Data Sheet No. PD-3.063

T-25-20

INTERNATIONAL RECTIFIER IOR

350PEQ SERIES

520 Amp RMS, ▽DI-VERGENCE* Gate, Hockey Puk, Inverter SCRs

Major Ratings and Characteristics

		350PEQ__W__	Units
$I_{T(RMS)}$		520	A
$I_{T(AV)}$ @ max. T_C		330	A
		70	°C
I_{TSM}	@ 50 Hz	6200	A
	@ 60 Hz	6500	
I^2t	@ 50 Hz	193,000	A^2s
	@ 60 Hz	176,000	
I_{GT}		150	mA
dv/dt		400	V/μs
di/dt		1200	A/μs
t_q (max.) ①		10 – 20	μs
T_J		-40 to 125	°C
V_{DRM}, V_{RRM} Range		500 – 1200	V

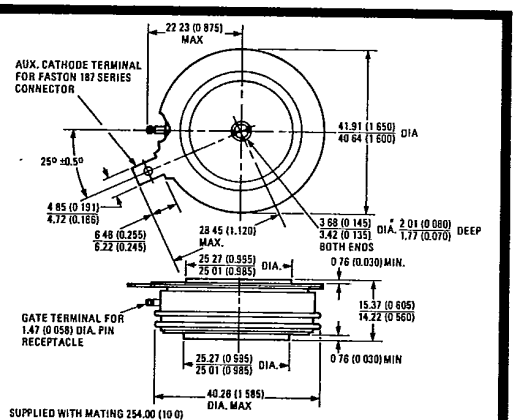
① Refer to the Electrical Specifications Table in this data sheet for specific turn-off times.

Description/Features

The PEQ Series high current, pressure assembled SCRs are designed for power switching at high voltages and high frequencies. The advanced Δ DI-VERGENCE* Gate geometry provides fast turn-on and high di/dt.

- Advanced Δ DI-VERGENCE* Gate geometry provides fast turn-on and high di/dt
- Very low switching losses at high frequency
- Short maximum guaranteed turn-off times
- Available up to 1,800 Volts
- Designed for power switching applications up to 5 KHz

* Divergence is the net outward rate of flow per unit of volume and time of electric charge, in this use.



IR Case Style A-29
Dimensions in Millimeters and (Inches)

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350PEQ Series

VOLTAGE RATINGS (Applied gate voltage zero or negative)

Part Number	V_{RRM} – Max. Repetitive Peak Reverse Voltage (V) T_J = -40°C to 125°C	V_{DRM} – Max. Repetitive Peak Off-State Voltage (V) ② T_J = -40°C to 125°C	V_{RSM} – Max. Non-Repetitive Peak Reverse Voltage (V) ($t_p \leq 5$ ms) T_J = 25°C to 125°C	I_{RM}, I_{DM} – Max. Peak Reverse and Off-State Current (mA) ① ④
350PEQ50W__	500	500	600	20
350PEQ60W__	600	600	700	20
350PEQ70W__	700	700	800	20
350PEQ80W__	800	800	900	20
350PEQ90W__	900	900	1000	20
350PEQ100W_	1000	1000	1100	20
350PEQ110W_	1100	1100	1200	20
350PEQ120W_	1200	1200	1300	20

① Units may be broken over non-repetitively in the off-state direction without damage if di/dt does not exceed 20 A/μs.

① At rated V_{RRM}, V_{DRM}, T_J = 125°C.

④ Zero gate bias voltage, gate open circuited.

ELECTRICAL SPECIFICATIONS

		350PEQ	Units	Conditions
	ON-STATE			
$I_{T(RMS)}$	Nominal RMS on-state current	520	A	–
$I_{T(AV)}$	Max. average on-state current	330	A	Max. T_C = 70°C, 180° half sine wave conduction.
I_{TSM}	Max. peak one cycle, non-repetitive surge current	6200	A	50 Hz half sine wave or 6 ms rectangular pulse — Following any rated load condition, and with rated V_{RRM} applied, SCR turned fully on.
		6500		60 Hz half sine wave or 5 ms rectangular pulse
		7400		50 Hz half sine wave or 6 ms rectangular pulse — Same conditions as above except with V_{RRM} following surge = 0.
		7700		60 Hz half sine wave or 5 ms rectangular pulse
I^2t	Max. I^2t capability for fusing	193,000	A^2s	t = 10 ms — Rated V_{RRM} following surge, initial T_J = 125°C.
		176,000		t = 8.3 ms
I^2t	Max. I^2t capability for individual device fusing	273,000	A^2s	t = 10 ms — V_{RRM} following surge = 0, initial T_J = 125°C.
		249,000		t = 8.3 ms
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ capability for individual device fusing ⑤	2,730,000	$A^2\sqrt{s}$	V_{RRM} following surge = 0, initial T_J = 125°C.
V_{TM}	Max. peak on-state voltage	3.05	V	T_J = 25°C, $I_{T(AV)}$ = 330A (1,037A peak).
I_H	Max. holding current	500	mA	T_C = 25°C, anode supply = 22V, initial I_T = 20A.
	BLOCKING			
dv/dt	Min. critical rate-of-rise of off-state voltage	400	V/μs	T_J = 125°C, exponential to 100% rated V_{DRM}. — Gate open circuited.
		1000		T_J = 125°C, Exponential to 67% rated V_{DRM}.
	SWITCHING			
t_d	Typical delay time	1.0	μs	T_C = 25°C, V_{DM} = rated V_{DRM}, I_T = 50A dc resistive circuit. Gate pulse 10V, 20Ω source, t_p = 6 μs, t_r = 0.5 μs.
di/dt	Max. non-repetitive rate of rise of turned-on current	1200	A/μs	T_C = 125°C, V_{DM} = rated V_{DRM}, I_{TM} = 2,400A, 60 p/s, snubber 0.2 μF, 15Ω. Gate pulse: 20V, 65Ω source, t_p = 6 μs, t_r = 0.5 μs.

⑤ I^2t for time $t_x = I^2\sqrt{t} \cdot \sqrt{t_x}$.

ELECTRICAL SPECIFICATIONS (Continued)

		350PEQ	Units	Conditions
	SWITCHING (Continued)			
t_q	Max. turn-off time without feedback diode 350PEQ _ W10 350PEQ _ W12 350PEQ _ W15 350PEQ _ W20	 10 12 15 20	μs	T_C = 125°C, I_{TM} = 500A, di/dt = -25A/μs, Min. V_R during turn-off interval = 50V, reapplied dv/dt = 400 V/μs linear to 80% of rated V_{DRM}. Gate bias: 0V, 100Ω.
$t_{q(diode)}$	Typical turn-off time with feedback diode 350PEQ _ W10 350PEQ _ W12 350PEQ _ W15 350PEQ _ W20	 11 15 17 22	μs	T_C = 125°C, I_{TM} = 500A, di/dt = -25A/μs, Min. V_R during turn-off interval = 1.5V, reapplied dv/dt = 200 V/μs linear to 80% of rated V_{DRM}. Gate bias: 0V, 100Ω.
Q_{RR}	Typical recovered charge	200	μC	T_J = 125°C, I_{TM} = 1,000A, di/dt = -100 A/μs.
	TRIGGERING			
P_{GM}	Max. peak gate power	100	W	t_p = 5 ms
$P_{G(AV)}$	Max. average gate power	3.0	W	
$+I_{GM}$	Max. peak positive gate current	10	A	
$+V_{GM}$	Max. peak positive gate voltage	40	V	
$-V_{GM}$	Max. peak negative gate voltage	5.0	V	
I_{GT}	Max. required DC gate current to trigger	350	mA	T_C = -40°C; Max. required gate trigger current (or voltage) is the lowest value which will trigger all units with +6V anode-to-cathode.
		150		T_C = 25°C
		100		T_C = 125°C
	Typical DC gate current to trigger	75	mA	T_C = 25°C
V_{GT}	Max. required DC gate voltage to trigger	5.0	V	T_C = -40°C; Max. required gate trigger current (or voltage) is the lowest value which will trigger all units with +6V anode-to-cathode.
		3.0		T_C = 25°C
	Typical DC gate voltage to trigger	1.25	V	T_C = 25°C
V_{GD}	Max. DC gate voltage not to trigger	0.25	V	T_C = 125°C. Max. gate current (or voltage) not to trigger is the maximum value which will not trigger any unit with rated V_{DRM} anode-to-cathode.

THERMAL-MECHANICAL SPECIFICATIONS

T_J	Operating junction temperature range	-40 to 125	°C	
T_{stg}	Storage temperature range	-40 to 150	°C	
R_{thJC}	Max. internal thermal resistance, junction-to-case	0.048	deg. C/W	DC operation, double side cooled.
R_{thCS}	Thermal resistance, case-to-sink	0.040	deg. C/W	One pole piece to one heat dissipator. (Mounting surface smooth, flat and greased.)
F	Mounting force	8,900 ±10% (2,000 ±10%)	N (lbf)	
wt	Approximate weight	85 (3.0)	g (oz.)	
	Case Style	IR A-29		

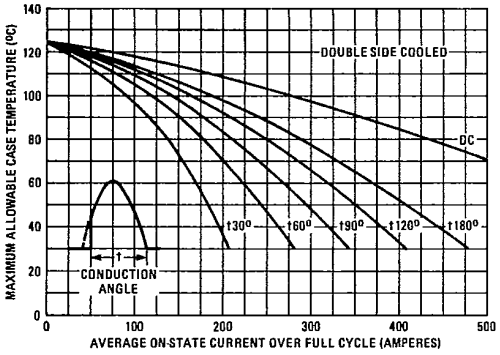

Fig. 1 – Maximum Allowable Case Temperature Vs Average On-State Current (Sinusoidal Current Waveform)

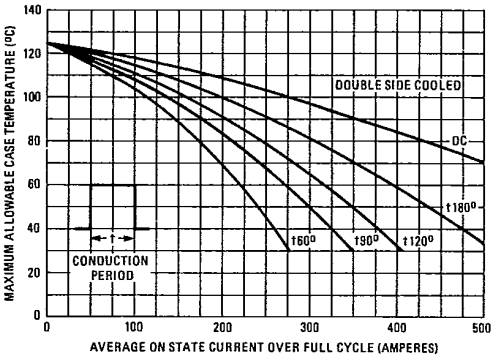

Fig. 2 – Maximum Allowable Case Temperature Vs Average On-State Current (Rectangular Current Waveform)

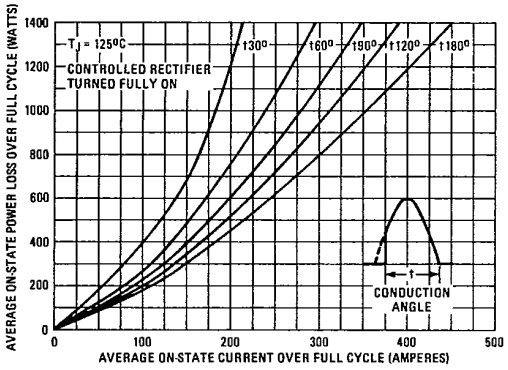

Fig. 3 – Maximum Low-Level On-State Power Loss Vs Average On-State Current (Sinusoidal Current Waveform)

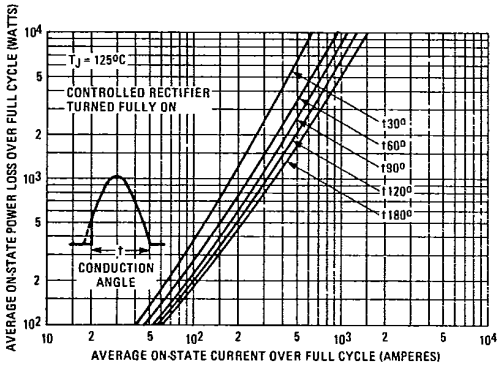

Fig. 4 – Maximum High Level On-State Power Loss Vs Average On-State Current (Sinusoidal Current Waveform)

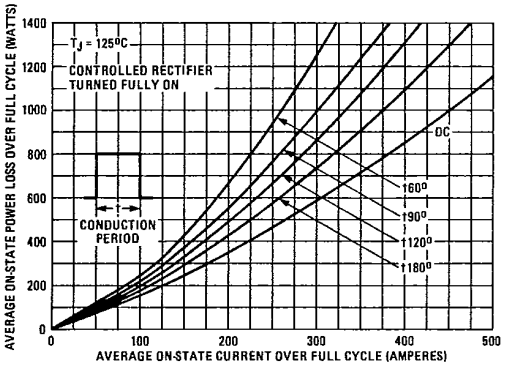

Fig. 5 – Maximum Low-Level On-State Power Loss Vs Average On-State Current (Rectangular Current Waveform)

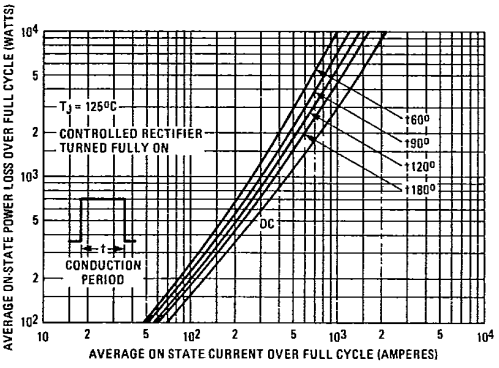

Fig. 6 – Maximum High-Level On-State Power Loss Vs Average On-State Current (Rectangular Current Waveform)

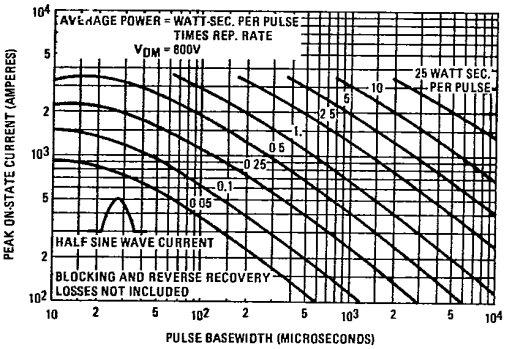

Fig. 7 – Maximum Energy Per Pulse for Half Sine Wave On-State Current

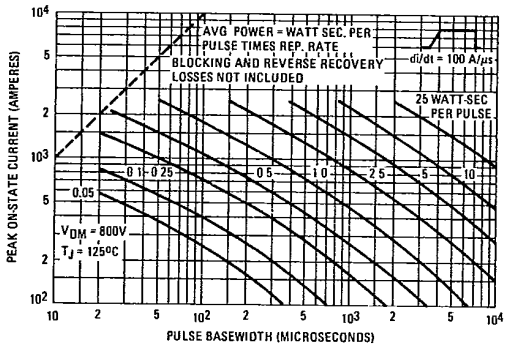

Fig. 8 – Maximum Energy Per Pulse for Trapezoidal On-State Current (di/dt = 100 A/μs)

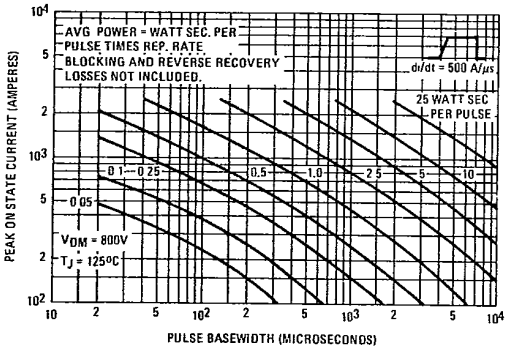

Fig. 9 – Maximum Energy Per Pulse for Trapezoidal On-State Current (di/dt = 500 A/μs)

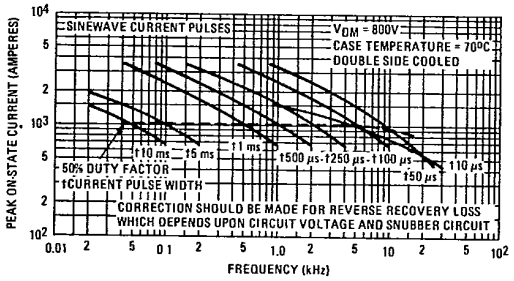

Fig. 10 – Maximum Allowable Peak On-State Current Vs Frequency (Sinewave Current Pulses – di/dt = 100 A/μs)

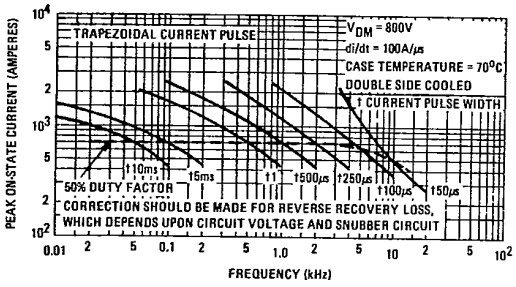

Fig. 11 – Maximum Allowable Peak On-State Current Vs Frequency (Trapezoidal Current Pulses)

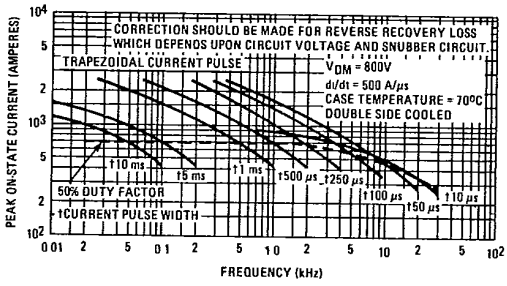

Fig. 12 – Maximum Allowable Peak On-State Current Vs Frequency (Trapezoidal Current Pulses – di/dt = 500 A/μs)

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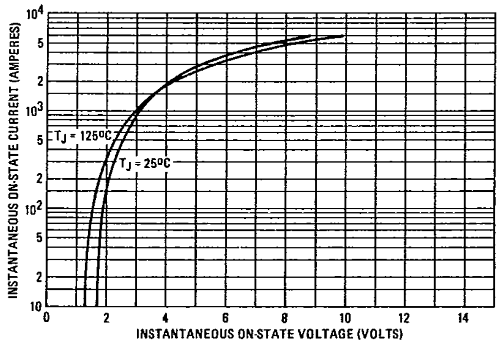

Fig. 13 — Maximum Instantaneous On-State Voltage Vs Instantaneous On-State Current

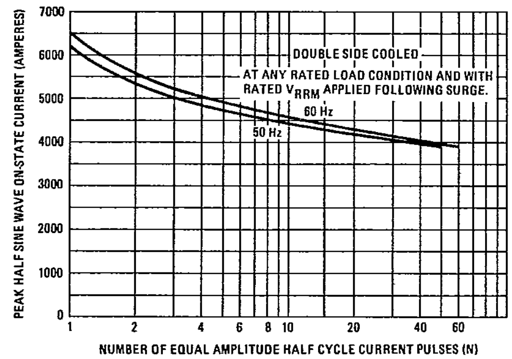

Fig. 14 — Maximum Non-Repetitive Surge Current Vs Number of Current Pulses

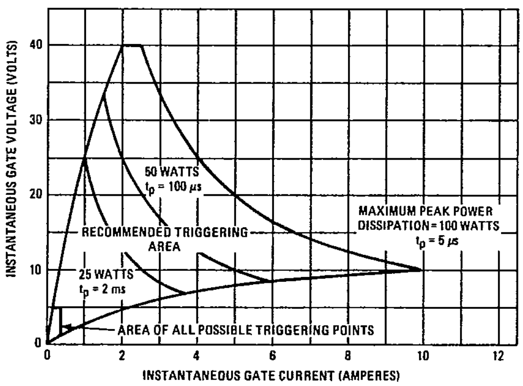

Fig. 15 — Gate Characteristics

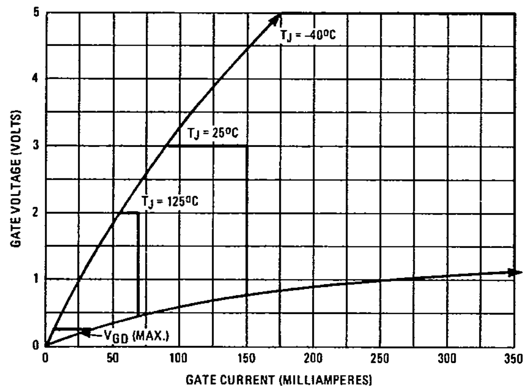

Fig. 15A — Areas of All Possible Triggering Points

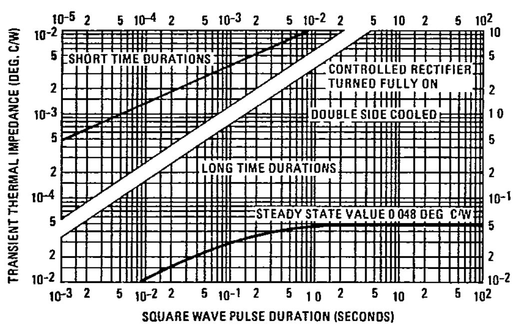

Fig. 16 — Transient Thermal Impedance, Junction-to-Case, Vs Square Wave Pulse Duration

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