Ruttonsha International Rectifier Ltd.

SILICON CONTROLLED RECTIFIERS

High Power Thyristor
Hockey Puk Version
Q-PUK Series 3500PQ

Types : 3500 PQ 420

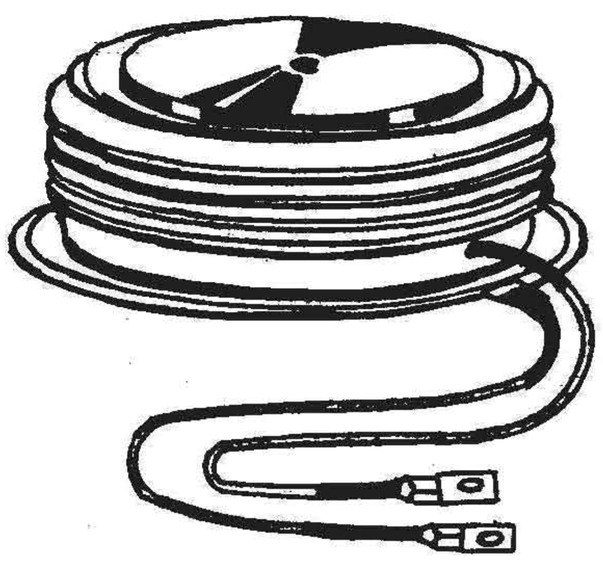
FEATURES

- *Center amplifying gate.*
- *Metal case with ceramic insulator*
- *High profile hockey - puk.*

TYPICAL APPLICATIONS

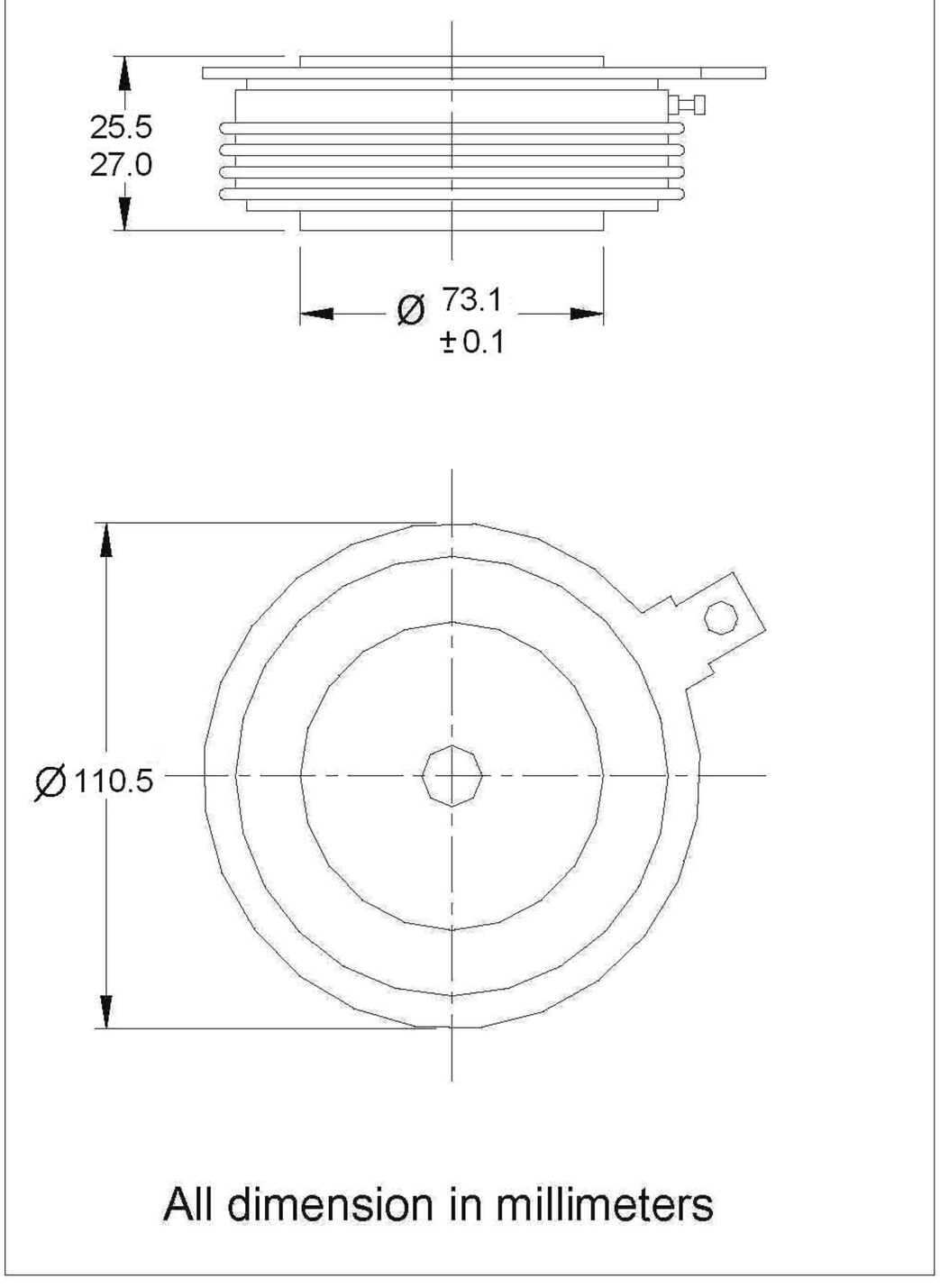
- *DC motor control (e.g. for machine tools).*
- *Controlled rectifiers (e.g. for battery charging, Uninterrupted Power Supply).*
- *AC controllers (e.g. for temperature control, lights control).*

3500 PQ (Q - PUK)



Major Ratings and Characteristics

Parameter		**3500PQ**	Units
$I_{T(AV)}$		3476	A
	@ T_{hs}	55	℃
$I_{T(RMS)}$		6787	A
	@ T_{hs}	55	℃
I_{TSM}	@ 50 Hz	52	KA
I^2t	@ 50 Hz	13520	KA^2s
V_{DRM}/V_{RRM}		3000 - 4200	V
t_q	typical	550	µs
T_J		-40 to +125	℃



All dimension in millimeters

ELECTRICAL SPECIFICATIONS — Types : 3500 PQ Series

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM}, max repetitive peak and off-state voltage V	V_{RSM},maximum non-repetitive peak voltage V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
3500PQ	300	3000/3000	3100	250
	320	3200/3200	3300	
	340	3400/3400	3500	
	360	3600/3600	3700	
	400	4000/4000	4100	
	420	4200/4200	4300	

On - state Conduction

	Parameter	3500PQ	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	3476	A	180° conduction, half sine wave		
	@ Heatsink temperature	55	°C	double side cooled		
$I_{T(RMS)}$	Max RMS on-state current	6787	A	DC@55°C heatsink temperature double side cooled		
I_{TSM}	Max. peak, one-cycle non-repetitive surge current	52	KA	t = 10 ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J=T_J$ max.
I^2t	Maximum I^2t for fusing	13520	KA^2s	t = 10 ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J=T_J$ max.
$V_{T(TO)}$	Threshold voltage	0.97	V	$T_J=T_J$ max.		
r_t	On-state slope resistance	0.18	mΩ	$T_J=T_J$ max.		
V_{TM}	Max. on state voltage	1.87	V	I_{PK} = 5000 A, $T_J=T_J$ max, t_P = 10 ms sine pulse		
I_H	Maximum holding current	1000	mA	T_J = 25°C , anode supply 12 V resistive load		

Types : 3500PQ Series

Switching

	Parameter	3500PQ	Units	Conditions
di/dt	Max. non-repetitive rate of rise of turned-on current	100	A/µs	Gate drive 20V, 20Ω , $t_r \leq 1\mu s$ $T_J = T_J$ max. anode voltage ≤ 80% V_{DRM}
t_q	Typical turn-off time	550	µs	I_{TM} = 4000 A, $T_J = T_J$ max. di/dt = 10 A/µs , V_R = 50V dv/dt = 20 V/µs, 0.8 V_{DRM} Reapplied , t_p = 2ms

Blocking

	Parameter	3500PQ	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	500	V/µs	$T_J = T_J$ max. linear to 80% rated V_{DRM}
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current	250	mA	$T_J = T_J$ max. rated V_{DRM} /V_{RRM} applied

Triggering

	Parameter	3500PQ	Units	Conditions
P_{GM}	Maximum peak gate power	50	W	$T_J = T_J$ max., $t_p \leq 5$ ms
$P_{G(AV)}$	Maximum average gate power	5		$T_J = T_J$ max., f = 50Hz, d% = 50
I_{GM}	Max. peak positive gate current	3.0	A	$T_J = T_J$ max., $t_p \leq 5$ ms
$+V_{GM}$	Maximum peak positive gate voltage	20	V	$T_J = T_J$ max., $t_p \leq 5$ ms
$-V_{GM}$	Maximum peak negative gate voltage	5.0		
I_{GT}	DC gate current required to trigger	300	mA	T_J = 25°C
V_{GT}	DC gate voltage required to trigger	3.0	V	T_J = 25°C

Max.required gate trigger/ current/voltage are the lowest value which will trigger all units 12 V anode-to-cathode applied

I_{GD}	DC gate current not to trigger	10	mA	$T_J = T_J$ max.	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	0.25	V		

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Thermal and Mechanical Specifications

	Parameter	3500PQ	Units	Conditions
T_J	Max.operating temperature range	-40 TO +125	°C	
T_{stg}	Max.storage temperature range	-40 TO +150		
$R_{thJ\text{-}hs}$	Max. thermal resistance, junction to heatsink	0.008	K/W	DC operation double side cooled
F	Mounting force, ± 10% ,	63 TO 77	KN	
wt.	Approximate weight	1200	g	
	Case style	**Q - PUK**		See Outline Table

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Curves

Figure 1 - On-state characteristics of Limit device

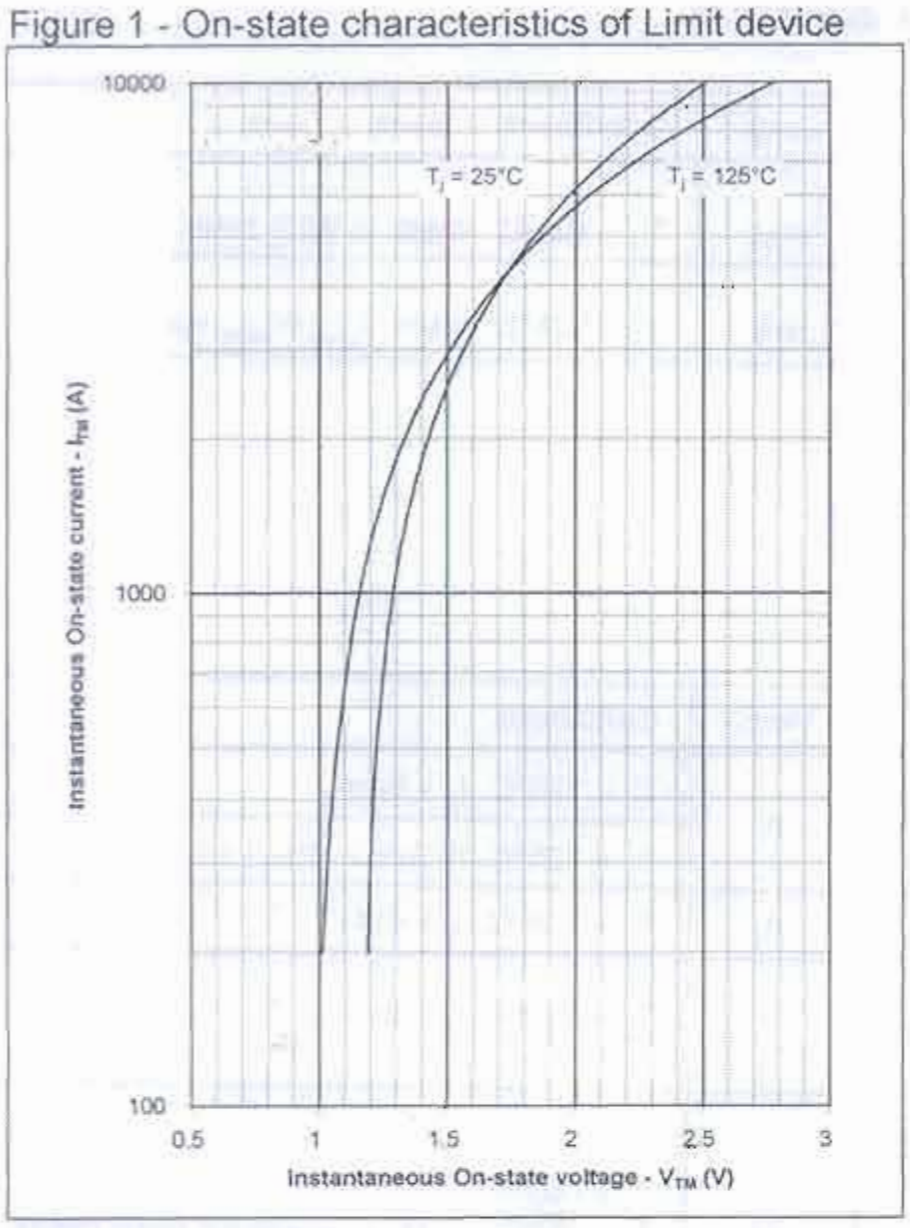

Figure 2 - Transient thermal impedance

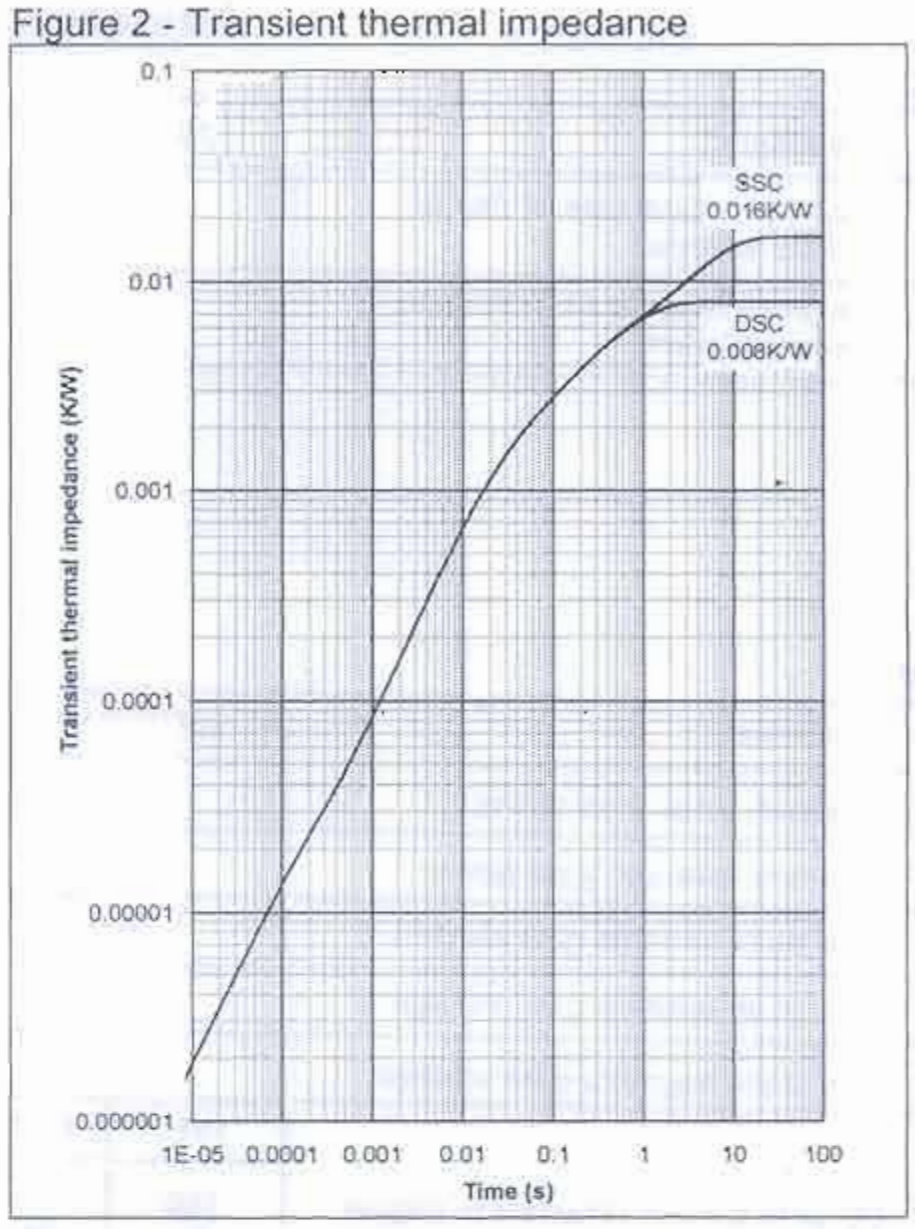

Figure 3 - Gate characteristics - Trigger limits

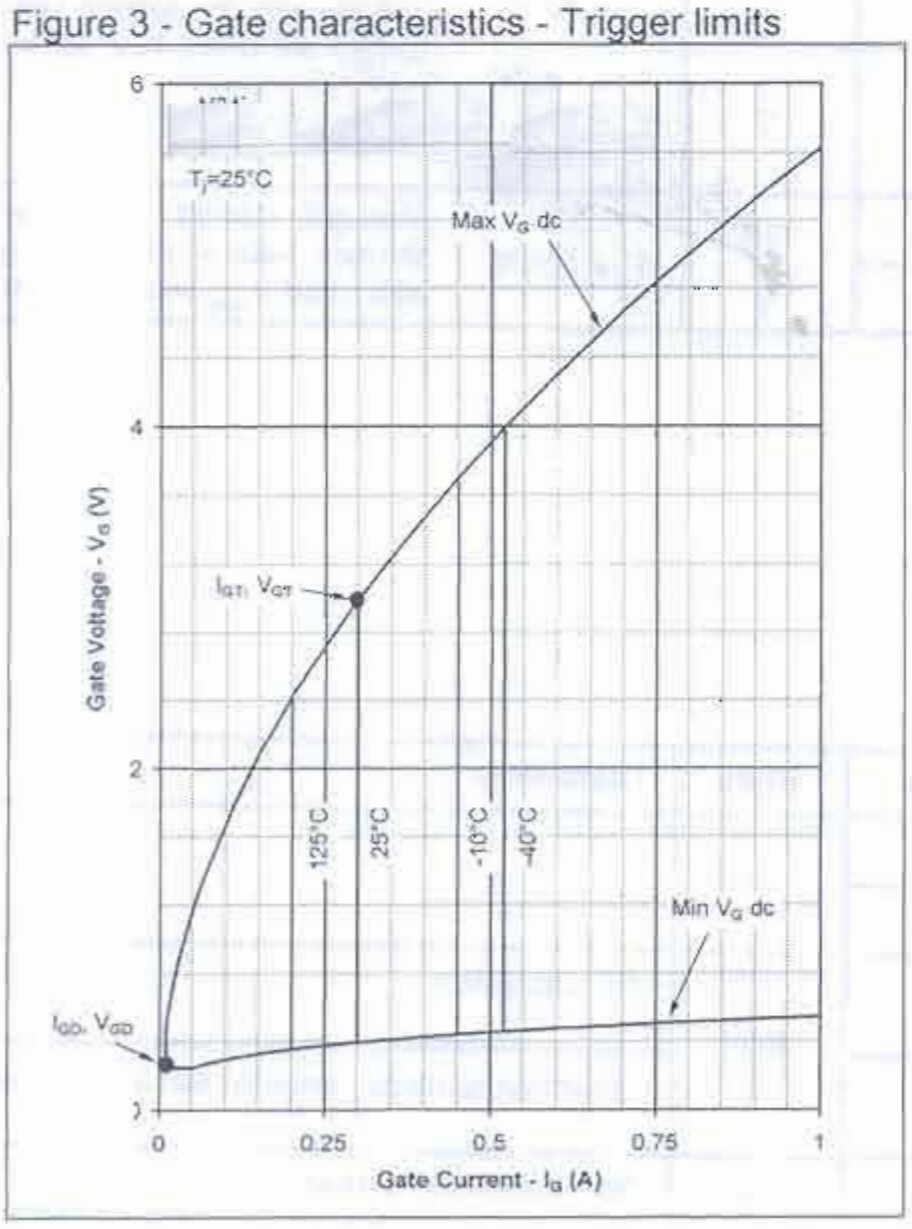

Figure 4 - Gate characteristics - Power curves

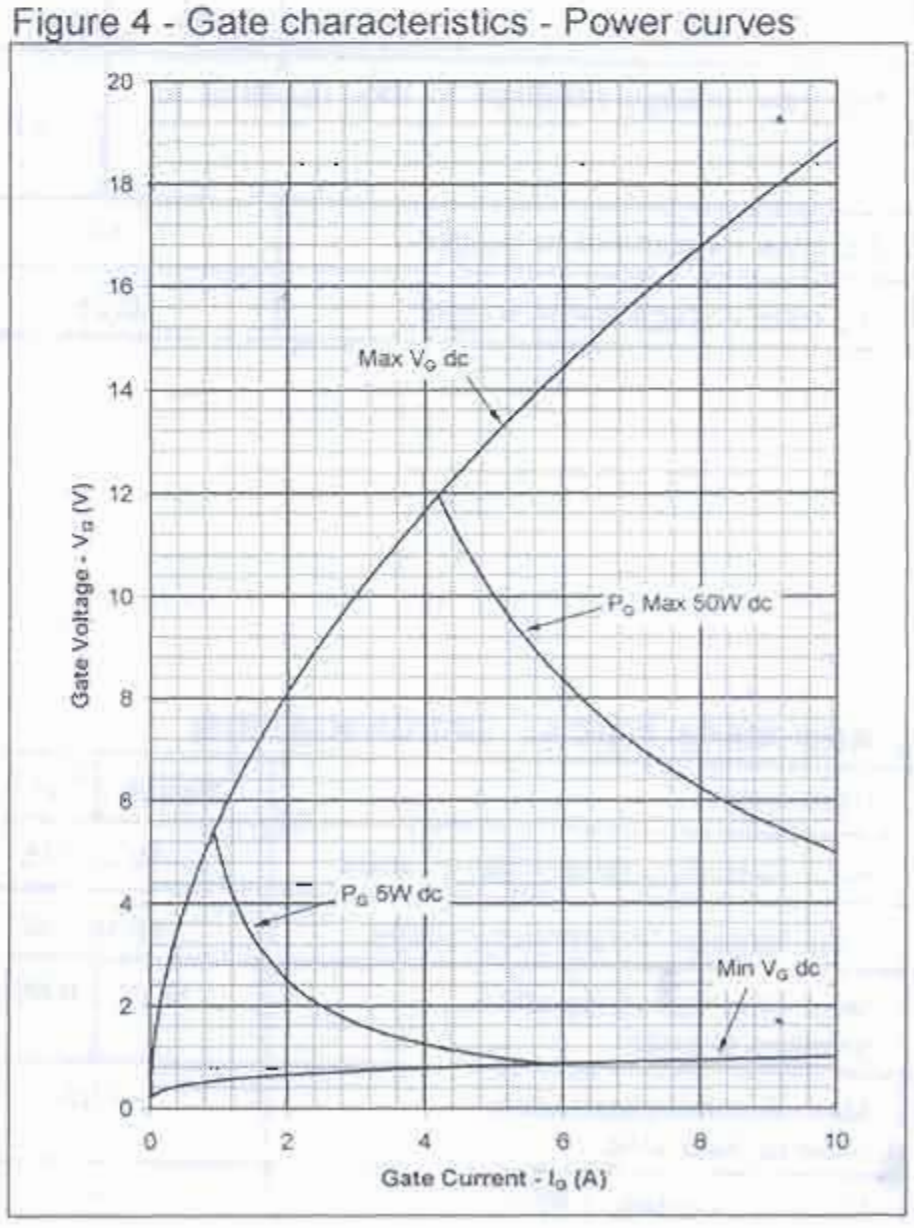

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Figure 5 - Total recovered charge, Q_{rr}

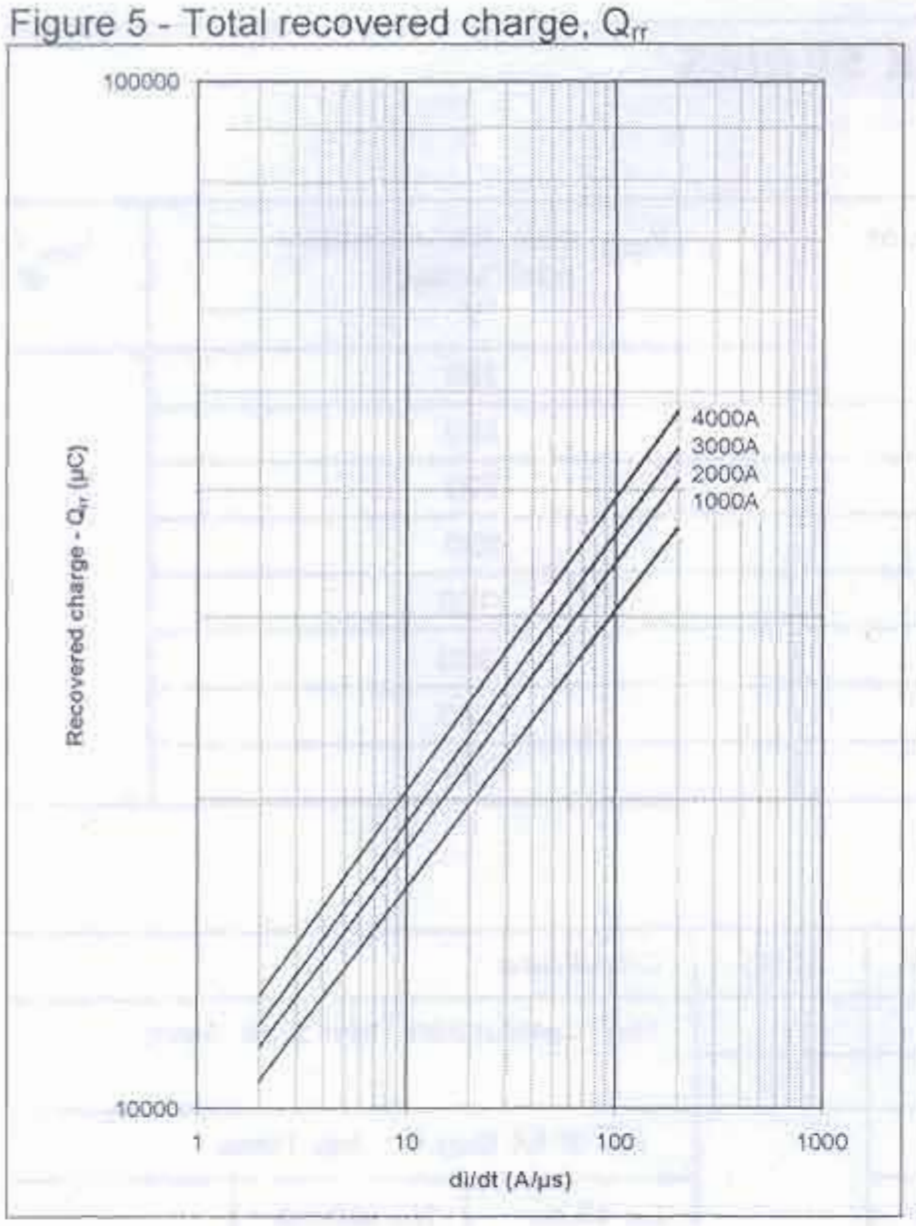

Figure 6 - Recovered charge, Q_{rr} (50% chord)

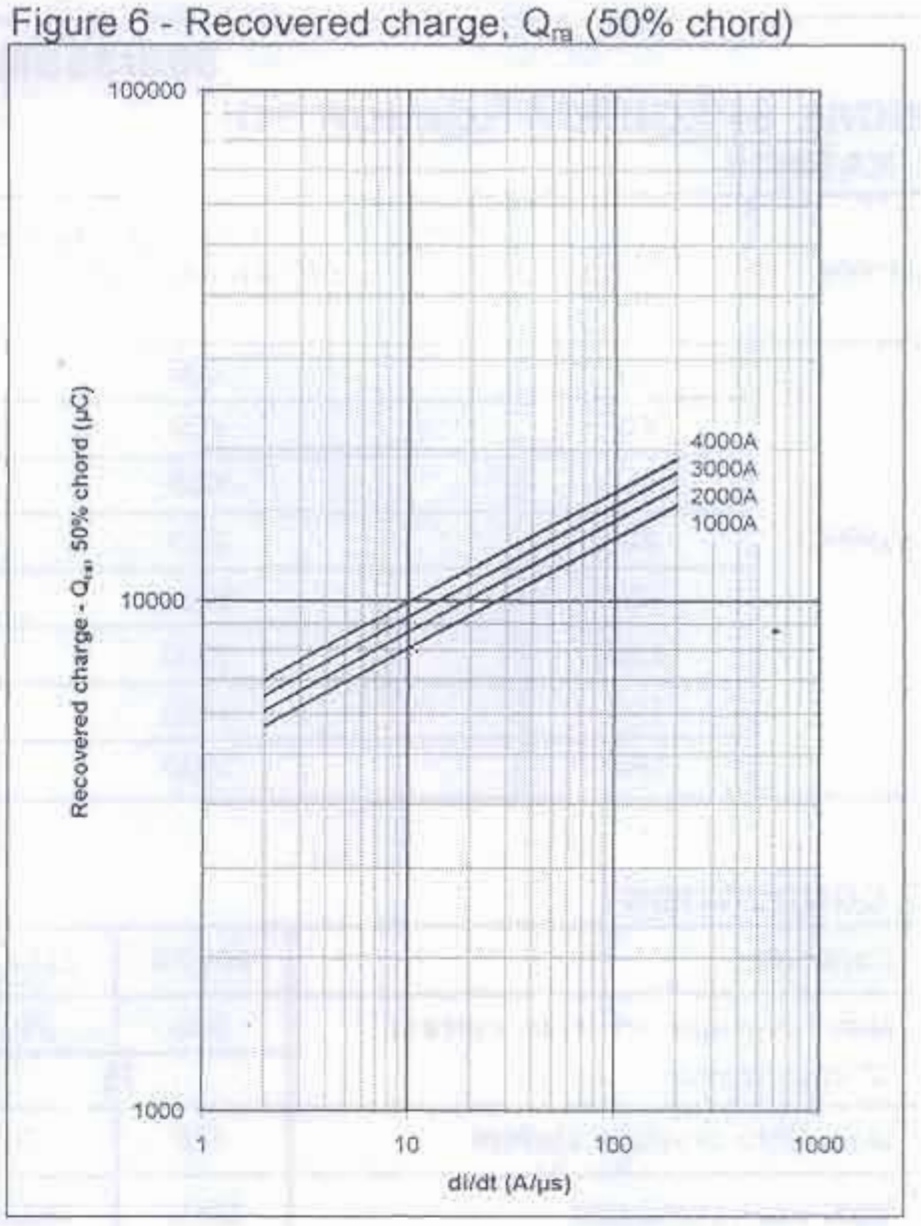

Figure 7 - Peak reverse recovery current, I_{rm}

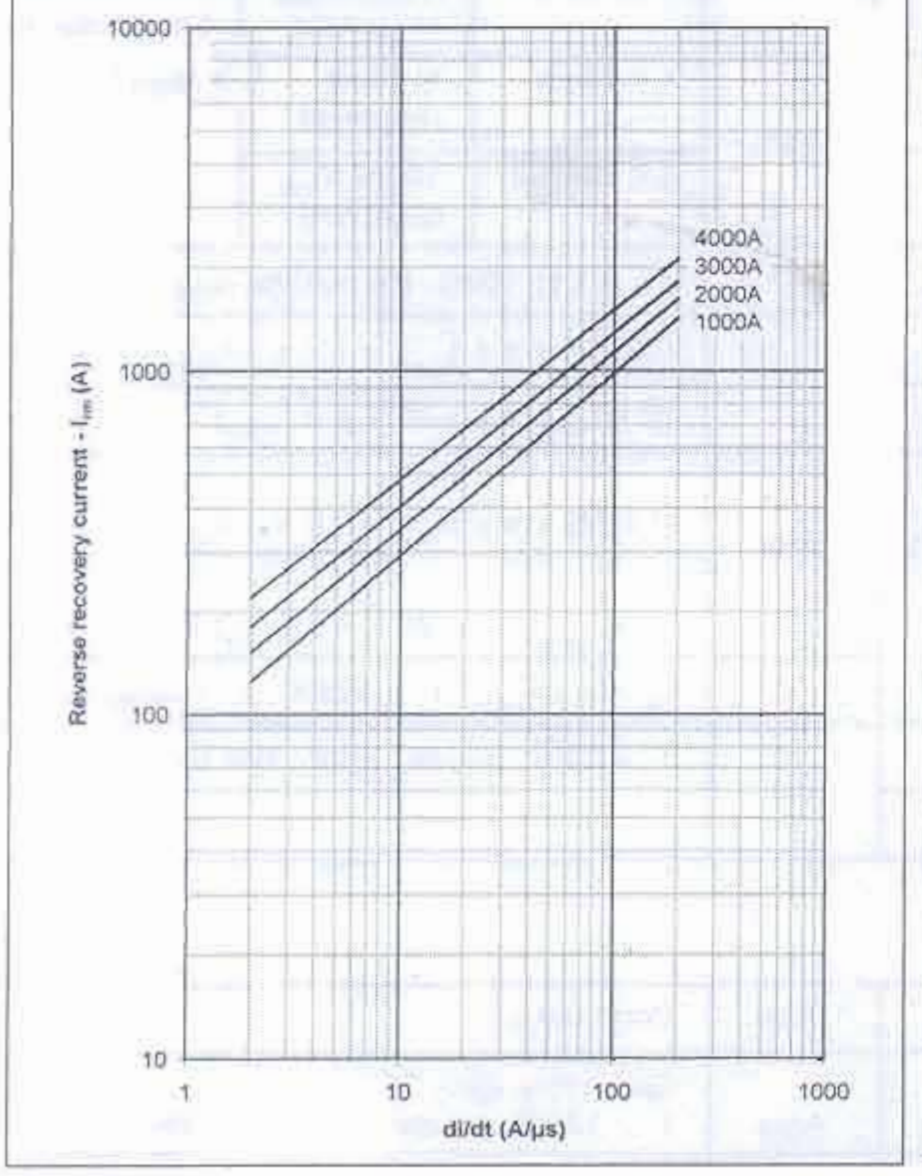

Figure 8 - Maximum recovery time, t_{rr} (50% chord)

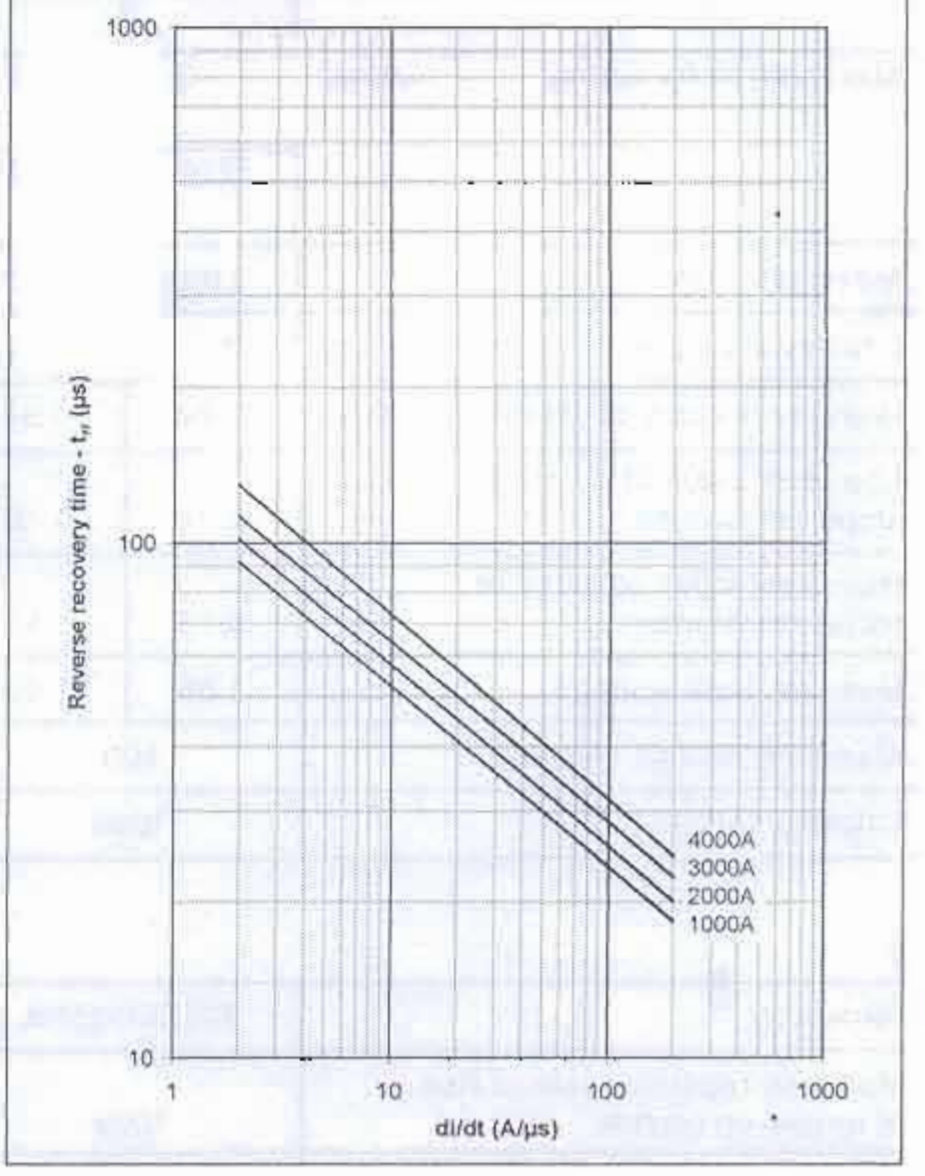

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Figure 9 – On-state current vs. Power dissipation – Double Side Cooled (Sine wave)

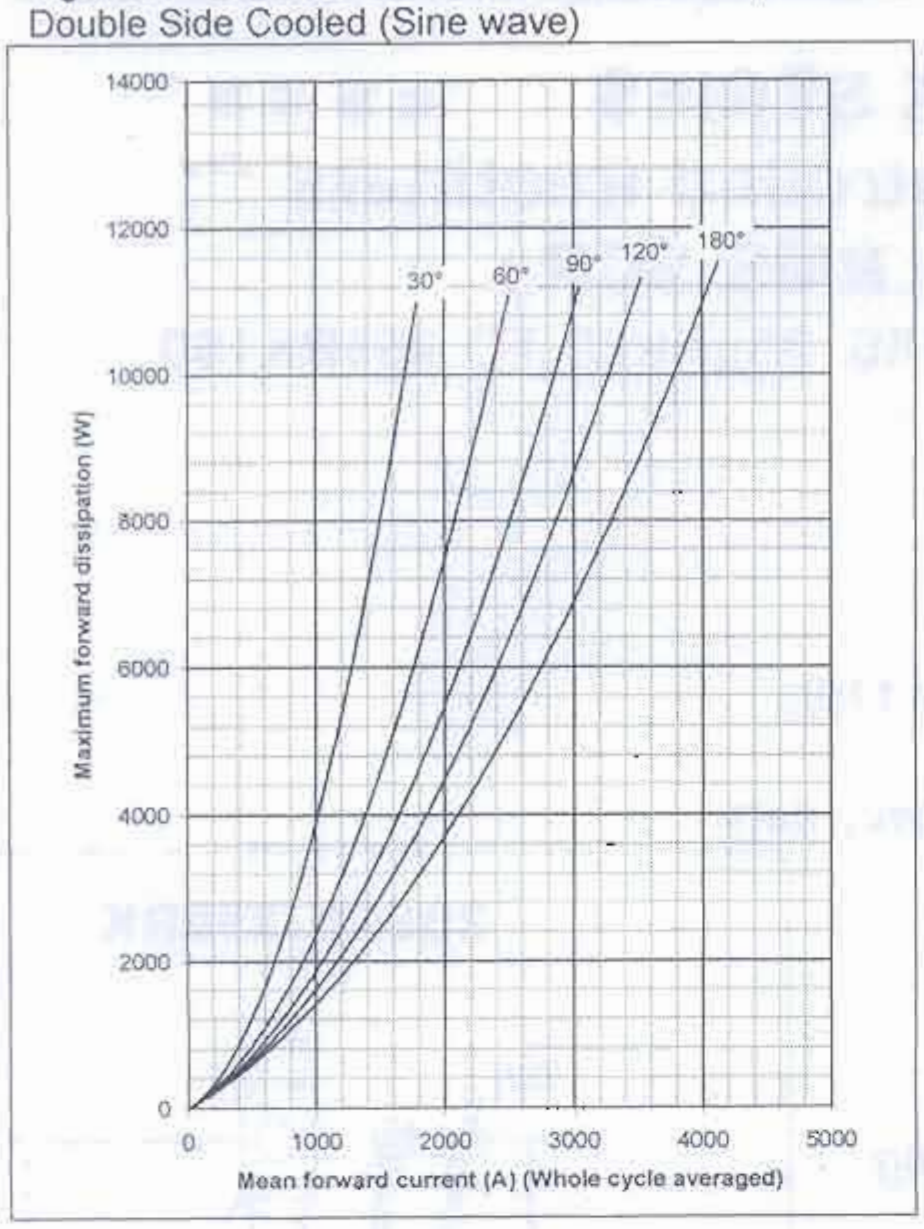

Figure 10 – On-state current vs. Heatsink temperature - Double Side Cooled (Sine wave)

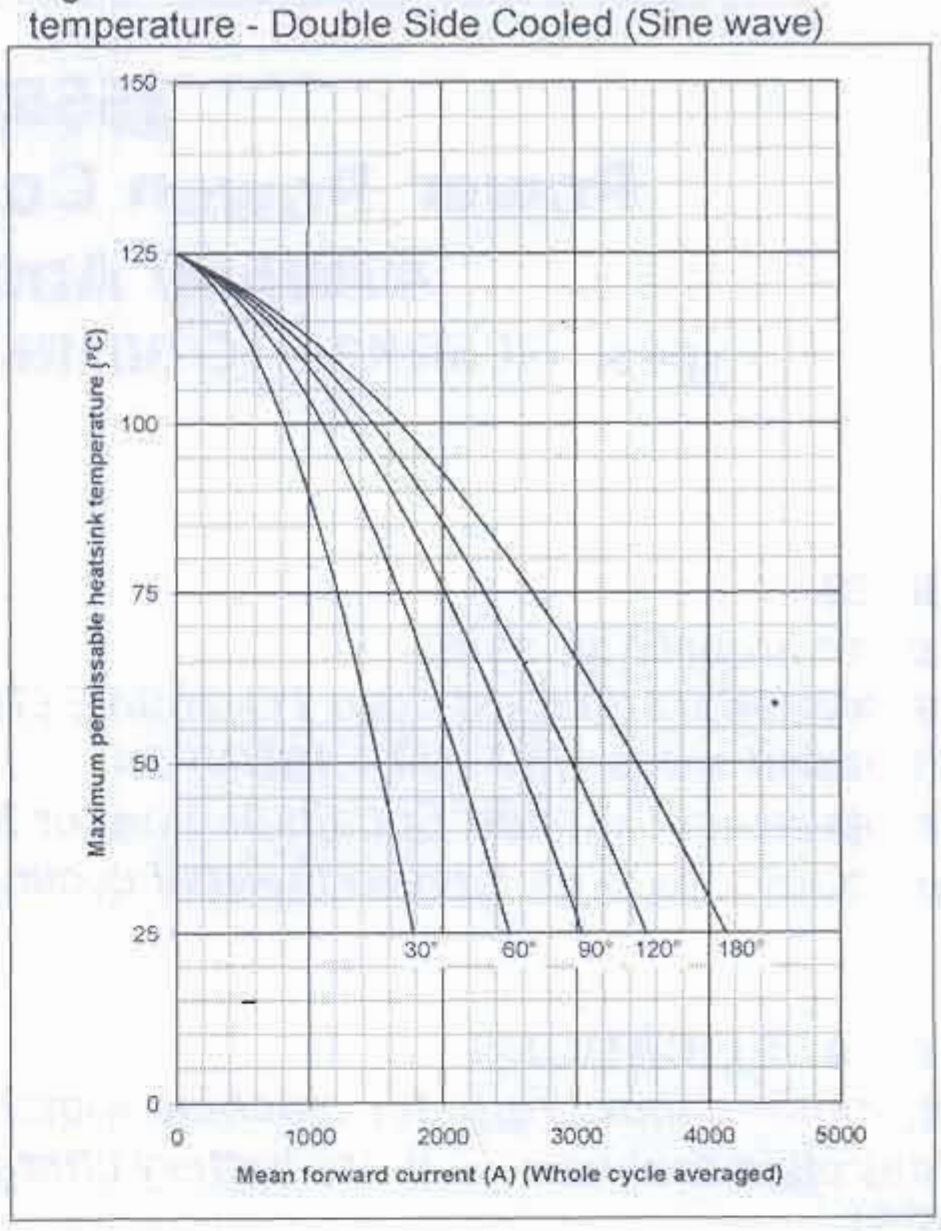

Figure 11 – On-state current vs. Power dissipation – Double Side Cooled (Square wave)

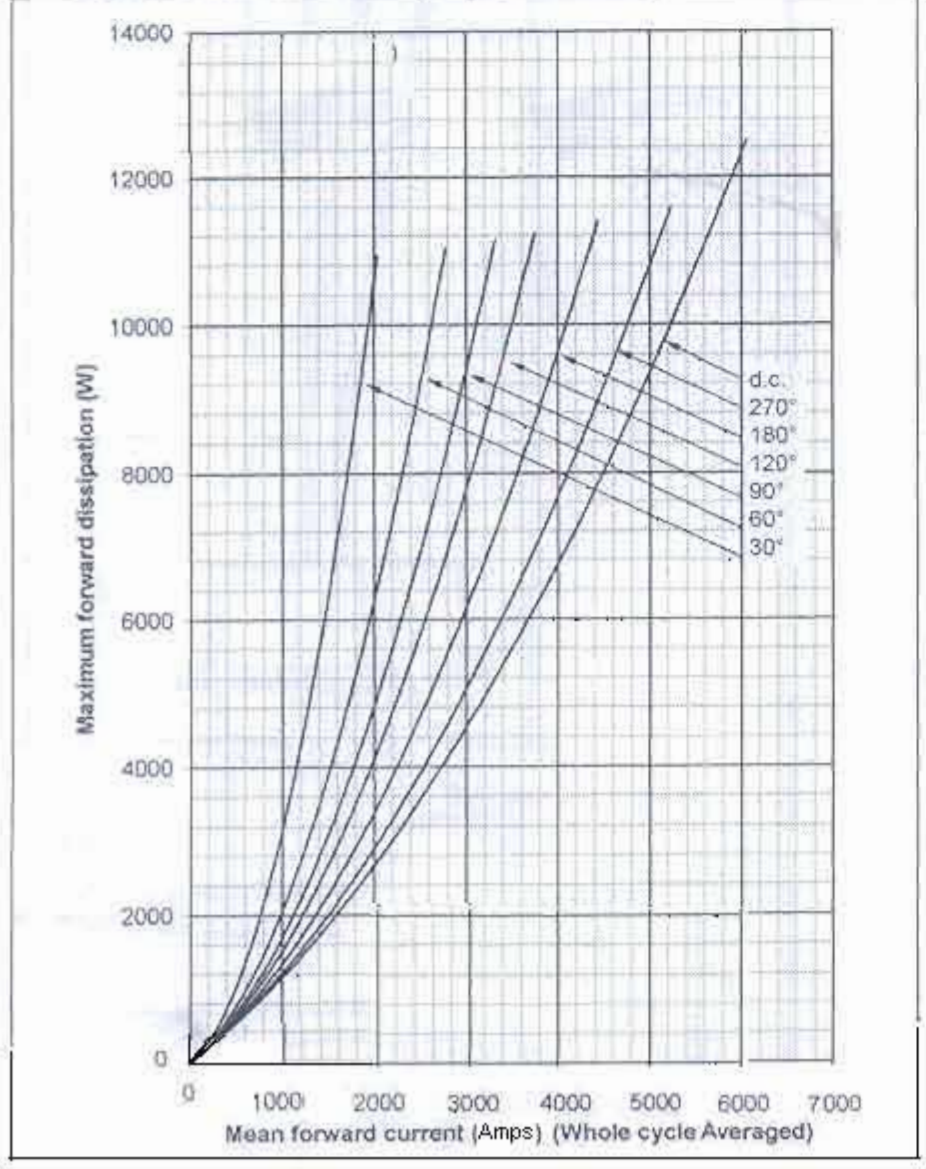

Figure 12 – On-state current vs. Heatsink temperature – Double Side Cooled (Square wave)

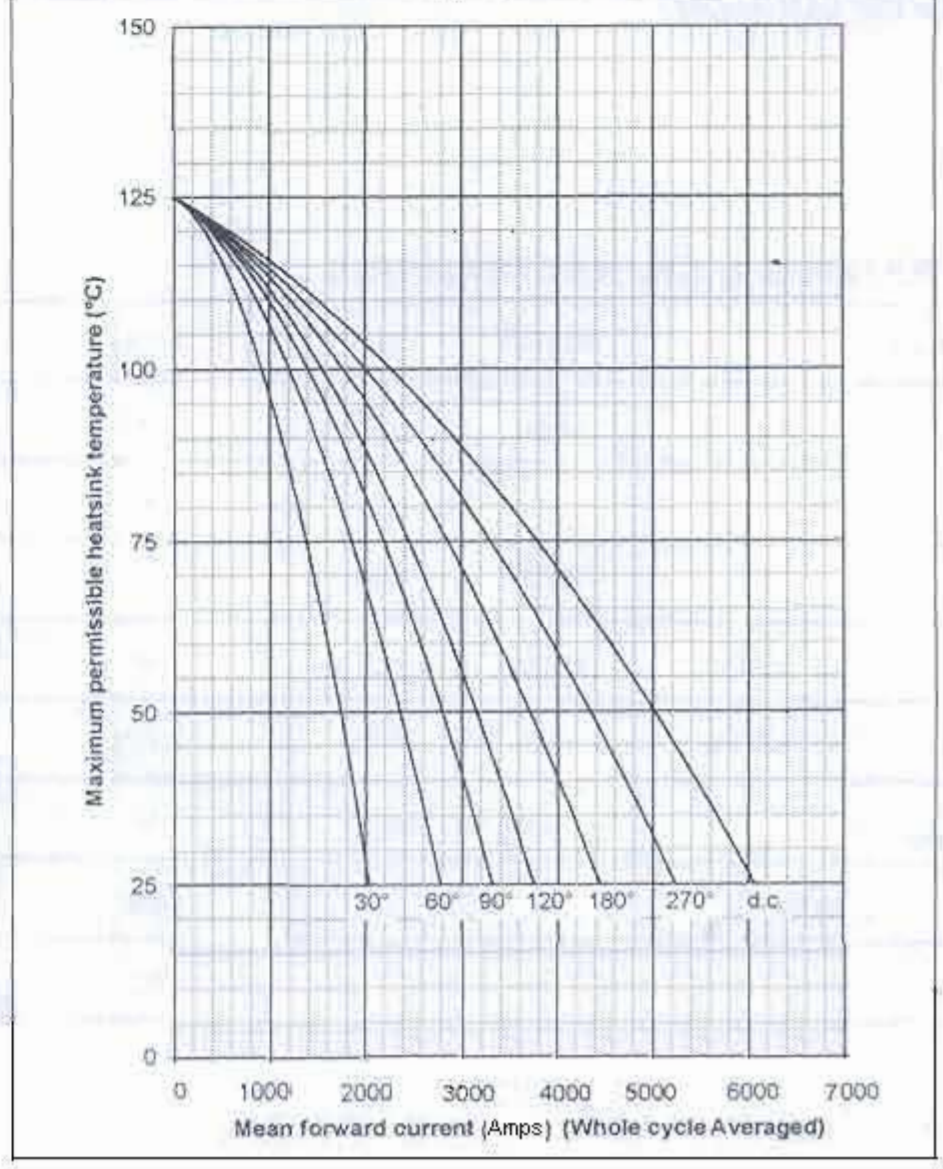

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Figure 13 – On-state current vs. Power dissipation – Single Side Cooled (Sine wave)

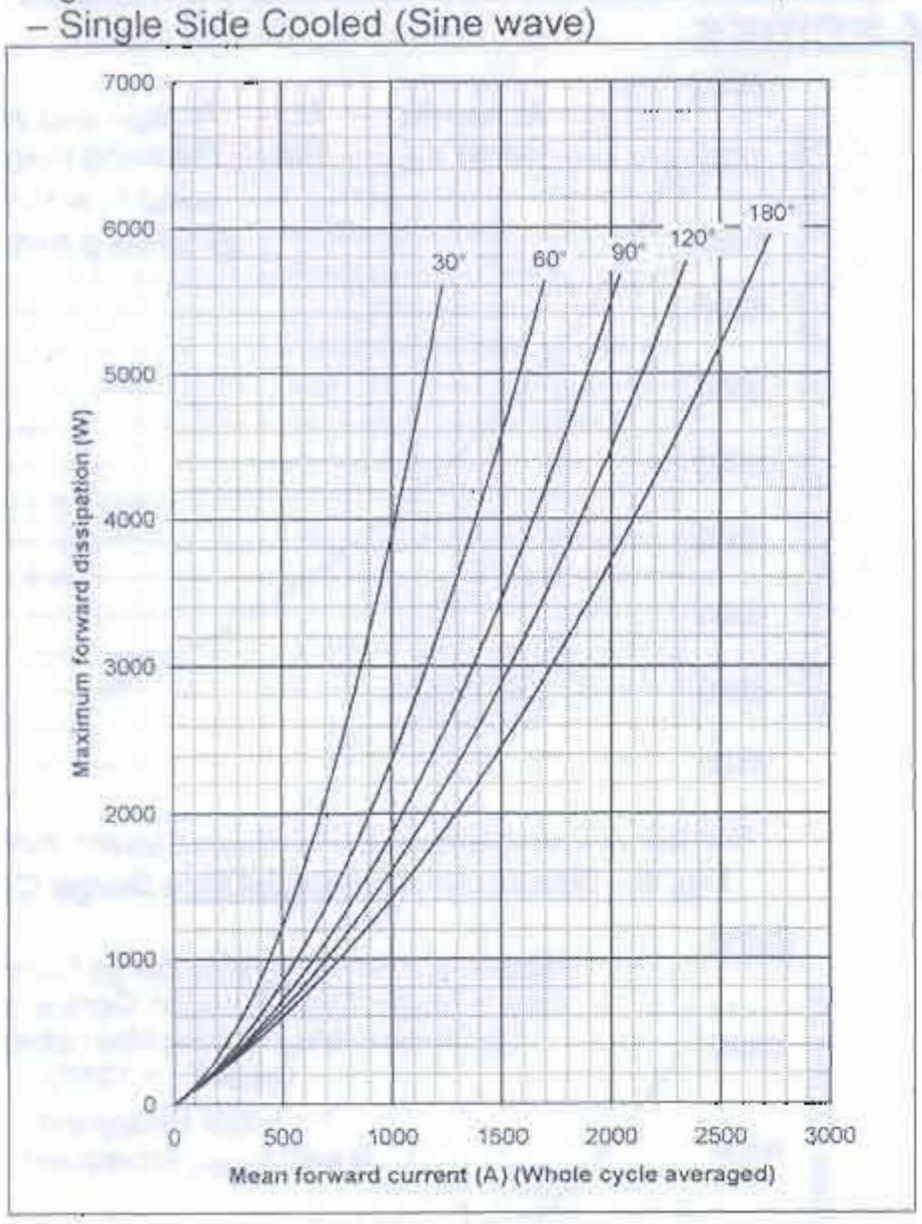

Figure 14 – On-state current vs. Heatsink temperature – Single Side Cooled (Sine wave)

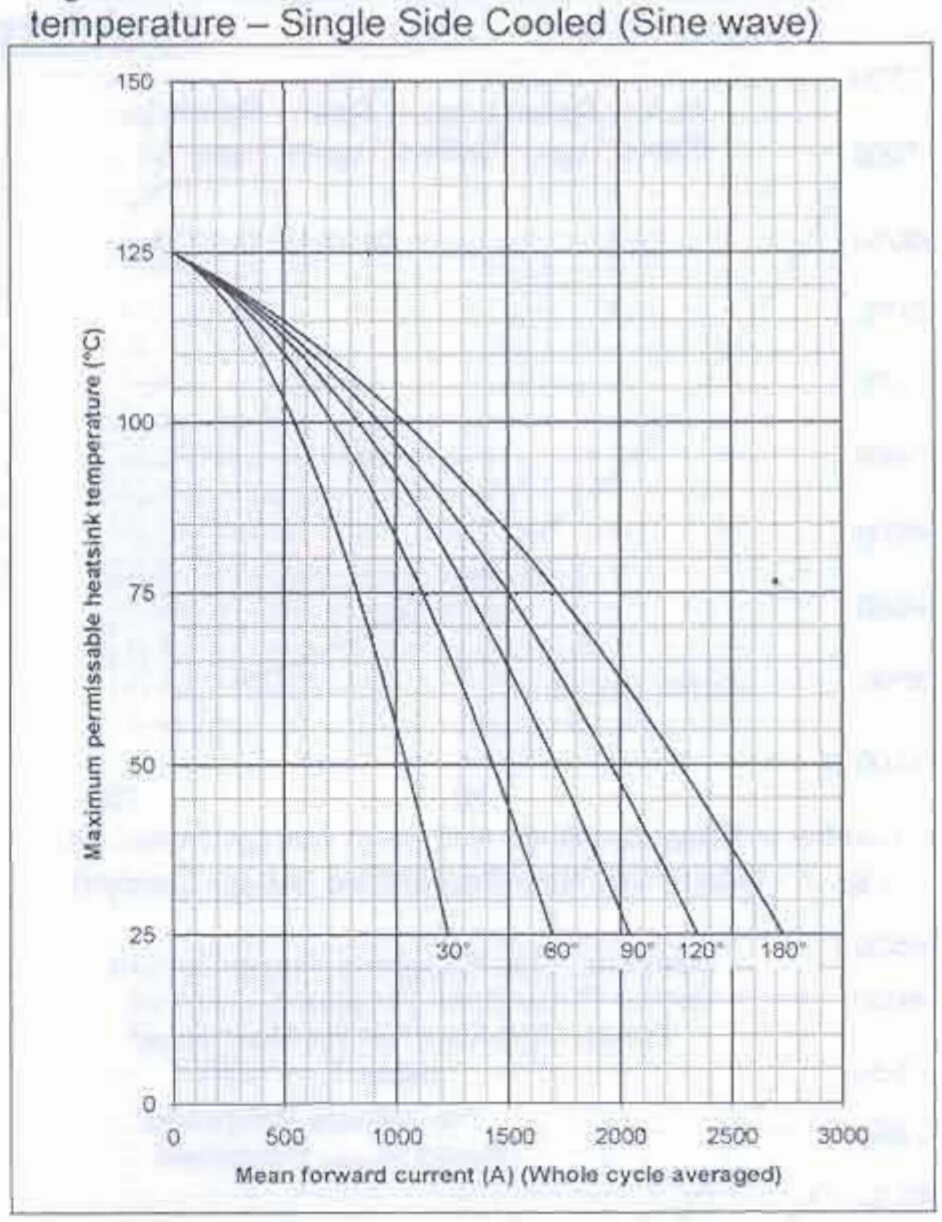

Figure 15 – On-state current vs. Power dissipation – Single Side Cooled (Square wave)

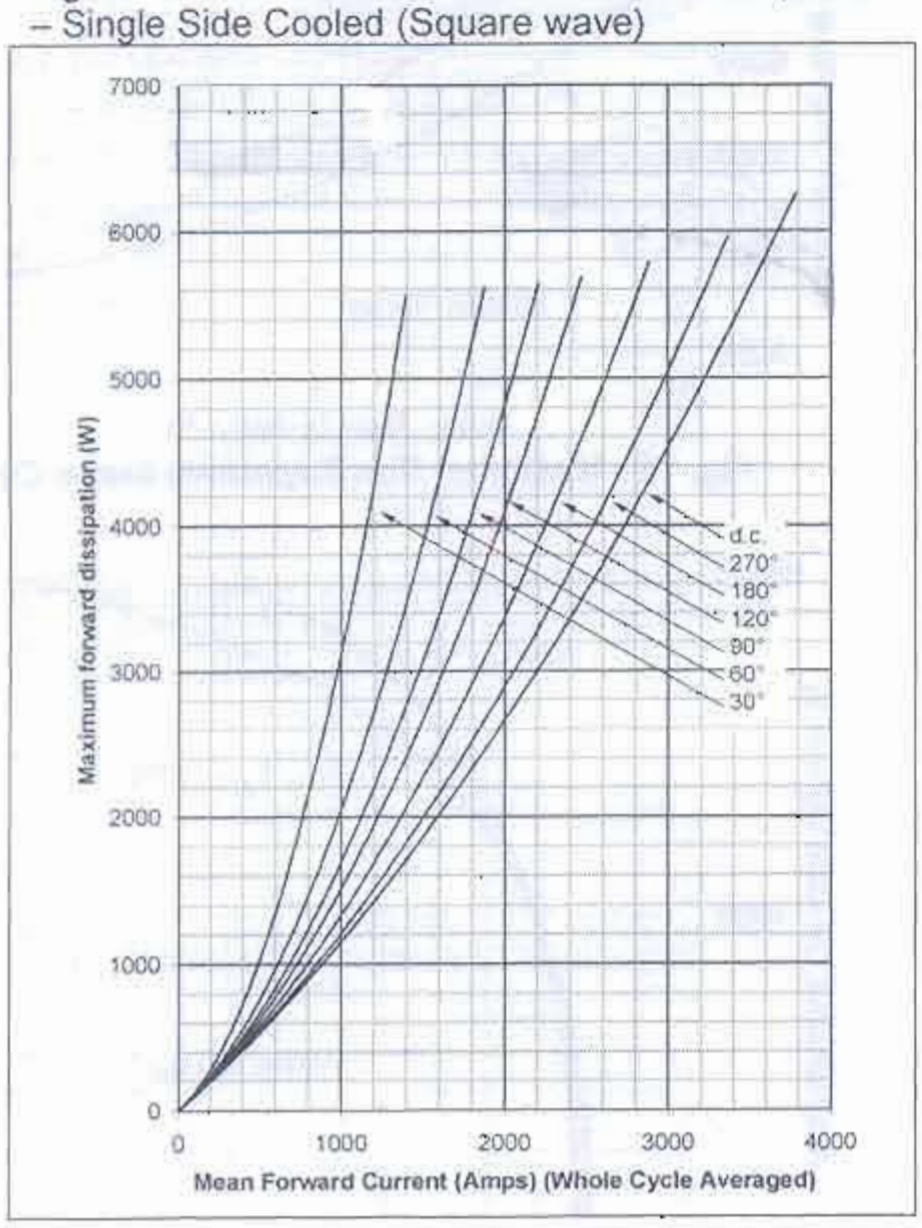

Figure 16 – On-state current vs. Heatsink temperature – Single Side Cooled (Square wave)

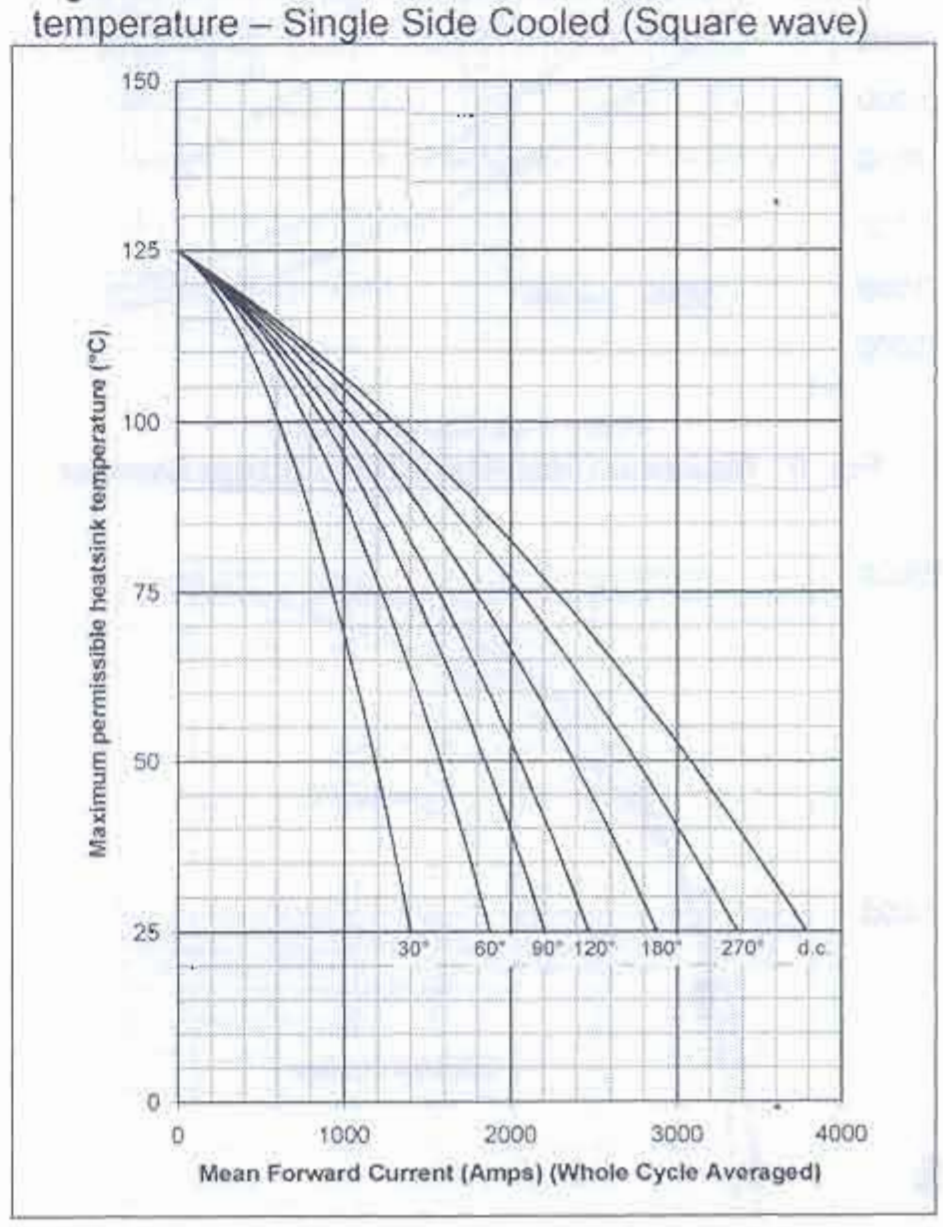

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Figure 17 - Maximum surge and I^2t Ratings