ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
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2N5665		2N3585	3-20
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2N5672		2N6339	3-188
2N5678		2N6378	3-191
2N5683	2N5683		3-112
2N5683JAN	2N5683JAN		3-112
2N5683JTX	2N5683JTX		3-112
2N5683JTXV	2N5683JTXV		3-112
2N5684	2N5684		3-112
2N5684JAN	2N5684JAN		3-112
2N5684JTX	2N5684JTX		3-112
2N5684JTXV	2N5684JTXV		3-112
2N5685	2N5685		3-112
2N5685JAN	2N5685JAN		3-112
2N5685JTX	2N5685JTX		3-112
2N5685JTXV	2N5685JTXV		3-112
2N5686	2N5686		3-112
2N5686JAN	2N5686JAN		3-112
2N5686JTX	2N5686JTX		3-112
2N5686JTXV	2N5686JTXV		3-112
2N5729		2N5337	3-97
2N5730		2N5339	3-97
2N5733		2N6274	3-168
2N5734		2N6338	3-188
2N5737		2N5878	3-120
2N5738		2N5880	3-123
2N5739		2N5878	3-120
2N5740		2N5880	3-123
2N5741		2N5883	3-127
2N5742		2N6029	3-105
2N5743		2N5883	3-127
2N5744		MJ4502	3-536
2N5745	2N5745		3-68
2N5745JAN	2N5745JAN		3-68
2N5745JTX	2N5745JTX		3-68
2N5745JTXV	2N5745JTXV		3-68
2N5758	2N5758		3-116
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2N5839		2N6308	3-181
2N5840		2N6308	3-181
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2N5868		2N3790	3-56
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2N5870		2N3714	3-26
2N5871		2N3789	3-56
2N5872		2N3790	3-56
2N5873		2N3714	3-26
2N5874		2N3714	3-26
2N5875	2N5875		3-120
2N5876	2N5876		3-120
2N5877	2N5877		3-120
2N5878	2N5878		3-120
2N5879	2N5879		3-123
2N5880	2N5880		3-123
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Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
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2N5885	2N5885		3-127
2N5886	2N5886		3-127
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2N5975		MJE2955	3-904
2N5976		MJE2955	3-904
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2N5978		MJE3055	3-904
2N5979		MJE3055	3-904
2N5980		MJE2955	3-904
2N5981		MJE2955	3-904
2N5982		2N5988	3-131
2N5983		MJE3055	3-904
2N5984		MJE3055	3-904
2N5985		2N5991	3-131
2N5986		2N6498	3-211
2N5987		2N6490	3-207
2N5988		2N6491	3-207
2N5989	2N5989		3-131
2N5990	2N5991		3-131
2N5991	2N5991		3-131
2N6021		TIP32C	3-1073
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2N6024		2N6124	3-154
2N6025		2N6125	3-154
2N6026		2N6125	3-154
2N6029	2N6029		3-105
2N6030	2N6030		3-105
2N6031	2N6031		3-105
2N6032		2N6275	3-168
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2N6034	2N6034		3-135
2N6035	2N6035		3-135
2N6036	2N6036		3-135
2N6037	2N6037		3-135
2N6038	2N6038		3-135
2N6039	2N6039		3-135
2N6040	2N6040		3-139
2N6041	2N6041		3-139
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2N6043	2N6043		3-139
2N6044	2N6044		3-139
2N6045	2N6045		3-139

*Consult Motorola if a direct replacement is necessary.

TABLE 5 — PLASTIC TO-220 (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
7	45	BD795	BD796	25 min	3				3	65
	50	2N6290	2N6109	30/150	2.5	0.4 typ	0.15 typ	3	4	40
	60	BD797	BD798	25 min	3				3	65
	70	2N6292	2N6107	30/150	3	0.4 typ	0.15 typ	3	4	40
	80	BD799	BD800	15 min	3				3	65
	100	BD801	BD802	15 min	3				3	65
	150	BU407,D		30 min	1.5		0.75	5	10	60
	200	BU406,D		30 min	1.5		0.75	5	10	60
	375	BU522##		250 min	2.5				7.5	75
	425	BU522A##		250 min	2.5				7.5	75
	450	BU522B##		250 min	2.5				7.5	75
8	40	2N6386##		1k/20k	3				20#	65
	45	BDX53##	BDX54##	750 min	3				4#	60
		BD895##	BD896##	750 min	3				1#	70
		BD895A##	BD896A##	750 min	4				1#	70
	60	2N6043##	2N6040##	1k/10k	4	1.5 typ	1.5 typ	3	4#	75
		BDX53A##	BDX54A##	750 min	3				4#	60
		BD897##	BD898##	750 min	3				1#	70
		BD897A##	BD898A##	750 min	4				1#	70
		TIP100##	TIP105##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
	80	2N6044##	2N6041##	1k/10k	4	1.5 typ	1.5 typ	3	4#	75
		BDX53B##	BDX54B##	750 min	3				4#	60
		BD899##	BD900##	750 min	3				1#	70
		BD899A##	BD900A##	750 min	4				1#	70
		TIP101##	TIP106##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
	100	2N6045##	2N6042##	1k/10k	3	1.5 typ	1.5 typ	3	4#	75
		BDX53C##	BDX54C##	750 min	3				4#	60
		BD901##	BD902##	750 min	3				1#	70
		TIP102##	TIP107##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
	120	BDX53D##	BDX54D##	750 min	3				4#	60
		MJE15028	MJE15029	20 min	4				30	50
	150	MJE15030	MJE15031	20 min	4				30	50
		BU807##		100 min	5	0.55 typ	0.2 typ	5		60
	200	BU806##		100 min	5	0.55 typ	0.2 typ	5		60
	300	MJE13006		5/30	5	3	0.7	5	4	80
		MJE5740##		200 min	4	8 typ	2 typ	6		80
			MJE5850	15 min	2	2	0.5	4		80
	350	MJE5741##		200 min	4	8 typ	2 typ	6		80
			MJE5851	15 min	2	2	0.5	4		80
	400	MJE5742##		200 min	4	8 typ	2 typ	6		80
		MJE13007		5/30	5	3	0.7	5	4	80
			MJE5852	15 min	2	2	0.5	4		80
		MJE16080		5 min	8	2	0.5	5		80
		MJE16106		6/25	8	2 typ	0.1 typ	5		100
	450	MJE16081		5 min	8	2	0.5	5		80
10	30		D45H1	20 min	4					50
			D45H2	40 min	4					50
	40	D44E1##		1000 min	5	2 typ	0.5 typ	10		50
	45	BDX33##	BDX34##	750 min	4				3	70
		BD805	BD806	15 min	4				1.5	90
			D45H4	20 min	4					50
		D44H5	D45H5	40 min	4					50
	60	BDX33A##	BDX34A##	750 min	4				3	70
		BD807	BD808	15 min	4				1.5	90

$|h_{fe}|$ @ 1 MHz, ## Darlington

(continued)

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)

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

2N6040 thru 2N6042 PNP
2N6043 thru 2N6045 NPN
MJE6040 thru MJE6041 PNP
MJE6043 thru MJE6045 NPN

PLASTIC MEDIUM-POWER COMPLEMENTARY SILICON TRANSISTORS

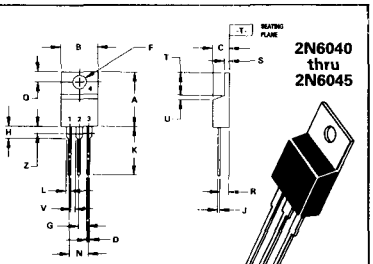
. . . designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain –
  h_{FE} = 2500 (Typ) @ I_C = 4.0 Adc
- Collector-Emitter Sustaining Voltage – @ 100 mAdc (1)
  $V_{CEO(sus)}$ = 60 Vdc (Min) – 2N6040, 2N6043
  = 80 Vdc (Min) – 2N6041, 2N6044
  = 100 Vdc (Min) – 2N6042, 2N6045
- Low Collector-Emitter Saturation Voltage – (1)
  $V_{CE(sat)}$ = 2.0 Vdc (Max) @ I_C = 4.0 Adc – 2N6040,41,2N6043,44
  = 2.0 Vdc (Max) @ I_C = 3.0 Adc – 2N6042, 2N6045
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors

(1) Applies to corresponding in-house part numbers also.

DARLINGTON 8 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS

60-80-100 VOLTS
75 WATTS



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.66	10.28	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.64	0.88	0.025	0.035
F	3.61	3.73	0.142	0.147
G	2.42	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
J	0.46	0.71	0.018	0.028
K	12.70	14.27	0.500	0.562
L	1.15	1.35	0.045	0.055
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

STYLE 1
PIN 1 BASE
2 COLLECTOR
3 EMITTER
4 COLLECTOR

NOTES:
1. DIMENSION NG AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

CASE 221A-04
TO-220AB

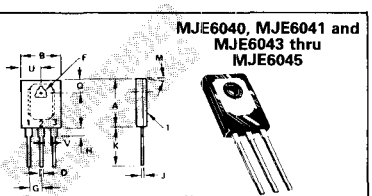
*MAXIMUM RATINGS

Rating	Symbol	2N6040 2N6043 MJE6040 MJE6043	2N6041 2N6044 MJE6041 MJE6044	2N6042 2N6045 MJE6045	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	100	Vdc
Collector-Base Voltage	V_{CB}	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current – Continuous	I_C	8.0			Adc
Peak		16			
Base Current	I_B	120			mAdc
Total Power Dissipation @ T_C = 25°C	P_D	75			Watts
Derate above 25°C		0.60			W/°C
Total Power Dissipation @ T_A 25°C	P_D	2.2			Watts
Derate above 25°C		0.0175			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}	1.67	°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	57	°C/W

*Indicates JEDEC Registered Data



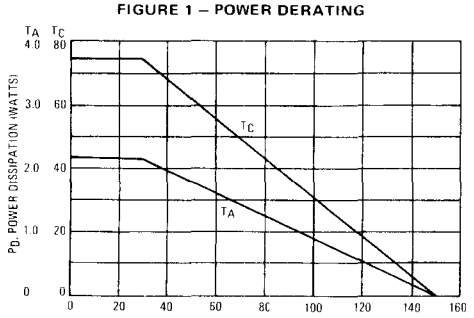
NOTES
1. DIM "D" UNCONTROLLED IN ZONE "H"
2. DIM "F" DIA THRU
3. HEAT SINK CONTACT AREA (BOTTOM)
4. LEADS WITHIN 0.005" RAD OF TRUE POSITION (TP) AT MAXIMUM MATERIAL CONDITION

STYLE 2
PIN 1 EMITTER
2 COLLECTOR
3 BASE

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	16.13	16.38	0.635	0.645
B	12.57	12.83	0.495	0.505
C	3.18	3.43	0.125	0.135
D	1.06	1.24	0.043	0.049
F	3.51	3.76	0.138	0.148
G	4.22 BSC		0.166 BSC	
H	2.67	2.92	0.105	0.115
J	0.813	0.864	0.032	0.034
K	15.11	16.38	0.595	0.645
M	90° TYP		90° TYP	
Q	4.70	4.95	0.185	0.195
R	1.91	2.16	0.075	0.085
U	6.22	6.48	0.245	0.255
V	2.03		0.080	

CASE 90-05
TO-225AB TYPE
(TO-127 TYPE)

FIGURE 1 – POWER DERATING



3

2N6040 thru 2N6042 PNP
2N6043 thru 2N6045 NPN
MJE6040 thru MJE6041 PNP
MJE6043 thru MJE6045 NPN

***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)	2N6040, 2N6043, MJE6040, MJE6043	$V_{CEO(sus)}$	60	–	Vdc
	2N6041, 2N6044, MJE6041, MJE6044		80	–	
	2N6042, 2N6045, MJE6045		100	–	
Collector Cutoff Current		I_{CEO}			μA
(V_{CE} = 60 Vdc, I_B = 0)	2N6040, 2N6043, MJE6040, MJE6043		–	20	
(V_{CE} = 80 Vdc, I_B = 0)	2N6041, 2N6044, MJE6041, MJE6044		–	20	
(V_{CE} = 100 Vdc, I_B = 0)	2N6042, 2N6045, MJE6045		–	20	
Collector Cutoff Current		I_{CEX}			μA
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6040, 2N6043, MJE6040, MJE6043		–	20	
(V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6041, 2N6044, MJE6041, MJE6044		–	20	
(V_{CE} = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	2N6042, 2N6045, MJE6045		–	20	
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6040, 2N6043, MJE6040, MJE6043		–	200	
(V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6041, 2N6044, MJE6041, MJE6044		–	200	
(V_{CE} = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6042, 2N6045, MJE6045		–	200	
Collector Cutoff Current		I_{CBO}			μA
(V_{CB} = 60 Vdc, I_E = 0)	2N6040, 2N6043, MJE6040, MJE6043		–	20	
(V_{CB} = 80 Vdc, I_E = 0)	2N6041, 2N6044, MJE6041, MJE6044		–	20	
(V_{CB} = 100 Vdc, I_E = 0)	2N6042, 2N6045, MJE6045		–	20	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}		2.0	mAdc
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			–
(I_C = 4.0 Adc, V_{CE} = 4.0 Vdc)	2N6040,41, 2N6043,44, MJE6040,41, MJE6043,44		1000	20,000	
(I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)	2N6042, 2N6045, MJE6045		1000	20,000	
(I_C = 8.0 Adc, V_{CE} = 4.0 Vdc)	All Types		100	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 4.0 Adc, I_B = 16 mAdc)	2N6040,41,2N6043,44,MJE6040,41,MJE6043,44		–	2.0	
(I_C = 3.0 Adc, I_B = 12 mAdc)	2N6042,2N6045,MJE6045		–	2.0	
(I_C = 8.0 Adc, I_B = 80 mAdc)	All Types		–	4.0	
Base-Emitter Saturation Voltage (I_C = 8.0 Adc, I_B = 80 mAdc)		$V_{BE(sat)}$	–	4.5	Vdc
Base-Emitter On Voltage (I_C = 4.0 Adc, V_{CE} = 4.0 Vdc)		$V_{BE(on)}$	–	2.8	Vdc
DYNAMIC CHARACTERISTICS					
Small-Signal Current Gain (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 MHz)		$\|h_{fe}\|$	4.0		–
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	2N6040/2N6042, MJE6040		–	300	
	2N6043/2N6045, MJE6043/MJE6045		–	200	
Small-Signal Current Gain (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 kHz)		h_{fe}	300	–	–

*Indicates JEDEC Registered Data.

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FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

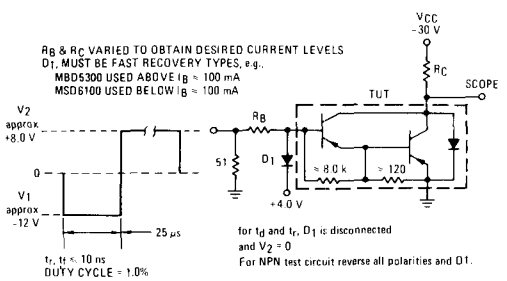


FIGURE 3 – SWITCHING TIMES

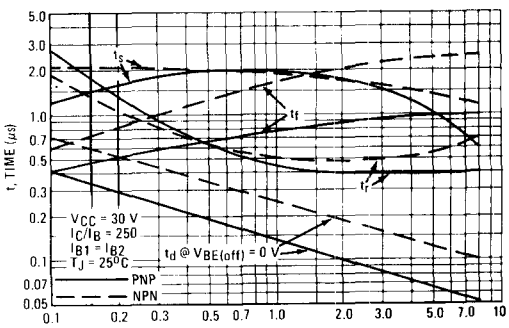


FIGURE 4 – THERMAL RESPONSE

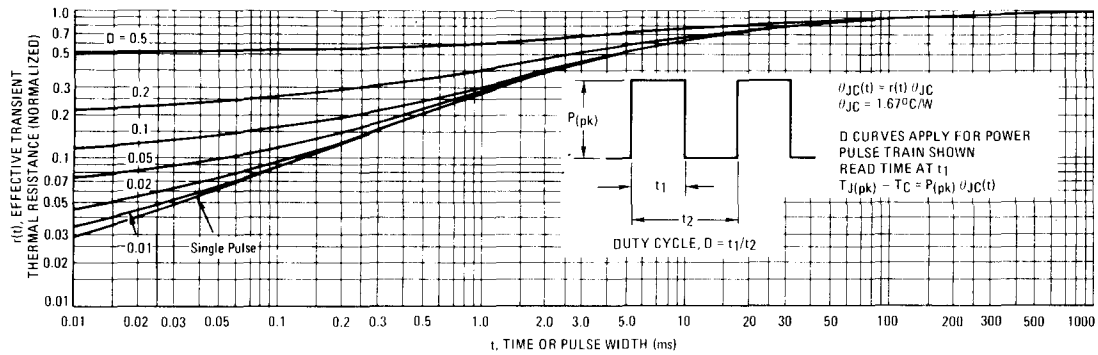
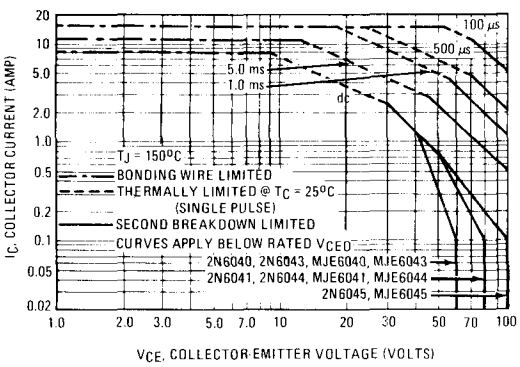


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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

3

FIGURE 6 – SMALL-SIGNAL CURRENT GAIN

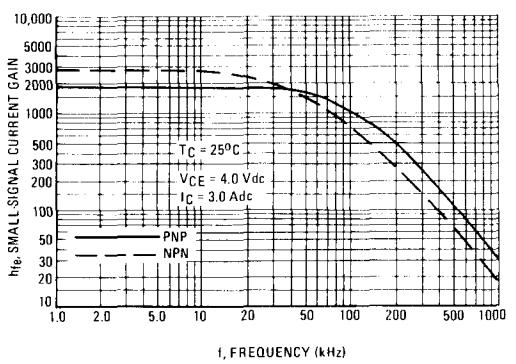
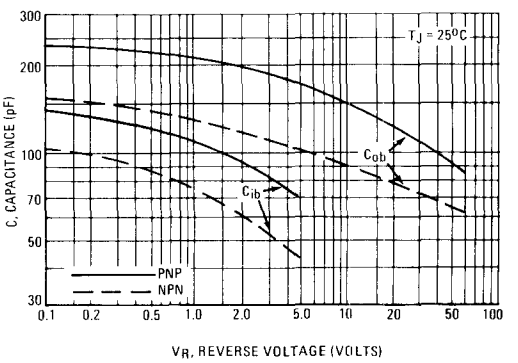


FIGURE 7 – CAPACITANCE

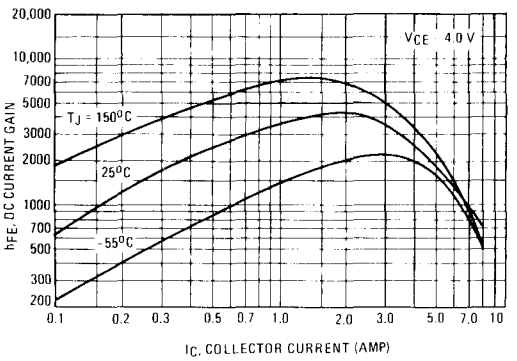


2N6040 thru 2N6042 PNP
2N6043 thru 2N6045 NPN
MJE6040 thru MJE6041 PNP
MJE6043 thru MJE6045 NPN

PNP
2N6040, 2N6041, 2N6042
MJE6040, MJE6041

NPN
2N6043, 2N6044, 2N6045
MJE6043, MJE6044, MJE6045

FIGURE 8 – DC CURRENT GAIN



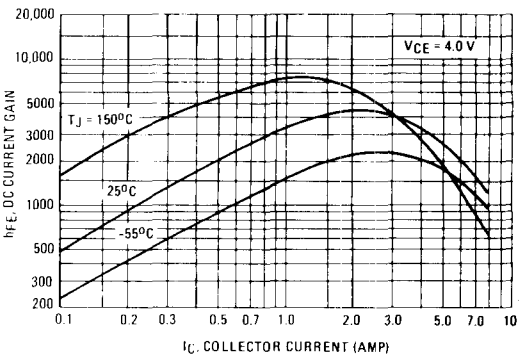
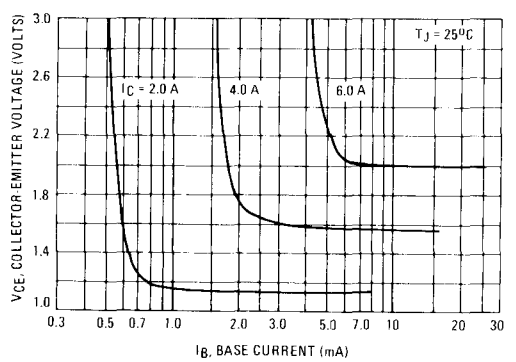


FIGURE 9 – COLLECTOR SATURATION REGION



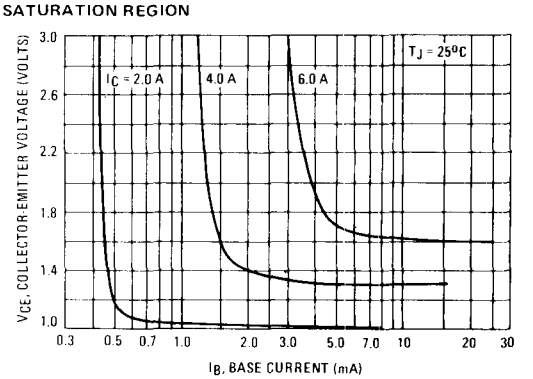


FIGURE 10 – "ON" VOLTAGES