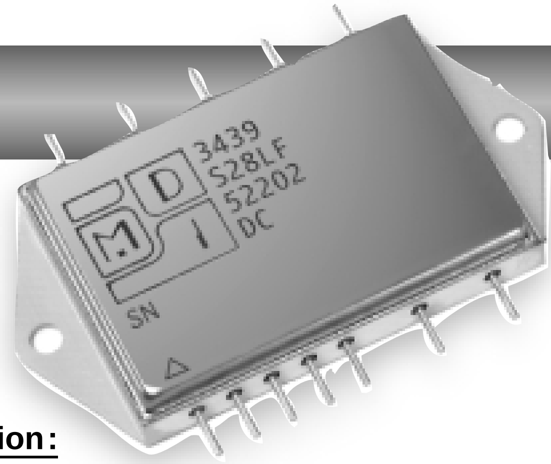
MDI Model 3439

Booster Hybrid DC/DC Converter



Functions:

Optimizes energy storage for hold up during input line drop outs

Eliminates CS01 effects for ultra low ripple requirements

Incorporates programmable inrush limit, reverse polarity protection

Contains master sync oscillator for synchronizing downstream DC/DC converters

Enables low line operation of 28 VDC converters

Contains full MIL-STD-461D EMI filter

Input power failure/auxiliary output function provided

Features:

Hermetic thick film hybrid construction

Built in EMI filtering meets MIL-STD-461D requirements CE101, CE102, CS101, CS102 and CS106

Adjustable from 30 to 50 VDC output

No external components needed for most applications

Programmable soft start time

300 kHz operation for low ripple, fast response time

Survives 80V transients/MIL-STD-704A

Specifications:

Input Voltage:
- 28 VDC Nominal
- 12 VDC to 50 VDC Continuous
- 10 VDC to 80 VDC for 1 second

Output Voltage/Current:
- 40 VDC nominal at 1 Ampere
- Adjustable from 30 to 50 VDC by external programming resistor
- Current rating based on 40 watt rating

Isolation:
- Input to Case: 100 V
- Output to Case: 100 V
- Input to Output: None
- Input Output and Case to Aux. output: 100 V

Environment:
- Operational Temperature: Per grade level
  - Storage: -65°C to +150°C
- Shock: 50 G's
- Pyro Shock: 2000 G's
- Vibration: 30 G's

Grades M, R and S:
- Full output power to +85°C
- Derates linearly to zero at +115°C

Grades containing E:
- Full output power to +125°C
- Derates linearly to zero at +135°C

Weight: 60 grams, typical

Package and Dimensions: Many case styles are available. See package option chart below.

Description:

The Model 3439 DC/DC Booster Hybrid is a front end component which expands the performance of DC/DC converters fed from its output, allowing users to meet many demanding systems requirements. Rated at 40 watts steady state, the booster can either drive one or several DC/DC converters, provided the power rating is observed.

Hold Up: Many applications require that the DC/DC converter continue to deliver power for a specified time after the input power is interrupted or drops below a specified value. This function, at a theoretical minimum, requires a capacitor and a rectifier. The capacitor stores energy and the rectifier prevents the charge from being drained by the low power line. In practice, if the difference between the drop out voltage and the minimum converter operating voltage is low, the capacitor value required can get quite large because the useful fraction of the capacitor's stored energy is small.

By using a booster, the capacitor voltage starts out relatively high in relation to the converter's minimum operating voltage. Therefore, most of the energy storage contained within the capacitor is useful for energy storage. For a given hold up time requirement, the size of the capacitor is minimized. Also, the booster converter contains the reverse polarity rectifier.

Conducted Susceptibility Improvement: When DC/DC converters are powered from a DC line containing a superimosed AC signal, there will be a corresponding unwanted AC signal on the output. Most DC/DC converters have between 30 dB and 50 dB of rejection against input line conducted susceptibility signals because they have a single stage of regulation. This rejection level is adequate for most applications.

Some applications require an extremely low output ripple. The high frequency components of ripple can be severely attenuated by relatively small filters. However, the audio frequency components require a second stage of regulation to further attenuate audio susceptibility signals because the required passive filters would be extremely large.

By using the Model 3439 booster preceding one or more DC/DC converters, an additional 45-50 dB (typical) of audio rejection can be obtained. This reduces the effect of unwanted signals due to audio conducted susceptibility on the DC/DC Converter outputs to extremely low levels. Since the 3439 booster is highly efficient, this improvement is achieved at a negligible power cost.

Inrush Current Limiting: When powering one or more DC/DC converters from a fast rising source, inrush currents can flow into the converter's input capacitors. High inrush currents can flow when, for example, converters are switched by relays. The uncontrolled inrush currents are due to the uncontrolled rise time of the power source. The peak inrush currents can cause fuses to blow or electronic circuit breakers to trip.

The Model 3439 booster contains an inrush limiting circuit, which applies a relatively gentle rise time to downstream DC/DC converters. The inrush limiting circuit consists of a FET in the negative input power leg. The nominal risetime of the FET is one millisecond. However, this may be increased

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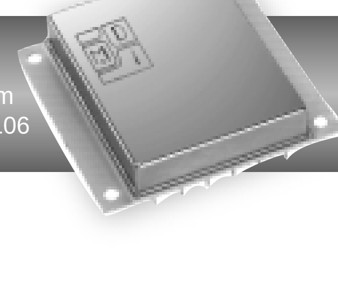


externally. Both terminals of the FET are brought to external pins. The FET may be externally bypassed for greater efficiency if the function is not wanted. Alternatively, the FET may be shunted by an external resistor to charge the input capacitors before the FET becomes conductive.

The inrush current limiting circuit can power one or more DC/DC converters, provided the input power of the load converters does not exceed 40 watts.

Input Reverse Polarity Protection: The Model 3439 booster incorporates series reverse polarity protection in the negative leg. For highest efficiency, the reverse polarity protection circuit uses an FET instead of a rectifier. The FET has lower voltage drops than a rectifier. Up to full input voltage may be applied without adverse effects.

Master Sync Oscillator: Many system applications require that multiple DC/DC converters be synchronized to prevent beat frequencies. The Model 3439 DC/DC Booster contains a stable synchronization source that produces a 300 kHz synchronizing signal. This signal is compatible with MDI DC/DC converters. Other frequencies may be obtained on special order.

Low Line Operation of 28 VDC Converters: Many DC/DC converters produce full power at input voltages of 19, 18 or 16 VDC. However, the Model 3439 DC/DC Booster produces full output power down to 12 VDC, and reduced power down to 10 VDC. In certain applications, it is advantageous to feed a DC/DC converter from the Model 3439 so that the low line minimum operating voltage can be extended.

MIL-STD-461D EMI Filtering: MIL-STD-461 revision D requires different measurement techniques than MIL-STD-461 revision C. This requires a slightly different EMI filter topology. In addition, the emissions requirement for “D” is more stringent in the lower frequency ranges. The EMI filter in the Model 3439 has been designed to meet MIL-STD-461 revision D. Therefore, when revision D must be met, the Model 3439 may be used to precede other converters that either have no EMI filter or have a filter that meets revision C.

Input Power Failure/Auxiliary Output: An isolated output is provided for use as an indication of input power line dropout. This output, which is rated at a nominal 13 VDC at 50 milliamperes, may also be used for other system functions. When input power to the Model 3439 DC/DC Booster drops below a usable value, the Input Power Failure/Auxiliary Output rapidly goes to zero. By sensing this output, advance warning is provided that downstream units are operating from stored energy only. This function allows time for an orderly shut down of the system.

Functional Schematic: A simplified functional diagram for the Model 3439 is shown. Input power is applied to a high frequency EMI filter. An inrush limiting FET is placed in the return leg, allowing the use of an N channel part. This is followed by an active reverse polarity protector. The drop across this circuit is considerably less than the drop across a rectifier.

Following these circuits is the low frequency EMI filter. Because it follows the inrush limiter, the capacitor charging current of the EMI filter is controlled.

The input DC voltage feeds a current mode boost converter operating at a nominal 300 kHz. The boost converter consists of a FET switch and an energy storage inductor. Each cycle, energy is stored in the inductor, then discharged from the inductor and released to an output capacitor. A feedback signal is derived from the output voltage, then compared to a fixed voltage reference. The pulse width modulator adjusts the duty cycle of the FET switch according to the difference between the output and the reference. By varying the duty cycle of the switch, a constant regulated output voltage is obtained.

The output voltage is passed through a common mode filter to attentuate high frequency spikes.

An auxiliary winding on the boost transformer generates a floating +15 VDC output whenever the booster is active. This output may be used to sense a) the absence or insufficiency of input voltage, such as caused by a power dropout or b) an input overvoltage higher than the output set point that causes the booster to cease switching.

Pin Descriptions:

Pin 1 : Case

Pin 2 : Sync output, nominally 5 VDC, going to ground at an approximate 10% duty cycle at a nominal 300 kHz rate. Other frequencies from 200 kHz to 400 kHz are available on special order. The sync signal is referenced to pin 11.

Pin 3 : Inrush Control, allows control of the inrush limiter FET gate for either inhibiting power application or increasing inrush limit charge time. This pin is clamped to 12 VDC through a 5.1K limiting resistor when power is applied to pin 7. The ground reference is pin 6.

Pin 4 : Terminal for connecting external inrush limiting resistor

Pin 5 : Terminal for connecting external inrush limiting resistor

Pin 6 : Negative power input (power return)

Pin 7 : Positive power input

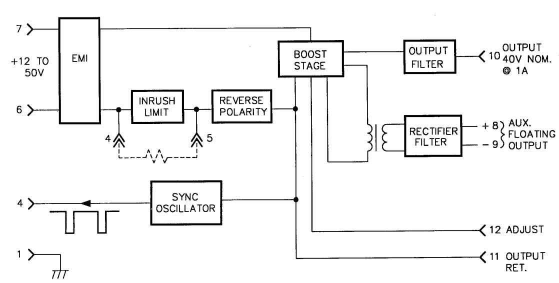
Pin 8 : +15 VDC auxiliary output (floating)

Pin 9 : +15 VDC auxiliary output return (floating)

Pin 10: Positive Boost output (nominal 40 VDC with respect to pin 6)

Pin 11: Boost output return (nominal 0 VDC with respect to pin 6)

Pin 12: Boost output (nominal 2.5 VDC). For a 50 VDC output, connect a 5.5K resistor from pin 12 to pin 11. For a 30 VDC output, connect an 80K resistor from pin 12 to pin 10.



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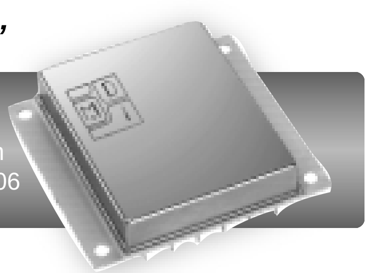
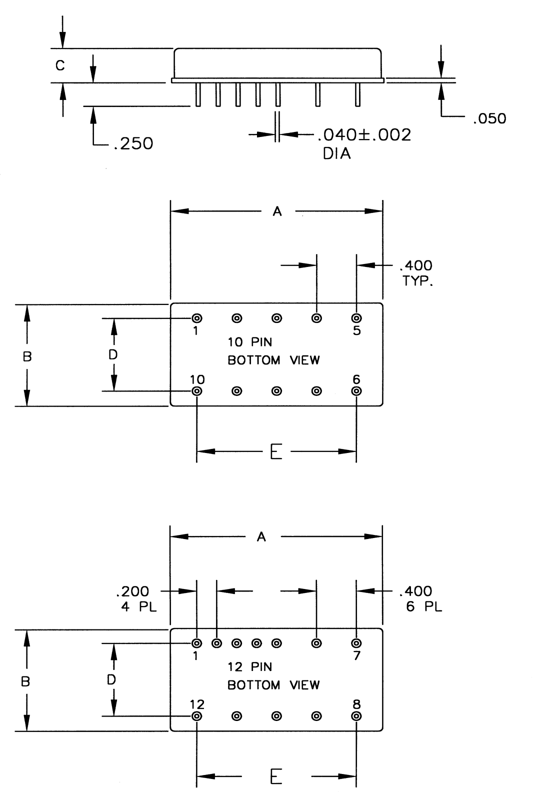


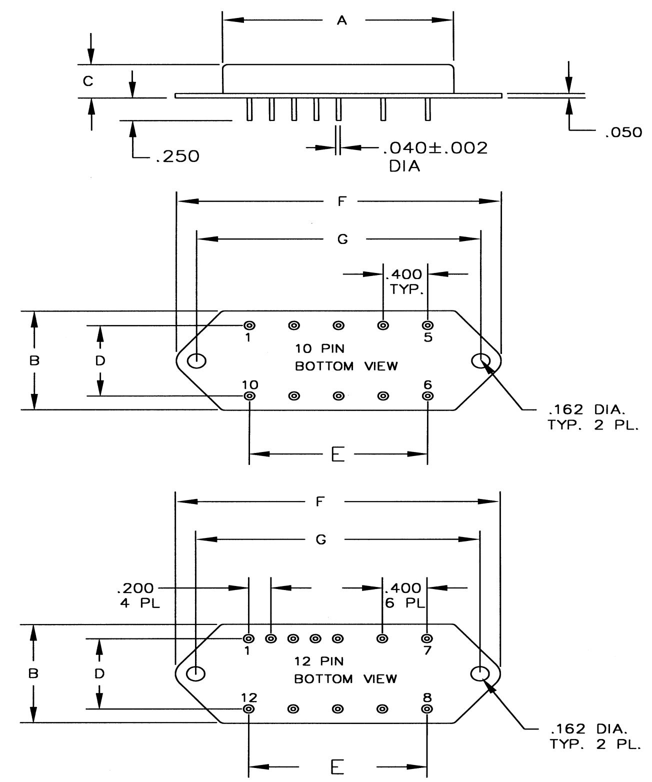
Case Dimensions									
Model Number	**Case Style**	**Pin Count**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
3439	2	12	2.130	1.120	0.495	0.800	1.600	--	--
3439 F	3	12	2.130	1.120	0.495	0.800	1.600	2.890	2.550
3439 H	5	12	2.130	1.120	0.495	0.800	1.600	--	--
3439 HF	6	12	2.130	1.120	0.495	0.800	1.600	2.890	2.550
3439 VF	8	12	2.160	1.510	0.495	--	1.600	2.890	2.550

All dimensions ±0.01 except F=max, C= +0.01/-0.020

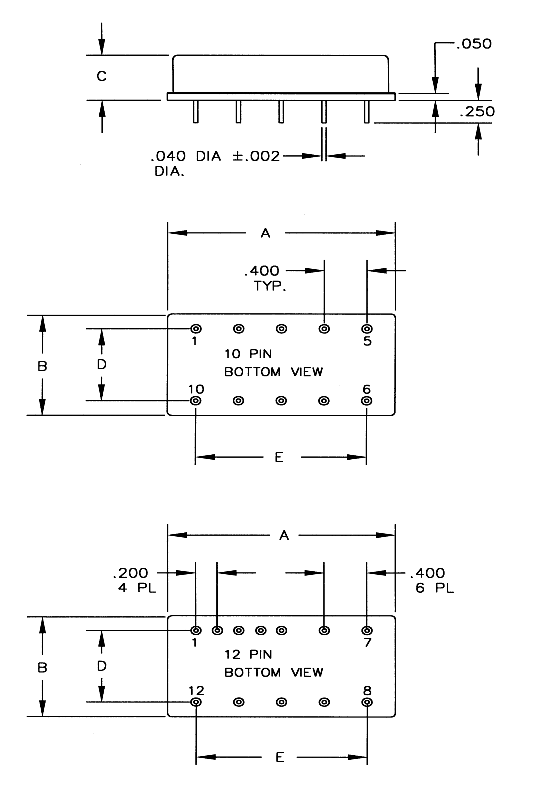
Case Style 2



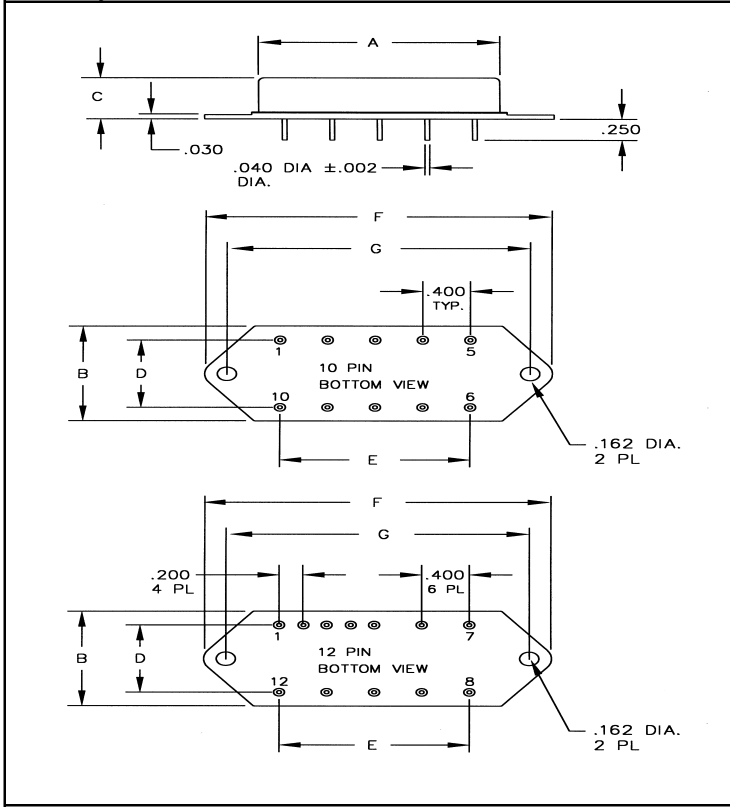
Case Style 3



Case Style 5



Case Style 6



Case Style 8