Solid State High Voltage Contactor Controller

Applications:
- Main DC Bus Switch
- DC Motor Bus Switch
- Battery Disconnect
- Bus Discharge

Description:
The Sensitron High Voltage Contactor Controller, when joined with an external contactor or relay, creates a hybrid switch ideal for handling capacitive loads and turn off voltage spikes. Where reliability is a concern, this hybrid switch can replace standalone mercury or electromechanical relays/contactors, with extended life and performance as benefits. Utilizing solid state circuitry, the Contactor Controller handles the relay damaging turn on and turn off switching currents and voltages. The external contactor or relay is utilized to reduce power dissipation.

Features:
- Automatic activation of external contactor
- Uses control voltage for contactor coil (6V to 36V) for operation
- Low standby power consumption (0.5W typical)
- Capacitor bank pre-charge current limiting - Up to 40A surge current at 300V
- Shunt voltage < 3V at 20A
- Built-in 500V clamp, between V1 and V2, for suppressing inductive flyback
- Isolation of 2000V: Control Input / Output to Power terminals; Control Input / Output and Power terminals to Baseplate
- Bidirectional conduction with 500V blocking
- Report over current or short circuit fault
- 3.60 in X 1.56 in X 1.20 in
- $R_{\theta JC} \leq 1.15^{o}C/W$

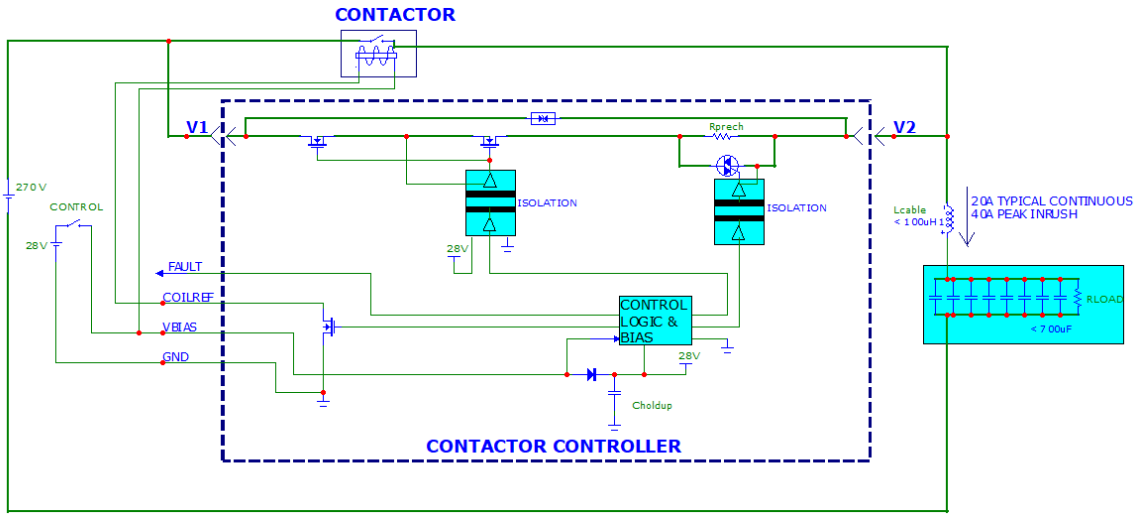


Figure 1: Typical Application

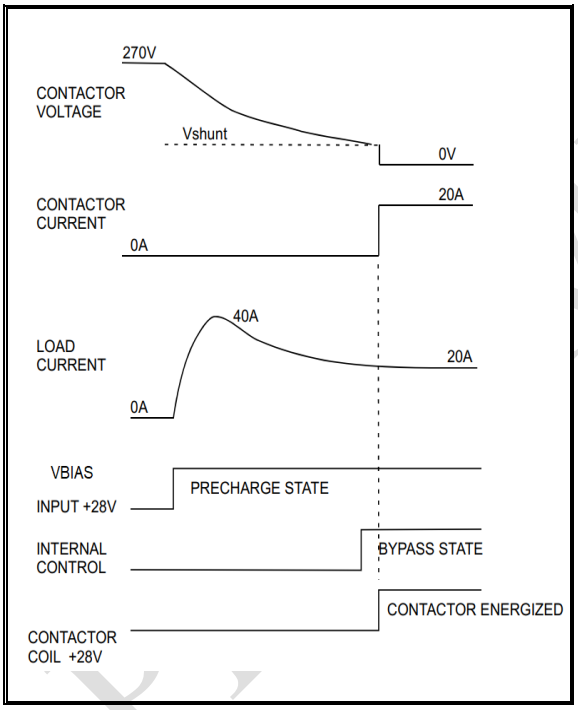


Figure 2: Turn ON Timing

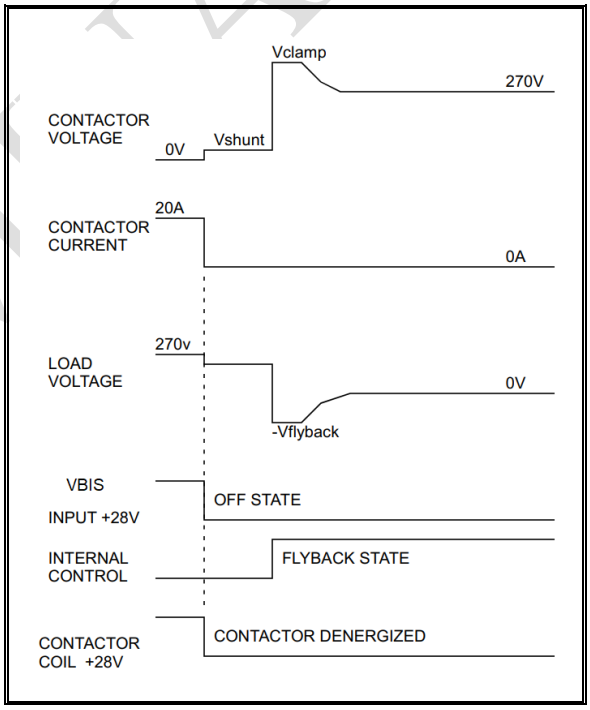


Figure 3: Turn OFF Timing

Control Input / Output Specifications:

Parameter	Description	MIN	TYP	MAX	Unit
	Turning on voltage of control input	18	28	36	VDC
	Turning off voltage of control input	1.5		7.0	VDC
	Control input over voltage withstanding	36		50	VDC
	Turning on voltage of control output	18	28	36	VDC
	Turning off voltage of control output			1.5	VDC

Contact Input / Output Specifications:

Parameter	Description	MIN	TYP	MAX	Unit
V_{OUT}	Max voltage on output of contactor controller	-	270	300	V_{DC}
Vin	Max voltage on input of contactor controller	-	270	300	V_{DC}
I_{OUT}	Max Continuous Current for minimum 10 seconds at 100 °C		20		A
I_{OUT_PEAK}	Max inrush current limited by contactor controller			40	A
I_{LEAK}	Output leakage		TBD		A
R_{ON}	Total resistance of contactor controller at 20A		150		mOhm
V_{DROP}	Voltage Drop on Contactor Controller at 20A		3		V
E_{AS}	Avalanche Energy, Single Pulse		TBD		

Switching Characteristics:

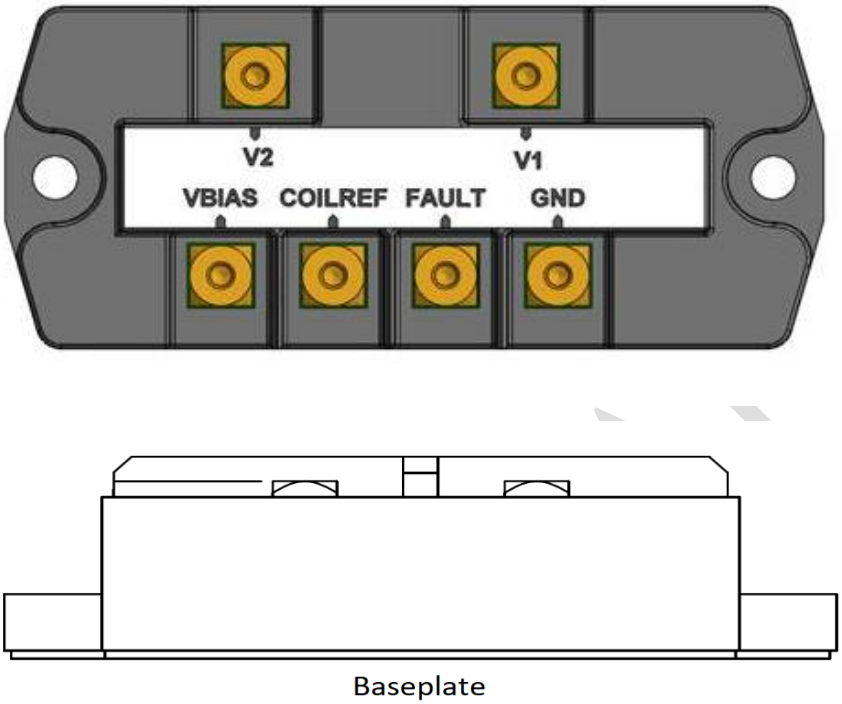
Parameter	Description	MIN	TYP	MAX	Unit
t_{on}			TBD		
t_{off}			TBD		
t_{don}			TBD		
t_{doff}			TBD		
t_{dlatch}			TBD		
F_{switch}			TBD		

Environmental

Parameter	Description	MIN	TYP	MAX	Unit
Isolation	Control Input / Output to power terminals, <1mA	2000	-	-	VDC
Isolation	Control Input / Output and power terminals to Case, <1mA	2000	-	-	VDC
T_{STG}	Storage Temperature	-55	-	150	°C
T_{CASE}	Operating Temperature (Baseplate)	-55	-	100	°C
T_J	Operating Temperature (Junction)	-55	-	150	°C
	Weight	-	TBD	-	g

Notes:
1. Parameters are characterized on initial design release and upon design changes which would affect these characteristics.

Mechanical Outline (PRELIMINARY)



Pin Assigments:

V1 – Connects to one power terminal of contactor, 20A continuous current rating
V2 – Connects to the other power terminal of contactor, 20A continuous current rating

VBIAS – Apply control voltage positive to this pin; also connects this pin to the positive terminal of the contractor coil
GND – Apply control voltage ground to this pin
COILREF – Connects to the negative terminal of the contactor coil
FAULT – Output from Contactor Controller, indicating overcurrent or short circuit

Note:

- V1 and V2 have no polarity and are interchangeable.

Application Notes:

The typical application shown in Figure 1 shows how the Contactor Controller is connected into a, possibly existing, power control circuit for a contactor or relay. The V1 and V2 terminals connect direct to the contactor power terminals. The contactor coil connects to VBIAS and COILREF, and VBIAS and GND of the Contactor Controller connect to 28V control supply. The Contactor Controller does not require heatsinking and is easily mounted to any flat surface near the contactor.

At contactor turn on, when 28V control voltage is set active, the voltage across the contactor is reduced to less than a few volts (Vshunt) prior to activating the contactor. Initially, for a fixed time duration (tprech), the Contactor Controller limits load current with a series resistor, Rprech. This resistor is then bypassed to reduce the V1-V2 voltage to less than Vshunt. The contactor coil is then energized using the 28V between VBIAS and COILREF. The Contactor Controller shunting action remains active as long as 28V control voltage is present. The diagram in Figure 2 shows the timing of these states.

At contactor turn off, when 28V control voltage is removed, the contactor coil is deenergized immediately. The shunting action of the Contactor Controller prevents the contactor power terminals from seeing more than a few volts (Vshunt) during turn off. After a fixed time delay (toff), a delay to allow the contactor time to fully open, the Contactor Controller disconnects from the load. Parasitic inductances of the power cabling will generate flyback voltage at this time. This potentially destructive voltage is clamped by the Contactor Controller. The $\frac{1}{2}*L*I^2$ energy is absorbed by the Contactor Controller clamp. The diagram in Figure 3 shows the timing of these states.

If the Vshunt voltage drop and added power loss is acceptable, the Contactor Controller may be used stand-alone, but heatsinking will be required.