



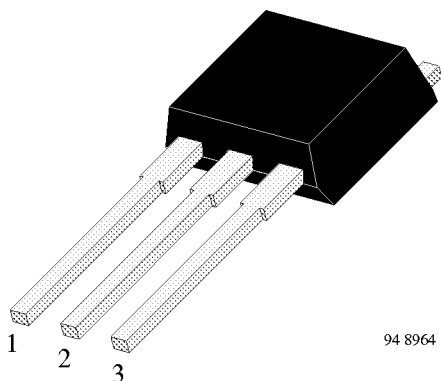
Silicon NPN High Voltage Switching Transistor

Features

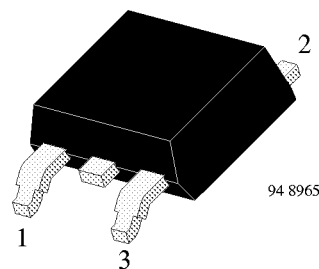
- Monolithic integrated C-E-free-wheel diode
- HIGH SPEED technology
- Planar passivation
- Very short switching times
- Very low switching losses
- Very low dynamic saturation
- Very low operating temperature
- High reverse voltage

Applications

Electronic lamp ballast circuits
Switch-mode power supplies



TD13004D • TD13005D 1 Base 2 Collector 3 Emitter



TD13004D • TD13005D -SMD 1 Base 2 Collector 3 Emitter

Absolute Maximum Ratings

T_{case} = 25°C, unless otherwise specified

Parameter	Test Conditions	Type	Symbol	Value	Unit
Collector-emitter voltage		TD13004D	V _{CEO}	300	V
		TD13005D	V _{CEO}	400	V
		TD13004D	V _{CES}	600	V
		TD13005D	V _{CES}	700	V
Emitter-base voltage			V _{EBO}	9	V
Collector current			I _C	6	A
Collector peak current			I _{CM}	8	A
Base current			I _B	2	A
Base peak current			I _{BM}	4	A
Total power dissipation	T _{case} ≤ 60°C		P _{tot}	30	W
Junction temperature			T _j	150	°C
Storage temperature range			T _{stg}	-65 to +150	°C

Maximum Thermal Resistance

$T_{\text{case}} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Test Conditions	Symbol	Value	Unit
Junction case		R_{thJC}	3	K/W

Electrical Characteristics

$T_{\text{case}} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Test Conditions	Type	Symbol	Min	Typ	Max	Unit
Transistor							
Collector cut-off current	$V_{\text{CE}} = 600 \text{ V}$	TD13004D	I_{CES}			50	μA
	$V_{\text{CE}} = 700 \text{ V}$	TD13005D	I_{CES}			50	μA
	$V_{\text{CE}} = 600 \text{ V}; T_{\text{case}} = 150^{\circ}\text{C}$	TD13004D	I_{CES}			0.5	mA
	$V_{\text{CE}} = 700 \text{ V}; T_{\text{case}} = 150^{\circ}\text{C}$	TD13005D	I_{CES}			0.5	mA
Collector-emitter breakdown voltage (figure 1)	$I_{\text{C}} = 300 \text{ mA}; L = 125 \text{ mH}; I_{\text{measure}} = 100 \text{ mA}$	TD13004D	$V_{(\text{BR})\text{CEO}}$	300			V
		TD13005D	$V_{(\text{BR})\text{CEO}}$	400			V
Emitter-base breakdown voltage	$I_{\text{E}} = 1 \text{ mA}$		$V_{(\text{BR})\text{EBO}}$	9			V
Collector-emitter saturation voltage	$I_{\text{C}} = 2 \text{ A}; I_{\text{B}} = 0.5 \text{ A}$		V_{CEsat}			0.6	V
Base-emitter saturation voltage	$I_{\text{C}} = 2 \text{ A}; I_{\text{B}} = 0.5 \text{ A}$		V_{BEsat}			1.6	V
DC forward current transfer ratio	$V_{\text{CE}} = 5 \text{ V}; I_{\text{C}} = 10 \text{ mA}$		h_{FE}	10			
	$V_{\text{CE}} = 5 \text{ V}; I_{\text{C}} = 1 \text{ A}$		h_{FE}	10			
	$V_{\text{CE}} = 5 \text{ V}; I_{\text{C}} = 4 \text{ A}$		h_{FE}	4			
Dynamic saturation voltage	$I_{\text{C}} = 2 \text{ A}; I_{\text{B}} = 0.4 \text{ A}; t = 1 \mu\text{s}$		V_{CEsatdyn}		3		V
	$I_{\text{C}} = 2 \text{ A}; I_{\text{B}} = 0.4 \text{ A}; t = 3 \mu\text{s}$		V_{CEsatdyn}		1		V
Gain bandwidth product	$V_{\text{CE}} = 10 \text{ V}; I_{\text{C}} = 500 \text{ mA}; f = 1 \text{ MHz}$		f_{T}	4			MHz
Free-wheel diode							
Forward voltage	$I_{\text{F}} = 2 \text{ A}$		V_{F}		1.3	1.5	V
Turn-on transient peak voltage	$I_{\text{F}} = 2.5 \text{ A}; di_{\text{F}}/dt = 10 \text{ A}/\mu\text{s}$		V_{FP}		4	5	V
Reverse recovery current	$I_{\text{F}} = 2.5 \text{ A}; -di_{\text{F}}/dt = 5 \text{ A}/\mu\text{s}; V_{\text{S}} = 200 \text{ V}$		I_{RM}		5		A

Switching Characteristics

$T_{case} = 25^{\circ}C$, unless otherwise specified

Parameter	Test Conditions	Type	Symbol	Min	Typ	Max	Unit
Resistive load (figure 3)							
Turn on time	$I_C = 2\text{ A}; I_{B1} = -I_{B2} = 0.4\text{ A};$ $V_S = 125\text{ V}$		t_{on}		0.25	0.4	μs
Storage time			t_s		1.5	2.5	μs
Fall time			t_f		0.15	0.3	μs
Inductive load (figure 4)							
Storage time	$I_C = 2\text{ A}; I_{B1} = 0.4\text{ A};$ $L = 200\text{ }\mu H; V_{clamp} = 300\text{ V};$ $-V_{BE} = 5\text{ V}; T_{case} = 100^{\circ}C$		t_s		1.2	2	μs
Cross over time			t_c		0.4	0.7	μs
Free-wheel diode							
Reverse recovery time	$I_F = 0.5\text{ A}; I_R = 1\text{ A}; i_R = 0.25\text{ A}$		t_{rr}		0.7	1	μs
Forward recovery time	$I_F = 2\text{ A}; di_F/dt = 10\text{ A}/\mu s$		t_{fr}		0.4		μs
Reverse recovery time	$I_F = 2\text{ A}; -di_F/dt = 5\text{ A}/\mu s$		t_{rr}		1.1		μs
	$I_F = 2\text{ A}; -di_F/dt = 5\text{ A}/\mu s$		t_{IRM}		0.9		μs

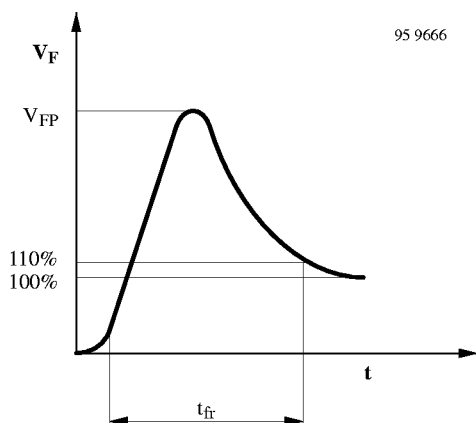


Figure 1. Turn on transient peak voltage

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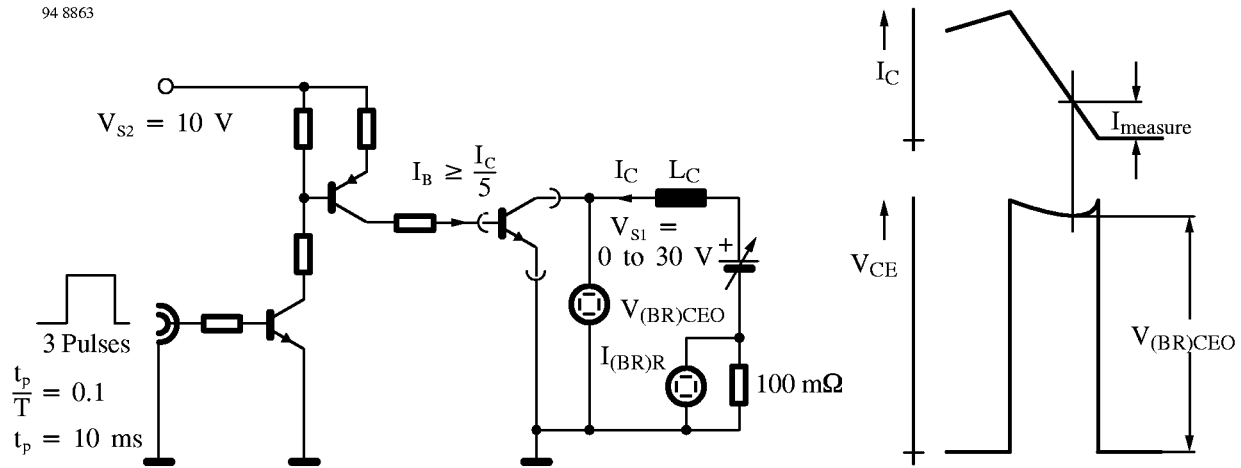
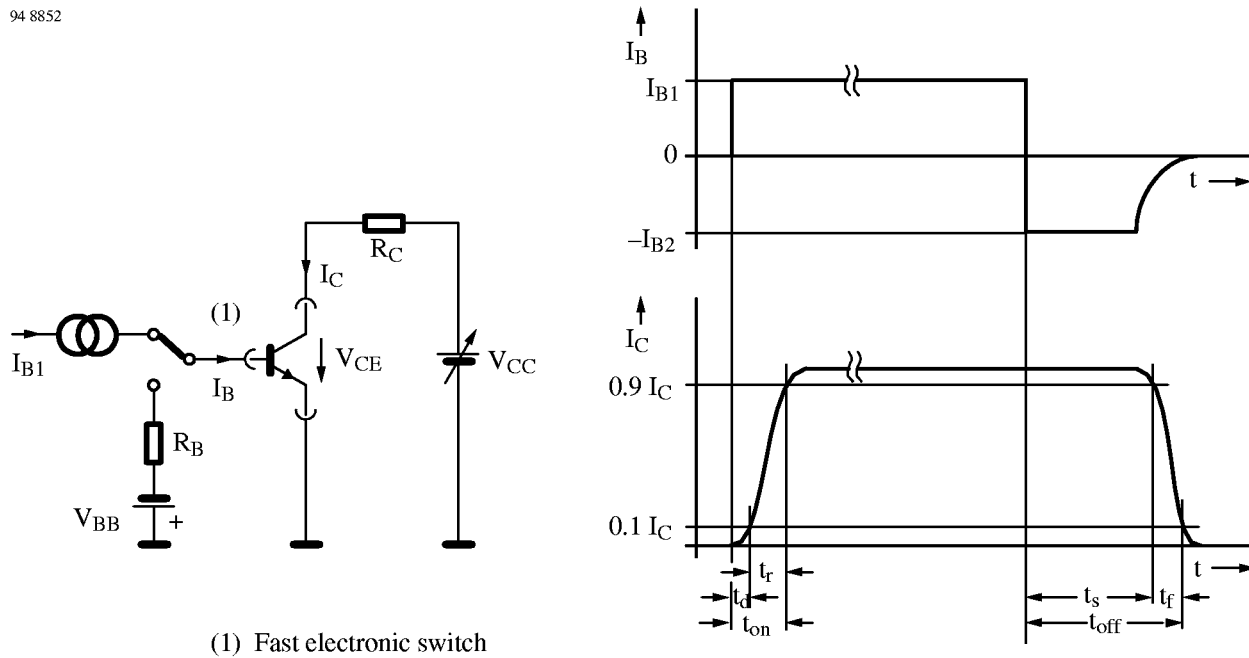


Figure 2. Test circuit for $V_{(BR)CEO}$

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(1) Fast electronic switch

Figure 3. Test circuit for switching characteristics – resistive load

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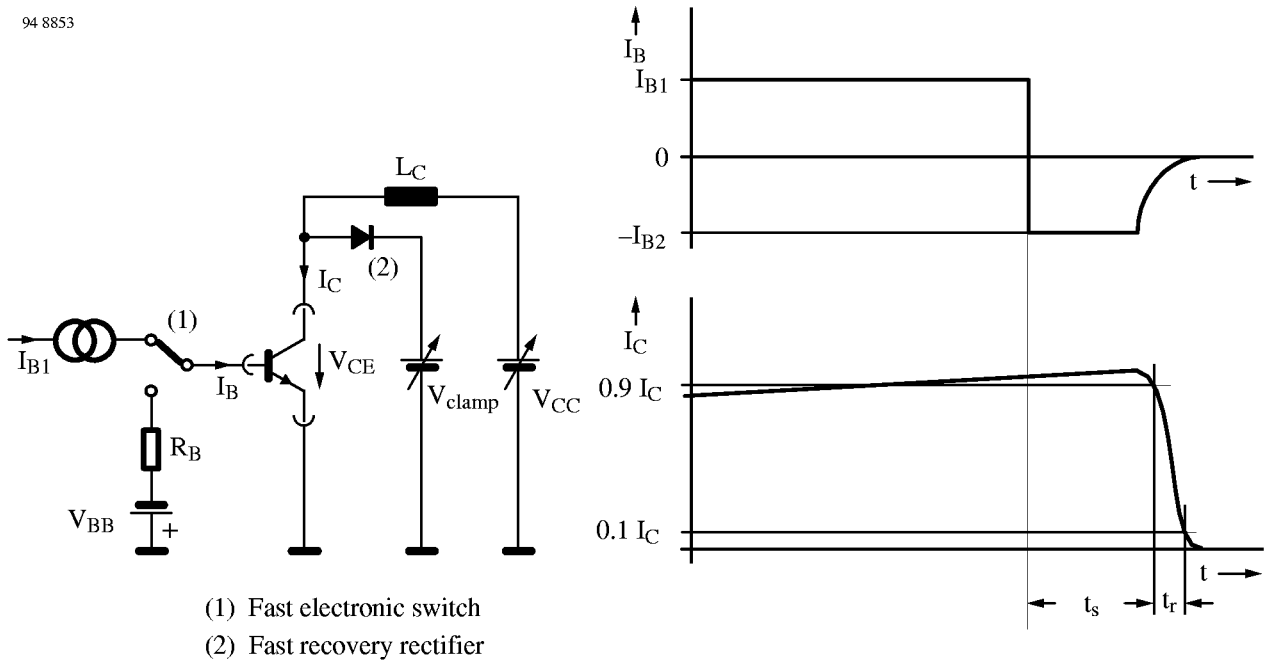
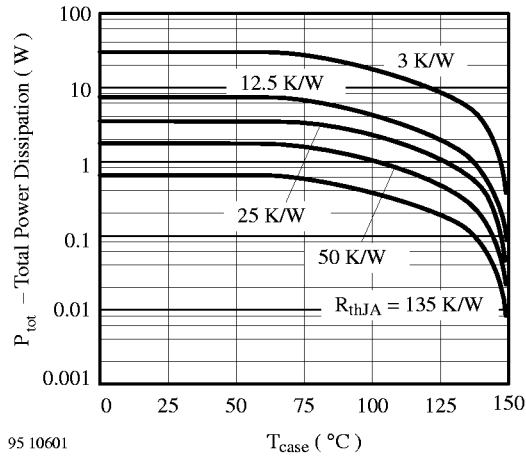


Figure 4. Test circuit for switching characteristics – inductive load

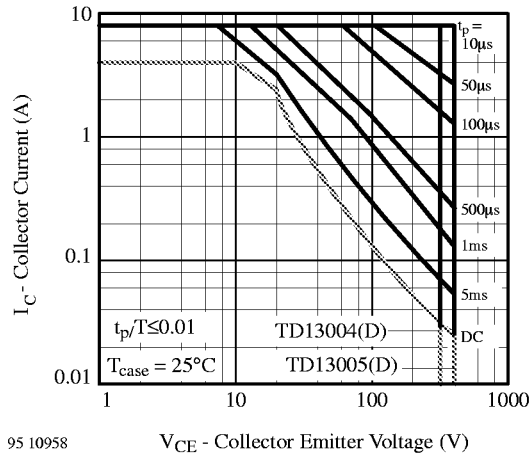


Typical Characteristics ($T_{case} = 25_C$ unless otherwise specified)



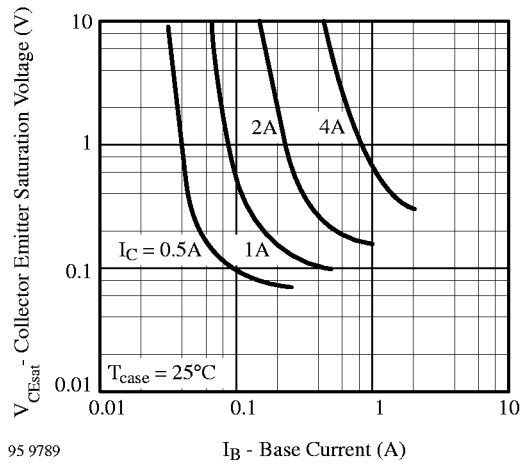
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Figure 5. P_{tot} vs. T_{case}



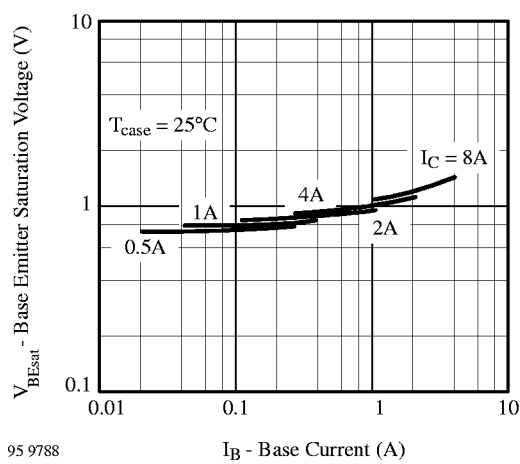
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Figure 8. I_C vs. V_{CE}



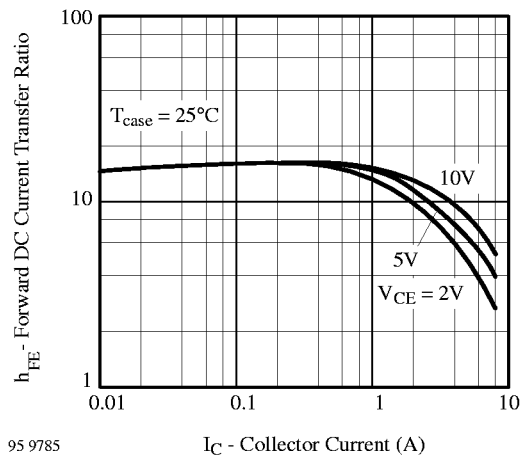
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Figure 6. $V_{CE(sat)}$ vs. I_B



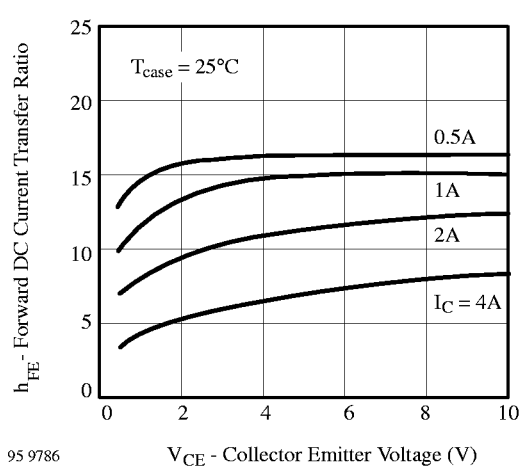
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Figure 9. $V_{BE(sat)}$ vs. I_B



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Figure 7. h_{FE} vs. I_C



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Figure 10. h_{FE} vs. V_{CE}

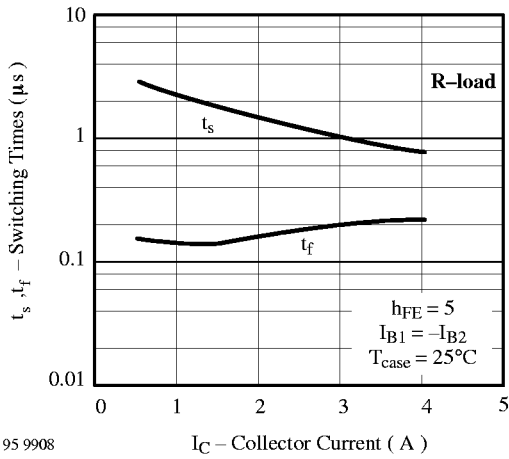


Figure 11. t_s, t_f vs. I_C

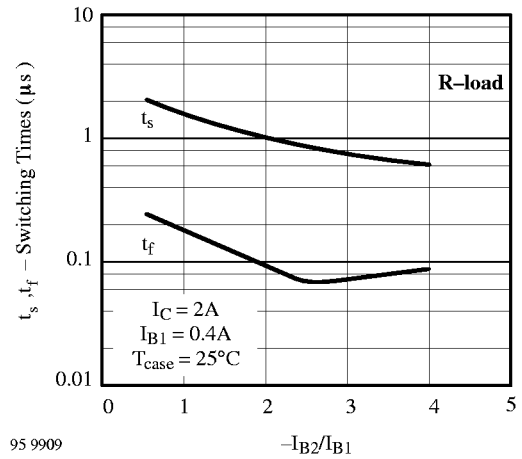


Figure 14. t_s, t_f vs. $-I_{B2}/I_{B1}$

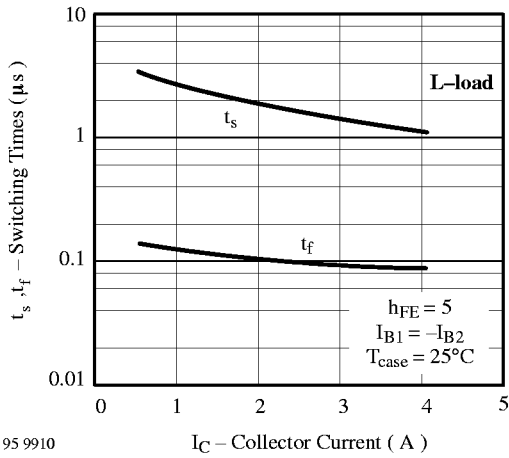


Figure 12. t_s, t_f vs. I_C

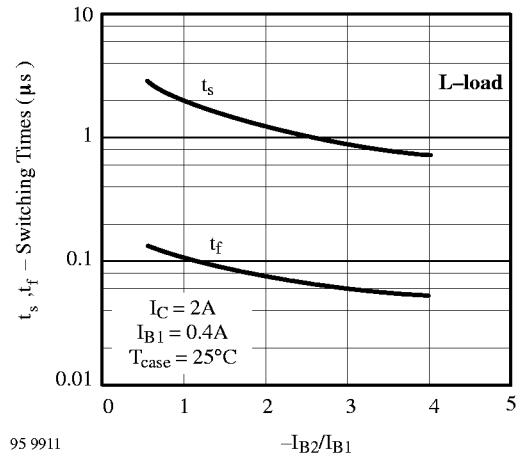


Figure 15. t_s, t_f vs. $-I_{B2}/I_{B1}$

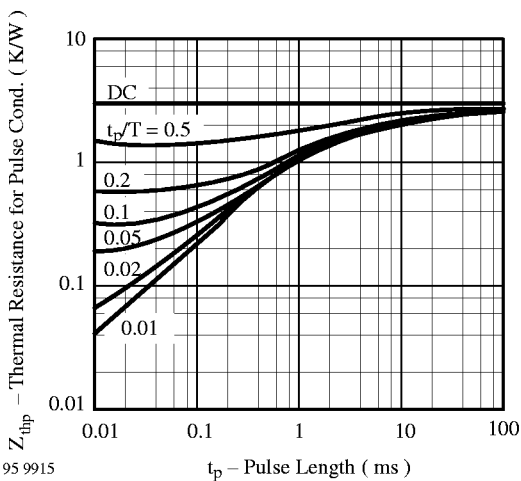


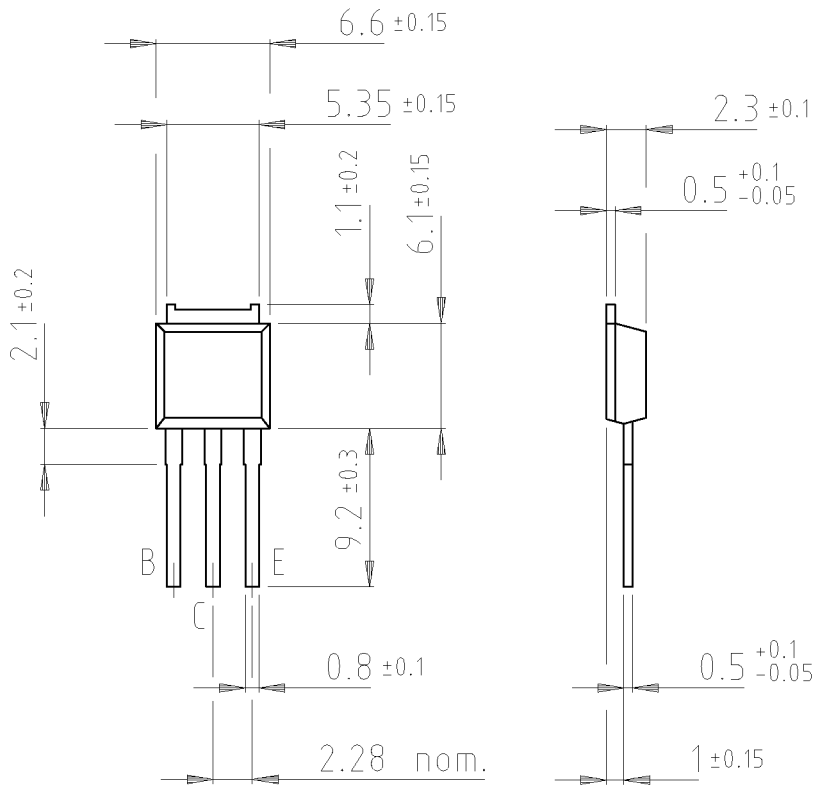
Figure 13. Z_{thp} vs. t_p

TD13004D • TD13005D

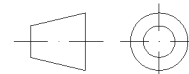
Vishay Telefunken



Dimensions in mm



Plastic case JEDEC TO 251
Collector connected with metallic surface



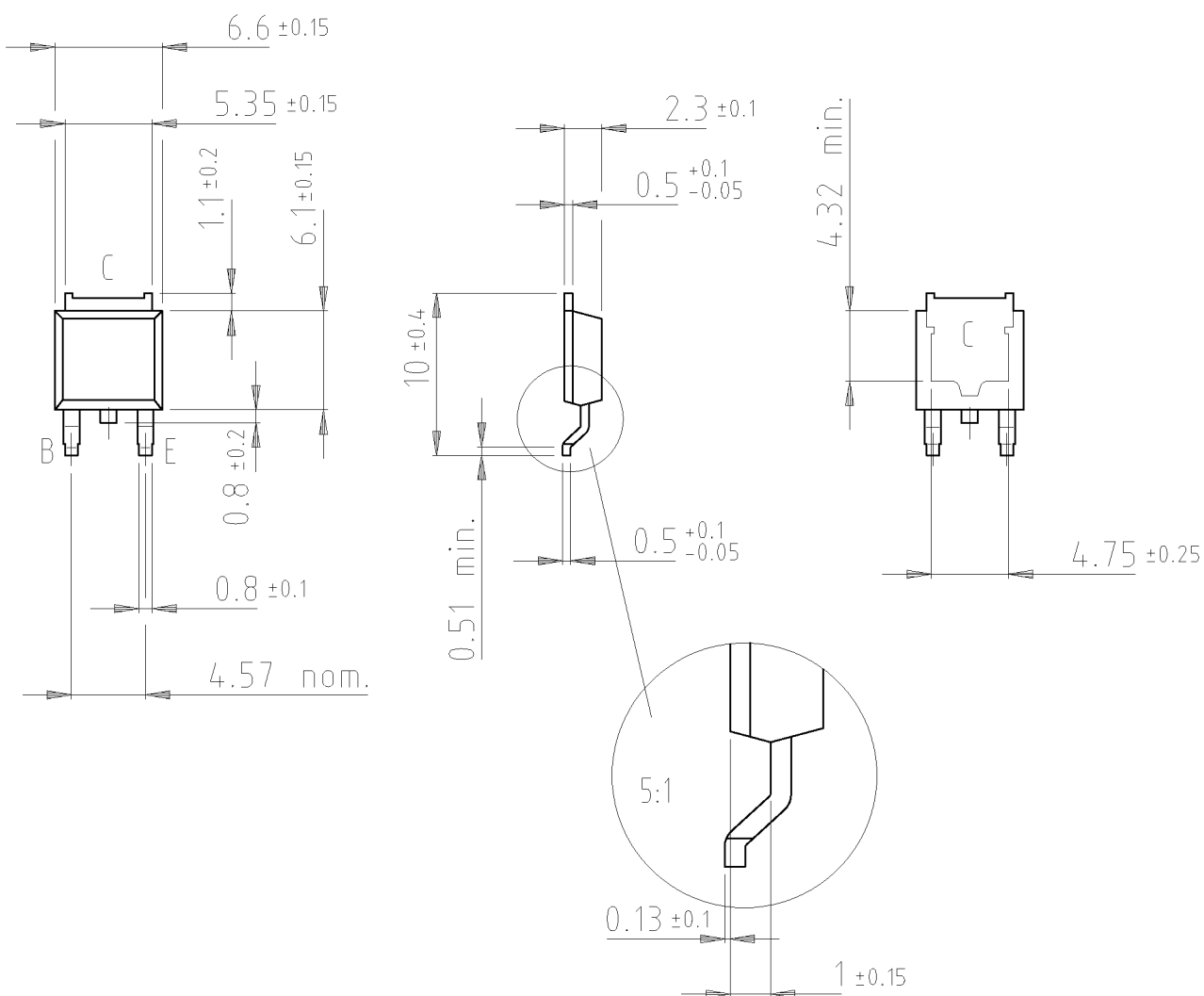
technical drawings
according to DIN
specifications

14292



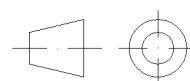
TD13004D • TD13005D

Vishay Telefunken



Plastic case JEDEC TO 252
Collector connected with metallic surface

14293



technical drawings
according to DIN
specifications

For ordering TO 252 add SMD to the type number (i.e. TD13004D • TD13005D –SMD)