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

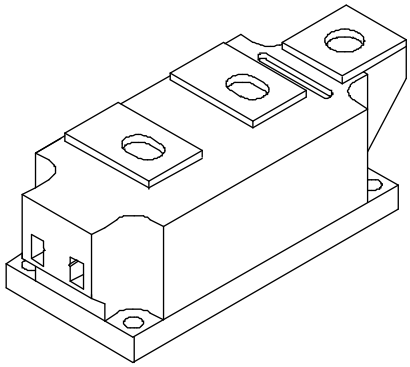
- High current capability
- 3000 V_{RMS} isolating voltage with non-toxic substrate
- High surge capability
- Industrial standard package
- UL E78996 approved

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

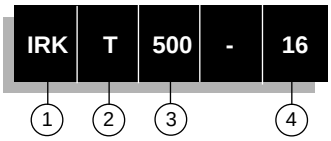
ΔR_{thJC} Conduction

(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

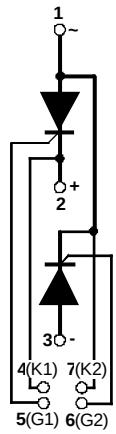
2 - Circuit configuration (See Circuit Configurations Table)

3 - Current rating

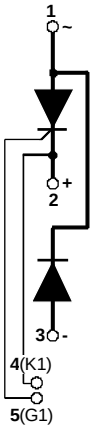
4 - Voltage code: Code x 100 = V_{RRM} (See Voltage Ratings Table)

Circuit Configurations Table

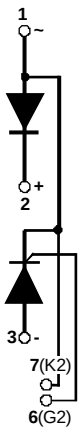
IRKT



IRKH



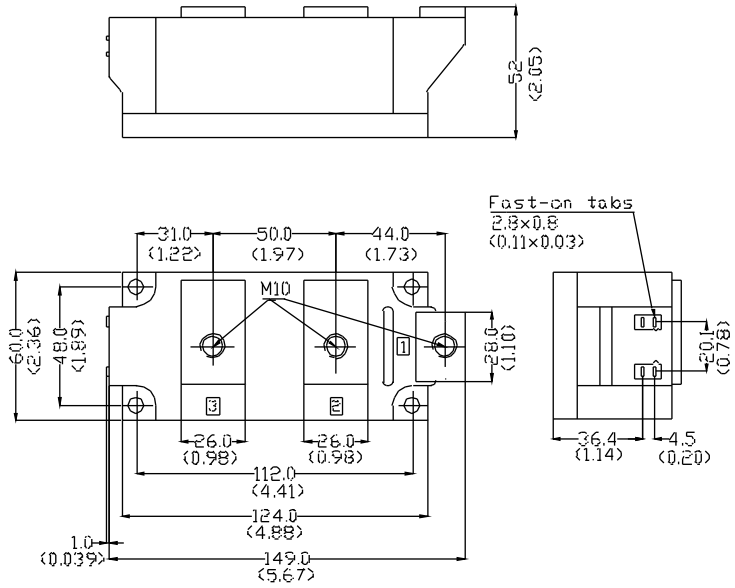
IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

Outline Table

All dimensions in millimeters (inches)



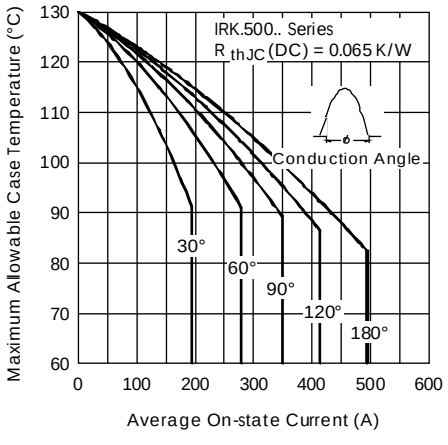


Fig. 1 - Current Ratings Characteristics

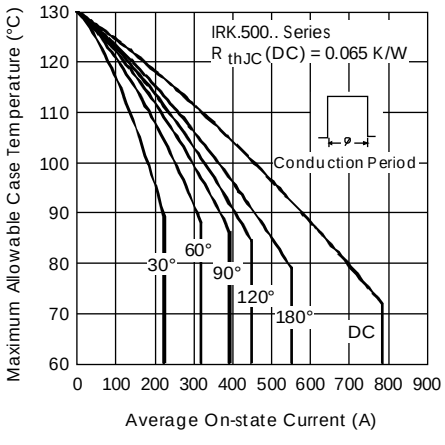


Fig. 2 - Current Ratings Characteristics

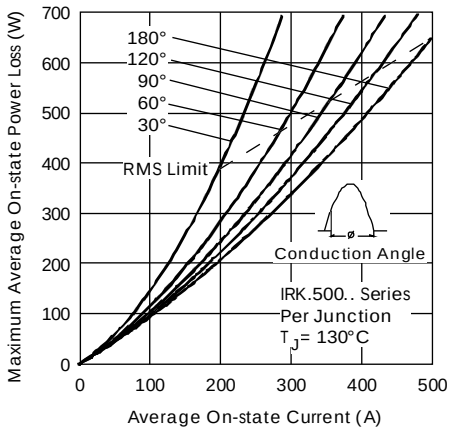


Fig. 3 - On-state Power Loss Characteristics

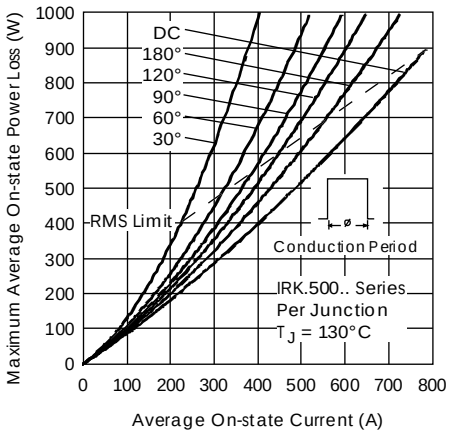


Fig. 4 - On-state Power Loss Characteristics

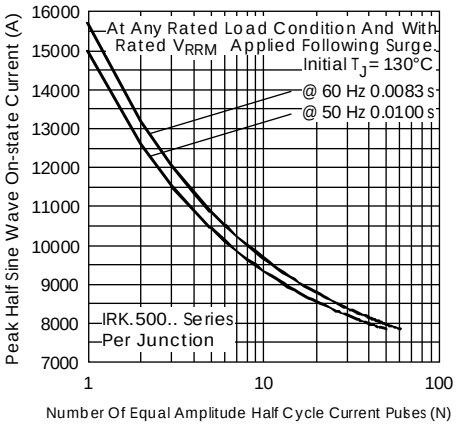


Fig. 5 - Maximum Non-Repetitive Surge Current

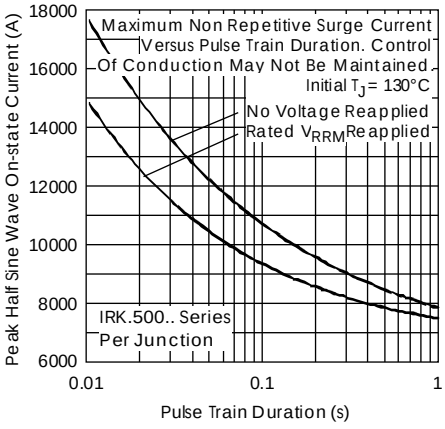


Fig. 6 - Maximum Non-Repetitive Surge Current

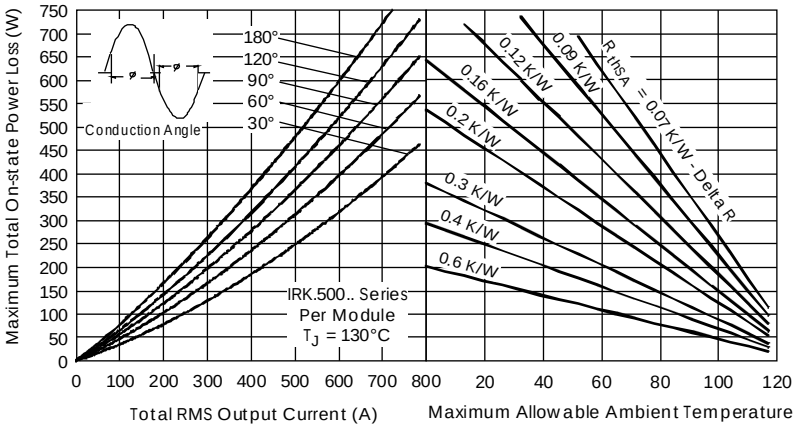


Fig. 7 - On-state Power Loss Characteristics

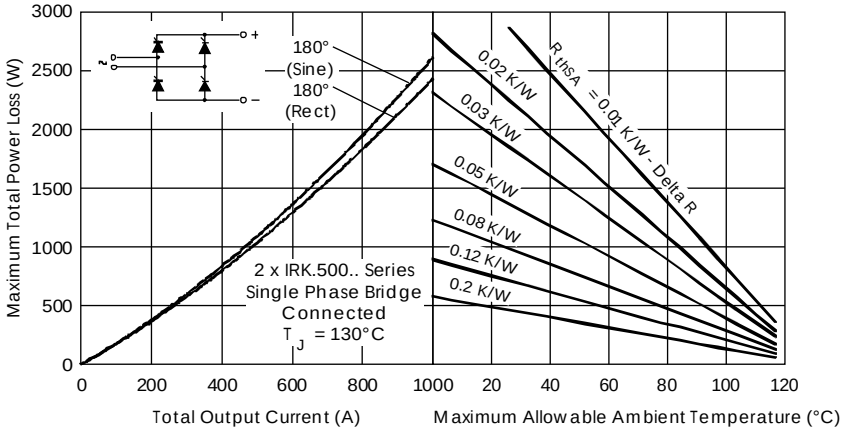


Fig. 8 - On-state Power Loss Characteristics

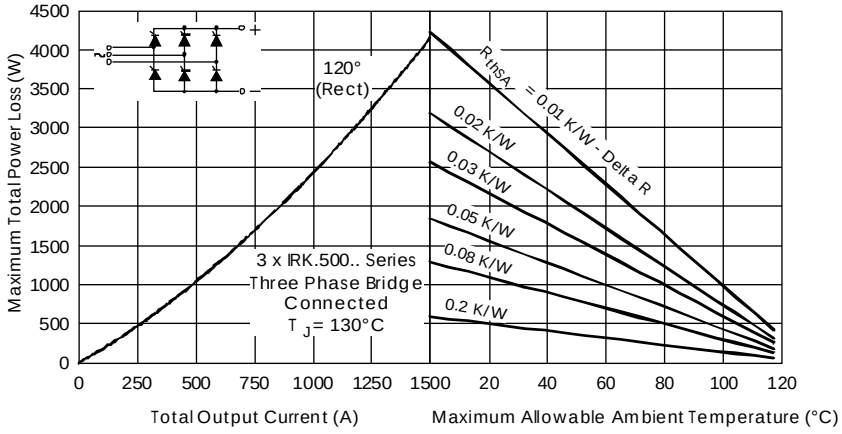


Fig. 9 - On-state Power Loss Characteristics

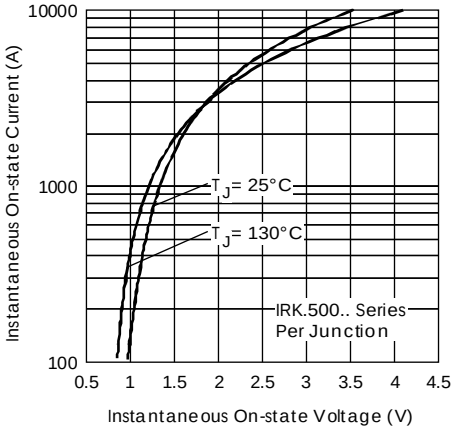


Fig. 10 - On-state Voltage Drop Characteristics

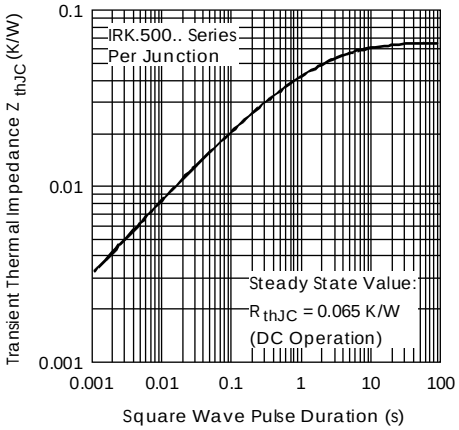


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

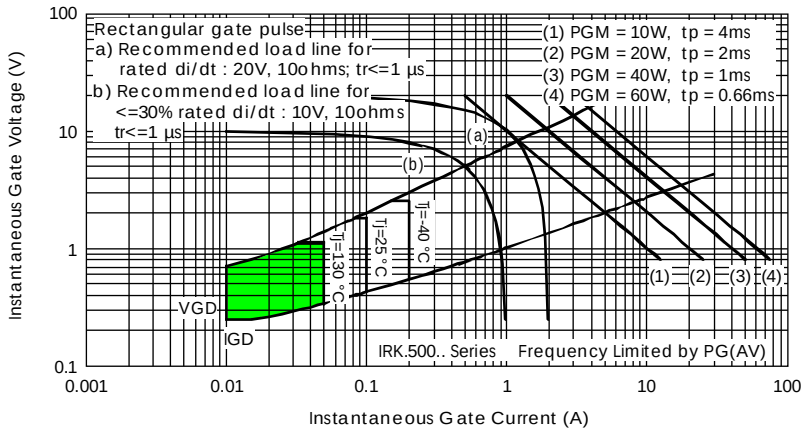


Fig. 12 - Gate Characteristics