

3469674 FAIRCHILD SEMICONDUCTOR

84D 27430 D



PN3644/FTSO3644  
 PN3645/FTSO3645 7-29-23

PNP Small Signal General Purpose  
 Amplifiers & Switches

- $V_{CE0}$  ... -45 V (Min) (PN/FTSO3644), 60 V (Min) (PN/FTSO3645)
- $h_{FE}$  ... 80-240 @ 50 mA
- $t_{on}$  ... 40 ns (Max) @ 300 mA
- $t_{off}$  ... 100 ns (Max) @ 300 mA
- Complements ... PN3569

PACKAGE	
PN3644	TO-92
PN3645	TO-92
FTSO3644	TO-236AA/AB
FTSO3645	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	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

**Voltages & Currents**

	3645	3644
$V_{CE0}$ Collector to Emitter Voltage (Note 4)	-60 V	-45 V
$V_{CBO}$ Collector to Base Voltage	-60 V	-45 V
$V_{EBO}$ Emitter to Base Voltage	-5.0 V	-5.0 V
$I_C$ Collector Current	500 mA	500 mA

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

SYMBOL	CHARACTERISTIC	3644		3645		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CBO}$	Collector to Base Breakdown Voltage	-45		-60		V	$I_C = 100 \mu A, I_E = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	-5.0		-5.0		V	$I_E = 10 \mu A, I_C = 0$
$I_{CES}$	Collector Reverse Current (Note 5)		35		35	nA	$V_{CE} = -30 V, V_{BE} = 0$
			2.0		2.0	$\mu A$	$V_{CE} = -50 V, V_{BE} = 0$
$h_{FE}$	DC Current Gain	40	80	40	80		$I_C = 100 \mu A, V_{CE} = -10 V$ $I_C = 1.0 mA, V_{CE} = -10 V$

**NOTES:**

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
  2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
  3. 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).
  4. Rating refers to a high current point where collector to emitter voltage is lowest.
  5. Pulse conditions: length = 300  $\mu s$ ; duty cycle = 1%.
  6. 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.

PN3644/FTSO3644

PN3645/FTSO3645

T-29-23

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

SYMBOL	CHARACTERISTIC	3644		3645		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$h_{FE}$	DC Pulse Current Gain (Note 5)	100 80 100 20	240 300	100 80 100 20	240 300		$I_C = 10 \text{ mA}, V_{CE} = -10 \text{ V}$ $I_C = 50 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 150 \text{ mA}, V_{CE} = -10 \text{ V}$ $I_C = 300 \text{ mA}, V_{CE} = -2.0 \text{ V}$
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Pulsed) (Notes 4 & 5)	-45		-60		V	$I_C = 10 \text{ mA}, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		-0.25 -0.4 -1.0		-0.25 -0.4 -1.0	V V V	$I_C = 50 \text{ mA}, I_B = 2.5 \text{ mA}$ $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 300 \text{ mA}, I_B = 30 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)		-1.0 -1.3 -2.0		-1.0 -1.3 -2.0	V V V	$I_C = 50 \text{ mA}, I_B = 2.5 \text{ mA}$ $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 300 \text{ mA}, I_B = 30 \text{ mA}$
$C_{ob}$	Output Capacitance		8.0		8.0	pF	$V_{CB} = -10 \text{ V}, I_E = 0, f = 140 \text{ kHz}$
$C_{ib}$	Input Capacitance		35		35	pF	$V_{EB} = -0.5 \text{ V}, I_C = 0, f = 140 \text{ kHz}$
$h_{fe}$	High Frequency Current Gain	2.0		2.0			$I_C = 20 \text{ mA}, V_{CE} = -20 \text{ V}, f = 100 \text{ MHz}$
$t_{on}$	Turn On Time (test circuit no. 246)		40		40	ns	$I_C \approx 300 \text{ mA}, I_{B1} \approx 30 \text{ mA}, V_{CC} = -30 \text{ V}$
$t_{off}$	Turn Off Time (test circuit no. 246)		100		100	ns	$I_C \approx 300 \text{ mA}, I_{B1} \approx I_{B2} \approx 30 \text{ mA}, V_{CC} = -30 \text{ V}$



A Schlumberger Company

**PN/MPS/FTSO3646** T-35-15  
**2N/FTSO5772**  
 NPN High Speed Saturated Logic Switches

- $V_{CE0}$  ... 15 V (Min)
- $\tau_s$  ... 18 ns (Max) @ 10 mA
- $t_{on}$  ... 18 ns (Max) @ 300 mA
- $t_{off}$  ... 28 ns (Max) @ 300 mA

**PACKAGE**

PN3646	TO-92
MPS3646	TO-92
2N5772	TO-92
FTSO3646	TO-236AA/AB
FTSO5772	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 25° C Ambient Temperature	<b>MPS</b> 0.625 W	<b>FTSO</b> 0.350 W*
25° C Case Temperature	1.0 W	

**Voltages & Currents**

$V_{CE0}$ Collector to Emitter Voltage (Note 4)	15 V
$V_{CES}$ Collector to Emitter Voltage	40 V
$V_{CBO}$ Collector to Base Voltage	40 V
$V_{EBO}$ Emitter to Base Voltage	5.0 V
$I_C$ Collector Current	200 mA
Pulse = 10 $\mu$ s	500 mA

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

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$BV_{CES}$	Collector to Emitter Breakdown Voltage	40		V	$I_C = 10 \mu A, V_{BE} = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	5.0		V	$I_C = 0, I_E = 100 \mu A$
$BV_{CBO}$	Collector to Base Breakdown Voltage	40		V	$I_C = 100 \mu A, I_E = 0$
$I_{CES}$	Collector Reverse Current		0.5	$\mu A$	$V_{CE} = 20 V, V_{BE} = 0$
$h_{FE}$	DC Current Gain (Note 5)	30 25 15	120		$I_C = 30 mA, V_{CE} = 0.4 V$ $I_C = 100 mA, V_{CE} = 0.5 V$ $I_C = 300 mA, V_{CE} = 1.0 V$

**NOTES:**

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
  2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
  3. These ratings give a maximum junction temperature of 150° C and (TO92) 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); (TO236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
  4. Rating refers to a high current point where collector to emitter voltage is lowest.
  5. Pulse conditions: length = 300  $\mu$ s; duty cycle = 1%.
  6. For product family characteristic curves, refer to Curve Set T162.
- \* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

PN/MPS/FTSO3646  
2N/FTSO5772

T-35-15

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

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		V	$I_C = 10 \text{ mA}$ , $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.20 0.28 0.5 0.3	V V V V	$I_C = 30 \text{ mA}$ , $I_B = 3.0 \text{ mA}$ $I_C = 100 \text{ mA}$ , $I_B = 10 \text{ mA}$ $I_C = 300 \text{ mA}$ , $I_B = 30 \text{ mA}$ $I_C = 30 \text{ mA}$ , $I_B = 3.0 \text{ mA}$ , $T_A = 65^\circ \text{ C}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.75	0.95 1.2 1.7	V V V	$I_C = 30 \text{ mA}$ , $I_B = 3.0 \text{ mA}$ $I_C = 100 \text{ mA}$ , $I_B = 10 \text{ mA}$ $I_C = 300 \text{ mA}$ , $I_B = 30 \text{ mA}$
$C_{ob}$	Output Capacitance		5.0	pF	$V_{CB} = 5.0 \text{ V}$ , $I_E = 0$ , $f = 140 \text{ kHz}$
$C_{TE}$	Emitter Transition Capacitance		8.0	pF	$V_{BE} = 0.5 \text{ V}$ , $I_C = 0$ , $f = 140 \text{ kHz}$
$h_{fe}$	High Frequency Current Gain	3.5			$I_C = 30 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 100 \text{ MHz}$
$\tau_s$	Charge Storage Time Constant (test circuit no. 3111)		18	ns	$I_C \approx I_{B1} \approx -I_{B2} \approx 10 \text{ mA}$ , $V_{CC} = 10 \text{ V}$
$t_{on}$	Turn On Time (test circuit no. 233)		18	ns	$I_C \approx 300 \text{ mA}$ , $I_{B1} \approx 30 \text{ mA}$ , $V_{CC} = 10 \text{ V}$
$t_{off}$	Turn Off Time (test circuit no. 233)		28	ns	$I_C \approx 300 \text{ mA}$ , $I_{B1} \approx -I_{B2} = 30 \text{ mA}$ , $V_{CC} = 10 \text{ V}$



**PN3693/FTSO3693** T-29-23  
**PN3694/FTSO3694**  
 NPN Small Signal General Purpose Amplifiers

- $V_{CE0}$  ... 45 V (Min)
- $h_{FE}$  ... 100-400 (PN/FTSO3694)
- $A_{FG}$  ... 55 dB (Typ) @ 455 kHz
- $G_c$  ... 20 dB (Typ) from 108 MHz to 10.7 MHz
- $NF$  ... 4.0 dB (Typ) @ 1.0 MHz
- Complements ... PN4121, PN4122

PACKAGE	
PN3693	TO-92
PN3694	TO-92
FTSO3693	TO-236AA/AB
FTSO3694	TO-236AA/AB

**ABSOLUTE MAXIMUM RATINGS** (Note 1)

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

Power Dissipation		PN	FTSO
Total Dissipation at 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 (Note 4)		45 V
$V_{CBO}$ Collector to Base Voltage		45 V
$V_{EBO}$ Emitter to Base Voltage		4.0 V
$I_c$ Collector Current		30 mA

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

SYMBOL	CHARACTERISTIC	3693		3694		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CBO}$	Collector to Base Breakdown Voltage	45		45		V	$I_c = 0.1$ mA, $I_E = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	4.0		4.0		V	$I_E = 100$ $\mu$ A, $I_c = 0$
$I_{EBO}$	Emitter Cutoff Current		100		100	$\mu$ A	$V_{EB} = 4.0$ V, $I_c = 0$
$I_{CBO}$	Collector Cutoff Current		50 5.0		50 5.0	nA $\mu$ A	$V_{CB} = 30$ V, $I_E = 0$ $V_{CB} = 30$ V, $I_E = 0$ , $T_A = 65^\circ$ C
$h_{FE}$	DC Pulse Current Gain (Note 5)	40	160	100	400		$I_c = 10$ mA, $V_{CE} = 10$ V
$V_{CE0(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	45		45		V	$I_c = 10$ mA (pulsed), $I_E = 0$

**NOTES:**

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
  2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
  3. 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).
  4. Rating refers to a high current point where collector to emitter voltage is lowest.
  5. Pulse conditions: length = 300  $\mu$ s; duty cycle = 1%.
  6. 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.

PN3693/FTSO3693

PN3694/FTSO3694

T.29-23

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

SYMBOL	CHARACTERISTIC	3693		3694		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$C_{ob}$	Output Capacitance	0.5	6.0	0.5	6.0	pF	$V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$
$h_{fe}$	High Frequency Current Gain	2.0	5.0	2.0	5.0		$I_C = 10 \text{ mA}$ , $V_{CE} = 15 \text{ V}$ , $f = 100 \text{ MHz}$
$r_b' C_c$	Collector Base Time Constant		55		55	ps	$I_C = 10 \text{ mA}$ , $V_{CE} = 15 \text{ V}$ , $f = 80 \text{ MHz}$



**PN4121/FTSO4121**  
**PN4122/FTSO4122** 7-29-23  
 PNP Small Signal General Purpose  
 Amplifiers & Switches

- $V_{CE0} \dots 40 \text{ V (Min)}$
- $h_{FE} \dots 150\text{-}300 @ 10 \text{ mA (PN/FTSO4122)}$
- $f_T \dots 450 \text{ MHz (Min) @ } 10 \text{ mA (PN/FTSO4122)}$
- $r_b' C_c \dots 50 \text{ ps (Max)}$
- $C_{cb} \dots 4.5 \text{ pF (Max)}$
- $NF \dots 6.0 \text{ dB (Max) @ } 100 \text{ MHz}$

PACKAGE	
PN4121	TO-92
PN4122	TO-92
FTSO4121	TO-236AA/AB
FTSO4122	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)		PN	FTSO
Total Dissipation at			0.350 W*
25° C Ambient Temperature		0.625 W	
70° C Ambient Temperature		0.400 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		100 mA

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

SYMBOL	CHARACTERISTIC	4121		4122		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CES}$	Collector to Emitter Breakdown Voltage	-40		-40		V	$I_C = 10 \mu\text{A}, V_{BE} = 0$
$BV_{CBO}$	Collector to Base Breakdown Voltage	-40		-40		V	$I_C = 10 \mu\text{A}, I_E = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	-5.0		-50.0		V	$I_E = 10 \mu\text{A}, I_C = 0$
$I_{CES}$	Collector Reverse Current		25 25		25 25	nA $\mu\text{A}$	$V_{CE} = -30 \text{ V}, V_{BE} = 0$ $V_{CE} = -30 \text{ V}, V_{BE} = 0, T_A = 65^\circ \text{C}$
$h_{FE}$	DC Current Gain	40 60		100 150			$I_C = 100 \mu\text{A}, V_{CE} = -1.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = -1.0 \text{ V}$

**NOTES:**

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. 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 80 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).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300  $\mu\text{s}$ ; duty cycle = 1%.
6. 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.

PN4121/FTSO4121  
 PN4122/FTSO4122 T-29-23

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

SYMBOL	CHARACTERISTIC	4121		4122		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$h_{FE}$	DC Pulse Current Gain (Note 5)	70 15	200	150 30	300		$I_C = 10 \text{ mA}$ , $V_{CE} = -1.0 \text{ V}$ $I_C = 50 \text{ mA}$ , $V_{CE} = -1.0 \text{ V}$
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-40		-40		V	$I_C = 10 \text{ mA}$ , $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.13		-0.13	V	$I_C = 1.0 \text{ mA}$ , $I_B = 0.1 \text{ mA}$
			-0.14		-0.14	V	$I_C = 10 \text{ mA}$ , $I_B = 1.0 \text{ mA}$
			-0.3		-0.3	V	$I_C = 50 \text{ mA}$ , $I_B = 5.0 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		-0.75		-0.75	V	$I_C = 1.0 \text{ mA}$ , $I_B = 0.1 \text{ mA}$
		-0.7	-0.9	-0.7	-0.9	V	$I_C = 10 \text{ mA}$ , $I_B = 1.0 \text{ mA}$
			-1.1		-1.1	V	$I_C = 50 \text{ mA}$ , $I_B = 5.0 \text{ mA}$
$C_{cb}$	Collector to Base Capacitance		4.5		4.5	pF	$V_{CB} = -10 \text{ V}$ , $I_E = 0$
$C_{ib}$	Open Circuit Input Capacitance		8.0		8.0	pF	$V_{EB} = -0.5 \text{ V}$ , $I_C = 0$
$ h_{fe} $	Magnitude of Small Signal Current Gain	4.0		4.5			$I_C = 10 \text{ mA}$ , $V_{CE} = -20 \text{ V}$ , $f = 100 \text{ MHz}$
$h_{fe}$	Forward Current Transfer Ratio	50	300	150	450		$I_C = 1.0 \text{ mA}$ , $V_{CE} = -10 \text{ V}$ , $f = 1.0 \text{ kHz}$
$h_{ie}$	Input Resistance	1.0	8.0	4.0	12	k $\Omega$	$I_C = 1.0 \text{ mA}$ , $V_{CE} = -10 \text{ V}$ , $f = 1.0 \text{ kHz}$
$h_{oe}$	Output Conductance	2.0	24	8.0	40	$\mu\text{mho}$	$I_C = 1.0 \text{ mA}$ , $V_{CE} = -10 \text{ V}$ , $f = 1.0 \text{ kHz}$
$h_{re}$	Voltage Feedback Ratio		3.0		4.0	$\times 10^{-4}$	$I_C = 1.0 \text{ mA}$ , $V_{CE} = -10 \text{ V}$ , $f = 1.0 \text{ kHz}$
$t_b'C_c$	Collector to Base Time Constant		50		50	ps	$I_C = 10 \text{ mA}$ , $V_{CE} = -20 \text{ V}$ , $f = 80 \text{ MHz}$
$t_{on}$	Turn On Time (test circuit no. 342)		40		40	ns	$I_C = 50 \text{ mA}$ , $I_{B1} = 5.0 \text{ mA}$ ,
$t_{off}$	Turn Off Time (see test circuit no. 342)		150		150	ns	$I_C = 50 \text{ mA}$ , $I_{B1} = 5.0 \text{ mA}$ , $I_{B2} = 5.0 \text{ mA}$
NF	Noise Figure		6.0		6.0	dB	$I_C = 1.0 \text{ mA}$ , $V_{CE} = -5.0 \text{ V}$ , $f = 100 \text{ MHz}$ , $BW = 15 \text{ MHz}$ , $R_S = 100 \Omega$
			4.0		4.0	dB	$I_C = 100 \mu\text{A}$ , $V_{CE} = -5.0 \text{ V}$ , $BW = 15 \text{ MHz}$ , $R_S = 1.0 \text{ k}\Omega$ $f = 10 \text{ Hz to } 10 \text{ kHz}$