


## “Full Bridge” IGBT MTP (Warp Speed IGBT), 50 A



MTP

PRIMARY CHARACTERISTICS	
$V_{CES}$	600 V
$I_C$ DC	69 A
$V_{CE(on)}$	2.22 V
Speed	8 kHz to 30 kHz
Package	MTP
Circuit configuration	Full bridge

### FEATURES

- Gen 4 warp speed IGBT technology
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- Very low conduction and switching losses
- Optional SMT thermistor
- $Al_2O_3$  DBC
- Very low stray inductance design for high speed operation
- Speed 8 kHz to 30 kHz > 20 kHz hard switching, > 200 kHz resonant mode
- UL approved file E78996 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### BENEFITS

- Optimized for welding, UPS and SMPS applications
- Low EMI, requires less snubbing
- Direct mounting to heatsink
- PCB solderable terminals
- 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	$I_C$	$T_C = 25\text{ }^\circ\text{C}$	69	A
		$T_C = 80\text{ }^\circ\text{C}$	46	
Pulsed collector current	$I_{CM}$		200	
Peak switching current	$I_{LM}$		200	
Diode continuous forward current	$I_F$	$T_C = 100\text{ }^\circ\text{C}$	25	
Peak diode forward current	$I_{FM}$		200	
Gate to emitter voltage	$V_{GE}$		$\pm 20$	
RMS isolation voltage	$V_{ISOL}$	Any terminal to case, t = 1 minute	2500	
Maximum power dissipation per single IGBT	$P_D$	$T_C = 25\text{ }^\circ\text{C}$	195	W
		$T_C = 100\text{ }^\circ\text{C}$	78	



ELECTRICAL SPECIFICATIONS (T <sub>J</sub> = 25 °C unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 250 μA	600	-	-	V
Temperature coefficient of breakdown voltage	ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 4 mA (25 °C to 125 °C)	-	+0.6	-	V/°C
Collector to emitter saturation voltage	V <sub>CE(on)</sub>	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 25 A	-	2.22	3.14	V
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 50 A	-	2.43	3.25	
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 25 A, T <sub>J</sub> = 150 °C	-	1.65	1.93	
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 50 A, T <sub>J</sub> = 150 °C	-	2.08	2.45	
Gate threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250 μA	3	-	6	
Temperature coefficient of threshold voltage	ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250 μA (25 °C to 125 °C)	-	-17	-	mV/°C
Transconductance	g <sub>fe</sub>	V <sub>CE</sub> = 100 V, I <sub>C</sub> = 25 A, PW = 80 μs	-	43	-	S
Zero gate voltage collector current	I <sub>CES</sub> (1)	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 600 V, T <sub>J</sub> = 25 °C	-	-	250	μA
		V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 600 V, T <sub>J</sub> = 150 °C	-	-	10	mA
Gate to emitter leakage current	I <sub>GES</sub>	V <sub>GE</sub> = ± 20 V	-	-	± 250	nA
Diode forward voltage drop	V <sub>FM</sub>	I <sub>C</sub> = 25 A	-	1.36	1.64	V
		I <sub>C</sub> = 50 A	-	1.57	1.93	
		I <sub>C</sub> = 25 A; T <sub>J</sub> = 150 °C	-	1.19	1.42	
		I <sub>C</sub> = 50 A; T <sub>J</sub> = 150 °C	-	1.48	1.80	

**Note**

(1) I<sub>CES</sub> includes also opposite leg overall leakage

SWITCHING CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q <sub>g</sub>	I <sub>C</sub> = 25 A V <sub>CC</sub> = 480 V V <sub>GE</sub> = 15 V	-	175	263	nC
Gate to emitter charge (turn-on)	Q <sub>ge</sub>		-	27	41	
Gate to collector charge (turn-on)	Q <sub>gc</sub>		-	71	107	
Turn-on switching loss	E <sub>on</sub>	R <sub>g</sub> = 5 Ω, I <sub>C</sub> = 25 A V <sub>CC</sub> = 480 V V <sub>GE</sub> = ± 15 V, T <sub>J</sub> = 25 °C	-	0.13	0.20	mJ
Turn-off switching loss	E <sub>off</sub>		-	0.42	0.62	
Total switching loss	E <sub>tot</sub>		-	0.55	0.82	
Turn-on switching loss	E <sub>on</sub>		R <sub>g</sub> = 5 Ω, I <sub>C</sub> = 25 A V <sub>CC</sub> = 480 V V <sub>GE</sub> = ± 15 V, T <sub>J</sub> = 125 °C	-	0.39	
Turn-off switching loss	E <sub>off</sub>	-		0.49	0.74	
Total switching loss	E <sub>tot</sub>	-		0.88	1.32	
Input capacitance	C <sub>ies</sub>	V <sub>GE</sub> = 0 V V <sub>CC</sub> = 30 V f = 1.0 MHz		-	3610	5415
Output capacitance	C <sub>oes</sub>		-	714	1071	
Reverse transfer capacitance	C <sub>res</sub>		-	58	87	
Diode reverse recovery time	t <sub>rr</sub>	V <sub>R</sub> = 200 V; I <sub>C</sub> = 25 A; di/dt = 200 A/μs	-	50	-	ns
Diode peak reverse current	I <sub>rr</sub>		-	4.5	-	A
Diode Recovery charge	Q <sub>rr</sub>		-	112	-	nC
Diode peak rate of fall of recovery during t <sub>b</sub>	di <sub>(rec)</sub> /dt		-	250	-	A/μs

**THERMAL AND MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T <sub>J</sub>		-40	-	150	°C
Storage temperature range	T <sub>Stg</sub>		-40	-	125	
Junction to case	IGBT	R <sub>thJC</sub>	-	-	0.64	°C/W
	Diode		-	-	0.9	
Case to sink per module	R <sub>thCS</sub>	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Clearance (1)		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage (1)		Shortest distance along external surface of the insulating material between 2 terminals	8	-	-	
Weight				66		g

**Note**

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

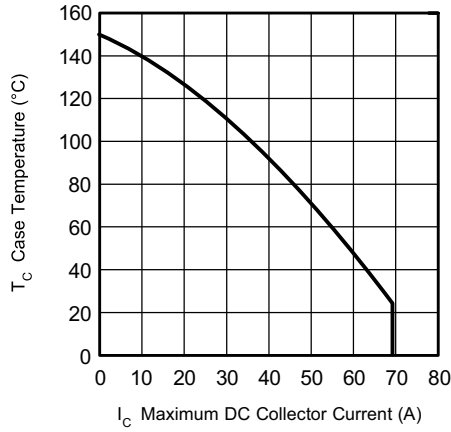


Fig. 1 - Maximum Collector Current vs. Case Temperature

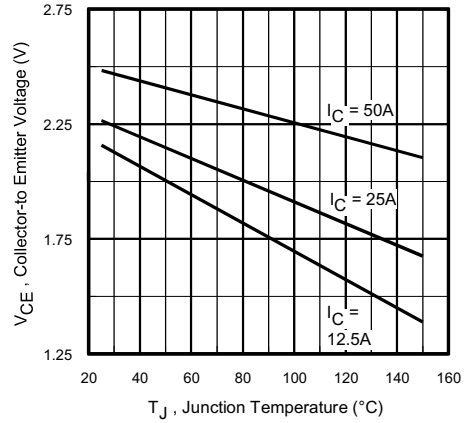


Fig. 2 - Typical Collector to Emitter Voltage vs. Junction Temperature

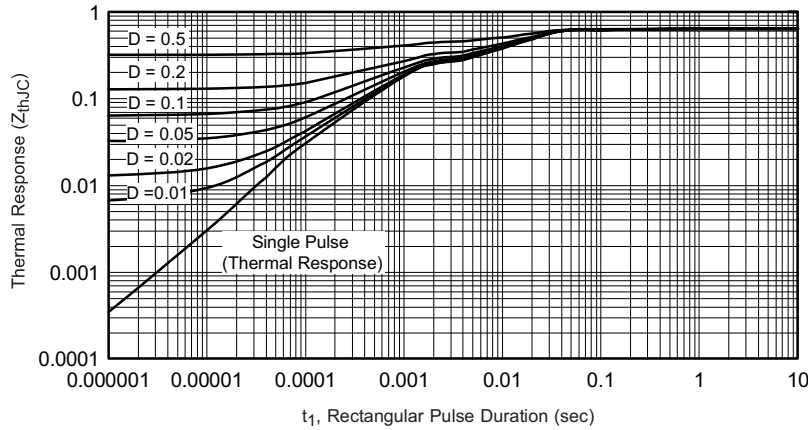


Fig. 3 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

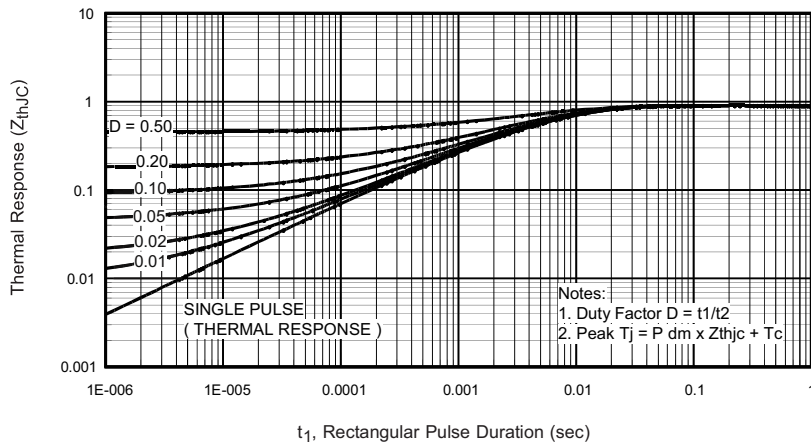


Fig. 4 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

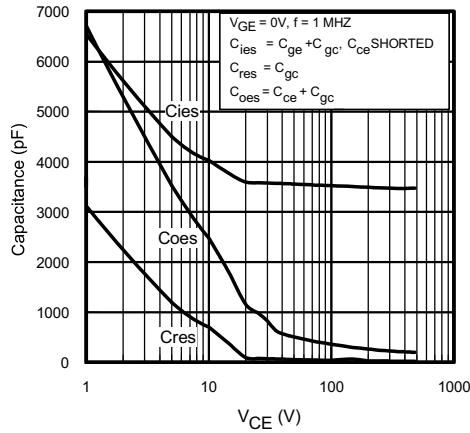


Fig. 5 - Typical Capacitance vs. Collector to Emitter Voltage

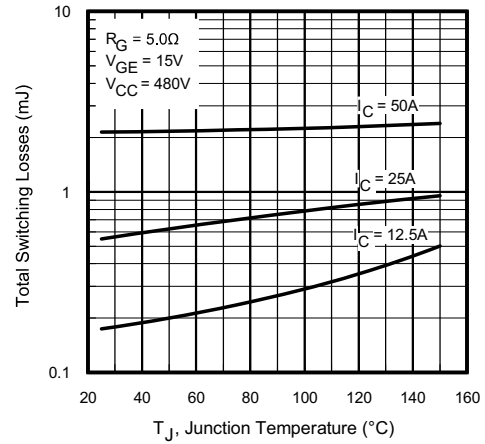


Fig. 8 - Typical Switching Losses vs. Junction Temperature

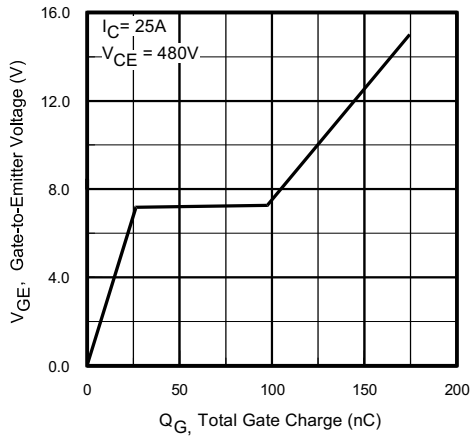


Fig. 6 - Typical Gate Charge vs. Gate to Emitter Voltage

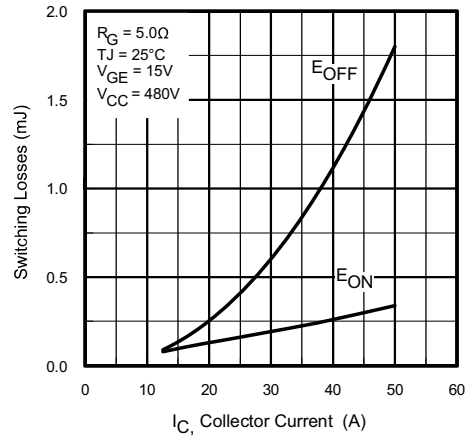


Fig. 9 - Typical Switching Losses vs. Collector to Emitter Current

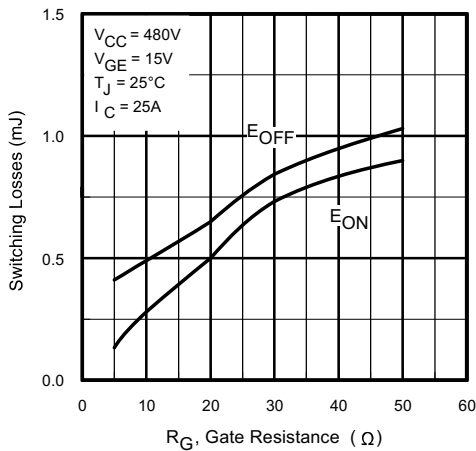


Fig. 7 - Typical Switching Losses vs. Gate Resistance

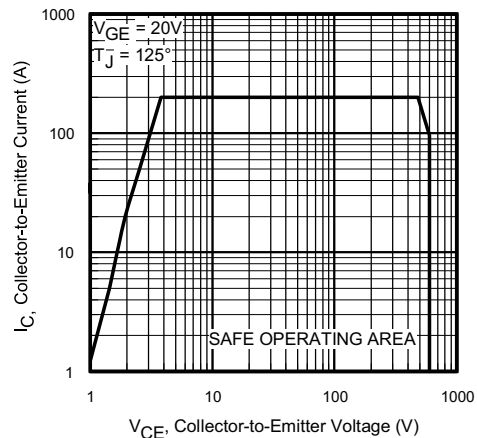


Fig. 10 - Turn-Off SOA

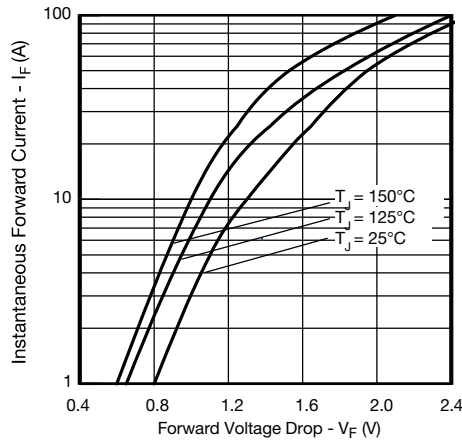


Fig. 11 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

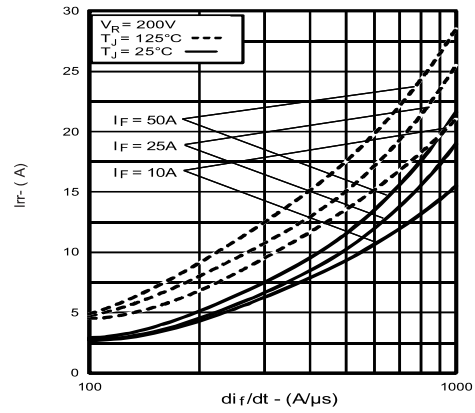


Fig. 13 - Typical Reverse Recovery Current vs.  $di_F/dt$

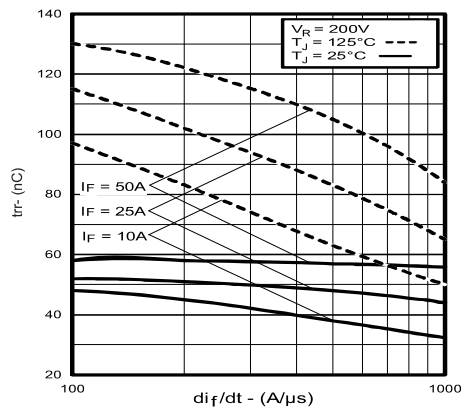


Fig. 12 - Typical Reverse Recovery Time vs.  $di_F/dt$

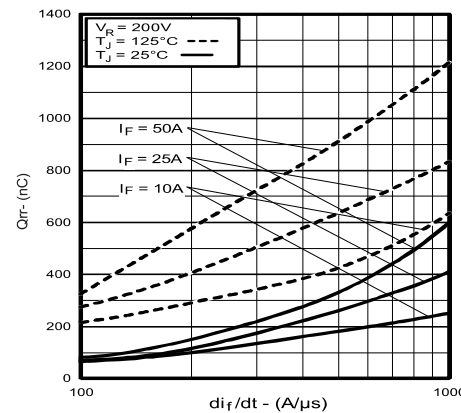


Fig. 14 - Typical Stored Charge vs.  $di_F/dt$

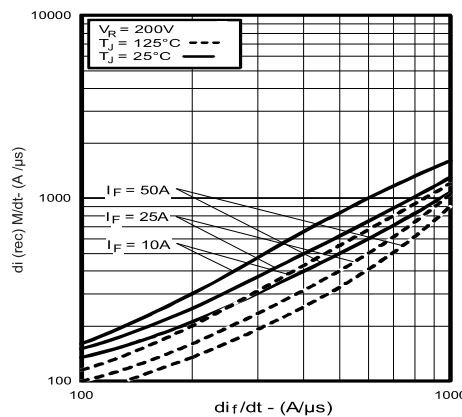


Fig. 15 - Typical  $di_{(rec)M}/dt$  vs.  $di_F/dt$

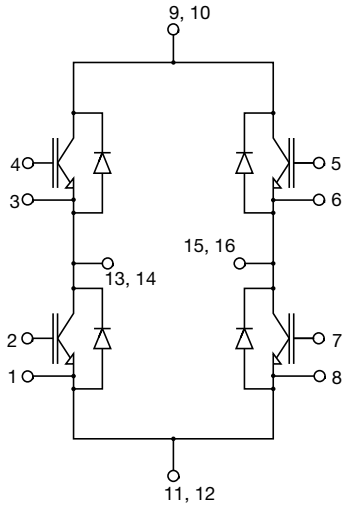


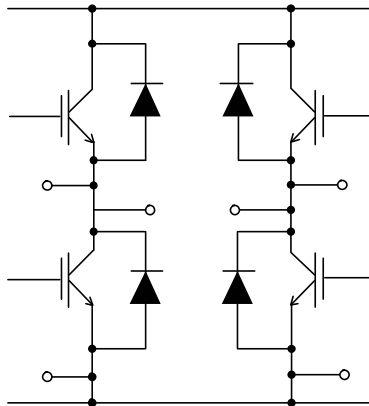
Fig. 16 - Electrical diagram

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>25</b>	<b>MT</b>	<b>060</b>	<b>W</b>	<b>F</b>	<b>A</b>	<b>PbF</b>
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Vishay Semiconductors product
- 2** - Current rating (25 = 25 A)
- 3** - Essential part number
- 4** - Voltage code (060 = 600 V)
- 5** - Speed / type (W = warp IGBT)
- 6** - Circuit configuration (F = full bridge)
- 7** - A = Al<sub>2</sub>O<sub>3</sub> DBC substrate
- 8** - PbF = lead (Pb)-free

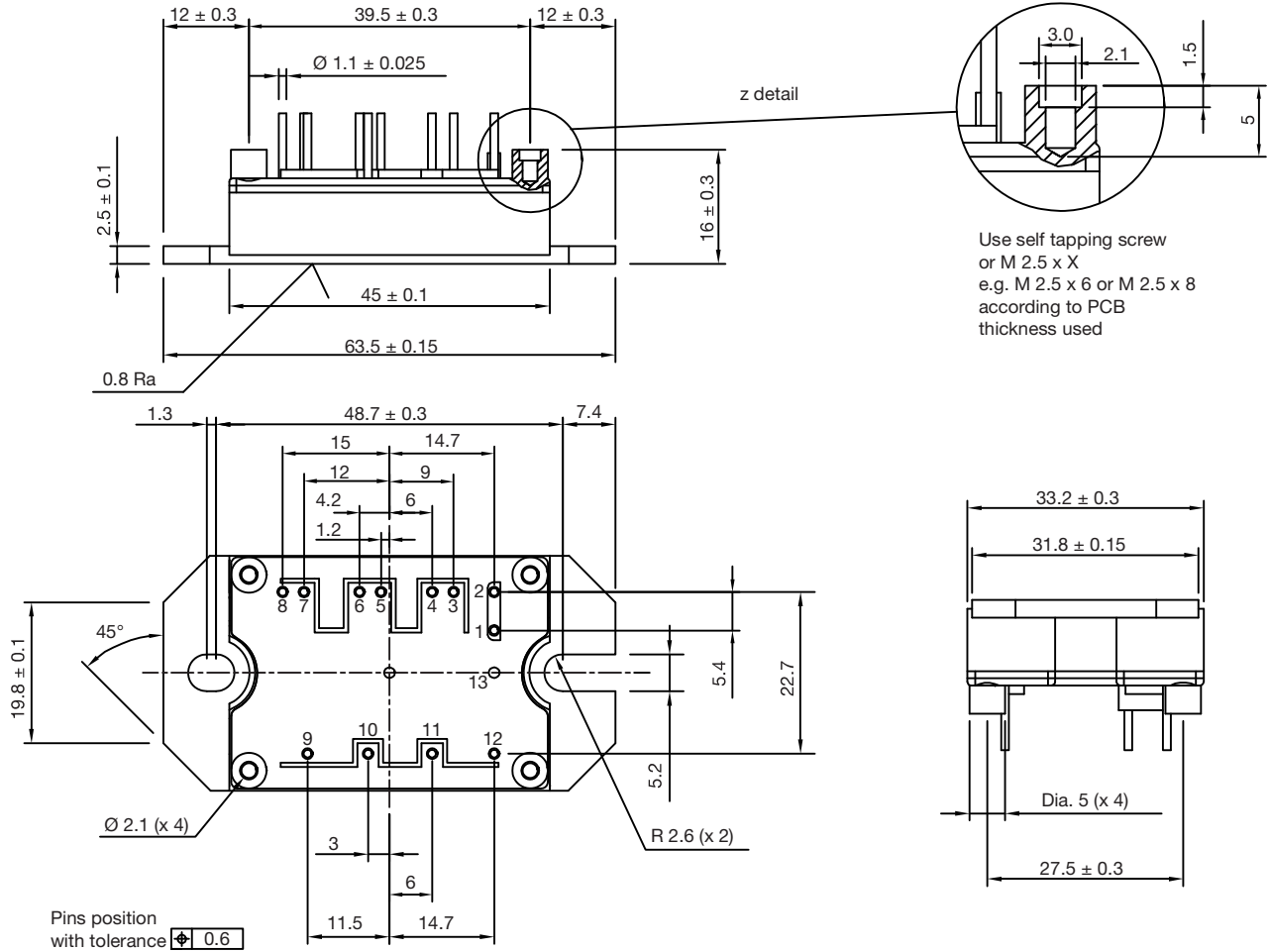
**CIRCUIT CONFIGURATION**



LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95245">www.vishay.com/doc?95245</a>

## MTP

**DIMENSIONS** in millimeters



**Note**

- Unused terminals are not assembled in the package



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