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[2N6052](#)

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**ON Semiconductor™**

## Darlington Complementary Silicon Power Transistors

... designed for general-purpose amplifier and low frequency switching applications.

- High DC Current Gain —  
 $h_{FE} = 3500$  (Typ) @  $I_C = 5.0$  Adc
- Collector–Emitter Sustaining Voltage — @ 100 mA  
 $V_{CEO(sus)} = 80$  Vdc (Min) — 2N6058  
 100 Vdc (Min) — 2N6052, 2N6059
- Monolithic Construction with Built–In Base–Emitter Shunt Resistors

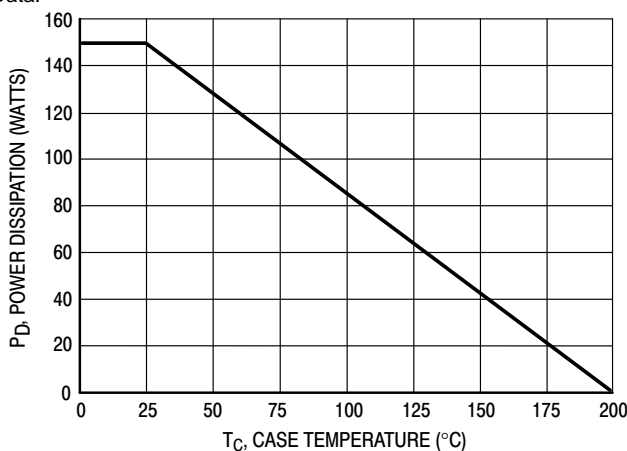
### MAXIMUM RATINGS (1)

Rating	Symbol	2N6058	2N6052 2N6059	Unit
Collector–Emitter Voltage	$V_{CEO}$	80	100	Vdc
Collector–Base Voltage	$V_{CB}$	80	100	Vdc
Emitter–Base voltage	$V_{EB}$	5.0		Vdc
Collector Current — Continuous Peak	$I_C$	12 20		Adc
Base Current	$I_B$	0.2		Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150		Watts
		0.857		W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +200 $^\circ\text{C}$		$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Rating	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.17	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.



**Figure 1. Power Derating**

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

**PNP  
2N6052\***

**NPN  
2N6058  
2N6059\***

\*ON Semiconductor Preferred Device

**DARLINGTON  
12 AMPERE  
COMPLEMENTARY  
SILICON  
POWER TRANSISTORS  
80–100 VOLTS  
150 WATTS**

**CASE 1–07  
TO–204AA  
(TO–3)**

## 2N6052

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Sustaining Voltage (2) ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	80 100	—	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	— —	1.0 1.0	mAdc
Collector Cutoff Current ( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	$I_{CEX}$	—	0.5 5.0	mAdc
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	2.0	mAdc

### ON CHARACTERISTICS (2)

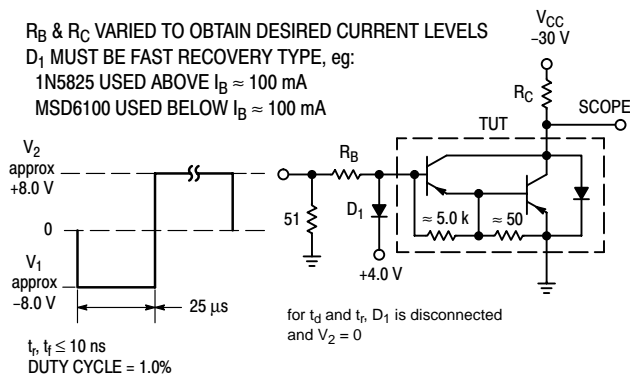
DC Current Gain ( $I_C = 6.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ ) ( $I_C = 12\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	$h_{FE}$	750 100	18,000 —	—
Collector-Emitter Saturation Voltage ( $I_C = 6.0\text{ Adc}$ , $I_B = 24\text{ mAdc}$ ) ( $I_C = 12\text{ Adc}$ , $I_B = 120\text{ mAdc}$ )	$V_{CE(sat)}$	— —	2.0 3.0	Vdc
Base-Emitter Saturation Voltage ( $I_C = 12\text{ Adc}$ , $I_B = 120\text{ mAdc}$ )	$V_{BE(sat)}$	—	4.0	Vdc
Base-Emitter On Voltage ( $I_C = 6.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	$V_{BE(on)}$	—	2.8	Vdc

### DYNAMIC CHARACTERISTICS

Magnitude of Common Emitter Small-Signal Short Circuit Forward Current Transfer Ratio ( $I_C = 5.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$ h_{fe} $	4.0	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{ob}$	— —	500 300	pF
Small-Signal Current Gain ( $I_C = 5.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	300	—	—

\*Indicates JEDEC Registered Data.

(2) Pulse test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.



For NPN test circuit reverse diode and voltage polarities.

Figure 2. Switching Times Test Circuit

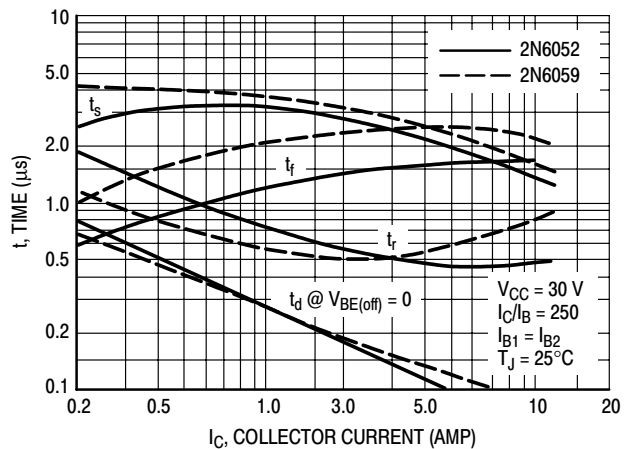


Figure 3. Switching Times

**2N6052**

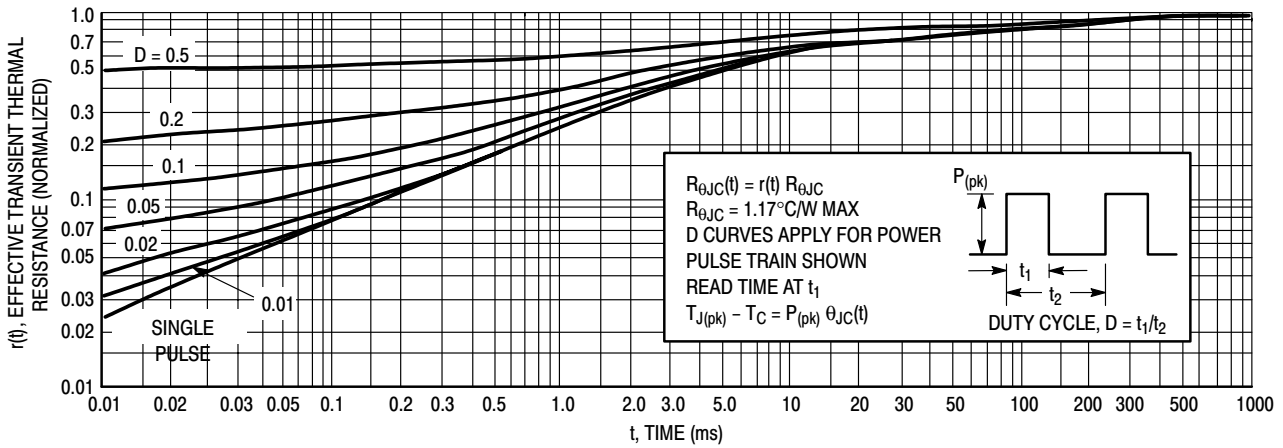


Figure 4. Thermal Response

**ACTIVE-REGION SAFE OPERATING AREA**

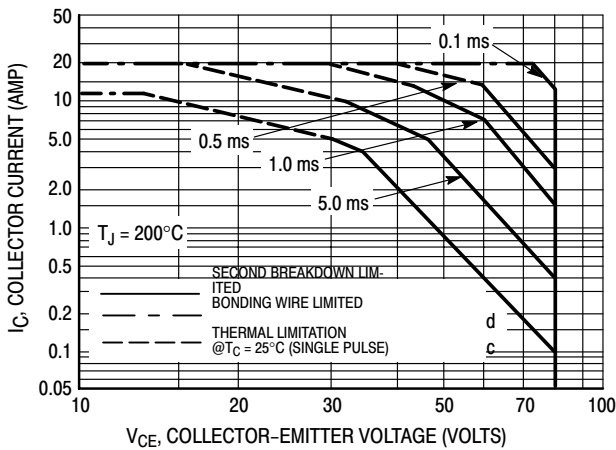


Figure 5. 2N6058

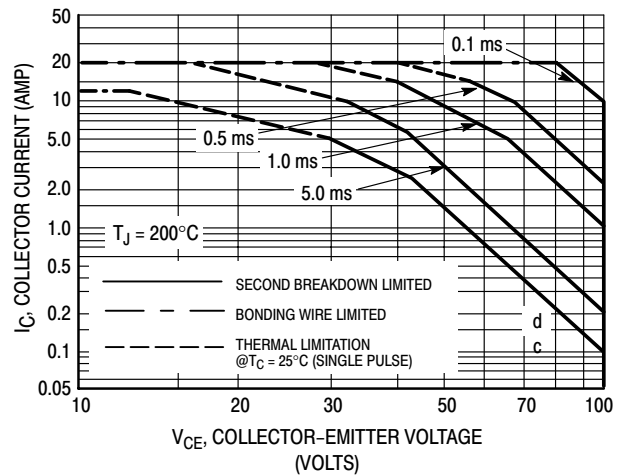


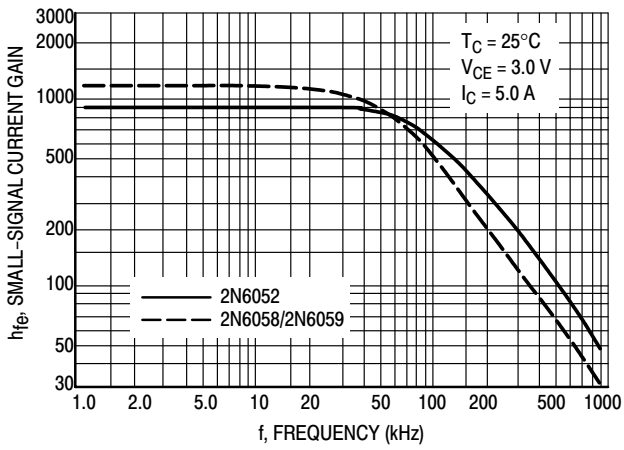
Figure 6. 2N6052, 2N6059

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.

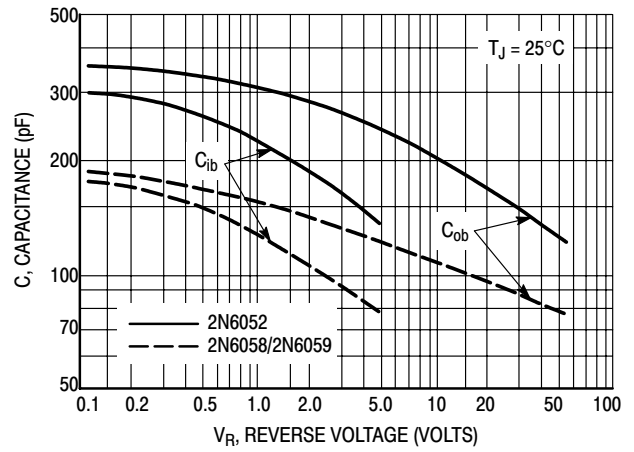
The data of Figures 5, 6, and 7 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown

pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 200^\circ\text{C}$ ;  $T_{J(pk)}$  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.

**2N6052**

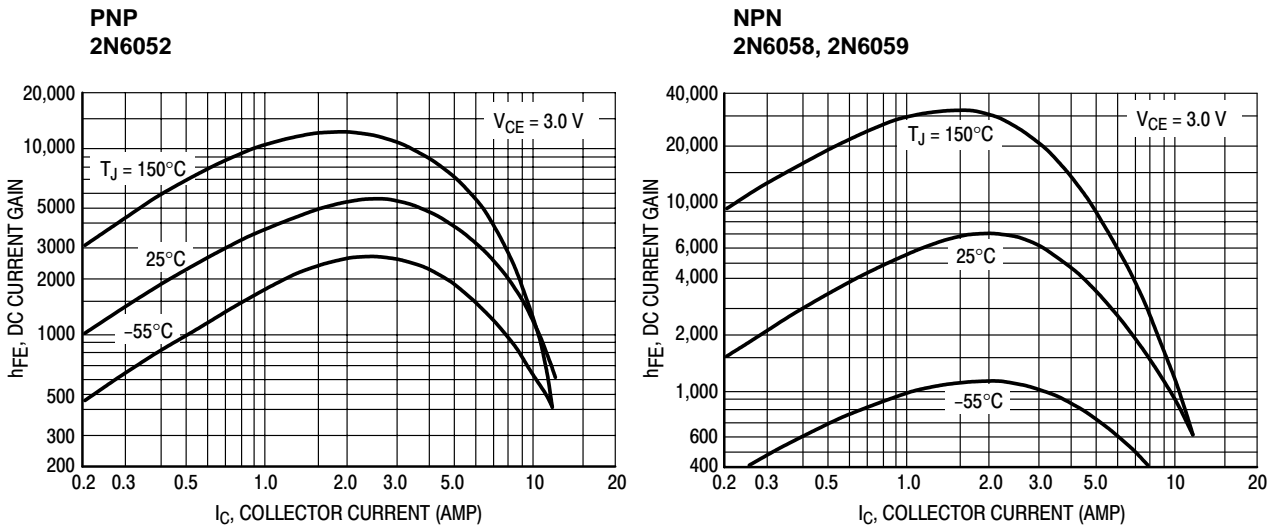


**Figure 7. Small-Signal Current Gain**

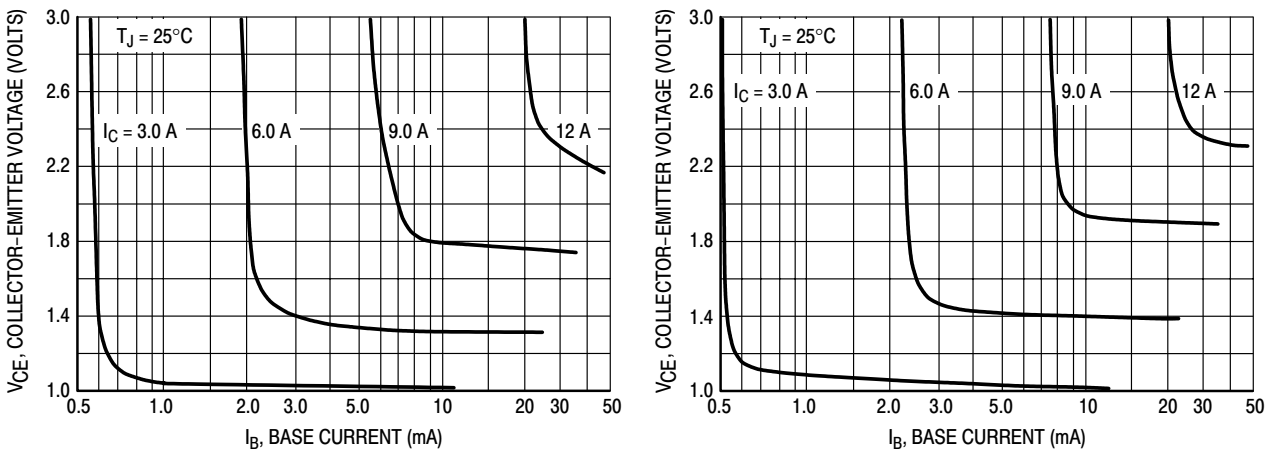


**Figure 8. Capacitance**

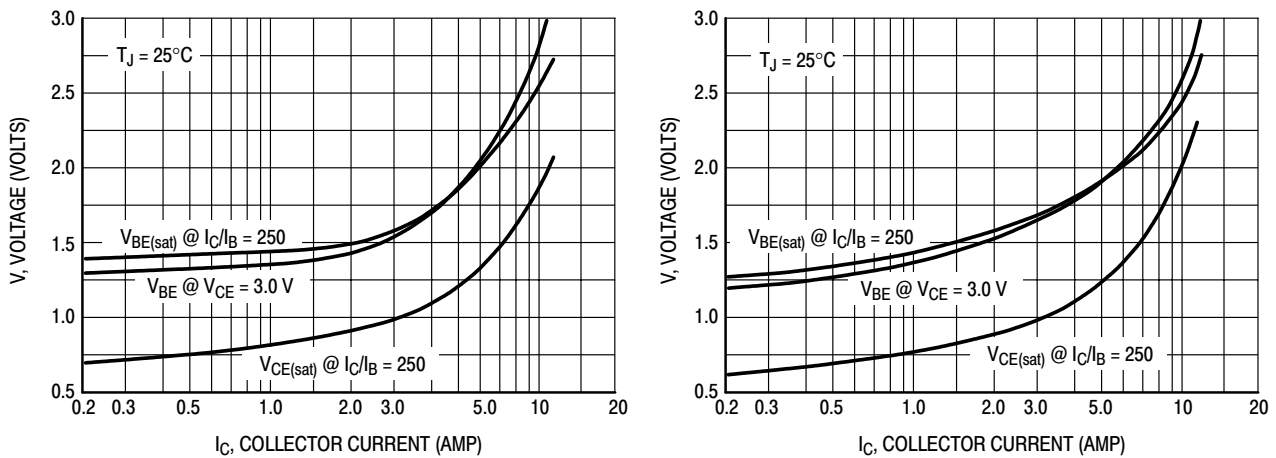
**2N6052**



**Figure 9. DC Current Gain**



**Figure 10. Collector Saturation Region**

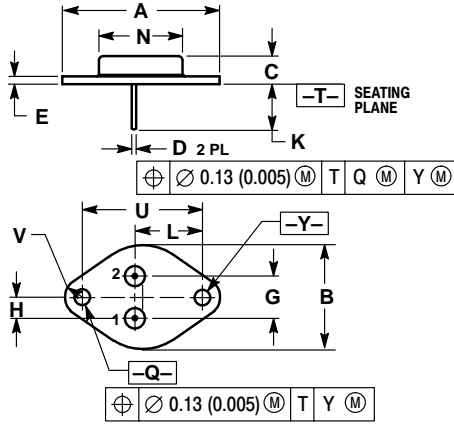


**Figure 11. "On" Voltages**

**2N6052**

**PACKAGE DIMENSIONS**

**CASE 1-07  
TO-204AA (TO-3)  
ISSUE Z**



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	---	1.050	---	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	---	0.830	---	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:


- PIN 1. BASE
- 2. EMITTER
- CASE: COLLECTOR

## **2N6052**

### **Notes**



**2N6052**

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