Bulletin I27401 rev. A 09/97

International
IOR Rectifier

IRK.500.. SERIES

THYRISTOR / DIODE and THYRISTOR / THYRISTOR

SUPER MAGN-A-pak™ Power Modules

500 A

Features

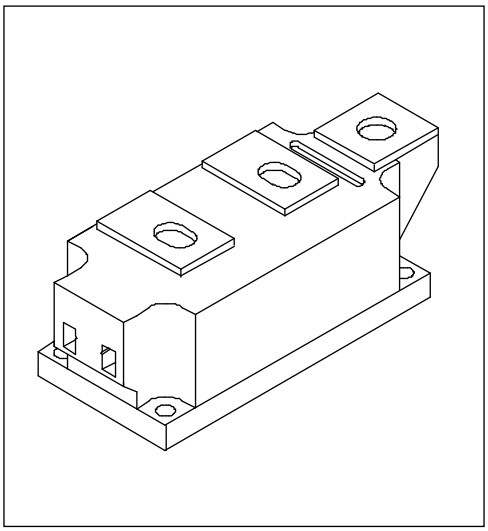
- High current capability
- 3000 V_{RMS} isolating voltage with non-toxic substrate
- High surge capability
- Industrial standard package
- UL E78996 approved

Typical Applications

- Motor starters
- DC motor controls - AC motor controls
- Uninterruptable power supplies

Major Ratings and Characteristics

Parameters		IRK.500..	Units
$I_{T(AV)}$ or $I_{F(AV)}$		500	A
	@ T_C	82	°C
$I_{T(RMS)}$		785	A
	@ T_C	82	°C
I_{TSM} or I_{FSM}	@ 50Hz	17.8	KA
	@ 60Hz	18.7	KA
I^2t	@ 50Hz	1591	KA^2s
	@ 60Hz	1452	KA^2s
$I^2\sqrt{t}$		15910	$KA^2\sqrt{s}$
V_{DRM}/V_{RRM}	range	800 to 1600	V
T_{STG}	range	-40 to 150	°C
T_J	range	-40 to 130	°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 rev. voltage V	I_{RRM}/I_{DRM} max. @ $T_J = T_J$ max. mA
IRK.500..	08	800	900	100
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

On-state Conduction

Parameter		IRK.500..	Units	Conditions		
$I_{T(AV)}$	Maximum average on-state current	500	A	180° conduction, half sine wave		
$I_{F(AV)}$	@ Case temperature	82	°C			
$I_{T(RMS)}$	Maximum RMS on-state current	785	A	180° conduction, half sine wave @ T_C = 82°C		
I_{TSM}	Maximum peak, one-cycle,	17.8	KA	t = 10ms	No voltage	Sinusoidal half wave, Initial $T_J = T_J$ max.
I_{FSM}	non-repetitive surge current	18.7		t = 8.3ms	reapplied	
		15.0		t = 10ms	100% V_{RRM}	
		15.7		t = 8.3ms	reapplied	
I^2t	Maximum I^2t for fusing	1591	KA^2s	t = 10ms	No voltage	
		1452		t = 8.3ms	reapplied	
		1125		t = 10ms	100% V_{RRM}	
		1027		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	15910	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	0.85	V	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ max.		
$V_{T(TO)2}$	High level value of threshold voltage	0.93		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t1}	Low level value of on-state slope resistance	0.36	mΩ	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t2}	High level value of on-state slope resistance	0.32		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.		
V_{TM}	Maximum on-state or forward	1.50	V	I_{pk} = 1500A, T_J = 25°C, t_p = 10ms sine pulse		
V_{FM}	voltage drop					
I_H	Maximum holding current	500	mA	T_J = 25°C, anode supply 12V resistive load		
I_L	Typical latching current	1000				

Switching

Parameter		IRK.500..	Units	Conditions
di/dt	Maximum rate of rise of turned-on current	1000	A/µs	$T_J = T_J$ max., I_{TM} = 400A, V_{DRM} applied
t_d	Typical delay time	2.0	µs	Gate current 1A, di_g/dt = 1A/µs V_d = 0.67% V_{DRM}, T_J = 25°C
t_q	Typical turn-off time	200	µs	I_{TM} = 750A, $T_J = T_J$ max, di/dt = -60A/µs, V_R = 50V, dv/dt = 20V/µs, Gate 0 V 100Ω

Blocking

	Parameter	IRK.500..	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	1000	V/µs	T_J = 130°C., linear to V_D = 80% V_{DRM}
V_{INS}	RMS isolation voltage	3000	V	t = 1 s
I_{RRM} I_{DRM}	Maximum peak reverse and off-state leakage current	100	mA	T_J = T_J max., rated V_{DRM}/V_{RRM} applied

Triggering

	Parameter	IRK.500..	Units	Conditions
P_{GM}	Maximum peak gate power	10	W	T_J = T_J max., $t_p \leq$ 5ms
$P_{G(AV)}$	Maximum peak average gate power	2.0	W	T_J = T_J max., f = 50Hz, d% = 50
+ I_{GM}	Maximum peak positive gate current	3.0	A	T_J = T_J max., $t_p \leq$ 5ms
+ V_{GM}	Maximum peak positive gate voltage	20	V	
- V_{GM}	Maximum peak negative gate voltage	5.0	V	
I_{GT}	Max. DC gate current required to trigger	200	mA	T_J = 25°C V_{ak} 12V
V_{GT}	DC gate voltage required to trigger	3.0	V	T_J = 25°C V_{ak} 12V
I_{GD}	DC gate current not to trigger	10	mA	T_J = T_J max.
V_{GD}	DC gate voltage not to trigger	0.25	V	

Thermal and Mechanical Specifications

	Parameter	IRK.500..	Units	Conditions
T_J	Max. junction operating temperature range	- 40 to 130	°C	
T_{stg}	Max. storage temperature range	- 40 to 150		
R_{thJC}	Max. thermal resistance, junction to case	0.065	K/W	Per junction, DC operation
R_{thC-hs}	Max. thermal resistance, case to heatsink	0.02	K/W	
T	Mounting torque ± 10% SMAP to heatsink	6 - 8	Nm	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
	busbar to SMAP	12 - 15		
wt	Approximate weight	1500	g	
	Case style	SUPER MAGN-A-pak		See outline table

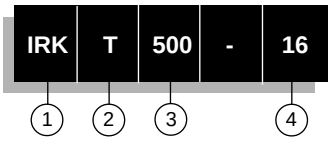
ΔR_{thJC} Conduction

(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.009	0.006	K/W	$T_J = T_J$ max.
120°	0.011	0.011		
90°	0.014	0.015		
60°	0.021	0.022		
30°	0.037	0.038		

Ordering Information Table

Device Code



1 - Module type

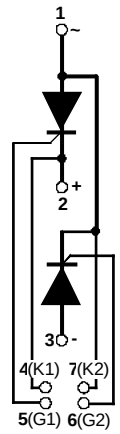
2 - Circuit configuration (See Circuit Configurations Table)

3 - Current rating

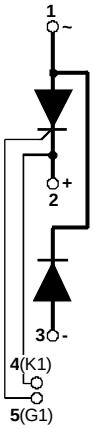
4 - Voltage code: Code x 100 = V_{RRM} (See Voltage Ratings Table)

Circuit Configurations Table

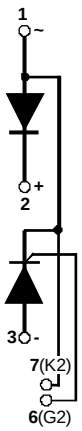
IRKT



IRKH



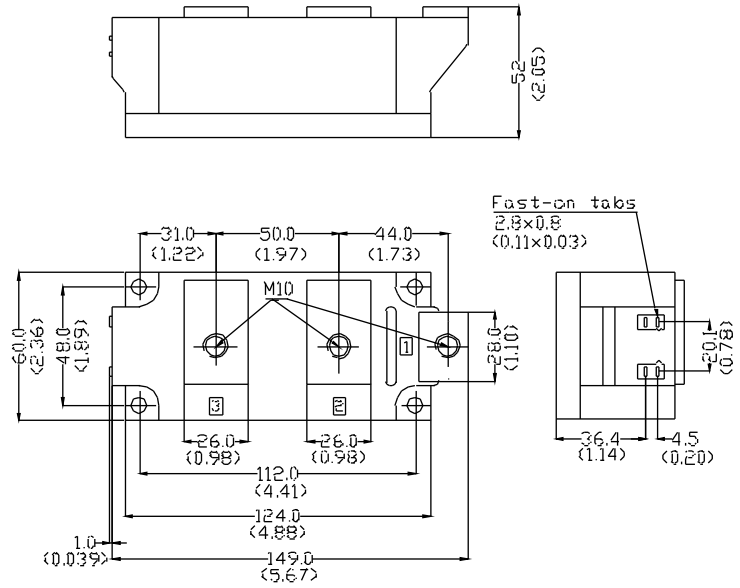
IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

Outline Table

All dimensions in millimeters (inches)



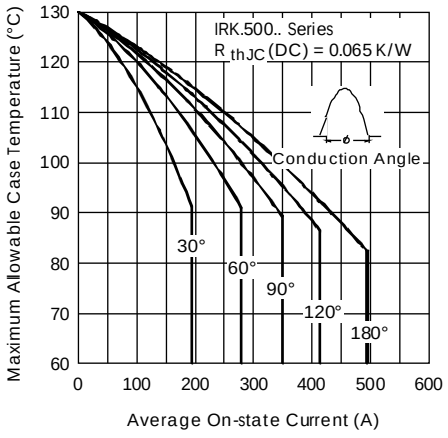


Fig. 1 - Current Ratings Characteristics

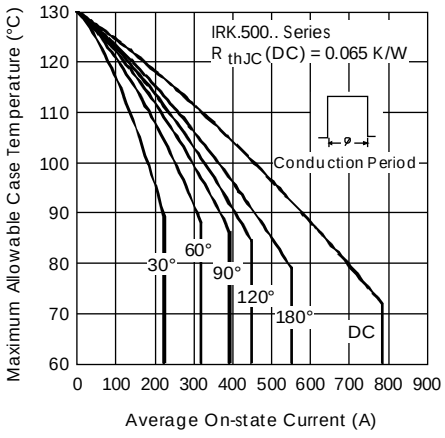


Fig. 2 - Current Ratings Characteristics

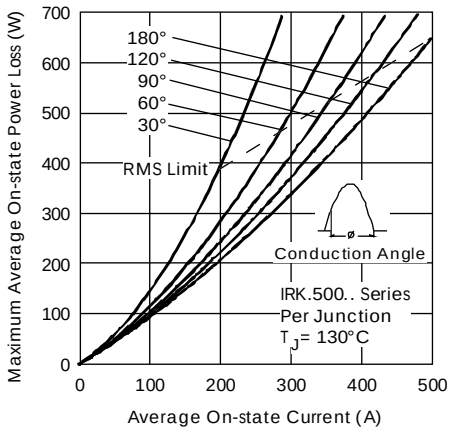


Fig. 3 - On-state Power Loss Characteristics

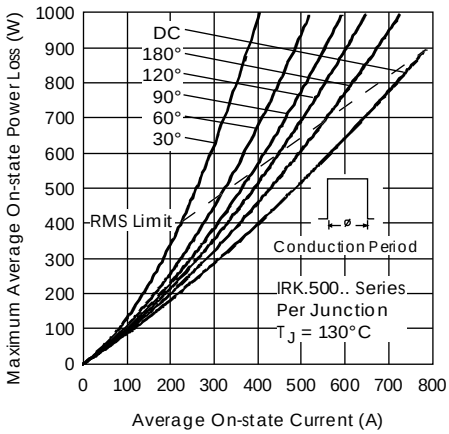


Fig. 4 - On-state Power Loss Characteristics

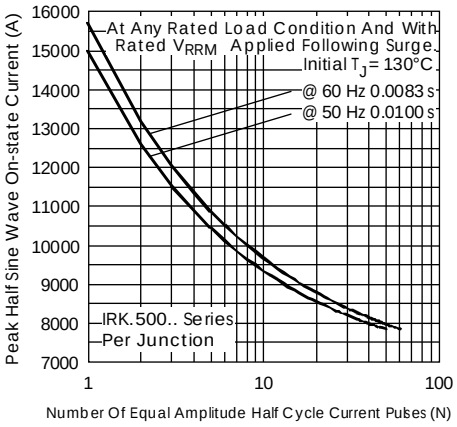


Fig. 5 - Maximum Non-Repetitive Surge Current

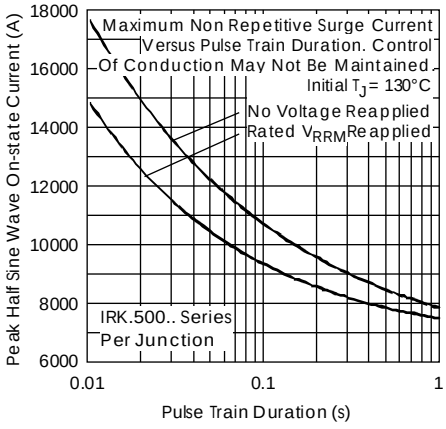


Fig. 6 - Maximum Non-Repetitive Surge Current

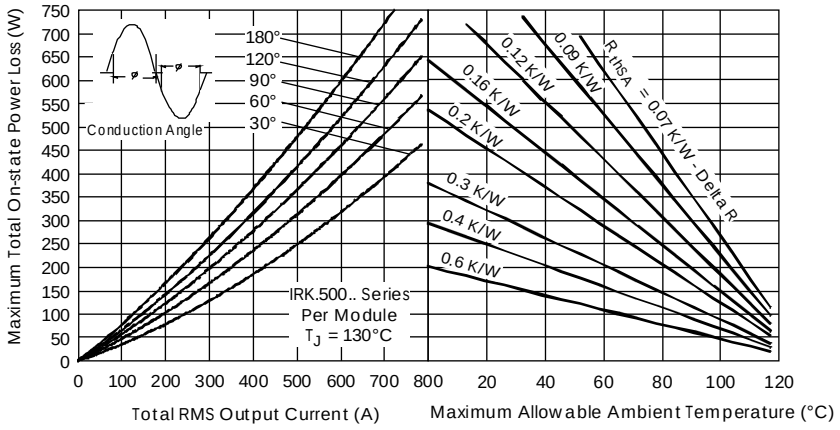


Fig. 7 - On-state Power Loss Characteristics

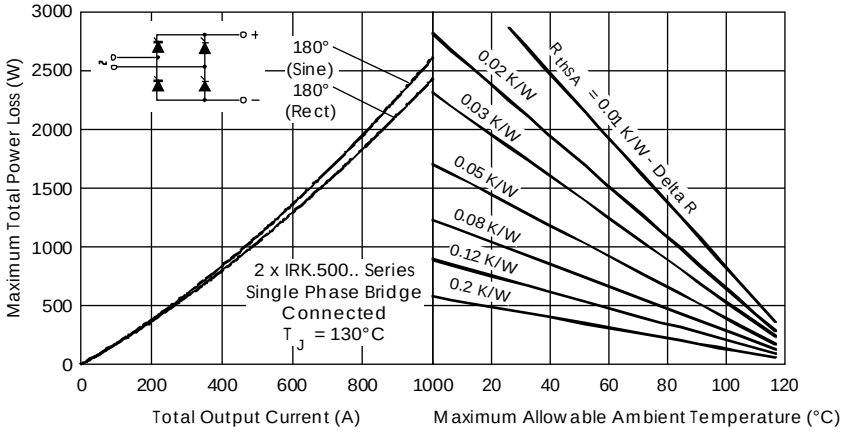


Fig. 8 - On-state Power Loss Characteristics

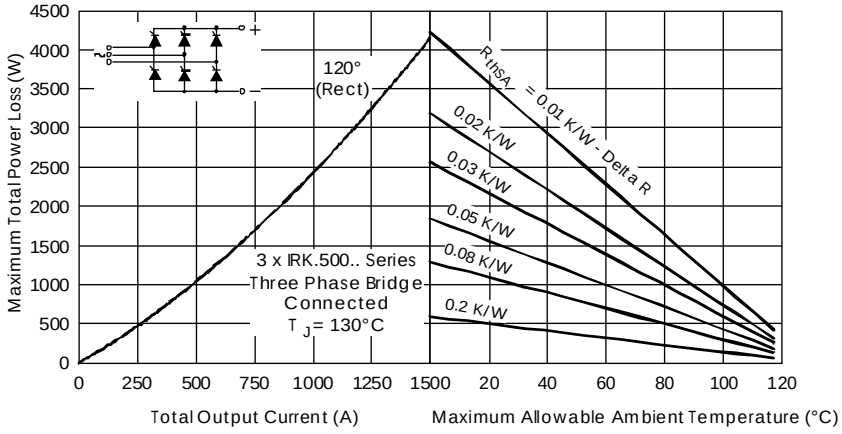


Fig. 9 - On-state Power Loss Characteristics

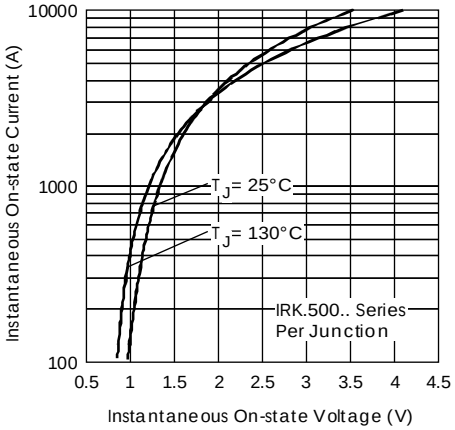


Fig. 10 - On-state Voltage Drop Characteristics

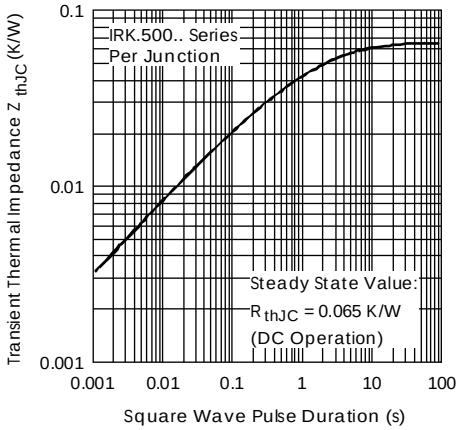


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

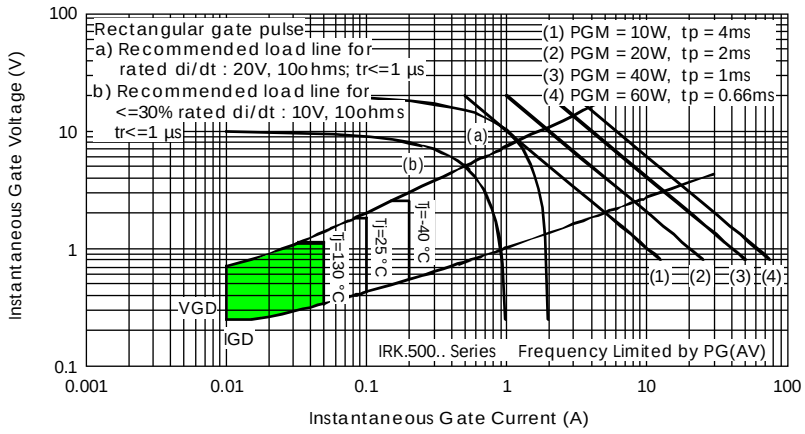


Fig. 12 - Gate Characteristics

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.