

SMALL SIGNAL NPN TRANSISTOR

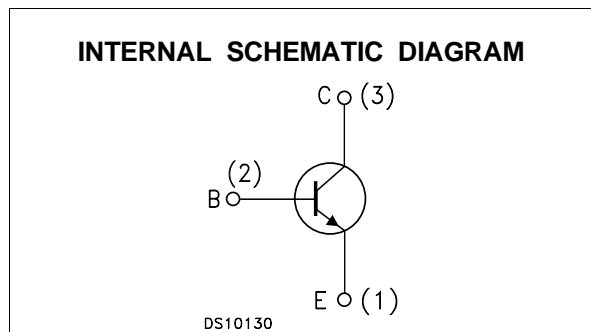
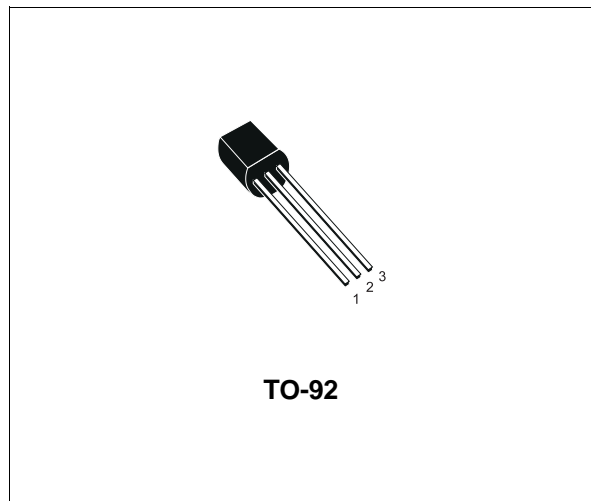
PRELIMINARY DATA

Type	Marking
2N3904	2N3904

- 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

$R_{thj-amb}$	Thermal Resistance Junction-Ambient	Max	200	$^{\circ}\text{C}/\text{W}$
$R_{thj-case}$	Thermal Resistance Junction-Case	Max	83.3	$^{\circ}\text{C}/\text{W}$

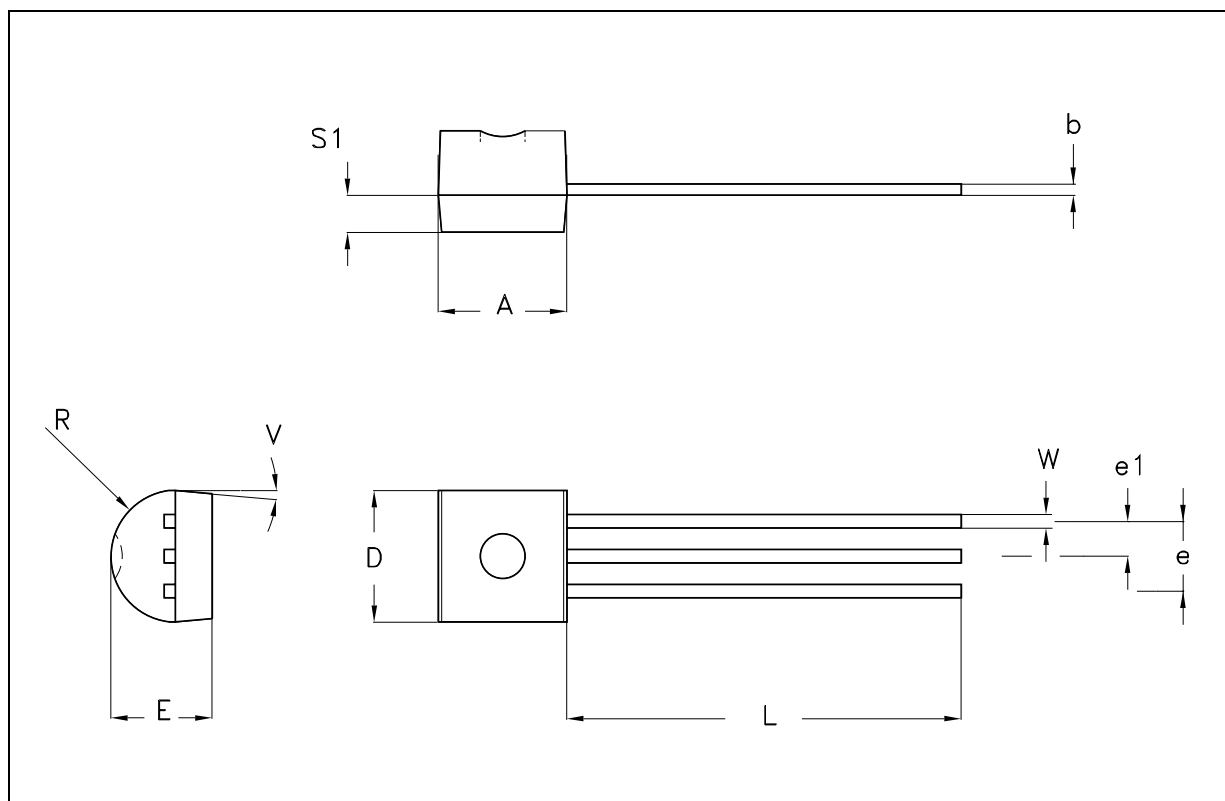
ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector Cut-off Current ($V_{BE} = -3\text{ V}$)	$V_{CE} = 30\text{ V}$			50	nA
I_{BEX}	Base Cut-off Current ($V_{BE} = -3\text{ V}$)	$V_{CE} = 30\text{ V}$			50	nA
$V_{(BR)CEO}^*$	Collector-Emitter Breakdown Voltage ($I_B = 0$)	$I_C = 1\text{ mA}$	40			V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage ($I_E = 0$)	$I_C = 10\text{ }\mu\text{A}$	60			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage ($I_C = 0$)	$I_E = 10\text{ }\mu\text{A}$	6			V
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 10\text{ mA}$ $I_B = 1\text{ mA}$ $I_C = 50\text{ mA}$ $I_B = 5\text{ mA}$			0.2 0.2	V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 10\text{ mA}$ $I_B = 1\text{ mA}$ $I_C = 50\text{ mA}$ $I_B = 5\text{ mA}$	0.65		0.85 0.95	V V
h_{FE}^*	DC Current Gain	$I_C = 0.1\text{ mA}$ $V_{CE} = 1\text{ V}$ $I_C = 1\text{ mA}$ $V_{CE} = 1\text{ V}$ $I_C = 10\text{ mA}$ $V_{CE} = 1\text{ V}$ $I_C = 50\text{ mA}$ $V_{CE} = 1\text{ V}$ $I_C = 100\text{ mA}$ $V_{CE} = 1\text{ V}$	60 80 100 60 30		300	
f_T	Transition Frequency	$I_C = 10\text{ mA}$ $V_{CE} = 20\text{ V}$ $f = 100\text{ MHz}$	250	270		MHz
C_{CBO}	Collector-Base Capacitance	$I_E = 0$ $V_{CB} = 10\text{ V}$ $f = 1\text{ MHz}$		4		pF
C_{EBO}	Emitter-Base Capacitance	$I_C = 0$ $V_{EB} = 0.5\text{ V}$ $f = 1\text{ MHz}$		18		pF
NF	Noise Figure	$V_{CE} = 5\text{ V}$ $I_C = 0.1\text{ mA}$ $f = 10\text{ Hz}$ to 15.7 KHz $R_G = 1\text{ K}\Omega$		5		dB
t_d	Delay Time	$I_C = 10\text{ mA}$ $I_B = 1\text{ mA}$			35	ns
t_r	Rise Time	$V_{CC} = 30\text{ V}$			35	ns
t_s	Storage Time	$I_C = 10\text{ mA}$ $I_{B1} = -I_{B2} = 1\text{ mA}$			200	ns
t_f	Fall Time	$V_{CC} = 30\text{ V}$			50	ns

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

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



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