

3469674 FAIRCHILD SEMICONDUCTOR

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FAIRCHILD

A Schlumberger Company

PN4248/FTSO4248**PN4249/FTSO4249****PN4250/FTSO4250****PN4250A/FTSO4250A**

PNP Low Level Low Noise Amplifiers

- V_{CEO} ... 40 V (Min) (PN4248/50); 60 V (Min) (PN4249/50A)
- h_{FE} ... 250-700 @ 100 μ A (PN4250/50A)
- NF ... 2.0 dB (Max) @ 1.0 kHz (PN4250/50A)
- Excellent Beta Linearity from 1.0 μ A to 50 mA

PACKAGE

PN4248	TO-92
PN4249	TO-92
PN4250	TO-92
PN4250A	TO-92
FTSO4248	TO-236AA/AB
FTSO4249	TO-236AA/AB
FTSO4250	TO-236AA/AB
FTSO4250A	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		
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

	4248/50	4249/50A
V_{CEO} Collector to Emitter Voltage	-40 V	-60 V
(Note 4)		
V_{CBO} Collector to Base Voltage	-40 V	-60 V
V_{CES} Collector to Emitter Voltage	-40 V	-60 V
V_{EBO} Emitter to Base Voltage	-5.0 V	-5.0 V

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

SYMBOL	CHARACTERISTIC	4248		4249		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CES}	Collector to Emitter Breakdown Voltage	-40		-60		V	$I_E = 10 \mu$ A, $I_C = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	-40		-60		V	$I_C = 10 \mu$ 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_{EBO}	Emitter Cutoff Current		20		20	nA	$V_{EB} = -3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 3.0		10 3.0	nA μ A	$V_{CB} = -40$ V, $I_E = 0$ $V_{CB} = -40$ V, $I_E = 0$, $T_A = 65^\circ$ C
h_{FE}	DC Current Gain	50 50		100 100	300		$I_C = 100 \mu$ A, $V_{CE} = -5.0$ V $I_C = 1.0$ mA, $V_{CE} = -5.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	50		100			$I_C = 10$ mA, $V_{CE} = -5.0$ 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 = 1%.
 - For product family characteristic curves, refer to Curve Set T219.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

PN4248/FTSO4248/PN4249/FTSO4249

PN4250/FTSO4250

PN4250A/FTSO4250A T-29-23

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

SYMBOL	CHARACTERISTIC	4248		4249		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-40		-60		V	$I_C = 5.0 \text{ mA}$ (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.25		-0.25	V	$I_C = 10 \text{ mA}$, $I_B = 0.5 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		-0.9		-0.9	V	$I_C = 10 \text{ mA}$, $I_B = 0.5 \text{ mA}$
C_{ob}	Output Capacitance		6.0		6.0	pF	$V_{CB} = -5.0 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
C_{ib}	Input Capacitance		16		16	pF	$V_{BE} = -0.5 \text{ V}$, $I_C = 0$, $f = 1.0 \text{ MHz}$
h_{fe}	High Frequency Current Gain	2.0		2.0			$I_C = 0.5 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 20 \text{ MHz}$
h_{fe}	Small Signal Current Gain	50	1000	100	550		$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{ie}	Input Resistance			2.5	17	k Ω	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{oe}	Output Conductance			5.0	40	μmhos	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{re}	Voltage Feedback Ratio				10	$\times 10^{-4}$	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
NF	Wide Band Noise Figure				3.0	dB	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, PBW = 15.7 kHz
NF	Narrow Band Noise Figure				3.0	dB	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, PBW = 150 Hz
					3.0	dB	$I_C = 250 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 1.0 \Omega$, PBW = 150 Hz

3469674 FAIRCHILD SEMICONDUCTOR

84D 27440 D ■

PN4248/FTSO4248/PN4249/FTSO4249

PN4250/FTSO4250

PN4250A/FTSO4250A T-29.23

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

SYMBOL	CHARACTERISTIC	4250		4250A		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-40		-60		V	$I_C = 5.0 \text{ mA}$ (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.25		-0.25	V	$I_C = 10 \text{ mA}$, $I_B = 0.5 \text{ mA}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		-0.9			V	$I_C = 10 \text{ mA}$, $I_B = 0.5 \text{ mA}$
C_{ob}	Output Capacitance		6.0		6.0	pF	$V_{CB} = -5.0 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
C_{ib}	Input Capacitance		16			pF	$V_{BE} = -0.5 \text{ V}$, $I_C = 0$, $f = 1.0 \text{ MHz}$
h_{fe}	High Frequency Current Gain	2.5					$I_C = 0.5 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 20 \text{ MHz}$
h_{fe}	Small Signal Current Gain	250	800	250	800		$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{ie}	Input Resistance	6.0	20	6.0	20	k Ω	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{oe}	Output Conductance	5.0	50	5.0	50	μmhos	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
h_{re}	Voltage Feedback Ratio		10		10	$\times 10^{-4}$	$I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$
NF	Wide Band Noise Figure		2.0		2.0	dB	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, PBW = 15.7 kHz
NF	Narrow Band Noise Figure		2.0		2.0	dB	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, PBW = 150 Hz
			2.0		2.0	dB	$I_C = 250 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 1.0 \text{ k}\Omega$, PBW = 150 Hz
BV_{CES}	Collector to Emitter Breakdown Voltage	-40		-60		V	$I_E = 10 \mu\text{A}$, $I_C = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	-40		-60		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		20		20	nA	$V_{EB} = -3.0 \text{ V}$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10			nA	$V_{CB} = -40 \text{ V}$, $I_E = 0$
			3.0		10	nA	$V_{CB} = -50 \text{ V}$, $I_E = 0$
						μA	$V_{CB} = -40 \text{ V}$, $I_E = 0$, $T_A = 65^\circ \text{ C}$
h_{FE}	DC Current Gain	250 250	700	250	700		$I_C = 100 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$ $I_C = 1.0 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$
h_{FE}	DC Pulse Current Gain (Note 5)	250					$I_C = 10 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$

FAIRCHILD

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PN4258/FTSO4258

T-37-15

PNP Small Signal Ultra High Speed
Logic Switch

- $V_{CEO} \dots 12 \text{ V (Min)}$
- $h_{FE} \dots 30\text{-}120 @ 10 \text{ mA}$
- $t_{on} \dots 15 \text{ ns (Max) @ } 10 \text{ mA}$
- Complement ... 2N/FTSO5769

PACKAGEPN4258
FTSO4258

TO-92

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 25°C Case Temperature**PN**
0.625 W**FTSO**
0.350 W*

1.0 W

Voltages & Currents V_{CEO} Collector to Emitter Voltage -12 V
(Note 4) V_{CBO} Collector to Base Voltage -12 V V_{EBO} Emitter to Base Voltage -4.5 V I_C Collector Current 50 mA **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	-12		V	$I_C = 100 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-4.5		V	$I_E = 100 \mu\text{A}$, $I_C = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	-12		V	$I_C = 100 \mu\text{A}$, $V_{CE} = 0$
I_{CES}	Collector Reverse Current		10 5.0	nA μA	$V_{CE} = -6.0 \text{ V}$, $V_{BE} = 0$ $V_{CE} = -6.0 \text{ V}$, $V_{BE} = 0$, $T_A = 65^{\circ}\text{C}$
h_{FE}	DC Current Gain (Note 5)	30 15 30	120		$I_C = 10 \text{ mA}$, $V_{CE} = -3.0 \text{ V}$ $I_C = 1.0 \text{ mA}$, $V_{CE} = -0.5 \text{ V}$ $I_C = 50 \text{ mA}$, $V_{CE} = -1.0 \text{ V}$

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 $8.0 \text{ mW}^{\circ}\text{C}$); junction-to-ambient thermal resistance of 200°C/W (derating factor of $5.0 \text{ mW}^{\circ}\text{C}$); (TO-236) junction-to-ambient thermal resistance of 357°C/W (derating factor of $2.8 \text{ mW}^{\circ}\text{C}$).
 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 T292.
- * Package mounted on 99.5% alumina $8 \text{ mm} \times 8 \text{ mm} \times 0.6 \text{ mm}$.

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

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.15 -0.5	V V	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$ $I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	-12		V	$I_C = 3.0 \text{ mA}$, $I_B = 0$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	-0.75	-0.95 -1.5	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_{cb}	Collector to Base Capacitance		3.0	pF	$V_{CB} = -5.0 \text{ V}$, $I_E = 0$
C_{ib}	Input Capacitance		3.5	pF	$V_{EB} = -5.0 \text{ V}$, $I_C = 0$
$ h_{fe} $	Magnitude of Small Signal Current Gain	7.0 5.0			$I_C = 10 \text{ mA}$, $V_{CE} = -10 \text{ V}$, $f = 100 \text{ MHz}$ $I_C = 10 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$, $f = 100 \text{ MHz}$
t_{on}	Turn On Time (test circuit no. 348)		15	ns	$I_C \approx 10 \text{ mA}$, $I_{B1} \approx 1.0 \text{ mA}$
t_{off}	Turn Off Time (test circuit no. 348)		20	ns	$I_C \approx 10 \text{ mA}$, $I_{B1} \approx -I_{B2} \approx 1.0 \text{ mA}$
τ_s	Charge Storage Time (test circuit no. 234)		20	ns	$I_C \approx 10 \text{ mA}$, $I_{B1} \approx -I_{B2} \approx 10 \text{ mA}$

FAIRCHILD

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PN4274/FTSO4274
PN4275/FTSO4275

T-35-15

NPN Small Signal High Speed
Saturated Switches

- V_{CEO} ... 12 V (Min) (PN/FTSO4274), 15 V (Min) (PN/FTSO4275)
- $V_{CE(sat)}$... 0.2 V (Max) @ 10 mA
- f_T ... 400 MHz (Min)
- C_{cb} ... 4.0 pF (Max) @ 5.0 V
- τ_s ... 13 ns (Max) @ 10 mA
- t_{on} and t_{off} ... 12 ns (Max) @ 10 mA
- Complement ... PN3640

PACKAGE

PN4274	TO-92
PN4275	TO-92
FTSO4274	TO-236AA/AB
FTSO4275	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	4274	4275
V_{CEO} Collector to Emitter Voltage (Note 4)	12 V	15 V
V_{CBO} Collector to Base Voltage	30 V	40 V
V_{CES} Collector to Emitter Voltage	30 V	40 V
V_{EBO} Emitter to Base Voltage	4.5 V	4.5 V
I_C Collector Current (10 μ s pulse)	500 mA	500 mA
I_C Collector Current	100 mA	100 mA

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

SYMBOL	CHARACTERISTIC	4274		4275		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CES}	Collector to Emitter Breakdown Voltage	30		40		V	$I_C = 10 \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30		40		V	$I_C = 10 \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.5		4.5		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 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 = 1%.
- 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.

PN4274/FTSO4274
 PN4275/FTSO4275 T-35-15

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

SYMBOL	CHARACTERISTIC	4274		4275		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
I_{CBO}	Collector Cutoff Current		10		10	μA	$V_{CB} = 20 V, I_E = 0, T_A = 65^\circ C$
I_{CES}	Collector Reverse Current		400		400	nA	$V_{CE} = 20 V, V_{BE} = 0$
h_{FE}	DC Pulse Current Gain	35 30 18	120	35 30 18	120		$I_C = 10 mA, V_{CE} = 1.0 V$ $I_C = 30 mA, V_{CE} = 0.4 V$ $I_C = 100 mA, V_{CE} = 1.0 V$
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	12		15		V	$I_C = 10 mA$ (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.20		0.20	V	$I_C = 10 mA, I_B = 1.0 mA$
			0.18		0.18	V	$I_C = 10 mA, I_B = 3.3 mA$
			0.25		0.25	V	$I_C = 30 mA, I_B = 3.0 mA$
			0.50		0.50	V	$I_C = 100 mA, I_B = 10 mA$
			0.30		0.30	V	$I_C = 10 mA, I_B = 1.0 mA, T_A = 65^\circ C$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.72	0.85	0.72	0.85	V	$I_C = 10 mA, I_B = 1.0 mA$
		0.74	1.00	0.74	1.00	V	$I_C = 10 mA, I_B = 3.3 mA$
			1.15		1.15	V	$I_C = 30 mA, I_B = 3.0 mA$
			1.60		1.60	V	$I_C = 100 mA, I_B = 10 mA$
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 5.0 V, I_E = 0$
h_{fe}	High Frequency Current Gain	4.0		4.0			$I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz$
τ_s	Charge Storage Time Constant (test circuit no. 3111)		13		13	ns	$I_C = I_{B1} = -I_{B2} = 10 mA,$
t_{on}	Turn On Time (test circuit no. 381)		12		12	ns	$I_C = 10 mA, I_{B1} = 3.3 mA$
t_{off}	Turn Off Time (test circuit no. 381)		12		12	ns	$I_C = 10 mA, I_{B1} = I_{B2} = 3.3 mA$



PN4354/FTSO4354 7-29-23
PN4355/MPS4355/FTSO4355
PN4356/MPS4356/FTSO4356
 PNP General Purpose Amplifiers

- V_{CEO} ... -60 V (Min) (PN4354, PN/MPS4355),
-80 V (Min) (PN/MPS4356)
- $V_{CE(sat)}$... -1.0 V (Max) @ $I_C = 1.0$ A (PN/MPS4355)
- NF ... 3.0 dB (Max) at 1.0 kHz
- Complements ... PN3567, PN3569

PACKAGE

PN4354	TO-92
PN4355	TO-92
PN4356	TO-92
MPS4355	TO-92
MPS4356	TO-92
FTSO4354	TO-236AA/AB
FTSO4355	TO-236AA/AB
FTSO4356	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/MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

	4354/5	4356
V_{CEO} Collector to Emitter Voltage (Note 4)	-60 V	-80 V
V_{CBO} Collector to Base Voltage	-60 V	-80 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	4354		4355		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CBO}	Collector to Base Breakdown Voltage	-60		-60		V	$I_C = 10 \mu A, I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.0		-5.0		V	$I_E = 10 \mu A, I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = -4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0		50 5.0	nA μA	$V_{CB} = -50$ V, $I_E = 0$ $V_{CB} = -50$ V, $I_E = 0$, $T_A = 75^\circ$ C
h_{FE}	DC Pulse Current Gain (Note 5)	25 40 50 40 30	500	60 75 100 75 75	400		$I_C = 100 \mu A, V_{CE} = -10$ V $I_C = 1.0$ mA, $V_{CE} = -10$ V $I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 100$ mA, $V_{CE} = -10$ V $I_C = 500$ mA, $V_{CE} = -10$ 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 = 1%.
- For product family characteristic curves, refer to Curve Set T224.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

PN4354/FTSO4354 T-2923
 PN4355/MPS4355/FTSO4355
 PN4356/MPS4356/FTSO4356

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

SYMBOL	CHARACTERISTIC	4354		4355		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-60		-60		V	$I_C = 10 \text{ mA}$ (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.15		-0.15	V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$
			-0.5		-0.5	V	$I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$
					-1.0	V	$I_C = 1.0 \text{ A}$, $I_B = 100 \text{ mA}$
$V_{BE(on)}$	Base to Emitter "On" Voltage (Note 3)		-1.1		-1.1	V	$I_C = 500 \text{ mA}$, $V_{CE} = -0.5 \text{ V}$
					-1.2	V	$I_C = 1.0 \text{ A}$, $V_{CE} = -1.0 \text{ V}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		-0.9		-0.9	V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ V}$
			-1.1		-1.1	V	$I_C = 500 \text{ mA}$, $I_B = 500 \text{ mA}$
					-1.2	V	$I_C = 1.0 \text{ A}$, $I_B = 100 \text{ mA}$
C_{cb}	Collector to Base Capacitance		30		30	pF	$V_{CB} = -10 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
C_{eb}	Emitter to Base Capacitance		110		110	pF	$V_{BE} = -0.5 \text{ V}$, $I_C = 0$, $f = 1.0 \text{ MHz}$
$ h_{fe} $	Magnitude of Common Emitter Small Signal Current Gain	1.0	5.0	1.0	5.0		$I_C = 50 \text{ mA}$, $V_{CE} = -10 \text{ V}$, $f = 100 \text{ MHz}$
t_{on}	Turn On Time (test circuit no. 341)		100		100	ns	$I_C \approx 500 \text{ mA}$, $I_{B1} \approx 50 \text{ mA}$, $V_{CC} = -30 \text{ V}$
t_{off}	Turn Off Time (test circuit no. 341)		400		400	ns	$I_C \approx 500 \text{ mA}$, $I_{B1} \approx I_{B2} = 50 \text{ mA}$, $V_{CC} = -30 \text{ V}$
NF	Noise Figure		3.0		3.0	dB	$I_C = 100 \mu\text{A}$, $V_{CE} = -10 \text{ V}$, $f = 1.0 \text{ kHz}$, $BW = 1.0 \text{ Hz}$, $R_S = 1.0 \text{ k}\Omega$

SYMBOL	CHARACTERISTIC	4356		UNITS	TEST CONDITIONS
		MIN	MAX		
BV_{CBO}	Collector to Base Breakdown Voltage	-60		V	$I_C = 10 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.0		V	$I_E = 10 \mu\text{A}$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = -4.0 \text{ V}$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = -50 \text{ V}$, $I_E = 0$
			5.0	μA	$V_{CB} = -50 \text{ V}$, $I_E = 0$, $T_A = 75^\circ \text{C}$
h_{FE}	DC Pulse Current Gain (Note 5)	25			$I_C = 100 \mu\text{A}$, $V_{CE} = -10 \text{ V}$
		40			$I_C = 1.0 \text{ mA}$, $V_{CE} = -10 \text{ V}$
		50	250		$I_C = 10 \text{ mA}$, $V_{CE} = -10 \text{ V}$
		40			$I_C = 100 \text{ mA}$, $V_{CE} = -10 \text{ V}$
		30			$I_C = 500 \text{ mA}$, $V_{CE} = -10 \text{ V}$

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 PN4355/MPS4355/FTSO4355
 PN4356/MPS4356/FTSO4356

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

SYMBOL	CHARACTERISTIC	4356		UNITS	TEST CONDITIONS
		MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	-80		V	$I_C = 10 \text{ mA}$ (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		-0.15 -0.5	V V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$
$V_{BE(on)}$	Base to Emitter "On" Voltage (Note 3)		-1.1	V	$I_C = 500 \text{ mA}$, $V_{CE} = -0.5 \text{ V}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		-0.9 1.1	V V	$I_C = 150 \text{ mA}$, $I_B = 15 \text{ V}$ $I_C = 500 \text{ mA}$, $I_B = 500 \text{ mA}$
C_{cb}	Collector to Base Capacitance		30	pF	$V_{CB} = -10 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$
C_{eb}	Emitter to Base Capacitance		110	pF	$V_{BE} = -0.5 \text{ V}$, $I_C = 0$, $f = 1.0 \text{ MHz}$
$ h_{fe} $	Magnitude of Common Emitter Small Signal Current Gain	1.0	5.0		$I_C = 50 \text{ mA}$, $V_{CE} = -10 \text{ V}$, $f = 100 \text{ MHz}$
t_{on}	Turn On Time (test circuit no. 341)		100	ns	$I_C \approx 500 \text{ mA}$, $I_{B1} \approx 50 \text{ mA}$, $V_{CC} = -30 \text{ V}$
t_{off}	Turn Off Time (test circuit no. 341)		400	ns	$I_C \approx 500 \text{ mA}$, $I_{B1} \approx I_{B2} = 50 \text{ mA}$, $V_{CC} = -30 \text{ V}$
NF	Noise Figure		3.0	dB	$I_C = 100 \mu\text{A}$, $V_{CE} = -10 \text{ V}$, $f = 1.0 \text{ kHz}$, $BW = 1.0 \text{ Hz}$, $R_S = 1.0 \text{ k}\Omega$

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PN4888/FTSO4888**PN4889/FTSO4889**PNP Low Noise High Voltage
Amplifiers

T-29.23

- $V_{CE0} \dots 150 \text{ V (Min)}$
- $h_{FE} \dots 80\text{-}300 @ 10 \text{ mA (PN/FTSO4889)}$
- $C_{ob} \dots 4.0 \text{ pF (Max)}$
- $NF \dots 3.0 \text{ dB (Max) @ } 1.0 \text{ kHz (PN/FTSO4889)}$
- Excellent Beta Linearity from $10 \mu\text{A}$ to 50 mA

PACKAGE

PN4888	TO-92
PN4889	TO-92
FTSO4888	TO-236AA/AB
FTSO4889	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

V_{CE0} Collector to Emitter Voltage	-150 V
(Note 4)	
V_{CBO} Collector to Base Voltage	-150 V
V_{EBO} Emitter to Base Voltage	-6.0 V
I_C Collector Current	100 mA

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

SYMBOL	CHARACTERISTIC	4888		4889		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV_{CES}	Collector to Emitter Breakdown Voltage	-150		-150		V	$I_C = 100 \mu\text{A}$, $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	-150		-150		V	$I_C = 100 \mu\text{A}$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-0.6		-0.6		V	$I_E = 10 \mu\text{A}$, $I_C = 0$
I_{E0}	Emitter Cutoff Current		50		10	nA	$V_{EB} = -4.0 \text{ V}$, $I_C = 0$
I_{C0}	Collector Cutoff Current		50		10	nA	$V_{CB} = -100 \text{ V}$, $I_E = 0$
			2.5		0.5	μA	$V_{CB} = -100 \text{ V}$, $I_E = 0$, $T_A = 65^{\circ}\text{C}$

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 150°C and (TO-92) junction-to-case thermal resistance of 125°C/W (derating factor of $8.0 \text{ mW}/^{\circ}\text{C}$); junction-to-ambient thermal resistance of 200°C/W (derating factor of $5.0 \text{ mW}/^{\circ}\text{C}$); (TO-236) junction-to-ambient thermal resistance of 357°C/W (derating factor of $2.8 \text{ mW}/^{\circ}\text{C}$).
 - Rating refers to a high current point where collector to emitter voltage is lowest.
 - Pulse conditions: length = $300 \mu\text{s}$; duty cycle = 1%.
 - For product family characteristic curves, refer to Curve Set T232.
- * Package mounted on 99.5% alumina $8 \text{ mm} \times 8 \text{ mm} \times 0.6 \text{ mm}$.

PN4888/FTSO4888

PN4889/FTSO4889

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

SYMBOL	CHARACTERISTIC	4888		4889		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
h_{FE}	DC Pulse Current Gain (Note 5)	30 40	400	60 70 80	300		$I_C = 100 \mu A, V_{CE} = -10 V$ $I_C = 1.0 mA, V_{CE} = -10 V$ $I_C = 10 mA, V_{CE} = -10 V$
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage	-150		-150		V	$I_C = 2.0 mA, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		-0.5		-0.5	V	$I_C = 10 mA, I_B = 1.0 mA$
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Pulsed) (Note 5)		-0.8		-0.7	V	$I_C = 1.0 mA, V_{CE} = -10 V$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)		-0.9		-0.9	V	$I_C = 10 mA, I_B = 1.0 mA$
C_{ob}	Output Capacitance		4.0		4.0	pF	$V_{CB} = -20 V, I_E = 0, f = 1.0 MHz$
C_{ib}	Input Capacitance		30		25	pF	$V_{BE} = -0.5 V, I_C = 0, f = 1.0 MHz$
h_{fe}	High Frequency Current Gain	1.5	8.0	2.0	8.0		$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 20 MHz$
h_{fe}	Common Emitter Small Signal Current Gain Forward Current Transfer Ratio	30	500	65	400		$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{ie}	Small Signal Short Circuit Input Resistance	0.75	20	1.7	12	k Ω	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{oe}	Small Signal Open Circuit Output Conductance	1.4	40	3.0	25	$\mu mhos$	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
h_{re}	Small Signal Open Circuit Reverse Voltage Feedback Ratio				5	$\times 10^{-4}$	$I_C = 1.0 mA, V_{CE} = -10 V$, $f = 1.0 kHz$
NF	Wide Band Noise Figure				4.0	dB	$I_C = 250 \mu A, V_{CE} = -5.0 V$, $f = 10 Hz$ to $10 kHz, R_S = 1.0 k\Omega$, $BW = 15.7 kHz$
NF	Narrow Band Noise Figure				10	dB	$I_C = 250 \mu A, V_{CE} = -5.0 V$, $R_S = 1.0 k\Omega, f = 100 Hz$, $BW = 15 Hz$
					3.0	dB	$I_C = 30 \mu A, V_{CE} = -5.0 V$, $R_S = 1.0 k\Omega, f = 1.0 kHz$, $BW = 150 Hz$
					3.0	dB	$I_C = 250 \mu A, V_{CE} = -5.0 V$, $R_S = 1.0 k\Omega, f = 10 kHz$, $BW = 1.5 kHz$
					4.0	dB	$I_C = 1.0 mA, V_{CE} = -10 V$, $R_S = 1.0 k\Omega, f = 1.0 MHz$, $BW = 2.0 kHz$