



**THE DATASHEET OF  
RJHSE-5084-02**



**NPN Silicon Switching Transistor**

- Low collector-emitter saturation voltage
- Complementary type:  
SMBT2907A / MMBT2907A (PNP)
- Pb-free (RoHS compliant) package
- Qualified according AEC Q101



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	
Collector current	$I_C$	600	mA
Total power dissipation- $T_S \leq 77\text{ °C}$	$P_{tot}$	330	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-65 ... 150	

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	$\leq 220$	K/W

<sup>1)</sup>For calculation of  $R_{thJA}$  please refer to Application Note AN077 (Thermal Resistance Calculation)

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>DC Characteristics</b>					
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-base cutoff current $V_{CB} = 60\text{ V}, I_E = 0$ $V_{CB} = 60\text{ V}, I_E = 0, T_A = 150^\circ\text{C}$	$I_{CBO}$	-	-	0.01 10	$\mu\text{A}$
Emitter-base cutoff current $V_{EB} = 3\text{ V}, I_C = 0$	$I_{EBO}$	-	-	10	nA
DC current gain <sup>1)</sup> $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$	$h_{FE}$	35 50 75 50 100 40	- - - - - -	- - - - 300 -	-
Collector-emitter saturation voltage <sup>1)</sup> $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{CEsat}$	- -	- -	0.3 1	V
Base emitter saturation voltage <sup>1)</sup> $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{BEsat}$	0.6 -	- -	1.2 2	

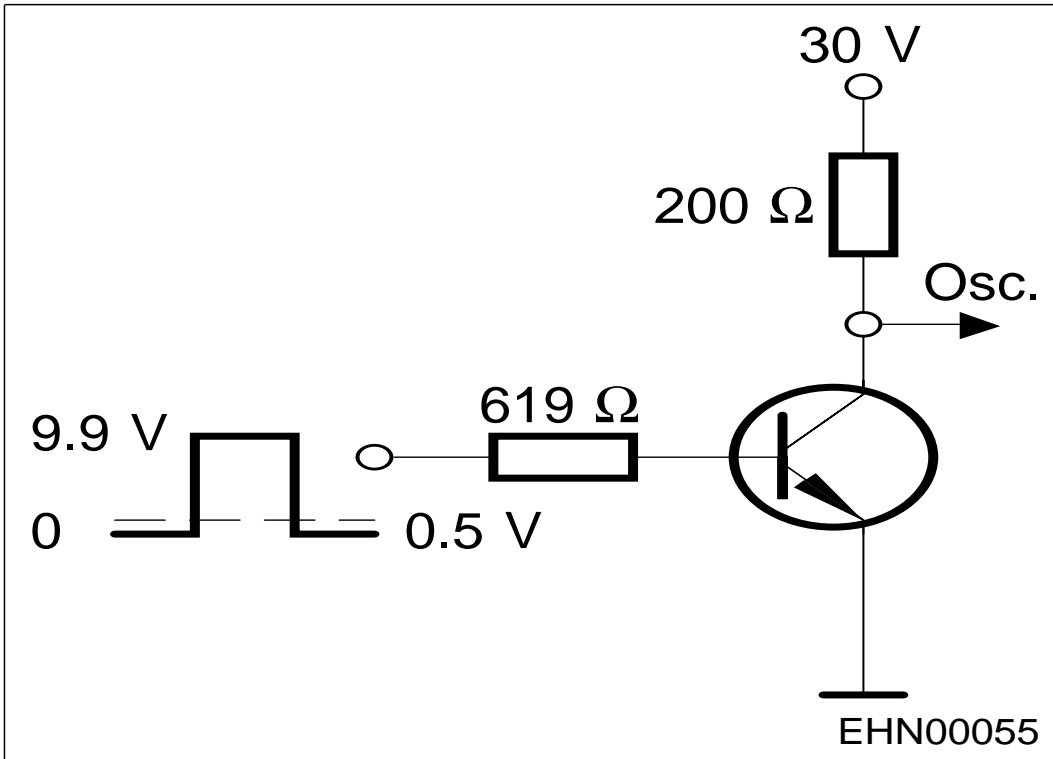
<sup>1)</sup>Pulse test:  $t < 300\mu\text{s}; D < 2\%$

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

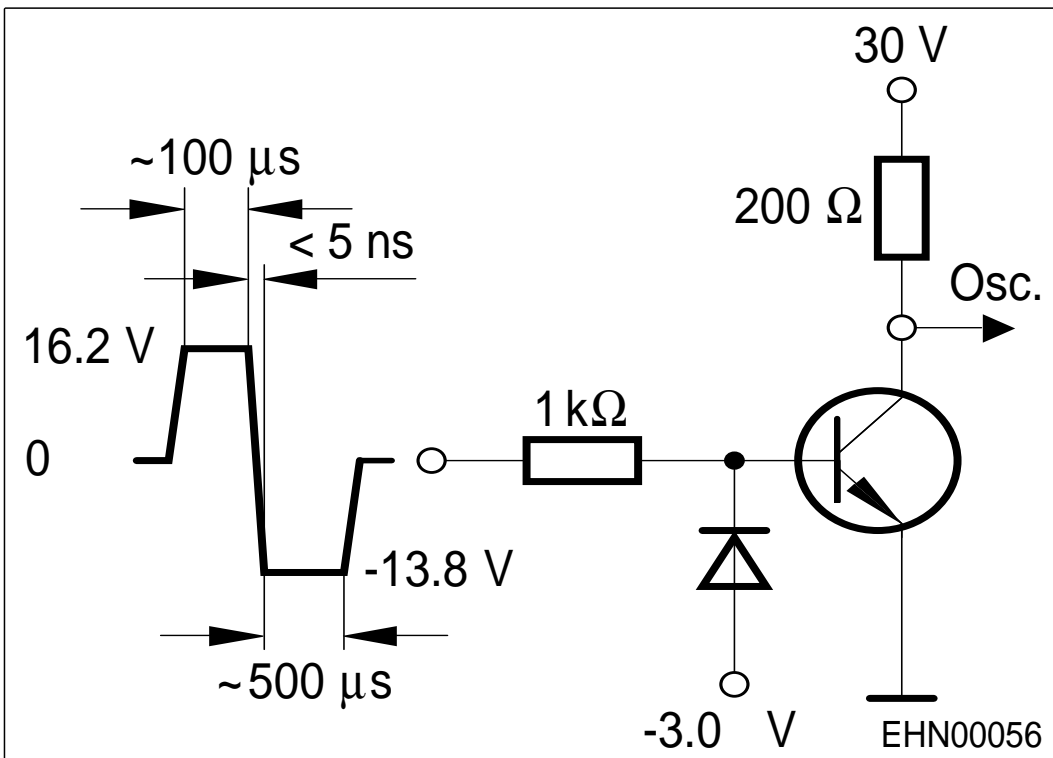
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics</b>					
Transition frequency $I_C = 20\text{ mA}$ , $V_{CE} = 20\text{ V}$ , $f = 100\text{ MHz}$	$f_T$	300	-	-	MHz
Collector-base capacitance $V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$	$C_{cb}$	-	2.5	5	pF
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$	$C_{eb}$	-	-	35	
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	$k\Omega$
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	$\mu\text{S}$
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	
Fall time $V_{CC} = 30\text{ V}$ , $I_C = 150\text{ mA}$ , $I_{B1} = I_{B2} = 15\text{ mA}$	$t_f$	-	-	60	
Noise figure $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 10\text{ V}$ , $f = 1\text{ kHz}$ , $\Delta f = 200\text{ Hz}$ , $R_S = 1\text{ k}\Omega$	$F$	-	-	4	dB

Test circuit

Delay and rise time



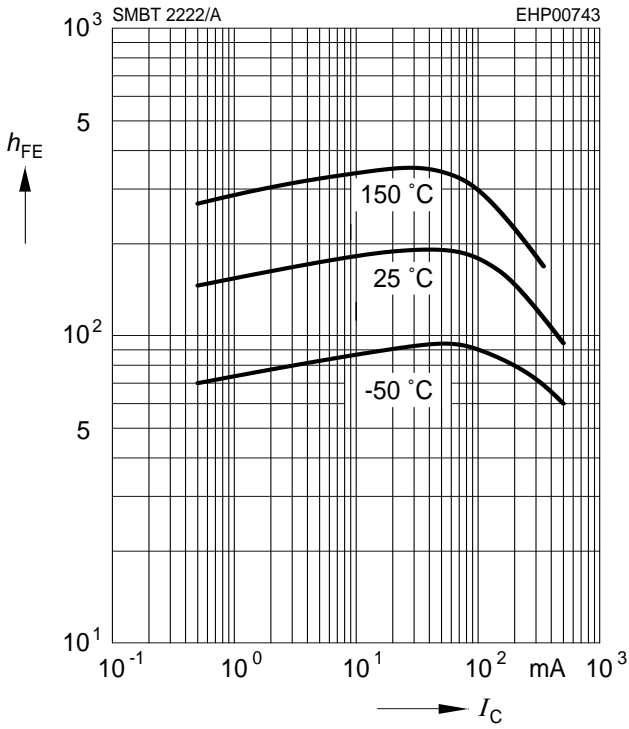
Storage and fall time



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

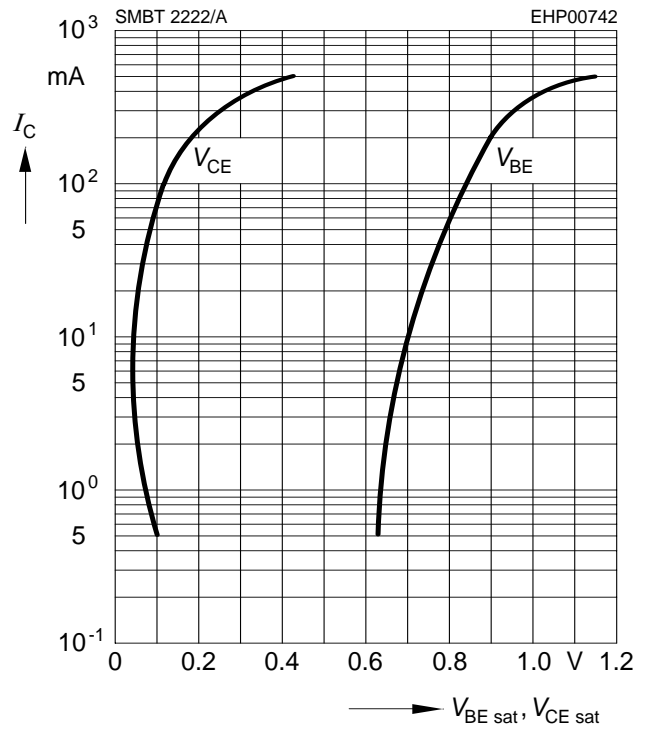
**DC current gain  $h_{FE} = f(I_C)$**

$V_{CE} = 10\text{ V}$



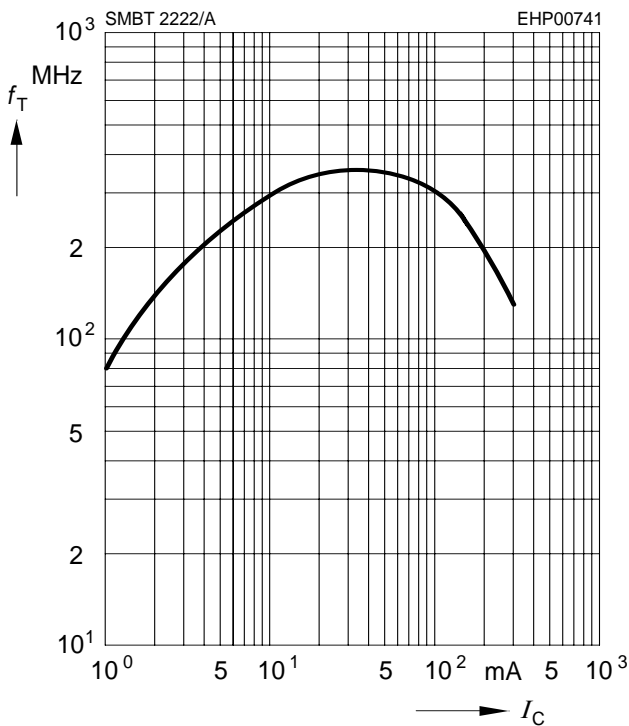
**Saturation voltage  $I_C = f(V_{BEsat}; V_{CEsat})$**

$h_{FE} = 10$



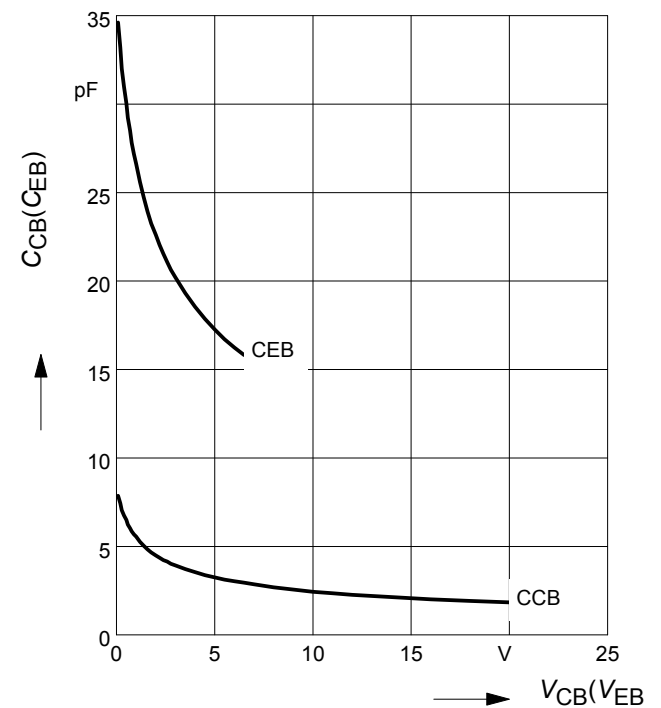
**Transition frequency  $f_T = f(I_C)$**

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

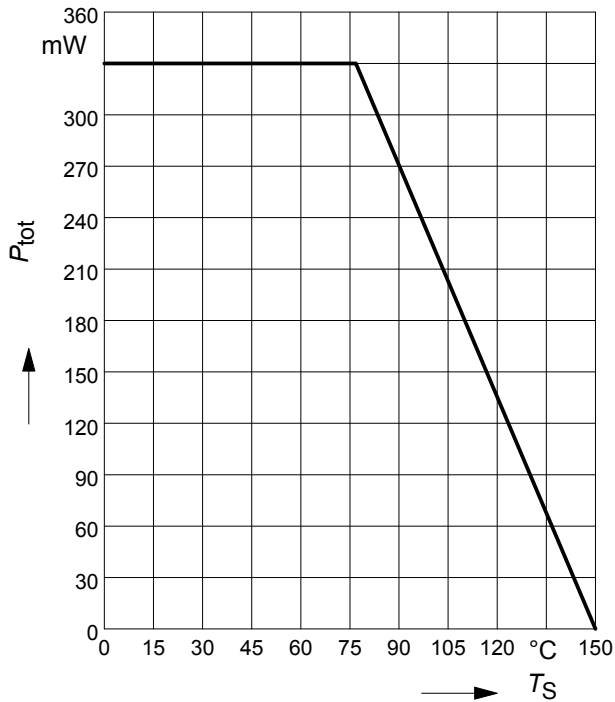


**Collector-base capacitance  $C_{cb} = f(V_{CB})$**

**Emitter-base capacitance  $C_{eb} = f(V_{EB})$**

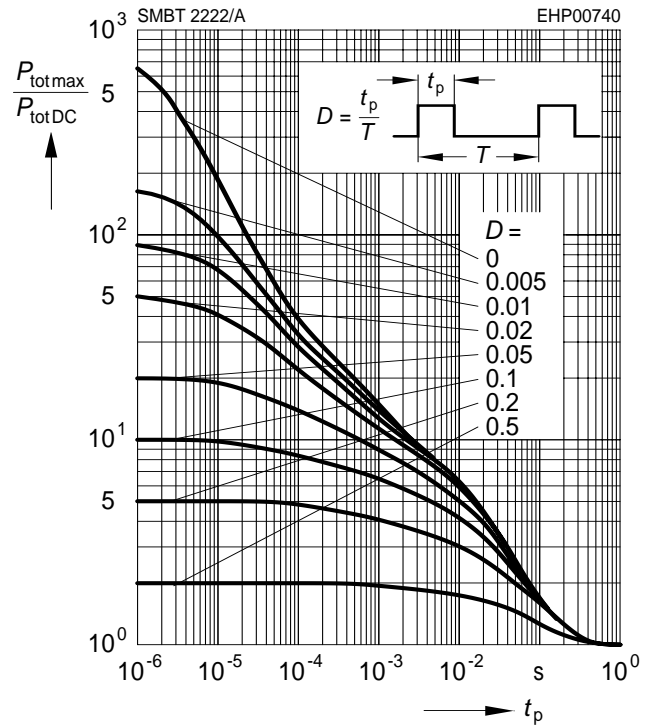


**Total power dissipation  $P_{tot} = f(T_S)$**



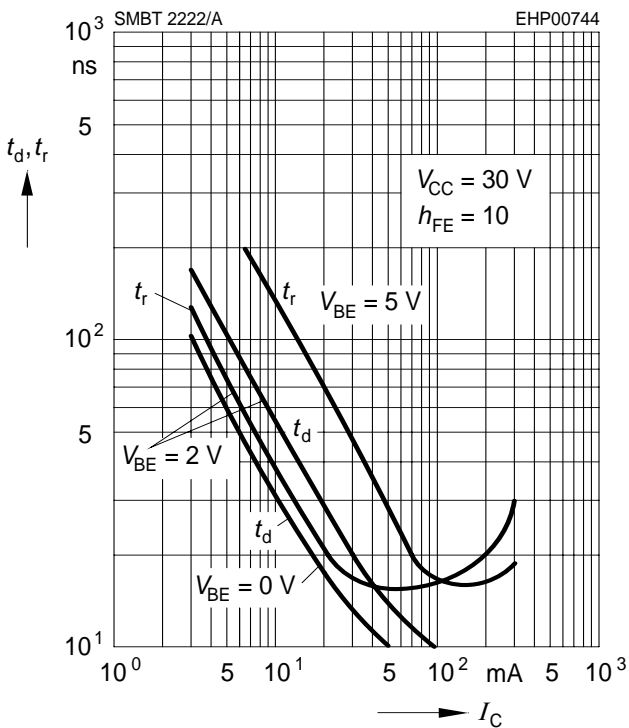
**Permissible Pulse Load**

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



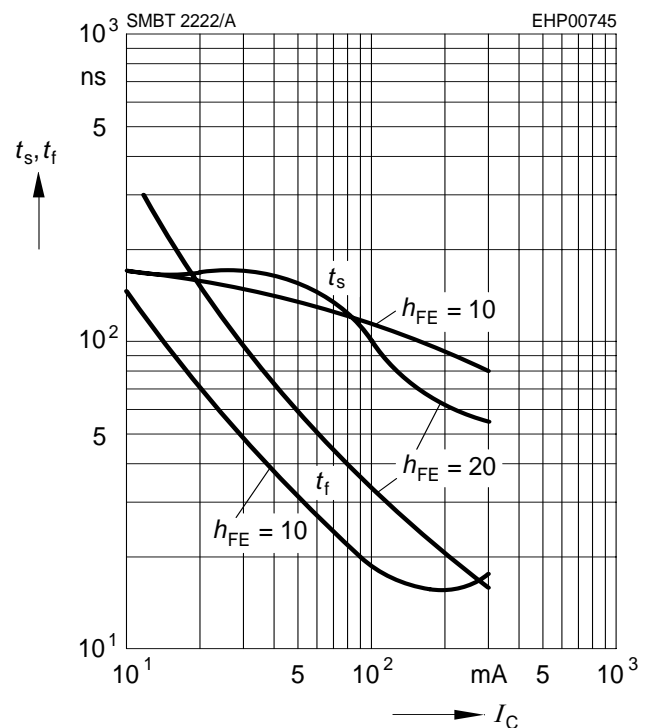
**Delay time  $t_d = f(I_C)$**

**Rise time  $t_r = f(I_C)$**

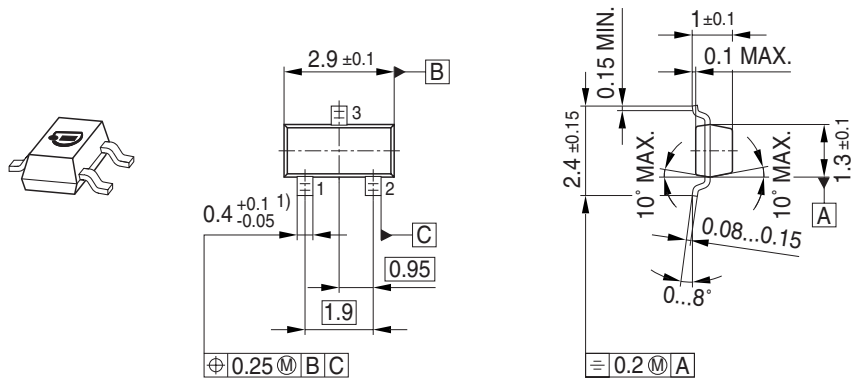


**Storage time  $t_{stg} = f(I_C)$**

**Fall time  $t_f = f(I_C)$**

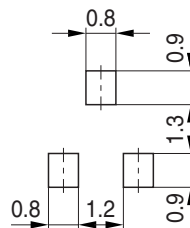


Package Outline

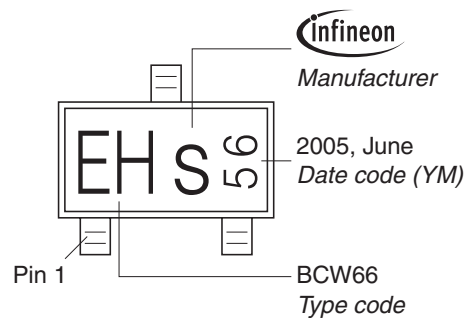


1) Lead width can be 0.6 max. in dambar area

Foot Print

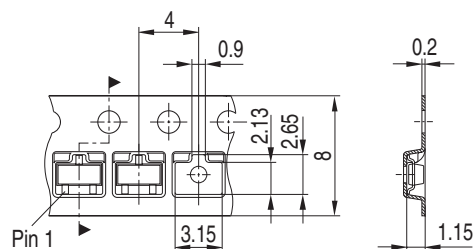


Marking Layout (Example)



Standard Packing

Reel  $\varnothing$ 180 mm = 3.000 Pieces/Reel  
 Reel  $\varnothing$ 330 mm = 10.000 Pieces/Reel



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