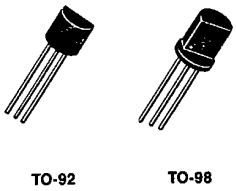
# 2N5305, 6, 6A, GES5305, 6, 6A

## Silicon Darlington Transistors



TO-92 TO-98

The GE/RCA 2N5305, 06, 06A and GES5305, 6, and 6A are planar, epitaxial, passivated NPN silicon Darlington transistors designed for preamplifier stages requiring input impedances of several megohms or extremely low-level, high-gain low-noise amplifier applications. These types can be used in medium-speed switching circuits in consumer and industrial control applications.

The 2N5305, 6, and 6A are supplied in JEDEC TO-98 package, the GES5305, 6, and 6A are supplied in JEDEC TO-92 package.

Devices in TO-98 package are supplied with and without seating flange (see Dimensional Outline).

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

| | |
|---|---|
| COLLECTOR TO EMITTER VOLTAGE ($V_{CEO}$) | 25 V |
| EMITTER TO BASE VOLTAGE ($V_{EBO}$) | 12 V |
| COLLECTOR TO BASE VOLTAGE ($V_{CBO}$) | 25 V |
| CONTINUOUS COLLECTOR CURRENT ($I_C$) | 300 mA |
| COLLECTOR CURRENT (PULSED)* ($I_C$) | 500 mA |
| CONTINUOUS BASE CURRENT ($I_B$) | 50 mA |
| TOTAL POWER DISSIPATION ($T_A \leq 25°C$) ($P_T$) | 400 mW |
| DERATE FACTOR ($T_A > 25°C$) | 4 mW/°C |
| OPERATING TEMPERATURE ($T_J$) | −65° to +125°C |
| STORAGE TEMPERATURE ($T_{STG}$) | −65° to +150°C |
| LEAD TEMPERATURE, 1/16" ± 1/32" (1.58mm ± 0.8mm) from case for 10s max ($T_L$) | +260°C |

*Pulsed Conditions: Pulse width ≤ 300 μs, Duty factor ≤ 2%.

File Number **2065**

T-29-27

Signal Transistors

# 2N5305, 6, 6A, GES5305, 6, 6A

**ELECTRICAL CHARACTERISTICS, At Ambient Temperature ($T_A$) = 25°C Unless Otherwise Specified**

| CHARACTERISTICS | SYMBOL | LIMITS MIN. | LIMITS MAX. | UNITS |
|---|---|---|---|---|
| Collector-To-Emitter Breakdown Voltage ($I_C$ = 10 mA, $I_B$ = 0) | $BV_{CEO}$ | 25 | – | V |
| Collector-To-Base Breakdown Voltage ($I_C$ = 0.1μA, $I_E$ = 0) | $BV_{CBO}$ | 25 | – | V |
| Emitter-To-Base Breakdown Voltage ($I_E$ = 0.1μA, $I_C$ = 0) | $BV_{EBO}$ | 12 | – | V |
| DC Forward Current Transfer Ratio ($I_C$ = 2mA, $V_{CE}$ = 5V) 2N5305, GES5305 | $h_{FE}$ | 2,000 | 20,000 | – |
| ($I_C$ = 100mA, $V_{CE}$ = 5V) 2N5305, GES5305 | $h_{FE}$ | 6,000 | – | – |
| ($I_C$ = 2 mA, $V_{CE}$ = 5V) 2N5306, GES5306A | $h_{FE}$ | 7,000 | 70,000 | – |
| ($I_C$ = 100mA, $V_{CE}$ = 5V) 2N5306, GES5306A | $h_{FE}$ | 20,000 | – | – |
| Collector-To-Emitter Saturation Voltage ($I_C$ = 200mA, $I_B$ = 0.2mA) | $V_{CE}(sat)$ | – | 1.4 | V |
| Base-To-Emitter Saturation Voltage ($I_C$ = 200mA, $I_B$ = 0.2mA) | $V_{BE}(sat)$ | – | 1.6 | V |
| Base-To-Emitter Voltage ($I_C$ = 200mA, $V_{CE}$ = 5V) | $V_{BE}$ | – | 1.5 | V |
| Collector-To-Base Cutoff Current ($V_{CB}$ = 25V, $I_E$ = 0) | $I_{CBO}$ | – | 100 | nA |
| ($V_{CB}$ = 25V, $I_E$ = 0, $T_A$ = 100°)C) | $I_{CBO}$ | – | 20 | μA |
| Small-Signal Current Transfer Ratio ($V_{CE}$ = 5V, $I_C$ = 2mA, f = 1 KHZ) 2N5305, GES5305 | $h_{fe}$ | 2,000 | – | – |
| ($V_{CE}$ = 5V, $I_C$ = 2mA, f = 1 KHZ) 2N5306, 6A, GES5306, 6A | $h_{fe}$ | 7,000 | – | – |
| ($V_{CE}$ = 5V, $I_C$ = 2mA, f = 10 MHZ) | $\lvert h_{fe} \rvert$ | 15.6 | – | dB |
| Input Capacitance ($V_{EB}$ = 0.5V, f = 1 MHZ) | $C_{eb}$ | 10.5 Typical | | pF |
| Output Capacitance ($V_{CB}$ = 10V, f = 1 MHZ) | $C_{cb}$ | 7.6 Typical | 10 | pF |
| Input Impedance ($V_{CE}$ = 5V, $I_C$ = 2mA, f = 1KHz) | | 650 Typical | | KΩ |
| Gain-Bandwidth Product ($V_{CE}$ = 5V, $I_C$ = 2mA, f = 10MHz) | $f_T$ | 60 | – | MHZ |
| Noise Figure ($V_{CE}$ = 5V, $I_C$ = 0.6mA, Rg = 160 kΩ, f = 10 Hz, to 10 kHz, Bandwidth = 15.7 kHz) 2N5306A, GES5306A | $e_n$ | 195 Typical | 230 | nV/√Hz |

**TERMINAL CONNECTIONS**

**TO-92 Package**
**Lead 1 - Emitter**
**Lead 2 - Base**
**Lead 3 - Collector**

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T-29-27

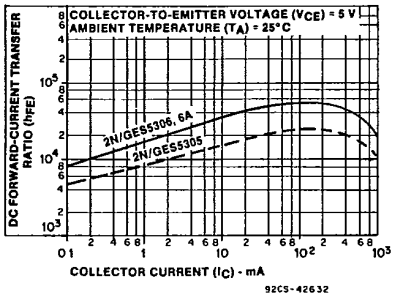


*Fig. 1—Typical dc forward-current transfer ratio characteristics.*

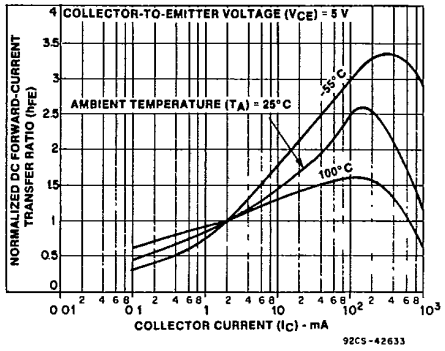


*Fig. 2—Normalized dc forward-current transfer ratio characteristics.*

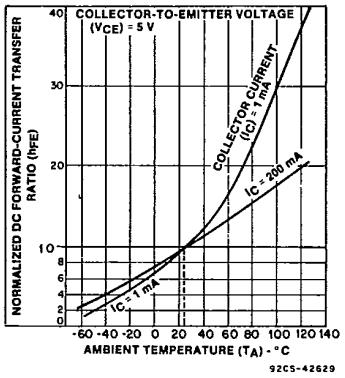


*Fig. 3—Normalized dc forward-current transfer ratio characteristics.*

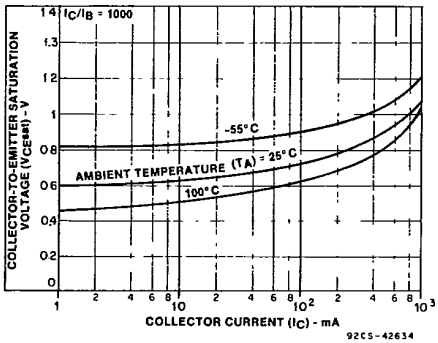


*Fig. 4—Typical collector-to-emitter saturation voltage characteristics.*

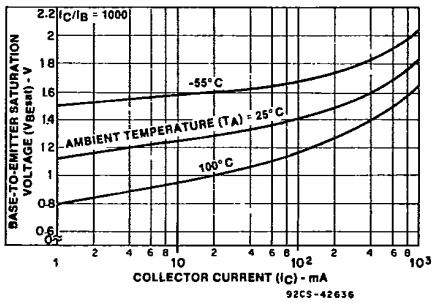


*Fig. 5—Typical base-to-emitter saturation voltage characteristics.*

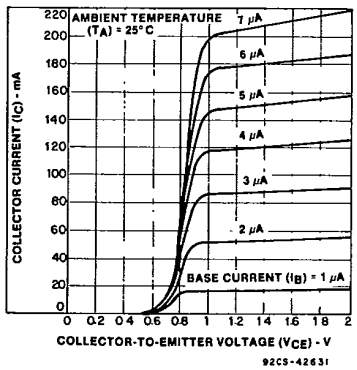


*Fig. 6—Typical output characteristics.*

Signal Transistors

T-29-27

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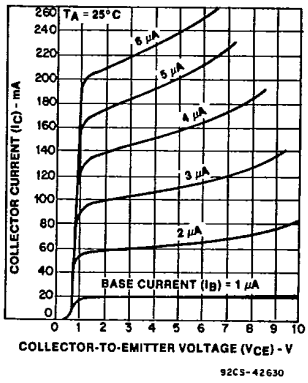



Fig. 7—Typical output characteristics.

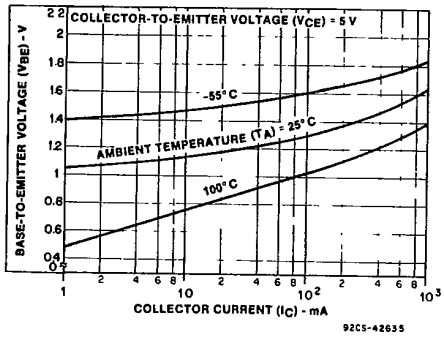



Fig. 8—Typical transfer characteristics.

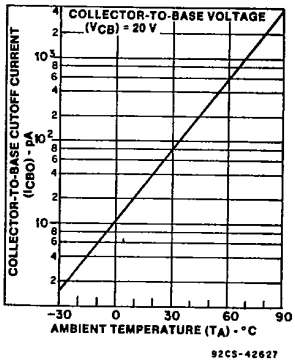



Fig. 9—Typical collector-to-base cutoff current characteristic.

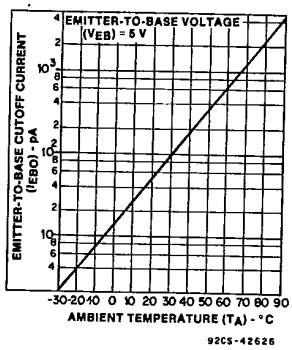
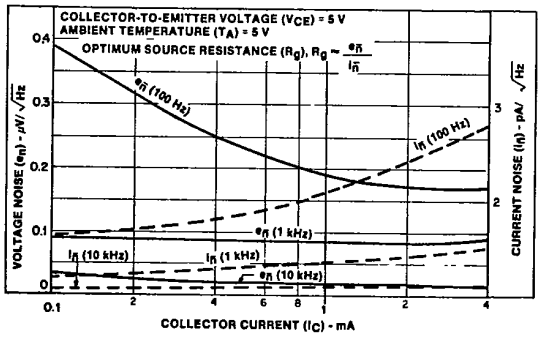



Fig. 10—Typical emitter-to-base cutoff current characteristic.




NOTE:
DUE TO THE NOISE CHARACTERISTICS OF THIS DEVICE VERSUS FREQUENCY, CALCULATION OF NOISE FIGURE (NF) FROM $e_{\overline{n}}$, $i_{\overline{n}}$ VALUES IS NOT ACCURATE [AS IS THE CASE WITH FIELD-EFFECT TRANSISTORS (FETs)].

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Fig. 11—Equivalent input noise-voltage and noise-current characteristics