MAGNETIC CORE COMPONENTS

For The Electronics Industry

AD-174

SPRAGUE ELECTRIC COMPANY

NORTH ADAMS, MASSACHUSETTS

SPRAGUE the mark of reliability

Engineering Bulletin

No. 9000

SUPERSEDES No. 550C

May, 1957

Core-Diode Type

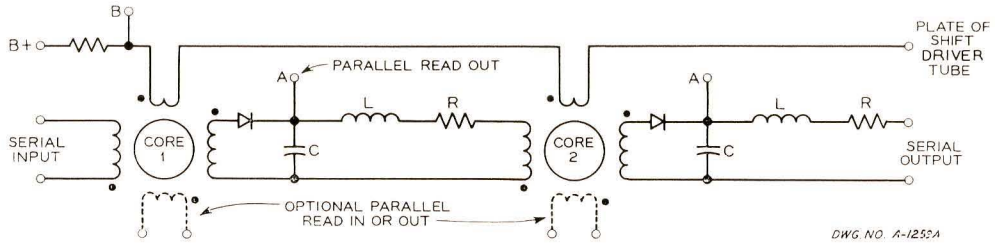
MAGNETIC SHIFT REGISTER ASSEMBLIES

MAGNETIC SHIFT REGISTERS consist of a number of square loop magnetic cores connected so that digital information may be logically shifted from one core to the next by the shift current pulse. The general circuit is shown below.

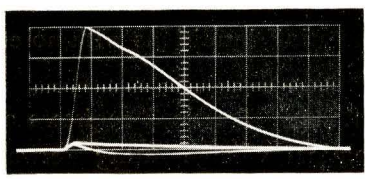
Information storage in a core is accomplished by arbitrarily associating the numbers 0 and 1 with the two residual magnetic states inherent in square BH curve types of magnetic material. With the application of a shift pulse, all cores are switched to the *zero* state. If a pulse is now applied to the input winding of core 1 this core will change to the *one* state and will be stored until such time as the shift pulse is again applied. As the shift pulse is applied core 1 returns to the *zero* state producing a large flux change which results in a voltage appearing at the output winding of core 1. This voltage causes current to flow through the diode and charges capacitor C.

After the shift pulse is completed the capacitor discharges through the pulse forming inductance and resistance causing current to flow in the input winding of core 2 switching it to the *one* state. In this manner *one* signals may be transferred down long lines of cores with no effective attenuation. The *zero* signal may be transferred from one core to another since there is no large flux change in the output winding and, hence, the next core receives no input signal. The ratio the *one* signal to the *zero* signal is an important measure of the electrical performance of the register and should be as large as possible.

Sprague offers single and multiple stage register assemblies with read and write provisions to meet individual system requirements. All units employ high reliability components ruggedly assembled for long service. Semi-conductor diodes may be externally connected between suitably spaced terminals or permanently packaged as an integral component of each assembly.



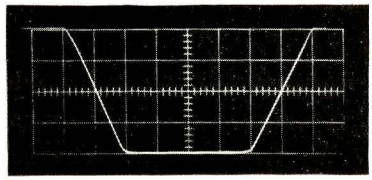
GENERAL CIRCUIT FOR CORE-DIODE TYPE MAGNETIC SHIFT REGISTERS



Parallel Read-Out Signal at A

OSCILLOGRAMS FOR A TYPICAL CORE-DIODE TYPE MAGNETIC SHIFT REGISTER

Scale:
5 μsec/division
1.25 volts/division



Shift Current Pulse at B

Scale:
100 ma/division
1 μsec/division

SPECIAL PRODUCTS DIVISION
SPRAGUE ELECTRIC COMPANY • North Adams, Massachusetts

Sprague core-diode type shift register assemblies are offered in a variety of package designs which have been developed to be compatible with all modern wiring techniques and equipment construction. Two general application groups have been recognized in the various package designs — ground and airborne equipments. The ground equipment packages are available in hermetically sealed corrosion-resistant metal cases with glass-to-metal solder-seal terminals for extreme humidity resistance and are also manufactured as plastic-embedded assemblies for moderate environmental conditions. For lower costs, assemblies can be packaged in an epoxy-dipped configuration.

The airborne package is a premium assembly of the smallest possible volume.

All units employ high reliability components assembled together to assure ruggedness and long life. Semi-conductor diodes may be externally connected between suitably spaced terminals or, in special designs, permanently packaged as an integral component of each assembly.

All Sprague shift register cores are subjected to rigid switching tests which carefully control the basic parameters important to reliable operation in the final circuit application. Finished assemblies are 100% pulse performance tested to insure uniformity and to maintain engineering specifications.

Further information on Sprague's production procedures will be found in the paper entitled "Quality Control of Magnetic Sub-Assemblies", which appeared in the Proceedings of the 1956 Electronic Components Symposium. Reprints of this paper may be obtained on letterhead request to the Technical Literature Section, Sprague Electric Company, North Adams, Mass.

Performance and operating details for representative units are given in various Sprague engineering data sheets. In addition to these single bit registers, numerous other assemblies have been custom engineered and, in some cases, have been manufactured on a confidential basis in accordance with a customer's own circuit design.

GENERAL PERFORMANCE CHARACTERISTICS

All assemblies are manufactured to the following general specifications:

1. Operating Temperature. The standard series of magnetic shift registers may be operated between —55 C and+85 C except where limited by the semi-conductor diodes.

2. Humidity Resistance. Hermetically-sealed units meet applicable requirements of military specification MIL-T-27 for transformers. The resin-embedded units will meet more moderate specifications.

3. Insulation Resistance. The minimum insulation resistance between electrically isolated terminals and between terminal and case shall be 20,000 megohms at 25 C when measured at 180 volts d-c.

4. Life Tests. All individual components employed will meet appropriate life tests at one and a half times peak operating conditions with no evidence of deterioration.

5. D-C Voltage Rating. Standard registers are designed for a nominal voltage rating between windings of 400 volts d-c. Special designs are available for higher actual working voltages.

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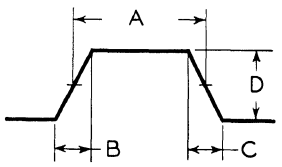
Definitions of

PARAMETERS AND CHARACTERISTIC TERMS USED IN CONNECTION WITH MAGNETIC SHIFT REGISTERS

SHIFT PULSE

The shift or advance pulse is derived from the driver stage which is a pulse current source, and which provides the energy for operating the magnetic system. The general wave shape of the shift pulse is shown below:

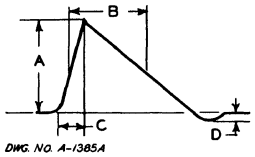


DWG. NO. A-1098B

A = Half Amplitude Pulse Width–microseconds
B = Rise Time (10% to 90%) – microseconds
C = Fall Time (10% to 90%) – microseconds
D = Amplitude–milliamperes

PARALLEL OUTPUT PULSE

The parallel output pulse is the pulse voltage developed across the capacitor as the result of applying a shift pulse to a core containing a *one*. The general wave shape is shown below:



DWG. NO. A-1385A

A = Amplitude–volts
B = Half Amplitude Pulse Width – microseconds
C = Rise Time (10% to 90%) – microseconds
D = Undershoot – volts

The load impedance is defined as the smallest resistive load which may be connected across the parallel output terminals (across the capacitor) without modifying the output signal or the tolerance curve.

INPUT PULSE

The input pulse sets a core to the *one* state. This input is used to introduce serial information into the shift register. The pulse shape is not critical but should have the time average amplitude as stated in the required interval. The input pulse may be larger in amplitude over a shorter period of time or vice versa, as long as the core is fully set to the *one* state before the shift pulse occurs. The nominal value is stated in each case. The input terminals present a low impedance load.

PEAK PULSE POWER

This term describes the maximum peak pulse power required to transfer a *one* from one core to another and is defined as the product of the peak voltage developed across a single shift winding and the peak amplitude of the shift pulse current.

SPRAGUE ELECTRIC COMPANY

North Adams, Massachusetts

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MAKERS OF RELIABLE ELECTRONIC COMPONENTS

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

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E-3-59

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September, 1957

PART NUMBERING SYSTEM FOR CORE-DIODE TYPE MAGNETIC SHIFT REGISTERS

ALWAYS SPECIFY BY COMPLETE CATALOG NUMBER, SUCH AS:

80Z 8 B 2 1

1 — VOLTAGE SIGNAL LEVEL.

Voltage Level Code

1 = 4 volts
2 = 10 volts
3 = 15 volts
4 = 20 volts
5 = 30 volts

2 — REPETITION RATE.

Repetition Rate Code

1 = 0-1 kc
2 = 0-25 kc
3 = 0-100 kc
4 = 0-200 kc
5 = 0-500 kc

B — TYPE OF TERMINAL: A = Press Lead; B = Wire Pin; C = Turret Lug; F = Wire Lead
D = Lug-Type Glass-to-Metal Solder Seal; E = Miniature Tube Pin

8 — NUMBER OF TERMINALS: 8, 9, or 10.

The number of terminals is determined by the schematic diagram. Standard schematic drawings are shown on page 2.

80Z — SPRAGUE PACKAGE TYPE.

Electrical performance characteristics are given in the applicable Engineering Data Sheets. Only those shown are available as standard items.

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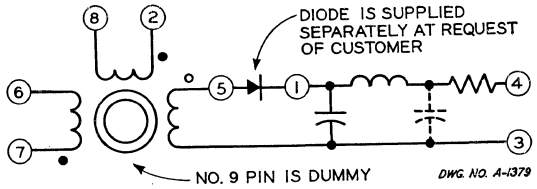
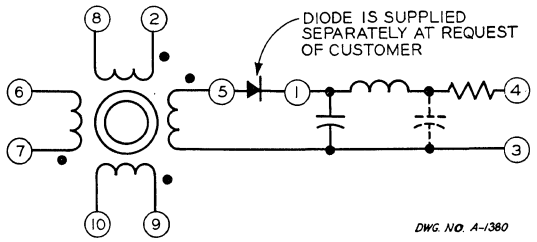
SPRAGUE ELECTRIC COMPANY • North Adams, Massachusetts

STANDARD SCHEMATIC DRAWINGS

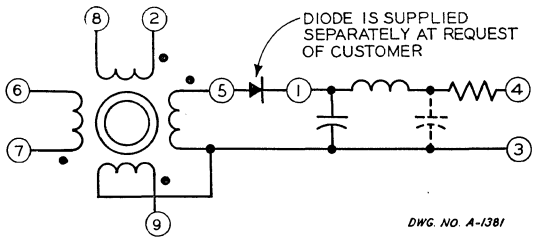


WITHOUT EXTRA WINDING

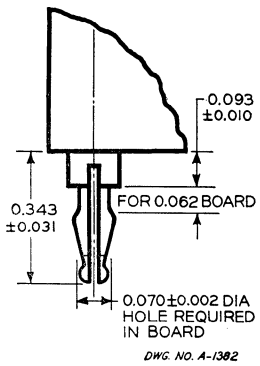


WITH EXTRA WINDING

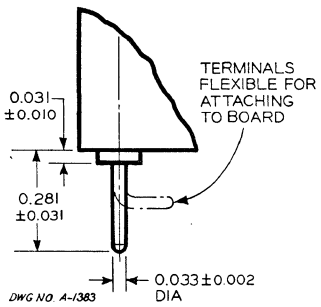
WHEN EXTRA WINDING IS REQUIRED WITH PLUG-IN PACKAGES 86Z AND 91Z, THE FOLLOWING SCHEMATIC APPLIES:



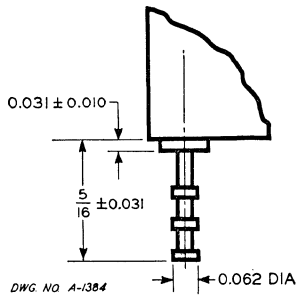
TYPES OF TERMINALS



STYLE A—Press Lead



STYLE B—Wire Pin



STYLE C—Turret Lug

STYLE D = Solder-lug with hole used on glass-to-metal solder-seal terminals.
STYLE E = Standard JETEC Miniature Tube Pin.
STYLE F = Wire Lead.

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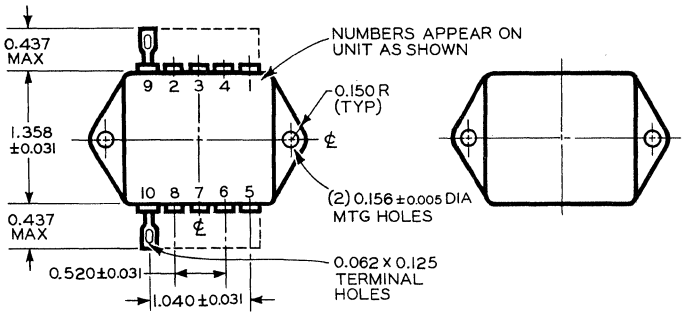
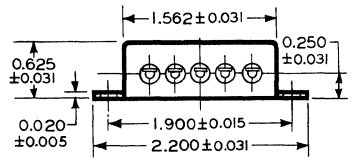
MAGNETIC SHIFT REGISTERS

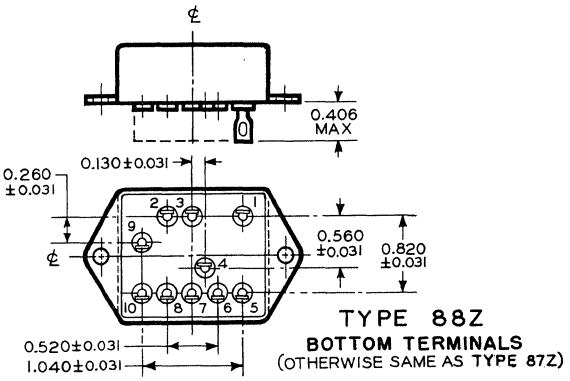
STANDARD MECHANICAL CONFIGURATIONS FOR METAL-ENCASED, HERMETICALLY SEALED MAGNETIC SHIFT REGISTERS





TYPE 87Z
SIDE TERMINALS

WHEN ONLY 8 TERMINALS ARE REQUIRED, TERMINALS 9 AND 10 ARE OMITTED



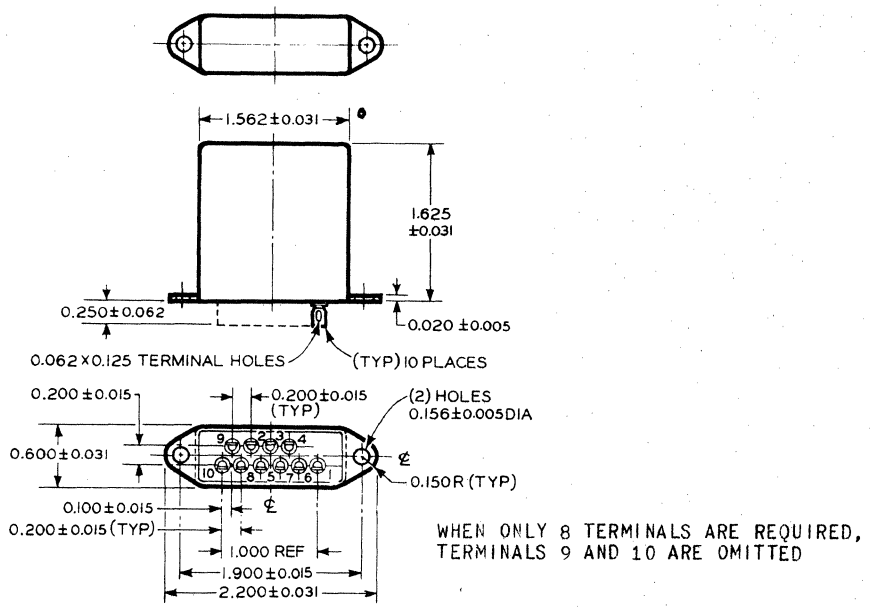
TYPE 88Z
BOTTOM TERMINALS
(OTHERWISE SAME AS TYPE 87Z)

TYPE 87Z AND 88Z
Horizontal Type, Chassis Mounting
Available Only With Style D Terminals

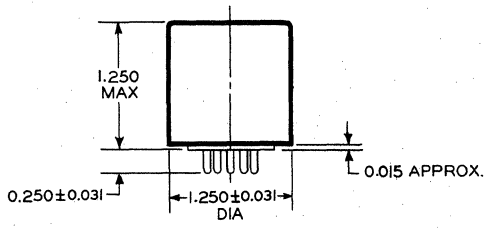
Tolerance on dimensions ±.010 unless otherwise specified.

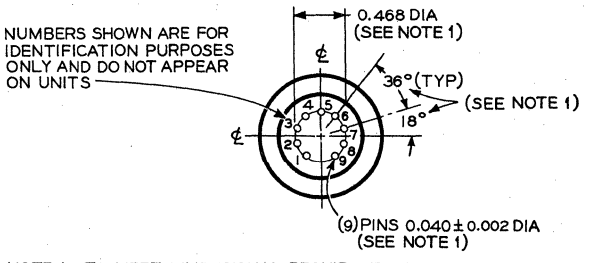
SPRAGUE ENGINEERING DATA SHEET 9020

MAGNETIC SHIFT REGISTERS



TYPE 89Z
Vertical Type, Chassis Mounting
Available Only With Style D Terminals





NOTE 1: TO MEET DIMENSIONAL REQUIREMENTS OF RETMA STANDARD (9) PIN MINIATURE TUBE BASE (E9-1)

TYPE 90Z AND 91Z
9-Pin Plug-In Type, Socket Mounting
Available Only With Style E Terminals

Type 90Z without extra winding
Type 91Z with extra winding

Tolerance on dimensions ±.005 unless otherwise specified.

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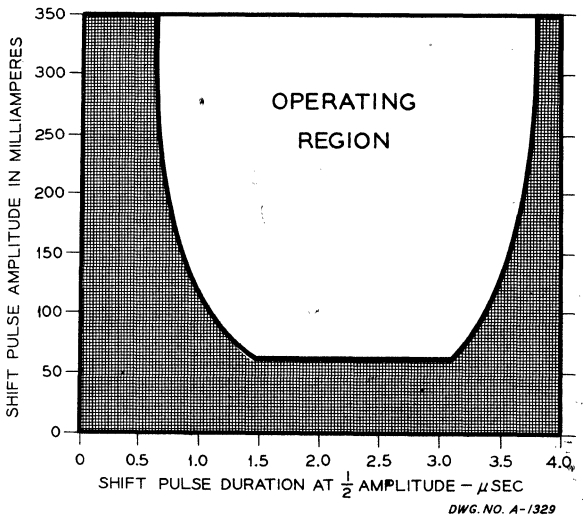
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9121

NOMINAL PERFORMANCE CHARACTERISTICS OF 100 KC, 4 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-100 kc
Recommended	0-90 kc
Shift Pulse	
Nominal Operating Current	140 ma
Voltage Drop per Stage	8.0 volts
Duration (at half amplitude)	2.0 μsec
Rise time	0.8 μsec
Fall time	0.8 μsec
Peak Pulse Power	1.12 watts
Input Pulse	
Amplitude	15 ma
Duration	3.0 μsec
Parallel Output Pulse	
Amplitude	5 volts
Ratio	8:1 min
Load Impedance (Minimum)	1800 ohms
Diode	
Type	T-7 or equiv.



DWG. NO. A-1329

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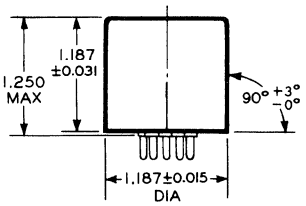
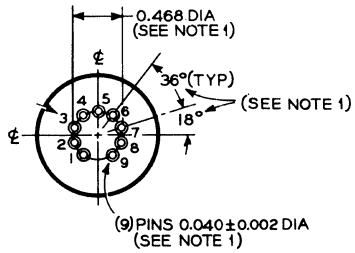




NOTE 1: TO MEET DIMENSIONAL REQUIREMENTS OF RETMA STANDARD (9) PIN MINIATURE TUBE BASE (E9-1)

TYPE 85Z AND 86Z
9-Pin Plug-in Type, Socket Mounting and for Mounting on Printed Wiring Boards
Style E Terminals

Type 85Z without extra winding
Type 86Z with extra winding

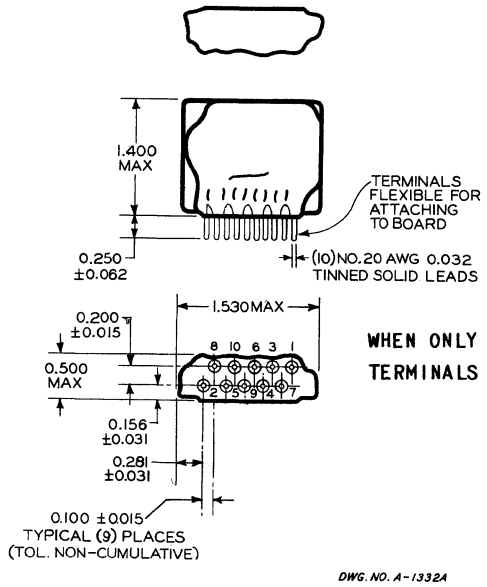
SPRAGUE ENGINEERING DATA SHEET 9021

MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9022A

STANDARD MECHANICAL CONFIGURATIONS FOR RESIN-DIPPED MAGNETIC SHIFT REGISTERS



TYPE 92Z

Vertical Type for Mounting on Printed Wiring Boards

SPRAGUE ENGINEERING DATA SHEET 9022A

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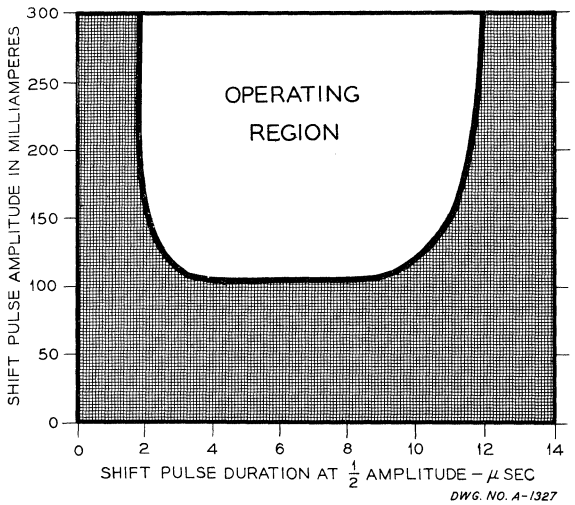
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9113

NOMINAL PERFORMANCE CHARACTERISTICS OF 25 KC, 15 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-25 kc
Recommended	0-20 kc
Shift Pulse	
Nominal Operating Current	250 ma
Voltage Drop per Stage	6.0 volts
Duration (at half amplitude)	6.0 μsec
Rise time	1.8 μsec
Fall time	1.8 μsec
Peak Pulse Power	1.5 watts
Input Pulse	
Amplitude	10 ma
Duration	10 μsec
Parallel Output Pulse	
Amplitude	16 volts
Ratio	8:1 min
Load Impedance (Minimum)	6000 ohms
Diode	
Type	T-7 or equiv.



DWG. NO. A-1327

SPRAGUE ENGINEERING DATA SHEET 9113

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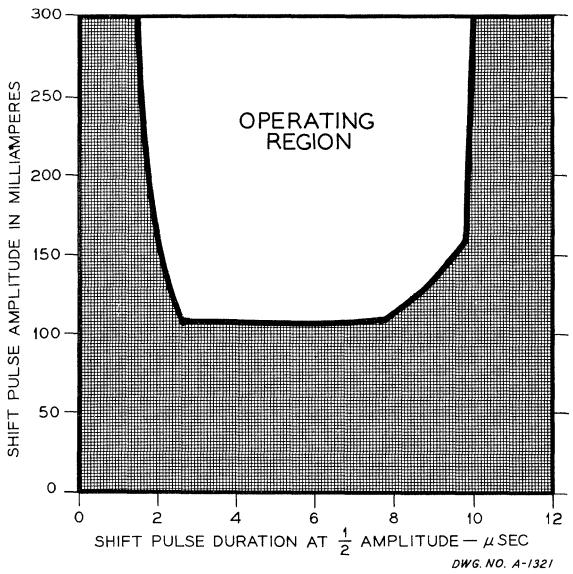
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9115

NOMINAL PERFORMANCE CHARACTERISTICS OF 25 KC, 30 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-25 kc
Recommended	0-20 kc
Shift Pulse	
Nominal Operating Current	200 ma
Voltage Drop per Stage	8 volts
Duration (at half amplitude)	5.8 μsec
Rise time	1.8 μsec
Fall time	0.9 μsec
Peak Pulse Power	1.6 watts
Input Pulse	
Amplitude	5 ma
Duration	10 μsec
Parallel Output Pulse	
Amplitude	32 volts
Ratio	8:1 min
Load Impedance (Minimum)	25,000 ohms
Diode	
Type	T-7 or equiv.



SPRAGUE ENGINEERING DATA SHEET 9115

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SPRAGUE

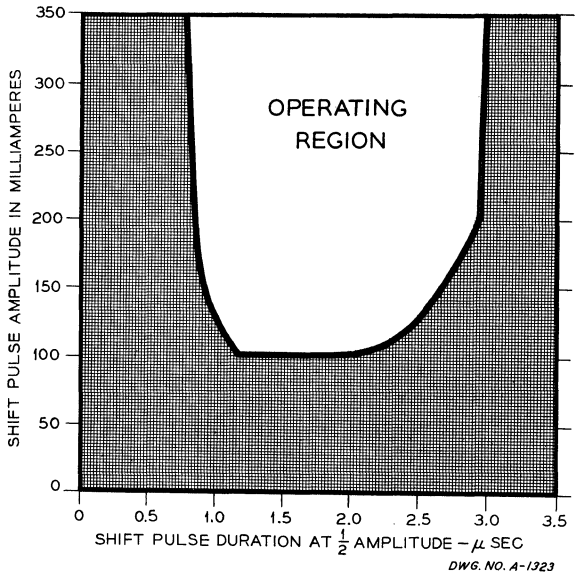
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9123

NOMINAL PERFORMANCE CHARACTERISTICS OF 100 KC, 15 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-100 kc
Recommended	0-90 kc
Shift Pulse	
Nominal Operating Current	220 ma
Voltage Drop per Stage	10 volts
Duration (at half amplitude)	2.0 μsec
Rise time	0.8 μsec
Fall time	0.8 μsec
Peak Pulse Power	2 watts
Input Pulse	
Amplitude	10 ma
Duration	3 μsec
Parallel Output Pulse	
Amplitude	16 volts
Ratio	8:1 min
Load Impedance (Minimum)	25,000 ohms
Diode	
Type	T-7 or equiv.



DWG. NO. A-1323

SPRAGUE ENGINEERING DATA SHEET 9123

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Engineering Data Sheet

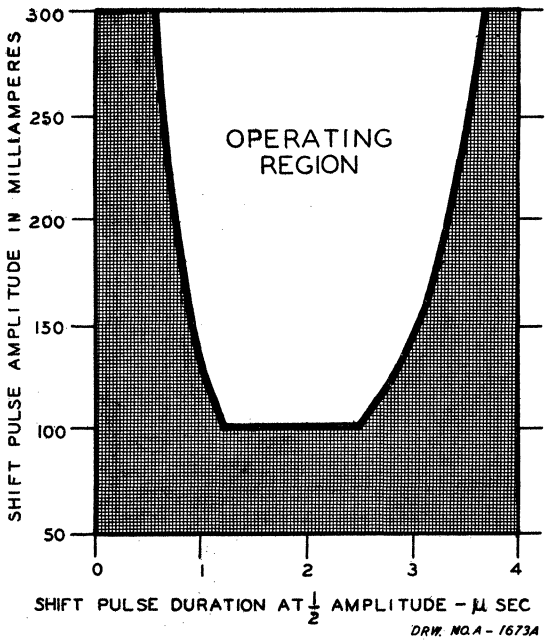
9124A

SUPERSEDES NO. 9124

May, 1959

NOMINAL PERFORMANCE CHARACTERISTICS OF 100 KC, 18 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-100 kc
Recommended	0-90 kc
Shift Pulse	
Nominal Operating Current	200 ma
Voltage Drop per Stage	2.5 volts
Duration (at half amplitude)	2.0 μsec
Rise Time (10%-90%)	0.50 μsec
Fall Time (10%-90%)	0.20 μsec
Peak Pulse Power	0.5 watts
Input Pulse	
Amplitude	10 ma
Duration	4 μsec
Parallel Output Pulse at NOP	
Amplitude	18.7 volts
Duration (at half amplitude)	2.8 μsec
Ratio	8:1 min.
Load Impedance	15,000 ohms



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SPRAGUE ENGINEERING DATA SHEET 9124A

SPRAGUE
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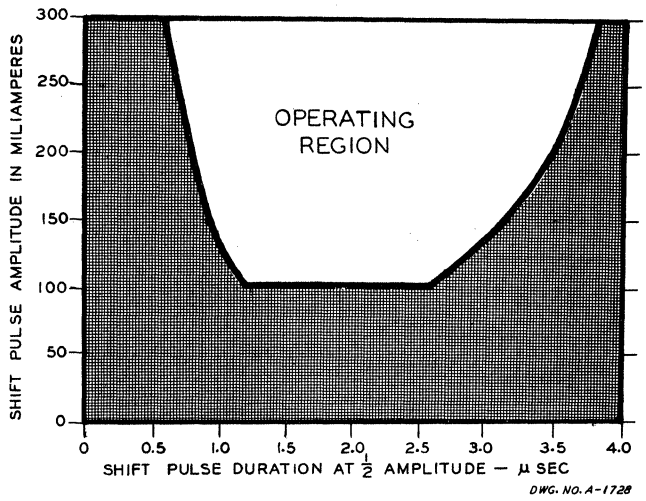
Engineering Data Sheet

9126

April, 1959

NOMINAL PERFORMANCE CHARACTERISTICS OF 100 KC, 18 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-100 kc
Recommended	0-90 kc
Shift Pulse	
Nominal Operating Current	200 ma
Voltage Drop per Stage	2.5 volts
Duration (at half amplitude)	2.0 μsec
Rise Time	0.50 μsec
Fall Time	0.20 μsec
Peak Pulse Power	0.5 watts
Input Pulse	
Amplitude	10 ma
Duration	4 μsec
Parallel Output Pulse	
Amplitude	18.7 volts
Duration	2.8 μsec
Ratio	8:1 min
Load Impedance	15,000 ohms



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SPRAGUE ENGINEERING DATA SHEET 9126

SPRAGUE

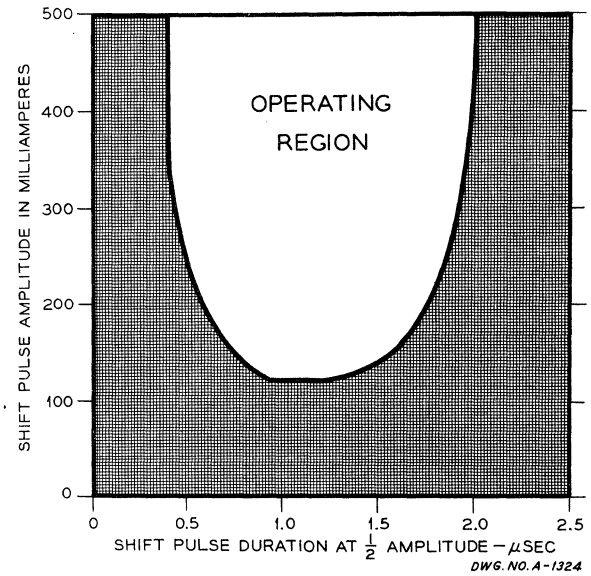
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9133

NOMINAL PERFORMANCE CHARACTERISTICS OF 200 KC, 15 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-200 kc
Recommended	0-190 kc
Shift Pulse	
Nominal Operating Current	220 ma
Voltage Drop per Stage	6.0 volts
Duration (at half amplitude)	1.2 μsec
Rise time	0.3 μsec
Fall time	0.3 μsec
Peak Pulse Power	1.4 watts
Input Pulse	
Amplitude	10 ma
Duration	2 μsec
Parallel Output Pulse	
Amplitude	16 volts
Ratio	8:1 min
Load Impedance (Minimum)	10,000 ohms
Diode	
Type	T-5 or equiv.



SPRAGUE DATA SHEET 9133

SPRAGUE ELECTRIC COMPANY
NORTH ADAMS, MASSACHUSETTS

Issue of May 15, 1957

Litho In U. S.

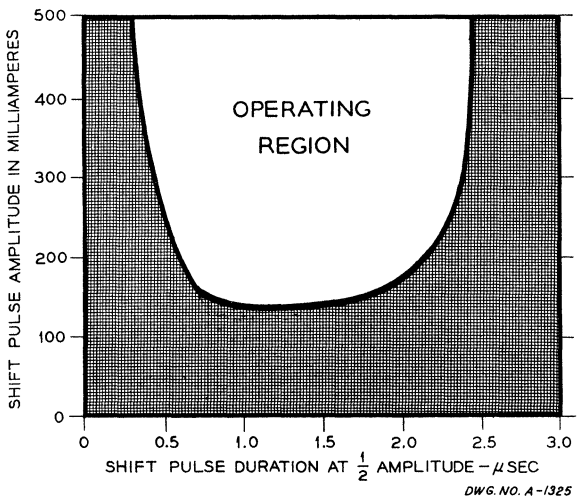
MAGNETIC SHIFT REGISTERS

ENGINEERING DATA SHEET

9135

NOMINAL PERFORMANCE CHARACTERISTICS OF 200 KC, 30 VOLT CORE-DIODE MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-200 kc
Recommended	0-190 kc
Shift Pulse	
Nominal Operating Current	240 ma
Voltage Drop per Stage	9.1 volts
Duration (at half amplitude)	1.3 μsec
Rise time	0.4 μsec
Fall time	0.3 μsec
Peak Pulse Power	2.2 watts
Input Pulse	
Amplitude	10 ma
Duration	3 μsec
Parallel Output Pulse	
Amplitude	30 volts
Ratio	8:1 min
Load Impedance (Minimum)	18,000 ohms
Diode	
Type	T-5 or equiv.



SPRAGUE ENGINEERING DATA SHEET 9135

SPRAGUE ELECTRIC COMPANY
NORTH ADAMS, MASSACHUSETTS

Issue of August 19, 1957
Supersedes Issue of May 15, 1957
Litho in U. S. Am

SPRAGUE the mark of reliability

Engineering Bulletin

No. 9200

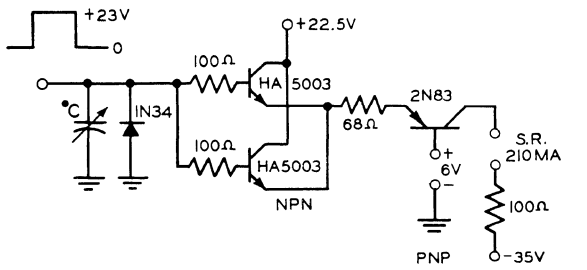
May, 1957

SUGGESTED DRIVER CIRCUITS FOR TEST OPERATION OF CORE-DIODE TYPE MAGNETIC SHIFT REGISTERS

Sprague core-diode type shift registers have been designed so that sixteen stages may be operated from one driver source. The operation of more than sixteen stages can be accomplished by modifying the standard designs and driver circuits.

The standard shift registers can be driven with transistors, blocking oscillators, or pentode current switches depending on the repetition rate and signal level of the shift register.

Transistors may be used with the four volt designs and at repetition rates up to 25 kc. A typical transistor driver is shown below. The number of stages that may be driven vary with the transistor type. For other transistors, individual customer engineering will be provided through the Sprague Field Engineering Service.

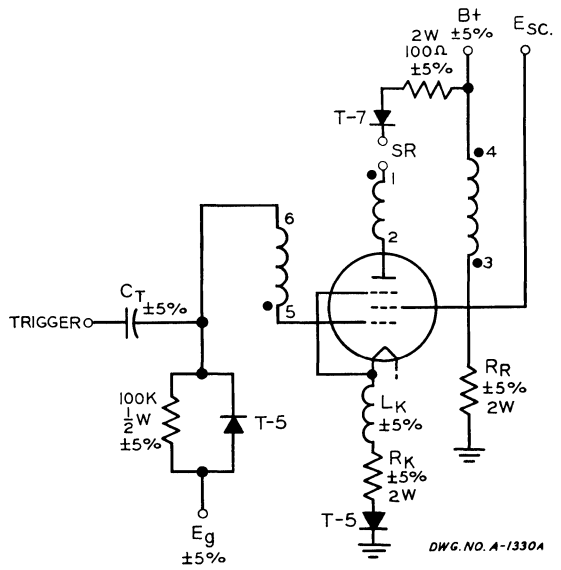


INPUT Z≥1 K MAX. REP. RATE=25KC

PULSE GEN. = GENERAL RADIO UNIT PULSER

*C SELECTED FOR PROPER RISE TIME DWG. NO. A-1331

Blocking oscillators may be used as drivers up to repetition rates of 100 kc. These circuits have the advantage of developing the required wave form as well as acting as a current switch. A standard circuit is shown in the following figure with a table of component values and electrical performance.



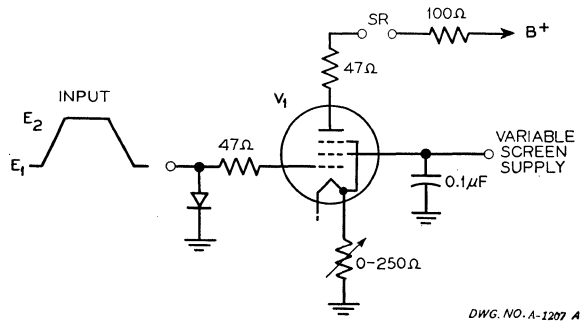
DWG. NO. A-1330A

Rep. Freq. (KC)	Cur. Pulse Out (MA)	Min Trigger (Volts)	Esc	B+	Eg	R_R (K)	L_K (μH)	R_K (Ω)	C_T	Transformer Type	Tube Type
25	180	13	150	250	-15	82	120	160	.0003	40Z135	6197
25	180	20	150	250	-15	82	120	130	.0001	40Z135	6197
80	200	20	210	250	-20	62	100	182	.0003	40Z136	6197
25	300	40	100	250	-50	68	140	33	.0004	40Z137	6AU5
100	200	60	150	250	-50	39	115	81	.0004	40Z138	6AU5

These blocking oscillators may be triggered by shift registers, for example in decade counter circuits. In circuits of this type, signal levels of the shift registers should be selected in terms of the minimum trigger voltages demanded by the various blocking oscillator. For further details on pulse transformers, such as blocking oscillator transformers, see the Sprague engineering bulletins on pulse transformers.

SPRAGUE ENGINEERING BULLETIN 9200

Pentode current drivers may be employed at all repetition rates and with all shift register designs. A typical circuit is shown below:



The driver tube V_1 should be selected in terms of the required current, total voltage drop across the shift registers, duty factor, and plate dissipation. The tube types normally used are 6197, 6005, and 6293. The input voltage applied to the grid of V_1 is usually obtained from a cathode follower and the voltage levels E_1 and E_2 are selected to cut off the tube and to develop the required drive current. The diode clamp on the grid is not necessary. The input voltage rise time, pulse width, and fall time are chosen to give the specified current pulse in the plate circuit of V_1.

The Sprague Electric Company does not provide drivers or driver circuits for use in final equipment, but our Field Engineering Department will furnish you with advice and service in connection with your shift register problems.

All the shift registers manufactured as standard units by Sprague have been designed to operate from a single driver and including as many as sixteen stages. When sixteen stages are to be operated, a diode should be inserted in the shift bus between B+ and the first shift register winding. If fewer than ten stages are to be driven from one tube, the diode may be omitted. The diode should be a 1N270 or equivalent.

If more than sixteen stages are to be driven, two diodes should be inserted in the shift bus. The second diode should be located midway along the shift windings between B+ and the driver plate. If many more than 16 stages are to be driven, a request should be made for special design. These special designs will operate at a higher shift current amplitude, but with very little change in the peak pulse power required to transfer a *one*.

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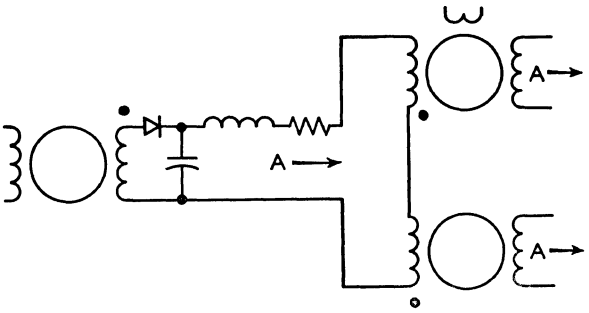
Printed in U. S. Amer.

SPRAGUE the mark of reliability
Engineering Bulletin
9300
SUPERSEDES NO. 551
May, 1957

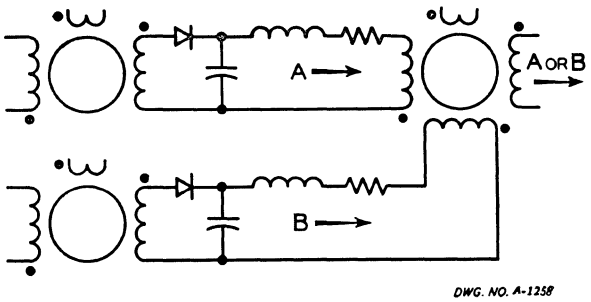
APPLICATION NOTES ON THE USE OF SPRAGUE CORE-DIODE TYPE MAGNETIC SHIFT REGISTERS

SPRAGUE shift register assemblies may be readily modified to perform various logical operations. These changes usually consist of one or more additional windings on the cores.

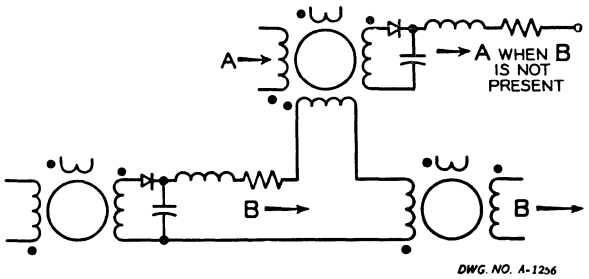
One core may drive two cores.



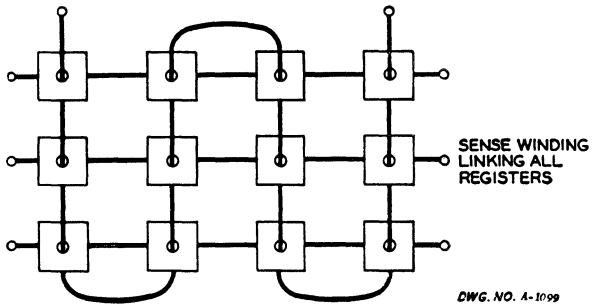
The outputs of two cores may be mixed into one core.



One core may inhibit another core.



Each unit may be provided with a core access hole to accommodate 1 or more sensing wires for *matrix operation of shift registers.*

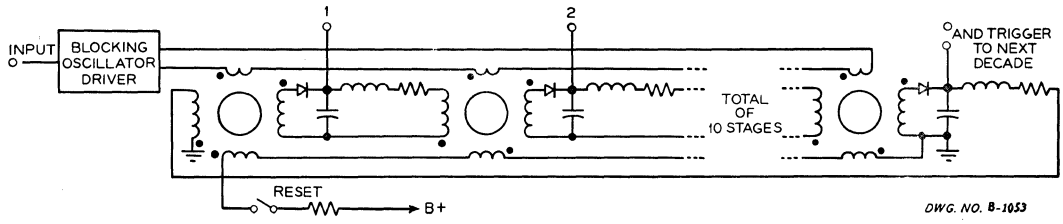


SPECIAL PRODUCTS DIVISION
SPRAGUE ELECTRIC COMPANY • North Adams, Massachusetts

Sprague Shift registers may be inter-connected as counters.

A typical decimal ring counter decade circuit is shown below. Such a counter circuit may be used for measuring the RPM of machines, counting turns on coil winders, and other types of repetitive production events.

DECIMAL COUNTER DECADE CIRCUIT



Sprague magnetic ring counters employ one shift current driver per decade and may include as many decades as each particular application requires. The pulses to be counted may be of a random nature as long as the time between adjacent pulses does not become less than that determined by the maximum repetition frequency. Running visual indication by means of neon bulbs may be realized up to 3 kilocycles and final count indication may be obtained at the termination of any count at high repetition rates.

Binary counters which are frequently employed in computer type systems may be designed using Sprague magnetic shift register assemblies. A number of different electrical circuits exist which offer a maximum total count per total number of cores but which operate at inherently lower speed than a counter circuit designed for maximum counting rate utilizing more cores per total count.

Where N is the total number of cores, one counter system will count up to a total of two to the Nth power but at a speed which is N times as low as the basic core bit employed in the circuit. Another counter system will count up to N total counts at the maximum rate of the basic core assembly. For these reasons, binary counters are engineered to individual customer requirements.

Magnetic counters require a minimum of active circuit elements and offer reliable long term storage of count information.

Counter input signal requirements are determined by the blocking oscillator driver design and may be varied over wide limits. The standard shift register blocking oscillator with input trigger requirements is shown in Engineering Bulletin 9200. When the blocking oscillator is to be triggered by a magnetic core circuit, the signal level must be larger than the minimum trigger voltage requirement.

Typical Systems Applications for Magnetic Shift Registers:

Serial Read In and Serial Read Out

Serial Read In and Parallel Read Out

Parallel Read In and Serial Read Out

Buffer Storage between any two parts of a system operating at different repetition rates.

Distribution and division of clock pulses.

Small, short access time internal memory.

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Engineering Data Sheet

9612

April, 1959

NOMINAL PERFORMANCE CHARACTERISTICS OF 35 KC, 7 VOLT CORE-TRANSISTOR MAGNETIC SHIFT REGISTER

Operating Frequency

Maximum	0-40 kc
Recommended	0-35 kc

Shift Pulse

Nominal Operating Current	100 ma
Voltage Drop per Stage	< 0.2 volt
Duration (at half amplitude)	8.0 μsec
Rise Time	1.0 μsec
Fall Time	1.0 μsec
Peak Pulse Power	< 0.02 watt

Input Pulse

Amplitude	8 ma
Duration	10 μsec

Parallel Output Pulse

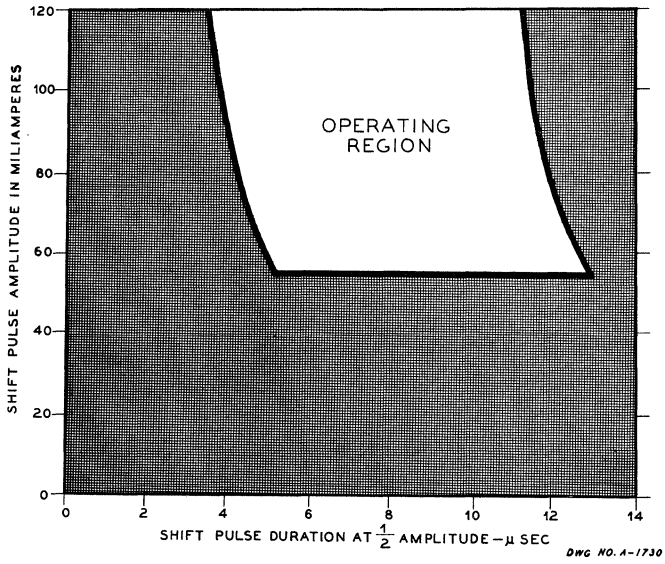
Amplitude	7 volts
Duration (at half amplitude)	12 μsec
Duration (at 90% full amplitude)	6 μsec
Rise Time	1.7 μsec
Fall Time	12 μsec
Signal to Noise Ratio	10:1 min
Load Impedance (Minimum)	
1. Capacitor Returned to Ground	2000 ohms
2. Capacitor Returned to Supply	10000 ohms

Transistor

Type	2N43 or equiv.

Power Supply

Voltage	7 volts
Average Current per Stage for All "Ones" at 35 Kc	6 ma
Peak Current per Stage for All "Ones"	120 ma



SPRAGUE ENGINEERING DATA SHEET 9612

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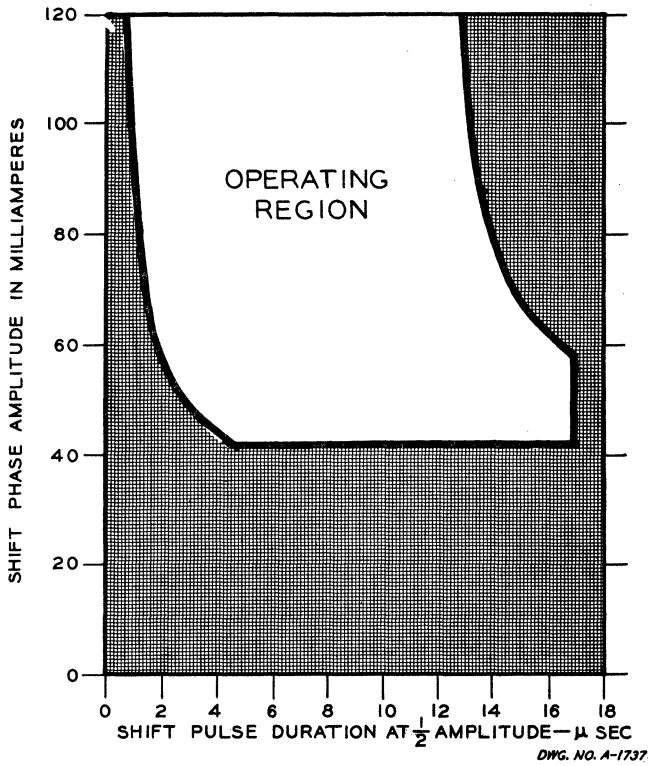
Engineering Data Sheet

9615

May, 1959

NOMINAL PERFORMANCE CHARACTERISTICS OF 25 KC, 12 VOLT CORE-TRANSISTOR MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-30 kc
Recommended	0-25 kc
Shift Pulse	
Nominal Operating Current	100 ma
Voltage Drop per Stage	<0.25 volt
Duration (at half amplitude)	8.0 μsec
Rise Time	1.0 μsec
Fall Time	1.0 μsec
Peak Pulse Power	<0.025 watt
Input Pulse	
Amplitude	6 ma
Duration	10 μsec
Rise Time	2.0 μsec
Fall Time	2.0 μsec
Parallel Output Pulse	
Amplitude	12 volts
Duration (at half amplitude)	10.4 μsec
Duration (at 90% full amplitude)	4 μsec
Rise Time	1.2 μsec
Fall Time	14.5 μsec
Signal to Noise Ratio	> 10:1 min
Load Impedance (Minimum)	2000 ohms
Transistor	
Type	2N43 or equiv.
Power Supply	
Voltage	12±10% volts
Average Current per Stage for All "Ones" at 25 kc	5 ma
Peak Current per Stage for All "Ones"	135 ma



DWG. NO. A-1737

SPRAGUE ENGINEERING DATA SHEET 9615

SPRAGUE the mark of reliability

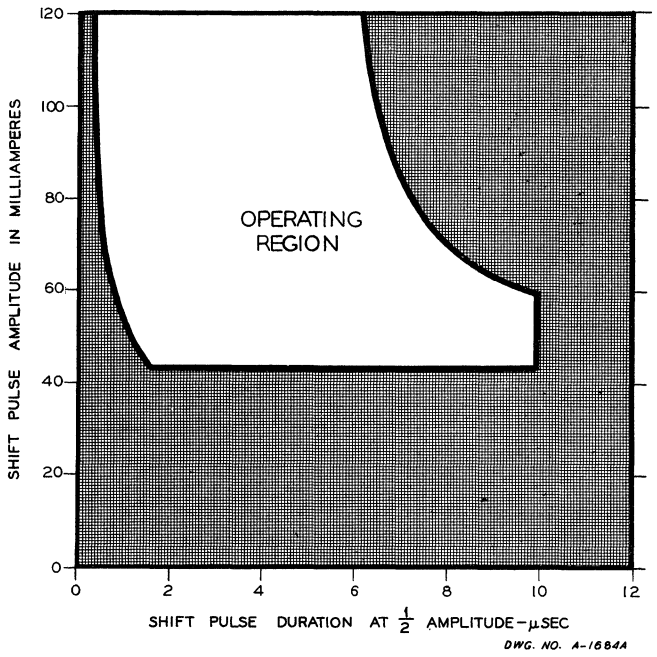
Engineering Data Sheet

9623A

October, 1959

NOMINAL PERFORMANCE CHARACTERISTICS OF 75 KC, 8 VOLT CORE-TRANSISTOR MAGNETIC SHIFT REGISTER

Operating Frequency	
Maximum	0-90 kc
Recommended	0-75 kc
Shift Pulse	
Nominal Operating Current	80 ma
Voltage Drop per Stage	0.4 volt
Duration (at half amplitude)	3.0 μsec
Rise Time	0.5 μsec
Fall Time	0.5 μsec
Peak Pulse Power	0.032 watt
Input Pulse	
Amplitude	8 ma
Duration	3 μsec
Rise Time	0.8 μsec
Fall Time	0.8 μsec
Parallel Output Pulse	
Amplitude	8 volts
Duration (at half amplitude)	4.6 μsec
Duration (at 90% full amplitude)	2.1 μsec
Rise Time	1.3 μsec
Fall Time	4.3 μsec
Signal to Noise Radio	10.1 min.
Load Impedance (Minimum)	2000 ohms
1. Capacitance Returned to Ground	2000 ohms
2. Capacitance Returned to Supply	10000 ohms
Transistor	
Type	2N43 or equiv.



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SPRAGUE ENGINEERING DATA SHEET 9623A

SPRAGUE

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North Adams, Massachusetts

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MAKERS OF RELIABLE ELECTRONIC COMPONENTS

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

E-7 59

Printed in U. S. Amer.

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Engineering Data Sheet

No. 10005

SUPERSEDES 503

March, 1959

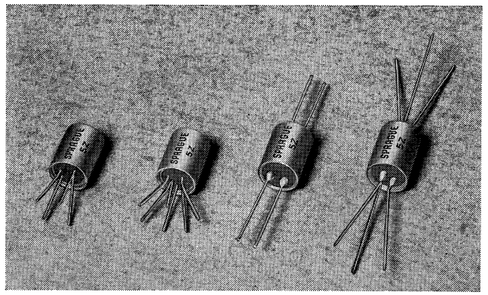
Type 5Z

SUBMINIATURE METAL-CLAD PULSE TRANSFORMERS

THESE HERMETICALLY-SEALED transformers are encased in corrosion resistant non-magnetic cases with glass-to-metal solder seals on all terminals.

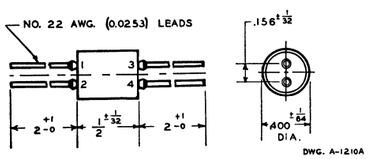
The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 5Z Subminiature Pulse Transformers are recommended for pulse voltages up to 60 volts at an average power rating of 0.3 watt (maximum). The maximum suggested volt-microsecond product for Type 5Z Pulse Transformers is 150.

The same electrical parameter values specified in this data sheet may be obtained in block-shaped pulse transformers, such as Type 42Z, Style 1; and 'pancake' pulse transformers, such as Type 31Z, Style 1.



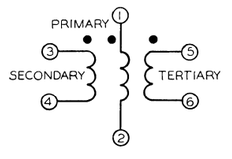
7013

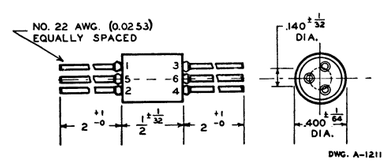
Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.



DWG. A-1210A

FIGURE 1—2-winding construction





DWG. A-1211A

FIGURE 2—3-winding construction

TYPE 5Z, STYLE 1

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	5Z1	.5	1.5	6	9	1.1	.40	.22
	5Z9	1.0	2.0	6	17	2.2	.80	.44
	5Z102	2.0	4.0	7	20	4.3	1.60	.87
	5Z17	2.5	4.5	7	22	5.4	2.00	1.0
	5Z103	3.0	5.0	7	23	6.5	2.40	1.3
	5Z104	4.0	7.0	8	24	8.6	3.20	1.7
	5Z105	5.0	8.0	8	25	10.8	4.00	2.2
	5Z25	6.0	10.0	10	25	13.0	4.80	2.6
	5Z107	8.0	13.0	10	31	17.3	6.40	3.5

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TYPE 5Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	5Z108	.5	1.5	6	9	1.1	.40	.22
	5Z109	1.0	2.0	6	17	2.2	.80	.44
	5Z110	2.0	4.0	7	20	4.3	1.60	.87
	5Z111	3.0	5.0	7	23	6.5	2.40	1.3
	5Z112	4.0	7.0	8	24	8.6	3.20	1.7
	5Z113	5.0	8.0	8	25	10.8	4.00	2.2
	5Z114	6.0	10.0	10	25	13.0	4.80	2.6
	5Z115	8.0	13.0	10	31	17.3	6.40	3.5
2:1	5Z116	.5	1.7	6	9	1.1	.40	.22
	5Z117	1.0	3.3	6	17	2.2	.80	.44
	5Z118	2.0	6.7	7	20	4.3	1.60	.87
	5Z119	3.0	10.0	7	23	6.5	2.40	1.3
	5Z120	4.0	14.0	8	24	8.6	3.20	1.7
	5Z121	5.0	17.0	8	25	10.8	4.00	2.2
	5Z122	6.0	20.0	10	25	13.0	4.80	2.6
	5Z123	8.0	28.0	10	31	17.3	6.40	3.5
2½:1	5Z124	.5	1.7	6	9	1.1	.40	.22
	5Z125	1.0	3.3	6	17	2.2	.80	.44
	5Z126	2.0	6.7	7	20	4.3	1.60	.87
	5Z127	3.0	0.0	7	23	6.5	2.40	1.3
	5Z128	4.0	14.0	8	24	8.6	3.20	1.7
	5Z129	5.0	17.0	8	25	10.8	4.00	2.2
	5Z130	6.0	20.0	10	25	13.0	4.80	2.6
	5Z131	8.0	28.0	10	31	17.3	6.40	3.5
3:1	5Z3	.5	2.5	6	9	1.1	.40	.22
	5Z11	1.0	5.0	6	17	2.2	.80	.44
	5Z134	2.0	10.0	7	20	4.3	1.60	.87
	5Z19	2.5	12.0	7	22	5.4	2.00	1.0
	5Z135	3.0	15.0	7	23	6.5	2.40	1.3
	5Z136	4.0	20.0	8	24	8.6	3.20	1.7
	5Z137	5.0	25.0	8	25	10.8	4.00	2.2
	5Z27	6.0	30.0	10	25	13.0	4.80	2.6
	5Z139	8.0	40.0	10	31	17.3	6.40	3.5
4:1	5Z140	.5	2.5	6	9	1.1	.40	.22
	5Z141	1.0	5.0	6	17	2.2	.80	.44
	5Z142	2.0	10.0	7	20	4.3	1.60	.87
	5Z143	3.0	15.0	7	23	6.5	2.40	1.3
	5Z144	4.0	20.0	8	24	8.6	3.20	1.7
	5Z145	5.0	25.0	8	25	10.8	4.00	2.2
	5Z146	6.0	30.0	10	25	13.0	4.80	2.6
	5Z147	8.0	40.0	10	31	17.3	6.40	3.5
5:1	5Z5	.5	5.0	6	9	1.1	.40	.22
	5Z13	1.0	10.0	6	17	2.2	.80	.44
	5Z150	2.0	20.0	7	20	4.3	1.60	.87
	5Z21	2.5	25.0	7	21	5.4	2.00	1.0
	5Z151	3.0	30.0	7	23	6.5	2.40	1.3
	5Z152	4.0	40.0	8	24	8.6	3.20	1.7
	5Z153	5.0	50.0	8	25	10.8	4.00	2.2
	5Z29	6.0	60.0	10	25	13.0	4.80	2.6
	5Z155	8.0	80.0	10	31	17.3	6.40	3.5
6:1	5Z156	.5	5.0	6	9	1.1	.40	.22
	5Z157	1.0	10.0	6	17	2.2	.80	.44
	5Z158	2.0	20.0	7	20	4.3	1.60	.87
	5Z159	3.0	30.0	7	23	6.5	2.40	1.3
	5Z160	4.0	40.0	8	24	8.6	3.20	1.7
	5Z161	5.0	50.0	8	25	10.8	4.00	2.2
	5Z162	6.0	60.0	10	25	13.0	4.80	2.6
	5Z163	8.0	80.0	10	31	17.3	6.40	3.5

TYPE 5Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	5Z164	.5	1.0	6	9	1.1	.40	.22
	5Z165	1.0	2.0	6	17	2.2	.80	.44
	5Z166	2.0	4.0	7	20	4.3	1.60	.87
	5Z167	3.0	5.0	7	23	6.5	2.40	1.3
	5Z168	4.0	7.0	8	24	8.6	3.20	1.7
	5Z169	5.0	8.0	8	25	10.8	4.00	2.2
	5Z170	6.0	10.0	10	25	13.0	4.80	2.6
	5Z171	8.0	13.0	10	31	17.3	6.40	3.5
1:3	5Z172	.5	1.0	6	9	1.1	.40	.22
	5Z173	1.0	2.0	6	17	2.2	.80	.44
	5Z174	2.0	4.0	7	20	4.3	1.60	.87
	5Z175	3.0	5.0	7	23	6.5	2.40	1.3
	5Z176	4.0	7.0	8	24	8.6	3.20	1.7
	5Z177	5.0	8.0	8	25	10.8	4.00	2.2
	5Z178	6.0	10.0	10	25	13.0	4.80	2.6
	5Z179	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	5Z7	.5	1.5	6	9	1.1	.40	.22
	5Z15	1.0	2.0	6	17	2.2	.80	.44
	5Z182	2.0	4.0	7	20	4.3	1.60	.87
	5Z23	2.5	4.5	7	22	5.4	2.00	1.0
	5Z183	3.0	5.0	7	23	6.5	2.40	1.3
	5Z184	4.0	7.0	8	24	8.6	3.20	1.7
	5Z185	5.0	8.0	8	25	10.8	4.00	2.2
	5Z31	6.0	10.0	10	25	13.0	4.80	2.6
	5Z187	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	5Z188	.5	1.5	6	9	1.1	.40	.22
	5Z189	1.0	2.0	6	17	2.2	.80	.44
	5Z190	2.0	4.0	7	20	4.3	1.60	.87
	5Z191	3.0	5.0	7	23	6.5	2.40	1.3
	5Z192	4.0	7.0	8	24	8.6	3.20	1.7
	5Z193	5.0	8.0	8	25	10.8	4.00	2.2
	5Z194	6.0	10.0	10	25	13.0	4.80	2.6
	5Z195	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 5Z, STYLE 2

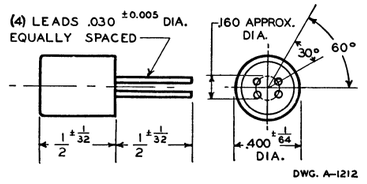
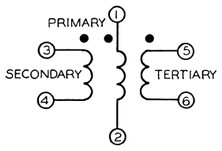


FIGURE 3—2-winding construction



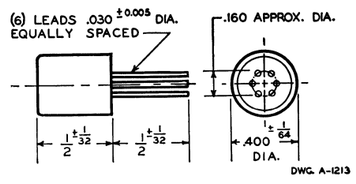


FIGURE 4—3-winding construction

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	5Z2	.5	1.5	6	9	1.1	.40	.22
	5Z10	1.0	2.0	6	17	2.2	.80	.44
	5Z202	2.0	4.0	7	20	4.3	1.60	.87
	5Z18	2.5	4.5	7	22	5.4	2.00	1.0
	5Z203	3.0	5.0	7	23	6.5	2.40	1.3
	5Z204	4.0	7.0	8	24	8.6	3.20	1.7
	5Z205	5.0	8.0	8	25	10.8	4.00	2.2
	5Z26	6.0	10.0	10	25	13.0	4.80	2.6
	5Z207	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 5Z, STYLE 2 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	5Z208	.5	1.5	6	9	1.1	.40	.22
	5Z209	1.0	2.0	6	17	2.2	.80	.44
	5Z210	2.0	4.0	7	20	4.3	1.60	.87
	5Z211	3.0	5.0	7	23	6.5	2.40	1.3
	5Z212	4.0	7.0	8	24	8.6	3.20	1.7
	5Z213	5.0	8.0	8	25	10.8	4.00	2.2
	5Z214	6.0	10.0	10	25	13.0	4.80	2.6
	5Z215	8.0	13.0	10	31	17.3	6.40	3.5
2:1	5Z216	.5	1.7	6	9	1.1	.40	.22
	5Z217	1.0	3.3	6	17	2.2	.80	.44
	5Z218	2.0	6.7	7	20	4.3	1.60	.87
	5Z219	3.0	10.0	7	23	6.5	2.40	1.3
	5Z220	4.0	14.0	8	24	8.6	3.20	1.7
	5Z221	5.0	17.0	8	25	10.8	4.00	2.2
	5Z222	6.0	20.0	10	25	13.0	4.80	2.6
	5Z223	8.0	28.0	10	31	17.3	6.40	3.5
2½:1	5Z224	.5	1.7	6	9	1.1	.40	.22
	5Z225	1.0	3.3	6	17	2.2	.80	.44
	5Z226	2.0	6.7	7	20	4.3	1.60	.87
	5Z227	3.0	10.0	7	23	6.5	2.40	1.3
	5Z228	4.0	14.0	8	24	8.6	3.20	1.7
	5Z229	5.0	17.0	8	25	10.8	4.00	2.2
	5Z230	6.0	20.0	10	25	13.0	4.80	2.6
	5Z231	8.0	28.0	10	31	17.3	6.40	3.5
3:1	5Z4	.5	2.5	6	9	1.1	.40	.22
	5Z12	1.0	5.0	6	17	2.2	.80	.44
	5Z234	2.0	10.0	7	20	4.3	1.60	.87
	5Z20	2.5	12.0	7	22	5.4	2.00	1.0
	5Z235	3.0	15.0	7	23	6.5	2.40	1.3
	5Z236	4.0	20.0	8	24	8.6	3.20	1.7
	5Z237	5.0	25.0	8	25	10.8	4.00	2.2
	5Z28	6.0	30.0	10	25	13.0	4.80	2.6
	5Z239	8.0	40.0	10	31	17.3	6.40	3.5
4:1	5Z240	.5	2.5	6	9	1.1	.40	.22
	5Z241	1.0	5.0	6	17	2.2	.80	.44
	5Z242	2.0	10.0	7	20	4.3	1.60	.87
	5Z243	3.0	15.0	7	23	6.5	2.40	1.3
	5Z244	4.0	20.0	8	24	8.6	3.20	1.7
	5Z245	5.0	25.0	8	25	10.8	4.00	2.2
	5Z246	6.0	30.0	10	25	13.0	4.80	2.6
	5Z247	8.0	40.0	10	31	17.3	6.40	3.5
5:1	5Z6	.5	5.0	6	9	1.1	.40	.22
	5Z14	1.0	10.0	6	17	2.2	.80	.44
	5Z250	2.0	20.0	7	20	4.3	1.60	.87
	5Z22	2.5	25.0	7	22	5.4	2.00	1.0
	5Z251	3.0	30.0	7	23	6.5	2.40	1.3
	5Z252	4.0	40.0	8	24	8.6	3.20	1.7
	5Z253	5.0	50.0	8	25	10.8	4.00	2.2
	5Z30	6.0	60.0	10	25	13.0	4.80	2.6
	5Z255	8.0	80.0	10	31	17.3	6.40	3.5
6:1	5Z256	.5	5.0	6	9	1.1	.40	.22
	5Z257	1.0	10.0	6	17	2.2	.80	.44
	5Z258	2.0	20.0	7	20	4.3	1.60	.87
	5Z259	3.0	30.0	7	23	6.5	2.40	1.3
	5Z260	4.0	40.0	8	24	8.6	3.20	1.7
	5Z261	5.0	50.0	8	25	10.8	4.00	2.2
	5Z262	6.0	60.0	10	25	13.0	4.80	2.6
	5Z263	8.0	80.0	10	31	17.3	6.40	3.5

TYPE 5Z, STYLE 2 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	5Z264	.5	1.0	6	9	1.1	.40	.22
	5Z265	1.0	2.0	6	17	2.2	.80	.44
	5Z266	2.0	4.0	7	20	4.3	1.60	.87
	5Z267	3.0	5.0	7	23	6.5	2.40	1.3
	5Z268	4.0	7.0	8	24	8.6	3.20	1.7
	5Z269	5.0	8.0	8	25	10.8	4.00	2.2
	5Z270	6.0	10.0	10	25	13.0	4.80	2.6
	5Z271	8.0	13.0	10	31	17.3	6.40	3.5
1:3	5Z272	.5	1.0	6	9	1.1	.40	.22
	5Z273	1.0	2.0	6	17	2.2	.80	.44
	5Z274	2.0	4.0	7	20	4.3	1.60	.87
	5Z275	3.0	5.0	7	23	6.5	2.40	1.3
	5Z276	4.0	7.0	8	24	8.6	3.20	1.7
	5Z277	5.0	8.0	8	25	10.8	4.00	2.2
	5Z278	6.0	10.0	10	25	13.0	4.80	2.6
	5Z279	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	5Z8	.5	1.5	6	9	1.1	.40	.22
	5Z16	1.0	2.0	6	17	2.2	.80	.44
	5Z282	2.0	4.0	7	20	4.3	1.60	.87
	5Z24	2.5	4.5	7	22	5.4	2.00	1.0
	5Z283	3.0	5.0	7	23	6.5	2.40	1.3
	5Z284	4.0	7.0	8	24	8.6	3.20	1.7
	5Z285	5.0	8.0	8	25	10.8	4.00	2.2
	5Z32	6.0	10.0	10	25	13.0	4.80	2.6
	5Z287	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	5Z288	.5	1.5	6	9	1.1	.40	.22
	5Z289	1.0	2.0	6	17	2.2	.80	.44
	5Z290	2.0	4.0	7	20	4.3	1.60	.87
	5Z291	3.0	5.0	7	23	6.5	2.40	1.3
	5Z292	4.0	7.0	8	24	8.6	3.20	1.7
	5Z293	5.0	8.0	8	25	10.8	4.00	2.2
	5Z294	6.0	10.0	10	25	13.0	4.80	2.6
	5Z295	8.0	13.0	10	31	17.3	6.40	3.5

SPRAGUE the mark of reliability

Engineering Data Sheet

No. 10010A

SUPERSEDES 10010

March, 1959

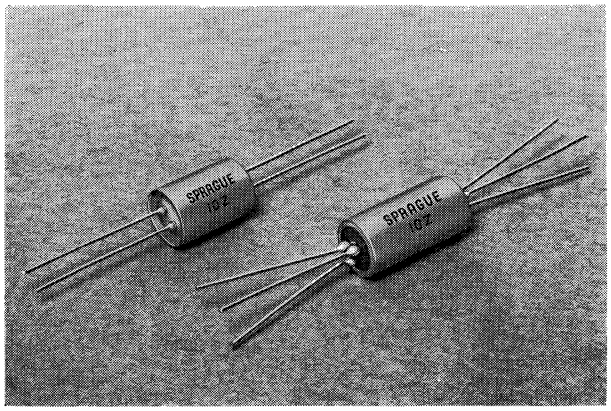
Type 10Z Hermetically-sealed

MINIATURE METAL-CLAD PULSE TRANSFORMERS

THESE HERMETICALLY-SEALED transformers are encased in corrosion resistant non-magnetic cases with glass-to-metal solder seals on all terminals.

The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 10Z Tubular Pulse Transformers are recommended for pulse voltages up to 100 volts at an average power rating of 0.5 watt (maximum). The maximum suggested volt-microsecond product for Type 10Z Miniature Tubular Pulse Transformers is 340.

The same electrical parameter values specified in this data sheet may be obtained in 'pancake' pulse transformers, such as Type 31Z, Style 2; and block shaped transformers, such as Type 42Z, Style 2.



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Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.

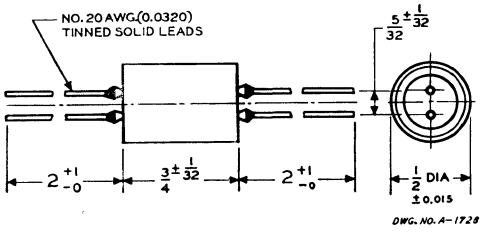

Figure 1
2-winding construction

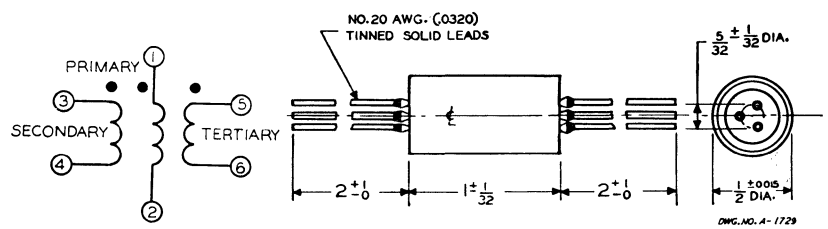

Figure 2
3-winding construction

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	10Z100	.5	1.5	4	7	1.1	.40	.22
	10Z102	1.0	2.0	5	14	2.2	.80	.44
	10Z103	2.0	4.0	7	20	4.3	1.60	.87
	10Z197	3.0	5.0	7	20	6.5	2.40	1.3
	10Z104	4.0	7.0	7	20	8.6	3.20	1.7
	10Z108	5.0	8.0	7	21	10.8	4.00	2.2
	10Z105	6.0	10.0	7	21	13.0	4.80	2.6
	10Z106	8.0	13.0	10	22	17.3	6.40	3.5

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	10Z109	.5	1.5	4	7	1.1	.40	.22
	10Z110	1.0	2.0	5	14	2.2	.80	.44
	10Z111	2.0	4.0	7	20	4.3	1.60	.87
	10Z112	3.0	5.0	7	20	6.5	2.40	1.3
	10Z113	4.0	7.0	7	20	8.6	3.20	1.7
	10Z114	5.0	8.0	7	21	10.8	4.00	2.2
	10Z115	6.0	10.0	7	21	13.0	4.80	2.6
	10Z116	8.0	13.0	10	22	17.3	6.40	3.5
2:1	10Z117	.5	1.7	4	7	1.1	.40	.22
	10Z118	1.0	3.3	5	14	2.2	.80	.44
	10Z119	2.0	6.7	7	20	4.3	1.60	.87
	10Z120	3.0	10.0	7	20	6.5	2.40	1.3
	10Z121	4.0	14.0	7	20	8.6	3.20	1.7
	10Z122	5.0	17.0	7	21	10.8	4.00	2.2
	10Z123	6.0	20.0	8	21	13.0	4.80	2.6
	10Z124	8.0	28.0	10	22	17.3	6.40	3.5
2½:1	10Z125	.5	1.7	4	7	1.1	.40	.22
	10Z126	1.0	3.3	5	14	2.2	.80	.44
	10Z127	2.0	6.7	7	20	4.3	1.60	.87
	10Z128	3.0	10.0	7	20	6.5	2.40	1.3
	10Z129	4.0	14.0	7	20	8.6	3.20	1.7
	10Z130	5.0	17.0	7	21	10.8	4.00	2.2
	10Z131	6.0	20.0	8	21	13.0	4.80	2.6
	10Z132	8.0	28.0	10	22	17.3	6.40	3.5
3:1	10Z133	.5	2.5	4	7	1.1	.40	.22
	10Z134	1.0	5.0	5	14	2.2	.80	.44
	10Z135	2.0	10.0	7	20	4.3	1.60	.87
	10Z136	3.0	15.0	7	20	6.5	2.40	1.3
	10Z137	4.0	20.0	7	20	8.6	3.20	1.7
	10Z138	5.0	25.0	7	21	10.8	4.00	2.2
	10Z139	6.0	30.0	8	21	13.0	4.80	2.6
	10Z140	8.0	40.0	10	22	17.3	6.40	3.5
4:1	10Z141	.5	2.5	4	7	1.1	.40	.22
	10Z142	1.0	5.0	5	14	2.2	.80	.44
	10Z143	2.0	10.0	7	20	4.3	1.60	.87
	10Z144	3.0	15.0	7	20	6.5	2.40	1.3
	10Z145	4.0	20.0	7	20	8.6	3.20	1.7
	10Z146	5.0	25.0	7	21	10.8	4.00	2.2
	10Z147	6.0	30.0	8	21	13.0	4.80	2.6
	10Z148	8.0	40.0	10	22	17.3	6.40	3.5
5:1	10Z149	.5	5.0	4	7	1.1	.40	.22
	10Z150	1.0	10.0	5	14	2.2	.80	.44
	10Z151	2.0	20.0	7	20	4.3	1.60	.87
	10Z152	3.0	30.0	7	20	6.5	2.40	1.3
	10Z153	4.0	40.0	7	20	8.6	3.20	1.7
	10Z154	5.0	50.0	7	21	10.8	4.00	2.2
	10Z155	6.0	60.0	7	21	13.0	4.80	2.6
	10Z156	8.0	80.0	10	22	17.3	6.40	3.5
6:1	10Z157	.5	5.0	4	7	1.1	.40	.22
	10Z158	1.0	10.0	5	14	2.2	.80	.44
	10Z159	2.0	20.0	7	20	4.3	1.60	.87
	10Z160	3.0	30.0	7	20	6.5	2.40	1.3
	10Z161	4.0	40.0	7	20	8.6	3.20	1.7
	10Z162	5.0	50.0	7	21	10.8	4.00	2.2
	10Z163	6.0	60.0	7	21	13.0	4.80	2.6
	10Z164	8.0	70.0	10	22	17.3	6.40	3.5

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	10Z165	.5	1.0	4	7	1.1	.40	.22
	10Z166	1.0	2.0	5	14	2.2	.80	.44
	10Z167	2.0	4.0	7	20	4.3	1.60	.87
	10Z168	3.0	5.0	7	20	6.5	2.40	1.3
	10Z169	4.0	7.0	7	20	8.6	3.20	1.7
	10Z170	5.0	8.0	7	21	10.8	4.00	2.2
	10Z171	6.0	10.0	7	21	13.0	4.80	2.6
	10Z172	8.0	13.0	10	22	17.3	6.40	3.5
1:3	10Z173	.5	1.0	4	7	1.1	.40	.22
	10Z174	1.0	2.0	5	14	2.2	.80	.44
	10Z175	2.0	4.0	7	20	4.3	1.60	.87
	10Z176	3.0	5.0	7	20	6.5	2.40	1.3
	10Z177	4.0	7.0	7	20	8.6	3.20	1.7
	10Z178	5.0	8.0	7	21	10.8	4.00	2.2
	10Z179	6.0	10.0	7	21	13.0	4.80	2.6
	10Z180	8.0	13.0	10	22	17.3	6.40	3.5
1:1:1	10Z181	.5	1.5	4	7	1.1	.40	.22
	10Z182	1.0	2.0	5	14	2.2	.80	.44
	10Z183	2.0	4.0	7	20	4.3	1.60	.87
	10Z184	3.0	5.0	7	20	6.5	2.40	1.3
	10Z185	4.0	7.0	7	20	8.6	3.20	1.7
	10Z186	5.0	8.0	7	21	10.8	4.00	2.2
	10Z187	6.0	10.0	7	21	13.0	4.80	2.6
	10Z188	8.0	13.0	10	22	17.3	6.40	3.5
1:1:2	10Z189	.5	1.5	4	7	1.1	.40	.22
	10Z190	1.0	2.0	5	14	2.2	.80	.44
	10Z191	2.0	4.0	7	20	4.3	1.60	.87
	10Z192	3.0	5.0	7	20	6.5	2.40	1.3
	10Z193	4.0	7.0	7	20	8.6	3.20	1.7
	10Z194	5.0	8.0	7	21	10.8	4.00	2.2
	10Z195	6.0	10.0	7	21	13.0	4.80	2.6
	10Z196	8.0	13.0	10	22	17.3	6.40	3.5

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In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

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Engineering Data Sheet

No. 10020A

SUPERSEDES 10020

March, 1959

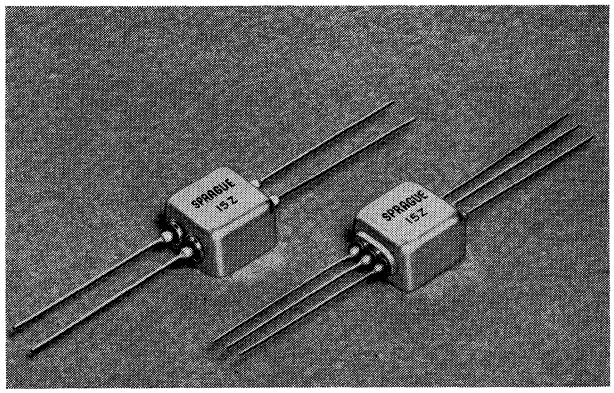
Type 15Z Hermetically-Sealed

SUBMINIATURE 'BATHTUB' PULSE TRANSFORMERS

THESE HERMETICALLY-SEALED transformers are encased in corrosion resistant non-magnetic cases with glass-to-metal solder seals on all terminals.

The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 15Z Subminiature 'Bathtub' Pulse Transformers are recommended for pulse voltages up to 200 volts at an average power rating of 1.0 watt (maximum). The maximum suggested volt-microsecond product for Type 15Z Pulse Transformers is 1200.

The same electrical parameter values specified in this data sheet may be obtained in 'pancake' pulse transformers, such as Type 31Z, Style 3; cast-housing plug-in transformers, such as Type 40Z; metal-encased plug-in transformers, such as Type 41Z; and block-shaped pulse transformers, such as Type 42Z, Style 3.



7015

Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.

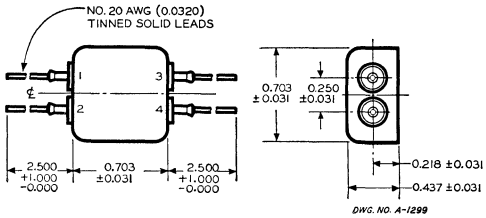


Figure 1
2-winding construction

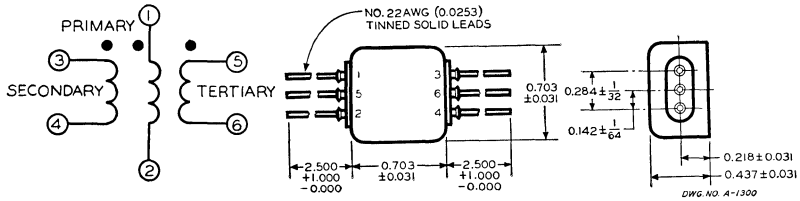


Figure 2
3-winding construction

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	15Z100	6	10	10	31	13	4.8	2.6
	15Z101	10	17	12	35	22	8.0	4.4
	15Z102	15	25	12	35	33	12	6.4
	15Z103	20	33	12	38	45	16	8.7
	15Z104	25	42	13	42	55	20	11.0
	15Z105	30	50	13	43	60	24	12.5
	15Z106	35	58	13	46	72	28	15.0
	15Z107	40	66	14	49	88	32	17.0

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	15Z108	6	10	10	31	13	4.8	2.6
	15Z109	10	17	12	35	22	8.0	4.4
	15Z110	15	25	12	35	33	12	6.4
	15Z111	20	33	12	38	45	16	8.7
	15Z112	25	42	13	42	55	20	11.0
	15Z113	30	50	13	43	60	24	12.5
	15Z114	35	58	13	46	72	28	15.0
	15Z115	40	66	14	49	88	32	17.0
2:1	15Z117	10	20	12	35	22	8.0	4.4
	15Z118	15	30	12	35	33	12	6.4
	15Z119	20	40	12	38	45	16	8.7
	15Z120	25	50	13	42	55	20	11.0
	15Z121	30	60	13	43	60	24	12.5
	15Z122	35	70	13	46	72	28	15.0
	15Z123	40	80	14	49	88	32	17.0
2½:1	15Z124	6	12	10	31	13	4.8	2.6
	15Z125	10	20	12	35	22	8.0	4.4
	15Z126	15	30	12	35	33	12	6.4
	15Z127	20	40	12	38	45	16	8.7
	15Z128	25	50	13	42	55	20	11.0
	15Z129	30	60	13	43	60	24	12.5
	15Z130	35	70	13	46	72	28	15.0
	15Z131	40	80	14	49	86	32	17.0
3:1	15Z132	6	12	10	31	13	4.8	2.6
	15Z133	10	20	12	35	22	8.0	4.4
	15Z134	15	30	12	35	33	12	6.4
	15Z135	20	40	12	38	45	16	8.7
	15Z136	25	50	13	42	55	20	11.0
	15Z137	30	60	13	43	60	24	12.5
	15Z138	35	70	13	46	72	28	15.0
	15Z139	40	80	14	49	88	32	17.0
4:1	15Z140	6	12	10	31	13	4.8	2.6
	15Z141	10	20	12	35	22	8.0	4.4
	15Z142	15	30	12	35	33	12	6.4
	15Z143	20	40	12	38	45	16	8.7
	15Z144	25	50	13	42	55	20	11.0
	15Z145	30	60	13	43	60	24	12.5
	15Z146	35	70	13	46	72	28	15.0
	15Z147	40	80	14	49	88	32	17.0
5:1	15Z148	6	20	10	31	13	4.8	2.6
	15Z149	10	33	12	35	22	8.0	4.4
	15Z150	15	50	12	35	33	12	6.4
	15Z151	20	66	12	38	45	16	8.7
	15Z152	25	83	13	42	55	20	11.0
	15Z153	30	100	13	43	60	24	12.5
	15Z154	35	115	13	46	72	28	15.0
	15Z155	40	130	14	49	88	32	17.0
6:1	15Z156	6	20	10	31	13	4.8	2.6
	15Z157	10	33	12	35	22	8.0	4.4
	15Z158	15	50	12	35	33	12	6.4
	15Z159	20	66	12	38	45	16	8.7
	15Z160	25	83	13	42	55	20	11.0
	15Z161	30	110	13	43	60	24	12.5
	15Z162	35	115	13	46	72	28	15.0
	15Z163	40	130	14	49	88	32	17.0

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1.4	15Z4	6	15	10	31	13	4.8	2.6
1:2	15Z164	6	10	10	31	13	4.8	2.6
	15Z165	10	17	12	35	22	8.0	4.4
	15Z166	15	25	12	35	33	12	6.4
	15Z167	20	33	12	38	45	16	8.7
	15Z168	25	42	13	42	55	20	11.0
	15Z169	30	50	13	43	60	24	12.5
	15Z170	35	58	13	46	72	28	15.0
	15Z171	40	66	14	49	88	32	17.0
1:3	15Z172	6	10	10	31	13	4.8	2.6
	15Z173	10	17	12	35	22	8.0	4.4
	15Z174	15	25	12	35	33	12	6.4
	15Z175	20	33	12	38	45	16	8.7
	15Z176	25	42	13	42	55	20	11.0
	15Z177	30	50	13	43	60	24	12.5
	15Z178	35	58	13	46	72	28	15.0
	15Z179	40	66	14	49	88	32	17.0
1:1:1	15Z180	6	10	10	31	13	4.8	2.6
	15Z181	10	17	12	35	22	8.0	4.4
	15Z182	15	25	12	35	33	12	6.4
	15Z183	20	33	12	38	45	16	8.7
	15Z184	25	42	13	42	55	20	11.0
	15Z185	30	50	13	43	60	24	12.5
	15Z186	35	58	13	46	72	28	15.0
	15Z187	40	66	14	49	88	32	17.0
1:1:2	15Z188	6	10	10	31	13	4.8	2.6
	15Z189	10	17	12	35	22	8.0	4.4
	15Z190	15	25	12	35	33	12	6.4
	15Z191	20	33	12	38	45	16	8.7
	15Z192	25	42	13	42	55	20	11.0
	15Z193	30	50	13	43	60	24	12.5
	15Z194	35	58	13	46	72	28	15.0
	15Z195	40	66	14	49	88	32	17.0

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E-9-59

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Engineering Data Sheet

No. 10030A
SUPERSEDES 10030

March, 1959

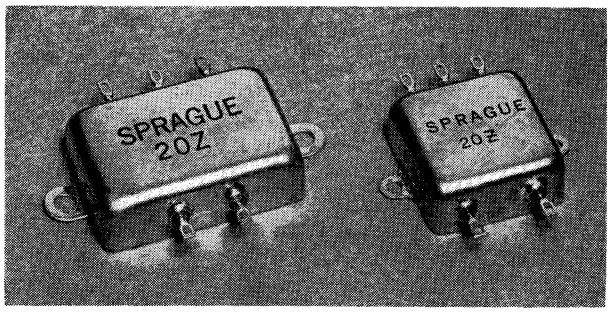
Type 20Z Hermetically-sealed

MINIATURE 'BATHTUB' PULSE TRANSFORMERS

THESE HERMETICALLY-SEALED transformers are encased in corrosion resistant non-magnetic cases with glass-to-metal solder seals on all terminals.

The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 20Z Miniature 'Bathtub' Pulse Transformers are recommended for pulse voltages up to 300 volts at an average power rating of 2.0 watts (maximum). The maximum suggested volt-microsecond product for Type 20Z Pulse Transformers is 3000.

The same electrical parameter values specified in this data sheet may be obtained in 'pancake' pulse transformers, such as Type 31Z, Style 4, and block-shaped pulse transformers, such as Type 42Z, Style 4.



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Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.

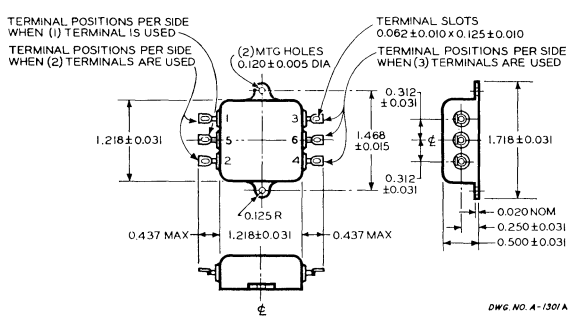

FIGURE 1
2-winding and 3-winding constructions

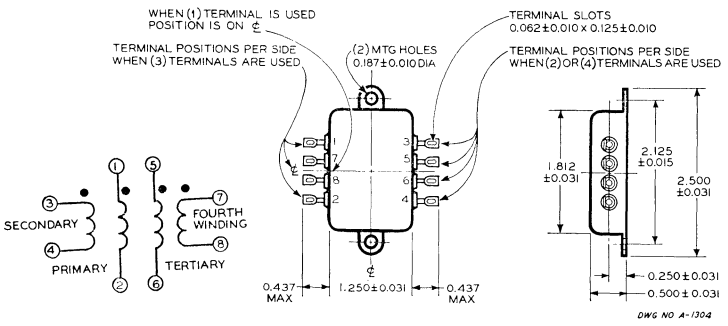

FIGURE 2
4-winding construction

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	20Z103	40	67	26	77	87	32	17.5
	20Z108	45	75	26	81	97	36	19.6
	20Z104	50	83	28	84	108	40	22.0
	20Z109	55	92	29	84	119	44	24.0
	20Z105	60	100	30	84	130	48	26.0
	20Z110	65	109	31	86	141	52	28.0
	20Z106	70	117	32	88	152	56	30.4
	20Z107	80	133	33	91	173	64	35.0

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Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	20Z111	40	67	26	77	87	32	17.5
	20Z112	45	75	26	81	97	36	19.6
	20Z113	50	83	28	84	108	40	22.0
	20Z114	55	92	29	84	119	44	24.0
	20Z115	60	100	30	84	130	48	26.0
	20Z116	65	109	31	86	141	52	28.0
	20Z117	70	117	32	88	152	56	30.4
	20Z118	80	133	33	91	173	64	35.0
2:1	20Z119	40	80	26	77	87	32	17.5
	20Z120	45	90	26	81	97	36	19.6
	20Z121	50	100	28	84	108	40	22.0
	20Z122	55	110	29	84	119	44	24.0
	20Z123	60	120	30	84	130	48	26.0
	20Z124	65	130	31	86	141	52	28.0
	20Z125	70	140	32	88	152	56	30.4
	20Z126	80	160	33	91	173	64	35.0
2½:1	20Z127	40	80	26	77	87	32	17.5
	20Z128	45	90	26	81	97	36	19.6
	20Z129	50	100	28	84	108	40	22.0
	20Z130	55	110	29	84	119	44	24.0
	20Z131	60	120	30	84	130	48	26.0
	20Z132	65	130	31	86	141	52	28.0
	20Z133	70	140	32	88	152	56	30.4
	20Z134	80	160	33	91	173	64	35.0
3:1	20Z135	40	80	26	77	87	32	17.5
	20Z136	45	90	26	81	97	36	19.6
	20Z137	50	100	28	84	108	40	22.0
	20Z138	55	110	29	84	119	44	24.0
	20Z139	60	120	30	84	130	48	26.0
	20Z140	65	130	31	86	141	52	28.0
	20Z141	70	140	32	88	152	56	30.4
	20Z142	80	160	33	91	173	64	35.0
4:1	20Z143	40	80	26	77	87	32	17.5
	20Z144	45	90	26	81	97	36	19.6
	20Z145	50	100	28	84	108	40	22.0
	20Z146	55	110	29	84	119	44	24.0
	20Z147	60	120	30	84	130	48	26.0
	20Z148	65	130	31	86	141	52	28.0
	20Z149	70	140	32	88	152	56	30.4
	20Z150	80	160	33	91	173	64	35.0
5:1	20Z151	40	133	26	77	87	32	17.5
	20Z152	45	150	26	81	97	36	19.6
	20Z153	50	166	28	84	108	40	22.0
	20Z154	55	183	29	84	119	44	24.0
	20Z155	60	200	30	84	130	48	26.0
	20Z156	65	216	31	86	141	52	28.0
	20Z157	70	233	32	88	152	56	30.4
	20Z158	80	266	33	91	173	64	35.0
6:1	20Z159	40	133	26	77	87	32	17.5
	20Z160	45	150	26	81	97	36	19.6
	20Z161	50	166	28	84	108	40	22.0
	20Z162	55	183	29	84	119	44	24.0
	20Z163	60	200	30	84	130	48	26.0
	20Z164	65	216	31	86	141	52	28.0
	20Z165	70	233	32	88	152	56	30.4
	20Z166	80	266	33	91	173	64	35.0

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	20Z167	40	67	26	77	87	32	17.5
	20Z168	45	75	26	81	97	36	19.6
	20Z169	50	83	28	84	108	40	22.0
	20Z170	55	92	29	84	119	44	24.0
	20Z171	60	100	30	84	130	48	26.0
	20Z172	65	109	31	86	141	52	28.0
	20Z173	70	117	32	88	152	56	30.4
	20Z174	80	133	33	91	173	64	35.0
1:3	20Z175	40	67	26	77	87	32	17.5
	20Z176	45	75	26	81	97	36	19.6
	20Z177	50	83	28	84	108	40	22.0
	20Z178	55	92	29	84	119	44	24.0
	20Z179	60	100	30	84	130	48	26.0
	20Z180	65	109	31	86	141	52	28.0
	20Z181	70	117	32	88	152	56	30.4
	20Z182	80	133	33	91	173	64	35.0
1:1:1	20Z183	40	67	26	77	87	32	17.5
	20Z184	45	75	26	81	97	36	19.6
	20Z185	50	83	28	84	108	40	22.0
	20Z186	55	92	29	84	119	44	24.0
	20Z187	60	100	30	84	130	48	26.0
	20Z188	65	109	31	86	141	52	28.0
	20Z189	70	117	32	88	152	56	30.4
	20Z190	80	133	33	91	173	64	35.0
1:1:2	20Z191	40	67	26	77	87	32	17.5
	20Z192	45	75	26	81	97	36	19.6
	20Z193	50	83	28	84	108	40	22.0
	20Z194	55	92	29	84	119	44	24.0
	20Z195	60	100	30	84	130	48	26.0
	20Z196	65	109	31	86	141	52	28.0
	20Z197	70	117	32	88	152	56	30.4
	20Z198	80	133	33	91	173	64	35.0

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Printed in U. S. Amer.

E-2-59

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Engineering Data Sheet

10100A
SUPERSEDES 10100

March, 1959

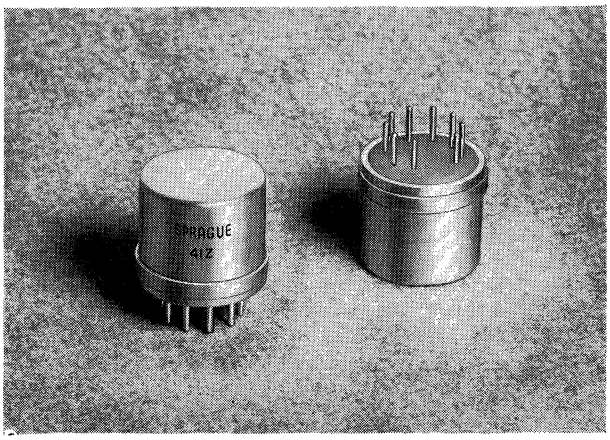
Type 41Z

METAL-ENCASED PLUG-IN PULSE TRANSFORMERS

THESE HERMETICALLY-SEALED transformers are encased in corrosion resistant non-magnetic cases with glass-to-metal solder seals on all terminals. The plug-in base fits standard subminiature tube bases.

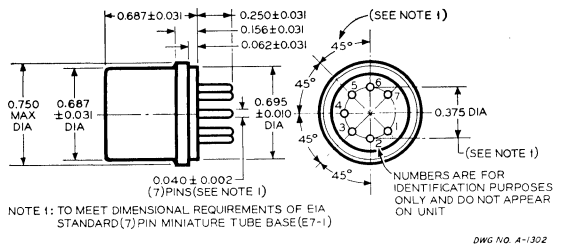
The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 41Z Plug-In Pulse Transformers are recommended for pulse voltages up to 200 volts at an average power rating of 1.0 watt (maximum). The maximum suggested volt-microsecond product for Type 41Z Pulse Transformers is 1200.

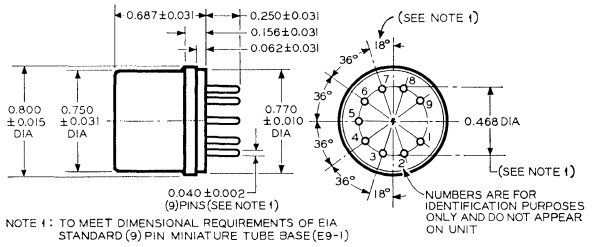
The same electrical parameter values specified in this data sheet may be obtained in hermetically-sealed subminiature 'bathtub' transformers, such as Type 15Z; 'pancake' pulse transformers, such as Type 31Z, Style 3; cast-housing plug-in transformers, such as Type 40Z; and block-shaped pulse transformers, such as Type 42Z, Style 3.



7017

Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.





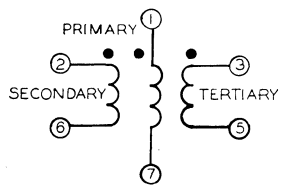


FIGURE 1
2-winding and 3-winding constructions

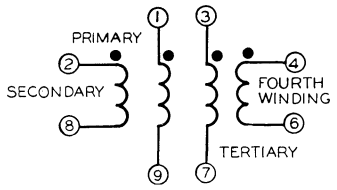


FIGURE 2
4-winding construction

Turns Ratio	Catalog No.	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level For 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	41Z100	6	10	10	31	13	4.8	2.6
	41Z101	10	17	12	35	22	8.0	4.4
	41Z102	15	25	12	35	33	12	6.4
	41Z103	20	33	12	38	45	16	8.7
	41Z104	25	42	13	42	55	20	11.0
	41Z105	30	50	13	43	60	24	12.5
	41Z106	35	58	13	46	72	28	15.0
	41Z107	40	66	14	49	88	32	17.0

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1½:1	41Z108	6	10	10	31	13	4.8	2.6
	41Z109	10	17	12	35	22	8.0	4.4
	41Z110	15	25	12	35	33	12	6.4
	41Z111	20	33	12	38	45	16	8.7
	41Z112	25	42	13	42	55	20	11.0
	41Z113	30	50	13	43	60	24	12.5
	41Z114	35	58	13	46	72	28	15.0
	41Z115	40	66	14	49	88	32	17.0
2:1	41Z116	6	12	10	31	13	4.8	2.6
	41Z117	10	20	12	35	22	8.0	4.4
	41Z118	15	30	12	35	33	12	6.4
	41Z119	20	40	12	38	45	16	8.7
	41Z120	25	50	13	42	55	20	11.0
	41Z121	30	60	13	43	60	24	12.5
	41Z122	35	70	13	46	72	28	15.0
	41Z123	40	80	14	49	88	32	17.0
2½:1	41Z124	6	12	10	31	13	4.8	2.6
	41Z125	10	20	12	35	22	8.0	4.4
	41Z126	15	30	12	35	33	12	6.4
	41Z127	20	40	12	38	45	16	8.7
	41Z128	25	50	13	42	55	20	11.0
	41Z129	30	60	13	43	60	24	12.5
	41Z130	35	70	13	46	72	28	15.0
	41Z131	40	80	14	49	88	32	17.0
3:1	41Z132	6	17	10	31	13	4.8	2.6
	41Z133	10	28	12	35	22	8.0	4.4
	41Z134	15	42	12	35	33	12	6.4
	41Z135	20	55	12	38	45	16	8.7
	41Z136	25	70	13	42	55	20	11.0
	41Z137	30	85	13	43	60	24	12.5
	41Z138	35	100	13	46	72	28	15.0
	41Z139	40	115	14	49	88	32	17.0
4:1	41Z140	6	17	10	31	13	4.8	2.6
	41Z141	10	28	12	35	22	8.0	4.4
	41Z142	15	42	12	35	33	12	6.4
	41Z143	20	55	12	38	45	16	8.7
	41Z144	25	70	13	42	55	20	11.0
	41Z145	30	85	13	43	60	24	12.5
	41Z146	35	100	13	46	72	28	15.0
	41Z147	40	115	14	49	88	32	17.0
5:1	41Z148	6	20	10	31	13	4.8	2.6
	41Z149	10	33	12	35	22	8.0	4.4
	41Z150	15	50	12	35	33	12	6.4
	41Z151	20	66	12	38	45	16	8.7
	41Z152	25	83	13	42	55	20	11.0
	41Z153	30	100	13	43	60	24	12.5
	41Z154	35	115	13	46	72	28	15.0
	41Z155	40	130	14	49	88	32	17.0
6:1	41Z156	6	20	10	31	13	4.8	2.6
	41Z157	10	33	12	35	22	8.0	4.4
	41Z158	15	50	12	35	33	12	6.4
	41Z159	20	66	12	38	45	16	8.7
	41Z160	25	83	13	42	55	20	11.0
	41Z161	30	100	13	43	60	24	12.5
	41Z162	35	115	13	46	72	28	15.0
	41Z163	40	130	14	49	88	32	17.0

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	41Z164	6	10	10	31	13	4.8	2.6
	41Z165	10	17	12	35	22	8.0	4.4
	41Z166	15	25	12	35	33	12	6.4
	41Z167	20	33	12	38	45	16	8.7
	41Z168	25	42	13	42	55	20	11.0
	41Z169	30	50	13	43	60	24	12.5
	41Z170	35	58	13	46	72	28	15.0
	41Z171	40	66	14	49	88	32	17.0
1:3	41Z172	6	10	10	31	13	4.8	2.6
	41Z173	10	17	12	35	22	8.0	4.4
	41Z174	15	25	12	35	33	12	6.4
	41Z175	20	33	12	38	45	16	8.7
	41Z176	25	42	13	42	55	20	11.0
	41Z177	30	50	13	43	60	24	12.5
	41Z178	35	58	13	46	72	28	15.0
	41Z179	40	66	14	49	88	32	17.0
1:1:1	41Z180	6	10	10	31	13	4.8	2.6
	41Z181	10	17	12	35	22	8.0	4.4
	41Z182	15	25	12	35	33	12	6.4
	41Z183	20	33	12	38	45	16	8.7
	41Z184	25	42	13	42	55	20	11.0
	41Z185	30	50	13	43	60	24	12 5
	41Z186	35	58	13	46	72	28	15.0
	41Z187	40	66	14	49	88	32	17.0
1:1:2	41Z188	6	10	10	31	13	4.8	2.6
	41Z189	10	17	12	35	22	8.0	4.4
	41Z190	15	25	12	35	33	12	6.4
	41Z191	20	33	12	38	45	16	8.7
	41Z192	25	42	13	42	55	20	11.0
	41Z193	30	50	13	43	60	24	12.5
	41Z194	35	58	13	46	72	28	15.0
	41Z195	40	66	14	49	88	32	17.0

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SPRAGUE ELECTRIC COMPANY

North Adams, Massachusetts

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MAKERS OF RELIABLE ELECTRONIC COMPONENTS

In the construction of the componerts described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

E-1-60

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SPRAGUE
the mark of reliability

Engineering Data Sheet

10230A
SUPERSEDES 10230, 10235, 10240, 10245

March, 1959

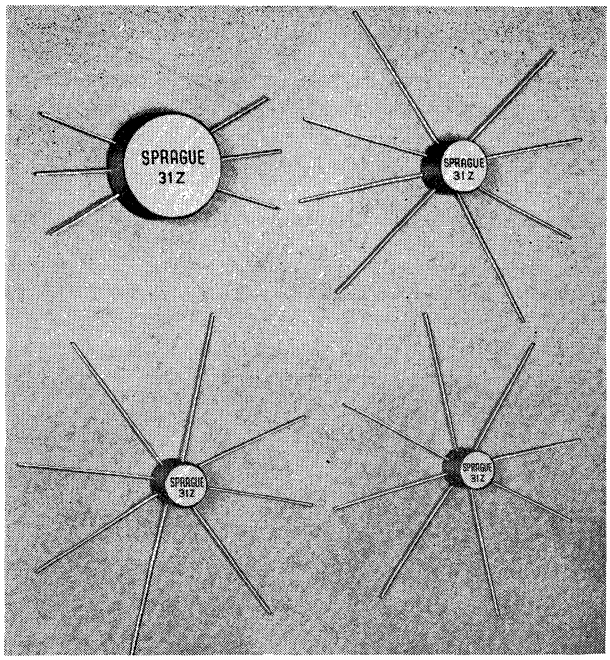
Type 31Z

'PANCAKE' PULSE TRANSFORMERS

THESE MINIATURE UNITS have the transformer section embedded in an epoxy resin inside of a pre-molded outer protective shell. The 'Pancake' style design is excellent for mounting on printed wiring boards as well as on conventional chassis.

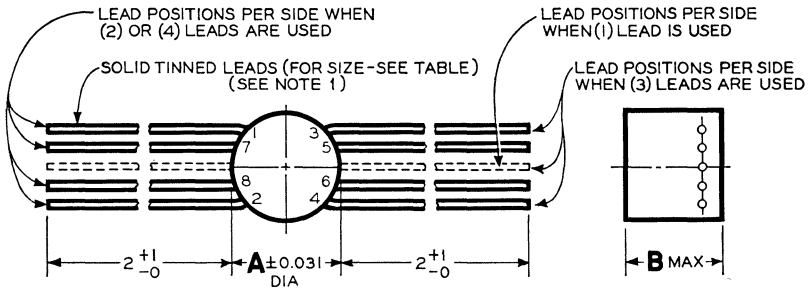
The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 31Z Style 1 units are recommended for pulse voltages up to 60 volts, Style 2 units up to 100 volts, Style 3 units up to 200 volts, and Style 4 units up to 300 volts at an average power rating of 0.3 watt, 0.5 watt, 1.0 watt, and 2.0 watts (maximum), respectively. The maximum suggested volt-microsecond product is 150 for Style 1 units, 340 for Style 2, 1200 for Style 3, and 3000 for Style 4.

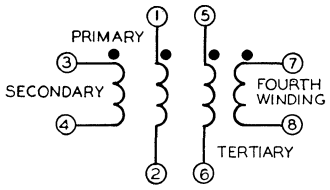
The same electrical parameter values specified for Style 1 transformers may be obtained in hermetically-sealed cylindrical subminiature transformers such as Type 5Z, and block-shaped transformers such as Type 42Z, Style 1; values for Style 2 units may be obtained in hermetically-sealed miniature tubular transformers such as Type 10Z and in block-shaped transformers such as Type 42Z, Style 2; values for Style 3 units may be obtained in hermetically-sealed subminiature 'bathtub' transformers such as Type 15Z, block-shaped transformers such as Type 42Z, Style 3, cast-housing plug-in transformers such as Type 40Z and in metal-encased plug-in transformers such as Type 41Z; values for Style 4 units may be obtained in hermetically-sealed miniature 'bathtub' transformers such as Type 20Z and in block-shaped transformers such as Type 42Z, Style 4.



7018

Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.





STYLE	A	B	LEAD SIZE		MAX NUMBER OF LEADS
			AWG	DIA	
NO.1	0.500	0.500	NO. 22	0.0253	3 EACH SIDE
NO.2	0.562	0.500	NO. 22	0.0253	4 EACH SIDE
NO.3	0.687	0.562	NO. 20	0.0320	4 EACH SIDE
NO.4	1.250	0.562	NO. 20	0.0320	4 EACH SIDE

NOTE 1: UNITS ARE AVAILABLE WITH ANY COMBINATION OF LEADS NECESSARY FOR SPECIFIC ELECTRICAL REQUIREMENTS, WITHIN THE MAX LEAD QUANTITY LIMITATIONS PER TABLE

DWG. NO. A-1297

SPRAGUE ENGINEERING DATA SHEET 10230A

TYPE 31Z, STYLE 1

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	31Z100	.5	1.5	6	9	1.1	.40	.22
	31Z101	1.0	2.0	6	17	2.2	.80	.44
	31Z105	2.0	4.0	7	20	4.3	1.60	.87
	31Z106	3.0	5.0	7	23	6.5	2.40	1.3
	31Z107	4.0	7.0	8	24	8.6	3.20	1.7
	31Z108	5.0	8.0	8	25	10.8	4.00	2.2
	31Z103	6.0	10.0	10	25	13.0	4.80	2.6
	31Z104	8.0	13.0	10	31	17.3	6.40	3.5
1½:1	31Z109	.5	1.5	6	9	1.1	.40	.22
	31Z110	1.0	2.0	6	17	2.2	.80	.44
	31Z111	2.0	4.0	7	20	4.3	1.60	.87
	31Z112	3.0	5.0	7	23	6.5	2.40	1.3
	31Z113	4.0	7.0	8	24	8.6	3.20	1.7
	31Z114	5.0	8.0	8	25	10.8	4.00	2.2
	31Z115	6.0	10.0	10	25	13.0	4.80	2.6
	31Z116	8.0	13.0	10	31	17.3	6.40	3.5
2:1	31Z117	.5	1.7	6	9	1.1	.40	.22
	31Z118	1.0	3.3	6	17	2.2	.80	.44
	31Z119	2.0	6.7	7	20	4.3	1.60	.87
	31Z120	3.0	10.0	7	23	6.5	2.40	1.3
	31Z121	4.0	14.0	8	24	8.6	3.20	1.7
	31Z122	5.0	17.0	8	25	10.8	4.00	2.2
	31Z123	6.0	20.0	10	25	13.0	4.80	2.6
	31Z124	8.0	28.0	10	31	17.3	6.40	3.5
2½:1	31Z125	.5	1.7	6	9	1.1	.40	.22
	31Z126	1.0	3.3	6	17	2.2	.80	.44
	31Z127	2.0	6.7	7	20	4.3	1.60	.87
	31Z128	3.0	10.0	7	23	6.5	2.40	1.3
	31Z129	4.0	14.0	8	24	8.6	3.20	1.7
	31Z130	5.0	17.0	8	25	10.8	4.00	2.2
	31Z131	6.0	20.0	10	25	13.0	4.80	2.6
	31Z132	8.0	28.0	10	31	17.3	6.40	3.5
3:1	31Z133	.5	2.5	6	9	1.1	.40	.22
	31Z134	1.0	5.0	6	17	2.2	.80	.44
	31Z135	2.0	10.0	7	20	4.3	1.60	.87
	31Z136	3.0	15.0	7	23	6.5	2.40	1.3
	31Z137	4.0	20.0	8	24	8.6	3.20	1.7
	31Z138	5.0	25.0	8	25	10.8	4.00	2.2
	31Z139	6.0	30.0	10	25	13.0	4.80	2.6
	31Z140	8.0	40.0	10	31	17.3	6.40	3.5
4:1	31Z141	.5	2.5	6	9	1.1	.40	.22
	31Z142	1.0	5.0	6	17	2.2	.80	.44
	31Z143	2.0	10.0	7	20	4.3	1.60	.87
	31Z144	3.0	15.0	7	23	6.5	2.40	1.3
	31Z145	4.0	20.0	8	24	8.6	3.20	1.7
	31Z146	5.0	25.0	8	25	10.8	4.00	2.2
	31Z147	6.0	30.0	10	25	13.0	4.80	2.6
	31Z148	8.0	40.0	10	31	17.3	6.40	3.5

TYPE 31Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	31Z149	.5	5.0	6	9	1.1	.40	.22
	31Z150	1.0	10.0	6	17	2.2	.80	.44
	31Z151	2.0	20.0	7	20	4.3	1.60	.87
	31Z152	3.0	30.0	7	23	6.5	2.40	1.3
	31Z153	4.0	40.0	8	24	8.6	3.20	1.7
	31Z154	5.0	50.0	8	25	10.8	4.00	2.2
	31Z155	6.0	60.0	10	25	13.0	4.80	2.6
	31Z156	8.0	80.0	10	31	17.3	6.40	3.5
6:1	31Z157	.5	5.0	6	9	1.1	.40	.22
	31Z158	1.0	10.0	6	17	2.2	.80	.44
	31Z159	2.0	20.0	7	20	4.3	1.60	.87
	31Z160	3.0	30.0	7	23	6.5	2.40	1.3
	31Z161	4.0	40.0	8	24	8.6	3.20	1.7
	31Z162	5.0	50.0	8	25	10.8	4.00	2.2
	31Z163	6.0	60.0	10	25	13.0	4.80	2.6
	31Z164	8.0	80.0	10	31	17.3	6.40	3.5
1:2	31Z165	.5	1.0	6	9	1.1	.40	.22
	31Z166	1.0	2.0	6	17	2.2	.80	.44
	31Z167	2.0	4.0	7	20	4.3	1.60	.87
	31Z168	3.0	5.0	7	23	6.5	2.40	1.3
	31Z169	4.0	7.0	8	24	8.6	3.20	1.7
	31Z170	5.0	8.0	8	25	10.8	4.00	2.2
	31Z171	6.0	10.0	10	25	13.0	4.80	2.6
	31Z172	8.0	13.0	10	31	17.3	6.40	3.5
1:3	31Z173	.5	1.0	6	9	1.1	.40	.22
	31Z174	1.0	2.0	6	17	2.2	.80	.44
	31Z175	2.0	4.0	7	20	4.3	1.60	.87
	31Z176	3.0	5.0	7	23	6.5	2.40	1.3
	31Z177	4.0	7.0	8	24	8.6	3.20	1.7
	31Z178	5.0	8.0	8	25	10.8	4.00	2.2
	31Z179	6.0	10.0	10	25	13.0	4.80	2.6
	31Z180	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	31Z181	.5	1.5	6	9	1.1	.40	.22
	31Z182	1.0	2.0	6	17	2.2	.80	.44
	31Z183	2.0	4.0	7	20	4.3	1.60	.87
	31Z184	3.0	5.0	7	23	6.5	2.40	1.3
	31Z185	4.0	7.0	8	24	8.6	3.20	1.7
	31Z186	5.0	8.0	8	25	10.8	4.00	2.2
	31Z187	6.0	10.0	10	25	13.0	4.80	2.6
	31Z188	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	31Z189	.5	1.5	6	9	1.1	.40	.22
	31Z190	1.0	2.0	6	17	2.2	.80	.44
	31Z191	2.0	4.0	7	20	4.3	1.60	.87
	31Z192	3.0	5.0	7	23	6.5	2.40	1.3
	31Z193	4.0	7.0	8	24	8.6	3.20	1.7
	31Z194	5.0	8.0	8	25	10.8	4.00	2.2
	31Z195	6.0	10.0	10	25	13.0	4.80	2.6
	31Z196	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 31Z, STYLE 2

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	31Z200	.5	1.5	4	7	1.1	.40	.22
	31Z201	1.0	2.0	5	14	2.2	.80	.44
	31Z202	2.0	4.0	7	20	4.3	1.60	.87
	31Z296	3.0	5.0	7	20	6.5	2.40	1.3
	31Z203	4.0	7.0	7	20	8.6	3.20	1.7
	31Z207	5.0	8.0	7	21	10.8	4.00	2.2
	31Z204	6.0	10.0	7	21	13.0	4.80	2.6
	31Z205	8.0	13.0	10	22	17.3	6.40	3.5
1½:1	31Z208	.5	1.5	4	7	1.1	.40	.22
	31Z209	1.0	2.0	5	14	2.2	.80	.44
	31Z210	2.0	4.0	7	20	4.3	1.60	.87
	31Z211	3.0	5.0	7	20	6.5	2.40	1.3
	31Z212	4.0	7.0	7	20	8.6	3.20	1.7
	31Z213	5.0	8.0	7	21	10.8	4.00	2.2
	31Z214	6.0	10.0	7	21	13.0	4.80	2.6
	31Z215	8.0	13.0	10	22	17.3	6.40	3.5
2:1	31Z216	.5	1.7	4	7	1.1	.40	.22
	31Z217	1.0	3.3	5	14	2.2	.80	.44
	31Z218	2.0	6.7	7	20	4.3	1.60	.87
	31Z219	3.0	10.0	7	20	6.5	2.40	1.3
	31Z220	4.0	14.0	7	20	8.6	3.20	1.7
	31Z221	5.0	17.0	7	21	10.8	4.00	2.2
	31Z222	6.0	20.0	8	21	13.0	4.80	2.6
	31Z223	8.0	28.0	10	22	17.3	6.40	3.5
2½:1	31Z224	.5	1.7	4	7	1.1	.40	.22
	31Z225	1.0	3.3	5	14	2.2	.80	.44
	31Z226	2.0	6.7	7	20	4.3	1.60	.87
	31Z227	3.0	10.0	7	20	6.5	2.40	1.3
	31Z228	4.0	14.0	7	20	8.6	3.20	1.7
	31Z229	5.0	17.0	7	21	10.8	4.00	2.2
	31Z230	6.0	20.0	8	21	13.0	4.80	2.6
	31Z231	8.0	28.0	10	22	17.3	6.40	3.5
3:1	31Z232	.5	2.5	4	7	1.1	.40	.22
	31Z233	1.0	5.0	5	14	2.2	.80	.44
	31Z234	2.0	10.0	7	20	4.3	1.60	.87
	31Z235	3.0	15.0	7	20	6.5	2.40	1.3
	31Z236	4.0	20.0	7	20	8.6	3.20	1.7
	31Z237	5.0	25.0	7	21	10.8	4.00	2.2
	31Z238	6.0	30.0	8	21	13.0	4.80	2.6
	31Z239	8.0	40.0	10	22	17.3	6.40	3.5
4:1	31Z240	.5	2.5	4	7	1.1	.40	.22
	31Z241	1.0	5.0	5	14	2.2	.80	.44
	31Z242	2.0	10.0	7	20	4.3	1.60	.87
	31Z243	3.0	15.0	7	20	6.5	2.40	1.3
	31Z244	4.0	20.0	7	20	8.6	3.20	1.7
	31Z245	5.0	25.0	7	21	10.8	4.00	2.2
	31Z246	6.0	30.0	8	21	13.0	4.80	2.6
	31Z247	8.0	40.0	10	22	17.3	6.40	3.5

TYPE 31Z, STYLE 2 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	31Z248	.5	5.0	4	7	1.1	.40	.22
	31Z249	1.0	10.0	5	14	2.2	.80	.44
	31Z250	2.0	20.0	7	20	4.3	1.60	.87
	31Z251	3.0	30.0	7	20	6.5	2.40	1.3
	31Z252	4.0	40.0	7	20	8.6	3.20	1.7
	31Z253	5.0	50.0	7	21	10.8	4.00	2.2
	31Z254	6.0	60.0	7	21	13.0	4.80	2.6
	31Z255	8.0	80.0	10	22	17.3	6.40	3.5
6:1	31Z256	.5	5.0	4	7	1.1	.40	.22
	31Z257	1.0	10.0	5	14	2.2	.80	.44
	31Z258	2.0	20.0	7	20	4.3	1.60	.87
	31Z259	3.0	30.0	7	20	6.5	2.40	1.3
	31Z260	4.0	40.0	7	20	8.6	3.20	1.7
	31Z261	5.0	50.0	7	21	10.8	4.00	2.2
	31Z262	6.0	60.0	7	21	13.0	4.80	2.6
	31Z263	8.0	80.0	10	22	17.3	6.40	3.5
1:2	31Z264	.5	1.0	4	7	1.1	.40	.22
	31Z265	1.0	2.0	5	14	2.2	.80	.44
	31Z266	2.0	4.0	7	20	4.3	1.60	.87
	31Z267	3.0	5.0	7	20	6.5	2.40	1.3
	31Z268	4.0	7.0	7	20	8.6	3.20	1.7
	31Z269	5.0	8.0	7	21	10.8	4.00	2.2
	31Z270	6.0	10.0	7	21	13.0	4.80	2.6
	31Z271	8.0	13.0	10	22	17.3	6.40	3.5
1:3	31Z272	.5	1.0	4	7	1.1	.40	.22
	31Z273	1.0	2.0	5	14	2.2	.80	.44
	31Z274	2.0	4.0	7	20	4.3	1.60	.87
	31Z275	3.0	5.0	7	20	6.5	2.40	1.3
	31Z276	4.0	7.0	7	20	8.6	3.20	1.7
	31Z277	5.0	8.0	7	21	10.8	4.00	2.2
	31Z278	6.0	10.0	7	21	13.0	4.80	2.6
	31Z279	8.0	13.0	10	22	17.3	6.40	3.5
1:1:1	31Z280	.5	1.5	4	7	1.1	.40	.22
	31Z281	1.0	2.0	5	14	2.2	.80	.44
	31Z282	2.0	4.0	7	20	4.3	1.60	.87
	31Z283	3.0	5.0	7	20	6.5	2.40	1.3
	31Z284	4.0	7.0	7	20	8.6	3.20	1.7
	31Z285	5.0	8.0	7	21	10.8	4.00	2.2
	31Z286	6.0	10.0	7	21	13.0	4.80	2.6
	31Z287	8.0	13.0	10	22	17.3	6.40	3.5
1:1:2	31Z288	.5	1.5	4	7	1.1	.40	.22
	31Z289	1.0	2.0	5	14	2.2	.80	.44
	31Z290	2.0	4.0	7	20	4.3	1.60	.87
	31Z291	3.0	5.0	7	20	6.5	2.40	1.3
	31Z292	4.0	7.0	7	20	8.6	3.20	1.7
	31Z293	5.0	8.0	7	21	10.8	4.00	2.2
	31Z294	6.0	10.0	7	21	13.0	4.80	2.6
	31Z295	8.0	13.0	10	22	17.3	6.40	3.5

TYPE 31Z, STYLE 3

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	31Z300	6	10	10	31	13	4.8	2.6
	31Z301	10	17	12	35	22	8.0	4.4
	31Z302	15	25	12	35	33	12	6.4
	31Z303	20	33	12	38	45	16	8.7
	31Z304	25	42	13	42	55	20	11.0
	31Z305	30	50	13	43	60	24	12.5
	31Z306	35	58	13	46	72	28	15.0
	31Z307	40	66	14	49	88	32	17.0
1½:1	31Z308	6	10	10	31	13	4.8	2.6
	31Z309	10	17	12	35	22	8.0	4.4
	31Z310	15	25	12	35	33	12	6.4
	31Z311	20	33	12	38	45	16	8.7
	31Z312	25	42	13	42	55	20	11.0
	31Z313	30	50	13	43	60	24	12.5
	31Z314	35	58	13	46	72	28	15.0
	31Z315	40	66	14	49	88	32	17.0
2:1	31Z316	6	12	10	31	13	4.8	2.6
	31Z317	10	20	12	35	22	8.0	4.4
	31Z318	15	30	12	35	33	12	6.4
	31Z319	20	40	12	38	45	16	8.7
	31Z320	25	50	13	42	55	20	11.0
	31Z321	30	60	13	43	60	24	12.5
	31Z322	35	70	13	46	72	28	15.0
	31Z323	40	80	14	49	88	32	17.0
2½:1	31Z324	6	12	10	31	13	4.8	2.6
	31Z325	10	20	12	35	22	8.0	4.4
	31Z326	15	30	12	35	33	12	6.4
	31Z327	20	40	12	38	45	16	8.7
	31Z328	25	50	13	42	55	20	11.0
	31Z329	30	60	13	43	60	24	12.5
	31Z330	35	70	13	46	72	28	15.0
	31Z331	40	80	14	49	88	32	17.0
3:1	31Z332	6	17	10	31	13	4.8	2.6
	31Z333	10	28	12	35	22	8.0	4.4
	31Z334	15	42	12	35	33	12	6.4
	31Z335	20	55	12	38	45	16	8.7
	31Z336	25	70	13	42	55	20	11.0
	31Z337	30	85	13	43	60	24	12.5
	31Z338	35	100	13	46	72	28	15.0
	31Z339	40	115	14	49	88	32	17.0
4:1	31Z340	6	17	10	31	13	4.8	2.6
	31Z341	10	28	12	35	22	8.0	4.4
	31Z342	15	42	12	35	33	12	6.4
	31Z343	20	55	12	38	45	16	8.7
	31Z344	25	70	13	42	55	20	11.0
	31Z345	30	85	13	43	60	24	12.5
	31Z346	35	100	13	46	72	28	15.0
	31Z347	40	115	14	49	88	32	17.0

TYPE 31Z, STYLE 3 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	31Z348	6	20	10	31	13	4.8	2.6
	31Z349	10	33	12	35	22	8.0	4.4
	31Z350	15	50	12	35	33	12	6.4
	31Z351	20	66	12	38	45	16	8.7
	31Z352	25	83	13	42	55	20	11.0
	31Z353	30	100	13	43	60	24	12.5
	31Z354	35	115	13	46	72	28	15.0
	31Z355	40	130	14	49	88	32	17.0
6:1	31Z356	6	20	10	31	13	4.8	2.6
	31Z357	10	33	12	35	22	8.0	4.4
	31Z358	15	50	12	35	33	12	6.4
	31Z359	20	66	12	38	45	16	8.7
	31Z360	25	83	13	42	55	20	11.0
	31Z361	30	100	13	43	60	24	12.5
	31Z362	35	115	13	46	72	28	15.0
	31Z363	40	130	14	49	88	32	17.0
1:2	31Z364	6	10	10	31	13	4.8	2.6
	31Z365	10	17	12	35	22	8.0	4.4
	31Z366	15	25	12	35	33	12	6.4
	31Z367	20	33	12	38	45	16	8.7
	31Z368	25	42	13	42	55	20	11.0
	31Z369	30	50	13	43	60	24	12.5
	31Z370	35	58	13	46	72	28	15.0
	31Z371	40	66	14	49	88	32	17.0
1:3	31Z372	6	10	10	31	13	4.8	2.6
	31Z373	10	17	12	35	22	8.0	4.4
	31Z374	15	25	12	35	33	12	6.4
	31Z375	20	33	12	38	45	16	8.7
	31Z376	25	42	13	42	55	20	11.0
	31Z377	30	50	13	43	60	24	12.5
	31Z378	35	58	13	46	72	28	15.0
	31Z379	40	66	14	49	88	32	17.0
1:1:1	31Z380	6	10	10	31	13	4.8	2.6
	31Z381	10	17	12	35	22	8.0	4.4
	31Z382	15	25	12	35	33	12	6.4
	31Z383	20	33	12	38	45	16	8.7
	31Z384	25	42	13	42	55	20	11.0
	31Z385	30	50	13	43	60	24	12.5
	31Z386	35	58	13	46	72	28	15.0
	31Z387	40	66	14	49	88	32	17.0
1:1:2	31Z388	6	10	10	31	13	4.8	2.6
	31Z389	10	17	12	35	22	8.0	4.4
	31Z390	15	25	12	35	33	12	6.4
	31Z391	20	33	12	38	45	16	8.7
	31Z392	25	42	13	42	55	20	11.0
	31Z393	30	50	13	43	60	24	12.5
	31Z394	35	58	13	46	72	28	15.0
	31Z395	40	66	14	49	88	32	17.0

TYPE 31Z, STYLE 4

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	31Z403	40	67	26	77	87	32	17.5
	31Z408	45	75	26	81	97	36	19.6
	31Z404	50	83	28	84	108	40	22.0
	31Z409	55	92	29	84	119	44	24.0
	31Z405	60	100	30	84	130	48	26.0
	31Z410	65	109	31	86	141	52	28.0
	31Z406	70	117	32	88	152	56	30.4
	31Z407	80	133	33	91	173	64	35.0
1½:1	31Z411	40	67	26	77	87	32	17.5
	31Z412	45	75	26	81	97	36	19.6
	31Z413	50	83	28	84	108	40	22.0
	31Z414	55	92	29	84	119	44	24.0
	31Z415	60	100	30	84	130	48	26.0
	31Z416	65	109	31	86	141	52	28.0
	31Z417	70	117	32	88	152	56	30.4
	31Z418	80	133	33	91	173	64	35.0
2:1	31Z419	40	80	26	77	87	32	17.5
	31Z420	45	90	26	81	97	36	19.6
	31Z421	50	100	28	84	108	40	22.0
	31Z422	55	110	29	84	119	44	24.0
	31Z423	60	120	30	84	130	48	26.0
	31Z424	65	130	31	86	141	52	28.0
	31Z425	70	140	32	88	152	56	30.4
	31Z426	80	160	33	91	173	64	35.0
2½:1	31Z427	40	80	26	77	87	32	17.5
	31Z428	45	90	26	81	97	36	19.6
	31Z429	50	100	28	84	108	40	22.0
	31Z430	55	110	29	84	119	44	24.0
	31Z431	60	120	30	84	130	48	26.0
	31Z432	65	130	31	86	141	52	28.0
	31Z433	70	140	32	88	152	56	30.4
	31Z434	80	160	33	91	173	64	35.0
3:1	31Z435	40	80	26	77	87	32	17.5
	31Z436	45	90	26	81	97	36	19.6
	31Z437	50	100	28	84	108	40	22.0
	31Z438	55	110	29	84	119	44	24.0
	31Z439	60	120	30	84	130	48	26.0
	31Z440	65	130	31	86	141	52	28.0
	31Z441	70	140	32	88	152	56	30.4
	31Z442	80	160	33	91	173	64	35.0
4:1	31Z443	40	80	26	77	87	32	17.5
	31Z444	45	90	26	81	97	36	19.6
	31Z445	50	100	28	84	108	40	22.0
	31Z446	55	110	29	84	119	44	24.0
	31Z447	60	120	30	84	130	48	26.0
	31Z448	65	130	31	86	141	52	28.0
	31Z449	70	140	32	88	152	56	30.4
	31Z450	80	160	33	91	173	64	35.0

TYPE 31Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	31Z149	.5	5.0	6	9	1.1	.40	.22
	31Z150	1.0	10.0	6	17	2.2	.80	.44
	31Z151	2.0	20.0	7	20	4.3	1.60	.87
	31Z152	3.0	30.0	7	23	6.5	2.40	1.3
	31Z153	4.0	40.0	8	24	8.6	3.20	1.7
	31Z154	5.0	50.0	8	25	10.8	4.00	2.2
	31Z155	6.0	60.0	10	25	13.0	4.80	2.6
	31Z156	8.0	80.0	10	31	17.3	6.40	3.5
6:1	31Z157	.5	5.0	6	9	1.1	.40	.22
	31Z158	1.0	10.0	6	17	2.2	.80	.44
	31Z159	2.0	20.0	7	20	4.3	1.60	.87
	31Z160	3.0	30.0	7	23	6.5	2.40	1.3
	31Z161	4.0	40.0	8	24	8.6	3.20	1.7
	31Z162	5.0	50.0	8	25	10.8	4.00	2.2
	31Z163	6.0	60.0	10	25	13.0	4.80	2.6
	31Z164	8.0	80.0	10	31	17.3	6.40	3.5
1:2	31Z165	.5	1.0	6	9	1.1	.40	.22
	31Z166	1.0	2.0	6	17	2.2	.80	.44
	31Z167	2.0	4.0	7	20	4.3	1.60	.87
	31Z168	3.0	5.0	7	23	6.5	2.40	1.3
	31Z169	4.0	7.0	8	24	8.6	3.20	1.7
	31Z170	5.0	8.0	8	25	10.8	4.00	2.2
	31Z171	6.0	10.0	10	25	13.0	4.80	2.6
	31Z172	8.0	13.0	10	31	17.3	6.40	3.5
1:3	31Z173	.5	1.0	6	9	1.1	.40	.22
	31Z174	1.0	2.0	6	17	2.2	.80	.44
	31Z175	2.0	4.0	7	20	4.3	1.60	.87
	31Z176	3.0	5.0	7	23	6.5	2.40	1.3
	31Z177	4.0	7.0	8	24	8.6	3.20	1.7
	31Z178	5.0	8.0	8	25	10.8	4.00	2.2
	31Z179	6.0	10.0	10	25	13.0	4.80	2.6
	31Z180	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	31Z181	.5	1.5	6	9	1.1	.40	.22
	31Z182	1.0	2.0	6	17	2.2	.80	.44
	31Z183	2.0	4.0	7	20	4.3	1.60	.87
	31Z184	3.0	5.0	7	23	6.5	2.40	1.3
	31Z185	4.0	7.0	8	24	8.6	3.20	1.7
	31Z186	5.0	8.0	8	25	10.8	4.00	2.2
	31Z187	6.0	10.0	10	25	13.0	4.80	2.6
	31Z188	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	31Z189	.5	1.5	6	9	1.1	.40	.22
	31Z190	1.0	2.0	6	17	2.2	.80	.44
	31Z191	2.0	4.0	7	20	4.3	1.60	.87
	31Z192	3.0	5.0	7	23	6.5	2.40	1.3
	31Z193	4.0	7.0	8	24	8.6	3.20	1.7
	31Z194	5.0	8.0	8	25	10.8	4.00	2.2
	31Z195	6.0	10.0	10	25	13.0	4.80	2.6
	31Z196	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 31Z, STYLE 4 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	31Z451	40	133	26	77	87	32	17.5
	31Z452	45	150	26	81	97	36	19.6
	31Z453	50	166	28	84	108	40	22.0
	31Z454	55	183	29	84	119	44	24.0
	31Z455	60	200	30	84	130	48	26.0
	31Z456	65	216	31	86	141	52	28.0
	31Z457	70	233	32	88	152	56	30.4
	31Z458	80	266	33	91	173	64	35.0
6:1	31Z459	40	133	26	77	87	32	17.5
	31Z460	45	150	26	81	97	36	19.6
	31Z461	50	166	28	84	108	40	22.0
	31Z462	55	183	29	84	119	44	24.0
	31Z463	60	200	30	84	130	48	26.0
	31Z464	65	216	31	86	141	52	28.0
	31Z465	70	233	32	88	152	56	30.4
	31Z466	80	266	33	91	173	64	35.0
1:2	31Z467	40	67	26	77	87	32	17.5
	31Z468	45	75	26	81	97	36	19.6
	31Z469	50	83	28	84	108	40	22.0
	31Z470	55	92	29	84	119	44	24.0
	31Z471	60	100	30	84	130	48	26.0
	31Z472	65	109	31	86	141	52	28.0
	31Z473	70	117	32	88	152	56	30.4
	31Z474	80	133	33	91	173	64	35.0
1:3	31Z475	40	67	26	77	87	32	17.5
	31Z476	45	75	26	81	97	36	19.6
	31Z477	50	83	28	84	108	40	22.0
	31Z478	55	92	29	84	119	44	24.0
	31Z479	60	100	30	84	130	48	26.0
	31Z480	65	109	31	86	141	52	28.0
	31Z481	70	117	32	88	152	56	30.4
	31Z482	80	133	33	91	173	64	35.0
1:1:1	31Z483	40	67	26	77	87	32	17.5
	31Z484	45	75	26	81	97	36	19.6
	31Z485	50	83	28	84	108	40	22.0
	31Z486	55	92	29	84	119	44	24.0
	31Z487	60	100	30	84	130	48	26.0
	31Z488	65	109	31	86	141	52	28.0
	31Z489	70	117	32	88	152	56	30.4
	31Z490	80	133	33	91	173	64	35.0
1:1:2	31Z491	40	67	26	77	87	32	17.5
	31Z492	45	75	26	81	97	36	19.6
	31Z493	50	83	28	84	108	40	22.0
	31Z494	55	92	29	84	119	44	24.0
	31Z495	60	100	30	84	130	48	26.0
	31Z496	65	109	31	86	141	52	28.0
	31Z497	70	117	32	88	152	56	30.4
	31Z498	80	133	33	91	173	64	35.0

SPRAGUE ELECTRIC COMPANY

North Adams, Massachusetts

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MAKERS OF RELIABLE ELECTRONIC COMPONENTS

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

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Engineering Data Sheet

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SUPERSEDES 10330, 10335, 10340, 10345

March, 1959

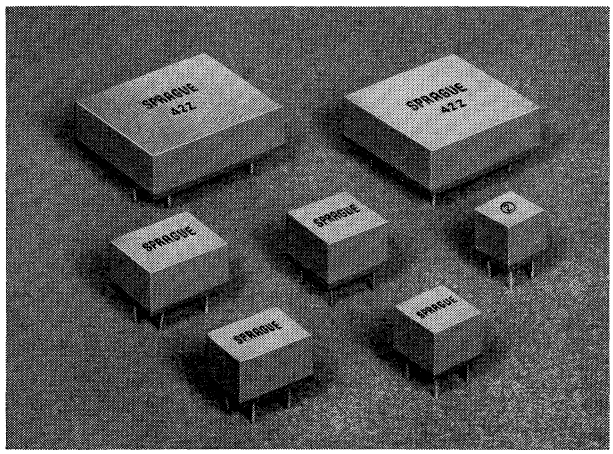
Type 42Z

BLOCK-SHAPED PULSE TRANSFORMERS For Printed Circuit Applications

THESE MINIATURE block-shaped pulse transformers are cast in epoxy resin for mechanical and moisture protection. They are especially suited for mounting on printed wiring boards.

The pulse width measurements shown were taken at a voltage level of 20 volts or less. Type 42Z, Style 1 units are recommended for pulse voltages up to 60 volts, Style 2 units up to 100 volts, Style 3 units up to 200 volts, and Style 4 units up to 300 volts at an average power rating of 0.3 watt, 0.5 watt, 1.0 watt, and 2.0 watts (maximum), respectively. The maximum suggested volt-microsecond product is 150 for Style 1, 340 for Style 2, 1200 for Style 3, and 3000 for Style 4.

The same electrical parameter values specified for Style 1 transformers may be obtained in hermetically-sealed cylindrical subminiature transformers, such as Type 5Z, and 'pancake' pulse transformers, such as Type 31Z, Style 1; values for Style 2 units may be obtained in hermetically-sealed miniature tubulars such as Type 10Z and 'pancake' pulse transformers such as Type 31Z, Style 2; values for Style 3 units may be obtained in hermetically-sealed subminiature 'bathtub' transformers such as Type 15Z, 'pancake' pulse transformers such as Type 31Z, Style 3, block-shaped transformers such as Type 40Z and cast-housing plug-in transformers such as Type 41Z; values for Style 4 units may be obtained in hermetically-sealed miniature 'bathtub' transformers such as Type 20Z and in 'pancake' pulse transformers such as Type 31Z, Style 4.



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Complete performance specifications are given in the latest issue of Sprague Engineering Bulletin No. 10,000.

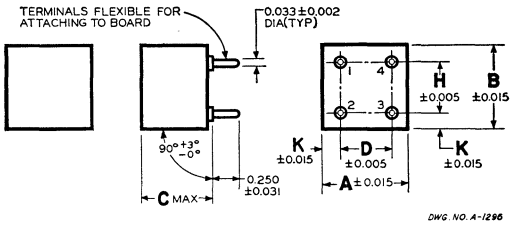

FIGURE 1
Standard 2-winding constructions

Style	A	B	C	D	H	K
1	.500	.500	.531	.300	.300	.100
2	.600	.600	.531	.400	.400	.100
3	.700	.700	.531	.500	.500	.100
4	1.400	1.400	.531	1.000	1.000	.200

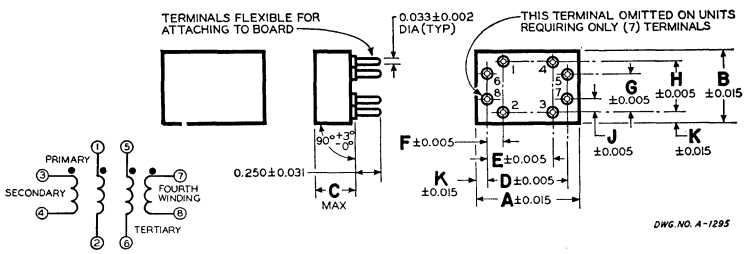

FIGURE 2
2-winding, 3-winding or 4-winding constructions

Style	A	B	C	D	E	F	G	H	J	K
1	.700	.500	.531	.500	.400	.100	.200	.300	.100	.100
2	.800	.600	.531	.600	.500	.200	.300	.400	.100	.100
3	.900	.700	.531	.700	.600	.100	.300	.500	.100	.100
4	1.600	1.400	.531	1.400	1.200	.200	.700	1.000	.300	.200

SPRAGUE ENGINEERING DATA SHEET 10330A

TYPE 42Z, STYLE 1

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	42Z100	.5	1.5	6	9	1.1	.40	.22
	42Z101	1.0	2.0	6	17	2.2	.80	.44
	42Z105	2.0	4.0	7	20	4.3	1.60	.87
	42Z106	3.0	5.0	7	23	6.5	2.40	1.3
	42Z107	4.0	7.0	8	24	8.6	3.20	1.7
	42Z108	5.0	8.0	8	25	10.8	4.00	2.2
	42Z103	6.0	10.0	10	25	13.0	4.80	2.6
	42Z104	8.0	13.0	10	31	17.3	6.40	3.5
1½:1	42Z109	.5	1.5	6	9	1.1	.40	.22
	42Z110	1.0	2.0	6	17	2.2	.80	.44
	42Z111	2.0	4.0	7	20	4.3	1.60	.87
	42Z112	3.0	5.0	7	23	6.5	2.40	1.3
	42Z113	4.0	7.0	8	24	8.6	3.20	1.7
	42Z114	5.0	8.0	8	25	10.8	4.00	2.2
	42Z115	6.0	10.0	10	25	13.0	4.80	2.6
	42Z116	8.0	13.0	10	31	17.3	6.40	3.5
2:1	42Z117	.5	1.7	6	9	1.1	.40	.22
	42Z118	1.0	3.3	6	17	2.2	.80	.44
	42Z119	2.0	6.7	7	20	4.3	1.60	.87
	42Z120	3.0	10.0	7	23	6.5	2.40	1.3
	42Z121	4.0	14.0	8	24	8.6	3.20	1.7
	42Z122	5.0	17.0	8	25	10.8	4.00	2.2
	42Z123	6.0	20.0	10	25	13.0	4.80	2.6
	42Z124	8.0	28.0	10	31	17.3	6.40	3.5
2½:1	42Z125	.5	1.7	6	9	1.1	.40	.22
	42Z126	1.0	3.3	6	17	2.2	.80	.44
	42Z127	2.0	6.7	7	20	4.3	1.60	.87
	42Z128	3.0	10.0	7	23	6.5	2.40	1.3
	42Z129	4.0	14.0	8	24	8.6	3.20	1.7
	42Z130	5.0	17.0	8	25	10.8	4.00	2.2
	42Z131	6.0	20.0	10	25	13.0	4.80	2.6
	42Z132	8.0	28.0	10	31	17.3	6.40	3.5
3:1	42Z133	.5	2.5	6	9	1.1	.40	.22
	42Z134	1.0	5.0	6	17	2.2	.80	.44
	42Z135	2.0	10.0	7	20	4.3	1.60	.87
	42Z136	3.0	15.0	7	23	6.5	2.40	1.3
	42Z137	4.0	20.0	8	24	8.6	3.20	1.7
	42Z138	5.0	25.0	8	25	10.8	4.00	2.2
	42Z139	6.0	30.0	10	25	13.0	4.80	2.6
	42Z140	8.0	40.0	10	31	17.3	6.40	3.5
4:1	42Z141	.5	2.5	6	9	1.1	.40	.22
	42Z142	1.0	5.0	6	17	2.2	.80	.44
	42Z143	2.0	10.0	7	20	4.3	1.60	.87
	42Z144	3.0	15.0	7	23	6.5	2.40	1.3
	42Z145	4.0	20.0	8	24	8.6	3.20	1.7
	42Z146	5.0	25.0	8	25	10.8	4.00	2.2
	42Z147	6.0	30.0	10	25	13.0	4.80	2.6
	42Z148	8.0	40.0	10	31	17.3	6.40	3.5

TYPE 42Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	42Z149	.5	5.0	6	9	1.1	.40	.22
	42Z150	1.0	10.0	6	17	2.2	.80	.44
	42Z151	2.0	20.0	7	20	4.3	1.60	.87
	42Z152	3.0	30.0	7	23	6.5	2.40	1.3
	42Z153	4.0	40.0	8	24	8.6	3.20	1.7
	42Z154	5.0	50.0	8	25	10.8	4.00	2.2
	42Z155	6.0	60.0	10	25	13.0	4.80	2.6
	42Z156	8.0	80.0	10	31	17.3	6.40	3.5
6:1	42Z157	.5	5.0	6	9	1.1	.40	.22
	42Z158	1.0	10.0	6	17	2.2	.80	.44
	42Z159	2.0	20.0	7	20	4.3	1.60	.87
	42Z160	3.0	30.0	7	23	6.5	2.40	1.3
	42Z161	4.0	40.0	8	24	8.6	3.20	1.7
	42Z162	5.0	50.0	8	25	10.8	4.00	2.2
	42Z163	6.0	60.0	10	25	13.0	4.80	2.6
	42Z164	8.0	80.0	10	31	17.3	6.40	3.5
1:2	42Z165	.5	1.0	6	9	1.1	.40	.22
	42Z166	1.0	2.0	6	17	2.2	.80	.44
	42Z167	2.0	4.0	7	20	4.3	1.60	.87
	42Z168	3.0	5.0	7	23	6.5	2.40	1.3
	42Z169	4.0	7.0	8	24	8.6	3.20	1.7
	42Z170	5.0	8.0	8	25	10.8	4.00	2.2
	42Z171	6.0	10.0	10	25	13.0	4.80	2.6
	42Z172	8.0	13.0	10	31	17.3	6.40	3.5
1:3	42Z173	.5	1.0	6	9	1.1	.40	.22
	42Z174	1.0	2.0	6	17	2.2	.80	.44
	42Z175	2.0	4.0	7	20	4.3	1.60	.87
	42Z176	3.0	5.0	7	23	6.5	2.40	1.3
	42Z177	4.0	7.0	8	24	8.6	3.20	1.7
	42Z178	5.0	8.0	8	25	10.8	4.00	2.2
	42Z179	6.0	10.0	10	25	13.0	4.80	2.6
	42Z180	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	42Z181	.5	1.5	6	9	1.1	.40	.22
	42Z182	1.0	2.0	6	17	2.2	.80	.44
	42Z183	2.0	4.0	7	20	4.3	1.60	.87
	42Z184	3.0	5.0	7	23	6.5	2.40	1.3
	42Z185	4.0	7.0	8	24	8.6	3.20	1.7
	42Z186	5.0	8.0	8	25	10.8	4.00	2.2
	42Z187	6.0	10.0	10	25	13.0	4.80	2.6
	42Z188	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	42Z189	.5	1.5	6	9	1.1	.40	.22
	42Z190	1.0	2.0	6	17	2.2	.80	.44
	42Z191	2.0	4.0	7	20	4.3	1.60	.87
	42Z192	3.0	5.0	7	23	6.5	2.40	1.3
	42Z193	4.0	7.0	8	24	8.6	3.20	1.7
	42Z194	5.0	8.0	8	25	10.8	4.00	2.2
	42Z195	6.0	10.0	10	25	13.0	4.80	2.6
	42Z196	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 42Z, STYLE 2

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	42Z200	.5	1.5	4	7	1.1	.40	.22
	42Z201	1.0	2.0	5	14	2.2	.80	.44
	42Z202	2.0	4.0	7	20	4.3	1.60	.87
	42Z296	3.0	5.0	7	20	6.5	2.40	1.3
	42Z203	4.0	7.0	7	20	8.6	3.20	1.7
	42Z207	5.0	8.0	7	21	10.8	4.00	2.2
	42Z204	6.0	10.0	7	21	13.0	4.80	2.6
	42Z205	8.0	13.0	10	22	17.3	6.40	3.5
1½:1	42Z208	.5	1.5	4	7	1.1	.40	.22
	42Z209	1.0	2.0	5	14	2.2	.80	.44
	42Z210	2.0	4.0	7	20	4.3	1.60	.87
	42Z211	3.0	5.0	7	20	6.5	2.40	1.3
	42Z212	4.0	7.0	7	20	8.6	3.20	1.7
	42Z213	5.0	8.0	7	21	10.8	4.00	2.2
	42Z214	6.0	10.0	7	21	13.0	4.80	2.6
	42Z215	8.0	13.0	10	22	17.3	6.40	3.5
2:1	42Z216	.5	1.7	4	7	1.1	.40	.22
	42Z217	1.0	3.3	5	14	2.2	.80	.44
	42Z218	2.0	6.7	7	20	4.3	1.60	.87
	42Z219	3.0	10.0	7	20	6.5	2.40	1.3
	42Z220	4.0	14.0	7	20	8.6	3.20	1.7
	42Z221	5.0	17.0	7	21	10.8	4.00	2.2
	42Z222	6.0	20.0	8	21	13.0	4.80	2.6
	42Z223	8.0	28.0	10	22	17.3	6.40	3.5
2½:1	42Z224	.5	1.7	4	7	1.1	.40	.22
	42Z225	1.0	3.3	5	14	2.2	.80	.44
	42Z226	2.0	6.7	7	20	4.3	1.60	.87
	42Z227	3.0	10.0	7	20	6.5	2.40	1.3
	42Z228	4.0	14.0	7	20	8.6	3.20	1.7
	42Z229	5.0	17.0	7	21	10.8	4.00	2.2
	42Z230	6.0	20.0	8	21	13.0	4.80	2.6
	42Z231	8.0	28.0	10	22	17.3	6.40	3.5
3:1	42Z232	.5	2.5	4	7	1.1	.40	.22
	42Z233	1.0	5.0	5	14	2.2	.80	.44
	42Z234	2.0	10.0	7	20	4.3	1.60	.87
	42Z235	3.0	15.0	7	20	6.5	2.40	1.3
	42Z236	4.0	20.0	7	20	8.6	3 20	1.7
	42Z237	5.0	25.0	7	21	10.8	4.00	2.2
	42Z238	6.0	30.0	8	21	13.0	4.80	2.6
	42Z239	8.0	40.0	10	22	17.3	6.40	3.5
4:1	42Z240	.5	2.5	4	7	1.1	.40	.22
	42Z241	1.0	5.0	5	14	2.2	.80	.44
	42Z242	2.0	10.0	7	20	4.3	1.60	.87
	42Z243	3.0	15.0	7	20	6.5	2.40	1.3
	42Z244	4.0	20.0	7	20	8.6	3.20	1.7
	42Z245	5.0	25.0	7	21	10.8	4.00	2.2
	42Z246	6.0	30.0	8	21	13.0	4.80	2.6
	42Z247	8.0	40.0	10	22	17.3	6.40	3.5

TYPE 42Z, STYLE 2 - - continued

Turns Ratio	Catalog Number	L_p (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	42Z248	.5	5.0	4	7	1.1	.40	.22
	42Z249	1.0	10.0	5	14	2.2	.80	.44
	42Z250	2.0	20.0	7	20	4.3	1.60	.87
	42Z251	3.0	30.0	7	20	6.5	2.40	1.3
	42Z252	4.0	40.0	7	20	8.6	3.20	1.7
	42Z253	5.0	50.0	7	21	10.8	4.00	2.2
	42Z254	6.0	60.0	7	21	13.0	4.80	2.6
	42Z255	8.0	80.0	10	22	17.3	6.40	3.5
6:1	42Z256	.5	5.0	4	7	1.1	.40	.22
	42Z257	1.0	10.0	5	14	2.2	.80	.44
	42Z258	2.0	20.0	7	20	4.3	1.60	.87
	42Z259	3.0	30.0	7	20	6.5	2.40	1.3
	42Z260	4.0	40.0	7	20	8.6	3.20	1.7
	42Z261	5.0	50.0	7	21	10.8	4.00	2.2
	42Z262	6.0	60.0	7	21	13.0	4.80	2.6
	42Z263	8.0	80.0	10	22	17.3	6.40	3.5
1:2	42Z264	.5	1.0	4	7	1.1	.40	.22
	42Z265	1.0	2.0	5	14	2.2	.80	.44
	42Z266	2.0	4.0	7	20	4.3	1.60	.87
	42Z267	3.0	5.0	7	20	6.5	2.40	1.3
	42Z268	4.0	7.0	7	20	8.6	3.20	1.7
	42Z269	5.0	8.0	7	21	10.8	4.00	2.2
	42Z270	6.0	10.0	7	21	13.0	4.80	2.6
	42Z271	8.0	13.0	10	22	17.3	6.40	3.5
1:3	42Z272	.5	1.0	4	7	1.1	.40	.22
	42Z273	1.0	2.0	5	14	2.2	.80	.44
	42Z274	2.0	4.0	7	20	4.3	1.60	.87
	42Z275	3.0	5.0	7	20	6.5	2.40	1.3
	42Z276	4.0	7.0	7	20	8.6	3.20	1.7
	42Z277	5.0	8.0	7	21	10.8	4.00	2.2
	42Z278	6.0	10.0	7	21	13.0	4.80	2.6
	42Z279	8.0	13.0	10	22	17.3	6.40	3.5
1:1:1	42Z280	.5	1.5	4	7	1.1	.40	.22
	42Z281	1.0	2.0	5	14	2.2	.80	.44
	42Z282	2.0	4.0	7	20	4.3	1.60	.87
	42Z283	3.0	5.0	7	20	6.5	2.40	1.3
	42Z284	4.0	7.0	7	20	8.6	3.20	1.7
	42Z285	5.0	8.0	7	21	10.8	4.00	2.2
	42Z286	6.0	10.0	7	21	13.0	4.80	2.6
	42Z287	8.0	13.0	10	22	17.3	6.40	3.5
1:1:2	42Z288	.5	1.5	4	7	1.1	.40	.22
	42Z289	1.0	2.0	5	14	2.2	.80	.44
	42Z290	2.0	4.0	7	20	4.3	1.60	.87
	42Z291	3.0	5.0	7	20	6.5	2.40	1.3
	42Z292	4.0	7.0	7	20	8.6	3.20	1.7
	42Z293	5.0	8.0	7	21	10.8	4.00	2.2
	42Z294	6.0	10.0	7	21	13.0	4.80	2.6
	42Z295	8.0	13.0	10	22	17.3	6.40	3.5

TYPE 42Z, STYLE 3

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	42Z300	6	10	10	31	13	4.8	2.6
	42Z301	10	17	12	35	22	8.0	4.4
	42Z303	15	25	12	35	33	12	6.4
	42Z304	20	33	12	38	45	16	8.7
	42Z306	25	42	13	42	55	20	11.0
	42Z307	30	50	13	43	60	24	12.5
	42Z308	35	58	13	46	72	28	15.0
	42Z309	40	66	14	49	88	32	17.0
1½:1	42Z310	6	10	10	31	13	4.8	2.6
	42Z311	10	17	12	35	22	8.0	4.4
	42Z312	15	25	12	35	33	12	6.4
	42Z313	20	33	12	38	45	16	8.7
	42Z314	25	42	13	42	55	20	11.0
	42Z315	30	50	13	43	60	24	12.5
	42Z316	35	58	13	46	72	28	15.0
	42Z317	40	66	14	49	88	32	17.0
2:1	42Z318	6	12	10	31	13	4.8	2.6
	42Z319	10	20	12	35	22	8.0	4.4
	42Z320	15	30	12	35	33	12	6.4
	42Z321	20	40	12	38	45	16	8.7
	42Z322	25	50	13	42	55	20	11.0
	42Z323	30	60	13	43	60	24	12.5
	42Z324	35	70	13	46	72	28	15.0
	42Z325	40	80	14	49	88	32	17.0
2½:1	42Z326	6	12	10	31	13	4.8	2.6
	42Z327	10	20	12	35	22	8.0	4.4
	42Z328	15	30	12	35	33	12	6.4
	42Z329	20	40	12	38	45	16	8.7
	42Z330	25	50	13	42	55	20	11.0
	42Z331	30	60	13	43	60	24	12.5
	42Z332	35	70	13	46	72	28	15.0
	42Z333	40	80	14	49	88	32	17.0
3:1	42Z334	6	17	10	31	13	4.8	2.6
	42Z335	10	28	12	35	22	8.0	4.4
	42Z336	15	42	12	35	33	12	6.4
	42Z337	20	55	12	38	45	16	8.7
	42Z338	25	70	13	42	55	20	11.0
	42Z339	30	85	13	43	60	24	12.5
	42Z340	35	100	13	46	72	28	15.0
	42Z341	40	115	14	49	88	32	17.0
4:1	42Z342	6	17	10	31	13	4.8	2.6
	42Z343	10	28	12	35	22	8.0	4.4
	42Z344	15	42	12	35	33	12	6.4
	42Z345	20	55	12	38	45	16	8.7
	42Z346	25	70	13	42	55	20	11.0
	42Z347	30	85	13	43	60	24	12.5
	42Z348	35	100	13	46	72	28	15.0
	42Z349	40	115	14	49	88	32	17.0

TYPE 42Z, STYLE 3 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
	42Z350	6	20	10	31	13	4.8	2.6
	42Z351	10	33	12	35	22	8.0	4.4
	42Z352	15	50	12	35	33	12	6.4
5:1	42Z353	20	66	12	38	45	16	8.7
	42Z354	25	83	13	42	55	20	11.0
	42Z355	30	100	13	43	60	24	12.5
	42Z356	35	115	13	46	72	28	15.0
	42Z357	40	130	14	49	88	32	17.0
	42Z358	6	20	10	31	13	4.8	2.6
	42Z359	10	33	12	35	22	8.0	4.4
	42Z360	15	50	12	35	33	12	6.4
6:1	42Z361	20	66	12	38	45	16	8.7
	42Z362	25	83	13	42	55	20	11.0
	42Z363	30	100	13	43	60	24	12.5
	42Z364	35	115	13	46	72	28	15.0
	42Z365	40	130	14	49	88	32	17.0
	42Z366	6	10	10	31	13	4.8	2.6
	42Z367	10	17	12	35	22	8.0	4.4
	42Z368	15	25	12	35	33	12	6.4
1:2	42Z369	20	33	12	38	45	16	8.7
	42Z370	25	42	13	42	55	20	11.0
	42Z371	30	50	13	43	60	24	12.5
	42Z372	35	58	13	46	72	28	15.0
	42Z373	40	66	14	49	88	32	17.0
	42Z374	6	10	10	31	13	4.8	2.6
	42Z375	10	17	12	35	22	8.0	4.4
	42Z376	15	25	12	35	33	12	6.4
1:3	42Z377	20	33	12	38	45	16	8.7
	42Z378	25	42	13	42	55	20	11.0
	42Z379	30	50	13	43	60	24	12.5
	42Z380	35	58	13	46	72	28	15.0
	42Z381	40	66	14	49	88	32	17.0
	42Z382	6	10	10	31	13	4.8	2.6
	42Z383	10	17	12	35	22	8.0	4.4
	42Z384	15	25	12	35	33	12	6.4
1:1:1	42Z385	20	33	12	38	45	16	8.7
	42Z386	25	42	13	42	55	20	11.0
	42Z387	30	50	13	43	60	24	12.5
	42Z388	35	58	13	46	72	28	15.0
	42Z389	40	66	14	49	88	32	17.0
	42Z390	6	10	10	31	13	4.8	2.6
	42Z391	10	17	12	35	22	8.0	4.4
	42Z392	15	25	12	35	33	12	6.4
1:1:2	42Z393	20	33	12	38	45	16	8.7
	42Z394	25	42	13	42	55	20	11.0
	42Z395	30	50	13	43	60	24	12.5
	42Z396	35	58	13	46	72	28	15.0
	42Z397	40	66	14	49	88	32	17.0

TYPE 42Z, STYLE 4

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:1	42Z403	40	67	26	77	87	32	17.5
	42Z408	45	75	26	81	97	36	19.6
	42Z404	50	83	28	84	108	40	22.0
	42Z409	55	92	29	84	119	44	24.0
	42Z405	60	100	30	84	130	48	26.0
	42Z410	65	109	31	86	141	52	28.0
	42Z406	70	117	32	88	152	56	30.4
	42Z407	80	133	33	91	173	64	35.0
1½:1	42Z411	40	67	26	77	87	32	17.5
	42Z412	45	75	26	81	97	36	19.6
	42Z413	50	83	28	84	108	40	22.0
	42Z414	55	92	29	84	119	44	24.0
	42Z415	60	100	30	84	130	48	26.0
	42Z416	65	109	31	86	141	52	28.0
	42Z417	70	117	32	88	152	56	30.4
	42Z418	80	133	33	91	173	64	35.0
2:1	42Z419	40	80	26	77	87	32	17.5
	42Z420	45	90	26	81	97	36	19.6
	42Z421	50	100	28	84	108	40	22.0
	42Z422	55	110	29	84	119	44	24.0
	42Z423	60	120	30	84	130	48	26.0
	42Z424	65	130	31	86	141	52	28.0
	42Z425	70	140	32	88	152	56	30.4
	42Z426	80	160	33	91	173	64	35.0
2½:1	42Z427	40	80	26	77	87	32	17.5
	42Z428	45	90	26	81	97	36	19.6
	42Z429	50	100	28	84	108	40	22.0
	42Z430	55	110	29	84	119	44	24.0
	42Z431	60	120	30	84	130	48	26.0
	42Z432	65	130	31	86	141	52	28.0
	42Z433	70	140	32	88	152	56	30.4
	42Z434	80	160	33	91	173	64	35.0
3:1	42Z435	40	80	26	77	87	32	17.5
	42Z436	45	90	26	81	97	36	19.6
	42Z437	50	100	28	84	108	40	22.0
	42Z438	55	110	29	84	119	44	24.0
	42Z439	60	120	30	84	130	48	26.0
	42Z440	65	130	31	86	141	52	28.0
	42Z441	70	140	32	88	152	56	30.4
	42Z442	80	160	33	91	173	64	35.0
4:1	42Z443	40	80	26	77	87	32	17.5
	42Z444	45	90	26	81	97	36	19.6
	42Z445	50	100	28	84	108	40	22.0
	42Z446	55	110	29	84	119	44	24.0
	42Z447	60	120	30	84	130	48	26.0
	42Z448	65	130	31	86	141	52	28.0
	42Z449	70	140	32	88	152	56	30.4
	42Z450	80	160	33	91	173	64	35.0

TYPE 42Z, STYLE 1 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D (μμF)	C_C (μμF)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	42Z149	.5	5.0	6	9	1.1	.40	.22
	42Z150	1.0	10.0	6	17	2.2	.80	.44
	42Z151	2.0	20.0	7	20	4.3	1.60	.87
	42Z152	3.0	30.0	7	23	6.5	2.40	1.3
	42Z153	4.0	40.0	8	24	8.6	3.20	1.7
	42Z154	5.0	50.0	8	25	10.8	4.00	2.2
	42Z155	6.0	60.0	10	25	13.0	4.80	2.6
	42Z156	8.0	80.0	10	31	17.3	6.40	3.5
6:1	42Z157	.5	5.0	6	9	1.1	.40	.22
	42Z158	1.0	10.0	6	17	2.2	.80	.44
	42Z159	2.0	20.0	7	20	4.3	1.60	.87
	42Z160	3.0	30.0	7	23	6.5	2.40	1.3
	42Z161	4.0	40.0	8	24	8.6	3.20	1.7
	42Z162	5.0	50.0	8	25	10.8	4.00	2.2
	42Z163	6.0	60.0	10	25	13.0	4.80	2.6
	42Z164	8.0	80.0	10	31	17.3	6.40	3.5
1:2	42Z165	.5	1.0	6	9	1.1	.40	.22
	42Z166	1.0	2.0	6	17	2.2	.80	.44
	42Z167	2.0	4.0	7	20	4.3	1.60	.87
	42Z168	3.0	5.0	7	23	6.5	2.40	1.3
	42Z169	4.0	7.0	8	24	8.6	3.20	1.7
	42Z170	5.0	8.0	8	25	10.8	4.00	2.2
	42Z171	6.0	10.0	10	25	13.0	4.80	2.6
	42Z172	8.0	13.0	10	31	17.3	6.40	3.5
1:3	42Z173	.5	1.0	6	9	1.1	.40	.22
	42Z174	1.0	2.0	6	17	2.2	.80	.44
	42Z175	2.0	4.0	7	20	4.3	1.60	.87
	42Z176	3.0	5.0	7	23	6.5	2.40	1.3
	42Z177	4.0	7.0	8	24	8.6	3.20	1.7
	42Z178	5.0	8.0	8	25	10.8	4.00	2.2
	42Z179	6.0	10.0	10	25	13.0	4.80	2.6
	42Z180	8.0	13.0	10	31	17.3	6.40	3.5
1:1:1	42Z181	.5	1.5	6	9	1.1	.40	.22
	42Z182	1.0	2.0	6	17	2.2	.80	.44
	42Z183	2.0	4.0	7	20	4.3	1.60	.87
	42Z184	3.0	5.0	7	23	6.5	2.40	1.3
	42Z185	4.0	7.0	8	24	8.6	3.20	1.7
	42Z186	5.0	8.0	8	25	10.8	4.00	2.2
	42Z187	6.0	10.0	10	25	13.0	4.80	2.6
	42Z188	8.0	13.0	10	31	17.3	6.40	3.5
1:1:2	42Z189	.5	1.5	6	9	1.1	.40	.22
	42Z190	1.0	2.0	6	17	2.2	.80	.44
	42Z191	2.0	4.0	7	20	4.3	1.60	.87
	42Z192	3.0	5.0	7	23	6.5	2.40	1.3
	42Z193	4.0	7.0	8	24	8.6	3.20	1.7
	42Z194	5.0	8.0	8	25	10.8	4.00	2.2
	42Z195	6.0	10.0	10	25	13.0	4.80	2.6
	42Z196	8.0	13.0	10	31	17.3	6.40	3.5

TYPE 42Z, STYLE 4 - - continued

Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
5:1	42Z451	40	133	26	77	87	32	17.5
	42Z452	45	150	26	81	97	36	19.6
	42Z453	50	166	28	84	108	40	22.0
	42Z454	55	183	29	84	119	44	24.0
	42Z455	60	200	30	84	130	48	26.0
	42Z456	65	216	31	86	141	52	28.0
	42Z457	70	233	32	88	152	56	30.4
	42Z458	80	266	33	91	173	64	35.0
6:1	42Z459	40	133	26	77	87	32	17.5
	42Z460	45	150	26	81	97	36	19.6
	42Z461	50	166	28	84	108	40	22.0
	42Z462	55	183	29	84	119	44	24.0
	42Z463	60	200	30	84	130	48	26.0
	42Z464	65	216	31	86	141	52	28.0
	42Z465	70	233	32	88	152	56	30.4
	42Z466	80	266	33	91	173	64	35.0
1:2	42Z467	40	67	26	77	87	32	17.5
	42Z468	45	75	26	81	97	36	19.6
	42Z469	50	83	28	84	108	40	22.0
	42Z470	55	92	29	84	119	44	24.0
	42Z471	60	100	30	84	130	48	26.0
	42Z472	65	109	31	86	141	52	28.0
	42Z473	70	117	32	88	152	56	30.4
	42Z474	80	133	33	91	173	64	35.0
1:3	42Z475	40	67	26	77	87	32	17.5
	42Z476	45	75	26	81	97	36	19.6
	42Z477	50	83	28	84	108	40	22.0
	42Z478	55	92	29	84	119	44	24.0
	42Z479	60	100	30	84	130	48	26.0
	42Z480	65	109	31	86	141	52	28.0
	42Z481	70	117	32	88	152	56	30.4
	42Z482	80	133	33	91	173	64	35.0
1:1:1	42Z483	40	67	26	77	87	32	17.5
	42Z484	45	75	26	81	97	36	19.6
	42Z485	50	83	28	84	108	40	22.0
	42Z486	55	92	29	84	119	44	24.0
	42Z487	60	100	30	84	130	48	26.0
	42Z488	65	109	31	86	141	52	28.0
	42Z489	70	117	32	88	152	56	30.4
	42Z490	80	133	33	91	173	64	35.0
1:1:2	42Z491	40	67	26	77	87	32	17.5
	42Z492	45	75	26	81	97	36	19.6
	42Z493	50	83	28	84	108	40	22.0
	42Z494	55	92	29	84	119	44	24.0
	42Z495	60	100	30	84	130	48	26.0
	42Z496	65	109	31	86	141	52	28.0
	42Z497	70	117	32	88	152	56	30.4
	42Z498	80	133	33	91	173	64	35.0

SPRAGUE ELECTRIC COMPANY

North Adams, Massachusetts

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MAKERS OF RELIABLE ELECTRONIC COMPONENTS

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

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Turns Ratio	Catalog Number	L_P (mH)	L_L (μH)	C_D ($\mu\mu$F)	C_C ($\mu\mu$F)	Pulse Width Range and Impedance Level for 10% Droop: Width at 100Ω (μsec)	Width at 250Ω (μsec)	Width at 500Ω (μsec)
1:2	40Z364	6	10	10	31	13	4.8	2.6
	40Z365	10	17	12	35	22	8.0	4.4
	40Z366	15	25	12	35	33	12	6.4
	40Z367	20	33	12	38	45	16	8.7
	40Z368	25	42	13	42	55	20	11.0
	40Z369	30	50	13	43	60	24	12.5
	40Z370	35	58	13	46	72	28	15.0
	40Z371	40	66	14	49	88	32	17.0
1:3	40Z372	6	10	10	31	13	4.8	2.6
	40Z373	10	17	12	35	22	8.0	4.4
	40Z374	15	25	12	35	33	12	6.4
	40Z375	20	33	12	38	45	16	8.7
	40Z376	25	42	13	42	55	20	11.0
	40Z377	30	50	13	43	60	24	12.5
	40Z378	35	58	13	46	72	28	15.0
	40Z379	40	66	14	49	88	32	17.0
1:1:1	40Z380	6	10	10	31	13	4.8	2.6
	40Z381	10	17	12	35	22	8.0	4.4
	40Z382	15	25	12	35	33	12	6.4
	40Z383	20	33	12	38	45	16	8.7
	40Z384	25	42	13	42	55	20	11.0
	40Z385	30	50	13	43	60	24	12.5
	40Z386	35	58	13	46	72	28	15.0
	40Z387	40	66	14	49	88	32	17.0
1:1:2	40Z388	6	10	10	31	13	4.8	2.6
	40Z389	10	17	12	35	22	8.0	4.4
	40Z390	15	25	12	35	33	12	6.4
	40Z391	20	33	12	38	45	16	8.7
	40Z392	25	42	13	42	55	20	11.0
	40Z393	30	50	13	43	60	24	12.5
	40Z394	35	58	13	46	72	28	15.0
	40Z395	40	66	14	49	88	32	17.0

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SPRAGUE the mark of reliability

Engineering Bulletin

No. 10950

SUPERSEDES 504A

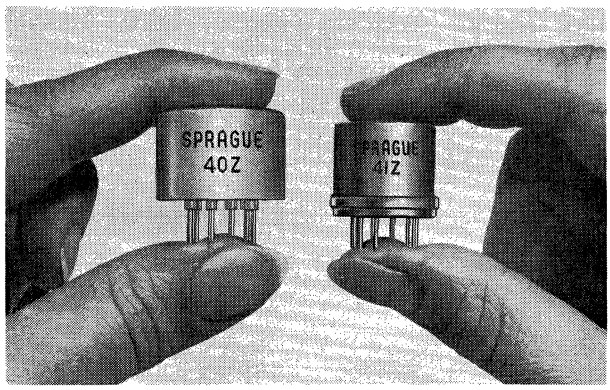
March, 1959

MAGNETIC SWITCHING TRANSFORMERS

MAGNETIC SWITCHING CORES are used in computer systems to perform the logical functions of selection or gating. The cores, in general, are provided with at least three windings to provide access for the write, read and output signals. The output wave form can be shaped and precisely controlled in design for a particular application. As a result of the above high reliability capabilities switch cores have been designed into matrix switching circuits used in conjunction with coincident current memory arrays. In addition, they find wide application in simultaneously gating and pulse forming signals between various computer circuits.

Sprague switch cores are rigidly controlled with respect to performance by precision pulse testing of the basic core and by a final performance test designed to simulate the actual circuit application.

Sprague Type 41Z switch core assemblies are hermetically sealed in corrosion resistant metal cases with glass-to-metal sealed terminals for extreme reliability. In addition, lower-cost embedded housings have been designed to meet typical commercial environment requirements. Such units

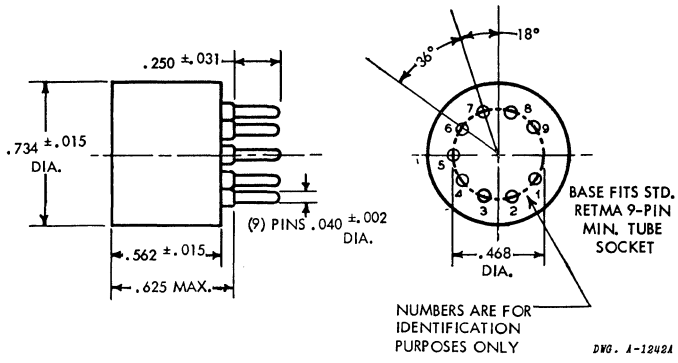


7003

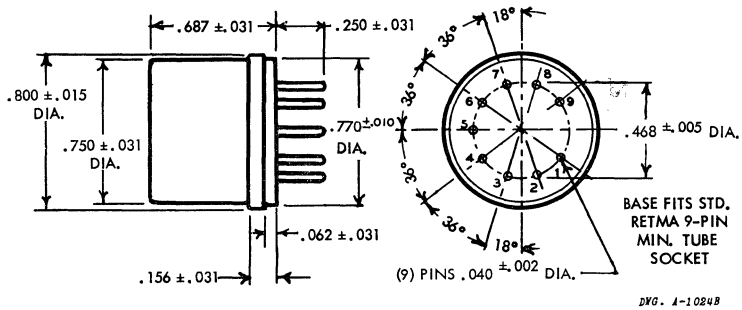
are the Type 40Z series. Both have miniature 9-pin electron tube bases in accordance with EIA standards.

Special packaging designs are available for printed wiring board mounting and for miniature assemblies for use in ground or airborne systems equipment.

Performance and operating details are given on the following page. In addition, the Sprague Electric Company will furnish you with field engineering assistance without obligation on your part in connection with the electrical or packaging design of switching transformers to meet your specific needs.



TYPE 40Z — PLASTIC-EMBEDDED



TYPE 41Z — METAL-ENCASED

GENERAL PERFORMANCE CHARACTERISTICS

1. D-C Voltage Rating. Standard transformers are designed for a nominal voltage rating between windings of 300 volts d-c. Special designs are available for higher actual working voltages.

2. Temperature Range Ratings. Standard switching transformers are designed for operation over the temperature range of —55 C to +85 C.

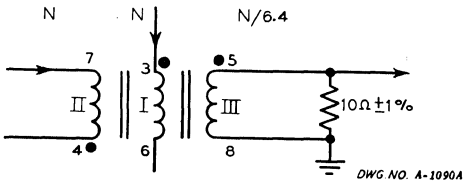
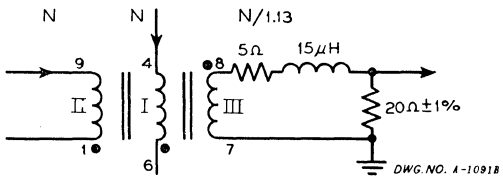
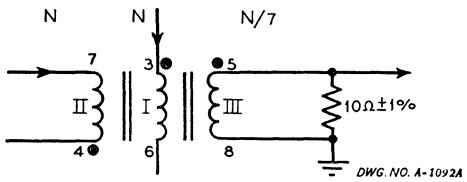
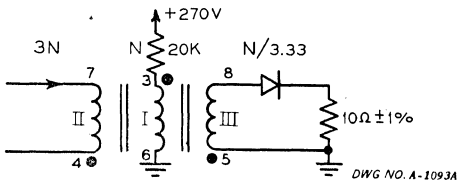
3. Insulation Resistance. The minimum insulation resistance between any one terminal and case and between windings shall be 30,000 megohms at 25 C.

3.1 Measurements shall be made following a two-minute charge at 180 volts d-c.

4. Voltage Test. Transformers shall withstand a d-c voltage of three times rated value for one minute maximum between terminals and case and between terminals of different windings. This is a d-c voltage applied through a 1,000 ohm resistor.

5. Life Test. Standard switching transformers shall be capable of withstanding a voltage between windings of 500 volts d-c for 250 hours at 85 C with not more than one failure per 12 units tested.

SUMMARY OF SWITCHING TRANSFORMER CHARACTERISTICS

Type	Characteristics	Write Pulse Winding I	Read Pulse Winding II	Output Pulse, Winding III		Winding Schematic
				Positive	Negative	
40Z125 and 41Z8	Polarity	Neg	Neg			
	Peak Ampl.	71 ma	71 ma	4 volts	4 volts	
	Pulse Width	3.7 μsec	2.7 μsec	2.2 μsec	2.2 μsec	
	Rise Time	0.25 μsec	0.25 μsec	0.3 μsec	0.3 μsec	
	Fall Time	0.5 μsec	0.5 μsec	0.7 μsec	0.7 μsec	
	Droop	≦ 2%	≦ 2%	≦ 5%	≦ 5%	
40Z126 and 41Z9	Polarity	Pos	Neg			
	Peak Ampl.	400 ma	400 ma	7.9 volts	7.9 volts	
	Pulse Width	8.0 μsec	8.0 μsec	3.6 μsec	3.6 μsec	
	Rise Time	0.2 μsec	0.5 μsec	0.5 μsec	0.5 μsec	
	Fall Time	0.5 μsec	0.5 μsec	0.8 μsec	0.8 μsec	
	Droop	≦ 2%	≦ 2%	≦ 5%	≦ 5%	
40Z127 and 41Z10	Polarity	Neg	Neg			
	Peak Ampl.	70 ma	70 ma	4 volts	4 volts	
	Pulse Width	6.2 μsec	3.9 μsec	3.0 μsec	3.0 μsec	
	Rise Time	0.4 μsec	0.4 μsec	0.5 μsec	0.5 μsec	
	Fall Time	0.5 μsec	0.5 μsec	0.7 μsec	0.7 μsec	
	Droop	≦ 2%	≦ 2%	≦ 5%	≦ 5%	
40Z128 and 41Z11	Polarity		Neg			
	Peak Ampl.	18.8 ma	50 ma	4 volts		
	Pulse Width	D-C	4.0 μsec	35 μsec		
	Rise Time		0.4 μsec	0.5 μsec		
	Fall Time		0.5 μsec	0.7 μsec		
	Droop		≦ 2%	≦ 5%		

Pulse Width, 10% of Rise to 90% of Fall Time Rise Time, 10% to 90% Fall Time, 10% to 90%

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SPRAGUE the mark of reliability

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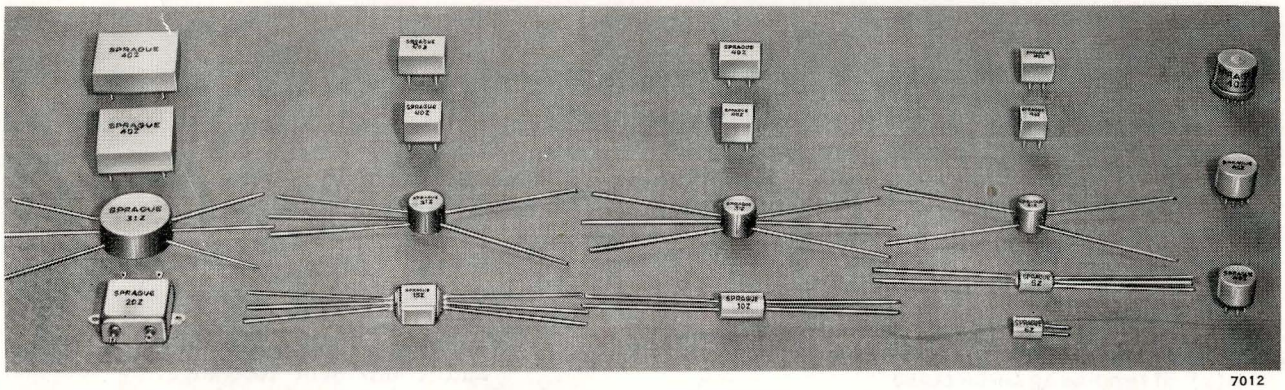
Supersedes No. 10,000

March, 1960

General Data On

MINIATURE PULSE TRANSFORMERS



7012

SPRAGUE miniature pulse transformers are ideally suited for application in low-power, high-speed computer circuitry where pulse signals may range up from 20 milli-microseconds and wider in duration, at repetition rates as high as 10 megacycles with pulse levels ranging from fractions of a volt to several hundred volts.* Described below are several typical circuits utilizing pulse transformers and the various applications of pulse transformers in these circuits. Also described below are typical transistor blocking oscillator circuits as well as the performance characteristics of Sprague miniature pulse transformers when used in these circuits.

*Pulse signals of 100 milli-microseconds or less in duration are normally half sine wave in shape, while those of wider duration have the usual trapezoidal wave shape.

TYPICAL CIRCUITS

Pulse Amplifiers. Sprague pulse transformers may be used for current step-up or voltage step-up, impedance matching, decoupling, pulse inversion and push-pull operation.

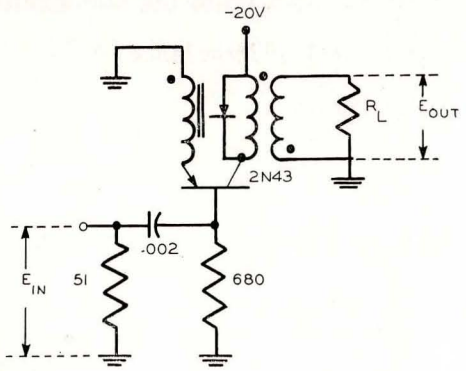
Pulse Shaping. Sprague pulse transformers may be used in circuits where pulse shaping or pulse differentiating is desired.

Blocking Oscillators. Sprague pulse transformers may be used in regenerative circuits of the triggered and self-triggered type. Pulse output may be obtained from the cathode, plate or grid of the circuit or from an additional winding or windings on the transformer.

Transistorized Circuits. Sprague pulse transformers are also ideally suited for transistor circuits in applications similar to the general types listed above.

BLOCKING OSCILLATOR APPLICATION

A typical transistor blocking oscillator circuit is shown below. The performance of typical Sprague pulse transformers in the circuit is shown in the table.



E_{in} – 4 VOLTS, 0.2μSEC. DWG. NO. A-1774A

Cat. No.	Amplitude in Volts	Nominal Pulse Width μsec	Rise Time μsec	Fall Time μsec	Per Cent Droop	Min. R_L (Ω)
43Z1	5.2	1.0	0.11	0.35	5	75
43Z2	5.2	2.0	0.11	0.35	5	75
43Z3	5.2	3.0	0.11	0.40	5	75
43Z4	5.2	4.0	0.11	0.40	5	75
43Z5	5.2	5.0	0.11	0.45	5	75

VOLT - MICROSECOND PRODUCT

An important characteristic of a pulse transformer is the volt-microsecond product value of the unit. This value output relates the pulse voltage, pulse width, and output turns for a given type of core. The value is determined under the conditions of maximum flux change that can take place in a core when driven by a uni-directional pulse program and from the maximum number of output turns that are normally possible for a given type of construction.

For a given construction, the volt-microsecond value will determine the maximum pulse voltage that may be used without saturating the core when operating at a given pulse width; e.g. $Et=K$ where K is the product constant, E is the pulse voltage in volts and t is the time in microseconds.

The volt-microsecond values listed for the various constructions are suggested maximums. These values may be subject to modification depending on the number of windings or the ratio of a given unit.

CUSTOM-DESIGNED PULSE TRANSFORMERS

Sprague Electric will supply custom-designed transformers upon request. In order to design transformers of this type, it is necessary that complete information be given regarding the application of the transformer. Shown below are five methods of supplying information for a custom-designed transformer.

1. Specify the desired parameters as
   (a) Magnetizing Inductance
   (b) Leakage Inductance
   (c) Distributed and Coupling Capacitance
   (d) Turns Ratio
   (e) Physical Construction

   In some cases it may be convenient to specify that parameters as leakage inductance and distributed or coupling capacitance be as small as possible for maximum high frequency response.

2. Specify the desired characteristics when the transformer is operated at a specified impedance level. The following information is needed.
   (a) Source and load impedance
   (b) Turns ratio
   (c) Pulse voltage
   (d) Pulse width
   (e) Repetition rate
   (f) Desired output such as droop, rise time, fall time, ringing, etc.
   (g) Physical construction

3. Specify the circuit in which the transformer is to operate. The following should be included.
   (a) Complete circuit with voltages, tube type and component tolerances
   (b) Input pulse signal or trigger
   (c) Turns ratio
   (d) Desired pulse output
   (e) Physical construction

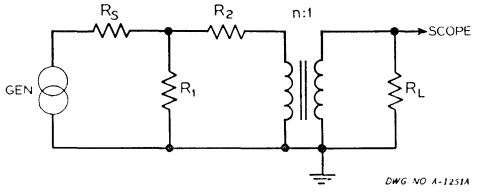
4. Specify a standard Sprague transformer with modifications that may be desired such as turns ratio change or added winding, a common center tap or modified construction, etc.

5. Specify the desired sine wave band pass characteristics of the transformer when operated at specified impedance and voltage levels. The following information is needed:
   (a) Source and load impedance
   (b) Voltage Level
   (c) Required band pass

METHOD USED FOR MEASURING PULSE CHARACTERISTICS

The pulse characteristics of transformers are measured using the test circuit shown below. The impedance levels specified on the applicable data sheets are source impedances and related to the load by:
Source impedance = n^2R_L.

Test Circuit



R_S = Pulse Generator Impedance

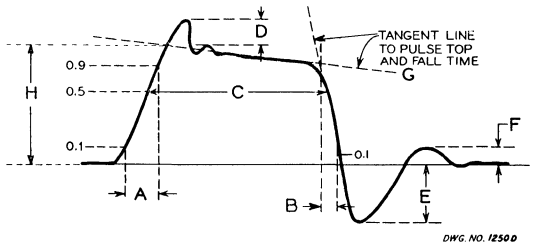
R_1 = R_S

$R_2 + \frac{1}{2}R_1$ = Source Impedance

R_L = Load Impedance

Source Z = n^2R_L

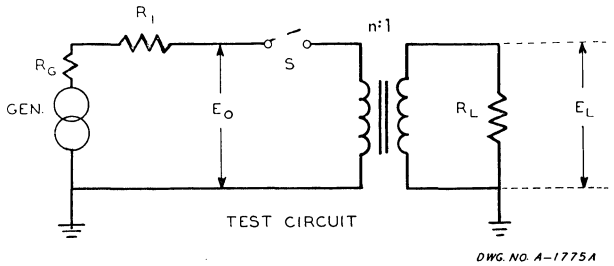
DESCRIPTION OF PULSE CHARACTERISTICS



A = Rise Time
B = Fall Time
C = Pulse Width
D = Overshoot of Leading Edge
E = Negative Overshoot of Tail
F = Positive Overshoot of Tail
G = Slope of Tangent Line (Droop)
H = Peak Voltage

METHOD USED FOR MEASURING BAND PASS CHARACTERISTICS

The sine-wave band pass characteristics of transformers are measured using the test circuit shown below:



$R_1 + R_G$ = Source Impedance
R_G = Generator Impedance
R_L = Load
E_O = Generator Voltage (S open)
E_L = Output Voltage

$$20 \log \left[\frac{\frac{nE_L}{n^2R_L}}{\frac{(R_1+R_G)+n^2R_L}{}} (E_o) \right] = \text{Insertion Loss (db)}$$

METHOD USED FOR MEASURING TRANSFORMER PARAMETERS

The transformer parameters specified on Sprague engineering data sheets are as follows:

The transformer parameters are measured using a Boonton Type 260A Q-meter or equivalent.

Magnetizing Inductance (L_P) is measured at the primary winding with the secondary open-circuited.

Leakage Inductance (L_L) is measured at the primary with the reference winding short-circuited.

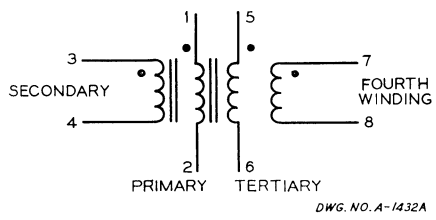
Coupling Capacitance (C_C) is measured by shorting the primary and secondary windings and measuring the capacitance between the windings.

Distributed Capacitance (C_d) is the capacitance of the primary winding excluding reflected capacitance of other windings.

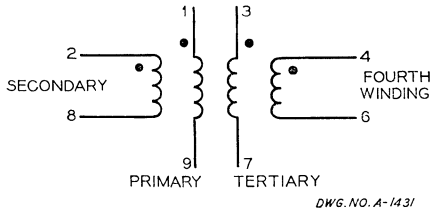
NOTE: The input capacitance (C_I) or total capacitance as measured at the primary can be supplied upon request.

TERMINAL MARKINGS

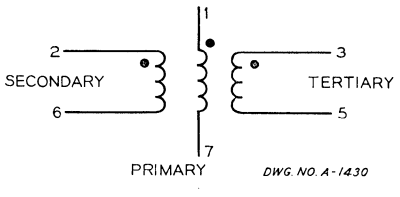
TERMINAL MARKINGS
STANDARD



TERMINAL MARKINGS
FOR 9 PIN PLUG-IN UNITS



TERMINAL MARKINGS
FOR 7 PIN PLUG-IN UNITS



GENERAL PERFORMANCE CHARACTERISTICS

1. D-C Voltage Rating. Standard transformers are designed for a nominal voltage rating between windings and to case of 300 volts d-c. Special designs are available for higher actual working voltages.

2. Temperature Range Ratings. Standard pulse transformers are designed for operation over the temperature range of —55 C to +105 C.

2.1 Transformers for operation up to 130 C are available upon request.

2.2 Variation of parameters, but no degradation can be expected when operating over the temperature extremes.

3. Insulation Resistance. The minimum insulation resistance between any one terminal and case and between windings shall be 10,000 megohms at 25 C.

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SPRAGUE

SPRAGUE ELECTRIC COMPANY

EXECUTIVE OFFICES: North Adams, Massachusetts

SPECIAL PRODUCTS DIVISION

Laboratories and Manufacturing Facilities at North Adams, Mass. and Visalia, California

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MAKERS OF RELIABLE DIGITAL ELECTRONIC COMPONENTS

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