

# High-Power PNP Silicon Transistors

... designed for use in industrial–military power amplifier and switching circuit applications.

- High Collector–Emitter Sustaining Voltage —  
 $V_{CEO(sus)} = 80 \text{ Vdc (Min)} \text{ — } 2N6436$   
 $= 100 \text{ Vdc (Min)} \text{ — } 2N6437$   
 $= 120 \text{ Vdc (Min)} \text{ — } 2N6438$
- High DC Current Gain —  
 $h_{FE} = 20\text{--}80 @ I_C = 10 \text{ Adc}$   
 $= 12 \text{ (Min)} @ I_C = 25 \text{ Adc}$
- Low Collector–Emitter Saturation Voltage —  
 $V_{CE(sat)} = 1.0 \text{ Vdc (Max)} @ I_C = 10 \text{ Adc}$
- Fast Switching Times @  $I_C = 10 \text{ Adc}$   
 $t_r = 0.3 \mu\text{s (Max)}$   
 $t_s = 1.0 \mu\text{s (Max)}$   
 $t_f = 0.25 \mu\text{s (Max)}$
- Complement to NPN 2N6338 thru 2N6341

## MAXIMUM RATINGS (1)

Rating	Symbol	2N6436	2N6437	2N6438	Unit
Collector–Base Voltage	$V_{CB}$	100	120	140	Vdc
Collector–Emitter Voltage	$V_{CEO}$	80	100	120	Vdc
Emitter–Base Voltage	$V_{EB}$	6.0			Vdc
Collector Current — Continuous Peak	$I_C$	25 50			A dc
Base Current	$I_B$	10			A dc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	200 1.14			Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +200			$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.875	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

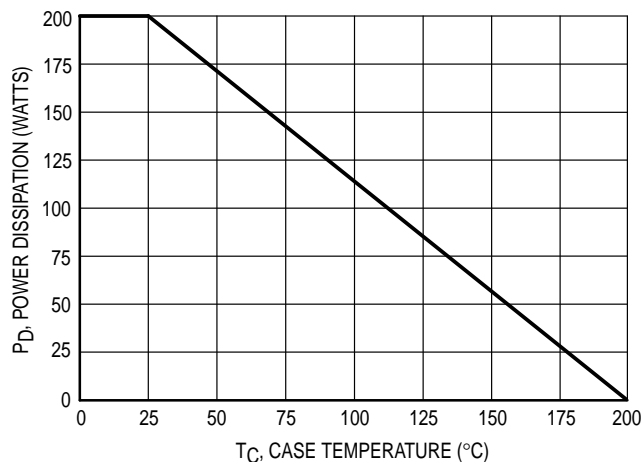


Figure 1. Power Derating

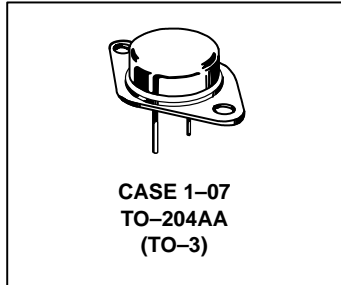
Preferred devices are Motorola recommended choices for future use and best overall value.

REV 7

**2N6436**  
**2N6437**  
**2N6438\***

\*Motorola Preferred Device

**25 AMPERE**  
**POWER TRANSISTORS**  
**PNP SILICON**  
**80, 100, 120 VOLTS**  
**200 WATTS**



# 2N6436 2N6437 2N6438

\*ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage (1) ( $I_C = 50\text{ mAdc}$ , $I_B = 0$ )	2N6436 2N6437 2N6438	$V_{CEO(sus)}$	80 100 120	— — —	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )	2N6436 2N6437 2N6438	$I_{CEO}$	— — —	50 50 50	$\mu\text{Adc}$
Collector Cutoff Current ( $V_{CE} = 90\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ ) ( $V_{CE} = 110\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ ) ( $V_{CE} = 130\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ ) ( $V_{CE} = 100\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ ) ( $V_{CE} = 120\text{ Vdc}$ , $V_{BE(off)} = -1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	2N6436 2N6437 2N6438 2N6436 2N6437 2N6438	$I_{CEX}$	— — — — — —	10 10 10 1.0 1.0 1.0	$\mu\text{Adc}$   mAdc
Collector Cutoff Current ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 120\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 140\text{ Vdc}$ , $I_E = 0$ )	2N6436 2N6437 2N6438	$I_{CBO}$	— — —	10 10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 6.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	100	$\mu\text{Adc}$

## ON CHARACTERISTICS

DC Current Gain (1) ( $I_C = 0.5\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) ( $I_C = 10\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) ( $I_C = 25\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )	$h_{FE}$	30 20 12	— 120 —	—
Collector–Emitter Saturation Voltage (1) ( $I_C = 10\text{ Adc}$ , $I_B = 1.0\text{ Adc}$ ) ( $I_C = 25\text{ Adc}$ , $I_B = 2.5\text{ Adc}$ )	$V_{CE(sat)}$	— —	1.0 1.8	Vdc
Base–Emitter Saturation Voltage (1) ( $I_C = 10\text{ Adc}$ , $I_B = 1.0\text{ Adc}$ ) ( $I_C = 25\text{ Adc}$ , $I_B = 2.5\text{ Adc}$ )	$V_{BE(sat)}$	— —	1.8 2.5	Vdc

## DYNAMIC CHARACTERISTICS

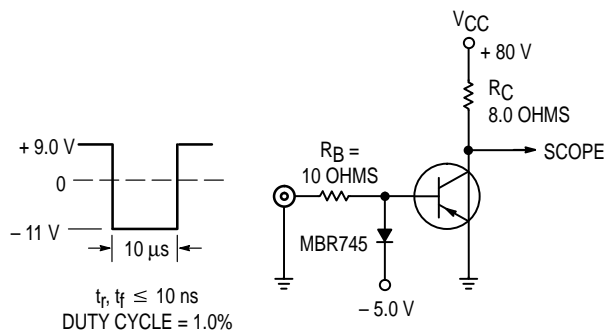
Current–Gain — Bandwidth Product ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ )	$f_T$	40	—	MHz
Output Capacitance ( $V_{CE} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 100\text{ kHz}$ )	$C_{ob}$	—	700	pF

## SWITCHING CHARACTERISTICS

Rise Time ( $V_{CC} = 80\text{ Vdc}$ , $I_C = 10\text{ A}$ , $V_{BE(off)} = 6.0\text{ Vdc}$ , $I_{B1} = 1.0\text{ Adc}$ )	$t_r$	—	0.3	$\mu\text{s}$
Storage ( $V_{CC} = 80\text{ Vdc}$ , $I_C = 10\text{ A}$ , $V_{BE(off)} = 6.0\text{ Vdc}$ , $I_{B1} = I_{B2} = 1.0\text{ Adc}$ )	$t_s$	—	1.0	$\mu\text{s}$
Fall Time ( $V_{CC} = 80\text{ Vdc}$ , $I_C = 10\text{ A}$ , $V_{BE(off)} = 6.0\text{ Vdc}$ , $I_{B1} = I_{B2} = 1.0\text{ Adc}$ )	$t_f$	—	0.25	$\mu\text{s}$

\* Indicates JEDEC Registered Data.

(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .



NOTE: For information on Figures 3 and 6,  $R_B$  and  $R_C$  were varied to obtain desired test conditions.

Figure 2. Switching Time Test Circuit

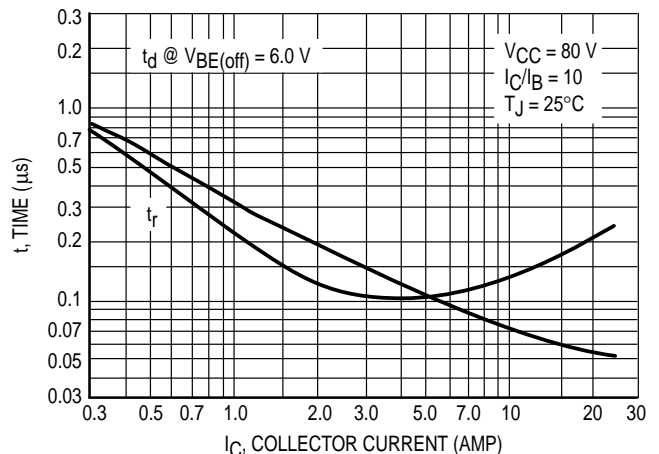


Figure 3. Turn–On Time

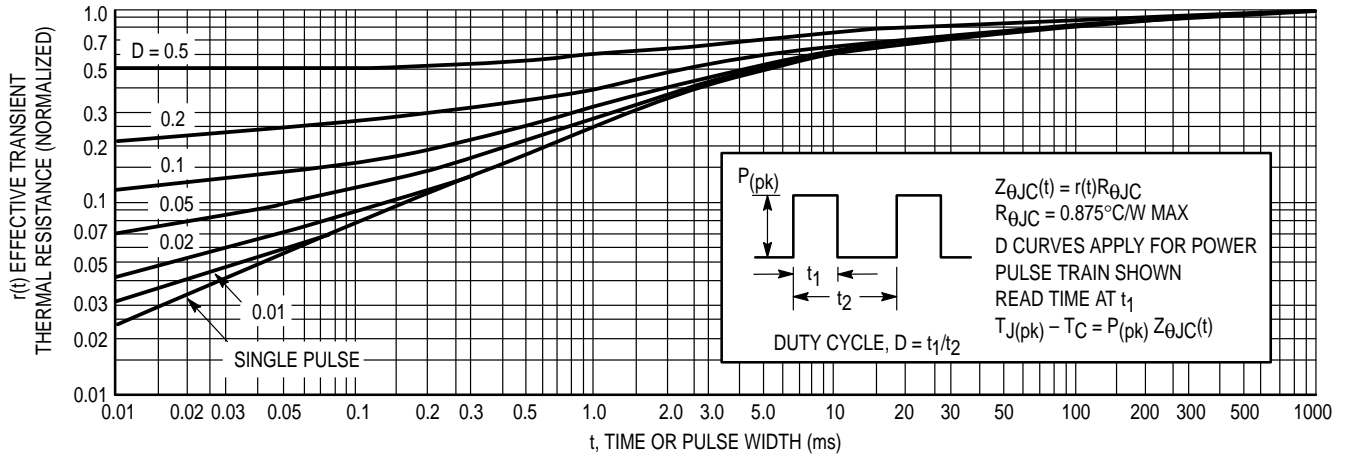


Figure 4. Thermal Response

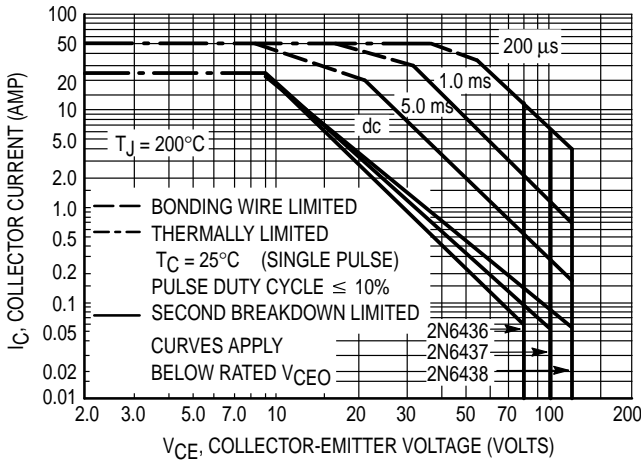


Figure 5. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 200^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

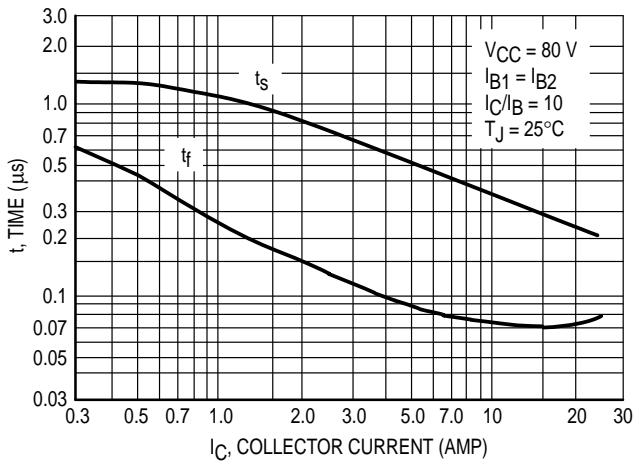


Figure 6. Turn-Off Time

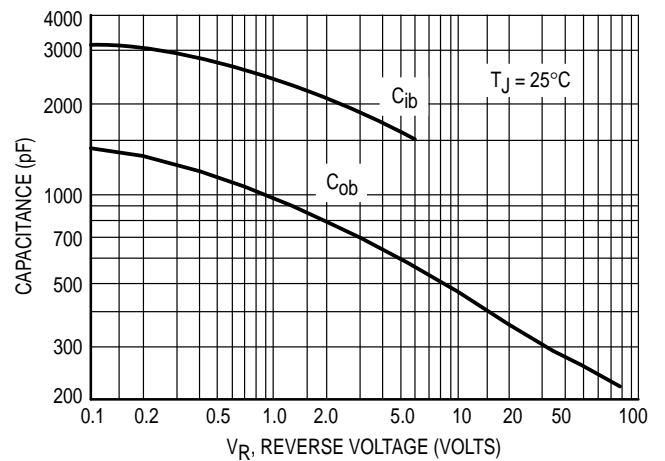


Figure 7. Capacitance

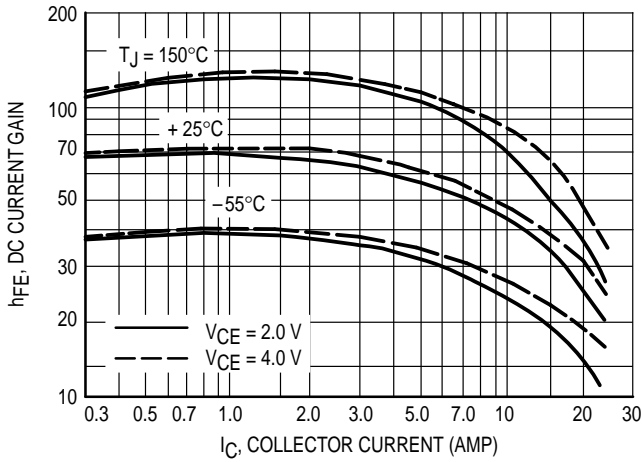


Figure 8. DC Current Gain

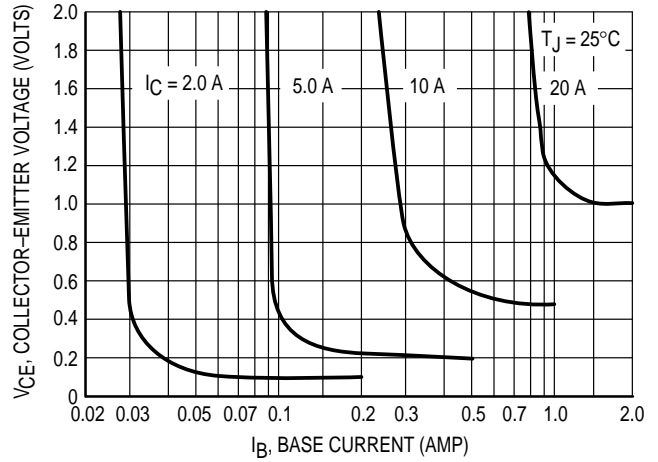


Figure 9. Collector Saturation Region

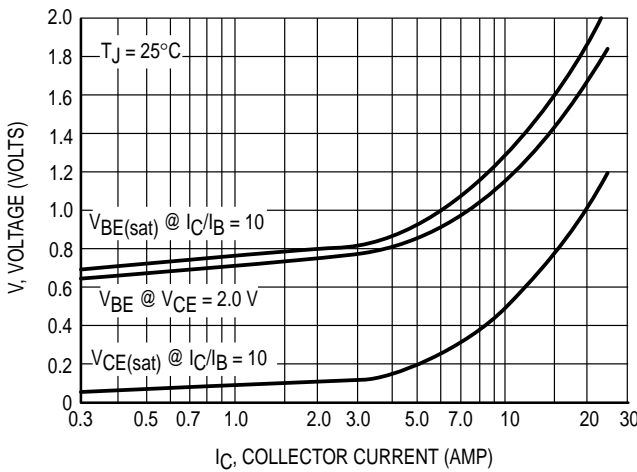


Figure 10. "On" Voltages

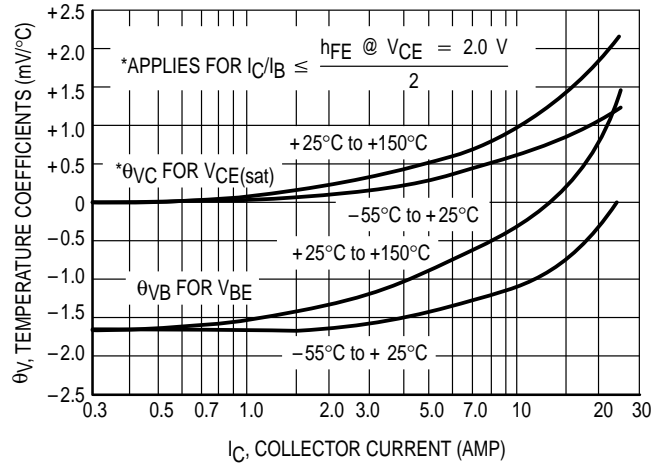


Figure 11. Temperature Coefficients

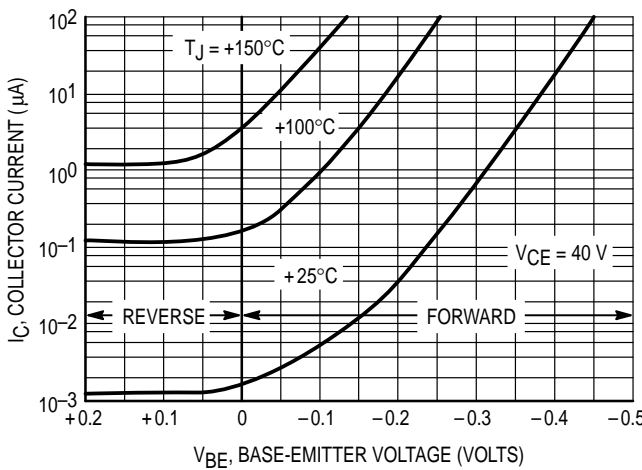


Figure 12. Collector Cut-Off Region

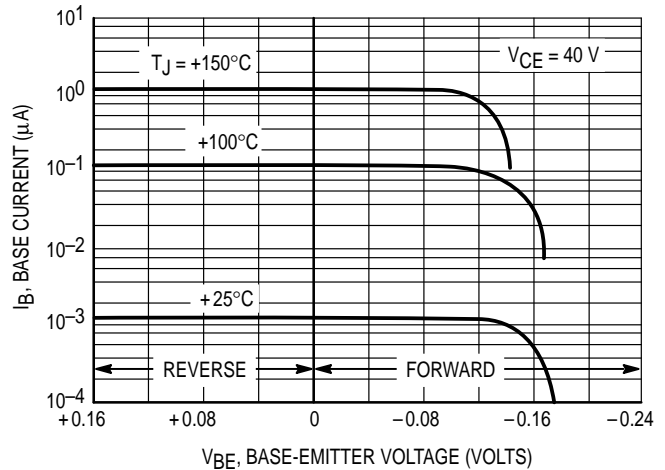
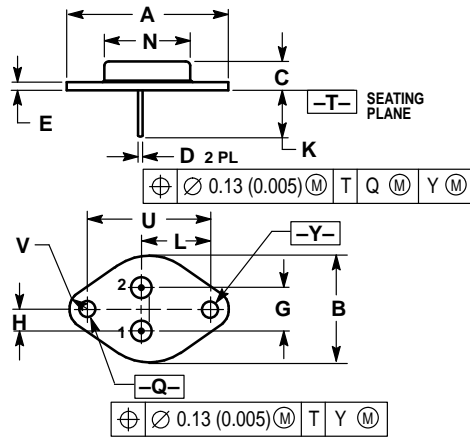


Figure 13. Base Cutoff Region

PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF	—	39.37 REF	—
B	—	1.050	—	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC	—	10.92 BSC	—
H	0.215 BSC	—	5.46 BSC	—
K	0.440	0.480	11.18	12.19
L	0.665 BSC	—	16.89 BSC	—
N	—	0.830	—	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC	—	30.15 BSC	—
V	0.131	0.188	3.33	4.77

STYLE 1:  
 PIN 1: BASE  
 2: EMITTER  
 CASE: COLLECTOR

CASE 1-07  
 TO-204AA (TO-3)  
 ISSUE Z

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**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

