

2N6686, 2N6687, 2N6688
RJH6686, RJH6687, RJH6688

File Number 1171

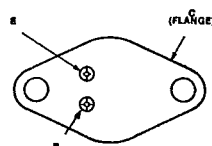
25-A SwitchMax Power Transistors

N-P-N Types for Power Supplies and Other High Voltage Switching Applications

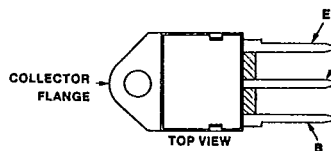
Features:

- High-temperature parameters guaranteed
- Fast switching speed
- Low $V_{CE(sat)}$

TERMINAL DESIGNATIONS



JEDEC TO-204AA



JEDEC TO-218AC

The RCA 2N6686, 2N6687 and 2N6688*, RJH6686, RJH6687, and RJH6688 SwitchMax series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings. They are specially designed for converters, inverters, pulse-width-modulated regulators and a variety of power switching circuits. These high-current, high-speed transistors are 100-percent tested for parameters that are essential to the design of high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are

guaranteed at 125°C as well as at 25°C, to provide information necessary for worst-case design.

The 2N6686, 2N6687, and 2N6688 transistors are supplied in steel JEDEC TO-204AA hermetic packages. The RJH6686, RJH6687, and RJH6688 transistors are supplied in JEDEC TO-218AC plastic packages.

*Formerly RCA Dev. Type Nos. TA9119A, TA9119B, TA9119C, respectively.

MAXIMUM RATINGS, Absolute-Maximum Values:

	RJH6686	RJH6687	RJH6688	2N6686	2N6687	2N6688	
* V_{CEV}							
$V_{BE} = -1.5$ V	260	280	300	260	280	300	V
* V_{CEX} (Clamped)							
$V_{BE} = -1.5$ V	210	230	250	210	230	250	V
* V_{CEO}	160	180	200	160	180	200	V
* V_{ESD}				8			V
$I_C(sat)$	25	25	20	25	25	20	A
* I_C	25	25	20	25	25	20	A
I_{CM}				50			A
* I_B				8			A
* P_T							
T_C up to 25°C			200				W
T_C above 25°C, derate linearly		1.6			1.14		W/°C
* T_{100} , T_J		-65 to 150			-65 to 200		°C
* T_L							
At distance $\geq 1/16$ in (1.58 mm) from seating plane for 10 s max.					235		°C
T_L							
At distance $\geq 1/8$ in (3.17 mm) from seating plane for 10 s max.		235					°C

* In accordance with JEDEC registration data (2N6686, 2N6687, 2N6688 only).

2N6686, 2N6687, 2N6688
RJH6686, RJH6687, RJH6688ELECTRICAL CHARACTERISTICS $T_c = 25^\circ\text{C}$

T-33-15

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6686 RJH6686		2N6687 RJH6687		2N6688 RJH6688		
	V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	Min.	Max.	
I _{CEV}	260 280 300	-1.5 -1.5 -1.5	— — —	— — —	— — —	50 — —	— — —	— 50 —	— — 50	— — —	μA
I _{EBO}	—	-8	0	—	—	100	—	100	—	100	
V _{CE0(SUS)} ^b	—	—	0.2 ^a	0	160	—	180	—	200	—	V
h _{FE}	2 2 2 2	— — — —	1 ^a 10 ^a 20 ^a 25 ^a	— — — —	30 25 — 15	— 100 — —	30 25 — 15	— 100 — —	25 20 15 —	— 80 — —	—
V _{BE(sat)}	— —	— —	20 ^a 25 ^a	2 2.5	— —	— 1.8	— —	— 1.8	— —	1.8 —	V
V _{CE(sat)}	— —	— —	20 ^a 25 ^a	2 2.5	— —	— 1.5	— —	— 1.5	— —	1.5 —	
V _{CEX} ^b (Clamped E _{s,b}) L = 25 μH, R _{BB} = 10 Ω	—	-4	25	3	210	—	230	—	250	—	
I _{s,b} 2N6686, 2N6687, 2N6688	18	—	11.1	—	1	—	1	—	1	—	s
RJH6686, RJH6687, RJH6688	18	—	11.1	—	0.5	—	0.5	—	0.5	—	
h _{re} f = 5 MHz	10	—	1	—	4	20	4	20	4	20	—
f _T	10	—	1	—	20	100	20	100	20	100	MHz
C _{obo} f = 0.1 MHz	10 ^c	—	—	—	300	650	300	650	300	650	pF
t _d ^d	— —	-4 -4	20 25	2 2.5	— —	— 0.1	— —	— 0.1	— —	0.1 —	μs
t _r ^d	— —	-4 -4	20 25	2 2.5	— —	— 0.60	— —	— 0.60	— —	0.60 —	
t _s ^d	— —	-4 -4	20 25	2 ^e 2.5 ^e	— —	— 1.50	— —	— 1.50	— —	1.50 —	
t _f ^d	— —	-4 -4	20 25	2 ^e 2.5 ^e	— —	— 0.25	— —	— 0.25	— —	0.25 —	
t _c V _{CC} = 80 V, L = 25 μH, R _C ≤ 4 Ω, Collector clamped to V _{CEX}	— —	-4 -4	20 25	3 ^e 3 ^e	— —	— 0.5	— —	— 0.5	— —	0.5 —	

2N6686, 2N6687, 2N6688
 RJH6686, RJH6687, RJH6688

ELECTRICAL CHARACTERISTICS $T_C = 25^\circ\text{C}$

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CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6686 RJH6686		2N6687 RJH6687		2N6688 RJH6688		
	V _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	Min.	Max.	
I _{CEV}	260	-1.5	—	—	—	0.5	—	—	—	—	mA
	280	-1.5	—	—	—	—	—	0.5	—	—	
	300	-1.5	—	—	—	—	—	—	—	0.5	
V _{CE(sat)}	—	—	20 ^a	2	—	—	—	—	—	1.5	V
	—	—	25 ^a	2.5	—	1.5	—	1.5	—	—	
t _r ^d	—	-4	20	2	—	—	—	—	—	0.8	μs
	—	-4	25	2.5	—	0.8	—	0.8	—	—	
t _s ^d	—	-4	20	2	—	—	—	—	—	2.5	
	—	-4	25	2.5 ^e	—	2.5	—	2.5	—	—	
t _f ^d	—	-4	20	2	—	—	—	—	—	0.8	
	—	-4	25	2.5 ^e	—	0.8	—	0.8	—	—	
t _c V _{CC} = 80 V, L = 25 μH, R _C ≤ 4 Ω, Collector Clamped to V _{CEx}	—	-4	20	3 ^e	—	—	—	—	—	0.8	°C/W
	—	-4	25	3 ^e	—	0.8	—	0.8	—	—	
R _{θJC} 2N6686, 2N6687, 2N6688	10	—	5	—	—	0.875	—	0.875	—	0.875	°C/W
R _{θJC} RJH6686, RJH6687, RJH6688	10	—	5	—	—	0.625	—	0.625	—	0.625	

* In accordance with JEDEC registration data.

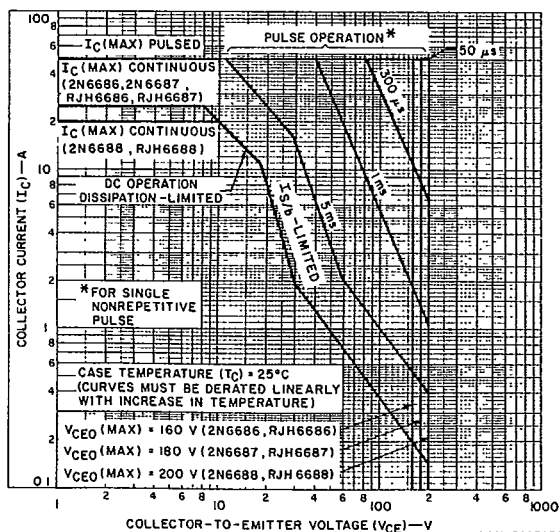
^a Pulsed: pulse duration = 300 μs , duty factor $\leq 2\%$.^b CAUTION: The sustaining voltage $V_{CE(sus)}$ and V_{CEX} MUST NOT be measured on a curve tracer.^c V_{CB} value.^d $V_{CC} = 80\text{ V}$, $t_p = 20\ \mu\text{s}$.^e $I_{B1} = -I_{B2}$.

Fig. 1 - Maximum operation areas of all types.
 $(T_C = 25^\circ)$.

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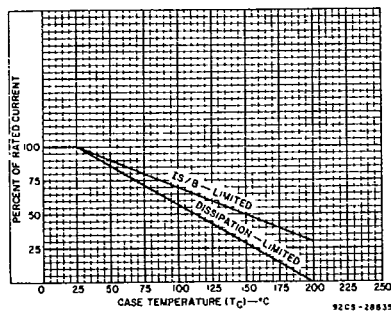


Fig. 2 - Dissipation and $I_{s,b}$ derating curves for 2N6686, 2N6687, and 2N6688.

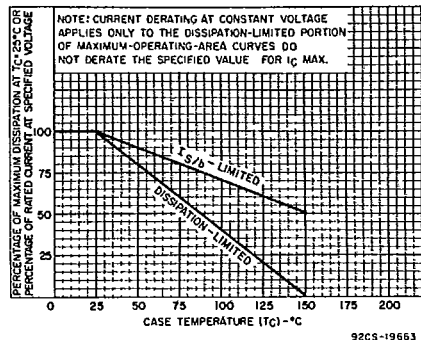


Fig. 3 - Dissipation and $I_{s,b}$ derating curves for RJH6686, RJH6687, and RJH6688.

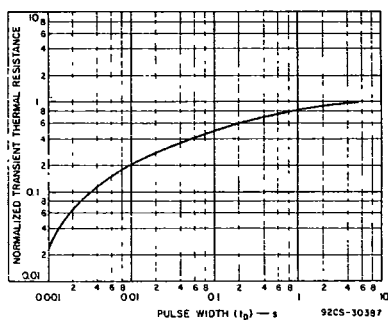


Fig. 4 - Typical thermal-response characteristic for all types.

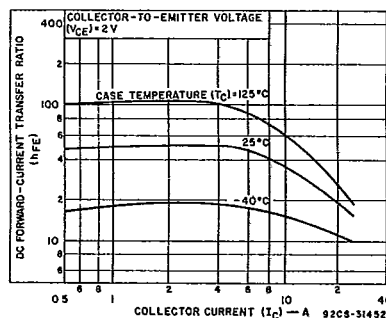


Fig. 5 - Typical dc beta characteristics for all types.

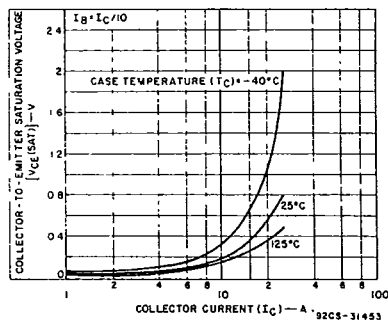


Fig. 6 - Typical collector-to-emitter saturation voltage characteristics for all types.

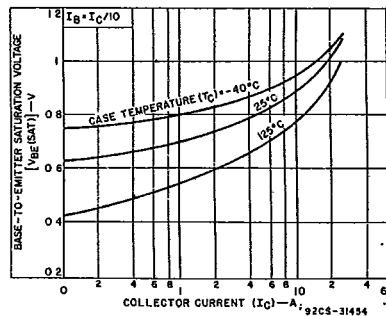


Fig. 7 - Typical base-to-emitter saturation voltage characteristic for all types.

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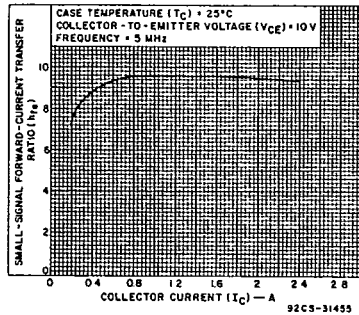


Fig. 8 - Typical small-signal forward-current transfer ratio characteristic for all types ($f = 5$ MHz).

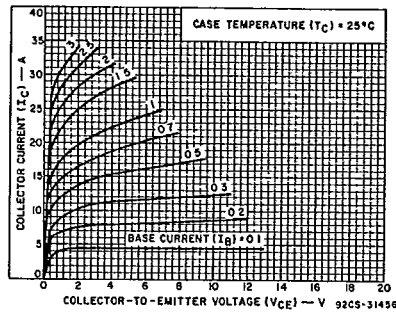


Fig. 9 - Typical output characteristics for all types.

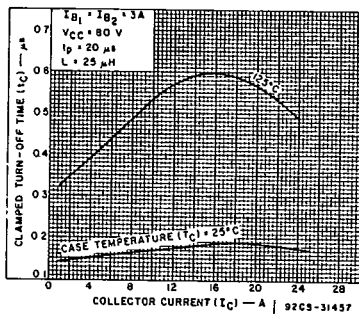


Fig. 10 - Typical clamped turn-off time characteristics for all types.

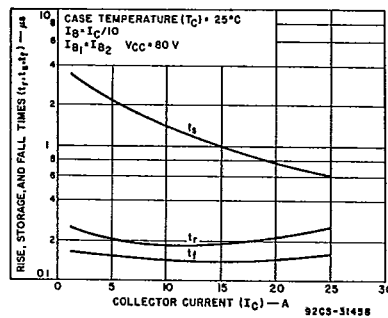


Fig. 11 - Typical saturated-switching-time characteristics as a function of collector current for all types.

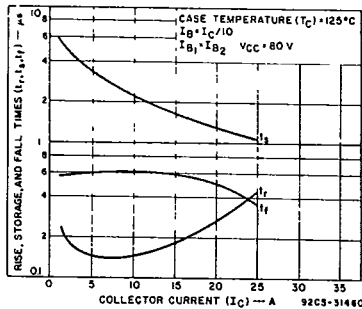


Fig. 12 - Typical saturated-switching-time characteristics at $T_C = 125^\circ\text{C}$ as a function of collector current for all types.

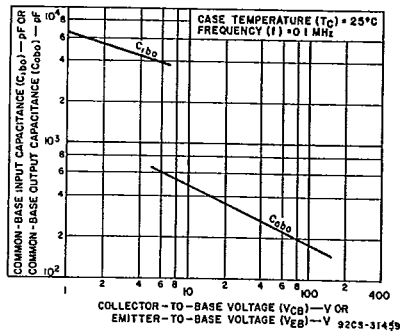


Fig. 13 - Typical common-base input (C_{ibo}) or output (C_{obo}) capacitance characteristic for all types.

2N6686, 2N6687, 2N6688

RJH6686, RJH6687, RJH6688

HARRIS SEMICONDUCTOR

27E D

4302271 0020071 7 HAS

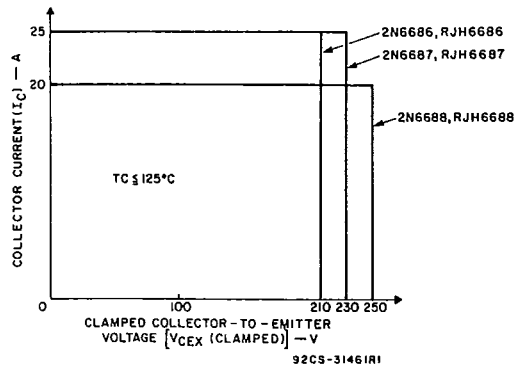


Fig. 14 - Maximum operating conditions for switching between saturation and cutoff for all types.

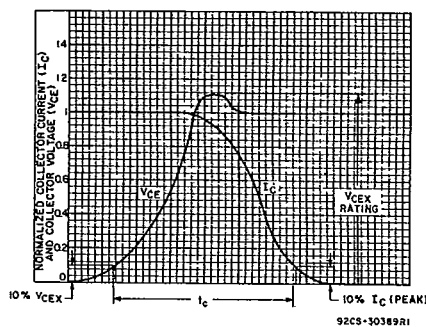


Fig. 15 - Oscilloscope display for normalized measurements of clamped inductive switching time (t_c).