



2N3904

SMALL SIGNAL NPN TRANSISTOR

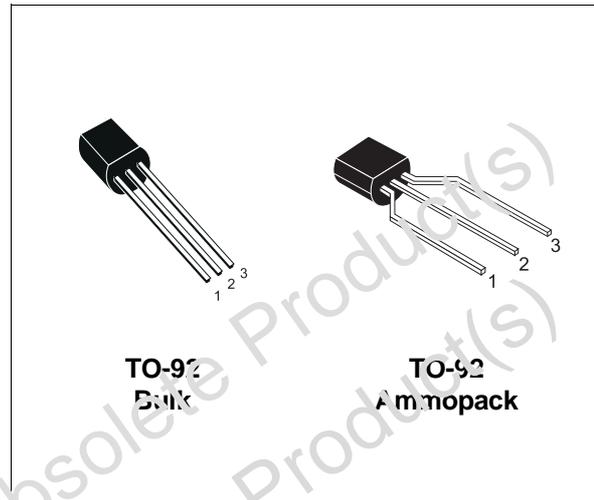
PRELIMINARY DATA

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

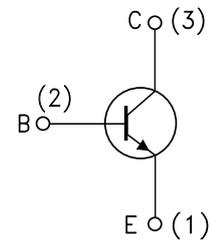
- SILICON EPITAXIAL PLANAR NPN TRANSISTOR
- TO-92 PACKAGE SUITABLE FOR THROUGH-HOLE PCB ASSEMBLY
- THE PNP COMPLEMENTARY TYPE IS 2N3906

APPLICATIONS

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



INTERNAL SCHEMATIC DIAGRAM



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 $T_C = 25^\circ\text{C}$	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 _{thj-amb}	Thermal Resistance Junction-Ambient	Max	200	°C/W
R _{thj-case}	Thermal Resistance Junction-Case	Max	83.3	°C/W

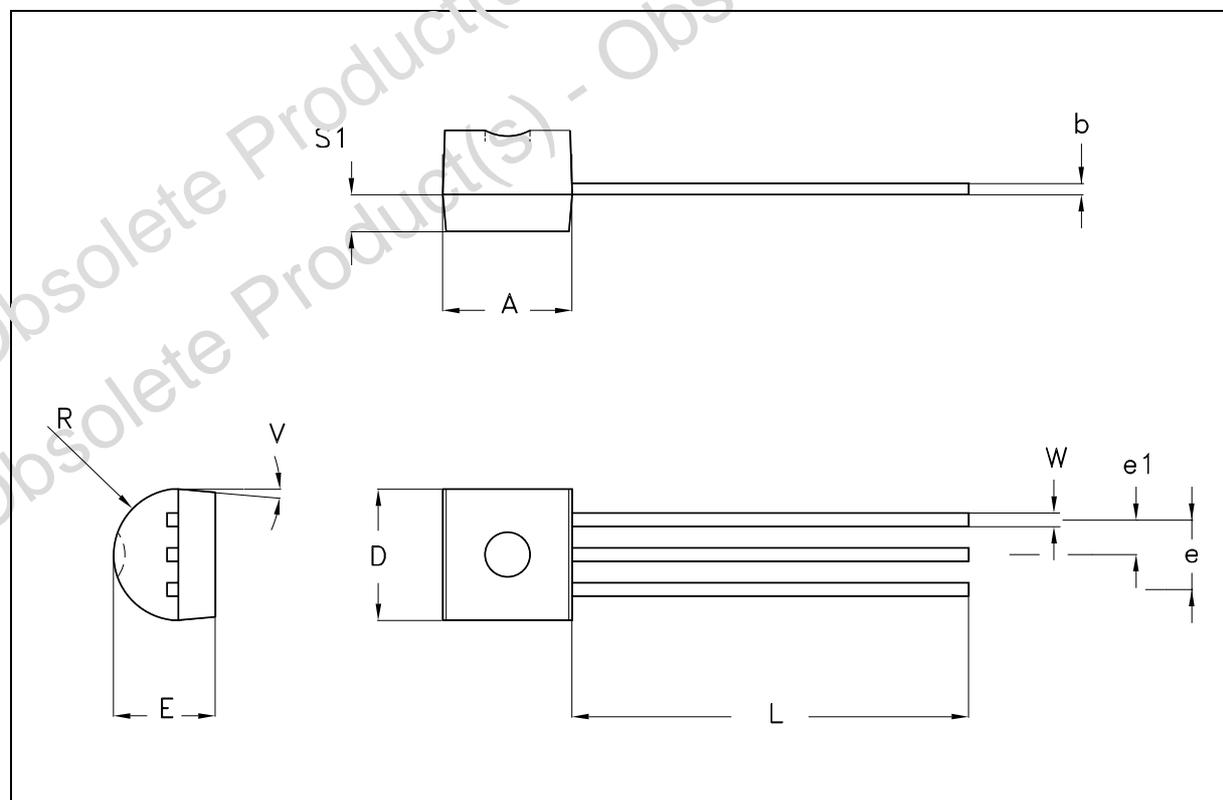
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

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

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

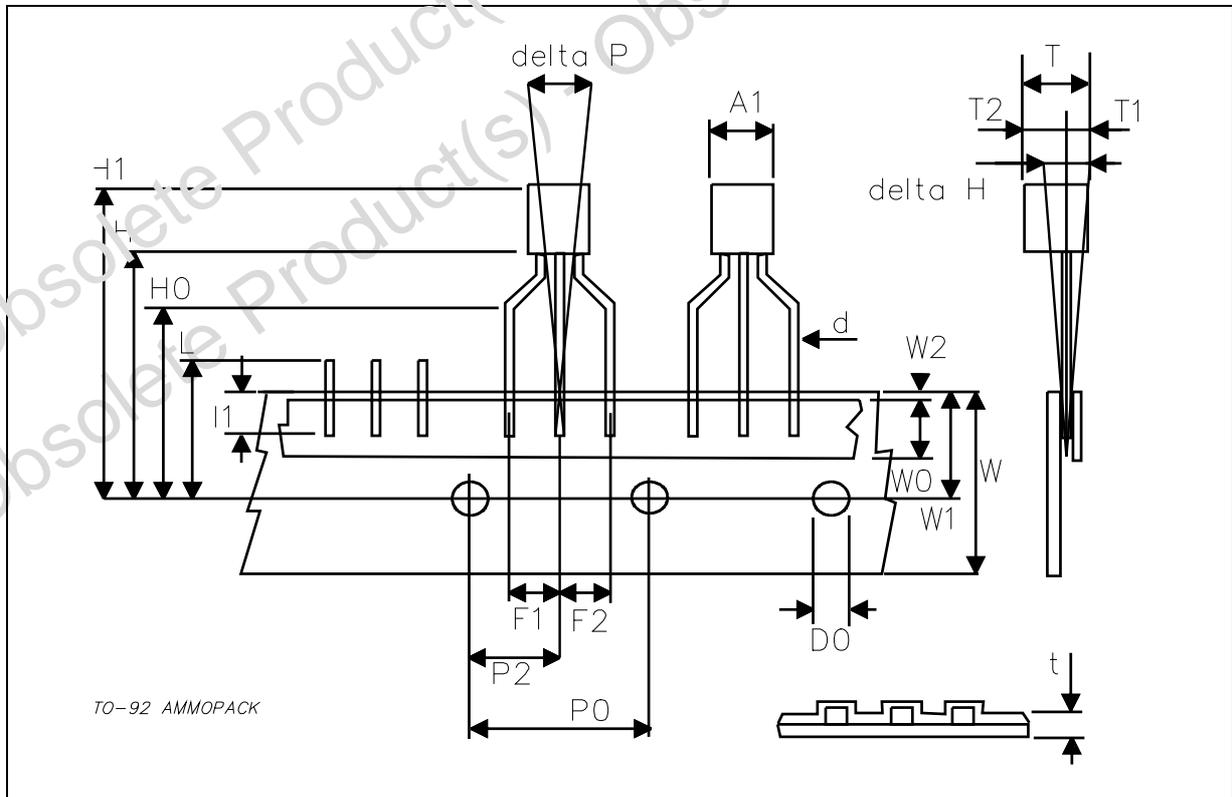
TO-92 MECHANICAL DATA

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			0.30			0.035
L			11.00			0.433
I1	3.00			0.118		
delta P	-1.00		1.00	-0.039		0.039



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