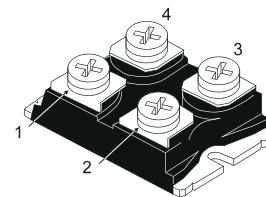


## NPN DARLINGTON POWER MODULE

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

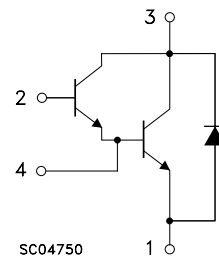
### INDUSTRIAL APPLICATIONS:

- MOTOR CONTROL
- 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                                       | 67         | A                  |
| $I_{CM}$       | Collector Peak Current ( $t_p = 10\text{ ms}$ )         | 100        | A                  |
| $I_B$          | Base Current                                            | 3          | A                  |
| $I_{BM}$       | Base Peak Current ( $t_p = 10\text{ ms}$ )              | 6          | A                  |
| $P_{tot}$      | Total Dissipation at $T_c = 25\text{ }^{\circ}\text{C}$ | 150        | 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 (transistor)                   | Max | 0.83 | $^{\circ}\text{C/W}$ |
| $R_{thj-case}$ | Thermal Resistance Junction-case (diode)                        | Max | 1.2  | $^{\circ}\text{C/W}$ |
| $R_{thc-h}$    | 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>$V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                                                                             |      |                           | 1.5<br>16       | mA<br>mA                                        |
| $I_{CEV} \#$              | Collector Cut-off Current ( $V_{BE} = -5\text{V}$ ) | $V_{CE} = V_{CEV}$<br>$V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                                                                             |      |                           | 1<br>11         | mA<br>mA                                        |
| $I_{EBO} \#$              | Emitter Cut-off Current ( $I_C = 0$ )               | $V_{EB} = 5 \text{ V}$                                                                                                                                                                                                                                               |      |                           | 1               | mA                                              |
| $V_{CEO(SUS)}^*$          | Collector-Emitter Sustaining Voltage                | $I_C = 0.2 \text{ A} \quad L = 25 \text{ mH}$<br>$V_{clamp} = 300 \text{ V}$                                                                                                                                                                                         | 300  |                           |                 | V                                               |
| $h_{FE}^*$                | DC Current Gain                                     | $I_C = 56 \text{ A} \quad V_{CE} = 5 \text{ V}$                                                                                                                                                                                                                      |      | 300                       |                 |                                                 |
| $V_{CE(sat)}^*$           | Collector-Emitter Saturation Voltage                | $I_C = 40 \text{ A} \quad I_B = 0.4 \text{ A}$<br>$I_C = 40 \text{ A} \quad I_B = 0.4 \text{ A} \quad T_j = 100^{\circ}\text{C}$<br>$I_C = 56 \text{ A} \quad I_B = 1.6 \text{ A}$<br>$I_C = 56 \text{ A} \quad I_B = 1.6 \text{ A} \quad T_j = 100^{\circ}\text{C}$ |      | 1.25<br>1.4<br>1.5<br>1.8 | 1.8<br>2.2      | V<br>V<br>V<br>V                                |
| $V_{BE(sat)}^*$           | Base-Emitter Saturation Voltage                     | $I_C = 56 \text{ A} \quad I_B = 1.6 \text{ A}$<br>$I_C = 56 \text{ A} \quad I_B = 1.6 \text{ A} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                     |      | 2.4<br>2.5                | 3               | V<br>V                                          |
| $di_C/dt$                 | Rate of Rise of On-state Collector                  | $V_{CC} = 300 \text{ V} \quad R_C = 0 \quad t_p = 3 \mu\text{s}$<br>$I_{B1} = 0.6 \text{ A} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                         | 220  | 260                       |                 | A/ $\mu\text{s}$                                |
| $V_{CE(3 \mu\text{s})}^*$ | Collector-Emitter Dynamic Voltage                   | $V_{CC} = 300 \text{ V} \quad R_C = 7.5 \Omega$<br>$I_{B1} = 0.6 \text{ A} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                                          |      | 3                         | 6               | V                                               |
| $V_{CE(5 \mu\text{s})}^*$ | Collector-Emitter Dynamic Voltage                   | $V_{CC} = 300 \text{ V} \quad R_C = 7.5 \Omega$<br>$I_{B1} = 0.6 \text{ A} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                                          |      | 2.2                       | 4               | V                                               |
| $t_s$<br>$t_f$<br>$t_c$   | Storage Time<br>Fall Time<br>Cross-over Time        | $I_C = 40 \text{ A} \quad V_{CC} = 50 \text{ V}$<br>$V_{BB} = -5 \text{ V} \quad R_{BB} = 0.6 \Omega$<br>$V_{clamp} = 300 \text{ V} \quad I_{B1} = 0.4 \text{ A}$<br>$L = 0.06 \text{ mH} \quad T_j = 100^{\circ}\text{C}$                                           |      | 2<br>0.35<br>0.8          | 3<br>0.6<br>1.2 | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| $V_{CEW}$                 | Maximum Collector Emitter Voltage Without Snubber   | $I_{CWOFF} = 67 \text{ A} \quad I_{B1} = 1.6 \text{ A}$<br>$V_{BB} = -5 \text{ V} \quad V_{CC} = 50 \text{ V}$<br>$L = 0.037 \text{ mH} \quad R_{BB} = 0.6 \Omega$<br>$T_j = 125^{\circ}\text{C}$                                                                    | 300  |                           |                 | V                                               |
| $V_F^*$                   | Diode Forward Voltage                               | $I_F = 56 \text{ A} \quad T_j = 100^{\circ}\text{C}$                                                                                                                                                                                                                 |      | 1.15                      | 1.6             | V                                               |
| $I_{RM}$                  | Reverse Recovery Current                            | $V_{CC} = 200 \text{ V} \quad I_F = 56 \text{ A}$<br>$di_F/dt = -220 \text{ A}/\mu\text{s} \quad L < 0.05 \mu\text{H}$<br>$T_j = 100^{\circ}\text{C}$                                                                                                                |      | 12                        | 17              | A                                               |

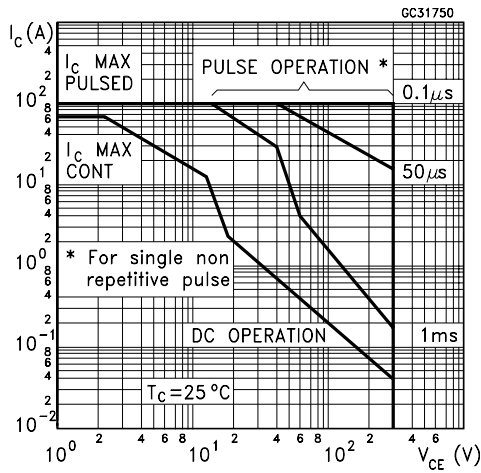
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

# See test circuit in databook introduction

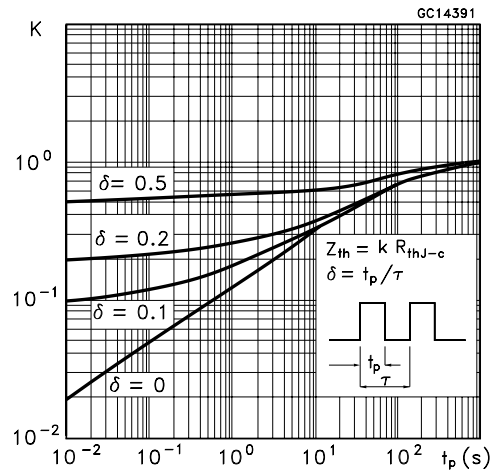
To evaluate the conduction losses of the diode use the following equations:

$$V_F = 1.1 + 0.0045 I_F \quad P = 1.1 I_{F(AV)} + 0.0045 I_{F(RMS)}^2$$

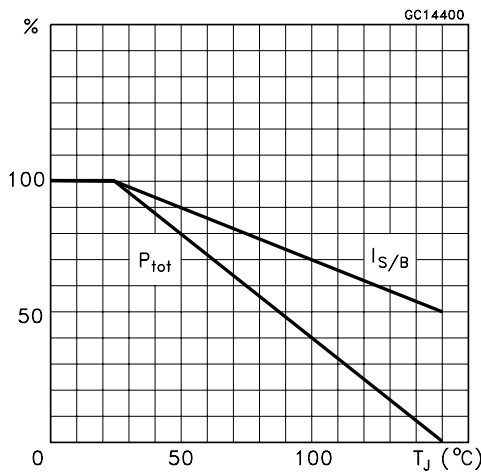
## Safe Operating Areas



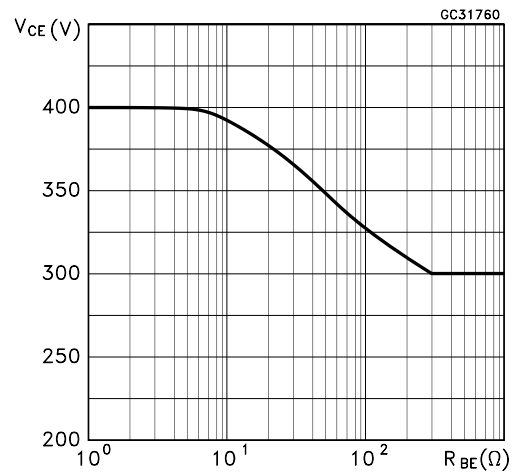
## Thermal Impedance



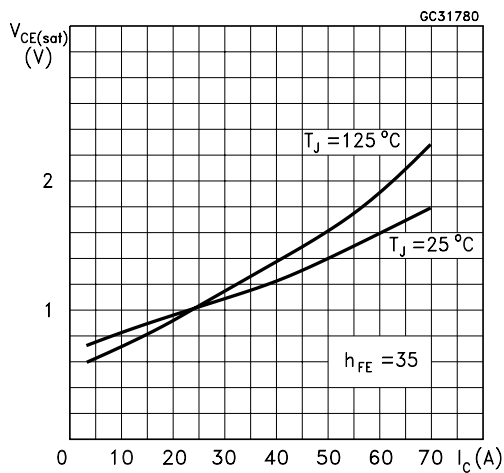
## Derating Curve



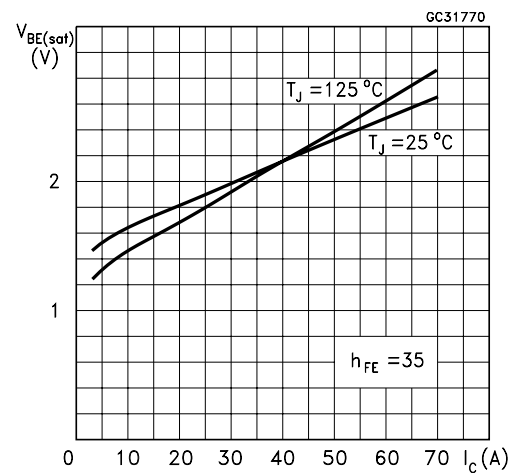
## Collector-emitter Voltage Versus base-emitter Resistance



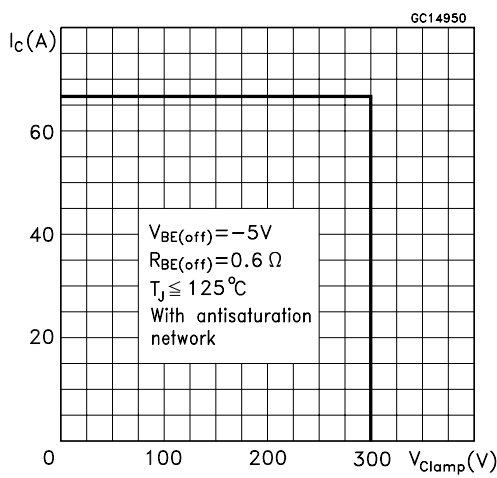
## Collector Emitter Saturation Voltage



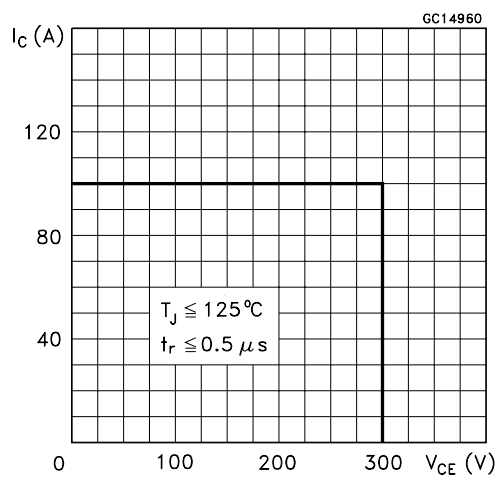
## Base-Emitter Saturation Voltage



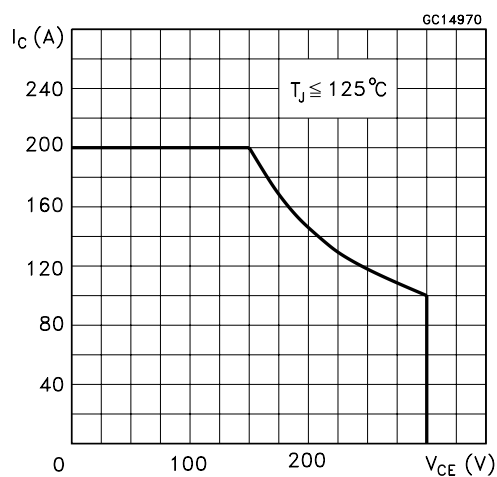
Reverse Biased SOA



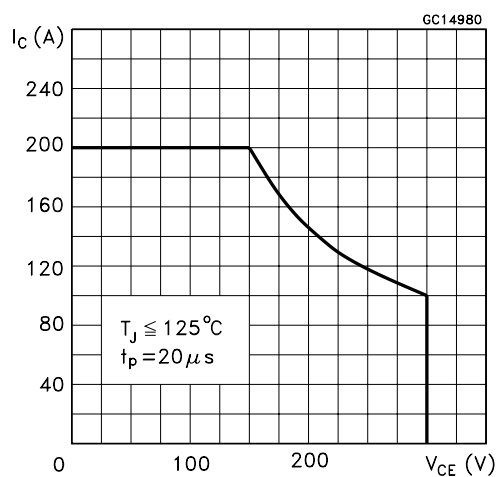
Foward Biased SOA



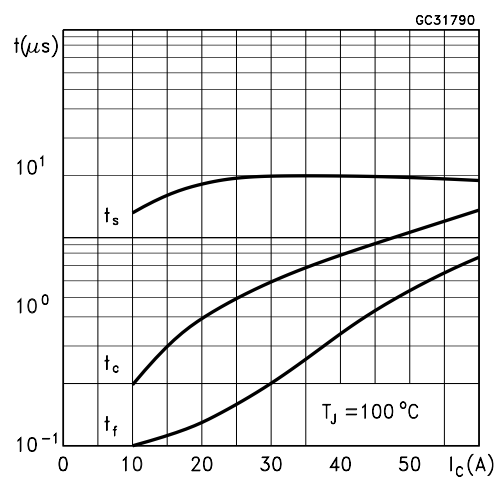
Reverse Biased AOA



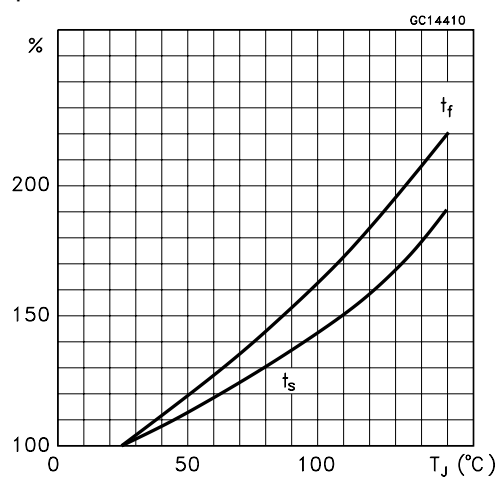
Forward Biased AOA



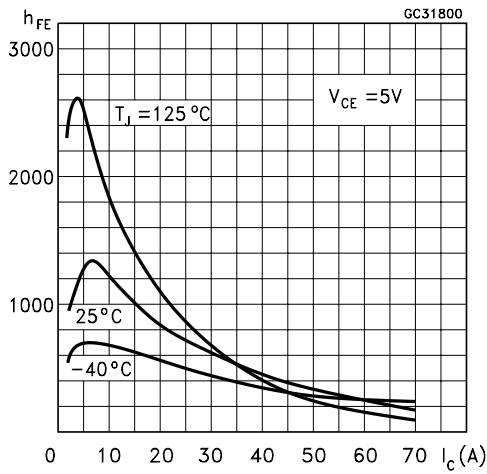
Switching Times Inductive Load



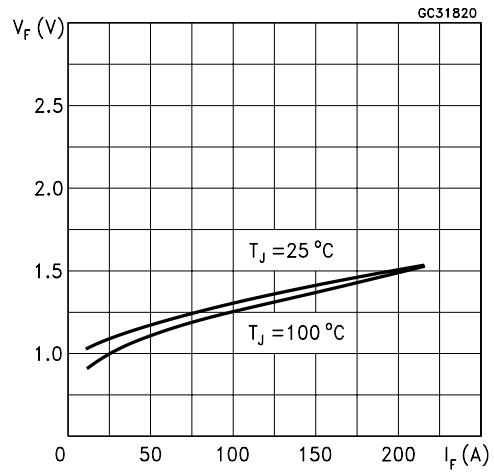
Switching Times Inductive Load Versus Temperature



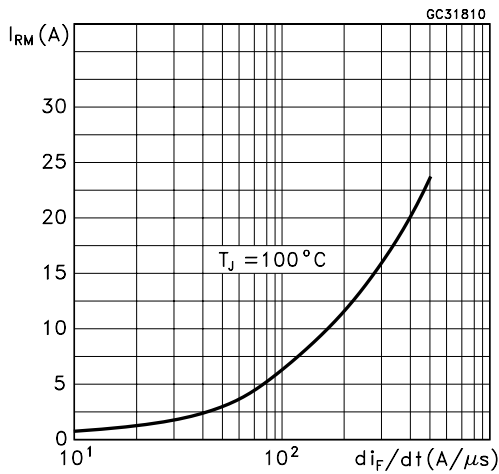
Dc Current Gain



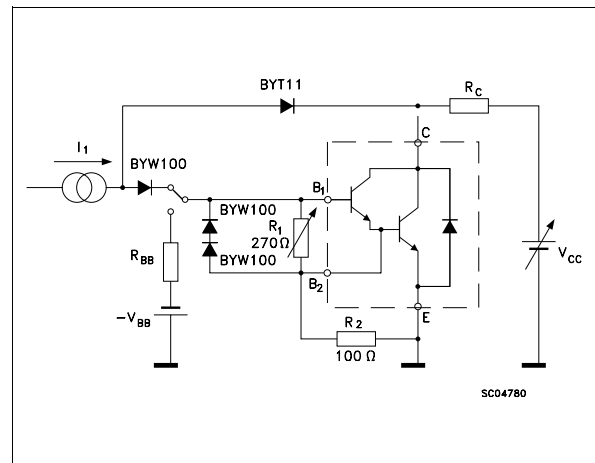
Typical  $V_F$  Versus  $I_F$



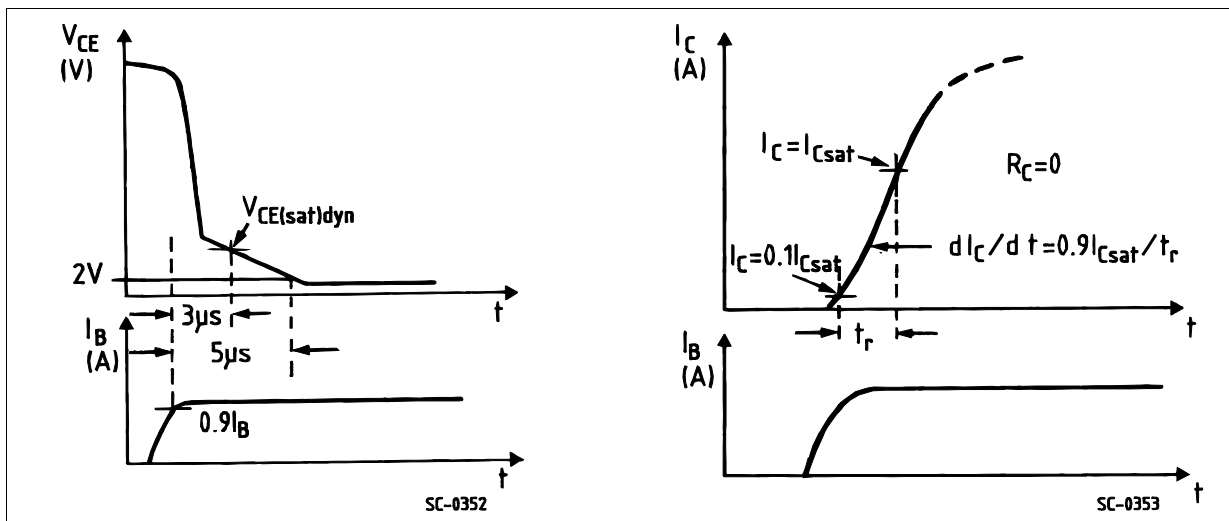
Peak Reverse Current Versus  $di_F/dt$



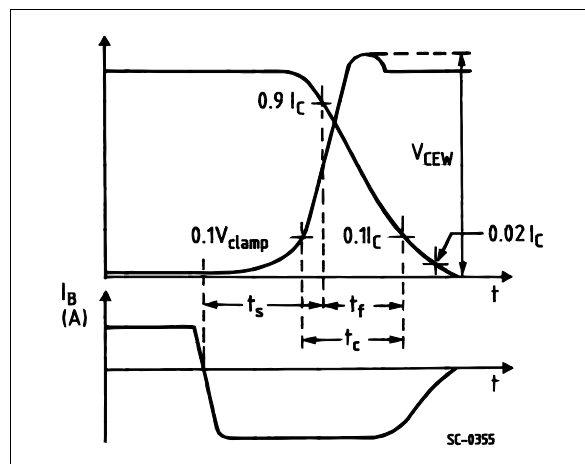
Turn-on Switching Test Circuit



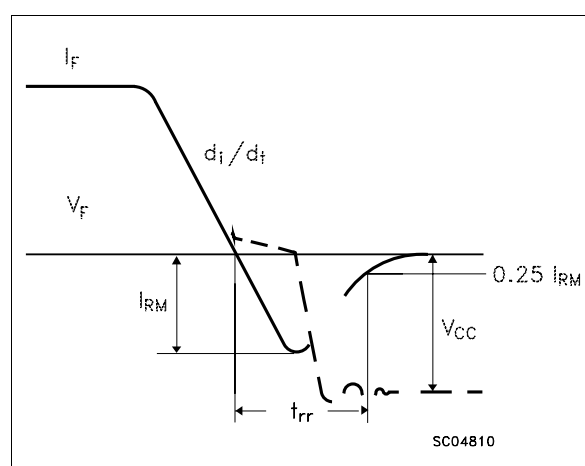
Turn-on Switching Waveforms



## Turn-off Switching Waveforms

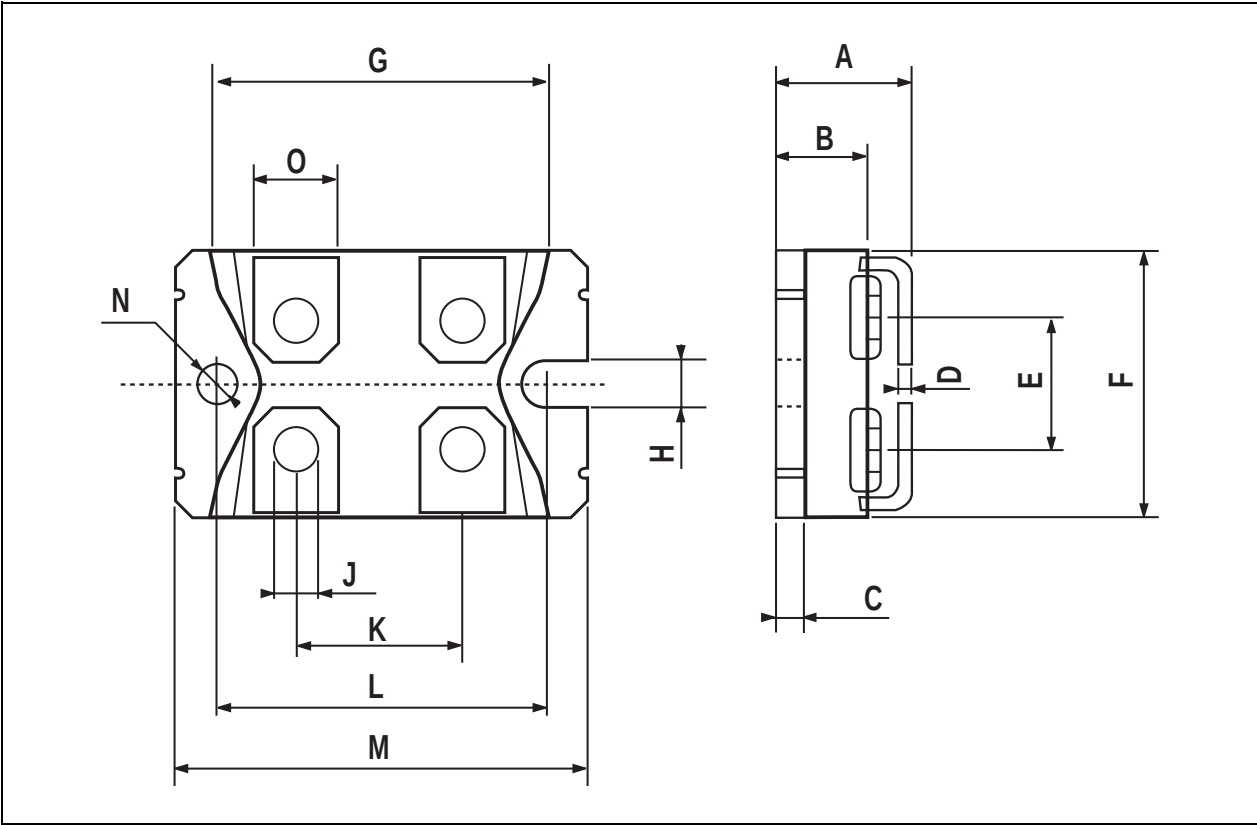


### Turn-off Switching Waveform of Diode



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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