Bulletin I27131 rev. C 09/97

International
IOR Rectifier

IRK.41, .56 SERIES

THYRISTOR/ DIODE and THYRISTOR/ THYRISTOR

NEW ADD-A-pak™ Power Modules

45 A
60 A

Features

- Electrically isolated: DBC 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 E78996 approved

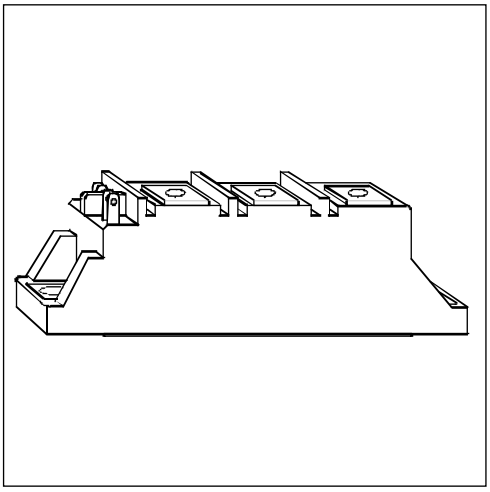
Description

These IRK series of NEW ADD-A-paks use power diodes and thyristors in a variety of circuit configurations. The semiconductor chips are electrically isolated from the base plate, 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.41	IRK.56	Units
$I_{T(AV)}$ or $I_{F(AV)}$ @85°C	45	60	A
$I_{O(RMS)}$ (*)	100	135	A
I_{TSM} @50Hz	850	1310	A
I_{FSM} @60Hz	890	1370	A
I^2t @50Hz	3.61	8.50	KA^2s
@60Hz	3.30	7.82	KA^2s
$I^2\sqrt{t}$	36.1	85.0	$KA^2\sqrt{s}$
V_{RRM} range	400 to 1600		V
T_{STG}	-40 to 125		°C
T_J	-40 to 125		°C

(*) As AC switch.

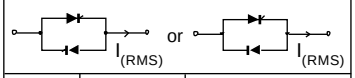


ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{RRM}, maximum repetitive peak reverse voltage	V_{RSM}, maximum non-repetitive peak reverse voltage	V_{DRM}, max. repetitive peak off-state voltage, gate open circuit	I_{RRM} I_{DRM} 125°C
	-	V	V	V	mA
IRK.41/ .56	04	400	500	400	15
	06	600	700	600	
	08	800	900	800	
	10	1000	1100	1000	
	12	1200	1300	1200	
	14	1400	1500	1400	
	16	1600	1700	1600	

On-state Conduction

Parameters		IRK.41	IRK.56	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current (Thyristors)	45	60	A	180° conduction, half sine wave, T_C = 85°C		
$I_{F(AV)}$	Maximum average forward current (Diodes)	45	60				
$I_{O(RMS)}$	Max. continuous RMS on-state current. As AC switch	100	135				
I_{TSM} or I_{FSM}	Max. peak, one cycle non-repetitive on-state or forward current	850	1310		t=10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max.
		890	1370		t=8.3ms		
		715	1100		t=10ms	100% V_{RRM} reapplied	
		750	1150		t=8.3ms		
		940	1450		t=10ms	T_J = 25°C, no voltage reapplied	
		985	1520		t=8.3ms		
I^2t	Max. I^2t for fusing	3.61	8.56	KA^2s	t=10ms	No voltage reapplied	Initial $T_J = T_J$ max.
		3.30	7.82		t=8.3ms		
		2.56	6.05		t=10ms	100% V_{RRM} reapplied	
		2.33	5.53		t=8.3ms		
		4.42	10.05		t=10ms	T_J = 25°C, no voltage reapplied	
		4.03	9.60		t=8.3ms		
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ for fusing (1)	36.1	85.6	$KA^2\sqrt{s}$	t=0.1 to 10ms, no voltage reapplied		
$V_{T(TO)}$	Max. value of threshold voltage (2)	0.88	0.85	V	Low level (3)		$T_J = T_J$ max
		0.91	0.88		High level (4)		
r_t	Max. value of on-state slope resistance (2)	5.90	3.53	mΩ	Low level (3)		$T_J = T_J$ max
		5.74	3.41		High level (4)		
V_{TM}	Max. peak on-state or forward voltage	1.81	1.54	V	$I_{TM} = \pi \times I_{T(AV)}$		T_J = 25°C
V_{FM}					$I_{FM} = \pi \times I_{F(AV)}$		
di/dt	Max. non-repetitive rate of rise of turned on current	150		A/µs	T_J = 25°C, from 0.67 V_{DRM}, $I_{TM} = \pi \times I_{T(AV)}$, I_g = 500mA, t_r < 0.5 µs, t_p > 6 µs		
I_H	Max. holding current	200		mA	T_J = 25°C, anode supply = 6V, resistive load, gate open circuit		
I_L	Max. latching current	400			T_J = 25°C, anode supply = 6V, resistive load		

(1) I^2t for time $t_x = I^2\sqrt{t} \times \sqrt{t_x}$ (2) Average power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$ (3) 16.7% x π x I_{AV} < I < π x I_{AV}
(4) I > π x I_{AV}

Triggering

	Parameters	IRK.41	IRK.56	Units	Conditions	
P_{GM}	Max. peak gate power	10	10	W		
$P_{G(AV)}$	Max. average gate power	2.5	2.5			
I_{GM}	Max. peak gate current	2.5	2.5	A		
$-V_{GM}$	Max. peak negative gate voltage	10		V		
V_{GT}	Max. gate voltage required to trigger	4.0			T_J = - 40°C	Anode supply = 6V resistive load
		2.5			T_J = 25°C	
		1.7			T_J = 125°C	
I_{GT}	Max. gate current required to trigger	270		mA	T_J = - 40°C	Anode supply = 6V resistive load
		150			T_J = 25°C	
		80			T_J = 125°C	
V_{GD}	Max. gate voltage that will not trigger	0.25		V	T_J = 125°C, rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	6		mA	T_J = 125°C, rated V_{DRM} applied	

Blocking

	Parameters	IRK.41	IRK.56	Units	Conditions
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	15		mA	T_J = 125 °C, gate open circuit
V_{INS}	RMS isolation voltage	2500 (1 min) 3500 (1 sec)		V	50 Hz, circuit to base, all terminals shorted
dv/dt	Max. critical rate of rise of off-state voltage (5)	500		V/µs	T_J = 125°C, linear to 0.67 V_{DRM}, gate open circuit

(5) Available with dv/dt = 1000V/µs, to complete code add S90 i.e. IRKT41/16 S90.

Thermal and Mechanical Specifications

	Parameters	IRK.41	IRK.56	Units	Conditions
T_J	Junction operating temperature range	- 40 to 125		°C	
T_{stg}	Storage temp. range	- 40 to 125			
R_{thJC}	Max. internal thermal resistance, junction to case	0.23	0.20	K/W	Per module, DC operation
R_{thCS}	Typical thermal resistance case to heatsink	0.1			Mounting surface flat, smooth and greased. Flatness < 0.03 mm; roughness < 0.02 mm
T	Mounting torque ± 10% to heatsink	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
	busbar	3			
wt	Approximate weight	83 (3)		g (oz)	
	Case style	TO-240AA		JEDEC	

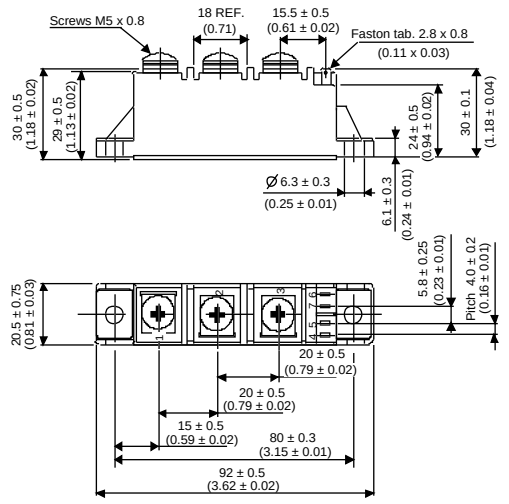
ΔR Conduction (per Junction)

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

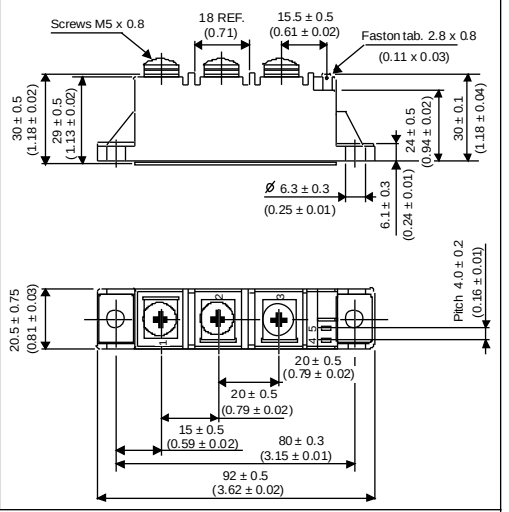
Devices	Sine half wave conduction					Rect. wave conduction					Units
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
IRK.41	0.11	0.13	0.17	0.23	0.34	0.09	0.14	0.18	0.23	0.34	°C/W
IRK.56	0.09	0.11	0.13	0.18	0.27	0.07	0.11	0.14	0.19	0.28	

Outlines Table

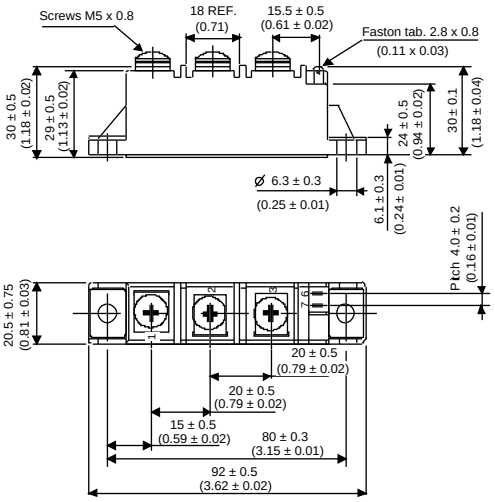
IRKT../.. (*)



IRKH../.. (*)



IRKL../.. (*)

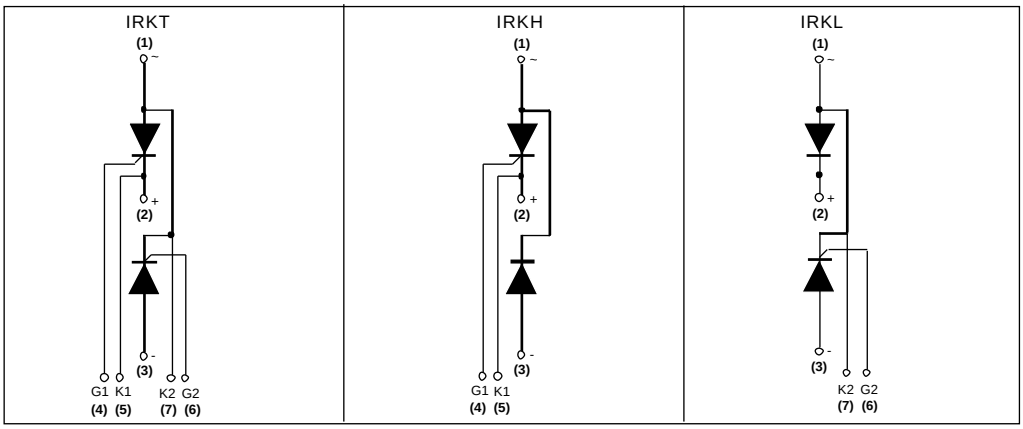


All dimensions in millimeters (inches)

(*) For terminals connections, see Circuit configurations Table

NOTE: To order the Optional Hardware see Bulletin I27900

Circuit Configurations Table



Ordering Information Table

Device Code

IRK	T	56	/	16	S90
①	②	③		④	⑤

1 - Module type

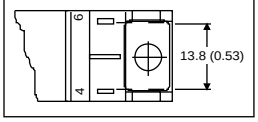
2 - Circuit configuration (See Circuit Configuration table)

3 - Current code ******

4 - Voltage code (See Voltage Ratings table)

5 - dv/dt code: S90 = dv/dt 1000 V/µs
No letter = dv/dt 500 Vµs

IRK.57 types
With no auxiliary cathode



****** Available with no auxiliary cathode.
To specify change: 41 to 42
56 to 57
e.g. : IRKT57/16 etc.

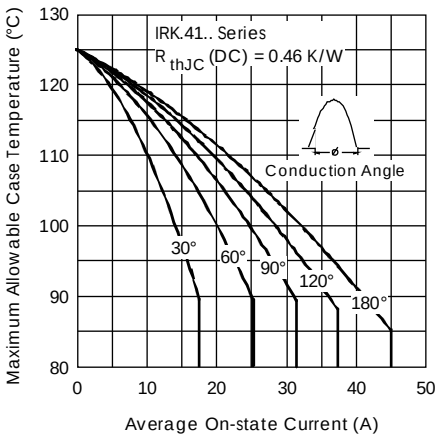


Fig. 1 - Current Ratings Characteristics

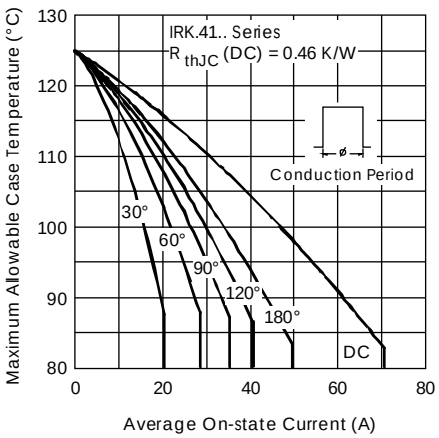


Fig. 2 - Current Ratings Characteristics

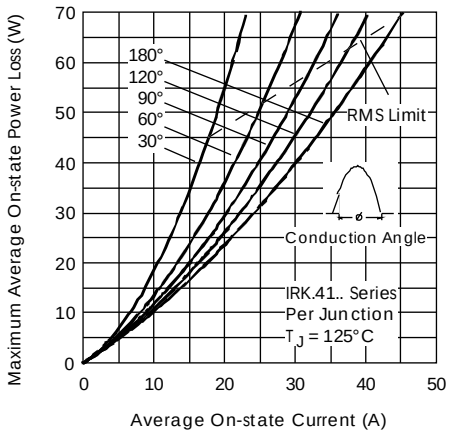


Fig. 3 - On-state Power Loss Characteristics

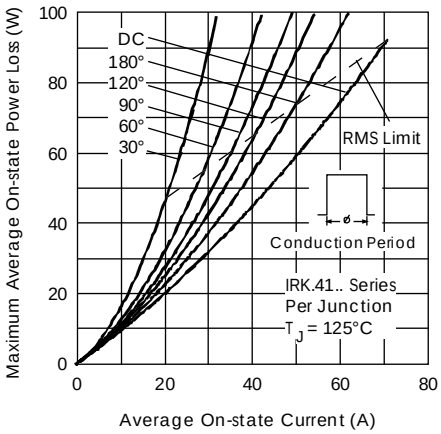


Fig. 4 - On-state Power Loss Characteristics

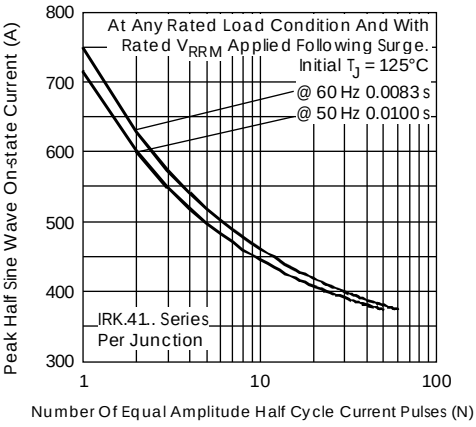


Fig. 5 - Maximum Non-Repetitive Surge Current

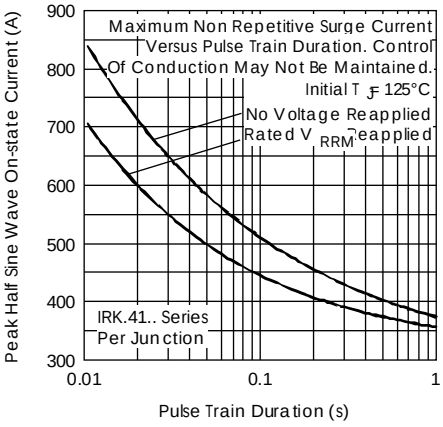


Fig. 6 - Maximum Non-Repetitive Surge Current

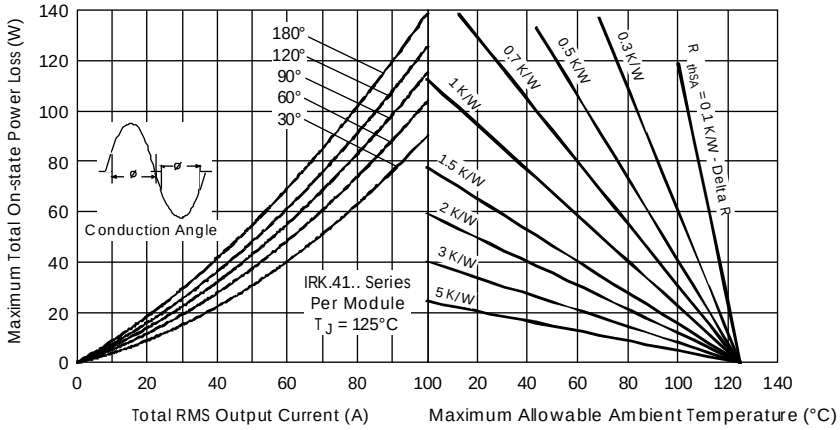


Fig. 7 - On-state Power Loss Characteristics

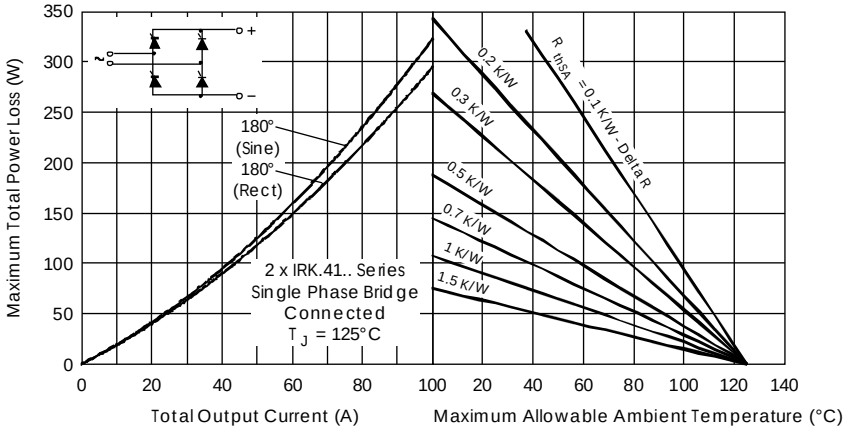


Fig. 8 - On-state Power Loss Characteristics

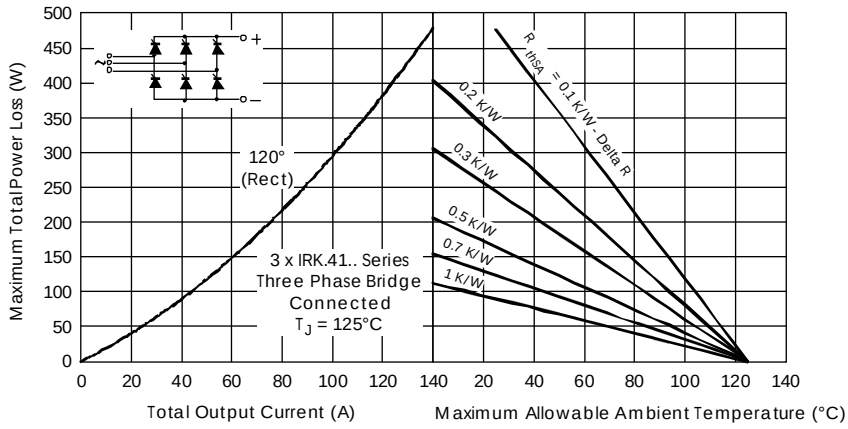


Fig. 9 - On-state Power Loss Characteristics

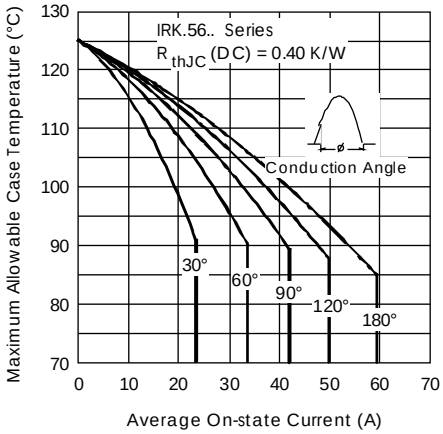


Fig. 10 - Current Ratings Characteristics

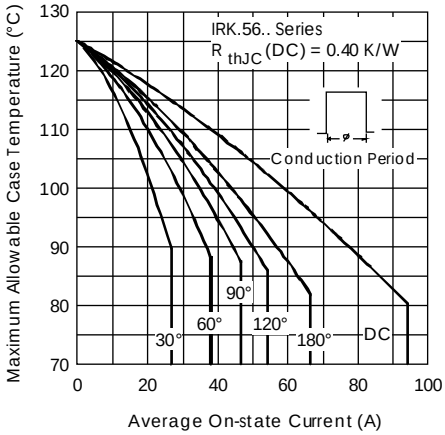


Fig. 11 - Current Ratings Characteristics

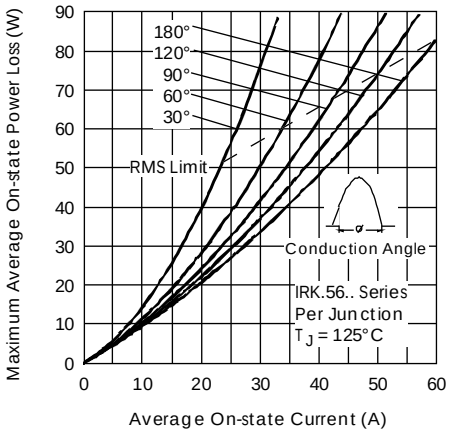


Fig. 12 - On-state Power Loss Characteristics

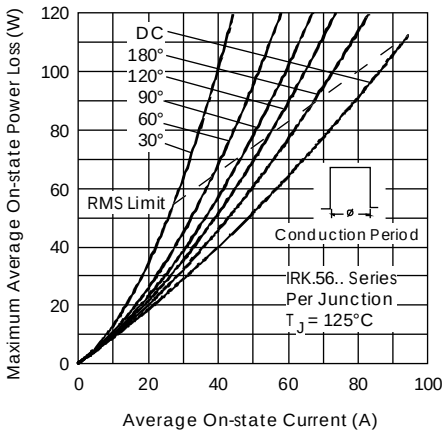


Fig. 13 - On-state Power Loss Characteristics

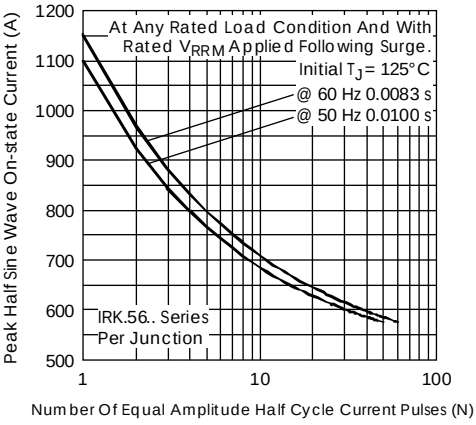


Fig. 14 - Maximum Non-Repetitive Surge Current

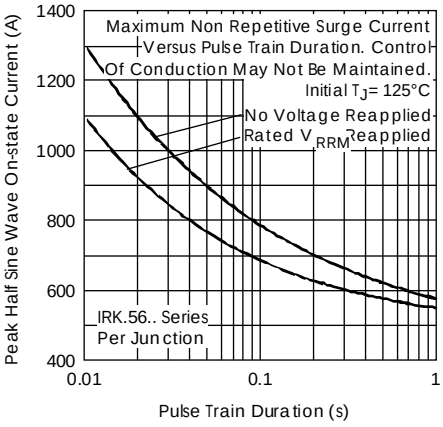


Fig. 15 - Maximum Non-Repetitive Surge Current

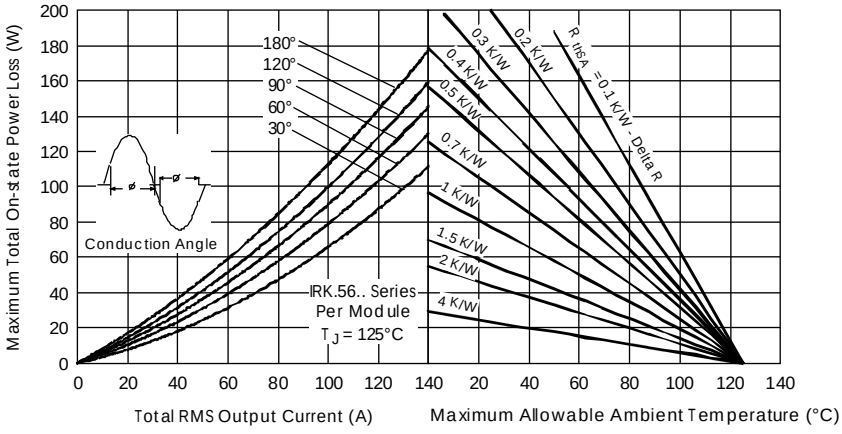


Fig. 16 - On-state Power Loss Characteristics

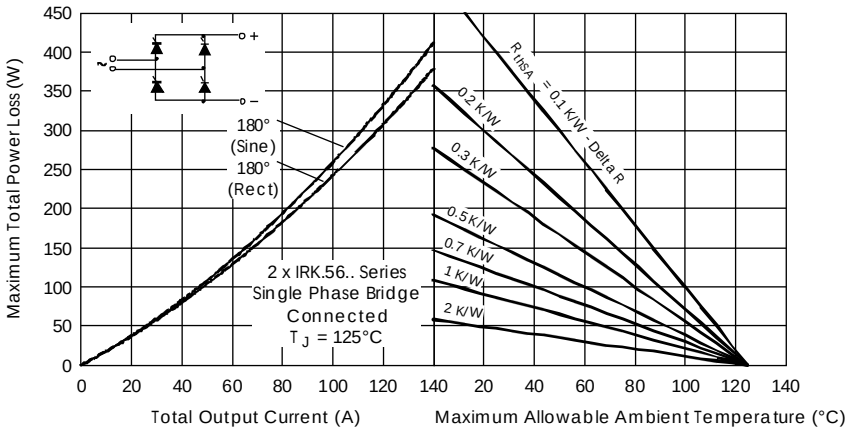


Fig. 17 - On-state Power Loss Characteristics

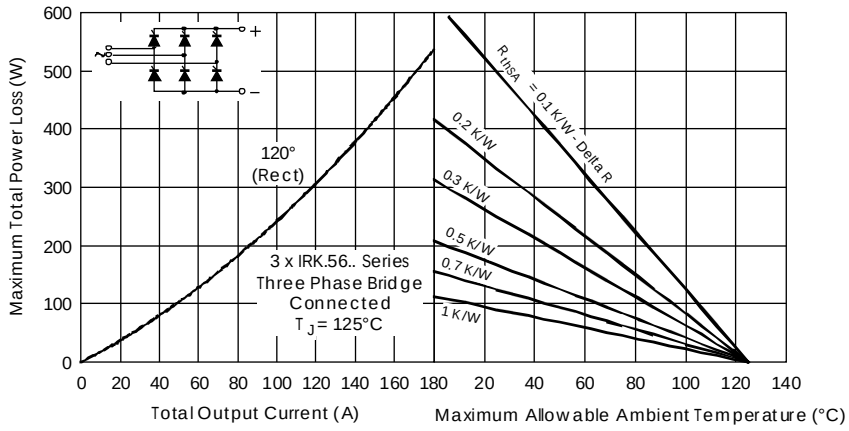


Fig. 18 - On-state Power Loss Characteristics

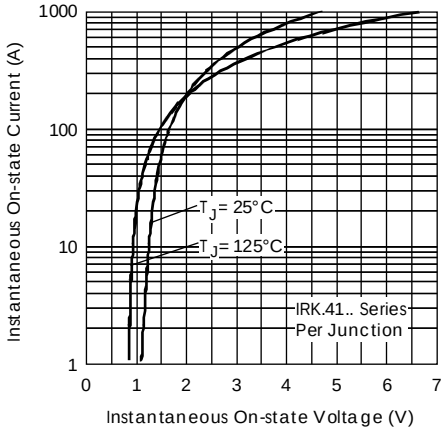


Fig. 19 - On-state Voltage Drop Characteristics

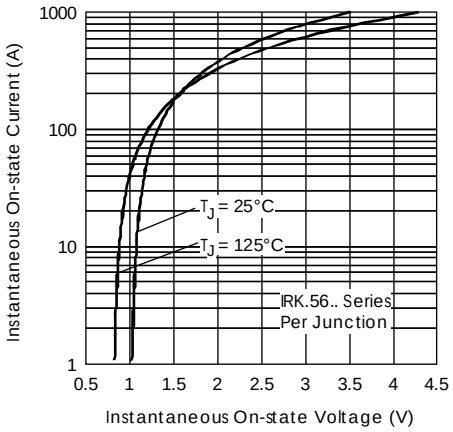


Fig. 20 - On-state Voltage Drop Characteristics

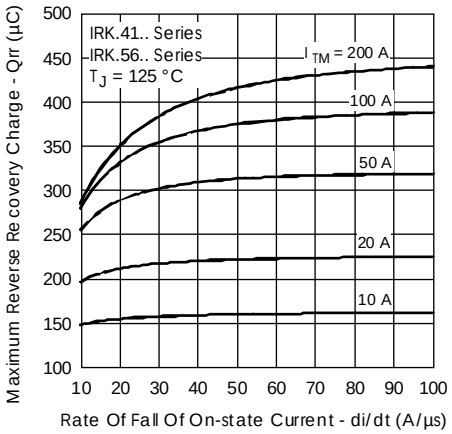


Fig. 21 - Recovery Charge Characteristics

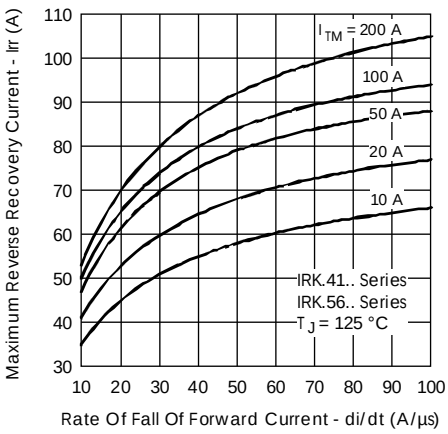


Fig. 22 - Recovery Current Characteristics

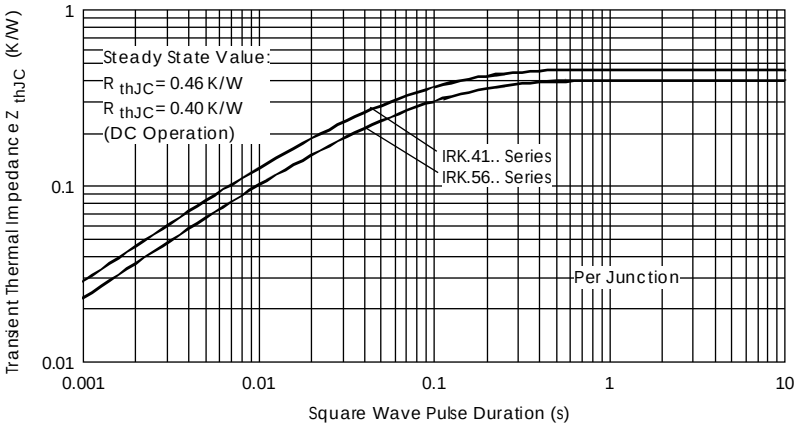


Fig. 23 - Thermal Impedance Z_{thJC} Characteristics

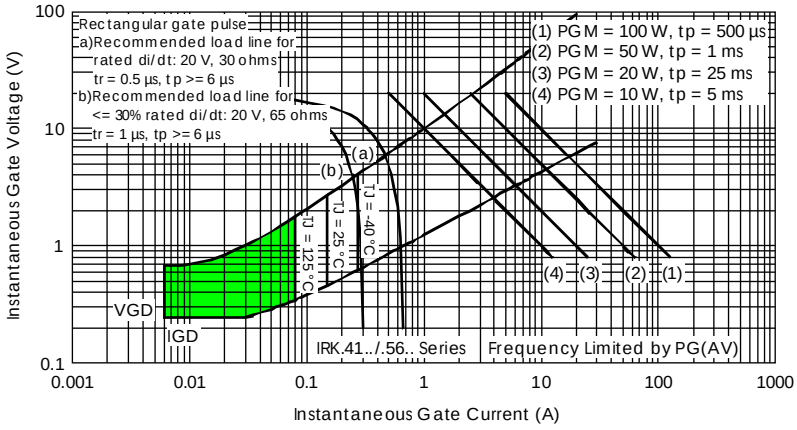


Fig. 24 - Gate Characteristics