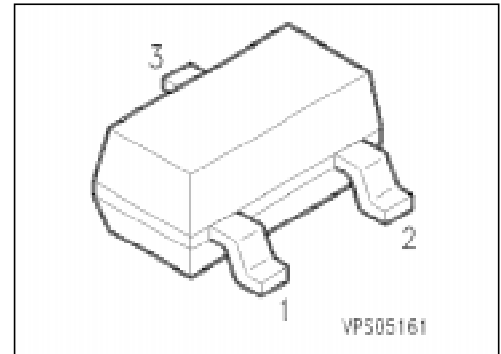


NPN Silicon Switching Transistors

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, $T_s = 77\text{ °C}$	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 $T_A = 25\text{ °C}$, 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 $V_{CB} = 50\text{ V}$ $V_{CB} = 60\text{ V}$ $V_{CB} = 50\text{ V}, T_A = 150\text{ °C}$ $V_{CB} = 60\text{ V}, T_A = 150\text{ °C}$	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 $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}^{1)}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}^{1)}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V},$ $T_A = 55\text{ °C}$	SMBT 2222 SMBT 2222 A SMBT 2222 SMBT 2222 A	h_{FE}	35 50 75 50 100 30 40 35	— — — — — — — —	— — — — 300 — — —	—
Collector-emitter saturation voltage ¹⁾ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	SMBT 2222 SMBT 2222 A SMBT 2222 SMBT 2222 A	V_{CEsat}	— — — —	— — — —	0.4 0.3 1.6 1.0	V
Base-emitter saturation voltage ¹⁾ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	SMBT 2222 SMBT 2222 A SMBT 2222 SMBT 2222 A	V_{BEsat}	— 0.6 — —	— — — —	1.3 1.2 2.6 2.0	

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

Electrical Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics

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

Electrical Characteristics

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

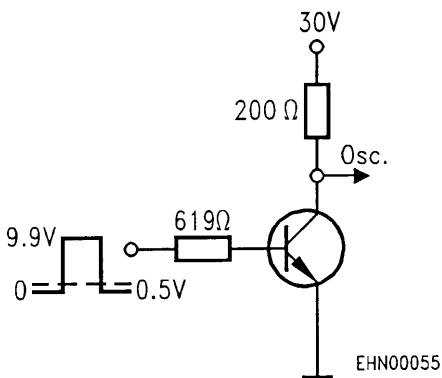
Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC characteristics (continued)

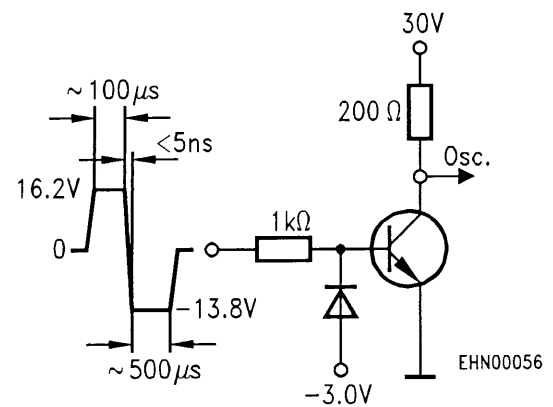
$V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$, $I_{B1} = 15\text{ mA}$ $V_{BE(off)} = 0.5\text{ V}$					
Delay time	t_d	—	—	10	ns
Rise time	t_r	—	—	25	ns
$V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$, $I_{B1} = I_{B2} = 15\text{ mA}$					
Storage time	t_{stg}	—	—	225	ns
Fall time	t_f	—	—	60	ns

Test circuits

Delay and rise time



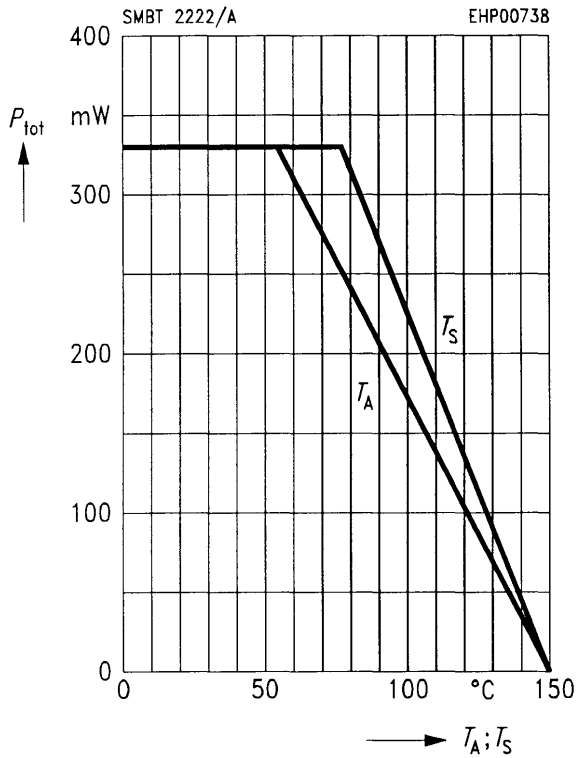
Storage and fall time



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

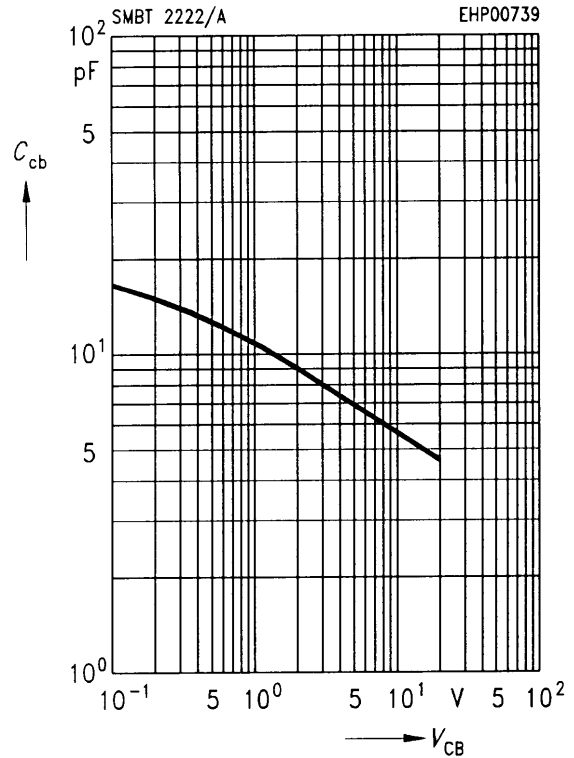
Total power dissipation $P_{tot} = f(T_A^*; T_S)$

* Package mounted on epoxy



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

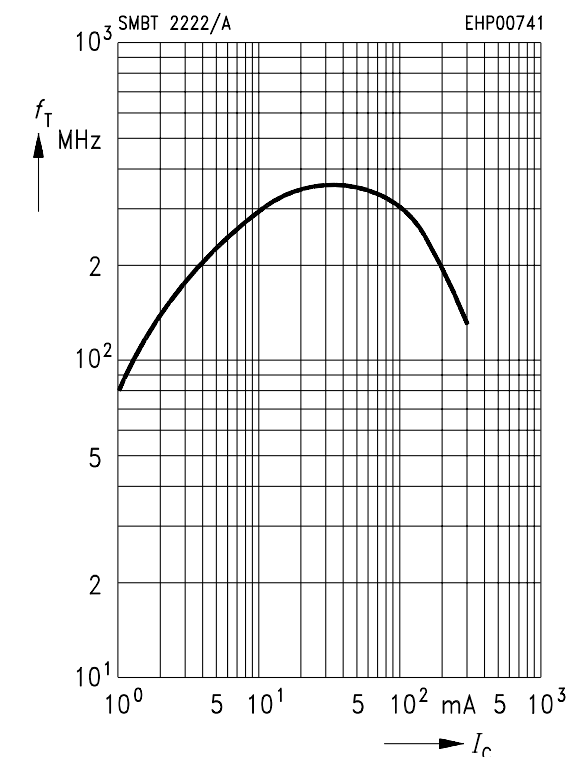
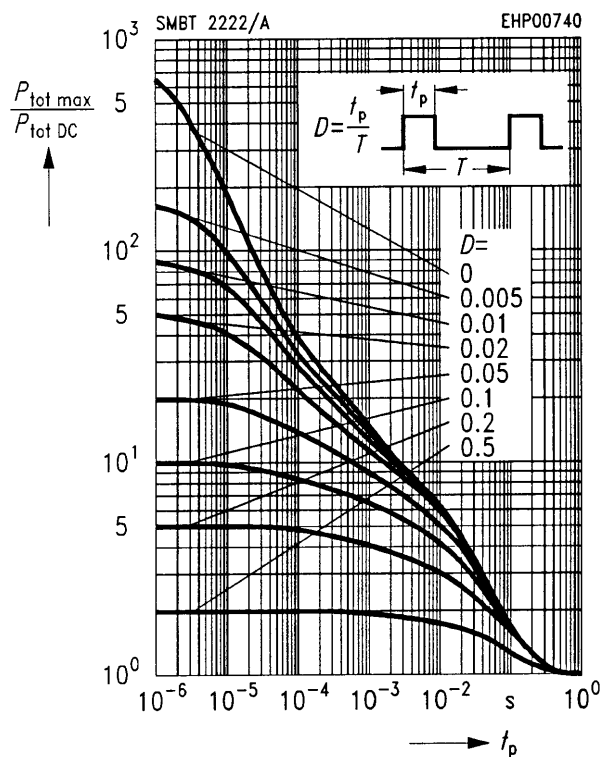
$f = 1 \text{ MHz}$



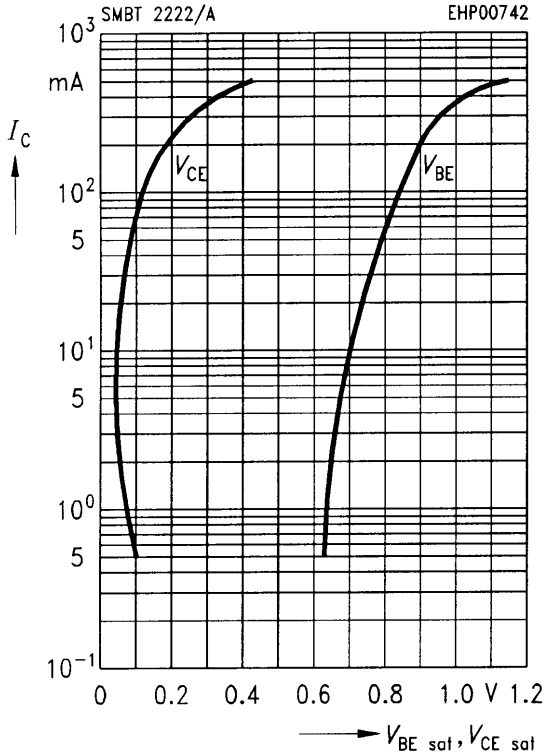
Permissible pulse load $P_{tot \text{ max}}/P_{tot \text{ DC}} = f(t_p)$

Transition frequency $f_T = f(I_C)$

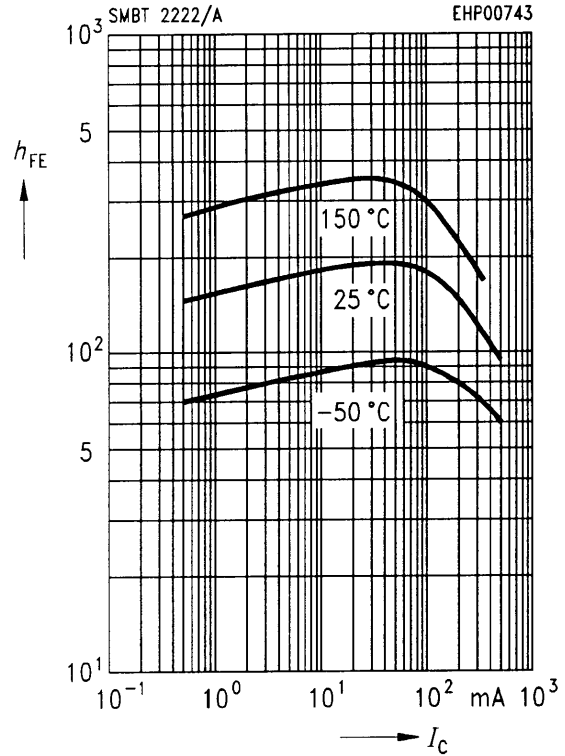
$V_{CE} = 20 \text{ V}$



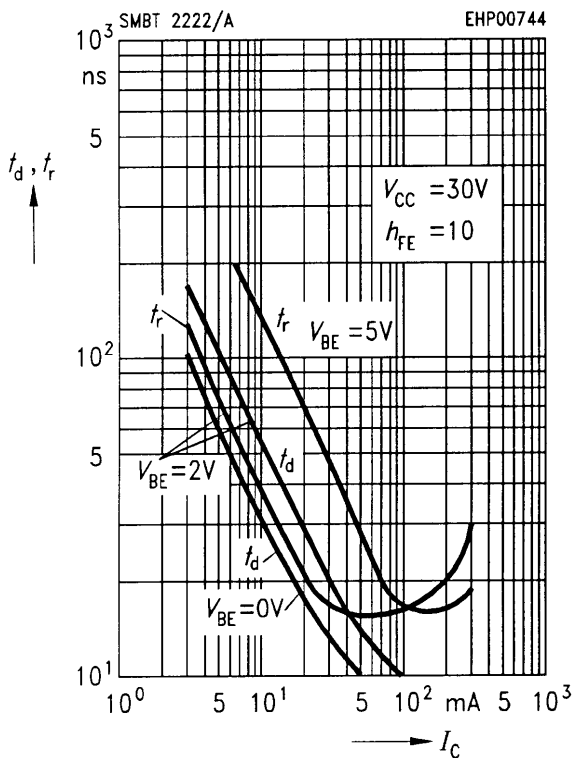
Saturation voltage $I_C = f(V_{BEsat}, V_{CEsat})$
 $h_{FE} = 10$



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



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



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

