TYPES BD743, BD743A, BD743B, BD743C, BD743D
NPN SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

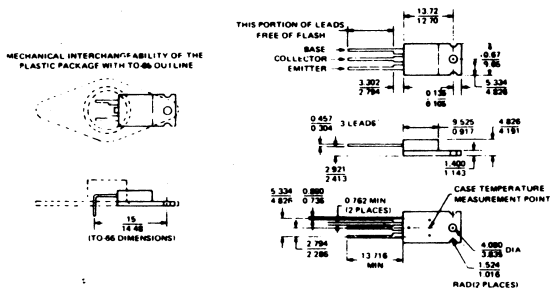
MARCH 78

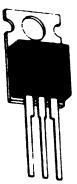
FOR POWER-AMPLIFIER AND HIGH-SPEED-SWITCHING APPLICATIONS
DESIGNED FOR COMPLEMENTARY USE WITH BD744 SERIES

- 90 W at 25 °C Case Temperature
- 15 A Rated Collector Current
- Min f_T of 5 MHz at 4 V, 1 A

mechanical data

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB





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

	BD743	BD743A	BD743B	BD743C	BD743D
Collector-Base Voltage	50 V	70 V	90 V	110 V	130 V
Collector-Emitter Voltage (See Note 1)	45 V	60 V	80 V	100 V	120 V
Emitter-Base Voltage	5 V	5 V	5 V	5 V	5 V
Continuous Collector Current	←		15 A		→
Peak Collector Current ($T_p \leq 300\ \mu s$, $d \leq 10\%$	←		20 A		→
Continuous Base Current	←		5 A		→
Safe Operating Region at (or below) 25 °C Case Temperature	←		See Figure 11		→
Continuous Device Dissipation at (or below) 25 °C Case Temperature (See Note 2)	←		90 W		→
Continuous Device Dissipation at (or below) 25 °C Free-Air Temperature (See Note 3)	←		2 W		→
Unclamped Inductive Load Energy (See Note 4)	←		90 mJ		→
Operating Collector Junction Temperature Range	←		−65 °C to 150 °C		→
Storage Temperature Range	←		−65 °C to 150 °C		→
Lead Temperature 3 mm from Case for 10 Seconds	←		260 °C		→

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. Derate linearly to 150 °C case temperature at the rate of 0.72 W/°C or refer to Dissipation Derating Curve, Figure 9.
3. Derate linearly to 150 °C free-air temperature at the rate of 16 mW/°C or refer to Dissipation Derating Curve, Figure 10.
4. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = 20 V. Energy $\approx I_C^2 L/2$.

TYPES BD743, BD743A, BD743B, BD743C, BD743D
NPN SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

electrical characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS	BD743		BD743A		BD743B		BD743C		BD743D		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 30 mA, I_B = 0, See Note 5	45		60		80		100		120		V
$V_{(BR)CEV}$	Collector-Emitter Breakdown Voltage	I_C = 30 mA, V_{BE} = −1.5 V, See Note 5	50		70		90		110		130		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 30 V, I_B = 0 V_{CE} = 60 V, I_B = 0		100		100		100		100		100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = 50 V V_{CB} = 70 V V_{CB} = 90 V V_{CB} = 110 V V_{CB} = 130 V		100		100		100		100		100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = V_{CB} rated, T_C = 125 °C		5		5		5		5		5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5 V, I_C = 0		500		500		500		500		500	μA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, See Notes 5 and 6	40		40		40		40		40		
		V_{CE} = 4 V, I_C = 5 A, See Notes 5 and 6	20	150	20	150	20	150	20	150	20	150	
		V_{CE} = 4 V, I_C = 15 A, See Notes 5 and 6	5		5		5		5		5		
V_{BE}	Base-Emitter Voltage	V_{CE} = 4 V, I_C = 5 A, See Notes 5 and 6		1		1		1		1		1	V
		V_{CE} = 4 V, I_C = 15 A, See Notes 5 and 6		3		3		3		3		3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = 0.5 A, I_C = 5 A, See Notes 5 and 6		1		1		1		1		1	V
		I_B = 5 A, I_C = 15 A, See Notes 5 and 6		3		3		3		3		3	V
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, f = 1 kHz	25		25		25		25		25		
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, f = 1 MHz	5		5		5		5		5		

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.

6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

thermal characteristics

PARAMETER		TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance		1.4	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance		62.5	°C/W
$R_{\theta CHS}$	Case-to-Heat-Sink Thermal Resistance (See Note 7)	0.7		°C/W
$C_{\theta C}$	Thermal Capacitance of Case	0.9		J/°C

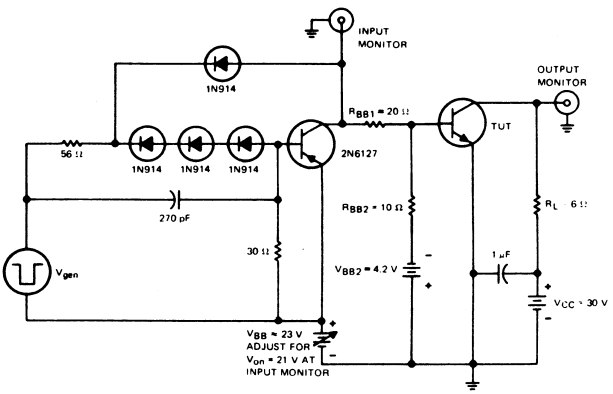
NOTE 7: This parameter is measured using a 78 μm mica insulator with Dow Corning II compound on both sides of the insulator, a M3 mounting screw with bushing, and a mounting torque of 10 kpcm.

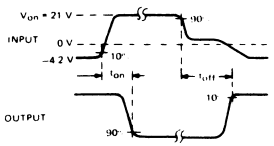
switching characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS+			TYP	UNIT
t_d	Delay Time	I_C = 5 A,	$I_{B(1)}$ = 500 mA,	$I_{B(2)}$ = −500 mA,	20	ns
t_r	Rise Time	$V_{BE(off)}$ = −4.2 V,	R_L = 6 Ω,	See Figure 1	350	
t_s	Storage Time				500	
t_f	Fall Time				400	

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

PARAMETER MEASUREMENT INFORMATION



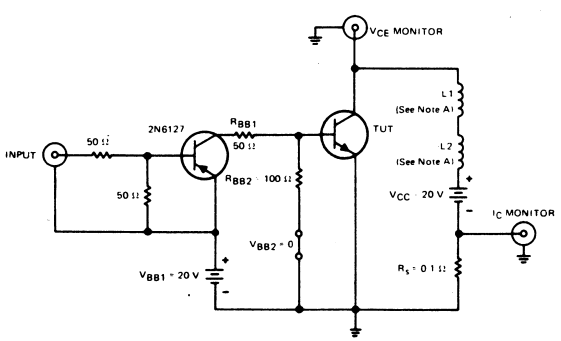


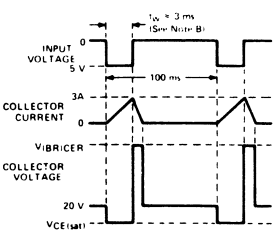
TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a −30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$, duty cycle ≤ 2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ M\Omega$, $C_{in} \leq 11.5$ pF.
D. Resistors must be noninductive types.
E. The d c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

INDUCTIVE LOAD SWITCHING





TEST CIRCUIT VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, Chicago Standard Transformer Corporation C 2688, or equivalent.
B. Input pulse width is increased until I_{CM} = 3A.

FIGURE 2

TYPICAL CHARACTERISTICS

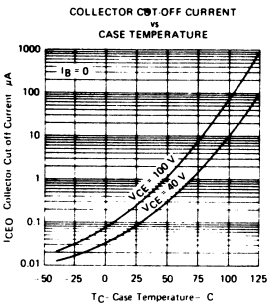


FIGURE 3

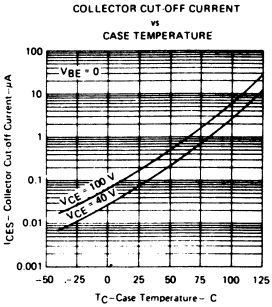


FIGURE 4

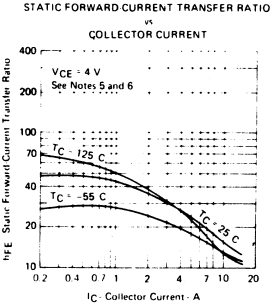


FIGURE 5

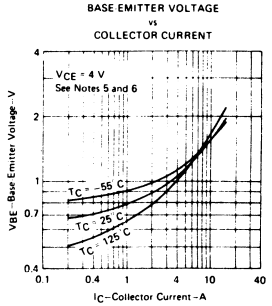


FIGURE 6

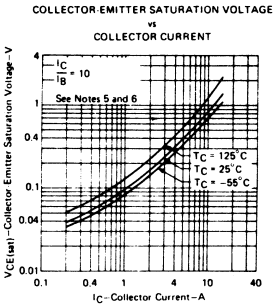


FIGURE 7

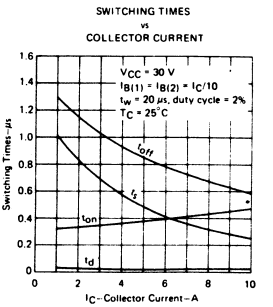


FIGURE 8

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 µs, duty cycle ≤ 2%.

6. These parameters are measured with voltage-sensing contacts seperate from the current-carrying contacts and located within 3 mm inch from the device body.

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

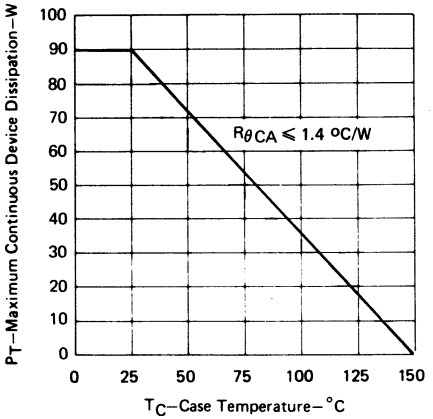


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

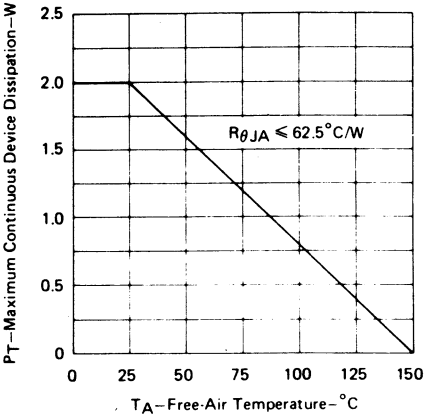


FIGURE 10

MAXIMUM SAFE OPERATING REGION

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

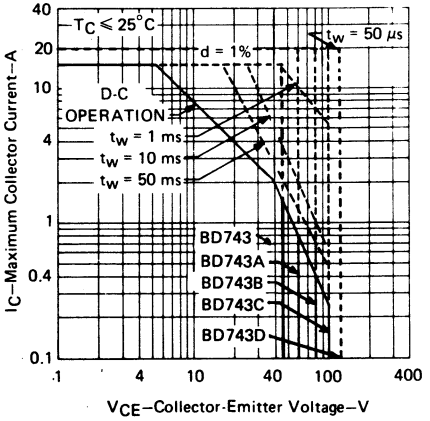


FIGURE 11

TYPES BD743, BD743A, BD743B, BD743C, BD743D
NPN SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

Single Diffused Silicon Power Transistors in Plastic Package — Product Selection Guide

V_{CEO} / I_C CONT	P_{TOT}	45 V	60 V	80 V	100 V	120 V	POLARITY	CASE
2 A	30 W	BD239 BD240	BD239A BD240A	BD239B BD240B	BD239C BD240C		NPN PNP	TO220
3 A	40 W	BD241 BD242	BD241A BD242A	BD241B BD242B	BD241C BD242C		NPN PNP	TO220
5 A	45 W	BD539 BD540	BD539A BD540A	BD539B BD540B	BD539C BD540C	BD539D BD540D	NPN PNP	TO220
6 A	65 W	BD243 BD244	BD243A BD244A	BD243B BD244B	BD243C BD244C		NPN PNP	TO220
8 A	70 W	BD543 BD544	BD543A BD544A	BD543B BD544B	BD543C BD544C	BD543D BD544D	NPN PNP	TO220
15 A	90 W	BD743 BD744	BD743A BD744A	BD743B BD744B	BD743C BD744C	BD743D BD744D	NPN PNP	TO220
10 A	80 W	BD245 BD246	BD245A BD246A	BD245B BD246B	BD245C BD246C		NPN PNP	TO3P
15 A	85 W	BD545 BD546	BD545A BD546A	BD545B BD546B	BD545C BD546C	BD545D BD546D	NPN PNP	TO3P
15 A	100 W		TIP3055 TIP2955				NPN PNP	TO3P
20 A	115 W	BD745 BD746	BD745A BD746A	BD745B BD746B	BD745C BD746C	BD745D BD746D	NPN PNP	TO3P
25 A	125 W	BD249 BD250	BD249A BD250A	BD249B BD250B	BD249C BD250C		NPN PNP	TO3P
30 A	150 W	TIP3771	TIP3772				NPN	TO3P

Single Diffused Silicon Power Darlingtons in Plastic Package — Product Selection Guide

V_{CEO} / I_C CONT	P_{TOT}	45 V	60 V	80 V	100 V	120 V	POLARITY	CASE
4 A	40 W	BDW53 BDW54	BDW53A BDW54A	BDW53B BDW54B	BDW53C BDW54C	BDW53D BDW54D	NPN PNP	TO220
4 A	50 W		TIP110 TIP115	TIP111 TIP116	TIP112 TIP117		NPN PNP	TO220
5 A	65 W		TIP120 TIP125	TIP121 TIP126	TIP122 TIP127		NPN PNP	TO220
6 A	60 W	BDW63 BDW64	BDW63A BDW64A	BDW63B BDW64B	BDW63C BDW64C	BDW63D BDW64D	NPN PNP	TO220
8 A	75 W		TIP130 TIP135	TIP131 TIP136	TIP132 TIP137		NPN PNP	TO220
8 A	80 W	BDW73 BDW74	BDW73A BDW74A	BDW73B BDW74B	BDW73C BDW74C	BDW73D BDW74D	NPN PNP	TO220
10 A	125 W		TIP140 TIP145	TIP141 TIP146	TIP142 TIP147		NPN PNP	TO3P
15 A	150 W	BDW83 BDW84	BDW83A BDW84A	BDW83B BDW84B	BDW83C BDW84C	BDW83D BDW84D	NPN PNP	TO3P

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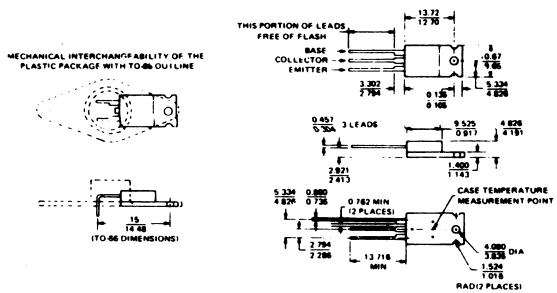
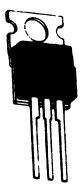


ALL DIMENSIONS ARE IN MILLIMETRES

FALLS WITHIN JEDEC TO-220 AB DIMENSIONS



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

	BD744	BD744A	BD744B	BD744C	BD744D
Collector-Base Voltage	−50 V	−70 V	−90 V	−110 V	−130 V
Collector-Emitter Voltage (See Note 1)	−45 V	−60 V	−80 V	−100 V	−120 V
Emitter-Base Voltage	−5 V	−5 V	−5 V	−5 V	−5 V
Continuous Collector Current	←		−15 A		→
Peak Collector Current ($T_p \leqslant 300\ \mu s$, $d \leqslant 10\%$	←		−20 A		→
Continuous Base Current	←		−5 A		→
Safe Operating Region at (or below) 25 °C Case Temperature	←		See Figure 11		→
Continuous Device Dissipation at (or below) 25 °C Case Temperature (See Note 2)	←		90 W		→
Continuous Device Dissipation at (or below) 25 °C Free-Air Temperature (See Note 3)	←		2 W		→
Unclamped Inductive Load Energy (See Note 4)	←		90 mJ		→
Operating Collector Junction Temperature Range	←		−65 °C to 150 °C		→
Storage Temperature Range	←		−65 °C to 150 °C		→
Lead Temperature 3 mm from Case for 10 Seconds	←		260 °C		→

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. Derate linearly to 150 °C case temperature at the rate of 0.72 W/°C or refer to Dissipation Derating Curve, Figure 9.
3. Derate linearly to 150 °C free-air temperature at the rate of 16 mW/°C or refer to Dissipation Derating Curve, Figure 10.
4. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = −20 V. Energy ≈ $I_C^2 L/2$.

TYPES BD744, BD744A, BD744B, BD744C, BD744D
PNP SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

electrical characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS	BD744		BD744A		BD744B		BD744C		BD744D		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = −30 mA, I_B = 0, See Note 5	−45		−60		−80		−100		−130		V
$V_{(BR)CEV}$	Collector-Emitter Breakdown Voltage	I_C = −30 mA, V_{BE} = 1.5 V, See Note 5	−50		−70		−90		−110		−130		V
I_{CEO}	Collector Cutoff Current	V_{CE} = −30 V, I_B = 0 V_{CE} = −60 V, I_B = 0		−100		−100		−100		−100		−100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = −50 V V_{CB} = −70 V V_{CB} = −90 V V_{CB} = −110 V V_{CB} = −130 V		−100		−100		−100		−100		−100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = V_{CB} rated, T_C = 125°C		−5		−5		−5		−5		−5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = −5 V, I_C = 0		−500		−500		−500		−500		−500	μA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, See Notes 5 and 6	40		40		40		40		40		
		V_{CE} = −4 V, I_C = −5 A, See Notes 5 and 6	20	150	20	150	20	150	20	150	20	150	
		V_{CE} = −4 V, I_C = −15 A, See Notes 5 and 6	5		5		5		5		5		
V_{BE}	Base-Emitter Voltage	V_{CE} = −4 V, I_C = −5 A, See Notes 5 and 6		−1		−1		−1		−1		−1	V
		V_{CE} = −4 V, I_C = −15 A, See Notes 5 and 6		−3		−3		−3		−3		−3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = −0.5 A, I_C = −5 A, See Notes 5 and 6		−1		−1		−1		−1		−1	V
		I_B = −5 A, I_C = −15 A, See Notes 5 and 6		−3		−3		−3		−3		−3	V
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, f = 1 kHz	25		25		25		25		25		
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, f = 1 MHz	5		5		5		5		5		

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

thermal characteristics

PARAMETER		TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance		1.4	°C/W
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$R_{\theta CHS}$	Case-to-Heat-Sink Thermal Resistance (See Note 7)	0.7		°C/W
$C_{\theta C}$	Thermal Capacitance of Case	0.9		J/°C

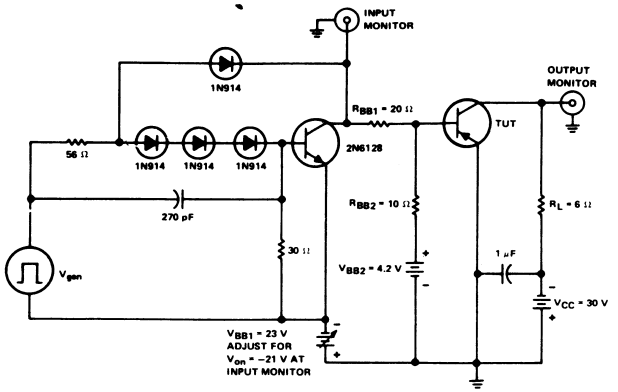
NOTE 7: This parameter is measured using a 78 μm mica insulator with Dow Corning II compound on both sides of the insulator, a M3 mounting screw with bushing, and a mounting torque of 10 kpcm.

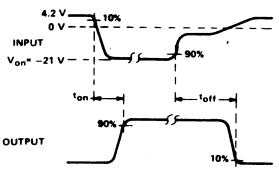
switching characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS †			TYP	UNIT
t_d	Delay Time	I_C = −5 A,	$I_{B(1)}$ = −500 mA,	$I_{B(2)}$ = 500 mA,	20	ns
t_r	Rise Time	$V_{BE(off)}$ = 4.2 V,	R_L = 6 Ω,	See Figure 1	120	
t_s	Storage Time				600	
t_f	Fall Time				300	

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

PARAMETER MEASUREMENT INFORMATION





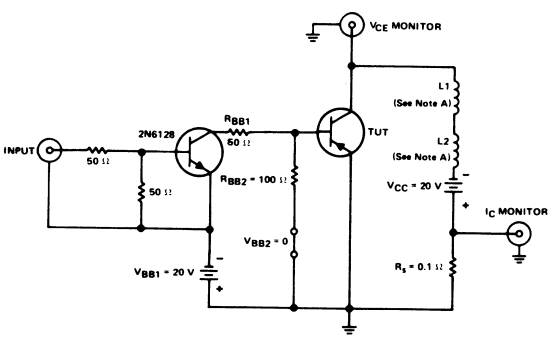
TEST CIRCUIT

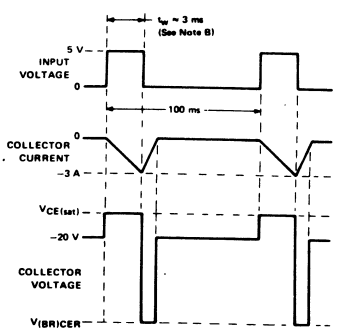
VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a 30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leqslant 15$ ns, $t_f \leqslant 15$ ns, Z_{out} = 50 Ω, t_w = 20 μs, duty cycle ≤2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leqslant 15$ ns, $R_{in} \geqslant 10$ MΩ, $C_{in} \leqslant 11.5$ pF.
D. Resistors must be noninductive types.
E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

INDUCTIVE LOAD SWITCHING





TEST CIRCUIT

VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, Chicago Standard Transformer Corporation C-2688, or equivalent.
B. Input pulse width is increased until I_{CM} = −3 A

FIGURE 2

TYPICAL CHARACTERISTICS

COLLECTOR CUT-OFF CURRENT vs CASE TEMPERATURE

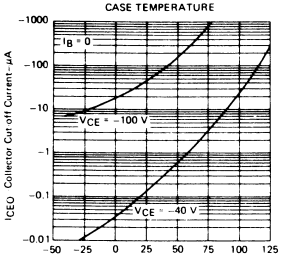


FIGURE 3

COLLECTOR CUT-OFF CURRENT vs CASE TEMPERATURE

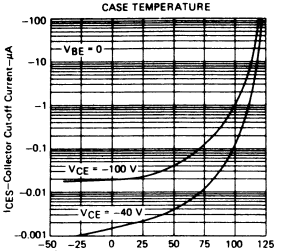


FIGURE 4

STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

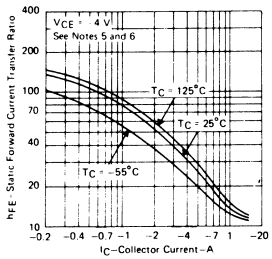


FIGURE 5

BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT

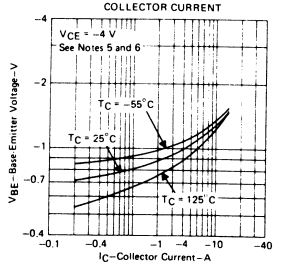


FIGURE 6

COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT

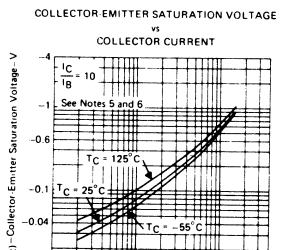


FIGURE 7

SWITCHING TIMES vs COLLECTOR CURRENT

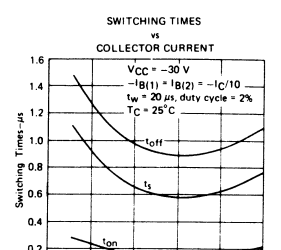


FIGURE 8

NOTES. 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

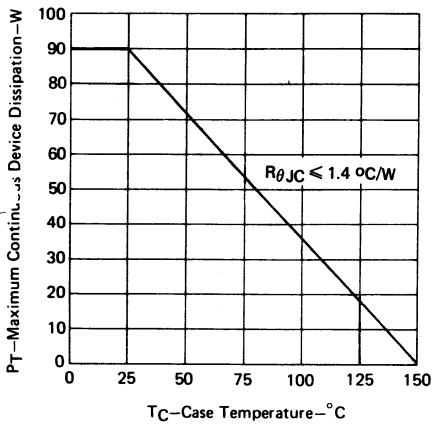


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

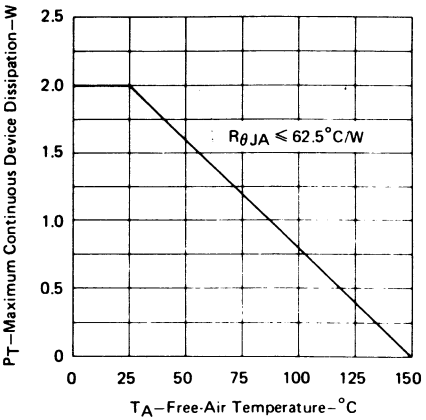


FIGURE 10

MAXIMUM SAFE OPERATION REGION

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

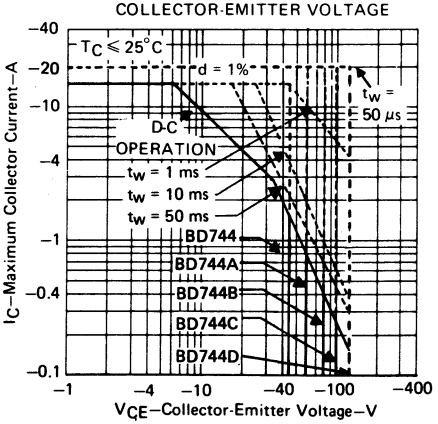


FIGURE 11

TYPES BD745, BD745A, BD745B, BD745C, BD745D
NPN SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

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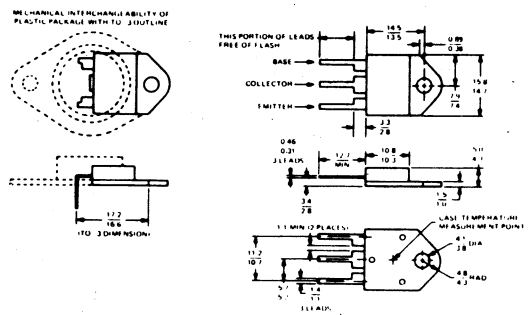
FOR POWER-AMPLIFIER AND HIGH-SPEED-SWITCHING APPLICATIONS
DESIGNED FOR COMPLEMENTARY USE WITH BD746 SERIES

- **115 W at 25 °C Case Temperature**
- **20 A Rated Collector Current**
- **Min f_T of 5 MHz at 4 V, 1 A**

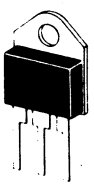
mechanical data

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB



TO 3 P

ALL DIMENSIONS ARE IN MILLIMETRES



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

	BD745	BD745A	BD745B	BD745C	BD745D
Collector-Base Voltage	50 V	70 V	90 V	110 V	130 V
Collector-Emitter Voltage (See Note 1)	45 V	60 V	80 V	100 V	120 V
Emitter-Base Voltage	5 V	5 V	5 V	5 V	5 V
Continuous Collector Current	←		20 A		→
Peak Collector Current ($T_p \leq 300\ \mu s$, $d \leq 10\%$	←		25 A		→
Continuous Base Current	←		5 A		→
Safe Operating Region at (or below) 25 °C Case Temperature	←		See Figure 11		→
Continuous Device Dissipation at (or below) 25 °C Case Temperature (See Note 2)	←		115 W		→
Continuous Device Dissipation at (or below) 25 °C Free-Air Temperature (See Note 3)	←		3.5 W		→
Unclamped inductive Load Energy (See Note 4)	←		90 mJ		→
Operating Collector Junction Temperature Range	←		–65 °C to 150 °C		→
Storage Temperature Range	←		–65 °C to 150 °C		→
Lead Temperature 3 mm from Case for 10 Seconds	←		260 °C		→

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. Derate linearly to 150 °C case temperature at the rate of 0.92 W/°C or refer to Dissipation Derating Curve, Figure 9.
3. Derate linearly to 150 °C free-air temperature at the rate of 28 mW/°C or refer to Dissipation Derating Curve, Figure 10.
4. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = 20 V. Energy $\approx I_C^2 L/2$.

TYPES BD745, BD745A, BD745B, BD745C, BD745D
NPN SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

electrical characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS	BD745		BD745A		BD745B		BD745C		BD745D		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 30 mA, I_B = 0, See Note 5	45		60		80		100		120		V
$V_{(BR)CEV}$	Collector-Emitter Breakdown Voltage	I_C = 30 mA, V_{BE} = −1.5 V, See Note 5	50		70		90		110		130		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 30 V, I_B = 0 V_{CE} = 60 V, I_B = 0		100		100		100		100		100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = 50 V V_{CB} = 70 V V_{CB} = 90 V V_{CB} = 110 V V_{CB} = 130 V		100		100		100		100		100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = V_{CB} rated T_C = 125°C		5		5		5		5		5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5 V, I_C = 0		500		500		500		500		500	μA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, See Notes 5 and 6	40		40		40		40		40		
		V_{CE} = 4 V, I_C = 5 A, See Notes 5 and 6	20	150	20	150	20	150	20	150	20	150	
		V_{CE} = 4 V, I_C = 20 A, See Notes 5 and 6	5		5		5		5		5		
V_{BE}	Base-Emitter Voltage	V_{CE} = 4 V, I_C = 5 A, See Notes 5 and 6		1		1		1		1		1	V
		V_{CE} = 4 V, I_C = 20 A, See Notes 5 and 6		3		3		3		3		3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = 0.5 A, I_C = 5 A, See Notes 5 and 6		1		1		1		1		1	V
		I_B = 5 A, I_C = 20 A, See Notes 5 and 6		3		3		3		3		3	V
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, f = 1 kHz	25		25		25		25		25		
$\lvert h_{fe} \rvert$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 4 V, I_C = 1 A, f = 1 MHz	5		5		5		5		5		

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

thermal characteristics

PARAMETER		TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance		1.1	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance		35.7	°C/W
$R_{\theta CHS}$	Case-to-Heat-Sink Thermal Resistance (See Note 7)	0.6		°C/W
$C_{\theta C}$	Thermal Capacitance of Case	1.4		J/°C

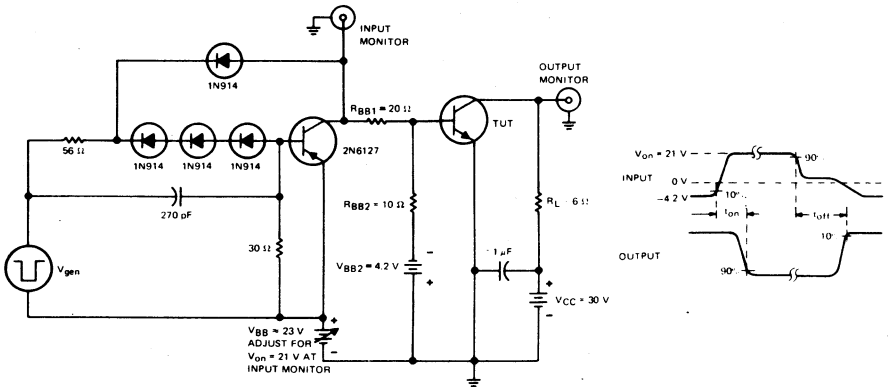
NOTE 7: This parameter is measured using a 78 μm mica insulator with Dow Corning II compound on both sides of the insulator, a M3 mounting screw with bushing, and a mounting torque of 10 kpcm.

switching characteristics at 25 °C case temperature

	PARAMETER	TEST CONDITIONS +	TYP	UNIT
t_d	Delay Time	I_C = 5 A, $I_{B(1)}$ = 500 mA, $I_{B(2)}$ = −500 mA $V_{BE(off)}$ = −4.2 V, R_L = 6 Ω, See Figure 1	20	ns
t_r	Rise Time		350	
t_s	Storage Time		500	
t_f	Fall Time		400	

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

PARAMETER MEASUREMENT INFORMATION

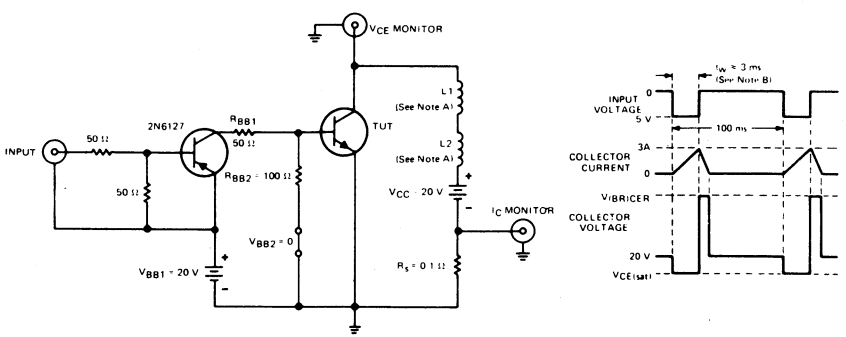


TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a −30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$, duty cycle ≤ 2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ M\Omega$, $C_{in} \leq 11.5$ pF.
D. Resistors must be noninductive types.
E. The d c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

INDUCTIVE LOAD SWITCHING



TEST CIRCUIT VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, Chicago Standard Transformer Corporation C 2688, or equivalent.
B. Input pulse width is increased until I_{CM} = 3A.

FIGURE 2

TYPICAL CHARACTERISTICS

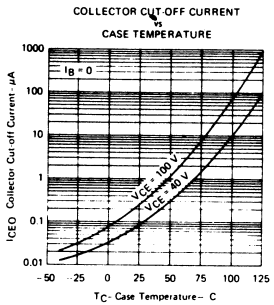


FIGURE 3

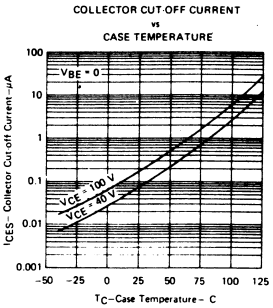


FIGURE 4

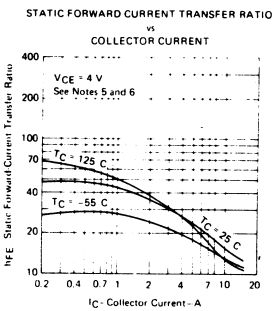


FIGURE 5

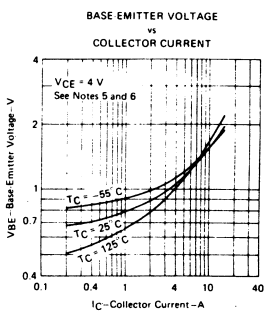


FIGURE 6

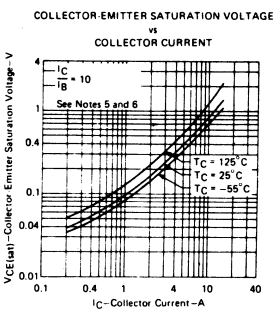


FIGURE 7

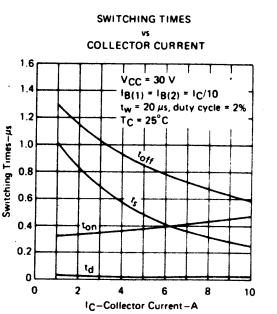


FIGURE 8

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

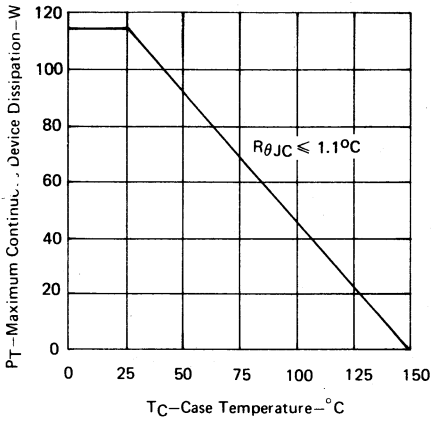


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

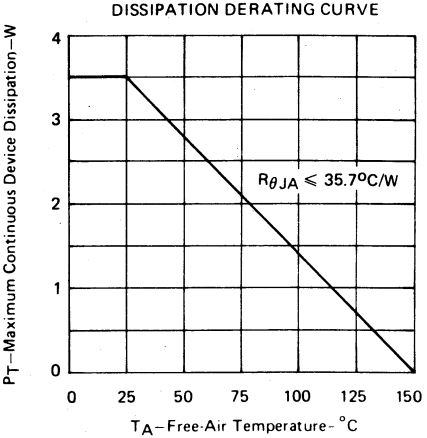


FIGURE 10

MAXIMUM SAFE OPERATION REGION

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

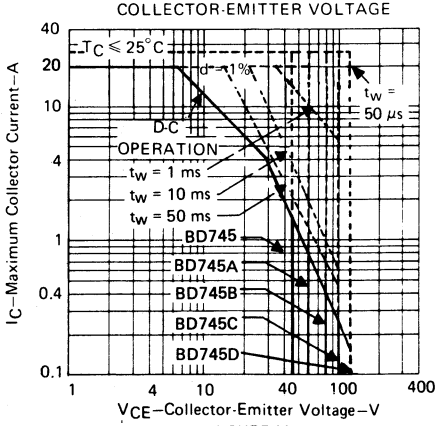


FIGURE 11

TYPES BD746, BD746A, BD746B, BD746C, BD746D
PNP SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

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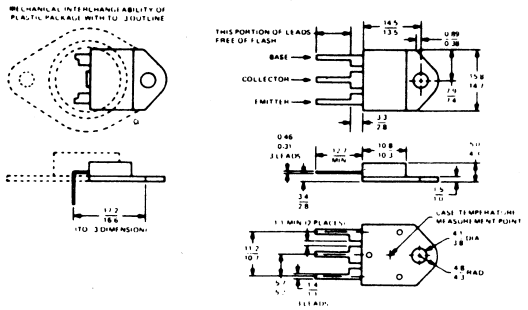
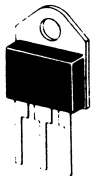
FOR POWER-AMPLIFIER AND HIGH-SPEED-SWITCHING APPLICATIONS
DESIGNED FOR COMPLEMENTARY USE WITH BD745 SERIES

- **115 W at 25 °C Case Temperature**
- **20 A Rated Collector Current**
- **Min f_T of 5 MHz at 4 V, 1 A**

mechanical data

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB





TO 3 P

ALL DIMENSIONS ARE IN MILLIMETRES

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

	BD746	BD746A	BD746B	BD746C	BD746D
Collector-Base Voltage	−50 V	−70 V	−90 V	−110 V	−130 V
Collector-Emitter Voltage (See Note 1)	−45 V	−60 V	−80 V	−100 V	−120 V
Emitter-Base Voltage	−5 V	−5 V	−5 V	−5 V	−5 V
Continuous Collector Current	←		−20 A		→
Peak Collector Current ($T_p \leqslant 300\ \mu s$, $d \leqslant 10\%$	←		−25 A		→
Continuous Base Current	←		−5 A		→
Safe Operating Region at (or below) 25 °C Case Temperature	←		See Figure 11		→
Continuous Device Dissipation at (or below) 25 °C Case Temperature (See Note 2)	←		115 W		→
Continuous Device Dissipation at (or below) 25 °C Free-Air Temperature (See Note 3)	←		3.5 W		→
Unclamped Inductive Load Energy (See Note 4)	←		90 mJ		→
Operating Collector Junction Temperature Range	←		−65 °C to 150 °C		→
Storage Temperature Range	←		−65 °C to 150 °C		→
Lead Temperature 3 mm from Case for 10 Seconds	←		260 °C		→

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. Derate linearly to 150 °C case temperature at the rate of 0.92 W/°C or refer to Dissipation Derating Curve, Figure 9.
3. Derate linearly to 150 °C free-air temperature at the rate of 28 mW/°C or refer to Dissipation Derating Curve, Figure 10.
4. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = −20 V, Energy ≈ $I_C^2 L/2$.

TYPES BD746, BD746A, BD746B, BD746C, BD746D
PNP SINGLE-DIFFUSED EPITAXIAL BASE POWER TRANSISTORS

electrical characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS	BD746		BD746A		BD746B		BD746C		BD746D		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = −30 mA, I_B = 0, See Note 5	−45		−60		−80		−100		−120		V
$V_{(BR)CEV}$	Collector-Emitter Breakdown Voltage	I_C = −30 mA, V_{BE} = 1.5 V See Note 5	−50		−70		−90		−110		−130		V
I_{CEO}	Collector Cutoff Current	V_{CE} = −30 V, I_B = 0 V_{CE} = −60 V, I_B = 0		−100		−100		−100		−100		−100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = −50 V V_{CB} = −70 V V_{CB} = −90 V V_{CB} = −110 V V_{CB} = −130 V		−100		−100		−100		−100		−100	μA
I_{CBO}	Collector Cutoff Current	V_{CB} = V_{CO} rated, T_C = 125°C		−5		−5		−5		−5		−5	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = −5 V, I_C = 0		−500		−500		−500		−500		−500	μA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, See Notes 5 and 6	40		40		40		40		40		
		V_{CE} = −4 V, I_C = −5 A, See Notes 5 and 6	20	150	20	150	20	150	20	150	20	150	
		V_{CE} = −4 V, I_C = −20 A, See Notes 5 and 6	5		5		5		5		5		
V_{BE}	Base-Emitter Voltage	V_{CE} = −4 V, I_C = −5 A, See Notes 5 and 6		−1		−1		−1		−1		−1	V
		V_{CE} = −4 V, I_C = −20 A, See Notes 5 and 6		−3		−3		−3		−3		−3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = −0.5 A, I_C = −5 A, See Notes 5 and 6		−1		−1		−1		−1		−1	V
		I_B = −5 A, I_C = −20 A, See Notes 5 and 6		−3		−3		−3		−3		−3	V
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, f = 1 kHz	25		25		25		25		25		
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = −4 V, I_C = −1 A, f = 1 MHz	5		5		5		5		5		

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ⩽2%.
6. These parameters are measured with voltage-sensing contacts separate from the current carrying contacts and located within 3 mm from the device body.

thermal characteristics

PARAMETER		TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance		1.1	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance		35.7	°C/W
$R_{\theta CHS}$	Case-to-Heat-Sink Thermal Resistance (See Note 7)	0.6		°C/W
$C_{\theta C}$	Thermal Capacitance of Case	1.4		J/°C

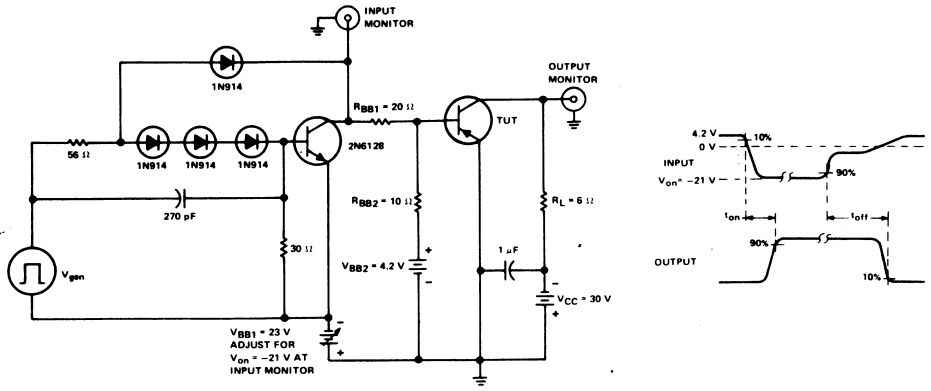
NOTE 7: This parameter is measured using a 78 μm mica insulator with Dow Corning II compound on both sides of the insulator, a M3 mounting screw with bushing, and a mounting torque of 10 kpcm.

switching characteristics at 25 °C case temperature

PARAMETER		TEST CONDITIONS+			TYP	UNIT
t_d	Delay Time				20	ns
t_r	Rise Time	I_C = −5 A,	$I_{B(1)}$ = −500 mA,	$I_{B(2)}$ = 500 mA,	120	
t_s	Storage Time	$V_{BE(off)}$ = 4.2 V,	R_L = 6 Ω,	See Figure 1	600	
t_f	Fall Time				300	

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

PARAMETER MEASUREMENT INFORMATION

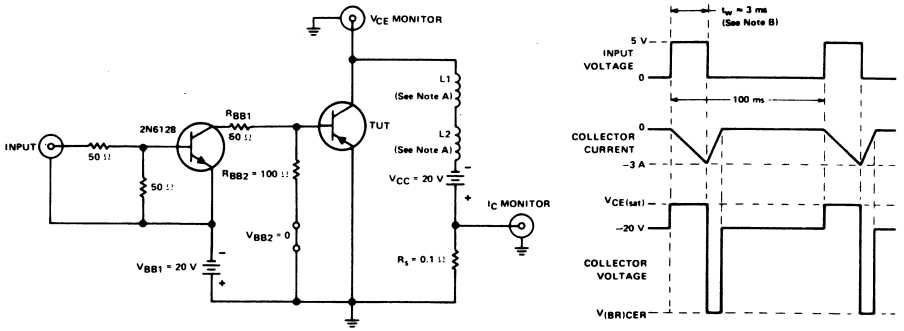


TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a 30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$ duty cycle ≤2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ M\Omega$, $C_{in} \leq 11.5$ pF.
D. Resistors must be noninductive types.
E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

INDUCTIVE LOAD SWITCHING



TEST CIRCUIT VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, Chicago Standard Transformer Corporation C 2688, or equivalent.
B. Input pulse width is increased until $I_{CM} = -3$ A

FIGURE 2

TYPICAL CHARACTERISTICS

COLLECTOR CUT-OFF CURRENT vs CASE TEMPERATURE

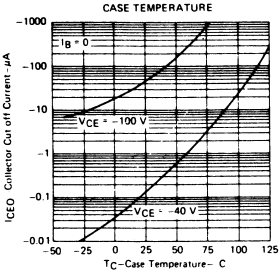


FIGURE 3

COLLECTOR CUT-OFF CURRENT vs CASE TEMPERATURE

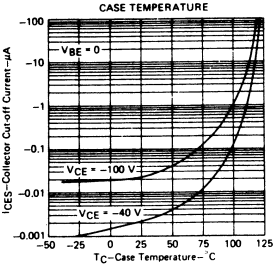


FIGURE 4

STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

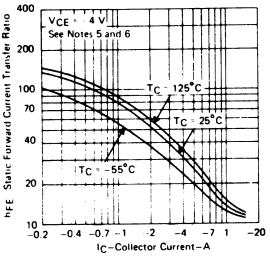


FIGURE 5

BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT

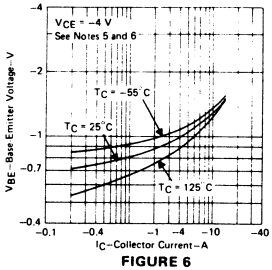


FIGURE 6

COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT

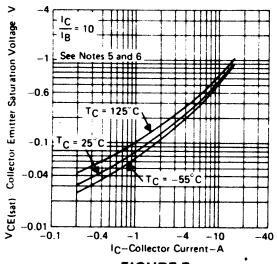


FIGURE 7

SWITCHING TIMES vs COLLECTOR CURRENT

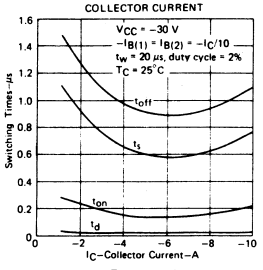


FIGURE 8

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ⩽2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3 mm from the device body.

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

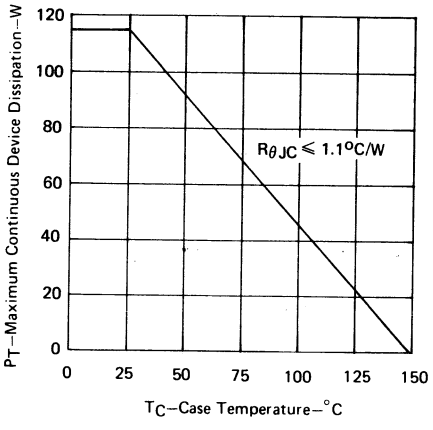


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

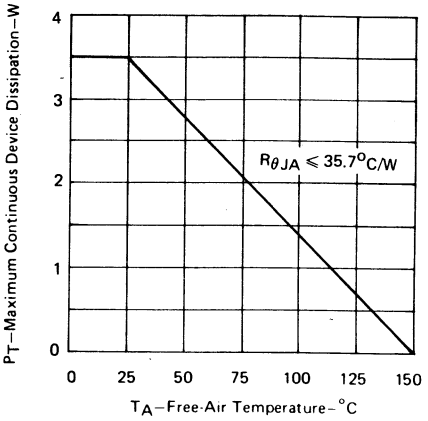


FIGURE 10

MAXIMUM SAFE OPERATION REGION

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

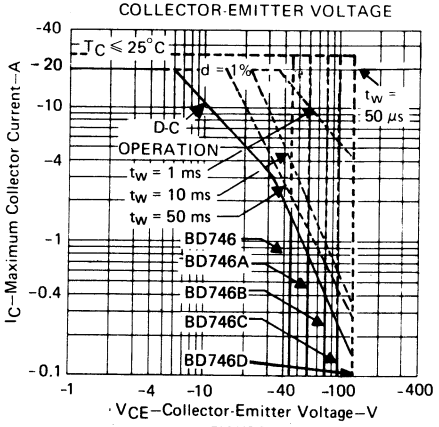


FIGURE 11