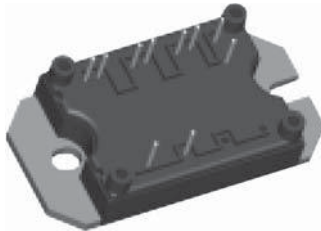


# "Low Side Chopper" IGBT MTP (Ultrafast Speed IGBT), 100 A



MTP

## FEATURES

- Generation 4 ultrafast speed IGBT technology
- HEXFRED® diode with ultrasoft reverse recovery
- Very low conduction and switching losses
- Optional SMD thermistor (NTC)
- Al<sub>2</sub>O<sub>3</sub> DBC
- Very low stray inductance design for high speed operation
- UL approved file E78996
- Speed 8 kHz to 60 kHz > 20 kHz hard switching, > 200 kHz resonant mode
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS**  
COMPLIANT

PRODUCT SUMMARY	
V <sub>CES</sub>	600 V
I <sub>C</sub> DC	100 A
V <sub>CE(on)</sub>	1.68 V

## 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 <sub>CES</sub>		600	V
Continuous collector current	I <sub>C</sub>	T <sub>C</sub> = 25 °C	100	A
		T <sub>C</sub> = 122 °C	50	
Pulsed collector current	I <sub>CM</sub>		200	
Peak switching current	I <sub>LM</sub>		200	
Diode continuous forward current	I <sub>F</sub>	T <sub>C</sub> = 100 °C	48	
Peak diode forward current	I <sub>FM</sub>		200	
Gate to emitter voltage	V <sub>GE</sub>		± 20	V
RMS isolation voltage	V <sub>ISOL</sub>	Any terminal to case, t = 1 minute	2500	
Maximum power dissipation	IGBT	T <sub>C</sub> = 25 °C	445	W
		T <sub>C</sub> = 100 °C	175	
	Diode	T <sub>C</sub> = 25 °C	205	
		T <sub>C</sub> = 100 °C	83	



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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$	-	1.69	2.31	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	1.96	2.55	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	1.88	2.24	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 0.5\text{ mA}$	3	-	6	
Diode reverse breakdown voltage	$V_{BR}$	$I_R = 200\text{ }\mu\text{A}$	600	-	-	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 500\text{ }\mu\text{A}$	-	-13	-	mV/ $^\circ\text{C}$
Forward transconductance	$g_{fe}$	$V_{CE} = 50\text{ V}, I_C = 100\text{ A}$	22	29	-	S
Collector to emitter leaking current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	-	0.25	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	6	
Diode forward voltage drop	$V_{FM}$	$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$	-	1.64	1.82	V
		$I_F = 100\text{ A}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	1.56	1.74	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	$\pm 250$	nA

SWITCHING CHARACTERISTICS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$I_C = 100\text{ A}$ $V_{CC} = 480\text{ V}$ $V_{GE} = 15\text{ V}$	-	370	555	nC
Gate to emitter charge (turn-on)	$Q_{ge}$		-	64	96	
Gate to collector charge (turn-on)	$Q_{gc}$		-	163	245	
Turn-on switching loss	$E_{on}$	$V_{CC} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V},$ $R_g = 5\text{ }\Omega, T_J = 25\text{ }^\circ\text{C},$ energy losses include tail and diode reverse recovery	-	0.7	1.2	mJ
Turn-off switching loss	$E_{off}$		-	1.7	2.6	
Total switching loss	$E_{ts}$		-	2.4	3.8	
Turn-on switching loss	$E_{on}$	$V_{CC} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V},$ $R_g = 5\text{ }\Omega, T_J = 125\text{ }^\circ\text{C},$ energy losses include tail and diode reverse recovery	-	1.1	1.7	
Turn-off switching loss	$E_{off}$		-	2.5	3.8	
Total switching loss	$E_{ts}$		-	3.6	5.5	
Input capacitance	$C_{ies}$	$V_{GE} = 0\text{ V}$ $V_{CC} = 30\text{ V}$ $f = 1.0\text{ MHz}$	-	9800	14 700	pF
Output capacitance	$C_{oes}$		-	602	903	
Reverse transfer capacitance	$C_{res}$		-	121	182	
Diode junction capacitance	$C_t$		$V_R = 600\text{ V}, f = 1.0\text{ MHz}$	-	118	
Diode reverse recovery time	$t_{rr}$	$V_{CC} = 480\text{ V}, I_C = 50\text{ A}$ $di/dt = 200\text{ A}/\mu\text{s}$ $R_g = 5\text{ }\Omega$	-	99	150	ns
Diode peak reverse current	$I_{rr}$		-	6.5	9.8	A
Diode recovery charge	$Q_{rr}$		-	320	735	nC
Diode peak rate of fall of recovery during $t_b$	$dl_{(rec)M}/dt$		-	236	-	A/ $\mu\text{s}$



THERMISTOR SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	$R_0^{(1)}$	$T_0 = 25\text{ }^\circ\text{C}$	-	30	-	$\text{k}\Omega$
Sensitivity index of the thermistor material	$\beta^{(1)(2)}$	$T_0 = 25\text{ }^\circ\text{C}$ $T_1 = 85\text{ }^\circ\text{C}$	-	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
Operating junction temperature range	$T_J$		- 40	-	150	$^\circ\text{C}$
Storage temperature range	$T_{Stg}$		- 40	-	125	
Junction to case	$R_{thJC}$	IGBT	-	-	0.28	$^\circ\text{C}/\text{W}$
		Diode	-	-	0.6	
Case to sink per module	$R_{thCS}$	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Mounting torque to heatsink $\pm 10\%$		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			Nm
Weight			66			g

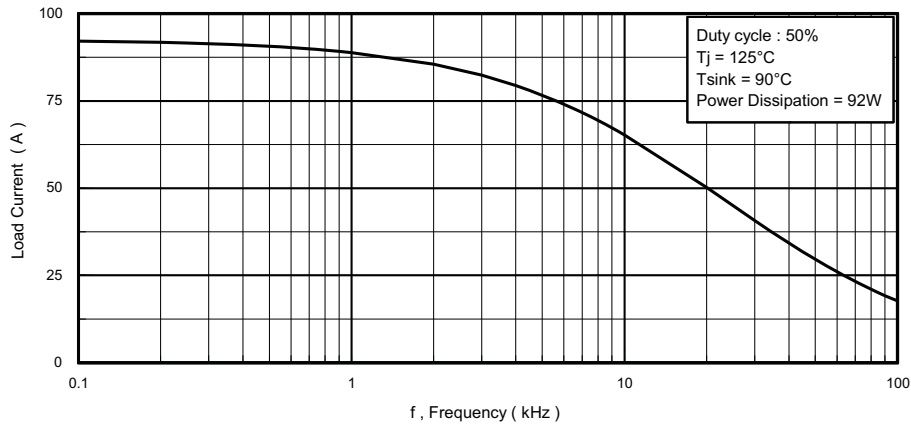


Fig. 1 - Typical Load Current vs. Frequency (Load Current =  $I_{RMS}$  of Fundamental)

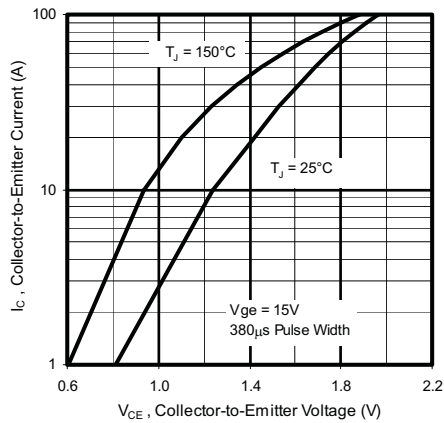


Fig. 2 - Typical Output Characteristics

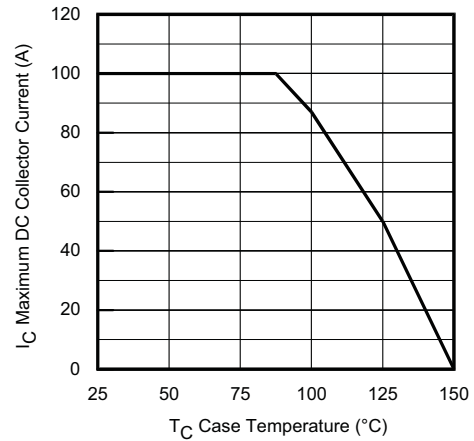


Fig. 4 - Maximum Collector Current vs. Case Temperature

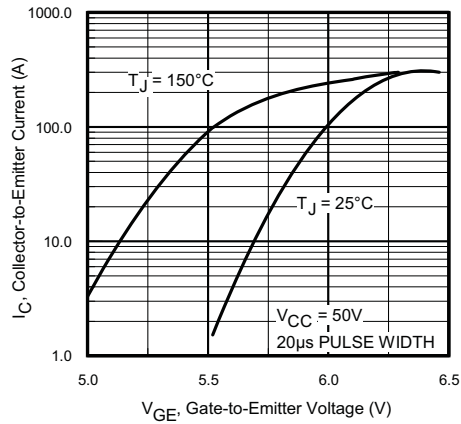


Fig. 3 - Typical Transfer Characteristics

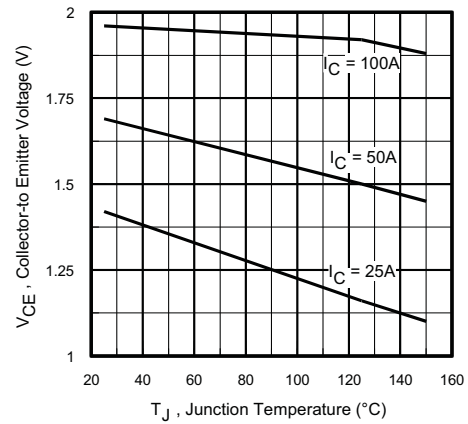


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

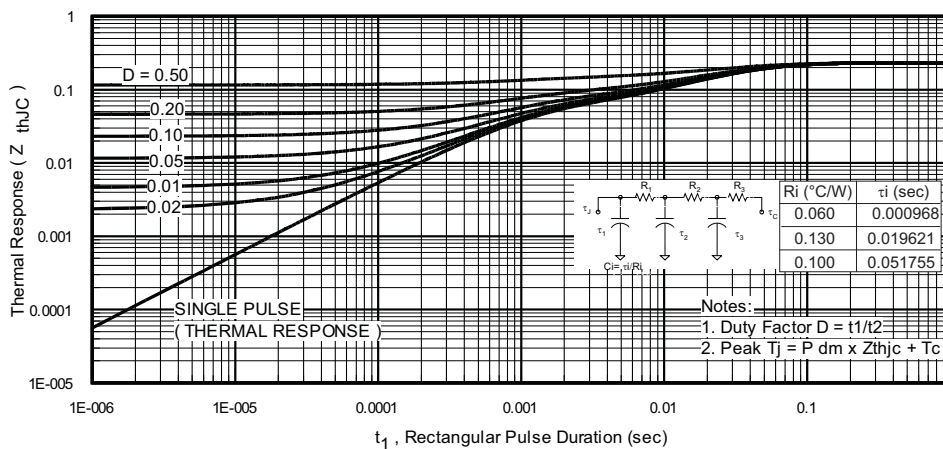


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

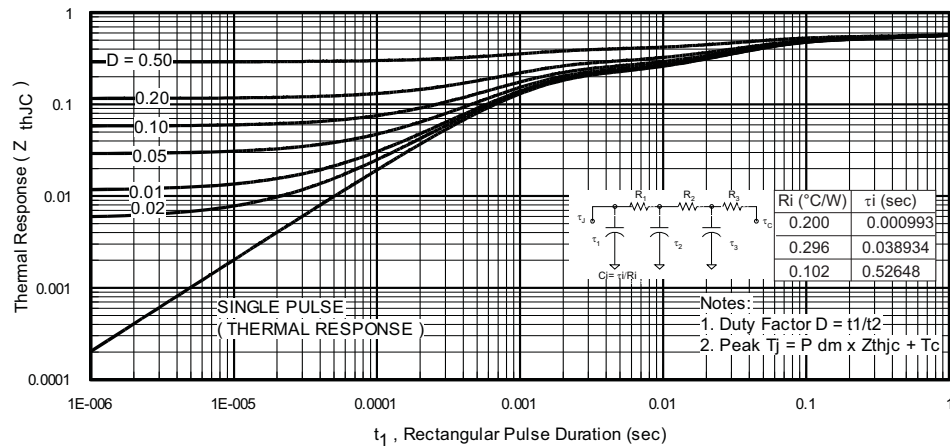


Fig. 7 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

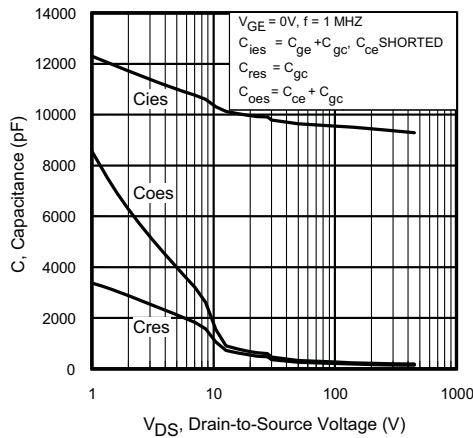


Fig. 8 - Typical Capacitance vs. Collector to Emitter Voltage

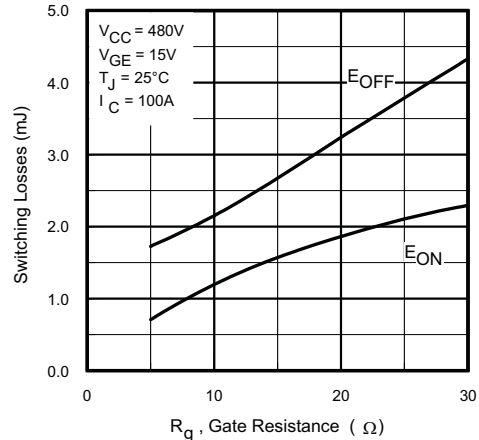


Fig. 10 - Typical Switching Losses vs. Gate Resistance

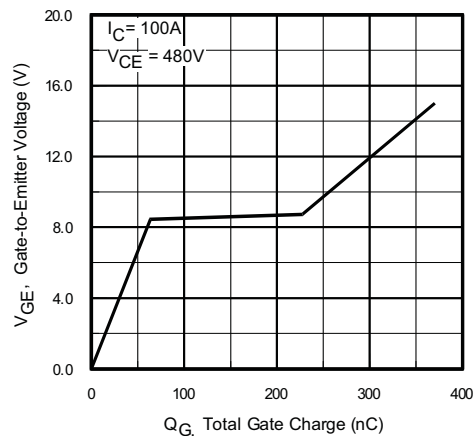


Fig. 9 - Typical Gate Charge vs. Gate to Emitter Voltage

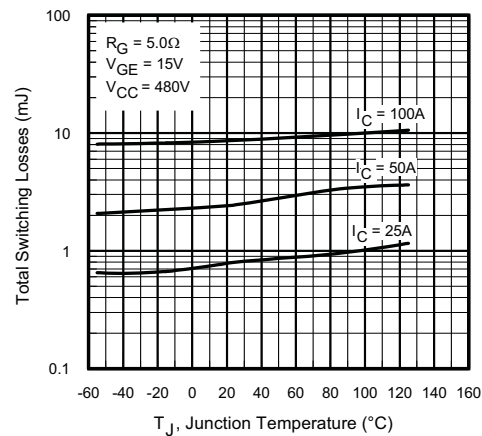


Fig. 11 - Typical Switching Losses vs. Junction Temperature

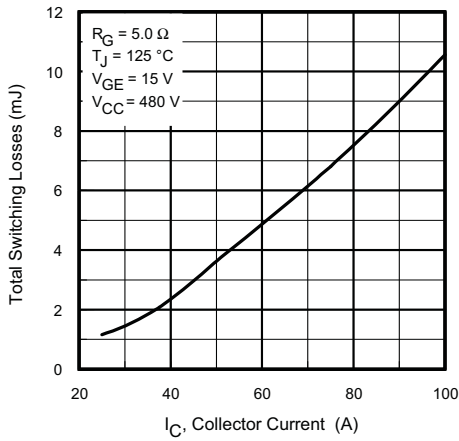


Fig. 12 - Typical Switching Losses vs. Collector to Emitter Current

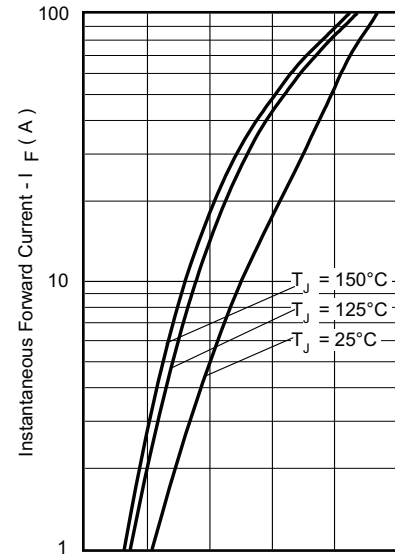


Fig. 14 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

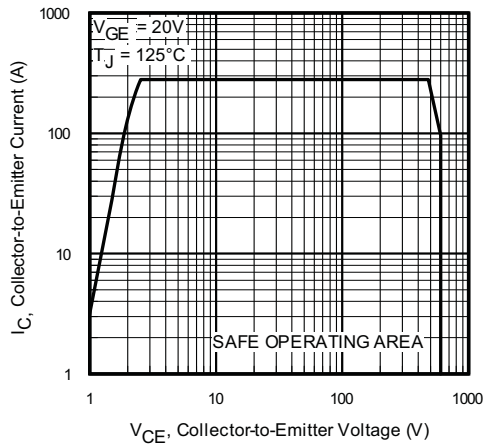


Fig. 13 - Turn-Off SOA

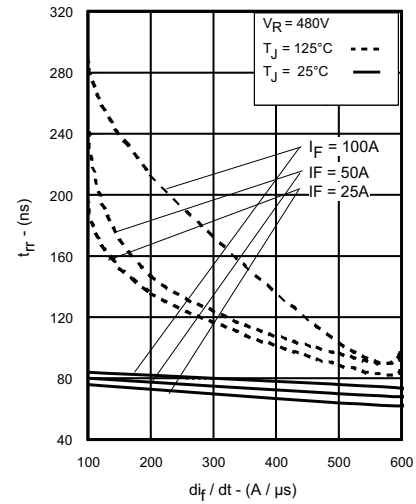


Fig. 15 - Typical Reverse Recovery Time vs.  $di_F/dt$

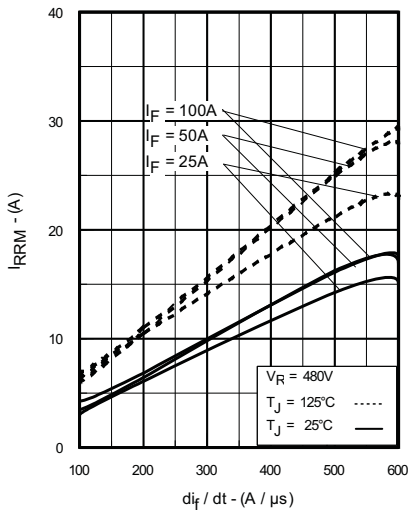


Fig. 16 - Typical Recovery Current vs.  $di_F/dt$

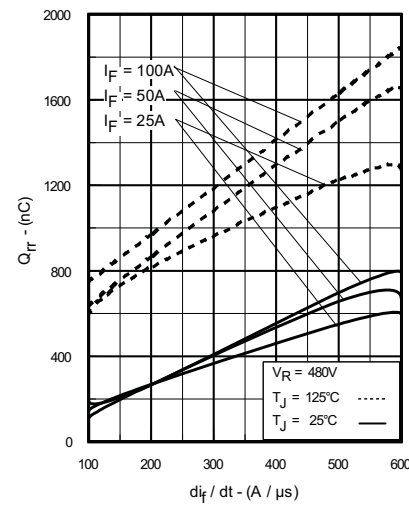


Fig. 17 - Typical Stored Charge vs.  $di_F/dt$

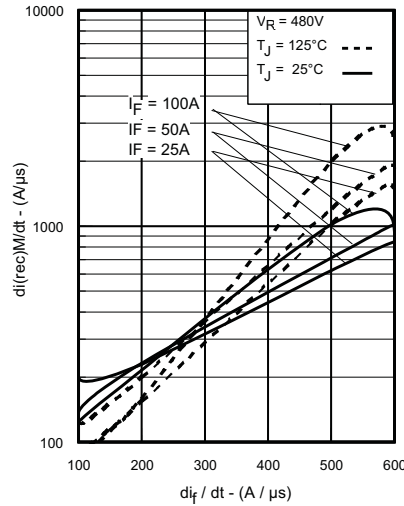


Fig. 18 - Typical  $dI_{(rec)M}/dt$  vs.  $di_F/dt$

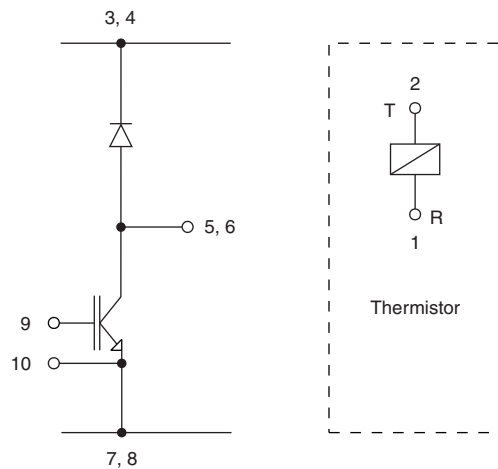
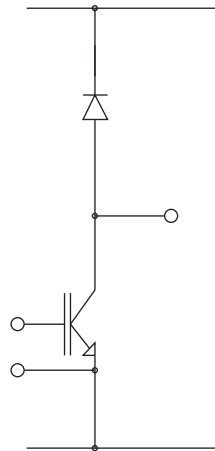


Fig. 19 - Electrical diagram

**ORDERING INFORMATION TABLE**

Device code	<b>50</b>	<b>MT</b>	<b>060</b>	<b>U</b>	<b>LS</b>	<b>T</b>	<b>A</b>	<b>PbF</b>
	1	2	3	4	5	6	7	8

- |          |   |  |
|----------|---|--|
| <b>1</b> | - | Current rating (50 = 50 A)   |
| <b>2</b> | - | Essential part number  |
| <b>3</b> | - | Voltage rating (060 = 600 V)   |
| <b>4</b> | - | Speed/type (U = Ultrafast IGBT)  |
| <b>5</b> | - | Circuit configuration (LS = Low side chopper)  |
| <b>6</b> | - | Special option: <ul style="list-style-type: none"> <li>• None = No special option</li> <li>• T = Thermistor</li> </ul> |
| <b>7</b> | - | A = Al <sub>2</sub> O <sub>3</sub> DBC substrate   |
| <b>8</b> | - | PbF = Lead (Pb)-free   |

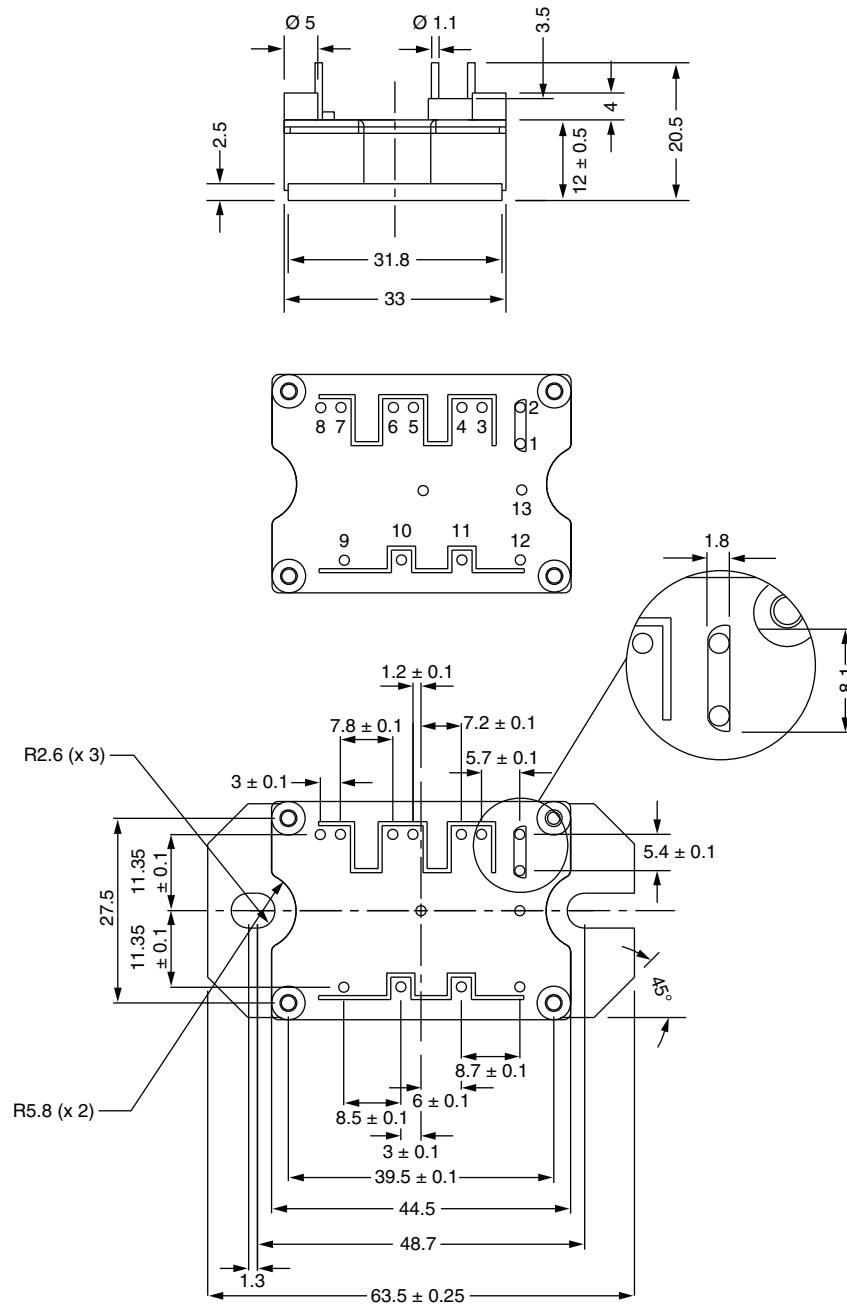
**CIRCUIT CONFIGURATION**

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95175">www.vishay.com/doc?95175</a>
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## MTP

**DIMENSIONS** in millimeters



**Note**

- Unused terminals are not assembled in the package



## Disclaimer

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