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## 2N4400 & 2N4401 Silicon NPN Transistor General Purpose TO92 Type Package

**Absolute Maximum Ratings:**

Collector–Emitter Voltage, $V_{CE0}$ .....	40V
Collector–Base Voltage, $V_{CBO}$ .....	60V
Emitter–Base Voltage, $V_{EBO}$ .....	6V
Continuous Collector Current, $I_C$ .....	600mA
Total Device Dissipation ( $T_A = +25^\circ\text{C}$ ), $P_D$ .....	625mW
Derate Above $25^\circ\text{C}$ .....	5.0mW/ $^\circ\text{C}$
Operating Junction Temperature Range, $T_J$ .....	$-55^\circ$ to $+150^\circ\text{C}$
Storage Temperature Range, $T_{stg}$ .....	$-55^\circ$ to $+150^\circ\text{C}$
Thermal Resistance, Junction to Case, $R_{thJC}$ .....	83.3 $^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient, $R_{thJA}$ .....	200 $^\circ\text{C}/\text{W}$

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Collector–Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{mA}$ , $I_B = 0$ , Note 1	40	–	–	V
Collector–Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 0.1\text{mA}$ , $I_E = 0$	60	–	–	V
Emitter–Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 0.1\text{mA}$ , $I_C = 0$	6	–	–	V
Collector Cutoff Current	$I_{CEX}$	$V_{CE} = 35\text{V}$ , $V_{EB} = 0.4\text{V}$	–	–	0.1	$\mu\text{A}$
Base Cutoff Current	$I_{BEV}$	$V_{CE} = 35\text{V}$ , $V_{EB} = 0.4\text{V}$	–	–	0.1	$\mu\text{A}$
<b>ON Characteristics (Note 1)</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 1\text{V}$ , $I_C = 0.1\text{mA}$	20	–	–	
2N4401						
2N4400		$V_{CE} = 1\text{V}$ , $I_C = 1\text{mA}$	20	–	–	
2N4401						
2N4400		$V_{CE} = 1\text{V}$ , $I_C = 10\text{mA}$	40	–	–	
2N4401						
2N4400		$V_{CE} = 1\text{V}$ , $I_C = 150\text{mA}$	50	–	150	
2N4401						
2N4400		$V_{CE} = 2\text{V}$ , $I_C = 500\text{mA}$	20	–	–	
2N4401						
2N4400	40	–	–			
2N4401						

Note 1. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>ON Characteristics (Cont'd)</b> (Note 1)						
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}$	–	–	0.4	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	–	–	0.75	V
Base–Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}$	0.75	–	0.95	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	–	–	1.2	V
<b>Small–Signal Characteristics</b>						
Current Gain–Bandwidth Product 2N4400	$f_T$	$I_C = 20\text{mA}, V_{CE} = 10\text{V}, f = 100\text{MHz}$	200	–	–	MHz
			250	–	–	MHz
Collector–Base Capacitance	$C_{cb}$	$V_{CB} = 5\text{V}, I_E = 0, f = 100\text{kHz}$	–	–	6.5	pF
Emitter–Base Capacitance	$C_{eb}$	$V_{BE} = 0.5\text{V}, I_C = 0, f = 100\text{kHz}$	–	–	30	pF
Input Impedance 2N4400	$h_{ie}$	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	0.5	–	7.5	k $\Omega$
			1.0	–	15	k $\Omega$
2N4401						
Voltage Feedback Ratio	$h_{re}$	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	0.1	–	8.0	$\times 10^{-4}$
Small–Signal Current Gain 2N4400	$h_{fe}$	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	20	–	250	
			40	–	500	
2N4401						
Output Admittance	$h_{oe}$	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	1.0	–	30	$\mu\text{mhos}$
<b>Switching Characteristics</b>						
Delay Time	$t_d$	$V_{CC} = 30\text{V}, V_{EB} = 2\text{V}, I_C = 150\text{mA}, I_{B1} = 15\text{mA}$	–	–	15	ns
Rise Time	$t_r$		–	–	20	ns
Storage Time	$t_s$	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, I_{B1} = I_{B2} = 15\text{mA}$	–	–	225	ns
Fall Time	$t_f$		–	–	30	ns

Note 1. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

