

*Product Preview*  
**Hybrid Power Module**  
**Integrated Power Stage for 1.0 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 1.0 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

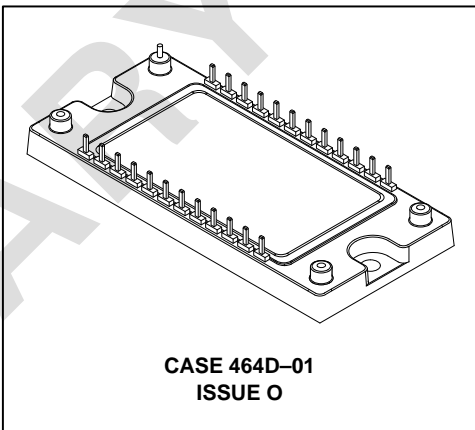
**ORDERING INFORMATION**

Device	Voltage Rating	Current Rating	Equivalent Horsepower
PHPM7A5S120DC3	1200	5.0	1.0

**MHPM7A5S120DC3**

Motorola Preferred Device

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



**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 ( $T_C = 25^\circ\text{C}$ )	$I_{Cmax}$	5.0	A
Repetitive Peak IGBT Collector Current (2)	$I_{C(pk)}$	10	A
Continuous Free-Wheeling Diode Current ( $T_C = 80^\circ\text{C}$ )	$I_{F80}$	5.0	A
Repetitive Peak Free-Wheeling Diode Current (2)	$I_{F(pk)}$	10	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 ( $T_C = 95^\circ\text{C}$ )	$P_D$	19	W
Free-Wheeling Diode Power Dissipation per die ( $T_C = 95^\circ\text{C}$ )	$P_D$	8.0	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.

## MHPM7A5S120DC3

### 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 ( $I_F = 5.0\text{ A}$ )	$V_F$	—	0.92	1.09	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 ( $I_F = I_{F80}$ , $V_{GE} = 0\text{ V}$ )	$V_F$	1.7	2.0	2.5	V
Input Capacitance ( $V_{GE} = 0\text{ V}$ , $V_{CE} = 25\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{ies}$	—	930	—	pF
Input Gate Charge ( $V_{CE} = 600\text{ V}$ , $I_C = I_{Cmax}$ , $V_{GE} = 15\text{ V}$ )	$Q_T$	—	31	—	nC
<b>THERMAL CHARACTERISTICS, EACH DIE</b>					
Thermal Resistance — IGBT	$R_{\theta JC}$	—	2.1	2.8	$^\circ\text{C/W}$
Thermal Resistance — Free–Wheeling (Fast Soft) Diode	$R_{\theta JC}$	—	5.0	6.6	$^\circ\text{C/W}$
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

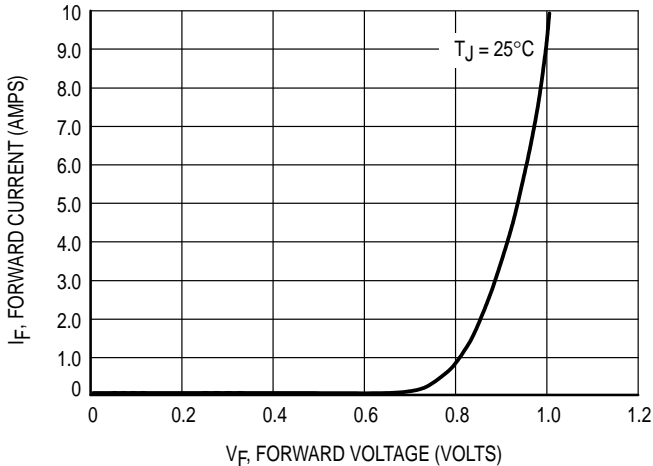


Figure 1. Forward Characteristics — Input Rectifier

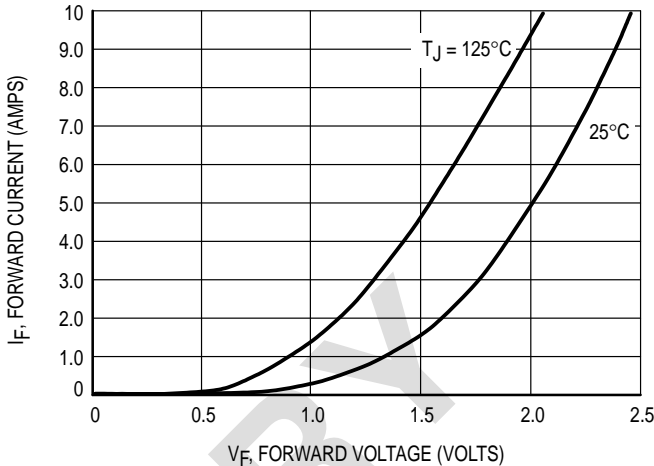


Figure 2. Forward Characteristics — Free-Wheeling Diode

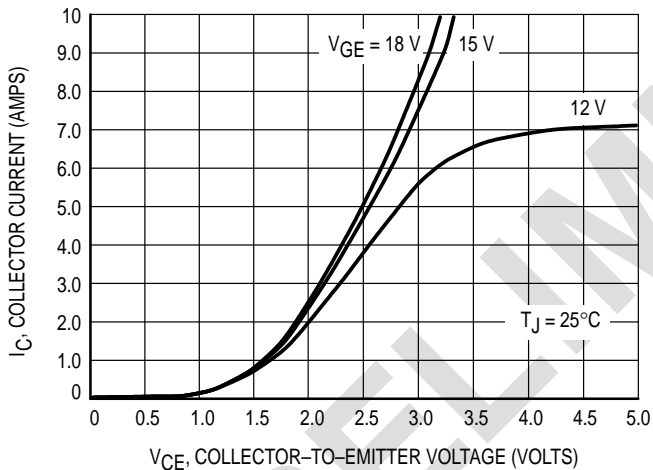


Figure 3. Forward Characteristics,  $T_J = 25^\circ\text{C}$

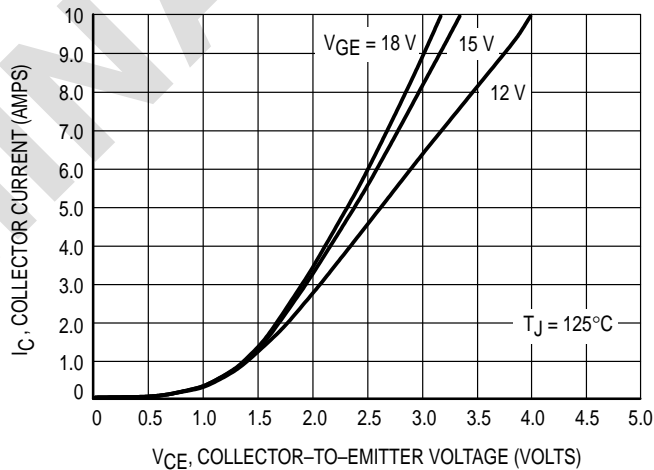


Figure 4. Forward Characteristics,  $T_J = 125^\circ\text{C}$

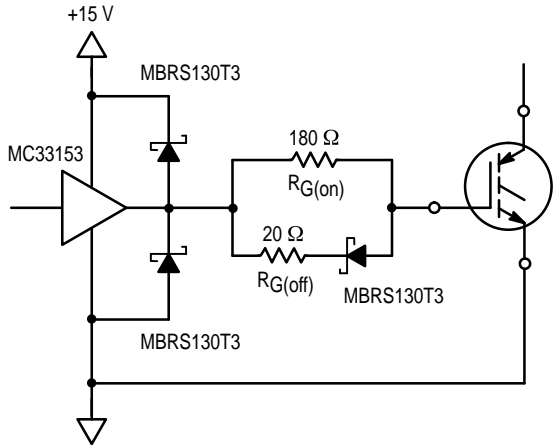


Figure 5. Recommended Gate Drive Circuit

TYPICAL CHARACTERISTICS

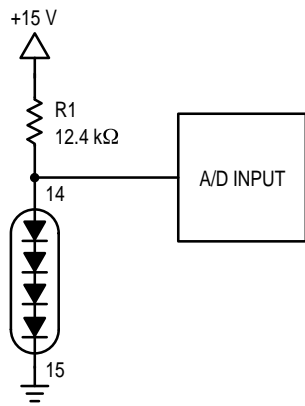


Figure 6. Recommended Temperature Sense Bias Circuit

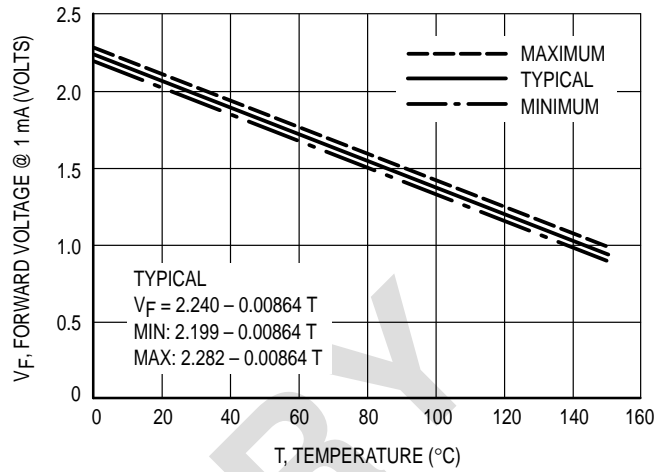


Figure 7. BAV99LT1 Temperature Sense Diode Performance:  $V_F = 2.59 - 7.31E-3 T_C$

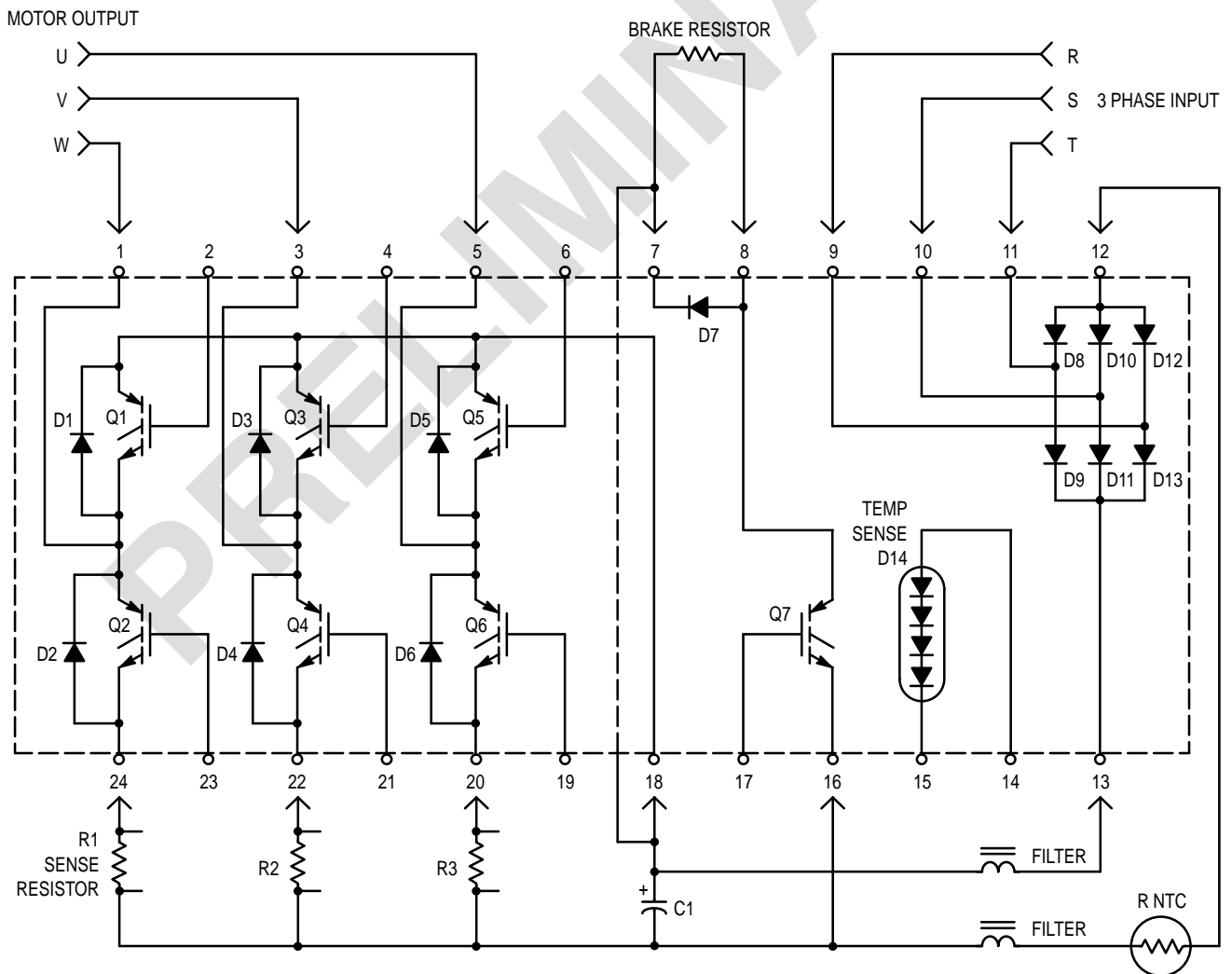
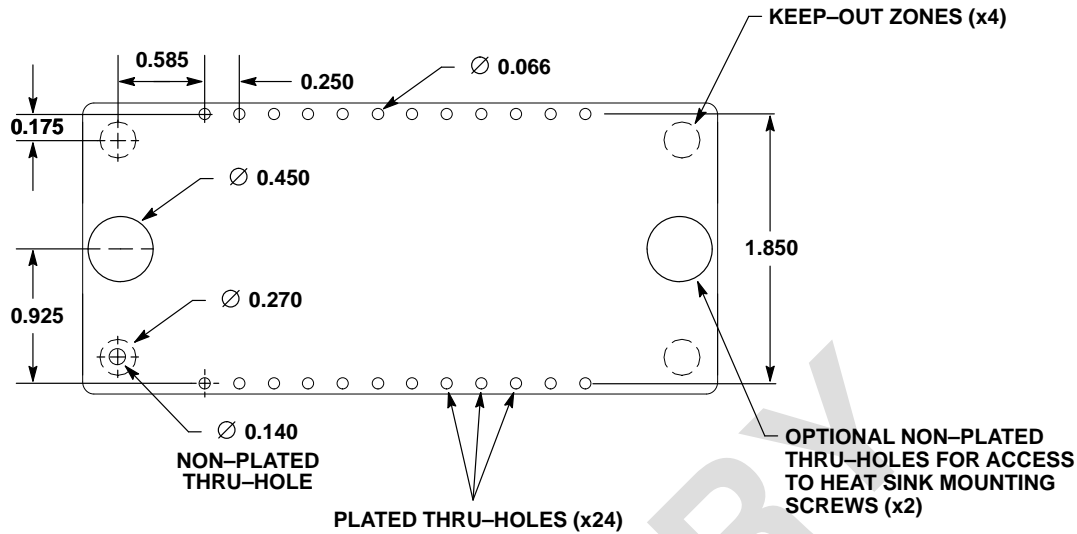


Figure 8. Schematic of Module, Showing Pin-Out and External Connections



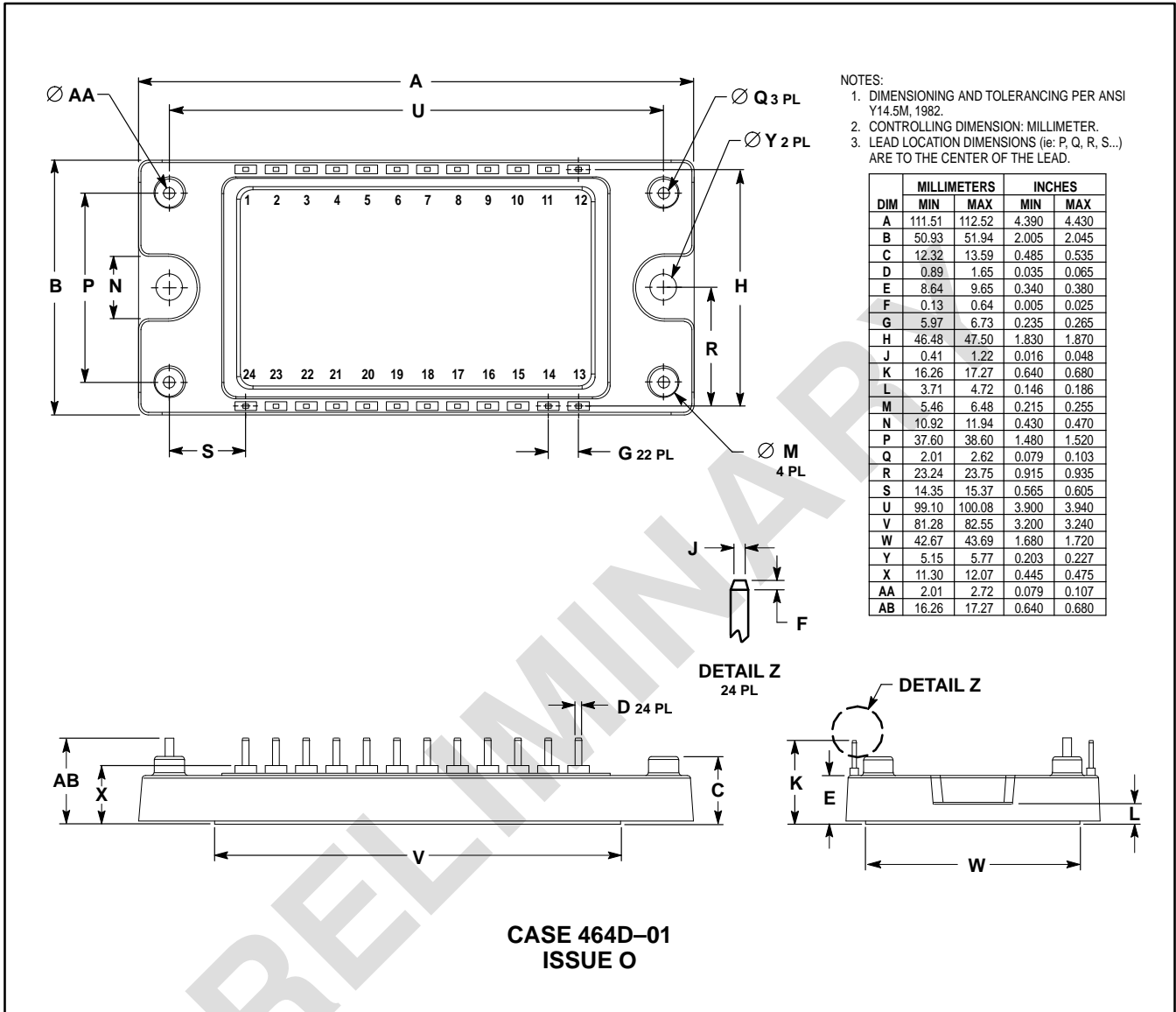
NOTES:

- 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)

PRELIMINARY

PACKAGE DIMENSIONS



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