

## 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<sub>RMS</sub> isolating voltage
- Industrial standard package

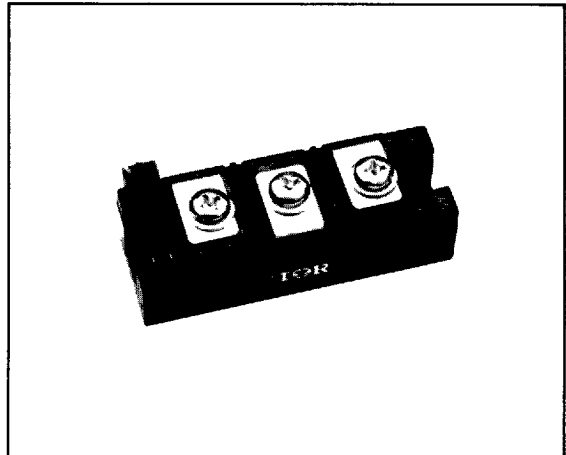
81A

### 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
$I_{T(AV)}$	81	A
@ $T_C$	90	°C
$I_{T(RMS)}$	180	A
$I_{TSM}$ @ 50Hz	2200	A
@ 60Hz	2300	A
$I^2t$ @ 50Hz	24.2	kA <sup>2</sup> s
@ 60Hz	22.1	kA <sup>2</sup> s
$I^2/t$	242	kA <sup>2</sup> /s
$V_{TM}$	1.96	V
$V_{RRM}/V_{DRM}$	200 to 800	V
$t_q$ range	10 to 20	μs
$t_r$ (diode)	2 max	μs
$T_J$	-40 to 125	°C
$V_{INS}$	3000	V



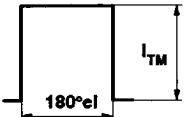
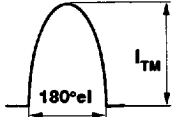
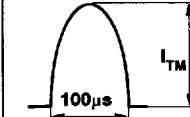
## ELECTRICAL SPECIFICATIONS

## 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/NF82	02	200	200	30
IRKT/H/L/U/V/K/NF82	04	400	400	30
IRKT/H/L/U/V/K/NF82	06	600	600	30
IRKT/H/L/U/V/K/NF82	08	800	800	30

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

## Current Carrying Capacity

Frequency f							Units
50Hz	160	265	250	400	2240	3100	A
400Hz	200	320	290	475	1070	1550	A
2500Hz	150	240	260	400	370	550	A
5000Hz	135	215	235	355	235	355	A
10000Hz	90	160	190	275	-	-	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	22Ω/0.15µF		22Ω/0.15µF		22Ω/0.15µF		

## On-state Conduction

Parameters	Values	Units	Conditions			
$I_{T(AV)}$ Max. average on-state current	81	A	180° sinusoidal conduction Max. case temperature $T_c = 90^\circ\text{C}$			
$I_{T(RMS)}$ Maximum RMS current	180	A	$T_c = 90^\circ\text{C}$ , as AC switch			
$I_{TSM}$ Maximum peak one half cycle non repetitive surge current	2200	A	10ms	No voltage reappplied	Sinusoidal half Wave Initial $T_j = 125^\circ\text{C}$	
	2300	A	8.3ms			
	1850	A	10ms	100% $V_{RRM}$ reappplied	Sinusoidal half Wave Initial $T_j = 125^\circ\text{C}$	
	1950	A	8.3ms			
$I^2t$ Maximum $I^2t$ for fusing	24.2	$\text{kA}^2\text{s}$	10ms	No voltage reappplied	Initial $T_j = 125^\circ\text{C}$	
	22.1	$\text{kA}^2\text{s}$	8.3ms			
	17.1	$\text{kA}^2\text{s}$	10ms	100% $V_{RRM}$ reappplied	Initial $T_j = 125^\circ\text{C}$	
	15.6	$\text{kA}^2\text{s}$	8.3ms			
$I^2t$ Maximum $I^2t$ for fusing	242	$\text{kA}^2\text{s}$	t=0 to 10ms, no voltage reappplied			Initial $T_j = 125^\circ\text{C}$

On-state Conduction **INTERNATIONAL RECTIFIER 65E D**

Parameters	Values	Units	Conditions
$V_{TM}$ Max. peak on-state voltage	1.96	V	$I_T=350A$ (peak) half sine wave, $T_J=T_{Jmax}$ , $t_p=10ms$
$V_{T(TO)1}$ Low level value of threshold voltage	1.20	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	1.24	V	$T_J=125^\circ C$ ( $\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$ )
$r_{\theta 1}$ Low level value of on-state slope resistance	2.18	m $\Omega$	$T_J=125^\circ C$ ( $16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$ )
$r_{\theta 2}$ High level value of on-state slope resistance	2.00	m $\Omega$	$T_J=125^\circ C$ ( $\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$ )
$I_H$ 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	40	W	$f=50$ Hz, $d\%=50$
$P_{G(AV)}$ Maximum average gate power	5	W	$T_J=125^\circ C$ , $f=50$ Hz, $d\%=50$
$I_{GM}$ Maximum peak gate current	5	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/ $\mu s$	$T_J=125^\circ C$ 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	N	M	L	P	K	$\mu s$	$I_T=350A$ , $T_J=125^\circ C$ $-di/dt=25$ A/ $\mu s$ $V_R=50V$ $dv/dt=50$ V/ $\mu s$ linear to 80% $V_{DRM}$
	10	12	15	18	20		
$t_{rr}$ Maximum recovery time	2					$\mu s$	$I_T=350A$ , $-di/dt=25$ A/ $\mu s$ , $V_R=50V$ , $T_J=25^\circ C$
$di/dt$ Max. non-repetitive rate of rise	800					A/ $\mu s$	Gate drive 20V, 20 $\Omega$ , $t_r \leq 1\mu s$ , $V_D=80\%$ $V_{DRM}$ $T_J=125^\circ C$

Thermal and Mechanical Specifications

INTERNATIONAL RECTIFIER

65E D

$T_J$	Junction temperature range	-40 to 125	°C	
$T_{stg}$	Storage temperature range	-40 to 150	°C	
$R_{thJC}$	Internal thermal resistance, junction to case	0.25	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, ±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.
	INT-A-pak to heatsink	35 to 53	lb * in	
	Busbar to INT-A-pak	4 to 6	Nm	
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

(SEE TABLE)      A      A

CONTAINS BERYLLIUM OXIDE CERAMIC

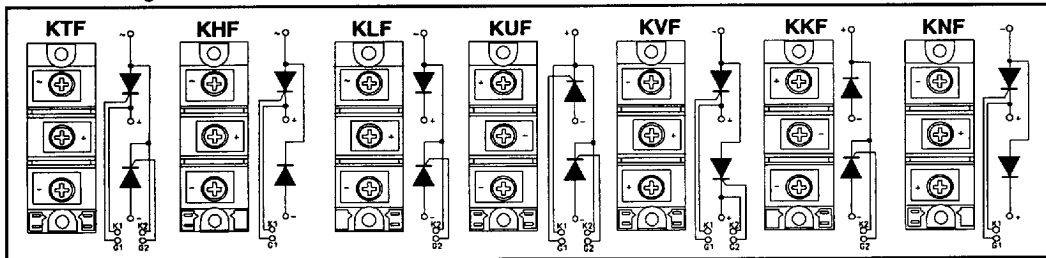
- May contain Beryllium Oxide Ceramic, and under normal circumstances is non hazardous
- Do not open, cut or grind.
- Unserviceable parts must be disposed of as harmful waste

HARMFUL

- All dimensions in millimetres (inches)
- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for cathode wire: UL 1385
- UL identification number for package: UL 94V0

For all types	A	B	C	D	E
IRK 1	25(0.98)	---	---	41(1.61)	47(1.85)
IRK 2	23(0.91)	30(1.18)	36(1.42)	---	---

Circuit Configuration Table

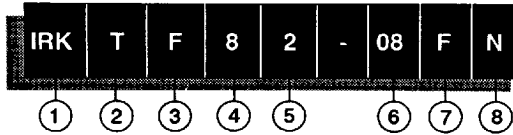


Ordering Information Table

INTERNATIONAL RECTIFIER

B5E D

Device Code



- 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)

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

tq	
N	≤ 10μs
M	≤ 12μs
L	≤ 15μs
P	≤ 18μs
K	≤ 20μs

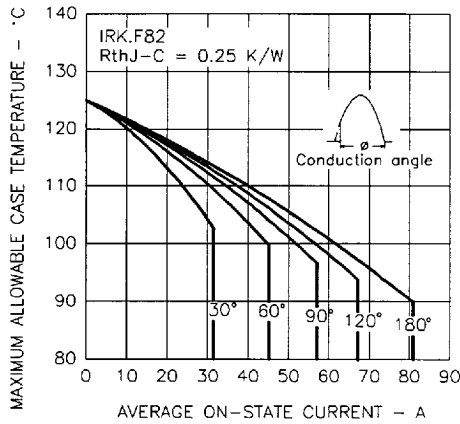


Fig. 1 - Current Ratings Characteristics

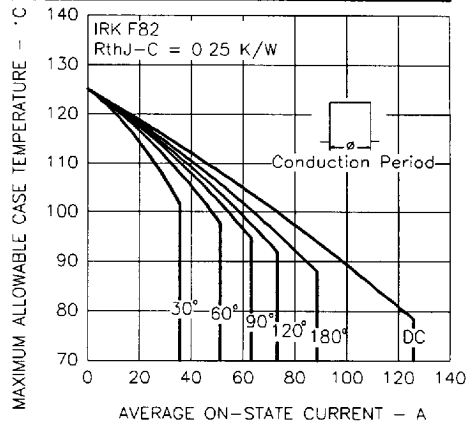


Fig. 2 - Current Ratings Characteristics

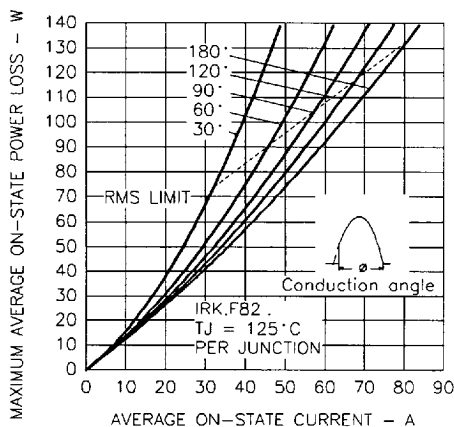


Fig. 3 - On-state Power Loss Characteristics

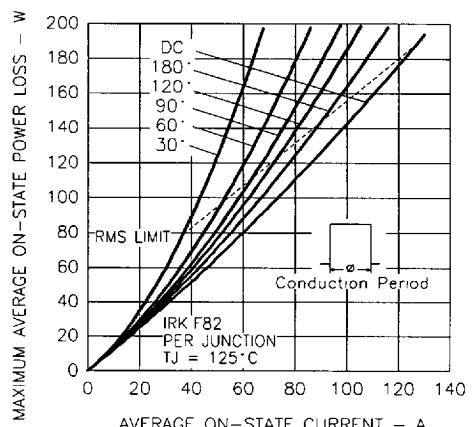


Fig. 4 - On-state Power Loss Characteristics

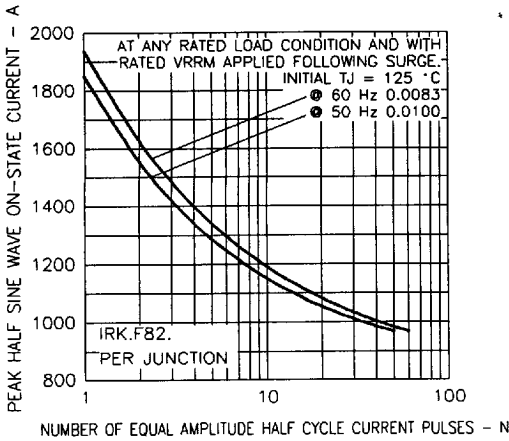


Fig. 5 - Maximum Non-Repetitive Surge Current

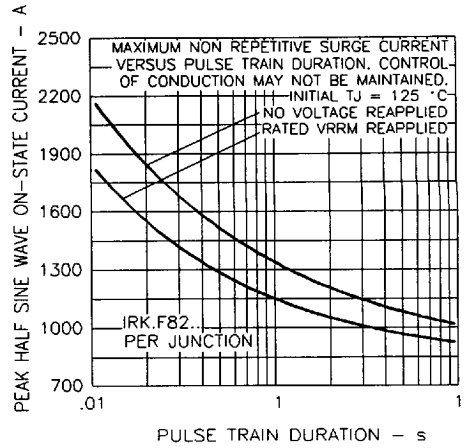


Fig. 6 - Maximum Non-Repetitive Surge Current

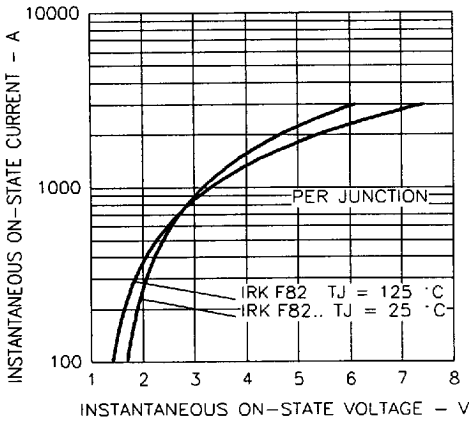


Fig. 7 - On-state Voltage Drop Characteristics

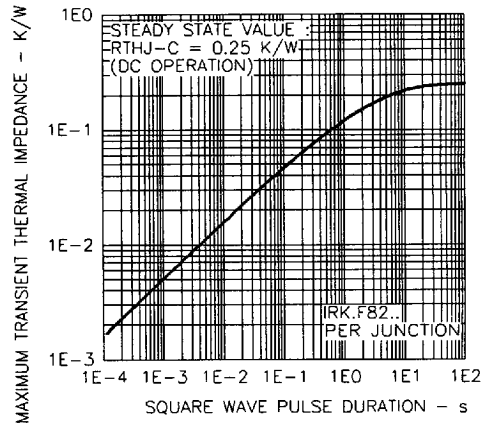


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

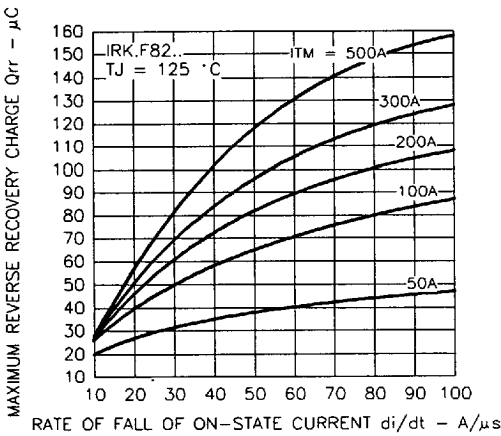


Fig. 9 - Reverse Recovery Charge Characteristics (Thyristor)

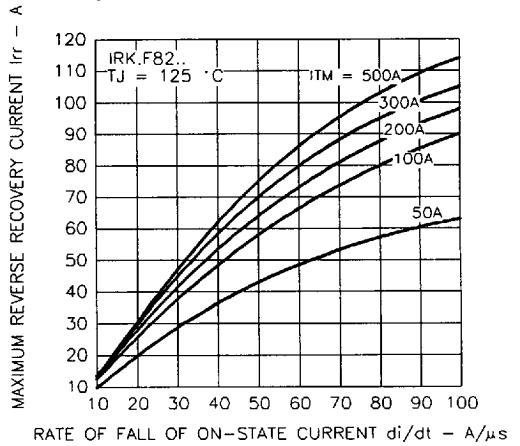


Fig. 10 - Reverse Recovery Current Characteristics (Thyristor)

INTERNATIONAL RECTIFIER GSE D

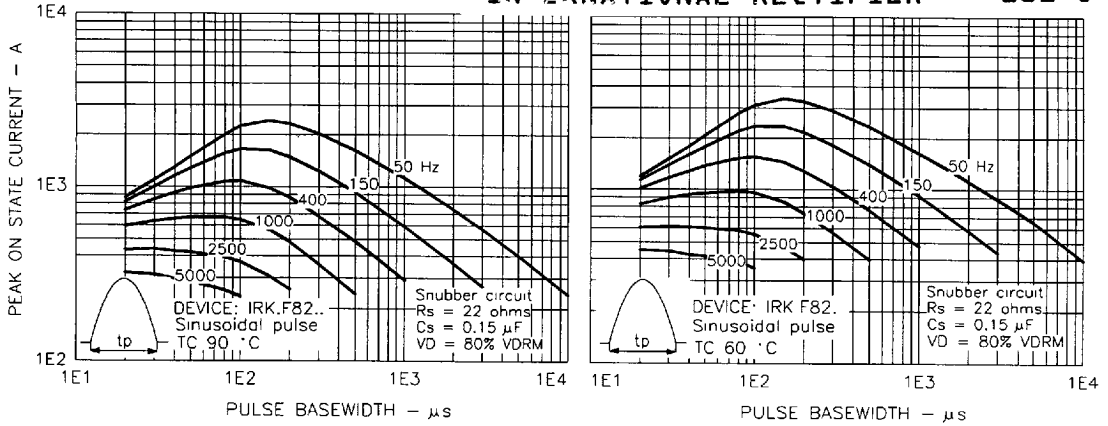


Fig. 11 - Frequency Characteristics

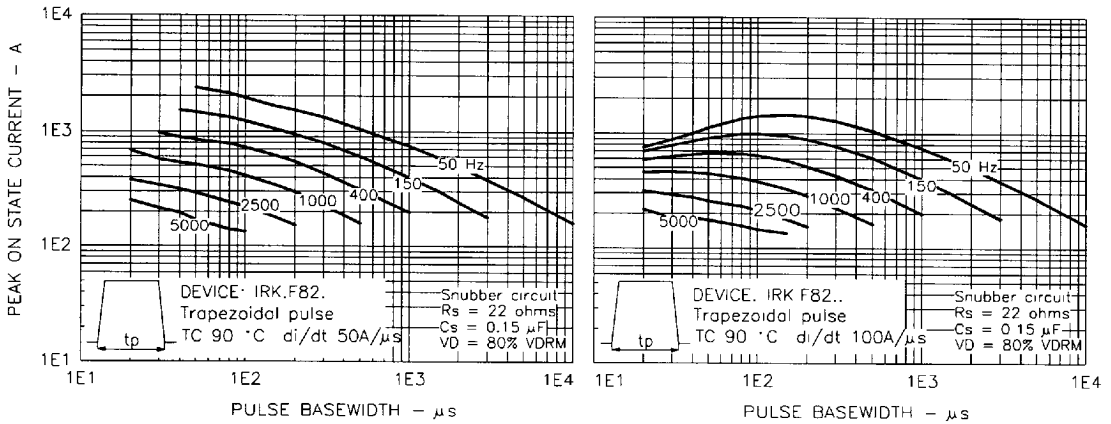


Fig. 12 - Frequency Characteristics

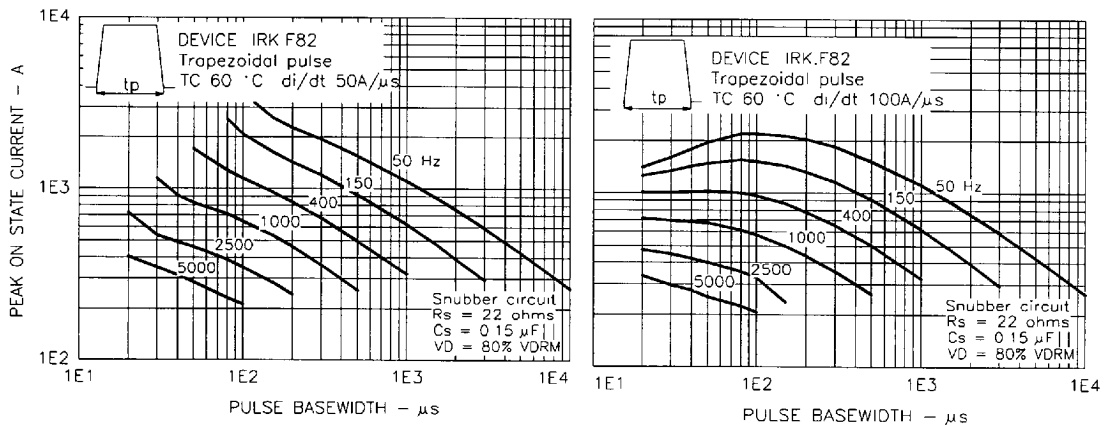


Fig. 13 - Frequency Characteristics

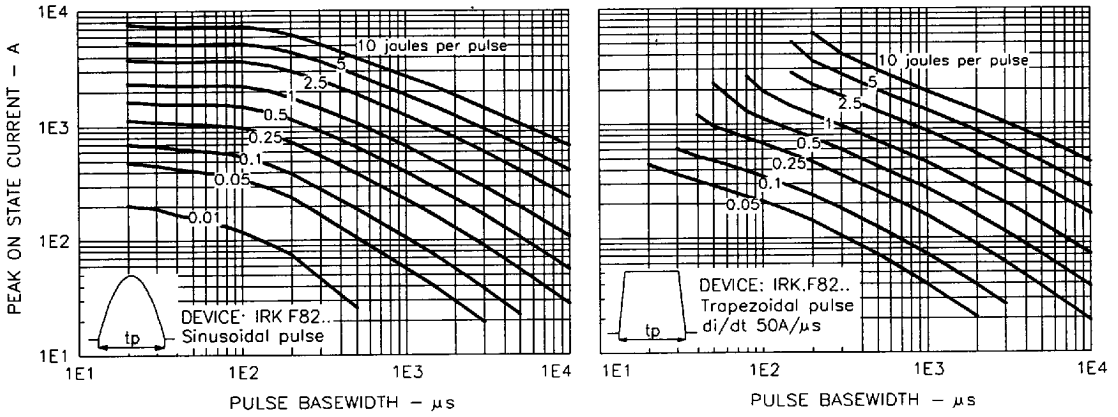


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

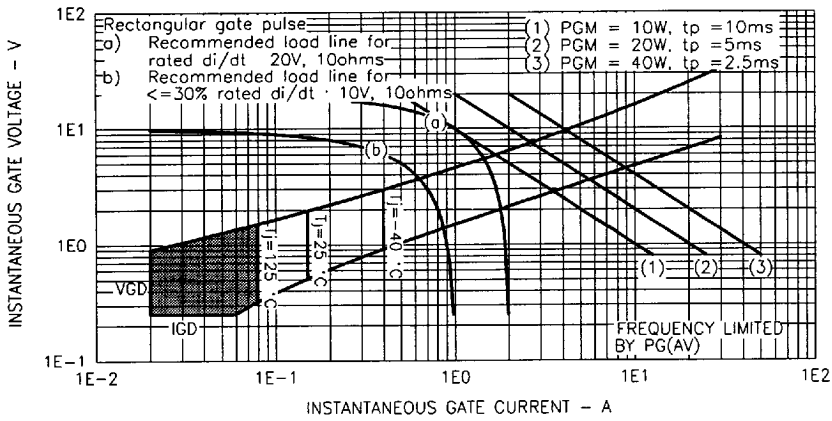


Fig. 15 - Gate Characteristics