

# 2N5060 Series

Preferred Device

## Sensitive Gate Silicon Controlled Rectifiers

### Reverse Blocking Thyristors

Annular PNP devices designed for high volume consumer applications such as relay and lamp drivers, small motor controls, gate drivers for larger thyristors, and sensing and detection circuits. Supplied in an inexpensive plastic TO-92/TO-226AA package which is readily adaptable for use in automatic insertion equipment.

#### Features

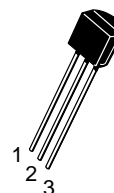
- Sensitive Gate Trigger Current – 200  $\mu$ A Maximum
- Low Reverse and Forward Blocking Current – 50  $\mu$ A Maximum,  $T_C = 110^\circ\text{C}$
- Low Holding Current – 5 mA Maximum
- Passivated Surface for Reliability and Uniformity
- Device Marking: Device Type, e.g., 2N5060, Date Code
- Pb-Free Packages are Available\*



ON Semiconductor®

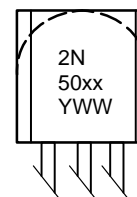
<http://onsemi.com>

### SILICON CONTROLLED RECTIFIERS 0.8 A RMS, 30 – 200 V



TO-92  
CASE 29  
STYLE 10

#### MARKING DIAGRAM



50xx    Specific Device Code  
Y        = Year  
WW     = Work Week

#### 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.

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

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

## 2N5060 Series

### 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) 2N5060 2N5061 2N5062 2N5064	$V_{\text{DRM}}$ , $V_{\text{RRM}}$	30 60 100 200	V
On-State Current RMS ( $180^\circ$ Conduction Angles; $T_C = 80^\circ\text{C}$ )	$I_{\text{T(RMS)}}$	0.8	A
*Average On-State Current ( $180^\circ$ Conduction Angles) ( $T_C = 67^\circ\text{C}$ ) ( $T_C = 102^\circ\text{C}$ )	$I_{\text{T(AV)}}$	0.51 0.255	A
*Peak Non-repetitive Surge Current, $T_A = 25^\circ\text{C}$ (1/2 cycle, Sine Wave, 60 Hz)	$I_{\text{TSM}}$	10	A
Circuit Fusing Considerations ( $t = 8.3$ ms)	$I^2t$	0.4	$\text{A}^2\text{s}$
*Average On-State Current ( $180^\circ$ Conduction Angles) ( $T_C = 67^\circ\text{C}$ ) ( $T_C = 102^\circ\text{C}$ )	$I_{\text{T(AV)}}$	0.51 0.255	A
*Forward Peak Gate Power (Pulse Width $\leq 1.0$ $\mu\text{sec}$ ; $T_A = 25^\circ\text{C}$ )	$P_{\text{GM}}$	0.1	W
*Forward Average Gate Power ( $T_A = 25^\circ\text{C}$ , $t = 8.3$ ms)	$P_{\text{G(AV)}}$	0.01	W
*Forward Peak Gate Current (Pulse Width $\leq 1.0$ $\mu\text{sec}$ ; $T_A = 25^\circ\text{C}$ )	$I_{\text{GM}}$	1.0	A
*Reverse Peak Gate Voltage (Pulse Width $\leq 1.0$ $\mu\text{sec}$ ; $T_A = 25^\circ\text{C}$ )	$V_{\text{RGM}}$	5.0	V
*Operating Junction Temperature Range	$T_J$	$-40$ to $+110$	$^\circ\text{C}$
*Storage Temperature Range	$T_{\text{stg}}$	$-40$ 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.  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  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.

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
*Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta\text{JC}}$	75	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta\text{JA}}$	200	$^\circ\text{C/W}$
*Lead Solder Temperature (Lead Length $\geq 1/16"$ from case, 10 s Max)	–	+230*	$^\circ\text{C}$

2. This measurement is made with the case mounted "flat side down" on a heatsink and held in position by means of a metal clamp over the curved surface.

\*Indicates JEDEC Registered Data.

## 2N5060 Series

### 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 3) ( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}$ )	$I_{DRM}, I_{RRM}$	–	–	10	$\mu\text{A}$
$T_C = 25^\circ\text{C}$		–	–	50	$\mu\text{A}$
$T_C = 110^\circ\text{C}$		–	–		

#### ON CHARACTERISTICS

*Peak Forward On-State Voltage (Note 4) ( $I_{TM} = 1.2 \text{ A peak @ } T_A = 25^\circ\text{C}$ )	$V_{TM}$	–	–	1.7	V
Gate Trigger Current (Continuous DC) (Note 5) *( $V_{AK} = 7.0 \text{ Vdc}, R_L = 100 \Omega$ )	$I_{GT}$	–	–	200	$\mu\text{A}$
$T_C = 25^\circ\text{C}$		–	–	350	
$T_C = -40^\circ\text{C}$		–	–		
Gate Trigger Voltage (Continuous DC) (Note 5) *( $V_{AK} = 7.0 \text{ Vdc}, R_L = 100 \Omega$ )	$V_{GT}$	–	–	0.8	V
$T_C = 25^\circ\text{C}$		–	–	1.2	
$T_C = -40^\circ\text{C}$		–	–		
*Gate Non-Trigger Voltage ( $V_{AK} = \text{Rated } V_{DRM}, R_L = 100 \Omega$ ) $T_C = 110^\circ\text{C}$	$V_{GD}$	0.1	–	–	V
Holding Current (Note 5) *( $V_{AK} = 7.0 \text{ Vdc}$ , initiating current = 20 mA)	$I_H$	–	–	5.0	mA
$T_C = 25^\circ\text{C}$		–	–	10	
$T_C = -40^\circ\text{C}$		–	–		
Turn-On Time Delay Time Rise Time ( $I_{GT} = 1.0 \text{ mA}, V_D = \text{Rated } V_{DRM}$ , Forward Current = 1.0 A, $di/dt = 6.0 \text{ A}/\mu\text{s}$ )	$t_d$ $t_r$	–	3.0 0.2	–	$\mu\text{s}$
Turn-Off Time (Forward Current = 1.0 A pulse, Pulse Width = 50 $\mu\text{s}$ , 0.1% Duty Cycle, $di/dt = 6.0 \text{ A}/\mu\text{s}$ , $dv/dt = 20 \text{ V}/\mu\text{s}, I_{GT} = 1 \text{ mA}$ )	$t_q$	–	–	–	$\mu\text{s}$
2N5060, 2N5061		–	10	–	
2N5062, 2N5064		–	30	–	

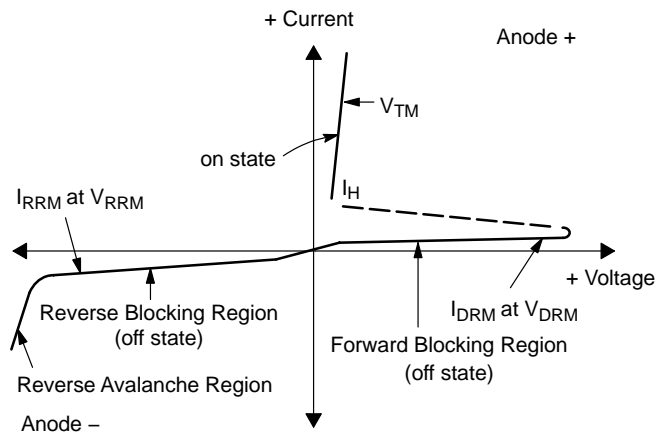
#### DYNAMIC CHARACTERISTICS

Critical Rate of Rise of Off-State Voltage (Rated $V_{DRM}$ , Exponential)	$dv/dt$	–	30	–	$\text{V}/\mu\text{s}$
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- $R_{GK} = 1000 \Omega$  is included in measurement.
  - Forward current applied for 1 ms maximum duration, duty cycle  $\leq 1\%$ .
  - $R_{GK}$  current is not included in measurement.
- \*Indicates JEDEC Registered Data.

### 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



# 2N5060 Series

## CURRENT DERATING

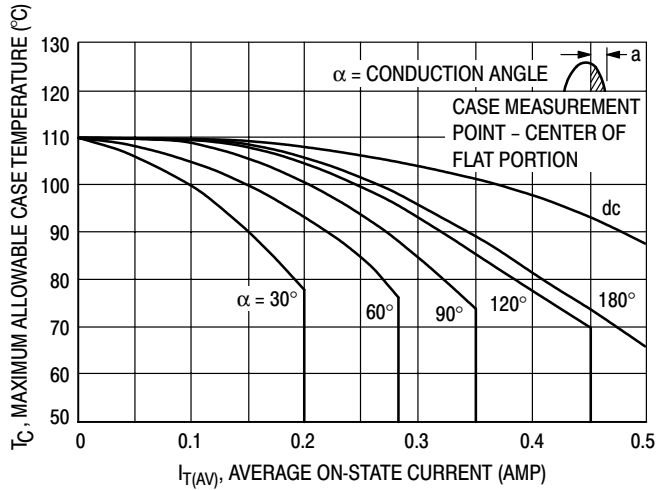


Figure 1. Maximum Case Temperature

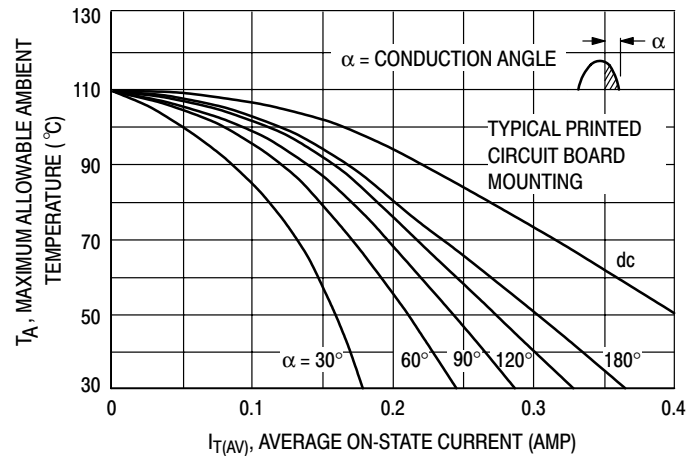


Figure 2. Maximum Ambient Temperature

## CURRENT DERATING

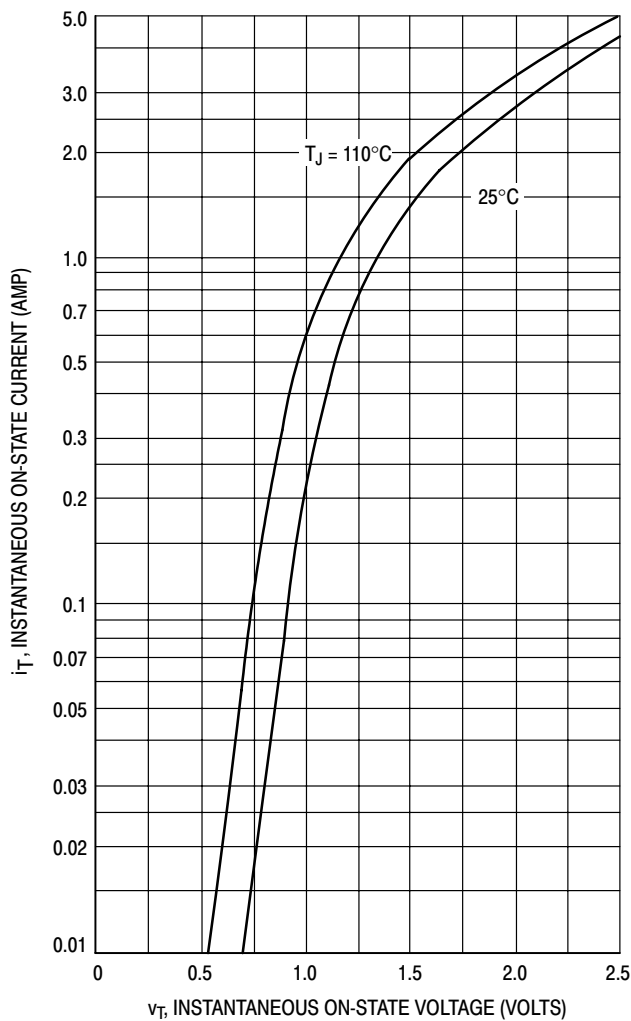


Figure 3. Typical Forward Voltage

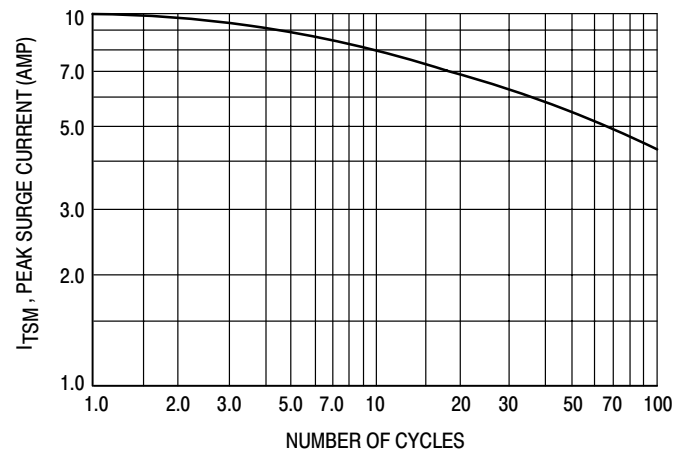


Figure 4. Maximum Non-Repetitive Surge Current

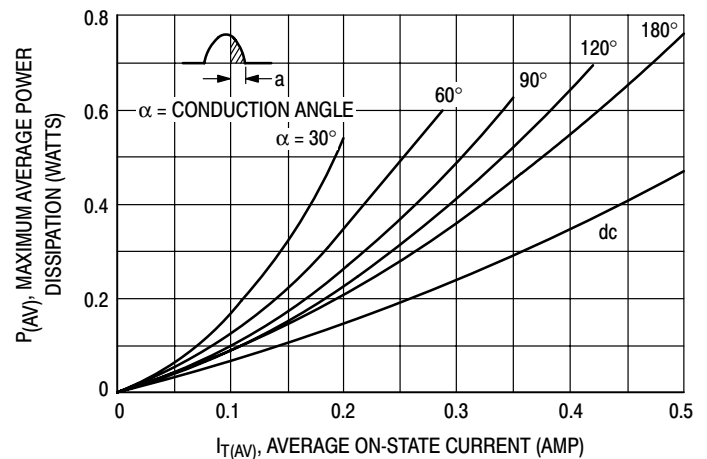


Figure 5. Power Dissipation

## 2N5060 Series

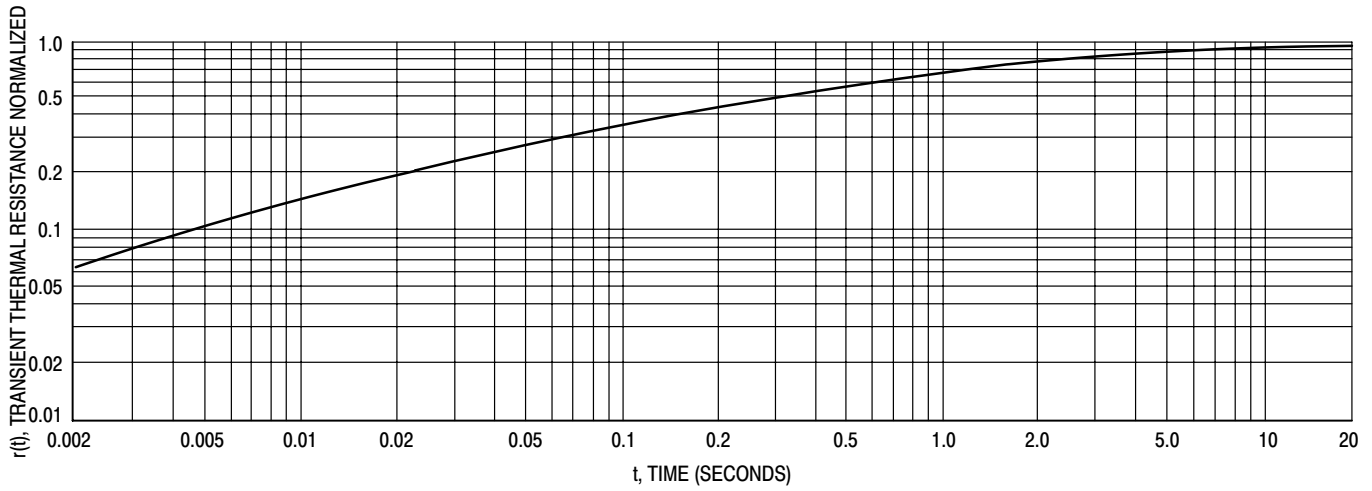


Figure 6. Thermal Response

### TYPICAL CHARACTERISTICS

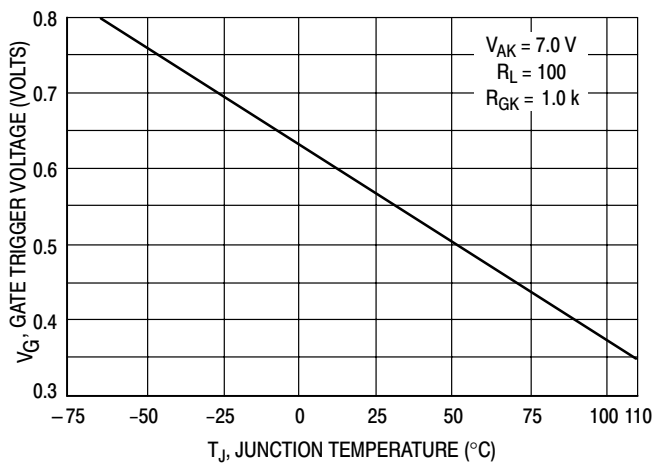


Figure 7. Typical Gate Trigger Voltage

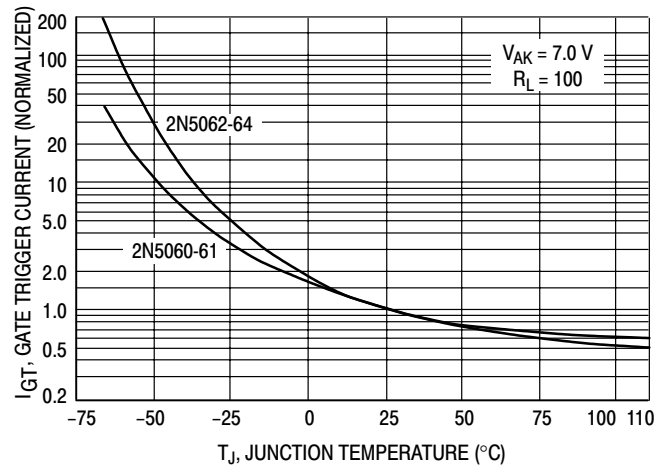


Figure 8. Typical Gate Trigger Current

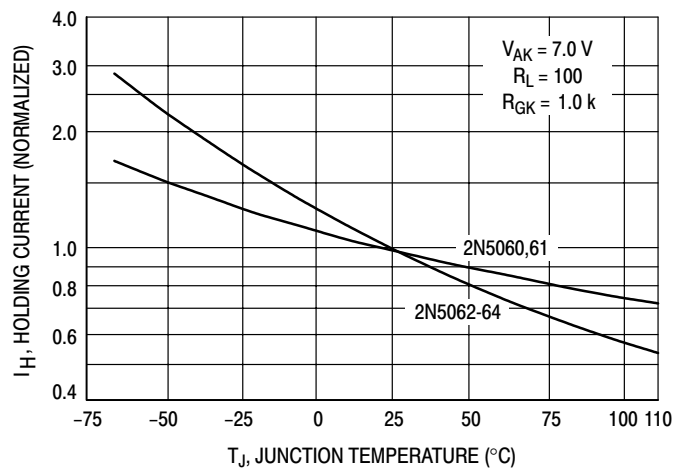


Figure 9. Typical Holding Current

## 2N5060 Series

### ORDERING INFORMATION

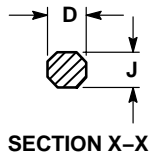
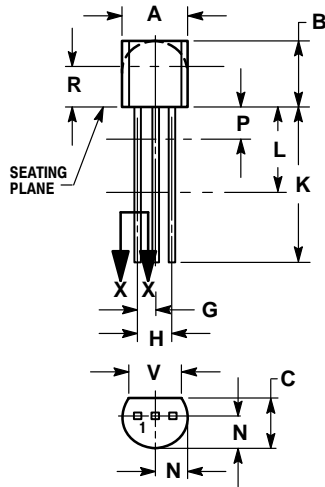
Device	Package	Shipping <sup>†</sup>
2N5060	TO-92	5,000 Units / Box
2N5060RLRA	TO-92	2,000 / Tape & Reel
2N5060RLRAG	TO-92 (Pb-Free)	2,000 / Tape & Reel
2N5060RLRM	TO-92	2,000 / Ammo Pack
2N5061	TO-92	5,000 Units / Box
2N5061G	TO-92 (Pb-Free)	5,000 Units / Box
2N5061RLRA	TO-92	2,000 / Tape & Reel
2N5061RLRAG	TO-92 (Pb-Free)	2,000 / Tape & Reel
2N5061RLRM	TO-92	2,000 / Ammo Pack
2N5062	TO-92	5,000 Units / Box
2N5062G	TO-92 (Pb-Free)	5,000 Units / Box
2N5062RLRA	TO-92	2,000 / Tape & Reel
2N5062RLRAG	TO-92 (Pb-Free)	2,000 / Tape & Reel
2N5064	TO-92	5,000 Units / Box
2N5064RLRA	TO-92	2,000 / Tape & Reel
2N5064RLRM	TO-92	2,000 / Ammo Pack
2N5064RLRMG	TO-92 (Pb-Free)	2,000 / Ammo Pack
2N5060RL1	TO-92	2,000 / Tape & Reel

<sup>†</sup>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.

# 2N5060 Series

## PACKAGE DIMENSIONS

TO-92  
TO-226AA  
CASE 29-11  
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
E	0.045	0.055	1.15	1.39
F	0.095	0.105	2.42	2.66
G	0.015	0.020	0.39	0.50
H	0.500	---	12.70	---
I	0.250	---	6.35	---
J	0.080	0.105	2.04	2.66
K	---	0.100	---	2.54
L	0.115	---	2.93	---
M	0.135	---	3.43	---

### STYLE 10:

1. CATHODE
2. GATE
3. ANODE

## 2N5060 Series

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