

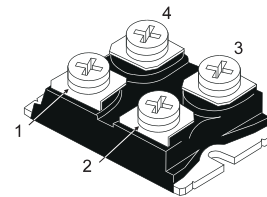


## NPN DARLINGTON POWER MODULE

- 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

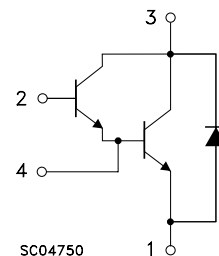
### APPLICATIONS:

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



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	42	A
$I_{CM}$	Collector Peak Current ( $t_p = 10$ ms)	63	A
$I_B$	Base Current	4	A
$I_{BM}$	Base Peak Current ( $t_p = 10$ ms)	8	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	150	W
$T_{stg}$	Storage Temperature	-55 to 150	°C
$T_j$	Max. Operating Junction Temperature	150	°C

# ESM4045DV

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.83	$^{\circ}\text{C}/\text{W}$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	1.5	$^{\circ}\text{C}/\text{W}$
$R_{thc-h}$	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 ( $R_{BE} = 5 \Omega$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$			1.5 20	$\text{mA}$ $\text{mA}$
$I_{CEV}$ #	Collector Cut-off Current ( $V_{BE} = -5$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV} \quad T_j = 100^{\circ}\text{C}$			1 13	$\text{mA}$ $\text{mA}$
$I_{EBO}$ #	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 5 \text{ V}$			1	$\text{mA}$
$V_{CEO(SUS)}^*$	Collector-Emitter Sustaining Voltage ( $I_B = 0$ )	$I_C = 0.2 \text{ A} \quad L = 25 \text{ mH}$ $V_{clamp} = 450 \text{ V}$	450			$\text{V}$
$h_{FE}^*$	DC Current Gain	$I_C = 35 \text{ A} \quad V_{CE} = 5 \text{ V}$		220		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 25 \text{ A} \quad I_B = 0.5 \text{ A}$ $I_C = 25 \text{ A} \quad I_B = 0.5 \text{ A} \quad T_j = 100^{\circ}\text{C}$ $I_C = 35 \text{ A} \quad I_B = 2 \text{ A}$ $I_C = 35 \text{ A} \quad I_B = 2 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.15 1.3 1.4 1.5	2 2	$\text{V}$ $\text{V}$ $\text{V}$ $\text{V}$
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 35 \text{ A} \quad I_B = 2 \text{ A}$ $I_C = 35 \text{ A} \quad I_B = 2 \text{ A} \quad T_j = 100^{\circ}\text{C}$		2.3 2.3	3	$\text{V}$ $\text{V}$
$di/dt$	Rate of Rise of On-state Collector	$V_{CC} = 300 \text{ V} \quad R_C = 0 \quad t_p = 3 \mu\text{s}$ $I_{B1} = 0.75 \text{ A} \quad T_j = 100^{\circ}\text{C}$	200	250		$\text{A}/\mu\text{s}$
$V_{CE(3 \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 12 \Omega$ $I_{B1} = 0.75 \text{ A} \quad T_j = 100^{\circ}\text{C}$		4.5	8	$\text{V}$
$V_{CE(5 \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 12 \Omega$ $I_{B1} = 0.75 \text{ A} \quad T_j = 100^{\circ}\text{C}$		2.5	4.5	$\text{V}$
$t_s$	Storage Time	$I_C = 25 \text{ A} \quad V_{CC} = 50 \text{ V}$		3.2	5	$\mu\text{s}$
$t_f$	Fall Time	$V_{BB} = -5 \text{ V} \quad R_{BB} = 0.6 \Omega$		0.25	0.5	$\mu\text{s}$
$t_c$	Cross-over Time	$V_{clamp} = 450 \text{ V} \quad I_{B1} = 0.5 \text{ A}$ $L = 0.1 \text{ mH} \quad T_j = 100^{\circ}\text{C}$		0.75	1.5	$\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 42 \text{ A} \quad I_{B1} = 2 \text{ A}$ $V_{BB} = -5 \text{ V} \quad V_{CC} = 50 \text{ V}$ $L = 0.06 \text{ mH} \quad R_{BB} = 0.6 \Omega$ $T_j = 125^{\circ}\text{C}$	450			$\text{V}$
$V_F^*$	Diode Forward Voltage	$I_F = 35 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.5	1.85	$\text{V}$
$I_{RM}$	Reverse Recovery Current	$V_{CC} = 200 \text{ V} \quad I_F = 35 \text{ A}$ $di_F/dt = -200 \text{ A}/\mu\text{s} \quad L < 0.05 \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		20	24	$\text{A}$

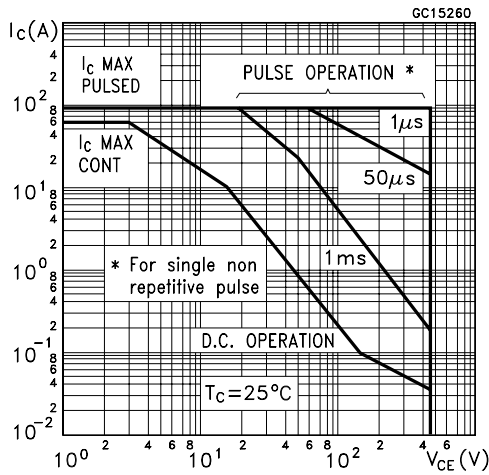
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

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

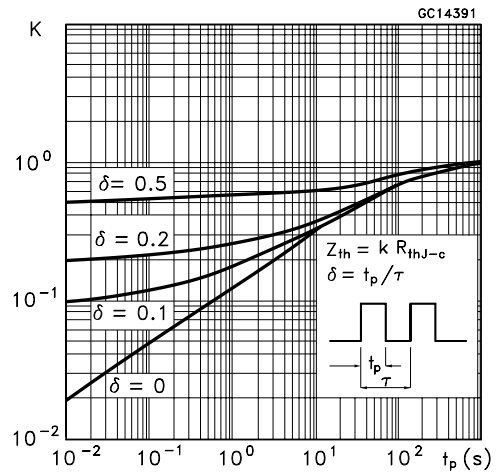
$$V_F = 1.5 + 0.001 I_F \quad P = 1.5 I_{F(AV)} + 0.001 I_{F(RMS)}^2$$

# See test circuits in databook introduction

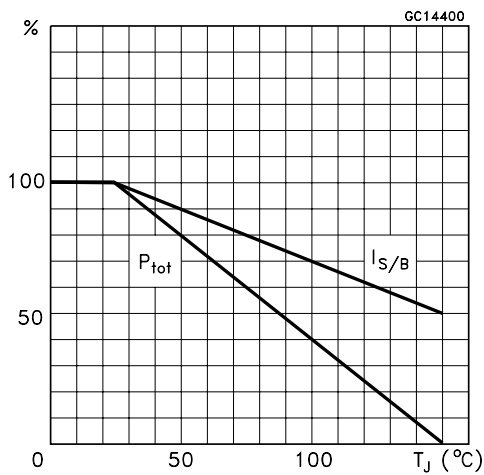
Safe Operating Areas



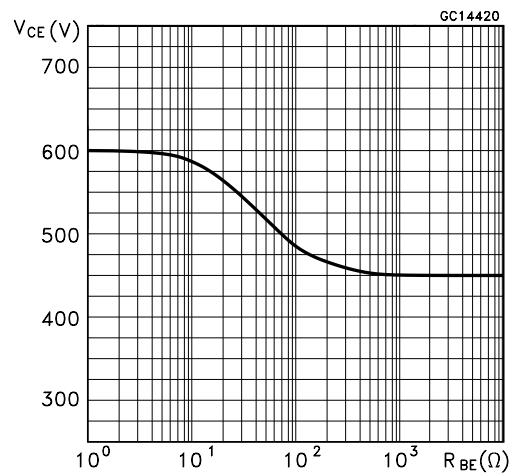
Thermal Impedance



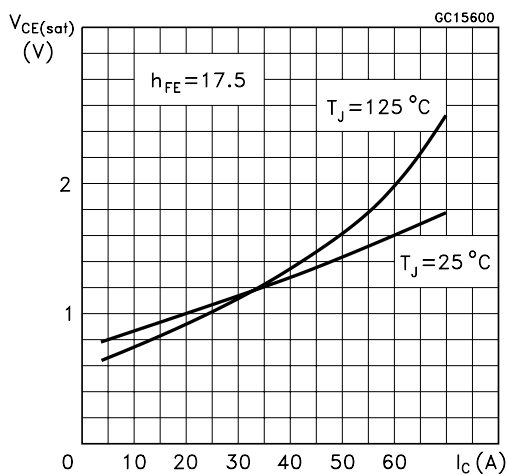
Derating Curve



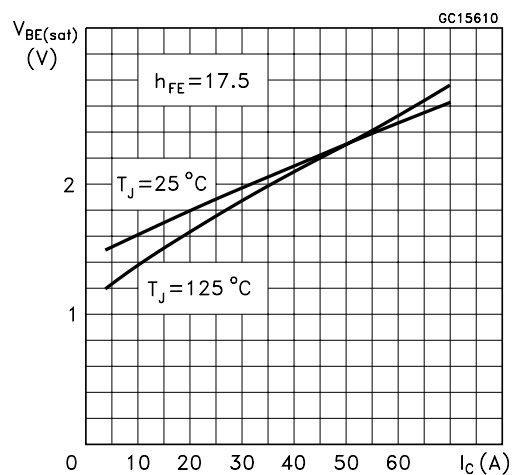
Collector-emitter Voltage Versus base-emitter Resistance



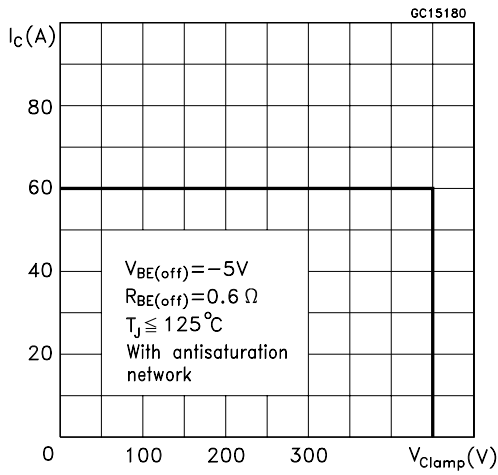
Collector Emitter Saturation Voltage



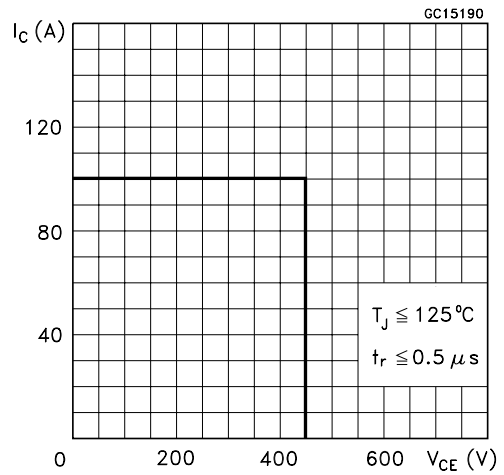
Base-Emitter Saturation Voltage



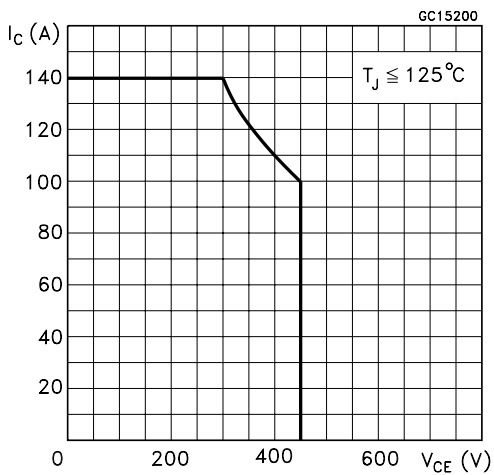
Reverse Biased SOA



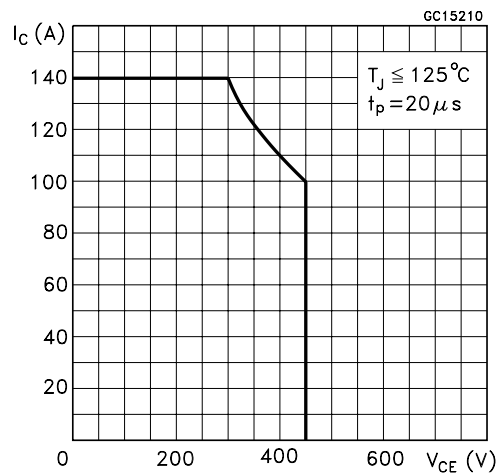
Forward Biased SOA



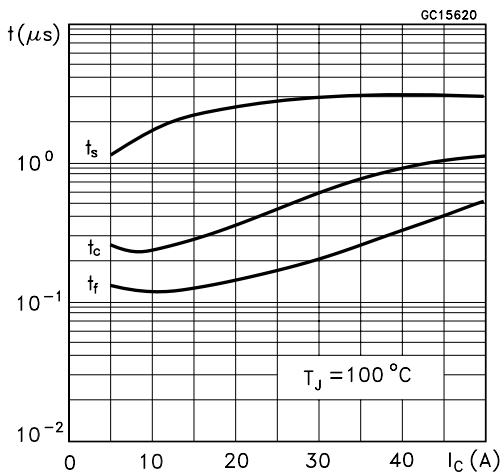
Reverse Biased AOA



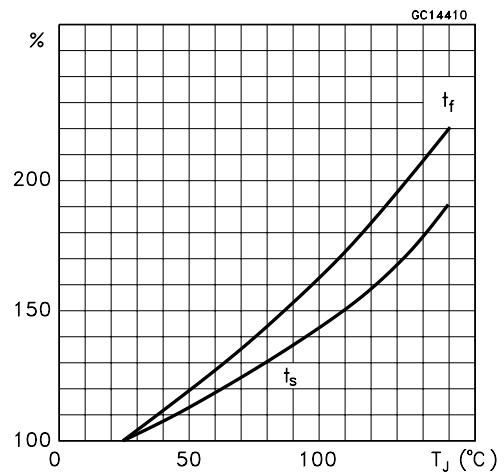
Forward Biased AOA



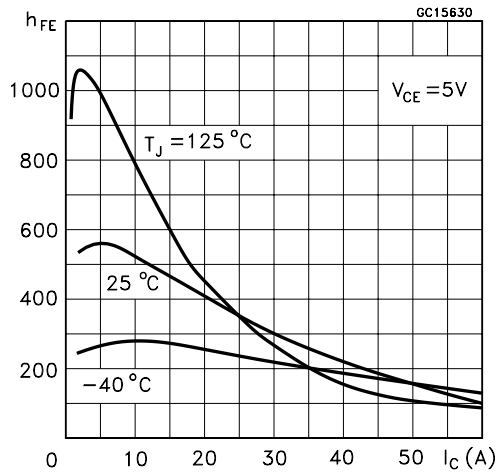
Switching Times Inductive Load



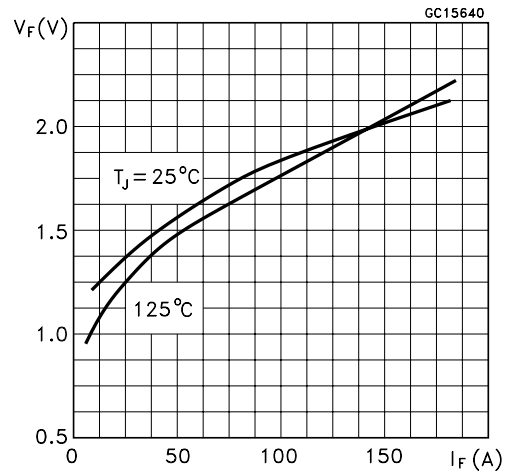
Switching Times Inductive Load Versus Temperature



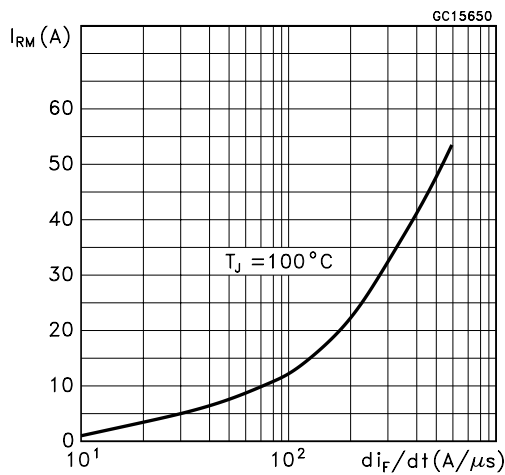
Dc Current Gain



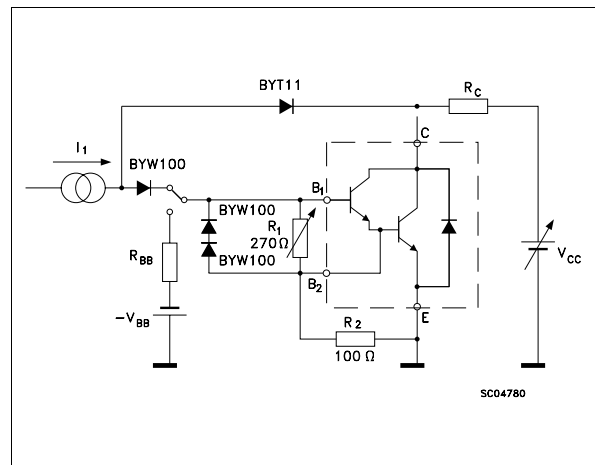
Typical  $V_F$  Versus  $I_F$



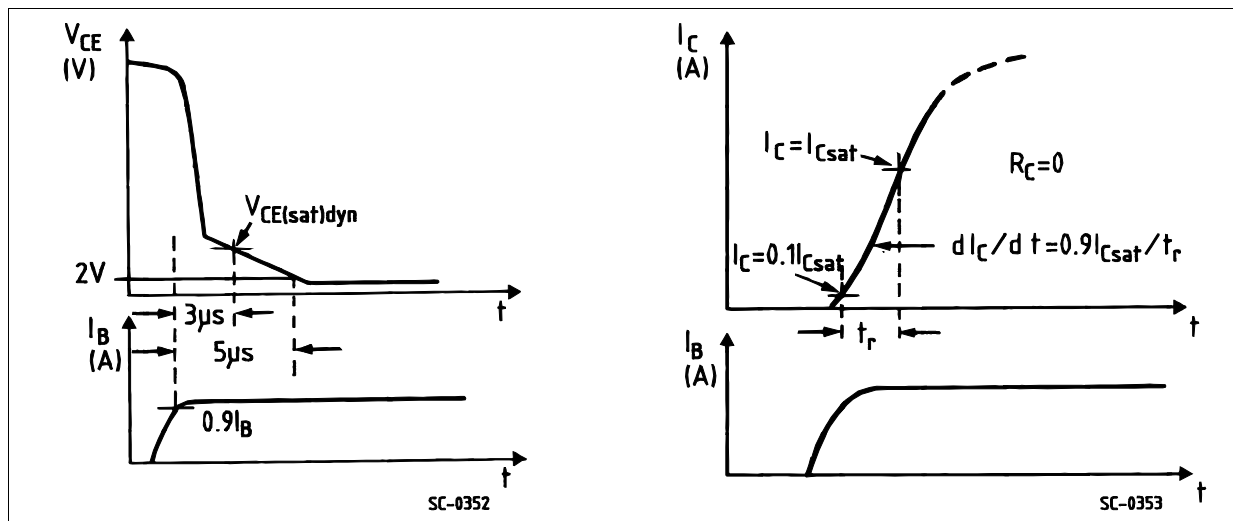
Peak Reverse Current Versus  $di_F/dt$



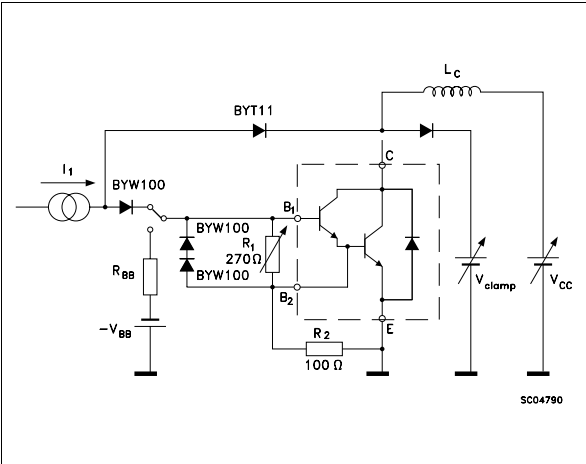
Turn-on Switching Test Circuit



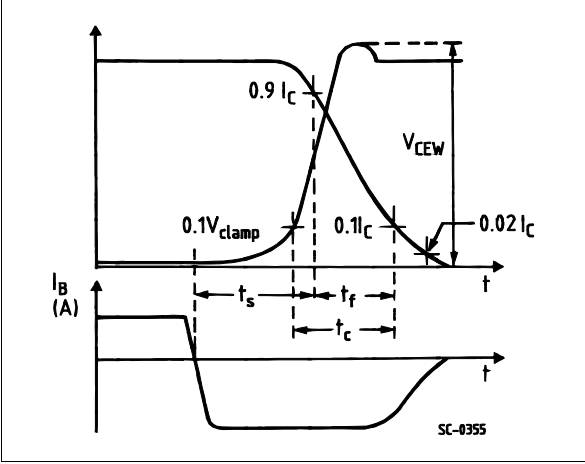
Turn-on Switching Waveforms



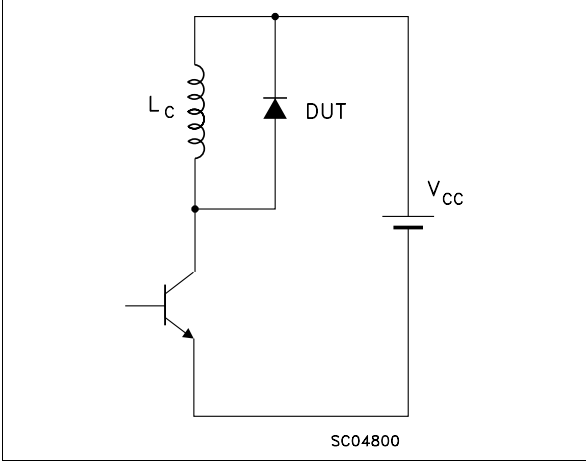
Turn-on Switching Test Circuit



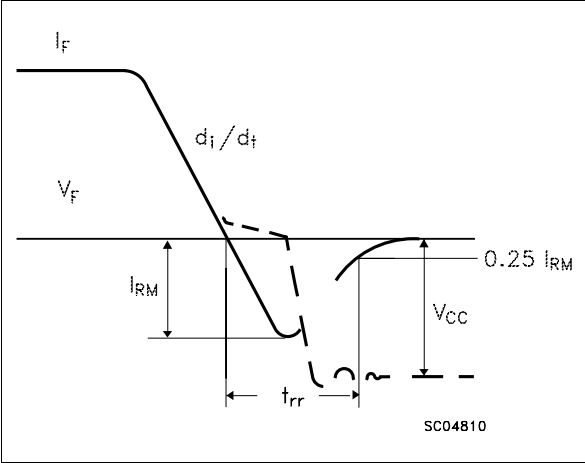
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

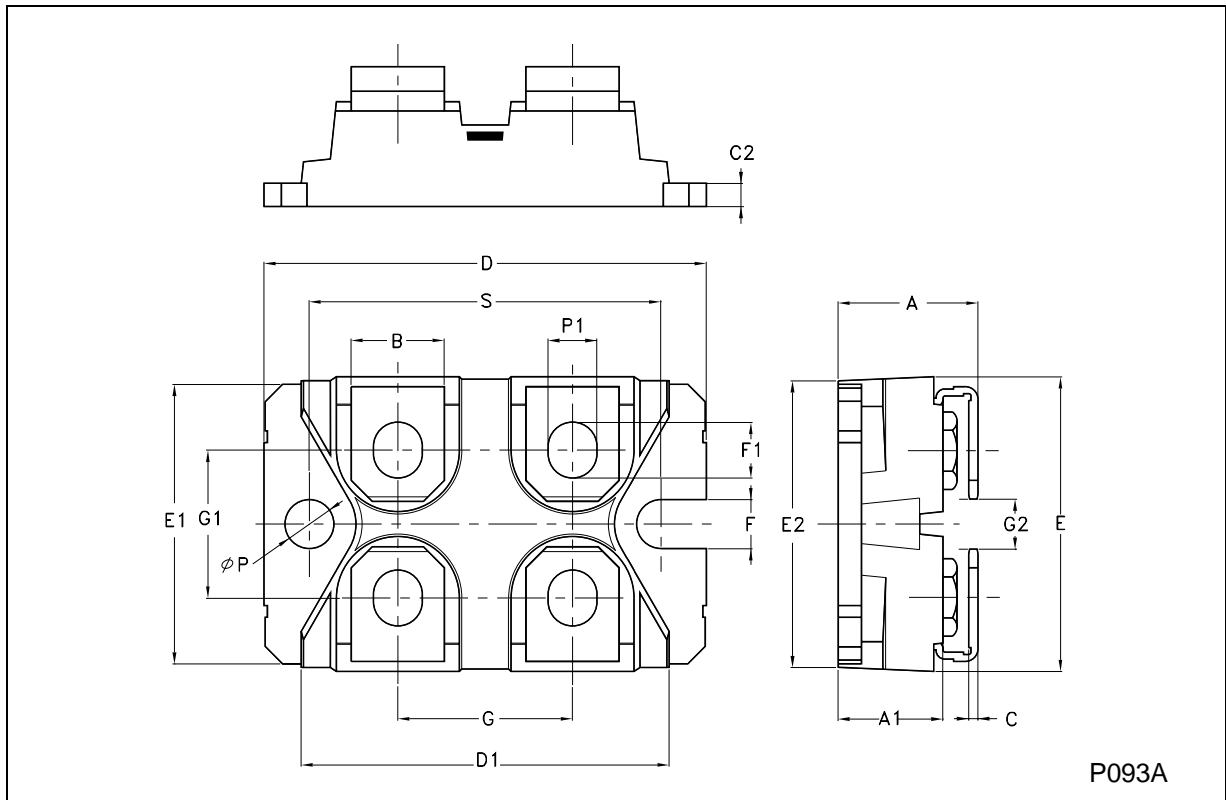


Turn-off Switching Waveform of Diode



**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



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics.

All other names are the property of their respective owners.

© 2003 STMicroelectronics – All Rights reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

<http://www.st.com>