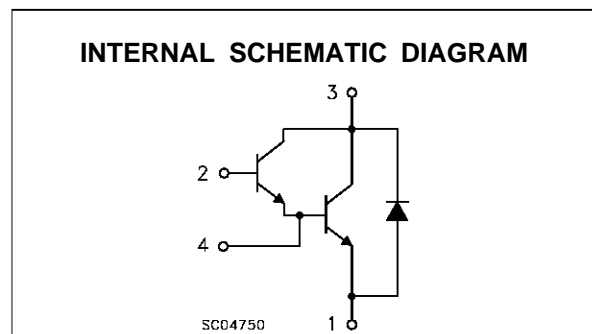
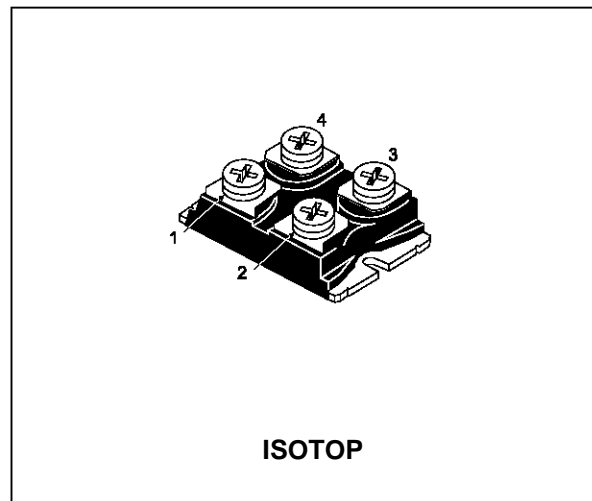


NPN DARLINGTON POWER MODULE

- 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
- SMPS & UPS
- WELDING EQUIPMENT


ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------|--|------------|------|
| V_{CEV} | Collector-Emitter Voltage ($V_{BE} = -5$ V) | 600 | V |
| $V_{CEO(sus)}$ | Collector-Emitter Voltage ($I_B = 0$) | 450 | V |
| V_{EBO} | Emitter-Base Voltage ($I_C = 0$) | 7 | V |
| I_C | Collector Current | 60 | A |
| I_{CM} | Collector Peak Current ($t_p = 10$ ms) | 90 | A |
| I_B | Base Current | 6 | A |
| I_{BM} | Base Peak Current ($t_p = 10$ ms) | 12 | A |
| P_{tot} | Total Dissipation at $T_C = 25$ °C | 175 | W |
| T_{stg} | Storage Temperature | -55 to 150 | °C |
| T_j | Max. Operating Junction Temperature | 150 | °C |
| V_{ISO} | Insulation Withstand Voltage (AC-RMS) | 2500 | °C |

ESM5045DV

THERMAL DATA

| | | | | |
|----------------|---|-----|------|-----------------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case (transistor) | Max | 0.71 | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-case}$ | Thermal Resistance Junction-case (diode) | Max | 1.2 | $^{\circ}\text{C}/\text{W}$ |
| R_{thc-h} | Thermal Resistance Case-heatsink With Conductive Grease Applied | Max | 0.05 | $^{\circ}\text{C}/\text{W}$ |

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 ($R_{BE} = 5 \Omega$) | $V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$ | | | 1.5 20 | mA mA |
| I_{CEV} # | Collector Cut-off Current ($V_{BE} = -5$) | $V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$ | | | 1 13 | mA mA |
| I_{EBO} # | Emitter Cut-off Current ($I_C = 0$) | $V_{EB} = 5 \text{ V}$ | | | 1 | mA |
| $V_{CEO(SUS)}$ * | Collector-Emitter Sustaining Voltage | $I_C = 0.2 \text{ A} \quad L = 25 \text{ mH}$ $V_{clamp} = 450 \text{ V}$ | 450 | | | V |
| h_{FE} * | DC Current Gain | $I_C = 50 \text{ A} \quad V_{CE} = 5 \text{ V}$ | | 150 | | |
| $V_{CE(sat)}$ * | Collector-Emitter Saturation Voltage | $I_C = 35 \text{ A} \quad I_B = 0.7 \text{ A}$ $I_C = 35 \text{ A} \quad I_B = 0.7 \text{ A} \quad T_j = 100^{\circ}\text{C}$ $I_C = 50 \text{ A} \quad I_B = 2.8 \text{ A}$ $I_C = 50 \text{ A} \quad I_B = 2.8 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | | 1.2 1.4 1.4 1.6 | 2 2 | V V V V |
| $V_{BE(sat)}$ * | Base-Emitter Saturation Voltage | $I_C = 50 \text{ A} \quad I_B = 2.8 \text{ A}$ $I_C = 50 \text{ A} \quad I_B = 2.8 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | | 2.3 2.3 | 3 | V V |
| di/dt | Rate of Rise of On-state Collector | $V_{CC} = 300 \text{ V} \quad R_C = 0 \quad t_p = 3 \mu\text{s}$ $I_{B1} = 1.05 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | 300 | 400 | | $\text{A}/\mu\text{s}$ |
| $V_{CE(3 \mu\text{s})}$ • | Collector-Emitter Dynamic Voltage | $V_{CC} = 300 \text{ V} \quad R_C = 8.5 \Omega$ $I_{B1} = 1.05 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | | 4.5 | 8 | V |
| $V_{CE(5 \mu\text{s})}$ • | Collector-Emitter Dynamic Voltage | $V_{CC} = 300 \text{ V} \quad R_C = 8.5 \Omega$ $I_{B1} = 1.05 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | | 2.5 | 4.5 | V |
| t_s t_f t_c | Storage Time Fall Time Cross-over Time | $I_C = 35 \text{ A} \quad V_{CC} = 50 \text{ V}$ $V_{BB} = -5 \text{ V} \quad R_{BB} = 0.6 \Omega$ $V_{clamp} = 450 \text{ V} \quad I_{B1} = 0.7 \text{ A}$ $L = 0.07 \text{ mH} \quad T_j = 100^{\circ}\text{C}$ | | 3.2 0.25 0.75 | 5 0.5 1.5 | μs μs μs |
| V_{CEW} | Maximum Collector Emitter Voltage Without Snubber | $I_{C\text{Woff}} = 60 \text{ A} \quad I_{B1} = 2.8 \text{ A}$ $V_{BB} = -5 \text{ V} \quad V_{CC} = 50 \text{ V}$ $L = 42 \mu\text{H} \quad R_{BB} = 0.6 \Omega$ $T_j = 125^{\circ}\text{C}$ | 450 | | | V |
| V_F * | Diode Forward Voltage | $I_F = 50 \text{ A} \quad T_j = 100^{\circ}\text{C}$ | | 1.5 | 1.8 | V |
| I_{RM} | Reverse Recovery Current | $V_{CC} = 200 \text{ V} \quad I_F = 50 \text{ A}$ $di_F/dt = -300 \text{ A}/\mu\text{s} \quad L < 0.05 \mu\text{H}$ $T_j = 100^{\circ}\text{C}$ | | 32 | 38 | A |

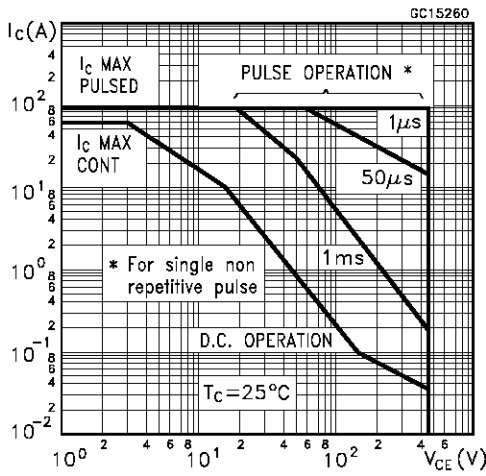
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

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

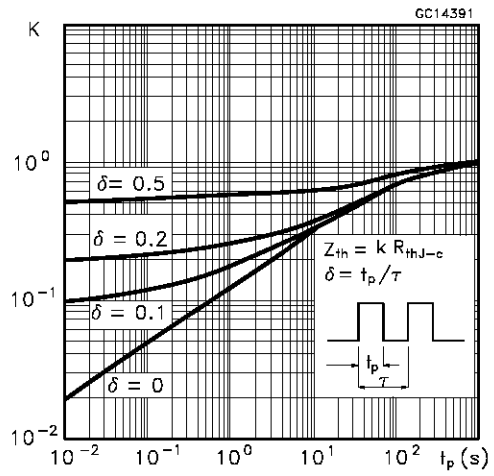
$$V_F = 1.5 + 0.0055 I_F \quad P = 1.5 I_{F(AV)} + 0.0055 I_{F(RMS)}^2$$

See test circuits in databook introduction

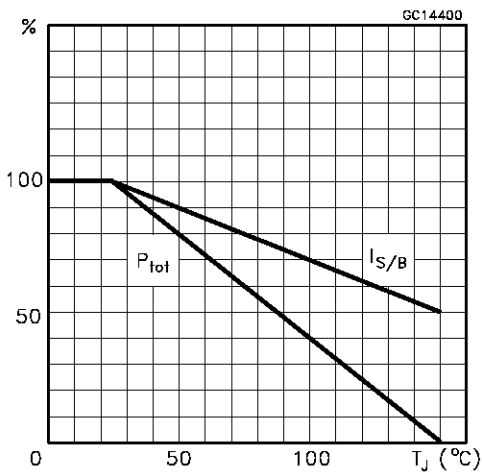
Safe Operating Areas



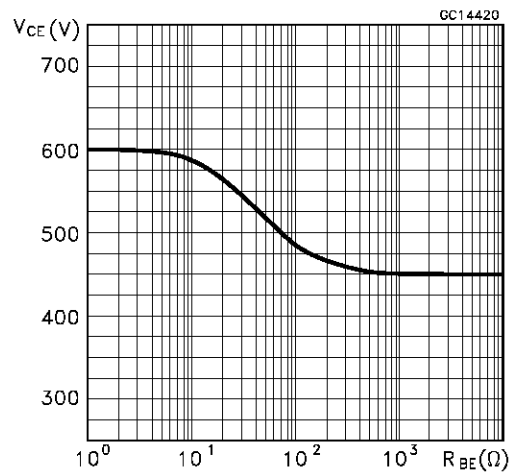
Thermal Impedance



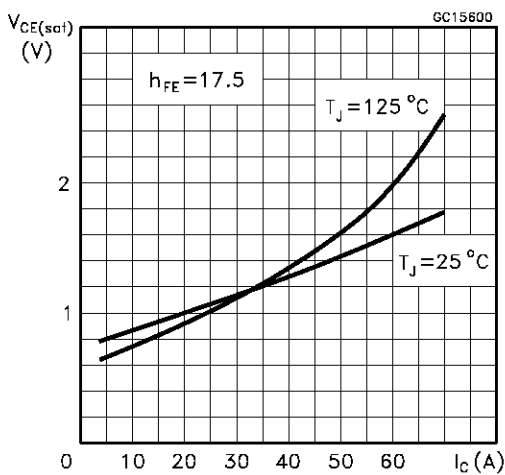
Derating Curve



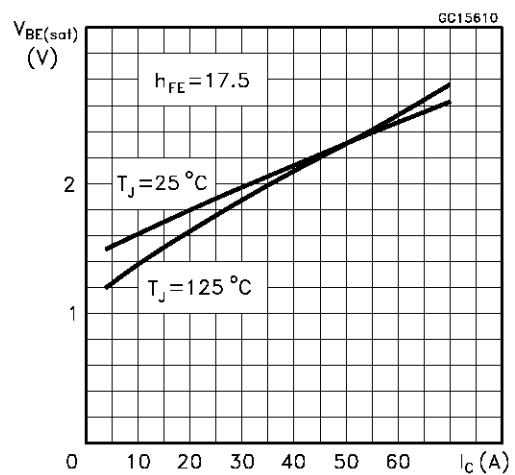
Collector-emitter Voltage Versus base-emitter Resistance



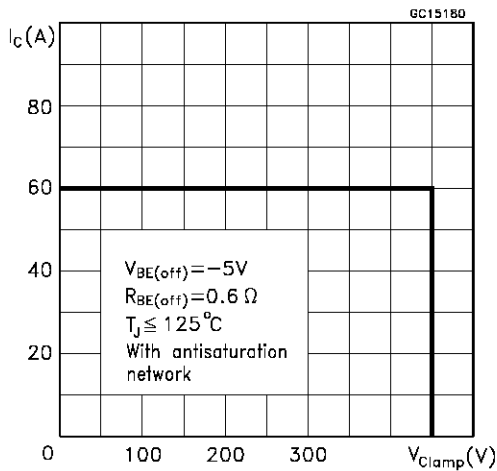
Collector Emitter Saturation Voltage



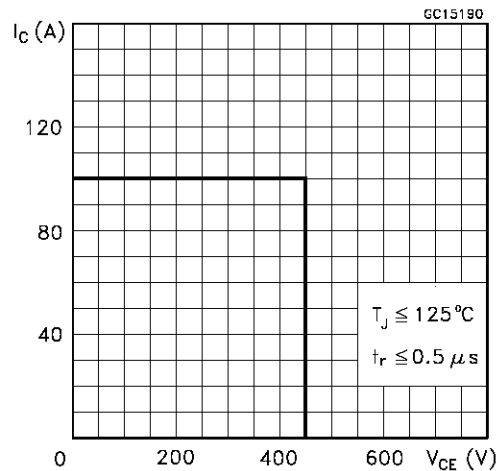
Base-Emitter Saturation Voltage



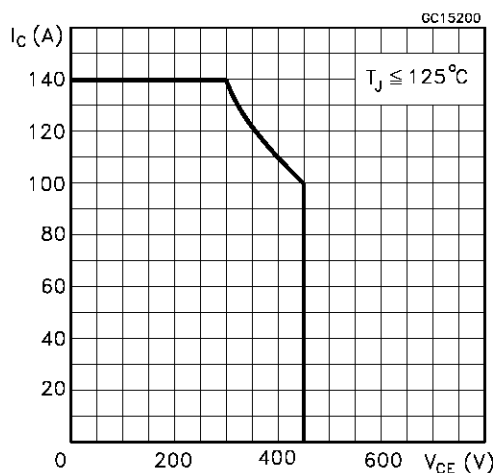
Reverse Biased SOA



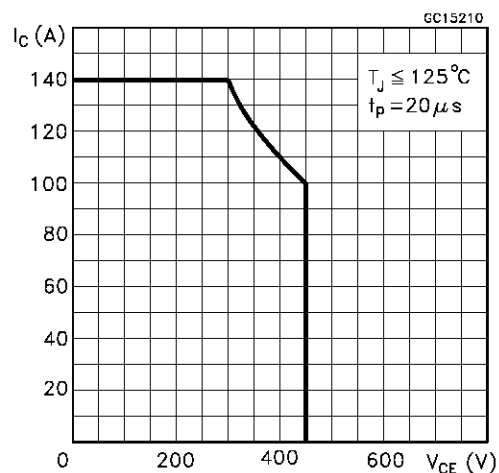
Forward Biased SOA



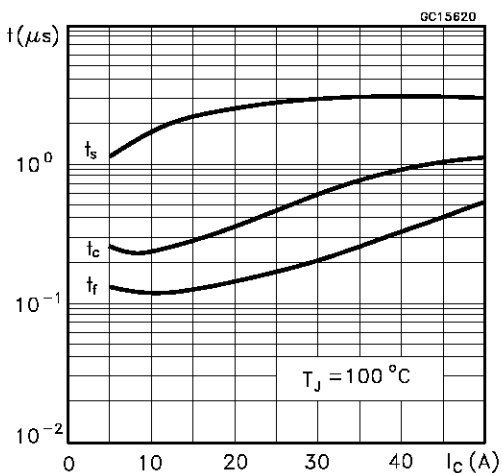
Reverse Biased AOA



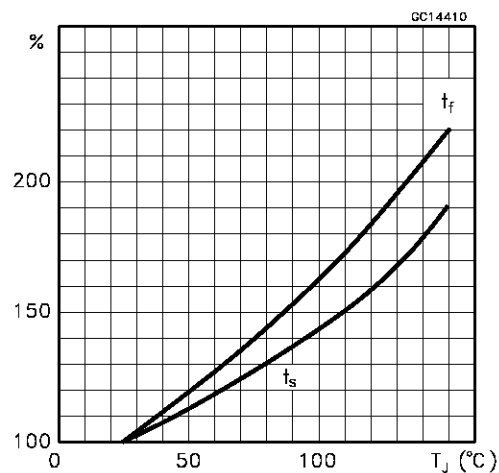
Forward Biased AOA



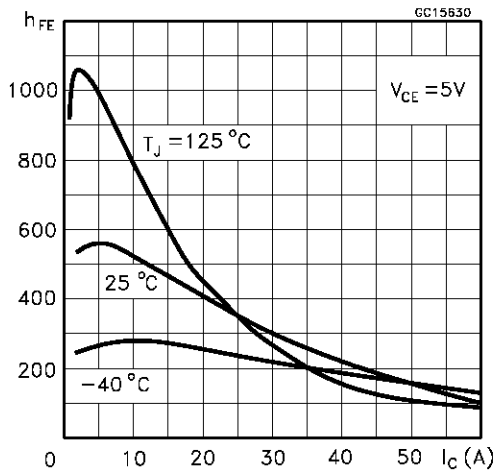
Switching Times Inductive Load



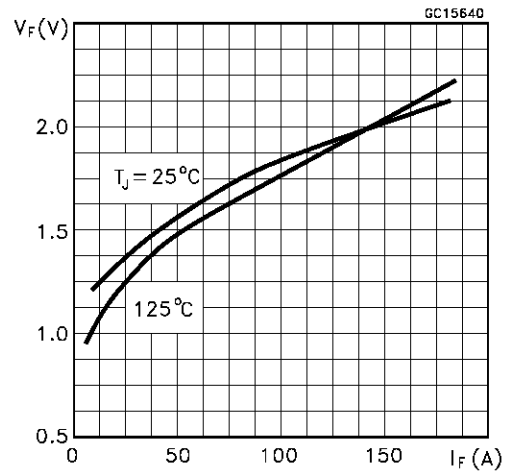
Switching Times Inductive Load Versus Temperature



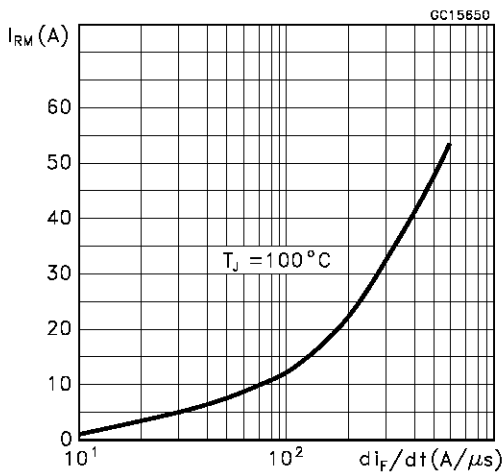
Dc Current Gain



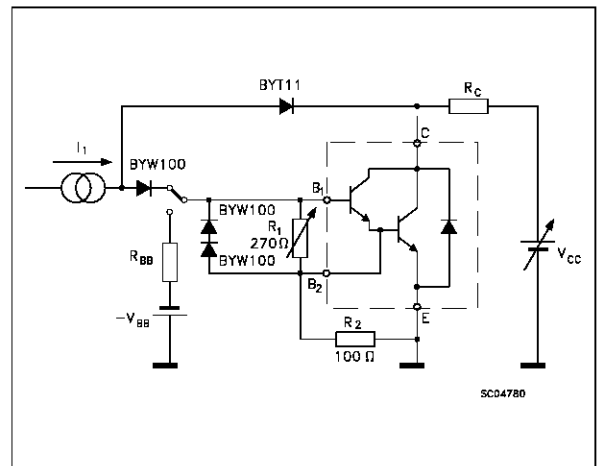
Typical V_F Versus I_F



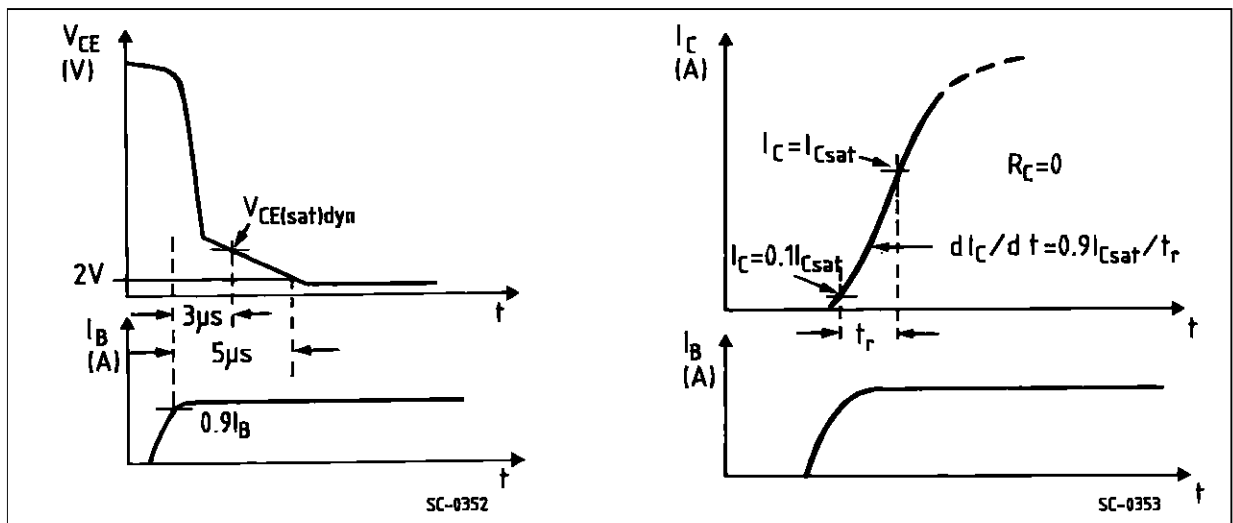
Peak Reverse Current Versus di_F/dt



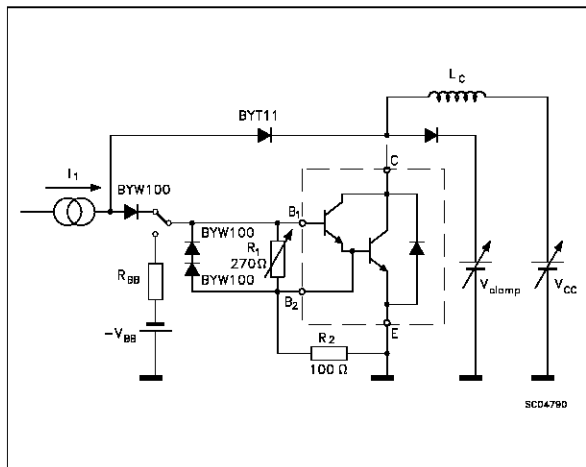
Turn-on Switching Test Circuit



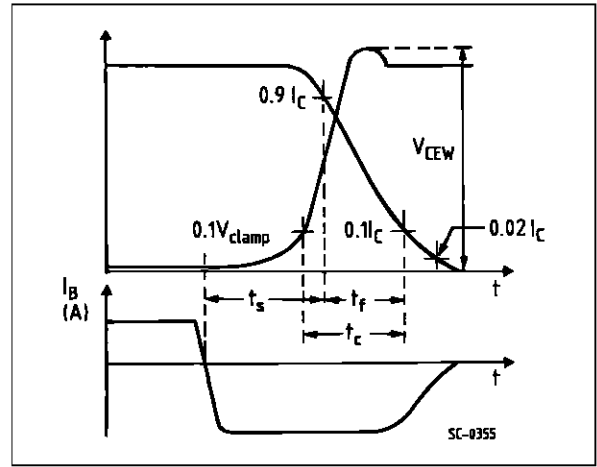
Turn-on Switching Waveforms



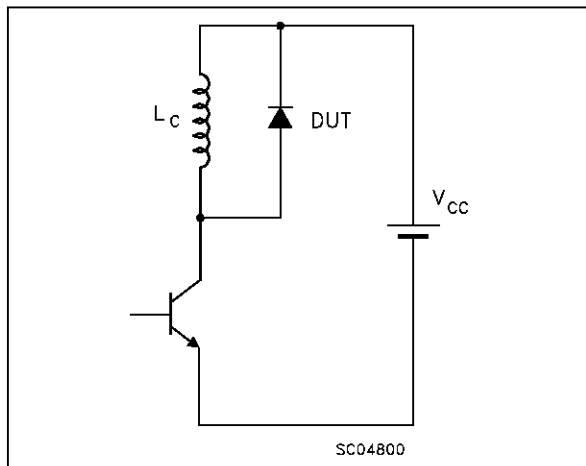
Turn-on Switching Test Circuit



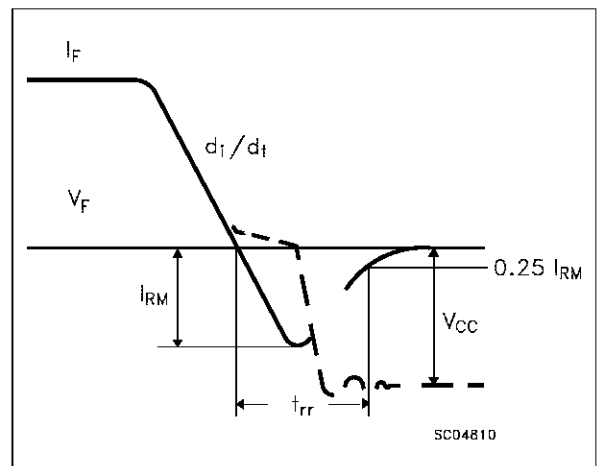
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

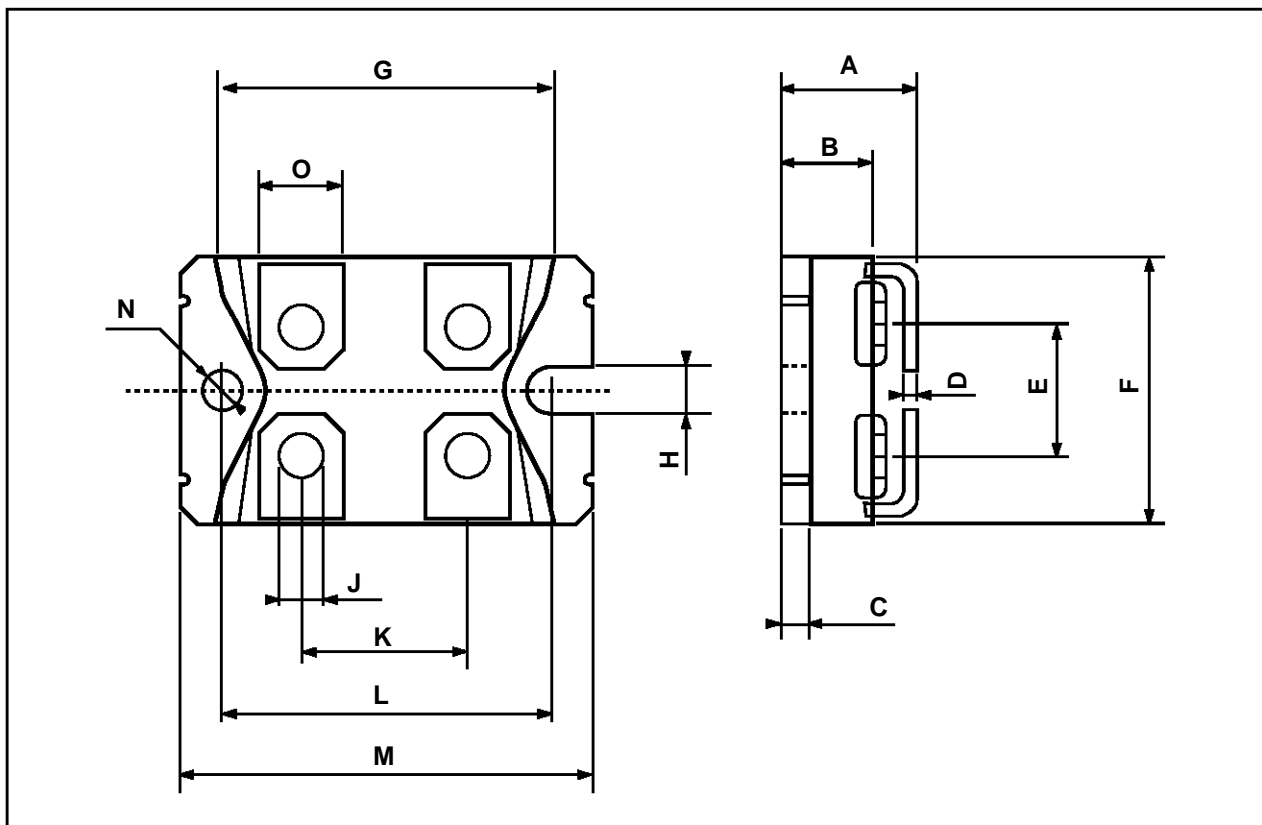


Turn-off Switching Waveform of Diode



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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