



## 6-Pin DIP Optoisolators Transistor Output

The 4N25A, 4N26, 4N27 and 4N28 devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Most Economical Optoisolator Choice for Medium Speed, Switching Applications
- Meeting or Exceeds All JEDEC Registered Specifications
- **For all devices that are tested and marked per VDE 0884 requirements, the suffix "V" must be included at end of part number. VDE 0884 is a test option.**

### Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- Line Interfacing
- Solid State Relays

### MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
--------	--------	-------	------

#### INPUT LED

Reverse Voltage	V <sub>R</sub>	3	Volts
Forward Current — Continuous	I <sub>F</sub>	60	mA
LED Power Dissipation @ T <sub>A</sub> = 25°C with Negligible Power in Output Detector Derate above 25°C	P <sub>D</sub>	120	mW
		1.41	mW/°C

#### OUTPUT TRANSISTOR

Collector–Emitter Voltage	V <sub>CEO</sub>	30	Volts
Emitter–Collector Voltage	V <sub>ECO</sub>	7	Volts
Collector–Base Voltage	V <sub>CBO</sub>	70	Volts
Collector Current — Continuous	I <sub>C</sub>	150	mA
Detector Power Dissipation @ T <sub>A</sub> = 25°C with Negligible Power in Input LED Derate above 25°C	P <sub>D</sub>	150	mW
		1.76	mW/°C

#### TOTAL DEVICE

Isolation Surge Voltage(1) (Peak ac Voltage, 60 Hz, 1 sec Duration)	V <sub>ISO</sub>	7500	Vac(pk)
Total Device Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	250	mW
		2.94	mW/°C
Ambient Operating Temperature Range(2)	T <sub>A</sub>	–55 to +100	°C
Storage Temperature Range(2)	T <sub>stg</sub>	–55 to +150	°C
Soldering Temperature (10 sec, 1/16" from case)	T <sub>L</sub>	260	°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.

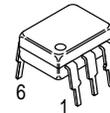
**Preferred** devices are Motorola recommended choices for future use and best overall value. GlobalOptoisolator is a trademark of Motorola, Inc.

**4N25\***  
**4N25A\***  
**4N26\***  
[CTR = 20% Min]  
**4N27**  
**4N28**

[CTR = 10% Min]

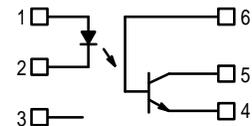
\*Motorola Preferred Devices

### STYLE 1 PLASTIC



STANDARD THRU HOLE  
CASE 730A-04

### SCHEMATIC



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

# 4N25 4N25A 4N26 4N27 4N28

## 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 ( $I_F = 10\text{ mA}$ )	$V_F$	$T_A = 25^\circ\text{C}$	—	1.15	1.5	Volts
		$T_A = -55^\circ\text{C}$	—	1.3	—	
		$T_A = 100^\circ\text{C}$	—	1.05	—	
Reverse Leakage Current ( $V_R = 3\text{ V}$ )	$I_R$	—	—	100	$\mu\text{A}$	
Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ )	$C_J$	—	18	—	pF	

## OUTPUT TRANSISTOR

Collector–Emitter Dark Current ( $V_{CE} = 10\text{ V}$ , $T_A = 25^\circ\text{C}$ )	4N25,25A,26,27	$I_{CEO}$	—	1	50	nA
	4N28		—	1	100	
( $V_{CE} = 10\text{ V}$ , $T_A = 100^\circ\text{C}$ )	All Devices	$I_{CEO}$	—	1	—	$\mu\text{A}$
Collector–Base Dark Current ( $V_{CB} = 10\text{ V}$ )		$I_{CBO}$	—	0.2	—	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–Collector Breakdown Voltage ( $I_E = 100\text{ }\mu\text{A}$ )		$V_{(BR)ECO}$	7	7.8	—	Volts
DC Current Gain ( $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ )		$h_{FE}$	—	500	—	—
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 ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ )	$I_C$ (CTR) <sup>(2)</sup>	2 (20) 1 (10)	7 (70) 5 (50)	— —	mA (%)
4N25,25A,26 4N27,28					
Collector–Emitter Saturation Voltage ( $I_C = 2\text{ mA}$ , $I_F = 50\text{ mA}$ )	$V_{CE(sat)}$	—	0.15	0.5	Volts
Turn–On Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_{on}$	—	2.8	—	$\mu\text{s}$
Turn–Off Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_{off}$	—	4.5	—	$\mu\text{s}$
Rise Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_r$	—	1.2	—	$\mu\text{s}$
Fall Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_f$	—	1.3	—	$\mu\text{s}$
Isolation Voltage ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ ) <sup>(4)</sup>	$V_{ISO}$	7500	—	—	Vac(pk)
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	—	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 11.

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

TYPICAL CHARACTERISTICS

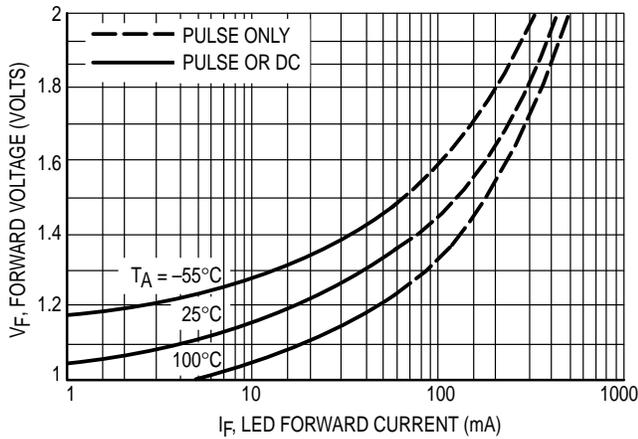


Figure 1. LED Forward Voltage versus Forward Current

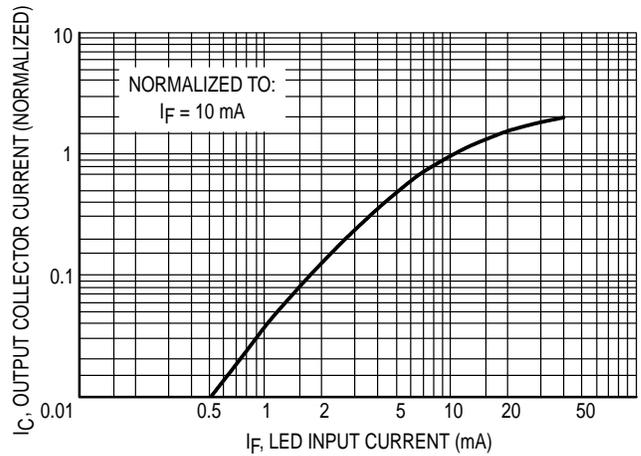


Figure 2. Output Current versus Input Current

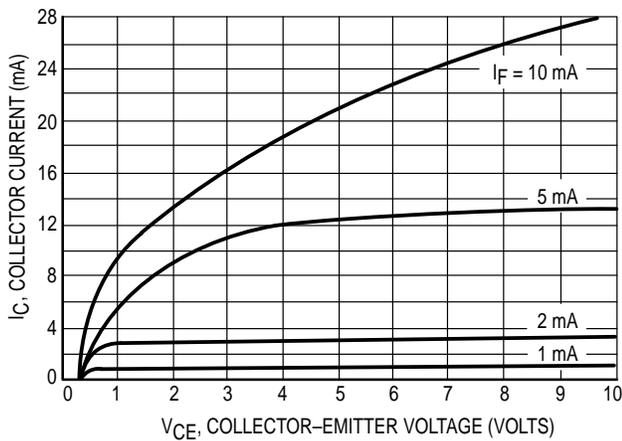


Figure 3. Collector Current versus Collector-Emitter Voltage

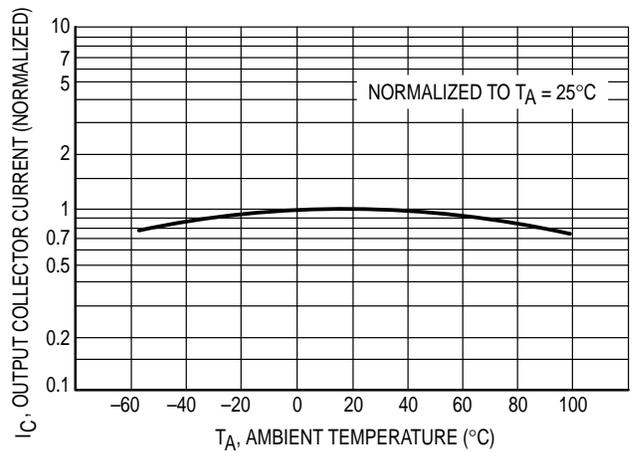


Figure 4. Output Current versus Ambient Temperature

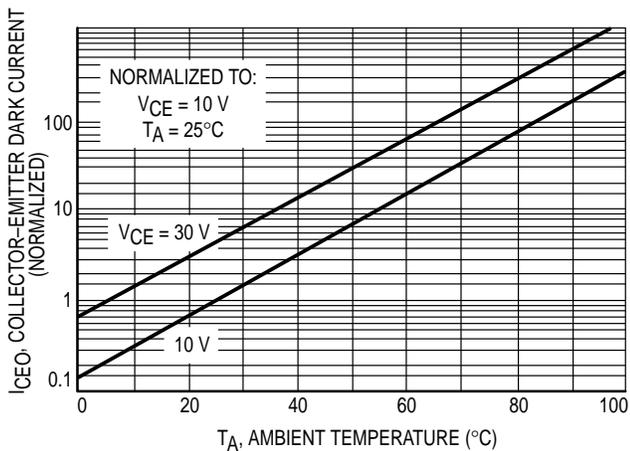


Figure 5. Dark Current versus Ambient Temperature

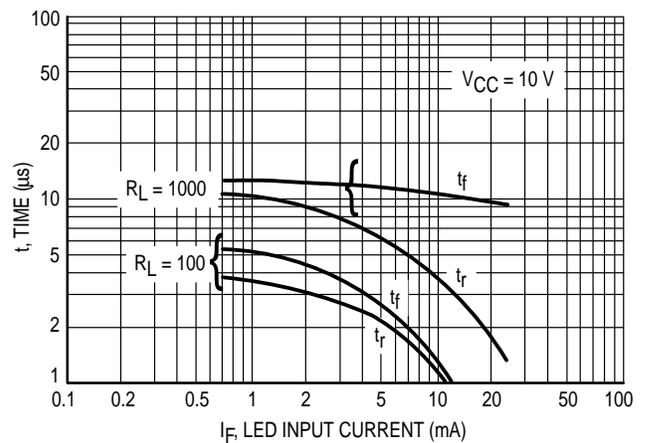
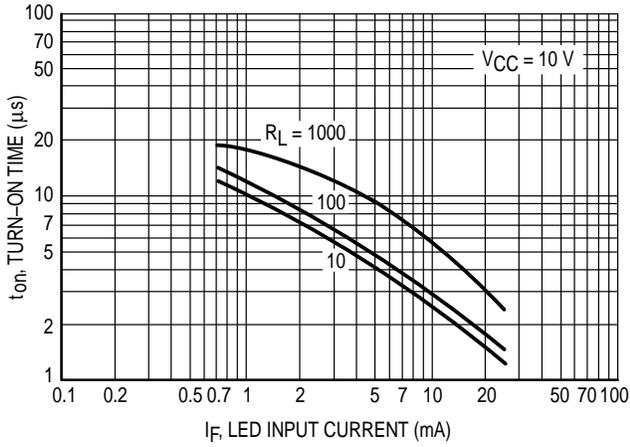
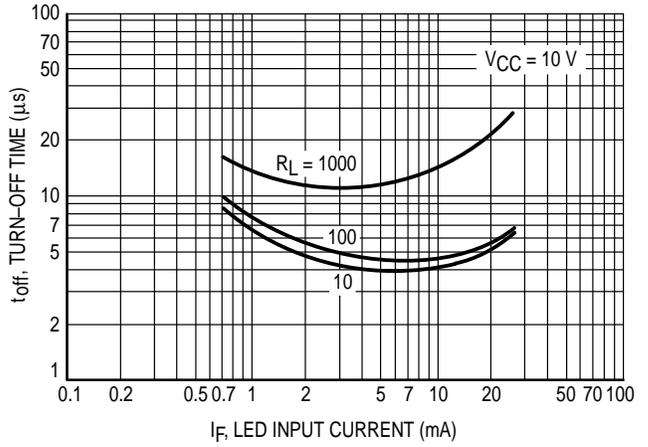


Figure 6. Rise and Fall Times (Typical Values)

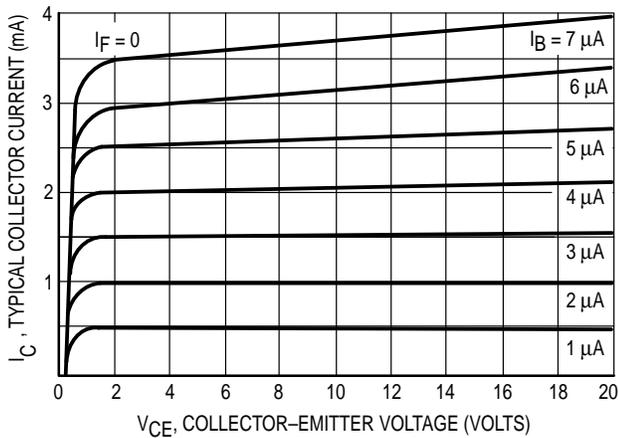
**4N25 4N25A 4N26 4N27 4N28**



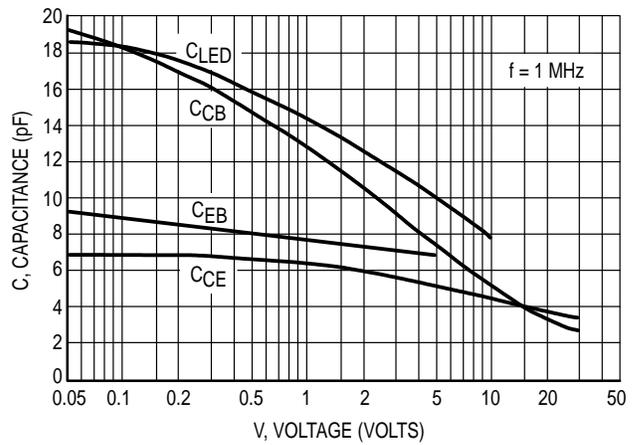
**Figure 7. Turn-On Switching Times (Typical Values)**



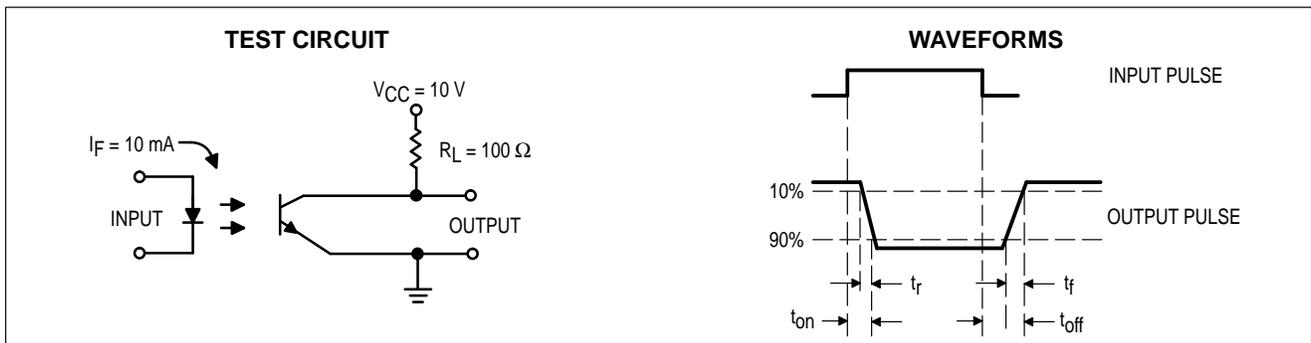
**Figure 8. Turn-Off Switching Times (Typical Values)**



**Figure 9. DC Current Gain (Detector Only)**



**Figure 10. Capacitances versus Voltage**



**Figure 11. Switching Time Test Circuit and Waveforms**

# 4N25 4N25A 4N26 4N27 4N28

## PACKAGE DIMENSIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
J	0.008	0.012	0.21	0.30
K	0.100	0.150	2.54	3.81
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.015	0.100	0.38	2.54

STYLE 1:

- PIN 1. ANODE
- CATHODE
- NC
- EMITTER
- COLLECTOR
- BASE

**CASE 730A-04  
ISSUE G**

NOTES:

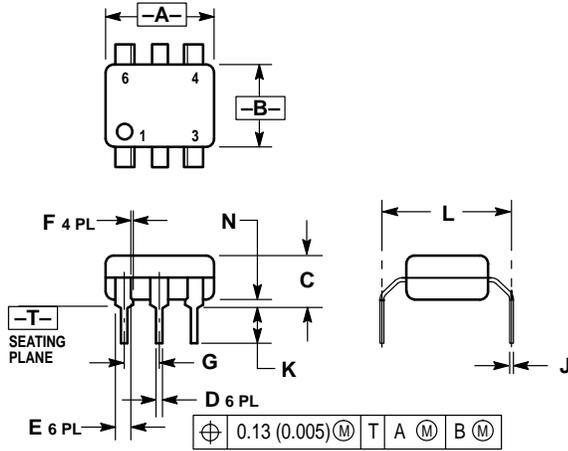
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
H	0.020	0.025	0.51	0.63
J	0.008	0.012	0.20	0.30
K	0.006	0.035	0.16	0.88
L	0.320 BSC		8.13 BSC	
S	0.332	0.390	8.43	9.90

**\*Consult factory for leadform option availability**

**CASE 730C-04  
ISSUE D**

# 4N25 4N25A 4N26 4N27 4N28



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
J	0.008	0.012	0.21	0.30
K	0.100	0.150	2.54	3.81
L	0.400	0.425	10.16	10.80
N	0.015	0.040	0.38	1.02

**\*Consult factory for leadform option availability**

**CASE 730D-05  
ISSUE D**

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 can and do vary in different applications. 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.

**How to reach us:**

**USA / EUROPE:** Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

**MFAX:** RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244-6609  
**INTERNET:** http://Design-NET.com

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

