

FAIRCHILD

A Schlumberger Company

2N3253

T-35-19

NPN Switching Type

ABSOLUTE MAXIMUM RATINGS (Note 1)**Temperatures**

Storage Temperature -65° C to 200° C
 Operating Junction Temperature 200° C

PACKAGE

2N3253

TO-39

Power Dissipation (Notes 2 & 3)

Total Dissipation at
 25° C Ambient Temperature 0.8 W
 25° C Case Temperature 3.0 W

Voltages & Currents

V_{CEO} Collector to Emitter Voltage 40 V
 (Note 4)
 V_{CBO} Collector to Base Voltage 75 V
 V_{EBO} Emitter to Base Voltage 5.0 V
 I_C Collector Current 1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 10 \mu A, I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10 \mu A, I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 4.0 V, I_C = 0$
I_{CBO}	Collector Reverse Current (100° C)		500 75	nA μA	$V_{CB} = 60 V, I_E = 0$ $V_{CB} = 60 V, I_E = 0$
I_{CEX}	Collector Reverse Current		500	nA	$V_{CE} = 60 V, V_{EB} = 4.0 V$
I_{BL}	Base Current		500	nA	$V_{CE} = 60 V, V_{OB} = 4.0 V$
h_{FE}	DC Pulse Current Gain (Note 5)	25 25 20	75		$I_C = 150 mA, V_{CE} = 1.0 V$ $I_C = 375 mA, V_{CE} = 1.0 V$ $I_C = 750 mA, V_{CE} = 5.0 V$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	40		V	$I_C = 10 mA, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		0.35 0.6 1.2	V V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$ $I_C = 1.0 A, I_B = 100 mA$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)	0.7	1.0 1.3 1.8	V V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$ $I_C = 1.0 A, I_B = 100 mA$

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-238) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
- Rating refers to a high current point where collector to emitter voltage is lowest.
- Pulse conditions: length = 300 μs ; duty cycle $\leq 1\%$.
- For product family characteristic curves, refer to Curve Set T139.

FAIRCHILD SEMICONDUCTOR

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3469674 FAIRCHILD SEMICONDUCTOR

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2N3253

T.35-19

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		12	pF	$V_{CB} = 20 \text{ V}$, $I_E = 0$
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5 \text{ V}$, $I_C = 0$
h_{fe}	High Frequency Current Gain	1.75			$I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 100 \text{ MHz}$
t_d	Turn On Delay Time (test circuit no. 3164)		15	ns	$I_C = 500 \text{ mA}$, $I_{B1} = 50 \text{ mA}$
t_r	Rise Time (test circuit no. 3164)		35	ns	$I_C = 500 \text{ mA}$, $I_{B1} = 50 \text{ mA}$
t_s	Storage Time (test circuit no. 3165)		40	ns	$I_C = 500 \text{ mA}$, $I_{B1} = I_{B2} = 50 \text{ mA}$
t_f	Fall Time (test circuit no. 3165)		30	ns	$I_C = 500 \text{ mA}$, $I_{B1} = I_{B2} = 50 \text{ mA}$
Q_T	Total Control Charge (test circuit no. 3163)		5.0	ncoul	$I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$

FAIRCHILD

A Schlumberger Company

2N3700/2N3701 7-29-23
NPN Small Signal General Purpose
Amplifiers

- $V_{CEO} \dots 80 \text{ V (Min) @ } 30 \text{ mA}$
- $V_{CE(sat)} \dots 0.5 \text{ V (Max) @ } 500 \text{ mA}$

PACKAGE

2N3700	TO-18
2N3701	TO-18

ABSOLUTE MAXIMUM RATINGS (Note 1)**Temperatures**

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.5 W
100° C Case Temperature	1.0 W
25° C Case Temperature	1.8 W

Voltages & Currents

V_{CEO} Collector to Emitter Voltage	80 V
(Note 4)	
V_{CBO} Collector to Base Voltage	140 V
V_{EBO} Emitter to Base Voltage	7.0 V
I_C Collector Current	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3700		3701		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CBO}	Collector to Base Breakdown Voltage	140		140		V	$I_C = 100 \mu\text{A}, I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		V	$I_E = 100 \mu\text{A}, I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	nA	$V_{EB} = 5.0 \text{ V}, I_C = 0$
I_{CBO}	Collector Cutoff Current		10		10	nA	$V_{CB} = 90 \text{ V}, I_E = 0$
			10		10	μA	$V_{CB} = 90 \text{ V}, I_E = 0, T_A = 150^\circ \text{C}$
h_{FE}	DC Pulse Current Gain (Note 5)	100	300	40	120		$I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}$
		90		40	120		$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$
		50		30	100		$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$
		50		30	100		$I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}$
		15		15			$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}$
		40					$I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = -55^\circ \text{C}$

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 97° C/W (derating factor of 10.3 mW/° C); junction-to-ambient thermal resistance of 350° C/W (derating factor of 2.85 mW/° C).
- Rating refers to a high current point where collector to emitter voltage is lowest.
- Pulse conditions: length = 300 μs ; duty cycle $\leq 1\%$.
- For product family characteristic curves, refer to Curve Set T149.

3469674 FAIRCHILD SEMICONDUCTOR

84D 27555 D

2N3700/2N3701

T-29-23

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3700		3701		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	80		80		V	$I_C = 30 \text{ mA}$, $I_B = 0$
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		0.2 0.5		0.2 0.5	V V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed)		1.1		1.1	V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$
C_{ob}	Output Capacitance		12		12	pF	$V_{CB} = 10 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
C_{ib}	Input Capacitance		60		60	pF	$V_{EB} = 0.5 \text{ V}$, $I_C = 0$, $f = 1.0 \text{ MHz}$
h_{fe}	High Frequency Current Gain	5.0	10	4.0	10		$I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 20 \text{ MHz}$
h_{ie}	Small Signal Current Gain	80	400	30	200		$I_C = 1.0 \text{ mA}$, $V_{CE} = 5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
$r_b'C_c$	Collector to Base Time Constant	25	400	25	400	ps	$I_C = 10 \text{ mA}$, $V_{CB} = 10 \text{ V}$, $f = 4.0 \text{ MHz}$
NF	Noise Figure		4.0			dB	$I_C = 100 \mu\text{A}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_G = 1.0 \text{ k}\Omega$

3469674 FAIRCHILD SEMICONDUCTOR

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FAIRCHILD

A Schlumberger Company

2N3724/2N3725
2N4013/2N4014

T-35-15

NPN Small Signal High Current High
Speed Switches

- V_{CEO} ... 30 V (Min) (2N3724, 2N4013), 50 V (Min) (2N3725, 2N4014)
- $V_{CE(sat)}$... 0.65 V (Max) @ 800 mA, 0.75 V (Max) @ 1.0 A (2N3724, 2N4013)
- h_{FE} ... 60-150 @ 1.0 A (2N3724, 2N4013)
- t_{on} ... 35 ns (Max), t_{off} ... 60 ns (Max) @ 500 mA

PACKAGE

2N3724	TO-5
2N3725	TO-5
2N4013	TO-18
2N4014	TO-18

ABSOLUTE MAXIMUM RATINGS (Note 1)**Temperatures**

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

	4013/4	3724/5
Total Dissipation at		
25° C Ambient Temperature	0.36 W	0.8 W
25° C Case Temperature	1.2 W	3.5 W

Voltages & Currents

	3724/4013	3725/4014
V_{CEO} Collector to Emitter Voltage (Note 4)	30 V	50 V
V_{CBO} Collector to Base Voltage	50 V	80 V
V_{CES} Collector to Emitter Voltage	50 V	80 V
V_{EBO} Emitter to Base Voltage	6.0 V	6.0 V
I_C Collector Current (Note 5)	1.0 A	1.0 A
I_C DC Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3724/4013		3725/4014		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CES}	Collector to Emitter Breakdown Voltage	50		80		V	$I_C = 10 \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	50		50		V	$I_C = 10 \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10 \mu A$, $I_C = 0$

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 50° C/W (derating factor of 20 mW/° C) for 2N3724 and 2N3725; and 146° C/W (derating factor of 6.85 mW/° C) for the 2N4013 and 2N4014; junction-to-ambient thermal resistance of 219° C/W (derating factor of 4.56 mW/° C) for the 2N3724, 2N3725, and 485° C/W (derating factor of 2.06 mW/° C) for the 2N4013 and 2N4014.
- Rating refers to a high current point where collector to emitter voltage is lowest.
- Pulse conditions: length = 300 μs ; duty cycle = 1%.
- For product family characteristic curves, refer to Curve Set T162 for 2N3724/5 and T139 for 2N4013/4

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84D 27557 D

2N3724/2N3725
2N4013/2N4014

T-35-15

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3724/4013		3725/4014		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
I_{CBO}	Collector Cutoff Current		1.7 120		1.7 120	μA μA μA	$V_{CB} = 40 V, I_E = 0$ $V_{CB} = 60 V, I_E = 0$ $V_{CB} = 40 V, I_E = 0, T_A = 100^\circ C$ $V_{CB} = 60 V, I_E = 0, T_A = 100^\circ C$
I_{CES}	Collector Reverse Current		10		10	μA μA	$V_{CE} = 50 V, I_E = 0$ $V_{CE} = 80 V, I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	60 35 40 30 30 25 30 20	150	60 35 40 25 30 20 30 20	150		$I_C = 100 mA, V_{CE} = 1.0 V$ $I_C = 500 mA, V_{CE} = 1.0 V$ $I_C = 300 mA, V_{CE} = 1.0 V$ $I_C = 1.0 A, V_{CE} = 5.0 V$ $I_C = 10 mA, V_{CE} = 1.0 V$ $I_C = 800 mA, V_{CE} = 2.0 V$ $I_C = 100 mA, V_{CE} = 1.0 V,$ $T_A = -55^\circ C$ $I_C = 500 mA, V_{CE} = 1.0 V,$ $T_A = -55^\circ C$
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	30		50		V	$I_C = 10 mA, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25 0.2 0.32 0.42 0.65 0.75		0.25 0.26 0.4 0.52 0.8 0.95	V V V V V V	$I_C = 10 mA, I_B = 1.0 mA$ $I_C = 100 mA, I_B = 10 mA$ $I_C = 300 mA, I_B = 30 mA$ $I_C = 500 mA, I_B = 50 mA$ $I_C = 800 mA, I_B = 80 mA$ $I_C = 1.0 A, I_B = 100 mA$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.76 0.86 1.1 1.5 1.7 0.8		0.76 0.86 1.1 1.5 1.7 0.8	V V V V V V	$I_C = 10 mA, I_B = 1.0 mA$ $I_C = 100 mA, I_B = 10 mA$ $I_C = 300 mA, I_B = 30 mA$ $I_C = 800 mA, I_B = 80 mA$ $I_C = 1.0 A, I_B = 100 mA$ $I_C = 500 mA, I_B = 50 mA$
C_{ob}	Output Capacitance		12		10	pF	$V_{CB} = 10 V, I_E = 0$
C_{ib}	Input Capacitance		55		55	pF	$V_{BE} = 0.5 V, I_C = 0$
h_{fe}	High Frequency Current Gain	3.0		3.0			$I_C = 50 mA, V_{CE} = 10 V,$ $f = 100 MHz$
t_{on}	Turn On Time (test circuit no. 265)		35		35	ns	$I_C = 500 mA, I_{B1} = 50 mA$
t_{off}	Turn Off Time (test circuit no. 265)		60		60	ns	$I_C = 500 mA, I_{B1} = 50 mA,$ $I_{B2} = -50 mA$

3469674 FAIRCHILD SEMICONDUCTOR

84D 27558 D

FAIRCHILD

A Schlumberger Company

2N3903/FTSO3903 7-35-15
2N3904/FTSO3904NPN Small Signal General Purpose
Amplifiers & Switches

- V_{CEO} ... 40 V (Min)
- h_{FE} ... 100-300 @ 10 mA (2N/FTSO3904)
- NF ... 5.0 dB (Max) Wide Band (2N/FTSO3904)
- Complements ... 2N3905, 2N3906

PACKAGE

2N3903	TO-92
2N3904	TO-92
FTSO3903	TO-236AA/AB
FTSO3904	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)**Temperatures**

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO} Collector to Emitter Voltage	40 V
(Note 4)	
V_{CBO} Collector to Base Voltage	60 V
V_{EBO} Emitter to Base Voltage	6.0 V
I_C Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3903		3904		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	40		40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 10$ μ A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10$ μ A, $I_C = 0$
I_{CEX}	Collector Cutoff Current		50		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
I_{BL}	Base Cutoff Current		50		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
h_{FE}	DC Current Gain (Note 4)	20		40			$I_C = 0.1$ mA, $V_{CE} = 1.0$ V
		35		70			$I_C = 1.0$ mA, $V_{CE} = 1.0$ V
		50	150	100	300		$I_C = 10$ mA, $V_{CE} = 1.0$ V
		30		60			$I_C = 50$ mA, $V_{CE} = 1.0$ V
		15		30			$I_C = 100$ mA, $V_{CE} = 1.0$ V

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
 - These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
 - These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
 - Pulse conditions: length = 300 μ s; duty cycle = 2%.
 - For product family characteristic curves, refer to Curve Set T144.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

2N3903/FTSO3903

2N3904/FTSO3904

T-35-15

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3903		3904		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.2 0.3		0.2 0.3	V V	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$ $I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)	0.65	0.85 0.95	0.65	0.85 0.95	V V	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$ $I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$
C_{ob}	Output Capacitance		4.0		4.0	pF	$V_{CB} = 5.0 \text{ V}$, $I_E = 0$, $f = 100 \text{ kHz}$
C_{ib}	Input Capacitance		8.0		8.0	pF	$V_{BE} = 0.5 \text{ V}$, $I_C = 0$, $f = 100 \text{ kHz}$
h_{fe}	Small Signal Current Gain	50	200	100	400		$I_C = 1.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{ie}	Input Impedance	1.0	8.0	1.0	10	k Ω	$I_C = 1.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{oe}	Output Admittance	1.0	40	1.0	40	μmho	$I_C = 1.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{re}	Voltage Feedback Ratio	0.1	5.0	0.5	8.0	$\times 10^{-4}$	$I_C = 1.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$
f_T	Current Gain Bandwidth Product	250		300		MHz	$I_C = 10 \text{ mA}$, $V_{CE} = 20 \text{ V}$, $f = 100 \text{ MHz}$
t_d	Turn On Delay Time (test circuit no. 526)		35		35	ns	$I_C = 10 \text{ mA}$, $V_{CC} = 3.0 \text{ V}$, $I_{B1} = 10 \text{ mA}$, $V_{BE(OFF)} = 0.5 \text{ V}$
t_r	Rise Time (test circuit no. 526)		35		35	ns	$I_C = 10 \text{ mA}$, $V_{CC} = 3.0 \text{ V}$, $I_{B1} = 10 \text{ mA}$, $V_{BE(OFF)} = 0.5 \text{ V}$
t_s	Storage Time (test circuit no. 527)		175		200	ns	$I_C = 10 \text{ mA}$, $V_{CC} = 3.0 \text{ V}$, $I_{B1} = I_{B2} = 1.0 \text{ mA}$
t_f	Fall Time (test circuit no. 527)		50		50	ns	$I_C = 10 \text{ mA}$, $V_{CC} = 3.0 \text{ V}$, $I_{B1} = I_{B2} = 1.0 \text{ mA}$
NF	Noise Figure		6.0		5.0	dB	$I_C = 100 \mu\text{A}$, $V_{CE} = 5.0 \text{ V}$, $f = 10 \text{ Hz to } 15.7 \text{ kHz}$, $R_G = 1.0 \text{ k}\Omega$

3469674 FAIRCHILD SEMICONDUCTOR

84D 27560 D ■

FAIRCHILD

A Schlumberger Company

2N3905/FTSO3905 T-37-15
2N3906/FTSO3906PNP Small Signal General Purpose
Amplifiers & Switches

- V_{CEO} ... -40 V (Min)
- h_{FE} ... 100-300 @ 10 mA (2N3906)
- NF ... 4.0 dB (Max) Wide Band (2N3906)
- Complements ... 2N3903, 2N3904

PACKAGE

2N3905	TO-92
2N3906	TO-92
FTSO3905	TO-236AA/AB
FTSO3906	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)**Temperatures**

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO} Collector to Emitter Voltage	-40 V
(Note 4)	
V_{CBO} Collector to Base Voltage	-40 V
V_{EBO} Emitter to Base Voltage	-5.0 V
I_C Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3905		3906		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	-40		-40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	-40		-40		V	$I_C = 10$ μ A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.0		-5.0		V	$I_E = 10$ μ A, $I_C = 0$
I_{CEX}	Collector Cutoff Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = -3.0$ V
I_{BL}	Base Cutoff Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = -3.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30 40 50 30 15	150	60 80 100 60 30	300		$I_C = 0.1$ mA, $V_{CE} = -1.0$ V $I_C = 1.0$ mA, $V_{CE} = -1.0$ V $I_C = 10$ mA, $V_{CE} = -1.0$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V $I_C = 100$ mA, $V_{CE} = -1.0$ V

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
- Rating refers to a high current point where collector to emitter voltage is lowest.
- Pulse conditions: length = 300 μ s; duty cycle $\leq$ 2%.
- For product family characteristic curves, refer to Curve Set T215.
- Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

2N3905/FTSO3905

2N3906/FTSO3906

T-37-15

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3905		3906		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.25 -0.4		-0.25 -0.4	V V	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	-0.65	-0.85 -0.95	-0.65	-0.85 -0.95	V V	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$
C_{ob}	Output Capacitance		4.5		4.5	pF	$V_{CB} = -5.0 \text{ V}, I_E = 0, f = 100 \text{ kHz}$
C_{ib}	Input Capacitance		10		10	pF	$V_{EB} = -0.5 \text{ V}, I_C = 0, f = 100 \text{ kHz}$
h_{fe}	Small Signal Current Gain	50	200	100	400		$I_C = 1.0 \text{ mA}, V_{CE} = -10 \text{ V}, f = 1.0 \text{ kHz}$
h_{ie}	Input Impedance	0.5	8.0	2.0	10	k Ω	$I_C = 1.0 \text{ mA}, V_{CE} = -10 \text{ V}, f = 1.0 \text{ kHz}$
h_{oe}	Output Admittance	1.0	40	3.0	60	μmho	$I_C = 1.0 \text{ mA}, V_{CE} = -10 \text{ V}, f = 1.0 \text{ kHz}$
h_{re}	Voltage Feedback Ratio	0.1	5.0	0.1	10	$\times 10^{-4}$	$I_C = 1.0 \text{ mA}, V_{CE} = -10 \text{ V}, f = 1.0 \text{ kHz}$
f_T	Current Gain Bandwidth Product	200		250		MHz	$I_C = 10 \text{ mA}, V_{CE} = -20 \text{ V}, f = 100 \text{ MHz}$
t_d	Turn On Delay Time (test circuit no. 333)		35		35	ns	$I_C \cong 10 \text{ mA}, I_{B1} \cong 1.0 \text{ mA}, V_{CC} = -3.0 \text{ V}$
t_r	Rise Time (test circuit no. 333)		35		35	ns	$I_C \cong 10 \text{ mA}, I_{B1} \cong 1.0 \text{ mA}, V_{CC} = -3.0 \text{ V}$
t_s	Storage Time (test circuit no. 239)		200		225	ns	$I_C \cong 10 \text{ mA}, I_{B1} \cong 1.0 \text{ mA}, I_{B2} \cong -1.0 \text{ mA}, V_{CC} = -3.0 \text{ V}$
t_f	Fall Time (test circuit no. 239)		60		75	ns	$I_C \cong 10 \text{ mA}, I_{B1} \cong 1.0 \text{ mA}, I_{B2} \cong -1.0 \text{ mA}, V_{CC} = -3.0 \text{ V}$
NF	Wide Band Noise Figure		5.0		4.0	dB	$I_C = 100 \mu\text{A}, V_{CE} = -5.0 \text{ V}, R_S = 1.0 \text{ k}\Omega, f = 10 \text{ Hz to } 15.7 \text{ kHz}$