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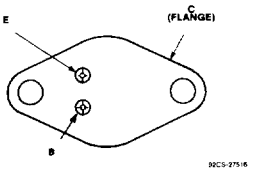
TERMINAL DESIGNATIONS



JEDEC TO-204AA

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 $V_{CE}(sat)$*

The 2N6686 and 2N6687 and 2N6688* 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 off-line power supplies, converter circuits, and pulse-width-modulated regulators. These high-current, high-speed transistors are 100% 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.

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

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6686	2N6687	2N6688	
* V_{CEV}				
V_{BE} = -1.5 V	260	280	300	V
* V_{CEX} (Clamped)				
V_{BE} = -1.5 V	210	230	250	V
* V_{CEO}	160	180	200	V
* V_{EBO}	8			V
$I_C(sat)$	25	25	20	A
* I_C	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	1.14			W/°C
* T_{stg}, T_J	-65 to 200			°C
* T_L				
At distance ≥ 1/16 in. (1.58 mm) from seating plane for 10 s max.	235			°C

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

ELECTRICAL CHARACTERISTICS T_C = 25°C

	CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
		VOLTAGE V dc		CURRENT A dc		2N6686		2N6687		2N6688		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
*	I_{CEV}	260	-1.5	—	—	—	50	—	—	—	—	μA
		280	-1.5	—	—	—	—	—	50	—	—	
		300	-1.5	—	—	—	—	—	—	—	50	
*	I_{EBO}	—	-8	0	—	—	100	—	100	—	100	
*	$V_{CEO}(sus)$[b]	—	—	0.2[a]	0	160	—	180	—	200	—	V
*	h_{FE}	2	—	1[a]	—	30	—	30	—	25	—	—
		2	—	10[a]	—	25	100	25	100	20	80	
		2	—	20[a]	—	—	—	—	—	15	—	
		2	—	25[a]	—	15	—	15	—	—	—	
*	$V_{BE}(sat)$	—	—	20[a]	2	—	—	—	—	—	1.8	V
		—	—	25[a]	2.5	—	1.8	—	1.8	—	—	
*	$V_{CE}(sat)$	—	—	20[a]	2	—	—	—	—	—	1.5	
		—	—	25[a]	2.5	—	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	—	
*	$\|h_{fe}\|$ 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	20	2	—	—	—	—	—	0.1	μs
		—	-4	25	2.5	—	0.1	—	0.1	—	—	
*	t_r[d]	—	-4	20	2	—	—	—	—	—	0.60	
		—	-4	25	2.5	—	0.60	—	0.60	—	—	
*	t_s[d]	—	-4	20	2[e]	—	—	—	—	—	1.50	
		—	-4	25	2.5[e]	—	1.50	—	1.50	—	—	
*	t_f[d]	—	-4	20	2[e]	—	—	—	—	—	0.25	
		—	-4	25	2.5[e]	—	0.25	—	0.25	—	—	
*	t_c V_{CC} = 80 V, L = 25 μH, $R_C \leq 4$ Ω, Collector clamped to V_{CEX}	—	-4	20	3[e]	—	—	—	—	—	0.5	
		—	-4	25	3[e]	—	0.5	—	0.5	—	—	

ELECTRICAL CHARACTERISTICS T_C = 25° C

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		2N6686		2N6687		2N6688		
	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
	—	—	25a	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, $R_C \leq 4\ \Omega$, Collector Clamped to V_{CEX}	—	-4	20	3[e]	—	—	—	—	—	0.8	
	—	-4	25	3[e]	—	0.8	—	0.8	—	—	
$R\theta_{JC}$ 2N6686, 2N6687, 2N6688	10	—	5	—	—	0.875	—	0.875	—	0.875	°C/W

* In accordance with JEDEC registration data.

[a] **Pulsed:** pulse duration = 300 μs, duty factor ≤ 2%.

[b] **CAUTION:** The sustaining voltage V_{CEO}(sus) and V_{CEX} **MUST NOT** be measured on a curve tracer.

[c] V_{CB} value.

[d] V_{CC} = 80 V, t_p = 20 μs.

[e] $I_{B_1} = -I_{B_2}$.

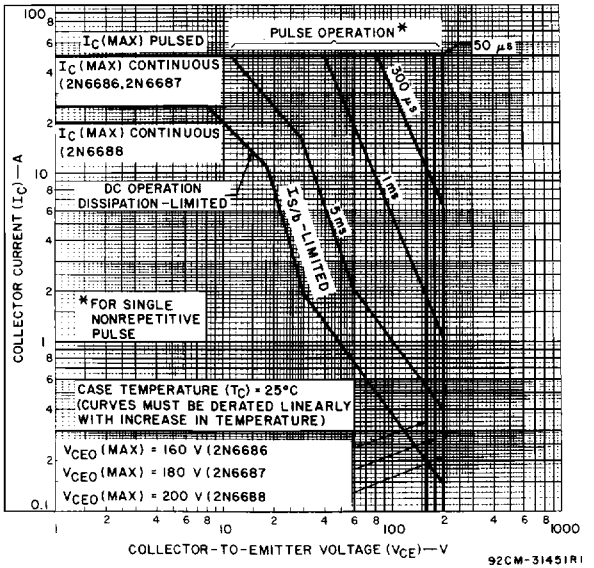


Fig. 1 - Maximum operation areas of all types. (T_C = 25°).

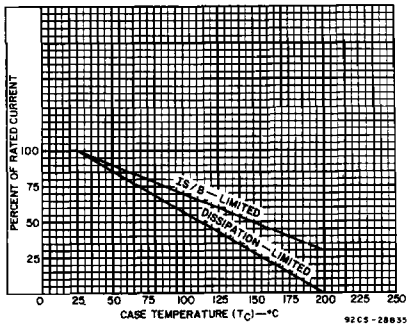


Fig. 2 - Dissipation and $I_{S/b}$ derating curves for 2N6686 and 2N6687 and 2N6688.

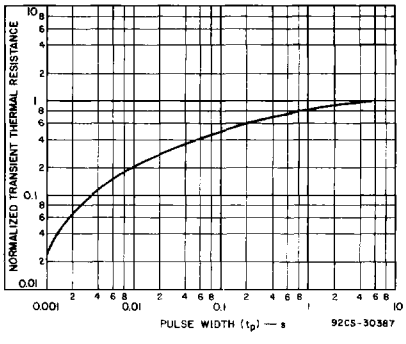


Fig. 3 - Typical thermal-response characteristic for all types.

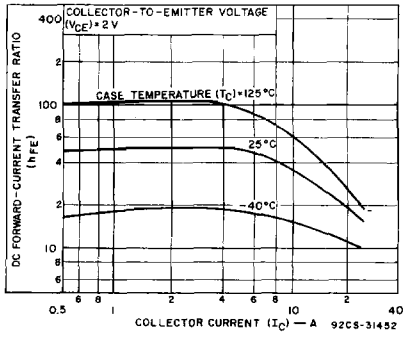


Fig. 4 - Typical dc beta characteristics for all types.

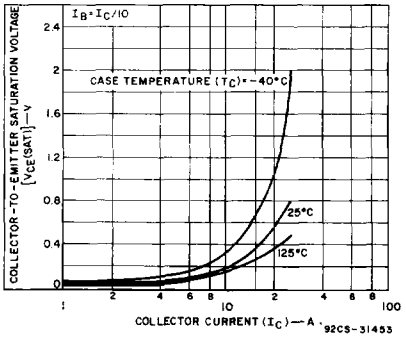


Fig. 5 - Typical collector-to-emitter saturation voltage characteristics for all types.

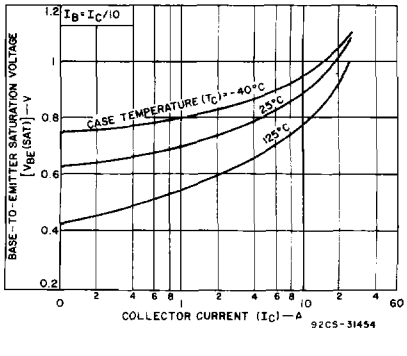


Fig. 6 - Typical base-to-emitter saturation voltage characteristics for all types.

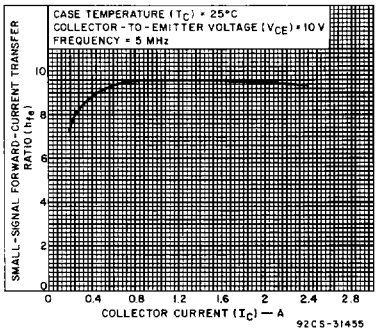


Fig. 7 - Typical small-signal forward current transfer ratio characteristic for all types (f = 5MHz).

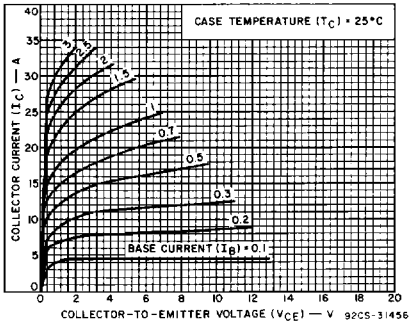


Fig. 8 - Typical output characteristics for all types.

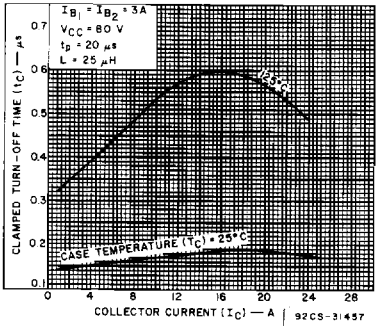


Fig. 9 - Typical clamped turn-off time characteristics for all types.

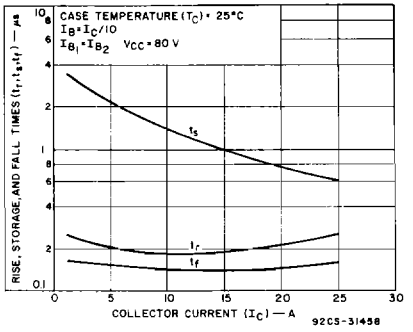


Fig. 10 - Typical saturated-switching-time characteristics as a function of collector current for all types.

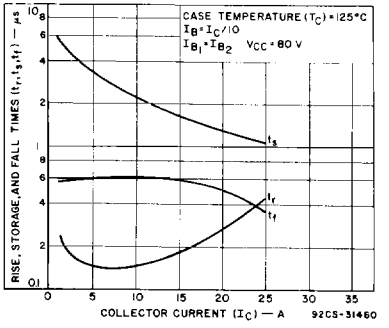


Fig. 11 - Typical saturated-switching-time characteristics at T_C = 125°C as a function of collector current for all types.

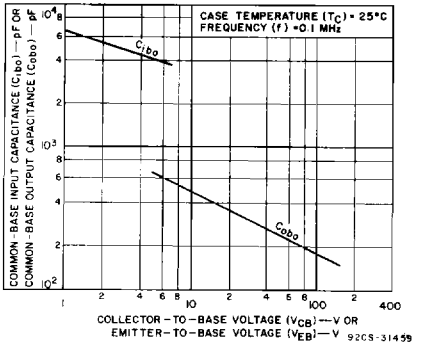


Fig. 12 - Typical common-base input (C_{ibo}) or output (C_{obo}) capacitance characteristics for all types.

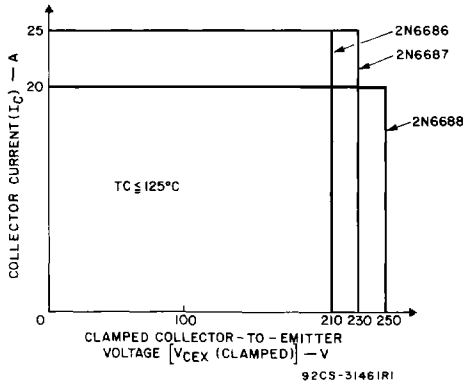


Fig. 13 - Maximum operating conditions for switching between saturation and cutoff for all types.

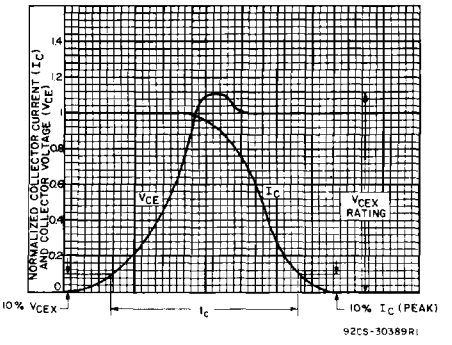


Fig. 14 - Oscilloscope display for normalized measurement of clamped inductive switching time (t_c).