ALPHANUMERIC INDEX — CROSS-REFERENCE

The following table represents an index and cross-reference guide for all low-frequency power transistors which are either manufactured directly by Motorola or for which Motorola manufactures a suitable equivalent. Where the Motorola part number differs from the industry part number, the Motorola device is a "form, fit and function" replacement for the industry type number — however, subtle differences in characteristics and/or specifications may exist.

1

Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
1SI10A-100		MJ16018	3-782
2N1487		2N5877	3-120
2N1488		2N5878	3-120
2N1489		2N5877	3-120
2N1490		2N5878	3-120
2N1702		2N5877	3-120
2N3016		2N5337	3-97
2N3021		2N3789	3-56
2N3022		2N3789	3-56
2N3023		2N3789	3-56
2N3024		2N3791	3-56
2N3025		2N3791	3-56
2N3026		2N3791	3-56
2N3054	2N3054		3-2
2N3054A	2N3054A		3-2
2N3055	2N3055		3-6
2N3055A	2N3055A		3-9
2N3055H		2N3055A	3-9
2N3055JAN		2N5302JAN	3-93
2N3055SD		2N3055A	3-9
2N3055UB		2N3055A	3-9
2N3076		2N6249	3-164
2N3079		2N6308	3-181
2N3080		2N6543	3-215
2N3171		2N3789	3-56
2N3172		2N3789	3-56
2N3173		2N3790	3-56
2N3174		MJ15016	3-9
2N3183		2N3789	3-56
2N3184		2N3789	3-56
2N3185		2N3790	3-56
2N3186		MJ15016	3-9
2N3195		2N3789	3-56
2N3196		2N3790	3-56
2N3198		MJ15016	3-9
2N3202		2N3719	3-32
2N3203		2N3720	3-32
2N3204		2N6303	3-32
2N3232		2N5877	3-120
2N3233		2N5882	3-123
2N3234		2N5760	3-116
2N3235		2N3055	3-6
2N3236		2N5882	3-123
2N3237		2N5302	3-93
2N3238		2N5882	3-123
2N3239		2N5882	3-123
2N3240		2N5882	3-123
2N3419		2N5336	3-97
2N3420		2N5336	3-97
2N3421		2N5336	3-97

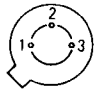
Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
2N3441	2N3441		3-13
2N3442	2N3442		3-15
2N3445	2N3447		3-18
2N3446	2N3448		3-18
2N3447	2N3447		3-18
2N3448	2N3448		3-18
2N3583	2N3583		3-20
2N3584	2N3584		3-20
2N3585	2N3585		3-20
2N3667		2N5881	3-123
2N3713		2N5881	3-123
2N3714	2N3714		3-26
2N3715	2N3715		3-26
2N3715JAN	2N3715JAN		3-26
2N3715JTX	2N3715JTX		3-26
2N3715JTXV	2N3715JTXV		3-26
2N3716	2N3716		3-26
2N3716JAN	2N3716JAN		3-26
2N3716JTX	2N3716JTX		3-26
2N3716JTXV	2N3716JTXV		3-26
2N3719	2N3719		3-32
2N3720	2N3720		3-32
2N3738	2N3738		3-37
2N3739	2N3739		3-37
2N3739JAN	2N3739JAN		3-37
2N3739JTX	2N3739JTX		3-37
2N3739JTXV	2N3739JTXV		3-37
2N3740	2N3740		3-41
2N3740A		2N3740	3-41
2N3740JAN	2N3740JAN		3-41
2N3740JTX	2N3740JTX		3-41
2N3740JTXV	2N3740JTXV		3-41
2N3741	2N3741		3-41
2N3741A	2N3741A		3-41
2N3741JAN	2N3741JAN		3-41
2N3741JTX	2N3741JTX		3-41
2N3741JTXV	2N3741JTXV		3-41
2N3766	2N3766		3-44
2N3766JAN	2N3766JAN		3-44
2N3766JTX	2N3766JTX		3-44
2N3766JTXV	2N3766JTXV		3-44
2N3767	2N3767		3-44
2N3767JAN	2N3767JAN		3-44
2N3767JTX	2N3767JTX		3-44
2N3767JTXV	2N3767JTXV		3-44
2N3771	2N3771		3-48
2N3772	2N3772		3-48
2N3773	2N3773		3-52
2N3788		2N6543	3-215
2N3789	2N3789		3-56

TABLE 1 — METAL TO-204, TO-204AE (continued)

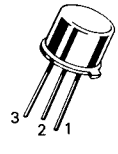
I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s μs Max	Resistive Switching t_f μs Max	Resistive Switching @ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C
50	200	BUS51•		15 min	50					350
	400	MJ10015•##		10 min	40	2.5	1	20		250
	500	BUT34•##		15 min	32	3	1.5	32		250
		MJ10016•##		10 min	40	2.5	1	20		250
56	400	BUT33•##		20 min	36	3.3	1.6	36		250
60	60	MJ14000•	MJ14001•	15/100	50					300
	80	MJ14002•	MJ14003•	15/100	50					300
	200	MJ10020•##		75 min	15	3.5	0.5	30		250
	250	MJ10021•##		75 min	15	3.5	0.5	30		250
70	125	BUS50•		15 min	50					350

• Modified TO-3, 60 mil pins, # $|h_{fe}|$ @ 1 MHz, ## Darlington

TABLE 2 — METAL TO-205 (Formerly TO-39)



STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR
(Pin 3 connected to case)



CASE 79-04 (TO-205AD)

I_CCont 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
0.5	300		MJ4646	20 min	0.5	0.72*		0.05	40	5
	400		MJ4647	20 min	0.5	0.72*		0.05	30	5
3	40		2N3719	25/180	1	0.4*		1	60	6
			2N3867	40/200	1.5	0.4*		1.5	60	6
	60		2N3720	25/180	1	0.4*		1	60	6
			2N3868	30/150	1.5	0.4*		1.5	60	6
	80		2N6303	30/150	1.5	0.4*		1.5	60	6
4	60	2N4877		20/100	4	1.5	0.5	4	4	10
5	80	2N5336	2N6190	30/120	2	2	0.2	2	30	6
		2N5337	2N6191	60/240	2	2	0.2	2	30	6
	100	2N5338		30/120	2	2	0.2	2	30	10
		2N5339	2N6193	60/240	2	2	0.2	2	30	6

*t_{off}

JAN, JTX, JTXV Available

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

2N3719, 2N3720
2N3867, 2N3868
2N6303

SILICON PNP POWER TRANSISTORS

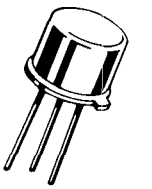
. . . designed for high-speed, medium-current switching and high-frequency amplifier applications.

- Collector-Emitter Sustaining Voltage –
  $V_{CEO(sus)}$ = 40 Vdc (Min) – 2N3719,2N3867
  = 60 Vdc (Min) – 2N3720,2N3868
  = 80 Vdc (Min) – 2N6303
- DC Current Gain –
  h_{FE} = 25-180 @ I_C = 1.0 Adc – 2N3719,2N3720
  = 40-200 @ I_C = 1.5 Adc – 2N3867
  = 30-150 @ I_C = 1.5 Adc – 2N3868,2N6303
- *Low Collector-Emitter Saturation Voltage* –
  $V_{CE(sat)}$ = 0.75 Vdc @ I_C = 1.0 Adc – 2N3719,2N3720
  = 0.75 Vdc @ I_C = 1.5 Adc – 2N3867,2N3868, 2N6303
- High Current-Gain – Bandwidth Product –
  f_T = 90 MHz (Typ)
- 2N3867 JAN and 2N3868 JAN also Available

3 AMPERE

POWER TRANSISTORS
PNP SILICON

40,60,80 VOLTS
6 WATTS



***MAXIMUM RATINGS**

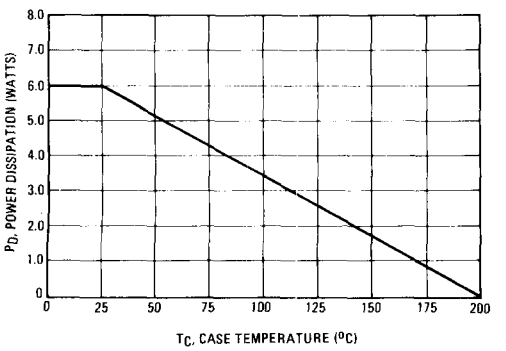
Rating	Symbol	2N3719 2N3867	2N3720 2N3868	2N6303	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector-Base Voltage	V_{CB}	40	60	80	Vdc
Emitter-Base Voltage	V_{EB}	4.0			Vdc
Collector Current – Continuous Peak	I_C	3.0 10			Adc
Base Current	I_B	0.5			Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	6.0 34.3			Watts mW/°C
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.0 5.71			Watt mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200			°C

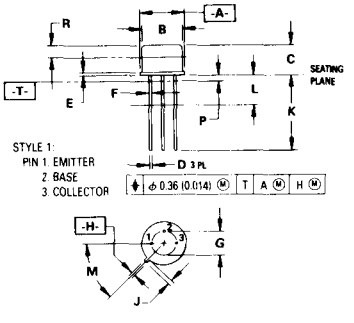
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	29	°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	175	°C/W

*Indicates JEDEC Registered Data

FIGURE 1 – POWER DERATING





DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.50	0.305	0.335
C	6.10	6.60	0.240	0.260
D	0.41	0.53	0.016	0.021
E	0.23	1.04	0.009	0.041
F	0.41	0.48	0.016	0.019
G	5.08 BSC		0.200 BSC	
H	0.72	0.86	0.028	0.034
J	0.74	1.14	0.029	0.045
K	12.70	19.05	0.500	0.750
L	6.35	—	0.250	—
M	45° BSC		45° BSC	
P	—	1.27	—	0.050
R	2.54	—	0.100	—

CASE 79-04
TO-205AD
(TO-39)

3

*ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (1) (I_C = 20 mAdc, I_B = 0)	2N3867	$V_{CEO(sus)}$	40	–	Vdc
	2N3868		60	–	
	2N6303		80	–	
Collector-Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	2N3867	$V_{(BR)CBO}$	40	–	Vdc
	2N3868		60	–	
	2N6303		80	–	
Emitter-Base Breakdown Voltage (I_E = 100 μAdc, I_C = 0)		$V_{(BR)EBO}$	4.0	–	Vdc
Collector Cutoff Current (V_{CE} = Rated V_{CB}, $V_{BE(off)}$ = 2.0 Vdc)		I_{CEX}	–	1.0	μAdc
Collector Cutoff Current (V_{CB} = Rated V_{CB}, I_E = 0, T_C = 150°C)		I_{CBO}	–	150	μAdc
ON CHARACTERISTICS (1)					
DC Current Gain		h_{FE}			–
(I_C = 500 mAdc, V_{CE} = 1.0 Vdc)	2N3867		50	–	
	2N3868, 2N6303		35	–	
(I_C = 1.5 Adc, V_{CE} = 2.0 Vdc)	2N3867		40	200	
	2N3868, 2N6303		30	150	
(I_C = 2.5 Adc, V_{CE} = 3.0 Vdc)	2N3867		25	–	
	2N3868, 2N6303		20	–	
(I_C = 3.0 Adc, V_{CE} = 5.0 Vdc)	2N3867		20	–	
	2N3868, 2N6303				
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 500 mAdc, I_B = 50 mAdc)			–	0.5	
(I_C = 1.5 Adc, I_B = 150 mAdc)			–	0.75	
(I_C = 2.5 Adc, I_B = 250 mAdc)			–	1.3	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 500 mAdc, I_B = 50 mAdc)			–	1.0	
(I_C = 1.5 Adc, I_B = 150 mAdc)			0.9	1.4	
(I_C = 2.5 Adc, I_B = 250 mAdc)			–	2.0	
DYNAMIC CHARACTERISTICS					
Current-Gain – Bandwidth Product (2) (I_C = 100 mAdc, V_{CE} = 5.0 Vdc, f_{test} = 20 MHz)		f_T	60	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)		C_{ob}	–	120	pF
Input Capacitance (V_{EB} = 3.0 Vdc, I_C = 0, f = 0.1 MHz)		C_{ib}	–	1000	pF
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = 30 Vdc, $V_{BE(off)}$ = 0, I_C = 1.5 Adc, I_{B1} = 150 mAdc)	t_d	–	35	ns
Rise Time		t_r	–	65	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 1.5 Adc, I_{B1} = I_{B2} = 150 mAdc)	t_s	–	325	ns
Fall Time		t_f	–	75	ns

*Indicates JEDEC Registered Data

(1) *Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.*

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

3

FIGURE 4 – THERMAL RESISTANCE

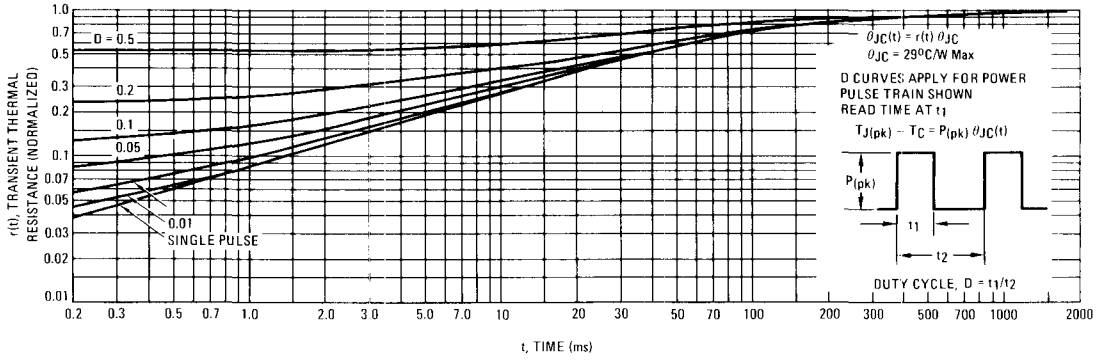
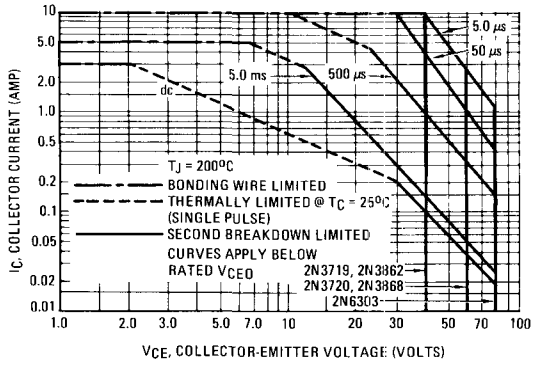


FIGURE 5 – ACTIVE REGION SAFE OPERATING AREA



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 $T_{J(pk)}$ = 200°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leqslant 200^{\circ}C$. $T_{J(pk)}$ 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

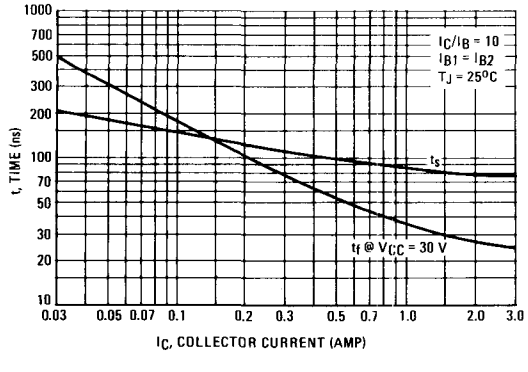
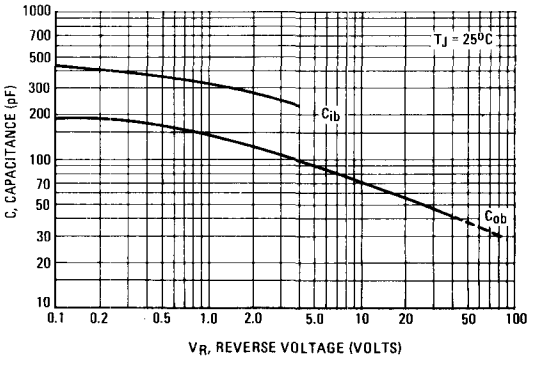


FIGURE 7 – CAPACITANCE



3

FIGURE 8 – DC CURRENT GAIN

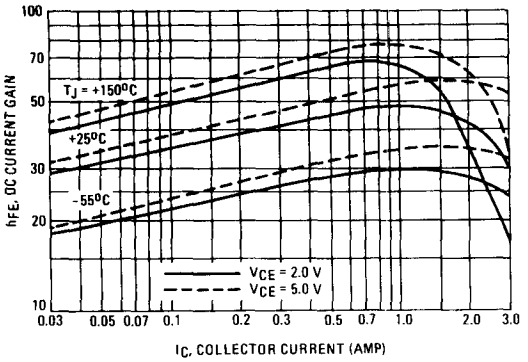


FIGURE 9 – COLLECTOR SATURATION REGION

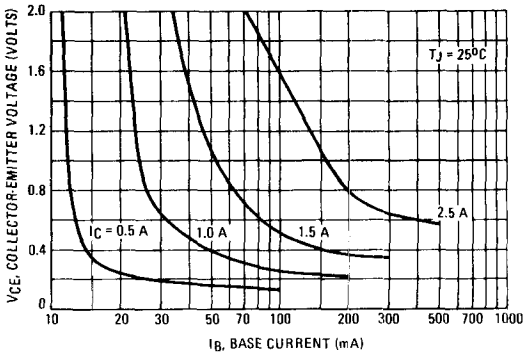


FIGURE 10 – "ON" VOLTAGES

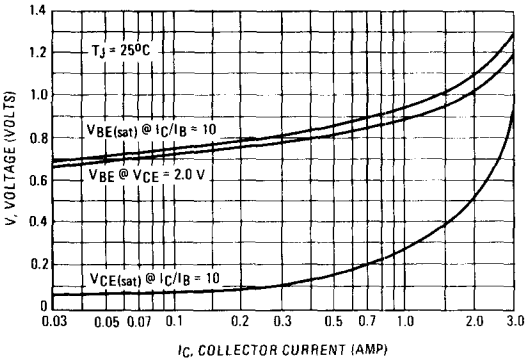


FIGURE 11 – TEMPERATURE COEFFICIENTS

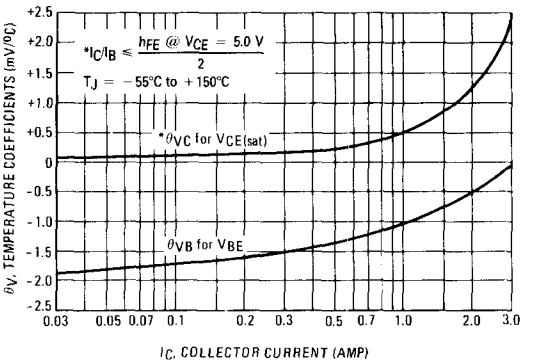


FIGURE 12 – COLLECTOR CUT-OFF REGION

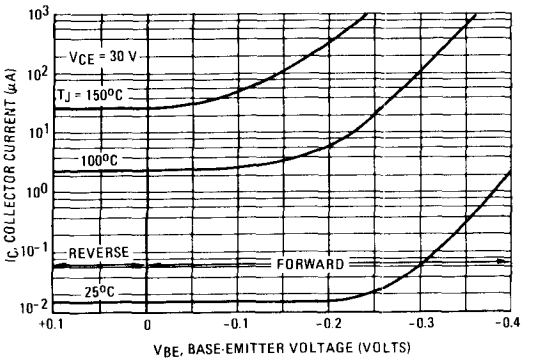
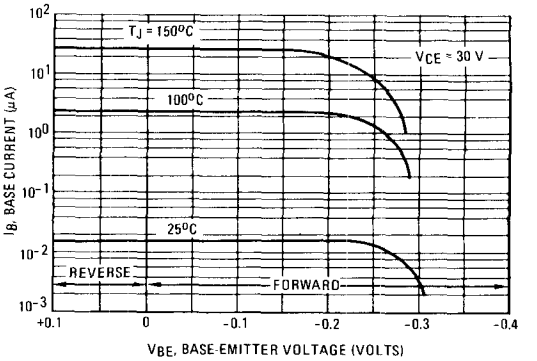


FIGURE 13 – BASE CUT-OFF REGION



3