

Design Tip for SAFEIR™

Inrush Current Control in Motor Drives

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Topics covered:

The Problem
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A Different Approach
Benefits

1. THE PROBLEM

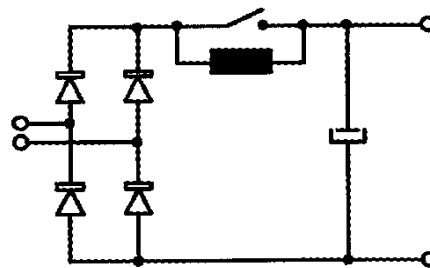
In motor drive controllers, the first (input) stage is often represented by a half-controlled bridge, used to charge a large buffer capacitor placed between the input stage itself and the output stage.

When this circuit is switched on, the capacitor, which has no charge, generates a large current pulse in the input bridge that must be controlled using some appropriate technique in order to limit the current peak below a value safe for the devices in the bridge.

2. TRADITIONAL SOLUTION

Traditionally, a series resistor is inserted in the circuit between the input bridge and the capacitor as a current limiter at the system turn-on. In order to avoid the energy dissipation due to the presence of this resistor, some way to bypass it in normal operation is usually provided.

In the circuit diagram shown in the figure below, this is represented by the switch placed in parallel to the resistor.



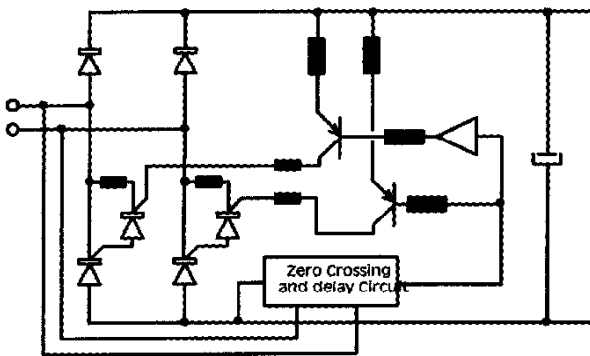
3. A DIFFERENT APPROACH

IR has suggested a totally new approach to control the inrush current in bridges for motor controllers. The major point is the use of surface-mounting power diodes and thyristors, like 16TTS..S series and 20ETS..S series, on IMS (Insulated Metal Substrate) boards. The use of surface mount devices, now available from IR, makes convenient the realization of an active circuit for the control of the inrush current at turn-on. Combining SMD with IMS technologies, a new generation of motor drive controllers can be developed, as on the same IMS substrate also the inverter part can be realized.

Design Tip

The use of 16TTS..S series thyristors and 20ETS..S series diodes also provides important advantages as far as the immunity to voltage spikes at the input stage is concerned. In fact, these *SAFEIR* devices have a much higher high-voltage surge capability than every competing device.

The electrical diagram shown here below gives a rough idea of a possible circuit configuration for an active control of the inrush current at turn-on.



4. BENEFITS

- More compact design using SMD assembly and IMS substrates.
- More efficient heat dissipation using IMS.
- No energy dissipation from current surge limiting resistors.
- Input stage with improved high voltage spikes immunity.
- Possibility to integrate on the same IMS board both the input (rectifier) and the output (inverter) stages.
- Very cost-effective solutions compared to the traditional approach.