Plastic Darlington Complementary Silicon Power Transistors

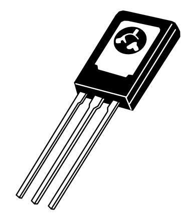
. . . designed for general–purpose amplifier and low–speed switching applications.

- High DC Current Gain —
  h_{FE} = 2000 (Typ) @ I_C = 2.0 Adc
- Collector–Emitter Sustaining Voltage — @ 100 mAdc
  $V_{CEO(sus)}$ = 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

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

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		Adc
Base Current	I_B	100		mAdc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	40 0.32		Watts W/°C
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.5 0.012		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.12	°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	83.3	°C/W

(1) Indicates JEDEC Registered Data.

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

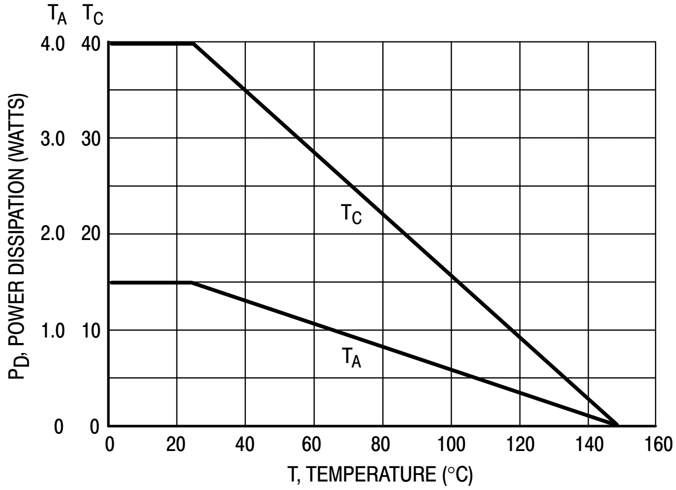


Figure 1. Power Derating

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (I_C = 100 mAdc, I_B = 0)	2N6035, 2N6038 2N6036, 2N6039	$V_{CEO(sus)}$	60 80	— —	Vdc
Collector–Cutoff Current (V_{CE} = 60 Vdc, I_B = 0) (V_{CE} = 80 Vdc, I_B = 0)	2N6035, 2N6038 2N6036, 2N6039	I_{CEO}	— —	100 100	µA
Collector–Cutoff Current (V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc) (V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc) (V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C) (V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)	2N6035, 2N6038 2N6036, 2N6039 2N6035, 2N6038 2N6036, 2N6039	I_{CEX}	— — — —	100 100 500 500	µA
Collector–Cutoff Current (V_{CB} = 60 Vdc, I_E = 0) (V_{CB} = 80 Vdc, I_E = 0)	2N6035, 2N6038 2N6036, 2N6039	I_{CBO}	— —	0.5 0.5	mAdc
Emitter–Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	—	2.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.5 Adc, V_{CE} = 3.0 Vdc) (I_C = 2.0 Adc, V_{CE} = 3.0 Vdc) (I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)		h_{FE}	500 750 100	— 15,000 —	—
Collector–Emitter Saturation Voltage (I_C = 2.0 Adc, I_B = 8.0 mAdc) (I_C = 4.0 Adc, I_B = 40 mAdc)		$V_{CE(sat)}$	— —	2.0 3.0	Vdc
Base–Emitter Saturation Voltage (I_C = 4.0 Adc, I_B = 40 mAdc)		$V_{BE(sat)}$	—	4.0	Vdc
Base–Emitter On Voltage (I_C = 2.0 Adc, V_{CE} = 3.0 Vdc)		$V_{BE(on)}$	—	2.8	Vdc
DYNAMIC CHARACTERISTICS					
Small–Signal Current–Gain (I_C = 0.75 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz)		$\|h_{fe}\|$	25	—	—
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	2N6035, 2N6036 2N6038, 2N6039	C_{ob}	— —	200 100	pF

*Indicates JEDEC Registered Data.

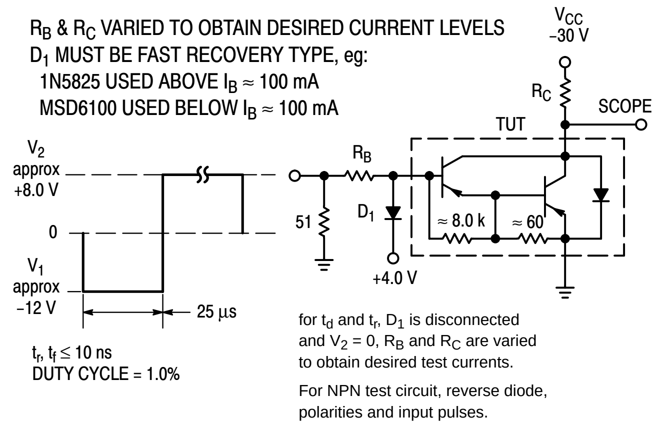


Figure 2. Switching Times Test Circuit

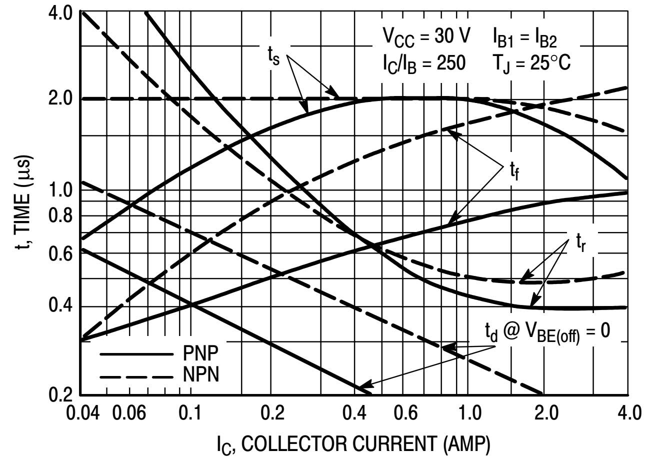


Figure 3. Switching Times

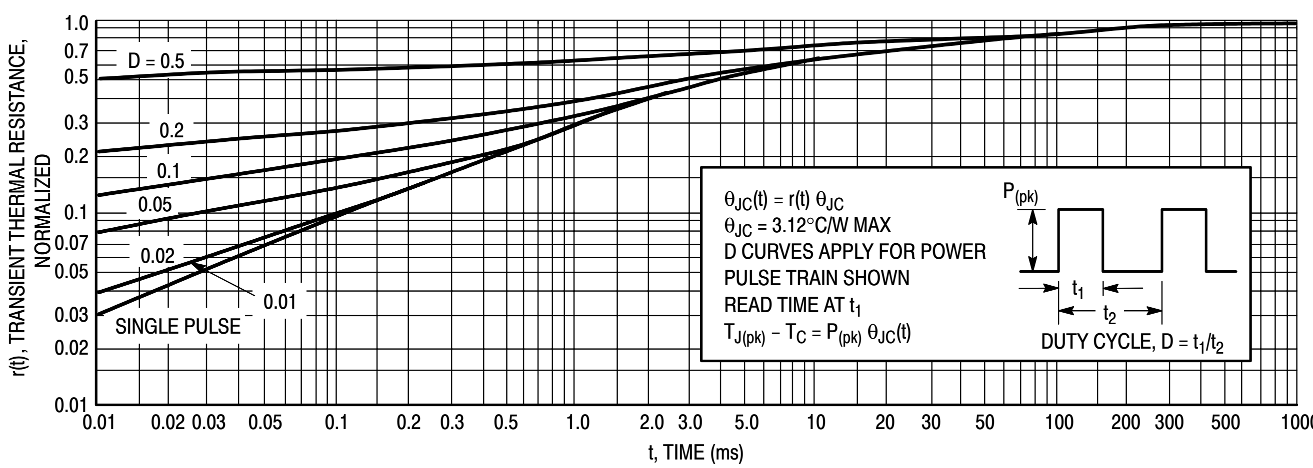


Figure 4. Thermal Response

ACTIVE–REGION SAFE–OPERATING AREA

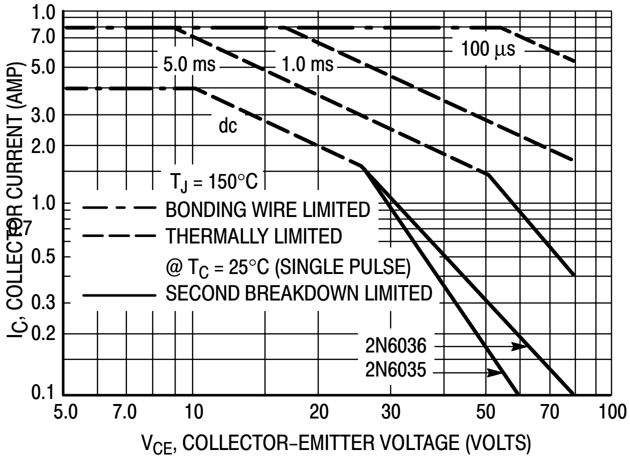


Figure 5. 2N6035, 2N6036

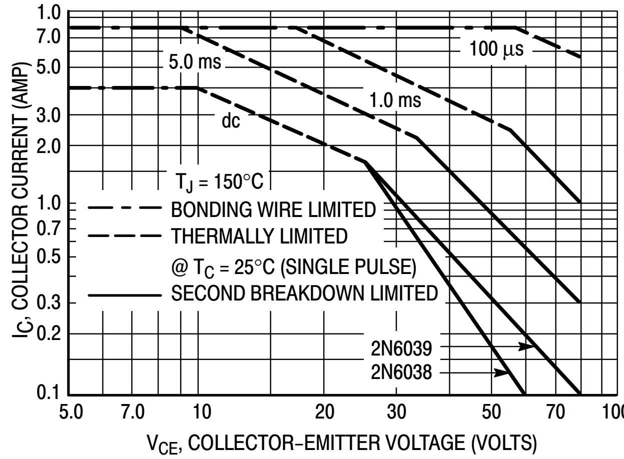


Figure 6. 2N6038, 2N6039

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 $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150°C$. $T_{J(pk)}$ 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.

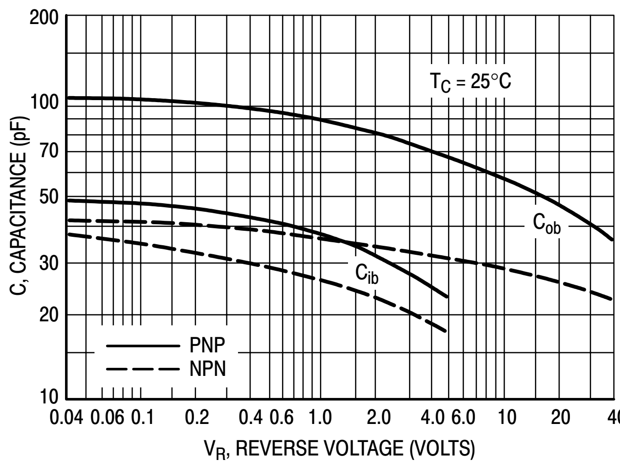


Figure 7. Capacitance

PNP
2N6035, 2N6036

NPN
2N6038, 2N6039

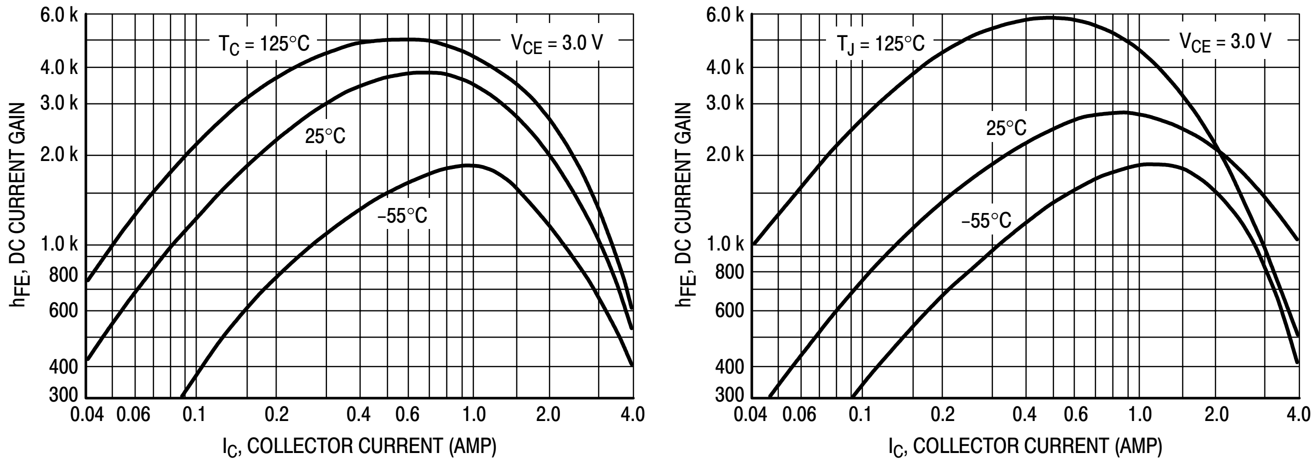


Figure 8. DC Current Gain

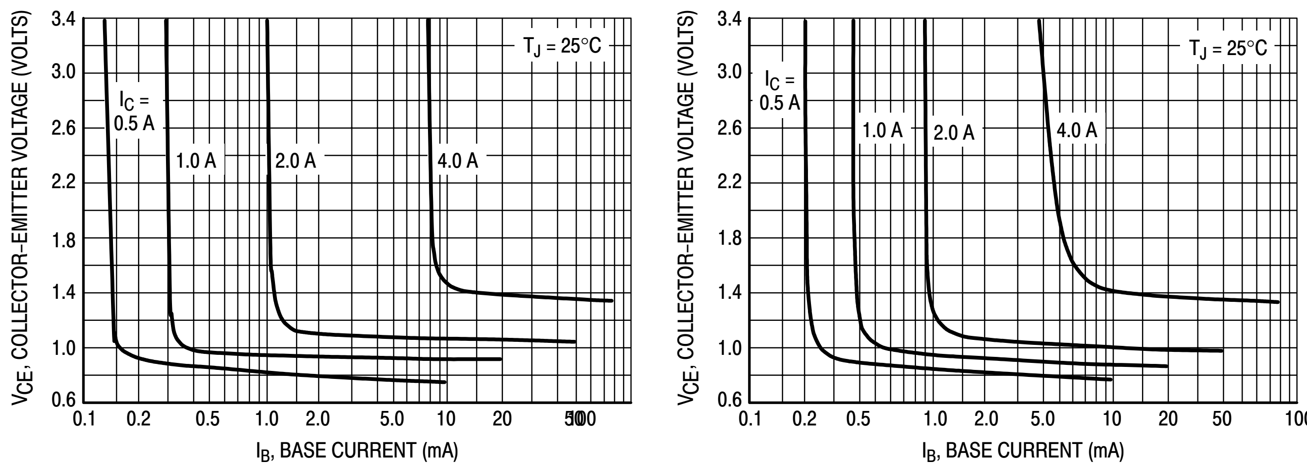


Figure 9. Collector Saturation Region

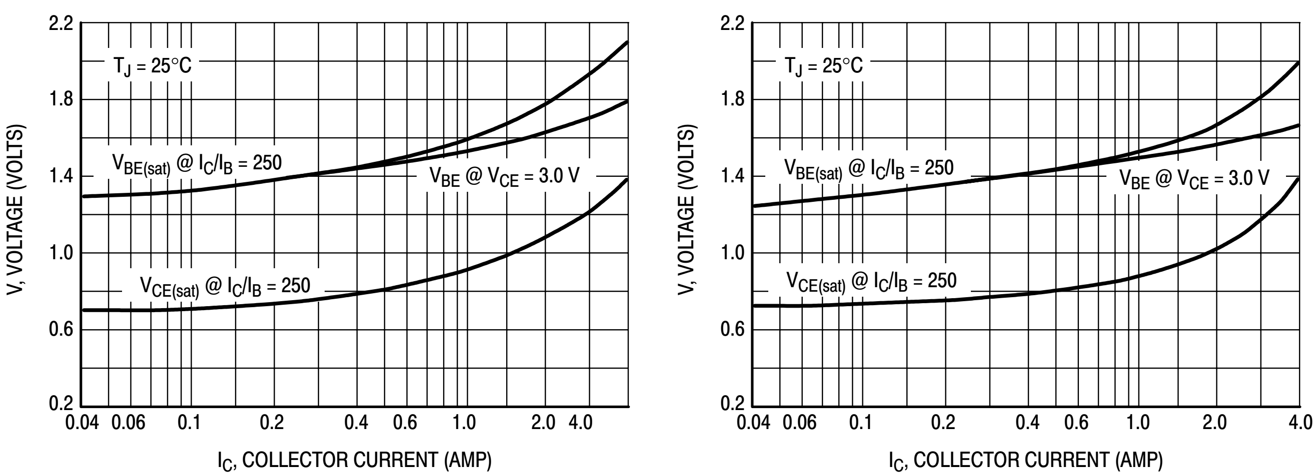
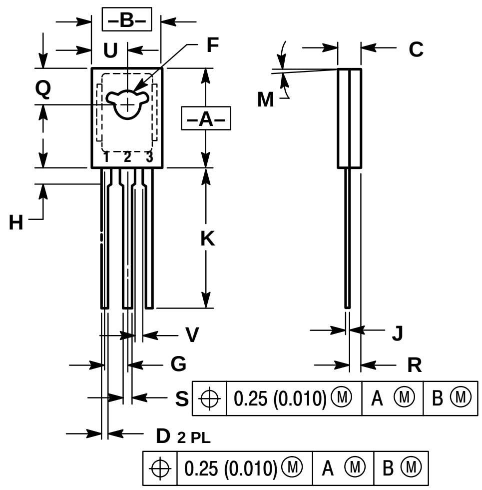


Figure 10. “On” Voltages

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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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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