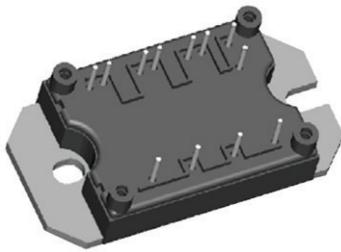


“Half Bridge” IGBT MTP, 121 A


MTP

FEATURES

- Trench IGBT technology
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- Very low conduction and switching losses
- Optional SMD thermistor (NTC)
- Very low junction to case thermal resistance
- UL approved file E78996 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

PRIMARY CHARACTERISTICS	
V_{CES}	600 V
$V_{CE(on)}$ typical at $I_C = 50$ A	1.41 V
I_C at $T_C = 25$ °C	121 A
Speed	30 kHz to 100 kHz
Package	MTP
Circuit configuration	Half bridge

BENEFITS

- Optimized for welding, UPS and SMPS applications
- Low EMI, requires less snubbing
- Direct mounting to heatsink
- PCB solderable terminals
- Very low stray inductance design for high speed operation

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25$ °C	121	A
		$T_C = 117$ °C	50	
Pulsed collector current	I_{CM}	$T_J = 150$ °C, $t_p = 6$ ms, $V_{GE} = 15$ V	250	
Peak switching current	I_{LM}		76	
Diode continuous forward current	I_F	$T_C = 109$ °C	34	
Peak diode forward current	I_{FM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V
Maximum power dissipation	P_D	$T_C = 25$ °C	305	W
		$T_C = 100$ °C	122	

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, $I_C = 0.4$ mA	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15$ V, $I_C = 50$ A	-	1.41	1.64	V
		$V_{GE} = 15$ V, $I_C = 100$ A	-	1.77	-	
		$V_{GE} = 15$ V, $I_C = 50$ A, $T_J = 150$ °C	-	1.46	-	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 1$ mA	2.9	4.2	5.3	
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0$ V, $I_C = 600$ A	-	0.8	100	µA
		$V_{GE} = 0$ V, $I_C = 600$ A, $T_J = 150$ °C	-	1980	-	
Diode forward voltage drop	V_{FM}	$I_F = 50$ A, $V_{GE} = 0$ V	-	1.58	1.8	V
		$I_F = 50$ A, $V_{GE} = 0$ V, $T_J = 150$ °C	-	1.49	-	
		$I_F = 100$ A, $V_{GE} = 0$ V, $T_J = 25$ °C	-	1.9	-	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20$ V	-	-	± 250	nA



SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q _g	I _C = 50 A	-	239	-	nC
Gate to emitter charge (turn-on)	Q _{ge}	V _{CC} = 520 V	-	33	-	
Gate to collector charge (turn-on)	Q _{gc}	V _{GE} = 15 V	-	70	-	
Turn-on switching loss	E _{on}	I _C = 50 A, V _{CC} = 480 V, V _{GE} = 15 V, R _g = 10 Ω, L = 500 μH energy losses include tail and diode reverse recovery, T _J = 25 °C	-	1.09	-	mJ
Turn-off switching loss	E _{off}		-	0.37	-	
Total switching loss	E _{ts}		-	1.46	-	
Turn-on switching loss	E _{on}	I _C = 50 A, V _{CC} = 480 V, V _{GE} = 15 V, R _g = 10 Ω, L = 500 μH energy losses include tail and diode reverse recovery, T _J = 150 °C	-	1.46	-	mJ
Turn-off switching loss	E _{off}		-	0.62	-	
Total switching loss	E _{ts}		-	2.08	-	
Input capacitance	C _{ies}	V _{GE} = 0 V V _{CC} = 25 V f = 1.0 MHz	-	6000	-	pF
Output capacitance	C _{oes}		-	100	-	
Reverse transfer capacitance	C _{res}		-	22	-	
Diode reverse recovery time	t _{rr}	V _{CC} = 200 V, I _C = 50 A di/dt = 200 A/μs	-	82	-	ns
Diode peak reverse current	I _{rr}		-	8.3	-	A
Diode recovery charge	Q _{rr}		-	340	-	nC
Diode reverse recovery time	t _{rr}	V _{CC} = 200 V, I _C = 50 A di/dt = 200 A/μs T _J = 125 °C	-	137	-	ns
Diode peak reverse current	I _{rr}		-	12.7	-	A
Diode recovery charge	Q _{rr}		-	870	-	nC

THERMISTOR SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	R ₀ ⁽¹⁾	T ₀ = 25 °C	-	30	-	kΩ
Sensitivity index of the thermistor material	β ⁽¹⁾⁽²⁾	T ₀ = 25 °C T ₁ = 85 °C	-	4000	-	K

Notes

(1) T₀, T₁ are thermistor's temperatures

(2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, temperature in Kelvin

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	T _J , T _{Stg}		-40	-	150	°C
Junction to case	R _{thJC}	IGBT	-	-	0.41	°C/W
		Diode	-	-	0.8	
Case to sink per module	R _{thCS}		-	0.06	-	
Clearance ⁽¹⁾		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage ⁽¹⁾		Shortest distance along the external surface of the insulating material between 2 terminals	8	-	-	
Mounting torque to heatsink		A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads.	3 ± 10 %			Nm
Weight			66			g

Note

(1) Standard version only i.e. without optional thermistor

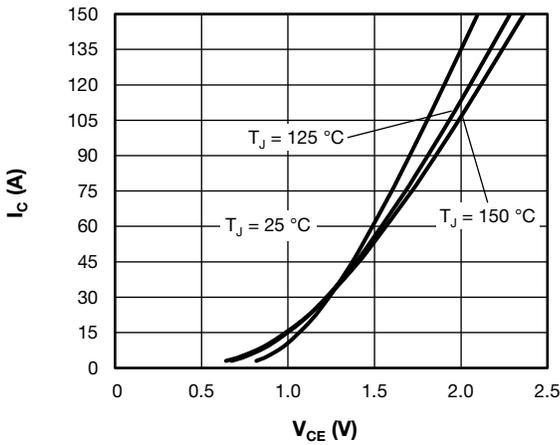


Fig. 1 - Typical Trench IGBT Output Characteristics, $V_{GE} = 15\text{ V}$

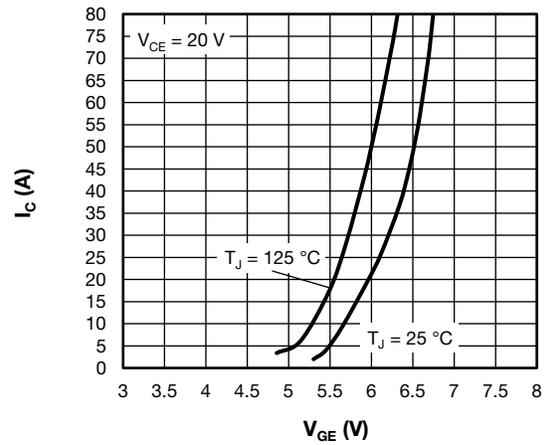


Fig. 4 - Typical Trench IGBT Transfer Characteristics

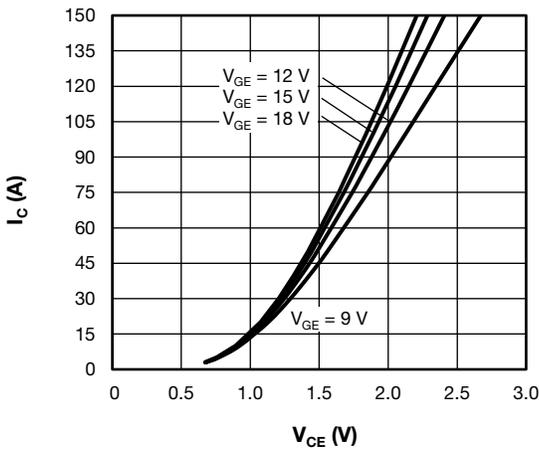


Fig. 2 - Typical Trench IGBT Output Characteristics, $T_J = 125\text{ °C}$

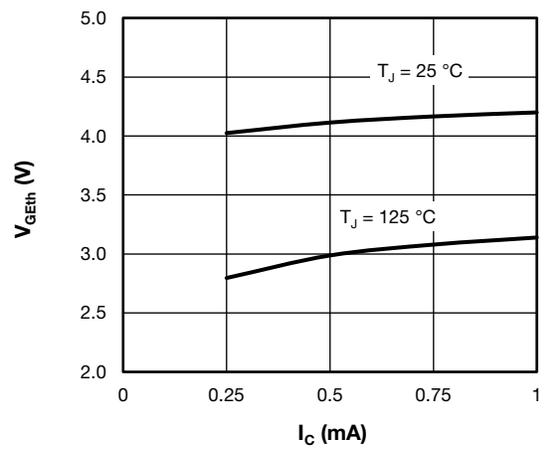


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

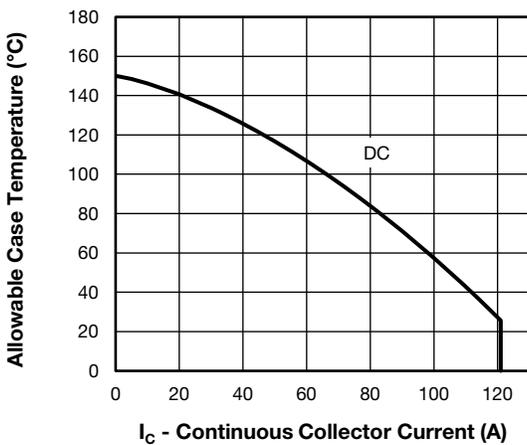


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

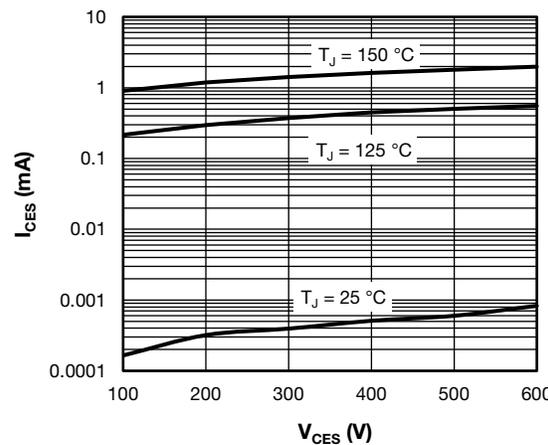


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current



$T_J = 150\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\text{ }\mu\text{H}$

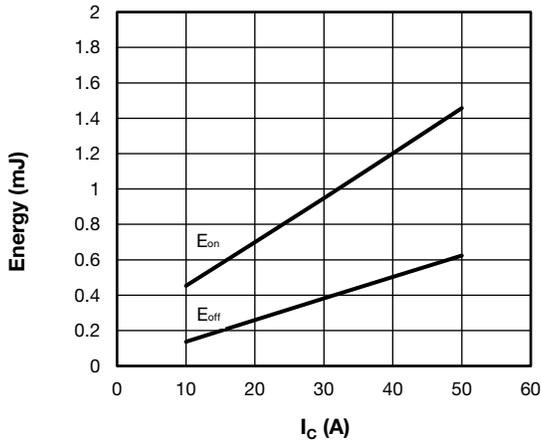


Fig. 7 - Typical Trench IGBT Energy Loss vs. I_C (with Antiparallel Diode)

$T_J = 150\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 10\text{ }\Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\text{ }\mu\text{H}$

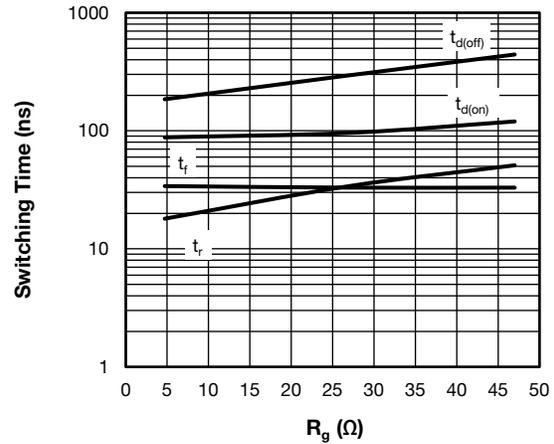


Fig. 10 - Typical Trench IGBT Switching Time vs. R_g (with Antiparallel Diode)

$T_J = 150\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\text{ }\mu\text{H}$

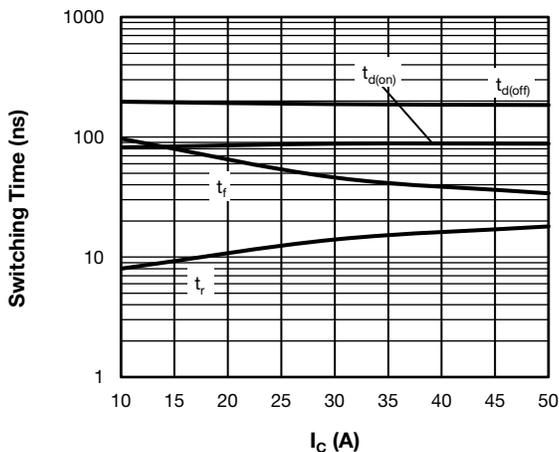


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C (with Antiparallel Diode)

$T_J = 150\text{ }^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 10\text{ }\Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\text{ }\mu\text{H}$

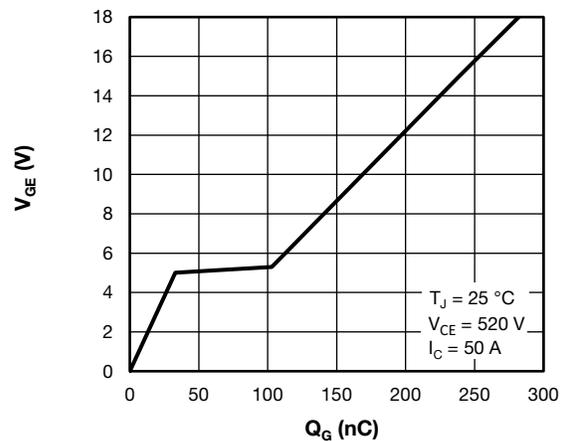


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

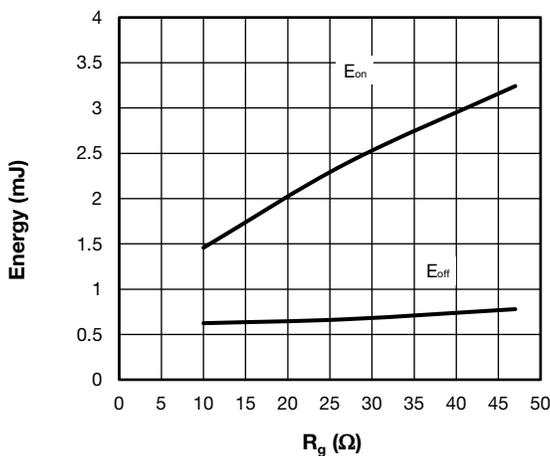


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g (with Antiparallel Diode)

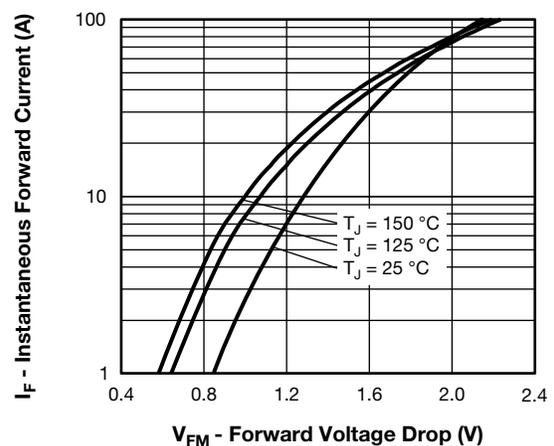


Fig. 12 - Typical Diode Forward Characteristics

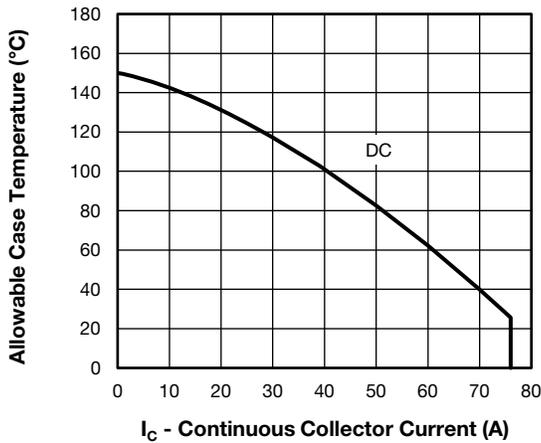


Fig. 13 - Maximum Diode Continuous Collector Current vs. Case Temperature

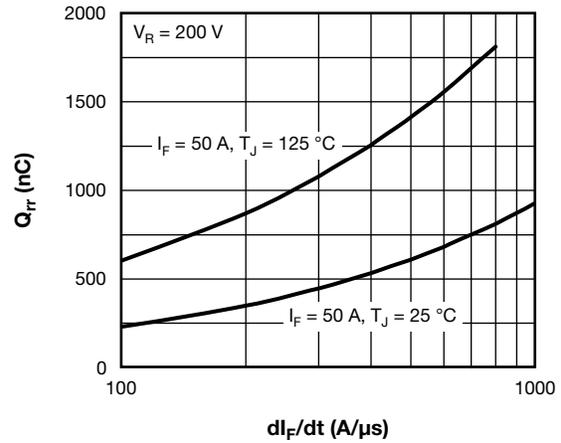


Fig. 16 - Typical Antiparallel Diode Reverse Recovery Charge vs. dI_F/dt

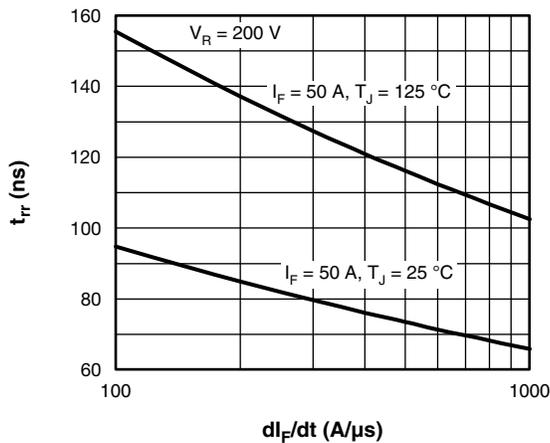


Fig. 14 - Typical Antiparallel Diode Reverse Recovery Time vs. dI_F/dt

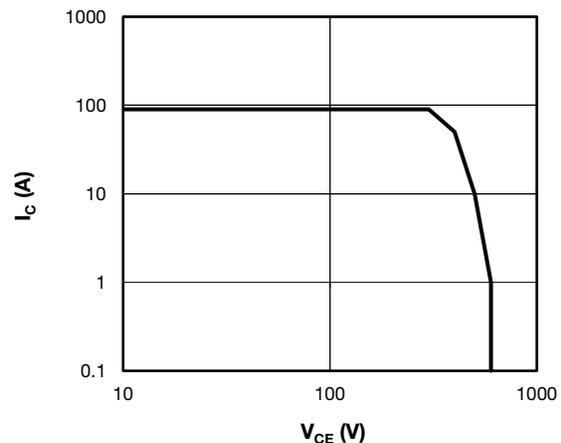


Fig. 17 - Trench IGBT Reverse BIAS SOA
 $T_J = 150\text{ }^\circ\text{C}$, $I_C = 90\text{ A}$, $R_g = 10\text{ }\Omega$, $V_{GE} = +15\text{ V}/0\text{ V}$, $V_{CC} = 300\text{ V}$, $V_p = 600\text{ V}$

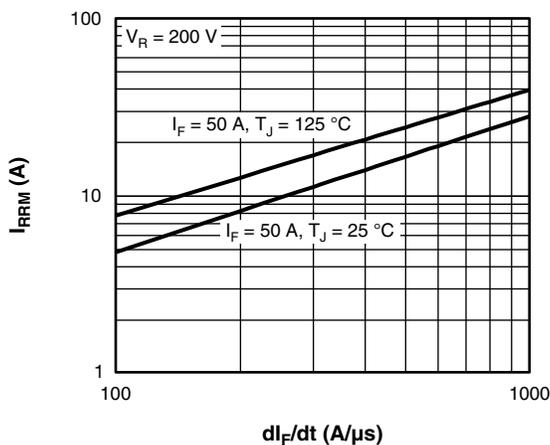


Fig. 15 - Typical Antiparallel Diode Reverse Recovery Current vs. dI_F/dt

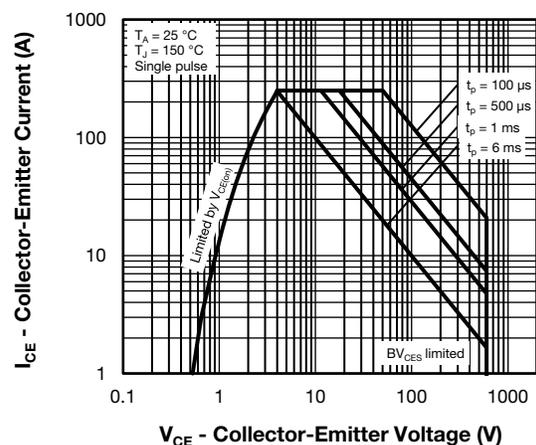


Fig. 18 - Trench IGBT Safe Operating Area

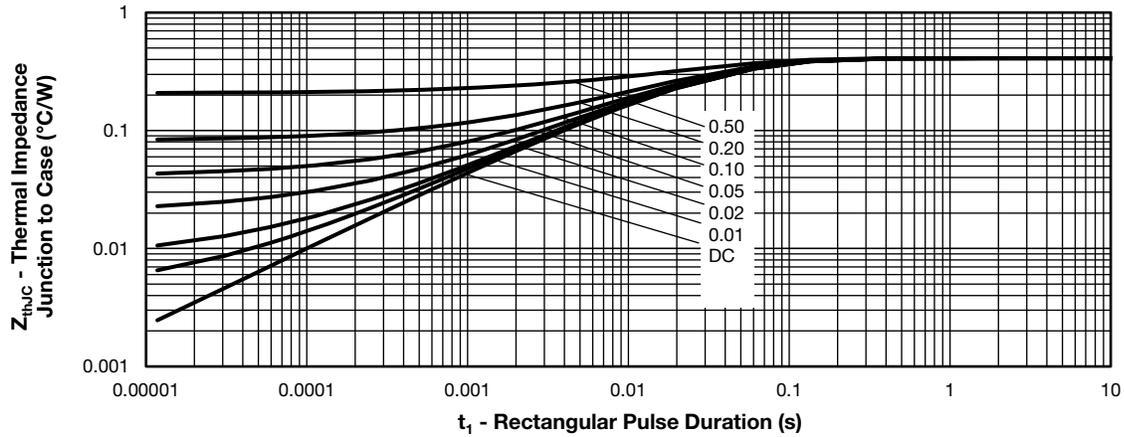


Fig. 19 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

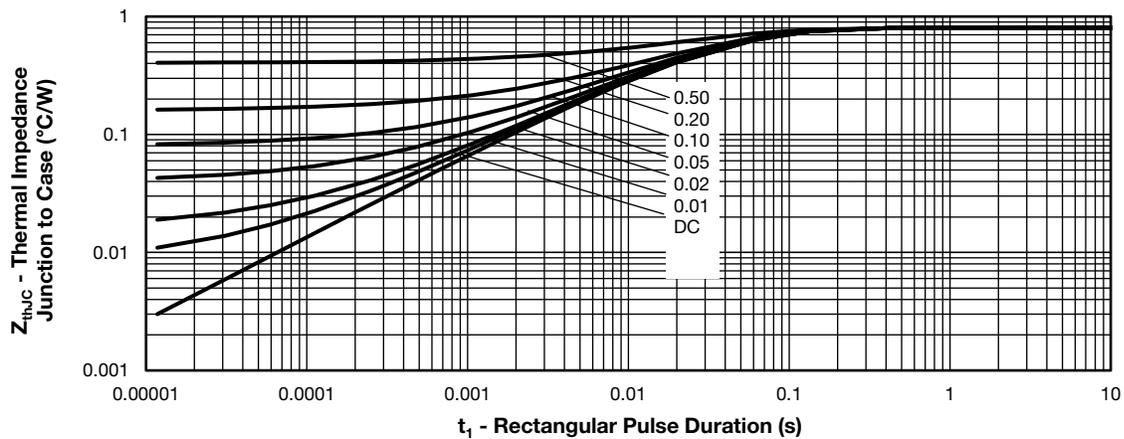


Fig. 20 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics

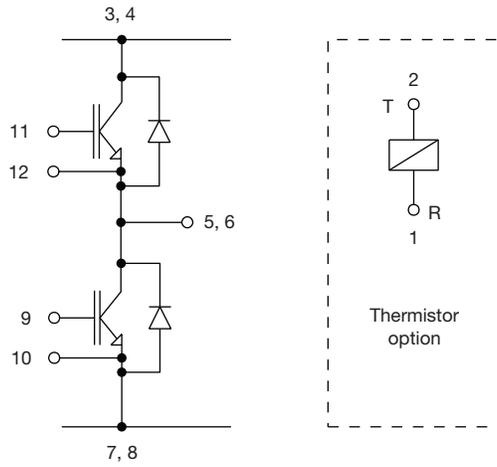
ORDERING INFORMATION TABLE

Device code	VS-	50	MT	060	P	H	T	A	PbF
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- 1** - Vishay Semiconductors product
- 2** - Current rating (50 = 50 A)
- 3** - Essential part number
- 4** - Voltage rating (060 = 600 V)
- 5** - Speed / type (P = Trench IGBT)
- 6** - Circuit configuration (H = half bridge)
- 7** - T = thermistor
- 8** - A = Al₂O₃ substrate
- 9** - Lead (Pb)-free



CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95175
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