

Epitaxial-Base, Silicon N-P-N and P-N-P VERSAWATT Transistors

General-Purpose Medium-Power Types for
Switching and Amplifier Applications

Features:

- Low saturation voltages
- Complementary n-p-n and p-n-p types
- Maximum safe-area-of-operation curves specified for dc operation

The 2N6106-2N6111, 2N6288-2N6293, and 2N6473-2N6476 are epitaxial-base silicon transistors supplied in a VERSAWATT package. The 2N6288-2N6293, 2N6473, and 2N6474* are n-p-n complements of p-n-p types 2N6106-2N6111, 2N6475, and 2N6476[‡], respectively. All these transistors are intended for a wide variety of medium-power switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers.

The 2N6289, 2N6291, and 2N6293 n-p-n types and 2N6106, 2N6108, and 2N6110 p-n-p devices fit into TO-213AA sockets. The remaining types are supplied in the JEDEC TO-220AB straight-lead version of the VERSAWATT package. All of these devices are also available on special order in a variety of lead-form configurations.

*Formerly RCA Dev. Nos. TA7784, TA8323, TA7783, TA8232, TA7782, TA8231, TA8444, and TA8723, respectively.

‡Formerly RCA Dev. Nos. TA8210, TA7741, TA8211, TA7742, TA8212, TA7743, TA8445, and TA8722, respectively.

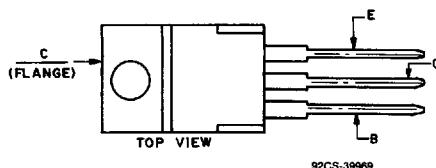
MAXIMUM RATINGS, Absolute-Maximum Values:

	2N6288	2N6290	2N6292		
N-P-N	2N6289	2N6291	2N6293	2N6473	2N6474
P-N-P	2N6110‡ 2N6111‡	2N6108‡ 2N6109‡	2N6106‡ 2N6107‡	2N6475‡	2N6476‡
* V_{CE0}	40	60	80	110	130
* $V_{CEX}(sus)$ $R_{\theta SA} = 100 \Omega, V_{BE} = 0 V$	40	60	80	110	130
$V_{CE0}(sus)$	30	50	70	100	120
* V_{BE0}			5		
* $I_C (T_C \leq 106^\circ C)$		7		4	
* $I_E (T_C \leq 130^\circ C)$		3		2	
P_T					
* $T_C \leq 25^\circ C$			40		
$T_C > 25^\circ C \leq 100^\circ C$			16		
$T_C > 25^\circ C$			Derate linearly 0.32		
$T_A \leq 25^\circ C$			1.8		
$T_A > 25^\circ C$			Derate linearly 0.0144		
* T_{sig}, T_J			-65 to 150		
* T_L					
At distances $\geq 1/8$ in. (3.17 mm) from case for 10 s max.			235		

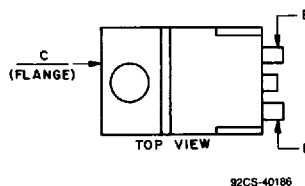
*In accordance with JEDEC registration data.

‡For p-n-p devices, voltage and current values are negative.

TERMINAL DESIGNATIONS



JEDEC TO-220AB



JEDEC TO-220AA

ELECTRICAL CHARACTERISTICS At Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARAC- TERISTIC	TEST CONDITIONS [†]				LIMITS						UNITS	
	VOLTAGE V dc		CURRENT A dc		2N6292 2N6293 2N6106 [‡] 2N6107 [‡]		2N6290 2N6291 2N6108 [‡] 2N6109 [‡]		2N6288 2N6289 2N6110 [‡] 2N6111 [‡]			
	V _{CE}	V _{BE}	I _C	I _B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
I _{CER} (R _{BE} = 100 Ω)	75 55 35				— — —	0.1 — —	— — —	— 0.1 —	— — —	— — 0.1	mA	
(R _{BE} = 100 Ω, T _C = 150°C)	70 50 30				— — —	2 — —	— — —	— 2 —	— — 2			
* I _{CEX} (R _{BE} = 100 Ω)	75 56 37.5	—1.5 —1.5 —1.5			— — —	0.1 — —	— — —	— 0.1 —	— — —	— — 0.1		
(R _{BE} = 100 Ω, T _C = 150°C)	70 50 30	—1.5 —1.5 —1.5			— — —	2 — —	— — —	— 2 —	— — 2			
* I _{CEO}	60 40 20			0 0 0	— — —	1 — —	— — —	— 1 —	— — —	— — 1		
I _{EBO}		—5	0		—	1	—	1	—	1		
* V _{CEO(sus)} ^b			0.1 ^a	0	70	—	50	—	30	—		V
V _{CER(sus)} ^b (R _{BE} = 100 Ω)			0.1 ^a		80	—	60	—	40	—		
* h _{FE}	4 4 4 4		2 ^a 2.5 ^a 3 ^a 7 ^a		30 — — 2.3	150 — — —	— 30 — 2.3	— 150 — —	— — 30 2.3	— — 150 —		V
V _{BE}	4 4 4 4		2 ^a 2.5 ^a 3 ^a 7 ^a		— — — —	1.5 — — 3	— — — —	— 1.5 — 3	— — — —	— — 1.5 3		
* V _{CE(sat)}			2 ^a 2.5 ^a 3 ^a 7 ^a	0.2 0.25 0.3 3	— — — —	1 — — 3.5	— — — —	— 1 — 3.5	— — — —	— — 1 3.5		
* h _{fe} (f = 1 MHz) 2N6288-93	4		0.5		4	—	4	—	4	—		
2N6106-11	—4		—0.5		10	—	10	—	10	—		
* h _{fe} (f = 50 kHz)	4		0.5		20	—	20	—	20	—		
f _T 2N6288-93	4		0.5		10	—	10	—	10	—		MHz
2N6106-11	—4		—0.5		10	—	10	—	10	—		
* C _{obo} (f = 1 MHz)	10 ^c		0		—	250	—	250	—	250	pF	
R _{θJC}					—	3.125	—	3.125	—	3.125	°C/W	
R _{θJA}					—	70	—	70	—	70		

* In accordance with JEDEC registration data.

^a Pulsed: Pulse duration = 300 μs, duty factor = 0.018.^b CAUTION: The sustaining voltage V_{CEO(sus)} and V_{CER(sus)} MUST NOT be measured on a curve tracer.^c V_{CEB} value.[‡] For p-n-p devices, voltage and current values are negative.

2N6106-2N6111, 2N6288-2N6293, 2N6473-2N6476

ELECTRICAL CHARACTERISTICS At Case Temperature (T_C) = 25°C Unless Otherwise Specified

CHARACTERISTIC	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		2N6474 2N6476*		2N6473 2N6475*		
	V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	
I _{CER} (R _{BE} = 100 Ω)	120 100				— —	0.1 —	— —	— 0.1	mA
(R _{BE} = 100 Ω T _C = 100°C)	120 100				— —	2 —	— —	— 2	
* I _{CEX} (R _{BE} = 100 Ω)	120 100	—1.5 —1.5			— —	0.1 —	— —	— 0.1	
(R _{BE} = 100 Ω, T _C = 100°C)	120 100	—1.5 —1.5			— —	2 —	— —	— 2	
* I _{CEO}	60 50			0 0	— —	1 —	— —	— 1	
* I _{EBO}		—5		0	—	1	—	1	
* V _{CEO(sus)} ^b			0.1 ^a	0	120	—	100	—	V
V _{CER(sus)} ^b (R _{BE} = 100 Ω)			0.1 ^a		130	—	110	—	
* h _{FE}	4 2.5		1.5 ^a 4 ^a		15 2	150 —	15 2	150 —	V
* V _{BE}	4 2.5		1.5 ^a 4 ^a		— —	2 3.5	— —	2 3.5	
* V _{CE(sat)}			1.5 ^a 4 ^a	0.15 2	— —	1.2 2.5	— —	1.2 2.5	
* h _{fe} (f = 1 MHz) 2N6473-74	4		0.5		4	—	4	—	MHz
2N6475-76	—4		—0.5		5	—	5	—	
* h _{fe} (f = 50 kHz)	4		0.5		20	—	20	—	
f _T 2N6473-74	4		0.5		4	—	4	—	pF
2N6475-76	—4		—0.5		5	—	4	—	
* C _{obo} (f = 1 MHz)	10 ^c		0		—	250	—	250	°C/W
R _{θJC}					—	3.125	—	3.125	
R _{θJA}					—	70	—	70	

* In accordance with JEDEC registration data

^a Pulsed: Pulse duration = 300 μs , duty factor = 0.018.

^b CAUTION: The sustaining voltage $V_{CEO(sus)}$ are $V_{CER(sus)}$ **MUST NOT** be measured on a curve tracer.

^c V_{CB} value.

* For p-n-p devices, voltage and current values are negative.

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HARRIS SEMICONDUCTOR

POWER TRANSISTORS

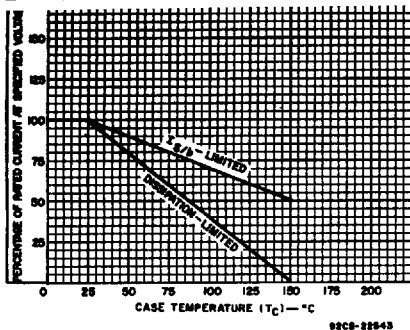


Fig. 1 - Current derating curves for all types.

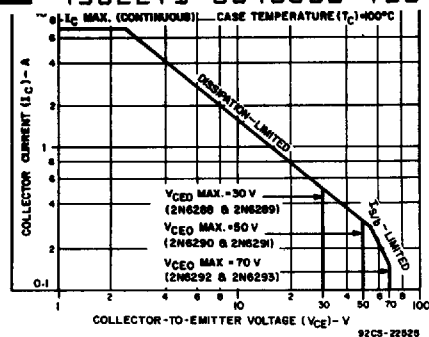
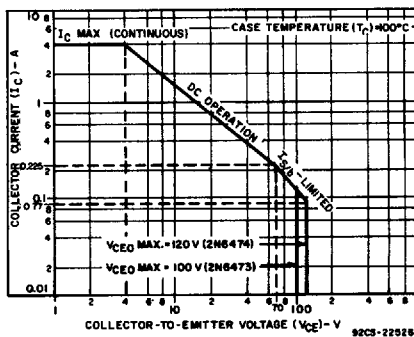
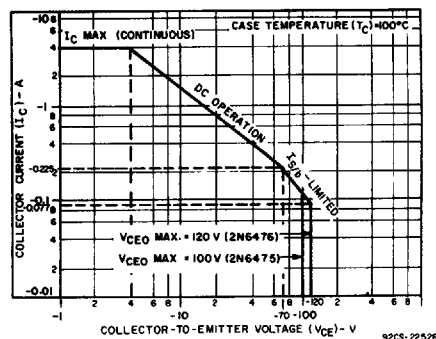
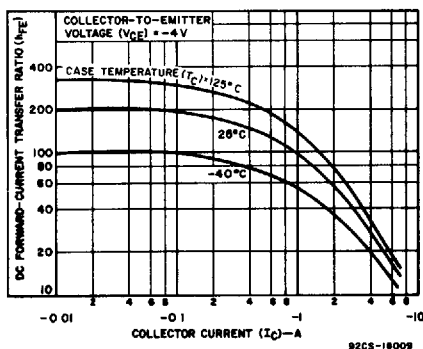
Fig. 2 - Maximum operating areas for 2N6288 - 2N6293 ($T_C = 100^\circ\text{C}$).Fig. 3 - Maximum operating areas for 2N6473 - 2N6474 ($T_C = 100^\circ\text{C}$).Fig. 4 - Maximum operating areas for 2N6475 and 2N6476 ($T_C = 100^\circ\text{C}$).

Fig. 5 - Typical dc beta characteristics for 2N6106 - 2N6111.

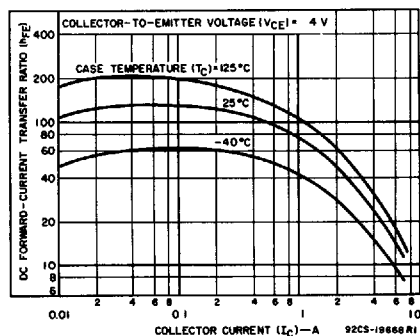


Fig. 6 - Typical dc beta characteristics for 2N6288 - 2N6293.

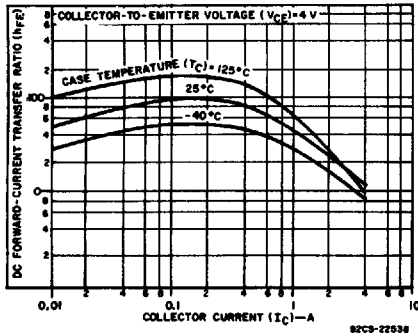


Fig. 7 - Typical dc beta characteristics for 2N6473 and 2N6474.

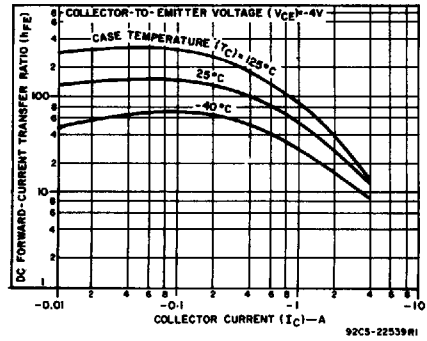


Fig. 8 - Typical dc beta characteristics for 2N6475 and 2N6476.

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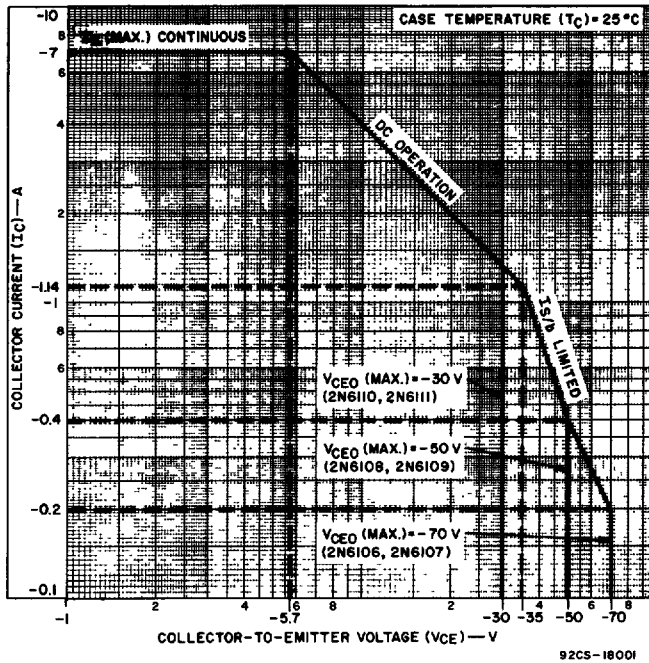


Fig. 9 - Maximum operating areas for 2N6106 - 2N6111 ($T_C = 25^\circ\text{C}$).

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HARRIS SEMICONDUCTOR POWER TRANSISTORS

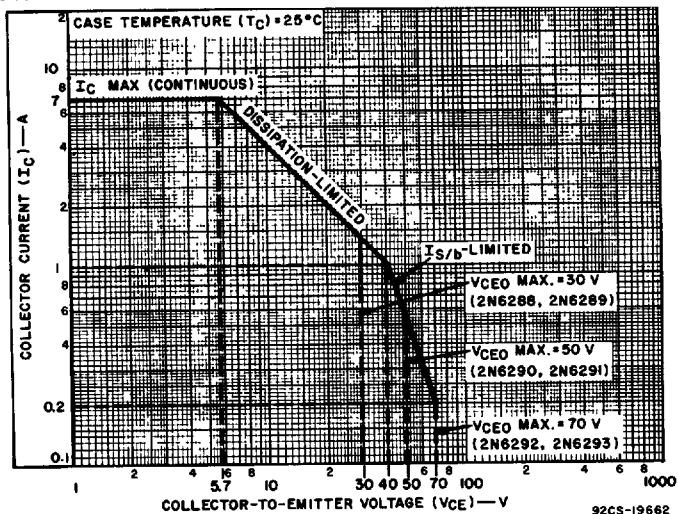


Fig. 10 - Maximum operating areas for 2N6288-2N6293 ($T_C = 25^\circ\text{C}$).

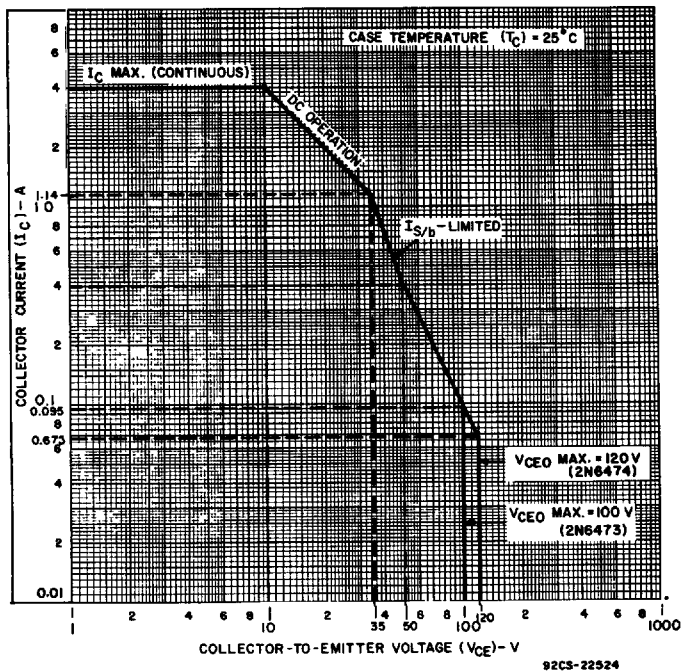


Fig. 11 - Maximum operating areas for 2N6473 and 2N6474 ($T_C = 25^\circ\text{C}$).

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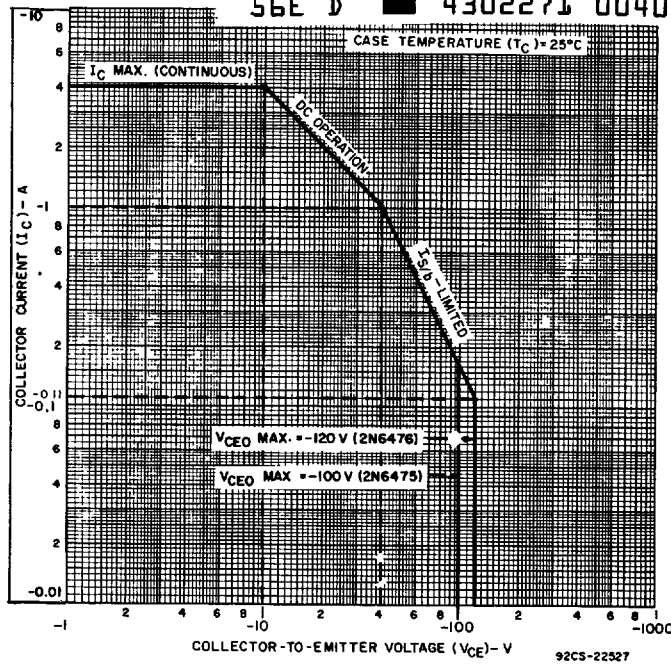


Fig. 12 - Maximum operating areas for 2N6475 - 2N6476 ($T_C = 25^\circ\text{C}$).

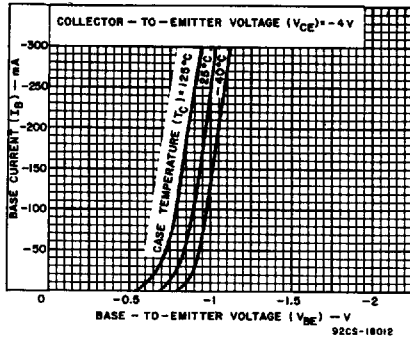


Fig. 13 - Typical input characteristics for 2N6106 - 2N6111, 2N6475, and 2N6476.

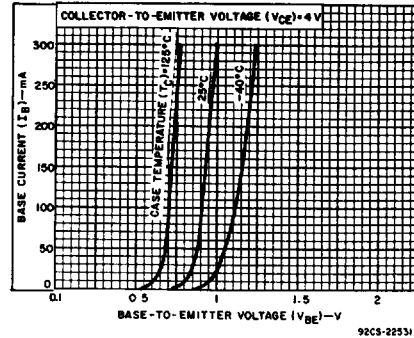


Fig. 14 - Typical input characteristics for 2N6288 - 2N6293.

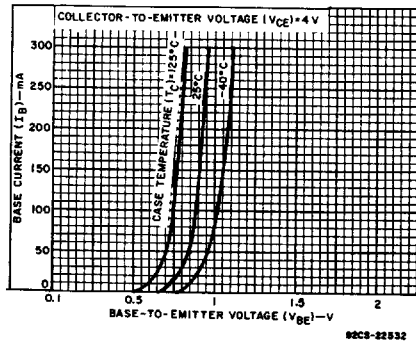


Fig. 15 - Typical input characteristics for 2N6473 - 2N6474.

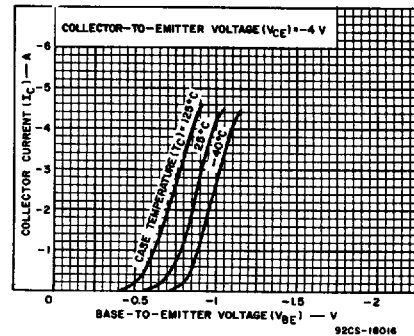


Fig. 16 - Typical transfer characteristics for 2N6106 - 2N6111.

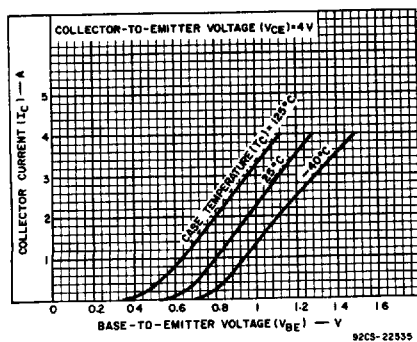


Fig. 17 - Typical transfer characteristics for 2N6288 - 2N6293.

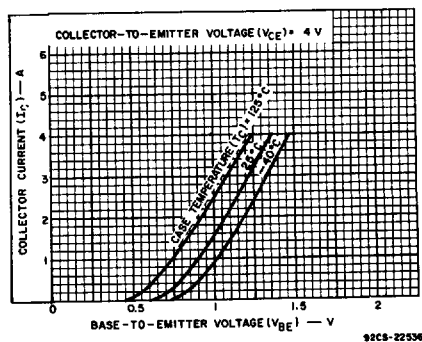


Fig. 18 - Typical transfer characteristics for 2N6473 and 2N6474.

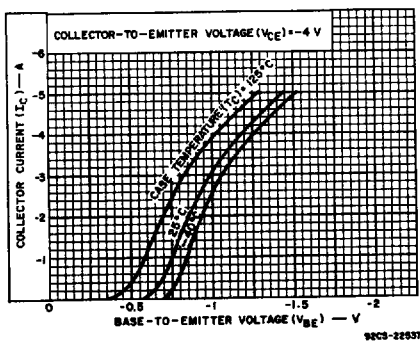


Fig. 19 - Typical transfer characteristics for 2N6475 and 2N6476.

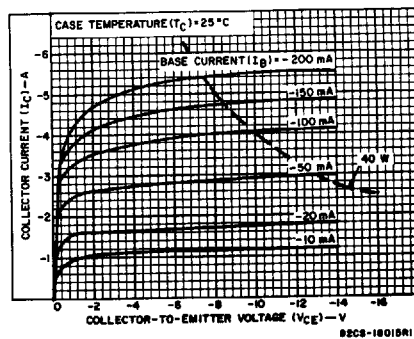


Fig. 20 - Typical output characteristics for 2N6106 - 2N6111.

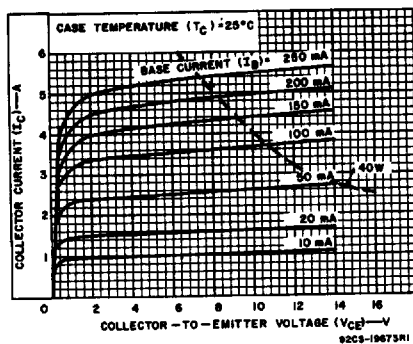


Fig. 21 - Typical output characteristics for 2N6288 - 2N6293.

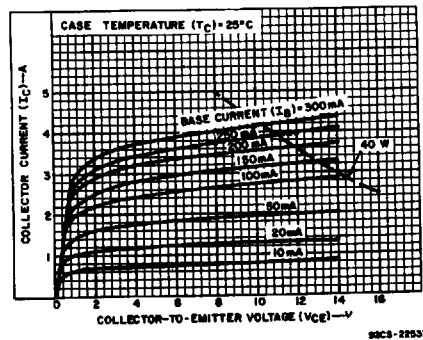


Fig. 22 - Typical output characteristics for 2N6473 and 2N6474.

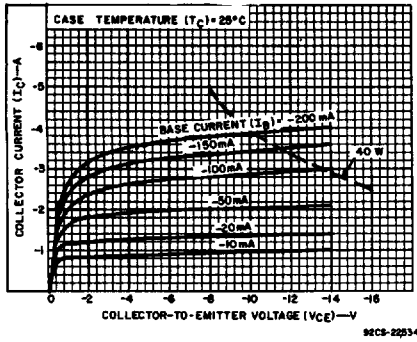


Fig. 23 - Typical output characteristics for 2N6475 and 2N6476.

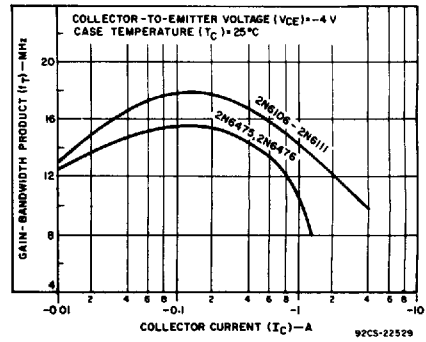


Fig. 24 - Typical gain-bandwidth product 2N6106 - 2N6111, 2N6475, and 2N6476.

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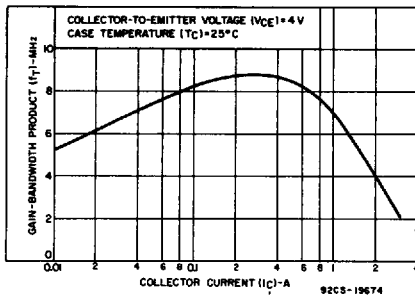


Fig. 25 - Typical gain-bandwidth product for 2N6288 - 2N6293.

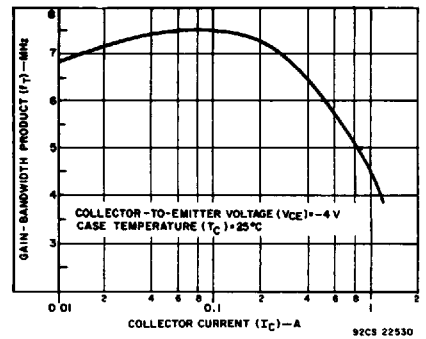


Fig. 26 - Typical gain-bandwidth product for 2N6473 and 2N6474.

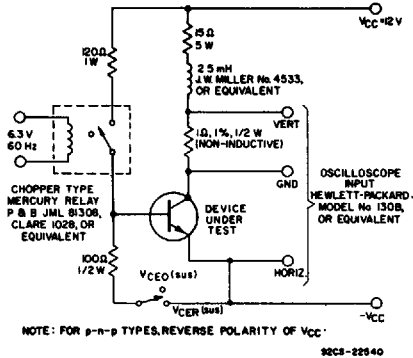
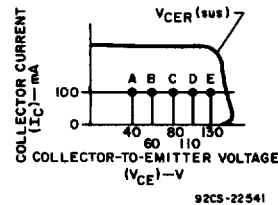


Fig. 27 - Circuit used to measure sustaining voltage $V_{CE(sus)}$ for all types.



Note: Curve will be inverted and polarity reversed for p-n-p types. The sustaining voltage, $V_{CE(sus)}$, is acceptable when the traces fall to the right and above the designated points:
 Point A: 2N6110, 2N6111, 2N6288, 2N6289
 Point B: 2N6108, 2N6109, 2N6290, 2N6291
 Point C: 2N6106, 2N6107, 2N6292, 2N6293
 Point D: 2N6475, 2N6473
 Point E: 2N6476, 2N6474

Fig. 28 - Oscilloscope delay for measurement of sustaining voltage (test circuit shown in Fig. 27).