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

Absolute Maximum Ratings:

Collector–Emitter Voltage, V_{CEO}	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°C	5.0mW/ $^\circ\text{C}$
Total Device Dissipation ($T_C = +25^\circ\text{C}$), P_D	1.5W
Derate Above 25°C	12mW/ $^\circ\text{C}$
Operating Junction Temperature Range, T_J	-55° to $+150^\circ\text{C}$
Storage Temperature Range, T_{stg}	-55° 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
OFF Characteristics						
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	$^\circ\text{A}$
Base Cutoff Current	I_{BEV}	$V_{CE} = 35\text{V}$, $V_{EB} = 0.4\text{V}$	–	–	0.1	$^\circ\text{A}$
ON Characteristics (Note 1)						
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		$V_{CE} = 1\text{V}$, $I_C = 150\text{mA}$	40	–	–	
2N4401						
2N4400		$V_{CE} = 1\text{V}$, $I_C = 150\text{mA}$	50	–	150	
2N4401						
2N4400	$V_{CE} = 2\text{V}$, $I_C = 500\text{mA}$	100	–	300		
2N4401						
2N4400	$V_{CE} = 2\text{V}$, $I_C = 500\text{mA}$	20	–	–		
2N4401						
2N4400	$V_{CE} = 2\text{V}$, $I_C = 500\text{mA}$	40	–	–		
2N4401						

Note 1. Pulse Test: Pulse Width $\leq 300^\circ\text{s}$, 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
ON Characteristics (Cont'd) (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
Small–Signal Characteristics						
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	$k\Omega$
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	
Output Admittance	h_{oe}	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	1.0	–	30	$^\circ\text{mhos}$
Switching Characteristics						
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 $\leq 300^\circ\text{s}$, Duty Cycle $\leq 2\%$.

