

# MCR22-6, MCR22-8

Preferred Device

## Sensitive Gate Silicon Controlled Rectifiers Reverse Blocking Thyristors

Designed and tested for repetitive peak operation required for CD ignition, fuel ignitors, flash circuits, motor controls and low-power switching applications.

### Features

- 150 A for 2  $\mu$ s Safe Area
- High dv/dt
- Very Low Forward "On" Voltage at High Current
- Low-Cost TO-226 (TO-92)
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                                                                                                                     | Symbol                   | Value           | Unit                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------|----------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>( $R_{GK} = 1\text{K}$ , $T_J = -40$ to $+110^\circ\text{C}$ , Sine Wave,<br>50 to 60 Hz, $R_{GK} = 1\text{k}\Omega$ )<br>MCR22-6<br>MCR22-8 | $V_{DRM}$ ,<br>$V_{RRM}$ | 400<br>600      | V                    |
| On-State Current RMS<br>( $180^\circ$ Conduction Angles, $T_C = 80^\circ\text{C}$ )                                                                                                        | $I_T(\text{RMS})$        | 1.5             | A                    |
| Peak Non-repetitive Surge Current,<br>@ $T_A = 25^\circ\text{C}$ , (1/2 Cycle, Sine Wave, 60 Hz)                                                                                           | $I_{TSM}$                | 15              | A                    |
| Circuit Fusing Considerations ( $t = 8.3$ ms)                                                                                                                                              | $I^2t$                   | 0.9             | $\text{A}^2\text{s}$ |
| Forward Peak Gate Power<br>(Pulse Width $\leq 1.0$ $\mu\text{sec}$ , $T_A = 25^\circ\text{C}$ )                                                                                            | $P_{GM}$                 | 0.5             | W                    |
| Forward Average Gate Power<br>( $t = 8.3$ msec, $T_A = 25^\circ\text{C}$ )                                                                                                                 | $P_{G(AV)}$              | 0.1             | W                    |
| Forward Peak Gate Current<br>(Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_A = 25^\circ\text{C}$ )                                                                                            | $I_{FGM}$                | 0.2             | A                    |
| Reverse Peak Gate Voltage<br>(Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_A = 25^\circ\text{C}$ )                                                                                            | $V_{RGM}$                | 5.0             | V                    |
| Operating Junction Temperature Range<br>@ Rated $V_{RRM}$ and $V_{DRM}$                                                                                                                    | $T_J$                    | $-40$ to $+110$ | $^\circ\text{C}$     |
| Storage Temperature Range                                                                                                                                                                  | $T_{stg}$                | $-40$ to $+150$ | $^\circ\text{C}$     |

### THERMAL CHARACTERISTICS

| Characteristic                                                            | Symbol          | Max  | Unit               |
|---------------------------------------------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case                                      | $R_{\theta JC}$ | 50   | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient                                   | $R_{\theta JA}$ | 160  | $^\circ\text{C/W}$ |
| Lead Solder Temperature<br>(Lead Length $\geq 1/16"$ from case, 10 S Max) | $T_L$           | +260 | $^\circ\text{C}$   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1.  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

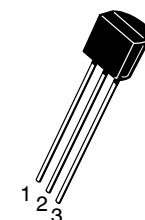
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



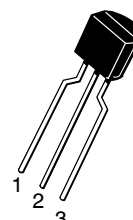
ON Semiconductor®

<http://onsemi.com>

SCRs  
1.5 AMPERES RMS  
400 thru 600 VOLTS



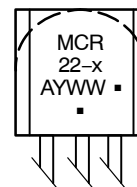
STRAIGHT LEAD  
BULK PACK



BENT LEAD  
TAPE & REEL  
AMMO PACK

TO-92 (TO-226)  
CASE 029  
STYLE 10

### MARKING DIAGRAMS



MCR22-x = Device Code  
x = 6 or 8

A = Assembly Location

Y = Year

WW = Work Week

■ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN ASSIGNMENT

|   |         |
|---|---------|
| 1 | Cathode |
| 2 | Gate    |
| 3 | Anode   |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

## MCR22-6, MCR22-8

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

#### OFF CHARACTERISTICS

|                                                                                                                                             |                                                       |                    |        |        |                            |
|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------|--------|--------|----------------------------|
| Peak Repetitive Forward or Reverse Blocking Current<br>( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}; R_{GK} = 1 \text{ k}\Omega$ ) | $T_C = 25^\circ\text{C}$<br>$T_C = 110^\circ\text{C}$ | $I_{DRM}, I_{RRM}$ | –<br>– | –<br>– | 10<br>200<br>$\mu\text{A}$ |
|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------|--------|--------|----------------------------|

#### ON CHARACTERISTICS

|                                                                                                            |                                                       |          |        |          |            |               |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------|--------|----------|------------|---------------|
| Peak Forward On-State Voltage (Note 2)<br>( $I_{TM} = 1 \text{ A Peak}$ )                                  |                                                       | $V_{TM}$ | –      | 1.2      | 1.7        | V             |
| Gate Trigger Current (Continuous dc) (Note 3)<br>( $V_{AK} = 6 \text{ Vdc}, R_L = 100 \Omega$ )            | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$ | $I_{GT}$ | –<br>– | 30<br>–  | 200<br>500 | $\mu\text{A}$ |
| Gate Trigger Voltage (Continuous dc) (Note 3)<br>( $V_{AK} = 7 \text{ Vdc}, R_L = 100 \Omega$ )            | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$ | $V_{GT}$ | –<br>– | –<br>–   | 0.8<br>1.2 | V             |
| Gate Non-Trigger Voltage<br>( $V_{AK} = 12 \text{ Vdc}, R_L = 100 \Omega$ )                                | $T_C = 110^\circ\text{C}$                             | $V_{GD}$ | 0.1    | –        | –          | V             |
| Holding Current<br>( $V_{AK} = 12 \text{ Vdc}, R_{GK} = 1 \text{ k}\Omega$ )<br>Initiating Current = 20 mA | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$ | $I_H$    | –<br>– | 2.0<br>– | 5.0<br>10  | mA            |

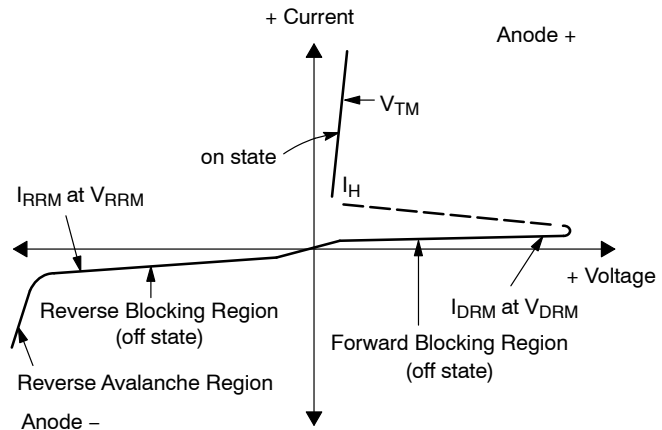
#### DYNAMIC CHARACTERISTICS

|                                                                                                              |  |         |   |    |   |                  |
|--------------------------------------------------------------------------------------------------------------|--|---------|---|----|---|------------------|
| Critical Rate of Rise of Off-State Voltage ( $R_{GK} = 1 \text{ k}\Omega$ )<br>( $T_C = 110^\circ\text{C}$ ) |  | $dv/dt$ | – | 25 | – | V/ $\mu\text{s}$ |
|--------------------------------------------------------------------------------------------------------------|--|---------|---|----|---|------------------|

2. Pulse Width = 1.0 ms, Duty Cycle  $\leq 1\%$ .
3.  $R_{GK}$  Current not included in measurement.

### Voltage Current Characteristic of SCR

| Symbol    | Parameter                                 |
|-----------|-------------------------------------------|
| $V_{DRM}$ | Peak Repetitive Off State Forward Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Off State Reverse Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Peak on State Voltage                     |
| $I_H$     | Holding Current                           |



# MCR22-6, MCR22-8

## CURRENT DERATING

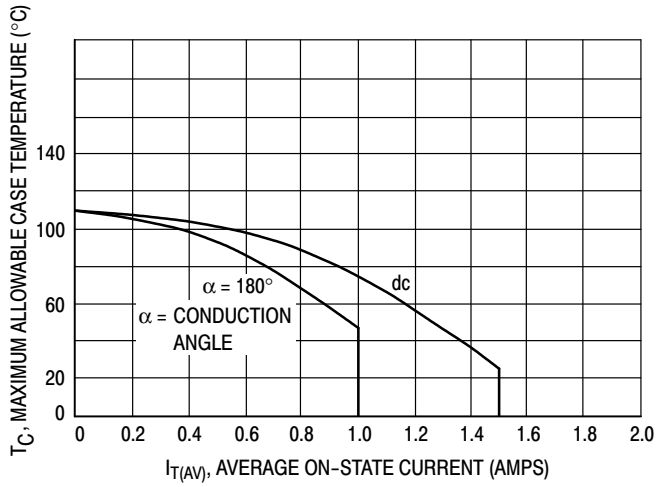


Figure 1. Maximum Case Temperature

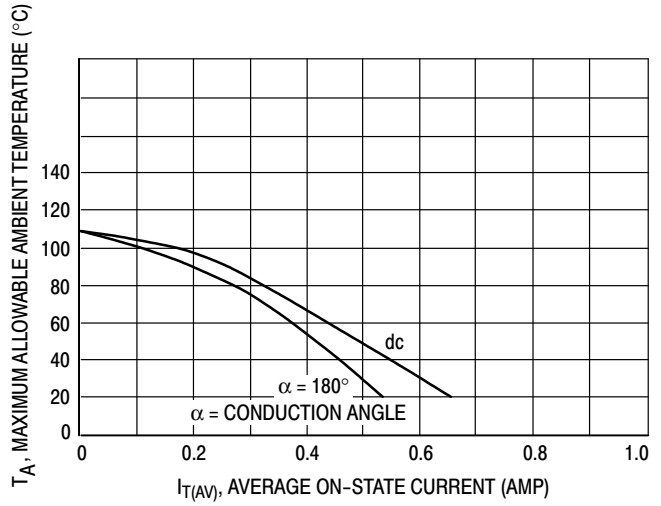


Figure 2. Maximum Ambient Temperature

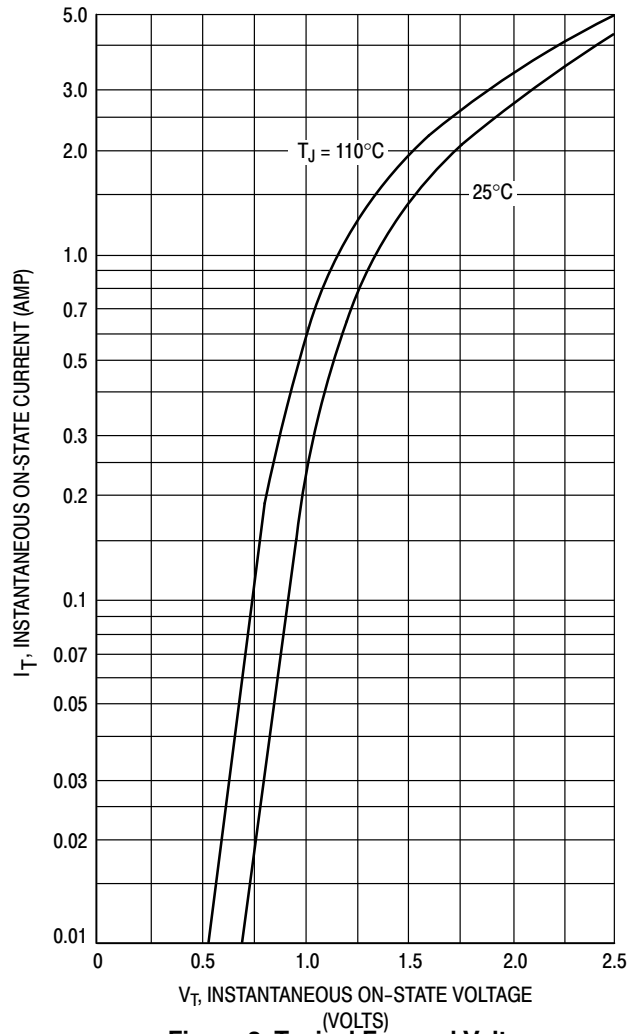


Figure 3. Typical Forward Voltage

# MCR22-6, MCR22-8

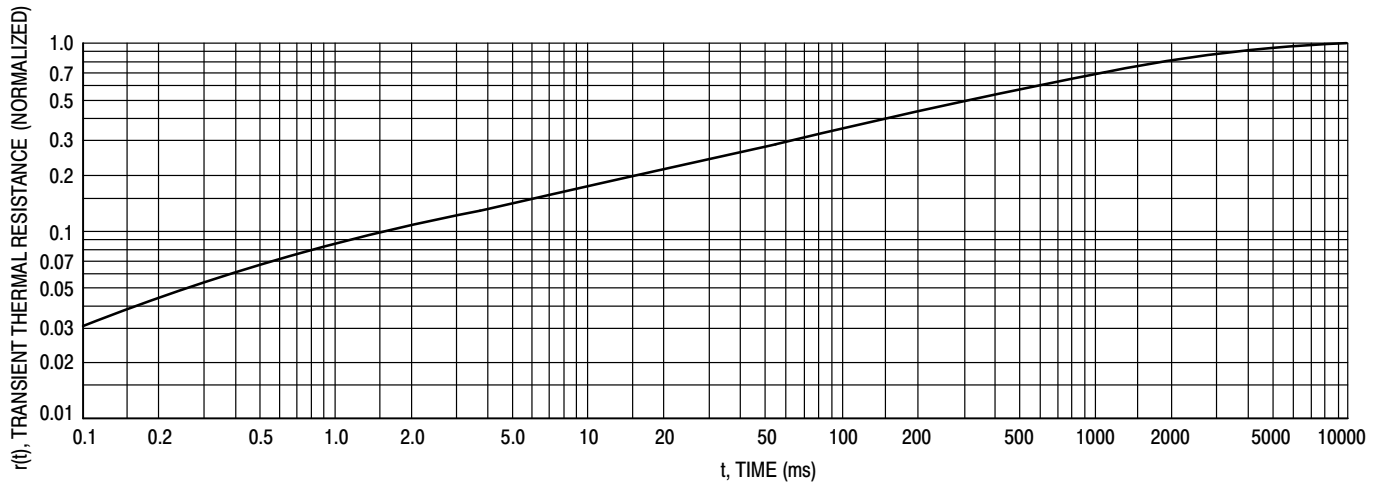


Figure 4. Thermal Response

## TYPICAL CHARACTERISTICS

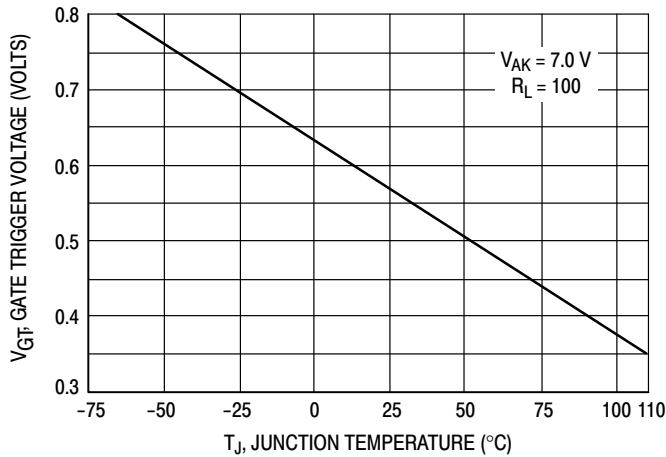


Figure 5. Typical Gate Trigger Voltage

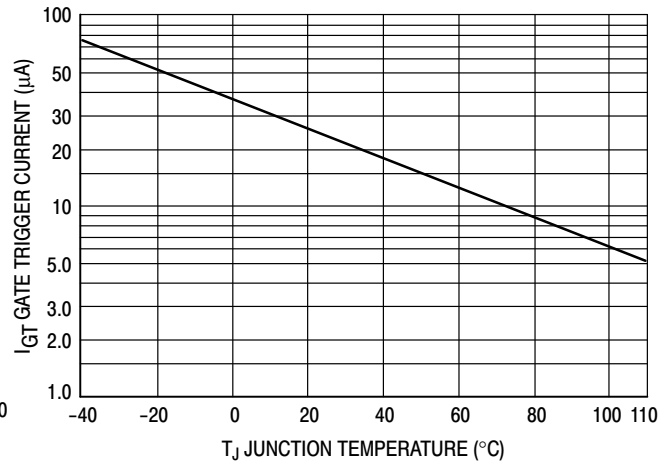


Figure 6. Typical Gate Trigger Current

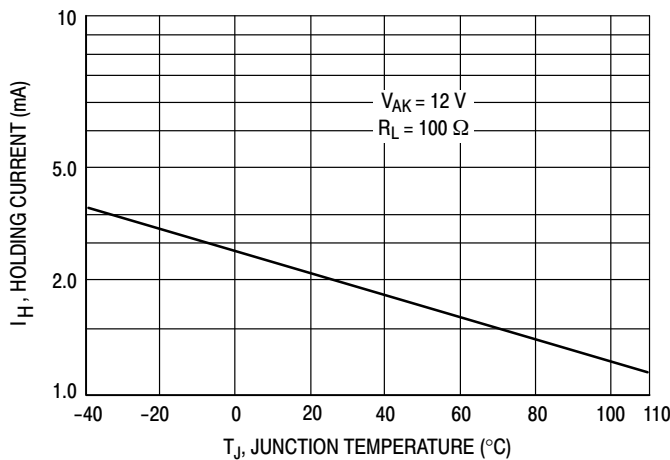


Figure 7. Typical Holding Current

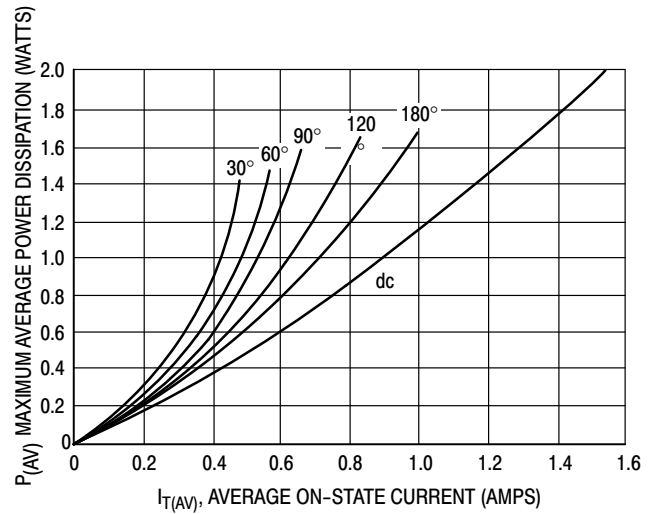


Figure 8. Power Dissipation

## TO-92 EIA RADIAL TAPE IN FAN FOLD BOX OR ON REEL

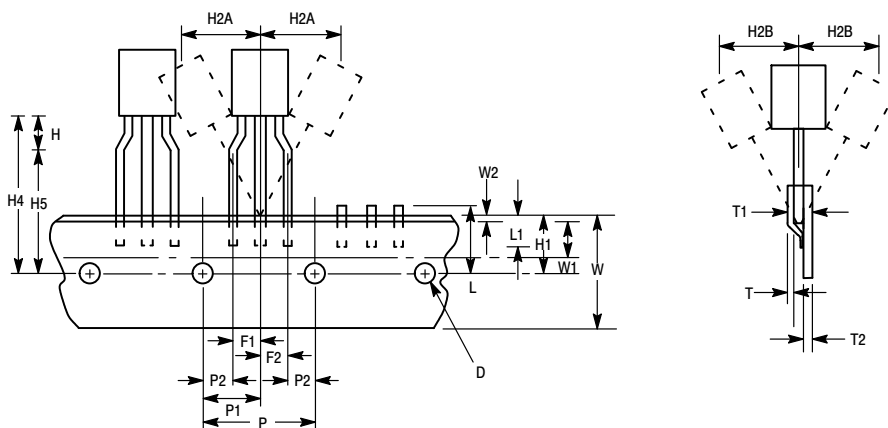


Figure 9. Device Positioning on Tape

| Item                                 | Symbol | Specification |         |            |      |
|--------------------------------------|--------|---------------|---------|------------|------|
|                                      |        | Inches        |         | Millimeter |      |
|                                      |        | Min           | Max     | Min        | Max  |
| Tape Feedhole Diameter               | D      | 0.1496        | 0.1653  | 3.8        | 4.2  |
| Component Lead Thickness Dimension   | D2     | 0.015         | 0.020   | 0.38       | 0.51 |
| Component Lead Pitch                 | F1, F2 | 0.0945        | 0.110   | 2.4        | 2.8  |
| Bottom of Component to Seating Plane | H      | .059          | .156    | 1.5        | 4.0  |
| Feedhole Location                    | H1     | 0.3346        | 0.3741  | 8.5        | 9.5  |
| Deflection Left or Right             | H2A    | 0             | 0.039   | 0          | 1.0  |
| Deflection Front or Rear             | H2B    | 0             | 0.051   | 0          | 1.0  |
| Feedhole to Bottom of Component      | H4     | 0.7086        | 0.768   | 18         | 19.5 |
| Feedhole to Seating Plane            | H5     | 0.610         | 0.649   | 15.5       | 16.5 |
| Defective Unit Clipped Dimension     | L      | 0.3346        | 0.433   | 8.5        | 11   |
| Lead Wire Enclosure                  | L1     | 0.09842       | –       | 2.5        | –    |
| Feedhole Pitch                       | P      | 0.4921        | 0.5079  | 12.5       | 12.9 |
| Feedhole Center to Center Lead       | P1     | 0.2342        | 0.2658  | 5.95       | 6.75 |
| First Lead Spacing Dimension         | P2     | 0.1397        | 0.1556  | 3.55       | 3.95 |
| Adhesive Tape Thickness              | T      | 0.06          | 0.08    | 0.15       | 0.20 |
| Overall Taped Package Thickness      | T1     | –             | 0.0567  | –          | 1.44 |
| Carrier Strip Thickness              | T2     | 0.014         | 0.027   | 0.35       | 0.65 |
| Carrier Strip Width                  | W      | 0.6889        | 0.7481  | 17.5       | 19   |
| Adhesive Tape Width                  | W1     | 0.2165        | 0.2841  | 5.5        | 6.3  |
| Adhesive Tape Position               | W2     | .0059         | 0.01968 | .15        | 0.5  |

## NOTES:

1. Maximum alignment deviation between leads not to be greater than 0.2 mm.
2. Defective components shall be clipped from the carrier tape such that the remaining protrusion (L) does not exceed a maximum of 11 mm.
3. Component lead to tape adhesion must meet the pull test requirements.
4. Maximum non-cumulative variation between tape feed holes shall not exceed 1 mm in 20 pitches.
5. Holddown tape not to extend beyond the edge(s) of carrier tape and there shall be no exposure of adhesive.
6. No more than 1 consecutive missing component is permitted.
7. A tape trailer and leader, having at least three feed holes is required before the first and after the last component.
8. Splices will not interfere with the sprocket feed holes.

## MCR22-6, MCR22-8

### ORDERING & SHIPPING INFORMATION: MCR22 Series Packaging Options, Device Suffix

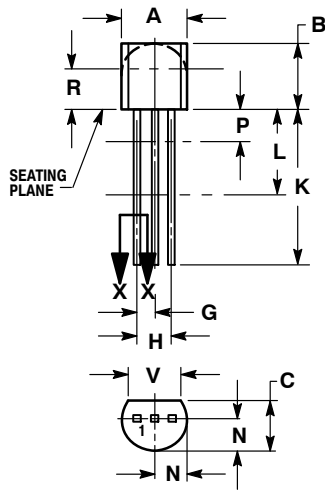
| U.S.         | Europe Equivalent | Shipping†               | Description of TO-92 Tape Orientation         |
|--------------|-------------------|-------------------------|-----------------------------------------------|
|              | MCR22-8RL1        | 2000 / Tape & Reel      | Flat side of TO-92 and adhesive tape visible  |
|              | MCR22-8RL1G       |                         |                                               |
| MCR22-6      |                   | 5000 Units / Box        | N/A, Bulk                                     |
| MCR22-6G     |                   |                         |                                               |
| MCR22-8      |                   |                         |                                               |
| MCR22-8G     |                   |                         |                                               |
| MCR22-6RLRA  |                   | 2000 / Tape & Reel      | Round side of TO-92 and adhesive tape visible |
| MCR22-6RLRAG |                   |                         |                                               |
| MCR22-6RLRP  |                   | 2000 / Tape & Ammo Pack | Flat side of TO-92 and adhesive tape visible  |
| MCR22-6RLRPG |                   |                         |                                               |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

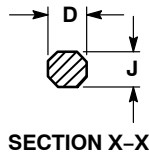
# MCR22-6, MCR22-8

## PACKAGE DIMENSIONS

### TO-92 (TO-226) CASE 29-11 ISSUE AM



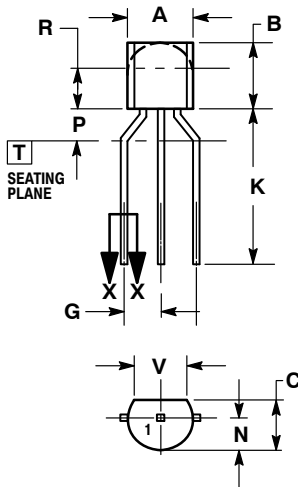
STRAIGHT LEAD  
BULK PACK



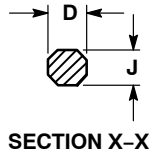
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ---   | 12.70       | ---   |
| L   | 0.250  | ---   | 6.35        | ---   |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ---    | 0.100 | ---         | 2.54  |
| R   | 0.115  | ---   | 2.93        | ---   |
| V   | 0.135  | ---   | 3.43        | ---   |



BENT LEAD  
TAPE & REEL  
AMMO PACK



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 4.45        | 5.20 |
| B   | 4.32        | 5.33 |
| C   | 3.18        | 4.19 |
| D   | 0.40        | 0.54 |
| G   | 2.40        | 2.80 |
| J   | 0.39        | 0.50 |
| K   | 12.70       | ---  |
| N   | 2.04        | 2.66 |
| P   | 1.50        | 4.00 |
| R   | 2.93        | ---  |
| V   | 3.43        | ---  |

#### STYLE 10:

1. CATHODE
2. GATE
3. ANODE

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