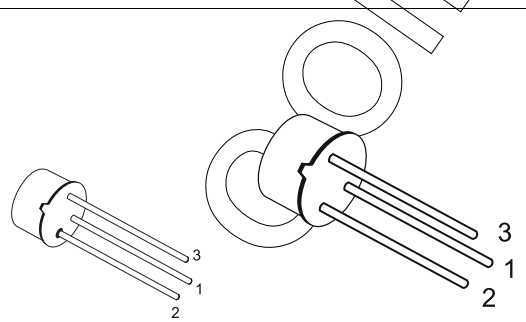
# 2N2219A
# 2N2222A

## HIGH SPEED SWITCHES

**PRELIMINARY DATA**

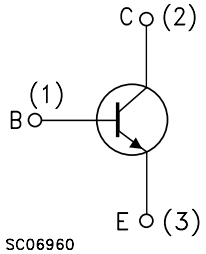
### DESCRIPTION

The 2N2219A and 2N2222A are silicon Planar Epitaxial NPN transistors in Jedec TO-39 (for 2N2219A) and in Jedec TO-18 (for 2N2222A) metal case. They are designed for high speed switching application at collector current up to 500mA, and feature useful current gain over a wide range of collector current, low leakage currents and low saturation voltage.




**TO-18** **TO-39**

**INTERNAL SCHEMATIC DIAGRAM**






### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector-Base Voltage ($I_E$ = 0) | 75 | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 40 | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | 6 | V |
| $I_C$ | Collector Current | 0.6 | A |
| $I_{CM}$ | Collector Peak Current ($t_p$ < 5 ms) | 0.8 | A |
| $P_{tot}$ | Total Dissipation at $T_{amb} \leq 25\ ^oC$ | | |
| | for **2N2219A** | 0.8 | W |
| | for **2N2222A** | 0.5 | W |
| | at $T_C \leq 25\ ^oC$ | | |
| | for **2N2219A** | 3 | W |
| | for **2N2222A** | 1.8 | W |
| $T_{stg}$ | Storage Temperature | -65 to 175 | $^oC$ |
| $T_j$ | Max. Operating Junction Temperature | 175 | $^oC$ |

## THERMAL DATA

| | | TO-39 | TO-18 | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-Case Max | 50 | 83.3 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-Ambient Max | 187.5 | 300 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 °C unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | Collector Cut-off Current ($I_E$ = 0) | $V_{CB}$ = 60 V<br>$V_{CB}$ = 60 V $T_j$ = 150 °C | | | 10<br>10 | nA<br>µA |
| $I_{CEX}$ | Collector Cut-off Current ($V_{BE}$ = -3V) | $V_{CE}$ = 60 V | | | 10 | nA |
| $I_{BEX}$ | Base Cut-off Current ($V_{BE}$ = -3V) | $V_{CE}$ = 60 V | | | 20 | nA |
| $I_{EBO}$ | Emitter Cut-off Current ($I_C$ = 0) | $V_{EB}$ = 3 V | | | 10 | nA |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage ($I_E$ = 0) | $I_C$ = 10 µA | 75 | | | V |
| $V_{(BR)CEO}$* | Collector-Emitter Breakdown Voltage ($I_B$ = 0) | $I_C$ = 10 mA | 40 | | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage ($I_C$ = 0) | $I_E$ = 10 µA | 6 | | | V |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 150 mA $I_B$ = 15 mA<br>$I_C$ = 500 mA $I_B$ = 50 mA | | | 0.3<br>1 | V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 150 mA $I_B$ = 15 mA<br>$I_C$ = 500 mA $I_B$ = 50 mA | 0.6 | | 1.2<br>2 | V<br>V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 0.1 mA $V_{CE}$ = 10 V<br>$I_C$ = 1 mA $V_{CE}$ = 10 V<br>$I_C$ = 10 mA $V_{CE}$ = 10 V<br>$I_C$ = 150 mA $V_{CE}$ = 10 V<br>$I_C$ = 500 mA $V_{CE}$ = 10 V<br>$I_C$ = 150 mA $V_{CE}$ = 1 V<br>$I_C$ = 10 mA $V_{CE}$ = 10 V<br>$T_{amb}$ = -55 °C | 35<br>50<br>75<br>100<br>40<br>50<br><br>35 | | <br><br><br>300<br><br><br><br> | |
| $h_{fe}$* | Small Signal Current Gain | $I_C$ = 1 mA $V_{CE}$ = 10 V f = 1KHz<br>$I_C$ = 10 mA $V_{CE}$ = 10 V f = 1KHz | 50<br>75 | | 300<br>375 | |
| $f_T$ | Transition Frequency | $I_C$ = 20 mA $V_{CE}$ = 20 V<br>f = 100 MHz | | 300 | | MHz |
| $C_{EBO}$ | Emitter-Base Capacitance | $I_C$ = 0 $V_{EB}$ = 0.5 V f = 100KHz | | | 25 | pF |
| $C_{CBO}$ | Collector-Base Capacitance | $I_E$ = 0 $V_{CB}$ = 10 V f = 100 KHz | | | 8 | pF |
| $R_{e(hie)}$ | Real Part of Input Impedance | $I_C$ = 20 mA $V_{CE}$ = 20 V<br>f = 300MHz | | | 60 | Ω |

* Pulsed: Pulse duration = 300 µs, duty cycle ≤ 1 %

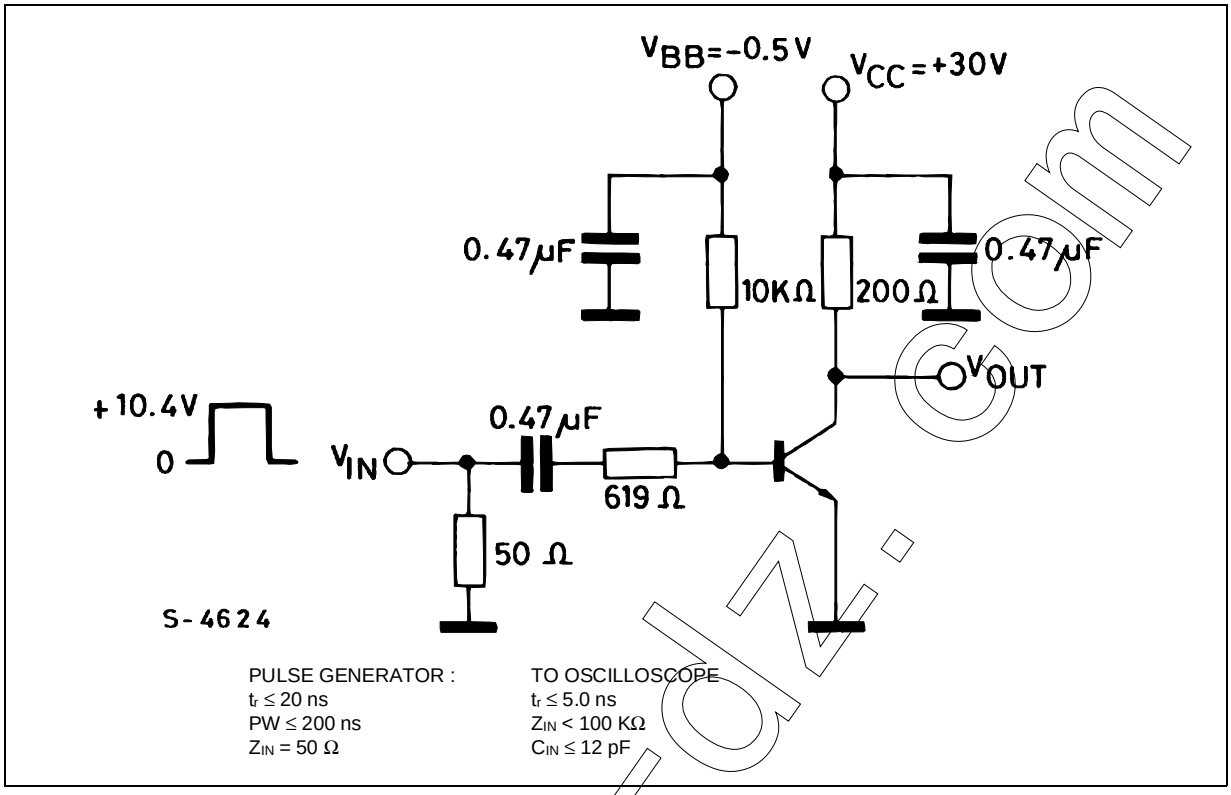
**ELECTRICAL CHARACTERISTICS** (continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| NF | Noise Figure | $I_C$ = 0.1 mA $V_{CE}$ = 10 V<br>f = 1KHz $R_g$ = 1KΩ | | 4 | | dB |
| $h_{ie}$ | Input Impedance | $I_C$ = 1 mA $V_{CE}$ = 10 V<br>$I_C$ = 10 mA $V_{CE}$ = 10 V | 2<br>0.25 | | 8<br>1.25 | kΩ<br>kΩ |
| $h_{re}$ | Reverse Voltage Ratio | $I_C$ = 1 mA $V_{CE}$ = 10 V<br>$I_C$ = 10 mA $V_{CE}$ = 10 V | | | $8 \times 10^{-4}$<br>$4 \times 10^{-4}$ | |
| $h_{oe}$ | Output Admittance | $I_C$ = 1 mA $V_{CE}$ = 10 V<br>$I_C$ = 10 mA $V_{CE}$ = 10 V | 5<br>25 | | 35<br>200 | µS<br>µS |
| $t_d$** | Delay Time | $V_{CC}$ = 30 V $I_C$ = 150 mA<br>$I_{B1}$ = 15 mA $V_{BB}$ = -0.5 V | | | 10 | ns |
| $t_r$** | Rise Time | $V_{CC}$ = 30 V $I_C$ = 150 mA<br>$I_{B1}$ = 15 mA $V_{BB}$ = -0.5 V | | | 25 | ns |
| $t_s$** | Storage Time | $V_{CC}$ = 30 V $I_C$ = 150 mA<br>$I_{B1}$ = $-I_{B2}$ = 15 mA | | | 225 | ns |
| $t_f$** | Fall Time | $V_{CC}$ = 30 V $I_C$ = 150 mA<br>$I_{B1}$ = $-I_{B2}$ = 15 mA | | | 60 | ns |
| $r_{bb'} C_{b'c}$ | Feedback Time Constant | $I_C$ = 20 mA $V_{CE}$ = 20 V<br>f = 31.8MHz | | | 150 | ps |

∗ Pulsed: Pulse duration = 300 µs, duty cycle ≤ 1 %

∗∗ See test circuit

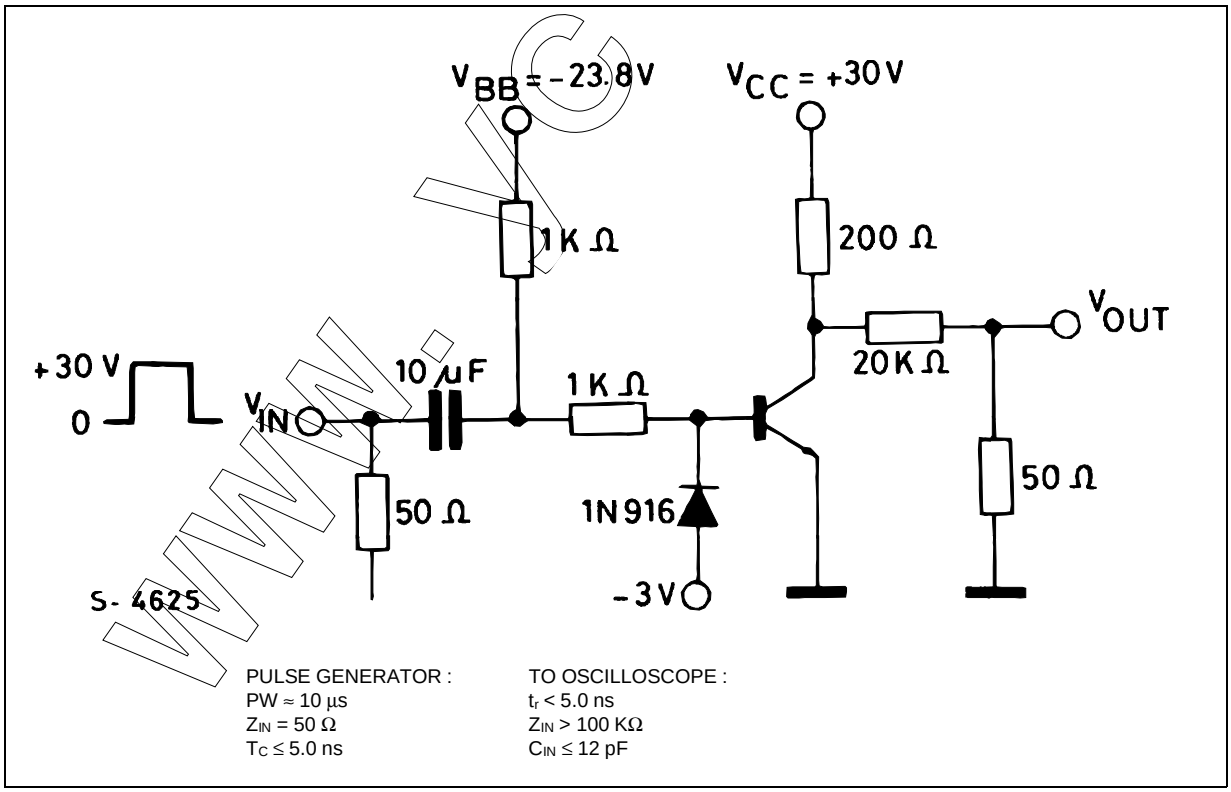
Test Circuit fot $t_d$, $t_r$.




PULSE GENERATOR :
$t_r \leq 20$ ns
PW ≤ 200 ns
$Z_{IN} = 50\ \Omega$

TO OSCILLOSCOPE
$t_r \leq 5.0$ ns
$Z_{IN} < 100\ K\Omega$
$C_{IN} \leq 12$ pF

Test Circuit fot $t_d$, $t_r$.

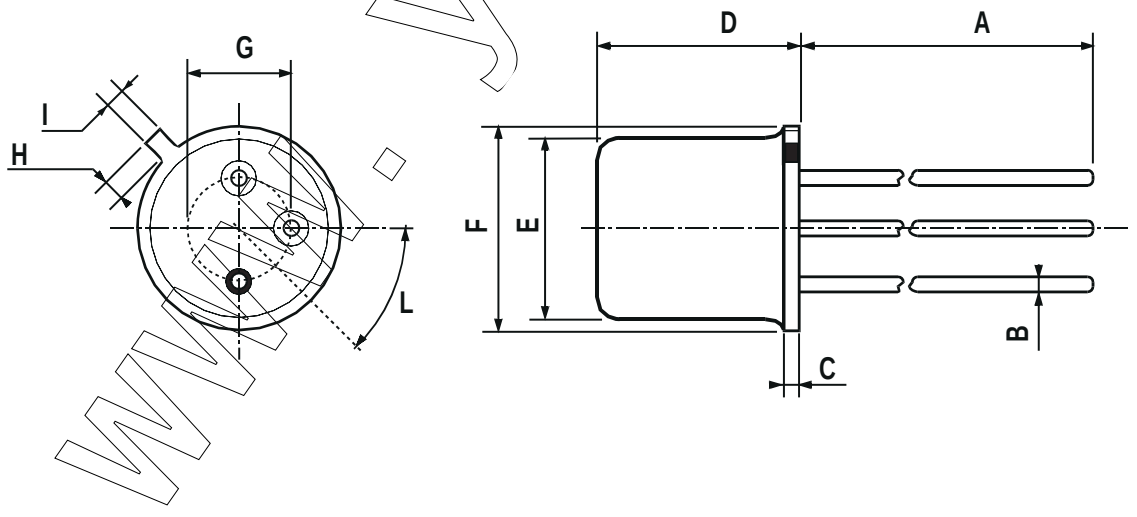



PULSE GENERATOR :
PW ≈ 10 µs
$Z_{IN} = 50\ \Omega$
$T_C \leq 5.0$ ns

TO OSCILLOSCOPE :
$t_r < 5.0$ ns
$Z_{IN} > 100\ K\Omega$
$C_{IN} \leq 12$ pF

## TO-18 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | 12.7 | | | 0.500 | |
| B | | | 0.49 | | | 0.019 |
| D | | | 5.3 | | | 0.208 |
| E | | | 4.9 | | | 0.193 |
| F | | | 5.8 | | | 0.228 |
| G | 2.54 | | | 0.100 | | |
| H | | | 1.2 | | | 0.047 |
| I | | | 1.16 | | | 0.045 |
| L | $45^o$ | | | $45^o$ | | |

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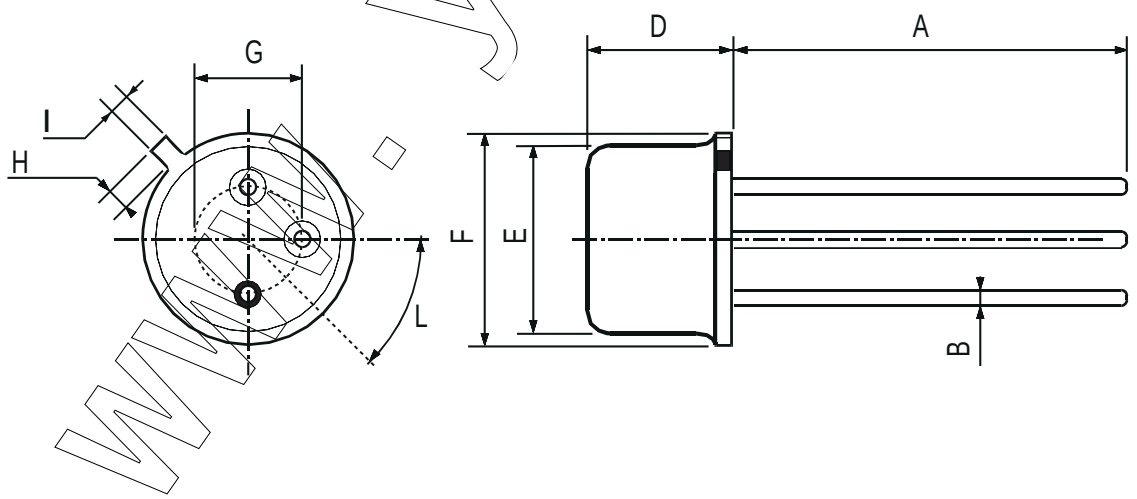
## TO-39 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 12.7 | | | 0.500 | | |
| B | | | 0.49 | | | 0.019 |
| D | | | 6.6 | | | 0.260 |
| E | | | 8.5 | | | 0.334 |
| F | | | 9.4 | | | 0.370 |
| G | 5.08 | | | 0.200 | | |
| H | | | 1.2 | | | 0.047 |
| I | | | 0.9 | | | 0.035 |
| L | 45° (typ.) | | | | | |

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