SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a TO-18 metal envelope with the collector connected to the case. They are primarily intended for high speed switching. The 2N2222 is also suitable for d.c. and v.h.f./u.h.f. amplifiers.

QUICK REFERENCE DATA

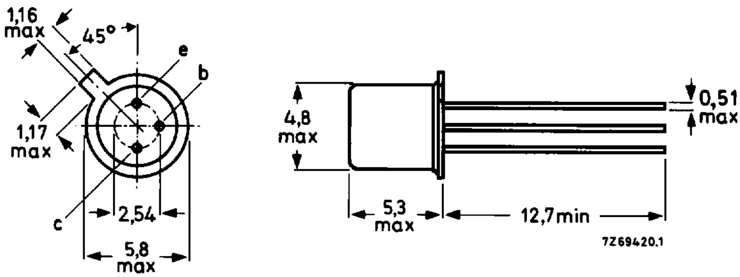
			2N2222	2N2222A	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Collector current (d.c.)	I_C	max.	800	800	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	0,5	0,5	W
Junction temperature	T_j	max.	200	200	°C
D.C. current gain at T_j = 25 °C I_C = 10 mA; V_{CE} = 10 V	h_{FE}	>	75	75	
Transition frequency at f = 100 MHz I_C = 20 mA; V_{CE} = 20 V	f_T	>	250	300	MHz
Storage time I_C = 150 mA; $I_B = -I_{BM}$ = 15 mA	t_s	<	–	225	ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-18.

Collector connected to case



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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			2N2222	2N2222A	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40*	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	6	V
Collector current (d.c.)	I_C	max.	800		mA
Total power dissipation					
up to T_{amb} = 25 °C	P_{tot}	max.	0,5		W
up to T_{case} = 25 °C	P_{tot}	max.	1,2		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	200		°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	350	K/W
From junction to case	$R_{th\ j\text{-}c}$	=	146	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N2222	2N2222A	
Collector cut-off current					
$I_E = 0$; V_{CB} = 50 V	I_{CBO}	<	10	–	nA
$I_E = 0$; V_{CB} = 50 V; T_{amb} = 150 °C	I_{CBO}	<	10	–	μA
$I_E = 0$; V_{CB} = 60 V	I_{CBO}	<	–	10	nA
$I_E = 0$; V_{CB} = 60 V; T_{amb} = 150 °C	I_{CBO}	<	–	10	μA
Emitter cut-off current					
$I_C = 0$; V_{EB} = 3 V	I_{EBO}	<	10	10	nA
Currents at reverse biased emitter junction					
V_{CE} = 60 V; $-V_{BE}$ = 3 V	I_{CEX}	<	–	10	nA
	$-I_{BEX}$	<	–	20	nA

* Applicable up to I_C = 500 mA.

			2N2222	2N2222A
Breakdown voltages				
$I_E = 0$; $I_C = 10\ \mu A$	$V_{(BR)CBO}$	>	60	75 V
$I_B = 0$; $I_C = 10$ mA	$V_{(BR)CEO}$	>	30	40 V
$I_C = 0$; $I_E = 10\ \mu A$	$V_{(BR)EBO}$	>	5	6 V
Saturation voltages *				
$I_C = 150$ mA; $I_B = 15$ mA	V_{CEsat}	<	0,4	0,3 V
	V_{BEsat}	>	–	0,6 V
	V_{BEsat}	<	1,3	1,2 V
$I_C = 500$ mA; $I_B = 50$ mA	V_{CEsat}	<	1,6	1,0 V
	V_{BEsat}	<	2,6	2,0 V
D.C. current gain				
$I_C = 0{,}1$ mA; $V_{CE} = 10$ V	h_{FE}	>	35	35
$I_C = 1$ mA; $V_{CE} = 10$ V	h_{FE}	>	50	50
$I_C = 10$ mA; $V_{CE} = 10$ V	h_{FE}	>	75	75
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = -55\ ^oC$	h_{FE}	>	–	35
$I_C = 150$ mA; $V_{CE} = 1$ V *	h_{FE}	>	50	50
$I_C = 150$ mA; $V_{CE} = 10$ V *	h_{FE}		100 to 300	100 to 300
$I_C = 500$ mA; $V_{CE} = 10$ V *	h_{FE}	>	30	40
Transition frequency at f = 100 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V	f_T	>	250	300 MHz
Collector capacitance at f = 100 kHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	8	8 pF
Emitter capacitance at f = 100 kHz				
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	<	–	25 pF
Feedback time constant at f = 31,8 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V	$r_{b'}C_c$	<	–	150 ps

* Pulse duration $\leqslant 300\ \mu s$; duty cycle $\leqslant 2\%$.

h-parameters (common emitter)

			2N2222	2N2222A	
I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz					
Input impedance	h_{ie}			2 to 8	kΩ
Reverse voltage transfer ratio	h_{re}	<		8	10^{-4}
Small signal current	h_{fe}			50 to 300	
Output admittance	h_{oe}			5 to 35	µS
I_C = 10 mA; V_{CE} = 10 V; f = 1 kHz					
Input impedance	h_{ie}			0,25 to 1,25	kΩ
Reverse voltage transfer ratio	h_{re}	<		4	10^{-4}
Small signal current gain	h_{fe}			75 to 375	
Output admittance	h_{oe}			25 to 200	µS
I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz			**2N2222**	**2N2222A**	
Small signal current gain	h_{fe}	>	2,5	3,0	
I_C = 20 mA; V_{CE} = 20 V; f = 300 MHz					
Real part of input impedance	$Re(h_{ie})$	<	60	60	Ω
Noise figure at f = 1 kHz I_C = 0,1 mA; V_{CE} = 10 V R_G = 1 kΩ; B = 1 Hz	F	<	–	4	dB
Switching times for 2N2222A Turn on time when switched from $-V_{BE}$ = 0,5 V to I_C = 150 mA; I_B = 15 mA					
Delay time	t_d	<		10	ns
Rise time	t_r	<		25	ns

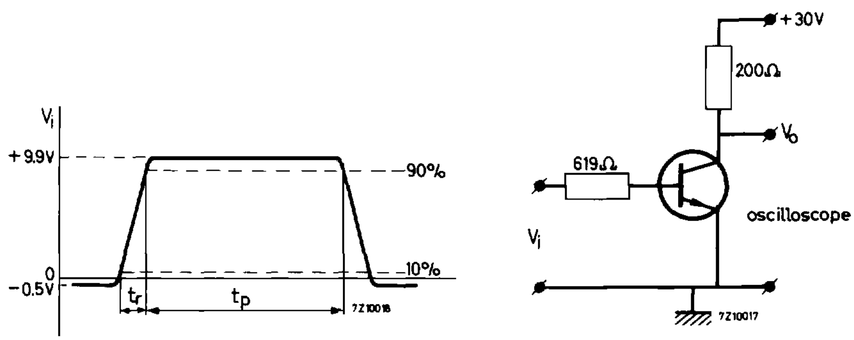

Fig. 2 Test circuit and waveform.

Pulse generator:

pulse duration	$t_p \leqslant 200$ ns
rise time	$t_r \leqslant 2$ ns

Oscilloscope:

input resistance	$R_i > 100$ kΩ
input capacitance	$C_i < 12$ pF
rise time	$t_r < 5$ ns

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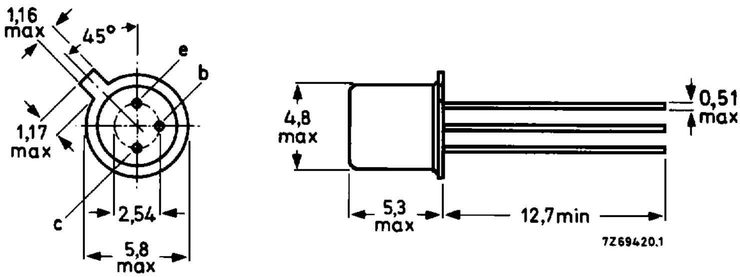

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