

Model MHP



Non-Inductive Planar
Thick Film Power Resistor
20 Watt, TO220 Package

Applications

- Switching power supplies
- Snubbers
- In-rush / bleeder resistors
- Current limiters

Features

- High power density
- Power is dissipated above circuit board
- Low thermal resistance
- Non-flammable
- Non-Inductive planar

Electrical

Resistance Range, Ohms	0.01Ω to 100K
Resistance Tolerances	Standard 5%, Optional 1% & 2%
Operating Temperature Range	-55°C to +155°C
Temperature Coefficient of Resistance, Maximum **	100ppm/°C
Power Ratings *	20 Watts
Operating Voltage, Maximum	500V
Peak Current	15 x rated current up to 8ms Δ(R±0.5%)
Dielectric Strength	1500V

* Power rating at 25°C case temperature.

Power rating without a heat sink is 2.25 watts at 25°C

** Consult factory for values below 0.1 Ohm

Standard Resistance Values (Ohms)

Value - Ohms	0.01	0.1	1	5	10	20	50	100	200	1K	2K	10K	20K	50K	100K
Code	OR01	OR1	1R0	5R0	100	200	500	101	201	102	202	103	203	503	104

Mechanical

Lead Material	Tin Plated Copper Alloy
Substrate Material	96% Alumina
Resistor Material	Thick Film

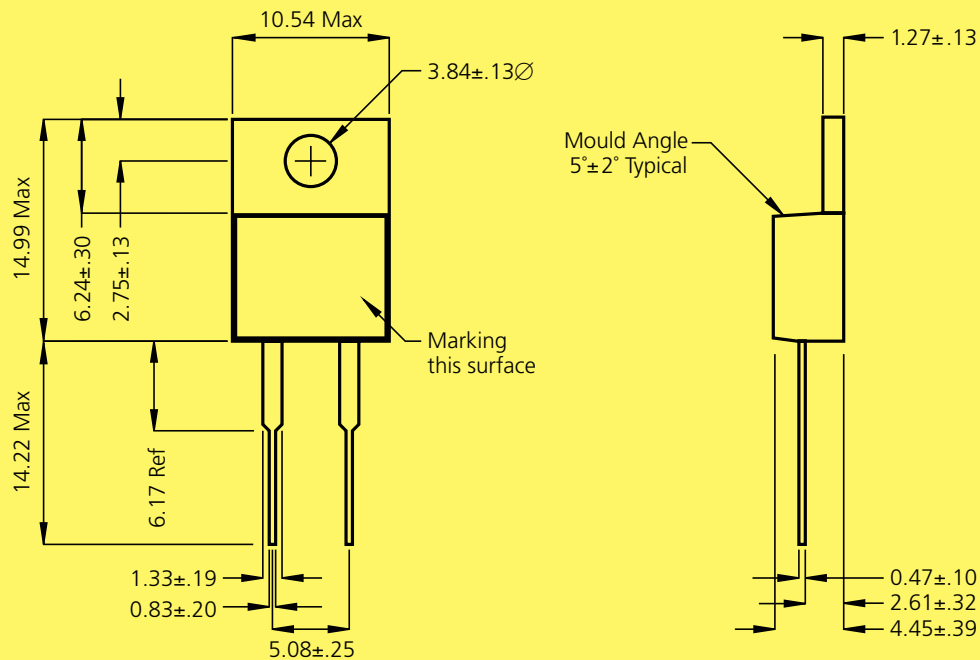


Environmental (Per MIL-PRF-83401)

Thermal Shock	Max ΔR ± 0.50%
Terminal Strength	Max ΔR ± 0.25%
Short Time Overload 2 x rated Power for 5 Seconds	Max ΔR ± 0.50%
Moisture Resistance	Max ΔR ± 0.50%
Mechanical Shock	30 G's, ΔR ± 0.25%
Vibration Shock	10G's, 10 to 500 Hz ΔR ± 0.25%
Low Temperature Storage	Max ΔR ± 0.25%
High Temperature Exposure	Max ΔR ± 0.25%
Load Life 1,000 Hours	Max ΔR ± 2.00%
Resistance to Solder Heat	Max ΔR ± 0.25%
Dielectric Withstanding Voltage, Minimum	1500V
Marking Permanency	MIL-STD-202, Method 215
Lead Solderability	MIL-STD-202, Method 208
Flammability	UL 94V-0 Rated
Storage	-55°C to +155°C

- Specifications subject to change without notice.
- Contact factory for custom products, non standard values and tolerances.

Outline Dimensions (mm)



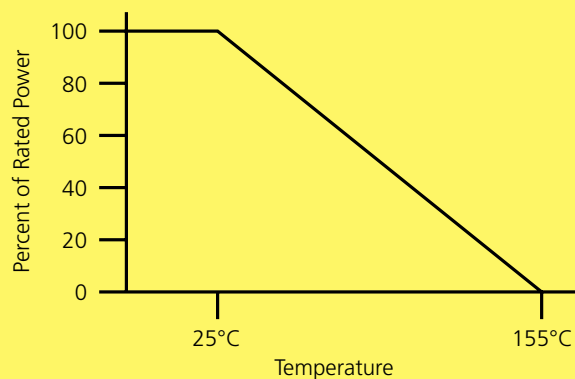
Dimensions are in millimetres

Substrate Material: 96% Alumina

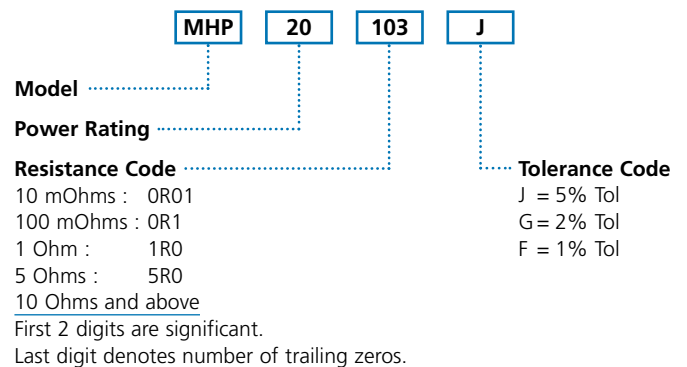
Lead Material: Copper Alloy, Tin Plated

Resistor Material: Thick Film

Power Derating Curve



Ordering Information



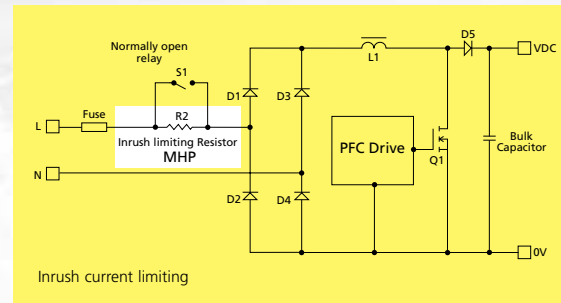
Packaging

50 per Tube

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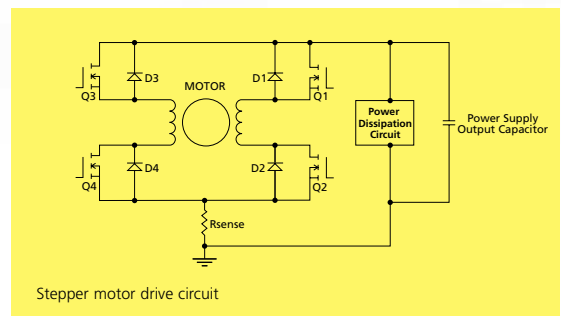
1. Inrush Current limiting

The PFC circuit generates a regulated DC output while controlling the input power factor. The input current is sinusoidal and in-phase with the mains voltage. Due to the large bulk capacitors at the PFC converter output a substantial inrush current can be drawn at power-up. The magnitude of the inrush current depends upon the instance of the AC waveform at which the unit is turned on. Inserting a current limiting resistor in series with the mains supply will control start-up inrush current. The resistor is short-circuited by using a relay once the bulk capacitor is charged.

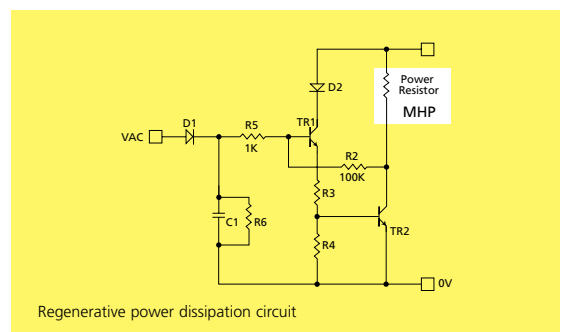


2. Regenerative Power Dissipation

A stepper motor will act like a generator if the shaft is mechanically rotated. Thus inertia energy supplied to the motor during acceleration is returned to the drive during deceleration. This is regeneration and increases the motor current, which could damage the power switches. A current threshold detector in the circuit detects the increased current and momentarily turns off the switches. The regenerated current now has a path back to the supply and charges the bulk capacitor to a higher voltage. Since the power switches have been turned off the current in the threshold detector falls below the threshold and the power switches are turned on again. If the current remains higher than the threshold the drive returns to the regenerative state.

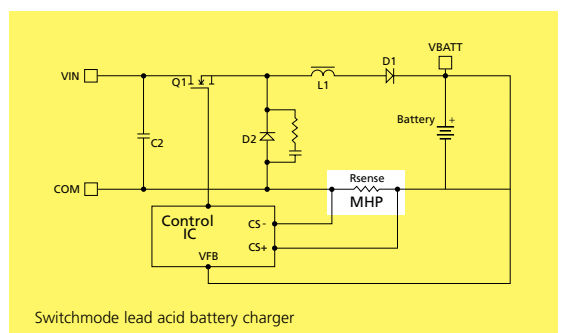


If the power supply capacitor voltage increases to a high enough level then the power switches may be damaged. To avoid this regenerative power dissipation circuit can be used. A reference voltage equal to the incoming AC is developed across C1 and under normal conditions will equal the drive circuits bulk capacitor voltage. During regeneration when the bulk capacitor voltage rises above the incoming AC peak the regenerative power dissipation circuit transistor will turn on connecting a power resistor across the bulk capacitor. When this voltage has decreased to the AC peak value the transistor will turn off. The instantaneous regenerative current will be high but the average power dissipation in the resistor will be low due to the short regeneration period. The value and power rating of the power resistor will depend upon the regeneration energy, bulk capacitor value and AC voltage. One or more MHP resistors may be used and the regenerative power dissipation may be considered a temporary overload provided the regenerative energy is dissipated is less than 5 seconds.



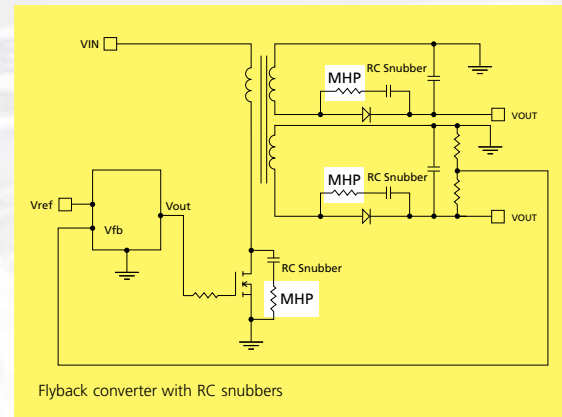
3. Current Sensing

Non-inductive resistors are suitable for current sensing applications. When switching at high frequencies stray inductance can cause ringing with parasitic capacitances. This may cause the over current sensing to shutdown the power switch prematurely limiting the output power. Even with the correct choice of resistor care must be taken to keep the component leads and PCB traces short to minimize inductance. A buck converter lead acid battery charging application using a current sense resistor is shown opposite.



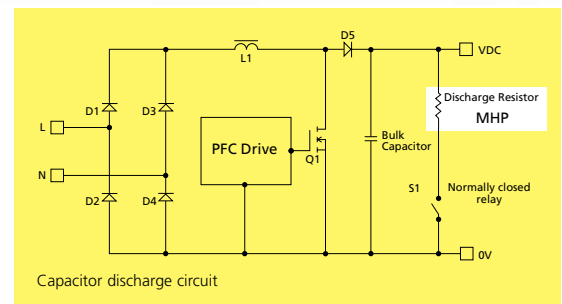
4. Snubber Circuits

The low inductive properties of the MHP power resistors make them ideal for high frequency snubbing applications. This example shows a flyback converter with snubbing circuits on the primary switch and output diodes. Leakage inductances in the circuit are unclamped and responsible for voltage spikes at the drain of the power switch as well as the secondary output diodes during the switching transitions. The RC snubber network dampens circuit resonance, caused by component parasitics; this limits the voltage stress on the devices, improves circuit efficiency and reduces radiated EMI. RC snubber circuit components that have extremely low parasitic inductance should be chosen to avoid unwanted resonance in the circuit. Ceramic capacitors are available with low ESR and ESL values. Wire wound resistors often have too much inductance and will cause ringing and voltage overshoots.



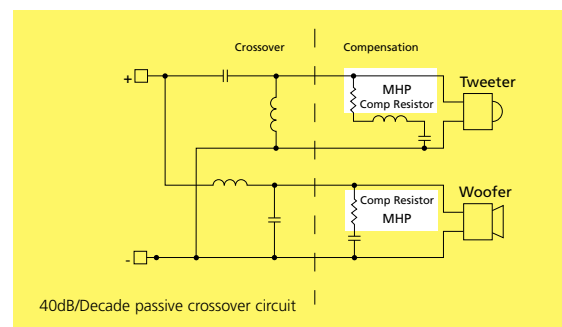
5. Capacitor Discharge

An important aspect in power supply design is the provision of a quick safe discharge of the bulk capacitors at turn off. The electrolytic capacitors can hold large charges, which if left to self-discharge allow dangerous voltages to remain for long periods of time presenting potential safety hazards for service personnel. The discharge of 0.25J of stored energy to the human body can provide a heavy shock and 10J can be fatal. Thus a discharge resistor is required. The energy stored by the input capacitors is equal to $1/2CV^2$ where V is the PFC output voltage. The discharge resistor must be chosen to provide a quick discharge to a safe voltage when the unit is turned off. Using $V = V_0 e^{-t/\tau}$, τ the RC time constant is calculated. If the resistor continuously dissipated power it would represent an unacceptably high loss. It is only switched into the circuit when needed therefore reducing the required resistor power rating. The capacitor discharge may be considered a temporary overload condition.



6. Audio Crossover Circuits

Loud speakers are optimised to reproduce sound within specific frequency bands. A crossover circuit in the speaker system splits the audio signal into multiple signals. So the signal going to the bass (or woofer) has just the low frequencies in it. The signal to the mid-range has the middle frequencies, and the signal to the tweeter has the high frequencies. The goal of the audio system is to generate an accurate response to the input signal over the complete audio spectrum however the frequency response of the individual speakers is not always flat through the crossover region. Thus a compensation network is required to correct for the impedance variations of the speakers. Non-inductive resistors are suitable for this application.



BI Technologies - SMT

Company Profile

BI Technologies, SMT Division is a World Class manufacturer of thick film Passive Components. The company was established in 1958 in Glenrothes, Scotland. BI Technologies have earned a great reputation as a high quality, high volume, cost effective and responsive supplier of thick film passive components for telecommunications, computer, automotive, medical and industrial applications.



Product Range

- Packaged SIL, DIL and Surface Mount Resistor Networks
- Chip Resistor Arrays
- Chip Resistor - Capacitor Arrays
- Planar Power Resistors
- Surge Resistors
- Thick Film Substrates
- Custom Thick Film products
- High Voltage Resistors and Networks

BI Technologies - ECD

Company Profile

BI Technologies has been an innovator and leader in electronic components for more than 50 years manufacturing products for communication, computer, industrial and automotive applications.

BI Technologies serves a global customer base with manufacturing locations in the United States, Mexico, Scotland, Japan, China and Malaysia.



Product Range

- Trimming and Precision Potentiometers
- Position Sensors
- Chip Resistor Arrays
- Resistor Networks
- Integrated Passive Networks
- Inductors
- Transformers
- Turns Counting Dials
- Hybrid Microelectronics and Custom Integration Products

BI Technologies - MCD

Company Profile

BI Technologies, Magnetic Component Division, headquartered in Fullerton, California, with a manufacturing base in Kuantan, Malaysia, is a world leader in miniature surface mount high power inductors. The magnetic material and manufacturing expertise of various inductors, choke coils, transformers and assemblies has expanded the customer and market base into automotive, medical, computer, data communication and industrial in addition to other specialized magnetic assembly applications.



Product Range

- Transformers both surface mount and through hole
- Surface Mount high powered inductors
- Toroidal inductors (through hole and surface mount)
- High power specialty laminate transformers
- Data communication modules, filters, and transformers for ethernet and DSL
- Common mode filters and chokes
- Planar transformer solutions

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