2N6027, 2N6028

Preferred Device

Programmable Unijunction Transistor

Programmable Unijunction Transistor Triggers

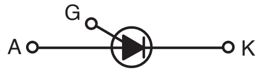
Designed to enable the engineer to “program’’ unijunction characteristics such as R_{BB}, η, I_V, and I_P by merely selecting two resistor values. Application includes thyristor−trigger, oscillator, pulse and timing circuits. These devices may also be used in special thyristor applications due to the 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.

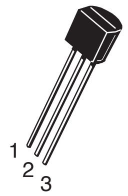
- Programmable − R_{BB}, η, I_V and I_P
- Low On−State Voltage − 1.5 V Maximum @ $I_F = 50$ mA
- Low Gate to Anode Leakage Current − 10 nA Maximum
- High Peak Output Voltage − 11 V Typical
- Low Offset Voltage − 0.35 V Typical ($R_G = 10$ kΩ)
- Device Marking: Device Type, e.g., 2N6027, Date Code

ON Semiconductor®

http://onsemi.com

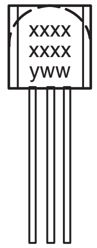
PUTs
40 V
300 mW





TO−92 (TO−226AA)
CASE 029
STYLE 16

MARKING DIAGRAM



xxxx = Specific Device Code
Y = Year
WW = Work Week

PIN ASSIGNMENT	
1	Anode
2	Gate
3	Cathode

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 32 of this data sheet.

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

June, 2004 − Rev. 4

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Dissipation* Derate Above 25°C	P_F $1/\theta_{JA}$	300 4.0	mW mW/°C
DC Forward Anode Current* Derate Above 25°C	I_T	150 2.67	mA mA/°C
DC Gate Current*	I_G	± 50	mA
Repetitive Peak Forward Current 100 μs Pulse Width, 1% Duty Cycle 20 μs Pulse Width, 1% Duty Cycle*	I_{TRM}	 1.0 2.0	A
Non−Repetitive Peak Forward Current 10 μs 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}	±40	V
Capacitive Discharge Energy (Note 2)	E	250	μJ
Power Dissipation (Note 3)	P_D	300	mW
Operating Temperature	T_{OPR}	–50 to +100	°C
Junction Temperature	T_J	–50 to +125	°C
Storage Temperature Range	T_{stg}	–55 to +150	°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.

*Indicates JEDEC Registered Data

1. Anode positive, R_{GA} = 1000 Ω
   Anode negative, R_{GA} = open
2. E = 0.5 • CV^2 capacitor discharge energy limiting resistor and repetition.
3. Derate current and power above 25°C.

THERMAL CHARACTERISTICS

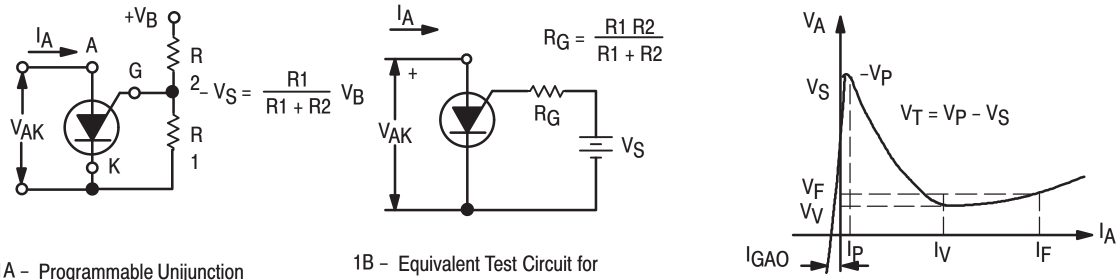
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	75	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	200	°C/W
Maximum Lead Temperature for Soldering Purposes (< 1/16″ from case, 10 seconds maximum)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Fig. No.	Symbol	Min	Typ	Max	Unit
Peak Current*		2,9,11	I_P				μA
(V_S = 10 Vdc, R_G = 1 MΩ)	2N6027			–	1.25	2.0	
	2N6028			–	0.08	0.15	
(V_S = 10 Vdc, R_G = 10 kΩ)	2N6027			–	4.0	5.0	
	2N6028			–	0.70	1.0	
Offset Voltage*		1	V_T				V
(V_S = 10 Vdc, R_G = 1 MΩ)	2N6027			0.2	0.70	1.6	
	2N6028			0.2	0.50	0.6	
(V_S = 10 Vdc, R_G = 10 kΩ)	(Both Types)			0.2	0.35	0.6	
Valley Current*		1,4,5	I_V				μA
(V_S = 10 Vdc, R_G = 1 MΩ)	2N6027			–	18	50	
	2N6028			–	18	25	
(V_S = 10 Vdc, R_G = 10 k Ω)	2N6027			70	150	–	
	2N6028			25	150	–	
(V_S = 10 Vdc, R_G = 200 Ω)	2N6027			1.5	–	–	
	2N6028			1.0	–	–	mA
Gate to Anode Leakage Current*		–	I_{GAO}				nAdc
(V_S = 40 Vdc, T_A = 25°C, Cathode Open)				–	1.0	10	
(V_S = 40 Vdc, T_A = 75°C, Cathode Open)				–	3.0	–	
Gate to Cathode Leakage Current (V_S = 40 Vdc, Anode to Cathode Shorted)		–	I_{GKS}	–	5.0	50	nAdc
Forward Voltage* (I_F = 50 mA Peak) (Note 4)		1,6	V_F	–	0.8	1.5	V
Peak Output Voltage* (V_G = 20 Vdc, C_C = 0.2 μF)		3,7	V_o	6.0	11	–	V
Pulse Voltage Rise Time (V_B = 20 Vdc, C_C = 0.2 μF)		3	t_r	–	40	80	ns

*Indicates JEDEC Registered Data

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



1A – Programmable Unijunction with "Program" Resistors R1 and R2

1B – Equivalent Test Circuit for Figure 1A used for electrical characteristics testing (also see Figure 2)

IC – Electrical Characteristics

Figure 1. Electrical Characterization

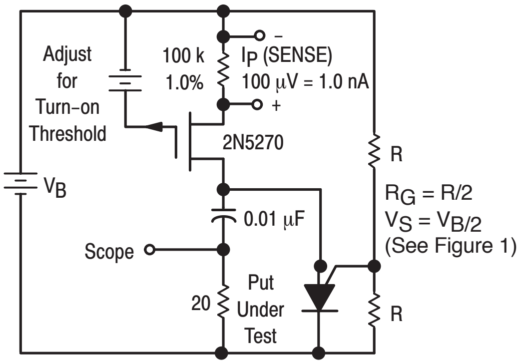


Figure 2. Peak Current (I_P) Test Circuit

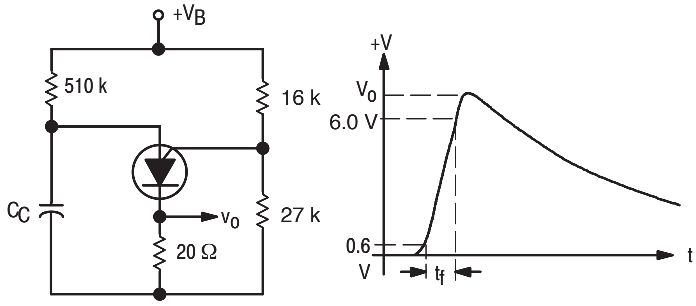


Figure 3. V_O and t_r Test Circuit

TYPICAL VALLEY CURRENT BEHAVIOR

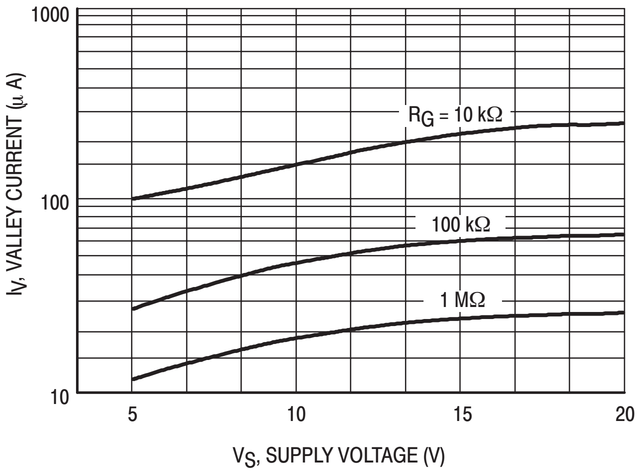


Figure 4. Effect of Supply Voltage

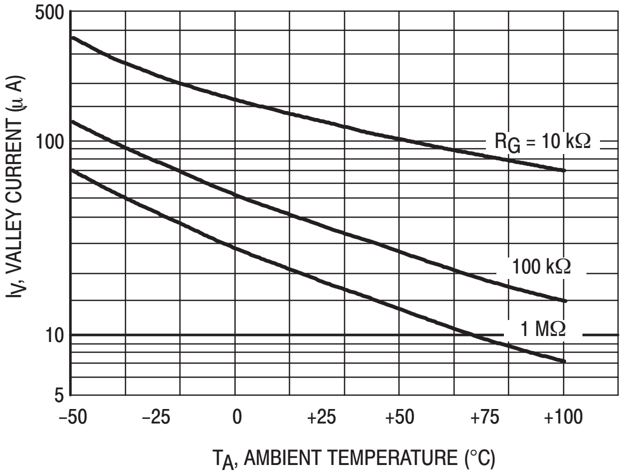


Figure 5. Effect of Temperature

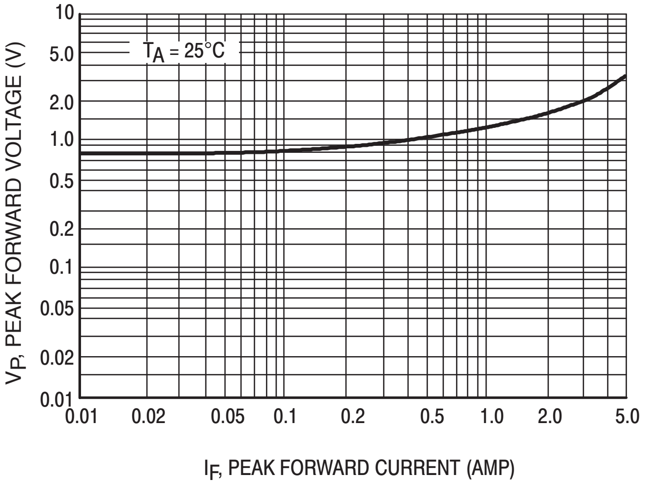


Figure 6. Forward Voltage

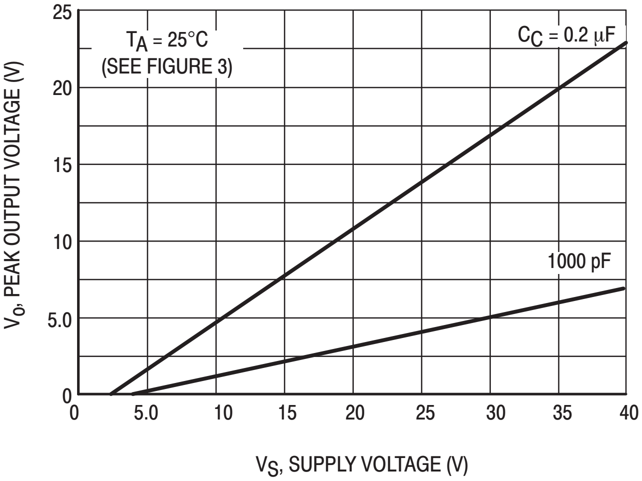
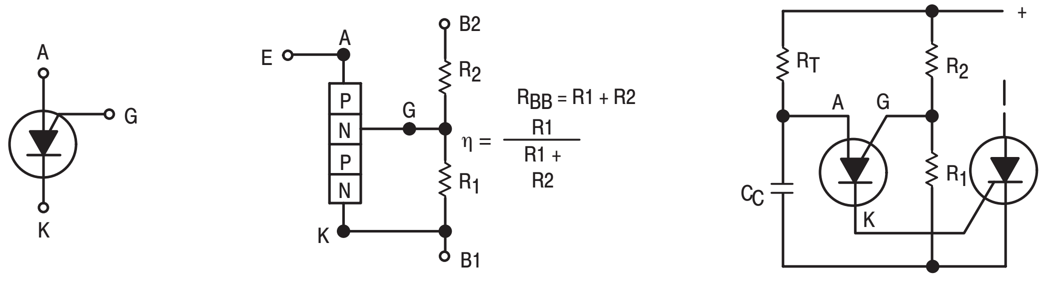


Figure 7. Peak Output Voltage



Circuit Symbol

Equivalent Circuit with External "Program" Resistors R1 and R2

Typical Application

Figure 8. Programmable Unijunction

TYPICAL PEAK CURRENT BEHAVIOR

2N6027

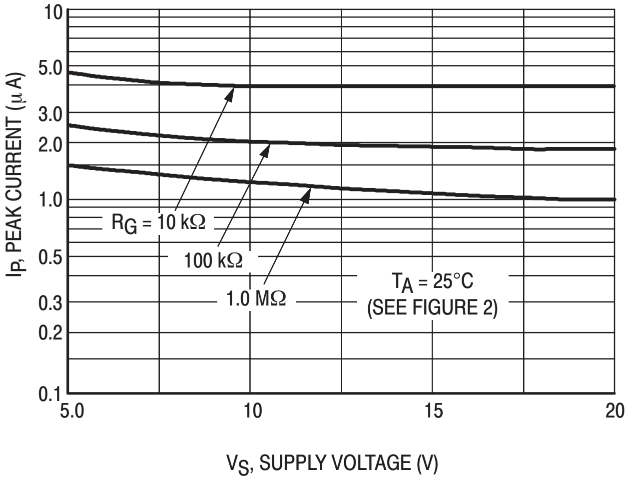


Figure 9. Effect of Supply Voltage and R_G

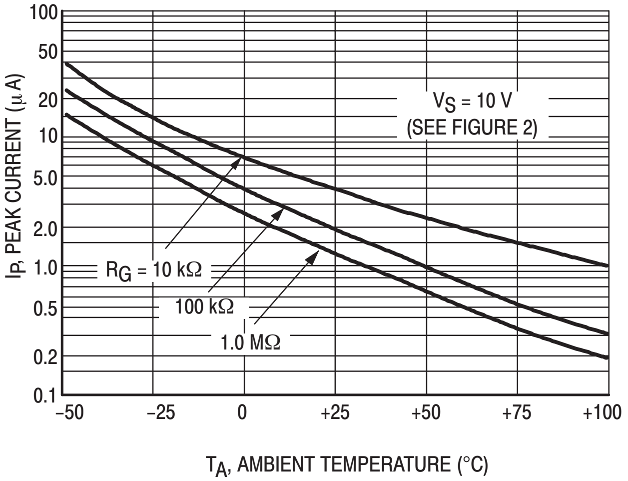


Figure 10. Effect of Temperature and R_G

2N6028

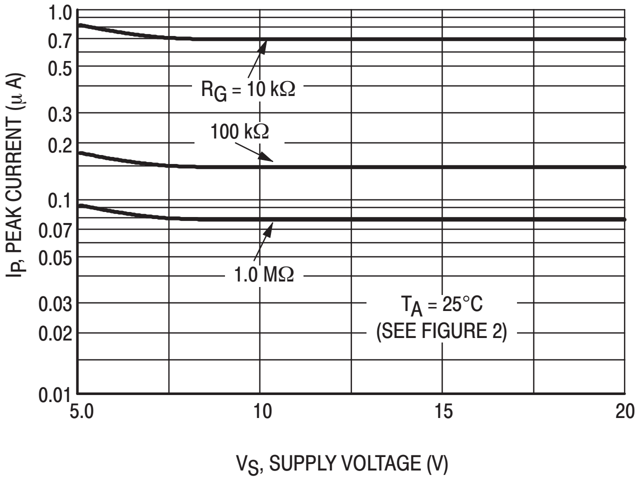


Figure 11. Effect of Supply Voltage and R_G

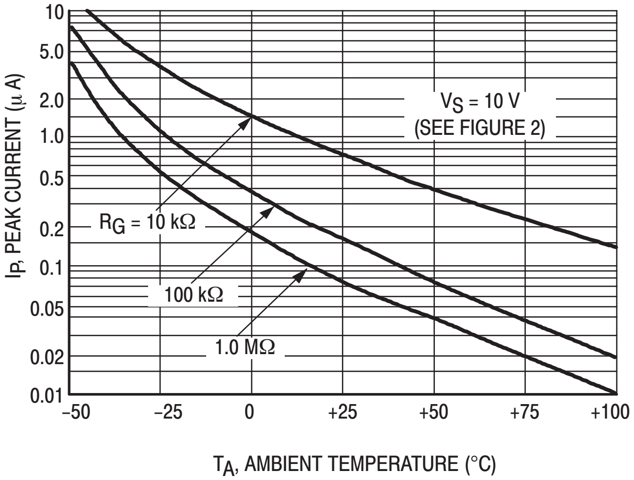


Figure 12. Effect of Temperature and R_G

ORDERING INFORMATION

U.S.	Europe Equivalent	Shipping†	Description of TO–92 Tape Orientation
2N6027, 2N6028		5000 Bulk / Box	N/A, Bulk
2N6027, 2N6028RLRA		2000 / Tape and Reel	Round side of TO–92 and adhesive tape visible
	2N6027RL1	2000 / Tape and Reel	Flat side of TO–92 and adhesive tape visible
2N6028RLRM		2000 / Tape and Ammunition	Flat side of TO–92 and adhesive tape visible
2N6028RLRP		2000 / Tape and Ammunition	Round side of TO–92 and adhesive tape visible

†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.