

OVAL PRECISION OPTICAL PERFORMANCE LED LAMPs

Technical Data

12/27/2002

Description

These Precision Optical Performance oval LEDs are specifically designed for Full Color / Video and Passenger Information signs.

High efficiency LED materials are used in these lamps: Aluminum Indium Gallium Phosphide (AlInGaP) for red, amber and green, and Indium Gallium Nitride (InGaN) for true green and blue.

Designers can select parallel (where the axis of the leads is parallel to the wide axis of the oval radiation pattern) or perpendicular orientation. Designers can also choose between lamps with or without standoffs.

Features

- Smooth, Consistent Spatial Radiation Patterns
- High Luminous Output
- Emitting Colors :
 - 632 nm Ultra Red
 - 625 nm Red
 - 605 nm Orange
 - 590 nm Amber
 - 573 nm Green
 - 525 nm True Green
 - 470 nm Blue
- Superior Resistance to Moisture
- Choice of Package Options

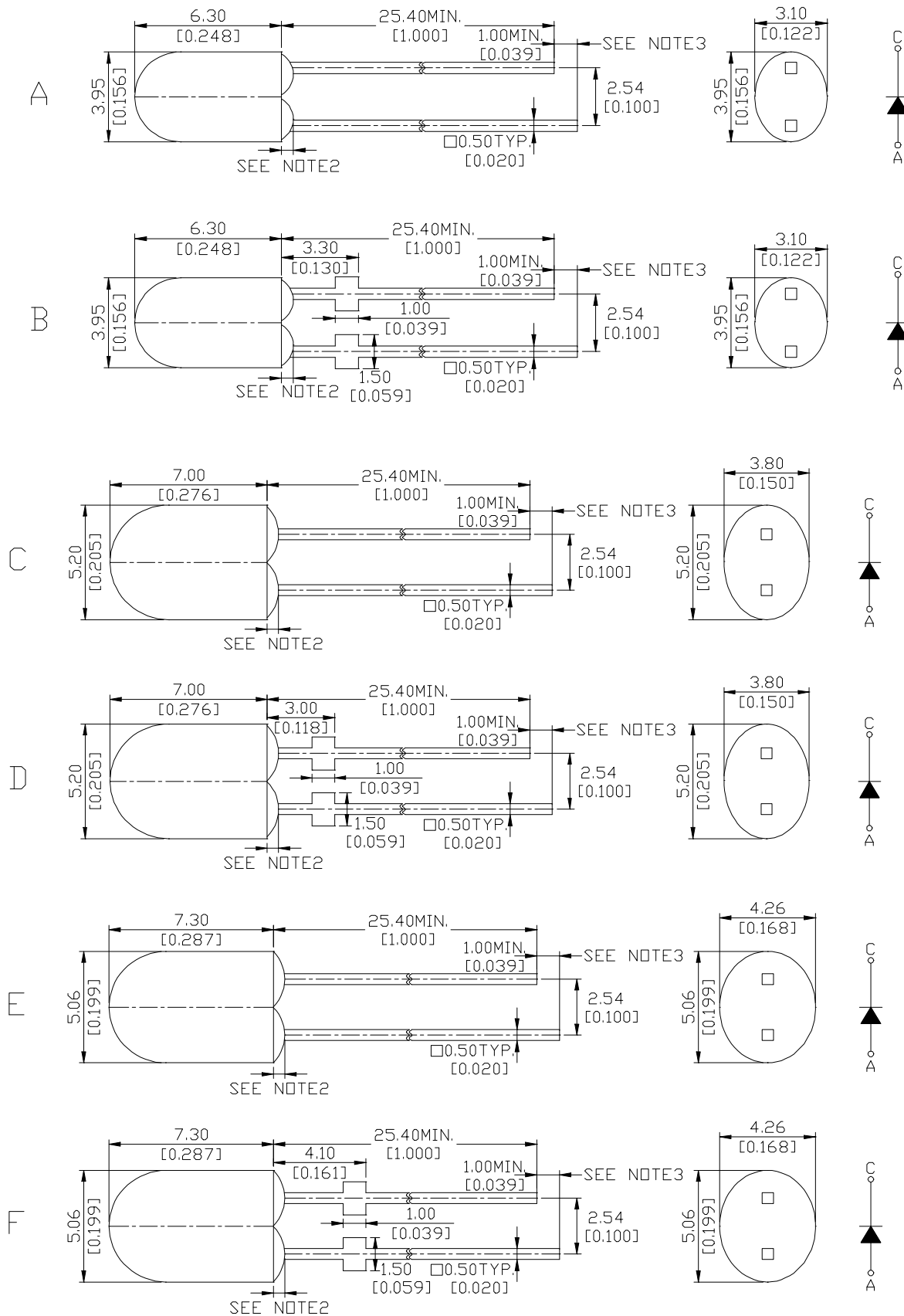
Benefits

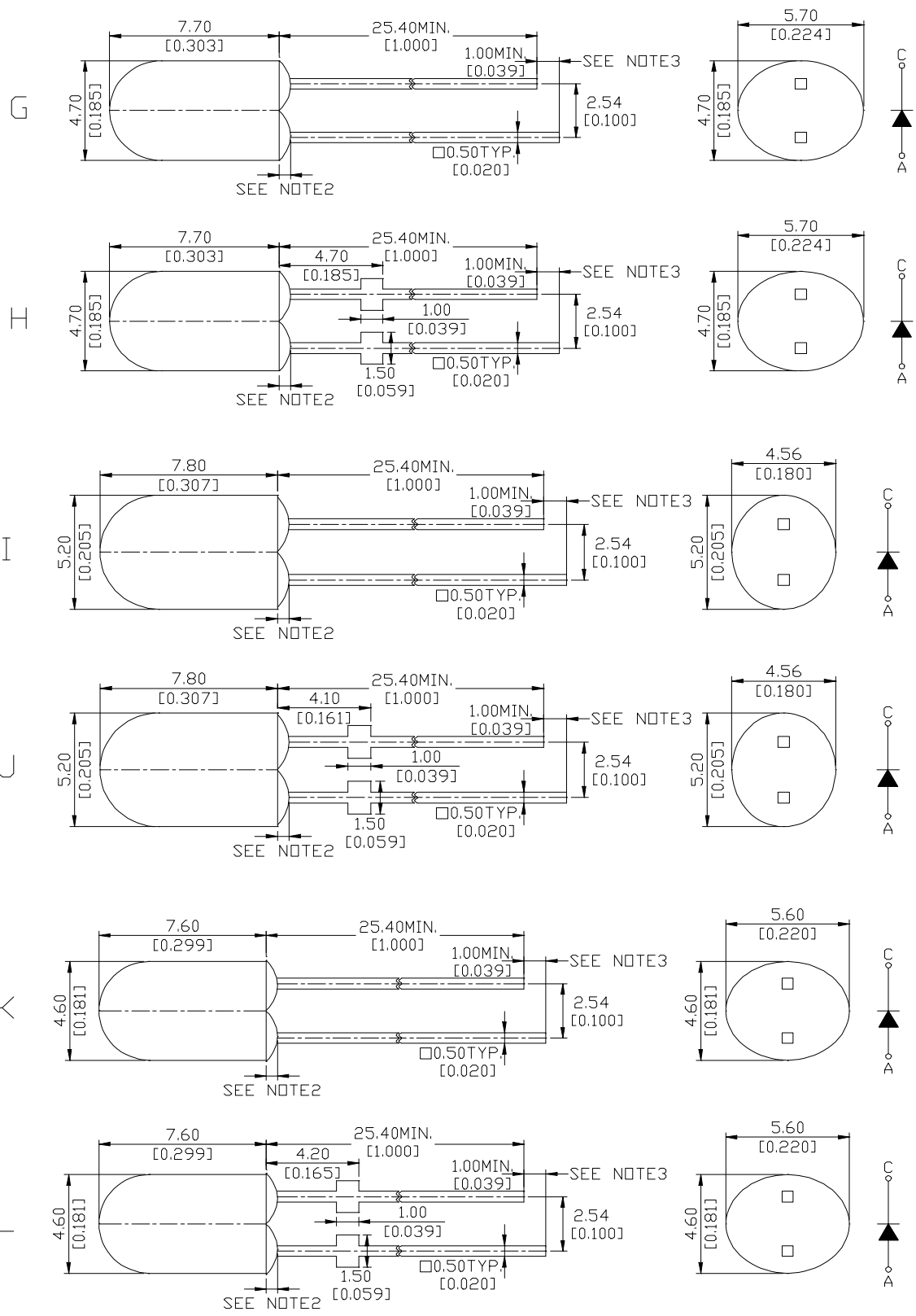
- Viewing Angle Designed for Wide Field of View Applications
- Red, True Green, and Blue Radiation Patterns Matched for Full Color Signs
- Superior Outdoor Environmental Performance

Applications

- Full Color / Video Signs
- Variable Message Signs
 - Passenger Information
 - Advertising
 - Time / Temperature

Package Dimension





- Notes :
1. Tolerance is ± 0.25 mm (.010") unless otherwise noted.
 2. Protruded resin under flange is 1.5 mm (.059") max.
 3. Lead spacing is measured where the leads emerge from the package.

Part Numbering Scheme

MVL-6 A B C D

where A = Leadframe Orientation

and Package Dimension

- "3" = Parallel Leadframe (3.10 X 3.95 mm)
- "5" = Parallel Leadframe (4.26 X 5.06 mm)
- "6" = Perpendicular Leadframe (4.70 X 5.70 mm)
- "7" = Parallel Leadframe (3.80 X 5.20 mm)
- "8" = Parallel Leadframe (4.56 X 5.20 mm)
- "9" = Perpendicular Leadframe (4.60 X 5.60 mm)

where C = Color Option

- "UROK" = 632 nm Ultra Red
- "NUOL" = 625 nm Red
- "UOL" = 625 nm Red
- "TUOL" = 625 nm Red
- "SO" = 605 nm Orange
- "UYL" = 590 nm Amber
- "TUYL" = 590 nm Amber
- "UG" = 573 nm Green
- "HTG / UTG" = 525 nm True Green
- "HB / UB" = 470 nm Blue

where B = Package Color

- "1" = color diffuse
- "2" = diffuse
- "3" = Matching Color
- "4" = Water Clear

where D = Standoff Option

- "N/A" = Without
- "-S" = With Stopper

Absolute Maximum Ratings at T_A=25°C

| Parameter | "UROK" | "UOL" | "SO" | "UYL" | "TUOL" | "TUYL" | "UG" | Units |
|--|---|--------------|----------------------|--------------|--------------|--------------|--------------|-------|
| | AlInGaP | AlInGaP | InGaN | InGaN | InGaN | InGaN | InGaN | |
| DC Forward Current | 50 | 30 | 30 | 30 | 30 | 30 | 30 | mA |
| Power Dissipation | 105 | 70 | 125 | 125 | 125 | 125 | 125 | mW |
| Peak Forward Current(1/10 Duty Cycle 100 μs pulse width) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | mA |
| Reverse Voltage (I _R =100μA) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | V |
| Operating Temp Range | -20 to + 85 | -20 to + 85 | -20 to + 80 | -20 to + 80 | -20 to + 80 | -20 to + 80 | -20 to + 80 | °C |
| Storage Temp | -40 to + 100 | -40 to + 100 | -30 to + 100 | -30 to + 100 | -30 to + 100 | -30 to + 100 | -30 to + 100 | °C |
| Electrostatic Discharge Threshold | N/A | N/A | 300 ^{NOTE1} | 1000 | 1000 | 1000 | 1000 | V |
| Solder Temperature | 260°C for 5 seconds [1.5mm (0.06 in.) below seating plane] | | | | | | | |

Notes: 1. Product resistance to electrostatic discharge (ESD) is measured by simulating ESD using a rapid avalanche energy test (RAET). The RAET procedures are designed to approximate the maximum ESD ratings shown. Seller gives no other assurances regarding the ability of Products to withstand ESD.

MVL-63XXX

AllnGaP

Device Selection Guide (Red, Orange, Amber, Green)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle 2 θ 1/2 (Degrees) Typ | |
|---------------|--|--|------|---------------|-----------------------|------------------------|-----------------|--|-------|
| | | Min. | Typ. | | | | | Major | Minor |
| MVL-632UOL | Red 625 | 150 | 300 | diffuse | No | Parallel | A | 110 | 60 |
| MVL-632UOL-S | | | | | Yes | | B | | |
| MVL-633UOL | | 150 | 300 | Red | No | | A | | |
| MVL-633UOL-S | | | | | Yes | | B | | |
| MVL-634NUOL | | 150 | 300 | Water Clear | No | | A | | |
| MVL-634NUOL-S | | | | | Yes | | B | | |
| MVL-634UOL | | 150 | 300 | Water Clear | No | | A | | |
| MVL-634UOL-S | | | | | Yes | | B | | |
| MVL-633SO | Orange 605 | 150 | 300 | Orange | No | | A | | |
| MVL-633SO-S | | | | | Yes | | B | | |
| MVL-634SO | | 150 | 300 | Water Clear | No | | A | | |
| MVL-634SO-S | | | | | Yes | | B | | |
| MVL-633UYL | Amber 590 | 170 | 350 | Amber | No | | A | | |
| MVL-633UYL-S | | | | | Yes | | B | | |
| MVL-634UYL | | 170 | 350 | Water Clear | No | | A | | |
| MVL-634UYL-S | | | | | Yes | | B | | |
| MVL-631TUYL | | 400 | 450 | Amber diffuse | No | A | | | |
| MVL-631TUYL-S | | | | | Yes | B | | | |
| MVL-632TUYL | | 400 | 450 | diffuse | No | A | | | |
| MVL-632TUYL-S | | | | | Yes | B | | | |
| MVL-634UG | Green 573 | 100 | 150 | Water Clear | No | A | | | |
| MVL-634UG-S | | | | | Yes | B | | | |

InGaN

Device Selection Guide (True Green,Blue)

| | | | | | | | | | |
|--------------|----------------|-----|-----|-------------|-----|----------|---|-----|----|
| MVL-633HTG | True Green 525 | 350 | 650 | Green | No | Parallel | A | 110 | 60 |
| MVL-633HTG-S | | | | | Yes | | B | | |
| MVL-634HTG | | 350 | 650 | Water Clear | No | | A | | |
| MVL-634HTG-S | | | | | Yes | | B | | |
| MVL-633HB | Blue 470 | 100 | 200 | Blue | No | | A | | |
| MVL-633HB-S | | | | | Yes | | B | | |
| MVL-634HB | | 100 | 200 | Water Clear | No | | A | | |
| MVL-634HB-S | | | | | Yes | | B | | |
| MVL-633UTG | True Green 525 | 250 | 450 | Green | No | | A | | |
| MVL-633UTG-S | | | | | Yes | | B | | |
| MVL-634UTG | | 250 | 450 | Water Clear | No | | A | | |
| MVL-634UTG-S | | | | | Yes | | B | | |
| MVL-633UB | Blue 470 | 70 | 140 | Blue | No | | A | | |
| MVL-633UB-S | | | | | Yes | | B | | |
| MVL-634UB | | 70 | 140 | Water Clear | No | | A | | |
| MVL-634UB-S | | | | | Yes | | B | | |

MVL-65XXX

AlInGaP

Device Selection Guide (Red, Orange, Amber, Green)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle $2\theta_{1/2}$ (Degrees) | |
|--------------|--|--|------|---------------|-----------------------|------------------------|-----------------|---|-------|
| | | Min. | Typ. | | | | | Typ | Major |
| MVL-653UOL | Red 625 | 400 | 600 | Red | No | Parallel | E | 50 | 30 |
| MVL-653UOL-S | | | | | Yes | | F | | |
| MVL-654UOL | | 400 | 600 | Water Clear | No | | E | | |
| MVL-654UOL-S | | | | | Yes | | F | | |
| MVL-653SO | Orange 605 | 400 | 700 | Orange | No | | E | | |
| MVL-653SO-S | | | | | Yes | | F | | |
| MVL-654SO | | 400 | 700 | Water Clear | No | | E | | |
| MVL-654SO-S | | | | | Yes | | F | | |
| MVL-653UYL | Amber 590 | 500 | 800 | Amber | No | | E | | |
| MVL-653UYL-S | | | | | Yes | | F | | |
| MVL-654UYL | | 500 | 800 | Water Clear | No | | E | | |
| MVL-654UYL-S | | | | | Yes | | F | | |
| MVL-653UG | Green 573 | 80 | 150 | Green | No | | E | | |
| MVL-653UG-S | | | | | Yes | | F | | |
| MVL-654UG | | 80 | 150 | Water Clear | No | | E | | |
| MVL-654UG-S | | | | | Yes | | F | | |

InGaN

Device Selection Guide (True Green,Blue)

| | | | | | | | | | |
|--------------|----------------|-----|------|-------------|-----|----------|---|----|----|
| MVL-653HTG | True Green 525 | 750 | 1500 | Green | No | Parallel | E | 50 | 30 |
| MVL-653HTG-S | | | | | Yes | | F | | |
| MVL-654HTG | | 750 | 1500 | Water Clear | No | | E | | |
| MVL-654HTG-S | | | | | Yes | | F | | |
| MVL-653HB | Blue 470 | 200 | 400 | Blue | No | | E | | |
| MVL-653HB-S | | | | | Yes | | F | | |
| MVL-654HB | | 200 | 400 | Water Clear | No | | E | | |
| MVL-654HB-S | | | | | Yes | | F | | |

MVL-66XXX

AllnGaP

Device Selection Guide (Red, Orange, Amber)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle $2\theta_{1/2}$ (Degrees) | |
|---------------|--|--|------|---------------|-----------------------|------------------------|-----------------|---|-------|
| | | Min. | Typ. | | | | | Major | Minor |
| MVL-663UOL | Red 625 | 200 | 400 | Red | No | Perpendicular | G | 80 | 40 |
| MVL-663UOL-S | | | | | Yes | | H | | |
| MVL-664UOK | | 150 | 300 | Ultra Red | No | | G | | |
| MVL-664UOK-S | | | | | Yes | | H | | |
| MVL-664UOL | | 200 | 400 | Water Clear | No | | G | | |
| MVL-664UOL-S | | | | | Yes | | H | | |
| MVL-663TUOL | | 400 | 800 | Red | No | | G | | |
| MVL-663TUOL-S | | | | | Yes | | H | | |
| MVL-664TUOL | | 400 | 800 | Water Clear | No | | G | | |
| MVL-664TUOL-S | | | | | Yes | | H | | |
| MVL-663SO | Orange 605 | 250 | 500 | Orange | No | G | 80 | 40 | |
| MVL-663SO-S | | | | | Yes | H | | | |
| MVL-664SO | | 250 | 500 | Water Clear | No | G | | | |
| MVL-664SO-S | | | | | Yes | H | | | |
| MVL-663UYL | Amber 590 | 300 | 600 | Amber | No | G | 80 | 40 | |
| MVL-663UYL-S | | | | | Yes | H | | | |
| MVL-664UYL | | 300 | 600 | Water Clear | No | G | | | |
| MVL-664UYL-S | | | | | Yes | H | | | |
| MVL-663TUYL | | 400 | 800 | Amber | No | G | | | |
| MVL-663TUYL-S | | | | | Yes | H | | | |
| MVL-664TUYL | | 400 | 800 | Water Clear | No | G | | | |
| MVL-664TUYL-S | | | | | Yes | H | | | |

InGaN

Device Selection Guide (True Green,Blue)

| | | | | | | | | | | | |
|--------------|----------------|-----|------|-------------|-----|---------------|----|----|----|----|----|
| MVL-663HTG | True Green 525 | 600 | 1200 | Green | No | Perpendicular | G | 80 | 40 | | |
| MVL-663HTG-S | | | | | Yes | | H | | | | |
| MVL-664HTG | | 600 | 1200 | Water Clear | No | | G | | | | |
| MVL-664HTG-S | | | | | Yes | | H | | | | |
| MVL-663MTG | True Green 525 | 700 | 1300 | Green | No | | G | | | 80 | 40 |
| MVL-663MTG-S | | | | | Yes | | H | | | | |
| MVL-664MTG | | 700 | 1300 | Water Clear | No | | G | | | | |
| MVL-664MTG-S | | | | | Yes | | H | | | | |
| MVL-663HB | Blue 470 | 100 | 250 | Blue | No | | G | | | 80 | 40 |
| MVL-663HB-S | | | | | Yes | | H | | | | |
| MVL-664HB | | 100 | 250 | Water Clear | No | | G | | | | |
| MVL-664HB-S | | | | | Yes | | H | | | | |
| MVL-663MB | Blue 470 | 200 | 380 | Blue | No | G | 80 | 40 | | | |
| MVL-663MB-S | | | | | Yes | H | | | | | |
| MVL-664MB | | 200 | 380 | Water Clear | No | G | | | | | |
| MVL-664MB-S | | | | | Yes | H | | | | | |

MVL-67XXX

AlInGaP

Device Selection Guide (Red)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle $2\theta_{1/2}$ (Degrees) | |
|---------------|--|--|------|---------------|-----------------------|------------------------|-----------------|---|-------|
| | | Min. | Typ. | | | | | Major | Minor |
| MVL-671UOL | Red 625 | 250 | 500 | Red diffuse | No | Parallel | C | 70 | 30 |
| MVL-671UOL-S | | | | | Yes | | D | | |
| MVL-673UOL | | 250 | 500 | Red | No | | C | | |
| MVL-673UOL-S | | | | | Yes | | D | | |
| MVL-674UOL | | 250 | 500 | Water Clear | No | | C | | |
| MVL-674UOL-S | | | | | Yes | | D | | |
| MVL-671TUOL | | 500 | 900 | Red diffuse | No | | C | 80 | 30 |
| MVL-671TUOL-S | | | | | Yes | | D | | |
| MVL-672TUOL | | 500 | 900 | diffuse | No | | C | | |
| MVL-672TUOL-S | | | | | Yes | | D | | |
| MVL-673TUOL | | 800 | 1300 | Red | No | | C | | |
| MVL-673TUOL-S | | | | | Yes | | D | | |
| MVL-674TUOL | | 800 | 1300 | Water Clear | No | | C | | |
| MVL-674TUOL-S | | | | | Yes | | D | | |
| MVL-673UG | Green 573 | 70 | 150 | Green | No | C | 70 | 30 | |
| MVL-673UG-S | | | | | Yes | D | | | |
| MVL-674UG | | 70 | 150 | Water Clear | No | C | | | |
| MVL-674UG-S | | | | | Yes | D | | | |

InGaN

Device Selection Guide (True Green,Blue)

| | | | | | | | | | |
|--------------|----------------|-----|------|---------------|-----|----------|----|----|----|
| MVL-671HTG | True Green 525 | 600 | 1100 | Green diffuse | No | Parallel | C | 70 | 30 |
| MVL-671HTG-S | | | | | Yes | | D | | |
| MVL-673HTG | | 700 | 1200 | Green | No | | C | | |
| MVL-673HTG-S | | | | | Yes | | D | | |
| MVL-674HTG | | 700 | 1200 | Water Clear | No | | C | | |
| MVL-674HTG-S | | | | | Yes | | D | | |
| MVL-671HB | Blue 470 | 100 | 200 | Blue diffuse | No | C | 70 | 30 | |
| MVL-671HB-S | | | | | Yes | D | | | |
| MVL-673HB | | 100 | 250 | Blue | No | C | | | |
| MVL-673HB-S | | | | | Yes | D | | | |
| MVL-674HB | | 100 | 250 | Water Clear | No | C | | | |
| MVL-674HB-S | | | | | Yes | D | | | |

MVL-68XXX

AlInGaP

Device Selection Guide (Red)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle $2\theta/2$ (Degrees) | |
|--------------|--|--|------|---------------|-----------------------|------------------------|-----------------|-------------------------------------|-------|
| | | Min. | Typ. | | | | | Major | Minor |
| MVL-681UOL | Red 625 | 300 | 600 | Red diffuse | No | Parallel | I | 60 | 30 |
| MVL-681UOL-S | | | | | Yes | | J | | |
| MVL-682UOL | | 300 | 600 | diffuse | No | | I | | |
| MVL-682UOL-S | | | | | Yes | | J | | |
| MVL-683UOL | | 400 | 800 | Red | No | | I | | |
| MVL-683UOL-S | | | | | Yes | | J | | |
| MVL-684UOL | | 400 | 800 | Water Clear | No | | I | | |
| MVL-684UOL-S | | | | | Yes | | J | | |

InGaN

Device Selection Guide (True Green,Blue)

| | | | | | | | | | |
|--------------|----------------|-----|------|---------------|-----|----------|---|----|----|
| MVL-681HTG | True Green 525 | 600 | 1200 | Green diffuse | No | Parallel | I | 60 | 30 |
| MVL-681HTG-S | | | | | Yes | | J | | |
| MVL-682HTG | | 600 | 1200 | diffuse | No | | I | | |
| MVL-682HTG-S | | | | | Yes | | J | | |
| MVL-683HTG | | 650 | 1300 | Green | No | | I | | |
| MVL-683HTG-S | | | | | Yes | | J | | |
| MVL-684HTG | | 650 | 1300 | Water Clear | No | | I | | |
| MVL-684HTG-S | | | | | Yes | | J | | |
| MVL-681HB | Blue 470 | 100 | 200 | Blue diffuse | No | Parallel | I | 60 | 30 |
| MVL-681HB-S | | | | | Yes | | J | | |
| MVL-682HB | | 100 | 200 | diffuse | No | | I | | |
| MVL-682HB-S | | | | | Yes | | J | | |
| MVL-683HB | | 150 | 300 | Blue | No | | I | | |
| MVL-683HB-S | | | | | Yes | | J | | |
| MVL-684HB | | 150 | 300 | Water Clear | No | | I | | |
| MVL-684HB-S | | | | | Yes | | J | | |

MVL-69XXX

AlInGaP

Device Selection Guide (Red)

| Part Number | Color and Typical Dominant Wavelength λ_d (nm) | Luminous Intensity Iv(mcd) at $I_F=20mA$ | | Package Color | Leads with Stand-Offs | Lead Frame Orientation | Package Drawing | Viewing Angle $2\theta_{1/2}$ (Degrees) | |
|---------------|--|--|------|---------------|-----------------------|------------------------|-----------------|---|-------|
| | | Min. | Typ. | | | | | Major | Minor |
| MVL-693TUOL | Red 625 | 1000 | 2000 | Red | No | Perpendicular | K | 50 | 25 |
| MVL-693TUOL-S | | | | | Yes | | L | | |
| MVL-694TUOL | | 1000 | 2000 | Water Clear | No | | K | | |
| MVL-694TUOL-S | | | | | Yes | | L | | |
| MVL-693TUYL | Amber 590 | 1000 | 2000 | Amber | No | | K | 50 | 25 |
| MVL-693TUYL-S | | | | | Yes | | L | | |
| MVL-694TUYL | | 1000 | 2000 | Water Clear | No | | K | | |
| MVL-694TUYL-S | | | | | Yes | | L | | |

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

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|--|-----------------------|------|---------|------|---------------|--|
| Typical Viewing Angle Major/Minor | | | | | | |
| MVL-63XXX | $2\theta_{1/2}$ | | 110/60 | | Degrees | $I_F = 20\text{mA}$ |
| MVL-65XXX | | | 50/30 | | | |
| MVL-66XXX | | | 80/40 | | | |
| MVL-67XXX | | | 70/30 | | | |
| MVL-68XXX | | | 60/30 | | | |
| MVL-69XXX | | | 50/25 | | | |
| Peak/Dominant Wavelength | | | | | | |
| MVL-6XXUROK(-S) | λ_p/λ_d | | 637/632 | | nm | Peak and Dominant of Wavelength of Spectral Distribution at $I_F = 20\text{ mA}$ |
| MVL-6XXNUOL(-S) | | | 630/625 | | | |
| MVL-6XXUOL(-S) | | | 630/625 | | | |
| MVL-6XXTUOL(-S) | | | 630/625 | | | |
| MVL-6XXSO(-S) | | | 610/605 | | | |
| MVL-6XXUYL(-S) | | | 592/590 | | | |
| MVL-6XXTUYL(-S) | | | 592/590 | | | |
| MVL-6XXUG(-S) | | | 575/573 | | | |
| MVL-6XXUTG(-S) | | | 523/525 | | | |
| MVL-6XXHTG(-S) | | | 523/525 | | | |
| MVL-6XXUB(-S) | | | 468/470 | | | |
| MVL-6XXHB(-S) | | | 468/470 | | | |
| Spectral Halfwidth | | | | | | |
| Ultra Red ($\lambda_d = 632\text{ nm}$) | $\Delta\lambda_{1/2}$ | | 22 | | nm | Wavelength Width at Spectral Distribution 1/2 Power Point at $I_F = 20\text{mA}$ |
| Red ($\lambda_d = 625\text{ nm}$) | | | 17 | | | |
| Orange ($\lambda_d = 605\text{ nm}$) | | | 13 | | | |
| Amber ($\lambda_d = 590\text{ nm}$) | | | 17 | | | |
| Yellow Green ($\lambda_d = 573\text{ nm}$) | | | 20 | | | |
| Ture Green ($\lambda_d = 525\text{ nm}$) | | | 40 | | | |
| Blue ($\lambda_d = 470\text{ nm}$) | | | 26 | | | |
| Forward Voltage | | | | | | |
| AlInGaP | V_F | 1.6 | 2.1 | 2.6 | V | $I_F = 20\text{mA}$ |
| InGaN | | 2.8 | 3.5 | 4.2 | | |
| Reverse Current | | | | | | |
| AlInGaP | I_R | | | 100 | μA | $V_R = 5\text{V}$ |
| InGaN "HTG" "HB" | | | | 100 | | |
| "UTG" "UB" | | | | 10 | | |

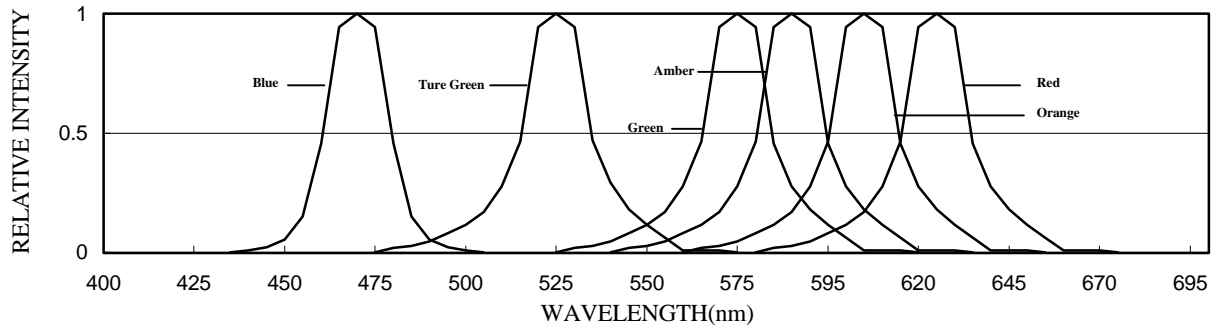
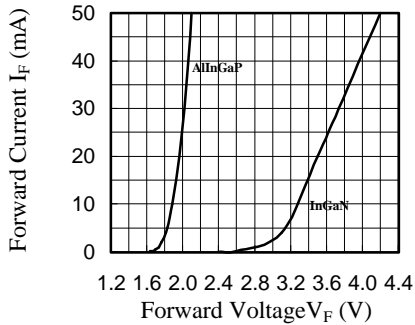
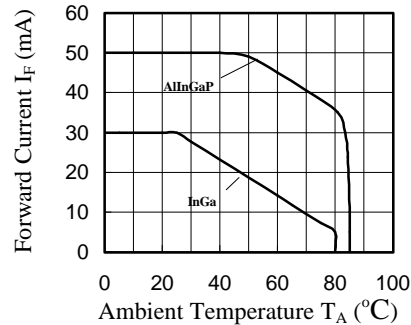


Figure 1. RELATIVE INTENSITY



1.2 1.6 2.0 2.4 2.8 3.2 3.6 4.0 4.4
Forward Voltage V_F (V)

FIG.2 FORWARD CURRENT VS. FORWARD VOLTAGE



0 20 40 60 80 100
Ambient Temperature T_A (°C)

FIG.3 FORWARD CURRENT VS. AMBIENT TEMPERATURE

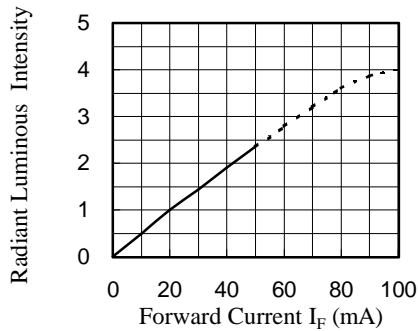


FIG.4 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

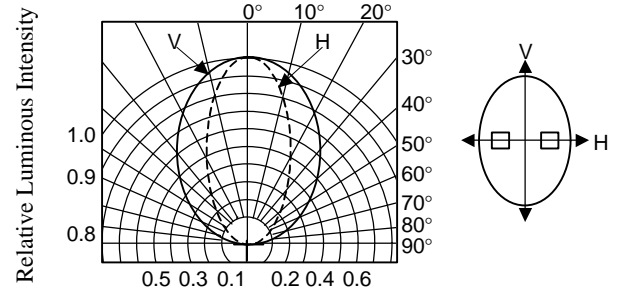


FIG.5 SPATIAL RADIATION PATTERN 80 X 40 DEGREE LAMPS

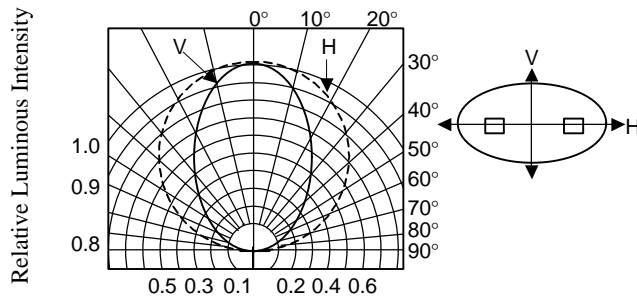


FIG.6 SPATIAL RADIATION PATTERN 110 X 60 DEGREE LAMPS

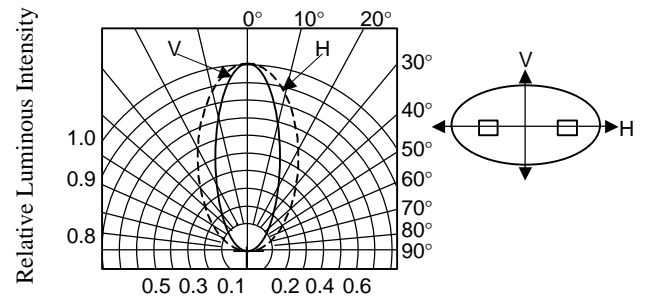


FIG.7 SPATIAL RADIATION PATTERN 50 X 30 DEGREE LAMPS

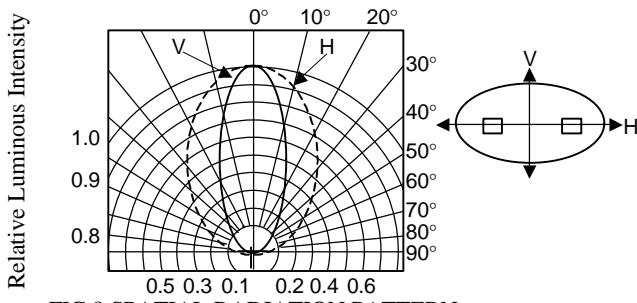


FIG.8 SPATIAL RADIATION PATTERN
70 X 30 DEGREE LAMPS

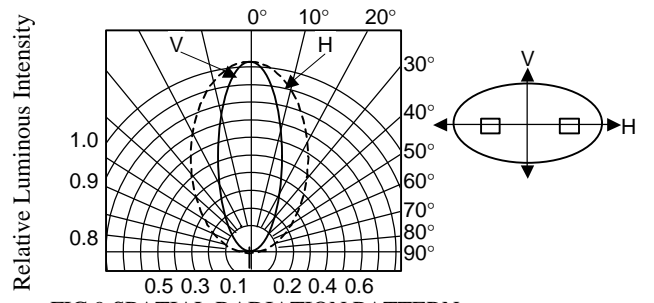


FIG.9 SPATIAL RADIATION PATTERN
60 X 30 DEGREE LAMPS

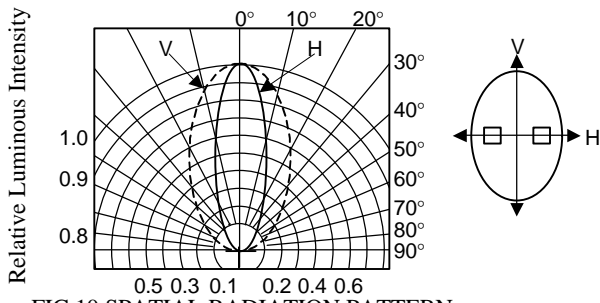


FIG.10 SPATIAL RADIATION PATTERN
50 X 25 DEGREE LAMPS

Unity Oval LEDs Bin Table

| Luminous Intensity | | |
|--------------------|---------------------------------|------|
| BIN RANGE | I_V (mcd) @ $I_F=20\text{mA}$ | |
| | MIN | MAX |
| J | 41 | 70 |
| K | 58 | 100 |
| L | 81 | 141 |
| M | 115 | 199 |
| N | 163 | 282 |
| O | 230 | 398 |
| P | 326 | 563 |
| Q | 461 | 796 |
| R | 652 | 1126 |
| S | 922 | 1593 |
| T | 1303 | 2253 |
| U | 1843 | 3185 |

Unity OVAL LED Bin Codes

| Category code | | |
|---------------|----------|----------|
| R | 2 | 2 |

| Luminous Intensity @ $I_F=20\text{mA}$ UNIT:mcd | | | | | | | | |
|---|-----|-----|----------|-----|------|----------|-------|-------|
| code | MIN | MAX | code | MIN | MAX | code | MIN | MAX |
| A | 2 | 3 | J | 41 | 70 | S | 922 | 1593 |
| B | 3 | 4 | K | 58 | 100 | T | 1303 | 2253 |
| C | 4 | 6 | L | 81 | 141 | U | 1843 | 3185 |
| D | 5 | 9 | M | 115 | 199 | V | 2606 | 4506 |
| E | 7 | 12 | N | 163 | 282 | W | 3686 | 6371 |
| F | 10 | 18 | O | 230 | 398 | X | 5213 | 9011 |
| G | 14 | 25 | P | 326 | 563 | Y | 7373 | 12742 |
| H | 20 | 35 | Q | 461 | 796 | Z | 10425 | 18002 |
| I | 29 | 50 | R | 652 | 1126 | | | |

| Dominant wavelength (Second code) @ $I_F=20\text{mA}$ UNIT:nm | | | | | | | | | | |
|---|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Material | BIN CODE | | 1 | | 2 | | 3 | | 4 | |
| | Wavelength(typ.) | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| AlInGaP | UOL | 625 | 619 | 624 | 622 | 628 | 626 | 631 | | |
| | SOL | 615 | 609 | 614 | 612 | 618 | 616 | 621 | | |
| | SO | 605 | 599 | 604 | 602 | 608 | 606 | 611 | | |
| | UYL | 590 | 584 | 589 | 587 | 591 | 589 | 593 | 591 | 596 |
| | UG | 572 | 568 | 573 | 571 | 576 | 574 | 579 | | |
| InGaN | TG | 525 | 519 | 524 | 522 | 528 | 526 | 532 | 530 | 536 |
| | SG | 505 | 499 | 504 | 502 | 508 | 506 | 511 | | |
| | BG | 490 | 484 | 489 | 487 | 493 | 491 | 496 | | |
| | B | 470 | 464 | 469 | 467 | 473 | 471 | 476 | | |

| Forward Voltage @ $I_F=20\text{mA}$ UNIT:Voltage | | | | |
|--|---------|------|-------|------|
| | AlInGaP | | InGaN | |
| VF | MIN | MAX | MIN | MAX |
| 1 | 1.35 | 1.65 | 2.55 | 2.85 |
| 2 | 1.55 | 1.85 | 2.75 | 3.05 |
| 3 | 1.75 | 2.05 | 2.95 | 3.25 |
| 4 | 1.95 | 2.25 | 3.15 | 3.45 |
| 5 | 2.15 | 2.45 | 3.34 | 3.65 |
| 6 | 2.35 | 2.65 | 3.55 | 3.85 |
| 7 | 2.55 | 2.85 | 3.75 | 4.05 |
| 8 | | | 3.95 | 4.25 |

Unity OVAL LED Bin Codes

| Category code | | |
|---------------|----------|----------|
| R | D | 2 |

| Luminous Intensity @ $I_F=20\text{mA}$ UNIT:mcd | | | | | | | | |
|---|-----|-----|----------|-----|------|----------|-------|-------|
| code | MIN | MAX | code | MIN | MAX | code | MIN | MAX |
| A | 2 | 3 | J | 41 | 70 | S | 922 | 1593 |
| B | 3 | 4 | K | 58 | 100 | T | 1303 | 2253 |
| C | 4 | 6 | L | 81 | 141 | U | 1843 | 3185 |
| D | 5 | 9 | M | 115 | 199 | V | 2606 | 4506 |
| E | 7 | 12 | N | 163 | 282 | W | 3686 | 6371 |
| F | 10 | 18 | O | 230 | 398 | X | 5213 | 9011 |
| G | 14 | 25 | P | 326 | 563 | Y | 7373 | 12742 |
| H | 20 | 35 | Q | 461 | 796 | Z | 10425 | 18002 |
| I | 29 | 50 | R | 652 | 1126 | | | |

| Color Ranks | | | | | |
|-------------|--------|-------|-------|-------|-------|
| Blue | Rank A | | | | |
| | x | 0.151 | 0.127 | 0.151 | 0.171 |
| | y | 0.013 | 0.037 | 0.068 | 0.040 |
| | Rank B | | | | |
| | x | 0.137 | 0.114 | 0.142 | 0.161 |
| | y | 0.027 | 0.058 | 0.091 | 0.058 |
| Green | Rank C | | | | |
| | x | 0.122 | 0.100 | 0.135 | 0.152 |
| | y | 0.048 | 0.087 | 0.122 | 0.081 |
| | Rank D | | | | |
| | x | 0.105 | 0.081 | 0.130 | 0.137 |
| | y | 0.077 | 0.133 | 0.171 | 0.112 |
| Red | Rank E | | | | |
| | x | 0.144 | 0.059 | 0.131 | 0.203 |
| | y | 0.560 | 0.665 | 0.745 | 0.625 |
| | Rank F | | | | |
| | x | 0.178 | 0.111 | 0.168 | 0.227 |
| | y | 0.610 | 0.730 | 0.755 | 0.630 |
| Red | Rank G | | | | |
| | x | 0.202 | 0.143 | 0.216 | 0.252 |
| | y | 0.620 | 0.750 | 0.755 | 0.630 |
| | Rank H | | | | |
| | x | 0.230 | 0.186 | 0.279 | 0.296 |
| | y | 0.628 | 0.760 | 0.734 | 0.619 |
| Red | Rank I | | | | |
| | x | 0.663 | 0.630 | 0.685 | 0.721 |
| | y | 0.292 | 0.331 | 0.328 | 0.287 |
| | Rank J | | | | |
| | x | 0.675 | 0.648 | 0.706 | 0.734 |
| | y | 0.280 | 0.312 | 0.307 | 0.274 |

| Forward Voltage @ $I_F=20\text{mA}$ UNIT:Voltage | | | | |
|--|---------|------|-------|------|
| VF | AlInGaP | | InGaN | |
| | MIN | MAX | MIN | MAX |
| 1 | 1.35 | 1.65 | 2.55 | 2.85 |
| 2 | 1.55 | 1.85 | 2.75 | 3.05 |
| 3 | 1.75 | 2.05 | 2.95 | 3.25 |
| 4 | 1.95 | 2.25 | 3.15 | 3.45 |
| 5 | 2.15 | 2.45 | 3.35 | 3.65 |
| 6 | 2.35 | 2.65 | 3.55 | 3.85 |
| 7 | 2.55 | 2.85 | 3.75 | 4.05 |
| 8 | | | 3.95 | 4.25 |