

*Product Preview*  
**Hybrid Power Module**  
**Integrated Power Stage for 3.0 hp**  
**460 VAC Motor Drive**

This module integrates a 3-phase inverter, 3-phase rectifier, brake, and temperature sense in a single convenient package. It is designed for 3.0 hp general purpose 3-phase induction motor drive applications. The inverter incorporates advanced insulated gate bipolar transistors (IGBT) matched with fast soft free-wheeling diodes to give optimum performance. The solderable top connector pins are designed for easy interfacing to the user's control board.

- Short Circuit Rated 10  $\mu$ s @ 125°C, 720 V
- Pin-to-Baseplate Isolation Exceeds 2500 Vac (rms)
- Compact Package Outline
- Access to Positive and Negative DC Bus
- Independent Brake Circuit Connections
- UL Recognition Pending

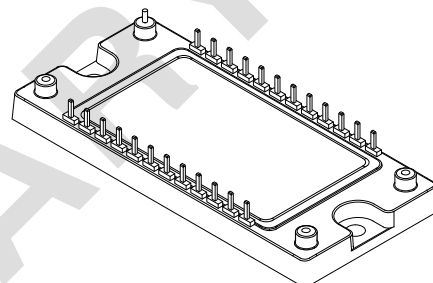
**ORDERING INFORMATION**

Device	Voltage Rating	Current Rating	Equivalent Horsepower
PHPM7A15S120DC3	1200	15	3.0

**MHPM7A15S120DC3**

Motorola Preferred Device

**15 AMP, 1200 VOLT  
HYBRID POWER MODULE**



**CASE 464D-01  
ISSUE 0**

**MAXIMUM DEVICE RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
Repetitive Peak Input Rectifier Reverse Voltage ( $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ )	$V_{RRM}$	900	V
Non-Repetitive Peak Input Rectifier Reverse Voltage (1) ( $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ )	$V_{RSM}$	1600	V
IGBT Reverse Voltage	$V_{CES}$	1200	V
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V
Continuous IGBT Collector Current ( $T_C = 25^\circ\text{C}$ )	$I_{Cmax}$	15	A
Repetitive Peak IGBT Collector Current (2)	$I_{C(pk)}$	30	A
Continuous Free-Wheeling Diode Current ( $T_C = 25^\circ\text{C}$ )	$I_{Fmax}$	15	A
Continuous Free-Wheeling Diode Current ( $T_C = 80^\circ\text{C}$ )	$I_{F80}$	11.7	A
Repetitive Peak Free-Wheeling Diode Current (2)	$I_{F(pk)}$	30	A
Average Converter Output Current (Peak-to-Average ratio of 10, $T_C = 95^\circ\text{C}$ )	$I_{Omax}$	16	A
IGBT Power Dissipation per die ( $T_C = 95^\circ\text{C}$ )	$P_D$	36	W
Free-Wheeling Diode Power Dissipation per die ( $T_C = 95^\circ\text{C}$ )	$P_D$	16	W
Junction Temperature Range	$T_J$	-40 to +150	$^\circ\text{C}$
Short Circuit Duration ( $V_{CE} = 720$ V, $T_J = 125^\circ\text{C}$ )	$t_{sc}$	10	$\mu$ s
Isolation Voltage, pin to baseplate	$V_{ISO}$	2500	Vac
Operating Case Temperature Range	$T_C$	-40 to +95	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to +150	$^\circ\text{C}$
Mounting Torque — Heat Sink Mounting Holes	—	12	lb-in

(1) Half-Sine 60 Hz, maximum reverse voltage capability decreases by 0.1% per  $^\circ\text{C}$  at lower temperature

(2) 1.0 ms = 1.0% duty cycle

**Preferred** devices are Motorola recommended choices for future use and best overall value.

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

## MHPM7A15S120DC3

### ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>DC AND SMALL SIGNAL CHARACTERISTICS</b>					
Input Rectifier Forward Voltage ( $I_F = 15\text{ A}$ )	$V_F$	—	1.09	1.38	V
Gate–Emitter Leakage Current ( $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$ )	$I_{GES}$	—	—	$\pm 20$	$\mu\text{A}$
Collector–Emitter Leakage Current ( $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{ V}$ )	$I_{CES}$	—	5.0	100	$\mu\text{A}$
Gate–Emitter Threshold Voltage ( $V_{CE} = V_{GE}$ , $I_C = 1.0\text{ mA}$ )	$V_{GE(th)}$	4.0	6.0	8.0	V
Collector–Emitter Breakdown Voltage ( $I_C = 10\text{ mA}$ , $V_{GE} = 0\text{ V}$ )	$V_{(BR)CES}$	1200	—	—	V
Collector–Emitter Saturation Voltage ( $I_C = I_{Cmax}$ , $V_{GE} = 15\text{ V}$ )	$V_{CE(sat)}$	—	2.5	3.5	V
Free–Wheeling Diode Forward Voltage ( $I_F = I_{Fmax}$ , $V_{GE} = 0\text{ V}$ )	$V_F$	1.8	2.0	2.5	V
Input Capacitance ( $V_{GE} = 0\text{ V}$ , $V_{CE} = 25\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{ies}$	—	2800	—	pF
Input Gate Charge ( $V_{CE} = 600\text{ V}$ , $I_C = I_{Cmax}$ , $V_{GE} = 15\text{ V}$ )	$Q_T$	—	100	—	nC
<b>THERMAL CHARACTERISTICS, EACH DIE</b>					
Thermal Resistance — IGBT	$R_{\theta JC}$	—	1.1	1.5	$^\circ\text{C/W}$
Thermal Resistance — Free–Wheeling (Fast Soft) Diode	$R_{\theta JC}$	—	2.4	3.3	$^\circ\text{C/W}$
Thermal Resistance — Input Rectifier	$R_{\theta JC}$	—	3.2	4.2	$^\circ\text{C/W}$
<b>TEMPERATURE SENSE DIODE</b>					
Forward Voltage (@ $I_F = 1.0\text{ mA}$ )	$V_F$	1.983	2.024	2.066	V
Forward Voltage Temperature Coefficient (@ $I_F = 1.0\text{ mA}$ )	$TC_{VF}$	—	–8.64	—	$\text{mV}/^\circ\text{C}$

TYPICAL CHARACTERISTICS

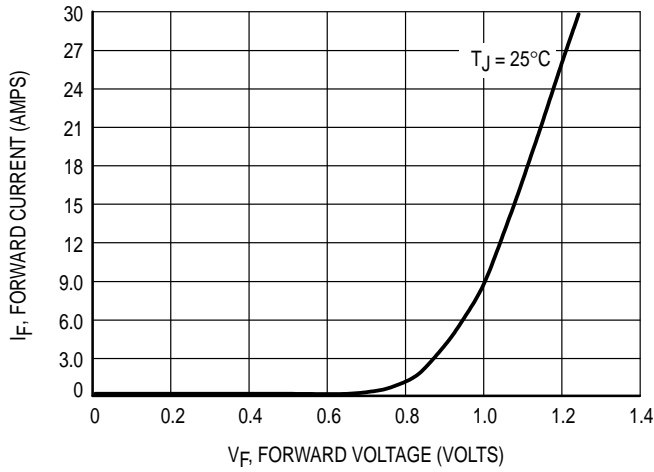


Figure 1. Forward Characteristics — Input Rectifier

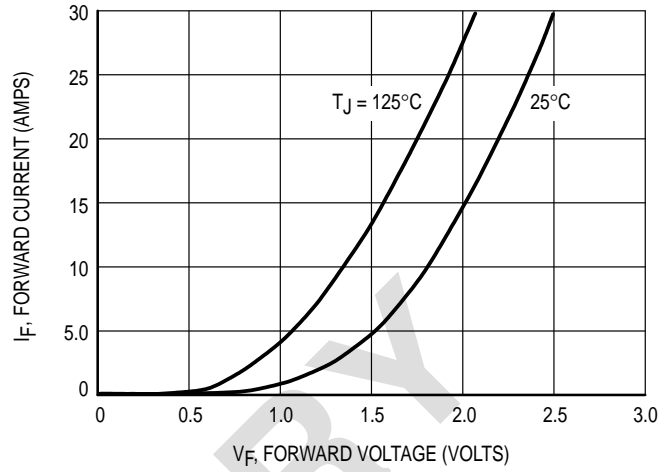


Figure 2. Forward Characteristics — Free-Wheeling Diode

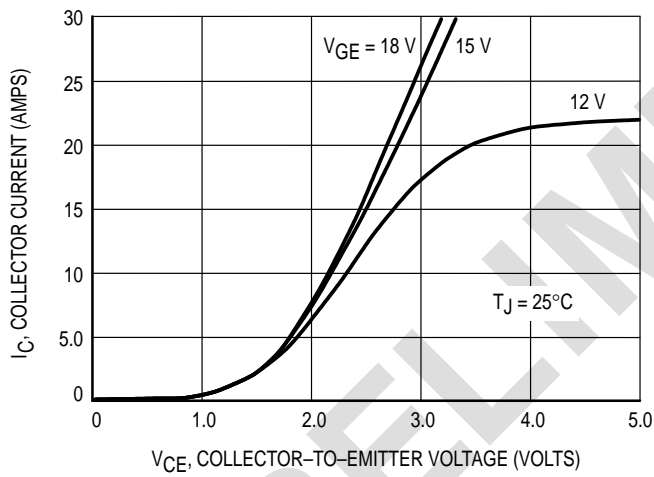


Figure 3. Forward Characteristics,  $T_J = 25^\circ\text{C}$

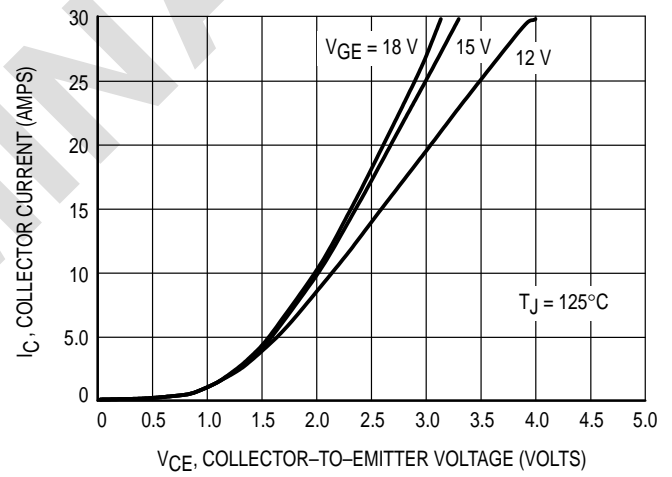


Figure 4. Forward Characteristics,  $T_J = 125^\circ\text{C}$

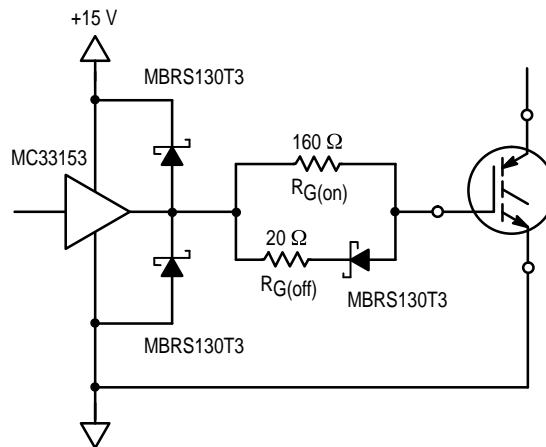


Figure 5. Recommended Gate Drive Circuit

TYPICAL CHARACTERISTICS

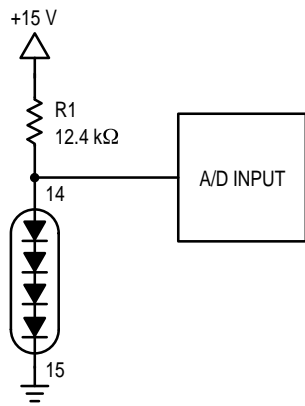


Figure 6. Recommended Temperature Sense Bias Circuit

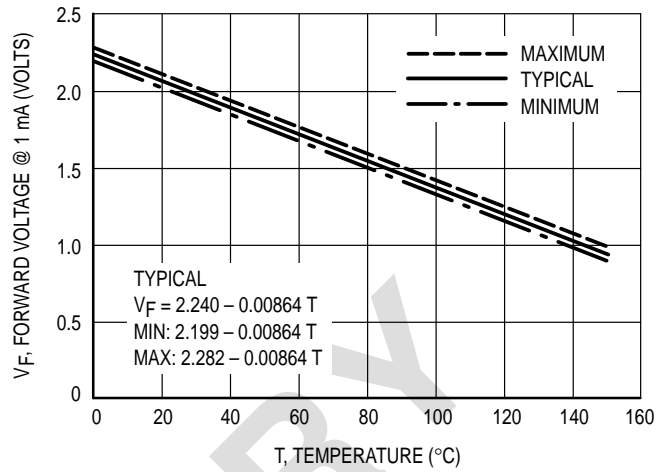


Figure 7. BAV99LT1 Temperature Sense Diode Performance:  $V_F = 2.59 - 7.31E-3 T_C$

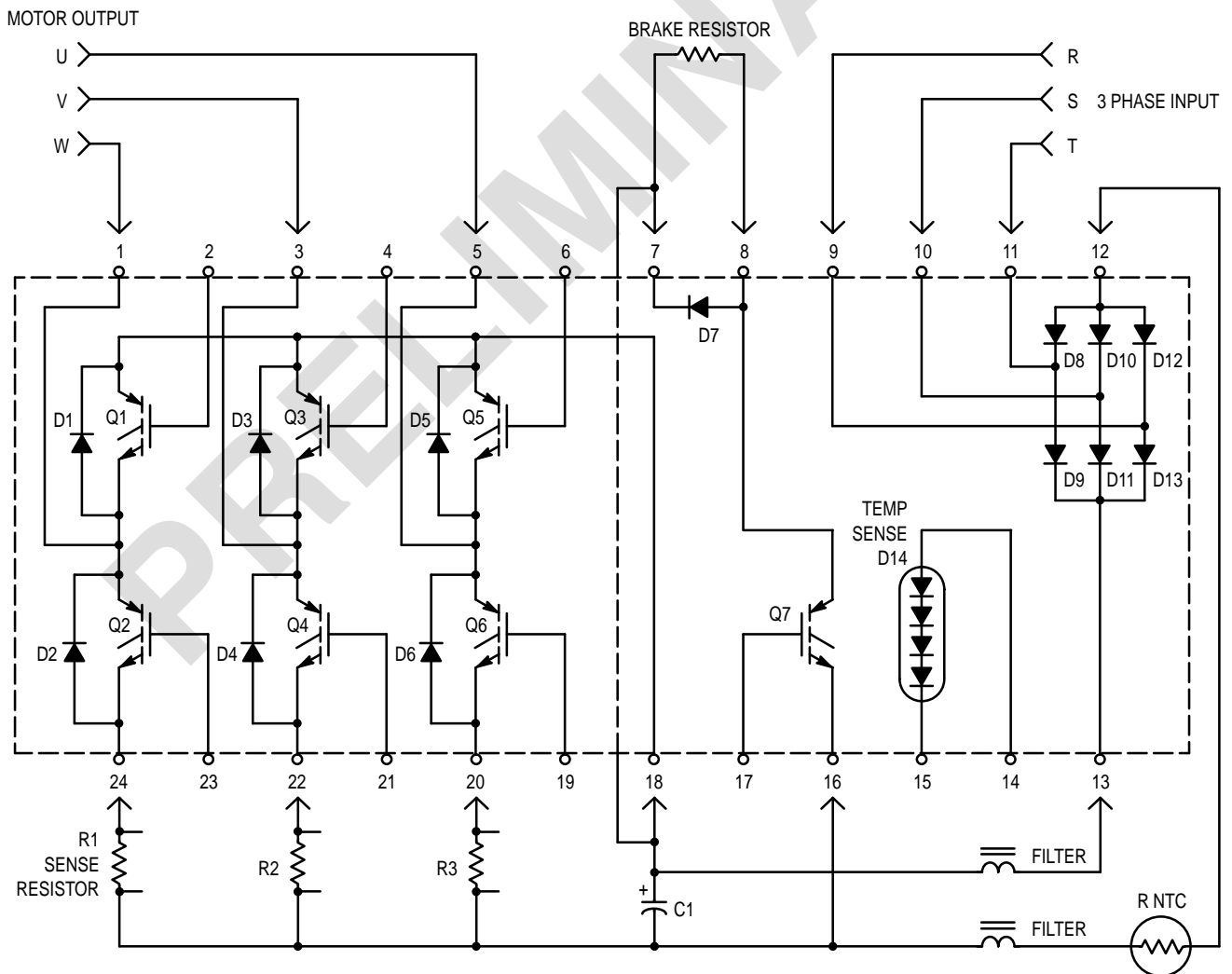
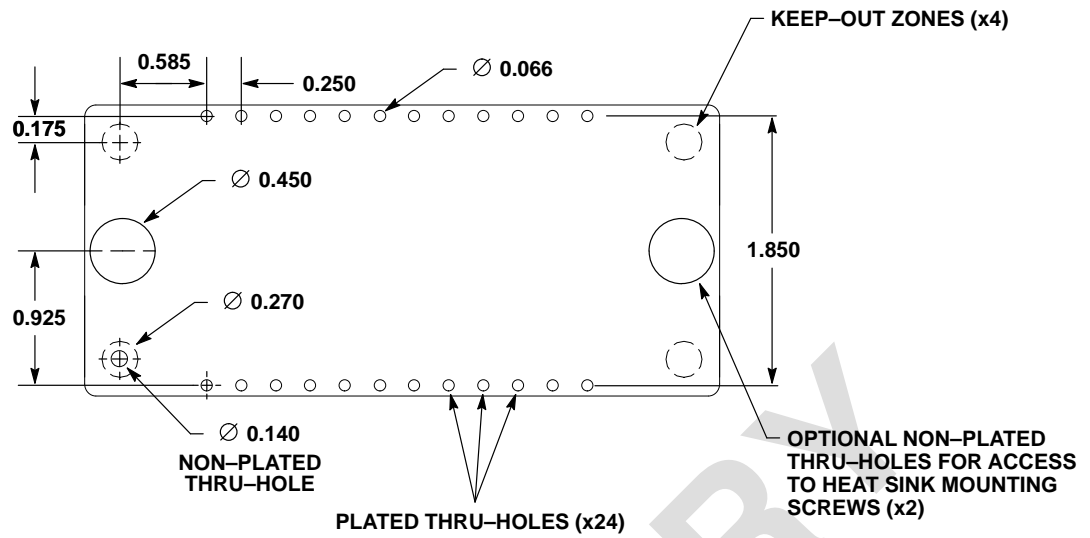


Figure 8. Schematic of Module, Showing Pin-Out and External Connections

# MHPM7A15S120DC3

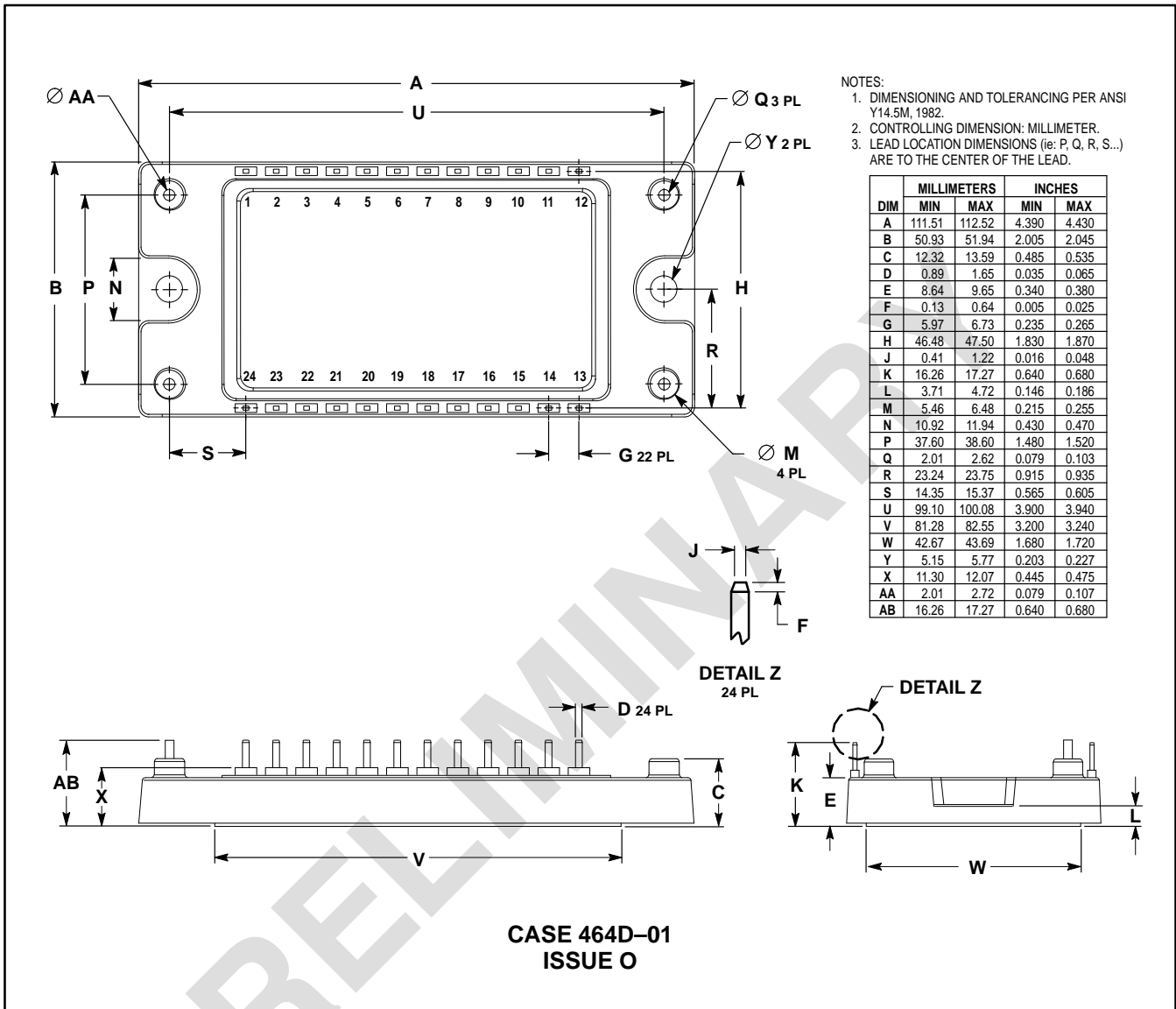


### NOTES:

1. Package is symmetrical, except for a polarizing plastic post near pin 1, indicated by a non-plated thru-hole in the footprint.
2. Dimension of plated thru-holes indicates finished hole size after plating.
3. Access holes for mounting screws may or may not be necessary depending on assembly plan for finished product.

**Figure 9. Package Footprint (Dimensions in Inches)**

PACKAGE DIMENSIONS



Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

**How to reach us:**

**USA/EUROPE/Locations Not Listed:** Motorola Literature Distribution; P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.: SPD, Strategic Planning Office, 141, 4-32-1 Nishi-Gotanda, Shagawa-ku, Tokyo, Japan. 03-5487-8488

**Customer Focus Center: 1-800-521-6274**

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609  
 Motorola Fax Back System – US & Canada ONLY 1-800-774-1848  
 – http://sps.motorola.com/mfax/

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park, 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

**HOME PAGE:** http://motorola.com/sps/

