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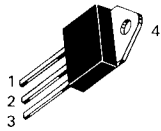
*Consult Motorola if a direct replacement is necessary.

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

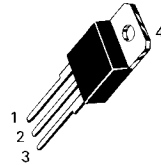
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MJF3055	MJF3055		—	MPSU02	MPS-U02		3-1042
MJF47	MJF47		3-1007	MPSU03	MPS-U03		3-1044
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MJH10012	MJH10012		3-596	MPSU05	MPS-U05		3-1048
MJH11017	MJH11017		3-1034	MPSU06	MPS-U06		3-1048
MJH11018	MJH11018		3-1034	MPSU07	MPS-U07		3-1050
MJH11019	MJH11019		3-1034	MPSU10	MPS-U10		3-1052
MJH11020	MJH11020		3-1034	MPSU11		MPS-U10	3-1052
MJH11021	MJH11021		3-1034	MPSU12		MPS-U45	3-1055
MJH11022	MJH11022		3-1034	MPSU45	MPS-U45		3-1055
MJH12004	MJH12004		3-644	MPSU51	MPS-U51		3-1058
MJH12005	MJH12005		—	MPSU51A	MPS-U51A		3-1058
MJH13090	MJH13090		3-688	MPSU52	MPS-U52		3-1060
MJH13091	MJH13091		3-758	MPSU55	MPS-U55		3-1062
MJH16002	MJH16002		3-976	MPSU56	MPS-U56		3-1062
MJH16002A	MJH16002A		3-734	MPSU57	MPS-U57		3-1064
MJH16004	MJH16004		3-976	MPSU60	MPS-U60		3-1066
MJH16006	MJH16006		3-742	MPSU95	MPS-U95		3-1068
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MJH16010	MJH16010		3-758	NSD104		2N4923	3-79
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MJH16012	MJH16012		3-758	NSD106		2N4923	3-79
MJH16018	MJH16018		3-782	NSD131		MJE340	3-876
MJH16032	MJH16032		3-984	NSD132		MJE340	3-876
MJH16034	MJH16034		3-984	NSD133		MJE340	3-876
MJH6282	MJH6282		3-1030	NSD134		MJE340	3-876
MJH6283	MJH6283		3-1030	NSD135		MJE340	3-876
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MJH6285	MJH6285		3-1030	NSD152		MJE800	3-888
MJH6286	MJH6286		3-1030	NSD202		2N4919	3-75
MJH6287	MJH6287		3-1030	NSD203		2N4919	3-75
MJH6676	MJH6676		3-758	NSD204		2N4919	3-75
MJH6677	MJH6677		3-758	NSD205		2N4919	3-75
MJH6678	MJH6678		3-758	NSD206		2N4919	3-75
MPC900			3-143	NSD3439		MJE3439	3-908
MPS-U01	MPS-U01		3-1040	NSD3440		MJE3440	3-908
MPS-U01A	MPS-U01A		3-1040	NSDU01		MPS-UC1	3-1040
MPS-U02	MPS-U02		3-1042	NSDU01A		MPS-UC1A	3-1040
MPS-U03	MPS-U03		3-1044	NSDU05		MPS-U05	3-1048
MPS-U04	MPS-U04		3-1044	NSDU06		MPS-U06	3-1048
MPS-U05	MPS-U05		3-1048	NSDU07		MPS-U07	3-1050
MPS-U06	MPS-U06		3-1048	NSDU45		MPS-U45	3-1055
MPS-U07	MPS-U07		3-1050	NSDU51		MPS-U51	3-1058
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MPS-U12		MPS-U45	3-1055	NSDU56		MPS-U56	3-1062
MPS-U31		MPS-U06	3-1048	NSDU57		MPS-U57	3-1064
MPS-U45	MPS-U45		3-1055	NSE170		MJE170	3-862
MPS-U47		MPS-U06	3-1048	NSE171		MJE171	3-862
MPS-U51	MPS-U51		3-1058	NSE180		MJE180	3-862
MPS-U51A	MPS-U51A		3-1058	NSE181		MJE181	3-862
MPS-U52	MPS-U52		3-1060	NSP105		TIP42A	3-1083
MPS-U55	MPS-U55		3-1062	NSP2010		TIP42	3-1083
MPS-U56	MPS-U56		3-1062	NSP2011		TIP42A	3-1083
MPS-U57	MPS-U57		3-1064	NSP2021		TIP41A	3-1083

*Consult Motorola if a direct replacement is necessary.

TABLE 4 — PLASTIC TO-218



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



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

CASE 340-02 (TO-218AC)

IC 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	750	MJH16032		4 min	3	2	1.5	2		125
	850	MJH16034		4 min	3	2	1.5	2		125
5	400	BUW11		6 min	3	4	0.8	3		125
	450	BUW11A		6 min	2.5	4	0.8	2.5		125
		MJH16002		5 min	5	3	0.3	3		100
		MJH16004		7 min	5	2.7	0.35	3		100
	500	MJH16002A		5 min	5	3	0.3	3		100
6	1500*	MJH12004		2.5 min	4.5	—	1	4.5	4	100
	375	BU426†		30 typ	0.6	2 typ	0.5 typ	2.5	6 typ	113
8	400	BUW12		6 min	6	4	0.8	5		125
		MJH16106		6/25	8	2 typ	0.1 typ	5		125
9	450	BUW12A		6 min	5	4	0.8	5		125
		MJH16006		5 min	8	2.5	0.25	5		125
		MJH16008		7 min	8	2.2	0.25	5		125
	500	BUT50P##†		30 min	2	0.75 typ	0.1 typ	5		100
		MJH16006A		5 min	8	2.5	0.25	5		125
10	700	BU508,A		2.25 min	4.5	8 typ	0.5 typ	4.5	7	125
		BU508D,AD		2.25 min	4.5	8 typ	0.5 typ	4.5	7	125
15	750	MJH12005					0.4 typ	5	4	100
	400	BUV47†		7 min	5	2	0.4	6		128
15	450	BUV47A†		7 min	6	2	0.4	6		128
10	40	TIP33	TIP34	20 min	3				3	80
	60	BDV65##†	BDV64##†	1k min	5					125
		TIP33A	TIP34A	20 min	3				3	80
		TIP140##	TIP145##	500 min	10	2.5 typ	2.5 typ	5	4#	125
	80	BDV65A##†	BDV64A##†	1k min	5					125
		TIP33B	TIP34B	20 min	3				3	80
		TIP141##	TIP146##	500 min	10	2.5 typ	2.5 typ	5	4#	125
	100	BDV65B##†	BDV64B##†	1k min	5					125
		TIP33C	TIP34C	20 min	3				3	80
		TIP142##	TIP147##	500 min	10	2.5 typ	2.5 typ	5	4#	125
	120	BDV65C##†	BDV64C##†	1k min	5					125
15	200	BU323P##†		150 min	6	15	15	6		125
	250	BU323AP##†		150 min	6	15	15	6		125
	400	MJH10012##		100/2k	6	15	15	6		118
	800	MJH16018		4 min	5	4.5 typ	0.2 typ	5		150
	250	MJH11022##		400/15k	10				3#	150
15	60	TIP3055	TIP2955	5 min	10				2.5	80
	150	MJH11018##	MJH11017##	400/15k	10				3#	150
	200	MJH11020##	MJH11019##	400/15k	10				3#	150
	250	MJH11022##	MJH11021##	400/15k	10				3#	150

[h_{FE}] @ 1 MHz, ## Darlington

* V_{(BR)CEX} or V_{(BR)CES}

† These devices supplied in Case 340D-01. Consult Motorola for details.

(continued)

TABLE 12 — POWER DARLINGTONS (continued)

I _C Cont Amps Max	V _{CE(sus)} Volts Min	Device Type		h _{FE} 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			
10	400	MJ10012		100/2k	6	15	15	6		175	TO-204/1
	600	MJ10014●		10/250	10	2.5	0.8	10		175	TO-204/1
12	60	2N6057	2N6050	750/18k	6	1.6 typ	1.5 typ	6	4	150	TO-204/1
	80	2N6058	2N6051	750/18k	6	1.6 typ	1.5 typ	6	4	150	TO-204/1
	100	2N6059	2N6052	750/18k	6	1.6 typ	1.5 typ	6		150	TO-204/1
	1000	BUT16●		5 min	8	3.3	1.5	8		150	TO-204/1
15	60	2N6576		2k/20k	4	2	7	10	10/200	120	TO-204/1
	90	2N6577		2k/20k	4	2	7	10	10/200	120	TO-204/1
	120	2N6578		2k/20k	4	2	7	10	10/200	120	TO-204/1
	150	MJ11018 MJH11018	MJ11017 MJH11017	100 min 100 min	15 15				3 3	175 150	TO-204/1 TO-218/340
	200	MJ11020 MJH11020	MJ11019 MJH11019	100 min 100 min	15 15				3 3	175 150	TO-204/1 TO-218/340
	250	MJ11022 MJH11022	MJ11021 MJH11021	100 min 100 min	15 15				3 3	175 150	TO-204/1 TO-218/340
	500	BUT51P		40 min	5	1.1	0.16	10		125	TO-218/340D
20	60	2N6282 MJH6282	2N6285 MJH6285	750/18k 750/18k	10 10	2.5 typ 2.5 typ	2.5 typ 2.5 typ	10 10	4 4	160 125	TO-204/1 TO-218/340
	80	2N6283 MJH6283	2N6286 MJH6286	750/18k 750/18k	10 10	2.5 typ 2.5 typ	2.5 typ 2.5 typ	10 10	4 4	160 125	TO-204/1 TO-218/340
	100	2N6284 MJH6284	2N6287 MJH6287	750/18k 750/18k	10 10	2.5 typ 2.5 typ	2.5 typ 2.5 typ	10 10	4 4	160 125	TO-204/1 TO-218/340
	350	MJ10000 MJ10004●		40/400 40/400	10 10	3 1.5	1.8 0.5	10 10	10 10	175 175	TO-204/1 TO-204/1
	400	MJ10001 MJ10005●		40/400 40/400	10 10	3 1.5	1.8 0.5	10 10	10 10	175 175	TO-204/1 TO-204/1
	450	MJ10008●		30/300	10	2	0.6	10	8	175	TO-204/1
	500	MJ10009●		30/300	10	2	0.6	10	8	175	TO-204/1
	700	BUT15●		15 min	12	2.5	0.8	12		175	TO-204/1
	750	MJ10024●		50/600	5	5	1.8	10		250	TO-204/1
	850	MJ10025●		50/600	5	5	1.8	10		250	TO-204/1
25	500	BUT14●		15 min	16	2.8	0.8	16		175	TO-204/1
28	400	BUT13●		20 min	20	2.6	0.8	18		175	TO-204/1
30	60	MJ11012	MJ11011	1k min	20				4	200	TO-204/1
	90	MJ11014	MJ11013	1k min	20				4	200	TO-204/1
	120	MJ11016	MJ11015	1k min	20				4	200	TO-204/1
40	350	MJ10022●		50/600	10	2.5	0.9	20		250	TO-204/197
	400	MJ10023●		50/600	10	2.5	0.9	20		250	TO-204/197
	700	BUT35●		15 min	24	4	1.2	24		250	TO-204/197
50	60	MJ11028	MJ11029	400 min	50					300	TO-204/197

● Darlington with speed-up diode.

(continued)

PNP	NPN
MJH11017	MJH11018
MJH11019	MJH11020
MJH11021	MJH11022

**COMPLEMENTARY DARLINGTON
SILICON POWER TRANSISTORS**

... designed for use as general purpose amplifiers, low frequency switching and motor control applications.

- High DC Current Gain @ 10 Adc — $h_{FE} = 400$ Min (All Types)
- Collector-Emitter Sustaining Voltage
 $V_{CE(sus)} = 150$ Vdc (Min) — MJH11018, 17
 $= 200$ Vdc (Min) — MJH11020, 19
 $= 250$ Vdc (Min) — MJH11022, 21
- Low Collector-Emitter Saturation Voltage
 $V_{CE(sat)} = 1.2$ V (Typ) @ $I_C = 5.0$ A
 $= 1.8$ V (Typ) @ $I_C = 10$ A
- Monolithic Construction

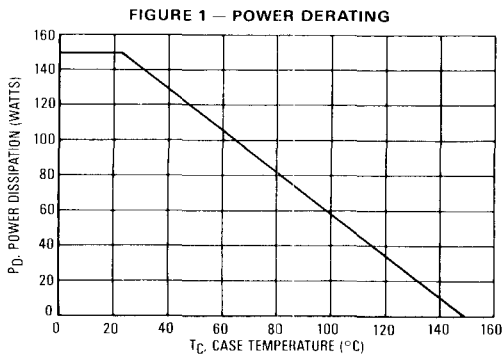
MAXIMUM RATINGS

Rating	Symbol	MJH			Unit
		11018 11017	11020 11019	11022 11021	
Collector-Emitter Voltage	V_{CEO}	150	200	250	Vdc
Collector-Base Voltage	V_{CB}	150	200	250	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current — Continuous — Peak (1)	I_C	15 30			Adc
Base Current	I_B	0.5			Adc
Total Device Dissipation @ $T_C = 25^{\circ}\text{C}$ Derate Above 25°C	P_D	150 1.2			Watts W/ $^{\circ}\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150			$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.83	$^\circ\text{C}/\text{W}$

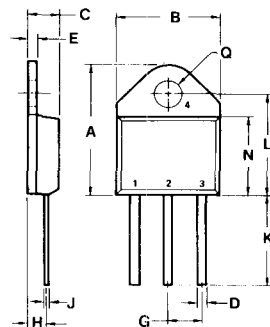
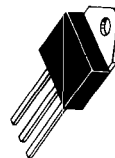
(1) Pulse Test: Pulse Width ≤ 5.0 ms, Duty Cycle $\leq 10\%$.



15 AMPERE

**DARLINGTON
POWER TRANSISTORS
COMPLEMENTARY SILICON**

**150, 200, 250 VOLTS
150 WATTS**



STYLE 1:

- PIN 1: BASE
2: COLLECTOR
3: EMITTER
4: COLLECTOR

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.49	15.90	0.610	0.626
C	4.19	5.08	0.165	0.200
D	1.02	1.65	0.040	0.065
E	1.35	1.65	0.053	0.065
G	5.21	5.72	0.205	0.225
H	2.41	3.20	0.095	0.126
J	0.38	0.64	0.015	0.025
K	12.70	15.49	0.500	0.610
L	15.88	16.51	0.625	0.650
N	12.19	12.70	0.480	0.500
Q	4.04	4.22	0.159	0.166

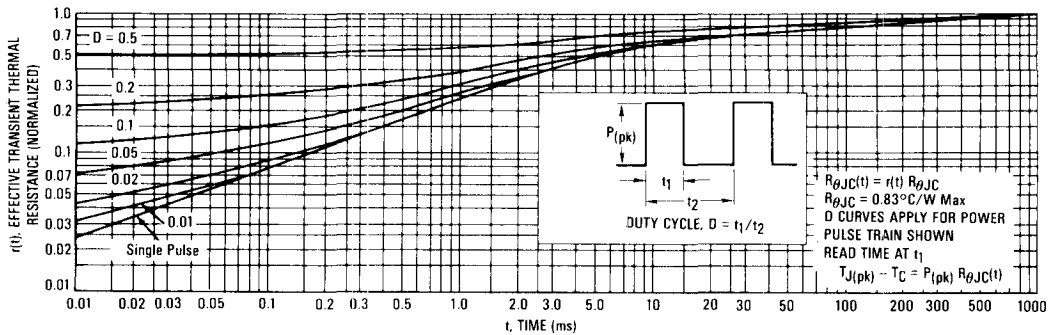
**CASE 340-02
TO-18AC**

3

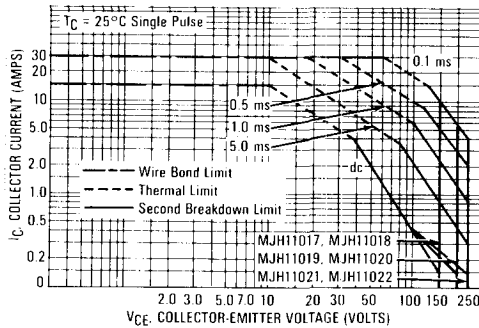
3-1035

**MJH11017, MJH11019, MJH11021 PNP
MJH11018, MJH11020, MJH11022 NPN**

FIGURE 3 — THERMAL RESPONSE



**FIGURE 4 — MAXIMUM RATED FORWARD BIAS
SAFE OPERATING AREA (FBSOA)**

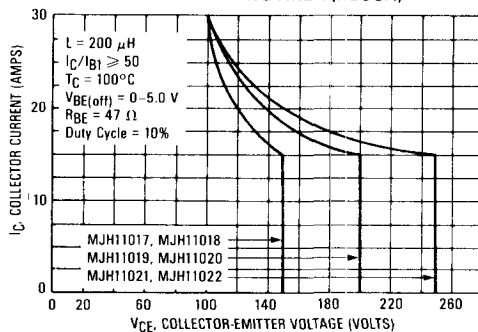


FORWARD BIAS

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 4 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 3. 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 5 — MAXIMUM RATED REVERSE BIAS
SAFE OPERATING AREA (RBSOA)**



REVERSE BIAS

For inductive loads, high voltage and high current must be sustained simultaneously during turn-off, in most cases, with the base to emitter junction reverse biased. Under these conditions the collector voltage must be held to a safe level at or below a specific value of collector current. This can be accomplished by several means such as active clamping, RC snubbing, load line shaping, etc. The safe level for these devices is specified as Reverse Bias Safe Operating Area and represents the voltage-current conditions during reverse biased turn-off. This rating is verified under clamped conditions so that the device is never subjected to an avalanche mode. Figure 5 gives RBSOA characteristics.

MJH11017, MJH11019, MJH11021 PNP
MJH11018, MJH11020, MJH11022 NPN

FIGURE 6 — DC CURRENT GAIN

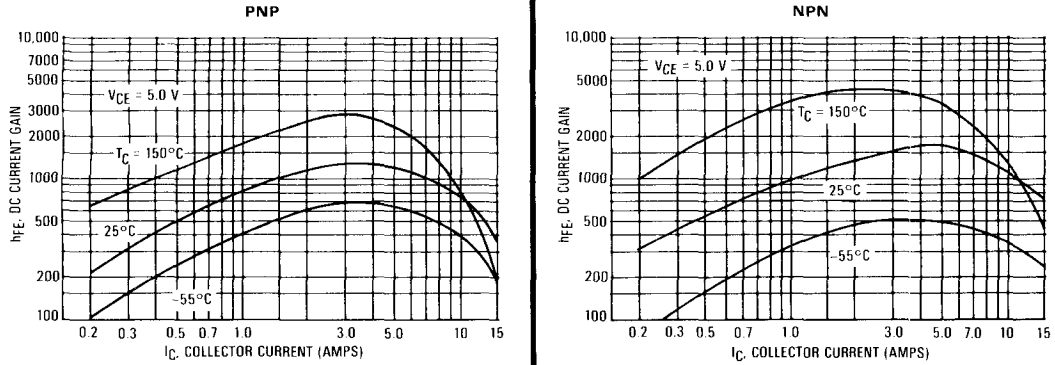


FIGURE 7 — COLLECTOR SATURATION REGION

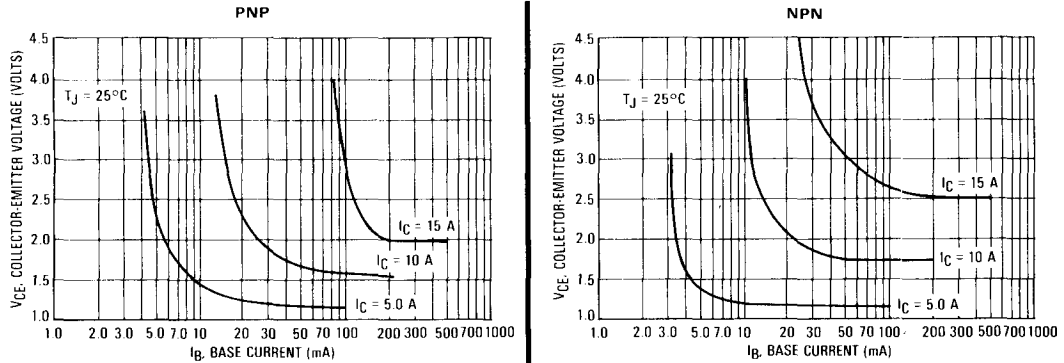
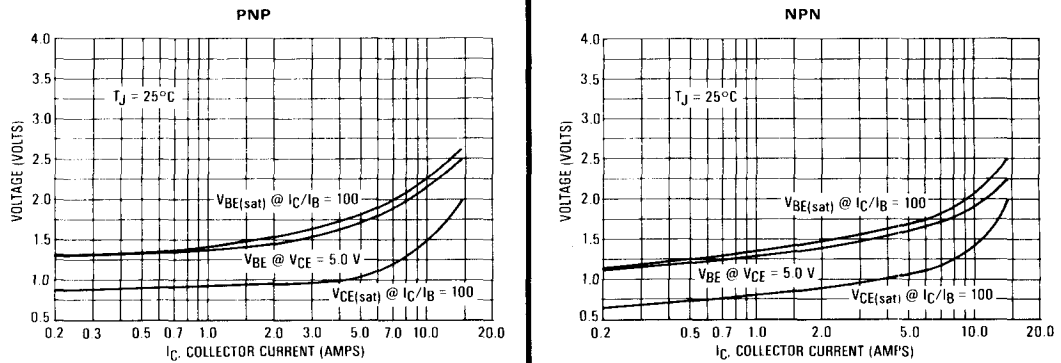


FIGURE 8 — "ON" VOLTAGES



MJH11017, MJH11019, MJH11021 PNP
MJH11018, MJH11020, MJH11022 NPN

FIGURE 9 — DARLINGTON SCHEMATIC

