

*Product Preview*  
**Hybrid Power Module**  
**Integrated Power Stage**  
**for 230 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 2.0 hp general purpose 3-phase induction motor drive applications. The inverter incorporates advanced insulated gate bipolar transistors (IGBT) with integrated ESD protection Gate-Emitter zener diodes and ultrafast soft (UFS) 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, 400 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

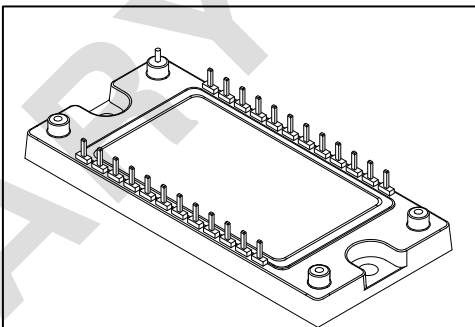
**ORDERING INFORMATION**

Device	Voltage Rating	Current Rating	Equivalent Horsepower
PHPM7A20E60DC3	600	20	2.0

**MHPM7A20E60DC3**

Motorola Preferred Device

**20 AMP, 600 VOLT  
HYBRID POWER MODULE**



**CASE 464D-01  
ISSUE O**

**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
IGBT Reverse Voltage	$V_{CES}$	600	V
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V
Continuous IGBT Collector Current ( $T_C = 25^\circ\text{C}$ )	$I_{Cmax}$	20	A
Continuous IGBT Collector Current ( $T_C = 80^\circ\text{C}$ )	$I_{Cmax}$	15.8	A
Repetitive Peak IGBT Collector Current (1)	$I_{C(pk)}$	40	A
Continuous Free-Wheeling Diode Current ( $T_C = 25^\circ\text{C}$ )	$I_{Fmax}$	20	A
Continuous Free-Wheeling Diode Current ( $T_C = 80^\circ\text{C}$ )	$I_{F80}$	14.1	A
Repetitive Peak Free-Wheeling Diode Current (1)	$I_{F(pk)}$	40	A
Average Converter Output Current (Peak-to-Average ratio of 10, $T_C = 95^\circ\text{C}$ )	$I_{Omax}$	20	A
IGBT Power Dissipation per die ( $T_C = 95^\circ\text{C}$ )	$P_D$	25	W
Free-Wheeling Diode Power Dissipation per die ( $T_C = 95^\circ\text{C}$ )	$P_D$	17	W
Junction Temperature Range	$T_J$	-40 to +150	$^\circ\text{C}$
Short Circuit Duration ( $V_{CE} = 400$ 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) 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.

## MHPM7A20E60DC3

### 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 ( $I_F = 20\text{ A}$ )	$V_F$	—	1.0	1.25	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 ( $V_{CE} = 600\text{ V}$ , $V_{GE} = 0\text{ V}$ )	$I_{CES}$	—	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 ( $I_C = 10\text{ mA}$ , $V_{GE} = 0\text{ V}$ )	$V_{(BR)CES}$	600	—	—	V
Collector–Emitter Saturation Voltage ( $I_C = I_{Cmax}$ , $V_{GE} = 15\text{ V}$ )	$V_{CE(sat)}$	—	2.2	2.6	V
Free–Wheeling Diode Forward Voltage ( $I_F = I_{Fmax}$ , $V_{GE} = 0\text{ V}$ )	$V_F$	1.6	2.0	2.3	V
<b>THERMAL CHARACTERISTICS, EACH DIE</b>					
Thermal Resistance — IGBT	$R_{\theta JC}$	—	1.8	2.2	$^\circ\text{C/W}$
Thermal Resistance — Free–Wheeling (Fast Soft) Diode	$R_{\theta JC}$	—	2.6	3.3	$^\circ\text{C/W}$
Thermal Resistance — Input Rectifier	$R_{\theta JC}$	—	3.4	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

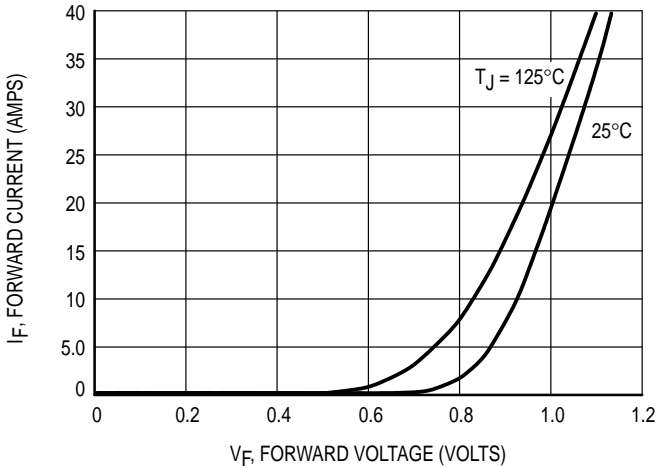


Figure 1. Forward Characteristics — Input Rectifier

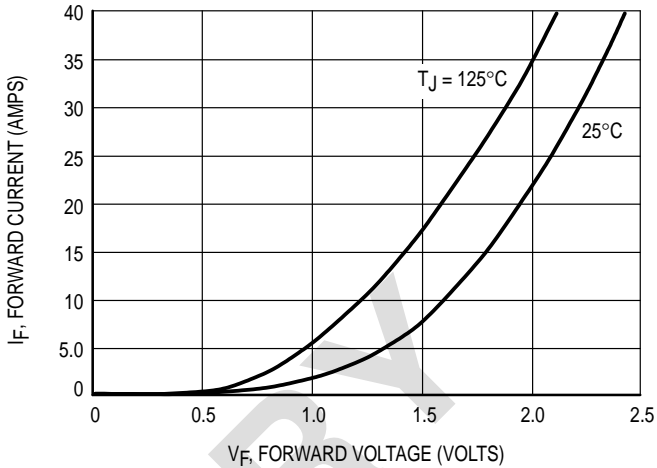


Figure 2. Forward Characteristics — Free-Wheeling Diode

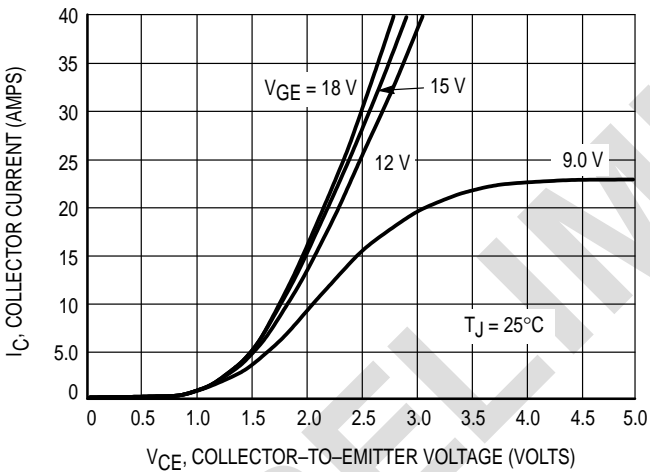


Figure 3. Forward Characteristics, TJ = 25°C

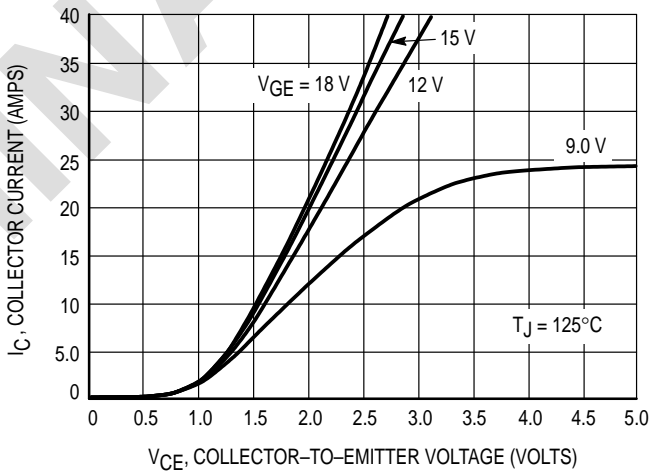


Figure 4. Forward Characteristics, TJ = 125°C

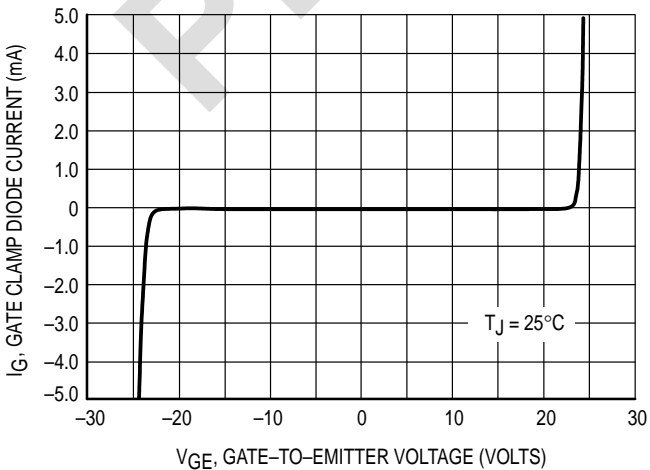


Figure 5. Gate-Emitter Zener Diode Clamp Characteristic

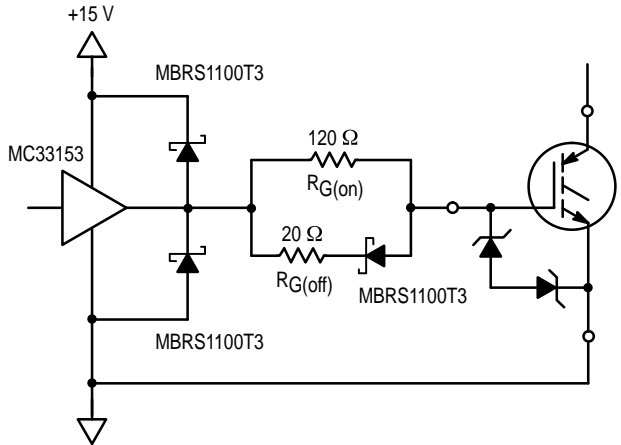


Figure 6. Recommended Gate Drive Circuit

TYPICAL CHARACTERISTICS

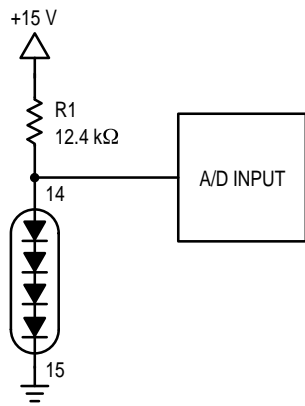


Figure 7. Recommended Temperature Sense Bias Circuit

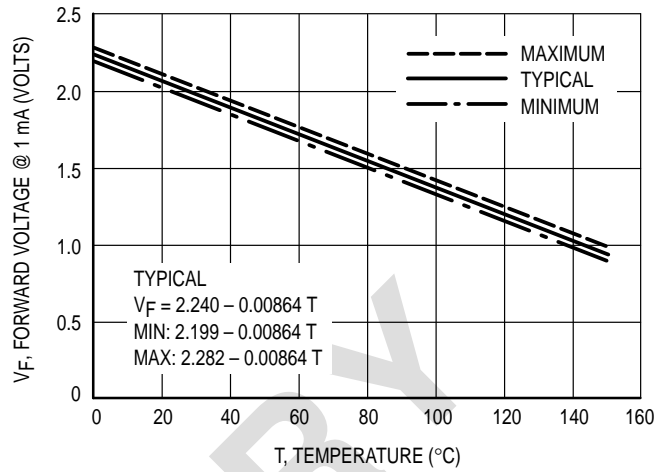


Figure 8. BAV99LT1 Temperature Sense Diode Performance:  $V_F = 2.59 - 7.31E-3 T_C$

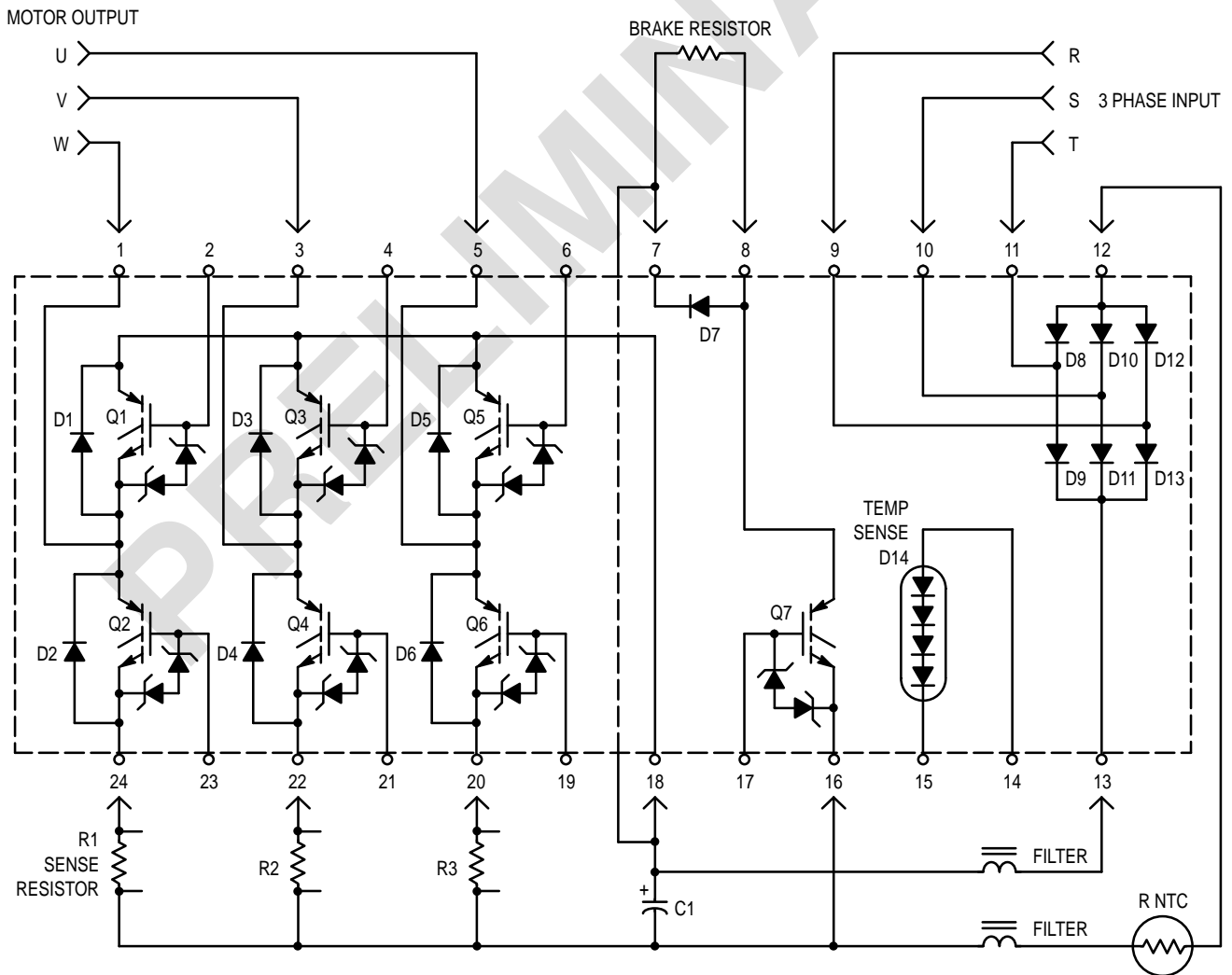
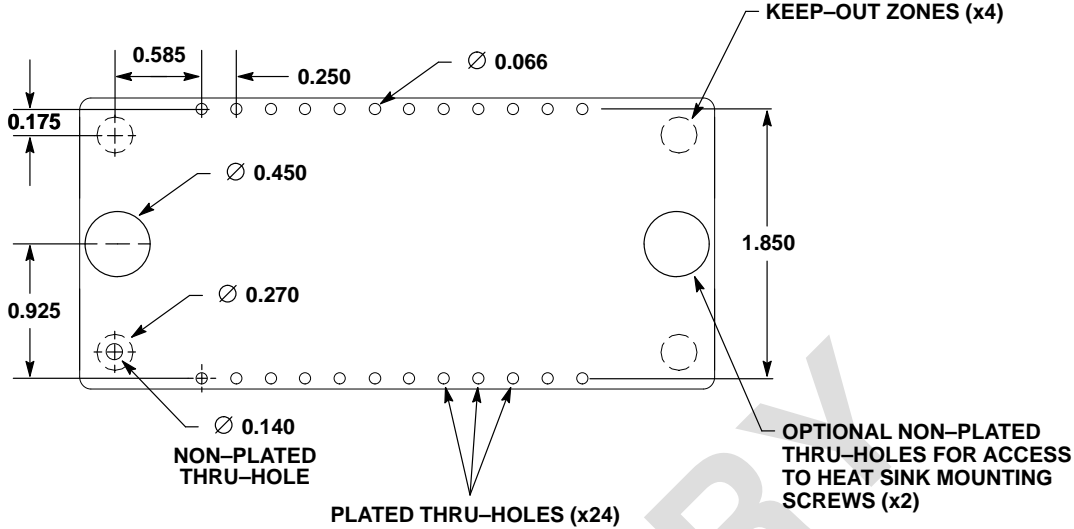


Figure 9. Schematic of Module, Showing Pin-Out and External Connections

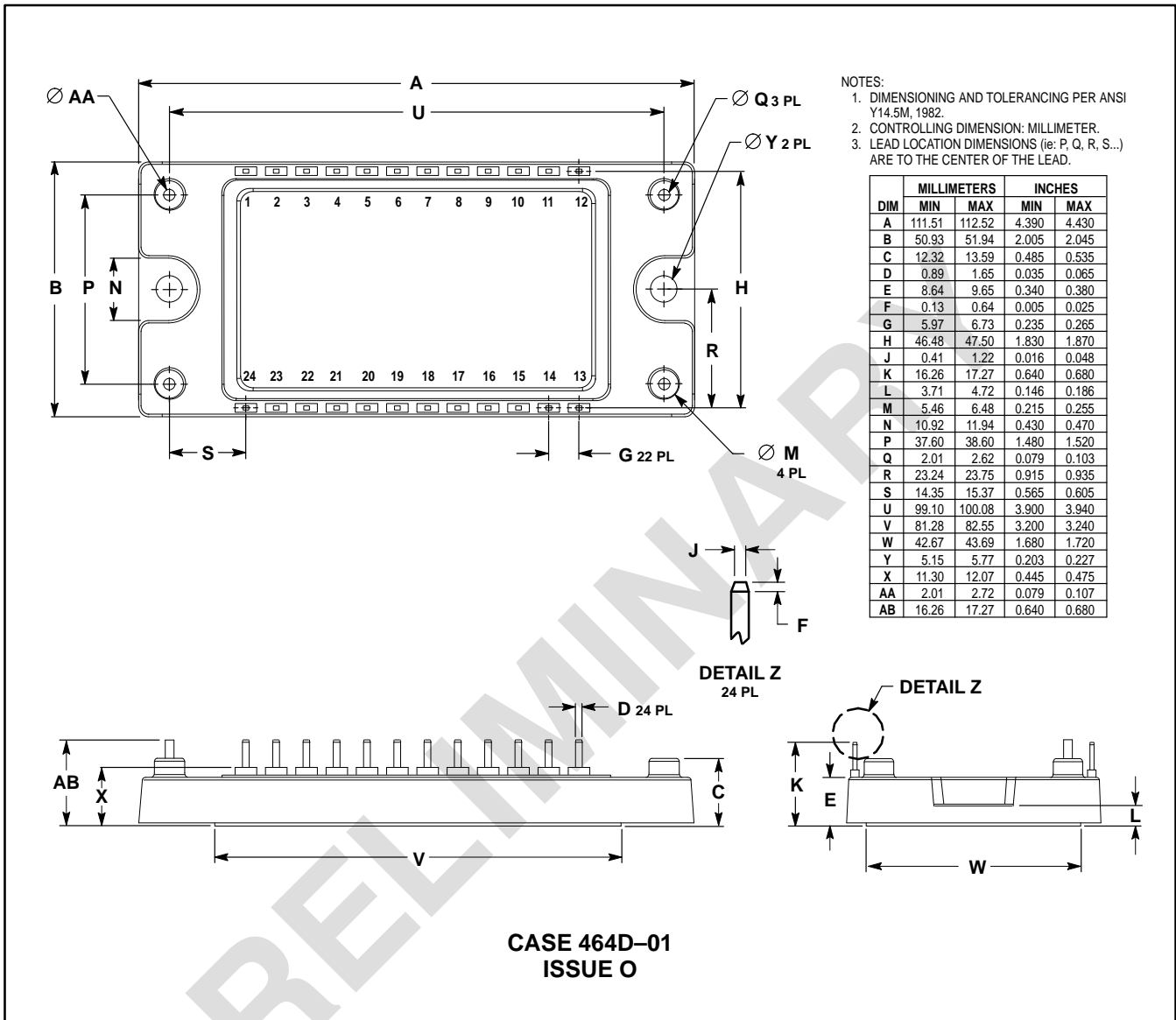


- NOTES:
1. Package is symmetrical, except for a polarizing plastic post near pin 1, indicated by a non-plated thru-hole in the footprint.
  2. Dimension of plated thru-holes indicates finished hole size after plating.
  3. Access holes for mounting screws may or may not be necessary depending on assembly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

Figure 10. Package Footprint (Dimensions in Inches)

PRELIMINARY

PACKAGE DIMENSIONS



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