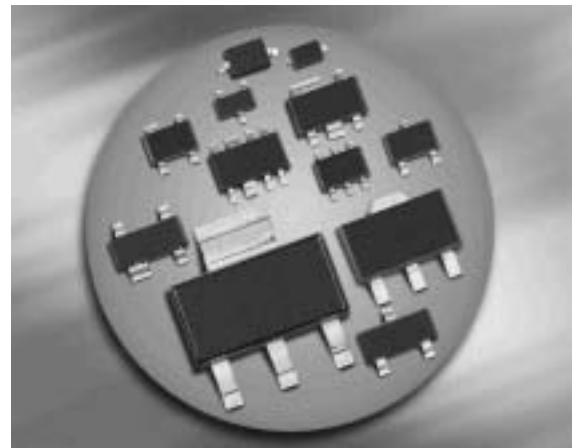
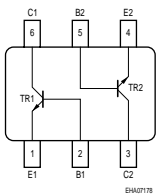


**NPN Silicon Switching Transistors**

- 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) package<sup>1)</sup>
- Qualified according AEC Q101



**SMBT3904S/U**



Type	Marking	Pin Configuration						Package
		1=B	2=E	3=C	-	-	-	
SMBT3904/MMBT3904	s1A	1=B	2=E	3=C	-	-	-	SOT23
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

<sup>1</sup>Pb-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	
$T_S \leq \text{tbd}^\circ\text{C}$		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 <sup>1)</sup>	$R_{thJS}$		K/W
SMBT3904/MMBT3904		$\leq 245$	
SMBT3904S		$\leq 140$	
SMBT3904U		$\leq 135$	

<sup>1</sup>For 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.	
<b>DC Characteristics</b>					
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 <sup>1)</sup> $I_C = 100 \mu\text{A}, V_{CE} = 1 \text{ V}$ $I_C = 1 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 50 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1 \text{ V}$	$h_{FE}$	40 70 100 60 30	- - - - -	- - 300 - -	-
Collector-emitter saturation voltage <sup>1)</sup> $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$	$V_{CEsat}$	- -	- -	0.2 0.3	V
Base emitter saturation voltage <sup>1)</sup> $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$	$V_{BEsat}$	0.65 -	- -	0.85 0.95	

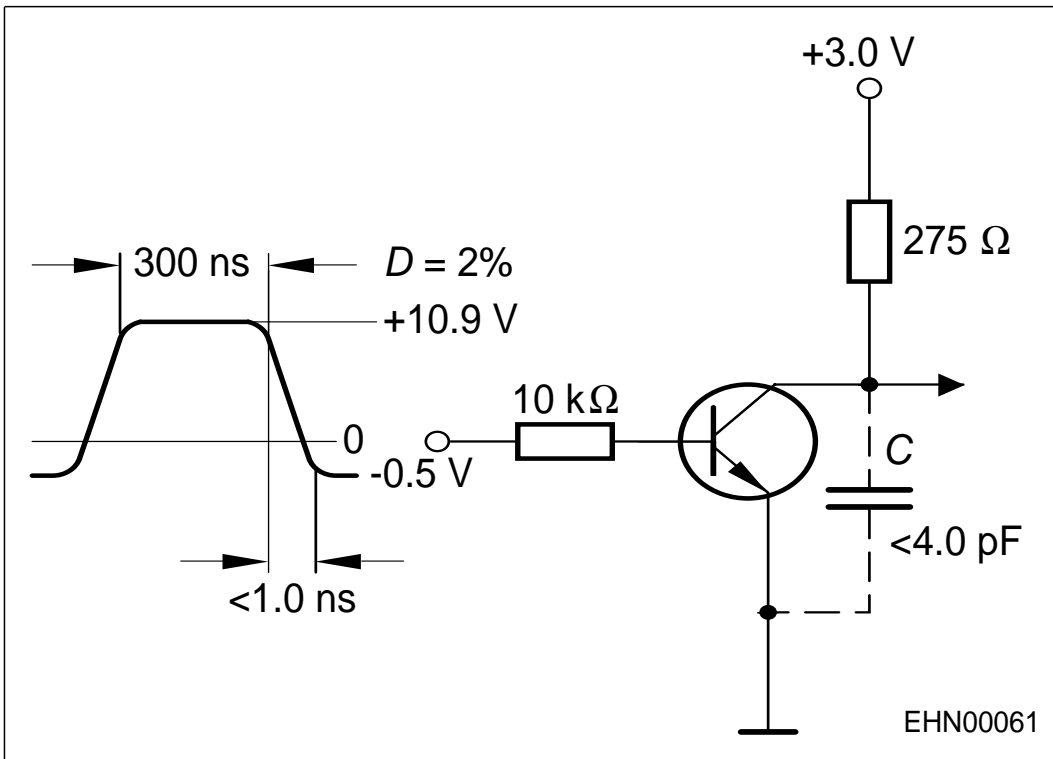
<sup>1)</sup>Pulse test:  $t < 300\mu\text{s}$ ;  $D < 2\%$

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

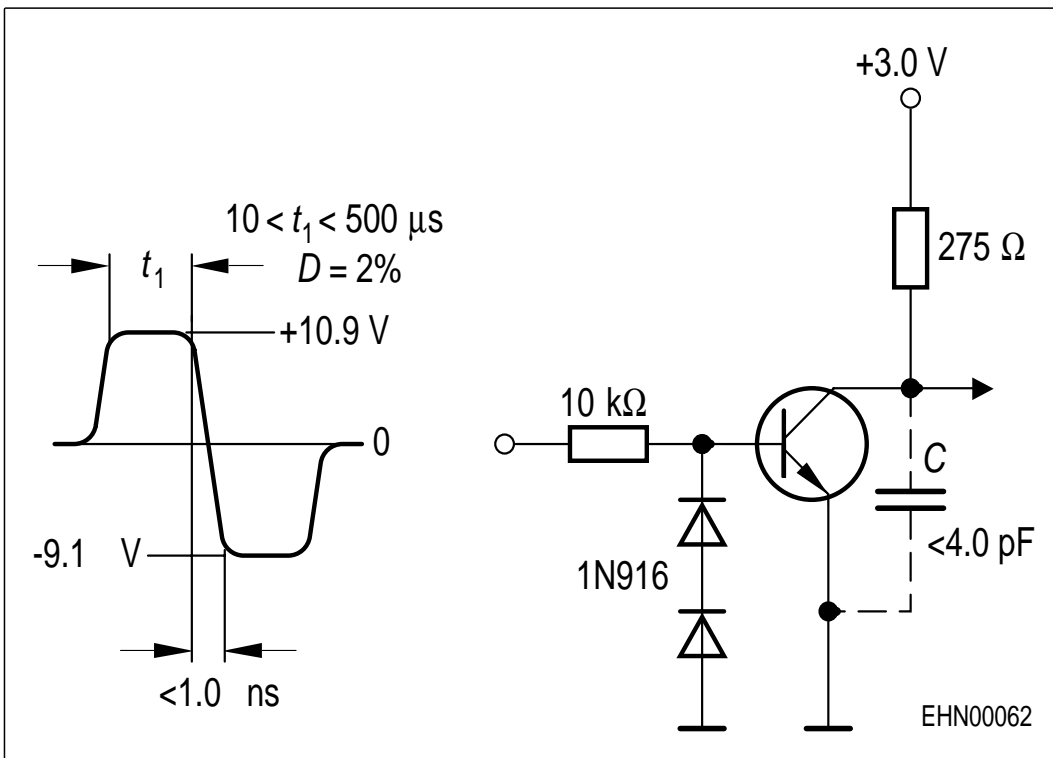
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics</b>					
Transition frequency $I_C = 10\text{ mA}$ , $V_{CE} = 20\text{ V}$ , $f = 100\text{ MHz}$	$f_T$	300	-	-	MHz
Collector-base capacitance $V_{CB} = 5\text{ V}$ , $f = 1\text{ MHz}$	$C_{cb}$	-	-	3.5	pF
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$	$C_{eb}$	-	-	8	
Delay time $V_{CC} = 3\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = 1\text{ mA}$ , $V_{BE(off)} = 0.5\text{ V}$	$t_d$	-	-	35	ns
Rise time $V_{CC} = 3\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = 1\text{ mA}$ , $V_{BE(off)} = 0.5\text{ V}$	$t_r$	-	-	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

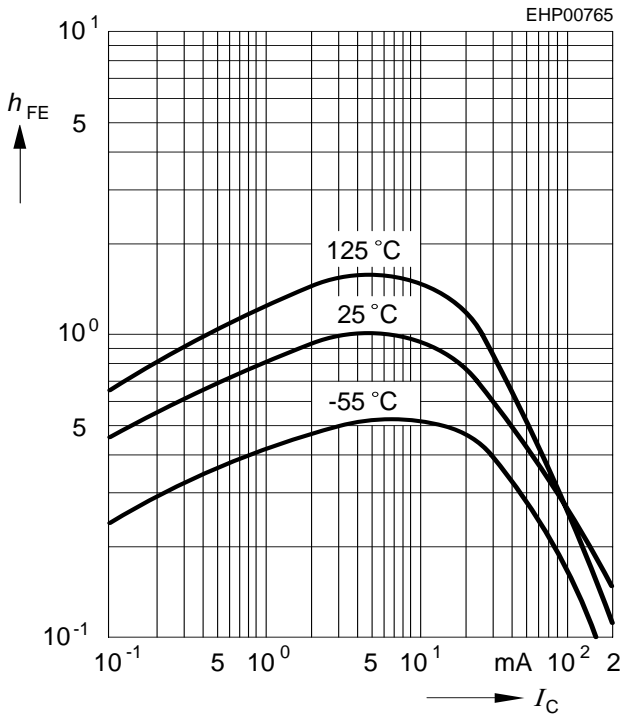


Storage and fall time



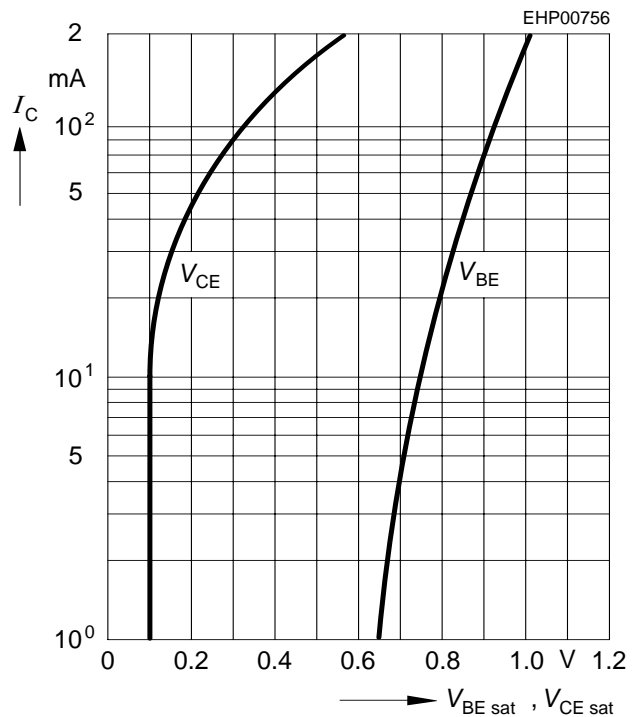
**DC current gain  $h_{FE} = f(I_C)$**

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



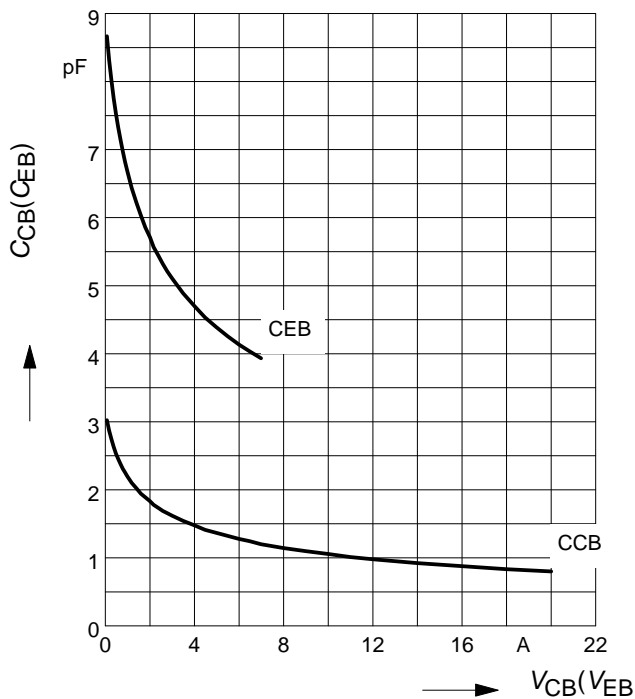
**Saturation voltage  $I_C = f(V_{BEsat}; V_{CEsat})$**

$h_{FE} = 10$



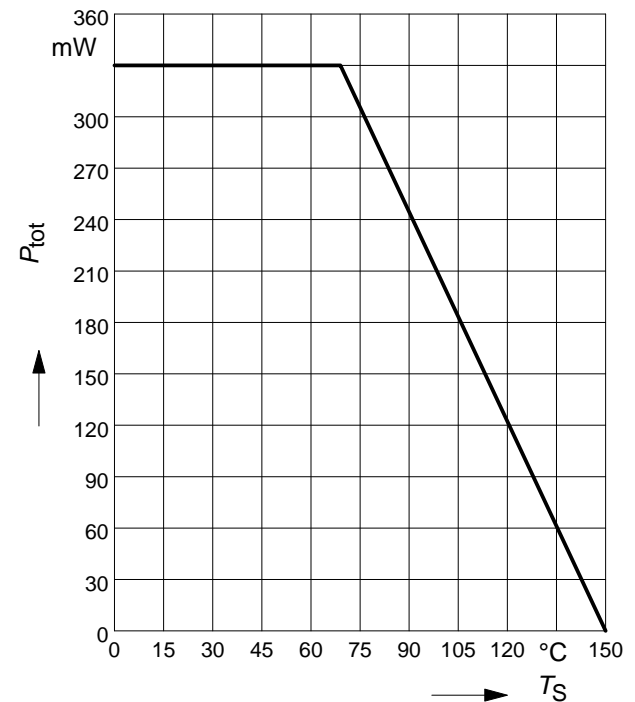
**Collector-base capacitance  $C_{cb} = f(V_{CB})$**

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



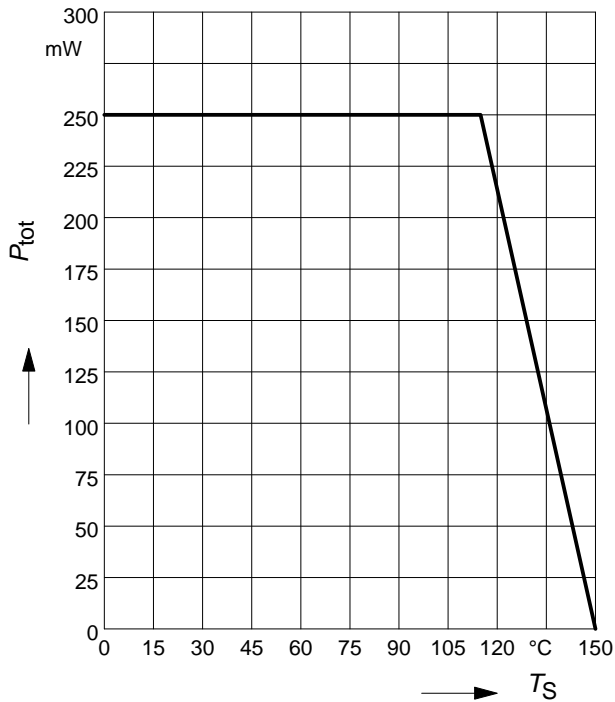
**Total power dissipation  $P_{tot} = f(T_S)$**

SMBT3904/MMBT3904



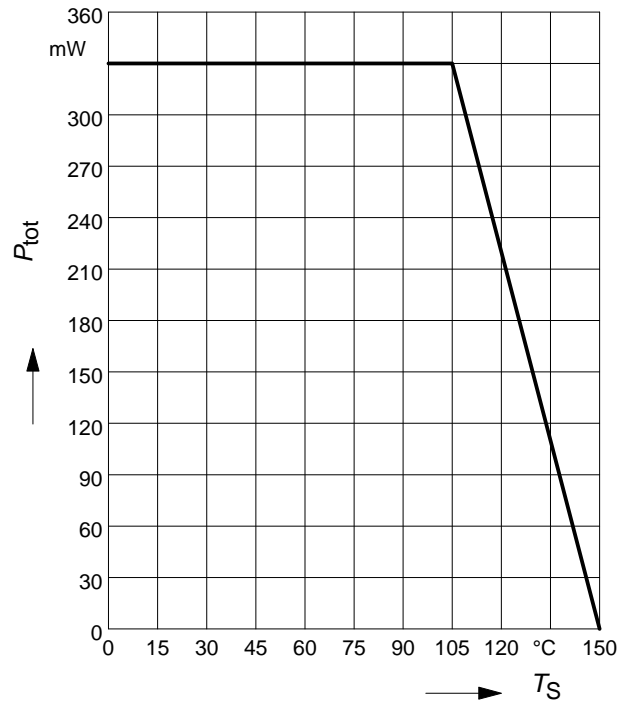
**Total power dissipation  $P_{tot} = f(T_S)$**

SMBT3904S



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

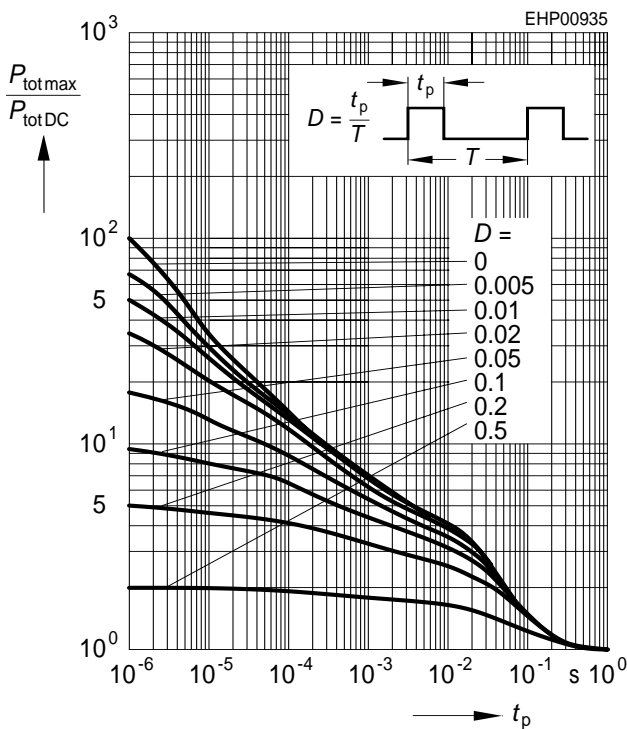
SMBT3904U



**Permissible Pulse Load**

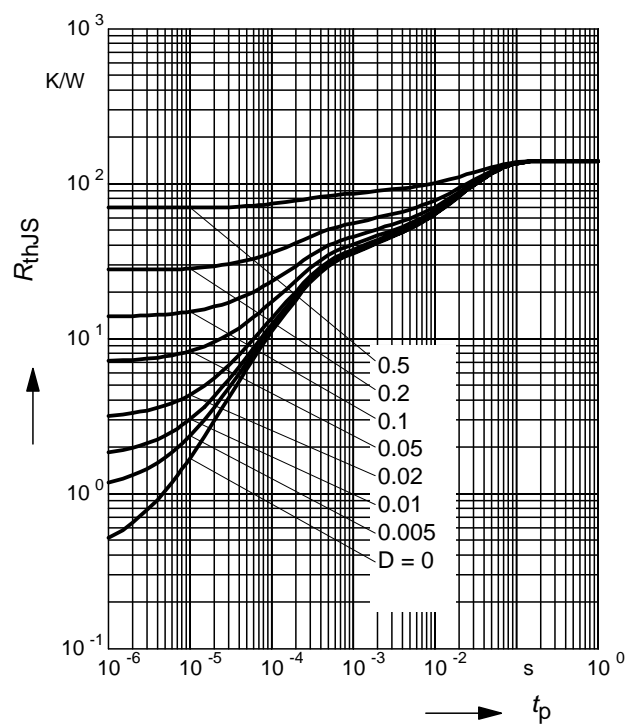
$P_{totmax}/P_{totDC} = f(t_p)$

SMBT3904/MMBT3904



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

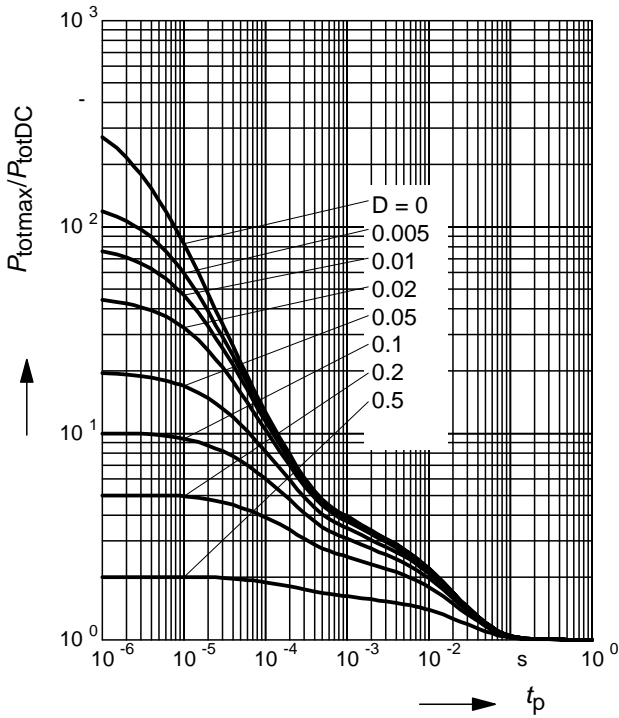
SMBT3904S



**Permissible Pulse Load**

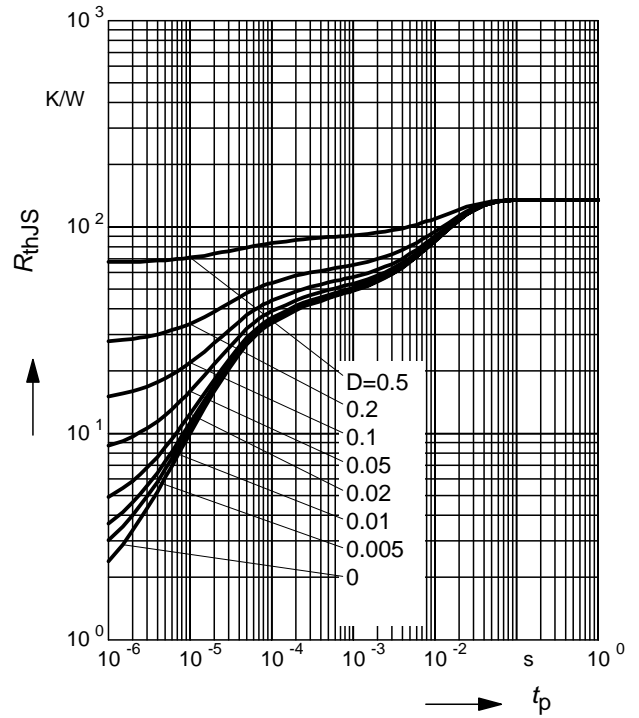
$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$

SMBT3904S



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

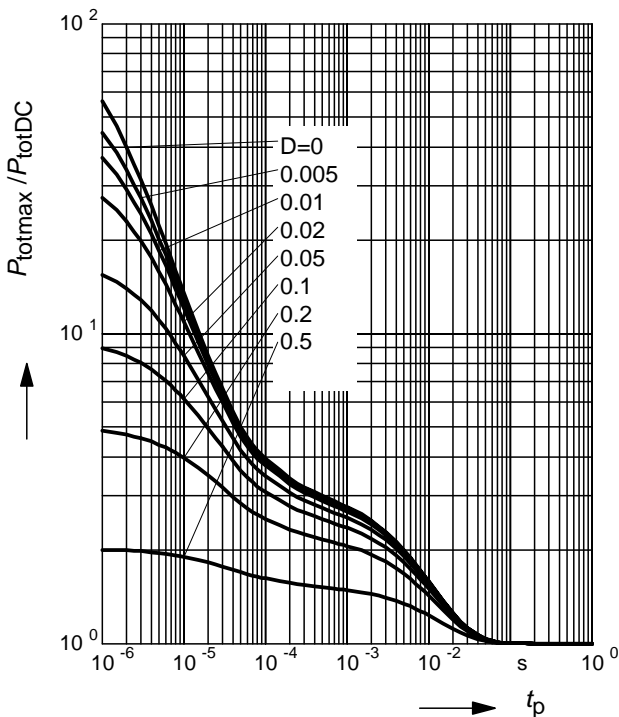
SMBT3904U



**Permissible Pulse Load**

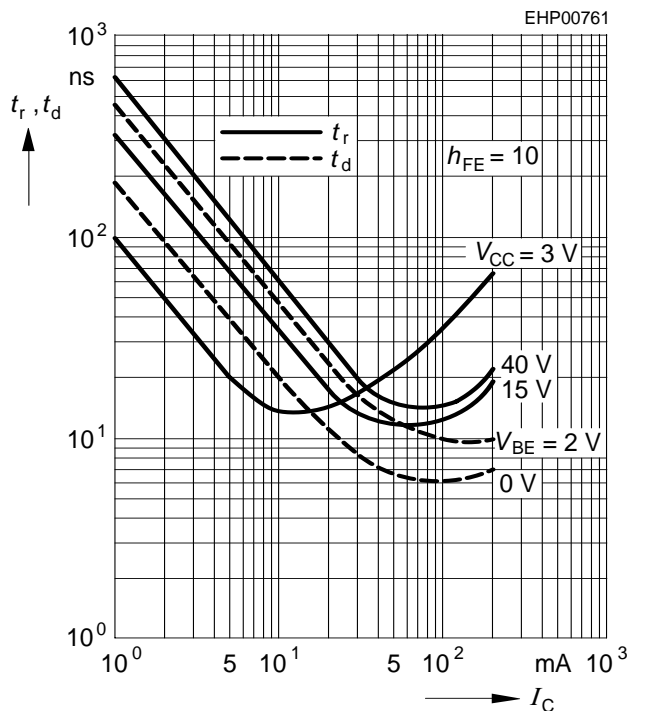
$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$

SMBT3904U



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

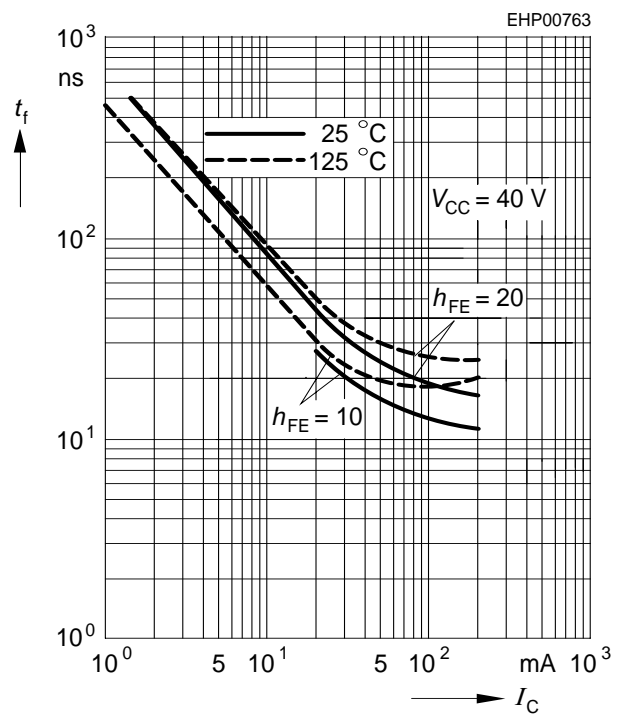
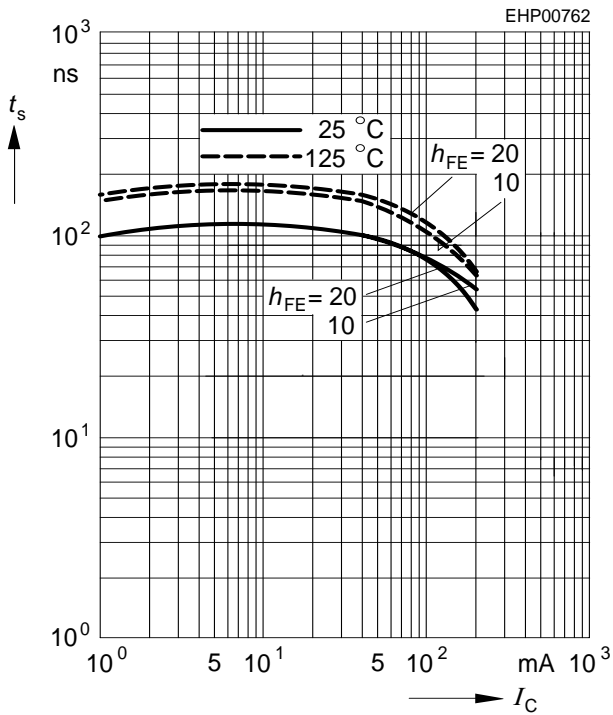
**Rise time  $t_r = f(I_C)$**



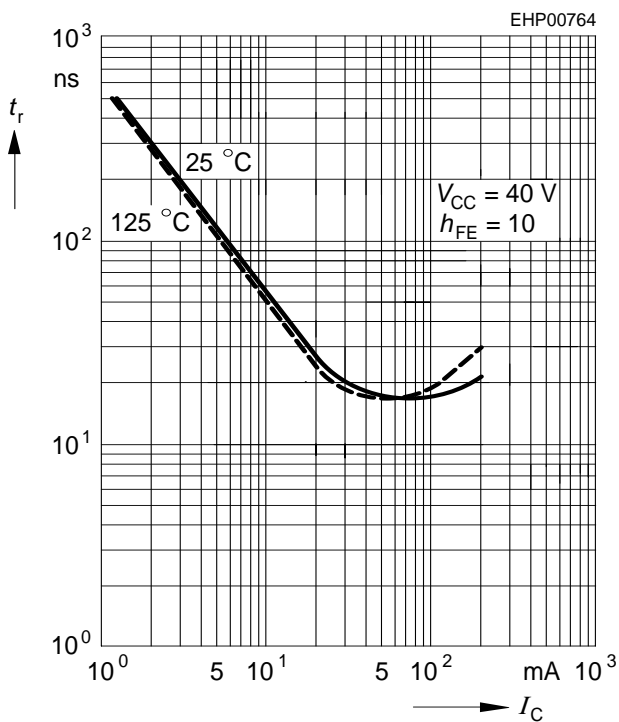


Storage time  $t_{stg} = f(I_C)$

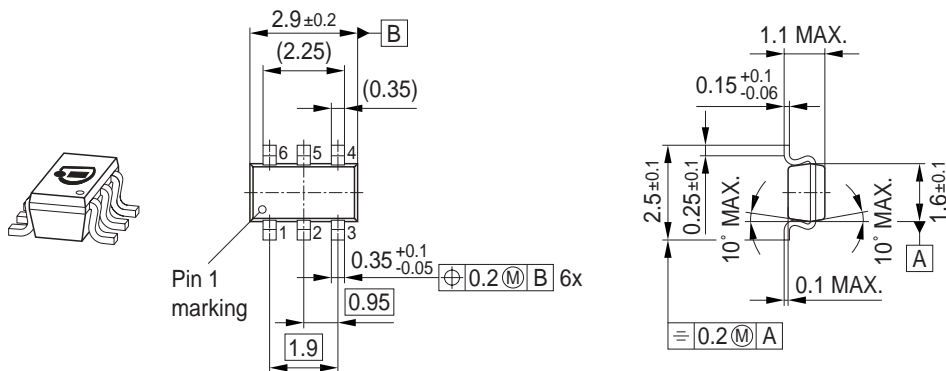
Fall time  $t_f = f(I_C)$



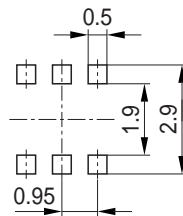
Rise time  $t_r = f(I_C)$



Package Outline

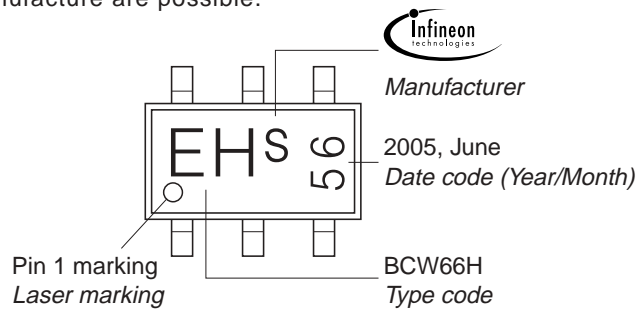


Foot Print



Marking Layout (Example)

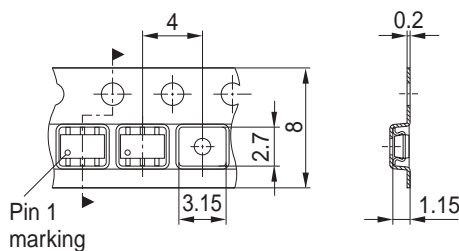
Small variations in positioning of Date code, Type code and Manufacture are possible.



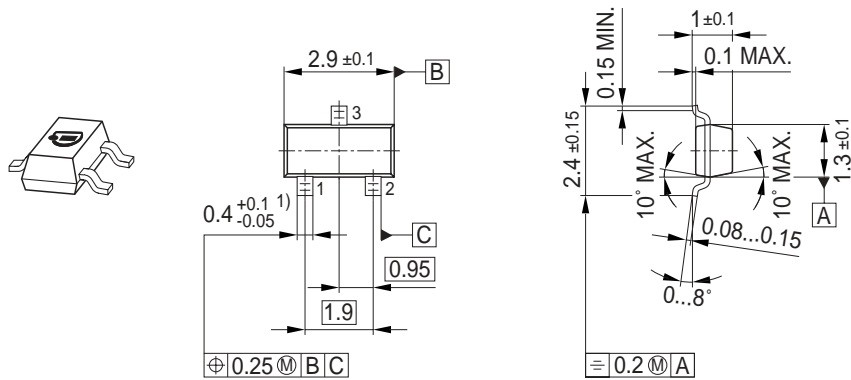
Standard Packing

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.

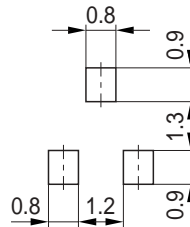


Package Outline

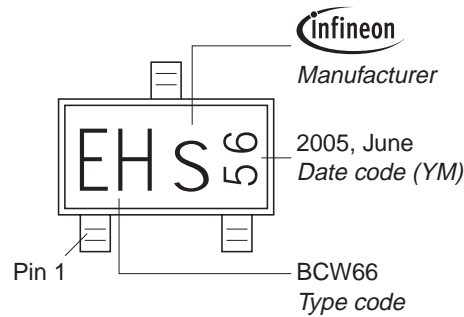


1) Lead width can be 0.6 max. in dambar area

Foot Print

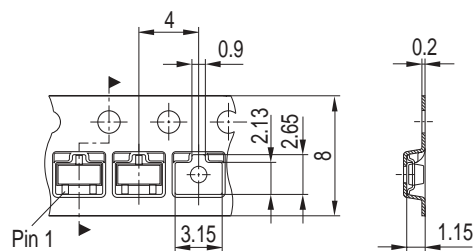


Marking Layout (Example)

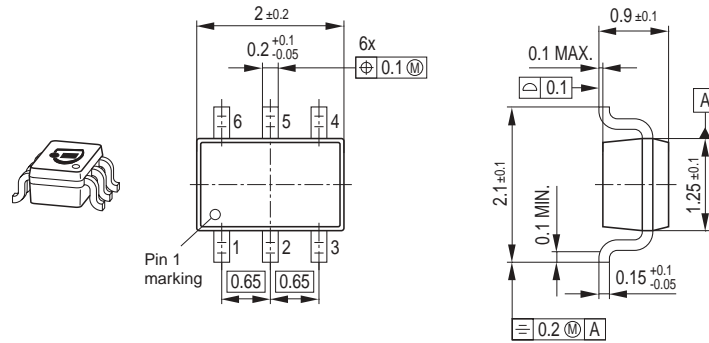


Standard Packing

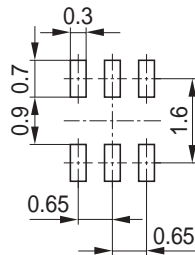
Reel  $\varnothing$ 180 mm = 3.000 Pieces/Reel  
 Reel  $\varnothing$ 330 mm = 10.000 Pieces/Reel



### Package Outline

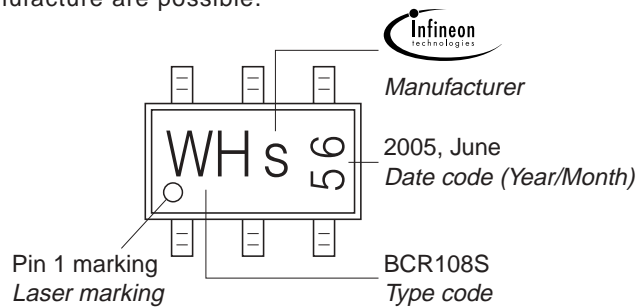


### Foot Print



### Marking Layout (Example)

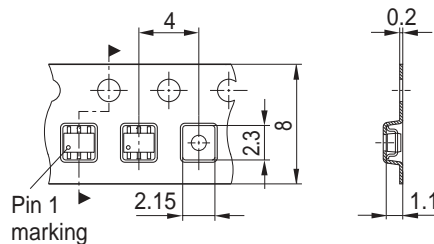
Small variations in positioning of Date code, Type code and Manufacture are possible.



### 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.



Edition 2006-02-01

Published by

Infineon Technologies AG

81726 München, Germany

© Infineon Technologies AG 2007.

All Rights Reserved.

### **Attention please!**

The information given in this dokument shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

### **Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

### **Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system.

Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.