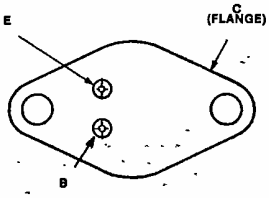
File Number **15.84**

# GE5060, GE5061, GE5062

T-33-29

## 20-Ampere N-P-N Darlington Power Transistors

**TERMINAL DESIGNATION**




92CS-27516

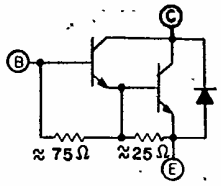
**JEDEC TO-204AA**

**Features:**

- *High-voltage operation: 350, 400, 450 volts*
- *Gain of 100 at 10A*

**Applications:**

- *Series/shunt regulators*
- *Automotive ignition*
- *Power switching*
- *Solenoid driver*




**DEVICE CIRCUIT**

The GE5060, GE5061, and GE5062 silicon n-p-n Darlington power transistors are designed for use in high-speed switching applications, such as: off-line power supplies, AC and DC motor control, UPS systems, ultrasonic equipment, and other high-frequency power conversion equipment.

These devices are supplied in the JEDEC TO-204AA steel hermetic package.

**MAXIMUM RATINGS ($T_A$ = 25°C)** (unless otherwise specified)

| RATING | SYMBOL | GE5060 | GE5061 | GE5062 | UNITS |
|---|---|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 400 | 450 | 500 | Volts |
| Collector-Emitter Voltage | $V_{CEO}$ | 350 | 400 | 450 | Volts |
| Emitter Base Voltage | $V_{EBO}$ | 8 | 8 | 8 | Volts |
| Collector Current — Continuous<br>Peak (Repetitive)<br>Peak (Non-Repetitive) | $I_C$<br>$I_{CM}$<br>$I_{CSM}$ | 20<br>25<br>42.5 | 20<br>25<br>42.5 | 20<br>25<br>42.5 | A |
| Base Current — Continuous<br>Peak (Non-Repetitive) | $I_B$<br>$I_{BM}$ | 4<br>6 | 4<br>6 | 4<br>6 | A |
| Total Power Dissipation @ $T_C$ = 25°C | $P_D$ | 125 | 125 | 125 | Watts |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{STG}$ | -65 to +150 | -65 to +150 | -65 to +150 | °C |

**THERMAL CHARACTERISTICS**

| | | | | | |
|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1 | 1 | 1 | °C/W |
| Maximum Lead Temperature for Soldering Purposes: ⅛" from Case for 5 Seconds | $T_L$ | 300 | 300 | 300 | °C |

## GE5060, GE5061, GE5062

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**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C) (unless otherwise specified)

| CHARACTERISTIC | | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS**(1) | | | | | | |
| Collector-Emitter Sustaining Voltage ($I_C$ = 0.5mA) ($V_{clamp}$ = $V_{CEO}$ Rated) | GE5060<br>GE5061<br>GE5062 | $V_{CEO(sus)}$ | 350<br>400<br>450 | —<br>—<br>— | —<br>—<br>— | Volts |
| Collector-Base Voltage ($I_C$ = 0.25mA) | GE5060<br>GE5061<br>GE5062 | $V_{CBO}$ | 400<br>450<br>500 | —<br>—<br>— | —<br>—<br>— | Volts |
| Collector Cutoff Current ($V_{CB}$ = $V_{CBO}$ Rated) | | $I_{CBO}$ | — | — | 0.25 | mA |
| Emitter Cutoff Current ($V_{EB}$ = 4.5V, $I_C$ = 0) | | $I_{EBO}$ | — | — | 200 | mA |
| **SECOND BREAKDOWN** | | | | | | |
| Second Breakdown with Base Forward Biased | | FBSOA | SEE FIGURE 16 | | | |
| Clamped Inductive SOA with Base Reversed Biased | | RBSOA | SEE FIGURE 17 | | | |
| **ON CHARACTERISTICS**(1) | | | | | | |
| DC Current Gain ($I_C$ = 10A, $V_{CE}$ = 5V) ($I_C$ = 15A, $V_{CE}$ = 5V) ($I_C$ = 20A, $V_{CE}$ = 5V) | | $h_{FE}$ | 100<br>40<br>15 | 160<br>115<br>65 | —<br>—<br>— | — |
| Collector-Emitter Saturation Voltage ($I_C$ = 10A, $I_B$ = 1A) ($I_C$ = 10A, $I_B$ = 2A) ($I_C$ = 20A, $I_B$ = 2A) | | $V_{CE(sat)}$ | —<br>—<br>— | 1.2<br>1.15<br>1.6 | 1.5<br>1.4<br>2 | V |
| Base-Emitter Voltage ($I_C$ = 10A, $I_B$ = 1A) ($I_C$ = 20A, $I_B$ = 2A) | | $V_{BE(sat)}$ | —<br>— | 1.95<br>2.3 | 2.5<br>3.5 | V |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Resistive Load | | | | | | |
| Rise Time | $I_C$ = 15A, $I_{B1}$ = 0.75A, $I_{B2}$ = -1.5A | $t_r$ | — | 0.3 | — | μs |
| Storage Time | $V_{CC}$ = 300V, $t_p$ = 50 μsec | $t_s$ | — | 2.7 | — | |
| Fall Time | | $t_f$ | — | 1.15 | — | |
| Inductive Load, Clamped | | | | | | |
| Storage Time | $V_{CC}$ = 300V, L = 100 μH | $t_s$ | — | 3.3 | — | μs |
| Crossover Time | $I_C$ = 15A, $I_{B1}$ = 0.75A, $I_{B2}$ = -1.5A | $t_c$ | — | 1.7 | — | |
| Fall Time | | $t_f$ | — | 0.4 | — | |
| **EMITTER-COLLECTOR DIODE CHARACTERISTICS** | | | | | | |
| Forward Voltage $I_F$ = 10A $I_F$ = 25A | | $V_F$ | —<br>— | 1.9<br>2.8 | —<br>— | Volts |

## TYPICAL CHARACTERISTICS

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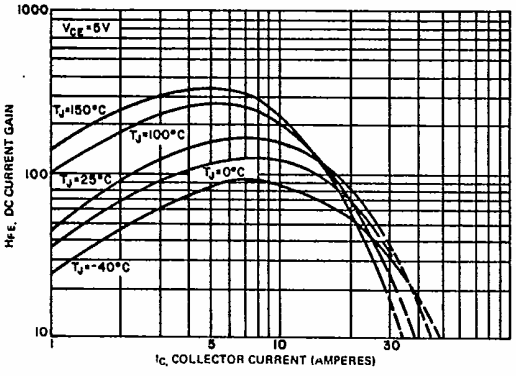


FIGURE 1. DC CURRENT GAIN ($V_{CE}$ = 2V)

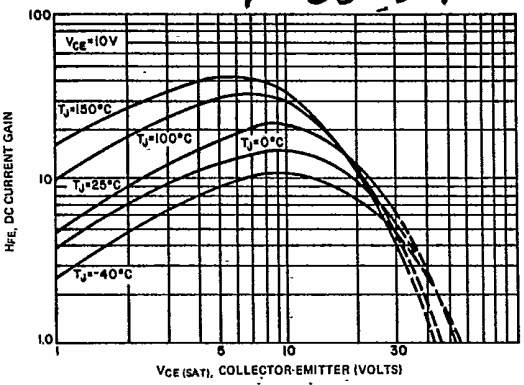


FIGURE 2. DC CURRENT GAIN ($V_{CE}$ = 10V)

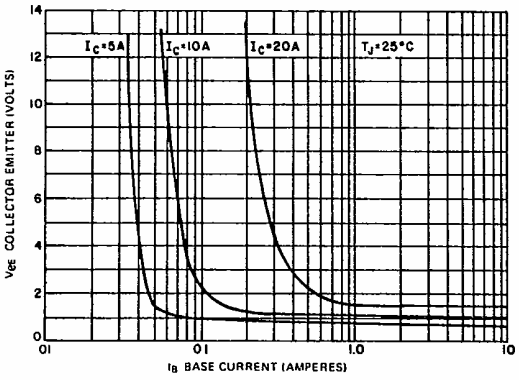


FIGURE 3. COLLECTOR SATURATION REGION

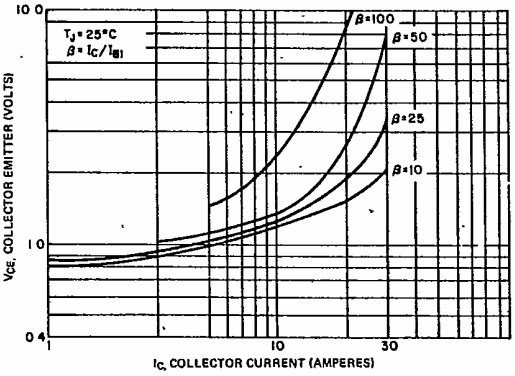


FIGURE 4. $V_{CE(SAT)}$ VS. $I_C$, $T_J$ = 25°C

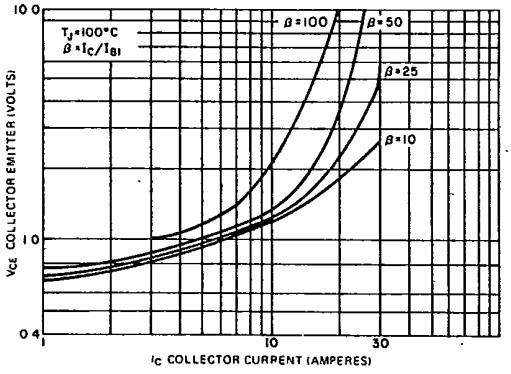


FIGURE 5. $V_{CE(SAT)}$ VS. $I_C$, $T_J$ = 100°C

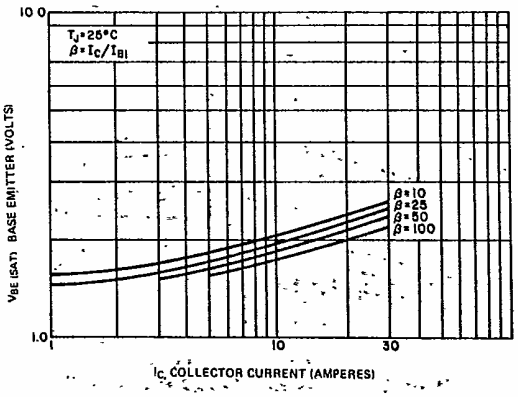


FIGURE 6. $V_{BE(SAT)}$ VS. $I_C$, $T_J$ = 25°C

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## TYPICAL CHARACTERISTICS

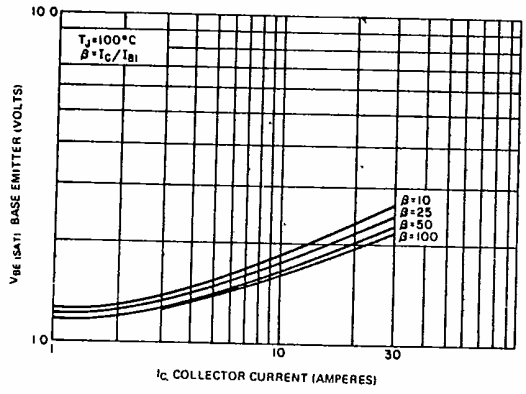


FIGURE 7. $V_{BE(SAT)}$ VS. $I_C$, $T_J$ = 100°C

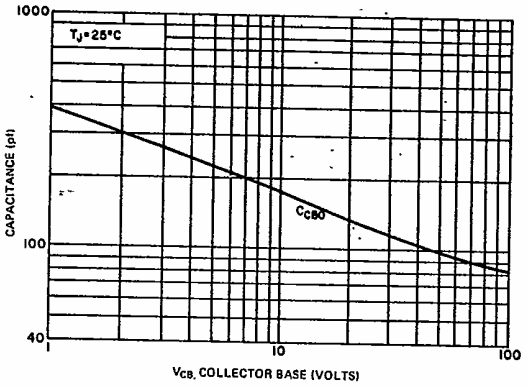


FIGURE 8. CAPACITANCE ($C_{CBO}$)

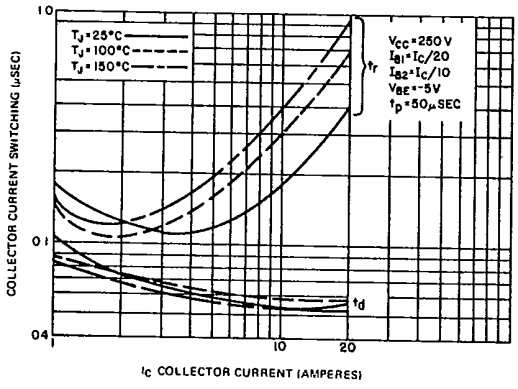


FIGURE 9. TURN-ON TIME (RESISTIVE LOAD)

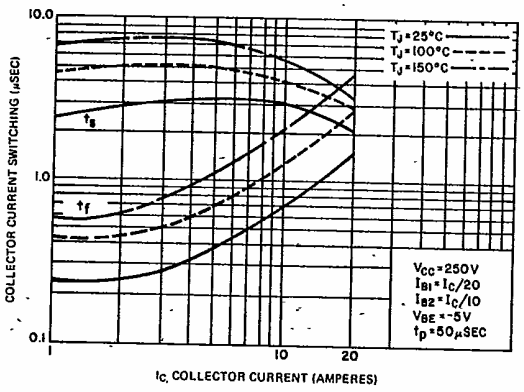


FIGURE 10. TURN-OFF TIME (RESISTIVE)

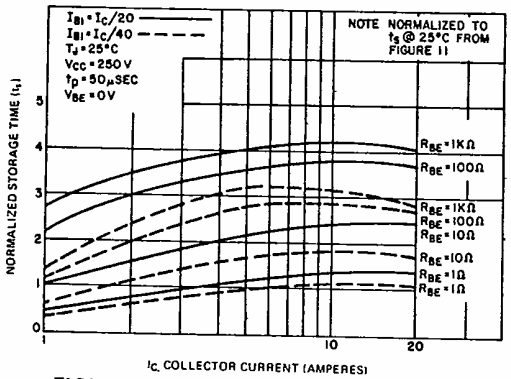


FIGURE 11. NORMALIZED RESISTIVE SWITCHING STORAGE TIME ($R_{BE}$ VARIATIONS) VS. COLLECTOR CURRENT

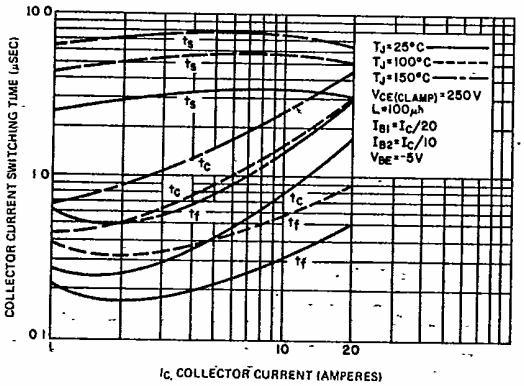


FIGURE 12. CLAMPED INDUCTIVE TURN-OFF TIME

## TYPICAL CHARACTERISTICS

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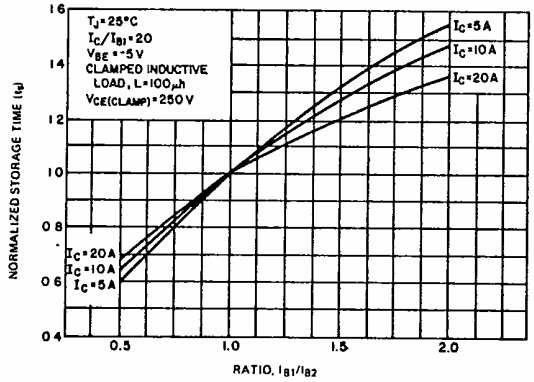


FIGURE 13. STORAGE TIME VARIATION WITH $I_{B2}$

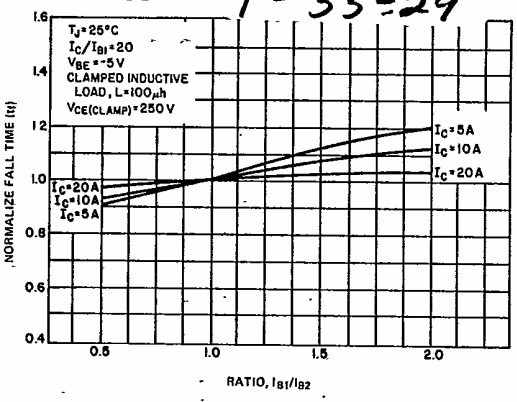


FIGURE 14. FALL TIME VARIATION WITH $I_{B2}$

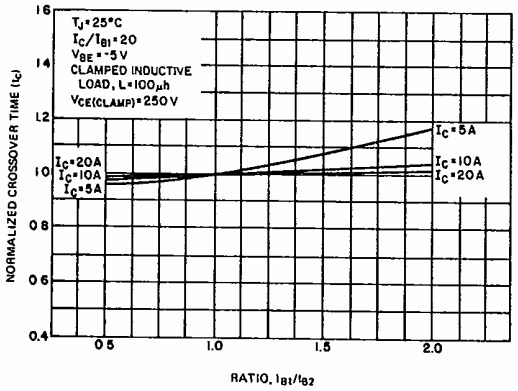


FIGURE 15. CROSS-OVER TIME VARIATION WITH $I_{B2}$

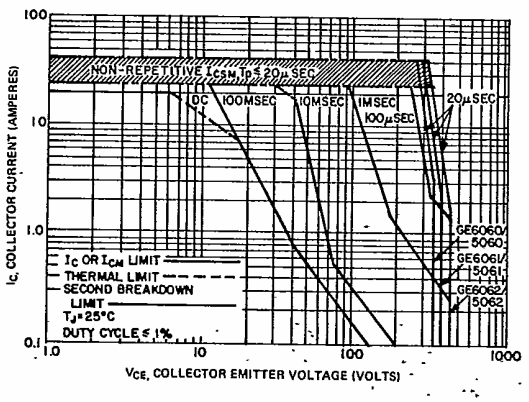


FIGURE 16. FORWARD BIAS SAFE OPERATING AREA

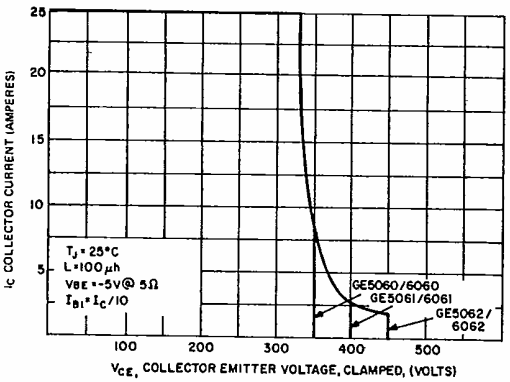


FIGURE 17. REVERSE BIAS SAFE OPERATING AREA

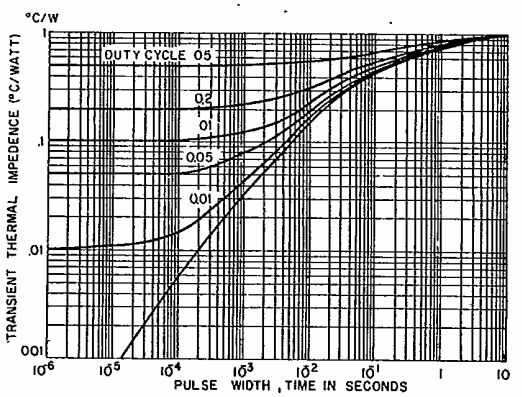


FIGURE 18. TRANSIENT THERMAL RESPONSE

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## TYPICAL CHARACTERISTICS

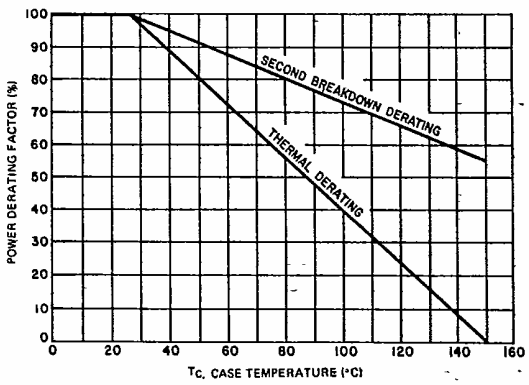


FIGURE 19. POWER DERATING

## DIODE CHARACTERISTICS

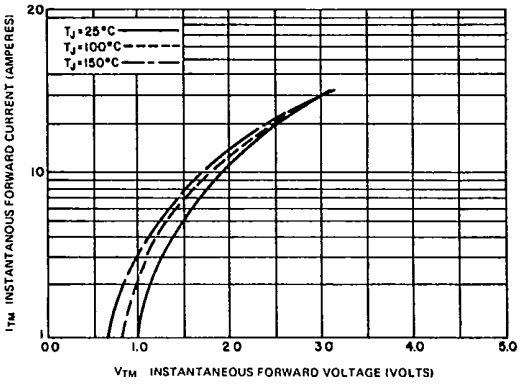


FIGURE 20. FORWARD CHARACTERISTICS

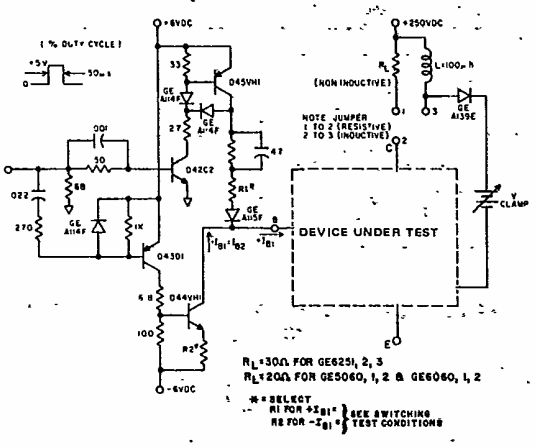


FIGURE 21. SWITCHING TIME TEST CIRCUIT