Product Preview

Hybrid Power Module

Integrated Power Stage for 3.0 hp 460 VAC Motor Drive

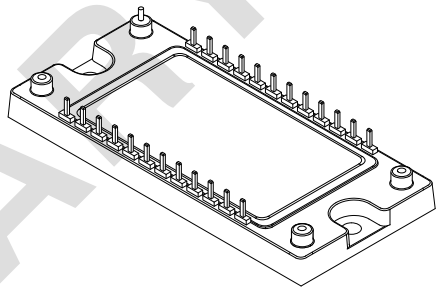
MHPM7A15S120DC3

Motorola Preferred Device

15 AMP, 1200 VOLT
HYBRID POWER MODULE

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 µs @ 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



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ORDERING INFORMATION

Device	Voltage Rating	Current Rating	Equivalent Horsepower
PHPM7A15S120DC3	1200	15	3.0

MAXIMUM DEVICE RATINGS (T_J = 25°C unless otherwise noted)

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

(1) Half–Sine 60 Hz, maximum reverse voltage capability decreases by 0.1% per °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.
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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

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

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TYPICAL CHARACTERISTICS

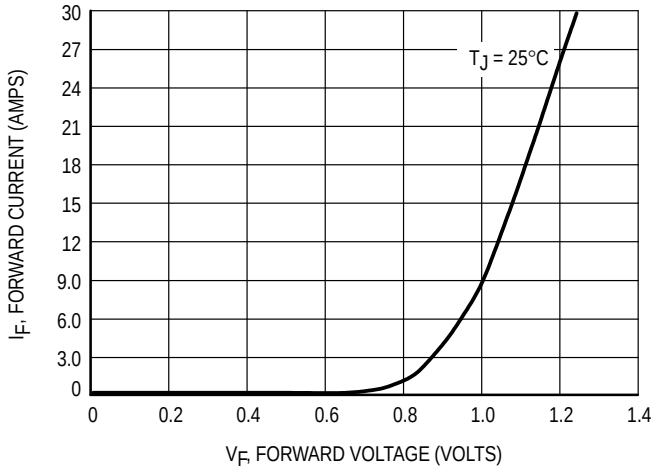


Figure 1. Forward Characteristics — Input Rectifier

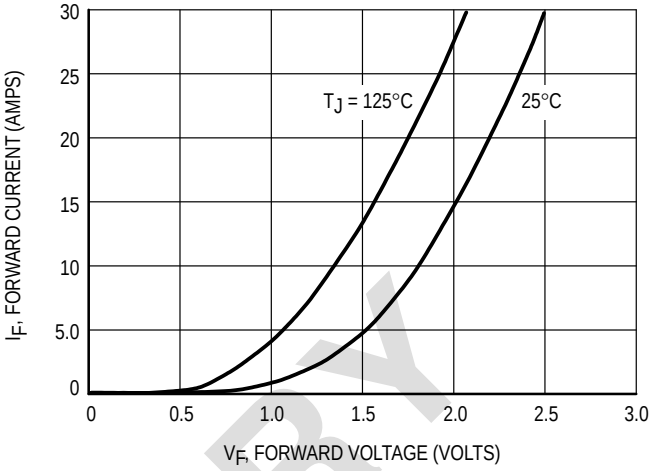


Figure 2. Forward Characteristics — Free–Wheeling Diode

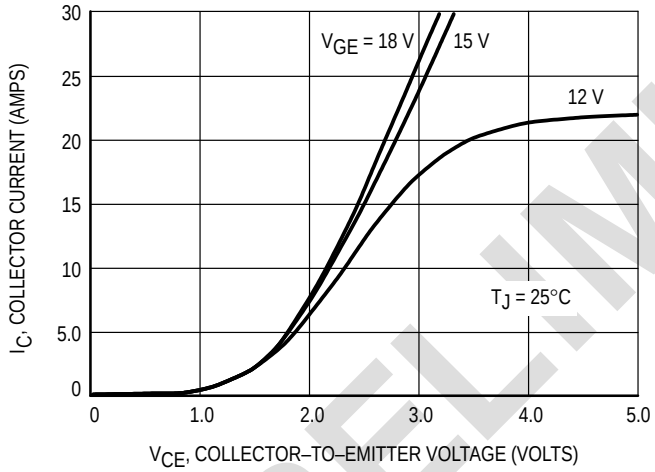


Figure 3. Forward Characteristics, T_J = 25°C

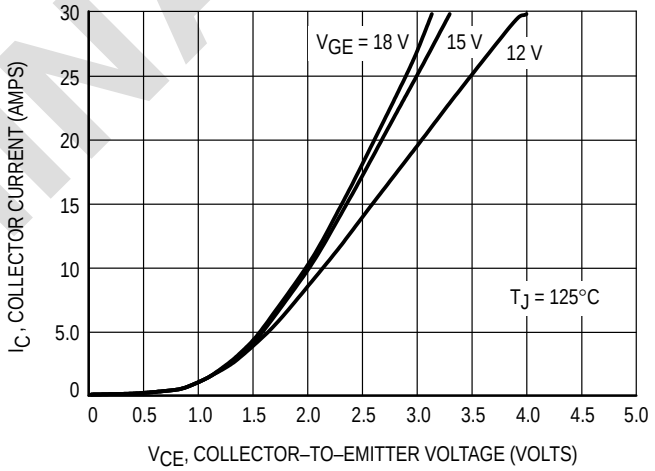


Figure 4. Forward Characteristics, T_J = 125°C

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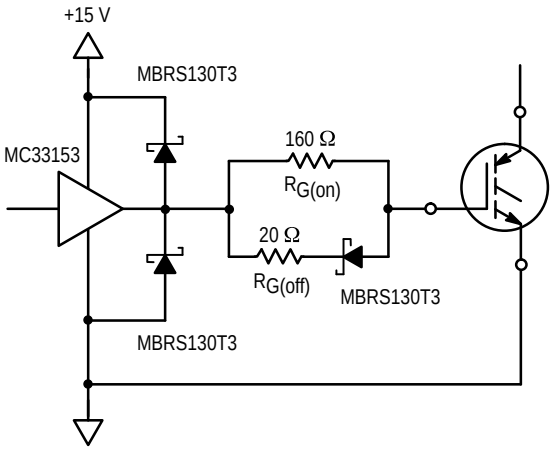


Figure 5. Recommended Gate Drive Circuit

TYPICAL CHARACTERISTICS

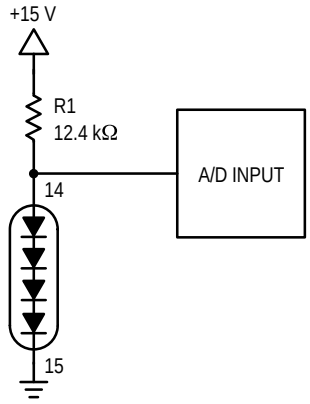


Figure 6. Recommended Temperature Sense Bias Circuit

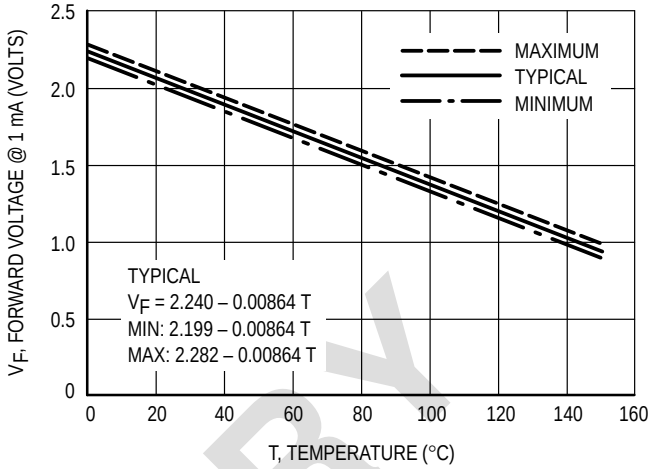


Figure 7. BAV99LT1 Temperature Sense Diode Performance: $V_F = 2.59 – 7.31E–3\ T_C$

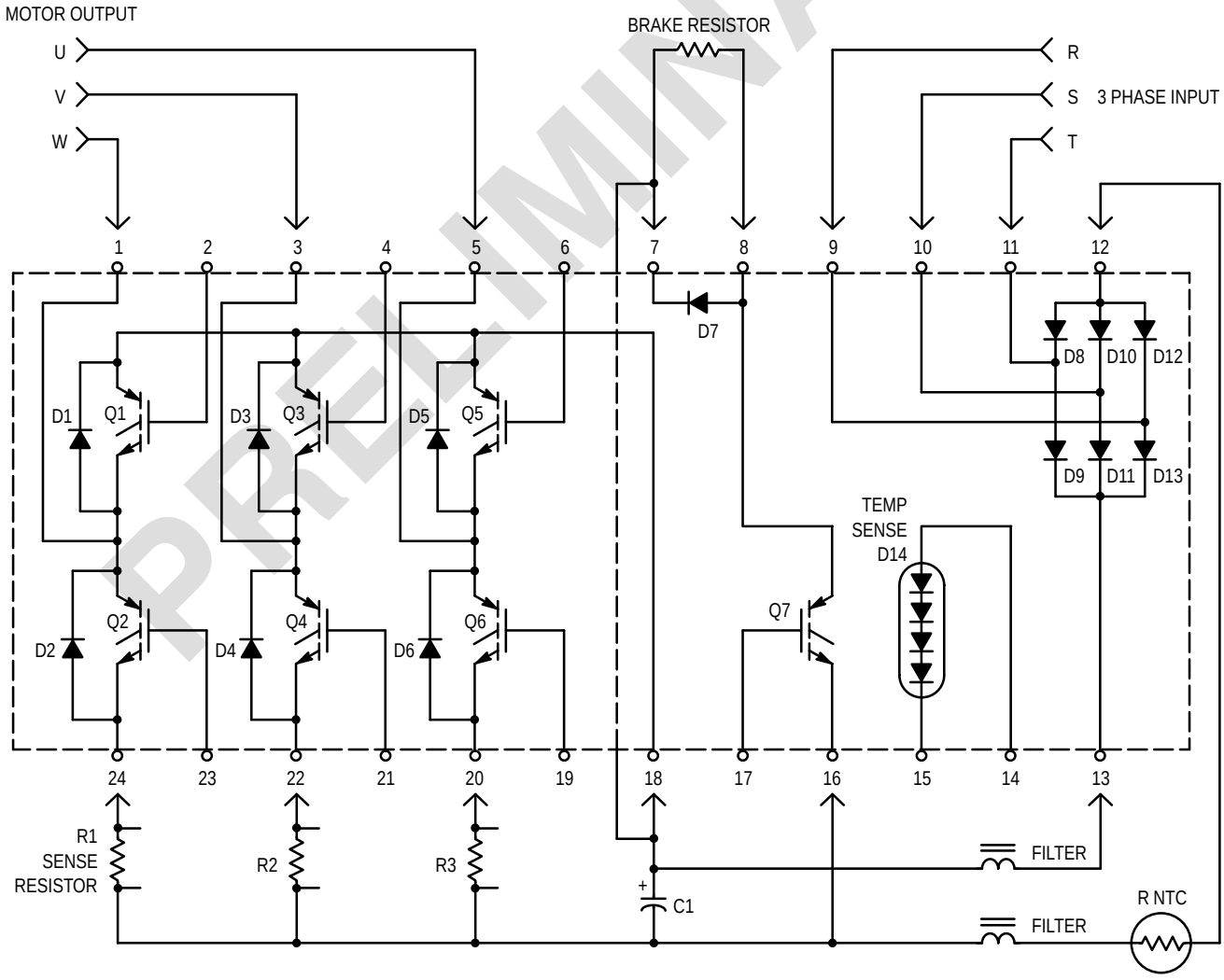
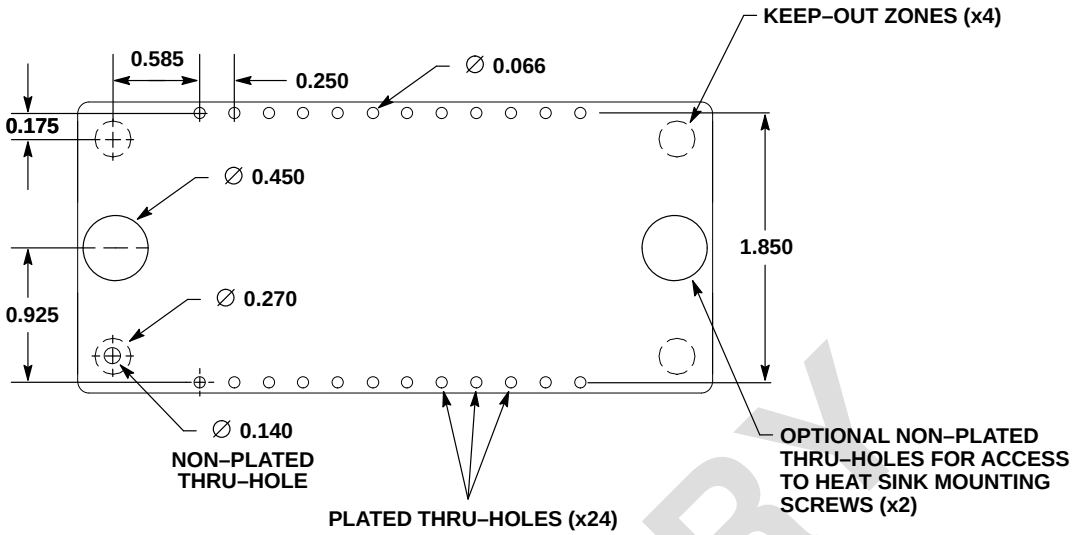


Figure 8. Schematic of Module, Showing Pin–Out and External Connections

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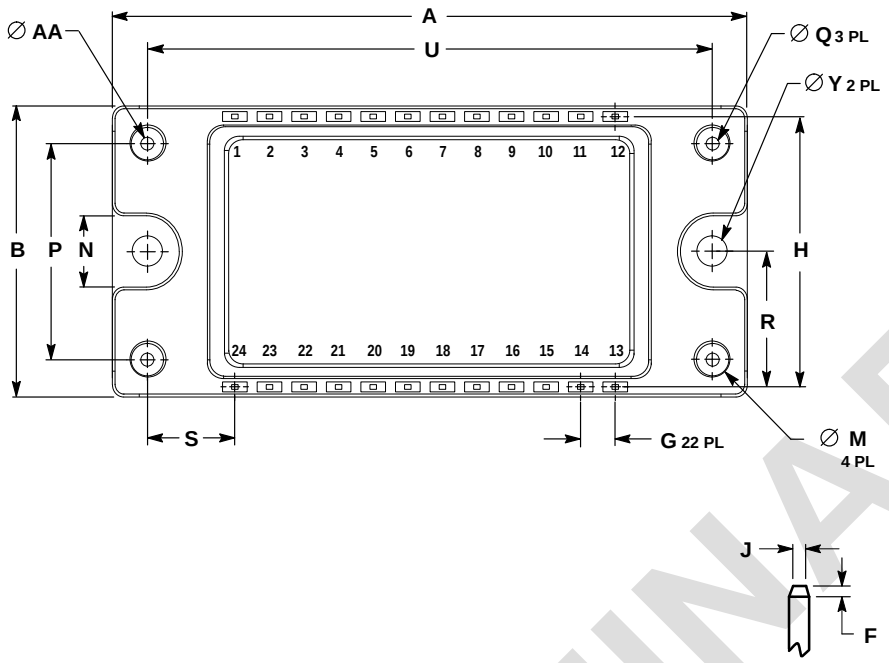


NOTES:
1. Package is symmetrical, except for a polarizing plastic post near pin 1, indicated by a non–plated thru–hole in the footprint.
2. Dimension of plated thru–holes indicates finished hole size after plating.
3. Access holes for mounting screws may or may not be necessary depending on assembly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

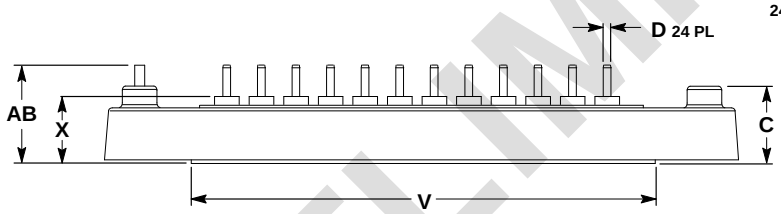
Figure 9. Package Footprint (Dimensions in Inches)

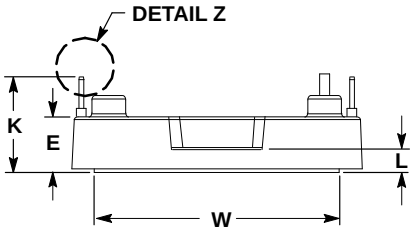
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PACKAGE DIMENSIONS



DETAIL Z
24 PL





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. LEAD LOCATION DIMENSIONS (ie: P, Q, R, S...) ARE TO THE CENTER OF THE LEAD.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	111.51	112.52	4.390	4.430
B	50.93	51.94	2.005	2.045
C	12.32	13.59	0.485	0.535
D	0.89	1.65	0.035	0.065
E	8.64	9.65	0.340	0.380
F	0.13	0.64	0.005	0.025
G	5.97	6.73	0.235	0.265
H	46.48	47.50	1.830	1.870
J	0.41	1.22	0.016	0.048
K	16.26	17.27	0.640	0.680
L	3.71	4.72	0.146	0.186
M	5.46	6.48	0.215	0.255
N	10.92	11.94	0.430	0.470
P	37.60	38.60	1.480	1.520
Q	2.01	2.62	0.079	0.103
R	23.24	23.75	0.915	0.935
S	14.35	15.37	0.565	0.605
U	99.10	100.08	3.900	3.940
V	81.28	82.55	3.200	3.240
W	42.67	43.69	1.680	1.720
Y	5.15	5.77	0.203	0.227
X	11.30	12.07	0.445	0.475
AA	2.01	2.72	0.079	0.107
AB	16.26	17.27	0.640	0.680

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