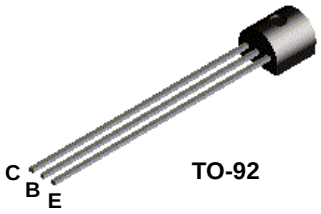
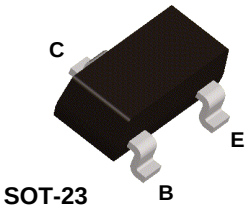
FAIRCHILD SEMICONDUCTOR™

Discrete POWER & Signal Technologies

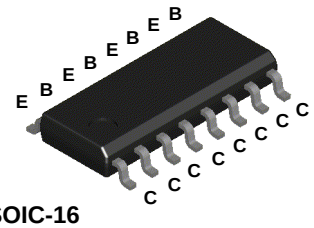
PN2369A MMBT2369A MMPQ2369



TO-92



SOT-23
Mark: 1S



SOIC-16

NPN Switching Transistor

This device is designed for high speed saturation switching at collector currents of 10 mA to 100 mA. Sourced from Process 21.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	15	V
V_{CBO}	Collector-Base Voltage	40	V
V_{EBO}	Emitter-Base Voltage	4.5	V
I_C	Collector Current - Continuous	200	mA
T_J, T_{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:
1) These ratings are based on a maximum junction temperature of 150 degrees C.
2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

TA = 25°C unless otherwise noted

Symbol	Characteristic	Max			Units
		PN2369A	MMBT2369A*	MMPQ2369	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125			°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357	556	 125 240	°C/W °C/W °C/W

*Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

NPN Switching Transistor
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	15		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA, V_{BE} = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	4.5		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 20 V, I_E = 0 V_{CB} = 20 V, I_E = 0, T_A = 125°C		0.4 30	µA µA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain*	I_C = 10 mA, V_{CE} = 1.0 V I_C = 10 mA,V_{CE} = 0.35 V,T_A = -55°C I_C = 100 mA, V_{CE} = 2.0 V	40 20 20	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA,T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA		0.2 0.3 0.25 0.5	V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA,T_A = -55°C I_C = 10 mA, I_B = 1.0 mA,T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA	0.7 0.59	0.85 1.02 1.15 1.6	V V V V V
SMALL SIGNAL CHARACTERISTICS					
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		4.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz		5.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 10 V, R_G = 2.0 kΩ, f = 100 MHz	5.0		
SWITCHING CHARACTERISTICS (except MMPQ2369)					
t_s	Storage Time	I_{B1} = I_{B2} = I_C = 10 mA		13	ns
t_{on}	Turn-On Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA		12	ns
t_{off}	Turn-Off Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA, I_{B2} = 1.5 mA		18	ns

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

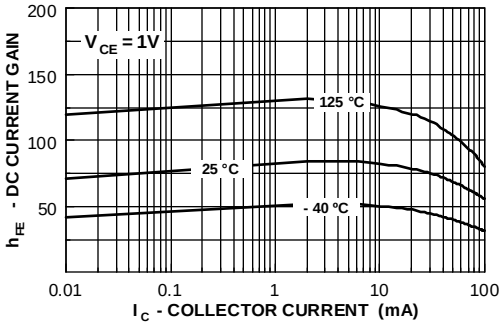
Spice Model

NPN (Is=44.14f Xti=3 Eg=1.11 Vaf=100 Bf=78.32 Ne=1.389 Ise=91.95f Ikf=.3498 Xtb=1.5 Br=12.69m Nc=2 Isc=0 Ikr=0 Rc=.6 Cjc=2.83p Mjc=86.19m Vjc=.75 Fc=.5 Cje=4.5p Mje=.2418 Vje=.75 Tr=1.073u Tf=227.6p Itf=.3 Vtf=4 Xtf=4 Rb=10)

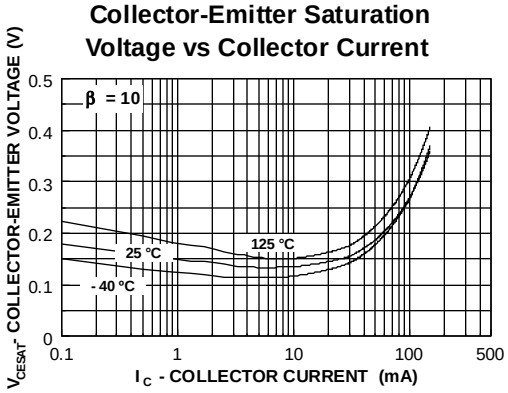
NPN Switching Transistor
(continued)

DC Typical Characteristics

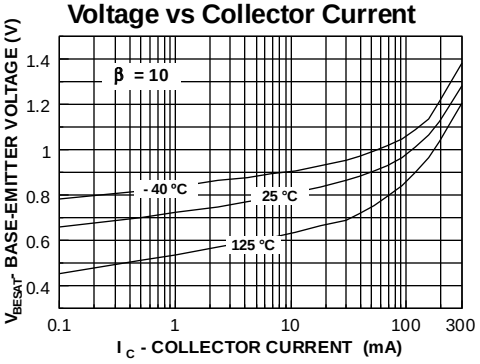
DC Current Gain vs Collector Current



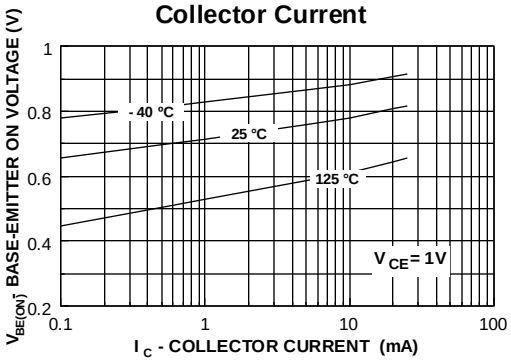
Collector-Emitter Saturation Voltage vs Collector Current



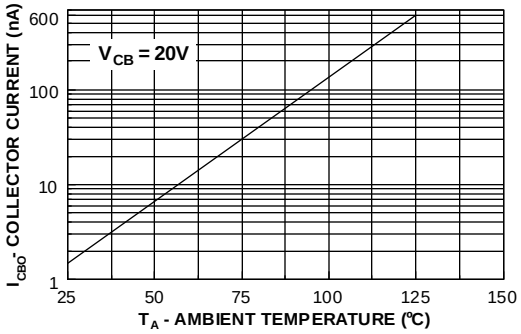
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current

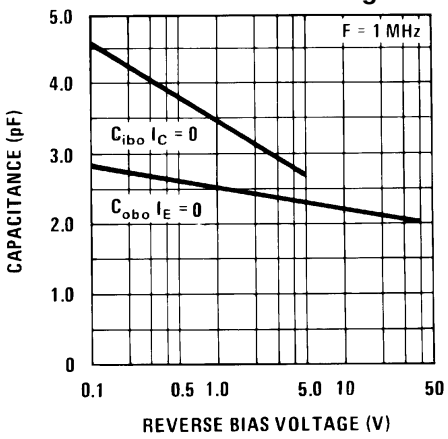


Collector-Cutoff Current vs Ambient Temperature

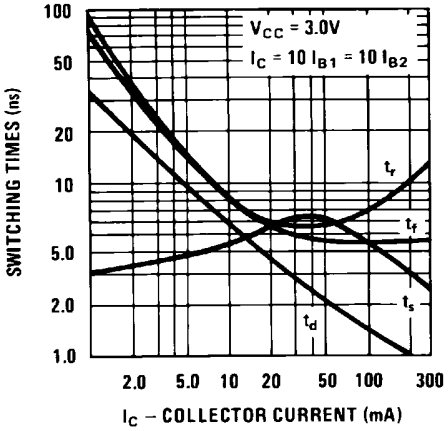


AC Typical Characteristics

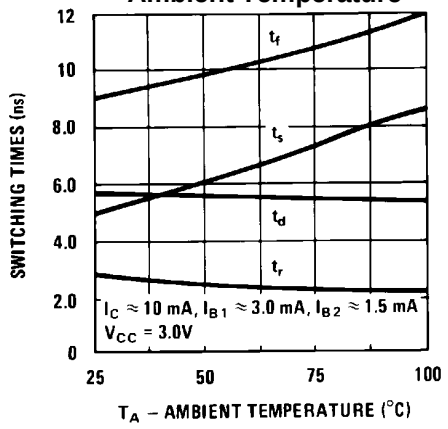
Output Capacitances vs. Reverse Bias Voltage



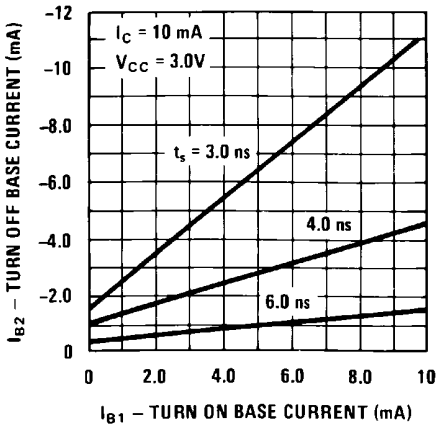
Switching Times vs. Collector Current



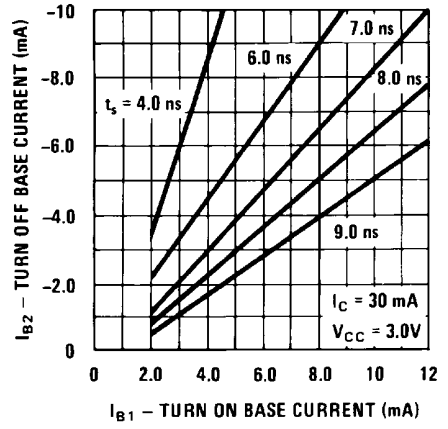
Switching Times vs. Ambient Temperature



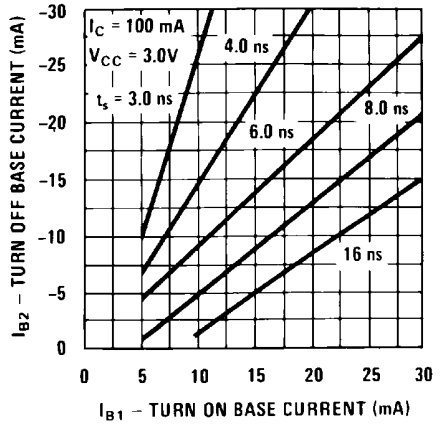
Storage Time vs. Turn On and Turn Off Base Currents



Storage Time vs. Turn On and Turn Off Base Currents

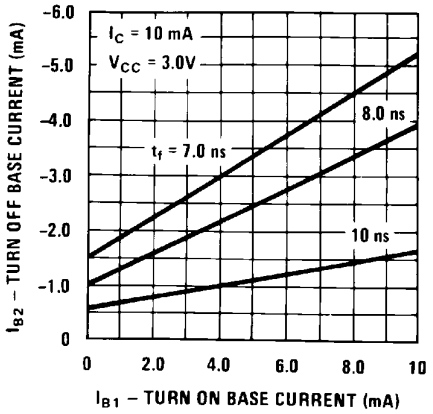


Storage Time vs. Turn On and Turn Off Base Currents

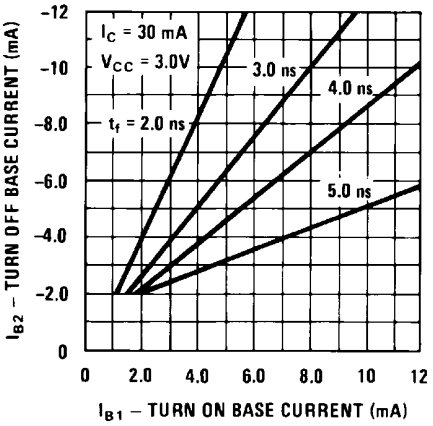


AC Typical Characteristics (continued)

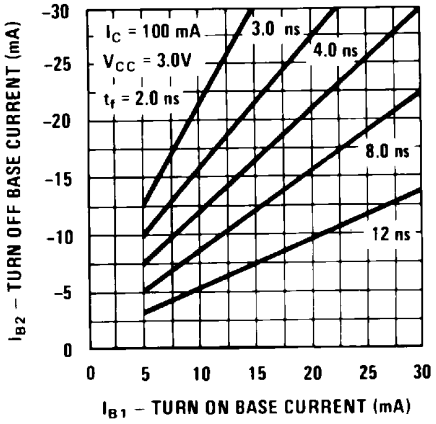
Fall Time vs. Turn On and Turn Off Base Currents



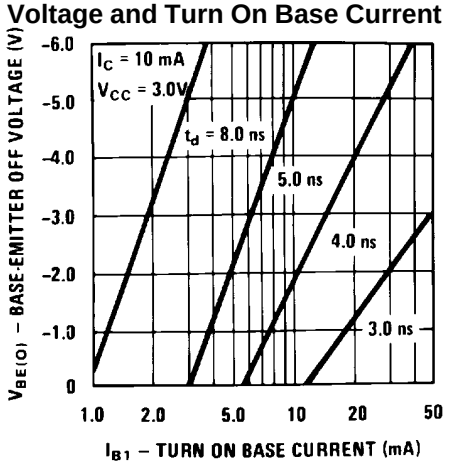
Fall Time vs. Turn On and Turn Off Base Currents



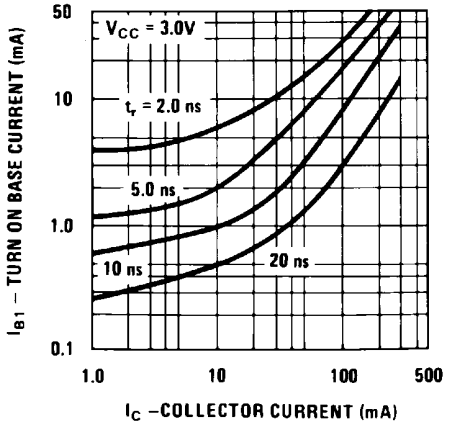
Fall Time vs. Turn On and Turn Off Base Currents



Delay Time vs. Base-Emitter OFF Voltage and Turn On Base Current

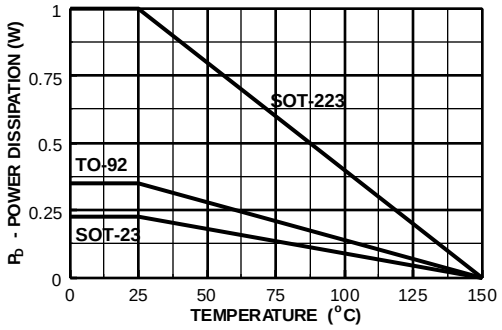


Rise Time vs. Turn On Base Current and Collector Current



AC Typical Characteristics (continued)

POWER DISSIPATION vs AMBIENT TEMPERATURE



Test Circuits

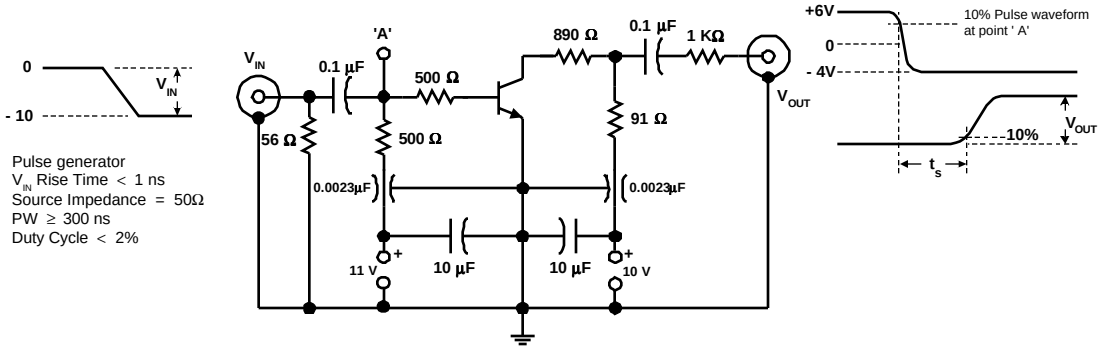


FIGURE 1: Charge Storage Time Measurement Circuit

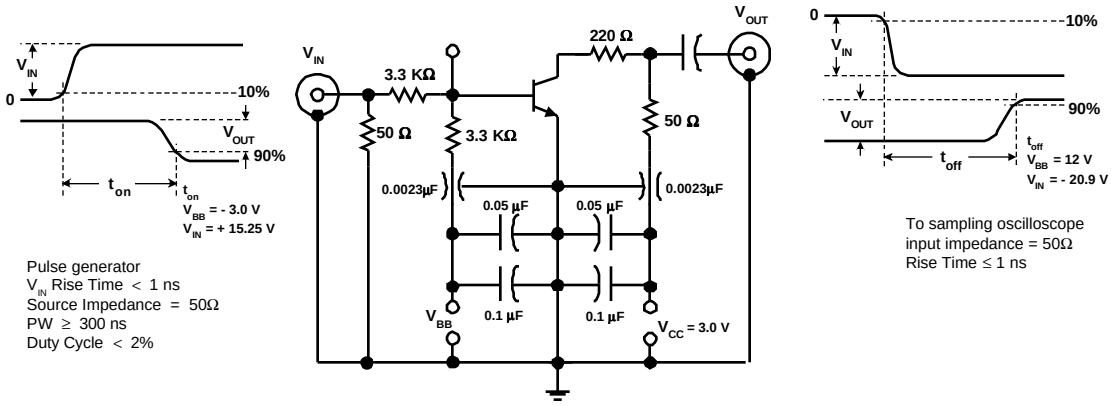


FIGURE 2: t_{ON}, t_{OFF} Measurement Circuit