

# BD787 - NPN, BD788 - PNP

## Complementary Plastic Silicon Power Transistors

These devices are designed for lower power audio amplifier and low current, high-speed switching applications.

### Features

- Low Collector-Emitter Sustaining Voltage –  $V_{CEO(sus)}$  60 Vdc (Min)
- High Current-Gain – Bandwidth Product –  
 $f_T = 50$  MHz (Min) @  $I_C = 100$  mAdc
- Collector-Emitter Saturation Voltage Specified at 0.5, 1.0, 2.0 and 4.0 Adc
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	Vdc
Collector-Base Voltage	$V_{CBO}$	80	Vdc
Emitter Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current – Continuous – Peak	$I_C$	4.0 8.0	Adc
Base Current – Continuous	$I_B$	1.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	15 0.12	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

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

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

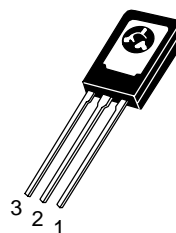
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

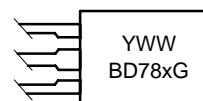
<http://onsemi.com>

**4 AMPERES  
POWER TRANSISTORS  
COMPLEMENTARY SILICON  
60 VOLTS, 15 WATTS**



TO-225  
CASE 77  
STYLE 1

### MARKING DIAGRAM



Y = Year  
WW = Work Week  
BD78x = Device Code  
x = 7 or 8  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
BD787	TO-225	500 Units/Box
BD787G	TO-225 (Pb-Free)	500 Units/Box
BD788	TO-225	500 Units/Box
BD788G	TO-225 (Pb-Free)	500 Units/Box

## BD787 – NPN, BD788 – PNP

### ELECTRICAL CHARACTERISTICS\* ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

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

\*Indicates JEDEC Registered Data

1. Pulse Test; Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

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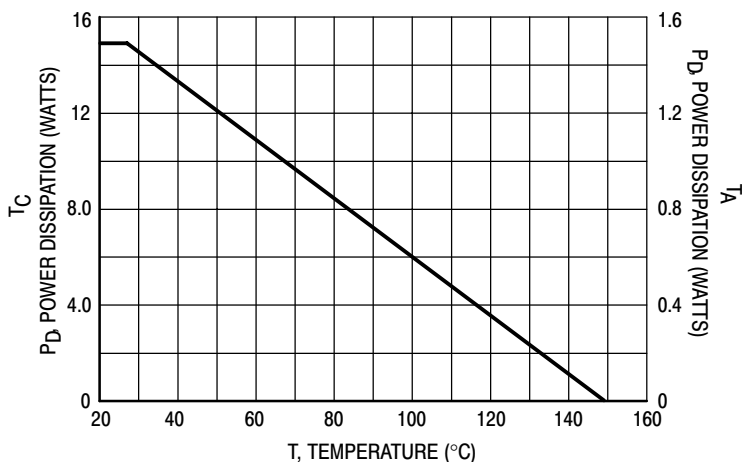


Figure 1. Power Derating

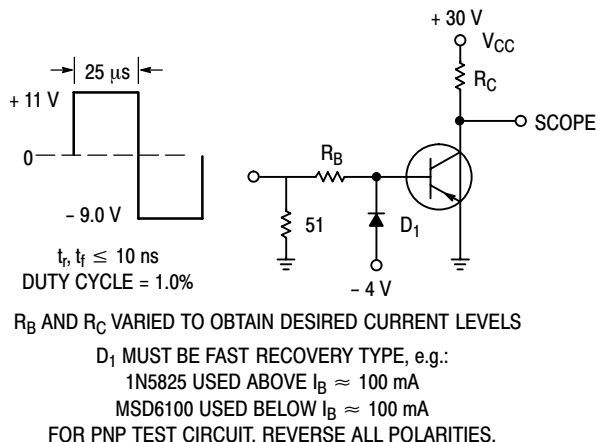


Figure 2. Switching Time Test Circuit

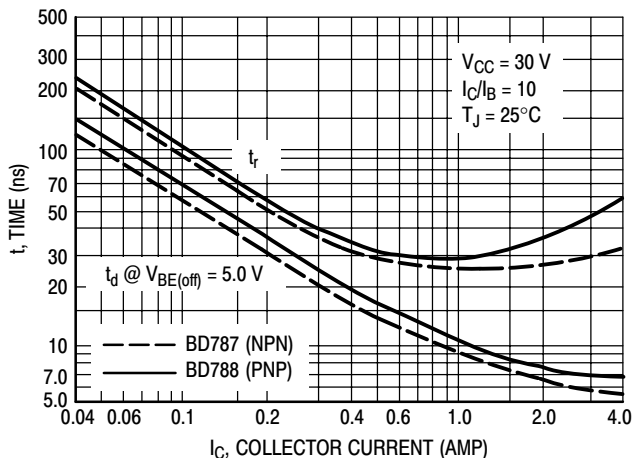


Figure 3. Turn-On Time

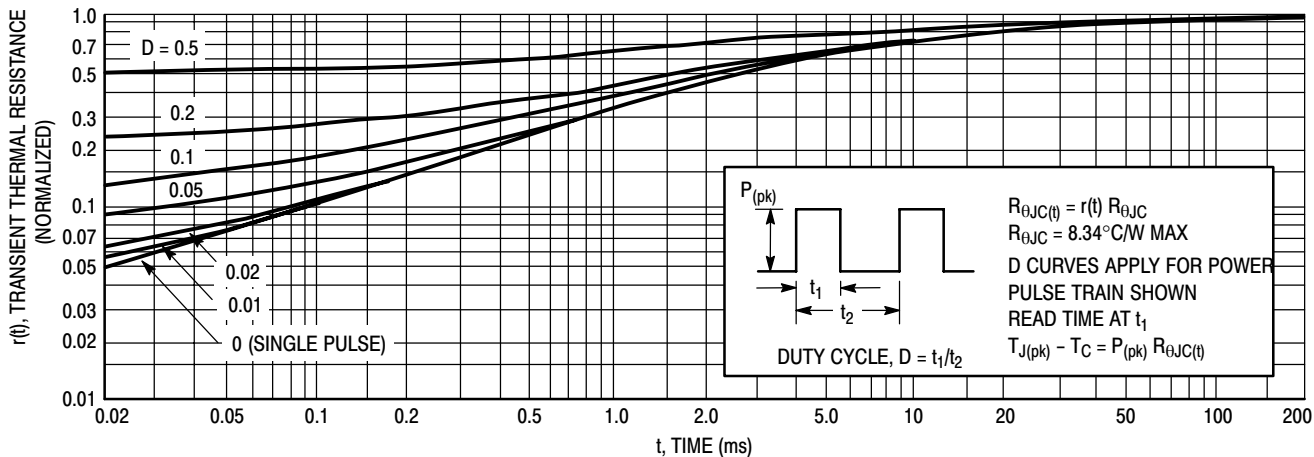
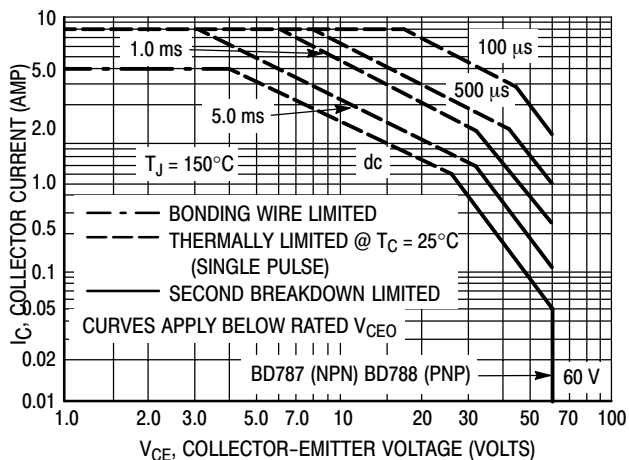


Figure 4. Thermal Response

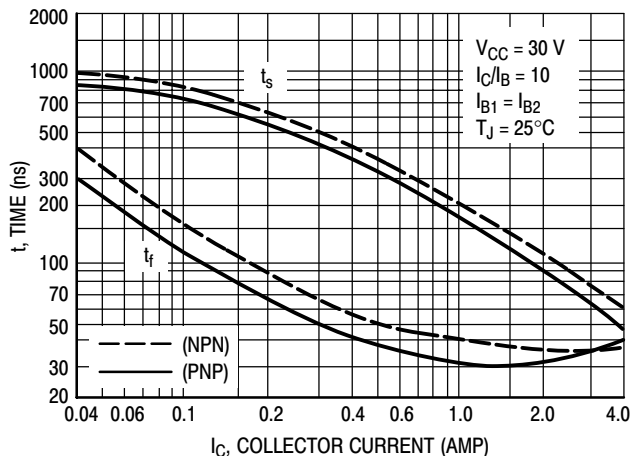
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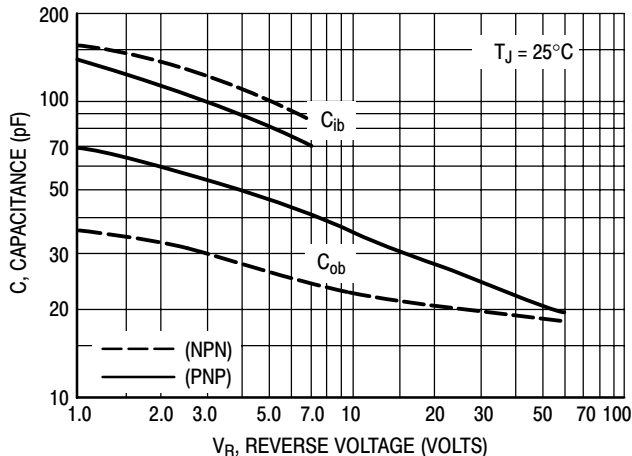
**Figure 5. Active Region Safe Operating Area**

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.

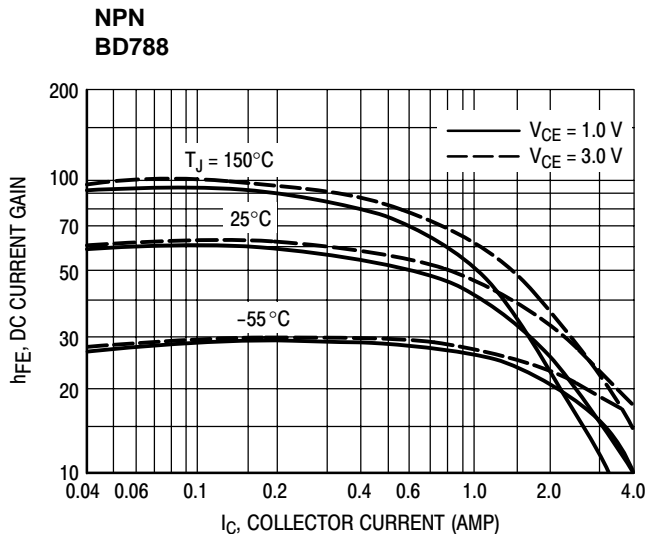
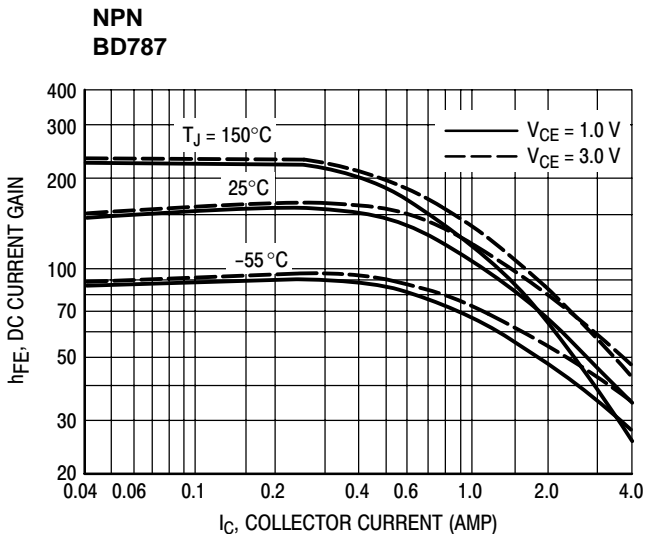
The data of Figure 5 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures,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



**Figure 6. Turn-Off Time**



**Figure 7. Capacitance**



**Figure 8. DC Current Gain**

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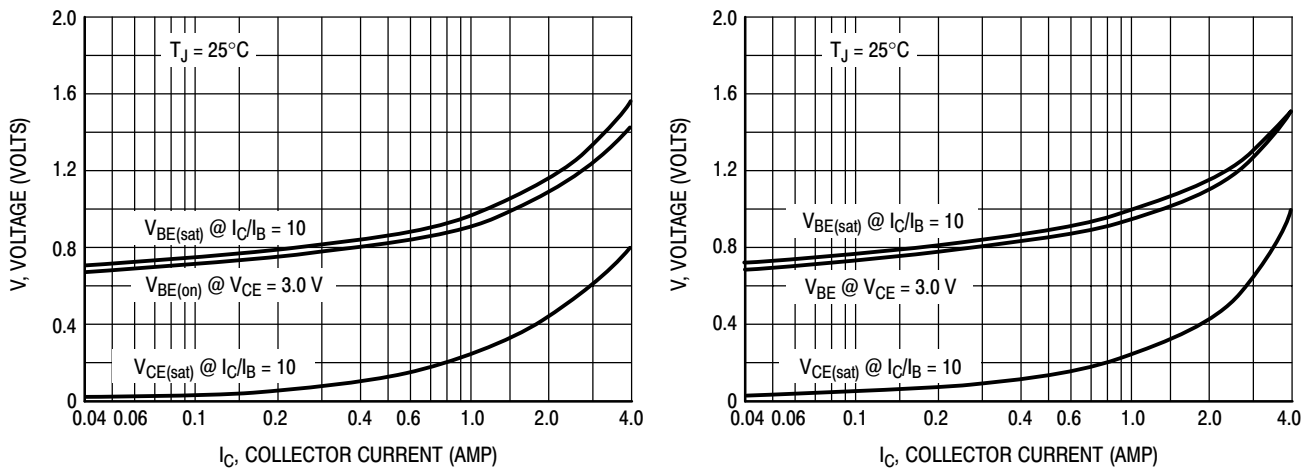


Figure 9. "On" Voltages

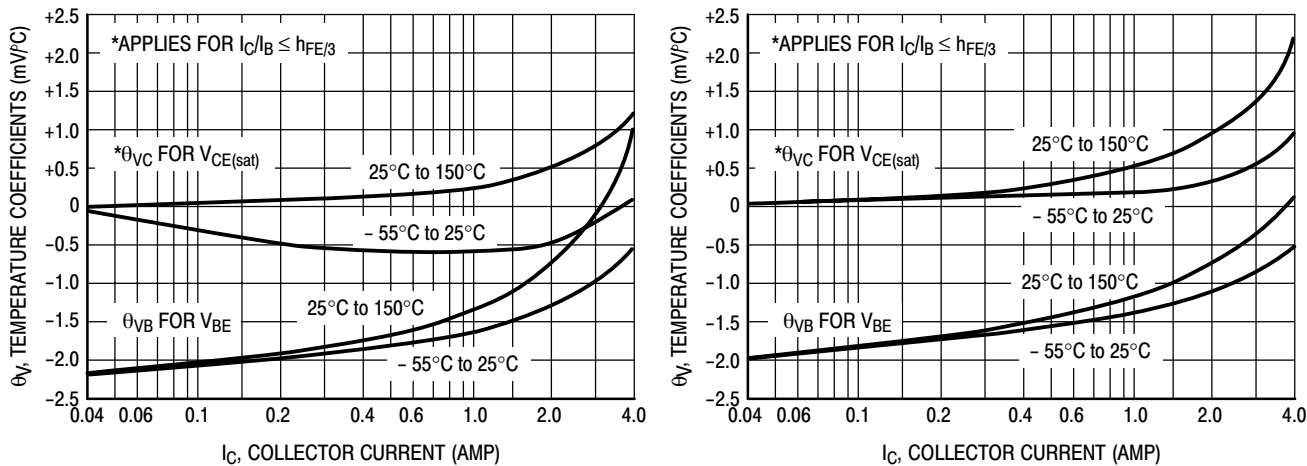
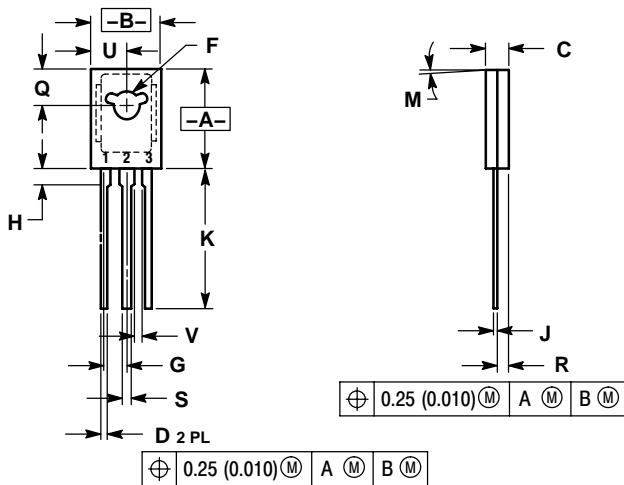


Figure 10. Temperature Coefficients

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## PACKAGE DIMENSIONS

TO-225  
CASE 77-09  
ISSUE Z



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 077-01 THRU -08 OBSOLETE, NEW STANDARD 077-09.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.065	1.15	1.65
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	---	1.02	---

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

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