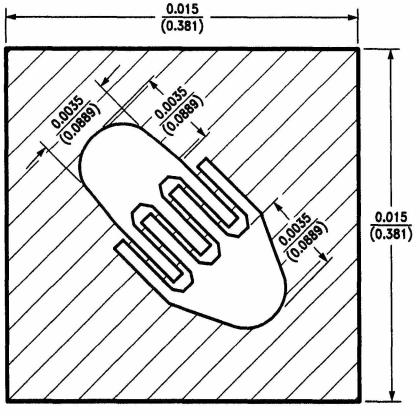
National Semiconductor

Process 22
NPN High Speed Switch



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DESCRIPTION

Process 22 is an overlay, double-diffused, gold doped, silicon epitaxial device.

APPLICATION

This device was designed for high speed logic and core driver applications to 300 mA.

PRINCIPAL DEVICE TYPES

TO-52 EBC: 2N3013

TO-92 EBC: 2N5772, PN3646

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

Symbol	Conditions	Min	Typ	Max	Units
t_s	I_C = 10 mA, I_{B1} = I_{B2} = 10 mA *(Figure 1)*		12	18	ns
t_{ON}	I_C = 300 mA, I_{B1} = I_{B2} = 30 mA *(Figure 2)*		10	18	ns
t_{OFF}	I_C = 300 mA, I_{B1} = I_{B2} = 30 mA		18	30	ns
C_{ob}	V_{CB} = 5V, f = 1 MHz		3.0	5.0	pF
C_{ib}	V_{EB} = 0.5V, f = 1 MHz			8.0	pF
h_{fe}	I_C = 30 mA, V_{CE} = 10V, f = 100 MHz	3.5	7.0		
h_{FE}	V_{CE} = 1V, 10 mA V_{CE} = 1V, I_C = 30 mA V_{CE} = 1V, I_C = 100 mA V_{CE} = 1V, I_C = 300 mA V_{CE} = 0.4V, I_C = 30 mA V_{CE} = 0.5V, I_C = 100 mA	20 25 20 15 20 20	 60 45	 150 150	
$V_{CE(SAT)}$	I_C = 30 mA, I_B = 3 mA I_C = 100 mA, I_B = 10 mA I_C = 300 mA, I_B = 30 mA			0.20 0.30 0.50	V V V
$V_{BE(SAT)}$	I_C = 30 mA, I_B = 3 mA I_C = 100 mA, I_B = 10 mA I_C = 300 mA, I_B = 30 mA			0.95 1.2 1.7	V V V
BV_{CBO}	I_C = 10 μA	35			V
BV_{CEO}	I_C = 10 mA	15			V
BV_{EBO}	I_E = 10 μA	5.0			V
I_{CBO}	V_{CB} = 25V			100	nA
I_{EBO}	V_{EB} = 3V			100	nA

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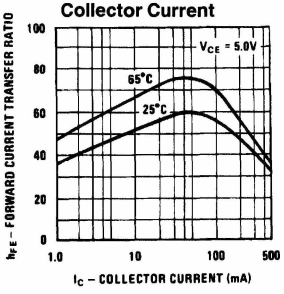
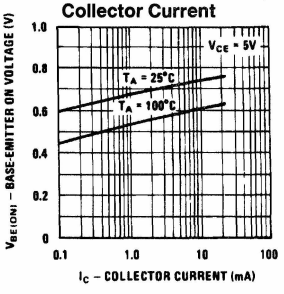
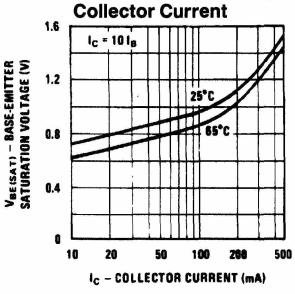
DC Current Gain vs Collector Current



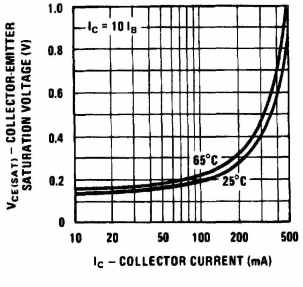
Base-Emitter On Voltage vs Collector Current



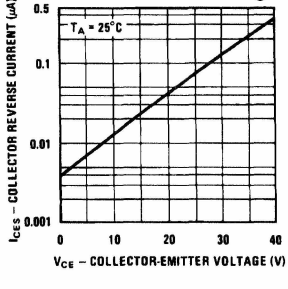
Base Saturation Voltage vs Collector Current



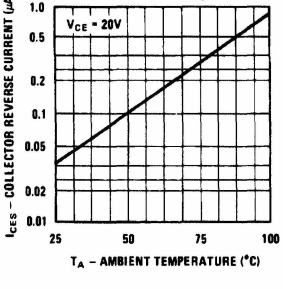
Collector Saturation Voltage vs Collector Current



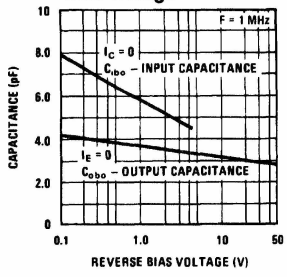
Collector Reverse Current vs Reverse Bias Voltage



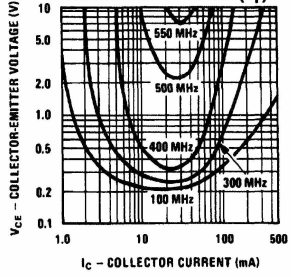
Collector Reverse Current vs Ambient Temperature



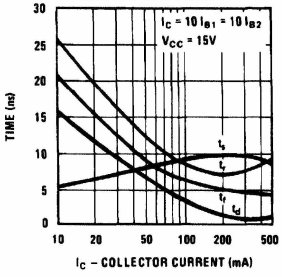
Input and Output Capacitance vs Reverse Bias Voltage



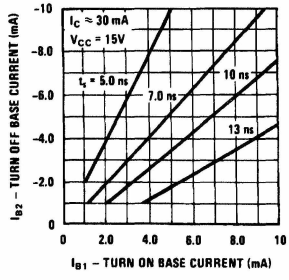
Contours of Constant Gain Bandwidth Product (f_T)



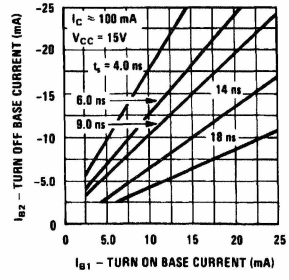
Switching Times vs Collector Current



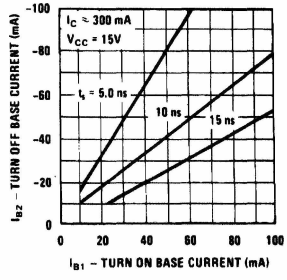
Storage Time vs Turn On and Turn Off Base Currents



Storage Time vs Turn On and Turn Off Base Currents



Storage Time vs Turn On and Turn Off Base Currents



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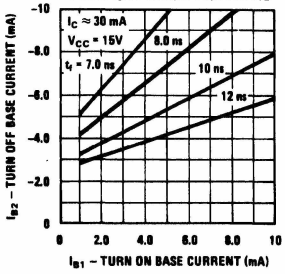
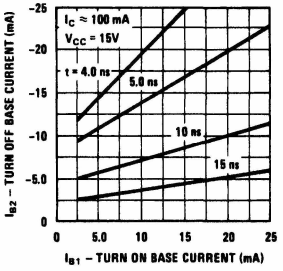
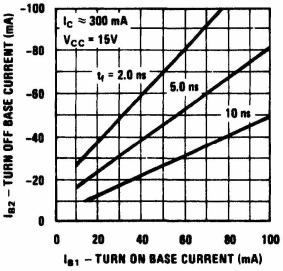
Fall Time vs Turn On and Turn Off Base Currents



Fall Time vs Turn On and Turn Off Base Currents



Fall Time vs Turn On and Turn Off Base Currents



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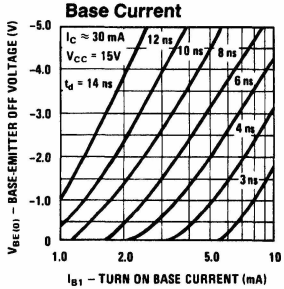
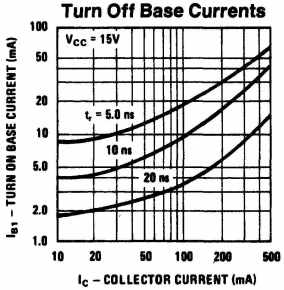
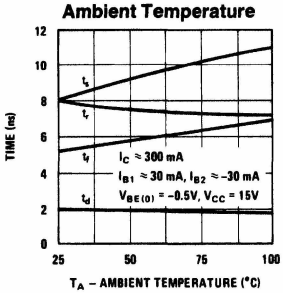
Delay Time vs Base-Emitter Off Voltage and Turn On Base Current



Rise Time vs Collector and Turn Off Base Currents



Switching Time vs Ambient Temperature



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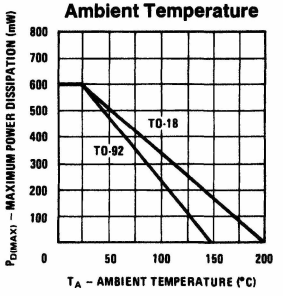
Maximum Power Dissipation vs Ambient Temperature



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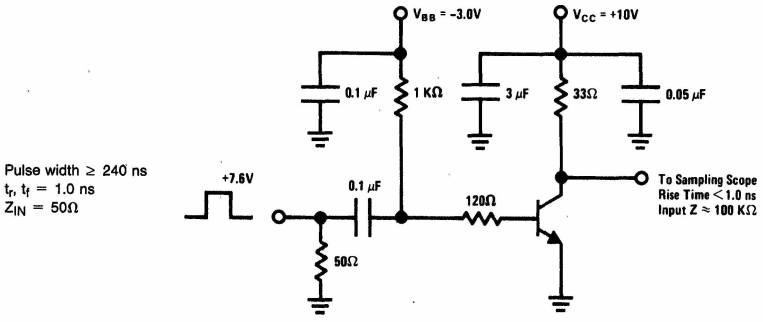

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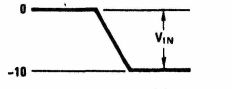
FIGURE 1. t_{ON}, t_{OFF} Test Circuit



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Pulse generator
V_{IN} rise time < 1 ns
Source impedance = 50Ω
PW ≥ 300 ns
Duty cycle < 2%

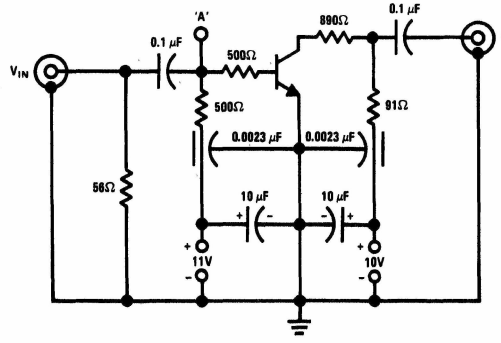

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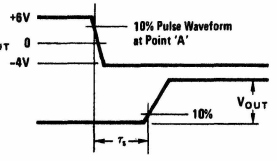
FIGURE 2. Charge Storage Time Measurement Circuit



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To sampling oscilloscope
Z_{IN} = 100 kΩ
Rise Time ≤ 1 ns