GENERAL PURPOSE AMPS AND SWITCHES (Continued)

PNP Transistors

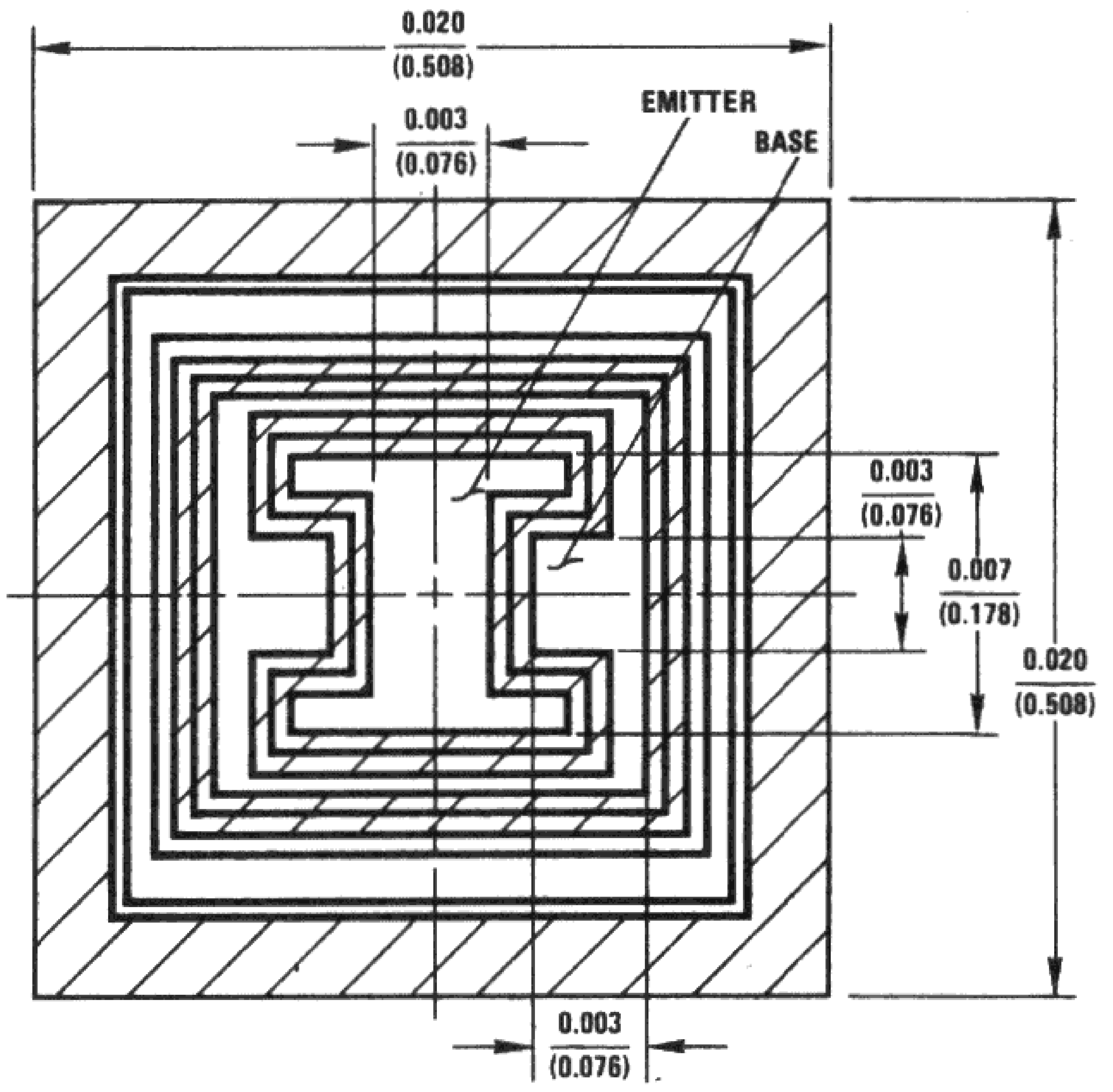
Type No.	Case Style	V_{CBO} (V) Min	V_{CEO} (V) Min	V_{EBO} (V) Min	I_{CBO} (nA) Max @	V_{CB} (V)	h_{FE} Min	h_{FE} Max	@ I_C (mA)	& V_{CE} (V)	$V_{CE(SAT)}$ (V) Max	& $V_{BE(SAT)}$ (V) Min	$V_{BE(SAT)}$ (V) Max	@ I_C (mA)	C_{ob} (pF) Max	f_T (MHz) Min	f_T (MHz) Max	@ I_C (mA)	t_{off} (ns) Max	NF (dB) Min	Test Condition	Process No.
2N4291	TO-92 (74)	40	30	6	200	30	100	300	100	10	0.4		1.5	100	10	100		10				63
							50		10	10												
							30		0.1	10												
2N4402	TO-92 (72)	40	40	5			20		500	2	0.4	0.7	0.95	150	10	150		20	255		4	63
							50	150	150	2												
							50		10	1	0.75		1.3	500								
							30		1	1												
2N4403	TO-92 (72)	40	40	5			20		500	2					10	200		20	255		4	63
							100	300	150	2	0.4	0.75	0.95	150								
							100		10	1												
							30		1	1	0.75		1.3	500								
							60		0.1	1												
2N4916	TO-92 (72)	Same as PN4916, see page 2-18 for explanation																				66
2N4917	TO-92 (72)	Same as PN4917, see page 2-18 for explanation																				66
2N4971	TO-92 (72)	Same as PN2906, see page 2-16 for explanation																				63
2N4972	TO-92 (72)	Same as PN2907, see page 2-16 for explanation																				63
2N5138	TO-92 (72)	Same as PN5138, see page 2-18 for explanation																				66
2N5139	TO-92 (72)	Same as PN5139, see page 2-18 for explanation																				66
2N5142	TO-92 (72)	Same as PN5142, see page 2-18 for explanation																				63
2N5143	TO-92 (72)	Same as PN5143, see page 2-18 for explanation																				63
2N5221	TO-92 (72)	15	15	3	100	10	30	600	50	10	0.5		1.1	150	15	100		20				63
							30		10	10												
2N5226	TO-92 (72)	25	25	4	300	15	30	600	50	10	0.8		1.0	100	20	50		20				63
							25		10	10												
2N5356	TO-92 (74)	25	25	4	100	25	40	120	50	1	0.25			50	8							63
2N5355	TO-92 (74)	25	25	4	100	25	100	300	50	1	0.25			50	8							63
2N5365	TO-92 (74)	40	40	4	100	40	20		300	5	0.25		1.1	50	8							63
							40	120	50	1												
							32		2	1	1.0		2.0	300								

TEST CONDITIONS:

(1) I_C = 300mA, V_{CC} = 10V, $I_{B1} = I_{B2}$ = 30mA. **(2)** I_C = 150mA, V_{CC} = 6V, $I_{B1} = I_{B2}$ = 15mA. **(3)** I_C = 300mA, V_{CC} = 15V, $I_{B1} = I_{B2}$ = 30mA. **(4)** I_C = 300mA, V_{CC} = 30V, $I_{B1} = I_{B2}$ = 30mA. **(5)** I_C = 10mA, V_{CC} = 3V, $I_{B1} = I_{B2}$ = 1mA. **(6)** I_C = 100 μA, V_{CE} = 5V, f = 100Hz. **(7)** I_C = 30 μA, V_{CE} = 5V, f = 1kHz. **(8)** I_C = 100 μA, V_{CE} = 5V, f = 1kHz. **(9)** I_C = 250 μA, V_{CE} = 5V, f = 1kHz. **(10)** I_C = 10 μA, V_{CE} = 5V, f = 1kHz. **(11)** I_C = 50mA, V_{CC} = 30V, $I_{B1} = I_{B2}$ = 5mA. **(12)** I_C = 150mA, V_{CC} = 30V, $I_{B1} = I_{B2}$ = 15mA. **(13)** I_C = 50mA, V_{CC} = 10V, $I_{B1} = I_{B2}$ = 5mA.

National Semiconductor

Process 63 PNP Medium Power



DESCRIPTION

Process 63 is a nonoverlay double diffused, silicon epitaxial device. Complement to Process 20.

APPLICATION

This device was designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA.

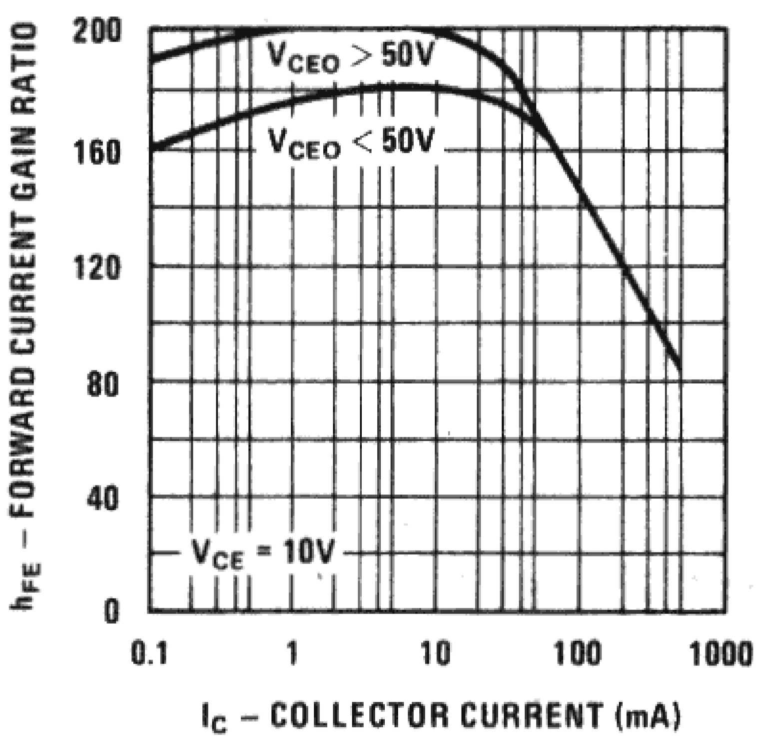
PRINCIPAL DEVICE TYPES

TO-5	2N2905A
TO-18	2N2907A
TO-92	2N4403 (EBC), 2N3702 (ECB)
TO-105	2N3645
TO-106	2N4143
TO-92+	TN2905A

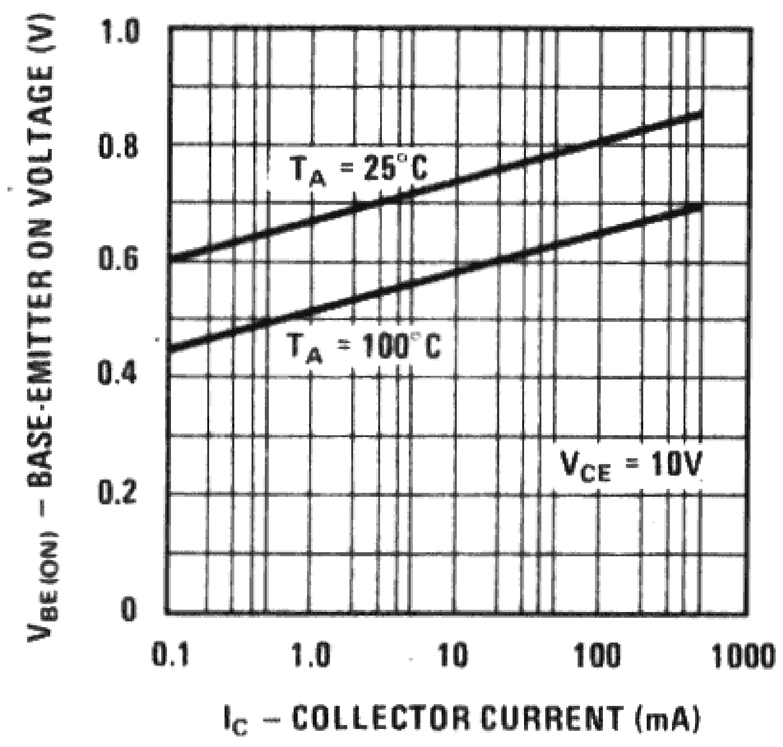
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
t_{on}	I_C = 150 mA, I_{B1} = 15 mA		30	45	ns	Fig. 1
t_{off}	I_C = 150 mA, I_{B2} = 15 mA		220	290	ns	Fig. 2
C_{cb}	V_{CB} = 10V		6	8	pF	TO-18
C_{eb}	V_{EB} = 0.50V		15	18	pF	TO-18
h_{fe}	I_C = 20 mA, V_{CE} = 20V, f = 100 MHz	1.5	2.5			
NF (spot)	I_C = 100 μA, V_{CE} = 10V, R_S = 1k f = 1 kHz		1.5	3	dB	
h_{FE}	I_C = 1 mA, V_{CE} = 10V	50	140	400		
h_{FE}	I_C = 10 mA, V_{CE} = 10V	50	140	400		
h_{FE}	I_C = 100 mA, V_{CE} = 10V	50	95	400		
h_{FE}	I_C = 150 mA, V_{CE} = 10V	40	150	350		
h_{FE}	I_C = 500 mA, V_{CE} = 10V	40	50	200		
$V_{CE(SAT)}$	I_C = 150 mA, I_B = 15 mA		0.25	0.40	V	
$V_{CE(SAT)}$	I_C = 500 mA, I_B = 50 mA		0.60	1.00	V	
$V_{BE(SAT)}$	I_C = 150 mA, I_B = 15 mA		0.90	1.3	V	
$V_{BE(SAT)}$	I_C = 500 mA, I_B = 50 mA		1.10	1.6	V	
BV_{CEO}	I_C = 10 mA	35	50	65	V	
BV_{CBO}	I_C = 100 μA	45	70	95	V	
BV_{CES}	I_C = 10 μA	0.45		90	V	
BV_{EBO}	I_E = 10 μA	7			V	
I_{CBO}	V_{CB} = 40V			50	nA	
I_{EBO}	V_{EB} = 3V			50	nA	

Process 63

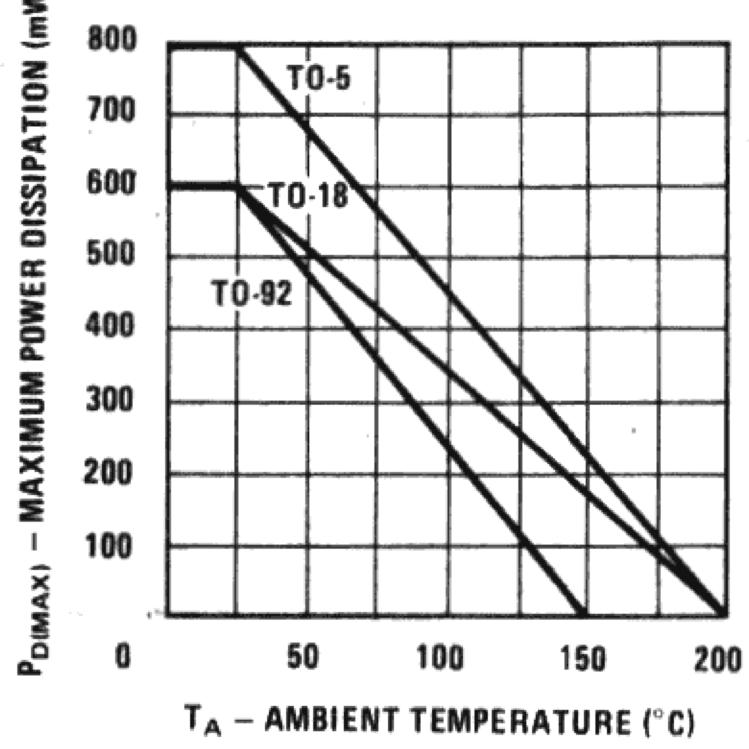
DC Pulse Current Gain vs Collector Current



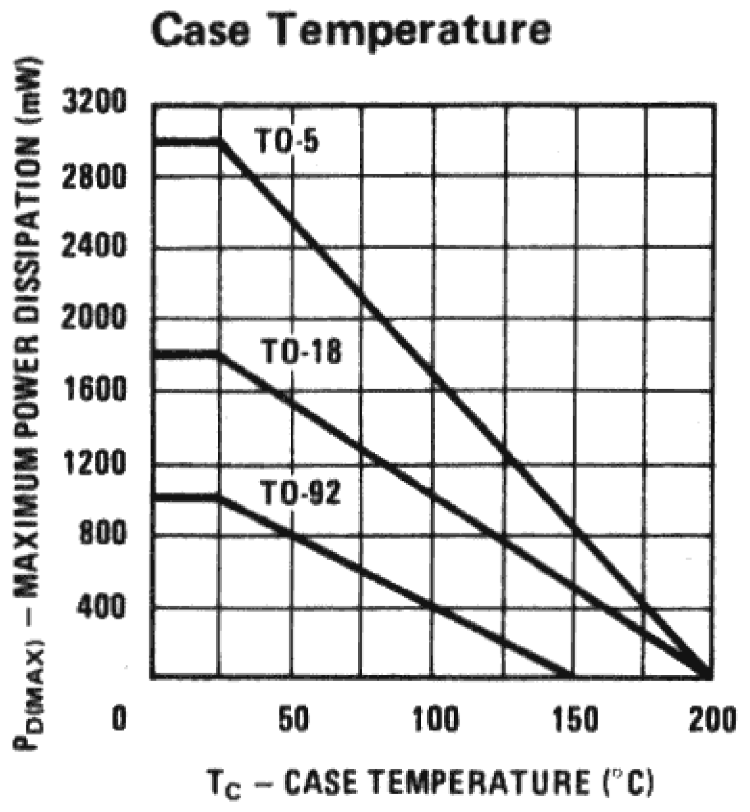
Base-Emitter On Voltage vs Collector Current



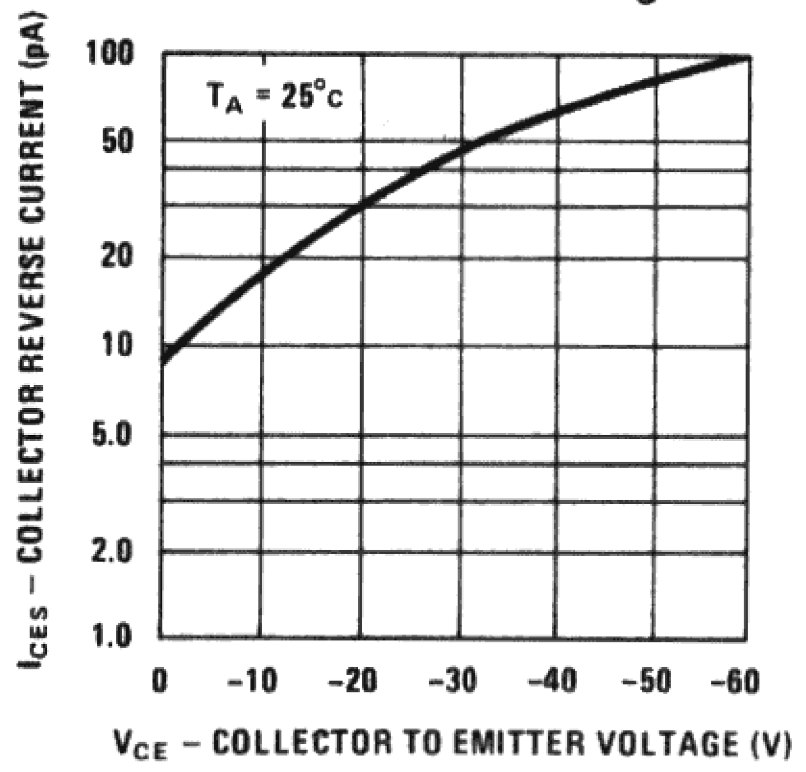
Maximum Power Dissipation vs Ambient Temperature



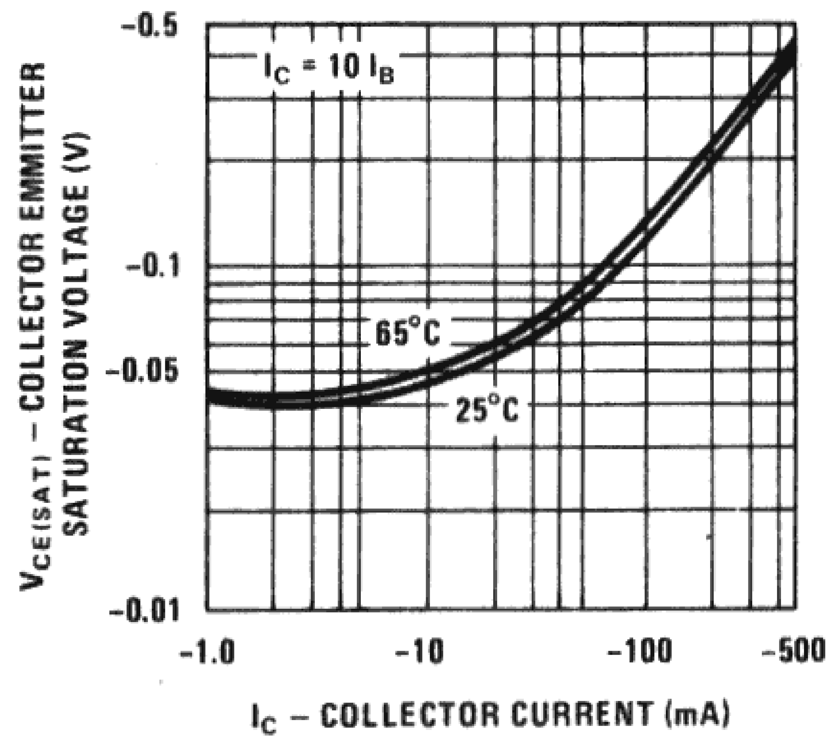
Maximum Power Dissipation vs Case Temperature



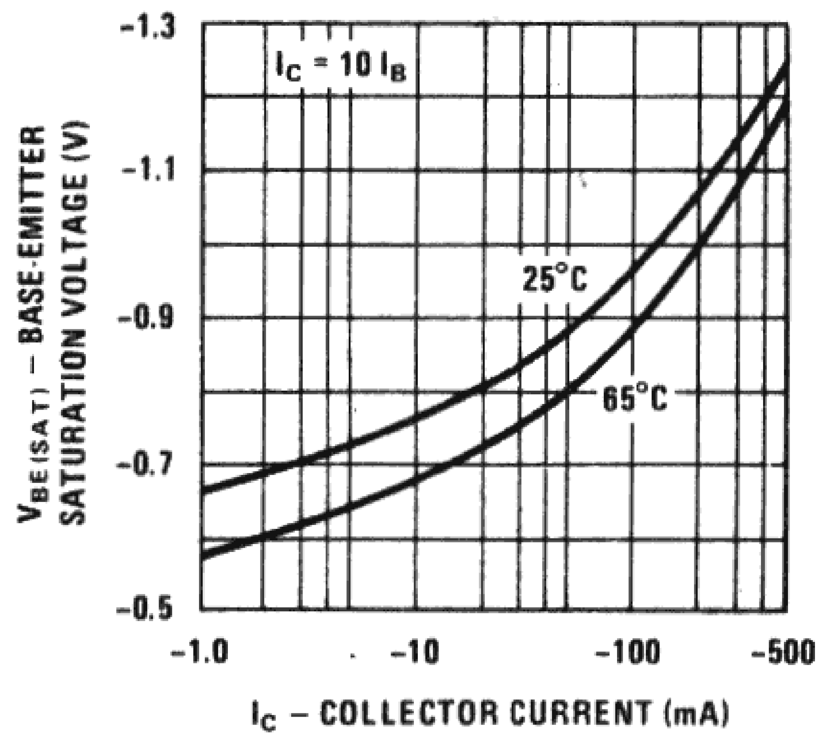
Collector Reverse Current vs Reverse Bias Voltage



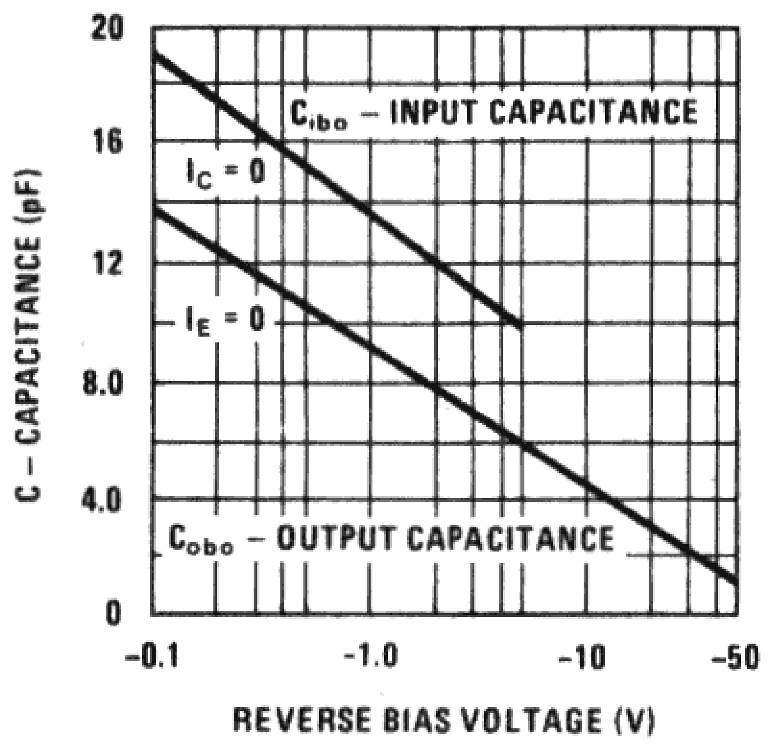
Pulsed Collector Saturation Voltage vs Collector Current



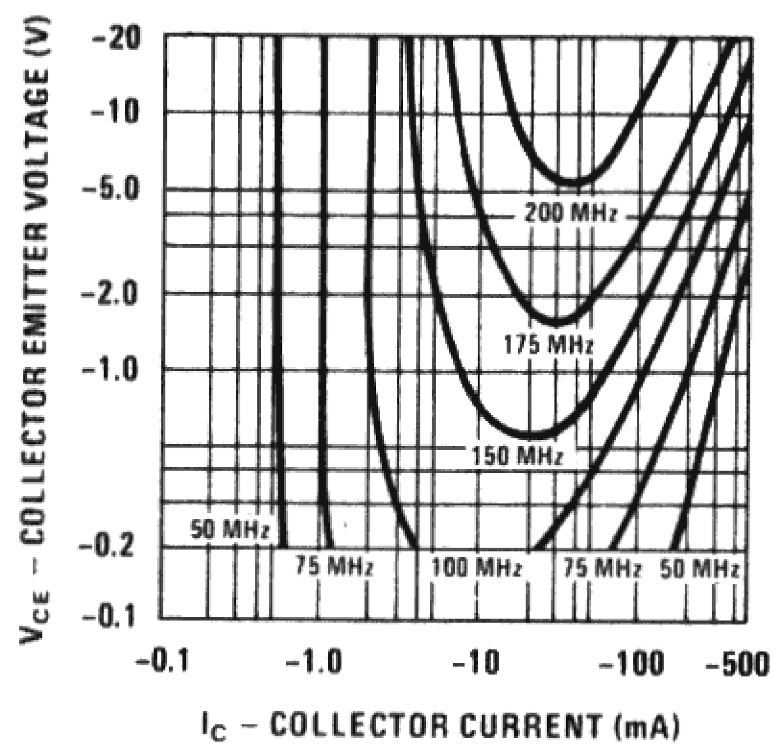
Pulsed Base Saturation Voltage vs Collector Current



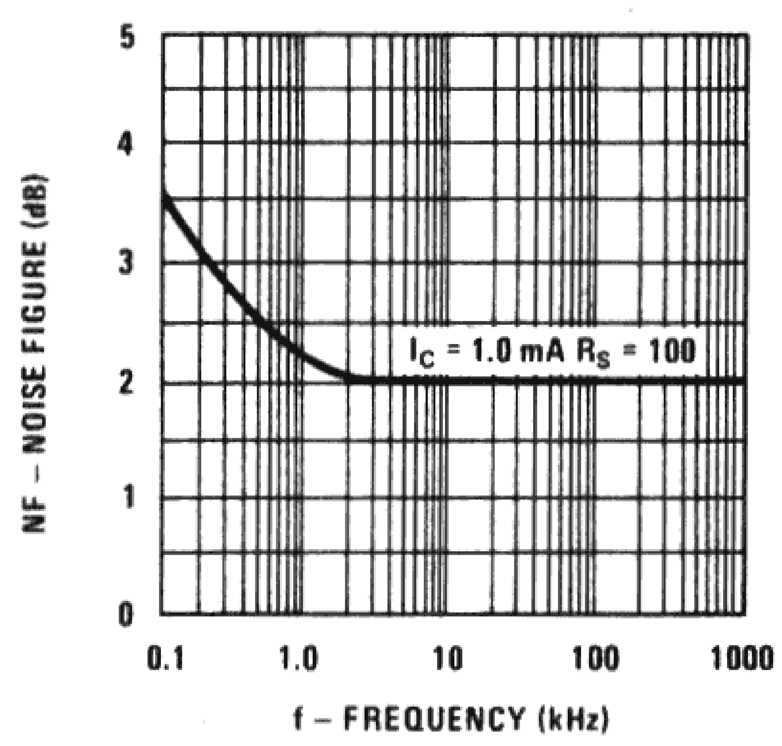
Input and Output Capacitances vs Reverse Bias Voltage



Contours of Constant Gain Bandwidth Product (f_T)

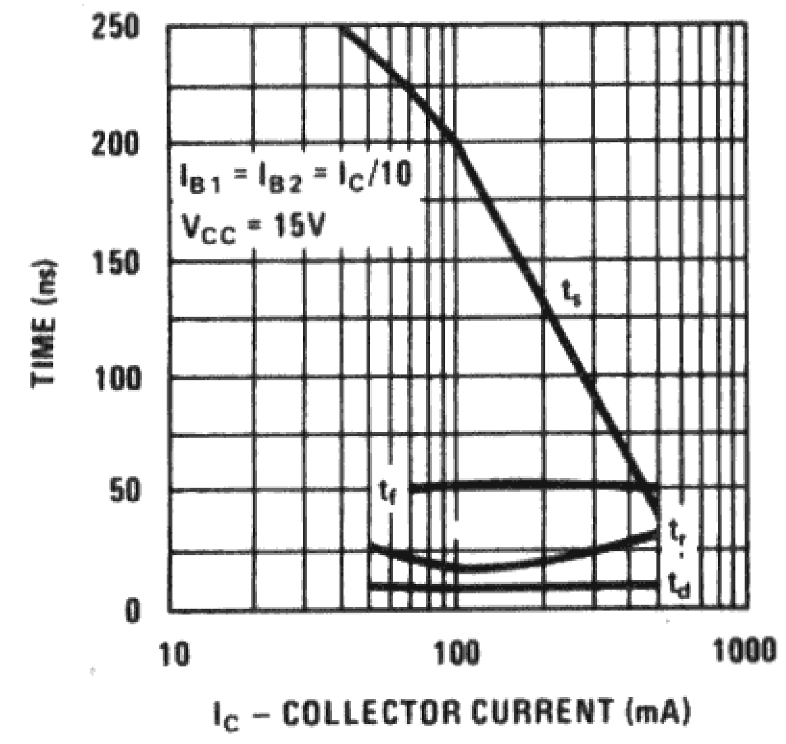


Noise Figure vs Frequency

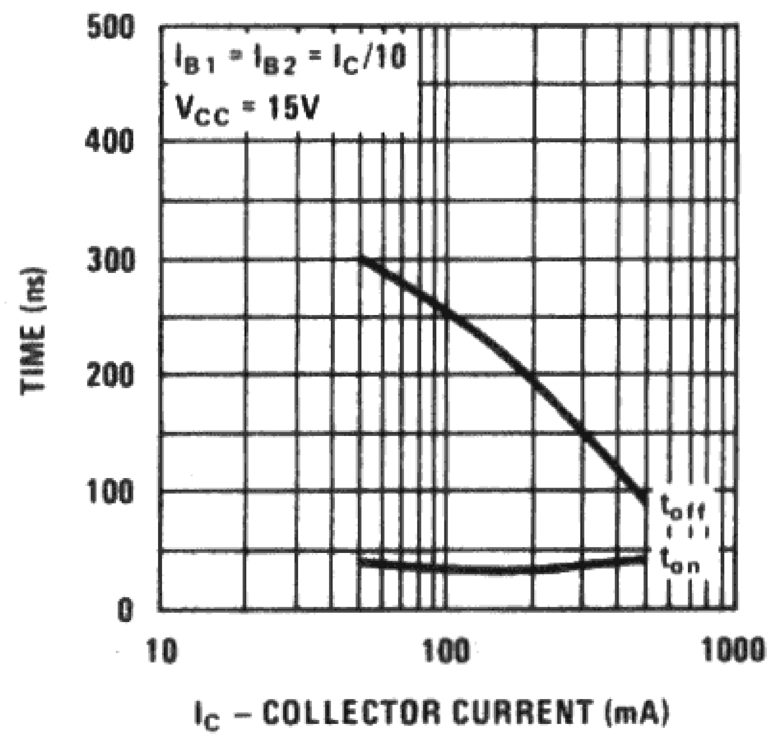


Process 63

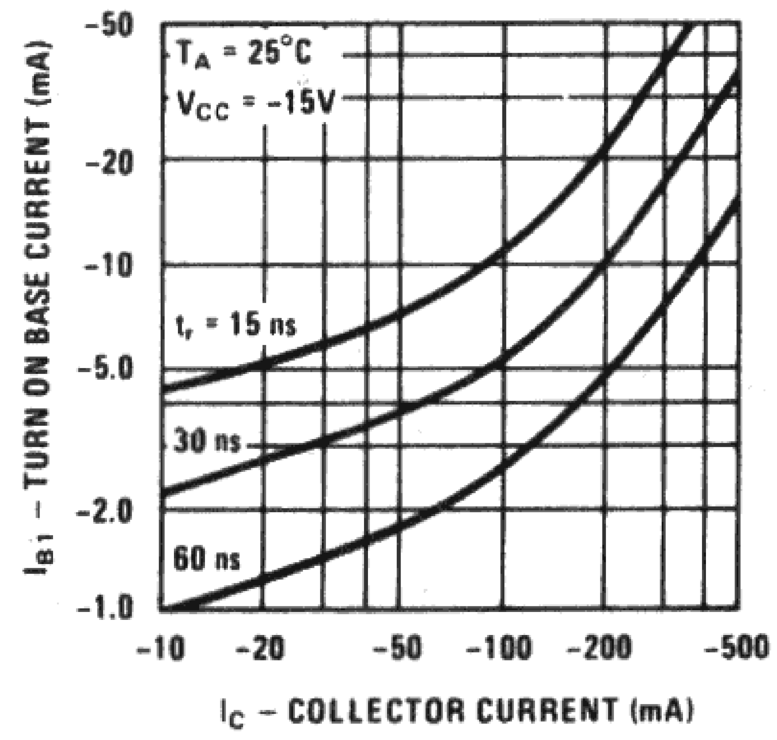
Switching Times vs Collector Current



Turn On and Turn Off Times vs Collector Current



Rise Time vs Collector and Turn On Base Currents



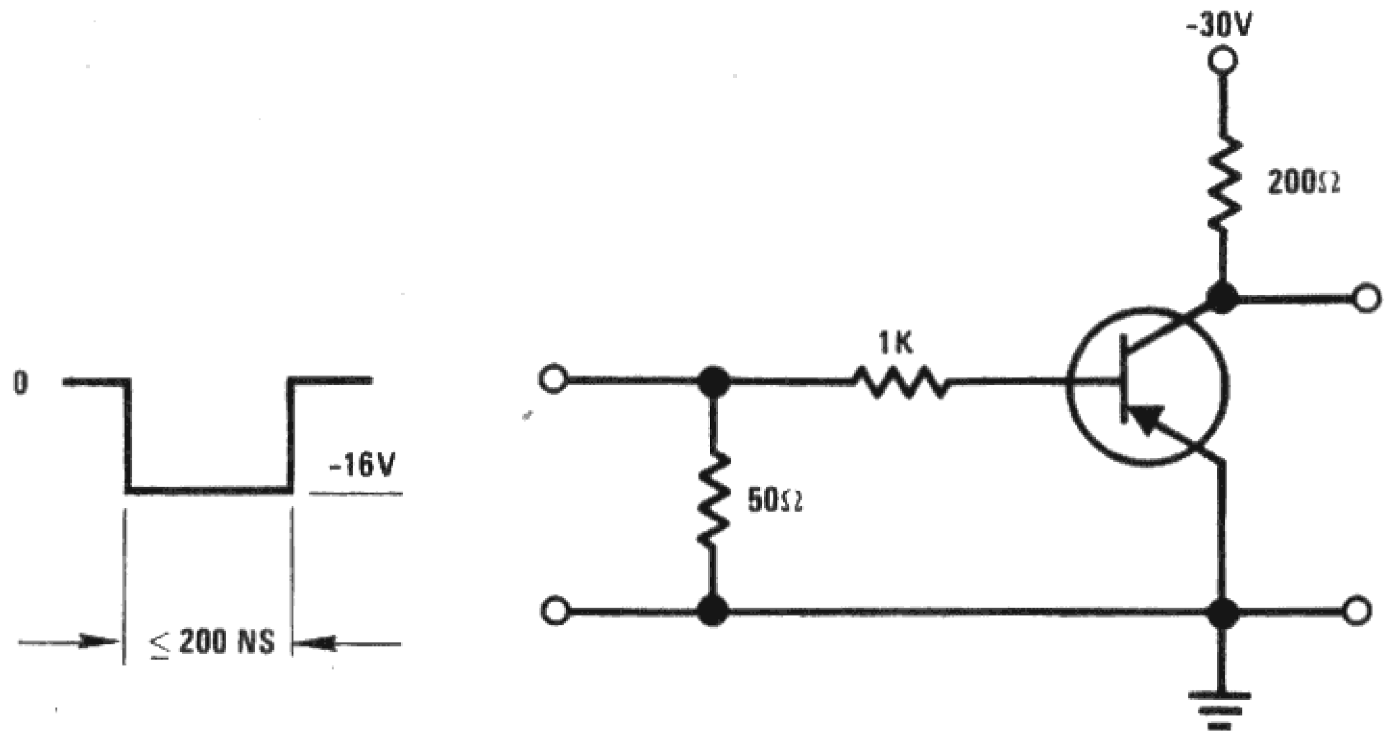


FIGURE 1. Saturated Turn-On Switching Time Test Circuit

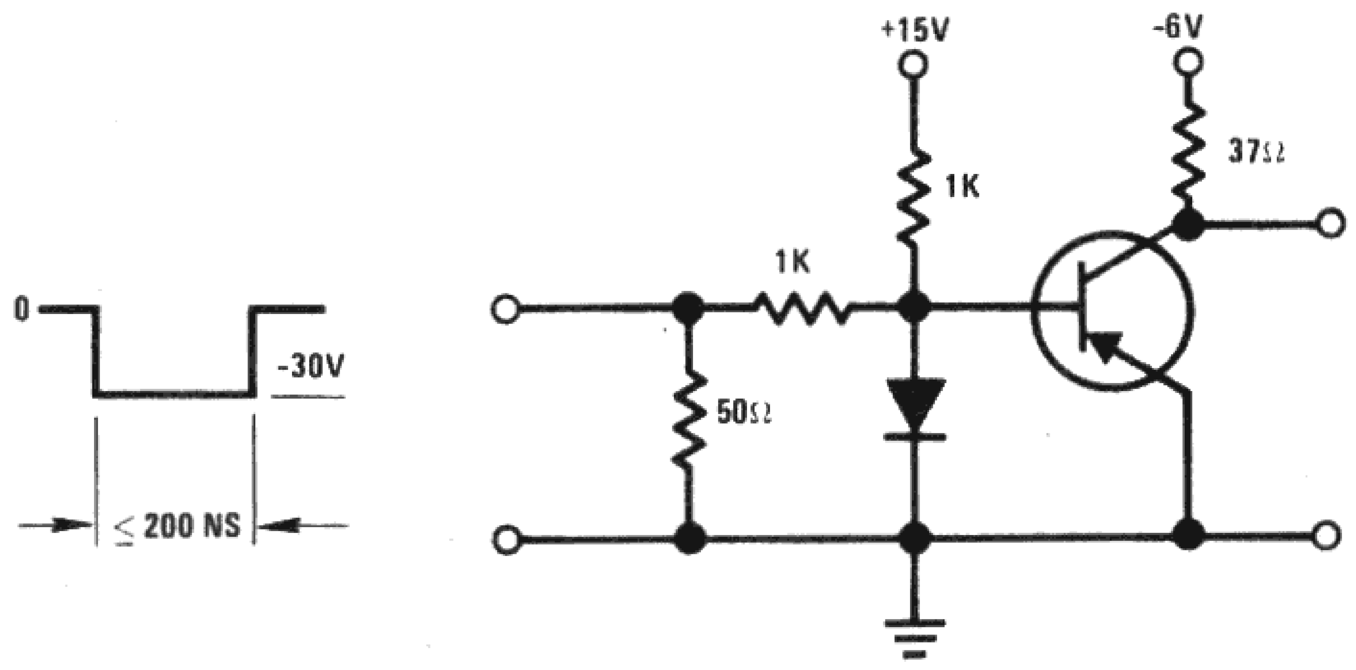
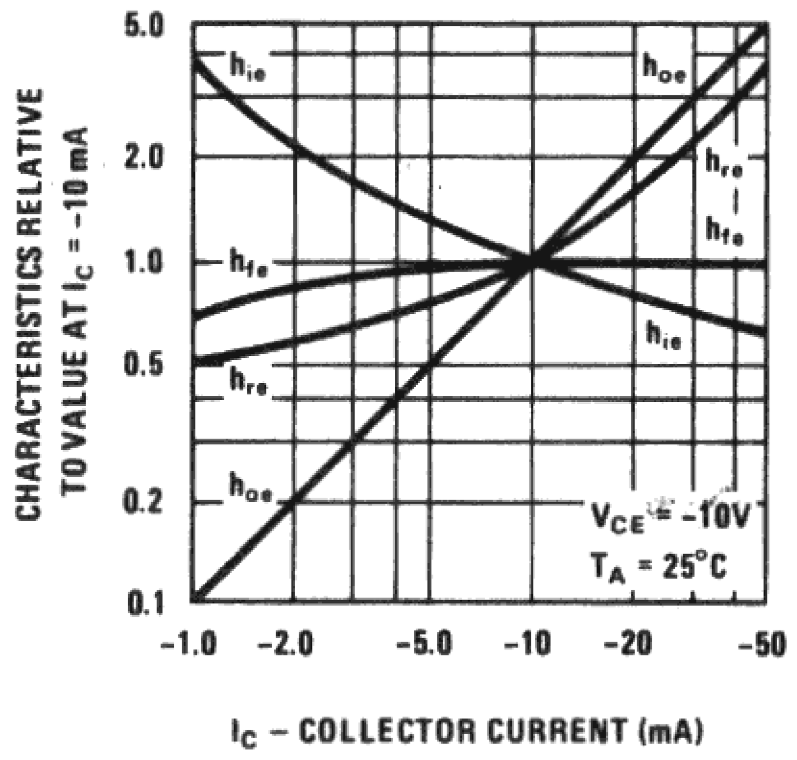


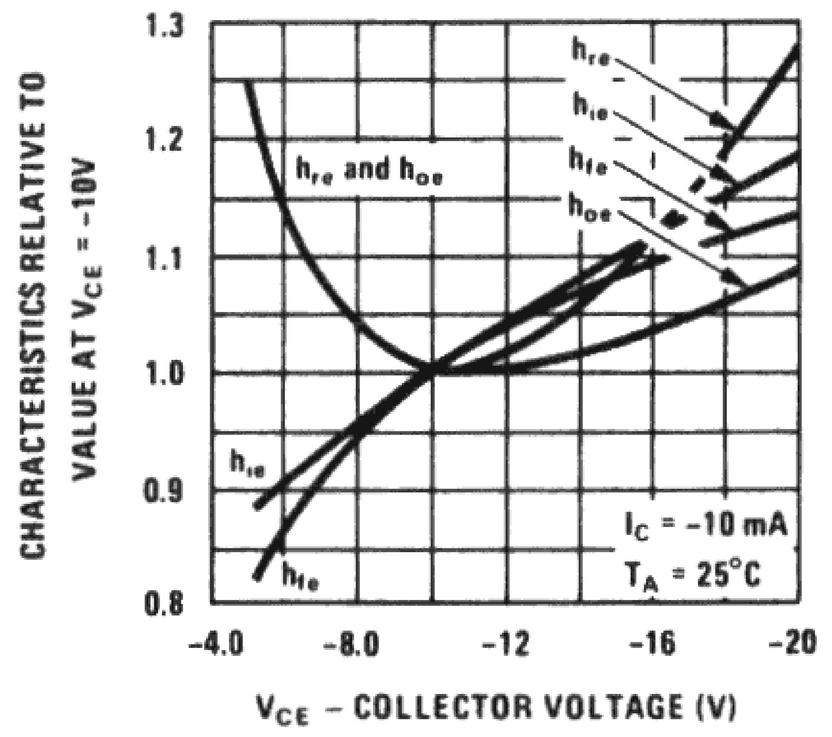
FIGURE 2. Saturated Turn-Off Switching Time Test Circuit

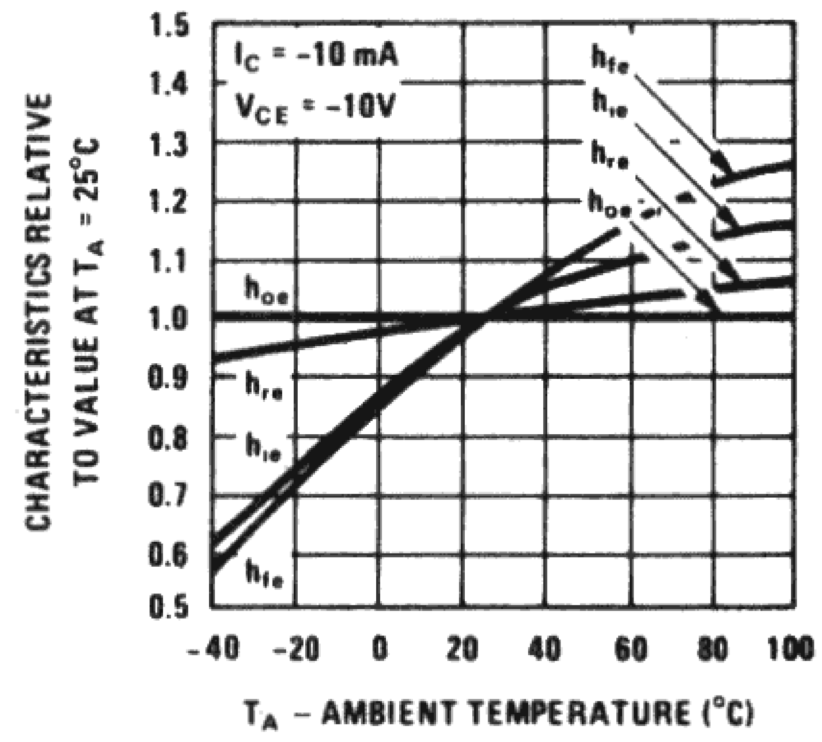
SMALL SIGNAL CHARACTERISTICS (f = 1.0 kH-)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance		480	2000	ohms	$I_C = 10$ mA	$V_{CE} = -10V$
h_{oe}	Output Conductance		80	1200	μmhos	$I_C = 10$ mA	$V_{CE} = -10V$
h_{re}	Voltage Feedback Ratio		162	1500	$x10^{-6}$	$I_C = 10$ mA	$V_{CE} = -10V$
h_{fe}	Small Signal Current Gain	100				$I_C = 10$ mA	$V_{CE} = -10V$

TYPICAL COMMON EMITTER CHARACTERISTICS (f = 1.0 kHz)







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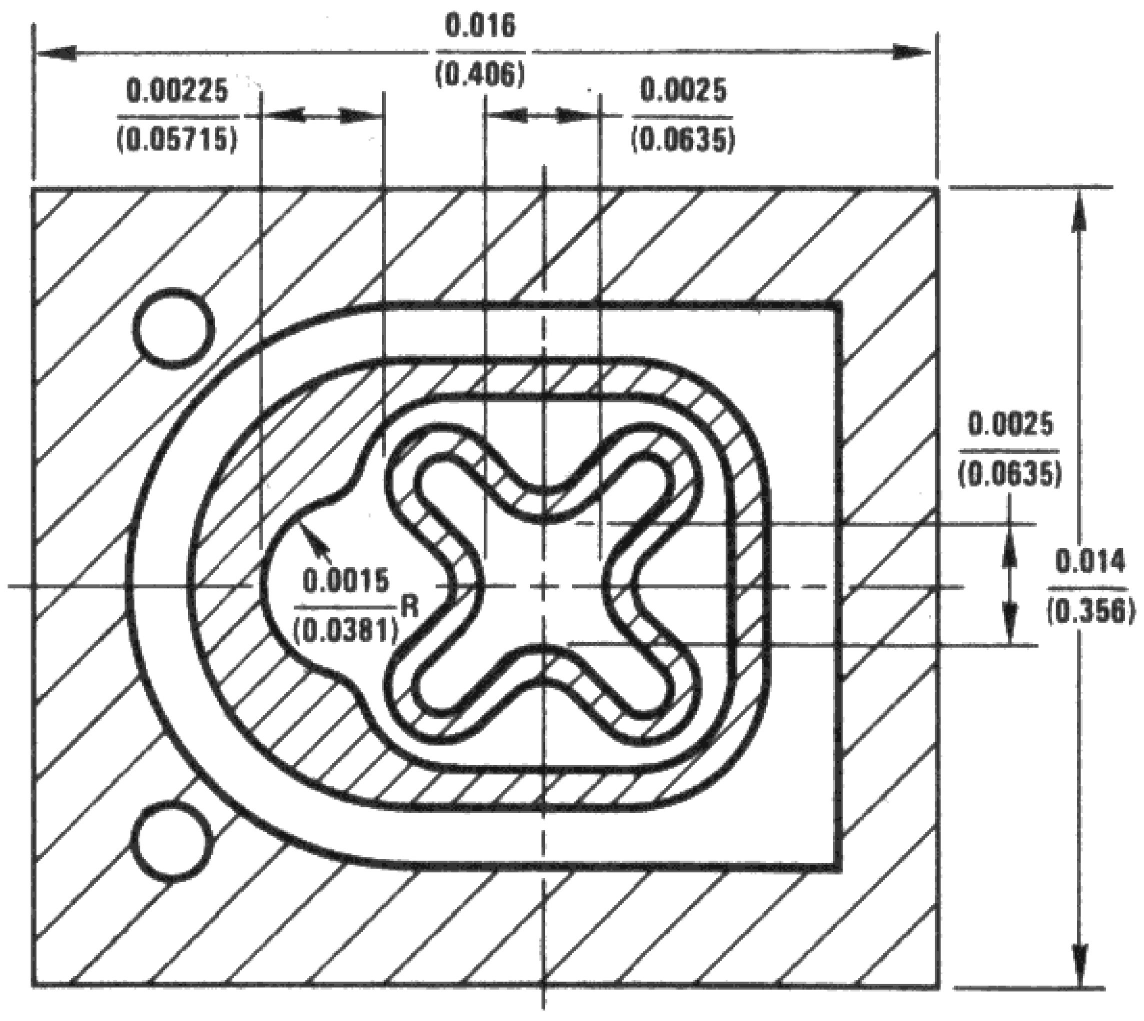
Process 66 PNP Small Signal



DESCRIPTION

Process 66 is a nonoverlay double diffused, gold doped, silicon epitaxial device. Complement to Process 23.

APPLICATION

This device was designed for general purpose amplifier and switching applications at collector currents of 10 μA to 100 mA.

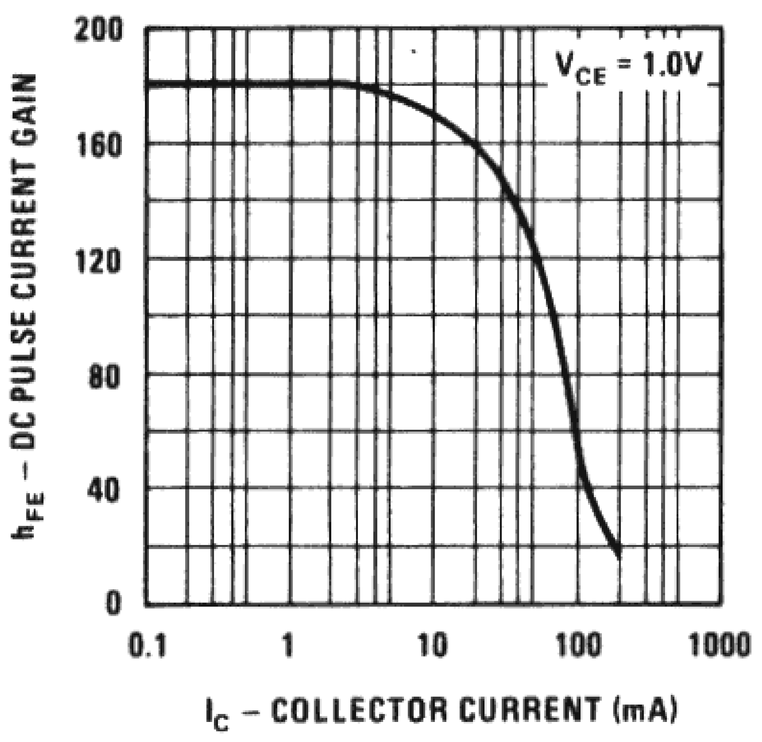
PRINCIPAL DEVICE TYPES

TO-92   2N3906

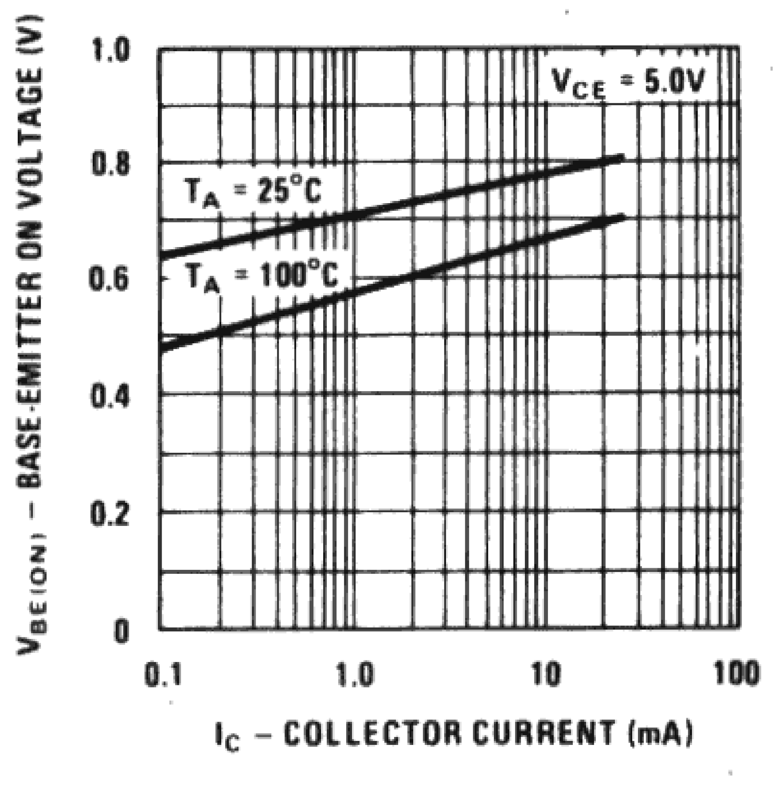
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
t_{off}	I_C = 10 mA, I_{B2} = 1 mA		125	300	ns	
t_{on}	I_C = 10 mA, I_{B1} = 1 mA		30	70	ns	
C_{ob}	V_{CB} = 5V		3.0	4.5	pF	TO-92
C_{ib}	V_{EB} = 0.5V		6.0	10.0	pF	TO-92
h_{fe}	f = 100 MHz, V_{CE} = 20V, I_C = 10 mA	2.5	6.0			
NF (wide band)	I_C = 100 μA, V_{CE} = 5V, R_S = 1 kΩ		2.0	4.0	dB	
h_{fe}	I_C = 0.1 mA, V_{CE} = 1V	40	80			
h_{fe}	I_C = 1 mA, V_{CE} = 1V	50	120			
h_{fe}	I_C = 10 mA, V_{CE} = 1V	50	150	300		
h_{fe}	I_C = 50 mA, V_{CE} = 1V	40	110			
h_{fe}	I_C = 100 mA, V_{CE} = 1V	20	40			
$V_{CE(SAT)}$	I_C = 10 mA, I_B = 1 mA		0.07	0.25	V	
$V_{CE(SAT)}$	I_C = 50 mA, I_B = 5 mA		0.12	0.40	V	
$V_{BE(SAT)}$	I_C = 10 mA, I_B = 1 mA		0.75	0.85	V	
$V_{BE(SAT)}$	I_C = 50 mA, I_B = 5 mA		0.85	0.95	V	
BV_{CEO}	I_C = 1 mA	30	45	60	V	
BV_{CBO}	I_C = 100 μA	45		70	V	
BV_{CES}	I_C = 10 μA	45		70	V	
BV_{EBO}	I_C = 10 μA	5.0			V	
I_{CBO}	V_{CB} = 25V			50	nA	
I_{EBO}	V_{EB} = 4V			50	nA	

Process 66

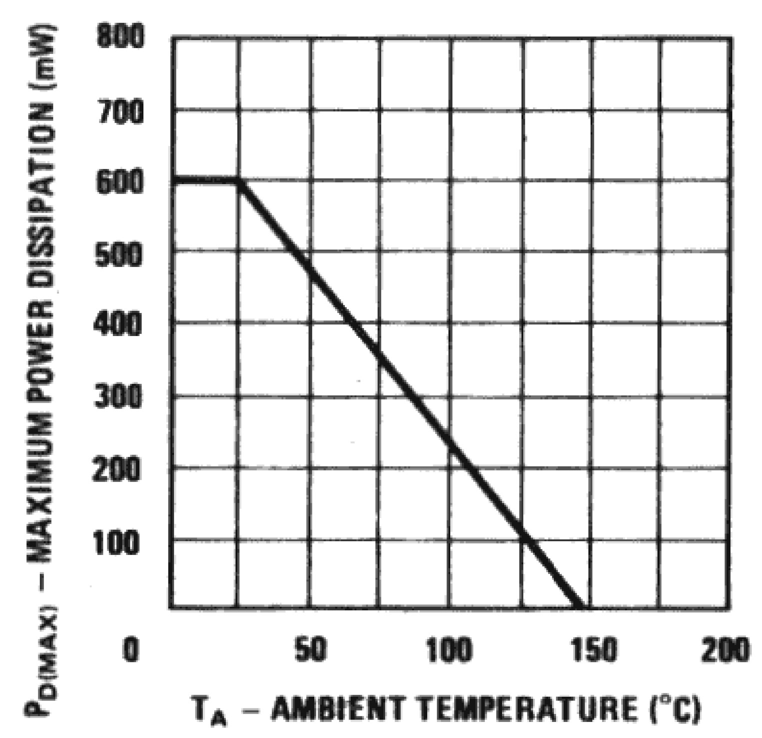
DC Pulse Current Gain vs Collector Current



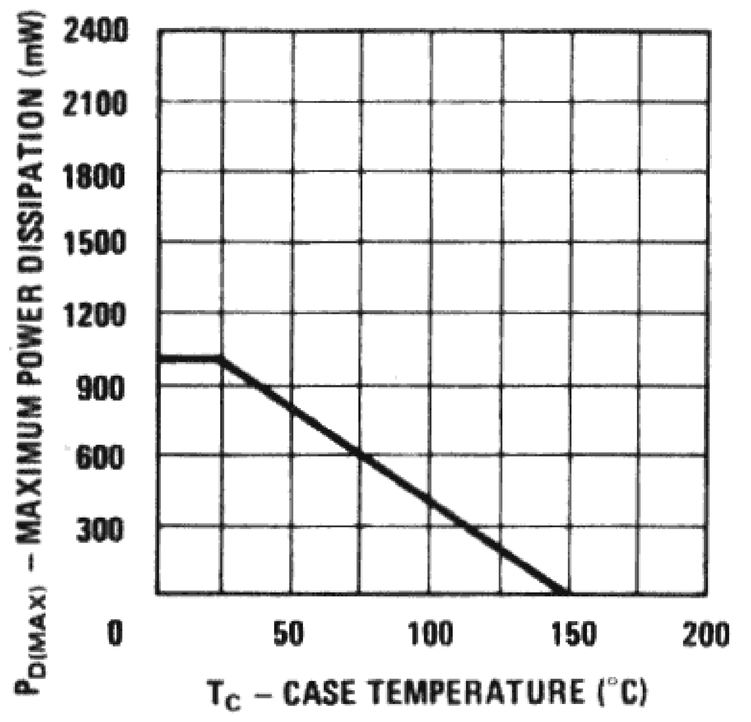
Base-Emitter On Voltage vs Collector Current



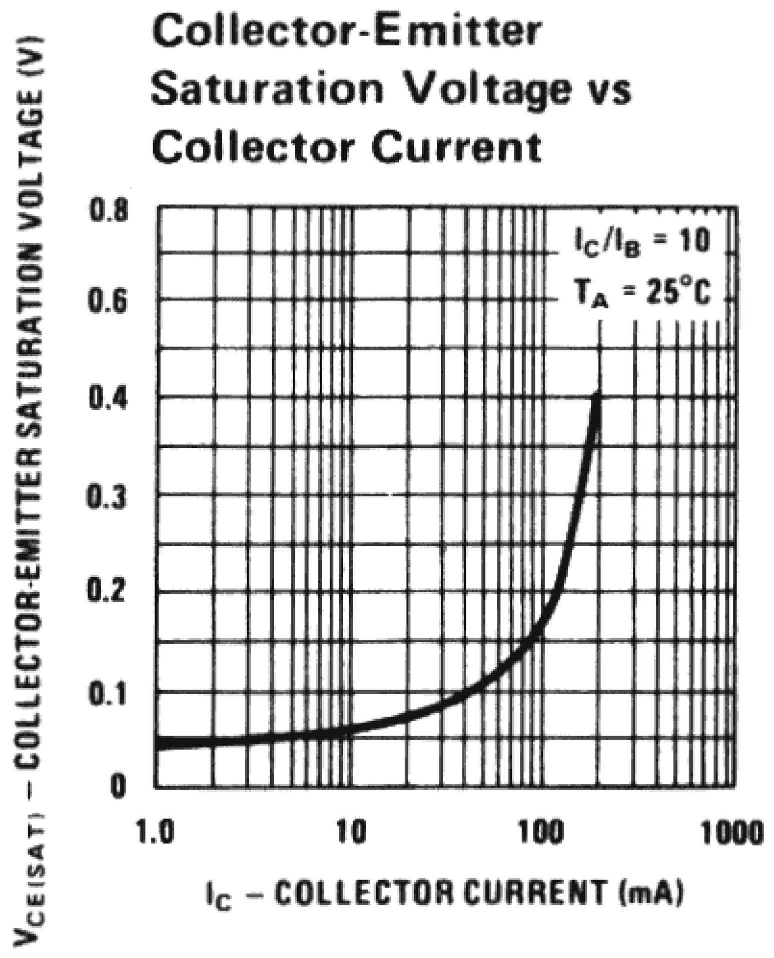
Maximum Power Dissipation vs Ambient Temperature TO-92



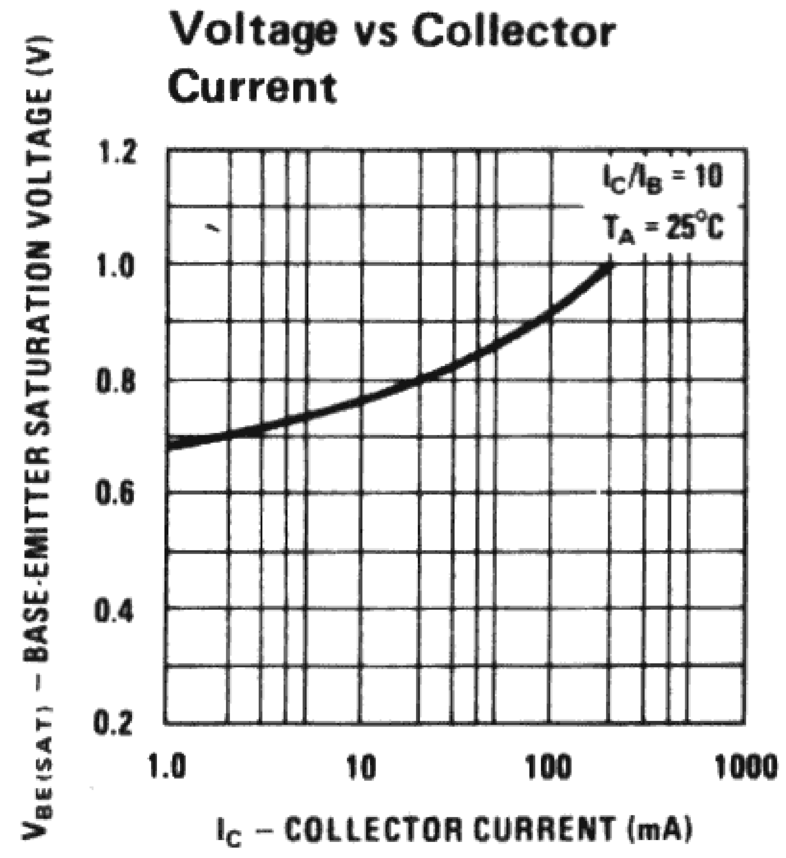
Maximum Power Dissipation vs Case Temperature TO-92



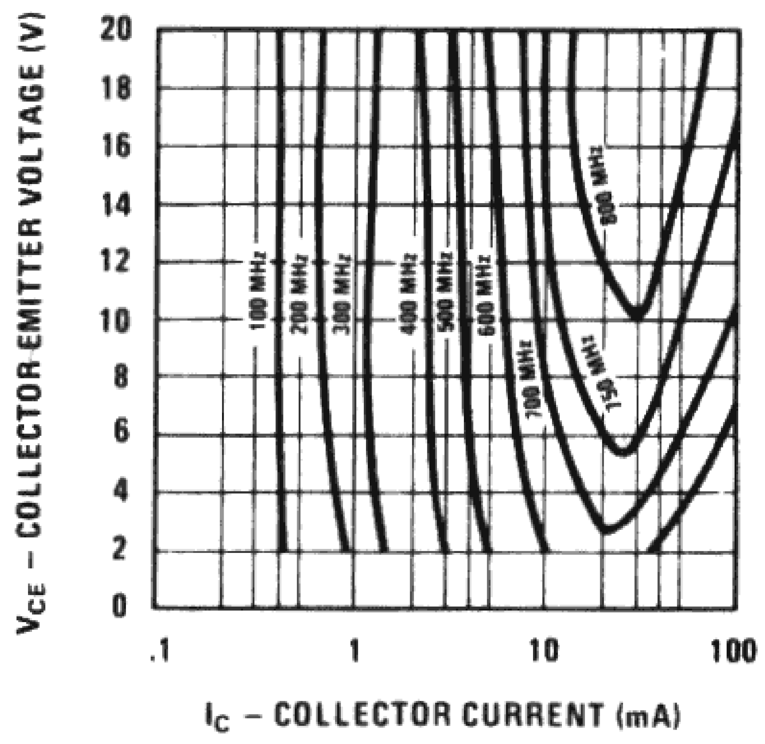
Collector-Emitter Saturation Voltage vs Collector Current



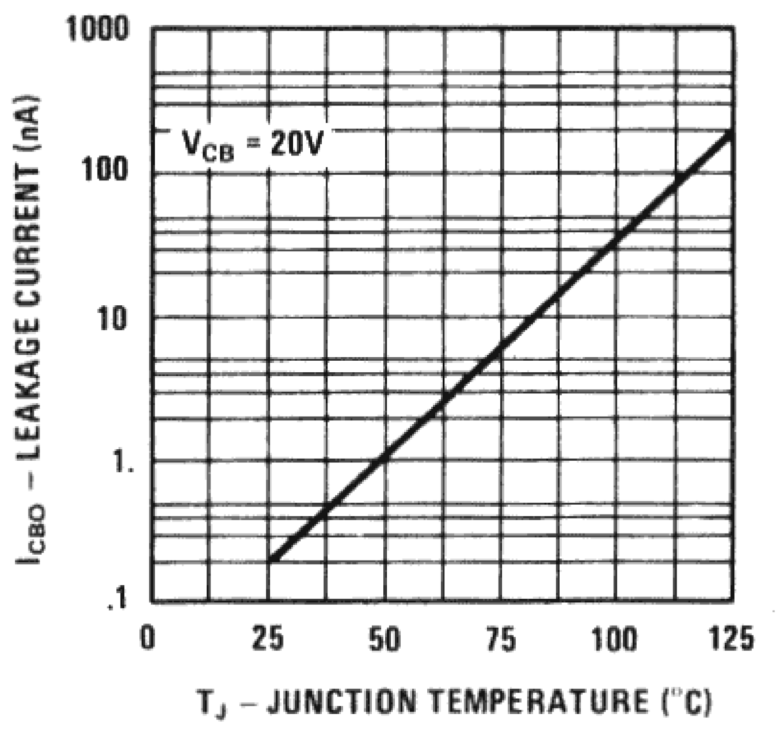
Base-Emitter Saturation Voltage vs Collector Current



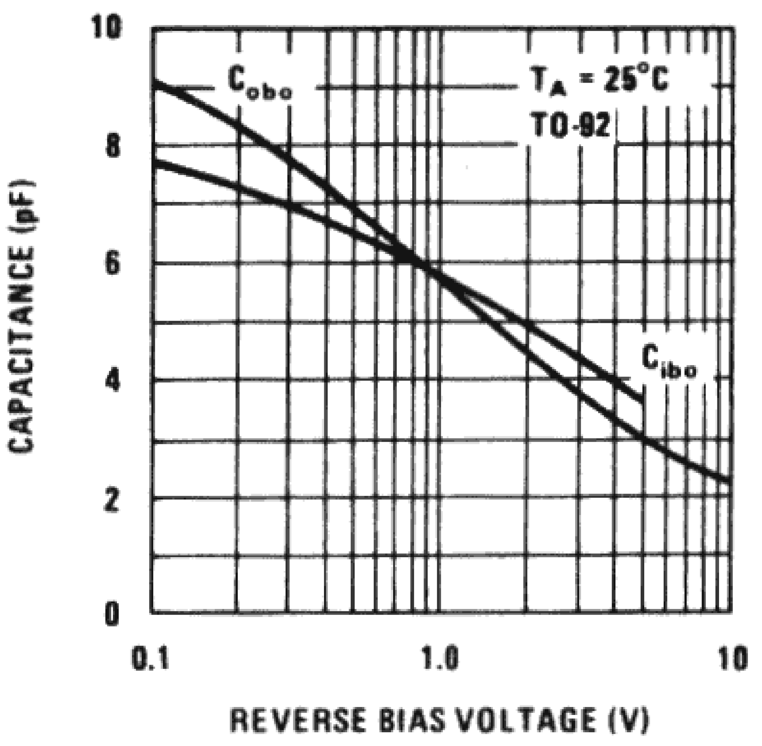
Contours of Constant Gain Bandwidth Product (f_T)



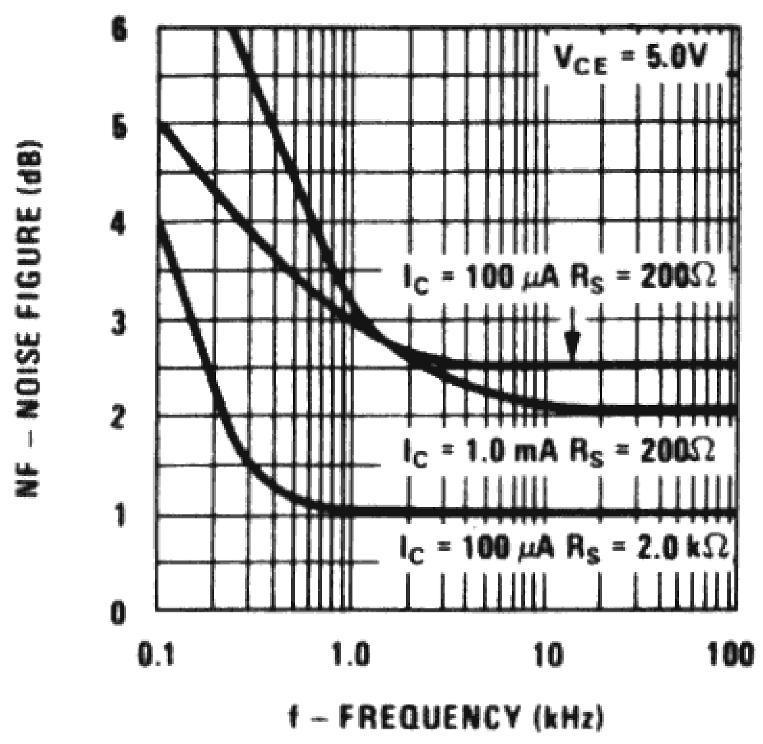
Collector-Base Diode Reverse Current vs Temperature



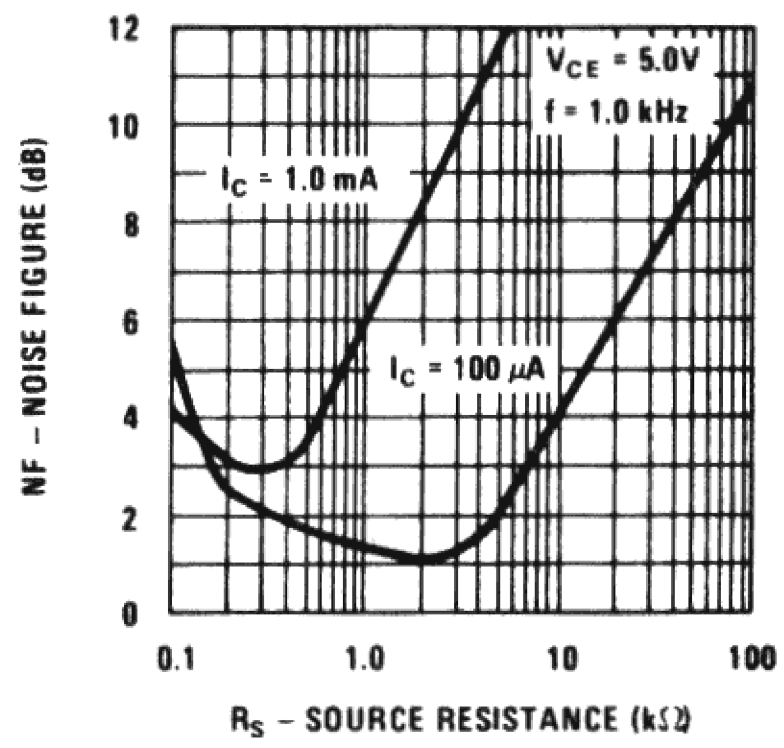
Common Base Open Circuit Input and Output Capacitance vs Reverse Bias Voltage



Noise Figure vs Frequency

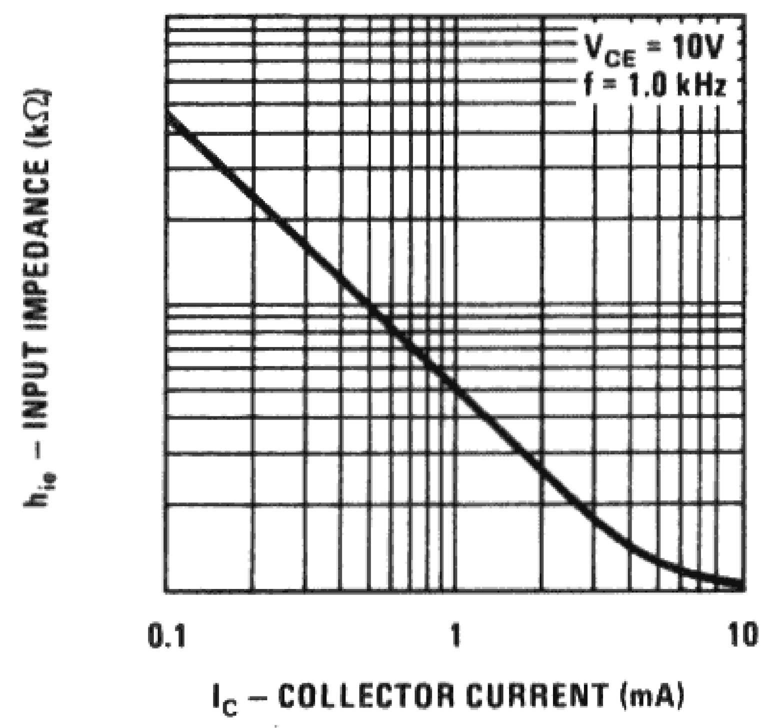


Noise Figure vs Source Resistance

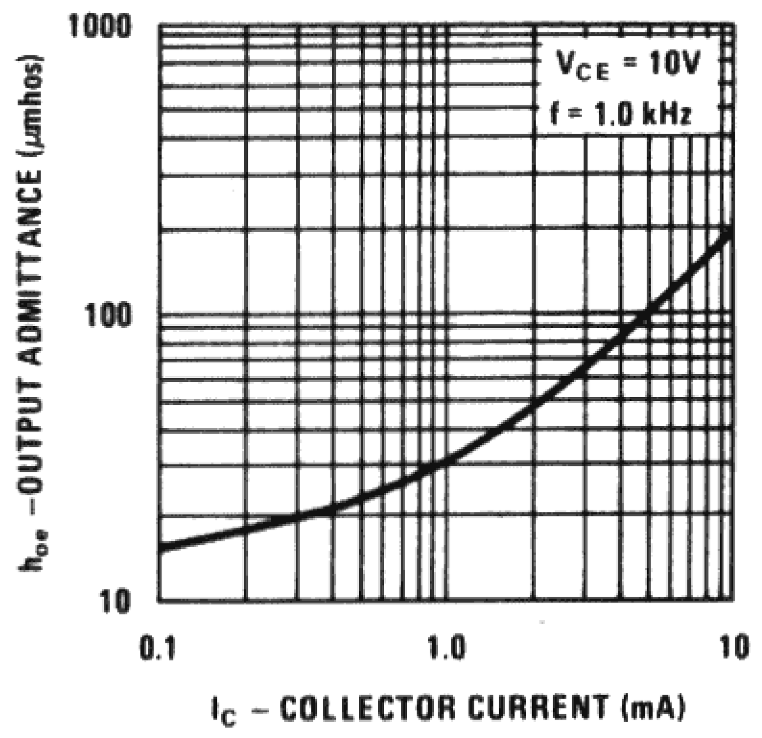


Process 66

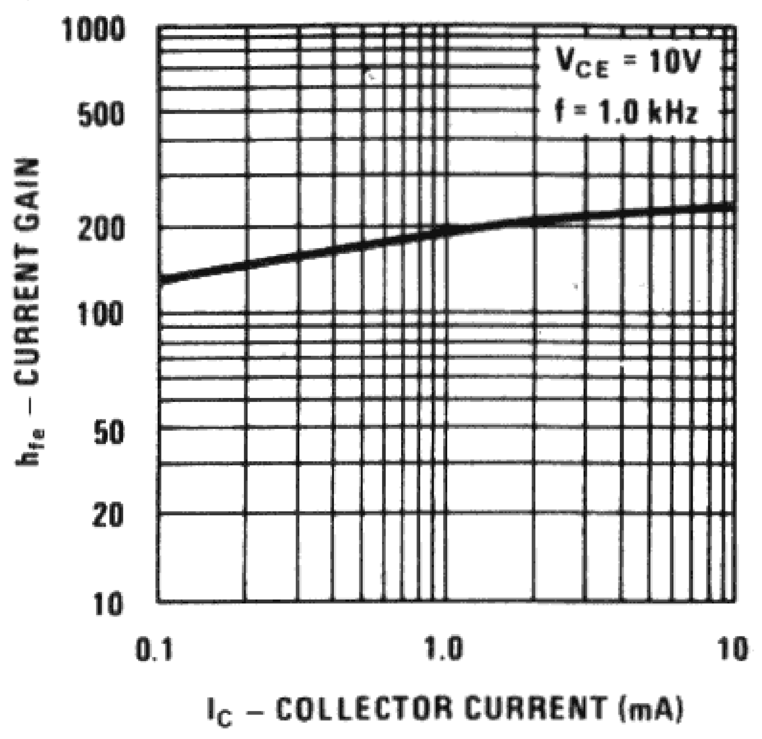
Input Impedance



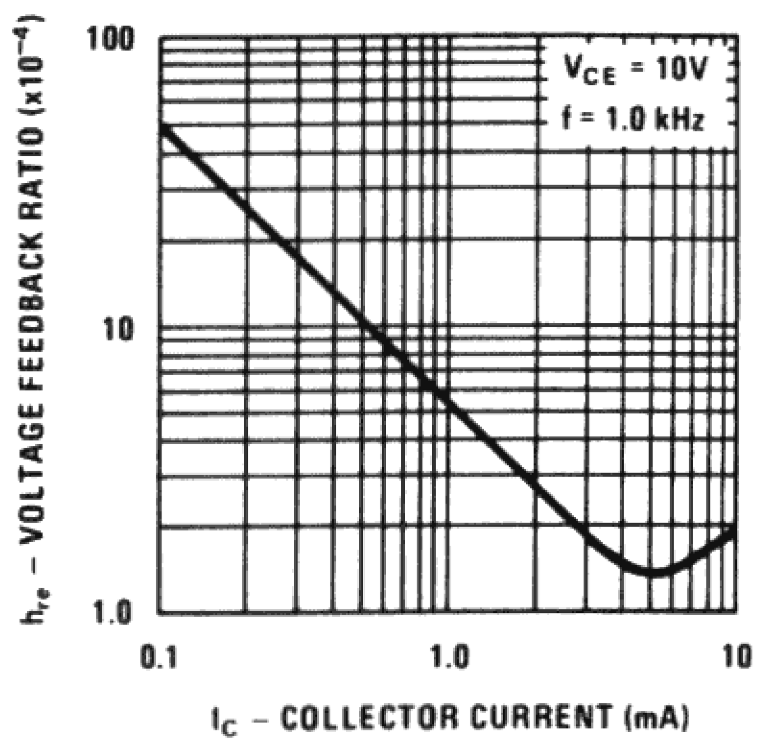
Output Admittance



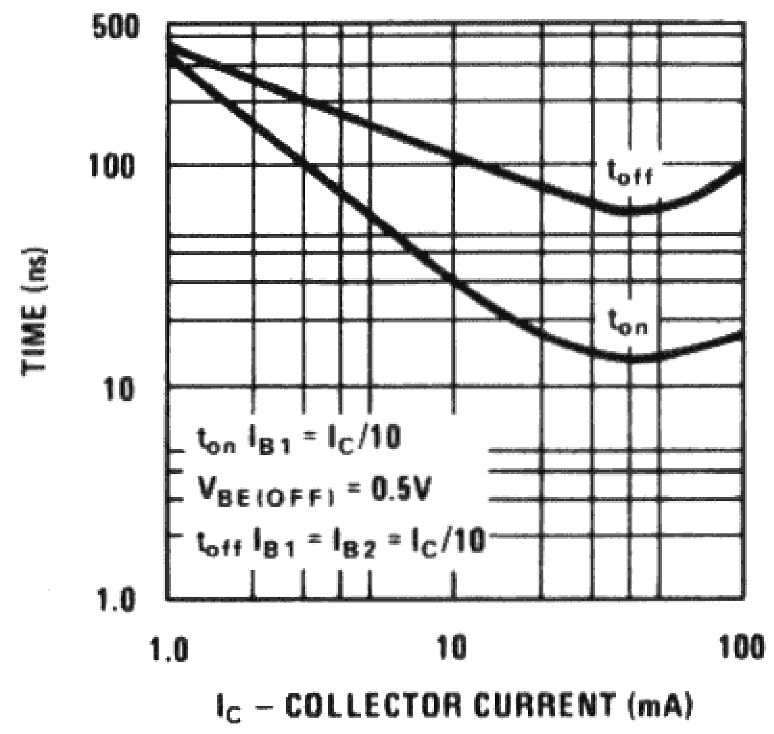
Current Gain



Voltage Feedback Ratio



Turn On and Turn Off Times vs Collector Current



Switching Times vs Collector Current