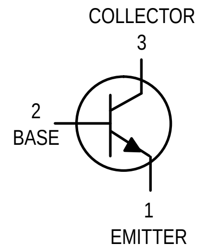
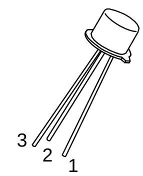
Switching Transistors

NPN Silicon

2N2369
2N2369A*

***Motorola Preferred Device**





CASE 22–03, STYLE 1
TO–18 (TO–206AA)

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 (10 μs pulse)	$I_{C(Peak)}$	500	mA
Collector Current — Continuous	I_C	200	mA
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	0.36 2.06	Watt mW/°C
Total Device Dissipation @ T_C = 100°C Derate above 100°C	P_D	0.68 6.85	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	486	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	147	°C/W

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage (I_C = 10 μA, V_{BE} = 0)		$V_{(BR)CES}$	40	—	Vdc
Collector–Emitter Sustaining Voltage(1) (I_C = 10 mAdc, I_B = 0)		$V_{CEO(sus)}$	15	—	Vdc
Collector–Base Breakdown Voltage (I_C = 10 μA, I_B = 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} = 20 Vdc, I_E = 0) (V_{CB} = 20 Vdc, I_E = 0, T_A = 150°C)	 2N2369 2N2369A	I_{CBO}	 — —	 0.4 30	μAdc
Collector Cutoff Current (V_{CE} = 20 Vdc, V_{BE} = 0)	 2N2369A	I_{CES}	—	0.4	μAdc
Base Current (V_{CE} = 20 Vdc, V_{BE} = 0)	 2N2369A	I_B	—	0.4	μAdc

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

Preferred devices are Motorola recommended choices for future use and best overall value.

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

Characteristic		Symbol	Min	Max	Unit
ON CHARACTERISTICS					
DC Current Gain[1]		h_{FE}			—
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)	2N2369		40	120	
	2N2369A		—	120	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc, T_A = –55°C)	2N2369		20	—	
(I_C = 10 mAdc, V_{CE} = 0.35 Vdc, T_A = –55°C)	2N2369A		20	—	
(I_C = 30 mAdc, V_{CE} = 0.4 Vdc)	2N2369A		30	—	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	2N2369A		20	—	
(I_C = 100 mAdc, V_{CE} = 2.0 Vdc)	2N2369		20	—	
Collector–Emitter Saturation Voltage[1]		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	2N2369		—	0.25	
	2N2369A		—	0.20	
(I_C = 10 mAdc, I_B = 1.0 mAdc, T_A = +125°C)	2N2369A		—	0.30	
(I_C = 30 mAdc, I_B = 3.0 mAdc)	2N2369A		—	0.25	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N2369A		—	0.50	
Base–Emitter Saturation Voltage[1]		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	All Types		0.70	0.85	
(I_C = 10 mAdc, I_B = 1.0 mAdc, T_A = +125°C)	2N2369A		0.59	—	
(I_C = 10 mAdc, I_B = 1.0 mAdc, T_A = –55°C)	2N2369A		—	1.02	
(I_C = 30 mAdc, I_B = 3.0 mAdc)	2N2369A		—	1.15	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N2369A		—	1.60	
SMALL–SIGNAL CHARACTERISTICS					
Current–Gain — Bandwidth Product (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)		f_T	500	—	MHz
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	—	4.0	pF
Input Capacitance (V_{EB} = 1.0 Vdc, I_C = 0, f = 1.0 MHz)		C_{ibo}	—	4.0	pF
SWITCHING CHARACTERISTICS					
Storage Time (I_C = I_{B1} = 10 mAdc, I_{B2} = –10 mAdc)		t_s	—	13	ns
Turn–On Time (I_C = 10 mAdc, I_{B1} = 3.0 mA, I_{B2} = –1.5 mA, V_{CC} = 3.0 Vdc)		t_{on}	—	12	ns
Turn–Off Time (I_C = 10 mAdc, I_{B1} = 3.0 mA, I_{B2} = –1.5 mA, V_{CC} = 3.0 Vdc)		t_{off}	—	18	ns

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

SWITCHING TIME EQUIVALENT TEST CIRCUITS FOR 2N2369, 2N3227

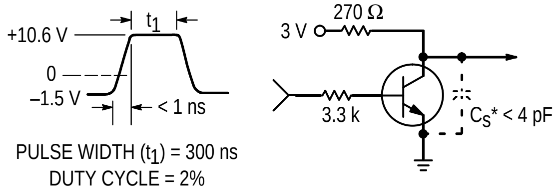


Figure 1. t_{on} Circuit — 10 mA

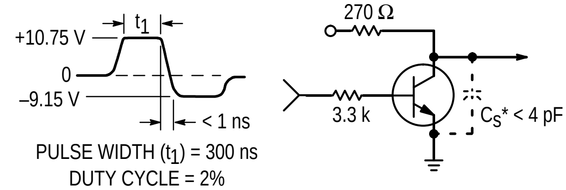


Figure 3. t_{off} Circuit — 10 mA

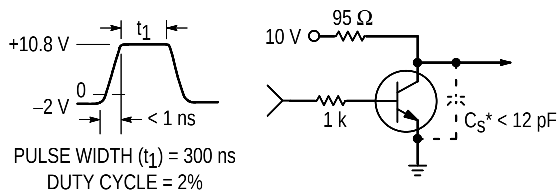


Figure 2. t_{on} Circuit — 100 mA

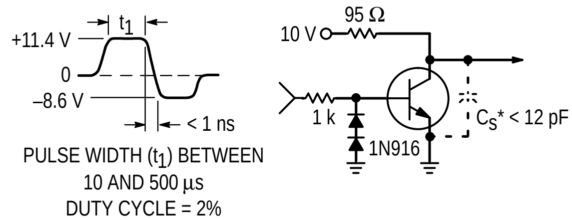


Figure 4. t_{off} Circuit — 100 mA

* Total shunt capacitance of test jig and connectors.

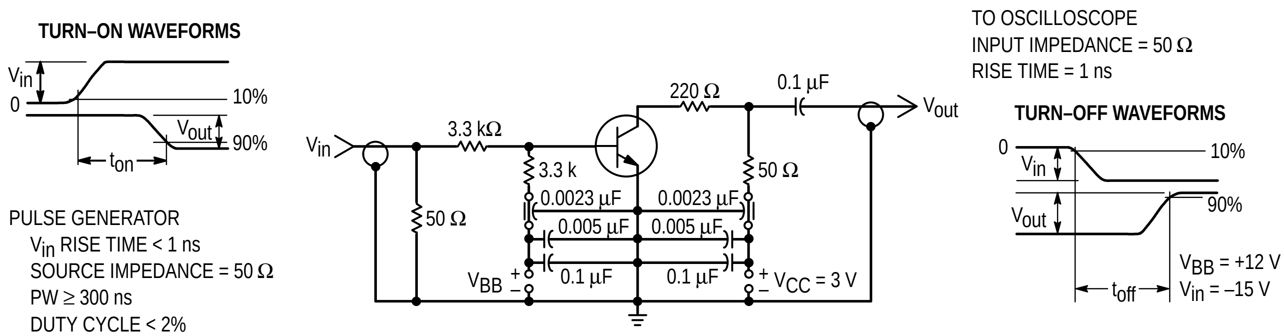


Figure 5. Turn–On and Turn–Off Time Test Circuit

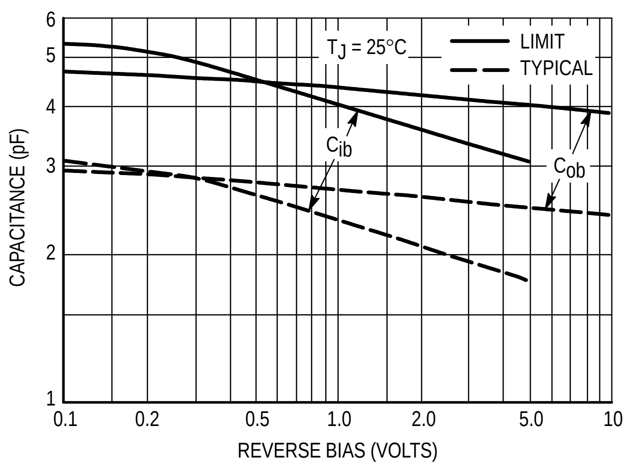


Figure 6. Junction Capacitance Variations

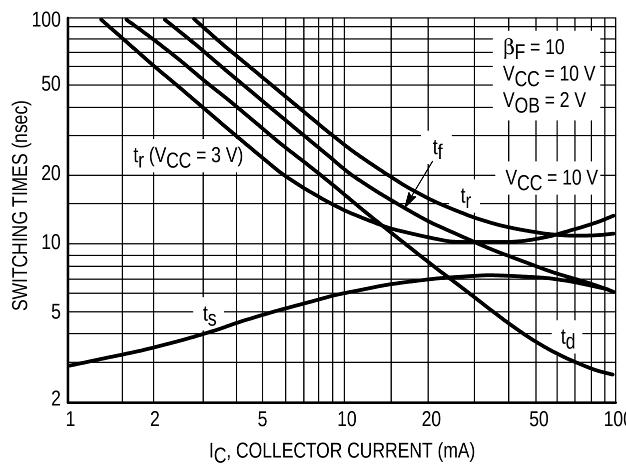


Figure 7. Typical Switching Times

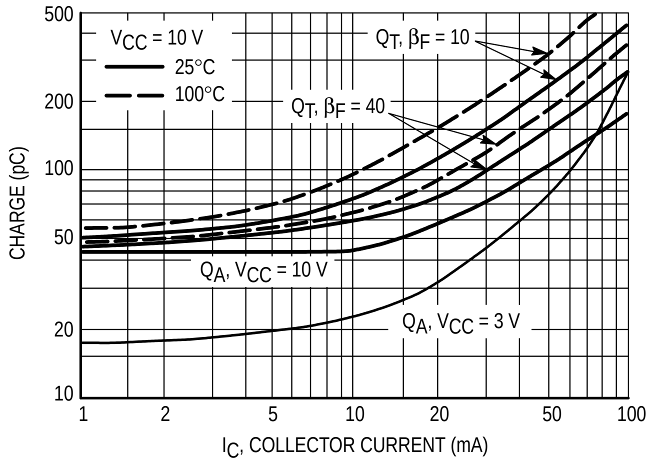


Figure 8. Maximum Charge Data

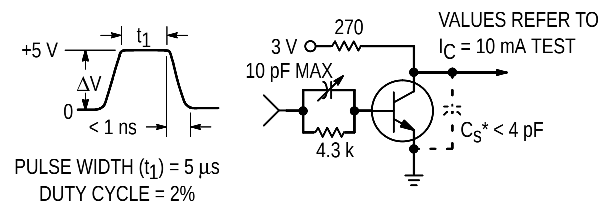


Figure 9. Q_T Test Circuit

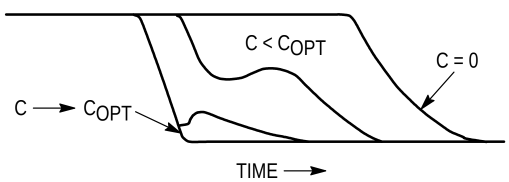


Figure 10. Turn–Off Waveform

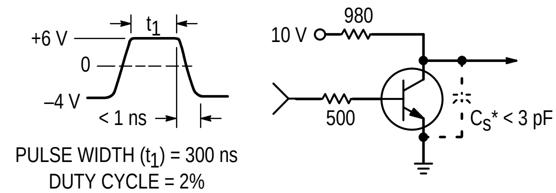


Figure 11. Storage Time Equivalent Test Circuit

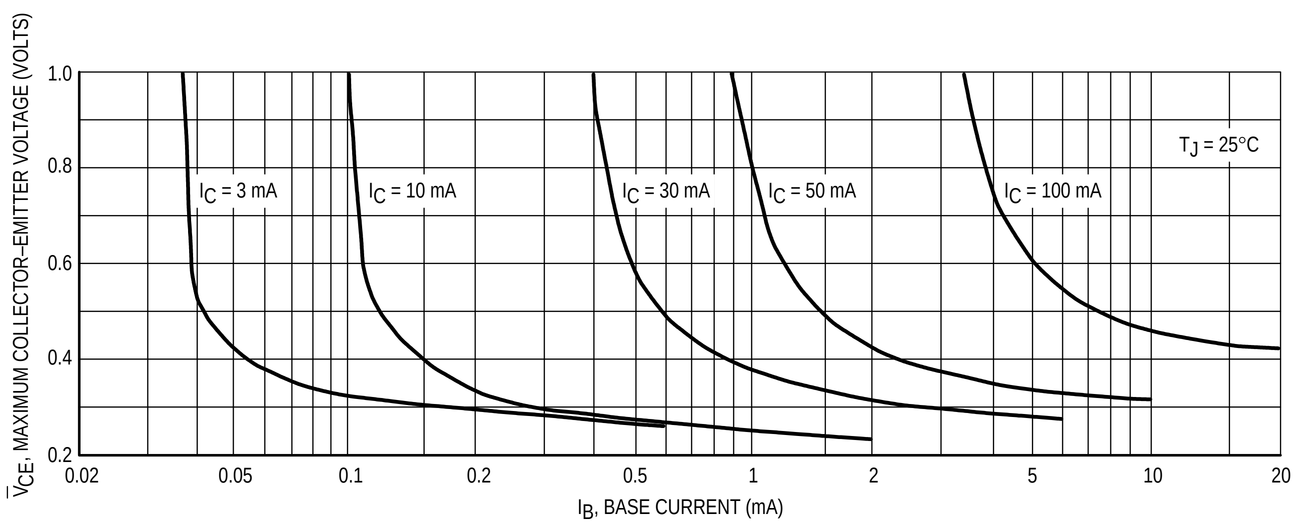


Figure 12. Maximum Collector Saturation Voltage Characteristics

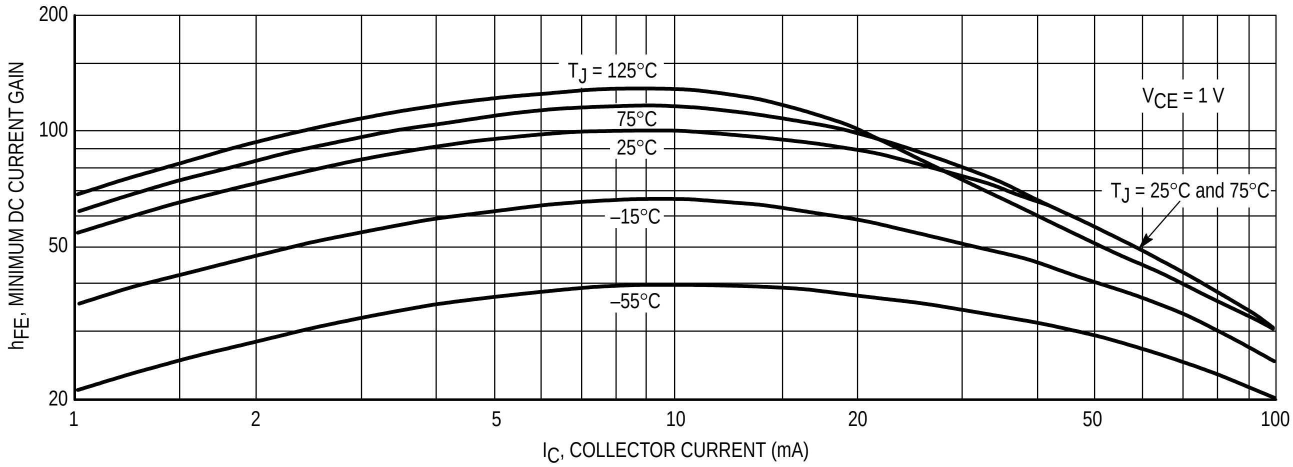


Figure 13. Minimum Current Gain Characteristics

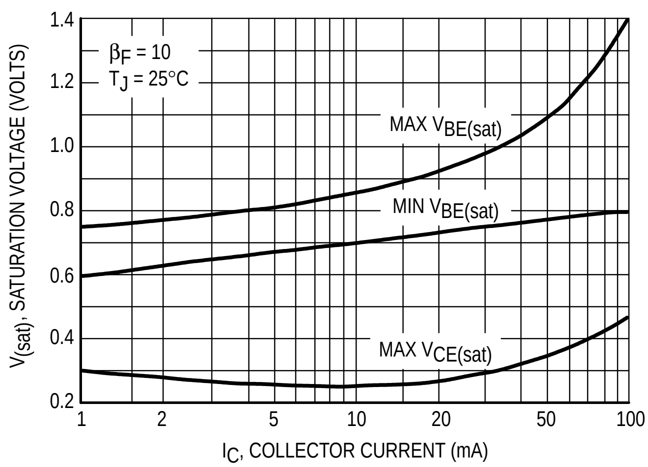


Figure 14. Saturation Voltage Limits

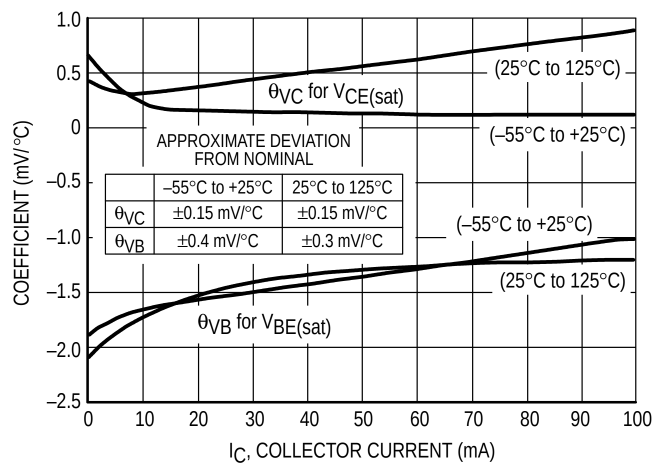
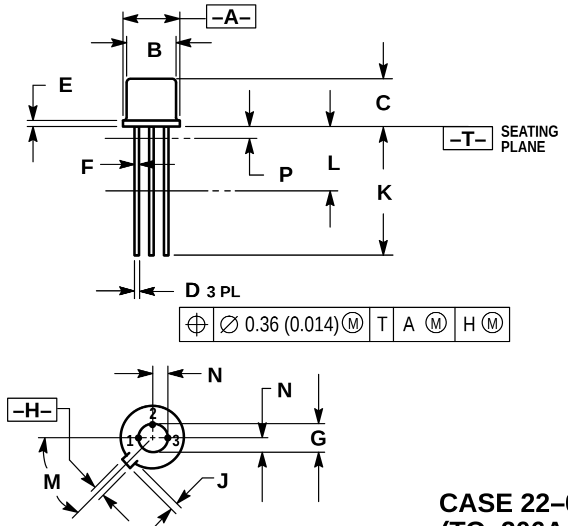


Figure 15. Typical Temperature Coefficients

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM.
4. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM.
5. DIMENSION E INCLUDES THE TAB THICKNESS. (TAB THICKNESS IS 0.51(0.002) MAXIMUM).

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.209	0.230	5.31	5.84
B	0.178	0.195	4.52	4.95
C	0.170	0.210	4.32	5.33
D	0.016	0.021	0.406	0.533
E	—	0.030	—	0.762
F	0.016	0.019	0.406	0.483
G	0.100 BSC		2.54 BSC	
H	0.036	0.046	0.914	1.17
J	0.028	0.048	0.711	1.22
K	0.500	—	12.70	—
L	0.250	—	6.35	—
M	45° BSC		45° BSC	
N	0.050 BSC		1.27 BSC	
P	—	0.050	—	1.27

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

CASE 22–03
(TO–206AA)
ISSUE R

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