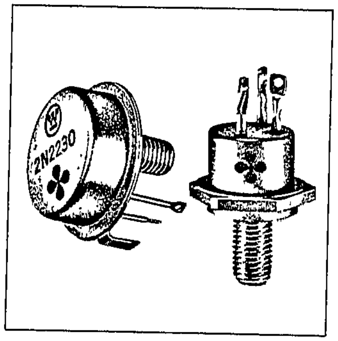
Westinghouse

Silicon Power Transistors Ultra-High Gain JEDEC Types 2N2226-33 2N3470-77

10 Amperes, 150 Watts
Collector-to-Emitter Voltage 50 to 200 Volts



Thermal Characteristics

Thermal resistance, θ_{JC}, °C/watt, max. . .0.5
Power dissipation, P_T at T_C=75°C watts, max. 150
Typical thermal drop, case to heat sink, °C/watt. 0.3

Application

The Westinghouse 2N2226 and 2N3470 series are high gain NPN fused silicon power transistors. These transistors have guaranteed minimum gains of 100 for the 2N2226-29/2N3470-73 series and 400 for the 2N2230-33/2N3474-77 series at their maximum collector currents of 10 amperes. Current gains over 1,000 are typical with collector currents of 2 amperes. Exhibiting extremely low saturation resistance, low thermal resistance, and unequaled operating capabilities at true voltage ratings coupled with high temperature capabilities, these transistors result in new flexibility in circuit applications.

Like all Westinghouse silicon power transistors, these devices are free from second breakdown within the complete range of maximum current-voltage ratings. Hard solder construction assures freedom from thermal fatigue. These devices also feature Westinghouse exclusive quality assurance with 100 per cent power testing for the ultimate in application reliability. In addition, each production lot is further subjected to rigid environmental testing.

All of these transistors carry the Westinghouse Lifetime Guarantee.

Guarantee

Westinghouse warrants to the original purchaser that it will correct any defect or defects in workmanship, by repair or replacement f.o.b. factory, for any silicon power semiconductor bearing this symbol ✤ ™ during the life of the equipment in which it is originally installed, provided said device is used within manufacturer's published ratings and applied in accordance with good engineering practice. This warranty shall constitute a fulfillment of all Westinghouse liabilities in respect to said products. This warranty is in lieu of all other warranties expressed or implied. Westinghouse shall not be liable for any consequential damages.

Maximum Ratings

Voltage

Collector to emitter, V_{CE},③ Vdc	2N2226	2N2230	2N3470	2N3474 50
	2N2227	2N2231	2N3471	2N3475 100
	2N2228	2N2232	2N3472	2N3476 150
	2N2229	2N2233	2N3473	2N3477 200

Emitter to base, V_{EB}, Vdc 15
Collector to base, V_{CB}, Vdc .... equal to rated V_{CE}

Current

Collector current, I_C, Adc 10
Base current, I_B, Adc 1.0
Emitter current, I_E, Adc 10

Temperature

Junction temperature, T_J, °C .... +150
Storage temperature, T_{stg}, °C min. .... − 65
max. .... +150

③ The maximum collector to emitter voltage rating is guaranteed up to the maximum rated power dissipation of the transistor with the base emitter forward biased.

The maximum collector to emitter voltage rating is below the various "break-down" voltages, BV_{CEX}, BV_{CES}, BV_{CER} and the $\alpha m = 1$ curve in the sustaining region, V_{CEO} (sus). Each transistor is power tested within its maximum limits of V_{CE}, P_D and I_C (see figures 6 and 12).

Electrical Characteristics $T_C = 25°C$ unless otherwise specified

	Symbol	Minimum	Typical	Max.	Units
2N2226-33/2N3470-77					
Collector current at $V_{CEX} = V_{CE}$ (from max. ratings), $T_C = 150°C$, $V_{BE} = -1.5$ Vdc	I_{CEX}	...	......	20	mAdc
Emitter current at $V_{BE} = -15$ Vdc, $I_C = 0$, $T_C = 150°C$	I_{EBO}	...	......	15	mAdc
Emitter current at $V_{BE} = -15$ Vdc, $I_C = 0$	I_{EBO}	...	......	30	mAdc
Gain bandwidth product at $I_C = 10$ Adc	f_T	...	500	.....	kc
2N2226-29/2N3470-73					
Saturation resistance at $I_C = 10$ Adc, $I_B = 150$ mAdc	r_{CE} (sat)	...	0.22	0.35	ohms
Dc current gain at $V_{CE} = 6$ Vdc, $I_C = 10$ Adc	h_{FE}	100	360	....	.....
Base voltage, at $I_C = 10$ Adc, $I_B = 150$ mAdc	V_{BE} (sat)	...	3.0	4.0	Vdc
Beta cut-off frequency at $V_{CE} = 12$ Vdc, $I_C = 7$ Adc	f_{hfe}	...	10	.....	kc
Turn-on time at $I_C = 10$ Adc, $I_{B\ on} = 400$ mAdc, $V_{CE} = 12$ Vdc	$t_d + t_r$	...	4.5	.....	μsec
Turn-off time at $I_C = 10$ Adc, $I_{B\ off} = -400$ mAdc, $V_{CE} = 12$ Vdc, $V_{BE\ off} = -15$ Vdc	$t_s + t_f$	...	25	.....	μsec
2N2230-33/2N3474-77					
Saturation resistance at $I_C = 10$ Adc, $I_B = 40$ mAdc	r_{CE} (sat)	...	0.22	0.35	ohms
Dc current gain at $V_{CE} = 6$ Vdc, $I_C = 10$ Adc	h_{FE}	400	660	.....	.....
Base voltage, at $I_C = 10$ Adc, $I_B = 40$ mAdc	V_{BE} (sat)	...	3.0	4.0	Vdc
Beta cut-off frequency at $V_{CE} = 12$ Vdc, $I_C = 7$ Adc	f_{hfe}	...	7	.....	kc
Turn-on time at $I_C = 1C$ Adc, $I_{B\ on} = 200$ mAdc, $V_{CE} = 12$ Vdc	$t_d + t_r$	...	5	.....	μsec
Turn-off time at $I_C = 10$ Adc, $I_{B\ off} = -200$ mAdc, $V_{CE} = 12$ Vdc, $V_{BE\ off} = -15$ Vdc	$t_s + t_f$	...	29	.....	μsec

Typical Characteristics, 2N2226-29/2N3470-73 Series

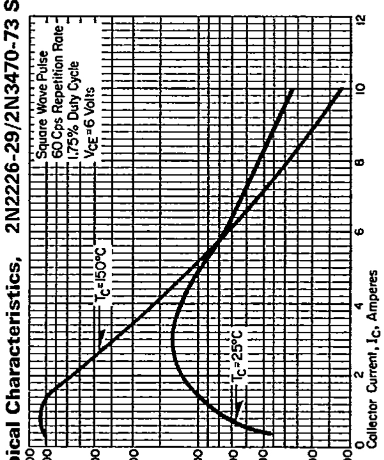


Figure 1. Dc gain versus collector current.

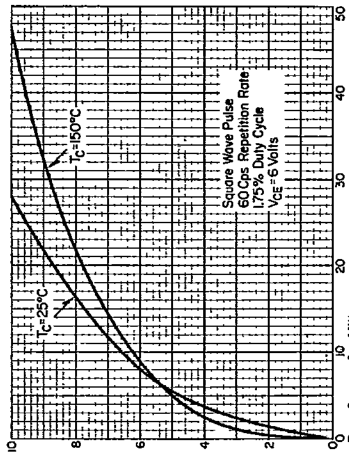


Figure 2. Forward current transfer characteristics.

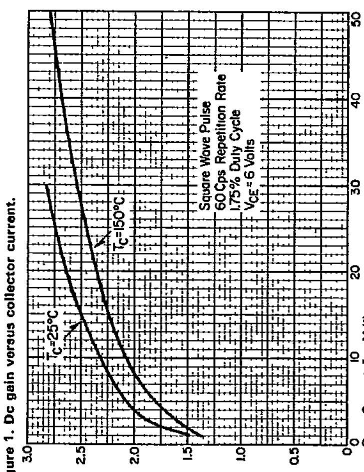


Figure 3. Input characteristics.

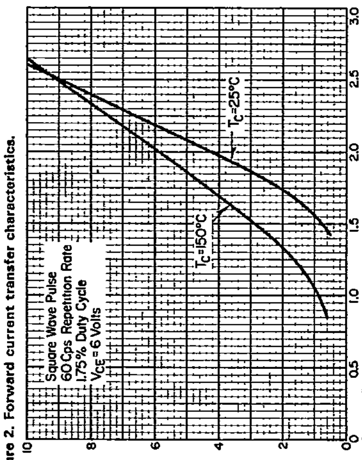


Figure 4. Transconductance characteristics.

Typical Characteristics

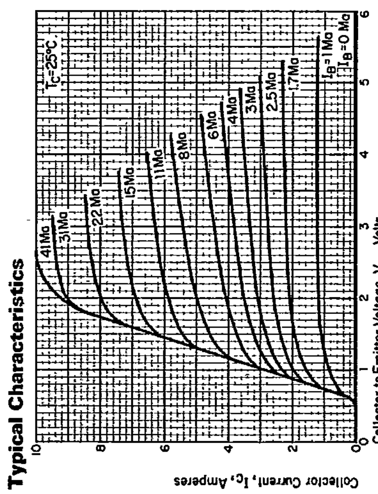


Figure 5. Output characteristics.

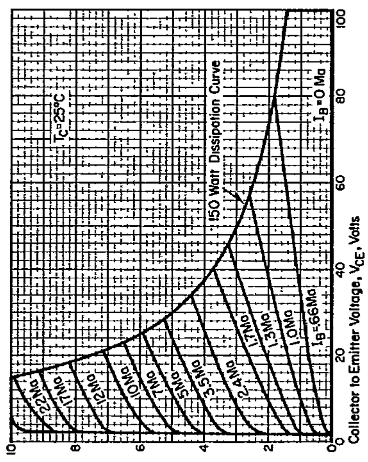


Figure 6. Recommended operating region.

2N2230-33/2N3474-77 Series

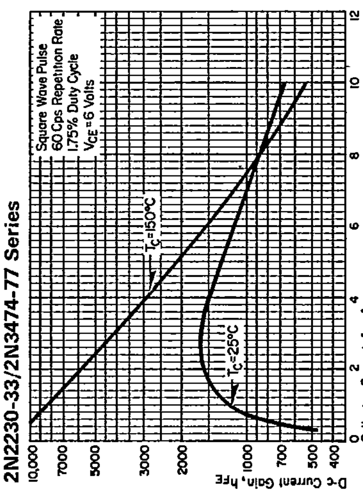


Figure 7. Dc gain versus collector current.

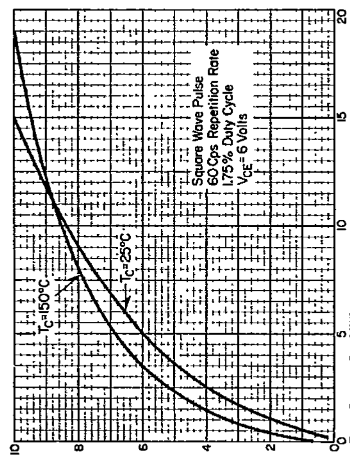


Figure 8. Forward current transfer characteristics.

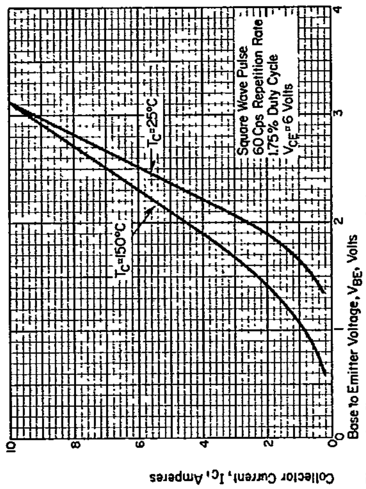


Figure 10. Transconductance characteristics.

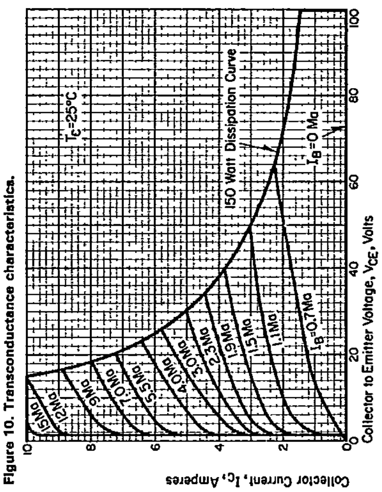


Figure 12. Recommended operating region.

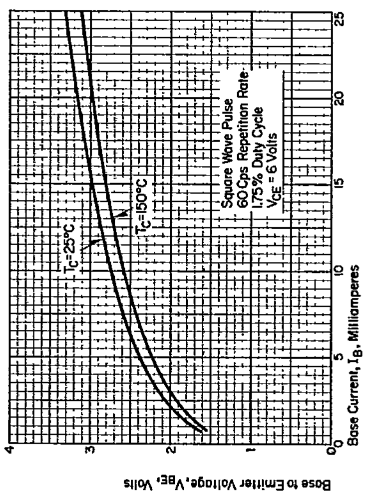


Figure 9. Input characteristics.

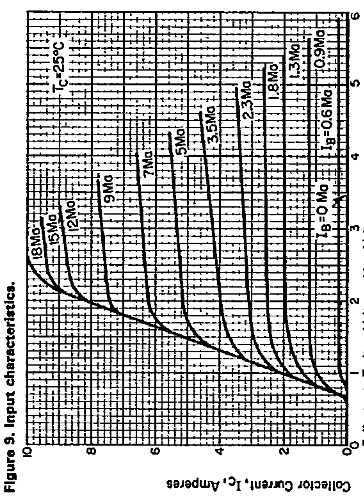


Figure 11. Output characteristics.

Typical Characteristics, 2N2226-33/2N3470-77 Series

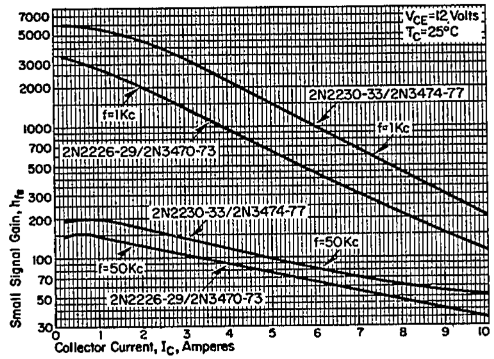


Figure 13. Small signal current gain versus collector current.

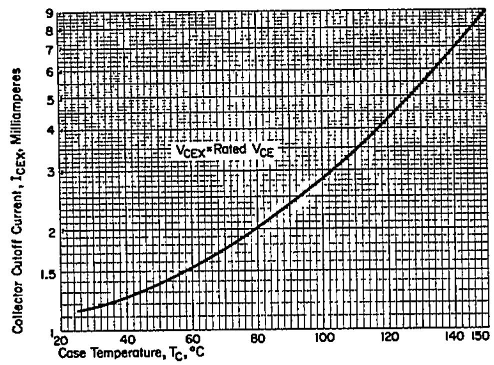


Figure 14. Collector cutoff current versus case temperature.

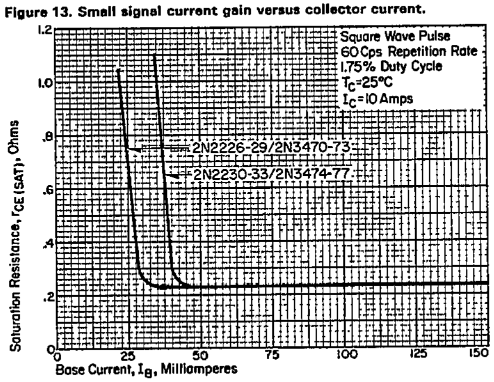


Figure 15. Saturation characteristics versus base current.

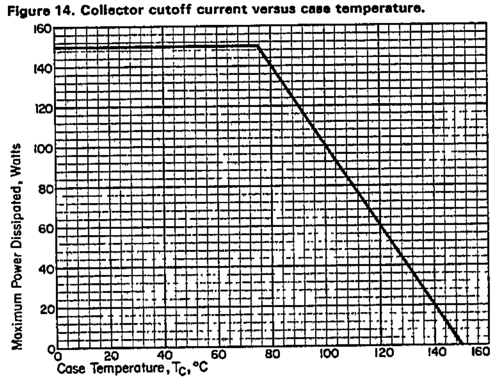
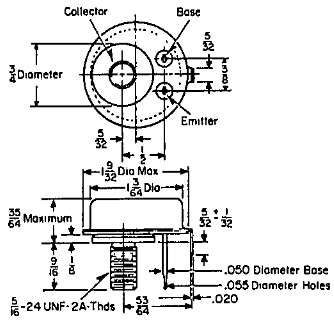
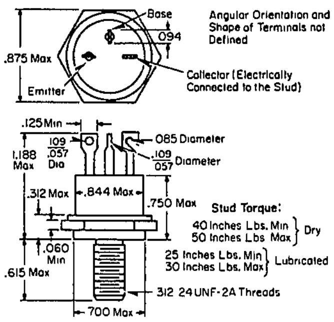


Figure 16. Derating curve.

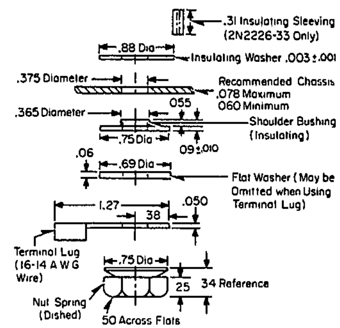
Dimensions in Inches



2N2226-33 Power Transistor



2N3470-77 Power Transistor



Insulating Hardware

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