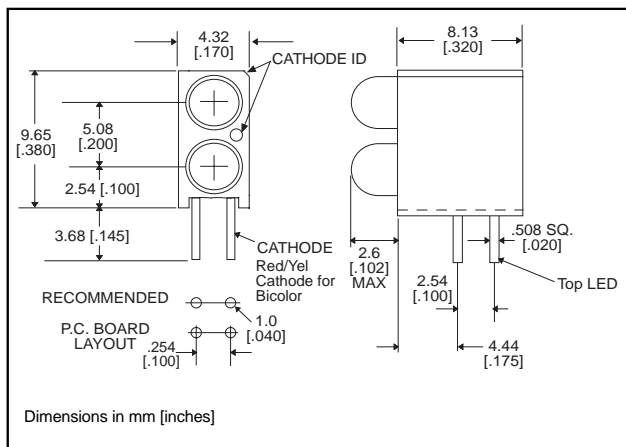


# 3mm LED CBI® Circuit Board Indicator Bi-level



## 553-XXXX



Dimensions in mm [inches]

Standard Polarity shown in drawing: Cathode right

### Features

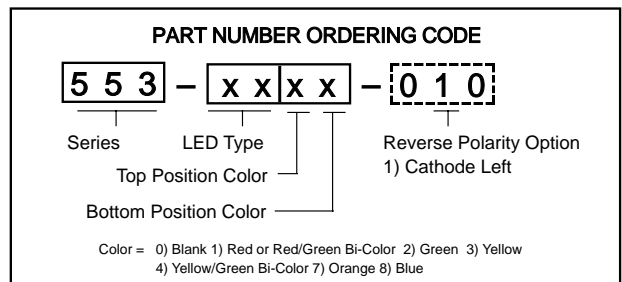
- Multiple CBIs form horizontal LED arrays on 4.45mm (0.175") center-lines. See page 4-41 and 4-42 for pre-assembled arrays
- High Contrast, UL 94 V-0 rated, black housing
- Oxygen index: 32%
- Polymer content: PBT, 0.343 g
- Housing stand-offs facilitate PCB cleaning
- Solderability per MIL-STD-202F, method 208F
- LEDs are safe for direct viewing per IEC 825-1, EN-60825-1

### Tolerance note: As noted, otherwise:

- LED Protrusion: ±0.04 mm [±0.016]
- CBI Housing: ±0.02mm[±0.008]

### Custom Combinations

- Contact factory for information on custom bi-level arrays and color combinations.



-010 Ordering Code Suffix required ONLY for Reverse Polarity Option

### PART NO.

### COLOR\*

#### HIGH EFFICIENCY - LED TYPE 01

- 553-0111                      Red
- 553-0122                      Green
- 553-0133                      Yellow
- 553-0177                      Orange
- 553-0188                      Blue<sup>3</sup>



#### LOW CURRENT - LED TYPE 02

- 553-0211                      Red
- 553-0222                      Green
- 553-0233                      Yellow

#### RESISTOR 5 VOLTS - LED TYPE 03

- 553-0311                      Red
- 553-0322                      Green
- 553-0333                      Yellow

#### BI-COLOR - LED TYPE 07

- 553-0711                      Red/Green
- 553-0744                      Yellow/Green

#### NON-DIFFUSED - LED TYPE 22

- 553-2211                      Red
- 553-2222                      Green
- 553-2233                      Yellow

\* Top-Bottom LED

To order any of the 553-xxxx part numbers with Reverse Polarity (Cathode Left), please add -010 to the part numbers shown above.



**ATTENTION**  
OBSERVE PRECAUTIONS  
FOR HANDLING  
ELECTROSTATIC  
SENSITIVE  
DEVICES

## Typical Operating Characteristics (T<sub>A</sub>=25°C)

See LED data sheet for additional information  
See page 4-70 and 4-71 for Reference Only LED Drive Circuit Examples. See page 4-72 for Pin Out

### HIGH EFFICIENCY

| Part Number | Color  | Peak Wavelength nm | I <sub>v</sub> mcd | V <sub>F</sub> Volts | Test Current (mA) | Viewing Angle 2Θ <sub>½</sub> | LED Data sheet | Page # |
|-------------|--------|--------------------|--------------------|----------------------|-------------------|-------------------------------|----------------|--------|
| 553-0111    | Red    | 650                | 10                 | 2                    | 10                | 45°                           | 521-9427       | 4-64   |
| 553-0122    | Green  | 563                | 16                 | 2.1                  | 10                | 45°                           | 521-9408       | 4-64   |
| 553-0133    | Yellow | 585                | 6.3                | 2.1                  | 10                | 45°                           | 521-9428       | 4-64   |
| 553-0177    | Orange | 600                | 7                  | 2.2                  | 10                | 60°                           | 521-9498       | 4-58   |
| 553-0188    | Blue   | 428                | 12                 | 3.5                  | 10                | 70°                           | 521-9831       | 4-57   |

### LOW CURRENT

| Part Number | Color  | Peak Wavelength nm | I <sub>v</sub> mcd | V <sub>F</sub> Volts | Test Current (mA) | Viewing Angle 2Θ <sub>½</sub> | LED Data sheet | Page # |
|-------------|--------|--------------------|--------------------|----------------------|-------------------|-------------------------------|----------------|--------|
| 553-0211    | Red    | 635                | 1.6                | 1.7                  | 2                 | 60°                           | 521-9324       | 4-60   |
| 553-0222    | Green  | 565                | 1.6                | 1.9                  | 2                 | 60°                           | 521-9326       | 4-60   |
| 553-0233    | Yellow | 585                | 1.6                | 1.8                  | 2                 | 60°                           | 521-9325       | 4-60   |

### INTEGRAL RESISTOR, 5 VOLTS

| Part Number | Color  | Peak Wavelength nm | I <sub>v</sub> mcd | Test Voltage | Forward Current (mA) | Viewing Angle 2Θ <sub>½</sub> | LED Data sheet | Page # |
|-------------|--------|--------------------|--------------------|--------------|----------------------|-------------------------------|----------------|--------|
| 553-0311    | Red    | 635                | 29                 | 5            | 10                   | 60°                           | 521-9215       | 4-59   |
| 553-0322    | Green  | 565                | 19                 | 5            | 10                   | 60°                           | 521-9323       | 4-59   |
| 553-0333    | Yellow | 585                | 12.6               | 5            | 10                   | 60°                           | 521-9322       | 4-59   |

### BI-COLOR

| Part Number | Color        | Peak Wavelength nm | I <sub>v</sub> mcd | V <sub>F</sub> Volts | Test Current (mA) | Viewing Angle 2Θ <sub>½</sub> | LED Data sheet | Page # |
|-------------|--------------|--------------------|--------------------|----------------------|-------------------|-------------------------------|----------------|--------|
| 553-0711    | Red/Green    | 635/565            | 4.7/10             | 2/2.1                | 10                | 50°                           | 521-9459       | 4-63   |
| 553-0744    | Yellow/Green | 585/565            | 4.3/6.3            | 2.1*/2.1*            | 10                | 80°                           | 521-9478       | 4-62   |

\* I<sub>F</sub> = 20mA

### NON-DIFFUSED

| Part Number | Color  | Peak Wavelength nm | I <sub>v</sub> mcd | V <sub>F</sub> Volts* | Test Current (mA) | Viewing Angle 2Θ <sub>½</sub> | LED Data sheet | Page # |
|-------------|--------|--------------------|--------------------|-----------------------|-------------------|-------------------------------|----------------|--------|
| 553-2211    | Red    | 635                | 29                 | 2                     | 10                | 45°                           | 521-9432       | 4-61   |
| 553-2222    | Green  | 565                | 50                 | 2.1                   | 10                | 45°                           | 521-9430       | 4-61   |
| 553-2233    | Yellow | 585                | 20                 | 2.1                   | 10                | 45°                           | 521-9431       | 4-61   |

\* I<sub>F</sub> = 20mA

### CBI ARRAYS .200 PITCH

Dialight offers its Multiarray to reduce insertions and to assure indicator alignment. Multiarrays mount indicators on .200 centers. These assemblies are available in arrays of 2 to 6. See pages 4-41 and 4-42 for information. Call factory for information on .185 pitched arrays.



# 3mm Discrete LED Tinted, Diffused

# Dialight

## 521-9831



**PART NO.** 521-9831  
**COLOR** Blue<sup>3</sup>

**MOUNTING CLIP:** 515-0006  
located on page 4-65



**ATTENTION**  
OBSERVE PRECAUTIONS  
FOR HANDLING  
ELECTROSTATIC  
SENSITIVE  
DEVICES

4

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

Blue  
-9831

|                            |                                    |
|----------------------------|------------------------------------|
| Power Dissipation (mW)     | 100                                |
| Forward Current (mA)       | 20                                 |
| Derating (mA/°C) From 55°C | .44                                |
| Operating Temperature (°C) | -40/+100                           |
| Storage Temperature (°C)   | -40/+100                           |
| Soldering Temperature      | 260°C, 5 seconds, 1.6 mm from case |

Solder Adherence per MIL-STD-202E, Method 208C

### OPERATING CHARACTERISTICS (T<sub>A</sub>=25°C)

Blue  
-9831

|                                    |         |     |
|------------------------------------|---------|-----|
| Luminous Intensity (mcd)           | Min.    | 6.3 |
| I <sub>F</sub> =10mA               | Typical | 12  |
| Peak Wavelength (nm)               | Typical | 428 |
| λ Peak                             |         |     |
| Viewing Angle (2Θ <sub>1/2</sub> ) | Typical | 70° |
| Forward Voltage (V)                | Typical | 3.5 |
| I <sub>F</sub> =10mA               | Max.    | 4.2 |
| Reverse Voltage (V) IR=10μA        | Min.    | 3   |

Θ<sub>1/2</sub> is the off axis angle at which the luminous intensity is half the axial luminous intensity

# 3mm Discrete LED

## High Efficiency

### Diffused

521-9210, -9211, -9216, -9498, -9636

# Dialight



#### PART NO. COLOR

521-9210 Green

521-9211 Yellow

521-9216 Red

521-9498 Orange

521-9636 Red



**MOUNTING CLIP: 515-0006**

located on page 4-65

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A=25^\circ\text{C}$ ) | Green<br><b>-9210</b>              | Yellow<br><b>-9211</b> | Red<br><b>-9216</b> | Orange<br><b>-9498</b> | Red<br><b>-9636</b> |
|--|------------------------------------|------------------------|---------------------|------------------------|---------------------|
| Power Dissipation (mW)                                     | 100                                | 60                     | 100                 | 135                    | 100                 |
| Forward Current (mA)                                       | 30                                 | 20                     | 30                  | 25                     | 40                  |
| Derating (mA/°C) <i>From 50°C 1 from 25°C</i>              | .4                                 | .25                    | .4                  | .5                     | .5 <sup>1</sup>     |
| Operating Temperature (°C)                                 | -55/+100                           | -55/+100               | -55/+100            | -55/+100               | -55/+100            |
| Storage Temperature (°C)                                   | -55/+100                           | -55/+100               | -55/+100            | -55/+100               | -55/+100            |
| Soldering Temperature                                      | 260°C, 5 seconds, 1.6 mm from body |                        |                     |                        |                     |

*Solder Adherence per MIL-STD-202E, Method 208C*

| <b>OPERATING CHARACTERISTICS</b> ( $T_A=25^\circ\text{C}$ ) |         | Green<br><b>-9210</b> | Yellow<br><b>-9211</b> | Red<br><b>-9216</b> | Orange<br><b>-9498</b> | Red<br><b>-9636</b> |
|---|---------|-----------------------|------------------------|---------------------|------------------------|---------------------|
| Luminous Intensity (mcd)                                    | Min.    | 4.7                   | 7.4                    | 7.4                 | 3.4                    | 8.7 <sup>1</sup>    |
|   | Typical | 12.6                  | 10                     | 10                  | 7                      | 48 <sup>1</sup>     |
| Peak Wavelength (nm)  | Typical | 565                   | 585                    | 635                 | 600                    | 660                 |
| Viewing Angle ( $2\theta$ °)                                | Typical | 60°                   | 60°                    | 60°                 | 60°                    | 60°                 |
| Forward Voltage (V)   | Typical | 2.1 <sup>1</sup>      | 2.1 <sup>1</sup>       | 2 <sup>1</sup>      | 2.2                    | 1.8 <sup>1</sup>    |
|   | Max.    | 2.8 <sup>1</sup>      | 2.8 <sup>1</sup>       | 2.8 <sup>1</sup>    | 3                      | 2.4 <sup>1</sup>    |
| Reverse Voltage (V), $I_R=100\mu\text{A}$                   | Max.    | 5                     | 5                      | 5                   | 5                      | 4                   |

<sup>1</sup>  $\theta$  is the off axis angle at which the luminous intensity is half the axial luminous intensity

**3mm Discrete LED  
Integral Resistor, 5V  
Diffused**

**Dialight**

**521-9215, -9322, -9323**



| PART NO. | COLOR  |
|----------|--------|
| 521-9215 | Red    |
| 521-9322 | Yellow |
| 521-9323 | Green  |

**MOUNTING CLIP: 515-0006**  
located on page 4-65

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A=25^\circ\text{C}$ ) | Red  | Yellow       | Green        |
|--|--|--------------|--------------|
|  | <b>-9215</b>                                       | <b>-9322</b> | <b>-9323</b> |
| Forward Voltage (V)  | 7.5  | 7.5          | 7.5          |
| Derating ( $V/^\circ\text{C}$ ) From $50^\circ\text{C}$    | .086   | .086         | .071         |
| Operating Temperature ( $^\circ\text{C}$ )                 | -40/+85  | -40/+85      | -20/+85      |
| Storage Temperature ( $^\circ\text{C}$ )                   | -55/+100   | -55/+100     | -55/+100     |
| Soldering Temperature                                      | 260 $^\circ\text{C}$ , 5 seconds, 1.6 mm from case |              |              |

Solder Adherence per MIL-STD-202E, Method 208C

| <b>OPERATING CHARACTERISTICS</b> ( $T_A=25^\circ\text{C}$ ) |         | Red          | Yellow       | Green        |
|---|---------|--------------|--------------|--------------|
|   |         | <b>-9215</b> | <b>-9322</b> | <b>-9323</b> |
| Luminous Intensity (mcd)                                    | Min.    | 8.7          | 3.7          | 5.6          |
|   | Typical | 29           | 12.6         | 19           |
| Peak Wavelength (nm)  | Typical | 635          | 585          | 565          |
| $\lambda$ Peak  |         |              |              |              |
| Viewing Angle ( $2\theta_{1/2}$ )                           | Typical | 60 $^\circ$  | 60 $^\circ$  | 60 $^\circ$  |
| Forward Current (mA)  | Typical | 10           | 10           | 10           |
|   | Max.    | 20           | 20           | 20           |
| Reverse Voltage (V), $I_R=100\mu\text{A}$                   | Min.    | 5            | 5            | 5            |

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

**4**

# 3mm Discrete LED

## Low Current

## Diffused

# Dialight

## 521-9324, -9325, -9326



### PART NO. COLOR

|          |        |
|----------|--------|
| 521-9324 | Red    |
| 521-9325 | Yellow |
| 521-9326 | Green  |

**MOUNTING CLIP:** 515-0006  
located on page 4-65

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

|  | Red<br>-9324                       | Yellow<br>-9325 | Green<br>-9326 |
|--|------------------------------------|-----------------|----------------|
| Power Dissipation (mW)                   | 20                                 | 20              | 20             |
| Forward Current (mA)                     | 7                                  | 7               | 7              |
| Derating (mA/°C) From 90°C               | .7                                 | .7              | .7             |
| Peak Current (mA)<br>Pulse width = 10 μs | 500                                | 500             | 500            |
| Operating Temperature (°C)               | -55/+100                           | -55/+100        | -55/+100       |
| Storage Temperature (°C)                 | -55/+100                           | -55/+100        | -55/+100       |
| Soldering Temperature                    | 260°C, 5 seconds, 1.6 mm from case |                 |                |

Solder Adherence per MIL-STD-202E, Method 208C

### OPERATING CHARACTERISTICS (T<sub>A</sub>=25°C)

|   |         | Red<br>-9324 | Yellow<br>-9325 | Green<br>-9326 |
|---|---------|--------------|-----------------|----------------|
| Luminous Intensity (mcd)<br>I <sub>F</sub> =2mA | Min.    | 1            | 1               | 1              |
|   | Typical | 1.6          | 1.6             | 1.6            |
| Peak Wavelength (nm)<br>λ Peak                  | Typical | 635          | 585             | 565            |
| Viewing Angle (2Θ °)                            | Typical | 60°          | 60°             | 60°            |
| Forward Voltage (V)<br>I <sub>F</sub> =2mA      | Typical | 1.7          | 1.8             | 1.9            |
|   | Max.    | 2.2          | 2.7             | 2.2            |
| Reverse Voltage (V), I <sub>R</sub> =50μA       | Min.    | 5            | 5               | 5              |

Θ is the off axis angle at which the luminous intensity is half the axial luminous intensity

**3mm Discrete LED**  
**High Efficiency**  
**Tinted, Non-Diffused**

**Dialight**

**521-9430, -9431, -9432**



**PART NO.**

**COLOR**

521-9430  
 521-9431  
 521-9432

Green  
 Yellow  
 Red

**MOUNTING CLIP: 515-0006**  
 located on page 4-65

**ABSOLUTE MAXIMUM RATINGS** ( $T_A=25^\circ\text{C}$ )

|  | Green<br><b>-9430</b>              | Yellow<br><b>-9431</b> | Red<br><b>-9432</b> |
|--|------------------------------------|------------------------|---------------------|
| Power Dissipation (mW)                   | 100                                | 60                     | 100                 |
| Forward Current (mA)                     | 30                                 | 20                     | 30                  |
| Derating (mA/°C) From 50°C               | .4                                 | .25                    | .4                  |
| Peak Current (mA)<br>Pulse width = 100µs | 120                                | 80                     | 120                 |
| Operating Temperature (°C)               | -55/+100                           | -55/+100               | -55/+100            |
| Storage Temperature (°C)                 | -55/+100                           | -55/+100               | -55/+100            |
| Soldering Temperature                    | 260°C, 5 seconds, 1.6 mm from case |                        |                     |

Solder Adherence per MIL-STD-202E, Method 208C

**OPERATING CHARACTERISTICS** ( $T_A=25^\circ\text{C}$ )

|   |         | Green<br><b>-9430</b> | Yellow<br><b>-9431</b> | Red<br><b>-9432</b> |
|---|---------|-----------------------|------------------------|---------------------|
| Luminous Intensity (mcd)<br>$I_F=10\text{mA}$ | Min.    | 32                    | 10                     | 8.7                 |
|   | Typical | 50                    | 20                     | 29                  |
| Peak Wavelength (nm)<br>$\lambda$ Peak        | Typical | 565                   | 585                    | 635                 |
| Viewing Angle ( $2\theta_{1/2}$ )             | Typical | 45°                   | 45°                    | 45°                 |
| Forward Voltage (V)<br>$I_F=20\text{mA}$      | Typical | 2.1                   | 2.1                    | 2                   |
|   | Max.    | 2.8                   | 2.8                    | 2.8                 |

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

**4**

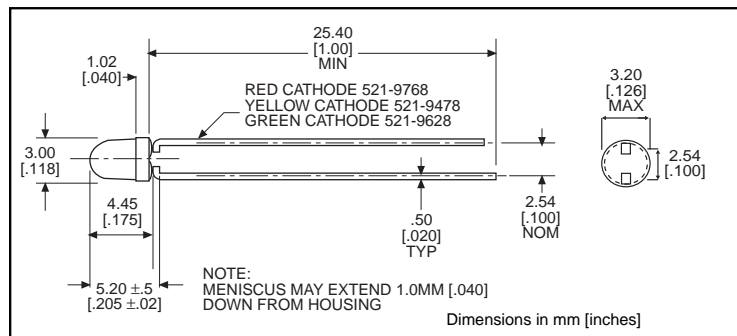
# 3mm Discrete LED

## Bi-Color

### Non-Tinted, Diffused



# 521-9478, -9628, -9768



| PART NO. | COLOR        |
|----------|--------------|
| 521-9478 | Yellow/Green |
| 521-9628 | Red/Green    |
| 521-9768 | Red/Yellow   |

**MOUNTING CLIP: 515-0006**  
located on page 4-65

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A=25^\circ\text{C}$ ) | Yellow/Green<br><b>-9478</b>        | Red/Green<br><b>-9628</b> | Red/Yellow<br><b>-9768</b>        |
|--|-------------------------------------|---------------------------|-----------------------------------|
| Power Dissipation (mW)                                     | 60/100                              | 140/100                   | 100/60                            |
| Forward Current (mA)                                       | 20/30                               | 40/30                     | 30/20                             |
| Derating (mA/°C) From 25°C From 50°C                       | .25 <sup>1</sup> /.40 <sup>1</sup>  | .5/.4                     | .4 <sup>1</sup> /.25 <sup>1</sup> |
| Peak Current (mA)<br>Pulse width = 10µs                    | 80/120                              | 200/120                   | 120/80                            |
| Operating Temperature (°C)                                 | -55/+100                            | -55/+100                  | -55/+100                          |
| Storage Temperature (°C)                                   | -55/+100                            | -55/+100                  | -55/+100                          |
| Soldering Temperature                                      | 260°C, 5 seconds, 1.66 mm from case |                           |                                   |

Solder Adherence per MIL-STD-202E, Method 208C

| <b>OPERATING CHARACTERISTICS</b> ( $T_A=25^\circ\text{C}$ ) |         | Yellow/Green<br><b>-9478</b> | Red/Green<br><b>-9628</b> | Red/Yellow<br><b>-9768</b> |
|---|---------|------------------------------|---------------------------|----------------------------|
| Luminous Intensity (mcd)                                    | Min.    | 2.5/2.5                      | 3.7*/1.1*                 | 1.7*/1.7*                  |
|   | Typical | 4.3/6.3                      | 12.6*/3.7*                | 5.6*/5.6*                  |
| Peak Wavelength (nm)  | Typical | 585/565                      | 660/565                   | 630/585                    |
| Viewing Angle ( $2\theta$ °)                                | Typical | 80°                          | 200°                      | 80°                        |
| Forward Voltage (V)   | Typical | 2.1/2.1                      | 1.8/2.1                   | 2/2.1                      |
|   | Max.    | 2.8/2.8                      | 2.4/2.8                   | 2.8/2.8                    |
| Reverse Voltage (V) $I_R=100\text{ua}$                      | Min.    | 5                            | 5                         | 5                          |

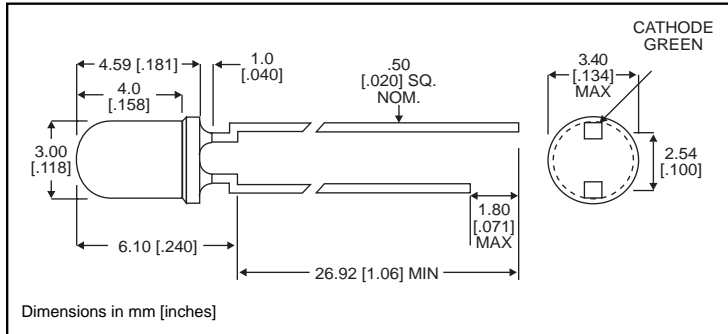
° is the off axis angle at which the luminous intensity is half the axial luminous intensity



**3mm Discrete LED  
Bi-Color  
Non-Tinted, Diffused**

**Dialight**

**521-9459**



**PART NO.** 521-9459  
**COLOR** Red/Green

**MOUNTING CLIP:** 515-0006  
located on page 4-65

**4**

**ABSOLUTE MAXIMUM RATINGS** ( $T_A=25^\circ\text{C}$ )

Red/Green  
**-9459**

|  |                                    |
|--|------------------------------------|
| Power Dissipation (mW)                         | 140                                |
| Forward Current (mA)                           | 45                                 |
| Derating (mA/°C) From 25°C                     | .6                                 |
| Peak Current (mA)<br><i>Pulse width = 10µs</i> | 1000                               |
| Operating Temperature (°C)                     | -55/+100                           |
| Storage Temperature (°C)                       | -55/+100                           |
| Soldering Temperature                          | 260°C, 5 seconds, 1.6 mm from case |

*Solder Adherence per MIL-STD-202E, Method 208C*

**OPERATING CHARACTERISTICS** ( $T_A=25^\circ\text{C}$ )

Red/Green  
**-9459**

|   |                 |                   |
|---|-----------------|-------------------|
| Luminous Intensity (mcd)<br>$I_F=10\text{mA}$ | Min.<br>Typical | 2.5/3.7<br>4.7/10 |
| Peak Wavelength (nm)<br>$\lambda$ Peak        | Typical         | 635/565           |
| Viewing Angle ( $2\theta_{1/2}$ )             | Typical         | 50°               |
| Forward Voltage (V)<br>$I_F=10\text{mA}$      | Typical<br>Max. | 2/2.1<br>2.8/2.8  |

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

# 3mm Discrete LED High Efficiency Diffused

# Dialight

## 521-94xx



**TYPE**  
521-9408  
521-9427  
521-9428

**COLOR**  
Green  
Red  
Yellow

**MOUNTING CLIP: 515-0006**  
located on page 4-65

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

|                            | Green<br><b>-9408</b>              | Red<br><b>-9427</b> | Yellow<br><b>-9428</b> |
|----------------------------|------------------------------------|---------------------|------------------------|
| Power Dissipation (mW)     | 75                                 | 60                  | 60                     |
| Forward Current (mA)       | 25                                 | 20                  | 20                     |
| Derating (mA/°C) From 50°C | .5                                 | .5                  | .5                     |
| Peak Current (mA)          | 60                                 | 60                  | 60                     |
| Operating Temperature (°C) | -25/+85                            | -25/+85             | -25/+85                |
| Storage Temperature (°C)   | -30/+100                           | -30/+100            | -30/+100               |
| Soldering Temperature      | 260°C, 5 seconds, 1.6 mm from case |                     |                        |

Solder Adherence per MIL-STD-202E, Method 208C

### OPERATING CHARACTERISTICS (T<sub>A</sub>=25°C)

|   |         | Green<br><b>-9408</b> | Red<br><b>-9427</b> | Yellow<br><b>-9428</b> |
|---|---------|-----------------------|---------------------|------------------------|
| Luminous Intensity (mcd)                  | Min.    | 5.6                   | 3.6                 | 2.2                    |
|   | Typical | 16                    | 10                  | 6.3                    |
| Peak Wavelength (nm)                      | Typical | 563                   | 650                 | 585                    |
| Viewing Angle (2θ <sup>1/2</sup> )        | Typical | 45°                   | 45°                 | 45°                    |
| Forward Voltage (V)                       | Typical | 2.1                   | 2                   | 2.1                    |
|   | Max.    | 3                     | 3                   | 3                      |
| Reverse Voltage (V), I <sub>R</sub> =10μA | Min.    | 3                     | 3                   | 3                      |

θ<sup>1/2</sup> is the off axis angle at which the luminous intensity is half the axial luminous intensity