



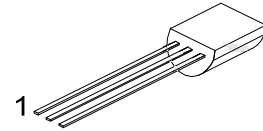
## 2N3904

## NPN SILICON TRANSISTOR

### NPN GENERAL PURPOSE AMPLIFIER

#### ■ FEATURES

- \* Collector-Emitter Voltage:  $V_{CEO}=40V$
- \* Collector Dissipation:  $P_{C(MAX)}=625mW$
- \* Complementary to 2N3906



TO-92

#### ■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N3904L-T92-B	2N3904G-T92-B	TO-92	E	B	C	Tape Box
2N3904L-T92-K	2N3904G-T92-K	TO-92	E	B	C	Bulk
2N3904L-T92-R	2N3904G-T92-R	TO-92	E	B	C	Tape Reel

<p>2N3904L-T92-B</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Free</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel</p> <p>(2) T92: TO-92</p> <p>(3) G: Halogen Free, L: Lead Free</p>
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■ ABSOLUTE MAXIMUM RATING ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	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	$^{\circ}\text{C}$
Operating and Storage Temperature	$T_{STG}$	-55 ~ +150	$^{\circ}\text{C}$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

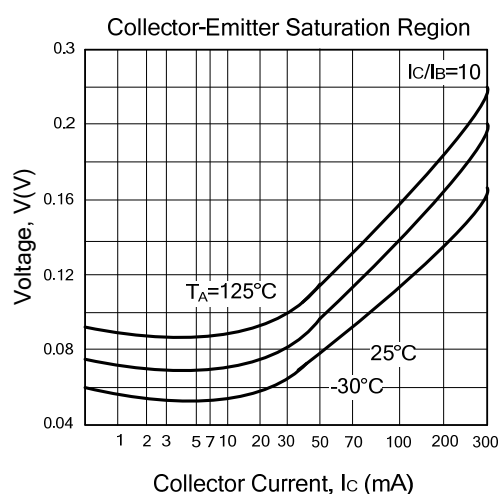
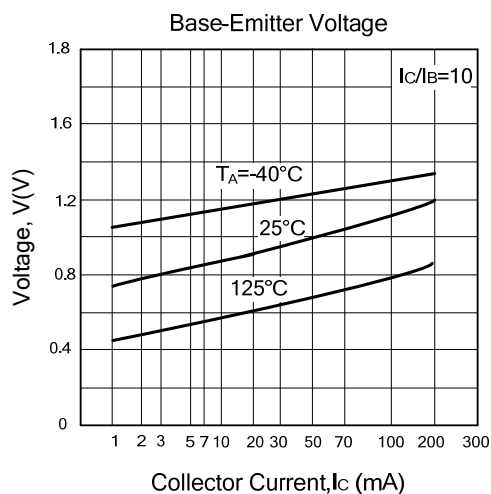
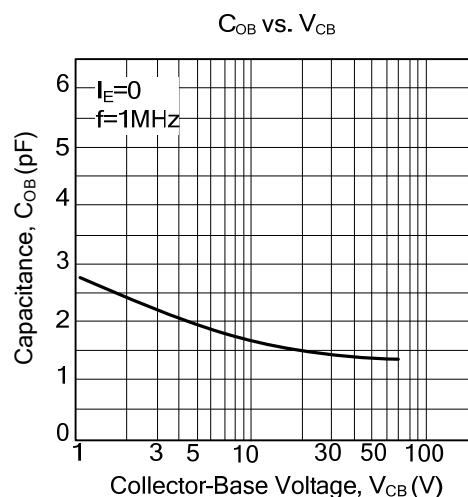
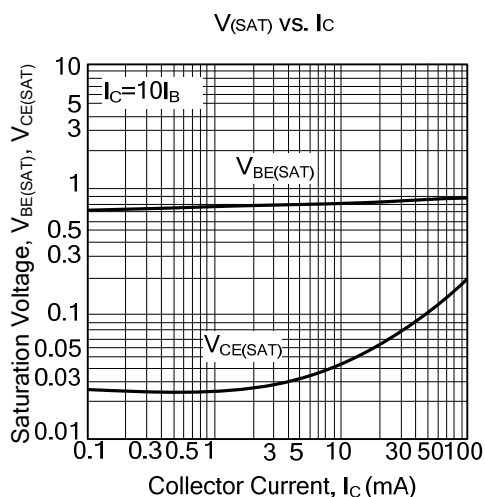
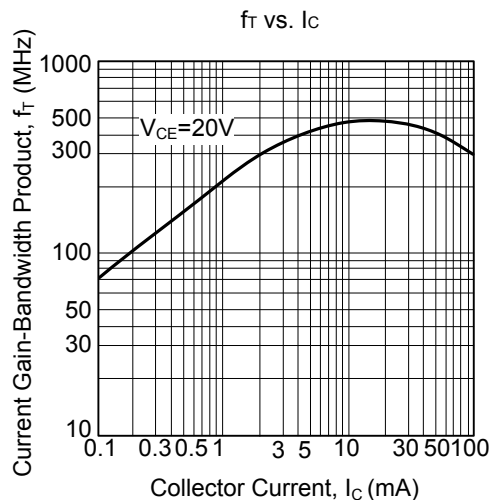
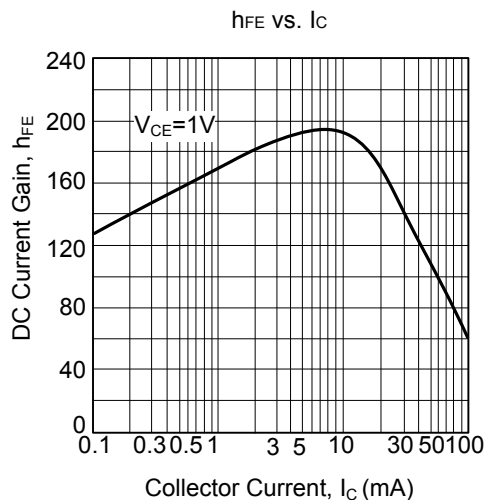
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified)

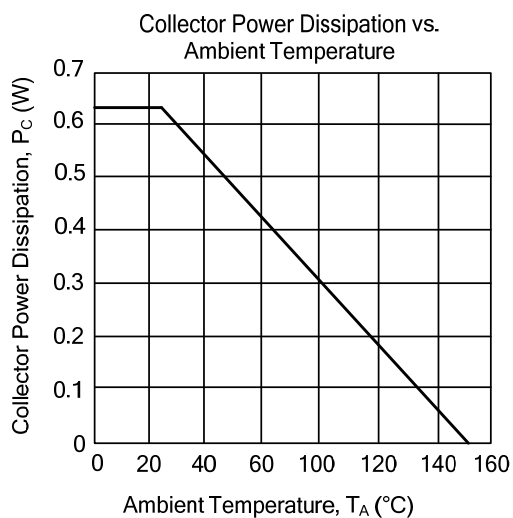
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Collector-Base Breakdown Voltage	$BV_{CBO}$	$I_C=10\mu\text{A}$ , $I_E=0$	60			V
Collector-Emitter Breakdown Voltage	$BV_{CEO}$	$I_C=1\text{mA}$ , $I_B=0$ (Note)	40			V
Emitter-Base Breakdown Voltage	$BV_{EBO}$	$I_E=10\mu\text{A}$ , $I_C=0$	6			V
Collector-Emitter Saturation Voltage (Note)	$V_{CE(SAT)1}$	$I_C=10\text{mA}$ , $I_B=1\text{mA}$			0.2	V
	$V_{CE(SAT)2}$	$I_C=50\text{mA}$ , $I_B=5\text{mA}$			0.3	V
Base-Emitter Saturation Voltage (Note)	$V_{BE(SAT)1}$	$I_C=10\text{mA}$ , $I_B=1\text{mA}$	0.65		0.85	V
	$V_{BE(SAT)2}$	$I_C=50\text{mA}$ , $I_B=5\text{mA}$			0.95	V
Collector Cut-off Current	$I_{CBO}$	$V_{CE}=30\text{V}$ , $V_{EB}=3\text{V}$			50	nA
Base Cut-off Current	$I_{BL}$	$V_{CE}=30\text{V}$ , $V_{EB}=3\text{V}$			50	nA
DC Current Gain (note)	$h_{FE1}$	$V_{CE}=1\text{V}$ , $I_C=0.1\text{mA}$	40			
	$h_{FE2}$	$V_{CE}=1\text{V}$ , $I_C=1\text{mA}$	70			
	$h_{FE3}$	$V_{CE}=1\text{V}$ , $I_C=10\text{mA}$	100		300	
	$h_{FE4}$	$V_{CE}=1\text{V}$ , $I_C=50\text{mA}$	60			
	$h_{FE5}$	$V_{CE}=1\text{V}$ , $I_C=100\text{mA}$	30			
Current Gain Bandwidth Product	$f_T$	$V_{CE}=20\text{V}$ , $I_C=10\text{mA}$ , $f=100\text{MHz}$	300			MHz
Output Capacitance	$C_{OB}$	$V_{CB}=5\text{V}$ , $I_E=0$ , $f=1\text{MHz}$			4	pF
Turn on Time	$t_{ON}$	$V_{CC}=3\text{V}$ , $V_{BE}=0.5\text{V}$ , $I_C=10\text{mA}$ , $I_{B1}=1\text{mA}$			70	ns
Turn off Time	$t_{OFF}$	$I_{B1}=1\text{mA}$ , $I_{B2}=1\text{mA}$			250	ns

Note: Pulse test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

# ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS(Cont.)



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