TEMIC

TELEFUNKEN Semiconductors

TD13004D • TD13005D

Silicon NPN High Voltage Switching Transistor

Features

- Monolithic integrated C-E-free-wheel diode
- HIGH SPEED technology
- Planarpassivation
- 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
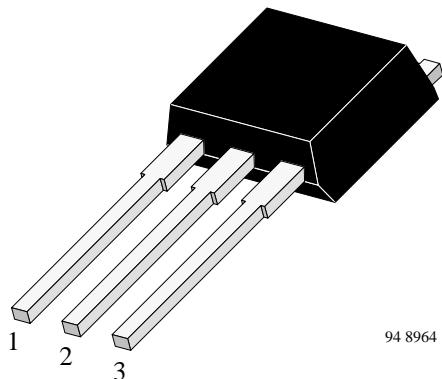
94 8964
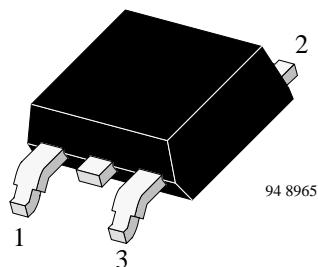
TD13004D
TD13005D
1 Base 2 Collector 3 Emitter

TD13004D –SMD
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	4	A
Collector peak current			I_{CM}	8	A
Base current			I_B	2	A
Base peak current			I_{BM}	4	A
Total power dissipation	$T_{case} \leq 60°C$		P_{tot}	30	W
Junction temperature			T_j	150	°C
Storage temperature range			T_{stg}	–65 to +150	°C

TD13004D • TD13005D

Maximum Thermal Resistance

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

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

Electrical Characteristics

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

Parameter	Test Conditions	Type	Symbol	Min	Typ	Max	Unit
Collector cut-off current	V_{CE} = 600 V	TD13004D	I_{CES}			50	μA
	V_{CE} = 700 V	TD13005D	I_{CES}			50	μA
	V_{CE} = 600 V; T_{case} = 150˚C	TD13004D	I_{CES}			0.5	mA
	V_{CE} = 700 V; T_{case} = 150˚C	TD13005D	I_{CES}			0.5	mA
Collector-emitter break-down voltage (figure 1)	I_C = 300 mA; L = 125 mH; $I_{measure}$ = 100 mA	TD13004D	$V_{(BR)CEO}$	300			V
		TD13005D	$V_{(BR)CEO}$	400			V
Emitter-base breakdown voltage	I_E = 1 mA		$V_{(BR)EBO}$	9			V
Collector-emitter saturation voltage	I_C = 2 A; I_B = 0.5 A		V_{CEsat}			0.6	V
Base-emitter saturation voltage	I_C = 2 A; I_B = 0.5 A		V_{BEsat}			1.6	V
DC forward current transfer ratio	V_{CE} = 5 V; I_C = 10 mA		h_{FE}	10			
	V_{CE} = 5 V; I_C = 1 A		h_{FE}	10			
	V_{CE} = 5 V; I_C = 4 A		h_{FE}	4			
Dynamic saturation voltage	I_C = 2 A; I_B = 0.4 A, t = 1 μs		$V_{CEsatdyn}$		3		V
	I_C = 2 A; I_B = 0.4 A, t = 3 μs		$V_{CEsatdyn}$		1		V
Gain bandwidth product	V_{CE} = 10 V; I_C = 500 mA; f = 1 MHz		f_T	4			MHz
Free-wheel diode							
Forward voltage	I_F = 2.5 A		V_F		1.3	1.5	V
Turn-on transient peak voltage	I_F = 2.5 A; di_F/dt = 10 A/μs		V_{FP}		4	5	V
Reverse recovery current	I_F = 2.5 A; $-di_F/dt$ = 5 A/μs; V_S = 200 V		I_{RM}		5		A

Switching Characteristics

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

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

94 8863
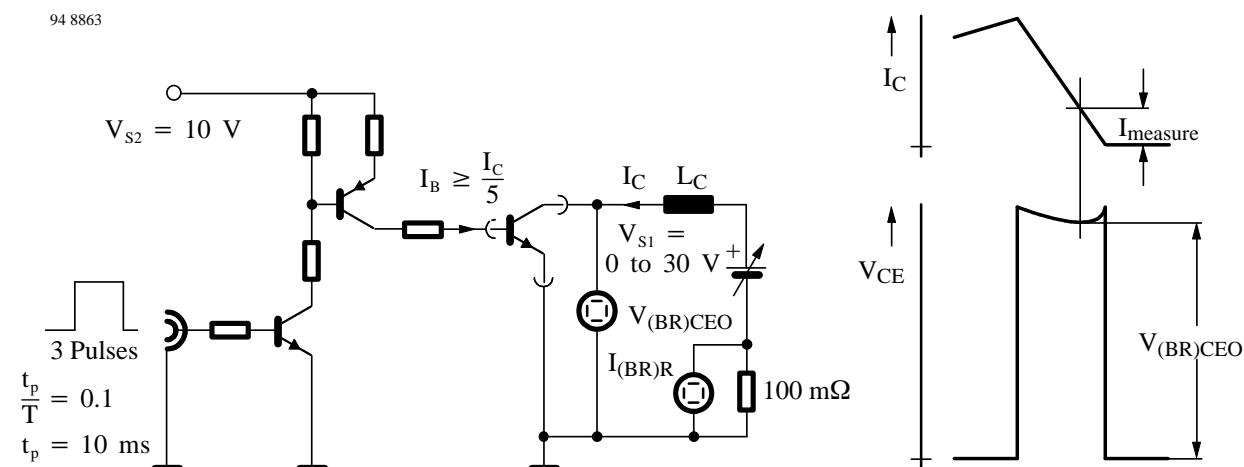
Figure 1. Test circuit for $V_{(BR)CE0}$
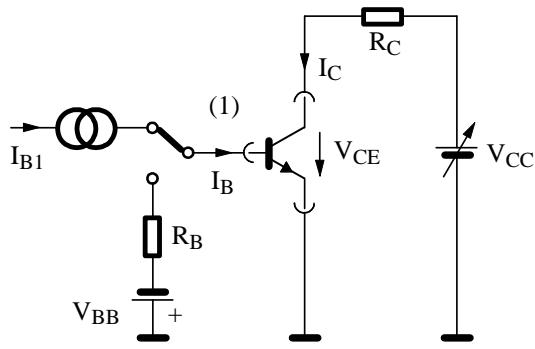
94 8852

(1) Fast electronic switch
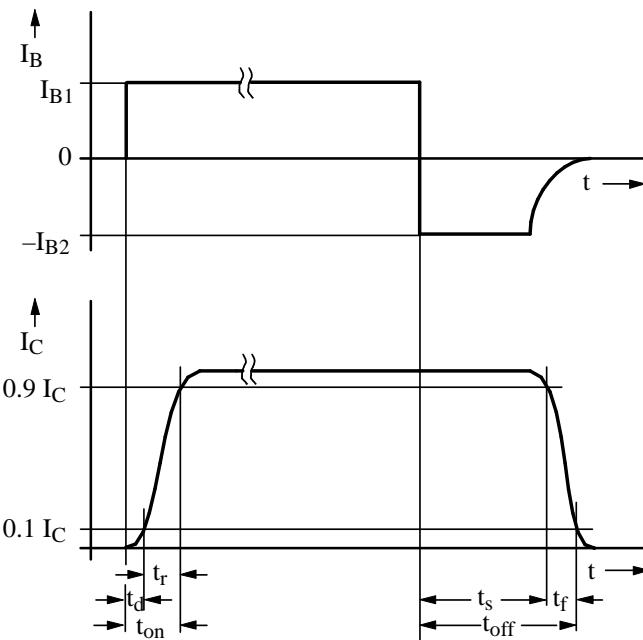
Figure 2. Test circuit for switching characteristics – resistive load

94 8853
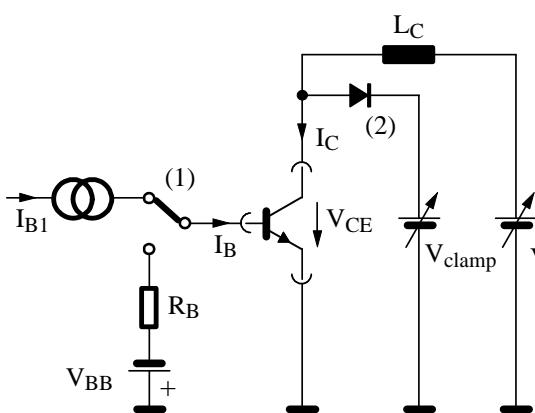

(1) Fast electronic switch
(2) Fast recovery rectifier
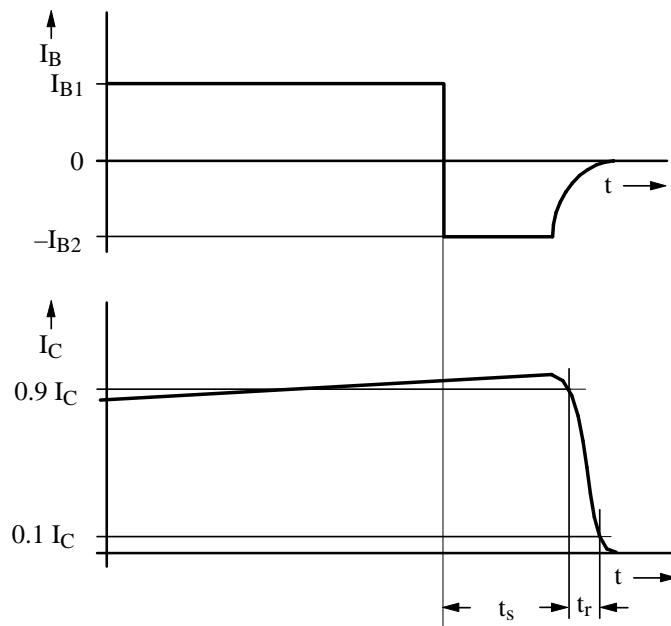
Figure 3. Test circuit for switching characteristics – inductive load

## Typical Characteristics ($T_{case} = 25°C$ unless otherwise specified)


95 9789

Figure 4. V_{CEsat} vs. I_B

95 9786

Figure 7. h_{FE} vs. V_{CE}

95 9785

Figure 5. h_{FE} vs. I_C

95 9908

Figure 8. t_s, t_f vs. I_C

95 9788

Figure 6. V_{BEsat} vs. I_B

95 9910

Figure 9. t_s, t_f vs. I_C
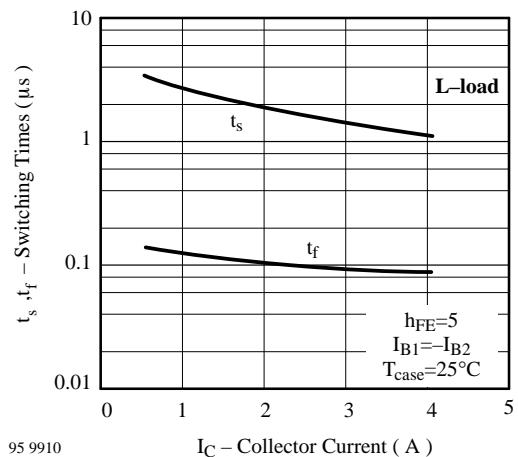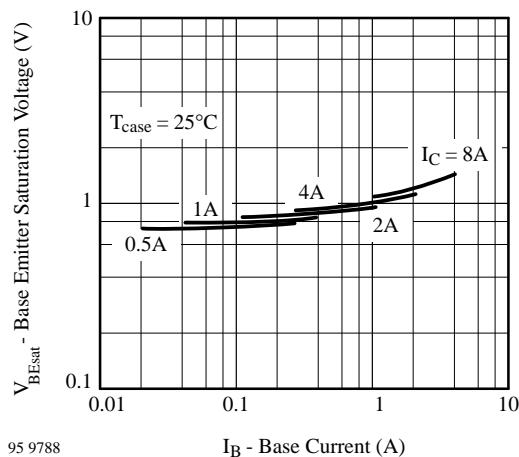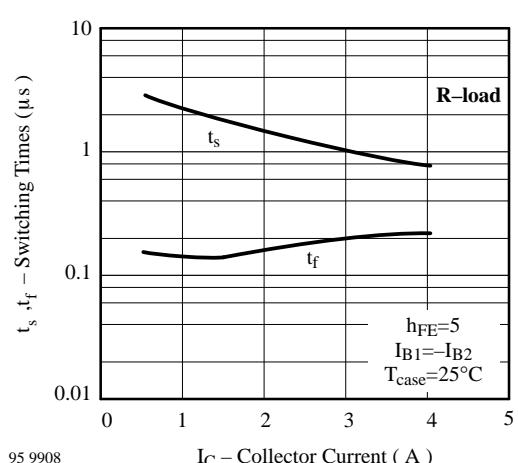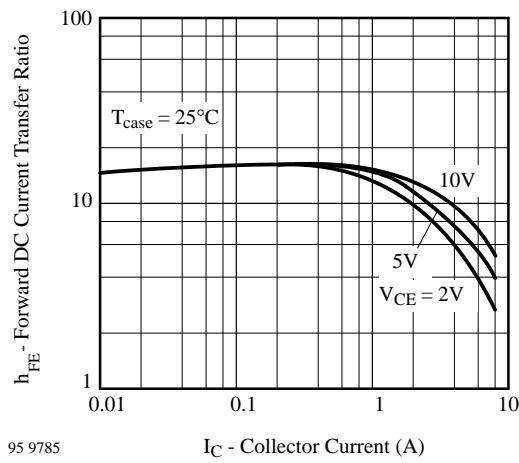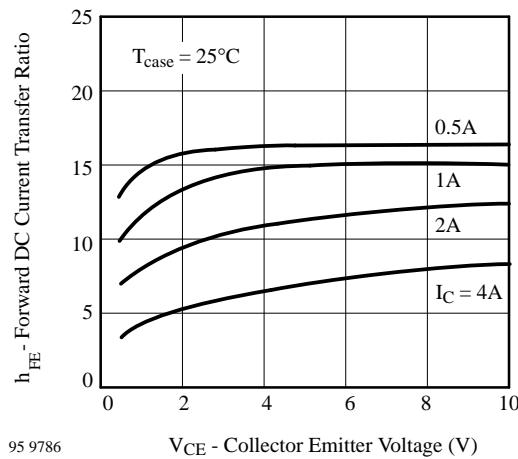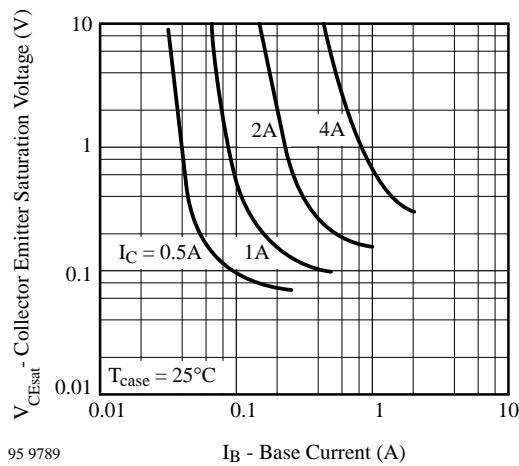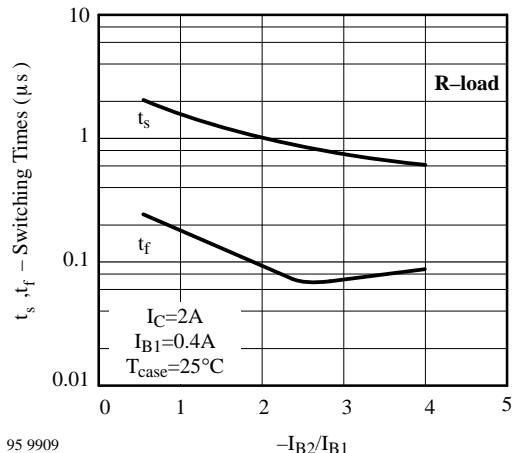
Figure 10. t_s, t_f vs. $-I_{B2}/I_{B1}$
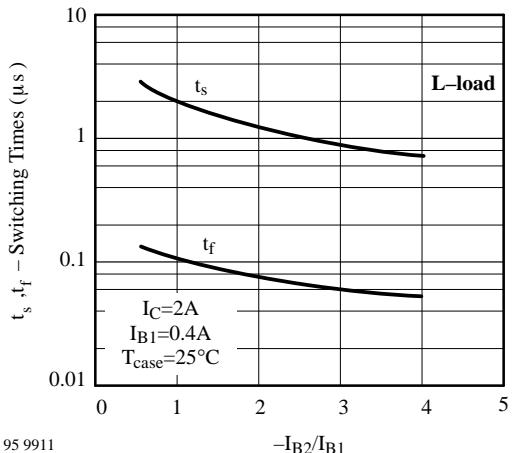
Figure 11. t_s, t_f vs. $-I_{B2}/I_{B1}$

Dimensions in mm

TO251

94 8966

technical drawings
according to DIN
specifications

TO252

94 8967

technical drawings
according to DIN
specifications
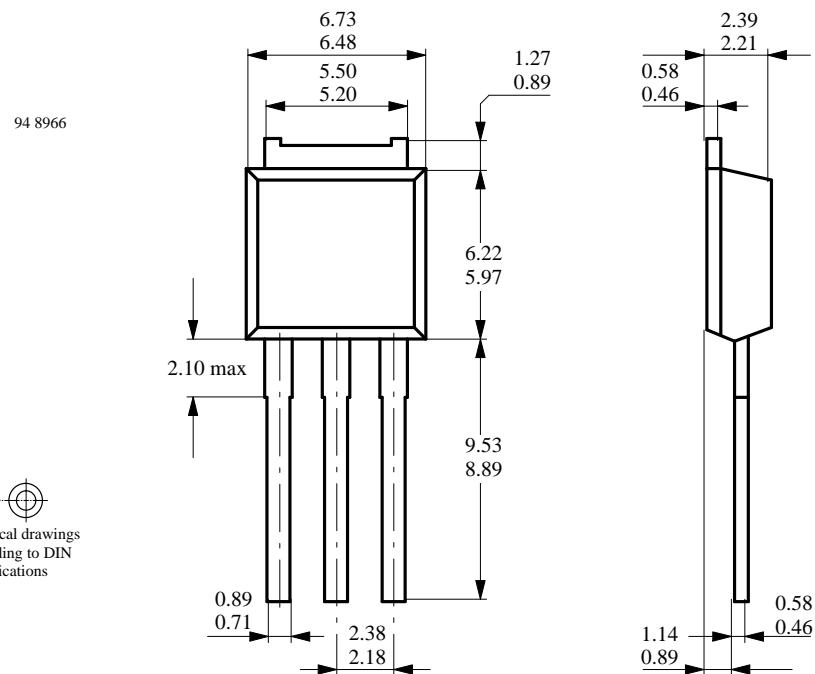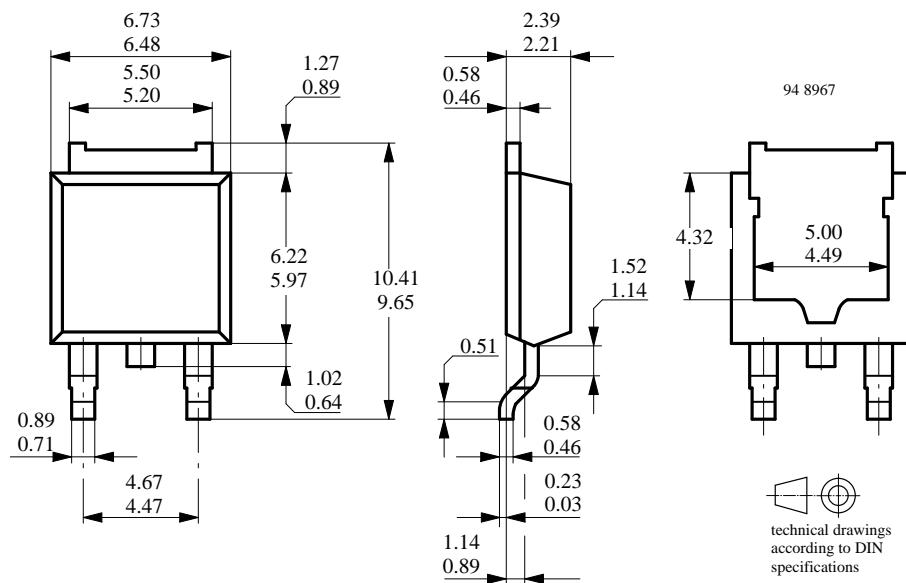
For ordering TO 252 add SMD to the type number (i.e. TD13005D –SMD)

Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.