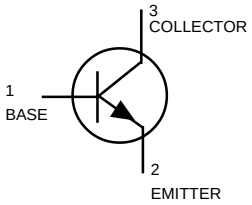
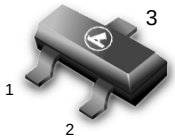
Switching Transistors

NPN Silicon



MMBT2369LT1
MMBT2369ALT1



CASE 318–08, STYLE 6
SOT–23 (TO–236AB)

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

THERMAL CHARACTERISTICS

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

DEVICE MARKING

MMBT2369LT1 = M1J, MMBT2369ALT1 = 1JA

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage(3) (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector–Emitter Breakdown Voltage (I_C = 10 µAdc, V_{BE} = 0)	$V_{(BR)CES}$	40	—	—	Vdc
Collector–Base Breakdown Voltage (I_C = 10 µAdc, I_E = 0)	$V_{(BR)CBO}$	40	—	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 10 µAdc, I_C = 0)	$V_{(BR)EBO}$	4.5	—	—	Vdc
Collector Cutoff Current(V_{CB} = 20Vdc, I_E = 0)	I_{CBO}	—	—	0.4	µAdc
(V_{CB} = 20Vdc, I_E = 0, T_A=150 °C)		—	—	30	
Collector Cutoff Current (V_{CE} = 20Vdc, V_{BE} = 0) MMBT2369A	I_{CES}	—	—	0.4	µAdc

1. FR–5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.
3. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%.

MMBT2369LT1 MMBT2369ALT1

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS						
DC Current Gain(3)		h_{FE}				—
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)	MMBT2369		40	—	120	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)	MMBT2369A		—	—	120	
(I_C = 10 mAdc, V_{CE} = 0.35 Vdc)	MMBT2369A		40	—	—	
(I_C = 10 mAdc, V_{CE} = 0.35 Vdc,T_A = –55°C)	MMBT2369A		20	—	—	
(I_C = 30 mAdc, V_{CE} = 0.4Vdc)	MMBT2369A		30	—	—	
(I_C = 100mAdc, V_{CE} = 2.0 Vdc)	MMBT2369		20	—	—	
(I_C = 100mAdc, V_{CE} = 1.0 Vdc)	MMBT2369A		20	—	—	
Collector–Emitter Saturation Voltage(3)		$V_{CE(sat)}$				Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	MMBT2369		—	—	0.25	
(I_C = 10 mAdc, I_B = 1.0 mAdc)	MMBT2369A		—	—	0.20	
(I_C = 10 mAdc, I_B = 1.0 mAdc, T_A = + 125°C)	MMBT2369A		—	—	0.30	
(I_C = 30mAdc, I_B = 3.0 mAdc)	MMBT2369A		—	—	0.25	
(I_C = 100mAdc, I_B = 10 mAdc)	MMBT2369A		—	—	0.50	
Base–Emitter Saturation Voltage		$V_{BE(sat)}$				Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	MMBT2369A		0.7	—	0.85	
(I_C = 10 mAdc, I_B = 1.0 mAdc, T_A = – 55°C)	MMBT2369A		—	—	1.02	
(I_C = 30 mAdc, I_B = 3.0 mAdc)	MMBT2369A		—	—	1.15	
(I_C = 100 mAdc, I_B = 10 mAdc)	MMBT2369A		—	—	1.60	
SMALL–SIGNAL CHARACTERISTICS						
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	—	—	4.0	pF
Small–Signal Current Gain (V_{CE}=10 Vdc, I_C = 10 mAdc, f = 100 MHz)		h_{fe}	5.0	—	—	—
SWITCHING CHARACTERISTICS						
Storage Time (I_{B1} = I_{B2} = I_C = 10 mAdc)		t_s	—	5.0	13	ns
Turn–On Time (V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = 3.0 mAdc)		t_{on}	—	8.0	12	ns
Turn–Off Time (V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = 3.0 mAdc, I_{B2} = 1.5 mAdc)		t_{off}	—	10	18	ns

3. Pulse Test: Pulse Width ≤ 300 ms, Duty Cycle ≤ 2.0%.

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SWITCHING TIME EQUIVALENT TEST CIRCUITS FOR 2N2369, 2N3227

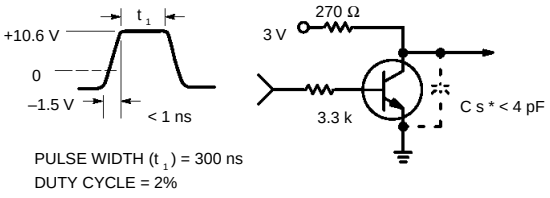

Figure 1. t_{on} Circuit — 10 mA

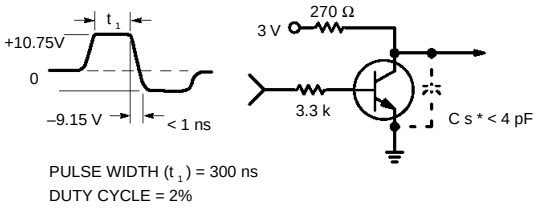

Figure 3. t_{off} Circuit — 10 mA

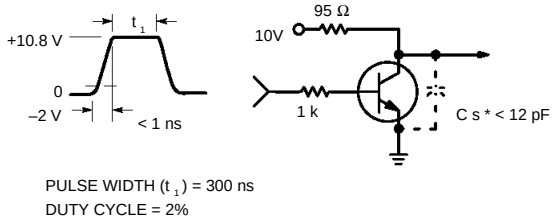

Figure 2. t_{on} Circuit — 100 mA

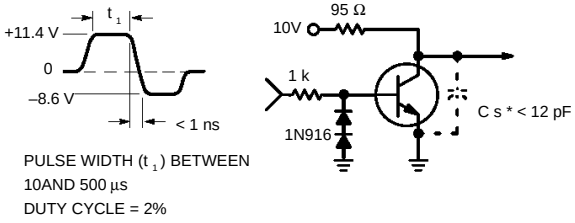

Figure 4. t_{off} Circuit — 100 mA

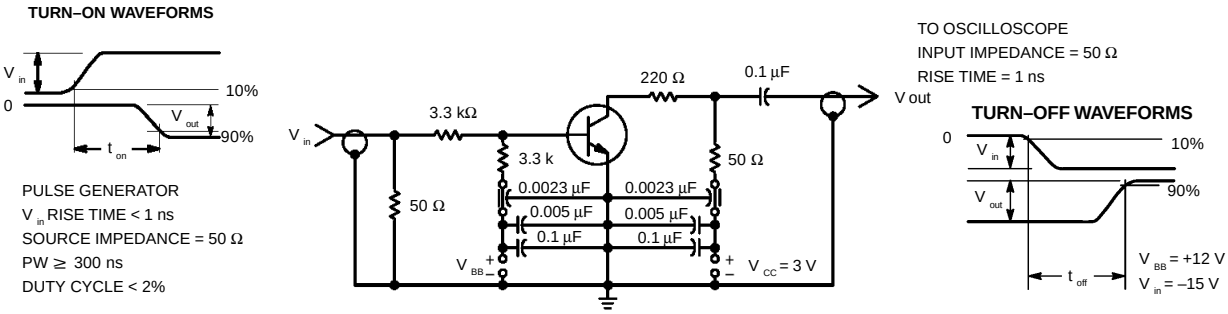

Figure 5. Turn–On and Turn–Off Time Test Circuit

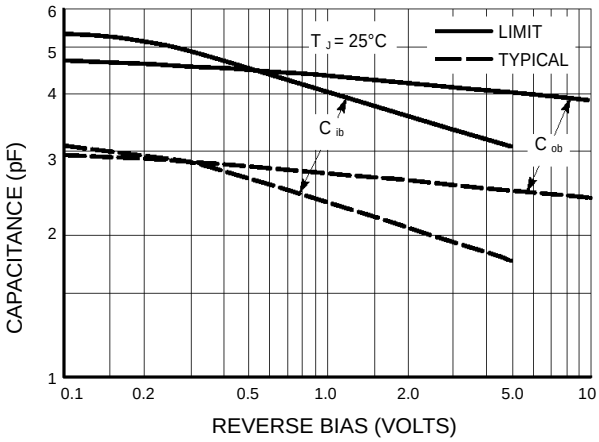

Figure 6. Junction Capacitance Variations

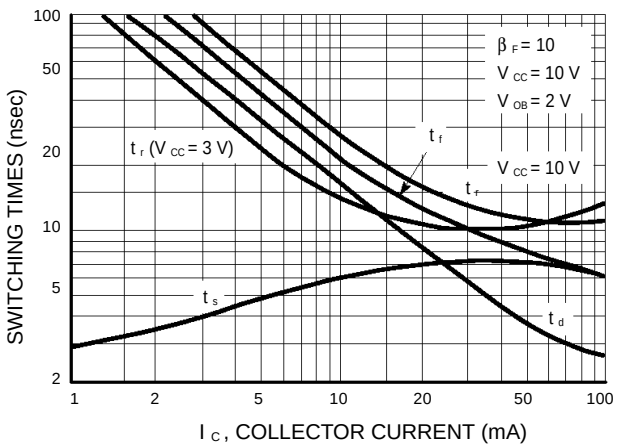

Figure 7. Typical Switching Times

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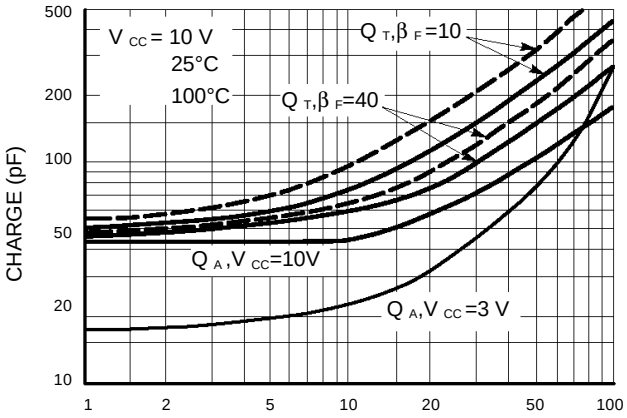

Figure 8. Maximum Charge Data

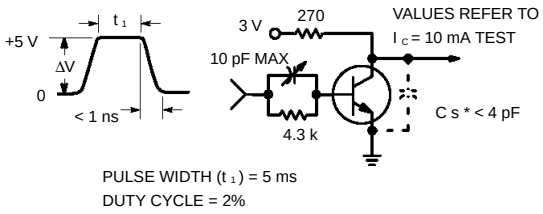

Figure 9. Q T Test Circuit

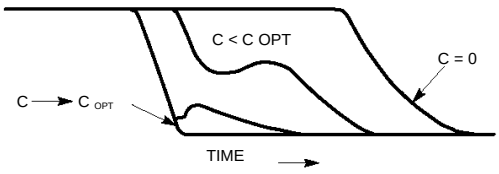

Figure 10. Turn–Off Waveform

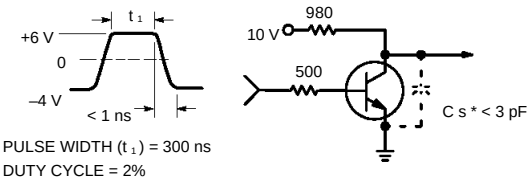

Figure 11. Storage Time Equivalent Test Circuit

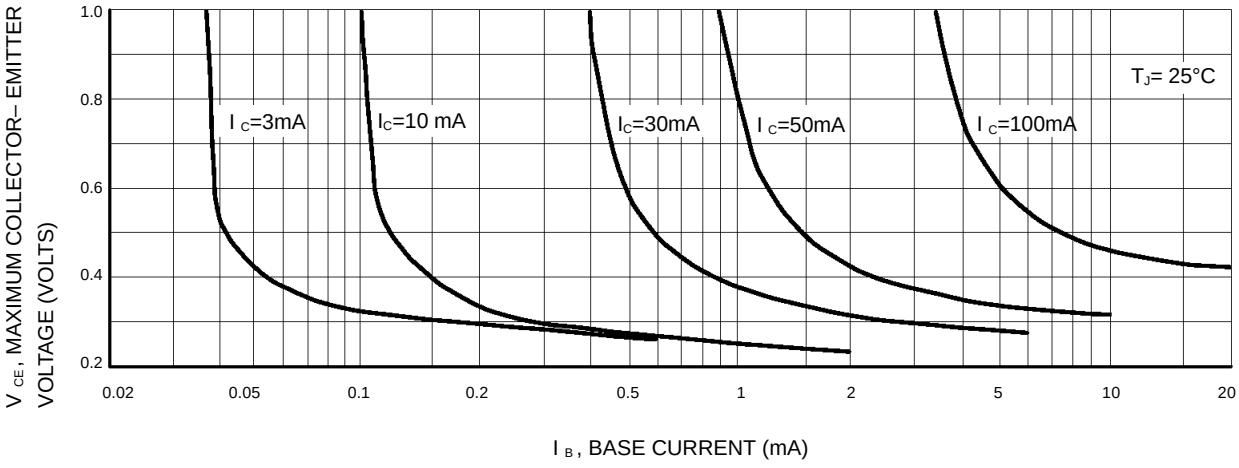

Figure 12. Maximum Collector Saturation Voltage Characteristics

MMBT2369LT1 MMBT2369ALT1

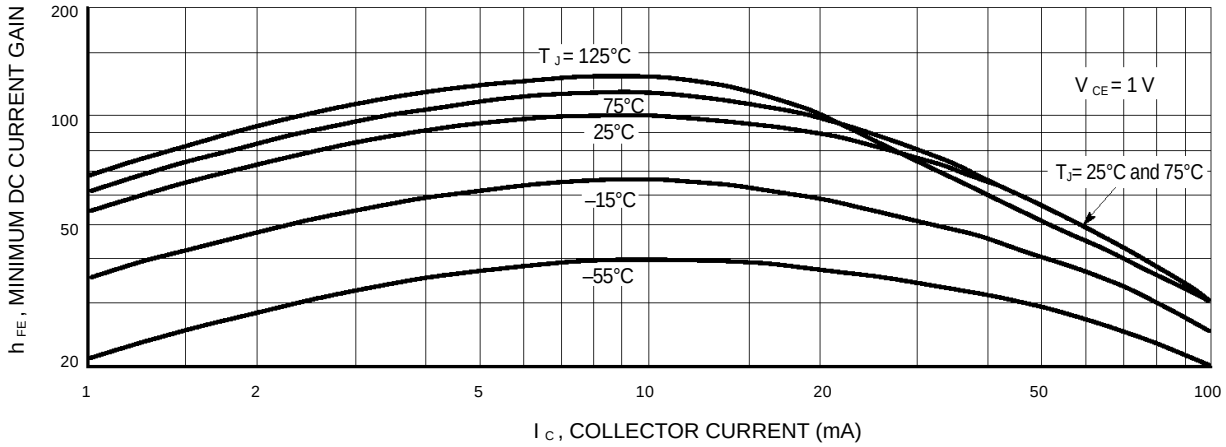

Figure 13. Minimum Current Gain Characteristics

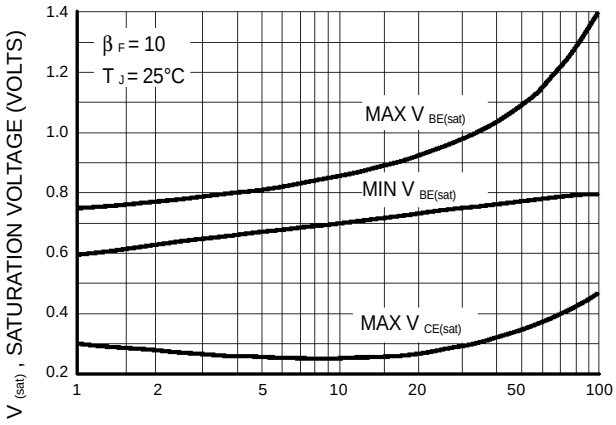

Figure 14. Saturation Voltage Limits

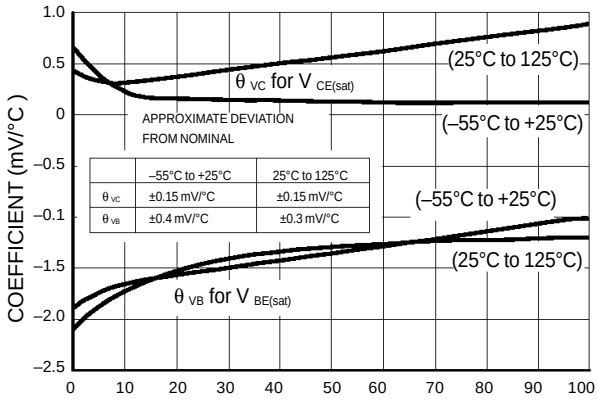

Figure 15. Typical Temperature Coefficients