

TRANSISTOR MUSEUM™
HISTORY OF TRANSISTORS
PRESERVATION COLLECTION

THE FIRST SILICON IN
SILICON VALLEY

VOLUME 1

Shockley 4-Layer Bistable
Transistor Diodes

Special Collection of Historic 1950s/60s
First Silicon Devices for the Engineer,
Historian, Researcher and Experimenter

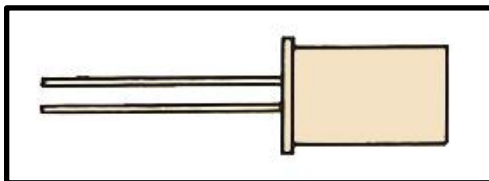
FIRST SILICON IN SILICON VALLEY



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TRANSISTOR MUSEUM™
PRESERVATION COLLECTION
THE SHOCKLEY
4-LAYER BISTABLE
TRANSISTOR DIODE
"TYPE D"
First Production Type

TYPE D - Shockley First
Production Type



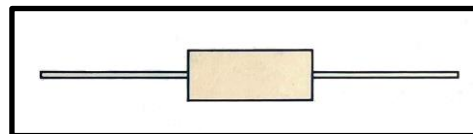
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TRANSISTOR MUSEUM™
PRESERVATION COLLECTION
THE SHOCKLEY
4-LAYER BISTABLE
TRANSISTOR DIODE
"TYPE E"
Final Production Type

TYPE E - Shockley Final
Production Type



INCLUDED ARE ORIGINAL 65-YEAR-OLD EXAMPLES
OF THESE FIRST SILICON VALLEY DEVICES

A Transistor Museum Preservation Collection

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ABOUT THIS TRANSISTOR MUSEUM PRESERVATION COLLECTION

Established in the late 1990s, the Transistor Museum has been an important online resource for documenting the history of the transistor. The Museum receives many thousands of web site visits each year from those who are interested in learning about the early days of transistor technology. The Museum has recently established the "Preservation Collection" program with the goal of actively preserving transistor history by making available truly historic transistor types, including display packaging and comprehensive documentation, for those who wish to further explore "The Greatest Invention of the 20th Century".

The *First Silicon in Silicon Valley-Volume 1* is the first in a series of History of Transistors Preservation Collections developed by the Transistor Museum™. This Volume 1 collection documents the first silicon devices produced in Silicon Valley in the mid-late 1950s. This unique device type (4-layer PNP transistor diode) was invented by William Shockley and manufactured by his pioneering company (Shockley Transistor Corp), which has been recognized as the first semiconductor company in Silicon Valley. These devices from the first days of the semiconductor revolution are truly a part of the great story begun in 1947 with the invention of the transistor at Bell labs and should be of great interest to the modern-day engineer, historian, researcher and experimenter. Included in this collection are extensive links to important online documentation, technical and historical commentary, circuits, and photographs of these famous silicon devices that first appeared in the 1950s in the very early days of Silicon Valley.

SHOCKLEY DIODES INCLUDED IN THIS PRESERVATION COLLECTION

DEVICE TYPE	HISTORICAL SIGNIFICANCE
"Type D" Shockley 4-Layer Transistor Diode	Historic First Shockley Production Type Gold-plated metal-cased device available commercially in 1958. This was the first product developed by Shockley Semiconductor and was promoted as a major advancement in solid state technology.
"Type E" Shockley 4-Layer Transistor Diode	Historic Final Shockley Production Type Lower-cost glass-cased device available in 1960. Manufactured in commercial quantities by Clevite Transistor Products after the sale of Shockley's company to Clevite.
TOTAL HISTORIC SHOCKLEY SEMICONDUCTORS INCLUDED = 2	

The Transistor Museum is dedicated to preserving the Greatest Invention of the 20th Century. Each historic semiconductor included in this Preservation Collection has been inspected to best ensure legibility of labelling and acceptable cosmetic condition. Informative and protective display envelopes and packaging are used to protect and archive the included transistors. Thank you for your interest and your support of our efforts to preserve these important historical artifacts.

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HISTORY OF TRANSISTORS PRESERVATION COLLECTION
THE FIRST SILICON IN SILICON VALLEY - VOLUME 1
First Edition - September 2024

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode

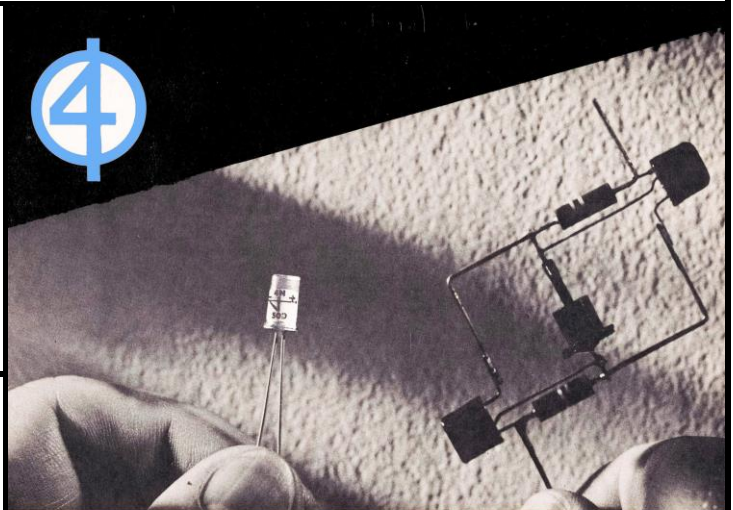
FIRST SILICON IN SILICON VALLEY



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TRANSISTOR MUSEUM™
PRESERVATION COLLECTION
THE SHOCKLEY
4-LAYER BISTABLE
TRANSISTOR DIODE

HISTORIC 1950s/60s
SHOCKLEY DEVICES



Equivalent to a combination of five separate elements

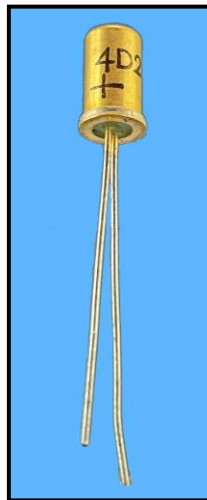
the shockley

**4-LAYER BISTABLE
TRANSISTOR DIODE**

for: computers
telephony
control
pulse circuitry

Shockley / Transistor Corporation

Above is a stylized version of the cover for a 1959 Shockley Transistor Corp product brochure with technical data for circuit designers. [Courtesy of Science History Institute.](#)



IEEE MILESTONE
Birthplace of Silicon Valley, 1956

At this location, 391 San Antonio Road, the Shockley Semiconductor Laboratory manufactured the first silicon devices in what became known as Silicon Valley. Some of the talented scientists and engineers initially employed there left to found their own companies, leading to the birth of the silicon electronics industry in the region. Hundreds of firms in electronics and computing can trace their origins back to Shockley Semiconductor.

May 2018



Preserving the Shockley Diode Legacy and the Birthplace of Silicon Valley

At left above is a recent photo of the commemorative two-story tall sculpture of the original-style Shockley 4-layer diode which has been placed at the entrance to the current building at [391 San Antonio Road](#). The IEEE Milestone statement for the "[Birthplace of Silicon Valley](#)" confirms that Shockley Semiconductor Labs began operations at this address in 1956 and developed the first silicon devices (4-layer diodes) in what is now known as "Silicon Valley". Above center is a photo of one of the few remaining 70+ year old early production Shockley Type D diodes. The [Computer History Museum](#) links below provide a wealth of additional information on early Shockley history and technology.

Computer History Museum Shockley Links
([History](#), [Documentary](#), [Shockley Alumni Recollections](#))

What's Inside?

At left is a colorized version of an x-ray view of an early Shockley diode. The tiny 4-layer "chip" is mounted between the two curved metal contacts directly above the red highlighted area. These "chips" were cut and processed from grown silicon crystals such as the 1950s [pencil-sized silicon crystal](#) shown above - this unique crystal was produced at the Shockley Semiconductor Labs site in Palo Alto. The X-ray photo courtesy of [Herminso Villarraga-Gómez](#).



Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode

Beckman Instruments Establishes Shockley Semiconductor Lab.

BECKMAN INSTRUMENTS has established the Shockley Semiconductor Laboratory near Stanford University to develop and produce transistors and other semiconductor devices in the field of advanced electronics for automatic production techniques.

Headed by Dr. William Shockley, pioneer in the development of the junction transistor, as director, initial lab members include Drs. G. Smoot Horsley, formerly of Motorola and Bell Laboratories; Leo B. Valdes, formerly of Pacific Semiconductor and Bell Laboratories; William W. Happ, formerly



William Shockley
April, 1956 — ELECTRONICS

of Raytheon and Sylvania and R. V. Jones.

Quartered temporarily in Mountain View, Calif. the group will move into the new \$500,000 research and development center Beckman is building in Stanford Industrial Park for its Spincor division and the Shockley Semiconductor Laboratory.

Completion of the facility is scheduled for August.

Dr. Shockley said that recent developments in physics and chemistry indicate great future expansion for semiconductors. "We have found corresponding phenomena in tran-

The influential Electronics magazine published this announcement of the establishment of Shockley Semiconductor Laboratory, an event which has been recognized as the beginning of Silicon Valley.



Shockley Semiconductor Laboratory. (Image source: Arnold and Mabel Beckman Foundation)



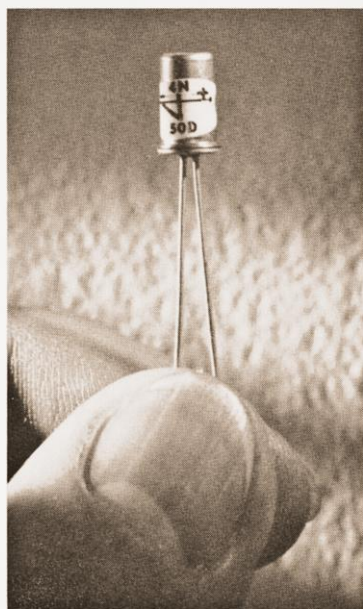
Beckman, Shockley and the Quonset Hut

Good news for Shockley and a key milestone in semiconductor history, the photo at left shows Shockley holding the signed contract founding Shockley Semiconductors Lab, with a beaming Arnold Beckman looking on. (Photo courtesy of [Science History Institute](#)). Much has been written about the first SSL facility located at [391 San Antonio Road](#) in Mountain View, which has been referred to as "The Quonset Hut". You can see the curved Quonset-style roof in the picture of this building shown above right. Beckman soon funded a more modern facility for [Shockley's company near Stanford](#). (Above).

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode



THE SHOCKLEY 4-LAYER BISTABLE TRANSISTOR DIODE

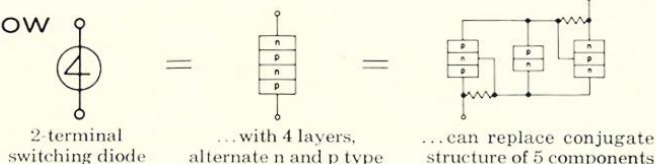
See it demonstrated during WESCON... in a typical bistable circuit... in a ring counter application. Let us demonstrate and discuss the application of this new npnp silicon switch in your circuits.

SHOCKLEY SUITE
BILTMORE HOTEL
Los Angeles

Shockley
Transistor Corporation

SHOCKLEY 4-LAYER TRANSISTOR DIODE* SIMPLIFIES SWITCHING CIRCUITRY FOR COMPUTERS, TELEPHONY, CONTROL

HERE'S HOW



RANGE OF CHARACTERISTICS

V_b (breakdown voltage) . . . 20-100v
 I_b (breakdown current) . . . < 500 μ a
 V_h (holding voltage) . . . < 2V
 I_h (holding current) . . . < 50 ma

R_h ("on" resistance) . . . < 20 ohms
 (from 1—3 amps., voltage < 1 volt
 plus 0.2 to 1.5 ohms times current)
 Dissipation . . . \approx 100 mw
 Time to close . . . < 0.1 μ sec
 Time to open . . . < 0.2 μ sec

STANDARD TYPES AVAILABLE FOR DELIVERY NOW

No.	V_b Volts	I_b μ a	V_h Volts	I_h ma	R_h ohms
4N20D	20 \pm 5	< 500	< 2	< 50	< 10
4N30D	30 \pm 5	< 500	< 2	< 50	< 10
4N40D	40 \pm 5	< 500	< 2	< 50	< 10
4N50D	50 \pm 5	< 500	< 2	< 50	< 10

ENGINEERING DATA AND ASSISTANCE

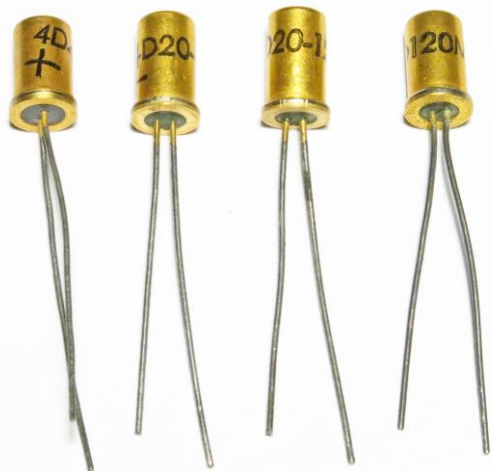
Our engineering staff, under the direction of Dr. William Shockley, will undertake circuit problems in typical applications such as: sawtooth oscillators, pulse generators, bistable circuits, ring counters and various switching functions. Special types of transistor diodes are being developed to individual specifications. Technical information on request. Write to Dept. 1A-718.

**Invented at Bell Telephone Laboratories.*

Shockley Transistor Corporation

1117 California Avenue, Palo Alto, Calif.

A SUBSIDIARY OF BECKMAN INSTRUMENTS, INC.



Shockley Announces a Revolutionary New Device at 1960 WESCON

The image shown above left is an excerpt of the [formal announcement](#) of the availability of "The Shockley 4-Layer Bistable Transistor Diode" from the Shockley Transistor Corporation. This announcement, with the associated technical demonstration and offer to discuss the applications of this device, was clearly directed at the potential for sales. This was a very important time frame for the semiconductor industry with the simultaneous announcement by Fairchild at the 1960 WESCON of the revolutionary [2N1613 planar transistor](#). At above right is a section of a 1958 ad documenting primary technical specifications for the Shockley diode (images [Courtesy of Science History Institute](#)). As shown in the ad, important performance characteristics include "breakdown voltage and current" which determine the electrical state at which the diode "fires" and conducts with very low resistance, and "holding voltage and current" which determine the electrical conditions required to maintain the "on" state. Shockley diodes were typically labelled with the "breakdown voltage", so for example the 4N20D has a 20 volt "firing voltage". Some of these diodes are also labelled with additional performance parameters, such as holding current. The four Shockley diodes shown at left illustrate the type included in this Preservation Collection and are from the first days of Shockley production. These are labelled with type numbers such as "4D20" or similar.

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode

PRICE LIST PL-1

September, 1958

SHOCKLEY 4-LAYER TRANSISTOR DIODE



Actual Size

Standard devices now being manufactured in production quantities are those with breakdown voltages between 20 and 50 volts.

Present production makes possible the following prices, superseding all prices previously quoted.

QUANTITY	UNIT PRICE
1 - 24	\$8.00
25 - 99	6.00
100 - 500	5.50

Prices for larger quantities on request.

CHARACTERISTICS OF STANDARD DEVICES

No.	V_b Volts	I_b μa	V_h Volts	I_h ma	R_h ohms
4N20D	20 ± 5	<500	<2	<50	<10
4N30D	30 ± 5	<500	<2	<50	<10
4N40D	40 ± 5	<500	<2	<50	<10
4N50D	50 ± 5	<500	<2	<50	<10
4N20-50DL	As above, and <4v drop for 3-amp pulse				

For applications requiring more specific limits, please request information.

SPECIAL DEVICES: In addition to the standard types, there are available sample quantities of devices with breakdown voltages in the range of 80v, 110v, and 200v. Other characteristics are the same as standard devices.

TERMS: Net 30 days; f. o. b. destination

DELIVERY: Within 30 days

SHOCKLEY TRANSISTOR CORPORATION

A subsidiary of Beckman Instruments, Inc.

Stanford Industrial Park

Palo Alto, California

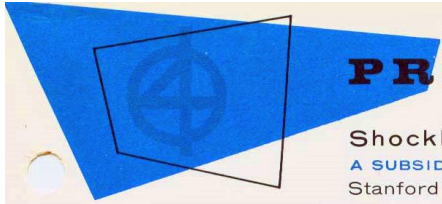
Shockley Transistor Corporation First Price List - September 1958

Development work on the early Shockley 4-layer diodes was started in mid-late 1957 at the newly updated [Beckman "Spinco"](#) building located in the Stanford Industrial Park in Palo Alto. These first devices were difficult to manufacture, and initial production quantities were low ([72 units up to 200 good PNP diodes per week](#)). Within the year, Shockley production quantities apparently had increased sufficiently to support commercial sales in "production quantities", as noted in the above 1958 price list (PL-1 = Price List 1). Note the \$8 per unit price is equivalent to approx. \$87 in 2024. The "Type D" model was the only type available initially, with "firing voltages" selected by testing and stamped on each device. This was a very challenging time for Shockley, with the September departure of the ["Traitorous Eight"](#) group of key scientists who jointly resigned from Shockley and soon started Fairchild Semiconductor. Much [has been written](#) about the impact of these events on Silicon Valley history.

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode



PRICE LIST

Shockley Transistor Corporation
A SUBSIDIARY OF BECKMAN INSTRUMENTS, INC.
Stanford Industrial Park • Palo Alto, California

SHOCKLEY
Effective November 15, 1959
PL-4

TYPE D - 4-layer diodes (silicon) for 2 amp. pulse current

STANDARD				MIL - LINE (for military requirements)			
TYPE	V _s (volts)	I _h (milliamperes)	Unit Price (all types)	TYPE	V _s (volts)	I _h (milliamperes)	Unit Price (all types)
4D20-3	20 ± 4	1-6	1-24 \$8.00	4D20M-3	20 ± 4	1-6	1-24 \$9.00
4D20-12	20 ± 4	5-20		4D20M-12	20 ± 4	5-20	
4D20-30	20 ± 4	20-45		4D20M-30	20 ± 4	20-45	
4D30-3	30 ± 4	1-6	25-99 \$6.00	4D30M-3	30 ± 4	1-6	25-99 \$8.10
4D30-12	30 ± 4	5-20		4D30M-12	30 ± 4	5-20	
4D30-30	30 ± 4	20-45		4D30M-30	30 ± 4	20-45	
4D40-3	40 ± 4	1-6	100-499 \$5.00	4D40M-3	40 ± 4	1-6	100-499 \$6.90
4D40-12	40 ± 4	5-20		4D40M-12	40 ± 4	5-20	
4D40-30	40 ± 4	20-45		4D40M-30	40 ± 4	20-45	
4D50-3	50 ± 4	1-6	500-2000 \$4.00	4D50M-3	50 ± 4	1-6	500-2000 \$5.80
4D50-12	50 ± 4	5-20		4D50M-12	50 ± 4	5-20	
4D50-30	50 ± 4	20-45		4D50M-30	50 ± 4	20-45	
4D80-3	80 ± 8	1-6		4D80M-3	80 ± 8	1-6	
4D80-7	80 ± 8	5-10		4D80M-7	80 ± 8	5-10	
4D120-3	120 ± 12	1-6		4D120M-3	120 ± 12	1-6	
4D200-3	200 ± 20	1-6		4D200M-3	200 ± 20	1-6	

TYPE AD & J - 4-layer diodes (silicon) for 20 amp. pulse current

STANDARD				MIL - LINE (for military requirements)			
TYPE	V _s (volts)	I _h (milliamperes)	Unit Price (all types)	TYPE	V _s (volts)	I _h (milliamperes)	Unit Price (all types)
4AD20-5	20 ± 4	1-10	1-24 \$15.00	4AD20M-5	20 ± 4	1-10	1-24 \$16.00
4AD20-20	20 ± 4	10-30		4AD20M-20	20 ± 4	10-30	
4AD30-5	30 ± 4	1-10	25-99 \$12.00	4AD30M-5	30 ± 4	1-10	25-99 \$15.00
4AD30-20	30 ± 4	10-30		4AD30M-20	30 ± 4	10-30	
4AD40-5	40 ± 4	1-10	100-499 \$11.00	4AD40M-5	40 ± 4	1-10	100-499 \$14.00
4AD40-20	40 ± 4	10-30		4AD40M-20	40 ± 4	10-30	
4AD50-5	50 ± 4	1-10	500-2000 \$10.00	4AD50M-5	50 ± 4	1-10	500-2000 \$12.00
4AD50-20	50 ± 4	10-30		4AD50M-20	50 ± 4	10-30	
4J200-5	200 ± 20	1-10		4J200M-5	200 ± 20	1-10	

TYPE G - 4-layer diodes (silicon) for 100 amp. pulse current

STANDARD (for both standard and military requirements)			
TYPE	V _s (volts)	I _h (milliamperes)	Unit Price (all types)
4G50	50 ± 4	1-50	1-24 \$40.00
			25-99 \$32.00
4G100	100 ± 10	1-50	100-499 \$25.00
4G200	200 ± 20	1-50	500-2000 \$20.00

NOTES:

1. For 4-layer diodes with a switching voltage (V_s) other than standard (e.g., V_s = 25 volts), add 10%.
2. For 4-layer diodes with a switching voltage (V_s) tolerance of half of the standard tolerance, add 10%. (e.g., 40 ± 2)
3. For 4-layer diodes with a holding current (I_h) tolerance of half of the standard tolerance, add 10%. (e.g., 1-3 ma)
4. For 4-layer diodes with a switching voltage (V_s) tolerance of half of the standard and a holding current tolerance (I_h) of half of the standard, add 20%.
5. 4-layer diodes to meet special tests available upon quotation.
6. Prices available upon request for quantities larger than shown above.
7. All prices subject to change without notice.
8. Terms: Net 30 days. F.O.B. - Palo Alto, California.
9. All sales subject to Shockley warranty and terms and conditions of sale.

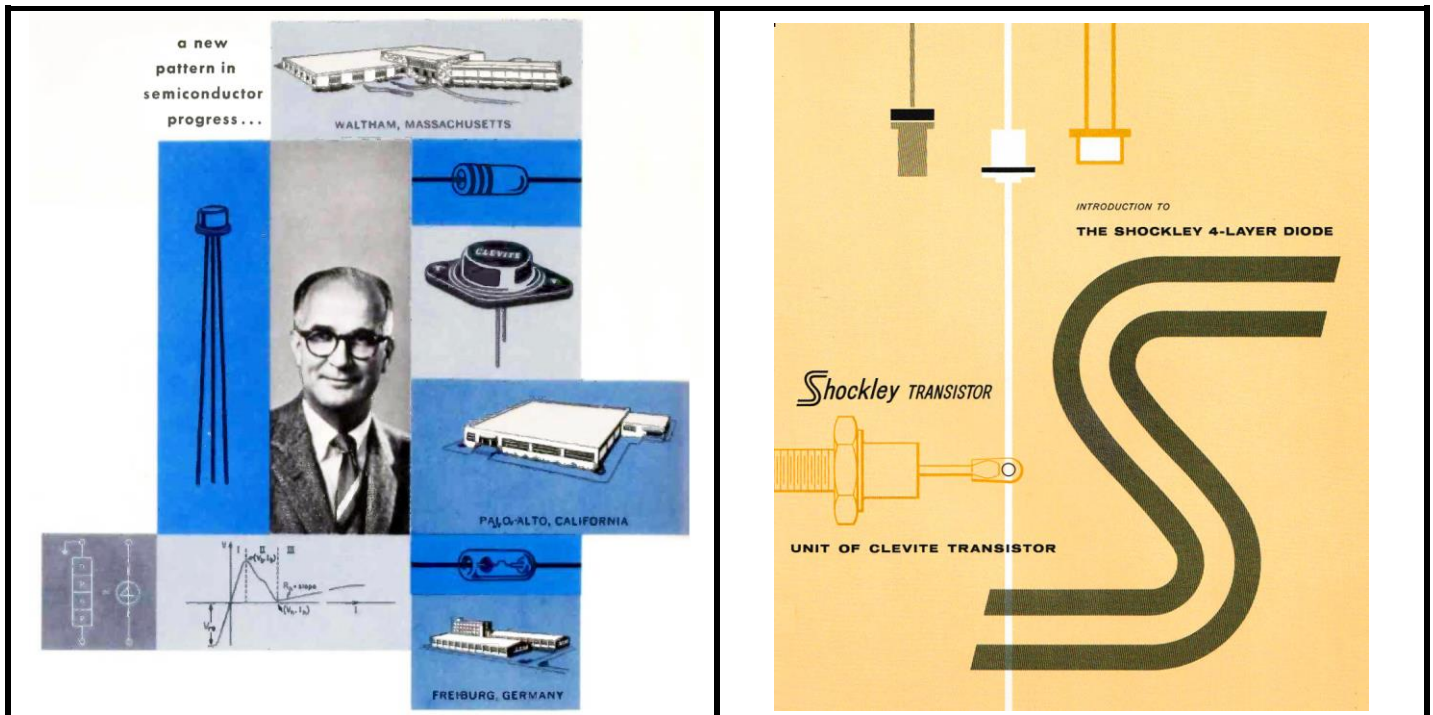
Shockley Transistor Corporation Price List #4 - November 1959

By November 1958 Shockley's product line had expanded beyond the original Type D model. As shown above in PL-4, three additional case styles were added within the first year of commercial sales - these are (1) [Type AD](#), (2) [Type J](#) and (3) [Type G](#).

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode



SHOCKLEY TRANSISTOR JOINS CLEVITE

In keeping with its program of advancement in semiconductors, Clevite has acquired the Shockley Transistor Corporation of Palo Alto, California.

Dr. William Shockley, noted solid state physicist and co-winner of the 1956 Nobel Prize for his work in the development of the transistor, joins Clevite, together with his research and development organization.

NEW PRODUCTS

In addition to Clevite Transistor's broad line of diodes and transistors, the corporation now offers to the industry Shockley devices which represent new advances in the semiconductor art. The Shockley 4-layer diode is a nearly ideal switch for pulse generation, pulse counting and high

power switching in such applications as computers, telephone and control circuits. A new plant in Palo Alto, California, is underway to fill the growing demand for these new devices.

NEW PLANTS

Besides the new plant for the Shockley organization in California, Clevite Transistor is nearing completion of its new \$4,000,000 Waltham, Massachusetts facility which will employ 2,000 people. The present Waltham plant will continue as a supplementary operation. Clevite's overseas operation, Intermetall G.m.b.H., now employs 1,000 people in a new plant at Freiburg, West Germany to serve the European market.

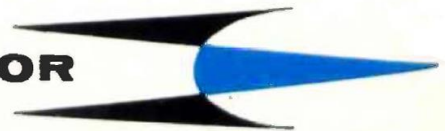
To find out more about our progress and our products, write:



Reliability In Volume . . .

CLEVITE TRANSISTOR

254 Crescent Street Waltham 54, Mass. Tel: TWinbrook 4-9330



SHOCKLEY TRANSISTOR UNIT - STANFORD INDUSTRIAL PARK, PALO ALTO, CALIFORNIA

Shockley Transistor is Sold to Clevite Corp

Shockley's pioneering company was founded in the mid-1950s and was active for five years until 1960 when the company was sold to [the Clevite Corp](#). The [scans above](#) highlight the potential importance of the Shockley sale, indicating "New Products" and "New Plants" for the development and manufacture of Shockley diodes - note the mention of Clevite sites in [Germany](#) and [Massachusetts](#). The unique and historic events leading to this sale of Shockley Transistor Corp has been documented in a number of excellent references including [Crystal Fire](#), [The Will to Think](#), and multiple [Computer History Museum](#) articles.

Transistor Museum™ Preservation Collection

Historic Semiconductor Fact Sheet

The Shockley 4-Layer Bistable Transistor Diode



Shockley Diodes from the 1950s/60s

[Shockley's first production units](#) from the late 1950s were metal-cased types. The leftmost device above is the Type D and was the first commercial Shockley type, available from Sept 1958. Other metal-cased types became available in 1959, including the Type AD shown 2nd from left. These case types were based on standards that had been established throughout the industry and were already in use for transistors and diodes manufactured by other companies. Beginning in the early 1960s and coinciding with the acquisition of Shockley Transistor by Clevite, small glass-cased types were introduced - the two white units at center above are examples. This case style was designated "E". Note the 4E30 model number: ("4" = 4-layer diode, "E" = glass case style and "30" = breakdown voltage. Clevite was a major producer of conventional germanium and silicon diodes using this same glass case technology and was able to ramp [up production quickly](#). Note the "S" stamped on the white unit third from left. This is an indication of very early production just after the Clevite acquisition. "S" = Shockley. Later units were identical, except the "S" was replaced with "C" for Clevite. The red "Clevite Transistor Palo Alto Plant" tape strip is typical for bulk packaging of strings of the "E" style devices. The larger metal stud device at far right is a "J" case style, which also was an industry case style standard. The type shown is a 4J50 which was manufactured by ITT, after their takeover of [Clevite in 1965](#). The small black unit shown is from the mid-1960s and was produced by Western Semiconductor, a relatively unknown west coast "second source" supplier.

YOU CAN COUNT ON 4-LAYER DIODES

For counting pulses...for timing...for digital read-out. The diagram shows one of several simplified ring counter circuits using Shockley 4-layer diodes. This silicon semiconductor switch is the key to circuit versatility. Apply appropriate resistors and capacitors, and speeds from less than one pulse per second to several hundred thousand per second may be obtained. At each stage enough power can be handled to operate signal lamps, enough voltage can be supplied to operate Nixie Tubes.

When broad temperature ranges and tough environmental conditions must be met, the MIL-LINE diode is available. Standard commercial 4-layer diodes are suggested for low cost, non-military applications. If your circuits involve ring counters, consider Shockley 4-layer diodes for faster, more dependable operation. For application notes on ring counters, how to make flip-flops, drive relays, convert DC to AC, pulse magnetrons, or for suggestions about the use of 4-layer diodes in the circuit you are developing now...call or write your local Shockley representative or write Dept. 12-2.

Shockley TRANSISTOR
UNIT OF CLEVITE TRANSISTOR
STANFORD INDUSTRIAL PARK, PALO ALTO, CALIF.

CLEVITE CORPORATION

ITT SEMICONDUCTORS

TYPE E 4E20 - 4E200
COMMERCIAL SERIES DIODE THYRISTORS
Package: DO-7

4-LAYER DIODE THYRISTORS

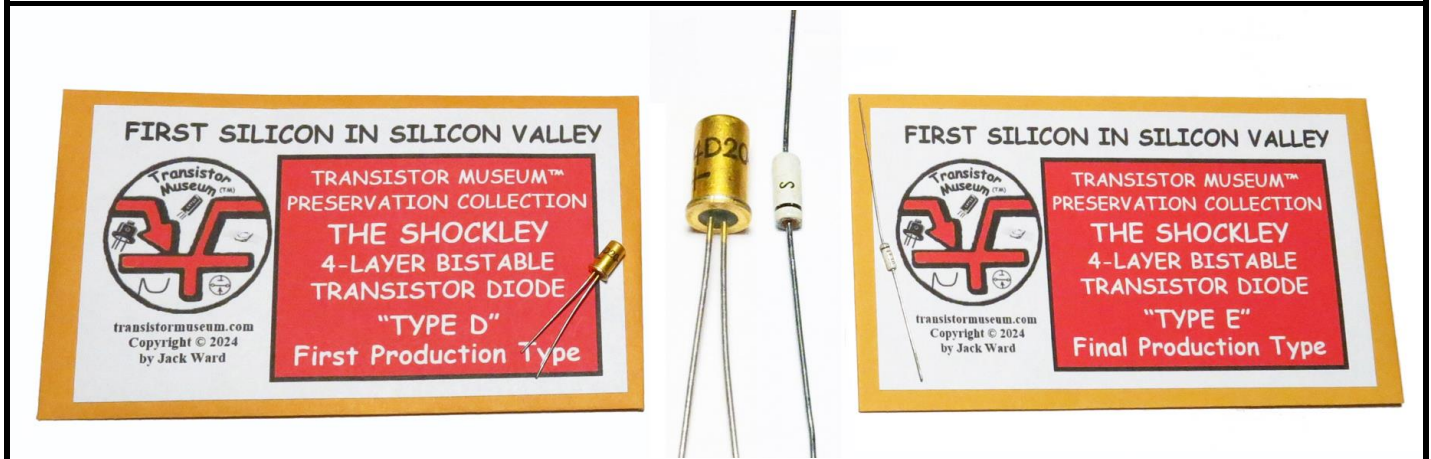
- Firing Voltages 20 to 200 volts
- Switching current <125 μ A @ 25°C
- ON resistance <2 Ω @ 70mA

The ITT diode thyristor is a reliable negative resistance device designed for use in switching circuits. Typical applications include ring counters, matrixes, pulse generators, relay drivers, multi-vibrators, pulse modulators, and timing circuits.

Shockley, Clevite and ITT

Clevite was very quick to promote the 4-layer diode technology acquired from Shockley Transistor in 1960. The "You can Count on 4-layer Diodes" is a [1960 industry ad](#) with prominent Clevite ownership noted. Clevite introduced the less expensive glass-cased Type E, but also continued to manufacture all Shockley models. ITT continued the complete product line after their purchase of Clevite in 1965, but began identifying the original Shockley diode technology as "4-Layer diode Thyristors", as shown in the scan above from a [1974 ITT catalogue](#).

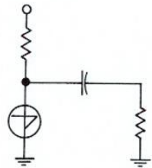
Transistor Museum™ Preservation Collection Historic Semiconductor Fact Sheet The Shockley 4-Layer Bistable Transistor Diode



What's Included in this Shockley 4-Layer Transistor Diode Historic Preservation Collection
 This preservation collection contains two historic 1950s/60s Shockley 4-Layer Bistable Transistor Diodes of the types shown above. At left is a rare metal-cased "Type D" which was the first Shockley production type, available commercially in 1958. At right is a glass-cased "Type E", which was the final Shockley production type - this type became available in 1960 when Shockley Transistor Corporation was acquired by Clevite Transistor. An enlarged view of each type is shown at center in the photo above. These are rare historic semiconductors that accurately represent the "First Silicon in Silicon Valley". Both of these Shockley devices are provided in individual Transistor Museum identification envelopes.

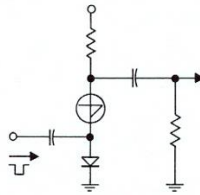
SHOCKLEY 4-LAYER DIODE CIRCUIT APPLICATIONS

SAWTOOTH OSCILLATOR



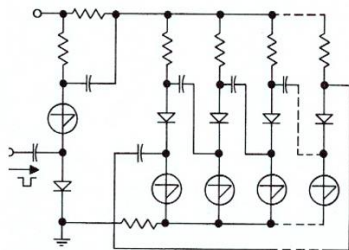
For oscillator, sweep generator, time delay and timing circuits.

PULSE GENERATOR



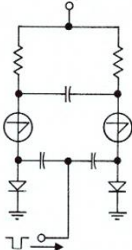
For generating or amplifying pulses and for triggering thyristors or squibs.

RING COUNTER



For logic and frequency divider circuits providing direct decimal readout. Write for Data Sheets: 10,001-A, 10,002-A, 10,003

FLIP-FLOP CIRCUIT



For free-running and one-shot multivibrators, flip-flops and square wave generators. Write for Data Sheet AD-6

Shockley Diode Circuits and Application

The above circuit applications are scanned from a 1961 "Shockley Transistor Unit of Clevite Transistor" technical packet that provides comprehensive specifications and applications information. Although seemingly flexible and adaptable to multiple applications, Shockley's famous PNP diode did not achieve commercial success. Related technologies are still in commercial use, including the [Diac](#), [SCR](#) and [Thyristor](#). Remaining Shockley diodes are historic and rare.