

7294621 POWEREX INC

40C 00594

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T-33-13



DATA SHEETS

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

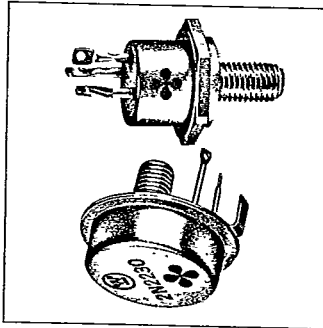
10 Amperes, 150 Watts
Collector-to-Emitter Voltage 50 to 200
Volts

Westinghouse

**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 unequalled 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

**Thermal Characteristics**

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

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.

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Maximum Ratings

Voltage

① 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_{CE0} (sus). Each transistor is power tested within its maximum limits of V_{CE} , P_D and I_C (see figures 6 and 12).

Collector to emitter, $2N2226$	$2N2230$	$2N3470$	$2N3474$	50
$V_{CE} \text{ @ } V_{BE} = 0$	$2N2231$	$2N3471$	$2N3475$	100
Collector to base, V_{CB} , Vdc	$2N2232$	$2N3472$	$2N3476$	150
Emitter to base, V_{EB} , Vdc	$2N2233$	$2N3473$	$2N3477$	200
Collector current, I_C , Adc				15
Base current, I_B , Adc				1.0
Emitter current, I_E , Adc				1.0
Junction temperature, T_J , °C				+150
Storage temperature, T_{stg} , °C min.				- 65
				max. +150

Current

Temperature

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise specified

2N2226-33/2N3470-77

Collector current at $V_{CE} = V_{CE}$ (from max. ratings), $T_C = 150^\circ\text{C}$, $V_{BE} = -1.5$ Vdc	Symbol	Minimum	Typical	Max.	Units
Emitter current at $V_{BE} = -15$ Vdc, $I_C = 0$, $T_C = 150^\circ\text{C}$	I_{CEX}	...	...	20	mAdc
Emitter current at $V_{BE} = -15$ Vdc, $I_C = 0$	I_{EBO}	...	...	15	mAdc
Gain bandwidth product at $I_C = 10$ Adc	f_T	...	500	30	kc

2N2226-29/2N3470-73

Saturation resistance at $I_C = 10$ Adc, $I_B = 150$ mAdc	$r_{CE} \text{ (sat)}$	...	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	$V_{BE} \text{ (sat)}$	...	3.0	4.0	Vdc
Beta cut-off frequency at $V_{CE} = 12$ Vdc, $I_C = 7$ Adc	f_{β}	...	10	...	kc
Turn-on time at $I_C = 10$ Adc, $I_B \text{ on} = 400$ mAdc, $V_{CE} = 12$ Vdc	$t_d + t_r$	...	4.5	...	μsec
Turn-off time at $I_C = 10$ Adc, $I_B \text{ off} = -400$ mAdc, $V_{CE} = 12$ Vdc, $V_{BE} \text{ off} = -15$ Vdc	$t_s + t_f$	...	25	...	μsec

2N2230-33/2N3474-77

Saturation resistance at $I_C = 10$ Adc, $I_B = 40$ mAdc	$r_{CE} \text{ (sat)}$	...	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	$V_{BE} \text{ (sat)}$	...	3.0	4.0	Vdc
Beta cut-off frequency at $V_{CE} = 12$ Vdc, $I_C = 7$ Adc	f_{β}	...	7	...	kc
Turn-on time at $I_C = 10$ Adc, $I_B \text{ on} = 200$ mAdc, $V_{CE} = 12$ Vdc	$t_d + t_r$	...	5	...	μsec
Turn-off time at $I_C = 10$ Adc, $I_B \text{ off} = -200$ mAdc, $V_{CE} = 12$ Vdc, $V_{BE} \text{ off} = -15$ Vdc	$t_s + t_f$	...	29	...	μsec

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

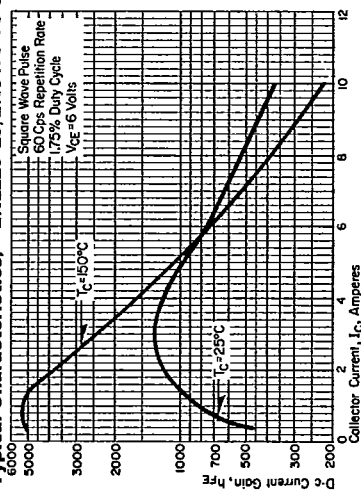


Figure 1. Dc gain versus collector current.

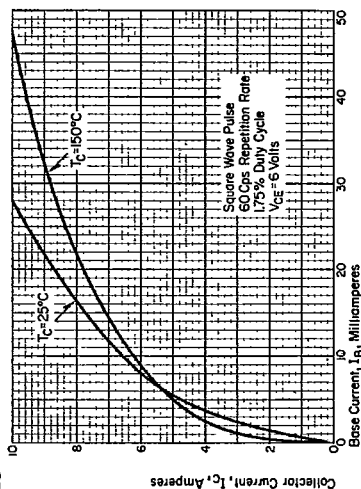


Figure 2. Forward current transfer characteristics.

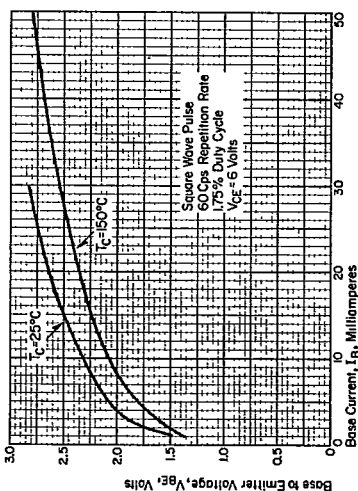


Figure 3. Input characteristics.

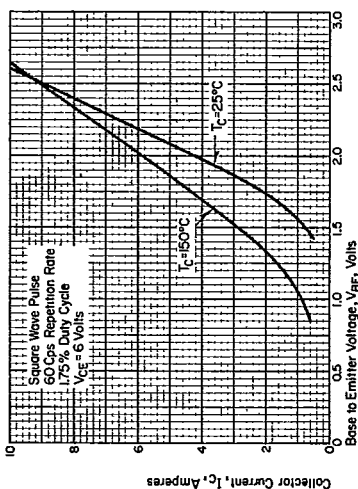


Figure 4. Transconductance characteristics.

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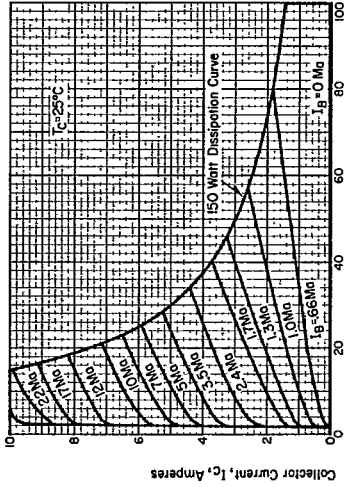


Figure 6. Recommended operating region.

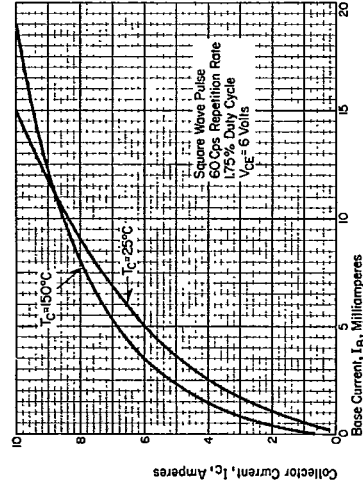


Figure 8. Forward current transfer characteristics.

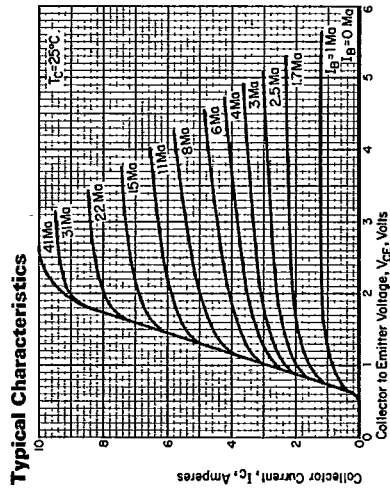


Figure 5. Output characteristics.

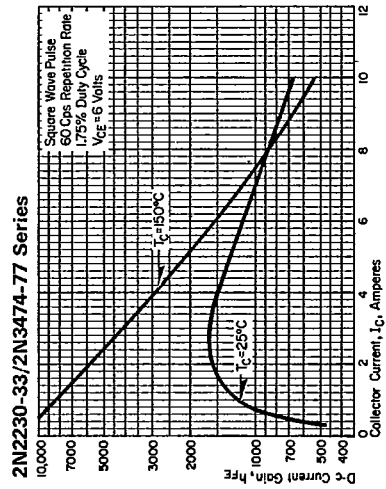


Figure 7. Dc gain versus collector current.

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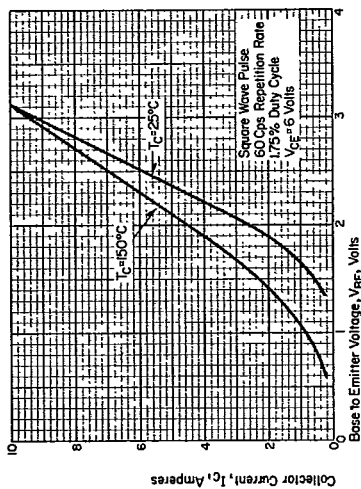


Figure 9. Input characteristics.

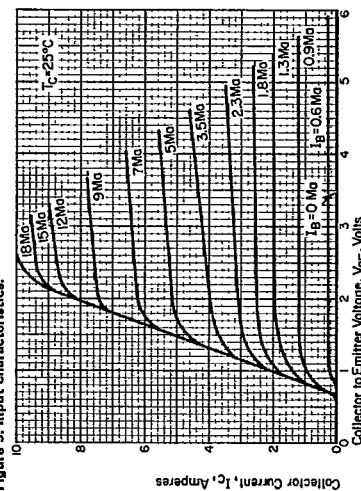


Figure 11. Output characteristics.

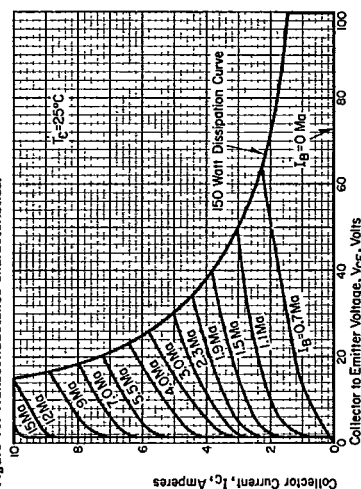


Figure 10. Transconductance characteristics.

Figure 12. Recommended operating region.

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

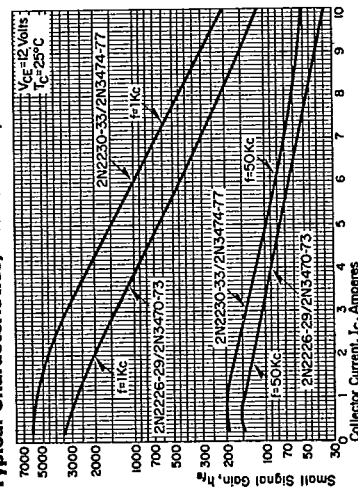


Figure 13. Small signal current gain versus collector current.

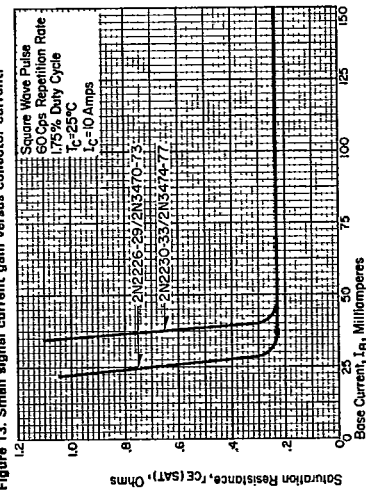


Figure 15. Saturation characteristics versus base current.

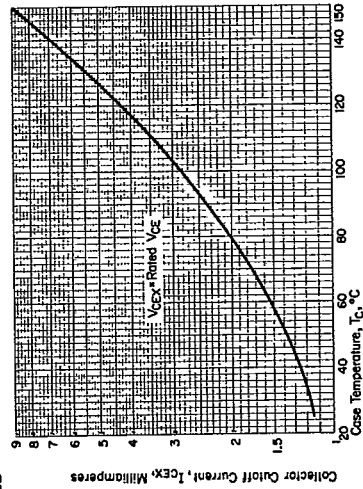


Figure 14. Collector cutoff current versus case temperature.

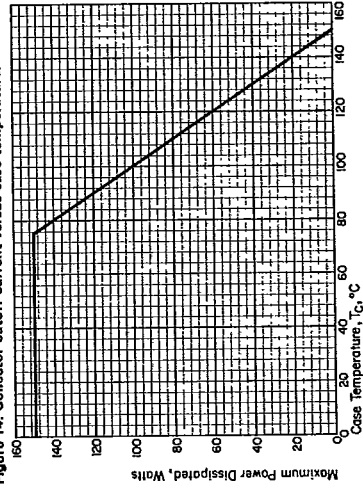


Figure 16. Derating curve.

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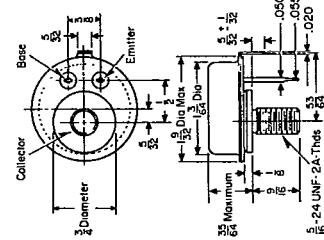
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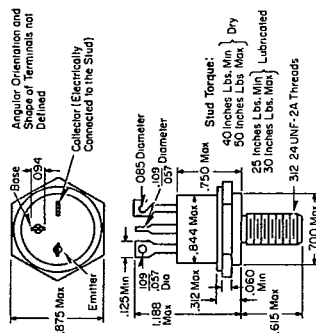
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Dimensions in Inches



2N2228-33 Power Transistor



2N3470-77 Power Transistor

