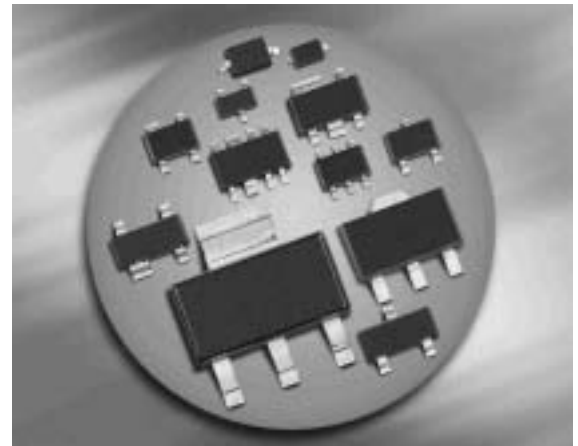
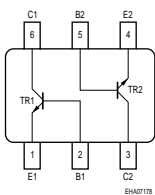


NPN Silicon Switching Transistors

- High DC current gain: 0.1 mA to 100 mA
- Low collector-emitter saturation voltage
- For SMBT3904S / SMBT3904U:
Two (galvanic) internal isolated transistors with good matching in one package
- Complementary types: SMBT3906... MMBT3906
- SMBT3904S / U: For orientation in reel see package information below
- Pb-free (RoHS compliant) package¹⁾
- Qualified according AEC Q101



SMBT3906S/U



Type	Marking	Pin Configuration						Package
		1=B	2=E	3=C	-	-	-	
SMBT3904/MMBT3904	s1A	1=B	2=E	3=C	-	-	-	SOT23
SMBT3904L3*	1A	1=B	2=E	3=C	-	-	-	TSLP-3-4
SMBT3904S	s1A	1=E1	2=B1	3=C2	4=E2	5=B2	6=C1	SOT363
SMBT3904U	s1A	1=E1	2=B1	3=C2	4=E2	5=B2	6=C1	SC74

* Preliminary data

¹Pb-containing package may be available upon special request

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	60	
Emitter-base voltage	V_{EBO}	6	
Collector current	I_C	200	mA
Total power dissipation-	P_{tot}		mW
$T_S \leq 69^\circ\text{C}$		330	
$T_S \leq tbd^\circ\text{C}$		250	
$T_S \leq 115^\circ\text{C}$		250	
$T_S \leq 105^\circ\text{C}$		330	
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ¹⁾	R_{thJS}		K/W
SMBT3904/MMBT3904		≤ 245	
SMBT3904L3		$\leq tbd$	
SMBT3904S		≤ 140	
SMBT3904U		≤ 135	

¹For calculation of R_{thJA} please refer to Application Note Thermal Resistance

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 $I_C = 1 \text{ mA}, I_B = 0$	$V_{(BR)CEO}$	40	-	-	V
Collector-base breakdown voltage $I_C = 10 \mu\text{A}, I_E = 0$	$V_{(BR)CBO}$	60	-	-	
Emitter-base breakdown voltage $I_E = 10 \mu\text{A}, I_C = 0$	$V_{(BR)EBO}$	6	-	-	
Collector-base cutoff current $V_{CB} = 30 \text{ V}, I_E = 0$	I_{CBO}	-	-	50	nA
DC current gain ¹⁾ $I_C = 100 \mu\text{A}, V_{CE} = 1 \text{ V}$ $I_C = 1 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 50 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1 \text{ V}$	h_{FE}	40 70 100 60 30	- - - - -	- - 300 - -	-
Collector-emitter saturation voltage ¹⁾ $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$	V_{CEsat}	- -	- -	0.2 0.3	V
Base emitter saturation voltage ¹⁾ $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$	V_{BEsat}	0.65 -	- -	0.85 0.95	

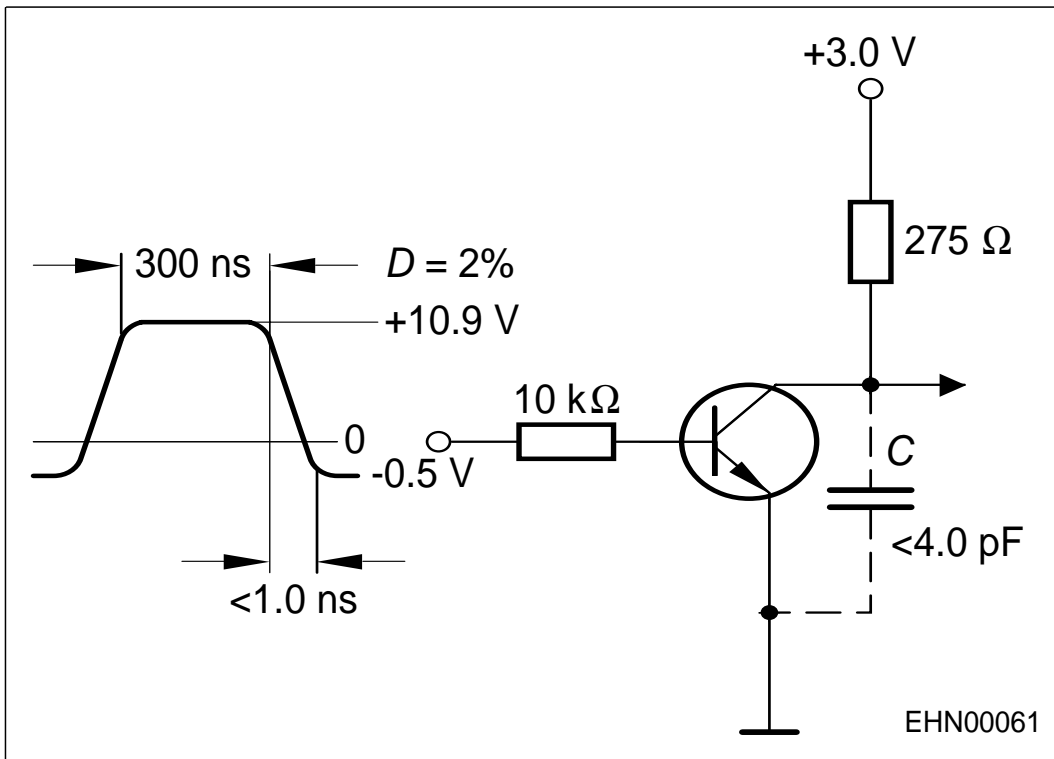
¹⁾Pulse test: $t < 300\mu\text{s}$; $D < 2\%$

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

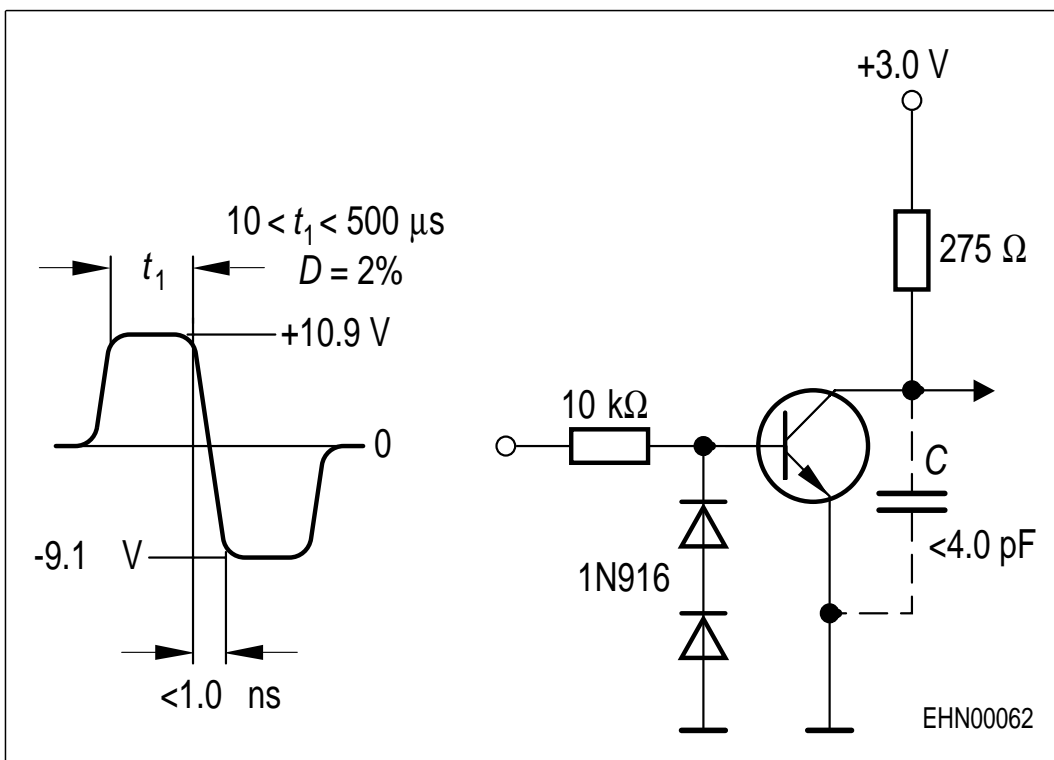
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 10\text{ mA}$, $V_{CE} = 20\text{ V}$, $f = 100\text{ MHz}$	f_T	300	-	-	MHz
Collector-base capacitance $V_{CB} = 5\text{ V}$, $f = 1\text{ MHz}$	C_{cb}	-	-	3.5	pF
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$	C_{eb}	-	-	8	
Delay time $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = 1\text{ mA}$, $V_{BE(\text{off})} = 0.5\text{ V}$	t_d	-	-	35	ns
Rise time $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = 1\text{ mA}$, $V_{BE(\text{off})} = 0.5\text{ V}$	t_r	-	-	35	
Storage time $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 1\text{ mA}$	t_{stg}	-	-	200	
Fall time $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 1\text{ mA}$	t_f	-	-	50	
Noise figure $I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5\text{ V}$, $f = 1\text{ kHz}$, $\Delta f = 200\text{ Hz}$, $R_S = 1\text{ k}\Omega$	F	-	-	5	dB

Test circuits

Delay and rise time

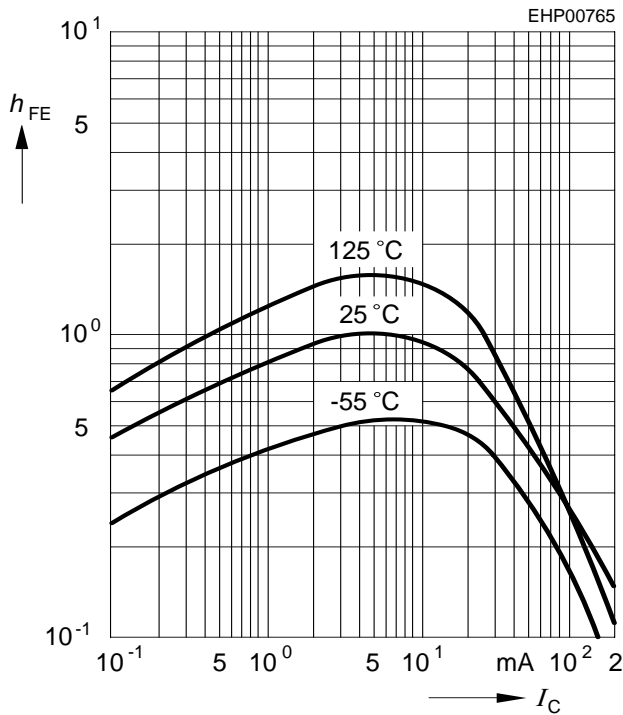


Storage and fall time



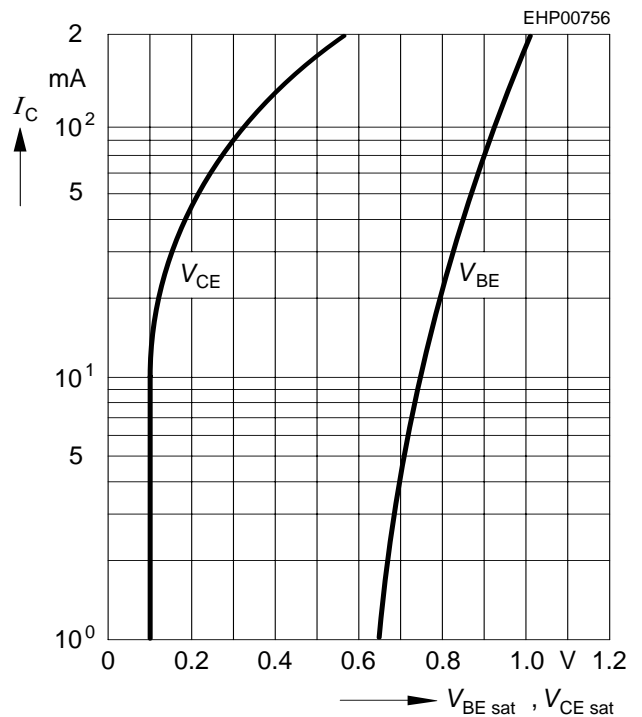
DC current gain $h_{FE} = f(I_C)$

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



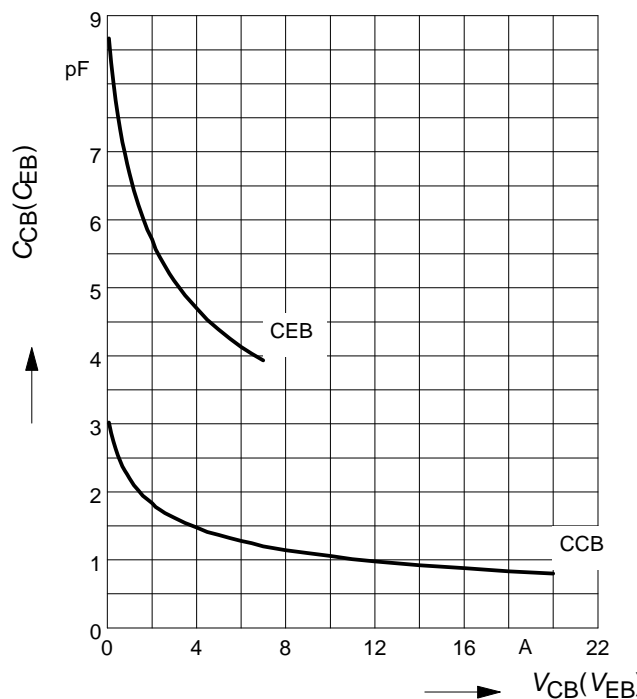
Saturation voltage $I_C = f(V_{BEsat}; V_{CEsat})$

$h_{FE} = 10$



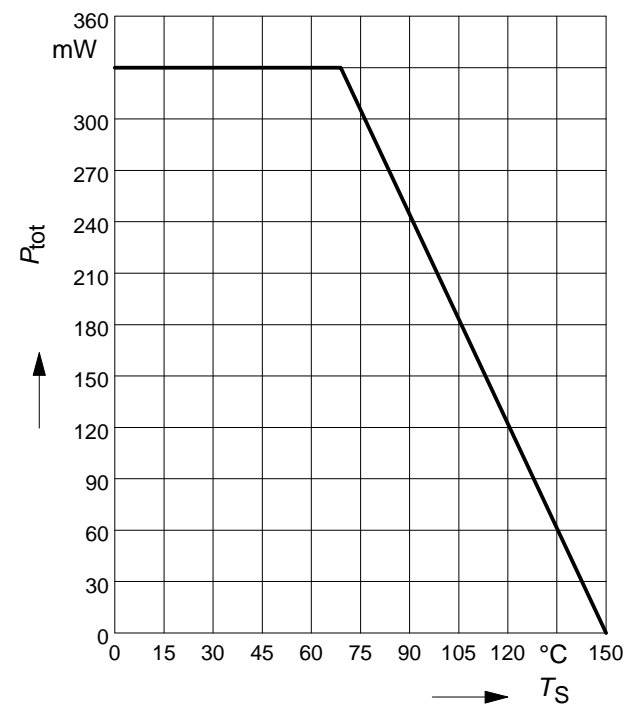
Collector-base capacitance $C_{cb} = f(V_{CB})$

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



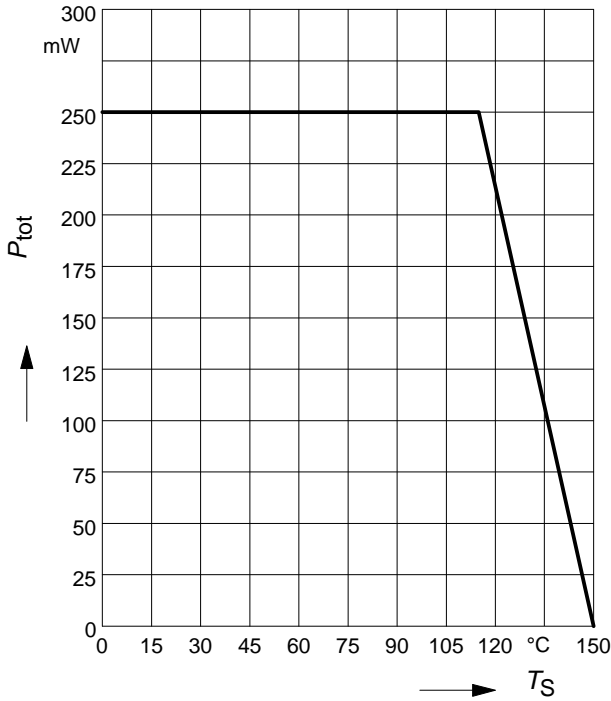
Total power dissipation $P_{tot} = f(T_S)$

SMBT3904/MMBT3904



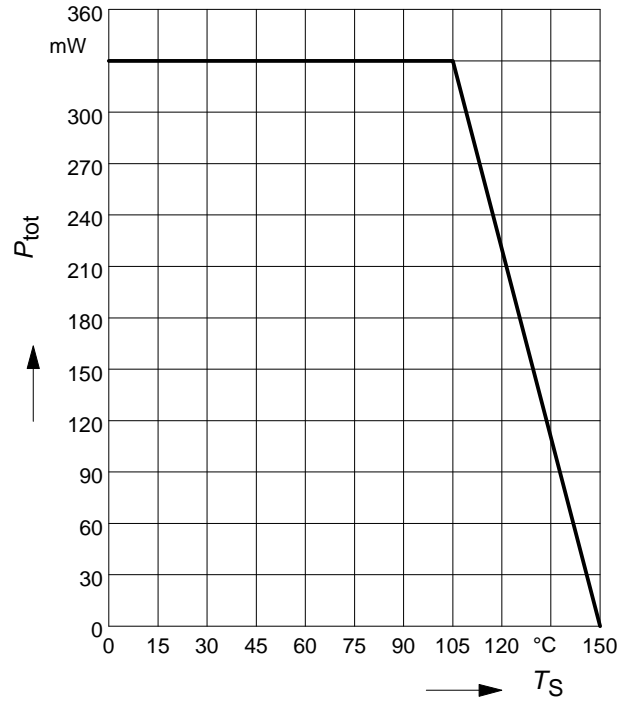
Total power dissipation $P_{tot} = f(T_S)$

SMBT3904S



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

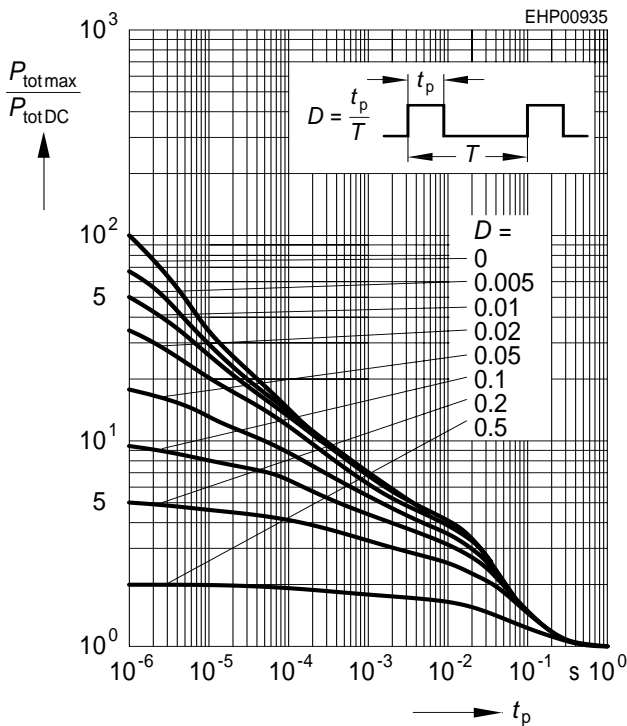
SMBT3904U



Permissible Pulse Load

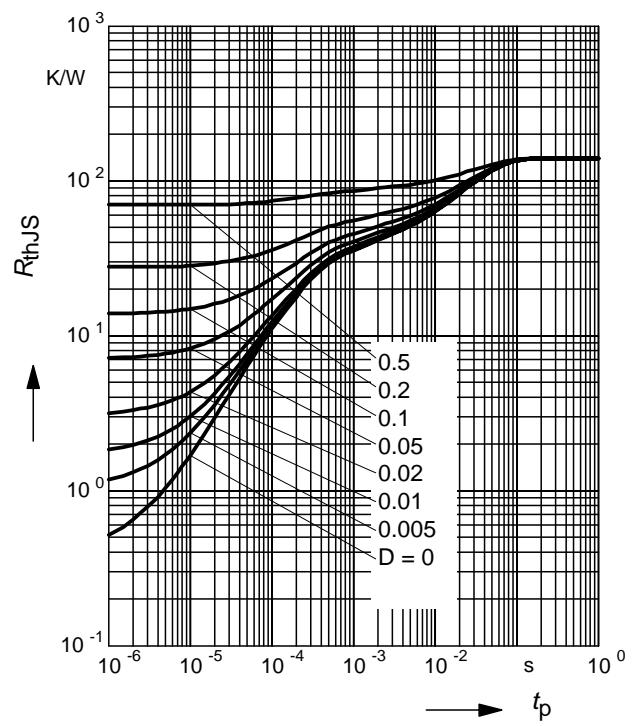
$P_{totmax}/P_{totDC} = f(t_p)$

SMBT3904/MMBT3904



Permissible Puls Load $R_{thJS} = f(t_p)$

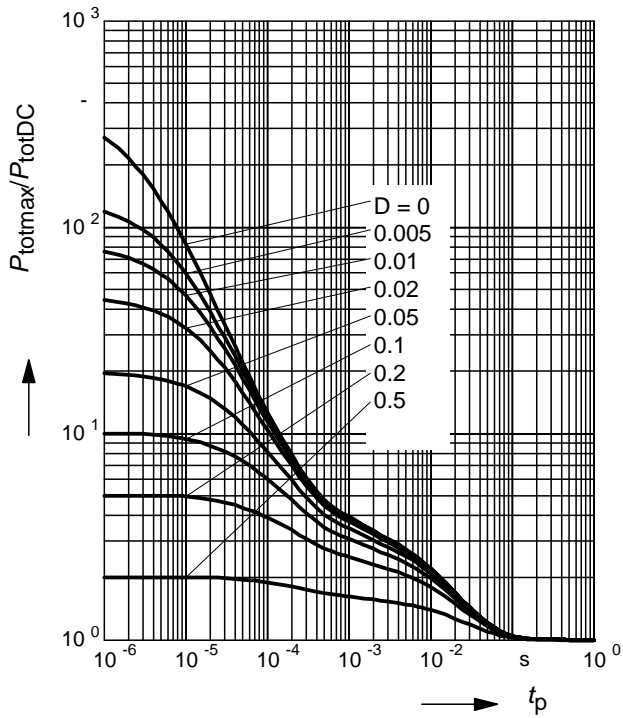
SMBT3904S



Permissible Pulse Load

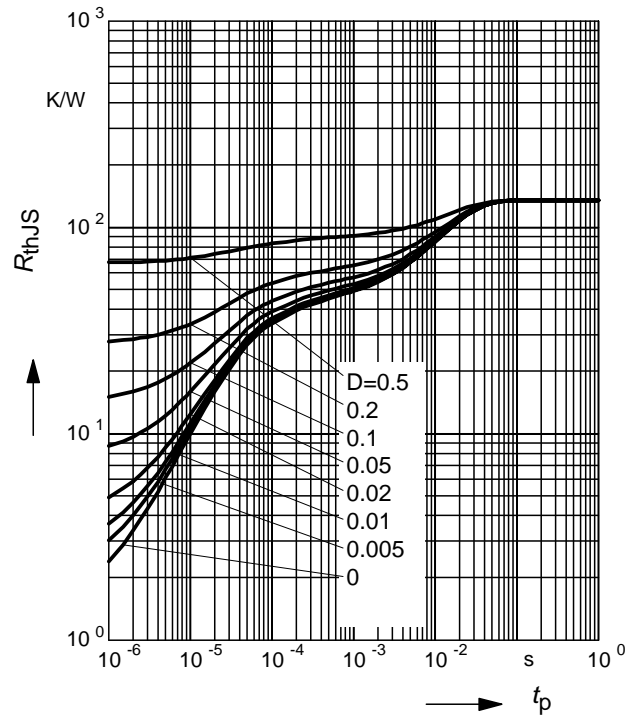
$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$

SMBT3904S



Permissible Puls Load $R_{\text{thJS}} = f(t_p)$

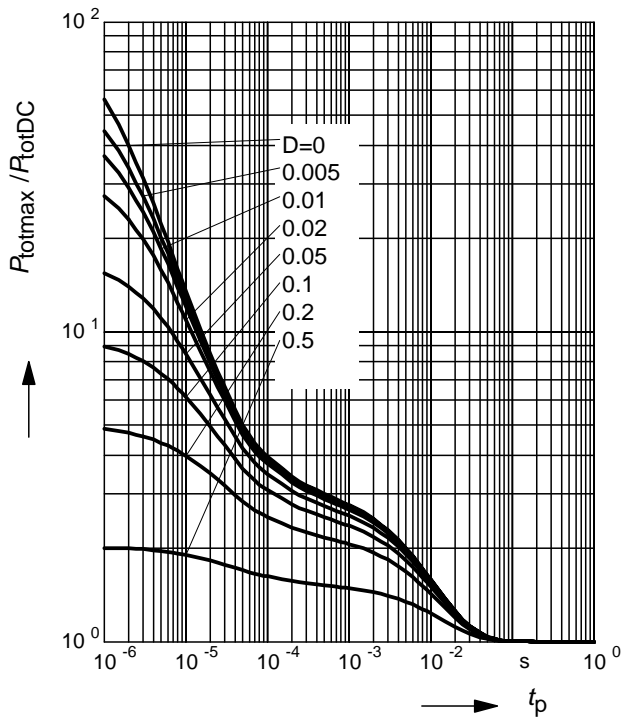
SMBT3904U



Permissible Pulse Load

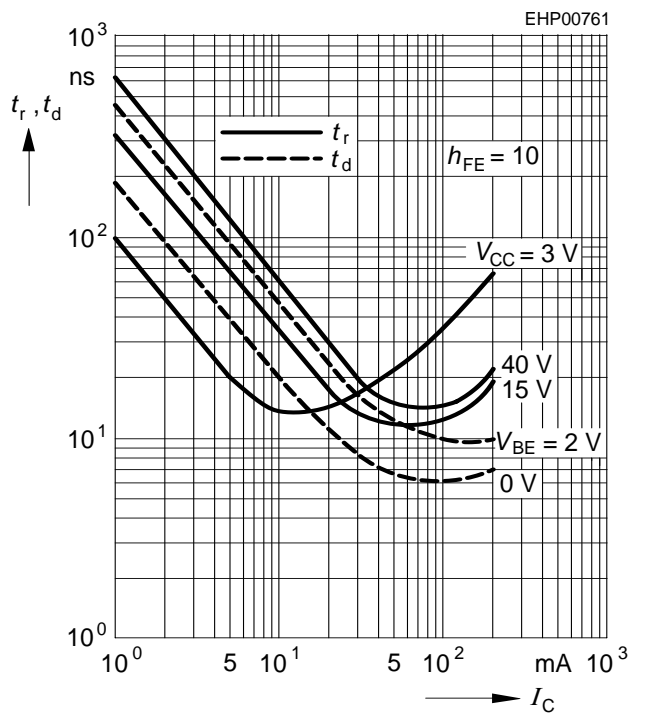
$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$

SMBT3904U



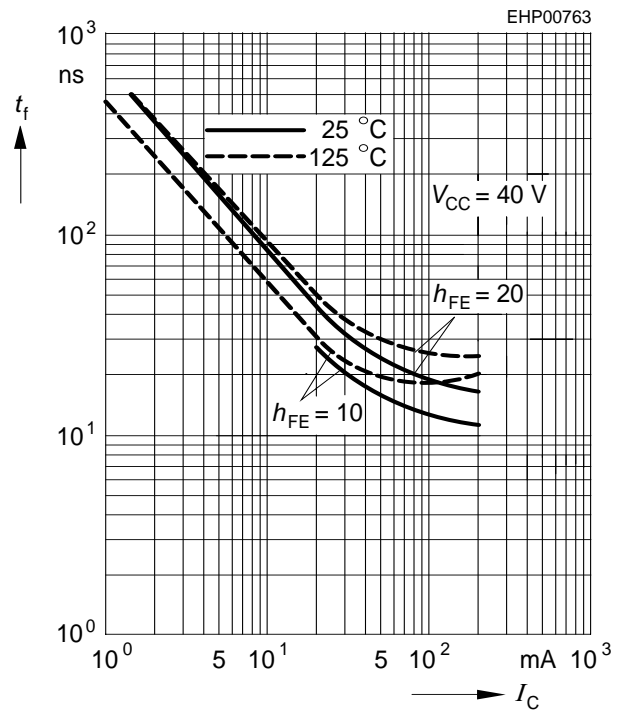
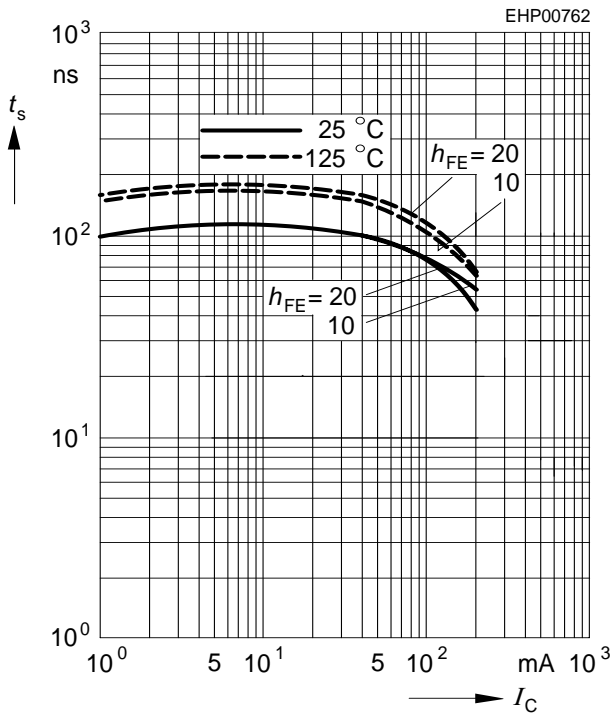
Delay time $t_d = f(I_C)$

Rise time $t_r = f(I_C)$

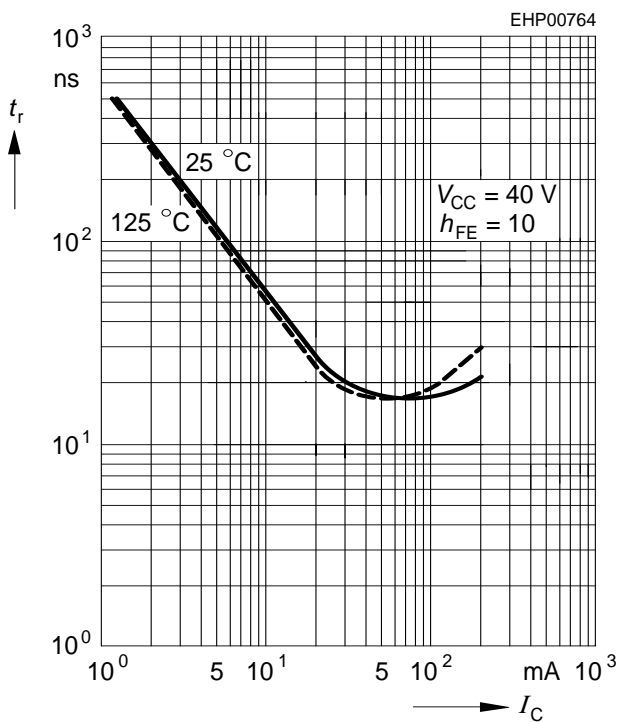


Storage time $t_{stg} = f(I_C)$

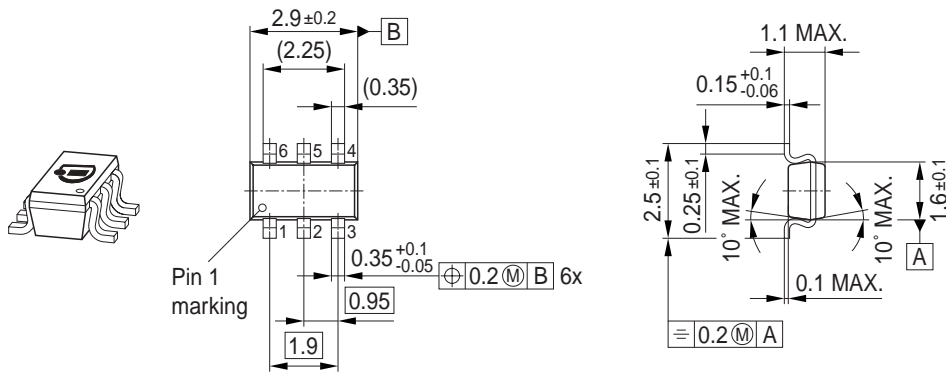
Fall time $t_f = f(I_C)$



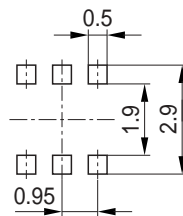
Rise time $t_r = f(I_C)$



Package Outline

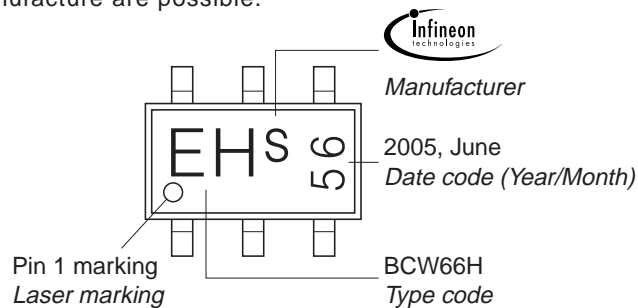


Foot Print



Marking Layout (Example)

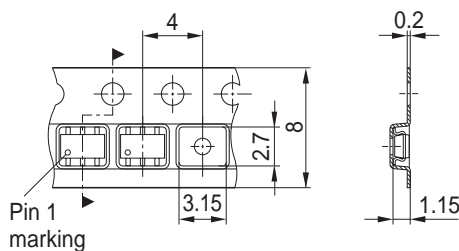
Small variations in positioning of Date code, Type code and Manufacture are possible.



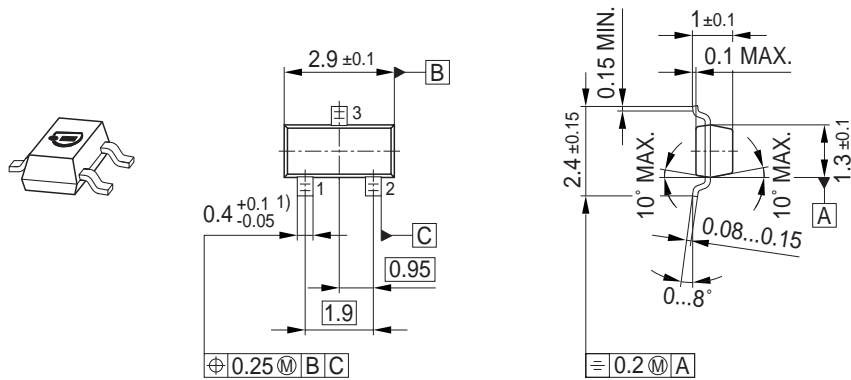
Standard Packing

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

For symmetric types no defined Pin 1 orientation in reel.

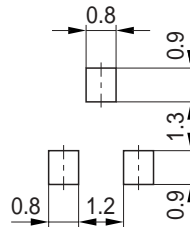


Package Outline

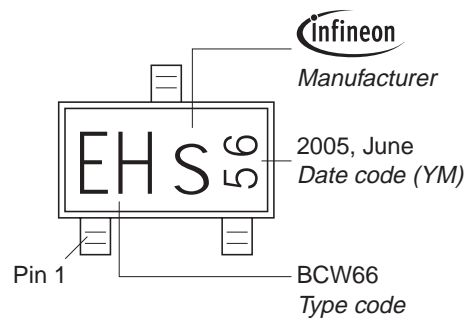


1) Lead width can be 0.6 max. in dambar area

Foot Print

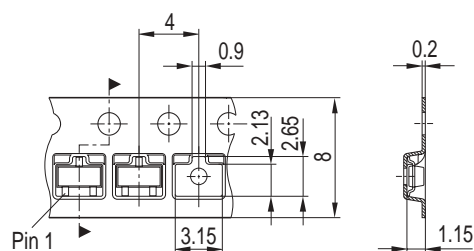


Marking Layout (Example)

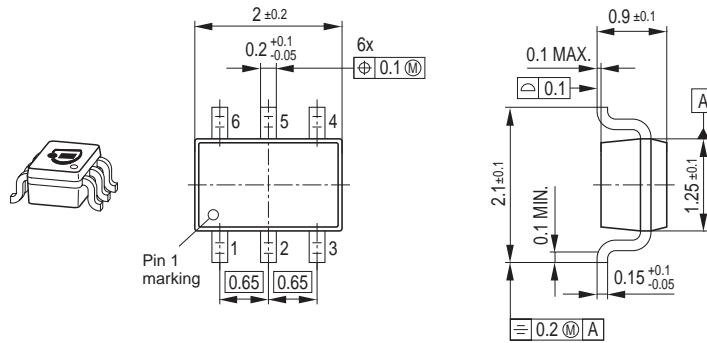


Standard Packing

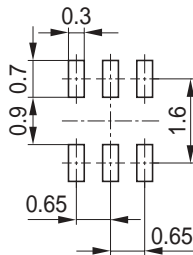
Reel \varnothing 180 mm = 3.000 Pieces/Reel
 Reel \varnothing 330 mm = 10.000 Pieces/Reel



Package Outline

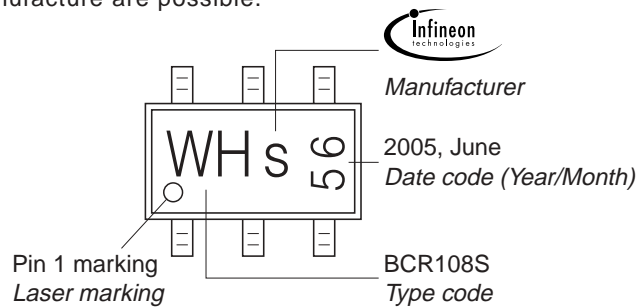


Foot Print



Marking Layout (Example)

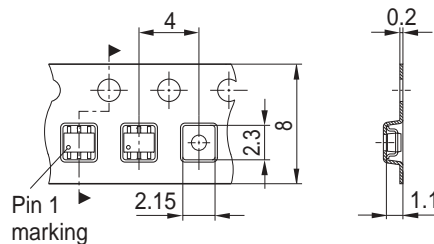
Small variations in positioning of Date code, Type code and Manufacture are possible.



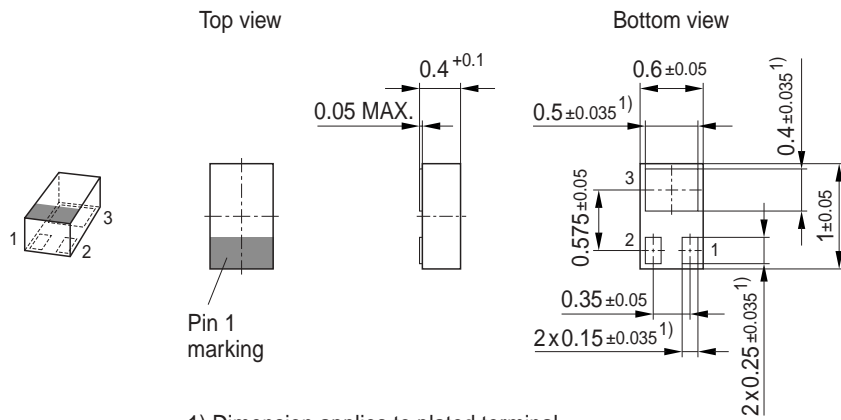
Standard Packing

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

For symmetric types no defined Pin 1 orientation in reel.



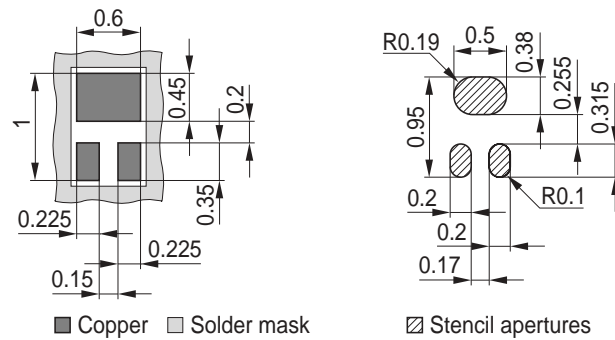
Package Outline



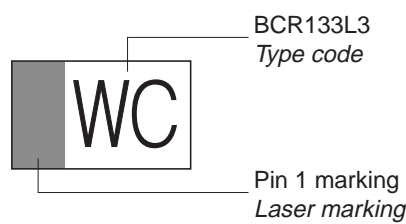
1) Dimension applies to plated terminal

Foot Print

For board assembly information please refer to Infineon website "Packages"

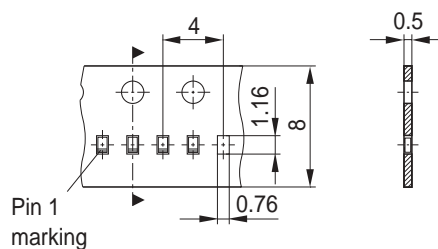


Marking Layout (Example)



Standard Packing

Reel ø180 mm = 15.000 Pieces/Reel



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