

MAXIMUM RATINGS

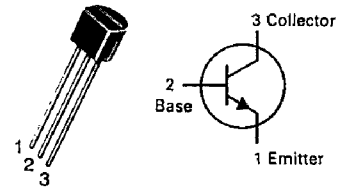
Rating	Symbol	MPS2222	MPS2222A	Unit
Collector-Emitter Voltage	V_{CEO}	30	40	Vdc
Collector-Base Voltage	V_{CBO}	60	75	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	6.0	Vdc
Collector Current — Continuous	I_C	600		mA dc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625	5.0	mW mW/°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5	12	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W

MPS2222,A★

CASE 29-04, STYLE 1
TO-92 (TO-226AA)



GENERAL PURPOSE TRANSISTORS

NPN SILICON

★MPS2222A is a Motorola
designated preferred device.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 10 \text{ mA dc}, I_B = 0$)	$V_{(BR)CEO}$	30 40	— —	Vdc
Collector-Base Breakdown Voltage ($I_C = 10 \text{ } \mu\text{A dc}, I_E = 0$)	$V_{(BR)CBO}$	60 75	— —	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \text{ } \mu\text{A dc}, I_C = 0$)	$V_{(BR)EBO}$	5.0 6.0	— —	Vdc
Collector Cutoff Current ($V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$)	I_{CEX}	—	10	nA dc
Collector Cutoff Current ($V_{CB} = 50 \text{ Vdc}, I_E = 0$) ($V_{CB} = 60 \text{ Vdc}, I_E = 0$) ($V_{CB} = 50 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$) ($V_{CB} = 50 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$)	I_{CBO}	— — — —	0.01 0.01 10 10	$\mu\text{A dc}$
Emitter Cutoff Current ($V_{EB} = 3.0 \text{ Vdc}, I_C = 0$)	I_{EBO}	—	100	nA dc
Base Cutoff Current ($V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$)	I_{BL}	—	20	nA dc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 0.1 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 1.0 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}, T_A = -55^\circ\text{C}$) ($I_C = 150 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$)(1) ($I_C = 150 \text{ mA dc}, V_{CE} = 1.0 \text{ Vdc}$)(1) ($I_C = 500 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$)(1)	h_{FE}	35 50 75 35 100 50 30 40	— — — — 300 — — —	—
Collector-Emitter Saturation Voltage(1) ($I_C = 150 \text{ mA dc}, I_B = 15 \text{ mA dc}$) ($I_C = 500 \text{ mA dc}, I_B = 50 \text{ mA dc}$)	$V_{CE(sat)}$	— — — —	0.4 0.3 1.6 1.0	Vdc

ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

MPS2222 CHARACTERISTICS (continued) (T _A = 25 °C unless otherwise noted.)					
Characteristic		Symbol	Min	Max	Unit
Base-Emitter Saturation Voltage(1)		V _{BE(sat)}			V _{dc}
(I _C = 150 mA _{dc} , I _B = 15 mA _{dc})	MPS2222		—	1.3	
	MPS2222A		0.6	1.2	
(I _C = 500 mA _{dc} , I _B = 50 mA _{dc})	MPS2222		—	2.6	
	MPS2222A		—	2.0	

SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product(2) ($I_C = 20\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	MPS2222 MPS2222A	f_T	250 300	—	MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)		C_{obo}	—	8.0	pF
Input Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$)	MPS2222 MPS2222A	C_{ibo}	—	30 25	pF
Input Impedance ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	MPS2222A MPS2222A	h_{ie}	2.0 0.25	8.0 1.25	k Ω
Voltage Feedback Ratio ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	MPS2222A MPS2222A	h_{re}	— —	8.0 4.0	$\times 10^{-4}$
Small-Signal Current Gain ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	MPS2222A MPS2222A	h_{fe}	50 75	300 375	—
Output Admittance ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	MPS2222A MPS2222A	h_{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant ($I_E = 20\text{ mA}$, $V_{CB} = 20\text{ Vdc}$, $f = 31.8\text{ MHz}$)	MPS2222A	$\tau_b'C_C$	—	150	ps
Noise Figure ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 10\text{ Vdc}$, $R_S = 1.0\text{ k}\Omega$, $f = 1.0\text{ kHz}$)	MPS2222A	NF	—	4.0	dB

SWITCHING CHARACTERISTICS MPS2222A only

Delay Time	(1) ($V_{CC} = 30\text{ Vdc}$, $V_{BE(off)} = -0.5\text{ Vdc}$, $I_C = 150\text{ mA}$, $I_{B1} = 15\text{ mA}$) (Figure 1)	t_d	—	10	ns
Rise Time		t_r	—	25	ns
Storage Time	(2) ($V_{CC} = 30\text{ Vdc}$, $I_C = 150\text{ mA}$, $I_{B1} = I_{B2} = 15\text{ mA}$) (Figure 2)	t_s	—	225	ns
Fall Time		t_f	—	60	ns

(1) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.(2) f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.**SWITCHING TIME EQUIVALENT TEST CIRCUITS**

FIGURE 1 — TURN-ON TIME

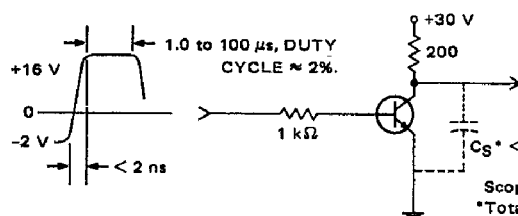


FIGURE 2 — TURN-OFF TIME

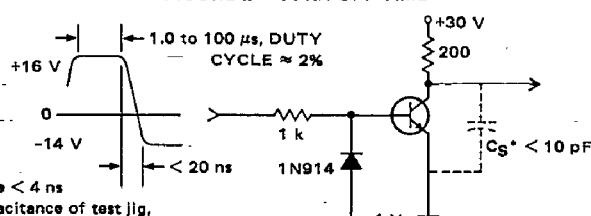


FIGURE 3 – DC CURRENT GAIN

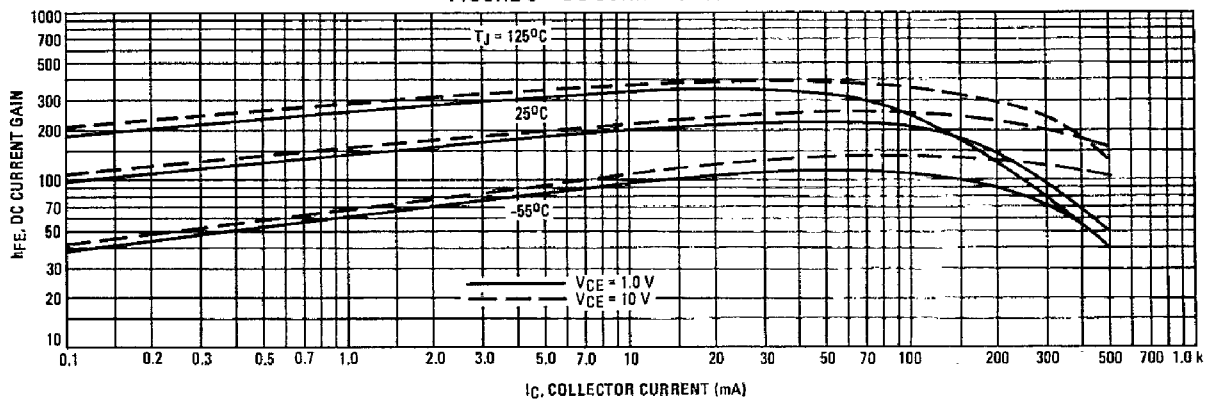


FIGURE 4 – COLLECTOR SATURATION REGION

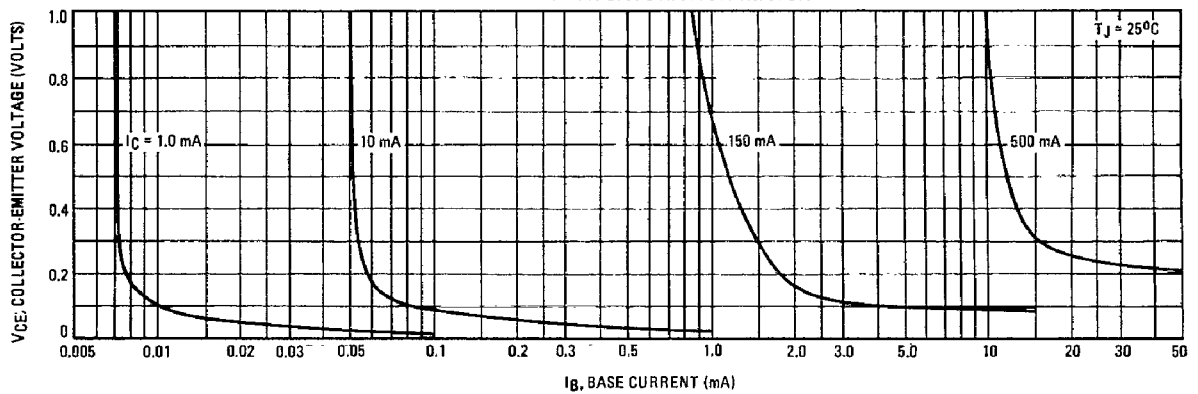


FIGURE 5 – TURN-ON TIME

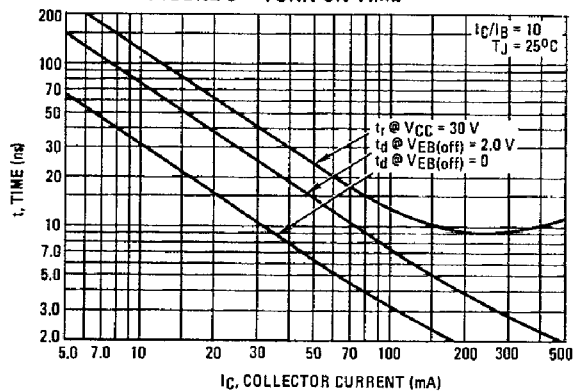


FIGURE 6 – TURN-OFF TIME

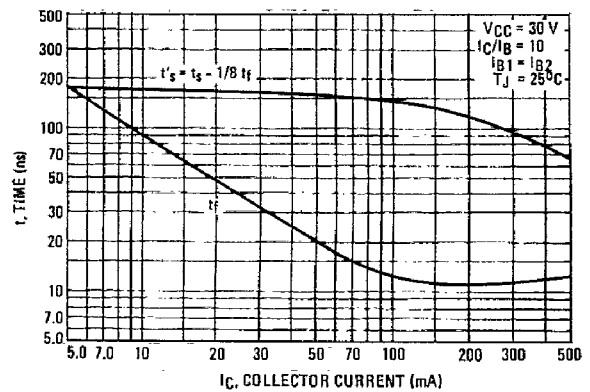


FIGURE 7 — FREQUENCY EFFECTS

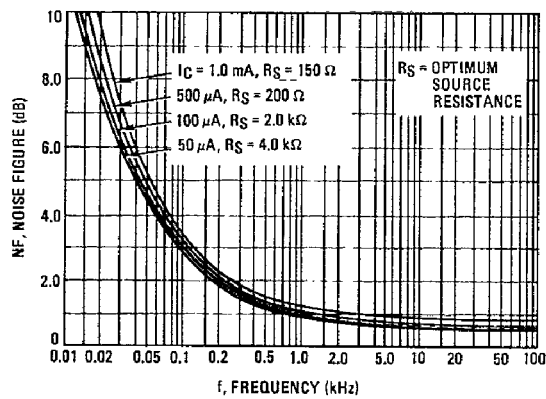


FIGURE 8 — SOURCE RESISTANCE EFFECTS

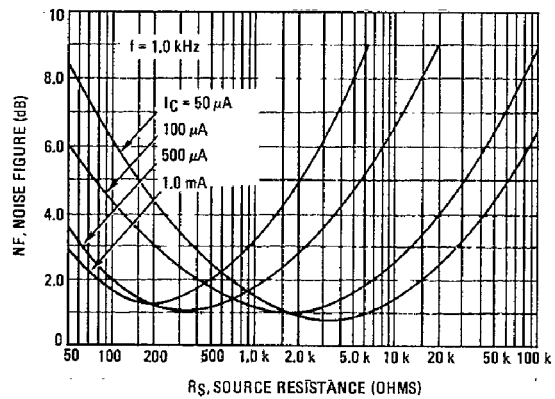


FIGURE 9 — CAPACITANCES

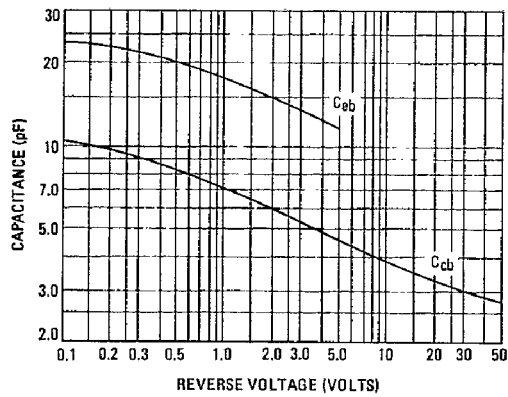


FIGURE 10 — CURRENT-GAIN BANDWIDTH PRODUCT

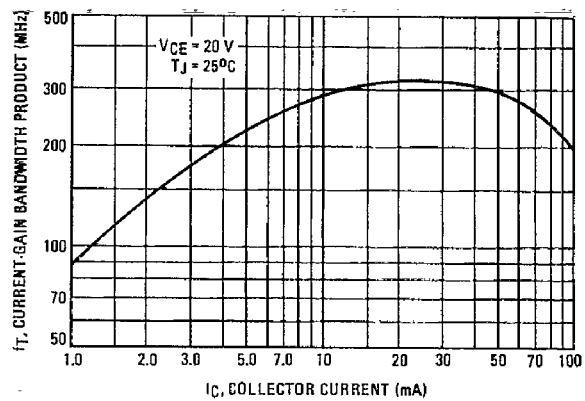


FIGURE 11 — "ON" VOLTAGES

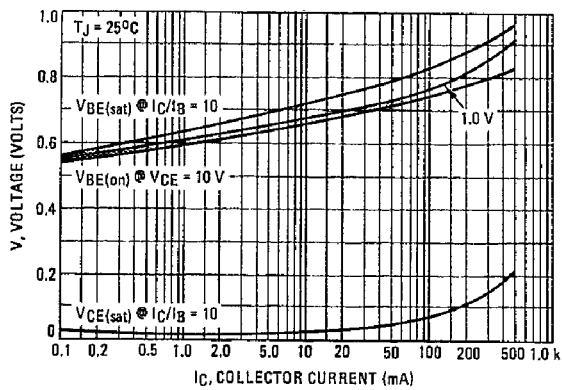
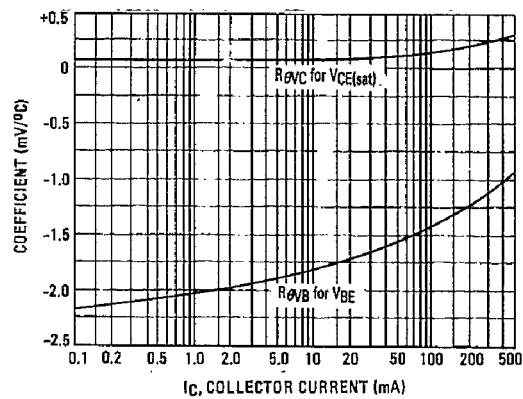


FIGURE 12 — TEMPERATURE COEFFICIENTS



MAXIMUM RATINGS

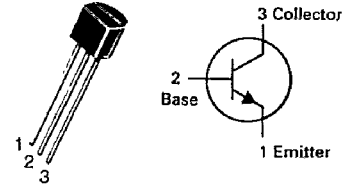
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Emitter Voltage	V_{CES}	40	Vdc
Collector-Base Voltage	V_{CBO}	40	Vdc
Emitter-Base Voltage	V_{EBO}	4.5	Vdc
Collector Current — Continuous	I_C	200	mA _{dc}
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	$^\circ\text{C}/\text{W}$

MPS2369,A★

**CASE 29-04, STYLE 1
TO-92 (TO-226AA)**



SWITCHING TRANSISTORS

NPN SILICON

★MPS2369A is a Motorola
designated preferred device.

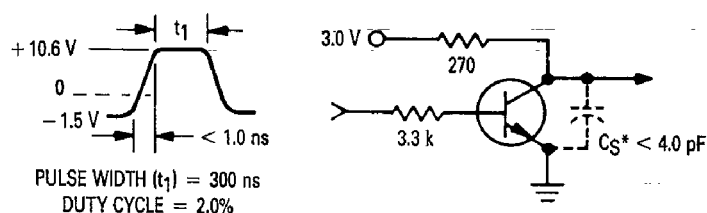
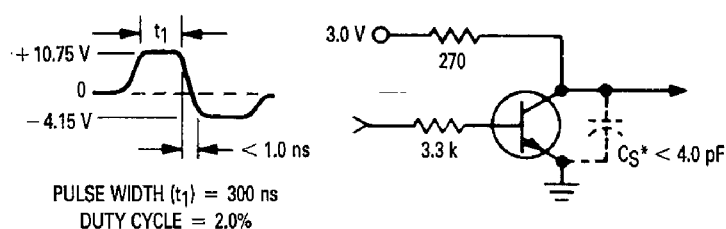
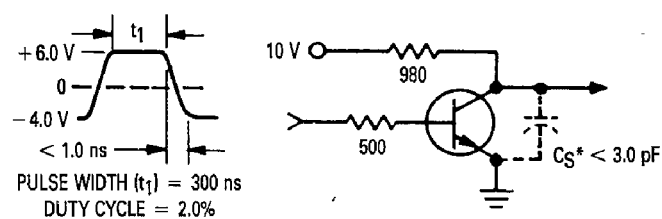
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) ($I_C = 10 \text{ mA}_{dc}, I_B = 0$)	MPS2369A $V_{(BR)CEO}$	15	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 10 \mu\text{A}_{dc}, V_{BE} = 0$)	MPS2369,A $V_{(BR)CES}$	40	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 10 \mu\text{A}_{dc}, I_E = 0$)	MPS2369,A $V_{(BR)CBO}$	40	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{A}_{dc}, I_C = 0$)	MPS2369,A $V_{(BR)EBO}$	4.5	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 20 \text{ Vdc}, I_E = 0$) ($V_{CB} = 20 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$)	MPS2369,A I_{CBO}	—	—	0.4 30	μA_{dc}
Collector Cutoff Current ($V_{CE} = 20 \text{ Vdc}, V_{BE} = 0$)	MPS2369,A I_{CES}	—	—	0.4	μA_{dc}
ON CHARACTERISTICS					
DC Current Gain(1) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 1.0 \text{ V}$) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 1.0 \text{ Vdc}, T_A = -55^\circ\text{C}$) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 0.35 \text{ Vdc}$) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 0.35 \text{ Vdc}, T_A = -55^\circ\text{C}$) ($I_C = 30 \text{ mA}_{dc}, V_{CE} = 0.4 \text{ Vdc}$) ($I_C = 100 \text{ mA}_{dc}, V_{CE} = 2.0 \text{ Vdc}$) ($I_C = 100 \text{ mA}_{dc}, V_{CE} = 1.0 \text{ Vdc}$)	MPS2369A MPS2369 MPS2369 MPS2369A MPS2369A MPS2369A MPS2369 MPS2369A	h_{FE}		— 20 40 40 20 30 20 20	— — 120 — — — — —
Collector-Emitter Saturation Voltage(1) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}$) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}$) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}, T_A = +125^\circ\text{C}$) ($I_C = 30 \text{ mA}_{dc}, I_B = 3.0 \text{ mA}_{dc}$) ($I_C = 100 \text{ mA}_{dc}, I_B = 10 \text{ mA}_{dc}$)	MPS2369 MPS2369A MPS2369A MPS2369A MPS2369A	$V_{CE(sat)}$		— — — — —	0.25 0.20 0.30 0.25 0.50
Base-Emitter Saturation Voltage(1) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}$) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}, T_A = +125^\circ\text{C}$) ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}, T_A = -55^\circ\text{C}$) ($I_C = 30 \text{ mA}_{dc}, I_B = 3.0 \text{ mA}_{dc}$) ($I_C = 100 \text{ mA}_{dc}, I_B = 10 \text{ mA}_{dc}$)	MPS2369 MPS2369A MPS2369A MPS2369A MPS2369A	$V_{BE(sat)}$		0.7 0.5 — — —	0.85 — 1.02 1.15 1.60

(1) Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

ELECTRICAL CHARACTERISTICS (Continued) ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
SMALL-SIGNAL CHARACTERISTICS					
Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{obo}	—	—	4.0	pF
Small Signal Current Gain ($I_C = 10\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 100\text{ MHz}$)	h_{fe}	5.0	—	—	—
SWITCHING CHARACTERISTICS					
Storage Time ($I_{B1} = I_{B2} = I_C = 10\text{ mAdc}$) (Figure 3)	t_s	—	5.0	13	ns
Turn-On Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mAdc}$, $I_{B1} = 3.0\text{ mAdc}$) (Figure 1)	t_{on}	—	8.0	12	ns
Turn-Off Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mAdc}$, $I_{B1} = 3.0\text{ mAdc}$, $I_{B2} = 1.5\text{ mAdc}$) (Figure 2)	t_{off}	—	10	18	ns

FIGURE 1 — t_{on} CIRCUIT**FIGURE 2 — t_{off} CIRCUIT****FIGURE 3 — STORAGE TEST CIRCUIT**

*TOTAL SHUNT CAPACITANCE OF TEST JIG AND CONNECTORS.