



Ph-free  
HEAT



# MU93 Series

Single Color / Light Bar Module

## Features

|                                     |                                                                                                                                                                                 |               |          |        |          |        |          |     |          |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|--------|----------|--------|----------|-----|----------|
| Light emitting surface (Outer size) | 10 x 10 mm (10 x 10 mm) (L x W)                                                                                                                                                 |               |          |        |          |        |          |     |          |
| Product features                    | <ul style="list-style-type: none"><li>▪ Single Color (Green, Yellow, Orange or Red)</li><li>▪ Lead-free soldering compatible</li><li>▪ RoHS compliant</li></ul>                 |               |          |        |          |        |          |     |          |
| Peak wavelength                     | <table><tr><td>Green</td><td>: 555 nm</td></tr><tr><td>Yellow</td><td>: 570 nm</td></tr><tr><td>Orange</td><td>: 605 nm</td></tr><tr><td>Red</td><td>: 660 nm</td></tr></table> | Green         | : 555 nm | Yellow | : 570 nm | Orange | : 605 nm | Red | : 660 nm |
| Green                               | : 555 nm                                                                                                                                                                        |               |          |        |          |        |          |     |          |
| Yellow                              | : 570 nm                                                                                                                                                                        |               |          |        |          |        |          |     |          |
| Orange                              | : 605 nm                                                                                                                                                                        |               |          |        |          |        |          |     |          |
| Red                                 | : 660 nm                                                                                                                                                                        |               |          |        |          |        |          |     |          |
| Die materials                       | <table><tr><td>Green, Yellow</td><td>: GaP</td></tr><tr><td>Orange</td><td>: GaAsP</td></tr><tr><td>Red</td><td>: GaAlAs</td></tr></table>                                      | Green, Yellow | : GaP    | Orange | : GaAsP  | Red    | : GaAlAs |     |          |
| Green, Yellow                       | : GaP                                                                                                                                                                           |               |          |        |          |        |          |     |          |
| Orange                              | : GaAsP                                                                                                                                                                         |               |          |        |          |        |          |     |          |
| Red                                 | : GaAlAs                                                                                                                                                                        |               |          |        |          |        |          |     |          |
| Soldering methods                   | TTW (Through The Wave) soldering and manual soldering                                                                                                                           |               |          |        |          |        |          |     |          |
| Soldering methods                   | More than 2kV(HBM)                                                                                                                                                              |               |          |        |          |        |          |     |          |
| Packing                             | Plastic bag                                                                                                                                                                     |               |          |        |          |        |          |     |          |

## Recommended Applications

Electric Household Appliances, OA/FA, Other General Applications

## Color and Luminous Intensity

| Part No.  | Material | Emitted Color | Resin Color | Luminous Intensity<br>I <sub>v</sub> (mcd) |      |                | Number of<br>Chips |
|-----------|----------|---------------|-------------|--------------------------------------------|------|----------------|--------------------|
|           |          |               |             | MIN.                                       | TYP. | I <sub>F</sub> |                    |
| MU93-5001 | GaP      | Green         | Green       | 1.5                                        | 3    | 20             | 1                  |
| MU93-4001 | GaP      | Yellow        | Yellow      | 4                                          | 8    | 20             | 1                  |
| MU93-3001 | GaAsP    | Orange        | Orange      | 4                                          | 8    | 20             | 1                  |
| MU93-2001 | GaAlAs   | Red           | Red         | 4                                          | 8    | 20             | 1                  |

## Absolute Maximum Ratings

(Ta=25°C)

| Item                            | Symbol            | Absolute Maximum Ratings |      |      |      | Unit  |
|---------------------------------|-------------------|--------------------------|------|------|------|-------|
|                                 |                   | 5001                     | 4001 | 3001 | 2001 |       |
| Power Dissipation               | P <sub>d</sub>    | 75                       | 75   | 75   | 60   | mW    |
| Forward Current                 | I <sub>F</sub>    | 30                       | 30   | 30   | 30   | mA    |
| Pulse Forward Current ※1        | I <sub>FRM</sub>  | 100                      | 100  | 100  | 300  | mA    |
| Derating<br>(Ta=25°C or higher) | ΔI <sub>F</sub>   | 0.33                     | 0.33 | 0.33 | 0.33 | mA/°C |
|                                 | ΔI <sub>FRM</sub> | 1.33                     | 1.33 | 1.33 | 4.00 | mA/°C |
| Reverse Voltage                 | V <sub>R</sub>    | 4                        | 4    | 4    | 4    | V     |
| Operating Temperature           | T <sub>opr</sub>  | -30~+85                  |      |      |      | °C    |
| Storage Temperature             | T <sub>stg</sub>  | -30~+85                  |      |      |      | °C    |

※1 I<sub>FRM</sub> Measurement condition : Pulse Width ≤ 1ms, Duty ≤ 1/20

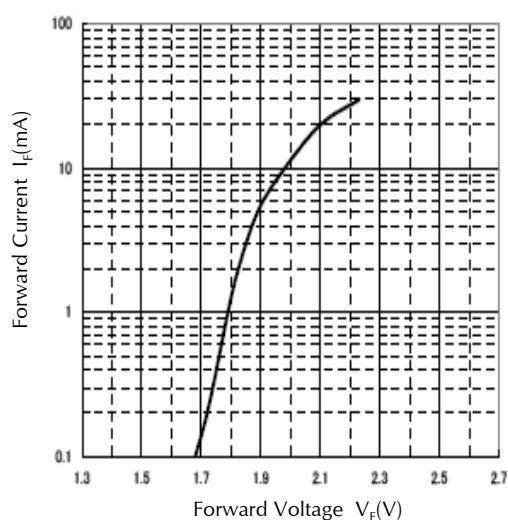
## Electro-Optical Characteristics

(Ta=25°C)

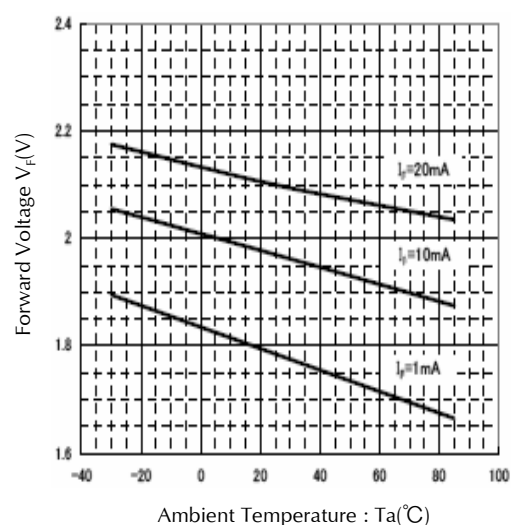
| Item                     |                      | Symbol         | Characteristics |      |      |      |      | Unit |
|--------------------------|----------------------|----------------|-----------------|------|------|------|------|------|
|                          | Conditions           |                |                 | 5001 | 4001 | 3001 | 2001 |      |
| Forward Voltage          | I <sub>F</sub> =20mA | V <sub>F</sub> | TYP.            | 2.2  | 2.1  | 2.2  | 1.7  | V    |
|                          |                      |                | MAX.            | 2.5  | 2.5  | 2.5  | 2.0  |      |
| Reverse Current          | V <sub>R</sub> =4V   | I <sub>R</sub> | MAX.            | 100  | 100  | 100  | 100  | μ A  |
| Peak Wavelength          | I <sub>F</sub> =20mA | λ <sub>p</sub> | TYP.            | 555  | 570  | 605  | 660  | nm   |
| Spectral Line Half Width | I <sub>F</sub> =20mA | Δ λ            | TYP.            | 30   | 30   | 30   | 30   | nm   |

## Technical Data(5001)

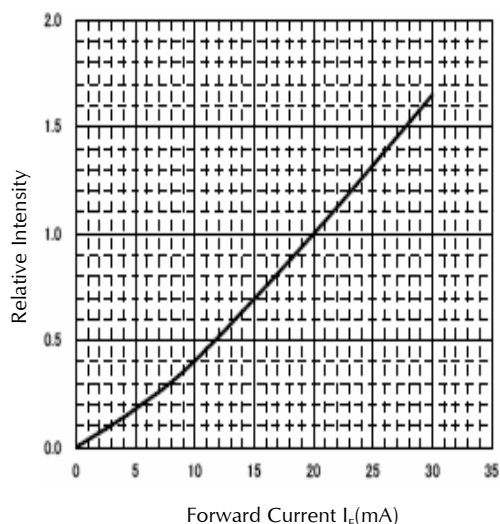
Forward Voltage vs. Forward Current  
Condition :  $T_a = 25^\circ\text{C}$



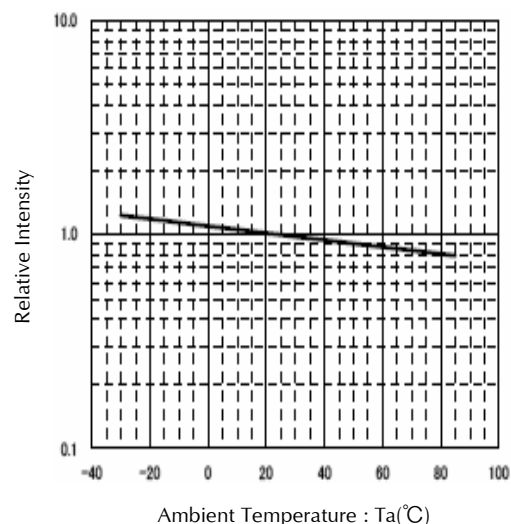
Ambient Temperature vs. Forward Voltage



Forward Current vs. Relative Intensity  
Condition :  $T_a = 25^\circ\text{C}$



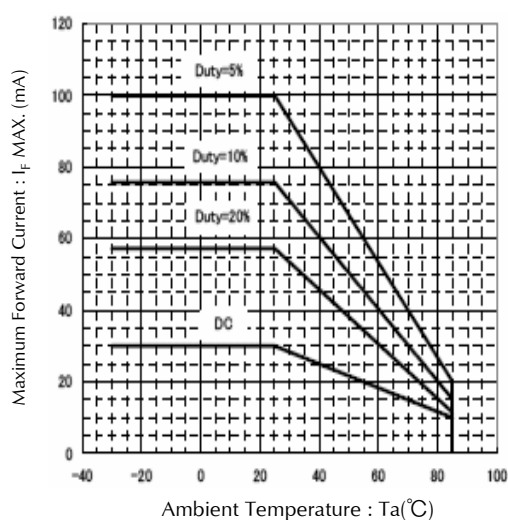
Ambient Temperature vs. Relative Intensity  
Condition :  $I_F = 20\text{mA}$



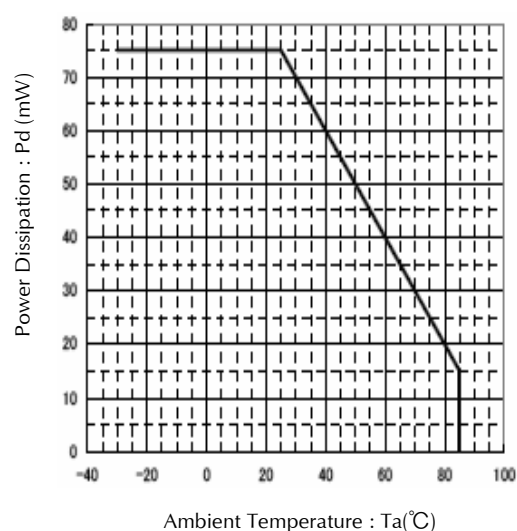
## Technical Data(5001)

### Derating

Ambient Temperature vs. Maximum Forward Current  
Repetition Frequency :  $f \geq 50\text{Hz}$

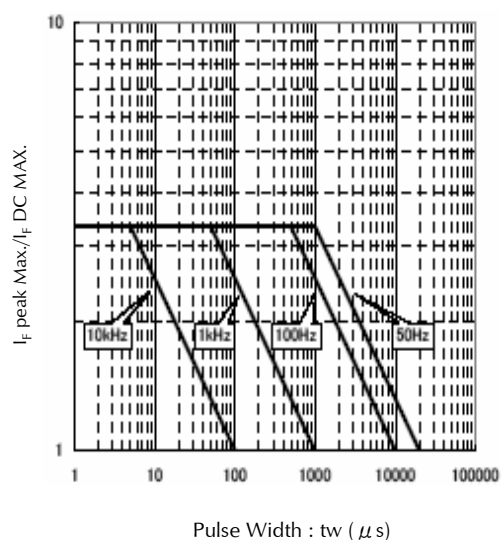


### Power Dissipation vs. Ambient Temperature



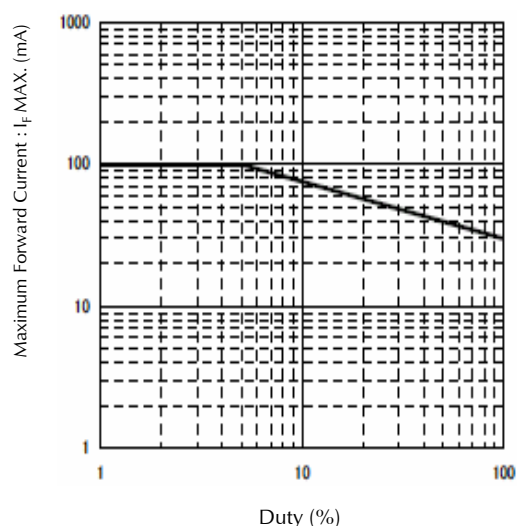
### Pulse Width vs. Maximum Tolerable Peak Current

Condition :  $T_a = 25^{\circ}\text{C}$



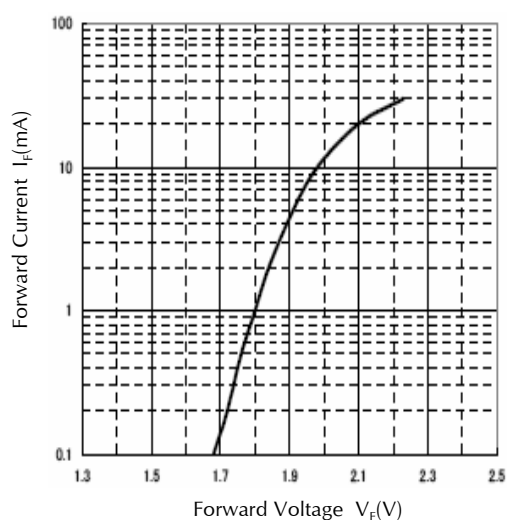
### Dynamic Drive Rating

Duty cycle vs. Maximum Forward Current  
Condition :  $T_a = 25^{\circ}\text{C}$

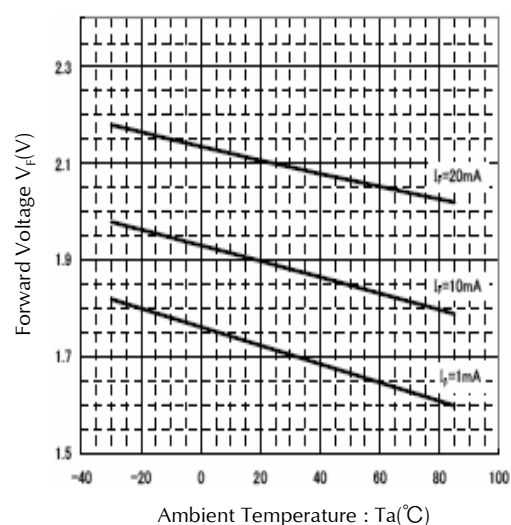


## Technical Data(4001)

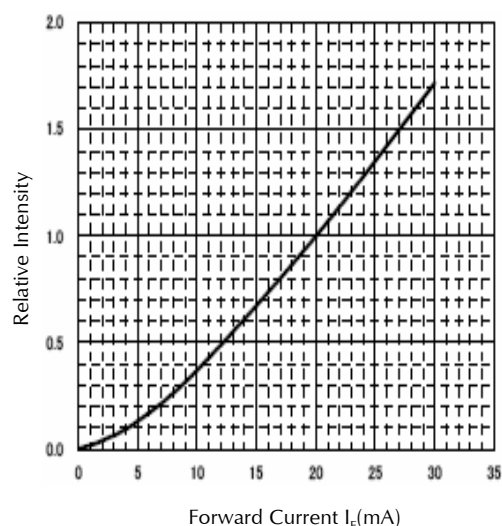
Forward Voltage vs. Forward Current  
Condition :  $T_a = 25^\circ\text{C}$



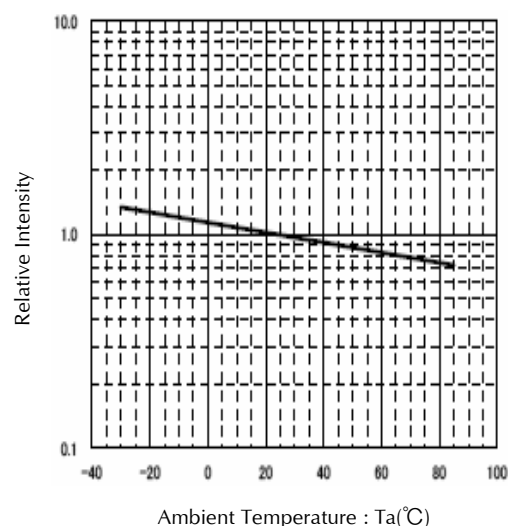
Ambient Temperature vs. Forward Voltage



Forward Current vs. Relative Intensity  
Condition :  $T_a = 25^\circ\text{C}$



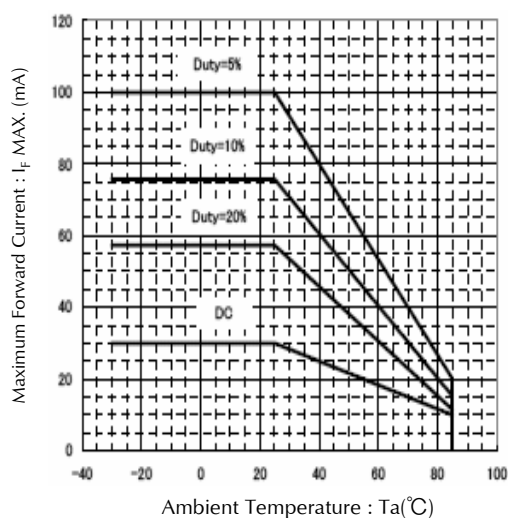
Ambient Temperature vs. Relative Intensity  
Condition :  $I_F = 20\text{mA}$



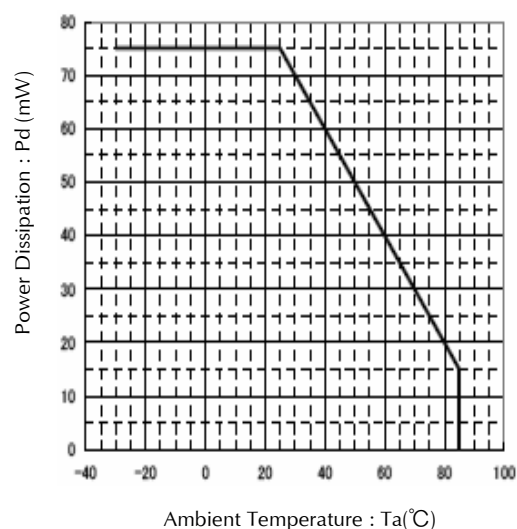
## Technical Data(4001)

### Derating

Ambient Temperature vs. Maximum Forward Current  
Repetition Frequency :  $f \geq 50\text{Hz}$

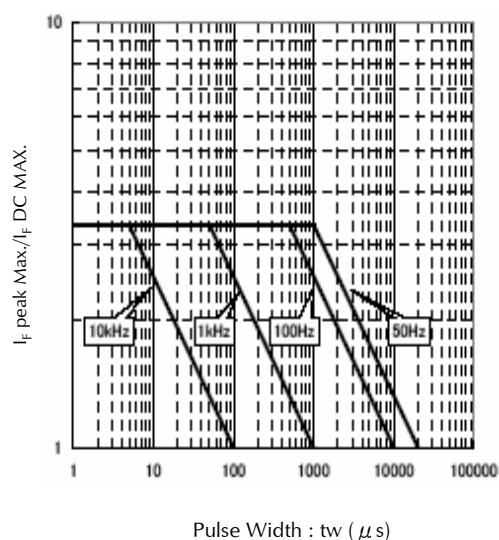


### Power Dissipation vs. Ambient Temperature



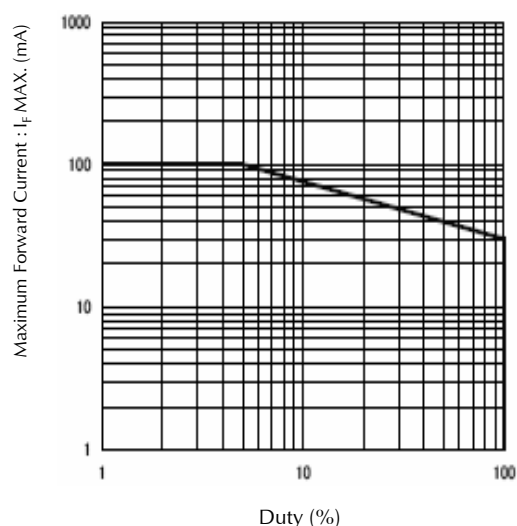
### Pulse Width vs. Maximum Tolerable Peak Current

Condition :  $T_a = 25^{\circ}\text{C}$



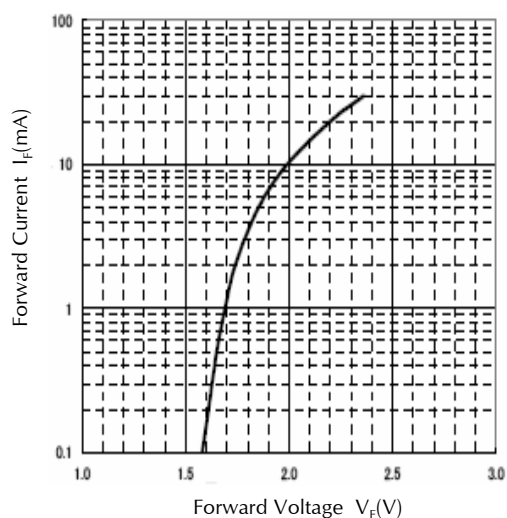
### Dynamic Drive Rating

Duty cycle vs. Maximum Forward Current  
Condition :  $T_a = 25^{\circ}\text{C}$

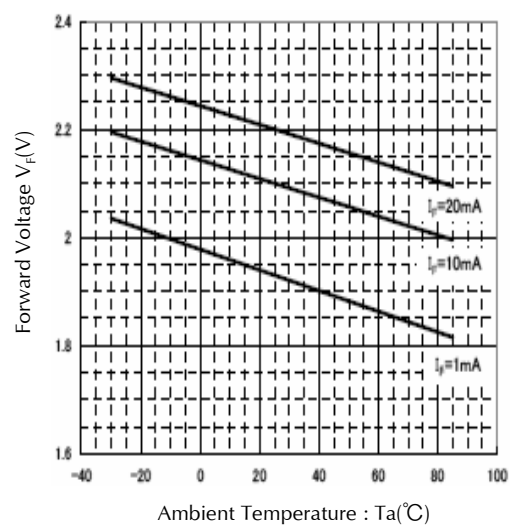


## Technical Data(3001)

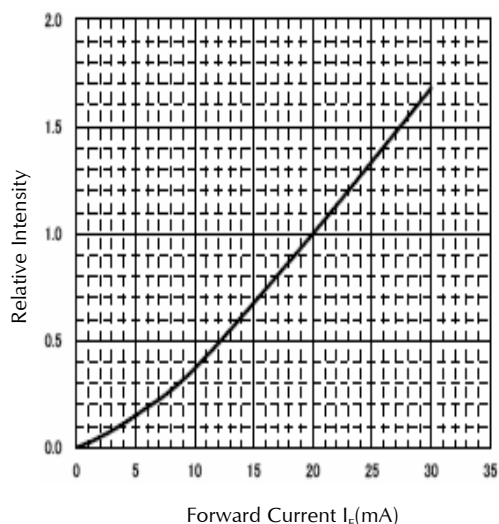
Forward Voltage vs. Forward Current  
Condition :  $T_a = 25^\circ\text{C}$



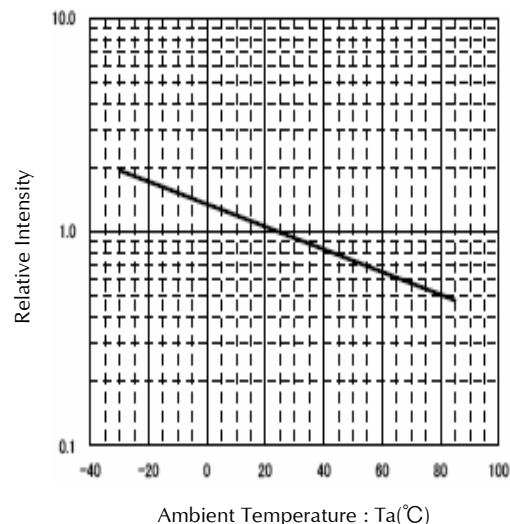
Ambient Temperature vs. Forward Voltage



Forward Current vs. Relative Intensity  
Condition :  $T_a = 25^\circ\text{C}$



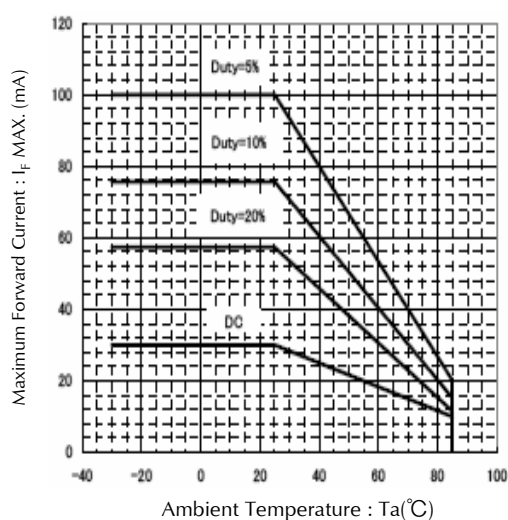
Ambient Temperature vs. Relative Intensity  
Condition :  $I_F = 20\text{mA}$



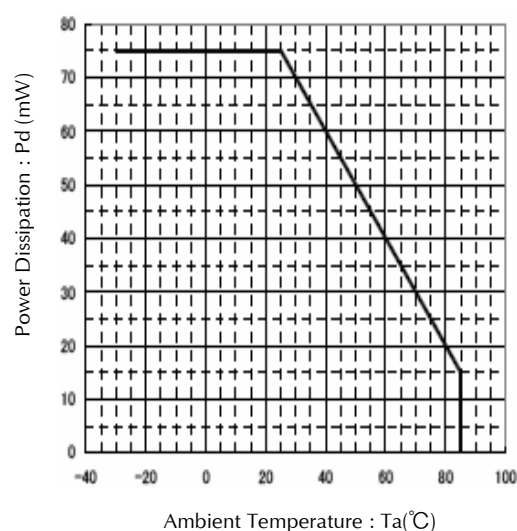
## Technical Data(3001)

### Derating

Ambient Temperature vs. Maximum Forward Current  
Repetition Frequency :  $f \geq 50\text{Hz}$

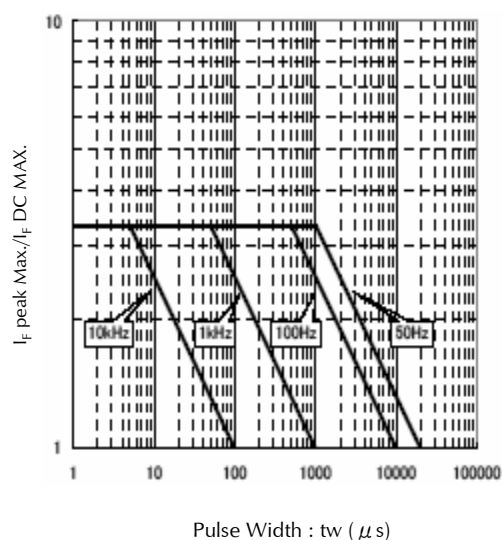


### Power Dissipation vs. Ambient Temperature



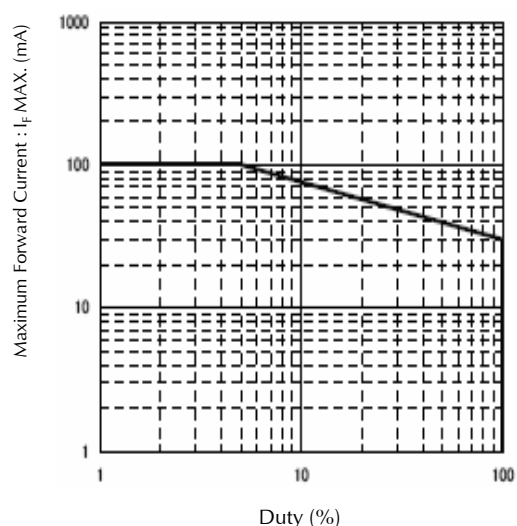
### Pulse Width vs. Maximum Tolerable Peak Current

Condition :  $T_a = 25^\circ\text{C}$



### Dynamic Drive Rating

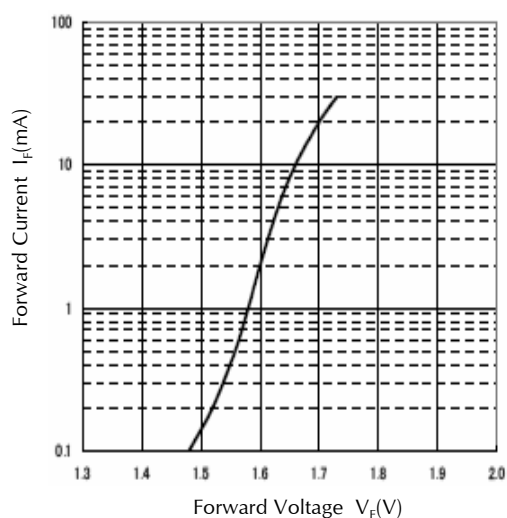
Duty cycle vs. Maximum Forward Current  
Condition :  $T_a = 25^\circ\text{C}$



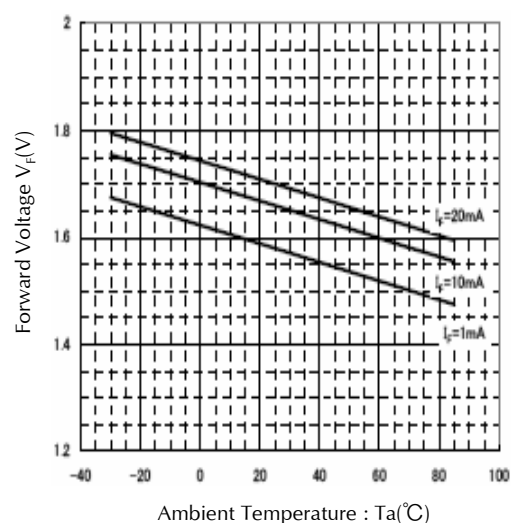


## Technical Data(2001)

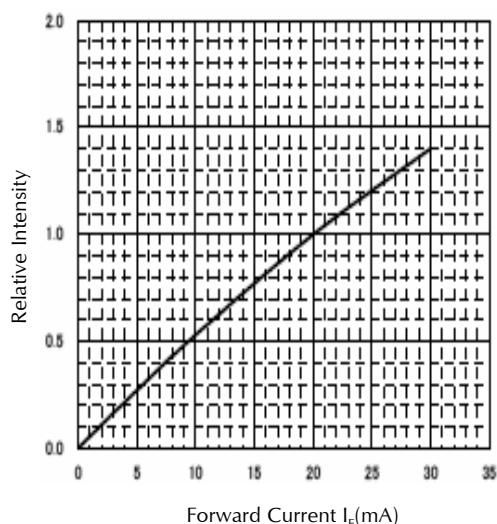
Forward Voltage vs. Forward Current  
Condition :  $T_a = 25^\circ\text{C}$



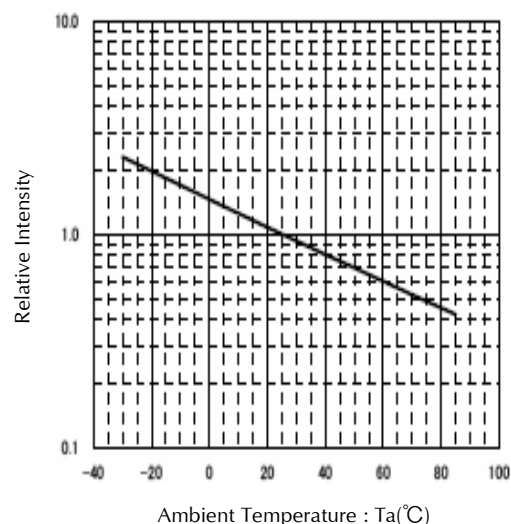
Ambient Temperature vs. Forward Voltage



Forward Current vs. Relative Intensity  
Condition :  $T_a = 25^\circ\text{C}$



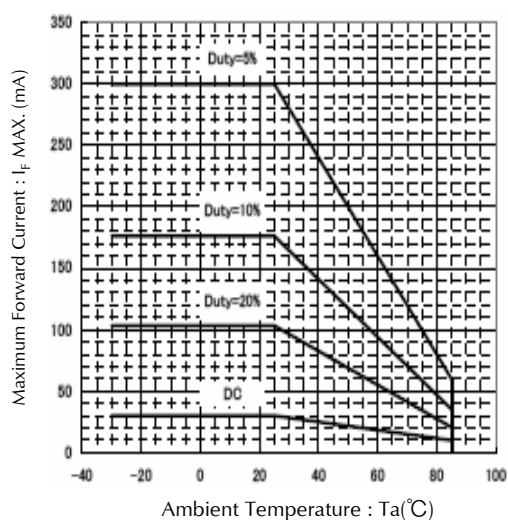
Ambient Temperature vs. Relative Intensity  
Condition :  $I_F = 20\text{mA}$



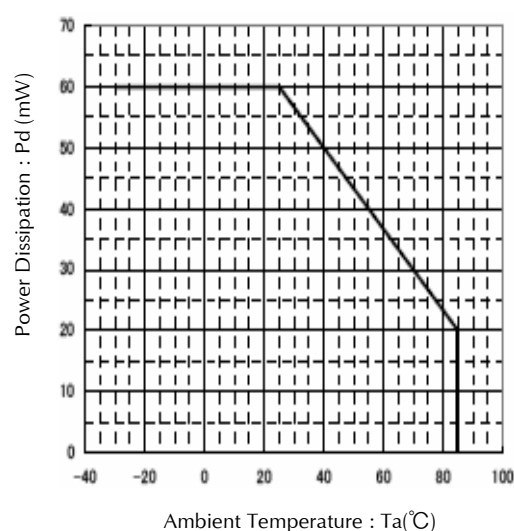
## Technical Data(2001)

### Derating

Ambient Temperature vs. Maximum Forward Current  
Repetition Frequency :  $f \geq 50\text{Hz}$

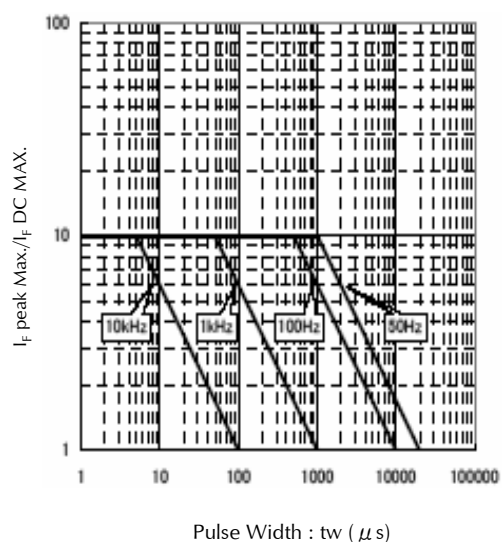


### Power Dissipation vs. Ambient Temperature



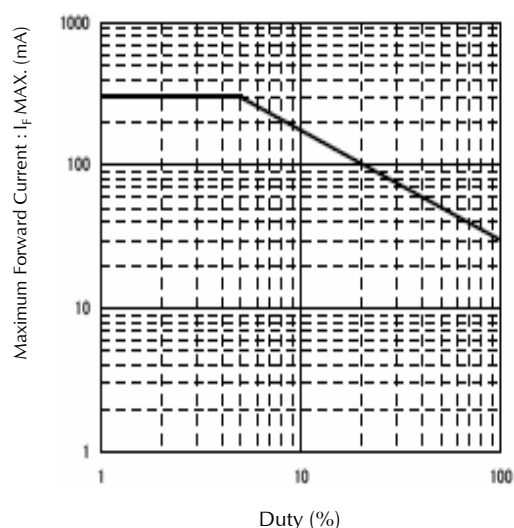
### Pulse Width vs. Maximum Tolerable Peak Current

Condition :  $T_a = 25^{\circ}\text{C}$



### Dynamic Drive Rating

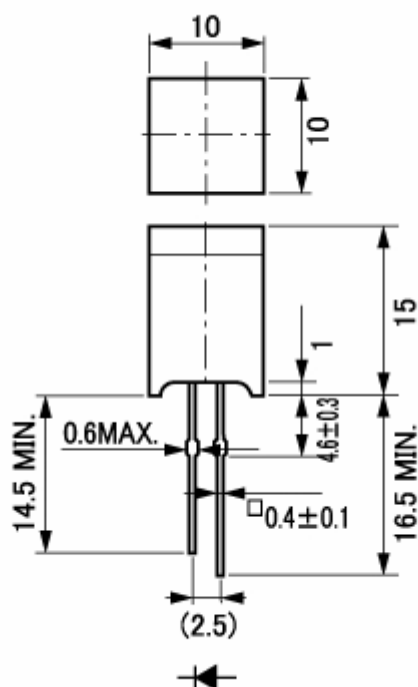
Duty cycle vs. Maximum Forward Current  
Condition :  $T_a = 25^{\circ}\text{C}$



## Package Dimensions

(Unit: mm)

(Tolerance :  $\pm 0.25$  mm)



## TTW (Through The Wave) soldering Conditions

|                   |                                      |                                            |
|-------------------|--------------------------------------|--------------------------------------------|
| Pre-heating       | 100 °C<br>60 s                       | (MAX.) Resin surface temperature<br>(MAX.) |
| Solder Bath Temp. | 265 °C                               | (MAX.)                                     |
| Dipping Time      | 5 s                                  | (MAX.)                                     |
| Position          | At least 3.0 mm away from resin body |                                            |

- 1) The dip soldering process shall be 2 times maximum.
- 2) The product shall be cooled to normal temperature before the second dipping process.

## Manual Soldering Conditions

|                              |                                      |                    |
|------------------------------|--------------------------------------|--------------------|
| Iron tip temp.               | 400 °C                               | (MAX.) (30 W Max.) |
| Soldering time and frequency | 3 s<br>2 times                       | (MAX.)<br>(MAX.)   |
| Position                     | At least 3.0 mm away from resin body |                    |

## Reliability Testing Result

| Reliability Testing Result    | Applicable Standard   | Testing Conditions                                                                                                                                | Duration | Failure |
|-------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|
| Room Temp. Operating Life     | EIAJ ED-4701/100(101) | Ta = 25°C, If = Maximum Rated Current                                                                                                             | 1,000 h  | 0/10    |
| Resistance to Soldering Heat  | EIAJ ED-4701/300(302) | 260±5°C, 3mm from package base                                                                                                                    | 10sec    | 0/10    |
| Temperature Cycling           | EIAJ ED-4701/100(105) | Minimum Rated Storage Temperature(30min)<br>~Normal Temperature(15min)<br>~Maximum Rated Storage Temperature(30min)<br>~Normal Temperature(15min) | 5 cycles | 0/10    |
| Wet High Temp. Storage Life   | EIAJ ED-4701/100(103) | Ta = 60±2°C, RH = 90±5%                                                                                                                           | 1,000 h  | 0/10    |
| High Temp. Storage Life       | EIAJ ED-4701/200(201) | Ta = Maximum Rated Storage Temperature                                                                                                            | 1,000 h  | 0/10    |
| Low Temp. Storage Life        | EIAJ ED-4701/200(202) | Ta = Minimum Rated Storage Temperature                                                                                                            | 1,000 h  | 0/10    |
| Lead Tension                  | EIAJ ED-4701/400(401) | 5N, 1time                                                                                                                                         | 10sec    | 0/10    |
| Vibration, Variable Frequency | EIAJ ED-4701/400(403) | 98.1m/s <sup>2</sup> (10G), 100 ~ 2KHz sweep for 20min., XYZ each direction                                                                       | 2 h      | 0/10    |
| Lead Bend                     | EIAJ ED-4701/400(401) | 2.5N, 0°↔90°                                                                                                                                      | 2 times  | 0/10    |
| Shock                         | JIS C 7201 A-8        | It falls on wood engraving from height of 75cm.                                                                                                   | 3 times  | 0/10    |

## Failure Criteria

| Items               | Symbols        | Conditions         | Failure criteria                                   |
|---------------------|----------------|--------------------|----------------------------------------------------|
| Luminous Intensity  | Iv             | If=20mA            | Testing Min. Value < Spec. Min. Value x 0.5        |
| Forward Voltage     | V <sub>F</sub> | If=20mA            | Testing Max. Value ≥ Spec. Max. Value x 1.2        |
| Reverse Current     | I <sub>R</sub> | V <sub>R</sub> =4V | Testing Max. Value ≥ Spec. Max. Value x 2.5        |
| Cosmetic Appearance | -              | -                  | No notable, decoloration, deformation and cracking |

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