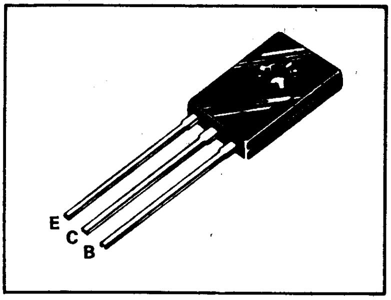
BD775 BD776
BD777 BD778
BD779 BD780

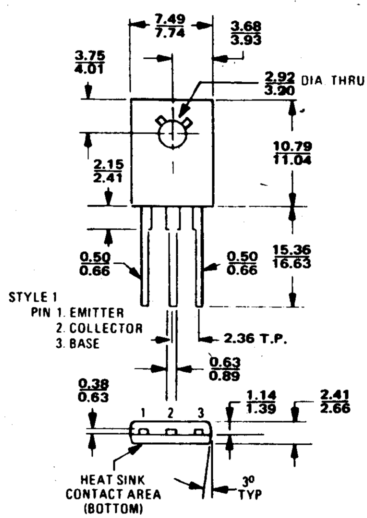
PLASTIC DARLINGTON COMPLEMENTARY SILICON ANNULAR◇ POWER TRANSISTORS

. . . designed for general purpose amplifier and high-speed switching applications such as hammer drivers for desk calculators.

- High DC Current Gain
  h_{FE} = 1400 (Typ) @ I_C = 2.0 Adc
- Collector-Emitter Sustaining Voltage – @ 10 mAdc
  V_{CEO} (sus) = 45 Vdc (Min) – BD775, 776
  = 60 Vdc (Min) – BD777, 778
  = 80 Vdc (Min) – BD779, 780
- Reverse Voltage Protection Diode
- Monolithic Construction with Built-in Base-Emitter output Resistor
- Thermopad II△ Construction with Hard Solder for High Reliability.

DARLINGTON
4-AMPERE
COMPLEMENTARY SILICON
POWER TRANSISTORS
45, 60, 80 VOLTS
15 WATTS





When mounting the device, torque not to exceed 0.07 m-kg

If lead bending is required, use suitable clamps or other supports between transistor case and point of bend.

All dimensions in millimeters

CASE 77-04

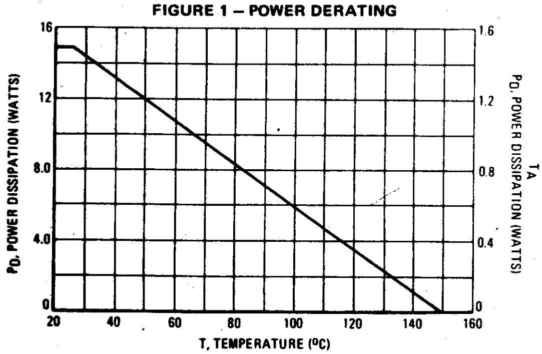
MAXIMUM RATINGS

Rating	Symbol	BD775 BD776	BD777 BD778	BD779 BD780	Unit
Collector-Emitter Voltage	V_{CEO}	45	60	80	Vdc
Collector-Base Voltage	V_{CB}	45	60	80	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current – Continuous Peak	I_C	4.0 6.0			Adc
Base Current	I_B	100			mAdc
Total Device Dissipation T_C = 25°C – Derate above 25°C	P_D	15 0.12			Watts W/°C
Operating and Storage junction Temperature Range	T_J, T_{stg} T_J, T_{stg}	– 65 to +150			°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Max.	Unit
Thermal Resistance, Junction to Case	$R\theta JC$	8.34	°C/W
Thermal Resistance, junction to Ambient	$R\theta JA$	83.3	°C/W

FIGURE 1 – POWER DERATING



◇ Annular Semiconductors Patented by Motorola Inc.
△ Trademark of Motorola Inc.

NPN

BD 785 BD 787

PNP

BD 786 BD 788

COMPLEMENTARY PLASTIC SILICON ANNULAR♦ POWER TRANSISTORS

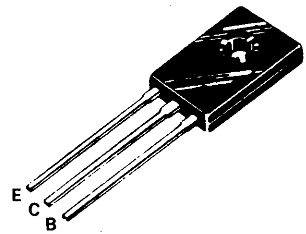
. . . designed for low power audio amplifier and low current, high-speed switching applications.

- Low Collector-Emitter Sustaining Voltage –
  $V_{CEO(sus)}$ 45 Vdc (Min) – BD785, BD786
  60 Vdc (Min) – BD787, BD788
- High Current-Gain – Bandwidth Product –
  f_T = 50 MHz (Min) @ I_C = 100 mAdc
- DC Current Gain Specified at 0.2, 1.0, 2.0 and 4.0 Adc
- Collector-Emitter Saturation Voltage Specified at 0.5, 1.0, 2.0 and 4.0 Adc

4 AMPERE POWER TRANSISTORS

COMPLEMENTARY SILICON

45, 60 VOLTS
15 WATTS



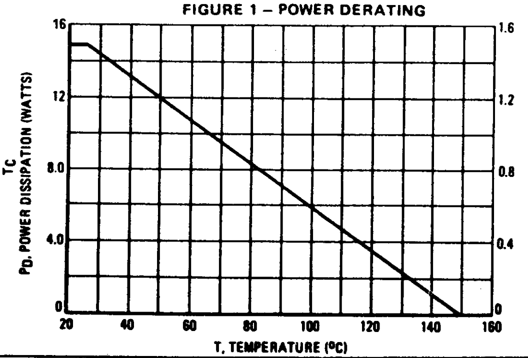
*MAXIMUM RATINGS

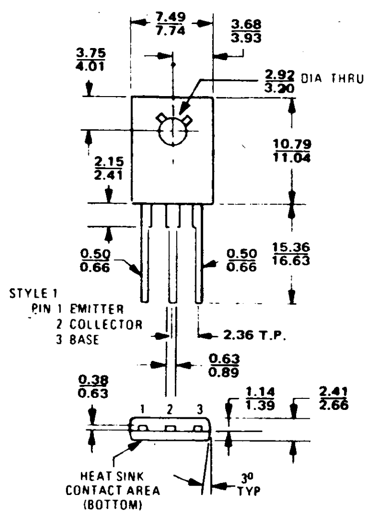
Rating	Symbol	BD785 BD786	BD787 BD788	Unit
Collector-Emitter Voltage	V_{CEO}	45	60	Vdc
Collector-Base Voltage	V_{CBO}	60	80	Vdc
Emitter-Base Voltage	V_{EBO}	6.0		Vdc
Collector Current – Continuous – Peak	I_C	4.0 8.0		Adc Adc
Base Current	I_B	1.0		Adc
Total Power Dissipation @ T_C = 25°C Derate Above 25°C	P_D	15 0.12		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	8.34	°C/W

FIGURE 1 – POWER DERATING





When mounting the device, torque not to exceed 0.07 m-kg

If lead bending is required, use suitable clamps or other supports between transistor case and point of bend.

All dimensions in millimeters

CASE 77-04

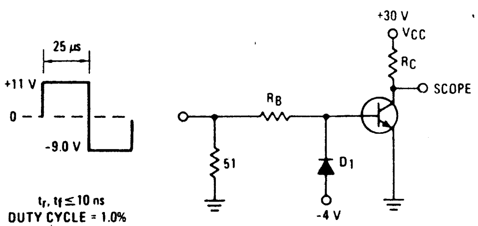
3

*ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (1)		$V_{CEO(sus)}$			Vdc
(I_C = 10 mAdc, I_B = 0)	BD785, BD786		45	–	
	BD787, BD788		60	–	
Collector Cutoff Current		I_{CEO}			μAdc
(V_{CE} = 20 Vdc, I_B = 0)	BD785, BD786		–	100	
(V_{CE} = 30 Vdc, I_B = 0)	BD787, BD788		–	100	
Collector Cutoff Current		I_{CEX}			
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	BD785, BD786		–	1.0	μAdc
(V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	BD787, BD788		–	1.0	
(V_{CE} = 30 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)	BD785, BD786		–	0.1	mAdc
(V_{CE} = 40 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C	BD787, BD788		–	0.1	
Emitter Cutoff Current (V_{EB} = 6.0 Vdc, I_C = 0)		I_{EBO}	–	1.0	μAdc
ON CHARACTERISTICS (1)					
DC Current Gain		h_{FE}			–
(I_C = 200 mAdc, V_{CE} = 3.0 Vdc)			40	250	
(I_C = 1.0 Adc, V_{CE} = 3.0 Vdc)			25	–	
(I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)			20	–	
(I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)			5.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 500 mAdc, I_B = 50 mAdc)			–	0.4	
(I_C = 1.0 Adc, I_B = 100 mAdc)			–	0.6	
(I_C = 2.0 Adc, I_B = 200 mAdc)			–	0.8	
(I_C = 4.0 Adc, I_B = 800 mAdc)			–	2.5	
Base-Emitter Saturation Voltage (I_C = 2.0 Adc, I_B = 200 mAdc)		$V_{BE(sat)}$	–	2.0	Vdc
Base-Emitter on Voltage (I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)		$V_{BE(on)}$	–	1.8	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain – Bandwidth Product (I_C = 100 mAdc, V_{CE} = 10 Vdc, f = 10 MHz)		f_T	50	–	MHz
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_C = 0)	BD785, BD787		–	50	
f = 0.1 MHz)	BD786, BD788		–	70	
Small-Signal Current Gain (I_C = 200 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	10	–	–

*Indicates JEDEC Registered Data.
(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

FIGURE 2 – SWITCHING TIME TEST CIRCUIT



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS

D_1 MUST BE FAST RECOVERY TYPE, eg:
MBD5300 USED ABOVE I_B ≈100 mA
MSD6100 USED BELOW I_B ≈100 mA

FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES

FIGURE 3 – TURN-ON TIME

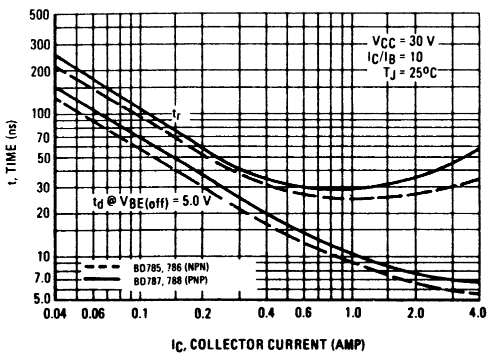


FIGURE 4 – THERMAL RESPONSE

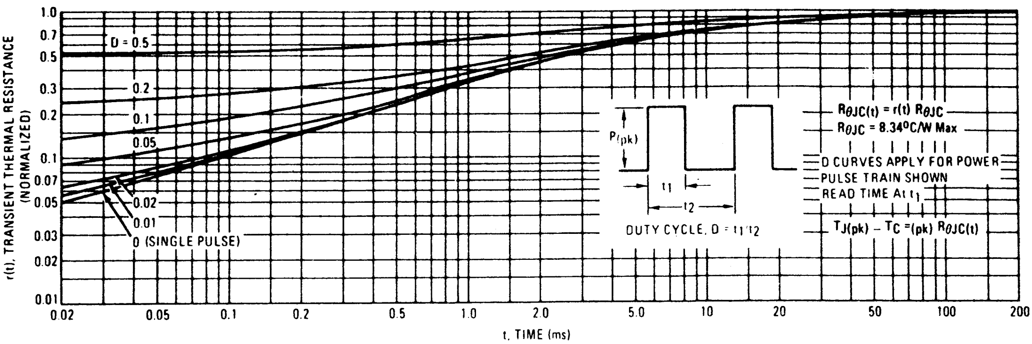
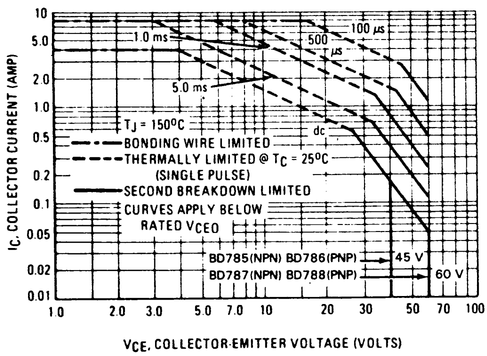


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor average junction temperature and second breakdown. Safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 150^oC$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^oC$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. (See AN-415A)

FIGURE 6 – TURN-OFF TIME

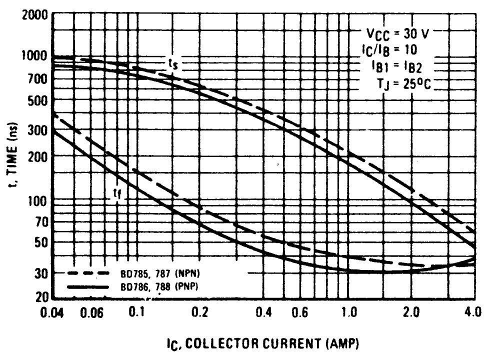
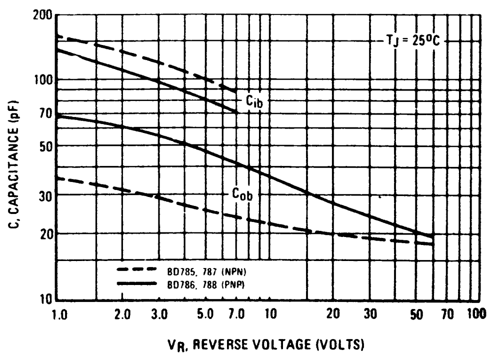


FIGURE 7 – CAPACITANCE

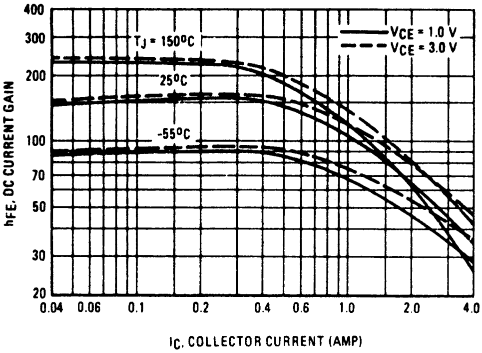


3

NPN BD785, BD787

PNP BD786, BD788

FIGURE 8 – DC CURRENT GAIN



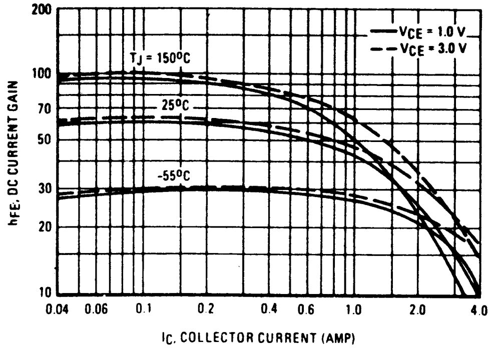
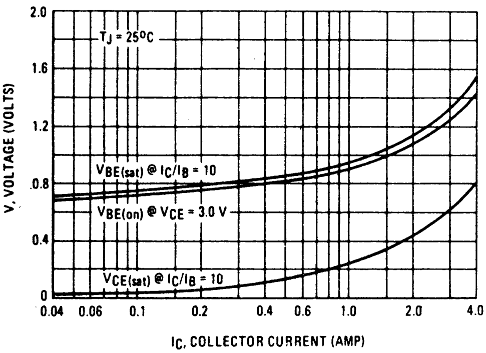


FIGURE 9 – "ON" VOLTAGES



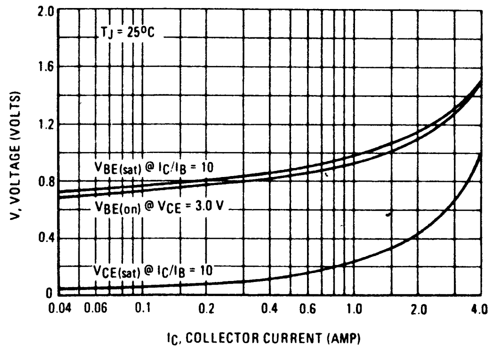
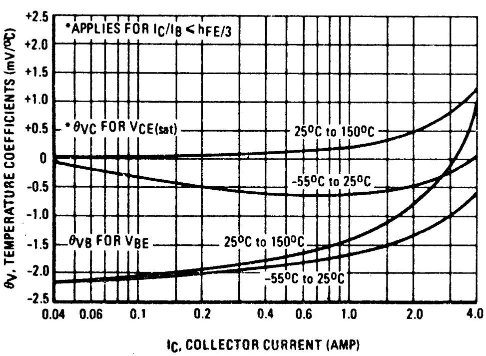
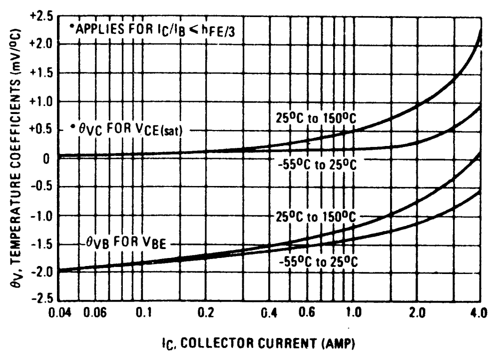


FIGURE 10 – TEMPERATURE COEFFICIENTS





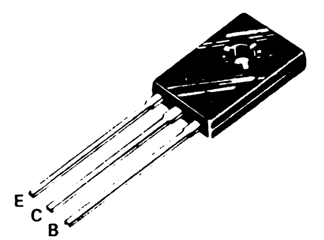
NPN
BD 789 BD 791
PNP
BD 790 BD 792

COMPLEMENTARY PLASTIC SILICON ANNULAR♦ POWER TRANSISTORS

. . . designed for low power audio amplifier and low-current, high speed switching applications.

- High Collector-Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 80 Vdc (Min) — BD789, BD790
  = 100 Vdc (Min) —BD791, BD792
- High DC Current Gain @ I_C = 200 mAdc
  h_{FE} = 40-250
- Low Collector-Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 0.5 Vdc (Max) @ I_C = 500 mAdc
- High Current Gain — Bandwidth Product —
  f_T = 40 MHz (Min) @ I_C = 100 mAdc)

4 AMPERE
POWER TRANSISTORS
COMPLEMENTARY SILICON
80, 100 VOLTS
15 WATTS



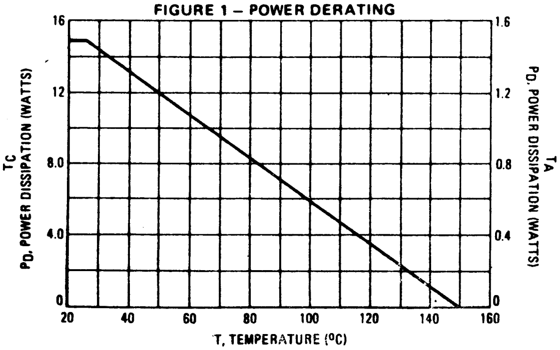
*MAXIMUM RATINGS

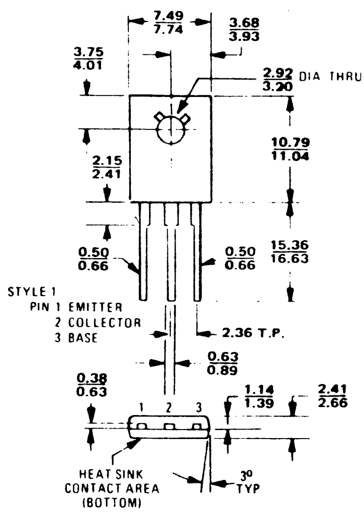
Rating	Symbol	BD789 BD790	BD791 BD792	Unit
Collector-Emitter Voltage	V_{CEO}	80	100	Vdc
Collector-Base Voltage	V_{CB}	80	100	Vdc
Emitter-Base Voltage	V_{EBO}	6.0		Vdc
Collector Current — Continuous — Peak	I_C	4.0 8.0		Adc
Base Current	I_B	1.0		Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	15 0.12		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	8.34	°C/W

FIGURE 1 — POWER DERATING





When mounting the device, torque not to exceed 0.07 m-kg

If lead bending is required, use suitable clamps or other supports between transistor case and point of bend.
All dimensions in millimeters

CASE 77-04

***ELECTRICAL CHARACTERISTICS** (T_C = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (1) (I_C = 10 mAdc, I_B = 0)	BD789, BD790	$V_{CEO(sus)}$	80	–	Vdc
	BD791, BD792		100	–	
Collector Cutoff Current (V_{CE} = 40 Vdc, I_B = 0)	BD789, BD790	I_{CEO}	–	100	µAdc
(V_{CE} = 50 Vdc, I_B = 0)	BD791, BD792		–	100	
Collector Cutoff Current (V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	BD789, BD790	I_{CEX}	–	1.0	µAdc
(V_{CE} = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	BD791, BD792		–	1.0	
(V_{CE} = 40 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)	BD789, BD790		–	0.1	mAdc
(V_{CE} = 50 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)	BD791, BD792		–	0.1	
Emitter Cutoff Current (V_{EB} = 6.0 Vdc, I_C = 0)		I_{EBO}	–	1.0	µAdc
ON CHARACTERISTICS (1)					
DC Current Gain		h_{FE}			–
(I_C = 200 mAdc, V_{CE} = 3.0 Vdc)			40	250	
(I_C = 1.0 Adc, V_{CE} = 3.0 Vdc)			20	–	
(I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)			10	–	
(I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)			5.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 500 mAdc, I_B = 50 mAdc)			–	0.5	
(I_C = 1.0 Adc, I_B = 100 mAdc)			–	1.0	
(I_C = 2.0 Adc, I_B = 200 mAdc)			–	2.5	
(I_C = 4.0 Adc, I_B = 800 mAdc)			–	3.0	
Base-Emitter Saturation Voltage (I_C = 2.0 Adc, I_B = 200 mAdc)		$V_{BE(sat)}$	–	1.8	Vdc
Base-Emitter On Voltage (I_C = 200 mAdc, V_{CE} = 3.0 Vdc)		$V_{BE(on)}$	–	1.5	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 100 mAdc, V_{CE} = 10 Vdc, f = 10 MHz)		f_T	40	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_C = 0, f = 0.1 MHz	BD789, BD791	C_{ob}	–	50	pF
	BD790, BD792		–	70	
Small-Signal Current Gain (I_C = 200 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	10	–	–

*Indicates JEDEC Registered Data.
(1) Pulse Test: Pulse Width ≤300 µs, Duty Cycle ≤2.0%.

FIGURE 2 – SWITCHING TIME TEST CIRCUIT

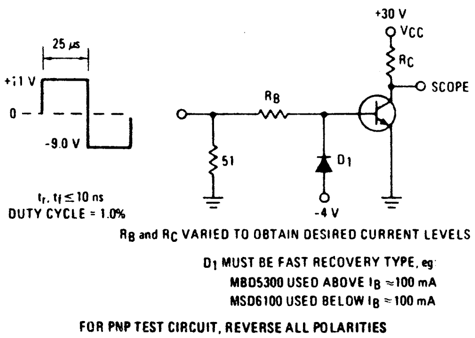


FIGURE 3 – TURN-ON TIME

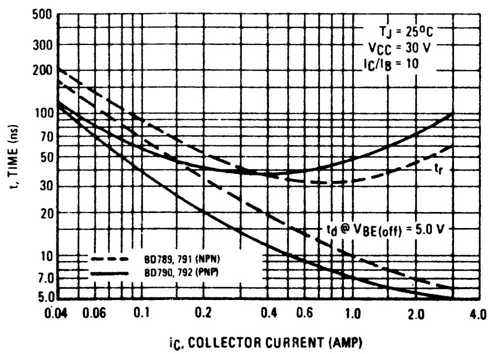


FIGURE 4 – THERMAL RESPONSE

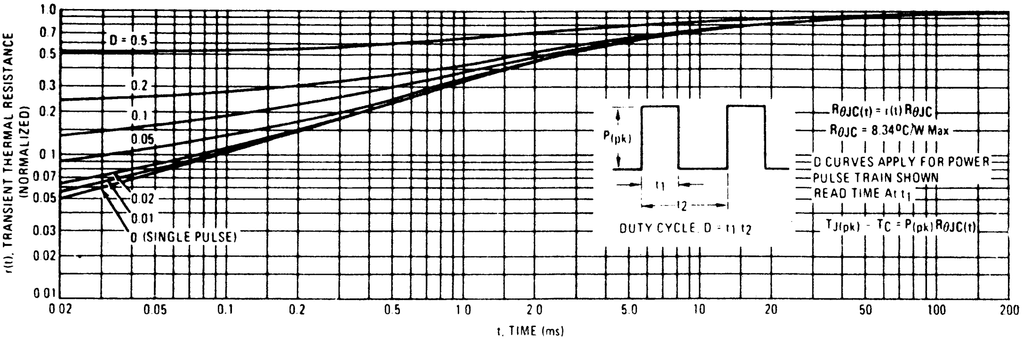
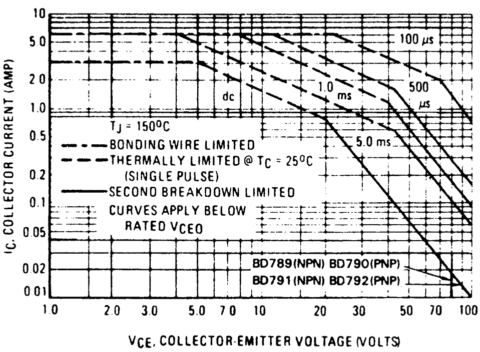


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C V_{CE} limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leqslant 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. (See AN-415A)

3

FIGURE 6 – TURN-OFF TIME

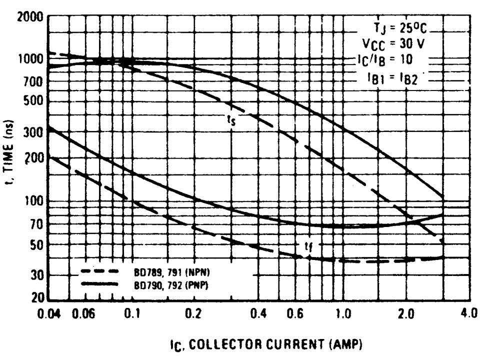
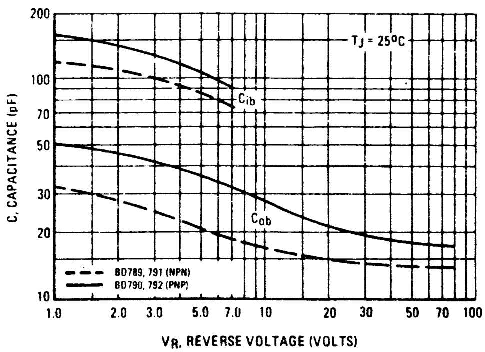


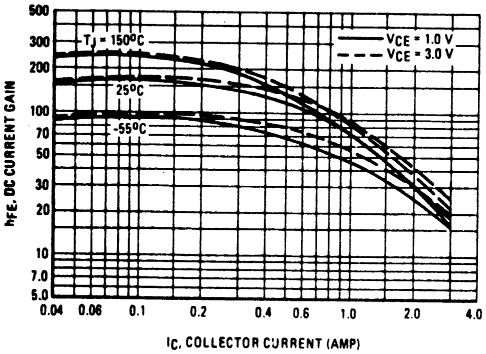
FIGURE 7 – CAPACITANCE



NPN • BD789, BD791
PNP • BD790, BD792

FIGURE 8 – DC CURRENT GAIN

NPN
BD789, BD791



PNP
BD790, BD792

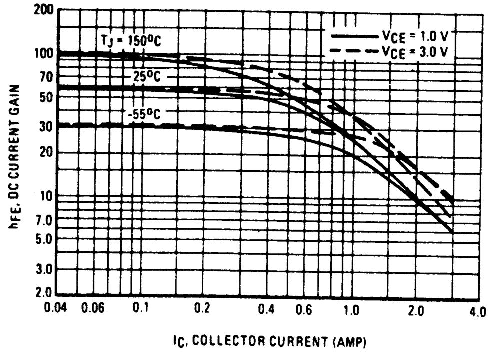
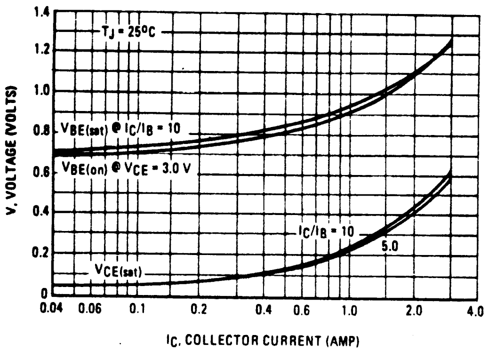


FIGURE 9 – "ON" VOLTAGES



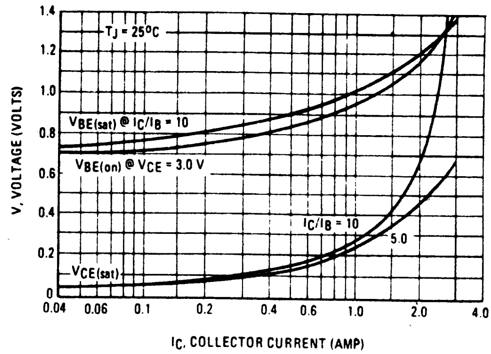
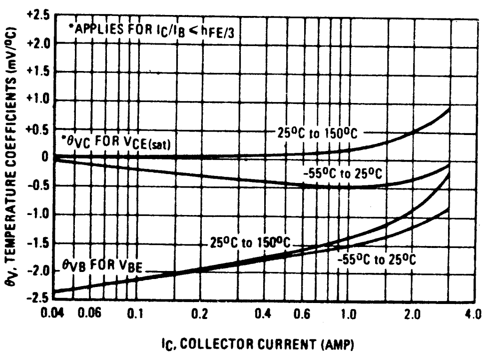
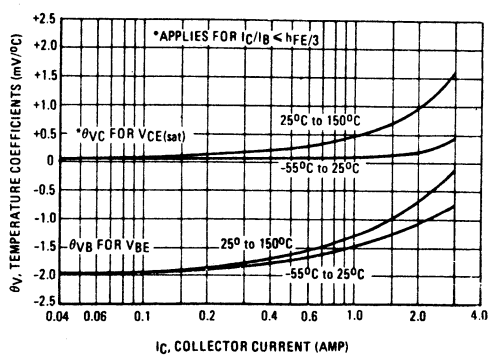


FIGURE 10 – TEMPERATURE COEFFICIENTS





BD805
BD807 • BD809

PLASTIC HIGH POWER SILICON NPN TRANSISTOR

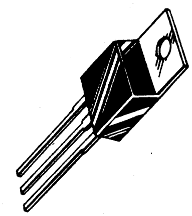
. . . designed for use in high power audio amplifiers utilizing complementary or quasi complementary circuits.

- DC Current—h_{FE} = 30 (Min) @ I_C = 2.0 Adc
- BD 805, 807, 809 are complementary with BD 806, 808, 810

10 AMPERE POWER TRANSISTOR

NPN SILICON

45, 60, 80 VOLTS 90 WATTS



MAXIMUM RATINGS

Rating	Symbol	Type	Value	Unit
Collector-Emitter Voltage	V_{CEO}	BD805 BD807 BD809	45 60 80	Vdc
Collector-Base Voltage	V_{CBO}	BD805 BD807 BD809	55 70 80	Vdc
Emitter-Base Voltage	V_{EBO}		5	Vdc
Collector Current	I_C		10.0	Adc
Base Current	I_B		6.0	Adc
Total Device Dissipation T_C=25°C Derate above 25°C	P_D		90 720	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}		—55 to +150	°C

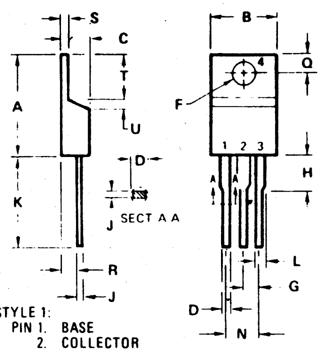
THERMAL CHARACTERISTICS

Characteristic	Symbol		Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}		1.39	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Type	Min	Max	Unit
Collector-Emitter Sustaining Voltage* (I_C = 0.2 Adc, I_B = 0)	BV_{CEO}*	BD805 BD807 BD809	45 60 80	– – –	Vdc
Collector Cutoff Current (V_{CB} = 55 Vdc, I_E = 0) (V_{CB} = 70 Vdc, I_E = 0) (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	BD805 BD807 BD809	– – –	1.0 1.0 1.0	mAdc
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)	I_{EBO}		—	2.0	mAdc
DC current Gain (I_C = 2A, V_{CE} = 2 V) (I_C = 4A, V_{CE} = 2 V)	h_{FE}*		30 15	— —	
Collector-Emitter Saturation Voltage* (I_C = 4 Adc, I_B = 0.4 Adc)	$V_{CE(sat)}$*		—	1.1	Vdc
Base-Emitter On Voltage* (I_C = 4 Adc, V_{CE} = 2.0 Vdc)	$V_{BE(on)}$*		—	1.6	Vdc
Current-Gain-Bandwidth Product (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz)	f_T		1.5	—	MHz

* Pulse Test: Pulse Width ≤ 300 μs. Duty Cycle ≤ 2.0%.

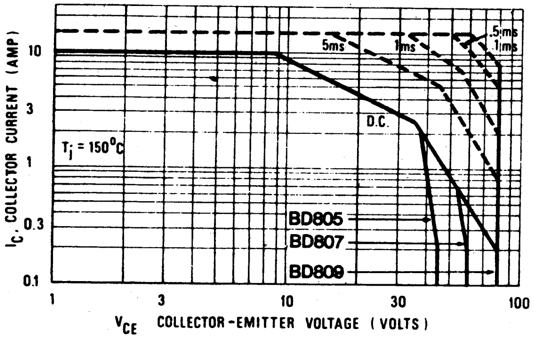


STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	15.11	15.75	0.595	0.620
B	9.78	10.03	0.385	0.395
C	4.06	4.82	0.160	0.190
D	0.64	0.89	0.025	0.035
F	3.61	3.73	0.142	0.147
G	2.41	2.67	0.095	0.105
H	2.79	3.30	0.110	0.130
J	0.36	0.56	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.14	1.27	0.045	0.050
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.14	1.39	0.045	0.055
T	5.97	6.48	0.235	0.255
U	0.76	1.27	0.030	0.050

CASE 221A-02
TO-220AB

FIGURE 1 — ACTIVE REGION DC SAFE OPERATING AREA



See Note 1

FIGURE 2 — POWER-TEMPERATURE DERATING CURVE

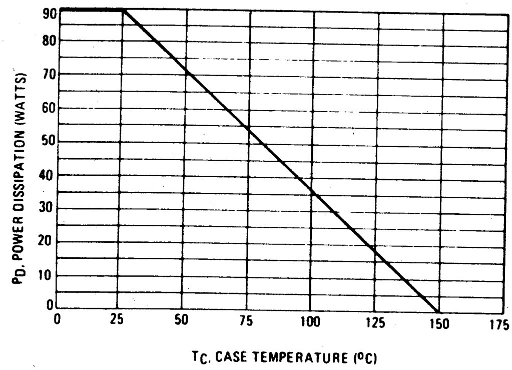


FIGURE 3 — "ON" VOLTAGES

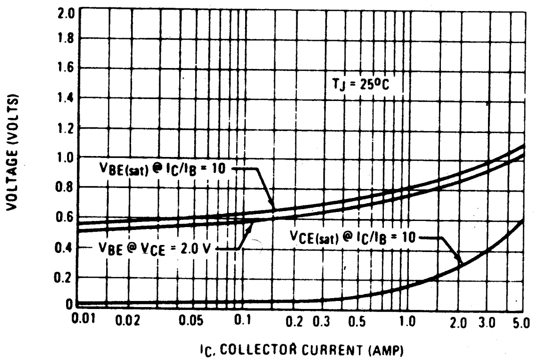


FIGURE 4 — CURRENT GAIN

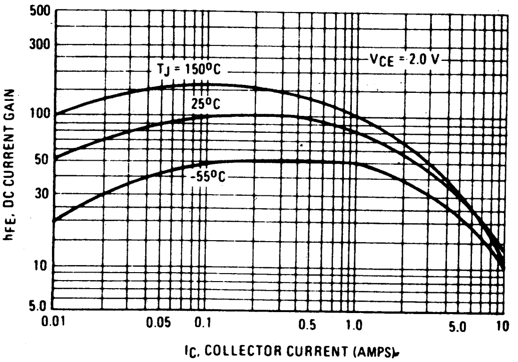
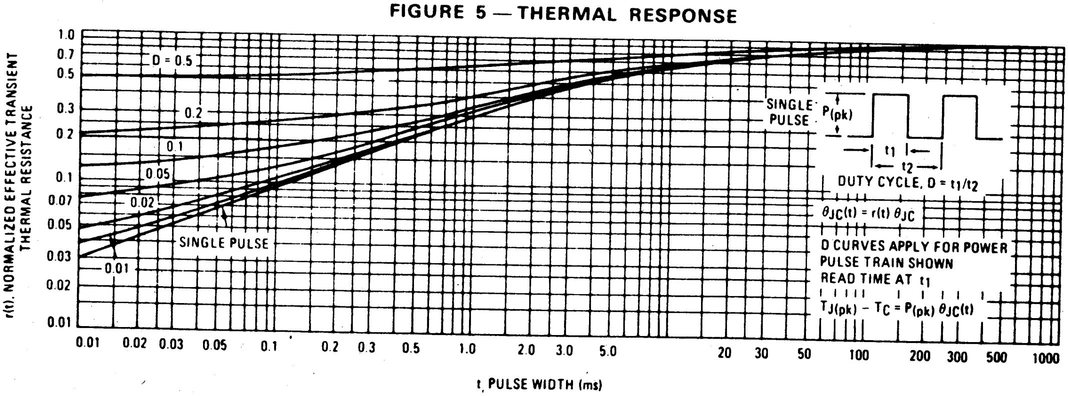


FIGURE 5 — THERMAL RESPONSE



Note 1:

There are two limitations on the power handling ability of a transistor; average junction temperature and second breakdown. Safe operating area curves indicate I_C - V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 1 is based on $T_{J(pk)} = 150^oC$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^oC$. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. (See AN-415)

BD806
BD808 • BD810

PLASTIC HIGH POWER SILICON PNP TRANSISTOR

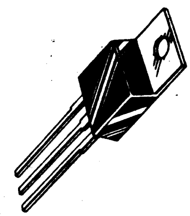
. . . designed for use in high power audio amplifiers utilizing complementary or quasi complementary circuits.

- DC Current—h_{FE} = 30 (Min) @ I_C = 2.0 Adc
- BD 806, 808, 810 are complementary with BD 805, 807, 809

10 AMPERE POWER TRANSISTOR

PNP SILICON

45, 60, 80 VOLTS
90 WATTS



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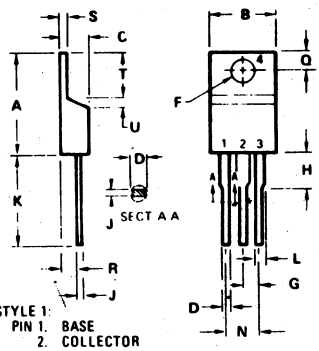

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TO-220AB