

High-Power NPN Silicon Transistors

**2N5301
2N5302
2N5303**

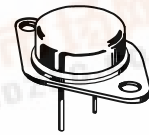
... for use in power amplifier and switching circuits applications.

- High Collector–Emitter Sustaining Voltage —
 $V_{CE(sus)} = 80 \text{ Vdc (Min) @ } I_C = 200 \text{ mAdc (2N5303)}$
- Low Collector–Emitter Saturation Voltage —
 $V_{CE(sat)} = 0.75 \text{ Vdc (Max) @ } I_C = 10 \text{ Adc (2N5301, 2N5302)}$
 $1.0 \text{ Vdc (Max) @ } I_C = 10 \text{ Adc (2N5303)}$
- Excellent Safe Operating Area —
200 Watt dc Power Rating to 30 Vdc (2N5303)
- Complements to PNP 2N4398, 2N4399 and 2N5745

**20 AND 30 AMPERE
POWER TRANSISTORS
NPN SILICON
40–60–80 VOLTS
200 WATTS**

*MAXIMUM RATINGS

Rating	Symbol	2N5301	2N5302	2N5303	Unit
Collector–Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector–Base Voltage	V_{CB}	40	60	80	Vdc
Collector Current — Continuous	I_C	30	30	20	Adc
Base Current	I_B	7.5			Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	200			Watts
		1.14			W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200			$^\circ\text{C}$



**CASE 1–07
TO–204AA
(TO–3)**

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.875	$^\circ\text{C/W}$
Thermal Resistance, Case to Ambient	θ_{CA}	34	$^\circ\text{C/W}$

* Indicates JEDEC Registered Data.

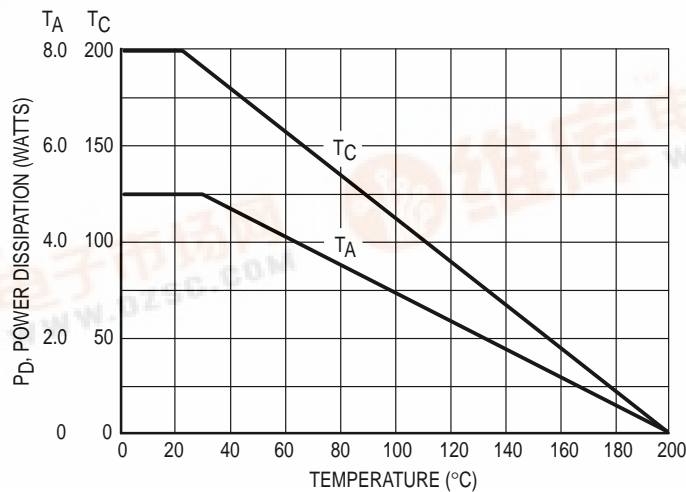


Figure 1. Power Temperature Derating Curve

2N5301 2N5302 2N5303

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

Characteristic	Symbol	Min	Max	Unit	
*OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (Note 1) ($I_C = 200\text{ mAdc}$, $I_B = 0$)	2N5301 2N5302 2N5303	$V_{CE(sus)}$	40 60 80	— — —	Vdc
Collector Cutoff Current ($V_{CE} = 40\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 80\text{ Vdc}$, $I_B = 0$)	2N5301 2N5302 2N5303	I_{CEO}	— — —	5.0 5.0 5.0	mAdc
Collector Cutoff Current ($V_{CE} = 40\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 60\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 80\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$)	2N5301 2N5302 2N5303	I_{CEX}	— — —	1.0 1.0 1.0	mAdc
Collector Cutoff Current ($V_{CE} = 40\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$) ($V_{CE} = 60\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$) ($V_{CE} = 80\text{ Vdc}$, $V_{EB(off)} = 1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$)	2N5301 2N5302 2N5303	I_{CEX}	— — —	10 10 10	mAdc
Collector Cutoff Current ($V_{CB} = 40\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80\text{ Vdc}$, $I_E = 0$)	2N5301 2N5302 2N5303	I_{CBO}	— — —	1.0 1.0 1.0	mAdc
Emitter Cutoff Current ($V_{BE} = 5.0\text{ Vdc}$, $I_C = 0$)		I_{EBO}	—	5.0	mAdc

ON CHARACTERISTICS

DC Current Gain (Note 1) *($I_C = 1.0\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) *($I_C = 10\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) *($I_C = 15\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 20\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$) ($I_C = 30\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$)	ALL TYPES 2N5303 2N5301, 2N5302 2N5303 2N5301, 2N5302	h_{FE}	40 15 15 5.0 5.0	— 60 60 — —	—
*Collector–Emitter Saturation Voltage (Note 1) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 15\text{ Adc}$, $I_B = 1.5\text{ Adc}$) ($I_C = 20\text{ Adc}$, $I_B = 2.0\text{ Adc}$) ($I_C = 20\text{ Adc}$, $I_B = 4.0\text{ Adc}$) ($I_C = 30\text{ Adc}$, $I_B = 6.0\text{ Adc}$)	2N5301, 2N5302 2N5303 2N5303 2N5301, 2N5302 2N5303 2N5301, 2N5302	$V_{CE(sat)}$	— — — — — —	0.75 1.0 1.5 2.0 2.0 3.0	Vdc
*Base–Emitter Saturation Voltage (Note 1) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 15\text{ Adc}$, $I_B = 1.5\text{ Adc}$) ($I_C = 15\text{ Adc}$, $I_B = 1.5\text{ Adc}$) ($I_C = 20\text{ Adc}$, $I_B = 2.0\text{ Adc}$) ($I_C = 20\text{ Adc}$, $I_B = 4.0\text{ Adc}$)	ALL TYPES 2N5301, 2N5302 2N5303 2N5301, 2N5302 2N5303	$V_{BE(sat)}$	— — — — —	1.7 1.8 2.0 2.5 2.5	Vdc
*Base–Emitter On Voltage (Note 1) ($I_C = 10\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 15\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 20\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$) ($I_C = 30\text{ Adc}$, $V_{CE} = 4.0\text{ Vdc}$)	2N5303 2N5301, 2N5302 2N5303 2N5301, 2N5302	$V_{BE(on)}$	— — — —	1.5 1.7 25 3.0	Vdc

*DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 1.0\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ MHz}$)	f_T	2.0	—	MHz
Small–Signal Current Gain ($I_C = 1.0\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	h_{fe}	40	—	—

*SWITCHING CHARACTERISTICS

Rise Time	$(V_{CC} = 30\text{ Vdc}$, $I_C = 10\text{ Adc}$, $I_{B1} = I_{B2} = 1.0\text{ Adc}$)	t_r	—	1.0	μs
Storage Time		t_s	—	2.0	μs
Fall Time		t_f	—	1.0	μs

* Indicates JEDEC Registered Data.

Note 1: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

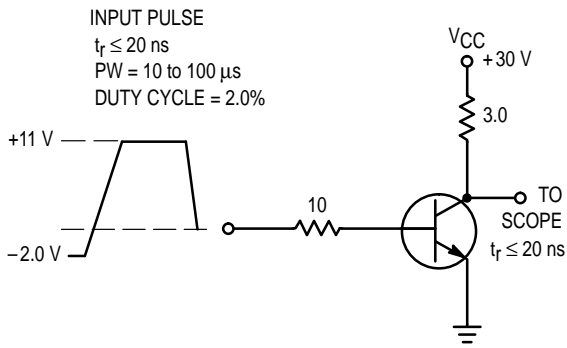


Figure 2. Turn-On time

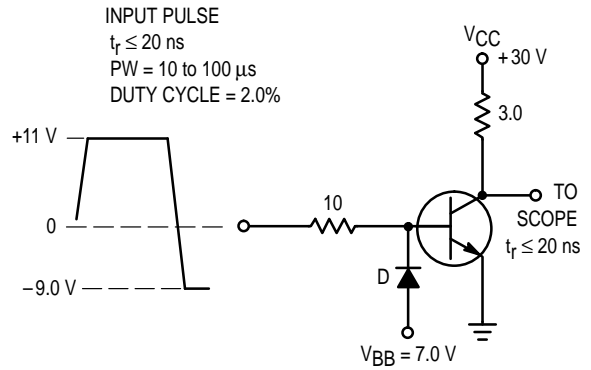


Figure 3. Turn-Off time

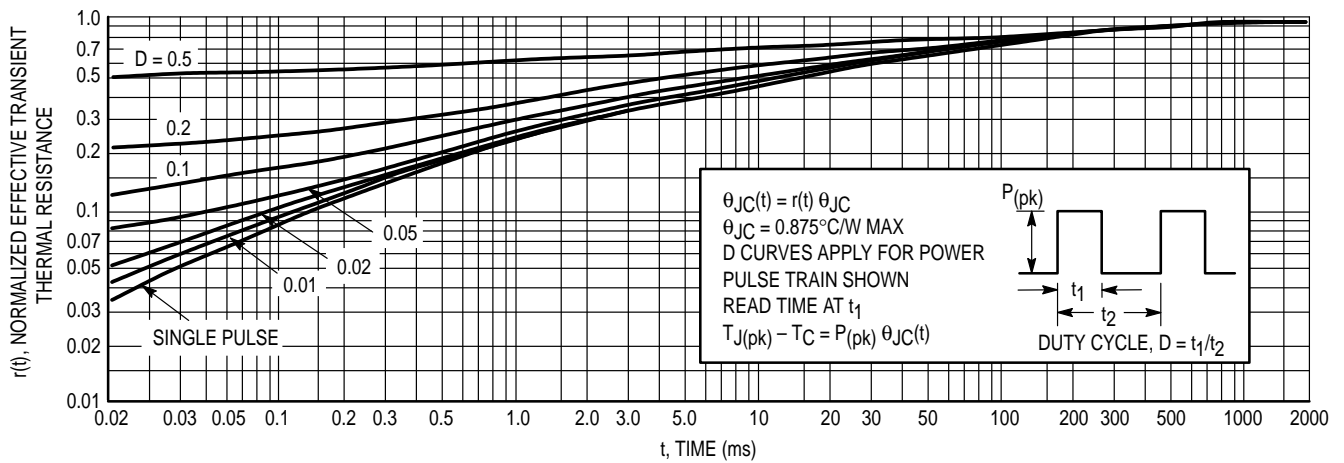


Figure 4. Thermal Response

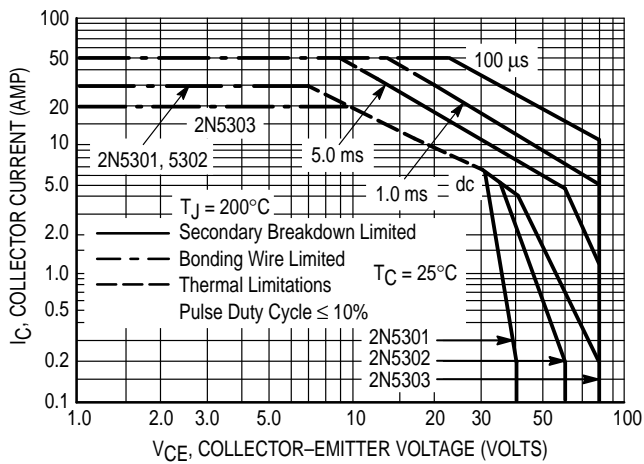


Figure 5. Active-Region Safe Operating Area

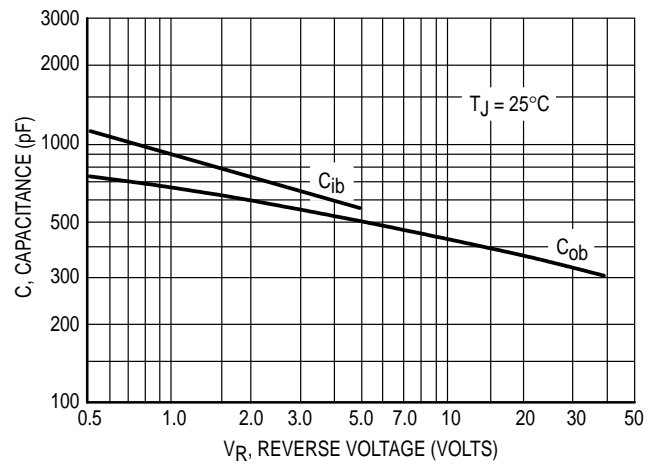


Figure 6. Capacitance versus Voltage

2N5301 2N5302 2N5303

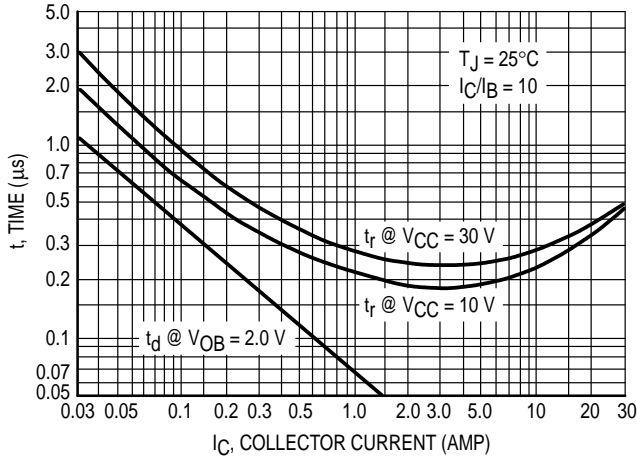


Figure 7. Turn-On Time

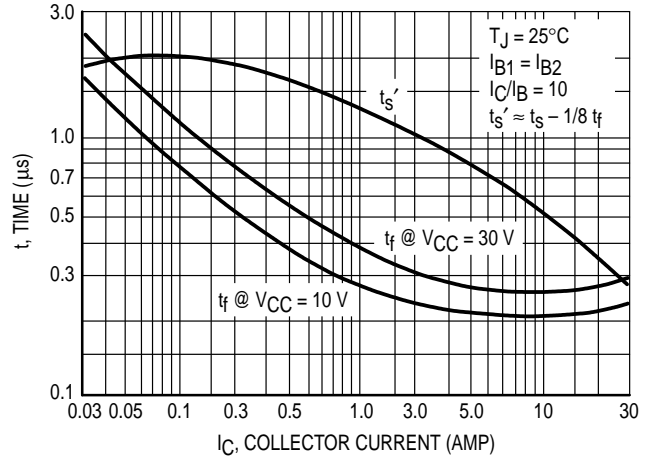


Figure 8. Turn-Off Time

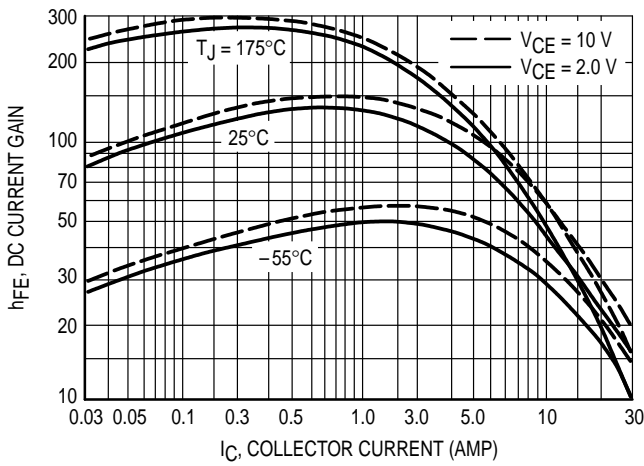


Figure 9. DC Current Gain

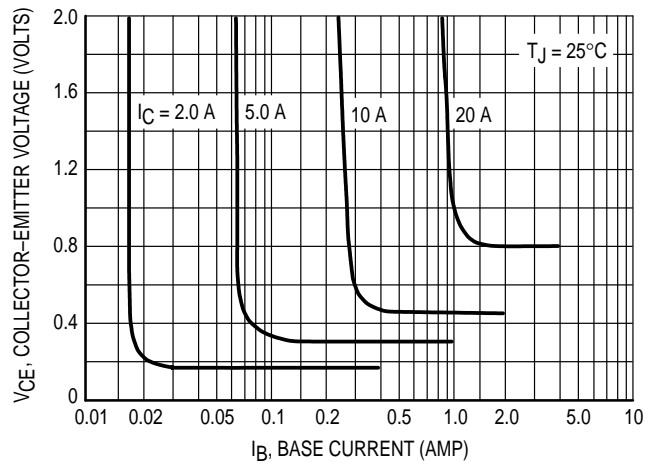


Figure 10. Collector Saturation Region

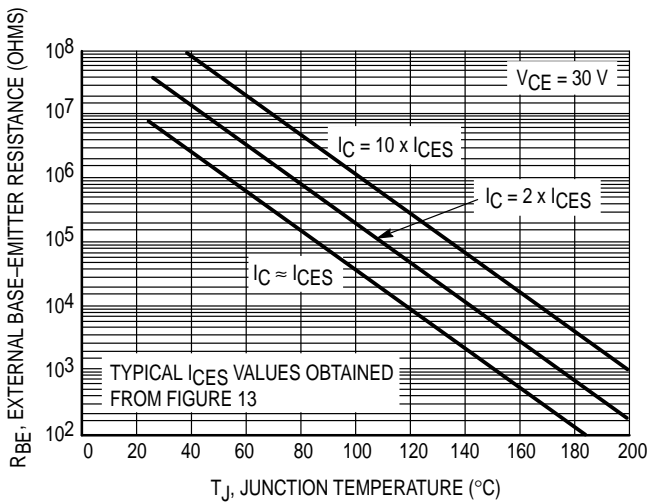


Figure 11. Effects of Base-Emitter Resistance

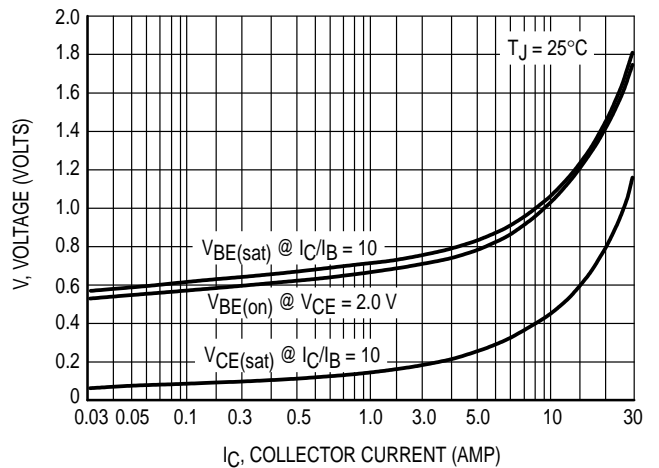


Figure 12. "On" Voltages

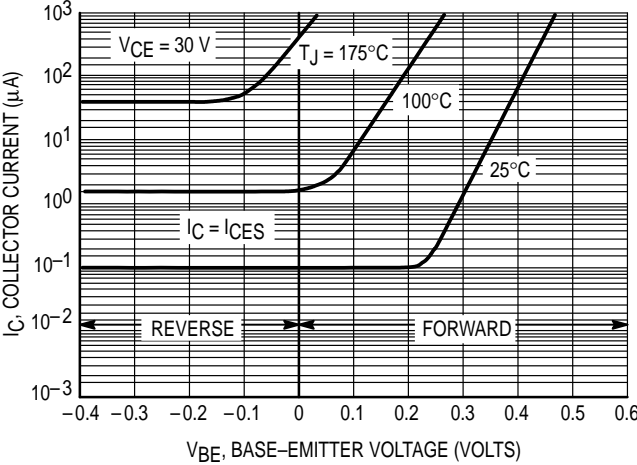


Figure 13. Collector Cut-Off Region

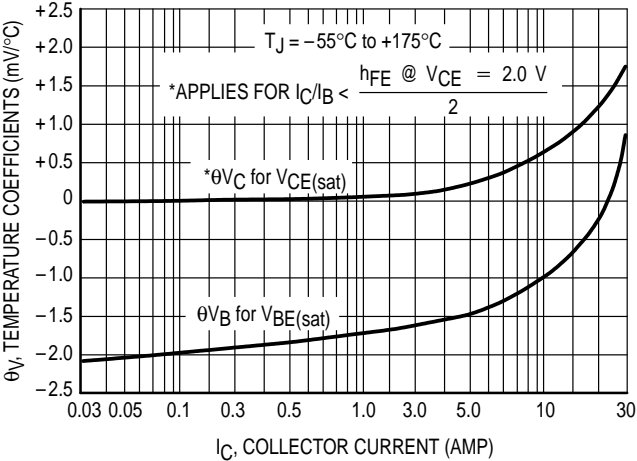
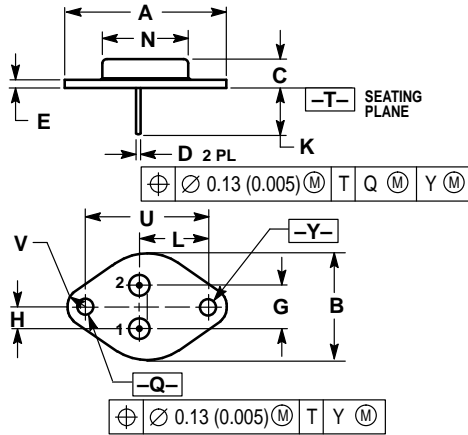


Figure 14. Temperature Coefficients

2N5301 2N5302 2N5303

PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF	—	39.37 REF	—
B	—	1.050	—	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC	—	10.92 BSC	—
H	0.215 BSC	—	5.46 BSC	—
K	0.440	0.480	11.18	12.19
L	0.665 BSC	—	16.89 BSC	—
N	—	0.830	—	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC	—	30.15 BSC	—
V	0.131	0.188	3.33	4.77

- STYLE 1:
 PIN 1: BASE
 2: EMITTER
 CASE: COLLECTOR

**CASE 1-07
 TO-204AA (TO-3)
 ISSUE Z**

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