

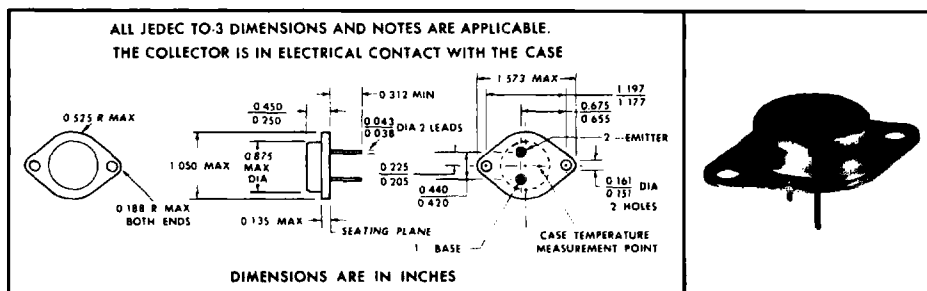
TYPES T13029, T13030, T13031 P-N-P ALLOY-JUNCTION GERMANIUM POWER TRANSISTORS

TYPES T13029, T13030, T13031
BULLETIN NO. DLS-695054, APRIL 1964
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HIGH-POWER TRANSISTORS for CONSUMER APPLICATIONS

mechanical data

These transistors are in a resistance-welded, hermetically sealed enclosure. The mounting base provides an excellent heat path from the collector junction to a heat sink. The entire mounting base must be in intimate contact with the heat sink for maximum heat transfer. A minimum torque of 10 inch-pounds applied to each of the mounting screws is recommended for mounting the device to the heat sink. Extreme cleanliness and the absence of flux during the assembly process prevents sealed-in contamination.



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absolute maximum ratings at 25°C case temperature (unless otherwise noted)

	T13029	T13030	T13031
Collector-Base Voltage	-80 v	-100 v	-120 v
Collector-Emitter Voltage (See Note 1)	-55 v	-60 v	-65 v
Emitter-Base Voltage	←	-20 v	→
Continuous Collector Current	←	-7 a	→
Continuous Base Current	←	-3 a	→
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 2)	←	106 w	→
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 3)	←	2 w	→
Operating Case Temperature Range	-65°C to +100°C		
Storage Temperature Range	-65°C to +100°C		
Lead Temperature 1/8 Inch from Case for 10 Seconds	←	230°C	→

- NOTES
1. These values apply when the base-emitter resistance $R_{BE} \leq 68 \Omega$.
 2. Derate linearly to 110°C case temperature at the rate of 1.25 w/°C.
 3. Derate linearly to 110°C free-air temperature at the rate of 23.5 mw/°C.

TYPES T13029, T13030, T13031

P-N-P ALLOY-JUNCTION GERMANIUM POWER TRANSISTORS

electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T13029		T13030		T13031		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
BV_{CBO} Collector-Base Breakdown Voltage	$I_C = -5 \text{ ma}$, $I_E = 0$	-80		-100		-120		v
BV_{CER} Collector-Emitter Breakdown Voltage	$I_C = -600 \text{ ma}$, $R_{BE} = 68 \Omega$, See Note 4	-55		-60		-65		v
I_{CBO} Collector Cutoff Current	$V_{CB} = -2 \text{ v}$, $I_E = 0$	-0.15		-0.15		-0.15		ma
	$V_{CB} = -50 \text{ v}$, $I_E = 0$	-1						
	$V_{CB} = -60 \text{ v}$, $I_E = 0$			-1				
	$V_{CB} = -70 \text{ v}$, $I_E = 0$					-1		
	$V_{CB} = -50 \text{ v}$, $I_E = 0$, $T_C = +70^\circ\text{C}$	-10						
	$V_{CB} = -60 \text{ v}$, $I_E = 0$, $T_C = +70^\circ\text{C}$			-10				
I_{EBO} Emitter Cutoff Current	$V_{EB} = -20 \text{ v}$, $I_C = 0$	-1		-1		-1		ma
	$V_{CE} = -2 \text{ v}$, $I_C = -1 \text{ a}$, See Note 4	70		70		70		
h_{FE} Static Forward Current Transfer Ratio	$V_{CE} = -2 \text{ v}$, $I_C = -3 \text{ a}$, See Note 4	40	250	40	250	40	250	
	$V_{CE} = -2 \text{ v}$, $I_C = -5 \text{ a}$, See Note 4	30		30		30		
	$V_{CE} = -2 \text{ v}$, $I_C = -5 \text{ a}$, See Note 4	30		30		30		
V_{BE} Base-Emitter Voltage	$V_{CE} = -2 \text{ v}$, $I_C = -3 \text{ a}$, See Note 4	-1.0		-1.0		-1.0		v
	$V_{CE} = -2 \text{ v}$, $I_C = -5 \text{ a}$, See Note 4	-1.5		-1.5		-1.5		
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_B = -300 \text{ ma}$, $I_C = -3 \text{ a}$, See Note 4	-0.5		-0.5		-0.5		v
	$I_B = -500 \text{ ma}$, $I_C = -5 \text{ a}$, See Note 4	-0.7		-0.7		-0.7		
$ h_{fe} $ Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = -2 \text{ v}$, $I_C = -1 \text{ a}$, $f = 100 \text{ kc}$	2		2		2		

NOTE 4: These parameters must be measured using pulse techniques. $PW = 300 \mu\text{sec}$, Duty Cycle $\leq 2\%$.

thermal characteristics

PARAMETER	TEST CONDITIONS	MAX	UNIT
θ_{J-C} Junction-to-Case Thermal Resistance	See notes in Thermal Characteristics section	0.8	$^\circ\text{C}/\text{w}$
θ_{J-HS} Junction-to-Heat-Sink Thermal Resistance		1.4	$^\circ\text{C}/\text{w}$
θ_{J-A} Junction-to-Free-Air Thermal Resistance		42.5	$^\circ\text{C}/\text{w}$

NUMERICAL SYSTEM FOR h_{FE} CODING

Upon request the transistors will be numerically coded to identify matched pairs. The transistors are in-house classified into 2-db (ratio 1.26 to 1) h_{FE} brackets and any two units within a bracket constitute a matched pair. A 10% tolerance is included in the bracket limits shown below to allow for test-set correlation.

No h_{FE} -bracket distribution is implied by this classification system.

BRACKET NUMBER	h_{FE} RANGE at $V_{CE} = -2 \text{ v}$, $I_C = -3 \text{ a}$
1	40 - 60
2	50 - 80
3	65 - 100
4	80 - 125
5	100 - 150
6	125 - 200
7	160 - 250

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THERMAL CHARACTERISTICS

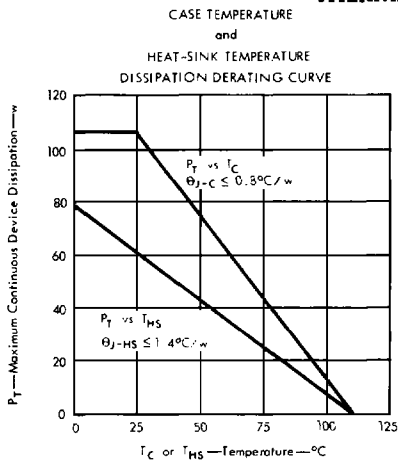


FIGURE 1

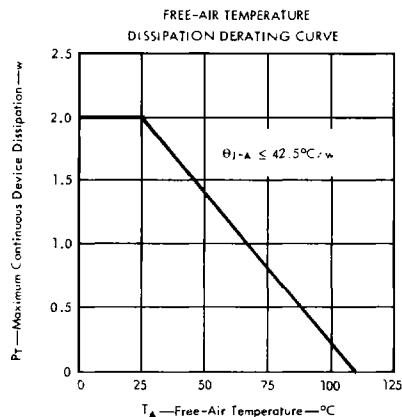


FIGURE 2

θ_{J-A} is the thermal resistance from the junction of the transistor to free-air. The curve shown above was determined by positioning the transistor in the center of a box 12 inches by 12 inches by 12 inches with the temperature measured two inches below the transistor.

θ_{J-C} is the thermal resistance from the junction of the transistor to the point on the mounting base of the transistor case specified on the outline drawing.

θ_{C-HS} is the thermal resistance from the mounting base of the transistor case to the mounting surface of the heat sink. The heat sink used to determine this value was a smooth, flat, copper plate, with the thermocouple mounted 0.05 inch below the mounting surface in an area beneath the center of the transistor. The transistor was mounted directly to a clean, dry, heat-sink surface, without the use of silicone grease, and a torque of ten inch-pounds was applied to each of the mounting screws.

θ_{J-HS} is the thermal resistance from the junction of the transistor to the mounting surface of the heat sink.

$$\theta_{J-HS} = \theta_{J-C} + \theta_{C-HS}$$

The dissipation levels shown above are verified statistically by operating-life tests.

TYPICAL CHARACTERISTICS

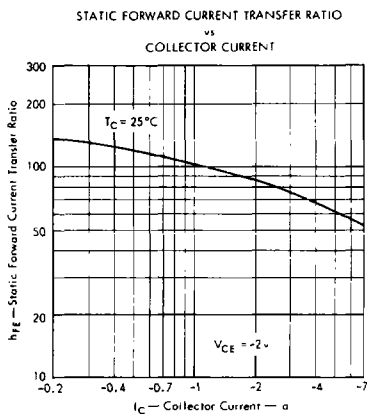


FIGURE 3

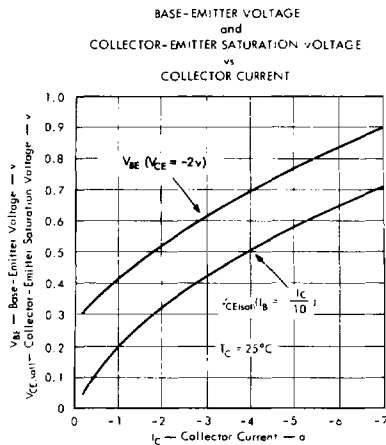
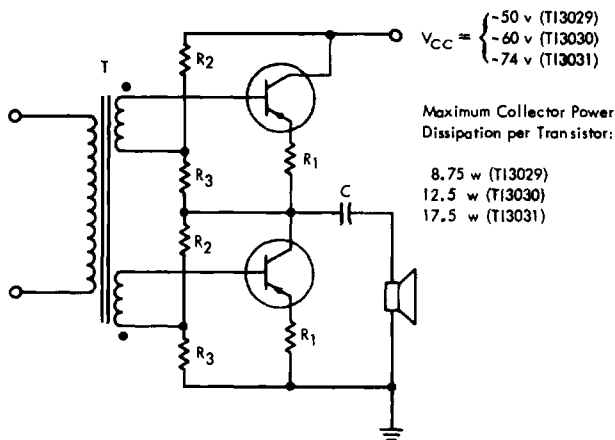


FIGURE 4

TYPES T13029, T13030, T13031 P-N-P ALLOY-JUNCTION GERMANIUM POWER TRANSISTORS

TYPICAL APPLICATION DATA

CLASS B AUDIO AMPLIFIER



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TYPICAL CIRCUIT PERFORMANCE CHARACTERISTICS

$T_A = 25^\circ\text{C}$, $f = 1000$ cps (except where noted)

	T13029	T13030	T13031
Minimum RMS Power Output at 5% Total Harmonic Distortion	35 w	50 w	70 w
Minimum Power Gain	26 db	25 db	20 db
Frequency Response	← 20 to 20,000 cps →		
D-C Collector Current with Zero Signal	-0.05 a	-0.05 a	-0.05 a
D-C Collector Current with Maximum Signal	-0.95 a	-1.10 a	-2.22 a
Peak Collector Current with Maximum Signal	-3.0 a	-3.5 a	-7.0 a
Input Impedance, Base-to-Base	88.5 Ω	74.5 Ω	69 Ω

CIRCUIT COMPONENT INFORMATION

	T13029	T13030	T13031
R_1 :	0.27 Ω , 1/2 w	0.27 Ω , 1/2 w	0.47 Ω , 3 w
R_2 :	330 Ω , 2 w	250 Ω , 5 w	150 Ω , 10 w
R_3 :	2.2 Ω , 1/2 w	1.2 Ω , 1/2 w	0.56 Ω , 1/2 w

Speaker
 Impedance: 8 Ω 8 Ω 4 Ω

All resistors $\pm 10\%$ tolerance

C: Selected to meet desired low-frequency response. Working voltage should be greater than 85% of V_{CC} .

T: Driver transformer primary-winding impedance, current-carrying capacity, and d-c resistance are determined by large-signal characteristics of driver stage. Secondary windings are bifilar wound. The a-c impedance of each secondary winding equals one-fourth of base-to-base input impedance.