

NPN Plastic Silicon Power Transistor

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

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

***MAXIMUM RATINGS**

Rating	Symbol	Max	Unit
Collector–Emitter Voltage	V_{CEO}	100	Vdc
Collector–Base Voltage	V_{CB}	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 @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	15 0.12	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$

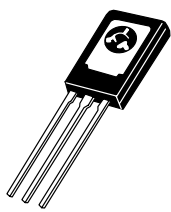
THERMAL CHARACTERISTICS

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

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ON Semiconductor Preferred Device

**4 AMPERE
POWER TRANSISTOR
SILICON
100 VOLTS
15 WATTS**



**CASE 77-09
TO-225AA TYPE**

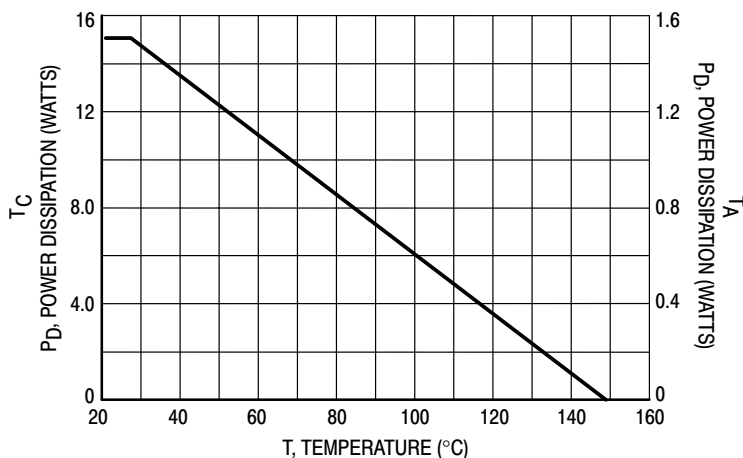


Figure 1. Power Derating

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

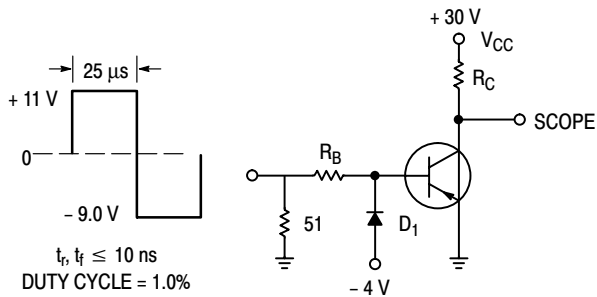
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***ELECTRICAL CHARACTERISTICS** ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Sustaining Voltage (1) ($I_C = 10\text{ mA}$, $I_B = 0$)	$V_{CE(sus)}$	100	—	Vdc
Collector Cutoff Current ($V_{CE} = 50\text{ Vdc}$, $I_B = 0$)	I_{CEO}	—	100	μAdc
Collector Cutoff Current ($V_{CE} = 100\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 50\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 125^\circ\text{C}$)	I_{CEX}	—	1.0 0.1	μAdc mAdc
Emitter Cutoff Current ($V_{EB} = 6.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	1.0	μAdc
ON CHARACTERISTICS (1)				
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 20 10 5.0	250 — — —	—
Collector Emitter Saturation Voltage ($I_C = 500\text{ mA}$, $I_B = 50\text{ mA}$) ($I_C = 1.0\text{ Adc}$, $I_B = 100\text{ mA}$) ($I_C = 2.0\text{ Adc}$, $I_B = 200\text{ mA}$) ($I_C = 4.0\text{ Adc}$, $I_B = 800\text{ mA}$)	$V_{CE(sat)}$	— — — —	0.5 1.0 2.5 3.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 2.0\text{ Adc}$, $I_B = 200\text{ mA}$)	$V_{BE(sat)}$	—	1.8	Vdc
Base–Emitter On Voltage ($I_C = 200\text{ mA}$, $V_{CE} = 3.0\text{ Vdc}$)	$V_{BE(on)}$	—	1.5	Vdc
DYNAMIC CHARACTERISTICS				
Current–Gain — Bandwidth Product ($I_C = 100\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 10\text{ MHz}$)	f_T	40	—	MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_C = 0$, $f = 0.1\text{ MHz}$)	C_{ob}	—	50	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 $\leq 2.0\%$.



R_B AND R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
 D_1 MUST BE FAST RECOVERY TYPE, eg
 MBR340 USED ABOVE $I_B \approx 100\text{ mA}$
 MSD6100 USED BELOW $I_B \approx 100\text{ mA}$
 FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES.

Figure 2. Switching Time Test Circuit

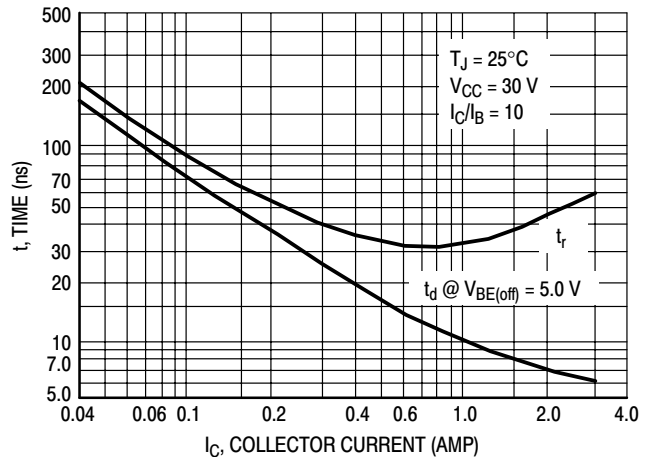


Figure 3. Turn–On Time

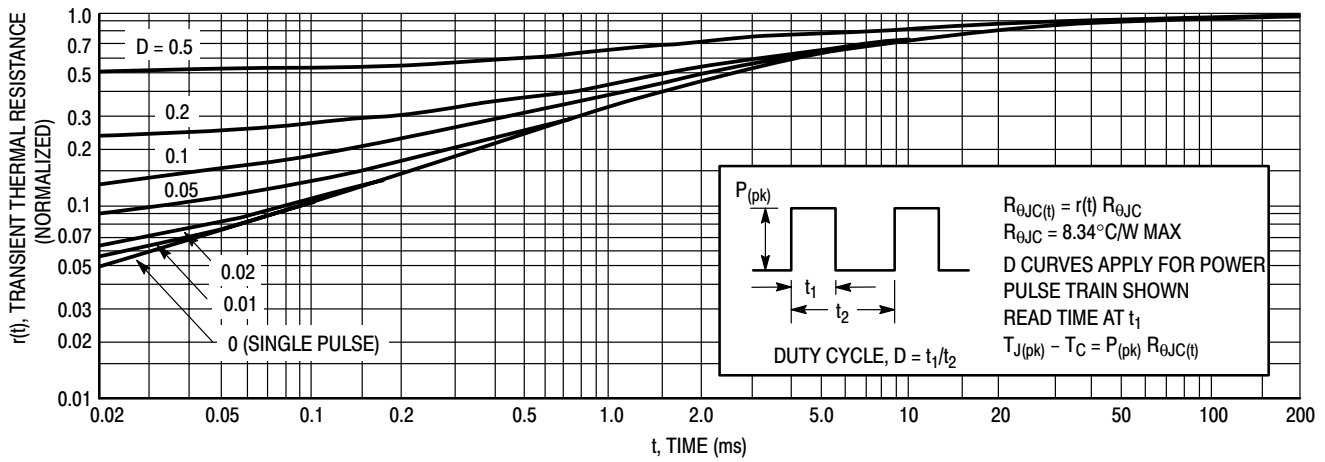


Figure 4. Thermal Response

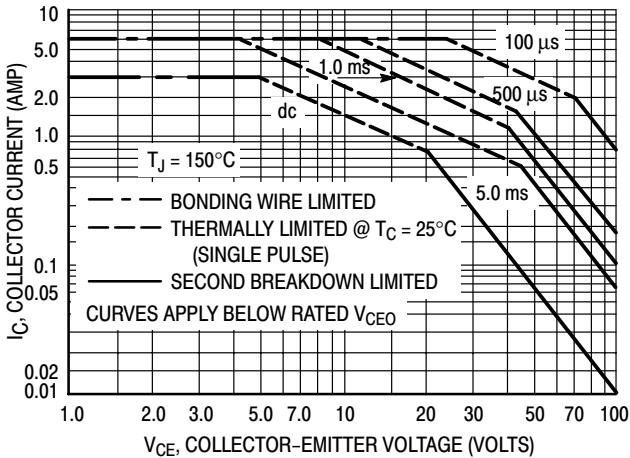


Figure 5. Active Region Safe Operating Area

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 $T_{J(pk)} = 150^\circ\text{C}$; 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.

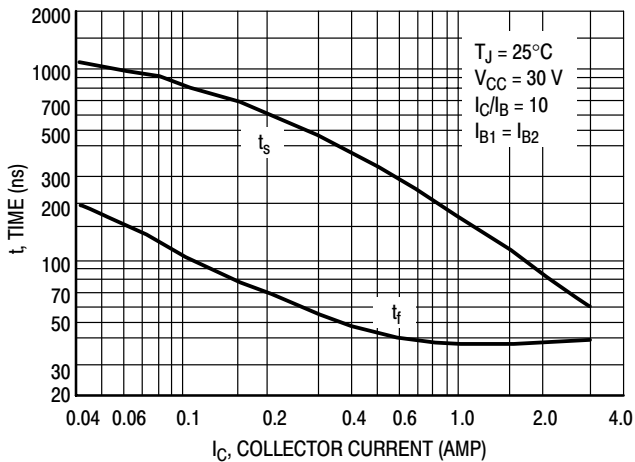


Figure 6. Turn-Off Time

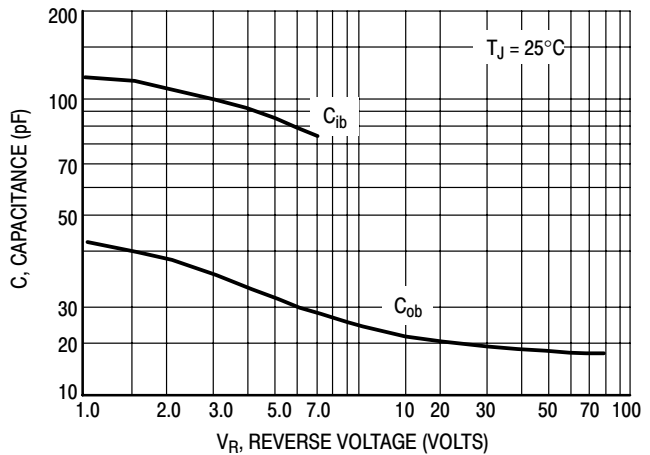


Figure 7. Capacitance

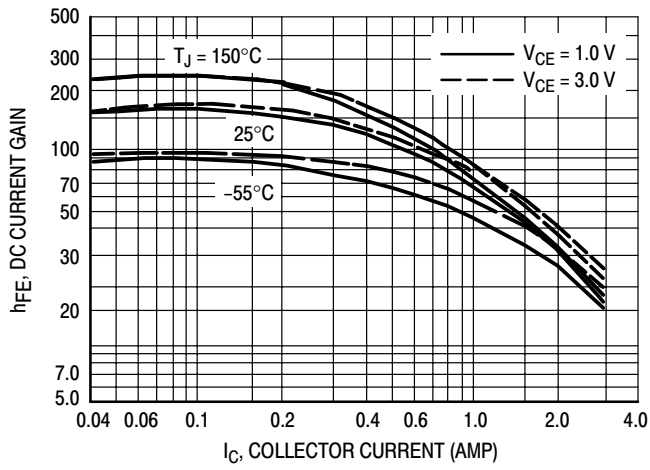


Figure 8. DC Current Gain

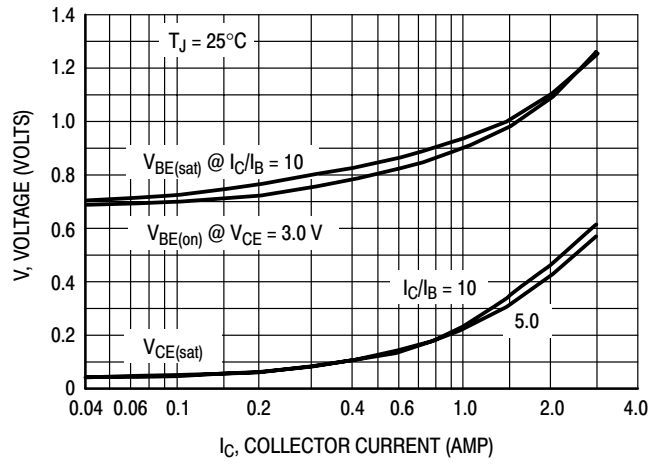


Figure 9. "On" Voltage

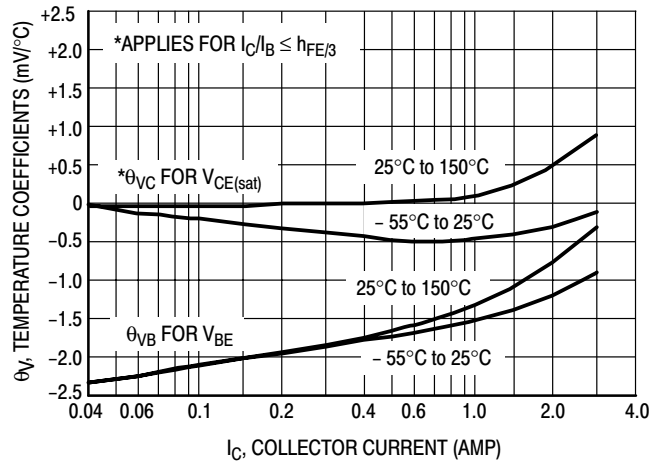
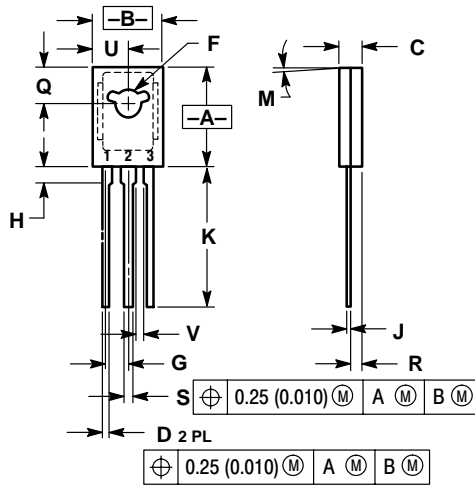


Figure 10. Temperature Coefficient

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PACKAGE DIMENSIONS

CASE 77-09 TO-225AA TYPE ISSUE W



- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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

Notes

Notes

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