

3875081 G E SOLID STATE
General-Purpose Power Transistors

01E 17396 D T-35-19
T-37-17

2N5781, 2N5782, 2N5783, 2N5784, 2N5785, 2N5786

File Number 413

Silicon N-P-N and P-N-P Epitaxial-Base Complementary-Symmetry Transistors

General-Purpose Types for Switching and Linear-Amplifier Applications

Features:

- Low saturation voltages
- Maximum safe-area-of-operation curves
- High gain at high current
- High breakdown voltages

RCA-2N5781, 2N5782, and 2N5783 are epitaxial-base silicon p-n-p transistors -- complements of the silicon n-p-n types 2N5784, 2N5785, and 2N5786*, respectively.

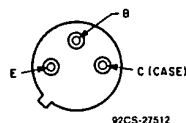
The three types in each family differ primarily in voltage ratings and saturation characteristics.

These transistors are intended for medium-power switching and complementary-symmetry audio amplifier applications.

All types are supplied in the JEDEC TO-205AD package.

- ♦ Formerly RCA Dev. Types TA7270, TA7271, TA7272, TA7289, TA7290, and TA7291 respectively.

TERMINAL DESIGNATIONS



JEDEC TO-205AD

MAXIMUM RATINGS, Absolute-Maximum Values:

		P-N-P	2N5781 [♦]	2N5782 [♦]	2N5783 [♦]	
		N-P-N	2N5784	2N5785	2N5786	
*COLLECTOR-TO-BASE VOLTAGE	V _{CBO}		80	65	45	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
* With external base-to-emitter resistance (R _{BE}) = 100 Ω	V _{CER(sus)}		80	65	45	V
With base open	V _{CEO(sus)}		65	50	40	V
*EMITTER-TO-BASE VOLTAGE	V _{EBO}		5	5	3.5	V
*CONTINUOUS COLLECTOR CURRENT	I _C		3.5	3.5	3.5	A
*CONTINUOUS BASE CURRENT	I _B		1	1	1	A
*TRANSISTOR DISSIPATION:						
At case temperatures up to 25°C	P _T		10	10	10	W
At ambient temperatures up to 25°C			1	1	1	W
At case temperatures above 25°C			0.057 W/°C, or see Fig. 7.			
At ambient temperatures above 25°C			0.0057			W/°C
*TEMPERATURE RANGE:						
Storage and operating (Junction)			-65 to +200			°C
*LEAD TEMPERATURE (During soldering):						
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.			230			°C

*In accordance with JEDEC registration data format JS-6 RDF-2.

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

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ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C unless otherwise specified

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CHARACTERISTIC	SYMBOL	TEST CONDITIONS [†]				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5781 p-n-p		2N5784 n-p-n		
		V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CER}	65				-	-10	-	10	μA
At T _C = 150°C		65				-	-1	-	1	mA
* With base-emitter junction reverse- biased and external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CEX}	-75	1.5			-	-10	-	-	μA
At T _C = 150°C		75	-1.5			-	-	-	10	mA
* With base open	I _{CEO}	50			0	-	-100	-	100	μA
* Emitter Cutoff Current	I _{EBO}		-5	0		-	-10	-	10	μA
* DC Forward-Current Transfer Ratio	h _{FE}	2		1 ^a		20	100	20	100	
		2		3.2 ^a		4	-	4	-	
* Collector-to-Emitter Sustaining Voltage (see Figs. 2 and 3): With base open	V _{CEO(sus)}			0.1 ^a	0	-65 ^b	-	65 ^b	-	V
With external base-to-emitter resistance (R _{BE}) = 100 Ω	V _{CER(sus)}			0.1 ^a		-80 ^b	-	80 ^b	-	V
* Base-to-Emitter Voltage	V _{BE}	2		1 ^a		-	-1.5	-	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case) ^c	V _{CE(sat)}			1 ^a	0.1	-	-0.5	-	0.5	V
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio ^d	h _{fe}									
f = 4 MHz		-2		-0.1		2	15	-	-	
f = 200 kHz	2		0.1				5	20		
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h _{fe}	2		0.1		25	-	25	-	
Saturated Switching Time (V _{CC} = 30 V, I _{B1} = I _{B2}):	t _{ON}			-1	-0.1	-	0.5	-	-	μs
Turn-on (t _d + t _r)				1	0.1	-	-	-	5	
Turn-off (t _s + t _f)	t _{OFF}			-1	-0.1	-	2.5	-	-	15
				1	0.1	-	-	-	15	
Thermal Resistance: Junction-to-case	R _{θJC}					-	17.5	-	17.5	°C/W
Junction-to-ambient	R _{θJA}					-	175	-	175	

* In accordance with JEDEC registration data format JS-6 RDF-2.

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

^a Pulsed, pulse duration = 300 μs, duty factor = 1.8%

^c Lead resistance is critical in this test.

^b CAUTION: Sustaining voltages V_{CEO(sus)}, and V_{CER(sus)} MUST NOT be measured on a curve tracer.

^d Measured at a frequency where |h_{fe}| is decreasing at approximately 6 dB per octave.

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ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C unless otherwise specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS [†]				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5782 p-n-p		2N5785 n-p-n		
		V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CER}	50				-	-10	-	10	μA
At T _C = 150°C		50				-	-1	-	1	mA
* With base-emitter junction reverse- biased and external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CEX}	-60	1.5			-	-10	-	-	μA
		60	-1.5			-	-	-	10	
* At T _C = 150°C		-60	1.5			-	-1	-	-	mA
		60	-1.5			-	-	-	1	
* With base open	I _{CEO}	35			0	-	-100	-	100	μA
* Emitter Cutoff Current	I _{EBO}		-5	0		-	-10	-	10	μA
* DC Forward-Current Transfer Ratio	h _{FE}	2		1.2 ^a		20	100	20	100	
		2		3.2 ^a		4	-	4	-	
* Collector-to-Emitter Sustaining Voltage (see Figs. 2 and 3): With base open	V _{CEO(sus)}			0.1 ^a	0	-50 ^b	-	50 ^b	-	V
With external base-to-emitter resistance (R _{BE}) = 100 Ω	V _{CER(sus)}			0.1 ^a		-65 ^b	-	65 ^b	-	
* Base-to-Emitter Voltage	V _{BE}	2		1.2 ^a		-	-1.5	-	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case) ^c	V _{CE(sat)}			1.2 ^a	0.12	-	-0.75	-	0.75	V
				3.2 ^a	0.8	-	-2	-	2	
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio ^d f = 4 MHz	h _{fe}	-2		-0.1		2	15	-	-	
f = 200 kHz		2		0.1		-	-	5	20	
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h _{fe}	2		0.1		25	-	25	-	
Saturated Switching Time (V _{CC} = 30 V, I _{B1} = I _{B2}):										
Turn-on (t _d + t _r)	t _{ON}			-1	-0.1	-	0.5	-	-	μs
				1	0.1	-	-	-	5	
Turn-off (t _s + t _f)	t _{OFF}			-1	-0.1	-	2.5	-	-	
				1	0.1	-	-	-	15	
Thermal Resistance:										
Junction-to-case	R _{θJC}						17.5	-	17.5	°C/W
Junction-to-ambient	R _{θJA}						-	175	-	175

* In accordance with JEDEC registration data format JS-6 RDF-2.

^a Pulsed, pulse duration = 300 μs, duty factor = 1.8%.

^b CAUTION: Sustaining voltages V_{CEO(sus)}, and V_{CER(sus)} MUST NOT be measured on a curve tracer.

[†] For p-n-p devices, voltage and current values are negative.

^c Lead resistance is critical in this test.

^d Measured at a frequency where |h_{fe}| is decreasing at approximately 6 dB per octave.

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ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C unless otherwise specified

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CHARACTERISTIC	SYMBOL	TEST CONDITIONS [♦]				LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc		2N5783 p-n-p		2N5786 n-p-n		
		V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	
Collector Cutoff Current: With external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CER}	40				-	-10	-	10	μA
At T _C = 150°C		40				-	-1	-	1	mA
* With base-emitter junction reverse- biased and external base-to-emitter resistance (R _{BE}) = 100 Ω	I _{CEX}	-45	1.5			-	-10	-	-	μA
		45	-1.5			-	-	-	10	
* At T _C = 150°C	I _{CEX}	-45	1.5			-	-1	-	-	mA
		45	-1.5			-	-	-	1	
* With base open	I _{CEO}	25			0	-	-100	-	100	μA
* Emitter Cutoff Current	I _{EBO}		-3.5	0		-	-10	-	10	μA
* DC Forward-Current Transfer Ratio	h _{FE}	2		1.6 ^a		20	100	20	100	
		2		3.2 ^a		4	-	4	-	
* Collector-to-Emitter Sustaining Voltage (see Figs. 2 and 3): With base open	V _{CEO(sus)}			0.1 ^a	0	-40 ^b	-	40 ^b	-	V
With external base-to-emitter resistance (R _{BE}) = 100 Ω	V _{CER(sus)}			0.1 ^a		-45 ^b	-	45 ^b	-	
* Base-to-Emitter Voltage	V _{BE}	2		1.6 ^a		-	-1.5	-	1.5	V
* Collector-to-Emitter Saturation Voltage (measured 0.25 in (6.35 mm) from case) ^c	V _{CE(sat)}			1.6 ^a	0.16	-	-1	-	1	V
				3.2 ^a	0.8	-	-2	-	2	
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio ^d	h _{fe}									
f = 4 MHz		-2		-0.1		2	15	-	-	
f = 200 kHz	2		0.1		-	-	5	20		
* Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h _{fe}	2		0.1		25	-	25	-	
Saturated Switching Time (V _{CC} = 30 V, I _{B1} = I _{B2}):										
Turn-on (t _d + t _r)	t _{ON}			-1	-0.1	-	0.5	-	-	μs
				1	0.1	-	-	-	5	
Turn-off (t _s + t _f)	t _{OFF}			-1	-0.1	-	2.5	-	-	
				1	0.1	-	-	-	15	
Thermal Resistance :										
Junction-to-case	R _{θJC}						17.5	-	17.5	°C/W
Junction-to-ambient	R _{θJA}						-	175	-	175

* In accordance with JEDEC registration data format JS-6 RDF-2.

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

^a Pulsed, pulse duration = 300 μs, duty factor = 1.8%.

^c Lead resistance is critical in this test.

^b CAUTION: Sustaining voltages V_{CEO(sus)}, and V_{CER(sus)} MUST NOT be measured on a curve tracer.

^d Measured at a frequency where |h_{fe}| is decreasing at approximately 6 dB per octave.

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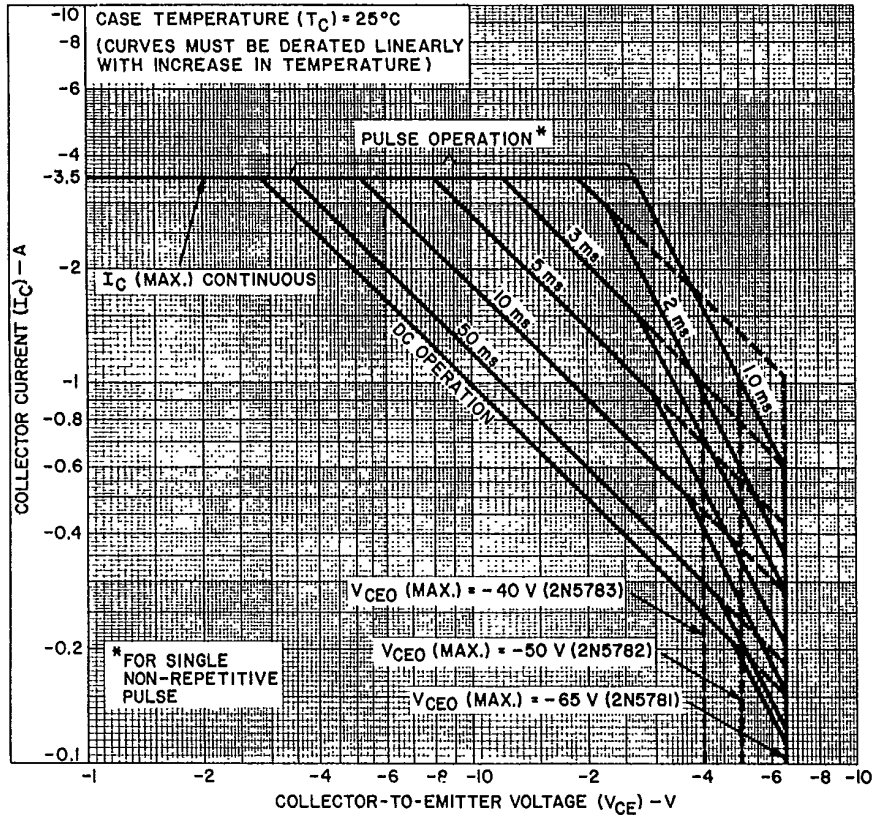
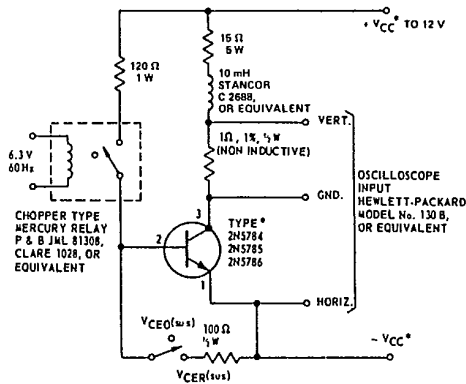


Fig. 1 - Maximum operating areas for types 2N5781, 2N5782, and 2N5783.

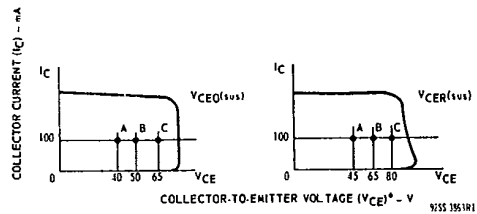
92CS-23943



* FOR P-N-P TYPES 2N5781, 2N5782, & 2N5783, REVERSE POLARITY OF V_{CC} .

92SS 3862R2

Fig. 2 - Circuit used to measure sustaining voltages $V_{CE(sus)}$ and $V_{CE(sus)}$.



* FOR TYPES 2N5781, 2N5782, AND 2N5783, THE VALUES FOR I_C AND V_{CE} ARE NEGATIVE.

The sustaining voltages $V_{CE0(sus)}$ and $V_{CE(sus)}$ are acceptable when the trace fails to the right and above point "A" (2N5783 & 2N5786), "B" (2N5782 & 2N5785), or "C" (2N5781 & 2N5784).

Fig. 3 - Oscilloscope display for measurement of sustaining voltages. (Test circuit shown in Fig. 2).

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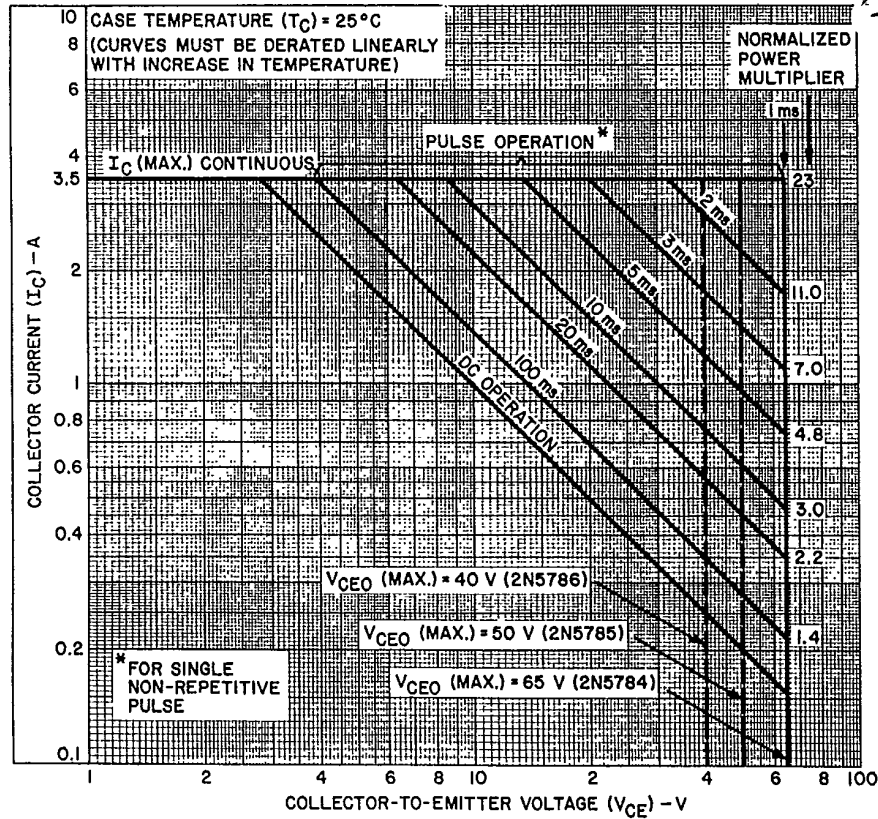


Fig. 4 - Maximum operating areas for types 2N5784, 2N5785, and 2N5786.

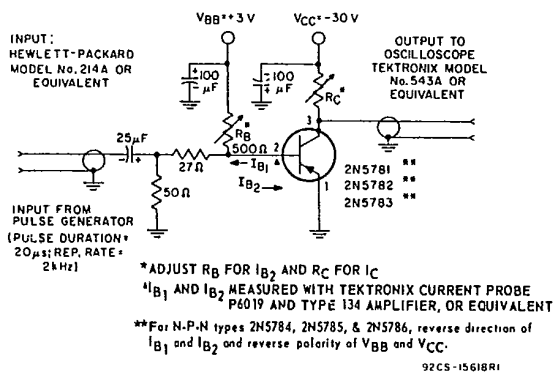


Fig. 5 - Circuit used to measure saturated switching times.

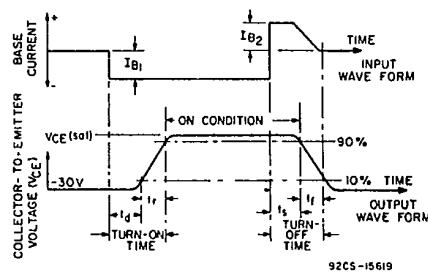


Fig. 6 - Oscilloscope display for measurement of switching times. (Test circuit shown in Fig. 5).

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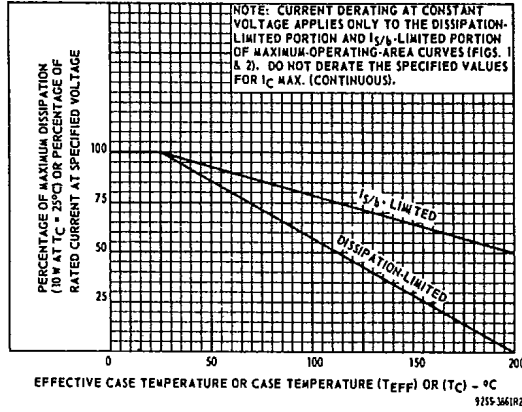


Fig. 7 - Dissipation derating curve for all types.

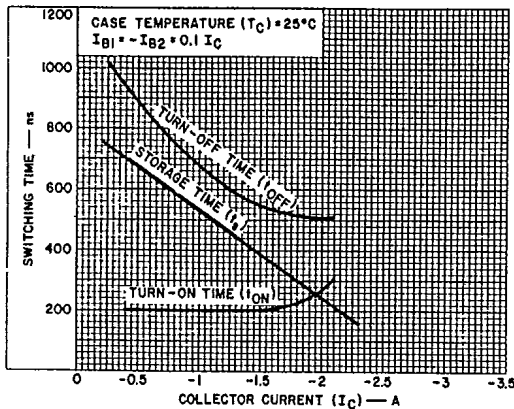


Fig. 8 - Typical saturated switching characteristics for types 2N5781, 2N5782, and 2N5783.

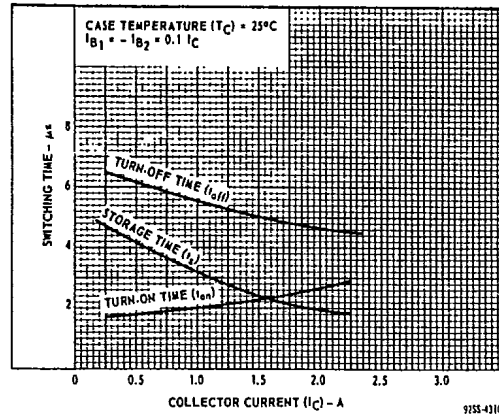


Fig. 9 - Typical saturated switching characteristics for types 2N5784, 2N5785, and 2N5786.

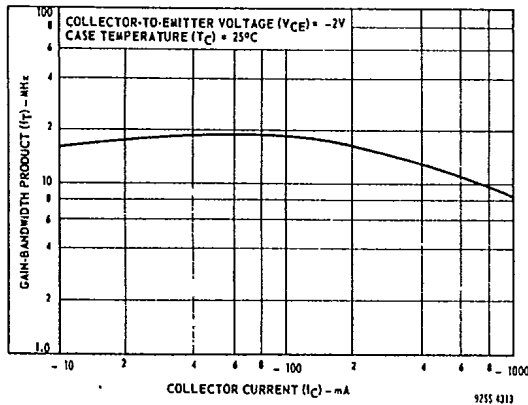


Fig. 10 - Typical gain-bandwidth product for types 2N5781, 2N5782, and 2N5783.

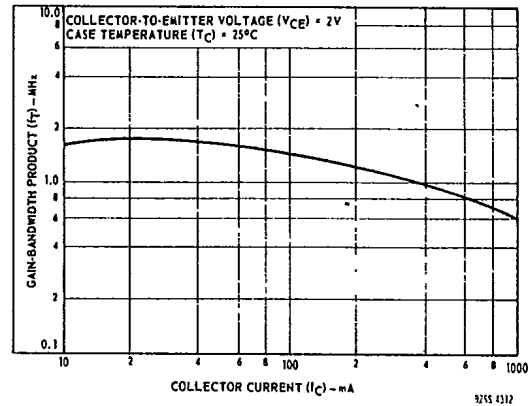


Fig. 11 - Typical gain-bandwidth product for types 2N5784, 2N5785, and 2N5786.

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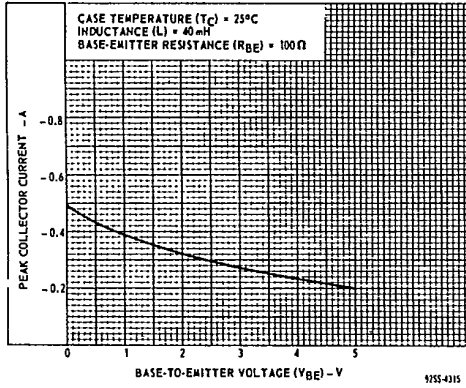


Fig. 12 - Reverse-bias second-breakdown characteristics for types 2N5781, 2N5782, and 2N5783.

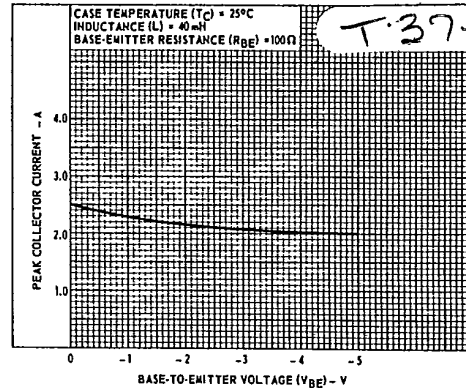


Fig. 13 - Reverse-bias second-breakdown characteristics for types 2N5784, 2N5785, and 2N5786.

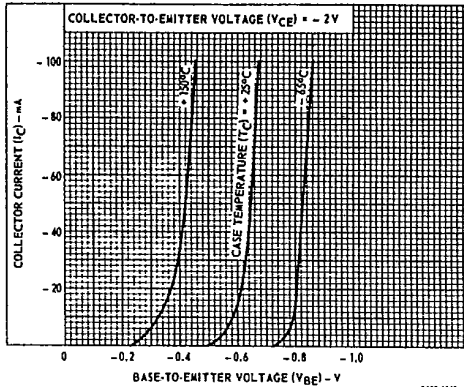


Fig. 14 - Typical transfer characteristics for types 2N5781, 2N5782, and 2N5783.

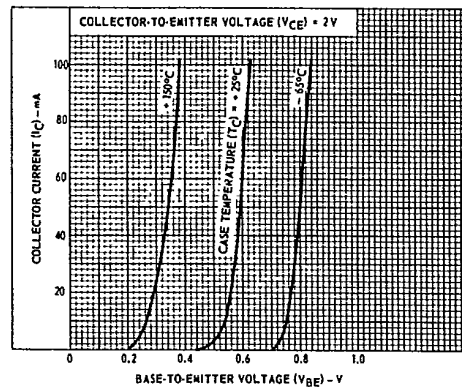


Fig. 15 - Typical transfer characteristics for types 2N5784, 2N5785, and 2N5786.

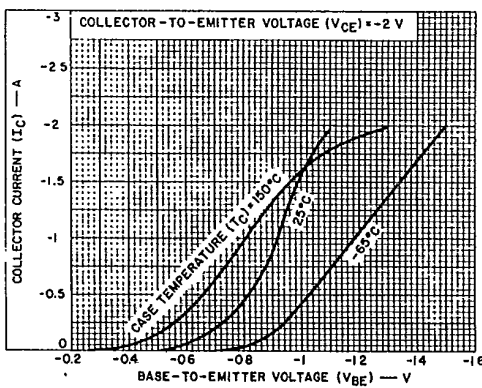


Fig. 16 - Typical transfer characteristics for types 2N5781, 2N5782, and 2N5783.

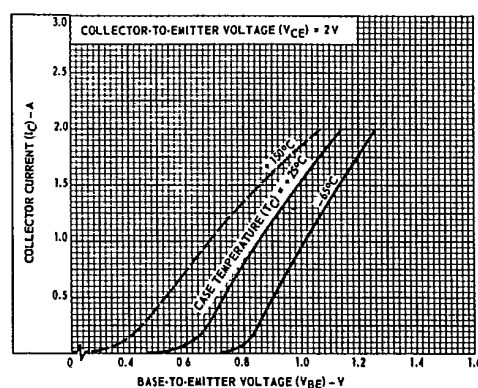


Fig. 17 - Typical transfer characteristics for types 2N5784, 2N5785, and 2N5786.

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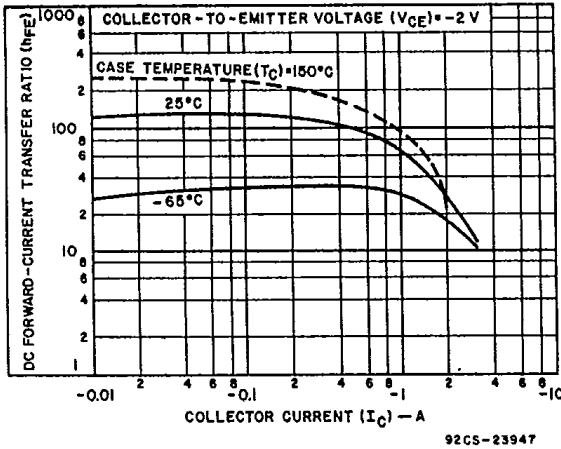


Fig. 18 - Typical dc beta characteristics for type 2N5781.

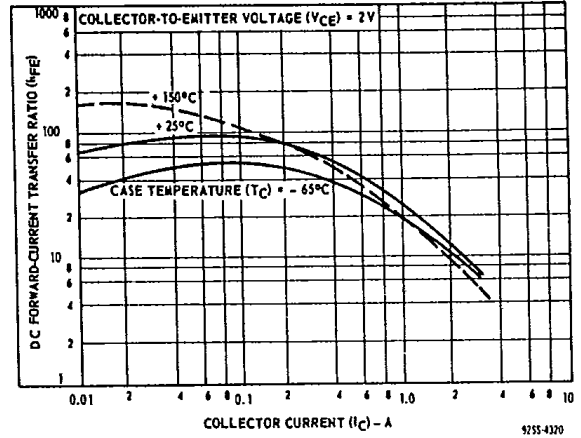


Fig. 19 - Typical dc beta characteristics for type 2N5784.

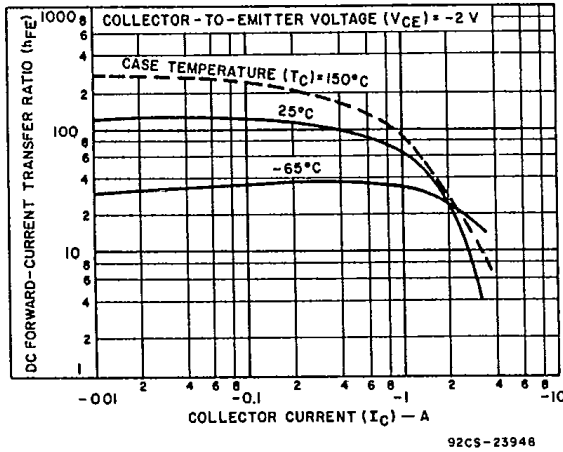


Fig. 20 - Typical dc beta characteristics for type 2N5782.

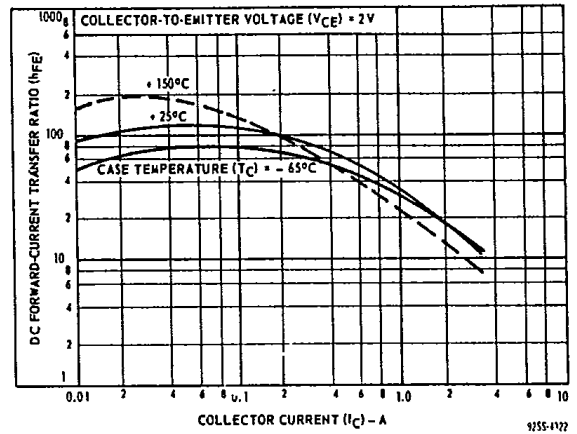


Fig. 21 - Typical dc beta characteristics for type 2N5785.

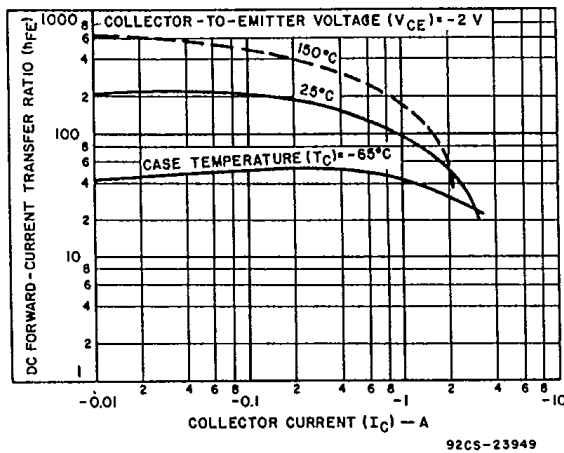


Fig. 22 - Typical dc beta characteristics for type 2N5783.

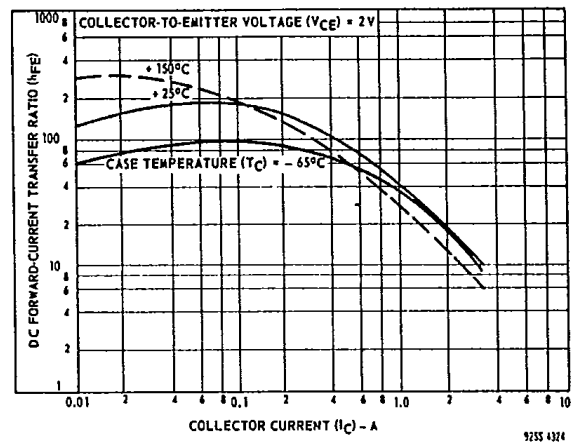


Fig. 23 - Typical dc beta characteristics for type 2N5786.

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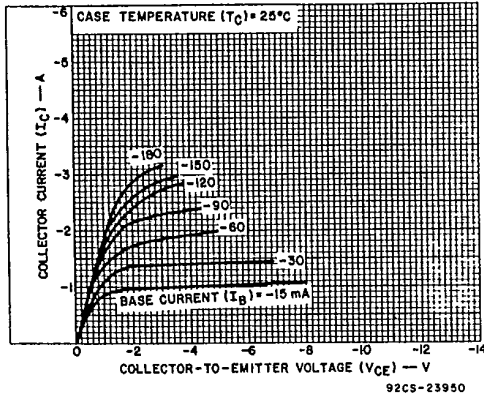


Fig. 24 - Typical output characteristics for type 2N5781.

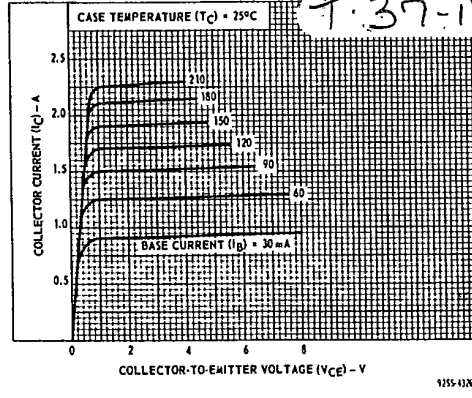


Fig. 25 - Typical output characteristics for type 2N5784.

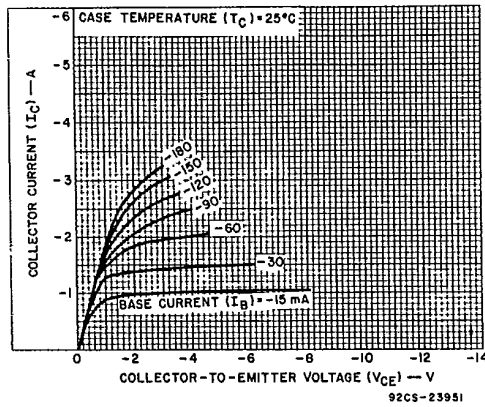


Fig. 26 - Typical output characteristics for type 2N5782.

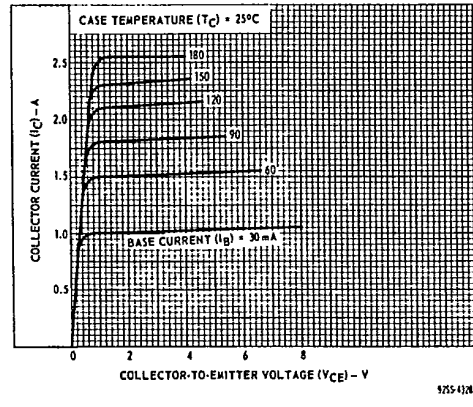


Fig. 27 - Typical output characteristics for type 2N5785.

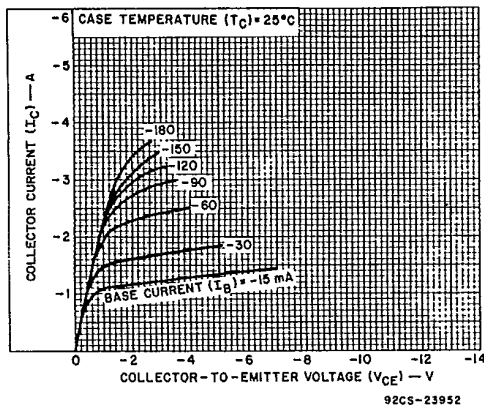


Fig. 28 - Typical output characteristics for type 2N5783.

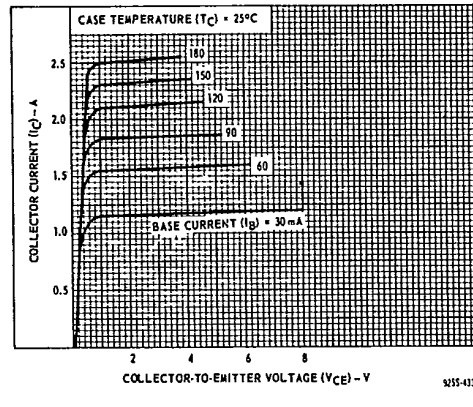


Fig. 29 - Typical output characteristics for type 2N5786.

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2N5781, 2N5782, 2N5783, 2N5784, 2N5785, 2N5786

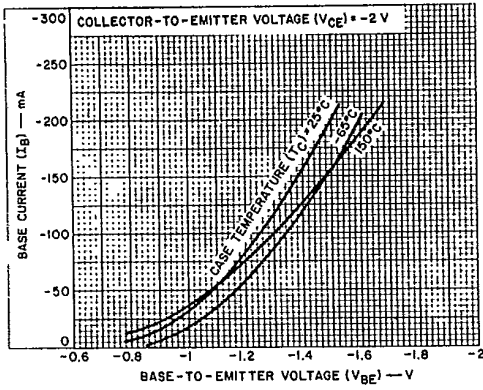


Fig. 30 - Typical input characteristics for type 2N5781.

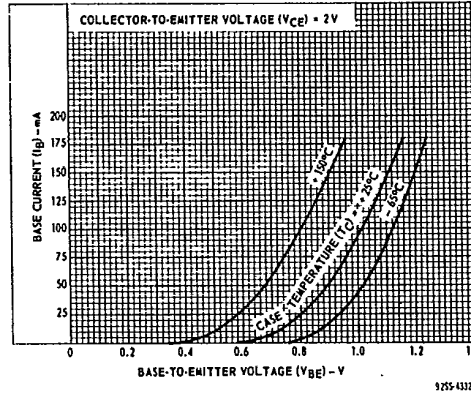


Fig. 31 - Typical input characteristics for type 2N5784.

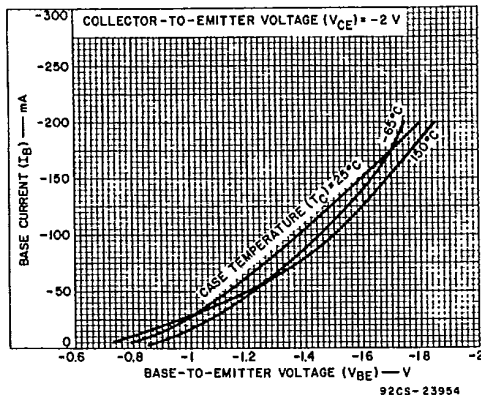


Fig. 32 - Typical input characteristics for type 2N5782.

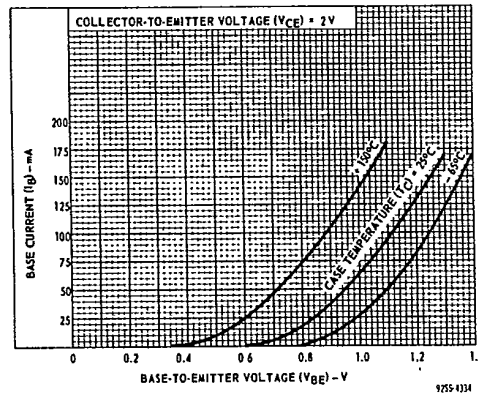


Fig. 33 - Typical input characteristics for type 2N5785.

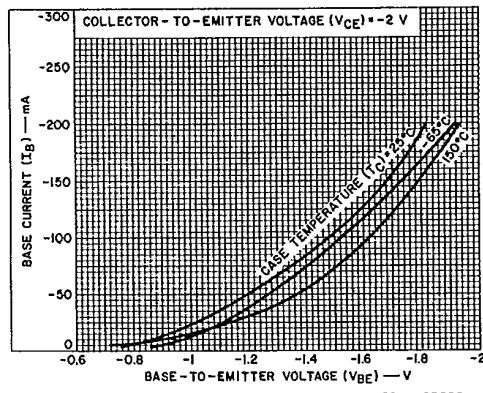


Fig. 34 - Typical input characteristics for type 2N5783.

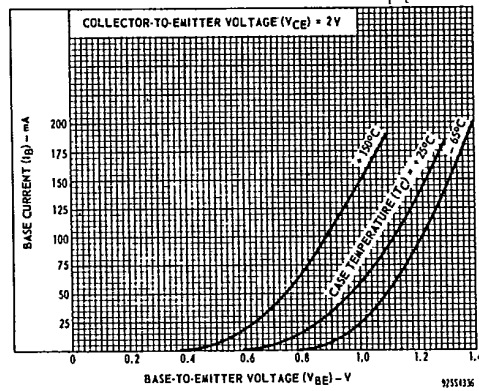


Fig. 35 - Typical input characteristics for type 2N5786.