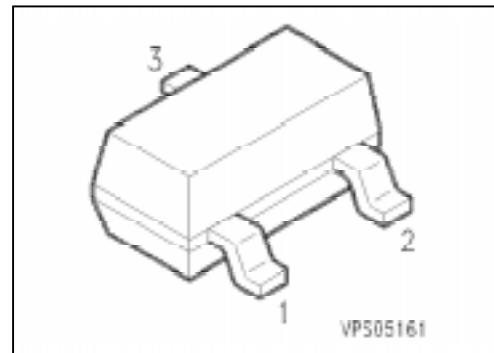


NPN Silicon Switching Transistors

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	s1B	Q68000-A6481	B	E	C	SOT-23
SMBT 2222 A	s1P	Q68000-A6473				

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, $T_s = 77^\circ\text{C}$	P_{tot}	330		mW
Junction temperature	T_j	150		$^\circ\text{C}$
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 Characteristicsat $T_A = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

DC characteristics

Collector-emitter breakdown voltage $I_C = 10 \text{ mA}$	$V_{(\text{BR})\text{CE}0}$	30 40	— —	— —	V
Collector-base breakdown voltage $I_C = 10 \mu\text{A}$	$V_{(\text{BR})\text{CB}0}$	60 75	— —	— —	
Emitter-base breakdown voltage $I_E = 10 \mu\text{A}$	$V_{(\text{BR})\text{EB}0}$	5 6	— —	— —	
Collector cutoff current $V_{CB} = 50 \text{ V}$	I_{CBO}	—	—	10	nA
$V_{CB} = 60 \text{ V}$		—	—	10	nA
$V_{CB} = 50 \text{ V}, T_A = 150^\circ\text{C}$		—	—	10	μA
$V_{CB} = 60 \text{ V}, T_A = 150^\circ\text{C}$		—	—	10	μA
Emitter cutoff current $V_{EB} = 3 \text{ V}$	I_{EBO}	—	—	10	nA
DC current gain $I_C = 100 \mu\text{A}, V_{CE} = 10 \text{ V}$	h_{FE}	35	—	—	—
$I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}$		50	—	—	
$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}^1)$		75	—	—	
$I_C = 150 \text{ mA}, V_{CE} = 1 \text{ V}^1)$		50	—	—	
$I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}^1)$		100	—	300	
$I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}^1)$	SMBT 2222 SMBT 2222 A	30 40	— —	— —	
$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V},$ $T_A = 55^\circ\text{C}$	SMBT 2222 A	35	—	—	
Collector-emitter saturation voltage ¹⁾ $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$	V_{CEsat}	— —	— —	0.4 0.3	V
$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	SMBT 2222 SMBT 2222 A	— —	— —	1.6 1.0	
Base-emitter saturation voltage ¹⁾ $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$	V_{BEsat}	— 0.6	— —	1.3 1.2	
$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	SMBT 2222 SMBT 2222 A	— —	— —	2.6 2.0	

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics

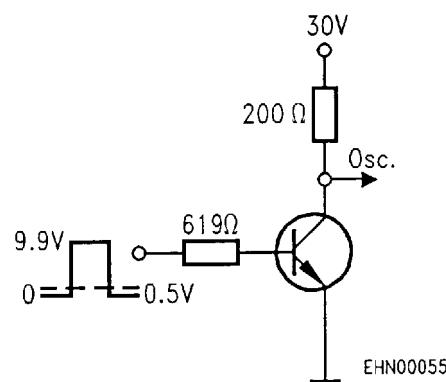
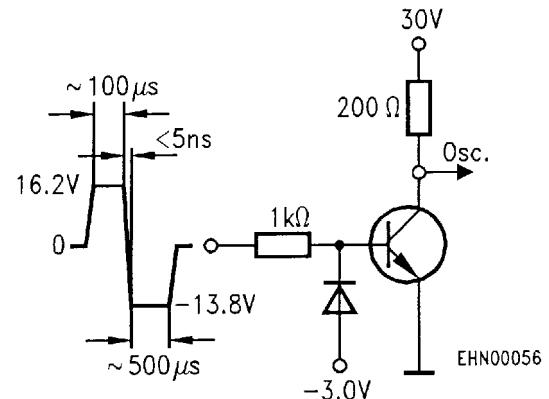
Transition frequency $I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 100 \text{ MHz}$ SMBT 2222 SMBT 2222 A	f	250 300	— —	— —	MHz
Output capacitance $V_{CB} = 10 \text{ V}, f = 1 \text{ MHz}$	C_{obo}	—	—	8	pF
Input capacitance $V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$ SMBT 2222 SMBT 2222 A	C_{ibo}	— —	— —	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	kΩ
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 $I_C = 100 \mu\text{A}, V_{CE} = 10 \text{ V}, R_S = 1 \text{ k}\Omega$ $f = 1 \text{ kHz}$ SMBT 2222 A	F	—	—	4.0	dB

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics (continued)

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

Test circuits**Delay and rise time****Storage and fall time**

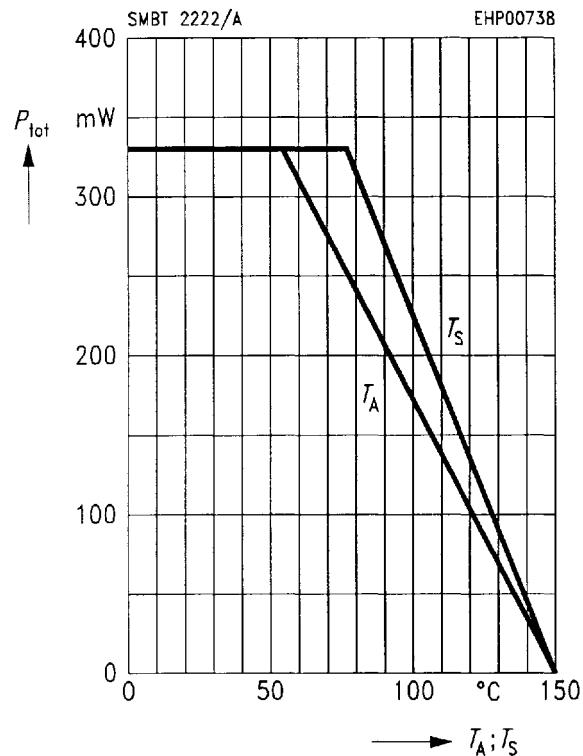
Oscillograph:

$$R > 100 \Omega$$

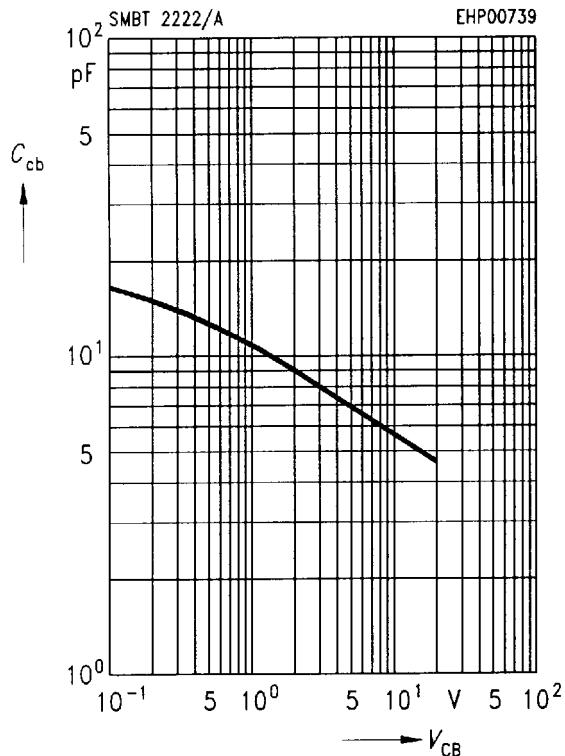
$$C < 12 \text{ pF}$$

$$t_r < 5 \text{ ns}$$

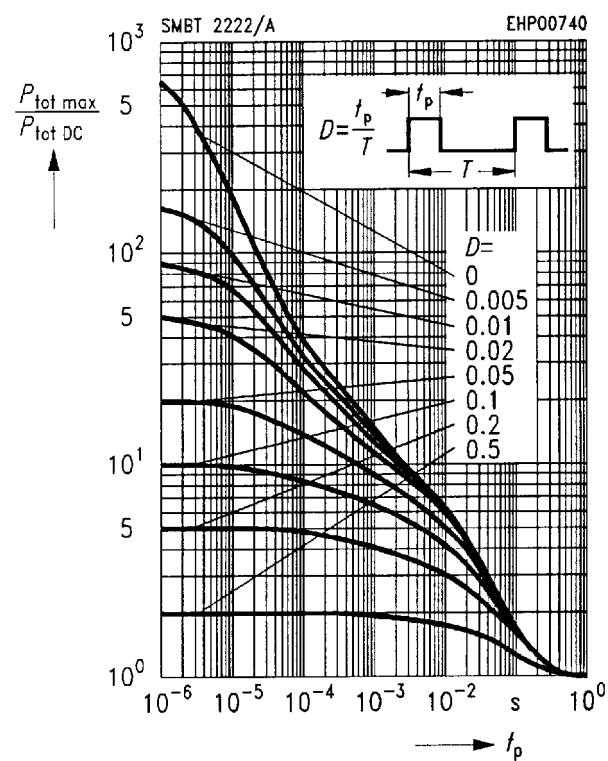
Total power dissipation $P_{\text{tot}} = f(T_A^*; T_S)$
 * Package mounted on epoxy



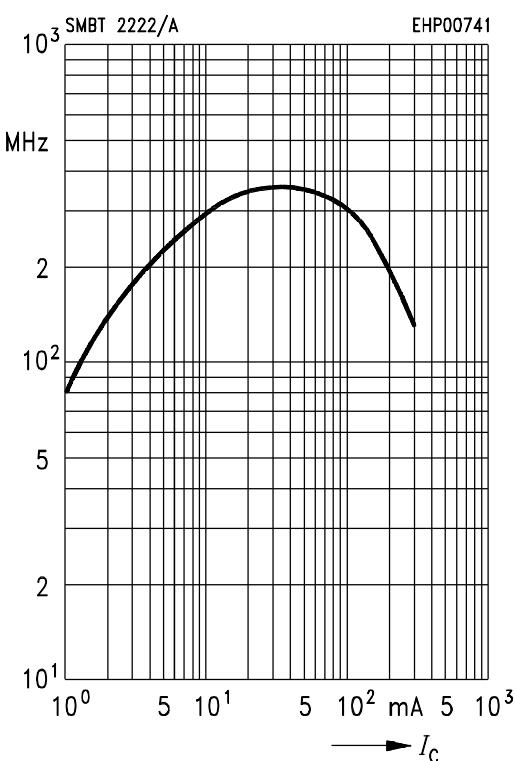
Collector-base capacitance $C_{\text{cb}} = f(V_{\text{CB}})$
 $f = 1 \text{ MHz}$



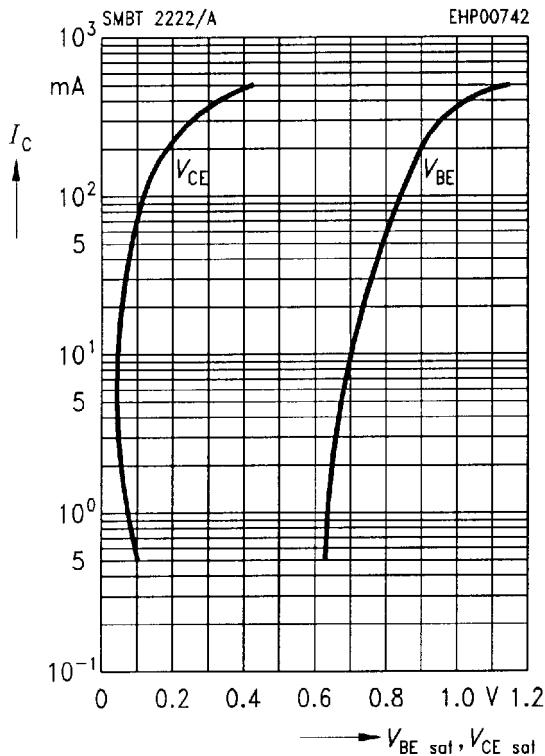
Permissible pulse load $P_{\text{tot max}}/P_{\text{tot DC}} = f(t_p)$



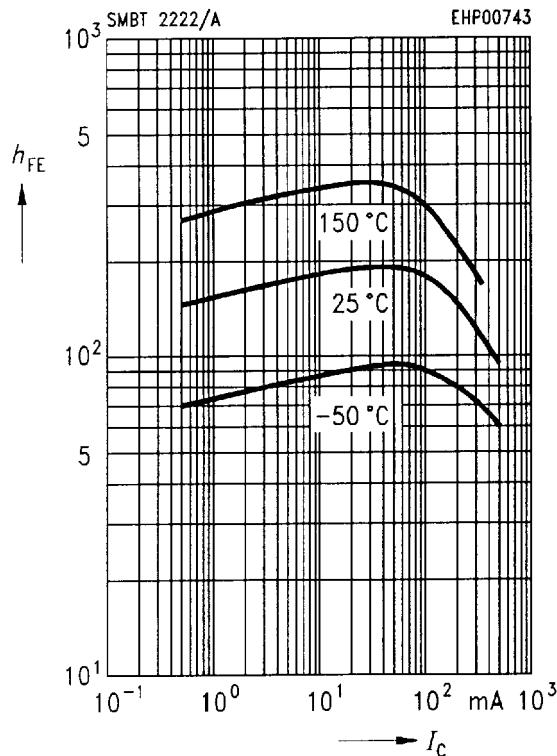
Transition frequency $f_T = f(I_C)$
 $V_{\text{CE}} = 20 \text{ V}$



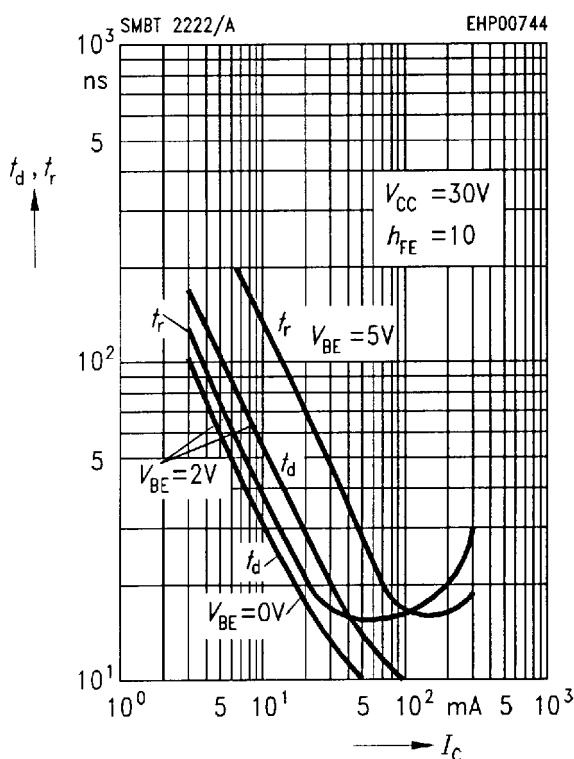
Saturation voltage $I_C = f(V_{BEsat}, V_{CEsat})$
 $h_{FE} = 10$



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 $t_f = f(I_C)$

