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ILEX SCX13 or PENETROX a-13

1.1   Assembly Range

Westcode Semiconductors Limited manufactures a complete range of Power Semiconductors at their Chippenham (UK) plant for building into assemblies.

These devices are available throughout the world either from Westcode direct, or from our Sales Offices and Distributors.

Principal Product Range	Current (Amps)	Voltage Range (Volts)
Rectifier Diodes	8400	6000
Fast Recovery Diodes	4000	6000
Phase Control Thyristors	4000	5000
Fast Turn-off Thyristors	4000	3200
Distributed Gate Thyristors	3000	3600
GTOs (I_{TGQ})	4000	6000

Testing of High Power Semiconductors

All Westcode devices are 100% tested at our UK plant, using test equipment specifically designed to accurately perform the tests required for the various parameters in the catalogue.

It should not be necessary for a customer to perform these tests again. In the event of tests being required, either at 'Goods In' or as part of a maintenance programme, they should **only** be carried out by trained personnel using equipment designed for the purpose. Otherwise, at best, misleading results could be obtained, at worst, devices could be damaged or destroyed. If capsule type semiconductors are to be tested, they should be in a 'compressed' condition in order that contact is made with the silicon element. Pressures in the order of 100s of kilograms are required. Testing uncompressed devices can result in an apparent 'open circuit' effect, or risk internal arcing which could case irreparable damage.

The use of electronic multimeters, on the resistance scale, can only confuse. A power semiconductor is a non-linear resistor. At the low voltages common to these instruments, such tests will produce false results. The 'resistance' indicated on an instrument can vary with battery voltage, even variances in that particular instrument, let alone from type to type. Consequently, resistance measurements, as a check of device characteristics, is totally irrelevant. There is a case, however, for using multimeters, if a device is thought to be Short Circuit. In such cases the 'resistance' will show as very low.

High voltage Insulation/Continuity testers should *not* be used as damage to the semiconductor device could occur.

Westcode Semiconductors Limited is an ISO9001 Registered company.

Silicon Assemblies

A wide range of units are available, incorporating international standard outline silicon semiconductors. Westcode products have gained a worldwide reputation for quality in military, industrial and domestic applications.

Standard extruded aluminium heatsink profiles are used for mounting discrete semiconductor devices in various configurations, for example:

Single-phase diode bridges with current ratings from 70 to 5170 Amps DC

Single-phase half or fully controlled bridges from 35 to 2200 Amps DC

Three-phase diode bridges with current ratings from 100 to 7190 Amps DC

Three-phase half or fully controlled bridges from 45 to 3790 Amps DC

Hexaphase single way diode assemblies from 200 to 14380 Amps DC

Hexaphase single way Thyristor assemblies from 90 to 7580 Amps DC

AC Regulators, single and three phase, from 40 to 2940 Amps RMS

Water Cooled AC Regulators

Included in our standard range are solid state, water cooled AC Regulators for resistance welding, with ratings from 315 to 3020 Amps $_{RMS}$.

Also available are water cooled, single and three phase assemblies from 1200 to 6000 Amps DC.

All the above range is suitable for 440 V$_{RMS}$ 50Hz mains operation.

Custom Built Assemblies

Custom built assemblies can be provided when a standard assembly is not suitable. Space saving designs are produced for air natural (AN), air forced with fans (AF), water forced (WF), oil natural (ON) and oil forced (OF) cooled assemblies.

NOTE: In the case of stud mounted devices the output, force air cooled, is restricted by the RMS current limit of the semiconductor.

Standard Range Assemblies

The coding comprises of five sections as follows:

S	8	G	250	HGD
1	2	3	4	5

Section 1 - Letter S denoting Silicon
Section 2 - Number denoting V_{RRM} divided by 100
Section 3 – Letter e.g. T or G denoting generic fin types
Section 4 – Number denoting output current rating of the stack at 25°C natural air cooled.
Section 5 – Letter(s) denoting circuit arrangement as follows**: (Click on description for ratings & outlines)**

B   - Single phase diode bridge
G   - Three phase diode bridge
HEX   - Hexaphase (Six-Phase) diode single way
HEXT   - Hexaphase (Six-Phase) thyristor single way
FB   - Single phase fully controlled bridge
FG   - Three phase fully controlled bridge
HBD   - Single phase positive half controlled bridge with free wheel diode
HB   - Single phase half controlled bridge (main bridge diodes in free wheel path)
HGD   - Three phase positive half controlled bridge with free wheel diode
FR   - Single phase fully controlled AC regulator
FM   - Three-phase fully controlled AC regulator

Thus, example above S8G250HGD indicates a G 'type' assembly, with devices having a V_{RRM} of 800 volts, three phase half controlled bridge common cathode with free wheel diode having a rating of 250 amperes at T_a25^{o}C.

For silicon devices it is normal to use a safety factor of greater than 2 between the device V_{RRM} listed and the operating peak voltage, i.e. 800V_{RRM} device for 250V_{RMS} supply and 1200V_{RRM} for 415V_{RMS}.

Surge suppression/Resistor-Capacitor networks **(Click here for Capacitor information)**, to protect the devices from voltage transients, and high speed fuses **(Click here for Fuse information)**, to protect the devices from short circuits, are usually required to ensure reliable and safe operating. Contact us for suitable types.

BS EN ISO 9001
QUALITY SYSTEM
FM 26085

1.2   Thermal Design

The thermal curves listed below enable calculations to be made to establish the correct standard assembly to meet operating conditions other than those listed in the standard tables.

Figure 6   TB Fin Outline

Figure 7   TB Fin (150mm) - Thermal impedance v. time (double side cooled)

Figure 8   TB Fin (300mm) - Thermal impedance v. time (Double side cooled)

Figure 8a   TC Fin Outline

Figure 9   G Fin Outline

Figure 10   G Fin (70mm) – Thermal impedance v. time (single side cooled)

Figure 11   G Fin (150mm) – Thermal impedance v. time (single side cooled)

Figure 12   Thermal resistance v. power dissipated (curves for H & T fins are for double side cooled)

Figure 13   GA Fin Outline

Figure 14   GA Fin (150mm) – Thermal impedance v. time (single side cooled)

Figure 15   GA Fin (300mm) – Thermal impedance v. time (single side cooled)

Figure 16   Thermal resistance v. power dissipated (curves for H & T fins are for double side cooled)

Figure 17   H Fin Outline

Figure 18   H Fin (150mm) - Thermal impedance v. time (double side cooled)

Figure 19   H Fin (300mm) - Thermal impedance v. time (double side cooled)

Figure 20   Thermal resistance v. power dissipated (curves for H & T Fins are double side cooled)

Figure 21   T Fin Outline

Figure 22   T Fin (150mm) – Thermal impedance v. time (double side cooled)

Figure 23   T Fin (300mm) - Thermal impedance v. time (double side cooled)

Figure 24   Thermal resistance v. power dissipated (curves for H & T Fins are for double side cooled)

For example, the following procedure can be used to establish the necessary level of forced air cooling for a specific duty and assembly type. The procedure can be rearranged when, for example, it is necessary to select an assembly type to meet a fixed air speed or non-standard maximum ambient temperature.

(a)   On the basis of initial estimates select the assembly type.

(b)   From the standard tables establish the fin and device types.

(c)   From the relevant outline diagram, establish whether there is more than one section of fin in series in a cooling path. This occurs for example in double sided capsule assemblies when the unit comprises of a single length of fin one side and two half lengths the other side. For such split fin arrangements a factor of 13% is added to the fin thermal impedance.

(d)   The calculations are as follows, in which a typical example is used of a 3 phase bridge of 6 diodes to feed an inductive load with forced air cooling available.

Example:

For 2100ADC Forced Air Cooling the initial type selection is SXT1480G using CXC935 diodes on a split T fin assembly.

Diode power dissipation is given by

$$W_{AV} = I_{AV} \cdot V_O + (I_{AV})^2 \cdot (FF)^2 \cdot r$$

Where I_{AV} = device current average over one supply period and FF = Form Factor.

FF = 1 for DC
= 1.57 for half sinewave, 180° conduction
= $\sqrt{3}$ for 3 phase, 120° conduction square-wave
= $\sqrt{6}$ for hexaphase, 60° conduction square-wave.

The device constants V_o and r are given in the Rectifier Short form Design Guide as V_o = 0.79 volt and r = 0.192 milliohm.

For a 3-phase bridge of six diodes conducting in pairs the value for $(FF)^2$ is 3, and the average of the square-wave 120° conduction current is 1/3 x d.c. load current or 700 amps.

The average power loss in each diode is

W_{AV} = 700 x 0.79 + 700^2 x 3 x 0.192 x 10^{-3} watts
W_{AV} = 835 watts

By using the device power loss figure in the next equation the required cooler thermal resistance to ambient temperature can be found.

$$R_{th(HS-A)} = \frac{T_J - T_A}{W_{AV}} - R_{th(J-HS)}$$

where T_J = diode maximum operating junction temperature
T_A = ambient temperature of cooling air
$R_{th(J-HS)}$ = effective diode thermal resistance, junction to heatsink (dependent on diode current waveform)

For this example: T_J = 175^oC
T_A = 40^oC
$R_{th(J-HS)}$ = 0.04 K/W (3-phase 120° conduction)

Entering values: $R_{th(HS-A)} = \frac{175-40}{835}$ - 0.04

= 0.122 K/W for the cooler

As a split fin assembly is being used, the 13% factor must be introduced, so $R_{th(HS-A)}$ becomes

$$\frac{0.122}{1.13} = 0.108 \text{ K/W}$$

Referring back to Figure 20 **(Click to View)**, follow the line from the vertical axis for 0.108 K/W until it crosses the R_{th} curve for a 150mm length giving the flow rate required, 3 metres/second on the horizontal axis.

Calculation of current ratings for ambient temperatures between 25°C and 45°C and forced air cooling rates other than 5m/s can be made as follows:

(a) **Ambient Temperature**

For ambient temperatures of x°C:

$$I(X°C) = [\ I(25°C) - I(45°C) \times \frac{(x-25)}{20}\ ] + I(45°C)$$

For example; for a 3 phase diode bridge SXG425G operating at 35°C

$$I(35°C) = [425 - 370 \times \frac{(35-25)}{20}] + 370 = 398A\ d.c.$$

(b) **Forced Air Cooling**

$$I = (I_{(5m/s)} - I_{(AN)} \times S + I_{(AN)}$$

Where S is as follows:

Airflow m/s	S
1	0.14
1.5	0.37
2	0.47
2.5	0.65
3	0.77
4	0.88
5	1.00

For Example; for a 3 phase diode bridge SXG425G operating at 3m/s forced air cooling at 25°C

$$I_{(3m/s)} = (870 - 525) \times 0.77 + 525$$
$$= 790A\ d.c.$$

1.3 Circuit Guidelines

Calculation of input and output voltages

The output regulation of a rectifier at constant mains voltage depends on two other factors in addition to its forward voltage drop, namely:

(1)   The presence of reactance in the ac input, e.g. leakage reactance in the transformer and any inductance in the a.c. circuit and,

(2)   resistance of transformer windings, busbars and wiring, etc.

The silicon rectifier has a small forward voltage drop, but the above factors have to be included in any assessment of voltage regulation since their effect may well be greater than that of the rectifier itself.

Formulae are given below for calculating the input and output voltages.

E   =   mean dc output voltage on load in volts.

N   =   the total number of cells in the rectifier connection.

P   =   the number of cells in parallel in each section.

Vf   =   the mean forward voltage drop per diode

R   =   the percentage resistance of the transformer supply source.

Q   =   the percentage regulation due to reactance.

Figure 25
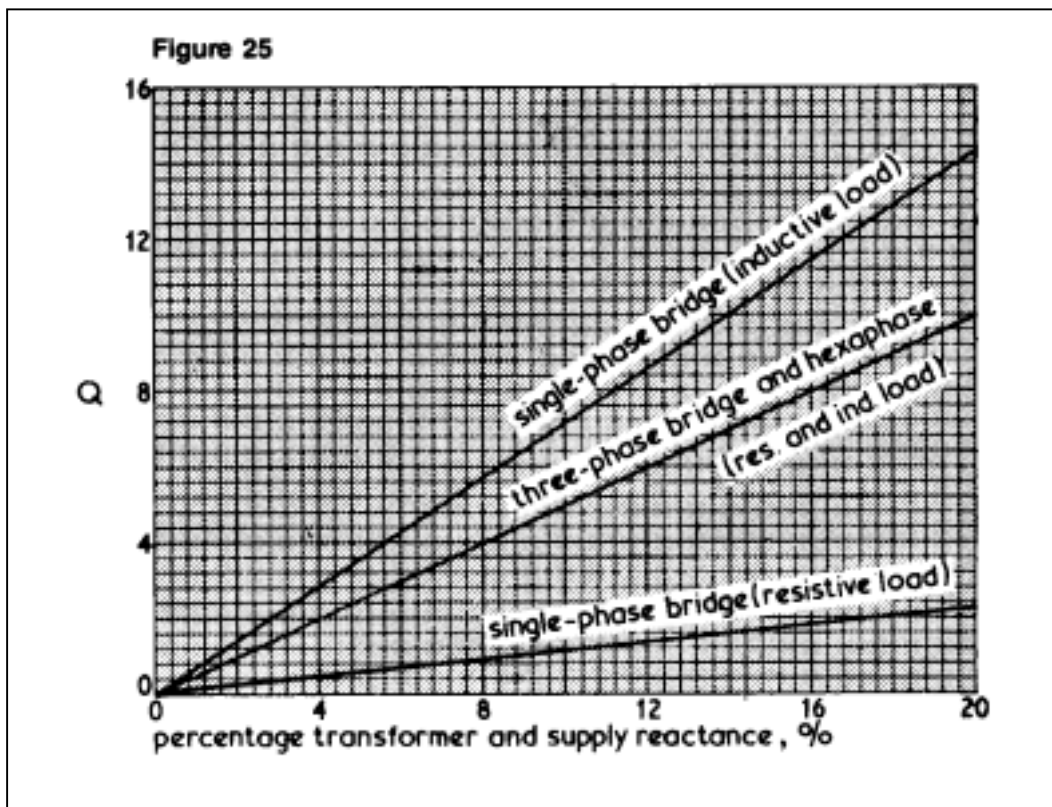
The rms open circuit input line voltage =

$$2.22 \left(E + \frac{NVf}{P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Single-phase centre-tap)

$$1.11 \left(E + \frac{NVf}{P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Single-phase bridge)

$$1.48 \left(E + \frac{NVf}{P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Three-phase half-wave)

$$0.742 \left(E + \frac{NVf}{P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Three-phase bridge)

$$1.48 \left(E + \frac{NVf}{2P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Double star with interphase reactor)

$$1.28 \left(E + \frac{NVf}{2P} \right) \left(1 + \frac{R}{100} + \frac{Q}{100} \right)$$

(Double star without interphase reactor)

Overload protection

In common with all other types of electrical equipment silicon rectifiers must be protected against overloads and short circuits. Owing to the limited thermal mass of the silicon diode junction the protection requirements are, however, more stringent than say, for a motor or transformer, and special care is usually merited.

The use of ultra rapid fuses, manufactured specially for semiconductor rectifier protection, or high speed breakers are recommended and our engineers will be pleased to advise on any particular application. **(Click here for full information on Ultra Rapid Semiconductor Protection Fuses).**

Surge voltage protection

Transient voltage surges, which can be caused by transformer switching, inductive load switching, hole storage, line disturbances, etc., can arise in most circuits. It is recommended that a surge suppression network be fitted to limit any transient voltages to less than the transient voltage rating of the unit.

A range of surge suppressors, suitable for this application, are available.

Our engineers will be pleased to advise on the composition and location of suitable networks.

Contact Us, please click here.

1.4 Rectifier Circuits

Single Phase

HALF WAVE		FULL WAVE CENTRE TAP		FULL WAVE BRIDGE	
Resistive Load	Inductive Load	Resistive Load	Inductive Load	Resistive Load	Inductive Load
$I_{RMS} = 1.57 I_{DC}$ $I_{MEAN} = I_{DC}$	$I_{RMS} = 1.41 I_{DC}$ $I_{MEAN} = I_{DC}$	$I_{RMS} = 0.786 I_{DC}$ $I_{MEAN} = 0.5 I_{DC}$	**29** $I_{RMS} = 0.707 I_{DC}$ $I_{MEAN} = 0.5 I_{DC}$	$I_{RMS} = 0.786 I_{DC}$ $I_{MEAN} = 0.5 I_{DC}$	$I_{RMS} = 0.707 I_{DC}$ $I_{MEAN} = 0.5 I_{DC}$
$I_{RMS} = 1.57 I_{DC}$ $E_{RMS} \triangleq 2.22 E_{DO}$	$I_{RMS} = 1.41 I_{DC}$ $E_{RMS} \triangleq 2.22 E_{DO}$	$I_{RMS} = 0.786 I_{DC}$ $E_{RMS} \triangleq 2.22 E_{DO}$	$I_{RMS} = 0.707 I_{DC}$ $E_{RMS} \triangleq 2.22 E_{DO}$	$I_{RMS} = 1.11 I_{DC}$ $E_{RMS} \triangleq 1.11 E_{DO}$	$I_{RMS} = I_{DC}$ $E_{RMS} \triangleq 1.11 E_{DO}$
$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 1 \ F_S$	$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 1 \ F_S$	$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 2 \ F_S$	$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 2 \ F_S$	$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 2 \ F_S$	$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 2 \ F_S$

Three Phase

A.C. REGULATOR	STAR		BRIDGE
Resistive or Inductive Load	Resistive Load	Inductive Load	Resistive or Inductive Load
$I_{RMSD} = 1.571 I_{MEAN}$ $I_{MEAN} = 0.45 I_{RMSL}$	$I_{RMS} = 0.587 I_{DC}$ $I_{MEAN} = 0.333 I_{DC}$	$I_{RMS} = 0.577 I_{DC}$ $I_{MEAN} = 0.333 I_{DC}$	$I_{RMS} = 0.58 I_{DC}$ $I_{MEAN} = 0.333 I_{DC}$
LINE I_{RMS}	$I_{RMS} = 0.587 I_{DC}$ $E_{RMS} \triangleq 1.48 E_{DO}$	$I_{RMS} = 0.577 I_{DC}$ $E_{RMS} \triangleq 1.48 E_{DO}$	$I_{RMS} = 0.817 I_{DC}$ $E_{RMS} \triangleq 0.742 E_{DO}$
$\beta = 180^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 1 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 3 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 3 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 6 \ F_S$
Above diagram represents single phase regulator. For three phase applications a similar arrangement is used in each line.			

Six Phase

Double Star (without I.P.T.)	Double Star (with I.P.T.)	Parallel Bridge (without I.P.T.)	Parallel Bridge (with I.P.T.)	Series Bridge
Resistive or Inductive Load	Resistive or Inductive Load	Resistive or Inductive Load	Resistive or Inductive Load	Resistive or Inductive Load
$I_{RMS} = 0.408 I_{DC}$ $I_{MEAN} = 0.167 I_{DC}$	$I_{RMS} = 0.29 I_{DC}$ $I_{MEAN} = 0.167 I_{DC}$	$I_{RMS} = 0.408 I_{DC}$ $I_{MEAN} = 0.167 I_{DC}$	$I_{RMS} = 0.29 I_{DC}$ $I_{MEAN} = 0.167 I_{DC}$	$I_{RMS} = 0.58 I_{DC}$ $I_{MEAN} = 0.333 I_{DC}$
$I_{RMS} = 0.408 I_{DC}$ $E_{RMS} \triangleq 1.28 E_{DO}$	$I_{RMS} = 0.29 I_{DC}$ $E_{RMS} \triangleq 1.48 E_{DO}$	$I_{RMS} = 0.577 I_{DC}$ $E_{RMS} \triangleq 0.715 E_{DO}$	$I_{RMS} = 0.408 I_{DC}$ $E_{RMS} \triangleq 0.742 E_{DO}$	$I_{RMS} = 0.817 I_{DC}$ $E_{RMS} \triangleq 0.37 E_{DO}$
$\beta = 60^\circ$ $E_{PR} = 1.63 E_{RMS}$ $F_D = 6 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.63 E_{RMS}$ $F_D = 6 \ F_S$	$\beta = 60^\circ$ $E_{PR} = 1.52 E_{RMS}$ $F_D = 12 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.52 E_{RMS}$ $F_D = 12 \ F_S$	$\beta = 120^\circ$ $E_{PR} = 1.41 E_{RMS}$ $F_D = 12 \ F_S$

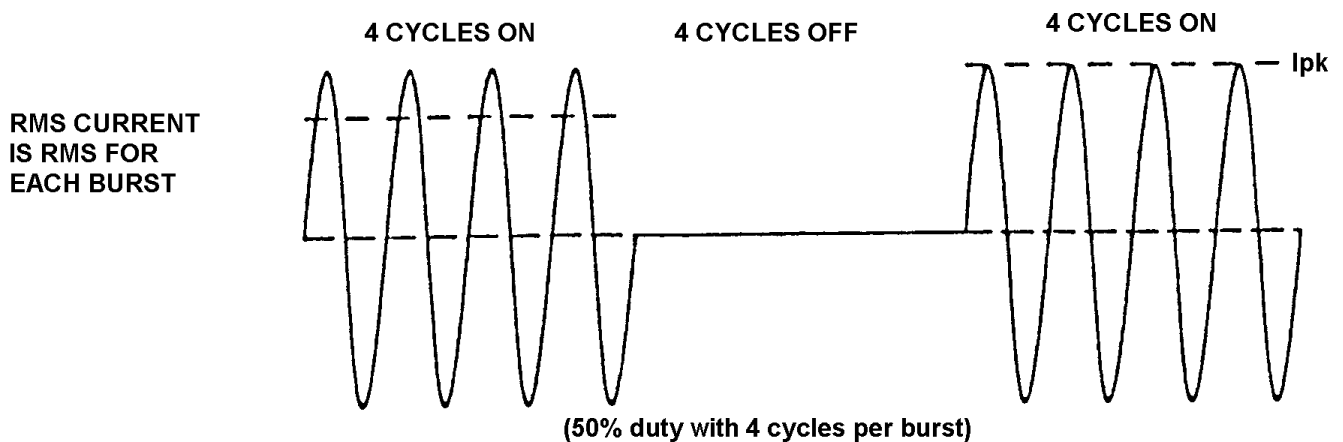β Maximum Device Conduction Period (Degrees) F_D D.C. Ripple Frequency (Hz.)

1.5   Single-Phase Water Cooled AC Regulator for Resistance Welding

Click here for Matrix, Outlines & Dimensions

Maximum RMS Current vs Duty Cycle Curves

The following curves give the maximum RMS current for a burst of pulses (equal to the peak current divided by sqrt2) versus the duty cycle. The duty cycle is expressed as the percentage of the number of cycles in a burst to the total number of cycles between the starts of each burst.

Each curve is labelled for the number of cycles in the burst, as shown below.

4 CYCLES ON   **4 CYCLES OFF**   **4 CYCLES ON**

Ipk

**RMS CURRENT
IS RMS FOR
EACH BURST**

(50% duty with 4 cycles per burst)

Gate Drives

The recommended gate driver for use with this switch must be equivalent to a source of 20V open-circuit voltage, 1A short-circuit current, with a short circuit current rise-time not exceeding 1 microsecond.

Click here for more Gate Drive Unit information WSL2106 or WSL2315.

Water Cooled AC Regulator Rating Curves

Click on reference below to view:

SXL 315

SXL 400 / SXL 410

SXL 420

SXL 570

SXL 595 / SXL 600

SXL 620

SXL 650

SXL 960

SXL 980 / SXL 990

SXL 1160

SXL 1630

SXL 1805

SXL 1950

SXL 3020

Isolated Semiconductor Power Module Range

Westcode offers a comprehensive range of power modules, **click here to view product matrix, outlines and dimensions**. These hermetically sealed, compression mounted ceramic capsules, ensuring high reliability, are available as:

Double Thyristor

Thyristor/Diode

Diode/Thyristor

Double Diode

Water Cooled Heatsinks Type LK, LKA, LKB & LKC Assemblies

These coolers are suitable for double side cooling of capsule devices with boss diameters up to 80mm and flange diameters up to 116mm.

This includes JEDEC outlines DO-200AA, DO-200AC and TO-200AB

Multiple Cooler Stacks

(i)   **2 Coolers per semiconductor**

The temperature of the water entering the last cooler pair should be taken into account.
The temperature rise of cooling water along the stack with respect to the ambient input water is $(\Delta T)_W$ where

$$(\Delta T)_W = \frac{14.4\ P(n-1)}{F}$$

where   P   is the power (in KW) dissipated in each semiconductor
        n   is the number of semiconductors
        F   is the water flow in litres/min.

The rise in temperature of the last cooler pair with respect to the ambient input water is then

$$(\Delta T)c = (\Delta T)_W + P\ R_{th(C-W)}$$

where * $R_{th(C-W)}$ is obtained from the curve for 2 coolers **(Figure 51 – click here to view)**.

(ii)　　**(n+1) coolers, n semiconductors, (n greater than or equal to 2)**

In any series stack of coolers with n greater than 2 the hottest cooler will usually be the last but one in the down-stream direction.

The inlet water temperature rise to the last but one cooler (relative to the stack inlet) may be calculated according to:

$$(\Delta T)_W \quad = \quad \frac{14.4\ P\ (2n-3)}{2F}$$

The effective temperature rise of the last but one cooler with respect to the stack input water is given by:

$$T_{(C-W)} \quad = \quad (\Delta T)_W \ + P\ R_{th(C-W)}$$

Where * $R_{th(C-W)}$ is obtained from the curve for 3 coolers **(Figure 51 - Click to view)**.

*Cooler evaluated with $\varnothing$47 poleface device.

For other sizes multiply the thermal resistance as follows: $\varnothing$34 - 1.38, $\varnothing$25 - 1.88, $\varnothing$19 - 2.47.

Click on the following Figures for further information:

LK/LKA Coolers:
Figure 51　　　Input water thermal resistance v. water flow rate
Figure 52　　　Water pressure difference (Output-Input)
Figure 53　　　Transient thermal impedance v. time (2 coolers/1 semiconductor)
Figure 54　　　Transient thermal impedance v. time (3 coolers/2 semiconductors)
Figure 55　　　Outline LK with busbar

LKB/LKC Coolers:
Figure 56　　　Input water thermal resistance v. water flow rate
Figure 57　　　Water pressure difference (output-Input)
Figure 58　　　Transient thermal impedance v. time
Figure 59　　　Transient thermal impedance v. time
Figure 60　　　Outline LKB with busbar

Water Cooled Heatsinks Types; LK, LKA, LKB and LKC Assemblies

Current ratings are based on two coolers for each device and 35°C inlet temperature at a flow rate of 5L/minute. Bridge configurations are based on two water paths for each bridge but all other configuration are based on a single path per circuit.

Click here to view Water Cooled Heatsink Configuration Matrix.

**Water Cooled Assemblies – Type LK - LKA**

Click here to view outline and configuration table for a typical 3 device, 6 cooler assembly.

Water Cooled Assemblies – Type LKB – LKC

Click here to view outline and configuration table for a typical 4 device, 8 cooler assembly.

1.6 Copper Fin Forced Air Cooled Assemblies

Shown below, in Figure 63, is an example of a typical copper fin forced air cooled assembly in a 3-Phase Fully Controlled Bridge 3 Fan Arrangement.

Figure 63
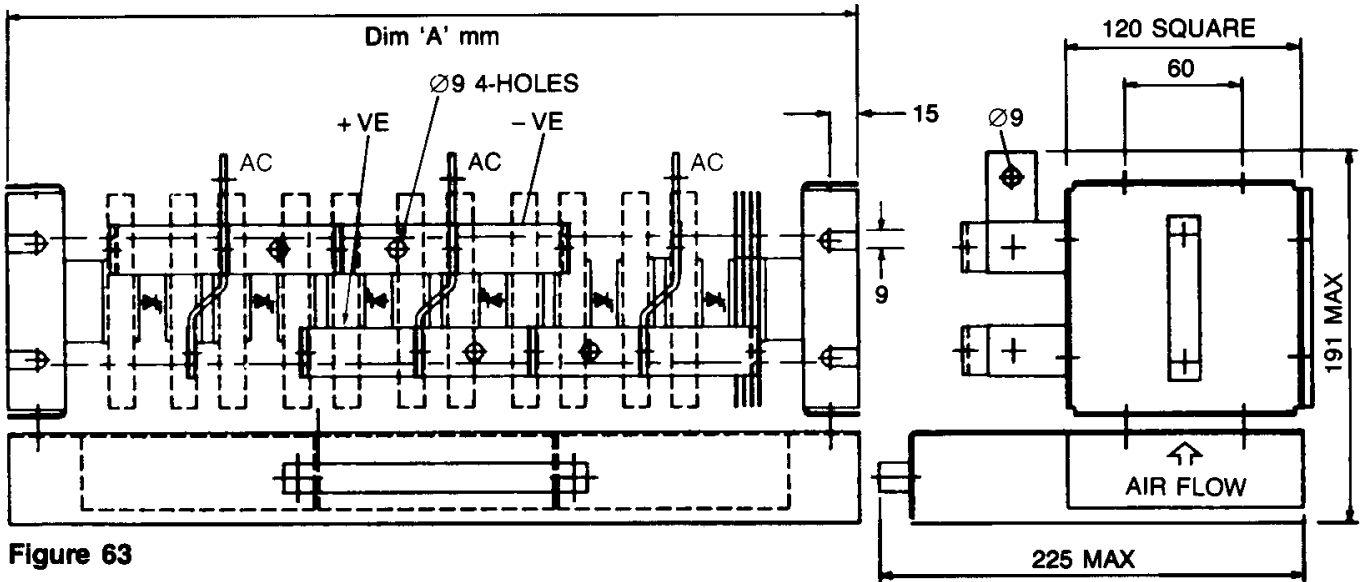
Assembly Code is compiled using the following tables:

S	X	FC	XXX	X
Silicon Assembly	Device Voltage Grade	Forced Air Cooled Copper Fin Assembly	DC Current Rating (I_{RMS} for AC Regulators)	Rectifier Arrangement

| Code | Number of Heatsinks | Number of Devices | Number of Fans | Device Mounting Surface Diameter | | | |
| | | | | 19mm and 25.1mm | | 34mm | |
				Dim 'A' mm	Approx. Weight in kg.	Dim 'A' mm	Approx Weight in kg.
SXFCXXXB	8	4	2	373	8	373	9
SXFCXXXG	12	6	3	510	11	525	13
SXFCXXXHEX	12	6	3	552	11	525	13
SXFCXXXHEXT	12	6	3	552	11	525	13
SXFCXXXFB	8	4	2	373	8	373	9
SXFCXXXFG	12	6	3	453	11	525	13
SXFCXXXHBD	10	5	3	453	10	453	11
SXFCXXXHB	8	4	2	373	8	373	9
SXFCXXXHGD	14	7	4	582	14	582	15
SXFCXXXFR	4	2	1	234	5	234	5
SXFCXXXFM	12	6	3	453	11	525	13

Click on figure number below **to view the following:**

Figure 64   Thermal impedance v. time (double side cooled)
Figure 65   Thermal resistance ∆PV air flow (double side cooled)

Matrix   Copper Fin Forced Air Cooled Assemblies – Types available (Fans included)

1.7   Capsule Mounting Clamps

Bar Type

The bar clamps are suitable for devices having from 19mm to 73mm diameter mounting surfaces and 450kgf to 4000kgf clamping forces.

Coding

CMK	**XXXX**	**S, D or DT**	**XX**	**M**
Capsule Mounting Kit	Nominal Clamping Force kgf	S – Single side cooled (tapped heatsink) D – Double side cooled (through hole in heatsink) DT – Double side cooled (tapped heatsink)	Maximum Capsule Diameter mm	Metric Fixings M8 , 10 or 12

Box Type

The box clamps are suitable for devices with 19mm, 25mm or 34mm diameter mounting surfaces and of 13.8mm or 14.6mm or 26.2mm nominal thickness respectively.

Coding

CMK	**XXX**	**B**	**XX**	**M**
Capsule Mounting Kit	Nominal Clamping Force kgf	Box Clamp	Capsule Mounting Surface Diameter 19, 25 or 34mm	Metric Fixing Bolts (see chart)

Click here for Types available

Assembly Procedure for Capsule Clamps

The 'Bar Type' clamps use a two rod system with a straight bar spring that is bent over a central point to give the clamping force on the device. This force is achieved when the indicators, metal shims at each end of the clamp, become just trapped.

The 'Box Type' clamps use a four bolt system with disc springs and the correct force on the device is achieved when the bottom of the box just touches the heatsink.

As the force indication is contained within these clamps, special equipment or torque spanners are not required. The clamps can therefore be reset to the correct force, at any time, using only a box spanner.

Click here for full mounting details.

1.8   Heatsink and Device Preparation

Aluminium Heatsinks[v] **Capsule Devices**

W1.   Apply a small amount of mounting grease[iv] to the heatsink contact area.

W2.   Scrub the heatsink contact area using a wire brush (a 25mm rotary wire cup brush is suitable). This action produces a 'slurry'.

W3.   Clean the device mounting surface[vi] (both sides for a capsule) and apply a thin film of mounting grease[iv] with a 10mm diameter bristle brush.

   Warning: Only a small bead of grease of approximately 0.1mm radius maximum should be squeezed out from the device-heatsink joint as excessive use of grease will cause a high voltage drop across the joint.

W4.   Remove the 'slurry' using a clean rag or tissue and immediately position the device on the contact area of the heatsink. Do not attempt to mount more than one device at a time.

W5.   Where a locating pin is used, ensure that the device is accurately located upon the pin. Ensure that the pin projects from the heatsink less than the depth of the hole in the device. See 'Warning' in A3.

Stud Base Devices

Y1.   Ensure the device contact face is clean[vi] and then apply a thin film of mounting grease[iv] before mounting the device. Ensure that the threads are clean and free of mounting grease[iv]. Do not apply a turning force to any part of the device other than the hexagonal base. Ensure that the specific torque is applied using a suitable torque wrench.

Plate Copper Heatsinks[v]

Z1.   When mounting capsule, flat base and stud devices on plated copper, ensure that the contact area of the device and heatsink is clean[vi] and apply a thin film of mounting grease[iv] to the contact face of the device only.

NOTES

(i)   The lower insulating block must be backed up by a heatsink thickness suitable for the device loading otherwise the insulating block will break.

(ii)   Do not position the circular steel spacer between the device and conducting right angle bar as this will give rise to additional volt drop.

(iii)   Press the locating pin into the conducting right angle bar and circular spacer (if fitted) prior to assembling the clamp making sure that the projection is less than 1.5mm on either side, see 'Warning' in A3.

(iv)   Recommended mounting grease –

ILEX SCX13 or PENETROX a-13.

(v)   Recommended machining tolerances over the device mounting area:

        Flatness 0.03mm
        Roughness 1.6μ metres Ra.

(vi)   It is permissible to use a scouring pad such as 'Scotchbrite' to remove stubborn dirt from device and heatsink contact surfaces followed by a clean rag or tissue.

(vii)   Recommended lubrication – Castrol LM2 grease.

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