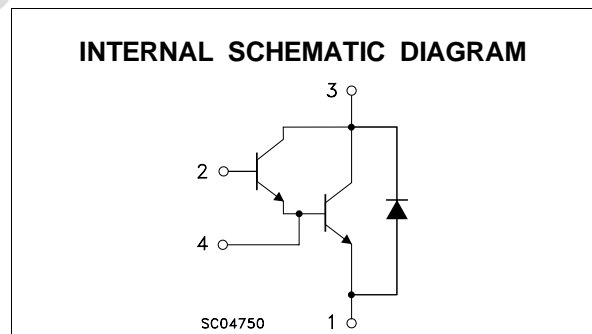
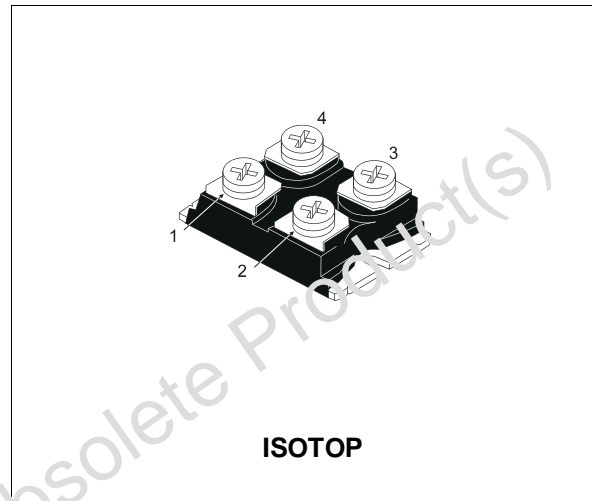


## NPN DARLINGTON POWER MODULE

- 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

# ESM2012DV

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.7	$^{\circ}\text{C}/\text{W}$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	0.9	$^{\circ}\text{C}/\text{W}$
$R_{thc-h}$	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 ( $R_{BE} = 5\ \Omega$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$			1.5 10	$\text{mA}$ $\text{mA}$
$I_{CEV\#}$	Collector Cut-off Current ( $V_{BE} = -5\text{V}$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$			1 7	$\text{mA}$ $\text{mA}$
$I_{EBO\#}$	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 5\ \text{V}$			1	$\text{mA}$
$V_{CEO(SUS)*}$	Collector-Emitter Sustaining Voltage ( $I_B = 0$ )	$I_C = 5\ \text{A}$ $L = 15\ \text{mH}$ $V_{clamp} = 125\ \text{V}$	125			$\text{V}$
$h_{FE*}$	DC Current Gain	$I_C = 100\ \text{A}$ $V_{CE} = 5\ \text{V}$		1200		
$V_{CE(sat)*}$	Collector-Emitter Saturation Voltage	$I_C = 70\ \text{A}$ $I_B = 0.25\ \text{A}$ $I_C = 70\ \text{A}$ $I_B = 0.25\ \text{A}$ $T_j = 100^{\circ}\text{C}$ $I_C = 100\ \text{A}$ $I_B = 1\ \text{A}$ $I_C = 100\ \text{A}$ $I_B = 1\ \text{A}$ $T_j = 100^{\circ}\text{C}$		1.25 1.35 1.5 1.65	1.5	$\text{V}$ $\text{V}$ $\text{V}$ $\text{V}$
$V_{BE(sat)*}$	Base-Emitter Saturation Voltage	$I_C = 100\ \text{A}$ $I_E = 1\ \text{A}$ $I_C = 100\ \text{A}$ $I_B = 1\ \text{A}$ $T_j = 100^{\circ}\text{C}$		2.3 2.35	3	$\text{V}$ $\text{V}$
$di_c/dt$	Rate of Rise of On-state Collector	$V_{CC} = 90\ \text{V}$ $R_C = 0$ $t_p = 3\ \mu\text{s}$ $I_{B1} = 0.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$	200	230		$\text{A}/\mu\text{s}$
$V_{CE(3\ \mu\text{s})**}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 90\ \text{V}$ $R_C = 1.3\ \Omega$ $I_{B1} = 0.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$		2	3	$\text{V}$
$V_{CE(5\ \mu\text{s})**}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 90\ \text{V}$ $R_C = 1.3\ \Omega$ $I_{B1} = 0.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$		1.8	2.5	$\text{V}$
$t_s$	Storage Time	$I_C = 70\ \text{A}$ $V_{CC} = 90\ \text{V}$		0.9	2	$\mu\text{s}$
$t_f$	Fall Time	$V_{BB} = -5\ \text{V}$ $R_{BB} = \Omega$		0.15	0.3	$\mu\text{s}$
$t_c$	Cross-over Time	$V_{clamp} = 125\ \text{V}$ $I_{B1} = 0.25\ \text{A}$ $L = 60\ \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		0.3	0.6	$\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 120\ \text{A}$ $I_{B1} = 1\ \text{A}$ $V_{BB} = -5\ \text{V}$ $V_{CC} = 90\ \text{V}$ $L = 60\ \mu\text{H}$ $R_{BB} = 1.25\ \Omega$ $T_j = 125^{\circ}\text{C}$	125			$\text{V}$
$V_F*$	Diode Forward Voltage	$I_F = 100\ \text{A}$ $T_j = 100^{\circ}\text{C}$		0.92	1	$\text{V}$
$I_{RM}$	Reverse Recovery Current	$V_{CC} = 125\ \text{V}$ $I_F = 100\ \text{A}$ $di_F/dt = -200\ \text{A}/\mu\text{s}$ $L < 0.05\ \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		10	14	$\text{A}$

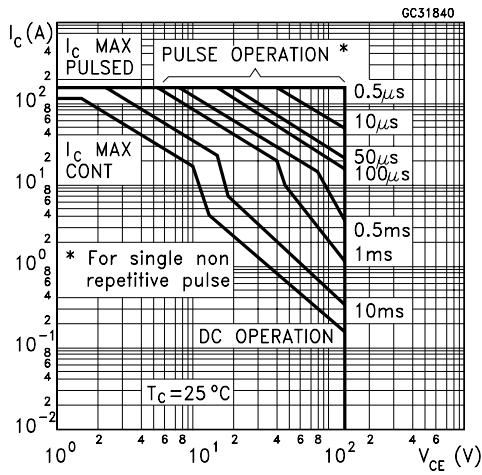
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

# See test circuits in databook introduction

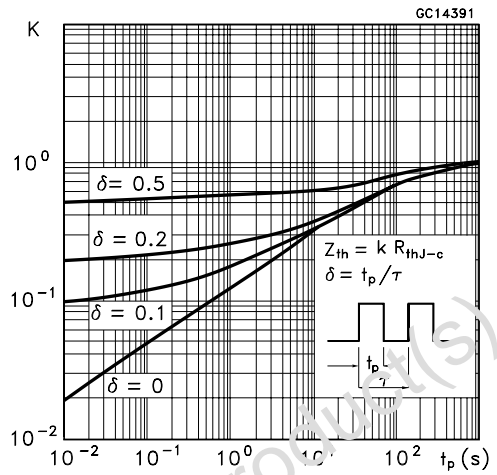
To evaluate the conduction losses of the diode use the following equations:

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

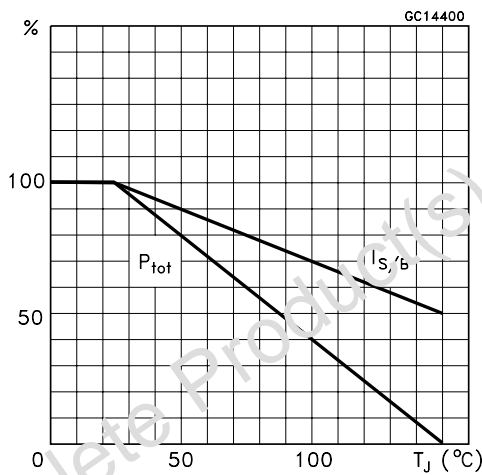
Safe Operating Areas



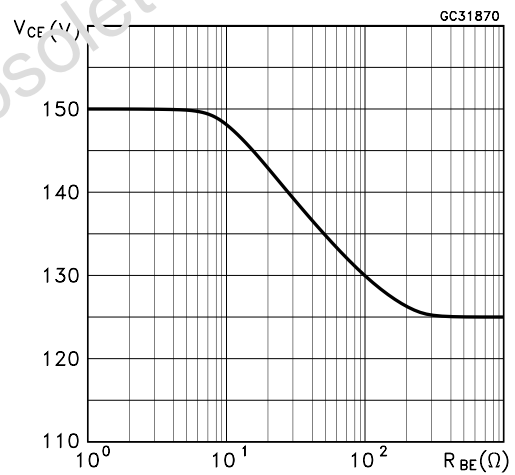
Thermal Impedance



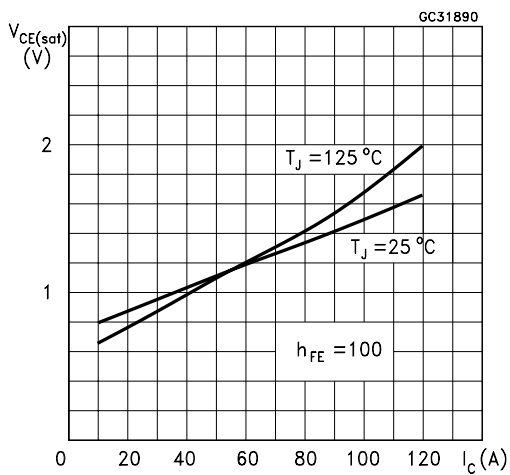
Derating Curve



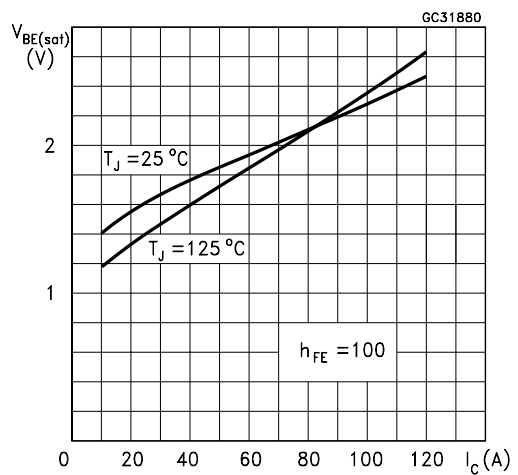
Collector-emitter Voltage Versus base-emitter Resistance



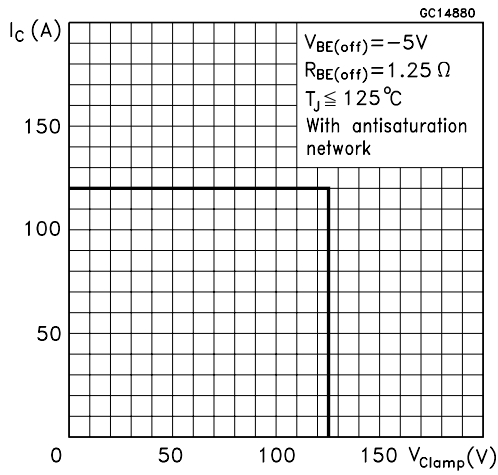
Collector Emitter Saturation Voltage



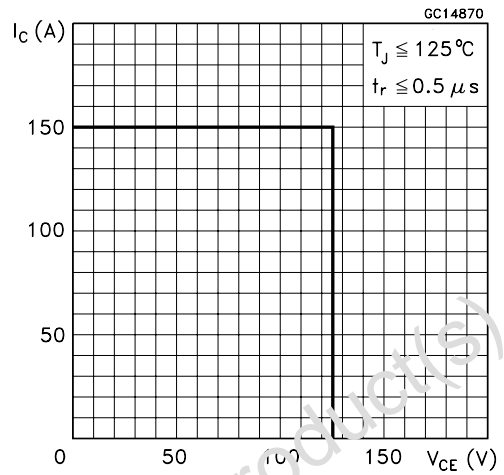
Base-Emitter Saturation Voltage



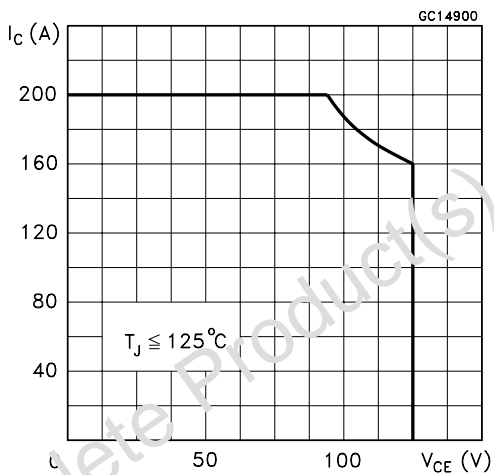
Reverse Biased SOA



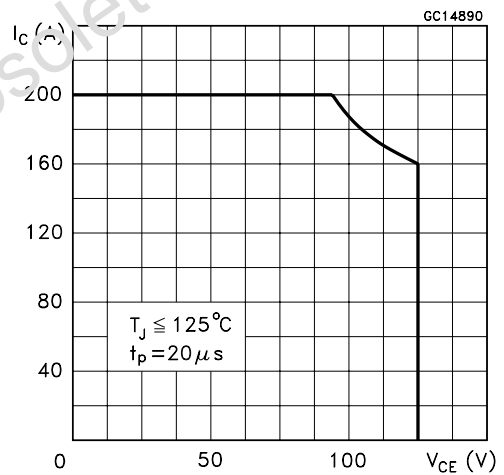
Forward Biased SOA



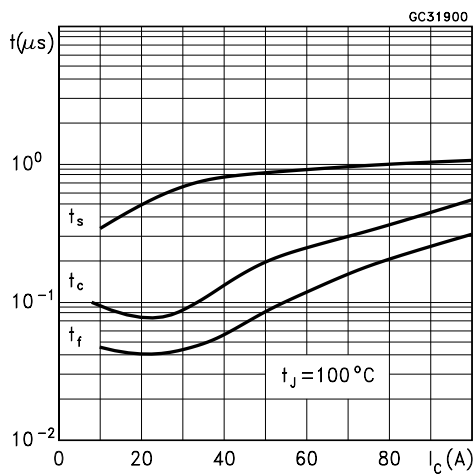
Reverse Biased AOA



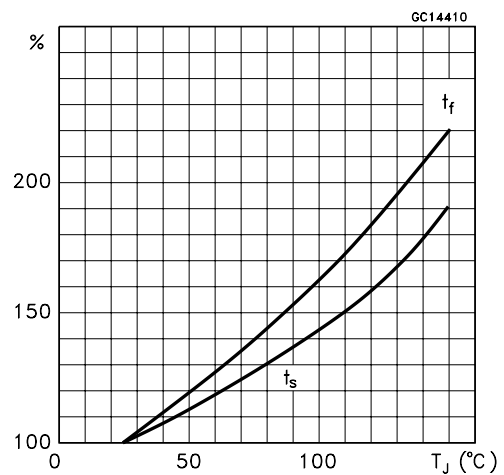
Forward Biased AOA



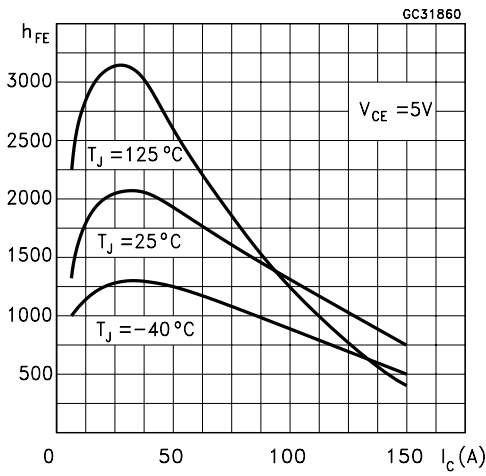
Switching Times Inductive Load



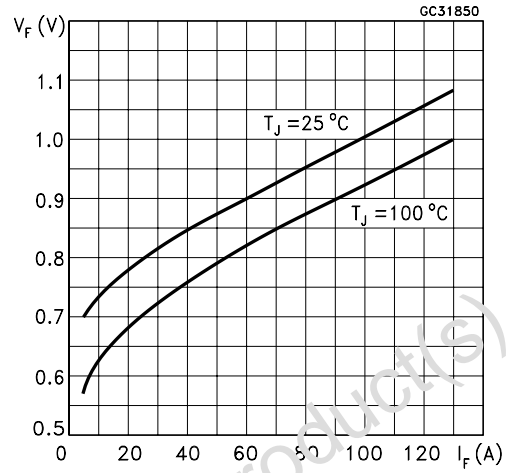
Switching Times Inductive Load Versus Temperature



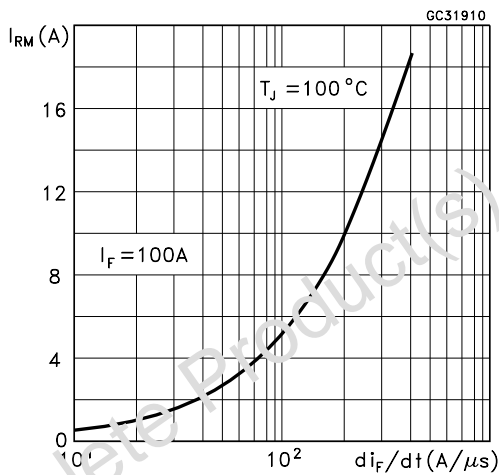
Dc Current Gain



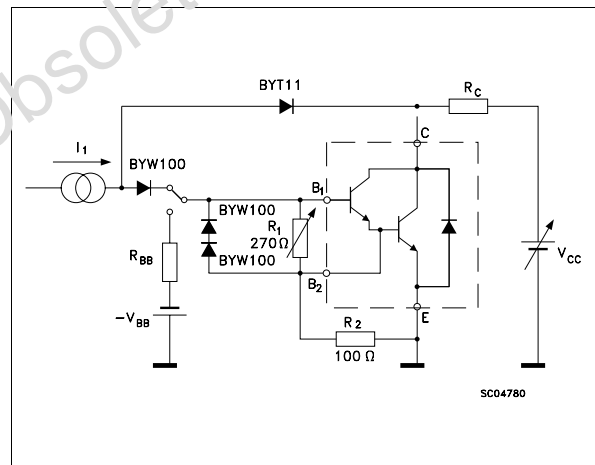
Typical  $V_F$  Versus  $I_F$



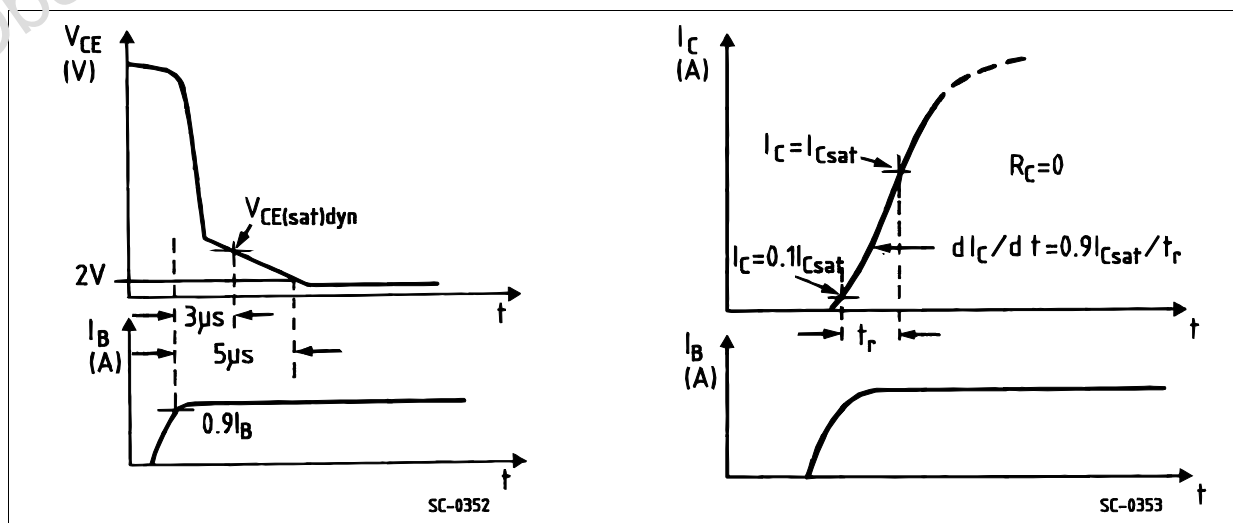
Peak Reverse Current Versus  $di_F/dt$



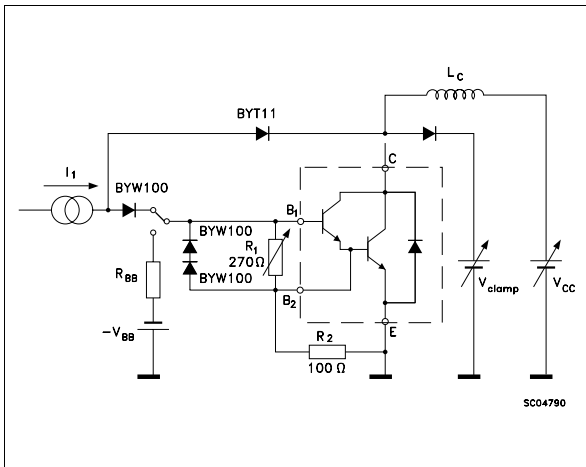
Turn-on Switching Test Circuit



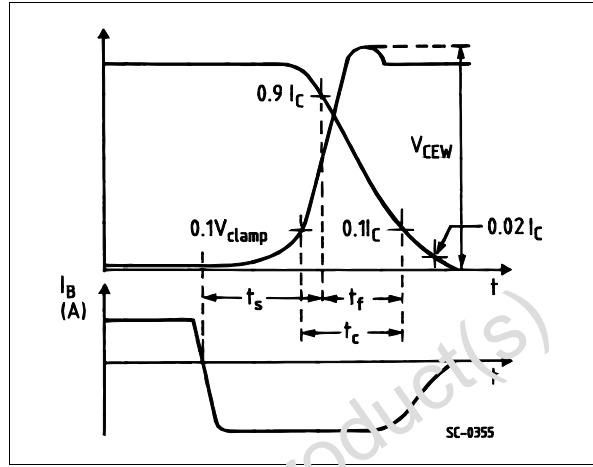
Turn-on Switching Waveforms



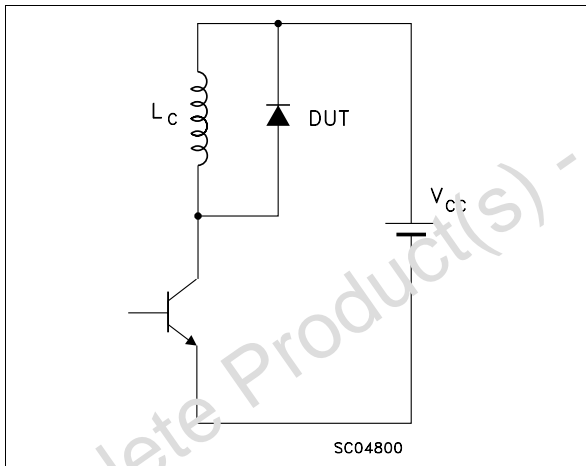
Turn-on Switching Test Circuit



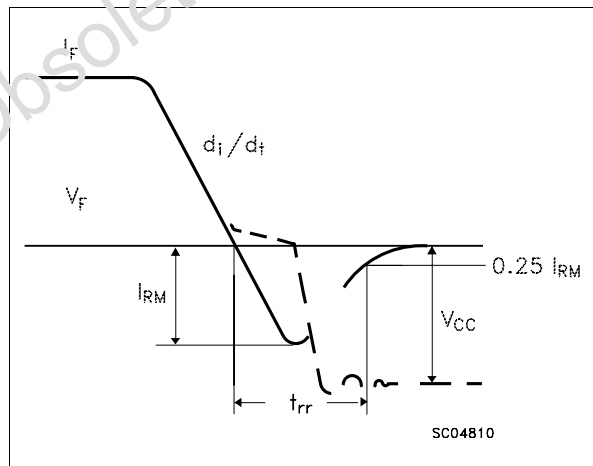
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

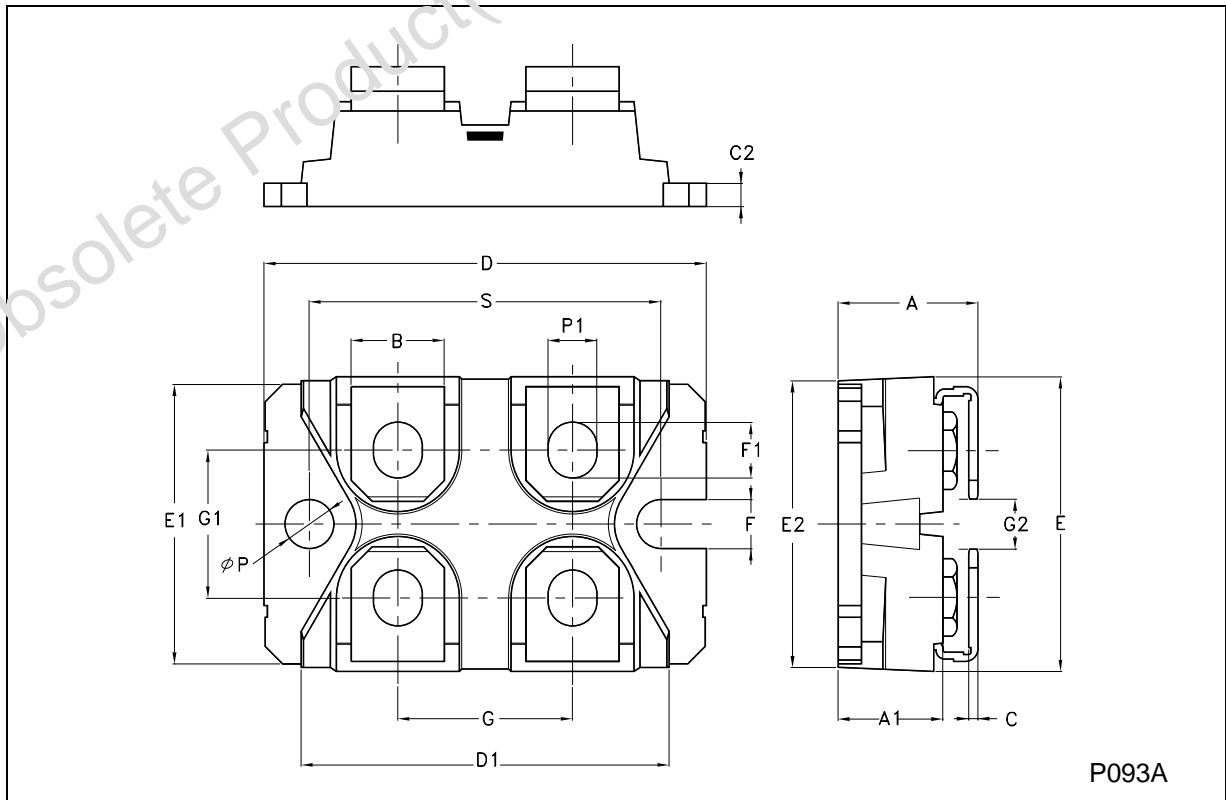


Turn-off Switching Waveform of Diode



**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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