

2N4060-2N4227

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} @ I _C		V _{CE(SAT)} @ I _C		h _{FE} —	Subscript	f _T —	Subscript	
2N4060	S	P	MPS6516	5-113	AFC	0.25W	A	150	30	30	0	45	165	1.0M	0.7	10M	45	E		
2N4061	S	P	MPS6517	5-113	AFC	0.25W	A	150	30	30	0	90	330	1.0M	0.7	10M	90	E		
2N4062	S	P	MPS6518	5-113	AFC	0.25W	A	150	30	30	0	180	660	1.0M	0.7	10M	180	E		
2N4063	S	N			LPA	10W	C	200	450	350	0	40	160	0.02A					15M	
2N4064	S	N			LPA	10W	C	200	300	250	0	40	160	0.02A					15M	
2N4065	Field Effect Transistors, see Table on Page 1-166																			
2N4066	S	N			RFA	500M	A	175	150	150	0	30		30M					50M	
2N4068	S	N			LPA	1.0W	C	175	150	150	0	30		0.03A					50M	
2N4069	S	N	2N3448	7-111	LPA	115W	C	200	100	80	0	40	120	5.0A	0.68	5.0A	40	E	10M	
2N4070	S	N		9-112	HPA	1.5W	C	200	40	20	0	10		25A					550M	
2N4072	S	N		9-112	HPA	1.5W	C	200	40	20	0	10		25A					550M	
2N4073	S	N																		
2N4074	S	N	2N3764	8-273	RFA	400M	A	175	40	40	0						400	E		
2N4075	S	N			LPA	30W	C	200		80	0	30	90						30M	
2N4076	S	N			LPA	30W	C	200		80	0	50	150						30M	
2N4080	S	P			HPA	300M	A	200	20	15	0	20		3.0M					1.0G	
2N4082	Field Effect Transistors, see Table on Page 1-166																			
2N4085	S	N	MPS6514	5-109	AFA	200M	A		12	12	0	150	300	2.0M			150	E		
2N4086	S	N	MPS6515	5-109	AFA	200M	A		12	12	0	250	500	2.0M			250	E		
2N4087	S	N	MPS6515	5-109	AFC	200M	A		12	12	0	250	500	2.0M			250	E		
2N4087A	S	N	MPS6515	5-109	AFC	200M	A		12	12	0	250	500	2.0M			250	E		
2N4088	Field Effect Transistors, see Table on Page 1-166																			
2N4095	Thyristors, see Table on Page 1-154																			
2N4096	Thyristors, see Table on Page 1-154																			
2N4098	S	N			DFA	300M	A	200	55	55	0	175		1.0M					150M	
2N4099	S	N			DFA	400M	A	200	55	55	0	175		1.0M					150M	
2N4100	Thyristors, see Table on Page 1-154																			
2N4101	Thyristors, see Table on Page 1-154																			
2N4103	S	N			RFA	300M	A	175	60	60	0						1400	E	540M	
2N4104	G	P	MP2060	7-220	AFA	1.6W	A		25			70	350	5.0M						
2N4106	Thyristors, see Table on Page 1-154																			
2N4108	Thyristors, see Table on Page 1-154																			
2N4110	S	N			LPA	30W	C		100	60	0	40	120	2.0A					70M	
2N4111	S	N			LPA	30W	C		100	60	0	100	300	2.0A					80M	
2N4112	S	N			LPA	30W	C		100	60	0	100	300	2.0A					80M	
2N4113	S	N			LPA	30W	C		120	80	0	40	120	2.0A					70M	
2N4114	S	N			LPA	3.0W	A		120	80	0	100	300	2.0A					80M	
2N4115	S	N			LPA	37W	C		120	80	0	40	120	2.0A					70M	
2N4116	S	N			LPA	37W	C		120	80	0	100	300	2.0A					80M	
2N4117A	Field Effect Transistors, see Table on Page 1-166																			
2N4120A	S	P	2N3905	5-16	RFA	200M	A	125	40	40	0	70		10M			50	E	400M	
2N4121	S	P	2N3906	5-16	RFA	200M	A	125	40	40	0	150		10M			150	E	450M	
2N4122	S	N		5-21	HPA	310M	A	135	40	30	0	50	150	2.0M	0.3	50M	50	E	250M	
2N4123	S	N		5-21	HPA	310M	A	135	30	25	0	120	360	2.0M	0.3	50M	120	E	300M	
2N4124	S	P		5-25	HPA	310M	A	135	30	30	0	50	150	2.0M	0.4	50M	50	E	200M	
2N4125	S	P		5-25	HPA	310M	A	135	25	25	0	120	360	2.0M	0.4	50M	120	E	250M	
2N4126	S	N			LPA	25W	C		60	40	0	10	80	0.2A					300M	
2N4127	S	N			LPA	40W	C		60	40	0	10	80	0.2A					200M	
2N4128	S	N			LPA	120W	C		80	65	0	10	60	2.0A					1.25M	
2N4130	S	N			LPA	60W	C		90	80	0	10	80	1.0A					150M	
2N4131	S	N			RFA	200M	A	200	30	30	0						200	E	350M	
2N4134	S	N			RFA	200M	A	200	30	30	0						200	E	425M	
2N4135	Pair of 2N430 and 2N431																			
2N4136	S	N			PMS	360M	A	200	40	40	0	40	120	10M					500M	
2N4137	S	N			CHP	300M	A	200	30	30	0	50		1.0M					20M	
2N4138	Thyristors, see Table on Page 1-154																			
2N4139	S	N	2N4400	5-34	RFA	300M	A	125	60	30	0		120	150M					250M	
2N4140	S	N	2N4401	5-34	RFA	300M	A	125	60	30	0		300	150M					250M	
2N4141	S	P	2N4402	5-39	RFA	300M	A	125	60	40	0		120	150M					200M	
2N4142	S	P	2N4403	5-39	RFA	300M	A	125	60	40	0		300	150M					200M	
2N4143	Thyristors, see Table on Page 1-154																			
2N4144	Thyristors, see Table on Page 1-154																			
2N4149	S	N			LPA	5W	C		100	80	0	40	120	5.0A					15M	
2N4150	Thyristors, see Table on Page 1-154																			
2N4151	Thyristors, see Table on Page 1-154																			
2N4204	S	P			HSS	300M	A	200	6.0	6.0	0	50	120	10M					650M	
2N4207	S	P			HSS	300M	A	200	12	12	0	30	120	10M					700M	
2N4208	S	P			HSS	300M	A	200	15	15	0	50	120	10M					850M	
2N4209	S	N			LPA	100W	C		80	60	0	20	100	10A					10M	
2N4210	S	N			LPA	100W	C		100	80	0	20	100	10A					10M	
2N4211	Thyristors, see Table on Page 1-154																			
2N4212	Thyristors, see Table on Page 1-154																			
2N4216	Field Effect Transistors, see Table on Page 1-166																			
2N4220A	Field Effect Transistors, see Table on Page 1-166																			
2N4224	S	N			LPA	5.0W	C		100	40	0	40	150	1.0A					150M	
2N4225	S	N			LPA	5.0W	C		200	60	0	40	150	1.0A					150M	
2N4226	S	N	2N4400	5-34	MSA	300M	A	125	60	30	0		150	150M					250M	
2N4227	S	N																		

PLASTIC SILICON SMALL-SIGNAL TRANSISTORS

CURRENT versus VOLTAGE SELECTOR GUIDE

I_C	50 μ A - 5.0 mA		5.0 mA - 25 mA		25 mA - 75 mA		75 mA - 500 mA	
V_{CE0} Volts (Min)	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN
<10			MPS3639					
10		MPS918 MPS2711 MPS2712 MPS2713 MPS2714 MPS2715 MPS2716 MPS2926 MPS3721	MPS3640	2N4264 2N4265 MPS706 MPS2369 MPS3563		MPS3646		
19								
20	2N4126 MPS6519 MPS6579 MPS6580	2N4124 2N5089 MPS2923 MPS2924 MPS2925 MPS3392 MPS3393 MPS3394 MPS3395 MPS3396 MPS3397 MPS3398 MPS6507 MPS6514 MPS6515 MPS6539 MPS6542 MPS6546 MPS6547 MPS6571	MPS3638 MPS3638A	MPS6511 MPS2923 MPS6552 MPS6553 MPS6554 MPS6555 MPS6541 MPS6543 MPS6548 MPS6568 MPS6569 MPS6570	MPS3702	MPS3706	MPS6562 MPS6563	MPS6560 MPS6561
29								
30	2N4125	2N4123 2N5088 MPS3707 MPS3708 MPS3709 MPS3710 MPS3711 MPS3712 MPS3713 MPS6540 MPS6573 MPS6574		MPS5834	MPS3703	MPS3704 MPS3705	MPS6535	MPS6532
39								
40	MPS6516 MPS6517 MPS6518	MPS6575 MPS6576	2N3905 2N3906	2N3903 2N3904 MPS3693 MPS3694 MPS3826 MPS3827 MPS6564 MPS6565 MPS6566 MPS6567		MPS6544 MPS6545	2N4402 2N4403 MPS6533 MPS6534	2N4400 2N4401 MPS6530 MPS6531
49								
>50	2N5086 2N5087	2N4409 2N4410						

PLASTIC SILICON SMALL-SIGNAL TRANSISTORS — SELECTOR GUIDES

On the following pages the plastic silicon small-signal devices subsequently characterized by complete data sheets have been grouped by applications for which they merit first consideration.

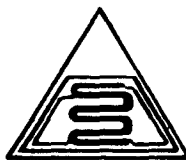
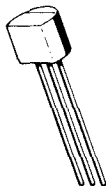
GENERAL PURPOSE SWITCHES & AMPLIFIERS — All devices in Case 29 (1)

Type NPN	MAXIMUM RATINGS		ELECTRICAL CHARACTERISTICS (T _A = 25°C unless otherwise noted)															
	V _{CE0}	V _{EB}	I _{CB0}	h _{FE} Min Max							V _{CE(sat)} & V _{BE(sat)} @ I _C	I _T @ I _C	C _{ob}	Switching Times ns				
	Volts	Volts	μA(Max)	@ I _C (mA)							Volts(Max)		mA	MHz	mA	μF(Max)	t _d	t _r
				0.1	1.0	2.0	10	50	100	150	500						t _s	t _f
2N3903	40	6.0	0.05	20	35	—	50	30	15	—	0.20 0.30	0.85 0.95	10 50	250	10	4.0	35	35
2N3904	40	6.0	0.05	40	70	—	100	60	30	—	0.20 0.30	0.85 0.95	10 50	300	10	4.0	35	35
2N3905*	40	5.0	0.05	30	40	—	50	30	15	—	0.25 0.40	0.85 0.95	10 50	200	10	4.5	35	35
2N3906*	40	5.0	0.05	60	80	—	100	60	30	—	0.25 0.40	0.85 0.95	10 50	250	10	4.5	35	35
2N4123	30	5.0	0.05	—	—	50	—	25	—	—	0.30	0.95	50	250	10	4.0	24	13
2N4124	25	5.0	0.05	—	—	120	—	80	—	—	0.30	0.95	50	300	10	4.0	24	13
2N4125*	30	4.0	0.05	—	—	50	—	25	—	—	0.40	0.95	50	200	10	4.5	25	18
2N4126*	25	4.0	0.05	—	—	120	—	80	—	—	0.40	0.95	50	250	10	4.5	25	18
2N4400	40	6.0	0.1	—	20	—	40	—	50	20	0.40 0.75	0.95 1.20	150 500	200	20	6.5†	15	20
2N4401	40	6.0	0.1	20	40	—	80	—	100	40	0.40 0.75	0.95 1.20	150 500	250	20	6.5†	15	20
2N4402*	40	5.0	0.1	—	30	—	50	—	50	20	0.40 0.75	0.95 1.20	150 500	150	20	8.5†	15	20
2N4403*	40	5.0	0.1	30	60	—	100	—	100	20	0.40 0.75	0.95 1.20	150 500	200	20	8.5†	15	20
MP33638*	25	4.0	—	—	—	—	20	30	—	20†	0.25 1.00	1.10 2.00	50 300	100	50	20	20	70
MP33638A	25	4.0	—	—	80	—	100	100	—	20†	0.25 2.00	1.10 2.00	50 300	150	50	10	20	70
MP33702*	25	5.0	0.1	—	—	—	60	—	—	—	0.25	—	50	100	50	12	—	—
MP33703*	30	5.0	0.1	—	—	—	30	—	—	—	0.25	—	50	100	50	12	—	—
MP33704	30	5.0	0.1	—	—	—	100	—	—	—	0.60	—	100	100	50	12	—	—
MP33705	30	5.0	0.1	—	—	—	50	—	—	—	0.80	—	100	100	50	12	—	—
MP33706	20	5.0	0.1	—	—	—	30	—	—	—	1.00	—	100	100	50	12	—	—
MP36530	40	5.0	0.05	—	—	—	30	—	40	25	0.50	1.00	100	390	50	5.0	—	—
MP36531	40	5.0	0.05	—	—	—	60	—	90	50	0.30	1.00	100	390	50	5.0	—	—
MP36532	30	5.0	0.1	—	—	—	—	30	—	—	0.50	1.20	100	390	50	5.0	—	—
MP36533*	40	4.0	0.05	—	—	—	30	—	40	25	0.50	1.00	100	260	50	6.0	—	—
MP36534*	40	4.0	0.05	—	—	—	60	—	90	50	0.30	1.00	100	260	50	6.0	—	—
MP36535	30	4.0	0.1	—	—	—	—	30	—	—	0.50	1.20	100	260	50	6.0	—	—
MP36585	45	4.0	0.1	—	—	—	40	—	—	—	0.40	—	10	200	10	3.5	—	—
MP36586	45	4.0	0.1	—	—	—	100	—	—	—	0.40	—	10	200	10	3.5	—	—

† C_{cb}

† I_C = 300 mA

2N4123 (SILICON)
2N4124



CASE 29 (1)
(TO-92)

NPN silicon transistors designed for general purpose switching and amplifier applications and for complementary circuitry with PNP types 2N4125 and 2N4126. Features one-piece, injection-molded plastic package for high reliability.

MAXIMUM RATINGS

Rating	Symbol	2N4123	2N4124	Unit
Collector-Emitter Voltage	V_{CEO}	30	25	Vdc
Collector-Base Voltage	V_{CB}	40	30	Vdc
Emitter-Base Voltage	V_{EB}	5		Vdc
Collector Current	I_C	200		mAdc
Total Device Dissipation @ $T_A = 60^\circ\text{C}$	P_D	210		mW
Total Device Dissipation @ $T_A = 25^\circ\text{C}$	P_D	310		mW
Derate above 25°C		2.81		mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to +135		$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	θ_{JA}	0.357	$^\circ\text{C}/\text{mW}$

FIGURE 1 — CAPACITANCE

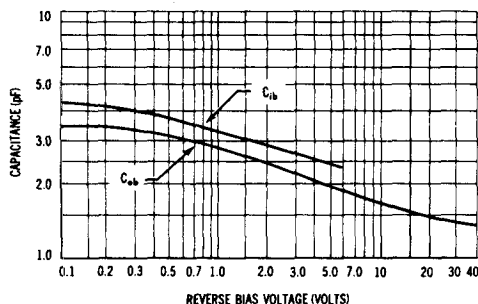
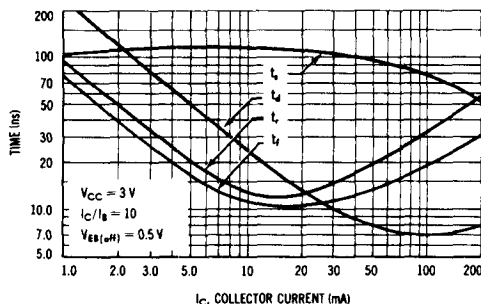


FIGURE 2 — SWITCHING TIMES



2N4123, 2N4124 (continued)

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

Characteristic	Fig. No.	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage* ($I_C = 1\text{ mAdc}$, $I_E = 0$)	2N4123 2N4124		BV_{CEO}^*	30 25	— —	Vdc
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{Adc}$, $I_E = 0$)	2N4123 2N4124		BV_{CBO}	40 30	— —	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{Adc}$, $I_C = 0$)			BV_{EBO}	5	—	Vdc
Collector Cutoff Current ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$)			I_{CBO}	—	50	nAdc
Emitter Cutoff Current ($V_{BE} = 3\text{ Vdc}$, $I_C = 0$)			I_{EBO}	—	50	nAdc

ON CHARACTERISTICS

DC Current Gain* ($I_C = 2\text{ mAdc}$, $V_{CE} = 1\text{ Vdc}$)	2N4123 2N4124	9	h_{FE}^*	50 120	150 360	—
($I_C = 50\text{ mAdc}$, $V_{CE} = 1\text{ Vdc}$)	2N4123 2N4124			25 60	— —	
Collector-Emitter Saturation Voltage* ($I_C = 50\text{ mAdc}$, $I_B = 5\text{ mAdc}$)		10, 11	$V_{CE(sat)}^*$	—	0.3	Vdc
Base-Emitter Saturation Voltage* ($I_C = 50\text{ mAdc}$, $I_B = 5\text{ mAdc}$)		11	$V_{BE(sat)}^*$	—	0.95	Vdc

SMALL SIGNAL CHARACTERISTICS

High-Frequency Current Gain ($I_C = 10\text{ mAdc}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	2N4123 2N4124		$ h_{fe} $	2.5 3.0	— —	—
Current-Gain — Bandwidth Product ($I_C = 10\text{ mAdc}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	2N4123 2N4124		f_T	250 300	— —	MHz
Output Capacitance ($V_{CB} = 5\text{ Vdc}$, $I_E = 0$, $f = 100\text{ kHz}$)		1	C_{ob}	—	4	pF
Input Capacitance ($V_{BE} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 100\text{ kHz}$)		1	C_{ib}	—	8	pF
Small-Signal Current Gain ($I_C = 2\text{ mAdc}$, $V_{CE} = 1\text{ Vdc}$, $f = 1\text{ kHz}$)	2N4123 2N4124	5	h_{fe}	50 120	200 480	—
Noise Figure ($I_C = 100\text{ }\mu\text{Adc}$, $V_{CE} = 5\text{ Vdc}$, $R_S = 1\text{ k ohm}$, Noise Bandwidth = 10 Hz to 15.7 kHz)	2N4123 2N4124	3, 4	NF	— —	6 5	dB

SWITCHING CHARACTERISTICS

Characteristic	Fig. No.	Symbol	Typ	Unit
Delay Time $V_{CC} = 3\text{ Vdc}$, $V_{EB(off)} = 0.5\text{ Vdc}$,	2	t_d	24	ns
Rise Time $I_C = 10\text{ mAdc}$, $I_{B1} = 1\text{ mAdc}$	2	t_r	13	ns
Storage Time $V_{CC} = 3\text{ Vdc}$, $I_C = 10\text{ mAdc}$,	2	t_s	125	ns
Fall Time $I_{B1} = I_{B2} = 1\text{ mAdc}$	2	t_f	11	ns

*Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%

2N4123, 2N4124 (continued)

AUDIO SMALL SIGNAL CHARACTERISTICS

NOISE FIGURE

$V_{CE} = 5 \text{ Vdc}$, $T_A = 25^\circ\text{C}$

FIGURE 3 — FREQUENCY VARIATIONS

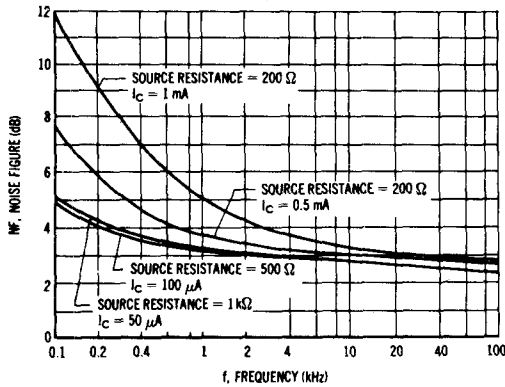
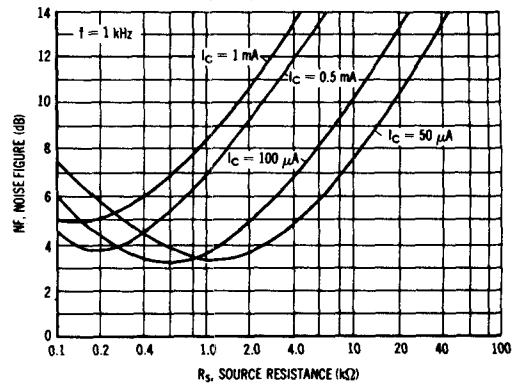


FIGURE 4 — SOURCE RESISTANCE



h PARAMETERS

$V_{CE} = 10 \text{ V}$, $f = 1 \text{ kHz}$, $T_A = 25^\circ\text{C}$

FIGURE 5 — CURRENT GAIN

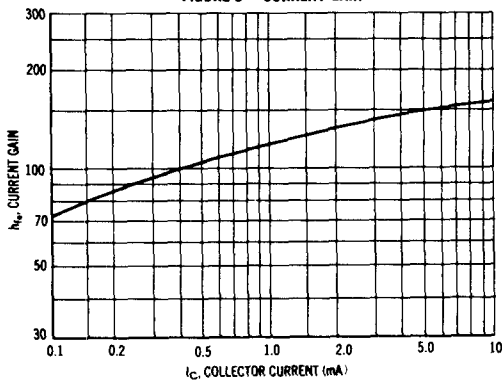


FIGURE 6 — OUTPUT ADMITTANCE

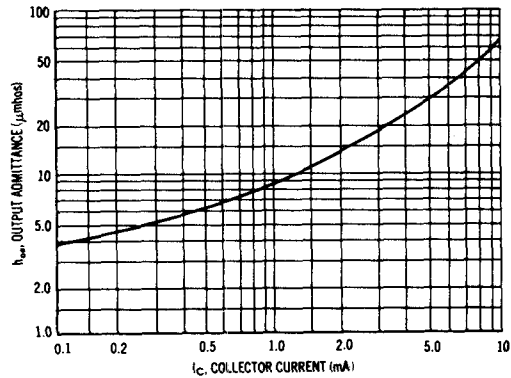


FIGURE 7 — INPUT IMPEDANCE

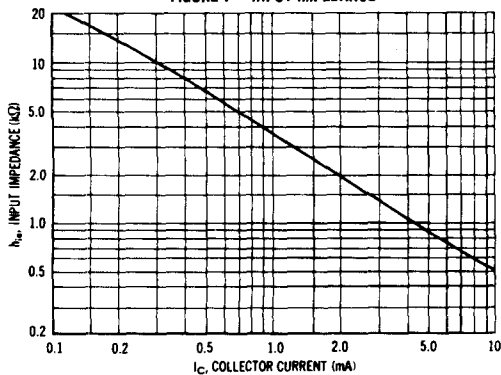
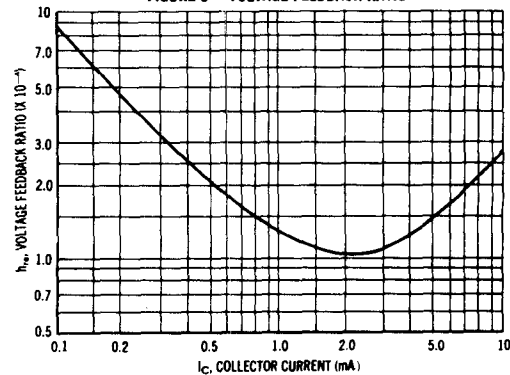


FIGURE 8 — VOLTAGE FEEDBACK RATIO



2N4123, 2N4124 (continued)

STATIC CHARACTERISTICS

FIGURE 9 — NORMALIZED CURRENT GAIN

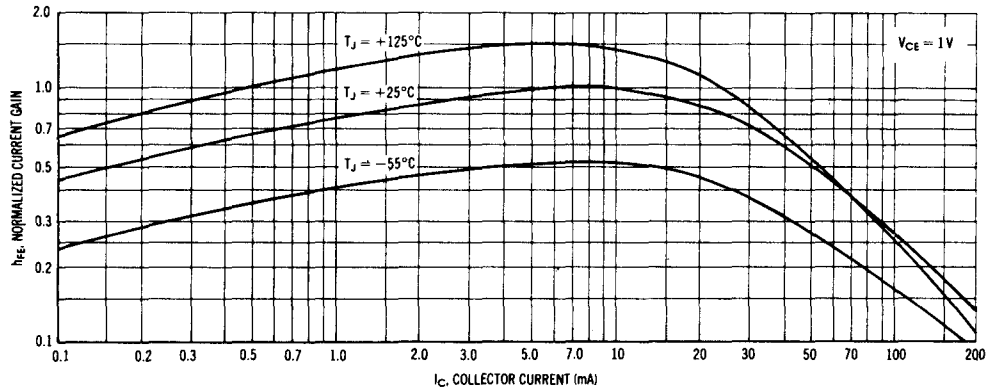


FIGURE 10 — COLLECTOR SATURATION REGION

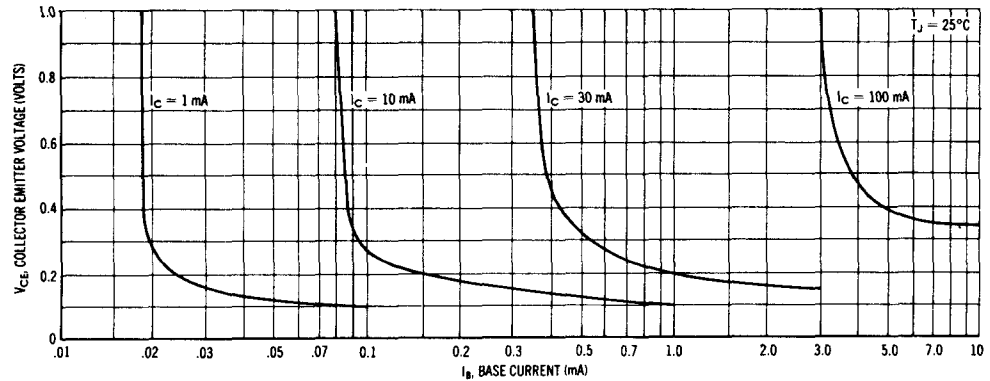


FIGURE 11 — "ON" VOLTAGES

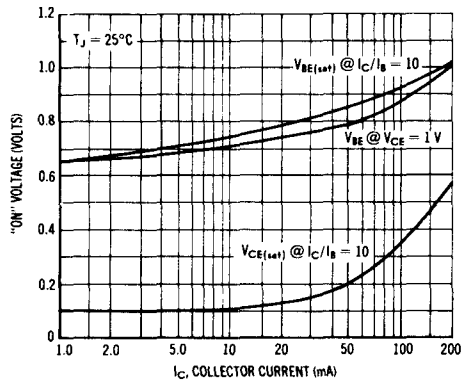


FIGURE 12 — TEMPERATURE COEFFICIENTS

