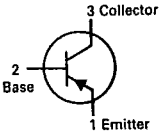
T-37-15

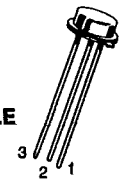
2N869A

JAN, JTX, JTXV AVAILABLE
CASE 22-03, STYLE 1
TO-18 (TO-206AA)



2N4453

JAN, JANTX AVAILABLE
CASE 26-03, STYLE 1
TO-46 (TO-206AB)



SWITCHING TRANSISTORS

PNP SILICON

3

MAXIMUM RATINGS

Rating	Symbol	2N869A	2N4453	Unit
Collector-Emitter Voltage	V_{CEO}	18	18	Vdc
Collector-Emitter Voltage	V_{CES}	25		Vdc
Collector-Base Voltage	V_{CBO}	25	25	Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current — Continuous	I_C	200		mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	360 2.06	400 2.29	mW mW/°C
Total Device Dissipation @ T_C = 25°C T_C = 100°C Derate above 25°C	P_D	1.2 0.686 6.86	2.0 1.03 11.3	Watts Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	2N869A	2N4453	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	146	97.5	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	486	585	°C/W

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I_C = 10 mAdc, I_B = 0)	2N4453	$V_{(BR)CEO}$	18	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 10 μAdc, V_{BE} = 0)	2N869A, 2N4453	$V_{(BR)CES}$	25	—	Vdc
Collector-Emitter Sustaining Voltage(1) (I_C = 10 mAdc, I_B = 0)		$V_{CEO(sus)}$	18	—	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	2N869A, 2N4453	$V_{(BR)CBO}$	25	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0, T_A = 150°C)	2N869A	I_{CBO}	—	25	μAdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0)		I_{CES}	—	10	nAdc
Emitter Cutoff Current (V_{EB} = 4.5 Vdc, I_C = 0)	2N4453	I_{EBO}	—	10	nAdc
Base Current (V_{CE} = 15 Vdc, V_{BE} = 0)	2N869A	I_B	—	10	nAdc
ON CHARACTERISTICS(1)					
DC Current Gain		h_{FE}			—
(I_C = 10 mAdc, V_{CE} = 0.3 Vdc)	2N869A		30	—	
(I_C = 10 mAdc, V_{CE} = 5.0 Vdc)	2N869A		40	120	
(I_C = 30 mAdc, V_{CE} = 0.5 Vdc)	2N869A, 2N4453		40	120	
(I_C = 30 mAdc, V_{CE} = 0.5 Vdc, T_A = −55°C)	2N869A, 2N4453		17	—	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	2N869A, 2N4453		25	—	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	2N869A		—	0.15	
(I_C = 30 mAdc, I_B = 1.5 mAdc)	2N4453		—	0.25	
(I_C = 30 mAdc, I_B = 3.0 mAdc)	2N869A		—	0.2	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N869A, 2N4453		—	0.5	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	2N869A		0.78	0.98	
(I_C = 30 mAdc, I_B = 1.5 mAdc)	2N4453		0.8	1.1	
(I_C = 30 mAdc, I_B = 3.0 mAdc)	2N869A		0.85	1.2	
(I_C = 100 mAdc, I_B = 10 mAdc)	2N869A, 2N4453		—	1.7	

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

Characteristic		Symbol	Min	Max	Unit
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product(1)(2) (I_C = 10 mAdc, V_{CE} = 15 Vdc, f = 100 MHz)		f_T	400	—	MHz
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 140 kHz)	2N869A	C_{obo}	—	6.0	pF
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 150 kHz)	2N869A	C_{ibo}	—	6.0	pF
Collector-Base Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	2N4453	C_{cb}	—	6.0	pF
Emitter-Base Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	2N4453	C_{eb}	—	6.0	pF
SWITCHING CHARACTERISTICS					
Turn-On Time	I_C = 30 mAdc, I_{B1} = 1.5 mAdc, V_{CC} = 2.0 Vdc, 2N869A	t_{on}	—	50	ns
Delay Time	I_C = 30 mAdc, I_{B1} = 1.5 mAdc, V_{CC} = 3.0 Vdc 2N4453	t_d	—	35	ns
Rise Time	I_C = 30 mAdc, I_{B1} = 1.5 mAdc, V_{CC} = 3.0 Vdc 2N4453	t_r	—	20	ns
Turn-Off Time	I_C = 30 mAdc, I_{B1} = I_{B2} = 1.5 mAdc, V_{CC} = 2.0 Vdc 2N869A	t_{off}	—	80	ns
Storage Time	I_C = 30 mAdc, I_{B1} = I_{B2} = 1.5 mAdc, V_{CC} = 3.0 Vdc 2N4453	t_s	—	65	ns
Fall Time	I_C = 30 mAdc, I_{B1} = I_{B2} = 1.5 mAdc, V_{CC} = 3.0 Vdc 2N4453	t_f	—	20	ns

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle = 1.0%.
(2) f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

TYPICAL SWITCHING CHARACTERISTICS

FIGURE 1 — CAPACITANCE

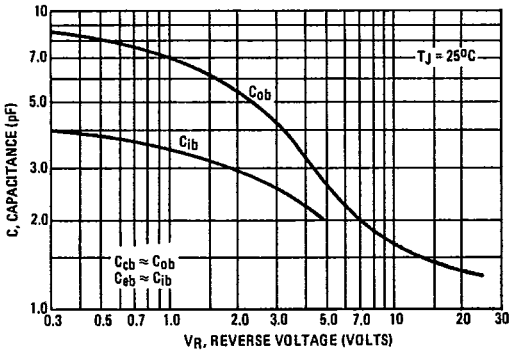


FIGURE 2 — DC CURRENT GAIN

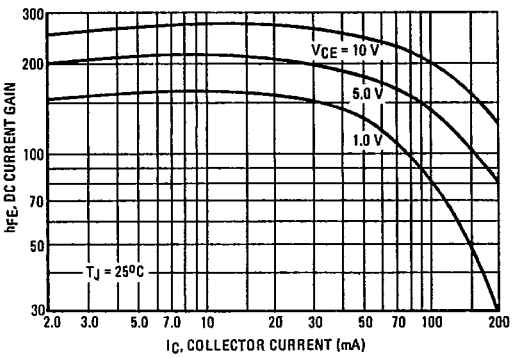


FIGURE 3 — "ON" VOLTAGES

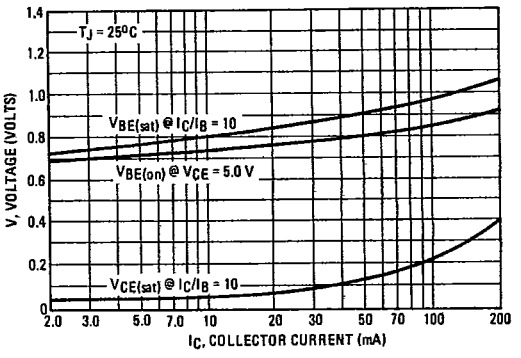


FIGURE 4 — CURRENT-GAIN — BANDWIDTH PRODUCT

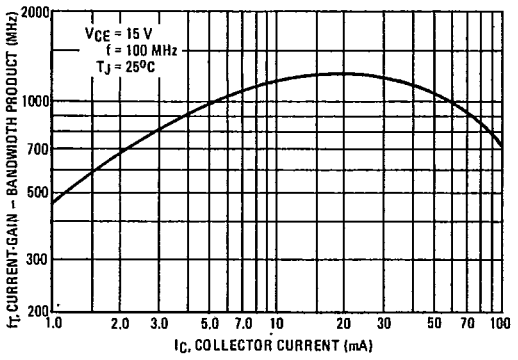
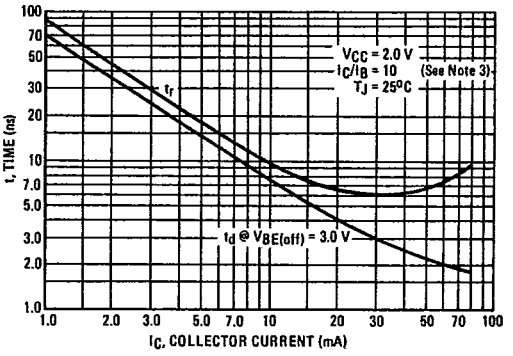


FIGURE 5 — TURN-ON TIME



3

FIGURE 6 — TURN-OFF TIME

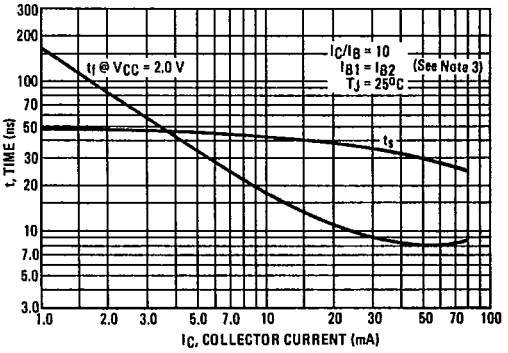


FIGURE 7 — SWITCHING TIME TEST CIRCUIT

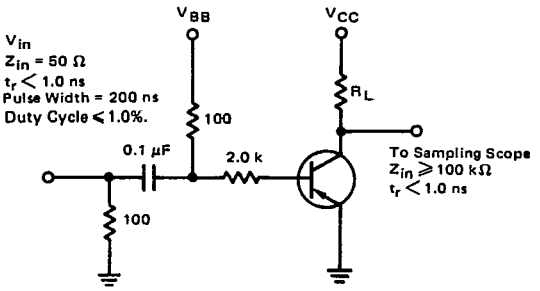


FIGURE 8 — SWITCHING TEST CIRCUIT VALUES

		V_{in} Volts	V_{BB} Volts	V_{CC} Volts	R_L Ohms	I_C mA	I_{B1}(4) mA	I_{B2}(4) mA
t_{on}, t_r, t_d	2N869A	-7.0	3.0	2.0	62	30	1.5	—
	2N4453	-7.0	3.0	3.0	91	30	1.5	—
t_{off}, t_s, t_f	2N869A	+6.0	-4.0	2.0	62	30	1.5	1.5
	2N4453	+6.0	-4.0	3.0	91	30	1.5	1.5

(3) I_C/I_B = 10. Switching is shown to reflect current industry practices. Compare the values shown in Figures 1 and 2 @ I_C = 30 mA to the typical values in the Electrical Characteristics table @ I_C/I_B = 20.

(4) I_{B1} = I_{B2} = 3.0 mA @ I_C/I_B = 10