SPRAGUE the mark of reliability

Engineering Bulletin

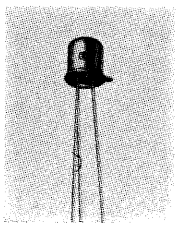
2N2845
2N2846

TYPE 2N2845 AND 2N2846 HIGH-SPEED, SEPT® TRANSISTORS

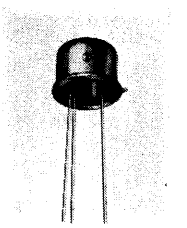
— N-P-N Silicon Planar Epitaxial Series

DESIGNED for high-speed switching applications over a wide current range, Type 2N2845 and 2N2846 Transistors feature:

- BV_{CBO}.....60 volts min.
- BV_{CEO}.....30 volts min.
- t_{on}.....40 nsec at I_C = 150mA
- f_T.....250 Mc



TYPE 2N2845
(TO-18 CASE)



TYPE 2N2846
(TO-5 CASE)

ABSOLUTE MAXIMUM RATINGS[1]

Collector to Base Voltage, V_{CBO} .....60 volts
Collector to Emitter Voltage, V_{CEO} .....30 volts
Emitter to Base Voltage, V_{EBO} .....5 volts
Collector Current, I_C . . limited by power dissipation only
Operating Collector Junction Temp . . −65C to +200C
Storage Temperature ..... −65C to +300C

	Type 2N2845	Type 2N2846
Total Device Dissipation at 25C Amb.	360 mW	800 mW
Derating Factor above 25C Amb.	2.1 mW/°C	4.6 mW/°C
Total Device Dissipation at 25C Case Temp.	1.2 Watts	3 Watts
Derating Factor above 25C Case Temp.	6.9 mW/°C	17.2 mW/°C

[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

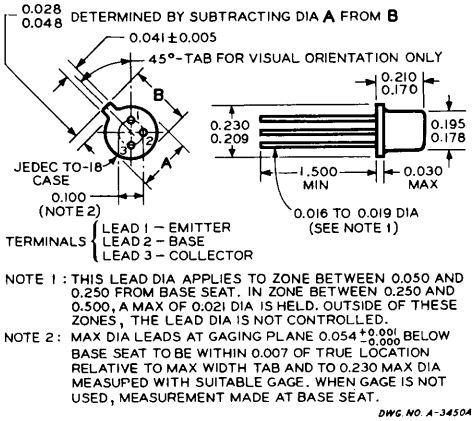
ELECTRICAL CHARACTERISTICS at T = 25 C

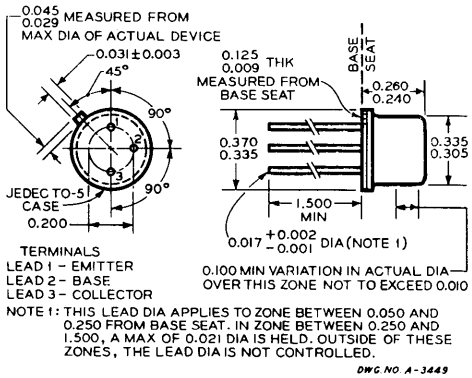
	CHARACTERISTICS	TEST CONDITIONS			MIN.	MAX.	UNITS
D-C CHARACTERISTICS							
BV_{CBO}	Collector Breakdown Voltage	I_C = 0.1mA	I_E = 0		60	—	Volts
BV_{CEO}	Collector Breakdown Voltage[2]	I_C = 30mA	I_B = 0		30	—	Volts
BV_{EBO}	Emitter Breakdown Voltage	I_E = 0.1mA	I_C = 0		5	—	Volts
I_{CES}	Collector Cutoff Current	V_{CE} = 30V	V_{EB} = 0		—	0.2	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = 30V	I_C = 0	T_A = 150C	—	200	μA
h_{FE}	Current Amplification Factor[2]	V_{CE} = 10V	I_C = 150mA		30	120	—
h_{FE}	Current Amplification Factor[2]	V_{CE} = 10V	I_C = 500mA		20	—	—
h_{FE}	Current Amplification Factor[2]	V_{CE} = 1.0V	I_C = 500mA		10	—	—
V_{BE}	Base Emitter Voltage	I_C = 150mA	I_B = 15mA		—	1.2	Volts
V_{BE}	Base Emitter Voltage[2]	I_C = 500mA	I_B = 50mA		—	1.6	Volts
$V_{CE(SAT)}$	Collector Saturation Voltage	I_C = 150mA	I_B = 15mA		—	0.4	Volts
$V_{CE(SAT)}$	Collector Saturation Voltage[2]	I_C = 500mA	I_B = 50mA		—	1.0	Volts
HIGH FREQUENCY CHARACTERISTICS							
f_T	Gain Bandwidth Product	V_{CE} = 10V	I_C = 50mA	f = 100Mc	250	—	Mc
C_{ob}	Output Capacitance	V_{CB} = 10V	I_E = 0		—	8	pF
t_{on}	Turn-On Time[3]	I_C = 150mA	I_{B1} = 15mA		—	40	nsec
t_{off}	Turn-Off Time[4]	I_C = 150mA	I_{B1} = 15mA	I_{B2} = −15mA	—	40	nsec

[2]Pulse Test [3]See Figure 1 [4]See Figure 2

SPRAGUE ENGINEERING BULLETIN 32,020

MECHANICAL SPECIFICATIONS





Marking. All transistors will be marked with the type number; the name SPRAGUE or the registered Sprague trademark, ②, at vendor's option; and date code of manufacture, unless otherwise specified.

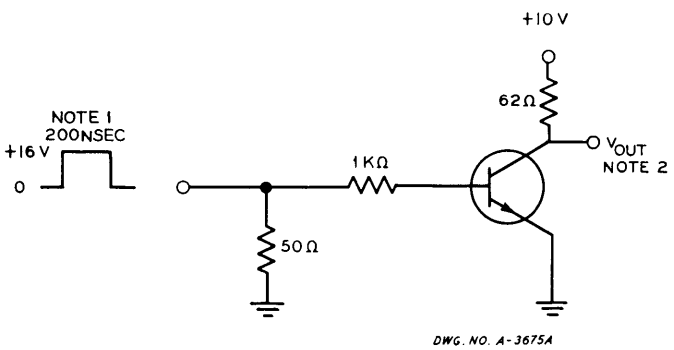


FIGURE 1
TURN-ON TEST CIRCUIT

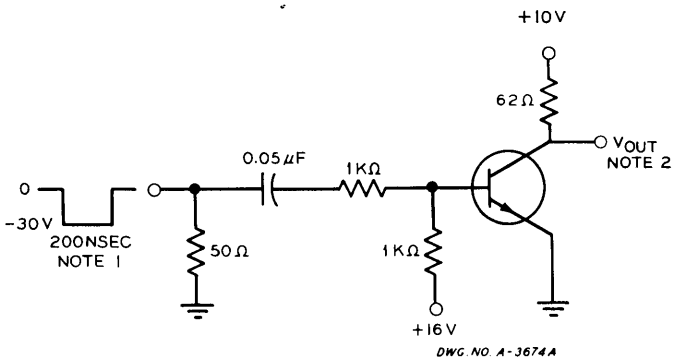


FIGURE 2
TURN-OFF TEST CIRCUIT

Note 1: Input rise time sufficiently fast that doubling or halving its value does not affect the measurement.

Note 2: Scope rise time and impedance are such that doubling or halving the value does not affect the measurement.

No. 32,022

SPRAGUE the mark of reliability

Engineering Bulletin

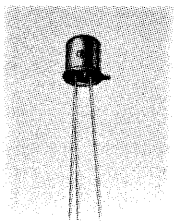
2N2847
2N2848

TYPE 2N2847 AND 2N2848 HIGH-SPEED, SEPT® TRANSISTORS

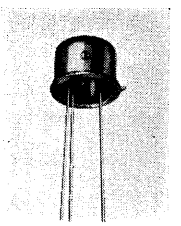
— N-P-N Silicon Planar Epitaxial Series

DESIGNED for high-speed switching applications over a wide current range, Type 2N2847 and 2N2848 Transistors feature:

- BV_{CBO} ..... 60 volts min.
- h_{FE} .....30 min. at I_C = 500mA
- t_{on}.....26 nsec at I_C = 150mA
- t_{off}.....40 nsec at I_C = 150mA



TYPE 2N2847
(TO-18 CASE)



TYPE 2N2848
(TO-5 CASE)

ABSOLUTE MAXIMUM RATINGS[1]

Collector to Base Voltage, V_{CBO} .....60 volts
Collector to Emitter Voltage, V_{CEO} .....20 volts
Emitter to Base Voltage, V_{EBO} .....5 volts
Collector Current, I_C . .limited by power dissipation only
Operating Collector Junction Temp. . . −65C to +200C
Storage Temperature.....−65C to +300C

	Type 2N2847	Type 2N2848
Total Device Dissipation at 25C Amb. . .	360mW	800mW
Derating Factor above 25C T_A	2.1mW/°C	4.6mW/°C
Total Device Dissipation at 25C Case Temp.....	1.2 Watts	3 Watts
Derating Factor above 25C Case Temp.	6.9mW/°C	17.2mW/°C

[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

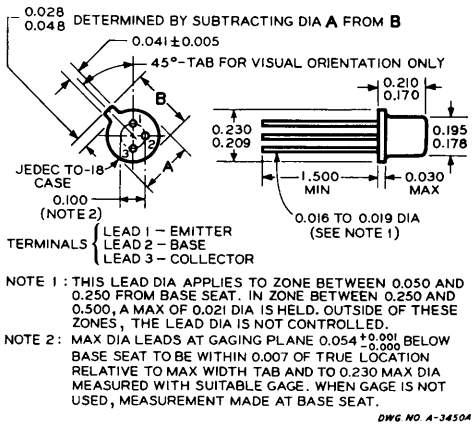
ELECTRICAL CHARACTERISTICS at T = 25 C

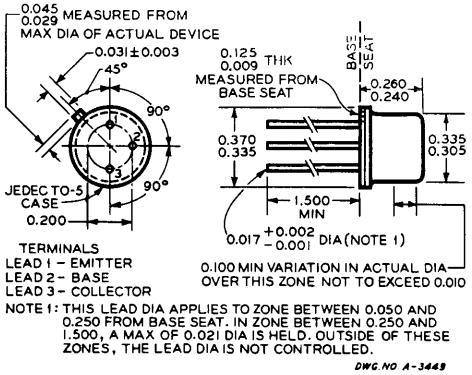
	CHARACTERISTICS	TEST CONDITIONS			MIN.	MAX.	UNITS
D-C CHARACTERISTICS							
BV_{CBO}	Collector Breakdown Voltage	I_C = 0.1mA	I_E = 0		60	—	Volts
BV_{CEO}	Collector Breakdown Voltage[2]	I_C = 30mA	I_B = 0		20	—	Volts
BV_{EBO}	Emitter Breakdown Voltage	I_E = 0.1mA	I_C = 0		5	—	Volts
I_{CES}	Collector Cutoff Current	V_{CE} = 30V	V_{EB} = 0		—	0.2	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = 30V	I_C = 0	T_A = 150C	—	200	μA
h_{FE}	Current Amplification Factor[2]	V_{CE} = 10V	I_C = 150mA		40	140	—
h_{FE}	Current Amplification Factor[2]	V_{CE} = 10V	I_C = 500mA		30	—	—
h_{FE}	Current Amplification Factor[2]	V_{CE} = 1.0V	I_C = 500mA		10	—	—
V_{BE}	Base Emitter Voltage	I_C = 150mA	I_B = 15mA		—	1.2	Volts
V_{BE}	Base Emitter Voltage[2]	I_C = 500mA	I_B = 50mA		—	1.6	Volts
$V_{CE(SAT)}$	Collector Saturation Voltage	I_C = 150mA	I_B = 15mA		—	0.4	Volts
$V_{CE(SAT)}$	Collector Saturation Voltage[2]	I_C = 500mA[1]	I_B = 50mA		—	0.75	Volts
HIGH FREQUENCY CHARACTERISTICS							
f_t	Gain Bandwidth Product	V_{CE} = 10V	I_C = 50mA	f = 100Mc	250	—	Mc
C_{ob}	Output Capacitance	V_{CB} = 10V	I_E = 0		—	8	pF
t_{on}	Turn-On Time[3]	I_C = 150mA	I_{B1} = 15mA		—	25	nsec
t_{off}	Turn-Off Time[4]	I_C = 150mA	I_{B1} = 15mA	I_{B2} = −15mA	—	40	nsec

[2]Pulse Test
[3]See Figure 1
[4]See Figure 2

SPRAGUE ENGINEERING BULLETIN 32,022

MECHANICAL SPECIFICATIONS





Marking. All transistors will be marked with the type number; the name SPRAGUE or the registered Sprague trademark, ②, at vendor's option; and date code of manufacture, unless otherwise specified.

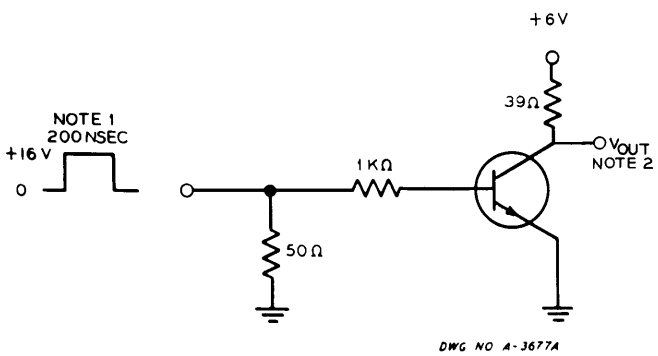


FIGURE 1
TURN-ON TEST CIRCUIT

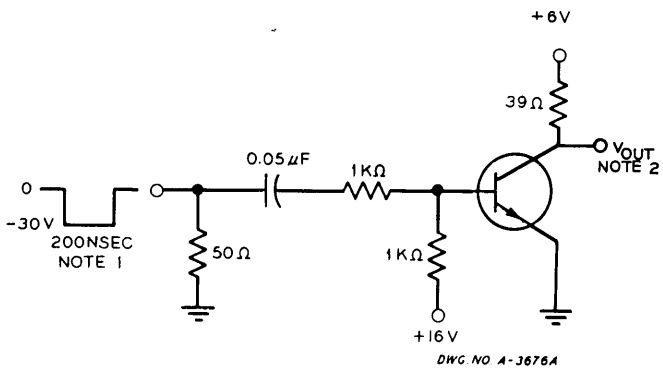


FIGURE 2
TURN-OFF TEST CIRCUIT

Note 1: Input rise time sufficiently fast that doubling or halving its value does not affect the measurement.

Note 2: Scope rise time and impedance are such that doubling or halving the value does not affect the measurement.

No. 31,169

SPRAGUE
THE MARK OF RELIABILITY

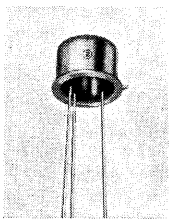
Engineering Bulletin

TYPE
2N2968
2N2969

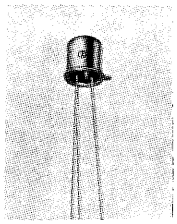
TYPE 2N2968 AND 2N2969 SYMMETRICAL P-N-P SILICON PRECISION ALLOY TRANSISTORS

DESIGNED for use in bi-directional switching, chopping, multiplex, and analog circuits, as well as many other applications where high inverse and forward gain is required, Type 2N2968 and 2N2969 symmetrical SPAT® transistors feature:

BV_{CBO} and BV_{EBO} ..... 30 volts min.
h_{FE} and h_{FC} ..... 15 min.
f_{T1} and f_{T2} ..... 10 Mc min.



TYPE 2N2968
(TO-5 CASE)



TYPE 2N2969
(TO-18 CASE)

ABSOLUTE MAXIMUM RATINGS[1]

Collector Voltage, V_{CB} ..... 30 volts
Collector Voltage, V_{CEO} ..... 10 volts
Emitter Voltage, V_{EB} ..... 30 volts
Emitter Voltage, V_{ECO} ..... 10 volts
Collector Current, I_C ..... 50 mA

Storage Temperature ..... −65 C to +140 C
Device Dissipation at 25 C ambient ..... 150 mW
Derating Factor above 25 C ambient ... 1.3 mW/°C
Lead Temperature at 1/16" ± 1/32" from case ..... 230 C

[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

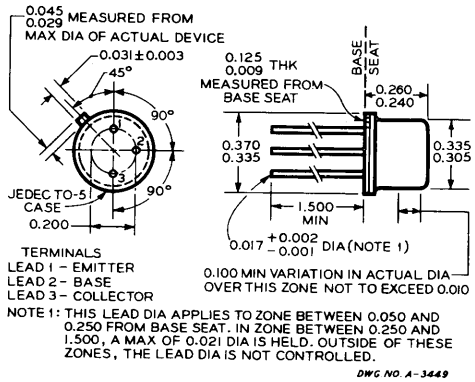
ELECTRICAL CHARACTERISTICS[2] at T = 25 C

	CHARACTERISTICS	TEST CONDITIONS			MIN.	MAX.	UNITS
D-C CHARACTERISTICS							
BV_{CBO}	Collector Breakdown Voltage	$I_C = -10\mu A$			30	—	Volts
BV_{CEO}	Collector Breakdown Voltage	$I_C = -10\mu A$			10	—	Volts
BV_{EBO}	Emitter Breakdown Voltage	$I_E = -10\mu A$			30	—	Volts
BV_{ECO}	Emitter Breakdown Voltage	$I_E = -10\mu A$			10	—	Volts
I_{CBO}	Collector Cutoff Current	$V_{CB} = -15V$			—	10	nA
I_{EBO}	Emitter Cutoff Current	$V_{EB} = -15V$			—	10	nA
h_{FE}	Current Amplification Factor	$V_{CE} = -0.5V$	$I_B = -100\mu A$		15	—	—
h_{FC}	Current Amplification Factor	$V_{EC} = -0.5V$	$I_B = -100\mu A$		15	—	—
V_{CE} (SAT)	Collector Saturation Voltage	$I_C = -10mA$	$I_B = -2mA$		—	60	mV
V_{EC} (SAT)	Emitter Saturation Voltage	$I_E = -10mA$	$I_B = -2mA$		—	60	mV
V_{off1}	Offset Voltage	$I_B = -200\mu A$			—	3	mV
V_{off2}	Offset Voltage	$I_B = -200\mu A$			—	3	mV
SMALL SIGNAL PARAMETERS							
C_{ob}	Output Capacitance	$V_{CB} = -6V$	$I_E = 0$	$f = 4Mc$	—	6	pF
C_{ib}	Input Capacitance	$V_{EB} = -6V$	$I_C = 0$	$f = 4Mc$	—	6	pF
f_{T1}	Gain Bandwidth Product	$V_{CE} = -6V$	$I_E = 1mA$	$f = 4Mc$	10	—	Mc
f_{T2}	Gain Bandwidth Product	$V_{EC} = -6V$	$I_C = 1mA$	$f = 4Mc$	10	—	Mc
r_{s1}	Dynamic Saturation Resistance	$I_B = -200\mu A$			—	30	ohms
r_{s2}	Dynamic Saturation Resistance	$I_B = -200\mu A$			—	30	ohms

[2]To avoid exceeding the maximum voltage ratings, the breakdown voltages must be measured by setting the voltage at the minimum specified (maximum rating). If the resultant current voltage is less than the value given as a condition of test, the breakdown voltage is within specification.

SPRAGUE ENGINEERING BULLETIN 31,169

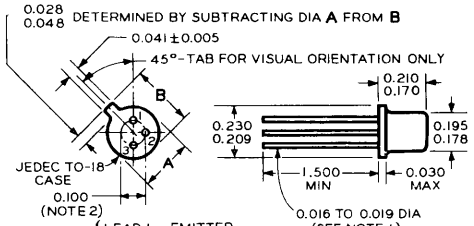
MECHANICAL SPECIFICATIONS



NOTE 1: THIS LEAD DIA APPLIES TO ZONE BETWEEN 0.050 AND 0.250 FROM BASE SEAT. IN ZONE BETWEEN 0.250 AND 1.500, A MAX OF 0.021 DIA IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIA IS NOT CONTROLLED.

DWG NO. A-3449

TYPE 2N2968
(TO-5 CASE)



NOTE 1: THIS LEAD DIA APPLIES TO ZONE BETWEEN 0.050 AND 0.250 FROM BASE SEAT. IN ZONE BETWEEN 0.250 AND 0.500, A MAX OF 0.021 DIA IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIA IS NOT CONTROLLED.

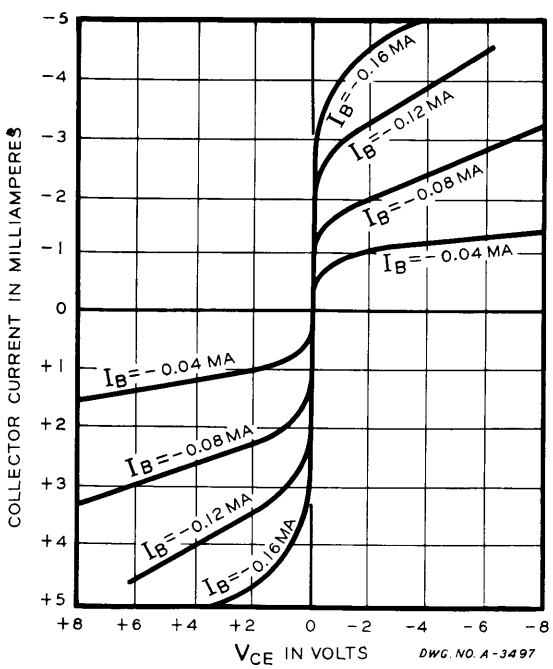
NOTE 2: MAX DIA LEADS AT GAGING PLANE $0.054^{+0.001}_{-0.000}$ BELOW BASE SEAT TO BE WITHIN 0.007 OF TRUE LOCATION RELATIVE TO MAX WIDTH TAB AND TO 0.230 MAX DIA MEASURED WITH SUITABLE GAGE. WHEN GAGE IS NOT USED, MEASUREMENT MADE AT BASE SEAT.

DWG NO A-3450A

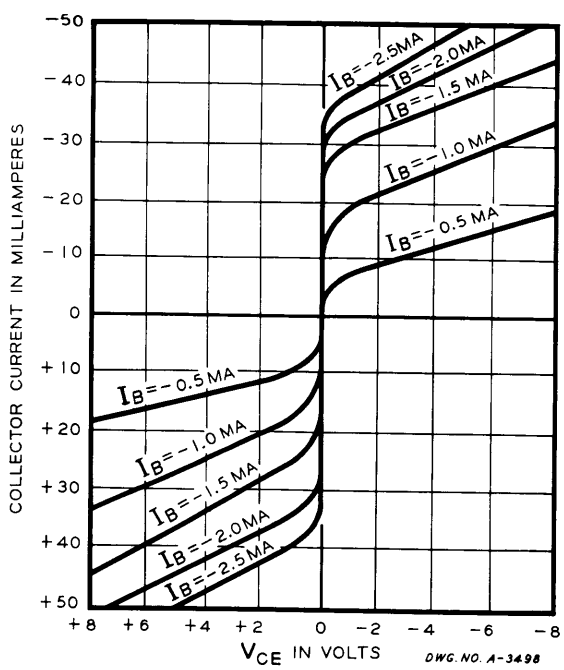
TYPE 2N2969
(TO-18 CASE)

• • •

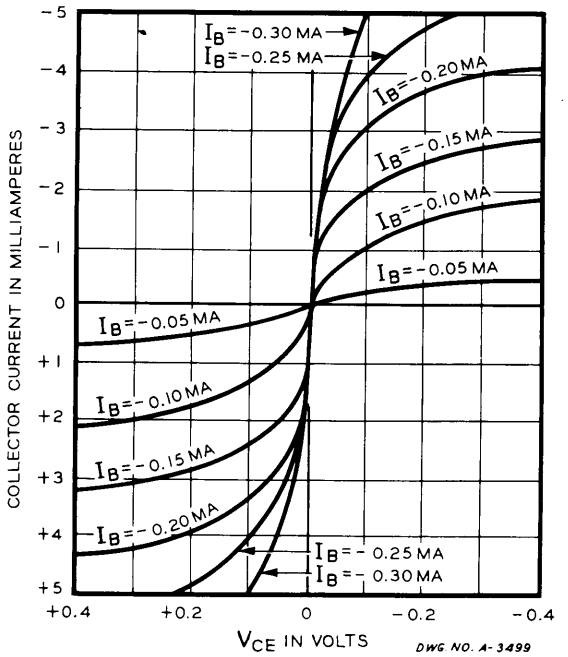
TYPICAL CHARACTERISTIC CURVES



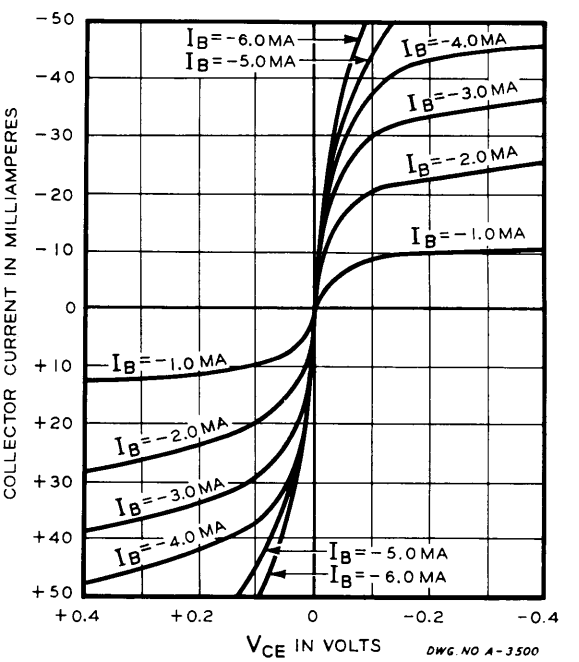
TYPICAL LOW CURRENT
COLLECTOR CHARACTERISTICS



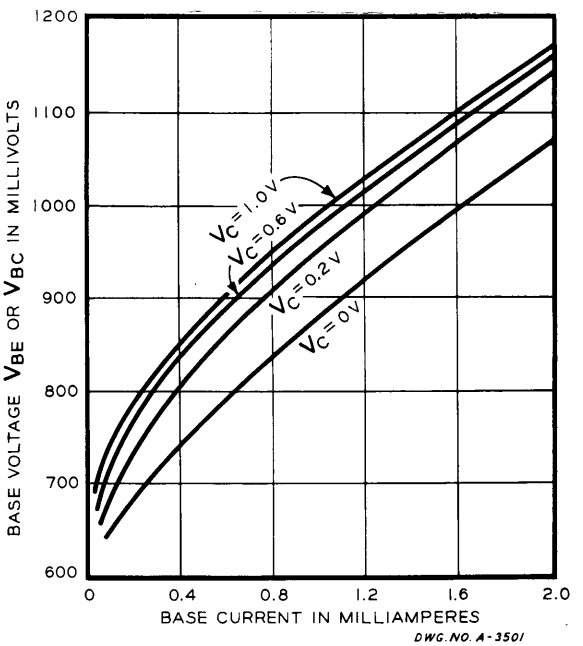
TYPICAL HIGH CURRENT
COLLECTOR CHARACTERISTICS



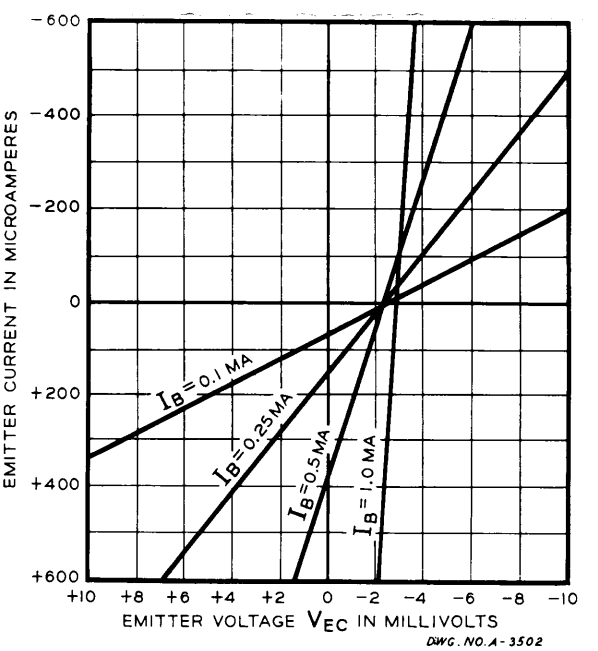
TYPICAL LOW CURRENT SATURATED REGION COLLECTOR CHARACTERISTICS



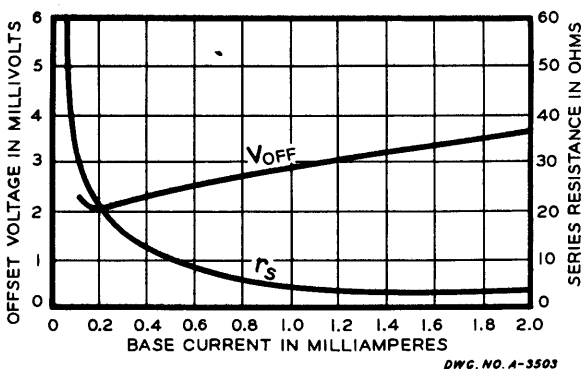
TYPICAL HIGH CURRENT SATURATED REGION COLLECTOR CHARACTERISTICS



TYPICAL BASE INPUT CHARACTERISTICS



TYPICAL SUPER SATURATED REGION EMITTER CHARACTERISTICS



TYPICAL OFFSET VOLTAGE AND SERIES RESISTANCE AS A FUNCTION OF BASE CURRENT

No. 31,171

SPRAGUE the mark of reliability

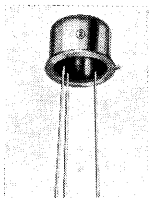
Engineering Bulletin

TYPE
2N2970
2N2971

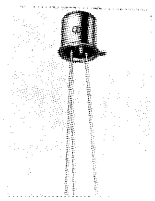
TYPE 2N2970 AND 2N2971 SYMMETRICAL P-N-P SILICON PRECISION ALLOY TRANSISTORS

DESIGNED for use in bi-directional switching, chopping, multiplex, and analog circuits, as well as many other applications where high inverse and forward gain is required, Type 2N2970 and 2N2971 symmetrical SPAT® transistors feature:

BV_{CBO} and BV_{EBO} ..... 30 volts min.
h_{FE} and h_{FC} ..... 10 min.
f_{T1} and f_{T2} ..... 8 Mc min.



TYPE 2N2970
(TO-5 CASE)



TYPE 2N2971
(TO-18 CASE)

ABSOLUTE MAXIMUM RATINGS[1]

Collector Voltage, V_{CB} ..... 30 volts
Collector Voltage, V_{CEO} ..... 20 volts
Emitter Voltage, V_{EB} ..... 30 volts
Emitter Voltage, V_{ECO} ..... 20 volts
Collector Current, I_C ..... 50 mA

Storage Temperature ..... −65 C to +140 C
Device Dissipation at 25 C ambient ..... 150 mW
Derating Factor above 25 C ambient ... 1.3 mW/°C
Lead Temperature at 1/16" ±1/32" from case ..... 230 C

[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

ELECTRICAL CHARACTERISTICS[2] at T = 25 C

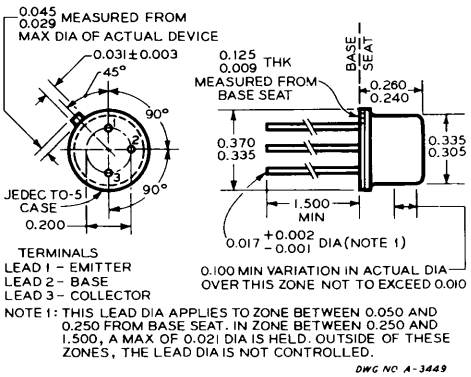
	CHARACTERISTICS	TEST CONDITIONS						MIN.	MAX.	UNITS
D-C CHARACTERISTICS										
BV_{CBO}	Collector Breakdown Voltage	I_C	= −10μA					30	—	Volts
BV_{CEO}	Collector Breakdown Voltage	I_C	= −10μA					20	—	Volts
BV_{EBO}	Emitter Breakdown Voltage	I_E	= −10μA					30	—	Volts
BV_{ECO}	Emitter Breakdown Voltage	I_E	= −10μA					20	—	Volts
I_{CBO}	Collector Cutoff Current	V_{CB}	= −15V					—	10	nA
I_{EBO}	Emitter Cutoff Current	V_{EB}	= −15V					—	10	nA
h_{FE}	Current Amplification Factor	V_{CE}	= −0.5V	I_B	= −100μA			10	—	—
h_{FC}	Current Amplification Factor	V_{EC}	= −0.5V	I_B	= −100μA			10	—	—
V_{CE} (SAT)	Collector Saturation Voltage	I_C	= −10mA	I_B	= −2mA			—	80	mV
V_{EC} (SAT)	Emitter Saturation Voltage	I_E	= −10mA	I_B	= −2mA			—	80	mV
V_{off1}	Offset Voltage	I_B	= −200μA					—	4	mV
V_{off2}	Offset Voltage	I_B	= −200μA					—	4	mV
SMALL SIGNAL PARAMETERS										
C_{ob}	Output Capacitance	V_{CB}	= −6V	I_E	= 0	f	= 4Mc	—	6	pF
C_{ib}	Input Capacitance	V_{EB}	= −6V	I_C	= 0	f	= 4Mc	—	6	pF
f_{T1}	Gain Bandwidth Product	V_{CE}	= −6V	I_E	= 1mA	f	= 4Mc	8	—	Mc
f_{T2}	Gain Bandwidth Product	V_{EC}	= −6V	I_C	= 1mA	f	= 4Mc	8	—	Mc
r_{s1}	Dynamic Saturation Resistance	I_B	= −200μA					—	40	ohms
r_{s2}	Dynamic Saturation Resistance	I_B	= −200μA					—	40	ohms

[2]To avoid exceeding the maximum voltage ratings, the breakdown voltages must be measured by setting the voltage at the minimum specified (maximum rating). If the resultant current voltage is less than the value given as a condition of test, the breakdown voltage is within specification.

"SPAT" is a registered trademark of the Philco Corp

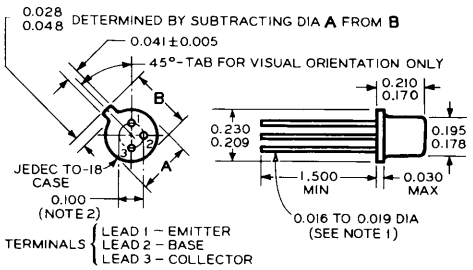
SPRAGUE ENGINEERING BULLETIN 31,171

MECHANICAL SPECIFICATIONS



NOTE 1: THIS LEAD DIA APPLIES TO ZONE BETWEEN 0.050 AND 0.250 FROM BASE SEAT. IN ZONE BETWEEN 0.250 AND 1.500, A MAX OF 0.021 DIA IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIA IS NOT CONTROLLED.

DWG NO A-3449



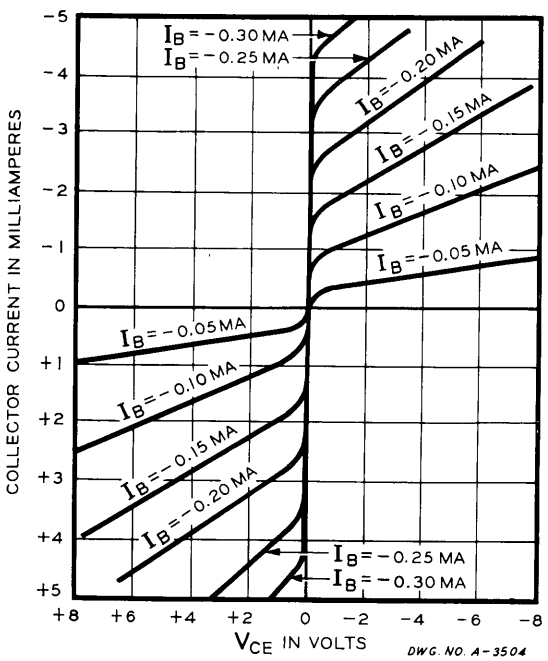
NOTE 1: THIS LEAD DIA APPLIES TO ZONE BETWEEN 0.050 AND 0.250 FROM BASE SEAT. IN ZONE BETWEEN 0.250 AND 0.500, A MAX OF 0.021 DIA IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIA IS NOT CONTROLLED.

NOTE 2: MAX DIA LEADS AT GAGING PLANE $0.054^{+0.001}_{-0.000}$ BELOW BASE SEAT TO BE WITHIN 0.007 OF TRUE LOCATION RELATIVE TO MAX WIDTH TAB AND TO 0.230 MAX DIA MEASURED WITH SUITABLE GAGE. WHEN GAGE IS NOT USED, MEASUREMENT MADE AT BASE SEAT.

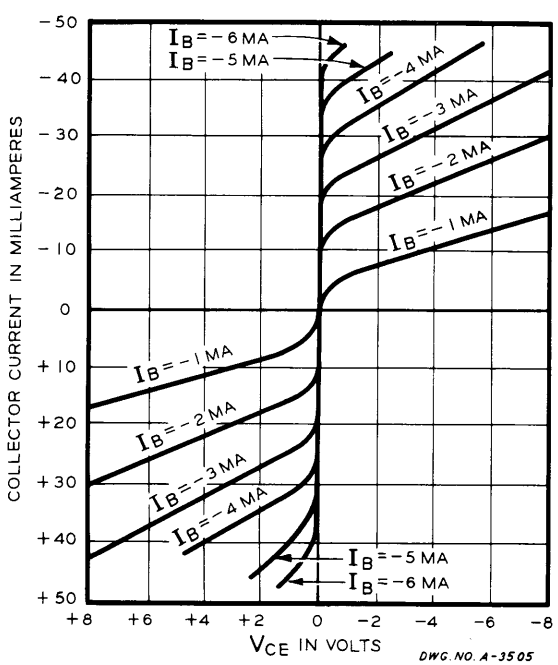
DWG NO A-3450A

• • •

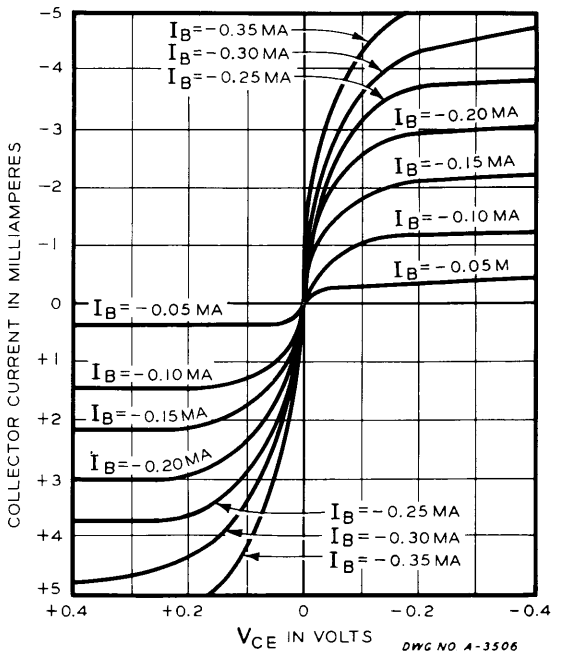
TYPICAL CHARACTERISTIC CURVES



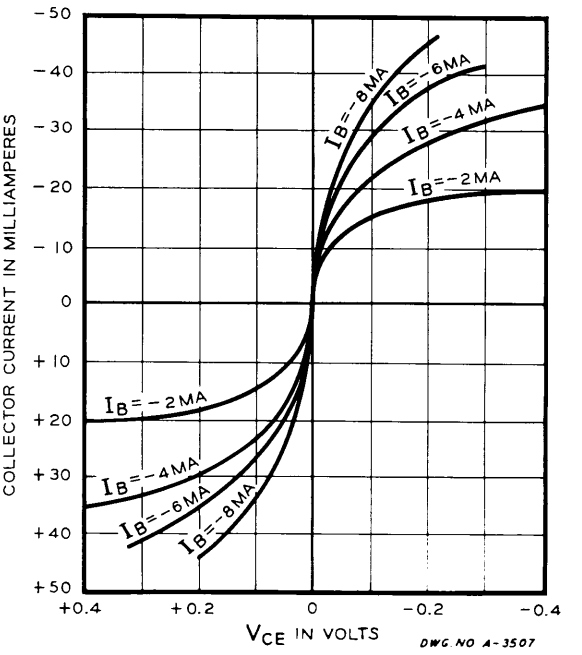
TYPICAL LOW CURRENT COLLECTOR CHARACTERISTICS



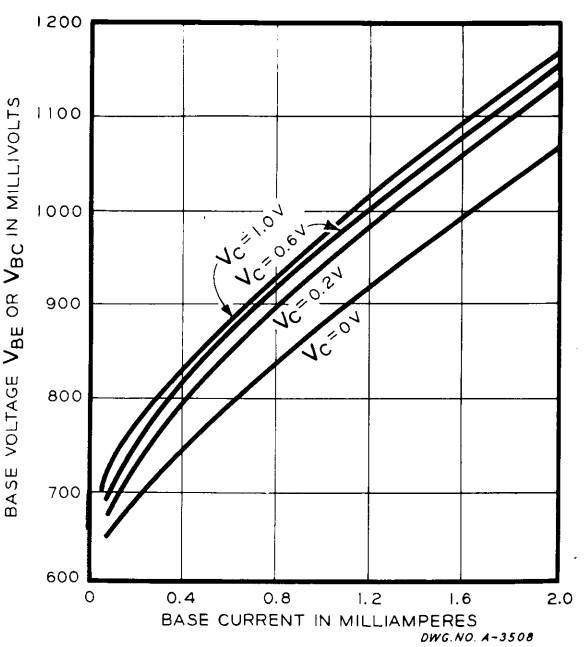
TYPICAL HIGH CURRENT COLLECTOR CHARACTERISTICS



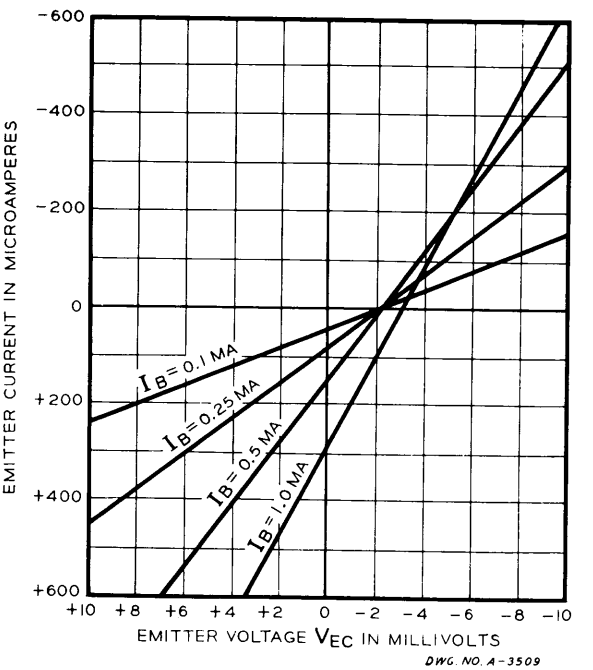
TYPICAL LOW CURRENT SATURATED REGION
COLLECTOR CHARACTERISTICS



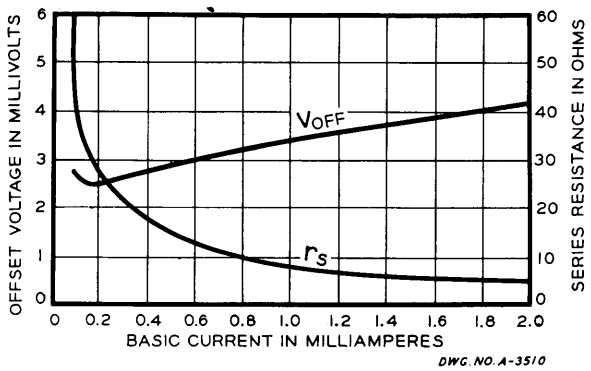
TYPICAL HIGH CURRENT SATURATED REGION
COLLECTOR CHARACTERISTICS



TYPICAL BASE INPUT CHARACTERISTICS



TYPICAL SUPER SATURATED REGION
EMITTER CHARACTERISTICS



TYPICAL OFFSET VOLTAGE AND SERIES RESISTANCE AS A FUNCTION OF BASE CURRENT

No. 34021

SPRAGUE THE MARK OF RELIABILITY

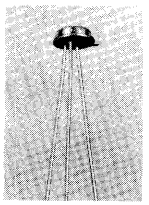
Engineering Bulletin

2N3060 thru 2N3065

TYPE 2N3060 thru 2N3065 SEPT® TRANSISTORS
—PNP Silicon Planar Epitaxial Series

DESIGNED FOR high-gain amplifier and control applications, Type 2N3060 through 2N3065 Transistors feature:

- BV_{CBO} ..... up to 110 volts
- BV_{EBO} ..... up to 50 volts
- h_{FE} ..... up to 60 min.



TO-46 CASE

ABSOLUTE MAXIMUM RATINGS[1]

Storage Temp. ..... −65 C to +200 C
Collector Current, I_C 100mA
Total Device Dissipation at 25 C Amb. ..... 400 mW
Derating Factor above 25 C Amb. ..... 2.3 mW/°C
Lead Temp. (1/16" from case for 10 sec.) ..... 240 C

	2N3060 2N3061	2N3062 2N3063	2N3064 2N3065
Collector to Base Voltage, V_{CBO}	70V	90V	110V
Collector to Emitter Voltage, V_{CEO}	60V	80V	100V
Emitter to Base Voltage, V_{EBO}	30V	40V	50V

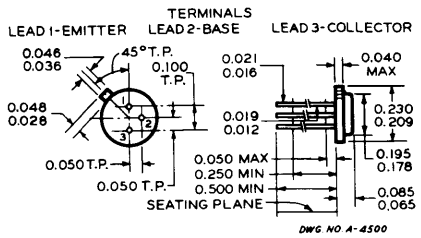
[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

ELECTRICAL CHARACTERISTICS at T = 25 C

	CHARACTERISTICS	TEST CONDITIONS		MIN.	MAX.	UNITS
		D-C CHARACTERISTICS				
I_{CBO}	Collector Cutoff Current	V_{CB} = 60V	2N3060/1	—	5	nA
		V_{CB} = 80V	2N3062/3	—	5	nA
		V_{CB} = 100V	2N3064/5	—	5	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = −20V	2N3060/1	—	5	nA
			2N3062/3	—	5	nA
			2N3064/5	—	5	nA
BV_{CBO}	Collector-Base Voltage	I_C = −1μA	2N3060/1	70	—	Volts
			2N3062/3	90	—	Volts
			2N3064/5	110	—	Volts
BV_{CEO}	Collector-Emitter Voltage	I_C = −1μA	2N3060/1	60	—	Volts
			2N3062/3	80	—	Volts
			2N3064/5	100	—	Volts
BV_{EBO}	Emitter-Base Voltage	I_E = −1μA	2N3060/1	30	—	Volts
			2N3062/3	40	—	Volts
			2N3064/5	50	—	Volts
h_{FE}	Forward Current Gain	V_{CE} = −6V, I_C = −1mA	2N3060	30	90	—
			2N3061	60	180	—
			2N3062	20	80	—
			2N3063	50	150	—
			2N3064	15	45	—
			2N3065	30	90	—
V_{BE}	Base Input Voltage	V_{CE} = −6V, I_C = −1mA		—	1	Volt
		HIGH FREQUENCY CHARACTERISTICS				
h_{fe}	Forward Current Gain	V_{CE} = −6V, I_C = −1mA, f = 1Kc	2N3060	30	120	—
			2N3061	60	240	—
			2N3062	20	110	—
			2N3063	50	200	—
			2N3064	15	60	—
			2N3065	30	120	—
C_{ob}	Collector Capacitance	V_{CB} = −6V, I_C = −1mA		—	10	pF

SPRAGUE ENGINEERING BULLETIN 34021

MECHANICAL SPECIFICATIONS



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.

LITHO IN U. S. AMER.

No. 32,208

SPRAGUE
the mark of reliability

Engineering Bulletin

2N3217
2N3218
2N3219

TYPE 2N3217, 2N3218, AND 2N3219 SEPT® TRANSISTORS

P-N-P Silicon Planar Epitaxial Series

DESIGNED FOR general purpose switching, chopper, and amplifier applications, Type 2N3217, 2N3218, and 2N3219 SEPT Transistors feature:

	2N3217	2N3218	2N3219	
BV_{EBO}	15	25	40	Volts
I_{CBO}	1	1	1	nA
h_{FE}	40	30	20	
V_{OFF}	1.25	1.5	2.5	mV

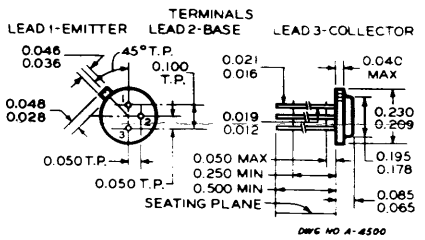
TO-46 CASE

ABSOLUTE MAXIMUM RATINGS[1]

	2N3217	2N3218	2N3219
Collector to Base Voltage, V_{CBO}	15V	25V	40V
Emitter to Base Voltage, V_{EBO}	15V	25V	40V
Collector to Emitter Voltage, V_{CEO}*	10V	20V	35V
Emitter to Collector Voltage, V_{ECO}	10V	20V	35V

Storage Temp. . . . . −65 C to +200 C
Collector Current, I_C 100mA
Total Device Dissipation at 25 C Amb. . . . . 400 mW
Derating Factor above 25 C Amb. . . . . 2.3 mW/°C
Lead Temp. (1/16" from case for 10 sec.) . . . . . 240 C

MECHANICAL SPECIFICATIONS



[1]The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.

ELECTRICAL CHARACTERISTICS at T = 25 C

	CHARACTERISTICS	CONDITIONS	2N3217 Min.	2N3217 Max.	2N3218 Min.	2N3218 Max.	2N3219 Min.	2N3219 Max.	UNITS
D-C CHARACTERISTICS									
I_{CBO}	Collector Cutoff Current	At max. rated voltage	—	1.0	—	1.0	—	1.0	nA
I_{EBO}	Emitter Cutoff Current	At max. rated voltage	—	1.0	—	1.0	—	1.0	nA
BV_{CEO}*	Collector-Emitter Voltage	$I_C = -1\mu A$	10	—	20	—	35	—	Volts
BV_{ECO}	Emitter-Collector Voltage	$I_E = -1\mu A$	10	—	20	—	35	—	Volts
h_{FE}*	Forward Current Gain	$V_{CE} = -0.5V$, $I_C = -5mA$	40	—	30	—	20	—	—
$V_{CE(SAT)}$*	Saturation Voltage	$I_B = -0.5mA$, $I_C = -5mA$	—	0.1	—	0.1	—	0.15	Volts
V_{BE}*	Base Input Voltage	$I_B = -0.5mA$, $I_C = -5mA$	0.65	1.0	0.65	1.0	0.65	1.0	Volts
V_{off}*	Offset Voltage	$I_B = -1mA$	—	1.25	—	1.5	—	2.5	mV
r_s*	Series Resistance	$I_B = -1mA$, $I_E = 100\mu A$	—	20.0	—	35.0	—	45.0	Ohms
V_{off}	Offset Voltage	$I_B = -200\mu A$	—	1.0	—	2.0	—	3.0	mV
$V_{EC(SAT)}$	Inverted Saturation Voltage	$I_B = -200\mu A$, $I_E = -10\mu A$	—	3.0	—	5.0	—	7.0	mV
HIGH FREQUENCY CHARACTERISTICS									
f_t	Gain Bandwidth Product	$V_{CE} = -6V$, $I_C = -1mA$	1	—	1	—	1	—	Mc
C_{ib}	Emitter Capacitance	$V_{EB} = -6V$, $I_E = 0$	—	8	—	8	—	8	pF
C_{ob}	Collector Capacitance	$V_{CB} = -6V$, $I_C = 0$	—	14	—	14	—	14	pF

*Data not registered with JEDEC.

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THE MARK OF RELIABILITY

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*Airconditioning and Refrigeration Components Only

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ISSUE OF JULY, 1965