2N3856–2N3961

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
2N3856	S	N	MPS6513	5-109	RFC	0.2W	A	150	18	18	O	100	200	2.0M					140M	T
2N3856A	S	N	MPS6513	5-109	RFC	0.2W	A	150	30	30	O	100	200	2.0M					140M	T
2N3857	S	P			AFA	0.6W	A	200	45	45	O	50	200	1.0M	0.1	10M	45	E	4.0M	T
2N3858	S	N	MPS6512	5-109	RFC	0.2W	A	125	30	30	O	60	120	2.0M					90M	T
2N3858A	S	N	MPS6566	5-148	RFA	200M	A	100	60	60	O	45		1.0M					90M	T
2N3859	S	N	MPS6513	5-109	RFC	0.2W	A	125	30	30	O	100	200	2.0M					90M	T
2N3859A	S	N	MPS6566	5-148	AFA	200M	A	100	60	60	O	75		1.0M					90M	T
2N3860	S	N	MPS6514	5-109	RFC	0.2W	A	125	30	30	O	150	300	2.0M					90M	T
2N3861	S	N			LPA	2.0W	A	175	530	530	V	30	200	25M	1.5	25M	20	E	50M	T
2N3862	S	N			HSS	0.36W	A	200	50	20	O	50	150	10M	0.25	10M			600M	T
2N3863	S	N	2N3715	7-125	PMS	117W	C	200	70	50	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3864	S	N	2N3716	7-125	PMS	117W	C	200	110	90	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3865	S	N			PMS	117W	C	200	160	150	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3866	S	N		9-91	HPA	5.0W	C	200	55	30	O	10	200	50M	1.0	0.1A			250M	T
2N3867	S	P			HSS	1.0W	A	200	40	40	O	40	200	1.5A	0.75	1.5A			60M	T
2N3868	S	P			HSS	1.0W	A	200	60	60	O	30	150	1.5A	0.75	1.5A			60M	T
2N3869	S	N			HPA	2.5W	C	175	40	20	O	20	150	30M	0.7	0.45A			0.4G	T
2N3870 thru 2N3873	Thyristors, see Table on Page 1-154																			
2N3876	S	N			LPA	150W	C	175	140	50	O	25	150	10A	1.0	10A	80	E	50M	T
2N3877	S	N	2N4410	5-45	AFC	0.2W	A	150	70	70	O	20	250	2.0M						
2N3877A	S	N	2N4410	5-45	AFC	0.2W	A	150	85	85	O	20	250	2.0M						
2N3878	S	N			HPA	35W	C	200	120	50	O	40	200	0.5A	2.0	4.0A	40	E	40M	T
2N3879	S	N			PMS	35W	C	200	120	75	O	12	100	4.0A	1.2	4.0A			40M	T
2N3880	S	N			RFA	0.2W	A	200	30	15	O	30	200	3.0M			50	E	1.2G	T
2N3881	S	N			RFA	0.6W	A	200	60	35	O				1.5	0.15A	50	E	70M	T
2N3882	Field Effect Transistor, see Table on Page 1-166																			
2N3883	G	P		8-282	HSS	0.3W	A	100	25	15	O	30		0.2A	0.5	0.2A			100M	T
2N3884 thru 2N3899	Thyristors, see Table on Page 1-154																			
2N3900	S	N	2N5088	5-59	AFC	0.2W	A	125	18	18	O	250	500	2.0M			170	E		
2N3900A	S	N	2N5088	5-59	AFC	0.2W	A	125	18	18	O	250	500	2.0M			170	E		
2N3901	S	N	2N5088	5-59	AFC	0.2W	A	125	18	18	O	350	700	2.0M			350	E		
2N3902	S	N			PMS	100W	C	150	400	400	O	20	100	1.0A	2.5	2.5A			40K	E
2N3903	S	N		5-11	HSS	0.31W	A	135	60	40	O	50	150	10M	0.2	10M	50	E	250M	T
2N3904	S	N		5-11	HSS	0.31W	A	135	60	40	O	100	300	10M	0.2	10M	100	E	300M	T
2N3905	S	P		5-16	HSS	0.31W	A	135	40	40	O	50	150	10M	0.25	10M	50	E	200M	T
2N3906	S	P		5-16	HSS	0.31W	A	135	40	40	O	100	300	10M	0.25	10M	100	E	250M	T
2N3907	S	N	2N2915	11-27	DFA	0.3W	A	200	60	45	O	60	300	10*	0.35	1.0M			60M	T
2N3908	S	N	2N2916	11-27	DFA	0.3W	A	200	60	60	O	100	500	10*	0.35	1.0M			60M	T
2N3909	Field Effect Transistor, see Table on Page 1-166																			
2N3910	S	P			CHP	0.5W	A	200	60	50	O	40	160	1.0M	0.3	10M			4.0M	T
2N3911	S	P			CHP	0.5W	A	200	60	40	O	60	240	1.0M	0.3	10M			8.0M	T
2N3912	S	P			CHP	0.5W	A	200	60	30	O	90		1.0M	0.3	10M			10M	T
2N3913	S	P			CHP	0.4W	A	200	60	50	O	40	160	1.0M	0.3	10M			4.0M	T
2N3914	S	P			CHP	0.4W	A	200	60	40	O	60	240	1.0M	0.3	10M			8.0M	T
2N3915	S	P			CHP	0.4W	A	200	60	30	O	90		1.0M	0.3	10M			10M	T
2N3916	S	N			LPA	5.0W	C	150	150	150	O	40	200	0.15A	5.0	0.15A	30	E	50M	T
2N3917	S	N			LPA	20W	C	150	80	40	O	30	120	1.0A	1.2	1.0A	15	E	50M	T
2N3918	S	N			LPA	20W	C	150	80	40	O	100	300	1.0A	1.2	1.0A	30	E	50M	T
2N3919	S	N			PMS	15W	C	150	120	60	O	40	120	2.0A	1.2	10A			80M	T
2N3920	S	N			PMS	15W	C	150	120	60	O	100	300	2.0A	1.2	10A			80M	T
2N3921 2N3922	Field Effect Transistors, see Table on Page 1-166																			
2N3923	S	N			VID	0.8W	A	200	150	150	O	30	120	25M	1.0	25M	20	E	40M	T
2N3924	S	N		9-96	HPA	7.0W	C	200	36	18	O								250M	T
2N3925	S	N		9-96	HPA	10W	C	200	36	18	O								250M	T
2N3926	S	N		9-96	HPA	11.6W	C	200	36	18	O								250M	T
2N3927	S	N		9-96	HPA	23.2W	C	200	36	18	O								200M	T
2N3928	S	N			PHS	7.5W	C	175	80	40	O	20	300	1.5A	5.0	1.5A			200M	T
2N3929	S	N			PHS	30W	C	175	80	40	O	20	300	1.5A	5.0	1.5A			200M	T
2N3930	S	P			AFA	0.4W	A	200	180	180	O	80	300	10M	0.25	10M	100	E	40M	T
2N3931	S	P			AFA	0.7W	A	200	180	180	O	80	300	10M	0.25	10M	100	E	40M	T
2N3932	S	N			RFA	0.2W	A	200	30	20	O	40	150	2.0M			50	E	750M	T
2N3933	S	N			RFA	0.2W	A	200	40	30	O	60	200	2.0M			60	E	750M	T
2N3934 2N3935	Field Effect Transistors, see Table on Page 1-166																			
2N3936 thru 2N3940	Thyristors, see Table on Page 1-154																			
2N3941	S	N			DFA	0.75W	C	200	60	45	O	400		10*			300	E	200M	T
2N3942	S	N			DFA	0.75W	C	200	60	45	O	400		10*			300	E	200M	T
2N3943	S	N			DFA	0.5W	C	200	60	45	O	400		10*			300	E	200M	T
2N3944	S	N			DFA	0.5W	C	200	60	45	O	400		10*			300	E	200M	T
2N3945	S	N			MNS	5.0W	C	200	70	50	O	40	250	0.15A	0.5	0.15A			60M	T
2N3946	S	N		8-286	HSA	360M	A	200	60	40	O	50	150	10M	0.3	50M	50	E	250M	T
2N3947	S	N		8-286	HSA	360M	A	200	60	40	O	100	300	10M	0.3	50M	100	E	300M	T
2N3948	S	N		9-102	HPA	1.0W	A	200	36	20	O	15		50M					700M	T
2N3950	S	N		9-106	HPA	70W	C	200	65	35	O								150M	T
2N3953	S	N			RFA	0.2W	A	200	15	12	O	30	360	2.0M			40	E	1.3G	T
2N3954 thru 2N3958	Field Effect Transistors, see Table on Page 1-166																			
2N3959	S	N		8-292	HNS	400M	A	200	20	12	O	40	200	10M	0.3	30M	13	E	1.3G	T
2N3960	S	N		8-292	HNS	400M	A	200	20	12	O	40	200	10M	0.3	30M	16	E	1.6G	T
2N3961	S	N		9-74	HPA	10W	C	200	65	40	O								400M	T

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

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

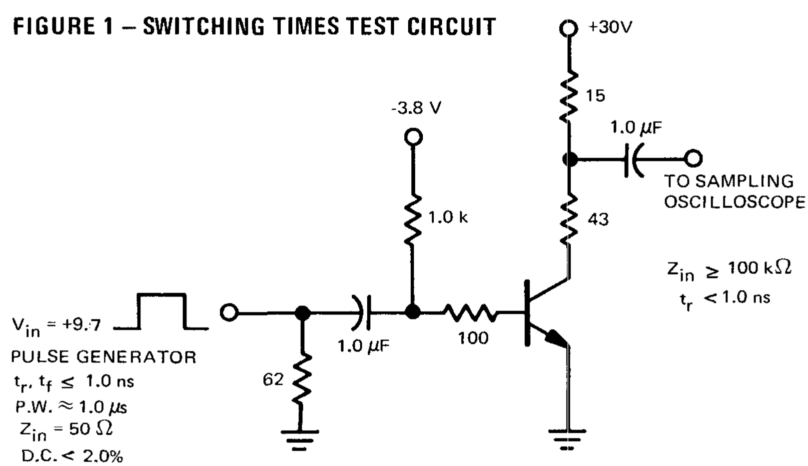
Characteristic		Symbol	Min	Max	Unit
ON CHARACTERISTICS (continued)					
Collector-Emitter Saturation Voltage*		$V_{CE(sat)}$*			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			-	0.25	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N3724, 2N4013		-	0.20	
	2N3725, 2N4014		-	0.26	
(I_C = 300 mAdc, I_B = 30 mAdc)	2N3724, 2N4013		-	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



RF POWER TRANSISTORS
(Listed in order of operating test frequency and power output)

ALL SILICON NPN

Type	f MHz	P_{out} W @	P_{in} W
2N3295	30	0.3	0.012
2N3296	30	3.0	0.075
2N3297	30	12	1.2
2N2948	30	15	2.0
2N2951, 52	50	0.6	0.1
2N2949, 50	50	3.5	0.35
2N2947	50	15	2.0
2N3950	50	50	4.5
2N3298	80	0.1	-
2N3375	100	7.5	1.0
2N3818	100	15	3.0
2N3553	175	2.5	0.25
2N3961	175	4.0	0.5
2N3924	175	4.0	1.0
2N3925	175	5.0	1.3
2N3926	175	7.0	2.0
2N3927	175	12	4.0
2N3632	175	13.5	3.5
2N3137	250	0.7	0.1
2N3664	250	2.2	0.4
2N3866	400	1.0	0.1
2N3948	400	1.0	0.25
2N4012	400	3.0 (typ)	1.0
2N3375	400	3.0 (min)	1.0
2N3733	400	10	4.0

HIGH-VOLTAGE TRANSISTORS

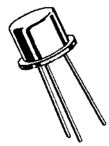
Type	V_{CEO}	f_T (MHz) min	max @	I_C mA
2N4924	100	100	500	20
2N4925	150	100	500	20
2N4926	200	30	300	10
2N4927	250	30	300	10

2N3866 (SILICON)

$V_{CB} = 55$ V

$I_C = 0.4$ A

$P_D = 5.0$ W



CASE 79
(TO-39)

NPN silicon transistor, designed for amplifier, frequency-multiplier, or oscillator applications in military and industrial equipment. Suitable for uses as output, driver, or pre-driver stages in VHF and UHF equipment.

Collector connected to case

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

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CB}	55	Vdc
Emitter-Base Voltage	V_{EB}	3.5	Vdc
Collector Current	I_C	0.4	Amp
Total Device Dissipation @ $T_C = 25°C$ Derate above 25°C	P_D	5 28.6	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (I_C = 5 mAdc, I_B = 0)	$BV_{CEO(sus)}$	30	—	—	Vdc
Collector-Base Breakdown Voltage (I_E = 0, I_C = 0.1 mAdc)	BV_{CBO}	55	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	BV_{EBO}	3.5	—	—	Vdc
Collector Cutoff Current (V_{CE} = 28 Vdc, I_B = 0)	I_{CEO}	—	—	20	μA
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.36 Adc, V_{CE} = 5 Vdc) (I_C = 0.05 Adc, V_{CE} = 5 Vdc)	h_{FE}	 5 10	 — —	 — 200	—
DYNAMIC CHARACTERISTICS					
Current-Gain—Bandwidth Product (I_C = 25 mAdc, V_{CE} = 15 Vdc, f = 200 MHz)	f_T	—	800	—	MHz
Output Capacitance (V_{CB} = 30 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	2.0	3.0	pF

FUNCTIONAL TEST

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Power Gain	Test Circuit-Figure 1 P_{in} = 0.1 W, V_{CE} = 28 Vdc f = 400 MHz, T_C = 25°C	G_{pe}	10	—	—	dB
Power Output		P_{out}	1.0	—	—	Watts
Collector Efficiency		η	45	—	—	%

2N3866 (continued)

FIGURE 1 — 400 MHz RF AMPLIFIER CIRCUIT FOR POWER-OUTPUT TEST

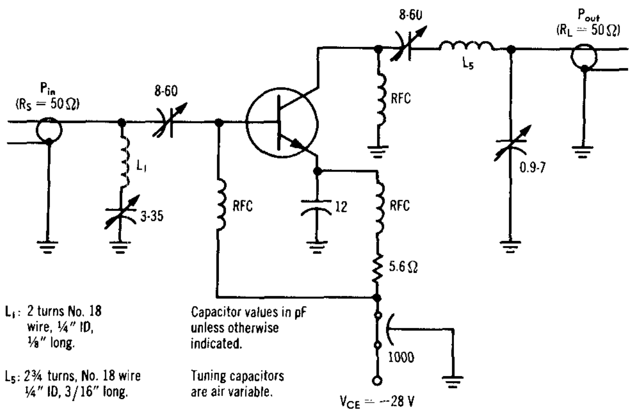


FIGURE 2 — POWER OUTPUT versus FREQUENCY (Class C)

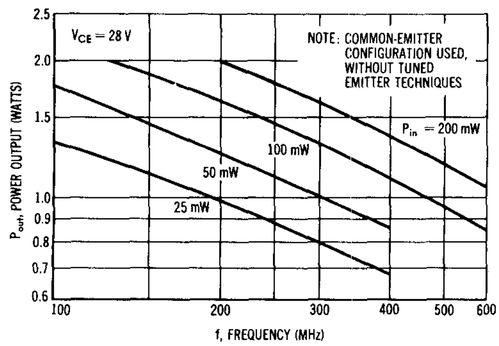


FIGURE 4 — PARALLEL INPUT RESISTANCE AND CAPACITANCE versus FREQUENCY (Class C)

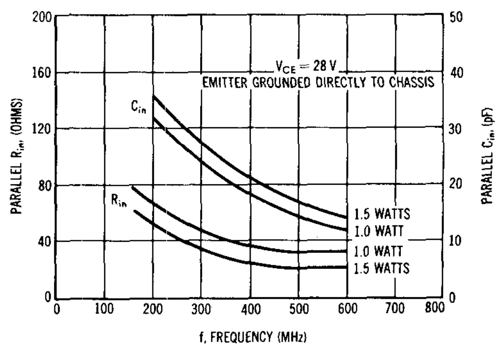


FIGURE 3 — POWER OUTPUT versus POWER INPUT (Class C)

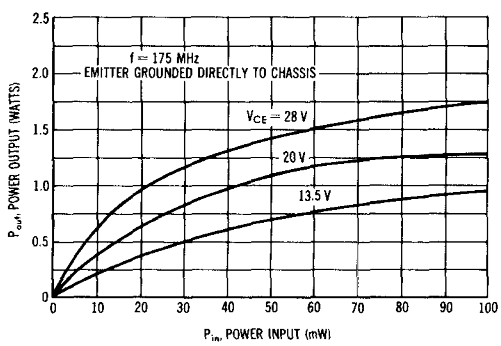
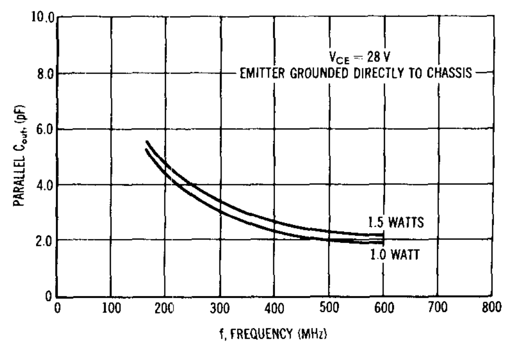


FIGURE 5 — PARALLEL OUTPUT CAPACITANCE versus FREQUENCY (Class C)



2N3866 (continued)

FIGURE 6 — SMALL-SIGNAL CURRENT GAIN versus FREQUENCY

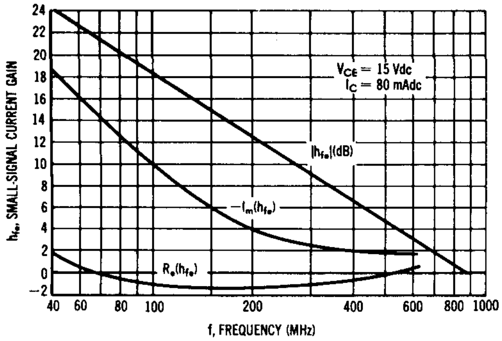


FIGURE 7 — OUTPUT CAPACITANCE versus COLLECTOR VOLTAGE

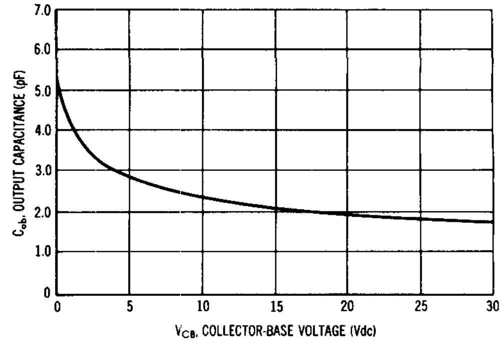


FIGURE 8 — f_T versus COLLECTOR CURRENT

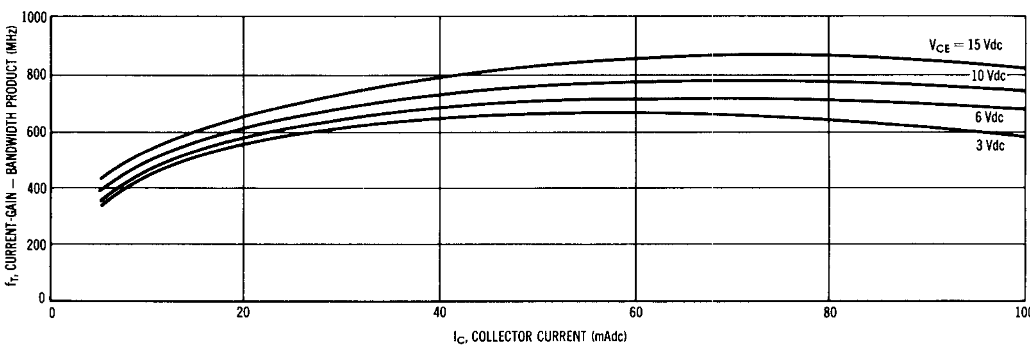


FIGURE 9 — $r_b'C_c$ versus COLLECTOR CURRENT

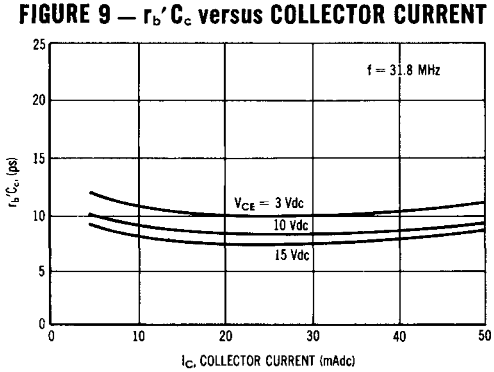
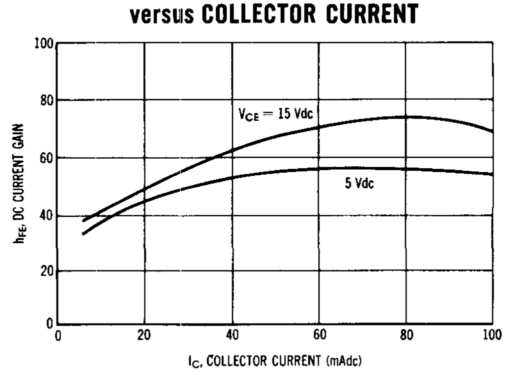


FIGURE 10 — DC CURRENT GAIN versus COLLECTOR CURRENT



2N3866 (continued)

y PARAMETER VARIATIONS

FIGURE 11 — SMALL-SIGNAL INPUT ADMITTANCE versus COLLECTOR CURRENT

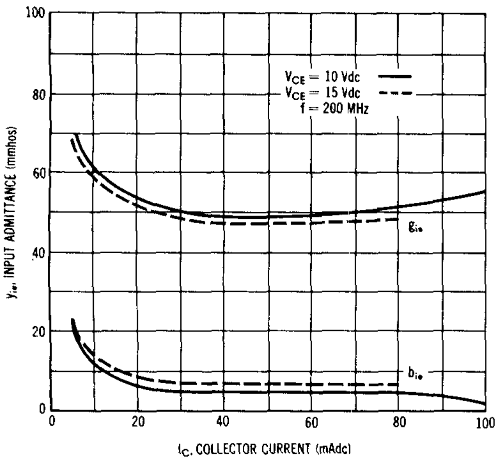


FIGURE 13 — SMALL-SIGNAL FORWARD TRANSFER ADMITTANCE versus COLLECTOR CURRENT

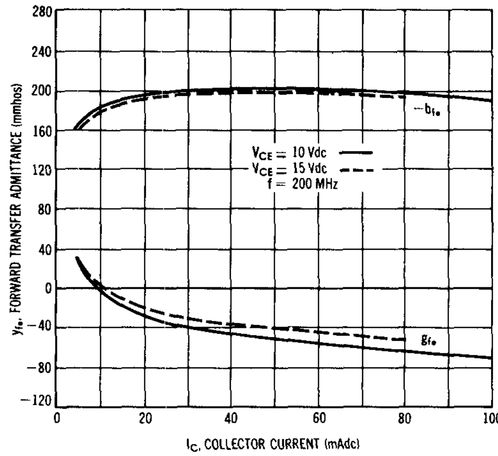


FIGURE 12 — SMALL-SIGNAL REVERSE TRANSFER ADMITTANCE versus COLLECTOR CURRENT

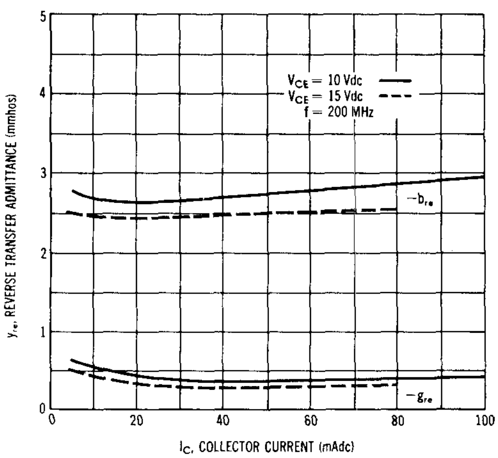
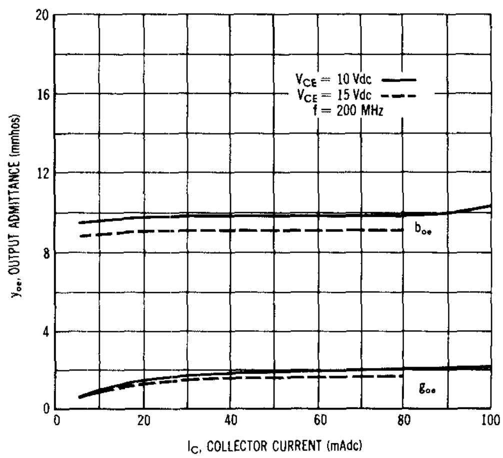


FIGURE 14 — SMALL-SIGNAL OUTPUT ADMITTANCE versus COLLECTOR CURRENT



DESIGN NOTE

Figures 11 through 18 show small-signal admittance-parameter data. This data can be used for Class A amplifier designs.

For Class C power-amplifier designs, the small-signal parameters are not applicable. Figures 4 and 5 give parallel output capacitance and the parallel input resistance and capacitance for Class C power-amplifier operation.

The parallel resistive portion of the collector load impedance for a power amplifier, R_L', may be computed by assuming a peak voltage swing equal to V_{CC}, and using the expression

$$R_L' = \frac{V_{CC}^2}{2P}$$

where P = RF power output. The computed R_L' may then be combined with the data in Figures 2 and 3 to comprise complete device impedance data for Class C power amplifier design.

2N3866 (continued)

y PARAMETER VARIATIONS

(V_{CE} = 15 Vdc, I_C = 80 mAdc, T_A = 25°C)

FIGURE 15 — SMALL-SIGNAL INPUT ADMITTANCE versus FREQUENCY

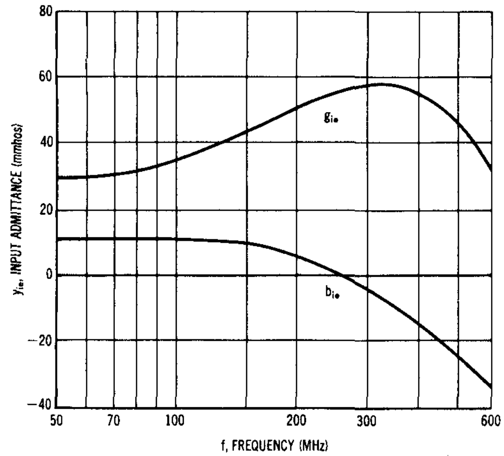


FIGURE 17 — SMALL-SIGNAL FORWARD TRANSFER ADMITTANCE versus FREQUENCY

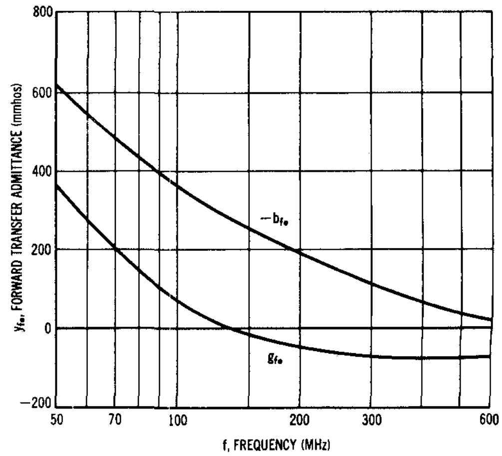


FIGURE 16 — SMALL-SIGNAL REVERSE TRANSFER ADMITTANCE versus FREQUENCY

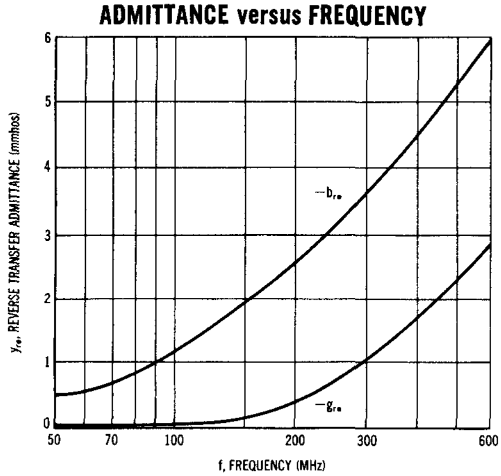


FIGURE 18 — SMALL-SIGNAL OUTPUT ADMITTANCE versus FREQUENCY