

**NPN POWER SILICON TRANSISTOR**  
*Qualified per MIL-PRF-19500/464*

**DEVICES**

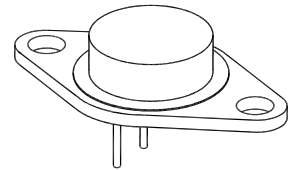
**2N5685      2N5686**

**LEVELS**

**JAN  
 JANTX  
 JANTV**

**ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$  unless otherwise noted)**

Parameters / Test Conditions	Symbol	2N5685	2N5686	Unit	
Collector-Emitter Voltage	$V_{CEO}$	60	80	Vdc	
Collector-Base Voltage	$V_{CBO}$	60	80	Vdc	
Emitter-Base Voltage	$V_{EBO}$	5.0	5.0	Vdc	
Base Current	$I_B$	15	15	Adc	
Collector Current	$I_C$	50	50	Adc	
Total Power Dissipation	$P_T$	@ $T_C = +25^\circ\text{C}$ <sup>(1)</sup>	300	300	W
		@ $T_C = +100^\circ\text{C}$ <sup>(1)</sup>	171	171	W
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +200		$^\circ\text{C}$	


**TO-3 (TO-204AE)**
**THERMAL CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	.0584	$^\circ\text{C}/\text{W}$

**Note:**

- Derate linearly 1.715 W/ $^\circ\text{C}$  between  $T_C = 25^\circ\text{C}$  and  $T_C = 200^\circ\text{C}$

**ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS <sup>(1)</sup></b>				
Collector-Emitter Breakdown Voltage $I_C = 100\text{mA}$	2N5685	$V_{(BR)CEO}$	60	Vdc
	2N5686		80	
Collector-Emitter Cutoff Current $V_{CE} = 30\text{Vdc}$	2N5685	$I_{CEO}$	500	$\mu\text{A}$
	2N5686			
Collector-Emitter Cutoff Current $V_{CE} = 60\text{Vdc}, V_{BE} = 1.5\text{Vdc}$	2N5685	$I_{CEX}$	10	$\mu\text{A}$
	2N5686			
Collector-Base Cutoff Current $V_{CE} = 60\text{Vdc}$	2N5685	$I_{CBO}$	2.0	mA
	2N5686			
Emitter-Base Cutoff Current $V_{EB} = 5.0\text{Vdc}$		$I_{EBO}$	1.0	mA

## ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS <sup>(2)</sup></b>				
Forward-Current Transfer Ratio $I_C = 5.0\text{A dc}$ , $V_{CE} = 2.0\text{V dc}$ $I_C = 25\text{A dc}$ , $V_{CE} = 2.0\text{V dc}$ $I_C = 50\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$	$h_{FE}$	30 15 5.0	60	
Collector-Emitter Saturation Voltage $I_C = 25\text{A dc}$ , $I_B = 2.5\text{A dc}$ $I_C = 50\text{A dc}$ , $I_B = 10\text{A dc}$	$V_{CE(sat)}$		1.0 5.0	Vdc
Base-Emitter Saturation Voltage $I_C = 25\text{A dc}$ , $I_B = 2.5\text{A dc}$	$V_{BE(sat)}$		2.0	Vdc
Base-Emitter Voltage $I_C = 25\text{A dc}$ , $V_{CE} = 2.0\text{A dc}$	$V_{BE(ON)}$		2.0	Vdc

## DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit, Forward Current Transfer Ratio $I_C = 5.0\text{A dc}$ , $V_{CE} = 10\text{V dc}$ , $f = 1.0\text{MHz}$	$ h_{fe} $	2.0	20	
Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 10\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$ , $f = 1.0\text{kHz}$	$h_{fe}$	15		
Output Capacitance $V_{CB} = 10\text{V dc}$ , $I_E = 0$ , $0.1\text{MHz} \leq f \leq 1.0\text{MHz}$	$C_{obo}$		1200	pF

## SWITCHING CHARACTERISTICS

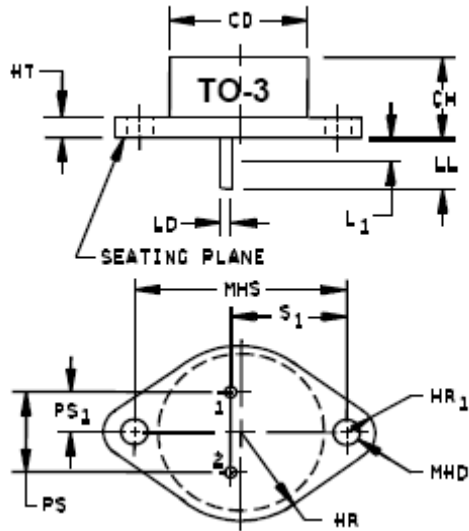
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $V_{CC} = 30\text{V dc}$ ; $I_C = 25\text{A dc}$ ; $I_{B1} = 2.5\text{A dc}$	$t_{on}$		1.5	$\mu\text{s}$
Turn-Off Time $V_{CC} = 30\text{V dc}$ ; $I_C = 25\text{A dc}$ ; $I_{B1} = -I_{B2} = 2.5\text{A dc}$	$t_{off}$		3.0	$\mu\text{s}$

## SAFE OPERATING AREA

<b>DC Tests</b> $T_C = +25^\circ\text{C}$ , 1 Cycle, $t = 1.0\text{s}$	
<b>Test 1</b> $V_{CE} = 6.0\text{V dc}$ , $I_C = 50\text{A dc}$	
<b>Test 2</b> $V_{CE} = 30\text{V dc}$ , $I_C = 10\text{A dc}$	
<b>Test 3</b> $V_{CE} = 50\text{V dc}$ , $I_C = 560\text{mA dc}$	2N5685
$V_{CE} = 60\text{V dc}$ , $I_C = 640\text{mA dc}$	2N5686

(2) Pulse Test: Pulse Width =  $300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## PACKAGE DIMENSIONS



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.875		22.22	3
CH	.250	.450	6.35	11.43	
HR	.495	.525	12.57	13.34	
HR <sub>1</sub>	.131	.188	3.33	4.78	6
HT	.060	.135	1.52	3.43	
LD	.057	.063	1.45	1.60	4, 5, 9
LL	.312	.500	7.92	12.70	4, 5, 9
L <sub>1</sub>		.050		1.27	5, 9
MHD	.151	.165	3.84	4.19	7
MHS	1.177	1.197	29.90	30.40	
PS	.420	.440	10.67	11.18	
PS <sub>1</sub>	.205	.225	5.21	5.72	5
S <sub>1</sub>	.655	.675	16.64	17.15	

### NOTE:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Body contour is optional within zone defined by CD.
4. These dimensions shall be measured at points .050 inch (1.27 mm) to .055 inch (1.40 mm) below seating plane. When gauge is not used, measurement shall be made at seating plane.
5. Both terminals.
6. At both ends.
7. Two holes.
8. The collector shall be electrically connected to the case.
9. LD applies between L<sub>1</sub> and LL. Lead diameter shall not exceed twice LD within L<sub>1</sub>.
10. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.
- \* 11. Terminal 1 is emitter; terminal 2 is base; case is collector.

\* **FIGURE 1.** Physical dimensions (TO-3)