

High-Current Complementary Silicon Power Transistors

... designed for use in high-power amplifier and switching circuit applications.

- High Current Capability — I_C Continuous = 50 Amperes.
- DC Current Gain —
 $h_{FE} = 15-60$ @ $I_C = 25$ Adc
- Low Collector-Emitter Saturation Voltage —
 $V_{CE(sat)} = 1.0$ Vdc (Max) @ $I_C = 25$ Adc

MAXIMUM RATINGS (1)

Rating	Symbol	2N5685	2N5684 2N5686	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	Vdc
Collector-Base Voltage	V_{CB}	60	80	Vdc
Emitter-Base Voltage	V_{EB}	5.0		Vdc
Collector Current — Continuous	I_C	50		Adc
Base Current	I_B	15		Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	300 1.715		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		$^\circ\text{C}$

THERMAL CHARACTERISTICS (1)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.584	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

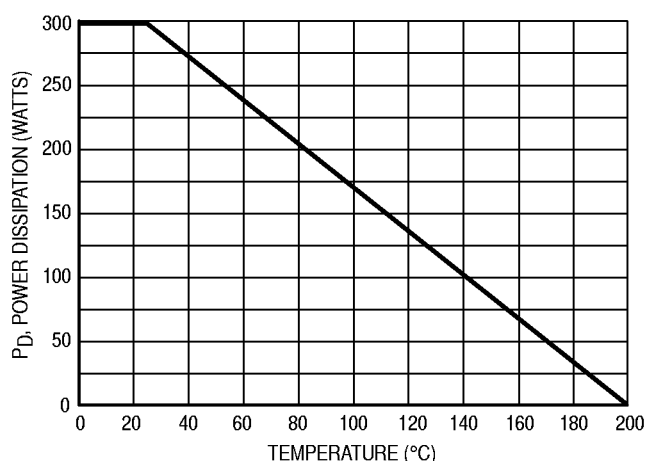


Figure 1. Power Derating

Safe Area Curves are indicated by Figure 5. All limits are applicable and must be observed.

Preferred devices are Motorola recommended choices for future use and best overall value.

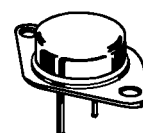
REV 7



PNP
2N5684
NPN
2N5685
2N5686*

*Motorola Preferred Device

50 AMPERE
COMPLEMENTARY
SILICON
POWER TRANSISTORS
60-80 VOLTS
300 WATTS



CASE 197A-05
TO-204AE

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (Note 1) ($I_C = 0.2 \text{ Adc}$, $I_B = 0$)	2N5685 2N5684, 2N5686	$V_{CEO(sus)}$	60 80	— —	Vdc
Collector Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $I_B = 0$) ($V_{CE} = 40 \text{ Vdc}$, $I_B = 0$)	2N5685 2N5684, 2N5686	I_{CEO}	— —	1.0 1.0	mAdc
Collector Cutoff Current ($V_{CE} = 60 \text{ Vdc}$, $V_{EB(off)} = 1.5 \text{ Vdc}$) ($V_{CE} = 80 \text{ Vdc}$, $V_{EB(off)} = 1.5 \text{ Vdc}$) ($V_{CE} = 60 \text{ Vdc}$, $V_{EB(off)} = 1.5 \text{ Vdc}$, $T_C = 150^\circ\text{C}$) ($V_{CE} = 80 \text{ Vdc}$, $V_{EB(off)} = 1.5 \text{ Vdc}$, $T_C = 150^\circ\text{C}$)	2N5685 2N5684, 2N5686 2N5685 2N5684, 2N5686	I_{CEX}	— — — —	2.0 2.0 10 10	mAdc
Collector Cutoff Current ($V_{CB} = 60 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80 \text{ Vdc}$, $I_E = 0$)	2N5685 2N5684, 2N5686	I_{CBO}	— —	2.0 2.0	mAdc
Emitter Cutoff Current ($V_{BE} = 5.0 \text{ Vdc}$, $I_C = 0$)		I_{EBO}	—	5.0	mAdc

ON CHARACTERISTICS

DC Current Gain (Note 1) ($I_C = 25 \text{ Adc}$, $V_{CE} = 2.0 \text{ Vdc}$) ($I_C = 50 \text{ Adc}$, $V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	15 5.0	60 —	—
Collector–Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$) ($I_C = 50 \text{ Adc}$, $I_B = 10 \text{ Adc}$)	$V_{CE(sat)}$	— —	1.0 5.0	Vdc
Base–Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$)	$V_{BE(sat)}$	—	2.0	Vdc
Base–Emitter On Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $V_{CE} = 2.0 \text{ Vdc}$)	$V_{BE(on)}$	—	2.0	Vdc

DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 5.0 \text{ Adc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ MHz}$)	f_T	2.0	—	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$)	C_{ob}	— —	2000 1200	pF
Small–Signal Current Gain ($I_C = 10 \text{ Adc}$, $V_{CE} = 5.0 \text{ Vdc}$, $f = 1.0 \text{ kHz}$)	h_{fe}	15	—	

* Indicates JEDEC Registered Data.

Note 1: Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

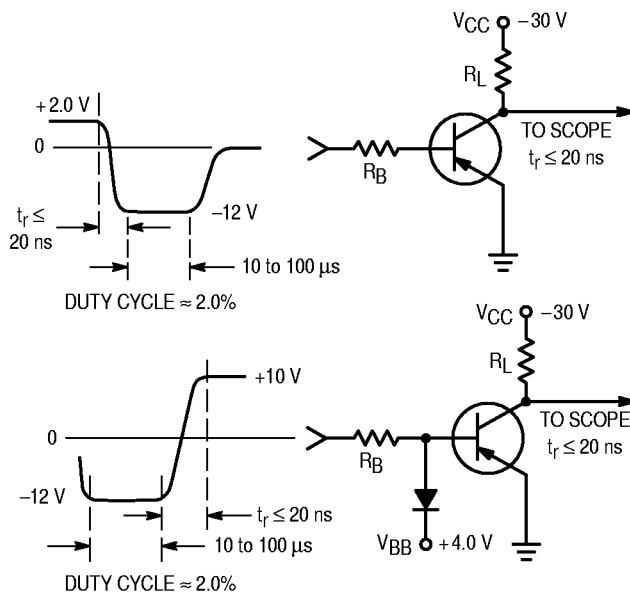


Figure 2. Switching Time Test Circuit

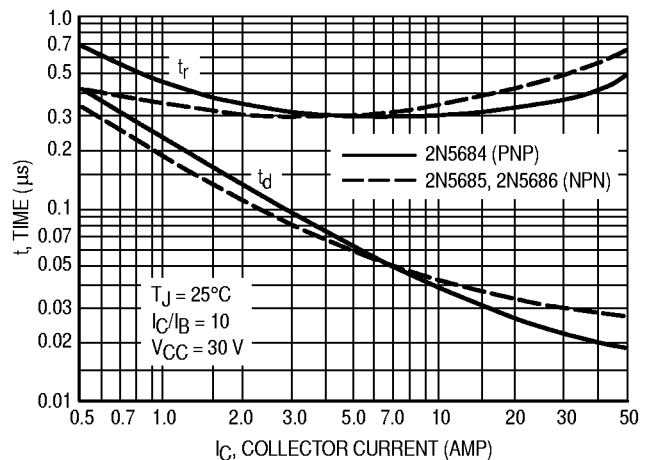


Figure 3. Turn–On Time

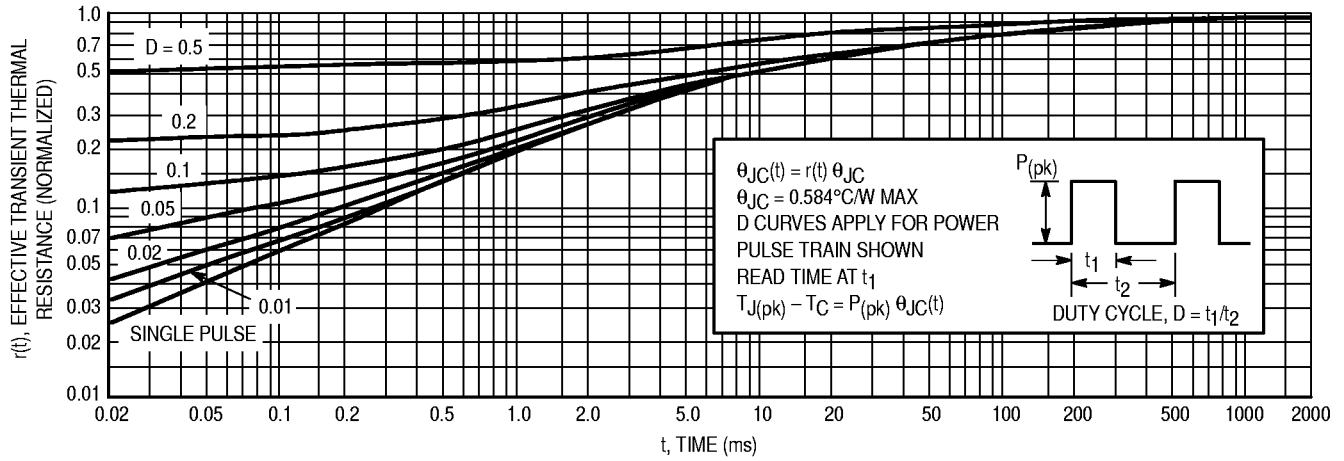


Figure 4. Thermal Response

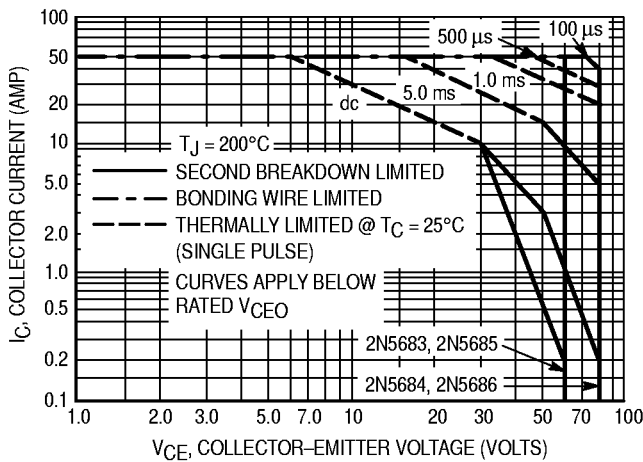


Figure 5. Active-Region Safe Operating Area

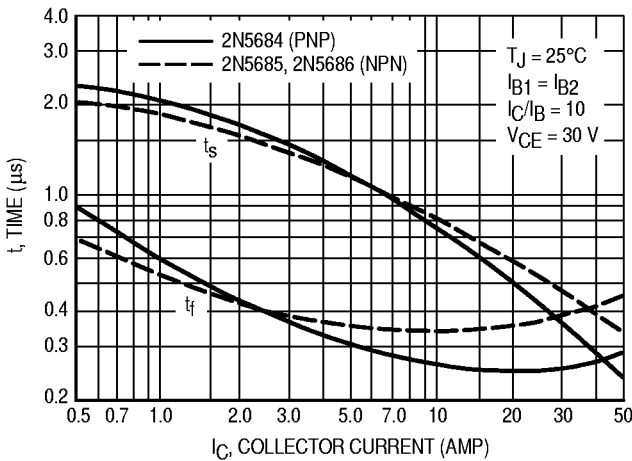


Figure 6. Turn-Off Time

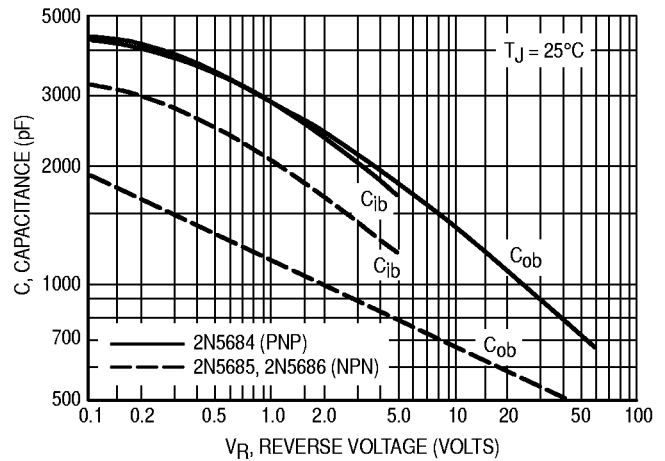


Figure 7. Capacitance

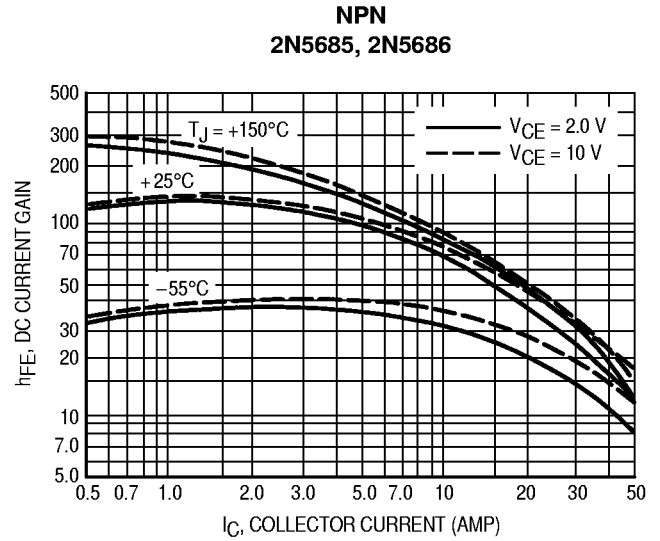
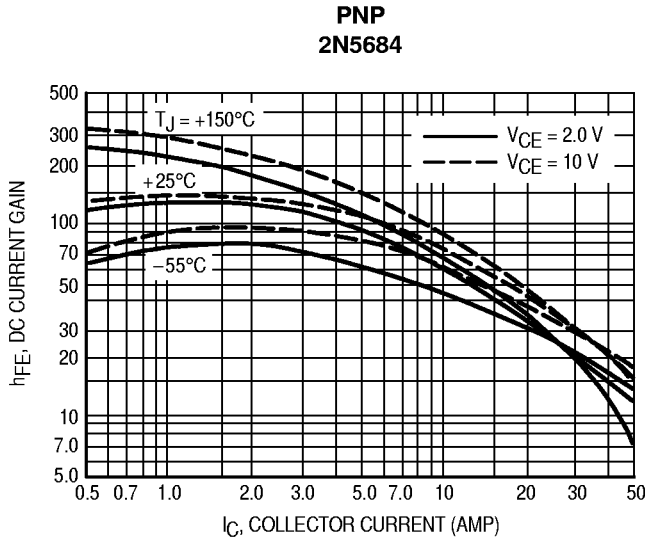


Figure 8. DC Current Gain

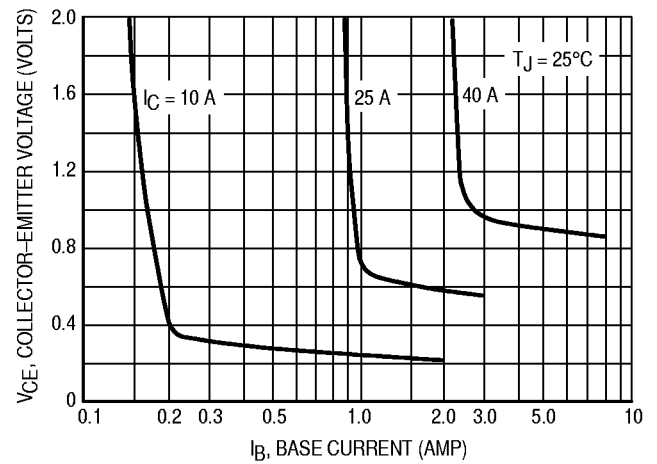
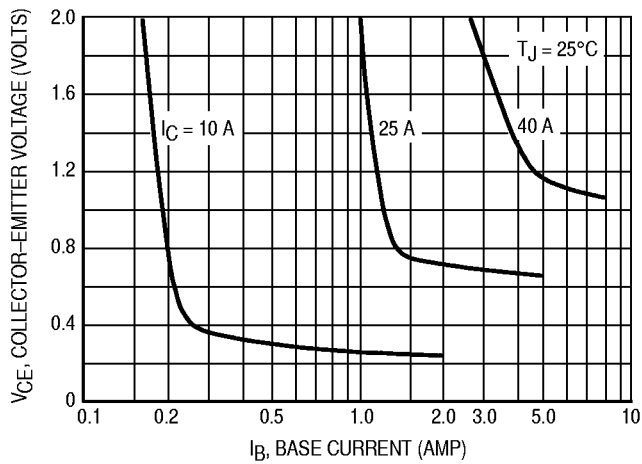


Figure 9. Collector Saturation Region

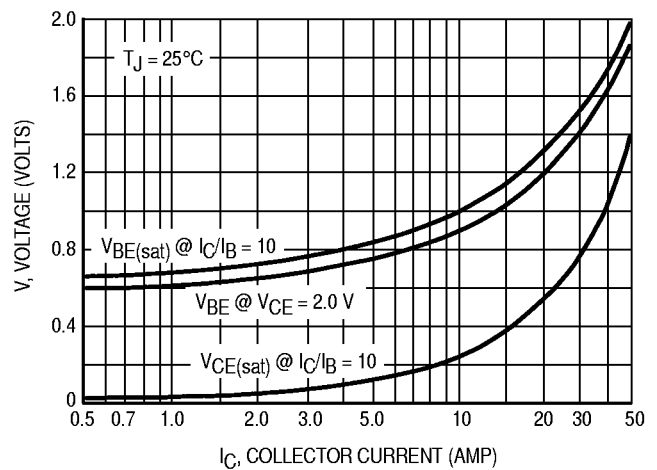
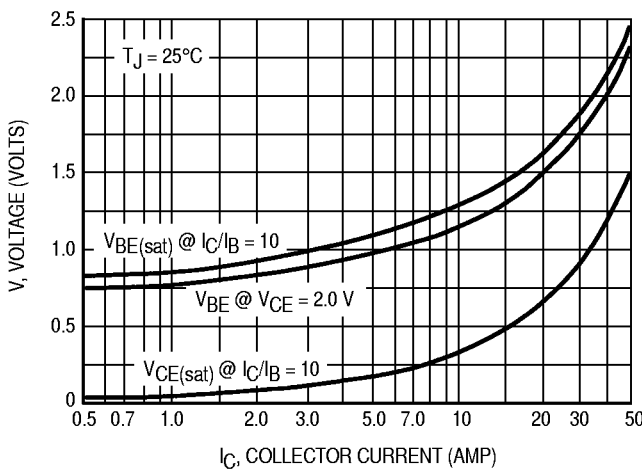
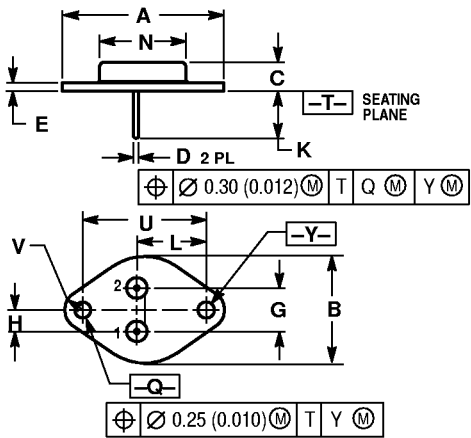


Figure 10. "On" Voltages

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.530 REF		38.86 REF	
B	0.990	1.050	25.15	26.67
C	0.250	0.335	6.35	8.51
D	0.057	0.063	1.45	1.60
E	0.060	0.070	1.53	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	0.760	0.830	19.31	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:
PIN 1: BASE
2: EMITTER
CASE: COLLECTOR

CASE 197A-05
TO-204AE
ISSUE J