**DIMENSIONS** in millimeters







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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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