



DATA SHEET

SEMICONDUCTOR

MMBT2369/MMBT2369A

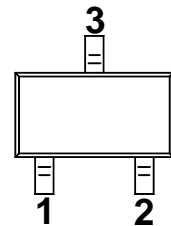
Switching Transistors



MAXIMUM RATINGS

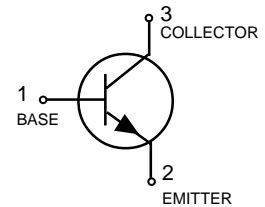
Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	15	Vdc
Collector–Emitter Voltage	V_{CES}	40	Vdc
Collector–Base Voltage	V_{CBO}	40	Vdc
Emitter–Base Voltage	V_{EBO}	4.5	Vdc
Collector Current — Continuous	I_C	200	mAdc

SOT-23 (TO-236AB)



THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board, (1) $T_A = 25^\circ\text{C}$	P_D	225	mW
Derate above 25°C		1.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Total Device Dissipation Alumina Substrate, (2) $T_A = 25^\circ\text{C}$	P_D	300	mW
Derate above 25°C		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$



DEVICE MARKING

MMBT2369 = M1J, MMBT2369A = 1JA

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage(3) ($I_C = 10\text{ mAdc}, I_B = 0$)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector–Emitter Breakdown Voltage ($I_C = 10\ \mu\text{Adc}, V_{BE} = 0$)	$V_{(BR)CES}$	40	—	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 10\ \mu\text{Adc}, I_E = 0$)	$V_{(BR)CBO}$	40	—	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10\ \mu\text{Adc}, I_C = 0$)	$V_{(BR)EBO}$	4.5	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 20\text{Vdc}, I_E = 0$) ($V_{CB} = 20\text{Vdc}, I_E = 0, T_A = 150^\circ\text{C}$)	I_{CBO}	—	—	0.4	μAdc
Collector Cutoff Current ($V_{CE} = 20\text{Vdc}, V_{BE} = 0$)	I_{CES}	—	—	0.4	μAdc

- FR-5 = 1.0 x 0.75 x 0.062 in.
- Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.
- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

ELECTRICAL CHARACTERISTICS

MMBT2369/MMBT2369A

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain(3)	h_{FE}				—
($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	MMBT2369	40	—	120	
($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	MMBT2369A	—	—	120	
($I_C = 10\text{ mA}$, $V_{CE} = 0.35\text{ Vdc}$)	MMBT2369A	40	—	—	
($I_C = 10\text{ mA}$, $V_{CE} = 0.35\text{ Vdc}$, $T_A = -55^\circ\text{C}$)	MMBT2369A	20	—	—	
($I_C = 30\text{ mA}$, $V_{CE} = 0.4\text{ Vdc}$)	MMBT2369A	30	—	—	
($I_C = 100\text{ mA}$, $V_{CE} = 2.0\text{ Vdc}$)	MMBT2369	20	—	—	
($I_C = 100\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	MMBT2369A	20	—	—	
Collector–Emitter Saturation Voltage(3)	$V_{CE(sat)}$				Vdc
($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)	MMBT2369	—	—	0.25	
($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)	MMBT2369A	—	—	0.20	
($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = +125^\circ\text{C}$)	MMBT2369A	—	—	0.30	
($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$)	MMBT2369A	—	—	0.25	
($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$)	MMBT2369A	—	—	0.50	
Base–Emitter Saturation Voltage	$V_{BE(sat)}$				Vdc
($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)	MMBT2369A	0.7	—	0.85	
($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = -55^\circ\text{C}$)	MMBT2369A	—	—	1.02	
($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$)	MMBT2369A	—	—	1.15	
($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$)	MMBT2369A	—	—	1.60	

SMALL–SIGNAL CHARACTERISTICS

Output Capacitance ($V_{CE} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{obo}	—	—	4.0	pF
Small–Signal Current Gain ($V_{CE} = 10\text{ Vdc}$, $I_C = 10\text{ mA}$, $f = 100\text{ MHz}$)	h_{fe}	5.0	—	—	—

SWITCHING CHARACTERISTICS

Storage Time ($I_{B1} = I_{B2} = I_C = 10\text{ mA}$)	t_s	—	5.0	13	ns
Turn–On Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$)	t_{on}	—	8.0	12	ns
Turn–Off Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $I_{B2} = 1.5\text{ mA}$)	t_{off}	—	10	18	ns

3. Pulse Test: Pulse Width $\leq 300\text{ ms}$, Duty Cycle $\leq 2.0\%$.

DEVICE CHARACTERISTICS

MMBT2369/MMBT2369A

SWITCHING TIME EQUIVALENT TEST CIRCUITS FOR 2N2369, 2N3227

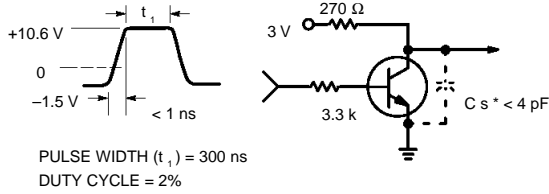


Figure 1. t_{on} Circuit — 10 mA

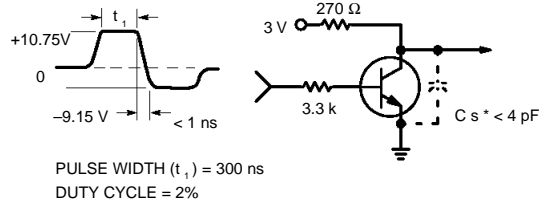


Figure 3. t_{off} Circuit — 10 mA

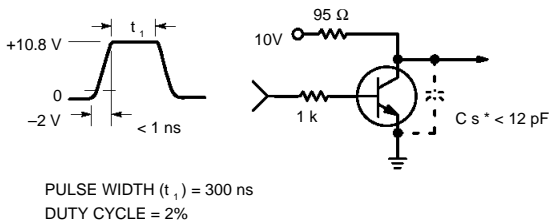


Figure 2. t_{on} Circuit — 100 mA

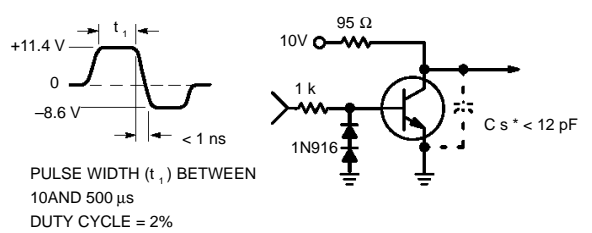


Figure 4. t_{off} Circuit — 100 mA

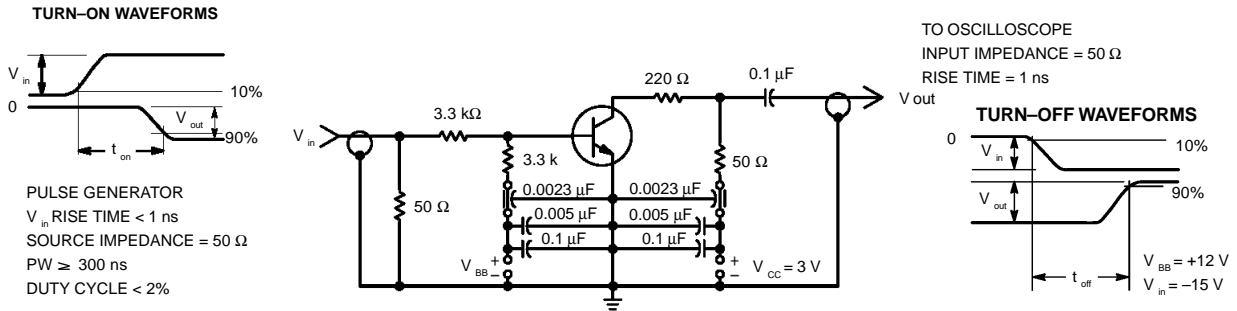


Figure 5. Turn-On and Turn-Off Time Test Circuit

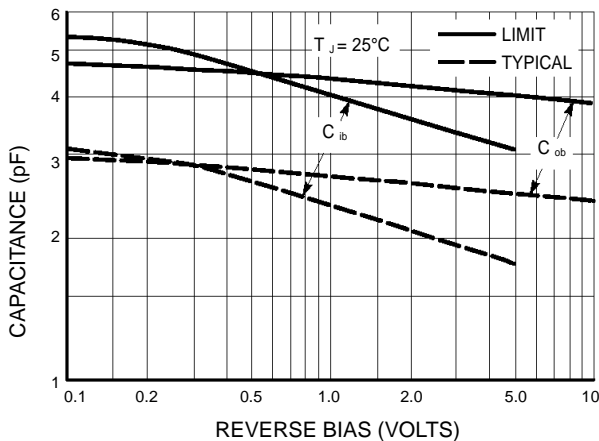


Figure 6. Junction Capacitance Variations

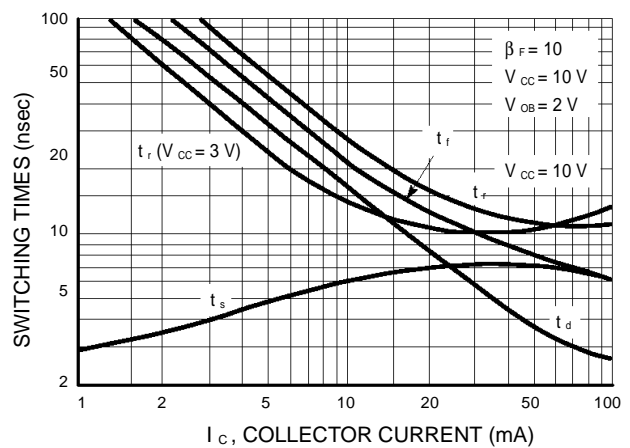


Figure 7. Typical Switching Times

DEVICE CHARACTERISTICS

MMBT2369/MMBT2369A

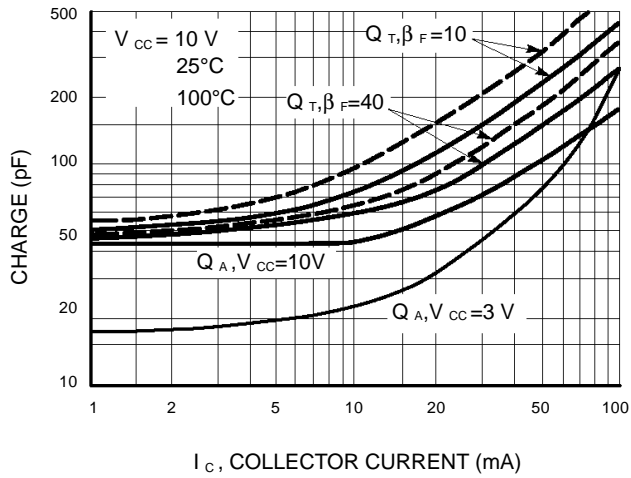


Figure 8. Maximum Charge Data

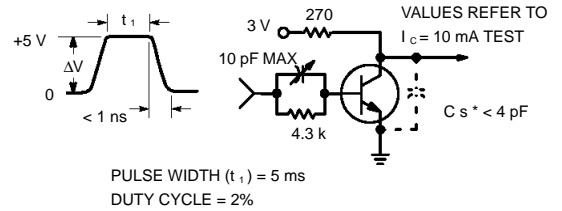


Figure 9. Q T Test Circuit

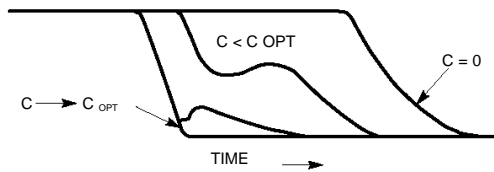


Figure 10. Turn-Off Waveform

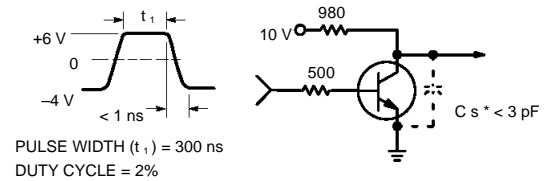


Figure 11. Storage Time Equivalent Test Circuit

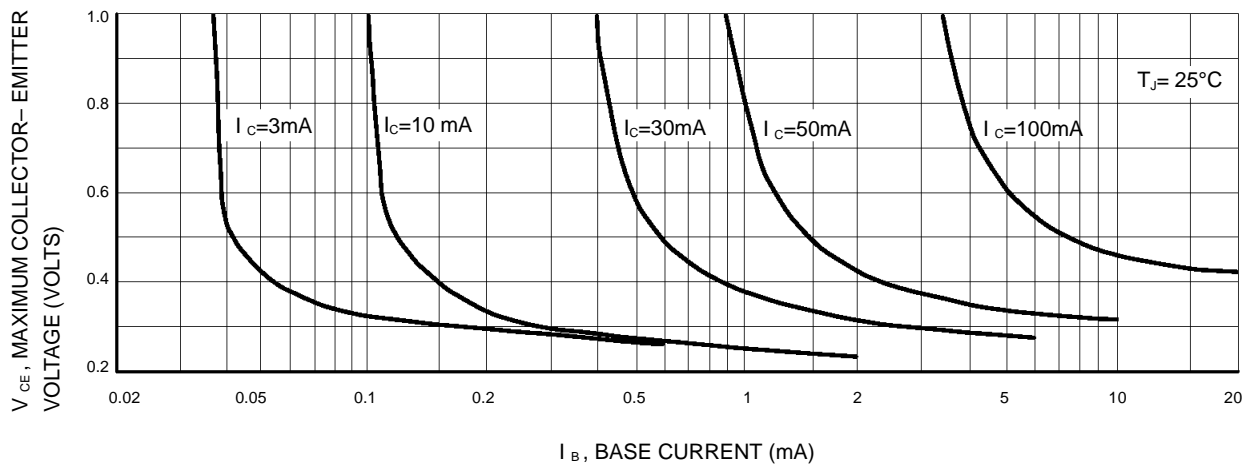


Figure 12. Maximum Collector Saturation Voltage Characteristics

DEVICE CHARACTERISTICS

MMBT2369/MMBT2369A

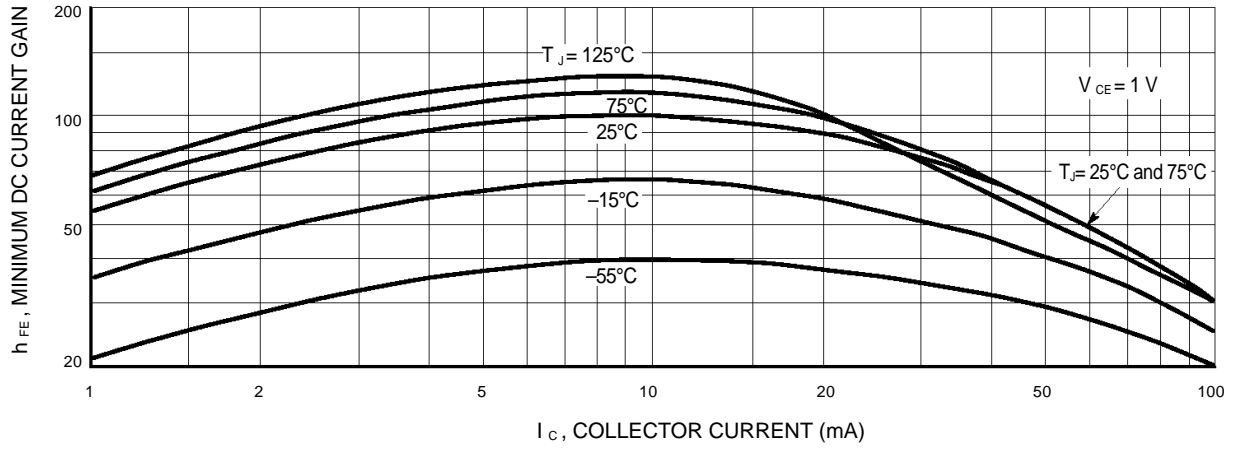


Figure 13. Minimum Current Gain Characteristics

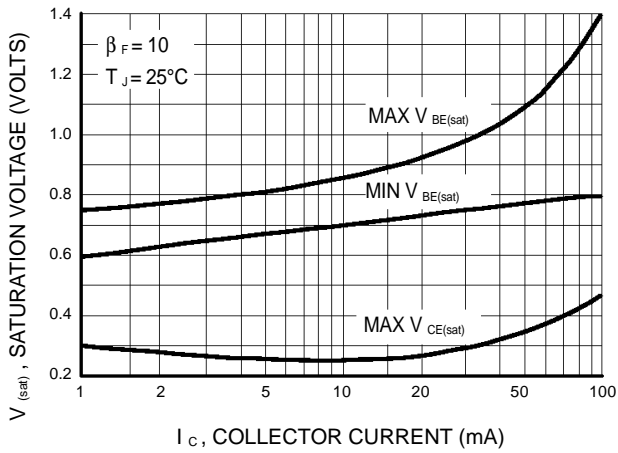


Figure 14. Saturation Voltage Limits

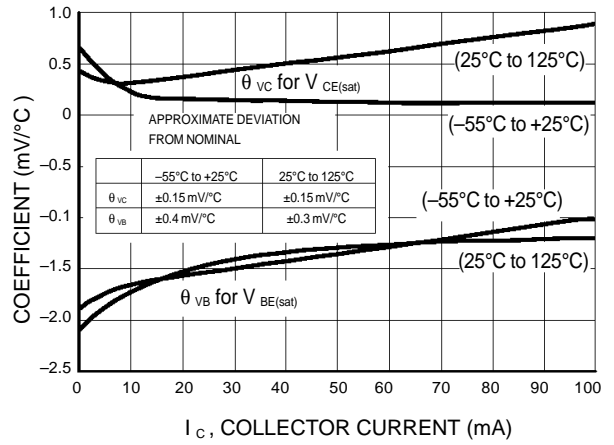
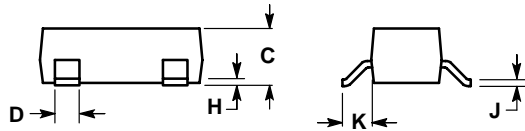
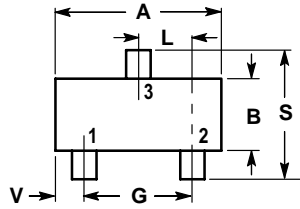


Figure 15. Typical Temperature Coefficients

PACKAGE OUTLINE & DIMENSIONS

MMBT2369/MMBT2369A

SOT-23



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

