Ruttonsha International Rectifier Ltd.

RUTTONSHA

POWER MODULES

IRK. 330 SERIES
High Voltage Thyristor/Diode and Thyristor/Thyristor

FEATURES

- *Electrically isolated base plate.*
- *3000 V_{RMS} isolating voltage.*
- *Industrial standard package.*
- *Simplified mechanical designs, rapid assembly.*
- *High surge capability.*
- *Large creepage distances.*
- *Beryllium oxide substrate.*

DESCRIPTION

These IRK series of Power Modules use power thyristors/diodes in four basic configurations. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges or as AC-switches when modules are connected in anti-parallel.
These modules are intended for general purpose applications such as battery chargers, welders and plating equipment.

MAJOR RATINGS & CHARACTERISTICS

Parameters		IRK.330	Units
$I_{T(AV)}$	@ 85°C	330	A
$I_{T(RMS)}$		520	A
I_{TSM}	@ 50 Hz	8000	A
I^2t	@ 50 Hz	320	kA^2s
$I^2\sqrt{t}$		3200	$kA^2\sqrt{s}$
V_{DRM} -V_{RRM}		Up to 1800	V
T_J		-40 to 125	°C

POWER MODULES

IRK. 330 SERIES

ELECTRICAL SPECIFICATION

VOLTAGE RATINGS

Type Number	Voltage Code	V_{RRM} / V_{DRM}, max. repetitive peak reverse and off-state voltage blocking voltage V	V_{RSM}, max. non-repetitive peak reverse voltage V	I_{DRM} / I_{RRM} max. @ 130°C mA
	04	400	500	70
	06	600	700	70
IRK.330	08	800	900	70
	10	1000	1100	70
	12	1200	1300	70
	14	1400	1500	70
	16	1600	1700	70
	18	1800	1900	70

ON-STATE CONDUCTION

	Parameters	IRK.330	Units	Conditions	
$I_{T(AV)}$	Max. average on-state current	330	A	180⁰ conduction, half sine wave	
	@ Case temperature	85	°C		
$I_{T(RMS)}$	Max. RMS on-state current	520	A	as AC switch	
I_{TSM}	Max. peak, one cycle on-state, non-repetitive surge current	8000	A	t = 10ms	Sinusoidall half wave, Initial T_J = T_J max.
I^2t	Maximum I^2t for fusing	320	kA^2s	t = 10ms	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	3200	$kA^2\sqrt{s}$	t = 0.1 to 10ms. No voltage reapplied.	
$V_{T(TO)}$	Threshold voltage	0.80	V	T_J = T_J max.	
r_t	On-state slope resistance	0.45	mΩ	T_J = T_J max.	
V_{TM}	Max. on-state voltage drop	1.44	V	$I_{TM} = \pi \times I_{T(AV)}$, T_J = T_J max., 180⁰ conduction AV. power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$	
I_H	Maximum holding current	300 max.	mA	Anode supply = 12V, initial I_T = 30A, T_J = 25°C	
I_L	Max. latching current	1200 max.	mA	Anode supply = 12V, resistive load = 1Ω, gate pulse : 10V, 100µs, T_J = 25°C	

SWITCHING

t_d	Typical delay time	1.0	µs	T_J = 25°C	Gate current = 1A $dI_g/_{dt}$ = 1A/µs
t_r	Typical rise time	2.0	µs	T_J = 25°C	Vd = 0.67% V_{DRM}
t_q	Typical turn-off time	250	µs	I_{TM} = 300A; dI/dt = 15A/µs; T_J = T_J max.: Vr = 50V; dV/dt = 20V/µs; Gate 0V, 100ohm	

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IRK. 330 SERIES

BLOCKING

	Parameter	330	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	500	V/µs	T_J = 125°C, exponential to 67% rated V_{DRM}
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current	70	mA	T_J = 125°C, rated V_{DRM}/V_{RRM} applied
V_{INS}	RMS isolation voltage	3500	V	50Hz,Circuit to base, all terminal shorted,25°C,1sec

TRIGGERING

	Parameter	330	Units	Conditions	
P_{GM}	Maximum peak gate power	10.0	W	T_J = 125°C, t_p ≤ 5ms	
$P_{G(AV)}$	Maximum average gate power	2.0		T_J = 125°C, f= 50Hz, d% = 50	
I_{GM}	Max. peak positive gate current	3.0	A	T_J = 125°C, t_p ≤ 5ms	
$+V_{GM}$	Max. peak positive gate voltage	20	V	T_J = 125°C, t_p ≤ 5ms	
$-V_{GM}$	Max. peak negative gate voltage	5.0			
		MAX.			
I_{GT}	DC gate current required to trigger	200	mA	T_J = 25°C	Max. required gate trigger/current / voltage are the lowest value which will trigger all units 12V anode-to-cathode applied.
V_{GT}	DC gate voltage required to trigger	2.0	V	T_J = 25°C	
V_{GD}	DC gate voltage not to trigger	0.20	V	T_J = 125°C	Max. gate current / voltage not to trigger the max. value which will not trigger any unit with rated V_{DRM}anode-to-cathode applied
I_{GD}	DC gate current not to trigger	10.0	mA	T_J = 125°C	
di/dt	Maximum critical rate of rise of turned-on current	100	A/µs	T_J = 125°C, I_{TM}=400A ,rated V_{DRM} applied	

THERMAL AND MECHANICAL SPECIFICATION

	Parameter	330	Units	Conditions
T_J	Max. operating temperature range	-40 to 135	°C	
T_{stg}	Max. storage temperature range	-40 to 135		
R_{thJ-C}	Max. thermal resistance, junction to case	0.111	K/W	Perjunction, DC operation
R_{thJ-C}	Max. thermal resistance, junction to heatsink	0.02	K/W	Mountingsufaceflat,smooth and greased
T	Mounting tourque, ±10%	(4 to 6)	Nm	For Module to heatsink and busbar to Module
w t	Approximate weight	800	g	
	Case style	MAGN-A-PAK		

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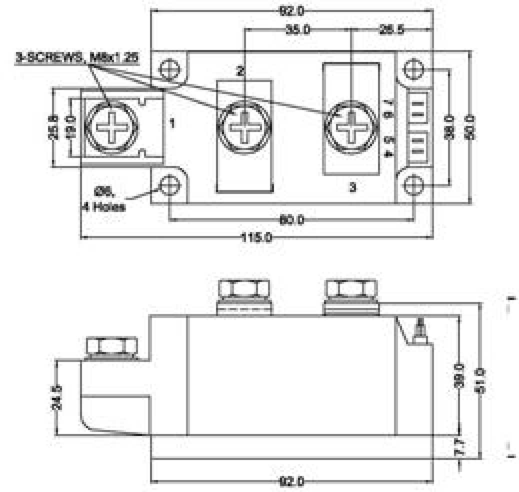
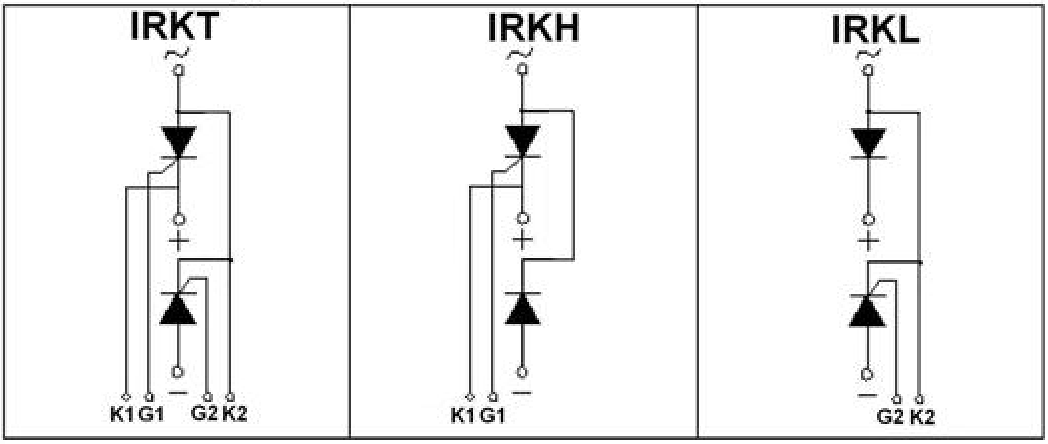
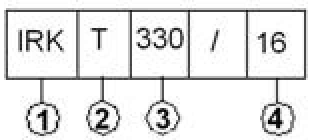
OUTLINE DIAGRAM



Circuit Configuration Table



Ordering Information Table

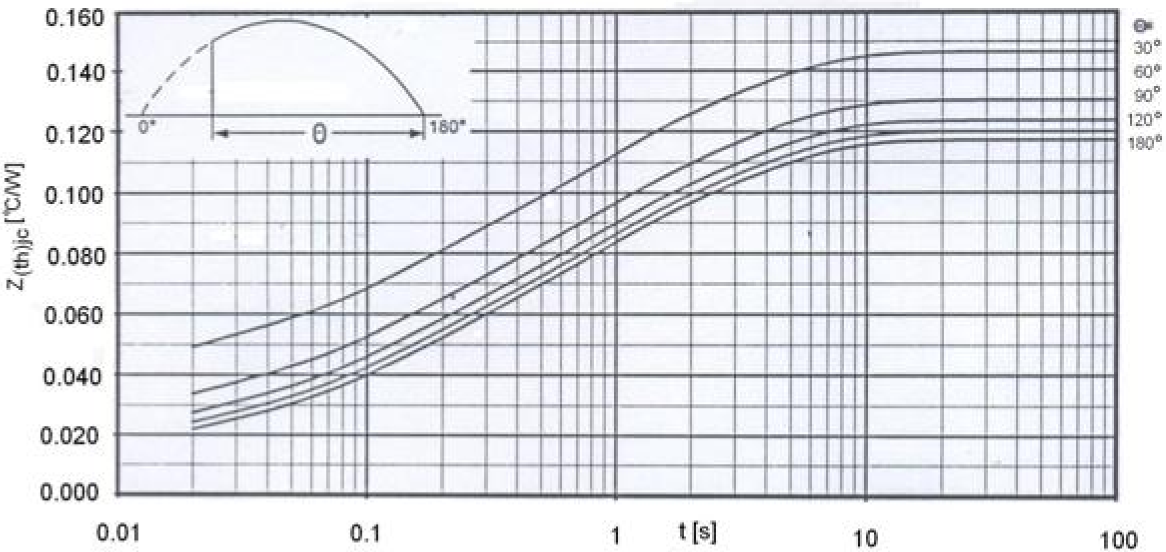


① - **Module type**

② - Circuit configuration (See Circuit Configuration table)

③ - Current Code

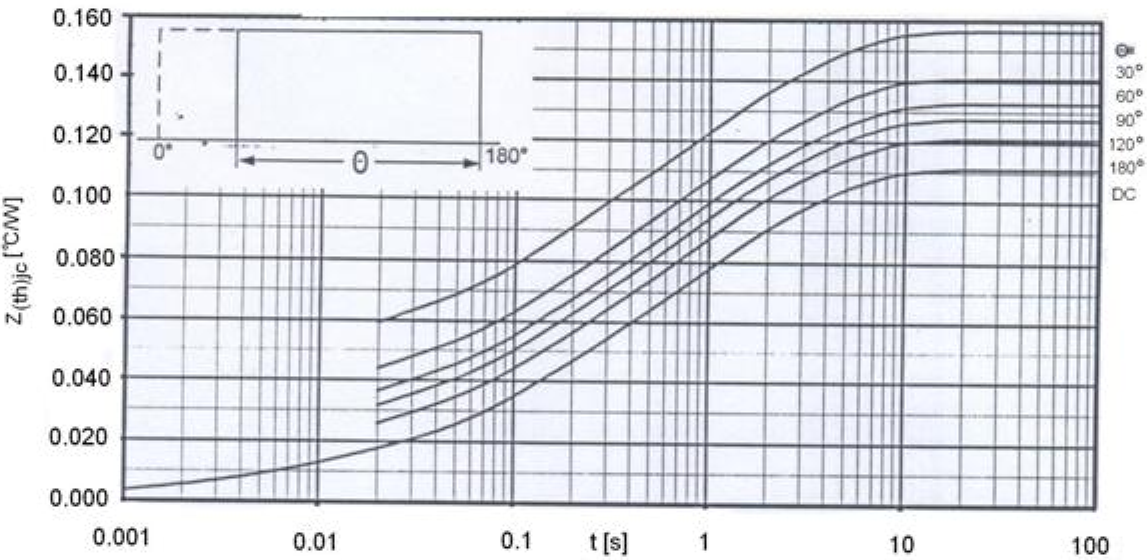
④ - Voltage Code (See Voltage Ratings table)



Transient thermal impedance per arm $Z_{thjc} = f(t)$

Sinusoidal current

Current conduction angle Θ

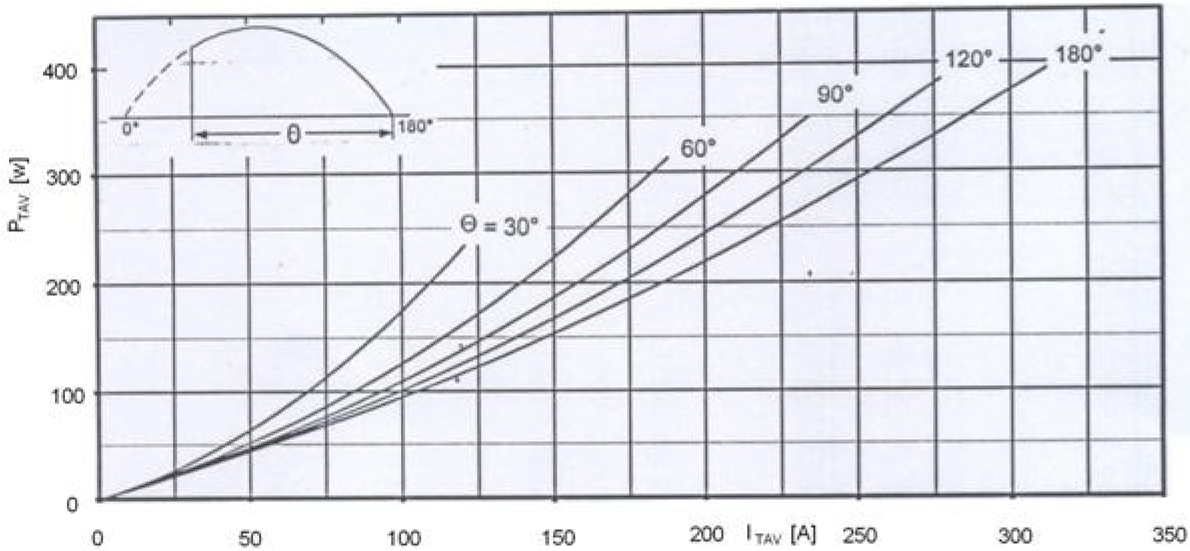


Transient thermal impedance per arm $Z_{thjc} = f(t)$

Rectangular Current

Current conduction angle Θ

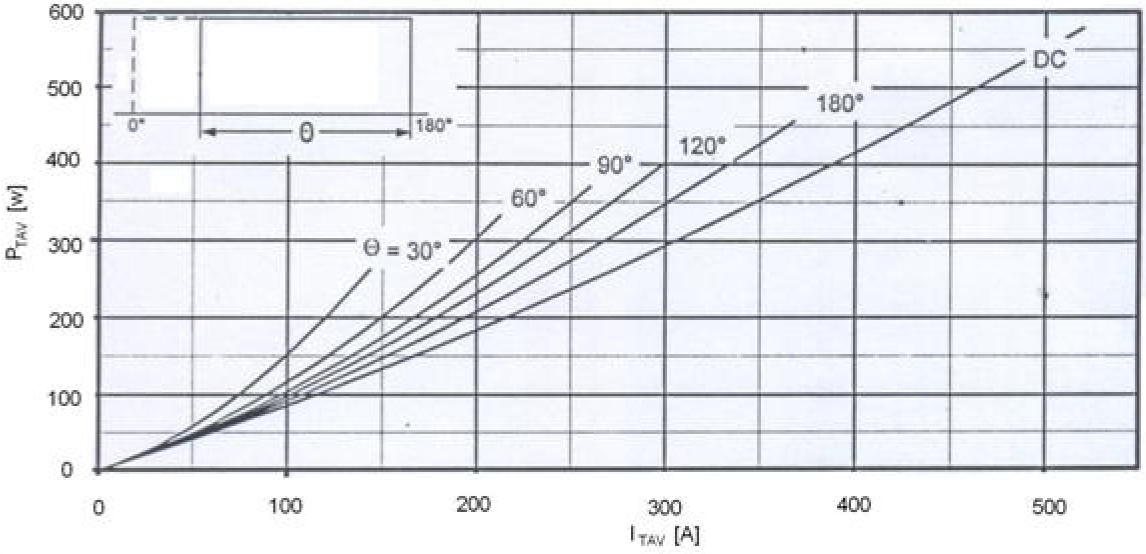
IRK. 330 SERIES



On-state power loss per arm $P_{TAV} = f(I_{TAV})$

Sinusoidal Current Strombelastung je Zweig / Current load per arm

Calculation base P_{TAV} (switching losses should be considered separately)



On-state power loss per arm $P_{TAV} = f(I_{TAV})$

Rectangular Current Strombelastung je Zweig / Current load per arm

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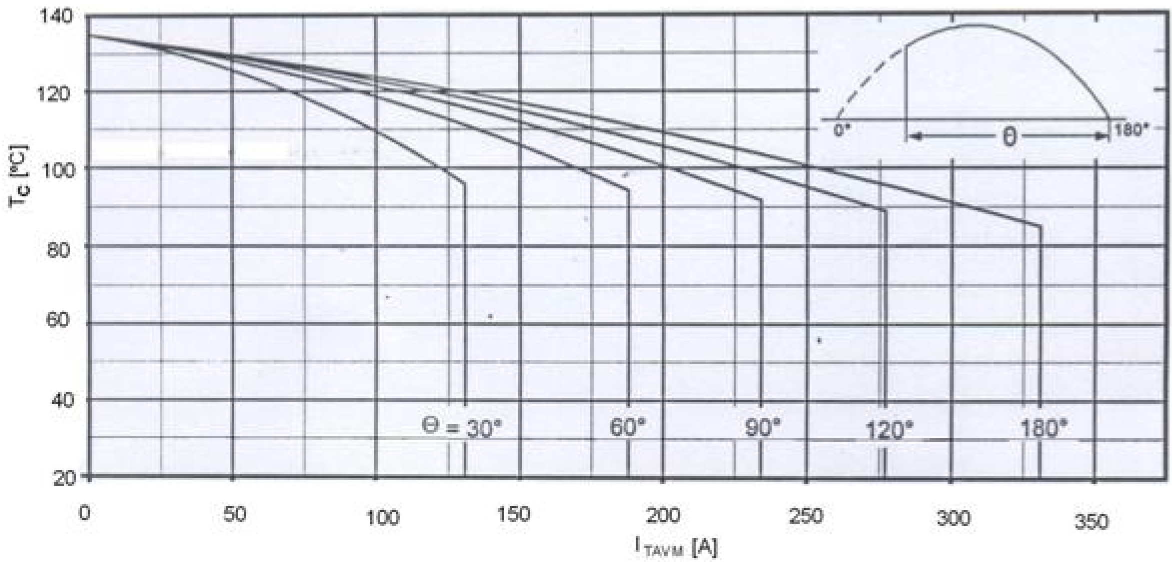
Current conduction angle Θ

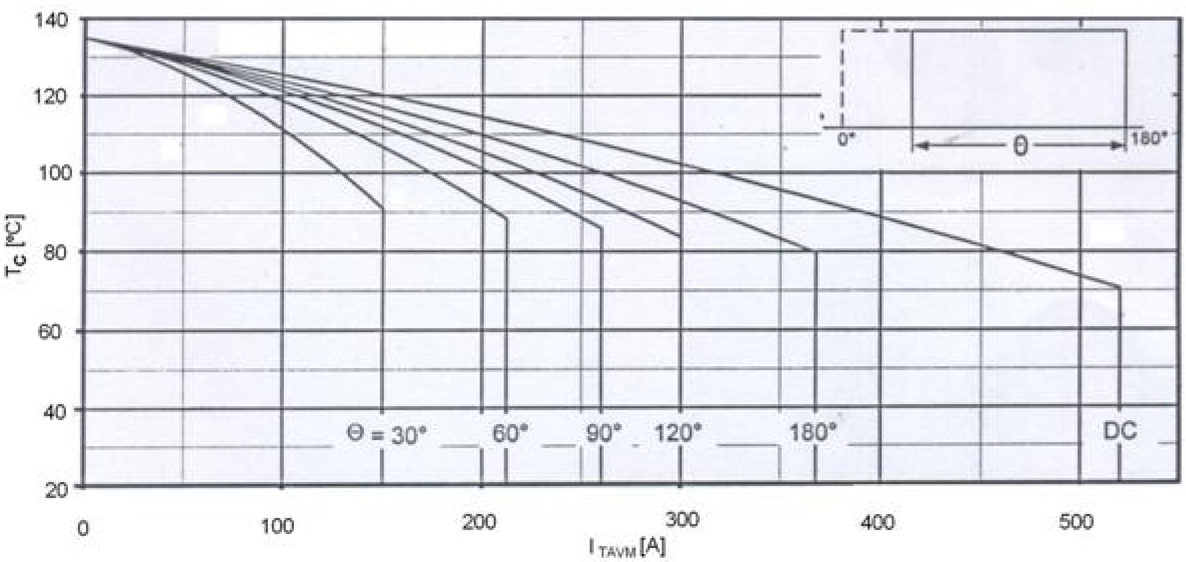


Maximum allowable case temperature Tc = f(I $_{TAV}$)

Sinusoidal Current Strombelastung je Zweig / Current load per arm

Calculation base P_{TAV} (switching losses should be considered separately)

Current conduction angle Θ



Maximum allowable case temperature Tc = f(I $_{TAV}$)

Rectangular Current Strombelastung je Zweig / Current load per arm

Calculation base P_{TAV} (switching losses should be considered separately)

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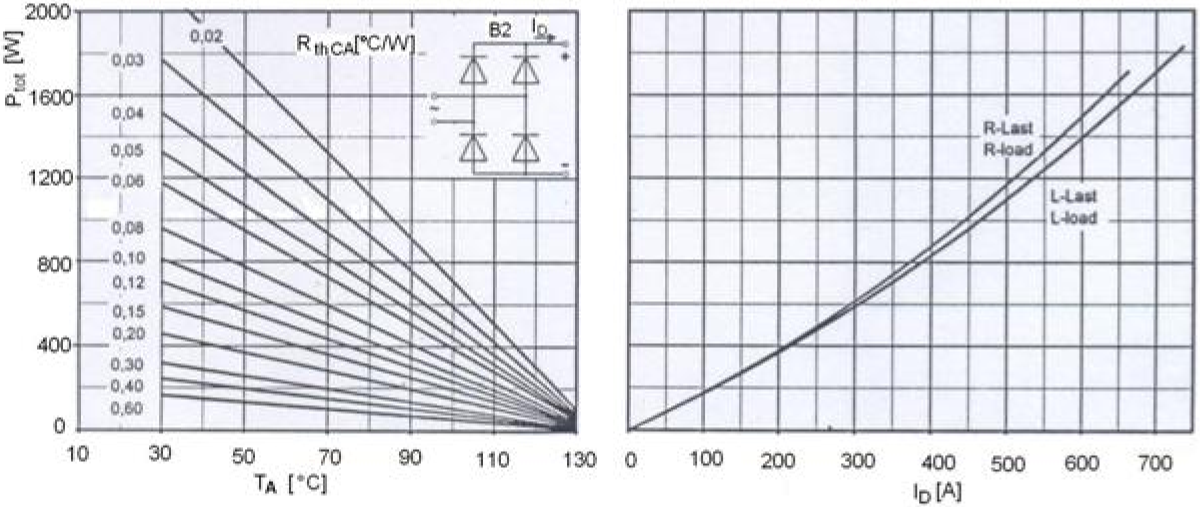
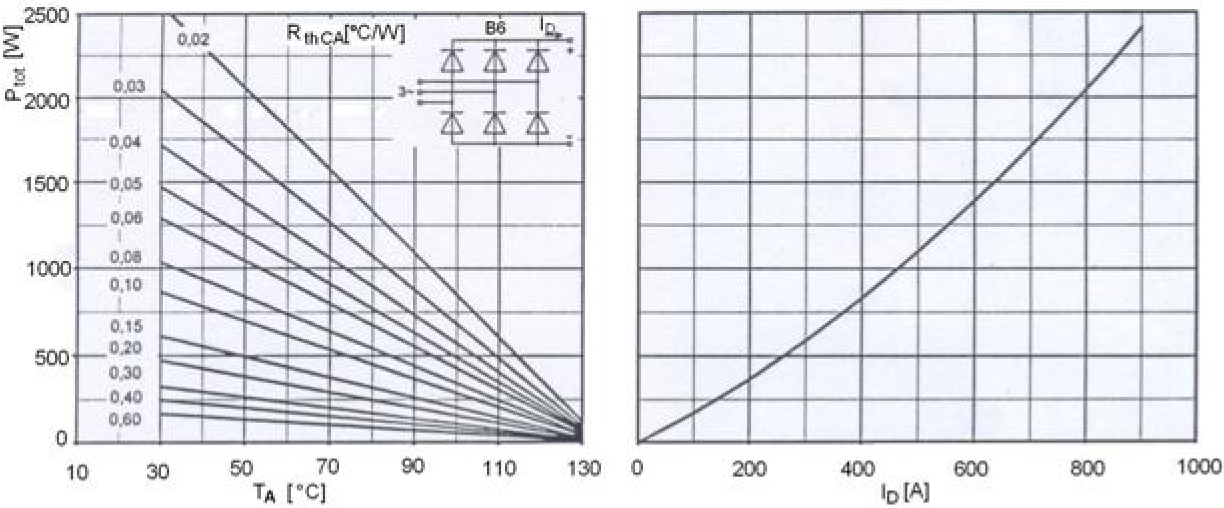


Maximum rated output current I_D

Two-pulse bridge circuit

Total power dissipation at circuit P_{tot}

Thermal resistance cases to ambient R_{thCA}



Maximum rated output current I_D

Six-pulse bridge circuit

Total power dissipation at circuit P_{tot}

Thermal resistance cases to ambient R_{thCA}

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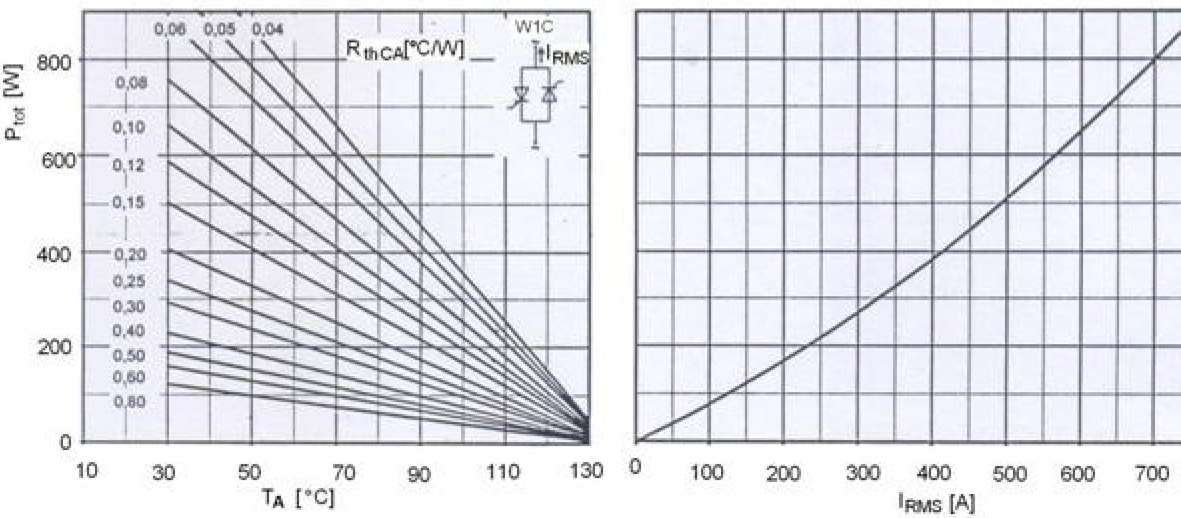
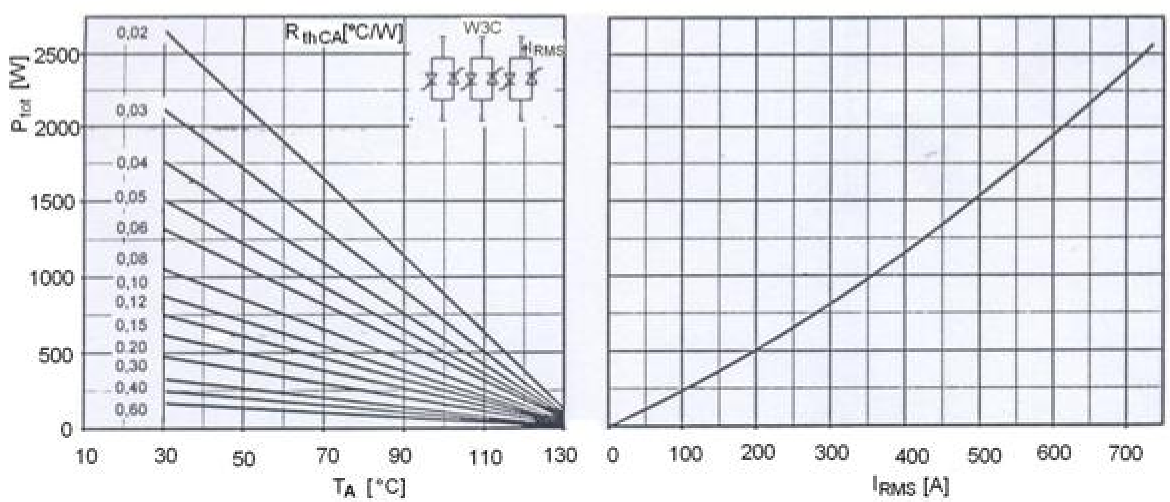


Maximum rated RMS current I_{RMS}

Single-Phase inverse parallel circuit

Total power dissipation at circuit P_{tot}

Thermal resistance cases to ambient R_{thCA}

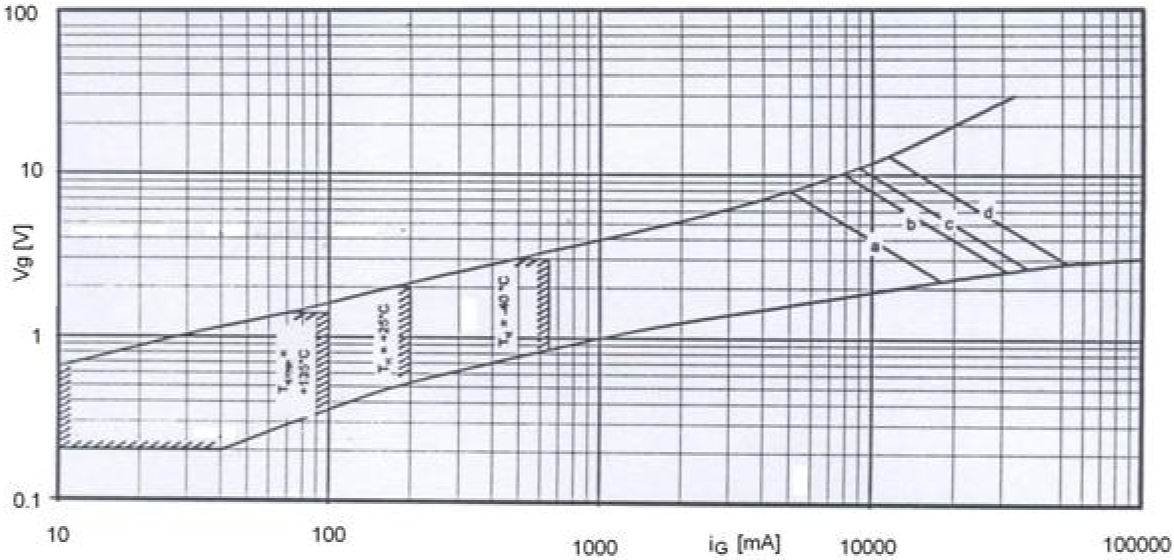


Maximum rated output current I_D

Three-Phase inverse parallel circuit

Total power dissipation at circuit P_{tot}

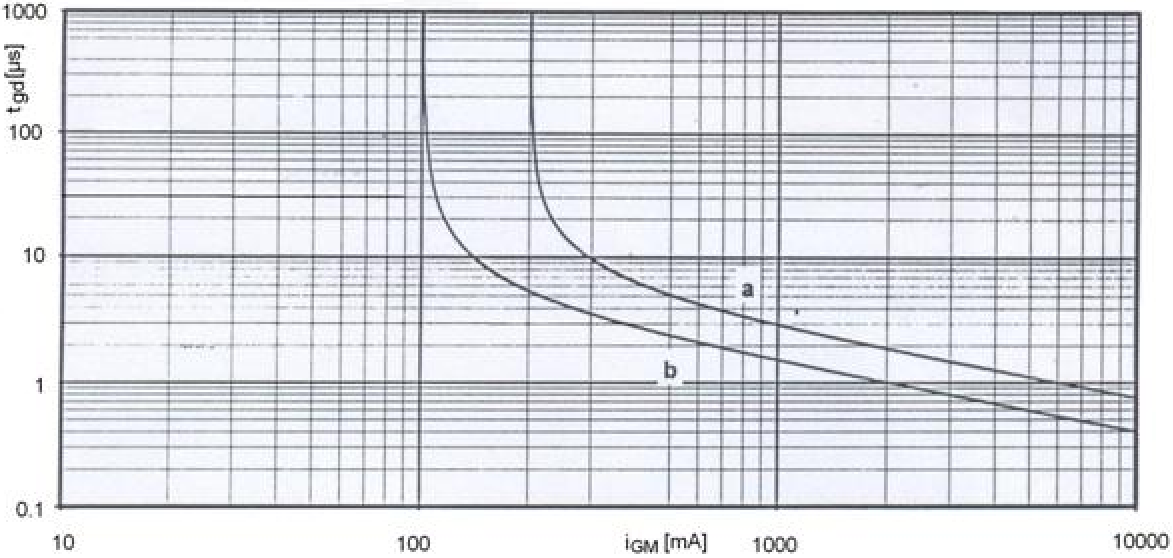
Thermal resistance cases to ambient R_{thCA}



Gate characteristic $v_G = f(i_G)$ with triggering area for $v_D = 6V$

Maximum rated peak gate power dissipation $P_{GM} = f(t_g)$

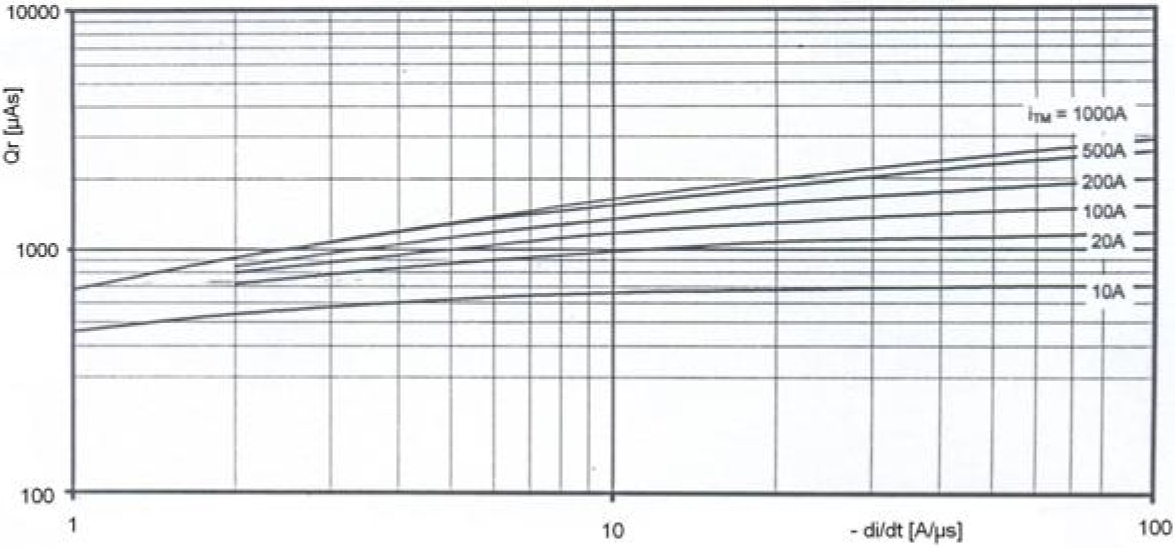
a - 40 W/10ms b - 80 W/1ms c - 100 W/ 0.5ms d - 150W/0.1s



Gate controlled delay time $t_{gd} = f(i_G)$

$T_{vj} = 25\,°C.\ di_G/dt = i_{GM}/1\mu s$

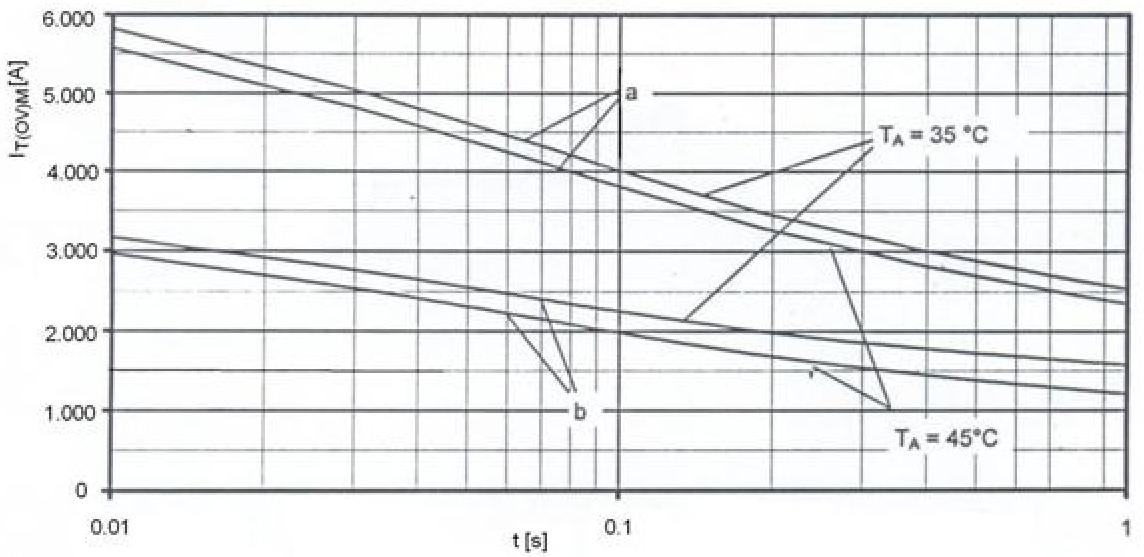
a - Limiting characteristic
b - Typical characteristic



Recovered charge Qr = f(-di/dt)

T_{vj} = T_{vj} max., $V_R \leq 0.5$ V_{RRM}, $V_{RM} = 0.8$ V_{RRM}

Parameter : On-state current i_{TM}



Maximum overload On-state current $I_{T(OV)M}$ = f(t), $V_{RM} = 0.8$ V_{RRM}

a: No-load conditions

b: after load with I_{TAVM}

T_A = 35 °C, Forced air cooling

T_A = 45 °C, Natural air cooling

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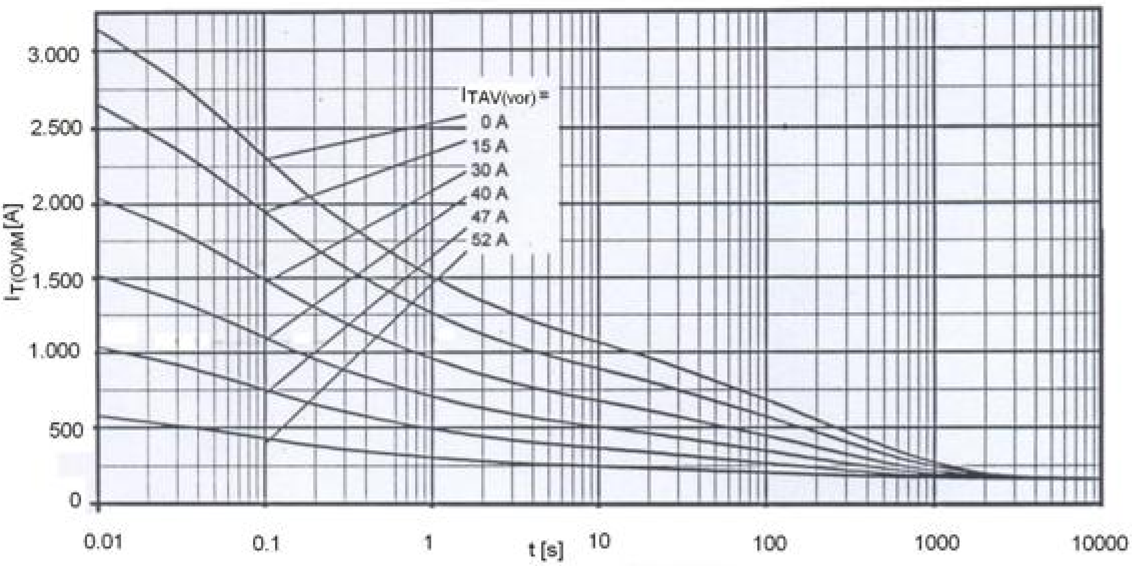
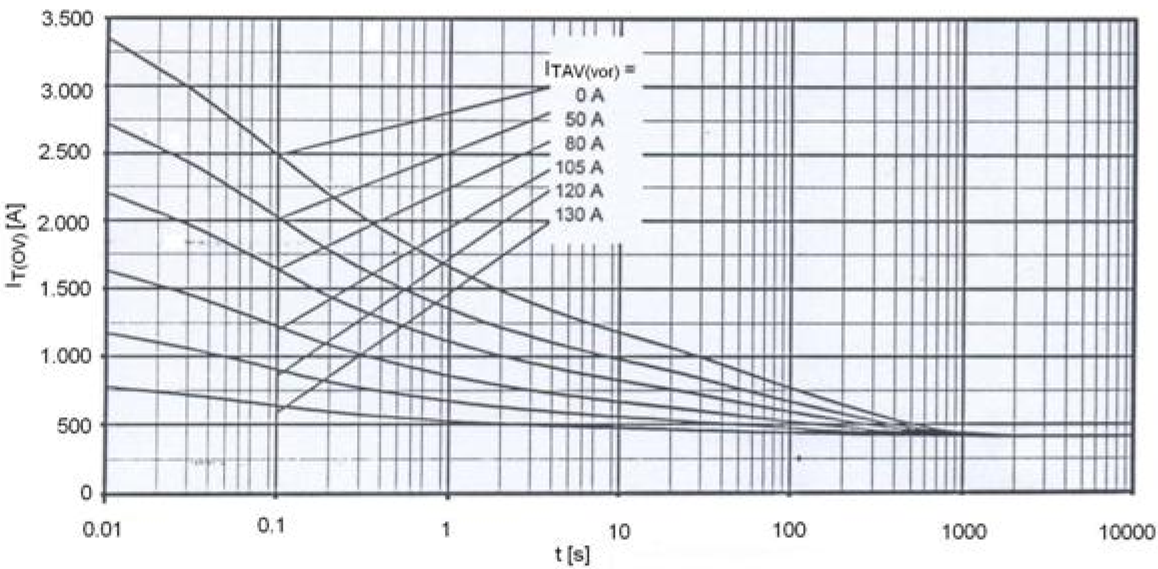


Overload On-state current $I_{T(OV)}$

B6- Six-pulse bridge circuit, 120° rectangular

Heatsink type KM17 (45W) Natural air cooling at T_A = 45 °C

Parameter: Pre-load current per arm $I_{TAV(vor)}$



Overload On-state current $I_{T(OV)}$

B6- Six-pulse bridge circuit, 120° rectangular

Heatsink type KM17 Forced air cooling at T_A = 35 °C

Parameter: Pre-load current per arm $I_{TAV(vor)}$