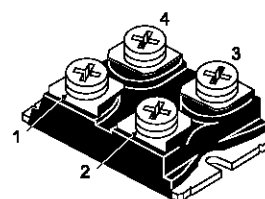


## NPN TRANSISTOR POWER MODULE

- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW  $R_{th}$  JUNCTION CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ISOLATED CASE (2500V RMS)
- EASY TO MOUNT
- LOW INTERNAL PARASITIC INDUCTANCE

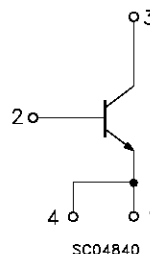
### INDUSTRIAL APPLICATIONS:

- MOTOR CONTROL
- SMPS & UPS
- DC/DC & DC/AC CONVERTERS



**ISOTOP**

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol         | Parameter                                             | Value      | Unit             |
|----------------|-------------------------------------------------------|------------|------------------|
| $V_{CEV}$      | Collector-Emitter Voltage ( $V_{BE} = -5\text{ V}$ )  | 400        | V                |
| $V_{CEO(sus)}$ | Collector-Emitter Voltage ( $I_B = 0$ )               | 300        | V                |
| $V_{EBO}$      | Emitter-Base Voltage ( $I_C = 0$ )                    | 7          | V                |
| $I_C$          | Collector Current                                     | 140        | A                |
| $I_{CM}$       | Collector Peak Current ( $t_p = 10\text{ ms}$ )       | 210        | A                |
| $I_B$          | Base Current                                          | 28         | A                |
| $I_{BM}$       | Base Peak Current ( $t_p = 10\text{ ms}$ )            | 42         | A                |
| $P_{tot}$      | Total Dissipation at $T_c = 25\text{ }^\circ\text{C}$ | 300        | W                |
| $T_{stg}$      | Storage Temperature                                   | -55 to 150 | $^\circ\text{C}$ |
| $T_j$          | Max. Operating Junction Temperature                   | 150        | $^\circ\text{C}$ |
| $V_{iso}$      | Insulation Withstand Voltage (AC-RMS)                 | 2500       | $^\circ\text{C}$ |

## THERMAL DATA

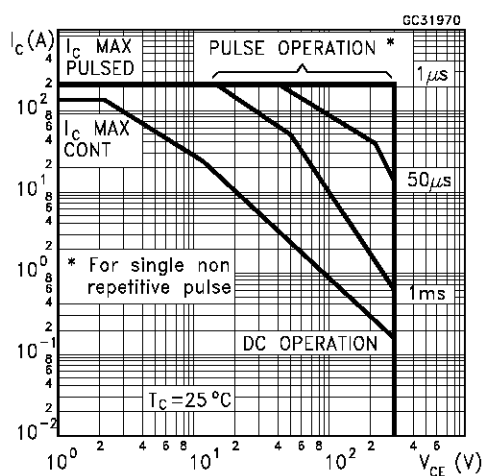
|                |                                                                 |     |      |                      |
|----------------|-----------------------------------------------------------------|-----|------|----------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case                                | Max | 0.41 | $^{\circ}\text{C/W}$ |
| $R_{thc-h}$    | Thermal Resistance Case-heatsink With Conductive Grease Applied | Max | 0.05 | $^{\circ}\text{C/W}$ |

ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}\text{C}$  unless otherwise specified)

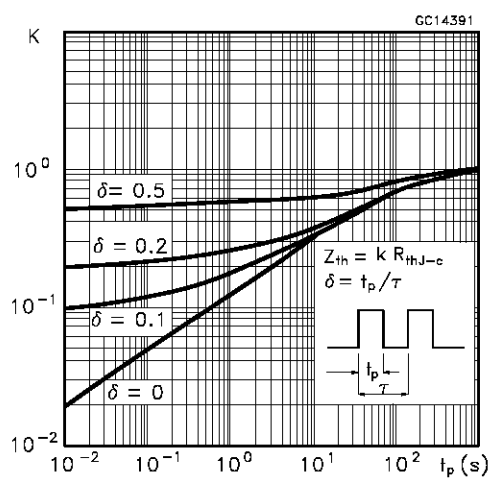
| Symbol                   | Parameter                                          | Test Conditions                                                                                                                                                                                                                            | Min. | Typ.                     | Max.            | Unit                                                 |
|--------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------|-----------------|------------------------------------------------------|
| $I_{CER}$                | Collector Cut-off Current ( $R_{BE} = 5\ \Omega$ ) | $V_{CE} = V_{CEV}$<br>$V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$                                                                                                                                                                       |      |                          | 1<br>5          | $\text{mA}$<br>$\text{mA}$                           |
| $I_{CEV}$                | Collector Cut-off Current ( $V_{BE} = -1.5$ )      | $V_{CE} = V_{CEV}$<br>$V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$                                                                                                                                                                       |      |                          | 1<br>4          | $\text{mA}$<br>$\text{mA}$                           |
| $I_{EBO}$                | Emitter Cut-off Current ( $I_C = 0$ )              | $V_{EB} = 5\ \text{V}$                                                                                                                                                                                                                     |      |                          | 1               | $\text{mA}$                                          |
| $V_{CEO(SUS)}^*$         | Collector-Emitter Sustaining Voltage               | $I_C = 0.2\ \text{A}$ $L = 25\ \text{mH}$<br>$V_{clamp} = 300\ \text{V}$                                                                                                                                                                   | 300  |                          |                 | $\text{V}$                                           |
| $h_{FE}^*$               | DC Current Gain                                    | $I_C = 70\ \text{A}$ $V_{CE} = 5\ \text{V}$                                                                                                                                                                                                |      | 17                       |                 |                                                      |
| $V_{CE(sat)}^*$          | Collector-Emitter Saturation Voltage               | $I_C = 35\ \text{A}$ $I_B = 1.75\ \text{A}$<br>$I_C = 35\ \text{A}$ $I_B = 1.75\ \text{A}$ $T_j = 100^{\circ}\text{C}$<br>$I_C = 70\ \text{A}$ $I_B = 7\ \text{A}$<br>$I_C = 70\ \text{A}$ $I_B = 7\ \text{A}$ $T_j = 100^{\circ}\text{C}$ |      | 0.5<br>0.7<br>0.5<br>0.9 | 1.9             | $\text{V}$<br>$\text{V}$<br>$\text{V}$<br>$\text{V}$ |
| $V_{BE(sat)}^*$          | Base-Emitter Saturation Voltage                    | $I_C = 70\ \text{A}$ $I_B = 7\ \text{A}$<br>$I_C = 70\ \text{A}$ $I_B = 7\ \text{A}$ $T_j = 100^{\circ}\text{C}$                                                                                                                           |      | 1.1<br>1                 | 1.3             | $\text{V}$<br>$\text{V}$                             |
| $di_C/dt$                | Rate of Rise of On-state Collector                 | $V_{CC} = 300\ \text{V}$ $R_C = 0$ $t_p = 3\ \mu\text{s}$<br>$I_{B1} = 10\ \text{A}$ $T_j = 100^{\circ}\text{C}$                                                                                                                           | 120  | 190                      |                 | $\text{A}/\mu\text{s}$                               |
| $V_{CE(3\ \mu\text{s})}$ | Collector-Emitter Dynamic Voltage                  | $V_{CC} = 200\ \text{V}$ $R_C = 3.25\ \Omega$<br>$I_{B1} = 6.4\ \text{A}$ $T_j = 100^{\circ}\text{C}$                                                                                                                                      |      | 2.5                      | 4               | $\text{V}$                                           |
| $V_{CE(5\ \mu\text{s})}$ | Collector-Emitter Dynamic Voltage                  | $V_{CC} = 200\ \text{V}$ $R_C = 3.25\ \Omega$<br>$I_{B1} = 6.4\ \text{A}$ $T_j = 100^{\circ}\text{C}$                                                                                                                                      |      | 1.4                      | 2.5             | $\text{V}$                                           |
| $t_s$<br>$t_f$<br>$t_c$  | Storage Time<br>Fall Time<br>Cross-over Time       | $I_C = 70\ \text{A}$ $V_{CC} = 250\ \text{V}$<br>$V_{BB} = -5\ \text{V}$ $R_{BB} = 0.6\ \Omega$<br>$V_{clamp} = 300\ \text{V}$ $I_{B1} = 7\ \text{A}$<br>$L = 0.3\ \text{mH}$ $T_j = 100^{\circ}\text{C}$                                  |      | 3<br>0.25<br>0.6         | 5<br>0.4<br>0.9 | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$      |
| $V_{CEW}$                | Maximum Collector Emitter Voltage Without Snubber  | $I_{C\text{Woff}} = 105\ \text{A}$ $I_{B1} = 7\ \text{A}$<br>$V_{BB} = -5\ \text{V}$ $V_{CC} = 50\ \text{V}$<br>$L = 42\ \mu\text{H}$ $R_{BB} = 0.6\ \Omega$<br>$T_j = 125^{\circ}\text{C}$                                                | 300  |                          |                 | $\text{V}$                                           |

\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

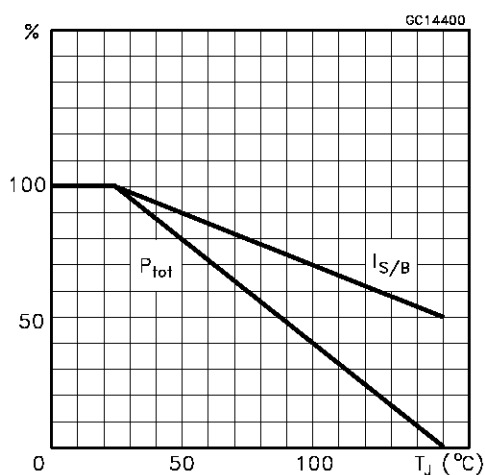
## Safe Operating Areas



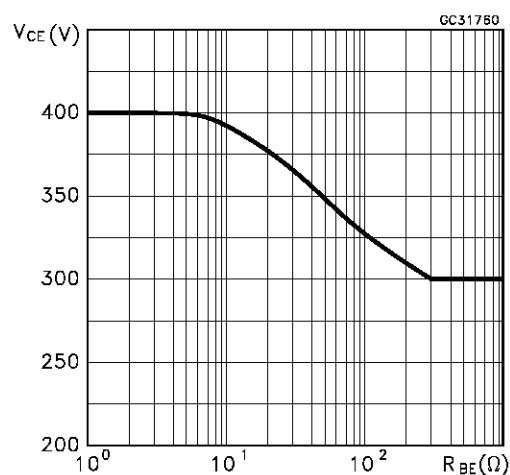
## Thermal Impedance



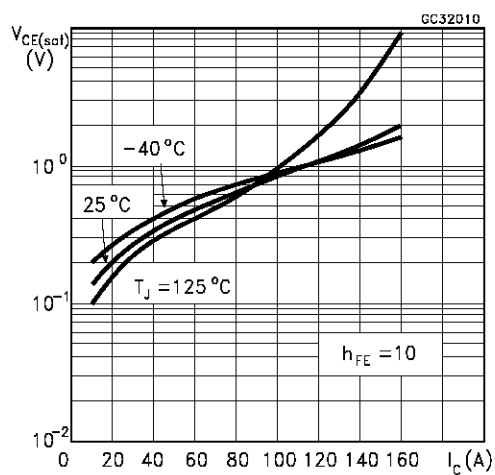
## Derating Curve



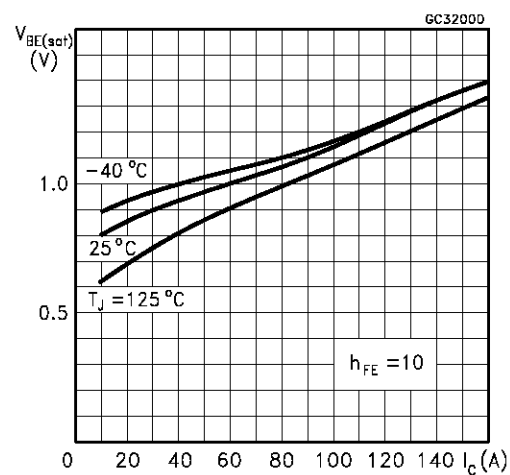
## Collector-emitter Voltage Versus base-emitter Resistance



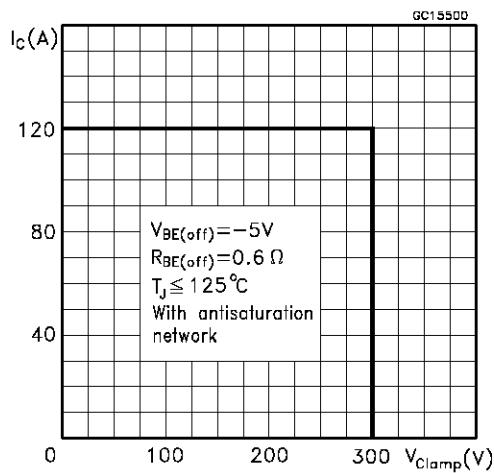
## Collector Emitter Saturation Voltage



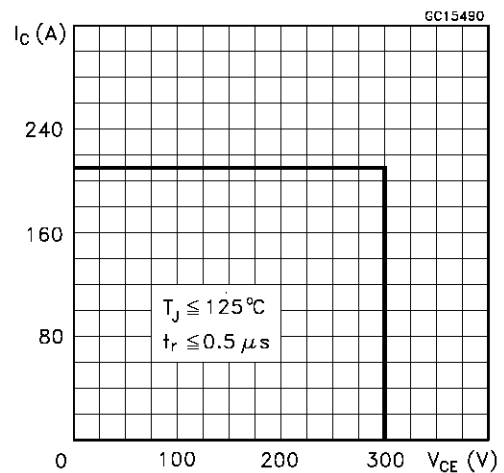
## Base-Emitter Saturation Voltage



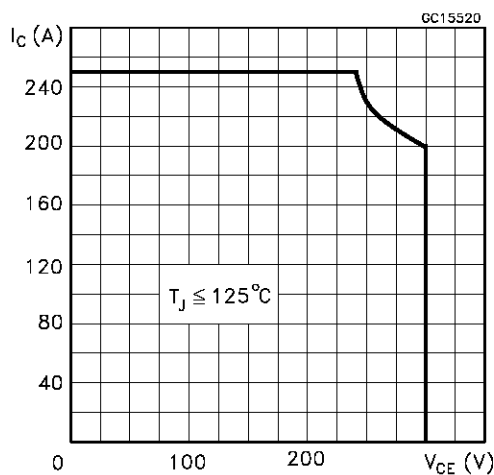
Reverse Biased SOA



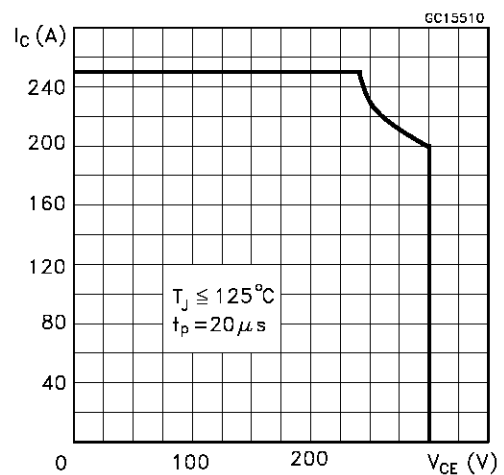
Forward Biased SOA



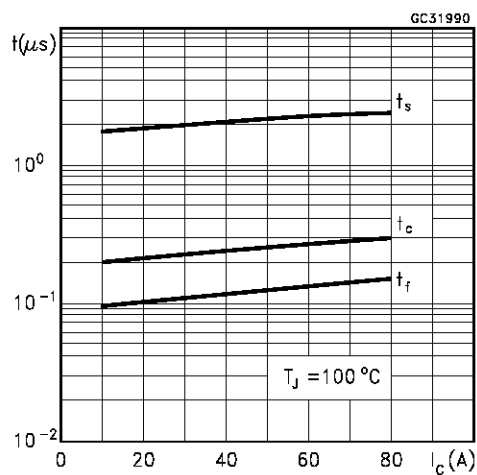
Reverse Biased AOA



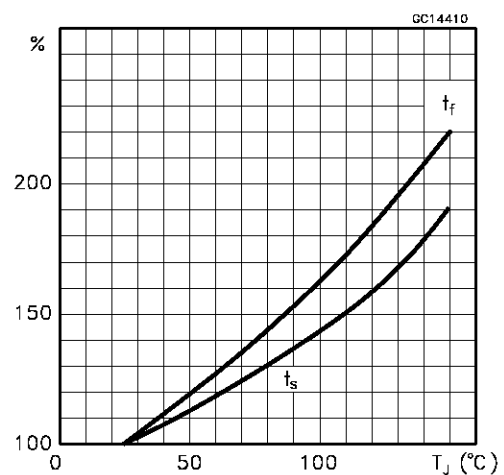
Forward Biased AOA



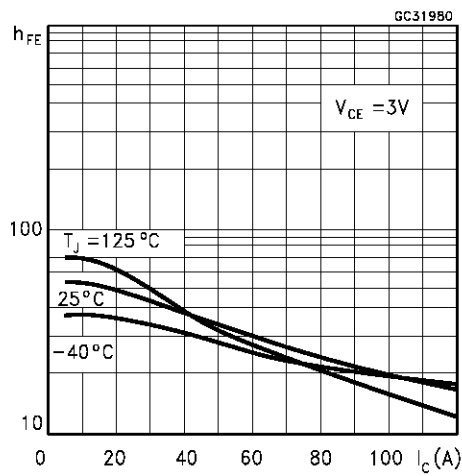
Switching Times Inductive Load



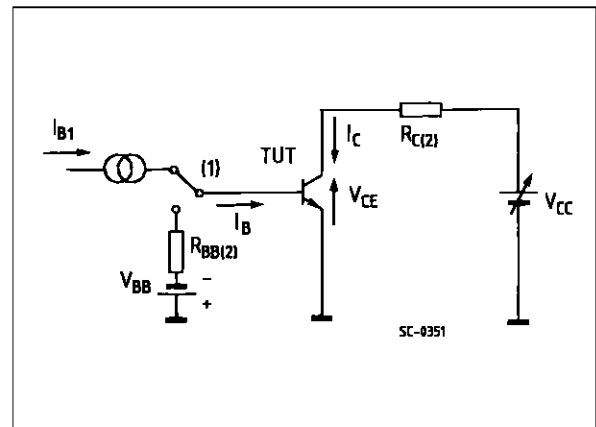
Switching Times Inductive Load Versus Temperature



## Dc Current Gain



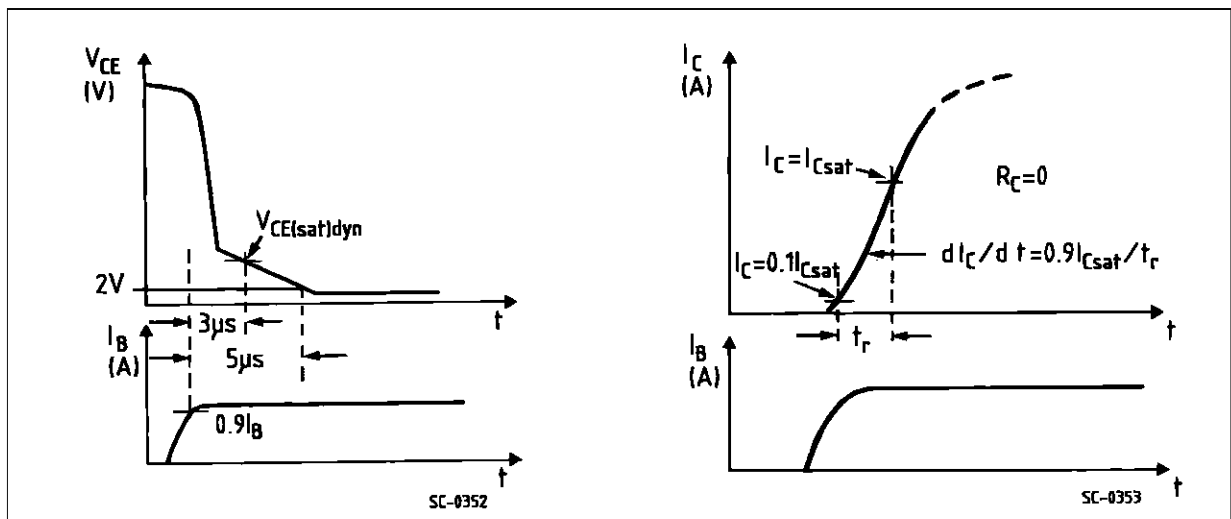
## Turn-on Switching Test Circuit



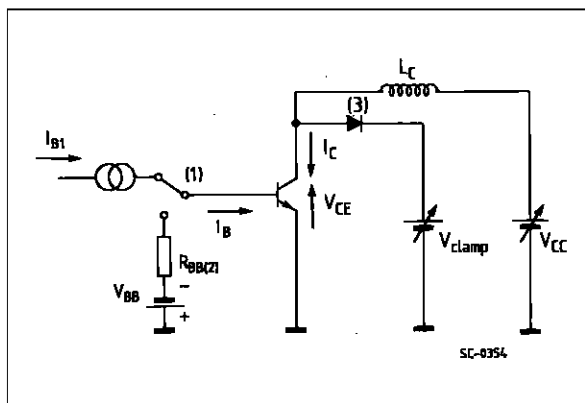
(1) Fast electronics switch

(2) Non-inductive load

## Turn-on Switching Waveforms



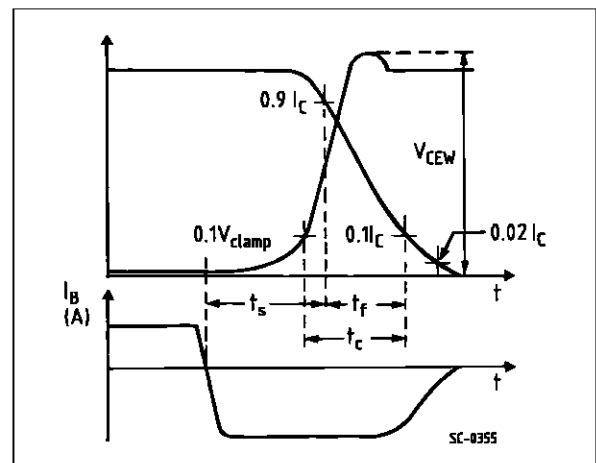
## Turn-off Switching Test Circuit



(1) Fast electronic switch  
(3) Fast recovery rectifier

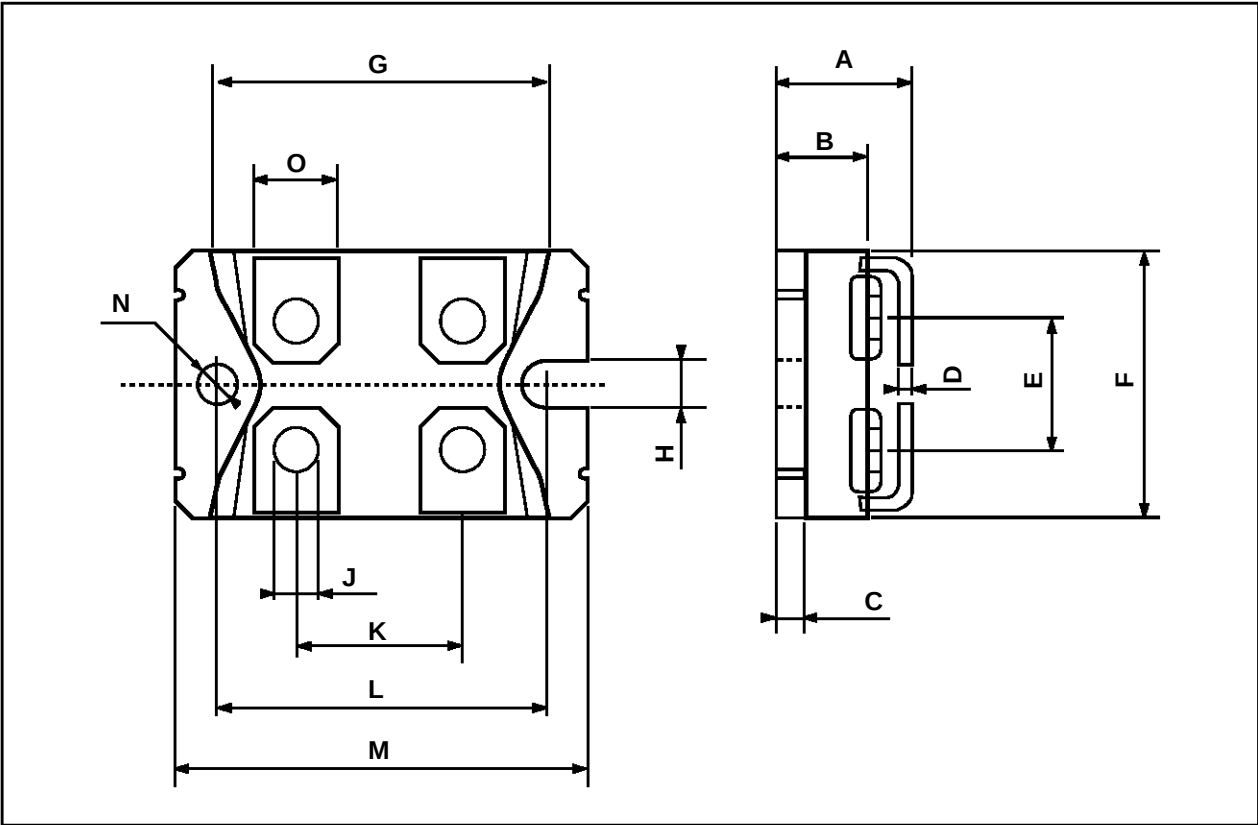
(2) Non-inductive load

## Turn-off Switching Waveforms



ISOTOP MECHANICAL DATA

| DIM. | mm    |      |      | inch  |      |       |
|------|-------|------|------|-------|------|-------|
|      | MIN.  | TYP. | MAX. | MIN.  | TYP. | MAX.  |
| A    | 11.8  |      | 12.2 | 0.466 |      | 0.480 |
| B    | 8.9   |      | 9.1  | 0.350 |      | 0.358 |
| C    | 1.95  |      | 2.05 | 0.076 |      | 0.080 |
| D    | 0.75  |      | 0.85 | 0.029 |      | 0.033 |
| E    | 12.6  |      | 12.8 | 0.496 |      | 0.503 |
| F    | 25.15 |      | 25.5 | 0.990 |      | 1.003 |
| G    | 31.5  |      | 31.7 | 1.240 |      | 1.248 |
| H    | 4     |      |      | 0.157 |      |       |
| J    | 4.1   |      | 4.3  | 0.161 |      | 0.169 |
| K    | 14.9  |      | 15.1 | 0.586 |      | 0.594 |
| L    | 30.1  |      | 30.3 | 1.185 |      | 1.193 |
| M    | 37.8  |      | 38.2 | 1.488 |      | 1.503 |
| N    | 4     |      |      | 0.157 |      |       |
| O    | 7.8   |      | 8.2  | 0.307 |      | 0.322 |



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