Formulating Technical Enquiries

Application Note

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If you have just written down or are about to write down a technical enquiry for thyristors, rectifiers or heatsink assemblies then please spare a few minutes to read through the following notes. This should help to minimise the response time to the enquiry.

The following notes are aimed specifically at converter thyristor and rectifier diode applications but the basic approach applies to other power semiconductor devices. For many applications design engineers will find most of the technical information they need in the device data sheets. However, for special applications or where technical help is needed a technical enquiry may be formulated and submitted to us. Below is a checklist which should help you, the enquirer, to include as much relevant information as possible in your enquiry. This approach may avoid the need for us to ask you for supplementary information .

Note, it is not possible to cover every possible application so that the check list cannot be considered as comprehensive. **Minimum information required by us to formulate a reply is covered by those items printed in ‘bold’.**

In formulating your enquiry try to consider particularly the duty on the diode and/or thyristor. For this, voltage and current waveforms are particularly important and, unless the application is very standard, should always be given. If waveforms are given, state whether they are real or computer modelled (eg from SPICE).

Clarify if a quote for either parts or assemblies is required. If YES, is requirement for devices only, or devices on heatsinks, or complete assemblies with snubbers and possibly fuses? **Also, give quantities and delivery required.**

1. What type of application?

DC motor control (eg phase controlled bridge or chopper).
AC motor control (eg variable frequency inverter).
Soft start circuit for ac motors.
AC controller (eg heating control, resistance welding).
Rectifying bridge or battery charger.
Power factor correction.
Crowbar.
Capacitor discharge.
Other.

2. Power supply details.

DC - give nominal voltage and current capability requirements, with tolerances, also prospective short circuit current and/or source inductance.
AC - remarks, as for DC but also state whether 1, 3 or 6 phase with connection type,eg star,delta.
Frequency.
Voltage transients, if known.

3. Load details.

Resistive? Inductive (give power factor).
Motor (what type?).
Capacitive (give power factor).
Current - include details, as appropriate, of I_{peak}, $I_{T(AV)}$, di/dt (turn-on and turn-off), frequency (including pwm chopping frequency). Include any details of overload duty and time, as well as repetitive load duty cycle.

4. Semiconductor equipment details.

It is assumed that this equipment is the control element between supply and load. *It contains the semiconductor devices or assemblies which are the subject of the enquiry.*
Configuration required? - eg bridge, chopper, ac controller.
What ratio is required between device voltage rating and supply voltage transient value? Typical ratios vary between 1.5 and 3.0. This ratio, or safety factor, is price sensitive so that the final choice must be for the customer.

Give details of the current in and the voltage across the semiconductor device (supply waveforms, if appropriate). Also duty cycle.

Thyristor gate trigger pulse to be used:
It is assumed that the enquirer will be using his own gate trigger source.
Give values of current and time indicated on the diagram below, particularly I_g peak, which can be taken as the gate driver short circuit current. Rate of rise of gate current is also important.
An alternative way to define the initial part of the

gate trigger pulse is to state the gate trigger unit open circuit voltage and short circuit current

5. Semiconductor Cooling.

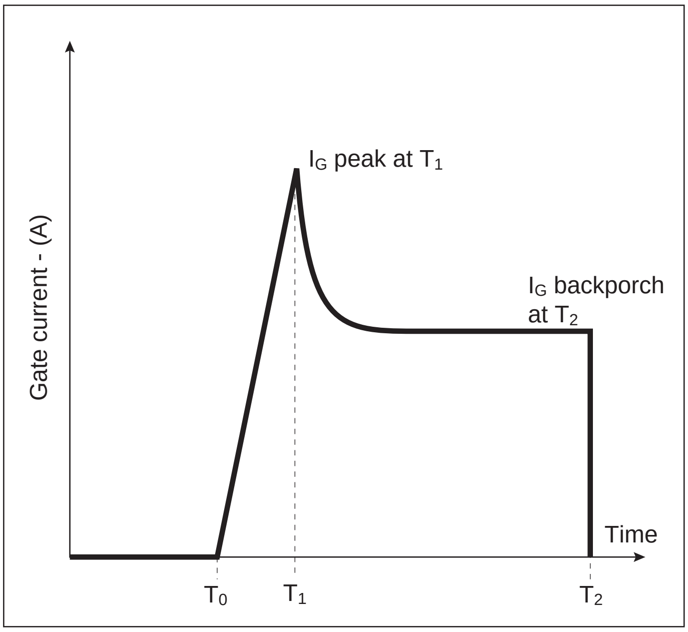

Fig.1

(a) If an enquirer is using his own heatsink, give details of heatsink steady state thermal resistance and, if appropriate, transient thermal resistance curve. State if single or double side cooling is to be used. Alternatively, state maximum steady state device case or heatsink temperature that will be reached.

(b) If an enquirer requires a complete assembly with heatsinks etc give details of available cooling media eg forced air, oil, water (give flow rates).

6. Fusing Details.

If fusing is required to be fitted to the assembly, state whether the fuses should be in series with each device or in the the power supply lines to the assembly.

7. Mechanical Details.

State dimensions of the available space and any other relevant details eg weight limitations.

8. Applications Involving Series Or Parallel Connection Of Devices.

Higher voltage and current applications can often be achieved using series and parallel connections. **Please state if your application will allow the use of devices in series or parallel. There is a trade-off between the cost of sharing components and the cost of device banding. In the initial response to the enquiry we will suggest suitable bandings.**

Series connections:
These require that devices are matched into blocking current bands to help equalise voltages during steady state blocking. For voltage sharing during the turn-off phase, devices should be matched into stored charge bands. The width of the blocking current and stored charge bands in part determines the values of the sharing resistors and capacitors.
Parallel connections:

The issue here is how well the current is shared between the devices in the parallel connection. A suitable sharing reactor in series with each device will equalise the currents but these tend to be bulky and costly. The usual approach is to use no reactors but to select the devices to be within a narrow band of on-state voltages. The narrower the band the better the current sharing which means fewer devices are needed in parallel for a given current duty.

9. Equipment Life

If the operational lifetime of the equipment is specified it may be possible to take advantage of device overload capability. Higher current ratings are possible if the number of operational cycles is restricted. If possible, the lifetime number of operational cycles should be stated.

10. Various

If a quotation for a product is required the following information would be helpful:

Other than for parallel and series sharing, are other device parameter special selections required? Perhaps all the special selection information exists in the form of a ‘customer procurement spec’? Please supply any relevant specs as soon as possible.

Are any special Quality tests required?

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