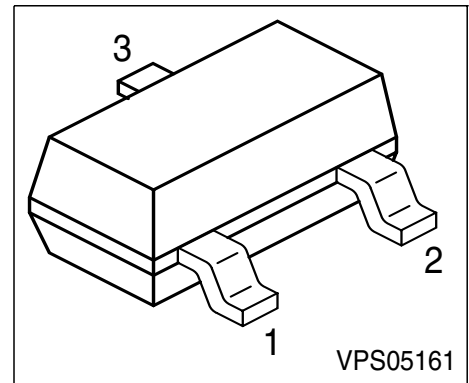


NPN Silicon Switching Transistor

- High DC current gain: 0.1mA to 500 mA
- Low collector-emitter saturation voltage
- Complementary type: SMBT2907A (PNP)



Type	Marking	Pin Configuration			Package
SMBT2222A/ MMBT2222A	s1P	1=B	2=E	3=C	SOT23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	75	
Emitter-base voltage	V_{EBO}	6	
DC collector current	I_C	600	mA
Total power dissipation, $T_S = 77\text{ °C}$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Junction - soldering point ¹⁾	R_{thJS}	≤220	K/W
--	------------	------	-----

¹⁾For calculation of R_{thJA} please refer to Application Note Thermal Resistance

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 10\text{ mA}, I_B = 0$	$V_{(BR)CEO}$	40	-	-	V
Collector-base breakdown voltage $I_C = 10\text{ }\mu\text{A}, I_E = 0$	$V_{(BR)CBO}$	75	-	-	
Emitter-base breakdown voltage $I_E = 10\text{ }\mu\text{A}, I_C = 0$	$V_{(BR)EBO}$	6	-	-	
Collector cutoff current $V_{CB} = 60\text{ V}, I_E = 0$	I_{CBO}	-	-	10	nA
Collector cutoff current $V_{CB} = 60\text{ V}, I_E = 0, T_A = 150\text{ }^\circ\text{C}$	I_{CBO}	-	-	10	μA
Emitter cutoff current $V_{EB} = 3\text{ V}, I_C = 0$	I_{EBO}	-	-	10	nA
DC current gain 1) $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}, T_A = 55^\circ\text{C}$	h_{FE}	35 50 75 50 100 40 35	- - - - - - -	- - - - 300 - -	-
Collector-emitter saturation voltage1) $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	V_{CEsat}	- -	- -	0.3 1	V
Base-emitter saturation voltage 1) $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	V_{BEsat}	0.6 -	- -	1.2 2	

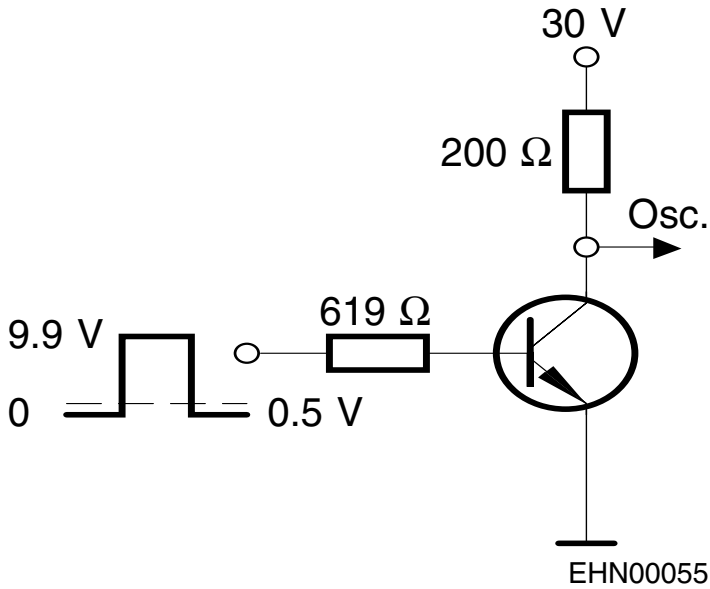
 1) Pulse test: $t \leq 300\mu\text{s}$, $D = 2\%$

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

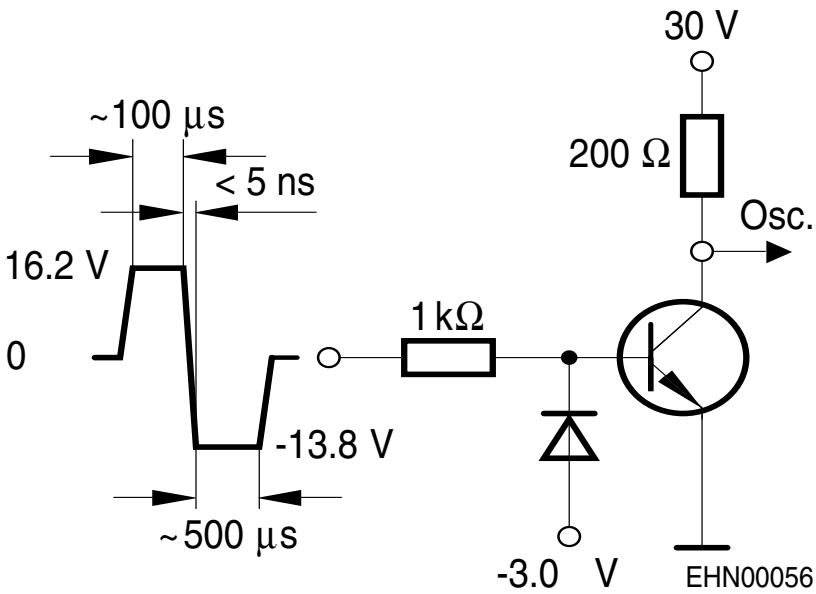
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 100 \text{ MHz}$	f_T	300	-	-	MHz
Collector-base capacitance $V_{CB} = 10 \text{ V}, f = 1 \text{ MHz}$	C_{cb}	-	-	8	pF
Emitter-base capacitance $V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$	C_{eb}	-	-	25	
Noise figure $I_C = 100 \mu\text{A}, V_{CE} = 10 \text{ V}, R_S = 1 \text{ k}\Omega,$ $f = 1 \text{ kHz}, \Delta f = 200 \text{ Hz}$	F	-	-	4	dB
Short-circuit input impedance $I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	h_{11e}	2 0.25	- -	8 1.25	k Ω
Open-circuit reverse voltage transf.ratio $I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	h_{12e}	- -	- -	8 4	10^{-4}
Short-circuit forward current transf.ratio $I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	h_{21e}	50 75	- -	300 375	-
Open-circuit output admittance $I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	h_{22e}	5 25	- -	35 200	μS
Delay time $V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA}, I_{B1} = 15 \text{ mA},$ $V_{BE(\text{off})} = 0.5 \text{ V}$	t_d	-	-	10	ns
Rise time $V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA}, I_{B1} = 15 \text{ mA},$ $V_{BE(\text{off})} = 0.5 \text{ V}$	t_r	-	-	25	
Storage time $V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA}, I_{B1}=I_{B2} = 15\text{mA}$	t_{stg}	-	-	225	ns
Fall time $V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA}, I_{B1}=I_{B2} = 15\text{mA}$	t_f	-	-	60	ns

Test circuits

Delay and rise time

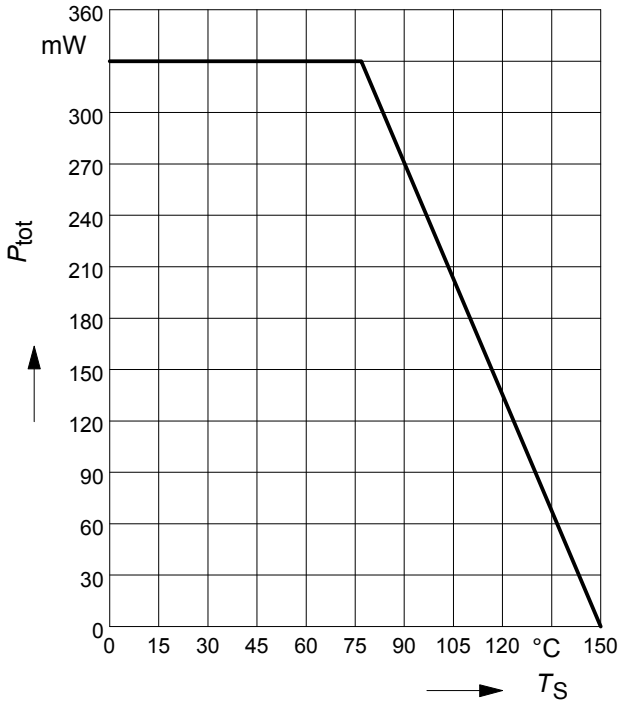


Storage and fall time



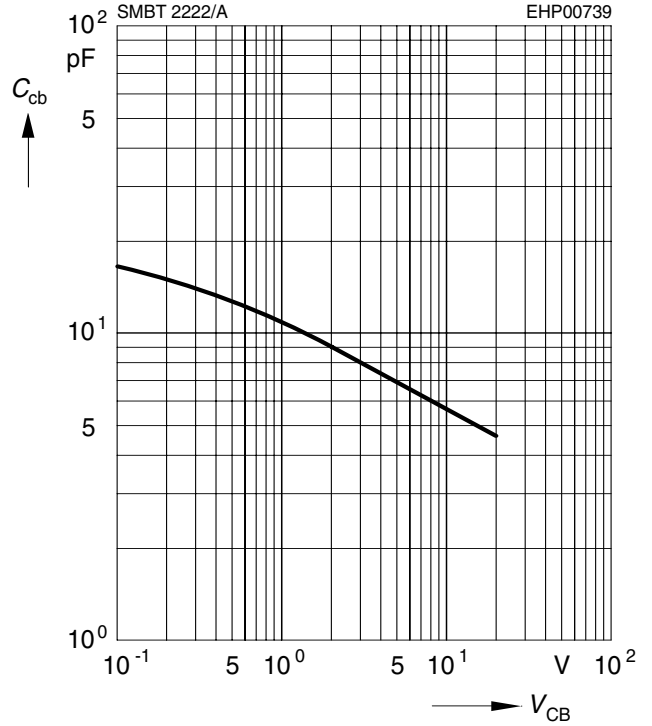
Oscilloscope: $R > 100\Omega$, $C < 12\text{pF}$, $t_r < 5\text{ns}$

Total power dissipation $P_{tot} = f(T_S)$



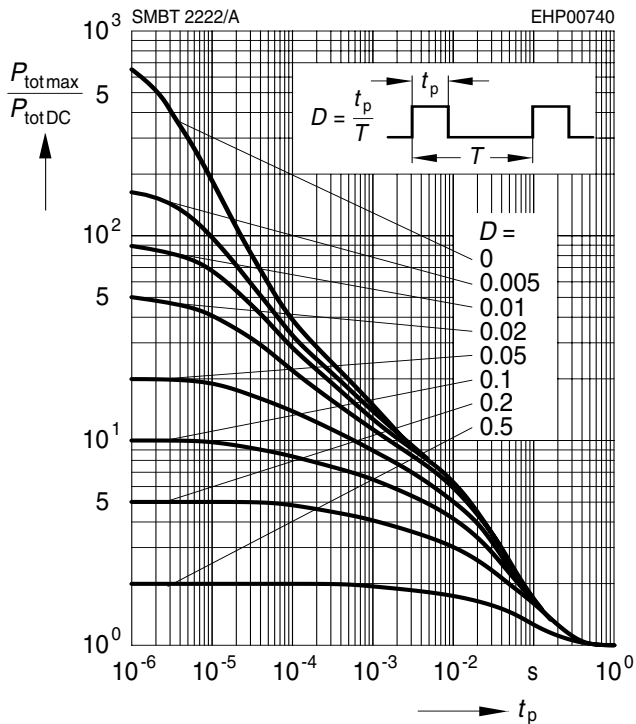
Collector-base capacitance $C_{CB} = f(V_{CB})$

$f = 1\text{MHz}$



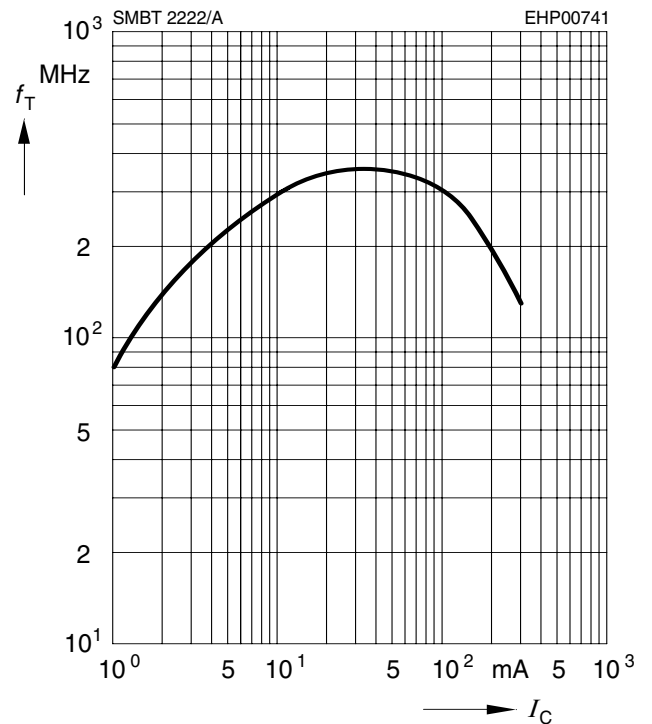
Permissible pulse load

$P_{totmax} / P_{totDC} = f(t_p)$

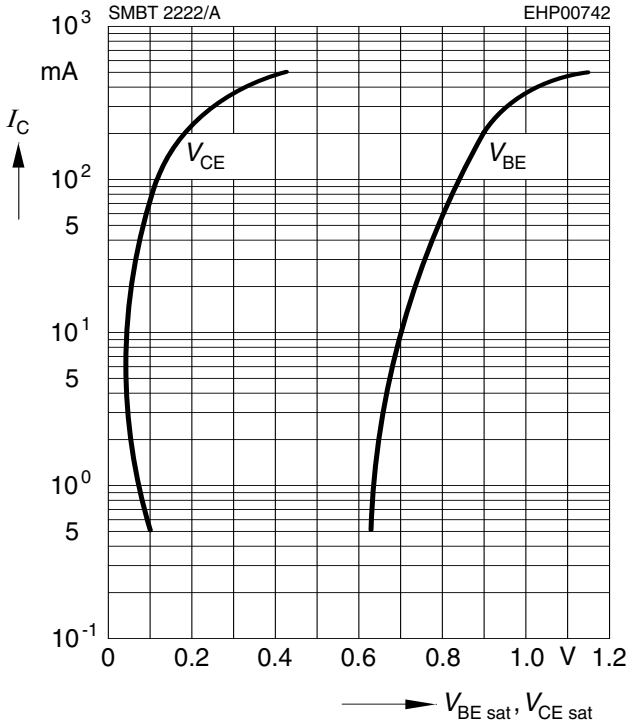


Transition frequency $f_T = f(I_C)$

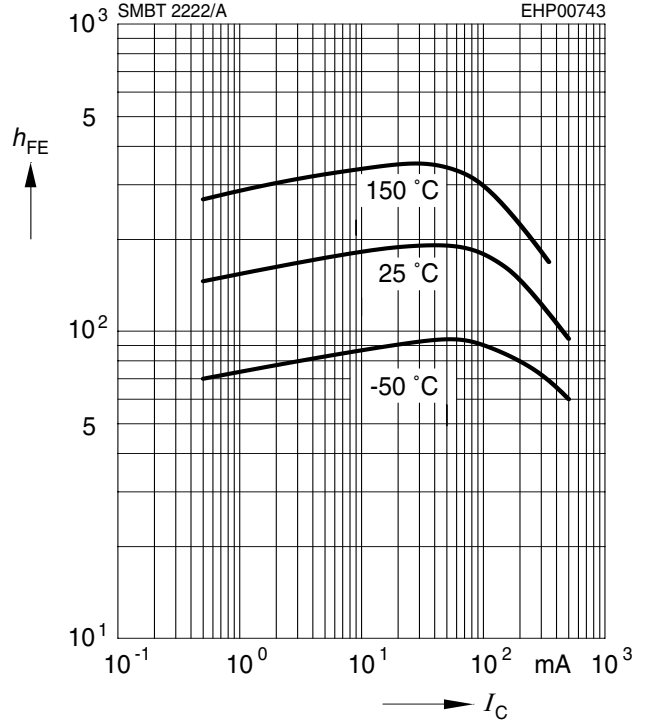
$V_{CE} = 20\text{V}$



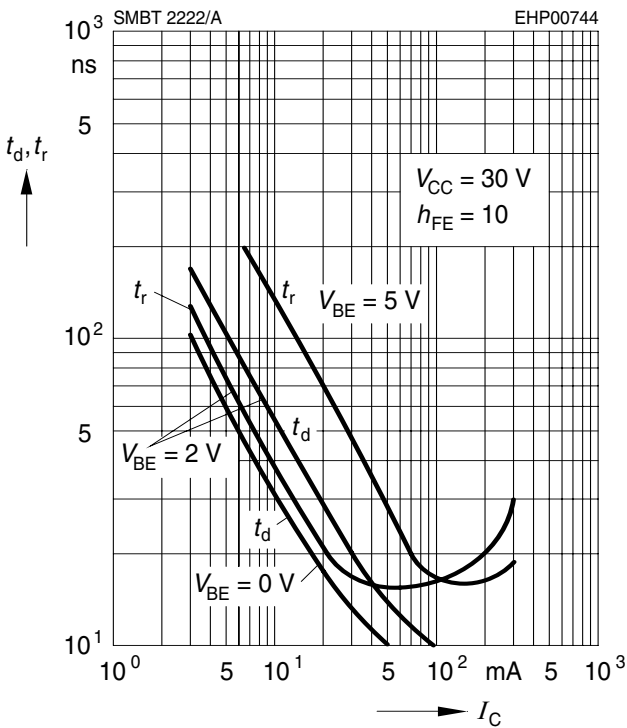
Saturation voltage $I_C = f(V_{BEsat}, V_{CEsat})$
 $h_{FE} = 10$



DC current gain $h_{FE} = f(I_C)$
 $V_{CE} = 10V$



Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



Storage time $t_{stg} = f(I_C)$
Fall time $t_f = f(I_C)$

