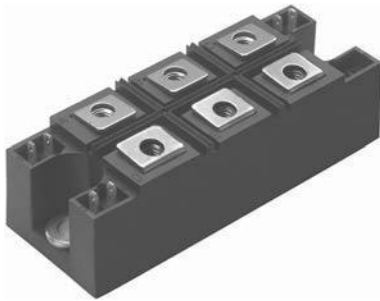



## Three Phase AC Switch (Power Modules), 50 A to 100 A



MTK

### FEATURES

- Package fully compatible with the industry standard INT-A-PAK power modules series
- High thermal conductivity package, electrically insulated case
- Outstanding number of power encapsulated components
- Excellent power volume ratio
- 4000 V<sub>RMS</sub> isolating voltage
- UL E78996 approved 
- Totally lead (Pb)-free
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

$I_o$	50 A to 100 A
-------	---------------

### DESCRIPTION

A range of extremely compact, encapsulated three phase AC switches offering efficient and reliable operation. They are intended for use in general purpose and heavy duty applications as control motor starter.

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	54MT.K	94MT.K	104MT.K	UNITS
$I_o$		50	90	100	A
	$T_C$	80	80	80	°C
$I_{FSM}$	50 Hz	390	950	1130	A
	60 Hz	410	1000	1180	
$I^2t$	50 Hz	770	4525	6380	A <sup>2</sup> s
	60 Hz	700	4130	5830	
$I^2\sqrt{t}$		7700	45250	63800	A <sup>2</sup> /s
$V_{RRM}$	Range	800 to 1600			V
$T_{Stg}, T_J$	Range	- 40 to 125			°C

# 54-94-104MT..KPbF Series



Vishay High Power Products Three Phase AC Switch  
(Power Modules), 50 A to 100 A

## ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS					
TYPE NUMBER	VOLTAGE CODE	V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	V <sub>DRM</sub> , MAXIMUM REPETITIVE PEAK OFF-STATE VOLTAGE, GATE OPEN CIRCUIT V	I <sub>RRM</sub> /I <sub>DRM</sub> , MAXIMUM AT T <sub>J</sub> = 125 °C mA
54MT..K	80	800	900	800	20 <sup>(1)</sup>
	100	1000	1100	1000	
	120	1200	1300	1200	
	140	1400	1500	1400	
	160	1600	1700	1600	
94/104MT..K	80	800	900	800	40 <sup>(1)</sup>
	100	1000	1100	1000	
	120	1200	1300	1200	
	140	1400	1500	1400	
	160	1600	1700	1600	

**Note**

<sup>(1)</sup> For single AC switch

FORWARD CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS		54MT.K	94MT.K	104MT.K	UNITS	
Maximum I <sub>RMS</sub> output current at case temperature	I <sub>O</sub>	For all conduction angle		50	90	100	A	
				80	80	80	°C	
Maximum peak, one-cycle forward, non-repetitive on state surge current	I <sub>TSM</sub>	t = 10 ms	No voltage reapplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	390	950	1130	A
		t = 8.3 ms			410	1000	1180	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		330	800	950	
		t = 8.3 ms			345	840	1000	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	770	4525	6380	A <sup>2</sup> s
		t = 8.3 ms			700	4130	5830	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		540	3200	4510	
		t = 8.3 ms			500	2920	4120	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 to 10 ms, no voltage reapplied		7700	45 250	63 800	A <sup>2</sup> √s	
Low level value of threshold voltage	V <sub>T(TO)1</sub>	(16.7 % × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> maximum		1.16	0.99	0.99	V	
High level value of threshold voltage	V <sub>T(TO)2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> maximum		1.44	1.19	1.15		
Low level value on-state slope resistance	r <sub>t1</sub>	16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> maximum		12.54	4.16	3.90	mΩ	
High level value on-state slope resistance	r <sub>t2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> maximum		11.00	3.56	3.48		
Maximum on-state voltage drop	V <sub>TM</sub>	I <sub>pk</sub> = 150 A, T <sub>J</sub> = 25 °C t <sub>p</sub> = 400 μs single junction		2.68	1.55	1.53	V	
Maximum non-repetitive rate of rise of turned on current	di/dt	T <sub>J</sub> = 25 °C, from 0.67 V <sub>DRM</sub> , I <sub>TM</sub> = π × I <sub>T(AV)</sub> , I <sub>g</sub> = 500 mA, t <sub>r</sub> < 0.5 μs, t <sub>p</sub> > 6 μs		150			A/μs	
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply = 6 V, resistive load, grate open circuit		200			mA	
Maximum latching current	I <sub>L</sub>	T <sub>J</sub> = 25 °C, anode supply = 6 V, resistive load		400				



# 54-94-104MT..KPbF Series

Three Phase AC Switch Vishay High Power Products  
(Power Modules), 50 A to 100 A

BLOCKING						
PARAMETER	SYMBOL	TEST CONDITIONS	54MT.K	94MT.K	104MT.K	UNITS
RMS isolation voltage	$V_{INS}$	$T_J = 25\text{ }^\circ\text{C}$ all terminal shorted $f = 50\text{ Hz}$ , $t = 1\text{ s}$		4000		V
Maximum critical rate of rise of off-state voltage	$dV/dt$ <sup>(1)</sup>	$T_J = T_J$ maximum, linear to $0.67 V_{DRM}$ , gate open circuit		500		V/ $\mu\text{s}$

**Note**

<sup>(1)</sup> Available with  $dV/dt = 1000\text{ V}/\mu\text{s}$ , to complete code add S90 i. e. 104MT160KBS90

TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS	54MT.K	94MT.K	104MT.K	UNITS
Maximum peak gate power	$P_{GM}$	$T_J = T_J$ maximum		10		W
Maximum average gate power	$P_{G(AV)}$			2.5		
Maximum peak gate current	$I_{GM}$			2.5		A
Maximum peak negative gate voltage	$-V_{GT}$			10		V
Maximum required DC gate voltage to trigger	$V_{GT}$	$T_J = -40\text{ }^\circ\text{C}$		4.0		
		$T_J = 25\text{ }^\circ\text{C}$	Anode supply = 6 V, resistive load	2.5		
		$T_J = 125\text{ }^\circ\text{C}$		1.7		
Maximum required DC gate current to trigger	$I_{GT}$	$T_J = -40\text{ }^\circ\text{C}$		270		mA
		$T_J = 25\text{ }^\circ\text{C}$		150		
		$T_J = 125\text{ }^\circ\text{C}$		80		
Maximum gate voltage that will not trigger	$V_{GD}$	$T_J = T_J$ maximum, rated $V_{DRM}$ applied		0.25		V
Maximum gate current that will not trigger	$I_{GD}$			6		mA

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	54MT.K	94MT.K	104MT.K	UNITS
Maximum junction operating and storage temperature range	$T_J, T_{Stg}$			- 40 to 125		$^\circ\text{C}$
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation per single AC switch	0.52	0.39	0.34	K/W
		DC operation per junction	1.05	0.77	0.69	
		180 $^\circ\text{C}$ sine cond. angle per single AC switch	0.56	0.40	0.36	
		180 $^\circ\text{C}$ sine cond. angle per junction	1.12	0.80	0.72	
Maximum thermal resistance, case to heatsink	$R_{thCS}$	Per module Mounting surface smooth, flat and grased		0.03		
Mounting torque $\pm 100\%$	to heatsink to terminal	A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Lubricated threads.		4 to 6		Nm
				3 to 4		
Approximate weight					225	

# 54-94-104MT..KPbF Series



Vishay High Power Products Three Phase AC Switch  
(Power Modules), 50 A to 100 A

<b>ΔR CONDUCTION PER JUNCTION</b>											
DEVICES	SINUSOIDAL CONDUCTION AT T <sub>J</sub> MAXIMUM					RECTANGULAR CONDUCTION AT T <sub>J</sub> MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
54MT.K	0.072	0.085	0.108	0.152	0.233	0.055	0.091	0.117	0.157	0.236	K/W
94MT.K	0.033	0.039	0.051	0.069	0.099	0.027	0.044	0.055	0.071	0.100	
104MT.K	0.027	0.033	0.042	0.057	0.081	0.023	0.037	0.046	0.059	0.082	

**Note**

- Table shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC

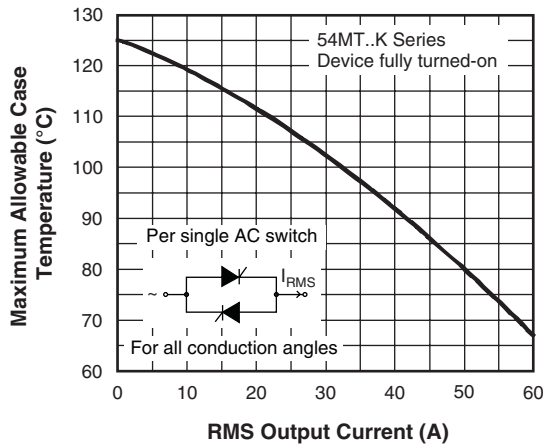


Fig. 1 - Current Ratings Characteristic

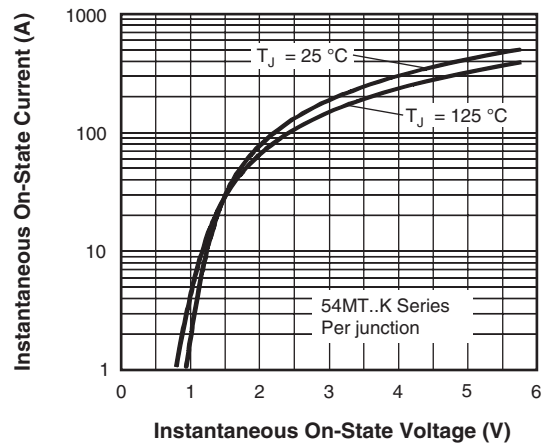


Fig. 2 - Forward Voltage Drop Characteristics

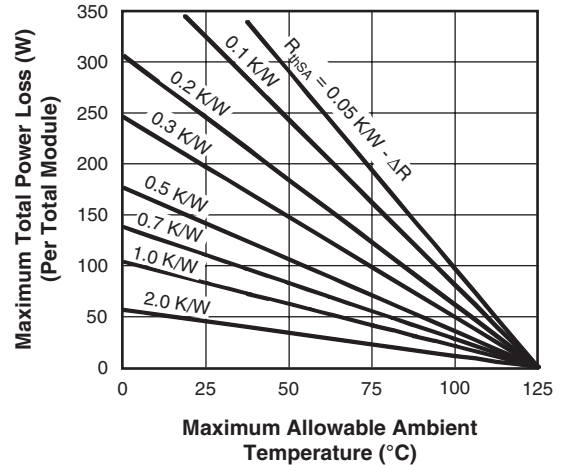
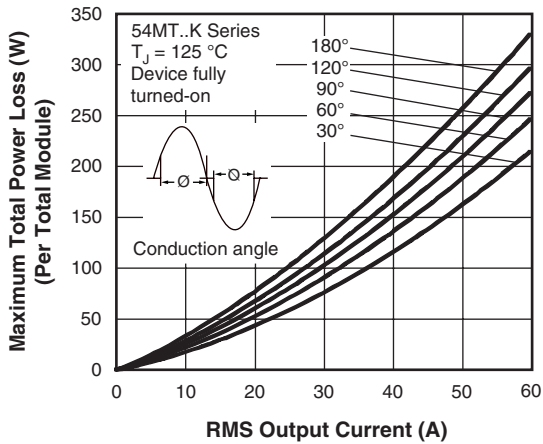


Fig. 3 Total Power Loss Characteristics

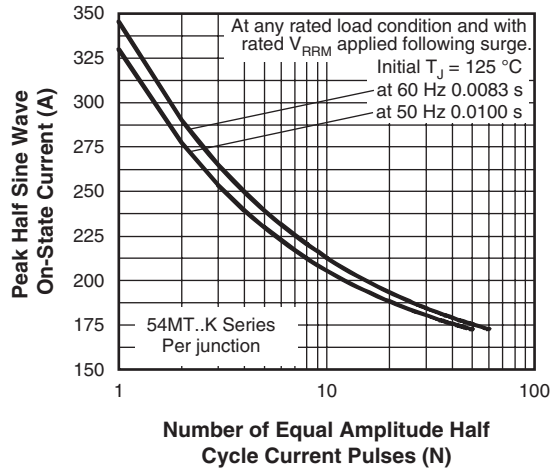


Fig. 4 - Maximum Non-Repetitive Surge Current

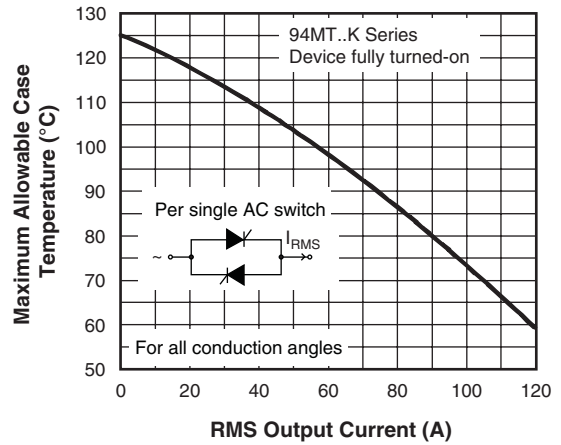


Fig. 6 - Current Ratings Characteristic

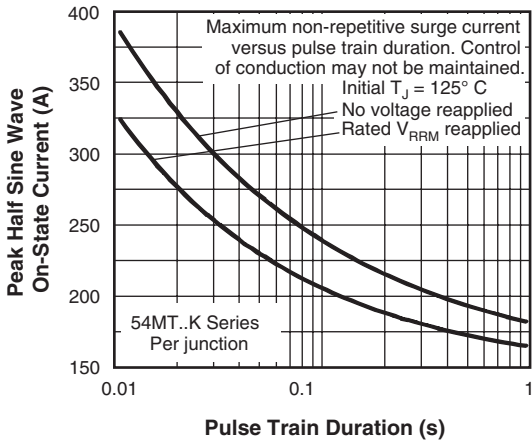


Fig. 5 - Maximum Non-Repetitive Surge Current

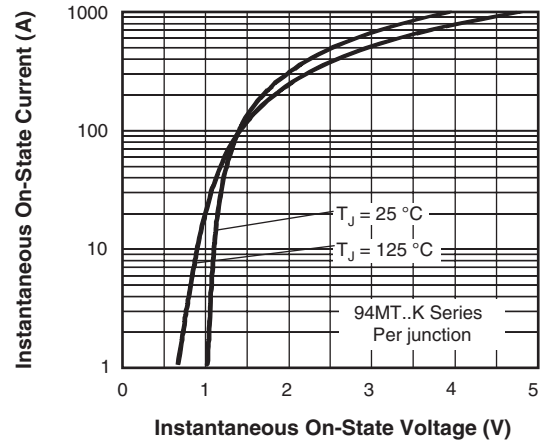


Fig. 7 - Forward Voltage Drop Characteristics

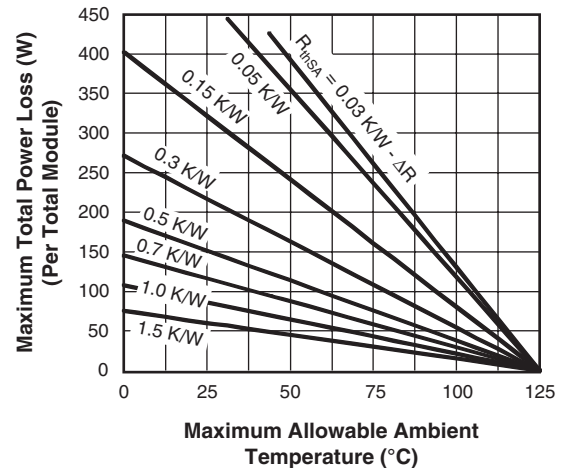
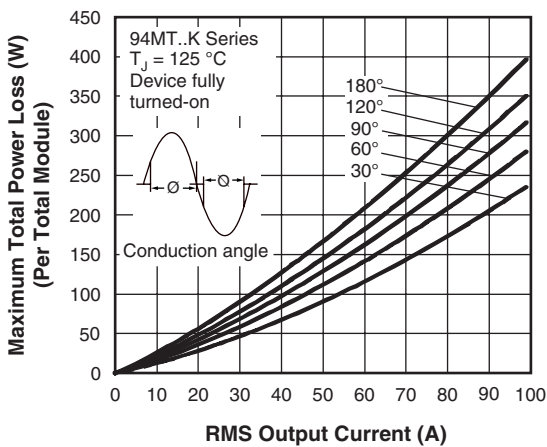


Fig. 8 - Total Power Loss Characteristics

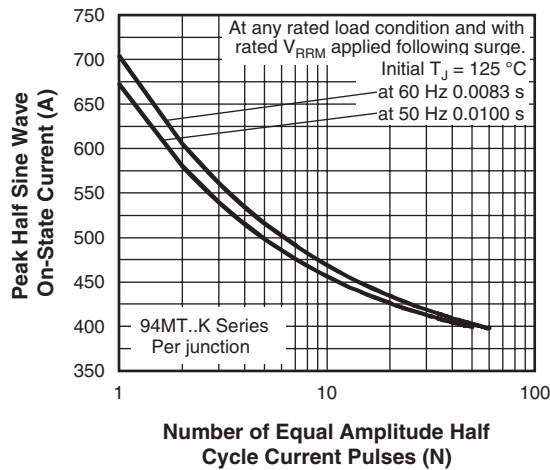


Fig. 9 - Maximum Non-Repetitive Surge Current

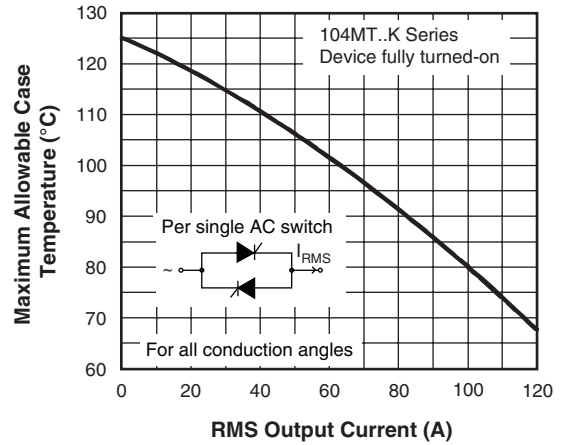


Fig. 11 - Current Ratings Characteristic

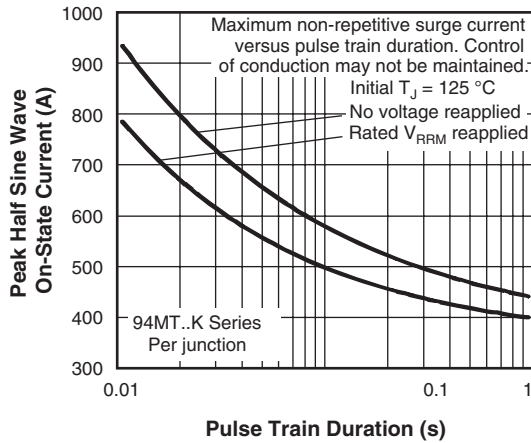


Fig. 10 - Maximum Non-Repetitive Surge Current

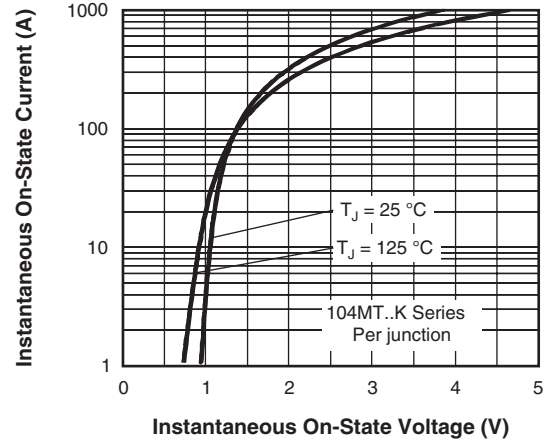


Fig. 12 - Forward Voltage Drop Characteristics

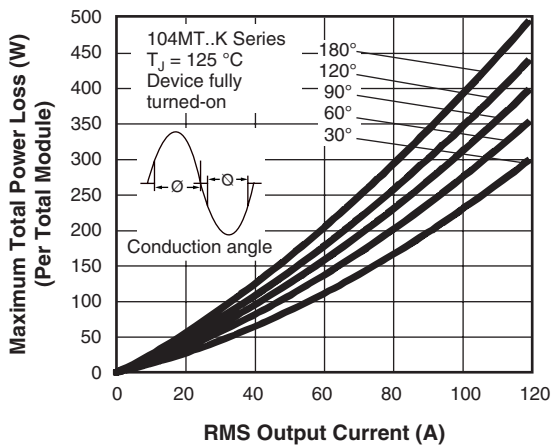
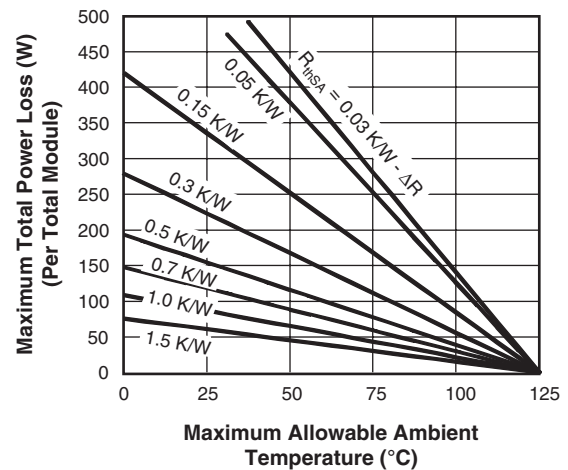


Fig. 13 - Total Power Loss Characteristics



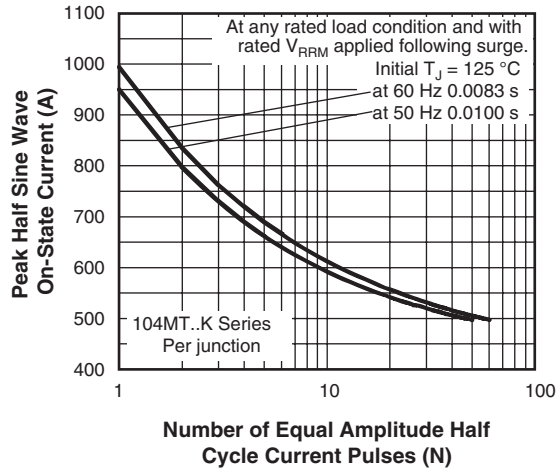


Fig. 14 - Maximum Non-Repetitive Surge Current

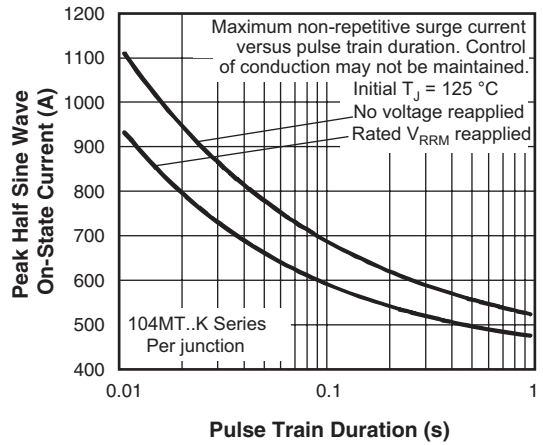


Fig. 15 - Maximum Non-Repetitive Surge Current

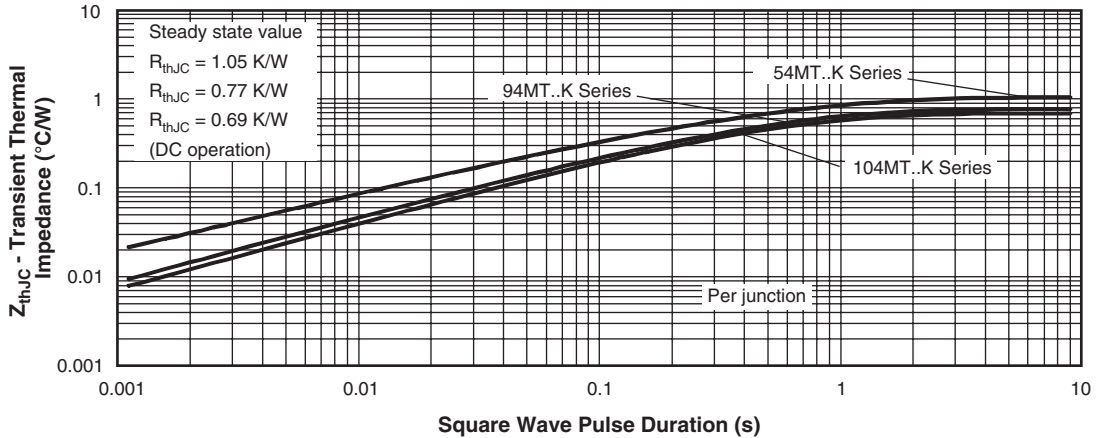


Fig. 16 - Thermal Impedance  $Z_{thJC}$  Characteristics

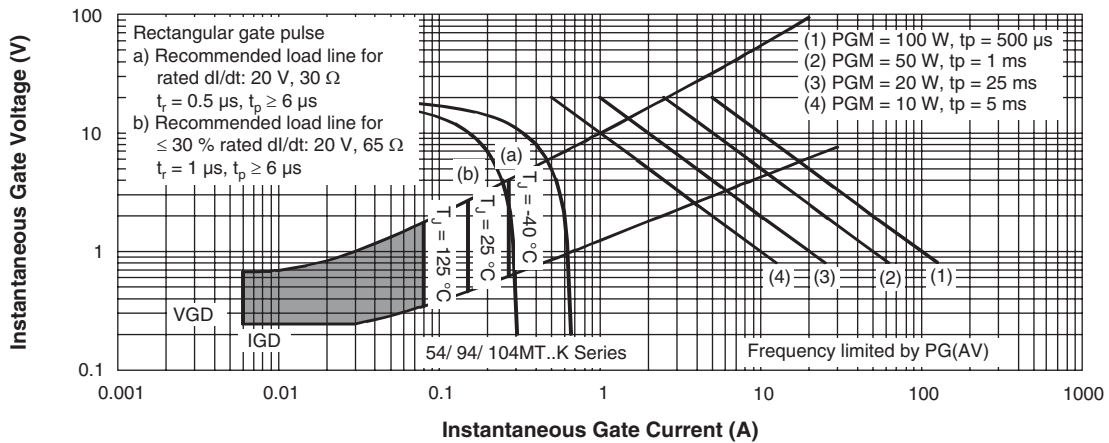


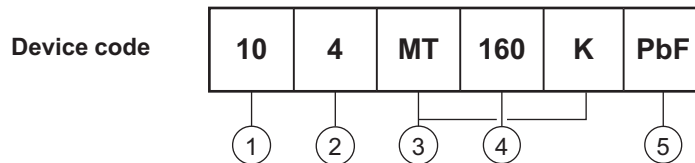
Fig. 17 - Gate Characteristics

# 54-94-104MT..KPbF Series



Vishay High Power Products Three Phase AC Switch  
(Power Modules), 50 A to 100 A

## ORDERING INFORMATION TABLE

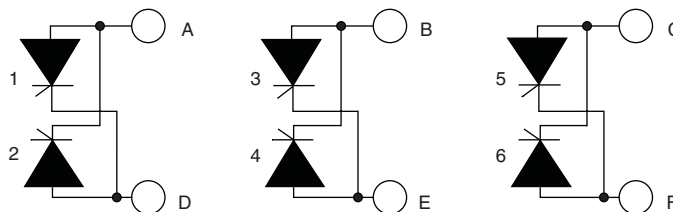


- 1** - Current rating code: 5 = 50 A (average)  
9 = 90 A (average)  
10 = 100 A (average)
- 2** - AC switch
- 3** - Essential part number
- 4** - Voltage code x 10 =  $V_{RRM}$  (see Voltage Ratings table)
- 5** - PbF = Lead (Pb)-free

### Note

- To order the optional hardware go to [www.vishay.com/doc?95172](http://www.vishay.com/doc?95172)

## CIRCUIT CONFIGURATION



### LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?95004">http://www.vishay.com/doc?95004</a>
------------	---





## Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.