Data Sheet No. PD-3.086

INTERNATIONAL RECTIFIER IOR

150 PFT SERIES

800A I_{TGQ} Gate Turn-Off Hockey Puk SCRs

Major Ratings and Characteristics

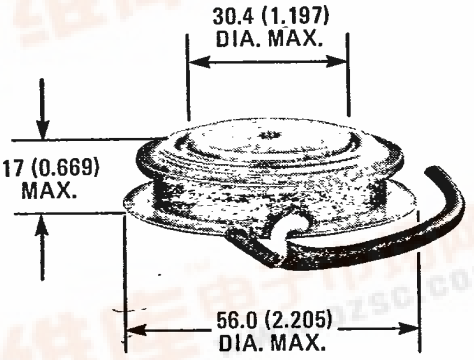
	150PFT200 150PFT250	Units
I_{TGQ}	800	A
$I_{T(RMS)}$	235	A
$I_{T(AV)}$	150	A
@ Max. T_C	81	°C
I_{TSM} @ 50 Hz	2000	A
@ 60 Hz	2100	
I^2t @ 50 Hz	20,000	A^2s
@ 60 Hz	18,000	
I_{GT}	1.5	A
dv/dt	1000	V/μs
di/dt	500	A/μs
t_{gq}	15	μs
T_J	-40 to 125	°C
V_{RRM}, V_{DRM}	2000 & 2500	V

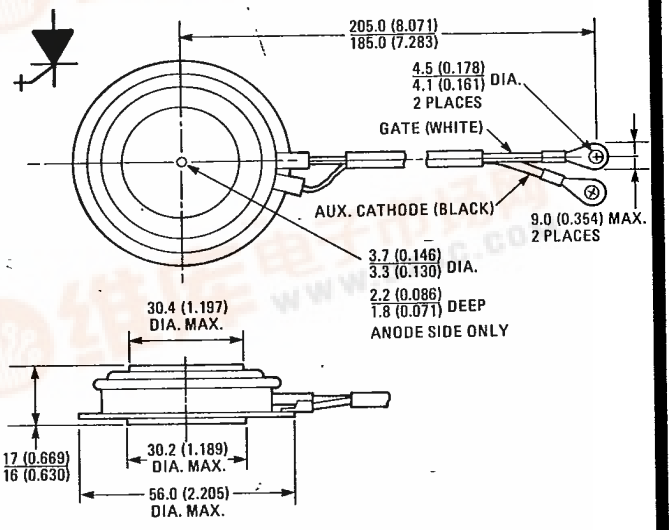
Description/Features

The 150PFT Series of GTO (gate turn-off) thyristors is designed for power control applications such as uninterruptible power supplies (UPS), variable speed ac motor drives, etc. Since they can be turned off by a negative current pulse to the gate, devices in the 150PFT Series allow reductions in overall size, weight, cost and acoustical noise when compared to conventional thyristors that require bulky commutating circuits.

- 150A average current.
- 800A controllable on-state current.
- Maximum turn-off time of 15 μsec.
- Critical dv/dt of 1000 V/μsec.
- Available with maximum repetitive peak off-state voltage (V_{DRM}) to 2500V.

CASE STYLE AND DIMENSIONS





IR Case Style A-30
Dimensions in Millimeters and (Inches)

150PFT Series

VOLTAGE RATINGS

Part Number	V_{RRM}, V_{DRM} – Max. Repetitive Peak Reverse and Off-State Voltage (V) T_J = –40°C to 125°C	V_{DSM} – Max. Non-Repetitive Peak Off-State Voltage $t_p \leqslant 5$ ms (V) T_J = 25°C to 125°C	V_{RSM} – Max. Non-Repetitive Peak Reverse Voltage $t_p \leqslant 5$ ms (V) T_J = 25°C to 125°C
150PFT200	2000	2200	2200
150PFT250	2500	2500	2750

ELECTRICAL SPECIFICATIONS

		150PFT200 150PFT250	Units	Conditions
	ON-STATE			
$I_{T(RMS)}$	Nominal RMS on-state current	235	A	
$I_{T(AV)}$	Max. average on-state current	150	A	
	@ Max. T_C	81	°C	180° sinusoidal conduction.
I_{TGQ}	Max. controllable peak on-state current	800	A	T_J = 125°C, V_{DM} = 0.5 V_{DRM}, G_{GQ} = 5.0, C_S = 2 μF. (2) Note: $V_S \leqslant$ 500V @ T_J = 25°C, $V_S \leqslant$ 450V @ T_J = 125°C (V_S is the voltage spike which appears on the dynamic on-state voltage trace during fall time.)
I_{TSM}	Max. peak one cycle, non-repetitive surge current	2000 2100	A	50 Hz half cycle sine wave or 6 ms rectangular pulse 60 Hz half cycle sine wave or 5 ms rectangular pulse Following any rated load condition, and with rated V_{RRM} applied following surge. SCR turned fully on.
I^2t	Max. I^2t capability for fusing	20,000 18,000	A^2s	t = 10 ms t = 8.3 ms Rated V_{RRM} applied following surge, initial $T_J \leqslant$ 125°C.
V_{TM}	Max. peak on-state voltage	3.20	V	T_J = 25°C, I_T(AV) = 150A (471A peak), I_G = 3A
I_L	Typical latching current	20	A	T_J = 25°C
I_H	Typical holding current	20	A	T_J = 25°C
	BLOCKING			
dv/dt	Min. critical rate-of-rise of off-state voltage	1000 600	V/μs	Gate voltage = –2V Gate-to-cathode resistance = 3Ω T_J = 125°C V_D = 0.5 V_{DRM}
I_{DM} & I_{RM}	Max. peak off-state and reverse current	80	mA	T_J = 125°C, V_{DM} = rated V_{DRM}. Peak off-state current applies for –2V or more negative gate voltage or for gate-to-cathode resistance = 3Ω.
	SWITCHING			
di/dt	Max. repetitive rate-of-rise of turned-on current	500	A/μs	$di_G/dt \geqslant$ 5 A/μs, $+I_{GM} \geqslant$ 7.5A $I_{TM} \leqslant$ 800A, $V_D \leqslant$ 0.5 V_{DRM}.
t_{gt}	Max. turn-on time	10	μs	t_{gt} is measured from instant at which i_G = 0.1I_{GM} to instant at which V_D = 0.1V_D with resistive load. T_J = 125°C, I_T = 800A, $+I_{GM}$ = 7.5A, $di/di_G/dt$ = 5 A/μs, V_D = 0.5 V_{DRM}.
t_{on}	Min. permissible on-time	20	μs	t_{on} is the time necessary to ensure that all cathode islands are in conduction. T_J = 125°C, I_T = 800A, V_D = 0.5 V_{DRM}, I_{GM} = 7.5A, di_G/dt = 5 A/μs
t_{gq}	Max. gate-controlled turn-off time	15	μs	t_{gq} is measured from instant at which I_G = –16A to instant at which I_T = 80A with resistive load. T_J = 125°C, I_T = 800A, V_D = 0.5 V_{DRM}, di_G/dt = 50 A/μs, G_{GQ} = 5. (2)
t_f	Max. fall time	1.5	μs	t_f is measured from instant at which I_T = 720A to instant at which I_T = 80A with resistive load. T_J = 125°C, I_T = 800A, V_D = 0.5 V_{DRM}, di_G/dt = 50 A/μs, G_{GQ} = 5. (2)
t_{off}	Min. permissible off-time	60	μs	t_{off} is measured from the instant at which the turn-off pulse is applied to the gate to the earliest instant at which the GTO may be retriggered. T_J = 125°C, I_T = 800A, di_G/dt = 50 A/μs, G_{GQ} = 5. (2)

(1) Peak off-state voltages apply for -2V or more negative gate voltage, or for gate-to-cathode resistance = 3Ω. Peak reverse voltages apply for zero or negative gate voltage.

(2) $G_{GQ} = \frac{I_T}{\text{applied } I_{GQ}}$ = forced turn-off gain. I_T = on-state current. Applied I_{GQ} = maximum negative gate current during turn-off interval.

IOR INTERNATIONAL RECTIFIER

ELECTRICAL SPECIFICATIONS (Continued)

		150PFT200 150PFT250	Units	Conditions
	TRIGGERING			
$P_{GF(AV)}$	Max. average forward gate power	15	W	Forward gate power is produced by positive gate current, reverse gate power is produced by negative gate current.
P_{GRM}	Max. peak reverse gate power	12,000	W	$t_p \leq 5\ \mu s.$
$P_{GR(AV)}$	Max. average reverse gate power	40	W	
$+I_{GM}$	Max. peak positive gate current	100	A	$t_p \leq 100\ \mu s.$ Positive gate current may not be applied during reverse recovery interval.
$-I_{GM}$	Max. peak negative gate current	50	mA	$T_J = 125^oC$, $-V_{GM}$ = rated $-V_{GRM}$, SCR blocking.
$-V_{GRM}$	Max. repetitive peak negative gate voltage	18	V	SCR blocking.
I_{GT}	Max. required DC gate current to trigger	3.3	A	$T_C = -40^oC$ — Max. required gate trigger current is the lowest value which will trigger all units with +12 volts anode-to-cathode and I_T = 50A after triggering.
		1.5		$T_C = 25^oC$
		0.5		$T_C = 125^oC$
V_{GT}	Max. required DC gate voltage to trigger	1.25	V	$T_C = -40^oC$ — Max. required gate trigger voltage is the lowest value which will trigger all units with +12 volts anode-to-cathode and I_T = 50A after triggering.
		1.0		$T_C = 25^oC$

THERMAL-MECHANICAL SPECIFICATIONS

T_J	Junction operating temperature range	-40 to 125	^oC	
T_{stg}	Storage temperature range	-40 to 125	^oC	
R_{thJC}	Max. internal thermal resistance, junction-to-case	0.075	deg. C/W	DC operation; double side cooled, mounting force = 4900N (1100 lbf).
R_{thCS}	Thermal resistance, case-to-sink	0.035	deg. C/W	Mounting surface smooth, flat and greased. flat and greased. One pole piece to one heat sink.
F	Mounting force	4900 to 5900 (1100 to 1325)	N (lbf)	
wt	Approximate weight	140 (5)	g (oz.)	
	Case Style	A-30		

② $G_{GQ} = \dfrac{I_T}{\text{applied } I_{GQ}}$ = forced turn-off gain. I_T = on-state current. Applied I_{GQ} = maximum negative gate current during turn-off interval.

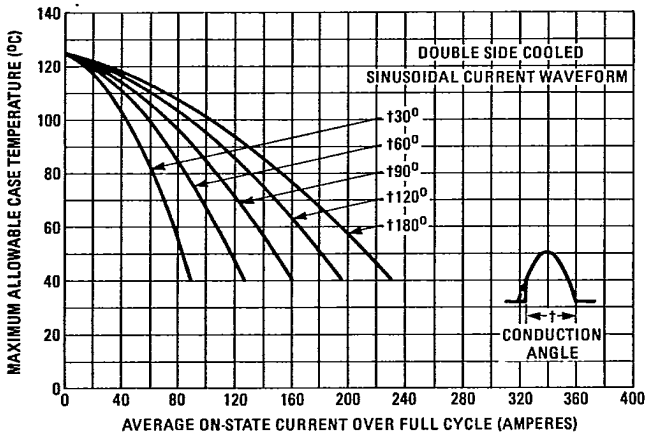


Fig. 1 — Maximum Allowable Case Temperature Vs. On-State Current

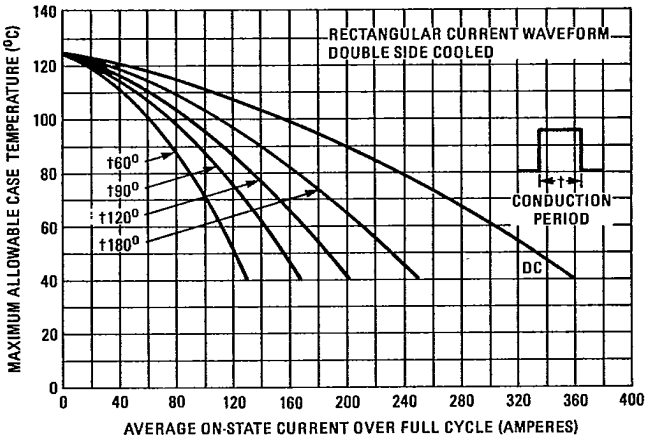


Fig. 2 — Maximum Allowable Case Temperature Vs. On-State Current

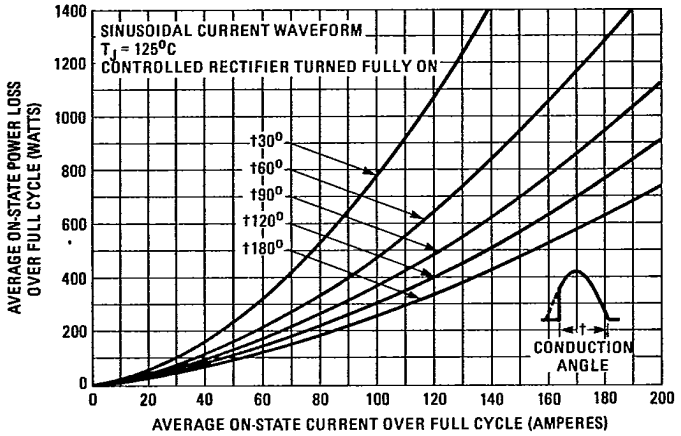


Fig. 3 — Maximum Low-Level On-State Power Loss Vs. Average On-State Current

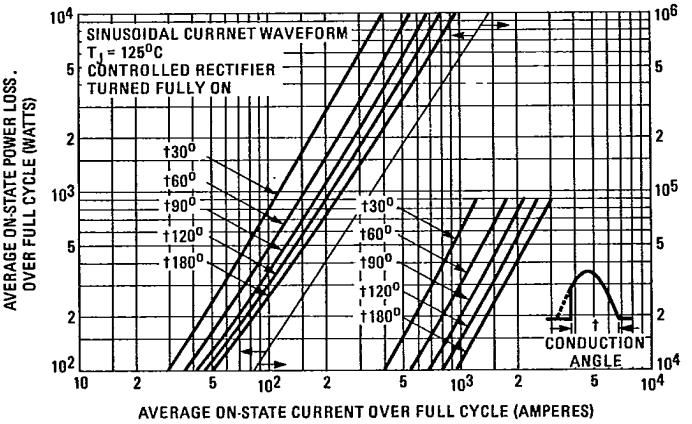


Fig. 4 — Maximum High-Level On-State Power Loss Vs. Average On-State Current

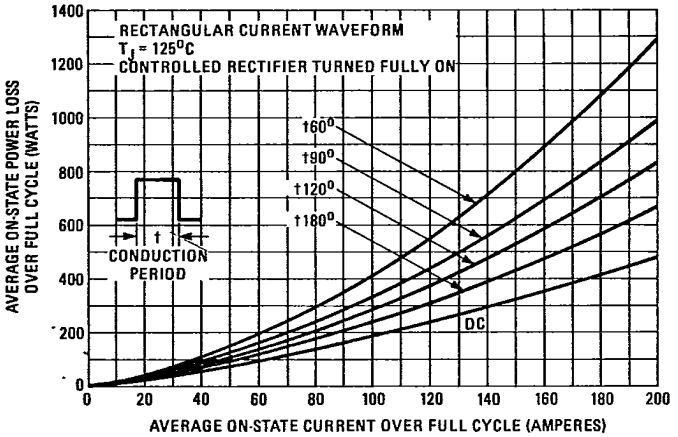


Fig. 5 — Maximum Low-Level On-State Power Loss Vs. Average On-State Current

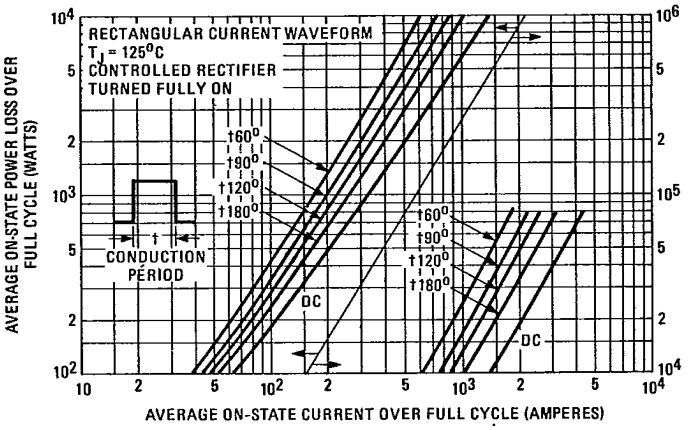


Fig. 6 — Maximum High-level On-State Power Loss Vs. Average On-State Current

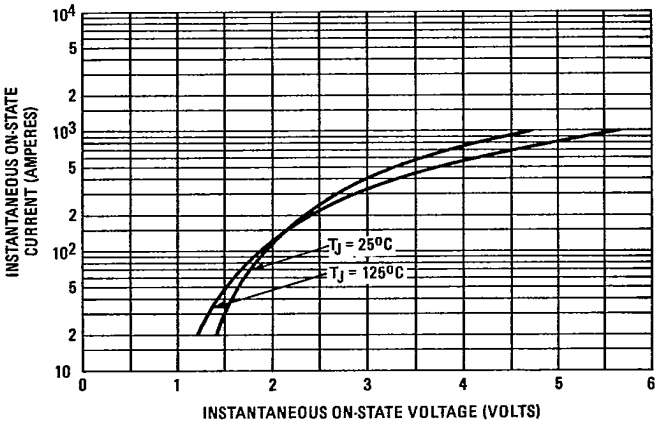


Fig. 7 — Maximum Instantaneous On-State Voltage Vs. Instantaneous On-State Current

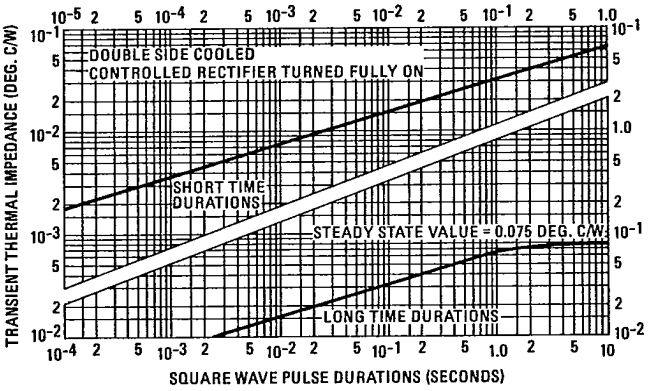


Fig 8 — Maximum Transient Thermal Impedance, Junction-to-Case Vs. Square Wave Pulse Duration

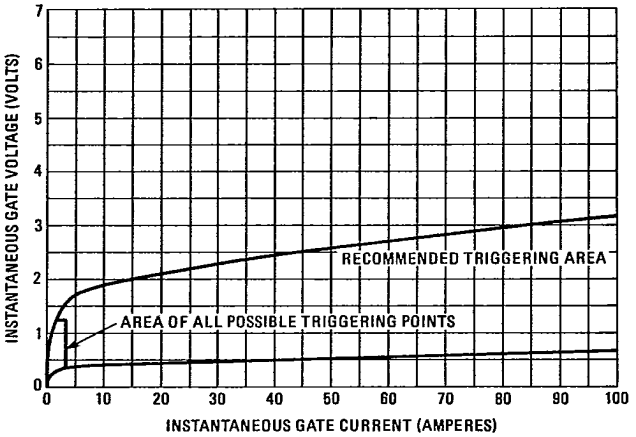


Fig. 9 — Gate Characteristics

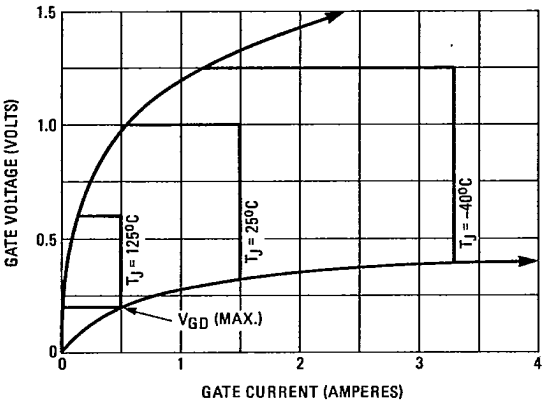


Fig. 9a — Areas of All Possible Triggering Points

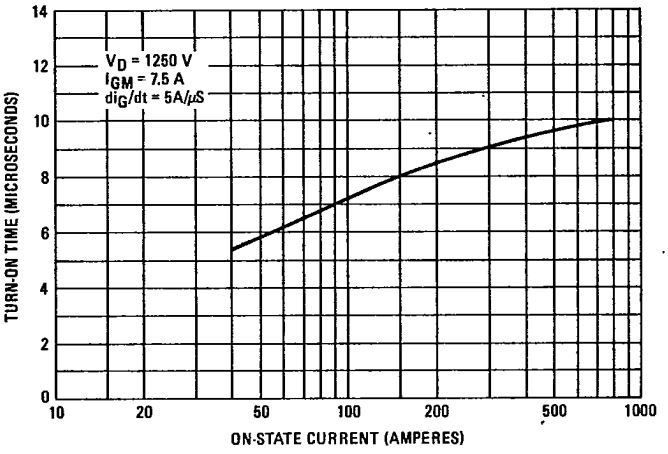


Fig. 10 — Turn-On Time Vs. On-State Current

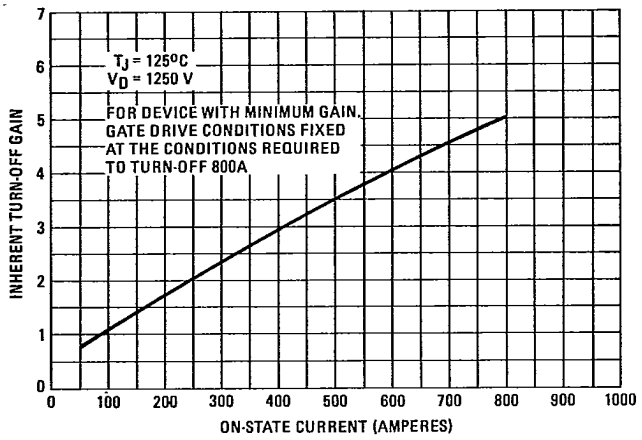


Fig. 11 — Inherent Turn-Off Gain Vs. Instantaneous On-State Current

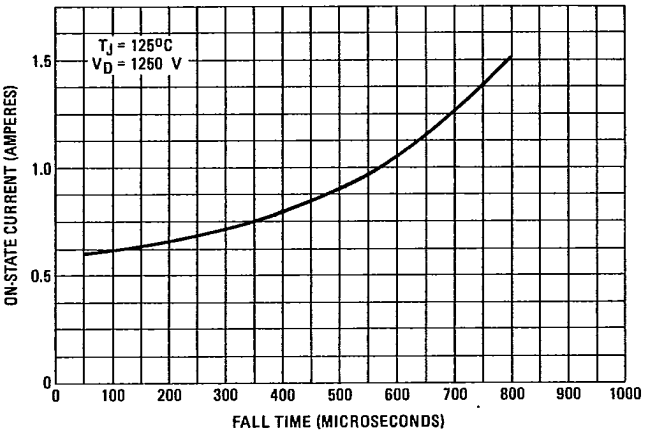


Fig. 12 — Maximum Fall-Time Vs. On-State Current

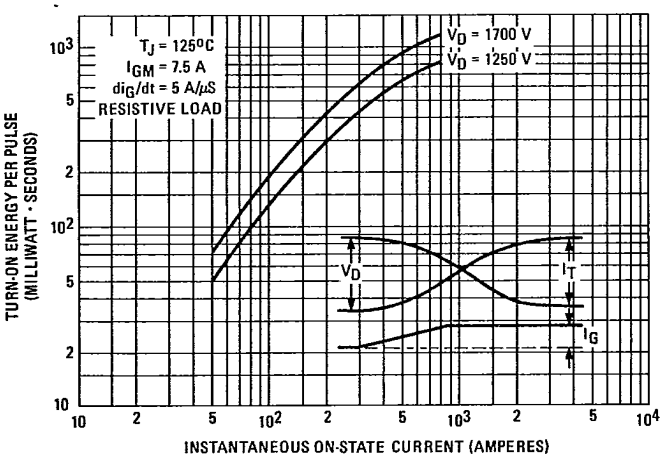


Fig. 13 — Maximum Turn-On Energy Per Pulse Vs. On-State Current

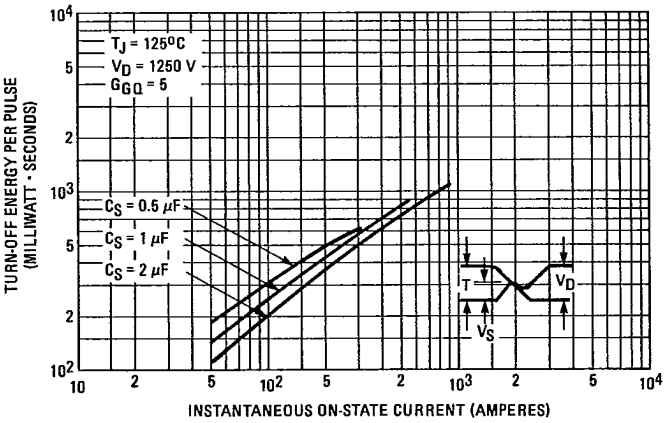


Fig. 14 — Maximum Turn-Off Energy Per Pulse Vs. On-State Current

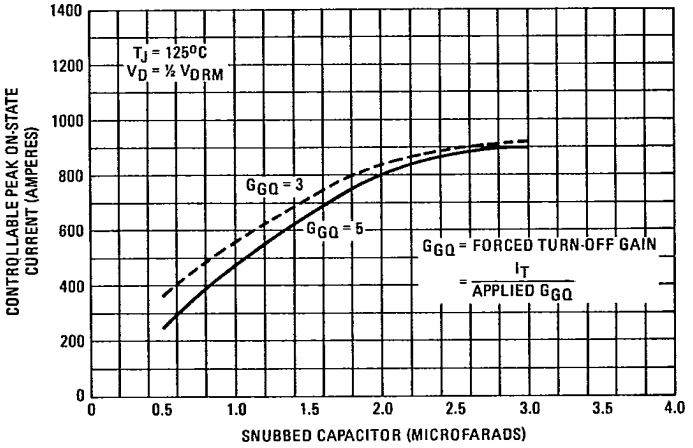


Fig. 15 — Maximum Controllable Peak On-State Current Vs. Snubber Capacitor Value

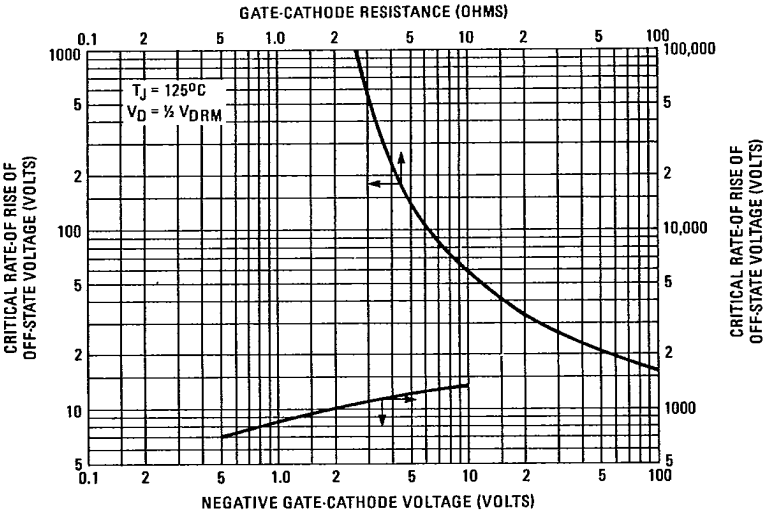


Fig. 16 — Minimum Critical Rate-of-Rise of Off-State Voltage Vs. Negative Gate-Cathode Voltage and Vs. Gate-Cathode Resistance

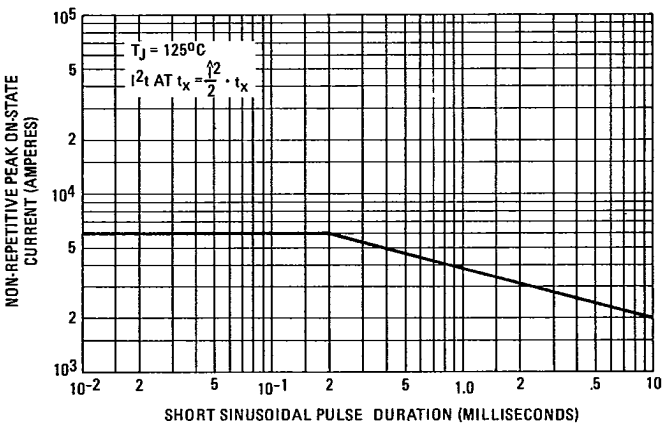
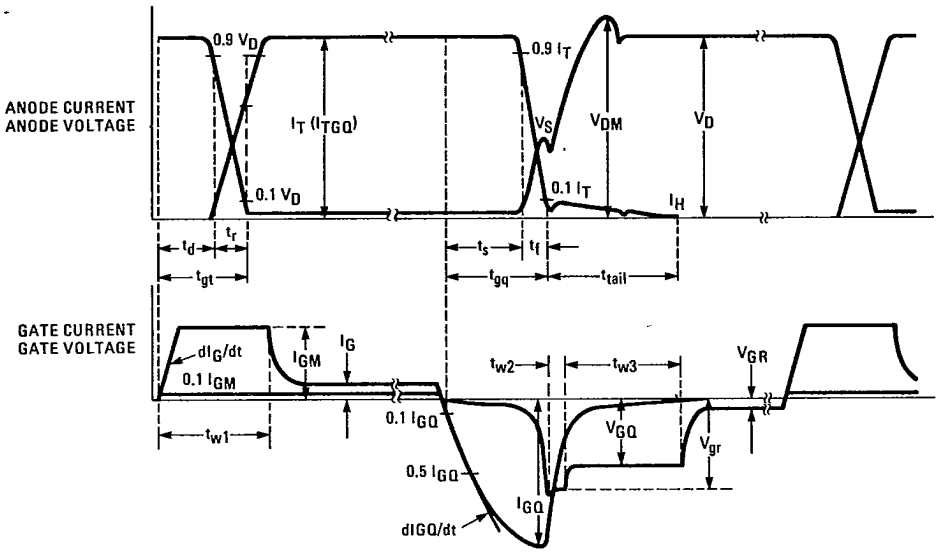


Fig. 17 — Non-Repetitive Peak On-State Current for Sinusoidal Pulse

RECOMMENDED GATING CONDITIONS



$I_{GM} \geq 9.5A^*$
$dIG/dt \geq 5\ A/\mu s$
$I_G \geq 1.9A^*$
$t_{w1} \geq 20\ \mu s$

$I_{GQ} \geq I_{TGQ}/5$
$diGQ/dt \geq 30\ A/\mu s$
$V_{GQ} = 12 \sim 18V$
$V_{GR} = 2 \sim 18V$

V_{gr}: AVALANCHE VOLTAGE OF G-K JUNCTION
$t_{w2} \leq 5\ \mu s$
$t_{w3} \geq 40\ \mu s$
$t_{w2} + t_{w3} \geq 45\ \mu s$

*ASSUMED DEVICE OPERATED DOWN TO -10°C.

Fig. 18 — Recommended Gating Conditions

SNUBBER CAPACITOR Cs (μF)	SNUBBER RESISTOR Rs (Ω)	MINIMUM ON-TIME (μs)
3	20	150
	10	90
2	20	100
	10	60
1	20	50
	10	30
0.5	20	25
	10	15