

2N5838, 2N5839, 2N5840

File Number 410

High-Voltage, High-Power Silicon N-P-N Power Transistors

For Switching and Linear Applications in Military, Industrial, and Commercial Equipment

Features:

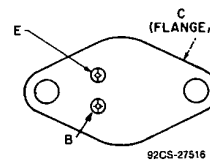
- Maximum safe-area-of-operation curves
- Low saturation voltages
- High voltage ratings
 - $V_{CER(SUS)} = 375 \text{ V [2N5840]}$
 - 300 V [2N5839]
 - 275 V [2N5838]
- High dissipation rating
 - $P_T = 100 \text{ W}$

RCA-2N5838, 2N5839 and 2N5840** are epitaxial silicon n-p-n power transistors. These devices employ the popular JEDEC TO-204AA package; they differ mainly in voltage, current-gain, and $V_{CE(sat)}$ ratings.

Featuring high breakdown voltage ratings and low-saturation voltage values, the 2N5838, 2N5839 and 2N5840 are especially suitable for use in inverters, deflection circuits, switching regulators, high-voltage bridged amplifiers, ignition circuits, and other high-voltage switching applications.

** Formerly RCA Dev. types TA7513, TA7530, and TA7420 respectively.

TERMINAL DESIGNATIONS



JEDEC TO-204AA

MAXIMUM RATINGS, Absolute-Maximum Values:

	2N5838	2N5839	2N5840	
*COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	275	300	375	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open $V_{CEO(SUS)}$	250	275	350	V
* With reverse bias (V_{BE}) of -1.5 V, (V_{CEV}) (SUS) *	275	300	375	V
With external base-to-emitter resistance (R_{BE}) $\leq 50 \Omega$, $V_{CER(SUS)}$	275	300	375	V
*EMITTER-TO-BASE VOLTAGE, V_{EBD}	6	6	6	V
*COLLECTOR CURRENT, I_C				
Continuous	3	3	3	A
Peak	5	5	5	A
*CONTINUOUS BASE CURRENT, I_B	1.5	1.5	1.5	A
*TRANSISTOR DISSIPATION, P_T :				
At case temperature up to 25°C and V_{CE} up to 40 V	100	100	100	W
At case temperatures up to 25°C and V_{CE} above 40 V	See Fig. 1.			
At case temperatures up to 25°C and V_{CE} above 40 V	See Figs. 1 & 2.			
*TEMPERATURE RANGE:				
Storage and operating (Junction)	-65 to +200			°C
*PIN TEMPERATURE (During soldering):				
At distances $\geq 1/32$ in. (0.8 mm) from case for 10 s max	230			°C

* In accordance with JEDEC registration data format (JS-6, RDF-1).

* Shown as $V_{CEX(SUS)}$ in JEDEC Registration Data.

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Characteristic	Symbol	Test Conditions							Limits									Units
		DC Collector Voltage (V)	DC Emitter or Base Voltage (V)		DC Current (A)			Type 2N5838			Type 2N5839			Type 2N5840				
		V _{CE}	V _{EB}	V _{BE}	I _C	I _B	I _E	Min	Max	Typ	Min	Max	Typ	Min	Max	Typ.		
Collector-Cutoff Current: With base open	I _{CEO}	200 250						-	2	-	-	-	2	-	-	2	-	mA
With base-emitter junction reverse biased	I _{CEV}	265 290 360		-1.5 -1.5 -1.5				-	5	-	-	2	-	-	-	-	-	mA
With base-emitter junction reverse biased	I _{CEV} T _C 100 °C	265 290 360		1.5 1.5 1.5					8			5			-	5	-	mA
Emitter-Cutoff Current	I _{EBO}		-6						1			1				1	-	mA
Collector-to Emitter Sustaining Voltage (See Figs. 4, 5, & 6) With base open	V _{CE0(sus)} ^a				0.2			250 ^b			275 ^b	-		350 ^b	-		-	V
With base-emitter junction reversed biased	V _{CEx(sus)} ^a			1.5	0.1			275 ^b	-	-	300 ^b	-	-	375 ^b	-	-	-	V
With external base-to-emitter resistance (R _{BE}) = 50 Ω	V _{CER(sus)} ^a				0.2			275 ^b	-	-	300 ^b	-	-	375 ^b	-	-	-	V
Emitter-to-Base Voltage	V _{EBO}						0.02	6	-	-	6	-	-	6	-	-	-	V
DC Forward-Current Transfer Ratio	h _{FE}	5 3 2			0.5 ^b 2 ^b 3 ^b			20 - 8	- 40	- -	20 10 -	- 50 -	- -	20 10 -	- 50 -	- -	- -	
Base-to-Emitter Saturation Voltage	V _{BE(sat)}				2 3	0.2 0.375		-	2		-	2		-	2		-	V
Collector-to-Emitter Saturation Voltage	V _{CE(sat)}				2 3	0.2 0.375		-	1		-	1.5		-	1.5		-	V
Output Capacitance (At 1 MHz)	C _{obo}		10d				0	150			150	-	-	150		-	pF	
Magnitude of Common-Emitter, Small-Signal, Short Circuit, Forward Current Transfer Ratio (f = 1 MHz)	h _{fe}	10			0.2			5			5			5		-		
Second Breakdown Collector Current (With base forward biased) Pulse duration (non-repetitive) 1 s	I _{S/bC}	40						2.5			2.5			2.5		-	A	
Switching Times: Delay	t _d	V _{CC} - 200			2 3	0.2 ^a 0.375 ^a		- -	- -	- 0.05	- -	- -	0.07	- -	- -	- -	0.07	
Rise	t _r	V _{CC} - 200			2 3	0.2 ^a 0.375 ^a		- 1.5	- 0.8	- -	1.5 -	0.6	- -	- -	1.75	-	0.6	
Storage	t _s	V _{CC} - 200			2 3	0.2 ^a 0.375 ^a		- 3.0	- 1.0	- -	- -	3.75 -	1.75	- -	- -	3.0	1.75	
Fall	t _f	V _{CC} - 200			2 3	0.2 ^a 0.375 ^a		- 1.5	- 0.4	- -	- -	1.5 -	0.35	- -	- -	1.5	0.35	
Thermal Resistance (Junction-to-Case)	θ _{J-C}	10			5			1.75	-	-	1.75	-	-	1.75		-	°C/W	

^a Pulsed; pulse duration ≤ 350 μs, Duty factor = 2%.^b CAUTION: The sustaining voltages V_{CE0(sus)}, V_{CEx(sus)} and V_{CER(sus)}, MUST NOT be measured on a curve tracer.^c I_{S/b} is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased for transistor operation in the active region.^d V_{CB}^e I_{B1} = I_{B2} = value shown.

* In accordance with JEDEC registration data format (JS-6 RDF-1).

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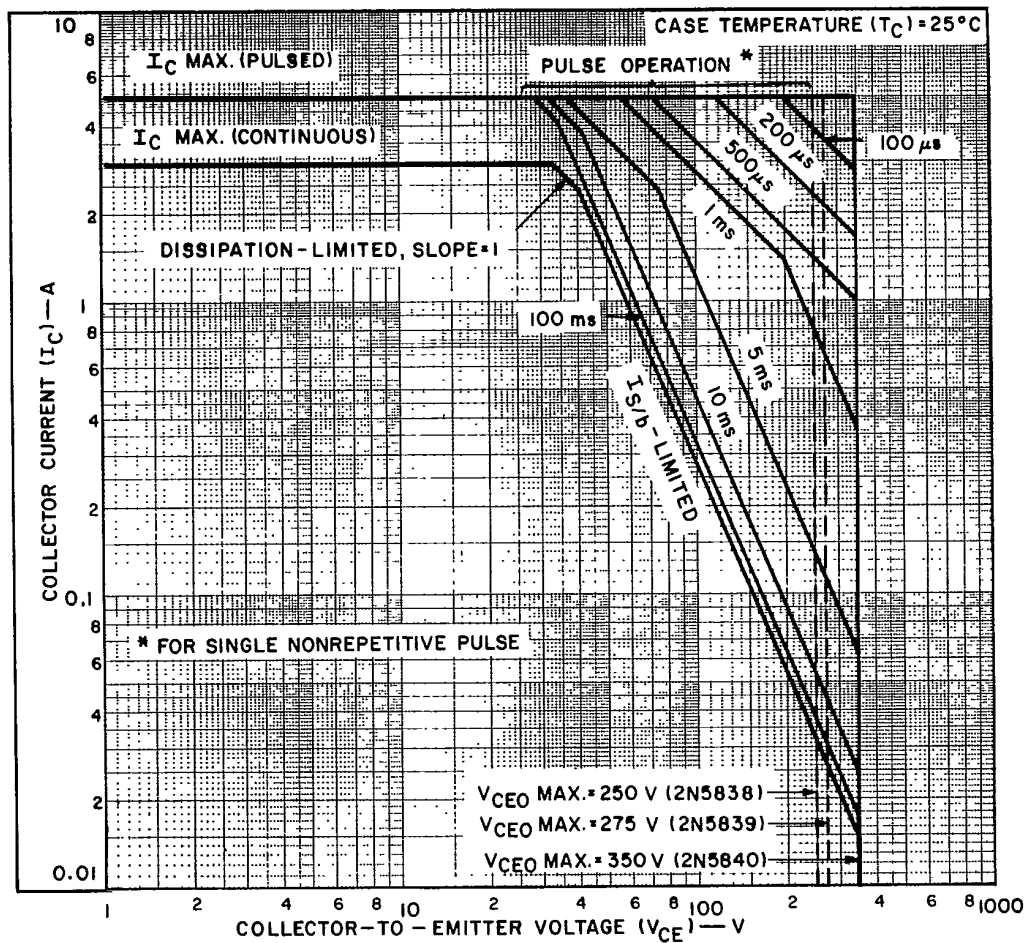


Fig. 1 — Maximum operating areas for all types.

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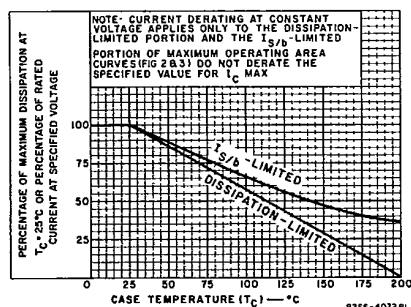


Fig. 2 — Derating curves for all types.

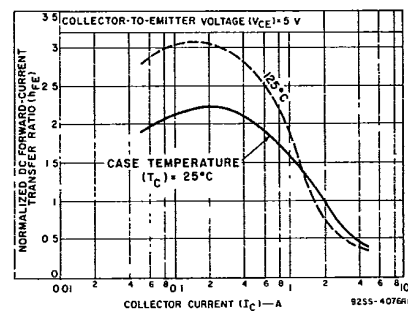
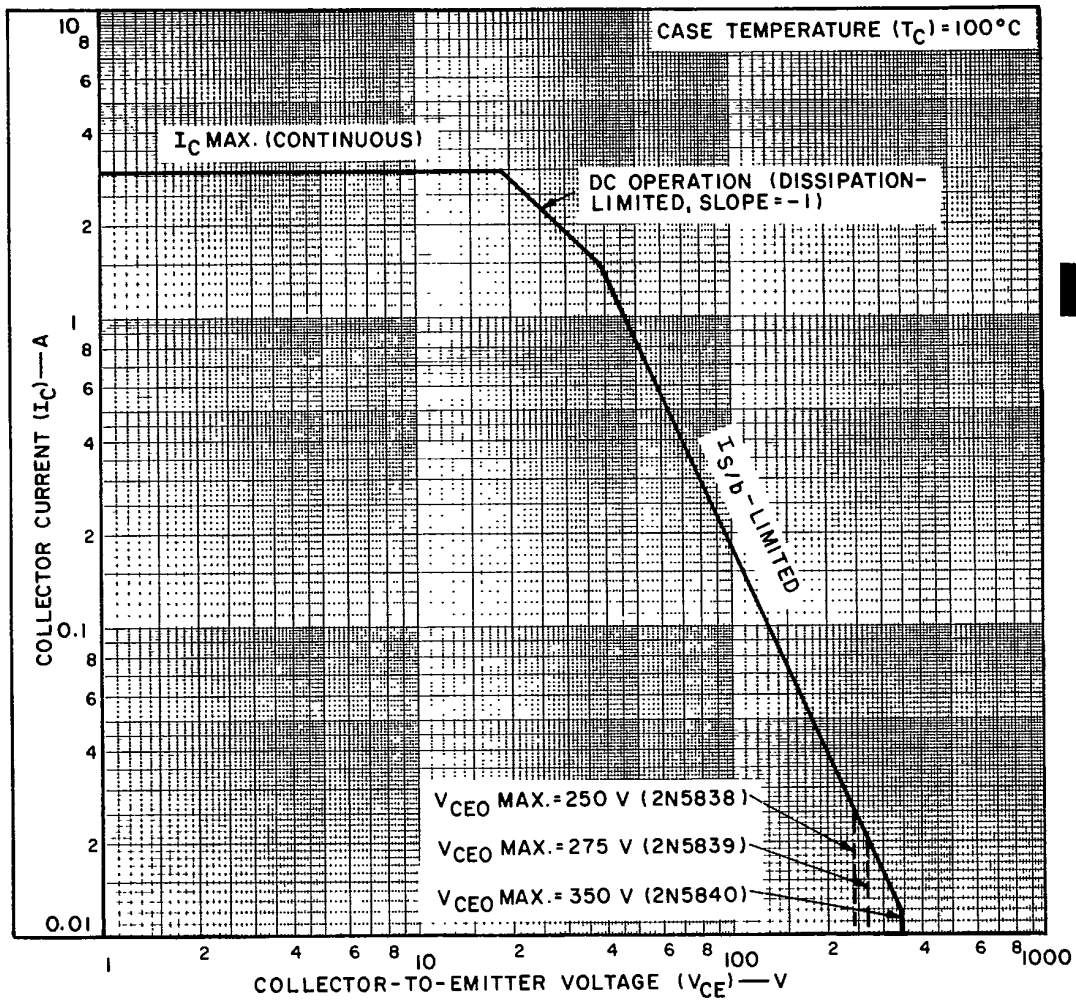


Fig. 3 — Typical normalized dc beta characteristics for all types.

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Fig. 4 — Maximum operating areas for all types.

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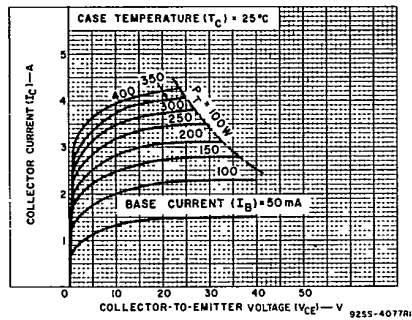


Fig. 5 — Typical output characteristics for all types.

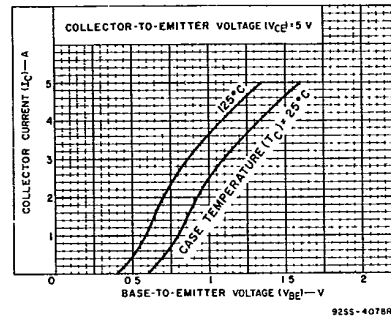


Fig. 6 — Typical transfer characteristics for all types.

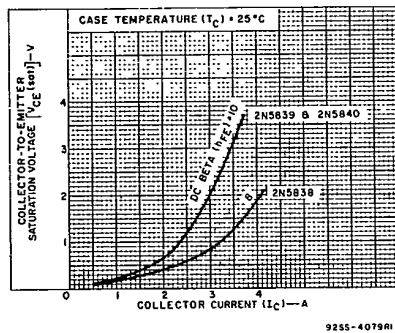


Fig. 7 — Typical saturation voltage characteristics for all types.

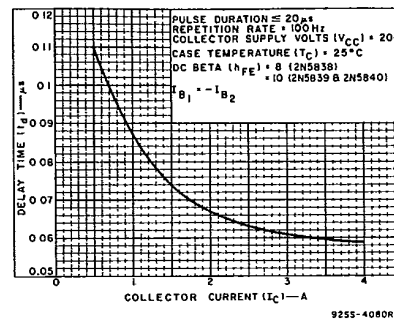


Fig. 8 — Typical delay-time characteristics for all types.

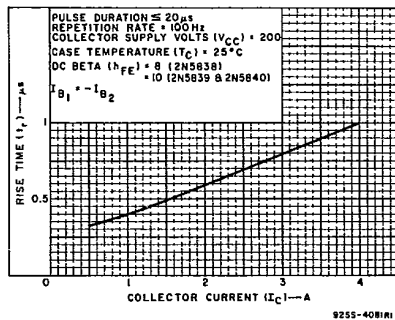


Fig. 9 — Typical rise-time characteristics for all types.

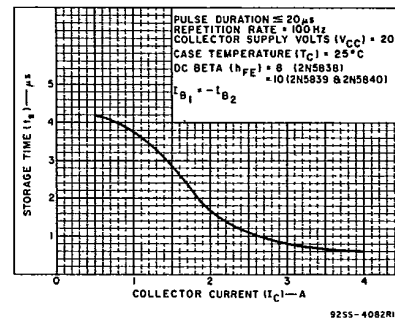


Fig. 10 — Typical storage-time characteristics for all types.

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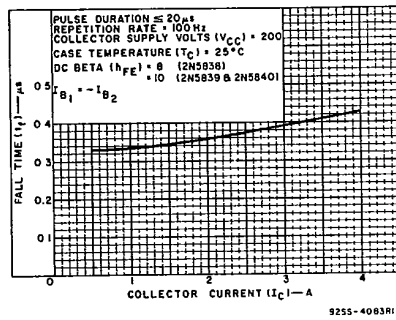


Fig. 11 — Typical fall-time characteristics for all types.

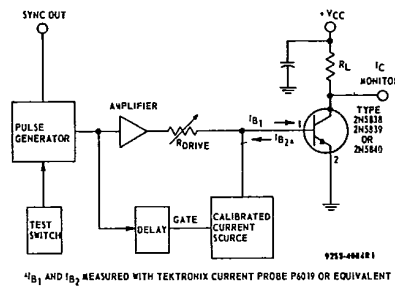


Fig. 12 — Circuit used to measure switching times for all types.

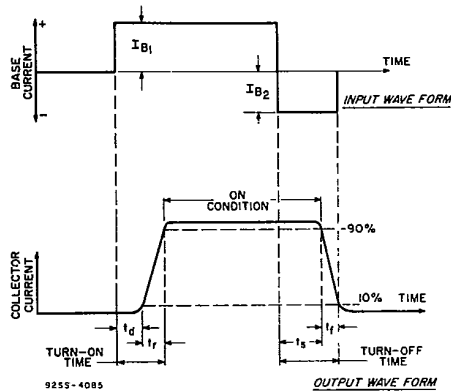


Fig. 13 — Phase relationship between input and output currents showing reference points for specification of switching times.

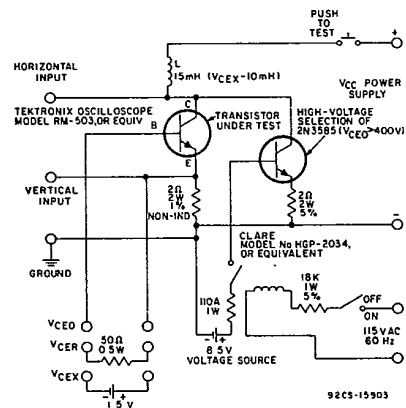
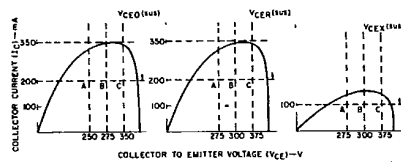


Fig. 14 — Circuit used to measure sustaining voltages $V_{CE(sus)}$, $V_{CER(sus)}$, and $V_{CEX(sus)}$ for all types.



The sustaining voltages $V_{CE(sus)}$, $V_{CER(sus)}$, and $V_{CEX(sus)}$ are acceptable when the traces fall to the right and above point "A" for type 2N5838, point "B" for type 2N5839, and point "C" for type 2N5840.

Fig. 15 — Oscilloscope display for measurement of sustaining voltages.