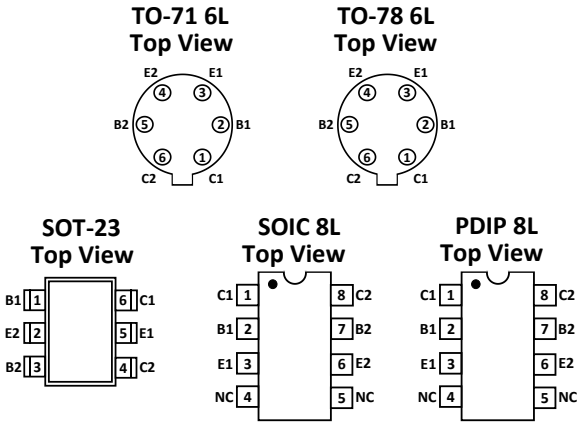
LS310/311/312/313

Monolithic Dual Matched NPN Transistor

LOW NOISE AND THERMALLY MATCHED MONOLITHIC DUAL NPN TRANSISTOR

Absolute Maximum Ratings @ 25 °C (unless otherwise stated)	
Maximum Temperatures	
Storage Temperature	-65 to +150°C
Junction Operating Temperature	-55 to +150°C
Maximum Power Dissipation	
Continuous Power Dissipation	400mW
Maximum Voltages	
Maximum Power Supply (LS312, see VCEO for others)	60V
Collector to Collector (LS312, see VCEO for others)	60V
Maximum Current	
Collector Current	40mA



Features

- Low Voltage Noise, 1.8nV/√Hz-typ at f=1kHz, IC=100µA
- Low Vbe Matching 0.5mV-max, 0.2mV-typ (LS312)
- Low Vbe Temperature Drift 0.5 µV/˚C-typ (LS312)
- High Current Gain 400-Min (LS313)
- High VCBO Breakdown Voltage-60V-min (LS312)
- High VCEO Breakdown Voltage-60V-min (LS312)
- High VCCO Breakdown Voltage +/-60V-min
- Dual PNP Counterpart Version: LS350/1/2

Benefits

- Unique Monolithic Dual Design Construction
- Improved System Noise Performance
- Wide Range of Parameter Operations
- Excellent Base-Emitter Voltage Differential (ΔVBE) and Drift
- Excellent Base Current Differential (IB1-IB2) and Drift
- High Frequency Performance
- Excellent Matching and Thermal Tracking
- High Voltage Operation-60V-min (LS312)

Applications

- Input Differential and Preamplifier Stages
- Multivibrator Circuits
- Music Synthesizers
- Current Sources
- Discreate Operational and Instrumentation Amplifiers
- Clocking Networks
- Voltage Controlled Oscillators
- Frequency Division

Description

The LS310/11/12/13 monolithic dual matched NPN transistors offer excellent matching characteristics and low voltage noise (refer to figure-14 for details.)

Low 2pF-max Cobo output capacitance further improves frequency characteristics and decreases signal distortion at the output. Low noise performance, low offset voltage and high bandwidth, make the products ideal for differential input stages and preamplifier applications.

Tight current gain matching, high current gain and high breakdown make the LS312 and LS313 an ideal choice for signal amplifying, accurate current biasing and mirroring circuits and designs.

LS310/11/12/13 output stages need very little error correction, due to their higher transconductance and have a positive temperature coefficient of current (Ib and Ic).

Due to high breakdown specifications, the products are suitable in high voltage applications requiring up to 60VMax. In addition to very small outline SOT-23 6L package, these products are available in TO-78 6L, TO-71 6L, PDIP 8L and SOIC 8L packages.

The LS310/11/12/13 is offered with custom electrical specifications called SELXXXX. Contact the factory for modified electrical specifications for these special versions of the LS310/11/12/13 SEL-XXXX.

Refer to LS350/1/2 products for dual PNP counterpart versions.

Electrical Characteristics @ 25 °C (Unless Otherwise Stated)

SYMBOL	CHARACTERISTICS	LS310	LS311	LS312	LS313		UNITS	CONDITIONS
BV_{CBO}	Collector to Base Voltage	25	45	60	45	MIN.	V	I_C = 10µA, 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 = 10µA, I_C = 0
BV_{CCO}	Collector to Collector Voltage	45	45	60	45	MIN.	V	I_C = 10µA, I_E = I_B = 0A
h_{FE}	DC Current Gain	150	150	200	400 1000	MIN. MAX.	--	I_C = 10µA, V_{CE} = 5V
h_{FE}	DC Current Gain	150	150	200	400	MIN.	--	I_C = 100µA, 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} = 5V
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	0.2	MAX.	nA	I_C = 0, V_{EB} = 3V
C_{OBO}	Output Capacitance	2	2	2	2	MAX.	pF	I_E = 0, V_{CB} = 5V, f = 1MHz
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} = 30V
f_T	Current Gain Bandwidth Product	200	200	200	200	MIN.	MHz	I_C = 1mA, V_{CE} = 5V
en	Voltage Noise	1.3	1.3	1.3	1.3	TYP.	nV/√Hz	VCE = 5V, IC = 1mA F = 1kHz, NBW = 1Hz
en	Voltage Noise	1.5	1.5	1.5	1.5	TYP.	nV/√Hz	VCE = 5V, IC = 1mA f = 10Hz, NBW = 1Hz
en	Voltage Noise	1.8	1.8	1.8	1.8	TYP.	nV/√Hz	VCE = 5V, IC = 100µA F = 1kHz, NBW = 1Hz
en	Voltage Noise	3.8	3.8	3.8	3.8	TYP.	nV/√Hz	VCE = 5V, IC = 100µA F = 10Hz, NBW = 1Hz

Notes

1. Absolute maximum ratings are limiting values above which serviceability may be impaired.
2. Pulse Test: PW ≤ 300µs, Duty Cycle ≤ 3%
3. All characteristics MIN/TYP/MAX numbers are absolute values. Negative values indicate electrical polarity only.

Typical Characteristics

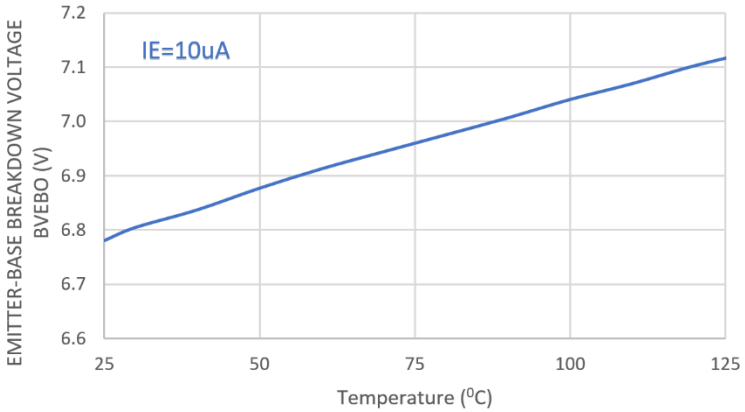


Figure-1 BVEBO(V) vs. Temperature

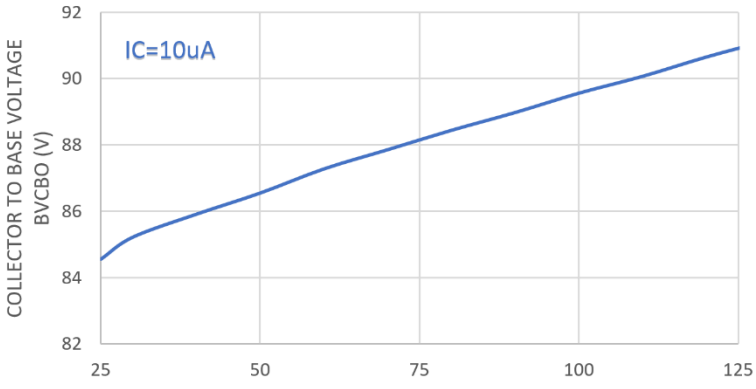


Figure-2 BVCBO(V) vs. Temperature

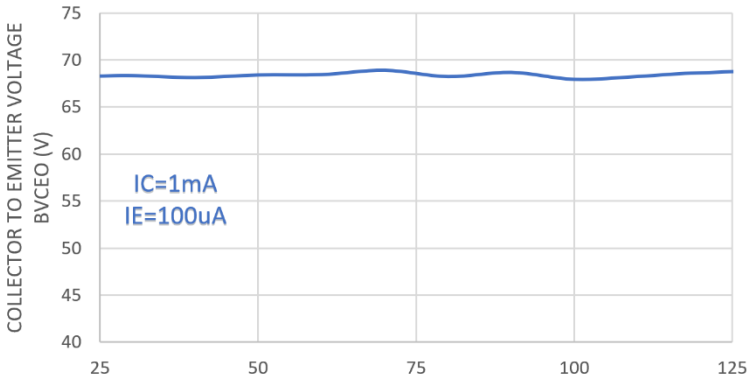


Figure-3 BVCEO(V) vs. Temperature

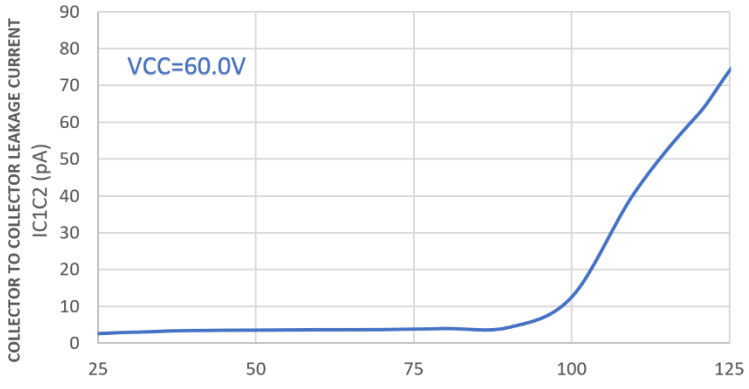


Figure-4 COLLECTOR TO COLLECTOR CURRENT LEAKAGE(pA) vs. Temperature

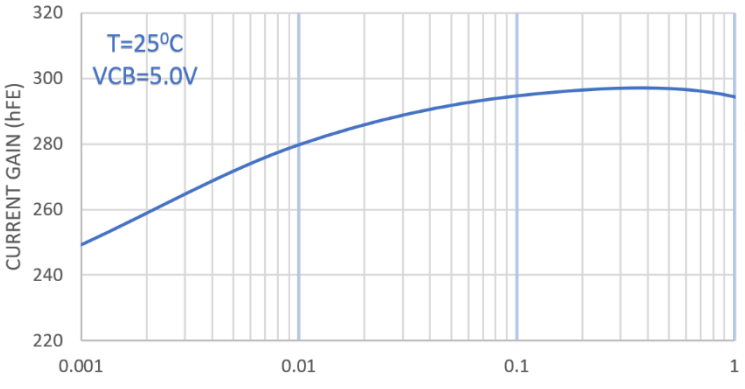


Figure-5 COLLECTOR CURRENT vs. CURRENT GAIN (hFE)

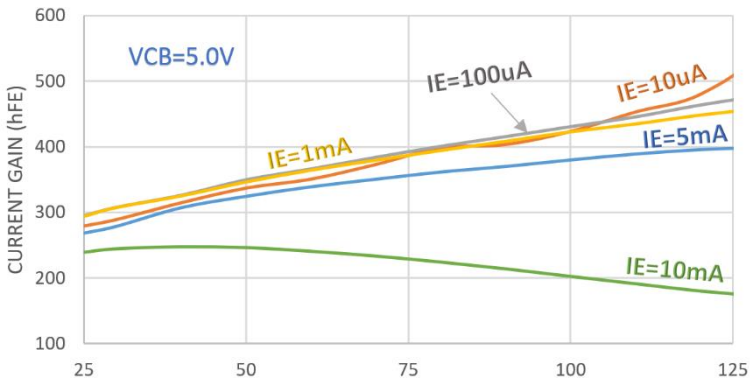


Figure-6 CURRENT GAIN(hFE) vs. Temperature

Typical Characteristics

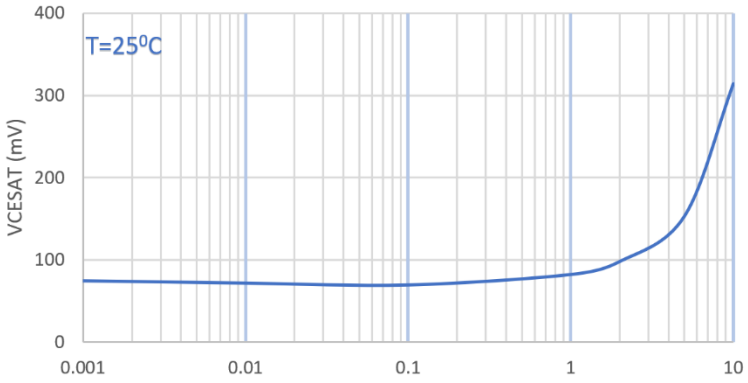


Figure-7 COLLECTOR CURRENT(mA) vs. VCE_{SAT}(mV)

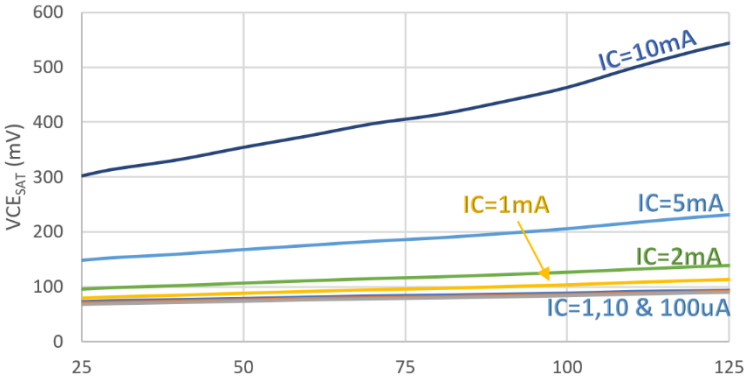


Figure-8 VCE_{SAT}(mV) vs. Temperature

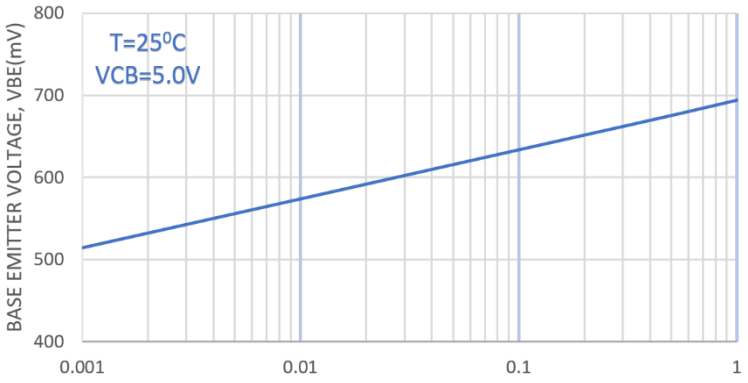


Figure-9 COLLECTOR CURRENT(mA) vs. BASE EMITTER VOLTAGE(V)

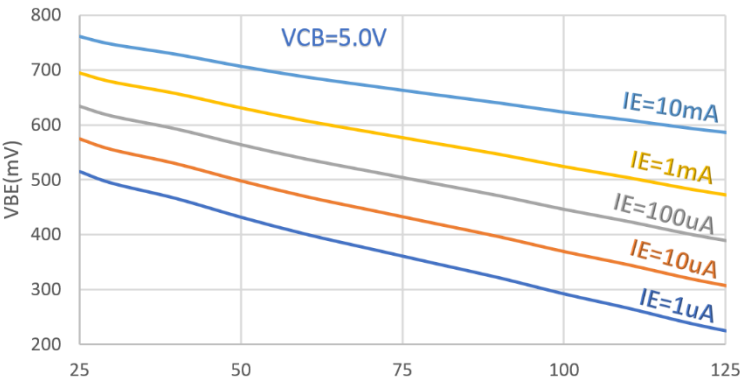


Figure-10 VBE(mV) vs. Temperature

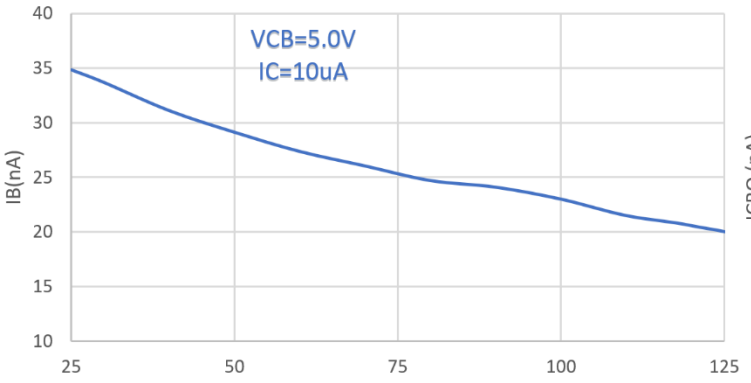


Figure-11 IB(nA) vs. Temperature

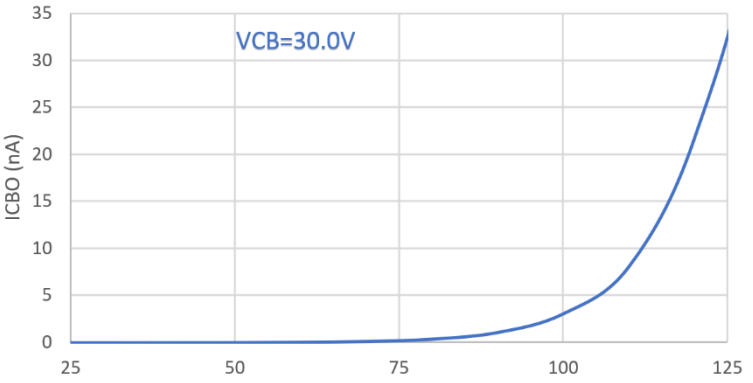


Figure-12 ICBO(nA) vs. Temperature

Typical Characteristics

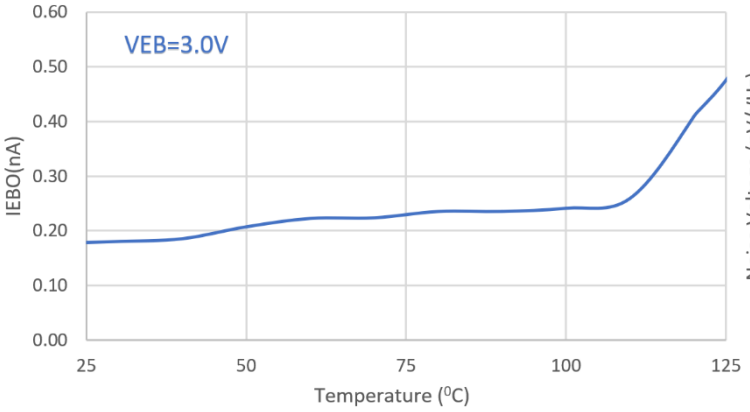


Figure-13 IEBO(nA) vs. Temperature

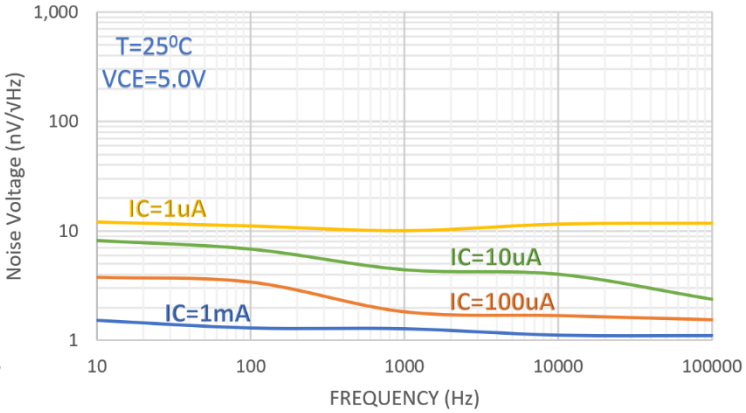


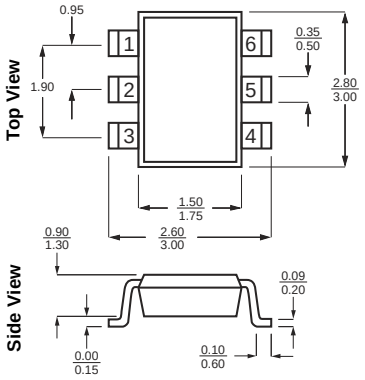
Figure-14 NOISE VOLTAGE vs. FREQUENCY

Ordering Information

Standard Part Call-Out
LS310/311/312/313 TO-71 6L RoHS
LS310/311/312/313 TO-78 6L RoHS
LS310/311/312/313 PDIP 8L RoHS
LS310/311/312/313 SOIC 8L RoHS
LS310/311/312/313 SOT-23 6L RoHS
Custom Part Call-out Custom Parts Include SEL+4 Digit Numeric Code
LS310/311/312/313 TO-71 6L RoHS SELXXXX
LS310/311/312/313 TO-78 6L RoHS SELXXXX
LS310/311/312/313 PDIP 8L RoHS SELXXXX
LS310/311/312/313 SOIC 8L RoHS SELXXXX
LS310/311/312/313 SOT-23 6L RoHS SELXXXX

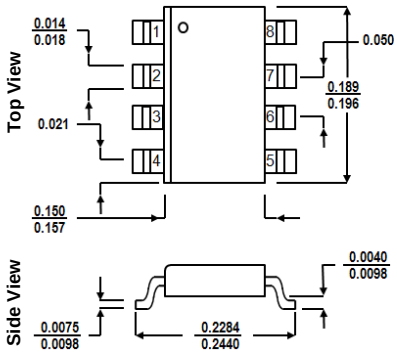
Package Dimensions

SOT-23 6 Lead



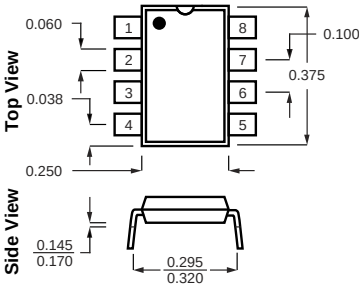
DIMENSIONS IN MILLIMETERS

SOIC-A 8 Lead



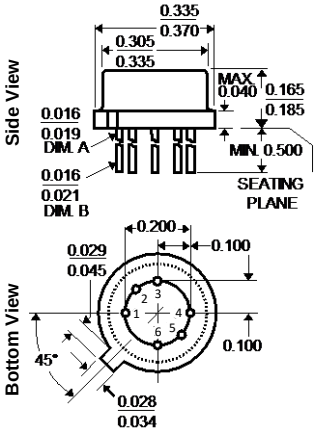
DIMENSIONS IN INCHES

PDIP 8 Lead



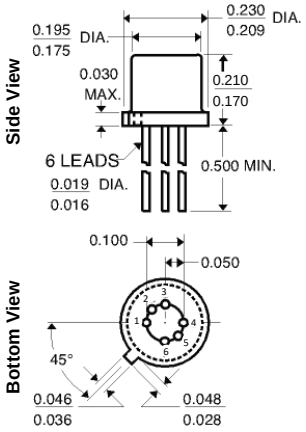
DIMENSIONS IN INCHES

TO-78 6 Lead



DIMENSIONS IN INCHES

TO-71 6 Lead



DIMENSIONS IN INCHES