

## **Excellent Integrated System Limited**

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

[Vishay Semiconductor/Diodes Division](#)  
[VS-50MT060WHTAPBF](#)

For any questions, you can email us directly:

[sales@integrated-circuit.com](mailto:sales@integrated-circuit.com)

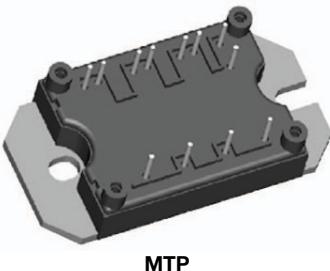


[www.vishay.com](http://www.vishay.com)

## VS-50MT060WHTAPbF

Vishay Semiconductors

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



MTP

#### 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](http://www.vishay.com/doc?99912)



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

#### 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

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	$V_{GE}$		$\pm 20$	V
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	



<b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(\text{BR})\text{CES}}$	$V_{\text{GE}} = 0 \text{ V}$ , $I_C = 500 \mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{\text{CE}(\text{on})}$	$V_{\text{GE}} = 15 \text{ V}$ , $I_C = 50 \text{ A}$	-	2.3	3.15	V
		$V_{\text{GE}} = 15 \text{ V}$ , $I_C = 100 \text{ A}$	-	2.5	3.2	
		$V_{\text{GE}} = 15 \text{ V}$ , $I_C = 50 \text{ A}$ , $T_J = 150^\circ\text{C}$	-	1.72	2.17	
Gate threshold voltage	$V_{\text{GE}(\text{th})}$	$I_C = 0.5 \text{ mA}$	3	-	6	
Collector to emitter leaking current	$I_{\text{CES}}$	$V_{\text{GE}} = 0 \text{ V}$ , $I_C = 600 \text{ A}$	-	-	0.4	mA
		$V_{\text{GE}} = 0 \text{ V}$ , $I_C = 600 \text{ A}$ , $T_J = 150^\circ\text{C}$	-	-	10	
Diode forward voltage drop	$V_{\text{FM}}$	$I_F = 50 \text{ A}$ , $V_{\text{GE}} = 0 \text{ V}$	-	1.58	1.80	V
		$I_F = 50 \text{ A}$ , $V_{\text{GE}} = 0 \text{ V}$ , $T_J = 150^\circ\text{C}$	-	1.49	1.68	
		$I_F = 100 \text{ A}$ , $V_{\text{GE}} = 0 \text{ V}$ , $T_J = 25^\circ\text{C}$	-	1.9	2.17	
Gate to emitter leakage current	$I_{\text{GES}}$	$V_{\text{GE}} = \pm 20 \text{ V}$	-	-	$\pm 250$	nA

<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$I_C = 52 \text{ A}$ $V_{\text{CC}} = 400 \text{ V}$ $V_{\text{GE}} = 15 \text{ V}$	-	331	385	nC
Gate to emitter charge (turn-on)	$Q_{\text{ge}}$		-	44	52	
Gate to collector charge (turn-on)	$Q_{\text{gc}}$		-	133	176	
Turn-on switching loss	$E_{\text{on}}$	Internal gate resistors (see electrical diagram) $I_C = 50 \text{ A}$ , $V_{\text{CC}} = 480 \text{ V}$ , $V_{\text{GE}} = 15 \text{ V}$ , $L = 200 \mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 25^\circ\text{C}$	-	0.26	-	mJ
Turn-off switching loss	$E_{\text{off}}$		-	1.2	-	
Total switching loss	$E_{\text{ts}}$		-	1.46	-	
Turn-on switching loss	$E_{\text{on}}$	Internal gate resistors (see electrical diagram) $I_C = 50 \text{ A}$ , $V_{\text{CC}} = 480 \text{ V}$ , $V_{\text{GE}} = 15 \text{ V}$ , $L = 200 \mu\text{H}$ Energy losses include tail and diode reverse recovery, $T_J = 150^\circ\text{C}$	-	0.73	-	mJ
Turn-off switching loss	$E_{\text{off}}$		-	1.66	-	
Total switching loss	$E_{\text{ts}}$		-	2.39	-	
Input capacitance	$C_{\text{ies}}$	$V_{\text{GE}} = 0 \text{ V}$ $V_{\text{CC}} = 30 \text{ V}$ $f = 1.0 \text{ MHz}$	-	7100	-	pF
Output capacitance	$C_{\text{oes}}$		-	510	-	
Reverse transfer capacitance	$C_{\text{res}}$		-	140	-	
Diode reverse recovery time	$t_{\text{rr}}$	$V_{\text{CC}} = 200 \text{ V}$ , $I_C = 50 \text{ A}$ $di/dt = 200 \text{ A}/\mu\text{s}$	-	82	97	ns
Diode peak reverse current	$I_{\text{rr}}$		-	8.3	10.6	A
Diode recovery charge	$Q_{\text{rr}}$		-	340	514	nC
Diode reverse recovery time	$t_{\text{rr}}$	$V_{\text{CC}} = 200 \text{ V}$ , $I_C = 50 \text{ A}$ $di/dt = 200 \text{ A}/\mu\text{s}$ $T_J = 125^\circ\text{C}$	-	137	153	ns
Diode peak reverse current	$I_{\text{rr}}$		-	12.7	14.8	A
Diode recovery charge	$Q_{\text{rr}}$		-	870	1132	nC

<b>THERMISTOR SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	$R_0$ <sup>(1)</sup>	$T_0 = 25^\circ\text{C}$	-	30	-	$\text{k}\Omega$
Sensitivity index of the thermistor material	$\beta$ <sup>(1)(2)</sup>	$T_0 = 25^\circ\text{C}$ $T_1 = 85^\circ\text{C}$	-	4000	-	K

**Notes**

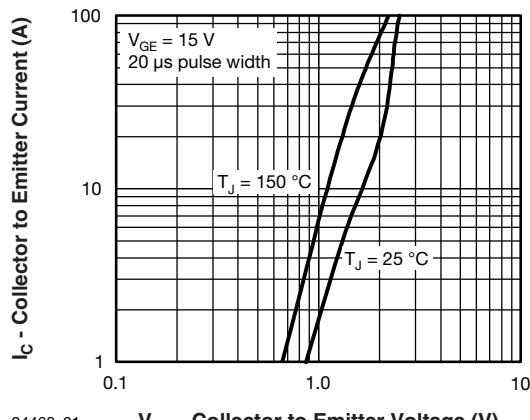
(1)  $T_0, T_1$  are thermistor's temperatures

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

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	$T_J$	IGBT, Diode Thermistor	-40	-	150	$^\circ\text{C}$
			-40	-	125	
Storage temperature range	$T_{\text{Stg}}$		-40	-	125	
Junction to case	$R_{\text{thJC}}$	IGBT Diode	-	-	0.38	$^\circ\text{C/W}$
			-	-	0.8	
Case to sink per module	$R_{\text{thCS}}$		-	0.06	-	
Clearance <sup>(1)</sup>		Heatsink compound thermal conductivity = 1 W/mK	5.5	-	-	mm
Creepage <sup>(1)</sup>		External shortest distance in air between 2 terminals	8	-	-	
Mounting torque to heatsink		Shortest distance along the external surface of the insulating material between 2 terminals				
Weight		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	
				66		g

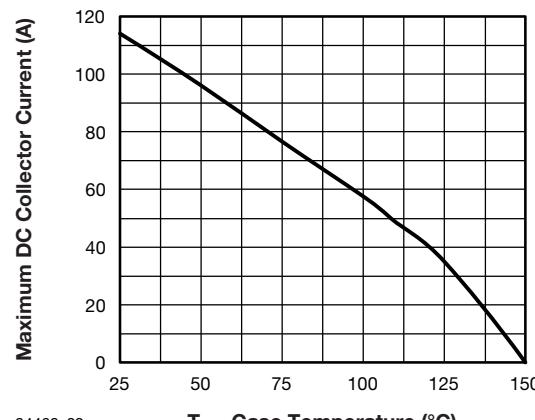
**Note**

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



94468\_01 **V<sub>CE</sub> - Collector to Emitter Voltage (V)**

Fig. 1 - Typical Output Characteristics



94468\_02 **T<sub>c</sub> - Case Temperature (°C)**

Fig. 2 - Maximum Collector Current vs. Case Temperature



[www.vishay.com](http://www.vishay.com)

## VS-50MT060WHTAPbF

Vishay Semiconductors

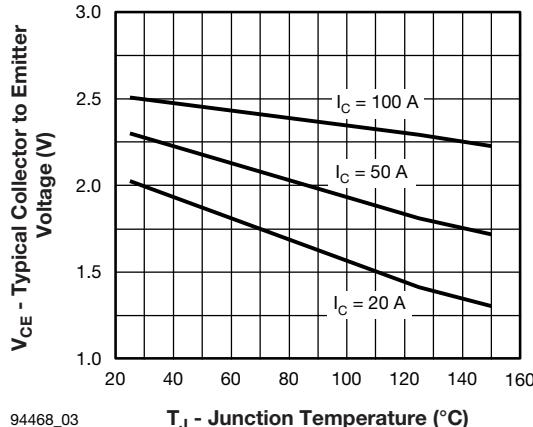


Fig. 3 - Typical Collector to Emitter Voltage vs. Junction Temperature

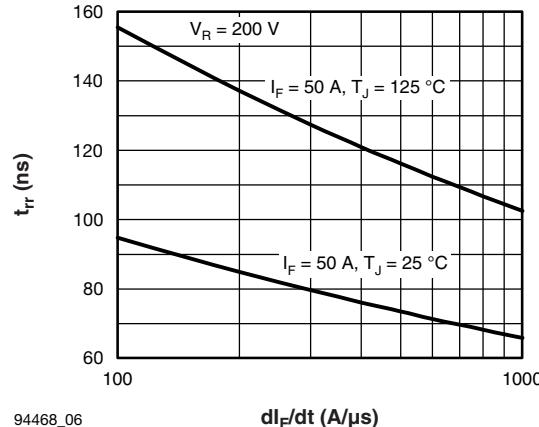


Fig. 6 - Typical Reverse Recovery Time vs.  $dI_F/dt$

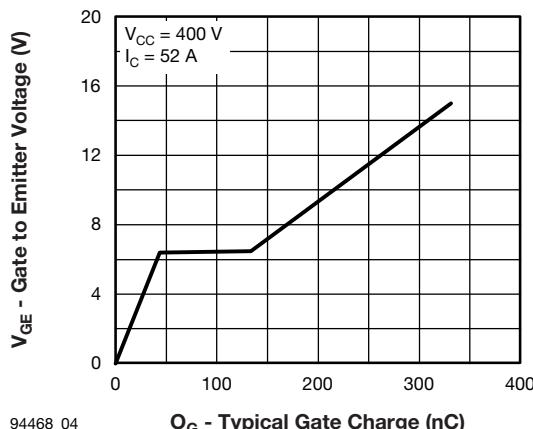


Fig. 4 - Typical Gate Charge vs. Gate to Emitter Voltage

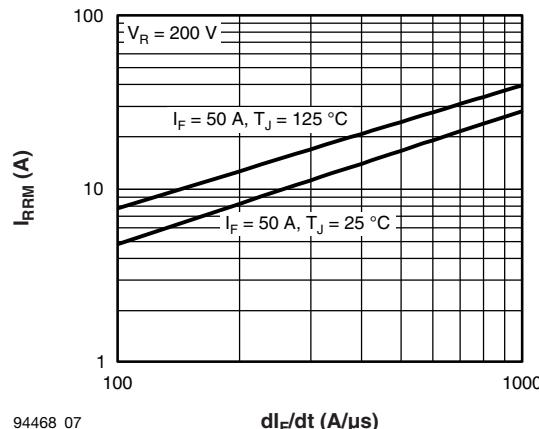


Fig. 7 - Typical Reverse Recovery Current vs.  $dI_F/dt$

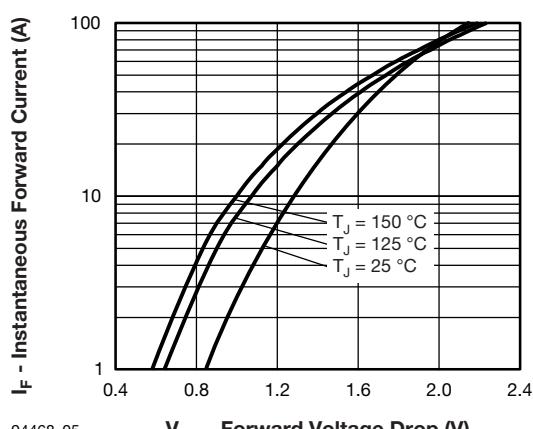


Fig. 5 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

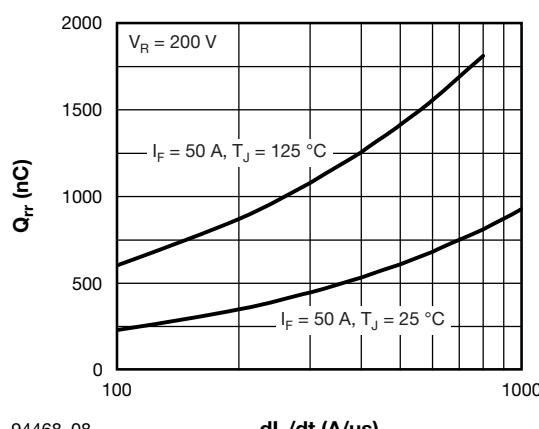


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$



[www.vishay.com](http://www.vishay.com)

## VS-50MT060WHTAPbF

Vishay Semiconductors

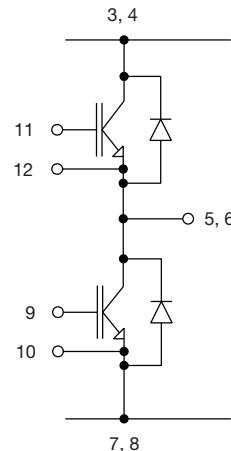


Fig. 9 - Functional Diagram

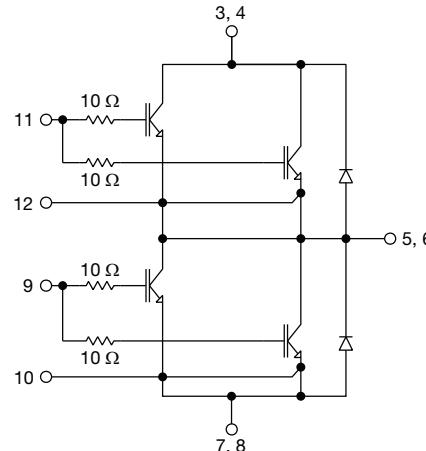
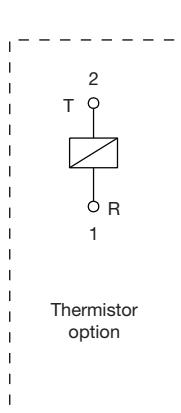
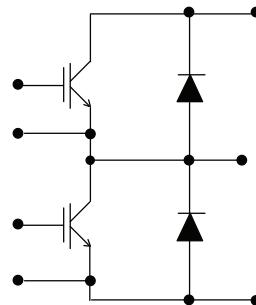


Fig. 10 - Electrical Diagram

### ORDERING INFORMATION TABLE

Device code	VS-	50	MT	060	W	H	T	A	PbF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<b>1</b> - Vishay Semiconductors product									
<b>2</b> - Current rating (50 = 50 A)									
<b>3</b> - Essential part number									
<b>4</b> - Voltage rating (060 = 600 V)									
<b>5</b> - Speed/type (W = Warp IGBT)									
<b>6</b> - Circuit configuration (H = Half bridge)									
<b>7</b> - T = Thermistor									
<b>8</b> - A = Al <sub>2</sub> O <sub>3</sub> substrate									
<b>9</b> - Lead (Pb)-free									

### CIRCUIT CONFIGURATION



#### LINKS TO RELATED DOCUMENTS

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

**Legal Disclaimer Notice**

Vishay

**Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.