

# NCR169D

## General Purpose Sensitive Gate Silicon Controlled Rectifier Reverse Blocking Thyristor

PNPN device designed for line-powered general purpose applications such as relay and lamp drivers, small motor controls, gate drivers for larger thyristors, and sensing and detection circuits. Supplied in a cost effective plastic TO-226AA package.

### Features

- Sensitive Gate Allows Direct Triggering by Microcontrollers and Other Logic Circuits
- On-State Current Rating of 0.8 Amperes RMS at 80°C
- Surge Current Capability – 10 Amperes
- Immunity to  $dV/dt$  – 20 V/ $\mu$ sec Minimum at 110°C
- Glass-Passivated Surface for Reliability and Uniformity
- Device Marking: NCR169D, Date Code
- 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.) ( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave, 50 to 60 Hz; Gate Open)	$V_{DRM}$ , $V_{RRM}$	400	Volts
On-State RMS Current ( $T_C = 80^\circ\text{C}$ ) 180° Conduction Angles	$I_{T(RMS)}$	0.8	Amp
Peak Non-Repetitive Surge Current (1/2 Cycle, Sine Wave, 60 Hz, $T_J = 25^\circ\text{C}$ )	$I_{TSM}$	10	Amps
Circuit Fusing Consideration ( $t = 10$ ms)	$I^2t$	0.415	$\text{A}^2\text{s}$
Forward Peak Gate Power ( $T_A = 25^\circ\text{C}$ , Pulse Width $\leq 1.0$ $\mu\text{s}$ )	$P_{GM}$	0.1	Watt
Forward Average Gate Power ( $T_A = 25^\circ\text{C}$ , $t = 20$ ms)	$P_{G(AV)}$	0.10	Watt
Forward Peak Gate Current ( $T_A = 25^\circ\text{C}$ , Pulse Width $\leq 1.0$ $\mu\text{s}$ )	$I_{GM}$	1.0	Amp
Reverse Peak Gate Voltage ( $T_A = 25^\circ\text{C}$ , Pulse Width $\leq 1.0$ $\mu\text{s}$ )	$V_{GRM}$	5.0	Volts
Operating Junction Temperature Range @ Rate $V_{RRM}$ and $V_{DRM}$	$T_J$	-40 to 110	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to 150	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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.



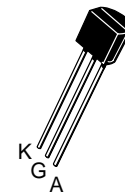
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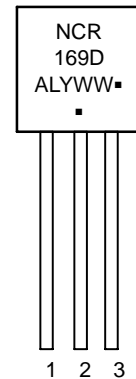
SCR  
0.8 AMPERES RMS  
400 VOLTS



### MARKING DIAGRAM



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



- A = Assembly Location
  - L = Wafer Lot
  - Y = Year
  - WW = Work Week
  - = Pb-Free Package
- (Note: Microdot may be in either location)

### PIN ASSIGNMENT

Pin	Assignment
1	Cathode
2	Gate
3	Anode

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

# NCR169D

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance – Junction to Case – Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	75 200	°C/W
Lead Solder Temperature ( < 1/16" from case, 10 secs max)	$T_L$	260	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit
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## OFF CHARACTERISTICS

Peak Repetitive Forward or Reverse Blocking Current (Note 1.) ( $V_D = \text{Rated } V_{DRM}$ and $V_{RRM}$ ; $R_{GK} = 1.0 \text{ k}\Omega$ )	$T_C = 25^\circ\text{C}$ $T_C = 110^\circ\text{C}$	$I_{DRM}, I_{RRM}$	– –	– –	10 0.1	$\mu\text{A}$ mA
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## ON CHARACTERISTICS

Peak Forward On-State Voltage(*) ( $I_{TM} = 1.0 \text{ Amp Peak @ } T_A = 25^\circ\text{C}$ )		$V_{TM}$	–	–	1.7	Volts
Gate Trigger Current (Continuous dc) (Note 2.) ( $V_{AK} = 12 \text{ V}$ , $R_L = 100 \text{ Ohms}$ )	$T_C = 25^\circ\text{C}$	$I_{GT}$	–	40	200	$\mu\text{A}$
Holding Current (Note 2.) ( $V_{AK} = 12 \text{ V}$ , $I_{GT} = 0.5 \text{ mA}$ )	$T_C = 25^\circ\text{C}$ $T_C = -40^\circ\text{C}$	$I_H$	– –	0.5 –	5.0 10	mA
Latch Current ( $V_{AK} = 12 \text{ V}$ , $I_{GT} = 0.5 \text{ mA}$ , $R_{GK} = 1.0 \text{ k}$ )	$T_C = 25^\circ\text{C}$ $T_C = -40^\circ\text{C}$	$I_L$	– –	0.6 –	10 15	mA
Gate Trigger Voltage (Continuous dc) (Note 2.) ( $V_{AK} = 12 \text{ V}$ , $R_L = 100 \text{ Ohms}$ , $I_{GT} = 10 \text{ mA}$ )	$T_C = 25^\circ\text{C}$ $T_C = -40^\circ\text{C}$	$V_{GT}$	– –	0.62 –	0.8 1.2	Volts

## DYNAMIC CHARACTERISTICS

Critical Rate of Rise of Off-State Voltage ( $V_D = \text{Rated } V_{DRM}$ , Exponential Waveform, $R_{GK} = 1000 \text{ Ohms}$ , $T_J = 110^\circ\text{C}$ )		dV/dt	20	35	–	V/ $\mu\text{s}$
Critical Rate of Rise of On-State Current ( $I_{PK} = 20 \text{ A}$ ; $P_w = 10 \mu\text{sec}$ ; $di/dt = 1.0 \text{ A}/\mu\text{sec}$ , $I_{gt} = 20 \text{ mA}$ )		di/dt	–	–	50	A/ $\mu\text{s}$

\*Indicates Pulse Test: Pulse Width  $\leq 1.0 \text{ ms}$ , Duty Cycle  $\leq 1\%$ .

1.  $R_{GK} = 1000 \text{ Ohms}$  included in measurement.
2. Does not include  $R_{GK}$  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

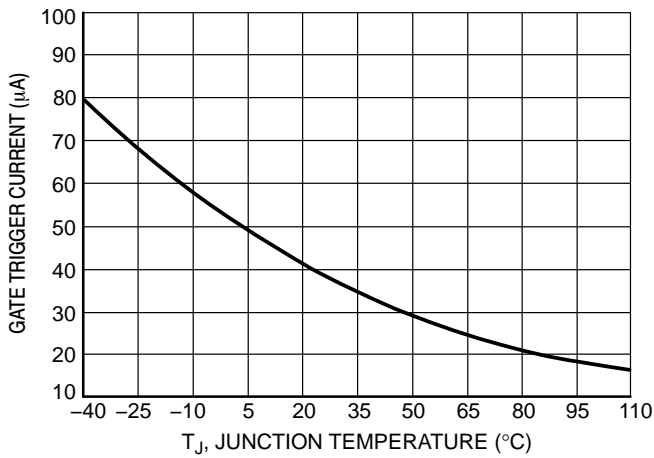
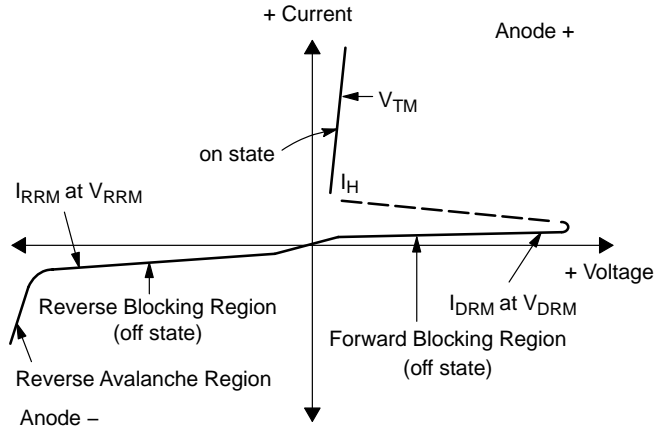


Figure 1. Typical Gate Trigger Current versus Junction Temperature

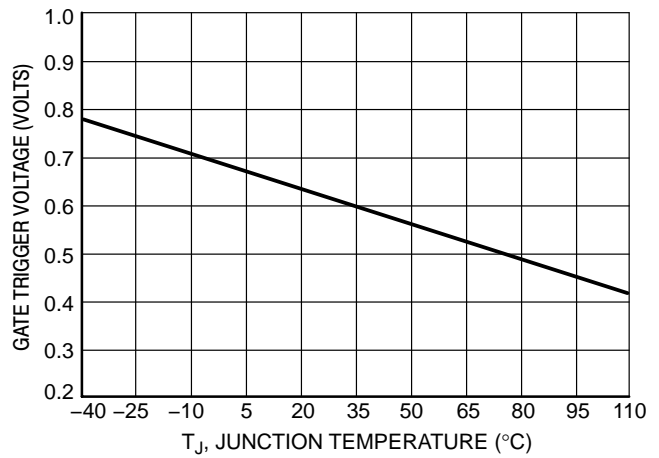
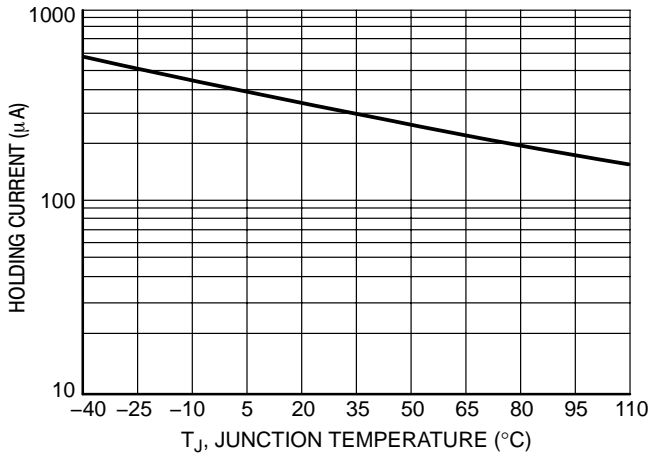
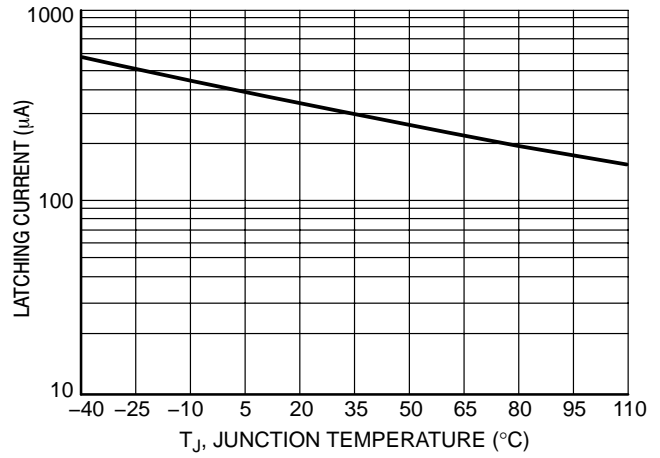


Figure 2. Typical Gate Trigger Voltage versus Junction Temperature

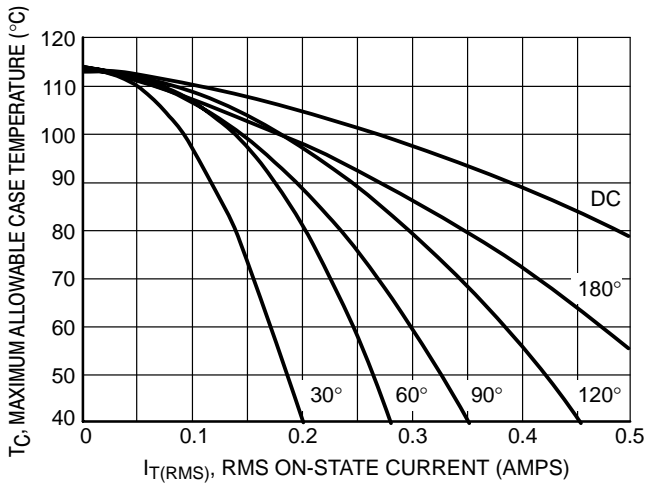
# NCR169D



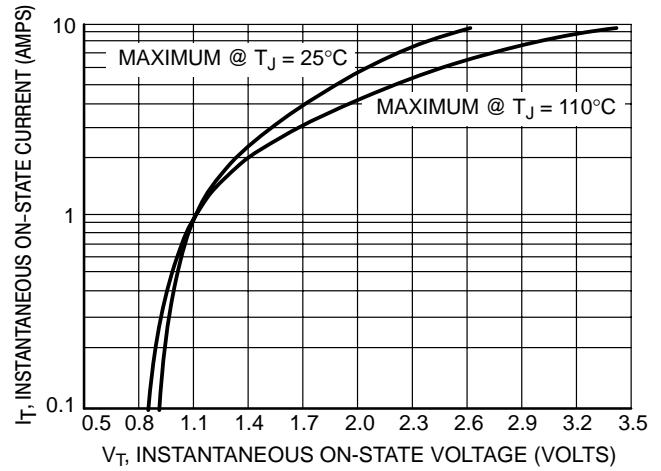
**Figure 3. Typical Holding Current versus Junction Temperature**



**Figure 4. Typical Latching Current versus Junction Temperature**



**Figure 5. Typical RMS Current Derating**



**Figure 6. Typical On-State Characteristics**

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

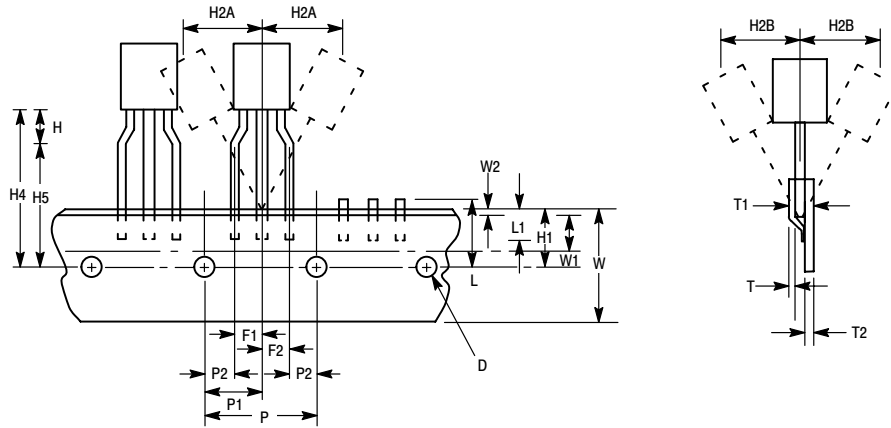


Figure 7. Device Positioning on Tape

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

# NCR169D

## ORDERING & SHIPPING INFORMATION: MCR100 Series packaging options, Device Suffix

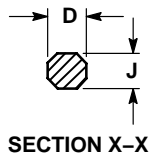
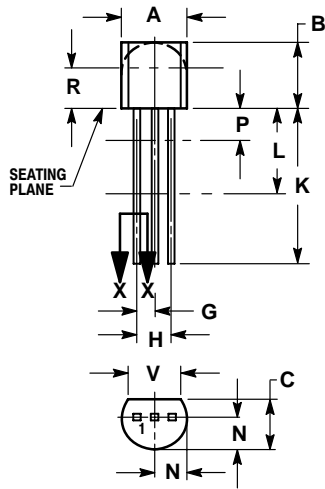
Device	Description of TO92 Tape Orientation	Shipping
NCR169D	N/A, Bulk	Bulk in Box (5K/Box)
NCR169DG	N/A, Bulk	Bulk in Box (5K/Box) (Pb-Free)
NCR169DRLRA	Round side of TO92 and adhesive tape visible	Radial Tape and Reel (2K/Reel)
NCR169DRLRAG	Round side of TO92 and adhesive tape visible	Radial Tape and Reel (2K/Reel) (Pb-Free)
NCR169DRLRM	Flat side of TO92 and adhesive tape visible	Radial Tape and Fan Fold Box (2K/Box)
NCR169DRLRMG	Flat side of TO92 and adhesive tape visible	Radial Tape and Fan Fold Box (2K/Box) (Pb-Free)
NCR169DRLRP	Flat side of TO92 and adhesive tape visible	Radial Tape and Fan Fold Box (2K/Box)
NCR169DRLRPG	Flat side of TO92 and adhesive tape visible	Radial Tape and Fan Fold Box (2K/Box) (Pb-Free)

†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.

# NCR169D

## PACKAGE DIMENSIONS

TO-92 (TO-226AA)  
CASE 029-11  
ISSUE AL



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	---

STYLE 10:

- PIN 1. CATHODE
2. GATE
3. ANODE

# NCR169D

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**NCR169D/D**