Product Preview

Hybrid Power Module

Integrated Power Stage for 230 VAC Motor Drive

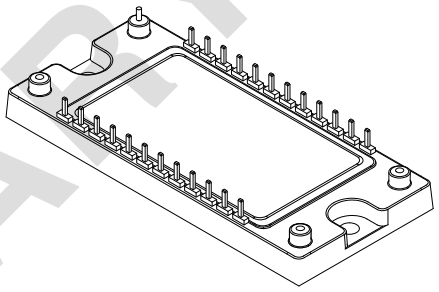
MHPM7A10E60DC3

Motorola Preferred Device

10 AMP, 600 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 1.0 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 μs @ 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



CASE 464D–01
ISSUE O

ORDERING INFORMATION

Device	Voltage Rating	Current Rating	Equivalent Horsepower
PHPM7A10E60DC3	600	10	1.0

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
IGBT Reverse Voltage	V_{CES}	600	V
Gate-Emitter Voltage	V_{GES}	±20	V
Continuous IGBT Collector Current (T_C = 80°C)	I_{Cmax}	10	A
Repetitive Peak IGBT Collector Current (1)	$I_{C(pk)}$	20	A
Continuous Free–Wheeling Diode Current (T_C = 25°C)	I_{Fmax}	10	A
Continuous Free–Wheeling Diode Current (T_C = 80°C)	I_{F80}	6.0	A
Repetitive Peak Free–Wheeling Diode Current (1)	$I_{F(pk)}$	20	A
Average Converter Output Current (Peak–to–Average ratio of 10, T_C = 95°C)	I_{Omax}	20	A
IGBT Power Dissipation per die (T_C = 95°C)	P_D	17	W
Free–Wheeling Diode Power Dissipation per die (T_C = 95°C)	P_D	9.1	W
Junction Temperature Range	T_J	–40 to +150	°C
Short Circuit Duration (V_{CE} = 400 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) 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.

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 = 10 A)	V_F	—	0.92	1.1	V
Gate–Emitter Leakage Current (V_{CE} = 0 V, V_{GE} = ±20 V)	I_{GES}	—	—	±20	μA
Collector–Emitter Leakage Current (V_{CE} = 600 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)	$V_{(BR)CES}$	600	—	—	V
Collector–Emitter Saturation Voltage (I_C = I_{Cmax}, V_{GE} = 15 V)	$V_{CE(sat)}$	—	2.0	2.4	V
Free–Wheeling Diode Forward Voltage (I_F = I_{Fmax}, V_{GE} = 0 V)	V_F	1.7	2.0	2.3	V
Input Capacitance (V_{GE} = 0 V, V_{CE} = 25 V, f = 1.0 MHz)	C_{ies}	—	1020	—	pF
Input Gate Charge (V_{CE} = 300 V, I_C = I_{Cmax}, V_{GE} = 15 V)	Q_T	—	57	—	nC
THERMAL CHARACTERISTICS, EACH DIE					
Thermal Resistance — IGBT	$R_{\theta JC}$	—	2.6	3.2	°C/W
Thermal Resistance — Free–Wheeling (Fast Soft) Diode	$R_{\theta JC}$	—	4.8	6.0	°C/W
Thermal Resistance — Input Rectifier	$R_{\theta JC}$	—	3.4	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

TYPICAL CHARACTERISTICS

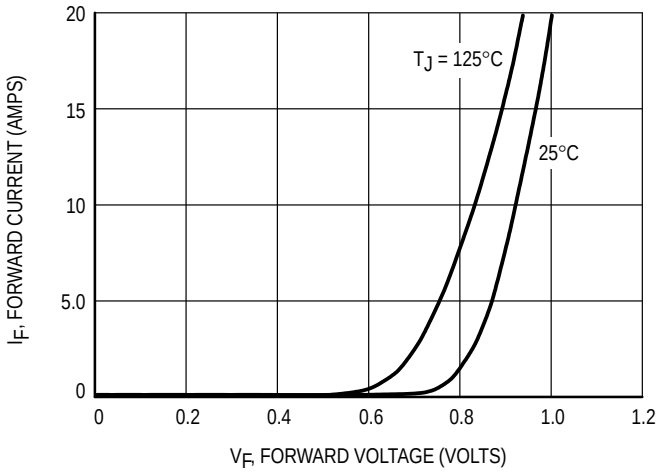


Figure 1. Forward Characteristics — Input Rectifier

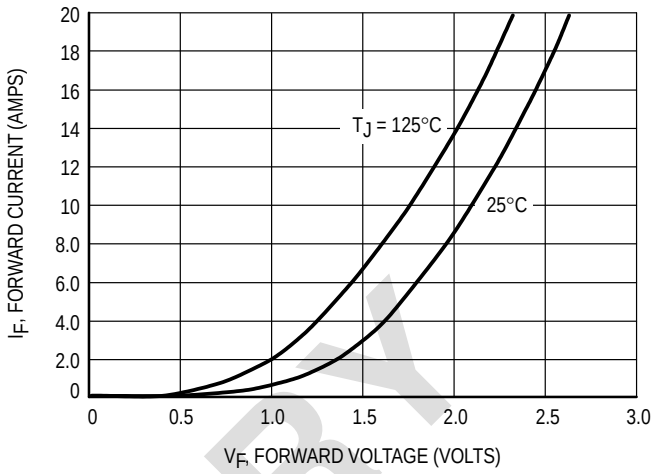


Figure 2. Forward Characteristics — Free–Wheeling Diode

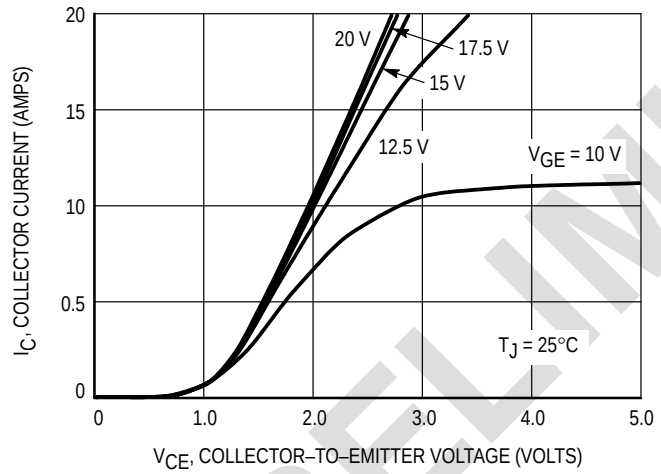


Figure 3. Forward Characteristics, T_J = 25°C

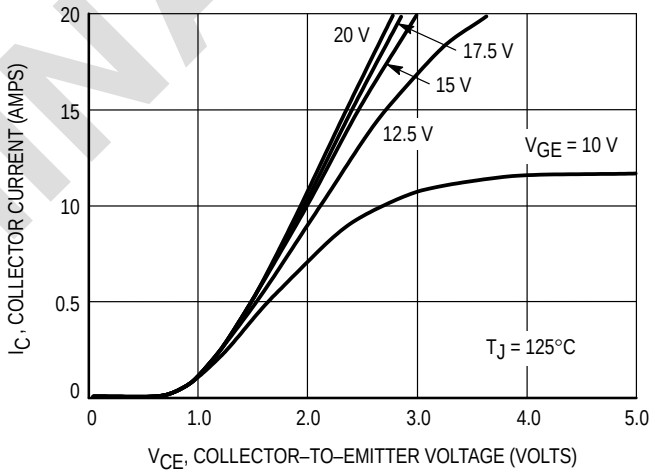


Figure 4. Forward Characteristics, T_J = 125°C

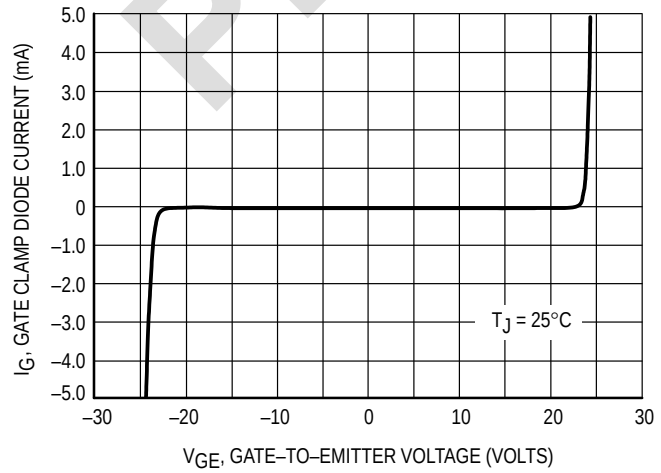


Figure 5. Gate–Emitter Zener Diode Clamp Characteristic

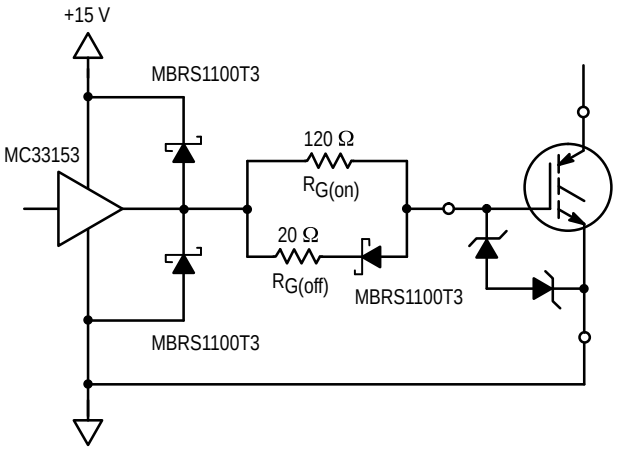


Figure 6. Recommended Gate Drive Circuit

TYPICAL CHARACTERISTICS

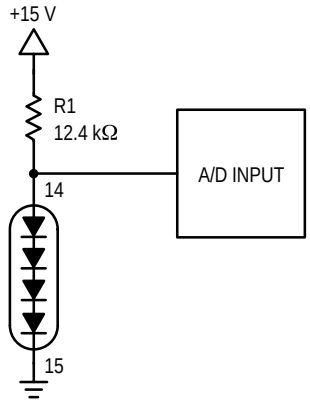


Figure 7. Recommended Temperature Sense Bias Circuit

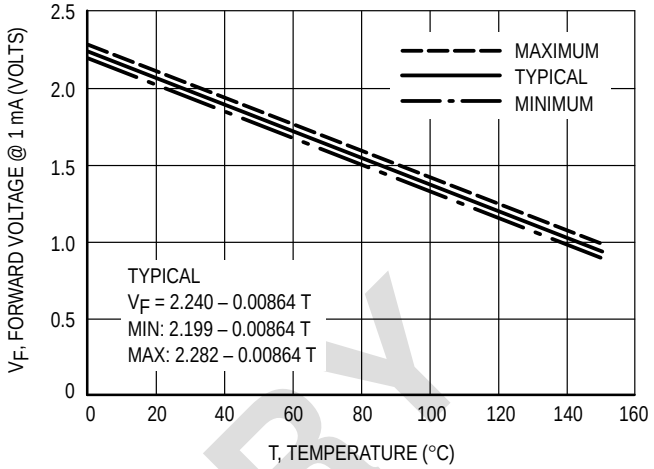


Figure 8. BAV99LT1 Temperature Sense Diode Performance: $V_F = 2.59 – 7.31E–3\ T_C$

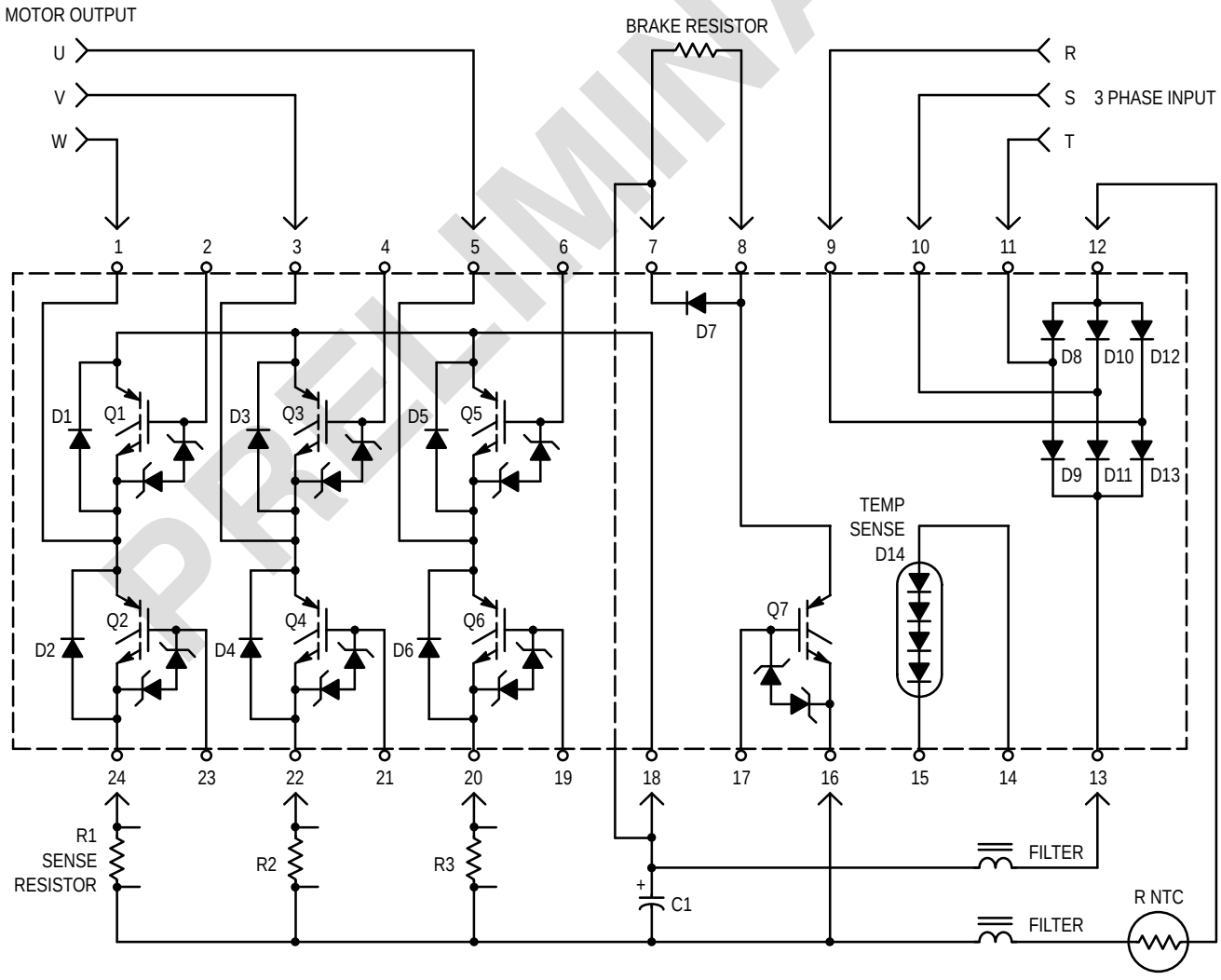
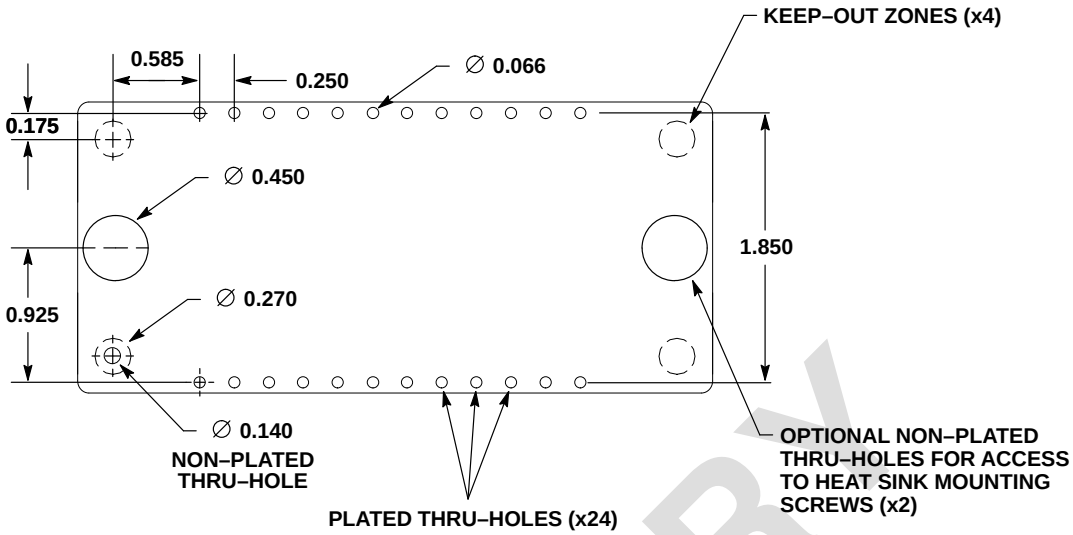


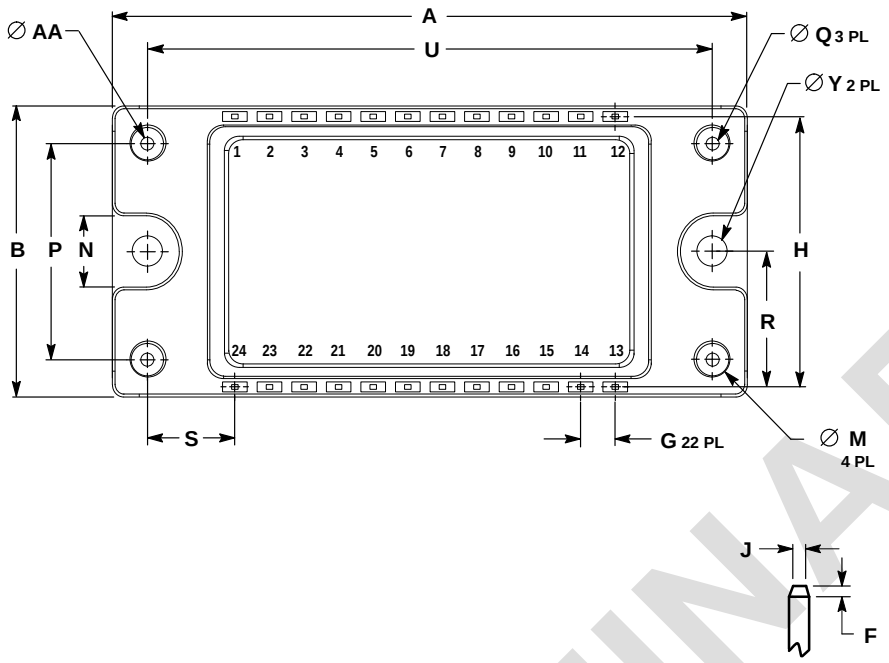
Figure 9. Schematic of Module, Showing Pin–Out and External Connections



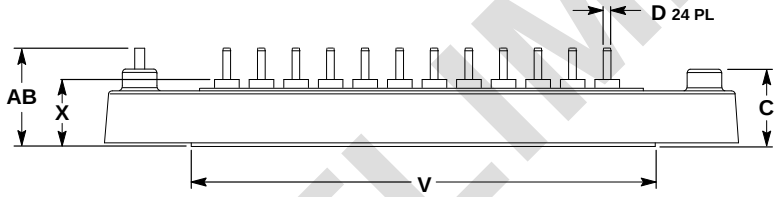
NOTES:
1. Package is symmetrical, except for a polarizing plastic post near pin 1, indicated by a non–plated thru–hole in the footprint.
2. Dimension of plated thru–holes indicates finished hole size after plating.
3. Access holes for mounting screws may or may not be necessary depending on assembly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

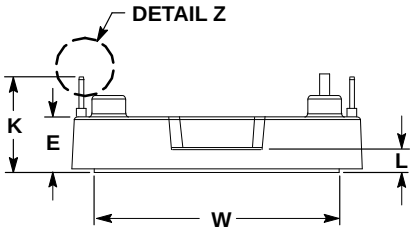
Figure 10. Package Footprint (Dimensions in Inches)

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

CASE 464D–01
ISSUE O

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/