Dual INT-A-PAK Low Profile "Half-Bridge" (Standard Speed IGBT), 400 A

Dual INT-A-PAK Low Profile

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC at T_C = 25 °C	750 A
$V_{CE(on)}$ (typical) at 400 A, 25 °C	1.24 V

FEATURES

- Generation 4 IGBT technology
- Standard: Optimized for hard switching speed DC to 1 kHz
- 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
- Compliant to RoHS Directive 2002/95/EC
- Designed for industrial level

RoHS COMPLIANT

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 °C	750	A
		T_C = 80 °C	525	
Pulsed collector current	I_{CM}		1000	
Clamped inductive load current	I_{LM}		1000	
Diode continuous forward current	I_F	T_C = 25 °C	219	
		T_C = 80 °C	145	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation (IGBT)	P_D	T_C = 25 °C	1563	W
		T_C = 80 °C	875	
RMS isolation voltage	V_{ISOL}	Any terminal to case (V_{RMS} t = 1 s, T_J = 25 °C)	3500	V

Note

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

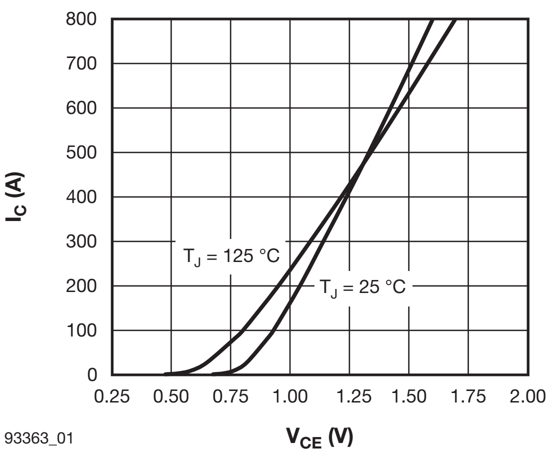
ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CES)}$	V_{GE} = 0 V, I_C = 500 μA	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 300 A	-	1.14	1.35	
		V_{GE} = 15 V, I_C = 400 A	-	1.24	1.52	
		V_{GE} = 15 V, I_C = 300 A, T_J = 125 °C	-	1.08	1.29	
		V_{GE} = 15 V, I_C = 400 A, T_J = 125 °C	-	1.21	1.5	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 μA	3.0	4.6	6.3	
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	0.075	1	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C	-	1.8	10	
Diode forward voltage drop	V_{FM}	I_{FM} = 300 A	-	1.48	1.75	V
		I_{FM} = 400 A	-	1.63	1.98	
		I_{FM} = 300 A, T_J = 125 °C	-	1.50	1.77	
		I_{FM} = 400 A, T_J = 125 °C	-	1.70	2.04	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 200	nA

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise specified)

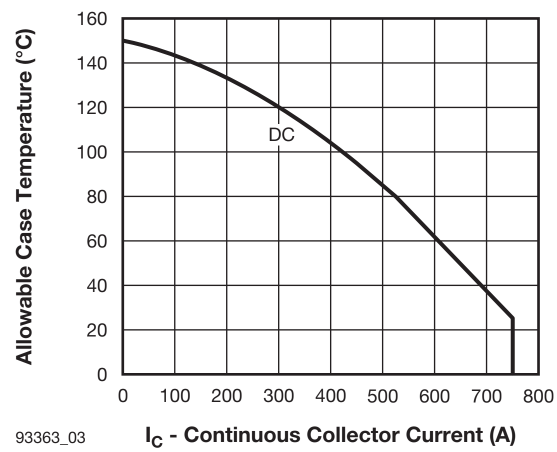
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on switching loss	E_{on}	I_C = 400 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 1.5 Ω, L = 500 μH, T_J = 25 °C	-	8.5	-	mJ
Turn-off switching loss	E_{off}		-	113	-	
Total switching loss	E_{tot}		-	121.5	-	
Turn-on switching loss	E_{on}	I_C = 400 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 1.5 Ω, L = 500 μH, T_J = 125 °C	-	21	-	
Turn-off switching loss	E_{off}		-	163	-	
Total switching loss	E_{tot}		-	184	-	
Turn-on delay time	$t_{d(on)}$		-	532	-	ns
Rise time	t_r		-	377	-	
Turn-off delay time	$t_{d(off)}$		-	496	-	
Fall time	t_f		-	1303	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 1000 A, V_{CC} = 400 V, V_P = 600 V, R_g = 22 Ω, V_{GE} = 15 V to 0 V, L = 500 μH		Fullsquare		
Diode reverse recovery time	t_{rr}	I_F = 300 A, dI_F/dt = 500 A/μs, V_{CC} = 400 V, T_J = 25 °C	-	150	179	ns
Diode peak reverse current	I_{rr}		-	43	59	A
Diode recovery charge	Q_{rr}		-	3.9	6.3	μC
Diode reverse recovery time	t_{rr}	I_F = 300 A, dI_F/dt = 500 A/μs, V_{CC} = 400 V, T_J = 125 °C	-	236	265	ns
Diode peak reverse current	I_{rr}		-	64	80	A
Diode recovery charge	Q_{rr}		-	8.6	11.1	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	R_{thJC}	-	-	0.08	°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



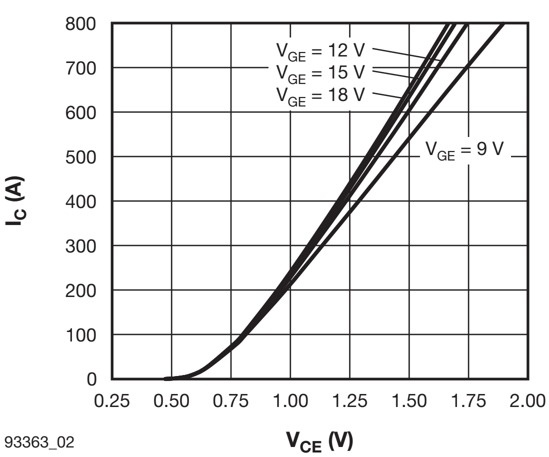
93363_01

Fig. 1 - Typical Output Characteristics, T_J = 25 °C, V_{GE} = 15 V



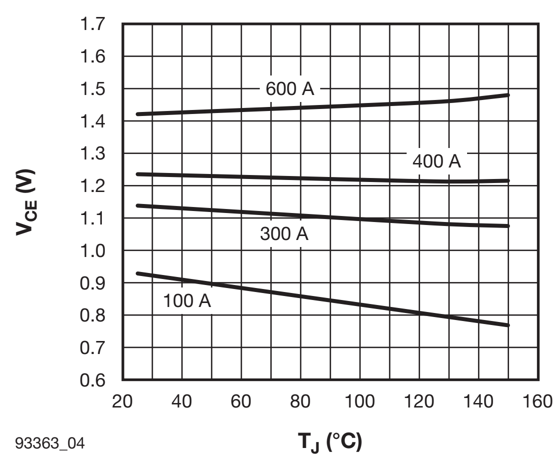
93363_03

Fig. 3 - Maximum DC IGBT Collector Current vs. Case Temperature



93363_02

Fig. 2 - Typical Output Characteristics, T_J = 125 °C



93363_04

Fig. 4 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

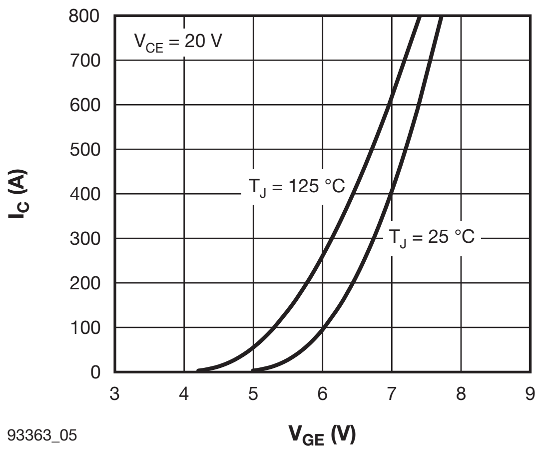


Fig. 5 - Typical IGBT Transfer Characteristics

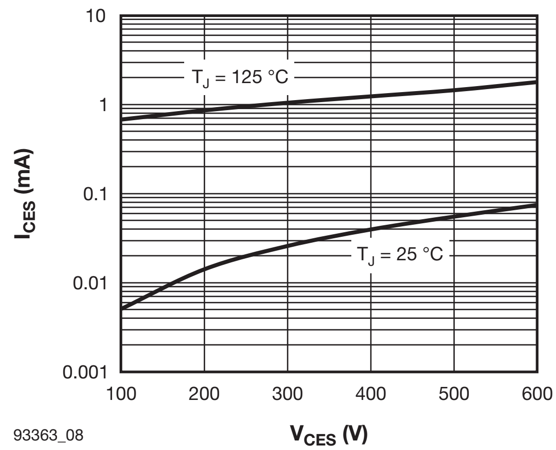


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

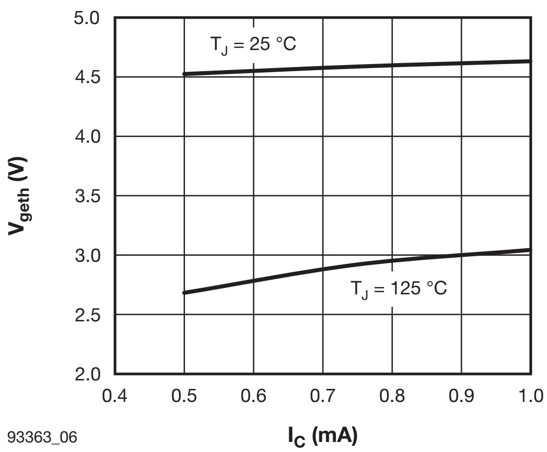


Fig. 6 - Typical IGBT Gate Threshold Voltage

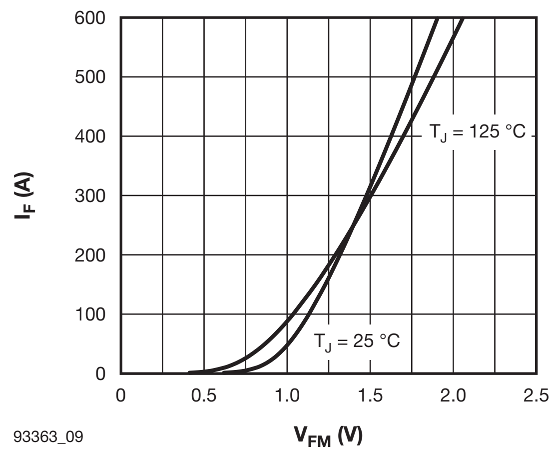


Fig. 9 - Typical Diode Forward Characteristics

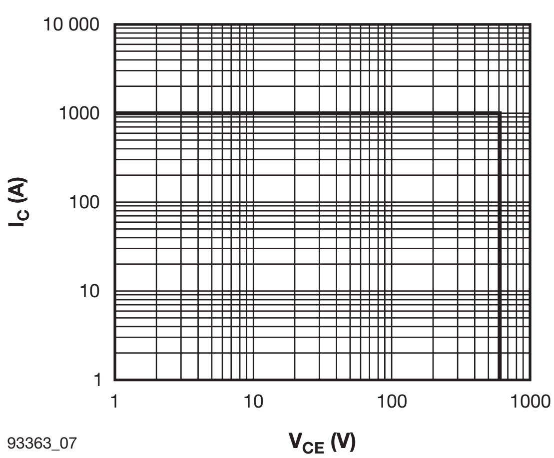


Fig. 7 - IGBT Reverse Bias SOA,
T_J = 150 °C, V_{GE} = 15 V, R_g = 22 Ω

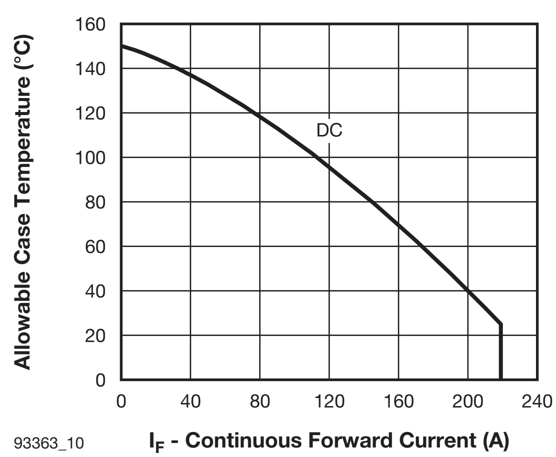


Fig. 10 - Maximum DC Forward Current vs. Case Temperature

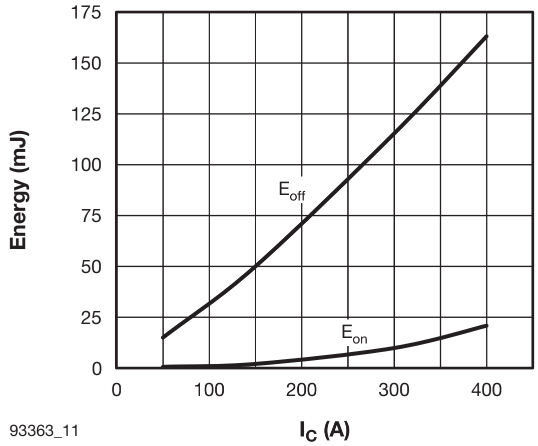


Fig. 11 - Typical IGBT Energy Loss vs. I_C, T_J = 125 °C, V_{CC} = 360 V, R_g = 1.5 Ω, V_{GE} = 15 V, L = 500 µH

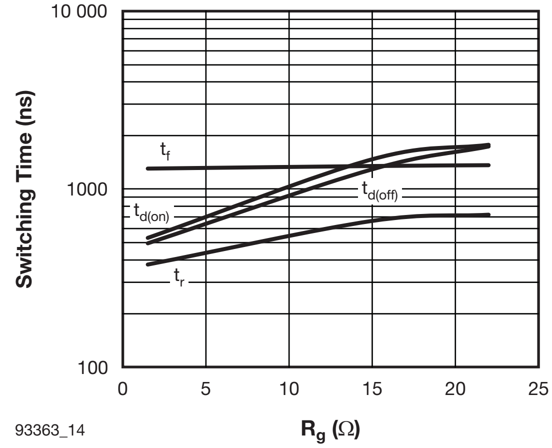


Fig. 14 - Typical IGBT Switching Time vs. R_g, T_J = 125 °C, I_C = 400 A, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH

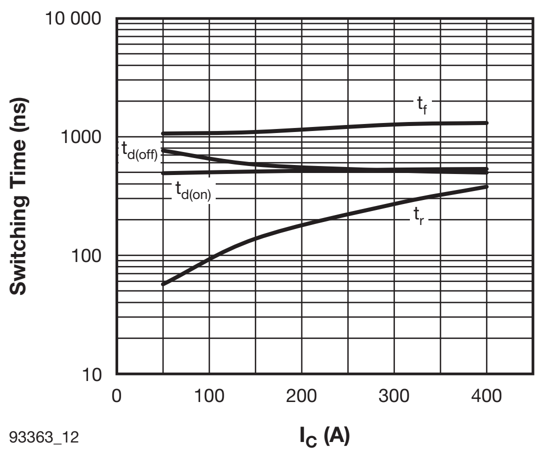


Fig. 12 - Typical IGBT Switching Time vs. I_C, T_J = 125 °C, V_{CC} = 360 V, R_g = 1.5 Ω, V_{GE} = 15 V, L = 500 µH

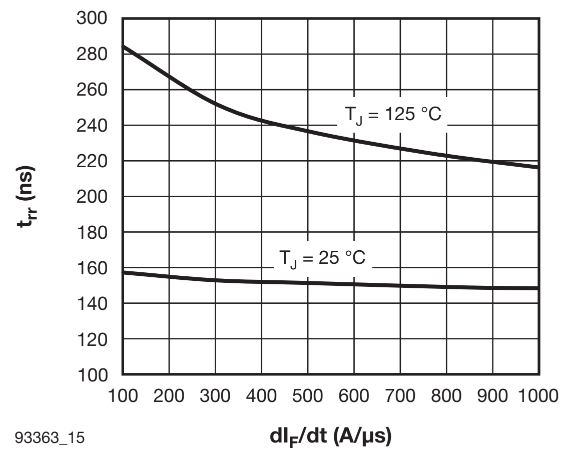


Fig. 15 - Typical Reverse Recovery Time vs. dI_F/dt, V_{CC} = 400 V, I_F = 300 A

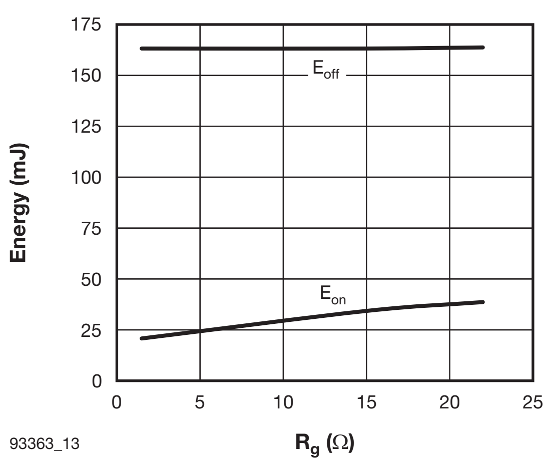


Fig. 13 - Typical IGBT Energy Loss vs. R_g, T_J = 125 °C, I_C = 400 A, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH

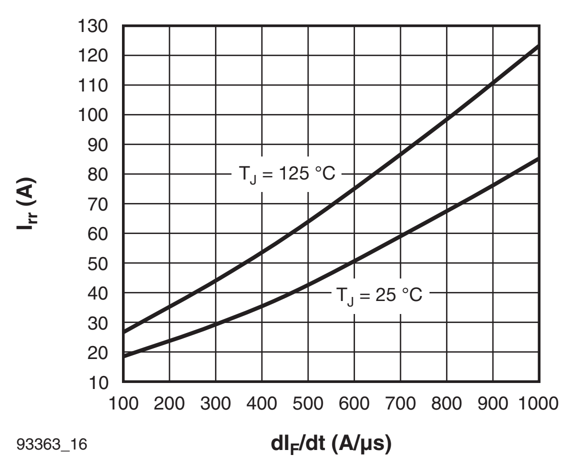


Fig. 16 - Typical Reverse Recovery Current vs. dI_F/dt, V_{CC} = 400 V, I_F = 300 A

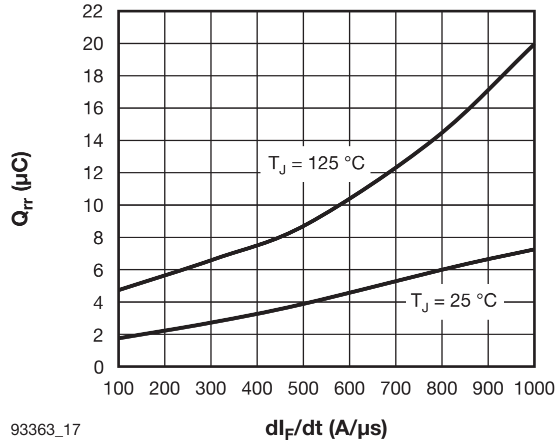


Fig. 17 - Typical Reverse Recovery Charge vs. dI_F/dt,
V_{CC} = 400 V, I_F = 300 A

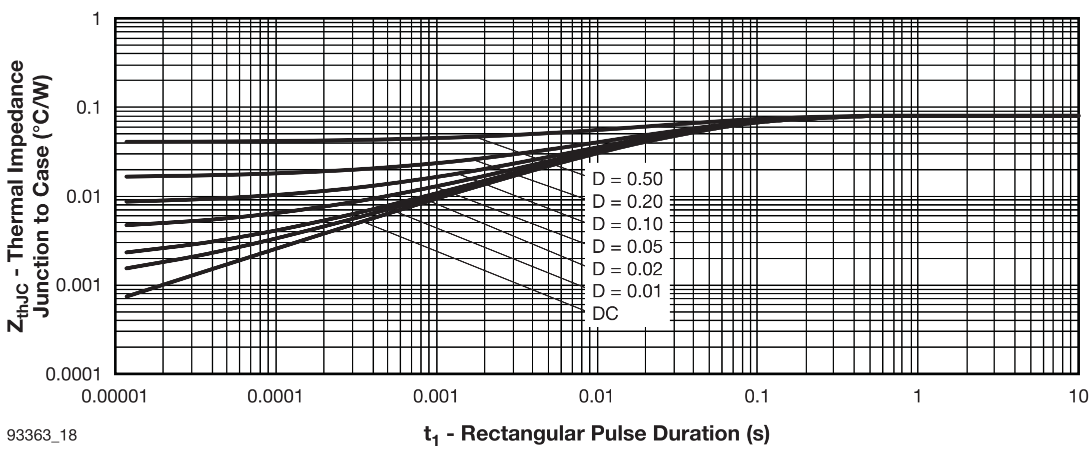


Fig. 18 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

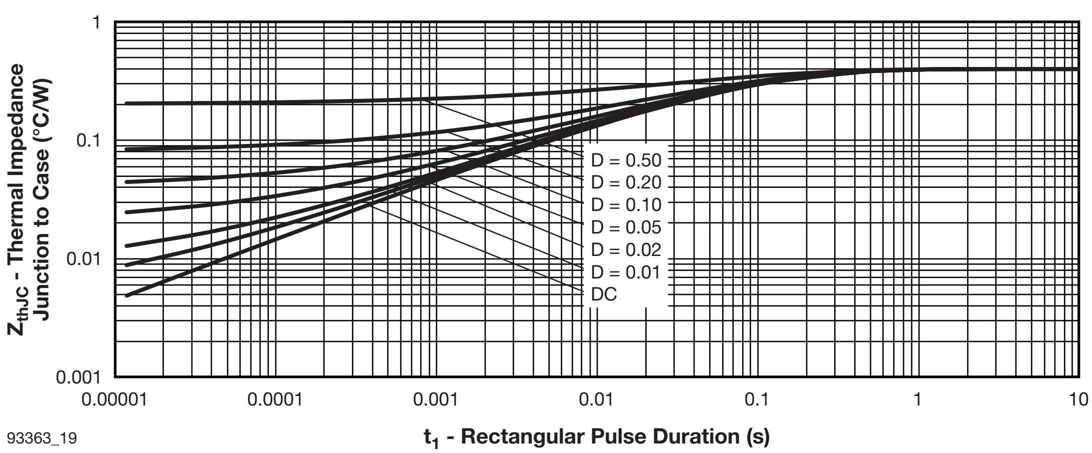


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

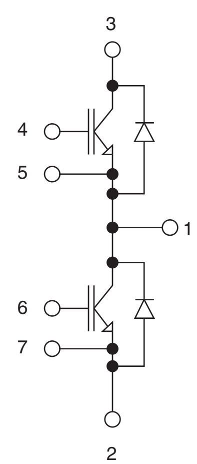
For technical questions, contact: indmodules@vishay.com

ORDERING INFORMATION TABLE

Device code	G	A	400	T	D	60	S
	1	2	3	4	5	6	7

1 - Insulated Gate Bipolar Transistor (IGBT)
2 - A = Generation 4 IGBT
3 - Current rating (400 = 400 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	www.vishay.com/doc?95435

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