

# High Performance Surface Mount Chip LEDs

## Technical Data

### SunPower Series

**HSMx-S660 Series**  
**HSMx-S670 Series**  
**HSMx-S690 Series**

#### Features

- **High Brightness AlInGaP Material**
- **Industry Standard 2.00 x 1.25 mm Package**
- **Industry Standard 1.6 x 0.8 mm (Low Profile) Package**
- **Right Angle Package**
- **Three Colors Available**
- **Diffused Optics**
- **Compatible with IR Solder Process**
- **Available in 8 mm Tape on 7" (178 mm) Diameter Reels**

#### Applications

- **Keypad Backlighting**
- **LCD Backlighting**
- **Symbol Backlighting**
- **Front Panel Indicator**

#### Description

These chip-type LEDs utilize aluminum indium gallium phosphide (AlInGaP) material technology. The AlInGaP material has a very high luminous efficiency, capable of producing high light output over a wide range of drive currents. The 590 nm amber, 605 nm orange, and 626 nm red colors are available in three compact, low profile packages.

The HSMx-S670 is the industry standard 2.0 x 1.25 mm package, and is an excellent all around package. The HSMx-S690 is the industry standard 1.6 x 0.8 mm package. Its low 0.7 mm profile and wide viewing angle make this LED excellent for backlighting



applications. The HSMx-S660 right angle, 3.0 x 2.0 x 1.0 mm LED is optimum for side lighting applications where direct back-lighting is not practical.

All packages are compatible with IR and convective reflow soldering processes.

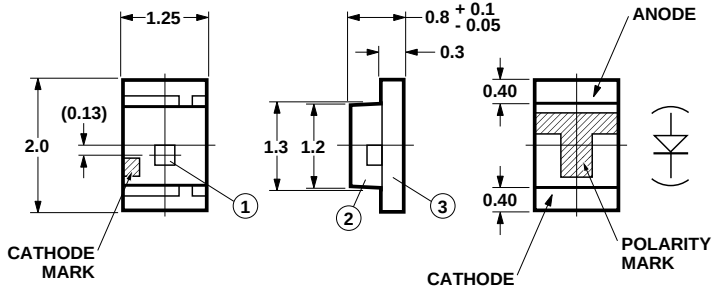
#### Device Selection Guide

| Footprint (mm) <sup>[1][2]</sup> | Amber 590 nm | Orange 605 nm | Red 626 nm |
|----------------------------------|--------------|---------------|------------|
| 1.6 x 0.8 x 0.7                  | HSMA-S690    | HSMD-S690     | HSMC-S690  |
| 2.0 x 1.25 x 0.8                 | HSMA-S670    | HSMD-S670     | HSMC-S670  |
| 3.0 x 2.0 x 1.0                  | HSMA-S660    | HSMD-S660     | HSMC-S660  |

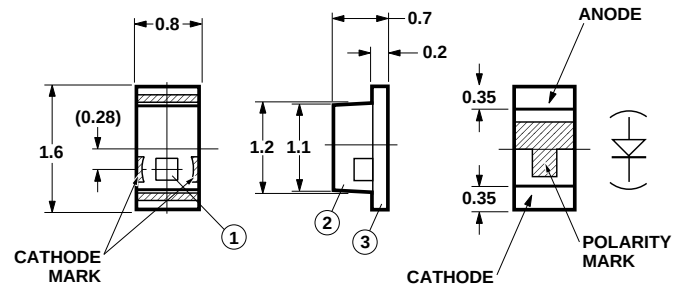
#### Notes:

1. Dimensions in mm.
2. Tolerance  $\pm 0.1$  mm unless otherwise noted.

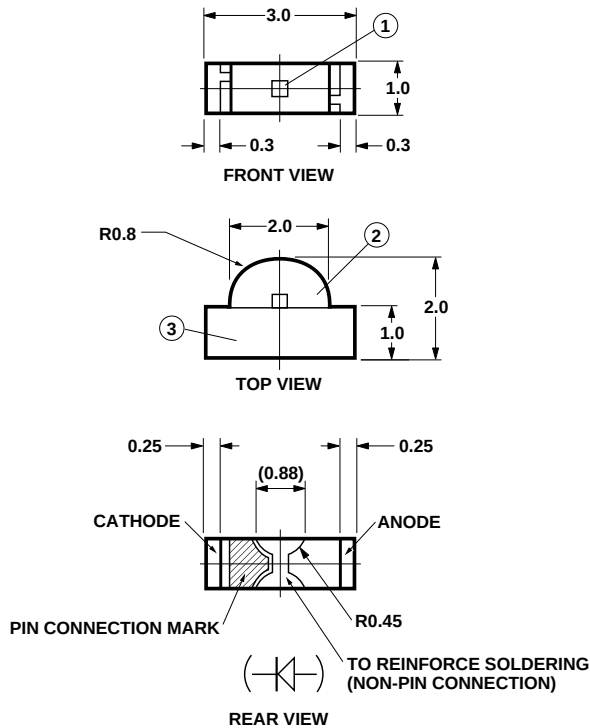
## Package Dimensions



**HSMx-S670 Series**



**HSMx-S690 Series**



**HSMx-S660 Series**

## Absolute Maximum Ratings at $T_A = 25^\circ\text{C}$

| Parameter                                   | HSMx-S660   | HSMx-S670   | HSMx-S690   | Units            |
|---------------------------------------------|-------------|-------------|-------------|------------------|
| DC Forward Current [1][2][3][4]             | 30          | 30          | 30          | mA               |
| Power Dissipation                           | 81          | 81          | 81          | mW               |
| Reverse Voltage ( $I_R = 100 \mu\text{A}$ ) | 5           | 5           | 5           | V                |
| Operating Temperature Range                 | -40 to +85  | -40 to +85  | -40 to +85  | $^\circ\text{C}$ |
| Storage Temperature Range                   | -40 to +100 | -40 to +100 | -40 to +100 | $^\circ\text{C}$ |

### Notes:

- Derate linearly as shown in Figure 4.
- Drive currents between 1 mA and 30 mA are recommended for best long term performance.
- Operating at currents below 1 mA is not recommended. Please contact your Agilent representative for further information.
- Maximum temperature for tape and reel packaging is  $60^\circ\text{C}$ .

### Optical Characteristics at $T_A = 25^\circ\text{C}$

| Part Number | Color  | Luminous Intensity $I_V$ (mcd) @ $I_F = 20\text{ mA}^{[1]}$ |      | Peak Wavelength $\lambda_{\text{peak}}$ (nm) Typ. | Color, Dominant Wavelength $\lambda_d^{[2]}$ (nm) Typ. | Viewing Angle $2\theta_{1/2}$ Degrees $^{[3]}$ Typ. | Luminous Efficacy $\eta_V$ (lm/W) |
|-------------|--------|-------------------------------------------------------------|------|---------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------|-----------------------------------|
|             |        | Min.                                                        | Typ. |                                                   |                                                        |                                                     |                                   |
| HSMA-S660   | Amber  | 16.0                                                        | 65.0 | 592                                               | 590                                                    | 155                                                 | 480                               |
| HSMA-S670   | Amber  | 16.0                                                        | 65.0 | 592                                               | 590                                                    | 165                                                 | 480                               |
| HSMA-S690   | Amber  | 16.0                                                        | 65.0 | 592                                               | 590                                                    | 165                                                 | 480                               |
| HSMD-S660   | Orange | 16.0                                                        | 65.0 | 609                                               | 605                                                    | 155                                                 | 370                               |
| HSMD-S670   | Orange | 16.0                                                        | 65.0 | 609                                               | 605                                                    | 165                                                 | 370                               |
| HSMD-S690   | Orange | 16.0                                                        | 65.0 | 609                                               | 605                                                    | 165                                                 | 370                               |
| HSMC-S660   | Red    | 16.0                                                        | 50.0 | 630                                               | 626                                                    | 155                                                 | 197                               |
| HSMC-S670   | Red    | 16.0                                                        | 50.0 | 630                                               | 626                                                    | 165                                                 | 197                               |
| HSMC-S690   | Red    | 16.0                                                        | 50.0 | 630                                               | 626                                                    | 165                                                 | 197                               |

#### Notes:

1. The luminous intensity  $I_V$  is measured at the peak of the spatial radiation pattern which may not be aligned with the mechanical axis of the lamp package.
2. The dominate wavelength  $\lambda_d$  is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.
3.  $\theta_{1/2}$  is the off-axis angle where the luminous intensity is 1/2 the peak intensity.

### Electrical Characteristics at $T_A = 25^\circ\text{C}$

| Part Number | Color  | Forward Voltage $V_F$ (Volts) @ $I_F = 20\text{ mA}$ |      | Reverse Breakdown $V_R$ (Volts) @ $I_R = 100\text{ }\mu\text{A}$ Min. | Capacitance $C$ (pF), $V_F = 0$ , $f = 1\text{ MHz}$ Typ. | Thermal Resistance $R_{\theta_{J-PIN}}$ ( $^\circ\text{C/W}$ ) |
|-------------|--------|------------------------------------------------------|------|-----------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------|
|             |        | Typ.                                                 | Max. |                                                                       |                                                           |                                                                |
| HSMA-S660   | Amber  | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 600                                                            |
| HSMA-S670   | Amber  | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |
| HSMA-S690   | Amber  | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |
| HSMD-S660   | Orange | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 600                                                            |
| HSMD-S670   | Orange | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |
| HSMD-S690   | Orange | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |
| HSMC-S660   | Red    | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 600                                                            |
| HSMC-S670   | Red    | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |
| HSMC-S690   | Red    | 1.9                                                  | 2.4  | 5                                                                     | 45                                                        | 300                                                            |

| <b>Yellow/Amber Color Bins<sup>[1]</sup></b> |                             |             |
|----------------------------------------------|-----------------------------|-------------|
|                                              | <b>Dom. Wavelength (nm)</b> |             |
| <b>Bin ID</b>                                | <b>Min.</b>                 | <b>Max.</b> |
| A                                            | 582.0                       | 584.5       |
| B                                            | 584.5                       | 587.0       |
| C                                            | 587.0                       | 589.5       |
| D                                            | 589.5                       | 592.0       |
| E                                            | 592.0                       | 594.5       |
| F                                            | 594.5                       | 597.0       |

Tolerance:  $\pm 0.5$  nm.

| <b>Orange Color Bins<sup>[1]</sup></b> |                             |             |
|----------------------------------------|-----------------------------|-------------|
|                                        | <b>Dom. Wavelength (nm)</b> |             |
| <b>Bin ID</b>                          | <b>Min.</b>                 | <b>Max.</b> |
| A                                      | 597.0                       | 600.0       |
| B                                      | 600.0                       | 603.0       |
| C                                      | 603.0                       | 606.0       |
| D                                      | 606.0                       | 609.0       |
| E                                      | 609.0                       | 612.0       |
| F                                      | 612.0                       | 615.0       |

Tolerance:  $\pm 1$  nm.

**Note:**

1. Bin categories are established for classification of products. Products may not be available in all bin categories. Please contact your Agilent representative for information on currently available bins.

| <b>Light Intensity (Iv) Bin Limits<sup>[1]</sup></b> |             |             |
|------------------------------------------------------|-------------|-------------|
| <b>Intensity (mcd)</b>                               |             |             |
| <b>Bin ID</b>                                        | <b>Min.</b> | <b>Max.</b> |
| A                                                    | 0.11        | 0.18        |
| B                                                    | 0.18        | 0.29        |
| C                                                    | 0.29        | 0.45        |
| D                                                    | 0.45        | 0.72        |
| E                                                    | 0.72        | 1.10        |
| F                                                    | 1.10        | 1.80        |
| G                                                    | 1.80        | 2.80        |
| H                                                    | 2.80        | 4.50        |
| J                                                    | 4.50        | 7.20        |
| K                                                    | 7.20        | 11.20       |
| L                                                    | 11.20       | 18.00       |
| M                                                    | 18.00       | 28.50       |
| N                                                    | 28.50       | 45.00       |
| P                                                    | 45.00       | 71.50       |
| Q                                                    | 71.50       | 112.50      |
| R                                                    | 112.50      | 180.00      |
| S                                                    | 180.00      | 285.00      |
| T                                                    | 285.00      | 450.00      |
| U                                                    | 450.00      | 715.00      |
| V                                                    | 715.00      | 1125.00     |
| W                                                    | 1125.00     | 1800.00     |
| X                                                    | 1800.00     | 2850.00     |
| Y                                                    | 2850.00     | 4500.00     |

Tolerance  $\pm 15\%$

**Note:**

1. Bin categories are established for classification of products. Products may not be available in all bin categories. Please contact your Agilent representative for information on currently available bins.

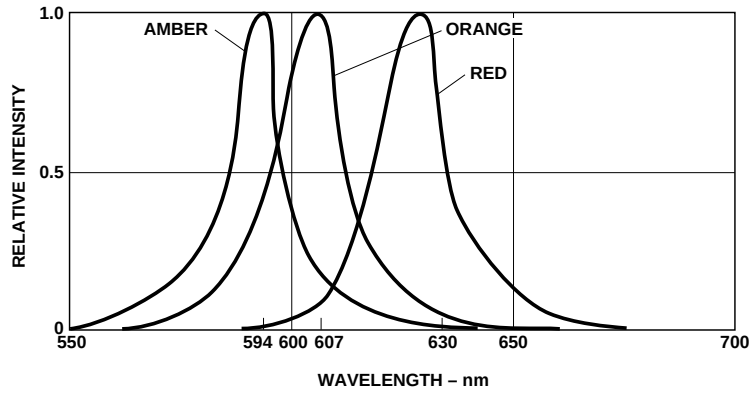


Figure 1. Relative Intensity vs. Wavelength.

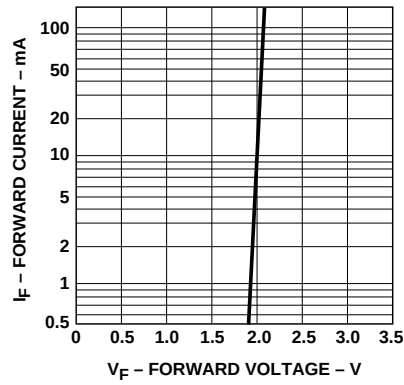


Figure 2. Forward Current vs. Forward Voltage.

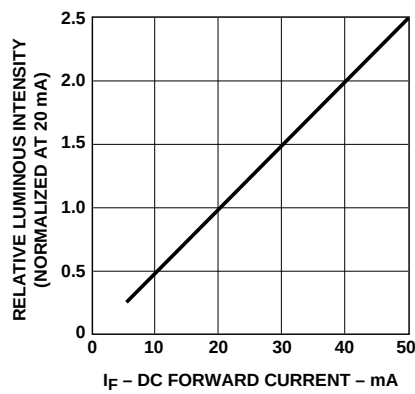


Figure 3. Relative Luminous Intensity vs. Forward Current.

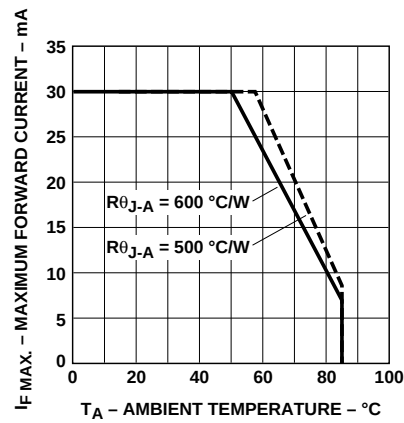


Figure 4. Maximum Forward Current vs. Ambient Temperature.

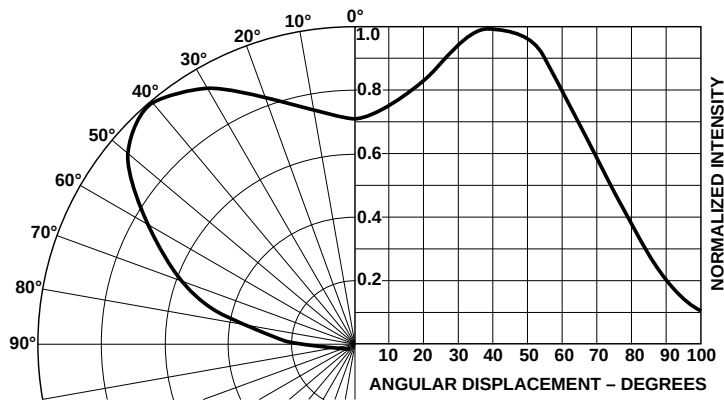


Figure 5. Relative Luminous Intensity vs. Angular Displacement for HSMx-S660.

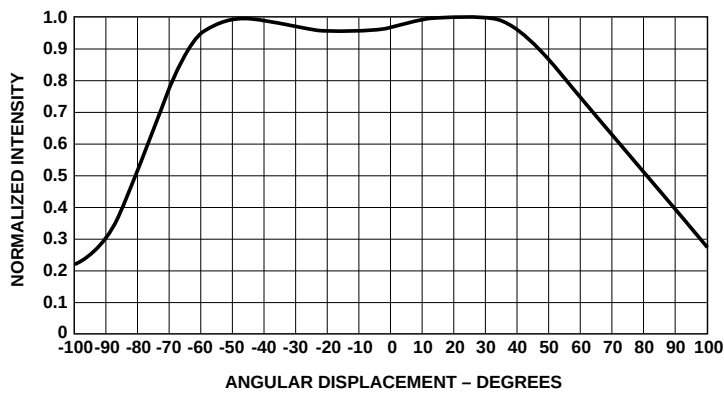


Figure 6. Relative Luminous Intensity vs. Angular Displacement for HSMx-S670.

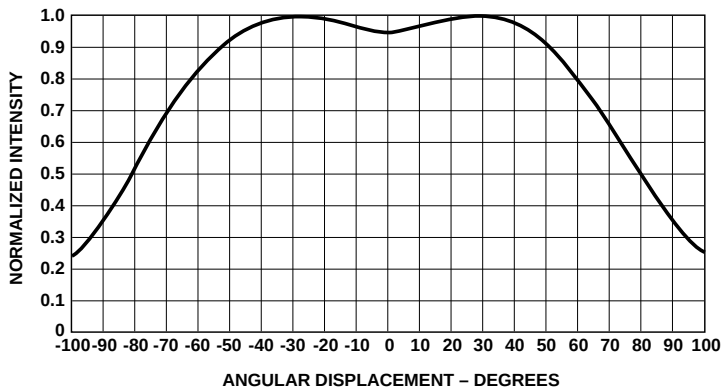


Figure 7. Relative Luminous Intensity vs. Angular Displacement for HSMx-S690.

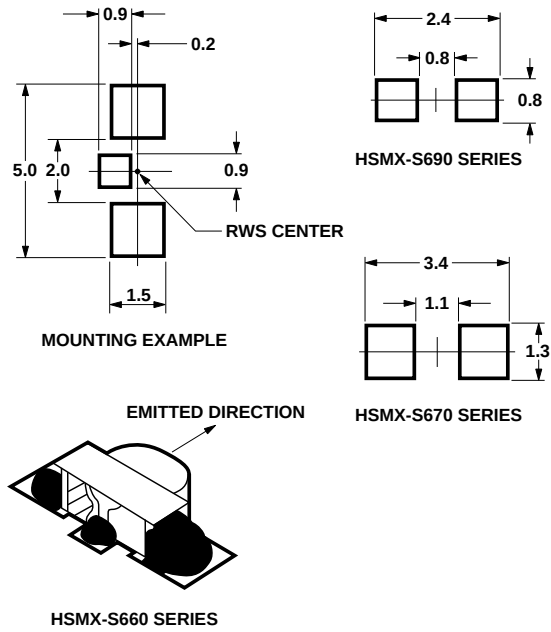
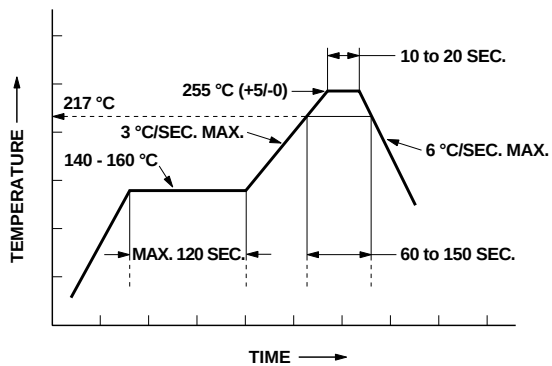


Figure 8. Recommended Solder Patterns.

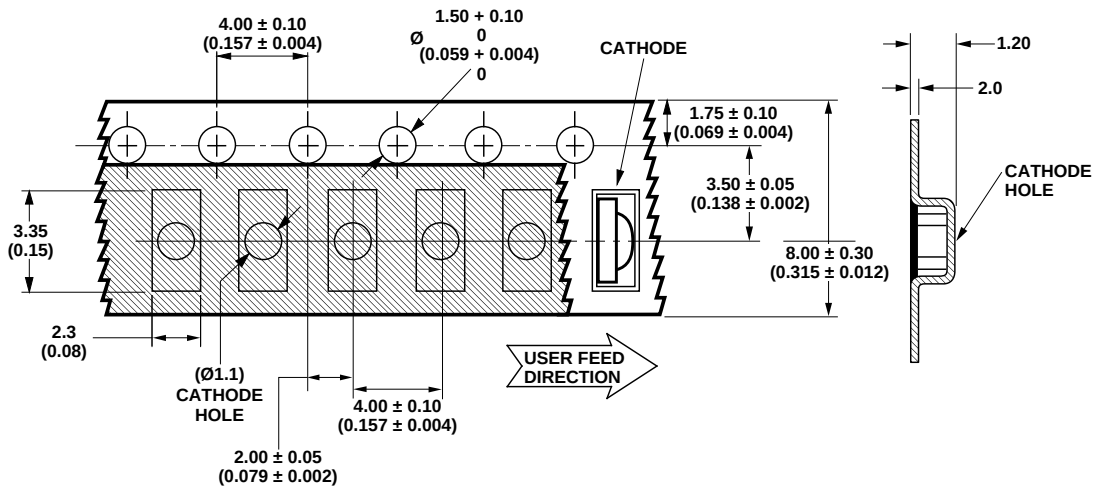


\* THE TIME FROM 25 °C TO PEAK TEMPERATURE = 6 MINUTES MAX.

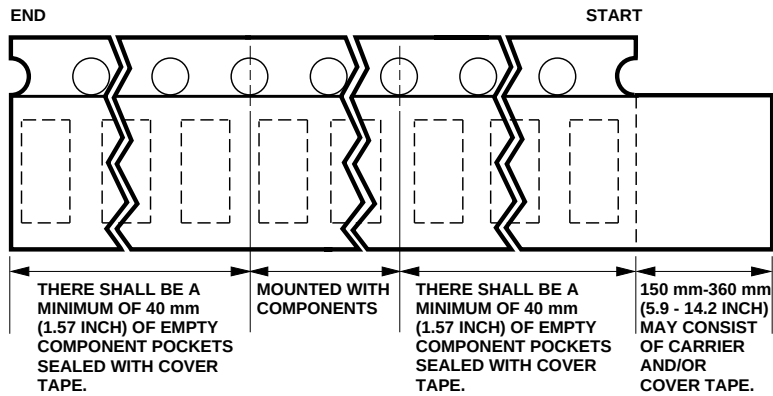
Figure 9. Recommended Pb-Free IR Reflow Profile.







**Figure 13. Tape Dimensions HSMx-S660.**



**Figure 14. Tape Leader and Trailer Dimensions.**

Storage Condition: 5 to 30° C @ 60% RH max.

Baking is required under the condition:

- the blue silica gel indicator becoming white/transparent color
- the pack has been opened for more than 1 week

Baking recommended condition: 60 +/- 5°C for 20 hours.

**[www.agilent.com/semiconductors](http://www.agilent.com/semiconductors)**

For product information and a complete list of distributors, please go to our web site.

For technical assistance call:

Americas/Canada: +1 (800) 235-0312 or  
(916) 788-6763

Europe: +49 (0) 6441 92460

China: 10800 650 0017

Hong Kong: (+65) 6756 2394

India, Australia, New Zealand: (+65) 6755 1939

Japan: (+81 3) 3335-8152 (Domestic/International), or 0120-61-1280 (Domestic Only)

Korea: (+65) 6755 1989

Singapore, Malaysia, Vietnam, Thailand,  
Philippines, Indonesia: (+65) 6755 2044

Taiwan: (+65) 6755 1843

Data subject to change.

Copyright © 2003 Agilent Technologies, Inc.

Obsoletes 5988-7964EN

October 2, 2003

5989-0164EN