Bulletin I27100 rev. B 04/98

International
IOR Rectifier

IRK.F180.. SERIES

FAST THYRISTOR/ DIODE and THYRISTOR/ THYRISTOR

MAGN-A-pak™ Power Modules

180 A

Features

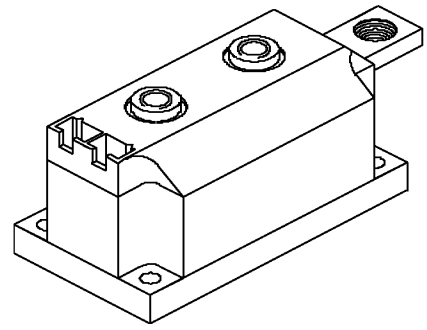
- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3000 V_{RMS} isolating voltage
- Industrial standard package
- UL E78996 approved

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

Parameters		IRK.F180..	Units
$I_{T(AV)}$		180	A
	@T_C	85	°C
$I_{T(RMS)}$		400	A
I_{TSM}	@50Hz	7130	A
	@60Hz	7470	A
I^2t	@50Hz	255	KA^2s
	@60Hz	232	KA^2s
$I^2\sqrt{t}$		2550	$KA^2\sqrt{s}$
t_q		20 and 25	µs
t_{rr}		2	µs
V_{DRM}/V_{RRM}		up to 1200	V
T_J	range	-40 to 125	°C

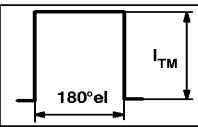
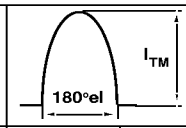
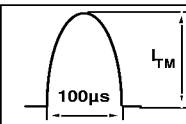


ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{RRM}/V_{DRM}, maximum repetitive peak reverse voltage V	V_{RSM}, maximum non-repetitive peak rev. voltage V	I_{RRM}/I_{DRM} max. @ T_J = 125°C mA
IRK.F180-	08	800	800	50
	12	1200	1200	

Current Carrying Capacity

Frequency f							Units
50Hz	370	530	565	800	2400	3150	A
400Hz	435	650	670	1000	1540	2050	A
2500Hz	290	430	490	720	610	830	A
5000Hz	240	345	390	540	390	540	A
10000Hz	170	270	290	390	-	-	A
Recovery voltage Vr	50	50	50	50	50	50	V
Voltage before turn-on Vd	80%V_{DRM}		80%V_{DRM}		80%V_{DRM}		V
Rise of on-state current di/dt	50	50	-	-	-	-	A/µs
Case temperature	85	60	85	60	85	60	°C
Equivalent values for RC circuit	10Ω/0.47µF		10Ω/0.47µF		10Ω/0.47µF		

On-state Conduction

	Parameter	IRK.F180..	Units	Conditions		
$I_{T(AV)}$	Maximum average on-state current	180	A	180° conduction, half sine wave		
	@ Case temperature	85	°C			
$I_{T(RMS)}$	Maximum RMS current	400	A	as AC switch		
I_{TSM}	Maximum peak, one-cycle, non-repetitive surge current	7130	A	t = 10ms	No voltage reapplied	Sinusoidal half wave, Initial T_J = 125°C
		7470		t = 8.3ms		
		6000		t = 10ms	100% V_{RRM} reapplied	
		6280		t = 8.3ms		
I^2t	Maximum I^2t for fusing	255	KA^2s	t = 10ms	No voltage reapplied	
		232		t = 8.3ms		
		180		t = 10ms	100% V_{RRM} reapplied	
		164		t = 8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	2550	$KA^2\sqrt{s}$	t = 0 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	1.30	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	1.38		(I > π x $I_{T(AV)}$), T_J = T_J max.		
r_{t1}	Low level value of on-state slope resistance	0.90	mW	(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	0.71		(I > π x $I_{T(AV)}$), T_J = T_J max.		
V_{TM}	Maximum on-state voltage drop	1.84	V	I_{pk} = 600A, T_J = T_J max., t_p = 10ms sine pulse		
I_H	Maximum holding current	600	mA	T_J = 25°C, I_T > 30 A		
I_L	Typical latching current	1000	mA	T_J = 25°C, V_A = 12V, Ra = 6Ω, Ig = 1A		

Switching

	Parameter	IRK.F180..		Units	Conditions
di/dt	Maximum non-repetitive rate of rise	800		A/µs	Gate drive 20V, 20Ω, tr ≤ 1ms, V_D= 80% V_{DRM} T_J = 25°C
t_{rr}	Maximum recovery time	2		µs	I_{TM} = 350A, di/dt = -25A/µs, V_R = 50V, T_J = 25°C
t_q	Maximum turn-off time	K	J		I_{TM} = 750A, T_J = 125°C, di/dt = -25A/µs,
		20	25	µs	V_R = 50V, dv/dt = 400V/µs linear to 80% V_{DRM}

Blocking

	Parameter	IRK.F180..	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	1000	V/µs	T_J = 125°C., exponential to = 67% V_{DRM}
V_{INS}	RMS isolation voltage	3000	V	50 Hz, circuit to base, T_J = 25°C, t = 1 s
I_{RRM} I_{DRM}	Maximum peak reverse and off-state leakage current	50	mA	T_J = 125°C, rated V_{DRM}/V_{RRM} applied

Triggering

	Parameter	IRK.F180..	Units	Conditions
P_{GM}	Maximum peak gate power	60	W	f = 50 Hz, d% = 50
$P_{G(AV)}$	Maximum peak average gate power	10	W	T_J = 125°C, f = 50Hz, d% = 50
I_{GM}	Maximum peak positive gate current	10	A	T_J = 125°C, t_p ≤ 5ms
- V_{GM}	Maximum peak negative gate voltage	5	V	
I_{GT}	Max. DC gate current required to trigger	200	mA	T_J = 25°C, V_{ak} 12V, Ra = 6
V_{GT}	DC gate voltage required to trigger	3	V	
I_{GD}	DC gate current not to trigger	20	mA	T_J = 125°C, rated V_{DRM} applied
V_{GD}	DC gate voltage not to trigger	0.25	V	

Thermal and Mechanical Specifications

	Parameter		IRK.F180..	Units	Conditions
T_J	Max. junction operating temperature range		- 40 to 125	°C	
T_{stg}	Max. storage temperature range		- 40 to 150		
R_{thJC}	Max. thermal resistance, junction to case		0.125	K/W	Per junction, DC operation
R_{thC-hs}	Max. thermal resistance, case to heatsink		0.02	K/W	Mounting surface flat and greased Per module
T	Mounting torque ± 10%	MAP to heatsink	4 - 6 (35 - 53)	Nm	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 recommendd, busbars should be used and restrained during tightening. Threads must be lubricated with a compound
		busbar to MAP	4 - 6 (35 - 53)	(lb*in)	
wt	Approximate weight		500 (17.8)	g (oz)	

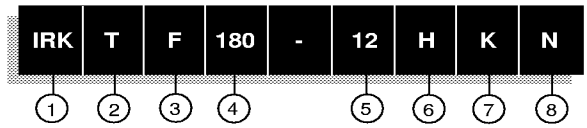
ΔR_{thJC} Conduction

(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 = 125°C
120°	0.010	0.011		
90°	0.014	0.015		
60°	0.020	0.020		
30°	0.032	0.033		

Ordering Information Table

Device Code



1 - Module type

2 - Circuit configuration

3 - Fast SCR

4 - Current rating: $I_{T(AV)}$ x 10 rounded

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

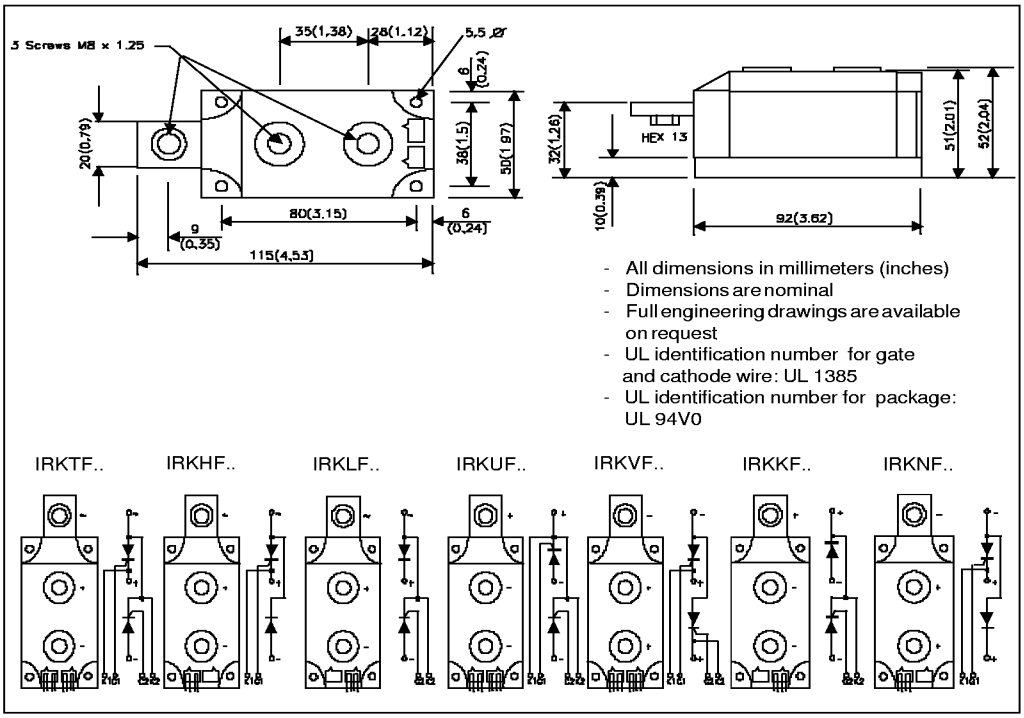
6 - dv/dt code: H ≤ 400V/µs

7 - t_q code: K ≤ 20µs
J ≤ 25µs

8 - None = Standard devices
N = Aluminum nitrade substrate

NOTE: To order the Optional Hardware see Bulletin I27900

Outline Table



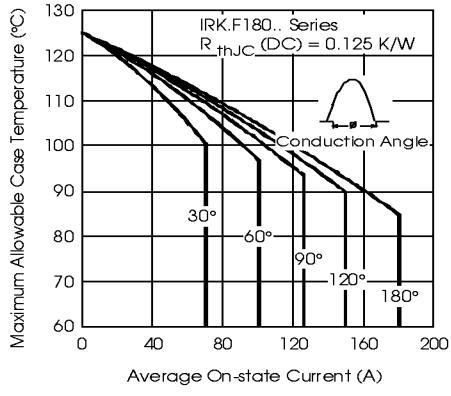


Fig. 1 - Current Ratings Characteristics

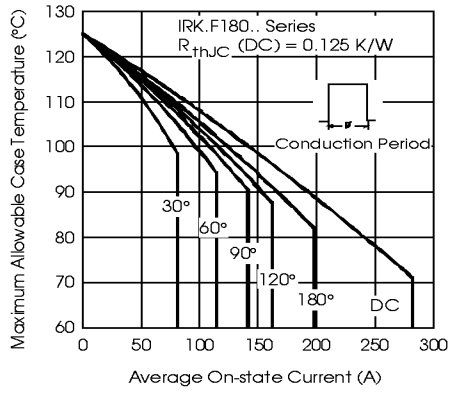


Fig. 2 - Current Ratings Characteristics

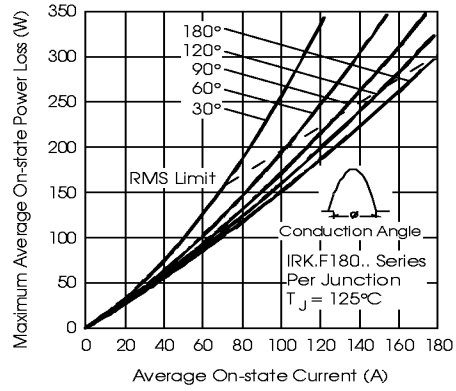


Fig. 3 - On-state Power Loss Characteristics

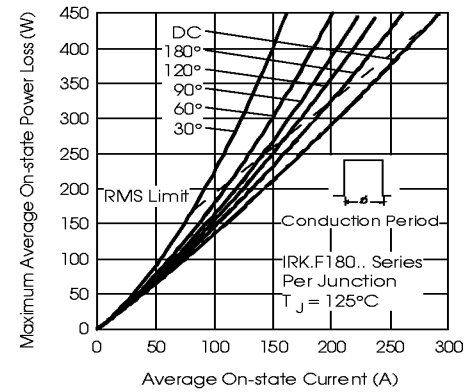


Fig. 4 - On-state Power Loss Characteristics

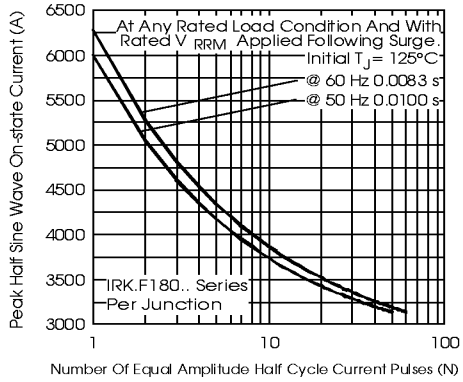


Fig. 5 - Maximum Non-Repetitive Surge Current

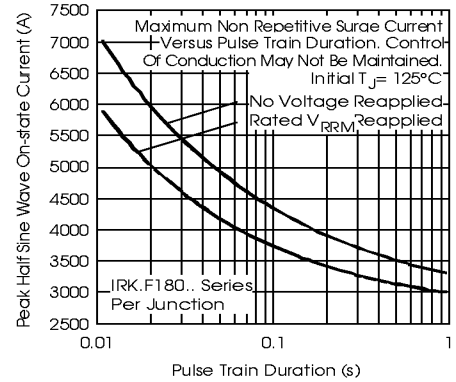


Fig. 6 - Maximum Non-Repetitive Surge Current

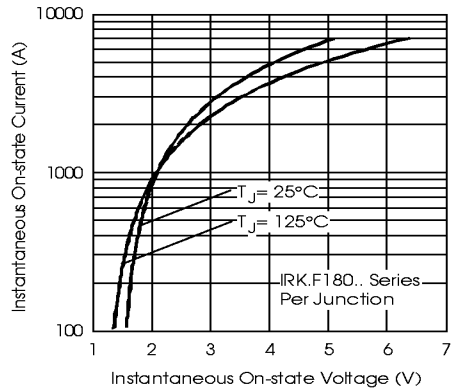


Fig. 7 - On-state Voltage Drop Characteristics

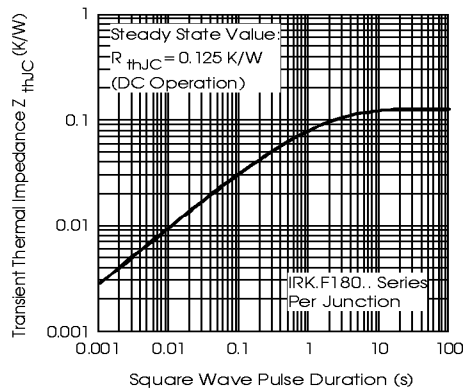


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

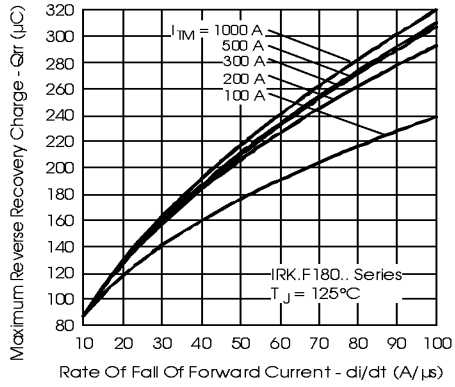


Fig. 9 - Reverse Recovery Charge Characteristics

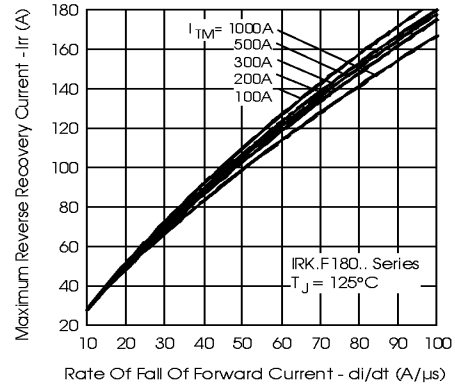


Fig. 10 - Reverse Recovery Current Characteristics

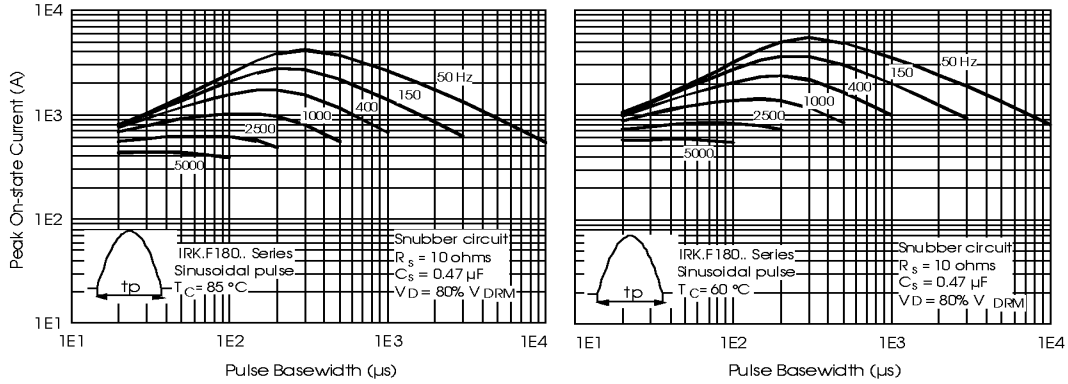


Fig. 11 - Frequency Characteristics

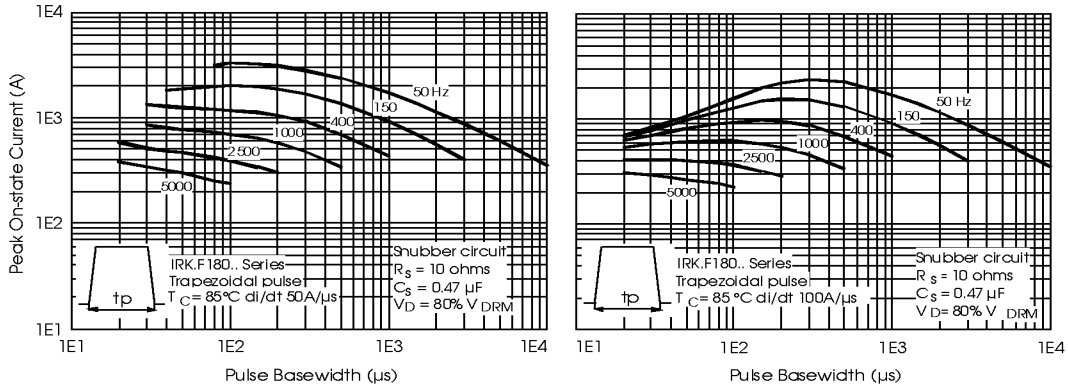


Fig. 12 - Frequency Characteristics

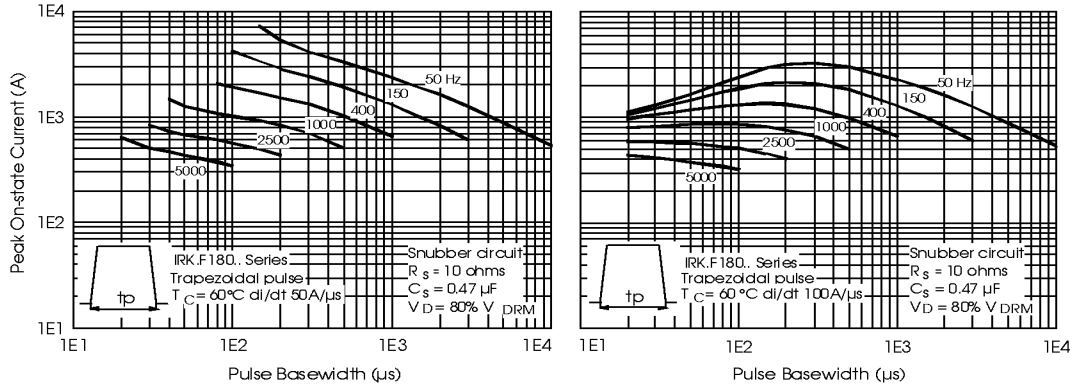


Fig. 13 - Frequency Characteristics

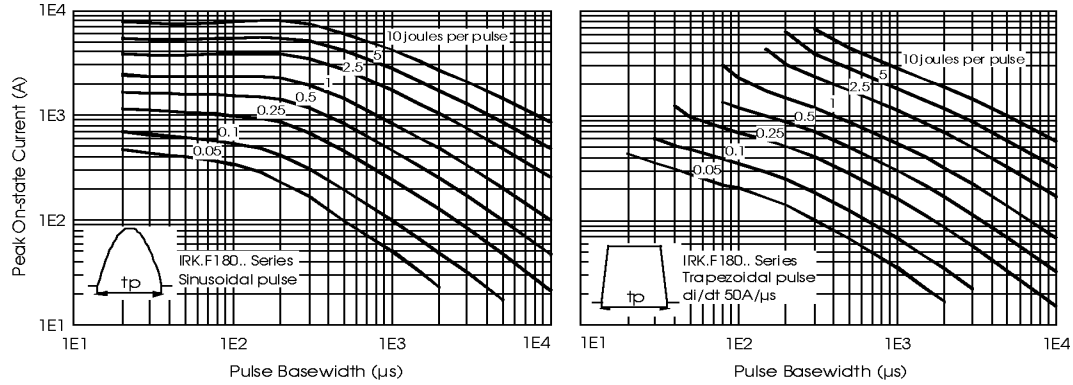


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

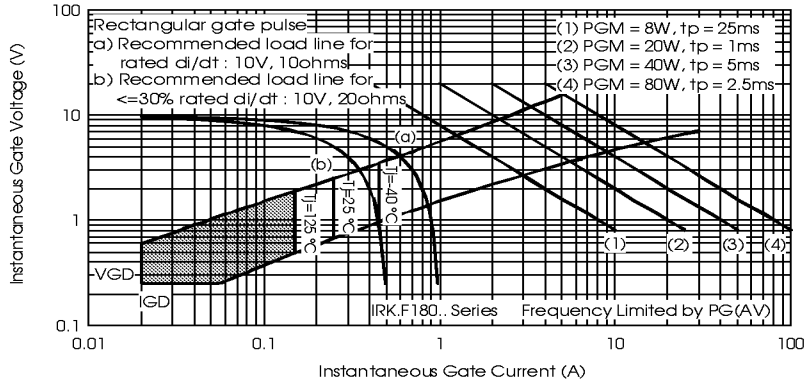


Fig. 15 - Gate Characteristics