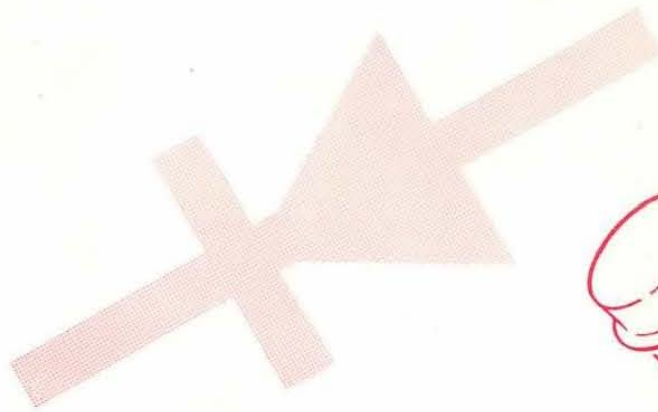


# TRANSISTORS and DIODES

*A guide in use and handling*



**Western Electric**



COPYRIGHT 1963  
by  
WESTERN ELECTRIC CO., INC.  
ALLENTOWN WORKS

No part of this book may be reproduced without written permission of the Engineer of Manufacture, Allentown (Pa.) Works.

# Contents

	Page
INTRODUCTION . . . . .	1
HANDLING . . . . .	4
Packing and Unpacking . . . . .	4
Storage . . . . .	5
Mechanical Shock . . . . .	6
Static Electrical Discharge . . . . .	7
Leads . . . . .	8
ASSEMBLY . . . . .	9
Leads . . . . .	9
Heat Sinks . . . . .	11
Soldering . . . . .	13
Static Charges and Transients . . . . .	15
Mechanical Shock . . . . .	16
ELECTRICAL TESTING . . . . .	17
Circuit Testing . . . . .	17
Circuit Troubleshooting . . . . .	19
Device Testing . . . . .	21
FAILURE ANALYSIS . . . . .	25
APPENDIXES	
A Western Electric Semiconductor Codes . . . . .	27
B Semiconductor Device Classification . . . . .	30
C Typical Transistor and Diode Construction . . . . .	31
D Basing Information . . . . .	43
E Transistor Circuit Configuration . . . . .	47
REFERENCE LIST . . . . .	49

# Appendix A

## Western Electric Semiconductor Codes

### TRANSISTORS

8 B	NPN	MW Ge Alloy
9 A	PNP	High Power Ge Alloy
9 B, D	PNP	Med Power Ge Alloy
12 A-N	PNP	MW Ge Alloy
15 A-D	PNP	MW Ge Diffused *
16 A-E	NPN	MW Si Diffused
16 D	NPN	MW Si Epitaxial
17 A	PNP	MW Ge Alloy
18 A-B	NPN	MW Si Diffused
19 A	NPN	MW Si Diffused
20 B-G	NPN	Med Power Si Diffused
20 D	NPN	Med Power Si Epitaxial
21 A-C	NPN	MW Si Diffused
22 A	NPN	Med Power Si Epitaxial
23 A	NPN	Med Power Si Diffused
24 A	NPN	Med Power Si Diffused
24 B	NPN	Med Power Si Epitaxial
25 A	NPN	MW Si Diffused
26 A, B	PNP	MW Ge Diffused *
28 A	PNP	MW Ge Alloy
29 A	NPN	MW Si Epitaxial
30 A	NPN	MW Ge Alloy
31 A	PNP	MW Ge Alloy
32 A	NPN	Med Power Ge Alloy
33 A	NPN	MW Si Diffused
35 A	PNP	MW Ge Alloy

---

MW (Milliwatt) — under 1/2 watt  
Medium Power — 1/2 - 2 watts

High Power — over 2 watts  
\*Ultra-High Frequency Types

## Transistors and Diodes

### DIODES

400 A-J	MW Ge Point Contact
401 A	MW Ge Point Contact
403 A-C	MW Si Point Contact
404 A-D	MW Si Point Contact
405 B-D	Microwave Si Point Contact
406 A, B	Microwave Si Point Contact
407 A-F	MW Ge Point Contact
408 A-415 A	MW Ge Point Contact
416 C	Microwave Si Point Contact
417 B	MW Si Alloy Junction
418 A	MW Si Point Contact
420 A-T	MW Si Alloy Junction
421 A-E	MW Si Alloy Junction
422 B	MW Si Alloy Junction
424 A	MW Ge Point Contact
425 A-N	High Power Si Diffused Junction
426 A-Y, AA-AH	Med Power Si Diffused Junction
427 A	Microwave Ge Gold Bonded

---

MW (Milliwatt) — under 1/2 watt

Medium Power — 1/2 - 2 watts

High Power — over 2 watts

## Western Electric Semiconductor Codes

### DIODES

431 A	Microwave Ge Point Contact
432 A	MW Si Diffused Junction
433 A, B	MW Si Alloy Junction
434 A, B	MW Si Diffused Junction
435 A-H	MW Si Diffused Junction
436 A	MW Si Diffused Junction
437 A, B	MW Si Diffused Junction
438 A	MW Si Diffused Junction
439 A	MW Si Diffused Junction
440 A	Med Power Si Diffused Junction
441 A-J	MW Ge Point Contact
442 A	MW Si Diffused Junction
444 A	MW Ge Point Contact
445 A	MW Ge Gold Bonded
446 A-F	MW Si Diffused Junction
447 A	MW Si Diffused Junction
448 A	MW Si Alloy Junction
449 A	MW Si Diffused Junction

---

MW (Milliwatt) — under 1/2 watt

Medium Power — 1/2 - 2 watts

High Power — over 2 watts

## Appendix B

### Semiconductor Device Classification

#### TRANSISTORS

MW Ge Alloy	PNP	12 A-N, 17 A, 28 A, 31 A, 35 A
Med Power Ge Alloy	PNP	9 B, D
High Power Ge Alloy	PNP	9 A
MW Ge Alloy	NPN	8 B, 30 A
Med Power Ge Alloy	NPN	32 A
MW Ge Diffused	PNP	15 A-D; 26 A, B
MW Si Diffused	NPN	16 A-E; 18 A, B; 19 A; 21 A-C; 25 A; 33 A
Med Power Si Diffused	NPN	20 B-G, 23 A, 24 A
Si Diffused Epitaxial	NPN	16 D, 20 D, 22 A, 24 B, 29 A
Ultra-High Frequency Type	PNP	15 A-D; 26 A, B

#### DIODES

Point Contact	400 A-J, 401 A, 403 A-C, 404 A-D, 407 A-F, 408 A-415 A, 418 B, 424 A, 441 A-J, 444 A
Microwave Point Contact	405 B-D; 406 A, B; 416 C; 431 A
Si Alloy Junction	417 B, 420 A-T, 421 A-E, 442 B, 433 A-B, 448 A
MW Si Diffused Junction	432 A; 434 A, B; 435 A-H; 436 A; 437 A, B; 438 A; 439 A, 440 A, 442 A, 446 A-F, 447 A, 449 A
Med Power Si Diffused Junction	426 A-Y, 426 AA-AH, 440 A
High Power Si Diffused Junction	425 A-N
MW Ge Gold Bonded	445 A
Microwave Ge Gold Bonded	427 A

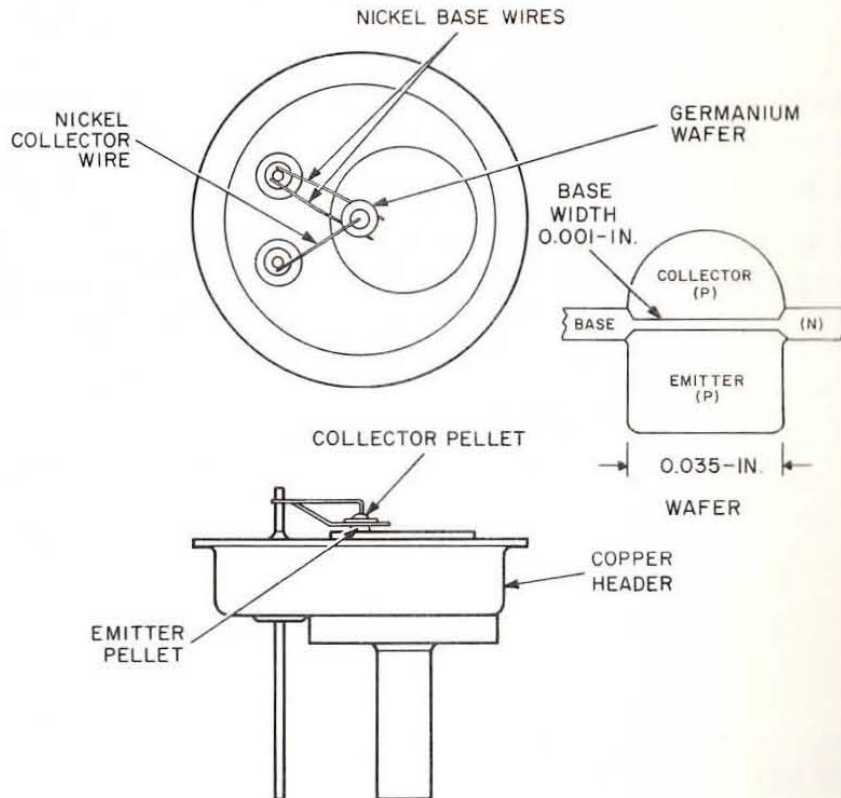
## *Appendix C*

### Typical Transistor and Diode Construction

The illustrations on the following pages show the internal construction of some basic transistors and diodes manufactured by the Western Electric Company. Note the minute dimensions of the active regions. Consult the data sheets for electrical ratings. (All dimensions shown on illustrations are approximate.)



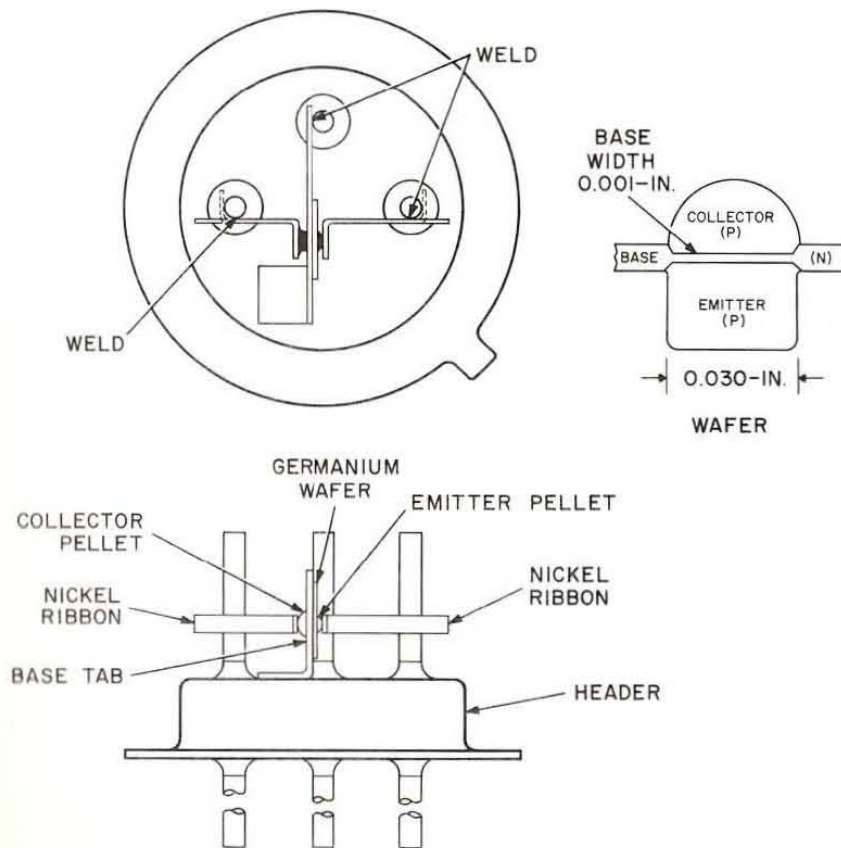
## Transistors and Diodes



### PNP MEDIUM POWER GERMANIUM ALLOY TRANSISTOR - 9 B, D TYPE

The 9 B, D transistor is suitable for use in medium-power, low-distortion amplifier, medium-speed switching and core-driving applications.

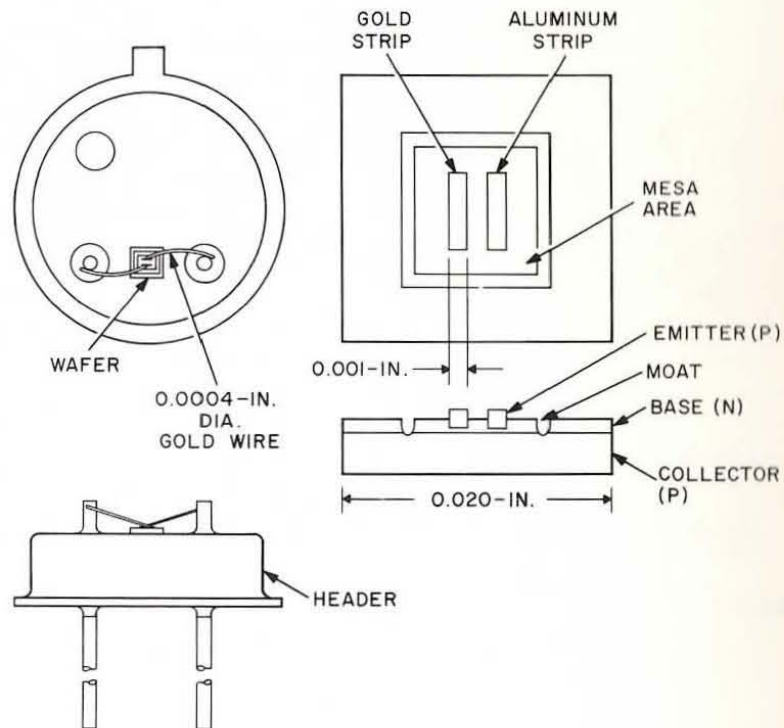
## Typical Transistor and Diode Construction



### MILLIWATT GERMANIUM ALLOY PNP TRANSISTOR - 12 TYPE

The 12-type transistor is a 1/4-watt, general purpose, PNP germanium alloy junction transistor. It is used principally as a medium-frequency amplifier or medium-speed switch.

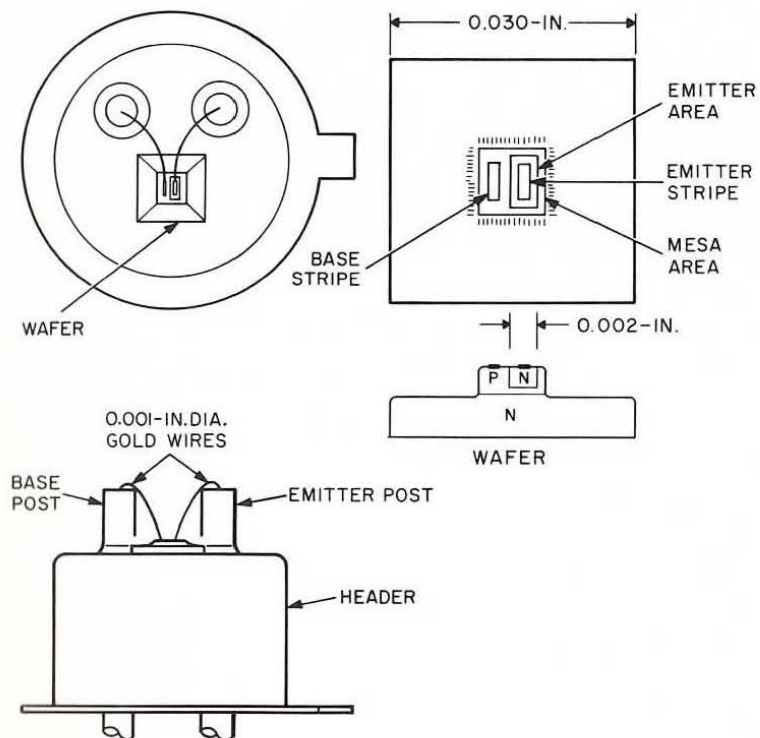
## Transistors and Diodes



### MILLIWATT GERMANIUM DIFFUSED BASE (ULTRA-HIGH FREQUENCY) PNP TRANSISTOR - 15 TYPE

The 15-type transistor is used principally as a VHF amplifier or very fast switch.

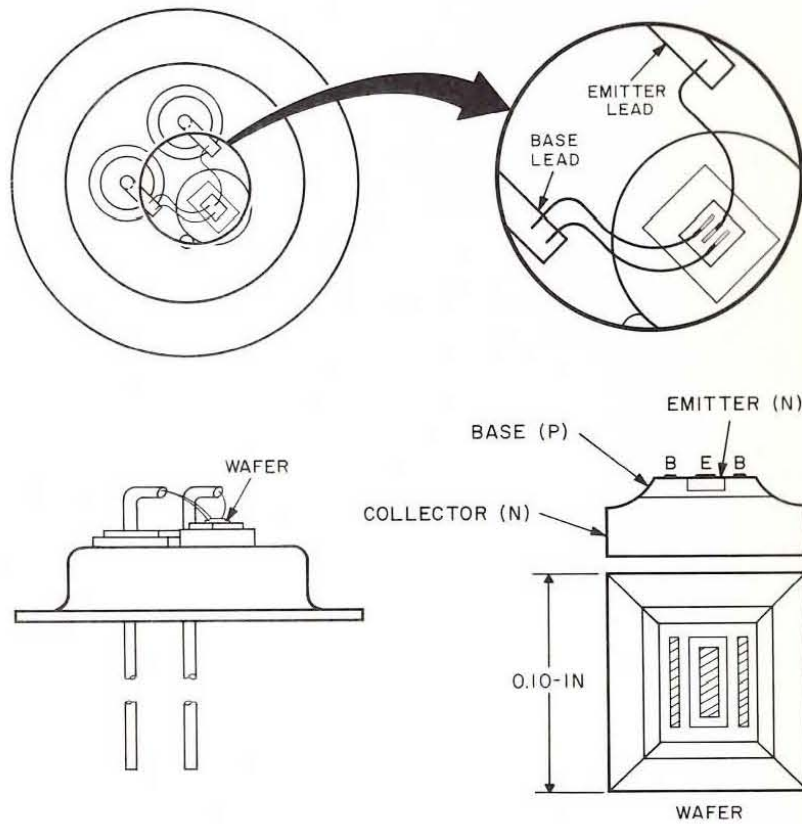
## Typical Transistor and Diode Construction



### NPN MILLIWATT SILICON DIFFUSED TRANSISTOR - 16 TYPE

The 16-type transistor is used principally as a general purpose, radio-frequency, small-signal amplifier or high-speed switch.

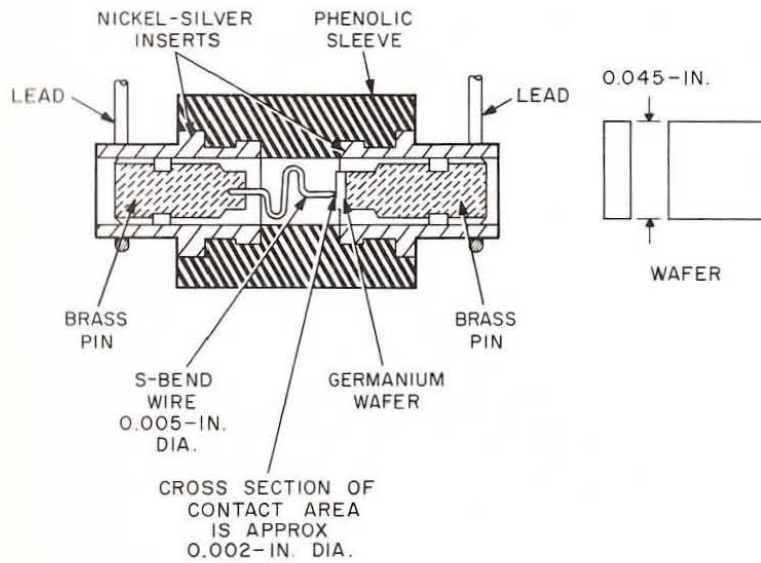
## Transistors and Diodes



NPN MEDIUM POWER DIFFUSED SILICON  
TRANSISTOR - 20 TYPE

The 20-type transistor is used principally as a medium-power amplifier or high-current switch.

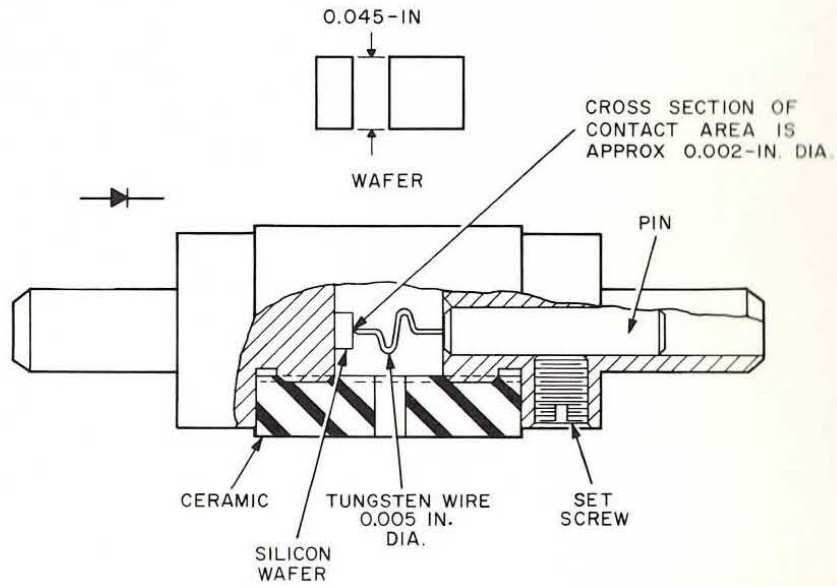
## Typical Transistor and Diode Construction



### POINT-CONTACT DIODE - 400 TYPE

The 400-type is a general purpose diode used principally as a detector or low-power rectifier. The 441-type diodes are electrically identical to the 400-type, except that they have axial leads.

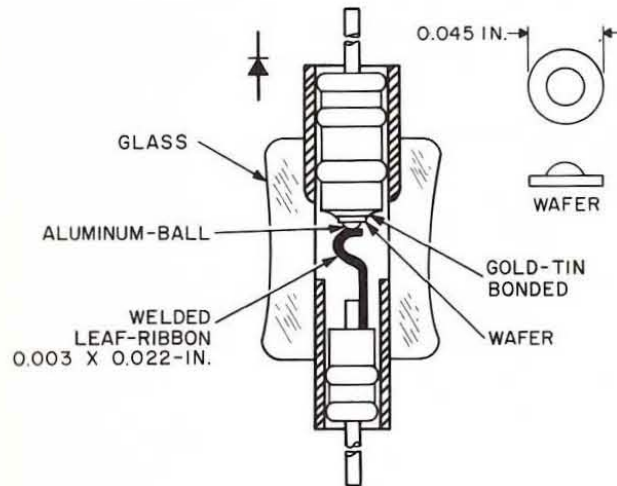
## Transistors and Diodes



### MICROWAVE POINT-CONTACT DIODE - 405C TYPE

The 405-type diode is principally used as a detector of microwave energy.

## Typical Transistor and Diode Construction

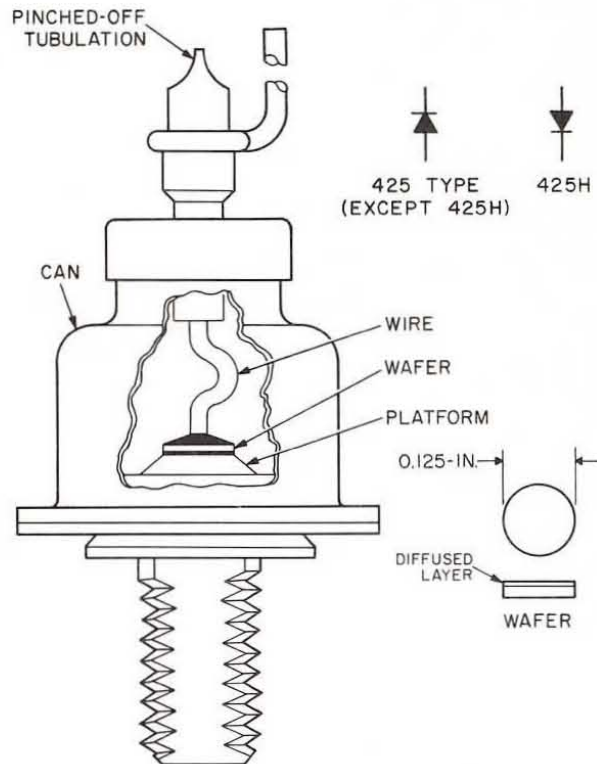


### SILICON ALLOY JUNCTION DIODE - 420 TYPE

The 420-type diode is used principally as a low-power rectifier with extremely low leakage currents, a voltage reference source or voltage regulator.



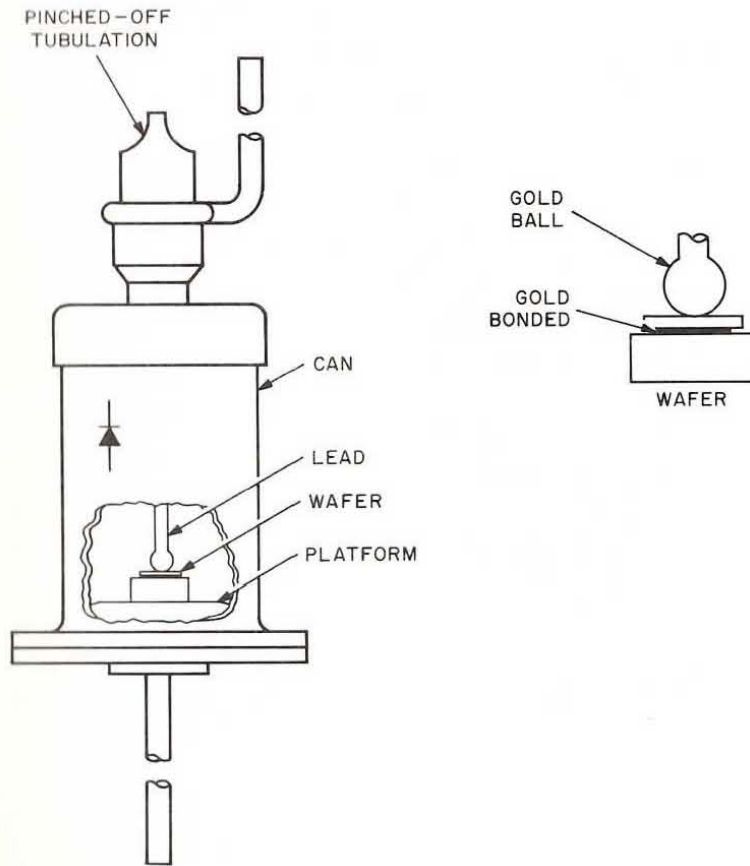
## Transistors and Diodes



### HIGH POWER SILICON DIFFUSED JUNCTION DIODE - 425 TYPE

The 425-type diode is used principally as a high-power rectifier or voltage regulator, capable of dissipating 10 watts when properly heat-sinked.

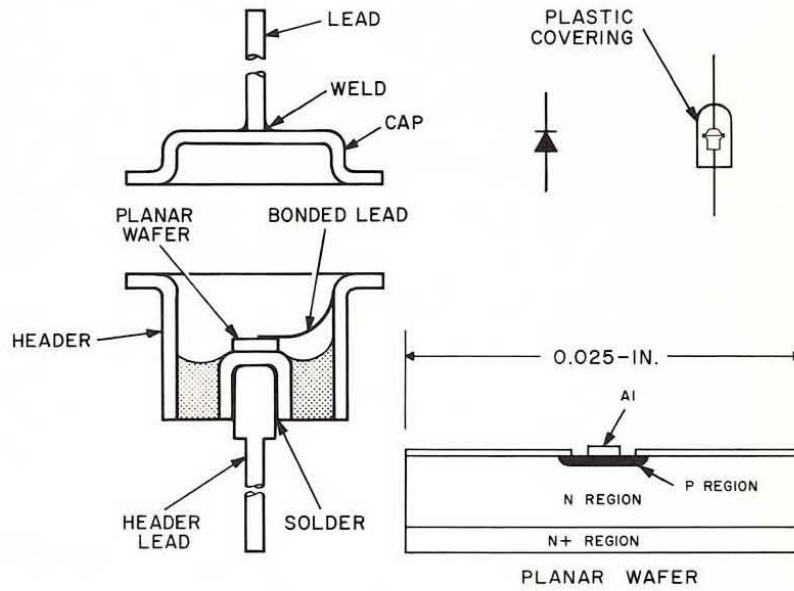
## Typical Transistor and Diode Construction



MEDIUM POWER SILICON DIFFUSED JUNCTION  
DIODE - 426 TYPE

The 426-type diode is used principally as a medium-power rectifier, or voltage regulator.

## Transistors and Diodes



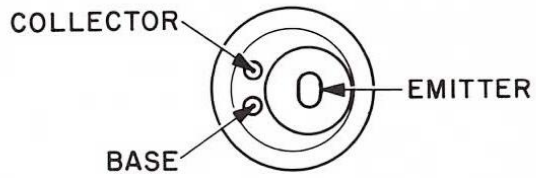
### MILLIWATT SILICON DIFFUSED JUNCTION DIODE - 432 TYPE

The 432-type diode is used principally in low-level, high-speed logic systems.

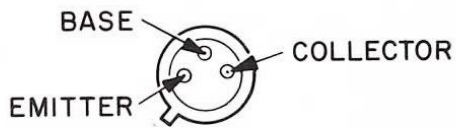
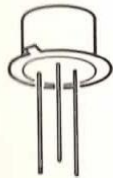
# Appendix D

## Basing Information

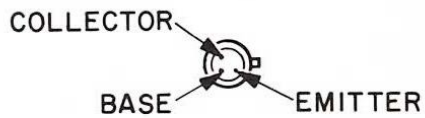
### TRANSISTORS



9 TYPE



12 AND 15 TYPE

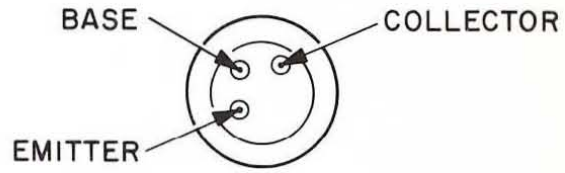
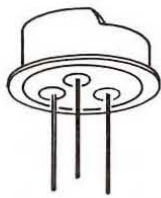


16 AND 21 TYPE

Transistors are shown approximately full size. For further information, see data sheet.

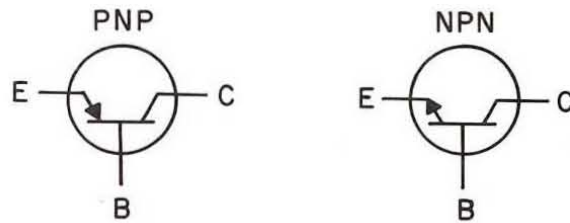
## Transistors and Diodes

### TRANSISTORS (Continued)



20 TYPE

Transistors are shown approximately full size. For further information, see data sheet.



SCHEMATIC REPRESENTATION

# Basing Information

## DIODES

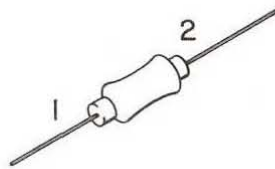
400 TYPE



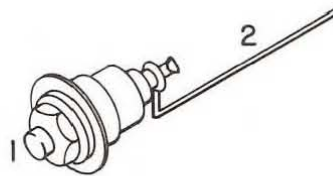
405 TYPE



420 TYPE



425 TYPE

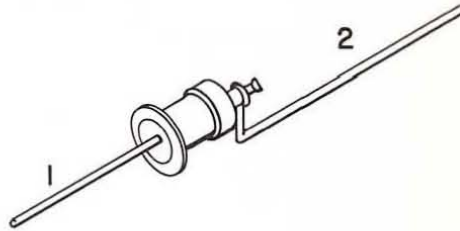


Diodes are shown approximately full size except leads. For further information, see data sheet.

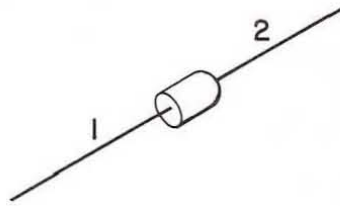
# Transistors and Diodes

## DIODES (Continued)

426 TYPE



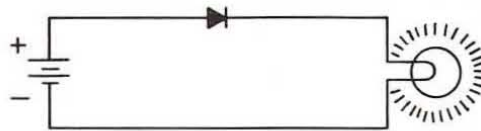
432 TYPE



SCHEMATIC



Diodes are shown approximately full size except leads. For further information, see data sheet.



FORWARD

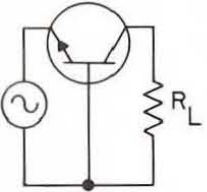
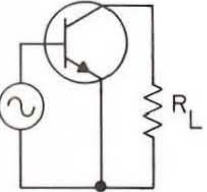
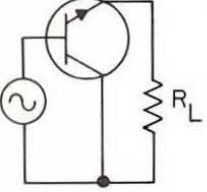


REVERSE

DIODE BIAS CIRCUITS

## Appendix E

### Transistor Circuit Configurations

CIRCUIT	CHARACTERISTICS
 <p style="text-align: center; margin-top: 5px;">COMMON BASE (CB)</p>	<p>Lowest input impedance            Highest output impedance            Low current gain (<math>&lt;1</math>)            High voltage gain            Moderate power gain</p>
 <p style="text-align: center; margin-top: 5px;">COMMON EMITTER (CE)</p>	<p>Moderate input impedance            Moderate output impedance            High current gain            High voltage gain            Highest power gain</p>
 <p style="text-align: center; margin-top: 5px;">COMMON COLLECTOR (CC) (EMITTER FOLLOWER)</p>	<p>Highest input impedance            Lowest output impedance            High current gain            Unity voltage gain            Lowest power gain</p>