

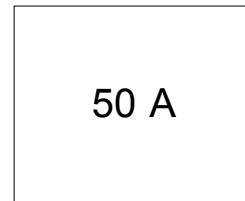
50RIA SERIES

MEDIUM POWER THYRISTORS

Stud Version

Features

- High current rating
- Excellent dynamic characteristics
- $dv/dt = 1000V/\mu s$ option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to 1600V V_{DRM}/V_{RRM}

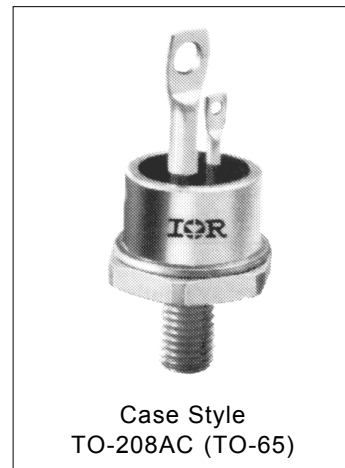


Typical Applications

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements

Major Ratings and Characteristics

Parameters	50RIA		Units
	10 to 120	140 to 160	
$I_{T(AV)}$	50	50	A
@ T_C	94	90	°C
$I_{T(RMS)}$	80	80	A
I_{TSM}			
@ 50Hz	1430	1200	A
@ 60Hz	1490	1257	A
I^2t			
@ 50Hz	10.18	7.21	KA ² s
@ 60Hz	9.30	6.58	KA ² s
V_{DRM}/V_{RRM}	100 to 1200	1400 to 1600	V
t_q typical	110		μs
T_J	- 40 to 125		°C



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E E T R I A S P E C I F I C A T I O N S

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM} , max. repetitive peak and off-state voltage (1) V	V_{RSM} , maximum non-repetitive peak voltage (2) V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
50RIA	10	100	150	15
	20	200	300	
	40	400	500	
	60	600	700	
	80	800	900	
	100	1000	1100	
	120	1200	1300	
	140	1400	1500	
	160	1600	1700	

(1) Units may be broken over non-repetitively in the off-state direction without damage, if di/dt does not exceed 20A/ μ s

(2) For voltage pulses with $t_p \leq 5$ ms

On-state Conduction

Parameter	50RIA		Units	Conditions		
	10 to 120	140 to 160				
$I_{T(AV)}$ Max. average on-state current @ Case temperature	50	50	A	180° sinusoidal conduction		
	94	90	°C			
$I_{T(RMS)}$ Max. RMS on-state current	80	80	A			
I_{TSM} Max. peak, one-cycle non-repetitive surge current	1430	1200	A	t = 10ms	No voltage	Sinusoidal half wave, Initial $T_J = T_J$ max.
	1490	1257		t = 8.3ms	reapplied	
	1200	1010		t = 10ms	100% V_{RRM}	
	1255	1057		t = 8.3ms	reapplied	
I^2t Maximum I^2t for fusing	10.18	7.21	KA ² s	t = 10ms	No voltage	
	9.30	6.58		t = 8.3ms	reapplied	
	7.20	5.10		t = 10ms	100% V_{RRM}	
	6.56	4.65		t = 8.3ms	reapplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	101.8	72.1	KA ² \sqrt{s}	t = 0.1 to 10ms, no voltage reapplied, $T_J = T_J$ max.		
$V_{T(TO)1}$ Low level value of threshold voltage	0.94	1.02	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
$V_{T(TO)2}$ High level value of threshold voltage	1.08	1.17		$(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{T1} Low level value of on-state slope resistance	4.08	4.78	m Ω	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{T2} High level value of on-state slope resistance	3.34	3.97		$(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
V_{TM} Max. on-state voltage	1.60	1.78	V	$I_{pk} = 157$ A, $T_J = 25^\circ\text{C}$		
I_H Maximum holding current	200		mA	$T_J = 25^\circ\text{C}$. Anode supply 22V, resistive load, Initial $I_T = 2$ A		
I_L Latching current	400			Anode supply 6V, resistive load		

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Switching

Parameter	50RIA	Units	Conditions
di/dt Max. rate of rise of turned-on current $V_{DRM} \leq 600V$ $V_{DRM} \leq 1600V$	200 100	A/ μs	$T_C = 125^\circ C$, $V_{DM} = \text{rated } V_{DRM}$ Gate pulse = 20V, 15 Ω , $t_p = 6\mu s$, $t_r = 0.1\mu s$ max. $I_{TM} = (2x \text{ rated } di/dt) A$
t_d Typical delay time	0.9	μs	$T_C = 25^\circ C$ $V_{DM} = \text{rated } V_{DRM}$ $I_{TM} = 10A$ dc resistive circuit Gate pulse = 10V, 15 Ω source, $t_p = 20\mu s$
t_q Typical turn-off time	110		$T_C = 125^\circ C$, $I_{TM} = 50A$, reapplied $dv/dt = 20V/\mu s$ $dir/dt = -10A/\mu s$, $V_R=50V$

Blocking

Parameter	50RIA	Units	Conditions
dv/dt Max. critical rate of rise of off-state voltage	200	$V/\mu s$	$T_J = T_J \text{ max. linear to } 100\% \text{ rated } V_{DRM}$
	500 (*)		$T_J = T_J \text{ max. linear to } 67\% \text{ rated } V_{DRM}$

(*) Available with $dv/dt = 1000V/\mu s$, to complete code add S90 i.e. 50RIA160S90.

Triggering

Parameter	50RIA	Units	Conditions
P_{GM} Maximum peak gate power	10	W	$T_J = T_J \text{ max, } t_p \leq 5ms$
$P_{G(AV)}$ Maximum average gate power	2.5		
I_{GM} Max. peak positive gate current	2.5	A	
$+V_{GM}$ Maximum peak positive gate voltage	20	V	
$-V_{GM}$ Maximum peak negative gate voltage	10		
I_{GT} DC gate current required to trigger	250	mA	Max. required gate trigger current/voltage are the lowest value which will trigger all units 6V anode-to-cathode applied
	100		
	50		
V_{GT} DC gate voltage required to trigger	3.5	V	$T_J = -40^\circ C$ $T_J = 25^\circ C$
	2.5		
I_{GD} DC gate current not to trigger	5.0	mA	$T_J = T_J \text{ max}$ $V_{DRM} = \text{rated voltage}$ Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V_{DRM} anode-to-cathode applied
V_{GD} DC gate voltage not to trigger	0.2	V	$T_J = T_J \text{ max}$

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Thermal and Mechanical Specification

Parameter	50RIA	Units	Conditions
T_J Max. operating temperature range	- 40 to 125	°C	
T_{stg} Max. storage temperature range	- 40 to 125	°C	
R_{thJC} Max. thermal resistance, junction to case	0.35	K/W	DC operation
R_{thCS} Max. thermal resistance, case to heatsink	0.25	K/W	Mounting surface, smooth, flat and greased
T Mounting torque	Min. 2.8 (25)	Nm	Non-lubricated threads
	Max. 3.4 (30)	(lbf-in)	
wt Approximate weight	28 (1.0)	g (oz)	
Case style	TO-208AC (TO-65)		See Outline Table

ΔR_{thJC} Conduction

(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°	0.078	0.057	K/W	$T_J = T_J \text{ max.}$
120°	0.094	0.098		
90°	0.120	0.130		
60°	0.176	0.183		
30°	0.294	0.296		

Ordering Information Table

<p>Device code</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 2px;">50</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 2px;">RIA</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 2px;">0</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 2px;">S</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 2px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">M</div> </div> <div style="display: flex; justify-content: center; margin-top: 5px;"> <div style="text-align: center; margin-right: 10px;">①</div> <div style="text-align: center; margin-right: 10px;">②</div> <div style="text-align: center; margin-right: 10px;">③</div> <div style="text-align: center; margin-right: 10px;">④</div> <div style="text-align: center;">⑤</div> </div>	
<p>■ - Current code</p> <p>■ - Essential part number</p> <p>■ - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)</p> <p>■ - Critical dv/dt: None = 500V/μs (Standard value) S90 = 1000V/μs (Special selection)</p> <p>5 - None = Stud base TO-208AC (TO-65) 1/4" 28UNF-2A M = Stud base TO-208AC (TO-65) M6 X 1</p>	

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Outline Table

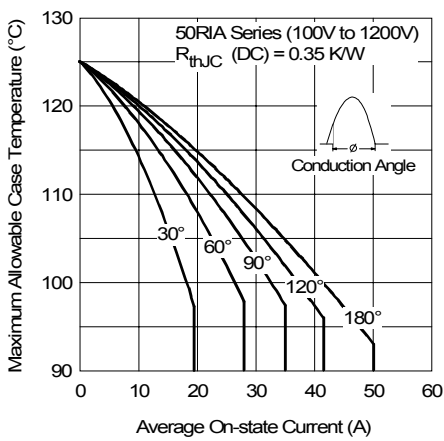
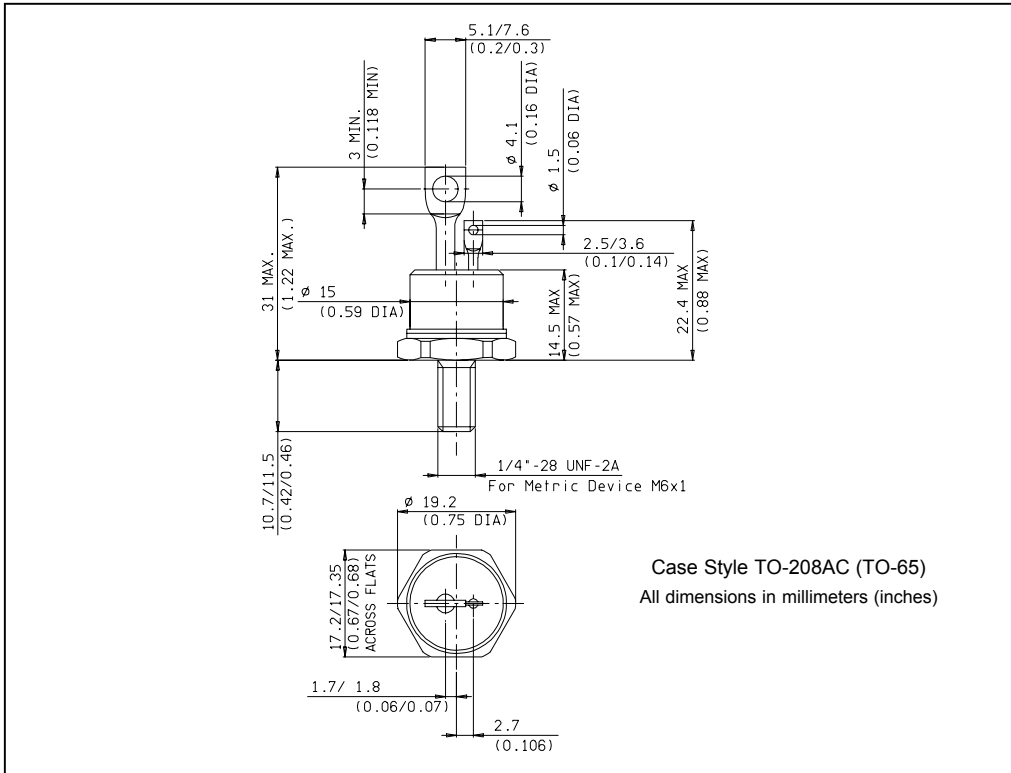


Fig. 1 - Current Ratings Characteristic

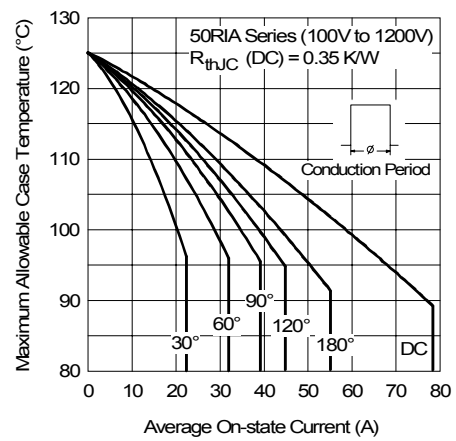


Fig. 2 - Current Ratings Characteristic

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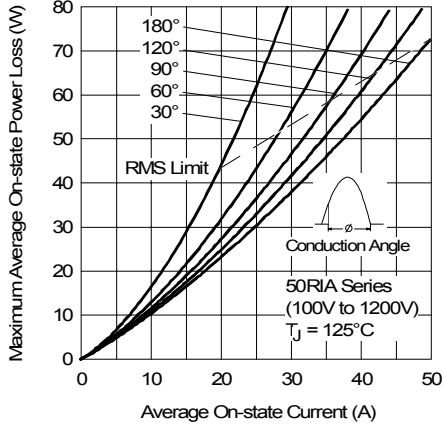


Fig. 3 - On-state Power Loss Characteristics

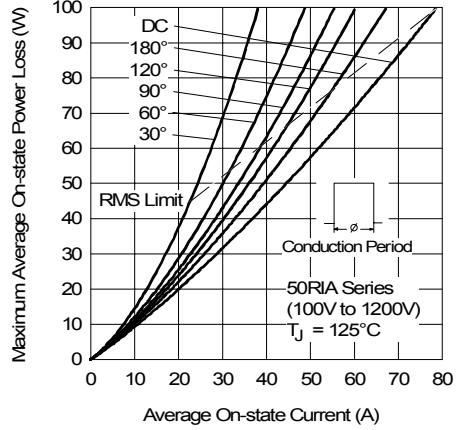


Fig. 4 - On-state Power Loss Characteristics

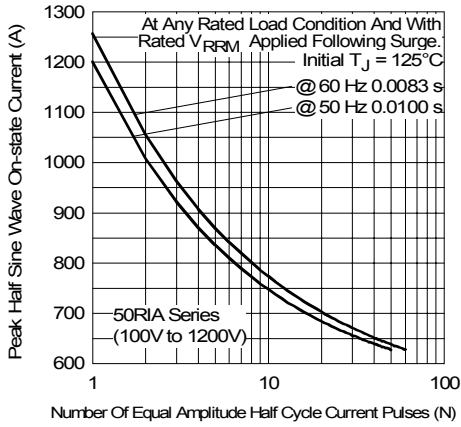


Fig. 5 - Maximum Non-Repetitive Surge Current

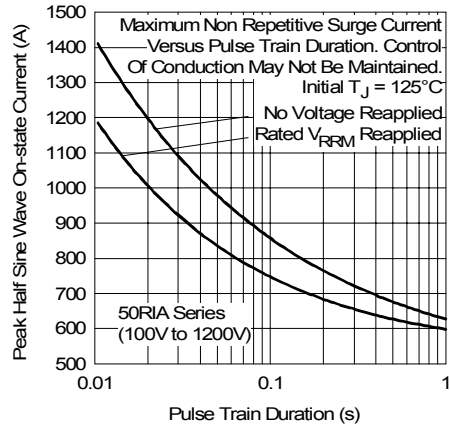


Fig. 6 - Maximum Non-Repetitive Surge Current

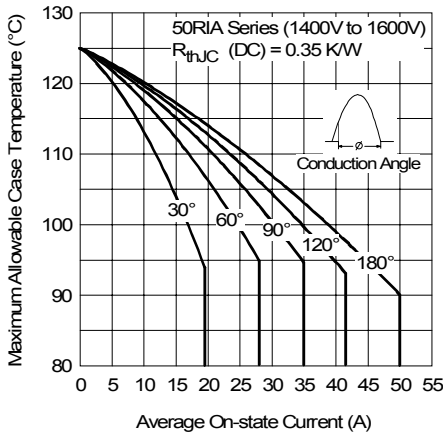


Fig. 7 - Current Ratings Characteristics

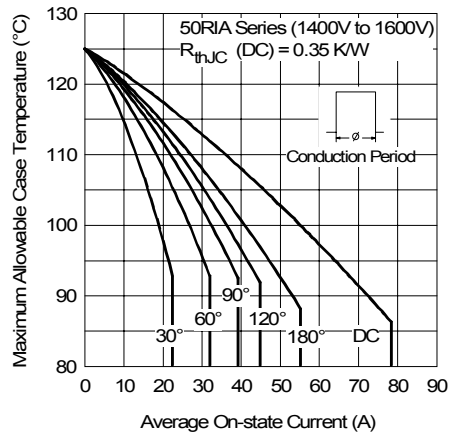


Fig. 8 - Current Ratings Characteristics

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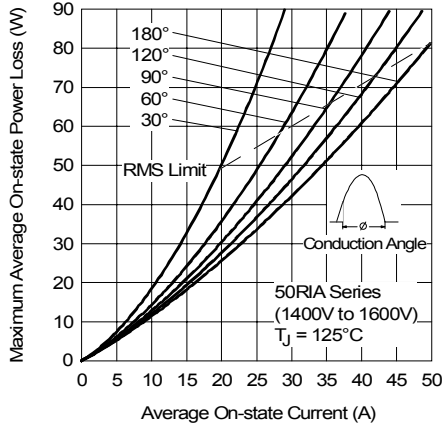


Fig. 9 - On-state Power Loss Characteristics

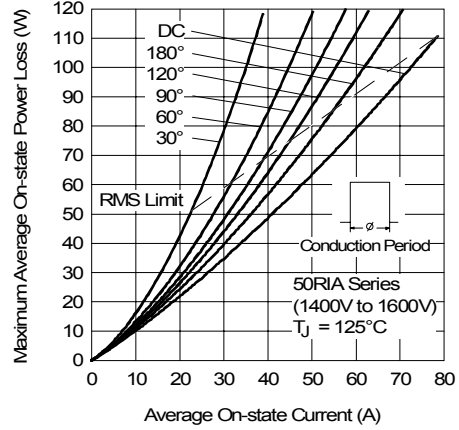


Fig. 10 - On-state Power Loss Characteristics

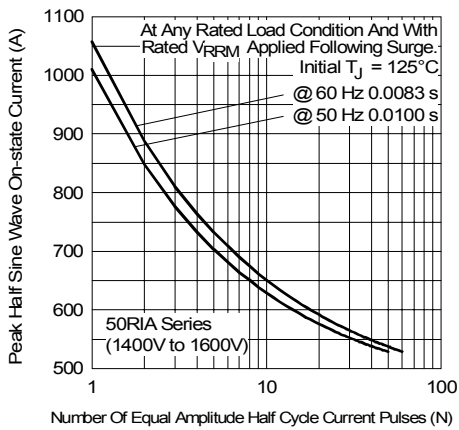


Fig. 11 - Maximum Non-Repetitive Surge Current

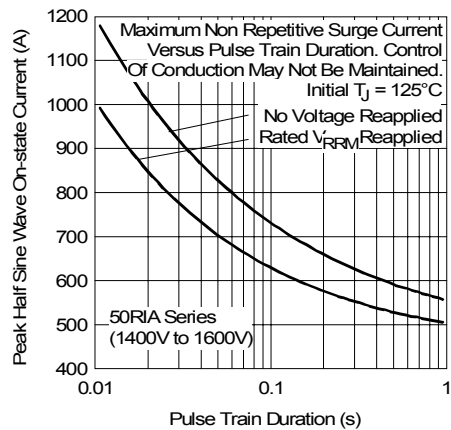


Fig. 12 - Maximum Non-Repetitive Surge Current

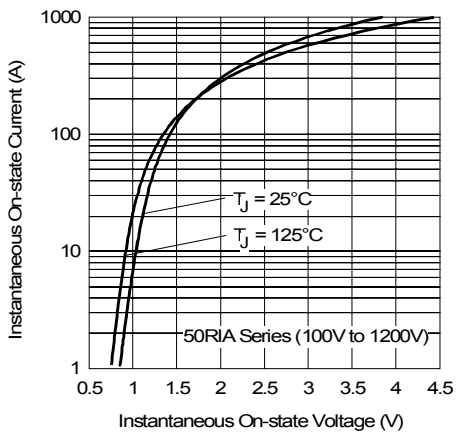


Fig. 13 - Forward Voltage Drop Characteristics

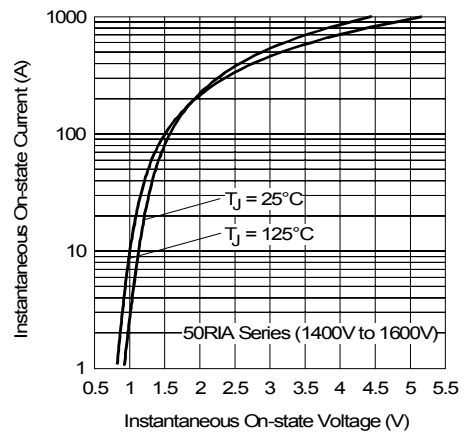


Fig. 14 - Forward Voltage Drop Characteristics

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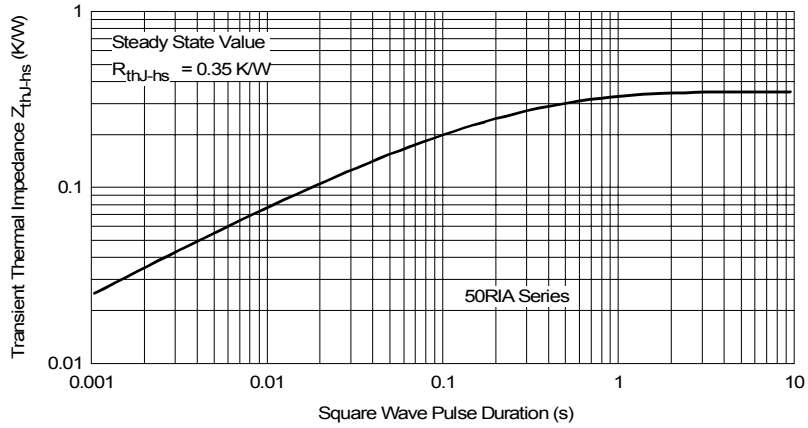


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

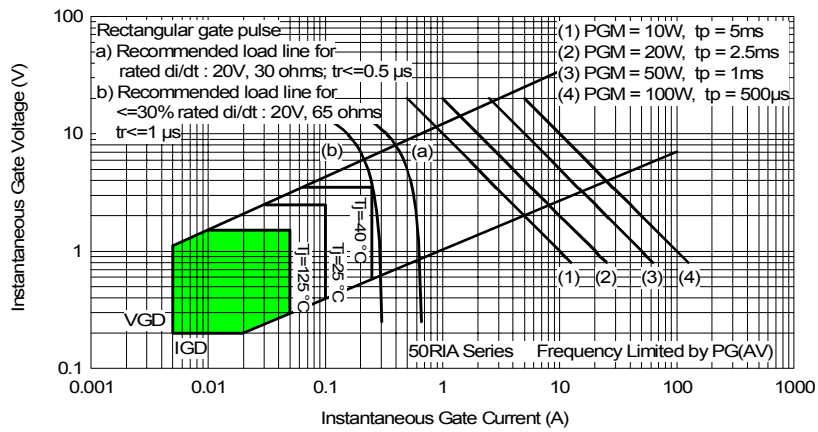


Fig. 16 - Gate Characteristics