

# Medium-Power Plastic NPN Silicon Transistors

... designed for driver circuits, switching, and amplifier applications. These high-performance plastic devices feature:

- Low Saturation Voltage —  
 $V_{CE(sat)} = 0.6 \text{ Vdc (Max) @ } I_C = 1.0 \text{ Amp}$
- Excellent Power Dissipation Due to Thermopad Construction —  
 $P_D = 30 \text{ W @ } T_C = 25^\circ\text{C}$
- Excellent Safe Operating Area
- Gain Specified to  $I_C = 1.0 \text{ Amp}$
- Complement to PNP 2N4918, 2N4919, 2N4920

### \*MAXIMUM RATINGS

Rating	Symbol	2N4921	2N4922	2N4923	Unit
Collector–Emitter Voltage	$V_{CEO}$	40	60	80	Vdc
Collector–Base Voltage	$V_{CB}$	40	60	80	Vdc
Emitter–Base Voltage	$V_{EB}$	5.0			Vdc
Collector Current — Continuous (1)	$I_C$	1.0 3.0			Adc
Base Current — Continuous	$I_B$	1.0			Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	30 0.24			Watts W/ $^\circ\text{C}$
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +150			$^\circ\text{C}$

### THERMAL CHARACTERISTICS (2)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	4.16	$^\circ\text{C/W}$

(1) The 1.0 Amp maximum  $I_C$  value is based upon JEDEC current gain requirements. The 3.0 Amp maximum value is based upon actual current handling capability of the device (see Figures 5 and 6).

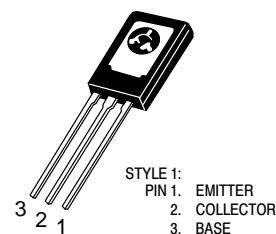
(2) Recommend use of thermal compound for lowest thermal resistance.

\*Indicates JEDEC Registered Data.

**2N4921  
thru  
2N4923 \***

\*ON Semiconductor Preferred Device

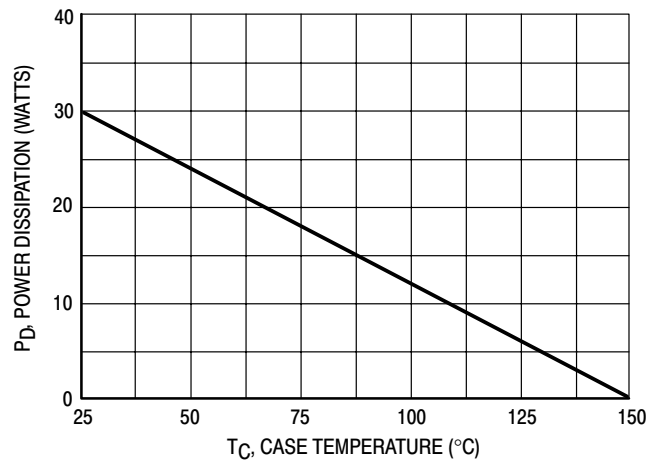
**1 AMPERE  
GENERAL-PURPOSE  
POWER TRANSISTORS  
40–80 VOLTS  
30 WATTS**



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

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

## 2N4921 thru 2N4923



**Figure 1. Power Derating**

Safe Area Curves are indicated by Figure 5. All limits are applicable and must be observed.

# 2N4921 thru 2N4923

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (3) ( $I_C = 0.1\text{ Adc}$ , $I_B = 0$ )	$V_{CE(sus)}$	40 60 80	—	Vdc
Collector Cutoff Current ( $V_{CE} = 20\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	— — —	0.5 0.5 0.5	mAdc
Collector Cutoff Current ( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )	$I_{CEX}$	— —	0.1 0.5	mAdc
Collector Cutoff Current ( $V_{CB} = \text{Rated } V_{CB}$ , $I_E = 0$ )	$I_{CBO}$	—	0.1	mAdc
Emitter Cutoff Current ( $V_{EB} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	1.0	mAdc

## ON CHARACTERISTICS

DC Current Gain (3) ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 1.0\text{ Vdc}$ )	$h_{FE}$	40 30 10	— 150 —	—
Collector–Emitter Saturation Voltage (3) ( $I_C = 1.0\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )	$V_{CE(sat)}$	—	0.6	Vdc
Base–Emitter Saturation Voltage (3) ( $I_C = 1.0\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )	$V_{BE(sat)}$	—	1.3	Vdc
Base–Emitter On Voltage (3) ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 1.0\text{ Vdc}$ )	$V_{BE(on)}$	—	1.3	Vdc

## SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ( $I_C = 250\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$f_T$	3.0	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 100\text{ kHz}$ )	$C_{ob}$	—	100	pF
Small–Signal Current Gain ( $I_C = 250\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	25	—	—

(3) Pulse Test:  $PW \approx 300\ \mu\text{s}$ , Duty Cycle  $\approx 2.0\%$ .

\*Indicates JEDEC Registered Data.

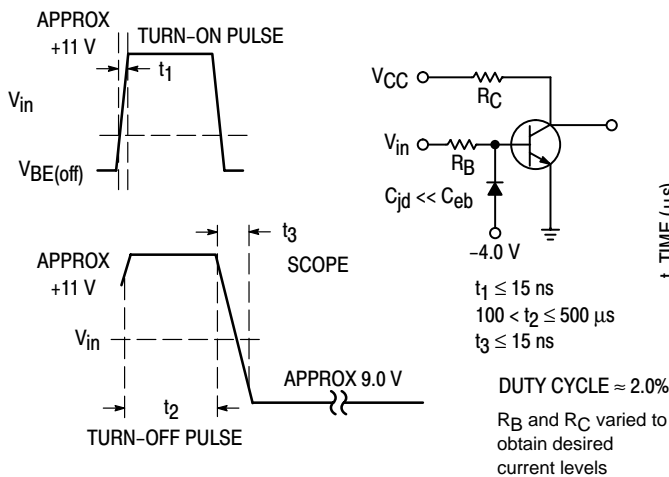


Figure 2. Switching Time Equivalent Circuit

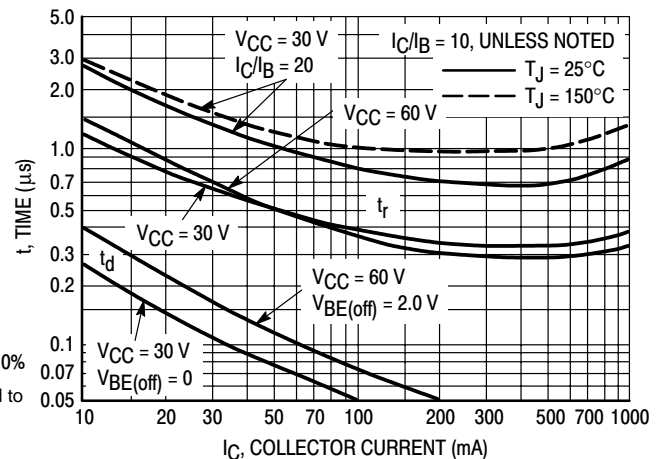
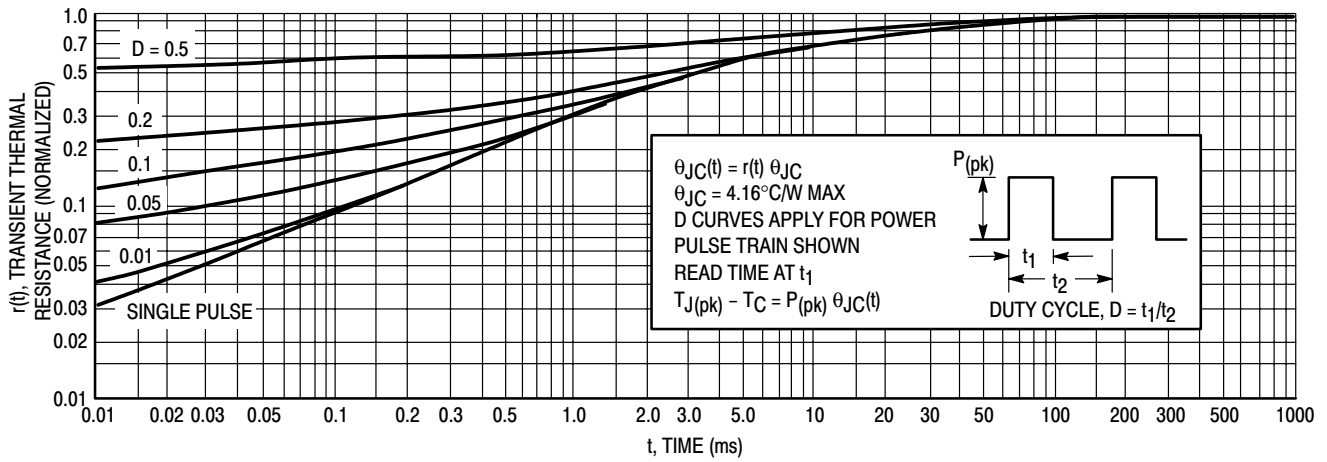
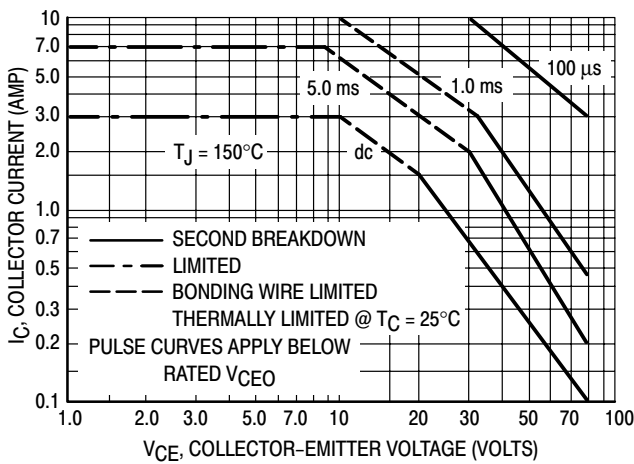


Figure 3. Turn-On Time

## 2N4921 thru 2N4923



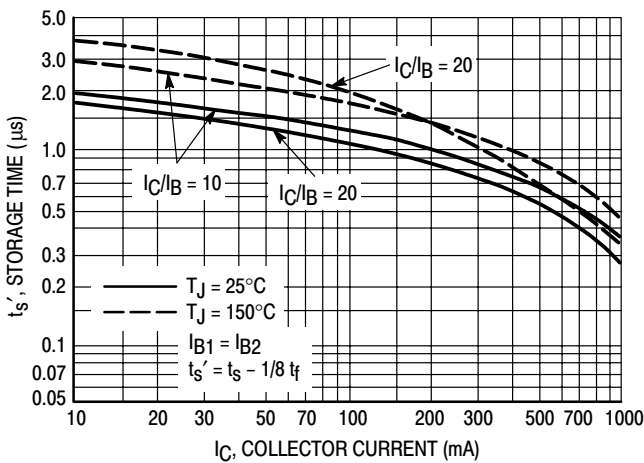
**Figure 4. Thermal Response**



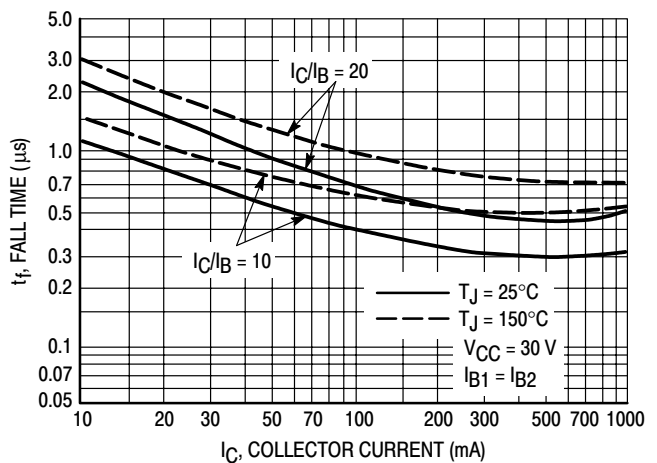
**Figure 5. Active-Region Safe Operating Area**

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  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  $T_{J(pk)} \leq 150^{\circ}\text{C}$ . 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. Storage Time**



**Figure 7. Fall Time**

# 2N4921 thru 2N4923

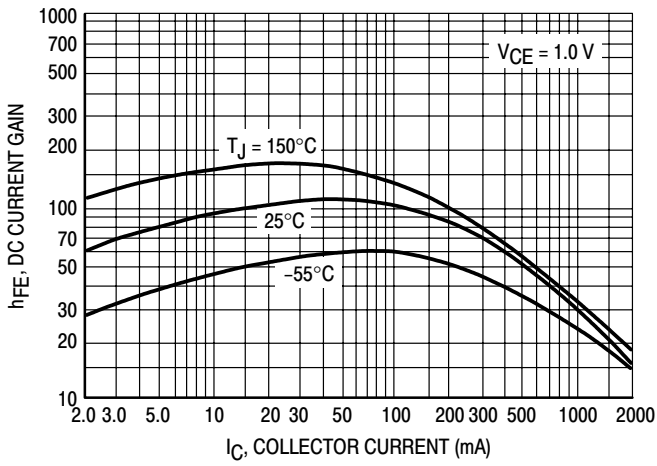


Figure 8. Current Gain

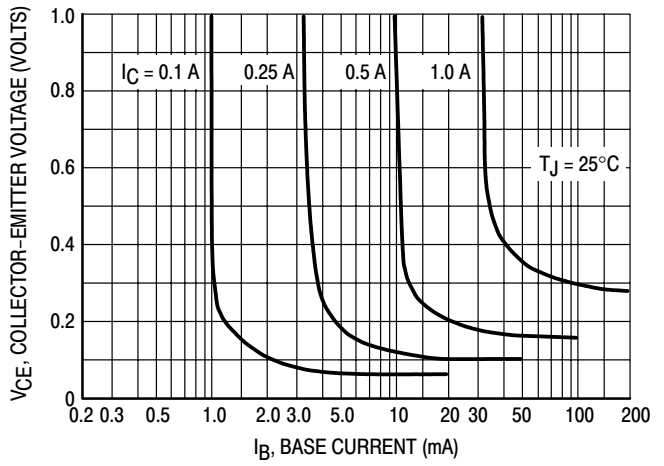


Figure 9. Collector Saturation Region

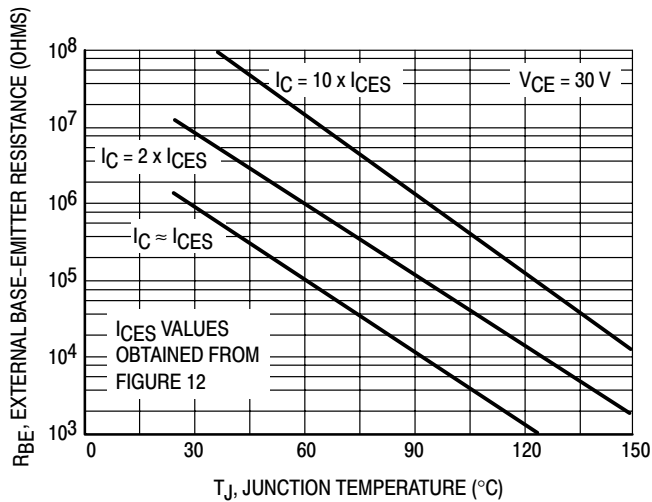


Figure 10. Effects of Base-Emitter Resistance

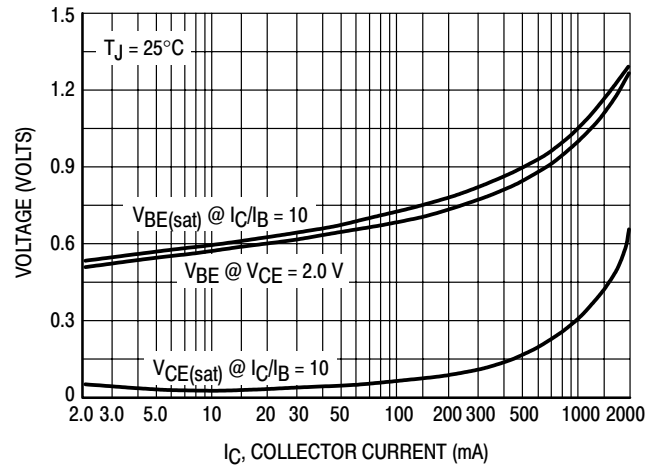


Figure 11. "On" Voltage

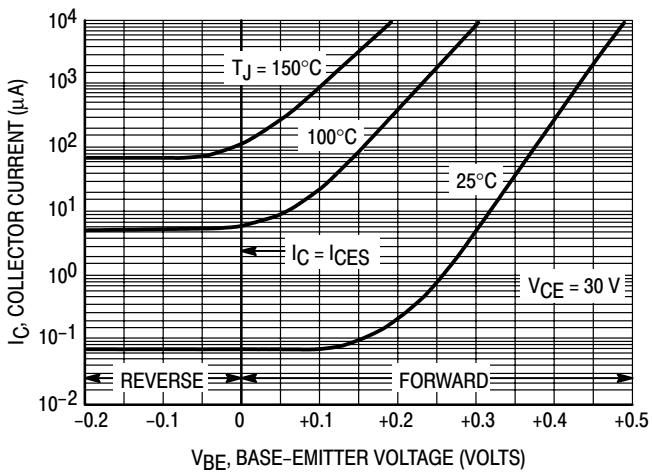


Figure 12. Collector Cut-Off Region

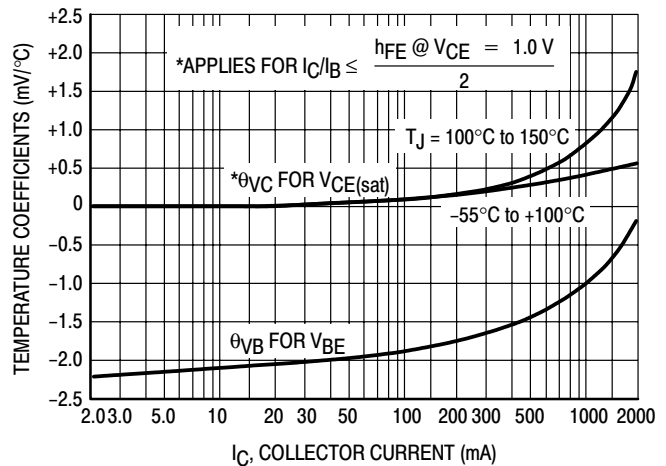
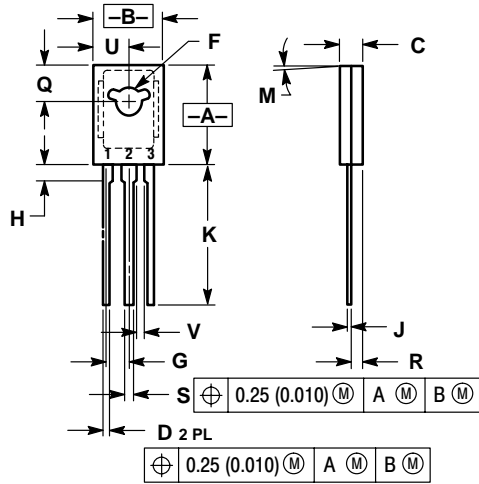


Figure 13. Temperature Coefficients

# 2N4921 thru 2N4923

## PACKAGE DIMENSIONS

### CASE 77-08 TO-225AA TYPE ISSUE V



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	0.055	1.15	1.39
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:

1. EMITTER
2. COLLECTOR
3. BASE

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