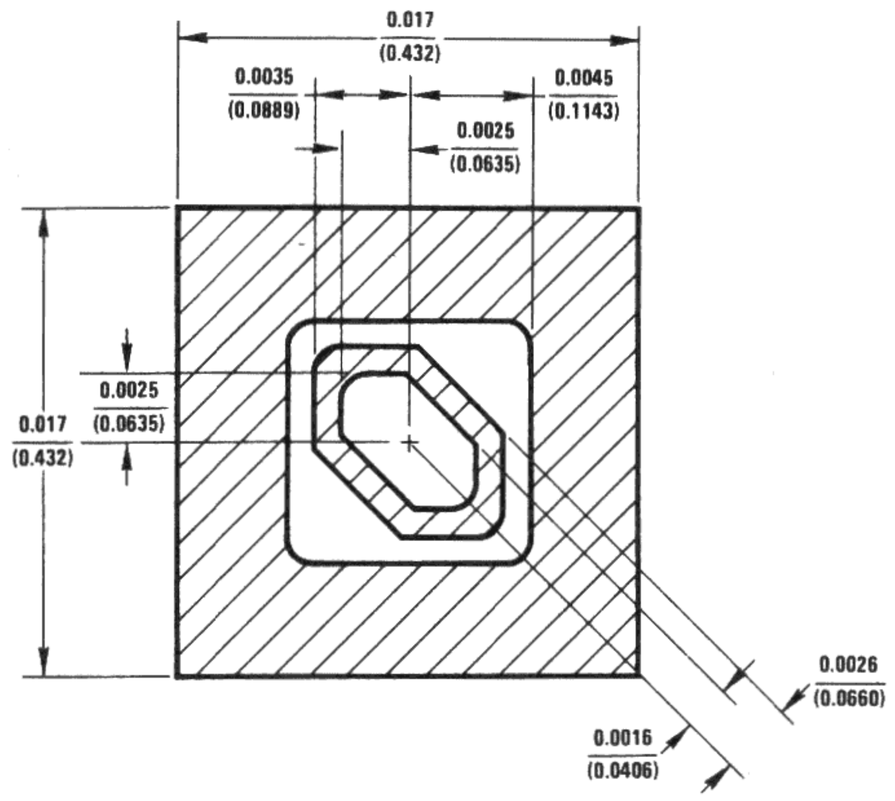
Type No.	Case Style	V_{CES}* V_{CBO} (V) Min	V_{CEO} (V) Min	V_{EBO} (V) Min	I_{CES}* I_{CBO} (nA) @ V_{CB} (V) Max	H_{FE} h_{fe} 1 kHz* @ I_C (mA) & V_{CE} (V) Min	Max			$V_{CE(SAT)}$ (V) & $V_{BE(ON)}$* (V) @ I_C (mA) Max	Min	Max		C_{ob} (pF) Max	f_T (MHz) @ I_C (mA) Min	Max		t_{off} (ns) Max	NF (dB) Max	Test Condition	Process No.
BC213LC	TO-92 (74)	45	30	5	15 @ 30	40		0.01	5	0.6		1.1	100	10	200		10		10	1	63
						80		2	5	0.25			10								
						350	600*	2	5		0.6	0.72*	2								
BC214	TO-92 (77)	45	30	5	15 @ 30	40		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						80		2	5	0.25			10								
						140	600*	2	5		0.6	0.72*	2								
BC214A	TO-92 (77)	45	30	5	15 @ 30	40		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						80		2	5	0.25			10								
						100	300*	2	5		0.6	0.72*	2								
BC214B	TO-92 (77)	45	30	5	15 @ 30	40		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						80		2	5	0.25			10								
						200	400*	2	5		0.6	0.72*	2								
BC214C	TO-92 (77)	45	30	5	15 @ 30	40		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						80		2	5	0.25			10								
						350	600*	2	5		0.6	0.72*	2								
BC214L	TO-92 (74)	45	30	5	15 @ 30	100		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						140	400	2	5	0.25			10								
						120		100	5		0.6	0.72*	2								
						140*		2	5												
BC214LB	TO-92 (74)	45	30	5	15 @ 30	100		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						140		2	5	0.25			10								
						120		100	5		0.6	0.72*	2								
						200	400*	2	5												
BC214LC	TO-92 (74)	45	30	5	15 @ 30	100		0.01	5	0.6		1.1	100	10	200		10		2	1	63
						140		2	5	0.25			10								
						120		100	5		0.6	0.72*	2								
						350	600*	2	5												
BC237-92	TO-92 (77)	50	45	6	50 @ 20	100		0.01	5	0.25		0.77*	10	4.5					10	1	04
						140		2	5			0.6	100								
						120		100	5												
						125	500*	2	5		0.55	0.70*	2								
BC237A-92	TO-92 (77)	50	45	6	50 @ 20	100		0.01	5	0.25		0.77*	10	4.5					10	1	04
						140		2	5			0.6	100								
						120		100	5												
						125	500*	2	5		0.55	0.70*	2								
BC237B-92	TO-92 (77)	50	45	6	50 @ 20	100		0.01	5	0.25		0.77*	10	4.5					10	1	04
						140		2	5			0.6	100								
						120		100	5												
						240	500*	2	5		0.55	0.70*	2								

TEST CONDITIONS:

(1) I_C = 200 μA, V_{CE} = 5V, f = 1kHz. **(2)** I_C = 100mA, V_{CC} = 20V, $I_B{}^1 = I_B{}^2$ = 5mA. **(3)** I_C = 200 μA, V_{CE} = 2V, f = 1kHz. **(4)** I_C = 100mA, V_{CC} = 10V, $I_B{}^1 = I_B{}^2$ = 10mA. **(5)** I_C = 10mA, V_{CC} = 3V, $I_B{}^1 = I_B{}^2$ = 1mA. **(6)** I_C = 100 μA, V_{CE} = 5V, f = 1kHz. **(7)** I_C = 1mA, V_{CE} = 10V, f = 200kHz. **(8)** I_C = 1mA, V_{CE} = 5V, f = 1kHz. **(9)** I_C = 150mA, V_{CC} = 6V, $I_B{}^1 = I_B{}^2$ = 15mA. **(10)** I_C = 200 μA, V_{CE} = 5V, f = 1kHz. **(11)** I_C = 150mA, V_{CC} = 10V, $I_B{}^1 = I_B{}^2$ = 75mA. **(12)** I_C = 300mA, V_{CC} = 25V, $I_B{}^1 = I_B{}^2$ = 30mA. **(13)** I_C = 10 μA, V_{CE} = 5V, f = WB. **(14)** I_C = 500mA, V_{CC} = 25V, $I_B{}^1$ = 50mA, $I_B{}^2$ = 25mA. **(15)** I_C = 10mA, V_{BE} = 2V, $I_B{}^1$ = 3mA, $I_B{}^2$ = 1mA. **(16)** I_C = 100mA, $I_B{}^1$ = 40mA, $I_B{}^2$ = 20mA.

National Semiconductor

Process 04 NPN Small Signal



DESCRIPTION

Process 04 is a non-overlay double diffused silicon epitaxial device. Complement to Process 71.

APPLICATION

This device was designed for low noise, high gain, general purpose amplifier application. From 1 μA to 100 mA collector current.

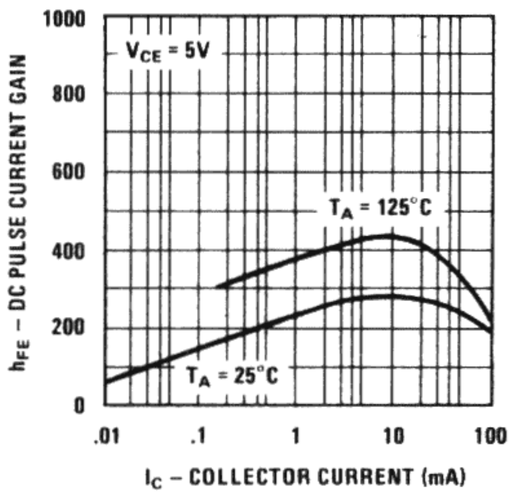
PRINCIPAL DEVICE TYPES

TO-18	BC107 Series
TO-92 (ECB)	2N2923 Series
TO-92 (EBC)	MPS2923 Series

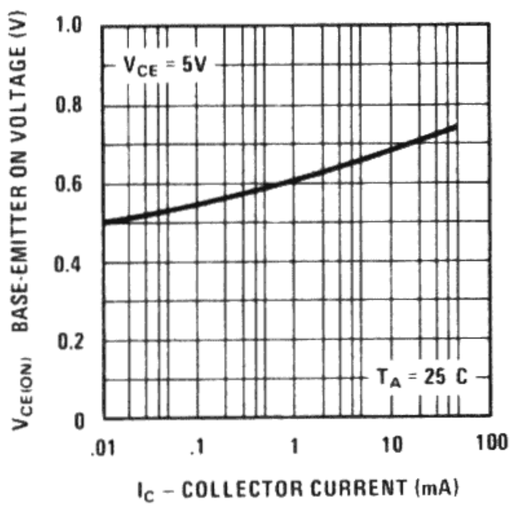
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
NF (spot)	I_C = 200 μA, V_{CE} = 5V f = 1 kHz, R_S = 2k		2.0	4.0	dB	TO-18
C_{ob}	V_{CB} = 10V, f = 1 MHz		3.2	3.5	pF	TO-18
C_{ib}	V_{EB} = 0.5V, f = 1 MHz		7.6	8.5	pF	TO-18
f_T	V_{CE} = 5V, I_C = 10 mA	150	350		MHz	
h_{FE}	V_{CE} = 5V, I_C = 100 μA	50	250	500		
h_{FE}	V_{CE} = 5V, I_C = 2 mA	50	250	750		
h_{FE}	V_{CE} = 5V, I_C = 100 mA	75	250	300		
h_{FE}	V_{CE} = 1V, I_C = 100 mA	30	100	150		
$V_{CE(sat)}$	I_C = 10 mA, I_B = 1 mA		0.040	0.080	V	
$V_{CE(sat)}$	I_C = 100 mA, I_B = 10 mA		0.120	0.180	V	
$V_{BE(sat)}$	I_C = 10 mA, I_B = 1 mA		0.75	0.85	V	
$V_{BE(sat)}$	I_C = 100 mA, I_B = 10 mA		0.89	0.95	V	
BV_{CBO}	I_C = 10 μA	50	40	120	V	
BV_{CEO}	I_C = 10 mA	20	45	55	V	
BV_{EBO}	I_E = 10 μA	7.0			V	
I_{CBO}	V_{CB} = 40V			10	NA	
I_{EBO}	V_{EB} = 4V			10	NA	

Process 04

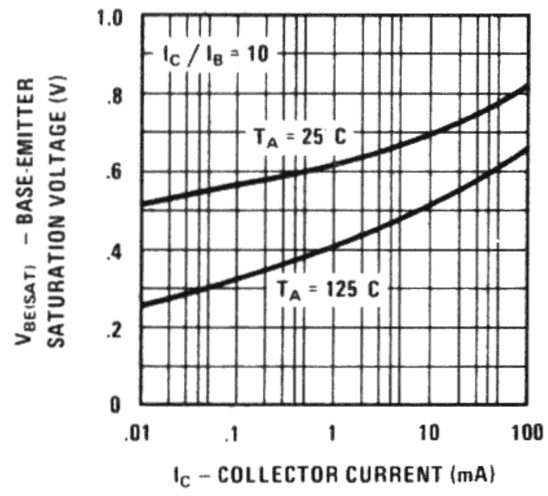
Pulsed DC Current Gain vs Collector Current



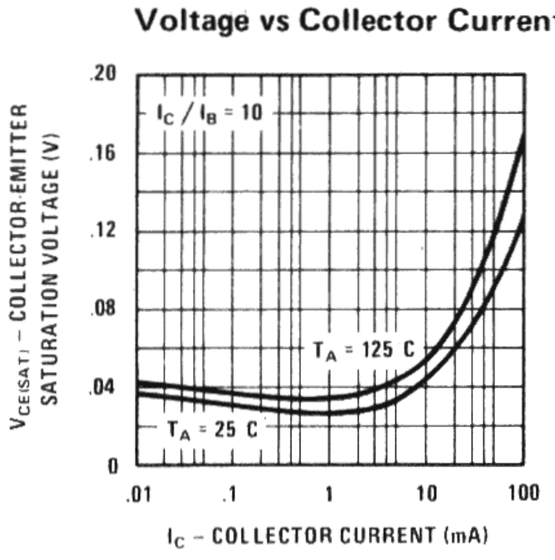
Base-Emitter On Voltage vs Collector Current



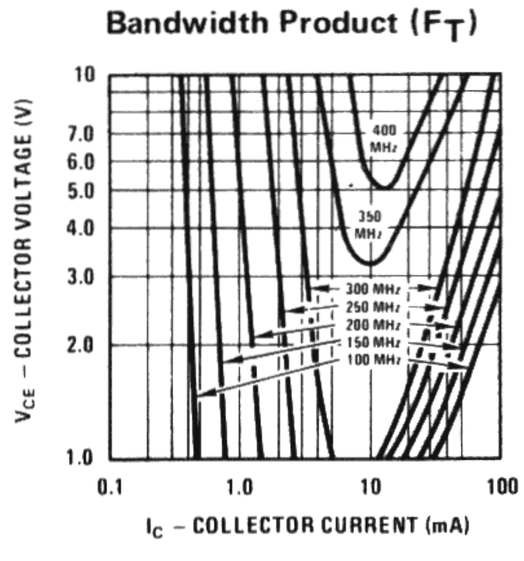
Base-Emitter Saturation Voltage vs Collector Current



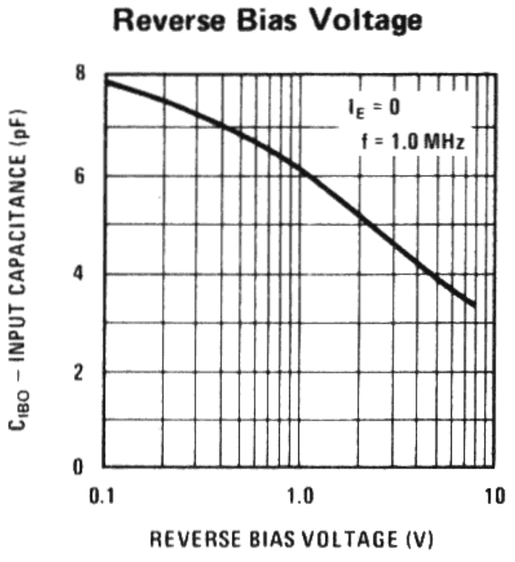
Collector-Emitter Saturation Voltage vs Collector Current



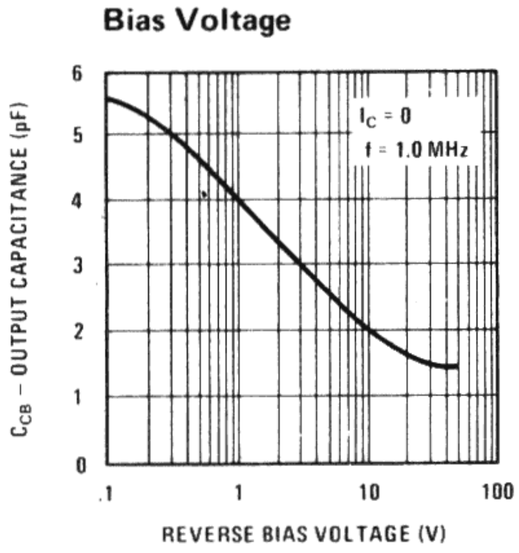
Contours of Constant Gain Bandwidth Product (F_T)



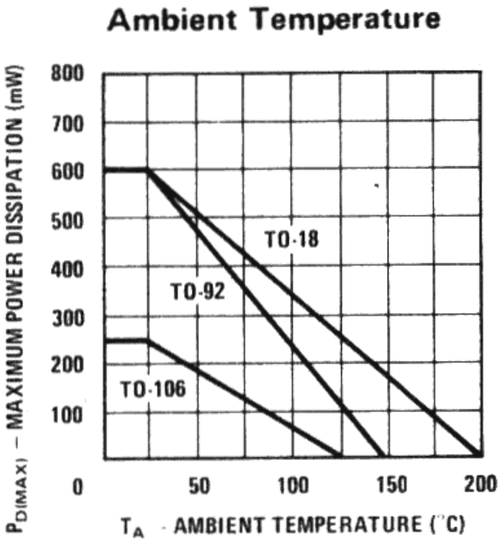
Input Capacitance vs Reverse Bias Voltage



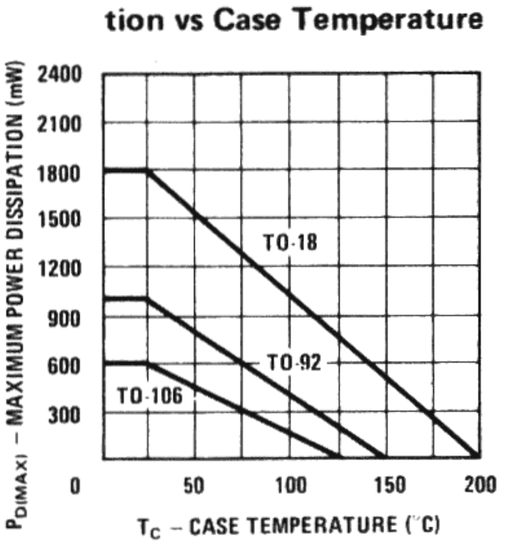
Output Capacitance vs Reverse Bias Voltage



Maximum Power Dissipation vs Ambient Temperature



Maximum Power Dissipation vs Case Temperature



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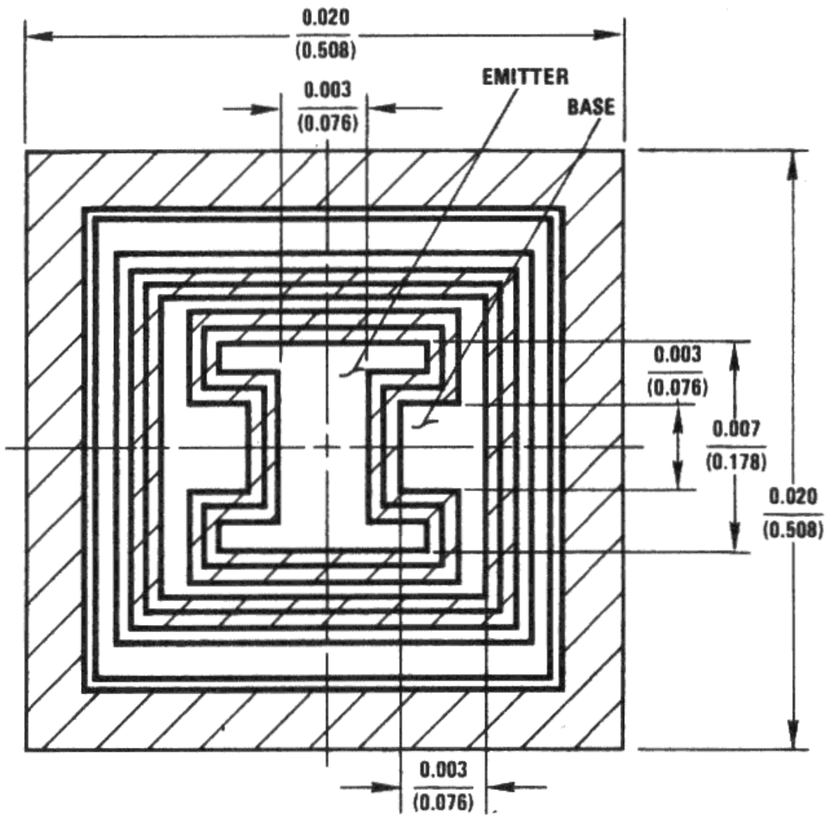
National Semiconductor

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.

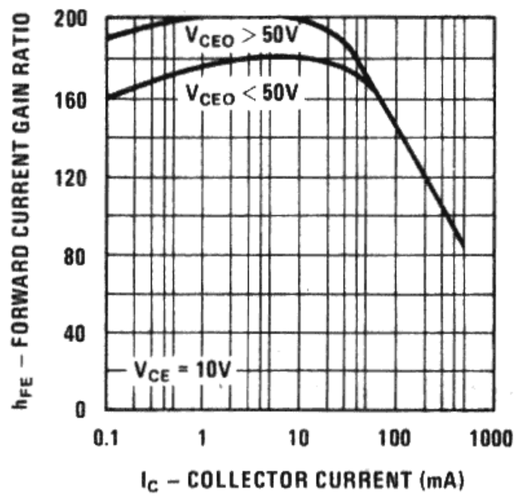
PRINCIPAL DEVICE TYPES

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

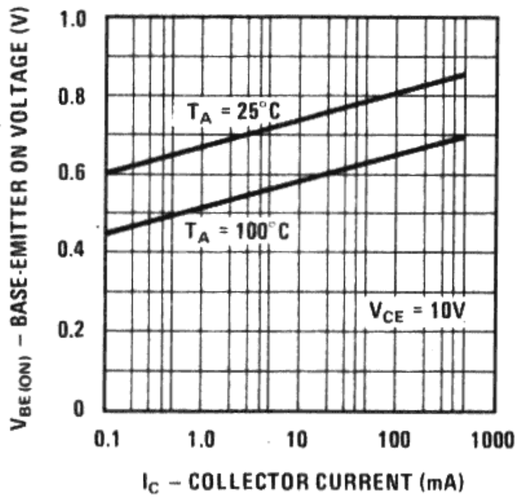
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
t_{on}	I_C = 150 mA, I_{B1} = 15 mA		30	45	ns	Fig. 1
t_{off}	I_C = 150 mA, I_{B2} = 15 mA		220	290	ns	Fig. 2
C_{cb}	V_{CB} = 10V		6	8	pF	TO-18
C_{eb}	V_{EB} = 0.50V		15	18	pF	TO-18
h_{fe}	I_C = 20 mA, V_{CE} = 20V, f = 100 MHz	1.5	2.5			
NF (spot)	I_C = 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

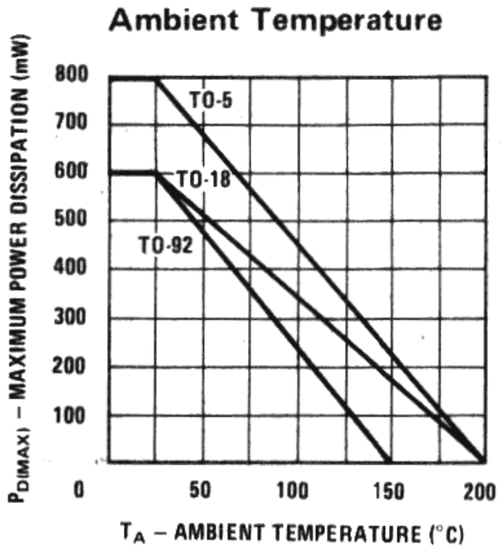
DC Pulse Current Gain vs Collector Current



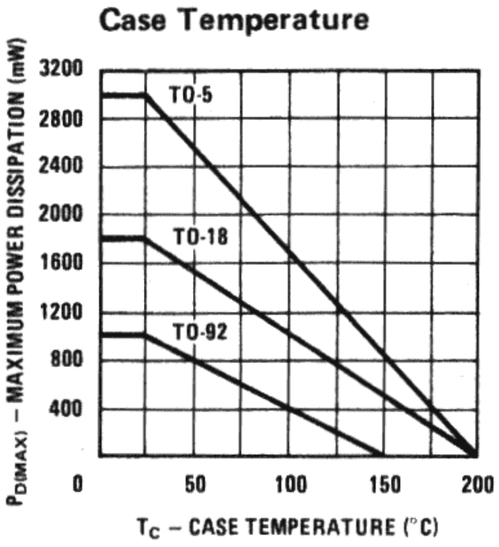
Base-Emitter On Voltage vs Collector Current



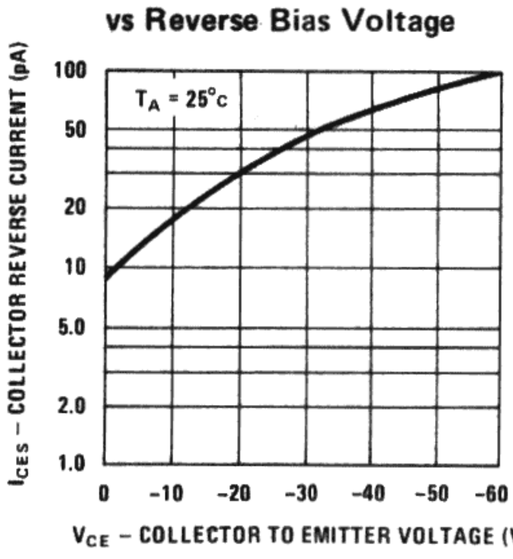
Maximum Power Dissipation vs Ambient Temperature



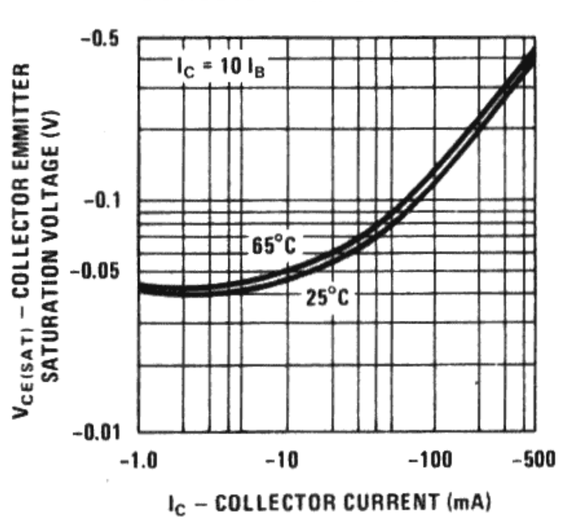
Maximum Power Dissipation vs Case Temperature



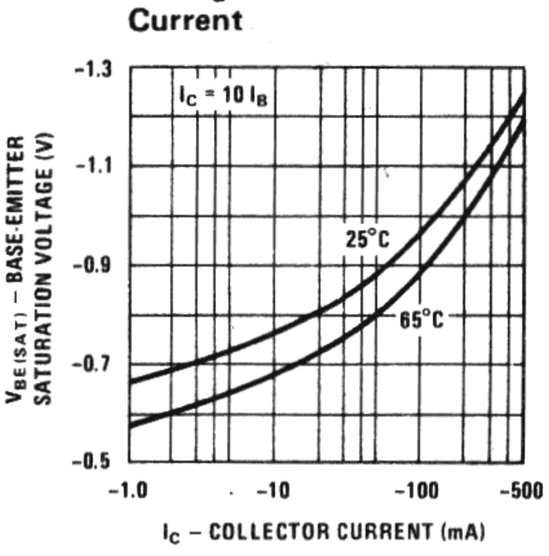
Collector Reverse Current vs Reverse Bias Voltage



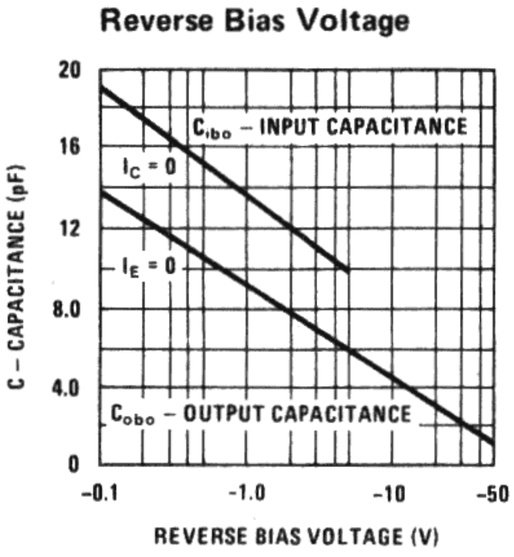
Pulsed Collector Saturation Voltage vs Collector Current



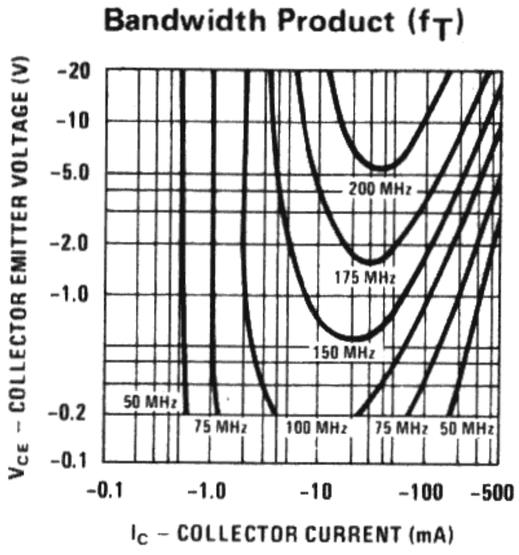
Pulsed Base Saturation Voltage vs Collector Current



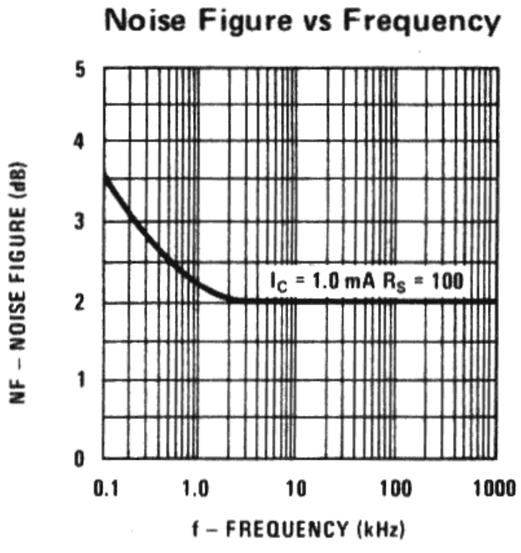
Input and Output Capacitances vs Reverse Bias Voltage



Contours of Constant Gain Bandwidth Product (f_T)

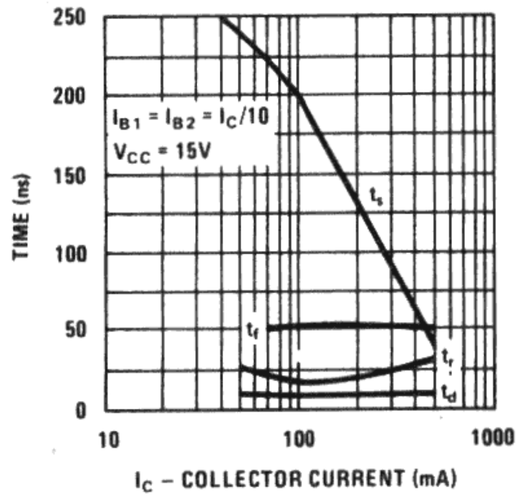


Noise Figure vs Frequency

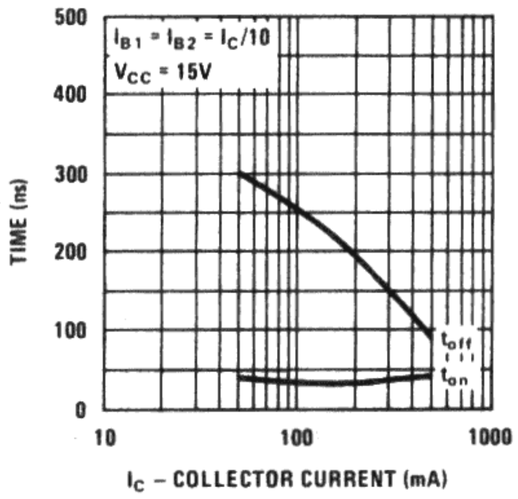


Process 63

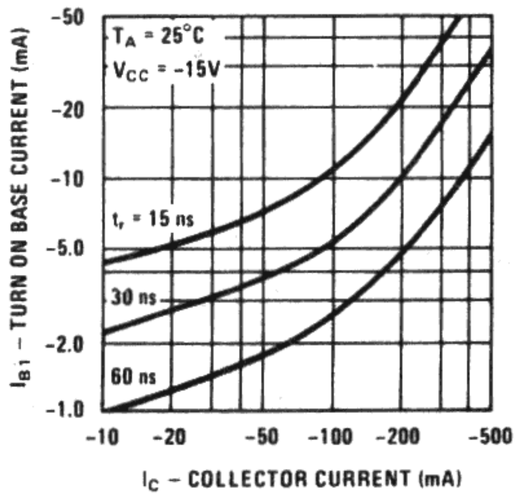
Switching Times vs Collector Current



Turn On and Turn Off Times vs Collector Current



Rise Time vs Collector and Turn On Base Currents



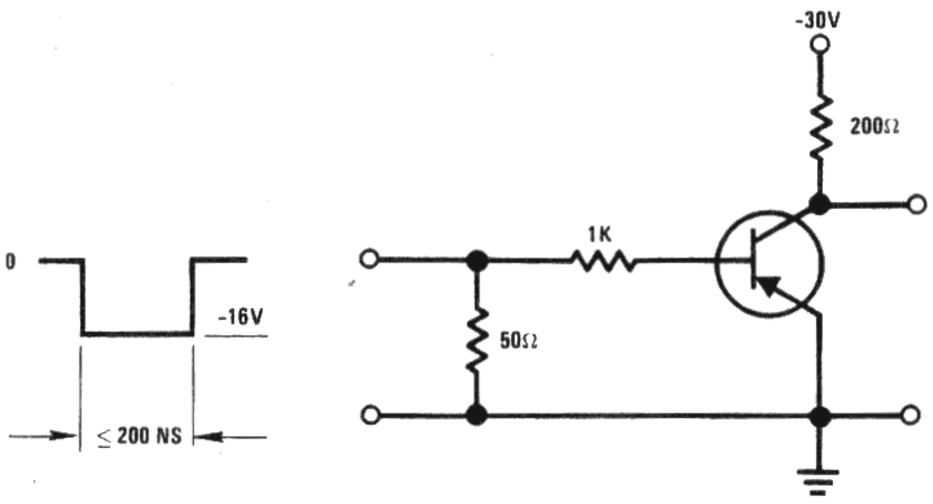


FIGURE 1. Saturated Turn-On Switching Time Test Circuit

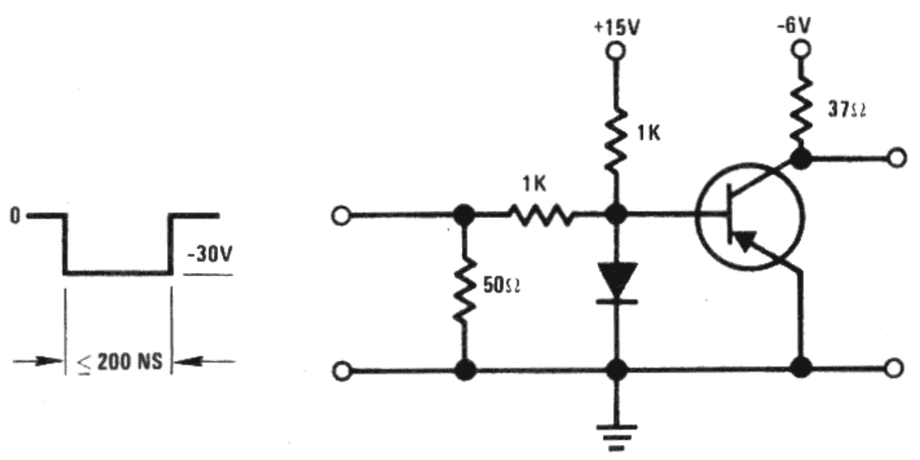


FIGURE 2. Saturated Turn-Off Switching Time Test Circuit

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)