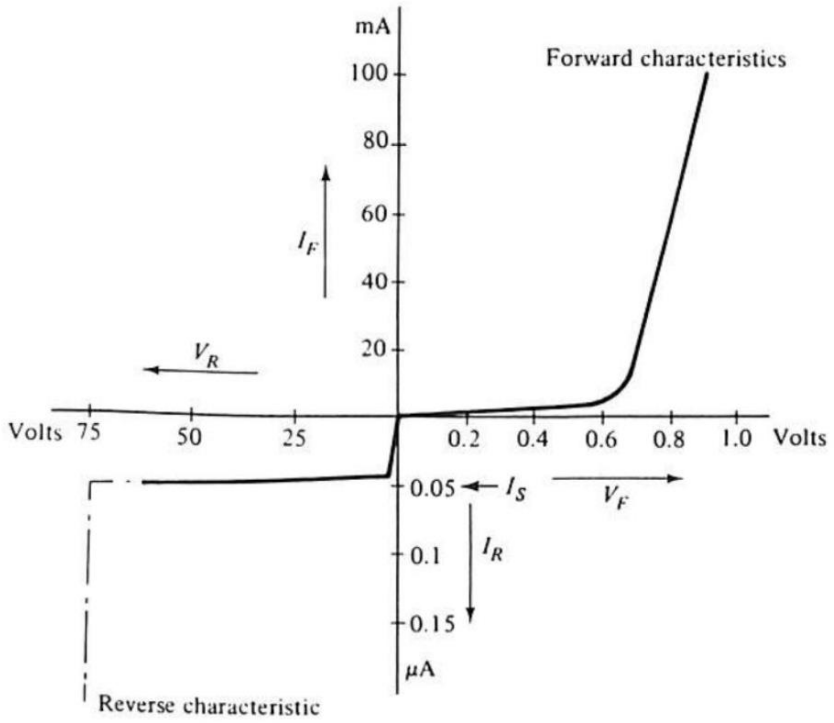
Diode Typical Characteristics:

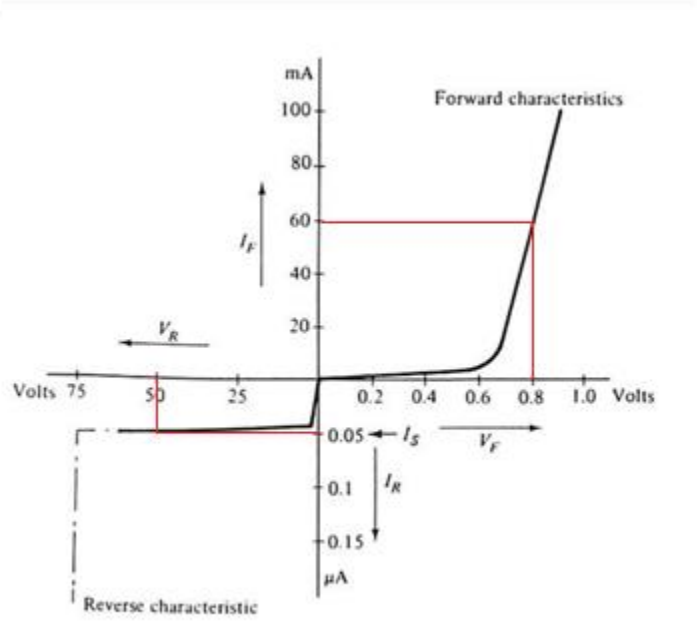
- Forward bias voltage (V_F) = 0.7V (silicon) 0.3V(germanium)
- Forward current (I_F) $\approx 10mA\ up\ to\ Max\ forward\ current$
- Diode power (P_D) = $I_F\ x\ V_F$
- Max forward current ($I_{F(Max)}$) $= \frac{P_{D(Max)}}{V_F}$
- Reverse voltage (V_R) $\approx 0 - 75V$
- Reverse current (I_R) "The reverse current I_R is at first equal to I_F; then it falls off to the reverse leakage current level," (Bell p.79)
- Reverse leakage current (I_S) $\approx 0.05\mu A$
- Reverse breakdown voltage ($V_{R(Max)}$) $\approx 75V$
- Reverse recovery time (t_{rr}) $\approx 4nS\ to\ 50nS$

"The reverse recovery time t_{rr} is the time required for the reverse current to fall to I_S." (Bell p.75)

"The speed with which a diode can be switched is determined by the reverse recovery time of the device."(Bell p.76)



Diode **Static** Resistance:

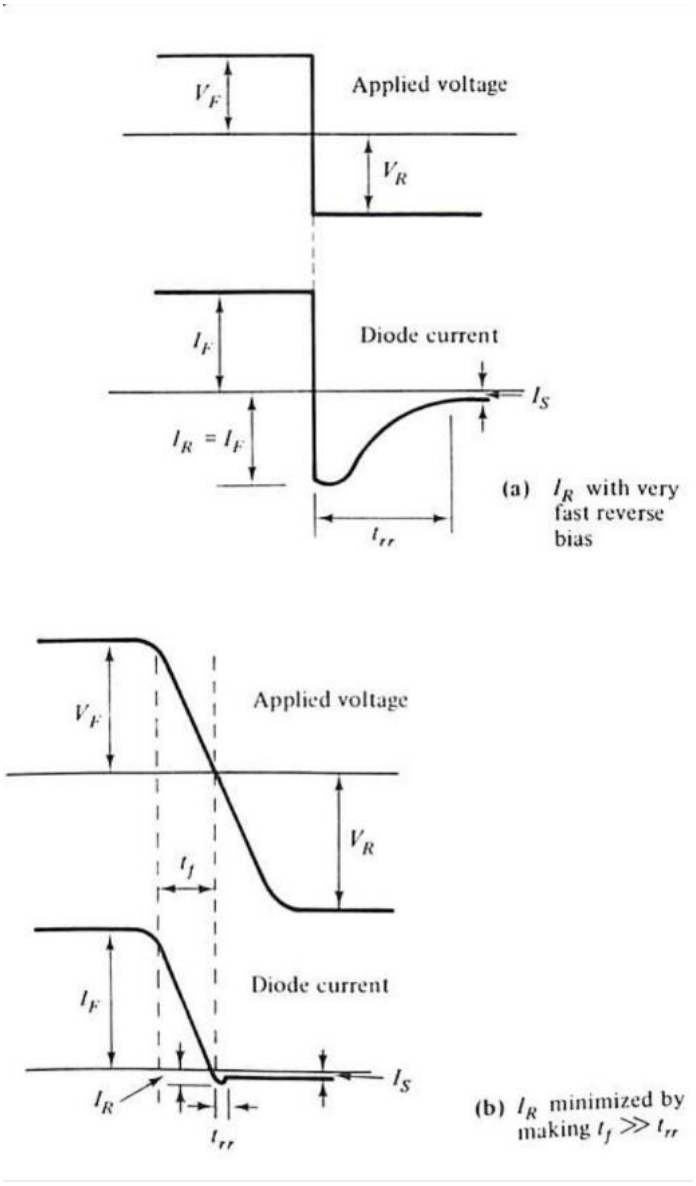


- Notice when the diode is forward biased at $V_F = 0.8v, I_F = 60mA$
  - We can now solve for the Diode Static Resistance when $I_F = 60mA$.
  - $R_D = \frac{V_F}{I_F}$
  - $R_D = \frac{0.8V}{60mA}$
  - $\boldsymbol{R_D = 13.333\Omega}$
  - How about solving the Diode Static Resistance when the diode is reverse biased at $V_R = -50V$
  - $R_D = \frac{V_R}{I_S}$
  - $R_D = \frac{50V}{.05\mu A}$
  - $\boldsymbol{R_D = 1G\Omega}$
  - This shows us that the Diode is acting like a switch.

Diode **Dynamic** Resistance:

- Very similar to Transistors, as AC voltages are applied to diodes they exhibit a dynamic resistance that can be calculated using the below formula.
  - $\boldsymbol{r'd = \frac{26mV}{I_F}}$

t_{rr} and Frequency Response.



- Practical Design considerations for switching diodes. The impact of the diode's recovery time can affect the circuits high frequency response. In order to negate the impact of the diodes t_{rr}, a diode with a recovery time that is ten times less than the desired Rise Time or Fall Time should be used.
  - $t_{rr} \leq \frac{Time_{Rise/Fall}}{10}$
  - $Time_{Rise/Fall} \geq (t_{rr} \times 10)$
  - $FC_H = \frac{.35}{Time_{Rise}}$

DEC

1N60, 1N60P

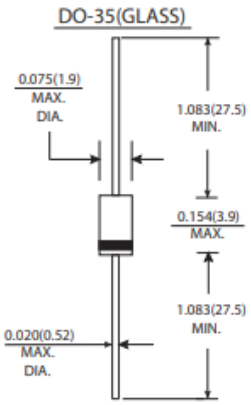
GERMANIUM DIODES

Features

- Metal silicon junction, majority carrier conduction
- High current capability, Low forward voltage drop
- Extremely low reverse current I_R
- Ultra speed switching characteristics
- Small temperature coefficient of forward characteristics
- Satisfactory Wave detection efficiency
- For use in RECORDER, TV, RADIO, TELEPHONE as detectors, super high speed switching circuits, small current rectifier

Mechanical Data

- Case : DO-35 glass case
- Polarity : Color band denotes cathode end
- Weight : Approx. 0.13 gram



Dimensions in inches and (millimeters)

Absolute Ratings (Limiting Values)

Symbols	Parameters		Value		Units
			1N60	1N60P	
V_{RRM}	Zenerepetitive Peak Reverse Voltage		40	45	Volts
I_F	Forward Continuous Crrent	T_A=25℃	30	50	mA
I_{FSM}	Peak Forward Surge Current(t=1S)		150	500	mA
T_{STG}/T_J	Storage junction Temperature Range		-65 to+125		℃
T_L	Maximum Lead Temperature for soldering 10S at 4mm from Case		230		℃

Electrical characteristics

Symbols	Parameters	Test Conditions		Value			Units
				Min	Typ.	Max.	
V_F	Forward Voltage	I_F=1mA	1N60		0.32	0.5	Volts
			1N60P		0.24	0.5	
		I_F=30mA	1N60		0.65	1.0	
		I_F=200mA	1N60P		0.65	1.0	
I_R	Reverse Current	V_R=15V	1N60		0.1	0.5	μA
			1N60P		0.5	1.0	
C_J	Junction Capacitance	V_R=1V f=1MHz	1N60		2.0		pF
		V_R=10V f=1MHz	1N60P		6.0		
η	Detection Effcienc(See diagram 4)	V_I=3V f=30MHz C_L=10pF R_L=3.8kΩ			60		%
trr	Revese Recovery time	I_F=I_R=1mA I_{rr}=1mA R_C=100Ω				1	ns
$R_{\Theta JA}$	Junction Amblent Thermal Resistance				400		℃/W

VISHAY
www.vishay.com

1N4148

Vishay Semiconductors

Small Signal Fast Switching Diodes

FEATURES

- Silicon epitaxial planar diode
- Electrically equivalent diodes: 1N4148 - 1N914
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- Extreme fast switches

DESIGN SUPPORT TOOLS click logo to get started

3D Models Available

MECHANICAL DATA

Case: DO-35 (DO-204AH)
Weight: approx. 105 mg
Cathode band color: black
Packaging codes / options:
TR/10K per 13" reel (52 mm tape), 50K/box
TAP/10K per ammopack (52 mm tape), 50K/box

PARTS TABLE

PART	ORDERING CODE	TYPE MARKING	CIRCUIT CONFIGURATION	REMARKS
1N4148	1N4148-TAP or 1N4148TR	V4148	Single	Tape and reel / ammopack

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Repetitive peak reverse voltage		V_{RRM}	100	V
Reverse voltage		V_R	75	V
Peak forward surge current	t_p = 1 µs	I_{FSM}	2	A
Repetitive peak forward current		I_{FRM}	500	mA
Forward continuous current		I_F	300	mA
Average forward current	V_R = 0	$I_{F(AV)}$	150	mA
Power dissipation	l = 4 mm, T_L = 45 °C	P_{tot}	440	mW
	l = 4 mm, $T_L \leq$ 25 °C	P_{tot}	500	mW

THERMAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Thermal resistance junction to ambient air	l = 4 mm, T_L = constant	R_{thJA}	350	K/W
Junction temperature		T_j	175	°C
Storage temperature range		T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 10 mA	V_F			1	V
Reverse current	V_R = 20 V	I_R			25	nA
	V_R = 20 V, T_j = 150 °C	I_R			50	µA
	V_R = 75 V	I_R			5	µA
Breakdown voltage	I_R = 100 µA, t_p/T = 0.01, t_p = 0.3 ms	$V_{(BR)}$	100			V
Diode capacitance	V_R = 0 V, f = 1 MHz, V_{HF} = 50 mV	C_D			4	pF
Rectification efficiency	V_{HF} = 2 V, f = 100 MHz	η_r	45			%
Reverse recovery time	$I_F = I_R$ = 10 mA, i_R = 1 mA	t_{rr}			8	ns
	I_F = 10 mA, V_R = 6 V, i_R = 0.1 x I_R, R_L = 100 Ω	t_{rr}			4	ns

FAIRCHILD

November 2014

1N4001 - 1N4007
General-Purpose Rectifiers

Features

- Low Forward Voltage Drop
- High Surge Current Capability

DO-41
COLOR BAND DENOTES CATHODE

Ordering Information

Part Number	Top Mark	Package	Packing Method
1N4001	1N4001	DO-204AL (DO-41)	Tape and Reel
1N4002	1N4002	DO-204AL (DO-41)	Tape and Reel
1N4003	1N4003	DO-204AL (DO-41)	Tape and Reel
1N4004	1N4004	DO-204AL (DO-41)	Tape and Reel
1N4005	1N4005	DO-204AL (DO-41)	Tape and Reel
1N4006	1N4006	DO-204AL (DO-41)	Tape and Reel
1N4007	1N4007	DO-204AL (DO-41)	Tape and Reel

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value							Unit
		1N 4001	1N 4002	1N 4003	1N 4004	1N 4005	1N 4006	1N 4007	
V_{RRM}	Peak Repetitive Reverse Voltage	50	100	200	400	600	800	1000	V
$I_{F(AV)}$	Average Rectified Forward Current .375 " Lead Length at T_A = 75°C	1.0							A
I_{FSM}	Non-Repetitive Peak Forward Surge Current 8.3 ms Single Half-Sine-Wave	30							A
I^2t	Rating for Fusing (t < 8.3 ms)	3.7							A^2sec
T_{STG}	Storage Temperature Range	-55 to +175							°C
T_J	Operating Junction Temperature	-55 to +175							°C

Thermal Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	3.0	W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	50	°C/W

Electrical Characteristics

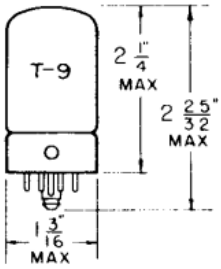
Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Value	Unit
V_F	Forward Voltage	I_F = 1.0 A	1.1	V
I_{rr}	Maximum Full Load Reverse Current, Full Cycle	T_A = 75°C	30	µA
I_R	Reverse Current at Rated V_R	T_A = 25°C	5.0	µA
		T_A = 100°C	50	
C_T	Total Capacitance	V_R = 4.0 V, f = 1.0 MHz	15	pF

TENTATIVE DATA 7Y4

TUNG-SOL

DOUBLE DIODE



GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 500 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7Y4 IS A HEATER TYPE HIGH VACUUM TWIN DIODE USING THE LOCK-IN CONSTRUCTION. IT IS INTENDED FOR USE AS A FULL-WAVE RECTIFIER IN EITHER AC OR STORAGE BATTERY OPERATED EQUIPMENT WHERE ECONOMY OF HEATER POWER IS DESIRED.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1 250	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)CONDENSER INPUT	325	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS) CHOKE INPUT	450	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	210	MA.
MAXIMUM OUTPUT CURRENT	70	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 70 MA. EACH PLATE)	22	VOLTS