

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

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BD608	BD808		3-318	BD702	BD902		3-322
BD609	BD809		3-316	BD705	BD795		3-312
BD610	BD810		3-318	BD706	BD796		3-314
BD611	BD437		3-292	BD707	BD797		3-312
BD612	BD438		3-295	BD708	BD798		3-314
BD613	BD437		3-292	BD709	BD799		3-312
BD614	BD438		3-295	BD710	BD800		3-314
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BD616	BD438		3-295	BD712	BD802		3-314
BD617	BD440		3-295	BD733	BD805		3-154
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BD647	BD899		3-320	BD775	BD778		3-302
BD648	BD900		3-322	BD776	BD779	BD780 BD785 BD786 BD787	3-302
BD649	BD901		3-320	BD777	BD780		3-304
BD650	BD902		3-322	BD778	BD785		3-304
BD661	BD185		3-272	BD779	BD786		3-304
BD661K			3-154	BD780	BD787		3-304
BD662			3-304	BD785	BD788	BD788 BD789 BD790 BD791 BD792	3-304
BD662K			3-154	BD786	BD789		3-308
BD663	BD795		3-312	BD787	BD790		3-308
BD664	BD796		3-314	BD788	BD791		3-308
BD675	BD675		3-298	BD789	BD792		3-312
BD675A	BD675A		3-298	BD790	BD795	BD796 BD797 BD798 BD799	3-314
BD676	BD676		3-300	BD791	BD796		3-312
BD676A	BD676A		3-300	BD792	BD797		3-314
BD677	BD677		3-298	BD795	BD798		3-312
BD677A	BD677A		3-298	BD796	BD799		3-312
BD678	BD678		3-300	BD797	BD800	BD801 BD802 BD805 BD806	3-314
BD678A	BD678A		3-300	BD798	BD801		3-314
BD679	BD679		3-298	BD799	BD802		3-316
BD679A	BD679A		3-298	BD800	BD805		3-318
BD680	BD680		3-300	BD801	BD806		
BD680A	BD680A		3-300	BD802			
BD681	BD681		3-298	BD805			
BD682	BD682		3-300	BD806			

*Consult Motorola if a direct replacement is necessary.

TABLE 7 — PLASTIC TO-225 Type (continued)

I _C Cont Amps Max	V _{CEO(sus)} Volts Min	Device Type		h _{FE} Min/Max	@ I _C Amp	Resistive Switching			f _T MHz Min	P _D (Case) Watts @ 25°C
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp		
3	45		BD176 BD176.6 BD176.10 BD176.16	40/250 40/100 63/160 100/250	0.15 0.15 0.15 0.15				3 3 3 3	30 30 30 30
		MJE181	MJE171	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5
		BD179 BD179.6 BD179.10 BD179.16 MJE182	BD180 BD180.6 BD180.10 BD180.16 MJE172	40/250 40/100 63/160 100/250 50/250	0.15 0.15 0.15 0.15 0.1				3 3 3 3 50	30 30 30 30 12.5
		BUY49P		30 min	0.5				25	20
	200									
4	30	BD185		15 min	2				20	40
	40	2N5190 MJE521 2N6037##	2N5193 MJE371 2N6034##	25/100 40 min 750/18k	1.5 1 2	0.4 typ 1.7 typ	0.4 typ 1.2 typ	1.5 2	2 25	40 40 40
		BD437 BD675## BD675A## BD785	BD438 BD676## BD676A## BD786 BD776##	40 min 750 min 750 min 20 min 750 min	2 1.5 2 2 2				3 50 20	36 40 40 15 15
	60	BD189		15 min	2				20	40
		BD677## BD677A## BD787 BD777## 2N5191 MJE800## MJE801## 2N6038##	BD440 BD678## BD678A## BD788 BD778## 2N5194 MJE700## MJE701## 2N6035##	25 min 750 min 750 min 20 min 750 min 25/100 750 min 750 min 750/18k	2 1.5 2 2 2 1.5 1.5 2 2				3 50 20 2 1# 1# 25	36 40 40 15 15 40 40 40
						0.4 typ	0.4 typ	1.5		
						1.7 typ	1.2 typ	2		
	80	2N5192 BD441 BD679## BD679A## BD789 BD779## MJE240 MJE241 MJE802## MJE803## 2N6039##	2N5195 BD442 BD680## BD680A## BD790 BD780## MJE250 MJE251 MJE702## MJE703## 2N6036##	25/100 15 min 750 min 750 min 10 min 750 min 40/200 40/120 750 min 750 min 750/18k	1.5 2 1.5 2 2 2 0.2 0.2 1.5 2 2	0.4 typ 0.15 typ 0.15 typ 1.7 typ	0.4 typ 0.07 typ 0.07 typ 1.2 typ	1.5 2 2 2	2 3 40 20 40 40 1# 1# 25	40 36 40 40 15 15 15 40 40 40
	100	BD681## BD791 MJE243 MJE244	BD682## BD792 MJE253 MJE254	750 min 10 min 40/120 25 min	1.5 2 0.2 0.2				40 40 40 40	40 15 15 15
5	25	MJE200	MJE210	45/180	2	0.13 typ	0.035 typ	2	65	15

● Case 77 (Style 3), # |h_{FE}| @ 1 MHz, ## Darlington

TABLE 12 — POWER DARLINGTONS (continued)

I _C Cont Amps Max	V _{CEO(sus)} Volts Min	Device Type		hFE Min/Max	@ I _C Amp	Resistive Switching			h _{FE} @ 1 MHz Min	P _D (Case) Watts @ 25°C	Case JEDEC/MOT	
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp				
4	40	MJE3300 2N6037	MJE3310 2N6034	1k min 750/1k	1 2				20 25	15 40	TO-225AA/77R TO-225AA/77	
	45	BD675 BD675A	BD676 BD676A BD776	750 min 750 min 750 min	1.5 2 2		1.7 typ	1.2 typ		40 40 15	TO-225AA/77 TO-225AA/77 TO-225AA/77	
		60	BD677 BD677A BD777	BD678 BD678A BD778	750 min 750 min 750 min	1.5 2 2					15 40 40	TO-225AA/77 TO-225AA/77 TO-225AA/77
			MJE3301 MJE800 MJE800T		1k min 750 min 750 min	1 1.5 1.5				20 20 1	15 40 40	TO-225AA/77R TO-225AA/77 TO-225AA/77
	MJE800T MJE801 2N6038 2N6294		MJE700 MJE700T MJE701 2N6035 2N6296	750 min 750 min 750/18k 750/18k	1.5 2 2 2	1.7 typ 0.9 typ	1.2 typ 0.7 typ	2 2	1 25 4	40 40 40 50	TO-220/221A TO-225AA/77 TO-225AA/77 TO-213AA/80	
	80		BD679 BD679A BD779	BD680 BD680A BD780	750 min 750 min 750 min	1.5 2 2					40 40 15	TO-225AA/77 TO-225AA/77 TO-225AA/77
			MJD6039 MJE802 MJE803	MJD6036 MJE702 MJE703	1k/12k 750 min 750 min	2 1.5 2	1.7 typ 1.7 typ	1.2 typ 1.2 typ	2 2	25 4	20 40 40	TO-252/369A-04 TO-225AA/77 TO-225AA/77
			2N6039 2N6295	2N6036 2N6297	750/18k 750/18k	2 2	0.9 typ 0.7 typ	0.7 typ 0.7 typ	2 2	25 4	40 50	TO-225AA/77 TO-213AA/80
			100	BD681	BD682	750 min	1.5					40
	5	60	MJE1100 MJE1101 TIP120	MJE1090 MJE1091 TIP125	750 min 750 min 1k min	3A 4A 3				1 1 4	70 70 65	TO-225AB/90 TO-225AB/90 TO-220/221A
80		MJE1102 MJE1103 TIP121	MJE1092 MJE1102 TIP126	750 min 750 min 1k min	3A 4A 3	1.5 typ 1.5 typ	1.5 typ 1.5 typ		1 1 4	70 70 65	TO-225AB/90 TO-225AB/90 TO-220/221A	
100		MJF122 TIP122	MJF127 TIP127	2k min 1k min	3 3	1.5 typ 1.5 typ	1.5 typ 1.5 typ	3 3	4 4	28 65	—/221C-02 TO-220/221A	
7	300	MJ3041		250 min	2.5					100	TO-204/1	
	350	MJ3042		250 min	2.5					100	TO-204/1	
	375	BU522		250 min	2.5				7.5	75	TO-220/221A	
	425	BU522A		250 min	2.5				7.5	75	TO-220/221A	
8	450	BU522B		250 min	2.5				7.5	75	TO-220/221A	
	40	2N6386		1k/20k	3				20	65	TO-220/221A	
	45	BDX53 BD895 BD895A	BDX54 BD896 BD896A	750 min 750 min 750 min	3 3 4				4 1 1	60 70 70	TO-220/221A TO-220/221A TO-220/221A	
		60	BDX53A BD897 BD897A	BDX54A BD898 BD898A	750 min 750 min 750 min	3 3 4				4 1 1	60 70 70	TO-220/221A TO-220/221A TO-220/221A
			MJ1000 TIP100	MJ900 TIP105	1k min 1k/20k	3 3					90 80	TO-204/1 TO-220/221A
	2N6043 2N6300		2N6040 2N6298	1k/10k 750k/18k	4 4	1.5 typ 1.5 typ	1.5 typ 1.5 typ	3 4	4 4	75 75	TO-220/221A TO-213AA/80	
	2N6055 MJE6043		2N6053 MJE6040	750k/18k 1k/20k	4 4	1.5 typ 1.5 typ	1.5 typ 1.5 typ	4 4	4 2	100 75	TO-204/1 TO-225AB/90	
	80		BDX53B BD899 BD899A	BDX54B BD900 BD900A	750 min 750 min 750 min	3 3 4				4 1 1	60 70 70	TO-220/221A TO-220/221A TO-220/221A

(continued)

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

**BD675, BD675A
BD677, BD677A
BD679, BD679A
BD681**

PLASTIC MEDIUM-POWER SILICON NPN DARLINGTONS

... for use as output devices in complementary general-purpose amplifier applications.

- High DC Current Gain –
 $h_{FE} = 750$ (Min) @ $I_C = 1.5$ and 2.0 Adc
- Monolithic Construction
- BD675, 675A, 677, 677A, 679, 679A, 681 are complementary with BD676, 676A, 678, 678A, 680, 680A, 682
- BD 677, 677A, 679, 679A are equivalent to MJE 800, 801, 802, 803

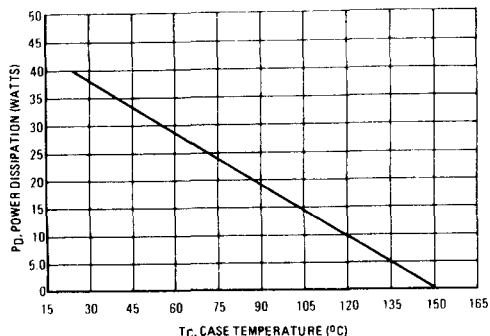
MAXIMUM RATINGS

Rating	Symbol	BD675 BD675A	BD677 BD677A	BD679 BD679A	BD681	Unit
Collector-Emitter Voltage	V_{CEO}	45	60	80	100	Vdc
Collector-Base Voltage	V_{CB}	45	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0				Vdc
Collector Current	I_C	4.0				Adc
Base Current	I_B	0.1				Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	40 0.32				Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperating Range	T_J, T_{stg}	-55 to +150				$^\circ\text{C}$

THERMAL CHARACTERISTICS

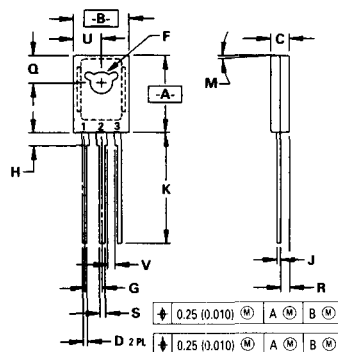
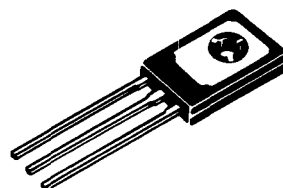
Characteristic	Symbol	Max.	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.13	$^\circ\text{C}/\text{W}$

FIGURE 1 – POWER TEMPERATURE DERATING



**4.0 AMPERE
DARLINGTON
POWER TRANSISTORS
NPN SILICON**

**45, 60, 80, 100 VOLTS
40 WATTS**



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.80	11.04	0.425	0.435
B	7.50	7.74	0.295	0.305
C	2.42	2.66	0.095	0.105
D	0.51	0.66	0.020	0.026
F	2.93	3.17	0.115	0.125
G	2.39 BSC		0.094 BSC	
H	1.27	2.41	0.050	0.095
J	0.39	0.63	0.015	0.025
K	14.61	16.63	0.575	0.655
M	3° TYP		3° TYP	
Q	3.76	4.01	0.148	0.158
R	1.15	1.39	0.045	0.055
S	0.64	0.88	0.025	0.035
U	3.69	3.93	0.145	0.155
V	1.02	—	0.040	—

STYLE 1:
PIN 1: EMITTER
2: COLLECTOR
3: BASE

**CASE 77-06
TO-225AA TYPE**

BD675, 675A, BD677, 677A, BD679, 679A, BD681

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage(1) (I _C = 50 mAdc, I _B = 0)	BD675, 675A BD677, 677A BD679, 679A BD681	BV _{CEO}	45 60 80 100	— —<

ON CHARACTERISTICS

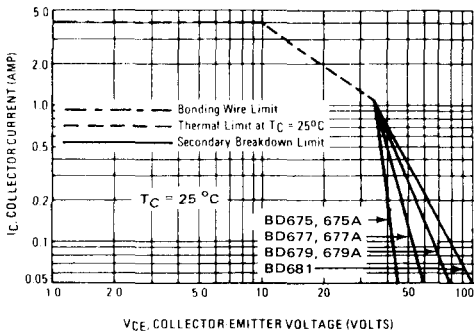
DC Current Gain(1) (I _C = 1.5 Adc, V _{CE} = 3.0 Vdc) (I _C = 2.0 Adc, V _{CE} = 3.0 Vdc)	BD675, 677, 679, 681 BD 675A, 677A, 679A	h _{FE}	750 750	—	—
Collector-Emitter Saturation Voltage(1) (I _C = 1.5 Adc, I _B = 30 mAdc) (I _C = 2.0 Adc, I _B = 40 mAdc)	BD 677, 679, 681 BD 675A, 677A, 679A	V _{CE(sat)}	—	2.5 2.8	Vdc
Base-Emitter On Voltage(1) (I _C = 1.5 Adc, V _{CE} = 3.0 Vdc) (I _C = 2.0 Adc, V _{CE} = 3.0 Vdc)	BD 677, 679, 681 BD 675A, 677A, 679A	V _{BE(on)}	—	2.5 2.5	Vdc

DYNAMIC CHARACTERISTICS

Small-Signal Current Gain (I _C = 1.5 Adc, V _{CE} = 3.0 Vdc, f = 1.0 MHz)	h _{fe}	1.0	—	—
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(1) Pulse Test Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

FIGURE 2 - DC SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: average junction temperature and secondary breakdown. Safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation; e.g., the transistor must not be subjected to greater dissipation than the curves indicate. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown. (See AN-415)

FIGURE 3 - DARLINGTON CIRCUIT SCHEMATIC

