GIGAVAC®
ADVANCED SWITCHING SOLUTIONS

APPLICATION NOTE

Application Note AN-016

Driving Contactors with external PWM

Gigavac offers the GX14, GX23, and GV200 with built-in PWM economizer (coil option M or N). For those customers that prefer to use their own PWM circuit, Gigavac can also provide the contactor without the internal economizer (coil option P or Q). This application note provides additional details on how to drive the contactor to insure that it can meet published ratings.

PWM

The GX14, GX23, and GV200 require an initial 50-100ms current/voltage pulse in order to fully close the contacts. Two control methods are typically used for PWM: current or voltage.

Voltage Controlled:

For Voltage Control the coil voltage is kept constant with varying input voltage. Since coil resistance varies with temperature the coil current will change with temperature. Table 1 and 2 show the design parameters for voltage control. Coil Current is at recommended voltage and is shown over the temperature range as a reference.

Table 1. Design Parameters for P coil, Voltage control

	Recommended Coil Voltage (V)	Allowable Coil Voltage Range (V)	Coil Current -55C (A)	Coil Current 25C (A)	Coil Current 125C (A)
During Pickup (first 50-100ms)	12	9-16	3.33 (1.80- 4.44)	2.31 (1.73-3.08)	1.67 (1.25-2.22)
During Hold	2.6	2.1-3.5	.72 (.58-.97)	.50 (.40-.67)	.36 (.29-.49)

Table 2. Design Parameters for Q coil, Voltage control

	Recommended Coil Voltage (V)	Allowable Coil Voltage Range (V)	Coil Current -55C (A)	Coil Current 25C (A)	Coil Current 125C (A)
During Pickup (first 50-100ms)	48	36-64	.82 (.61-1.09)	.57 (.42-.76)	.41 (.31-.55)
During Hold	11	8.5-14.5	.19 (.14-.25)	.13 (.10-.17)	.09 (.07-.12)

Current Feedback:
For Current feedback the coil current is kept constant with varying input voltage. Since coil resistance varies with temperature the coil voltage will change with temperature. Table 3 and 4 shows the design parameters for current feedback. Coil Voltage is at recommended coil current and is shown over the temperature range as a reference.

Table 3. Design Parameters for P coil, Current feedback

	Recommended Coil Current (A)	Allowable Coil Current Range (A)	Coil Voltage -55C (V)	Coil Voltage 25C (V)	Coil Voltage 125C (V)
During Pickup (first 50-100ms)	1.67	1.25-2.22	6.1 (4.5-8.0)	8.7 (6.7-11.5)	12 (9-16)
During Hold	.36	.29-.49	1.3 (1.1-1.8)	1.9 (1.5-2.5)	2.6 (2.1-3.5)

Table 4. Design Parameters for Q coil, Current feedback

	Recommended Coil Current (A)	Allowable Coil Current Range (A)	Coil Voltage -55C (V)	Coil Voltage 25C (V)	Coil Voltage 125C (V)
During Pickup (first 50-100ms)	.41	.31-.55	24 (18-32)	35 (26-47)	48 (36-64)
During Hold	.09	.07-.12	5.2 (4.4-7.2)	7.6 (6.0-10.0)	11 (8.5-14.5)

Coil Details
Table 5 shows coil resistance and inductance for the P and Q coils.

Table 5. Coil Details

Coil Designator	Coil Resistance Ohms at 25°C	Coil Inductance mH
P	5.2 +/-5%	18.5 +/-5%
Q	80 +/-5%	250 +/-5%

Fast Dropout

Gigavac contactors require that coil current does not flow when the contacts open. Since PWM circuits require a freewheeling or fly back diode be placed across the coil this diode must be removed from the circuit when the contacts are opened. Figure 1 shows a typical circuit that can be used to turn off a FET in the freewheeling path. C1 and R2 should be set to allow the FD FET to remain on while the PWM FET is running but decay within a few ms to shut off the FD FET before the contactor begins to open. A TVS is required to protect the FET from overvoltage when the coil is switched off.

Fast dropout TVS

Coil Designator	Recommended Bidirectional TVS
P	SMAJ43CA
Q	SMAJ78CA

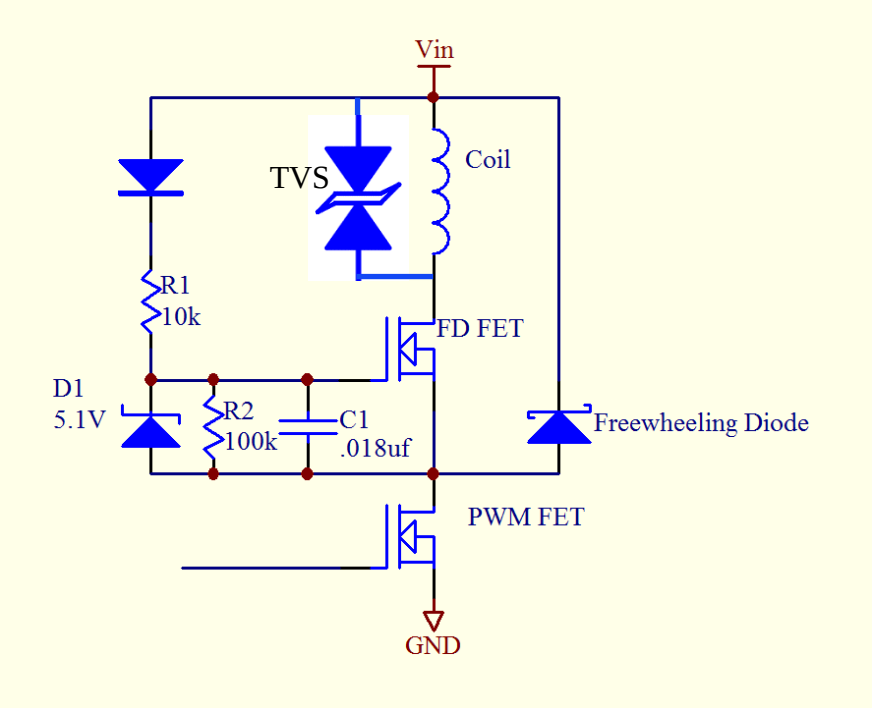

Figure 1. Fast dropout circuit

If you have any questions you can always call us at 805-684-8401.