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[2N6027RLRA](#)

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## 2N6027, 2N6028

Preferred Device

# Programmable Unijunction Transistor

## Programmable Unijunction Transistor Triggers

Designed to enable the engineer to “program” unijunction characteristics such as  $R_{BB}$ ,  $\eta$ ,  $I_V$ , and  $I_P$  by merely selecting two resistor values. Application includes thyristor-trigger, oscillator, pulse and timing circuits. These devices may also be used in special thyristor applications due to the availability of an anode gate. Supplied in an inexpensive TO-92 plastic package for high-volume requirements, this package is readily adaptable for use in automatic insertion equipment.

### Features

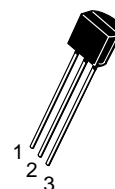
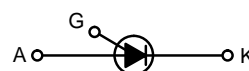
- Programmable –  $R_{BB}$ ,  $\eta$ ,  $I_V$  and  $I_P$
- Low On-State Voltage – 1.5 V Maximum @  $I_F = 50$  mA
- Low Gate to Anode Leakage Current – 10 nA Maximum
- High Peak Output Voltage – 11 V Typical
- Low Offset Voltage – 0.35 V Typical ( $R_G = 10$  k $\Omega$ )
- Pb-Free Packages are Available\*



**ON Semiconductor®**

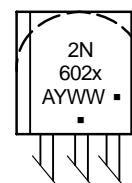
<http://onsemi.com>

**PUTs**  
**40 VOLTS, 300 mW**



**TO-92 (TO-226AA)**  
**CASE 029**  
**STYLE 16**

### MARKING DIAGRAM



2N602x = Device Code  
x = 7 or 8  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN ASSIGNMENT

	PIN ASSIGNMENT
1	Anode
2	Gate
3	Cathode

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 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.

## 2N6027, 2N6028

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

Rating	Symbol	Value	Unit
Power Dissipation* Derate Above $25^\circ\text{C}$	$P_F$ $1/\theta_{JA}$	300 4.0	mW mW/ $^\circ\text{C}$
DC Forward Anode Current* Derate Above $25^\circ\text{C}$	$I_T$	150 2.67	mA mA/ $^\circ\text{C}$
DC Gate Current*	$I_G$	$\pm 50$	mA
Repetitive Peak Forward Current 100 $\mu\text{s}$ Pulse Width, 1% Duty Cycle 20 $\mu\text{s}$ Pulse Width, 1% Duty Cycle*	$I_{TRM}$	1.0 2.0	A
Non-Repetitive Peak Forward Current 10 $\mu\text{s}$ Pulse Width	$I_{TSM}$	5.0	A
Gate to Cathode Forward Voltage*	$V_{GKF}$	40	V
Gate to Cathode Reverse Voltage*	$V_{GKR}$	-5.0	V
Gate to Anode Reverse Voltage*	$V_{GAR}$	40	V
Anode to Cathode Voltage* (Note 1)	$V_{AK}$	$\pm 40$	V
Capacitive Discharge Energy (Note 2)	E	250	$\mu\text{J}$
Power Dissipation (Note 3)	$P_D$	300	mW
Operating Temperature	$T_{OPR}$	-50 to +100	$^\circ\text{C}$
Junction Temperature	$T_J$	-50 to +125	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$

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.

\*Indicates JEDEC Registered Data

1. Anode positive,  $R_{GA} = 1000\ \Omega$   
Anode negative,  $R_{GA} = \text{open}$
2.  $E = 0.5 \bullet CV^2$  capacitor discharge energy limiting resistor and repetition.
3. Derate current and power above  $25^\circ\text{C}$ .

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	75	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	200	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes ( $< 1/16''$ from case, 10 seconds maximum)	$T_L$	260	$^\circ\text{C}$

## 2N6027, 2N6028

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Fig. No.	Symbol	Min	Typ	Max	Unit
Peak Current* (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 1 MΩ) (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 10 kΩ)	2,9,11	I <sub>P</sub>	— — — —	1.25 0.08 4.0 0.70	2.0 0.15 5.0 1.0	μA
Offset Voltage* (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 1 MΩ) (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 10 kΩ)	1	V <sub>T</sub>	0.2 0.2 0.2	0.70 0.50 0.35	1.6 0.6 0.6	V
Valley Current* (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 1 MΩ) (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 10 kΩ) (V <sub>S</sub> = 10 Vdc, R <sub>G</sub> = 200 Ω)	1,4,5	I <sub>V</sub>	— — 70 25 1.5 1.0	18 18 150 150 — —	50 25 — — — —	μA     mA
Gate to Anode Leakage Current* (V <sub>S</sub> = 40 Vdc, T <sub>A</sub> = 25°C, Cathode Open) (V <sub>S</sub> = 40 Vdc, T <sub>A</sub> = 75°C, Cathode Open)	—	I <sub>GAO</sub>	— —	1.0 3.0	10 —	nA <sub>dc</sub>
Gate to Cathode Leakage Current (V <sub>S</sub> = 40 Vdc, Anode to Cathode Shorted)	—	I <sub>GKS</sub>	—	5.0	50	nA <sub>dc</sub>
Forward Voltage* (I <sub>F</sub> = 50 mA Peak) (Note 4)	1,6	V <sub>F</sub>	—	0.8	1.5	V
Peak Output Voltage* (V <sub>G</sub> = 20 Vdc, C <sub>C</sub> = 0.2 μF)	3,7	V <sub>O</sub>	6.0	11	—	V
Pulse Voltage Rise Time (V <sub>B</sub> = 20 Vdc, C <sub>C</sub> = 0.2 μF)	3	t <sub>r</sub>	—	40	80	ns

\*Indicates JEDEC Registered Data

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

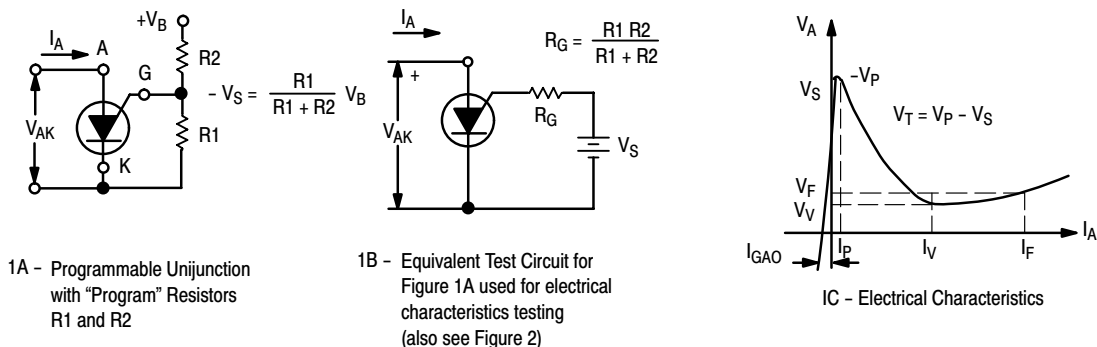


Figure 1. Electrical Characterization

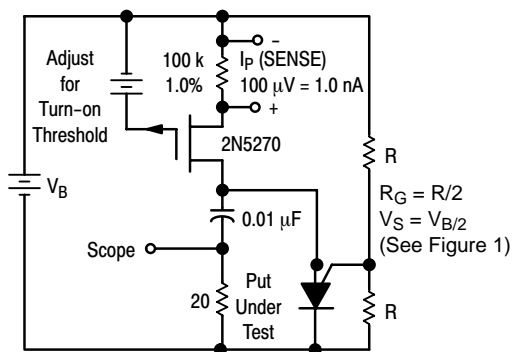


Figure 2. Peak Current (I<sub>P</sub>) Test Circuit

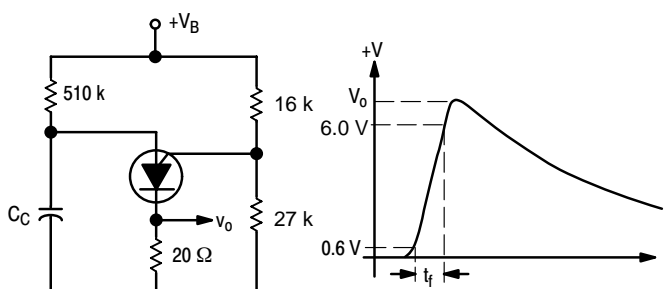


Figure 3. V<sub>O</sub> and t<sub>r</sub> Test Circuit

## 2N6027, 2N6028

### TYPICAL VALLEY CURRENT BEHAVIOR

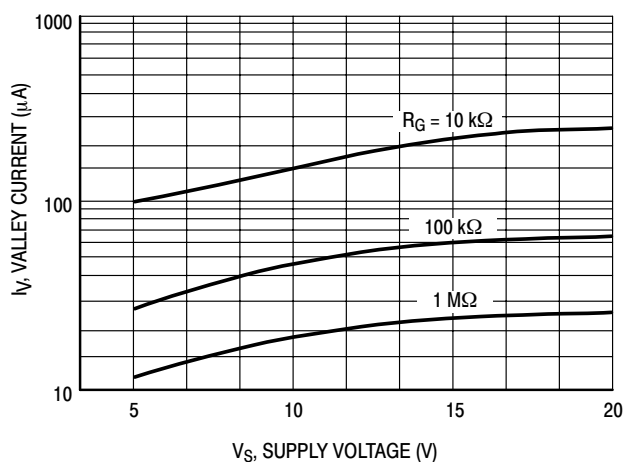


Figure 4. Effect of Supply Voltage

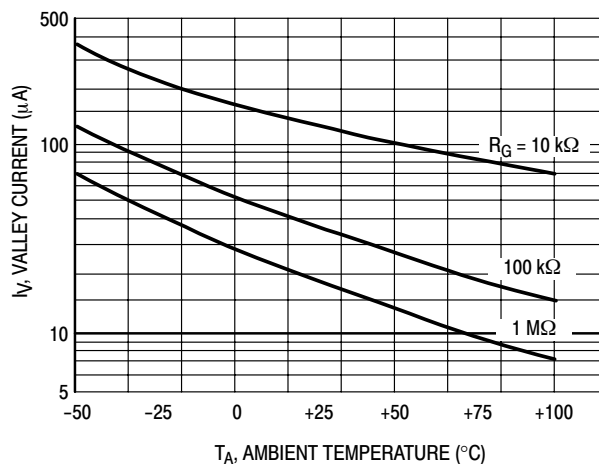


Figure 5. Effect of Temperature

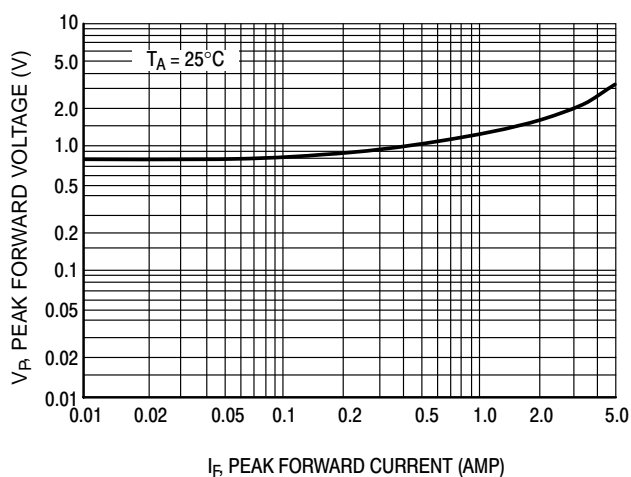


Figure 6. Forward Voltage

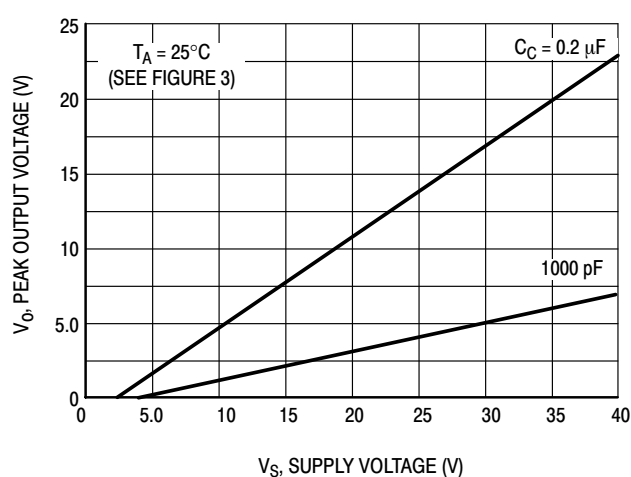
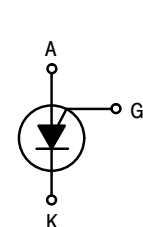
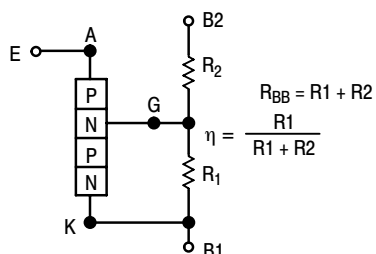


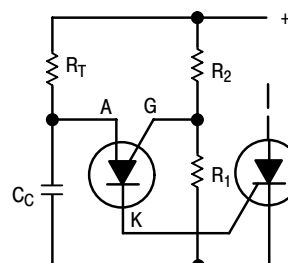
Figure 7. Peak Output Voltage



Circuit Symbol



Equivalent Circuit  
with External "Program"  
Resistors R1 and R2



Typical Application

Figure 8. Programmable Unijunction

## 2N6027, 2N6028

### TYPICAL PEAK CURRENT BEHAVIOR

#### 2N6027

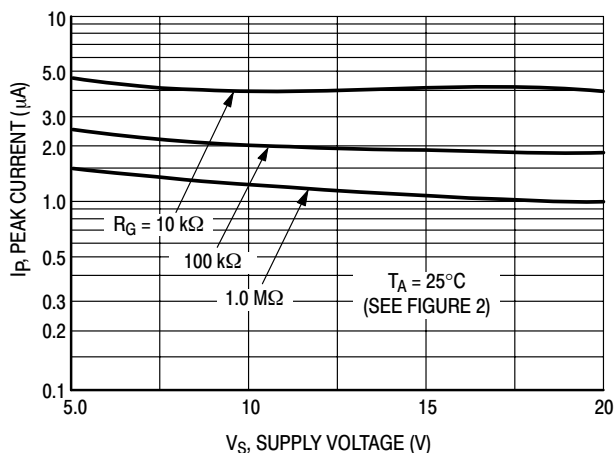


Figure 9. Effect of Supply Voltage and  $R_G$

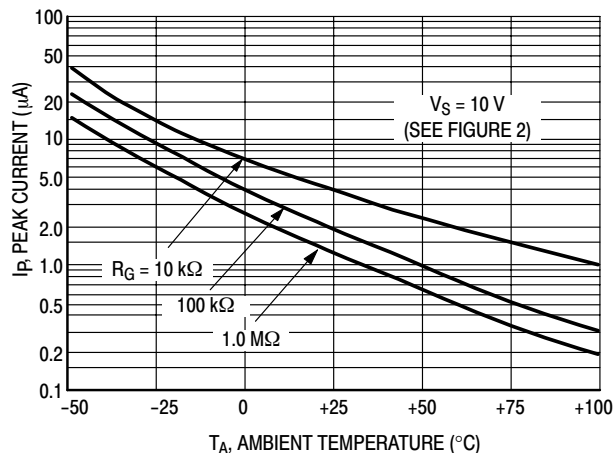


Figure 10. Effect of Temperature and  $R_G$

#### 2N6028

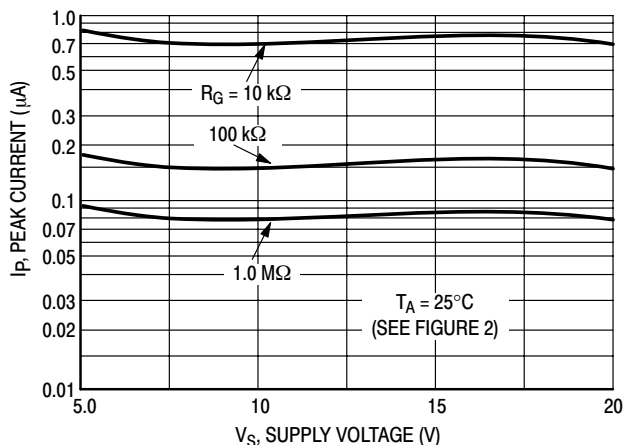


Figure 11. Effect of Supply Voltage and  $R_G$

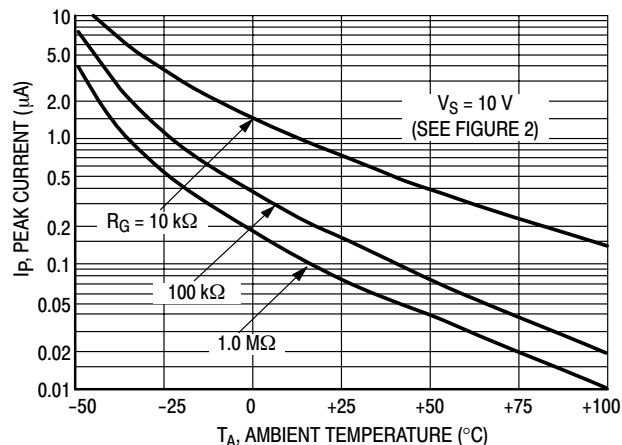


Figure 12. Effect of Temperature and  $R_G$

### ORDERING INFORMATION

U.S.	European Equivalent	Shipping <sup>†</sup>	Description of TO-92 Tape Orientation
2N6027	2N6027RL1 2N6027RL1G	5000 Units / Box	N/A – Bulk
2N6027G			
2N6028			
2N6028G			
2N6027RLRA		2000 / Tape & Reel	Round side of TO-92 and adhesive tape visible
2N6027RLRAG			
2N6028RLRA			
2N6028RLRAG			
2N6028RLRM		2000 / Tape & Ammo Box	Flat side of TO-92 and adhesive tape visible
2N6028RLRMG			
2N6028RLRP			Round side of TO-92 and adhesive tape visible
2N6028RLRPG			

<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.

\*The "G" suffix indicates Pb-Free package available.

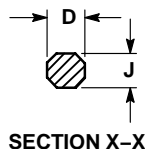
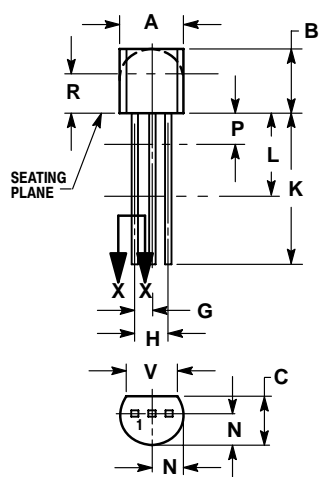
## 2N6027, 2N6028

### 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 16:

1. ANODE
2. GATE
3. CATHODE

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