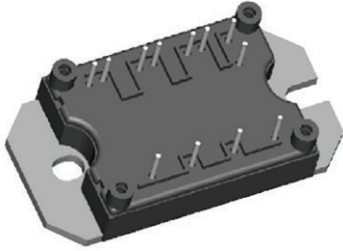



“Half Bridge” IGBT MTP (Warp 2 Speed IGBT), 70 A


MTP

RoHS
COMPLIANT

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 
- 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
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing
- Direct mounting to heatsink
- PCB solderable terminals

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
Package	MTP
Circuit	Half bridge

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}	$R_g = 10\text{ }\Omega$	-	1.1	-	mJ
Turn-off switching loss	E_{off}	$I_C = 70\text{ A}, V_{CC} = 480\text{ V}, V_{GE} = 15\text{ V}, L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 25\text{ }^\circ\text{C}$	-	0.9	-	
Total switching loss	E_{ts}	-	-	2	-	
Turn-on switching loss	E_{on}	$R_g = 10\text{ }\Omega$	-	1.27	-	
Turn-off switching loss	E_{off}	$I_C = 70\text{ A}, V_{CC} = 480\text{ V}, V_{GE} = 15\text{ V}, L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150\text{ }^\circ\text{C}$	-	1.13	-	
Total switching loss	E_{ts}	-	-	2.4	-	
Turn-on delay time	td_{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	-	314	-	ns
Rise time	t_r		-	49	-	
Turn-off delay time	td_{off}		-	308	-	
Fail time	t_f		-	68	-	
Turn-on delay time	td_{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, $T_J = 150\text{ }^\circ\text{C}$	-	312	-	ns
Rise time	t_r		-	50	-	
Turn-off delay time	td_{off}		-	320	-	
Fail time	t_f		-	78	-	
Input capacitance	C_{ies}	$V_{GE} = 0\text{ V}$ $V_{CC} = 30\text{ V}$ $f = 1.0\text{ MHz}$	-	8000	-	pF
Output capacitance	C_{oes}		-	790	-	
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	-	$k\Omega$
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

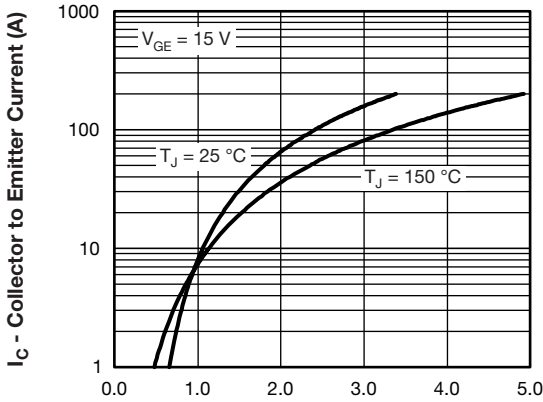
Notes

(1) T_0, T_1 are thermistor's temperatures

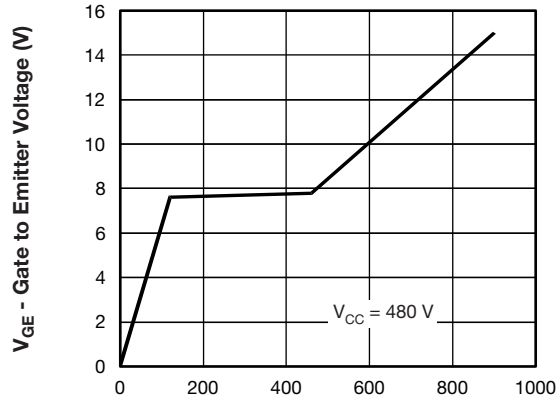
(2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, temperature in Kelvin

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

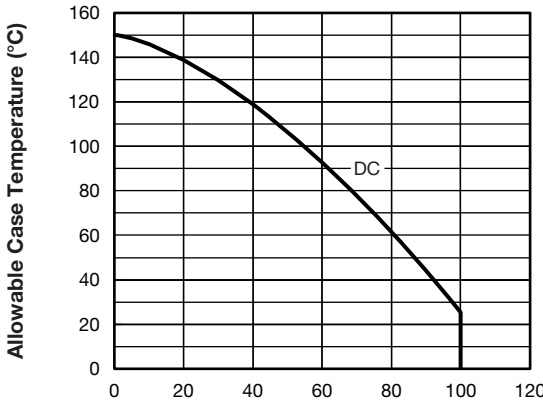
THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	IGBT, Diode	T_J	- 40	-	150	$^\circ\text{C}$
	Thermistor		- 40	-	125	
Storage temperature range	T_{Stg}		- 40	-	125	
Junction to case	IGBT	R_{thJC}	-	-	0.36	$^\circ\text{C}/\text{W}$
	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 ± 10 %			Nm
Weight			66			g



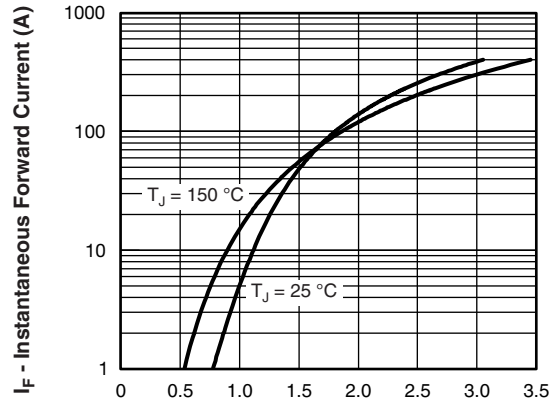
94469_01 **V_{CE} - Collector to Emitter Voltage (V)**
Fig. 1 - Typical Output Characteristics



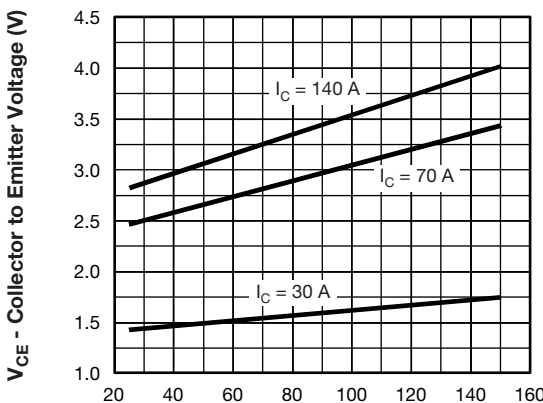
94469_04 **O_G - Total Gate Charge (nC)**
Fig. 4 - Typical Gate Charge vs. Gate to Emitter Voltage



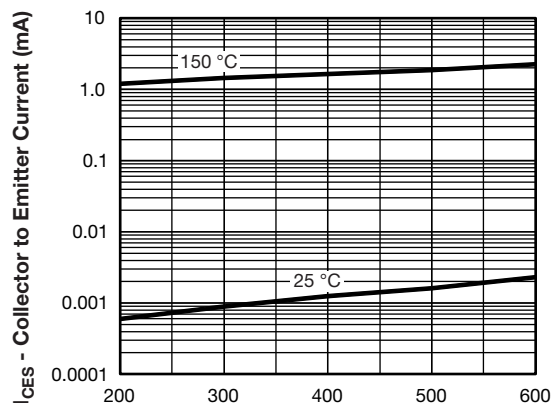
94469_02 **Maximum DC Collector Current (A)**
Fig. 2 - Maximum Collector Current vs. Case Temperature



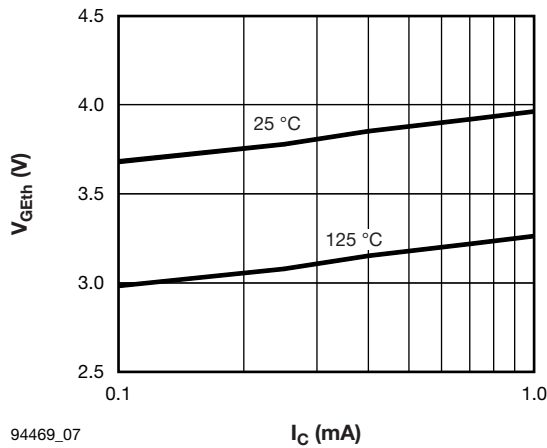
94469_05 **V_{FM} - Forward Voltage Drop (V)**
Fig. 5 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current



94469_03 **T_J - Junction Temperature (°C)**
Fig. 3 - Typical Collector to Emitter Voltage vs. Junction Temperature

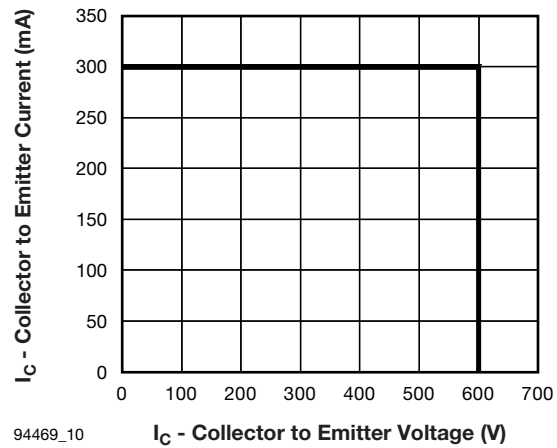


94469_06 **V_{CES} - Collector to Emitter Voltage (V)**
Fig. 6 - Typical Zero Gate Voltage Collector Current



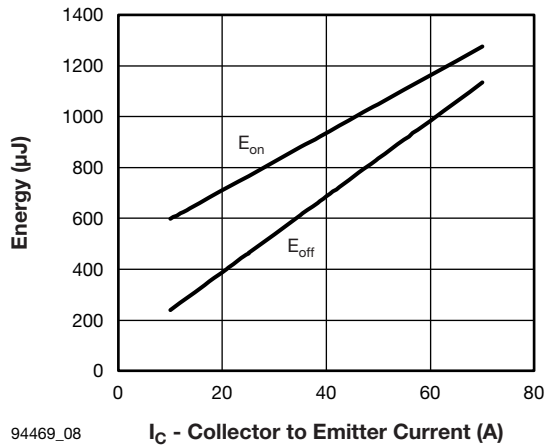
94469_07

Fig. 7 - Typical Gate Threshold Voltage



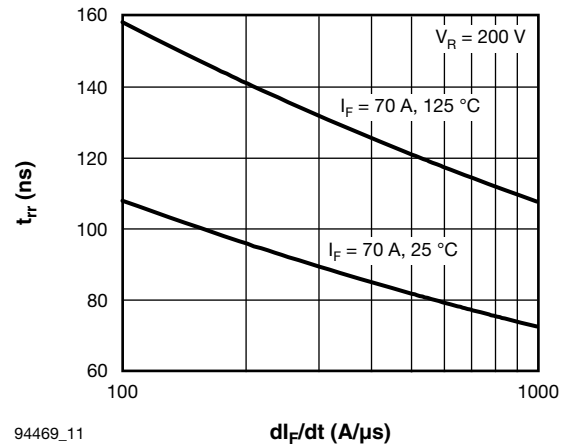
94469_10

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



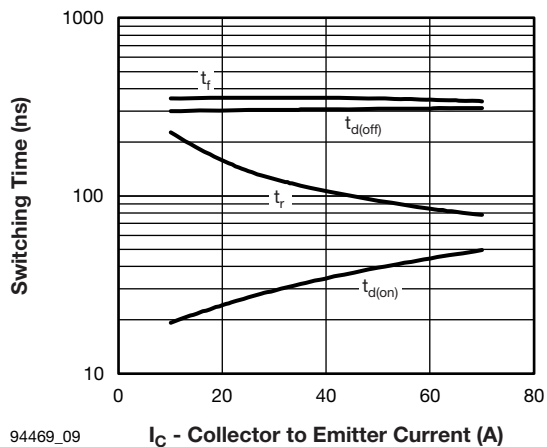
94469_08

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



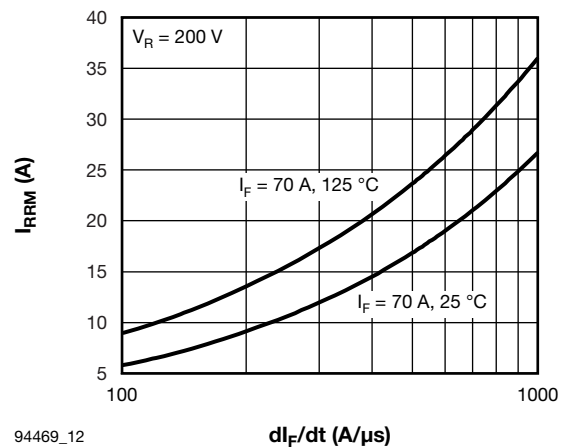
94469_11

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



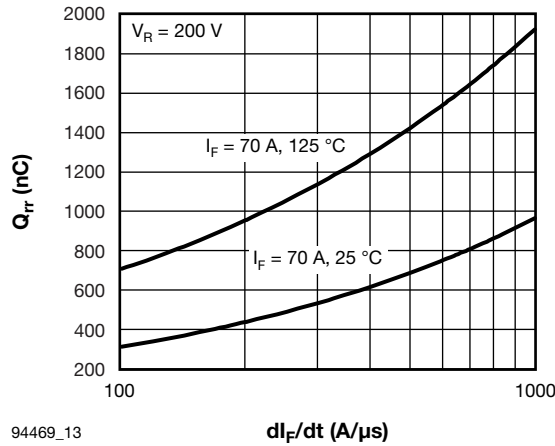
94469_09

Fig. 9 - Switching Time vs. I_C



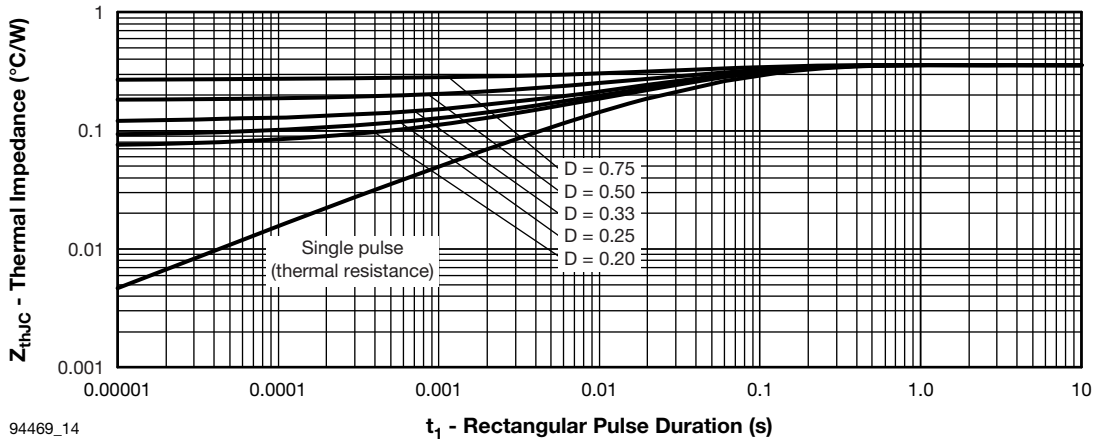
94469_12

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



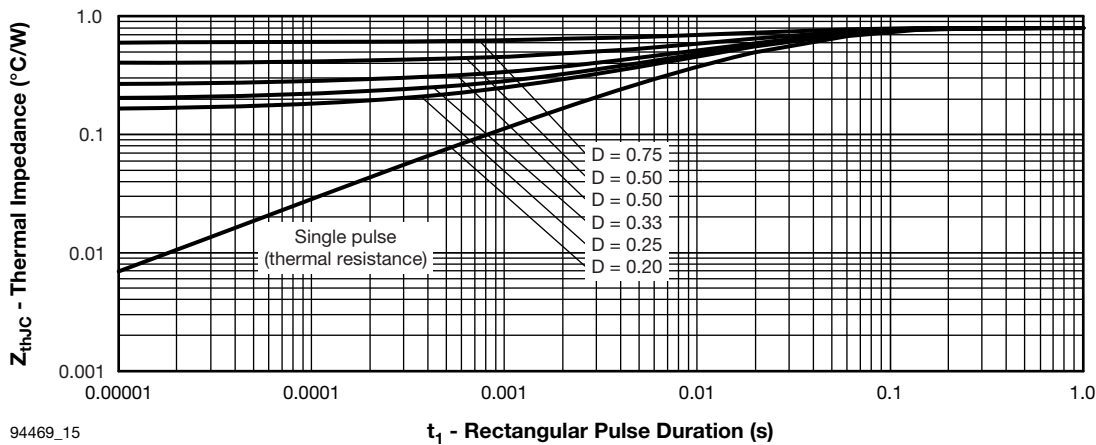
94469_13

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



94469_14

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



94469_15

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

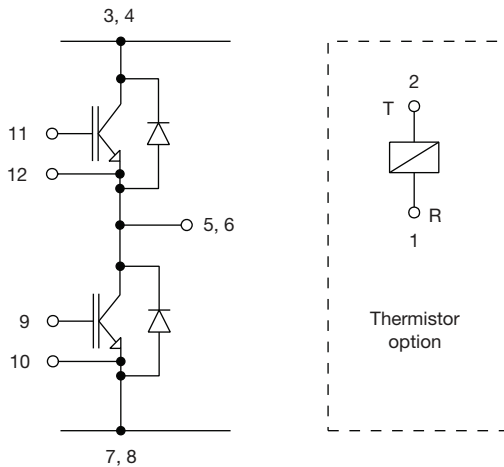


Fig. 16 - Electrical Diagram

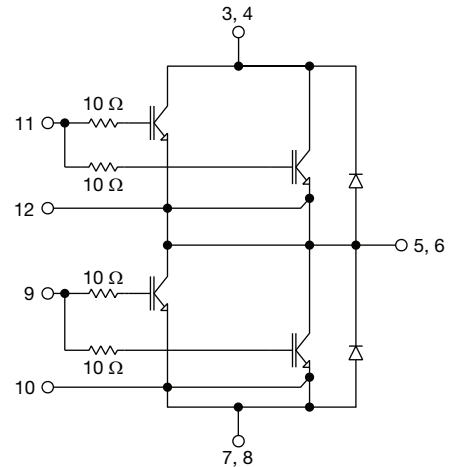
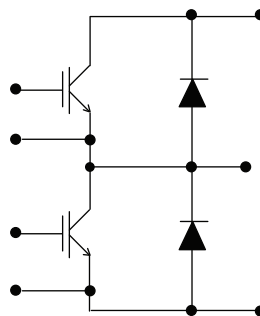


Fig. 17 - Functional Diagram

ORDERING INFORMATION TABLE

Device code	VS-	70	MT	060	W	H	T	A	PbF
	①	②	③	④	⑤	⑥	⑦	⑧	⑨
1	-	2	-	3	-	4	-	5	-
2	-	70	-	60	-	H	-	A	-
3	-		-	060	-	T	-		-
4	-		-		-		-		-
5	-		-		-		-		-
6	-		-		-		-		-
7	-		-		-		-		-
8	-		-		-		-		-
9	-		-		-		-		-

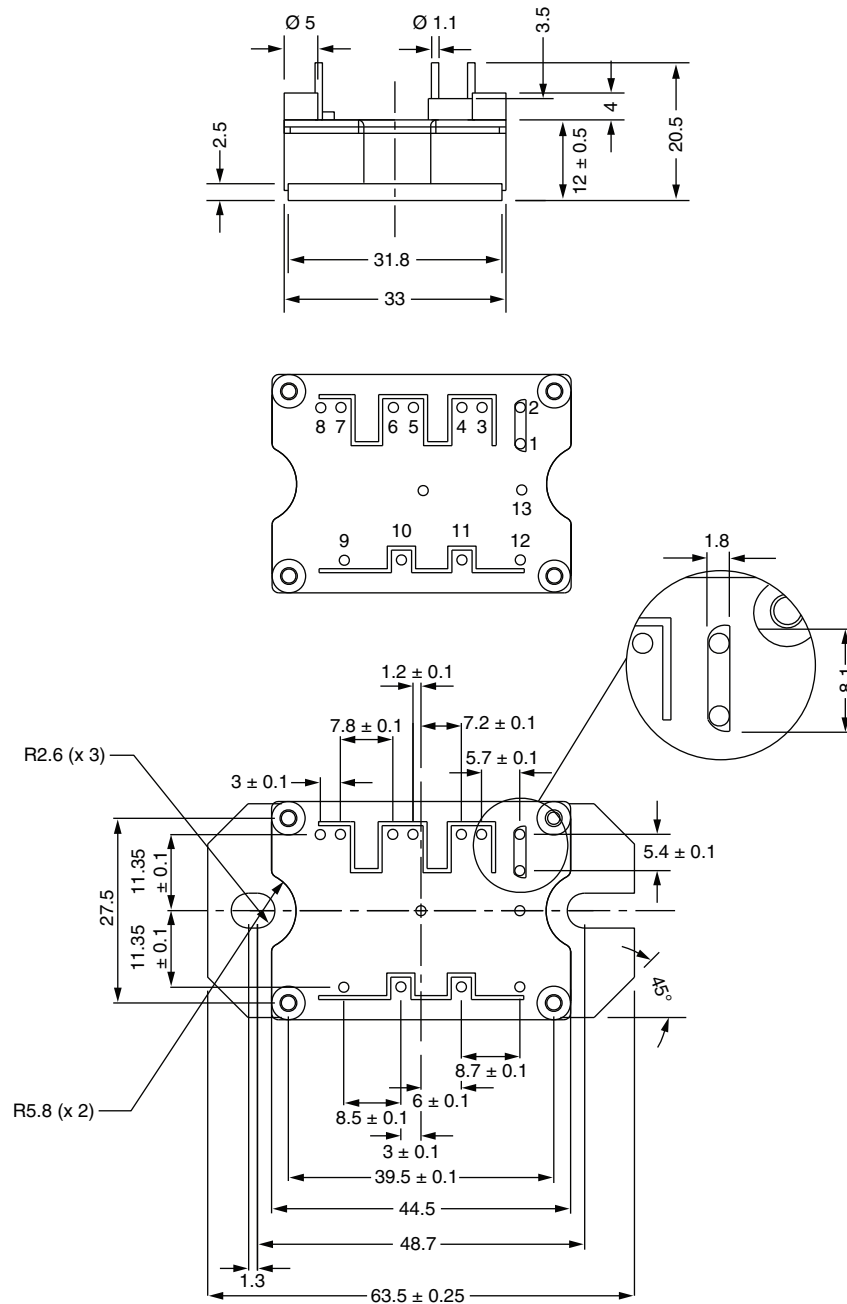
- 1** - Vishay Semiconductors product
- 2** - Current rating (70 = 70 A)
- 3** - Essential part number
- 4** - Voltage rating (060 = 600 V)
- 5** - Speed/type (W = Warp IGBT)
- 6** - Circuit configuration (H = Half bridge)
- 7** - T = Thermistor
- 8** - A = Al₂O₃ DBC substrate
- 9** - Lead (Pb)-free

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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