

International Rectifier

SERIES IRK.26, .41, .56, .71, .91

HIGH VOLTAGE THYRISTOR/ DIODE
and THYRISTOR/ THYRISTOR

ADD-A-pak™ Power Modules

Features INTERNATIONAL RECTIFIER

65E D

25A - 40A
55A - 70A
90A

- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Standard JEDEC package
- Simplified mechanical designs, rapid assembly
- Auxiliary cathode terminals for wiring convenience
- High surge capability
- Wide choice of circuit configurations
- Large creepage distances
- UL E 78996 approved

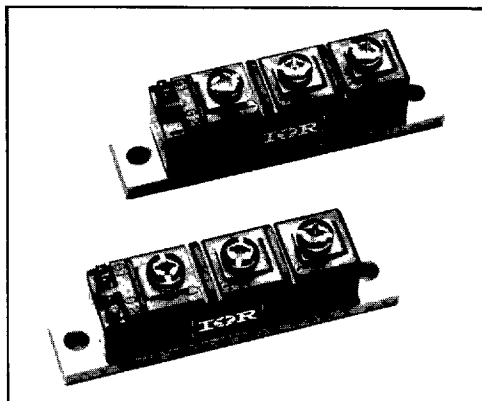
Description

These new IRK series of ADD-A-paks use high voltage power diodes and thyristors in a variety of circuit configurations. The semiconductor chips 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 AC controllers. These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, and temperature and motor speed control circuits.

Major Ratings and Characteristics

Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units
I _{T(AV)} or I _{F(AV)} @ 85°C	25	40	55	70	90	A
I _{O(RMS)} (*)	55.5	89	122	155	200	A
I _{TSM} @ 50Hz	535	770	1250	1550	1700	A
I _{FSM} @ 60Hz	560	810	1310	1610	1785	A
I ² _t @ 50Hz	1430	3000	7800	11950	14550	A ² s
@ 60Hz	1300	2700	7100	10900	13300	A ² s
I ² √f	14300	30000	78000	119500	145500	A ² √s
V _{RRM} range	1400 to 1800					V
T _{STG}	-40 to 125					°C
T _J	-40 to 125					°C

(*) As AC switch.

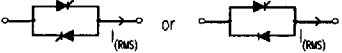


ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage code Code	V _{RRM} , maximum repetitive peak reverse voltage V	V _{RSM} , maximum non-repetitive peak reverse voltage V	V _{DRM} , max. repetitive peak off-state voltage, gate open circuit V	I _{RRM} I _{DRM} 125°C mA
IRK.26-/41-/56-/71-/91-	14	1400	1500	1400	20
	16	1600	1700	1600	20
	18	1800	1900	1800	20

On-state Conduction

Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions
I _{T(AV)} Max. average on-state current (Thyristors)	25	40	55	70	90	A	180° conduction, half sine wave T _C = 85°C (IRK.26, .71) T _C = 80°C (IRK.41, .56, .91)
I _{F(AV)} Maximum average forward current (Diodes)	25	40	55	70	90	A	
I _{O(RMS)} Max. continuous RMS on-state current. As AC switch	55.5	89	122	155	200	A	
I _{TSM} or I _{FSM} Max. peak, one cycle non-repetitive on-state or forward current	535	770	1250	1550	1700	A	t=10ms No voltage reappplied
	560	810	1310	1610	1785	A	t=8.3ms
	450	650	1050	1300	1435	A	t=10ms 100% V _{RRM} reappplied
	470	680	1100	1360	1500	A	t=8.3ms
	595	865	1360	1695	1830	A	t=10ms T _J = 25°C, no voltage reappplied
622	910	1425	1760	1910	A	t=8.3ms	
I ² t Max. I ² t for fusing	1430	3000	7800	11950	14550	A ² s	t=10ms No voltage reappplied
	1300	2700	7100	10900	13300	A ² s	t=8.3ms
	1010	2110	5500	8450	10300	A ² s	t=10ms 100% V _{RRM} reappplied
	920	1930	5000	7700	9400	A ² s	t=8.3ms
	1780	3750	9000	14300	16750	A ² s	t=10ms T _J = 25°C, no voltage reappplied
1600	3350	8250	13000	19250	A ² s	t=8.3ms	
I ² /t Max. I ² /t for fusing (1)	14300	30000	78000	119500	145500	A ² /s	t=0.1 to 10ms, no voltage reappplied
V _{T(TO)} Max. value of threshold voltage (2)	1.30	1.20	0.90	0.91	0.96	V	Low level (3)
	1.40	1.30	1.00	0.98	1.10	V	High level
r _t Max. value of on-state slope resistance (2)	8.5	4.4	4.1	3.2	2.5	mΩ	Low level (3)
	7.5	3.8	3.4	2.9	2.1	mΩ	High level
V _{TM} Max. peak on-state or forward voltage	1.92	1.77	1.55	1.60	1.62	V	I _{TM} = π × I _{T(AV)} T _J = 25°C
V _{FM} forward voltage	1.92	1.77	1.55	1.60	1.62	V	I _{FM} = π × I _{F(AV)} 180° conduction
di/dt Max. non-repetitive rate of rise of turned on current	150	150	150	150	150	A/μs	T _J = 25°C, from 0.67 V _{DRM} I _{TM} = π × I _{T(AV)} , I _g = 500mA, t _r < 0.5 μs, t _p > 6 μs
I _H Max. holding current	200	200	200	200	200	mA	T _J = 25°C, anode supply = 6V, resistive load, gate open circuit
I _L Max. latching current	400	400	400	400	400	mA	T _J = 25°C, anode supply = 6V, resistive load

(1) I²t for time t_x = I²/t × √t_x
 (3) 16.7% × π × I_{AV} < I < π × I_{AV}

(2) Average power = V_{T(TO)} × I_{T(AV)} + r_t × (I_{T(RMS)})²
 (4) π × I_{AV} < I < 20 × π × I_{AV}

Triggering

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Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions
P_{GM} Max. peak gate power	10	10	10	12	12	W	
$P_{G(AV)}$ Max. avg. gate power	2.5	2.5	2.5	3.0	3.0	W	
I_{GM} Max. peak gate current	2.5	2.5	2.5	3.0	3.0	A	
$-V_{GM}$ Max. peak negative gate voltage	10	10	10	10	10	V	
V_{GT} Max. gate voltage required to trigger	4.0	4.0	4.0	4.0	4.0	V	Anode supply = 6V resistive load
	2.5	2.5	2.5	2.5	2.5	V	
	1.5	1.5	1.5	1.5	1.5	V	
I_{GT} Max. gate current required to trigger	250	250	250	270	270	mA	Anode supply = 6V resistive load
	100	100	100	120	120	mA	
	50	50	50	60	60	mA	
V_{GD} Max. gate voltage that will not trigger	0.25	0.25	0.25	0.25	0.25	V	$T_J = 125^\circ\text{C}$, rated V_{DRM} applied
I_{GD} Max. gate current that will not trigger	6.0	6.0	6.0	6.0	6.0	mA	$T_J = 125^\circ\text{C}$, rated V_{DRM} applied

Blocking

I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current at V_{RRM} , V_{DRM}	20	20	20	20	20	mA	$T_J = 125^\circ\text{C}$, gate open circuit
V_{INS} RMS isolation voltage	3500	3500	3500	3500	3500	V	50 Hz, circuit to base, all terminal shorted, $t = 1\text{s}$
dv/dt Max. critical rate of rise of off-state voltage (5)	500	500	500	500	500	V/ μs	$T_J = 125^\circ\text{C}$, linear to $0.67 V_{DRM}$, gate open circuit

Thermal and Mechanical Specifications

Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions
T_J Junction operating temperature range	- 40 to 125					$^\circ\text{C}$	
T_{stg} Storage temp. range	- 40 to 125					$^\circ\text{C}$	
R_{thJC} Max. internal thermal resistance, junction to case	0.400	0.300	0.250	0.195	0.145	K/W	Per module, D.C. operation
R_{thCS} Max. thermal resistance case to heatsink	0.1					K/W	Mounting surface flat, smooth and greased (per module)
T Mounting torque $\pm 10\%$ ADD-A-pak to heatsink Busbar to ADD-A-pak	5					Nm	A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound
	3					Nm	
wt Approximate weight	140					g	
	5					oz	
Case style	TO-240AA						JEDEC

(5) Available with $dv/dt = 1000\text{V}/\mu\text{s}$, to complete code add S90 i.e. IRKT91-18 S90.

ΔR Conduction (per Junction)

(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

Devices	Sine half wave conduction					Rect. wave conduction					Units
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
IRK.91	0.033	0.063	0.080	0.110	0.190	0.033	0.065	0.087	0.122	0.196	K/W
IRK.71	0.050	0.080	0.104	0.152	0.252	0.049	0.085	0.113	0.158	0.255	K/W
IRK.56	0.055	0.109	0.138	0.200	0.331	0.066	0.112	0.149	0.208	0.334	K/W
IRK.41	0.070	0.132	0.168	0.229	0.369	0.080	0.137	0.182	0.255	0.410	K/W
IRK.26	0.165	0.182	0.233	0.340	0.563	0.110	0.189	0.252	0.352	0.567	K/W

Outlines Table

IRKT... (*)

A	B	C
0.8 (0.03)	4 (0.15)	5.8 (0.22)

** +0.4(0.015)

IRKH... (*)

A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)

All dimensions in millimeters (inches)

IRKL... (*)

A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)

IRK-92,72,57,42,27 types
With no auxiliary cathode

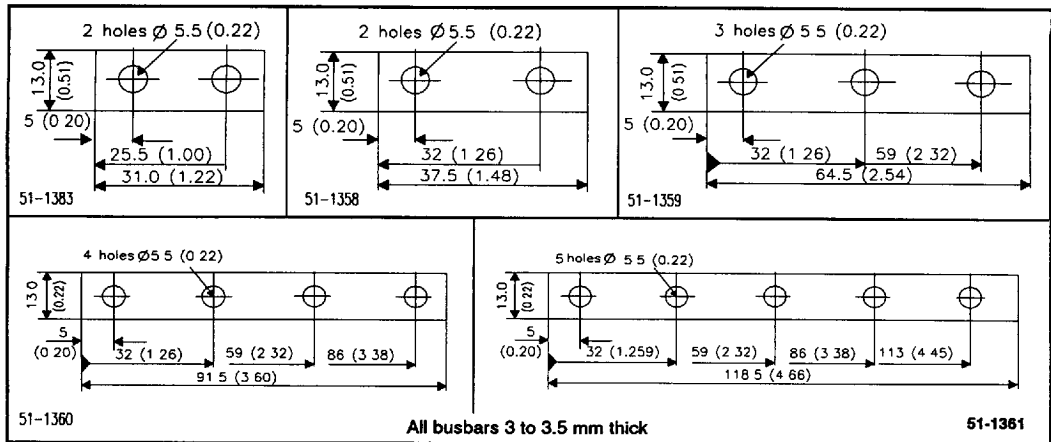
YELLOW : GATE TERMINAL
RED : AUXILIARY TERMINAL

1 pair supplied with "H", "L", "K" and "N" types
2 pairs supplied with "T", "U" and "V" types 13-0464

All dimensions in millimeters (inches)

(*) For terminals connections, see Circuit Configurations Table

Busbars Dimensions



Ordering Information Table

Circuit configurations Table						
IRKT	IRKU (A)	IRKV (A)	IRKH	IRKL	IRKK (A)	IRKN (A)
	(A) Available on request only. Contact factory					
1	2	3	4	** Available with no auxiliary cathode. To specify change: 26 to 27		
1	- Circuit code (See Circuit Configuration Table)			41 to 42		
2	- Current rating **			56 to 57		
3	- Voltage code (See Voltage Ratings Table)			71 to 72		
4	- dv/dt code: S90 = dv/dt 1000 V/μs			91 to 92		
No letter = dv/dt 500 V/μs				e.g. : IRKT92-18 etc.		

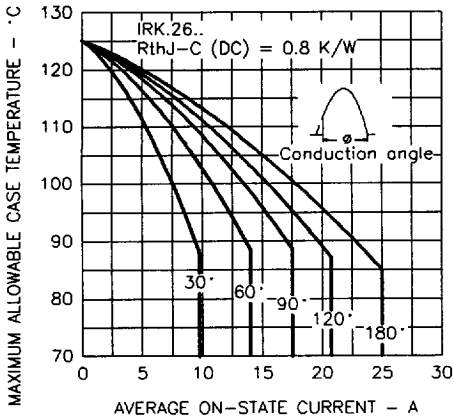


Fig. 1 - Current Ratings Characteristics

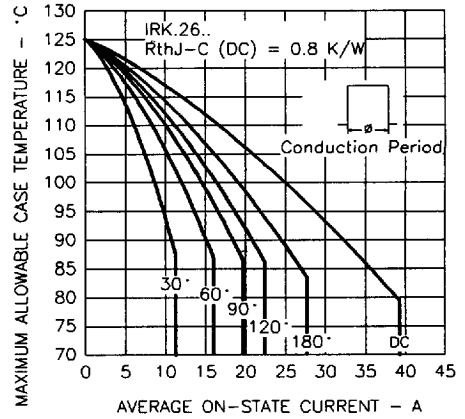


Fig. 2 - Current Ratings Characteristics

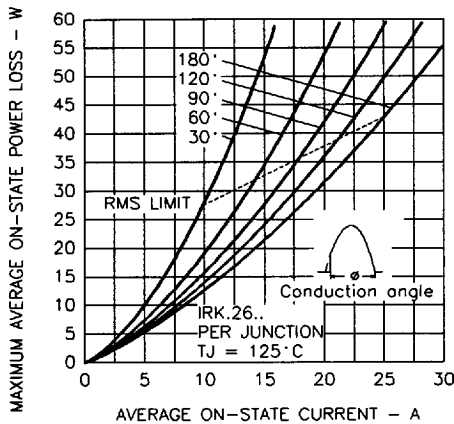


Fig. 3 - On-state Power Loss Characteristics

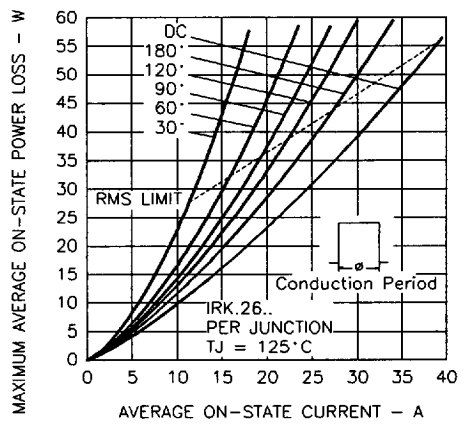


Fig. 4 - On-state Power Loss Characteristics

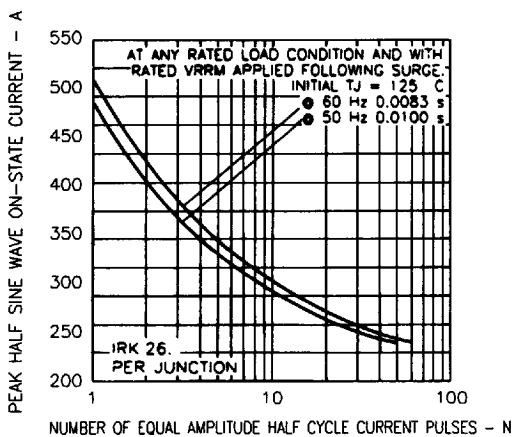


Fig. 5 - Maximum Non-Repulsive Surge Current

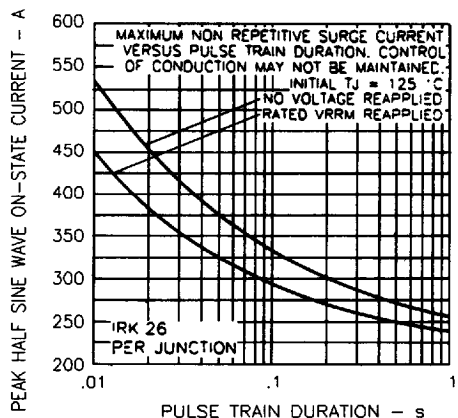


Fig. 6 - Maximum Non-Repulsive Surge Current

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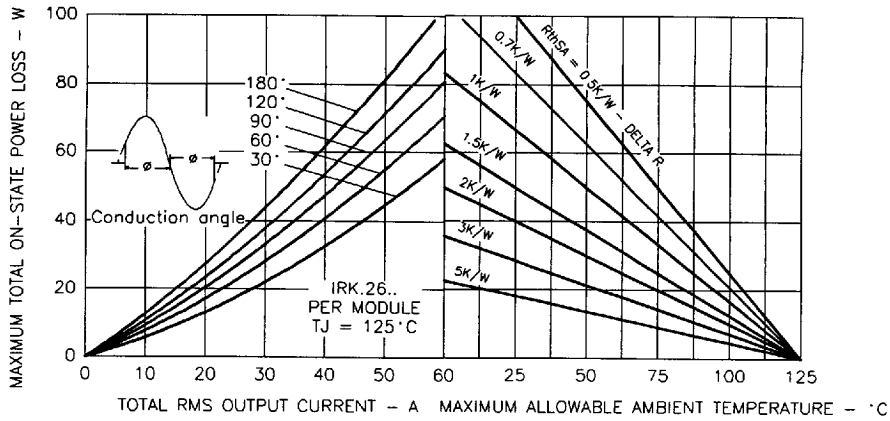


Fig. 7 - On-state Power Loss Characteristics

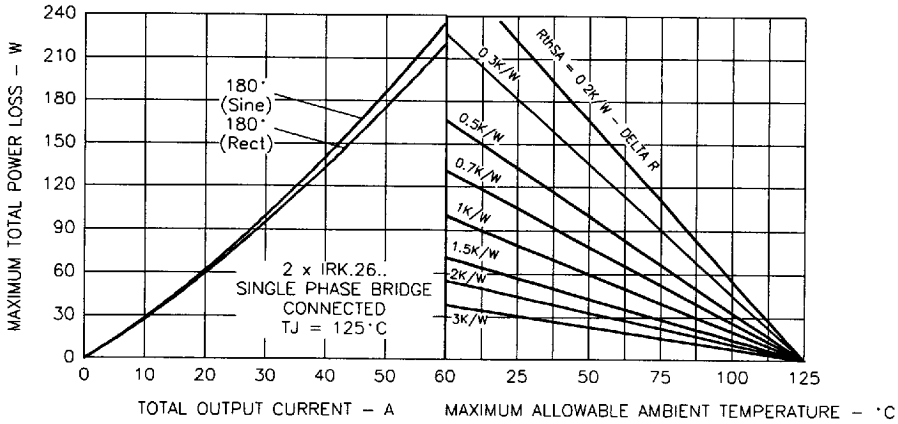


Fig. 8 - On-state Power Loss Characteristics

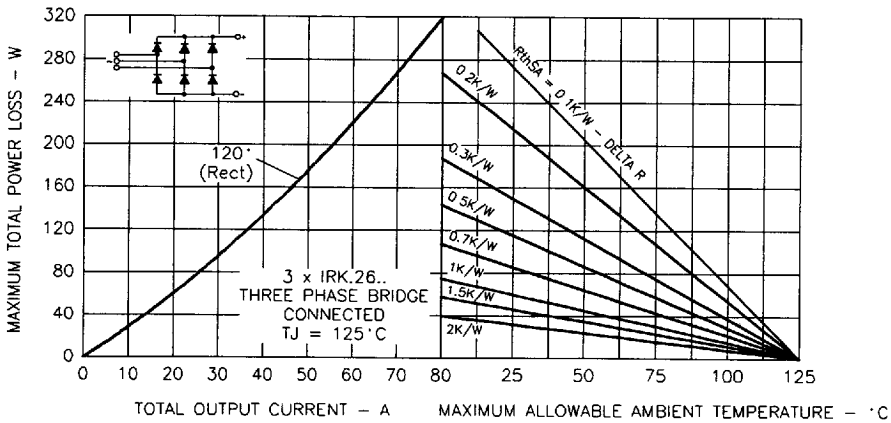


Fig. 9 - On-state Power Loss Characteristics

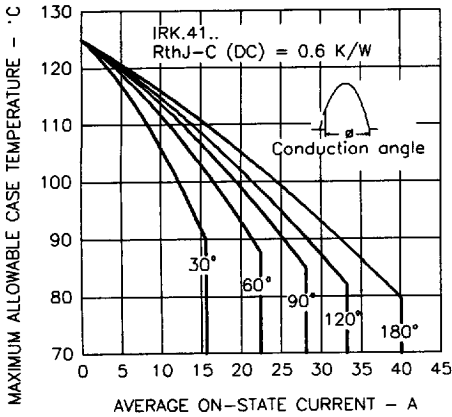


Fig. 10 - Current Ratings Characteristics

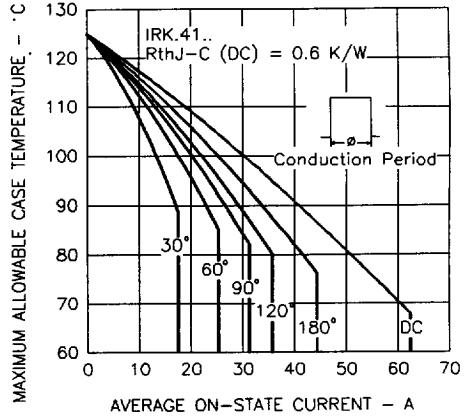


Fig. 11 - Current Ratings Characteristics

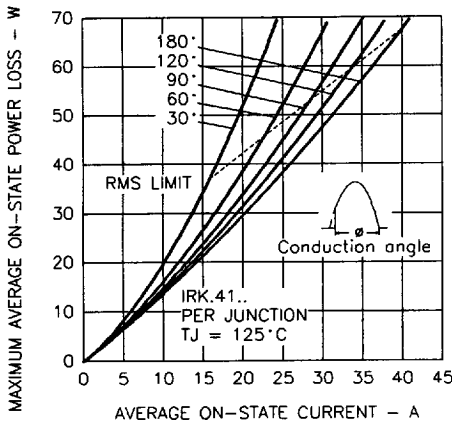


Fig. 12 - On-state Power Loss Characteristics

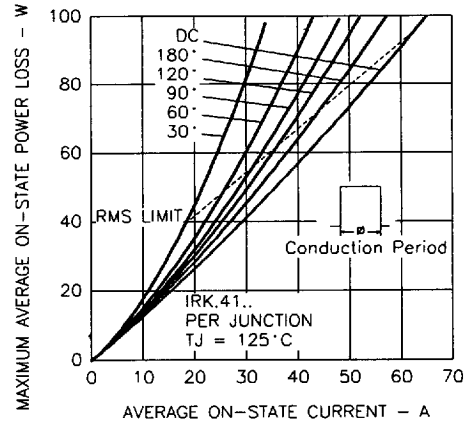


Fig. 13 - On-state Power Loss Characteristics

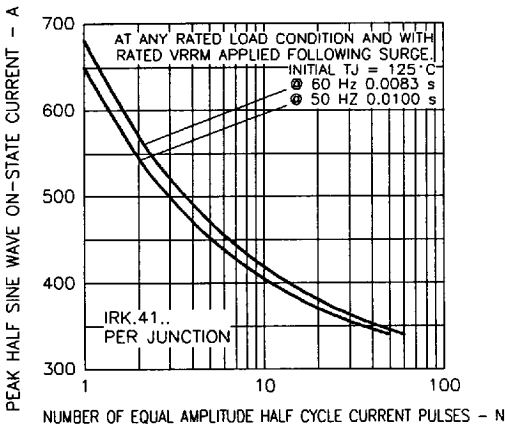


Fig. 14 - Maximum Non-Repetitive Surge Current

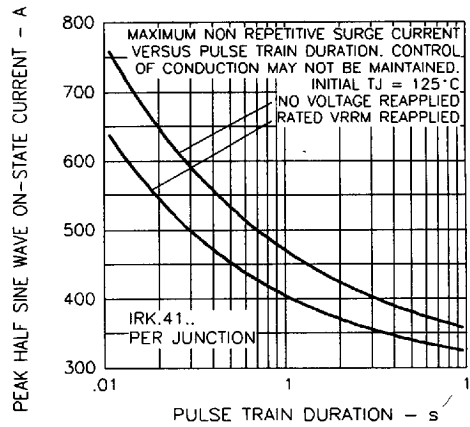


Fig. 15 - Maximum Non-Repetitive Surge Current

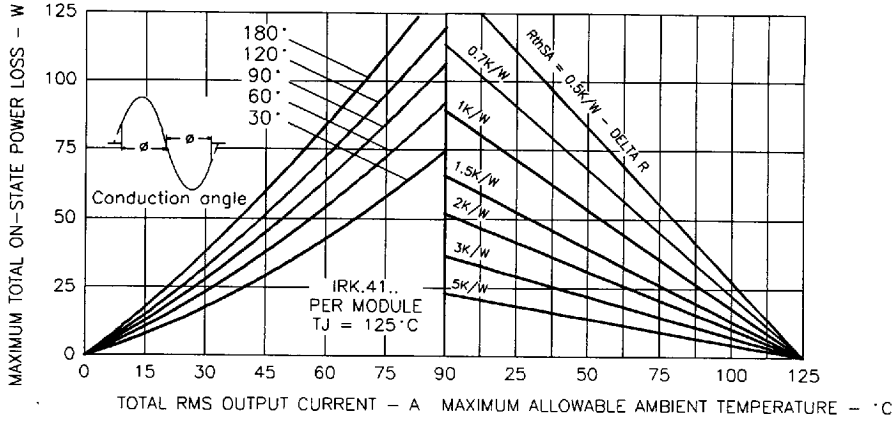


Fig. 16 - On-state Power Loss Characteristics

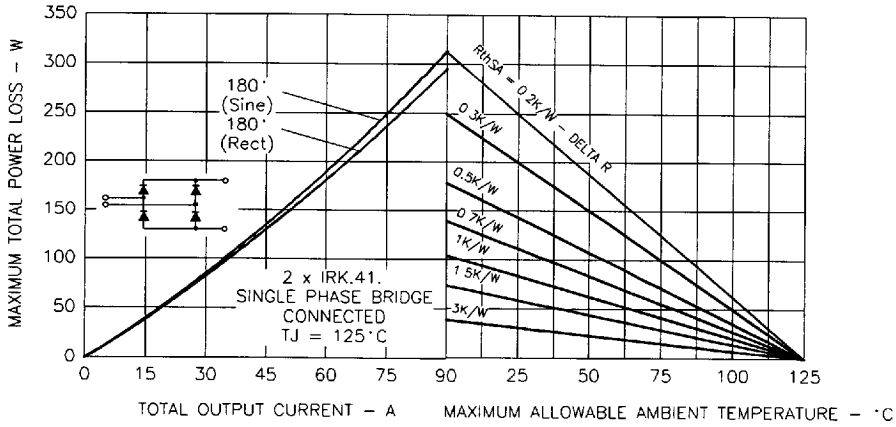


Fig. 17 - On-state Power Loss Characteristics

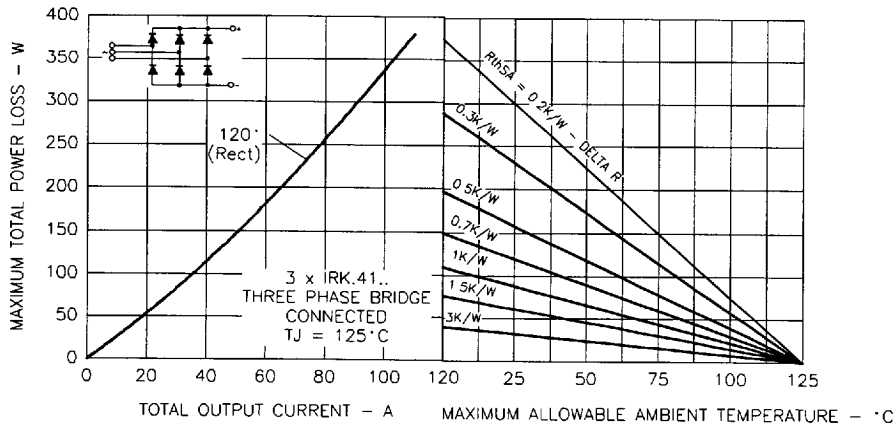


Fig. 18 - On-state Power Loss Characteristics

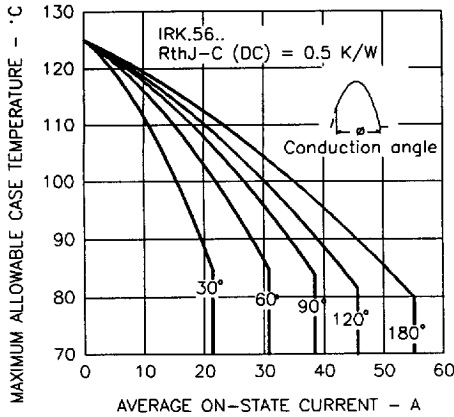


Fig. 19 - Current Ratings Characteristics

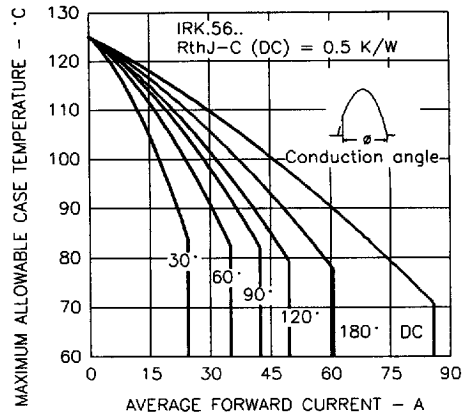


Fig. 20 - Current Ratings Characteristics

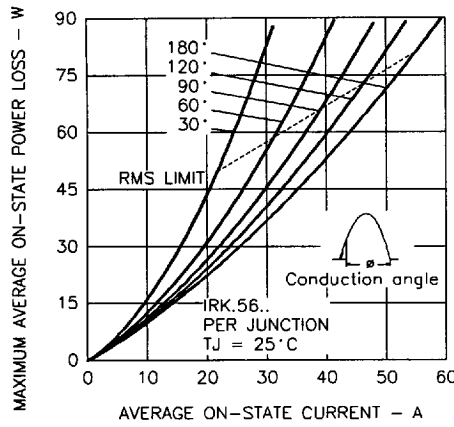


Fig. 21 - On-state Power Loss Characteristics

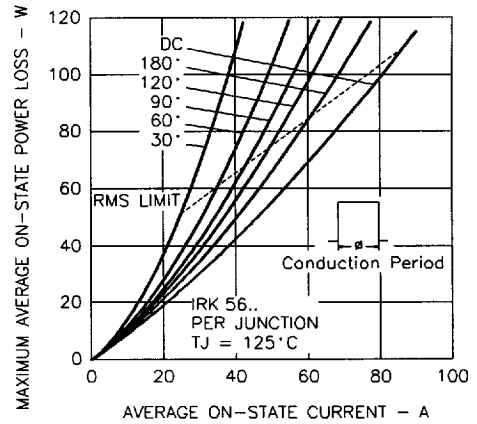


Fig. 22 - On-state Power Loss Characteristics

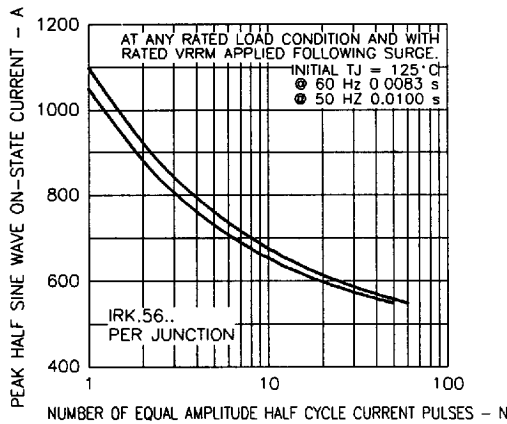


Fig. 23 - Maximum Non-Repetitive Surge Current

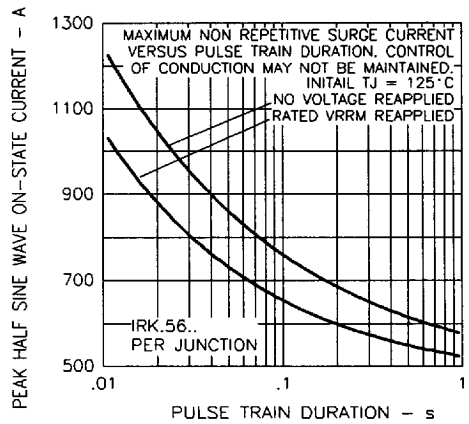


Fig. 24 - Maximum Non-Repetitive Surge Current

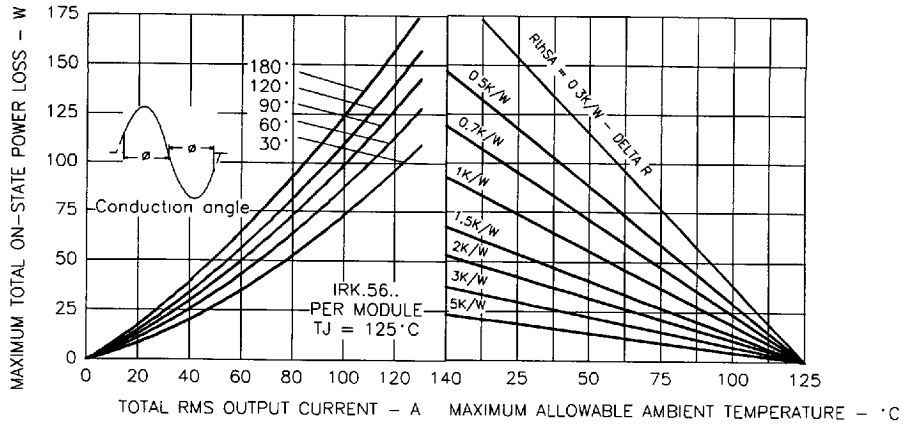


Fig. 25 - On-state Power Loss Characteristics

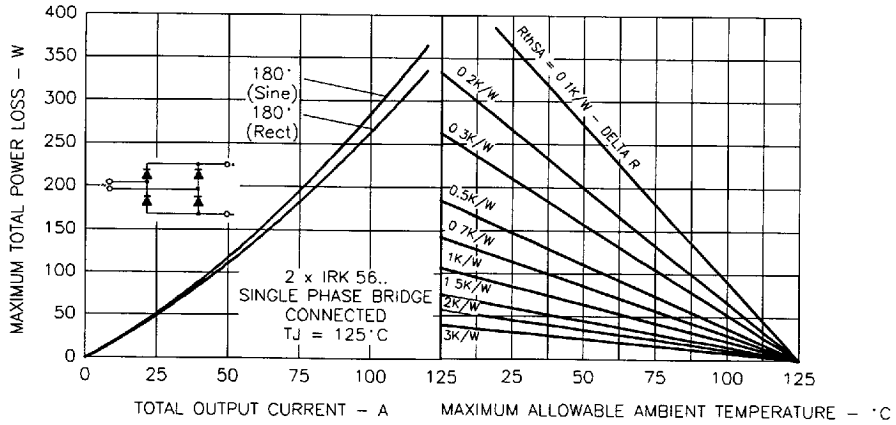


Fig. 26 - On-state Power Loss Characteristics

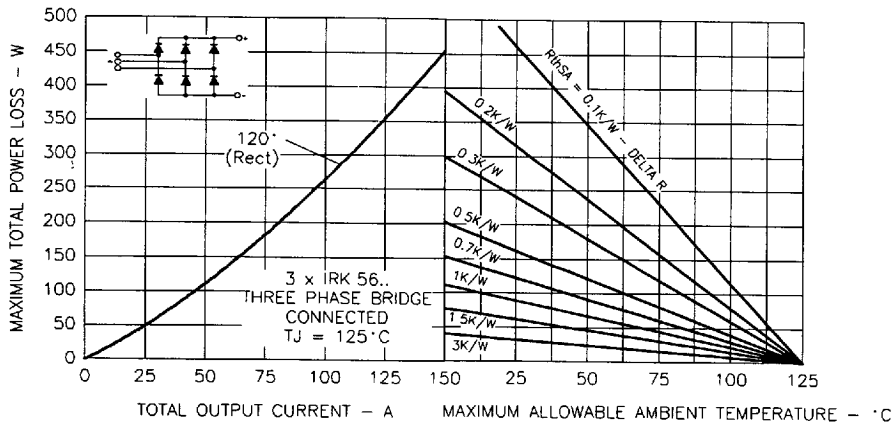


Fig. 27 - On-state Power Loss Characteristics

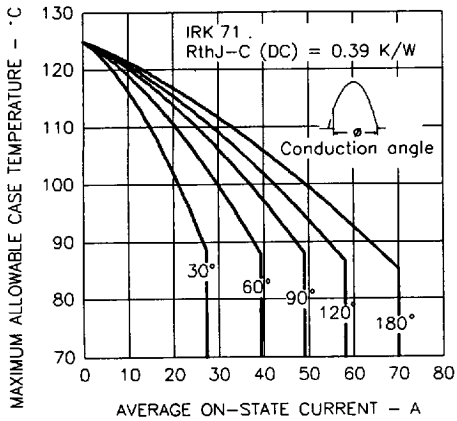


Fig. 28 - Current Ratings Characteristics

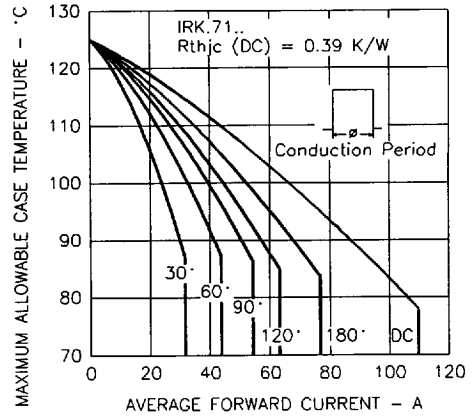


Fig. 29 - Current Ratings Characteristics

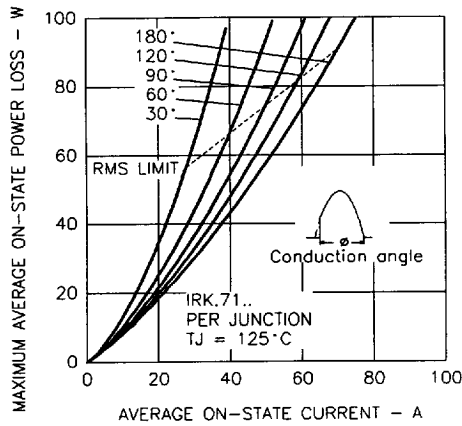


Fig. 30 - On-state Power Loss Characteristics

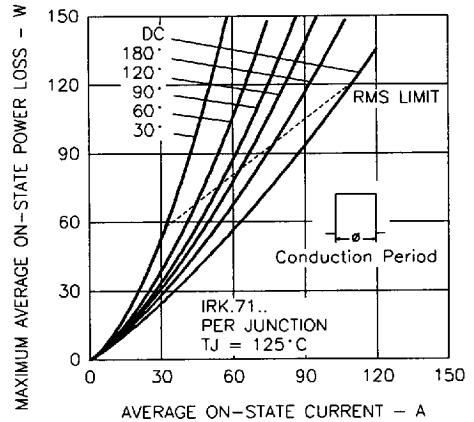


Fig. 31 - On-state Power Loss Characteristics

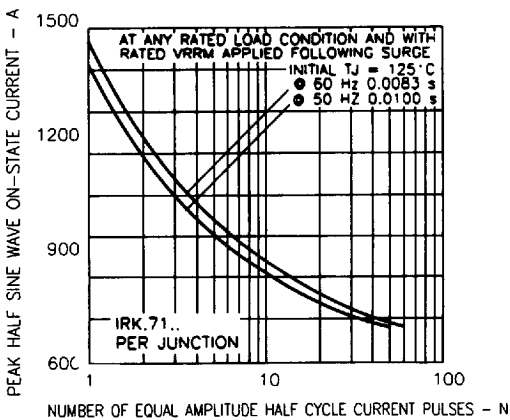


Fig. 32 - Maximum Non-Repetitive Surge Current

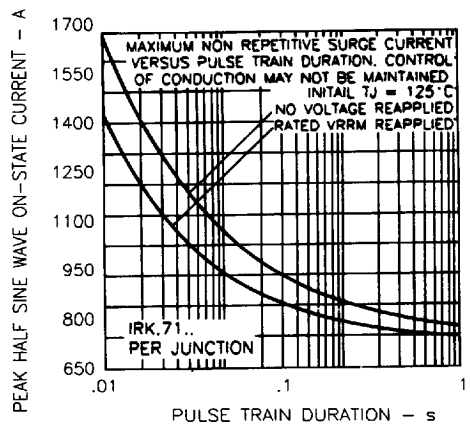


Fig. 33 - Maximum Non-Repetitive Surge Current

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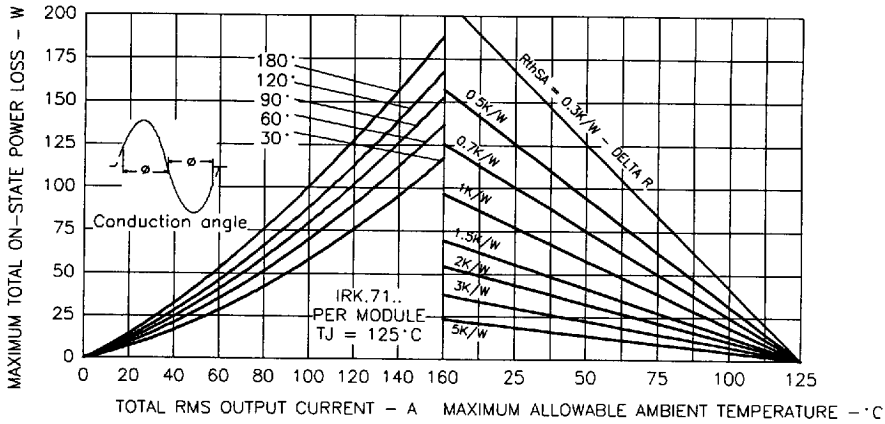


Fig. 34 - On-state Power Loss Characteristics

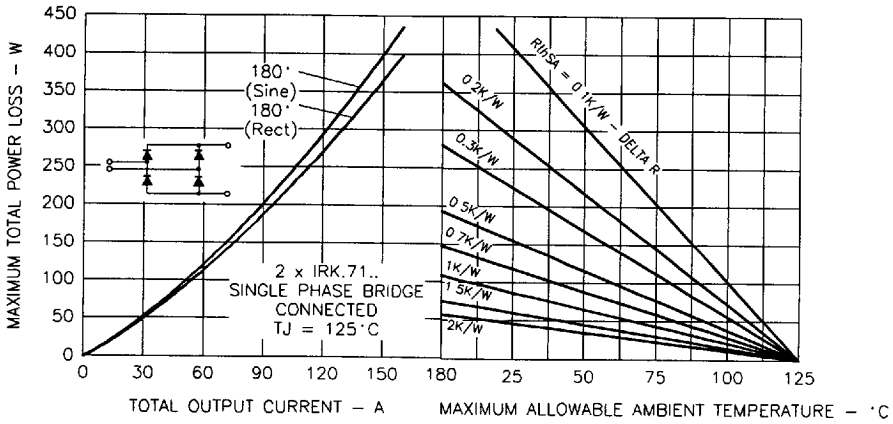


Fig. 35 - On-state Power Loss Characteristics

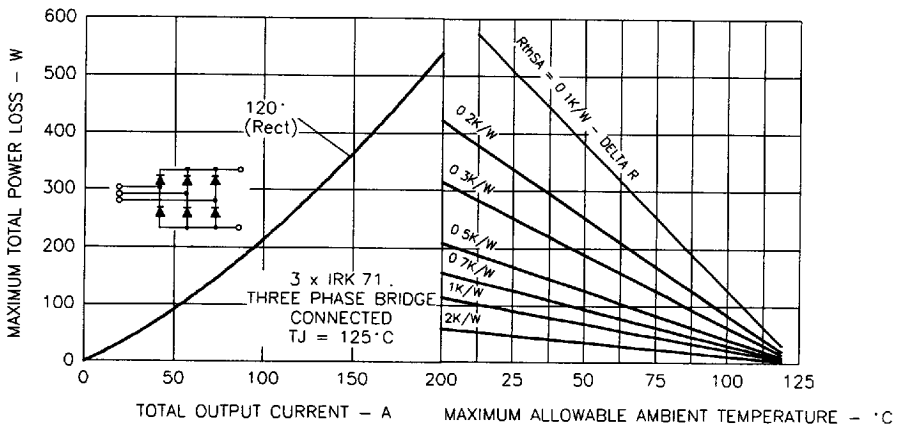


Fig. 36 - On-state Power Loss Characteristics

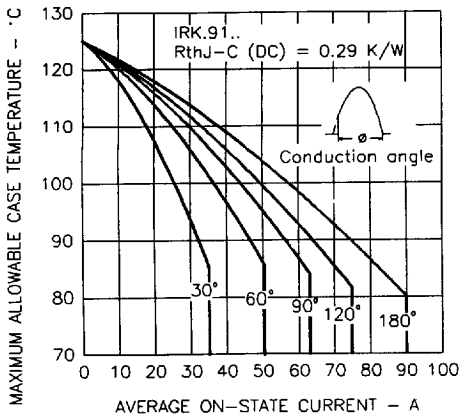


Fig. 37 - Current Ratings Characteristics

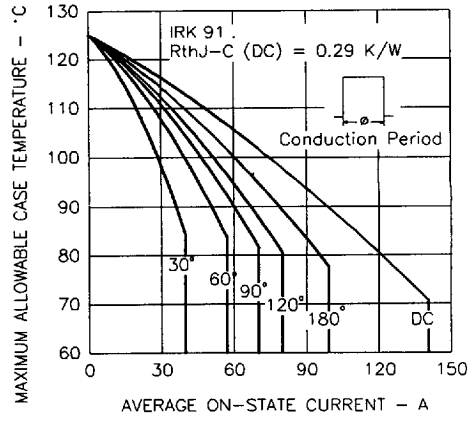


Fig. 38 - Current Ratings Characteristics

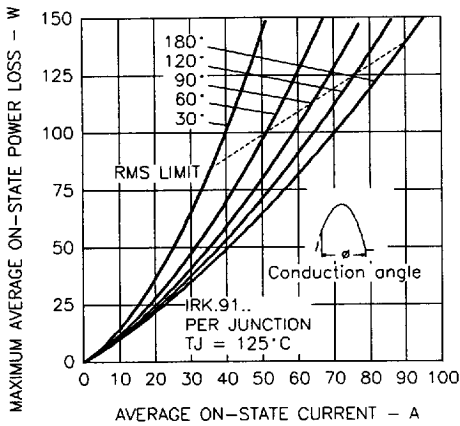


Fig. 39 - On-state Power Loss Characteristics

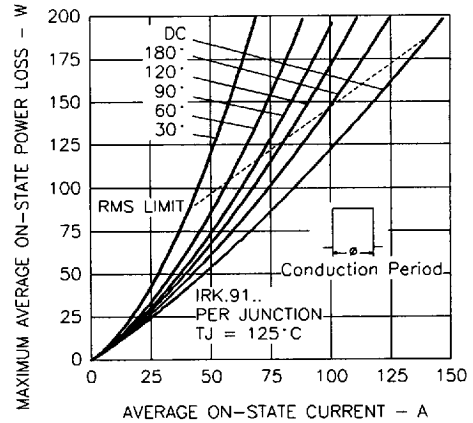


Fig. 40 - On-state Power Loss Characteristics

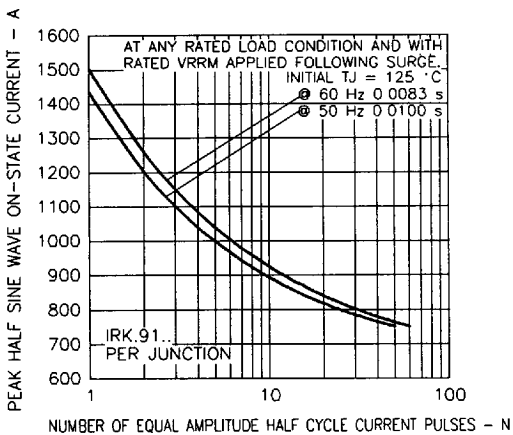


Fig. 41 - Maximum Non-Repetitive Surge Current

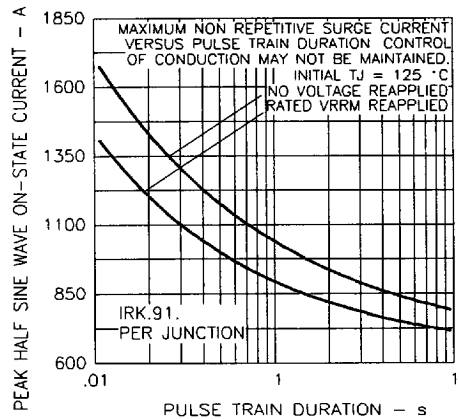


Fig. 42 - Maximum Non-Repetitive Surge Current

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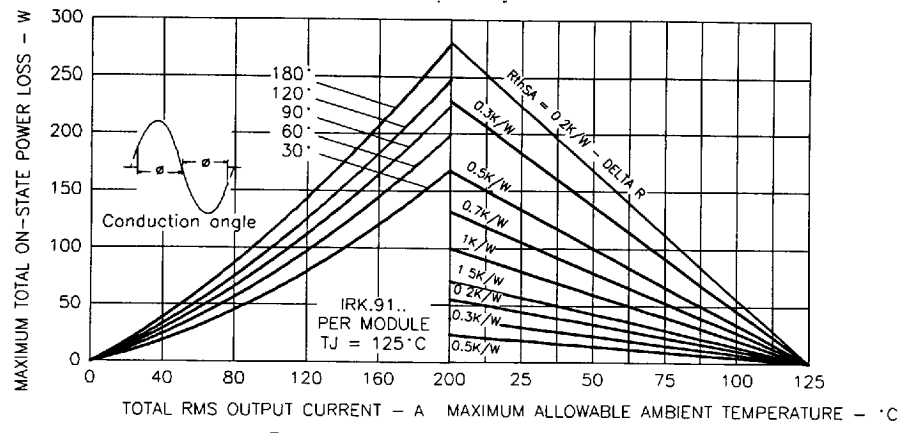


Fig. 43 - On-state Power Loss Characteristics

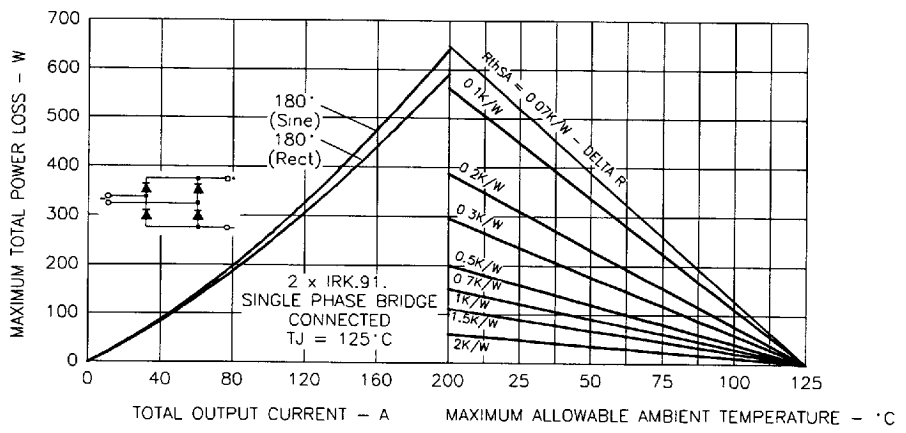


Fig. 44 - On-state Power Loss Characteristics

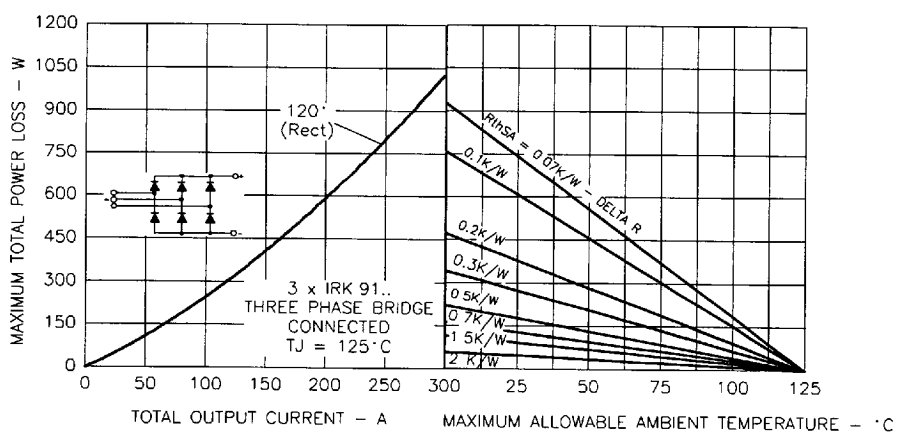


Fig. 45 - On-state Power Loss Characteristics

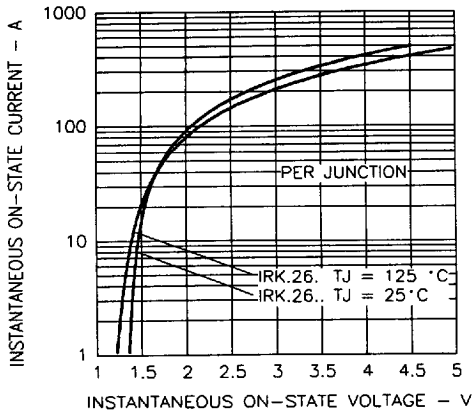


Fig. 46 - On-state Voltage Drop Characteristics

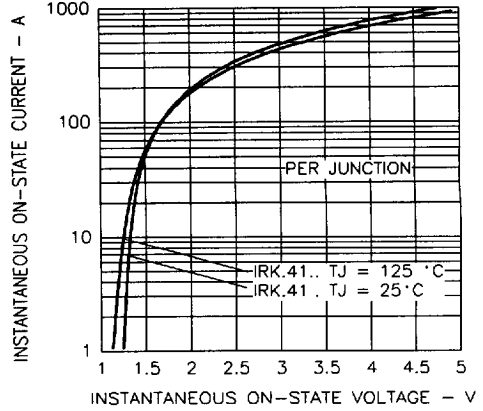


Fig. 47 - On-state Voltage Drop Characteristics

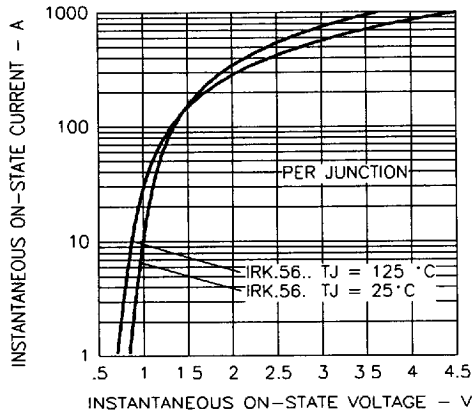


Fig. 48 - On-state Voltage Drop Characteristics

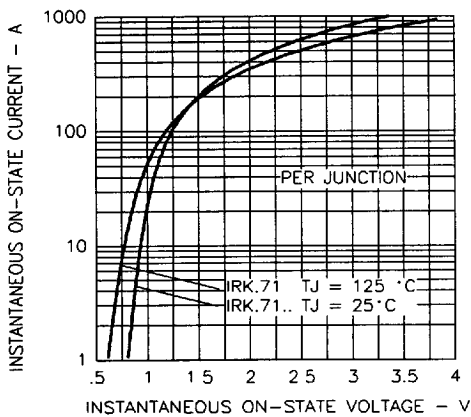


Fig. 49 - On-state Voltage Drop Characteristics

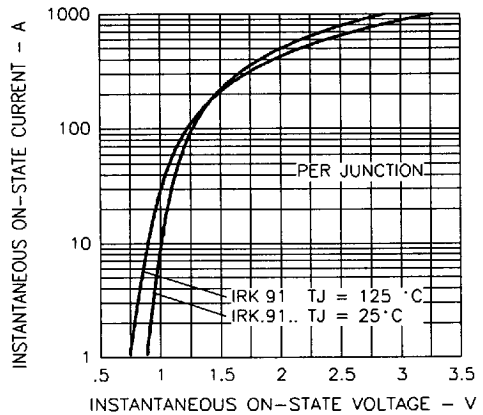


Fig. 50 - On-state Voltage Drop Characteristics

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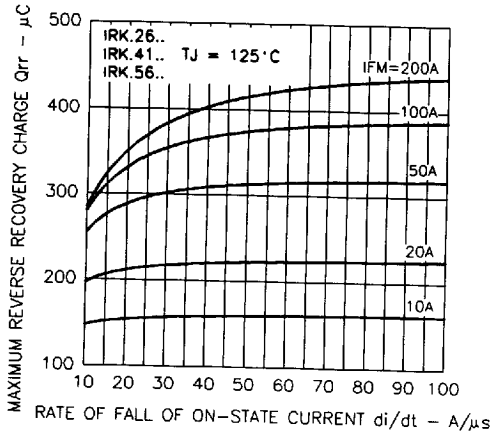


Fig. 51 - Recovery Charge Characteristics

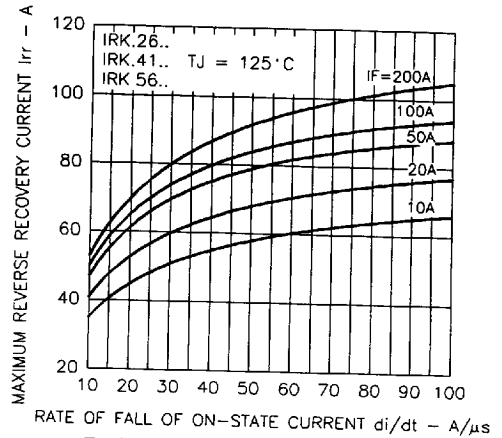


Fig. 52 - Recovery Current Characteristics

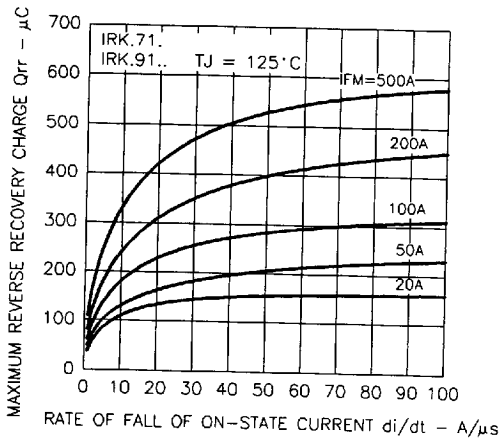


Fig. 53 - Recovery Charge Characteristics

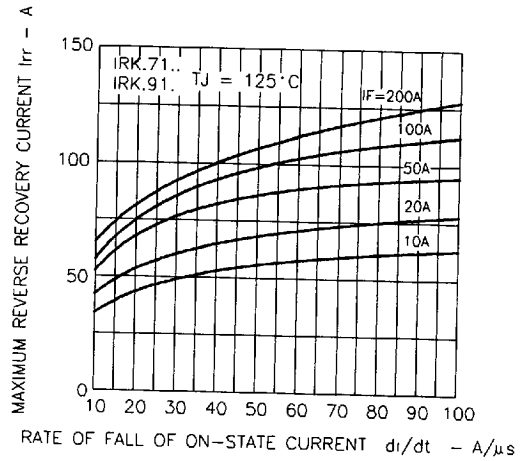


Fig. 54 - Recovery Current Characteristics

