

# T-1<sup>3</sup>/<sub>4</sub> (5 mm) Low Profile LED Lamps

## Technical Data

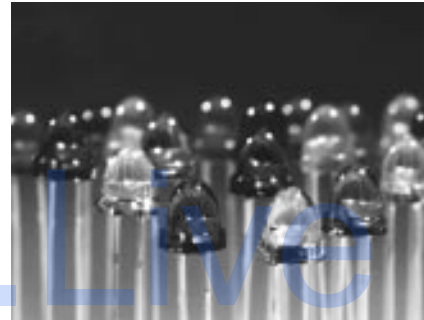
**HLMP-3351**  
**HLMP-3366**  
**HLMP-3451**  
**HLMP-3466**  
**HLMP-3554**  
**HLMP-3568**

### Features

- High Intensity
- Low Profile: 5.8 mm (0.23 in.) Nominal
- T-1<sup>3</sup>/<sub>4</sub> Diameter Package
- Diffused and Non-diffused Types
- General Purpose Leads
- IC Compatible/Low Current Requirements
- Reliable and Rugged

The HLMP-355x/-356x Series are Gallium Phosphide Green Light Emitting Diodes.

The Low Profile T-1<sup>3</sup>/<sub>4</sub> package provides space savings and is excellent for backlighting applications.

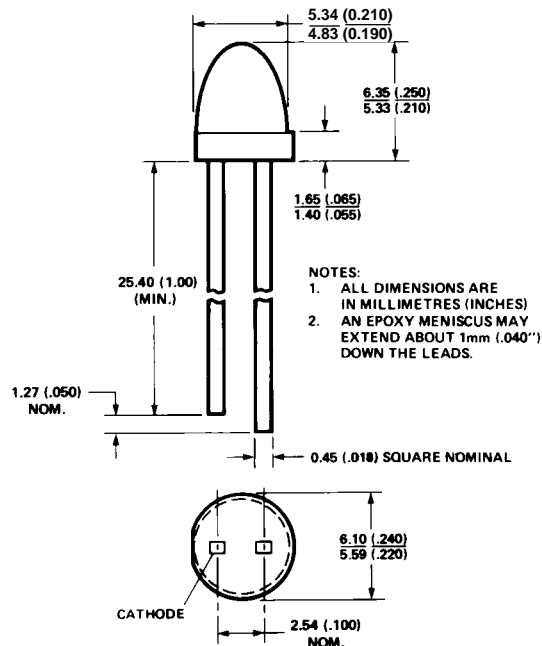


### Description

The HLMP-335x/-336x Series are Gallium Arsenide Phosphide on Gallium Phosphide High Efficiency Red Light Emitting Diodes.

The HLMP-345x/-346x Series are Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diodes.

### Package Dimensions

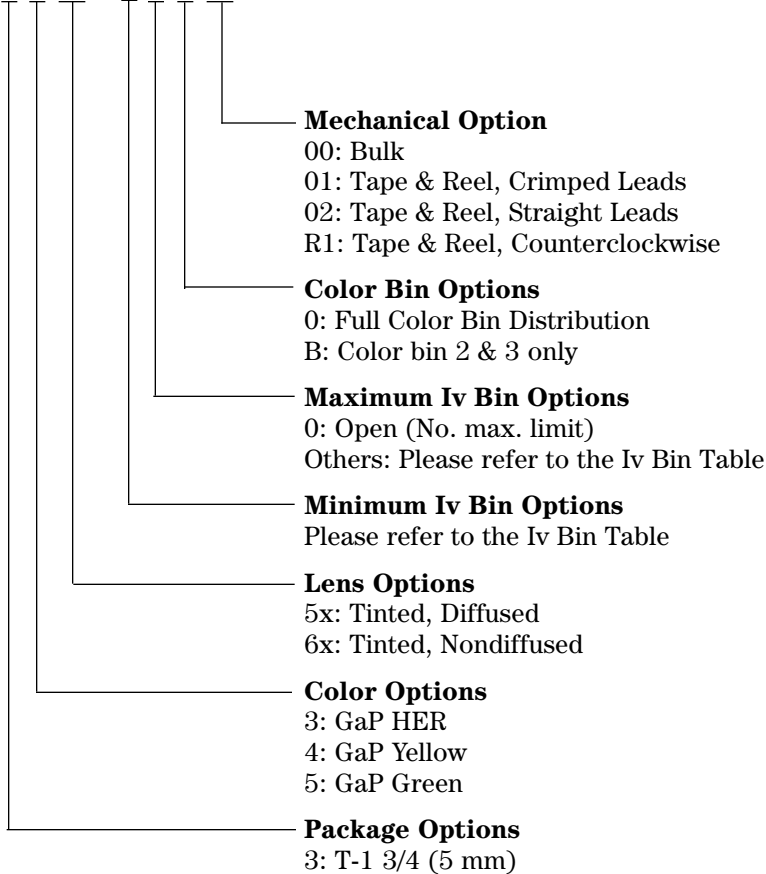


## Selection Guide

| Color  | Package Description          | 2 $\theta$ <sup>1/2</sup> [1] | Part Number<br>HLMP- | Luminous Intensity Iv (mcd) |      |
|--------|------------------------------|-------------------------------|----------------------|-----------------------------|------|
|        |                              |                               |                      | Min.                        | Max. |
| Red    | T-1 3/4 Tinted, diffused     | 50                            | 3351                 | 5.4                         | -    |
|        |                              |                               | 3351-D00xx           | 2.1                         | -    |
|        |                              |                               | 3351-F00xx           | 5.4                         | -    |
|        | T-1 3/4 Tinted, non-diffused | 45                            | 3366                 | 13.8                        | -    |
|        |                              |                               | 3366-H00xx           | 13.8                        | -    |
| Yellow | T-1 3/4 Tinted, diffused     | 50                            | 3451                 | 3.6                         | -    |
|        |                              |                               | 3451-D00xx           | 3.6                         | -    |
|        |                              |                               | 3451-EFBxx           | 5.7                         | 18.4 |
|        | T-1 3/4 Tinted, non-diffused | 45                            | 3466                 | 9.2                         | -    |
|        |                              |                               | 3466-F00xx           | 9.2                         | -    |
| Green  | T-1 3/4 Tinted, diffused     | 50                            | 3554                 | 6.7                         | -    |
|        |                              |                               | 3554-E00xx           | 6.7                         | -    |
|        | T-1 3/4 Tinted, non-diffused | 40                            | 3568                 | 10.6                        | -    |
|        |                              |                               | 3568-F00xx           | 10.6                        | -    |

## Part Numbering System

HLMP - 3 x xx - x x x xx



## High Efficiency Red HLMP-335x/-336x Series Electrical Specifications at $T_A = 25^\circ\text{C}$

| Symbol                   | Description  | Device<br>HLMP- | Min. | Typ.                 | Max. | Units              | Test<br>Conditions                  |
|--------------------------|--|-----------------|------|----------------------|------|--------------------|-------------------------------------|
| $2\theta^{1/2}$          | Including Angle Between Half Luminous Intensity Points | 3366            |      | 50<br>50<br>45<br>45 |      | Deg.               | Note 1 (Figure 11)                  |
| $\lambda_{\text{PEAK}}$  | Peak Wavelength  |                 |      | 635                  |      | nm                 | Measurement at Peak (Figure 1)      |
| $\lambda_d$              | Dominant Wavelength                                    |                 |      | 626                  |      | nm                 | Note 2                              |
| $\Delta\lambda_{1/2}$    | Spectral Line Halfwidth                                |                 |      | 40                   |      | nm                 |                                     |
| $\tau_s$                 | Speed of Response                                      |                 |      | 90                   |      | ns                 |                                     |
| C                        | Capacitance  |                 |      | 11                   |      | pF                 | $V_F = 0$ ; $f = 1 \text{ MHz}$     |
| $R\theta_{\text{J-PIN}}$ | Thermal Resistance                                     |                 |      | 260                  |      | $^\circ\text{C/W}$ | Junction to Cathode Lead            |
| $V_F$                    | Forward Voltage  |                 |      | 1.9                  | 2.4  | V                  | $I_F = 10 \text{ mA}$<br>(Figure 7) |
| $V_R$                    | Reverse Breakdown Voltage                              |                 | 5.0  |                      |      | V                  | $I_R = 100 \mu\text{A}$             |
| $\eta_V$                 | Luminous Efficacy                                      |                 |      | 145                  |      | lm/W               | Note 3                              |

### Notes:

- $\theta^{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
- Dominant wavelength,  $\lambda_d$ , is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
- Radiant Intensity,  $I_e$ , in watts/steradian may be found from the equation  $I_e = I_v/\eta_v$ , where  $I_v$  is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.

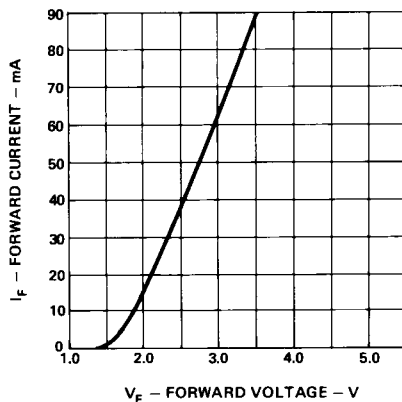


Figure 7. Forward Current vs. Forward Voltage.

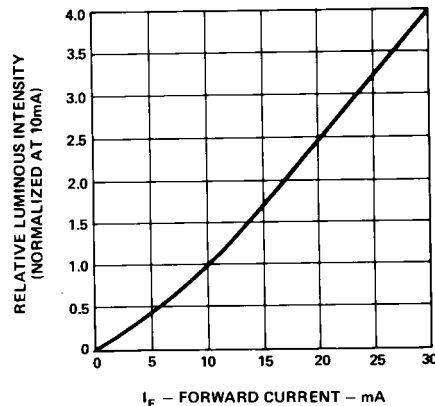


Figure 8. Relative Luminous Intensity vs. Forward Current.

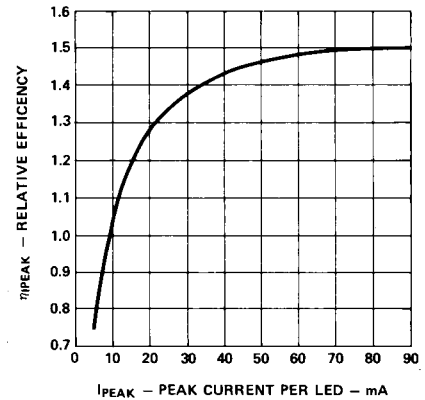


Figure 9. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

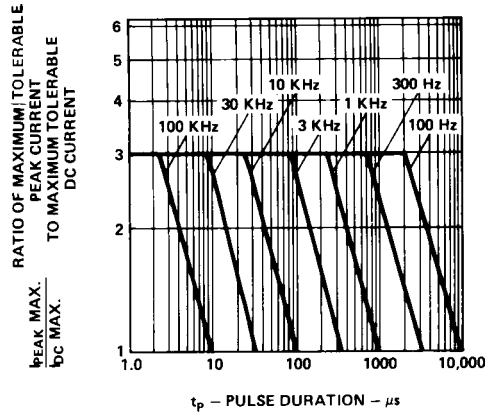


Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration. ( $I_{DC\ MAX}$  as per MAX Ratings).

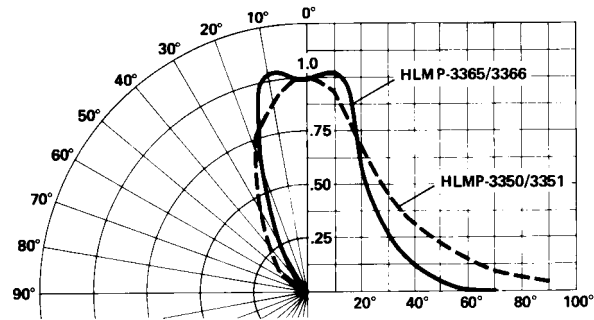


Figure 11. Relative Luminous Intensity vs. Angular Displacement.

### Yellow HLMP-345x/-346x Series Electrical Specifications at $T_A = 25^\circ\text{C}$

| Symbol                | Description  | Device HLMP- | Min. | Typ.                 | Max. | Units                     | Test Conditions                   |
|-----------------------|--|--------------|------|----------------------|------|---------------------------|-----------------------------------|
| $2\theta_{1/2}$       | Including Angle Between Half Luminous Intensity Points | 3466         |      | 50<br>50<br>45<br>45 |      | Deg.                      | Note 1 (Figure 16)                |
| $\lambda_{PEAK}$      | Peak Wavelength  |              |      | 583                  |      | nm                        | Measurement at Peak (Figure 1)    |
| $\lambda_d$           | Dominant Wavelength                                    |              |      | 585                  |      | nm                        | Note 2                            |
| $\Delta\lambda_{1/2}$ | Spectral Line Halfwidth                                |              |      | 36                   |      | nm                        |                                   |
| $\tau_s$              | Speed of Response                                      |              |      | 90                   |      | ns                        |                                   |
| C                     | Capacitance  |              |      | 15                   |      | pF                        | $V_F = 0$ ; $f = 1\ \text{MHz}$   |
| $R\theta_{J-PIN}$     | Thermal Resistance                                     |              |      | 260                  |      | $^\circ\text{C}/\text{W}$ | Junction to Cathode Lead          |
| $V_F$                 | Forward Voltage  |              |      | 2.0                  | 2.4  | V                         | $I_F = 10\ \text{mA}$ (Figure 12) |
| $V_R$                 | Reverse Breakdown Voltage                              |              | 5.0  |                      |      | V                         | $I_R = 100\ \mu\text{A}$          |
| $\eta_V$              | Luminous Efficacy                                      |              |      | 500                  |      | lm/W                      | Note 3                            |

#### Notes:

- $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
- Dominant wavelength,  $\lambda_d$ , is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
- Radiant Intensity,  $I_e$ , in watts/steradian may be found from the equation  $I_e = I_v/\eta_v$ , where  $I_v$  is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.

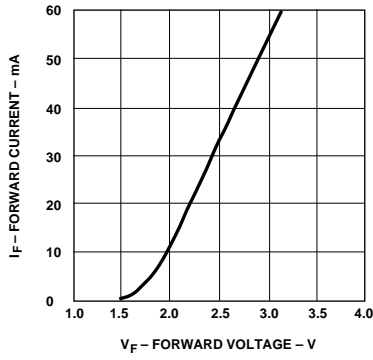


Figure 12. Forward Current vs. Forward Voltage.

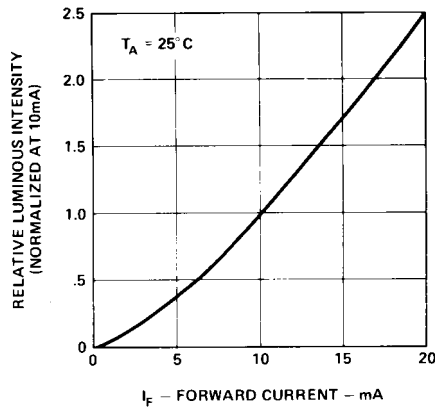


Figure 13. Relative Luminous Intensity vs. Forward Current.

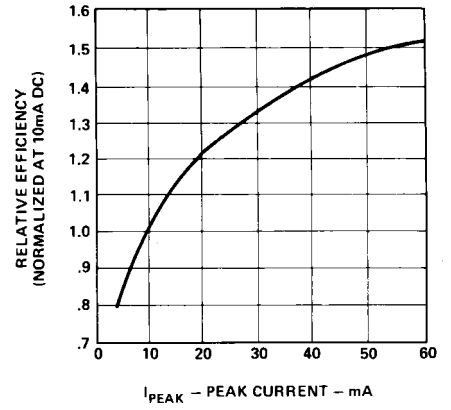


Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

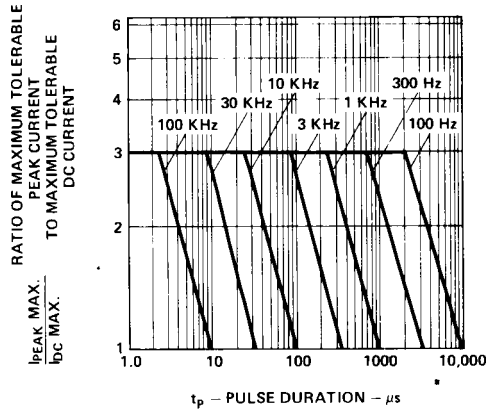


Figure 15. Maximum Tolerable Peak Current vs. Pulse Duration. ( $I_{DC}$  MAX as per MAX Ratings).

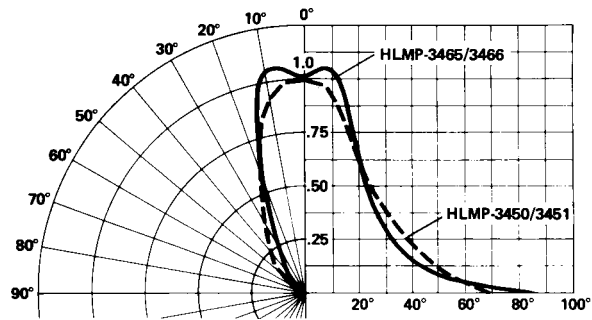


Figure 16. Relative Luminous Intensity vs. Angular Displacement.

## Green HLMP-355x/-356x Series

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

| Symbol                   | Description  | Device<br>HLMP- | Min. | Typ.     | Max. | Units              | Test<br>Conditions                   |
|--------------------------|--|-----------------|------|----------|------|--------------------|--------------------------------------|
| $2\theta_{1/2}$          | Including Angle Between Half Luminous Intensity Points | 3554<br>3568    |      | 50<br>40 |      | Deg.               | Note 1 (Figure 21)                   |
| $\lambda_{\text{PEAK}}$  | Peak Wavelength  |                 |      | 565      |      | nm                 | Measurement at Peak (Figure 1)       |
| $\lambda_d$              | Dominant Wavelength                                    |                 |      | 569      |      | nm                 | Note 2                               |
| $\Delta\lambda_{1/2}$    | Spectral Line Halfwidth                                |                 |      | 28       |      | nm                 |                                      |
| $\tau_s$                 | Speed of Response                                      |                 |      | 500      |      | ns                 |                                      |
| C                        | Capacitance  |                 |      | 18       |      | pF                 | $V_F = 0$ ; $f = 1 \text{ MHz}$      |
| $R\theta_{\text{J-PIN}}$ | Thermal Resistance                                     |                 |      | 260      |      | $^\circ\text{C/W}$ | Junction to Cathode Lead             |
| $V_F$                    | Forward Voltage  |                 |      | 2.1      | 2.7  | V                  | $I_F = 10 \text{ mA}$<br>(Figure 17) |
| $V_R$                    | Reverse Breakdown Voltage                              |                 | 5.0  |          |      | V                  | $I_R = 100 \mu\text{A}$              |
| $\eta_V$                 | Luminous Efficacy                                      |                 |      | 595      |      | lm/W               | Note 3                               |

#### Notes:

- $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
- Dominant wavelength,  $\lambda_d$ , is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
- Radiant Intensity,  $I_e$ , in watts/steradian may be found from the equation  $I_e = I_v/\eta_v$ , where  $I_v$  is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.

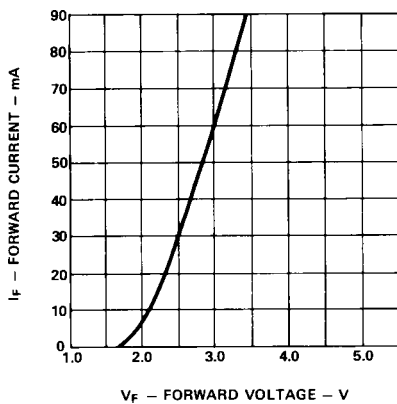


Figure 17. Forward Current vs. Forward Voltage.

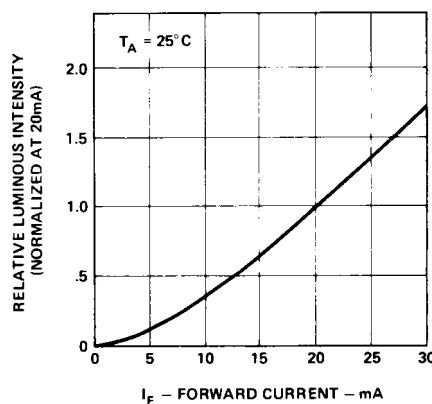


Figure 18. Relative Luminous Intensity vs. Forward Current.

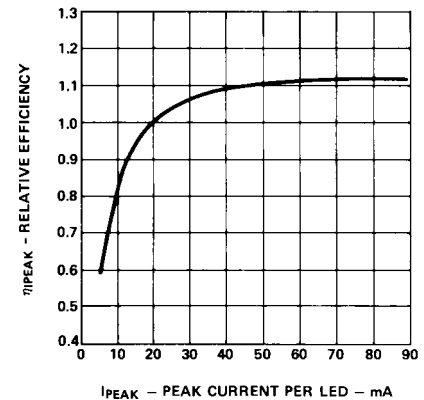


Figure 19. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

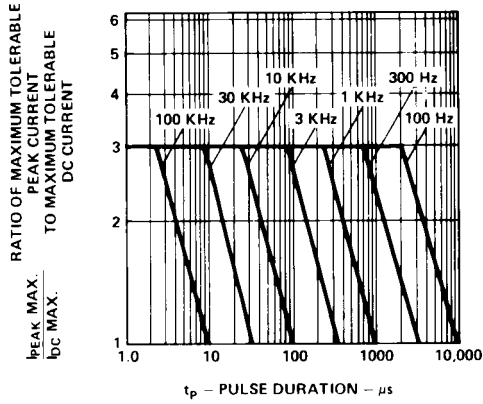


Figure 20. Maximum Tolerable Peak Current vs. Pulse Duration. ( $I_{DC}$  MAX as per MAX Ratings).

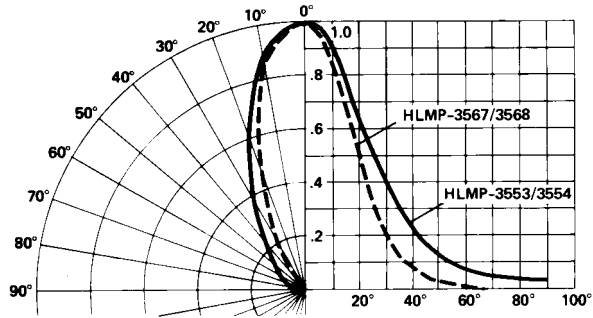


Figure 21. Relative Luminous Intensity vs. Angular Displacement.

### Intensity Bin Limits

| Color | Bin     | Intensity Range (mcd) |         |
|-------|---------|-----------------------|---------|
|       |         | Min.                  | Max.    |
| Red   | D       | 2.4                   | 3.8     |
|       | E       | 3.8                   | 6.1     |
|       | F       | 6.1                   | 9.7     |
|       | G       | 9.7                   | 15.5    |
|       | H       | 15.5                  | 24.8    |
|       | I       | 24.8                  | 39.6    |
|       | J       | 39.6                  | 63.4    |
|       | K       | 63.4                  | 101.5   |
|       | L       | 101.5                 | 162.4   |
|       | M       | 162.4                 | 234.6   |
|       | N       | 234.6                 | 340.0   |
|       | O       | 340.0                 | 540.0   |
|       | P       | 540.0                 | 850.0   |
|       | Q       | 850.0                 | 1200.0  |
|       | R       | 1200.0                | 1700.0  |
|       | S       | 1700.0                | 2400.0  |
|       | T       | 2400.0                | 3400.0  |
|       | U       | 3400.0                | 4900.0  |
|       | V       | 4900.0                | 7100.0  |
|       | W       | 7100.0                | 10200.0 |
| X     | 10200.0 | 14800.0               |         |
| Y     | 14800.0 | 21400.0               |         |
| Z     | 21400.0 | 30900.0               |         |

| Color  | Bin     | Intensity Range (mcd) |        |
|--------|---------|-----------------------|--------|
|        |         | Min.                  | Max.   |
| Yellow | D       | 4.0                   | 6.5    |
|        | E       | 6.5                   | 10.3   |
|        | F       | 10.3                  | 16.6   |
|        | G       | 16.6                  | 26.5   |
|        | H       | 26.5                  | 42.3   |
|        | I       | 42.3                  | 67.7   |
|        | J       | 67.7                  | 108.2  |
|        | K       | 108.2                 | 173.2  |
|        | L       | 173.2                 | 250.0  |
|        | M       | 250.0                 | 360.0  |
|        | N       | 360.0                 | 510.0  |
|        | O       | 510.0                 | 800.0  |
|        | P       | 800.0                 | 1250.0 |
| Q      | 1250.0  | 1800.0                |        |
| R      | 1800.0  | 2900.0                |        |
| S      | 2900.0  | 4700.0                |        |
| T      | 4700.0  | 7200.0                |        |
| U      | 7200.0  | 11700.0               |        |
| V      | 11700.0 | 18000.0               |        |
| W      | 18000.0 | 27000.0               |        |

Maximum tolerance for each bin limit is  $\pm 18\%$ .

### Intensity Bin Limits, continued

| Color | Bin     | Intensity Range (mcd) |         |
|-------|---------|-----------------------|---------|
|       |         | Min.                  | Max.    |
| Green | E       | 7.6                   | 12.0    |
|       | F       | 12.0                  | 19.1    |
|       | G       | 19.1                  | 30.7    |
|       | H       | 30.7                  | 49.1    |
|       | I       | 49.1                  | 78.5    |
|       | J       | 78.5                  | 125.7   |
|       | K       | 125.7                 | 201.1   |
|       | L       | 201.1                 | 289.0   |
|       | M       | 289.0                 | 417.0   |
|       | N       | 417.0                 | 680.0   |
|       | O       | 680.0                 | 1100.0  |
|       | P       | 1100.0                | 1800.0  |
|       | Q       | 1800.0                | 2700.0  |
|       | R       | 2700.0                | 4300.0  |
|       | S       | 4300.0                | 6800.0  |
|       | T       | 6800.0                | 10800.0 |
|       | U       | 10800.0               | 16000.0 |
| V     | 16000.0 | 25000.0               |         |
| W     | 25000.0 | 40000.0               |         |

Maximum tolerance for each bin limit is  $\pm 18\%$ .

### Color Categories

| Color | Cat #  | Lambda (nm) |       |
|-------|--------|-------------|-------|
|       |        | Min.        | Max.  |
| Green | 6      | 561.5       | 564.5 |
|       | 5      | 564.5       | 567.5 |
|       | 4      | 567.5       | 570.5 |
|       | 3      | 570.5       | 573.5 |
|       | 2      | 573.5       | 576.5 |
|       | Yellow | 1           | 582.0 |
| 3     |        | 584.5       | 587.0 |
| 2     |        | 587.0       | 589.5 |
| 4     |        | 589.5       | 592.0 |
| 5     |        | 592.0       | 593.0 |

Maximum tolerance for each bin limit is  $\pm 0.5$  nm.

### Mechanical Option Matrix

| Mechanical Option Code | Definition  |
|------------------------|---|
| 00                     | Bulk Packaging, minimum increment 500 pcs/bag                           |
| 01                     | Tape & Reel, crimped leads, minimum increment 1300 pcs/bag              |
| 02                     | Tape & Reel, straight leads, minimum increment 1300 pcs/bag             |
| R1                     | Tape & Reel, crimped leads, reeled counterclockwise, anode leaves first |

**Note:**

All categories are established for classification of products. Products may not be available in all categories. Please contact your local Agilent representative for further clarification/information.