

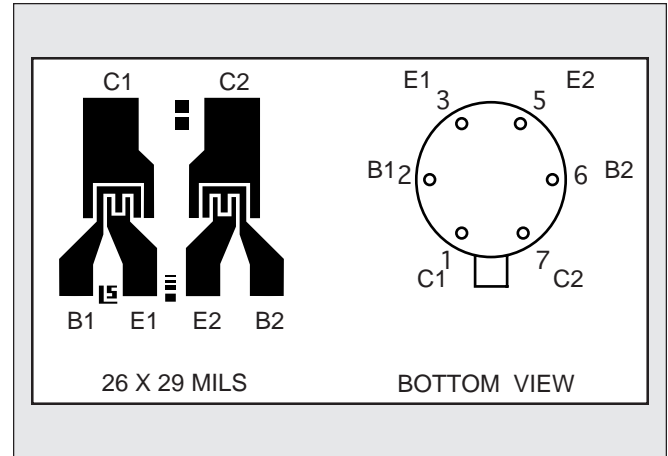
# LINEAR SYSTEMS

Linear Integrated Systems

LS310 LS311 LS312 LS313

## MONOLITHIC DUAL NPN TRANSISTORS

FEATURES		
VERY HIGH GAIN	$h_{FE} \geq 200$ @ 10 $\mu$ A-1mA	
TIGHT $V_{BE}$ MATCHING	$ V_{BE1} - V_{BE2}  = 0.2\text{mV TYP.}$	
HIGH $f_T$	250MHz TYP. @ 1mA	
ABSOLUTE MAXIMUM RATINGS NOTE 1 @ 25°C (unless otherwise noted)		
$I_C$	Collector Current	10mA
Maximum Temperatures		
Storage Temperature		-65° to +200°C
Operating Junction Temperature		+150°C
Maximum Power Dissipation		ONE SIDE
Device Dissipation @ Free Air		250mW
Linear Derating Factor		2.3mW/°C
		BOTH SIDES
Device Dissipation @ Free Air		500mW
Linear Derating Factor		4.3mW/°C



### ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

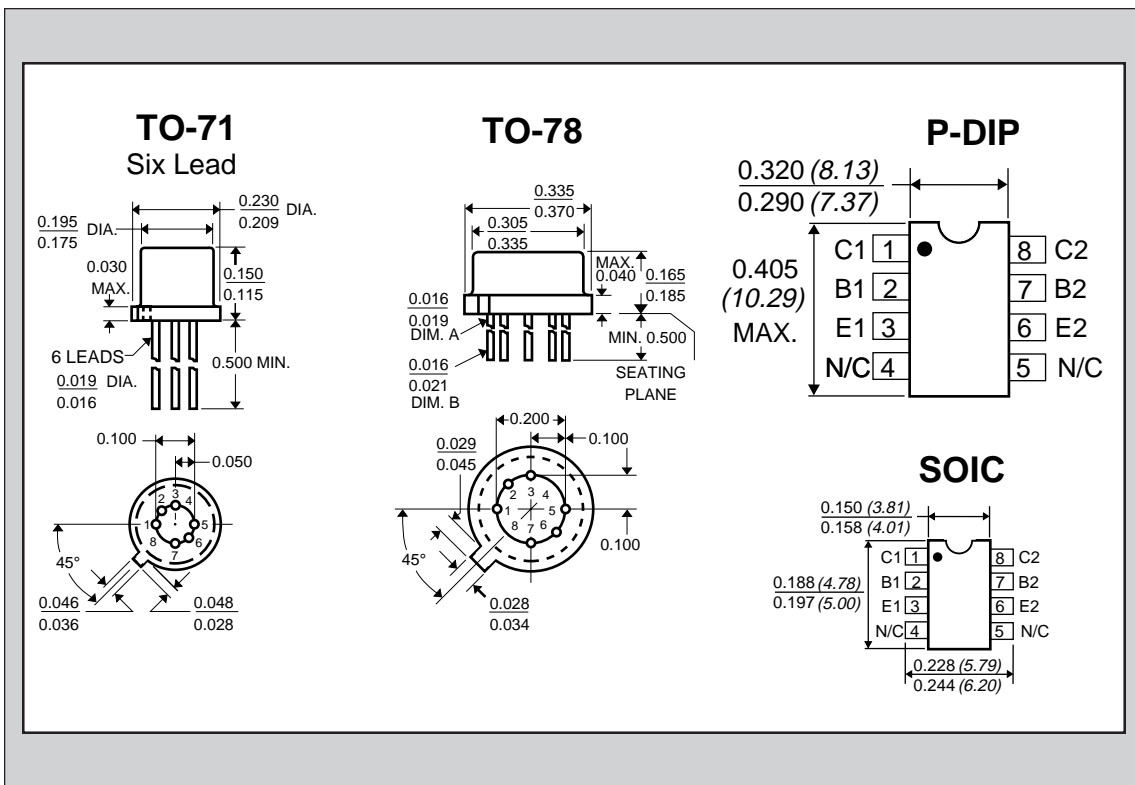
SYMBOL	CHARACTERISTICS	LS310	LS311	LS312	LS313	UNITS	CONDITIONS
$BV_{CBO}$	Collector to Base Voltage	25	45	60	45	MIN. V	$I_C = 10\mu\text{A}$ $I_E = 0$
$BV_{CEO}$	Collector to Emitter Voltage	25	45	60	45	MIN. V	$I_C = 10\mu\text{A}$ $I_B = 0$
$BV_{EBO}$	Emitter-Base Breakdown Voltage	6.2	6.2	6.2	6.2	MIN. V	$I_E = 10\mu\text{A}$ $I_C = 0$ NOTE 2
$BV_{CCO}$	Collector to Collector Voltage	30	100	100	100	MIN. V	$I_C = 10\mu\text{A}$ $I_E = 0$
$h_{FE}$	DC Current Gain	150	150	200	400	MIN. MAX.	$I_C = 10\mu\text{A}$ $V_{CE} = 5\text{V}$
$h_{FE}$	DC Current Gain	150	150	200	400	MIN.	$I_C = 100\mu\text{A}$ $V_{CE} = 5\text{V}$
$h_{FE}$	DC Current Gain	150	150	200	400	MIN.	$I_C = 1\text{mA}$ $V_{CE} = 5\text{V}$
$V_{CE(SAT)}$	Collector Saturation Voltage	0.25	0.25	0.25	0.25	MAX. V	$I_C = 1\text{mA}$ $I_B = 0.1\text{mA}$
$I_{CBO}$	Collector Cutoff Current	0.2	0.2	0.2	0.2	MAX. nA	$I_E = 0$ $V_{CB} = \text{NOTE 3}$
$I_{EBO}$	Emitter Cutoff Current	0.2	0.2	0.2	0.2	MAX. nA	$I_E = 0$ $V_{CB} = 3\text{V}$
$C_{OBO}$	Output Capacitance	2	2	2	2	MAX. pF	$I_E = 0$ $V_{CB} = 5\text{V}$
$C_{C1C2}$	Collector to Collector Capacitance	2	2	2	2	MAX. pF	$V_{CC} = 0$
$I_{C1C2}$	Collector to Collector Leakage Current	0.5	0.5	0.5	0.5	MAX. nA	$V_{CC} = \text{NOTE 4}$
$f_T$	Current Gain Bandwidth Product	200	200	200	200	MIN. MHz	$I_C = 1\text{mA}$ $V_{CE} = 5\text{V}$
NF	Narrow Band Noise Figure	3	3	3	3	MAX. dB	$I_C = 100\mu\text{A}$ $V_{CE} = 5\text{V}$ BW = 200Hz, $R_G = 10\text{K}\Omega$ $f = 1\text{KHz}$

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**ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)**

SYMBOL	CHARACTERISTICS	LS310	LS311	LS312	LS313	MIN.	UNITS	CONDITIONS
$ V_{BE1} - V_{BE2} $	Base Emitter Voltage Differential	1	0.4	0.2	0.4	TYP.	mV	$I_C = 10 \mu A$ $V_{CE} = 5V$
		3	1	0.5	1	MAX.	mV.	
$\Delta(V_{BE1} - V_{BE2})/^\circ C$	Base Emitter Voltage Differential Change with Temperature	2	1	0.5	1	TYP.	$\mu V/^\circ C$	$I_C = 10 \mu A$ $V_{CE} = 5V$ $T_A = -55^\circ C$ to $+125^\circ C$
		15	5	2	5	MAX.		
$ I_{B1} - I_{B2} $	Base Current Differential				1.25	TYP.	nA	$I_C = 10 \mu A$ $V_{CE} = 5V$
			10	5	5	MAX.	nA	
$ \Delta(I_{B1} - I_{B2})/^\circ C$	Base Current Differential Change With Temperature		0.5	0.3	0.5	MAX.	$nA/^\circ C$	$I_C = 10 \mu A$ $V_{CE} = 5V$ $T_A = -55^\circ C$ to $+125^\circ C$
$h_{FE1}/h_{FE2}$	Current Gain Differential	10	5	5	5	TYP.	%	$I_C = 10 \mu A$ $V_{CE} = 5V$



**NOTES:**

1. These ratings are limiting values above which the serviceability of any semiconductor may be impaired.
2. The reverse base-to-emitter voltage must never exceed 6.2 volts; the reverse base-to-emitter current must never exceed 10  $\mu A$ .
3. For LS310:  $V_{CB} = 20V$ ; for LS311, LS312 & LS313:  $V_{CB} = 30V$ .
4. For LS310, LS311 & LS313:  $V_{CC} = \pm 45V$ ; for LS312:  $V_{CC} = \pm 100V$ .