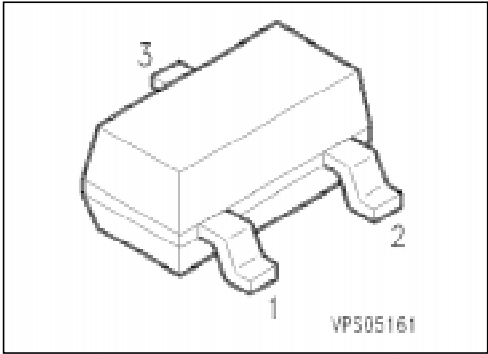


NPN Silicon Switching Transistors

SMBT 2222 SMBT 2222 A

- High DC current gain: 0.1 mA to 500 mA
- Low collector-emitter saturation voltage
- Complementary types: SMBT 2907,
SMBT 2907 A (PNP)



Type	Marking	Ordering Code (tape and reel)	Pin Configuration			Package ¹⁾
			1	2	3	
SMBT 2222 SMBT 2222 A	s1B s1P	Q68000-A6481 Q68000-A6473	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values		Unit
		SMBT 2222	SMBT 2222 A	
Collector-emitter voltage	V_{CE0}	30	40	V
Collector-base voltage	V_{CB0}	60	75	
Emitter-base voltage	V_{EB0}	5	6	
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 range	T_{stg}	− 65 ... + 150		

Thermal Resistance

Junction - ambient ²⁾	$R_{th\ JA}$	≤ 290	K/W
Junction - soldering point	$R_{th\ JS}$	≤ 220	

¹⁾ For detailed information see chapter Package Outlines.

²⁾ Package mounted on epoxy pcb 40 mm × 40 mm × 1.5 mm/6 cm² Cu.

Electrical Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

DC characteristics

Collector-emitter breakdown voltage $I_C = 10\text{ mA}$ SMBT 2222 SMBT 2222 A	$V_{(BR)CE0}$	30 40	— —	— —	V
Collector-base breakdown voltage $I_C = 10\text{ }\mu\text{A}$ SMBT 2222 SMBT 2222 A	$V_{(BR)CB0}$	60 75	— —	— —	
Emitter-base breakdown voltage $I_E = 10\text{ }\mu\text{A}$ SMBT 2222 SMBT 2222 A	$V_{(BR)EB0}$	5 6	— —	— —	
Collector cutoff current $V_{CB} = 50\text{ V}$ $V_{CB} = 60\text{ V}$ $V_{CB} = 50\text{ V}, T_A = 150\text{ }^{\circ}\text{C}$ $V_{CB} = 60\text{ V}, T_A = 150\text{ }^{\circ}\text{C}$ SMBT 2222 SMBT 2222 A SMBT 2222 SMBT 2222 A	I_{CB0}	— — — —	— — — —	10 10 10 10	nA nA μA μA
Emitter cutoff current $V_{EB} = 3\text{ V}$	I_{EB0}	—	—	10	nA
DC current gain $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}^{1)}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ SMBT 2222 SMBT 2222 A $I_C = 10\text{ mA}, V_{CE} = 10\text{ V},$ $T_A = 55\text{ }^{\circ}\text{C}$ SMBT 2222 A	h_{FE}	35 50 75 50 100 30 40 35	— — — — — — — —	— — — — 300 — — —	—
Collector-emitter saturation voltage ¹⁾ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ SMBT 2222 SMBT 2222 A $I_C = 500\text{ mA}, I_B = 50\text{ mA}$ SMBT 2222 SMBT 2222 A	V_{CEsat}	— — — —	— — — —	0.4 0.3 1.6 1.0	V
Base-emitter saturation voltage ¹⁾ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ SMBT 2222 SMBT 2222 A $I_C = 500\text{ mA}, I_B = 50\text{ mA}$ SMBT 2222 SMBT 2222 A	V_{BEsat}	— 0.6 — —	— — — —	1.3 1.2 2.6 2.0	

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

Electrical Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics

Transition frequency $I_C = 20\text{ mA}$, $V_{CE} = 20\text{ V}$, $f = 100\text{ MHz}$ SMBT 2222 SMBT 2222 A	f_T	250 300	— —	— —	MHz
Output capacitance $V_{CB} = 10\text{ V}$, $f = 1\text{ MHz}$	C_{obo}	—	—	8	pF
Input capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$ SMBT 2222 SMBT 2222 A	C_{ibo}	— —	— —	30 25	
Short-circuit input impedance $I_C = 1\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A	h_{11e}	2 0.25	— —	8 1.25	k Ω
Open-circuit reverse voltage transfer ratio $I_C = 1\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A	h_{12e}	— —	— —	8.0 4.0	10^{-4}
Short-circuit forward current transfer ratio $I_C = 1\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A	h_{21e}	50 75	— —	300 375	—
Open-circuit output admittance $I_C = 1\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$ SMBT 2222 A	h_{22e}	5 25	— —	35 200	μS
Collector-base time constant $I_E = 20\text{ mA}$, $V_{CB} = 10\text{ V}$, $f = 31.8\text{ MHz}$ SMBT 2222 A	$r_b'C_c$	—	—	150	ps
Noise figure $I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 10\text{ V}$, $R_S = 1\text{ k}\Omega$ $f = 1\text{ kHz}$ SMBT 2222 A	F	—	—	4.0	dB

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

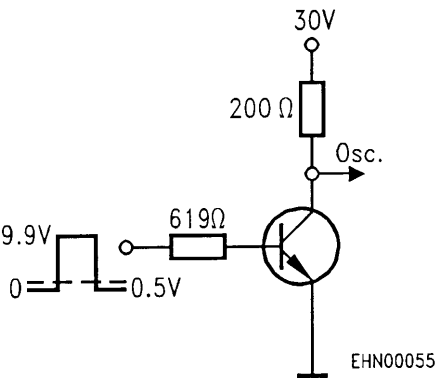
Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics (continued)

$V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$, $I_{B1} = 15\text{ mA}$ $V_{BE(off)} = 0.5\text{ V}$ Delay time	t_d	—	—	10	ns
Rise time	t_r	—	—	25	ns
$V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$, $I_{B1} = I_{B2} = 15\text{ mA}$ Storage time	t_{stg}	—	—	225	ns
Fall time	t_f	—	—	60	ns

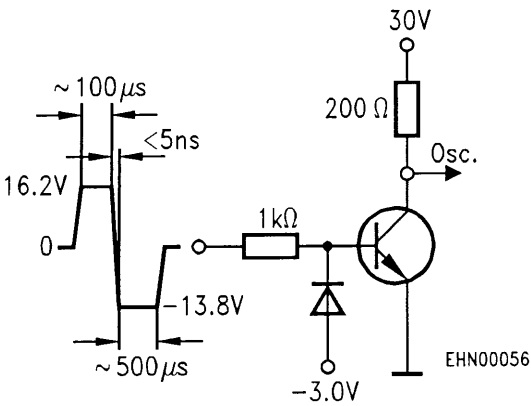
Test circuits

Delay and rise time

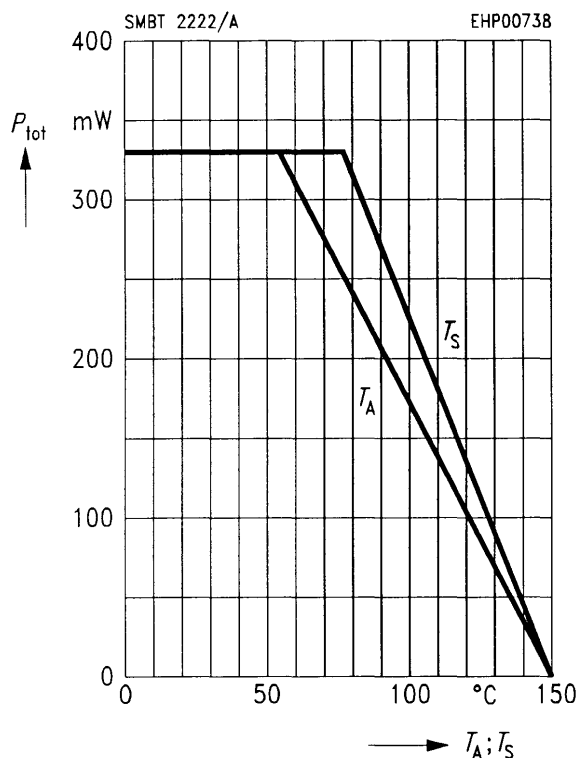


Oscilloscope: $R > 100\text{ }\Omega$
 $C < 12\text{ pF}$
 $t_r < 5\text{ ns}$

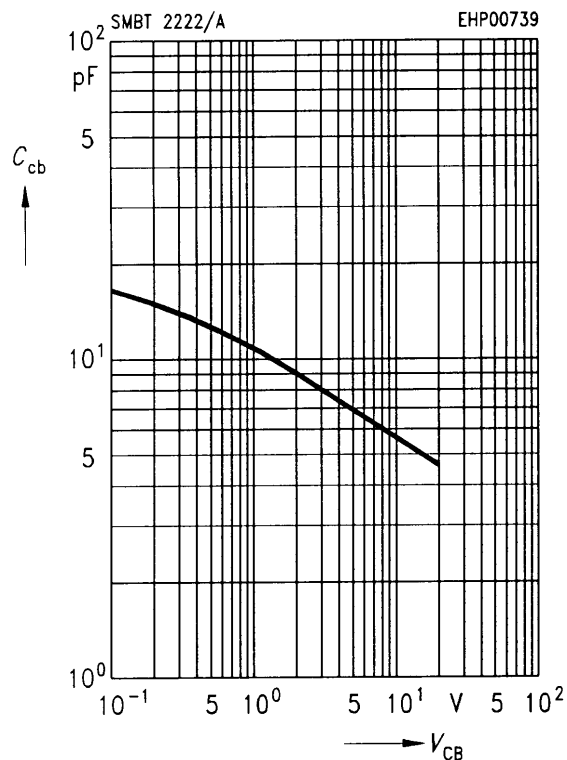
Storage and fall time



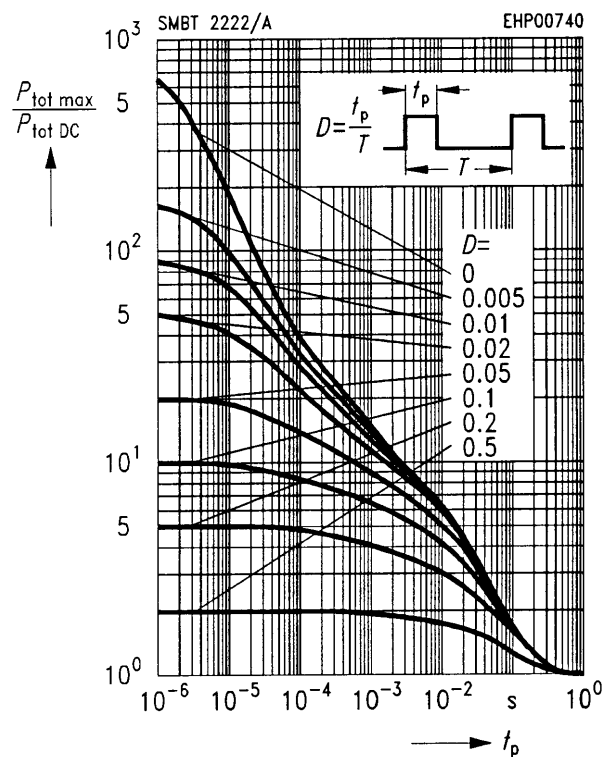
Total power dissipation $P_{\text{tot}} = f(T_A^*; T_S)$
* Package mounted on epoxy



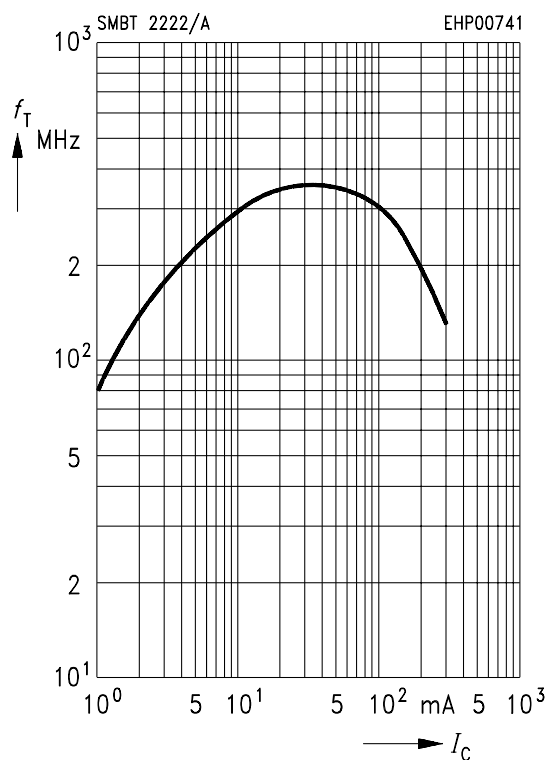
Collector-base capacitance $C_{\text{cb}} = f(V_{\text{CB}})$
 $f = 1 \text{ MHz}$



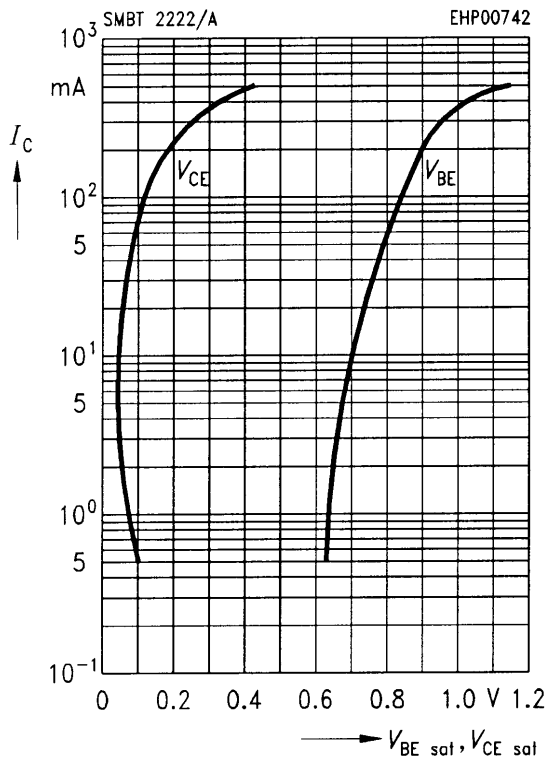
Permissible pulse load $P_{\text{tot max}}/P_{\text{tot DC}} = f(t_p)$



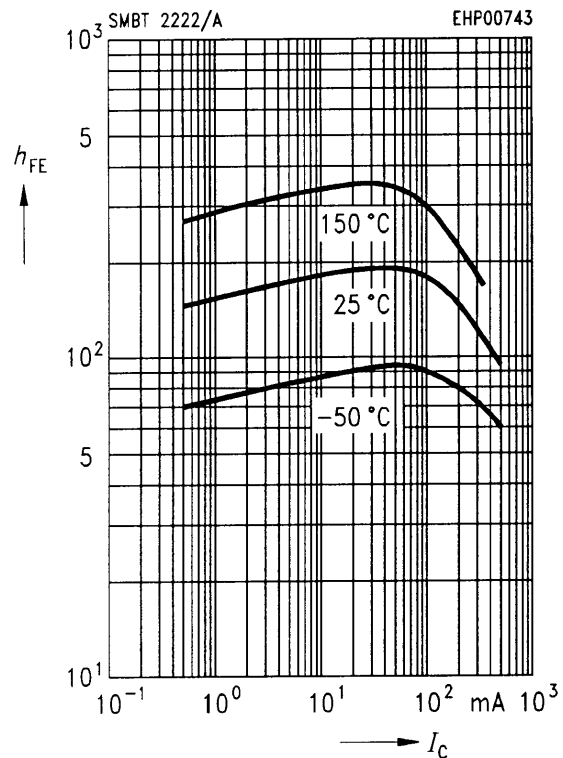
Transition frequency $f_T = f(I_C)$
 $V_{\text{CE}} = 20 \text{ V}$



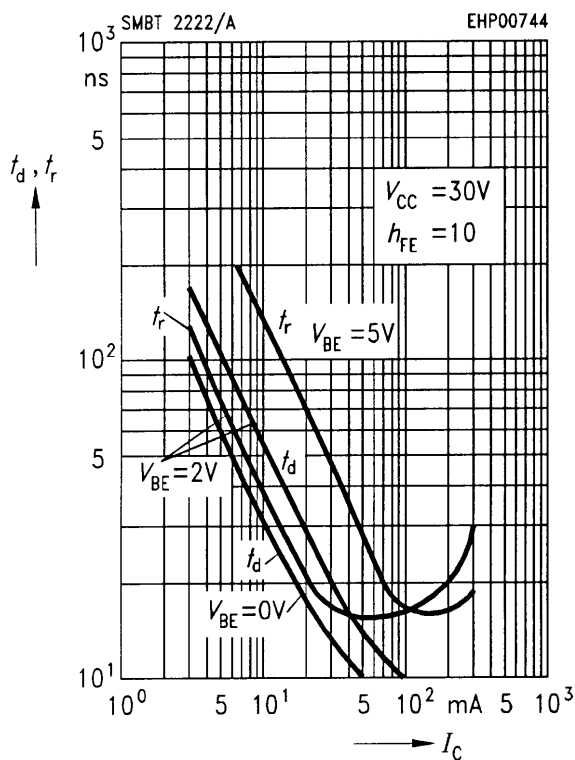
Saturation voltage $I_C = f(V_{BEsat}, V_{CEsat})$
 $h_{FE} = 10$



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



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



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

