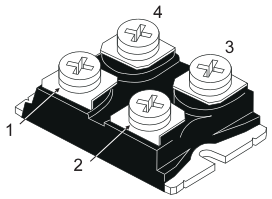
# ESM3045DV

## 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

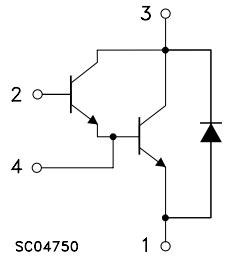
**INDUSTRIAL APPLICATIONS:**

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




**ISOTOP**

**INTERNAL SCHEMATIC DIAGRAM**




**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 | 24 | A |
| $I_{CM}$ | Collector Peak Current ($t_p$ = 10 ms) | 36 | A |
| $I_B$ | Base Current | 2.5 | A |
| $I_{BM}$ | Base Peak Current ($t_p$ = 10 ms) | 5 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 $^oC$ | 125 | W |
| $V_{isol}$ | Insulation Withstand Voltage (RMS) from All Four Terminals to Exernal Heatsink | 2500 | V |
| $T_{stg}$ | Storage Temperature | -55 to 150 | $^oC$ |
| $T_j$ | Max. Operating Junction Temperature | 150 | $^oC$ |

## THERMAL DATA

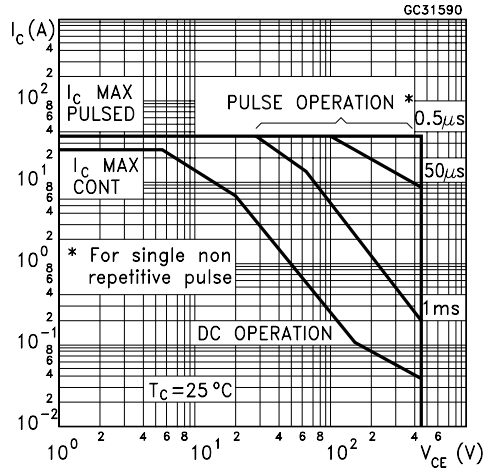
| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case (transistor) | Max | 1 | °C/W |
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case (diode) | Max | 2 | °C/W |
| $R_{thc\text{-}h}$ | Thermal Resistance Case-heatsink With Conductive Grease Applied | Max | 0.05 | °C/W |

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

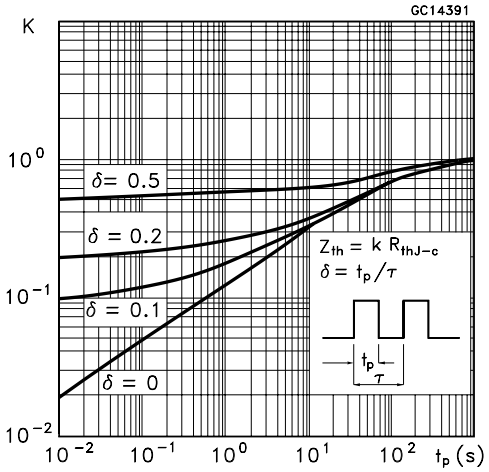
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CER}$ # | Collector Cut-off Current ($R_{BE}$ = 5 Ω) | $V_{CE} = V_{CEV}$<br>$V_{CE} = V_{CEV}$ $T_j$ = 100 °C | | | 1.5<br>17 | mA<br>mA |
| $I_{CEV}$ # | Collector Cut-off Current ($V_{BE}$ = -5) | $V_{CE} = V_{CEV}$<br>$V_{CE} = V_{CEV}$ $T_j$ = 100 °C | | | 1<br>12 | mA<br>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 L = 25 mH<br>$V_{clamp}$ = 450 V | 450 | | | V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 20 A $V_{CE}$ = 5 V | | 120 | | |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 15 A $I_B$ = 0.3 A<br>$I_C$ = 15 A $I_B$ = 0.3 A $T_j$ = 100 °C<br>$I_C$ = 20 A $I_B$ = 1.2 A<br>$I_C$ = 20 A $I_B$ = 1.2 A $T_j$ = 100 °C | | 1.2<br>1.3<br>1.4<br>1.6 | <br>2<br><br>2 | V<br>V<br>V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 20 A $I_B$ = 1.2 A<br>$I_C$ = 20 A $I_B$ = 1.2 A $T_j$ = 100 °C | | 2.1<br>2.1 | <br>3 | V<br>V |
| $dI_C/dt$ | Rate of Rise of On-state Collector | $V_{CC}$ = 300 V $R_C$ = 0 $t_p$ = 3 µs<br>$I_{B1}$ = 0.45 A $T_j$ = 100 °C | 125 | 160 | | A/µs |
| $V_{CE}$(3 µs)•• | Collector-Emitter Dynamic Voltage | $V_{CC}$ = 300 V $R_C$ = 20 Ω<br>$I_{B1}$ = 0.45 A $T_j$ = 100 °C | | 4.5 | 8 | V |
| $V_{CE}$(5 µs)•• | Collector-Emitter Dynamic Voltage | $V_{CC}$ = 300 V $R_C$ = 20 Ω<br>$I_{B1}$ = 0.45 A $T_j$ = 100 °C | | 2.5 | 4.5 | V |
| $t_s$<br>$t_f$<br>$t_c$ | Storage Time<br>Fall Time<br>Cross-over Time | $I_C$ = 15 A $V_{CC}$ = 50 V<br>$V_{BB}$ = -5 V $R_{BB}$ = 0.6 Ω<br>$V_{clamp}$ = 450 V $I_{B1}$ = 0.3 A<br>L = 0.17 mH $T_j$ = 100 °C | | 2.1<br>0.15<br>0.5 | 4<br>0.4<br>1.2 | µs<br>µs<br>µs |
| $V_{CEW}$ | Maximum Collector Emitter Voltage Without Snubber | $I_{CWoff}$ = 24 A $I_{B1}$ = 1.2 A<br>$V_{BB}$ = -5 V $V_{CC}$ = 50 V<br>L = 0.1 mH $R_{BB}$ = 0.6 Ω<br>$T_j$ = 125 °C | 450 | | | V |
| $V_F$* | Diode Forward Voltage | $I_F$ = 20 A $T_j$ = 100 °C | | 1.7 | 2 | V |
| $I_{RM}$ | Reverse Recovery Current | $V_{CC}$ = 200 V $I_F$ = 20 A<br>$di_F/dt$ = -125 A/µs L < 0.05 µH<br>$T_j$ = 100 °C | | 11 | 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:
$V_F = 1.47 + 0.0026\ I_F$ $P = 1.47\ I_{F(AV)} + 0.0026\ I^2_{F(RMS)}$

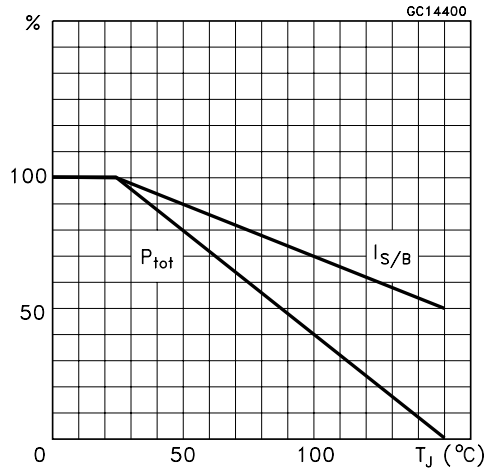
Safe Operating Areas



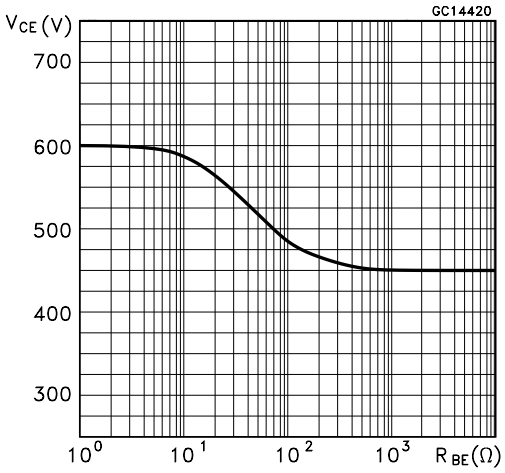

Thermal Impedance



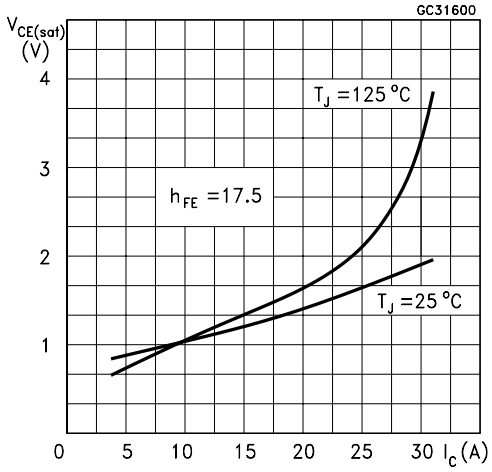

Derating Curve



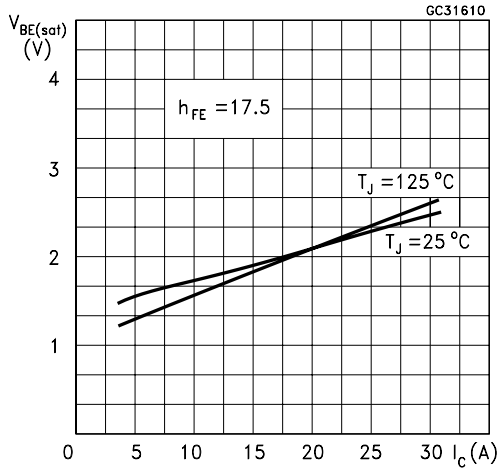

Collector-emitter Voltage Versus base-emitter Resistance



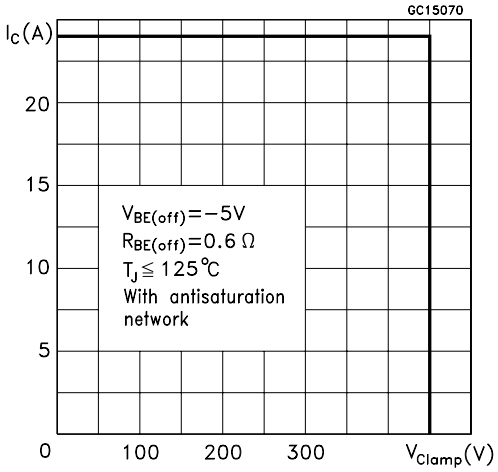

Collector Emitter Saturation Voltage



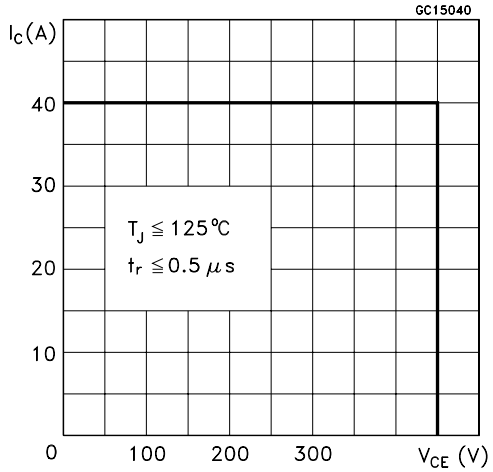

Base-Emitter Saturation Voltage



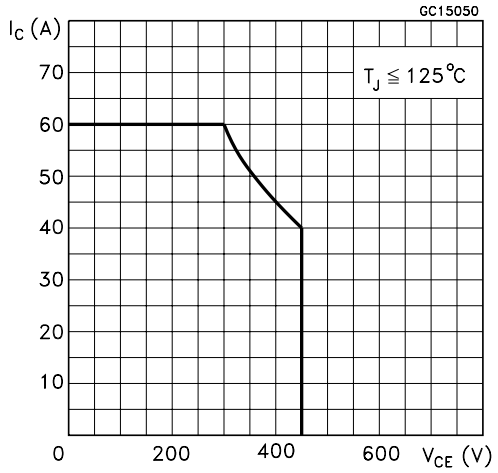
Reverse Biased SOA



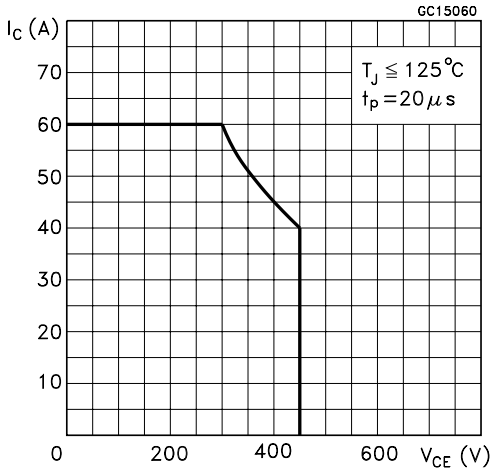

Foward Biased SOA



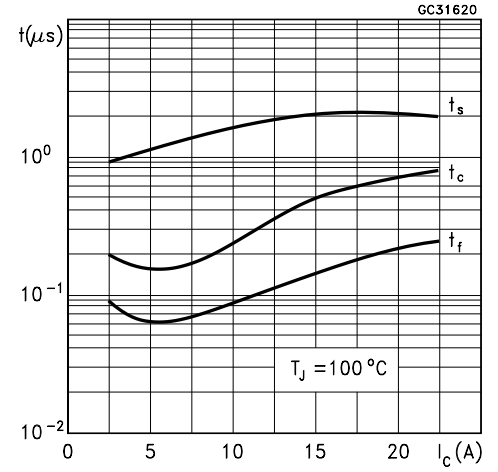

Reverse Biased AOA



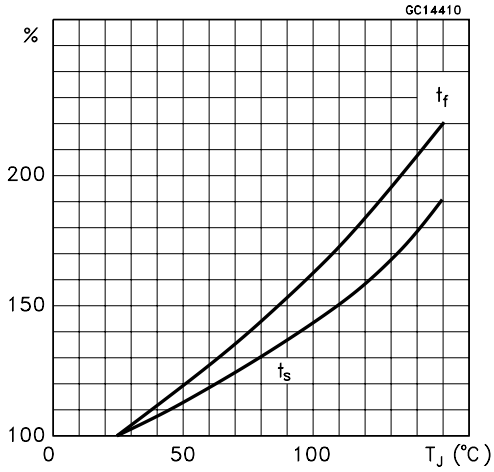

Forward Biased AOA



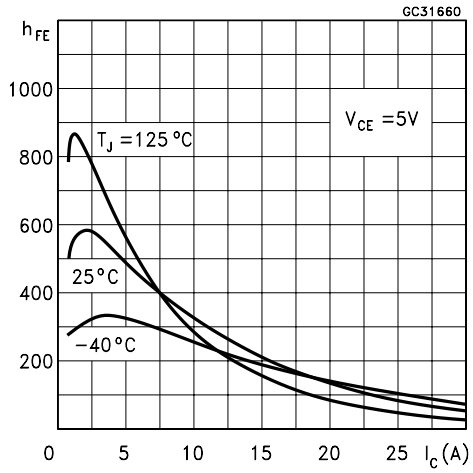

Switching Times Inductive Load



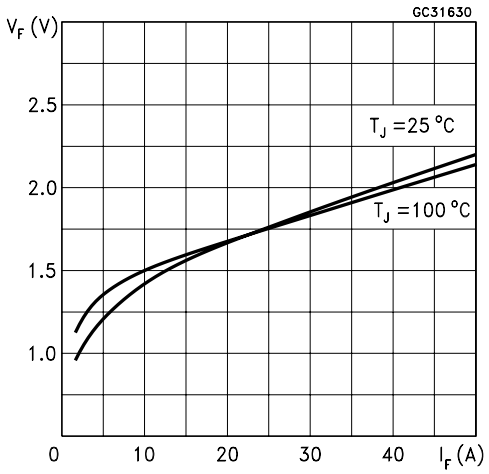

Switching Times Inductive Load Versus Temperature



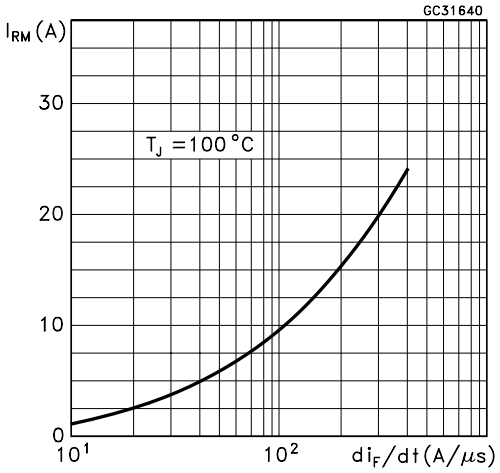
Dc Current Gain



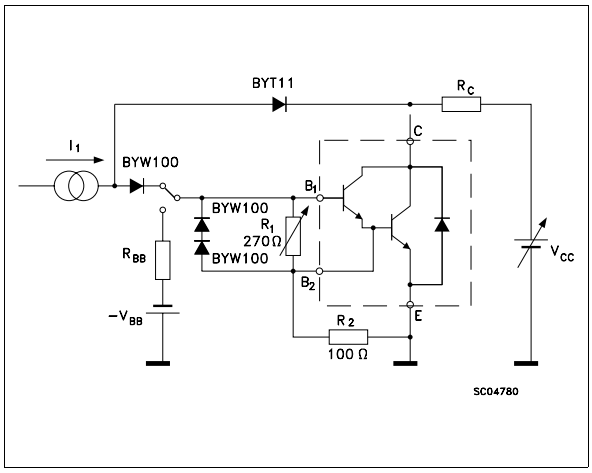

Typical $V_F$ Versus $I_F$



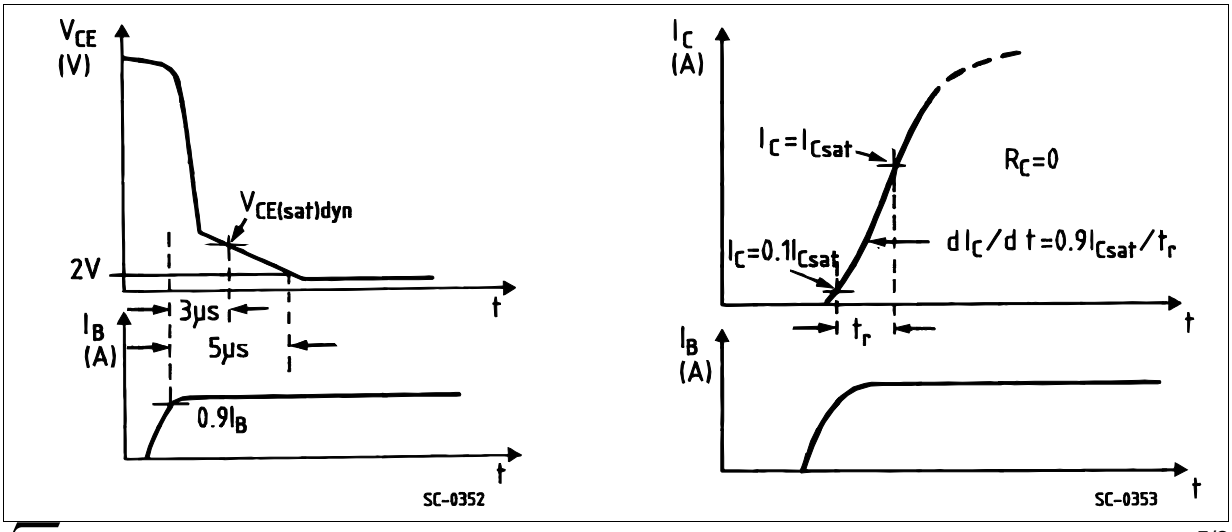

Peak Reverse Current Versus $di_F/dt$



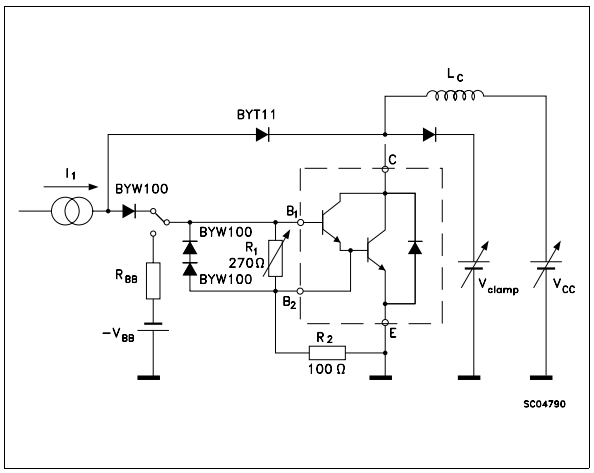

Turn-on Switching Test Circuit



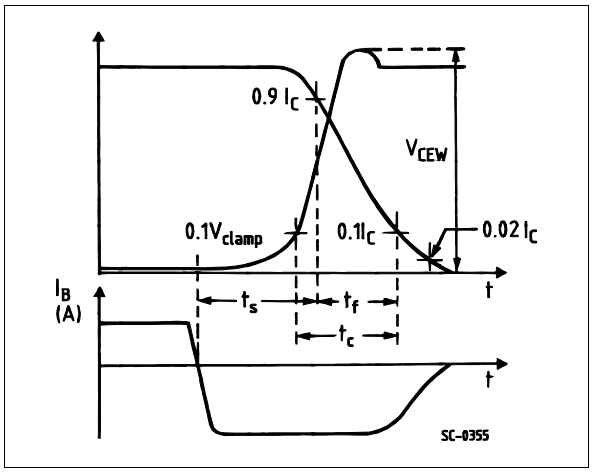

Turn-on Switching Waveforms



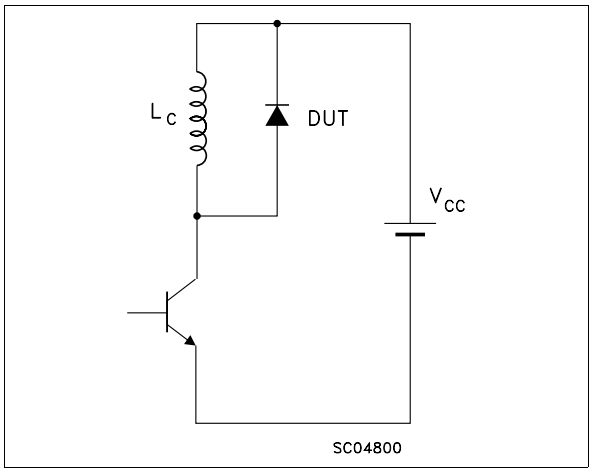
Turn-on Switching Test Circuit



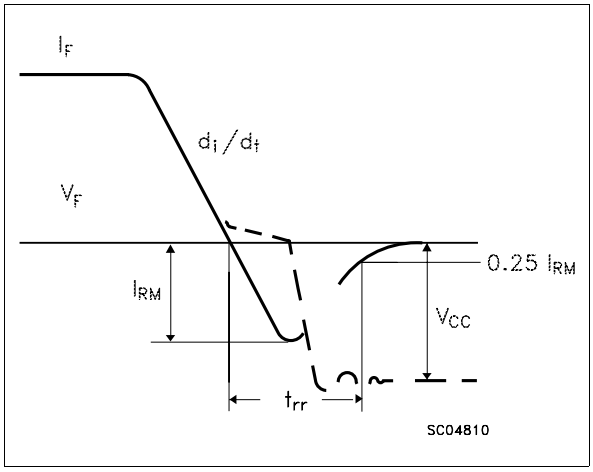

Turn-off Switching Waveforms




Turn-off Switching Test Circuit of Diode

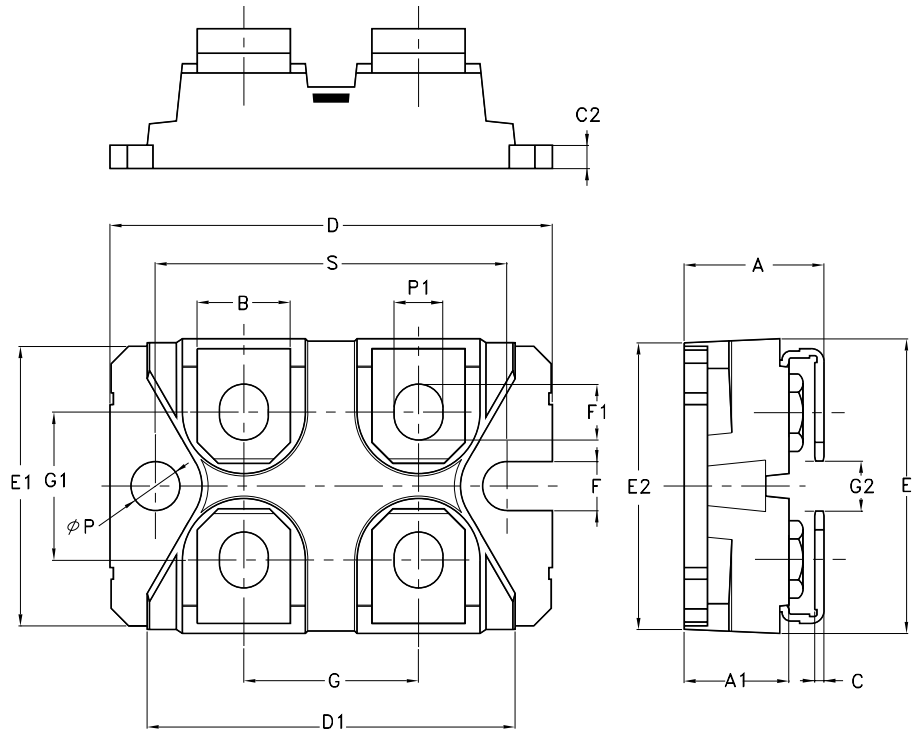



Turn-off Switching Waveform of Diode



## 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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