

# Transistors

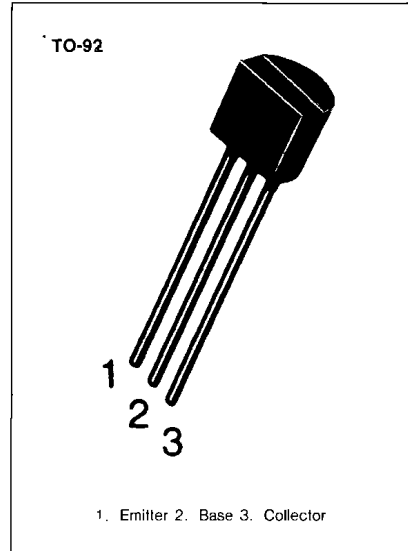
## 2N3904

### GENERAL PURPOSE TRANSISTOR

- Collector-Emitter Voltage:  $V_{CE0} = 40V$
- Collector Dissipation:  $P_C (\text{max}) = 625mW$

### ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ C$ )

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	$V_{CBO}$	60	V
Collector-Emitter Voltage	$V_{CEO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	6	V
Collector Current	$I_C$	200	mA
Collector Dissipation	$P_C$	625	mW
Junction Temperature	$T_J$	150	$^\circ C$
Storage Temperature	$T_{stg}$	-55 ~ 150	$^\circ C$



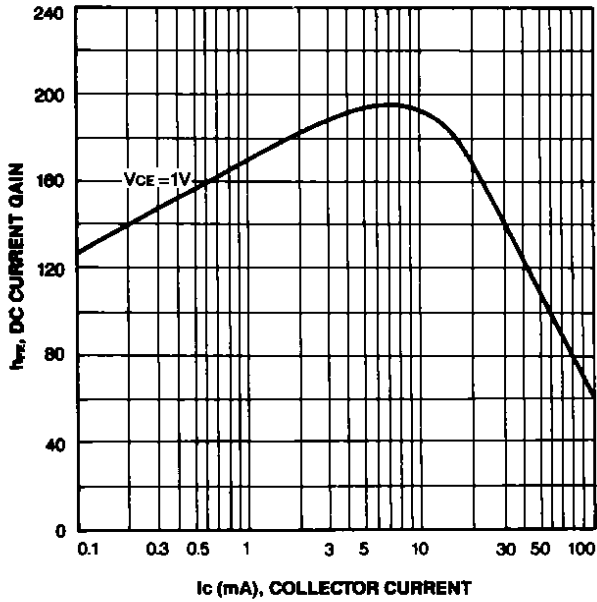
### ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ C$ )

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	$BV_{CBO}$	$I_C = 10\mu A, I_E = 0$	60			V
* Collector-Emitter Breakdown Voltage	$BV_{CEO}$	$I_C = 1mA, I_B = 0$	40			V
Emitter-Base Breakdown Voltage	$BV_{EBO}$	$I_E = 10\mu A, I_C = 0$	6			V
Collector Cut-off Current	$I_{CEX}$	$V_{CE} = 30V, V_{EB} = 3V$			50	nA
Base Cut-off Current	$I_{BL}$	$V_{CE} = 30V, V_{EB} = 3V$			50	nA
* DC Current Gain	$h_{FE}$		40			
			70			
			100		300	
			60			
			30			
* Collector-Emitter Saturation Voltage	$V_{CE} (\text{sat})$	$I_C = 10mA, I_B = 1mA$			0.2	V
		$I_C = 50mA, I_B = 5mA$			0.3	V
* Base-Emitter Saturation Voltage	$V_{BE} (\text{sat})$	$I_C = 10mA, I_B = 1mA$	0.65		0.85	V
		$I_C = 50mA, I_B = 5mA$			0.95	V
Output Capacitance	$C_{OB}$	$V_{CB} = 5V, I_E = 0$			4	pF
		$f = 1MHz$				
Current Gain Bandwidth Product	$f_T$	$V_{CE} = 20V, I_C = 10mA$				
		$f = 100MHz$	300			MHz
Turn On Time	$t_{ON}$	$V_{CC} = 3V, V_{BE} = 0.5V$			70	ns
		$I_C = 10mA, I_{B1} = 1mA$				
Turn Off Time	$t_{OFF}$	$V_{CC} = 3V, I_C = 10mA$				
		$I_{B1} = I_{B2} = 1mA$			250	ns

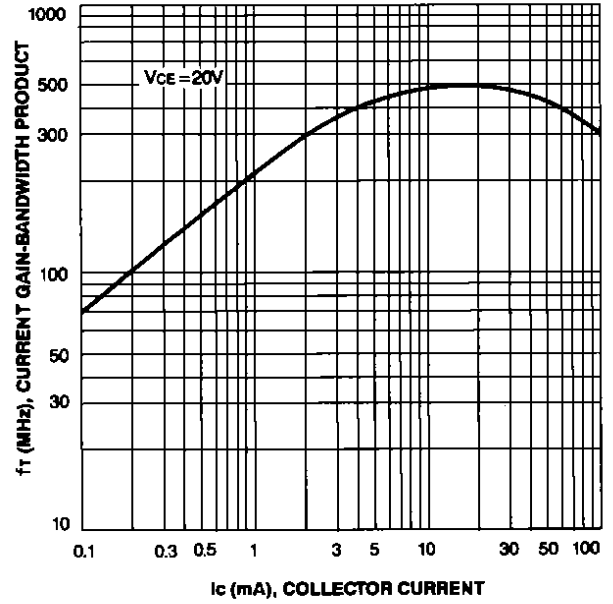
\*Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$



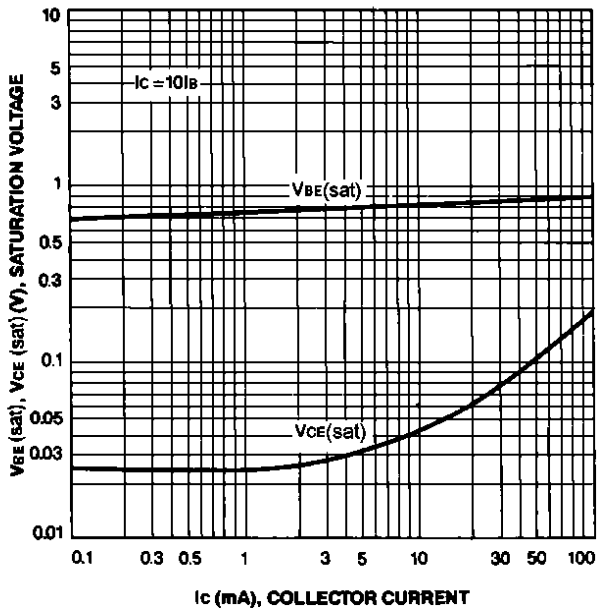
**DC CURRENT GAIN**



**CURRENT GAIN-BANDWIDTH PRODUCT**



**BASE-EMITTER SATURATION VOLTAGE  
COLLECTOR-EMITTER SATURATION VOLTAGE**



**OUTPUT CAPACITANCE**

