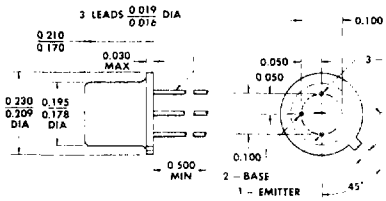
TYPES 2N3250, 2N3250A, 2N3251, 2N3251A
P-N-P SILICON TRANSISTORS

BULLETIN NO. DL-S 679650, MARCH 1967

DESIGNED FOR LOW-POWER SATURATED-SWITCHING AND AMPLIFIER APPLICATIONS

- **Low-Level h_{FE}: 80 Min at 100 μA (2N3251 and 2N3251A)**

***mechanical data**



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE

ALL JEDEC TO-18 DIMENSIONS AND NOTES ARE APPLICABLE

***absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)**

	2N3250 2N3251	2N3250A 2N3251A
Collector-Base Voltage	−50 V	−60 V
Collector-Emitter Voltage (See Note 1)	−40 V	−60 V
Emitter-Base Voltage	−5 V	−5 V
Continuous Collector Current	←— −200 mA —→	
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	←— 0.36 W —→	
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 3)	←— 1.2 W —→	
Storage Temperature Range	−65°C to 200°C	
Lead Temperature $\frac{1}{16}$ Inch from Case for 60 Seconds	←— 300°C —→	

***electrical characteristics at 25°C free-air temperature**

PARAMETER		TEST CONDITIONS		2N3250 MIN	2N3250 MAX	2N3250A MIN	2N3250A MAX	2N3251 MIN	2N3251 MAX	2N3251A MIN	2N3251A MAX	UNIT
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = −10 μA, I_E = 0		−50		−60		−50		−60		V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = −10 mA, I_B = 0,	See Note 4	−40		−60		−40		−60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = −10 μA, I_C = 0		−5		−5		−5		−5		V
I_{CEV}	Collector Cutoff Current	V_{CE} = −40 V, V_{BE} = 3 V			−20		−20		−20		−20	nA
I_{BEV}	Base Cutoff Current	V_{CE} = −40 V, V_{BE} = 3 V			50		50		50		50	nA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = −1 V, I_C = −0.1 mA	See Note 4	40		40		80		80		
		V_{CE} = −1 V, I_C = −1 mA		45		45		90		90		
		V_{CE} = −1 V, I_C = −10 mA		50	150	50	150	100	300	100	300	
		V_{CE} = −1 V, I_C = −50 mA		15		15		30		30		
V_{BE}	Base-Emitter Voltage	I_B = −1 mA, I_C = −10 mA	See Note 4	−0.6	−0.9	−0.6	−0.9	−0.6	−0.9	−0.6	−0.9	V
		I_B = −5 mA, I_C = −50 mA			−1.2		−1.2		−1.2		−1.2	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = −1 mA, I_C = −10 mA			−0.25		−0.25		−0.25		−0.25	V
		I_B = −5 mA, I_C = −50 mA			−0.5		−0.5		−0.5		−0.5	V
h_{ie}	Small-Signal Common-Emitter Input Impedance	V_{CE} = −10 V, I_C = −1 mA, f = 1 kHz		1	6	1	6	2	12	2	12	kΩ
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio			50	200	50	200	100	400	100	400	
h_{re}	Small-Signal Common-Emitter Reverse Voltage Transfer Ratio				10×10^{-4}		10×10^{-4}		20×10^{-4}		20×10^{-4}	
h_{oe}	Small-Signal Common-Emitter Output Admittance			4	40	4	40	10	60	10	60	μmho

NOTES: 1. These values apply between 0 and 200 mA collector current when the base-emitter diode is open-circuited.

2. Derate linearly to 200°C free-air temperature at the rate of 2.06 mW/deg.

3. Derate linearly to 200°C case temperature at the rate of 6.9 mW/deg.

4. These parameters must be measured using pulse techniques. t_p = 300 μs, duty cycle ≤ 2%.

*Indicates JEDEC registered data

USES CHIP P23

*electrical characteristics at 25°C free-air temperature (continued)

PARAMETER		TEST CONDITIONS	2N3250 2N3250A MIN	2N3250 2N3250A MAX	2N3251 2N3251A MIN	2N3251 2N3251A MAX	UNIT
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = -20$ V, $I_C = -10$ mA, f = 100 MHz	2.5		3		
f_T	Transition Frequency	$V_{CE} = -20$ V, $I_C = -10$ mA, See Note 5	250		300		MHz
C_{obo}	Common-Base Open-Circuit Output Capacitance	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz		6		6	pF
C_{ibo}	Common-Base Open-Circuit Input Capacitance	$V_{EB} = -1$ V, $I_C = 0$, f = 100 kHz		8		8	pF
$r_b'C_c$	Collector-Base Time Constant	$V_{CE} = -20$ V, $I_C = -10$ mA, f = 31.8 MHz	250		250		ps

NOTE 5: To obtain f_T, the h_{fe} response with frequency is extrapolated at the rate of −6 dB per octave from f = 100 MHz to the frequency at which $|h_{fe}| = 1$.

*operating characteristics at 25°C free-air temperature

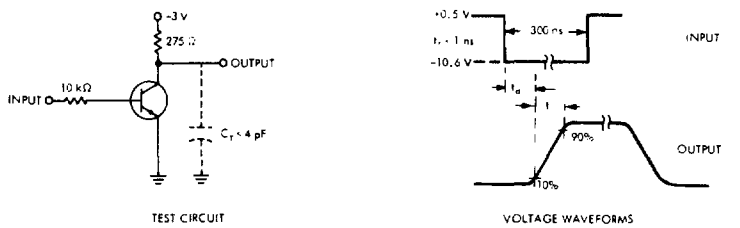
PARAMETER		TEST CONDITIONS	2N3250 2N3250A MAX	2N3251 2N3251A MAX	UNIT
NF	Spot Noise Figure	$V_{CE} = -5$ V, $I_C = -100$ μA, $R_G = 1$ kΩ, f = 100 Hz	6	6	dB

*switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS†	2N3250 2N3250A MAX	2N3251 2N3251A MAX	UNIT
t_d	Delay Time	$I_C = -10$ mA, $I_{B(1)} = -1$ mA, $V_{BE(off)} = 0.5$ V,	35	35	ns
t_r	Rise Time	$R_L = 275\ \Omega$, See Figure 1	35	35	ns
t_s	Storage Time	$I_C = -10$ mA, $I_{B(1)} = -1$ mA, $I_{B(2)} = 1$ mA,	175	200	ns
t_f	Fall Time	$R_L = 275\ \Omega$, See Figure 2	50	50	ns

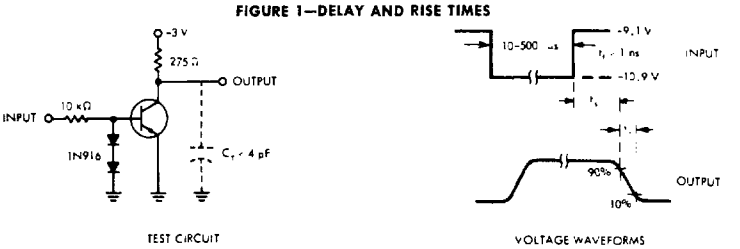
†Voltage and current values shown are nominal; exact values vary slightly with transistor parameters. Nominal base current for delay and rise times is calculated using the minimum value of V_{BE}. Nominal base currents for storage and fall times are calculated using the maximum value of V_{BE}

*PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT VOLTAGE WAVEFORMS

FIGURE 1—DELAY AND RISE TIMES



TEST CIRCUIT VOLTAGE WAVEFORMS

FIGURE 2 — STORAGE AND FALL TIMES

NOTES: a. The input waveforms are supplied by a generator with the following characteristics: $Z_{out} = 50\ \Omega$, duty cycle = 2%.
b. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 1$ ns, $R_{in} \geq 100$ kΩ.

*Indicates JEDEC registered data

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