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BD676A	BD676A		3-300
BD677	BD677		3-298
BD677A	BD677A		3-298
BD678	BD678		3-300
BD678A	BD678A		3-300
BD679	BD679		3-298
BD679A	BD679A		3-298
BD680	BD680		3-300
BD680A	BD680A		3-300
BD681	BD681		3-298
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Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
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BD696	BD896		3-322
BD696A	BD896A		3-322
BD697	BD897		3-320
BD697A	BD897A		3-320
BD698	BD898		3-322
BD698A	BD898A		3-322
BD699	BD899		3-320
BD699A	BD899A		3-320
BD700	BD900		3-322
BD700A	BD900A		3-322
BD701	BD901		3-320
BD702	BD902		3-322
BD705	BD795		3-312
BD706	BD796		3-314
BD707	BD797		3-312
BD708	BD798		3-314
BD709	BD799		3-312
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BD776	BD776		3-302
BD777	BD777		3-302
BD778	BD778		3-302
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BD780	BD780		3-302
BD785	BD785		3-304
BD786	BD786		3-304
BD787	BD787		3-304
BD788	BD788		3-304
BD789	BD789		3-308
BD790	BD790		3-308
BD791	BD791		3-308
BD792	BD792		3-308
BD795	BD795		3-312
BD796	BD796		3-314
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BD801	BD801		3-312
BD802	BD802		3-314
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*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 NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s μs Max	Resistive Switching t_f μs Max	Resistive Switching @ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C
3	45		BD176	40/250	0.15				3	30
			BD176.6	40/100	0.15				3	30
			BD176.10	63/160	0.15				3	30
			BD176.16	100/250	0.15				3	30
	60	MJE181	MJE171	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5
	80	BD179	BD180	40/250	0.15				3	30
		BD179.6	BD180.6	40/100	0.15				3	30
		BD179.10	BD180.10	63/160	0.15				3	30
		BD179.16	BD180.16	100/250	0.15				3	30
		MJE182	MJE172	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5
	200	BUY49P		30 min	0.5				25	20
4	30	BD185		15 min	2				20	40
	40	2N5190	2N5193	25/100	1.5	0.4 typ	0.4 typ	1.5	2	40
		MJE521	MJE371	40 min	1					40
		2N6037##	2N6034##	750/18k	2	1.7 typ	1.2 typ	2	25	40
	45	BD437	BD438	40 min	2				3	36
		BD675##	BD676##	750 min	1.5					40
		BD675A##	BD676A##	750 min	2					40
		BD785	BD786	20 min	2				50	15
			BD776##	750 min	2				20	15
	60	BD189		15 min	2				20	40
			BD440	25 min	2				3	36
		BD677##	BD678##	750 min	1.5					40
		BD677A##	BD678A##	750 min	2					40
		BD787	BD788	20 min	2				50	15
		BD777##	BD778##	750 min	2				20	15
		2N5191	2N5194	25/100	1.5	0.4 typ	0.4 typ	1.5	2	40
		MJE800##	MJE700##	750 min	1.5				1#	40
		MJE801##	MJE701##	750 min	2				1#	40
		2N6038##	2N6035##	750/18k	2	1.7 typ	1.2 typ	2	25	40
	80	2N5192	2N5195	25/100	1.5	0.4 typ	0.4 typ	1.5	2	40
		BD441	BD442	15 min	2				3	36
		BD679##	BD680##	750 min	1.5					40
		BD679A##	BD680A##	750 min	2					40
		BD789	BD790	10 min	2				40	15
		BD779##	BD780##	750 min	2				20	15
		MJE240	MJE250	40/200	0.2	0.15 typ	0.07 typ	2	40	15
		MJE241	MJE251	40/120	0.2	0.15 typ	0.07 typ	2	40	15
		MJE802##	MJE702##	750 min	1.5				1#	40
		MJE803##	MJE703##	750 min	2				1#	40
		2N6039##	2N6036##	750/18k	2	1.7 typ	1.2 typ	2	25	40
	100	BD681##	BD682##	750 min	1.5					40
		BD791	BD792	10 min	2				40	15
		MJE243	MJE253	40/120	0.2	0.15 typ	0.07 typ	2	40	15
		MJE244	MJE254	25 min	0.2	0.15 typ	0.07 typ	2	40	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 NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s μs Max	Resistive Switching t_f μs Max	Resistive Switching @ I_C Amp	$\|h_{fe}\|$ @ 1 MHz Min	P_D (Case) Watts @ 25°C	Case JEDEC/MOT
4	40	MJE3300	MJE3310	1k min	1				20	15	TO-225AA/77R
		2N6037	2N6034	750/1k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
	45	BD675	BD676	750 min	1.5					40	TO-225AA/77
		BD675A	BD676A	750 min	2					40	TO-225AA/77
			BD776	750 min	2				20	15	TO-225AA/77
	60	BD677	BD678	750 min	1.5					15	TO-225AA/77
		BD677A	BD678A	750 min	2					40	TO-225AA/77
		BD777	BD778	750 min	2				20	40	TO-225AA/77
		MJE3301		1k min	1				20	15	TO-225AA/77R
		MJE800	MJE700	750 min	1.5				1	40	TO-225AA/77
		MJE800T	MJE700T	750 min	1.5				1	40	TO-220/221A
		MJE801	MJE701	750 min	2				1	40	TO-225AA/77
		2N6038	2N6035	750/18k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
		2N6294	2N6296	750/18k	2	0.9 typ	0.7 typ	2	4	50	TO-213AA/80
	80	BD679	BD680	750 min	1.5					40	TO-225AA/77
		BD679A	BD680A	750 min	2					40	TO-225AA/77
		BD779	BD780	750 min	2				20	15	TO-225AA/77
		MJD6039	MJD6036	1k/12k	2	1.7 typ	1.2 typ	2	25	20	TO-252/369A-04
		MJE802	MJE702	750 min	1.5					40	TO-225AA/77
		MJE803	MJE703	750 min	2					40	TO-225AA/77
		2N6039	2N6036	750/18k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
		2N6295	2N6297	750/18k	2	0.9 typ	0.7 typ	2	4	50	TO-213AA/80
	100	BD681	BD682	750 min	1.5					40	TO-225AA/77
5	60	MJE1100	MJE1090	750 min	3A				1	70	TO-225AB/90
		MJE1101	MJE1091	750 min	4A				1	70	TO-225AB/90
		TIP120	TIP125	1k min	3	1.5 typ	1.5 typ	3	4	65	TO-220/221A
	80	MJE1102	MJE1092	750 min	3A				1	70	TO-225AB/90
		MJE1103	MJE1102	750 min	4A				1	70	TO-225AB/90
		TIP121	TIP126	1k min	3	1.5 typ	1.5 typ	3	4	65	TO-220/221A
	100	MJF122	MJF127	2k min	3	1.5 typ	1.5 typ	3	4	28	—/221C-02
		TIP122	TIP127	1k min	3	1.5 typ	1.5 typ	3	4	65	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
	450	BU522B		250 min	2.5				7.5	75	TO-220/221A
8	40	2N6386		1k/20k	3				20	65	TO-220/221A
	45	BDX53	BDX54	750 min	3				4	60	TO-220/221A
		BD895	BD896	750 min	3				1	70	TO-220/221A
		BD895A	BD896A	750 min	4				1	70	TO-220/221A
	60	BDX53A	BDX54A	750 min	3				4	60	TO-220/221A
		BD897	BD898	750 min	3				1	70	TO-220/221A
		BD897A	BD898A	750 min	4				1	70	TO-220/221A
		MJ1000	MJ900	1k min	3					90	TO-204/1
		TIP100	TIP105	1k/20k	3	1.5 typ	1.5 typ	3	4	80	TO-220/221A
		2N6043	2N6040	1k/10k	4	1.5 typ	1.5 typ	3	4	75	TO-220/221A
		2N6300	2N6298	750k/18k	4	1.5 typ	1.5 typ	4	4	75	TO-213AA/80
		2N6055	2N6053	750k/18k	4	1.5 typ	1.5 typ	4	4	100	TO-204/1
		MJE6043	MJE6040	1k/20k	4	1.5 typ	1.5 typ	4	2	75	TO-225AB/90
	80	BDX53B	BDX54B	750 min	3				4	60	TO-220/221A
		BD899	BD900	750 min	3				1	70	TO-220/221A
		BD899A	BD900A	750 min	4				1	70	TO-220/221A

(continued)

BD676, BD676A
BD678, BD678A
BD680, BD680A
BD682

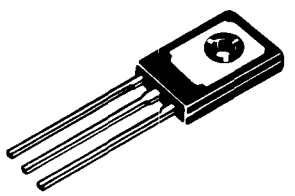
PLASTIC MEDIUM-POWER SILICON PNP DARLINGTONS

. . . 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
- BD676, 676A, 678, 678A, 680, 680A, 682 are complementary with BD675, 675A, 677, 677A, 679, 679A, 681
- BD 678, 678A, 680, 680A are equivalent to MJE 700, 701, 702, 703

4.0 AMPERE
DARLINGTON POWER TRANSISTORS PNP SILICON

45, 60, 80, 100 VOLTS
40 WATTS



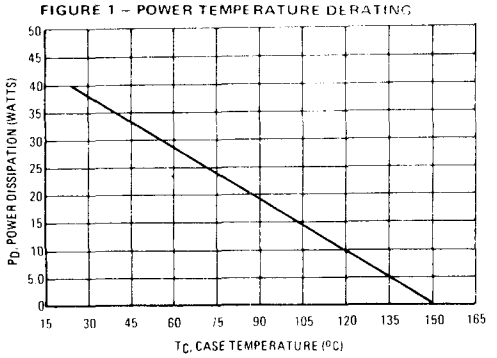
MAXIMUM RATING

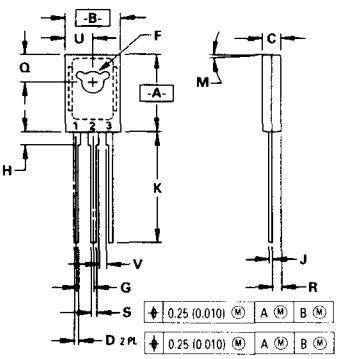
Rating	Symbol	BD676 BD676A	BD678 BD678A	BD680 BD680A	BD682	Unit
Collector-Emitter Voltage	V_{CEO}	45	60	80	100	Vdc
Collector-Base Voltage	V_{CB}	45	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0				Vdc
Collector Current	I_C	4.0				Adc
Base Current	I_B	0.1				Adc
Total Device Dissipation @ T_C = 25 °C Derate above 25 °C	P_D	40 0.32				Watts W/°C
Operating and Storage Junction Temperating Range	T_J, T_{stg}	−55 to +150				°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.13	°C/W

FIGURE 1 – POWER TEMPERATURE DERATING





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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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

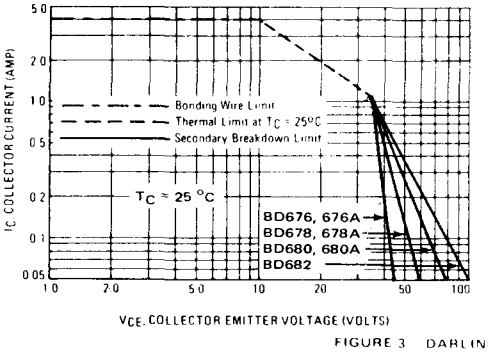
3

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)	BD676, 676A BD678, 678A BD680, 680A BD682	BV_{CEO}	45 60 80 100	– – – –	Vdc
Collector Cutoff Current (V_{CE} = Half Rated V_{CEO}, I_B = 0)		I_{CEO}	–	500	µAdc
Collector Cutoff Current (V_{CB} = Rated BV_{CEO}, I_E = 0) (V_{CB} = Rated BV_{CEO}, I_E = 0, T_C = 100°C)		I_{CBO}	– –	0.2 2.0	mAdc
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	–	2.0	mAdc
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)	BD676, 678, 680, 682 BD 676A, 678A, 680A	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 678, 680, 682 BD 676A, 678A, 680A	$V_{CE(sat)}$		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 678, 680, 682 BD 676A, 678A, 680A	$V_{BE(on)}$	–	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	–	–

(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