

# M4N37

## 6-Pin DIP Optoisolators Transistor Output

The M4N37 device consists of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Current Transfer Ratio — 100% Minimum @ Specified Conditions
- Guaranteed Switching Speeds
- Meets or Exceeds All JEDEC Registered Specifications

### Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- Regulation Feedback Circuits
- Monitor & Detection Circuits
- Solid State Relays

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
<b>INPUT LED</b>			
Reverse Voltage	$V_R$	6	Volts
Forward Current — Continuous	$I_F$	60	mA
LED Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Output Detector Derate above $25^\circ\text{C}$	$P_D$	100	mW
		1.41	mW/ $^\circ\text{C}$

### OUTPUT TRANSISTOR

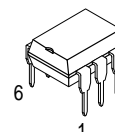
Collector-Emitter Voltage	$V_{CEO}$	30	Volts
Emitter-Base Voltage	$V_{EBO}$	7	Volts
Collector-Base Voltage	$V_{CBO}$	70	Volts
Collector Current — Continuous	$I_C$	50	mA
Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Input LED Derate above $25^\circ\text{C}$	$P_D$	150	mW
		1.76	mW/ $^\circ\text{C}$

### TOTAL DEVICE

Isolation Source Voltage <sup>(1)</sup> (Peak ac Voltage, 60 Hz, 1 sec Duration)	$V_{ISO}$	7500	Vac(pk)
Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250	mW
		2.94	mW/ $^\circ\text{C}$
Ambient Operating Temperature Range <sup>(2)</sup>	$T_A$	-55 to +100	$^\circ\text{C}$
Storage Temperature Range <sup>(2)</sup>	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Soldering Temperature (10 sec, 1/16" from case)	$T_L$	260	$^\circ\text{C}$

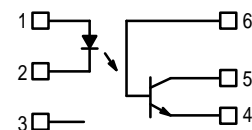
1. Isolation surge voltage is an internal device dielectric breakdown rating.  
For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.
2. Refer to Quality and Reliability Section in Opto Data Book for information on test conditions.

### STYLE 1 PLASTIC



### STANDARD THRU HOLE

### SCHEMATIC



- PIN 1. LED ANODE  
2. LED CATHODE  
3. N.C.  
4. EMITTER  
5. COLLECTOR  
6. BASE

# M4N37

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)<sup>(1)</sup>

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
<b>INPUT LED</b>					
Forward Voltage ( $I_F = 10\text{ mA}$ ) $T_A = 25^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$V_F$	0.8 0.9 0.7	1.15 1.3 1.05	1.5 1.7 1.4	Volts
Reverse Leakage Current ( $V_R = 6\text{ V}$ )	$I_R$	—	—	10	$\mu\text{A}$
Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ )	$C_J$	—	18	—	pF

## OUTPUT TRANSISTOR

Collector–Emitter Dark Current ( $V_{CE} = 10\text{ V}$ , $T_A = 25^\circ\text{C}$ ) ( $V_{CE} = 30\text{ V}$ , $T_A = 100^\circ\text{C}$ )	$I_{CEO}$	— —	1 —	50 500	nA $\mu\text{A}$
Collector–Base Dark Current ( $V_{CB} = 10\text{ V}$ ) $T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$I_{CBO}$	—	0.2 100	20 —	nA
Collector–Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$V_{(BR)CEO}$	30	45	—	Volts
Collector–Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{A}$ )	$V_{(BR)CBO}$	70	100	—	Volts
Emitter–Base Breakdown Voltage ( $I_E = 100\text{ }\mu\text{A}$ )	$V_{(BR)EBO}$	7	7.8	—	Volts
DC Current Gain ( $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ )	$h_{FE}$	—	400	—	—
Collector–Emitter Capacitance ( $f = 1\text{ MHz}$ , $V_{CE} = 0$ )	$C_{CE}$	—	7	—	pF
Collector–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{CB} = 0$ )	$C_{CB}$	—	19	—	pF
Emitter–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{EB} = 0$ )	$C_{EB}$	—	9	—	pF

## COUPLED

Output Collector Current ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ ) $T_A = 25^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$I_C\text{ (CTR)}^{(2)}$	10 (100) 4 (40) 4 (40)	30 (300) — —	— — —	mA (%)
Collector–Emitter Saturation Voltage ( $I_C = 0.5\text{ mA}$ , $I_F = 10\text{ mA}$ )	$V_{CE(sat)}$	—	0.14	0.3	Volts
Turn–On Time	$(I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_{on}$	—	7.5	$\mu\text{s}$
Turn–Off Time		$t_{off}$	—	5.7	
Rise Time		$t_r$	—	3.2	
Fall Time		$t_f$	—	4.7	
Isolation Voltage ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ )	$V_{ISO}$	7500	—	—	Vac(pk)
Isolation Current <sup>(4)</sup> ( $V_{I-O} = 1500\text{ Vpk}$ )	$I_{ISO}$	—	8	100	$\mu\text{A}$
Isolation Resistance ( $V = 500\text{ V}$ ) <sup>(4)</sup>	$R_{ISO}$	$10^{11}$	—	—	$\Omega$
Isolation Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ ) <sup>(4)</sup>	$C_{ISO}$	—	0.2	2	pF

1. Always design to the specified minimum/maximum electrical limits (where applicable).

2. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .

3. For test circuit setup and waveforms, refer to Figure 14.

4. For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.

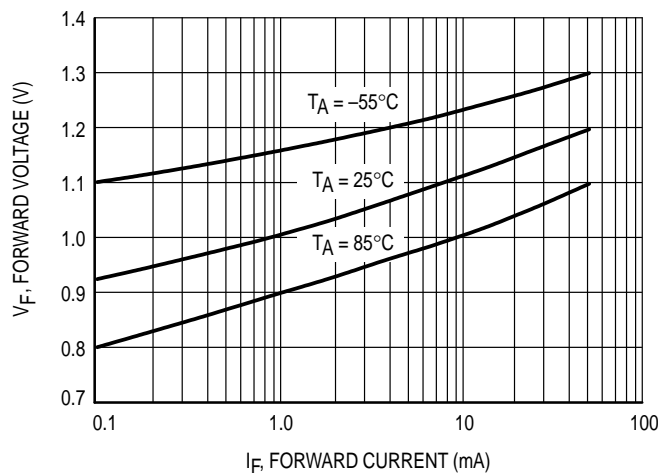
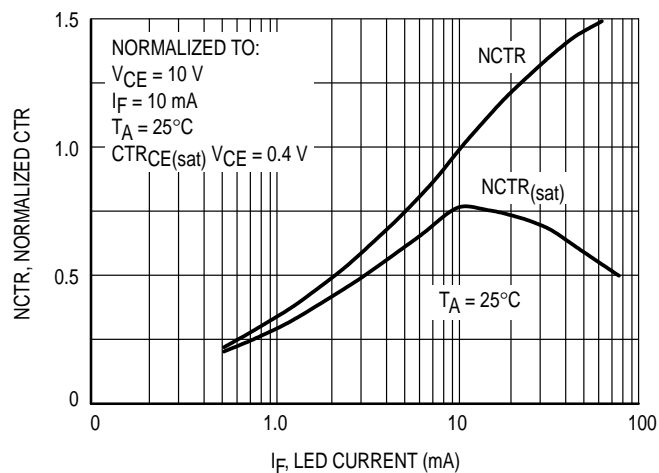
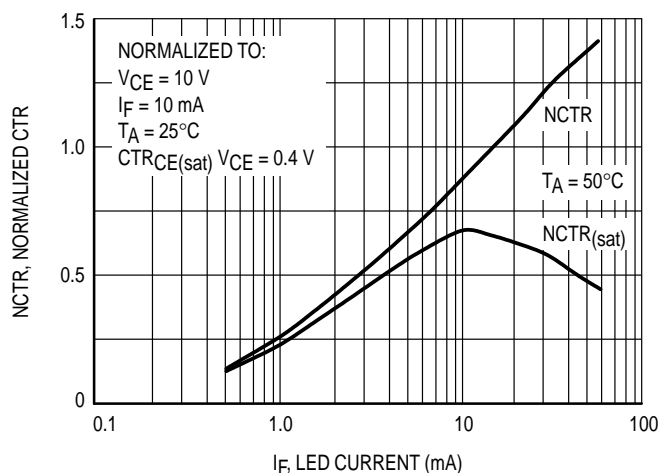
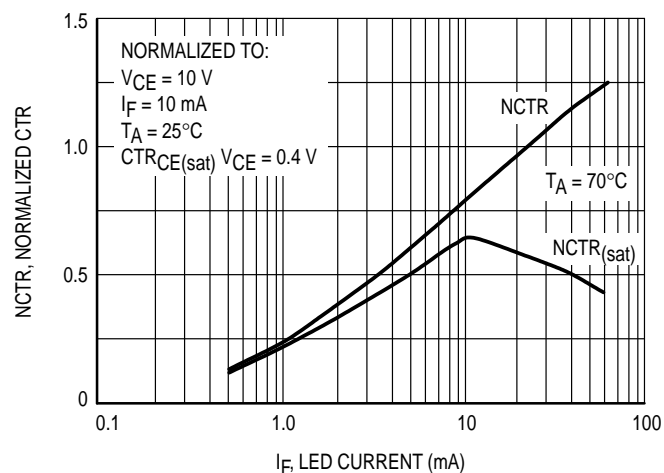
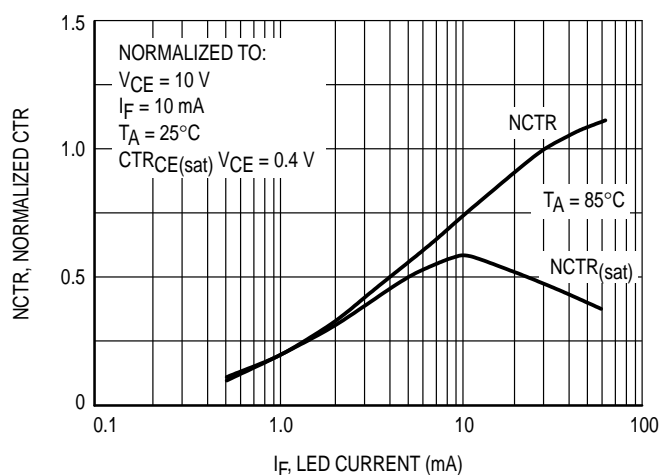
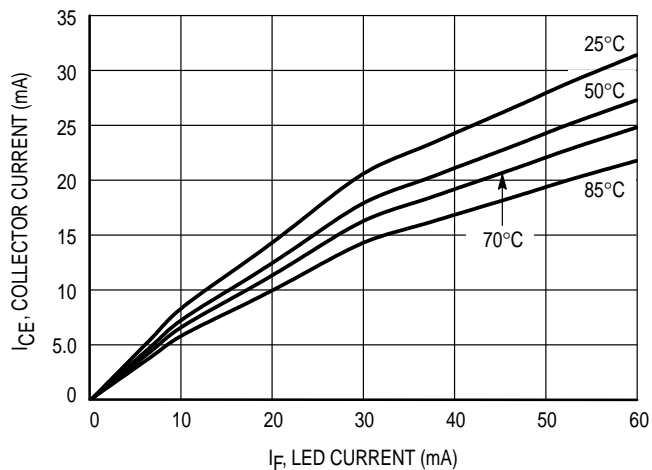
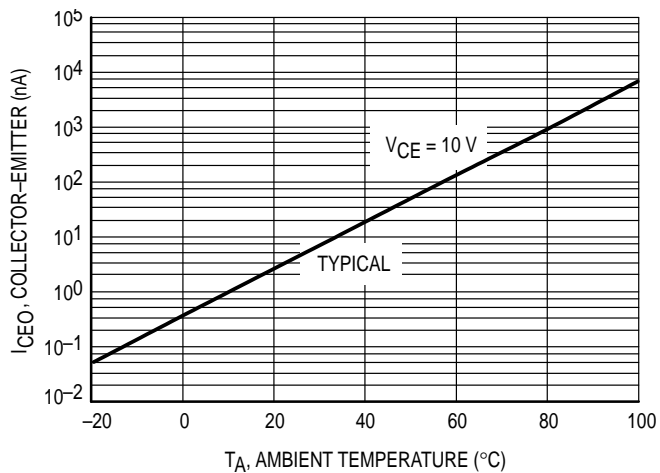


Figure 1. Forward Voltage vs. Forward Current

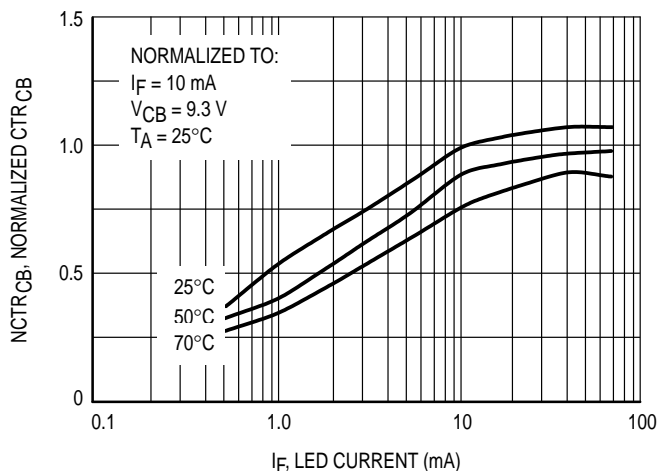
Figure 2. Normalized Non-Saturated and Saturated CTR,  $T_A = 25^\circ\text{C}$  vs. LED CurrentFigure 3. Normalized Non-Saturated and Saturated CTR,  $T_A = 50^\circ\text{C}$  vs. LED CurrentFigure 4. Normalized Non-Saturated and Saturated CTR,  $T_A = 70^\circ\text{C}$  vs. LED CurrentFigure 5. Normalized Non-Saturated and Saturated CTR,  $T_A = 85^\circ\text{C}$  vs. LED Current



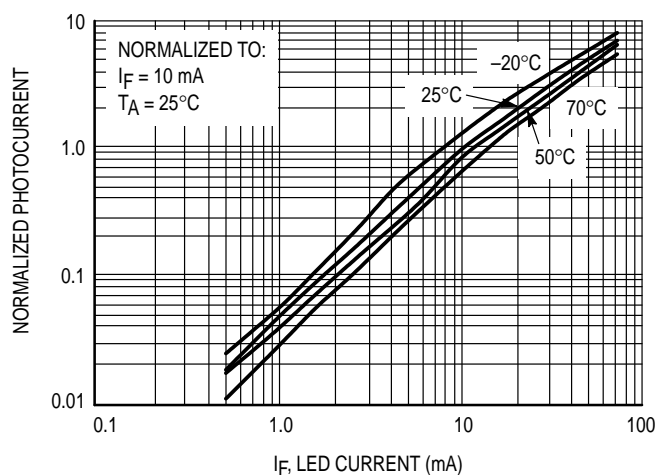
**Figure 6. Collector-Emitter Current vs. Temperature and LED Current**



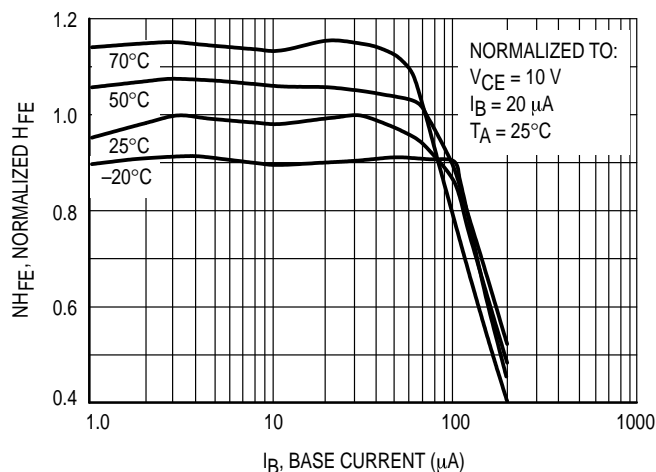
**Figure 7. Collector-Emitter Leakage Current vs. Temperature**



**Figure 8. Normalized CTRcb vs. LED Current and Temperature**



**Figure 9. Normalized Photocurrent vs.  $I_F$  and Temperature**



**Figure 10. Normalized Non-Saturated  $H_{FE}$  vs. Base Current and Temperature**

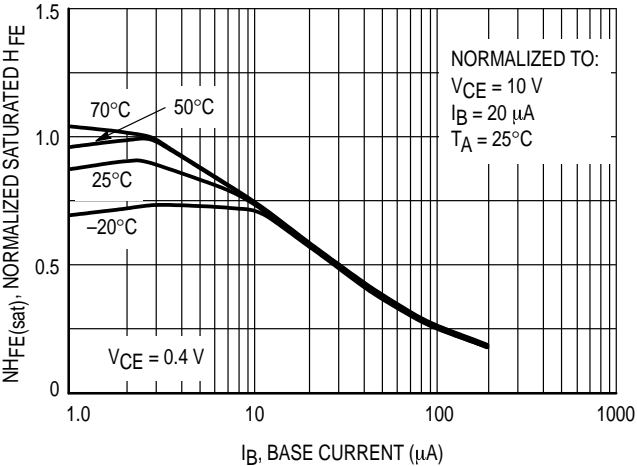


Figure 11. Normalized  $H_{FE}$  vs. Base Current and Temperature

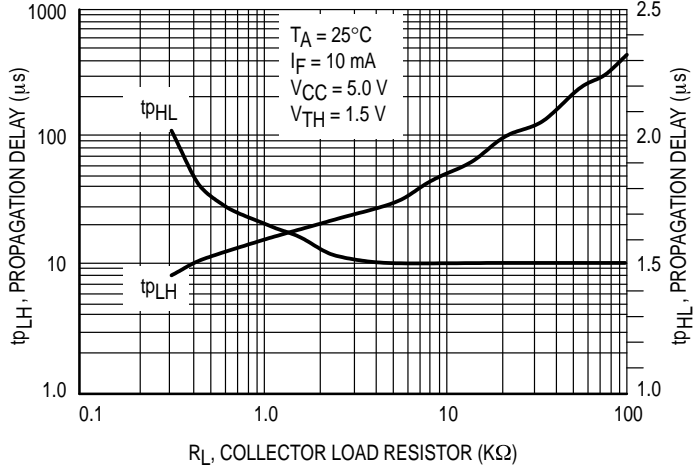


Figure 12. Propagation Delay vs. Collector Load Resistor

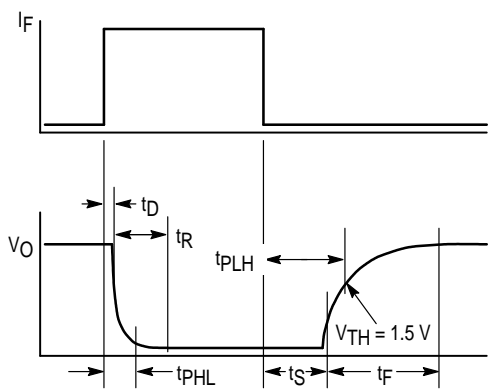


Figure 13. Switching Timing

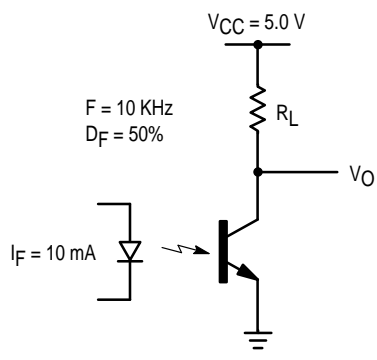
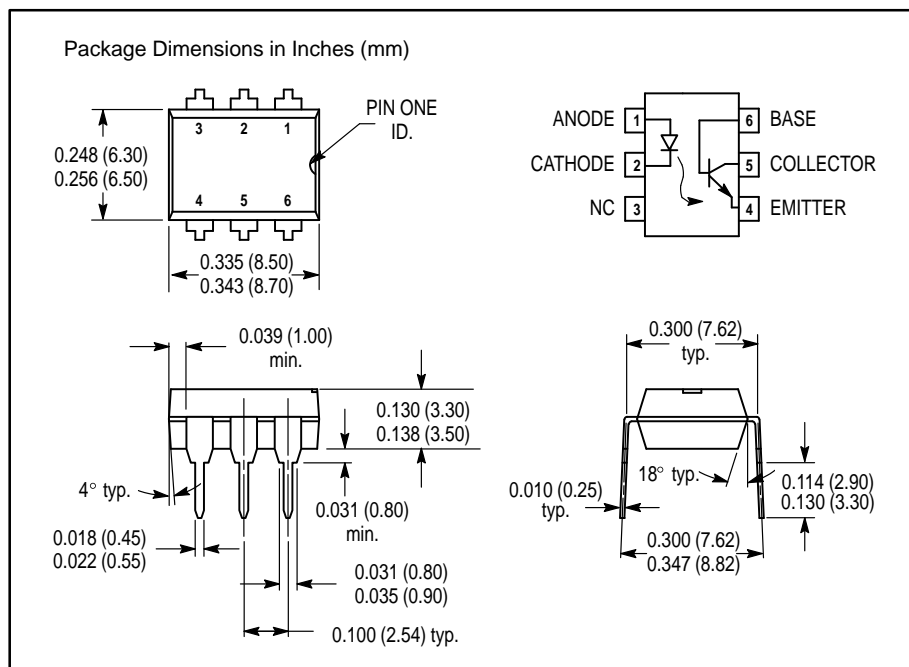



Figure 14. Switching Schematic



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. 303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,  
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609  
– US & Canada ONLY 1-800-774-1848

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

**INTERNET:** <http://www.mot.com/SPS/>



**MOTOROLA**

