

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



RoHS
COMPLIANT

PRIMARY CHARACTERISTICS	
V_{CES}	600 V
I_C DC at $T_C = 104\text{ °C}$	300 A
$V_{CE(on)}$ (typical) at 300 A, 25 °C	1.30 V
Speed	DC to 1 kHz
Package	Dual INT-A-PAK low profile
Circuit configuration	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 ⁽¹⁾	$T_C = 25\text{ °C}$	580	A
		$T_C = 80\text{ °C}$	400	
Pulsed collector current	I_{CM}		800	
Clamped inductive load current	I_{LM}		800	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	219	
		$T_C = 80\text{ °C}$	145	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation (IGBT)	P_D	$T_C = 25\text{ °C}$	1136	W
		$T_C = 80\text{ °C}$	636	
RMS isolation voltage	V_{ISOL}	Any terminal to case ($V_{RMS} t = 1\text{ s}$, $T_J = 25\text{ °C}$)	3500	V
Operating junction and storage temperature range	T_J, T_{Stg}		-40 to +150	°C

Note

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



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	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 150\text{ A}$	-	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/°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	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	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}	$V_{GE} = \pm 20\text{ V}$	-	-	± 500	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ 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	-	μC
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	-	μC



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	-	5	
Weight		-	270	-	g

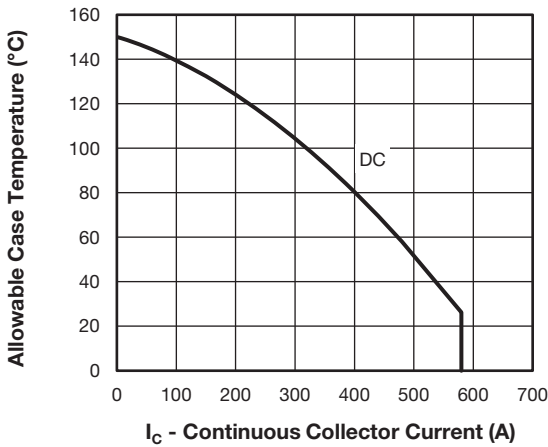


Fig. 1 - Maximum IGBT Continuous Collector Current vs. Case Temperature

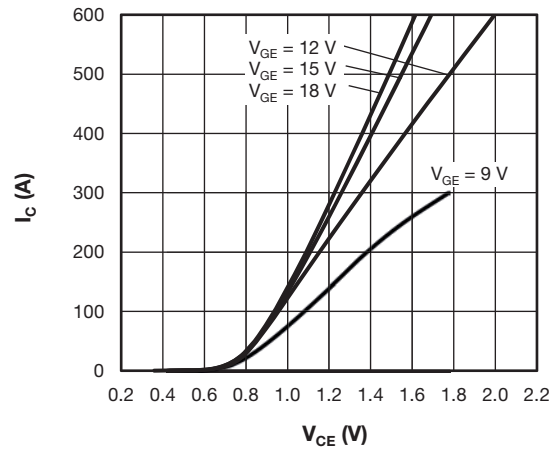


Fig. 3 - Typical IGBT Output Characteristics, $T_J = 125$ °C

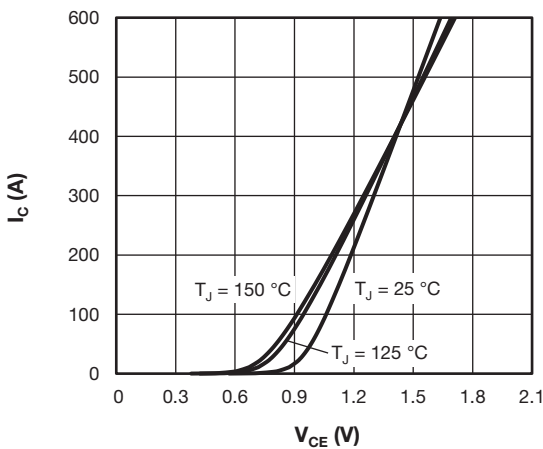


Fig. 2 - Typical IGBT Output Characteristics, $V_{GE} = 15$ V

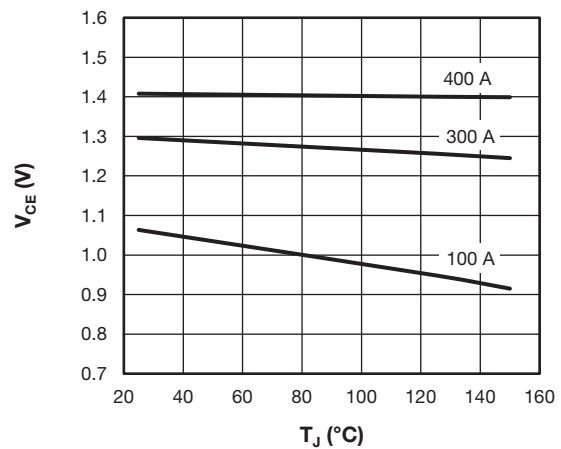


Fig. 4 - Collector to Emitter Voltage vs. Junction Temperature

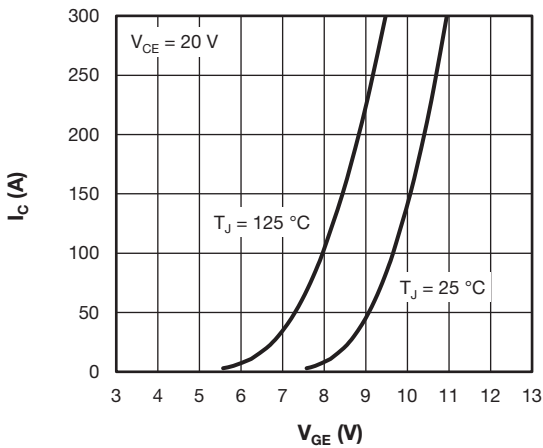


Fig. 5 - Typical IGBT Transfer Characteristics

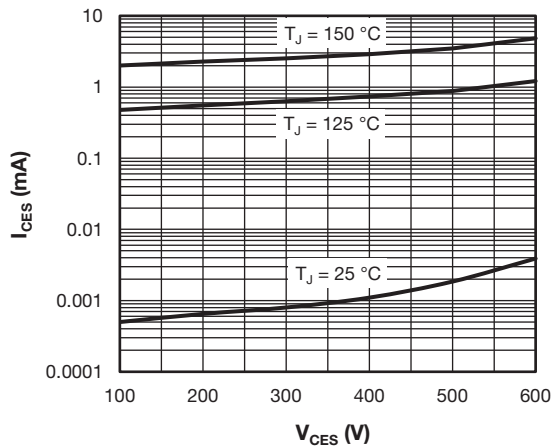


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

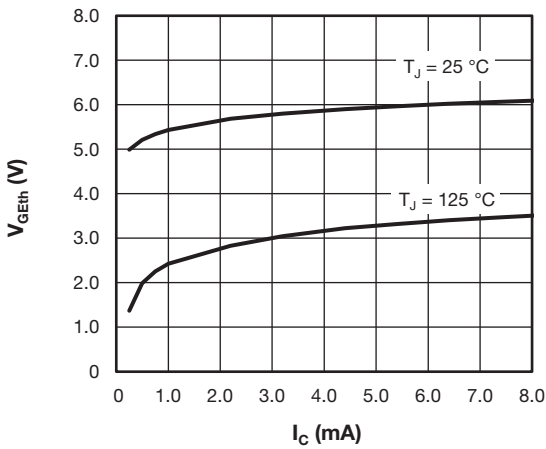


Fig. 6 - Typical IGBT Gate Threshold Voltage

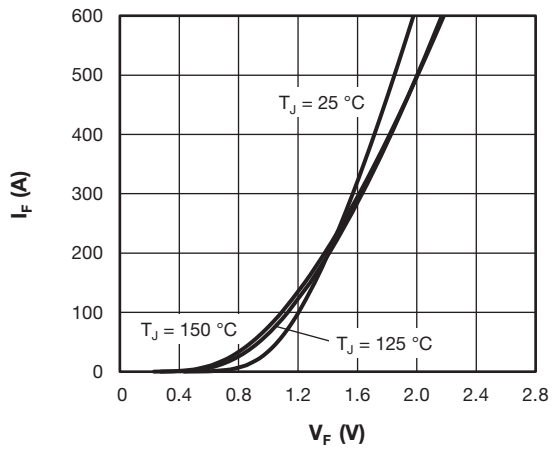


Fig. 9 - Typical Diode Forward Characteristics

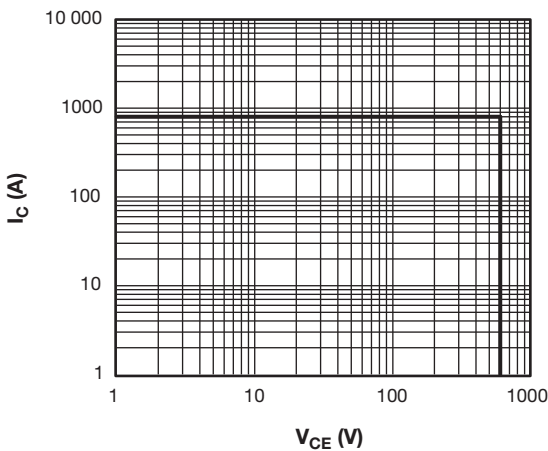


Fig. 7 - IGBT Reverse BIAS SOA $T_J = 150\text{ }^\circ\text{C}$, $V_{GE} = 15\text{ V}$

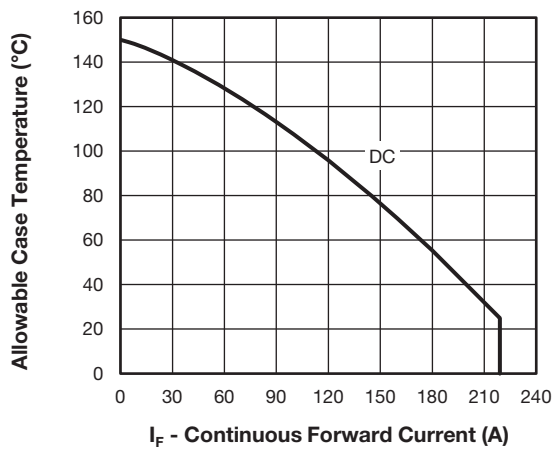


Fig. 10 - Maximum Diode Continuous Forward Current vs. Case Temperature

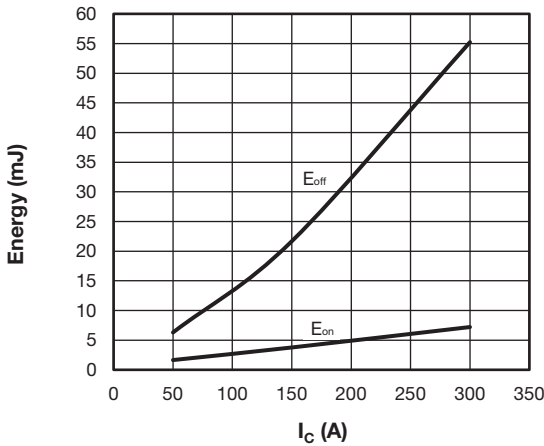


Fig. 11 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 1.5\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

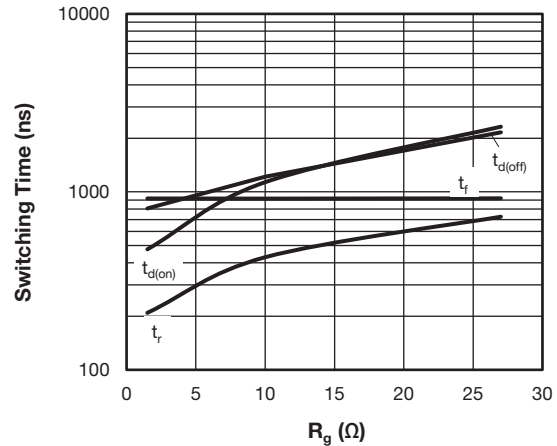


Fig. 14 - Typical IGBT Switching Time vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_C = 300\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

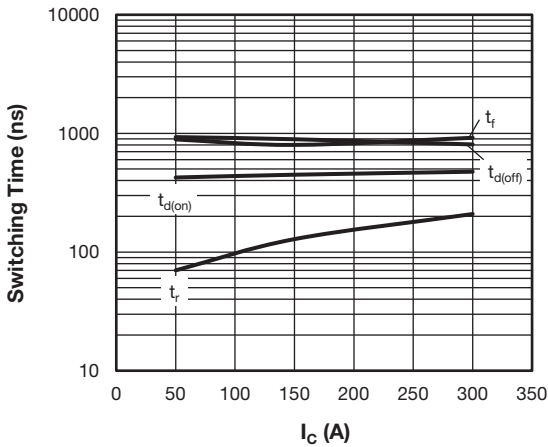


Fig. 12 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 1.5\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

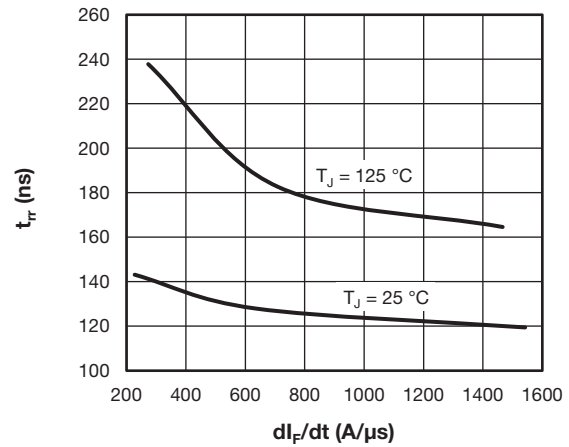


Fig. 15 - Typical Diode Reverse Recovery Time vs. dI_F/dt
 $V_{CC} = 300\text{ V}$, $I_F = 300\text{ A}$

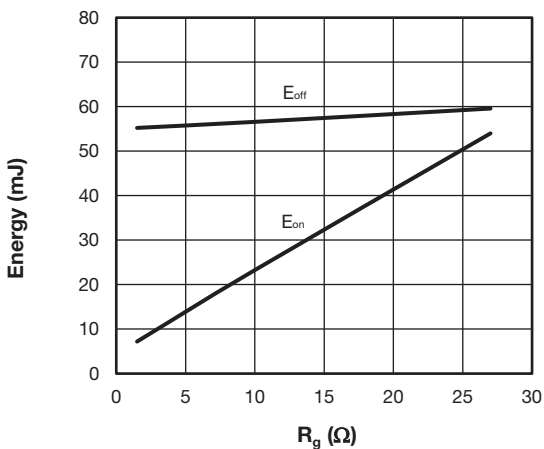


Fig. 13 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_C = 300\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

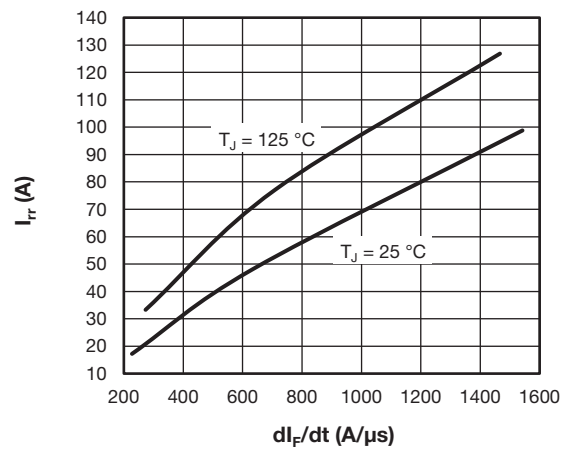


Fig. 16 - Typical Diode Reverse Recovery Current vs. dI_F/dt
 $V_{CC} = 300\text{ V}$, $I_F = 300\text{ A}$

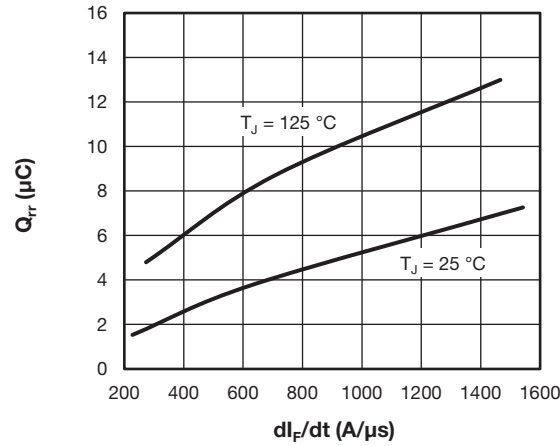


Fig. 17 - Typical Diode Reverse Recovery Charge vs. di_F/dt
 $V_{CC} = 300\text{ V}$, $I_F = 300\text{ A}$

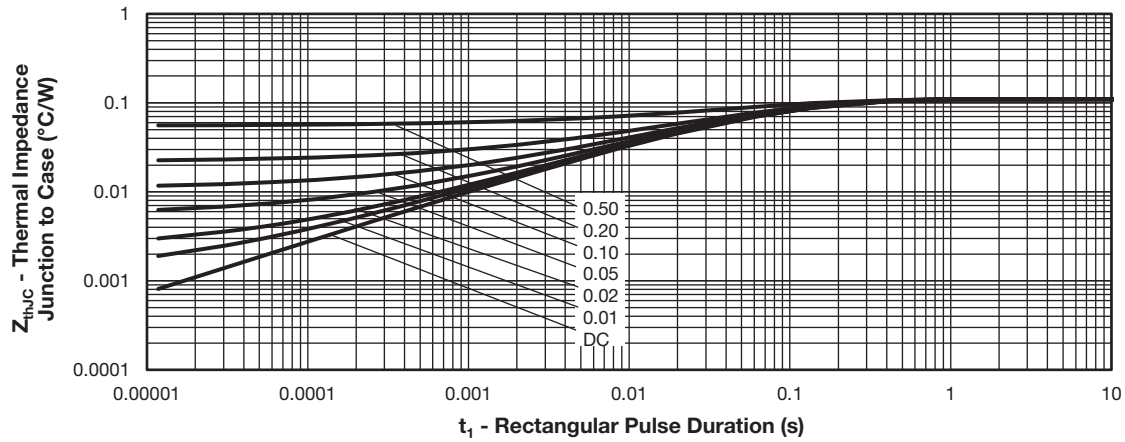


Fig. 18 - Maximum Thermal Impedance Z_{thJC} Characteristics - (IGBT)

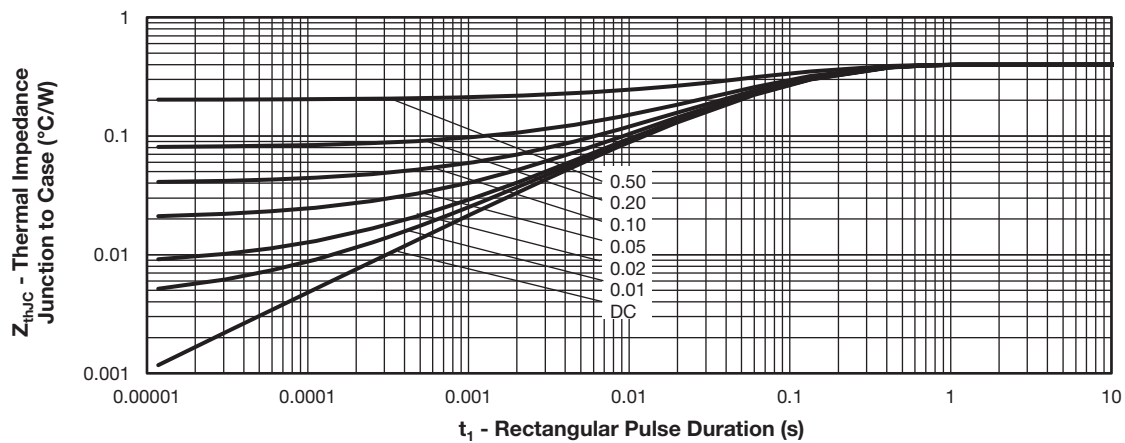


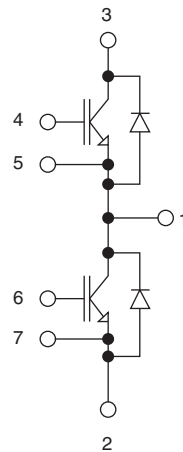
Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (Diode)

ORDERING INFORMATION TABLE

Device code	VS-	G	P	300	T	D	60	S
	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	www.vishay.com/doc?95435
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