International
IOR Rectifier

SERIES IRK.F180

FAST SCR / DIODE and SCR / SCR **MAGN-A-pak™ Power Modules**

180A

Features

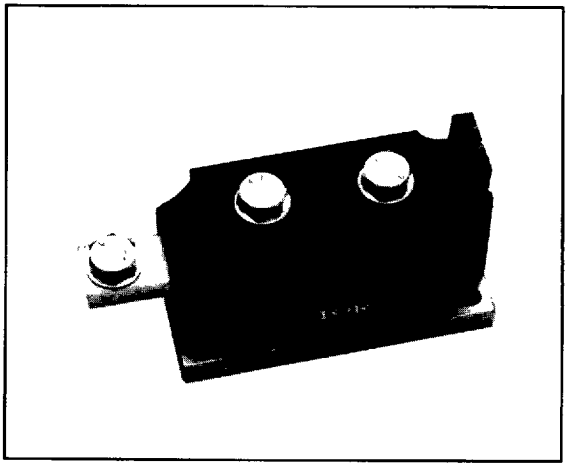
- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3000V_{RMS} isolating voltage
- Industrial standard package

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		Value	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	$kA^2\sqrt{s}$
V_{TM}		1.84	V
V_{RRM}/V_{DRM}		200 to 1200	V
t_q range		18 to 25	µs
t_{rr} (diode)		2 max	µs
T_J		-40 to 125	°C
V_{INS}		3000	V



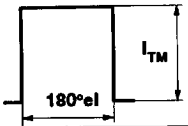
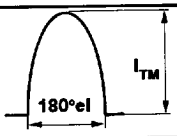
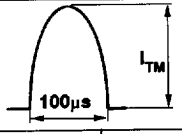
ELECTRICAL SPECIFICATIONS

Voltage Ratings

Part number (*)	Voltage code	V_{RRM}, maximum repetitive peak reverse voltage (V)	V_{DRM}, maximum repetitive peak off-state voltage (V)	I_{RRM}, I_{DRM} max @ 125°C (mA)
IRKT/H/L/U/V/K/NF180	02	200	200	50
	04	400	400	50
	06	600	600	50
	08	800	800	50
	10	1000	1000	50
	12	1200	1200	50

(*) Refer to Ordering Information Table to complete Part number

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

Parameters	Values	Units	Conditions		
$I_{T(AV)}$ Max. average on-state current	180	A	180° sinusoidal conduction Max. case temperature T_C = 85°C		
$I_{T(RMS)}$ Maximum RMS current	400	A	as AC switch		
I_{TSM} Maximum peak one half cycle non repetitive surge current	7130	A	10ms	No voltage reapplied	Sinusoidal half Wave Initial T_J=125°C
	7470	A	8.3ms		
	6000	A	10ms	100% V_{RRM} reapplied	Sinusoidal half Wave Initial T_J=125°C
	6280	A	8.3ms		
I^2t Maximum I^2t for fusing	255	kA^2s	10ms	No voltage reapplied	Initial T_J=125°C
	232	kA^2s	8.3ms		
	180	kA^2s	10ms	100% V_{RRM} reapplied	Initial T_J=125°C
	164	kA^2s	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		Initial T_J=125°C

On-state Conduction

	Parameters	Values	Units	Conditions
V_{TM}	Max. peak on-state voltage	1.84	V	I_T = 600A (peak) half sine wave, T_J=$T_J$max. tp = 10ms
$V_{T(TO)1}$	Low level value of threshold voltage	1.30	V	T_J=125°C (16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$)
$V_{T(TO)2}$	High level value of threshold voltage	1.38	V	T_J=125°C (π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$)
r_{t1}	Low level value of on-state slope resistance	0.90	mΩ	T_J=125°C (16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$)
r_{t2}	High level value of on-state slope resistance	0.710	mΩ	T_J=125°C (π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$)
I_H	Maximum holding current	600	mA	T_J=25°C, I_T > 30 A
I_L	Latching current	1000	mA	T_J=25°C, V_A = 12V, Ra = 6Ω, Ig = 1A

Triggering

	Parameters	Values	Units	Conditions
P_{GM}	Maximum peak gate power	60	W	f = 50 Hz, d% = 50
$P_{G(AV)}$	Maximum average gate power	10	W	T_J=125°C, f = 50 Hz, d% = 50
I_{GM}	Maximum peak gate current	10	A	T_J=125°C, tp ≤ 5ms
$-V_{GM}$	Maximum peak negative gate voltage	5	V	T_J=125°C, tp ≤ 5ms
V_{GT}	Maximum gate voltage required to fire all devices	3	V	T_J=25°C, V_A = 12V, Ra = 6Ω
I_{GT}	Maximum gate current required to fire all devices	200	mA	T_J=25°C, V_A = 12V, Ra = 6Ω
V_{GD}	Maximum gate voltage	0.25	V	T_J=125°C, rated V_{DRM} applied
I_{GD}	Maximum gate current that will not trigger any device	20	mA	T_J=125°C, rated V_{DRM} applied

Blocking

dv/dt	Maximum critical rate of rise of off-state voltage	400	V/µs	T_J=125°C linear to 80% V_{DRM} (*)
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current	30	mA	T_J=125°C rated V_{DRM}, V_{RRM} applied
V_{INS}	RMS isolation voltage	3000	V	50 Hz, circuit to base, T_J = 25°C, 1s

(*) *Contact factory for other selections*

Switching

t_q	Maximum turn-off time	P	K	J	µs	I_T = 750A, T_J=125°C $-di/dt$ = 25 A/µs V_R = 50V dv/dt = 50 V/µs linear to 80% V_{DRM}
		18	20	25		
t_{rr}	Maximum recovery time	2			µs	I_T = 350A, $-di/dt$ = 25 A/µs, V_R = 50V, T_J = 25°C
di/dt	Max. non-repetitive rate of rise	800			A/µs	Gate drive 20V, 20Ω, tr ≤ 1µs, V_D = 80% V_{DRM} T_J=125°C

Thermal and Mechanical Specifications

T_J	Junction temperature range	-40 to 125	°C	
T_{stg}	Storage temperature range	-40 to 150	°C	
R_{thJC}	Internal thermal resistance, junction to case	0.125	K/W	DC operation per junction
R_{thC-S}	Thermal resistance case to sink	0.025	K/W	Mounting surface flat and greased - Per module
T	Mounting torque, ±10%	4 to 6	Nm	A mounting compound is recommended. The torque should be rechecked after a period of about 3 hours to allow for the spread of the compound. Use of cable lugs is not recommended, busbars should be used and restrained during tightening. Threads must be lubricated with a compound.
	MAGN-A-pak to heatsink	35 to 53	lb * in	
	Busbar to MAGN-A-pak	8 to 10	Nm	
		70 to 90	lb * in	
wt	Approximate weight	850/30	g/oz	
	Case style	MAGN-A-pak		See Outline Table

ΔR Conduction (per Junction)

(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°	0.010	0.011	K/W	
90°	0.014	0.015	K/W	
60°	0.020	0.020	K/W	
30°	0.032	0.033	K/W	

Ordering Information Table

Device Code

IRK	T	F	180	-	12	H	J
①	②	③	④		⑤	⑥	⑦

1 - Module type
2 - Circuit configuration (See Circuit Configuration Table)
3 - Fast SCR
4 - Current rating
5 - Voltage code: Code x 100 = V_{RRM}
6 - dv/dt code (See table)
7 - tq code (See table)

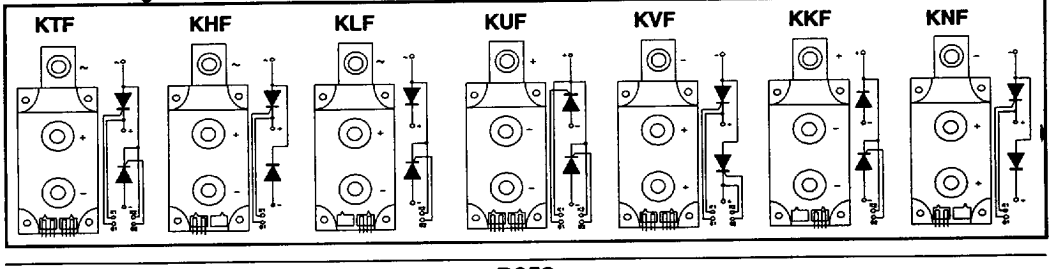
dv/dt

C = 20V/µs
D = 50V/µs
For the following selections contact factory
E = 100V/µs
F = 200V/µs
G = 300V/µs
H = 400V/µs

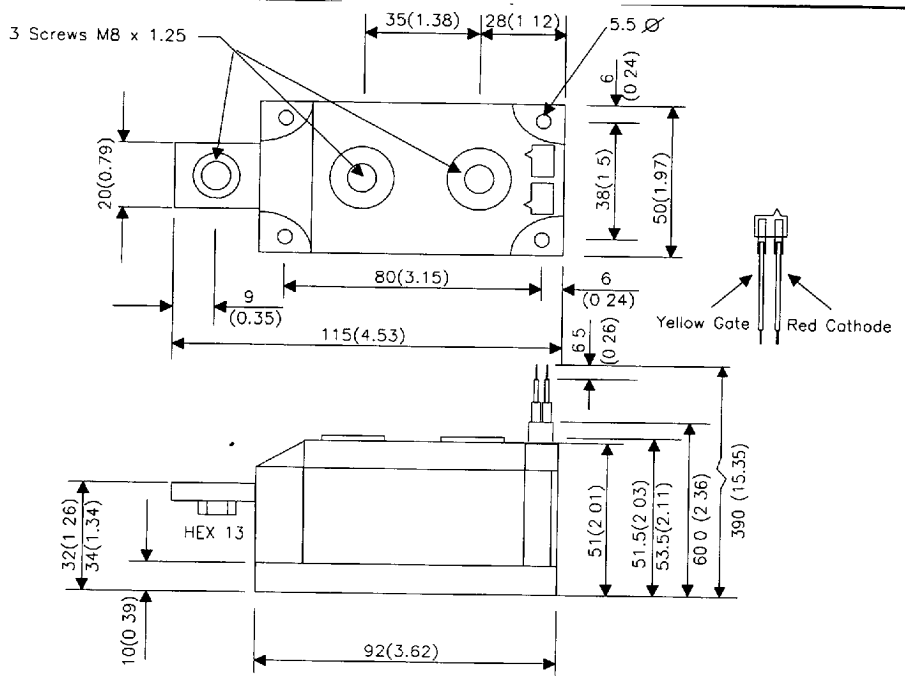
tq

P ≤ 18µs
K ≤ 20µs
J ≤ 25µs

Circuit Configuration Table



Outline Table



- All dimensions in millimeters (inches)
- 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 94V0

CONTAINS BERYLLIUM OXIDE CERAMIC

- May contain Beryllium Oxide Ceramic, and under normal circumstances is non hazardous
- Do not open, cut or grind
- Unserviceable parts must be disposed of as harmful waste

HARMFUL

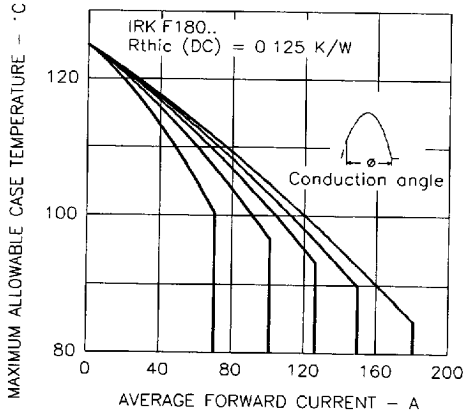


Fig. 1 - Current Ratings Characteristics

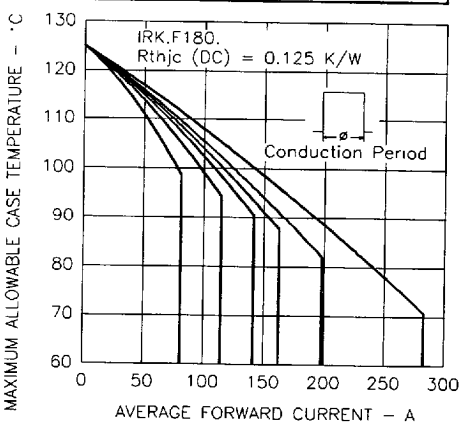


Fig. 2 - Current Ratings Characteristics

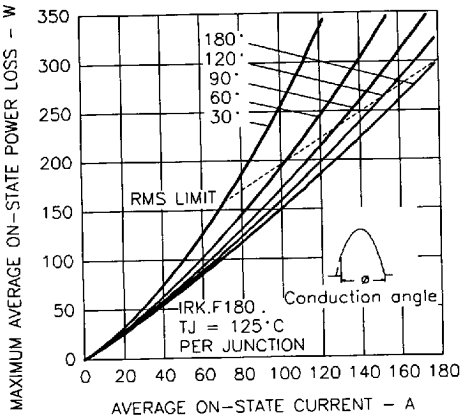


Fig. 3 - On-state Power Loss Characteristics

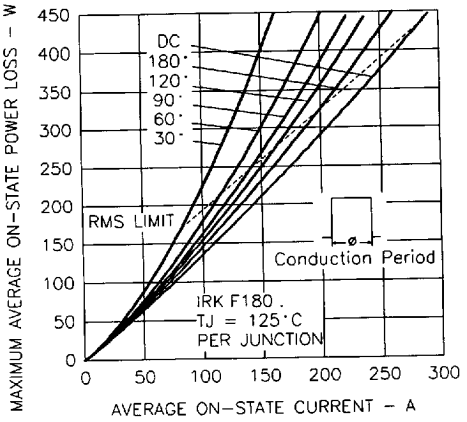


Fig. 4 - On-state Power Loss Characteristics

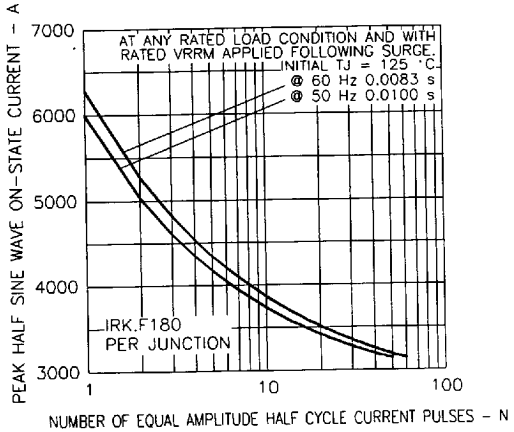


Fig. 5 - Maximum Non-Repetitive Surge Current

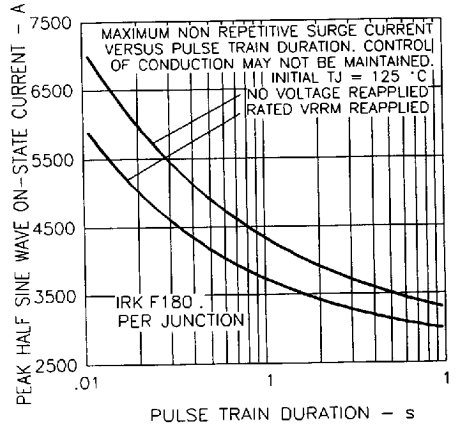


Fig. 6 - Maximum Non-Repetitive Surge Current

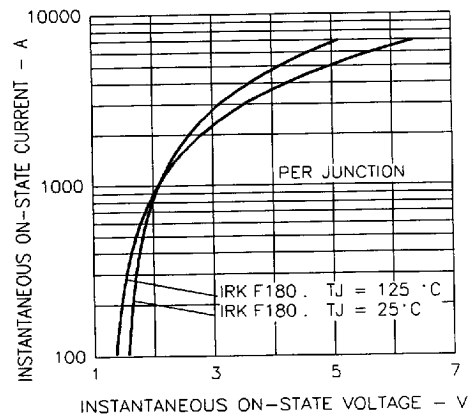


Fig. 7 - On-state Voltage Drop Characteristics

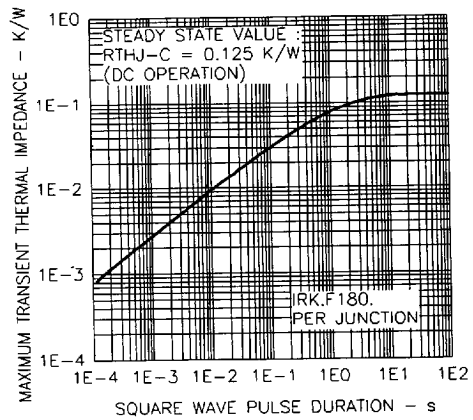


Fig. 8 - Thermal Impedance ZthJC Characteristics

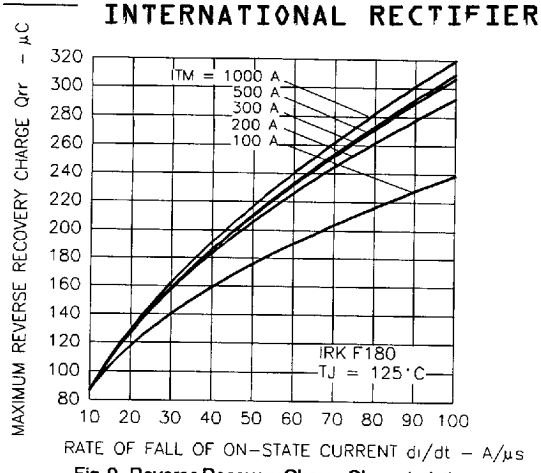


Fig. 9 - Reverse Recovery Charge Characteristics (Thyristor)

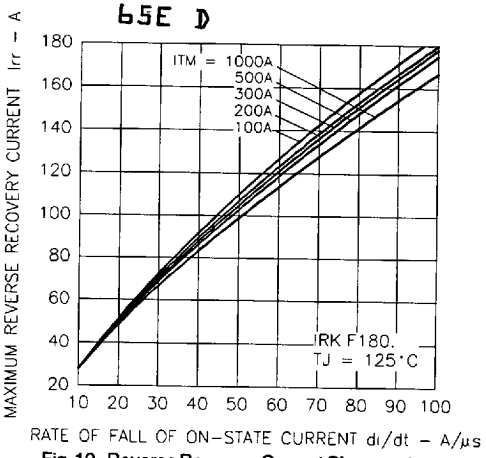


Fig. 10 - Reverse Recovery Current Characteristics (Thyristor)

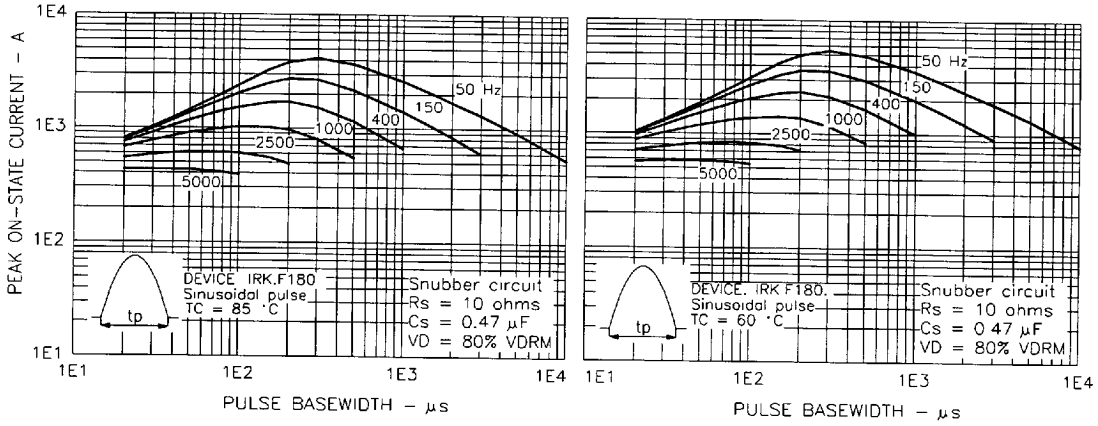


Fig. 11 - Frequency Characteristics

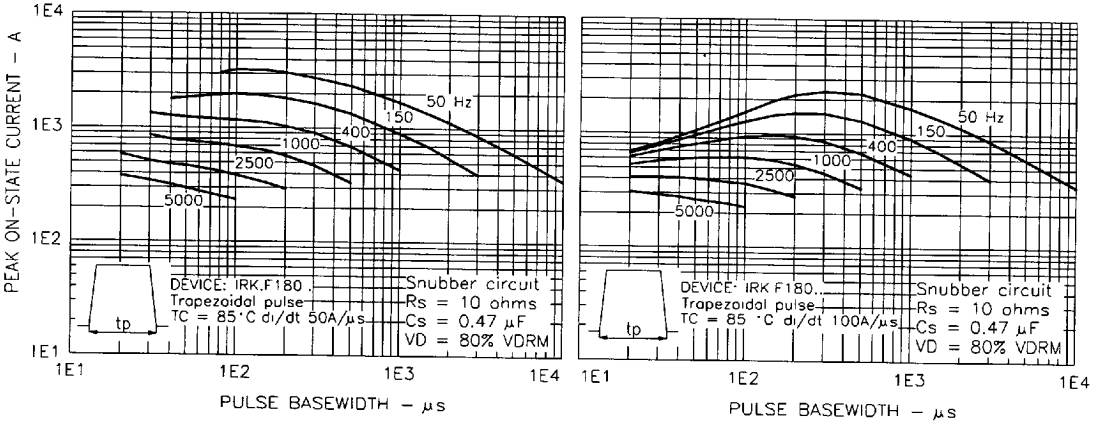


Fig. 12 - Frequency Characteristics

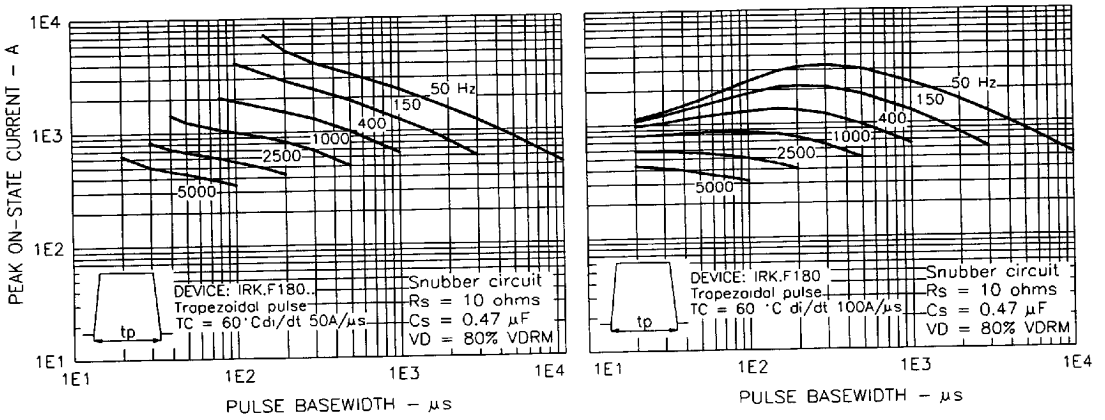


Fig. 13 - Frequency Characteristics

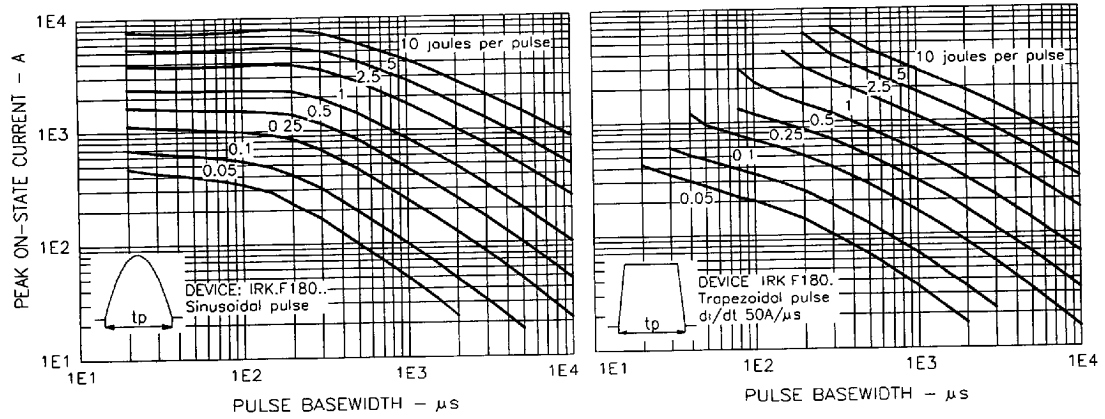


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

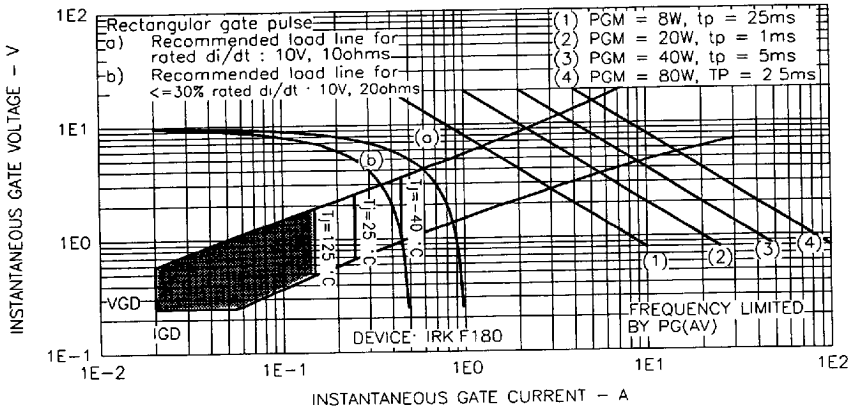


Fig. 15 - Gate Characteristics