

6367254 MOTOROLA SC (XSTRS/R F)

96D 80611

DT-33-11

T.33.21

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

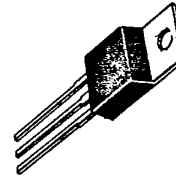
... designed for use in general purpose amplifier and switching applications.

- Collector-Emitter Saturation Voltage —
VCE = 0.8 Vdc (Max) @ IC = 2.0 Adc
- Collector-Emitter Sustaining Voltage —
VCEO (sus) = 45 Vdc (Min) BD533, BD534
= 60 Vdc (Min) BD535, BD536
= 80 Vdc (Min) BD537, BD538
- High Current Gain — Bandwidth Product
fT = 3.0 MHz (Min) @ IC = 250 mAdc
- Compact TO-220 AB Package
- TO-66 Leadform Also Available ordered with “-66” suffix

**NPN
BD533
BD535
BD537**

**PNP
BD534
BD536
BD538**

**4 AMPERE
POWER TRANSISTORS
COMPLEMENTARY SILICON
45, 60, 80 VOLTS
50 WATTS**



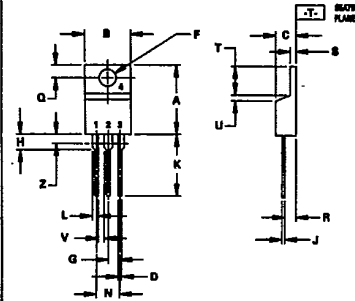
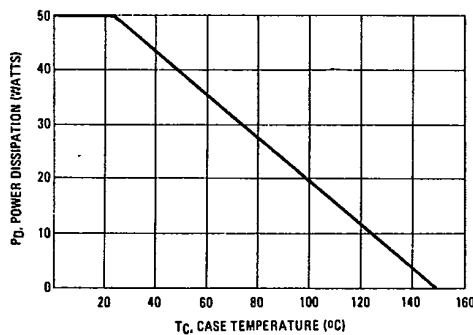
MAXIMUM RATINGS

Rating	Symbol	BD533 BD534	BD535 BD536	BD537 BD538	Unit
Collector-Emitter Voltage	VCE0	45	60	80	Vdc
Collector-Base Voltage	VCB	45	60	80	Vdc
Emitter-Base Voltage	VEB	5.0			Vdc
Collector Current - Continuous	IC	4.0			Adc
Peak		8.0			
Base Current	IB	1.0			Adc
Total Device Dissipation @ TC = 25°C	PD	50			Watts
Derate above 25°C		0.4			W/°C
Operating and Storage Junction Temperature Range	TJ, Tstg	-65 to +150			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	RθJC	2.5	°C/W
Thermal Resistance, Junction to Ambient	RθJA	70	°C/W

FIGURE 1 — POWER DERATING



- NOTES:
1. DIMENSIONING 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.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.58	10.29	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.84	0.86	0.033	0.034
F	3.81	3.73	0.150	0.147
G	2.42	2.86	0.095	0.113
H	2.80	3.81	0.110	0.150
J	0.46	0.71	0.018	0.028
K	12.70	14.27	0.500	0.562
L	1.15	1.30	0.045	0.051
N	4.83	6.35	0.190	0.250
O	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.30	0.045	0.051
T	6.87	8.47	0.270	0.333
U	0.90	1.27	0.035	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

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

**CASE 221A-04
TO-220AB**



0367254 MOTOROLA SC (XSTRS/R F)

96D 80612 D

BD533, BD535, BD537 NPN
BD534, BD536, BD538 PNP

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

Characteristic	Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage ¹ ($I_C = 0.1 \text{ A dc}, I_B = 0$)	BD533, BD534 BD535, BD536 BD537, BD538	$V_{CE(sus)}$	45 60 80	Vdc
Collector Cutoff Current ($V_{CB} = 45 \text{ Vdc}, I_E = 0$) ($V_{CB} = 60 \text{ Vdc}, I_E = 0$) ($V_{CB} = 80 \text{ Vdc}, I_E = 0$)	BD533, BD534 BD535, BD536 BD537, BD538	I_{CBO}	0.1 0.1 0.1	mAdc
Collector Cutoff Current ($V_{CE} = 45 \text{ Vdc}, V_{EB} = 0$) ($V_{CE} = 60 \text{ Vdc}, V_{EB} = 0$) ($V_{CE} = 80 \text{ Vdc}, V_{EB} = 0$)	BD533, BD534 BD535, BD536 BD537, BD538	I_{CES}	100 100 100	μAdc
Emitter Cutoff Current ($V_{BE} = 5.0 \text{ Vdc}, I_C = 0$)		I_{EBO}	1.0	mAdc
ON CHARACTERISTICS¹				
DC Current Gain ($I_C = 10 \text{ mAdc}, V_{CE} = 5 \text{ Vdc}$) ($I_C = 500 \text{ mAdc}, V_{CE} = 2 \text{ Vdc}$) ($I_C = 2 \text{ A dc}, V_{CE} = 2 \text{ Vdc}$)	BD533, BD534 BD535, BD536 BD537, BD538 BD533, BD534 BD535, BD536 BD537, BD538	h_{FE}	20 20 15 40 25 25 15	
Collector-Emitter Saturation Voltage ($I_C = 2.0 \text{ A dc}, I_B = 0.2 \text{ A dc}$)		$V_{CE(sat)}$	0.8	Vdc
Base-Emitter On Voltage ($I_C = 2.0 \text{ A dc}, V_{CE} = 2.0 \text{ Vdc}$)		$V_{BE(on)}$	1.5	Vdc
DYNAMIC CHARACTERISTICS				
Current Gain - Bandwidth Product ² ($I_C = 260 \text{ mAdc}, V_{CE} = 1 \text{ Vdc}, f_{test} = 1 \text{ MHz}$)		f_T	3.0	MHz

¹ Pulse test - Pulse width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

² $f_T = |h_{fe}| \cdot f_{test}$



FIGURE 2 - SWITCHING TIME EQUIVALENT CIRCUIT

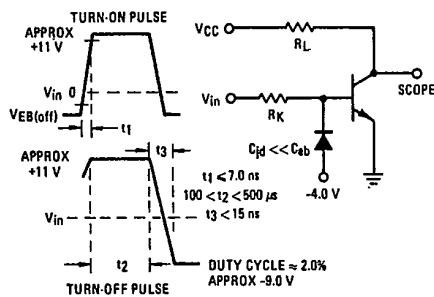
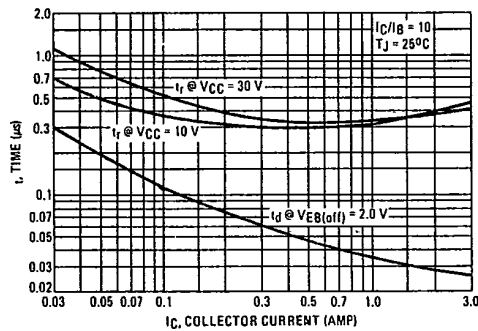


FIGURE 3 - TURN-ON TIME



6367254 MOTOROLA SC (XSTRS/R F)
 BD533, BD535, BD537 NPN
 BD534, BD536, BD538 PNP

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FIGURE 4 - THERMAL RESPONSE

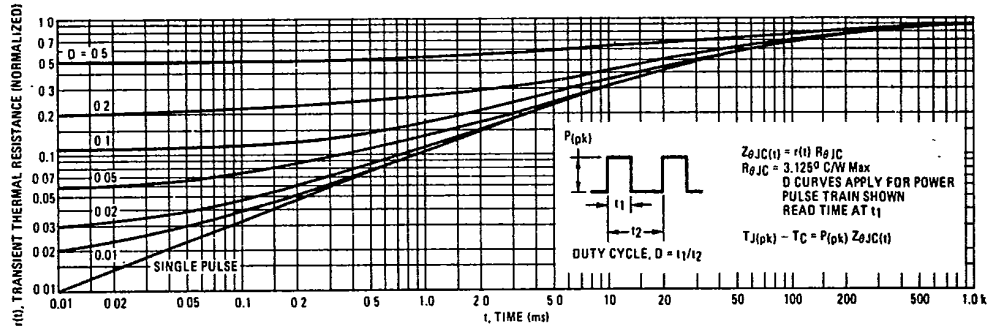
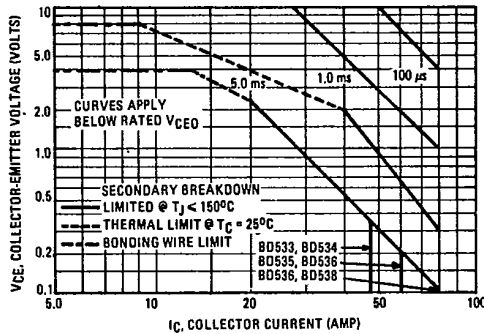


FIGURE 5 - ACTIVE REGION SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate IC-VCE 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. (See AN-415A).

FIGURE 6 - TURN-OFF TIME

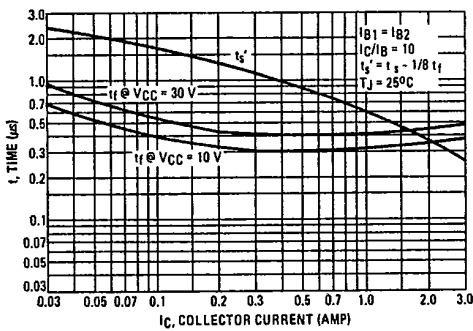
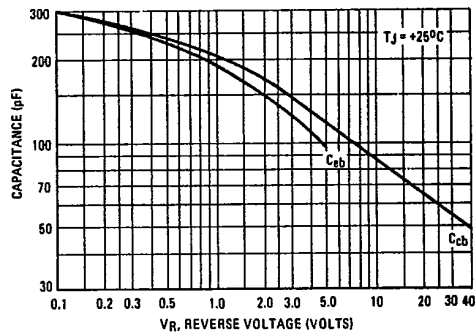


FIGURE 7 - CAPACITANCE



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BD533, BD535, BD537 NPN
BD534, BD536, BD538 PNP

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FIGURE 8 - DC CURRENT GAIN

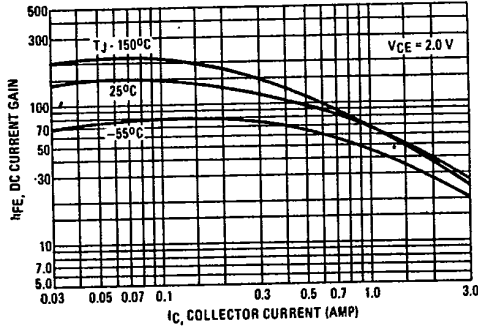


FIGURE 9 - COLLECTOR SATURATION REGION

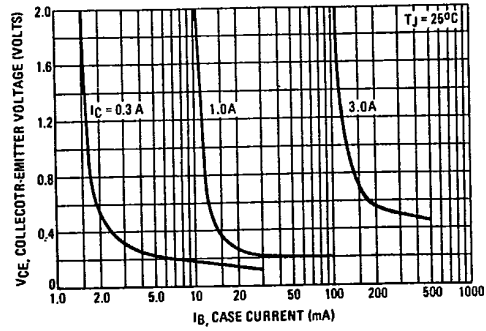


FIGURE 10 - "ON" VOLTAGES

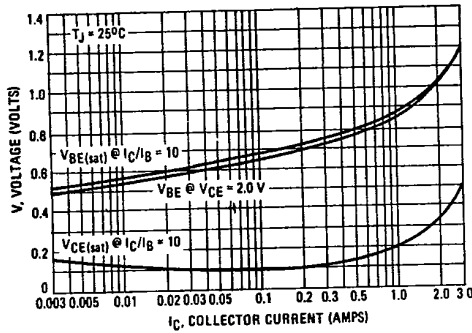


FIGURE 11 - TEMPERATURE COEFFICIENTS

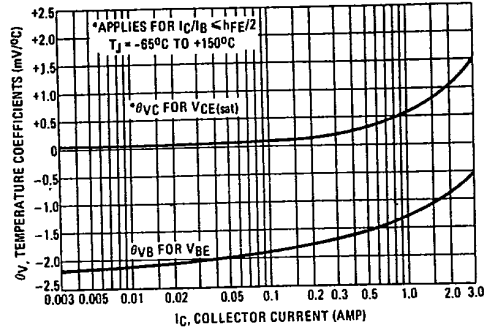


FIGURE 12 - COLLECTOR CUT-OFF REGION

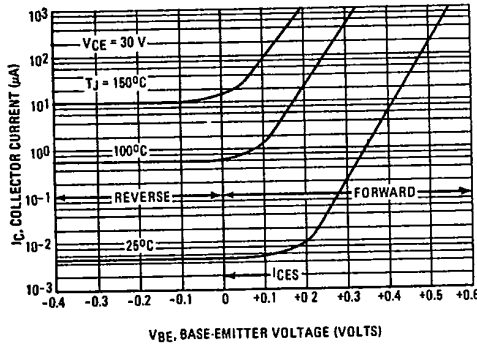


FIGURE 13 - EFFECTS OF BASE-EMITTER RESISTANCE

