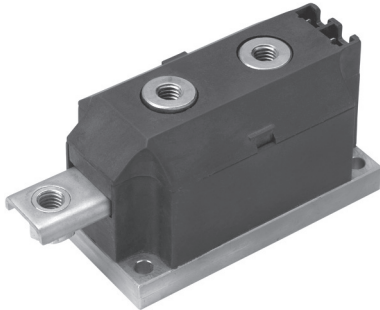



## Fast Thyristor/Diode and Thyristor/Thyristor (MAGN-A-PAK Power Modules), 180 A


**MAGN-A-PAK**
**FEATURES**

- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3000 V<sub>RMS</sub> isolating voltage
- Industrial standard package
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC


**RoHS  
COMPLIANT**
**PRODUCT SUMMARY**

$I_{T(AV)}$	180 A
Type	Modules - Thyristor, Fast

**DESCRIPTION**

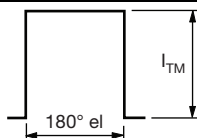
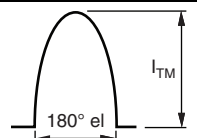
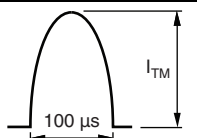
These series of MAGN-A-PAK modules are intended for applications such as self-commutated inverters, DC choppers, electronic welders, induction heating and others where fast switching characteristics are required.

**MAJOR RATINGS AND CHARACTERISTICS**

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$		180	A
	$T_C$	85	°C
$I_{T(RMS)}$		400	A
$I_{TSM}$	50 Hz	7130	
	60 Hz	7470	
$I^2t$	50 Hz	255	kA <sup>2</sup> s
	60 Hz	232	
$I^2\sqrt{t}$		2550	kA <sup>2</sup> √s
$t_q$		20/25	μs
$t_{rr}$		2	
$V_{DRM}/V_{RRM}$		800/1200	V
$T_J$	Range	- 40 to 125	°C

**ELECTRICAL SPECIFICATIONS**
**VOLTAGE RATINGS**

TYPE NUMBER	VOLTAGE CODE	$V_{RRM}/V_{DRM}$ , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	$I_{RRM}/I_{DRM}$ MAXIMUM AT $T_J = 125\text{ °C}$ mA
VSK.F180-	08	800	800	50
	12	1200	1200	

CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	370	530	565	800	2400	3150	A
400 Hz	435	650	670	1000	1540	2050	
2500 Hz	290	430	490	720	610	830	
5000 Hz	240	345	390	540	390	540	
10 000 Hz	170	270	290	390	-	-	
Recovery voltage $V_r$	50		50		50		V
Voltage before turn-on $V_d$	80 % $V_{DRM}$		80 % $V_{DRM}$		80 % $V_{DRM}$		
Rise of on-state current $di/dt$	50		-		-		A/μs
Case temperature	85	60	85	60	85	60	°C
Equivalent values for RC circuit	10/0.47		10/0.47		10/0.47		Ω/μF

ON-STATE CONDUCTION					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° conduction, half sine wave		180	A
				85	°C
Maximum RMS current	$I_{T(RMS)}$	As AC switch		400	A
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reapplied	7130	
		t = 8.3 ms	No voltage reapplied	7470	
		t = 10 ms	100 % $V_{RRM}$ reapplied	6000	
		t = 8.3 ms	100 % $V_{RRM}$ reapplied	6280	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reapplied	255	kA <sup>2</sup> s
		t = 8.3 ms	No voltage reapplied	232	
		t = 10 ms	100 % $V_{RRM}$ reapplied	180	
		t = 8.3 ms	100 % $V_{RRM}$ reapplied	164	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied		2550	kA <sup>2</sup> √s
Low level value or threshold voltage	$V_{T(TO)1}$	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)		1.30	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > $\pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)		1.38	
Low level value on-state slope resistance	$r_{t1}$	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)		0.90	mΩ
High level value on-state slope resistance	$r_{t2}$	(I > $\pi \times I_{T(AV)}$ , $T_J = T_J$ maximum)		0.71	
Maximum on-state voltage drop	$V_{TM}$	$I_{pk} = 600$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		1.84	V
Maximum holding current	$I_H$	$T_J = 25$ °C, $I_T > 30$ A		600	mA
Typical latching current	$I_L$	$T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_g = 1$ A		1000	



SWITCHING					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNITS
			K	J	
Maximum non-repetitive rate of rise	di/dt	Gate drive 20 V, 20 Ω, t <sub>r</sub> ≤ 1 ms, V <sub>D</sub> = 80 % V <sub>DRM</sub> T <sub>J</sub> = 25 °C	800		A/μs
Maximum recovery time	t <sub>rr</sub>	I <sub>TM</sub> = 350 A, di/dt = - 25 A/μs, V <sub>R</sub> = 50 V, T <sub>J</sub> = 25 °C	2		μs
Maximum turn-off time	t <sub>q</sub>	I <sub>TM</sub> = 750 A; T <sub>J</sub> = 125 °C; di/dt = - 25 A/μs; V <sub>R</sub> = 50 V; dV/dt = 400 V/μs linear to 80 % V <sub>DRM</sub>	20	25	

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	dV/dt	T <sub>J</sub> = 125 °C, exponential to 67 % V <sub>DRM</sub>	1000	V/μs
RMS insulation voltage	V <sub>INS</sub>	50 Hz, circuit to base, all terminals shorted, 25 °C, 1 s	3000	V
Maximum peak reverse and off-state leakage current	I <sub>RRM</sub> , I <sub>DRM</sub>	T <sub>J</sub> = 125 °C, rated V <sub>DRM</sub> /V <sub>RRM</sub> applied	50	mA

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P <sub>GM</sub>	f = 50 Hz, d% = 50	60	W
Maximum peak average gate power	P <sub>G(AV)</sub>	T <sub>J</sub> = 125 °C, f = 50 Hz, d% = 50	10	
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = 125 °C, t <sub>p</sub> ≤ 5 ms	10	A
Maximum peak negative gate voltage	- V <sub>GM</sub>		5	V
Maximum DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = 25 °C, V <sub>ak</sub> 12 V, R <sub>a</sub> = 6 Ω	200	mA
DC gate voltage required to trigger	V <sub>GT</sub>		3	V
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = 125 °C, rated V <sub>DRM</sub> applied	20	mA
DC gate voltage not to trigger	V <sub>GD</sub>		0.25	V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction operating temperature range	T <sub>J</sub>		- 40 to 125	°C
Maximum storage temperature range	T <sub>Stg</sub>		- 40 to 150	
Maximum thermal resistance, junction to case per junction	R <sub>thJC</sub>	DC operation	0.125	K/W
Maximum thermal resistance, case to heatsink per module	R <sub>thCS</sub>	Mounting surface, flat and greased	0.02	
Mounting torque ± 10 %	MAP to heatsink busbar to MAP	A mounting compound is recommended. The torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Use of cable lugs is not recommended, busbar should be used and restrained during tightening. Threads must be lubricated with a compound.	4 to 6 (35 to 53)	N · m (lbf · in)
Approximate weight			500	g
			17.8	oz.
Case style			MAGN-A-PAK	

$\Delta R_{thJC}$ CONDUCTION				
CONDUCTIONS ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.009	0.006	$T_J = 125\text{ }^\circ\text{C}$	K/W
120°	0.010	0.011		
90°	0.014	0.015		
60°	0.020	0.020		
30°	0.032	0.033		

**Note**

- Table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC

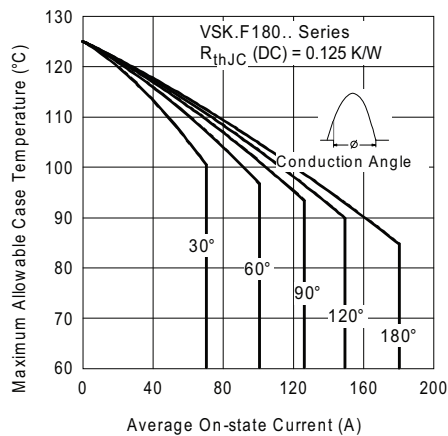


Fig. 1 - Current Ratings Characteristics

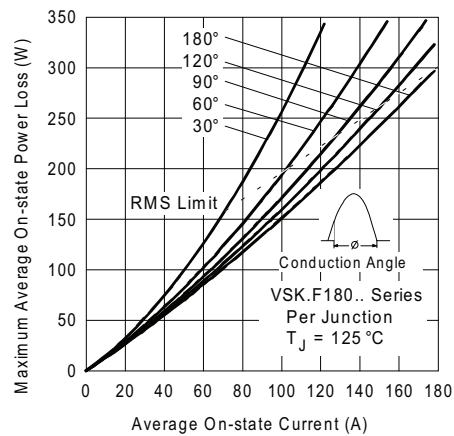


Fig. 3 - On-State Power Loss Characteristics

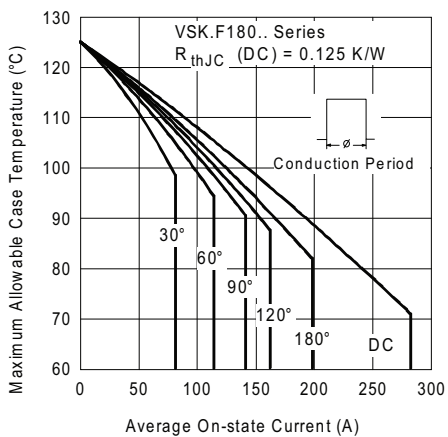


Fig. 2 - Current Ratings Characteristics

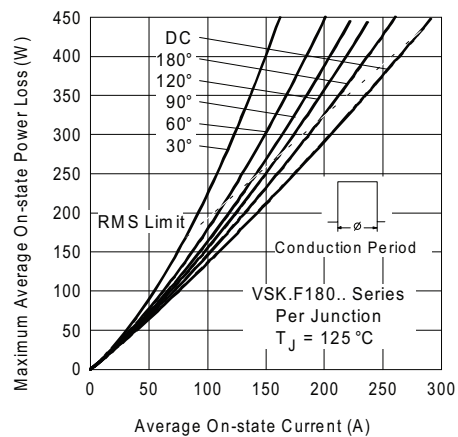


Fig. 4 - On-State Power Loss Characteristics

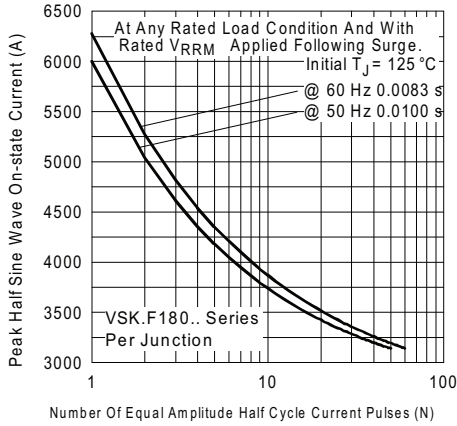


Fig. 5 - Maximum Non-Repetitive Surge Current

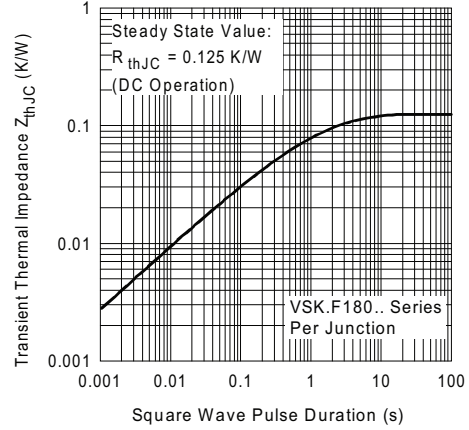


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

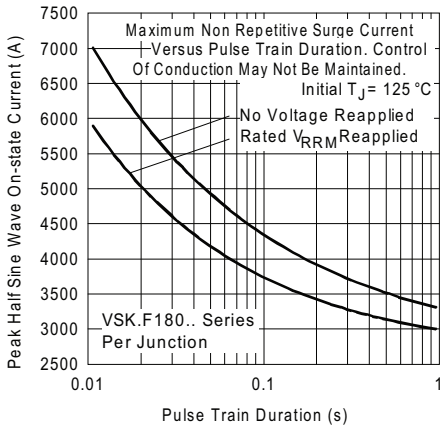


Fig. 6 - Maximum Non-Repetitive Surge Current

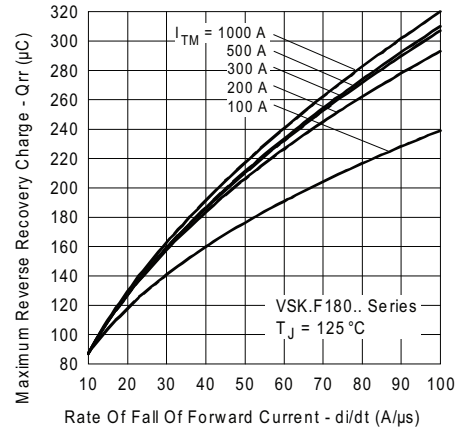


Fig. 9 - Reverse Recovery Charge Characteristics

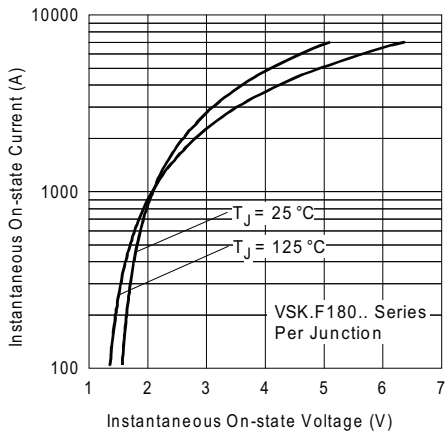


Fig. 7 - On-State Voltage Drop Characteristics

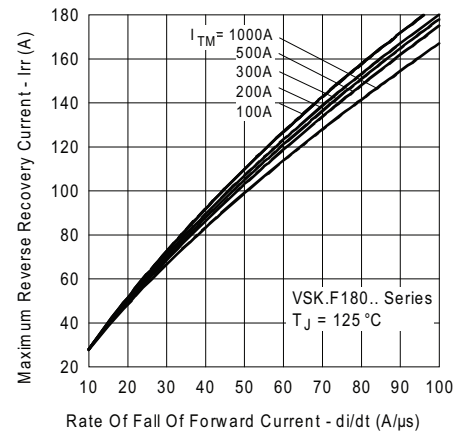


Fig. 10 - Reverse Recovery Current Characteristics

# VSK.F180..P Series



Vishay Semiconductors Fast Thyristor/Diode and Thyristor/Thyristor (MAGN-A-PAK Power Modules), 180 A

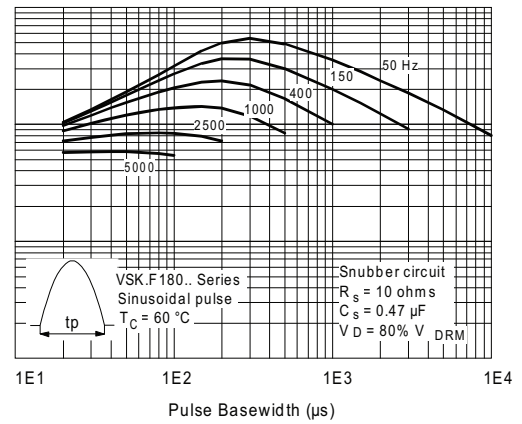
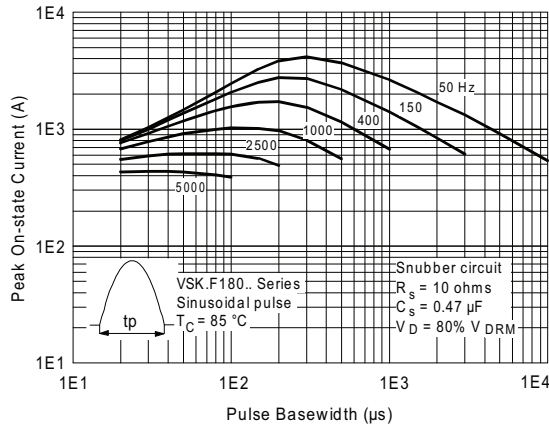


Fig. 11 - Frequency Characteristics

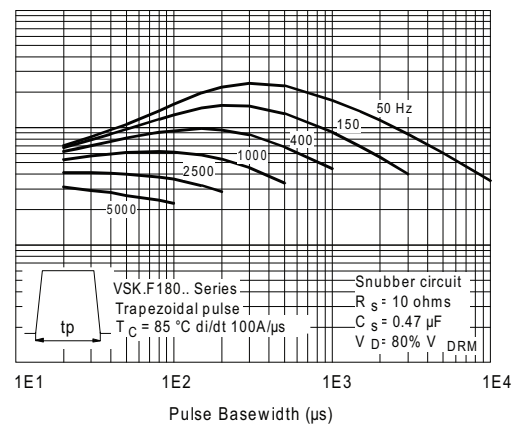
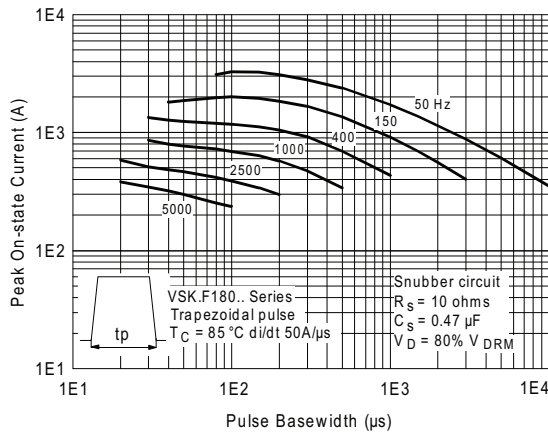


Fig. 12 - Frequency Characteristics

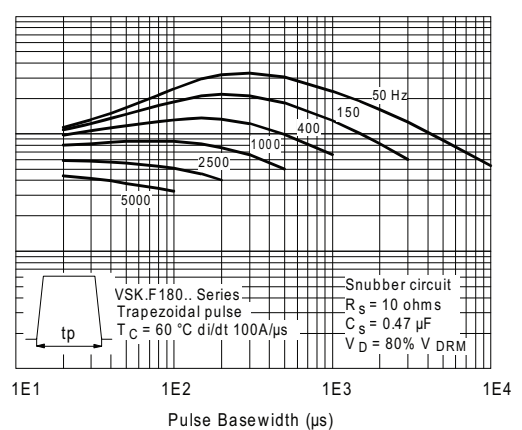
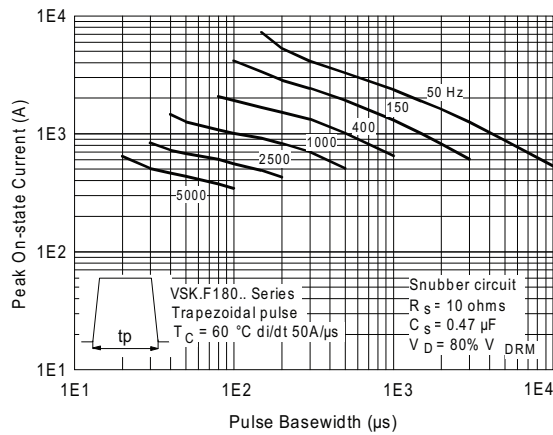


Fig. 13 - Frequency Characteristics

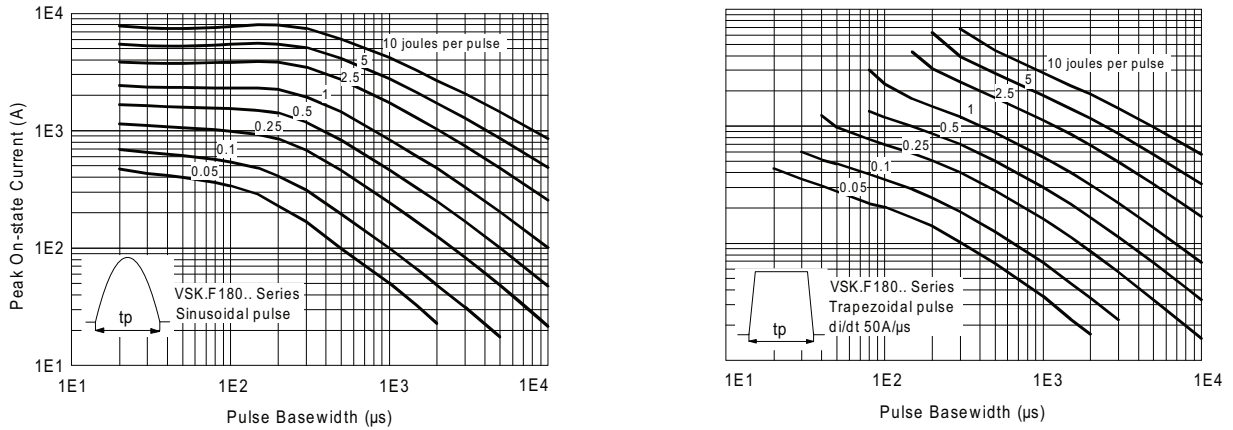


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

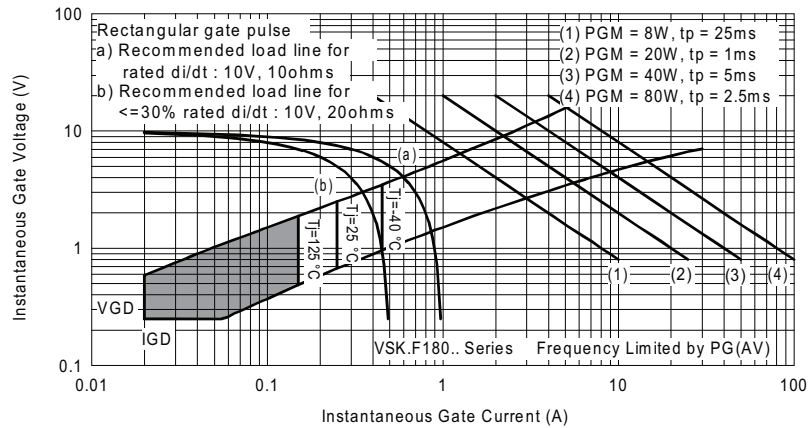


Fig. 15 - Gate Characteristics

# VSK.F180..P Series



Vishay Semiconductors Fast Thyristor/Diode and Thyristor/Thyristor  
(MAGN-A-PAK Power Modules), 180 A

## ORDERING INFORMATION TABLE

Device code	<b>VSK</b>	<b>T</b>	<b>F</b>	<b>180</b>	<b>-</b>	<b>12</b>	<b>H</b>	<b>K</b>	<b>P</b>
	①	②	③	④		⑤	⑥	⑦	⑧

- 1** - Module type
- 2** - Circuit configuration (see circuit configuration table)
- 3** - Fast SCR
- 4** - Current rating:  $I_{T(AV)} \times 10$  rounded
- 5** - Voltage code  $\times 100 = V_{RRM}$  (see Voltage Ratings table)
- 6** -  $dV/dt$  code:  $H \leq 400 \text{ V}/\mu\text{s}$
- 7** -  $t_q$  code:  $K \leq 20 \mu\text{s}$   
 $J \leq 25 \mu\text{s}$
- 8** - P = Lead (Pb)-free

### Note

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

CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two SCRs common cathodes	U	<p><b>VSKUF..</b></p>
SCR/diode common cathodes	K	<p><b>VSKKF..</b></p>
Two SCRs common anodes	V	<p><b>VSKVF..</b></p>





<b>CIRCUIT CONFIGURATION</b>		
<b>CIRCUIT DESCRIPTION</b>	<b>CIRCUIT CONFIGURATION CODE</b>	<b>CIRCUIT DRAWING</b>
SCR/diode common anodes	N	<p><b>VSKNF..</b></p>
SCR/diode doubler circuit, negative control	L	<p><b>VSKLF..</b></p>
Two SCRs doubler circuit	T	<p><b>VSKTF..</b></p>
SCR/diode doubler circuit, positive control	H	<p><b>VSKHF..</b></p>

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95086">www.vishay.com/doc?95086</a>

## MAGN-A-PAK

**DIMENSIONS** in millimeters (inches)



### Notes

- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for gate and cathode wire: UL 1385
- UL identification number for package: UL 94 V-0



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