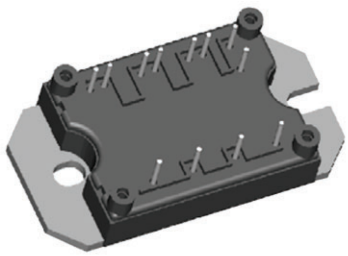
"Half Bridge" IGBT MTP, 121 A



MTP

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

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

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	
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} = ± 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 V_{CC} = 520 V V_{GE} = 15 V	-	239	-	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	33	-	
Gate to collector charge (turn-on)	Q_{gc}		-	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) T_0, T_1 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	IGBT	R_{thJC}		-	-	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

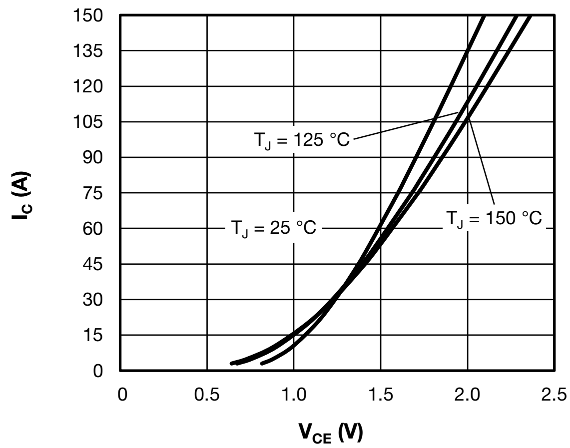


Fig. 1 - Typical Trench IGBT Output Characteristics, V_{GE} = 15 V

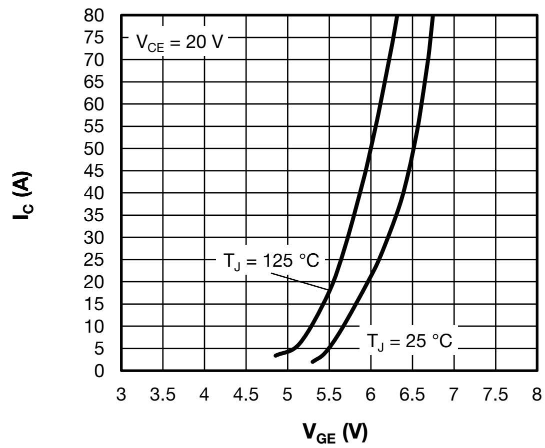


Fig. 4 - Typical Trench IGBT Transfer Characteristics

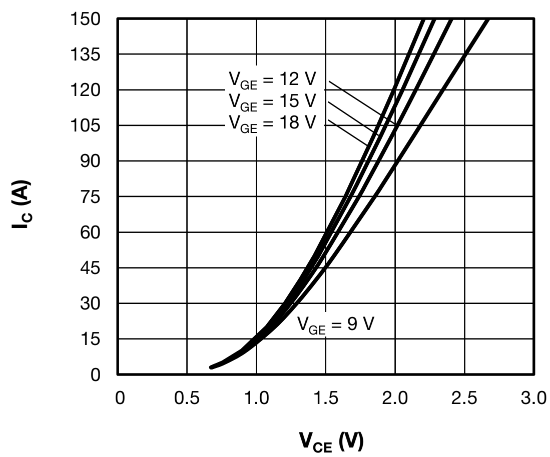


Fig. 2 - Typical Trench IGBT Output Characteristics, T_J = 125 °C

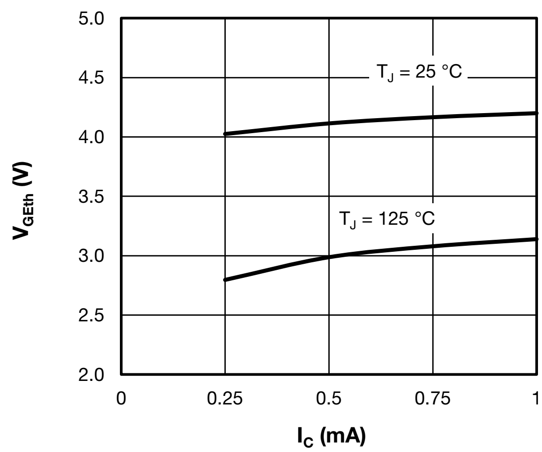


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

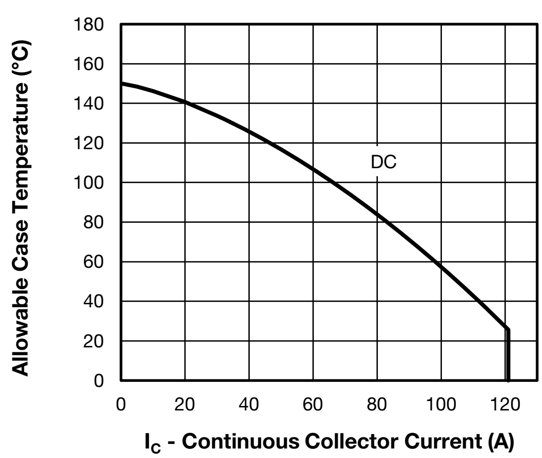


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

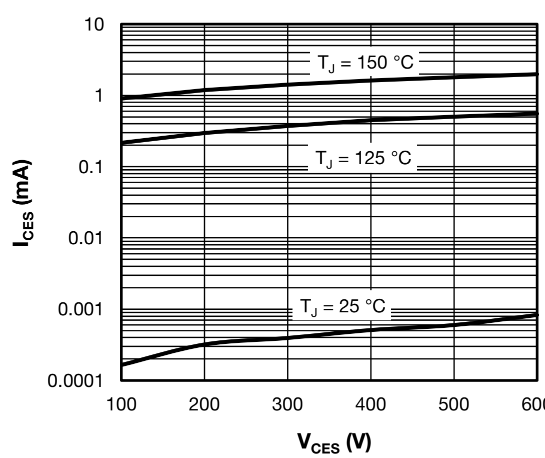


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current

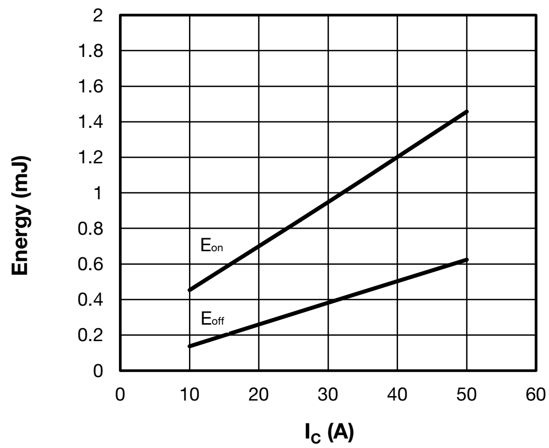


Fig. 7 - Typical Trench IGBT Energy Loss vs. I_C
(with Antiparallel Diode)
T_J = 150 °C, V_{CC} = 600 V, R_g = 10 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

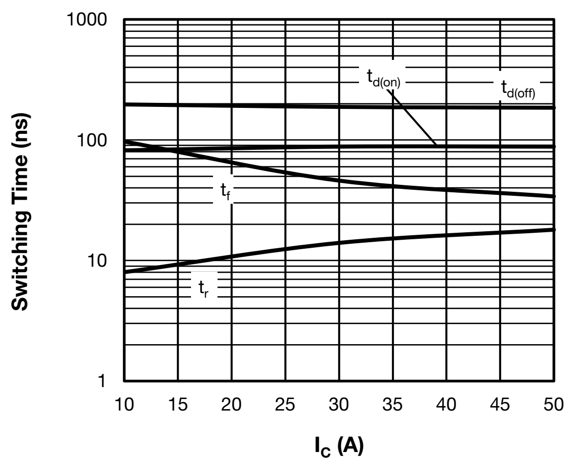


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C
(with Antiparallel Diode)
T_J = 150 °C, V_{CC} = 300 V, R_g = 10 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

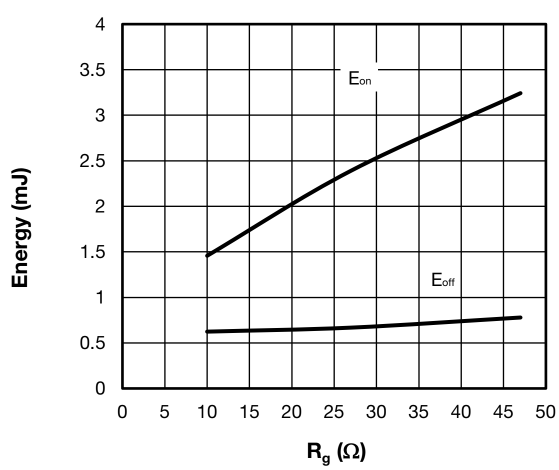


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g
(with Antiparallel Diode)
T_J = 150 °C, V_{CC} = 600 V, I_C = 50 A, V_{GE} = +15 V/-15 V, L = 500 μH

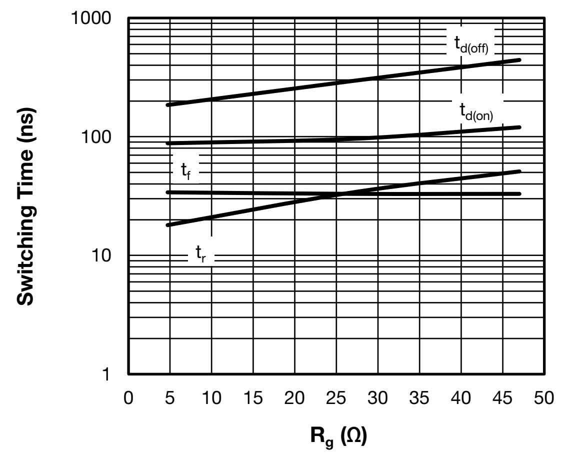


Fig. 10 - Typical Trench IGBT Switching Time vs. R_g
(with Antiparallel Diode)
T_J = 150 °C, V_{CC} = 600 V, I_C = 50 A, V_{GE} = +15 V/-15 V, L = 500 μH

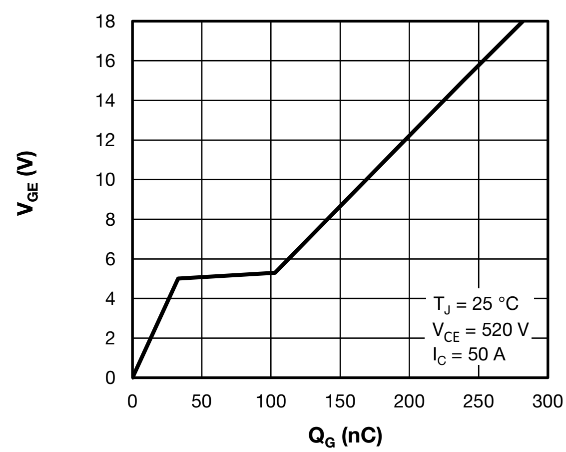


Fig. 11 - Typical Trench IGBT Gate Charge vs.
Gate to Emitter Voltage

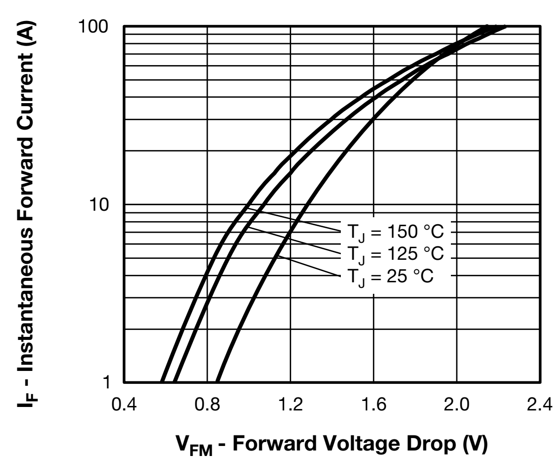


Fig. 12 - Typical Diode Forward Characteristics

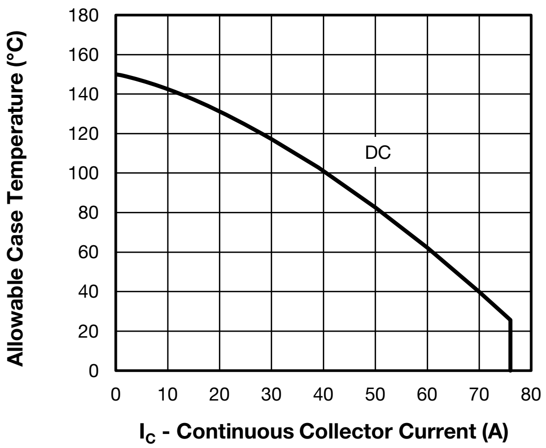


Fig. 13 - Maximum Diode Continuous Collector Current vs. Case Temperature

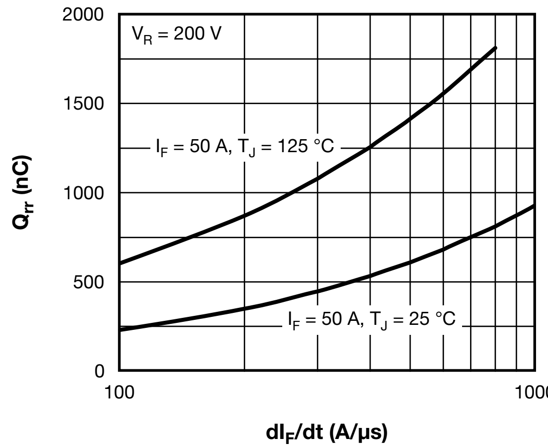


Fig. 16 - Typical Antiparallel Diode Reverse Recovery Charge vs. dI_F/dt

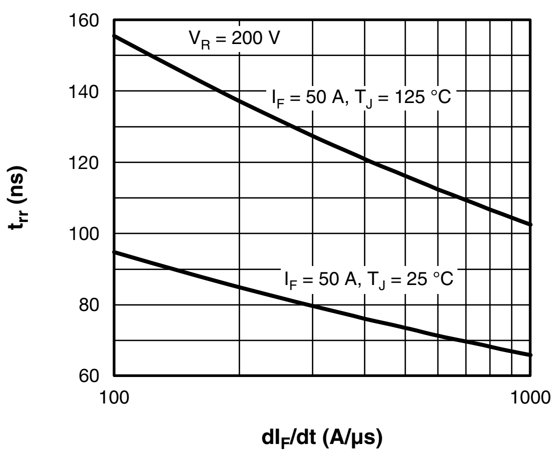


Fig. 14 - Typical Antiparallel Diode Reverse Recovery Time vs. dI_F/dt

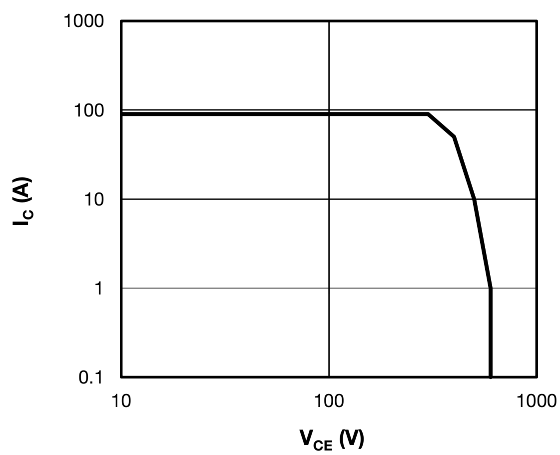


Fig. 17 - Trench IGBT Reverse BIAS SOA
T_J = 150 °C, I_C = 90 A, R_g = 10 Ω, V_{GE} = +15 V/0 V, V_{CC} = 300 V, V_p = 600 V

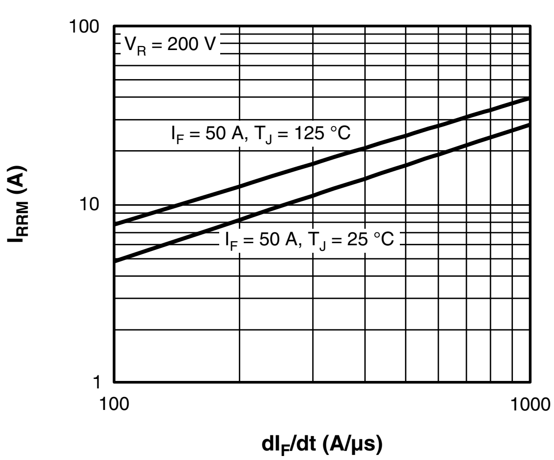


Fig. 15 - Typical Antiparallel Diode Reverse Recovery Current vs. dI_F/dt

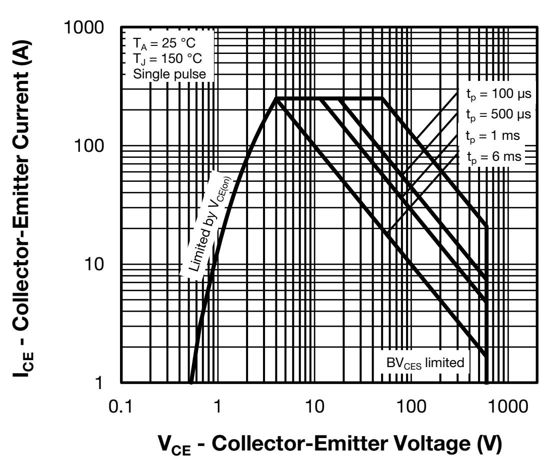


Fig. 18 - Trench IGBT Safe Operating Area

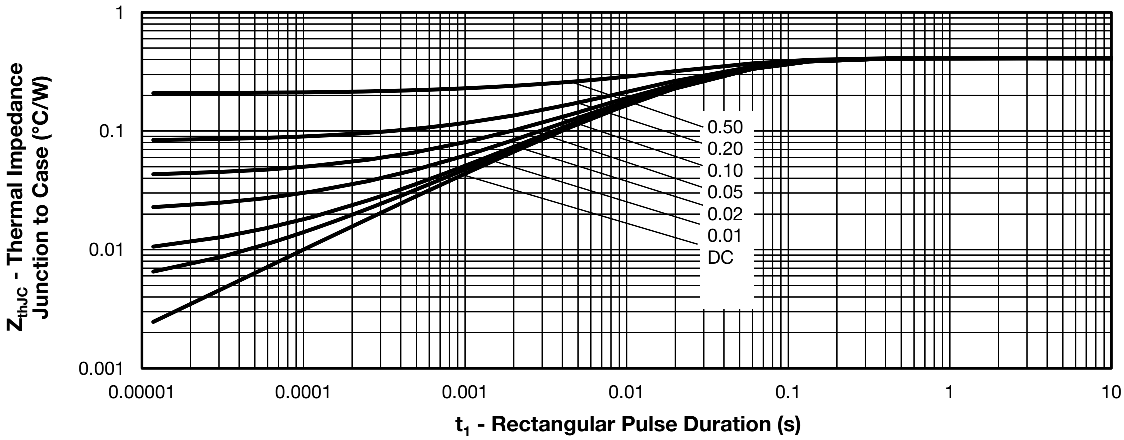


Fig. 19 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

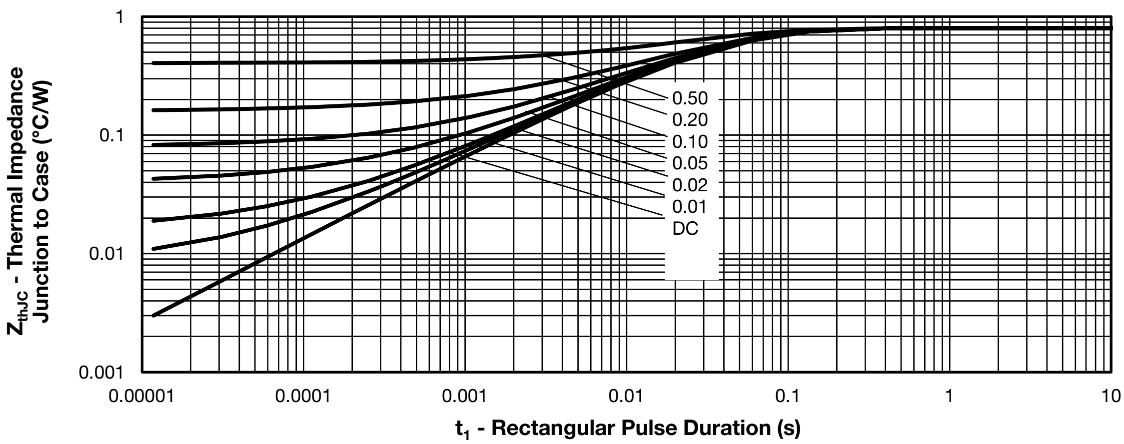


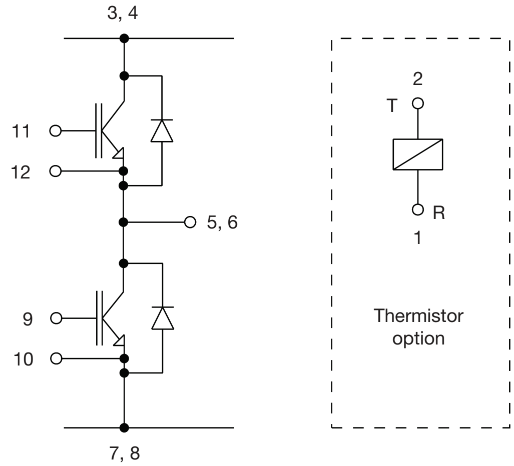
Fig. 20 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics

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 = Al_2O_3 substrate
9 - Lead (Pb)-free

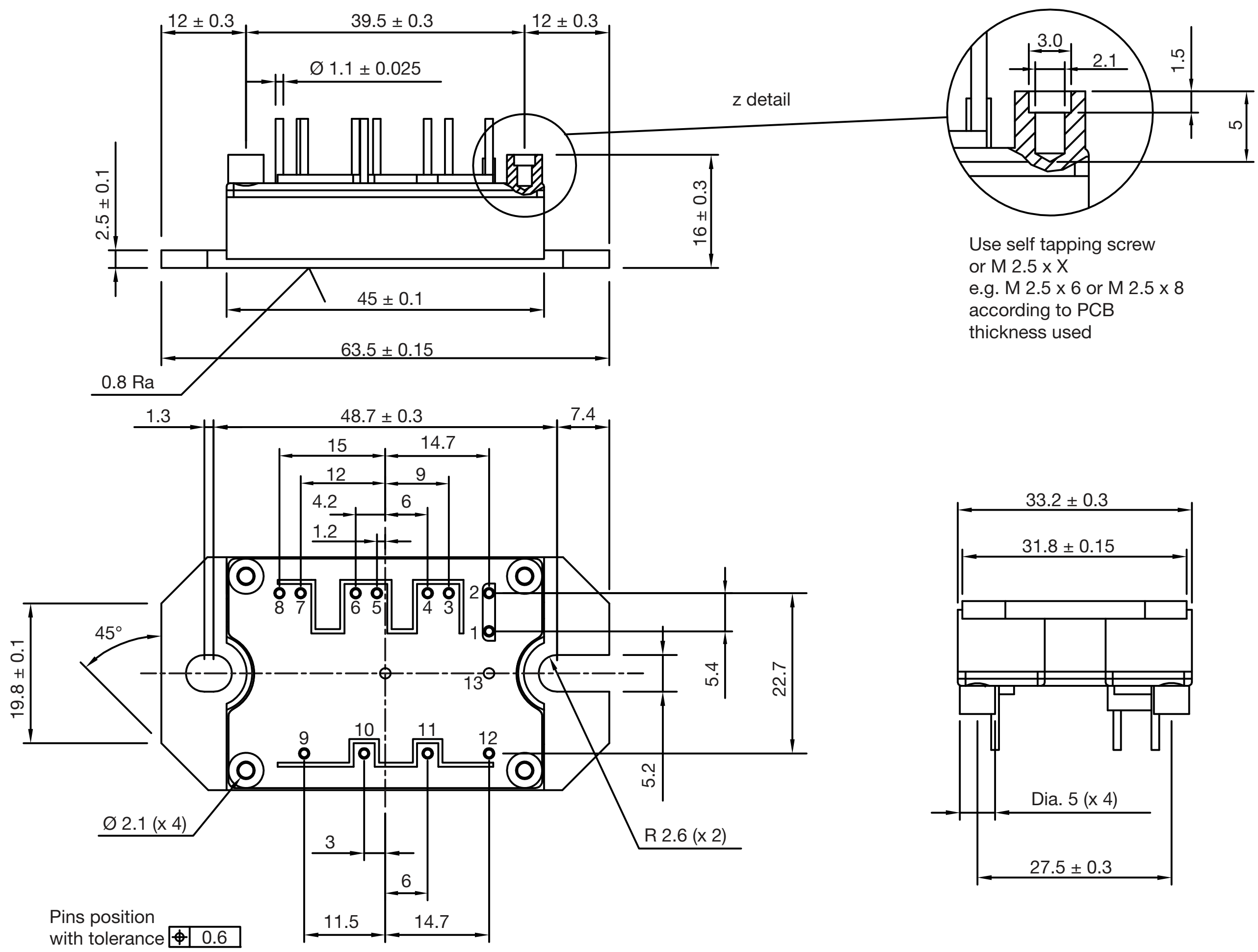
CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95175

MTP

DIMENSIONS in millimeters



Note

- Unused terminals are not assembled in the package

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