



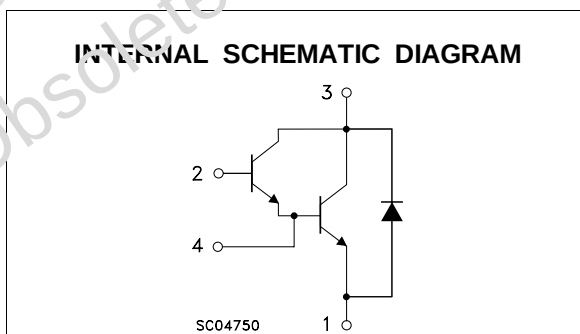
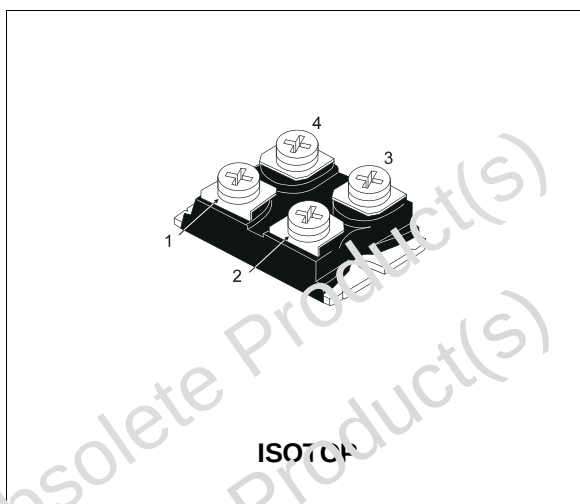
ESM4045DV

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_{CE}	Collector-Emitter Voltage ($V_{BE} = -5$ V)	600	V
$V_{CE(sus)}$	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

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.83	$^{\circ}\text{C/W}$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	1.5	$^{\circ}\text{C/W}$
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^{\circ}\text{C/W}$

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

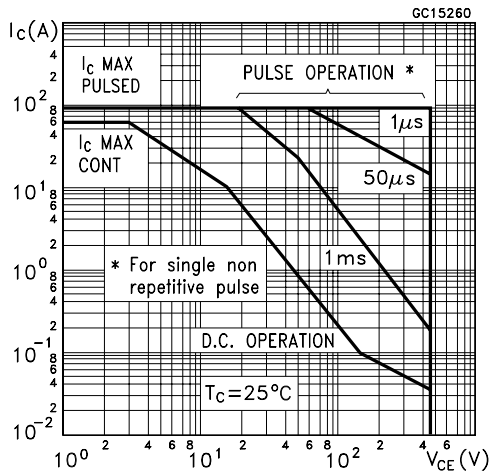
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

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

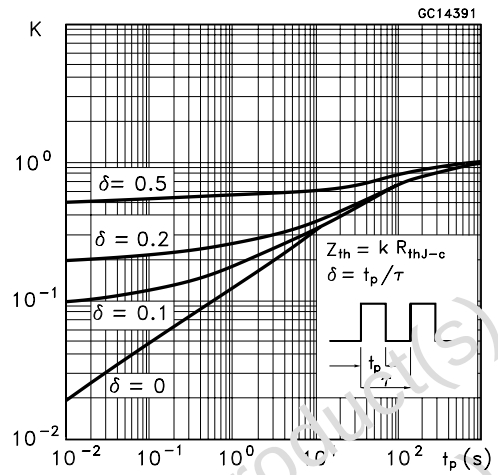
$$V_F = 1.5 + 0.001 I_F \quad P = 1.5 I_{F(AV)} + 0.001 I_{F(RMS)}^2$$

See test circuits in databook introduction

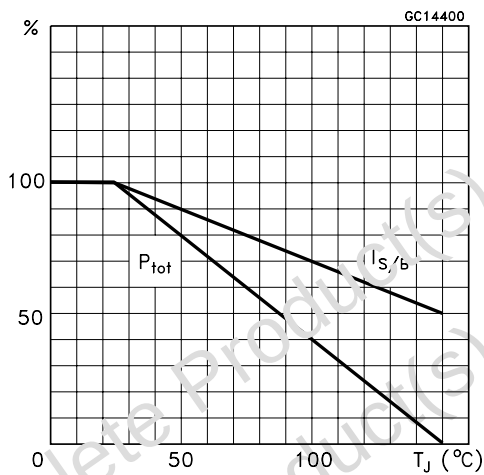
Safe Operating Areas



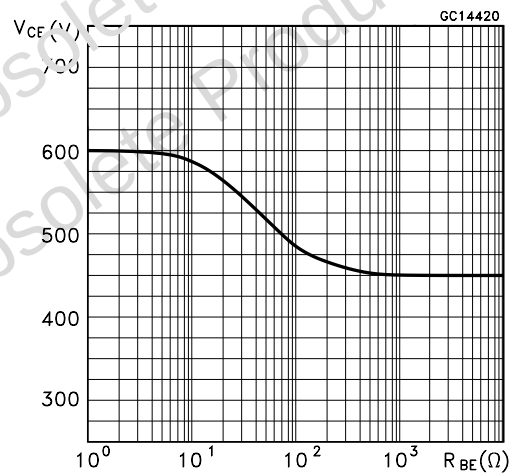
Thermal Impedance



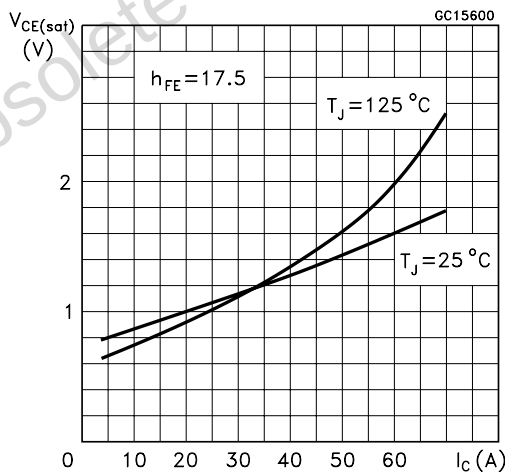
Derating Curve



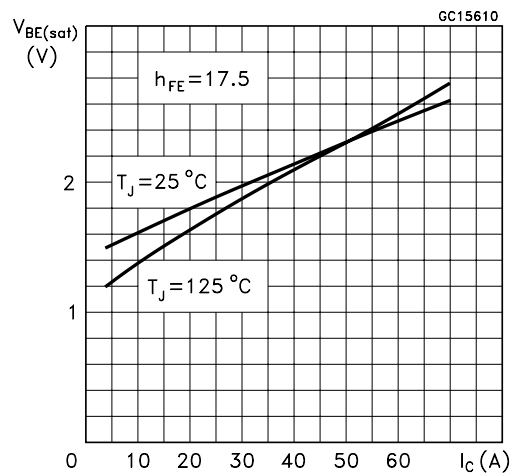
Collector-emitter Voltage Versus base-emitter Resistance



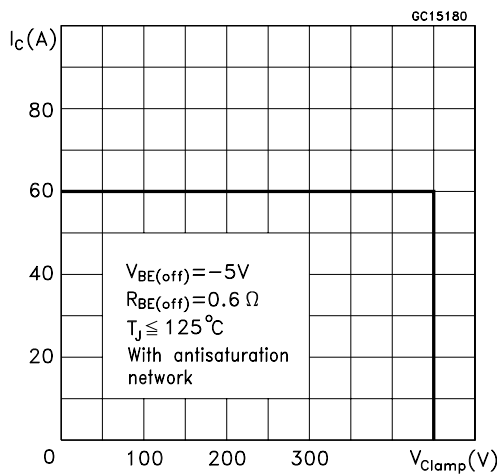
Collector Emitter Saturation Voltage



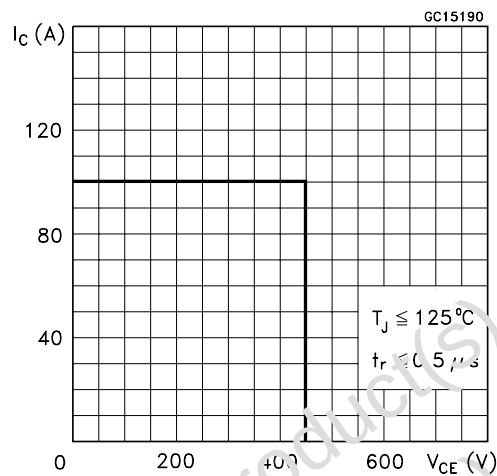
Base-Emitter Saturation Voltage



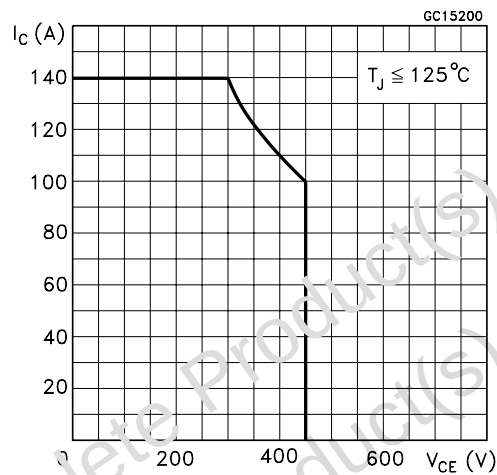
Reverse Biased SOA



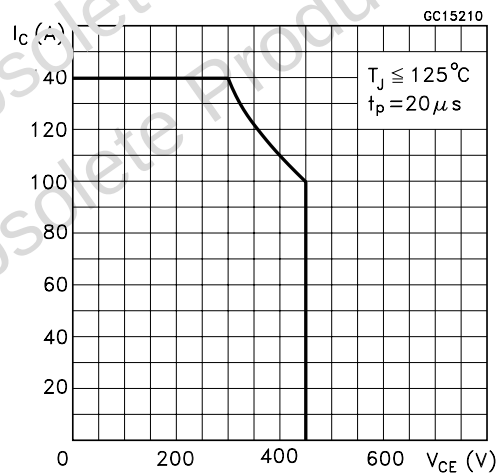
Foward Biased SOA



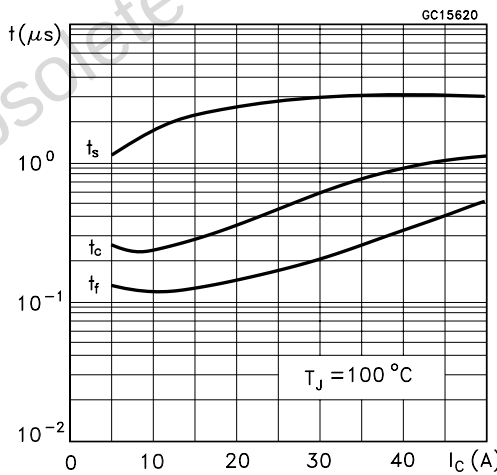
Reverse Biased AOA



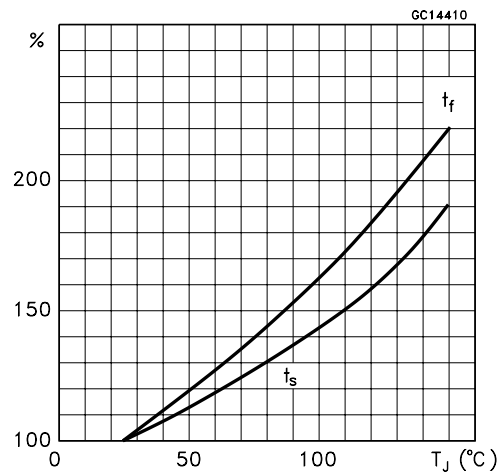
Forward Biased AOA



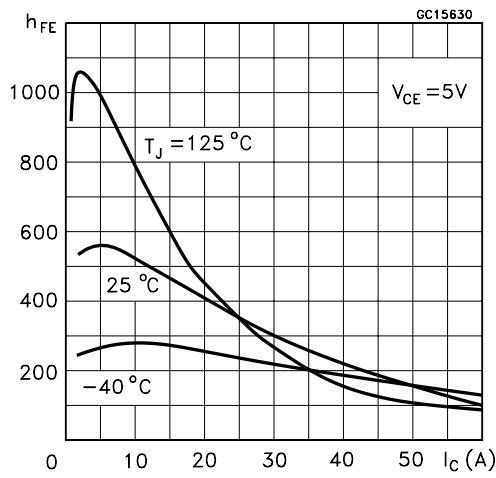
Switching Times Inductive Load



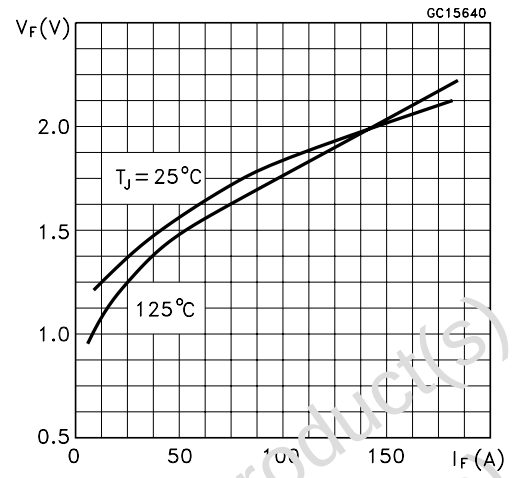
Switching Times Inductive Load Versus Temperature



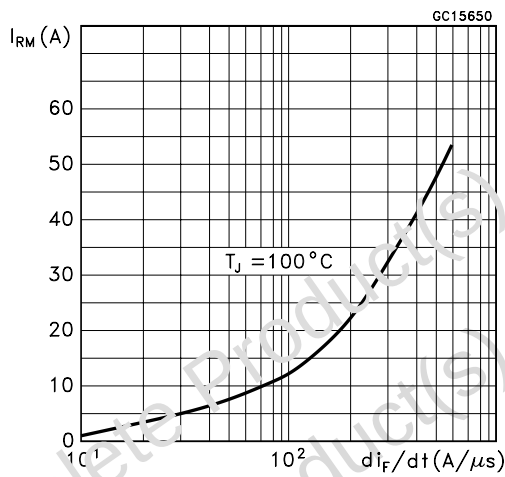
Dc Current Gain



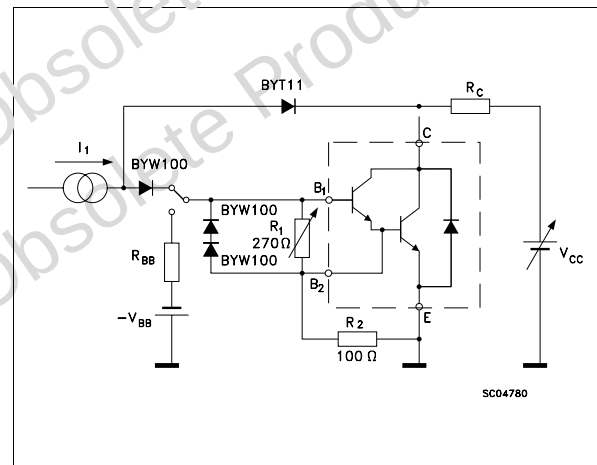
Typical V_F Versus I_F



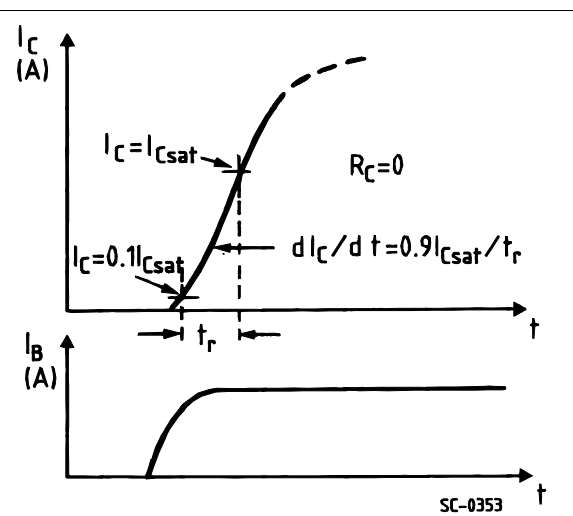
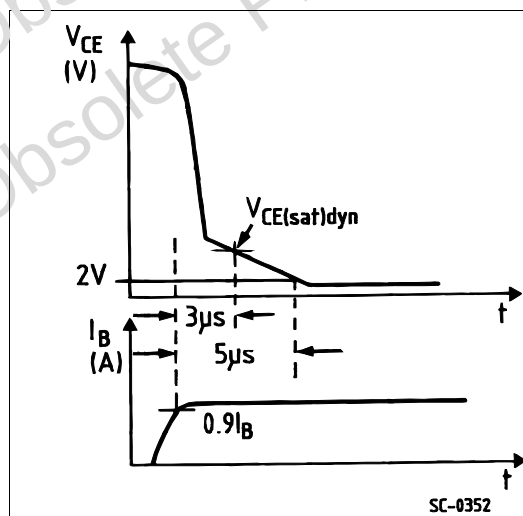
Peak Reverse Current Versus di_F/dt



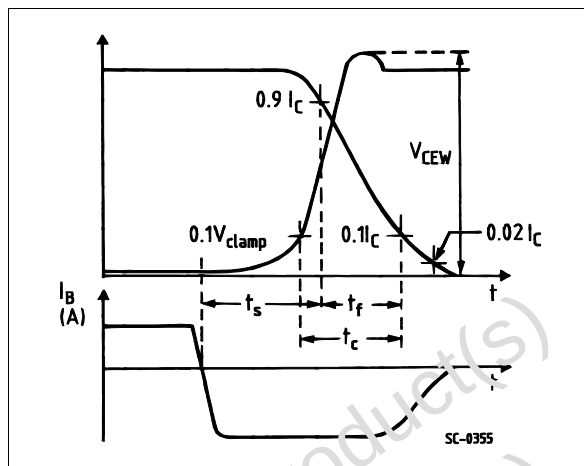
Turn-on Switching Test Circuit



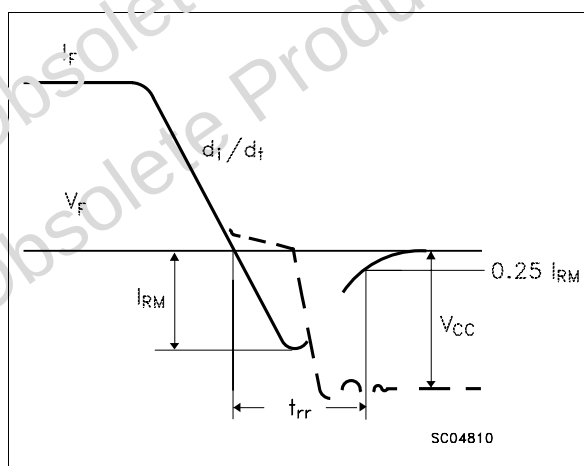
Turn-on Switching Waveforms



Turn-off Switching Waveforms

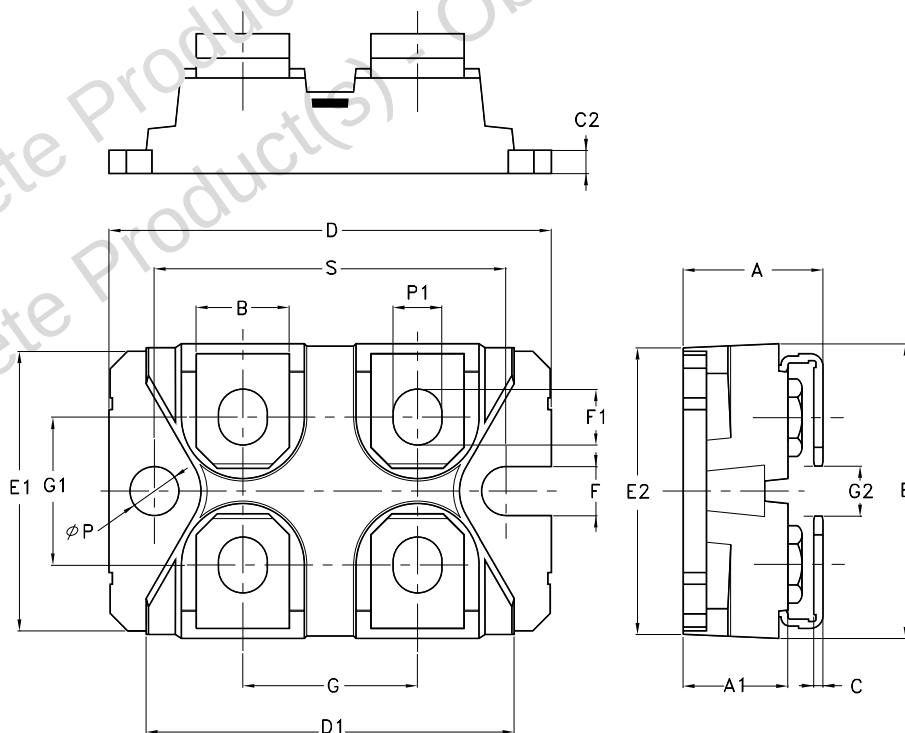


Turn-off Switching Waveform of Diode



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



P093A

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