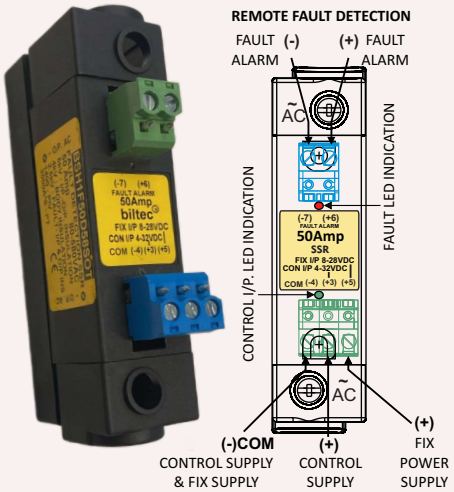
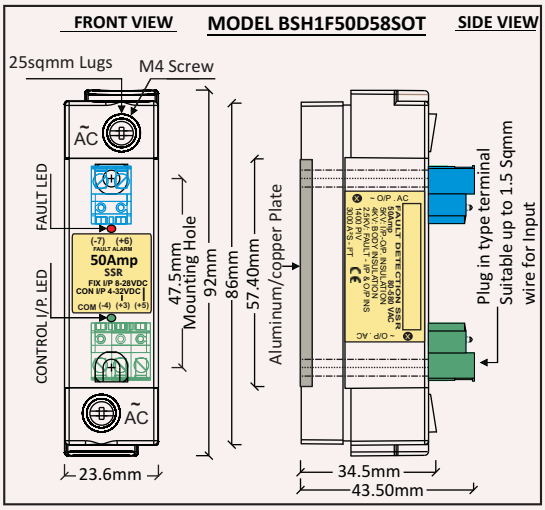
OUTPUT AC CONTROL
3Q TRIAC & BACK TO BACK SCR



FAULT DETECTION SOLID STATE RELAY



- Fault RED LED Indication & Remote Alarm O/P.

SPECIAL NOTE :

- DURING FAULT DETECTION BY PLC, CONTROL INPUT SUPPLY SHOULD BE ON-OFF BY PLC. IF FAULT REMAINS THEN INDICATION IS TRUE
- Fault Alarm/Remote O/P. will be latched "ON" up till Fault is not rectified.
- Zero Voltage Turn-On.
- With IP 20 protection cover.
- Rating from 16 Amp to 200 Amp @25°C 80-580 VAC SSR in 23.6 mm Width for Better space optimization
- Short Circuit Current Rating As Per UL508A.
- Short Circuit Protected SSR up to 100 Amp per phase current by help of suitable "B" curve MCB.
- No need to use semiconductor Fuse due to short circuit protected SSR.
- Fire Retardant Plastic as per UL94 VO GRADE.
- New improved SEMS Screw - Washers input & Output terminals.
- Improved Direct Bonded Copper (DBC) for higher Amp Relays.
- High resistance to aggressive chemicals and dust due to special Potting.
- Logic compatibility, Fast switching, Low coupling capacitance.

CONVENTIONAL SSR VS FAULT DETECTOR SSR

- SSR / Back to Back SCR / TRIAC is "SHORT" ,so overshoot of process temperature - No Indication
- SSR is "OPEN" due to the SSR Control Voltage Fault, so undershoot of process temperature - NO Indication
- Load is "OPEN" - No Indication
- Load is "SHORT" so M.C.B. Trips - No Indication

- Immediately Indication - when SSR / Back to Back SCR / TRIAC is "SHORT" ,so overshoot of process temperature
- Immediately Indication - when SSR is "OPEN" due to the SSR Control Voltage Fault, so undershoot of process temperature
- Immediately Indication - when Load is "OPEN"
- Immediately Indication - when Load is "SHORT" so M.C.B. Trips

ADVANTAGES OF FAULT DETECTION SSR MODEL 803

- Process Load will control
- Process Fault will Identified by signal lights or Remote O/P.
- No Process Production Loss
- Final product Reliability
- Increased system temperature accuracy
- High resistance to shock, vibration and abrasion
- No electro-mechanical or acoustical noise
- No contact arcing, low electromagnetic interference, high surge capability
- Logic compatibility
- Low coupling capacitance
- Long life cycle . Up to 10^{11} cycles
- Solid state relays offer a very fast response time with absolutely NO contact bounce
- SSRs are typically smaller than EMRs, conserving valuable real estate in printed-circuit board applications

ORDERING FORMAT

	MODEL	XX	X	X	X	XX	YYY	ZZ
		FD	D	D	A	58	50	01

FD : Fault Detection
Z : Zero Cross Over
D : DC Input
A : AC Output

Output Voltage
48: 80-480 VAC
58: 80-580 VAC

Output Current Rating
16
25
40
50
75
90
150
200

Control Input
01 : 4-32 VDC

EXAMPLES

COMPATIBLE TO STANDARD MOUNTING HOLE SIZE 47.5 mm

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FAULT DETECTION SOLID STATE RELAY

EASY TO USE WITH FAULT DETECTION

IP 20 PROTECTIVE COVER

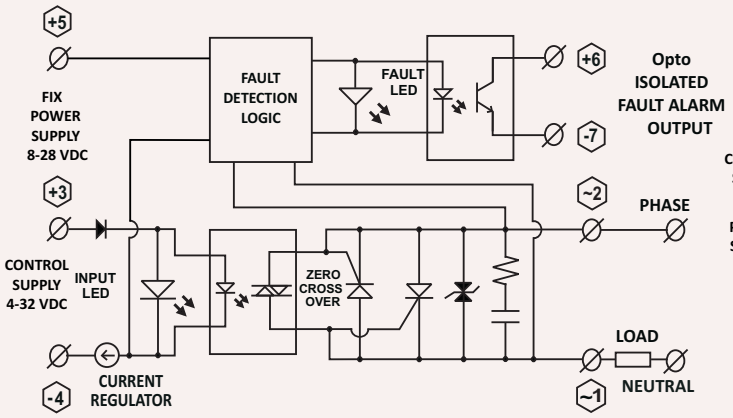
Slim SSR
WITH
25 sq. mm
Ring Terminal LUGS

EASY TO MOUNT IN PANEL

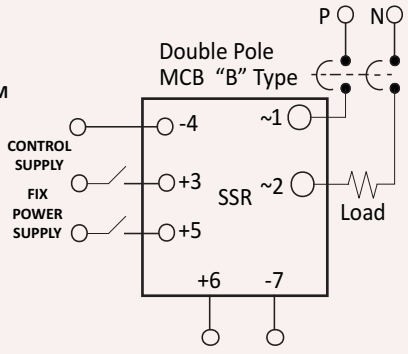
EASY TO MOUNT

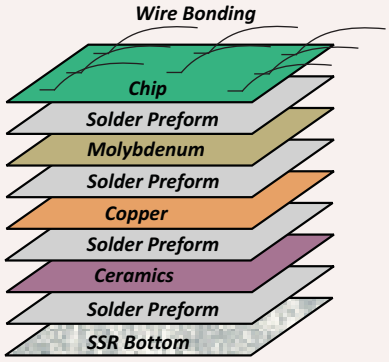
FIRE RESISTIVE

BLOCK DIAGRAM
FDZDA- ZERO CROSS OVER DC TO AC



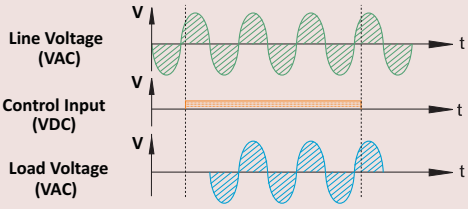
CONNECTION DIAGRAM
FDZDA



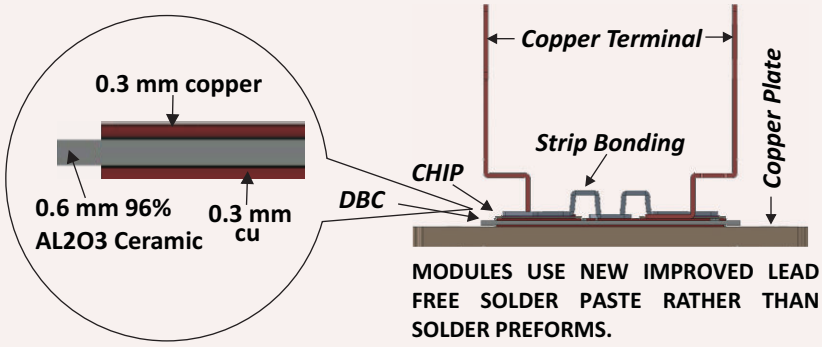


Conventional SSR
VS
SSR

Zero Cross Switching SSR (Z)



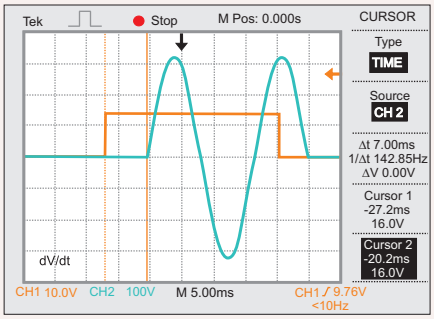
When control input is given to the SSR, irrespective of line voltage condition, output will be ON after zero crossing of sine wave. Zero cross switching SSRs are recommended when LOAD voltage gradually start to increase after zero crossing. It reduces chances of instant high voltage spike applied to the LOAD. Due to this characteristic, it reduces the surge current pass through LOAD during first conduction cycle. Load will be ON in less than 10mS duration for 50Hz line voltage & 8.33mS duration for 60Hz line voltage. These relays are most suitable for industrial applications of heater loads, inductive loads, capacitor bank switching etc. When control input is removed, output of the SSR will be OFF after load current decreases to minimum holding current of the thyristor. This is due to the characteristic of thyristor. Above graph indicates functionality of zero switching SSR.



MODULES USE NEW IMPROVED LEAD FREE SOLDER PASTE RATHER THAN SOLDER PREFORMS.

Direct Copper Bonded (DCB) or Direct Bonded Copper (DBC) improves the conduction of heat from semiconductor chip to external heat sink as well as reduces mechanical stress in connection to major load changes. Here two layers of 0.3 mm copper is bonded to ceramic at temperature above 1020 °C. Coefficient of thermal expansion of copper is higher than ceramic (96% AL203) so a joint layer is generated between them at high temperature which will not cause thermal stress or fatigue on power output semiconductors.

ZERO CROSSOVER Waveform



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FAULT DETECTION SOLID STATE RELAY

Input Technical Specifications

Parameters	Unit	ZDA
I/P. Control Supply Voltage Range	V	4-32 VDC
I/P. Control Supply Current Consumption	mA	6-18 mA
Input Impedance (Current Regulator Circuit Impedance)	Ω	1 kΩ - 2 kΩ
Power Supply Voltage Range	V	8-28 VDC
Power Supply Current Consumption	mA	5-25 mA
Reverse Polarity Protection	-	YES
Minimum Turn ON Voltage	VDC	3.5 VDC
Turn OFF Voltage	VDC	< 3.25 VDC
Maximum Turn ON Time	mS	⩽1/2 Cycle (10 mS)
Maximum Turn OFF Time	mS	⩽ 1/2 Cycle (10 mS)

Fault Alarm Output Specifications

Output Type	Isolated NPN open collector
Collector Voltage Range	3-35 VDC Max.
Max. Collector Current can be drawn	50 mA Max.
Minimum Isolation between Fault Alarm terminal (+6,-7) to I/P. (+3,-4,+5) & O/P. (~1,~2)	2.5 kV

General Specification

Max Barrier Layer Temperature (T_{max})	< 125 °C
Ambient Temperature Range (T_{amb})	0-85 °C
SSR Storage Temperature Range (T_{st})	-40°C to 80°C
Input Terminal Screw Torque Range	T = 0.5 N.m (Max.)
Output Terminal Screw Torque Range	T = 2.5 N.m (Max.)
Power Factor COSϕ @ Max. Load @ 480 VAC	> 0.55
Housing Material	UL-94 V0 Grade
Base Plate	Aluminium , Copper (Nickel Plated)
SSR Weight	90 grams
Control Input Electrical Wire Size (Max.)	Up to 2.1 sq mm(14 AWG)
Power Output Electrical Wire Size (Max.)	Up to 33.6 sq mm(2 AWG)
Test Standards:	ROHS,IP20
Pending Approvals:	UL 508,VDE ,TUV ,CSA 22-2 IEC 60947-5-1:2016 IEC 62314:2006

LED INDICATION

Control Input Status Indication	GREEN
Isolated Fault ALARM output Indication	RED

Output Technical Specifications @ 25°C Unless Specified

Parameters	Symbol	Unit	16 Amp	25 Amp	40 Amp	50 Amp	75 Amp	90 Amp	150 Amp	200 Amp
Operating Voltage Range	V_{AC}	V_{RMS}	80-480 VAC - 3Q TRIAC			80-580 VAC/ 80-660 VAC - Back to Back SCR				
Operating Frequency Range	f	Hz	47-63 Hz							
Peak Inverse Voltage	PIV	V_{PK}	800	800	800	1400	1400	1400	1400	1400
Max. Surge Voltage With Stand Capacity (<1 Second)	***V_{surge}***	***V_{RMS}***	***2700 V_{RMS} (3800 V_{PK})***							
Rated Operational Current AC51a @ 20°C (Resistive Load)	***I_T***	***Amp***	***16***	***25***	***40***	***50***	***75***	***90***	***150***	***200***
Rated Operational Current @ 40°C	I_T	Amp	11	20	28	42	50	65	80	85
Maximum Load Short Circuit Protection Current @ 55°C	***I_{SC}***	***Amp***	-	-	-	***15***	***30***	***50***	***78***	***100***
"B" Curve D.P. MCB Rating for Short Circuit Protection	-	***Amp***	-	-	-	***16***	***32***	***50***	***80***	***110***
NON Repetitive Surge Peak ON-State Current @ Rated V_{RRM} applied for 1/2 Cycle t=10 mS/t=8.33 mS (50 Hz/60 Hz) Cycle	***I_{TSM} @ 50 Hz***	***A_P***	***120***	***260***	***420***	***800***	***1100***	***1200***	***1750***	***2250***
	I_{TSM} @ 60 Hz	A_P	126	273	441	840	1155	1260	1837	2360
Max. I^2t for Fusing @ t=10 mS (50Hz)	***I^2t***	***A^2s***	***72***	***340***	***880***	***3000***	***6000***	***7200***	***15000***	***25000***
Max. I^2t for Fusing @ t=8.33 mS (60Hz)	I^2t	A^2s	65	305	795	2750	5470	6510	13850	22880
Max. Peak ON-state voltage Drop	V_{TM}	V_{RMS}	⩽1.2	⩽1.2	⩽1.2	⩽1.2	⩽1.2	⩽1.2	⩽1.2	⩽1.2
Minimum Isolation Resistance between Input Terminals (+5,+3,-4) to Output Terminals (~AC1,~AC2) @ 500 VDC	O	GΩ	50	50	50	50	50	50	50	50
Isolation Voltage Input Terminals (+5,+3,-4) to Output Terminals (~AC1,~AC2) for 1 Minute	V_{ISO}	kV	4	4	4	5	5	5	5	5
Isolation Voltage Input & Output Terminal (+5,+3,-4,~AC1,~AC2) to Body Isolation for 1 Minute	V_{ISO}	kV	4	4	4	4	4	4	4	4
Max. Rate of Rise OFF-State Voltage	dV/dt	V/µS	400	400	500	600	600	1000	1000	1000
Max. Rate of Rise OFF-State Current	di/dt	A/µS	50	22	50	100	125	150	300	300
Max. Peak Repetitive Forward OFF-State Voltage	V_{DRM}	V	800	800	800	1200	1200	1600	1600	1600
Max. Peak Repetitive Forward OFF-State current	I_{DRM}	mA	0.05	0.05	0.05	0.1	0.1	0.05	0.3	0.3
Max. Peak repetitive reverse off-state Voltage	V_{RRM}	V	800	800	800	1200	1200	1600	1600	1600
Max. Peak repetitive reverse off-state current	I_{RRM}	mA	0.05	0.05	0.05	0.1	0.1	0.05	0.3	0.3
Max. DC Gate Trigger Voltage	V_{GT}	V	1.2	1.2	1.5	1.5	1.3	1.5	1.3	1.3
Max. DC Gate Trigger Current	I_{GT}	mA	50	50	50	8.8	10	20	150	150
Turn OFF Time	t_q	µS	25	20	35	120	150	200	100	100
Maximum Latching Current	I_L	mA	80	100	100	160	180	200	400	500
Maximum Holding Current	I_H	mA	60	75	60	150	150	150	200	250
Thermal Resistance Rθ (Junction to case)	$R_{\theta(j-c)}$	°C/W	2	1.2	1.1	1	0.5	0.25	0.12	0.1
OFF State SSR Leakage Current @ Rated Voltage & Frequency (Snubber Leakage)	I_{leak}	mA	For 230 VAC < 1.5 mA							
			For 440 VAC < 2.5 mA							
SCCR Current Rating (less than 100 µS)	I_{SCCR}	kA	-	-	-	10 kA	10 kA	10 kA	10 kA	10 kA
Weight	W	gm	90	90	90	90	90	90	90	90

Digital Oscilloscope

SCR Parameter Tester

V_{TM} Tester

H.V. Insulation Break Down Tester

dv/dt Tester

I_{TSM} Tester

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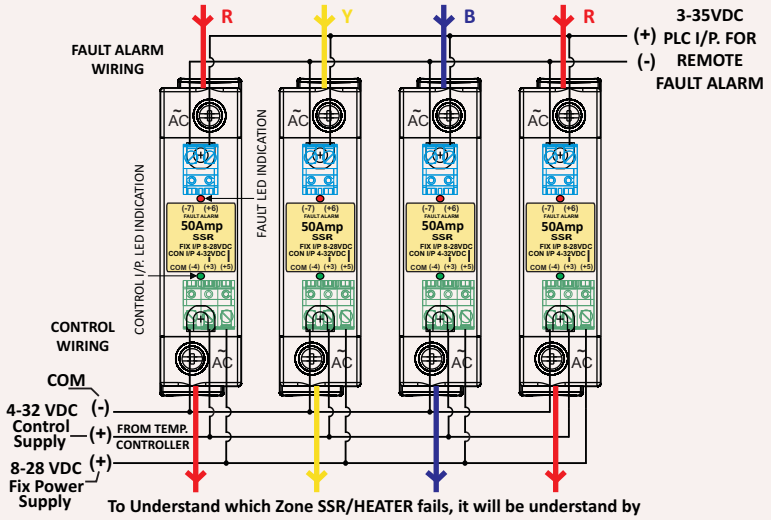
FAULT DETECTION SOLID STATE RELAY

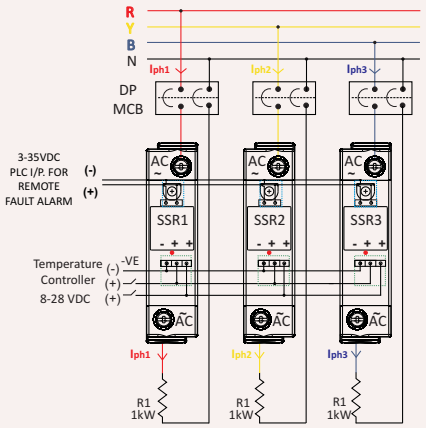
FAULT ALARM INDICATION WIRING MODEL & FAULT ALARM LED INDICATION TABLE



	INPUT LED	FAULT LED	REMARK
MAIN MCB ON	ON	OFF	LOAD HEALTHY CONDITION
MAIN MCB ON	OFF	OFF	LOAD HEALTHY CONDITION
MAIN MCB OFF	**ON**	ON	CONFUSION STATE
MAIN MCB OFF	**OFF**	ON	CONFUSION STATE
MAIN MCB ON	ON	ON	**FAULT**-LOAD OPEN OR SSR SHORT
MAIN MCB ON	OFF	ON	**FAULT**-LOAD OPEN OR SSR SHORT **(THIS CONDITION INDICATE FAULT)**
NOTE: IF FAULT IS DETECTED THAN SWITCH TO SSR ON/OFF FOR 200mS, IF FAULT LED IS ON & FAULT IS DETECT THAN IT IS REAL FAULT.			

ON/OFF TYPE SSR Connection Diagram

Circuit diagram 803 model - ON/OFF type Star Connection with neutral



Example 1.

	R	Y	B	3P4W
R1	1KW	1KW	1KW	3Phase 4 wire system
	1KW	1KW	1KW	= 3KW 3PHASE STAR WITH NEUTRAL

3kW 3PHASE STAR WITH NEUTRAL

R_L = 3kW Heater Load in three Phase with neutral so,

Watt = $\frac{3000}{3}$ = 1000W in each

$W = V_L \times I_{ph} \cos\emptyset$

$1000 = 230 \times I_{ph} \times 1$

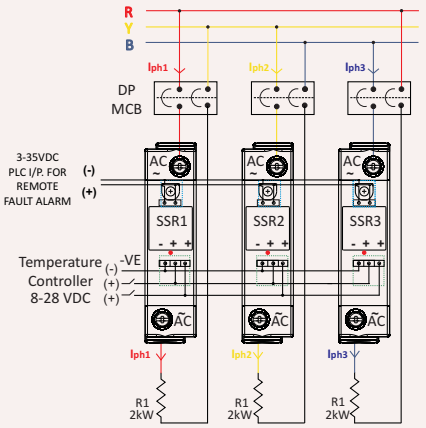
$I_{ph} = \frac{1000}{230}$ = 4.34Amp

I_{ph1} = 4.34Amp/Phase Current

I_{ph2} = 4.34Amp/Phase Current

I_{ph3} = 4.34Amp/Phase Current

Circuit diagram 803 model - ON/OFF type 440VAC Load In Open Delta



Example 1.

	R	Y	B	3P3W
R1	2KW	2KW	2KW	3Phase 3 wire system
	2KW	2KW	2KW	= 6KW 3PHASE OPEN DELTA

6kW 3PHASE Open Delta

R_L = 6kW Heater Load in three Phase system so,

Watt = $\frac{6000}{3}$ = 2000W in each

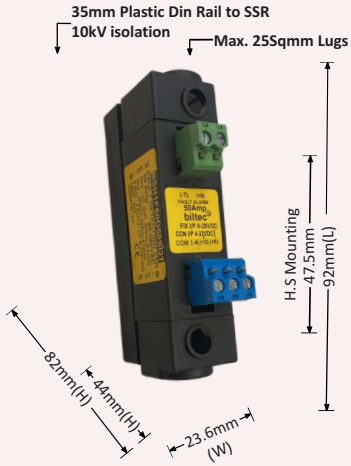
$W = V_L \times I_{ph}$

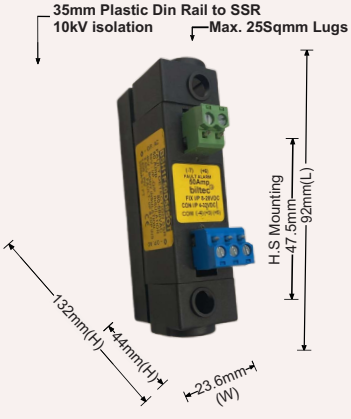
$I_{ph} = \frac{2000}{440}$ = 6.81Amp

I_{ph1} = 6.81Amp/Phase Current

I_{ph2} = 6.81Amp/Phase Current

I_{ph3} = 6.81Amp/Phase Current





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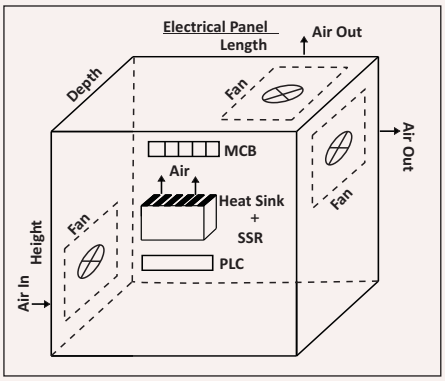
FAULT DETECTION SOLID STATE RELAY

AIRFLOW FOR EFFICIENT HEAT TRANSFER



- Heat Sink Fins should be in Vertical Position So that Hot Air Flow from Bottom to Top - Self Cooling.
- For thermal analysis of system horizontal convection & vertical both are important.
  Our heat sinks are designed in such manner that horizontal & vertical convection both occurs properly.
- Keep 20mm Gap at Top and Bottom of Heat Sink.
- Apply Heat Sink Compound between SSR and Heat Sink.
- The Screw should Tight Properly so 1800 Square mm of Total Exposed Aluminum is Sufficient To Dissipated One Watt of Heat Generated.
- **Advantages of using DBC Technology :**
  Copper has higher thermal conductivity So more heat dissipation of junction to case & case to sink. Due to this thermal resistance $R_{\theta JC}$ is very less. Reduction in thermal resistance increases thermal efficiency of whole system.

THERMAL CALCULATION	
$\Delta T = T_j - T_A$	= $P(R_{\theta JC}+R_{\theta CS}+R_{\theta SA})$
T_j	= Junction Temperature (°C) 125 °C
T_A	= Ambient Temperature(°C)
P_d	= Power Dissipation (Watts) Voltage Drop X Load Current
$R_{\theta JC}$	= Thermal Resistance Junction to Case°CW
$R_{\theta CS}$	= Thermal Resistance of Heat Sink Compound (0.2°C/W Type)
$R_{\theta SA}$	= Thermal Resistance of External Heat Sink (°C/W) it depend upon Length, Width, Expose Aluminum (0.5 to 5)

NOTE : If SSR Current Capacity is high and it is mounted on lower capacity heat sink than maximum load current will also decrease as heat dissipation area decreases.
Example: 1) 90Amp SSR used for 40Amp Load Current than "B-24" Type of Heat Sink. **2)** 50Amp SSR used for 24Amp Load Current than "V-87" Type of Heat Sink.

HEAT SINK SELECTION GUIDEHEAT SINK SELECTION GUIDE (Resistive LOAD)

803 MODEL / HEAT SINK	HEAT SINK RATING	16 Amp ON/OFF	25 Amp ON/OFF	40 Amp ON/OFF	50 Amp ON/OFF	75 Amp ON/OFF	90 Amp ON/OFF	150 Amp ON/OFF	200 Amp ON/OFF
V-87	20 Amp	11 Amp	20 Amp	22 Amp	24 Amp	26 Amp	-	-	-
B-24	32 Amp	-	-	28 Amp	32 Amp	37 Amp	40 Amp	42 Amp	-
B-72	63 Amp	-	-	-	42 Amp	50 Amp	60 Amp	62 Amp	65 Amp
		-	-	20 x 2= 40 Amp	25 x 2= 50 Amp	32 x 2= 64 Amp	35 x 2= 70 Amp	-	-
		-	-	18 x 3= 54 Amp	20 x 3= 60 Amp	22 x 3= 66 Amp	24 x 3= 72 Amp	-	-
B-96	80 Amp	-	-	-	-	-	65 Amp	80 Amp	85 Amp
		-	-	-	32 x 2= 64 Amp	38 x 2= 76 Amp	40 x 2= 80 Amp	42 x 2= 84 Amp	-
		-	15 x 4= 60 Amp	16 x 4= 64 Amp	18 x 4= 72 Amp	20 x 4= 80 Amp	-	-	-

* All above SSR Rating & Heat Sink Selections are considered on environment temperature @ 55 °C.

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