

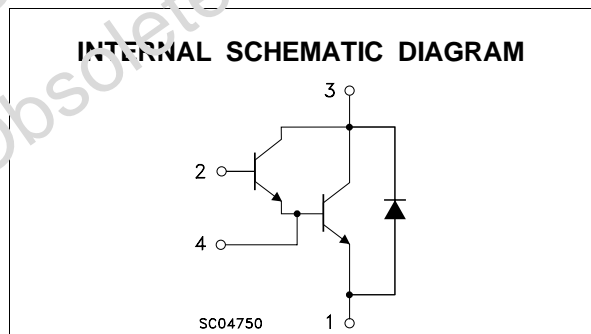
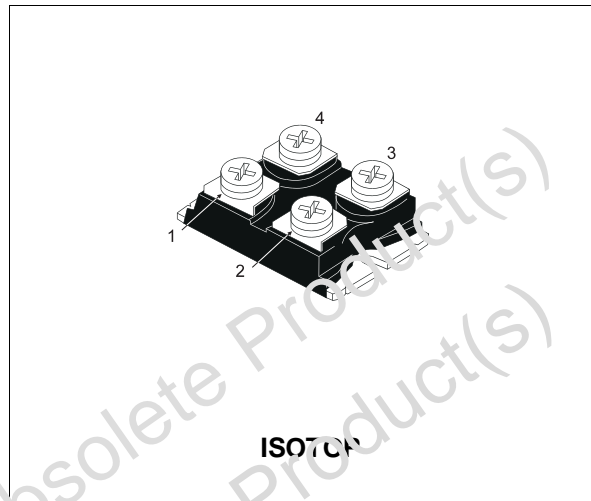


NPN DARLINGTON POWER MODULE

- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW R_{th} JUNCTION CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ULTRAFAST FREEWHEELING DIODE
- FULLY INSULATED PACKAGE (UL COMPLIANT)
- 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_{EBV} | 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 |
| V_{isol} | Insulation Withstand Voltage (RMS) from All Four Terminals to External Heatsink | 2500 | V |
| T_{stg} | Storage Temperature | -55 to 150 | °C |
| T_j | Max. Operating Junction Temperature | 150 | °C |

ESM5045DV

THERMAL DATA

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

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

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

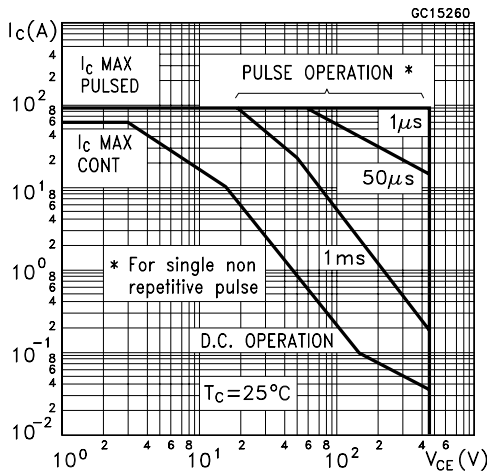
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

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

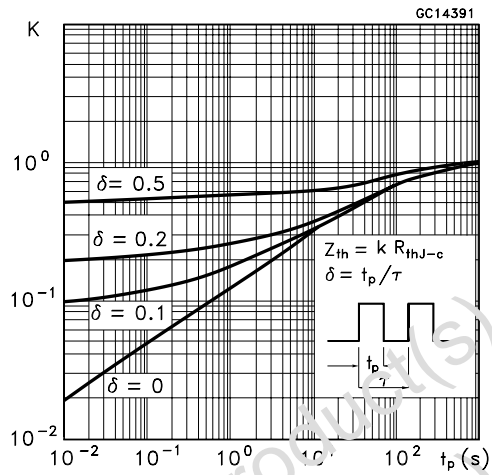
$$V_F = 1.5 + 0.0055 I_F \quad P = 1.5 I_{F(AV)} + 0.0055 I_{F(RMS)}^2$$

See test circuits in databook introduction

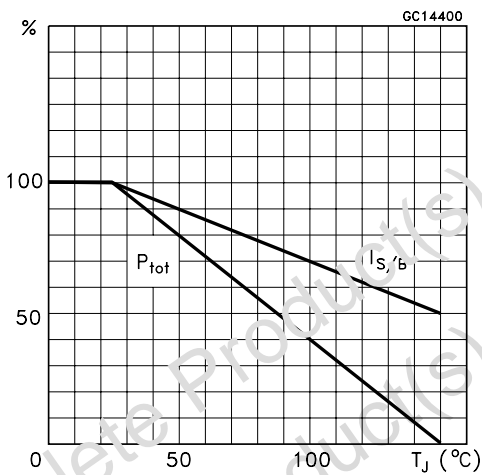
Safe Operating Areas



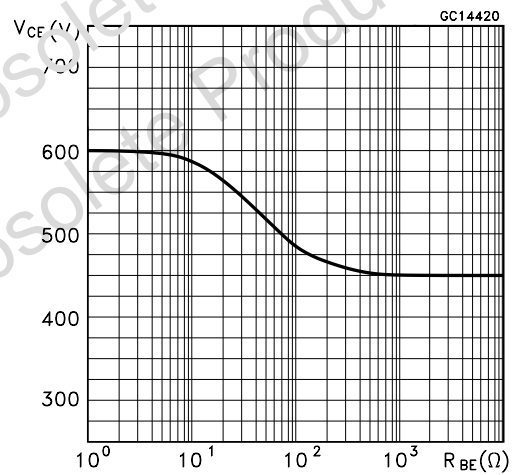
Thermal Impedance



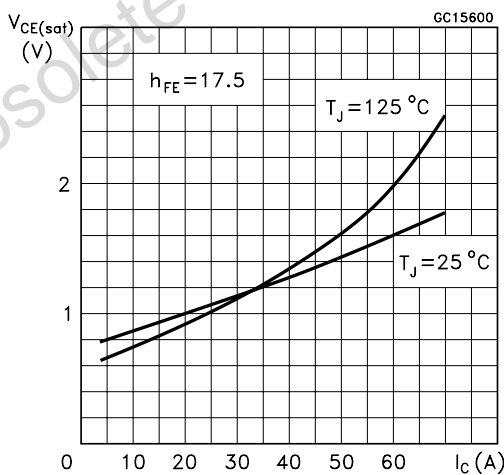
Derating Curve



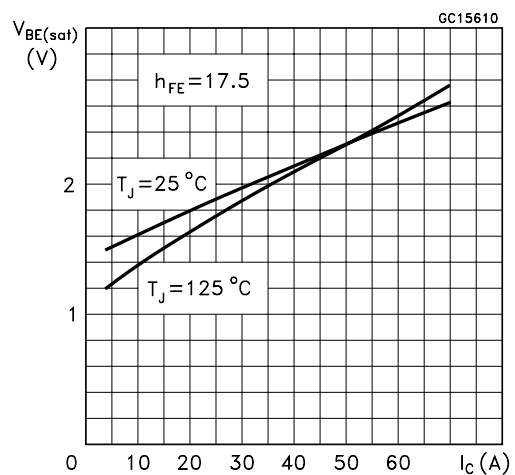
Collector-emitter Voltage Versus base-emitter Resistance



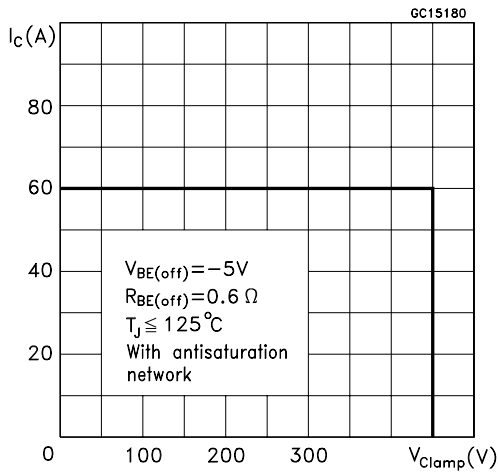
Collector Emitter Saturation Voltage



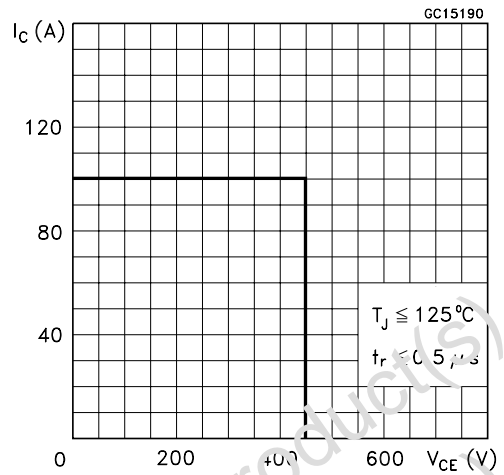
Base-Emitter Saturation Voltage



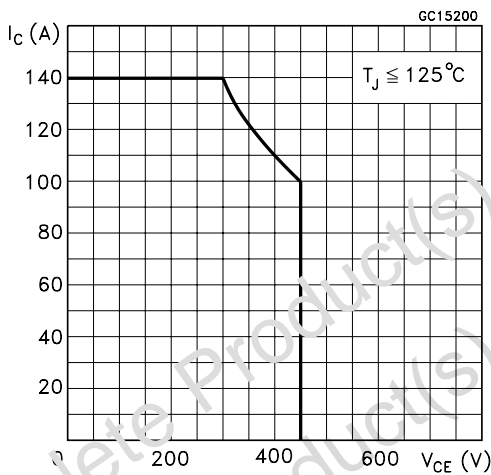
Reverse Biased SOA



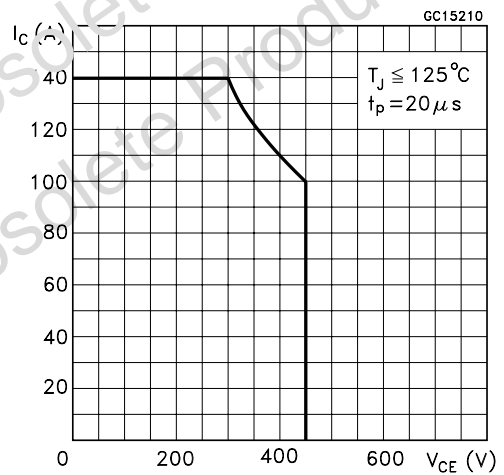
Forward Biased SOA



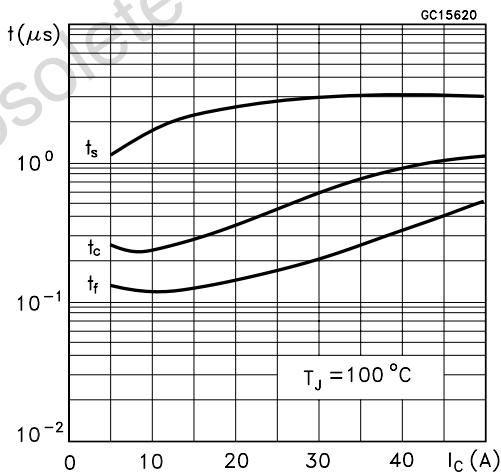
Reverse Biased AOA



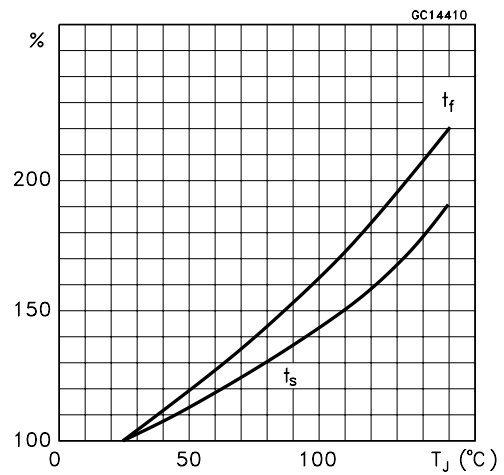
Forward Biased AOA



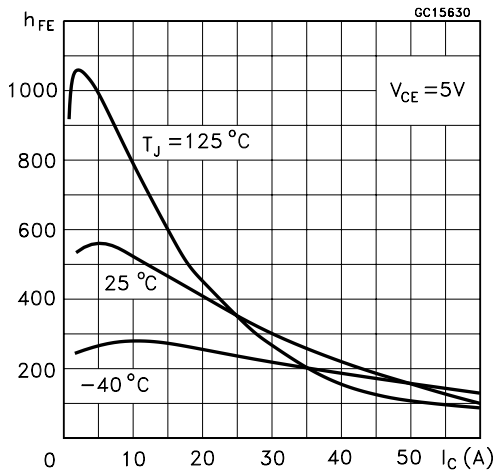
Switching Times Inductive Load



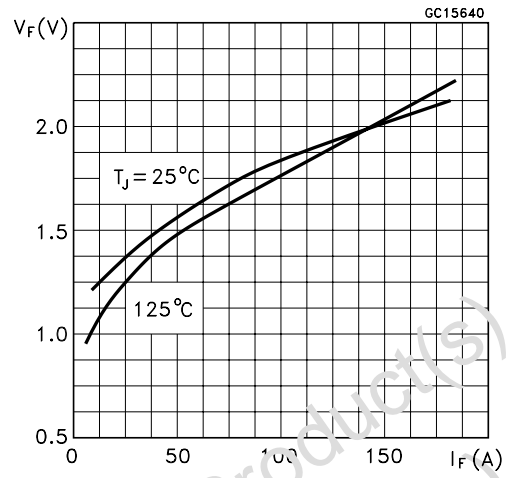
Switching Times Inductive Load Versus Temperature



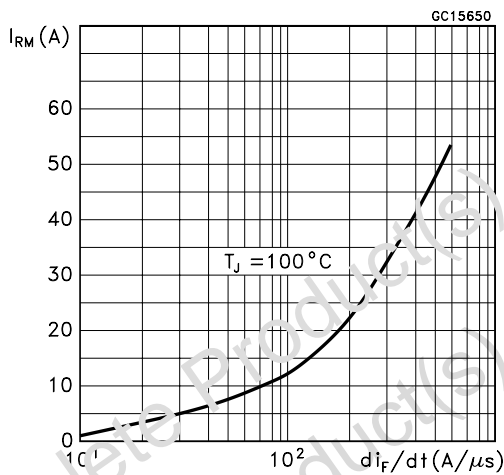
Dc Current Gain



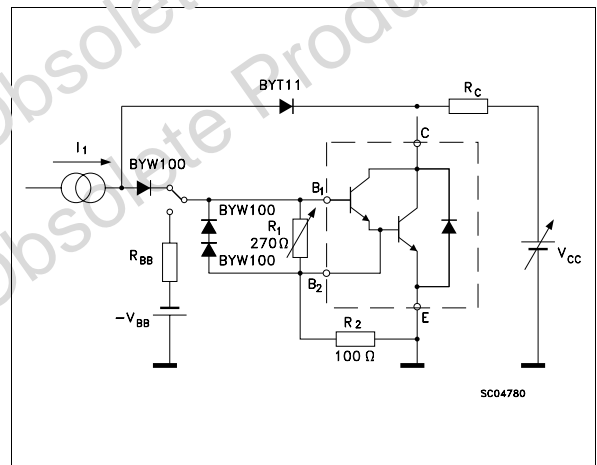
Typical V_F Versus I_F



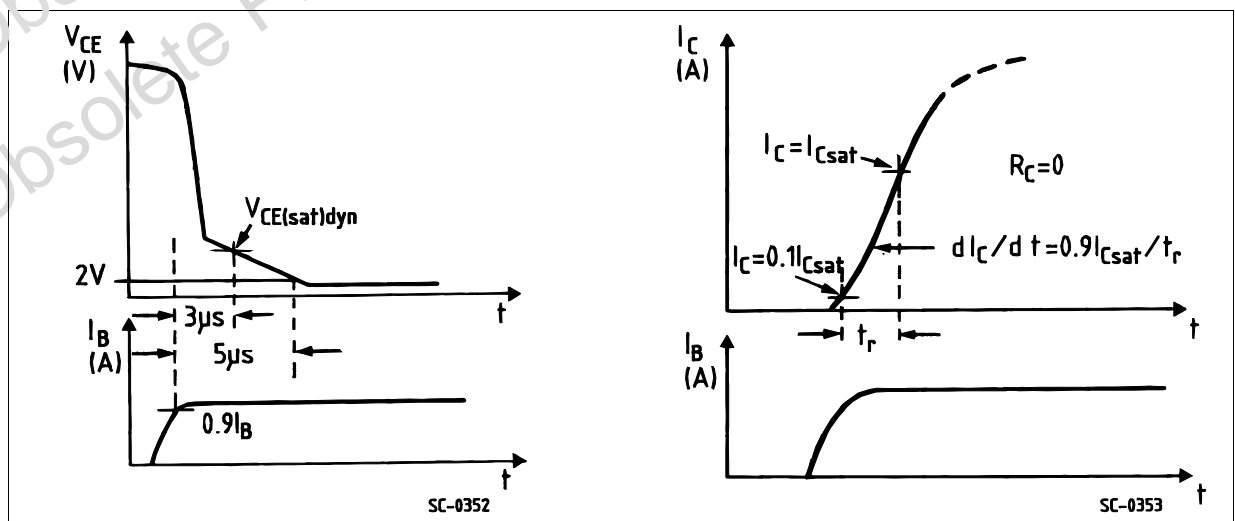
Peak Reverse Current Versus di_F/dt



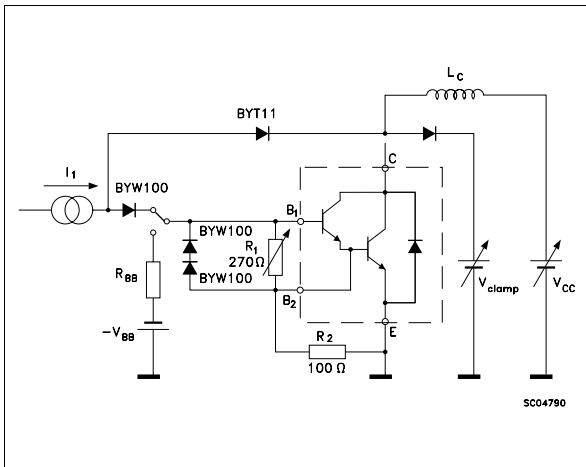
Turn-on Switching Test Circuit



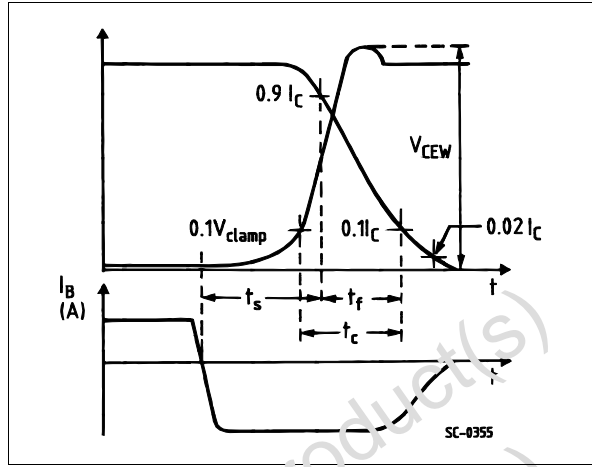
Turn-on Switching Waveforms



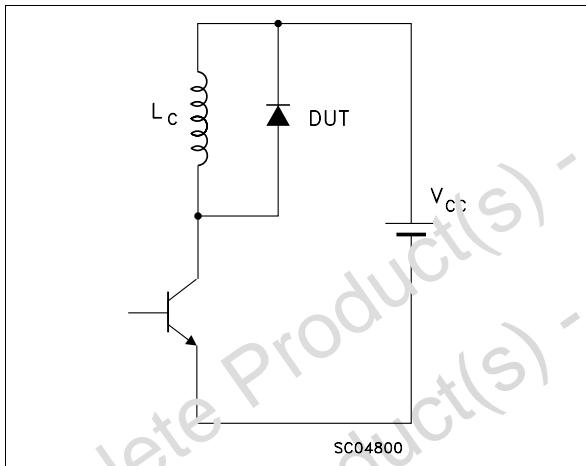
Turn-on Switching Test Circuit



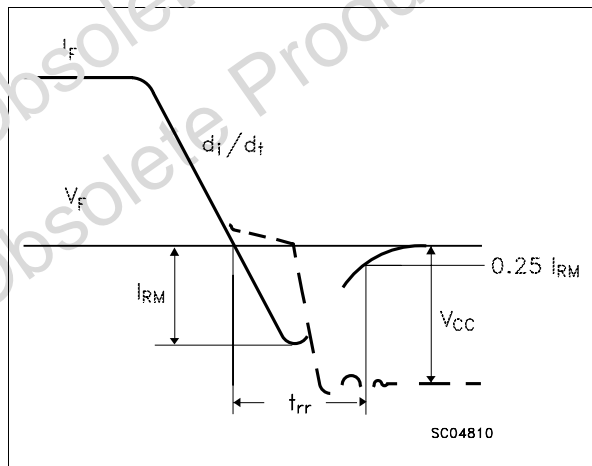
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

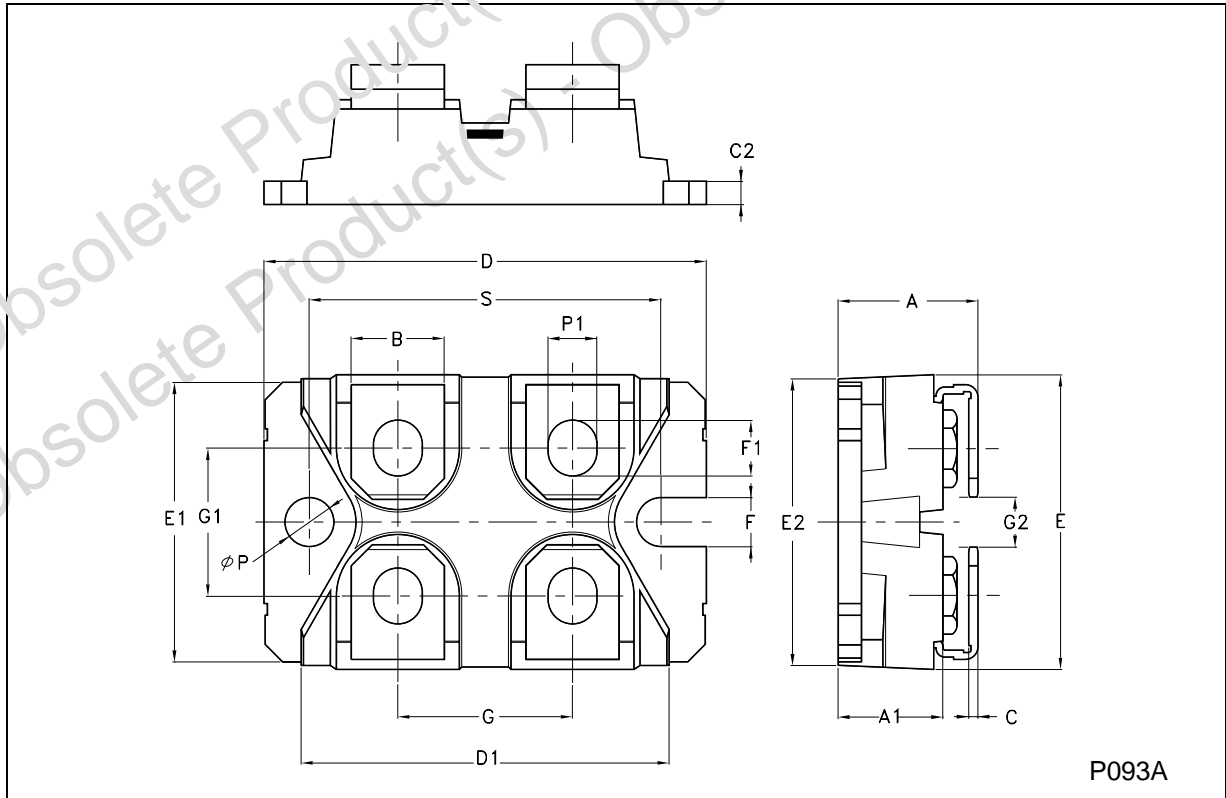


Turn-off Switching Waveform of Diode



ISOTOP MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 11.8 | | 12.2 | 0.465 | | 0.480 |
| A1 | 8.9 | | 9.1 | 0.350 | | 0.358 |
| B | 7.8 | | 8.2 | 0.307 | | 0.322 |
| C | 0.75 | | 0.85 | 0.029 | | 0.033 |
| C2 | 1.95 | | 2.05 | 0.076 | | 0.080 |
| D | 37.8 | | 38.2 | 1.488 | | 1.503 |
| D1 | 31.5 | | 31.7 | 1.240 | | 1.243 |
| E | 25.15 | | 25.5 | 0.990 | | 1.003 |
| E1 | 23.85 | | 24.15 | 0.938 | | 0.950 |
| E2 | | 24.8 | | | 0.976 | |
| G | 14.9 | | 15.1 | 0.586 | | 0.594 |
| G1 | 12.6 | | 12.8 | 0.496 | | 0.503 |
| G2 | 3.5 | | 4.3 | 0.137 | | 1.169 |
| F | 4.1 | | 4.3 | 0.161 | | 0.169 |
| F1 | 4.6 | | 5 | 0.181 | | 0.196 |
| P | 4 | | 4.3 | 0.157 | | 0.169 |
| P1 | 4 | | 4.4 | 0.157 | | 0.173 |
| S | 30.1 | | 30.3 | 1.185 | | 1.193 |



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