

**LITE-ON****T-1(3mm) SOLID STATE LAMPS**

LTL-4201/4201N RED

LTL-4211/4211N BRIGHT RED

LTL-4221/4221N HIGH EFFICIENCY RED

LTL-4231/4231N GREEN

LTL-4251/4251N YELLOW

LTL-4291/4291N ORANGE

T-41-21

**FEATURES**

- LOW POWER CONSUMPTION.
- HIGH EFFICIENCY.
- VERSATILE MOUNTING ON P.C. BOARD OR PANEL.
- I.C. COMPATIBLE/LOW CURRENT REQUIREMENTS.
- POPULAR T-1 DIAMETER, 25mm (1") LENGTH OF LEADS PACKAGE.
- RELIABLE AND RUGGED.
- LOW COST.

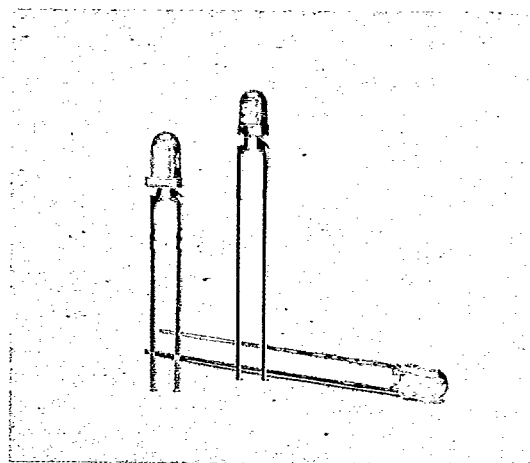
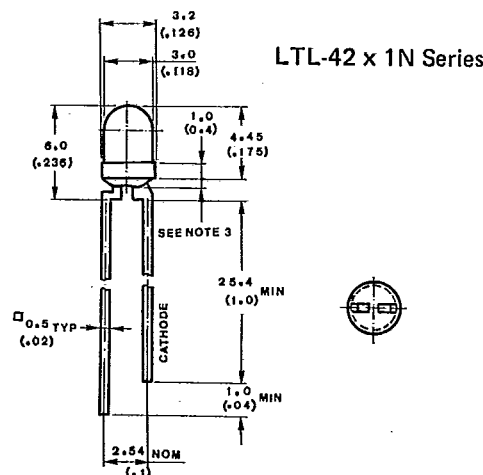
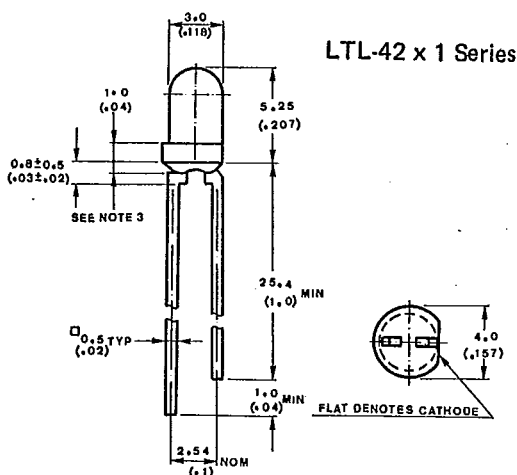
**DESCRIPTION**

The Red source color devices are made with Gallium Arsenide Phosphide Red Light Emitting Diode.

The Bright Red source color devices are made with Gallium Phosphide on Gallium Phosphide Red Light Emitting Diode.

The High Efficiency Red and Orange source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Orange Light Emitting Diode. The Green source color devices are made with Gallium Phosphide on Gallium Phosphide Green Light Emitting Diode.

The Yellow source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diode.

**PACKAGE DIMENSIONS****NOTES:**

1. All dimensions are in millimeters (inches).
2. Tolerance is  $\pm 0.25\text{mm}$  (.010") unless otherwise noted.
3. Protruded resin under flange is 1.5mm (.059") max.
4. Lead spacing is measured where the leads emerge from the package.
5. Specifications are subject to change without notice.

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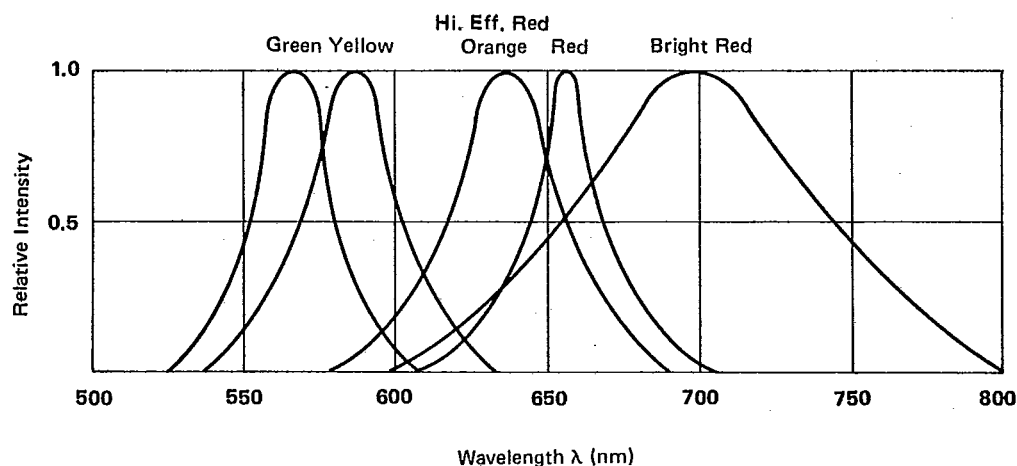
## DEVICES

| PART NO.<br>LTL- | LENS        |              | SOURCE COLOR |
|------------------|-------------|--------------|--------------|
|                  | COLOR       | DIFFUSION    |              |
| 4201             | Red         | Diffused     | Red          |
| 4202             | Red         | Transparent  |              |
| 4206             | Water Clear | Non-diffused |              |
| 4211             | Red         | Diffused     | Bright Red   |
| 4221             | Red         | Diffused     | Hi. Eff. Red |
| 4222             | Red         | Transparent  |              |
| 4231             | Green       | Diffused     | Green        |
| 4232             | Green       | Transparent  |              |
| 4251             | Yellow      | Diffused     | Yellow       |
| 4252             | Yellow      | Transparent  |              |
| 4291             | Orange      | Diffused     | Orange       |
| 4292             | Orange      | Transparent  |              |
| 4296             | Water Clear | Non-diffused |              |

| PART NO.<br>LTL- | LENS   |              | SOURCE COLOR |
|------------------|--------|--------------|--------------|
|                  | COLOR  | DIFFUSION    |              |
| 4201N            | Red    | Diffused     | Red          |
| 4202N            |        | Transparent  |              |
| 4211N            |        | Diffused     |              |
| 4221N            | Red    | Diffused     | Hi. Eff. Red |
| 4222N            |        | Transparent  |              |
| 4231N            | Green  | Diffused     | Green        |
| 4232N            |        | Transparent  |              |
| 4236N            |        | Non-diffused |              |
| 4251N            | Yellow | Diffused     | Yellow       |
| 4252N            |        | Transparent  |              |
| 4256N            |        | Non-diffused |              |
| 4291N            | Orange | Diffused     | Orange       |
| 4292N            |        | Transparent  |              |
| 4296N            |        | Non-diffused |              |

ABSOLUTE MAXIMUM RATINGS AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                                                    | RED                                         | BRIGHT RED | GREEN | YELLOW | HI. EFF. RED ORANGE | UNIT                 |
|--------------------------------------------------------------|---------------------------------------------|------------|-------|--------|---------------------|----------------------|
| Power Dissipation                                            | 80                                          | 40         | 100   | 60     | 100                 | mW                   |
| Peak Forward Current<br>(1/10 Duty Cycle, 0.1ms Pulse Width) | 200                                         | 60         | 120   | 80     | 120                 | mA                   |
| Continuous Forward Current                                   | 40                                          | 15         | 30    | 20     | 30                  | mA                   |
| Derating Linear From $25^\circ\text{C}$                      | 0.5                                         | 0.2        | 0.4   | 0.25   | 0.4                 | mA/ $^\circ\text{C}$ |
| Reverse Voltage                                              | 5                                           | 5          | 5     | 5      | 5                   | V                    |
| Operating Temperature Range                                  | $-55^\circ\text{C}$ to $+100^\circ\text{C}$ |            |       |        |                     |                      |
| Storage Temperature Range                                    | $-55^\circ\text{C}$ to $+100^\circ\text{C}$ |            |       |        |                     |                      |
| Lead Soldering Temperature<br>[1.6mm (0.063in) From Body]    | $260^\circ\text{C}$ for 5 Seconds           |            |       |        |                     |                      |



Wavelength  $\lambda$  (nm)

FIG. 1 RELATIVE INTENSITY VS. WAVELENGTH

ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-     | MIN.              | TYP.              | MAX.              | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|----------------------|-------------------|-------------------|-------------------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4201<br>4202<br>4211 | 0.3<br>1.1<br>0.6 | 0.8<br>4.0<br>1.7 |                   | mcđ           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4201<br>4202<br>4211 |                   | 40<br>20<br>40    |                   | deg.          | Note 2 (Fig. 6)                 |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4201<br>4202<br>4211 |                   | 655<br>655<br>697 |                   | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4201<br>4202<br>4211 |                   | 24<br>24<br>90    |                   | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4201<br>4202<br>4211 |                   | 1.7<br>1.7<br>2.1 | 2.0<br>2.0<br>2.8 | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4201<br>4202<br>4211 |                   |                   | 100               | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       | 4201<br>4202<br>4211 |                   | 30<br>30<br>55    |                   | pF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.

2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

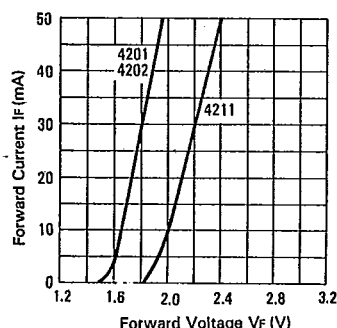


FIG. 2 FORWARD CURRENT VS FORWARD VOLTAGE.

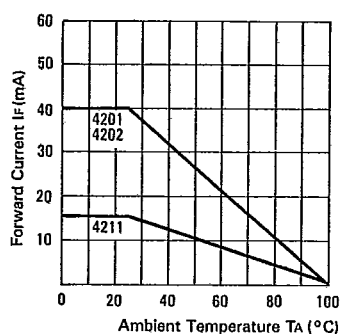


FIG. 3 FORWARD CURRENT DERATING CURVE

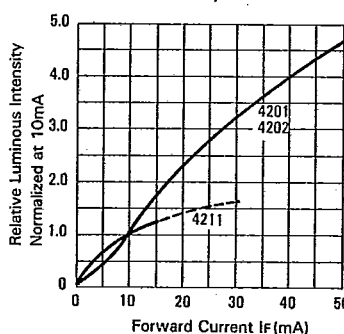


FIG. 4 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT.

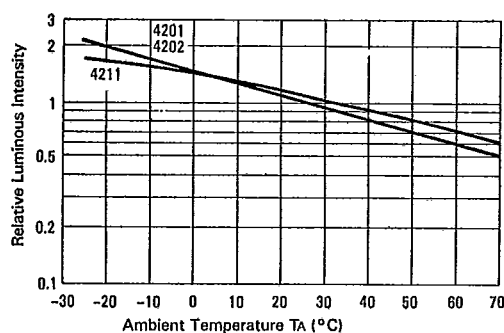


FIG. 5 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

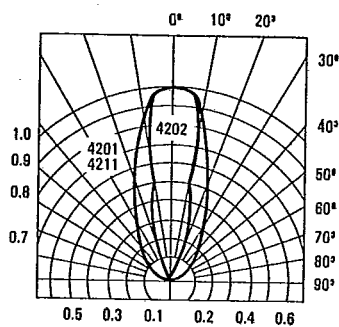


FIG. 6 SPATIAL DISTRIBUTION



ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL— | MIN.       | TYP.        | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|------------------|------------|-------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4221<br>4222     | 1.1<br>4.0 | 3.8<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4221<br>4222     |            | 40<br>20    |      | deg.          | Note 2 (Fig. 11)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4221<br>4222     |            | 635<br>635  |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4221<br>4222     |            | 40<br>40    |      | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4221<br>4222     |            | 2.0<br>2.0  | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4221<br>4222     |            |             | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capactance               | C                       | 4221<br>4222     |            | 20<br>20    |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.

2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

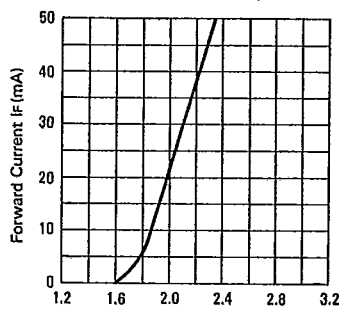


FIG. 7 FORWARD CURRENT VS. FORWARD VOLTAGE

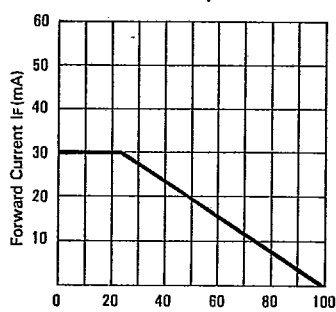


FIG. 8 FORWARD CURRENT DERATING CURVE

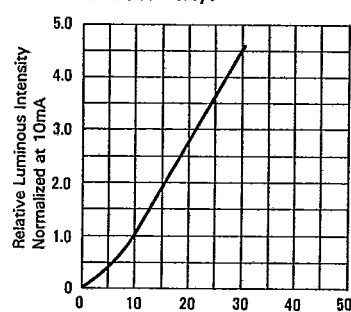


FIG. 9 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

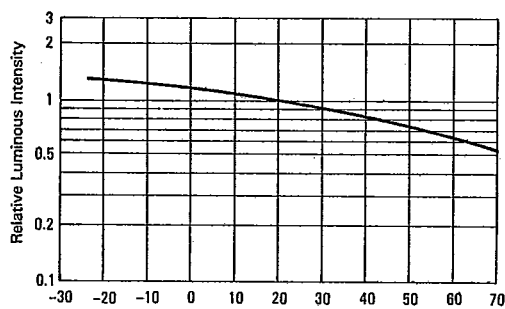


FIG. 10 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

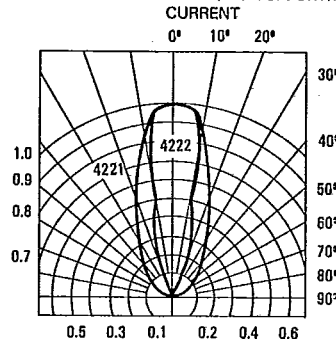


FIG. 11 SPATIAL DISTRIBUTION

ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-             | MIN.                     | TYP.                       | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|------------------------------|--------------------------|----------------------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_V$                   | 4231<br>4232<br>4251<br>4252 | 1.7<br>4.0<br>1.7<br>4.0 | 5.6<br>12.6<br>5.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4231<br>4232<br>4251<br>4252 |                          | 40<br>20<br>40<br>20       |      | deg.          | Note 2 (Fig. 16)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4231<br>4232<br>4251<br>4252 |                          | 565<br>565<br>585<br>585   |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4231<br>4232<br>4251<br>4252 |                          | 30<br>30<br>35<br>35       |      | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4231<br>4232<br>4251<br>4252 |                          | 2.1                        | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4231<br>4232<br>4251<br>4252 |                          |                            | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | $C$                     | 4231<br>4232<br>4251<br>4252 |                          | 35<br>35<br>15<br>15       |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

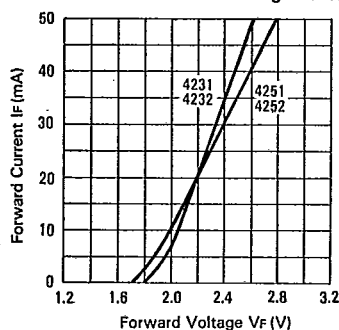


FIG. 12 FORWARD CURRENT VS. FORWARD VOLTAGE

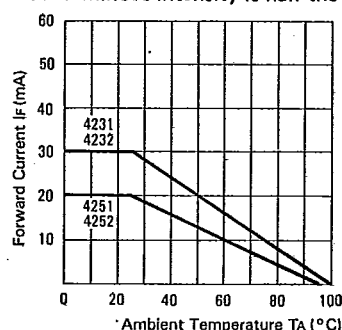


FIG. 13 FORWARD CURRENT DERATING CURVE

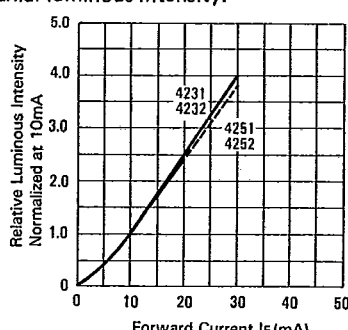


FIG. 14 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

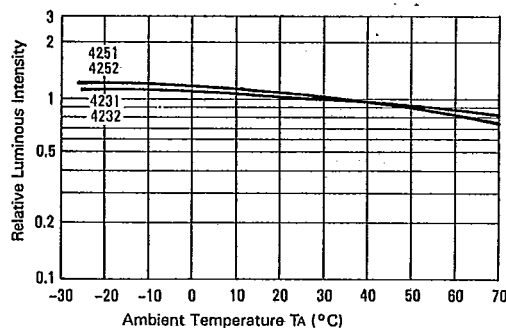


FIG. 15 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

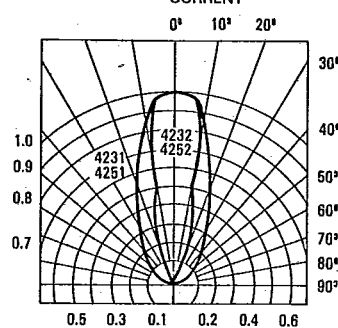


FIG. 16 SPATIAL DISTRIBUTION



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ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-     | MIN.              | TYP.                | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|----------------------|-------------------|---------------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4291<br>4292<br>4296 | 1.7<br>4.0<br>4.0 | 5.6<br>12.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4291<br>4292<br>4296 |                   | 40<br>20<br>20      |      | deg.          | Note 2 (Fig. 21)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ |                      |                   | 630                 |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         |                      |                   | 40                  |      | nm            |                                 |
| Forward Voltage          | $V_F$                   |                      |                   | 2.0                 | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   |                      |                   |                     | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       |                      |                   | 20                  |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.

2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

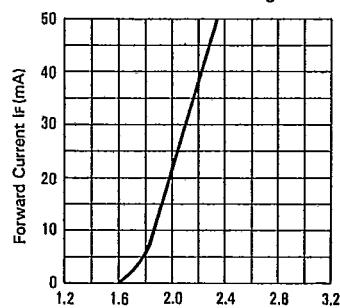


FIG. 17 FORWARD CURRENT VS. FORWARD VOLTAGE

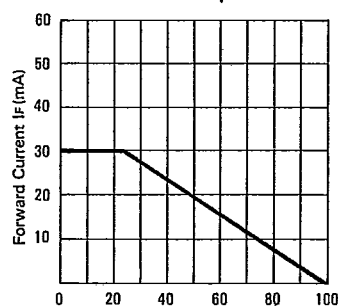


FIG. 18 FORWARD CURRENT DERATING CURVE

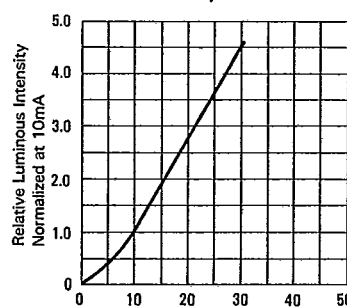


FIG. 19 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

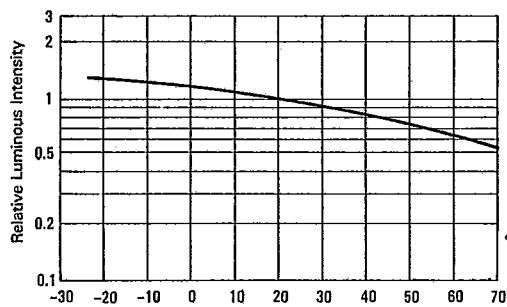


FIG. 20 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

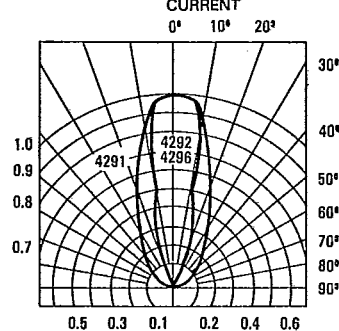


FIG. 21 SPATIAL DISTRIBUTION

ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-        | MIN.              | TYP.              | MAX.              | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|-------------------------|-------------------|-------------------|-------------------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4201N<br>4202N<br>4211N | 0.3<br>0.8<br>0.8 | 0.8<br>2.5<br>2.5 |                   | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4201N<br>4202N<br>4211N |                   | 60<br>45<br>60    |                   | deg.          | Note 2 (Fig. 26)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4201N<br>4202N<br>4211N |                   | 655<br>655<br>697 |                   | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4201N<br>4202N<br>4211N |                   | 24<br>24<br>90    |                   | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4201N<br>4202N<br>4211N |                   | 1.7<br>1.7<br>2.0 | 2.0<br>2.0<br>2.8 | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4201N<br>4202N<br>4211N |                   |                   | 100               | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       | 4201N<br>4202N<br>4211N |                   | 30<br>30<br>55    |                   | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

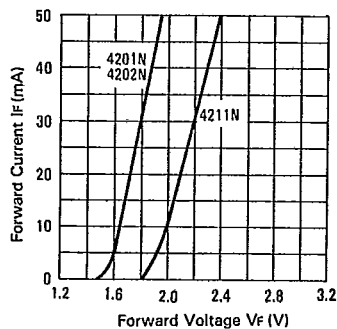


FIG. 22 FORWARD CURRENT VS. FORWARD VOLTAGE.

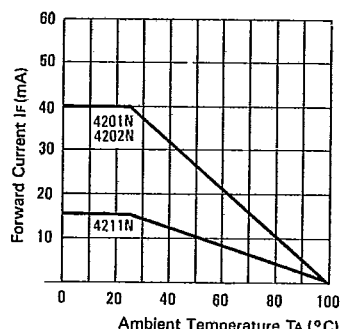


FIG. 23 FORWARD CURRENT DERATING CURVE

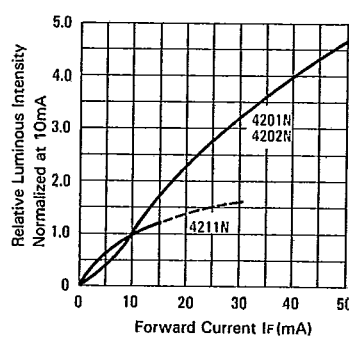


FIG. 24 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT.

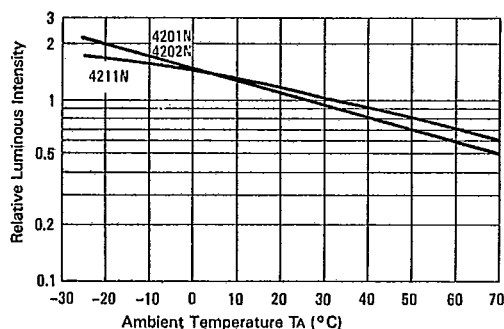


FIG. 25 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

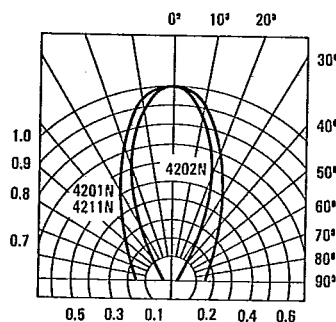


FIG. 26 SPATIAL DISTRIBUTION



ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL- | MIN.       | TYP.        | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|------------------|------------|-------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4221N<br>4222N   | 1.7<br>4.0 | 5.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4221N<br>4222N   |            | 60<br>45    |      | deg.          | Note 2 (Fig. 31)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4221N<br>4222N   |            | 635<br>635  |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4221N<br>4222N   |            | 40<br>40    |      | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4221N<br>4222N   |            | 2.0<br>2.0  | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4221N<br>4222N   |            |             | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       | 4221N<br>4222N   |            | 20<br>20    |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.

2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

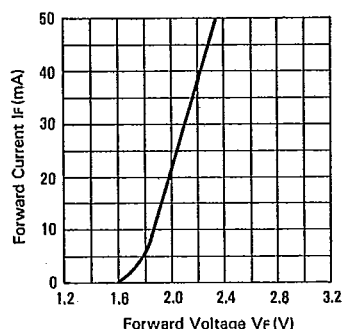


FIG. 27 FORWARD CURRENT VS. FORWARD VOLTAGE

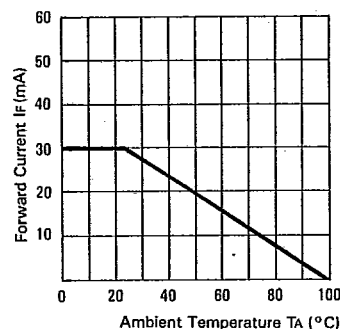


FIG. 28 FORWARD CURRENT DERATING CURVE

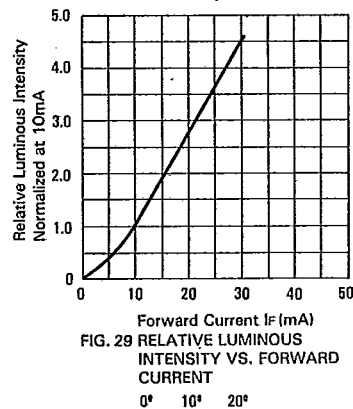


FIG. 29 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

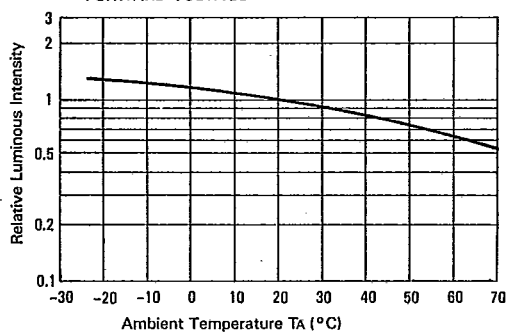


FIG. 30 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

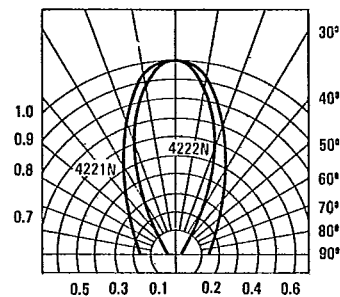


FIG. 31 SPATIAL DISTRIBUTION



ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-        | MIN.              | TYP.                | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|-------------------------|-------------------|---------------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4231N<br>4232N<br>4236N | 1.7<br>4.0<br>4.0 | 5.6<br>12.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4231N<br>4232N<br>4236N |                   | 60<br>45<br>45      |      | deg.          | Note 2 (Fig. 36)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4231N<br>4232N<br>4236N |                   | 565                 |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4231N<br>4232N<br>4236N |                   | 30                  |      | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4231N<br>4232N<br>4236N |                   | 2.1                 | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4231N<br>4232N<br>4236N |                   |                     | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       | 4231N<br>4232N<br>4236N |                   | 35                  |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

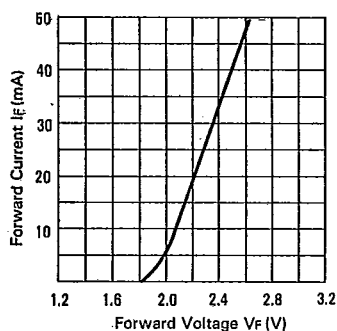


FIG. 32 FORWARD CURRENT VS. FORWARD VOLTAGE.

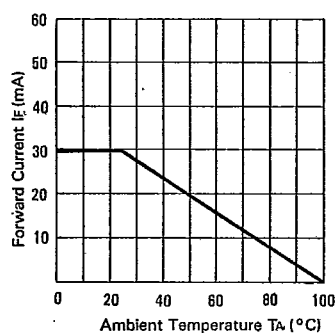


FIG. 33 FORWARD CURRENT DERATING CURVE.

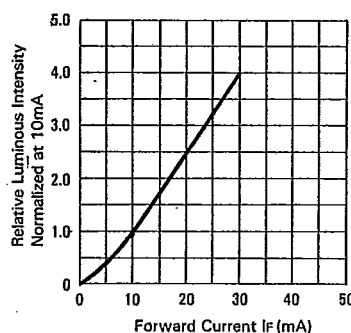


FIG. 34 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT.

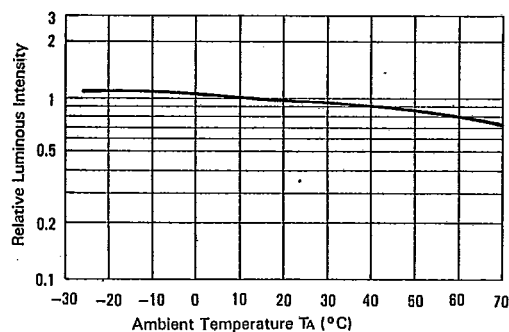


FIG. 35 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

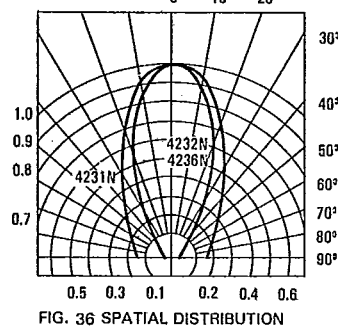


FIG. 36 SPATIAL DISTRIBUTION



ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-        | MIN.              | TYP.                | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|-------------------------|-------------------|---------------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4251N<br>4252N<br>4256N | 1.7<br>4.0<br>4.0 | 5.6<br>12.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4251N<br>4252N<br>4256N |                   | 60<br>45<br>45      |      | deg.          | Note 2 (Fig. 41)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ | 4251N<br>4252N<br>4256N |                   | 585                 |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         | 4251N<br>4252N<br>4256N |                   | 35                  |      | nm            |                                 |
| Forward Voltage          | $V_F$                   | 4251N<br>4252N<br>4256N |                   | 2.1                 | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   | 4251N<br>4252N<br>4256N |                   |                     | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       | 4251N<br>4252N<br>4256N |                   | 15                  |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.  
2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

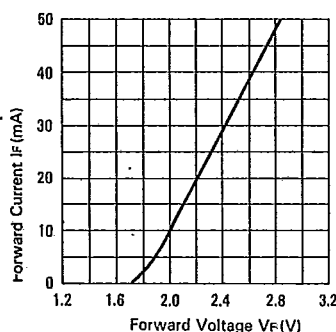


FIG. 37 FORWARD CURRENT VS. FORWARD VOLTAGE

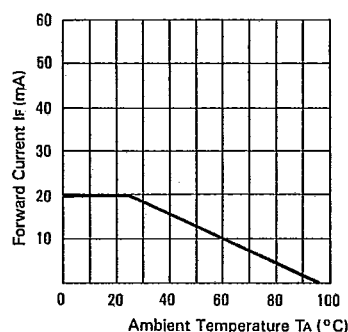


FIG. 38 FORWARD CURRENT DERATING CURVE

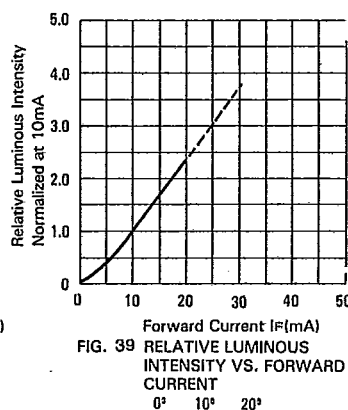


FIG. 39 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

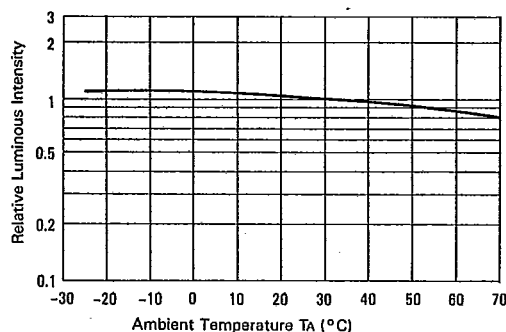


FIG. 40 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

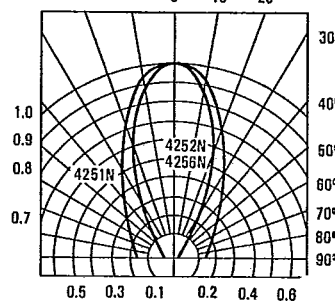


FIG. 41 SPATIAL DISTRIBUTION

ELECTRICAL/OPTICAL CHARACTERISTICS AND CURVES AT  $T_A = 25^\circ\text{C}$ 

| PARAMETER                | SYMBOL                  | PART NO.<br>LTL-        | MIN.              | TYP.                | MAX. | UNIT          | TEST<br>CONDITION               |
|--------------------------|-------------------------|-------------------------|-------------------|---------------------|------|---------------|---------------------------------|
| Luminous Intensity       | $I_v$                   | 4291N<br>4292N<br>4296N | 1.7<br>4.0<br>4.0 | 5.6<br>12.6<br>12.6 |      | mcd           | $I_F = 10\text{ mA}$<br>Note 1  |
| Viewing Angle            | $2\theta_{1/2}$         | 4291N<br>4292N<br>4296N |                   | 60<br>45<br>45      |      | deg.          | Note 2 (Fig. 46)                |
| Peak Emission Wavelength | $\lambda_{\text{PEAK}}$ |                         |                   | 630                 |      | nm            | Measurement<br>@ Peak (Fig. 1)  |
| Spectral Line Half Width | $\Delta\lambda$         |                         |                   | 40                  |      | nm            |                                 |
| Forward Voltage          | $V_F$                   |                         |                   | 2.0                 | 2.8  | V             | $I_F = 20\text{ mA}$            |
| Reverse Current          | $I_R$                   |                         |                   |                     | 100  | $\mu\text{A}$ | $V_R = 5\text{ V}$              |
| Capacitance              | C                       |                         |                   | 20                  |      | PF            | $V_F = 0$<br>$f = 1\text{ MHz}$ |

NOTES: 1. Luminous Intensity is measured with a light sensor and filter combination that approximates the CIE (Commission Internationale De L'Eclairage) eye-response curve.

2.  $\theta_{1/2}$  is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

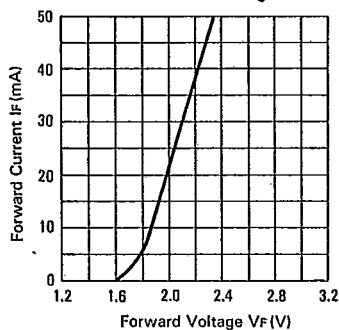


FIG. 42 FORWARD CURRENT VS. FORWARD VOLTAGE

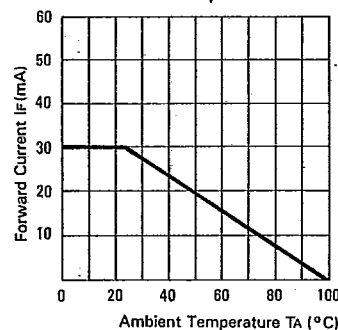


FIG. 43 FORWARD CURRENT DERATING CURVE

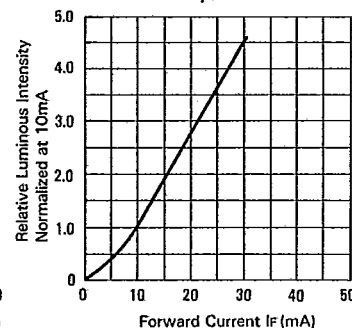


FIG. 44 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

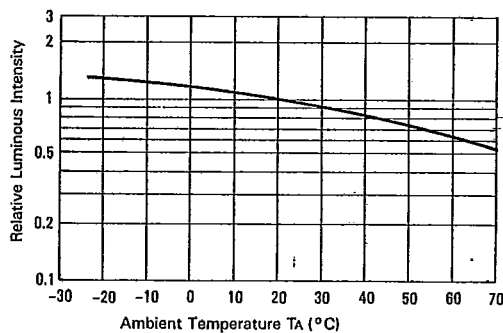


FIG. 45 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

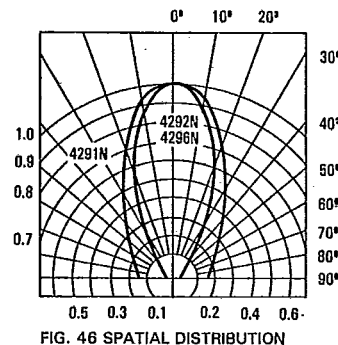


FIG. 46 SPATIAL DISTRIBUTION

