

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number	Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
BDT63A	BDW41		3-328	BDW51C	2N5882		3-123
BDT63B	BDW42		3-328	BDW52	2N3791		3-56
BDT63C	BDW43		3-328	BDW52A	2N3792		3-56
BDT64	BDW44		3-328	BDW52B	2N3792		3-56
BDT64A	BDW45		3-328	BDW52C	2N5880		3-123
BDT64B	BDW46		3-328	BDW53	TIP120		3-1098
BDT64C	BDW47		3-328	BDW53A	TIP120		3-1098
BDT65	BDW40		3-328	BDW53B	TIP121		3-1098
BDT65A	BDW41		3-328	BDW53C	BDX53C		3-338
BDT65B	BDW42		3-328	BDW53D	BDX53D		3-338
BDT65C	BDW43		3-328	BDW54	TIP125		3-1098
BDT91	BD807		3-316	BDW54A	TIP125		3-1098
BDT92	BD808		3-318	BDW54B	TIP126		3-1098
BDT93	BD809		3-316	BDW54C	BDX54C		3-338
BDT94	BD810		3-318	BDW54D	BDX54D		3-338
BDV64	BDV64		3-324	BDW55	BD135		3-258
BDV64A	BDV64A		3-324	BDW56	BD136		3-260
BDV64B	BDV64B		3-324	BDW57	BD137		3-258
BDV64C		BDV64B	3-324	BDW58	BD138		3-260
BDV65	BDV65		3-324	BDW59	BD139		3-258
BDV65A	BDV65A		3-324	BDW60	BD140		3-260
BDV65B	BDV65B		3-324	BDW63	BDX53		3-338
BDV65C		BDV65B	3-324	BDW63A	BDX53A		3-338
BDV66C	MJH11018		3-1034	BDW63B	BDX53B		3-338
BDV66C	MJH11017		3-1034	BDW63C	BDX53C		3-338
BDV66D	MJH11019		3-1034	BDW63D	BDX53D		3-338
BDV67D	MJH11020		3-1034	BDW64	BDX54		3-338
BDV91	MJE3055T		3-904	BDW64A	BDX54A		3-338
BDV92	TIP34B		3-1077	BDW64B	BDX54B		3-338
BDV93	TIP34C		3-1077	BDW64C	BDX54C		3-338
BDV94	TIP2955		3-1108	BDW73	BD895		3-320
BDV95	TIP33B		3-1077	BDW73A	BD897		3-320
BDV96	TIP33C		3-1077	BDW73B	BD899		3-320
BDW21	2N3714		3-26	BDW73C	BD901		3-320
BDW21A	2N3714		3-26	BDW73D	BDX33D		3-334
BDW21B	2N3714		3-26	BDW74	BD896		3-322
BDW21C		2N5882	3-123	BDW74A	BD898		3-322
BDW22	2N3789		3-56	BDW74B	BD900		3-322
BDW22A	2N3789		3-56	BDW74C	BD902		3-322
BDW22B	2N3790		3-56	BDW74D	BDX34D		3-334
BDW22C	2N5880		3-123	BDW83	BDV65		3-324
BDW23	BDX53		3-338	BDW83A	BDV65		3-324
BDW23A	BDX53A		3-338	BDW83B	BDV65A		3-324
BDW23B	BDX53B		3-338	BDW83C	BDV65B		3-324
BDW23C	BDX53C		3-338	BDW84	BDV64		3-324
BDW24	BDX54		3-338	BDW84A	BDV64		3-324
BDW24A	BDX54A		3-338	BDW84B	BDV64A		3-324
BDW24B	BDX54B		3-338	BDW84C	BDV64B		3-324
BDW24C	BDX54C		3-338	BDW93	BDW39		3-328
BDW39	BDW39		3-328	BDW93A	BDW40		3-328
BDW40	BDW40		3-328	BDW93B	BDW41		3-328
BDW41	BDW41		3-328	BDW93C	BDW42		3-328
BDW42	BDW42		3-328	BDW94	BDW44		3-328
BDW44	BDW44		3-328	BDW94A	BDW45		3-328
BDW45	BDW45		3-328	BDW94B	BDW46		3-328
BDW46	BDW46		3-328	BDW94C	BDW47		3-328
BDW47	BDW47		3-328	BDX10	2N3055A		3-9
BDW51	2N3715		3-26	BDX10-4	2N3055A		3-9
BDW51A	2N3715		3-26	BDX10-6	2N3055A		3-9
BDW51B	2N3716		3-26	BDX10-7	2N3055A		3-9

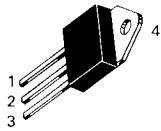
*Consult Motorola if a direct replacement is necessary.

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

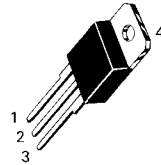
Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number	Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
TIP107	TIP107		3-1091	TIP32F		MJE15031	3-972
TIP110	TIP110		3-1095	TIP33	TIP33		3-1077
TIP111	TIP111		3-1095	TIP33A	TIP33A		3-1077
TIP112	TIP112		3-1095	TIP33B	TIP33B		3-1077
TIP115	TIP115		3-1095	TIP33C	TIP33C		3-1077
TIP116	TIP116		3-1095	TIP34	TIP34		3-1077
TIP117	TIP117		3-1095	TIP34A	TIP34A		3-1077
TIP120	TIP120		3-1098	TIP34B	TIP34B		3-1077
TIP121	TIP121		3-1098	TIP34C	TIP34C		3-1077
TIP122	TIP122		3-1098	TIP35	TIP35		3-1079
TIP125	TIP125		3-1098	TIP35A	TIP35A		3-1079
TIP126	TIP126		3-1098	TIP35B	TIP35B		3-1079
TIP127	TIP127		3-1098	TIP35C	TIP35C		3-1079
TIP140	TIP140		3-1104	TIP36	TIP36		3-1079
TIP140T		TIP100	3-1091	TIP36A	TIP36A		3-1079
TIP141	TIP141		3-1104	TIP36B	TIP36B		3-1079
TIP141T		TIP101	3-1091	TIP36C	TIP36C		3-1079
TIP142	TIP142		3-1104	TIP41	TIP41		3-1083
TIP142T		TIP102	3-1091	TIP41A	TIP41A		3-1083
TIP145	TIP145		3-1104	TIP41B	TIP41B		3-1083
TIP145T		TIP105	3-1091	TIP41C	TIP41C		3-1083
TIP146	TIP146		3-1104	TIP41D		MJE15030	3-972
TIP146T		TIP106	3-1091	TIP41E		MJE15030	3-972
TIP147	TIP147		3-1104	TIP41F		MJE15030	3-972
TIP147T		TIP107	3-1091	TIP42	TIP42		3-1083
TIP150		MJE13006	3-950	TIP42A	TIP42A		3-1083
TIP151		MJE13007	3-950	TIP42B	TIP42B		3-1083
TIP152		MJE13007	3-950	TIP42C	TIP42C		3-1083
TIP160		MJE5740	3-914	TIP42D		MJE15031	3-972
TIP161		MJE5741	3-914	TIP42E		MJE15031	3-972
TIP162		MJE5742	3-914	TIP42F		MJE15031	3-972
TIP29	TIP29		3-1071	TIP47	TIP47		3-1087
TIP2955	TIP2955		3-1108	TIP48	TIP48		3-1087
TIP29A	TIP29A		3-1071	TIP49	TIP49		3-1087
TIP29B	TIP29B		3-1071	TIP50	TIP50		3-1087
TIP29C	TIP29C		3-1071	TIP510		MJ15011	3-716
TIP29D		MJE15030	3-972	TIP511		MJ15011	3-716
TIP29E		MJE15030	3-972	TIP512		MJ15011	3-716
TIP29F		MJE15030	3-972	TIP513		MJ15012	3-716
TIP30	TIP30		3-1071	TIP514		MJE15030	3-972
TIP3055	TIP3055		3-1108	TIP517		2N6339	3-188
TIP30A	TIP30A		3-1071	TIP518		2N6341	3-188
TIP30B	TIP30B		3-1071	TIP519		MJ15012	3-716
TIP30C	TIP30C		3-1071	TIP520		MJ15012	3-716
TIP30D		MJE15031	3-972	TIP521		2N6211	3-161
TIP30E		MJE15031	3-972	TIP522		2N6211	3-161
TIP30F		MJE15031	3-972	TIP523		MJ15012	3-716
TIP31	TIP31		3-1073	TIP524		2N6497	3-211
TIP31A	TIP31A		3-1073	TIP525		MJ15011	3-716
TIP31B	TIP31B		3-1073	TIP526		MJ15011	3-716
TIP31C	TIP31C		3-1073	TIP527		MJ15012	3-716
TIP31D		MJE15030	3-972	TIP528		MJ15012	3-716
TIP31E		MJE15030	3-972	TIP536		MJ16006	3-742
TIP31F		MJE15030	3-972	TIP545		MJ15016	3-9
TIP32	TIP32		3-1073	TIP546		MJ15016	3-9
TIP32A	TIP32A		3-1073	TIP550		MJ12002	3-637
TIP32B	TIP32B		3-1073	TIP551		MJ12003	3-642
TIP32C	TIP32C		3-1073	TIP552		MJ12004	3-644
TIP32D		MJE15031	3-972	TIP553		MJ12004	3-644
TIP32E		MJE15031	3-972	TIP554		MJ13080	3-682

*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
	1500*	MJH12004		2.5 min	4.5	—	1	4.5	4	100
6	375	BU426†		30 typ	0.6	2 typ	0.5 typ	2.5	6 typ	113
	400	BU426A†		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
	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
		BUT50P##†		30 min	2	0.75 typ	0.1 typ	5		100
	700	MJH16006A		5 min	8	2.5	0.25	5		125
		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
	750	MJH12005					0.4 typ	5	4	100
9	400	BUV47†		7 min	5	2	0.4	6		128
	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
	200	BU323P##†		150 min	6	15	15	6		125
15	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
	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)

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

NPN
TIP3055
PNP
TIP2955

COMPLEMENTARY SILICON POWER TRANSISTORS

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

- DC Current Gain — $h_{FE} = 20-70$ @ $I_C = 4.0$ Adc
- Collector-Emitter Saturation Voltage — $V_{CE(sat)} = 1.1$ Vdc (Max) @ $I_C = 4.0$ Adc
- Excellent Safe Operating Area

**15 AMPERE
POWER TRANSISTORS**

COMPLEMENTARY SILICON

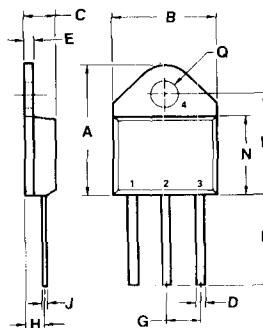
**60 VOLTS
90 WATTS**

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	60	Vdc
Collector-Emitter Voltage	V_{CER}	70	Vdc
Collector-Base Voltage	V_{CB}	100	Vdc
Emitter-Base Voltage	V_{EB}	7.0	Vdc
Collector Current — Continuous	I_C	15	A dc
Base Current	I_B	7.0	A dc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	90 0.72	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	$R_{\theta JC}$	1.39	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	35.7	$^\circ\text{C}/\text{W}$

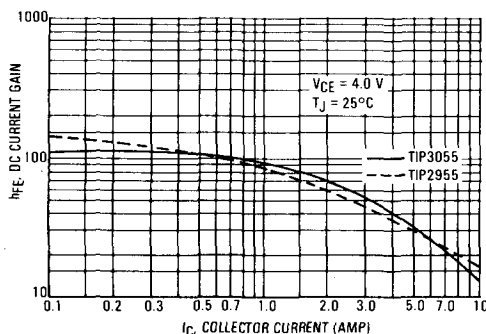


STYLE 1:
1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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-218AC**

FIGURE 1 — DC CURRENT GAIN



TIP3055NPN, TIP2955PNP

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (1) ($I_C = 30\text{ mAdc}$, $I_B = 0$)	$V_{CE(sus)}$	60	—	Vdc
Collector Cutoff Current ($V_{CE} = 70\text{ Vdc}$, $R_{BE} = 100\text{ Ohms}$)	I_{CER}	—	1.0	mAdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $I_B = 0$)	I_{CEO}	—	0.7	mAdc
Collector Cutoff Current ($V_{CE} = 100\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$)	I_{CEV}	—	5.0	mAdc
Emitter Cutoff Current ($V_{BE} = 7.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	5.0	mAdc

ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 4.0\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$) ($I_C = 10\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$)	h_{FE}	20 5.0	70 —	—
Collector-Emitter Saturation Voltage ($I_C = 4.0\text{ Adc}$, $I_B = 400\text{ mAdc}$) ($I_C = 10\text{ Adc}$, $I_B = 3.3\text{ Adc}$)	$V_{CE(sat)}$	— —	1.1 3.0	Vdc
Base-Emitter On Voltage ($I_C = 4.0\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$)	$V_{BE(on)}$	—	1.8	Vdc

SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased ($V_{CE} = 30\text{ Vdc}$, $t = 1.0\text{ s}$; Nonrepetitive)	$I_{S/b}$	3.0	—	Adc
---	-----------	-----	---	-----

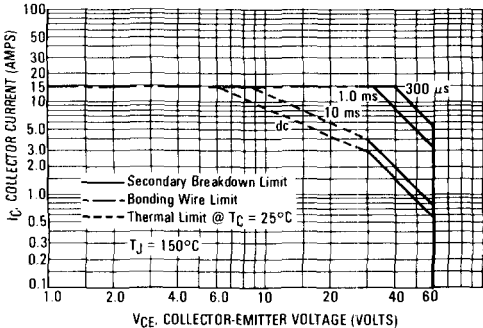
DYNAMIC CHARACTERISTICS

Current Gain—Bandwidth Product ($I_C = 0.5\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ MHz}$)	f_T	2.5	—	MHz
Small-Signal Current Gain ($V_{CE} = 4.0\text{ Vdc}$, $I_C = 1.0\text{ Adc}$, $f = 1.0\text{ kHz}$)	h_{fe}	15	—	kHz

(1) Pulse Test: Pulse Width = $300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Note: For additional design curves, refer to electrical characteristics curves of 2N3055.

**FIGURE 2 — MAXIMUM RATED FORWARD BIAS
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 2 is based on $T_C = 25^\circ\text{C}$; $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated for temperature.