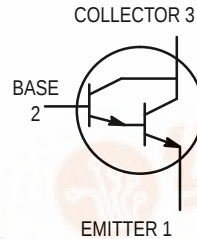


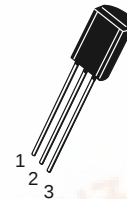
# One Watt Darlington Transistors

## NPN Silicon



**MPSW45**  
**MPSW45A\***

\*Motorola Preferred Device



CASE 29-05, STYLE 1  
TO-92 (TO-226AE)

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | MPSW45      | MPSW45A | Unit                          |
|----------------------------------------------------------------------------------------|----------------|-------------|---------|-------------------------------|
| Collector–Emitter Voltage                                                              | $V_{CES}$      | 40          | 50      | Vdc                           |
| Collector–Base Voltage                                                                 | $V_{CBO}$      | 50          | 60      | Vdc                           |
| Emitter–Base Voltage                                                                   | $V_{EBO}$      | 12          | 12      | Vdc                           |
| Collector Current — Continuous                                                         | $I_C$          | 1.0         | 1.0     | Adc                           |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.0<br>8.0  |         | Watts<br>mW/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 2.5<br>20   |         | Watts<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | –55 to +150 |         | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max | Unit                      |
|-----------------------------------------|-----------------|-----|---------------------------|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 125 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 50  | $^\circ\text{C}/\text{W}$ |

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                    |                   |               |          |            |      |
|--------------------------------------------------------------------------------------------------------------------|-------------------|---------------|----------|------------|------|
| Collector–Emitter Breakdown Voltage<br>( $I_C = 100 \mu\text{Adc}$ , $V_{BE} = 0$ )                                | MPSW45<br>MPSW45A | $V_{(BR)CES}$ | 40<br>50 | —<br>—     | Vdc  |
| Collector–Base Breakdown Voltage<br>( $I_C = 100 \mu\text{Adc}$ , $I_E = 0$ )                                      | MPSW45<br>MPSW45A | $V_{(BR)CBO}$ | 50<br>60 | —<br>—     | Vdc  |
| Emitter–Base Breakdown Voltage<br>( $I_E = 10 \mu\text{Adc}$ , $I_C = 0$ )                                         |                   | $V_{(BR)EBO}$ | 12       | —          | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 30 \text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 40 \text{ Vdc}$ , $I_E = 0$ ) | MPSW45<br>MPSW45A | $I_{CBO}$     | —<br>—   | 100<br>100 | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 10 \text{ Vdc}$ , $I_C = 0$ )                                                |                   | $I_{EBO}$     | —        | 100        | nAdc |

# MPSW45 MPSW45A

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) (Continued)

| Characteristic                                                                                                                                                                               | Symbol               | Min                       | Max               | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------|-------------------|------|
| <b>ON CHARACTERISTICS(1)</b>                                                                                                                                                                 |                      |                           |                   |      |
| DC Current Gain<br>(I <sub>C</sub> = 200 mAdc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 500 mAdc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 1.0 Adc, V <sub>CE</sub> = 5.0 Vdc) | h <sub>FE</sub>      | 25,000<br>15,000<br>4,000 | 150,000<br>—<br>— | —    |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 1.0 Adc, I <sub>B</sub> = 2.0 mAdc)                                                                                                | V <sub>CE(sat)</sub> | —                         | 1.5               | Vdc  |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = 1.0 Adc, I <sub>B</sub> = 2.0 mAdc)                                                                                                     | V <sub>BE(sat)</sub> | —                         | 2.0               | Vdc  |
| Base–Emitter On Voltage<br>(I <sub>C</sub> = 1.0 Adc, V <sub>CE</sub> = 5.0 Vdc)                                                                                                             | V <sub>BE(on)</sub>  | —                         | 2.0               | Vdc  |

## SMALL–SIGNAL CHARACTERISTICS

|                                                                                                         |                 |     |     |     |
|---------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-----|
| Current–Gain – Bandwidth Product<br>(I <sub>C</sub> = 200 mAdc, V <sub>CE</sub> = 5.0 Vdc, f = 100 MHz) | f <sub>T</sub>  | 100 | —   | MHz |
| Collector–Base Capacitance<br>(V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)               | C <sub>cb</sub> | —   | 6.0 | pF  |

1. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

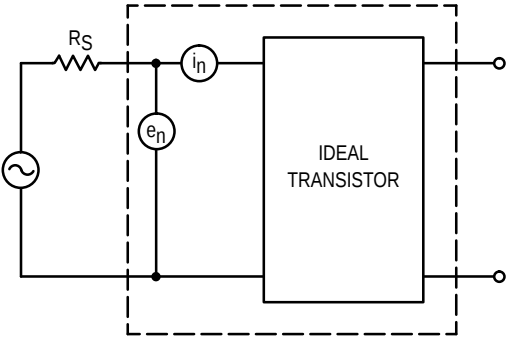


Figure 1. Transistor Noise Model

NOISE CHARACTERISTICS  
( $V_{CE} = 5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

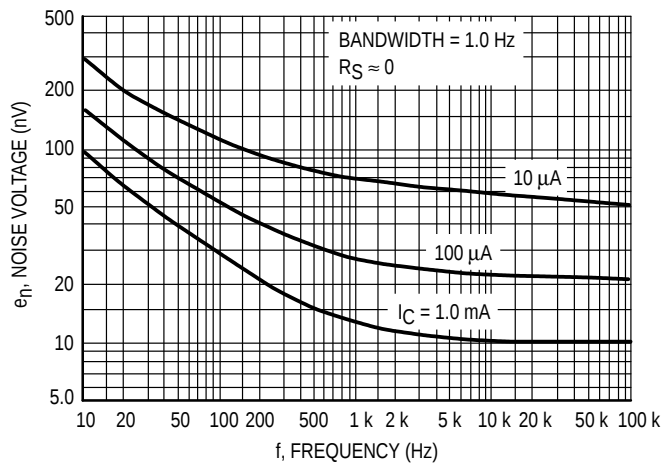


Figure 2. Noise Voltage

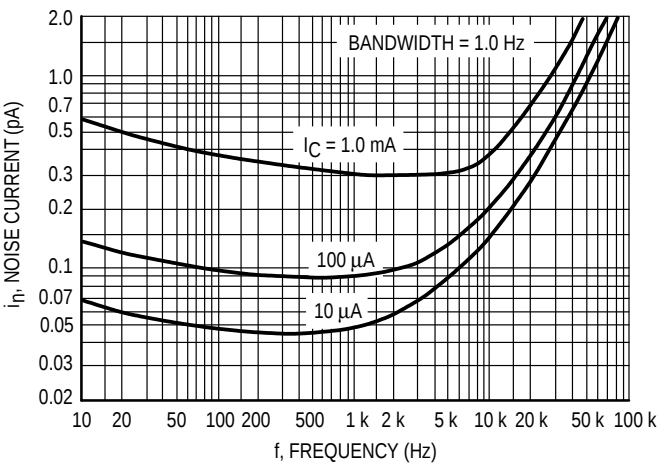


Figure 3. Noise Current

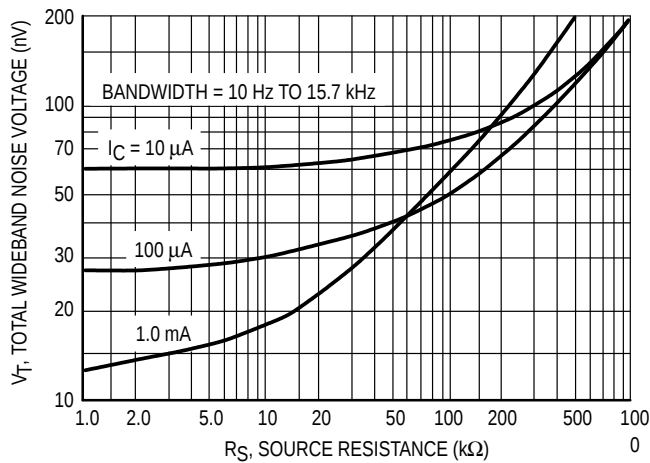


Figure 4. Total Wideband Noise Voltage

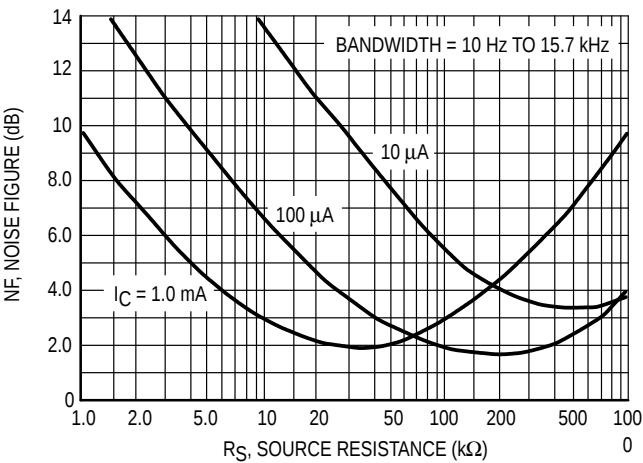


Figure 5. Wideband Noise Figure

## MPSW45 MPSW45A

### SMALL-SIGNAL CHARACTERISTICS

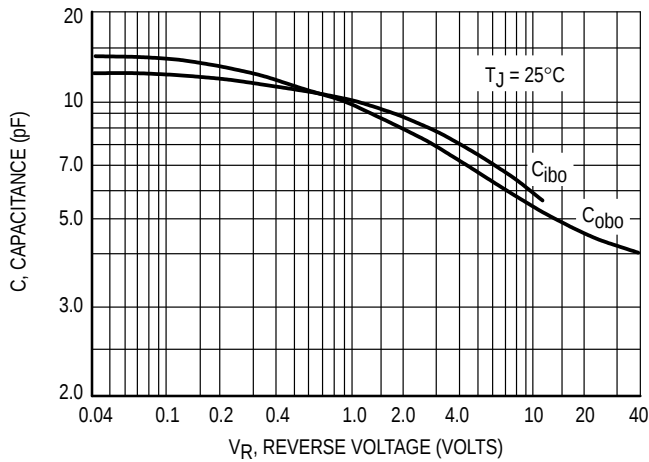


Figure 6. Capacitance

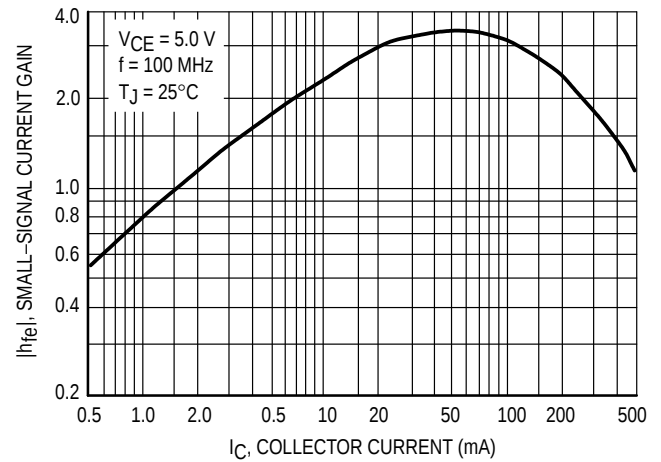


Figure 7. High Frequency Current Gain

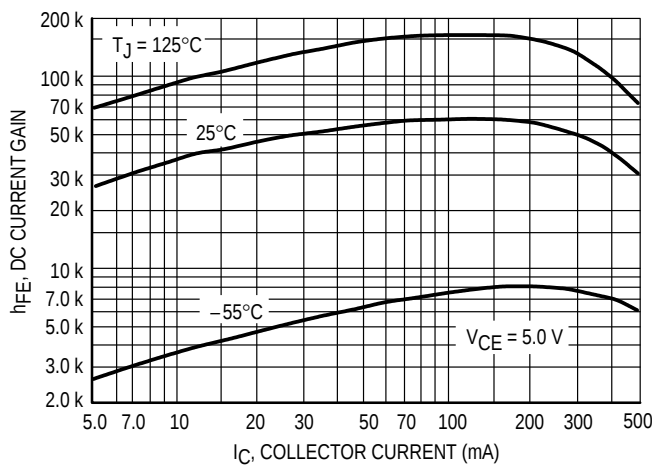


Figure 8. DC Current Gain

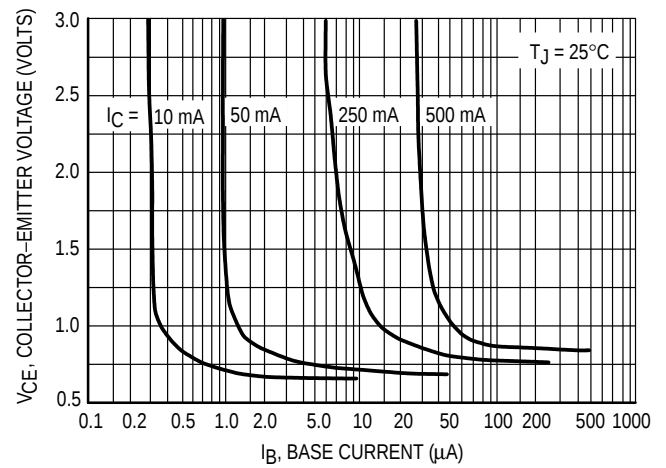


Figure 9. Collector Saturation Region

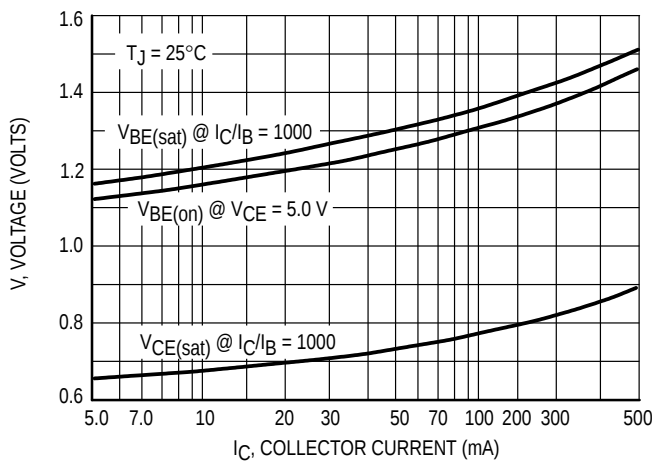


Figure 10. "On" Voltages

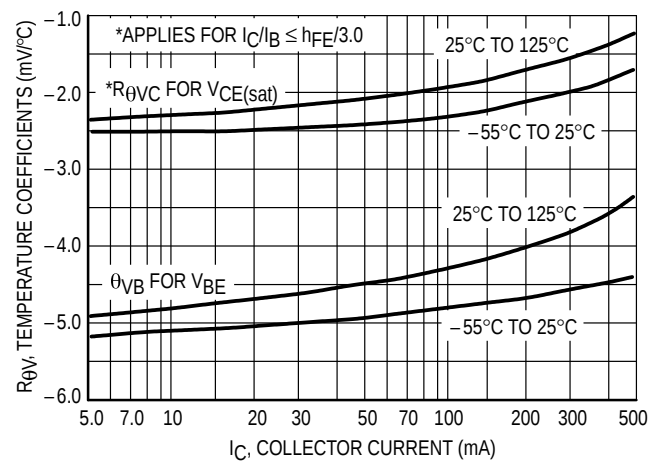


Figure 11. Temperature Coefficients

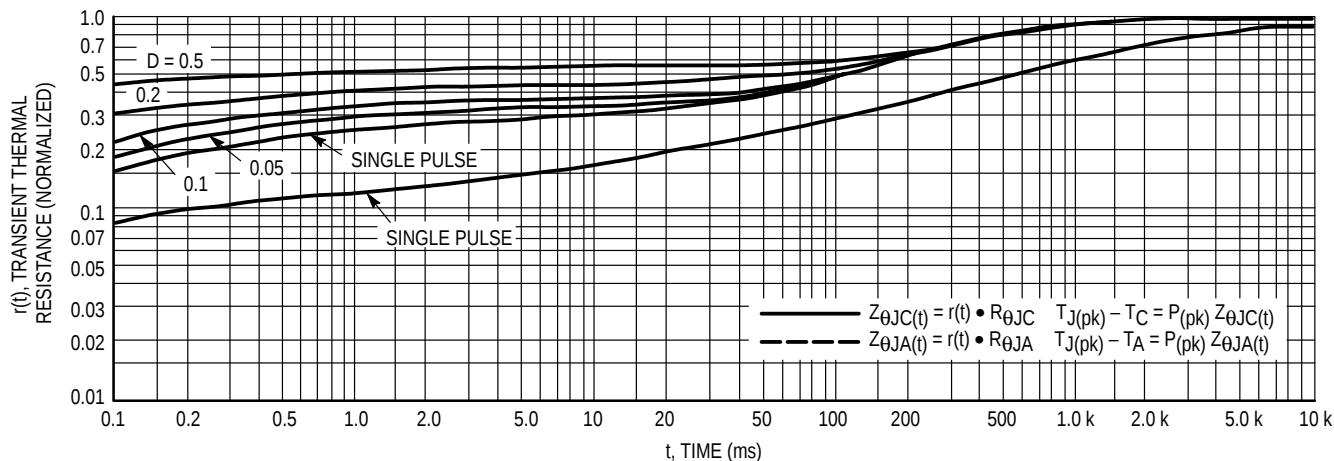


Figure 12. Thermal Response

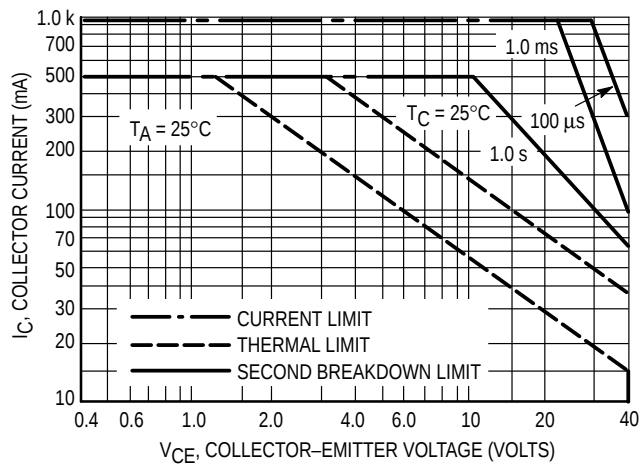
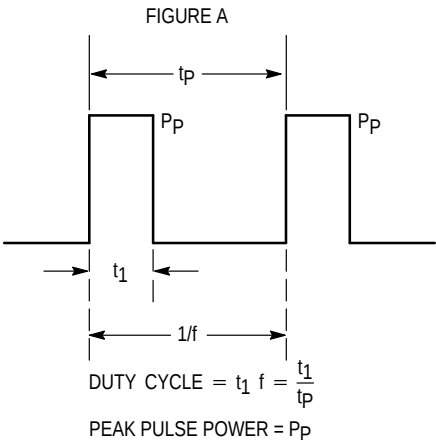


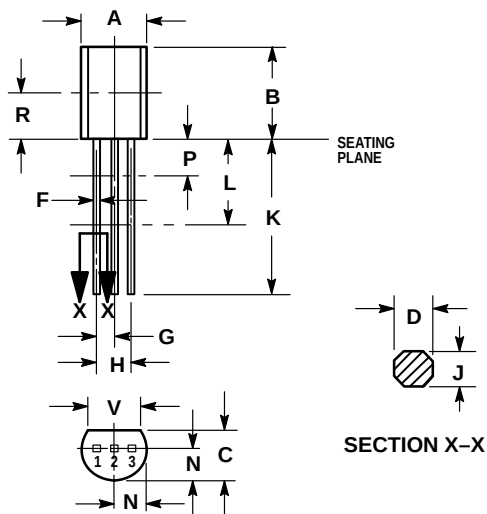
Figure 13. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

# MPSW45 MPSW45A

## PACKAGE DIMENSIONS



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSIONS D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.175  | 0.205 | 4.44        | 5.21 |
| B   | 0.290  | 0.310 | 7.37        | 7.87 |
| C   | 0.125  | 0.165 | 3.18        | 4.19 |
| D   | 0.018  | 0.022 | 0.46        | 0.56 |
| E   | 0.016  | 0.019 | 0.41        | 0.48 |
| F   | 0.045  | 0.055 | 1.15        | 1.39 |
| G   | 0.095  | 0.105 | 2.42        | 2.66 |
| H   | 0.018  | 0.024 | 0.46        | 0.61 |
| I   | 0.500  | —     | 12.70       | —    |
| J   | 0.250  | —     | 6.35        | —    |
| K   | 0.080  | 0.105 | 2.04        | 2.66 |
| L   | —      | 0.100 | —           | 2.54 |
| M   | 0.135  | —     | 3.43        | —    |
| N   | 0.135  | —     | 3.43        | —    |

CASE 029-05  
(TO-226AE)  
ISSUE AD

### STYLE 1:

1. PIN 1. EMITTER
2. BASE
3. COLLECTOR

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.

### How to reach us:

**USA / EUROPE / Locations Not Listed:** Motorola Literature Distribution;  
P.O. Box 20912, Phoenix, Arizona 85036. 1-800-441-2447 or 602-303-5454

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

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,  
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

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