

# (PNP) 2N6034, 2N6035, 2N6036; (NPN) 2N6038, 2N6039



ON Semiconductor®

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## Plastic Darlington Complementary Silicon Power Transistors

Plastic Darlington complementary silicon power transistors are designed for general purpose amplifier and low-speed switching applications.

### Features

- ESD Ratings: Machine Model, C; > 400 V  
Human Body Model, 3B; > 8000 V
- Epoxy Meets UL 94 V-0 @ 0.125 in
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage 2N6034 2N6035, 2N6038 2N6036, 2N6039	$V_{CEO}$	40 60 80	Vdc
Collector-Base Voltage 2N6034 2N6035, 2N6038 2N6036, 2N6039	$V_{CBO}$	40 60 80	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc
Collector Current Continuous Peak	$I_C$	4.0 8.0	Adc Apk
Base Current	$I_B$	100	mAdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	40 320	W mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

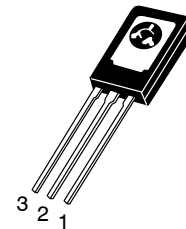
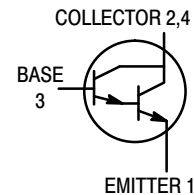
### THERMAL CHARACTERISTICS

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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## 4.0 AMPERES DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS 40, 60, 80 VOLTS, 40 WATTS



TO-225AA  
CASE 77  
STYLE 1

### MARKING DIAGRAM



Y = Year  
WW = Work Week  
2N603x = Device Code  
x = 4, 5, 6, 8, 9  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

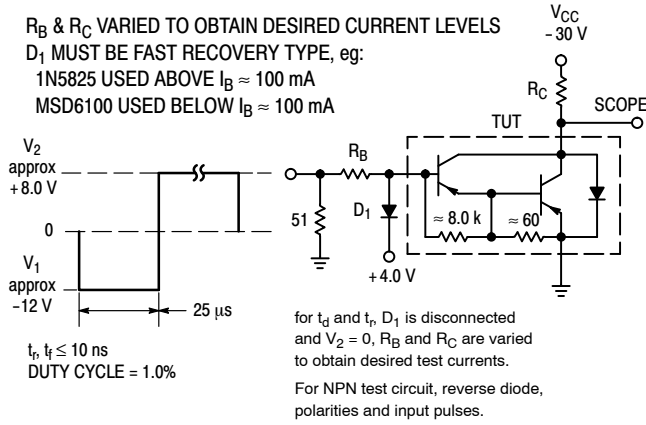
**(PNP) 2N6034, 2N6035, 2N6036; (NPN) 2N6038, 2N6039**

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

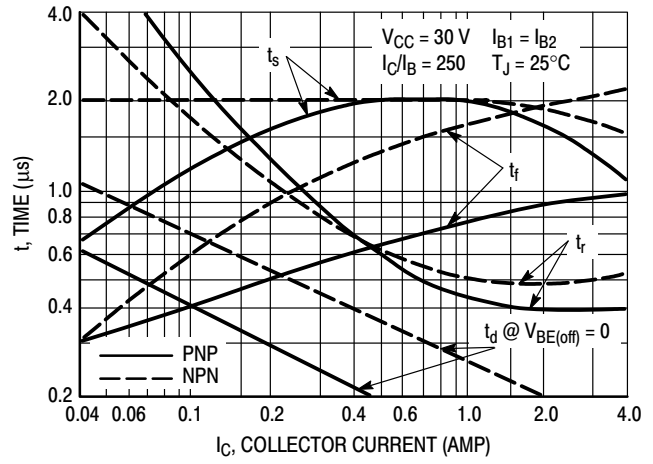
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	$V_{CE(sus)}$	40 60 80	– – –	Vdc
				2N6034 2N6035, 2N6038 2N6036, 2N6039
Collector–Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 80\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	– – –	100 100 100	$\mu\text{A}$
				2N6034 2N6035, 2N6038 2N6036, 2N6039
Collector–Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 60\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 40\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) ( $V_{CE} = 60\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )	$I_{CEX}$	– – – – – –	100 100 100 500 500 500	$\mu\text{A}$
				2N6034 2N6035, 2N6038 2N6036, 2N6039 2N6034 2N6035, 2N6038 2N6036, 2N6039
Collector–Cutoff Current ( $V_{CB} = 40\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	– – –	0.5 0.5 0.5	mAdc
				2N6034 2N6035, 2N6038 2N6036, 2N6039
Emitter–Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	2.0	mAdc
<b>ON CHARACTERISTICS</b>				
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
<b>DYNAMIC CHARACTERISTICS</b>				
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	$\mu\text{F}$
				2N6034, 2N6035, 2N6036 2N6038, 2N6039

\*Indicates JEDEC Registered Data.

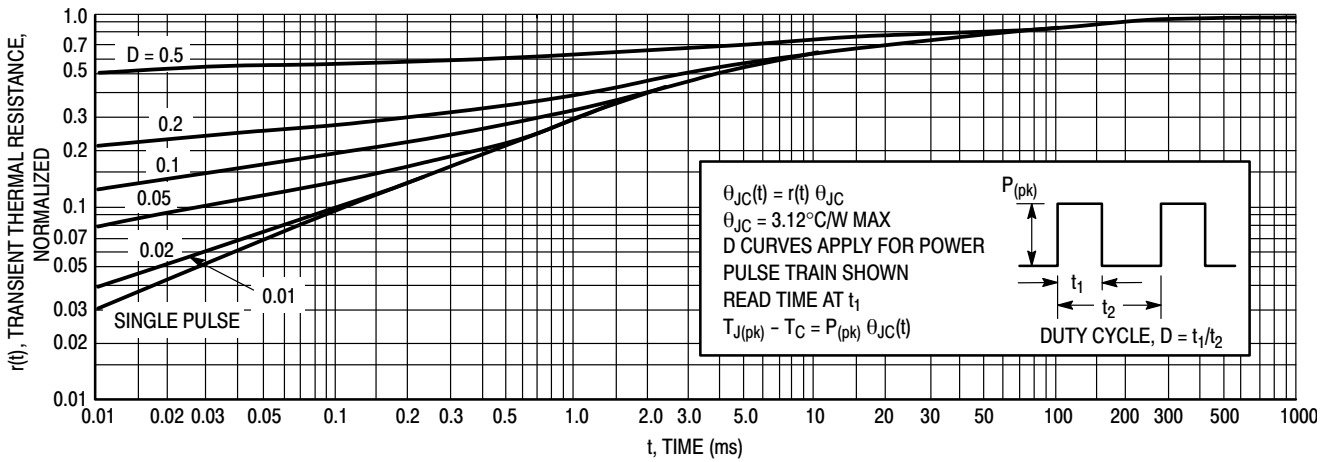
**(PNP) 2N6034, 2N6035, 2N6036; (NPN) 2N6038, 2N6039**



**Figure 1. Switching Times Test Circuit**



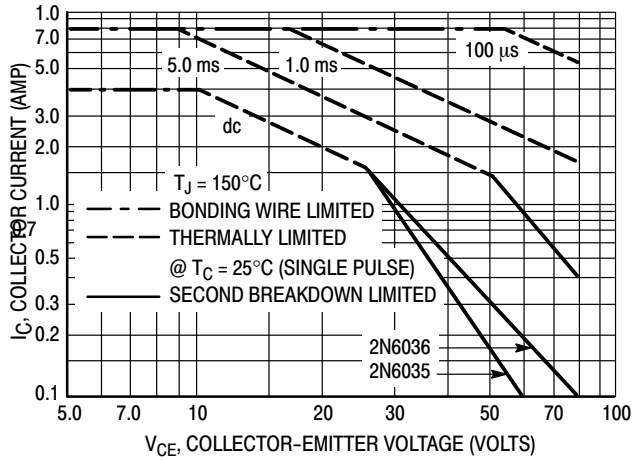
**Figure 2. Switching Times**



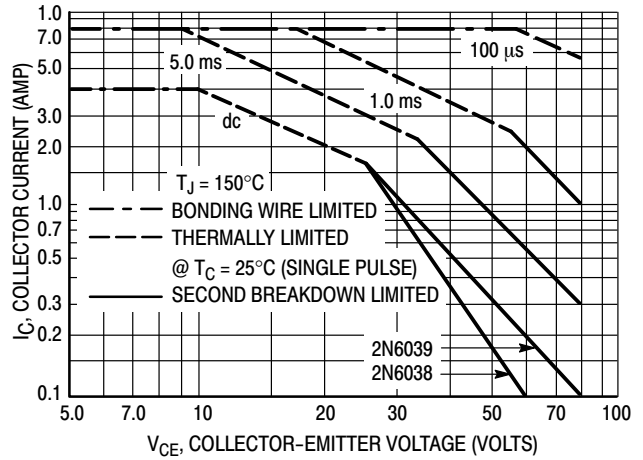
**Figure 3. Thermal Response**

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**ACTIVE-REGION SAFE-OPERATING AREA**



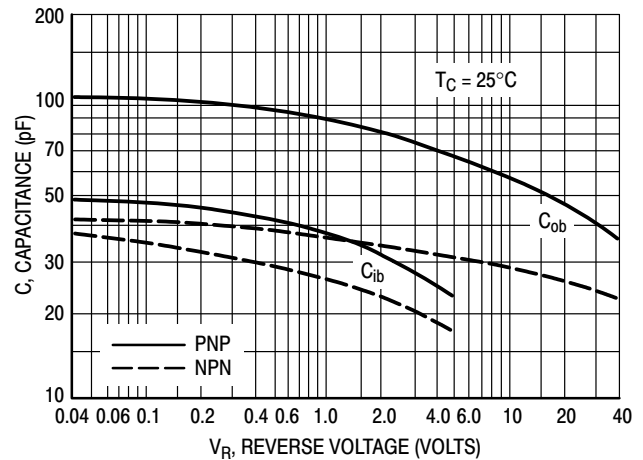
**Figure 4. 2N6035, 2N6036**



**Figure 5. 2N6038, 2N6039**

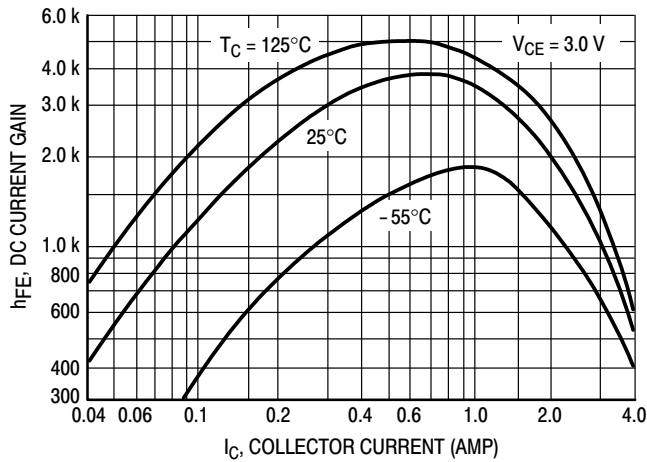
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 4 and 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  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 3. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

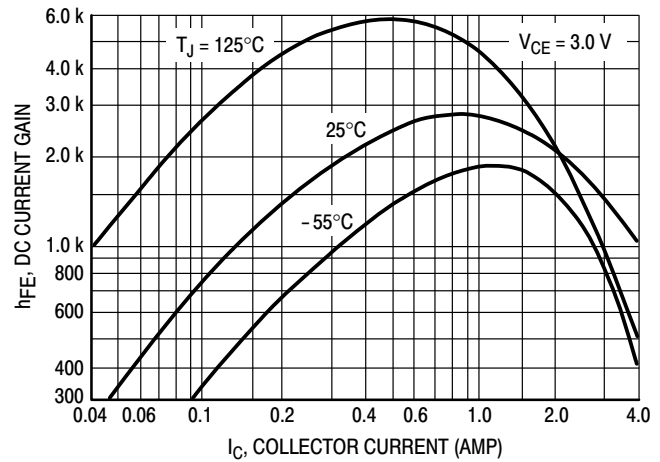


**Figure 6. Capacitance**

**PNP**  
**2N6034, 2N6035, 2N6036**

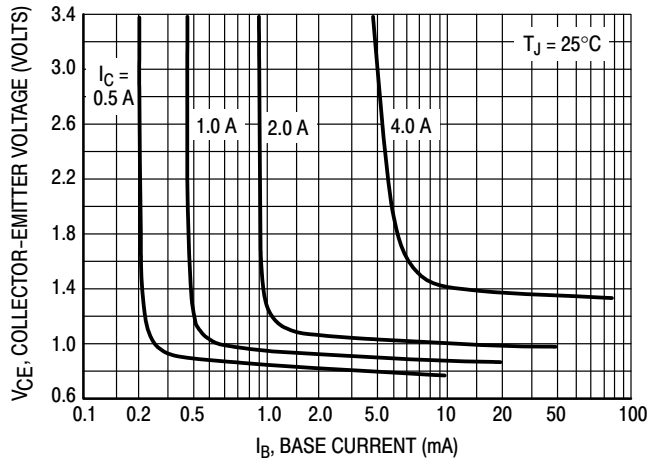
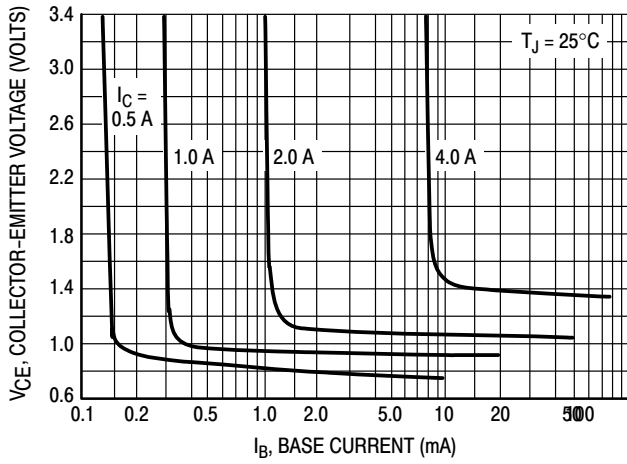


**NPN**  
**2N6038, 2N6039**

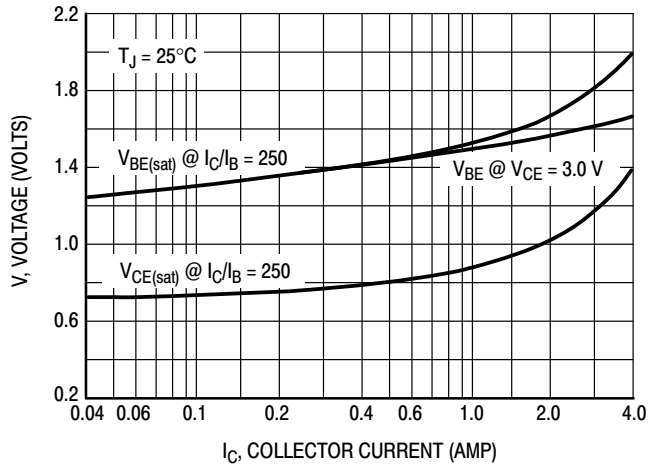
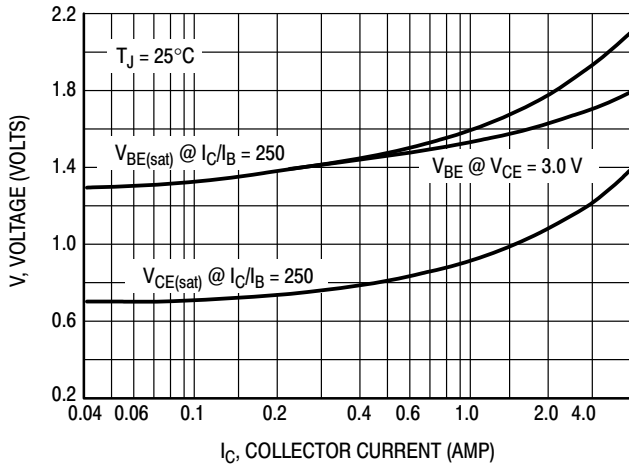


**Figure 7. DC Current Gain**

**(PNP) 2N6034, 2N6035, 2N6036; (NPN) 2N6038, 2N6039**



**Figure 8. Collector Saturation Region**



**Figure 9. "On" Voltages**

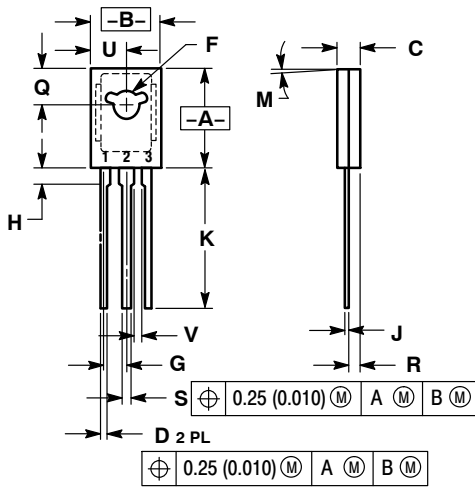
**ORDERING INFORMATION**

Device	Package	Shipping
2N6034	TO-225AA	500 Units / Box
2N6034G	TO-225AA (Pb-Free)	
2N6035	TO-225AA	
2N6035G	TO-225AA (Pb-Free)	
2N6036	TO-225AA	
2N6036G	TO-225AA (Pb-Free)	
2N6038	TO-225AA	
2N6038G	TO-225AA (Pb-Free)	
2N6039	TO-225AA	
2N6039G	TO-225AA (Pb-Free)	

(PNP) 2N6034, 2N6035, 2N6036; (NPN) 2N6038, 2N6039

PACKAGE DIMENSIONS

TO-225AA  
CASE 77-09  
ISSUE Z



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 077-01 THRU -08 OBSOLETE, NEW STANDARD 077-09.

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:

1. EMITTER
2. COLLECTOR
3. BASE

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