

# Germanium Power Devices Corp.

1N3712-20

1N3713-21

## Tunnel Diodes

## Specifications

1N3712 through 1N3720 and 1N3713 through 1N3721 are Germanium Tunnel Diodes offering peak currents of 1.0, 2.2, 4.7, 10, and 22 ma. These devices, which make use of the quantum mechanical tunneling phenomenon to obtain a negative conductance characteristic, are designed for low level switching and small signal applications at very high frequencies. All 1N3713-1N3721 version parameters are closely controlled for use in critical applications such as level detection, frequency converters, etc. These devices are housed in new hermetically sealed subminiature axial package.

### FEATURES:

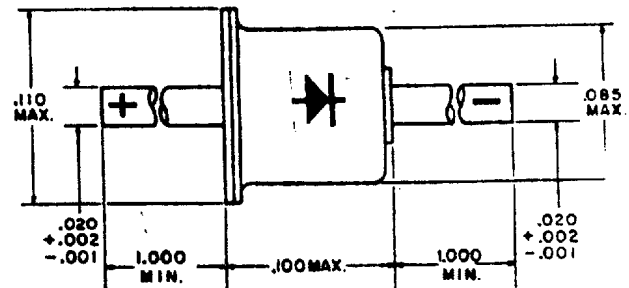
- ▶  $V_{rs}$  Specified for more accurate designing of lead lines
- ▶ Low capacitance
- ▶ Fast speed

### absolute maximum ratings

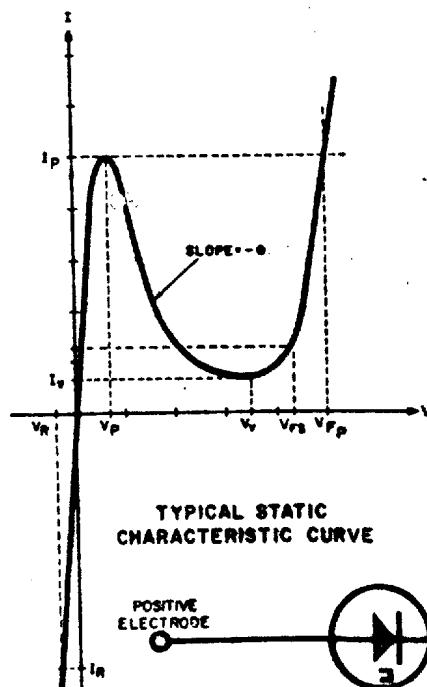
	1N3712	1N3714	1N3716	1N3718	1N3720	
	1N3713	1N3715	1N3717	1N3719	1N3721	
Forward Current*	5	10	25	50	100	ma
Reverse Current*	10	20	50	50	100	ma
Storage Temperature	← -55 to +100 →					°C
Lead Temperature $\frac{1}{16}'' \pm \frac{1}{32}''$ from case for 10 seconds	← 260 →					°C

\*Derate maximum currents 1% per °C ambient temperature above 25°C.

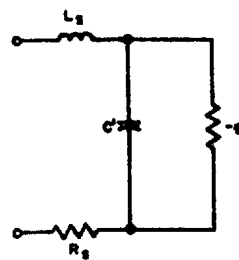
### AXIAL DIODE OUTLINE



ALL DIMENSIONS IN INCHES.  
DIMENSIONS ARE REFERENCE UNLESS TOLERANCED.



TYPICAL STATIC CHARACTERISTIC CURVE



EQUIVALENT CIRCUIT  
(BIASED IN NEGATIVE CONDUCTANCE REGION)



TUNNEL DIODE SYMBOL

electrical characteristics:

1N3712      1N3713      1N3714      1N3715

**STATIC CHARACTERISTICS**

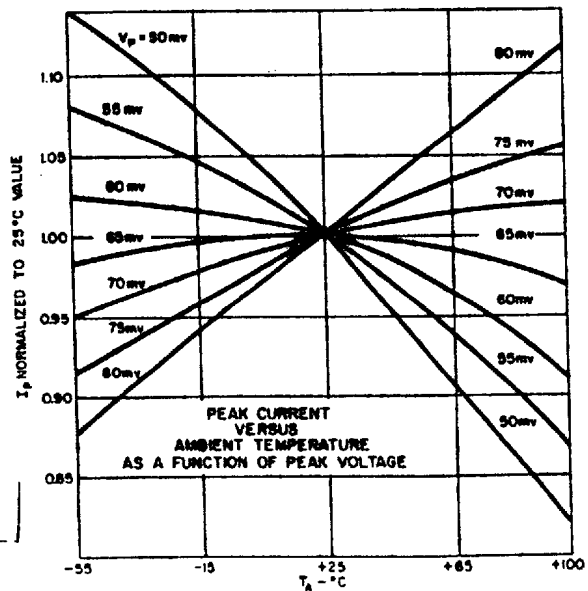
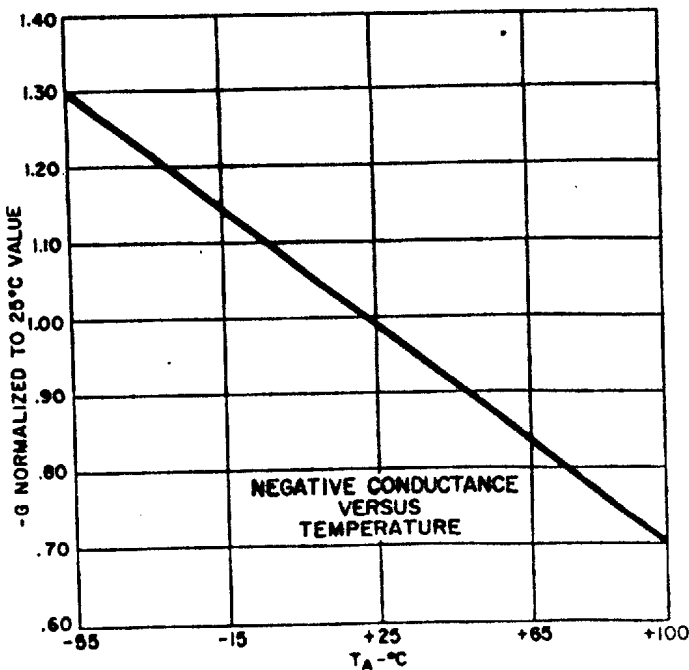
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
Peak Point Current	$I_P$	0.9	1.0	1.1	0.975	1.000	1.025	2.0	2.2	2.4	2.15	2.20	2.25
Valley Point Current	$I_V$		0.12	0.18	.075	.095	.140		0.29	0.48	.165	.210	.310
Peak Point Voltage	$V_P$		65		58	65	72		65		58	65	72
Valley Point Voltage	$V_V$		350		315	355	395		350		315	355	395
Reverse Voltage ( $I_R = I_P$ typ.)	$V_R$			40		20	40			40		20	40
Forward Voltage ( $I_F = I_P$ typ.)	$V_{FP}$		500		475	510	535		500		475	510	535
	( $I_F = .25 I_P$ typ.) $V_{FS}^*$				410	450					410	450	

**DYNAMIC CHARACTERISTICS**

Total Series Inductance	$L_S$		0.5		0.5		0.5		0.5		0.5		0.5
Total Series Resistance	$R_S$		1.5	4.0	1.7	4.0	1.0	3.0	1.1	3.0	7.0	10.0	
Valley Point Terminal Capacitance	$C$		5	10	3.5	5.0	10	25	7.0	10.0			
Max. Negative Terminal Conductance	$-G$		8		7.5	8.5	9.5	18	16	19	22		
Resistive Cutoff Frequency	$f_{ro}$		2.3		3.2		2.2		3.0				
Self-Resonant Frequency	$f_{rs}$		3.2		3.8		2.2		2.7				
Frequency of Oscillation	$F_{osc}^{**}$		3.2		3.8		2.2		2.7				
Rise Time	$t_r^{***}$				1.7				1.6				

\* $V_{FS}$  is defined as the value of forward voltage at a forward current of one quarter the typical peak current.  
 \*\*The frequency of oscillation (under short circuit conditions) for steady state large signal sinusoidal oscillation is given by equation (3) which is the maximum frequency attainable without capacitance compensation.

\*\*\*Switching speed with constant current drive.  $t_r \approx \frac{V_{FP} - V_P}{I_P - I_V} C$



1N3716			1N3717			1N3718			1N3719			1N3720			1N3721			
Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
4.2	4.7	5.2	4.58	4.70	4.82	9.0	10.0	11.0	9.75	10.00	10.25	20	22	24	21.5	22	22.5	ma
	0.60	1.04	.350	.45	.60		1.3	2.2	.75	.95	1.40		2.9	4.8	1.65	2.10	3.10	ma
	65		58	65	72		65		58	65	72		65		58	65	72	mv
	350		315	355	395		350		315	355	395		350		315	355	395	mv
		40		20	40			40		20	40			40		20	40	mv
	500		475	510	535		500		475	510	535		500		475	510	575	mv
			410	450					410	450					410	450		
	0.5		0.5				0.5		0.5				0.5		0.5			nh
	.50	2.0		.52	2.0		.30	1.5		.36	1.5		.20	1.0		.22	1.0	ohms
	25	50		13	25		50	90		27	50		90	150		55	100	pf
	40		36	41	46		80		75	85	95		180		160	190	220	10 <sup>-8</sup> mho
	1.8			3.4			1.6			2.8			1.6			2.6		KMC
	1.4			1.9			.97			1.3			.67			.78		KMC
	1.4			2.0			1.0			1.4			.74			.95		KMC
				1.4						1.3						1.2		nsec

$$f_{ro} = \frac{|g'|}{2\pi C'} \sqrt{\frac{1}{R_S |g'|} - 1} \quad (1)$$

$$f_{xo} = \frac{1}{2\pi} \sqrt{\frac{1}{L_S C'} - \left(\frac{|g'|}{C'}\right)^2} \quad (2)$$

$$f_{osc} = \frac{1}{2\pi} \sqrt{\frac{1}{L_S C} - \left(\frac{R_T}{L}\right)^2} \quad (3)$$

