

LINEAR SYSTEMS

Twenty-Five Years Of Quality Through Innovation

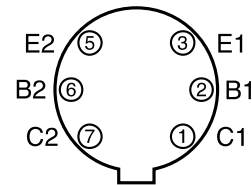
LS310 LS311 LS312 LS313

MONOLITHIC DUAL NPN TRANSISTORS

FEATURES

VERY HIGH GAIN	$h_{FE} \geq 200 @ 10\mu A - 1mA$	
TIGHT V_{BE} MATCHING	$ V_{BE1} - V_{BE2} = 0.2mV$ 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	-55° to +150°C	
Operating Junction Temperature	-55° to +150°C	
Maximum Power Dissipation	ONE SIDE	BOTH SIDES
Device Dissipation @ Free Air	250mW	500mW
Linear Derating Factor	2.3mW/°C	4.3mW/°C

TO71 & TO78



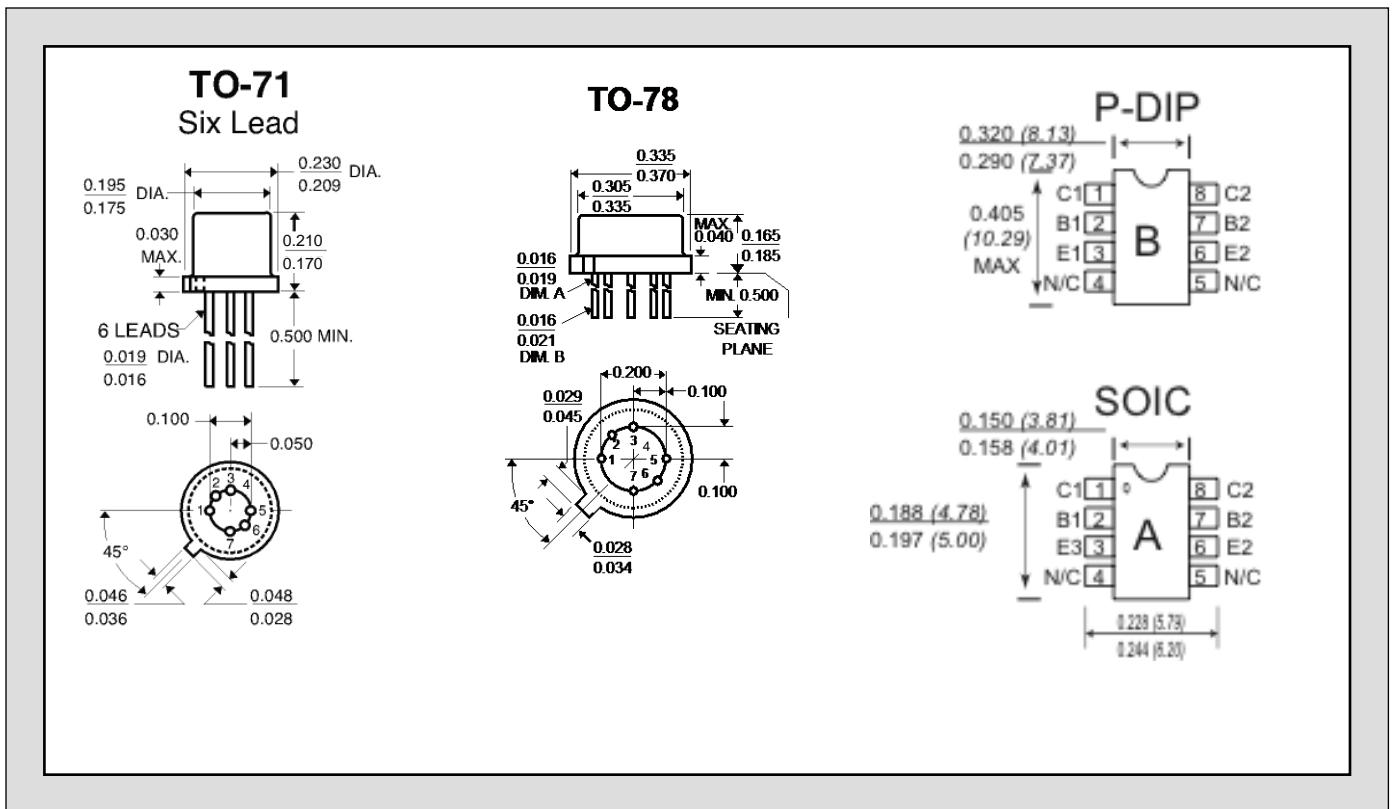
TOP VIEW

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	$I_C = 10\mu A, I_E = 0$
BV_{CEO}	Collector to Emitter Voltage	25	45	60	45	MIN.	V	$I_C = 1mA, I_B = 0$
BV_{EBO}	Emitter-Base Breakdown Voltage	6.0	6.0	6.0	6.0	MIN.	V	$I_E = 10\mu A, I_C = 0$ <u>NOTE 2</u>
BV_{CCO}	Collector to Collector Voltage	45	45	60	45	MIN.	V	$I_C = 10\mu A, I_E = I_B = 0A$
h_{FE}	DC Current Gain	150	150	200	400 1000	MIN. MAX.		$I_C = 10\mu A, V_{CE} = 5V$
h_{FE}	DC Current Gain	150	150	200	400	MIN.		$I_C = 100\mu A, V_{CE} = 5V$
h_{FE}	DC Current Gain	150	150	200	400	MIN.		$I_C = 1mA, V_{CE} = 5V$
$V_{CE(SAT)}$	Collector Saturation Voltage	0.25	0.25	0.25	0.25	MAX.	V	$I_C = 1mA, I_B = 0.1mA$
I_{CBO}	Collector Cutoff Current	0.2	0.2	0.2	0.2	MAX.	nA	$I_E = 0, V_{CB} =$ <u>NOTE 3</u>
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	0.2	MAX.	nA	$I_C = 0, V_{CB} = 3V$
C_{OBO}	Out put Capacitance	2	2	2	2	MAX.	pF	$I_E = 0, V_{CB} = 5V$
C_{C1C2}	Collector to Collector Capacitance	2	2	2	2	MAX.	pF	$V_{CC} = 0V$
I_{C1C2}	Collector to Collector Leakage Current	1.0	1.0	1.0	1.0	MAX.	μA	$V_{CC} =$ <u>NOTE 4</u>
f_T	Current Gain Bandwidth Product	200	200	200	200	MIN.	MHz	$I_C = 1mA, V_{CE} = 5V$
NF	Narrow Band Noise Figure	3	3	3	3	MAX.	dB	$I_C = 100\mu A, V_{CE} = 5V$ $BW = 200Hz, R_G = 10K\Omega$ $F = 1KHz$

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 3	0.4 1	0.2 0.5	0.4 1	TYP. MAX.	mV mV	$I_C = 10\mu A, V_{CE} = 5V$
$\Delta(V_{BE1}-V_{BE2})/^\circ C$	Base Emitter Voltage Differential Change with Temperature	2 15	1 5	0.5 2	1 5	TYP. MAX.	$\mu V/^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$ $T_A = -55^\circ C \text{ to } +125^\circ C$
$ I_{B1}-I_{B2} $	Base Current Differential		10	5	1.25 5	TYP. MAX.	nA nA	$I_C = 10\mu A, V_{CE} = 5V$
$ \Delta(I_{B1}-I_{B2})/^\circ C$	Base Current Differential Change with Temperature		0.5	0.3	0.5	MAX.	$nA/^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$ $T_A = -55^\circ C \text{ to } +125^\circ C$
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 10µA.
 3. For LS310: $V_{CB} = 20V$; for LS311, LS312 & LS313: $V_{CB} = 30V$
 4. For LS310, LS311 & LS313: $V_{CC} \pm 45V$; for LS312: $V_{CC} \pm 60V$.

Linear Integrated Systems (LIS) is a 25-year-old, third-generation precision semiconductor company providing high-quality discrete components. Expertise brought to LIS is based on processes and products developed at Amelco, Union Carbide, Intersil and Micro Power Systems by company President John H. Hall. Hall, a protégé of Silicon Valley legend Dr. Jean Hoerni, was the director of IC Development at Union Carbide, co-founder and vice president of R&D at Intersil, and founder/president of Micro Power Systems.