

3469674 FAIRCHILD SEMICONDUCTOR

84D 27459 D



A Schlumberger Company

**PN5135/FTSO5135** T-29-23  
**PN5136/FTSO5136**  
**PN5137/FTSO5137**  
 NPN Small Signal General Purpose Amplifiers

- $P_D$  ... 625 mW @  $T_A = 25^\circ C$
- $V_{CE0}$  ... 25 V (Min) (PN/FTSO5135)
- $h_{FE}$  ... 50-600 @ 10 mA (PN/FTSO5135), 20-400 @ 150 mA (PN/FTSO5136/7)
- $f_T$  ... 40 MHz (Min)
- Complements ... PN5142, PN5143

**PACKAGE**

PN5135	TO-92
PN5136	TO-92
PN5137	TO-92
FTSO5135	TO-236AA/AB
FTSO5136	TO-236AA/AB
FTSO5137	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	<b>PN</b>	<b>FTSO</b>
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

**Voltages & Currents**

	<b>5135</b>	<b>5136/7</b>
$V_{CE0}$ Collector to Emitter Voltage (Note 4)	25 V	20 V
$V_{CBO}$ Collector to Base Voltage	30 V	30 V
$V_{CES}$ Collector to Emitter Voltage	30 V	30 V
$V_{EBO}$ Emitter to Base Voltage	4.0 V	3.0 V
$I_C$ Collector Current	200 mA	200 mA

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

SYMBOL	CHARACTERISTIC	5135		5136		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$BV_{CES}$	Collector to Emitter Breakdown Voltage	30		30		V	$I_C = 100 \mu A, V_{BE} = 0$
$BV_{CBO}$	Collector to Base Breakdown Voltage	30		30		V	$I_C = 100 \mu A, I_E = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	4.0		3.0		V	$I_E = 10 \mu A, I_C = 0$
$I_{EBO}$	Emitter Cutoff Current		10		100	nA μA	$V_{EB} = 2.0 V, I_C = 0$ $V_{EB} = 4.0 V, I_C = 0$

**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 T145.
- \* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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PN5136/FTSO5136

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

SYMBOL	CHARACTERISTIC	5135		5136		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
$I_{CBO}$	Collector Cutoff Current	300			100	nA	$V_{CB} = 15\text{ V}, I_E = 0$ $V_{CB} = 20\text{ V}, I_E = 0$ $V_{CB} = 15\text{ V}, I_E = 0$ $T_A = 65^\circ\text{ C}$ $V_{CB} = 20\text{ V}, I_E = 0,$ $T_A = 65^\circ\text{ C}$
			10			nA	
					10	$\mu\text{A}$	
						$\mu\text{A}$	
$h_{FE}$	DC Pulse Current Gain (Note 5)	50	600				$I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 2.0\text{ mA}, V_{CE} = 1.0\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 1.0\text{ V}$ $I_C = 30\text{ mA}, V_{CE} = 1.0\text{ V}$
		15		20	400		
				20			
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	25		20		V	$I_C = 1.0\text{ mA (pulsed)}, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.0		0.25	V	$I_C = 100\text{ mA}, I_B = 10\text{ mA}$ $I_C = 150\text{ mA}, I_B = 15\text{ mA}$
$V_{BE(on)}$	Base to Emitter "On" Voltage (Note 5)		1.0		1.1	V	$I_C = 100\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 1.0\text{ V}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.0		1.1	V	$I_C = 100\text{ mA}, I_B = 10\text{ V}$ $I_C = 150\text{ mA}, I_B = 15\text{ V}$
$C_{cb}$	Collector to Base Capacitance		25		35	pF	$V_{CB} = 10\text{ V}, I_E = 0, f = 1.0\text{ MHz}$
$C_{eb}$	Emitter to Base Capacitance				85	pF	$V_{EB} = 0.5\text{ V}, I_C = 0, f = 1.0\text{ MHz}$
$ h_{fe} $	Magnitude of Common Emitter Small Signal Current Gain	2.0	15				$I_C = 30\text{ mA}, V_{CE} = 10\text{ V},$ $f = 20\text{ MHz}$ $I_C = 50\text{ mA}, V_{CE} = 5.0\text{ V},$ $f = 20\text{ MHz}$
				2.0	20		

SYMBOL	CHARACTERISTIC	5137		UNITS	TEST CONDITIONS
		MIN	MAX		
$BV_{CES}$	Collector to Emitter Breakdown Voltage	30		V	$I_C = 100\text{ }\mu\text{A}, V_{BE} = 0$
$BV_{CBO}$	Collector to Base Breakdown Voltage	30		V	$I_C = 100\text{ }\mu\text{A}, I_E = 0$
$BV_{EBO}$	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 10\text{ }\mu\text{A}, I_C = 0$
$I_{EBO}$	Emitter Cutoff Current		100	nA	$V_{EB} = 2.0\text{ V}, I_C = 0$
$I_{CBO}$	Collector Cutoff Current		100	nA	$V_{CB} = 20\text{ V}, I_E = 0$ $V_{CB} = 20\text{ V}, I_E = 0,$ $T_A = 65^\circ\text{ C}$
			10	$\mu\text{A}$	
$h_{FE}$	DC Pulse Current Gain (Note 5)	20	400		$I_C = 150\text{ mA}, V_{CE} = 1.0\text{ V}$ $I_C = 30\text{ mA}, V_{CE} = 1.0\text{ V}$
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SYMBOL	CHARACTERISTIC	5137		UNITS	TEST CONDITIONS
		MIN	MAX		
$V_{CE(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	20		V	$I_C = 1.0 \text{ mA (pulsed)}, I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.1	V	$I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.1	V	$I_C = 150 \text{ mA}, I_B = 15 \text{ V}$
$C_{cb}$	Collector to Base Capacitance		35	pF	$V_{CB} = 10 \text{ V}, I_E = 0, f = 1.0 \text{ MHz}$
$C_{eb}$	Emitter to Base Capacitance		85	pF	$V_{BE} = 0.5 \text{ V}, I_C = 0, f = 1.0 \text{ MHz}$
$ h_{re} $	Magnitude of Common Emitter Small Signal Current Gain	2.0	20		$I_C = 50 \text{ mA}, V_{CE} = 5.0 \text{ V}, f = 20 \text{ MHz}$