

FCOVF6100



Features:

Industry Standard
ASIC-Based Design

Variable frequency
range of operation:
30-140 Hz (nominal)
(others available)

Fully Connectorized

Independently
Configurable
Soft-Start and
Soft-Stop

Isolated Gate Drive
Circuitry

Phase Loss
Protection

Applications:

Generator Exciters

Battery Chargers

Wind Turbine
Controllers

DC Drives

FCOVF6100 Variable Frequency Three-Phase Six SCR Firing Board

Description

The FCOVF6100 variable frequency firing board provides the functionality of the industry-standard FCOG6100 firing board for applications with variable-frequency AC mains. An onboard frequency compensation scheme makes the firing circuit less sensitive to line frequency variations while an isolated DC-DC converter provides enhanced control power flexibility. The FCOVF6100 is offered in a standard 30-140 Hz frequency of operation range and customer-specific ranges to 600Hz.



Operational Features

Frequency Insensitivity: A frequency-to-voltage converter acts in concert with the delay angle determinator circuit to reduce delay angle variance over the operating frequency range. This scheme limits delay angle variance to approximately 3° over a frequency range of 30 to 140 Hz.

Analog Delay Angle Command Signal (SIG HI): Users may choose a variety of DC control signal ranges including 0-5 V, 0-10 V, 4-20 mA, or custom ranges.

Soft-Start and Soft-Stop: Upon soft-start, SCR firing is enabled and the delay angle command ramps from the maximum value to the setpoint value determined by the SIG HI command signal. Upon soft-stop, the delay angle ramps from the setpoint value to the maximum value after which SCR firing is inhibited.

Phase Loss Inhibit: A phase loss circuit instantly inhibits SCR firing if a loss of one or more phases or gross phase imbalance is sensed on the AC line. Firing will soft-start when such a fault is cleared.

Instant Enable and Inhibit: A contact closure (relay, switch, transistor) instantly enables or inhibits SCR firing at the delay angle commanded by the SIG HI delay angle command signal.

Phase Sequence Insensitivity: SCR gating is unaffected by mains voltage phase sequence.

High Current Picket Fence Gate Drive: The transformer-isolated gate drive circuits provide a hard firing initial 15 V open circuit/1.8 A short circuit firing pulse followed by sustaining "back porch" pulses at 7 V open circuit/0.5 A short circuit. The gate pulse burst frequency is 384 times the mains voltage frequency.

Analog Delay Determinator Circuit: Enerpro's gate delay determinator circuit is based on the Ainsworth three-phase PLL circuit and implemented with a proprietary ASIC. This circuit adjusts the gate delay firing angle in negative proportion to the SIG HI command. Gate drive phase balance is typically less than ±1°

Flexible Control Power Options: The FCOVF6100 board is typically configured to accept 24 or 48 VDC control power. In this configuration, an onboard 20 W DC-DC converter rated for 1600 V isolation (with a voltage limiting Zener preregulator) creates the necessary 30 VDC and 15 VDC rail voltages on the firing board. The customer may alternatively supply 30 and 15 VDC rails directly.

Board Construction: All circuit boards are assembled at the Enerpro plant in Goleta, California and are manufactured by a UL-approved fabricator from 2.4 mm thick FR4 fire resistant fiberglass epoxy laminate. All boards are conformal coated (MIL-1-46058, Type UR).

Enerpro applications engineers are available by e-mail or fax for applications assistance.

Product Datasheet		Ordering Guide		
<i>Maximum Ratings</i>		Parameter	Description	Code
AC mains voltage	600 Vac	SCR Circuit Type	01 AC Controller 02 DC Converter	
Pulse transformer hipot	3500 Vac (60 seconds)	Parallel SCRs	0 No 1 Yes (Note 1)	
Operating temperature range	-5 C to 85 C	Mains Frequency	01 30 - 140 Hz 02 Other, Specify (Note 2)	
Board supply voltage without DC-DC converter	30 and 15 VDC supplies \pm 5% max	Command Signal	1 0 - 5 V 2 0.85 - 5.85 V 3 0 - 10 V 4 1 - 2 V 5 4 - 20 mA 6 Other - Specify	
Board supply input range with DC-DC converter, 24 VDC nominal input	18 - 36 VDC	SCR Mains Voltage	XX Specify (Note 3)	
Board supply input range with DC-DC converter, 48 VDC nominal input	36 - 75 VDC	Control Power	0 Omit DC/DC Converter-Specify (Note 4) 1 With 24 Volt DC/DC Converter 2 With 48 Volt DC/DC Converter	
Board ac supply voltage	28 Vac (24 Vac nominal)	Phase References	1 On-board 2 External via J6, R5, R6 and R7 (Note 5)	
12 V regulator output current	20 mA (Note 1)	Notes		
5 V reference output current	5 mA (Note 1)	1 Auxiliary firing board required for parallel SCRs		
Auxiliary control power available from 30 V output	10 W (DC-DC)	2 Specify desired mains frequency range.		
Delay angle range	$10^\circ \leq \alpha \leq 170^\circ$	3 Specify code as mains voltage divided by 10. Example: 480 V / 10 = 48		
<i>Characteristics</i>		4 Customer must supply regulated 30 and 15 VDC for control power.		
Delay angle command signal (SIG HI)	0-5, 0.85-5.85, 0-10, 1-2 V 4-20 mA Or as specified	5 Connect ac mains via J6 (to be attenuated by R5, R6, and R7) to provide phase references.		
Delay angle reference phase shift	-60° (or application-specific)			
Control signal isolation from ground	653 k Ω			
Gate delay steady-state transfer function	Delay angle inversely proportional to delay angle command SIG HI			
Gate delay dynamic transfer function bandwidth	-3 dB at 119 Hz, phase shift -45° at 68 Hz			
Gate drive phase balance	$\pm 1^\circ$ (max)			
Lock acquisition time	30 ms (typ)			
Soft-start/stop time	0.05 - 20.0 s, independently configurable			
Phase rotation effect	None			
Phase loss inhibit	Automatic			
Power-on inhibit	Automatic			
Instant/soft inhibit/enable inputs	Dry contact			
SCR gate pulse waveform	120° burst or 2-30° bursts, 30° spaced			
Gate pulse burst frequency	384 times line frequency			
Initial gate pulse open circuit voltage	15 V (Note 1)			
Sustaining gate pulse open circuit voltage	7.0 V (Note 1)			
Initial gate drive short circuit current	2.0 A (Note 1 and 2)			
Sustaining gate drive short circuit current	0.5 A (Note 1 and 2)			
Short-circuit gate drive current rise time	1.0 A/ μ s (Note 1 and 2)			
Board dimensions	191 x 152 x 35 mm (L x W x D)			
Minimum creepage distance to ac mains With onboard phase references With phase references entering on J6	13 mm 10 mm			
Conformal Coating	per MIL-1-46058, Type UR			
NOTES				
1 Assumes nominal 30 V control power				
2 Assumes a purely resistive gate load of 1.0 Ω				

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