

International Rectifier

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

THYRISTOR/ DIODE and
 THYRISTOR/ THYRISTOR

ADD-A-pak™ Power Modules

INTERNATIONAL RECTIFIER 65E D

Features

- 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

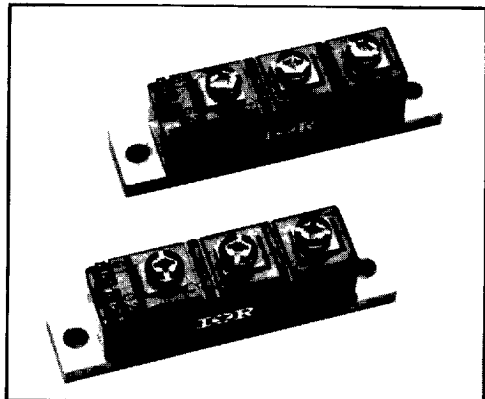
25A - 40A
 55A - 70A
 90A

Description

These IRK series of ADD-A-paks use 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	595	850	1310	1665	1785	A
I_{FSM} @ 60Hz	625	890	1370	1740	1870	A
i^2t @ 50Hz	1.77	3.61	8.50	13.86	15.91	KA ² s
@ 60Hz	1.62	3.30	7.82	12.56	14.52	KA ² s
$i^2\sqrt{t}$	17.7	36.1	85.6	138.6	159.1	KA ² √s
V _{RRM} range	400 to 1200					V
T _{STG}	-40 to 125					°C
T _J	-40 to 125					°C



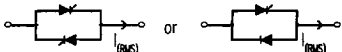
(*) As AC switch.

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-	04	400	500	400	15
	06	600	700	600	15
	08	800	900	800	15
	10	1000	1100	1000	15
	12	1200	1300	1200	15

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,	
$I_{F(AV)}$ Maximum average forward current (Diodes)	25	40	55	70	90	A	$T_c = 85^\circ\text{C}$	
$I_{O(RMS)}$ Max. continuous RMS on-state current. As AC switch	55.5	89	122	155	200	A		
I_{TSM} Max. peak, one cycle non-repetitive on-state or forward current	595	850	1310	1665	1785	A	t=10ms No voltage reappplied	
	625	890	1370	1740	1870	A	t=8.3ms reappplied	
	500	715	1100	1400	1500	A	t=10ms 100% V_{RRM} reappplied	
	525	750	1150	1470	1570	A	t=8.3ms reappplied	
	660	940	1450	1850	2000	A	t=10ms $T_J = 25^\circ\text{C}$, no voltage reappplied	
I^2t Max. I^2t for fusing	1.77	3.61	8.50	13.86	15.91	KA ² s	t=10ms No voltage reappplied	
	1.62	3.30	7.82	12.56	14.52	KA ² s	t=8.3ms reappplied	
	1.25	2.56	6.05	9.80	11.25	KA ² s	t=10ms 100% V_{RRM} reappplied	
	1.15	2.33	5.53	8.96	10.27	KA ² s	t=8.3ms reappplied	
	2.18	4.42	10.5	17.1	20.0	KA ² s	t=10ms $T_J = 25^\circ\text{C}$, no voltage reappplied	
I^2t Max. I^2t for fusing (1)	17.7	36.1	85.6	138.6	159.1	KA ² /s	t=0.1 to 10ms, no voltage reappplied	
	$V_{T(TO)}$ Max. value of threshold voltage (2)	0.91	0.90	0.81	0.76	0.78	V	Low level (3)
		1.22	1.22	0.85	0.91	1.03	V	High level
	r_t Max. value of on-state slope resistance (2)	12.4	6.58	3.35	2.98	2.78	mΩ	Low level (3)
		9.1	4.46	3.16	2.40	2.05	mΩ	High level
V_{TM} Max. peak on-state or forward voltage	1.90	1.75	1.40	1.55	1.55	V	$I_{TM} = \pi \times I_{T(AV)}$	
	1.90	1.75	1.40	1.55	1.55	V	$I_{FM} = \pi \times I_{F(AV)}$	
di/dt Max. non-repetitive rate of rise of turned on current	150	150	150	150	150	A/μs	$T_J = 25^\circ\text{C}$, from 0.67 V_{DRM} , $I_{TM} = \pi \times I_{T(AV)}$, $I_g = 500\text{mA}$, $t_f < 0.5\mu\text{s}$, $t_p > 6\mu\text{s}$	
I_H Max. holding current	200	200	200	200	200	mA	$T_J = 25^\circ\text{C}$, anode supply = 6V, resistive load, gate open circuit	
I_L Max. latching current	400	400	400	400	400	mA	$T_J = 25^\circ\text{C}$, anode supply = 6V,	

(1) I^2t for time $t_x = I^2t \times \sqrt{t_x}$.

(2) Average power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$

(3) $16.7\% \times \pi \times I_{AV} < I < \pi \times I_{AV}$

(4) $\pi \times I_{AV} < I < 20 \times \pi \times I_{AV}$

Triggering INTERNATIONAL RECTIFIER 65E D

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. average 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}	15	15	15	15	15	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 temper. 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. IRKT91-12 S90.

ΔR Conduction (per Junction)

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(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	0.03	0.06	0.09	0.14	0.24	0.02	0.06	0.08	0.13	0.20	K/W
IRK.71	0.05	0.09	0.12	0.18	0.27	0.035	0.06	0.09	0.13	0.20	K/W
IRK.56	0.07	0.13	0.17	0.26	0.41	0.05	0.10	0.14	0.21	0.31	K/W
IRK.41	0.06	0.10	0.16	0.26	0.45	0.04	0.08	0.14	0.23	0.39	K/W
IRK.26	0.11	0.17	0.22	0.33	0.52	0.08	0.11	0.16	0.22	0.36	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

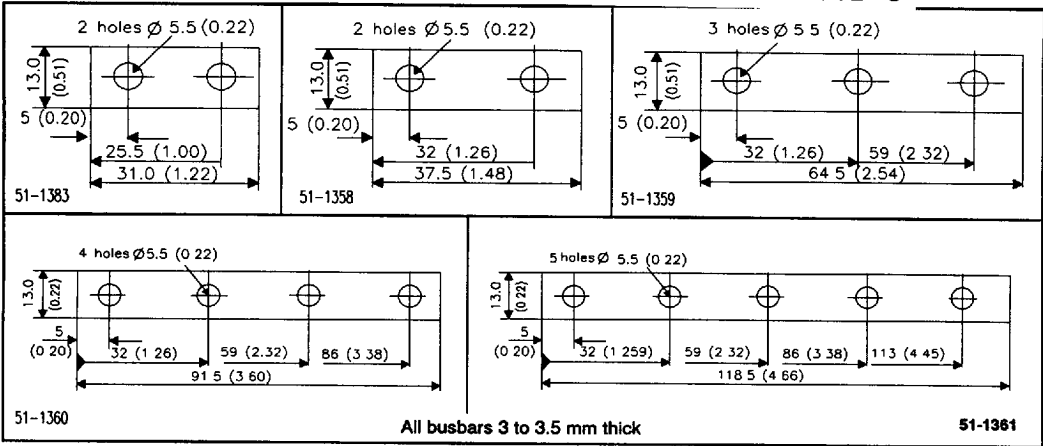
All dimensions in millimeters (inches)

(*) For terminals connections, see Circuit configurations Table

Busbars Dimensions

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Ordering Information Table

Circuit configurations Table

Device Code

IRK	T	91	-	12	S90
(1)	(2)	(3)	(4)		

(A) Available on request only. Contact factory

** Available with no auxiliary cathode. To specify change: 26 to 27

	41 to 42
	56 to 57
	71 to 72
	91 to 92

e.g. : IRKT92-12 etc.

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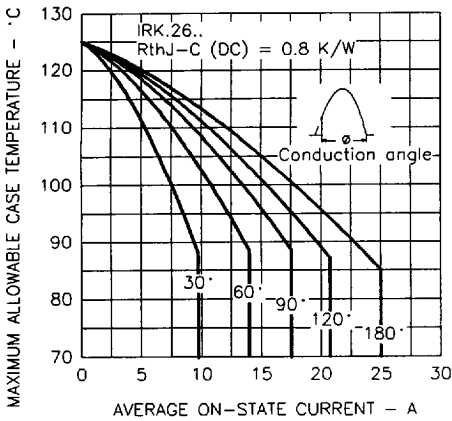


Fig. 1 - Current Ratings Characteristics

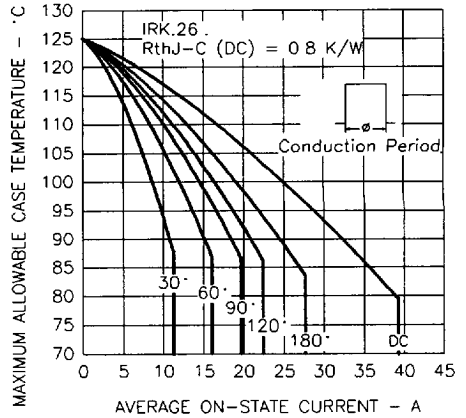


Fig. 2 - Current Ratings Characteristics

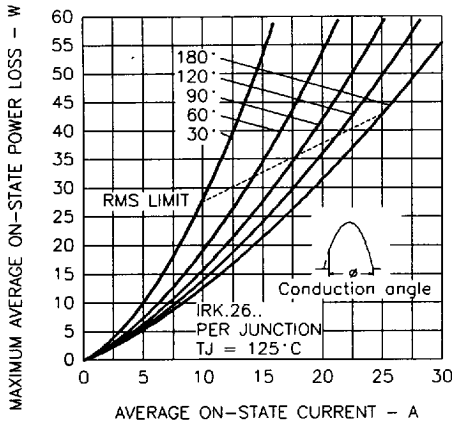


Fig. 3 - On-state Power Loss Characteristics

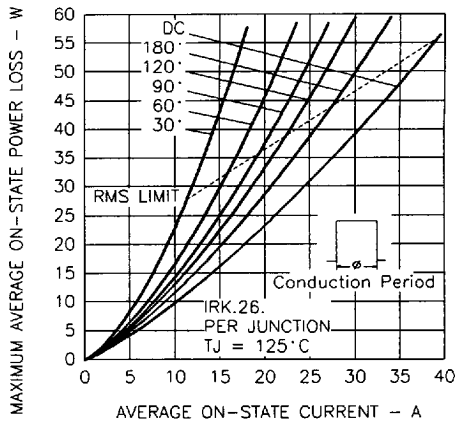


Fig. 4 - On-state Power Loss Characteristics

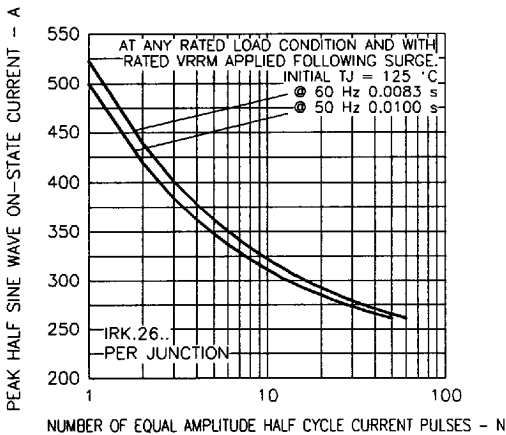


Fig. 5 - Maximum Non-Repetitive Surge Current

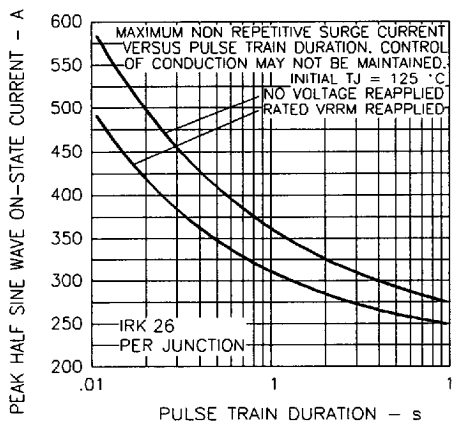


Fig. 6 - Maximum Non-Repetitive Surge Current

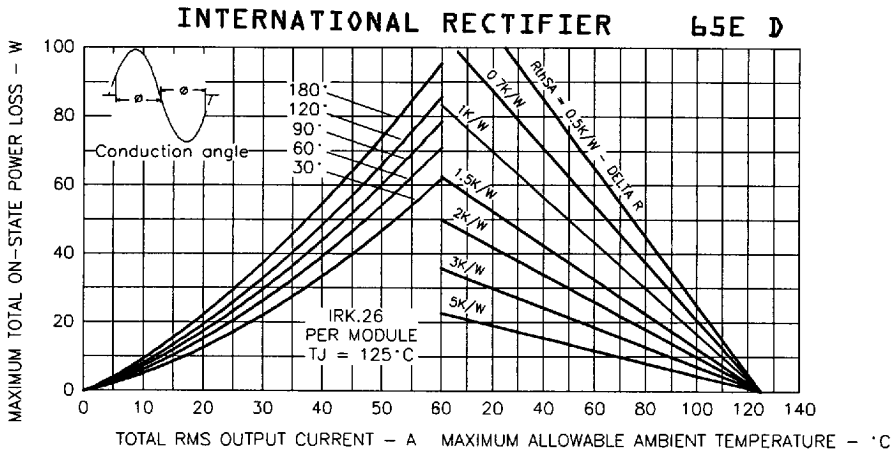


Fig. 7 - On-state Power Loss Characteristics

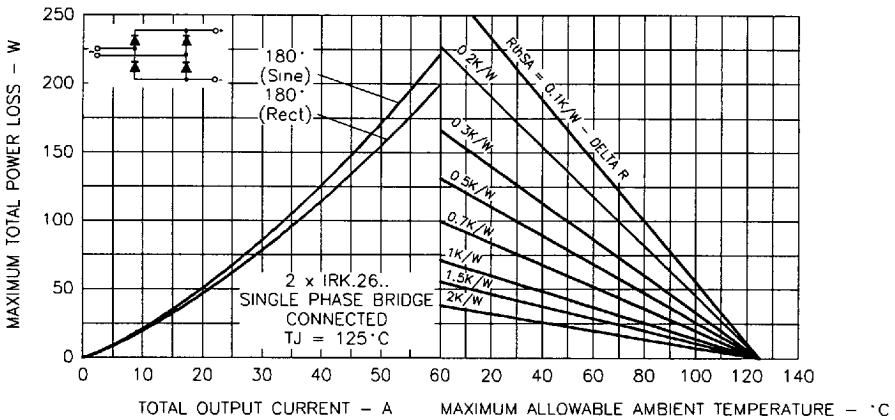


Fig. 8 - On-state Power Loss Characteristics

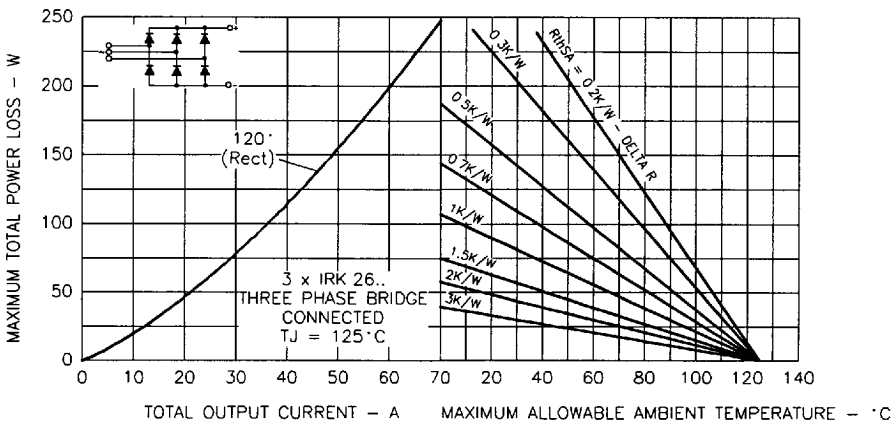


Fig. 9 - On-state Power Loss Characteristics

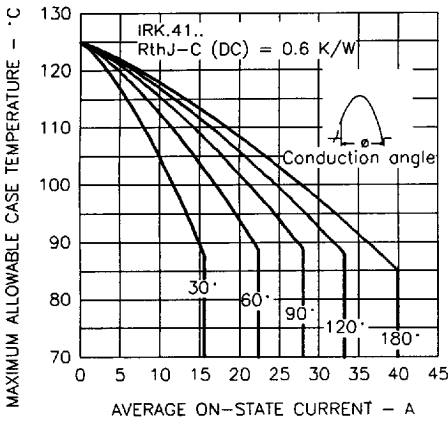


Fig. 10 - Current Ratings Characteristics

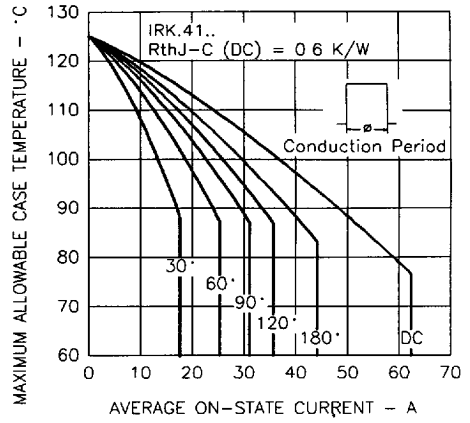


Fig. 11 - Current Ratings Characteristics

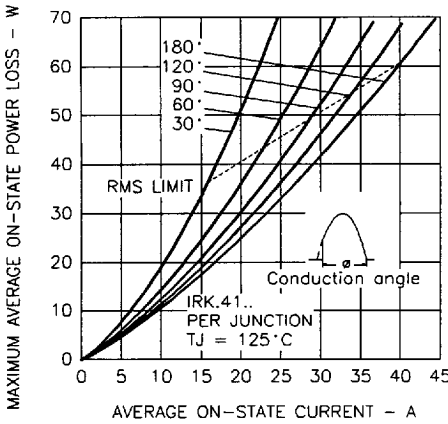


Fig. 12 - On-state Power Loss Characteristics

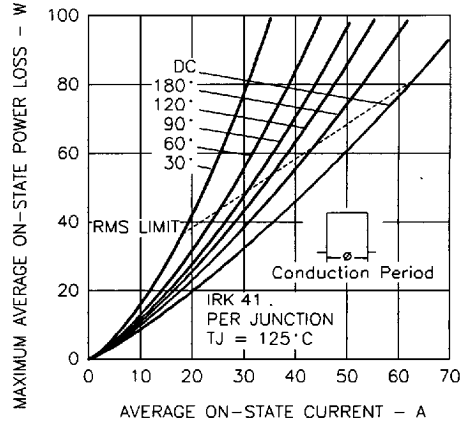


Fig. 13 - On-state Power Loss Characteristics

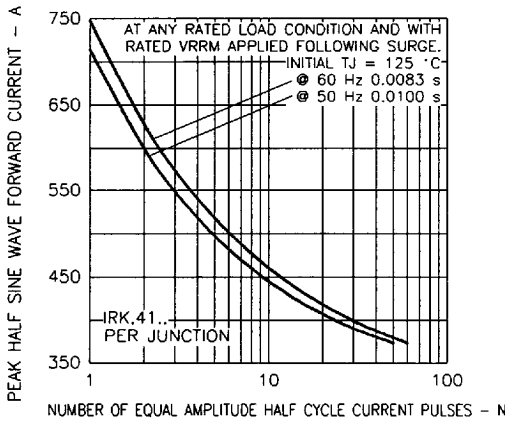


Fig. 14 - Maximum Non-Repetitive Surge Current

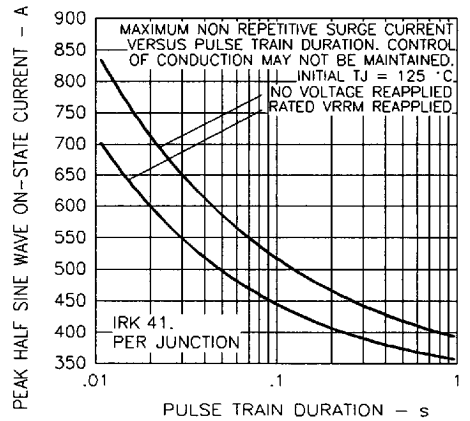


Fig. 15 - Maximum Non-Repetitive Surge Current

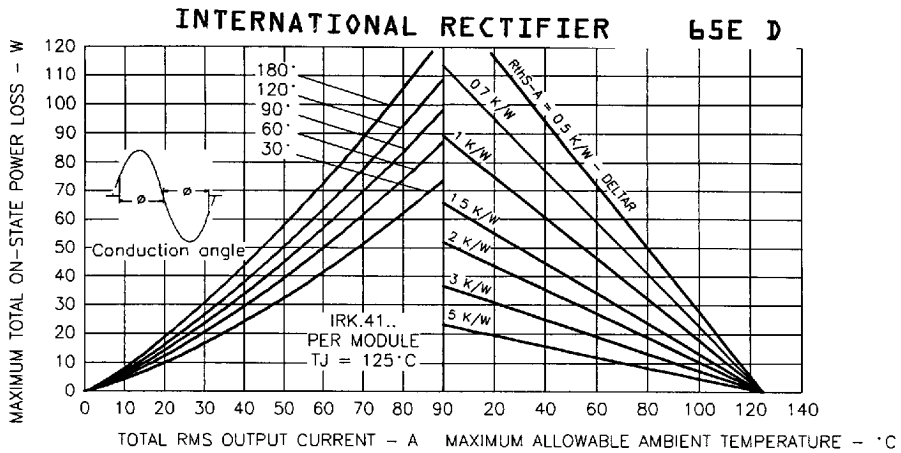


Fig. 16 - On-state Power Loss Characteristics

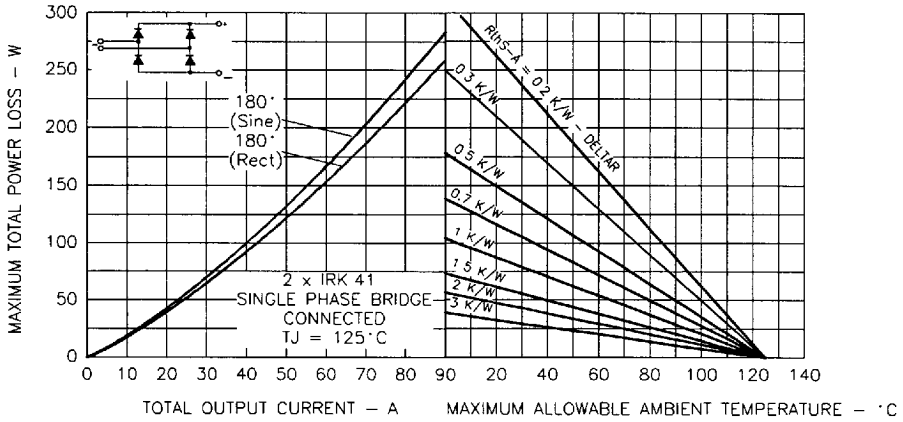


Fig. 17 - On-state Power Loss Characteristics

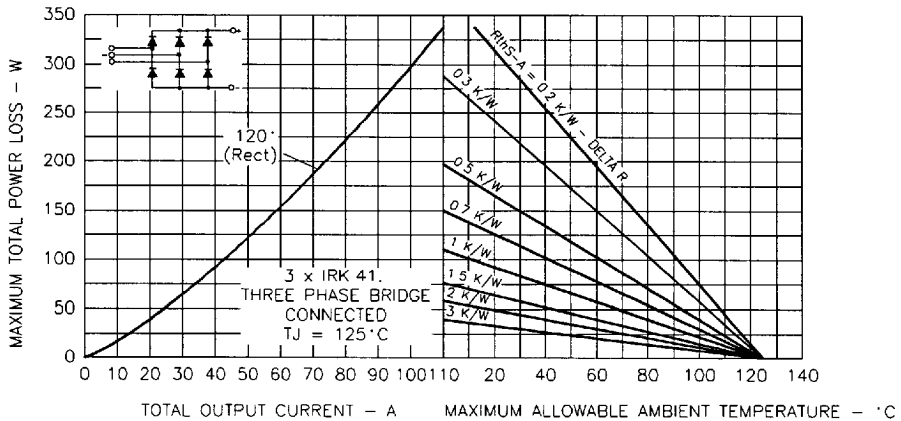


Fig. 18 - On-state Power Loss Characteristics

INTERNATIONAL RECTIFIER 65E D

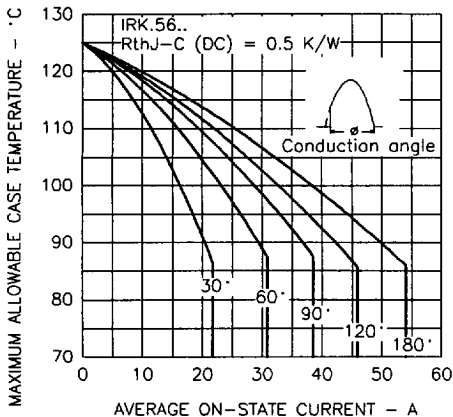


Fig. 19 - Current Ratings Characteristics

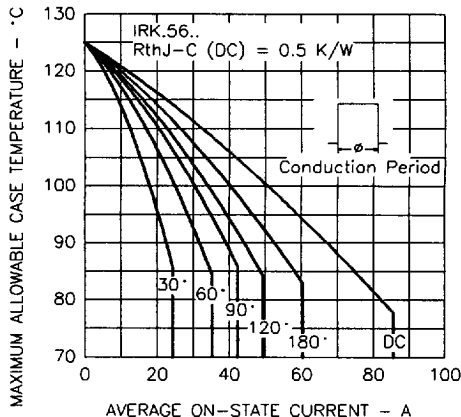


Fig. 20 - Current Ratings Characteristics

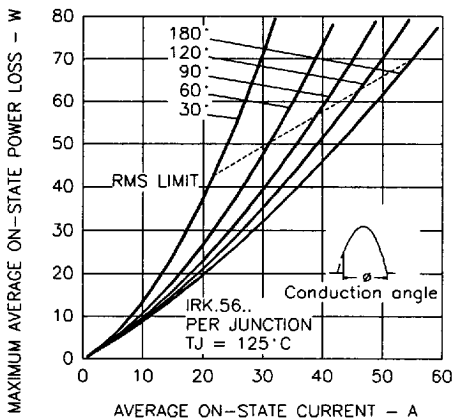


Fig. 21 - On-state Power Loss Characteristics

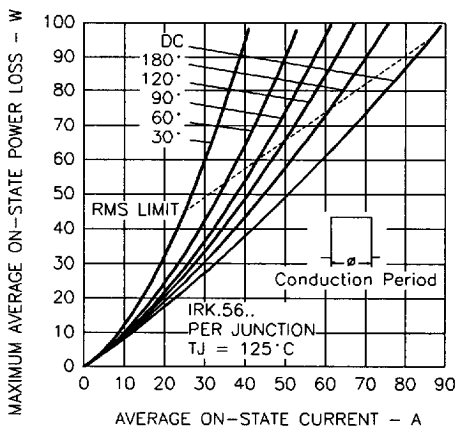


Fig. 22 - On-state Power Loss Characteristics

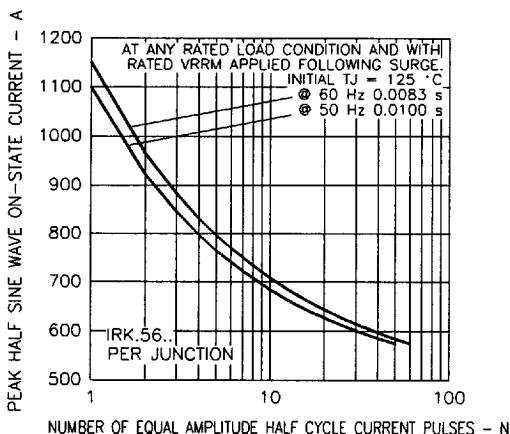


Fig. 23 - Maximum Non-Repetitive Surge Current

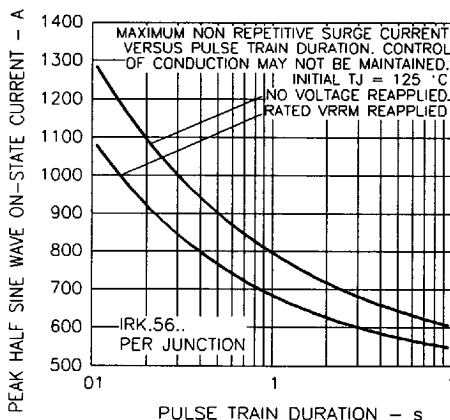


Fig. 24 - Maximum Non-Repetitive Surge Current

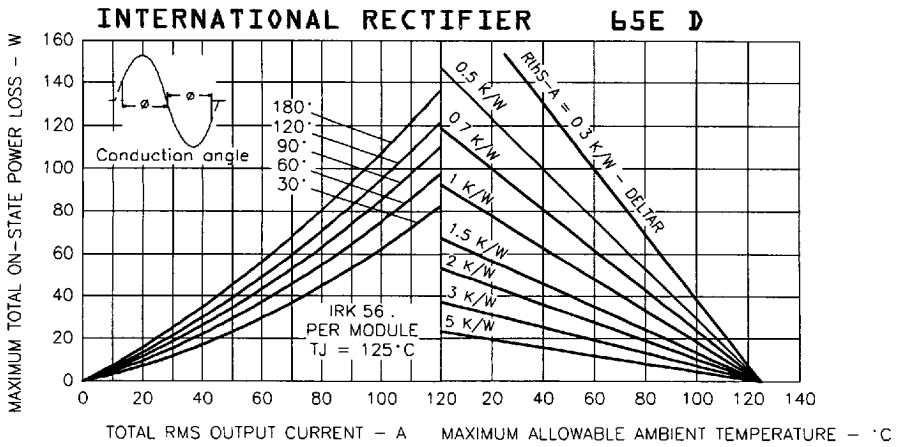


Fig. 25 - On-state Power Loss Characteristics

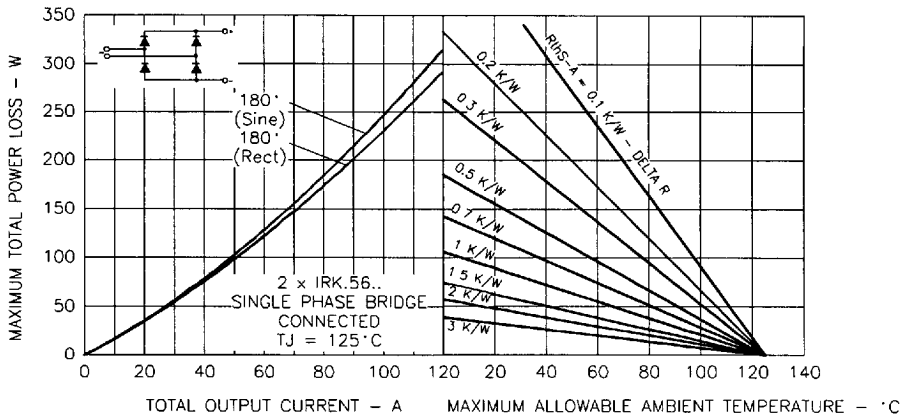


Fig. 26 - On-state Power Loss Characteristics

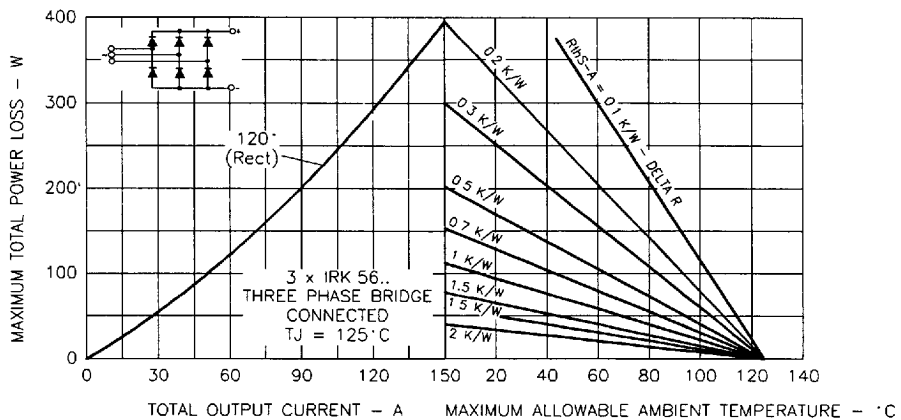


Fig. 27 - On-state Power Loss Characteristics

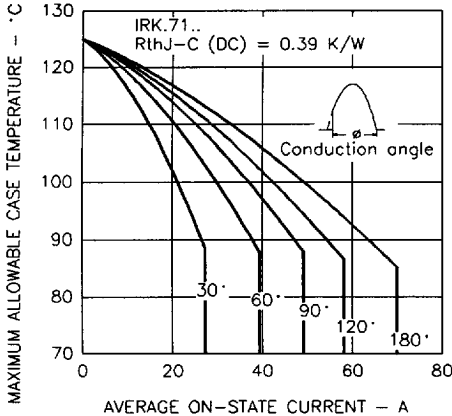


Fig. 28 - Current Ratings Characteristics

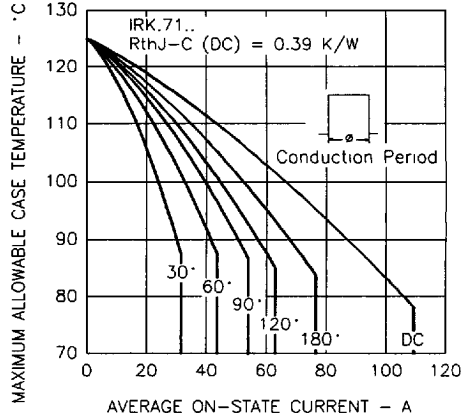


Fig. 29 - Current Ratings Characteristics

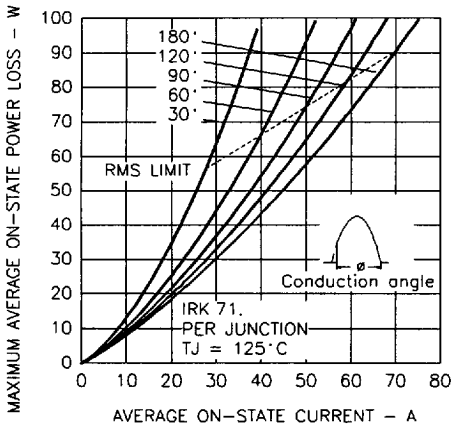


Fig. 30 - On-state Power Loss Characteristics

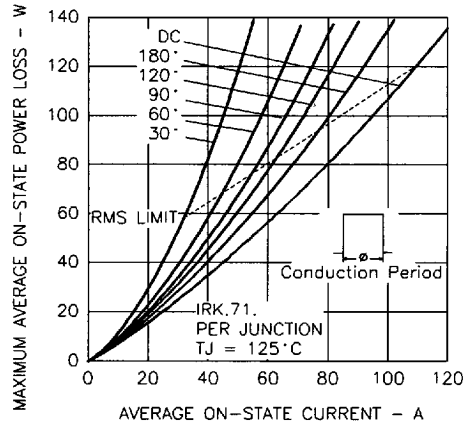


Fig. 31 - On-state Power Loss Characteristics

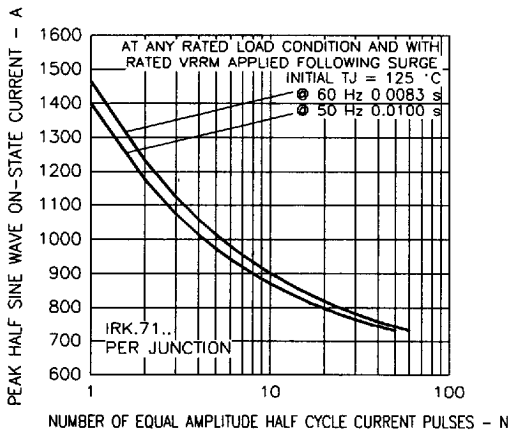


Fig. 32 - Maximum Non-Repetitive Surge Current

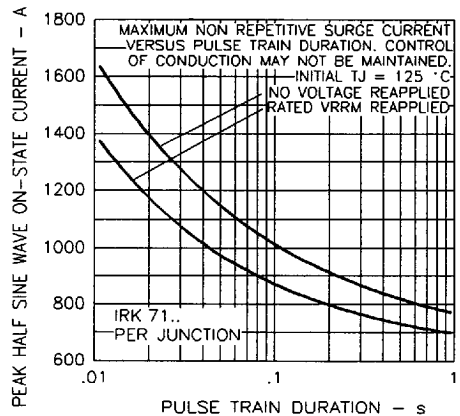
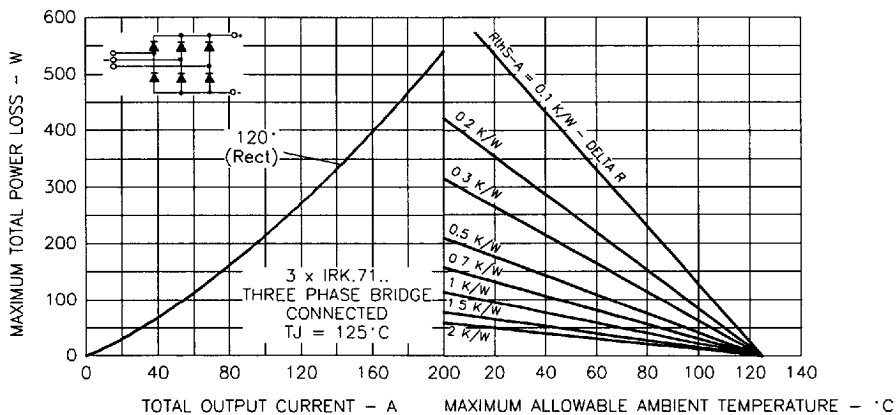
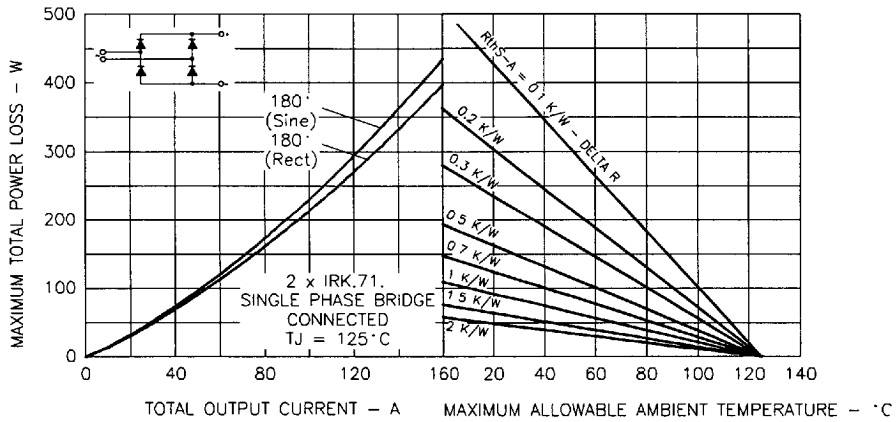
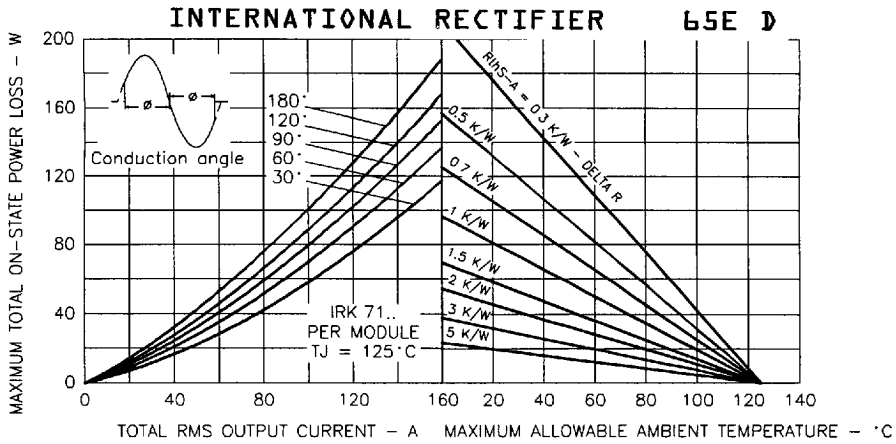


Fig. 33 - Maximum Non-Repetitive Surge Current



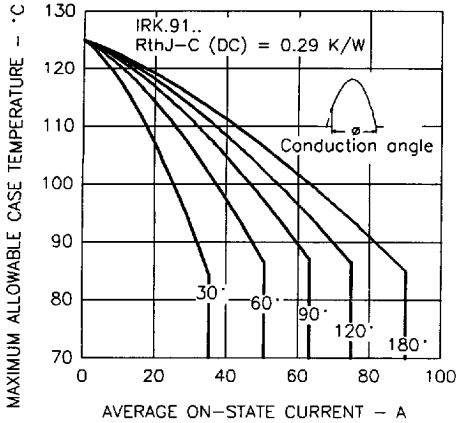


Fig. 37 - Current Ratings Characteristics

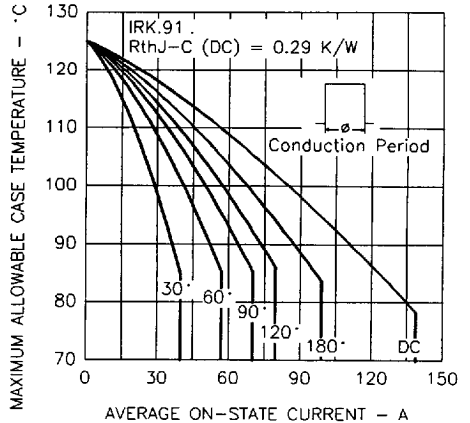


Fig. 38 - Current Ratings Characteristics

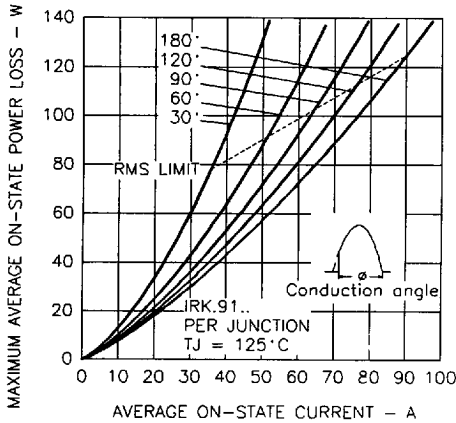


Fig. 39 - On-state Power Loss Characteristics

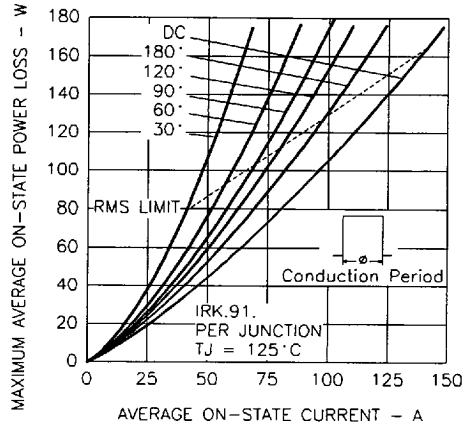


Fig. 40 - On-state Power Loss Characteristics

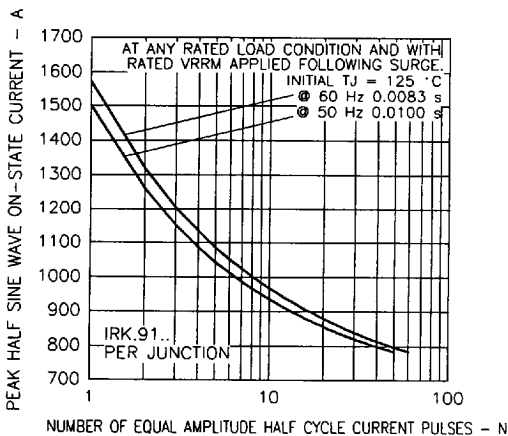


Fig. 41 - Maximum Non-Repetitive Surge Current

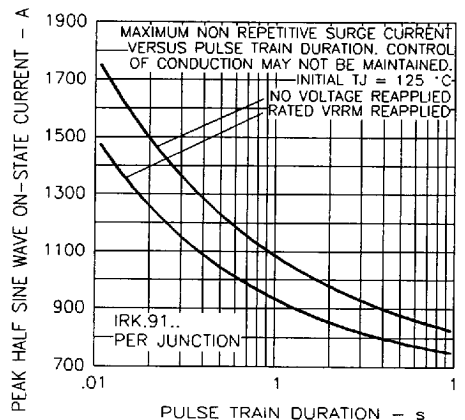
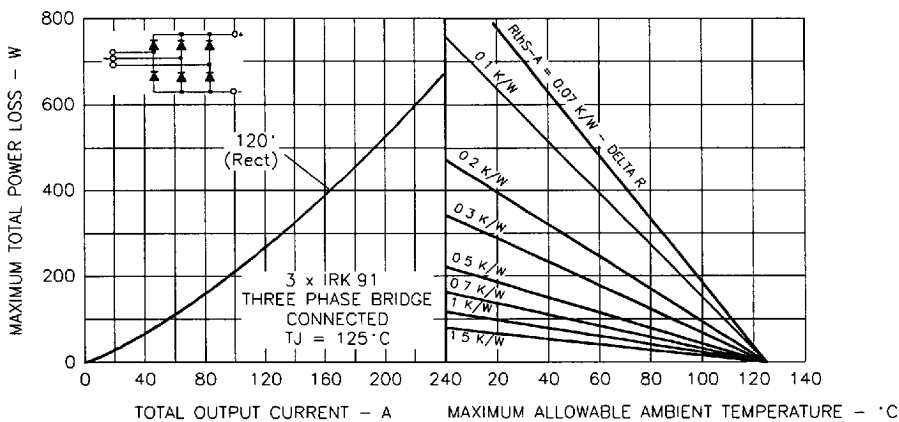
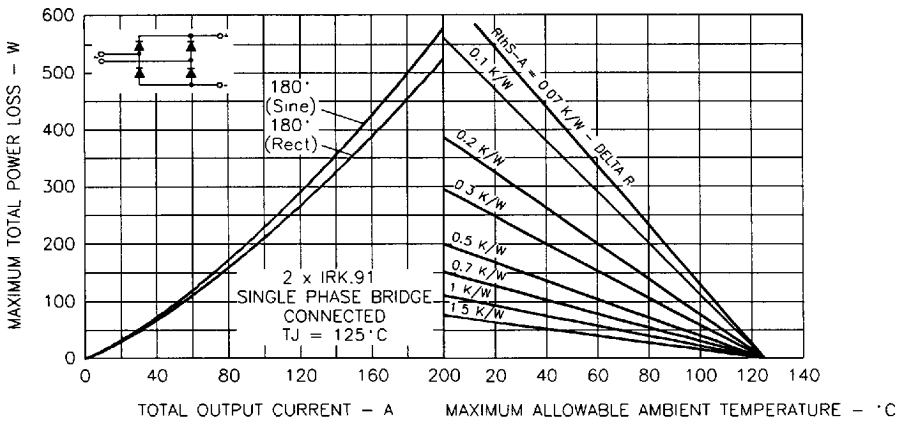
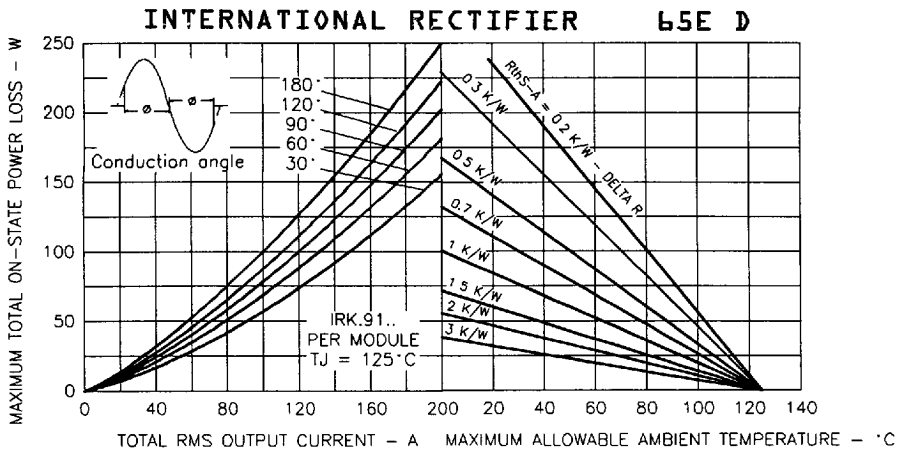


Fig. 42 - Maximum Non-Repetitive Surge Current



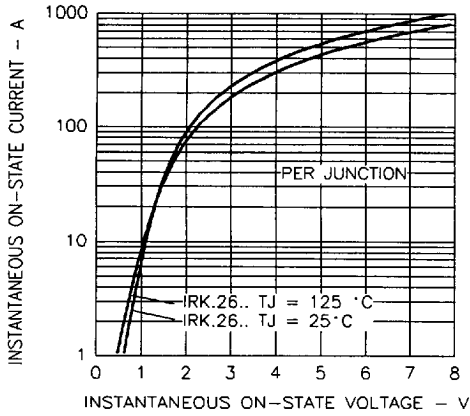


Fig. 46 - On-state Voltage Drop Characteristics

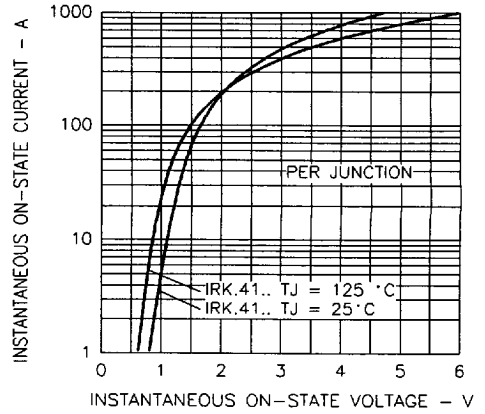


Fig. 47 - On-state Voltage Drop Characteristics

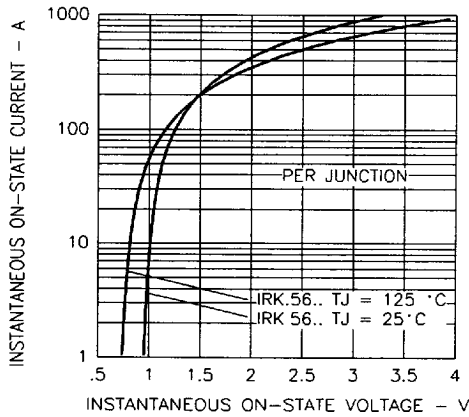


Fig. 48 - On-state Voltage Drop Characteristics

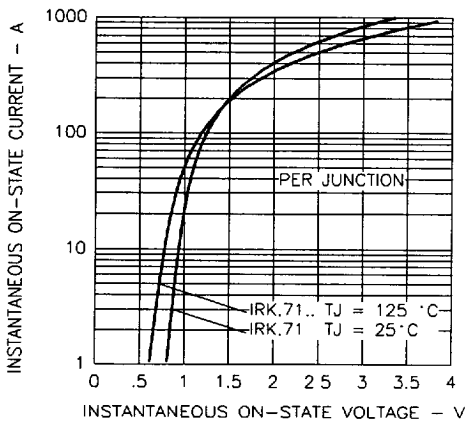


Fig. 49 - On-state Voltage Drop Characteristics

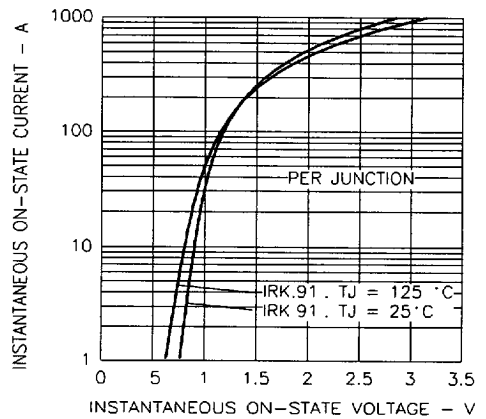


Fig. 50 - On-state Voltage Drop Characteristics

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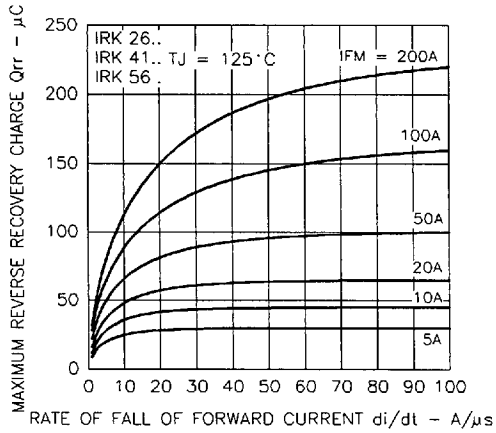


Fig. 51 - Recovery Charge Characteristics

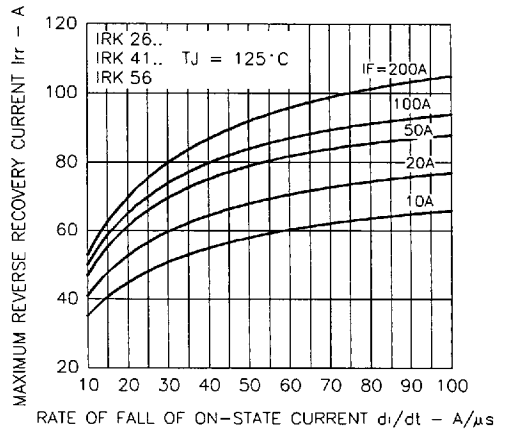


Fig. 52 - Recovery Current Characteristics

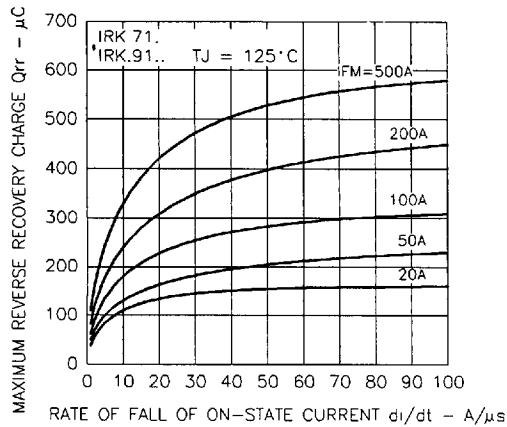


Fig. 53 - Recovery Charge Characteristics

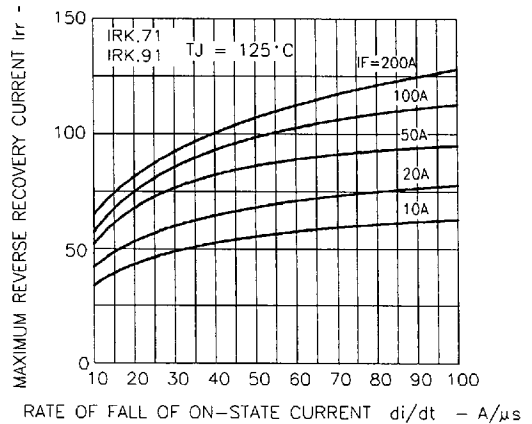


Fig. 54 - Recovery Current Characteristics

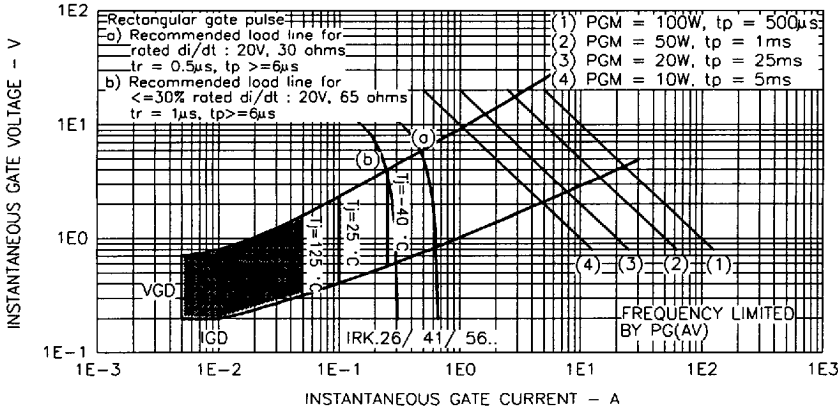


Fig. 55 - Gate Characteristics

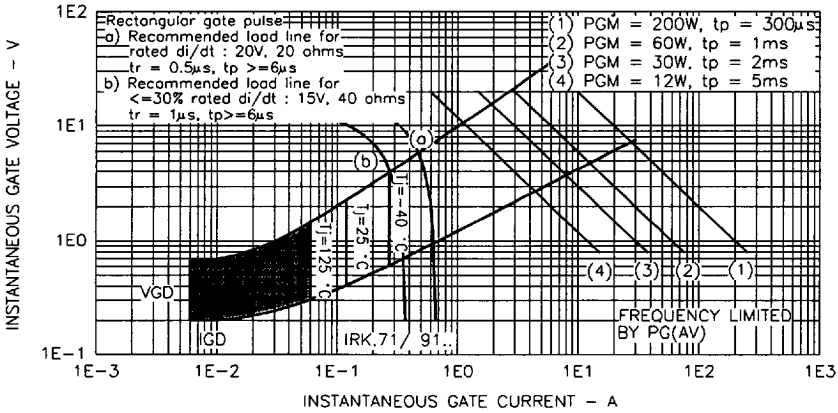


Fig. 56 - Gate Characteristics

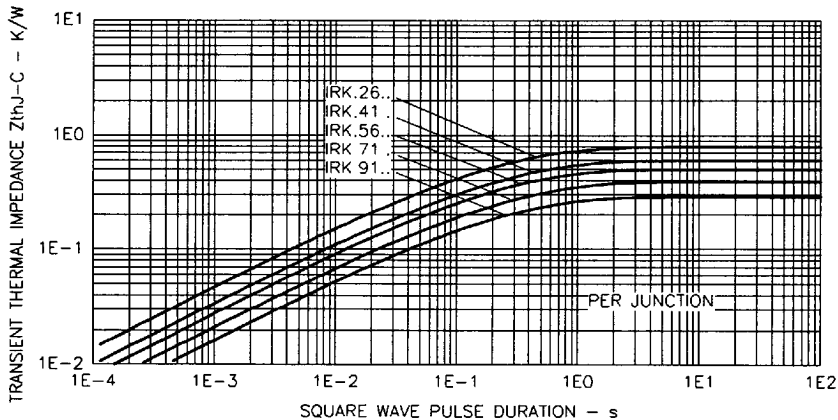


Fig. 57 - Thermal Impedance Z_{thJC} Characteristics