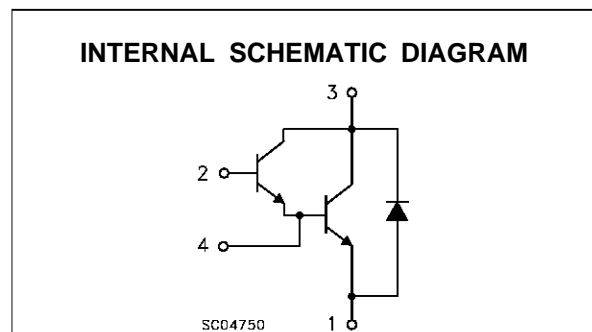
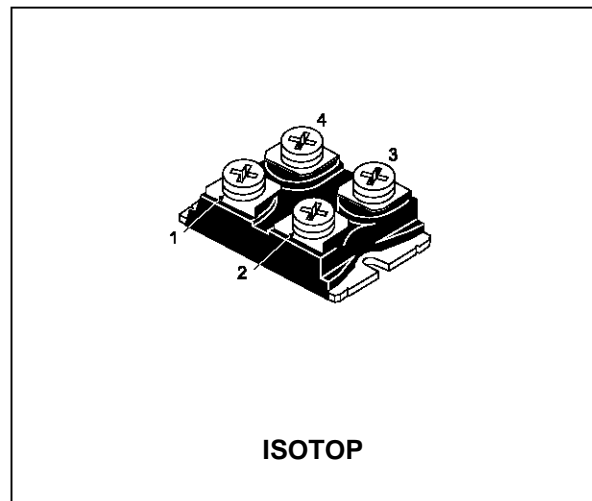


## NPN DARLINGTON POWER MODULE

- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW  $R_{th}$  JUNCTION CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ULTRAFAST FREEWHEELING DIODE
- ISOLATED CASE (2500V RMS)
- 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
$T_{stg}$	Storage Temperature	-55 to 150	°C
$T_j$	Max. Operating Junction Temperature	150	°C
$V_{ISO}$	Insulation Withstand Voltage (AC-RMS)	2500	°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 ( $R_{BE} = 5\ \Omega$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$			1.5 22	$\text{mA}$ $\text{mA}$
$I_{CEV}$ #	Collector Cut-off Current ( $V_{BE} = -5$ )	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100^{\circ}\text{C}$			1 15	$\text{mA}$ $\text{mA}$
$I_{EBO}$ #	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 5\ \text{V}$			1	$\text{mA}$
$V_{CEO(SUS)}^*$	Collector-Emitter Sustaining Voltage	$I_C = 0.2\ \text{A}$ $L = 25\ \text{mH}$ $V_{clamp} = 450\ \text{V}$	450			$\text{V}$
$h_{FE}^*$	DC Current Gain	$I_C = 70\ \text{A}$ $V_{CE} = 5\ \text{V}$		120		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 50\ \text{A}$ $I_B = 1\ \text{A}$ $I_C = 50\ \text{A}$ $I_B = 1\ \text{A}$ $T_j = 100^{\circ}\text{C}$ $I_C = 70\ \text{A}$ $I_B = 4\ \text{A}$ $I_C = 70\ \text{A}$ $I_B = 4\ \text{A}$ $T_j = 100^{\circ}\text{C}$		1.2 1.6 1.35 1.7	2 2	$\text{V}$ $\text{V}$ $\text{V}$ $\text{V}$
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 70\ \text{A}$ $I_B = 4\ \text{A}$ $I_C = 70\ \text{A}$ $I_B = 4\ \text{A}$ $T_j = 100^{\circ}\text{C}$		2.3 2.4	3	$\text{V}$ $\text{V}$
$di_C/dt$	Rate of Rise of On-state Collector	$V_{CC} = 300\ \text{V}$ $R_C = 0$ $t_p = 3\ \mu\text{s}$ $I_{B1} = 1.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$	375	450		$\text{A}/\mu\text{s}$
$V_{CE(3\ \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\ \text{V}$ $R_C = 6\ \Omega$ $I_{B1} = 1.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$		6	9	$\text{V}$
$V_{CE(5\ \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\ \text{V}$ $R_C = 6\ \Omega$ $I_{B1} = 1.5\ \text{A}$ $T_j = 100^{\circ}\text{C}$		3	4.5	$\text{V}$
$t_s$	Storage Time	$I_C = 50\ \text{A}$ $V_{CC} = 50\ \text{V}$		3.5	5.5	$\mu\text{s}$
$t_f$	Fall Time	$V_{BB} = -5\ \text{V}$ $R_{BB} = 0.3\ \Omega$		0.3	0.5	$\mu\text{s}$
$t_c$	Cross-over Time	$V_{clamp} = 450\ \text{V}$ $I_{B1} = 1\ \text{A}$ $L = 0.05\ \text{mH}$ $T_j = 100^{\circ}\text{C}$		0.8	1.7	$\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 84\ \text{A}$ $I_{B1} = 4\ \text{A}$ $V_{BB} = -5\ \text{V}$ $V_{CC} = 50\ \text{V}$ $L = 0.03\ \text{mH}$ $R_{BB} = 0.3\ \Omega$ $T_j = 125^{\circ}\text{C}$	450			$\text{V}$
$V_F^*$	Diode Forward Voltage	$I_F = 70\ \text{A}$ $T_j = 100^{\circ}\text{C}$		1.6	1.9	$\text{V}$
$I_{RM}$	Reverse Recovery Current	$V_{CC} = 200\ \text{V}$ $I_F = 70\ \text{A}$ $di_F/dt = -375\ \text{A}/\mu\text{s}$ $L < 0.05\ \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		38	45	$\text{A}$

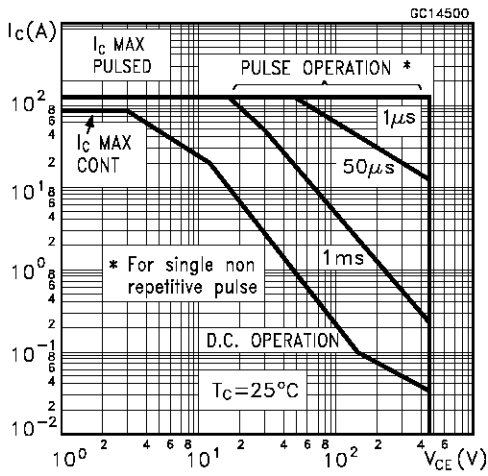
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

# See test circuits in databook introduction

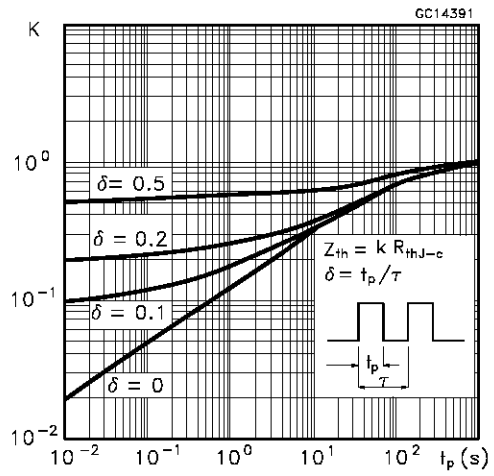
To evaluate the conduction losses of the diode use the following equations:

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

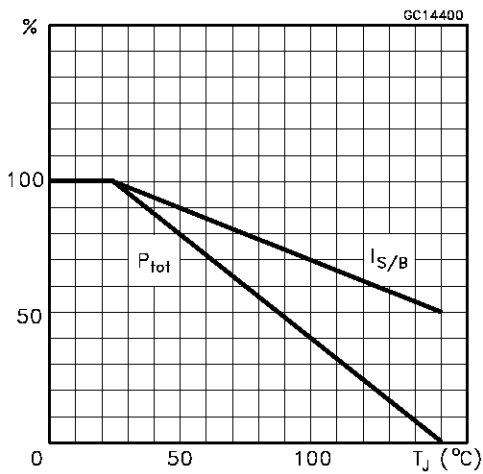
Safe Operating Areas



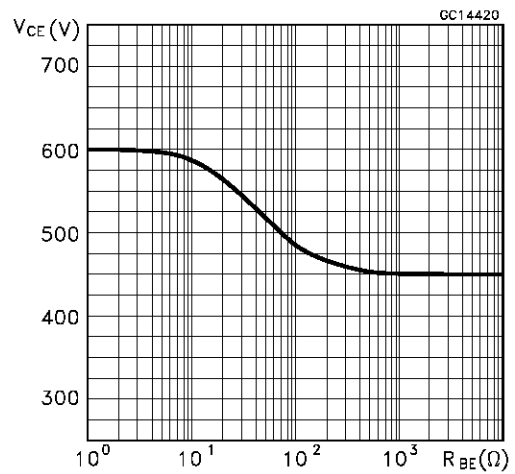
Thermal Impedance



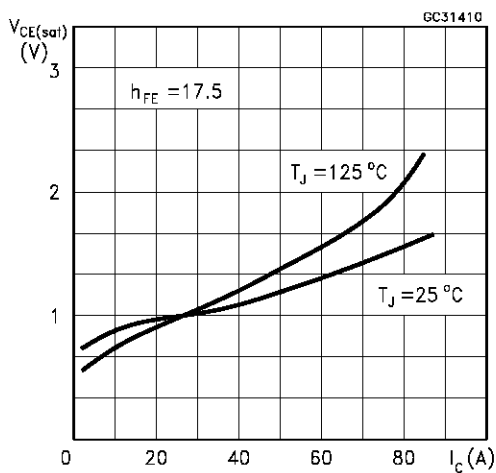
Derating Curve



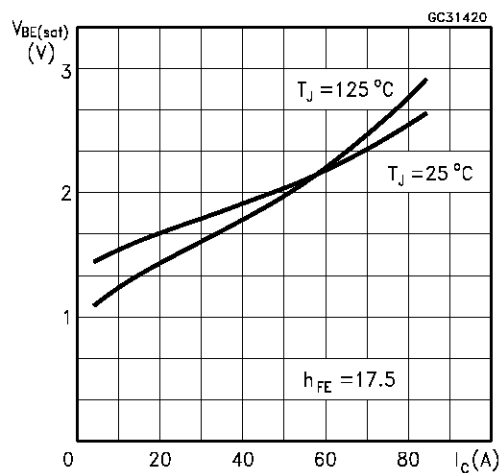
Collector-emitter Voltage Versus base-emitter Resistance



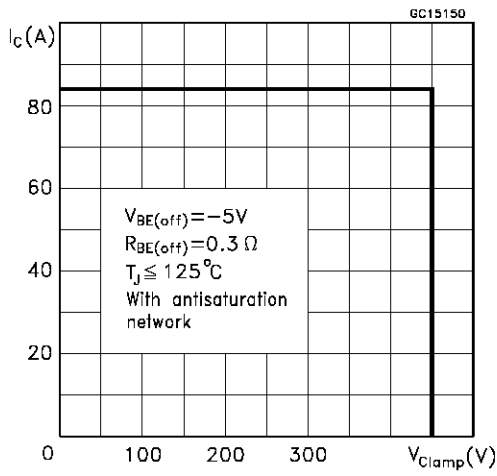
Collector Emitter Saturation Voltage



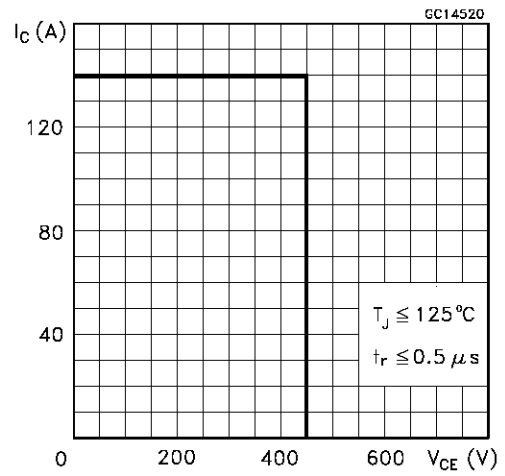
Base-Emitter Saturation Voltage



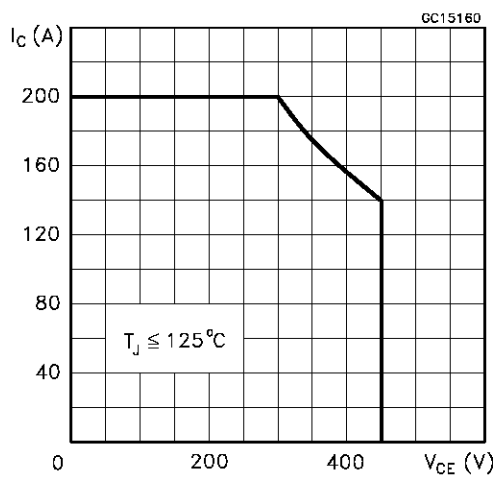
Reverse Biased SOA



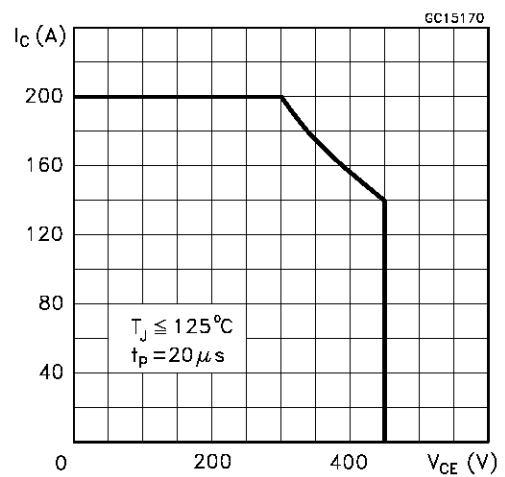
Forward Biased SOA



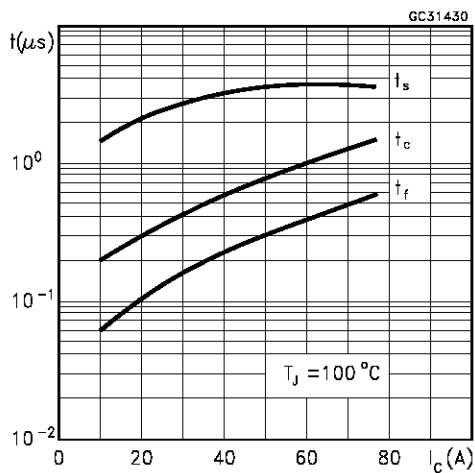
Reverse Biased AOA



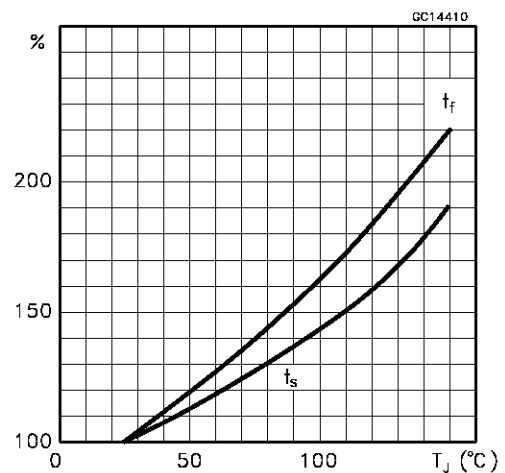
Forward Biased AOA



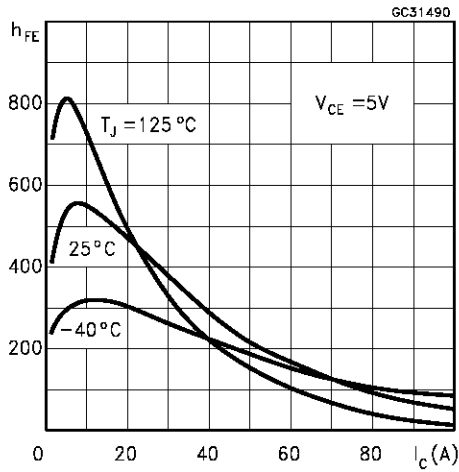
Switching Times Inductive Load



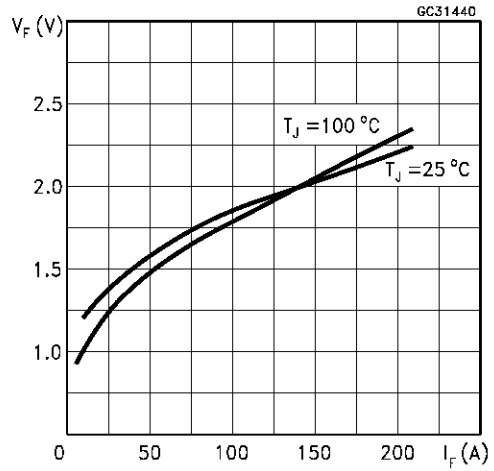
Switching Times Inductive Load Versus Temperature



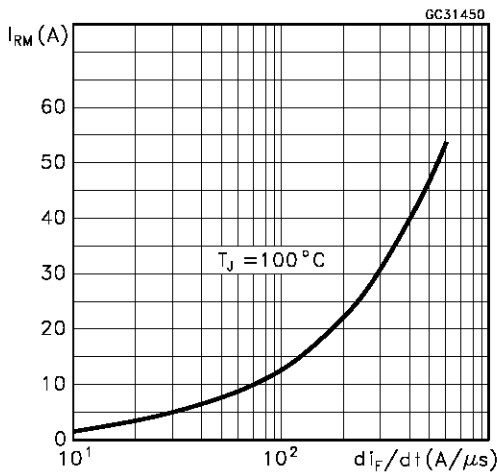
Dc Current Gain



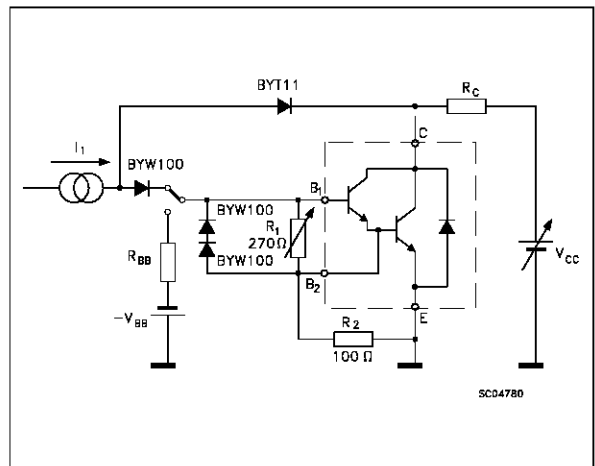
Typical  $V_F$  Versus  $I_F$



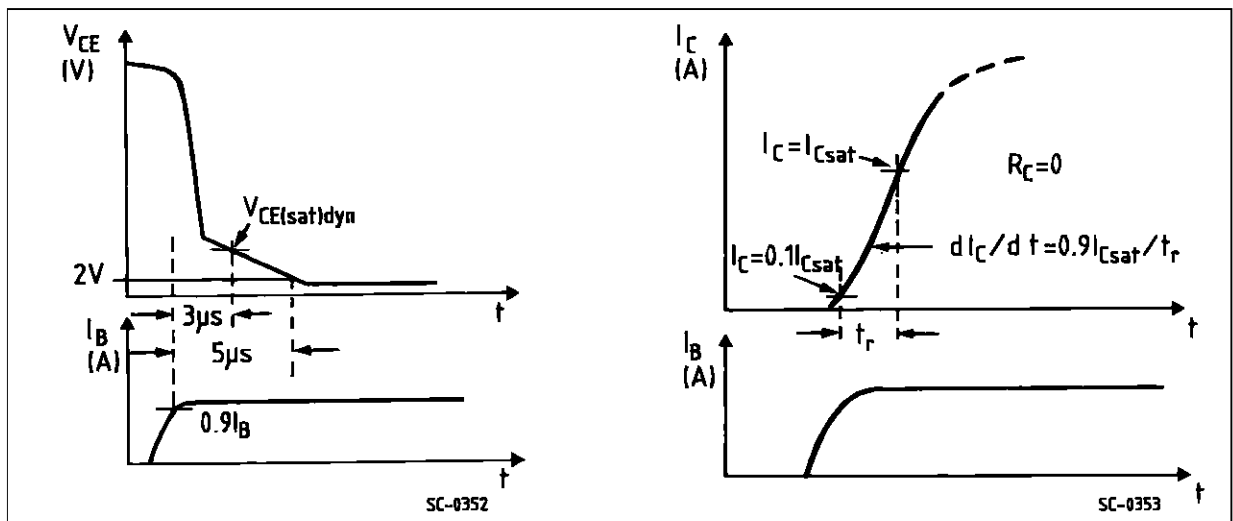
Peak Reverse Current Versus  $di_F/dt$



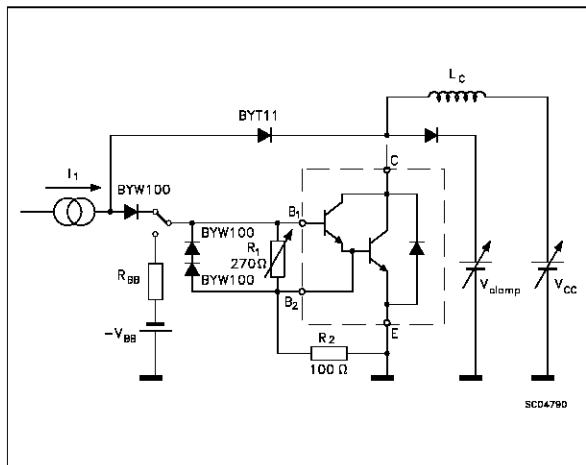
Turn-on Switching Test Circuit



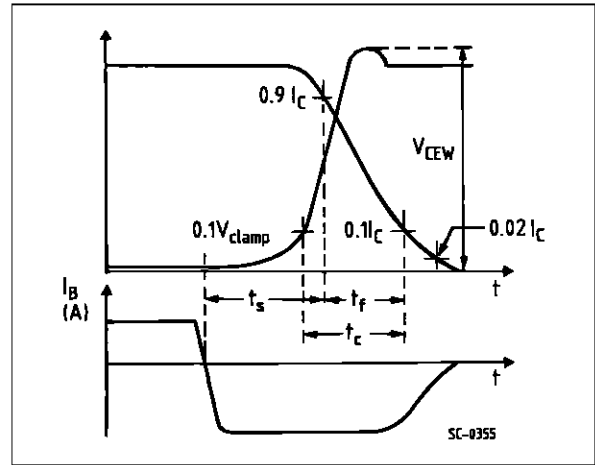
Turn-on Switching Waveforms



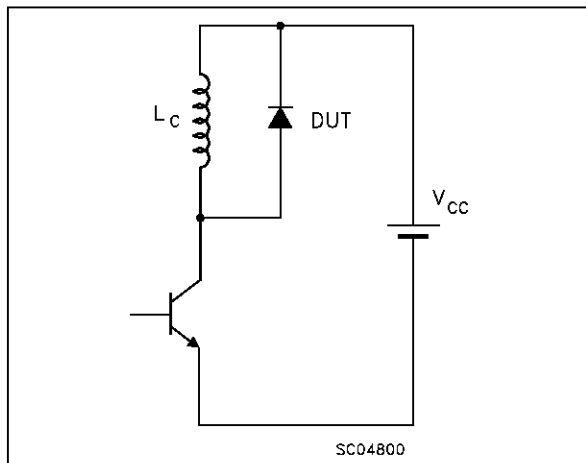
Turn-on Switching Test Circuit



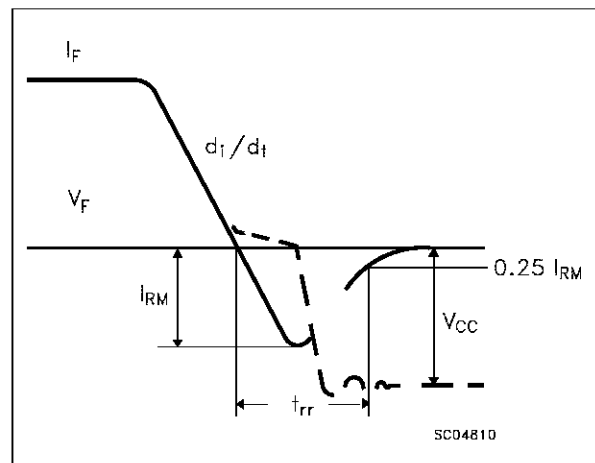
Turn-off Switching Waveforms



Turn-off Switching Test Circuit of Diode

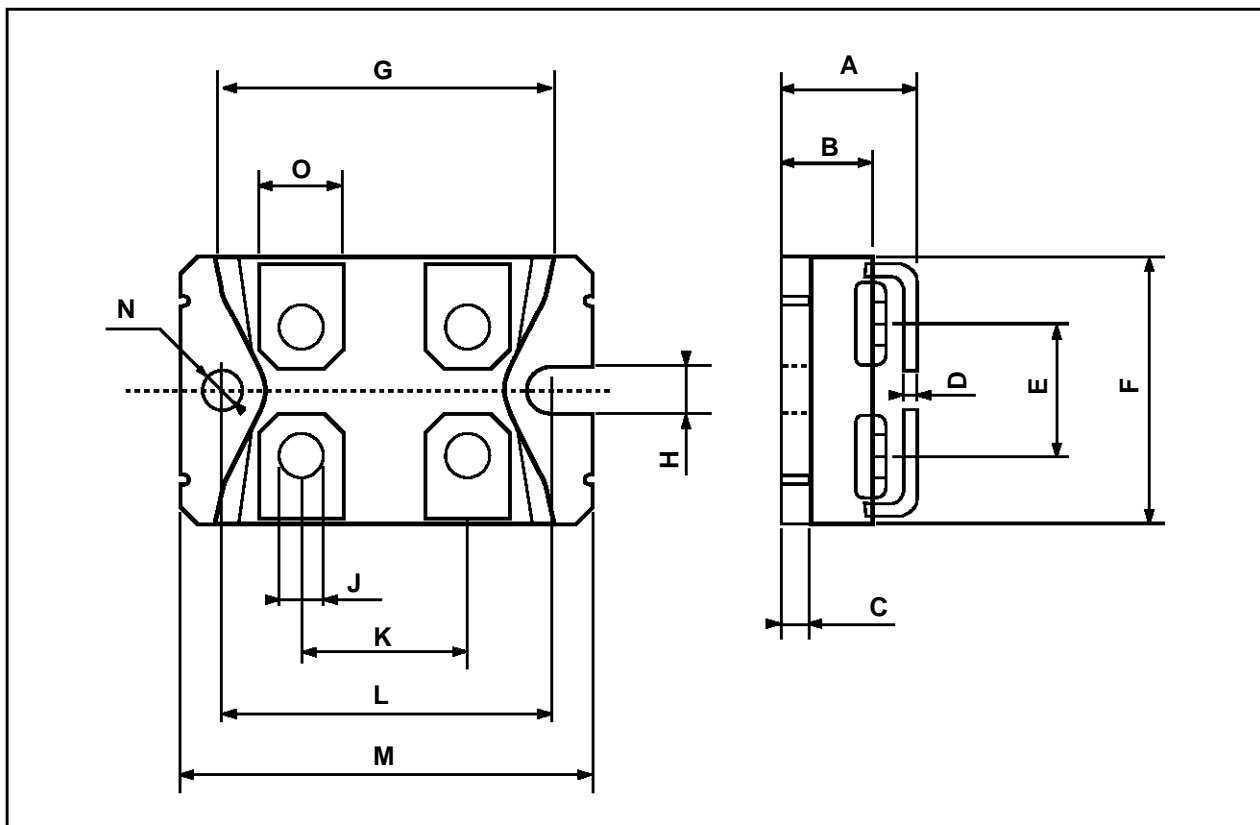


Turn-off Switching Waveform of Diode



## ISOTOP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322



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