

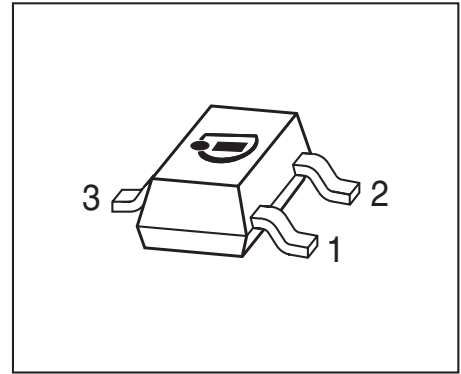


THE DATASHEET OF MMBT2222ALT1HTSA1



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 ¹⁾	R_{thJS}	≤ 220	K/W

¹⁾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.	
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-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	μA
Emitter-base cutoff current $V_{EB} = 3\text{ V}, I_C = 0$	I_{EBO}	-	-	10	nA
DC current gain ¹⁾ $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$	h_{FE}	35 50 75 50 100 40	- - - - - -	- - - - 300 -	-
Collector-emitter saturation voltage ¹⁾ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	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	

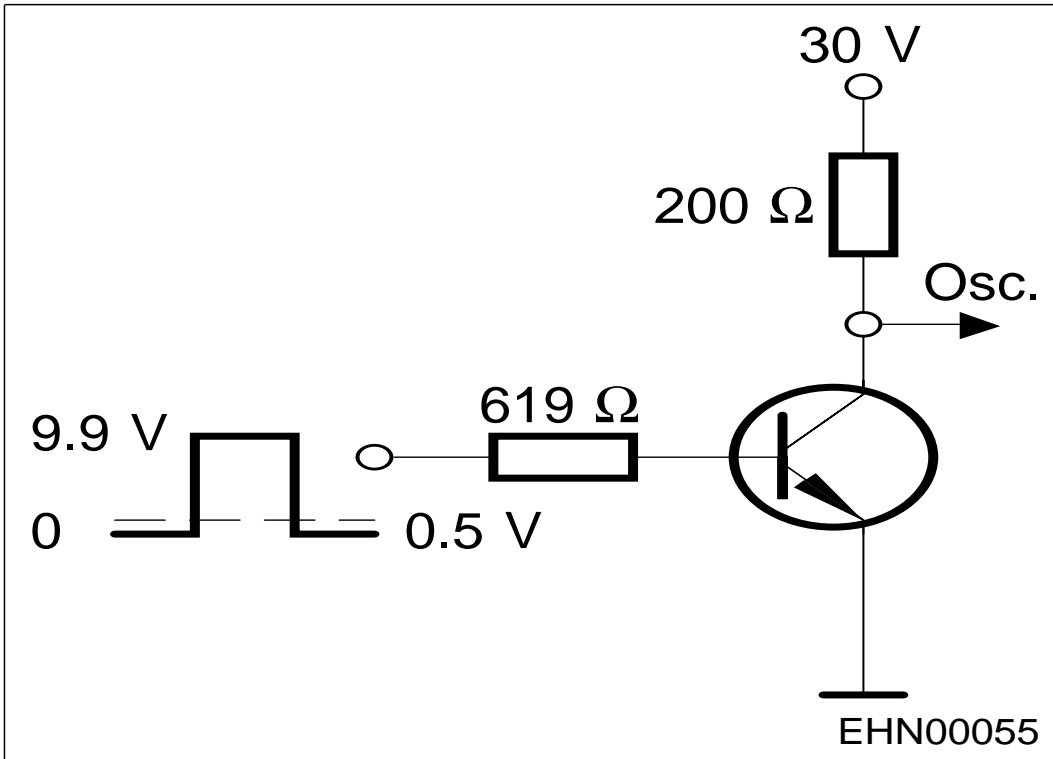
¹⁾Pulse test: $t < 300\text{ }\mu\text{s}; D < 2\%$

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

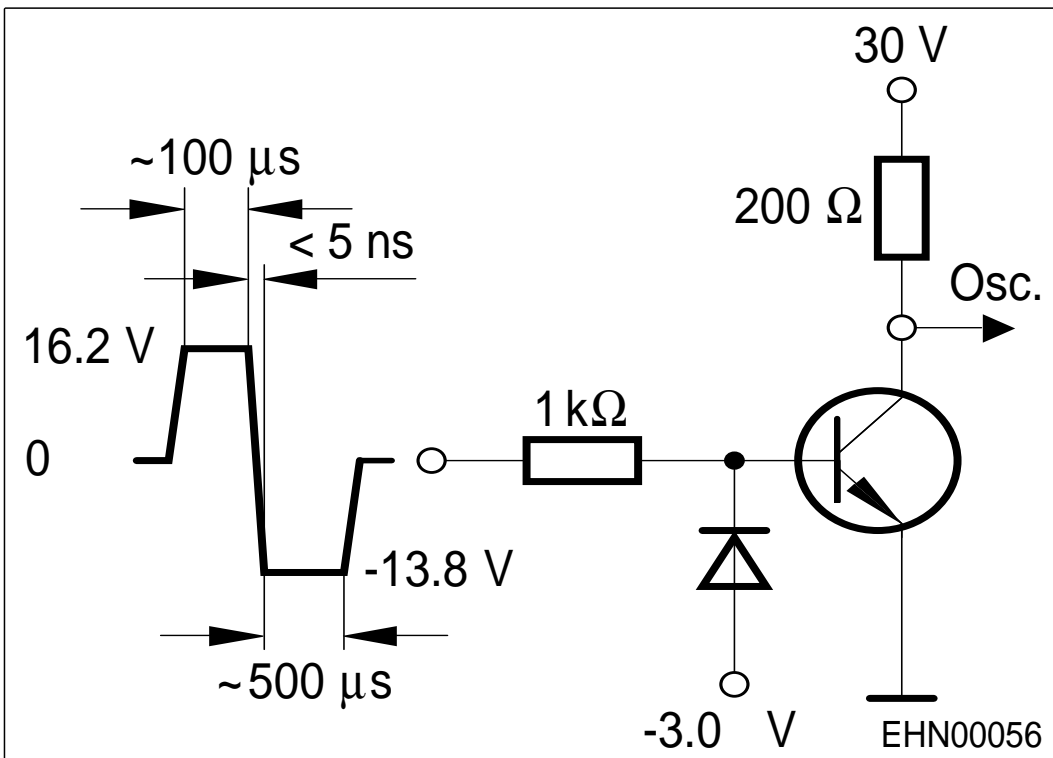
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 20\text{ mA}$, $V_{CE} = 20\text{ V}$, $f = 100\text{ MHz}$	f_T	300	-	-	MHz
Collector-base capacitance $V_{CB} = 10\text{ V}$, $f = 1\text{ MHz}$	C_{cb}	-	2.5	5	pF
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$	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	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	
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



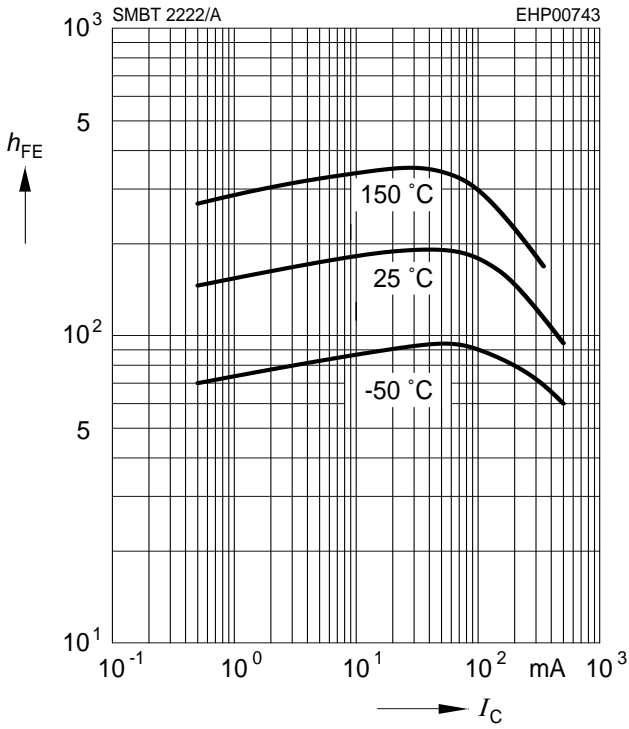
Storage and fall time



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

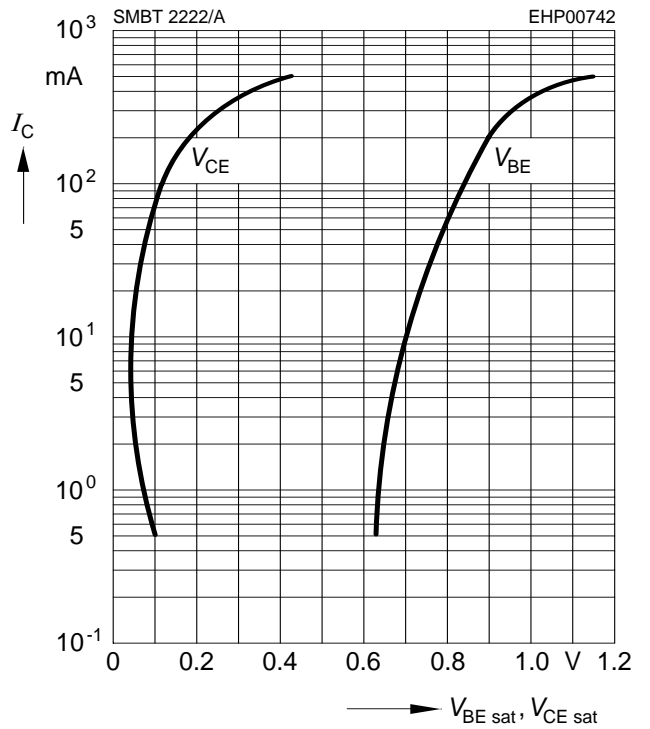
DC current gain $h_{FE} = f(I_C)$

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



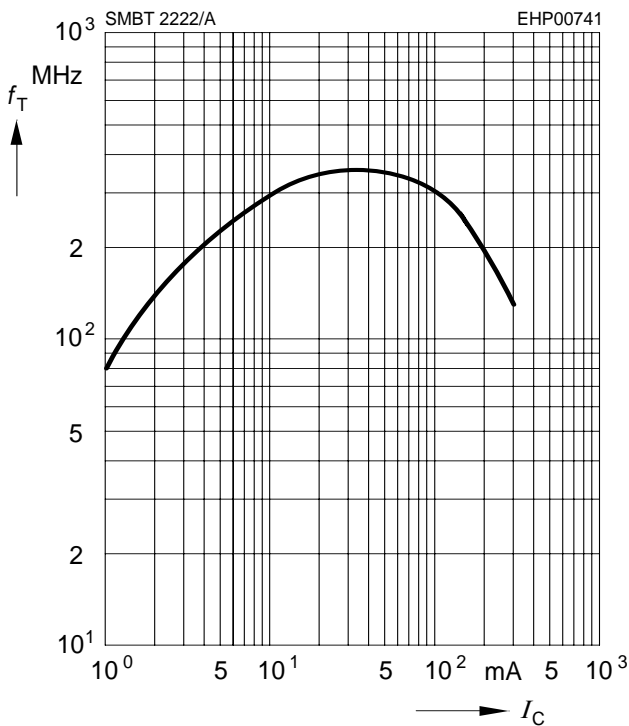
Saturation voltage $I_C = f(V_{BEsat}; V_{CEsat})$

$h_{FE} = 10$



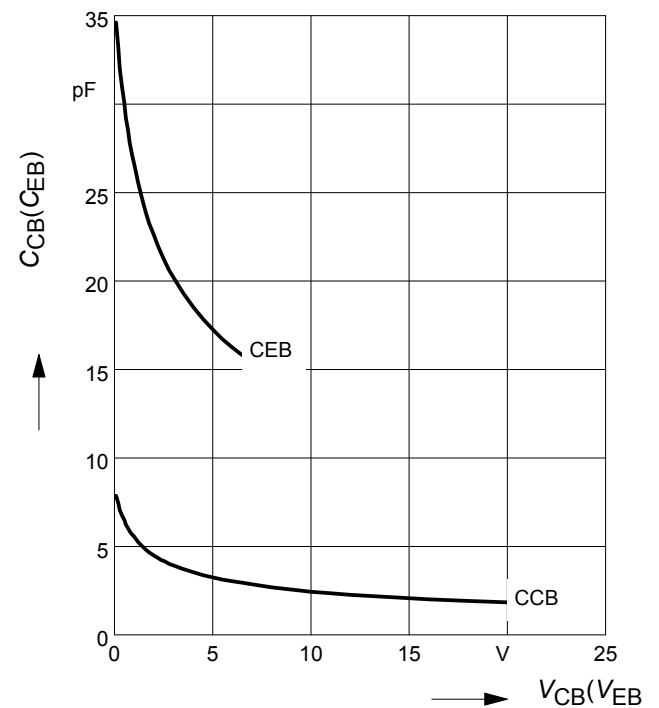
Transition frequency $f_T = f(I_C)$

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

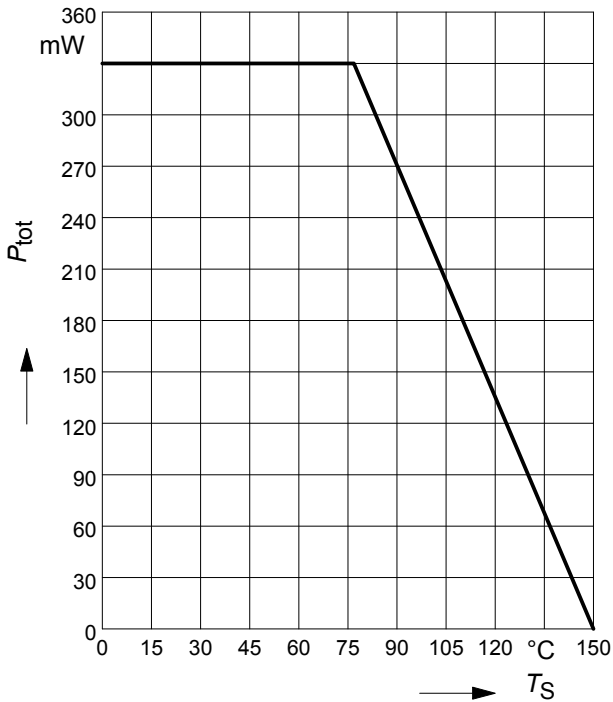


Collector-base capacitance $C_{cb} = f(V_{CB})$

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

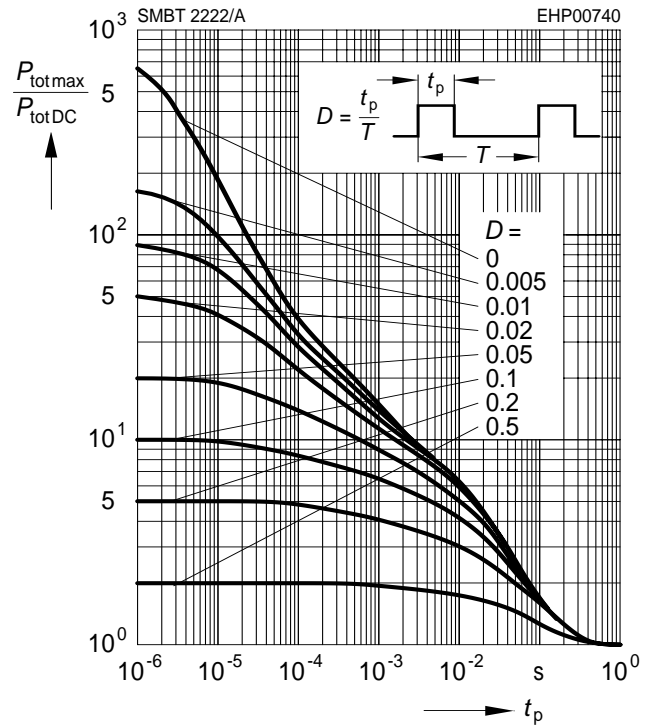


Total power dissipation $P_{tot} = f(T_S)$



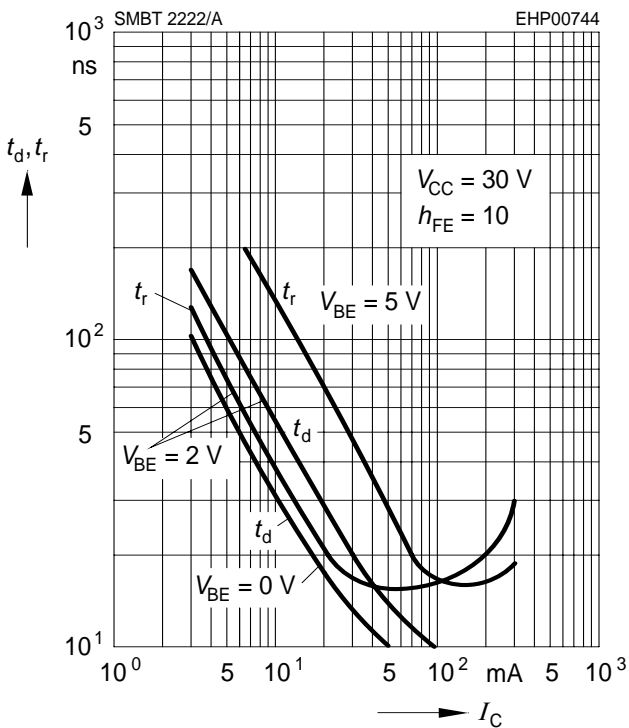
Permissible Pulse Load

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



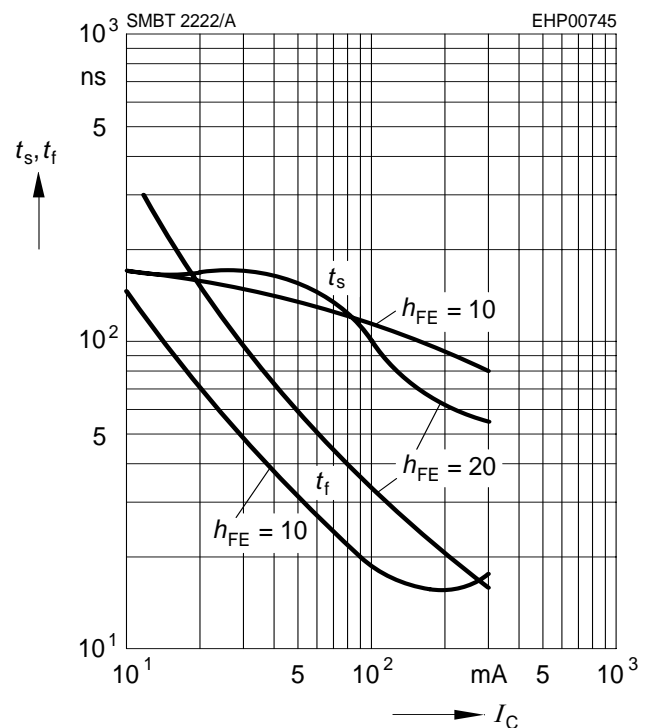
Delay time $t_d = f(I_C)$

Rise time $t_r = f(I_C)$

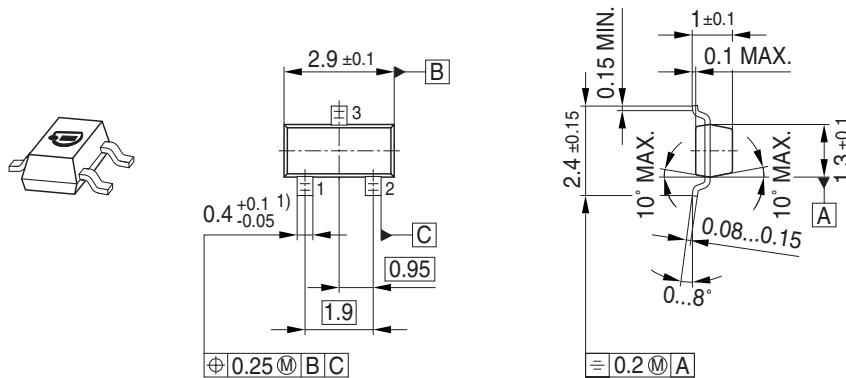


Storage time $t_{stg} = f(I_C)$

Fall time $t_f = f(I_C)$

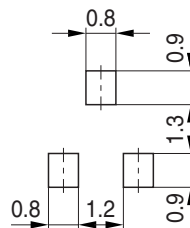


Package Outline

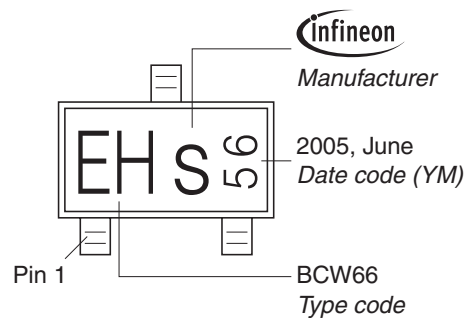


1) Lead width can be 0.6 max. in dambar area

Foot Print

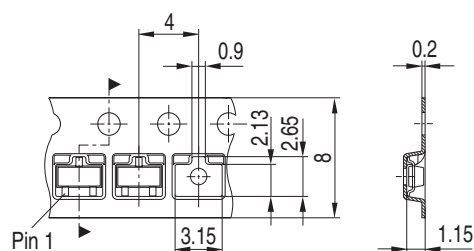


Marking Layout (Example)



Standard Packing

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



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