

## SMALL SIGNAL NPN TRANSISTOR

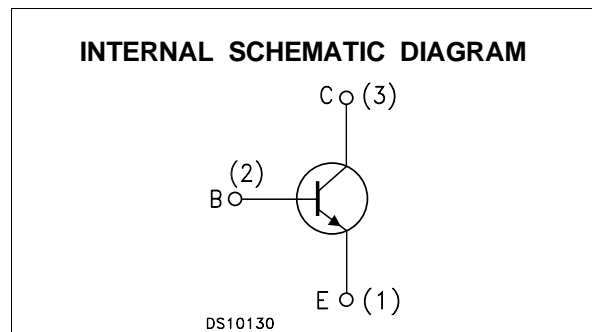
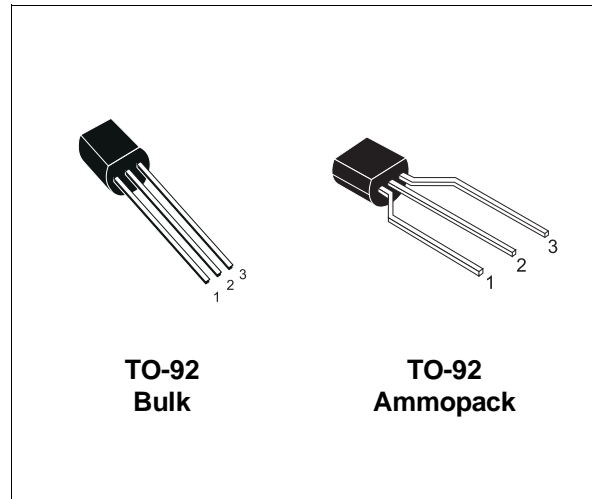
### PRELIMINARY DATA

Ordering Code	Marking	Package / Shipment
2N3904	2N3904	TO-92 / Bulk
2N3904-AP	2N3904	TO-92 / Ammopack

- SILICON EPITAXIAL PLANAR NPN TRANSISTOR
- TO-92 PACKAGE SUITABLE FOR THROUGH-HOLE PCB ASSEMBLY
- THE PNP COMPLEMENTARY TYPE IS 2N3906

### APPLICATIONS

- WELL SUITABLE FOR TV AND HOME APPLIANCE EQUIPMENT
- SMALL LOAD SWITCH TRANSISTOR WITH HIGH GAIN AND LOW SATURATION VOLTAGE



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-Base Voltage ( $I_E = 0$ )	60	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	40	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	6	V
$I_C$	Collector Current	200	mA
$P_{tot}$	Total Dissipation at $T_C = 25\text{ }^\circ\text{C}$	625	mW
$T_{stg}$	Storage Temperature	-65 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature	150	$^\circ\text{C}$

## THERMAL DATA

R <sub>thj-amb</sub> •	Thermal Resistance Junction-Ambient	Max	200	°C/W
R <sub>thj-case</sub> •	Thermal Resistance Junction-Case	Max	83.3	°C/W

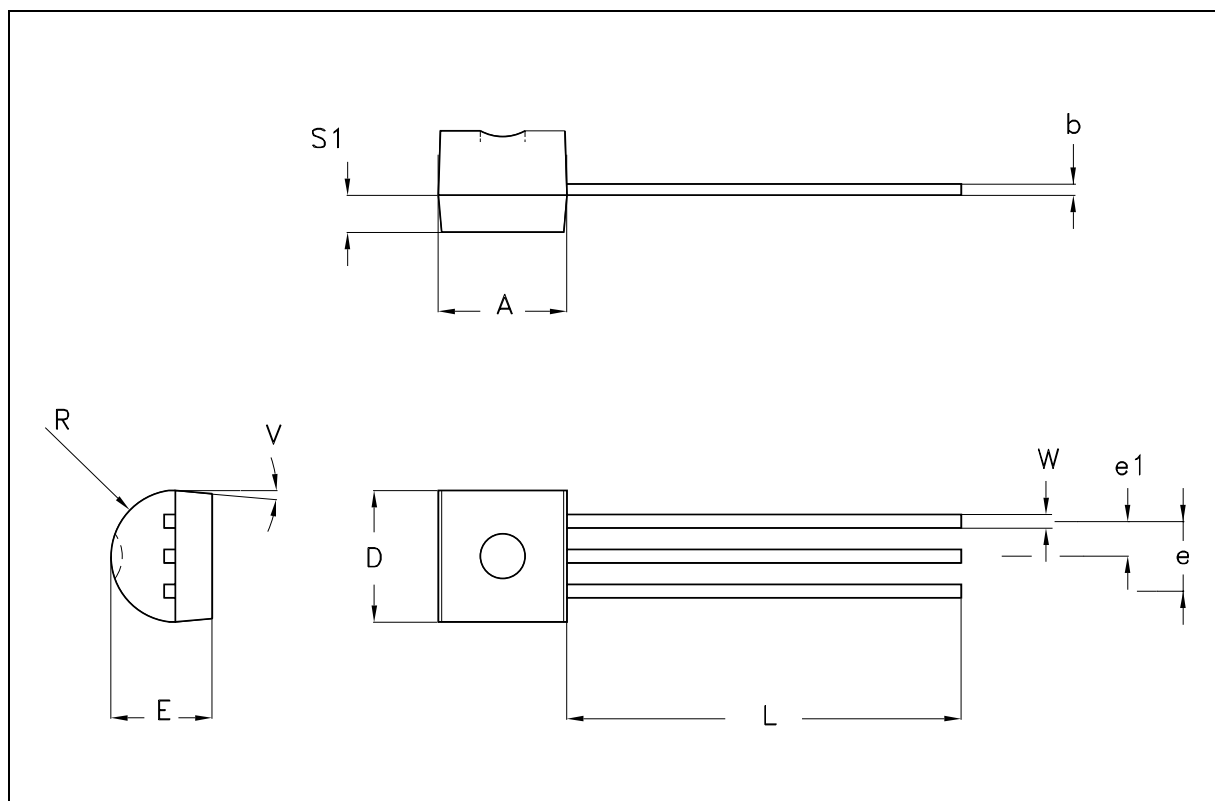
ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>CEX</sub>	Collector Cut-off Current (V <sub>BE</sub> = -3 V)	V <sub>CE</sub> = 30 V			50	nA
I <sub>BEX</sub>	Base Cut-off Current (V <sub>BE</sub> = -3 V)	V <sub>CE</sub> = 30 V			50	nA
V <sub>(BR)CEO*</sub>	Collector-Emitter Breakdown Voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 1 mA	40			V
V <sub>(BR)CBO</sub>	Collector-Base Breakdown Voltage (I <sub>E</sub> = 0)	I <sub>C</sub> = 10 μA	60			V
V <sub>(BR)EBO</sub>	Emitter-Base Breakdown Voltage (I <sub>C</sub> = 0)	I <sub>E</sub> = 10 μA	6			V
V <sub>CE(sat)*</sub>	Collector-Emitter Saturation Voltage	I <sub>C</sub> = 10 mA    I <sub>B</sub> = 1 mA I <sub>C</sub> = 50 mA    I <sub>B</sub> = 5 mA			0.2 0.2	V V
V <sub>BE(sat)*</sub>	Base-Emitter Saturation Voltage	I <sub>C</sub> = 10 mA    I <sub>B</sub> = 1 mA I <sub>C</sub> = 50 mA    I <sub>B</sub> = 5 mA	0.65		0.85 0.95	V V
h <sub>FE*</sub>	DC Current Gain	I <sub>C</sub> = 0.1 mA    V <sub>CE</sub> = 1 V I <sub>C</sub> = 1 mA       V <sub>CE</sub> = 1 V I <sub>C</sub> = 10 mA      V <sub>CE</sub> = 1 V I <sub>C</sub> = 50 mA      V <sub>CE</sub> = 1 V I <sub>C</sub> = 100 mA     V <sub>CE</sub> = 1 V	60 80 100 60 30		300	
f <sub>T</sub>	Transition Frequency	I <sub>C</sub> = 10 mA    V <sub>CE</sub> = 20 V    f = 100 MHz	250	270		MHz
C <sub>CB0</sub>	Collector-Base Capacitance	I <sub>E</sub> = 0    V <sub>CB</sub> = 10 V    f = 1 MHz		4		pF
C <sub>EBO</sub>	Emitter-Base Capacitance	I <sub>C</sub> = 0    V <sub>EB</sub> = 0.5 V    f = 1 MHz		18		pF
NF	Noise Figure	V <sub>CE</sub> = 5 V    I <sub>C</sub> = 0.1 mA    f = 10 Hz to 15.7 KHz    R <sub>G</sub> = 1 KΩ		5		dB
t <sub>d</sub>	Delay Time	I <sub>C</sub> = 10 mA    I <sub>B</sub> = 1 mA			35	ns
t <sub>r</sub>	Rise Time	V <sub>CC</sub> = 30 V			35	ns
t <sub>s</sub>	Storage Time	I <sub>C</sub> = 10 mA    I <sub>B1</sub> = -I <sub>B2</sub> = 1 mA			200	ns
t <sub>f</sub>	Fall Time	V <sub>CC</sub> = 30 V			50	ns

\* Pulsed: Pulse duration = 300 μs, duty cycle ≤ 2 %

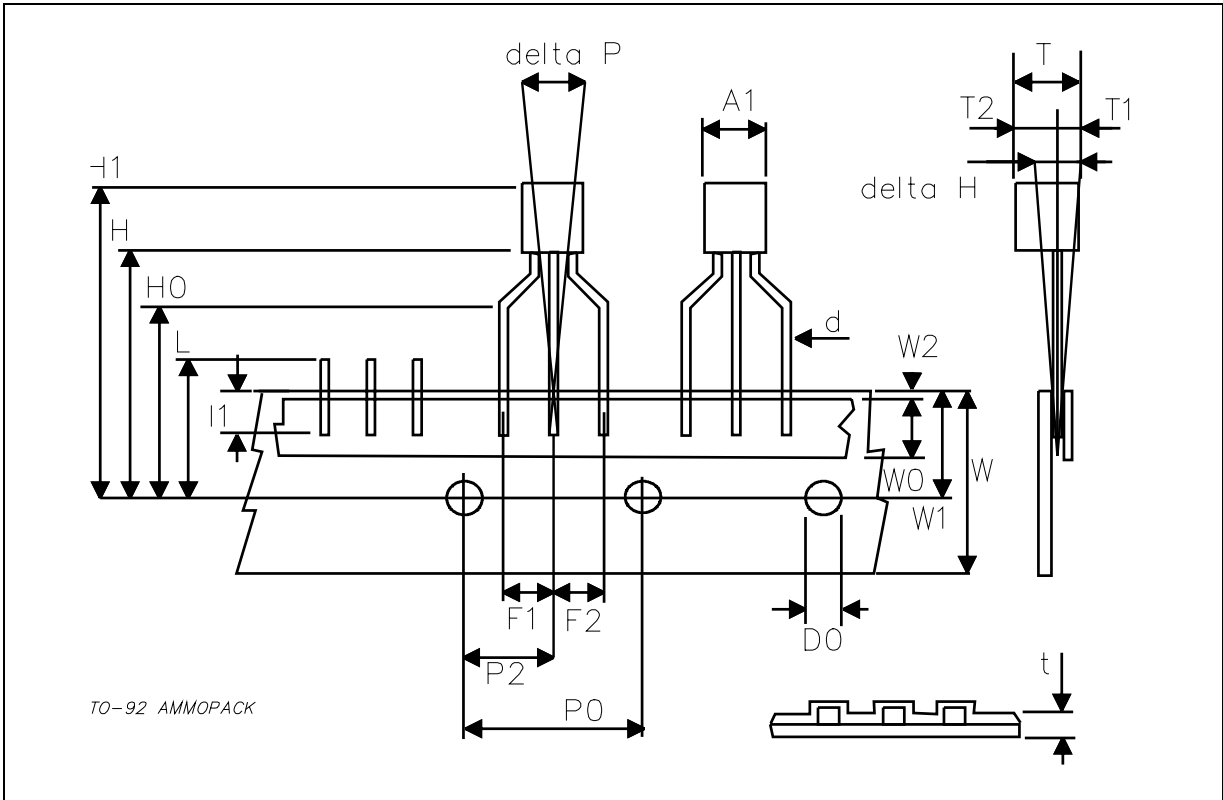
## TO-92 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	0.170		0.195
b	0.36		0.51	0.014		0.020
D	4.45		4.95	0.175		0.194
E	3.30		3.94	0.130		0.155
e	2.41		2.67	0.095		0.105
e1	1.14		1.40	0.045		0.055
L	12.70		15.49	0.500		0.609
R	2.16		2.41	0.085		0.094
S1	1.14		1.52	0.045		0.059
W	0.41		0.56	0.016		0.022
V	4 degree		6 degree	4 degree		6 degree



**TO-92 AMMOPACK SHIPMENT (Suffix"-AP") MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A1			4.80			0.189
T			3.80			0.150
T1			1.60			0.063
T2			2.30			0.091
d			0.48			0.019
P0	12.50	12.70	12.90	0.492	0.500	0.508
P2	5.65	6.35	7.05	0.222	0.250	0.278
F1,F2	2.44	2.54	2.94	0.096	0.100	0.116
delta H	-2.00		2.00	-0.079		0.079
W	17.50	18.00	19.00	0.689	0.709	0.748
W0	5.70	6.00	6.30	0.224	0.236	0.248
W1	8.50	9.00	9.25	0.335	0.354	0.364
W2			0.50			0.020
H	18.50		20.50	0.728		0.807
H0	15.50	16.00	16.50	0.610	0.630	0.650
H1			25.00			0.984
D0	3.80	4.00	4.20	0.150	0.157	0.165
t			0.90			0.035
L			11.00			0.433
I1	3.00			0.118		
delta P	-1.00		1.00	-0.039		0.039



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics

© 2003 STMicroelectronics – Printed in Italy – All Rights Reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

<http://www.st.com>