Thyristor/Thyristor
(MAGN-A-PAK Power Modules), 320 A

MAGN-A-PAK

FEATURES

- High voltage
- Electrically isolated base plate
- 3600 V_{RMS} isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL approved file E78996 ![UL]
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

DESCRIPTION

This new VSK series of MAGN-A-PAK modules uses high voltage power thyristor/thyristor in doubler circuit configuration. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges or as AC-switches when modules are connected in anti-parallel mode. These modules are intended for general purpose applications such as battery chargers, welders, motor drives, UPS, etc.

PRODUCT SUMMARY

$I_{T(AV)}$	320 A
Type	Modules - Thyristor, Standard
Package	MAGN-A-PAK
Circuit	Two SCRs doubler circuit

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$	70 °C	320	A
$I_{T(RMS)}$		710	
I_{TSM}	50 Hz	9000	
	60 Hz	9420	
I^2t	50 Hz	405	kA^{2}s
	60 Hz	370	
$I^2\sqrt{t}$		4050	kA$^2\sqrt{}$s
V_{DRM}/V_{RRM}		1200 to 1600	V
T_J	Range	-40 to 130	°C

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	V_{RRM}/V_{DRM}, MAXIMUM REPETITIVE PEAK REVERSE AND OFF-STATE BLOCKING VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM}/I_{DRM} AT 130 °C MAXIMUM mA
VS-VSKT320-	12	1200	1300	50
	16	1600	1700	

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			320	A
					70	°C
Maximum RMS on-state current	$I_{T(RMS)}$	As AC switch			710	
Maximum peak, one-cycle on-state non-repetitive, surge current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	9000	A
		t = 8.3 ms			9420	
		t = 10 ms	100 % V_{RRM} reapplied		7570	
		t = 8.3 ms			7920	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		405	kA^2s
		t = 8.3 ms			370	
		t = 10 ms	100 % V_{RRM} reapplied		287	
		t = 8.3 ms			262	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			4050	$kA^2\sqrt{s}$
Low level value or threshold voltage	$V_{T(TO)1}$	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.80	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.03	
Low level value on-state slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.75	$m\Omega$
High level value on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.53	
Maximum peak on-state or forward voltage drop	$V_{TM}, V_{FM},$	I_{TM} = 750 A, $T_J = T_J$ maximum, 180° conduction, average power = $V_{T(TO)}$ x $I_{T(AV)}$ + r_f x $(I_{T(RMS)})^2$			1.37	V
		I_{TM} = 750 A, T_J = 25 °C, 180° conduction, average power = $V_{T(TO)}$ x $I_{T(AV)}$ + r_t x $(I_{T(RMS)})^2$			1.40	
Maximum holding current	I_H	Anode supply = 12 V, initial I_T = 30 A, T_J = 25 °C			500	mA
Maximum latching current	I_L	Anode supply = 12 V, resistive load = 1 Ω, gate pulse: 10 V, 100 µs, T_J = 25 °C			1000	

SWITCHING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Typical delay time	t_d	T_J = 25 °C, gate current = 1 A dI_g/dt = 1 A/µs V_d = 0.67 % V_{DRM}	1.0	µs
Typical rise time	t_r		2.0	
Typical turn-off time range	t_q	I_{TM} = 300 A; dI/dt = 15 A/µs; $T_J = T_J$ maximum; V_R = 50 V; dV/dt = 20 V/µs; gate 0 V, 100 Ω	200 to 350	

BLOCKING

| PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	$T_J = T_J$ maximum	50	mA
RMS insulation voltage	V_{INS}	50 Hz, circuit to base, all terminals shorted, 25 °C, 1 s	3600	V
Critical rate of rise of off-state voltage	dV/dt	$T_J = T_J$ maximum, exponential to 67 % rated V_{DRM}	1000	V/µs

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak gate power	P_{GM}	$t_p \leq 5$ ms, $T_J = T_J$ maximum		10.0	W
Maximum average gate power	$P_{G(AV)}$	f = 50 Hz, $T_J = T_J$ maximum		2.0	
Maximum peak gate current	$+ I_{GM}$	$t_p \leq 5$ ms, $T_J = T_J$ maximum		3.0	A
Maximum peak negative gate voltage	$- V_{GT}$	$t_p \leq 5$ ms, $T_J = T_J$ maximum		5.0	V
Maximum required DC gate voltage to trigger	V_{GT}	$T_J = -40$ °C	Anode supply = 12 V, resistive load; Ra = 1 Ω	4.0	V
		$T_J = 25$ °C		3.0	
		$T_J = T_J$ maximum		2.0	
Maximum required DC gate current to trigger	I_{GT}	$T_J = -40$ °C	Anode supply = 12 V, resistive load; Ra = 1 Ω	350	mA
		$T_J = 25$ °C		200	
		$T_J = T_J$ maximum		100	
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}	$T_J = T_J$ maximum, rated V_{DRM} applied		10.0	mA
Maximum rate of rise of turned-on current	dI/dt	$T_J = T_J$ maximum, $I_{TM} = 400$ A, rated V_{DRM} applied		500	A/µs

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Junction operating and storage temperature range	T_J, T_{Stg}		-40 to 130	°C
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation	0.125	K/W
Typical thermal resistance, case to heatsink per module	R_{thCS}	Mounting surface flat, smooth and greased	0.02	
Mounting torque ± 10 % MAP to heatsink / busbar to MAP		A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound.	4 to 6	Nm
Approximate weight			500	g
			17.8	oz.
Case style			MAGN-A-PAK	

∆R CONDUCTION PER JUNCTION

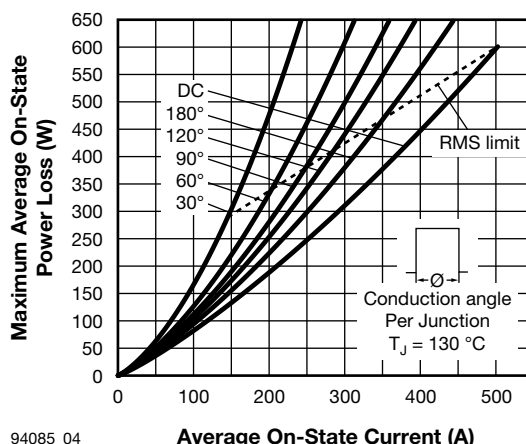| DEVICES	SINUSOIDAL CONDUCTION AT T_J MAXIMUM					RECTANGULAR CONDUCTION AT T_J MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
VSKT320-	0.009	0.010	0.013	0.020	0.032	0.007	0.011	0.015	0.020	0.033	K/W

Note
• Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC
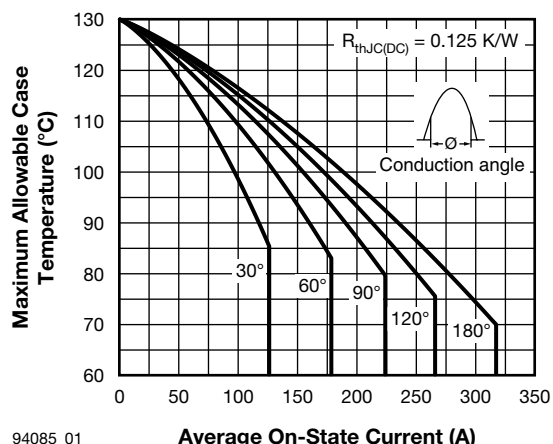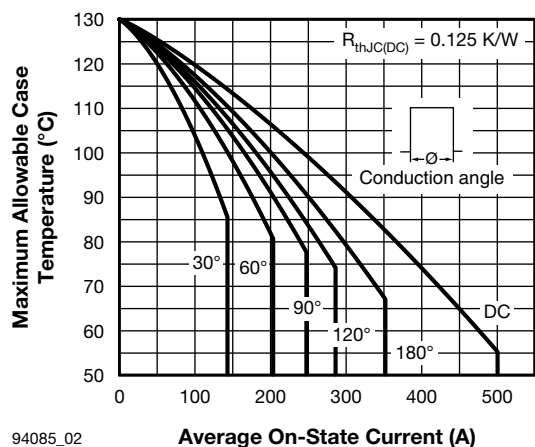
94085_01

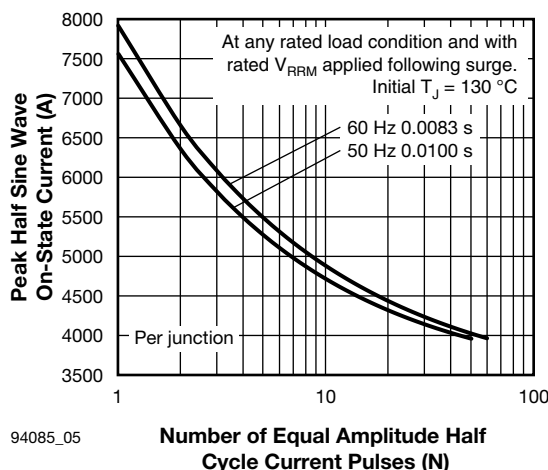Fig. 1 - Current Ratings Characteristics

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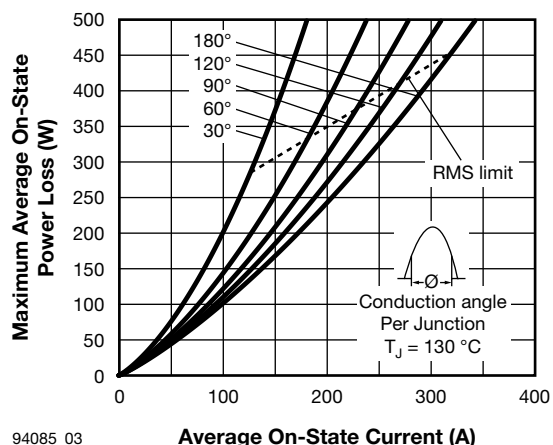Fig. 4 - On-State Power Loss Characteristics

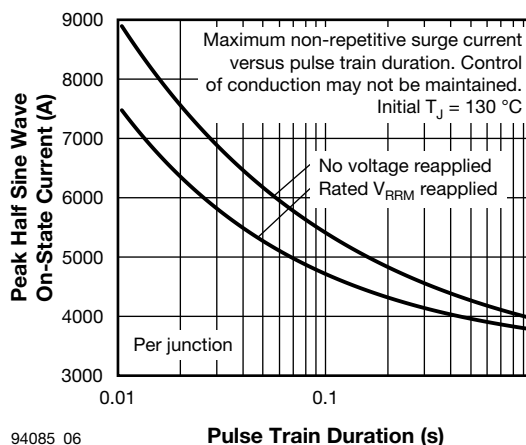94085_02

Fig. 2 - Current Ratings Characteristics

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Fig. 5 - Maximum Non-Repetitive Surge Current

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Fig. 3 - On-State Power Loss Characteristics

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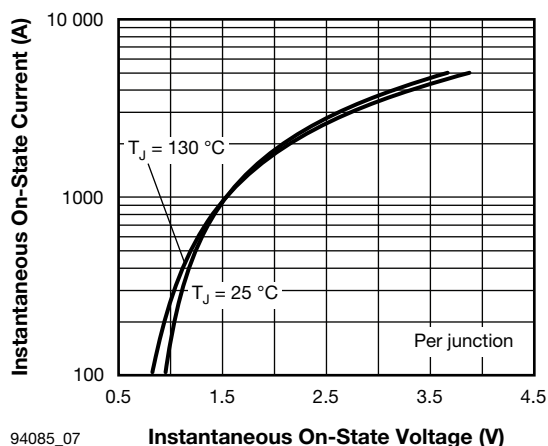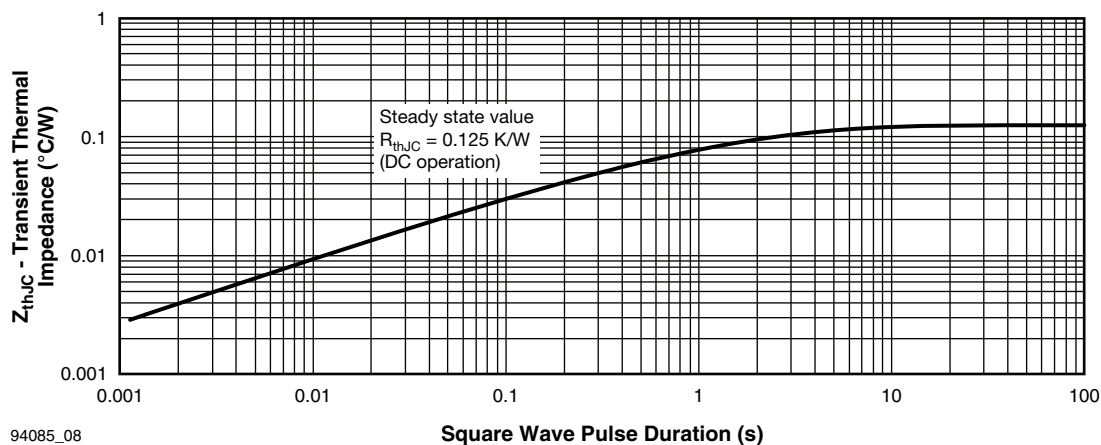
Fig. 6 - Maximum Non-Repetitive Surge Current

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Fig. 7 - On-State Voltage Drop Characteristics

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Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE
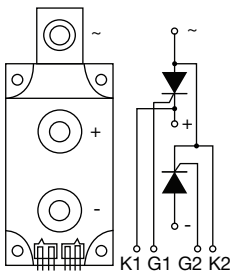
Device code	VS-VS	KT	320	-	16	PbF
	①	②	③		④	⑤

1	-	Vishay Semiconductors product
2	-	Circuit configuration (see dimensions - link at the end of datasheet)
3	-	Current rating
4	-	Voltage code x 100 = V_{RRM} (see voltage ratings table)
5	-	• None = standard production • PbF = lead (Pb)-free

Note

• To order the optional hardware go to www.vishay.com/doc?95172

CIRCUIT CONFIGURATION

CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two SCRs doubler circuit	KT	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95086

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