

Plastic Darlington Complementary Silicon Power Transistors

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

- High DC Current Gain —
 $h_{FE} = 2000$ (Typ) @ $I_C = 2.0$ Adc
- Collector–Emitter Sustaining Voltage — @ 100 mA dc
 $V_{CEO(sus)} = 60$ Vdc (Min) — 2N6035, 2N6038 = 80 Vdc (Min) — 2N6036, 2N6039
- Forward Biased Second Breakdown Current Capability
 $I_{S/b} = 1.5$ Adc @ 25 Vdc
- Monolithic Construction with Built–In Base–Emitter Resistors to Limit Leakage Multiplication
- Space–Saving High Performance–to–Cost Ratio TO–225AA Plastic Package

MAXIMUM RATINGS (1)

Rating	Symbol	2N6035 2N6038	2N6036 2N6039	Unit
Collector–Emitter Voltage	V_{CEO}	60	80	Vdc
Collector–Base Voltage	V_{CB}	60	80	Vdc
Emitter–Base Voltage	V_{EB}	5.0		Vdc
Collector Current — Continuous Peak	I_C	4.0 8.0		A dc
Base Current	I_B	100		mA dc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	40 0.32		Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5 0.012		Watts
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150		$^\circ\text{C}$

THERMAL CHARACTERISTICS

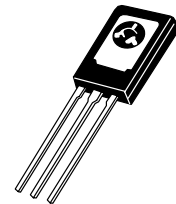
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.12	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	θ_{JA}	83.3	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

PNP
2N6035
2N6036*
NPN
2N6038
2N6039*

*ON Semiconductor Preferred Device

DARLINGTON
4-AMPERE
COMPLEMENTARY
SILICON
POWER TRANSISTORS
60, 80 VOLTS
40 WATTS



CASE 77-09
TO-225AA TYPE

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

2N6035 2N6036 2N6038 2N6039

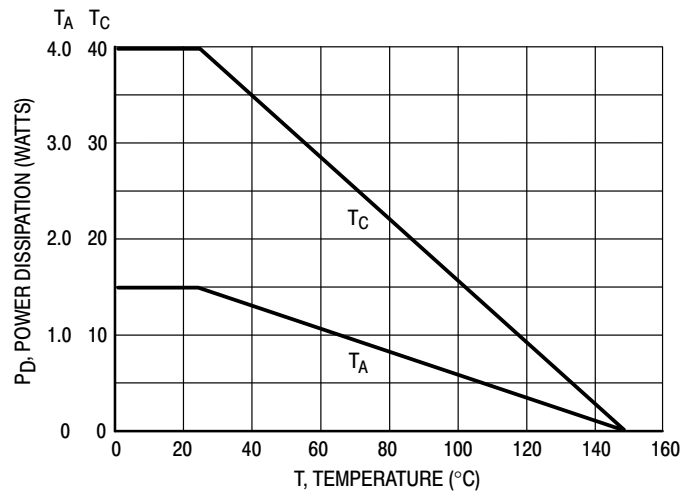


Figure 1. Power Derating

2N6035 2N6036 2N6038 2N6039

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CEO(sus)}$	60 80	— —	Vdc
Collector–Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 80\text{ Vdc}$, $I_B = 0$)	I_{CEO}	— —	100 100	μA
Collector–Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 80\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 60\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 125^\circ\text{C}$) ($V_{CE} = 80\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 125^\circ\text{C}$)	I_{CEX}	— — — —	100 100 500 500	μA
Collector–Cutoff Current ($V_{CB} = 60\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80\text{ Vdc}$, $I_E = 0$)	I_{CBO}	— —	0.5 0.5	mAdc
Emitter–Cutoff Current ($V_{BE} = 5.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	2.0	mAdc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$) ($I_C = 2.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$) ($I_C = 4.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$)	h_{FE}	500 750 100	— 15,000 —	—
Collector–Emitter Saturation Voltage ($I_C = 2.0\text{ Adc}$, $I_B = 8.0\text{ mAdc}$) ($I_C = 4.0\text{ Adc}$, $I_B = 40\text{ mAdc}$)	$V_{CE(sat)}$	— —	2.0 3.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 4.0\text{ Adc}$, $I_B = 40\text{ mAdc}$)	$V_{BE(sat)}$	—	4.0	Vdc
Base–Emitter On Voltage ($I_C = 2.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$)	$V_{BE(on)}$	—	2.8	Vdc
DYNAMIC CHARACTERISTICS				
Small–Signal Current–Gain ($I_C = 0.75\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ MHz}$)	$ h_{fe} $	25	—	—
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1\text{ MHz}$)	C_{ob}	— —	200 100	pF

*Indicates JEDEC Registered Data.

2N6035 2N6036 2N6038 2N6039

R_B & R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
 D_1 MUST BE FAST RECOVERY TYPE, eg:
 1N5825 USED ABOVE $I_B \approx 100$ mA
 MSD6100 USED BELOW $I_B \approx 100$ mA

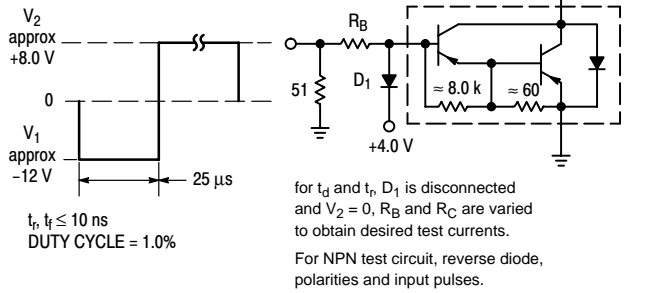


Figure 2. Switching Times Test Circuit

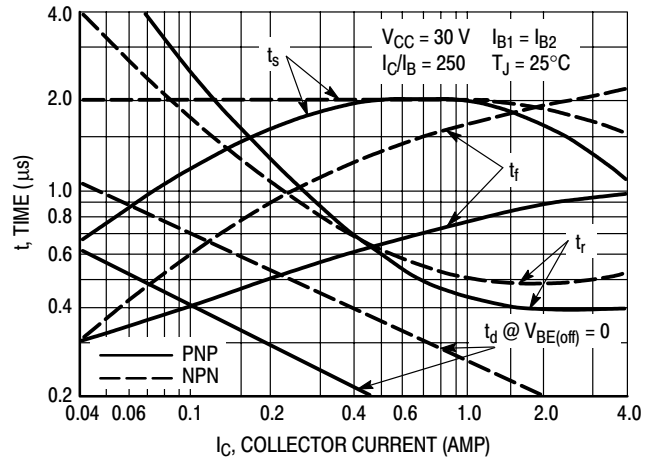


Figure 3. Switching Times

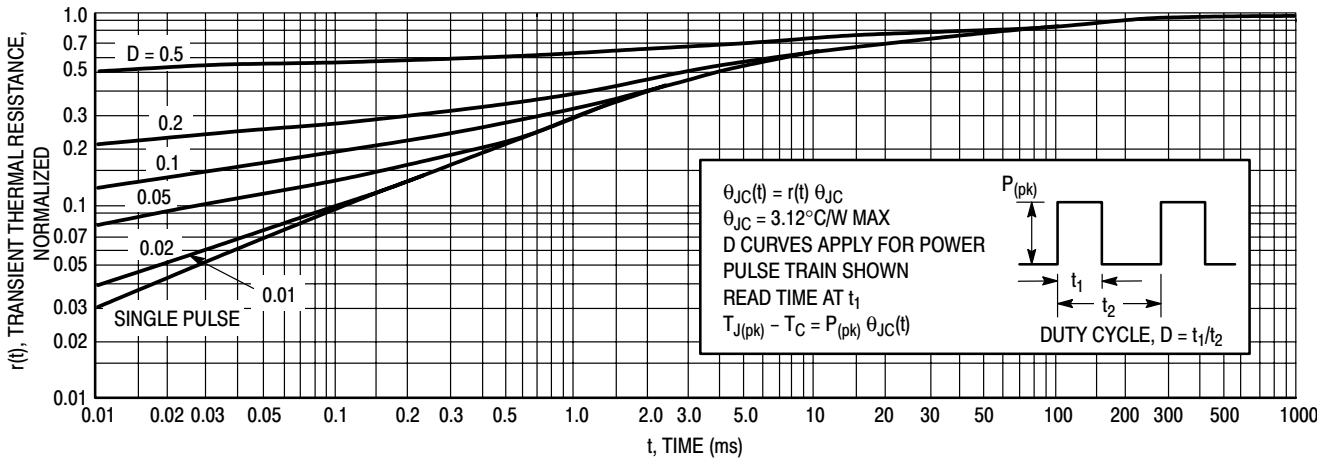


Figure 4. Thermal Response

ACTIVE-REGION SAFE-OPERATING AREA

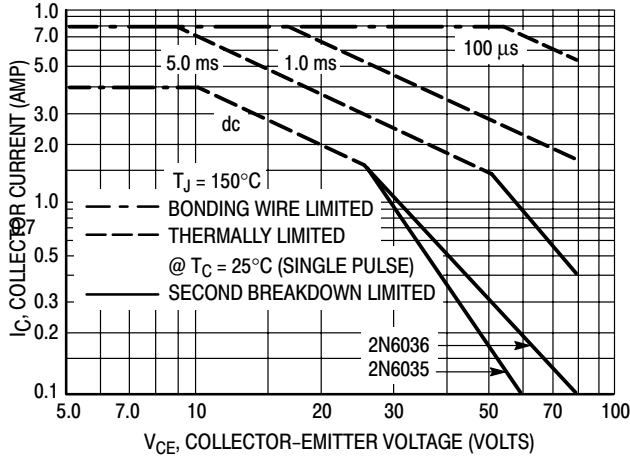


Figure 5. 2N6035, 2N6036

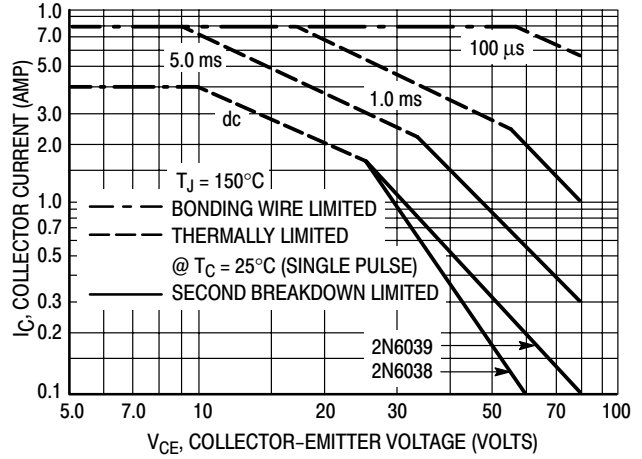


Figure 6. 2N6038, 2N6039

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 and 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 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.

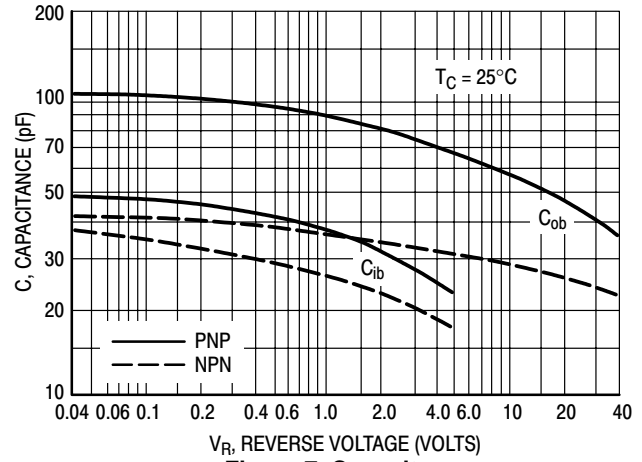


Figure 7. Capacitance

2N6035 2N6036 2N6038 2N6039

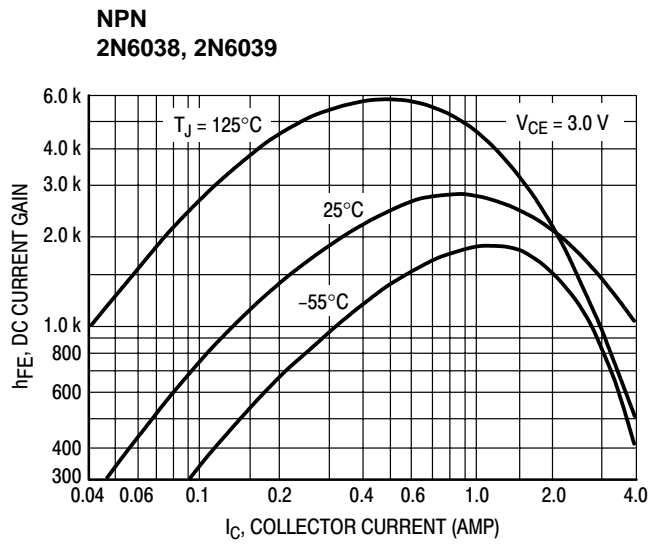
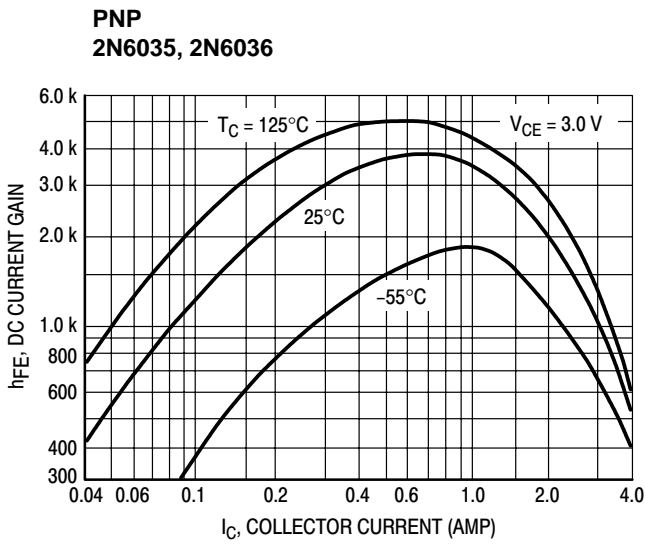


Figure 8. DC Current Gain

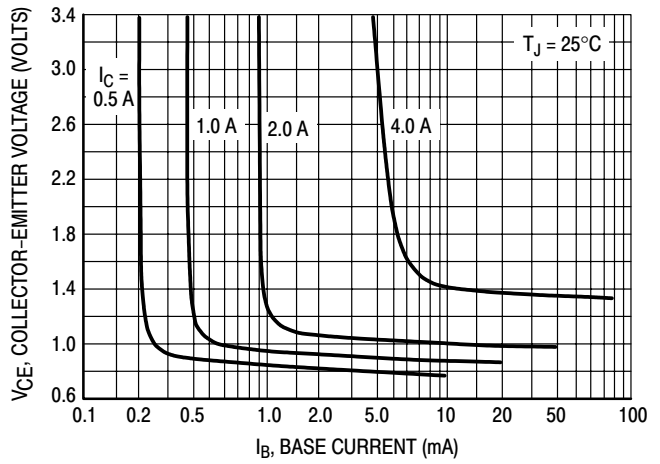
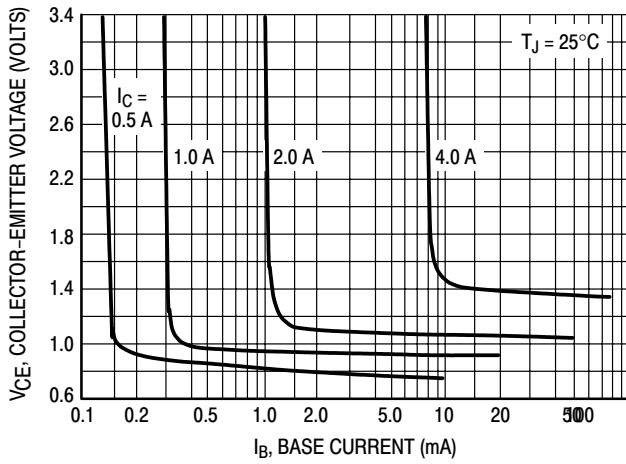


Figure 9. Collector Saturation Region

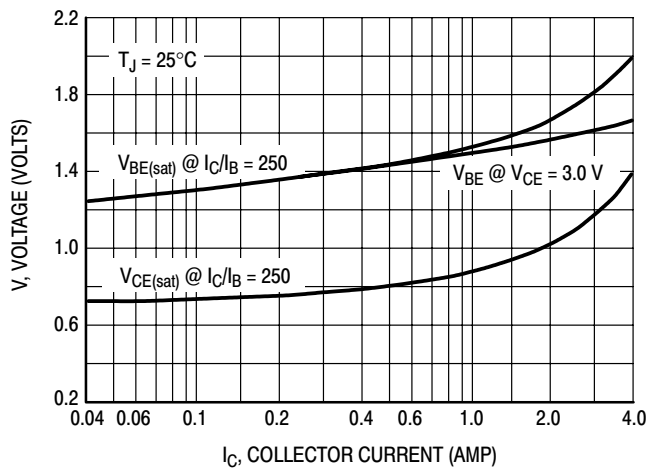
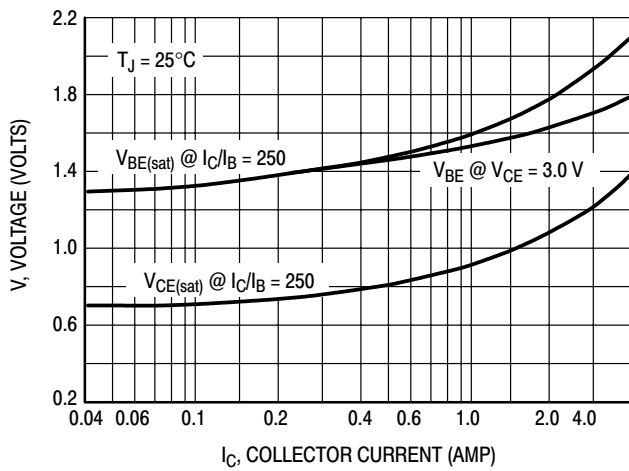
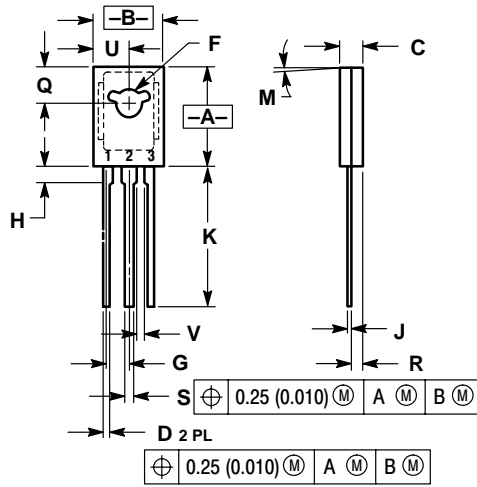


Figure 10. "On" Voltages

2N6035 2N6036 2N6038 2N6039

PACKAGE DIMENSIONS

TO-225AA
CASE 77-09
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	---

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