






**SILICON POWER TRANSISTOR SELECTOR GUIDE (continued)**

Type	$V_{CE0}$	$h_{FE}$ @ $I_C$	$V_{CE(sat)}$ @ $I_C$ & $I_B$
NPN	Volts (Max)	Min/Max	Volts (Max)
PNP			

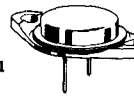
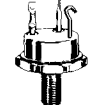
**3.0 AMP ( $T_{J(Max)} = 200^{\circ}C$ )**

 <p><b>Case 31</b> (TO-5) Solid Header</p>	<p><math>P_D = 6.0 W</math> <math>f_T = 3.0 MHz</math> <math>*f_T = 60 MHz</math></p>	2N3719*	40	25/180	1.0	0.75	1.0	0.1
		2N3720*	60	25/160	1.0	0.75	1.0	0.1
		2N3867*	40	40/200	1.5	0.75	1.5	0.15
		2N3868*	60	30/150	1.5	0.75	1.5	0.15
		2N4234	40	30/150	0.25	0.6	1.0	0.125
		2N4235	60	30/150	0.25	0.6	1.0	0.125
		2N4236	80	30/150	0.25	0.6	1.0	0.125
		2N4237	40	30/150	0.25	0.6	1.0	0.1
		2N4238	60	30/150	0.25	0.6	1.0	0.1
		2N4239	80	30/150	0.25	0.6	1.0	0.1

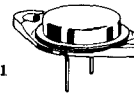
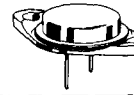

**4.0 AMP ( $T_{J(Max)} = 200^{\circ}C$ )**

 <p><b>Case 31</b> (TO-5)</p>	<p><math>P_D = 10 W</math> <math>f_T = 4.0 MHz</math></p>	2N4877	60	20/100	4.0	1.0	4.0	0.4
		 <p><b>Case 80</b> (TO-66)</p>	<p><math>P_D = 20 W</math> <math>f_T = 10 MHz</math></p>	2N3054*	60	25/100	0.5	1.0
2N3766	60			40/160	0.5	1.0	0.5	0.05
2N3767	80			40/160	0.5	1.0	0.5	0.05
<p><math>P_D = 25 W</math> <math>*f_T = 1.0 MHz</math> <math>f_T = 3.0 MHz</math> <math>**f_T = 4.0 MHz</math></p>	2N3740		60	30/100	0.25	0.6	1.0	0.125
	2N3741		80	30/100	0.25	0.6	1.0	0.125
	2N4898		40	20/100	0.5	0.6	1.0	0.1
	2N4899		60	20/100	0.5	0.6	1.0	0.1
	2N4900		80	20/100	0.5	0.6	1.0	0.1
<p><math>P_D = 35 W</math> <math>f_T = 1.0 MHz</math></p>	2N4910		40	20/100	0.5	0.6	1.0	0.1
	2N4911		60	20/100	0.5	0.6	1.0	0.1
	2N4912	80	20/100	0.5	0.6	1.0	0.1	
MJ4101**	40	25/100	1.5	1.0	1.5	0.15		
2N4231	40	25/100	1.5	0.7	1.5	0.15		
2N4232	60	25/100	1.5	0.7	1.5	0.15		
2N4233	80	25/100	1.5	0.7	1.5	0.15		

**5.0 AMP ( $T_{J(Max)} = 200^{\circ}C$ )**

 <p><b>Case 11</b> (TO-3)</p>	<p><math>P_D = 87.5 W</math> <math>f_T = 4.0 MHz</math></p>	2N4901	40	20/80	1.0	0.4	1.0	0.1
		2N4902	60	20/80	1.0	0.4	1.0	0.1
		2N4903	80	20/80	1.0	0.4	1.0	0.1
		2N4904	40	25/100	2.5	1.0	2.5	0.25
		2N4905	60	25/100	2.5	1.0	2.5	0.25
		2N4906	80	25/100	2.5	1.0	2.5	0.25
		2N4913	40	25/100	2.5	1.0	2.5	0.25
		2N4914	60	25/100	2.5	1.0	2.5	0.25
		2N4915	80	25/100	2.5	1.0	2.5	0.25
		2N5067	40	20/80	1.0	0.4	1.0	0.1
2N5068	60	20/80	1.0	0.4	1.0	0.1		
2N5069	80	20/80	1.0	0.4	1.0	0.1		
 <p><b>Case 9</b> (TO-61)</p>	<p><math>P_D = 117 W</math> <math>f_T = 10 MHz</math></p>	2N1724	80	20/90	2.0	1.0	2.0	0.2
		2N1725	80	50/150	2.0	1.0	2.0	0.2

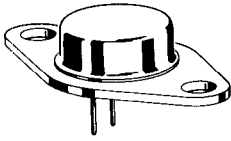
**7.5 AMP ( $T_{J(Max)} = 200^{\circ}C$ )**

 <p><b>Case 11</b> (TO-3)</p>	<p><math>P_D = 115 W</math> <math>f_T = 10 MHz</math></p>	2N3445	60	20/60	3.0	1.5	3.0	0.3
		2N3446	80	20/60	3.0	1.5	3.0	0.3
		2N3447	60	40/120	5.0	1.5	5.0	0.5
		2N3448	80	40/120	5.0	1.5	5.0	0.5
 <p><b>Case 1</b> (TO-3)</p>	<p><math>P_D = 117 W</math> <math>f_T = 1.0 MHz</math></p>	2N3232	60	15/75	3.0	2.5	3.0	0.2
 <p><b>Case 9</b> (TO-61)</p>	<p><math>P_D = 117 W</math> <math>f_T = 10 MHz</math></p>	2N3487	60	20/60	3.0	1.2	3.0	0.3
		2N3488	80	20/60	3.0	1.2	3.0	0.3
		2N3489	100	15/45	3.0	1.2	3.0	0.3
		2N3490	60	40/120	5.0	1.0	3.0	0.3
		2N3491	80	40/120	5.0	1.0	3.0	0.3
		2N3492	100	30/90	5.0	1.0	3.0	0.3

**2N3766 (SILICON)**  
**2N3767**



$V_{CB} = 80-100V$   
 $I_C = 4A$   
 $P_D = 20W$



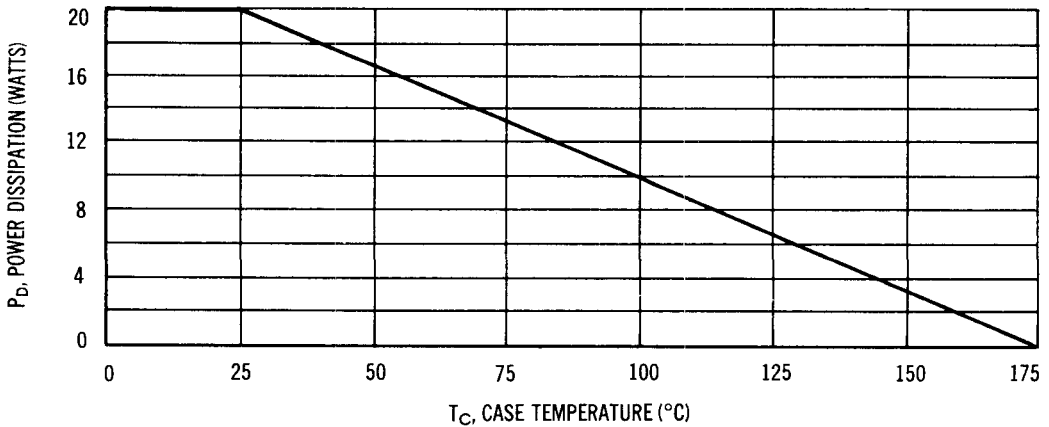
**CASE 80**  
 (TO-66)

Medium-power NPN silicon transistors, for use in switching, and medium-power-amplifier applications. Complement to PNP 2N3740 (2N3766) 2N3741 (2N3767).

**MAXIMUM RATINGS** ( $T_C = 25^\circ C$  unless otherwise noted)

Rating	Symbol	2N3766	2N3767	Unit
Collector-Base Voltage	$V_{CB}$	80	100	Vdc
Emitter-Base Voltage	$V_{EB}$	6	6	Vdc
Collector-Emitter Voltage	$V_{CEO}$	60	80	Vdc
Collector Current - Continuous	$I_C$	4.0		Adc
Peak		4.0		
Base Current	$I_B$	2.0		Adc
Total Device Dissipation @ $T_C = 25^\circ C$ Derate above $25^\circ C$	$P_D$	20		Watts W/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	7.5		$^\circ C/W$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to $^\circ 175$		$^\circ C$

**POWER-TEMPERATURE DERATING CURVE**



Safe area curves are indicated. Both limits are applicable and must be observed.

**2N3766, 2N3767** (continued)

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

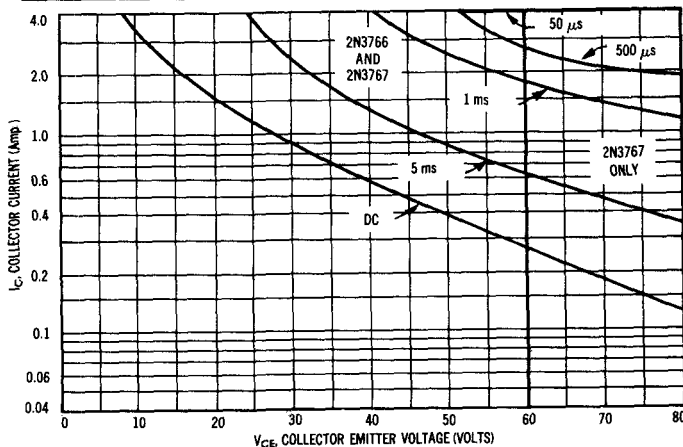
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Voltage* ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	$BV_{CEO}^*$	60	—	Vdc
	2N3766	80	—	
	2N3767	—	—	
Emitter-Base Cutoff Current ( $V_{EB} = 6\text{ Vdc}$ )	$I_{EBO}$	—	0.75	mAdc
Collector Cutoff Current ( $V_{CE} = 80\text{ Vdc}$ , $V_{BE} = 1.5\text{ Vdc}$ )	$I_{CEX}$	—	0.1	mAdc
( $V_{CE} = 100\text{ Vdc}$ , $V_{BE} = 1.5\text{ Vdc}$ )		—	0.1	
( $V_{CE} = 50\text{ Vdc}$ , $V_{BE} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )		—	1.0	
( $V_{CE} = 70\text{ Vdc}$ , $V_{BE} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	2N3767	—	1.0	
Collector-Emitter Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	—	0.7	mAdc
( $V_{CE} = 80\text{ Vdc}$ , $I_B = 0$ )		2N3766	—	
Collector-Base Cutoff Current ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	0.1	mAdc
( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ )		2N3766	—	
	2N3767	—	—	

**ON CHARACTERISTICS**

DC Current Gain ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 5\text{ Vdc}$ )	$h_{FE}$	30	—	—
( $I_C = 500\text{ mAdc}$ , $V_{CE} = 5\text{ Vdc}$ )		40	160	
( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ )		20	—	
Collector-Emitter Saturation Voltage ( $I_C = 1\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )	$V_{CE(sat)}$	—	2.5	Vdc
( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )		—	1.0	
Base-Emitter Voltage ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ )	$V_{BE}$	—	1.5	Vdc

**TRANSIENT CHARACTERISTICS**

Current-Gain - Bandwidth Product ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 10\text{ MHz}$ )	$f_T$	15	—	MHz
Common-Base Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_C = 0\text{ Adc}$ , $f = 100\text{ kHz}$ )	$C_{ob}$	—	50	pF
Small-Signal Current Gain ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1\text{ kHz}$ )	$h_{fe}$	40	—	—



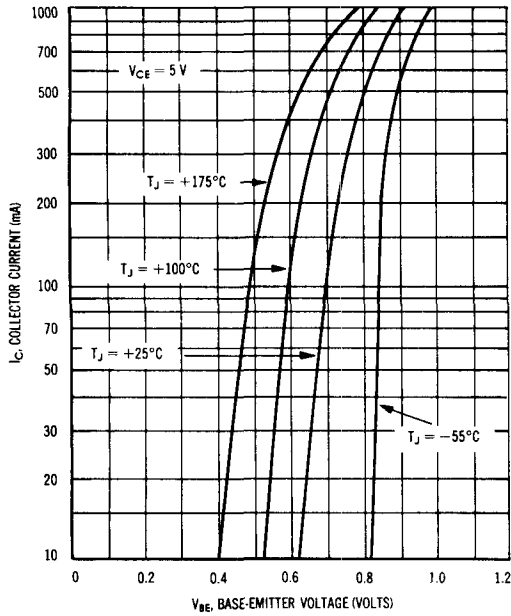
**ACTIVE REGION SAFE AREAS**

The Safe Operating Area Curves indicate  $I_C$ - $V_{CE}$  limits below which the device will not go into secondary breakdown. Collector load lines for specific circuits must fall within the applicable Safe Area to avoid causing a collector-emitter short. (Case temperature and duty cycle of the excursions make no significant change in these safe areas.) The load line may exceed the  $BV_{CEO}$  voltage limit only if the collector current has been reduced to 20 mA or less before or at the  $BV_{CES}$  limit; then and only then may the load line be extended to the absolute maximum voltage rating of  $BV_{CEO}$ . To insure operation below the maximum  $T_J$ , the power-temperature derating curve must be observed for both steady state and pulse power conditions.

**2N3766, 2N3767** (continued)

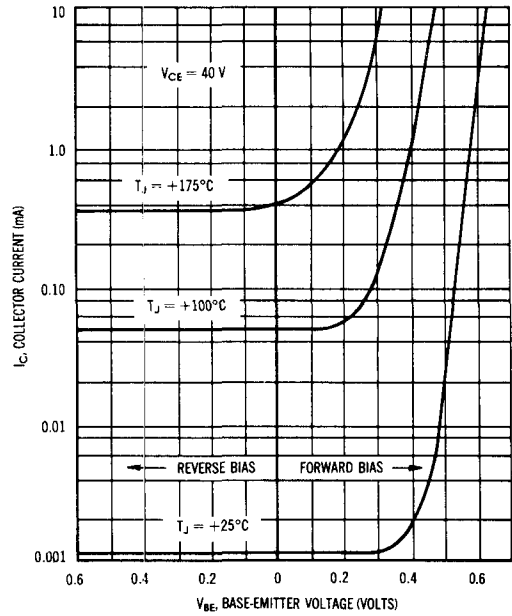
**LARGE SIGNAL CHARACTERISTICS**

**TRANSCONDUCTANCE**

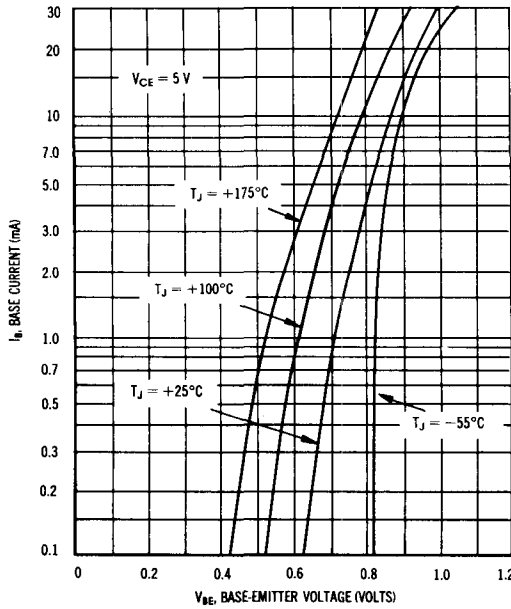


**CUT-OFF CHARACTERISTICS**

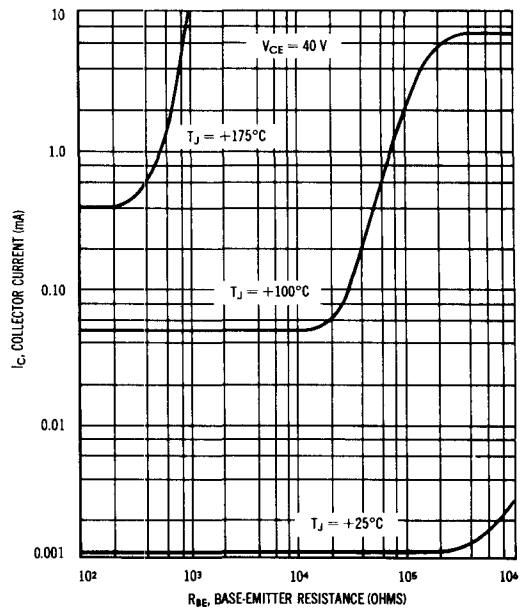
**TRANSCONDUCTANCE**



**INPUT ADMITTANCE**



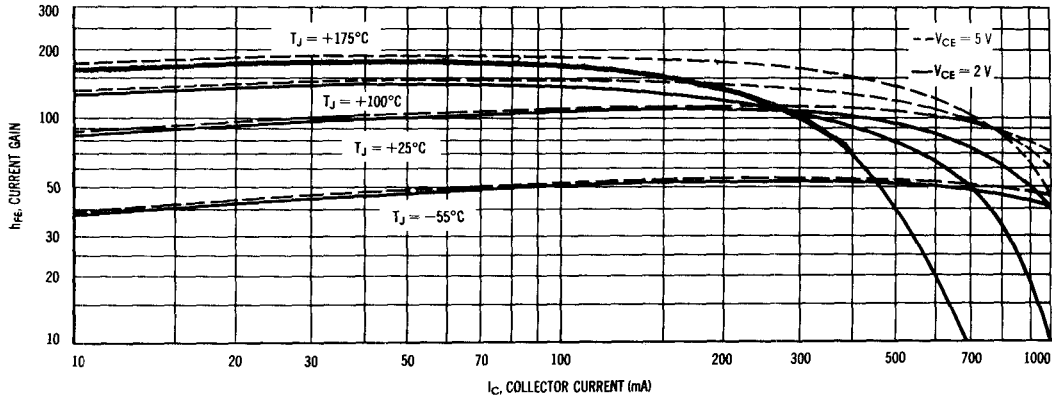
**EFFECT OF BASE-EMITTER RESISTANCE**



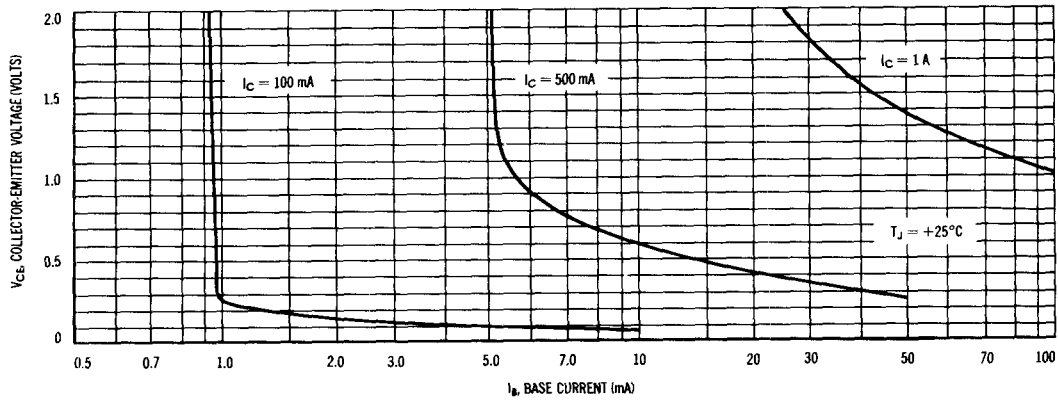
**Power Transistors**

**2N3766, 2N3767 (continued)**

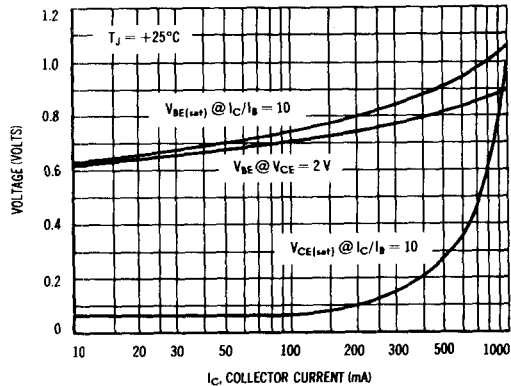
**CURRENT GAIN**



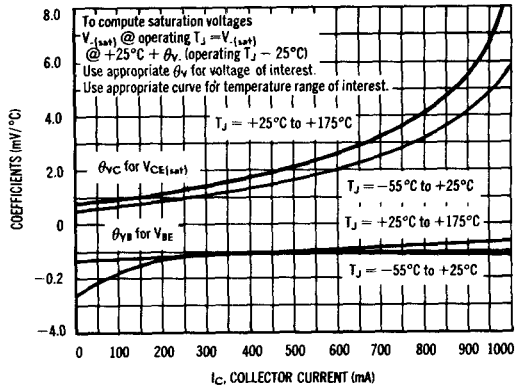
**COLLECTOR SATURATION REGION**



**"ON" VOLTAGES**



**TEMPERATURE CO-EFFICIENTS**

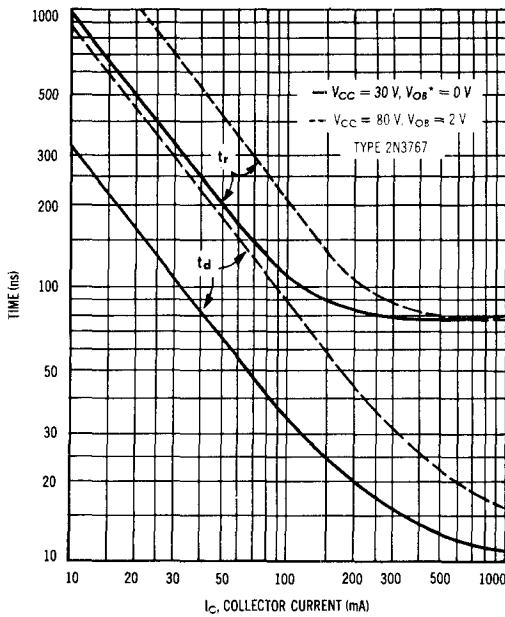


**2N3766, 2N3767** (continued)

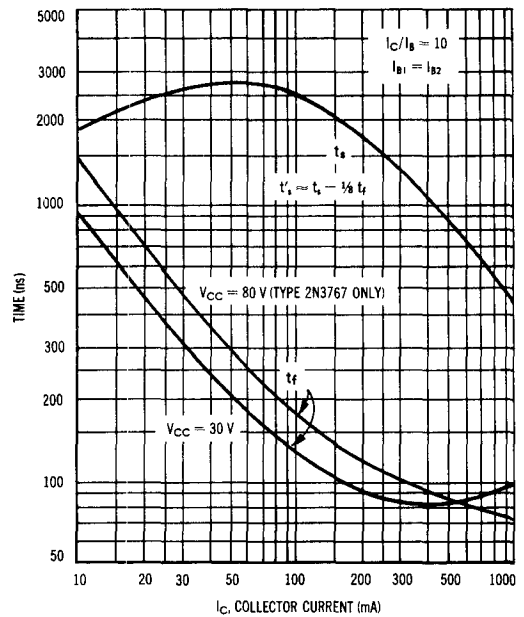
**TRANSIENT CHARACTERISTICS**

$(T_J = 25^\circ\text{C})$

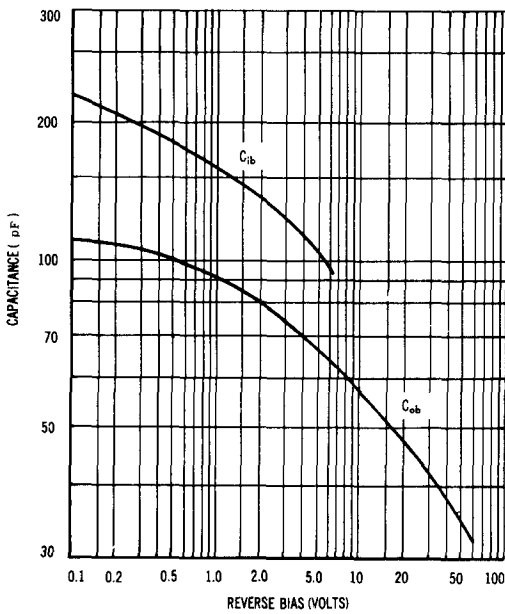
**TURN-ON TIME**



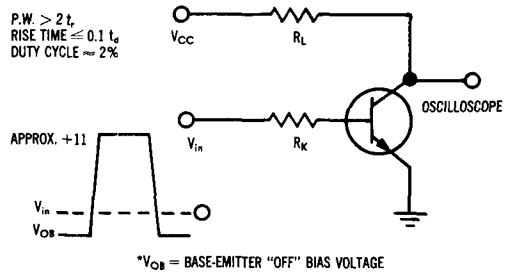
**TURN-OFF TIME**



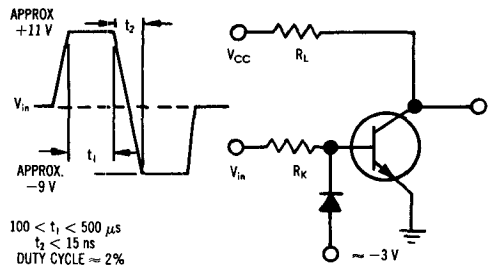
**CAPACITANCE**



**EQUIVALENT CIRCUIT FOR MEASURING DELAY AND RISE TIME**



**EQUIVALENT CIRCUIT FOR MEASURING STORAGE AND FALL TIMES**



**2N3724, 2N3725 — 2N4013, 2N4014 (continued)**

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

Characteristic	Symbol	Min	Max	Unit
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**ON CHARACTERISTICS (continued)**

Collector-Emitter Saturation Voltage* ( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ )	2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014	$V_{CE(sat)}^*$	-	0.25	Vdc
( $I_C = 100 \text{ mAdc}, I_B = 10 \text{ mAdc}$ )			-	0.20	
( $I_C = 300 \text{ mAdc}, I_B = 30 \text{ mAdc}$ )			-	0.26	
( $I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$ )			-	0.32	
( $I_C = 800 \text{ mAdc}, I_B = 80 \text{ mAdc}$ )			-	0.40	
( $I_C = 1.0 \text{ Adc}, I_B = 100 \text{ mAdc}$ )			-	0.42	
( $I_C = 1.0 \text{ Adc}, I_B = 100 \text{ mAdc}$ )			-	0.52	
Base-Emitter Saturation Voltage* ( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ )	2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014 2N3724, 2N4013 2N3725, 2N4014	$V_{BE(sat)}^*$	-	0.76	Vdc
( $I_C = 100 \text{ mAdc}, I_B = 10 \text{ mAdc}$ )			-	0.86	
( $I_C = 300 \text{ mAdc}, I_B = 30 \text{ mAdc}$ )			-	1.1	
( $I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$ )			0.9	1.2	
( $I_C = 800 \text{ mAdc}, I_B = 80 \text{ mAdc}$ )			-	1.5	
( $I_C = 1.0 \text{ Adc}, I_B = 100 \text{ mAdc}$ )			-	1.7	
( $I_C = 1.0 \text{ Adc}, I_B = 100 \text{ mAdc}$ )			-	0.95	

**SMALL-SIGNAL CHARACTERISTICS**

Current-Gain-Bandwidth Product ( $I_C = 50 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 100 \text{ MHz}$ )	$f_T$	300	-	MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 140 \text{ kHz}$ )	$C_{ob}$	-	12	pF
		-	10	
Input Capacitance ( $V_{BE} = 0.5 \text{ Vdc}, I_C = 0, f = 140 \text{ kHz}$ )	$C_{ib}$	-	55	pF

**SWITCHING CHARACTERISTICS**

Turn-On Time	$(V_{CC} = 30 \text{ Vdc}, V_{BE(off)} = 3.8 \text{ Vdc}, I_C = 500 \text{ mAdc}, I_{B1} = 50 \text{ mAdc})$ (See Figure 1)	$t_{on}$	-	35	ns
Delay Time		$t_d$	-	10	ns
Rise Time		$t_r$	-	30	ns
Turn-Off Time	$(V_{CC} = 30 \text{ Vdc}, I_C = 500 \text{ mAdc}, I_{B1} = I_{B2} = 50 \text{ mAdc})$ (See Figure 1)	$t_{off}$	-	60	ns
Storage Time		$t_s$	-	50	ns
Fall Time		$t_f$	-	25	ns
				30	ns

\* Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 1.0%.

**FIGURE 1 — SWITCHING TIMES TEST CIRCUIT**

