# GES2906, 6A, 7, 7A, MPS2906, 6A, 7, 7A, GES2221A, 22A, MPS2222A, PN2222A

## Silicon Transistors

TO-92

**Features:**

- *Low leakage currents*
- *High speed switching*
- *Epoxy encapsulation with proved reliablity – excellent characteristic stability under environmental stresses, 85°C @ 85% RH*
- *Low collector saturation voltages*

The GE/RCA GES2221A, 22A, MPS2222A, PN2222A NPN types, and GES2906, 06A, 07, 07A, MPS2906, 06A, 07, and 07A PNP types are planar epitaxial passivated silicon transistors intended for general purpose amplifiers, saturated switching, and core applications. The GES, MPS and PN prefixes can be used interchangeably, characteristics for each line are similar. PNP values are negative; observe proper polarity. These types are supplied in JEDEC TO-92 package.

**MAXIMUM RATINGS,** *Absolute-Maximum Values:*

| | 2221A 2222A | 2906,06A 2907,07A | |
|---|---|---|---|
| COLLECTOR TO EMITTER VOLTAGE ($V_{CEO}$) | 40 | −40 | V |
| EMITTER TO BASE VOLTAGE ($V_{EBO}$) | 5 | −5 | V |
| COLLECTOR TO BASE VOLTAGE ($V_{CBO}$) | 75 | −60 | V |
| CONTINUOUS COLLECTOR CURRENT ($I_C$) | 400 | −350 | mA |
| COLLECTOR CURRENT (peak)($I_C$) | 800 | −700 | mA |
| TOTAL POWER DISSIPATION $T_A \leq 25°C$ ($P_T$) | 360 | 360 | mW |
| TOTAL POWER DISSIPATION $T_C \leq 25°C$ ($P_T$) | 1000 | 1000 | mW |
| DERATE FACTOR, $T_A > 25°C$ | 3.6 | 3.6 | mW/°C |
| DERATE FACTOR, $T_C > 25°C$ | 10 | 7 | mW/°C |
| OPERATING TEMPERATURE ($T_J$) | −65 to +150 | | °C |
| STORAGE TEMPERATURE ($T_{STG}$) | −65 to +125 | | °C |
| LEAD TEMPERATURE 1/16" ± 1/32" (1.58mm ± 0.8mm) from case at 10s max. ($T_L$) | +260 | | °C |

# GES2906, 6A, 7, 7A, MPS2906, 6A, 7, 7A, GES2221A, 22A, MPS2222A, PN2222A

**ELECTRICAL CHARACTERISTICS, At Ambient Temperature ($T_A$) = 25°C Unless Otherwise Specified** T·29-23

| CHARACTERISTICS | SYMBOL | LIMITS | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|
| | | 2221A,22A | | 2906,06A | | 2907,07A | | |
| | | MIN. | MAX. | MIN. | MAX | MIN. | MAX. | |
| Collector-Emitter Breakdown Voltage ($I_C$ = 10mA, $I_B$ = 0)* | $V_{(BR)ECO}$ | 40 | – | –40 | – | –40 | – | V |
| Collector-Base Breakdown Voltage ($I_C$ = 10μA, $I_E$ = 0) | $V_{(BR)CBO}$ | 75 | – | –60 | – | –60 | – | |
| Emitter-Base Breakdown Voltage ($I_E$ = 10μA, $I_C$ = 0) | $V_{(BR)EBO}$ | 5 | – | –5 | – | –5 | – | |
| Collector-Cutoff Current ($V_{CB}$ = 60V, $I_E$ = 0)* | $I_{CBO}$ | – | 10 | – | –20 | – | –50 | nA |
| ($V_{CB}$ = 60V, $I_E$ = 0, $T_A$ = 100°C)* | | – | 10 | – | –20 | – | –20 | μA |
| Collector-Emitter Saturation Voltage ($I_C$ = 150mA, $I_B$ = 15mA)* | $V_{CE(SAT)}$ | – | 0.3 | – | –0.4 | – | –0.4 | V |
| ($I_C$ = 500mA, $I_B$ = 50mA) | | – | 1 | – | –1.6 | – | –1.6 | |
| Base-Emitter Saturation Voltage ($I_C$ = 150mA, $I_B$ = 15mA)* | $V_{CE(SAT)}$ | – | 1.1 | – | –1.3 | – | –1.3 | |
| ($I_C$ = 500mA, $I_B$ = 50mA)* | | – | 2 | – | –2.6 | – | –2.6 | |

| | | 2221A | | 2222A | | 2906,06A | | 2907,07A | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| DC Forward Current Transfer Ratio ($V_{CE}$ = 1.0V, $I_C$ = 150mA)* | $h_{FE}$ | 20 | – | 50 | – | – | – | – | – | – |
| ($V_{CE}$ = 10V, $I_C$ = 0.1mA) | | 20 | – | 35 | – | 20 | – | 35 | – | |
| ($V_{CE}$ = 10V, $I_C$ = 1.0mA) | | 25* | – | *50 | – | 25 | – | 50 | – | |
| ($V_{CE}$ = 10V, $I_C$ = 10mA) | | 35 | – | 75 | – | 35 | – | 75 | – | |
| ($V_{CE}$ = 10V, $I_C$ = 150mA)* | | 40 | 120 | 100 | 300 | 40 | 120 | 100 | 300 | |
| ($V_{CE}$ = 10V, $I_C$ = 500mA)* | | 20 | – | 30 | – | 20 | – | 30 | – | |
| Collector Capacitance ($V_{CB}$ = 10V, $I_E$ = 0, f = 1MHz) | $C_{cb}$ | – | 8 | – | 8 | – | 8 | – | 8 | pF |
| Emitter-Base Capacitance ($V_{EB}$ = 0.5V, $I_C$ = 0, f = 1MHz) | $C_{eb}$ | – | 25 | – | 25 | – | 30 | – | 30 | |
| Delay Time ($I_{CS}$ = 150mA, $I_{B1}$ = 15mA) | $t_d$ | – | – | – | – | – | 10 | – | 10 | ns |
| Rise Time ($I_{CS}$ = 150mA, $I_{B1}$ = 15mA) | $t_r$ | – | – | – | – | – | 40 | – | 40 | |
| Storage Time ($I_{CS}$ = 150mA, $I_{B1}$ = $I_{B2}$ = 15mA) | $t_s$ | – | – | – | – | – | 80 | – | 80 | |
| Fall Time ($I_{CS}$ = 150mA, $I_{B1}$ = 15mA) | $t_f$ | – | – | – | – | – | 30 | – | 30 | |
| Turn-On Time ($I_C$ = 150mA, $V_{CC}$ = 30V, $I_{B1}$ = 15mA) | $t_{ON}$ | – | 35 | – | 35 | – | – | – | – | |
| Turn-Off Time ($I_C$ = 150mA, $V_{CC}$ = 30V, $I_{B1}$ = $I_{B2}$ = 15mA) | | – | 285 | – | 285 | – | – | – | – | |

*Pulse conditions: 300μs pulse width, 2% duty cycle.

# GES2906, 6A, 7, 7A, MPS2906, 6A, 7, 7A, GES2221A, 22A, MPS2222A, PN2222A

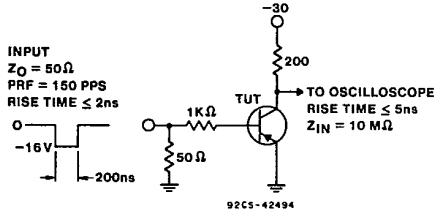


*Fig. 1—Delay time and rise time test circuit for pnp types (2906, 06A, 07, 07A).*

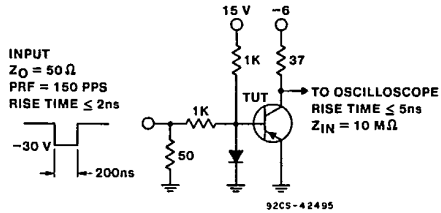


*Fig. 2—Storage time and fall time test circuit for pnp types (2906, 06A, 07, 07A).*

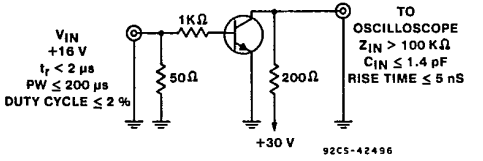


*Fig. 3—Turn-on time test circuit for npn types (2221A and 2222A).*

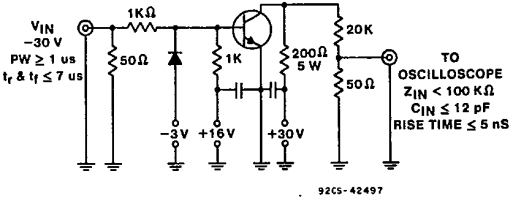


*Fig. 4—Turn-off time test circuit for npn types (2221A and 2222A).*

**TERMINAL CONNECTIONS**

**Lead 1 - Emitter**
**Lead 2 - Base**
**Lead 3 - Collector**