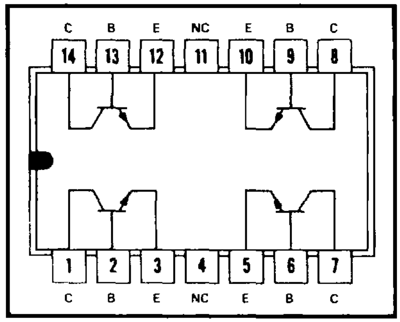
BULLETIN NO. DL-S 7311703, APRIL 1972–REVISED MARCH 1973

DESIGNED FOR MEDIUM-POWER SWITCHING AND GENERAL PURPOSE AMPLIFIER APPLICATIONS

- **High Breakdown Voltage Combined with Very-Low Saturation Voltage**
- **h_{FE} . . . Guaranteed from 100 μA to 500 mA**
- **High f_T . . . 250 MHz Min at 20 V, 20 mA**

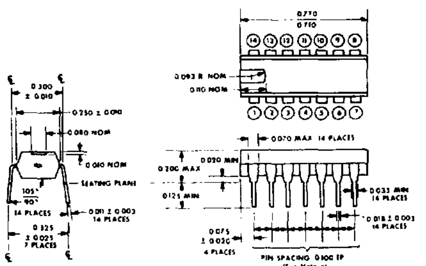
(TOP VIEW)



NC–No internal connection

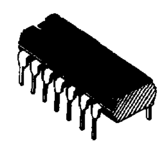
mechanical data

14-PIN PLASTIC DUAL-IN-LINE PACKAGE



NOTES:
a. The true-position pin spacing is 0.100 between centerlines. Each pin centerline is located within 0.010 of its true longitudinal position relative to pins 4 and 11.
b. All dimensions are in inches unless otherwise noted.

Falls Within JEDEC TO-116 and MO-001AA Dimensions



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

	EACH TRIODE	TOTAL DEVICE
Collector-Base Voltage	60 V	
Collector-Emitter Voltage (See Note 1)	30 V	
Emitter-Base Voltage	5 V	
Continuous Collector Current	0.8 A	
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	0.5 W†	1.5 W†
Storage Temperature Range	−55°C to 150°C	
Lead Temperature 1/16 Inch from Case for 10 Seconds	←260°C→	

NOTES: 1. This value applies between 0.01 mA and 500 mA collector current when the emitter-base diode is open-circuited.
2. Derate linearly to 150°C free-air temperature at the rates of 4 mW/°C for each triode and 12 mW/°C for the total device.

†*Previous editions of this data sheet showed higher power dissipation ratings which have been found to be in error. The new ratings correct these errors and do not represent product changes.*

USES CHIP N24

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TYPE Q2T2222
QUAD N-P-N SILICON TRANSISTOR

electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	MAX	UNIT
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10\ \mu A$,	$I_E = 0$		60		V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 10\ mA$,	$I_B = 0$,	See Note 3	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10\ \mu A$,	$I_C = 0$		5		V
I_{CBO}	Collector Cutoff Current	$V_{CB} = 50\ V$,	$I_E = 0$			10	nA
		$V_{CB} = 50\ V$,	$I_E = 0$,	$T_A = 100°C$		3	µA
I_{EBO}	Emitter Cutoff Current	$V_{EB} = 3\ V$,	$I_C = 0$			10	nA
h_{FE}	Static Forward Current Transfer Ratio	$V_{CE} = 10\ V$,	$I_C = 100\ \mu A$		35		
		$V_{CE} = 10\ V$,	$I_C = 1\ mA$		50		
		$V_{CE} = 10\ V$,	$I_C = 10\ mA$	See Note 3	75		
		$V_{CE} = 10\ V$,	$I_C = 150\ mA$		100	300	
		$V_{CE} = 10\ V$,	$I_C = 500\ mA$		30		
		$V_{CE} = 1\ V$,	$I_C = 150\ mA$		50		
V_{BE}	Base-Emitter Voltage	$I_B = 15\ mA$,	$I_C = 150\ mA$	See Note 3		1.3	V
		$I_B = 50\ mA$,	$I_C = 500\ mA$			2.6	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_B = 15\ mA$,	$I_C = 150\ mA$	See Note 3		0.4	V
		$I_B = 50\ mA$,	$I_C = 500\ mA$			1.6	
$\lvert h_{fe} \rvert$	Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 10\ V$,	$I_C = 20\ mA$,	f = 100 MHz	2.5		
f_T	Transition Frequency	$V_{CE} = 10\ V$,	$I_C = 20\ mA$,	See Note 4	250		MHz
C_{obo}	Common-Base Open-Circuit Output Capacitance	$V_{CB} = 10\ V$,	$I_E = 0$,	f = 1 MHz		8	pF
C_{ibo}	Common-Base Open-Circuit Input Capacitance	$V_{EB} = 0.5\ V$,	$I_C = 0$,	f = 1 MHz		25	pF
$Re(h_{ie})$	Real Part of Small-Signal Common-Emitter Input Impedance	$V_{CE} = 10\ V$,	$I_C = 20\ mA$,	f = 300 MHz		60	Ω

NOTES: 3. These parameters must be measured using pulse techniques. $t_w = 300\ \mu s$, duty cycle ≤ 2%.

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

switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS†			TYP	UNIT
t_d Delay Time	$V_{CC} = 30\ V$,	$I_C = 150\ mA$,	$I_{B(1)} = 15\ mA$,	8	ns
t_r Rise Time	$V_{BE(off)} = -0.5\ V$,		See Figure 1	12	ns
t_s Storage Time	$V_{CC} = 30\ V$,	$I_C = 150\ mA$,	$I_{B(1)} = 15\ mA$,	190	ns
t_f Fall Time	$I_{B(2)} = -15\ mA$,		See Figure 2	30	ns

†Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

PARAMETER MEASUREMENT INFORMATION

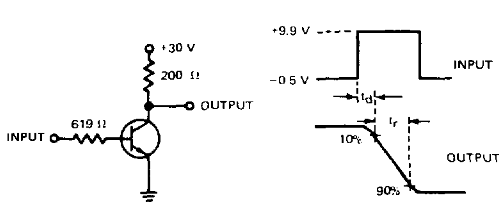

FIGURE 1—DELAY AND RISE TIMES

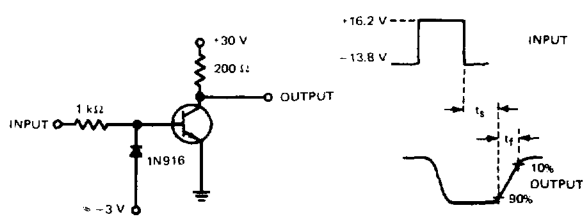

FIGURE 2—STORAGE AND FALL TIMES

NOTES: a. The input waveforms have the following characteristics: for figure 1, $t_r \leq 2$ ns, $t_w \leq 200$ ns, duty cycle ≤ 2%; for figure 2, $t_f \leq 5$ ns, $t_w \approx 100\ \mu s$, duty cycle ≤ 17%.

b. All waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 5$ ns, $R_{in} \geq 100\ k\Omega$, $C_{in} \leq 12$ pF.

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