

FAIRCHILD

A Schlumberger Company

PN4248/FTSO4248
PN4249/FTSO4249 T-29-23
PN4250/FTSO4250
PN4250A/FTSO4250A
 PNP Low Level Low Noise Amplifiers

- $V_{CEO} \dots 40 \text{ V (Min) (PN4248/50); } 60 \text{ V (Min) (PN4249/50A)}$
- $h_{FE} \dots 250\text{--}700 @ 100 \mu\text{A (PN4250/50A)}$
- $NF \dots 2.0 \text{ dB (Max) @ } 1.0 \text{ kHz (PN4250/50A)}$
- Excellent Beta Linearity from $1.0 \mu\text{A}$ 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 (Note 4)	-40 V	-60 V
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	$I_E = 10 \mu\text{A}, I_C = 0$
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 3.0		10 3.0	nA μA	$V_{CB} = -40 \text{ V}, I_E = 0$ $V_{CB} = -40 \text{ V}, I_E = 0, T_A = 65^{\circ}\text{C}$
h_{FE}	DC Current Gain	50 50		100 100	300		$I_C = 100 \mu\text{A}, V_{CE} = -5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = -5.0 \text{ V}$
h_{FE}	DC Pulse Current Gain (Note 5)	50		100			$I_C = 10 \text{ mA}, V_{CE} = -5.0 \text{ V}$

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 $8.0 \text{ mW/}^{\circ}\text{C}$); 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 T219.
- Package mounted on 99.5% alumina $8 \text{ mm} \times 8 \text{ mm} \times 0.6 \text{ mm}$.



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 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

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	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 10 \text{ Hz to } 10 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, $PBW = 15.7 \text{ kHz}$
NF	Narrow Band Noise Figure		2.0		2.0	dB	$I_C = 20 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 10 \text{ k}\Omega$, $PBW = 150 \text{ Hz}$
			2.0		2.0	dB	$I_C = 250 \mu\text{A}$, $V_{CE} = -5.0 \text{ V}$, $f = 1.0 \text{ kHz}$, $R_S = 1.0 \text{ k}\Omega$, $PBW = 150 \text{ Hz}$
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 μA	$V_{CB} = -50 \text{ V}$, $I_E = 0$ $V_{CB} = -40 \text{ V}$, $I_E = 0$, $T_A = 65^\circ \text{ C}$
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					$I_C = 10 \text{ mA}$, $V_{CE} = -5.0 \text{ V}$

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FAIRCHILD

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PN4258/FTSO4258PNP Small Signal Ultra High Speed
Logic Switch

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

PACKAGE

PN4258

TO-92

FTSO4258

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

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

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 μs ; duty cycle = 1%.
 - For product family characteristic curves, refer to Curve Set T292.
- * Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 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	V	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$
			-0.5	V	$I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$
$V_{CE(sus)}$	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	V	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$
			-1.5	V	$I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$
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	$I_C = 10 mA, I_{B1} = I_{B2} = 3.3 mA$

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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)

	PN/MPS	FTSO
Total Dissipation at 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-29-23
 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	250		$I_C = 100 \mu\text{A}$, $V_{CE} = -10 \text{ V}$
		40			$I_C = 1.0 \text{ mA}$, $V_{CE} = -10 \text{ V}$
		50			$I_C = 10 \text{ mA}$, $V_{CE} = -10 \text{ V}$
		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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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_{ie} $	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

- $V_{CE0} \dots 150 \text{ V (Min)}$
- $h_{FE} \dots 80-300 @ 10 \text{ mA (PN/FTSO4889)}$
- $C_{ob} \dots 4.0 \text{ pF (Max)}$
- $NF \dots 3.0 \text{ dB (Max) @ } 1.0 \text{ kHz (PN/FTSO4889)}$
- 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_{EBO}	Emitter Cutoff Current		50		10	nA	$V_{EB} = -4.0 \text{ V}, I_C = 0$
I_{CBO}	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	$I_C = 250 \mu A, V_{CE} = -5.0 V, f = 10 Hz \text{ to } 10 kHz, R_S = 1.0 k\Omega, BW = 15.7 kHz$
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	$I_C = 1.0 mA, V_{CE} = -10 V, R_S = 1.0 k\Omega, f = 1.0 MHz, BW = 2.0 kHz$