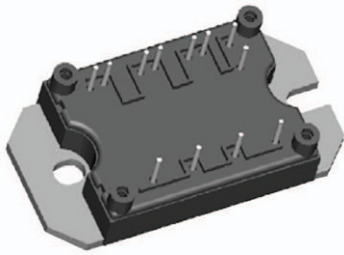



“Half Bridge” IGBT MTP (Warp Speed IGBT), 114 A


MTP

**RoHS
COMPLIANT**
FEATURES

- Gen 4 warp speed 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

PRODUCT SUMMARY

V_{CES}	600 V
$V_{CE(on)}$ typical at $V_{GE} = 15$ V	2.3 V
I_C at $T_C = 25$ °C	114 A
Speed	30 kHz to 100 kHz
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	114	A
		$T_C = 109$ °C	50	
Pulsed collector current	I_{CM}		350	
Peak switching current	I_{LM}		350	
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	
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	
Maximum power dissipation	P_D	$T_C = 25$ °C	658	W
		$T_C = 100$ °C	263	



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	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$	-	2.3	3.15	V
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	2.5	3.2	
		$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	1.72	2.17	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 0.5\text{ mA}$	3	-	6	
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0\text{ V}, I_C = 600\text{ A}$	-	-	0.4	mA
		$V_{GE} = 0\text{ V}, I_C = 600\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	-	10	
Diode forward voltage drop	V_{FM}	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$	-	1.58	1.80	V
		$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	1.49	1.68	
		$I_F = 100\text{ A}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$	-	1.9	2.17	
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	$I_C = 52\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$	-	331	385	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	44	52	
Gate to collector charge (turn-on)	Q_{gc}		-	133	176	
Turn-on switching loss	E_{on}	Internal gate resistors (see electrical diagram) $I_C = 50\text{ A}, V_{CC} = 480\text{ V}, V_{GE} = 15\text{ V}, L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 25\text{ }^\circ\text{C}$	-	0.26	-	mJ
Turn-off switching loss	E_{off}		-	1.2	-	
Total switching loss	E_{ts}		-	1.46	-	
Turn-on switching loss	E_{on}	Internal gate resistors (see electrical diagram) $I_C = 50\text{ A}, V_{CC} = 480\text{ V}, V_{GE} = 15\text{ V}, L = 200\text{ }\mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150\text{ }^\circ\text{C}$	-	0.73	-	mJ
Turn-off switching loss	E_{off}		-	1.66	-	
Total switching loss	E_{ts}		-	2.39	-	
Input capacitance	C_{ies}	$V_{GE} = 0\text{ V}$ $V_{CC} = 30\text{ V}$ $f = 1.0\text{ MHz}$	-	7100	-	pF
Output capacitance	C_{oes}		-	510	-	
Reverse transfer capacitance	C_{res}		-	140	-	
Diode reverse recovery time	t_{rr}	$V_{CC} = 200\text{ V}, I_C = 50\text{ A}$ $dI/dt = 200\text{ A}/\mu\text{s}$	-	82	97	ns
Diode peak reverse current	I_{rr}		-	8.3	10.6	A
Diode recovery charge	Q_{rr}		-	340	514	nC
Diode reverse recovery time	t_{rr}	$V_{CC} = 200\text{ V}, I_C = 50\text{ A}$ $dI/dt = 200\text{ A}/\mu\text{s}$ $T_J = 125\text{ }^\circ\text{C}$	-	137	153	ns
Diode peak reverse current	I_{rr}		-	12.7	14.8	A
Diode recovery charge	Q_{rr}		-	870	1132	nC



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

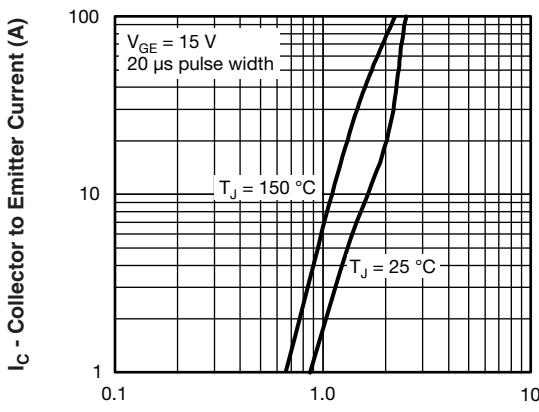
⁽¹⁾ T_0, T_1 are thermistor's temperatures

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

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	IGBT, Diode		-40	-	150	$^\circ\text{C}$
	Thermistor		-40	-	125	
Storage temperature range	T_{Stg}		-40	-	125	
Junction to case	IGBT		-	-	0.38	$^\circ\text{C/W}$
	Diode		-	-	0.8	
Case to sink per module	R_{thCS}	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 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 \pm 10 %			Nm
Weight			66			g

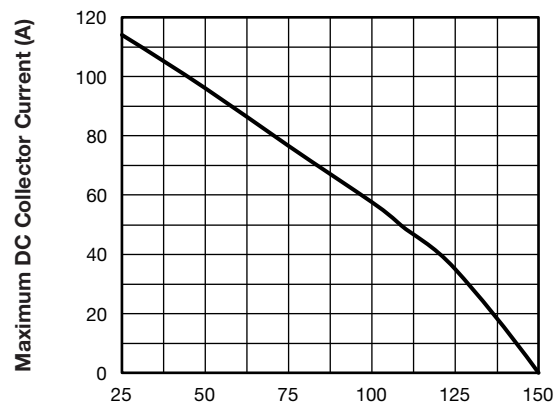
Note

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



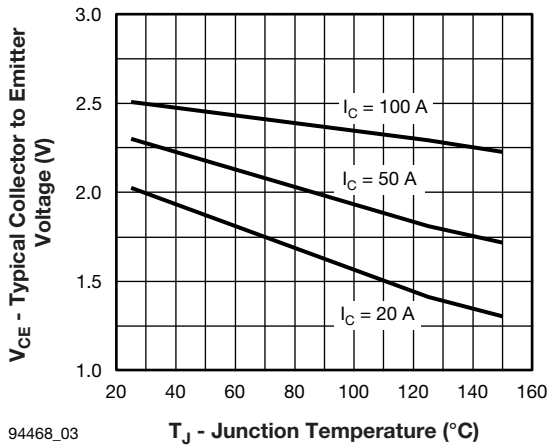
94468_01 V_{CE} - Collector to Emitter Voltage (V)

Fig. 1 - Typical Output Characteristics



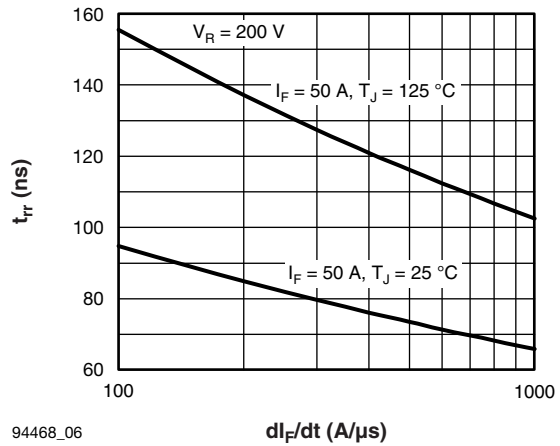
94468_02 T_C - Case Temperature ($^\circ\text{C}$)

Fig. 2 - Maximum Collector Current vs. Case Temperature



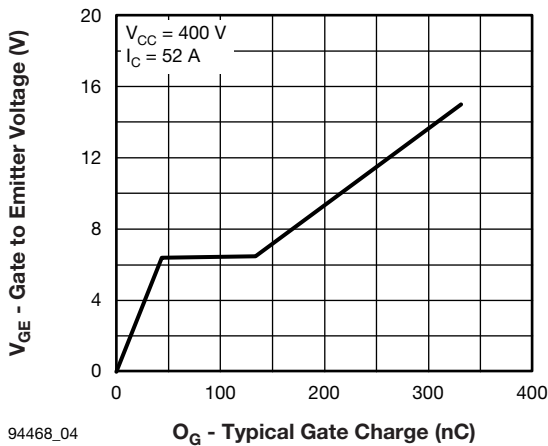
94468_03

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



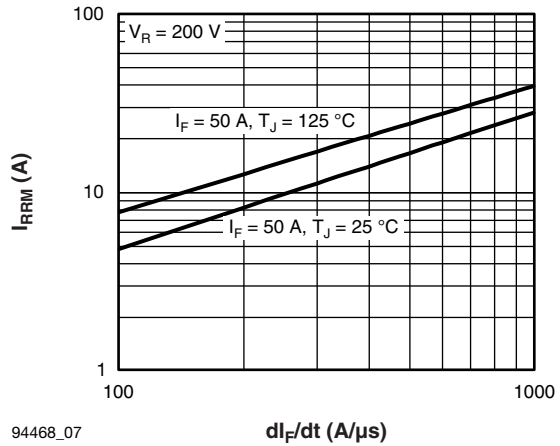
94468_06

Fig. 6 - Typical Reverse Recovery Time vs. di_F/dt



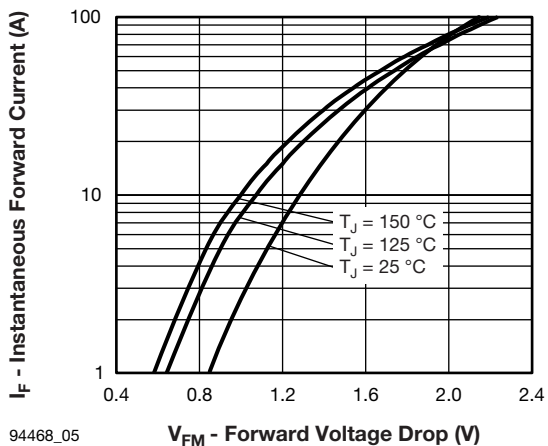
94468_04

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



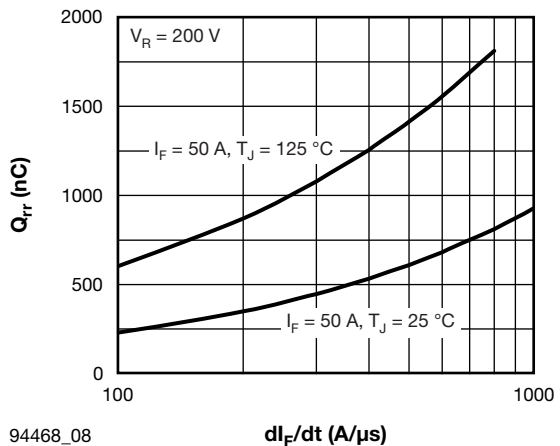
94468_07

Fig. 7 - Typical Reverse Recovery Current vs. di_F/dt



94468_05

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



94468_08

Fig. 8 - Typical Stored Charge vs. di_F/dt

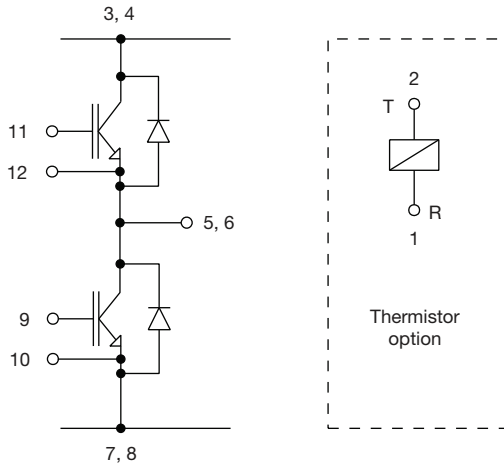


Fig. 9 - Functional Diagram

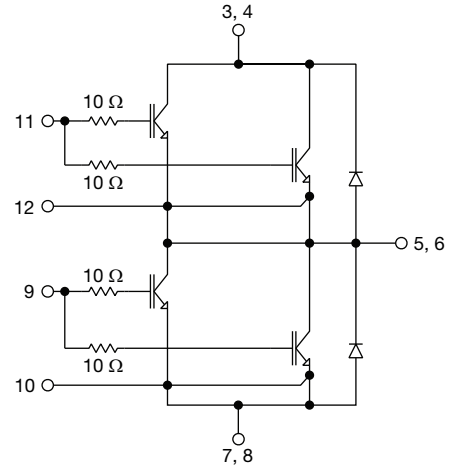


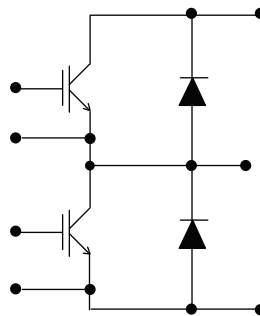
Fig. 10 - Electrical Diagram

ORDERING INFORMATION TABLE

Device code	VS-	50	MT	060	W	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 (W = Warp IGBT)
- 6** - Circuit configuration (H = Half bridge)
- 7** - T = Thermistor
- 8** - A = Al₂O₃ substrate
- 9** - Lead (Pb)-free

CIRCUIT CONFIGURATION



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



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