



# 0.36" Single Digit Numeric LED Displays

## Features

- 0.36 inch (9.14mm) digit height
- Continuous uniform segments.
- Choices of six bright colors-AlGaAs red/bright red/green/yellow/red orange/high efficiency red.
- Low power requirement.
- Excellent characters appearance.
- High brightness.
- Wide viewing angle.
- Solid state reliability.
- Categorized for luminous intensity.
- I.C. compatible.
- Easy mounting on P.C. board.

## Descriptions

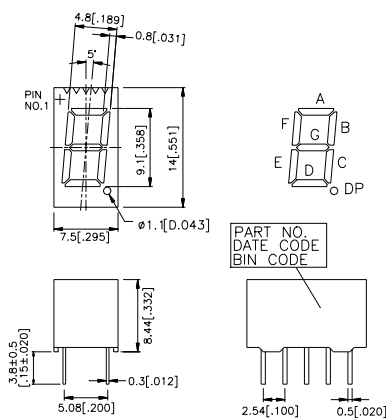
The LTS-360 series are 0.36 inch (9.14mm) height single digit displays. AlGaAs red displays has gray face and white segments. Bright red and high efficiency red displays have red face and red segments. Green, yellow AlGaAs red and red orange displays have gray face and white segments.

The AlGaAs red seven segment displays are designed for applications requiring low power consumption. They are tested and selected for their excellent low current characteristics to ensure that the segments are matched at low current. Drive current as low as 1 mA per segment is available.

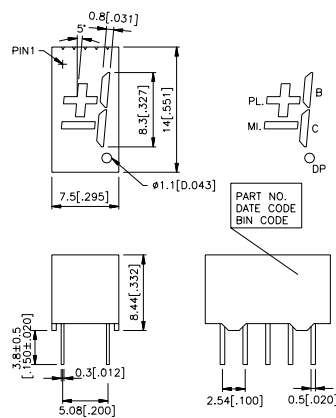
The AlGaAs red series devices utilize LED chips which are made from AlGaAs on a non-transparent GaAs substrate. The bright red and green series devices utilize LED chips which are made from GaP on a transparent GaP substrate. The yellow and red orange series devices utilize LED chips which are made from GaAsP on a transparent GaP substrate.

## Package Dimensions

A.LTS-360/367



B.LTS-368



Notes: All dimensions are in millimeters (inches). Tolerance:  $\pm 0.25\text{mm}$  (0.01") unless otherwise noted.

# Devices

| Part No. LTS- |            |       |        |            |             | Description                      | Package Dimension | Internal Circuit Diagram |
|---------------|------------|-------|--------|------------|-------------|----------------------------------|-------------------|--------------------------|
| AlGaAs Red    | Bright Red | Green | Yellow | Red Orange | Hi-EFF. Red |                                  |                   |                          |
| 360WC         | 360P       | 360G  | 360Y   | 360E       | 360HR       | Common Anode, Rt. Hand Decimal   | A                 | A                        |
| 367WC         | 367P       | 367G  | 367Y   | 367E       | 367HR       | Common Cathode, Rt. Hand Decimal | A                 | B                        |
| 368WC         | 368P       | 368G  | 368Y   | 368E       | 368HR       | Common Cathode, $\pm 1$ Overflow | B                 | C                        |

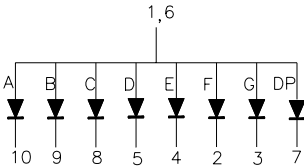
## Pin Connection

| Pin No. | Connection      |                   |                        |
|---------|-----------------|-------------------|------------------------|
|         | A.LTS-360       | B.LTS-367         | C.LTS-368              |
| 1.      | Common Anode *1 | Common Cathode *1 | Cathode Pl. & Mi. *2   |
| 2.      | Cathode F       | Anode F           | Anode Plus Sign        |
| 3.      | Cathode G       | Anode G           | Anode Minus Sign       |
| 4.      | Cathode E       | Anode E           | Cathode Pl. & Mi. *2   |
| 5.      | Cathode D       | Anode D           | No Pin                 |
| 6.      | Common Anode *1 | Common Cathode *1 | Cathode B, C & D.P. *3 |
| 7.      | Cathode D.P.    | Anode D.P.        | Anode D.P.             |
| 8.      | Cathode C       | Anode C           | Anode C                |
| 9.      | Cathode B       | Anode B           | Anode B                |
| 10.     | Cathode A       | Anode A           | Cathode B, C & D.P. *3 |

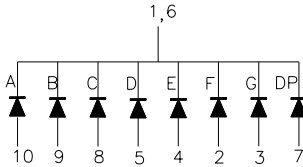
Note:1.Pin 1 & 6 are internally connected. 2.Pin 1 & 4 are internally connected. 3.Pin 6 & 10 are internally connected.

## Internal Circuit Diagrams

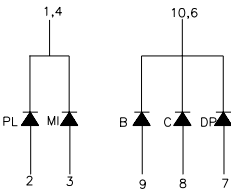
A.LTS-360



B.LTS-367

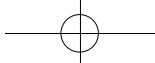


C.LTS-368



## Absolute Maximum Rating at Ta=25°C

| Parameter                                                               | AlGaAs Red     | Bright Red | Green | Yellow | Red Orange | Hi. -Eff. Red | Unit  |
|-------------------------------------------------------------------------|----------------|------------|-------|--------|------------|---------------|-------|
| Power Dissipation Per Segment                                           | 75             | 40         | 75    | 60     | 75         | 75            | mW    |
| Peak Forward Current Per Segment (1/10 Duty Cycle, 0.1ms Pulse Width)   | 125            | 60         | 100   | 80     | 100        | 100           | mA    |
| Continuous Forward Current Per Segment                                  | 30             | 15         | 25    | 20     | 25         | 25            | mA    |
| Derating Linear from 25°C Per Segment                                   | 0.4            | 0.2        | 0.33  | 0.27   | 0.33       | 0.33          | mA/°C |
| Reverse Voltage Per Segment                                             | 5              | 5          | 5     | 5      | 5          | 5             | V     |
| Operating Temperature Range                                             | -35°C to +85°C |            |       |        |            |               |       |
| Stroage Temperature Range                                               | -35°C to +85°C |            |       |        |            |               |       |
| Solder Temperature 1/16 Inch Below Seating Plane for 3 Seconds at 260°C |                |            |       |        |            |               |       |



## Electrical/Optical Characteristics at Ta=25°C

LTS-360WC/367WC/368WC

| Parameter                         | Symbol            | Min. | Typ. | Max. | Unit | Tset Condition       |
|-----------------------------------|-------------------|------|------|------|------|----------------------|
| Average Luminous Intensity        | I <sub>v</sub>    | 200  | 650  |      | μ cd | I <sub>F</sub> =1mA  |
|                                   |                   |      | 3400 |      |      | I <sub>F</sub> =5mA  |
| Peak Emission Wavelength          | λ P               |      | 660  |      | nm   | I <sub>F</sub> =20mA |
| Spectral Line Half-Width          | Δ λ               |      | 35   |      | nm   | I <sub>F</sub> =20mA |
| Dominant Wavelength               | λ d               |      | 638  |      | nm   | I <sub>F</sub> =20mA |
| Forward Voltage, Per Segment      | V <sub>F</sub>    |      | 1.6  | 2.4  | V    | I <sub>F</sub> =1mA  |
|                                   |                   |      | 1.7  |      |      | I <sub>F</sub> =5mA  |
|                                   |                   |      | 1.8  |      |      | I <sub>F</sub> =20mA |
| Reverse Current, Per Segment      | I <sub>R</sub>    |      |      | 100  | μ A  | V <sub>R</sub> =5V   |
| Luminous Intensity Matching Ratio | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>F</sub> =1mA  |

LTS-360P

| Parameter                            | Symbol            | Min. | Typ. | Max. | Unit | Tset Condition       |
|--------------------------------------|-------------------|------|------|------|------|----------------------|
| Average Luminous Intensity           | I <sub>v</sub>    | 320  | 750  |      | μ cd | I <sub>F</sub> =10mA |
| Peak Emission Wavelength             | λ P               |      | 697  |      | nm   | I <sub>F</sub> =20mA |
| Spectral Line Half-Width             | Δ λ               |      | 90   |      | nm   | I <sub>F</sub> =20mA |
| Dominant Wavelength                  | λ d               |      | 657  |      | nm   | I <sub>F</sub> =20mA |
| Forward Voltage, Per Segment or D.P. | V <sub>F</sub>    |      | 2.1  | 2.6  | V    | I <sub>F</sub> =20mA |
| Reverse Current, Per Segment or D.P. | I <sub>R</sub>    |      |      | 100  | μ A  | V <sub>R</sub> =5V   |
| Luminous Intensity Matching Ratio    | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>F</sub> =10mA |

LTS-360G

| Parameter                            | Symbol            | Min. | Typ. | Max. | Unit | Tset Condition       |
|--------------------------------------|-------------------|------|------|------|------|----------------------|
| Average Luminous Intensity           | I <sub>v</sub>    | 800  | 2000 |      | μ cd | I <sub>F</sub> =10mA |
| Peak Emission Wavelength             | λ P               |      | 565  |      | nm   | I <sub>F</sub> =20mA |
| Spectral Line Half-Width             | Δ λ               |      | 30   |      | nm   | I <sub>F</sub> =20mA |
| Dominant Wavelength                  | λ d               |      | 569  |      | nm   | I <sub>F</sub> =20mA |
| Forward Voltage, Per Segment or D.P. | V <sub>F</sub>    |      | 2.1  | 2.6  | V    | I <sub>F</sub> =20mA |
| Reverse Current, Per Segment or D.P. | I <sub>R</sub>    |      |      | 100  | μ A  | V <sub>R</sub> =5V   |
| Luminous Intensity Matching Ratio    | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>F</sub> =10mA |

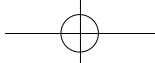
LTS-360Y

| Parameter                            | Symbol            | Min. | Typ. | Max. | Unit | Tset Condition       |
|--------------------------------------|-------------------|------|------|------|------|----------------------|
| Average Luminous Intensity           | I <sub>v</sub>    | 800  | 2000 |      | μ cd | I <sub>F</sub> =10mA |
| Peak Emission Wavelength             | λ P               |      | 585  |      | nm   | I <sub>F</sub> =20mA |
| Spectral Line Half-Width             | Δ λ               |      | 35   |      | nm   | I <sub>F</sub> =20mA |
| Dominant Wavelength                  | λ d               |      | 588  |      | nm   | I <sub>F</sub> =20mA |
| Forward Voltage, Per Segment or D.P. | V <sub>F</sub>    |      | 2.1  | 2.6  | V    | I <sub>F</sub> =20mA |
| Reverse Current, Per Segment or D.P. | I <sub>R</sub>    |      |      | 100  | μ A  | V <sub>R</sub> =5V   |
| Luminous Intensity Matching Ratio    | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>F</sub> =10mA |

LTS-360E

| Parameter                            | Symbol            | Min. | Typ. | Max. | Unit | Tset Condition       |
|--------------------------------------|-------------------|------|------|------|------|----------------------|
| Average Luminous Intensity           | I <sub>v</sub>    | 800  | 2000 |      | μ cd | I <sub>F</sub> =10mA |
| Peak Emission Wavelength             | λ P               |      | 630  |      | nm   | I <sub>F</sub> =20mA |
| Spectral Line Half-Width             | Δ λ               |      | 40   |      | nm   | I <sub>F</sub> =20mA |
| Dominant Wavelength                  | λ d               |      | 621  |      | nm   | I <sub>F</sub> =20mA |
| Forward Voltage, Per Segment or D.P. | V <sub>F</sub>    |      | 2.0  | 2.6  | V    | I <sub>F</sub> =20mA |
| Reverse Current, Per Segment or D.P. | I <sub>R</sub>    |      |      | 100  | μ A  | V <sub>R</sub> =5V   |
| Luminous Intensity Matching Ratio    | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>F</sub> =10mA |

9-130



# LTS-360HR

| Parameter                            | Symbol          | Min. | Typ. | Max. | Unit     | Tset Condition    |
|--------------------------------------|-----------------|------|------|------|----------|-------------------|
| Average Luminous Intensity           | $I_v$           | 800  | 2000 |      | $\mu$ cd | $I_F=10\text{mA}$ |
| Peak Emission Wavelength             | $\lambda_P$     |      | 635  |      | nm       | $I_F=20\text{mA}$ |
| Spectral Line Half-Width             | $\Delta\lambda$ |      | 40   |      | nm       | $I_F=20\text{mA}$ |
| Dominant Wavelength                  | $\lambda_d$     |      | 623  |      | nm       | $I_F=20\text{mA}$ |
| Forward Voltage, Per Segment or D.P. | $V_F$           |      | 2.1  | 2.6  | V        | $I_F=20\text{mA}$ |
| Reverse Current, Per Segment or D.P. | $I_R$           |      |      | 100  | $\mu$ A  | $V_R=5\text{V}$   |
| Luminous Intensity Matching Ratio    | $I_v\text{-m}$  |      |      | 2:1  |          | $I_F=10\text{mA}$ |

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

## Typical Electrical/Optical Characteristic Curves (25°C Ambient Temperature Unless Otherwise Noted)

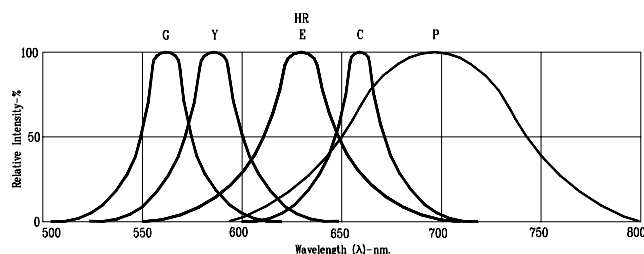


Fig1. RELATIVE INTENSITY VS. WAVELENGTH

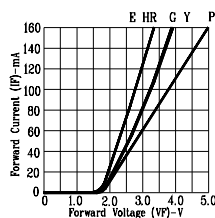


Fig2. FORWARD CURRENT VS. FORWARD VOLTAGE

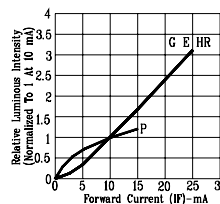


Fig3. RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

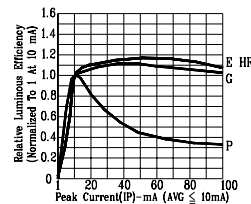


Fig4. RELATIVE LUMINOUS EFFICIENCY (LUMINOUS INTENSITY PER UNIT CURRENT) VS. PEAK CURRENT

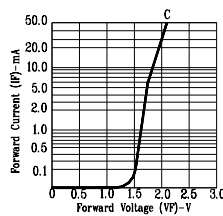


Fig5. FORWARD CURRENT VS. FORWARD VOLTAGE

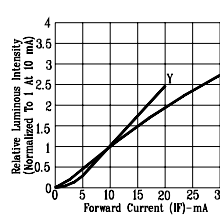


Fig6. RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

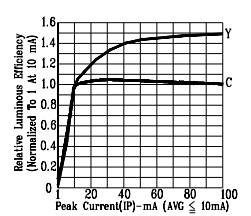


Fig7. RELATIVE LUMINOUS EFFICIENCY (LUMINOUS INTENSITY PER UNIT CURRENT) VS. PEAK CURRENT

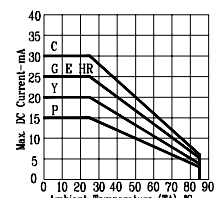


Fig8. MAX. ALLOWABLE DC CURRENT VS. AMBIENT TEMPERATURE

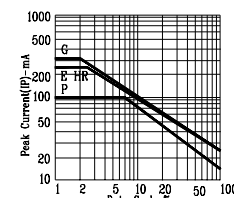


Fig9. MAX. PEAK CURRENT VS. DUTY CYCLE % (REFRESH RATE 1KHz)

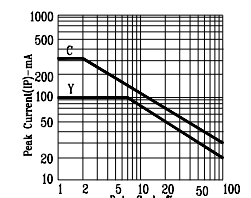


Fig10. MAX. PEAK CURRENT VS. DUTY CYCLE % (REFRESH RATE 1KHz)

NOTE: G=GREEN Y=YELLOW HR=HI-EFF. RED E=RED ORANGE C=AlGaAs RED P=BRIGHT RED (REFRESH RATE 1KHz)

DISPLAYS