2N3904

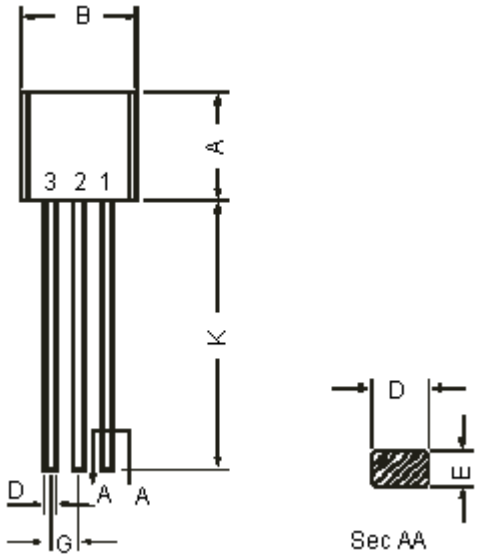
General Purpose Transistors NPN TO-92

High Speed Switching

Features:

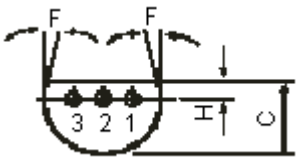
- NPN silicon planar switching transistors.
- Fast switching devices exhibiting short turn-off and low saturation voltage characteristics.
- General purpose switching and amplifier applications.

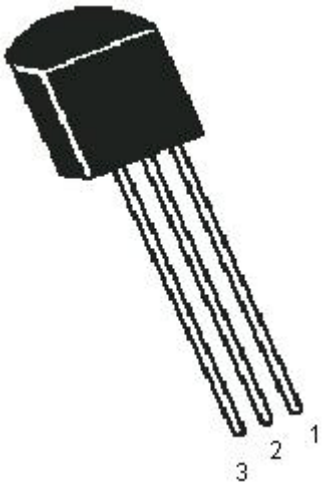
TO-92 Plastic Package



Dimensions	Minimum	Maximum
A	4.32	5.33
B	4.45	5.20
C	3.18	4.19
D	0.41	0.55
E	0.35	0.50
F	5°	
G	1.14	1.40
H		1.53
K	12.70	-

Dimensions : Millimetres





Pin Configuration:

1. Collector
2. Base
3. Emitter

Absolute Maximum Ratings

Description	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Collector-Base Voltage	V_{CBO}	60	
Emitter-Base Voltage	V_{EBO}	6.0	
Collector Current Continuous	I_C	200	mA
Power Dissipation at T_a = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Power Dissipation at T_c= 25°C Derate above 25°C		1.5 12	W mW/°C
Operating and Storage JunctionTemperature Range	T_j, T_{stg}	-55 to +150	°C
Thermal Resistance			
Junction to Case	$R_{th\ (j-c)}$	83.3	°C/W
Junction to Ambient	$R_{th\ (j-a)}$	200	

Electrical Characteristics (T_a = 25°C unless otherwise specified)

Description	Symbol	Test Condition	2N3904	Unit
Collector-Emitter Voltage	*V_{CEO}	I_C = 10mA, I_B = 0	>40	V
Collector-Base Voltage	V_{CBO}	I_C = 10µA, I_E = 0	>60	
Emitter-Base Voltage	V_{EBO}	I_E = 10µA, I_C = 0	>6.0	
Collector-Cut off Current	I_{CEX}	V_{CE} = 30V, V_{EB} = 3V	<50	nA
Base Current	I_{BL}			
DC Current Gain	*h_{FE}	I_C = 0.1mA, V_{CE} = 1V I_C = 1mA, V_{CE} = 1V I_C = 10mA, V_{CE} = 1V I_C = 50mA, V_{CE} = 1V I_C = 100mA, V_{CE} = 1V	>40 >70 100 - 300 >60 >30	-
Collector Emitter Saturation Voltage	*$V_{CE\ (sat)}$	I_C = 10mA, I_B = 1mA	<0.20 <0.30	V
Base Emitter Saturation Voltage	*$V_{BE\ (sat)}$	I_C = 50mA, I_B = 5mA	0.65 - 0.85 <0.95	V

Electrical Characteristics (T_a = 25°C unless otherwise specified)

Description	Symbol	Test Condition	2N3904	Units
Small Signal Characteristic				
Transistors Frequency	f_T	I_C = 10mA, V_{CE} = 20V, f = 100MHz	>300	MHz
Output Capacitance	C_{ob}	V_{CB} = 5V, I_E = 0, f = 1MHz	<4.0	pF
Input Capacitance	C_{ib}	V_{BE} = 0.5V, I_C = 0, f = 1MHz All f = kHz	<8.0	
Small Signal Current Gain	h_{fe}	I_C = 1mA, V_{CE} = 10V	100 - 400	-
Input Impedance	h_{ie}		1.0 - 10	kΩ
Output Admittance	h_{oe}		1.0 - 40	umhos
Voltage Feedback Ratio	h_{re}		0.5 - 0.8	x 10^{-4}
Noise Figure	NF	I_C = 100µA, V_{CE} = 5V	<5.0	dB
Switching Time				
Delay Time	t_d	V_{CC} = 3V, V_{BE} = 0.5V	<35	ns
Rise Time	t_r	I_C = 10mA, I_{B1} = 1mA		
Storage Time	t_s	V_{CC} = 3V, I_C = 10mA I_{B1} = I_{B2} = 1mA	<200	
Fall Time	t_f	-	<50	

*Pulse Condition: = 300µs, Duty Cycle = 2%

Specifications

V_{CEO} Maximum (V)	I_C Maximum (A)	$V_{CE\ (sat)}$ Maximum (V) at I_C = 10mA	t_{off} Maximum (ns) at I_C = 10mA	h_{FE} Minimum at I_C = 10mA	P_{tot} at 25°C (mW)	Package and Pin Out	Part Number
40	0.2	0.2	250	100	500	TO-92	2N3904

2N3904

General Purpose Transistors NPN TO-92

Notes:

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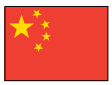

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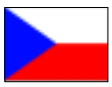

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