

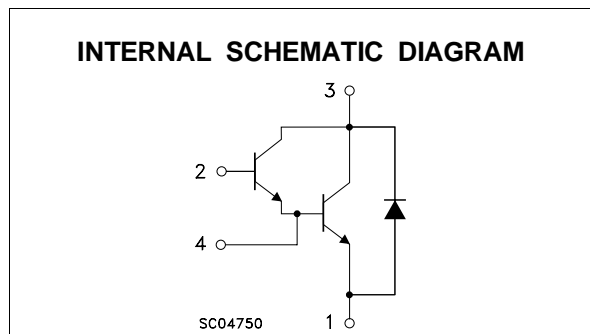
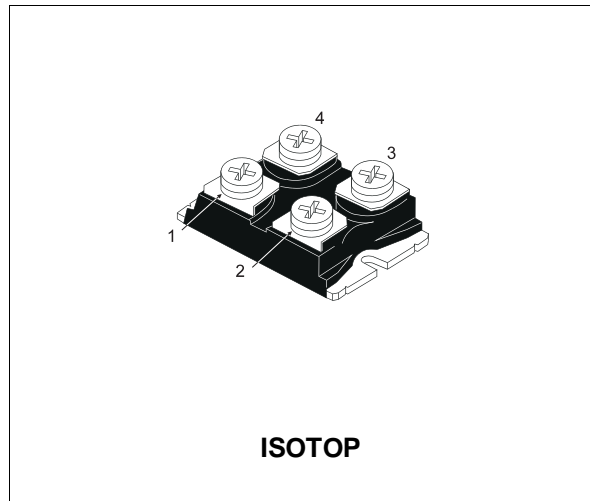


## NPN DARLINGTON POWER MODULE

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

### APPLICATIONS:

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



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CEV}$	Collector-Emitter Voltage ( $V_{BE} = -5\text{ V}$ )	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	42	A
$I_{CM}$	Collector Peak Current ( $t_p = 10\text{ ms}$ )	63	A
$I_B$	Base Current	4	A
$I_{BM}$	Base Peak Current ( $t_p = 10\text{ ms}$ )	8	A
$P_{tot}$	Total Dissipation at $T_c = 25\text{ }^\circ\text{C}$	150	W
$T_{stg}$	Storage Temperature	-55 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature	150	$^\circ\text{C}$

# ESM4045DV

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.83	$^{\circ}C/W$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	1.5	$^{\circ}C/W$
$R_{thc-h}$	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 ( $R_{BE} = 5 \Omega$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}C$			1.5 20	mA mA
$I_{CEV}$ #	Collector Cut-off Current ( $V_{BE} = -5$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}C$			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 ( $I_B = 0$ )	$I_C = 0.2 A$ $L = 25 mH$ $V_{clamp} = 450 V$	450			V
$h_{FE}^*$	DC Current Gain	$I_C = 35 A$ $V_{CE} = 5 V$		220		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 25 A$ $I_B = 0.5 A$ $I_C = 25 A$ $I_B = 0.5 A$ $T_j = 100^{\circ}C$ $I_C = 35 A$ $I_B = 2 A$ $I_C = 35 A$ $I_B = 2 A$ $T_j = 100^{\circ}C$		1.15 1.3 1.4 1.5	2 2	V V V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 35 A$ $I_B = 2 A$ $I_C = 35 A$ $I_B = 2 A$ $T_j = 100^{\circ}C$		2.3 2.3	3	V V
$di/dt$	Rate of Rise of On-state Collector	$V_{CC} = 300 V$ $R_C = 0$ $t_p = 3 \mu s$ $I_{B1} = 0.75 A$ $T_j = 100^{\circ}C$	200	250		A/ $\mu s$
$V_{CE(3 \mu s)}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 V$ $R_C = 12 \Omega$ $I_{B1} = 0.75 A$ $T_j = 100^{\circ}C$		4.5	8	V
$V_{CE(5 \mu s)}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 V$ $R_C = 12 \Omega$ $I_{B1} = 0.75 A$ $T_j = 100^{\circ}C$		2.5	4.5	V
$t_s$	Storage Time	$I_C = 25 A$ $V_{CC} = 50 V$		3.2	5	$\mu s$
$t_f$	Fall Time	$V_{BB} = -5 V$ $R_{BB} = 0.6 \Omega$		0.25	0.5	$\mu s$
$t_c$	Cross-over Time	$V_{clamp} = 450 V$ $I_{B1} = 0.5 A$ $L = 0.1 mH$ $T_j = 100^{\circ}C$		0.75	1.5	$\mu s$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 42 A$ $I_{B1} = 2 A$ $V_{BB} = -5 V$ $V_{CC} = 50 V$ $L = 0.06 mH$ $R_{BB} = 0.6 \Omega$ $T_j = 125^{\circ}C$	450			V
$V_F^*$	Diode Forward Voltage	$I_F = 35 A$ $T_j = 100^{\circ}C$		1.5	1.85	V
$I_{RM}$	Reverse Recovery Current	$V_{CC} = 200 V$ $I_F = 35 A$ $di_F/dt = -200 A/\mu s$ $L < 0.05 \mu H$ $T_j = 100^{\circ}C$		20	24	A

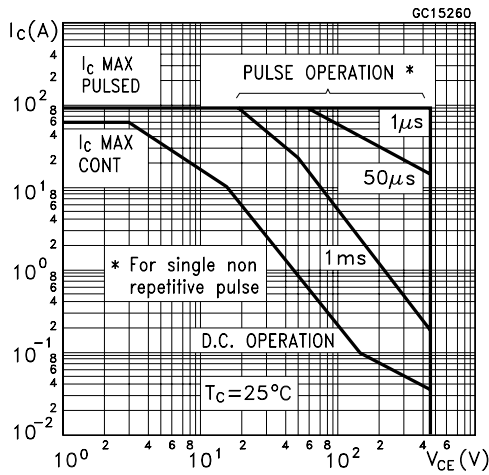
\* Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %

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

$$V_F = 1.5 + 0.001 I_F \quad P = 1.5 I_{F(AV)} + 0.001 I_{F(RMS)}^2$$

# See test circuits in databook introduction

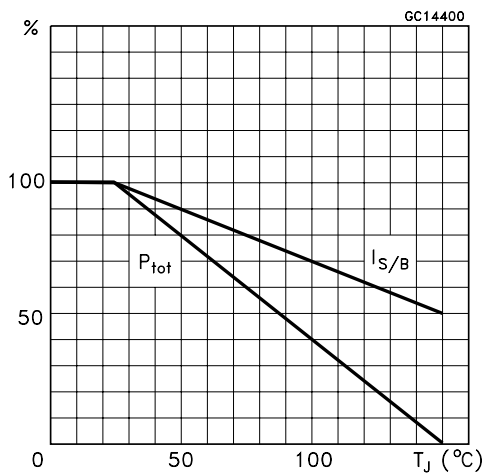
Safe Operating Areas



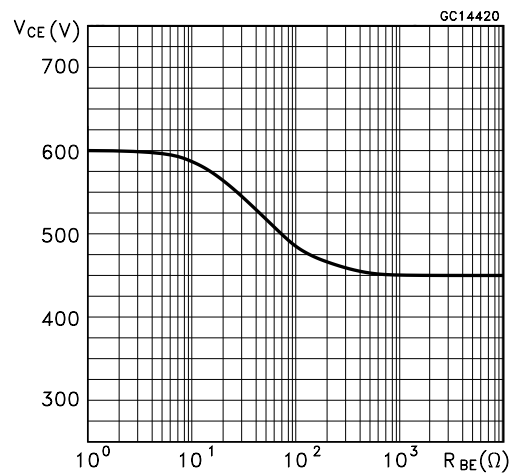
Thermal Impedance



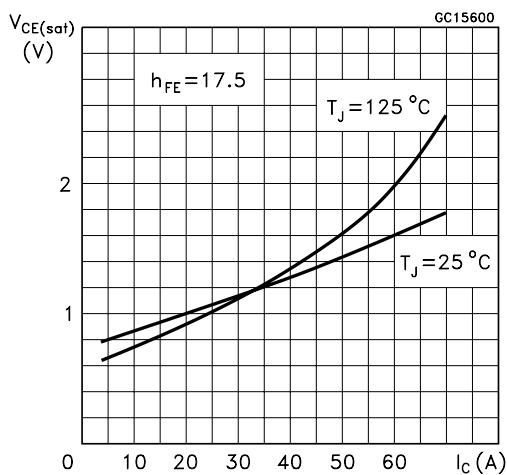
Derating Curve



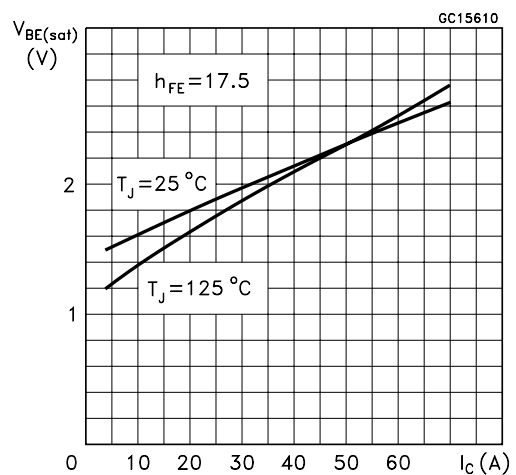
Collector-emitter Voltage Versus base-emitter Resistance



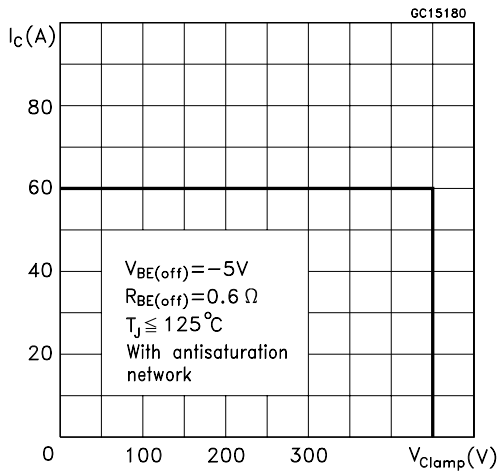
Collector Emitter Saturation Voltage



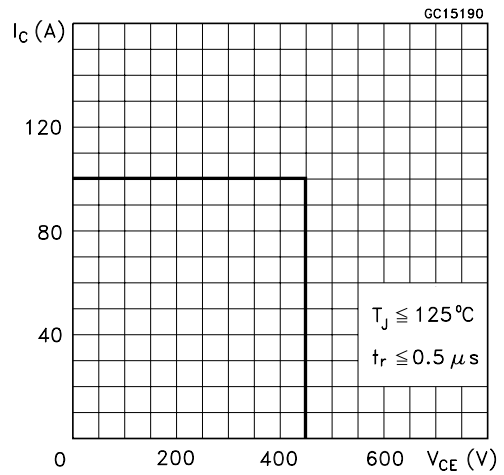
Base-Emitter Saturation Voltage



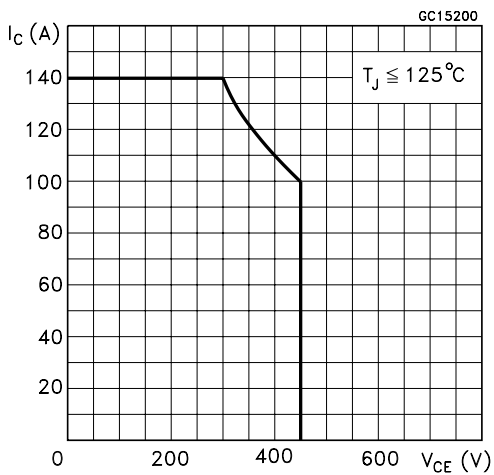
Reverse Biased SOA



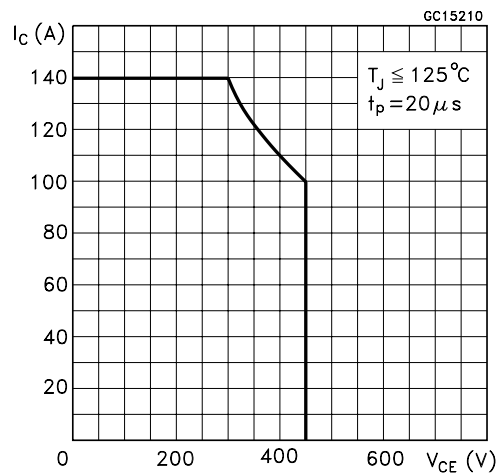
Forward Biased SOA



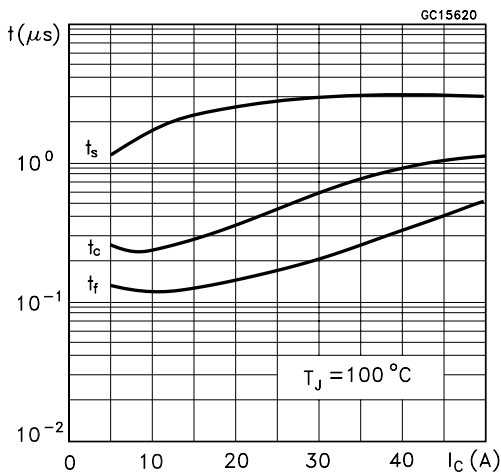
Reverse Biased AOA



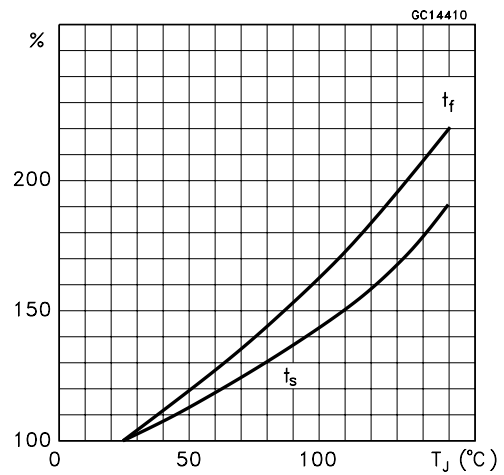
Forward Biased AOA



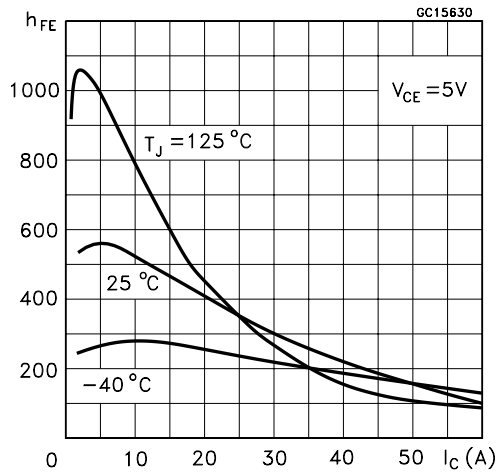
Switching Times Inductive Load



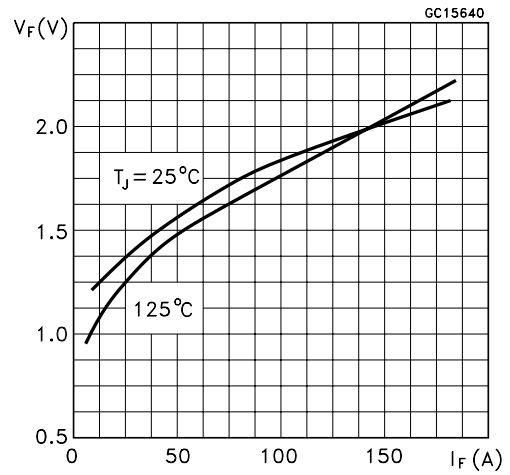
Switching Times Inductive Load Versus Temperature



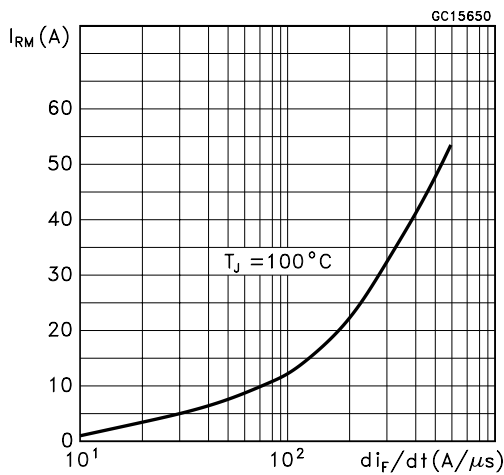
Dc Current Gain



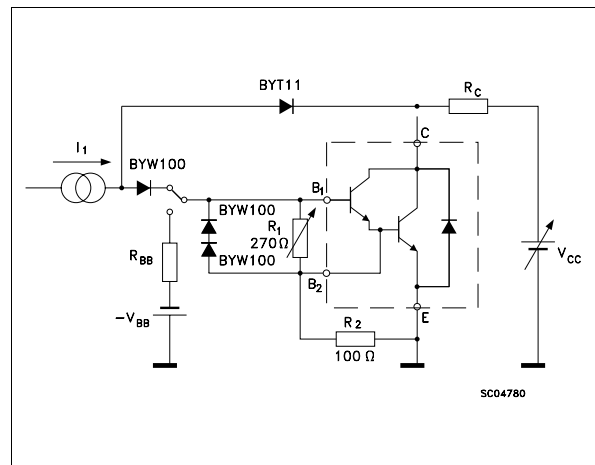
Typical  $V_F$  Versus  $I_F$



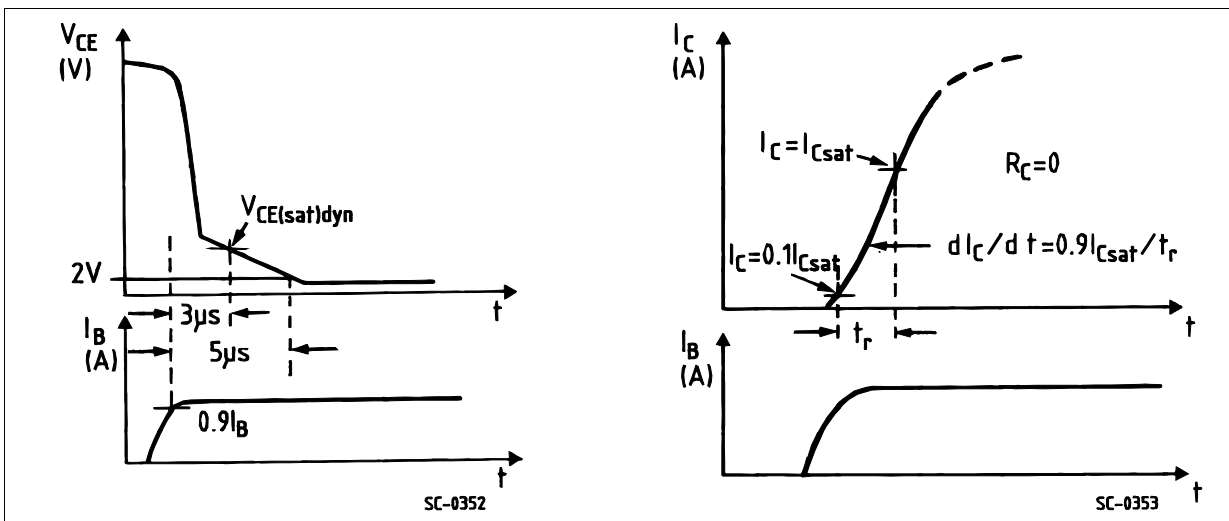
Peak Reverse Current Versus  $di_F/dt$



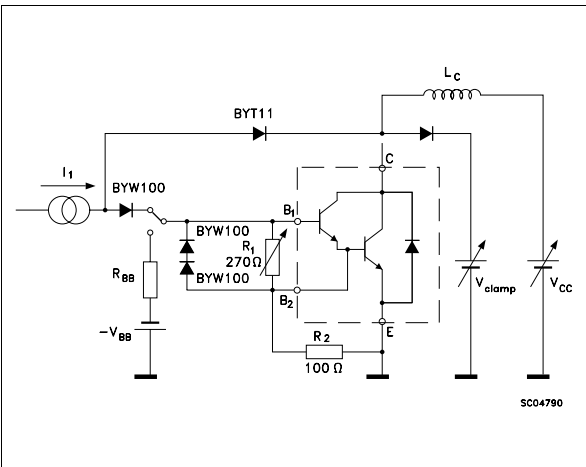
Turn-on Switching Test Circuit



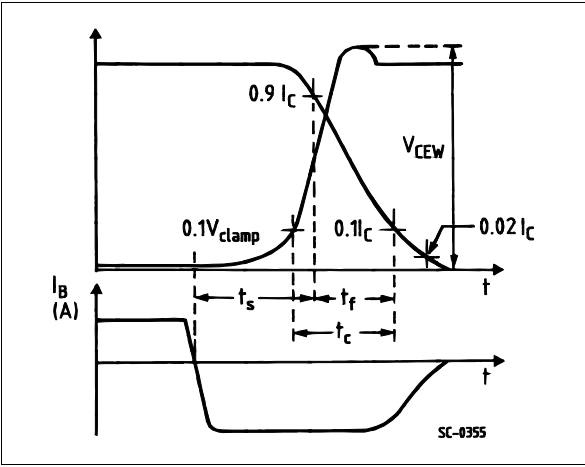
Turn-on Switching Waveforms



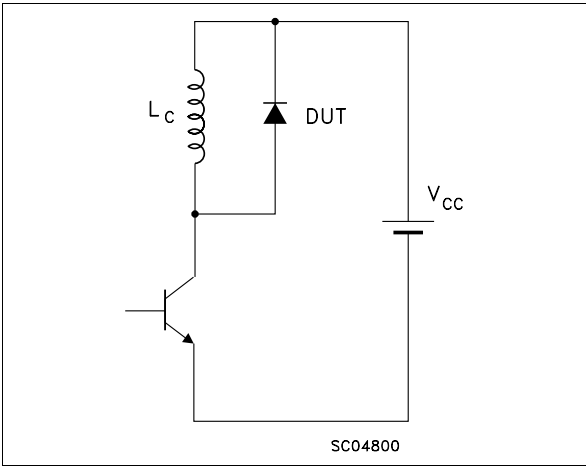
Turn-on Switching Test Circuit



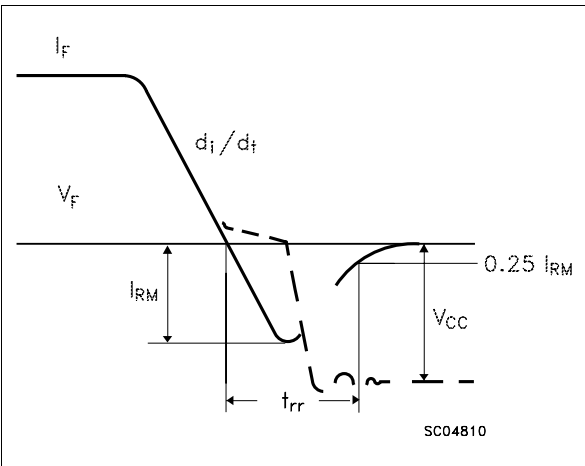
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

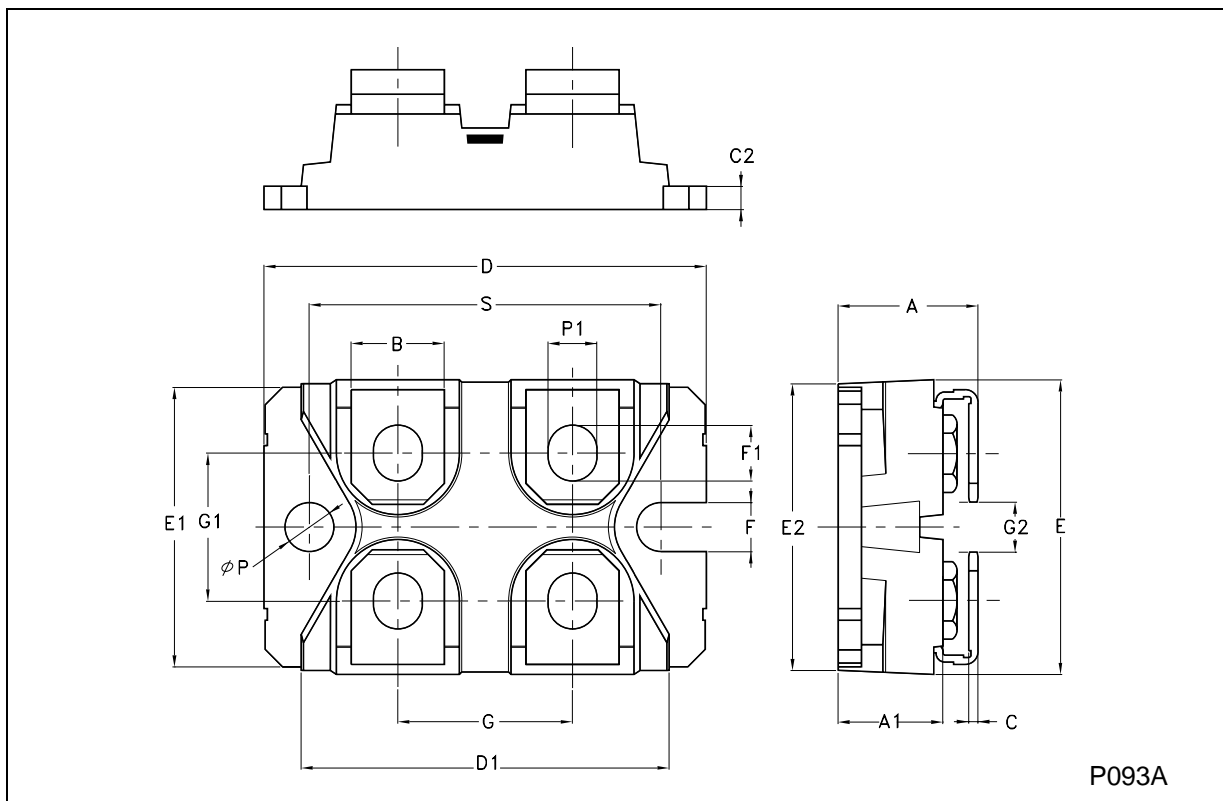


Turn-off Switching Waveform of Diode



## 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		1.248
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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