

3469674 FAIRCHILD SEMICONDUCTOR

84D 27581 D

FAIRCHILD

A Schlumberger Company

2N4400/FTSO4400 T-29-23
2N4401/FTSO4401Small Signal General Purpose
Amplifiers & Switches

- V_{CEO} ... 40 V (Min)
- h_{FE} ... 100-300 @ 150 mA (2N/FTSO4401);
40 (Min) @ 500 mA (2N/FTSO4401)
- t_{on} ... 35 ns (Max) @ 150 mA
- t_{off} ... 255 ns (Max) @ 150 mA
- Complements ... 2N4402, 2N4403

PACKAGE

2N4400	TO-92
2N4401	TO-92
FTSO4400	TO-236AA/AB
FTSO4401	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*
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	600 mA

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

SYMBOL	CHARACTERISTIC	4400		4401		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CE(US)}$	Collector to Emitter Sustaining Voltage (Note 5)	40		40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 100$ μ A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 100$ μ A, $I_C = 0$
I_{CEX}	Collector Cutoff Current		100		100	nA	$V_{CE} = 35$ V, $V_{EB} = 0.4$ V
I_{BL}	Base Reverse Current		100		100	nA	$V_{CE} = 35$ V, $V_{EB} = 0.4$ 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 T145.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

2N4400/FTSO4400

2N4401/FTSO4401

T-29-23

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

SYMBOL	CHARACTERISTIC	4400		4401		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	20 40		20 40 80			$I_C = 100 \mu A, V_{CE} = 1.0 V$ $I_C = 1.0 mA, V_{CE} = 1.0 V$ $I_C = 10 mA, V_{CE} = 1.0 V$
h_{FE}	DC Pulse Current Gain (Note 5)	50 20	150	100 40	300		$I_C = 150 mA, V_{CE} = 1.0 V$ $I_C = 500 mA, V_{CE} = 2.0 V$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.4 0.75		0.4 0.75	V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.75	0.95 1.2	0.75	0.95 1.2	V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$
C_{cb}	Collector to Base Capacitance		6.5		6.5	pF	$V_{CB} = 5.0 V, I_E = 0, f = 100 kHz$
C_{eb}	Emitter to Base Capacitance		30		30	pF	$V_{BE} = 0.5 V, I_C = 0, f = 100 kHz$
h_{fe}	Small Signal Current Gain	20	250	40	500		$I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz$
h_{ie}	Input Impedance	0.5	7.5	1.0	15	k Ω	$I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz$
h_{oe}	Output Admittance	1.0	30	1.0	30	$\mu mhos$	$I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz$
h_{re}	Voltage Feedback Ratio	0.1	8.0	0.1	8.0	$\times 10^{-4}$	$I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz$
f_T	Current Gain Bandwidth Product	200		250		MHz	$I_C = 20 mA, V_{CE} = 10 V, f = 100 MHz$
t_d	Turn On Delay Time (test circuit no. 559)		15		15	ns	$I_C = 150 mA, V_{CC} = 30 V, I_{B1} = 15 mA$
t_r	Rise Time (test circuit no. 559)		20		20	ns	$I_C = 150 mA, V_{CC} = 30 V, I_{B1} = 15 mA$
t_s	Storage Time (test circuit no. 560)		225		225	ns	$I_C = 150 mA, V_{CC} = 30 V, I_{B1} = I_{B2} = 15 mA$
t_f	Fall Time (test circuit no. 560)		30		30	ns	$I_C = 150 mA, V_{CC} = 30 V, I_{B1} = I_{B2} = 15 mA$

3469674 FAIRCHILD SEMICONDUCTOR

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FAIRCHILD

A Schlumberger Company

2N4402/FTSO4402**2N4403/FTSO4403**PNP Small Signal General Purpose
Amplifiers & Switches

T-29-23

- $V_{CE0} \dots -40 \text{ V (Min)}$
- $h_{FE} \dots 100-300 @ 150 \text{ mA (2N/FTSO4403)}$,
20 (Min) @ 500 mA (2N/FTSO4403)
- $t_{on} \dots 35 \text{ ns (Max) @ 150 mA}$
- $t_{off} \dots 255 \text{ ns (Max) @ 150 mA}$
- Complements ... 2N4400, 2N4401

PACKAGE

2N4402	TO-92
2N4403	TO-92
FTSO4402	TO-236AA/AB
FTSO4403	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*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CE0} 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	600 mA

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

SYMBOL	CHARACTERISTIC	4402		4403		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CE0(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-40		-40		V	$I_C = 1.0 \text{ mA}$, $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	-40		-40		V	$I_C = 100 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.0		-5.0		V	$I_E = 100 \mu\text{A}$, $I_C = 0$
I_{CEX}	Collector Reverse Current		100		100	nA	$V_{CE} = -35 \text{ V}$, $V_{EB} = -0.4 \text{ V}$
I_{BL}	Base Reverse Current		100		100	nA	$V_{CE} = -35 \text{ V}$, $V_{EB} = -0.4 \text{ V}$

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 μs ; duty cycle < 2%.
 - For product family characteristic curves, refer to Curve Set T212.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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2N4402/FTSO4402
2N4403/FTSO4403

T-29-23

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

SYMBOL	CHARACTERISTIC	4402		4403		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	30 50		30 60 100			$I_C = 100 \mu A, V_{CE} = 1.0 V$ $I_C = 1.0 mA, V_{CE} = -1.0 V$ $I_C = 10 mA, V_{CE} = -1.0 V$
h_{FE}	DC Pulse Current Gain (Note 5)	50 20	150	100 20	300		$I_C = 150 mA, V_{CE} = -2.0 V$ $I_C = 500 mA, V_{CE} = -2.0 V$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.4 -0.75		-0.4 -0.75	V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	-0.75	-0.95 -1.3	-0.75	-0.95 -1.3	V V	$I_C = 150 mA, I_B = 15 mA$ $I_C = 500 mA, I_B = 50 mA$
C_{cb}	Collector to Base Capacitance		8.5		8.5	pF	$V_{CB} = -10 V, I_E = 0, f = 140 kHz$
C_{eb}	Emitter to Base Capacitance		30		30	pF	$V_{EB} = -0.5 V, I_C = 0, f = 140 kHz$
h_{fe}	Small Signal Current Gain	30	250	60	500		$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{ie}	Input Impedance	0.75	7.5	1.5	15	k Ω	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{oe}	Output Admittance	1.0	100	1.0	100	$\mu mhos$	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{re}	Voltage Feedback Ratio	0.1	8.0	0.1	8.0	$\times 10^{-4}$	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
f_T	Current Gain Bandwidth Product	150		200		MHz	$I_C = 20 mA, V_{CE} = -10 V$, $f = 100 MHz$
t_d	Turn On Delay Time (test circuit no. 557)		15		15	ns	$I_C = 150 mA, V_{CC} = -30 V$, $I_{B1} = 15 mA$
t_r	Rise Time (test circuit no. 557)		20		20	ns	$I_C = 150 mA, V_{CC} = -30 V$, $I_{B1} = 15 mA$
t_s	Storage Time (test circuit no. 558)		225		225	ns	$I_C = 150 mA, V_{CC} = -30 V$, $I_{B1} = I_{B2} = 15 mA$
t_f	Fall Time (test circuit no. 558)		30		30	ns	$I_C = 150 mA, V_{CC} = -30 V$, $I_{B1} = I_{B2} = 15 mA$

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FAIRCHILD

A Schlumberger Company

2N4409/FTSO4409**2N4410/FTSO4410**

NPN Neon Display Tube Drivers

T. 29.23

- V_{CEO} ... 80 V (Min) (2N/FTSO4410)
- h_{FE} ... 60 V (Min) @ 1.0 and 10 mA
- Complements ... MPSA55, MPSA56

PACKAGE

2N4409	TO-92
2N4410	TO-92
FTSO4409	TO-236AA/AB
FTSO4410	TO-236AA/AB

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

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

Power Dissipation (Notes 2 & 3)

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

Voltages & Currents

	4409	4410
V_{CEO} Collector to Emitter Voltage	50 V	80 V
(Note 4)		
V_{CBO} Collector to Base Voltage	80 V	120 V
V_{EBO} Emitter to Base Voltage	5.0 V	5.0 V
I_C Collector Current	250 mA	250 mA

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

SYMBOL	CHARACTERISTIC	4409		4410		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CEO}	Collector to Emitter Breakdown Voltage	50		80		V	$I_C = 1.0 \text{ mA}$, $I_B = 0$
BV_{CEX}	Collector to Emitter Breakdown Voltage	80		120		V	$I_C = 500 \mu\text{A}$, $V_{BB} = -5.0 \text{ V}$, $R_{BE} = 8.2 \text{ k}\Omega$
BV_{CBO}	Collector to Base Breakdown Voltage	80		120		V	$I_C = 10 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10 \mu\text{A}$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 4.0 \text{ V}$, $I_C = 0$

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 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 μs ; duty cycle = 1%.
 - For product family characteristic curves, refer to Curve Set T147.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

2N4409/FTSO4409

2N4410/FTSO4410

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

SYMBOL	CHARACTERISTIC	4409		4410		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
I_{CBO}	Collector Cutoff Current		10 1.0		10 1.0	nA nA μA μA	$V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 100 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 100^\circ \text{ C}$ $V_{CB} = 100 \text{ V}, I_E = 0, T_A = 100^\circ \text{ C}$
h_{FE}	DC Current Gain	60		60			$I_C = 1.0 \text{ mA}, V_{CE} = 1.0 \text{ V}$
h_{FE}	DC Pulse Current Gain (Note 5)	60	400	60	400		$I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.2		0.2	V	$I_C = 1.0 \text{ mA}, I_B = 0.1 \text{ mA}$
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.8		0.8	V	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		0.8		0.8	V	$I_C = 1.0 \text{ mA}, I_B = 0.1 \text{ mA}$
C_{cb}	Collector to Base Capacitance		12		12	pF	$V_{CB} = 10 \text{ V}, I_E = 0, f = 140 \text{ kHz}$
C_{eb}	Emitter to Base Capacitance		50		50	pF	$V_{EB} = 0.5 \text{ V}, I_C = 0, f = 100 \text{ kHz}$
$ h_{fe} $	Magnitude of Common Emitter Small Signal Current Gain	2.0	10	2.0	10		$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 30 \text{ MHz}$

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2N4896

NPN Power

T-29-23

- $V_{CE(sat)} \dots 0.7 \text{ V @ } I_C = 2.0 \text{ A}$
- Low Leakage ... $I_{CES}^{(Max)} \mu^{100} \mu\text{A @ } T_C = 150^\circ \text{C}$

PACKAGE

2N4896

TO-39

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

Storage Temperature $-65^\circ \text{C to } 200^\circ \text{C}$
 Operating Junction Temperature 200°C

Power Dissipation (Notes 2 & 3)

Total Dissipation at
 25°C Ambient Temperature 0.8 W
 25°C Case Temperature
 100°C Case Temperature 4.0 W

Voltages & Currents

V_{CEO} Collector to Emitter Voltage 60 V
 (Note 4)
 V_{CBO} Collector to Base Voltage 120 V
 V_{EBO} Emitter to Base Voltage 6.0 V
 I_C Collector Current 5.0 A
 I_B Base Current 1.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		1.0 1.0	μA mA	$V_{EB} = 4.0 \text{ V}, I_E = 0$ $V_{EB} = 6.0 \text{ V}, I_C = 0$
I_{CES}	Collector Cutoff Current		0.1 1.0 1.0	mA mA μA	$V_{CE} = 60 \text{ V}, V_{BE} = 0, T_A = 150^\circ \text{C}$ $V_{CE} = 120 \text{ V}, V_{BE} = 0$ $V_{CE} = 60 \text{ V}, V_{BE} = 0$
h_{FE}	DC Current Gain (Note 5)	100 35	300		$I_C = 2.0 \text{ A}, V_{CE} = 2.0 \text{ V}$ $I_C = 2.0 \text{ A}, V_{CE} = 2.0 \text{ V}, T_A = -55^\circ \text{C}$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	60		V	$I_C = 50 \text{ mA}, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Notes 5 & 6))		1.0	V	$I_C = 5.0 \text{ mA}, I_B = 0.5 \text{ A}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Notes 5 & 6)		1.6	V	$I_C = 5.0 \text{ mA}, I_B = 0.5 \text{ A}$

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 25°C/W (derating factor of $40 \text{ mW}/^\circ \text{C}$); junction-to-ambient thermal resistance of 219°C/W (derating factor of $4.57 \text{ mW}/^\circ \text{C}$).
- Rating refers to a high current point where collector to emitter voltage is lowest.
- Pulse conditions: length = $300 \mu\text{s}$; duty cycle = 1%.
- Point of measurement: $1/4''$ from header.
- For product family characteristic curves, refer to Curve Set T145.

FAIRCHILD SEMICONDUCTOR

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3469674 FAIRCHILD SEMICONDUCTOR

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T-29-23

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C _{ob}	Output Capacitance		80	pF	V _{CB} = 10 V, I _E = 0, f = 0.14 MHz
C _{ib}	Input Capacitance		500	pF	V _{EB} = 0.5 V, I _C = 0, f = 0.14 MHz
h _{fe}	Magnitude of Common Emitter Small Signal Current Gain	4.0			I _C = 0.5 A, V _{CE} = 5.0 V, f = 20 MHz
t _d	Turn On Delay Time		50	ns	I _C = 5.0 A, I _{B1} = 0.5 A
t _r	Rise Time		300	ns	I _C = 5.0 A, I _{B1} = 0.5 A
t _s	Storage Time		350	ns	I _C = 5.0 A, I _{B1} = I _{B2} = 0.5 A
t _f	Fall Time		300	ns	I _C = 5.0 A, I _{B1} = I _{B2} = 0.5 A

3469674 FAIRCHILD SEMICONDUCTOR

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FAIRCHILD

A Schlumberger Company

2N5220/FTSO5220NPN Small Signal General Purpose
Complementary Amplifiers

T-29-23

- V_{CEO} ... 15 V (Min)
- h_{FE} ... 30-600 @ 50 mA
- $V_{CE(sat)}$... 0.5 V (max) @ 150 mA

PACKAGE

2N5220

TO92-1

FTSO5220

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*
25°C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO} Collector to Emitter Voltage	15 V
(Note 4)	
V_{CBO} Collector to Base Voltage	15 V
V_{EBO} Emitter to Base Voltage	3.0 V
I_C Collector Current	500 mA

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

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	15		V	$I_C = 10 \text{ mA}$, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	15		V	$I_C = 100 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 100 \mu\text{A}$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 3.0 \text{ V}$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 10 \text{ V}$, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	25 30	600		$I_C = 10 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5	V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.1	V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$
C_{cb}	Collector to Base Capacitance		10	pF	$V_{CB} = 5.0 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
h_{fe}	Small Signal Current Gain	30	1800		$I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$
f_T	Current Gain Bandwidth Product	100		MHz	$I_C = 20 \text{ mA}$, $V_{CE} = 10 \text{ V}$

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 μs ; duty cycle < 2%.
 - For product family characteristic curves, refer to Curve Set T145.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.