

MILITARY SPECIFICATION
 TRANSISTOR, PNP, SILICON
 TYPE JAN-2N1119

This specification has been approved by the Department of Defense, and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for silicon, PNP transistors for use in chopper & high-speed-switching circuitry.

1.2 Mechanical dimensions. See figure 1.

1.3 Absolute-maximum ratings:

$\frac{1}{P_T}$ (mW)	T_{stg} (°C)	V_{CBO} (Vdc)	V_{RT} (Vdc)	V_{EBO} (Vdc)
150	-65 to +140	-12	-10	-12

$\frac{1}{P_T}$ Derate 1.33 mW/°C for $T_A > 25^\circ \text{C}$.

1.4 Primary electrical characteristics:

	C_{ob} (pf)	f_t (mc)	V_{ECF} (mVdc)
Minimum	---	7.2	---
Maximum	9	---	4

1.5 Reliability ratings.

Steady-state operation life	High temperature life (nonoperating)
($P_T = 150 \text{ mW}$)	($T_A = 140^\circ \text{C}$)
λ	λ
10%	5%

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, forms a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-S-19491 - Semiconductor Devices, Preparation for Delivery of.

MIL-S-19500 - Semiconductor Devices, General Specification for.
STANDARD

Military

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with Specification MIL-S-19500, and as specified herein.

3.2 Abbreviations and symbols.

K's Hole storage

P_T Total power dissipation - sum of collector and emitter power dissipation:

$$P_T = (V_{CB}I_C) + (V_{EB}I_E)$$

rb'Cc Extrinsic base-resistance collector-capacitance product.

3.3 Design and construction. Transistors shall be of the design, construction, and physical dimensions specified on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III, and as follows:

3.4.1 Salt atmosphere (corrosion). The marking shall be legible at the conclusion of the test. (See 4.4.1.)

3.4.2 Barometric pressure, reduced (altitude operation). Transistors shall operate satisfactorily without voltage derating. (See table III)

3.5 Marking. The following marking specified in Specification MIL-S-19500 may be omitted from the body of the transistor:

(a) Country of origin.

(b) Manufacturer's identification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with Specification MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III.

4.3 Acceptance inspection. Acceptance inspection shall consist of groups A, B, and C.

4.3.1 Group A inspection. Group A inspection shall consist of the examination and tests specified in table I.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.3.3 Group C inspection. Group C inspection shall consist of the tests specified in table III.

4.3.4 Acceptance procedure. When a second sample is chosen, the total sample shall be associated with the minimum rejection numbers specified in Tables I, II, and III.

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, and III, and as follows:

4.4.1 Salt atmosphere (corrosion). Transistors shall be examined for legibility of marking before the specified measurements are made. (See 3.4.1 and table II.)

4.4.2 Voltage reach-through, collector to emitter. An adequate forward dc current shall be applied to the emitter terminal and a reverse dc voltage shall be applied between collector and base, starting at zero and increasing until the emitter to base voltage has reached the specified reverse value. The dc voltage between the collector and the base terminals shall then be measured. The V_{RT} will be equal to the reverse collector to base dc voltage less the reverse emitter to base dc voltage. (See tables I, subgroup 3.)

4.4.3 Inverted offset voltage. Inverted offset voltage is the voltage between the emitter and collector at the specified forward base current with the emitter open circuited. (See table I, subgroup 2.)

Table I. Group A Inspection

Examination or test	Symbol	MIL-STD-750		LTPD	Limits		Units	Min rej no
		Method	Details		Min	Max		
<u>Subgroup 1</u> Visual and mechanical inspection.		2071		5				4
<u>Subgroup 2</u> Emitter to base cutoff current.	I_{EBO}	3061	Cond D; $V_{EB} = -10 \text{ Vdc}$	5		-0.1	μAdc	4
Emitter to base cutoff current.	I_{EBO}	3061	Cond D; $V_{EB} = -12 \text{ Vdc}$			-1.0	μAdc	
Collector to base cutoff current.	I_{CBO}	3036	Cond D; $V_{CB} = -10 \text{ Vdc}$			-0.1	μAdc	
Collector to base cutoff current.	I_{CBO}	3036	Cond D; $V_{CB} = -12 \text{ Vdc}$			-1.0	μAdc	
Nonsaturated voltage.	V_{BE}	3066	Cond B; $I_C = -5\text{mA}$ dc; $I_B = -0.8\text{mA}$ dc		-0.75	-1.0	Vdc	
Saturation voltage and resistance.	$V_{CE}(\text{SAT})$	3071	$I_C = -5\text{mA}$ dc; $I_B = -0.8\text{mA}$ dc			-0.15	Vdc	
Forward-current transfer ratio.	h_{FE}	3076	$V_{CE} = -0.5\text{Vdc}$; $I_C = -15\text{mA}$ dc		15			
Inverted offset voltage.	V_{ECF}		$I_B = -1 \text{ mA}$ dc; $I_E = 0$ (See 4.4.3)			4	mVdc	

Table I. Group A Inspection. (contd)

Examination or test	Symbol	MIL-STD-750		LTPD	Limits		Units	Min ref no
		Method	Details		Min	Max		
<u>Subgroup 3</u> Voltage, reach-through, collector to emitter.	V_{RT}		$V_{EB} = -1Vdc$ (See 4.4.2)	5	-10		Vdc	4
Extrinsic base resistance collector capacitance product	$r_b' C_c$		$V_{CB} = -6 Vdc$; $I_E = 1 mA_{dc}$; (See figure 3)			5000	psec	
Extrapolated unity-gain frequency.	f_t	3261	$V_{CE} = -6 Vdc$; $I_E = 1 mA_{dc}$; $f = 4 mc$		7.2		mc	
Collector to emitter cutoff current.	I_{CE}	3041	Bias Cond A; $V_{CE} = -4.5 Vdc$; $V_{BE} = -0.45 Vdc$			-25	μA_{dc}	
<u>Subgroup 4</u> Hole storage	$K's$		$I_B = -1 mA_{dc}$ (See figure 4)	5		175	nsec	4
Open circuit output capacitance	C_{ob}	3236	$V_{CB} = -6 Vdc$; $I_C = -1 mA_{dc}$; $f = 4 mc$			9	pf	
<u>Subgroup 5</u> Pulse response	$t_d + t_r$ $t_s + t_f$	3251	(See figure 5) (See figure 6)	10		270 370	nsec nsec	5
<u>Subgroup 6</u> Collector to base cutoff current.	I_{CBO}	3036	$V_{CB} = -10Vdc$; $T_A = +125^\circ C$ min	15		15	μA_{dc}	5
Forward-current transfer ratio.	h_{FE}	3076	$V_{CE} = -0.5Vdc$; $I_C = -15 mA_{dc}$		10			

Table II. Group B Inspection.

Examination or test	Symbol	MIL-STD-750		LTPD	Limits		Units	Min ref no
		Method	Details		Min	Max		
<u>Subgroup 1</u> Physical dimensions		2066		5	(See fig. 1)			4
<u>Subgroup 2</u> Solderability		2026		15				5
Temperature cycling		1051	Cond C; except, $T_{max} = +140^\circ C$					
Thermal shock (glass strain)		1056	Cond B					
Moisture resistance		1021						
<u>End point tests:</u> Collector to base cutoff current	I_{CBO}	3036	Cond D; $V_{CB} = -10Vdc$			-0.3	μA_{dc}	
Forward-current transfer ratio	h_{FE}	3076	$V_{CE} = -0.5Vdc$; $I_C = -15 mA_{dc}$		12			

Table II. Group B Inspection. Contd

Examination or test	Symbol	MIL-STD-750		LTPD	Limits		Units	Min rej no
		Method	Details		Min	Max		
1/ <u>Subgroup 3</u> Shock		2016	nonoperating 500 G; 1 msec (approx) 5 blows each in orientations X, Y ₁ , Y ₂ , and Z (total) 20 blows)	15				5
Vibration fatigue		2046	Nonoperating; 10 G					
Vibration, variable frequency		2056	10 G					
Constant acceleration		2006	10,000 G					
<u>End point tests:</u> Same as subgroup 2								
1/ 2/ <u>Subgroup 4</u> Terminal strength		2036	Cond E	15				5
<u>Subgroup 5</u> Salt atmosphere (corrosion)		1041	(See 4.4.1)	15	(See 3.4.1)			5
<u>End point tests:</u> Same as subgroup 2								
<u>Subgroup 6</u> High temperature life - Nonoperating		1031	T _A = 140° C min	a = 5				4
<u>End point tests:</u> Collector to base cutoff current	I _{CBO}	3036	Cond D; V _{CB} = -12 Vdc			-2	uAde	
Forward-current transfer ratio	h _{FE}	3076	V _{CE} = -0.5 Vdc; I _C = -15 mAde		12			
<u>Subgroup 7</u> Steady state operation life		1026	V _{CB} = -10 Vdc; P _T = 150 mW	a = 10				5
<u>End point tests:</u> Same as subgroup 6								

1/ Destructive tests.

2/ Rejects from electrical test samples may be used for this test.

Table III. Group C Inspection.

Examination or test	Symbol	MIL-STD-750		LTPD	Limits		Units	Min rej no
		Method	Details		Min	Max		
Barometric pressure 1/ reduced (altitude operation)	I _{CBO}	1001	Pressure 15±2 mm Hg; Normal mounting t = 60 sec min V _{CB0} = -12Vdc;	20	(See 3.4.2)	1.0	uAde	4

1/ This test shall be conducted on the initial lot and every three months thereafter.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall be in accordance with Specification MIL-S-19491.

6. NOTES

6.1 Notes. The notes specified in Specification MIL-S-19500 are applicable to this specification.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

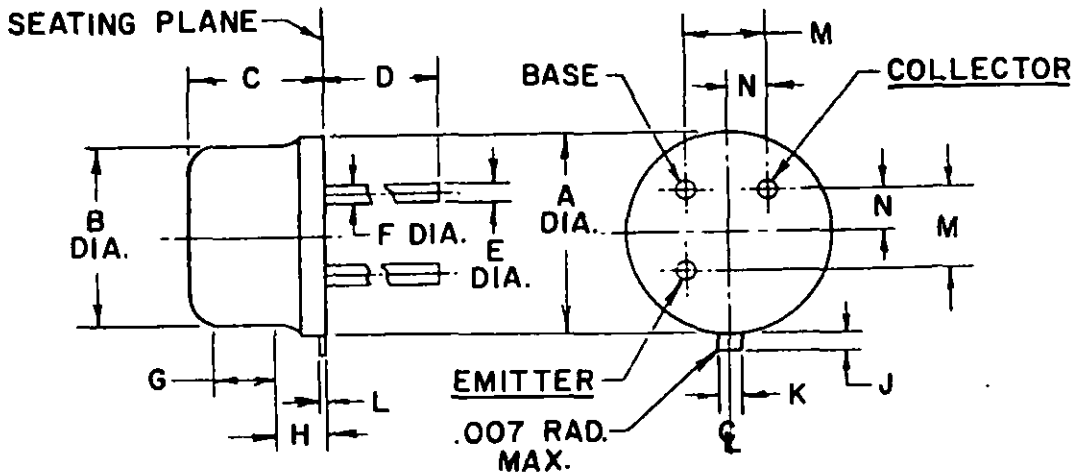
Custodians:

Army - EL
Navy - Ships
Air Force - ASD

Preparing activity:

Army - EL

(Project No. 5960-1475)

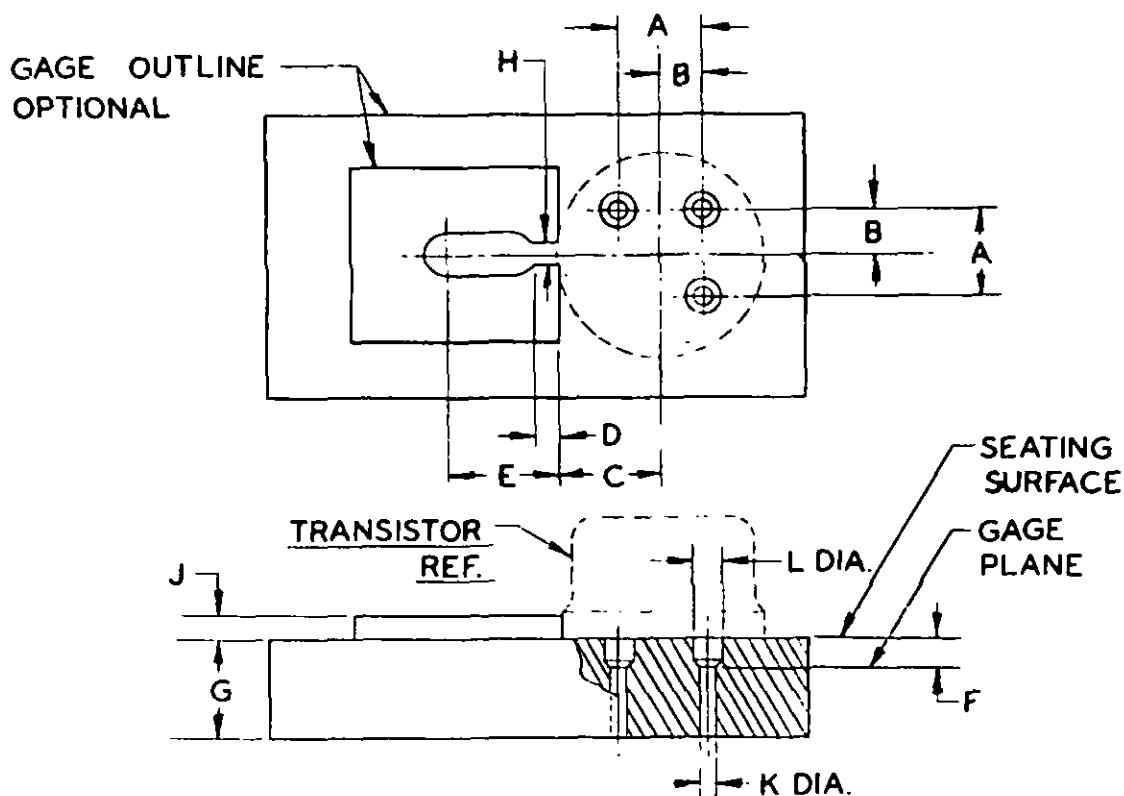


DIMENSIONS							NOTES
	INCHES			MILLIMETERS			
	MIN.	NOM.	MAX.	MIN.	NOM	MAX.	
A	.335		.370	8.51		9.40	
B	.305		.335	7.75		8.51	
C	.240		.260	6.10		6.60	
D	1.500			38.10			
E	.016		.019	0.41		0.48	1
F	.016		.021	0.41		0.53	2
G	.100			2.54			3
H							4
J	.029		.045	0.74		1.14	
K	.028		.034	0.71		0.86	
L	.009		.125	0.23		3.18	
M		.1414			3.59		5
N		.0707			1.80		5

NOTES:

1. Measured in the zone beyond .250(6.35) from the seating plane. 3 leads.
2. Measured in the zone .050 (1.25) and .250(6.35) from the seating plane. 3 leads.
3. Variations on Dim. B in this zone shall not exceed .010 (0.25).
4. Outline in this zone is not controlled.
5. When measured in a gaging plane $.054 \begin{smallmatrix} +.001 \\ -.000 \end{smallmatrix}$ ($1.37 \begin{smallmatrix} +.03 \\ -.00 \end{smallmatrix}$) below the seating plane of the transistor max. dia. leads shall be within .007 (0.18) of their true location. Smaller dia. leads shall fall within the outline of the max. dia. lead tolerance. Fig. 2. preferred measured method.
6. All leads electrically isolated from case.

FIGURE 1. Physical dimensions (TO6) transistor type.



	DIMENSIONS			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	.1409	.1419	3.58	3.60
B	.0702	.0712	1.78	1.81
C	.182	.199	4.62	5.05
D	.009	.011	0.23	0.28
E	.125 NOM.		3.18 NOM.	
F	.054	.055	1.37	1.40
G	.372	.378	9.45	9.60
H	.0350	.0355	0.89	0.90
J	.150 NOM.		3.81 NOM.	
K	.0325	.0335	0.83	0.85
L	.0595	.0605	1.51	1.54

Note:

The following gaging procedure shall be used:

The use of a pin straightener prior to insertion in the gage is permissible. The device being measured shall be inserted until its seating plane is 0.125 ± 0.010 from the seating surface of the gage. A spacer may be used to obtain the .125 distance from the gage seat prior to force application. A force of 8 oz. ± 0.5 shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed) the seating plane of the device shall be seated against the gage.

FIGURE 2. Gage for lead and tab location of TO-5 envelope.

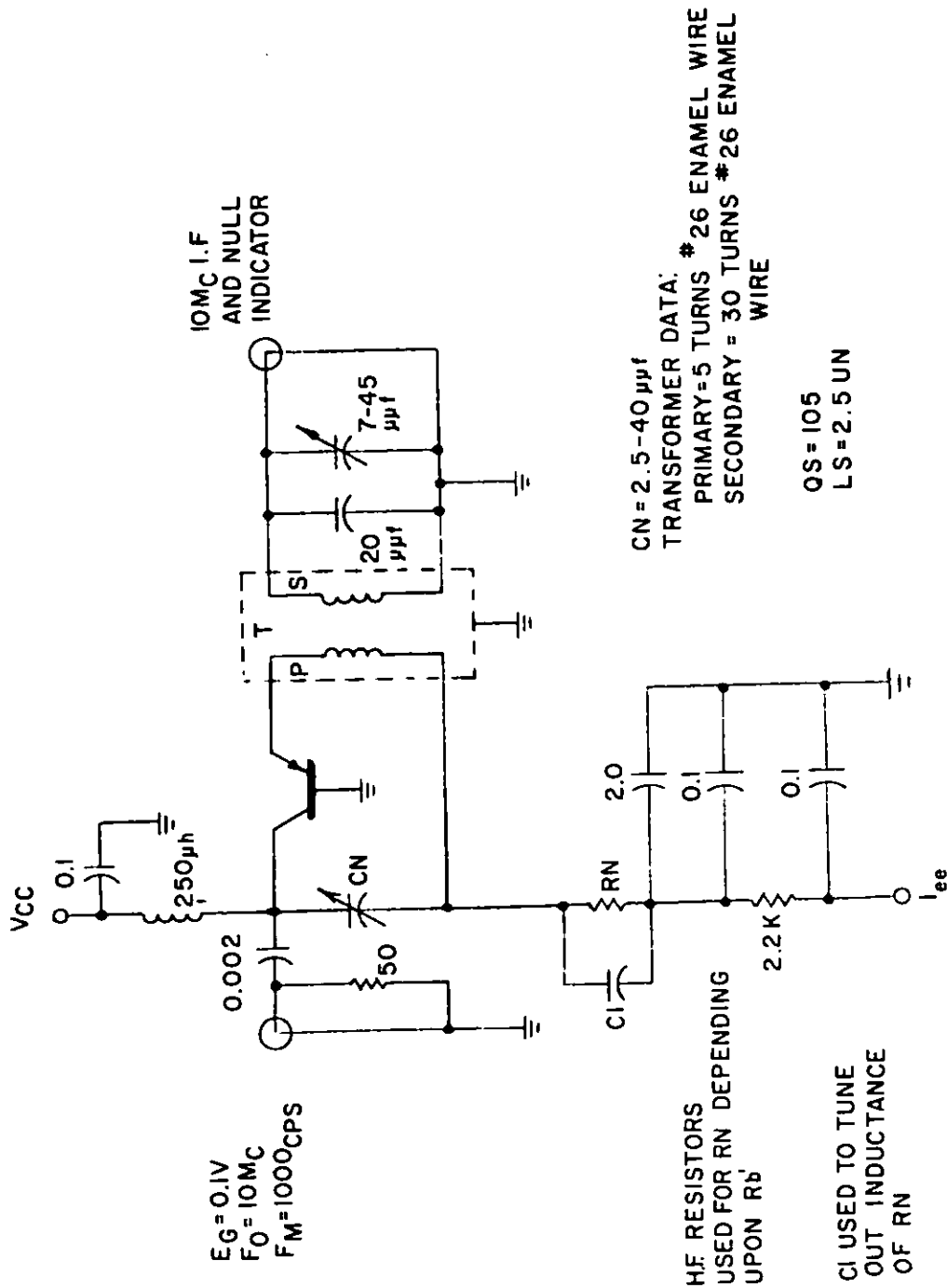


FIGURE 3. $R_N C_N$ test circuit.

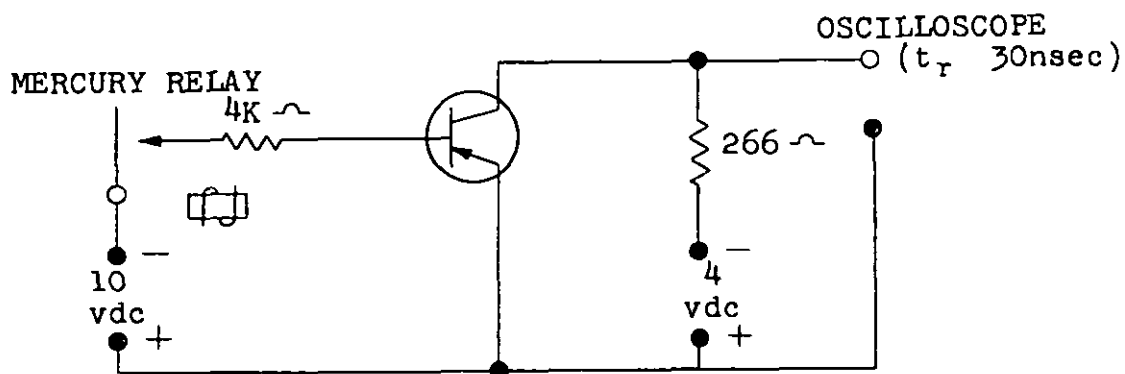


FIGURE 5. Delay + rise time test circuit.

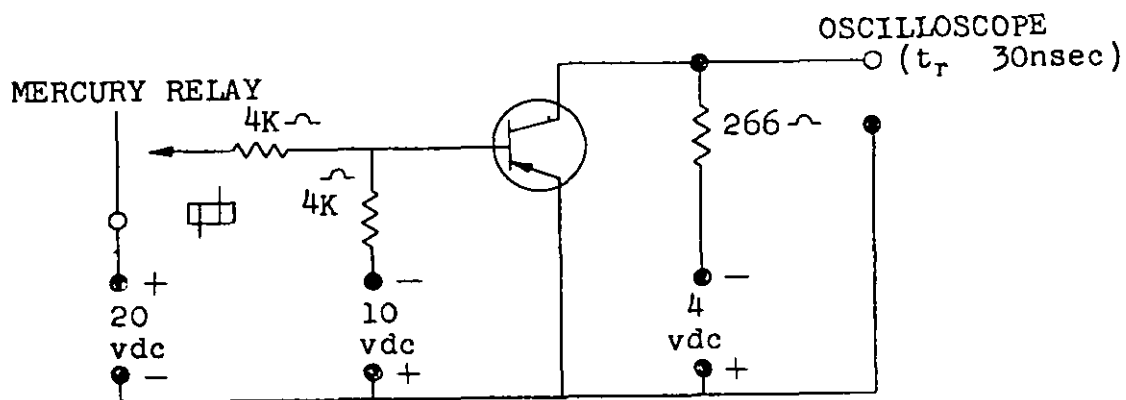


FIGURE 6. Storage + fall time test circuit.