

**2N6609**  
(See 2N3773)

**2N6667**  
**2N6668**

**PNP SILICON  
DARLINGTON  
POWER TRANSISTORS  
10 AMPERES  
60-80 VOLTS  
65 WATTS**

## Darlington Silicon Power Transistors

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

- High DC Current Gain —  $h_{FE} = 3500$  (Typ) @  $I_C = 4$  Adc
- Collector-Emitter Sustaining Voltage — @ 200 mAdc  
 $V_{CEO(sus)} = 60$  Vdc (Min) — 2N6667  
 $= 80$  Vdc (Min) — 2N6668
- Low Collector-Emitter Saturation Voltage —  $V_{CE(sat)} = 2$  Vdc (Max) @  $I_C = 5$  Adc
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors
- TO-220AB Compact Package
- Complementary to 2N6387, 2N6388

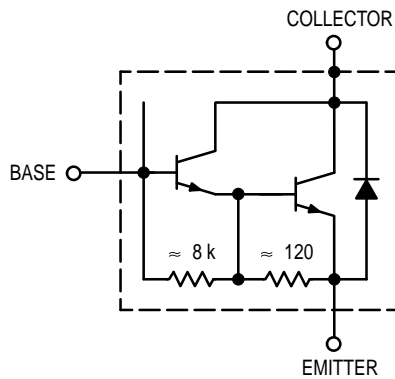
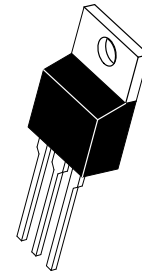


Figure 1. Darlington Schematic



CASE 221A-06  
TO-220AB

### MAXIMUM RATINGS (1)

Rating	Symbol	2N6667	2N6668	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	80	Vdc
Collector-Base Voltage	$V_{CB}$	60	80	Vdc
Emitter-Base Voltage	$V_{EB}$	5		Vdc
Collector Current — Continuous — Peak	$I_C$	10 15		A dc
Base Current	$I_B$	250		mA dc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	65 0.52		watts W/ $^\circ\text{C}$
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2 0.016		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	$R_{\theta JC}$	1.92	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

REV 1

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

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage (1) ( $I_C = 200\text{ mAdc}$ , $I_B = 0$ )	2N6667 2N6668	$V_{CEO(sus)}$	60 80	— —	Vdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 80\text{ Vdc}$ , $I_B = 0$ )	2N6667 2N6668	$I_{CEO}$	— —	1 1	mAdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )	2N6667 2N6668 2N6667 2N6668	$I_{CEX}$	— — — —	300 300 3 3	$\mu\text{Adc}$ mAdc
Emitter Cutoff Current ( $V_{BE} = 5\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	5	mAdc
<b>ON CHARACTERISTICS (1)</b>					
DC Current Gain ( $I_C = 5\text{ Adc}$ , $V_{CE} = 3\text{ Vdc}$ ) ( $I_C = 10\text{ Adc}$ , $V_{CE} = 3\text{ Vdc}$ )		$h_{FE}$	1000 100	20000 —	—
Collector–Emitter Saturation Voltage ( $I_C = 5\text{ Adc}$ , $I_B = 0.01\text{ Adc}$ ) ( $I_C = 10\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )		$V_{CE(sat)}$	— —	2 3	Vdc
Base–Emitter Saturation Voltage ( $I_C = 5\text{ Adc}$ , $I_B = 0.01\text{ Adc}$ ) ( $I_C = 10\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )		$V_{BE(sat)}$	— —	2.8 4.5	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Current Gain — Bandwidth Product ( $I_C = 1\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )		$ h_{fe} $	20	—	—
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1\text{ MHz}$ )		$C_{ob}$	—	200	pF
Small–Signal Current Gain ( $I_C = 1\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ , $f = 1\text{ kHz}$ )		$h_{fe}$	1000	—	—

\* Indicates JEDEC Registered Data

(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

$R_B$  &  $R_C$  VARIED TO OBTAIN DESIRED CURRENT LEVELS

$D_1$ , MUST BE FAST RECOVERY TYPES e.g.,

1N5825 USED ABOVE  $I_B \approx 100\text{ mA}$

MSD6100 USED BELOW  $I_B \approx 100\text{ mA}$

FOR  $t_d$  AND  $t_r$ ,  $D_1$  IS DISCONNECTED AND  $V_2 = 0$

$t_r$ ,  $t_f \leq 10\text{ ns}$

DUTY CYCLE = 1.0%

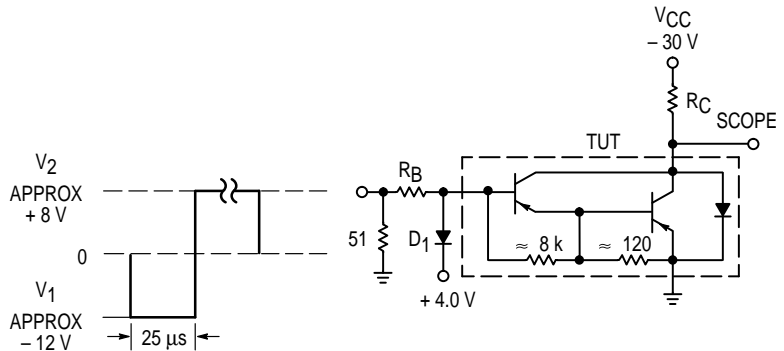


Figure 2. Switching Times Test Circuit

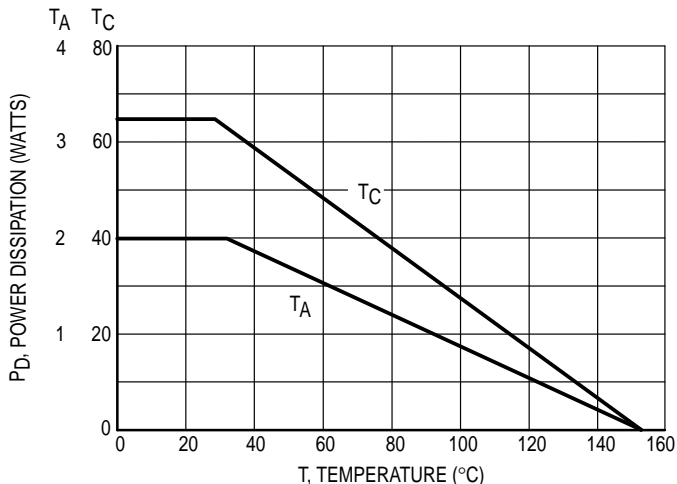


Figure 3. Power Derating

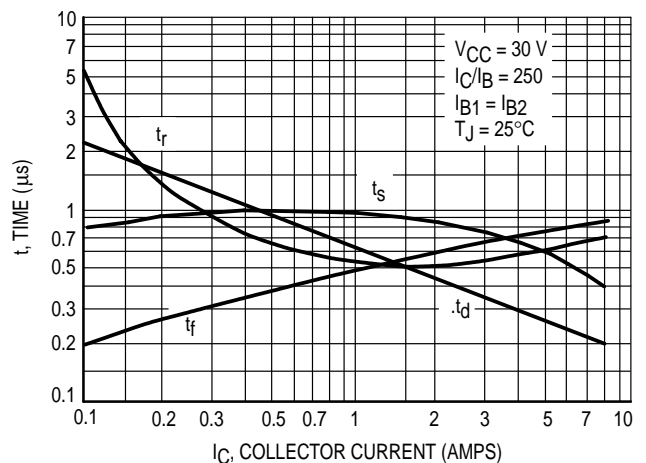


Figure 4. Typical Switching Times

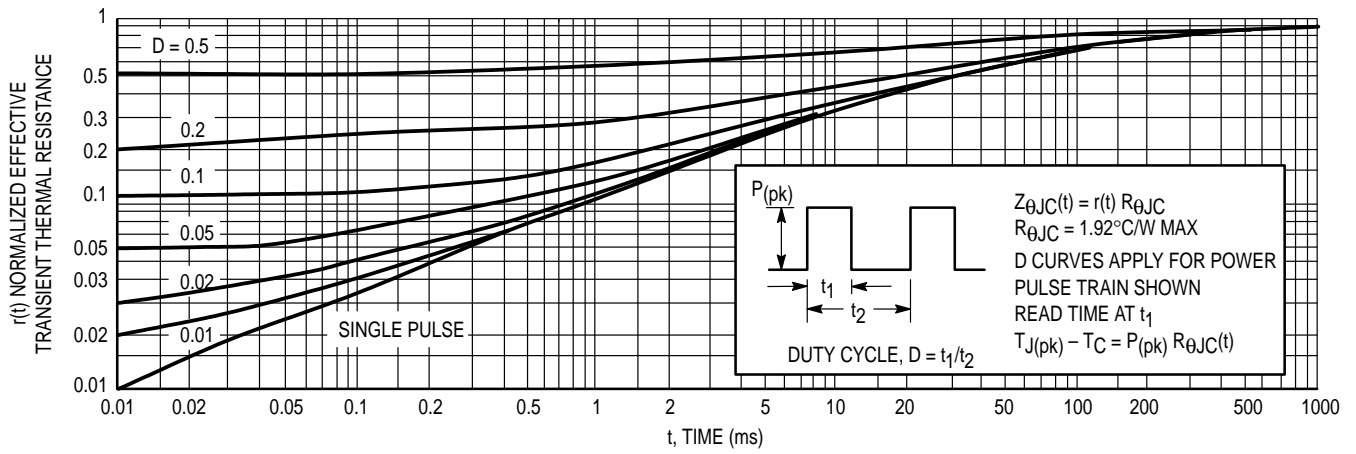


Figure 5. Thermal Response

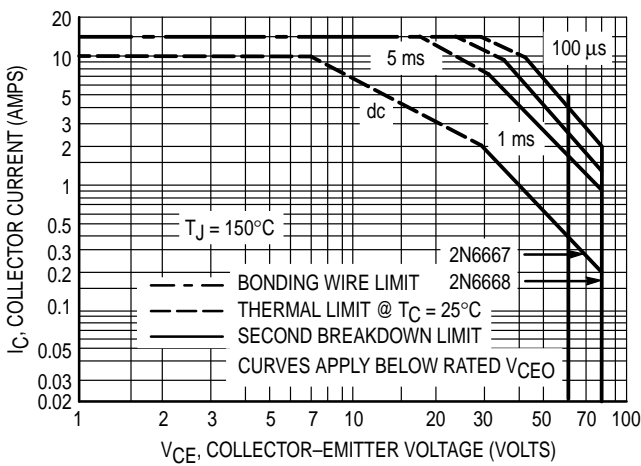


Figure 6. Maximum Safe Operating Area

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 6 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  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

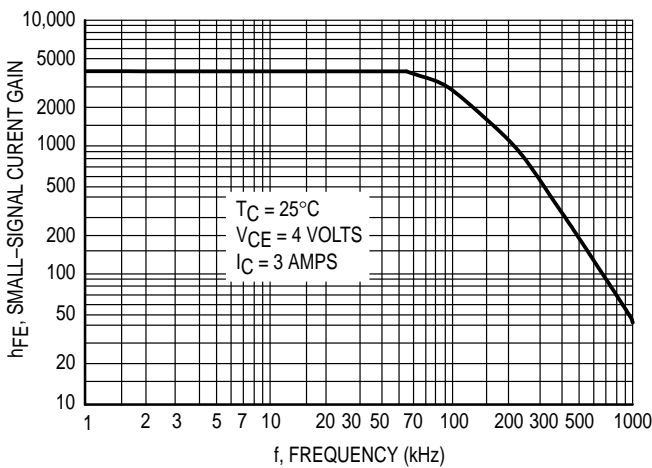


Figure 7. Typical Small-Signal Current Gain

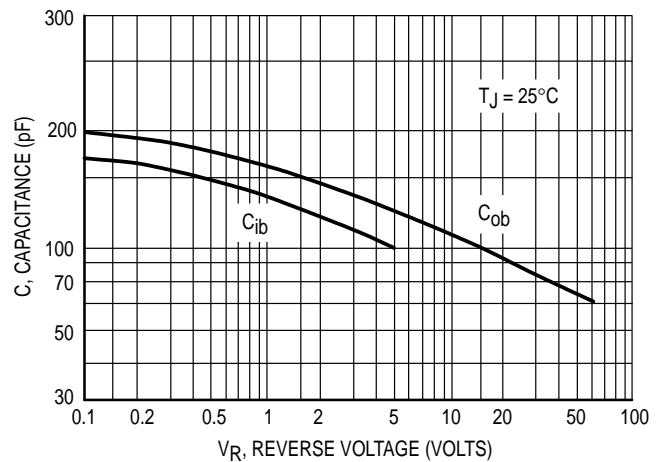


Figure 8. Typical Capacitance

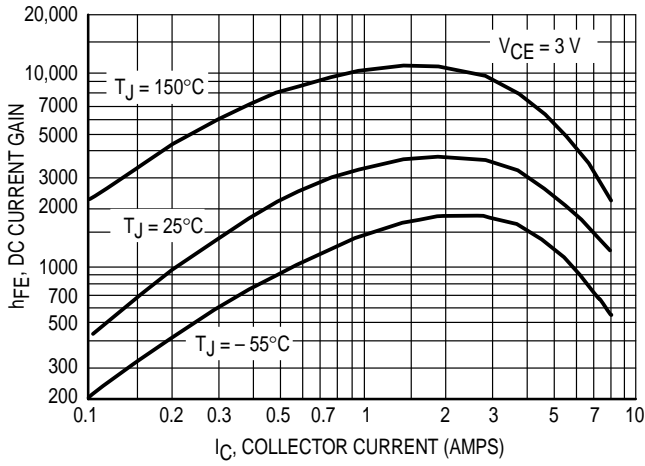


Figure 9. Typical DC Current Gain

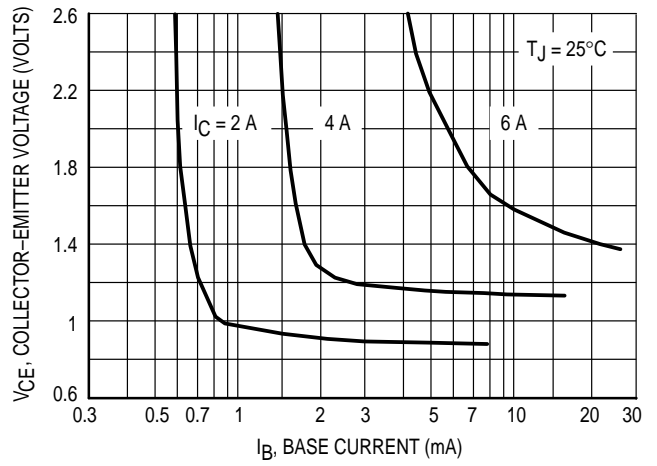


Figure 10. Typical Collector Saturation Region

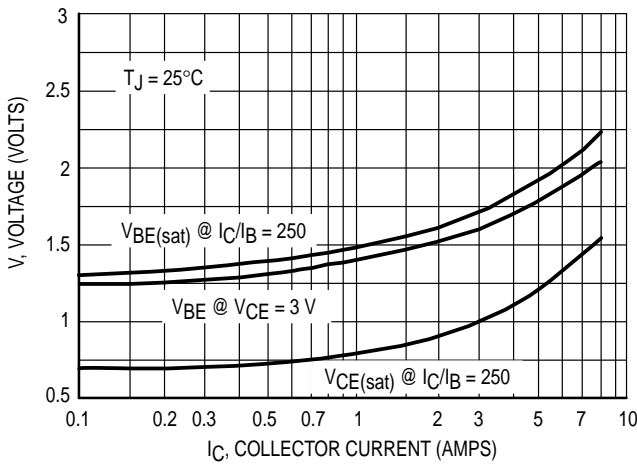


Figure 11. Typical "On" Voltages

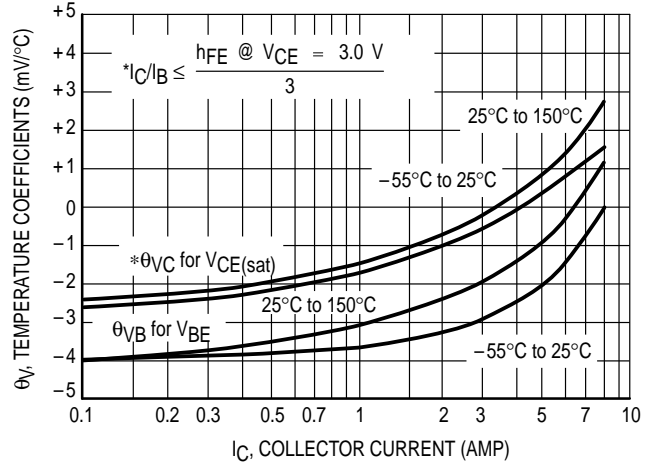


Figure 12. Typical Temperature Coefficients

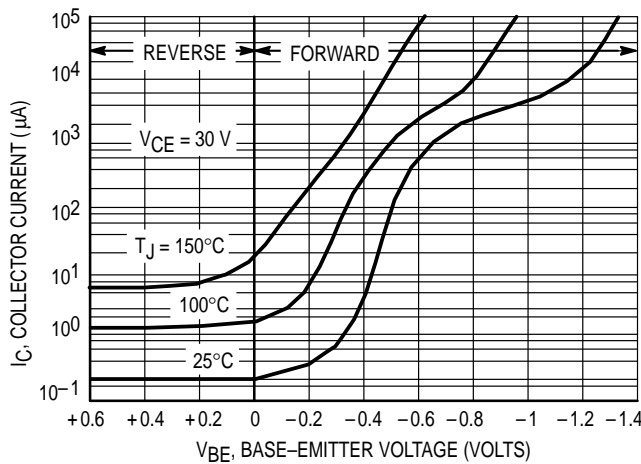
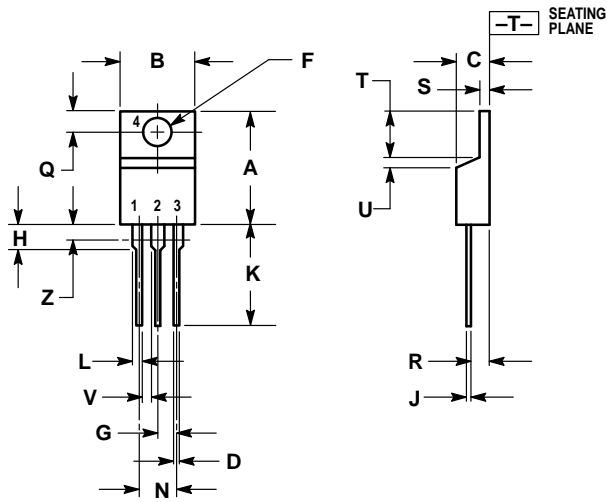


Figure 13. Typical Collector Cut-Off Region

PACKAGE DIMENSIONS




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

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

CASE 221A-06  
 TO-220AB  
 ISSUE Y

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