



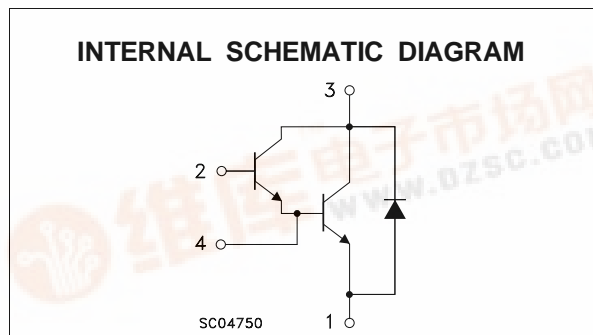
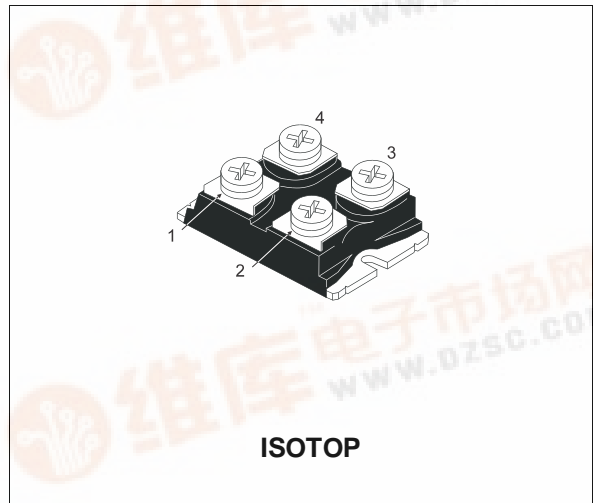
ESM2012DV

NPN DARLINGTON POWER MODULE

- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW R_{th} JUNCTION TO CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ULTRAFAST FREEWHEELING DIODE
- FULLY INSULATED PACKAGE (UL COMPLIANT)
- EASY TO MOUNT
- LOW INTERNAL PARASITIC INDUCTANCE

INDUSTRIAL APPLICATIONS:

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



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------|
| V_{CEV} | Collector-Emitter Voltage ($V_{BE} = -5$ V) | 150 | V |
| $V_{CEO(sus)}$ | Collector-Emitter Voltage ($I_B = 0$) | 120 | V |
| V_{EBO} | Emitter-Base Voltage ($I_C = 0$) | 7 | V |
| I_C | Collector Current | 120 | A |
| I_{CM} | Collector Peak Current ($t_p = 10$ ms) | 180 | A |
| I_B | Base Current | 2 | A |
| I_{BM} | Base Peak Current ($t_p = 10$ ms) | 4 | 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 |



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THERMAL DATA

| | | | | |
|----------------|---|-----|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-case (transistor) | Max | 0.7 | °C/W |
| $R_{thj-case}$ | Thermal Resistance Junction-case (diode) | Max | 0.9 | °C/W |
| R_{thc-h} | Thermal Resistance Case-heatsink With Conductive Grease Applied | Max | 0.05 | °C/W |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|--|--|------|-----------------------------|-----------------|-------------------------------|
| $I_{CER\#}$ | Collector Cut-off Current ($R_{BE} = 5\ \Omega$) | $V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$ | | | 1.5 10 | mA mA |
| $I_{CEV\#}$ | Collector Cut-off Current ($V_{BE} = -5V$) | $V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$ | | | 1 7 | 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 ($I_B = 0$) | $I_C = 5\text{ A}$ $L = 15\text{ mH}$ $V_{clamp} = 125\text{ V}$ | 125 | | | V |
| h_{FE*} | DC Current Gain | $I_C = 100\text{ A}$ $V_{CE} = 5\text{ V}$ | | 1200 | | |
| $V_{CE(sat)*}$ | Collector-Emitter Saturation Voltage | $I_C = 70\text{ A}$ $I_B = 0.25\text{ A}$ $I_C = 70\text{ A}$ $I_B = 0.25\text{ A}$ $T_j = 100\text{ °C}$ $I_C = 100\text{ A}$ $I_B = 1\text{ A}$ $I_C = 100\text{ A}$ $I_B = 1\text{ A}$ $T_j = 100\text{ °C}$ | | 1.25 1.35 1.5 1.65 | 1.5 2 | V V V V |
| $V_{BE(sat)*}$ | Base-Emitter Saturation Voltage | $I_C = 100\text{ A}$ $I_B = 1\text{ A}$ $I_C = 100\text{ A}$ $I_B = 1\text{ A}$ $T_j = 100\text{ °C}$ | | 2.3 2.35 | 3 | V V |
| di_C/dt | Rate of Rise of On-state Collector | $V_{CC} = 90\text{ V}$ $R_C = 0$ $t_p = 3\ \mu s$ $I_{B1} = 0.5\text{ A}$ $T_j = 100\text{ °C}$ | 200 | 230 | | A/ μs |
| $V_{CE(3\ \mu s)\bullet\bullet}$ | Collector-Emitter Dynamic Voltage | $V_{CC} = 90\text{ V}$ $R_C = 1.3\ \Omega$ $I_{B1} = 0.5\text{ A}$ $T_j = 100\text{ °C}$ | | 2 | 3 | V |
| $V_{CE(5\ \mu s)\bullet\bullet}$ | Collector-Emitter Dynamic Voltage | $V_{CC} = 90\text{ V}$ $R_C = 1.3\ \Omega$ $I_{B1} = 0.5\text{ A}$ $T_j = 100\text{ °C}$ | | 1.8 | 2.5 | V |
| t_s t_f t_c | Storage Time Fall Time Cross-over Time | $I_C = 70\text{ A}$ $V_{CC} = 90\text{ V}$ $V_{BB} = -5\text{ V}$ $R_{BB} = \Omega$ $V_{clamp} = 125\text{ V}$ $I_{B1} = 0.25\text{ A}$ $L = 60\ \mu H$ $T_j = 100\text{ °C}$ | | 0.9 0.15 0.3 | 2 0.3 0.6 | μs μs μs |
| V_{CEW} | Maximum Collector Emitter Voltage Without Snubber | $I_{C\text{Woff}} = 120\text{ A}$ $I_{B1} = 1\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{CC} = 90\text{ V}$ $L = 60\ \mu H$ $R_{BB} = 1.25\ \Omega$ $T_j = 125\text{ °C}$ | 125 | | | V |
| V_F* | Diode Forward Voltage | $I_F = 100\text{ A}$ $T_j = 100\text{ °C}$ | | 0.92 | 1 | V |
| I_{RM} | Reverse Recovery Current | $V_{CC} = 125\text{ V}$ $I_F = 100\text{ A}$ $di_F/dt = -200\text{ A}/\mu s$ $L < 0.05\ \mu H$ $T_j = 100\text{ °C}$ | | 10 | 14 | A |

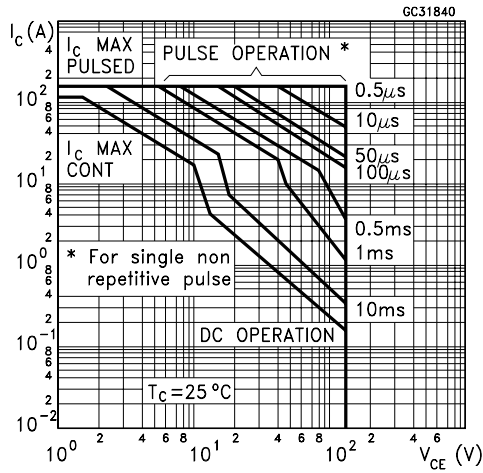
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

See test circuits in databook introduction

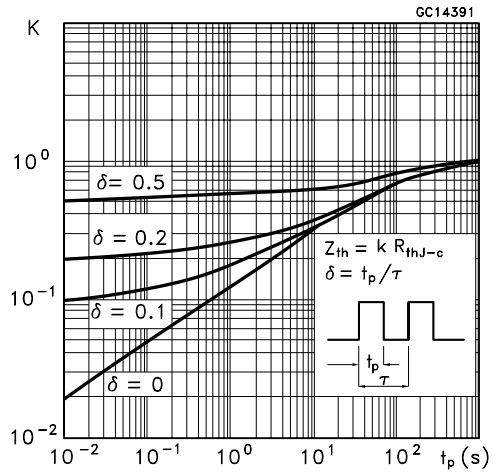
To evaluate the conduction losses of the diode use the following equations:

$$V_F = 0.66 + 0.0034 I_F \quad P = 0.66 I_{F(AV)} + 0.0034 I_{F(RMS)}^2$$

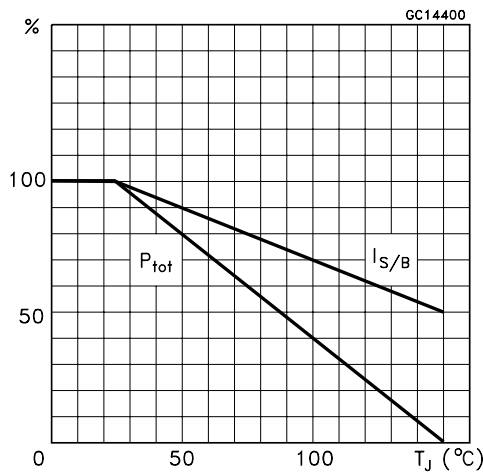
Safe Operating Areas



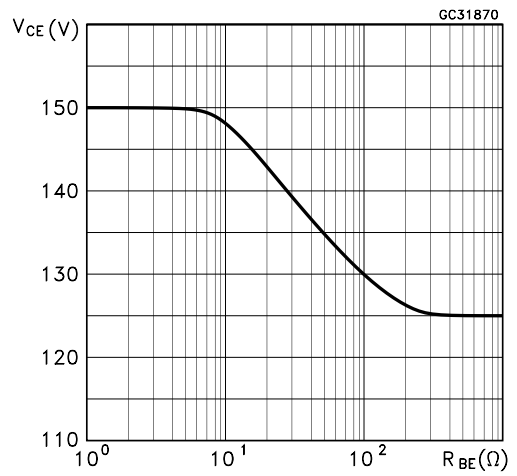
Thermal Impedance



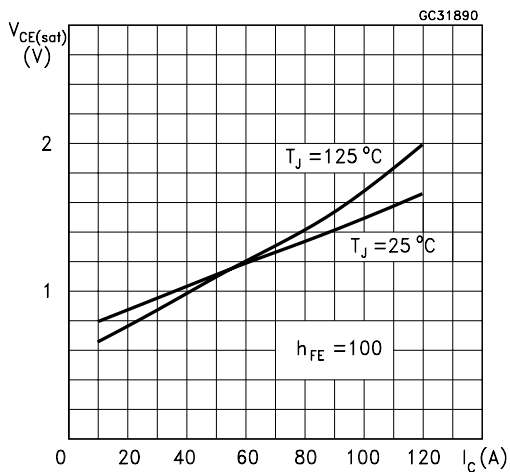
Derating Curve



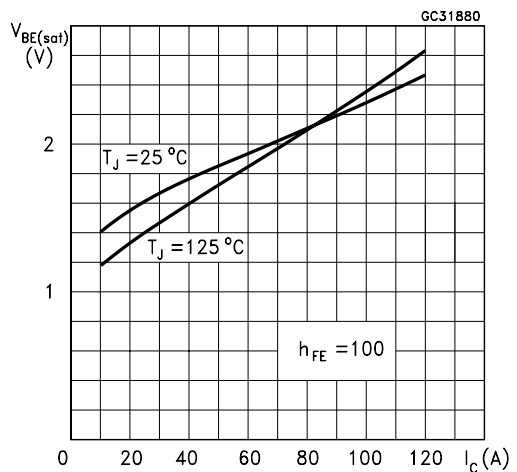
Collector-emitter Voltage Versus base-emitter Resistance



Collector Emitter Saturation Voltage

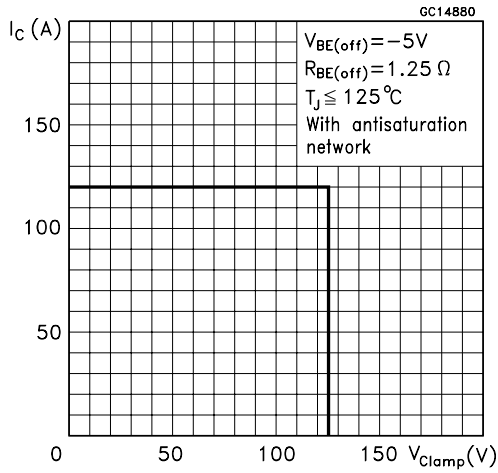


Base-Emitter Saturation Voltage

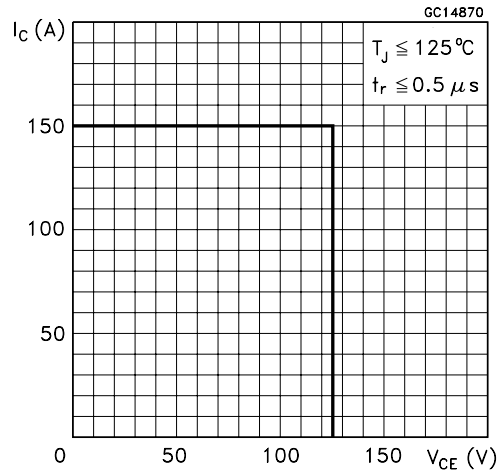


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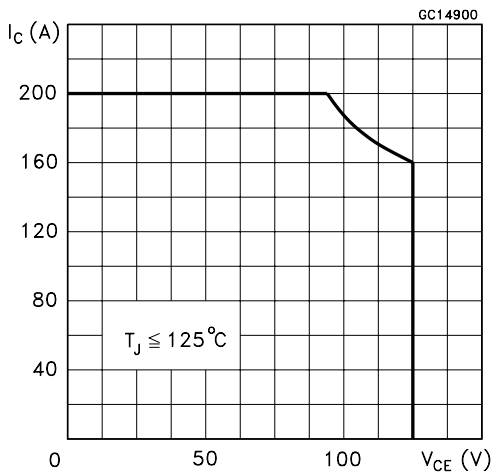
Reverse Biased SOA



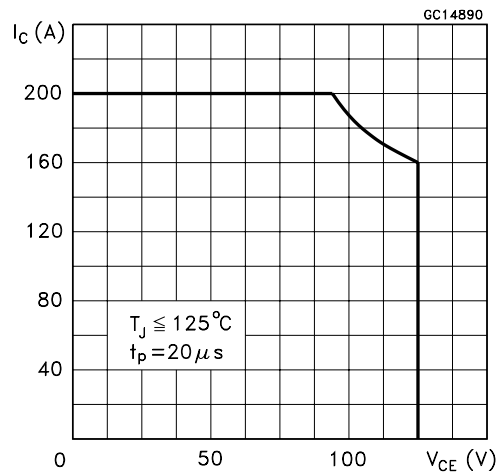
Foward Biased SOA



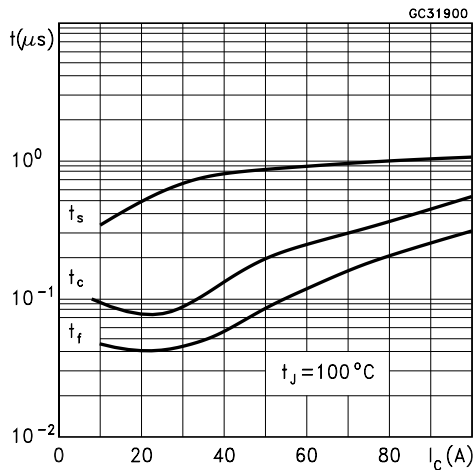
Reverse Biased AOA



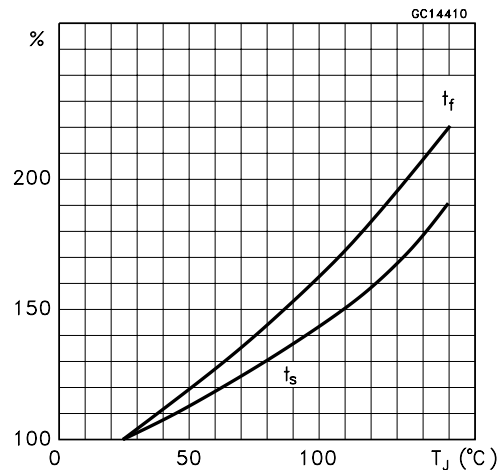
Forward Biased AOA



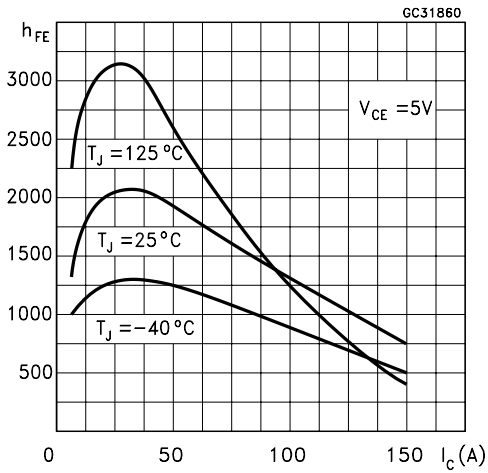
Switching Times Inductive Load



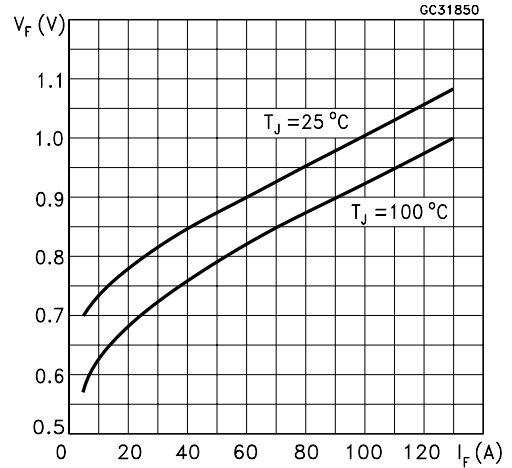
Switching Times Inductive Load Versus Temperature



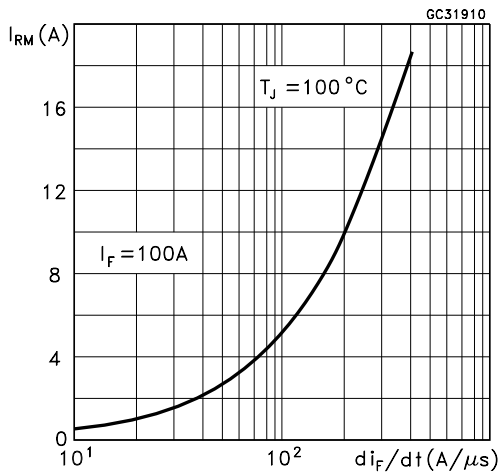
Dc Current Gain



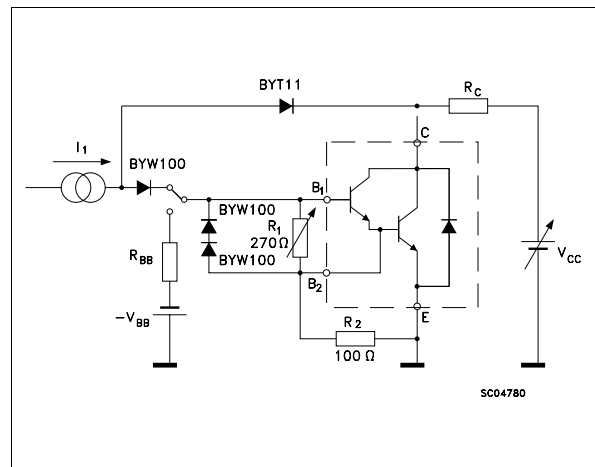
Typical V_F Versus I_F



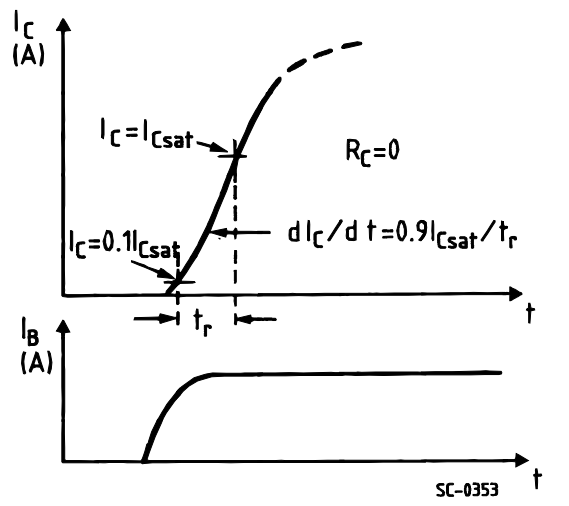
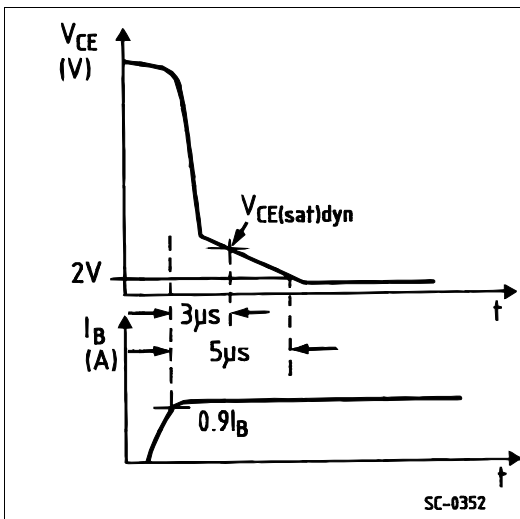
Peak Reverse Current Versus di_F/dt



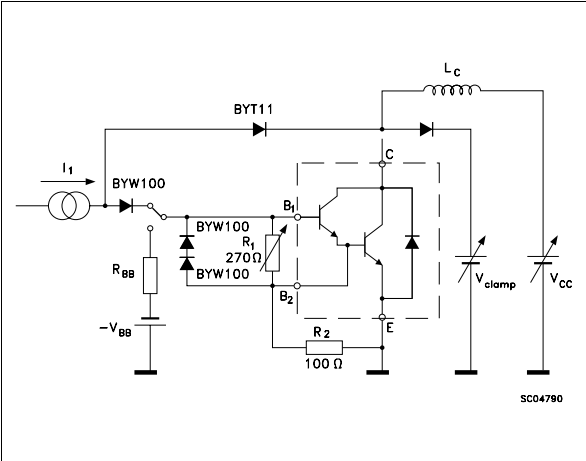
Turn-on Switching Test Circuit



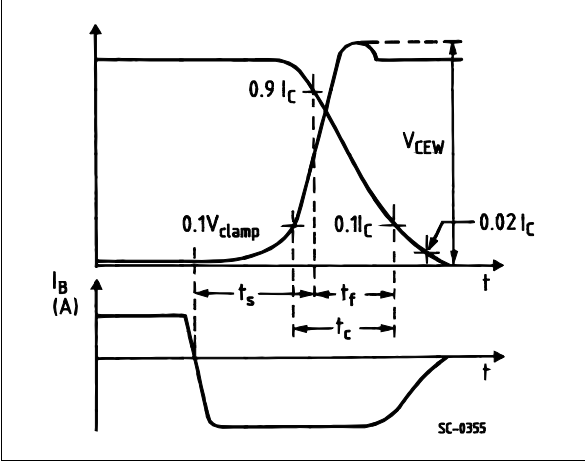
Turn-on Switching Waveforms



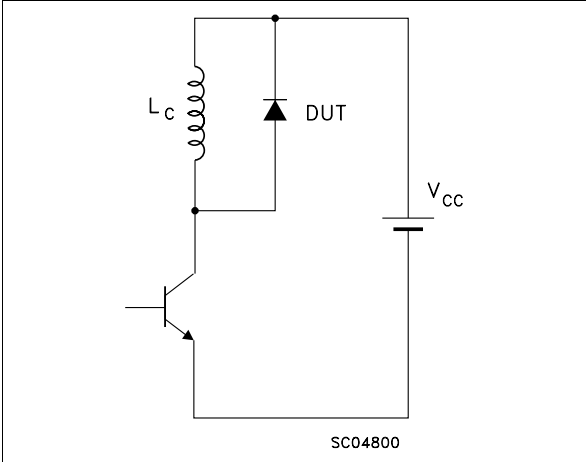
Turn-on Switching Test Circuit



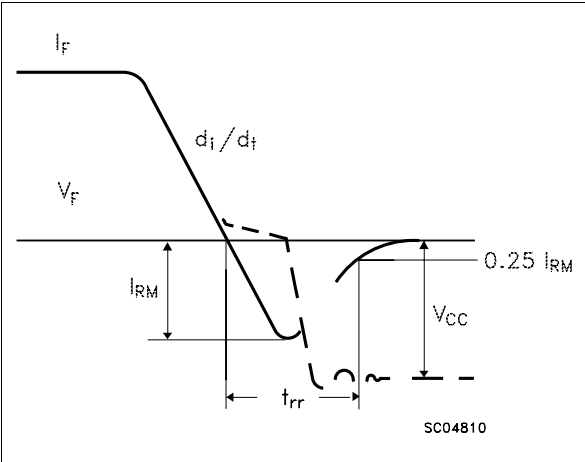
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

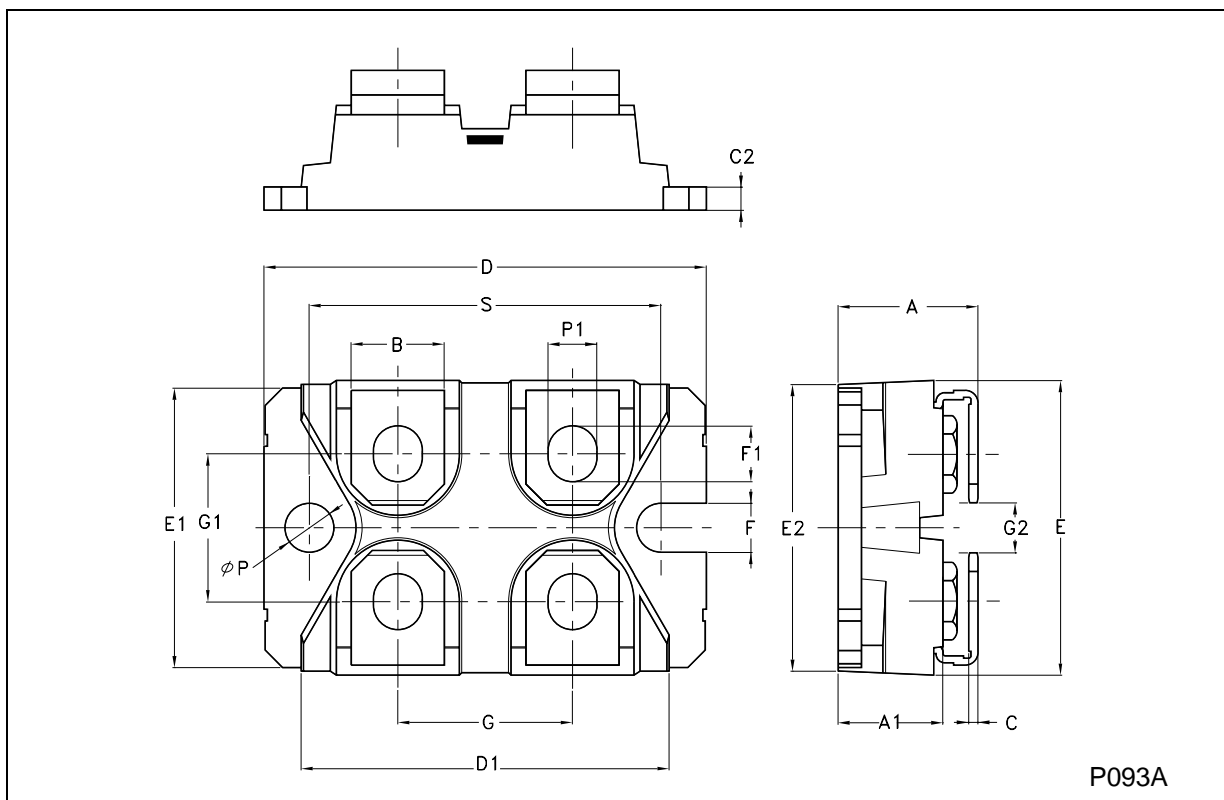


Turn-off Switching Waveform of Diode



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 | | 1.248 |
| 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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