

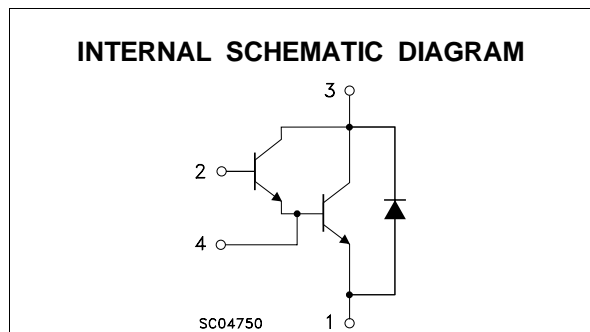
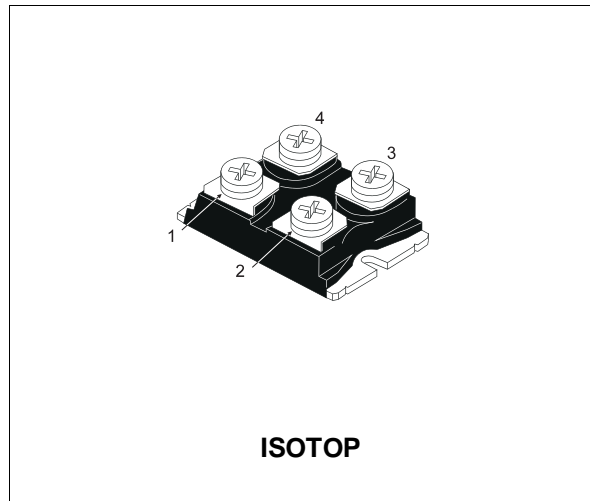


## NPN DARLINGTON POWER MODULE

- 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



### 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	84	A
$I_{CM}$	Collector Peak Current ( $t_p = 10$ ms)	126	A
$I_B$	Base Current	8	A
$I_{BM}$	Base Peak Current ( $t_p = 10$ ms)	16	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	250	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

# ESM6045DV

## THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case (transistor)	Max	0.5	°C/W
R <sub>thj-case</sub>	Thermal Resistance Junction-case (diode)	Max	1.2	°C/W
R <sub>thc-h</sub>	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

## ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>CER</sub> #	Collector Cut-off Current (R <sub>BE</sub> = 5 Ω)	V <sub>CE</sub> = V <sub>CEV</sub> V <sub>CE</sub> = V <sub>CEV</sub> T <sub>j</sub> = 100 °C			1.5 22	mA mA
I <sub>CEV</sub> #	Collector Cut-off Current (V <sub>BE</sub> = -5)	V <sub>CE</sub> = V <sub>CEV</sub> V <sub>CE</sub> = V <sub>CEV</sub> T <sub>j</sub> = 100 °C			1 15	mA mA
I <sub>EBO</sub> #	Emitter Cut-off Current (I <sub>C</sub> = 0)	V <sub>EB</sub> = 5 V			1	mA
V <sub>CEO(SUS)</sub> *	Collector-Emitter Sustaining Voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 0.2 A L = 25 mH V <sub>clamp</sub> = 450 V	450			V
h <sub>FE</sub> *	DC Current Gain	I <sub>C</sub> = 70 A V <sub>CE</sub> = 5 V		120		
V <sub>CE(sat)</sub> *	Collector-Emitter Saturation Voltage	I <sub>C</sub> = 50 A I <sub>B</sub> = 1 A I <sub>C</sub> = 50 A I <sub>B</sub> = 1 A T <sub>j</sub> = 100 °C I <sub>C</sub> = 70 A I <sub>B</sub> = 4 A I <sub>C</sub> = 70 A I <sub>B</sub> = 4 A T <sub>j</sub> = 100 °C		1.2 1.6 1.35 1.7	2 2	V V V V
V <sub>BE(sat)</sub> *	Base-Emitter Saturation Voltage	I <sub>C</sub> = 70 A I <sub>B</sub> = 4 A I <sub>C</sub> = 70 A I <sub>B</sub> = 4 A T <sub>j</sub> = 100 °C		2.3 2.4	3	V V
di <sub>c</sub> /dt	Rate of Rise of On-state Collector	V <sub>CC</sub> = 300 V R <sub>C</sub> = 0 t <sub>p</sub> = 3 μs I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C	375	450		A/μs
V <sub>CE(3 μs)</sub> **	Collector-Emitter Dynamic Voltage	V <sub>CC</sub> = 300 V R <sub>C</sub> = 6 Ω I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C		6	9	V
V <sub>CE(5 μs)</sub> **	Collector-Emitter Dynamic Voltage	V <sub>CC</sub> = 300 V R <sub>C</sub> = 6 Ω I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C		3	4.5	V
t <sub>s</sub>	Storage Time	I <sub>C</sub> = 50 A V <sub>CC</sub> = 50 V		3.5	5.5	μs
t <sub>f</sub>	Fall Time	V <sub>BB</sub> = -5 V R <sub>BB</sub> = 0.3 Ω		0.3	0.5	μs
t <sub>c</sub>	Cross-over Time	V <sub>clamp</sub> = 450 V I <sub>B1</sub> = 1 A L = 0.05 mH T <sub>j</sub> = 100 °C		0.8	1.7	μs
V <sub>CEW</sub>	Maximum Collector Emitter Voltage Without Snubber	I <sub>CWoff</sub> = 84 A I <sub>B1</sub> = 4 A V <sub>BB</sub> = -5 V V <sub>CC</sub> = 50 V L = 0.03 mH R <sub>BB</sub> = 0.3 Ω T <sub>j</sub> = 125 °C	450			V
V <sub>F</sub> *	Diode Forward Voltage	I <sub>F</sub> = 70 A T <sub>j</sub> = 100 °C		1.6	1.9	V
I <sub>RM</sub>	Reverse Recovery Current	V <sub>CC</sub> = 200 V I <sub>F</sub> = 70 A di <sub>F</sub> /dt = -375 A/μs L < 0.05 μH T <sub>j</sub> = 100 °C		38	45	A

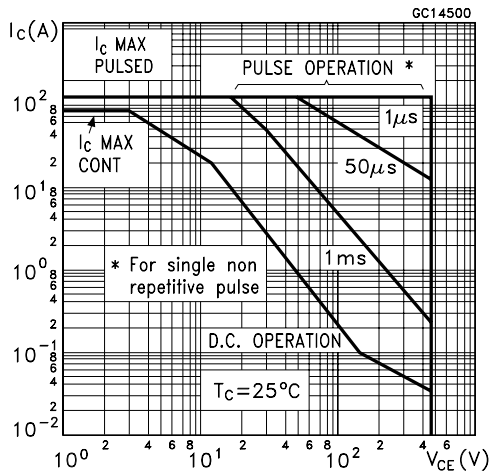
\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

# See test circuits in databook introduction

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

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

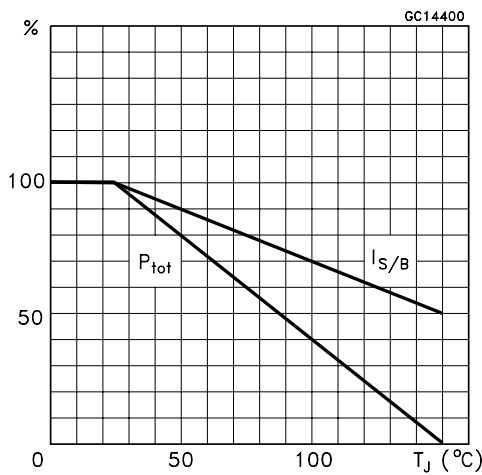
Safe Operating Areas



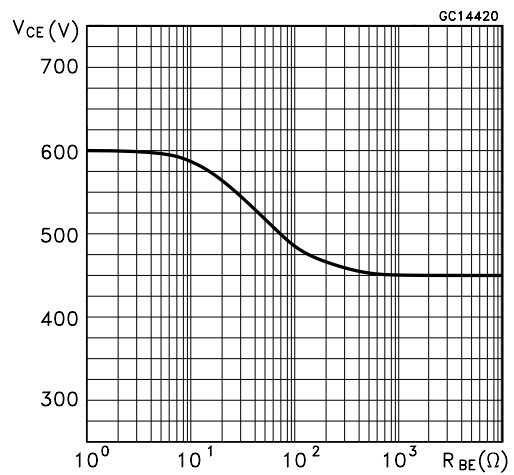
Thermal Impedance



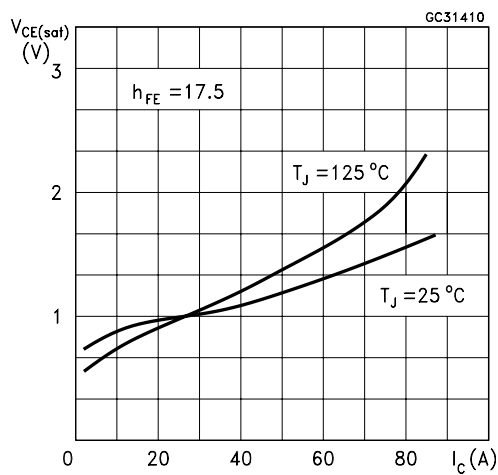
Derating Curve



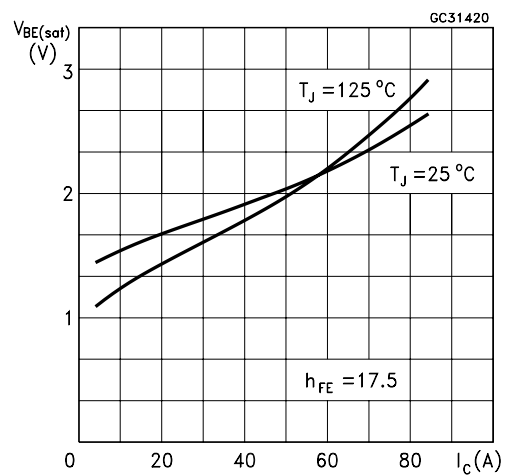
Collector-emitter Voltage Versus base-emitter Resistance



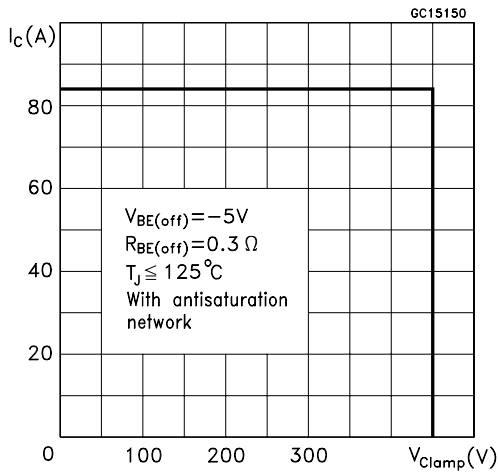
Collector Emitter Saturation Voltage



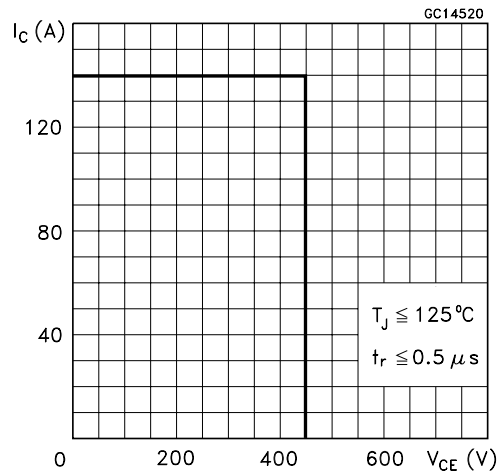
Base-Emitter Saturation Voltage



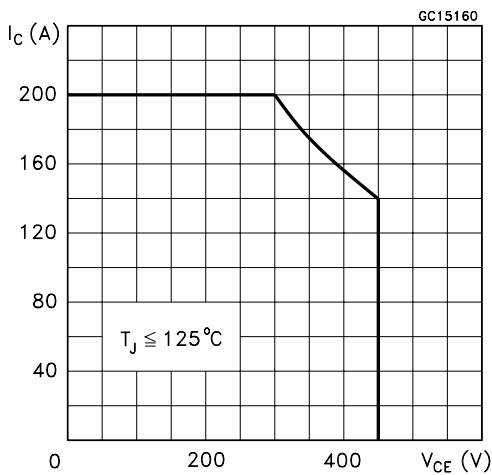
Reverse Biased SOA



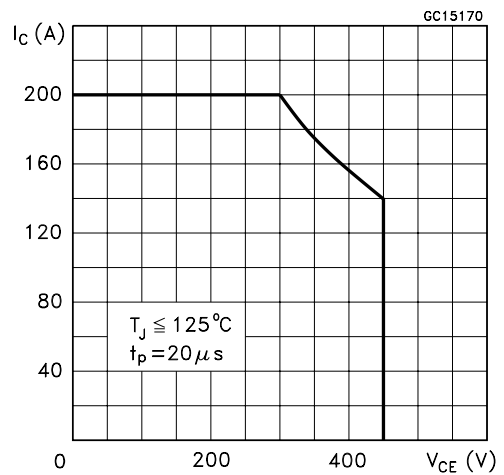
Forward Biased SOA



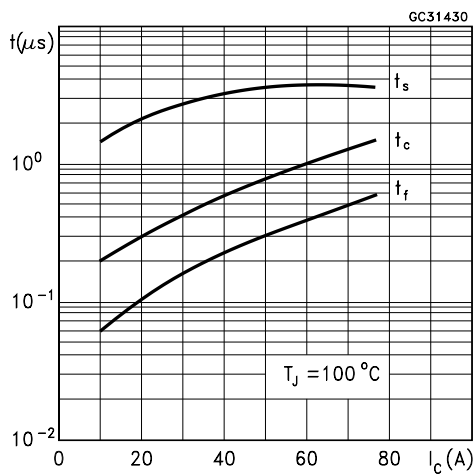
Reverse Biased AOA



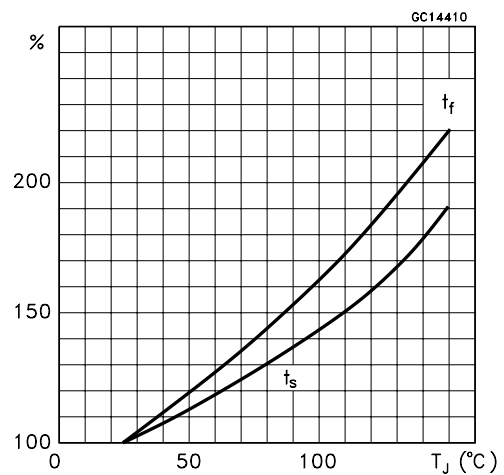
Forward Biased AOA



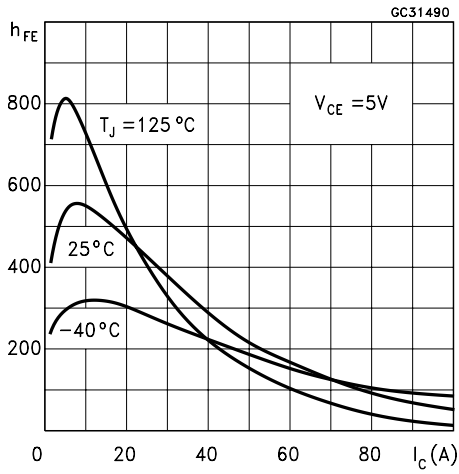
Switching Times Inductive Load



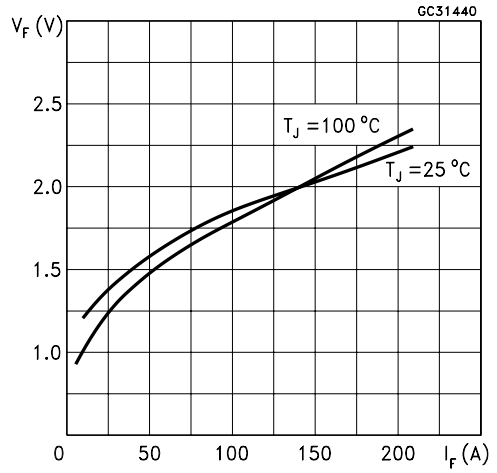
Switching Times Inductive Load Versus Temperature



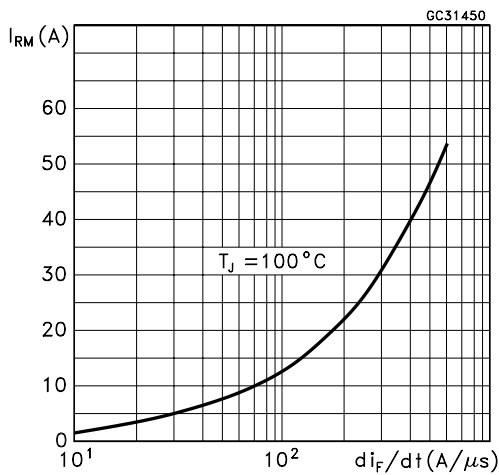
Dc Current Gain



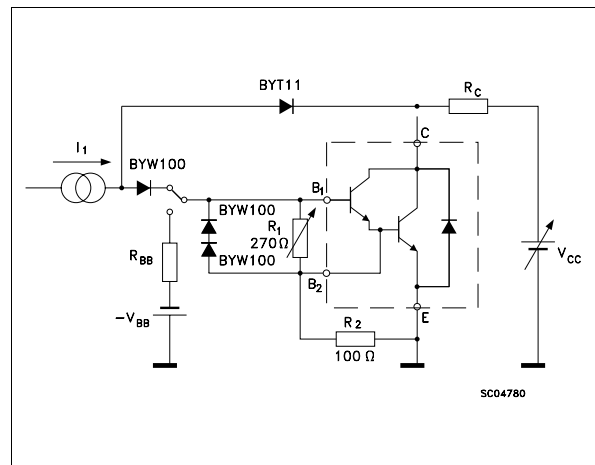
Typical VF Versus IF



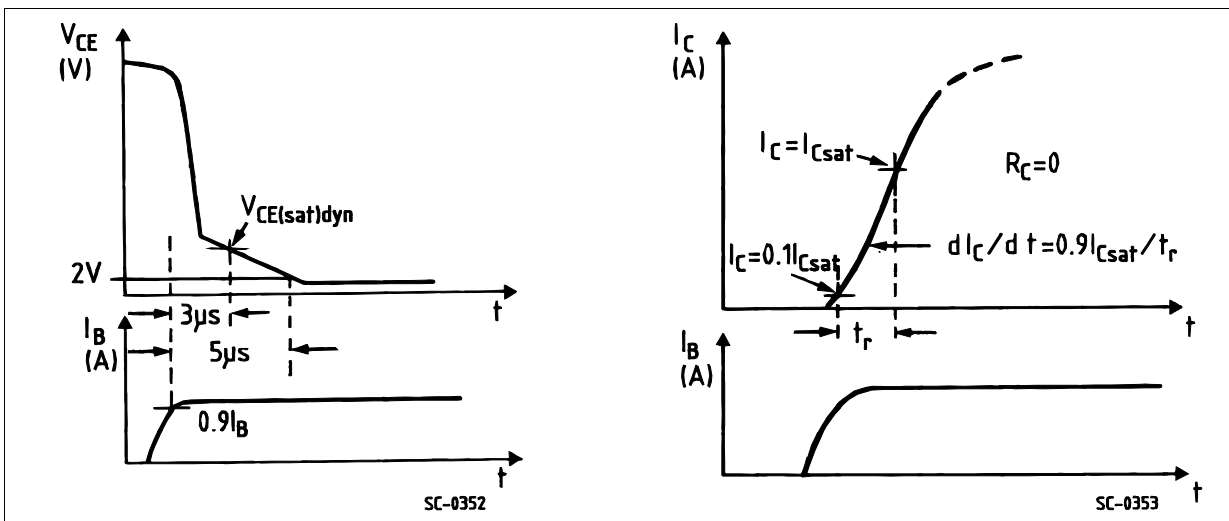
Peak Reverse Current Versus diF/dt



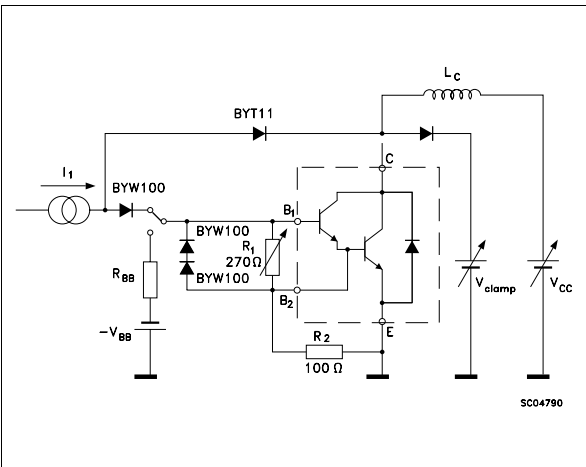
Turn-on Switching Test Circuit



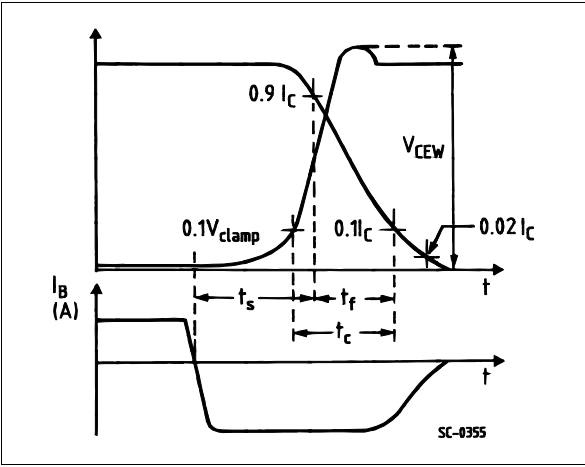
Turn-on Switching Waveforms



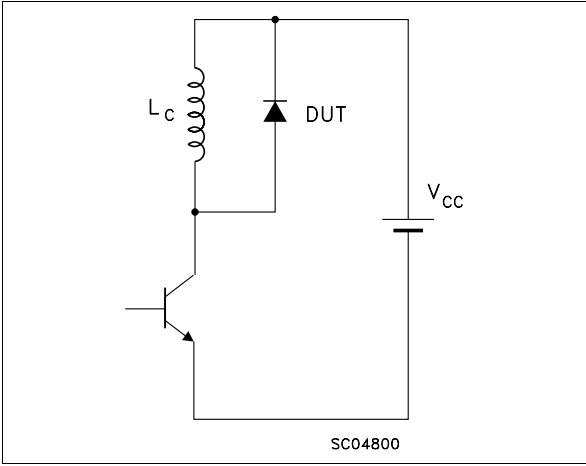
Turn-on Switching Test Circuit



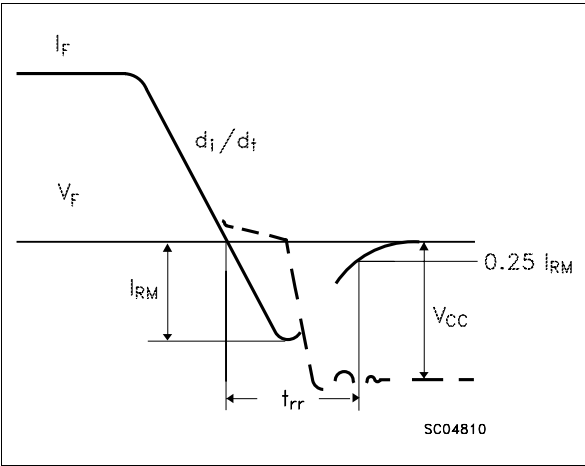
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

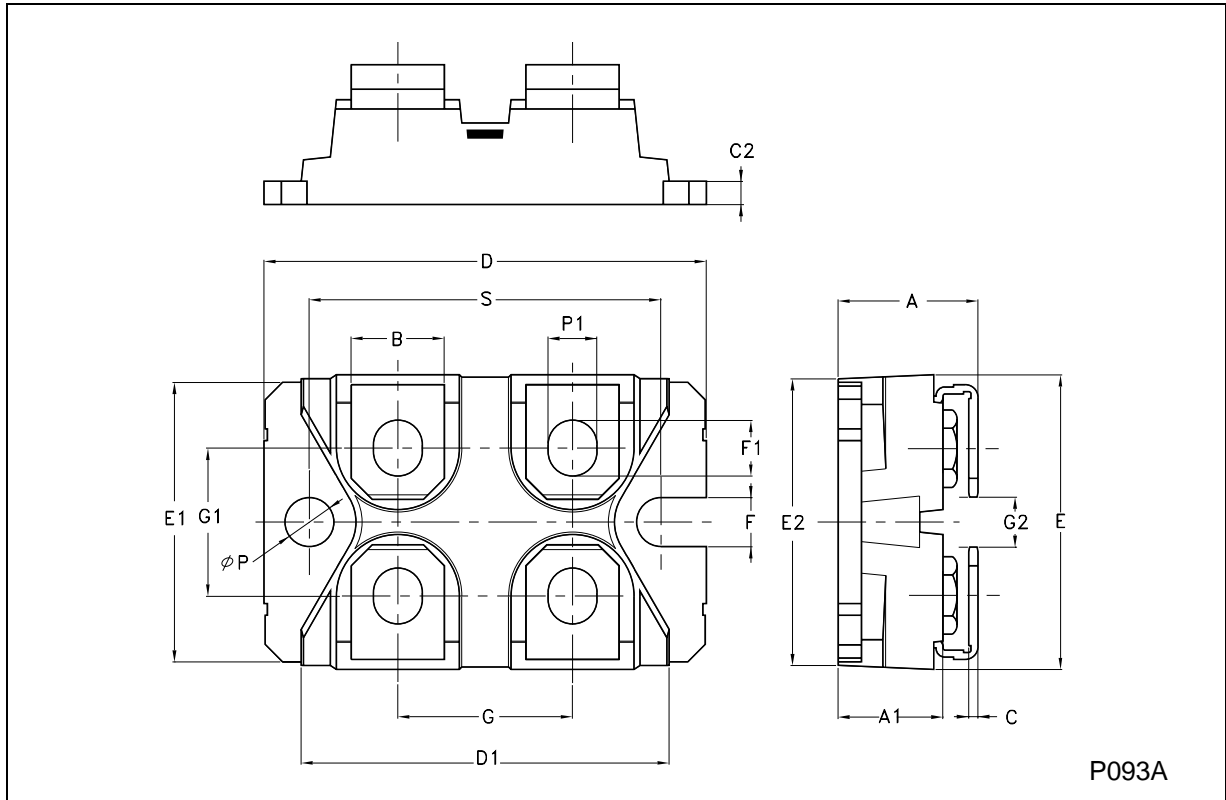


Turn-off Switching Waveform of Diode



**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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