International
IOR Rectifier

SERIES P400

PASSIVATED ASSEMBLED CIRCUIT ELEMENTS

40A

Features

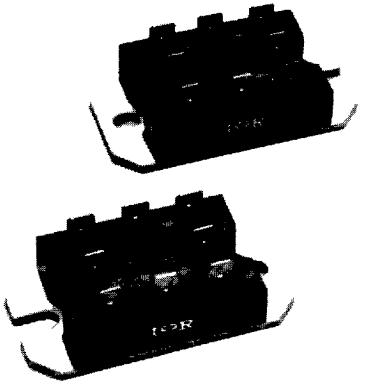
- Glass passivated junctions for greater reliability
- Electrically isolated base plate
- Available up to 1200 V_{RRM}, V_{DRM}
- High dynamic characteristics
- Wide choice of circuit configurations
- Simplified mechanical design and assembly
- UL E78996 approved

Description

The P400 series of Integrated Power Circuits consists of power thyristors and power diodes configured in a single package. With its isolating base plate, mechanical designs are greatly simplified giving advantages of cost reduction and reduced size.
Applications include power supplies, control circuits and battery chargers.

Major Ratings and Characteristics

Parameters		P400	Units
I_D		40	A
	@ T_C	85	°C
I_{FSM}	@ 50Hz	385	A
	@ 60Hz	400	A
I^2t	@ 50Hz	745	A^2s
	@ 60Hz	680	A^2s
$I^2\sqrt{t}$		7450	$A^2\sqrt{s}$
V_{RRM} range		400 to 1200	V
V_{INS}		2500	V
T_J		-40 to 125	°C



ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	V_{RRM} maximum repetitive peak reverse voltage V	V_{RSM} maximum non-repetitive peak reverse voltage V	V_{DRM} maximum repetitive peak off-state voltage V
P401, P411, P421, P431, P441, P461, P471	400	500	400
P402, P412, P422, P432, P442, P462, P472	600	700	600
P403, P413, P423, P433, P443, P463, P473	800	900	800
P404, P414, P424, P434, P444, P464, P474	1000	1100	1000
P405, P415, P425, P435, P445, P465, P475	1200	1300	1200

On-state Conduction

	Parameters	P400	Units	Conditions		
I_D	Maximum DC output Current	40	A	@ T_C = 85 °C, full bridge circuits 0,1,2 and 3		
$I_{T(AV)}$ $I_{F(AV)}$	Maximum average on-state and forward current	20	A	180° sine conduction circuits 6, 7		
I_{RMS}	Maximum RMS current	44	A	180° sine conduction circuit 4		
I_{TSM} I_{FSM}	Maximum peak one-cycle non repetitive on-state or forward current	385	A	10ms	No voltage reapplied	Sinusoidal half Wave Initial T_J=$T_J$max
		400	A	8.3ms		
		325	A	10ms	100% V_{RRM} reapplied	Sinusoidal half Wave Initial T_J=$T_J$max
		340	A	8.3ms		
I^2t	Maximum I^2t for fusing	745	A^2s	10ms	No voltage reapplied	Initial T_J=$T_J$max
		680	A^2s	8.3ms		
		530	A^2s	10ms	100% voltage reapplied	Initial T_J=$T_J$max
		480	A^2s	8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7450	$A^2\sqrt{s}$	t=0 to 10ms, no voltage reapplied I^2t for time tx = $I^2\sqrt{t} \cdot \sqrt{tx}$		
$V_{T(TO)}$	Maximum value of threshold voltage	0.85	V	T_J=125°C		
r_t	Maximum value of on-state or forward slope resistance	7.89	mΩ	T_J=125°C, Av. power = $V_{T(TO)} * I_{T(AV)} + r_t * (I_{T(RSM)})^2$		
V_{TM}	Maximum peak on-state or forward voltage drop	1.35	V	T_J=25°C I_{TM}=π x $I_{T(AV)}$		
V_{FM}		1.35	V	T_J=25°C I_{FM}=π x $I_{F(AV)}$		
$di/_{dt}$	Maximum non repetitive rate of rise of turned on current	200	A/μs	T_J=125°C from 0.67 V_{DRM} I_{TM}=π x $I_{T(AV)}$, I_g = 500mA, tr < 0.5 μs, tp > 6 μs		
I_H	Maximum holding current	100	mA	T_J=25°C anode supply=6V, resistive load, gate open		
I_L	Maximum latching current	250	mA	T_J=25°C anode supply=6V, resistive load.		

Blocking

	Parameters	P400	Units	Conditions
$dv/_{dt}$	Maximum critical rate of rise of off-state voltage	200	V/µs	T_J=125°C, exponential to 0.67 V_{DRM} gate open
I_{RRM} I_{DRM}	Maximum peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	10	mA	T_J=125°C, gate open circuit
I_{RRM}	Max. peak reverse leakage current	100	µA	T_J = 25°C
V_{INS}	RMS isolation voltage	2500	V	50Hz, circuit to base, all terminals shorted T_J = 25°C, t = 1 s

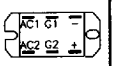
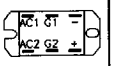
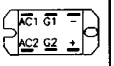
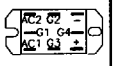
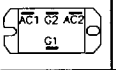
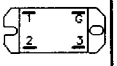
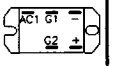
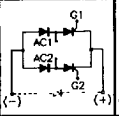
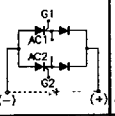
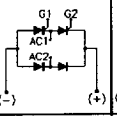
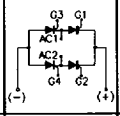
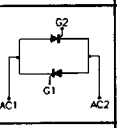
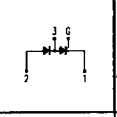
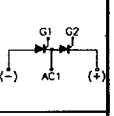
Triggering

	Parameters	P400	Units	Conditions	
P_{GM}	Maximum peak gate power	8.0	W		
$P_{G(AV)}$	Maximum average gate power	2.0	W		
I_{GM}	Maximum peak gate current	2.0	A		
$-V_{GM}$	Maximum peak negative gate voltage	10	V		
V_{GT}	Maximum gate voltage required to trigger	3.0	V	T_J=-40°C	Anode supply = 6V resistive load
		2.0	V	T_J= 25°C	
		1.0	V	T_J=125°C	
I_{GT}	Maximum gate current required to trigger	90	mA	T_J=-40°C	Anode supply = 6V resistive load
		60	mA	T_J= 25°C	
		35	mA	T_J=125°C	
V_{GD}	Maximum gate voltage that will not trigger	0.2	V	T_J=125°C, rated V_{DRM} applied	
I_{GD}	Maximum gate current that will not trigger	2.0	mA	T_J=125°C, rated V_{DRM} applied	

Thermal and Mechanical Specifications

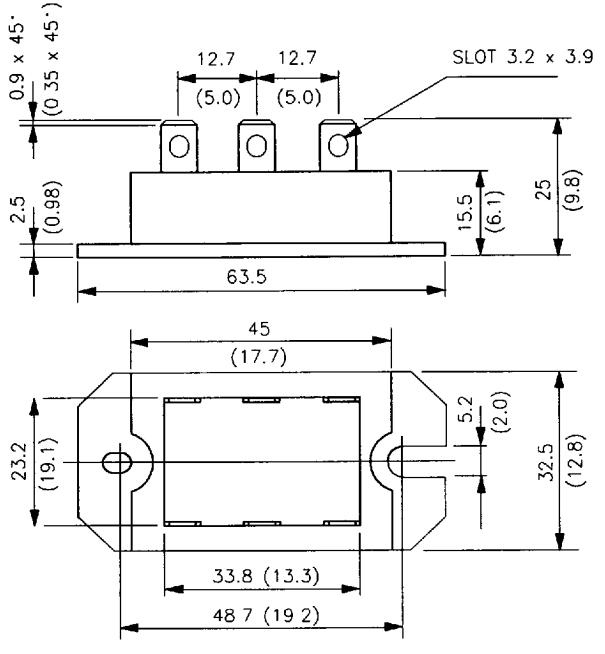
	Parameters	P400	Units	Conditions
T_J	Junction temperature range	-40 to 125	°C	
T_{stg}	Storage temperature range	-40 to 150	°C	
R_{thJC}	Maximum thermal resistance, junction to case	1.05	K/W	DC operation per junction
R_{thC-S}	Maximum thermal resistance	0.10	K/W	Mounting surface smooth and greased per module 0,1,2,3
		0.20	K/W	Mounting surface smooth and greased per module 4,6,7
T	Mounting torque, base to heatsink ±10%	5	Nm	A mounting compound is recommended and the torque should be checked after a period of 3 hours to allow for the spread of the compound.
wt	Approximate weight	58 (2.0)	g (oz)	

Circuit Type and Coding *

	Circuit "0"	Circuit "1"	Circuit "2"	Circuit "3"	Circuit "4"	Circuit "6"	Circuit "7"
Terminal Positions							
Schematic diagram							
	Single Phase Hybrid Bridge Common Cathode	Single Phase Hybrid Bridge Common Anode	Single Phase Hybrid Bridge Doubler Connection	Single Phase All SCR Bridge	SCR AC Switch	Hybrid Doubler	SCR Doubler
Basic series	P40.	P41.	P42.	P43.	P44.	P46.	P47.
With voltage suppression	P40.K	P41.K	P42.K	P43.K	P44.K	-	-
With free-wheeling diode	P40.W	41.W	-	-	-	-	-
With both voltage suppression and free-wheeling diode	P40.KW	P41.KW	-	-	-	-	-

* To complete code refer to voltage ratings table, i.e.: for 600V P410.W complete code is P402W

Outline Table



All dimensions in millimeters (inches)

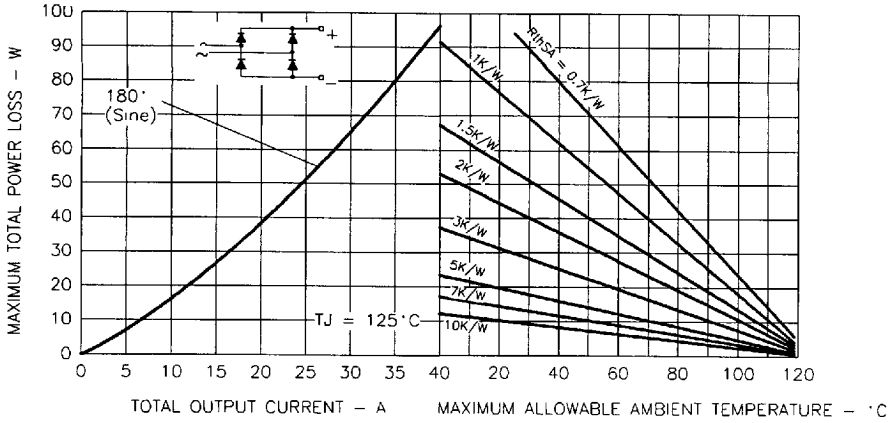


Fig. 1 - Current Rating Nomogram (1 Module Per Heatsink), Circuits '0', '1', '2', '3'

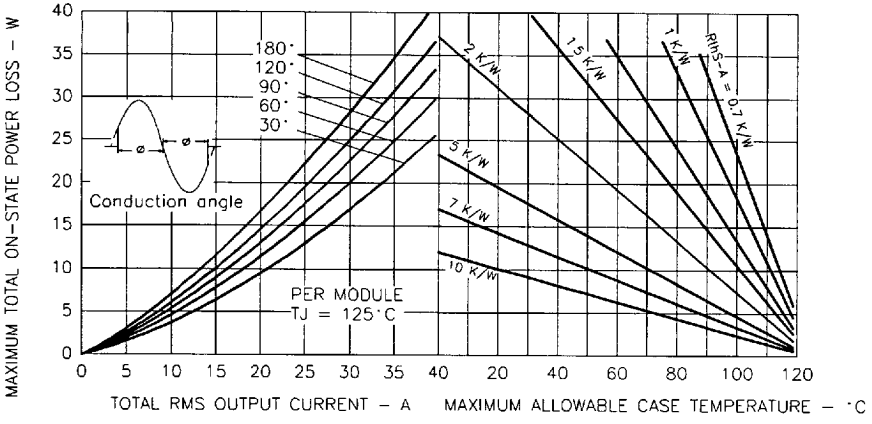


Fig. 2 - Current Rating Nomogram (1 Module Per Heatsink), Circuit '4'

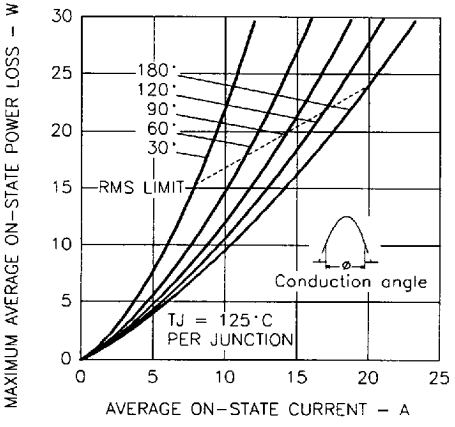


Fig. 3 - On-state Power Loss Characteristics

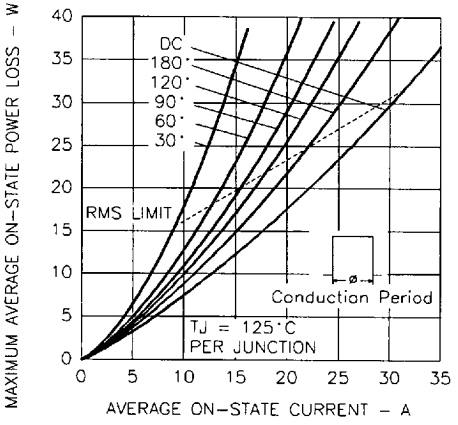


Fig. 4 - On-state Power Loss Characteristics

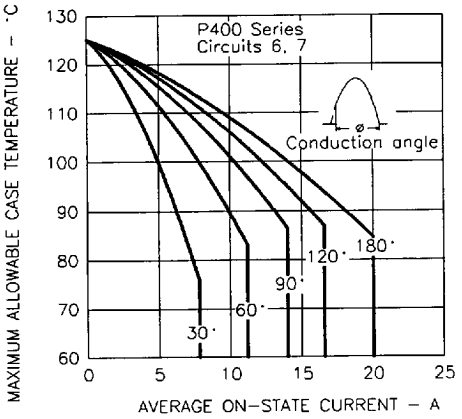


Fig. 5 - Current Ratings Characteristics

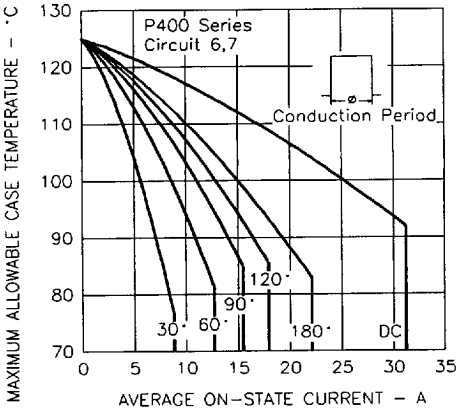


Fig. 6 - Current Ratings Characteristics

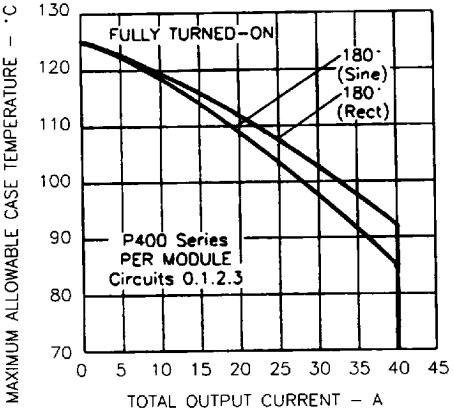


Fig. 7 - Current Ratings Characteristics

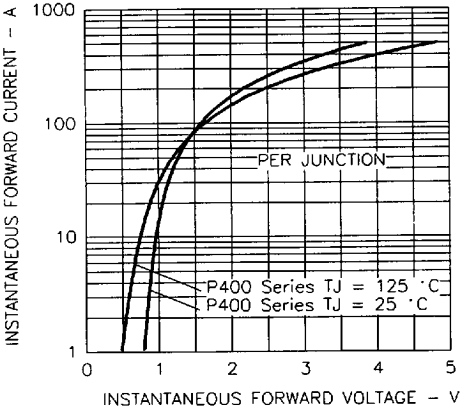


Fig. 8 - On-state Voltage Drop Characteristics

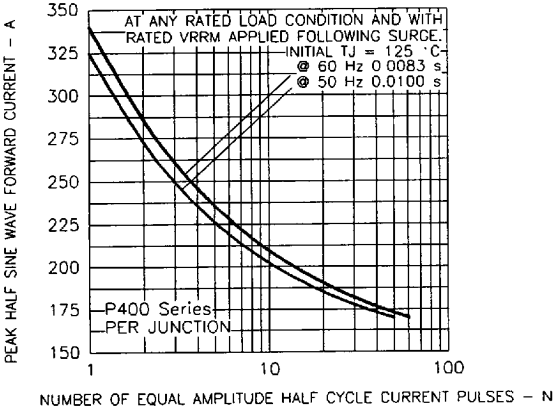


Fig. 9 - Maximum Non-Repetitive Surge Current

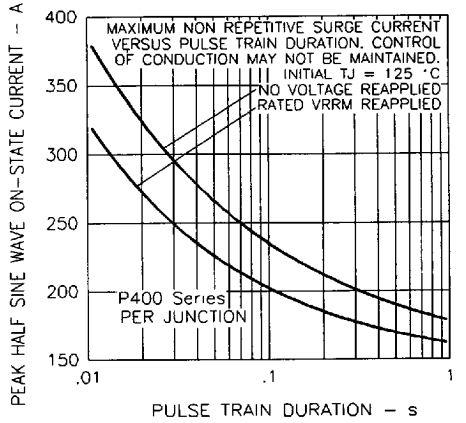


Fig. 10 - Maximum Non-Repetitive Surge Current

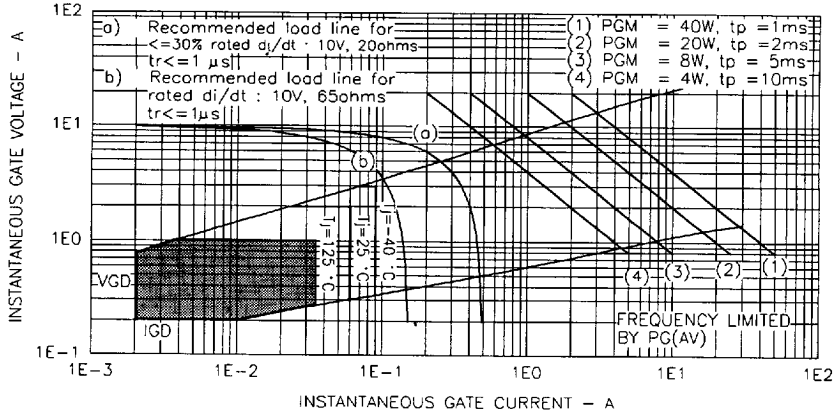


Fig. 11 - Gate Characteristics

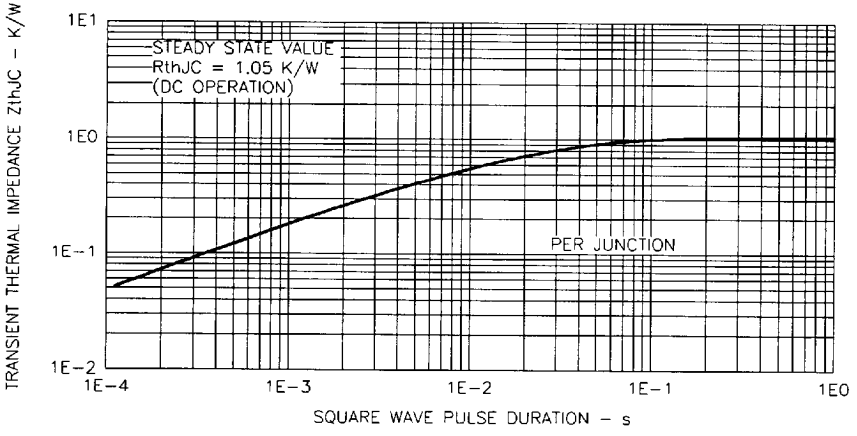


Fig. 12 - Thermal Impedance ZthJC Characteristics