40.29 8/67
(Supersedes 40.29 3/67

ELECTRONIC INNOVATIONS IN ACTION

SEMICONDUCTORS

Silicon Power Tab Transistors

for Consumer Electronics

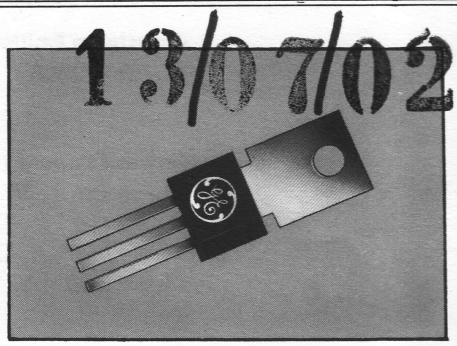
NPN

D28A5, 6

D28A12, 13

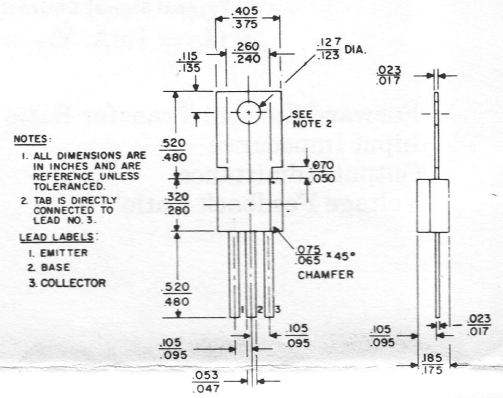
13/07/02

The D28A is a medium power, plastic encapsulated transistor intended for oscillators, amplifiers, buffers, and output stages of T.V., radio and audio equipments. Applications also include drivers for very high power amplifiers.



absolute maximum ratings: (25°C) (unless otherwise specified

		D28A5 D28A6	D28A12 D28A13	
Voltages				
Collector to Emitter	V_{CEO}	25	50	V
Emitter to Base	V_{EBO}	5	5	V
Collector to Base	V_{CBO}	35	50	V
Current				
Collector (Continuous)	I_C	500	500	mA
Dissipation				
Total Power (free air at 50°C) (derate 10mW/°C above 50°C ambient temperature)	P_T	1	1	W
Total Power (tab at 70°C) (derate 50 mW/°C for tab temperature above 70°C)	P_T	4	4	W
Temperature				
Storage	T_{stg}	−55 to +150		°C
Operating	T_j	+150	+150	°C
Lead Soldering, 1/16" ±1/32" from case for 10 seconds max.	T_L	+260	+260	°C



Leads can be formed to a TO-5 pin circle.

electrical characteristics: (25°C) (unless otherwise specified)

		Min.	Max.	
Collector Cutoff Current				
(V_{CB} = 50V), D28A12 and 13	I_{CBO}		0.1	μA
(V_{CB} = 35V), D28A5 and 6	I_{CBO}		0.1	μA
Collector Cutoff Current				
(T_A = 100°C)	I_{CBO}		15	μA
(V_{CB} = 50V), D28A12 and 13				
(V_{CB} = 35V), D28A5 and 6				
Emitter Cutoff Current				
(V_{EB} = 5V)	I_{EBO}		0.1	μA
Collector Saturation Voltage				
(I_B = 3 mA, I_C = 50 mA)	$V_{CE(sat)}$		0.30	V
Base Saturation Voltage				
(I_B = 3 mA, I_C = 50 mA)	$V_{BE(sat)}$		1.3	V

GENERAL ELECTRIC

40.29 8/67
(Supersedes 40.29 3/67

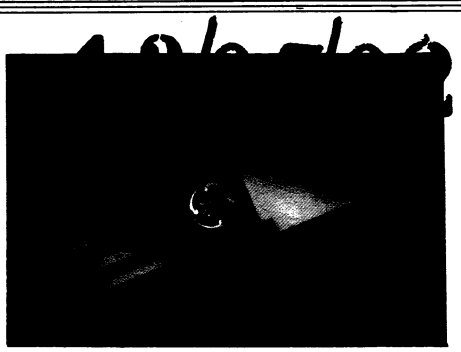
Silicon Power Tab Transistors

for Consumer Electronics

NPN

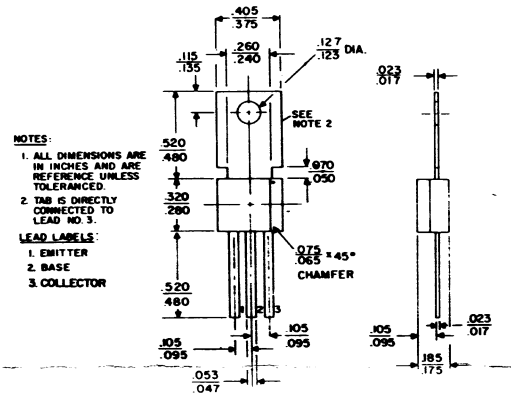
D28A5, 6
D28A12, 13

The D28A is a medium power, plastic encapsulated transistor intended for oscillators, amplifiers, buffers, and output stages of T.V., radio and audio equipments. Applications also include drivers for very high power amplifiers.



absolute maximum ratings: (25°C) (unless otherwise specified

		D28A5 D28A6	D28A12 D28A13	
Voltages				
Collector to Emitter	V_{CEO}	25	50	V
Emitter to Base	V_{EBO}	5	5	V
Collector to Base	V_{CBO}	35	50	V
Current				
Collector (Continuous)	I_C	500	500	mA
Dissipation				
Total Power (free air at 50°C) (derate 10mW/°C above 50°C ambient temperature)	P_T	1	1	W
Total Power (tab at 70°C) (derate 50 mW/°C for tab temperature above 70°C)	P_T	4	4	W
Temperature				
Storage	T_{stg}	−55 to +150		°C
Operating	T_j	+150	+150	°C
Lead Soldering, 1/16" ±1/32" from case for 10 seconds max.	T_L	+260	+260	°C



Leads can be formed to a TO-5 pin circle.

electrical characteristics: (25°C) (unless otherwise specified)

		Min.	Max.	
Collector Cutoff Current				
(V_{CB} = 50V), D28A12 and 13	I_{CBO}		0.1	μA
(V_{CB} = 35V), D28A5 and 6	I_{CBO}		0.1	μA
Collector Cutoff Current				
(T_A = 100°C) (V_{CB} = 50V), D28A12 and 13 (V_{CB} = 35V), D28A5 and 6	I_{CBO}		15	μA
Emitter Cutoff Current				
(V_{EB} = 5V)	I_{EBO}		0.1	μA
Collector Saturation Voltage				
(I_B = 3 mA, I_C = 50 mA)	$V_{CE(sat)}$		0.30	V
Base Saturation Voltage				
(I_B = 3 mA, I_C = 50 mA)	$V_{BE(sat)}$		1.3	V

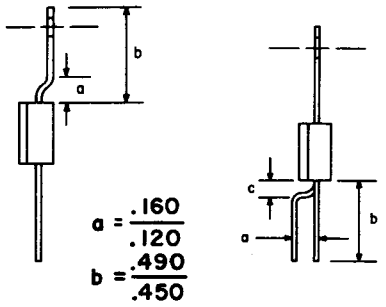
			Min.	Max.
Collector to Emitter Voltage				
($I_C = 1.0mA$)	D28A12 and 13	V_{CEO}	50	
	D28A5 and 6	V_{CEO}	25	
Forward Current Transfer Ratio				
($I_C = 2mA, V_{CE} = 4.5V$)				
	D28A5 and 12	h_{FE}	75	225
	D28A6 and 13	h_{FE}	180	540
($I_C = 400mA, V_{CE} = 1V$)				
	D28A5 and 6	h_{FE}	20	

Typical Signal Characteristics

($I_C = 1mA, V_{CE} = 10V, f = 1kHz, T_A = 25°C$)

		D28A5	D28A6	D28A12	D28A13	
Forward Current Transfer Ratio	h_{fe}	180	330	150	300	
Input Impedance	h_{ie}	5000	9000	4200	8300	ohms
Output Admittance	h_{oe}	14	21	10	20	μmhos
Voltage Feedback Ratio	h_{re}	.27	.45	.2	.4	$X10^{-3}$

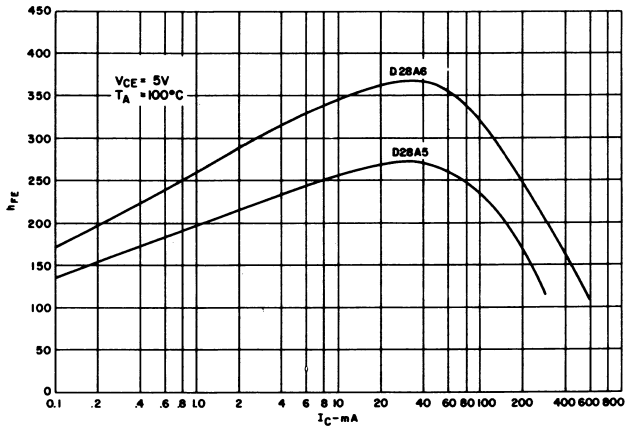
Lead Forming



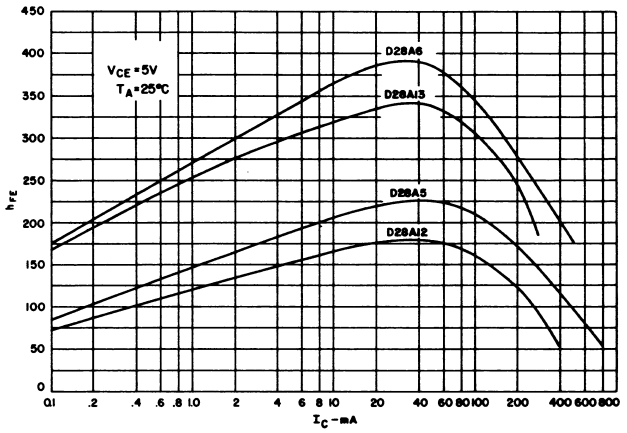
Rivet or Screw Mounting To Flat Surface

Printed Circuit Board Mounting

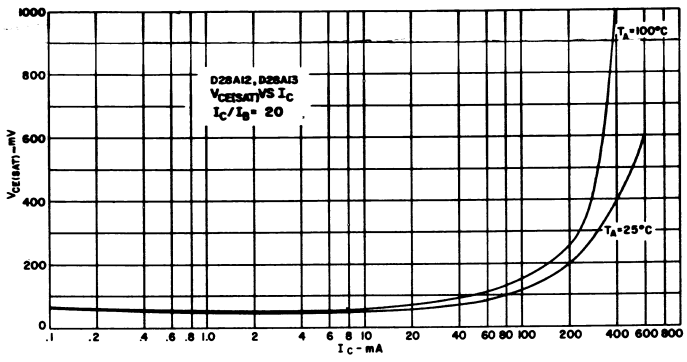
Typical h_{FE} vs. Collector Current



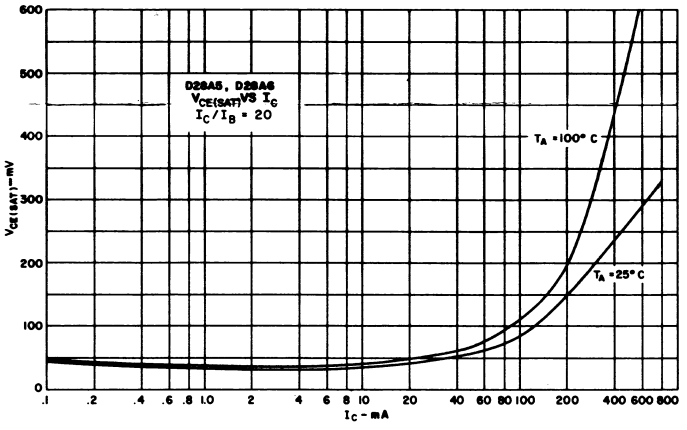
Typical h_{FE} vs. Collector Current



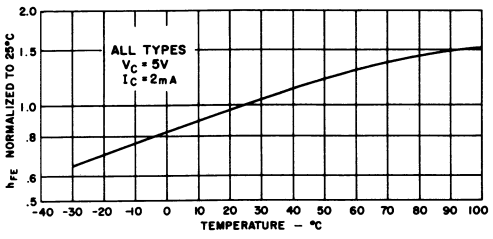
Typical $V_{CE(SAT)}$ vs. Collector Current



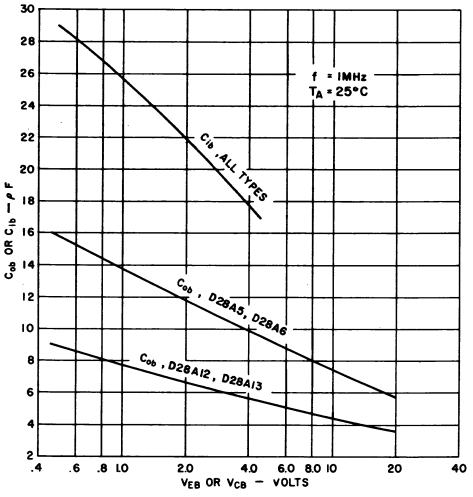
Typical $V_{CE(SAT)}$ vs. Collector Current



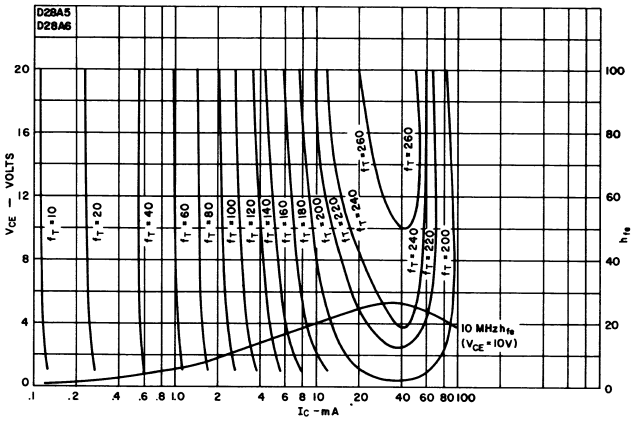
h_{FE} vs. Temperature



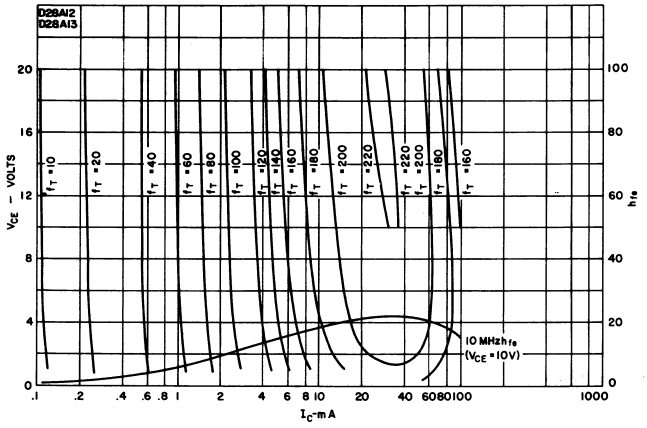
C_{ib} and C_{ob} vs. Voltage



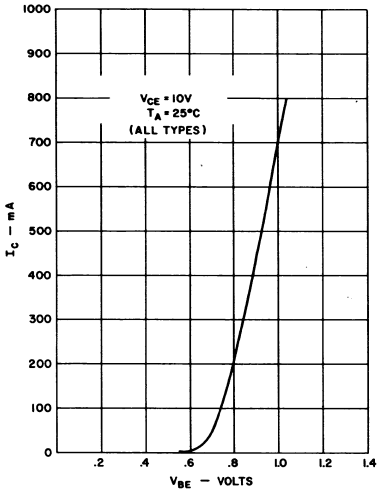
Contours of Constant f_T



Contours of Constant f_T



Transfer Characteristics



Printed in U.S.A.

ELECTRONIC INNOVATIONS IN ACTION
SEMICONDUCTORS

Silicon Power Tab Transistors

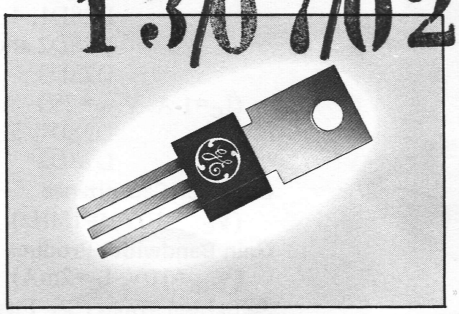
for Consumer and Industrial Electronics

40.30 3/68
Supersedes 40.30 8/67

NPN
D28D

13/07/02

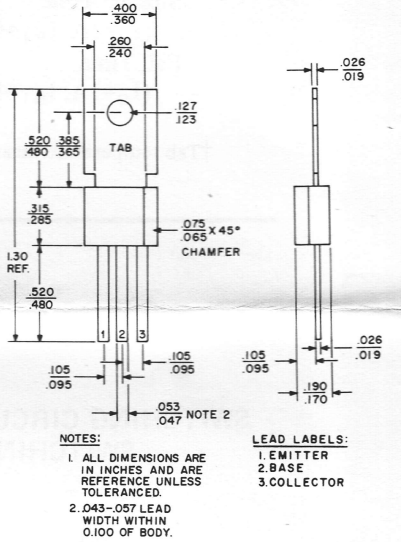
The D28D is a plastic encapsulated power transistor designed for output stages of medium power stereo amplifiers and drivers for very high power amplifiers. Applications also include oscillators, and output stages of TV, radio, intercoms and other audio equipments. Many switching applications are also possible with the D28D's fast switching times and low saturation voltages.



Leads Can Be Formed To A TO-5 Pin Circle

absolute maximum ratings: (25°C) (unless otherwise specified)

		D28D1 D28D2 D28D3	D28D4 D28D5	D28D7	D28D10	
Voltages						
Collector to Emitter	V_{CEO}	25	40	60	75	V
Emitter to Base	V_{EBO}	5	5	5	5	V
Collector to Emitter	V_{CES}	35	50	75	90	V
Current						
Collector (Continuous)	I_C	1	1	1	1	A
Collector (Peak) (50% duty cycle; 50 msec. pulse width)	I_C	1.5	1.5	1.5	1.5	A
Dissipation						
Total Power (free air at 50°C)	P_T					
With Tab		1	1	1	1	W
Without Tab		0.75	0.75	0.75	0.75	W
Total Power (tab at 70°C)†	P_T	4	4	4	4	W
Thermal Impedance						
Junction to Case (Tab)	θ_{JC}	13.75	13.75	13.75	13.75	°C/W
Junction to Ambient	θ_{JA}					
With Tab		75	75	75	75	°C/W
Without Tab		100	100	100	100	°C/W
Temperature						
Storage	T_{stg}		−55 to +150			°C
Lead Soldering, 1/16" ± 1/32" from case for 10 seconds max.	T_L	+260	+260	+260	+260	°C



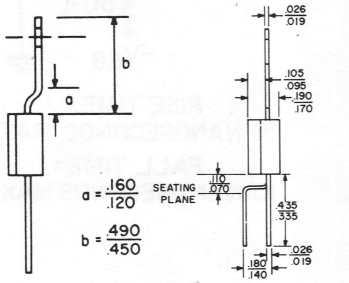
NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND ARE REFERENCE UNLESS TOLERANCED.
2. .043-.057 LEAD WIDTH WITHIN 0.100 OF BODY.

LEAD LABELS:
1. EMITTER
2. BASE
3. COLLECTOR

electrical characteristics: (25°C) (unless otherwise specified)

		Min.	Max.	
Collector Cutoff Current				
(V_{CE}= 35V), D28Dl, 2, and 3	I_{CES}		0.1	μA
(V_{CE}= 50V), D28D4 and 5	I_{CES}		0.1	μA
(V_{CE}= 75V), D28D7	I_{CES}		0.1	μA
(V_{CE}= 90V), D28D10	I_{CES}		0.1	μA
Collector Cutoff Current (T_J=125°C)				
(V_{CE}= 35V), D28D1, 2, and 3	I_{CES}		15	μA
(V_{CE}= 50V), D28D4 and 5	I_{CES}		15	μA
(V_{CE}= 75V), D28D7	I_{CES}		15	μA
(V_{CE}= 90V), D28D10	I_{CES}		15	μA
Emitter Cutoff Current (V_{EB} = 5V)	I_{EBO}		0.1	μA
Collector Saturation Voltage (I_B=50 mA, I_C=500 mA)	$V_{CE(sat)}$		0.5	V
Base Saturation Voltage (I_B=50 mA, I_C=500 mA)	$V_{BE(sat)}$		1.5	V
Collector to Emitter Voltage (I_C=10 mA) D28D1, 2, and 3	V_{CEO}	25		V
D28D4 and 5	V_{CEO}	40		V
D28D7	V_{CEO}	60		V
D28D10	V_{CEO}	75		V

Lead Forming



Rivet or Screw Mounting To Flat Surface

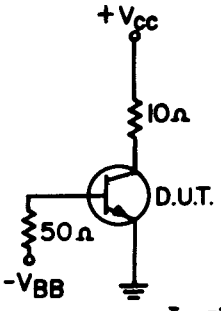
Printed Circuit Board Mounting

GENERAL ELECTRIC

		Min.	Typ.	Max.	
Collector Cutoff Current					
(V_{CE}=Rated V_{CEO}, T_J= 25°C)	I_{CEO}		1		μA
(T_J=125°C)	I_{CEO}		100		μA
Forward Current Transfer Ratio					
(I_C=100 mA, V_{CE}=2V)					
D28D1, 4, 7 and 10	h_{FE}	50	100	150	
D28D2 and 5	h_{FE}	120	250	360	
D28D3	h_{FE}	290	350		
(I_C=1 A, V_{CE}=2V)					
D28D1, 3, 4, 5, 7, 10	h_{FE}	10			
D28D2	h_{FE}	20			
Collector Capacitance					
(V_{CB} =10V, f=1MHz)	C_{CBO}		8		pF
Gain Bandwidth Product					
(V_{CE}=10V, I_C=2mA)	f_t		85 MHz		
Switching Times (See Figures 1 and 2)					
Rise Time and Delay Time					
(I_C=1A, I_{B1}=0.1A)	t_d+t_r		25		nsec
Storage Time					
(I_C=1A, I_{B1}=I_{B2}=0.1A)	t_s		200		nsec
Fall Time					
(I_C=1A, I_{B1}=I_{B2}=0.1A)	t_f		50		nsec

†Tab temperature measured on center of tab, 1/16" from plastic body.

SWITCHING CIRCUIT TO MEASURE SWITCHING TIMES



RISE TIME=
10 NANOSECONDS MAX

FALL TIME=
10 NANOSECONDS MAX

I_{B1}=I_{B2}=0.1 AMPS
PULSE=10μ SEC
P.R.T.=10m SEC
CRT=TEKTRONIX CURRENT TRANSFORMER

FIGURE 1

OSCILLOSCOPE DISPLAY OF INPUT AND OUTPUT PULSE WAVEFORM IS OF SWITCHING CIRCUIT SHOWN IN FIGURE 1

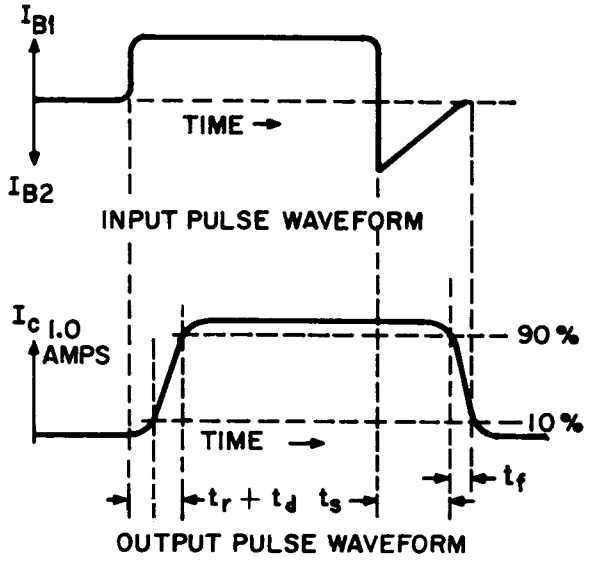
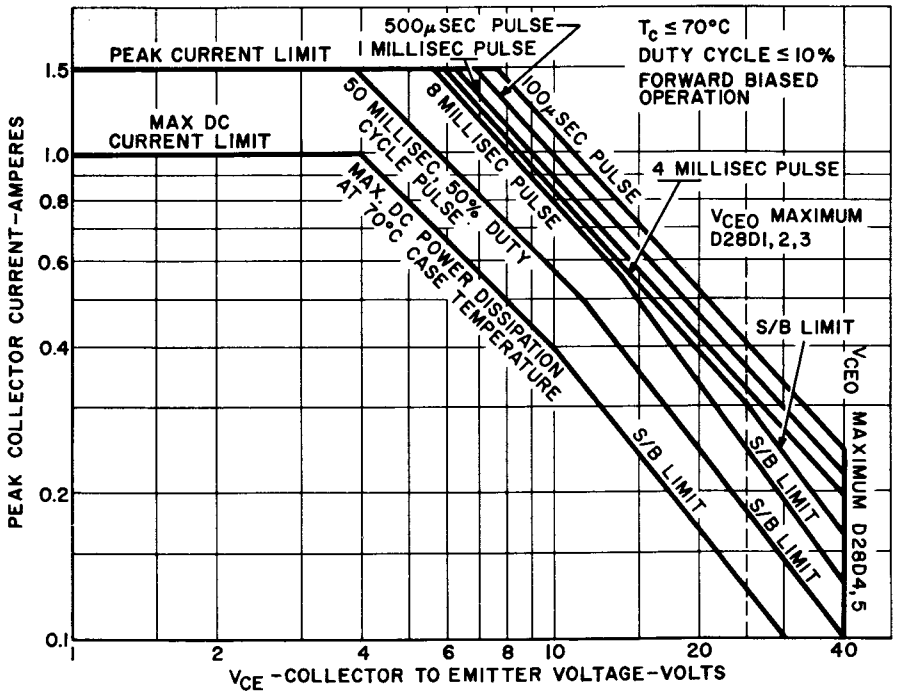
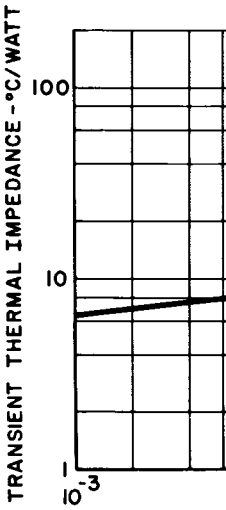


FIGURE 2

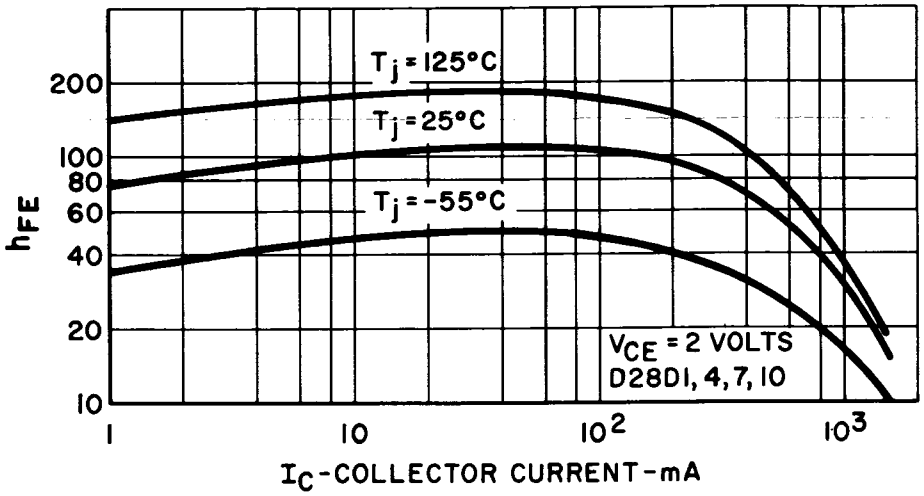
SAFE REGION OF OPERATION

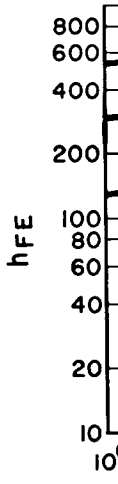


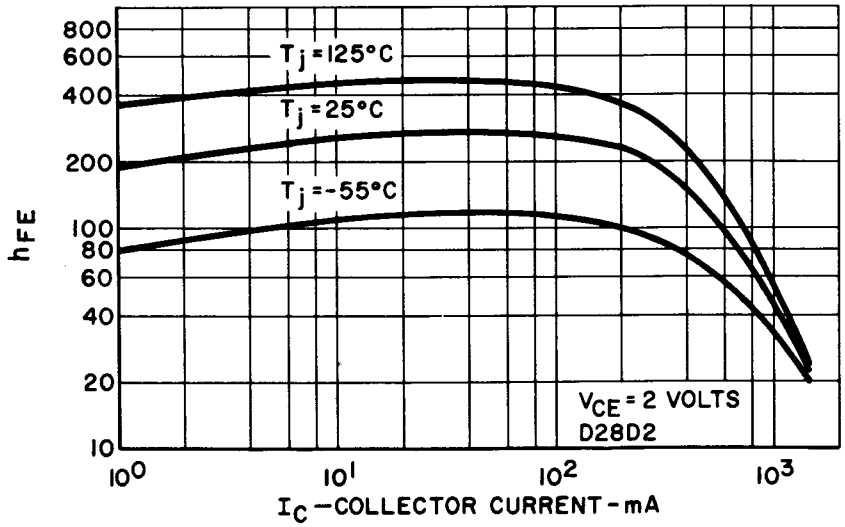
MA

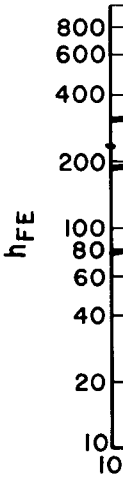


TYPICAL h_{FE} VS. I_C

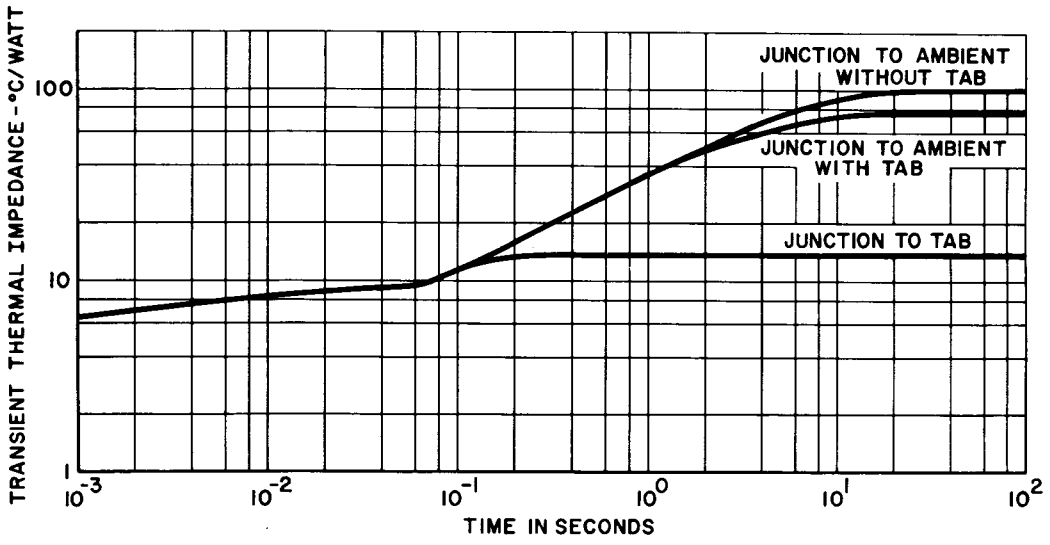


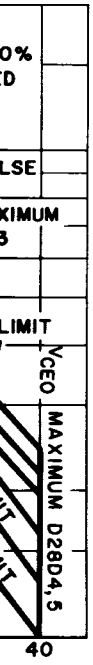




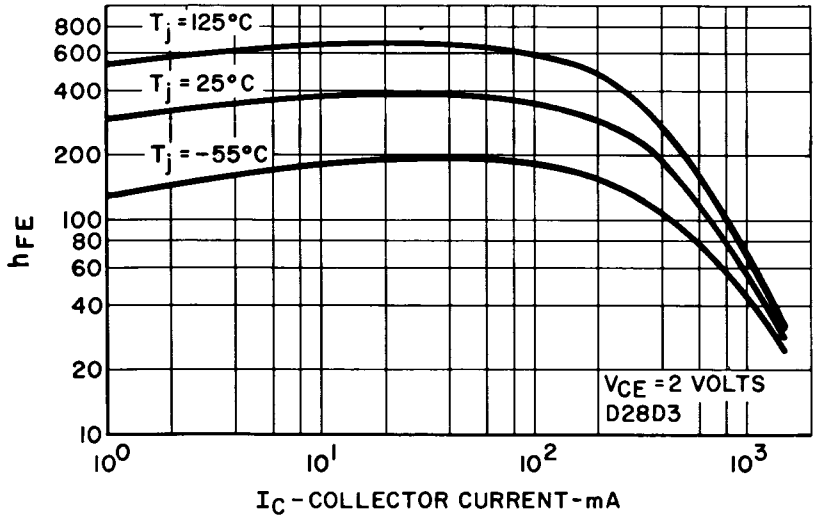


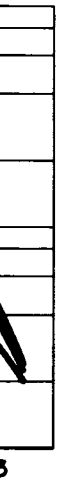
MAXIMUM TRANSIENT THERMAL IMPEDANCE

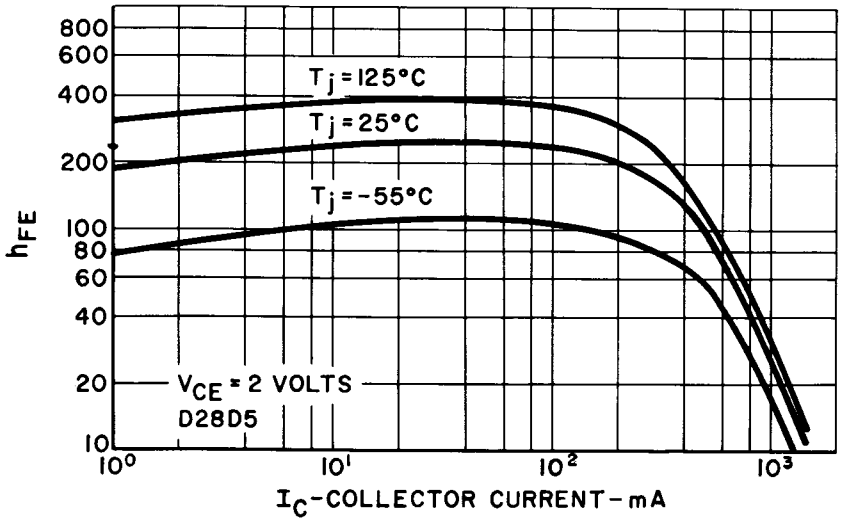




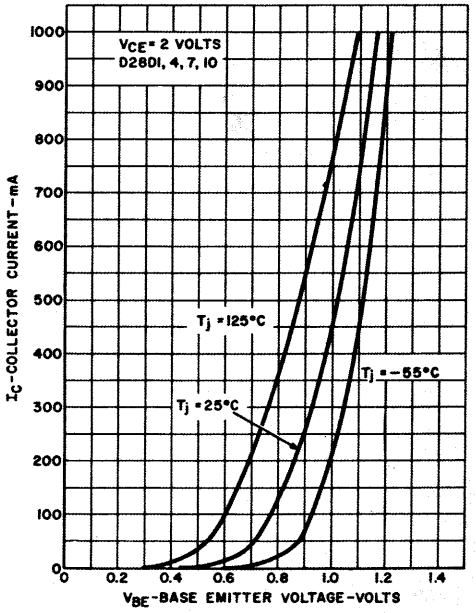
TYPICAL h_{FE} VS. I_C

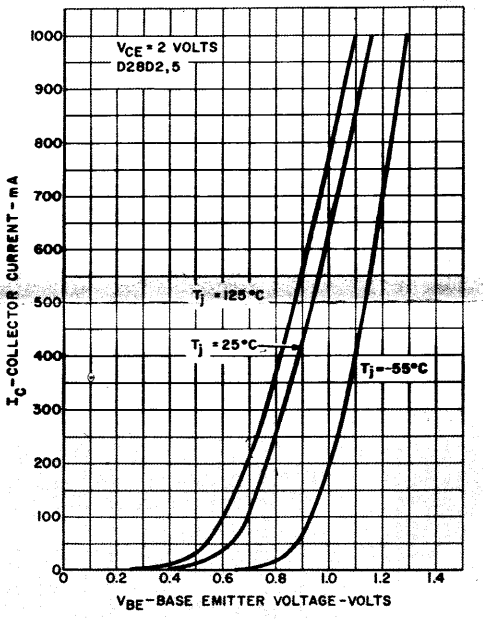


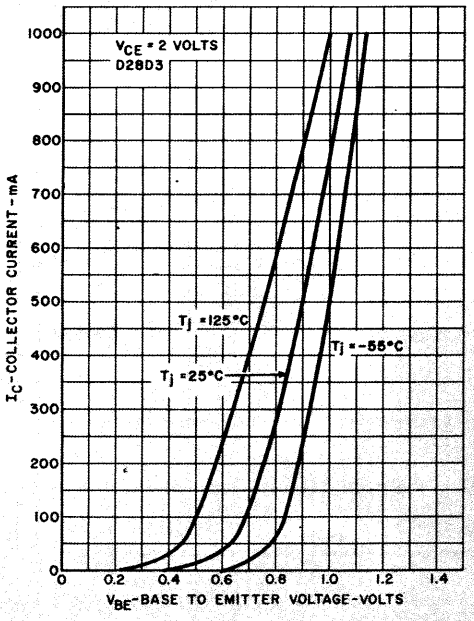




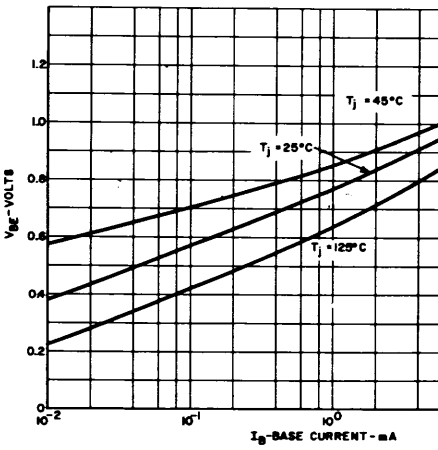
TYPICAL TRANSCONDUCTANCE CHARACTERISTICS



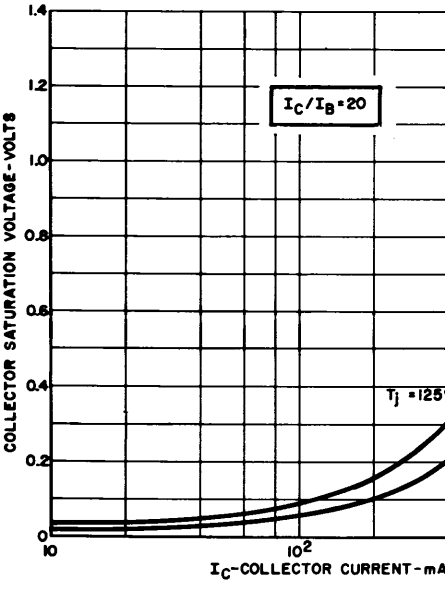


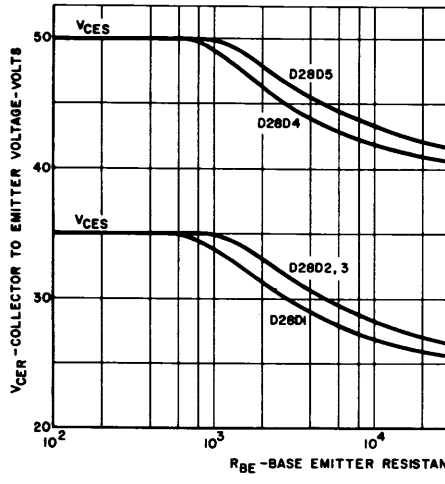


TYPICAL INPUT CHARACT



TYPICAL COLLECT
SATURATION CHARACTE





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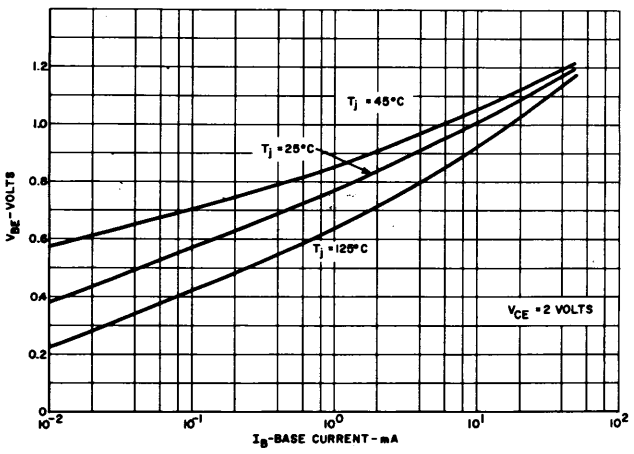
TYPICAL INPUT CHARACTERISTICS



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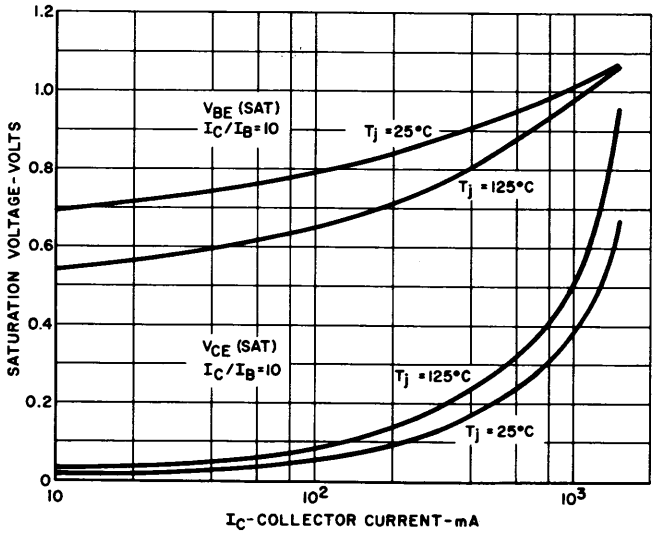
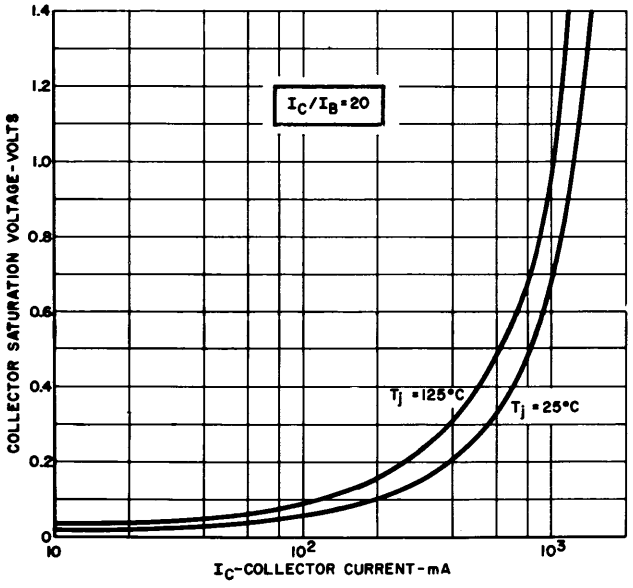
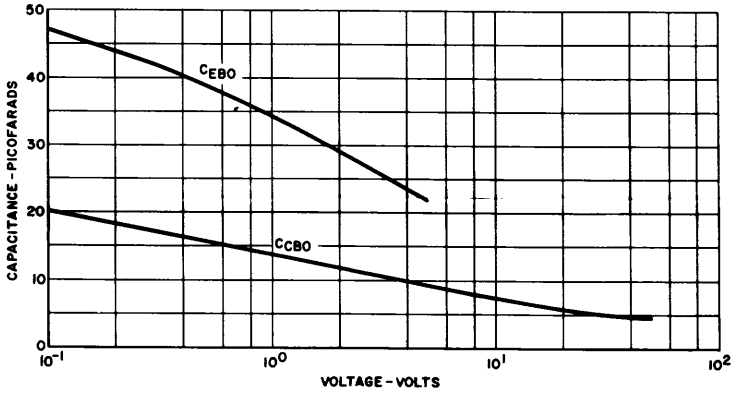


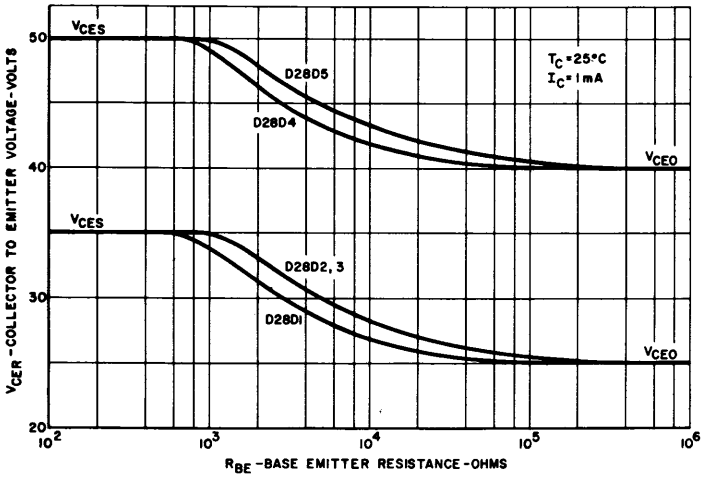
TYPICAL COLLECTOR SATURATION CHARACTERISTICS

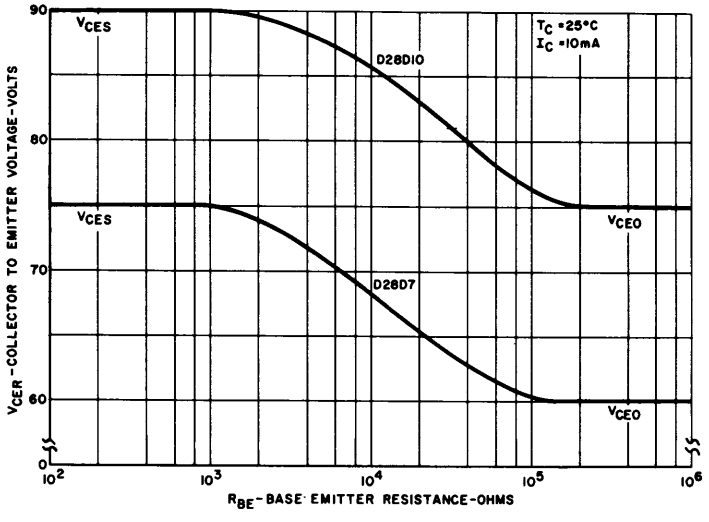


C_{CBO} & C_{EBO} vs. VOLTAGE



TYPICAL V_{CER}





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