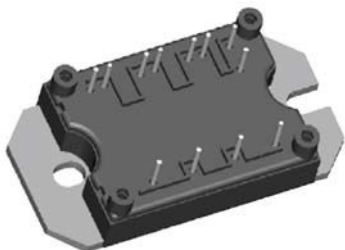


“Half Bridge” IGBT MTP (Warp 2 Speed IGBT), 70 A



MTP

FEATURES

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- SMD thermistor (NTC)
- Al₂O₃ BDC
- Very low stray inductance design for high speed operation
- UL pending
- Speed 60 kHz to 150 kHz
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{CES}	600 V
$V_{CE(on)}$ typical at $V_{GE} = 15$ V	2.1 V
I_C at $T_C = 78$ °C	70 A

BENEFITS

- Optimized for welding, UPS and SMPS applications
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing
- Direct mounting to heatsink
- PCB solderable terminals

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	100	A
		$T_C = 78$ °C	70	
Pulsed collector current	I_{CM}		300	
Peak switching current	I_{LM}		300	
Diode continuous forward current	I_F	$T_C = 78$ °C	53	
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, IGBT	P_D	$T_C = 25$ °C	347	W
		$T_C = 100$ °C	139	

**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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 500\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 70\text{ A}$	-	2.1	2.4	V
		$V_{GE} = 15\text{ V}$, $I_C = 140\text{ A}$	-	2.8	3.4	
		$V_{GE} = 15\text{ V}$, $I_C = 70\text{ A}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	2.7	3	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 0.5\text{ mA}$	3	-	6	
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0\text{ V}$, $I_C = 600\text{ V}$	-	-	0.7	mA
		$V_{GE} = 0\text{ V}$, $I_C = 600\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	-	10	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 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	$I_C = 70\text{ A}$ $V_{CC} = 480\text{ V}$ $V_{GE} = 15\text{ V}$	-	460	690	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	160	250	
Gate to collector charge (turn-on)	Q_{gc}		-	70	130	
Turn-on switching loss	E_{on}	$R_g = 10\text{ }\Omega$ $I_C = 70\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 25\text{ }^{\circ}\text{C}$	-	1.1	-	mJ
Turn-off switching loss	E_{off}		-	0.9	-	
Total switching loss	E_{ts}		-	2	-	
Turn-on switching loss	E_{on}	$R_g = 10\text{ }\Omega$ $I_C = 70\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150\text{ }^{\circ}\text{C}$	-	1.27	-	mJ
Turn-off switching loss	E_{off}		-	1.13	-	
Total switching loss	E_{ts}		-	2.4	-	
Turn-on delay time	t_{don}	$R_g = 10\text{ }\Omega$ $I_C = 70\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery	-	314	-	ns
Rise time	t_r		-	49	-	
Turn-off delay time	t_{doff}		-	308	-	
Fail time	t_f	$R_g = 10\text{ }\Omega$ $I_C = 70\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150\text{ }^{\circ}\text{C}$	-	68	-	ns
Turn-on delay time	t_{don}		-	312	-	
Rise time	t_r		-	50	-	
Turn-off delay time	t_{doff}	$R_g = 10\text{ }\Omega$ $I_C = 70\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150\text{ }^{\circ}\text{C}$	-	320	-	pF
Fail time	t_f		-	78	-	
Input capacitance	C_{ies}		-	8000	-	
Output capacitance	C_{oes}	$V_{GE} = 0\text{ V}$ $V_{CC} = 30\text{ V}$ $f = 1.0\text{ MHz}$	-	790	-	pF
Reverse transfer capacitance	C_{res}		-	110	-	
Reverse BIAS safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 300\text{ A}$ $V_{CC} = 400\text{ V}$, $V_P = 600\text{ V}$ $R_g = 22\text{ }\Omega$, $V_{GE} = +15\text{ V to }0\text{ V}$	Fullsquare			

**THERMISTOR SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	R_0 ⁽¹⁾	$T_0 = 25\text{ }^\circ\text{C}$	-	30	-	k Ω
Sensitivity index of the thermistor material	β ⁽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

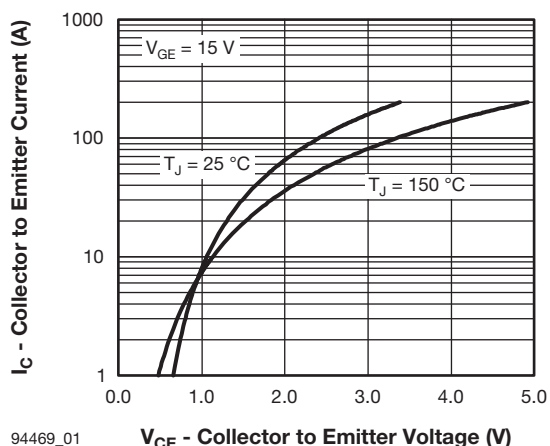
⁽²⁾ $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, temperature in Kelvin

DIODE SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Diode forward voltage drop	V_{FM}	$I_C = 70\text{ A}$, $V_{GE} = 0\text{ V}$	-	1.64	2.1	V
		$I_C = 140\text{ A}$, $V_{GE} = 0\text{ V}$	-	2.1	2.4	
		$I_C = 70\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	1.69	1.9	
Diode reverse recovery time	t_{rr}	$V_{CC} = 200\text{ V}$, $I_C = 70\text{ A}$ $di/dt = 200\text{ A}/\mu\text{s}$	-	96	126	ns
Diode peak reverse current	I_{rr}		-	9.4	12.8	A
Diode recovery charge	Q_{rr}		-	440	750	nC
Diode reverse recovery time	t_{rr}	$V_{CC} = 200\text{ V}$, $I_C = 70\text{ A}$ $di/dt = 200\text{ A}/\mu\text{s}$ $T_J = 125\text{ }^\circ\text{C}$	-	140	194	ns
Diode peak reverse current	I_{rr}		-	14	19	A
Diode recovery charge	Q_{rr}		-	950	1700	nC

THERMAL AND MECHANICAL SPECIFICATIONS

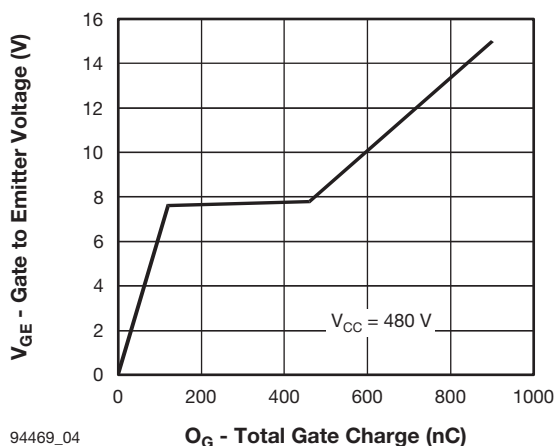
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J	IGBT, Diode	- 40	-	150	$^\circ\text{C}$
		Thermistor	- 40	-	125	
Storage temperature range	T_{Stg}		- 40	-	125	
Junction to case	R_{thJC}	IGBT	-	-	0.36	$^\circ\text{C}/\text{W}$
		Diode	-	-	0.8	
Case to sink per module	R_{thCS}	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
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.	$3 \pm 10\%$			Nm
Weight			66			g



94469_01

V_{CE} - Collector to Emitter Voltage (V)

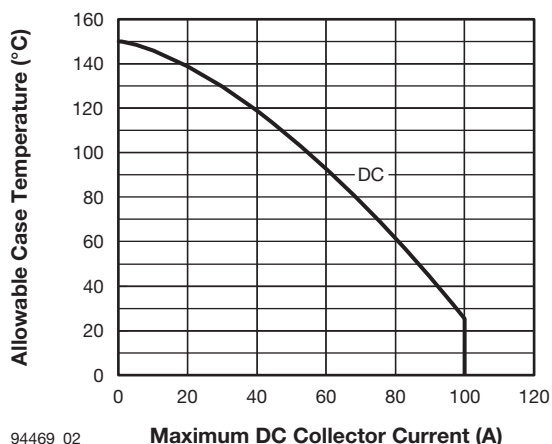
Fig. 1 - Typical Output Characteristics



94469_04

Q_G - Total Gate Charge (nC)

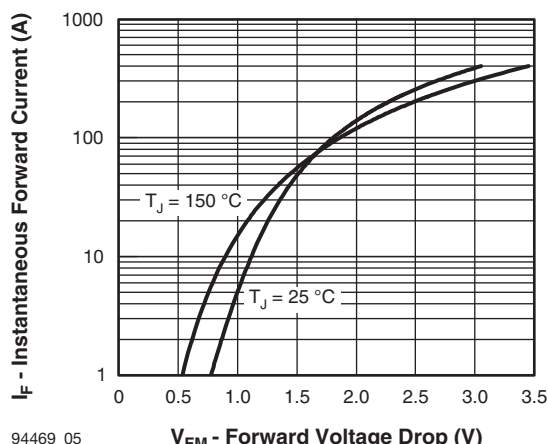
Fig. 4 - Typical Gate Charge vs. Gate to Emitter Voltage



94469_02

Maximum DC Collector Current (A)

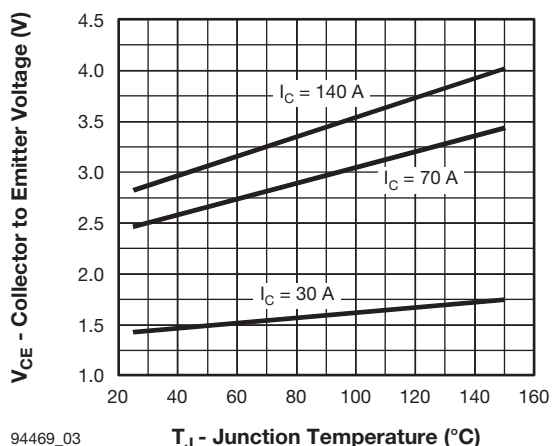
Fig. 2 - Maximum Collector Current vs. Case Temperature



94469_05

V_{FM} - Forward Voltage Drop (V)

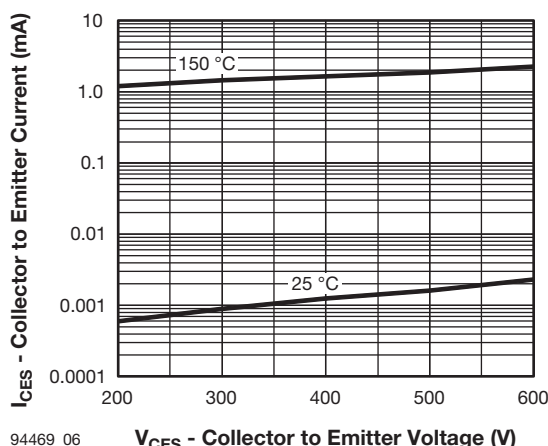
Fig. 5 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current



94469_03

T_J - Junction Temperature (°C)

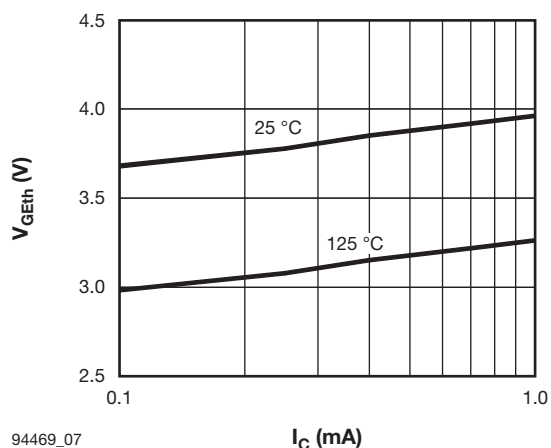
Fig. 3 - Typical Collector to Emitter Voltage vs. Junction Temperature



94469_06

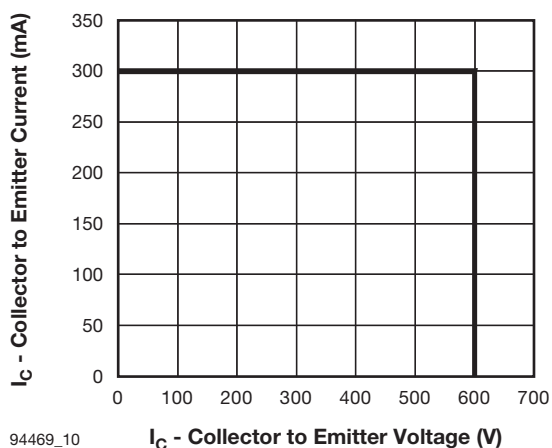
V_{CES} - Collector to Emitter Voltage (V)

Fig. 6 - Typical Zero Gate Voltage Collector Current

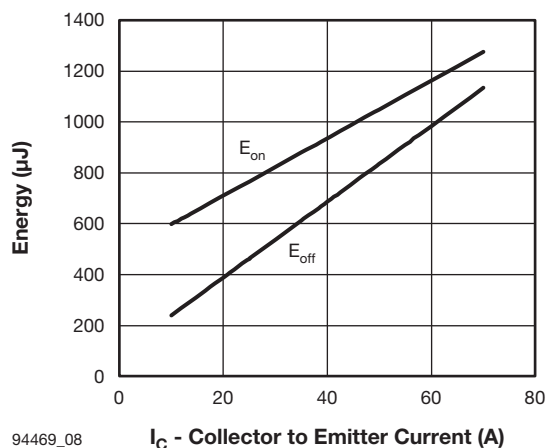


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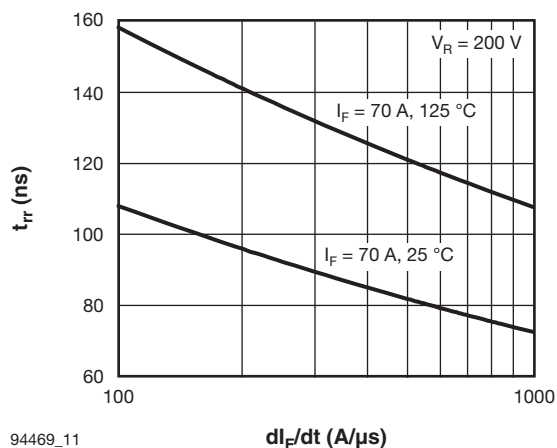
Fig. 7 - Typical Gate Threshold Voltage



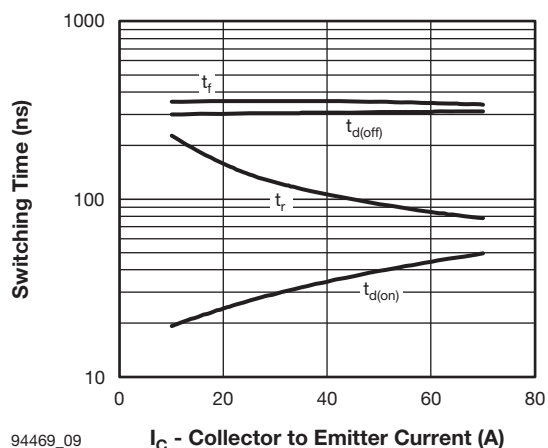
94469_10

Fig. 10 - Reverse BIAS SOA, $T_J = 150\text{ }^{\circ}\text{C}$


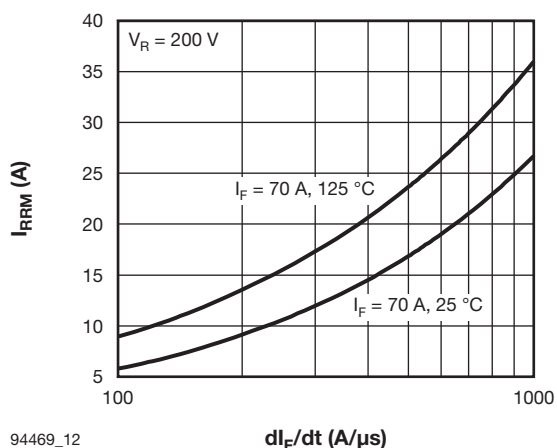
94469_08

Fig. 8 - Typical Energy Losses vs. I_C ($T_J = 150\text{ }^{\circ}\text{C}$)


94469_11

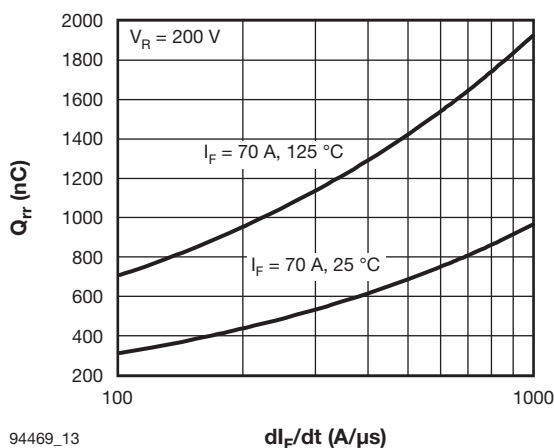
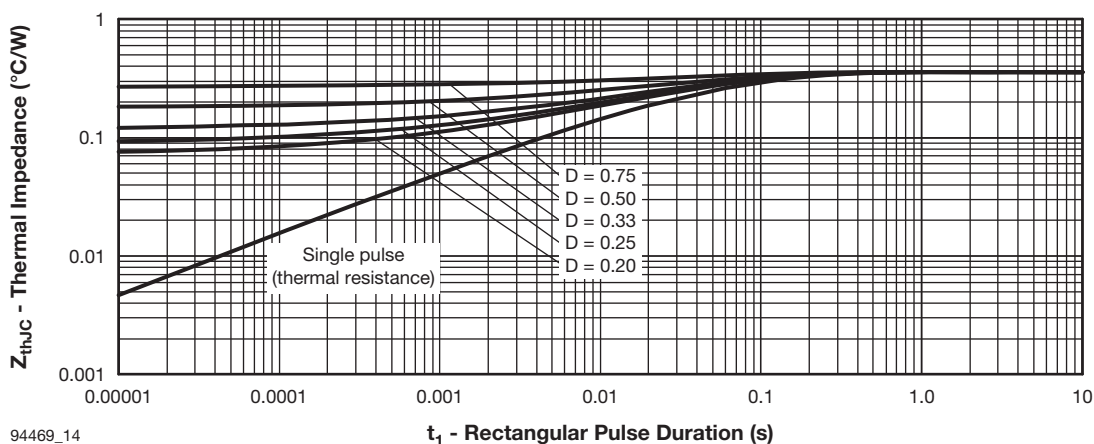
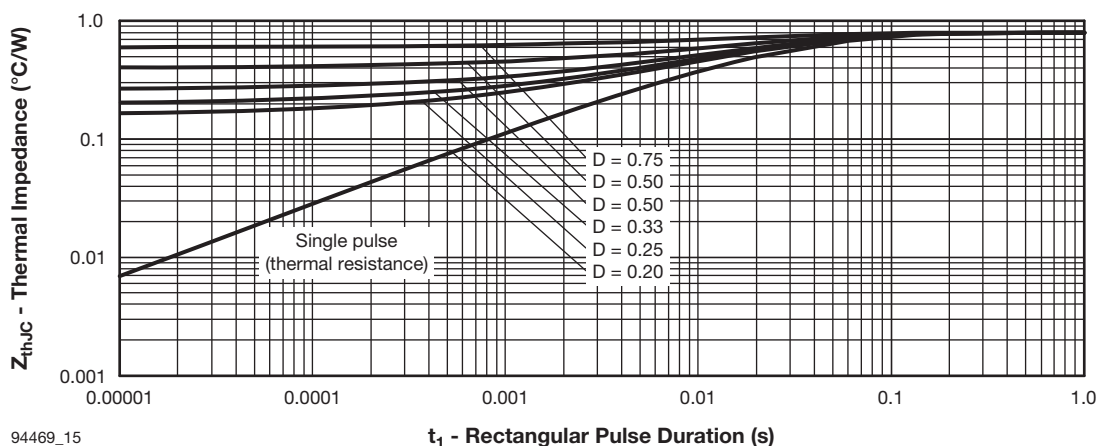
Fig. 11 - Typical Reverse Recovery Time vs. dI_F/dt


94469_09

Fig. 9 - Switching Time vs. I_C


94469_12

Fig. 12 - Typical Reverse Recovery Current vs. dI_F/dt


Fig. 13 - Typical Stored Charge vs. dI_F/dt

Fig. 14 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

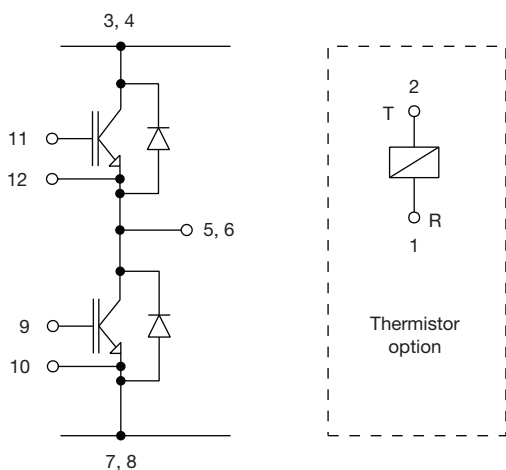


Fig. 16 - Electrical Diagram

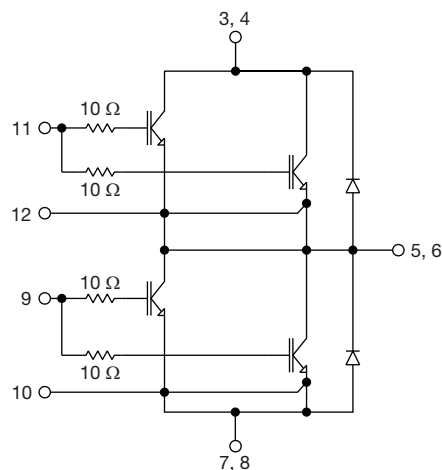
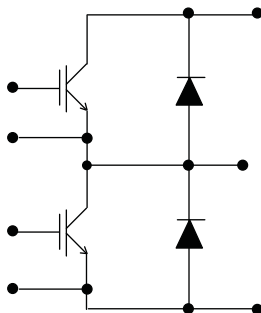


Fig. 17 - Functional Diagram

ORDERING INFORMATION TABLE

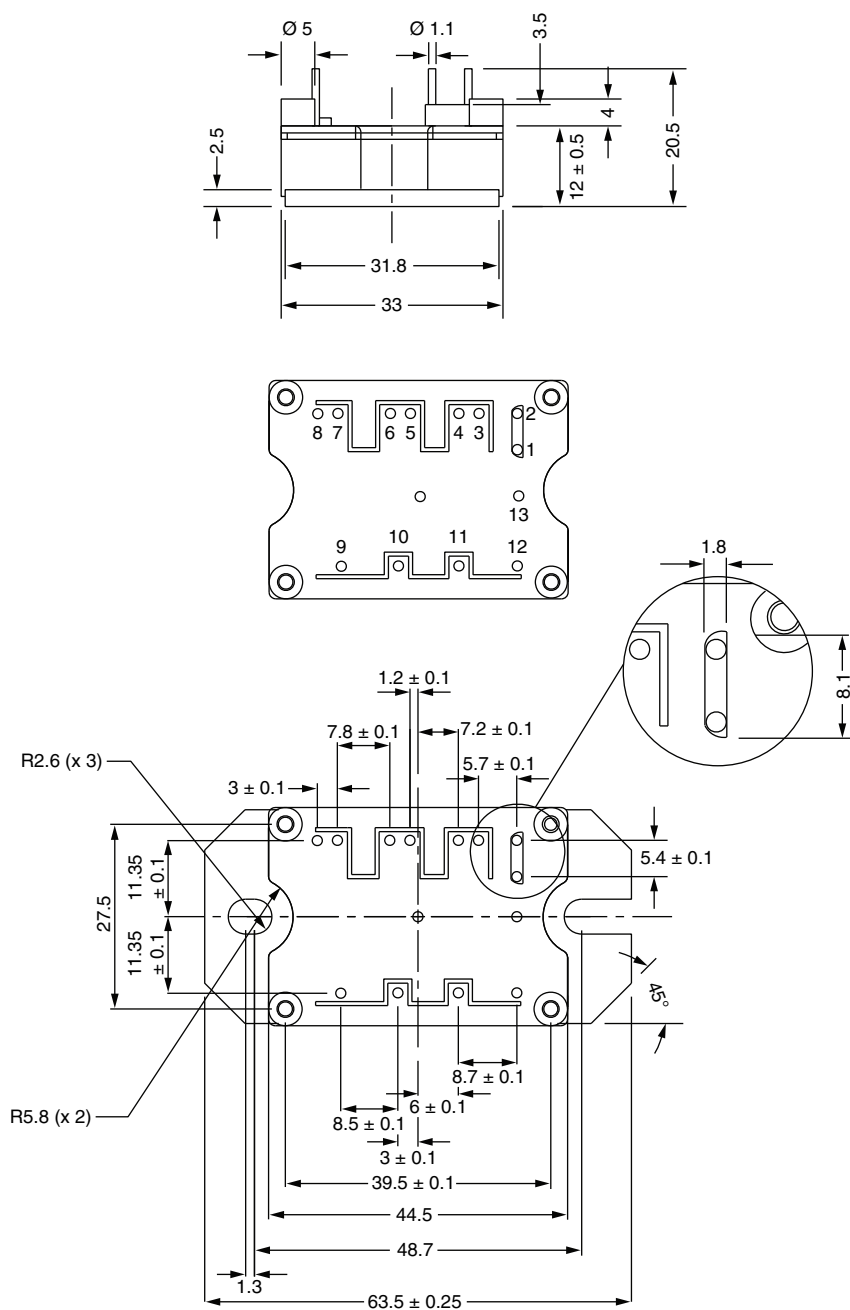
Device code	70	MT	060	W	H	T	A	PbF
	1	2	3	4	5	6	7	8
1	-	Current rating (70 = 70 A)						
2	-	Essential part number						
3	-	Voltage rating (060 = 600 V)						
4	-	Speed/type (W = Warp IGBT)						
5	-	Circuit configuration (H = Half bridge)						
6	-	T = Thermistor						
7	-	A = Al ₂ O ₃ DBC substrate						
8	-	Lead (Pb)-free						

CIRCUIT CONFIGURATION



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

DIMENSIONS in millimeters



- Unused terminals are not assembled in the package



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