

FAST SCR / DIODE and SCR / SCR

INT-A-PAK™ Power Modules

Features

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

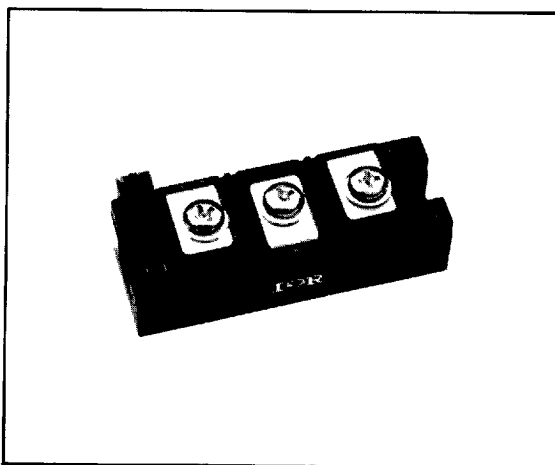
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Description

These series of INT-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
$I_{T(AV)}$	130	A
@ T_C	90	°C
$I_{T(RMS)}$	293	A
I_{TSM} @ 50Hz	3210	A
@ 60Hz	3360	A
i^2t @ 50Hz	51.5	kA ² s
@ 60Hz	47.0	kA ² s
i^2vt	515	kA ² /s
V_{TM}	1.71	V
V_{RRM}/V_{DRM}	200 to 800	V
t_q range	12 to 18	μs
t_{rr} (diode)	2 max	μs
T_J	-40 to 125	°C
V_{INS}	3000	V



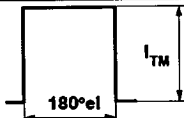
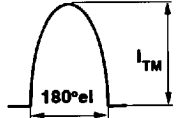
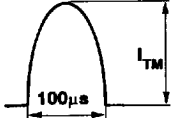
ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type 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/NF132	02	200	200	30
IRKT/H/L/U/V/K/NF132	04	400	400	30
IRKT/H/L/U/V/K/NF132	06	600	600	30
IRKT/H/L/U/V/K/NF132	08	800	800	30

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

Current Carrying Capacity

Frequency f				Units			
50Hz	250	420	408	640	2465	3460	A
400Hz	320	530	485	800	1470	2150	A
2500Hz	240	390	400	650	540	830	A
5000Hz	210	340	340	530	340	530	A
10000Hz	160	275	300	415	-	-	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	90	60	90	60	90	60	°C
Equivalent values for RC circuit	47Ω/0.22 µF		47Ω/0.22 µF		47Ω/0.22 µF		

On-state Conduction

Parameters		Values	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	130	A	180° sinusoidal conduction Max. case temperature $T_c = 90^{\circ}\text{C}$		
$I_{T(RMS)}$	Maximum RMS current	293	A	$T_c = 90^{\circ}\text{C}$, as AC switch		
I_{TSM}	Maximum peak one half cycle non repetitive surge current	3210	A	10ms	No voltage reapplied	Sinusoidal half Wave Initial $T_J = 125^{\circ}\text{C}$
		3360	A	8.3ms		
		2700	A	10ms	100% V_{RRM}	Sinusoidal half Wave Initial $T_J = 125^{\circ}\text{C}$
		2825	A	8.3ms	reapplied	
I^2t	Maximum I^2t for fusing	51.5	kA ² s	10ms	No voltage reapplied	Initial $T_J = 125^{\circ}\text{C}$
		47.0	kA ² s	8.3ms		
		36.5	kA ² s	10ms	100% V_{RRM}	Initial $T_J = 125^{\circ}\text{C}$
		33.3	kA ² s	8.3ms	reapplied	
I^2/t	Maximum I^2/t for fusing	515	kA ² /s	t=0 to 10ms, no voltage reapplied Initial $T_J = 125^{\circ}\text{C}$		

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On-state Conduction

Parameters	Values	Units	Conditions
V_{TM} Max. peak on-state voltage	1.71	V	$I_T = 600A$ (peak) half sine wave, $T_J = T_{J,max}$, $t_p = 10ms$
$V_{T(TO)1}$ Low level value of threshold voltage	1.16	V	$T_J = 125^\circ C$ ($16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$)
$V_{T(TO)2}$ High level value of threshold voltage	1.25	V	$T_J = 125^\circ C$ ($\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$)
r_{t1} Low level value of on-state slope resistance	0.92	m Ω	$T_J = 125^\circ C$ ($16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$)
r_{t2} High level value of on-state slope resistance	0.77	m Ω	$T_J = 125^\circ C$ ($\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$)
I_H Maximum holding current	600	mA	$T_J = 25^\circ C$, $I_T > 30A$
I_L Latching current	1000	mA	$T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$, $I_g = 1A$

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	$T_J = 125^\circ C$, $f = 50$ Hz, $d\% = 50$
I_{GM} Maximum peak gate current	10	A	$T_J = 125^\circ C$, $t_p \leq 5ms$
$-V_{GM}$ Maximum peak negative gate voltage	5	V	$T_J = 125^\circ C$, $t_p \leq 5ms$
V_{GT} Maximum gate voltage required to fire all devices	3	V	$T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$
I_{GT} Maximum gate current required to fire all devices	200	mA	$T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$
V_{GD} Maximum gate voltage	0.25	V	$T_J = 125^\circ C$, rated V_{DRM} applied
I_{GD} Maximum gate current that will not trigger any device	20	mA	$T_J = 125^\circ C$, rated V_{DRM} applied

Blocking

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

(*) Contact factory for other selections

Switching

t_q Maximum turn-off time	M	L	P	μs	$I_T = 350A$, $T_J = 125^\circ C$ - $di/dt = 25 A/\mu s$, $V_R = 50V$ $dv/dt = 50 V/\mu s$ linear to $80\% V_{DRM}$
	12	15	18		
t_{rr} Maximum recovery time	2			μs	$I_T = 350A$, $-di/dt = 25 A/\mu s$, $V_R = 50V$, $T_J = 25^\circ C$
di/dt Max. non-repetitive rate of rise	800			A/ μs	Gate drive 20V, 20 Ω , $tr \leq 1 \mu s$, $V_D = 80\% V_{DRM}$ $T_J = 125^\circ C$

Thermal and Mechanical Specifications

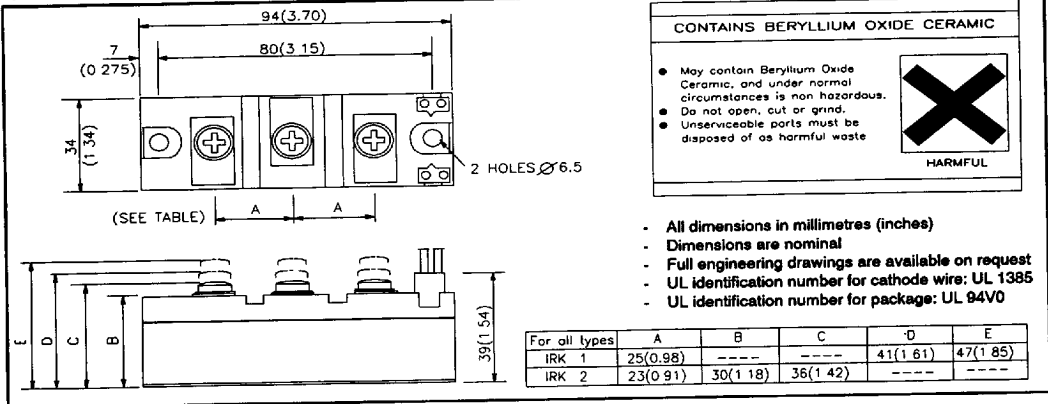
T_J	Junction temperature range	-40 to 125	°C	
T_{stg}	Storage temperature range	-40 to 150	°C	
R_{thJC}	Internal thermal resistance, junction to case	0.170	K/W	DC operation per junction
R_{thc-s}	Thermal resistance case to sink	0.035	K/W	Mounting surface flat and greased - Per module
T	Mounting torque, $\pm 10\%$	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.
		35 to 53	lb * in	
		4 to 6	Nm	
		35 to 53	lb * in	
wt	Approximate weight	500/17.8	g/oz	
Case style		INT-A-pak		

 ΔR Conduction (per Junction)

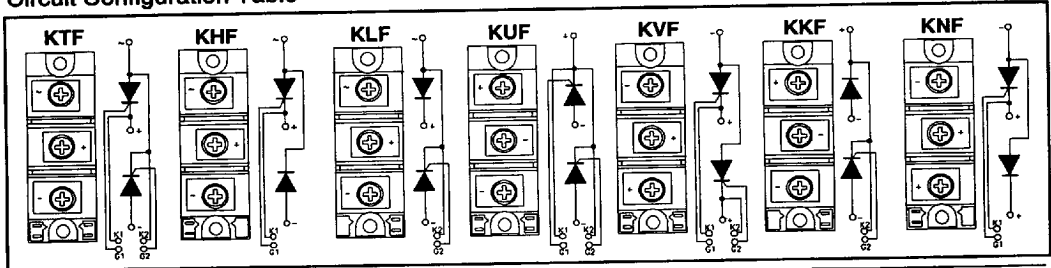
(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.016	0.011	K/W	$T_J = 125^\circ\text{C}$
120°	0.019	0.020	K/W	
90°	0.024	0.026	K/W	
60°	0.035	0.037	K/W	
30°	0.060	0.060	K/W	

Outline Table



Circuit Configuration Table



Ordering Information Table

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Device Code

IRK	T	F	13	2	-	08	D	M
①	②	③	④	⑤	⑥	⑦	⑧	

- 1 - Module type
- 2 - Circuit configuration (See Circuit Configuration Table)
- 3 - Fast SCR
- 4 - Current rating: Code x 10 = $I_{T(AV)}$
- 5 - 1 = option with spacers and longer terminal screws
2 = option with standard terminal screws
- 6 - Voltage code: Code x 100 = V_{RRM}
- 7 - dv/dt code (See table)
- 8 - tq code (See table)

tq
M ≤ 12μs
L ≤ 15μs
P ≤ 18μs

dv/dt
C = 20V/μs
D = 50V/μs
E = 100V/μs
F = 200V/μs
G = 300V/μs
H = 400V/μs

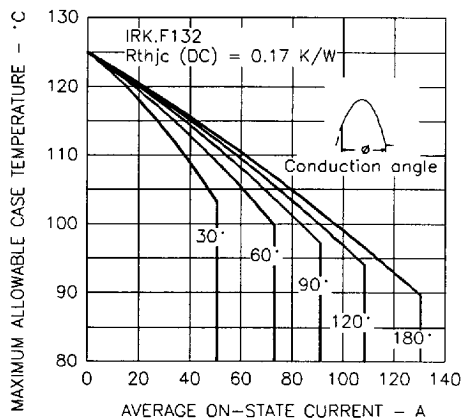


Fig. 1 - Current Ratings Characteristics

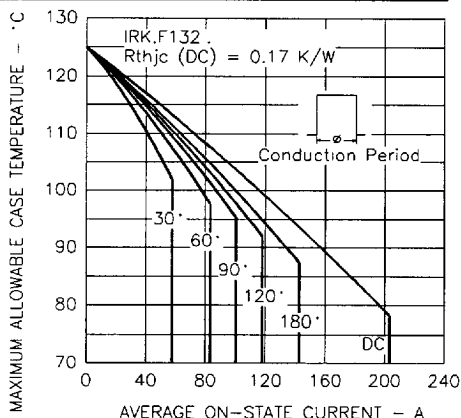


Fig. 2 - Current Ratings Characteristics

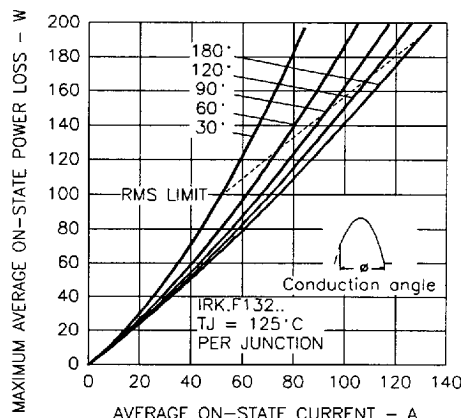


Fig. 3 - On-state Power Loss Characteristics

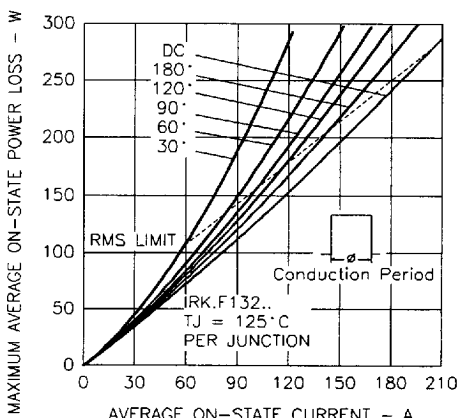


Fig. 4 - On-state Power Loss Characteristics

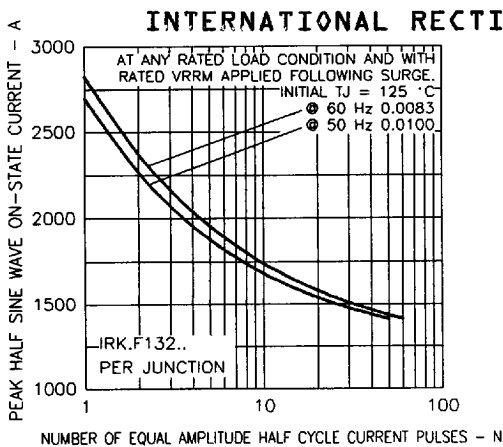


Fig. 5 - Maximum Non-Repetitive Surge Current

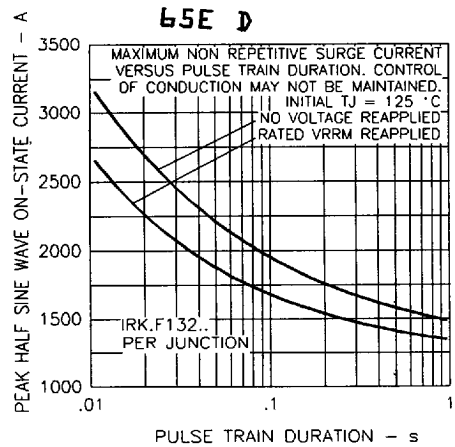


Fig. 6 - Maximum Non-Repetitive Surge Current

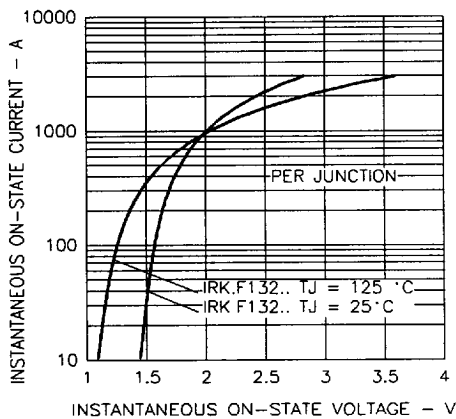


Fig. 7 - On-state Voltage Drop Characteristics

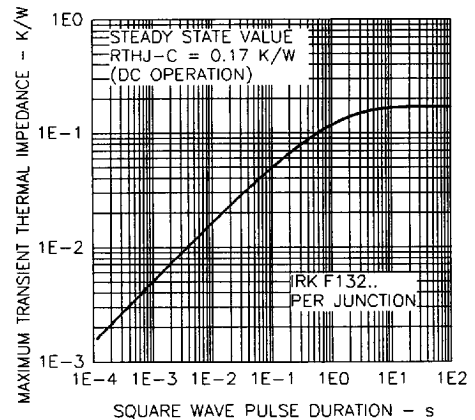
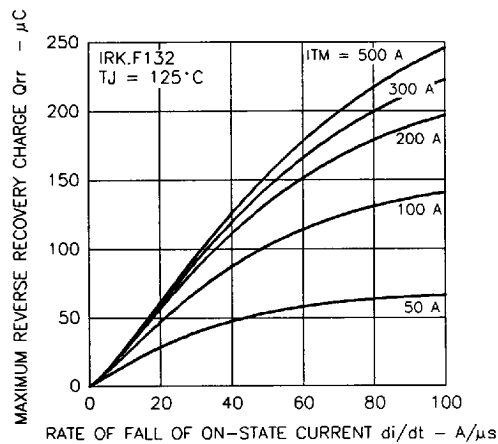
Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

Fig. 9 - Reverse Recovery Charge Characteristics (Thyristor)

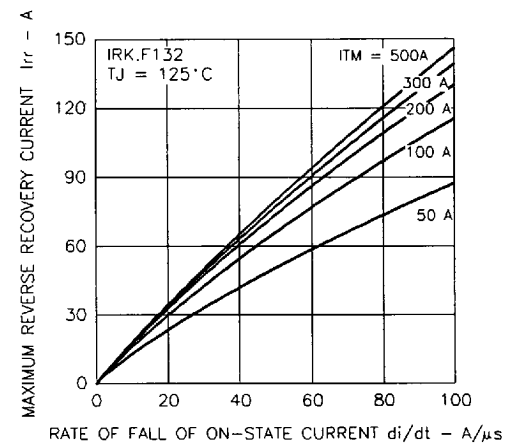


Fig. 10 - Reverse Recovery Current Characteristics (Thyristor)

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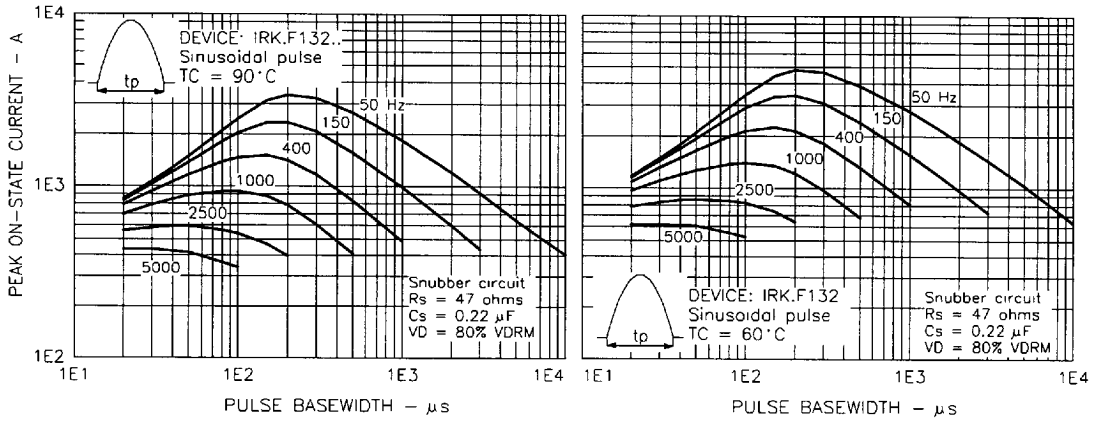


Fig. 11 - Frequency Characteristics

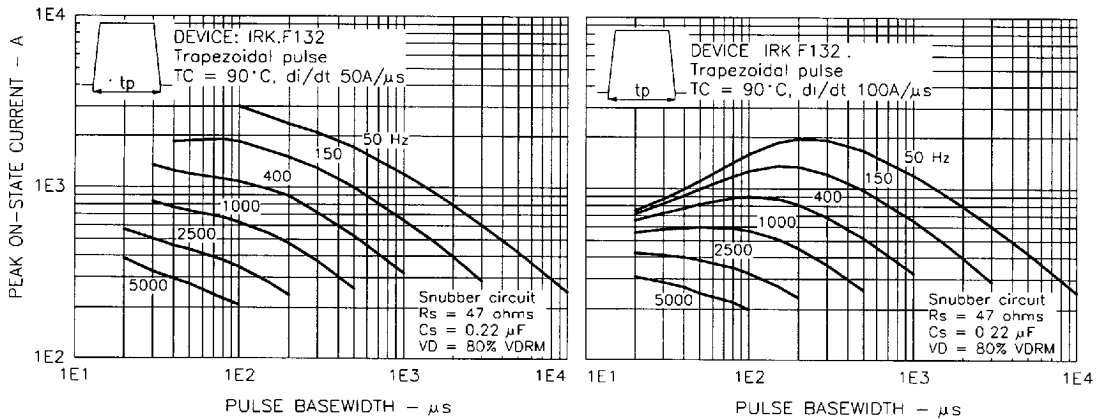


Fig. 12 - Frequency Characteristics

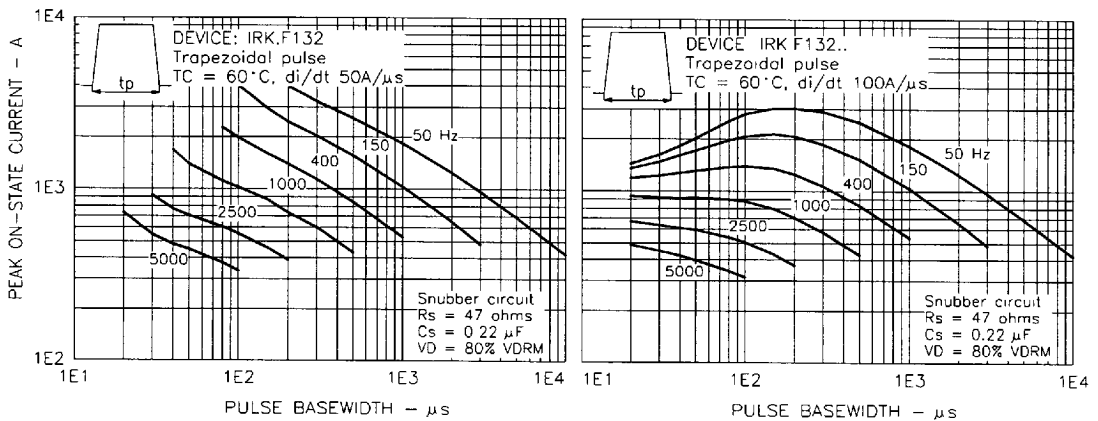


Fig. 13 - Frequency Characteristics

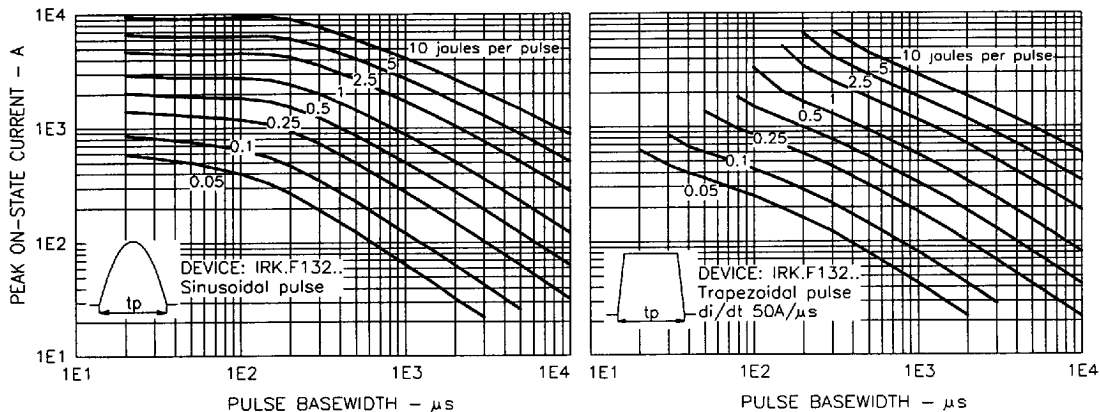


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

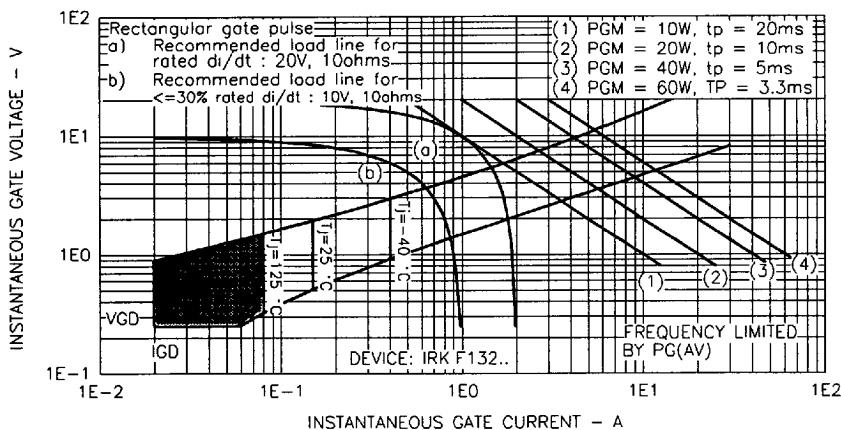


Fig. 15 - Gate Characteristics