2N3675–2N3765

TYPE	MATERIAL	POLARITY	REPLACE-MENT	PAGE NUMBER	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE--} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f--}	Subscript	f_{--} Units	Subscript
2N3675	S	N			PMS	8.8W	C	200	90	55	O	12	60	1.0A	0.8	1.0A			1.0M	T
2N3676	S	N			PMS	8.8W	C	200	90	90	O	12	60	1.0A	0.8	1.0A			1.0M	T
2N3677	S	P			CHP	0.4W	A	200	30	20	O								5.0M	T
2N3678	S	N			HSS	0.8W	A	200	75	55	O	40	120	0.15A	0.4	0.15A			250M	T
2N3679	Unijunction Transistor, see Table on Page 1-174																			
2N3680	S	N			DFA	0.3W	A	200	60	50	O	150	600	10*	0.7	10M	300	E	60M	T
2N3681	S	N			RFA	0.2W	A	200	10	7.0	O	20	220	2.0M	0.37	4.0M	20	E	1.0G	T
2N3682	S	N			RFA	0.36W	A	200	40	15	O	40	120	10M			45	E	600M	T
2N3683	S	N			RFA	0.2W	A	200	30	12	O	20	150	8.0M			30	E	1.0G	T
2N3684 thru 2N3687	Field Effect Transistors, see Table on Page 1-166																			
2N3688	S	N			RFC	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3689	S	N			RFC	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3690	S	N			RFC	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3691	S	N	MPS6512	5-109	AFC	0.2W	A	125	35	20	O	40	160	10M	0.7	10M	40	E	200M	T
2N3692	S	N	MPS6513	5-109	AFC	0.2W	A	125	35	20	O	100	400	10M	0.7	10M	100	E	200M	T
2N3693	S	N			RFC	0.2W	A	125	45	45	O	40	160	10M					200M	T
2N3694	S	N			RFC	0.2W	A	125	45	45	O	100	400	10M					200M	T
2N3695 thru 2N3698	Field Effect Transistors, see Table on Page 1-166																			
2N3700	S	N			RFA	0.5W	A	200	140	80	O	100	300	0.15A	0.2	0.15A	80	E	100M	T
2N3701	S	N			RFA	0.5W	A	200	140	80	O	40	120	0.15A	0.2	0.15A	30	E	80M	T
2N3702	S	P			AFC	0.3W	A	150	40	25	O	60	300	50M	0.25	50M			100M	T
2N3703	S	P			AFC	0.3W	A	150	50	30	O	30	150	50M	0.25	50M			100M	T
2N3704	S	N			AFC	0.36W	A	150	50	30	O	100	300	50M	0.6	0.1A			100M	T
2N3705	S	N			AFC	0.36W	A	150	50	30	O	50	150	50M	0.8	0.1A			100M	T
2N3706	S	N			AFC	0.36W	A	150	40	20	O	30	600	50M	1.0	0.1A			100M	T
2N3707	S	N			AFC	0.25W	A	150	30	30	O	100	400	0.1M	1.0	10M	100	E		
2N3708	S	N			AFC	0.25W	A	150	30	30	O	45	660	1.0M	1.0	10M	45	E		
2N3709	S	N			AFC	0.25W	A	150	30	30	O	45	165	1.0M	1.0	10M	45	E		
2N3710	S	N			AFC	0.25W	A	150	30	30	O	90	330	1.0M	1.0	10M	90	E		
2N3711	S	N			AFC	0.25W	A	150	30	30	O	180	660	1.0M	1.0	10M	180	E		
2N3712	S	N			RFC	0.8W	A	200	150	150	O	30	150	30M	2.0	50M	25	E	40M	T
2N3713	S	N		7-125	HPA	150W	C	200	80	60	O	25	75	1.0A	1.0	5.0A	25	E	30K	E
2N3714	S	N		7-125	HPA	150W	C	200	100	80	O	25	75	1.0A	1.0	5.0A	25	E	30K	E
2N3715	S	N		7-125	HPA	150W	C	200	80	60	O	50	150	1.0A	0.8	5.0A	25	E	30K	E
2N3716	S	N		7-125	HPA	150W	C	200	100	80	O	50	150	1.0A	0.8	5.0A	25	E	30K	E
2N3717	S	N			HPA	7.5W	C	200	60	60	S	2.0	100	0.5A	1.0	0.5A			250M	T
2N3718	S	N			HPA	10W	C	200	60	60	S	2.0	100	0.5A	1.0	0.5A			250M	T
2N3719	S	P		7-129	PHS	6.0W	C	200	40	40	O	25	180	1.0A	1.5	0.3A			60M	T
2N3720	S	P		7-129	PHA	6.0W	C	200	60	60	O	25	180	1.0A	1.5	3.0A			60M	T
2N3721	S	N			AFC	0.2W	A	125	18	18	O						60	E		
2N3722	S	N			MSS	0.8W	A	200	80	60	O	40	150	0.1A	0.22	0.1A			300M	T
2N3723	S	N			HSS	0.8W	A	200	100	80	O	40	150	0.1A	0.25	10M			300M	T
2N3724	S	N			HSS	0.8W	A	200	50	30	O	60	150	0.1A	0.2	0.1A			300M	T
2N3724A	S	N		8-257	HSS	1W	A		50	30	O	60	150	100M	0.2	100M				
2N3725	S	N			HSS	0.8W	A	200	80	50	O	60	150	0.1A	0.26	0.1A			300M	T
2N3725A	S	N		8-257	HSS	1W	A		80	50	O	60	150	100M	0.26	100M	3	E		
2N3726	S	P			DFA	0.4W	A	200	45	45	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N3727	S	P			DFA	0.4W	A	200	45	45	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N3728	S	N			DFA	0.45W	A	200	60	30	O	80	280	0.15A	0.22	0.15A	50	E	250M	T
2N3729	S	N			DFA	0.45W	A	200	60	30	O	80	280	0.15A	0.22	0.15A	50	E	250M	T
2N3730	G	P		8-259	LPA	10W	A	100	200	200	S									
2N3731	G	P		8-259	LPA	5.0W	A	100	320	320	S	15		6.0A						
2N3732	G	P		8-259	LPA	3.0W	A	100	100	100	S	35	500	0.7A					1.0M	T
2N3733	S	N		9-82	HPA	23W	C	200	65	40	O	10	150	0.25A	1.0	1.0A			250M	T
2N3734	S	N		8-259	HSS	1.0W	A	200	50	30	O	30	120	1.0A	0.2	10M			300M	T
2N3734A	S	N		8-259	HSS	1.0W	A		50	30	O	30	120	1.0A	0.9	1.0A	2.5	E		
2N3735	S	N		8-259	HSS	1.0W	A	200	75	50	O	20	80	1.0A	0.2	10M			250M	T
2N3735A	S	N		8-259	HSS	1.0W	A		75	50	O	20	80	1.0A	0.9	1.0A	2.5	E		
2N3736	S	N		8-259	HSS	0.5W	A	200	50	30	O	30	120	1.0A	0.2	10M			300M	T
2N3736A	S	N		8-259	HSS	0.5W	A		50	30	O	30	120	1.0A	0.9	1.0A	2.5	E		
2N3737	S	N		8-259	HSS	0.5W	A	200	75	50	O	20	80	1.0A	0.2	10M			250M	T
2N3737A	S	N		8-259	HSS	0.5W	A		75	50	O	20	80	1.0A	0.9	1.0A	2.5	E		
2N3738	S	N		7-133	LPA	20W	C	175	250	225	O	40	200	0.1A	2.5	0.25A	35	E	15M	T
2N3739	S	N		7-133	LPA	20W	C	175	325	300	O	40	200	0.1A	2.5	0.25A	35	E	15M	T
2N3740	S	P		7-137	LPA	25W	C	200	60	60	O	30	100	0.25A	0.6	1.0A	25	E	4.0M	T
2N3741	S	P		7-137	LPA	25W	C	200	80	80	O	30	100	0.25A	0.6	1.0A	25	E	4.0M	T
2N3742	S	N		8-265	VID	1.0W	A	200	300	300	O	20	200	30M	1.0	10M	20	E	30M	T
2N3743	S	P		8-269	VID	1.0W	A	200	300	300	O	25	250	30M	5.0	10M	30	E	30M	T
2N3744	S	N			HPA	30W	C	200	60	40	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3745	S	N			HPA	30W	C	200	80	60	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3746	S	N			HPA	30W	C	200	100	80	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3747	S	N			HPA	30W	C	200	60	40	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3748	S	N			HPA	30W	C	200	80	60	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3749	S	N			HPA	30W	C	200	100	80	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3750	S	N			HPA	30W	C	200	60	40	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3751	S	N			HPA	30W	C	200	80	60	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3752	S	N			HPA	30W	C	200	100	80	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3753 thru 2N3761	Thyristors, see Table on Page 1-154																			
2N3762	S	P		8-273	HSS	1.0W	A	200	40	40	O	30	120	1.0A	0.1	10M			180M	T
2N3763	S	P		8-273	HSS	1.0W	A	200	60	60	O	20	80	1.0A	0.1	10M			150M	T
2N3764	S	P		8-273	HSS	0.5W	A	200	40	40	O	30	120	1.0A	0.1	10M			180M	T
2N3765	S	P		8-273	HSS	0.5W	A	200	60	60	O	20	80	1.0A	0.1	10M			150M	T

QUICK SELECTOR GUIDES — SILICON HIGH-SPEED SWITCHING AND GENERAL PURPOSE TRANSISTORS

The following two tables categorize the silicon devices included in this section into two classifications — those intended for general-purpose switching and amplifier applications, and those recommended primarily for high-speed saturated switching purposes.

Only the preferred devices — those that merit first consideration for new designs — are listed. In each table, the devices are grouped in voltage and current ranges. The voltage given is the minimum collector-emitter breakdown voltage (BV_{CEO}). The current range columns represent operating current values for which optimum current gain (h_{FE}) and/or collector-emitter saturation voltage ($V_{CE(sat)}$) are specified in the data sheets.

SATURATED SWITCHING TRANSISTORS (SILICON)
Current versus Voltage

	OPTIMUM COLLECTOR CURRENT											
BV_{CEO} Min Volts	0 to 10 mA		10 mA to 100 mA		100 mA to 500 mA		500 mA to 1.0 A		1.0 A to 3.0 A		3.0 A to 5.0 A	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
0 ↓ 19	2N3010 2N3493 MM709 MM1748	2N2894 2N3546 2N4411	2N2369A 2N3009 2N3010 2N3011 2N3013 2N3210 2N3211	2N2894 2N3546	2N3009 2N3013 2N3510 2N3511 2N3647 2N3648		2N3303		2N3303			
20 ↓ 29	2N702 2N703		2N2501 2N3014 2N3227 2N3508 2N3509		2N2476 2N2477 2N2501 2N2847 2N2848							
30 ↓ 39			2N2537 2N2538 2N2539 2N2540		2N2537 2N2538 2N2539 2N2540 2N2845 2N2846 2N3015 2N3724 2N4013 2N4046		2N3252 2N3724 2N3734 2N3736 2N4013 2N4046		2N3734 2N3736			
40 ↓ 59			2N3725 2N4014		2N3725 2N4014 2N4047	2N3467 2N3468	2N3253 2N3444 2N3725 2N3735 2N3737 2N4014 2N4047	2N3467 2N3468 2N3762 2N3764	2N3444 2N3735 2N3737	2N3762 2N3764	2N3506 2N3507	
60 79								2N3763 2N3765		2N3763 2N3765		

2N3724, 2N3725 – 2N4013, 2N4014 (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

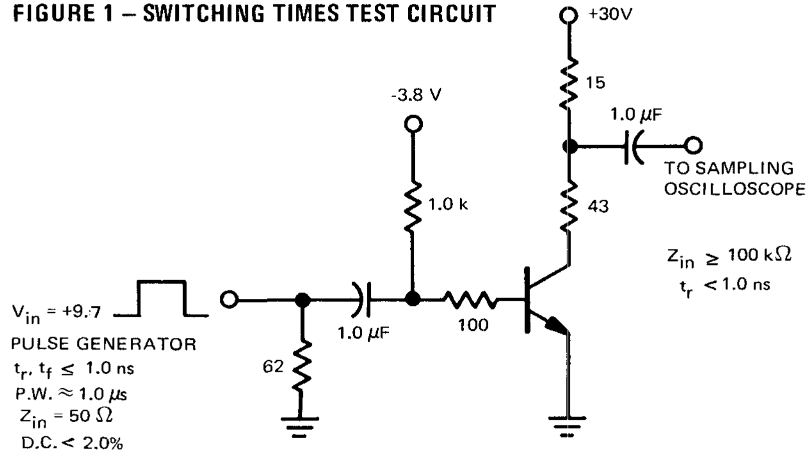
Characteristic		Symbol	Min	Max	Unit
ON CHARACTERISTICS (continued)					
Collector-Emitter Saturation Voltage*		$V_{CE(sat)}$*			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			-	0.25	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N3724, 2N4013		-	0.20	
	2N3725, 2N4014		-	0.26	
(I_C = 300 mAdc, I_B = 30 mAdc)	2N3724, 2N4013		-	0.32	
	2N3725, 2N4014		-	0.40	
(I_C = 500 mAdc, I_B = 50 mAdc)	2N3724, 2N4013		-	0.42	
	2N3725, 2N4014		-	0.52	
(I_C = 800 mAdc, I_B = 80 mAdc)	2N3724, 2N4013		-	0.65	
	2N3725, 2N4014		-	0.80	
(I_C = 1.0 Adc, I_B = 100 mAdc)	2N3724, 2N4013		-	0.75	
	2N3725, 2N4014		-	0.95	
Base-Emitter Saturation Voltage*		$V_{BE(sat)}$*			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			-	0.76	
(I_C = 100 mAdc, I_B = 10 mAdc)			-	0.86	
(I_C = 300 mAdc, I_B = 30 mAdc)			-	1.1	
(I_C = 500 mAdc, I_B = 50 mAdc)			0.9	1.2	
(I_C = 800 mAdc, I_B = 80 mAdc)			-	1.5	
(I_C = 1.0 Adc, I_B = 100 mAdc)			-	1.7	
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain—Bandwidth Product (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)		f_T	300	-	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 140 kHz)	2N3724, 2N4013	C_{ob}	-	12	pF
	2N3725, 2N4014		-	10	
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 140 kHz)		C_{ib}	-	55	pF

SWITCHING CHARACTERISTICS

Characteristic	Conditions	Symbol	Min	Max	Unit
Turn-On Time	(V_{CC} = 30 Vdc, $V_{BE(off)}$ = 3.8 Vdc, I_C = 500 mAdc, I_{B1} = 50 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 Vdc, I_C = 500 mAdc, I_{B1} = I_{B2} = 50 mAdc) (See Figure 1)	t_{off}	-	60	ns
Storage Time		t_s	-	50	ns
Fall Time	2N3724, 2N4013	t_f	-	25	ns
	2N3725, 2N4014		-	30	

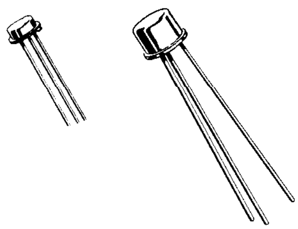
* Pulse Test: Pulse Width = 300 μs, Duty Cycle = 1.0%.

FIGURE 1 – SWITCHING TIMES TEST CIRCUIT



2N3734 (SILICON) 2N3735 2N3736 2N3737

V_{CEO} = 30 - 50 V
I_C = 1.5 A
C_{ob} = 9 pF (max)



CASE 26 (TO-46) **CASE 31** (TO-5)

Medium current NPN silicon annular transistor, designed for high-speed switching and driver applications.

Collector connected to case

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	2N3734 2N3736	2N3735 2N3737	Unit
Collector-Base Voltage	V_{CB}	50	75	Vdc
Collector-Emitter Voltage	V_{CEO}	30	50	Vdc
Emitter-Base Voltage	V_{EB}	5		Vdc
Collector Current	I_C	1.5		Adc
		TO-5 2N3734 2N3735	TO-46 2N3736 2N3737	
Total Device Dissipation @ T_A = 25°C Derating Factor Above 25°C	P_D	1.0 5.71	0.5 2.86	Watt mW/°C
Total Device Dissipation @ T_C = 25°C Derating Factor Above 25°C	P_D	4.0 22.8	2.0 11.4	Watts mW/°C
Thermal Resistance Junction to Air Junction to Case	 θ_{JA} θ_{JC}	 0.175 0.044	 0.35 0.088	°C/mW
Junction Temperature, Operating	T_J	+200		°C
Storage Temperature Range	T_{stg}	-65 to +200		°C

2N3734, 2N3735, 2N3736, 2N3737 (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

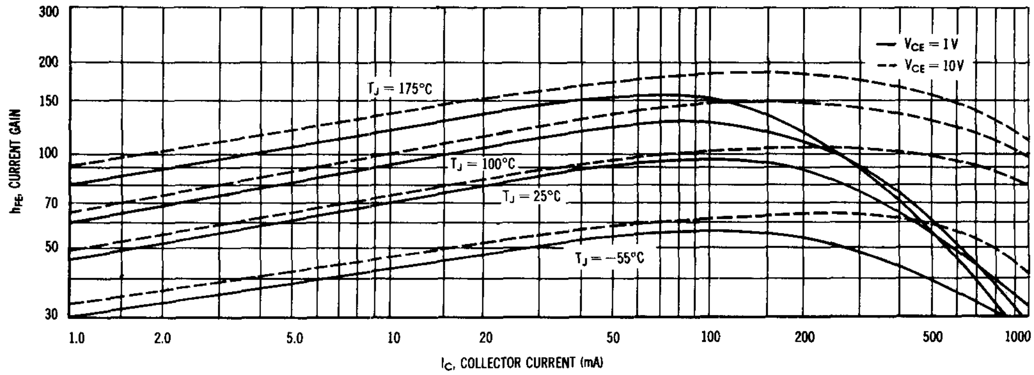
Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	2N3734, 2N3736	BV_{CBO}	50	—	Vdc
	2N3735, 2N3737		75	—	
Collector-Emitter Breakdown Voltage* (I_C = 10 mAdc, I_B = 0)	2N3734, 2N3736	BV_{CEO}*	30	—	Vdc
	2N3735, 2N3737		50	—	
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		BV_{EBO}	5	—	Vdc
Collector Cutoff Current (V_{CE} = 25 Vdc, V_{EB} = 2 Vdc)	2N3734, 2N3736	I_{CEX}	—	0.20	μAdc
(V_{CE} = 25 Vdc, V_{EB} = 2 Vdc, T_A = 100°C)			—	20	
(V_{CE} = 40 Vdc, V_{EB} = 2 Vdc)	2N3735, 2N3737		—	0.20	
(V_{CE} = 40 Vdc, V_{EB} = 2 Vdc, T_A = 100°C)			—	20	
Base Cutoff Current (V_{CE} = 25 Vdc, V_{EB} = 2 Vdc)	2N3734, 2N3736	I_{BL}	—	0.3	μAdc
(V_{CE} = 40 Vdc, V_{EB} = 2 Vdc)	2N3735, 2N3737		—	0.3	
ON CHARACTERISTICS					
DC Current Gain* (I_C = 10 mAdc, V_{CE} = 1 Vdc)		h_{FE}*	35	—	—
(I_C = 150 mAdc, V_{CE} = 1 Vdc)			40	—	
(I_C = 500 mAdc, V_{CE} = 1 Vdc)			35	—	
(I_C = 1 Adc, V_{CE} = 1.5 Vdc)	2N3734, 2N3736		30	120	
	2N3735, 2N3737		20	80	
(I_C = 1.5 Adc, V_{CE} = 5 Vdc)	2N3734, 2N3736		30	—	
	2N3735, 2N3737		20	—	
Collector Saturation Voltage* (I_C = 10 mAdc, I_B = 1 mAdc)		$V_{CE(sat)}$*	—	0.2	Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			—	0.3	
(I_C = 500 mAdc, I_B = 50 mAdc)			—	0.5	
(I_C = 1 Adc, I_B = 100 mAdc)			—	0.9	
Base-Emitter Saturation Voltage* (I_C = 10 mAdc, I_B = 1 mAdc)		$V_{BE(sat)}$*	—	0.8	Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			—	1.0	
(I_C = 500 mAdc, I_B = 50 mAdc)			—	1.2	
(I_C = 1 Adc, I_B = 100 mAdc)			0.9	1.4	
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{ob}	—	9	pF
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 100 kHz)		C_{ib}	—	80	pF
High-Frequency Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)		h_{fe}	2.5	—	—
Delay Time	(V_{CC} = 30 V, $V_{BE(off)}$ = 2 V, I_C = 1 Amp, I_{B1} = 100 mA)	t_d	—	8	ns
Rise Time		t_r	—	40	ns
Storage Time	(V_{CC} = 30 V, I_C = 1 Amp, I_{B1} = $-I_{B2}$ = 100 mA)	t_s	—	30	ns
Fall Time		t_f	—	30	ns
Total Control Charge (I_C = 1 Amp, I_B = 100 mA, V_{CC} = 30 V)		Q_T	—	10	nC

*Pulse Test: PW ≤ 300 μs, Duty Cycle ≤ 2%

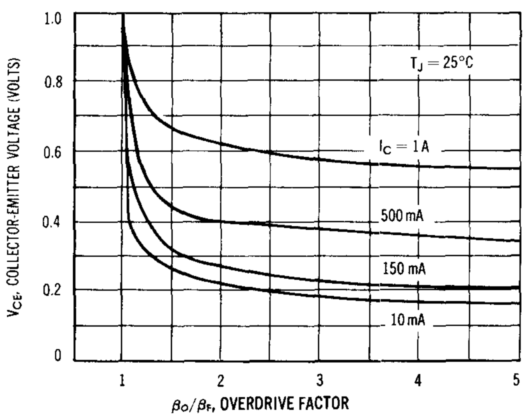
2N3734, 2N3735, 2N3736, 2N3737 (continued)

"ON" CONDITION CHARACTERISTICS

DC CURRENT GAIN



COLLECTOR SATURATION REGION

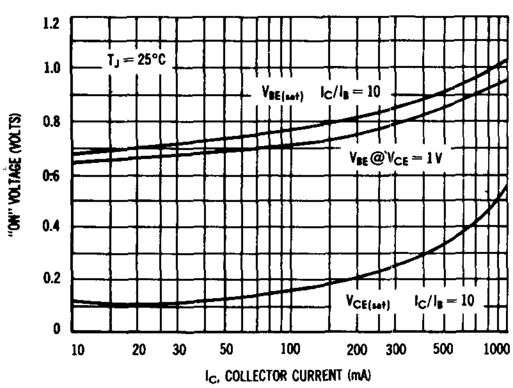


This graph shows the effect of base current on collector current. β_O (current gain at the edge of saturation) is the current gain of the transistor at 1 volt, and β_F (forced gain) is the ratio of I_C/I_{BF} in a circuit. EXAMPLE: For type 2N3734, estimate a base current (I_{BF}) to insure saturation at a temperature of 25°C and a collector current of 500 mA.

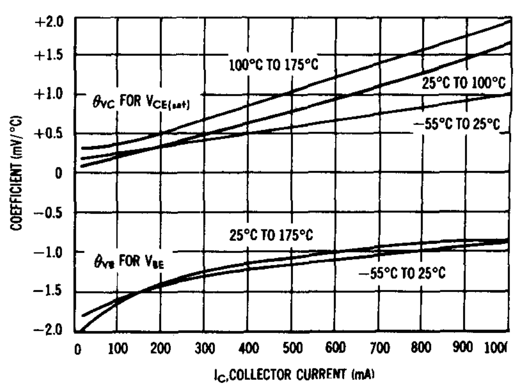
Observe that at $I_C = 500$ mA an overdrive factor of at least 2.0 is required to drive the transistor well into the saturation region. From Figure 1, it is seen that h_{FE} @ 1 volt is typically 54 (guaranteed limits from the Table of Characteristics can be used for "worst-case" design). ∴

$$\frac{\beta_O}{\beta_F} = \frac{h_{FE}@1\,\text{Volt}}{I_C/I_{BF}} \qquad 2 = \frac{54}{500\,\text{mA}/I_{BF}} \qquad I_{BF} \approx 18.5\,\text{mA typ}$$

"ON" VOLTAGES



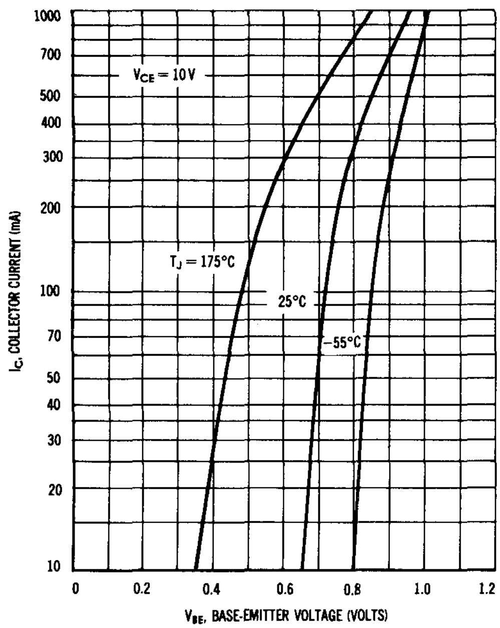
TEMPERATURE COEFFICIENTS



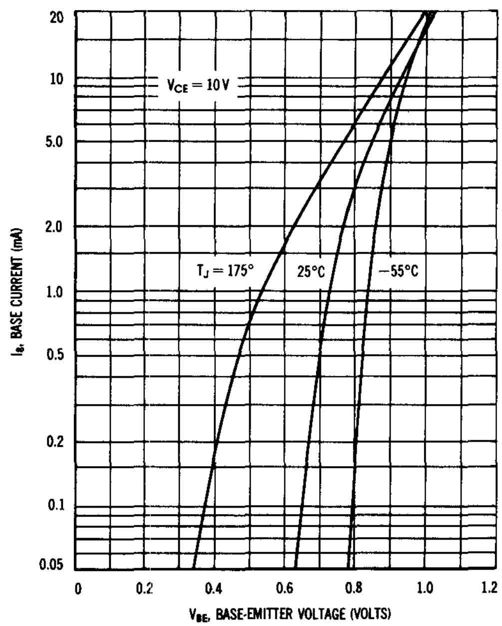
2N3734, 2N3735, 2N3736, 2N3737 (continued)

LARGE SIGNAL CHARACTERISTICS

TRANSCONDUCTANCE

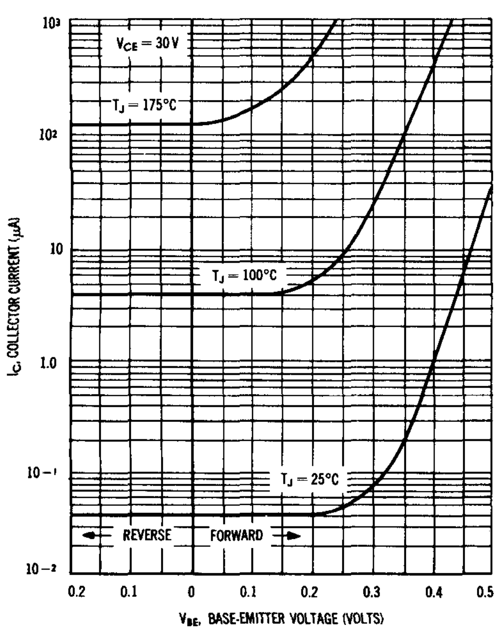


INPUT ADMITTANCE

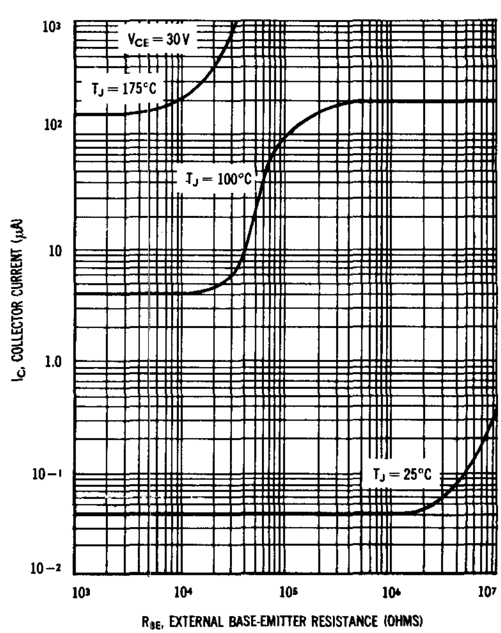


"OFF" CONDITION CHARACTERISTICS

TRANSCONDUCTANCE



EFFECT OF BASE-EMITTER RESISTANCE

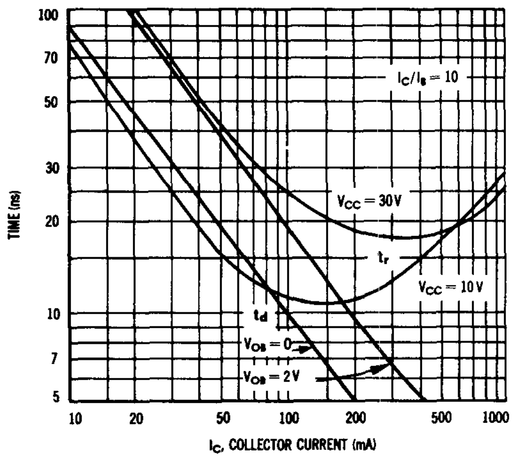


2N3734, 2N3735, 2N3736, 2N3737 (continued)

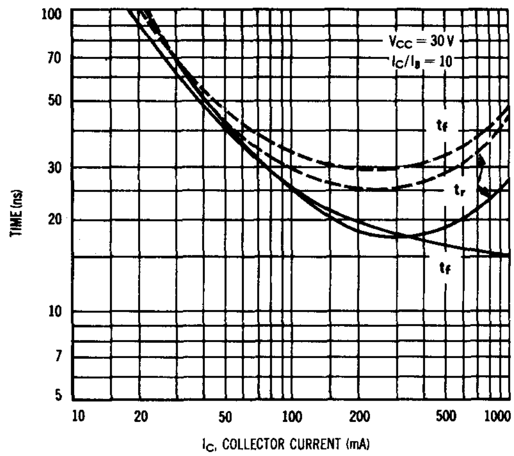
SWITCHING CHARACTERISTICS

— $T_J = 25°C$ -- $T_J = 150°C$

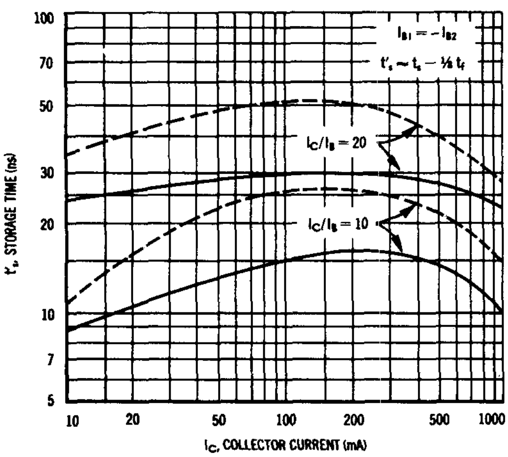
TURN-ON TIME



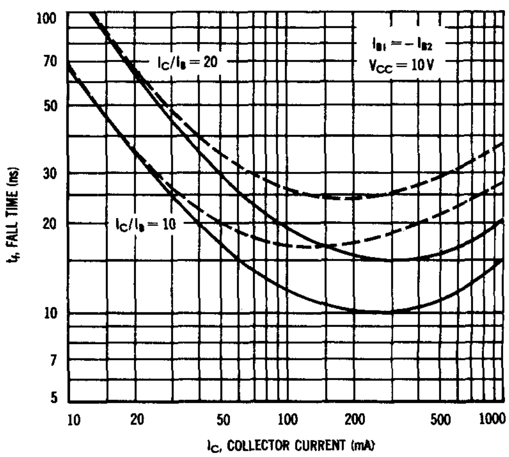
RISE AND FALL TIMES



STORAGE TIME

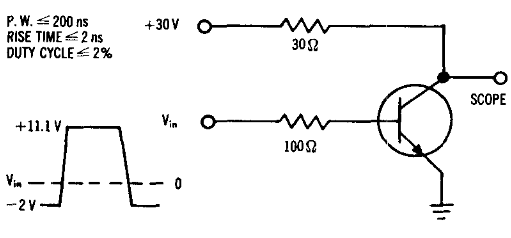


FALL TIME

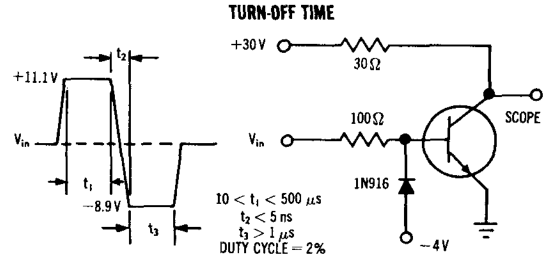


SWITCHING TIME EQUIVALENT TEST CIRCUITS

TURN-ON TIME



TURN-OFF TIME



2N3734, 2N3735, 2N3736, 2N3737 (continued)