



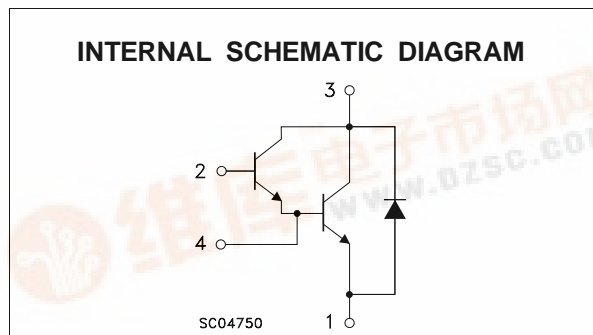
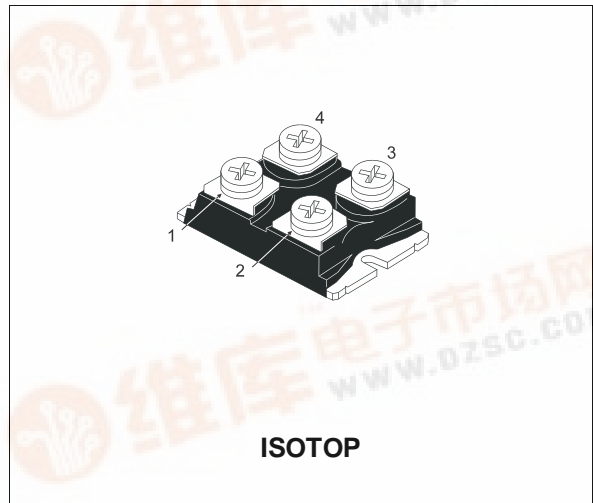
ESM6045DV

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 ($V_{BE} = -5\text{ V}$)	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	84	A
I_{CM}	Collector Peak Current ($t_p = 10\text{ ms}$)	126	A
I_B	Base Current	8	A
I_{BM}	Base Peak Current ($t_p = 10\text{ ms}$)	16	A
P_{tot}	Total Dissipation at $T_c = 25\text{ °C}$	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

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.5	$^{\circ}\text{C}/\text{W}$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	1.2	$^{\circ}\text{C}/\text{W}$
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 22	mA 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 15	mA mA
I_{EBO} #	Emitter Cut-off Current ($I_C = 0$)	$V_{EB} = 5 \text{ V}$			1	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			V
h_{FE}^*	DC Current Gain	$I_C = 70 \text{ A} \quad V_{CE} = 5 \text{ V}$		120		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 50 \text{ A} \quad I_B = 1 \text{ A}$ $I_C = 50 \text{ A} \quad I_B = 1 \text{ A} \quad T_j = 100^{\circ}\text{C}$ $I_C = 70 \text{ A} \quad I_B = 4 \text{ A}$ $I_C = 70 \text{ A} \quad I_B = 4 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.2 1.6 1.35 1.7	2 2	V V V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 70 \text{ A} \quad I_B = 4 \text{ A}$ $I_C = 70 \text{ A} \quad I_B = 4 \text{ A} \quad T_j = 100^{\circ}\text{C}$		2.3 2.4	3	V V
di_C/dt	Rate of Rise of On-state Collector	$V_{CC} = 300 \text{ V} \quad R_C = 0 \quad t_p = 3 \mu\text{s}$ $I_{B1} = 1.5 \text{ A} \quad T_j = 100^{\circ}\text{C}$	375	450		$\text{A}/\mu\text{s}$
$V_{CE(3 \mu\text{s})}^{\bullet\bullet}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 6 \Omega$ $I_{B1} = 1.5 \text{ A} \quad T_j = 100^{\circ}\text{C}$		6	9	V
$V_{CE(5 \mu\text{s})}^{\bullet\bullet}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 6 \Omega$ $I_{B1} = 1.5 \text{ A} \quad T_j = 100^{\circ}\text{C}$		3	4.5	V
t_s t_f t_c	Storage Time Fall Time Cross-over Time	$I_C = 50 \text{ A} \quad V_{CC} = 50 \text{ V}$ $V_{BB} = -5 \text{ V} \quad R_{BB} = 0.3 \Omega$ $V_{clamp} = 450 \text{ V} \quad I_{B1} = 1 \text{ A}$ $L = 0.05 \text{ mH} \quad T_j = 100^{\circ}\text{C}$		3.5 0.3 0.8	5.5 0.5 1.7	μs μs μs
V_{CEW}	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 84 \text{ A} \quad I_{B1} = 4 \text{ A}$ $V_{BB} = -5 \text{ V} \quad V_{CC} = 50 \text{ V}$ $L = 0.03 \text{ mH} \quad R_{BB} = 0.3 \Omega$ $T_j = 125^{\circ}\text{C}$	450			V
V_F^*	Diode Forward Voltage	$I_F = 70 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.6	1.9	V
I_{RM}	Reverse Recovery Current	$V_{CC} = 200 \text{ V} \quad I_F = 70 \text{ A}$ $di_F/dt = -375 \text{ A}/\mu\text{s} \quad L < 0.05 \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		38	45	A

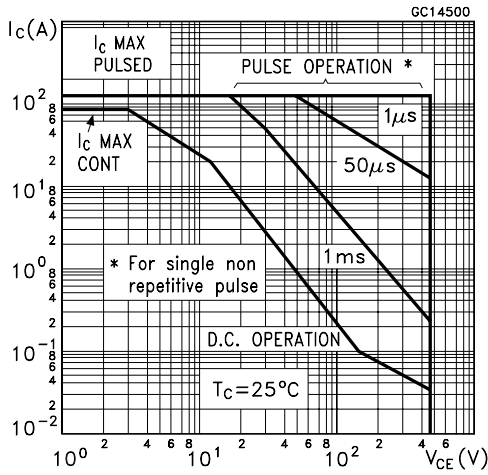
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

See test circuits in databook introduction

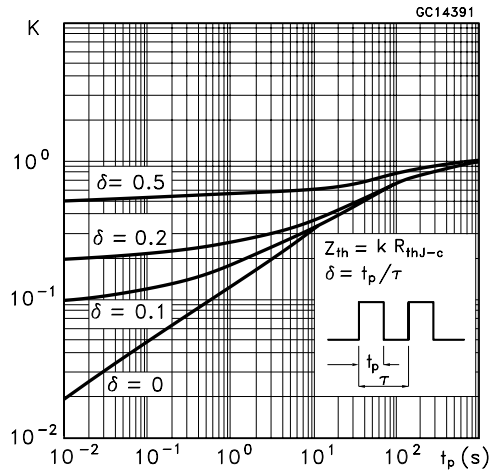
To evaluate the conduction losses of the diode use the following equations:

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

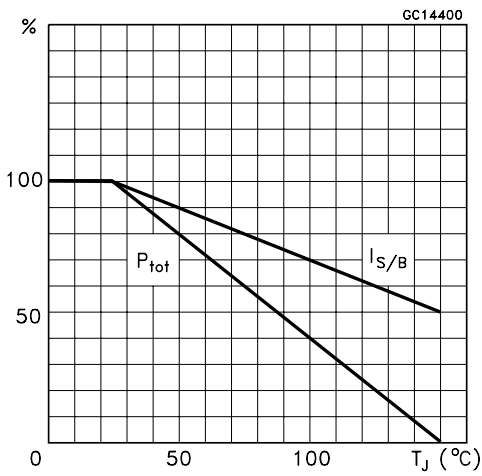
Safe Operating Areas



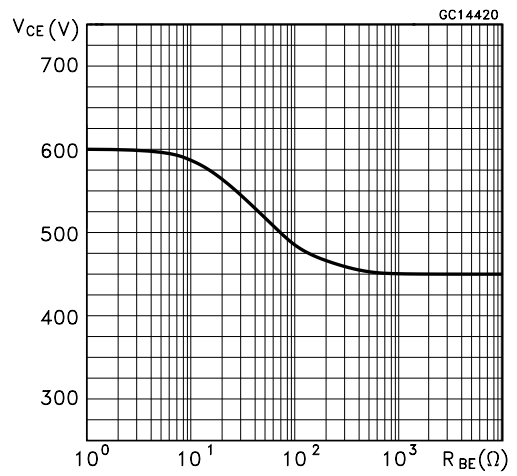
Thermal Impedance



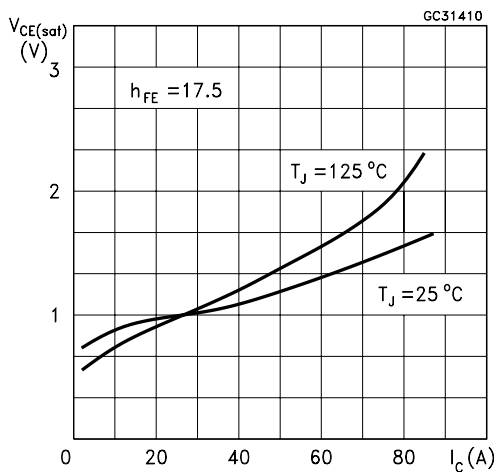
Derating Curve



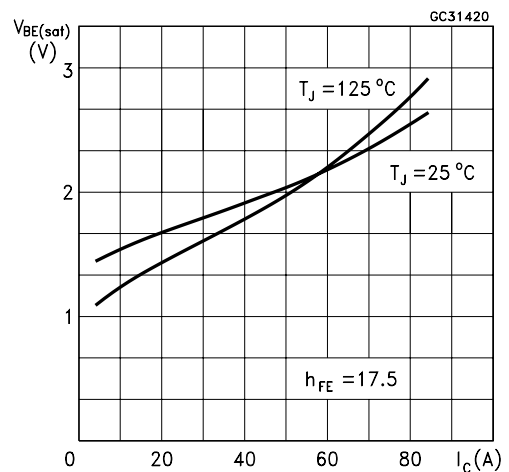
Collector-emitter Voltage Versus base-emitter Resistance



Collector Emitter Saturation Voltage

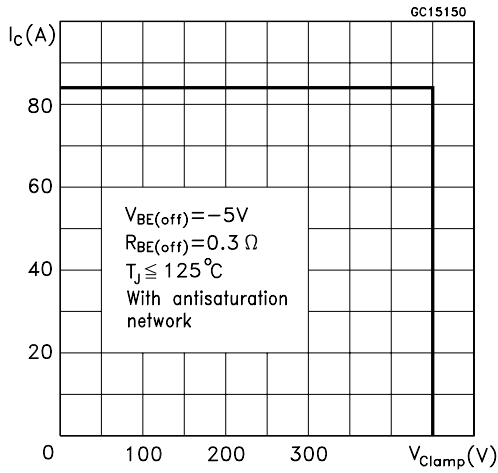


Base-Emitter Saturation Voltage

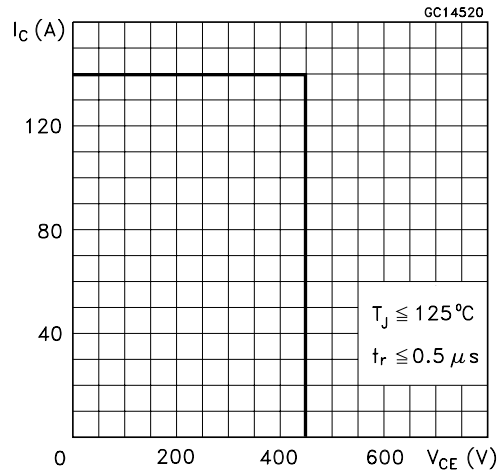


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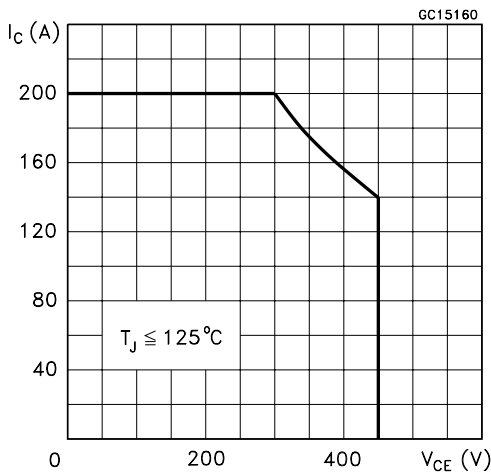
Reverse Biased SOA



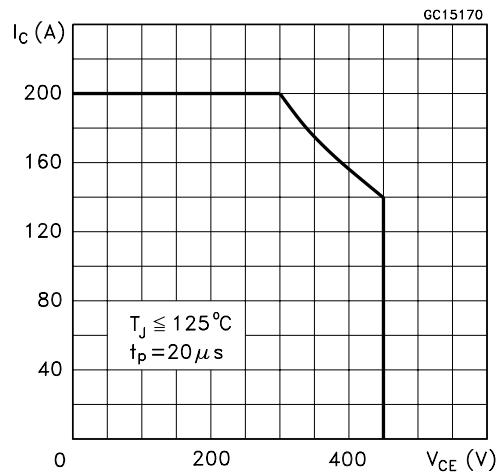
Foward Biased SOA



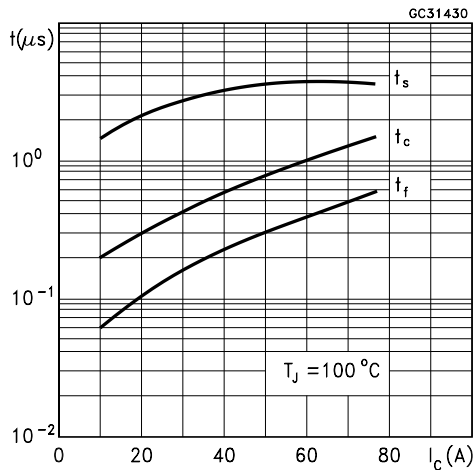
Reverse Biased AOA



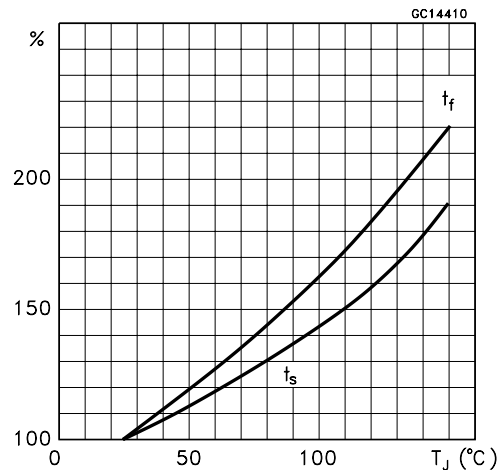
Forward Biased AOA



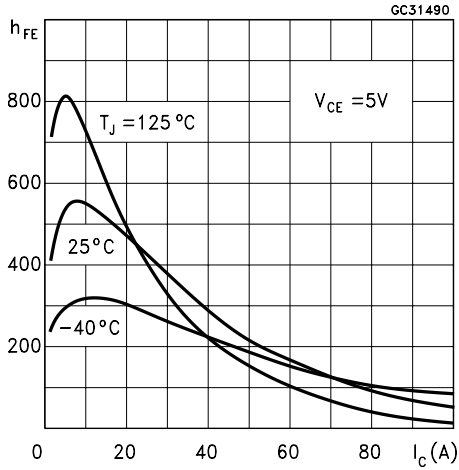
Switching Times Inductive Load



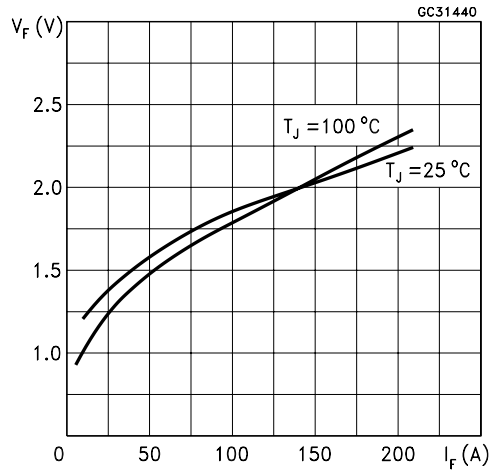
Switching Times Inductive Load Versus Temperature



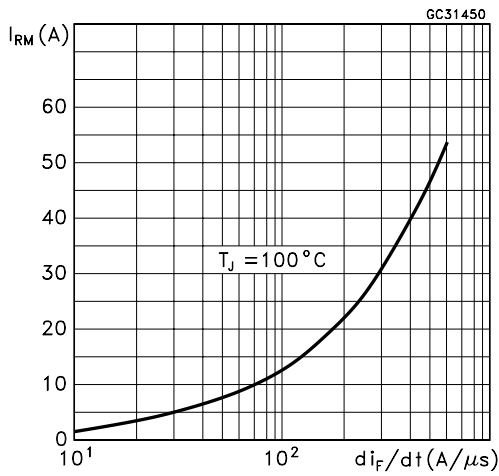
Dc Current Gain



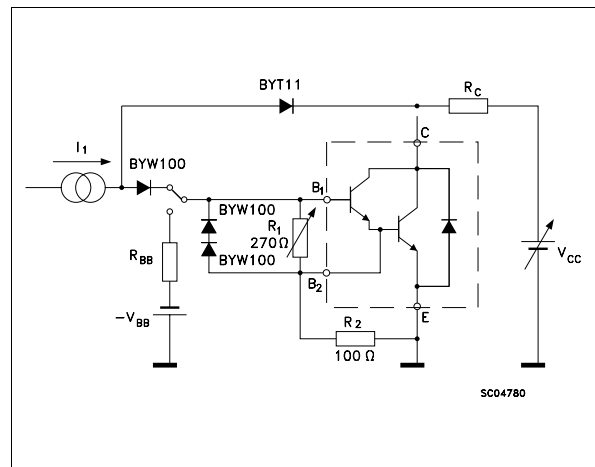
Typical V_F Versus I_F



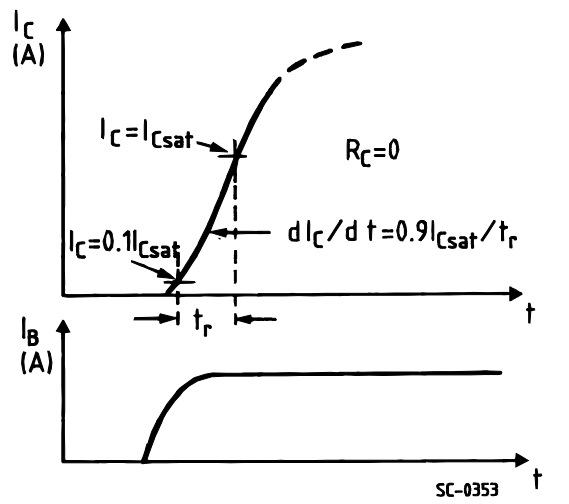
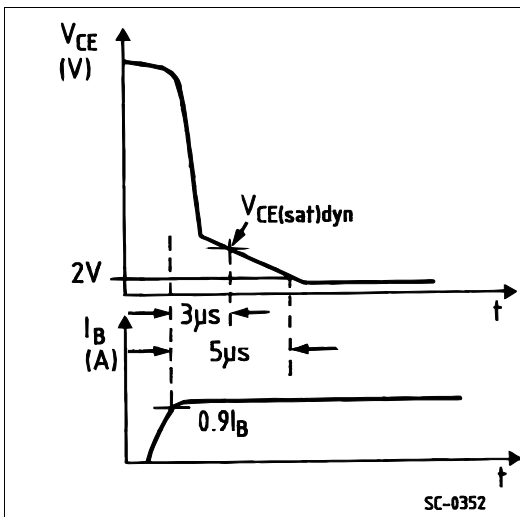
Peak Reverse Current Versus di_F/dt



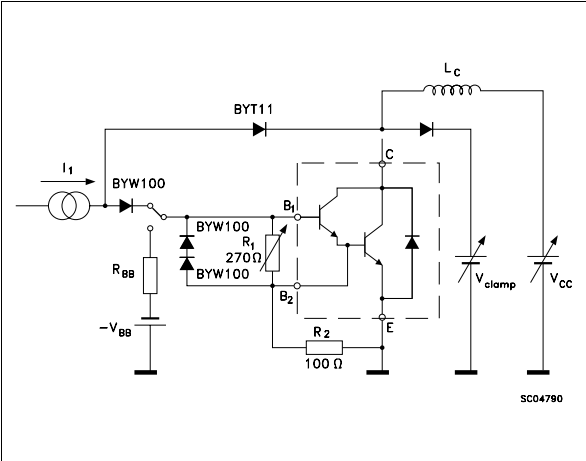
Turn-on Switching Test Circuit



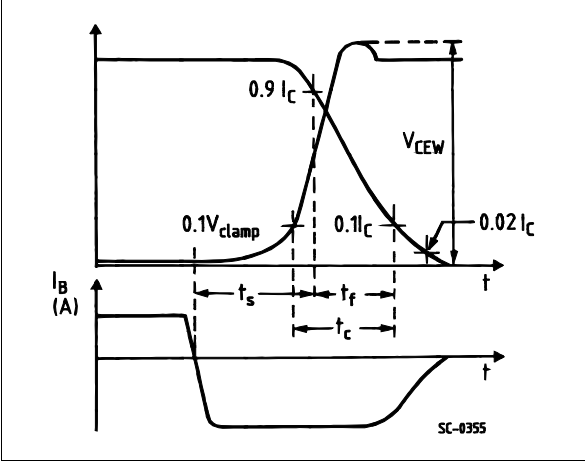
Turn-on Switching Waveforms



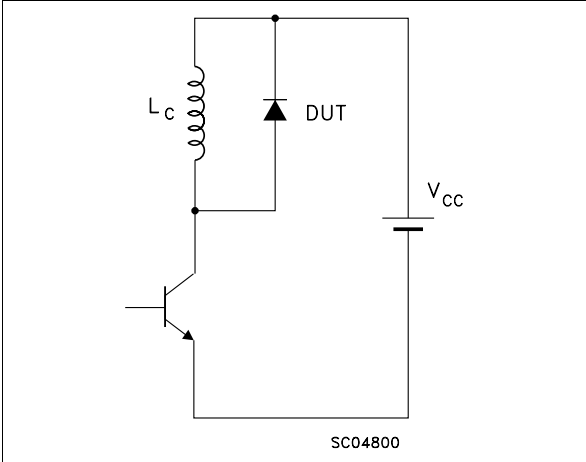
Turn-on Switching Test Circuit



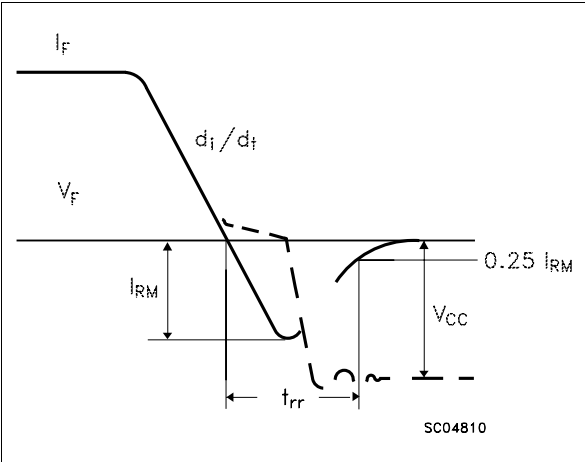
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

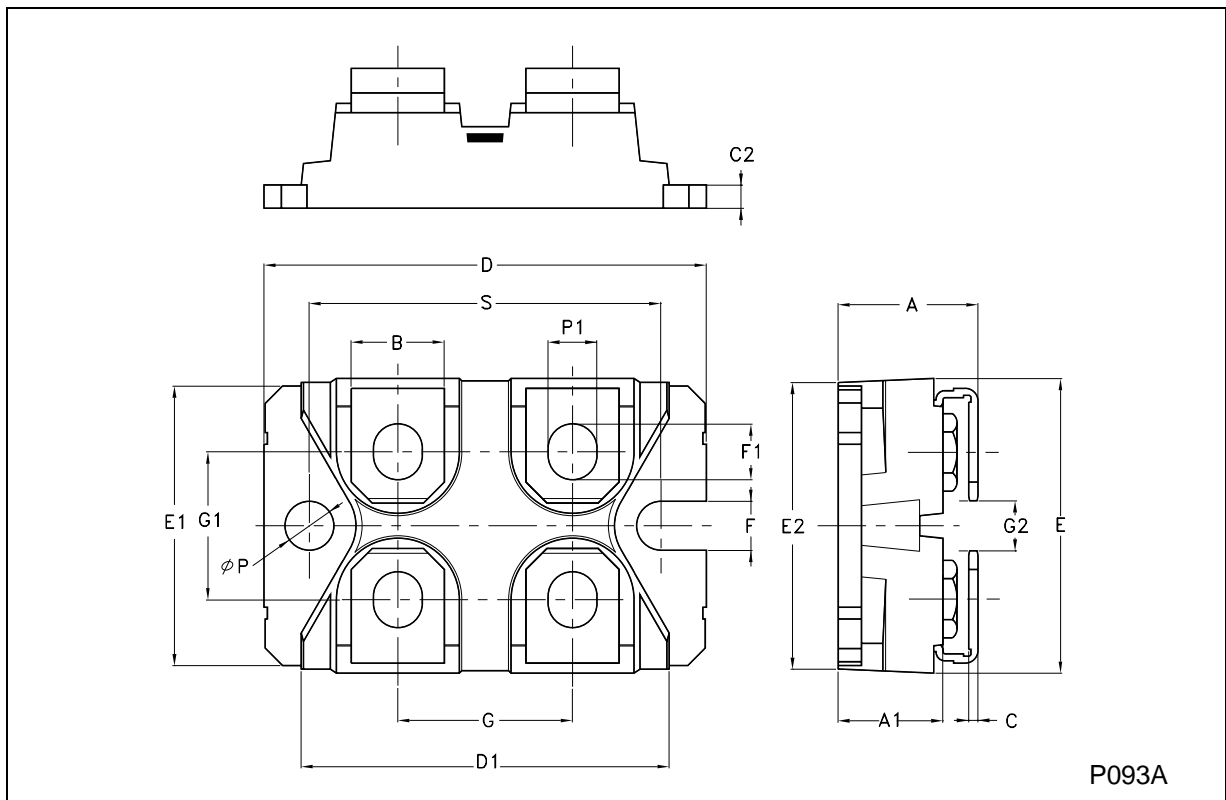


Turn-off Switching Waveform of Diode



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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