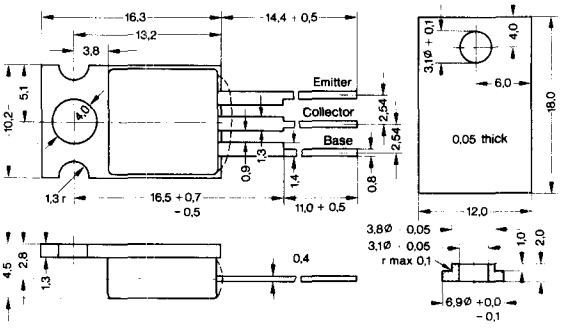
FOR POWER-AMPLIFIER AND HIGH-SPEED-SWITCHING APPLICATIONS
DESIGNED FOR COMPLEMENTARY USE WITH BD240A-C

- 30 W at 25 °C Case Temperature
- 2 A Rated Collector Current
- Min f_T of 3 MHz at 10 V, 200 mA

mechanical data



All dimensions are in mm

TO-66P

absolute maximum ratings at 25 °C case temperature (unless otherwise noted)

	BD239	BD239A	BD239B	BD239C
Collector-Emitter Voltage (R_{BE} = 100 Ω)	55 V	70 V	90 V	115 V
Collector-Emitter Voltage (See Note 1)	45 V	60 V	80 V	100 V
Emitter-Base Voltage	5 V			
Continuous Collector Current	2 A			
Peak Collector Current (See Note 2)	4 A			
Continuous Base Current	0.6 A			
Safe Operating Region at (or below) 25 °C Case Temperature	See Figure 5			
Continuous Device Dissipation at (or below) 25 °C Case Temperature (See Note 3)	30 W			
Continuous Device Dissipation at (or below) 25 °C Free-Air Temperature (See Note 4)	2 W			
Unclamped Inductive Load Energy (See Note 5)	32 mJ			
Operating Collector Junction Temperature Range	−65 °C to 150 °C			
Storage Temperature Range	−65 °C to 150 °C			
Lead Temperature 1/8 Inch from Case for 5 Seconds	250 °C			

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. This value applies for $t_w \leq 0.3$ ms, duty cycle ≤ 10 %.
3. Derate linearly to 150 °C case temperature at the rate of 0.24 W/°C.
4. Derate linearly to 150 °C free-air temperature at the rate of 16 mW/°C.
5. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB1} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = 10 V. Energy ≈ $I_C^2 L/2$.

electrical characteristics at 25 °C case temperature

PARAMETER	TEST CONDITIONS		BD239 MIN	BD239 MAX	BD239A MIN	BD239A MAX	BD239B MIN	BD239B MAX	BD239C MIN	BD239C MAX	UNIT
$V_{(BR)CEO}$	I_C = 30 mA, See Note 6	I_B = 0,	45		60		80		100		V
I_{CEO}	V_{CE} = 30 V,	I_B = 0		0.3		0.3					mA
	V_{CE} = 60 V,	I_B = 0						0.3		0.3	
I_{CES}	V_{CE} = 45 V,	V_{BE} = 0		0.2							
	V_{CE} = 60 V,	V_{BE} = 0				0.2					mA
	V_{CE} = 80 V,	V_{BE} = 0						0.2			
	V_{CE} = 100 V,	V_{BE} = 0								0.2	
I_{EBO}	V_{EB} = 5 V,	I_C = 0		1		1		1		1	mA
h_{FE}	V_{CE} = 4 V, See Notes 6 and 7	I_C = 0.2 A	40		40		40		40		
	V_{CE} = 4 V, See Notes 6 and 7	I_C = 1 A,	15		15		15		15		
V_{BE}	V_{CE} = 4 V, See Notes 6 and 7	I_C = 1 A,		1.3		1.3		1.3		1.3	V
$V_{CE(sat)}$	I_B = 200 mA, See Notes 6 and 7	I_C = 1 A,		0.7		0.7		0.7		0.7	V
h_{fe}	V_{CE} = 10 V, f = 1 kHz	I_C = 0.2 A,	20		20		20		20		
$\|h_{fe}\|$	V_{CE} = 10 V, f = 1 MHz	I_C = 0.2 A,	3		3		3		3		

NOTES: 6. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2 %.
7. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

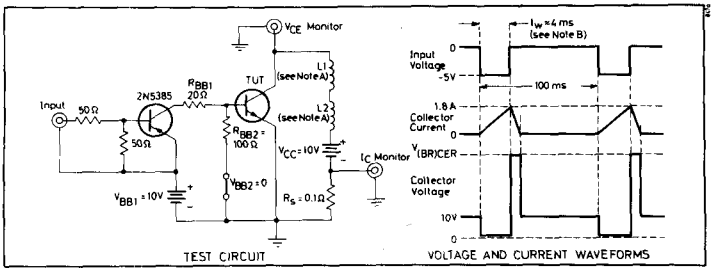
thermal characteristics

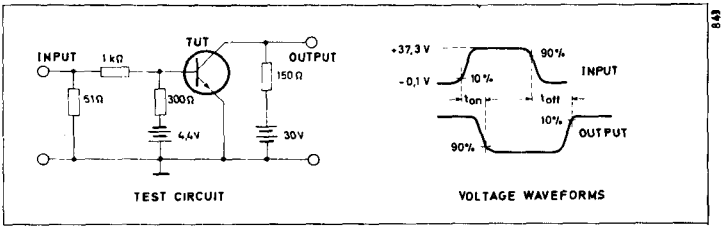
PARAMETER		MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance	4.17	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance	62.5	

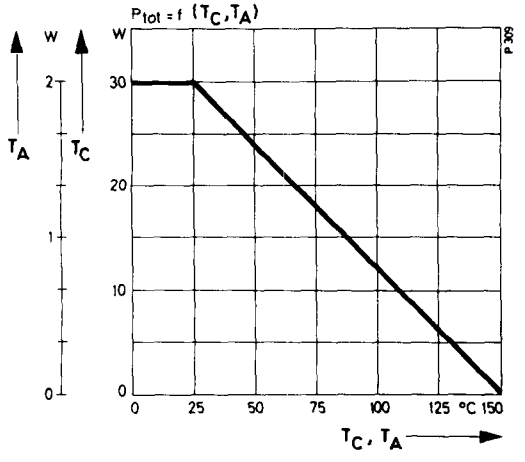
switching characteristics at 25 °C case temperature

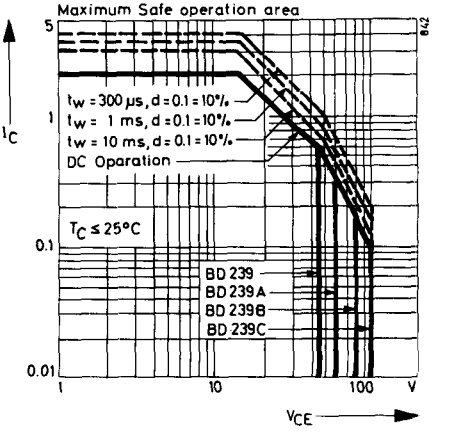
PARAMETER	TEST CONDITIONS †			TYP	UNIT
t_{on}	I_C = 200 mA,	$I_{B(1)}$ = 20 mA,	$I_{B(2)}$ = 20 mA,	0.3	μs
t_{off}	$V_{BE(off)}$ = −3.4 V,	R_L = 150 Ω,	See Figure 1	0.8	

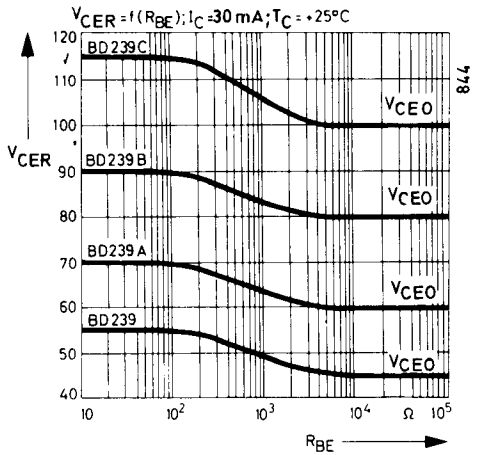
† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

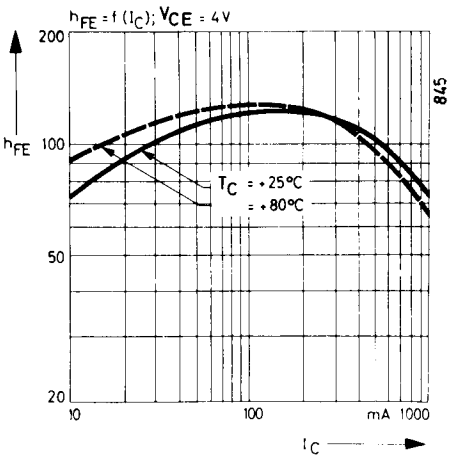

TEST CIRCUIT
VOLTAGE AND CURRENT WAVEFORMS
Input
50Ω
2N5385
R_{BB1} 20Ω
TUT
(see Note A)
R_{BB2} = 100Ω
V_{CC} = 10V
I_C Monitor
V_{BB1} = 10V
V_{BB2} = 0
R_S = 0.1Ω
V_{CE} Monitor
t_w = 4 ms (see Note B)
Input Voltage
100 ms
1.8 A
Collector Current
$V_{(BR)CER}$
Collector Voltage
10V

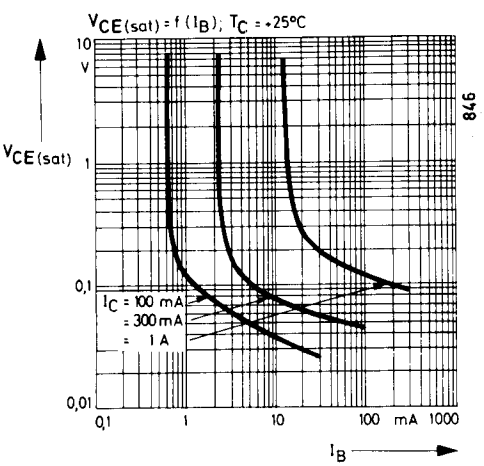

TEST CIRCUIT
VOLTAGE WAVEFORMS
INPUT
1 kΩ
51Ω
TUT
300Ω
4,4V
OUTPUT
150Ω
30V
+37,3 V
-0,1 V
90%
10%
INPUT
t_{on}
t_{off}
OUTPUT

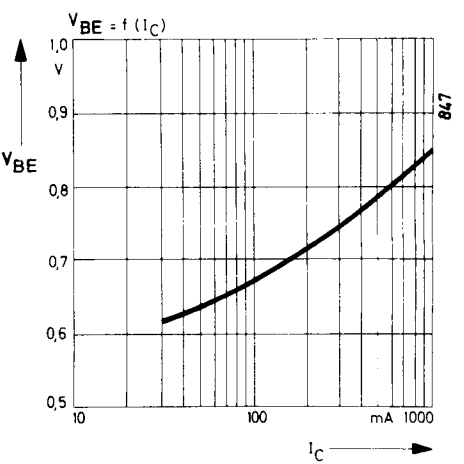

$P_{tot} = f(T_C, T_A)$
W
T_A
T_C
T_C, T_A
°C


Maximum Safe operation area
I_C
t_w = 300 µs, d = 0.1 = 10%
t_w = 1 ms, d = 0.1 = 10%
t_w = 10 ms, d = 0.1 = 10%
DC Operation
$T_C \leq 25°C$
BD 239
BD 239A
BD 239B
BD 239C
V_{CE}
V









SILIZIUM-KOMPLEMENTARE-LEISTUNGSTRANSISTOREN (Allgemeine und NF-Anwendungen)

SILICON COMPLEMENTARY POWER TRANSISTORS (General and Low-frequency Applications)

Typ type NPN	PNP	P_{tot} (@) T_C = 25 °C (100 °C) W	V_{CEO} min	I_{CD} max A	min	h_{FE} (@) max	I_C A
BD 239	BD 240	30	45	2	40		0,2
BD 239 A	BD 240 A	30	60	2	40		0,2
BD 239 B	BD 240 B	30	80	2	40		0,2
BD 239 C	BD 240 C	30	100	2	40		0,2
BD 241	BD 242	40	45	3	25		1
BD 241 A	BD 242 A	40	60	3	25		1
BD 241 B	BD 242 B	40	80	3	25		1
BD 241 C	BD 242 C	40	100	3	25		1
BD 243	BD 244	65	45	6	30		0,3
BD 243 A	BD 244 A	65	60	6	30		0,3
BD 243 B	BD 244 B	65	80	6	30		0,3
BD 243 C	BD 244 C	65	100	6	30		0,3
BD 245	BD 246	80	45	10	40		1
BD 245 A	BD 246 A	80	60	10	40		1
BD 245 B	BD 246 B	80	80	10	40		1
BD 245 C	BD 246 C	80	100	10	40		1
BD 249	BD 250	125	45	25	25		1,5
BD 249 A	BD 250 A	125	60	25	25		1,5
BD 249 B	BD 250 B	125	80	25	25		1,5
BD 249 C	BD 250 C	125	100	25	25		1,5
TIP 29	TIP 30	30	40	1	40	200	0,2
TIP 29 A	TIP 30 A	30	60	1	40	200	0,2
TIP 29 B	TIP 30 B	30	80	1	40	200	0,2
TIP 29 C	TIP 30 C	30	100	1	40	200	0,2
TIP 31	TIP 32	40	40	3	25	100	1
TIP 31 A	TIP 32 A	40	60	3	25	100	1
TIP 31 B	TIP 32 B	40	80	3	25	100	1
TIP 31 C	TIP 32 C	40	100	3	25	100	1
TIP 33	TIP 34	80	40	10	40	125	1
TIP 33 A	TIP 34 A	80	60	10	40	125	1
TIP 33 B	TIP 34 B	80	80	10	40	125	1
TIP 33 C	TIP 34 C	80	100	10	40	125	1
TIP 35	TIP 36	90	40	25	25	100	1,5
TIP 35 A	TIP 36 A	90	60	25	25	100	1,5

f_T min MHz	I_{CES} @ (I_{CEO}) µA	V_{CE} V	Gehäuse package	Anwendungen, Bemerkungen applications, remarks
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	
			TO-66P	Verstärker, Schalter
			TO-66P	amplifier, switch
			TO-66P	
			TO-3P	
			TO-3P	
			TO-3P	
			TO-3P	
			TO-3P	
			TO-3P	
			TO-3P	
			TO-3P	
3	200	40	TO-66P	Verstärker, Schalter, komplementär zu TIP 30 amplifier, switch, complementary to TIP 30
3	200	60	TO-66P	Verstärker, Schalter, komplementär zu TIP 30 A amplifier, switch, complementary to TIP 30 A
3	200	80	TO-66P	Verstärker, Schalter, komplementär zu TIP 30 B amplifier, switch, complementary to TIP 30 B
3	200	100	TO-66P	Verstärker, Schalter, komplementär zu TIP 30 C amplifier, switch, complementary to TIP 30 C
3	300	40	TO-66P	Verstärker, Schalter, komplementär zu TIP 32 amplifier, switch, complementary to TIP 32
3	300	60	TO-3P	Verstärker, Schalter, komplementär zu TIP 32 A amplifier, switch, complementary to TIP 32 A
3	300	80	TO-3P	Verstärker, Schalter, komplementär zu TIP 32 B amplifier, switch, complementary to TIP 32 B
3	300	100	TO-3P	Verstärker, Schalter, komplementär zu TIP 32 C amplifier, switch, complementary to TIP 32 C
3	400	40	TO-3P	Verstärker, Schalter, komplementär zu TIP 34 amplifier, switch, complementary to TIP 34
3	400	60	TO-3P	Verstärker, Schalter, komplementär zu TIP 34 A amplifier, switch, complementary to TIP 34 A
3	400	80	TO-3P	Verstärker, Schalter, komplementär zu TIP 34 B amplifier, switch, complementary to TIP 34 B
3	400	100	TO-3P	Verstärker, Schalter, komplementär zu TIP 34 C amplifier, switch, complementary to TIP 34 C
3	700	40	TO-3P	Verstärker, Schalter, komplementär zu TIP 36 amplifier, switch, complementary to TIP 36
3	700	60	TO-3P	Verstärker, Schalter, komplementär zu TIP 36 A amplifier, switch, complementary to TIP 36 A

Typ type	f MHz	V_{CC}	P_{in}	P_{out}	BV_{CBO}	BV_{CEO}	Gehäuse package
2N 5713	150	13	3,4	11	60	40	TO-128
2N 5773	400	28	0,12	1,5	65	35	TO-117
2N 5774	400	26	1	8	65	35	TO-129
2N 5848	50	12,5	3,25	20	48	24	145

NF-TRANSISTOREN PNP/NPN
NF TRANSISTORS PNP/NPN

Typ type PNP	NPN	P_{tot} @ T_C = 25 °C (100 °C) W	V_{CEO} min V	I_{CD} max A	min	h_{FE} max	@ I_C A
BD 136	BD 135	6,5	45	1	40	250	0,15
BD 138	BD 137	6,5	60	1	40	160	0,15
BD 140	BD 139	6,5	80	1	40	160	0,15
BD 240	BD 239	30	−45	−2	40		0,2
BD 240 A	BD 239 A	30	−60	−2	40		0,2
BD 240 B	BD 239 B	30	−80	−2	40		0,2
BD 240 C	BD 239 C	30	−100	−2	40		0,2
BD 242	BD 241	40	−45	−3	25		1
BD 242 A	BD 241 A	40	−60	−3	25		1
BD 242 B	BD 241 B	40	−80	−3	25		1
BD 242 C	BD 241 C	40	−100	−3	25		1
BD 244	BD 243	65	−45	−6	30		0,3
BD 244 A	BD 243 A	65	−60	−6	30		0,3
BD 244 B	BD 243 B	65	−80	−6	30		0,3
BD 244 C	BD 243 C	65	−100	−6	30		0,3
BD 246	BD 245	80	−45	−10	40		1
BD 246 A	BD 245 A	80	−60	−10	40		1
BD 246 B	BD 245 B	80	−80	−10	40		1
BD 246 C	BD 245 C	80	−100	−10	40		1
BD 250	BD 249	125	−45	−25	25		1,5
BD 250 A	BD 249 A	125	−60	−25	25		1,5
BD 250 B	BD 249 B	125	−80	−25	25		1,5
BD 250 C	BD 249 C	125	−100	−25	25		1,5
BDX 14		30	−60	−3	25	100	−0,5
BDX 15		117	−70	−10	20	70	−4

Typ type	f MHz	V_{CC}	P_{in}	P_{out}	BV_{CBO}	BV_{CEO}	Gehäuse package
2N 5941	30	28		40PEP	65	35	DIA-4L
2N 5942	30	28		80PEP	65	35	DIA-4L
2N 5943	250	15	50 mA	7 dB	40	30	TO-39

f-- rr in MHz	I_{CES} @ V_{CE} (I_{CEO}) µA V	Gehäuse package	Anwendungen, Bemerkungen applications, remarks
		SOT-32	
		SOT-32	$P_{tot} = T_C$ 65 °C
		SOT-32	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	
		TO-66P	Verstärker und Schalter
		TO-66P	amplifier and switch
		TO-66P	
		TO-3P	
		TO-3P	
		TO-3P	
		TO-3P	
		TO-3P	
		TO-3P	
		TO-3P	
		TO-3P	
0,8		TO-66	Schalter, Verstärker, komplementär 2N 3054
0,8		TO-3	Schalter, Verstärker, komplementär 2N 3055