

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.

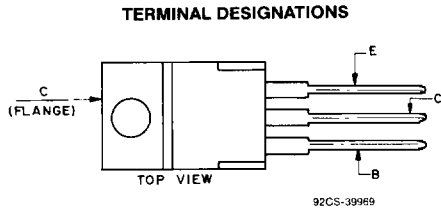
*Formerly RCA Dev. Nos. TA7784, TA8323, TA7783, TA8232, TA7782, TA8231, TA8444, and TA8723, respectively.

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

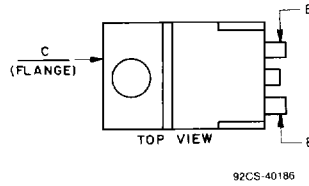
MAXIMUM RATINGS, Absolute-Maximum Values:

	N-P-N		P-N-P			
	2N6288 2N6289	2N6290 2N6291	2N6292 2N6293	2N6473 2N6474		
V_{CB0}	40	60	80	110	130	V
$V_{CEX(SUS)}$ $R_{BB} = 100 \Omega, V_{BB} = 0 V$	40	60	80	110	130	V
$V_{CE0(SUS)}$	30	50	70	100	120	V
V_{EBO}	5					V
$I_C (T_C \leq 106^\circ C)$	7		4			A
$I_B (T_C \leq 130^\circ C)$	3		2			A
P_T						
$T_C \leq 25^\circ C$	40					W
$T_C > 25^\circ C \leq 100^\circ C$	16					W
$T_C > 25^\circ C$	Derate linearly 0.32					W/°C
$T_A \leq 25^\circ C$	1.8					W
$T_A > 25^\circ C$	Derate linearly 0.0144					W/°C
T_{sto}, T_J	-65 to 150					°C
T_L At distances $\geq 1/8$ in. (3.17 mm) from case for 10 s max.	235					°C

*In accordance with JEDEC registration data.



JEDEC TO-220AB



JEDEC TO-220AA

[†]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		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				–	0.1	–	–	–	–	mA
	55				–	–	–	0.1	–	–	
	35				–	–	–	–	–	0.1	
(R _{BE} = 100 Ω, T _C = 150°C)	70				–	2	–	–	–	–	2
	50				–	–	–	2	–	–	
	30				–	–	–	–	–	–	
* I _{CEx} (R _{BE} = 100 Ω)	75	–1.5			–	0.1	–	–	–	–	mA
	56	–1.5			–	–	–	0.1	–	–	
	37.5	–1.5			–	–	–	–	–	0.1	
* I _{CEO}	70	–1.5			–	2	–	–	–	–	2
	50	–1.5			–	–	–	2	–	–	
	30	–1.5			–	–	–	–	–	–	
* I _{CEO}	60			0	–	1	–	–	–	–	1
	40			0	–	–	–	1	–	–	
	20			0	–	–	–	–	–	–	
* 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		2 ^a		30	150	–	–	–	–	
	4		2.5 ^a		–	–	30	150	–	–	
	4		3 ^a		–	–	–	–	30	150	
	4		7 ^a		2.3	–	2.3	–	2.3	–	
* V _{BE}	4		2 ^a		–	1.5	–	–	–	–	V
	4		2.5 ^a		–	–	–	1.5	–	–	
	4		3 ^a		–	–	–	–	–	1.5	
	4		7 ^a		–	3	–	3	–	3	
* V _{CE(sat)}			2 ^a	0.2	–	1	–	–	–	–	
			2.5 ^a	0.25	–	–	–	1	–	–	
			3 ^a	0.3	–	–	–	–	–	1	
			7 ^a	3	–	3.5	–	3.5	–	3.5	
* h _{fe} (f = 1 MHz) 2N6288-93	4		0.5		4	–	4	–	4	–	
	–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
	–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_{CB} 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				–	0.1	–	–	mA	
	100				–	–	–	0.1		
(R _{BE} = 100 Ω T _C = 100°C)	120				–	2	–	–		
	100				–	–	–	2		
* I _{CEX} (R _{BE} = 100 Ω)	120	–1.5			–	0.1	–	–		
	100	–1.5			–	–	–	0.1		
(R _{BE} = 100 Ω, T _C = 100°C)	120	–1.5			–	2	–	–		
	100	–1.5			–	–	–	2		
* I _{CEO}	60			0	–	1	–	–		
	50			0	–	–	–	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		1.5 ^a		15	150	15	150	V	
	2.5		4 ^a		2	–	2	–		
* V _{BE}	4		1.5 ^a		–	2	–	2		
	2.5		4 ^a		–	3.5	–	3.5		
* V _{CE(sat)}			1.5 ^a	0.15	–	1.2	–	1.2		
			4 ^a	2	–	2.5	–	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		
R _{θJC}					–	3.125	–	3.125	°C/W	
R _{θJA}					–	70	–	70		

* In accordance with JEDEC registration data

^c V_{CB} value.

^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.

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

2

POWER TRANSISTORS

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

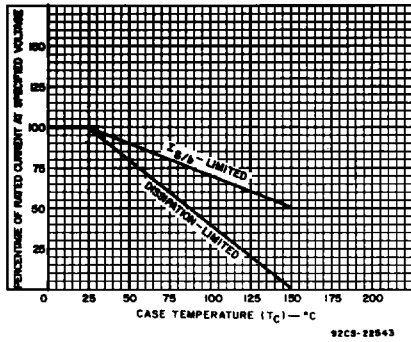


Fig. 1 - Current derating curves for all types.

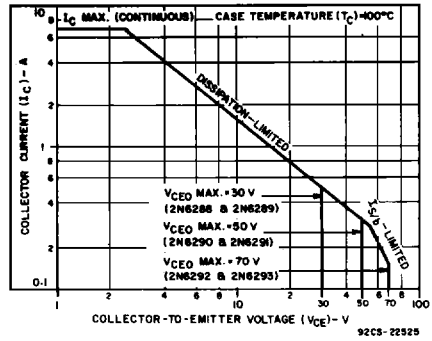


Fig. 2 - Maximum operating areas for 2N6288 - 2N6293 ($T_C = 100^\circ C$).

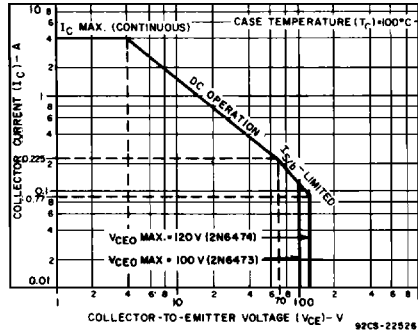


Fig. 3 - Maximum operating areas for 2N6473 - 2N6474 ($T_C = 100^\circ C$).

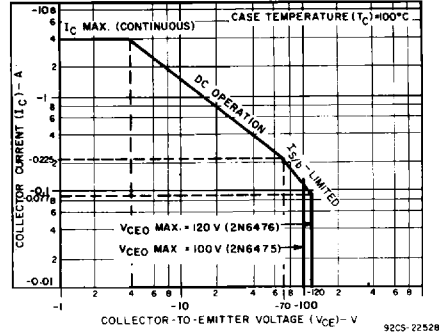


Fig. 4 - Maximum operating areas for 2N6475 and 2N6476 ($T_C = 100^\circ C$).

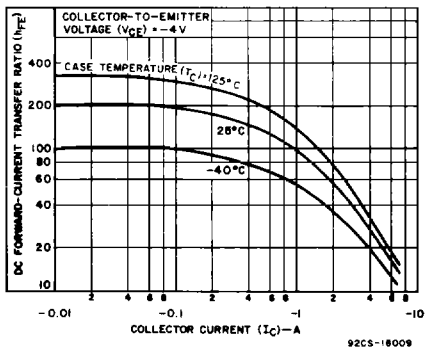


Fig. 5 - Typical dc beta characteristics for 2N6106 - 2N6111.

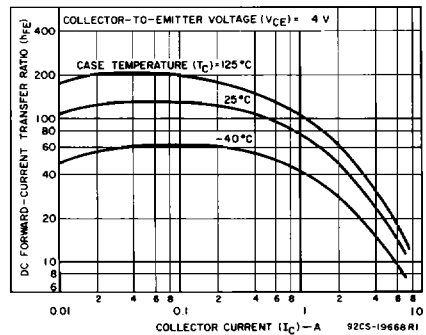


Fig. 6 - Typical dc beta characteristics for 2N6288 - 2N6293.

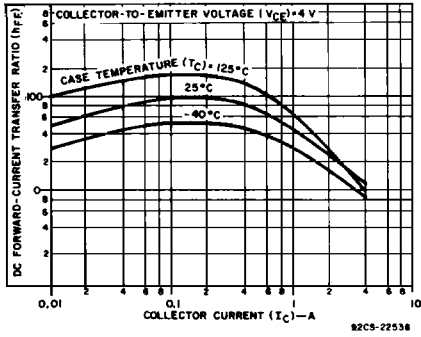


Fig. 7 - Typical dc beta characteristics for 2N6473 and 2N6474.

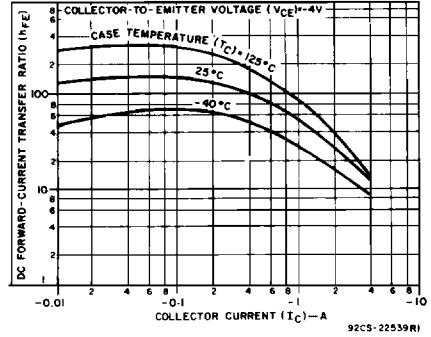


Fig. 8 - Typical dc beta characteristics for 2N6475 and 2N6476.

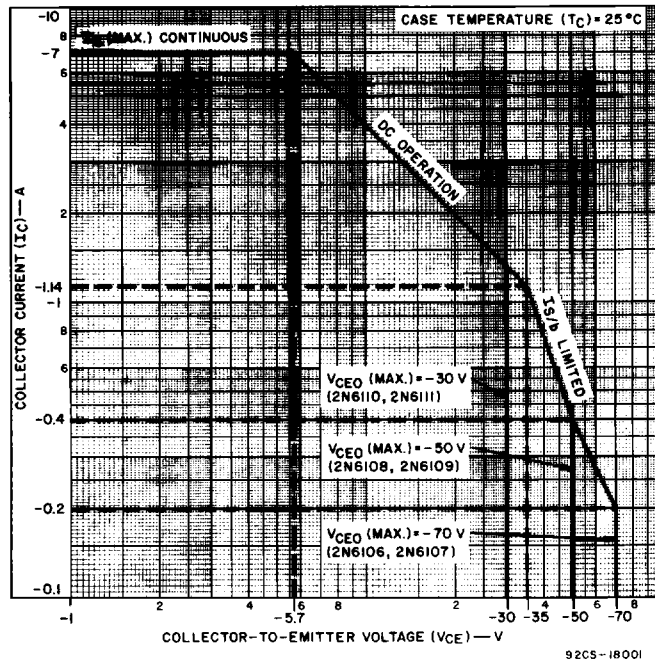


Fig. 9 - Maximum operating areas for 2N6106 - 2N6111 ($T_C = 25^\circ C$).

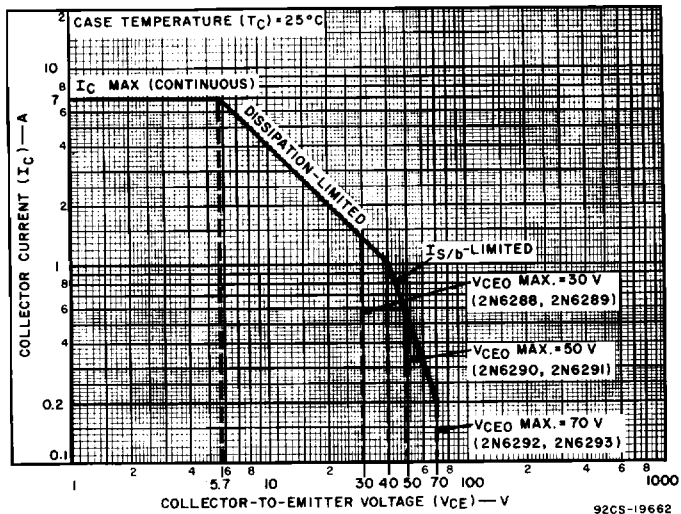


Fig. 10 - Maximum operating areas for 2N6288-2N6293 ($T_C = 25^\circ C$).

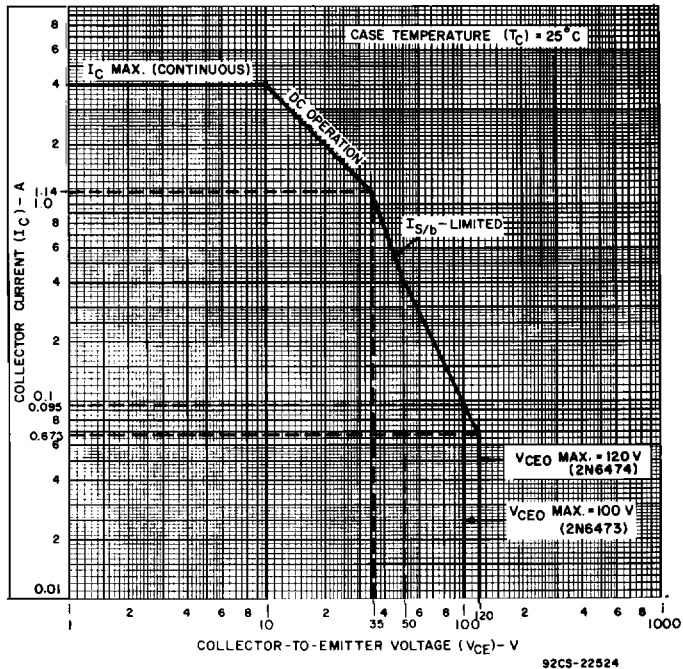


Fig. 11 - Maximum operating areas for 2N6473 and 2N6474 ($T_C = 25^\circ C$).

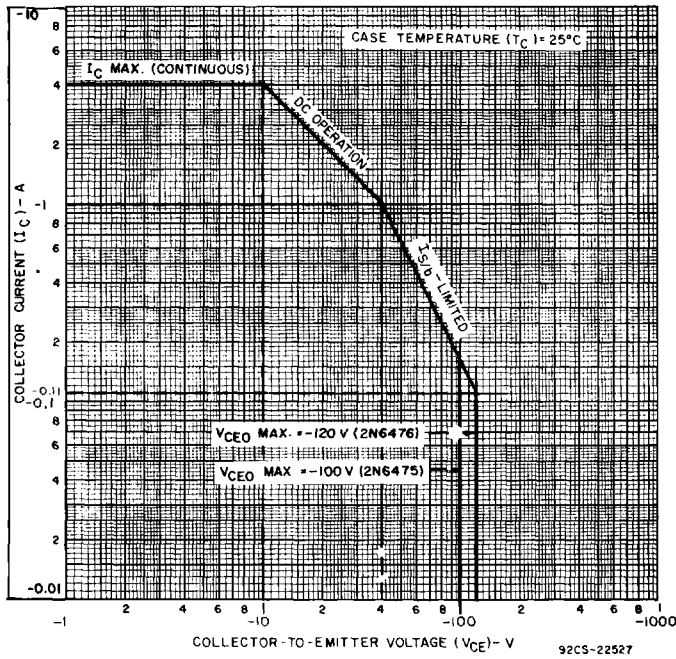


Fig. 12 - Maximum operating areas for 2N6475 - 2N6476 ($T_C = 25^\circ C$).

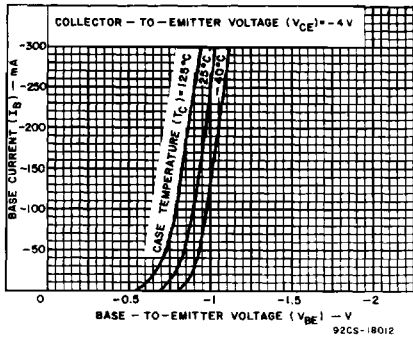


Fig. 13 - Typical input characteristics for 2N6106 - 2N6111, 2N6475, and 2N6476.

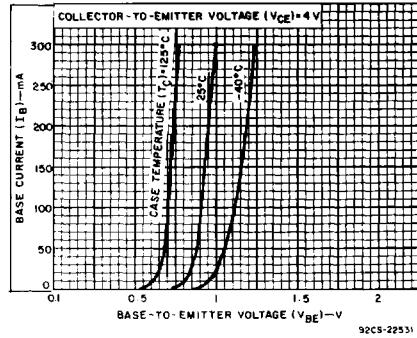


Fig. 14 - Typical input characteristics for 2N6288 - 2N6293.

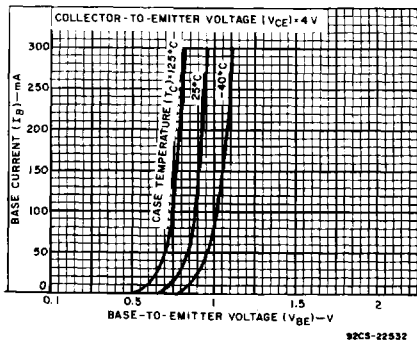


Fig. 15 - Typical input characteristics for 2N6473 - 2N6474.

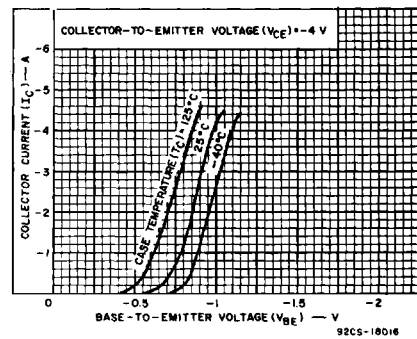


Fig. 16 - Typical transfer characteristics for 2N6106 - 2N6111.

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

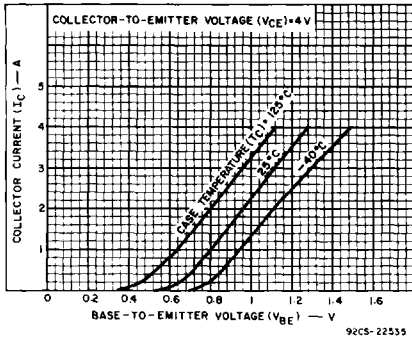


Fig. 17 - Typical transfer characteristics for 2N6288 - 2N6293.

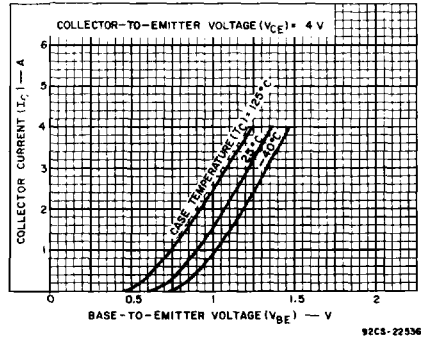


Fig. 18 - Typical transfer characteristics for 2N6473 and 2N6474.

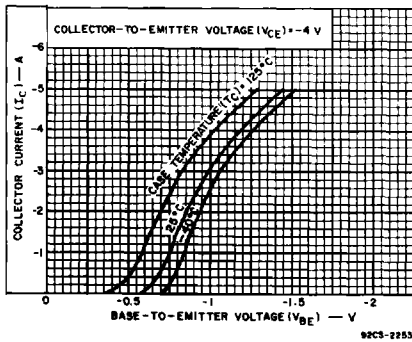


Fig. 19 - Typical transfer characteristics for 2N6475 and 2N6476.

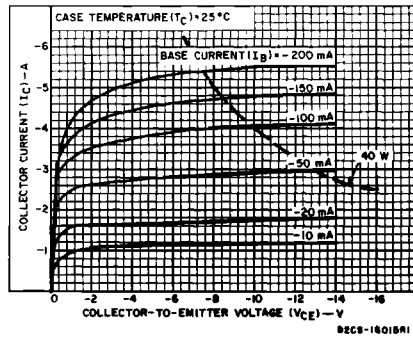


Fig. 20 - Typical output characteristics for 2N6106 - 2N6111.

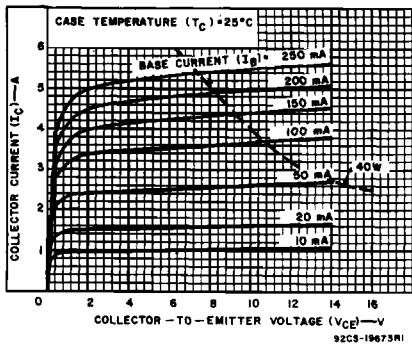


Fig. 21 - Typical output characteristics for 2N6288 - 2N6293.

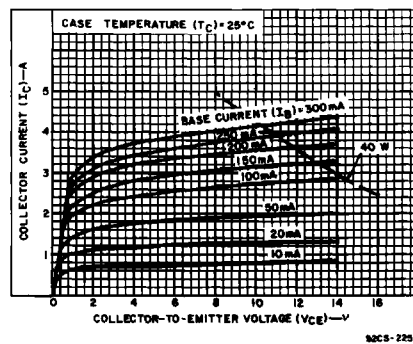


Fig. 22 - Typical output characteristics for 2N6473 and 2N6474.

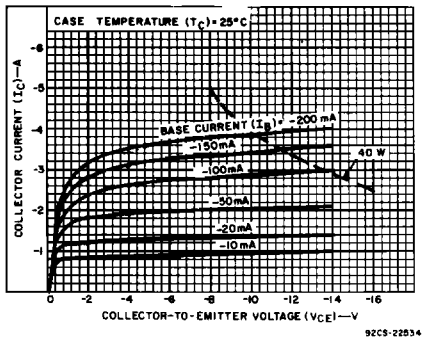


Fig. 23 - Typical output characteristics for 2N6475 and 2N6476.

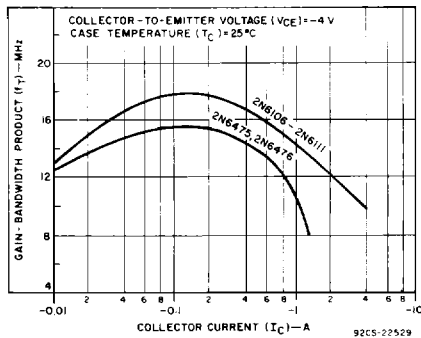


Fig. 24 - Typical gain-bandwidth product 2N6106 - 2N6111, 2N6475, and 2N6476.

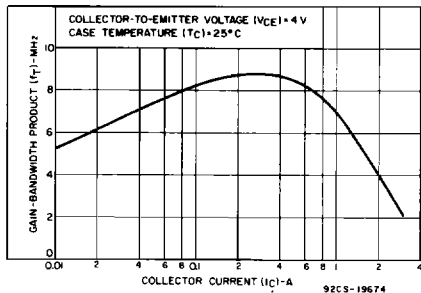


Fig. 25 - Typical gain-bandwidth product for 2N6288 - 2N6293.

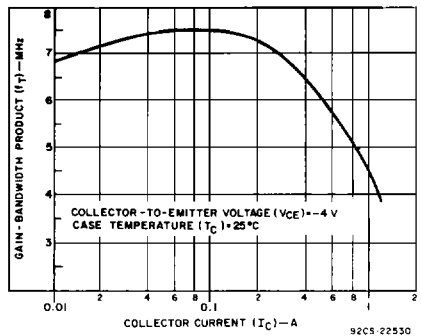


Fig. 26 - Typical gain-bandwidth product for 2N6473 and 2N6474.

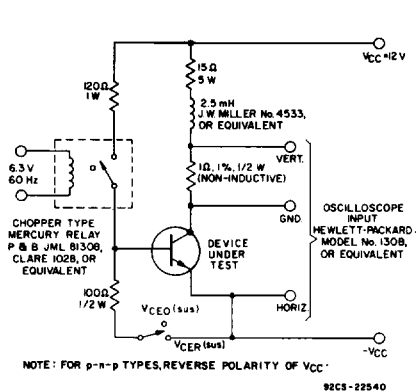
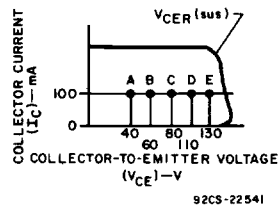


Fig. 27 - Circuit used to measure sustaining voltage $V_{CE}(sus)$ for all types.



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).