

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

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MJE221		MJE181	3-862	MJE31A		TIP31A	3-1073
MJE222		MJE181	3-862	MJE31B		TIP31B	3-1073
MJE223		MJE182	3-862	MJE31C		TIP31C	3-1073
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MJE225		MJE182	3-862	MJE32A		TIP32A	3-1073
MJE230		MJE171	3-862	MJE32B		TIP32B	3-1073
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MJE233		MJE172	3-862	MJE3300		2N6037	3-135
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MJE235		MJE172	3-862	MJE3302		2N6039	3-135
MJE2360		MJE2360T	3-900	MJE3310		2N6034	3-135
MJE2360T	MJE2360T		3-900	MJE3311		2N6035	3-135
MJE2361		MJE2361T	3-900	MJE3312		2N6036	3-135
MJE2361T	MJE2361T		3-900	MJE3370		MJE3370	3-882
MJE2370		TIP32	3-1073	MJE3371		2N5193	3-89
MJE2371		TIP32A	3-1073	MJE33A		TIP41A	3-1083
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MJE242	MJE243		3-870	MJE34		TIP42	3-1083
MJE243	MJE243		3-870	MJE340	MJE340		3-876
MJE244	MJE244		3-870	MJE340K		TIP48	3-1087
MJE2480		TIP31	3-1073	MJE341	MJE341		3-878
MJE2481		TIP31A	3-1073	MJE341K		TIP47	3-1087
MJE2482		2N6121	3-154	MJE3439	MJE3439		3-908
MJE2483		2N6122	3-154	MJE344	MJE344		3-878
MJE2490		TIP32	3-1073	MJE3440	MJE3440		3-908
MJE2491		TIP32A	3-1073	MJE344K		TIP47	3-1087
MJE250	MJE250		3-870	MJE345		MJE3439	3-908
MJE251	MJE251		3-870	MJE34A		TIP42A	3-1083
MJE252	MJE253		3-870	MJE34B		TIP42B	3-1083
MJE2520		TIP31	3-1073	MJE34C		TIP42C	3-1083
MJE2521		TIP31A	3-1073	MJE350	MJE350		3-880
MJE2522		TIP31	3-1073	MJE3520		MJE520	3-886
MJE2523		TIP31A	3-1073	MJE3521		2N5190	3-85
MJE253	MJE253		3-870	MJE370	MJE370		3-882
MJE254		MJE253	3-870	MJE370K		TIP32	3-1073
MJE270	MJE270		3-874	MJE371	MJE371		3-884
MJE271	MJE271		3-874	MJE371K		TIP32	3-1073

*Consult Motorola if a direct replacement is necessary.

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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				
		60	MJE181	MJE171	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5			
		80	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		
			200	BUY49P		30 min	0.5				25	20		
	BD185			15 min	2				20	40				
4	30	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				
		45	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 BD677## BD677A## BD787 BD777## 2N5191 MJE800## MJE801## 2N6038##	BD440 BD678## BD678A## BD788 BD778## 2N5194 MJE700## MJE701## 2N6035##	15 min 25 min 750 min 20 min 750 min 25/100 750 min 750 min 750/18k	2 2 1.5 2 2 1.5 1.5 2 2	0.4 typ 1.7 typ	0.4 typ 1.2 typ	1.5 2	2 3 50 20 1# 1# 25	40 36 40 15 15 40 40 40		
	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	0.15 typ 0.15 typ	0.07 typ 0.07 typ	2 2	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

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MJE200, NPN, MJE210, PNP

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage (1) ($I_C = 10 \text{ mAdc}$, $I_B = 0$)	$V_{CE(sus)}$	25	—	Vdc
Collector Cutoff Current ($V_{CB} = 40 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 40 \text{ Vdc}$, $I_E = 0$, $T_J = 125^\circ\text{C}$)	I_{CBO}	—	100 100	nAdc μAdc
Emitter Cutoff Current ($V_{BE} = 8.0 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	100	nAdc

ON CHARACTERISTICS

DC Current Gain (1) ($I_C = 500 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 2.0 \text{ Adc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 5.0 \text{ Adc}$, $V_{CE} = 2.0 \text{ Vdc}$)	h_{FE}	70 45 10	— 180 —	—
Collector-Emitter Saturation Voltage (1) ($I_C = 500 \text{ mAdc}$, $I_B = 50 \text{ mAdc}$) ($I_C = 2.0 \text{ Adc}$, $I_B = 200 \text{ mAdc}$) ($I_C = 5.0 \text{ Adc}$, $I_B = 1.0 \text{ Adc}$)	$V_{CE(sat)}$	— — —	0.3 0.75 1.8	Vdc
Base-Emitter Saturation Voltage (1) ($I_C = 5.0 \text{ Adc}$, $I_B = 1.0 \text{ Adc}$)	$V_{BE(sat)}$	—	2.5	Vdc
Base-Emitter On Voltage (1) ($I_C = 2.0 \text{ Adc}$, $V_{CE} = 1.0 \text{ Vdc}$)	$V_{BE(on)}$	—	1.6	Vdc

DYNAMIC CHARACTERISTICS

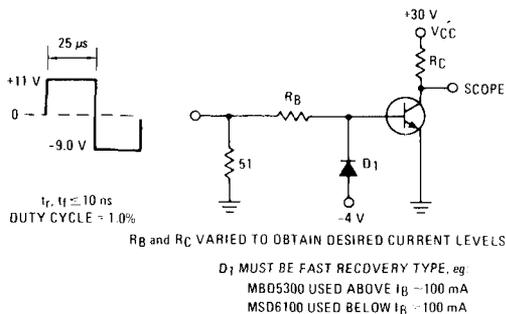
Current-Gain — Bandwidth Product (2) ($I_C = 100 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f_{test} = 10 \text{ MHz}$)	f_T	65	—	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$)	C_{ob}	— —	80 120	pF
				MJE200 MJE210

(1) Pulse test: Pulse Width = 300 μs , Duty Cycle $\approx 2.0\%$.

(2) $f_T = |h_{fe}| \cdot f_{test}$

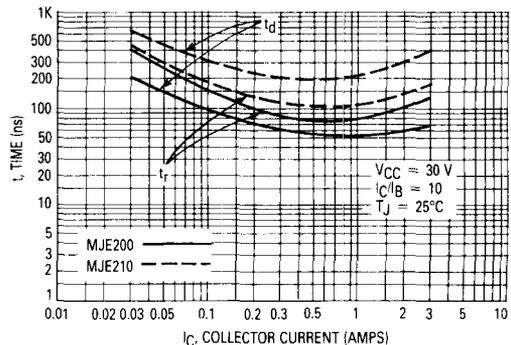
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FIGURE 2 — SWITCHING TIME TEST CIRCUIT



FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES

FIGURE 3 — TURN-ON TIME



MJE200, NPN, MJE210, PNP

FIGURE 4 – THERMAL RESPONSE

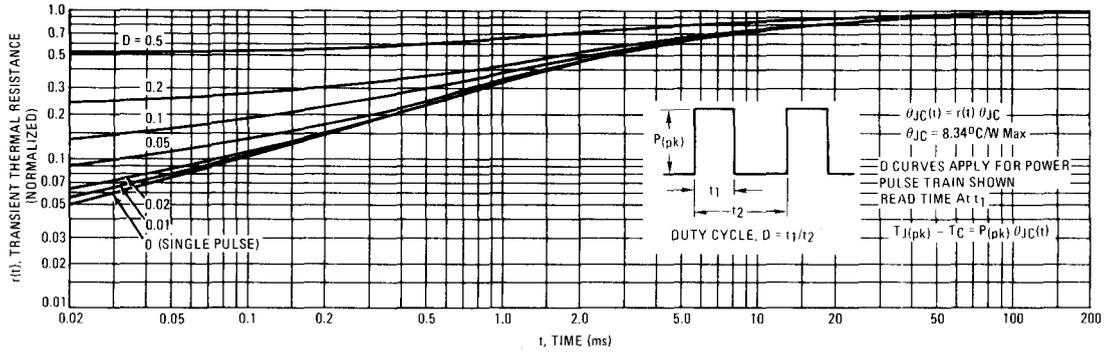
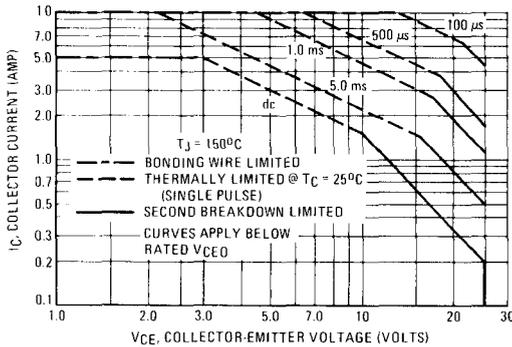


FIGURE 5 – ACTIVE REGION SAFE OPERATING AREA



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 Figure 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 $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ 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 6 – TURN-OFF TIME

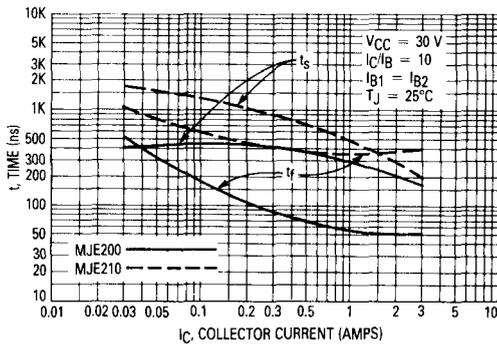
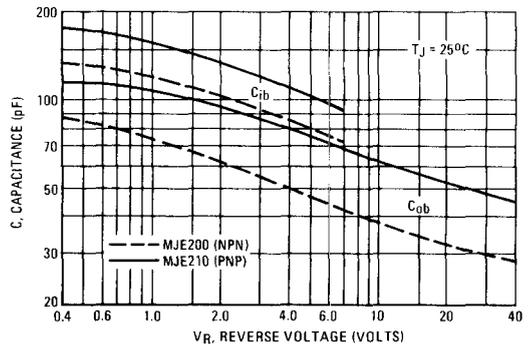


FIGURE 7 – CAPACITANCE



MJE200, NPN, MJE210, PNP

**NPN
MJE200**

**PNP
MJE210**

FIGURE 8 – DC CURRENT GAIN

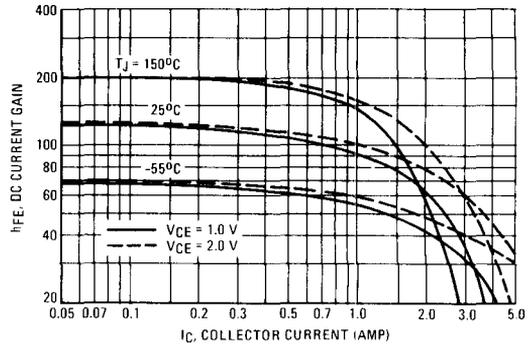
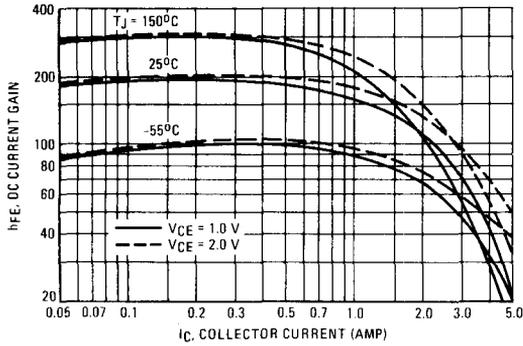


FIGURE 9 – "ON" VOLTAGE

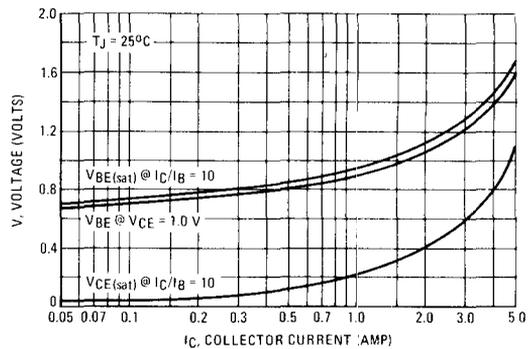
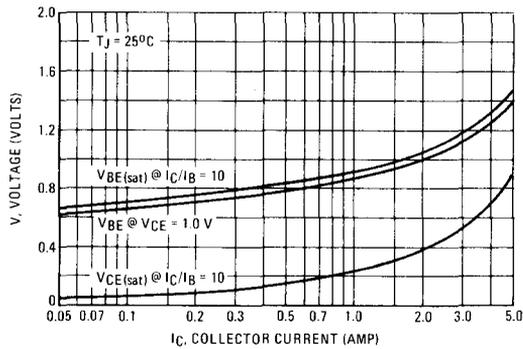
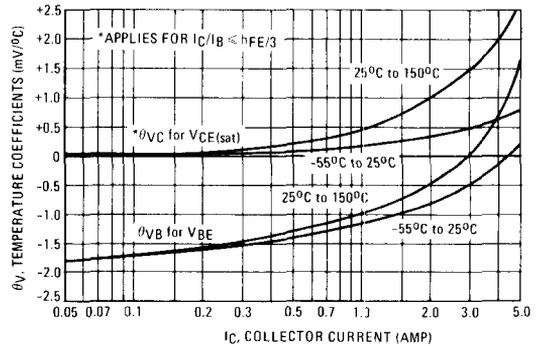
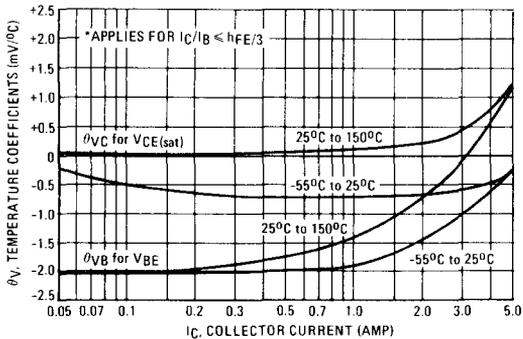


FIGURE 10 – TEMPERATURE COEFFICIENTS



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