

MOTOROLA

BIPOLAR POWER TRANSISTORS

**PRODUCT UPDATE
QUARTER 3, 1998**

BIPOLAR POWER TRANSISTORS SELECTOR GUIDE

SELECTION BY PACKAGE

Package	I_C Range (Amps)	V_{CE} Range (Volts)	P_D (Watts)
 TO-204AA (TO-3) CASE 1-07	4-30	40-1500	90-250
 TO-204AE CASE 197A-05	50-80	60-1000	150-300
 DPAK CASE 369-07	0.5-10	40-400	12.5-20
 DPAK CASE 369A-13	0.5-10	40-400	12.5-20
 TO-218 TYPE CASE 340D-02	5.0-25	60-1500	80-150
 TO-220AB CASE 221A-09	0.5-15	30-1800	30-125
 ISOLATED TO-220 TYPE CASE 221D-02	1-12	80-450	20-45
 TO-225AA (TO-126 TYPE) CASE 77-09	0.3-5.0	25-400	12.5-40
 CASE 340K-01 (TO-247 TYPE)	10-30	400-1500	125-180
 SOT-223 CASE 318E-04	3.0	30	2.0 (1)
 SO-8 CASE 751-06	3.0	30	2.0 (2)
 TO-264 CASE 340G-02	15-16	200-250	250

(1) Tested on 1" sq. FR4 Board

(2) Tested on 1" sq., 2 oz. copper

Table 1. PLASTIC TO-220AB — CASE 221A-09, Style 1

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		
0.5	350	MJE2361T		40 min	0.1				10 typ	30
1	100	TIP29C	TIP30C	15/75	1	0.6 typ	0.3 typ	1	3	30
	250	TIP47		30/150	0.3	2 typ	0.18 typ	0.3	10	40
	400	TIP50	MJE5731A	30/150	0.3	2 typ	0.18 typ	0.3	10	40
2	60	TIP110(2)	TIP115(2)	500 min	2	1.7 typ	1.3 typ	2	25(1)	50
	100	TIP112(2)	TIP117(2)	500 min	2	1.7 typ	1.3 typ	2	25(1)	50
	450/1000	BUX85		30	0.1	3.5	1.4	1	4	50
	450/1000	MJE18002		14/34	0.2	3	0.17	1	12 typ	40
3	80	TIP31B	TIP32B	25 min	1	0.6 typ	0.3 typ	1	3	40
	100	TIP31C	TIP32C	25 min	1	0.6 typ	0.3 typ	1	3	40
4	80	D44C12	D45C12	40/120	0.2			1	40 typ	30
	400/700	MJE13005		6/30	3	3	0.7	3	4	60
5	60	TIP120(2)	TIP125(2)	1k min	3	1.5 typ	1.5 typ	3	4(1)	65
	100	TIP122(2)	TIP127(2)	1k min	3	1.5 typ	1.5 typ	4	4(1)	75
	400/700	BUL45		14/34	0.3	1.7	0.15	1	12 typ	75
	450/1000	MJE16002		5 min	5	3	0.3	3		80
	550/1200	MJE18204		18/35	0.5	2.75	0.2	2	12	75
6	80	TIP41B	TIP42B	15/75	3	0.4 typ	0.15 typ	3	3	65
	100	TIP41C	TIP42C	15/75	3	0.4 typ	0.15 typ	3	3	65
	400/700	BUL146		14/34	0.5	1.75	0.15	3	14 typ	100
7	70	2N6292	2N6107	30/150	2	0.4 typ	0.15 typ	3	4	40
	150	BU407		30 min	1.5		0.75	5	10	60
8	60	TIP100(2)	TIP105(2)	1k/20k	3	1.5 typ	1.5 typ	3	4(1)	80
	100	BDX53C(2)	BDX54C(2)	750 min	3					
		TIP102(2)	TIP107(2)	1k/20k	3	1.5 typ	1.5 typ	3	4(1)	80
	150	MJE15030	MJE15031	20 min	4				30	50
	250	MJE15032	MJE15033	50 min	1				30	50
	350	MJE13007		5/30	5	3	0.7	5		80
			MJE5852	15 min	2	2	0.5	4		80
400/700	BUL147		14/34	1	2.5	0.18	2	14 typ	125	
10	60	MJE3055T	MJE2955T	20/70	4					75
	80	2N6388(2)	2N6668(2)	1k/20k	5				20(1)	65
		D44H11	D45H11	40 min	4	0.5 typ	0.14 typ	5	50 typ	50
	100	BDX33C(2)	BDX34C(2)	750 min	3				3	70
12	400/700	MJE13009		6/30	8	3	0.7	8	4	100
15	80	D44VH10	D45VH10	20 min	4	0.5	0.09	8	50 typ	83
	100	BDW42(2)	BDW47(2)	1k min	5	1 typ	1.5 typ	5	4	85

(1) |h_{FE}| @ 1 MHz

(2) Darlington

Devices listed in bold, italic are Motorola preferred devices.

**Table 2. PLASTIC TO-225AA Type
(Formerly TO-126 Type) — CASE 77-09, Styles 1 & 3**

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			
0.3	350	MJE3439		40/160	0.02				15	15	
0.5	200	MJE344		30/300	0.05				15	20.8	
	250	2N5655		30/250	0.1	3.5 typ	0.24 typ	0.1	10	20	
	300	MJE340	MJE350	30/240	0.05					20.8	
	350	2N5657		30/250	0.1	3.5 typ	0.24 typ	0.1	10	20	
1	40	2N4921	2N4918	20/100	0.5	0.6 typ	0.3 typ	0.5	3	30	
	80	2N4923	2N4920	20/100	0.5	0.6 typ	0.3 typ	0.5	3	30	
1.5	45	BD135	BD136	40/250	0.15					12.5	
	80	BD139	BD140	40/250	0.15					12.5	
	400	MJE13003 (1)		5/25	1	4	0.7	1	5	40	
2	80	BD237	BD238	25 min	1				3	25	
	100	MJE270 (1)(2)	MJE271 (1)(2)	1.5k min	0.12				6	15	
3	60	MJE181	MJE171	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5	
	80	MJE182	MJE172	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5	
4	40	MJE521	MJE371	40 min	1					40	
	45	BD437	BD438	40 min	2				3	36	
	60			BD440	25 min	2				3	36
			BD677 (2)	BD678 (2)	750 min	1.5					40
			BD787	BD788	20 min	2				50	15
			2N5191	2N5194	25/100	1.5	0.4 typ	0.4 typ	1.5	2	40
			MJE800 (2)	MJE700 (2)	750 min	1.5				1(3)	40
	80		2N5192	2N5195	25/100	1.5	0.4 typ	0.4 typ	1.5	2	40
			BD679 (2)	BD680 (2)	750 min	1.5					40
			BD679A (2)	BD680A (2)	750 min	2					40
			BD789	BD790	10 min	2				40	15
			MJE802(2)	MJE702(2)	750 min	1.5				1(3)	40
			MJE803 (2)	MJE703 (2)	750 min	2				1(3)	40
		2N6039 (2)	2N6036 (2)	750/18k	2	1.7 typ	1.2 typ	2	25	40	
100		BD681 (2)	BD682 (2)	750 min	1.5					40	
		MJE243	MJE253	40/120	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	

(1) Case 77, Style 3

(2) Darlington

(3) | @ 1 MHz

Table 3. SO-8 — CASE 751-06, Style 16

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	30	MMDJ3N03BJT	MMDJ3P03BJT	50	1				3	2

**Table 4. SURFACE MOUNT POWER PACKAGES
DPAK — CASE 369A-13 and 369-07**

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		
0.5	300	<i>MJD340</i>	<i>MJD350</i>	30/240	0.05					15
1	250	<i>MJD47</i>		30/150	0.3	2	0.2	0.3	10	15
	350		<i>MJD5731</i>	30/175	0.3	1.5	0.2	0.3	10	15
	400	<i>MJD50</i>		30/150	0.3	2	0.2	0.3	10	15
1.5	400	<i>MJD13003</i>		5/25	1	4	0.7	1	4	15
2	100	<i>MJD112</i> (2)	<i>MJD117</i> (2)	1000 min	2	1.7	1.3	2	25(1)	20
3	40	<i>MJD31</i>	<i>MJD32</i>	10 min	1	0.6	0.3	1	3	15
	100	<i>MJD31C</i>	<i>MJD32C</i>	10 min	1	0.6	0.3	1	3	15
4	45	<i>MJD148</i>		30 min	4				3	20
	80	<i>MJD6039</i> (2)	<i>MJD6036</i> (2)	1k/12k	2	1.7	1.2	2	25	20
	100	<i>MJD243</i>	<i>MJD253</i>	40/180	0.2	0.16	0.04	1	40	12.5
5	25	<i>MJD200</i>	<i>MJD210</i>	45/180	2	0.15	0.04	2	65	12.5
6	100	<i>MJD41C</i>	<i>MJD42C</i>	15/75	3	0.4	0.15	3	3	20
8	80	<i>MJD44H11</i>	<i>MJD45H11</i>	40 min	4	0.5	0.14	5	50 typ	20
	100	<i>MJD122</i> (2)	<i>MJD127</i> (2)	1k/12k	4	1.5	2	4	4(1)	20
10	60	<i>MJD3055</i>	<i>MJD2955</i>	20/100	4	1.5	1.5	3	2	20
	80	<i>MJD44E3</i> (2)		1k min	5	2	0.5	10		20

(1) |h_{FE}| @ 1 MHz

(2) Darlington

Table 5. SOT-223 — CASE 318E-04, Style 1

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	30	<i>MMJT9410</i>	<i>MMJT9435</i>	50	1					0.8

Table 6. LARGE PLASTIC TO-264 — CASE 340G-02

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		
15	200	<i>MJL3281A</i>	<i>MJL1302A</i>	60/175	0.1				30 typ	200
	650/1500	<i>MJL16218</i>		4/11	12				2.5 typ	170
16	250	<i>MJL21194</i>	<i>MJL21193</i>	25/75	8				4	200
16	250	<i>MJL21196</i>	<i>MJL21195</i>	25/75	8				4	200

Case 221D-02 is UL RECOGNIZED for its isolation feature. Case 221D-02 has been evaluated to 3500 volts RMS. Actual isolation rating depends on specific mounting position and maintaining required strike and creepage distances.


Table 7. PLASTIC (ISOLATED TO-220 TYPE) — CASE 221D-02, UL RECOGNIZED: File #E69369

I _C Cont Amps Max	V _{CEO} (sus) Volts Min	V _{CE} S 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		
1	250		MJF47		30/150	0.3	2 typ	0.17 typ	0.3	10	28
2	400	700	BUL44F		14/34	0.2	2.75 ⁽³⁾	0.2 ⁽³⁾	1	13 typ	25
		1000	MJF18002		14/34	0.2	2.75 ⁽³⁾	0.175 ⁽³⁾	1	13 typ	25
3	100		MJF31C	MJF32C	10 min	1	0.6	0.3	1	3	28
5	100		MJF122 ⁽²⁾	MJF127 ⁽²⁾	2000 min	3	1.5 typ	1.5 typ	3	4 ⁽¹⁾	28
		700	BUL45F		14/34	0.3	1.7 ⁽³⁾	0.15 ⁽³⁾	1	12 typ	35
	450	1000	BUT11AF		10 min	.005	4	0.8	2.5		40
		1000	MJF16002		5 min	5	3	0.3	3		40
	1000	MJF18004		14/34	0.3	1.7 ⁽³⁾	0.15 ⁽³⁾	1	13 typ	35	
6	250	550	MJF16204		5 min	6	1.5 ⁽³⁾	0.15 ⁽³⁾	1	10	45
	400	700	BUL146F		14/34	0.5	2.5 ⁽³⁾	0.15 ⁽³⁾	3	14 typ	40
	450	1000	MJF18006		14/34	0.5	3.2 ⁽³⁾	0.15 ⁽³⁾	3	14 typ	40
8	80			MJF6107	30/90	2	0.5 typ	0.13 typ	2	4	35
	150		MJF15030	MJF15031	40 min	3	1 typ	0.15 typ	3	30	35
	400	700	MJF13007		5/30	5	3	0.7	5	4	40
			BUL147F		14/34	1	2.5 ⁽³⁾	0.18 ⁽³⁾	2	14 typ	45
450	1000	MJF18008		16/34	1	2.75 ⁽³⁾	0.18 ⁽³⁾	2	13 typ	45	
10	60		MJF3055	MJF2955	20/100	4	—	—	—	2	40
	80		MJF44H11	MJF45H11	40/100	4	0.5 typ	0.14 typ	5	40	35
	100		MJF6388 ⁽²⁾	MJF6668 ⁽²⁾	3k/20k	3	1.5 typ	1.5 typ		20 ⁽¹⁾	40
12	400	700	MJF13009		6/30	8	3	0.7	8	8	40

(1) |h_{FE}| @ 1 MHz

(2) Darlington

(3) Switching tests performed w/special application simulator circuit. See data sheet for details.

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**Table 8. METAL TO-204AA (Formerly TO-3) — CASE 1-07
TO-204AE — CASE 197A-05, Style 1**

I _C Cont Amps Max	V _{CEO(sus)} Volts Min(8)	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		
4	250	MJ15020	MJ15021	30 min	1				20	150
8	80	MJ1001 (2)		1k min	3					90
10	80	2N3716	2N3792	30 min	3	0.3 typ	0.4 typ	5	4	150
		MJ3001(2)	MJ2501 (2)	1k min	5					150
	250	MJ15011	MJ15012	20/100	2					200
	325	MJ413		20/80	0.5				2.5	125
	400	MJ10012 (2)		100/2k	6	15	15	6		175
12	100	2N6059 (2)	2N6052 (2)	750/18k	6	1.6 typ	1.5 typ	6	4(1)	150
15	60	2N3055	MJ2955	20/70	4	0.7 typ	0.3 typ	4	2.5	115
	120	MJ15015	MJ15016	20/70	4	0.7 typ	0.3 typ	4	1	180
	140	MJ15001	MJ15002	25/150	4				2	200
	200	MJ3281A	MJ1302A	60/175	0.1				30 typ	250
	400/650	MJ16110		6/20	15	0.8 typ	0.1 typ	10		175
16	140	2N3773	2N6609	15/60	8	1.1 typ	1.5 typ	8	4	150
	200	MJ15022	MJ15023	15/60	8				5	250
	250	MJ21194	MJ21193	25/75	8				4	250
	250	MJ21196	MJ21195	25/75	8				5	250
20	80	2N6283 (2)	2N6286(2)	750/18k	10	2.5 typ	2.5 typ	10	4(1)	160
	100	2N6284 (2)	2N6287 (2)	750/18k	10	2.5 typ	2.5 typ	10	4(1)	160
	140	MJ15003	MJ15004	25/150	5				2	250
	400	MJ13333		10/60	5	4	0.7	10		175
	500	MJ10009 (2)		30/300	10	2	0.6	10	8(1)	175
25	60	2N5885	2N5883	20/100	10	1	0.8	10	4	200
	150	2N6341		30/120	10	1	0.25	10	40	200
30	60	2N5302	2N4399	15/60	15	2	1	10	2	200
	100	MJ802	MJ4502	25/100	7.5				2	200
	120	MJ11016 (2)	MJ11015 (2)	1k min	20				4(1)	200
	400/1000	BUX98		8 min	20	3	0.8	20		250
	450/850	MJ16020		5 min	30	1.8	0.2	20		250
40	400	MJ10023 (2)		50/600	10	2.5	0.9	20		250
50	80	2N5686	2N5684	15/60	25	0.5 typ	0.3 typ	25	2	300
	120	MJ11032 (2)	MJ11033 (2)	400 min	50					300
	125	BUV20		10 min	50	1.2	0.25	50	8	250
	400	MJ10015 (2)		10 min	40	2.5	1	20		250
60	80	MJ14002	MJ14003	15/100	50					300

(1) |h_{FE}| @ 1 MHz

(2) Darlington

BIPOLAR TRANSISTOR SWITCHMODE AND LAMP BALLAST PRODUCTS

D.C. CURRENT RATING	RATED V _{CEO} AND PACKAGE														
	400 VOLTS			450 VOLTS			500 VOLTS			700 VOLTS		800-900 VOLTS		1000 VOLTS	1600 VOLTS
	TO-220 and Fully Isolated	TO-204	TO-247	TO-220 and Fully Isolated	TO-204	TO-218 TO-247	TO-220	TO-204	TO-218 TO-247	TO-220	TO-220	TO-204	TO-247	TO-220	TO-220
2-4A	BUL44 BUL44F			MJE18002 MJE18002						BUL44D2	MJE1320			MJE1800D2	MJE18604D2
5A	BUL45 BUL45F			MJE16002 MJE18004 MJE18004		MJH16002	MJE18204 MJF18204			MJ16002A MJH16002A	BUL45D2				
6-8A	MJE16106 BUL146 BUL146F			MJE18006 MJE18006 MJE18009	MJ16006	MJH16006				MJ16006A MJH16006A					
8-10A	BUL147 BUL147F			MJE18008 MJE18008 MJE18009										MJ16018	MJW16018
15A		MJ16110	MJW16110		MJ16010	MJW16010 MJW16012				MJ16010A MJW16210					
20A					MJ16014										
30A					MJ16020										

New MJE/MJF18000 Series of advanced bipolar challenge MOSFETS in low cost off-line SMPS to 100 KHz. Applications specific BULxxx Series are designed for use in electronic lamp ballasts.

HORIZONTAL CRT DEFLECTION TRANSISTOR SELECTOR GUIDE

Monitor Description	Horizontal Scan Freq.	CRT Size	Pixel Size	Transistor	Diode
Monochrome					
Low Resolution to Mid Resolution	15-50 KHZ	12-15 in.	>1024 x 768	MJE/MJF16204	MUR860E
High Resolution	50-100 KHZ	15-19 in.	>2000 x 1600	MJW16206 MJW16210 MJW16212	MR/MUR10120E MR/MUR10120E MR/MUR10150E
Ultra-High Resolution	>100 KHZ	19-24 in.	>2000 x 2000	MJL16218	MR/MUR10150E
Color					
Low Resolution	15-22 KHZ	12-15 in.	>320 x 200	BU508A	MUR5150E
Mid Resolution	22-50 KHZ	12-15 in.	>1024 x 768	BU508A	MUR5150E
High Resolution	50-90 KHZ	17-27 in.	>1280 x 1024	MJW16206 MJW16210 MJW16212	MR/MUR10120E MR/MUR10120E MR/MUR10150E
Ultra-High Resolution	>90 KHZ	17-27 in.	>1600 x 1280	MJW16210(1) MJL16218	MUR8100E(1) MR/MUR10150E

(1) Use two in parallel.

APPLICATIONS LITERATURE DL1111/D Bipolar Power Data Book

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