Model 3844 10A Inrush Limiter Switch

PROTON RAD HARD 100K + ® TECHNOLOGY

28 – 120 VOLTS DC INPUT

Features:

- Rad Hard: TID > 100kRad(Si)
- 2:1 margin: Operates beyond 200kRad TID
- No SEE:LET > 82MeV*cm^2/mg
- Proton Resistant: No optocouplers used
- Overall inrush limiter for downstream converters when used with external resistor
- Effectively controls the power input and manages peak inrush current when series connected ahead of downstream DC-DC converters.
- Sequences the inhibit of downstream DC-DC converters after timeout and switch closure.
- Serves single or multiple converters.

Specifications:

Input Voltage Range:
18 – 160VDC

Input inhibit not pin open circuit voltage: 5 VDC

Input inhibit pin short circuit current: 0.5mA max

Output inhibit pin open circuit voltage withstand 60 VDC

Output inhibit pin short circuit current withstand: 10 mA

Case Temperature Range:
Storage: -65°C to 150°C
Operating: -55°C to 125°C (LE)
Operating: -55°C to 125°C (SE)

Weight:
20 grams typical

Pin #	Designation	PIN#	Designation
1	Ground	10	Output
2	Cext Timing Capacitor	11	Output
3	N/C	12	Output
4	Case Ground	13	Output
5	N/C	14	N/C
6	N/C	15	Input
7	N/C	16	Input
8	Inhibit Out	17	Input
9	Inhibit Not	18	Input

Parameter	Min	Nom	Max	Condition
Vin	18VDC	—	160VDC	—
Ic	—	—	10A	Max Oper. Temp
Rswitch	—	—	0.10Ω	25°C
Rswitch	—	—	0.15Ω	85°C
Rswitch	—	—	0.20Ω	125°C
Base Delay Time	8ms	10ms	12ms	—
Ext Added Time Delay per µF	20ms	25ms	30ms	—
Inhibit Not Short Circuit Current	—	—	0.5mA	Ground
Inhibit Not Trip Point	5.0VDC	5.7VDC	6.3VDC	—
Inhibit Not Open Circuit Voltage	5.0VDC	5.7VDC	6.3VDC	—
Inhibit Output V Open Circuit	—	—	40VDC	—
Inhibit Output I Short Circuit	—	—	10mA	—

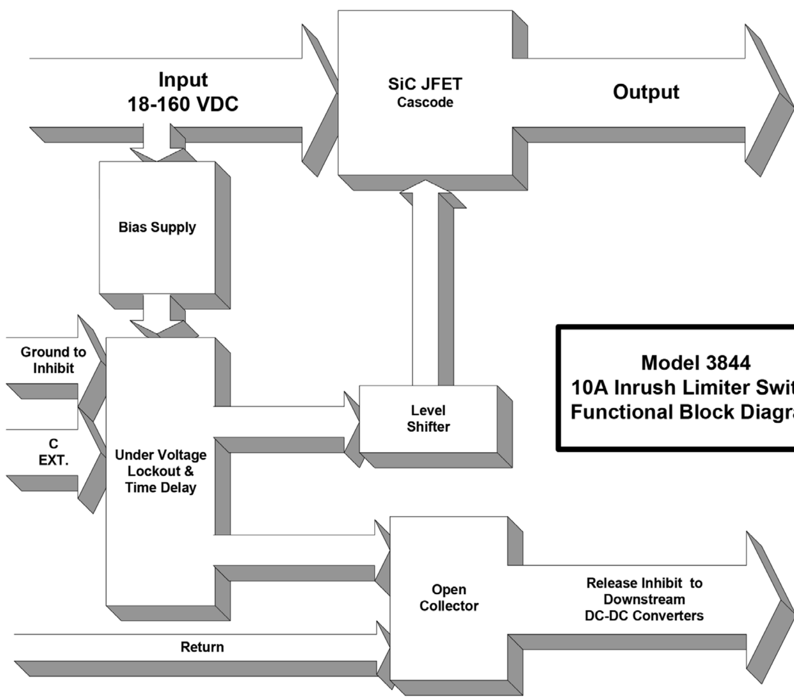
•Maximum Recommended Input Voltage is the maximum factory recommendation considering single event radiation effects. Absolute Maximum Input Range - No damage 18 – 160V.

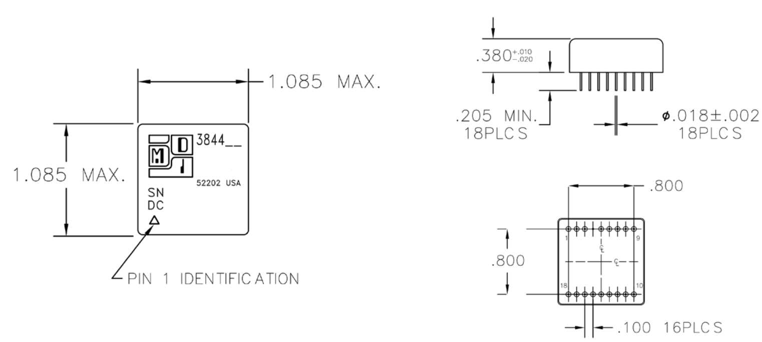
•Maximum continuous duty pass through current at rated max baseplate temp.

•Initial delay time factory set as Base Delay Time - Adjustable using external timing capacitor.

•Leakage Current at Max Recommended Input Voltage OFF State - Typical values.

•Quiescent Current at Nominal maximun - Typical values, input inhibited.





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3844 Inrush Limiter Switch

"Sometimes, the best inrush limiter is a resistor"- **Mark Twain**

The function of an inrush limiter is to charge a capacitor at a controlled maximum current value.

The function of an inrush limiter switch is to charge a capacitor through an external resistor, then bypass the resistor with a low resistance semiconductor switch.

Model 3844 10 Ampere Inrush Limiter Switch contains a low resistance high side switch, which bypasses an external current limiting resistor after a programmable time delay. It also has an input inhibit not and an output inhibit release which enables downstream DC-DC converters.

Model 3844 is rated at 10 amperes pass through current and operates from an 18 VDC to 160 VDC input voltage. Model 3844 is packaged in a 1.08" by 1.08" by 0.375" package.

Background: Many power electronics applications require large capacitor values but have restrictions on the magnitude of capacitor charging current. If DC-DC power conversion is involved, the inrush limiter can be at the input side or on the output side.

Inrush limiters limit the current flowing into a capacitor when voltage is applied. Charging a capacitor through a resistive element always incurs a power dissipation.

Energy stored in a capacitor has the units of watt-seconds and it takes an equivalent amount of watt seconds dissipated to charge the capacitor through a resistor, semiconductor or switch.

For relatively low stored energy, the limiting dissipative element can be a semiconductor (transistor or FET). An active constant current limiter can charge the capacitor linearly whereas the resistor current limiter charges the capacitor exponentially. So, an active current limiter can offer faster charge times.

However, for higher dissipations, the best limiter may be a resistor.

Resistors may have much larger surge power ratings for their size than semiconductors because they can operate at higher peak temperatures.

Once the capacitor is charged through a resistor, is shunted out of the circuit and the load connected to the voltage source with low resistance.

An inrush limiter switch is functionally an electronic time delay relay (delay on power on) with a low resistance high side switch. As compared to an inrush limiter with an active semiconductor dissipator, the inrush limiter switch uses an external resistor to dissipate the power lost when charging the capacitive load.

MDI's inrush limiter switches also have an inhibit input and an inhibit output. The inhibit output remains low (at the input return voltage) unit the delay interval is complete and the high side switch closes. Then, the inhibit output goes open collector. The inhibit output allows sequencing of input or output DC-DC converters.

Sizing the inrush resistor:

Divide the maximum input voltage by the desired peak inrush current to get the ohmic value of the resistor.

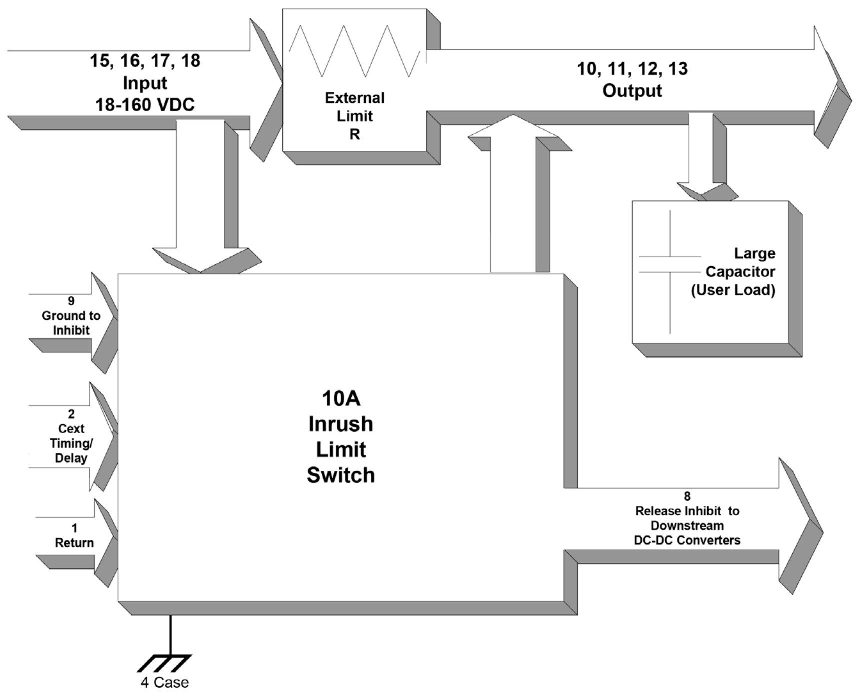
Multiply the resistor value by the capacitance to be charged to get the inrush time constant.

Using a multiple of three time constants, compute the recommended inrush limiter switch delay. Select an appropriate delay timing capacitor.

The energy stored in the load capacitor is $1/2CV^2$. Divide the stored energy (in watt seconds) by the inrush time constant to get an initial resistor wattage.

Using surge rating guidance from the resistor manufacturer, determine the actual resistor wattage rating to handle the inrush surge. Apply appropriate derating factors for voltage and power.

The resistor should be mounted so it's thermally able to dissipate the surge power.



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