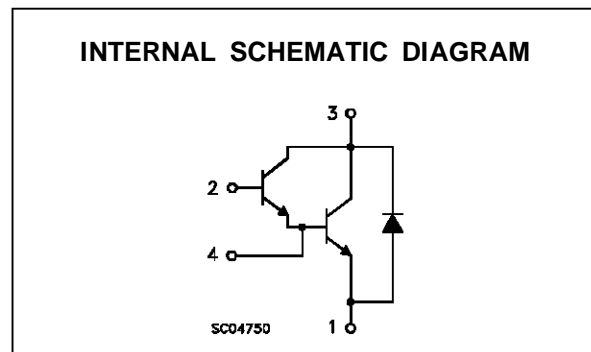
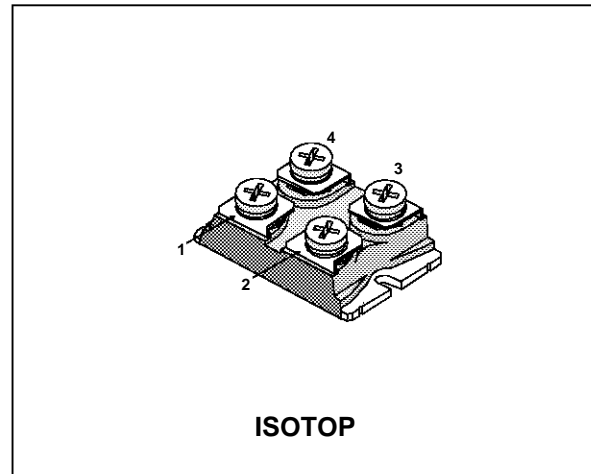


## NPN DARLINGTON POWER MODULE

- 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	24	A
$I_{CM}$	Collector Peak Current ( $t_p = 10$ ms)	36	A
$I_B$	Base Current	2.5	A
$I_{BM}$	Base Peak Current ( $t_p = 10$ ms)	5	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	125	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	V

## ESM3045DV

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	1	$^{\circ}\text{C}/\text{W}$
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	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 17	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 12	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	$I_C = 0.2 \text{ A} \quad L = 25 \text{ mH}$ $V_{clamp} = 450 \text{ V}$	450			V
$h_{FE}^*$	DC Current Gain	$I_C = 20 \text{ A} \quad V_{CE} = 5 \text{ V}$		120		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 15 \text{ A} \quad I_B = 0.3 \text{ A}$ $I_C = 15 \text{ A} \quad I_B = 0.3 \text{ A} \quad T_j = 100^{\circ}\text{C}$ $I_C = 20 \text{ A} \quad I_B = 1.2 \text{ A}$ $I_C = 20 \text{ A} \quad I_B = 1.2 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.2 1.3 1.4 1.6	2 2	V V V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 20 \text{ A} \quad I_B = 1.2 \text{ A}$ $I_C = 20 \text{ A} \quad I_B = 1.2 \text{ A} \quad T_j = 100^{\circ}\text{C}$		2.1 2.1	3	V V
$di_C/dt$	Rate of Rise of On-state Collector	$V_{CC} = 300 \text{ V} \quad R_C = 0 \quad t_p = 3 \mu\text{s}$ $I_{B1} = 0.45 \text{ A} \quad T_j = 100^{\circ}\text{C}$	125	160		A/ $\mu\text{s}$
$V_{CE(3 \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 20 \Omega$ $I_{B1} = 0.45 \text{ A} \quad T_j = 100^{\circ}\text{C}$		4.5	8	V
$V_{CE(5 \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300 \text{ V} \quad R_C = 20 \Omega$ $I_{B1} = 0.45 \text{ A} \quad T_j = 100^{\circ}\text{C}$		2.5	4.5	V
$t_s$ $t_f$ $t_c$	Storage Time Fall Time Cross-over Time	$I_C = 15 \text{ A} \quad V_{CC} = 50 \text{ V}$ $V_{BB} = -5 \text{ V} \quad R_{BB} = 0.6 \Omega$ $V_{clamp} = 450 \text{ V} \quad I_{B1} = 0.3 \text{ A}$ $L = 0.17 \text{ mH} \quad T_j = 100^{\circ}\text{C}$		2.1 0.15 0.5	4 0.4 1.2	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 24 \text{ A} \quad I_{B1} = 1.2 \text{ A}$ $V_{BB} = -5 \text{ V} \quad V_{CC} = 50 \text{ V}$ $L = 0.1 \text{ mH} \quad R_{BB} = 0.6 \Omega$ $T_j = 125^{\circ}\text{C}$	450			V
$V_F^*$	Diode Forward Voltage	$I_F = 20 \text{ A} \quad T_j = 100^{\circ}\text{C}$		1.7	2	V
$I_{RM}$	Reverse Recovery Current	$V_{CC} = 200 \text{ V} \quad I_F = 20 \text{ A}$ $di_F/dt = -125 \text{ A}/\mu\text{s} \quad L < 0.05 \mu\text{H}$ $T_j = 100^{\circ}\text{C}$		11	14	A

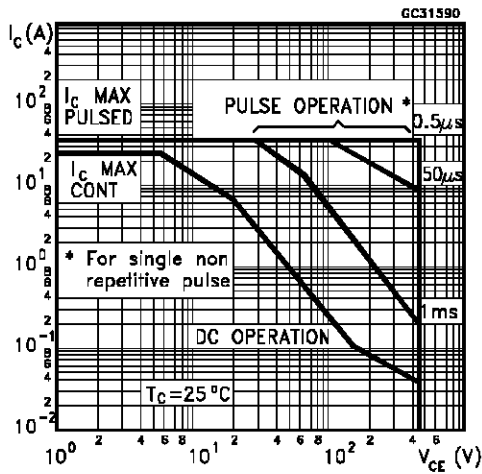
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

# See test circuits in databook introduction

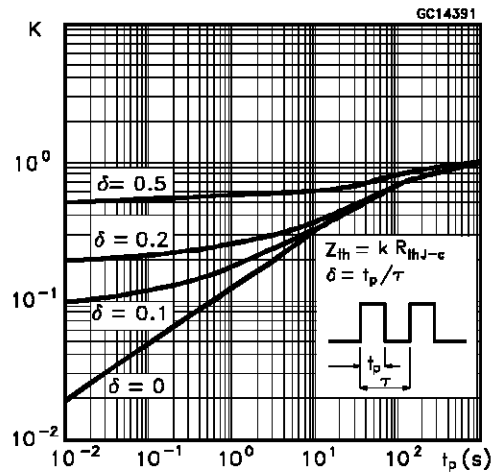
To evaluate the conduction losses of the diode use the following equations:

$$V_F = 1.47 + 0.0026 I_F \quad P = 1.47 I_{F(AV)} + 0.0026 I_{F(RMS)}^2$$

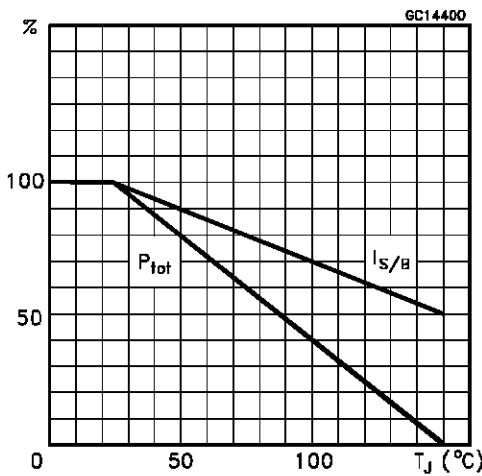
Safe Operating Areas



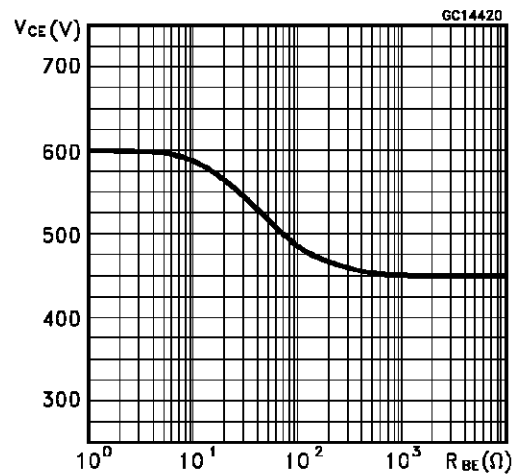
Thermal Impedance



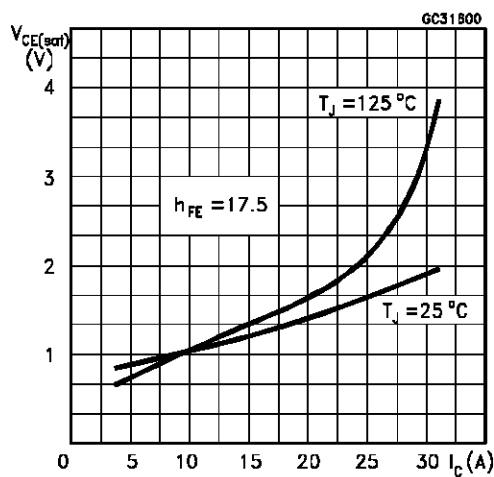
Derating Curve



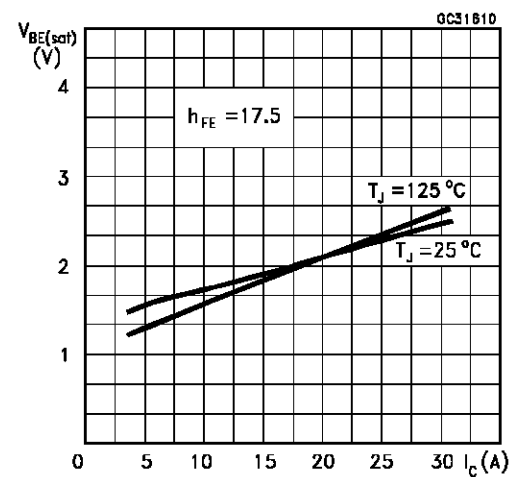
Collector-Emitter Voltage Versus Base-Emitter Resistance



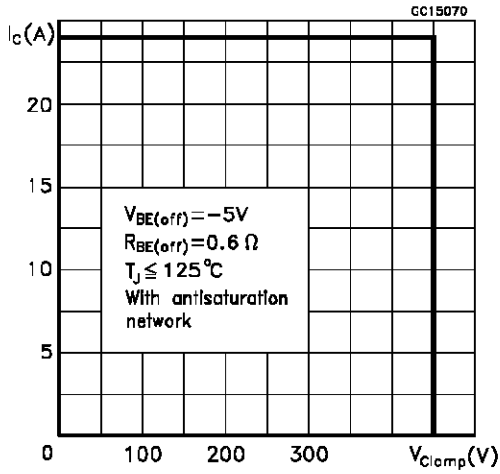
Collector-Emitter Saturation Voltage



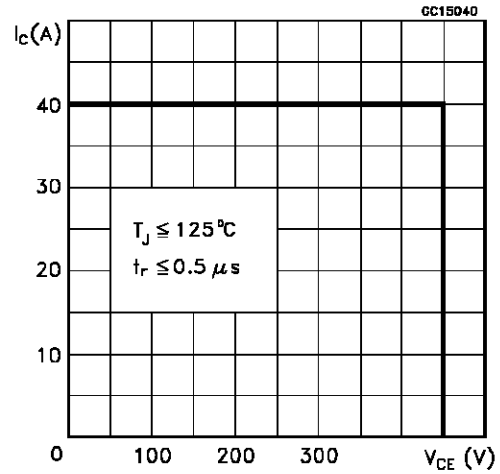
Base-Emitter Saturation Voltage



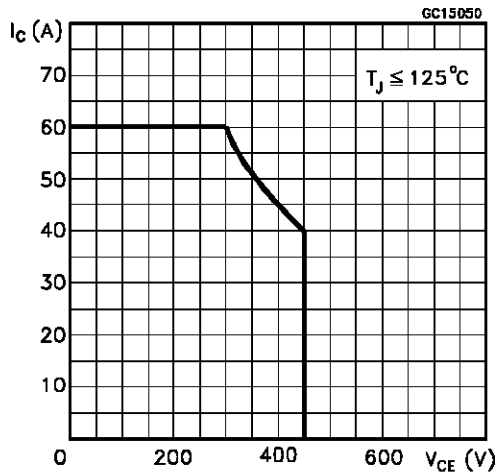
Reverse Biased SOA



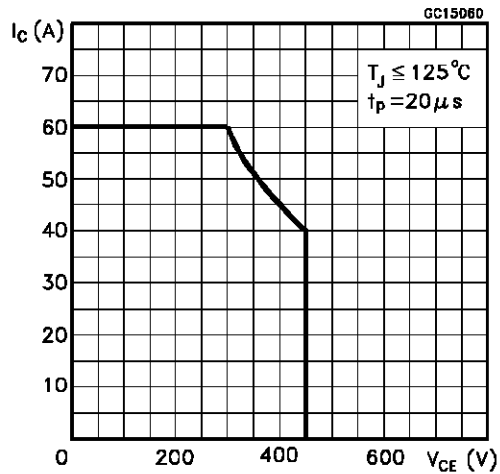
Forward Biased SOA



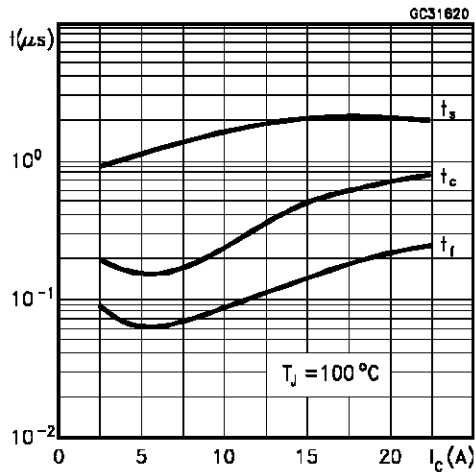
Reverse Biased AOA



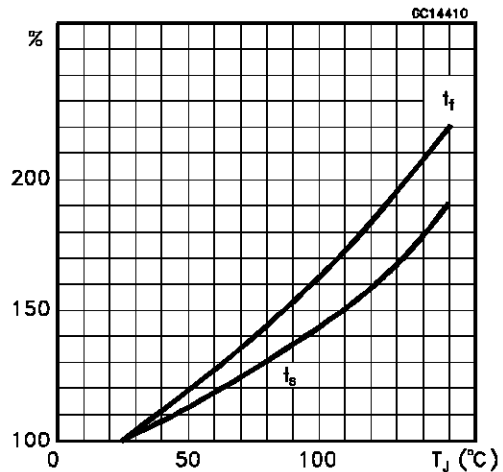
Forward Biased AOA



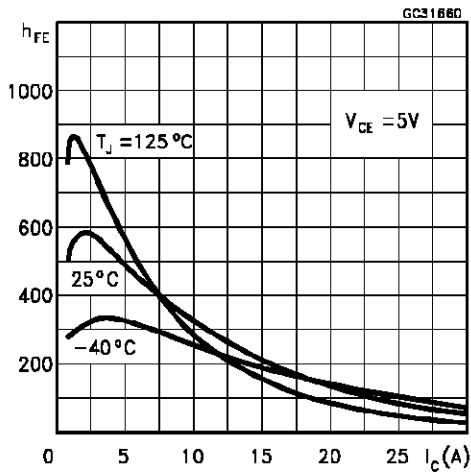
Switching Times Inductive Load



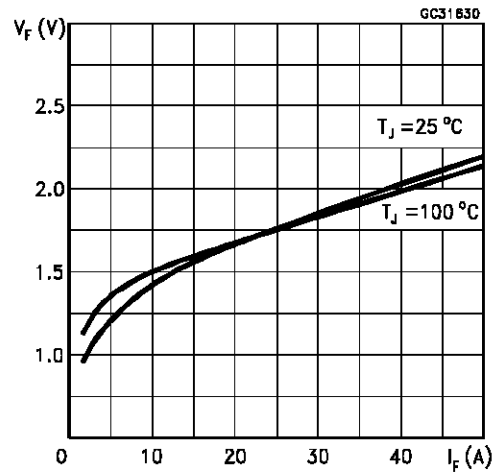
Switching Times Inductive Load Versus Temperature



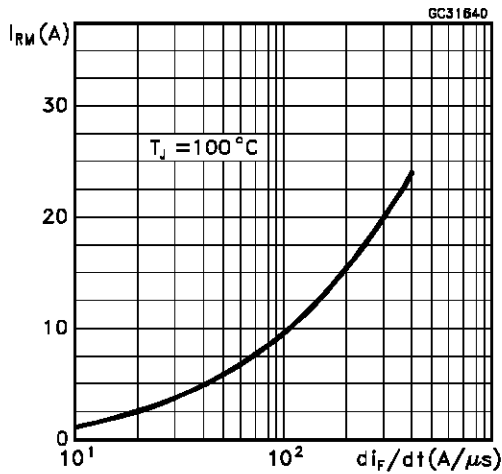
DC Current Gain



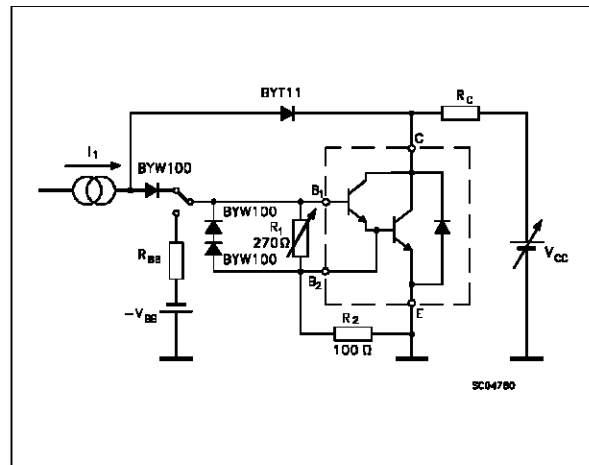
Typical  $V_F$  Versus  $I_F$



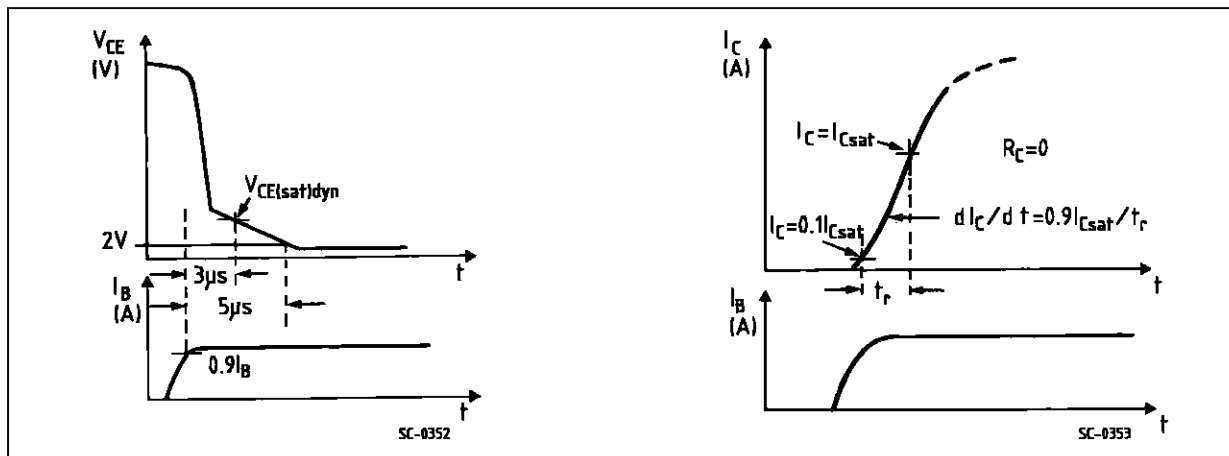
Peak Reverse Current Versus  $di_F/dt$



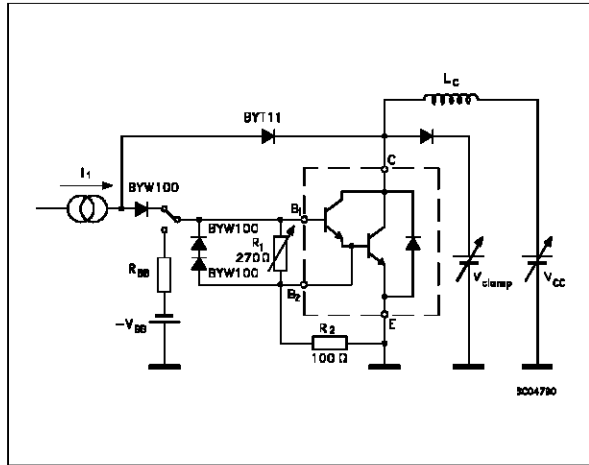
Turn-on Switching Test Circuit



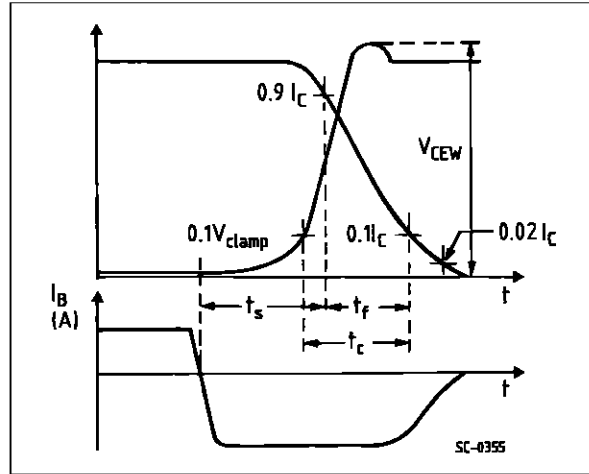
Turn-on Switching Waveforms



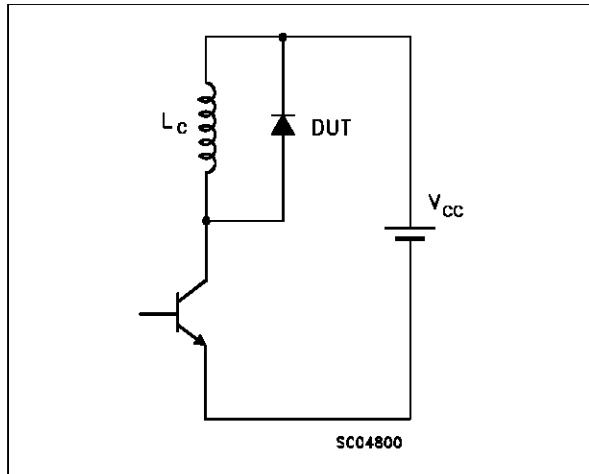
Turn-off Switching Test Circuit



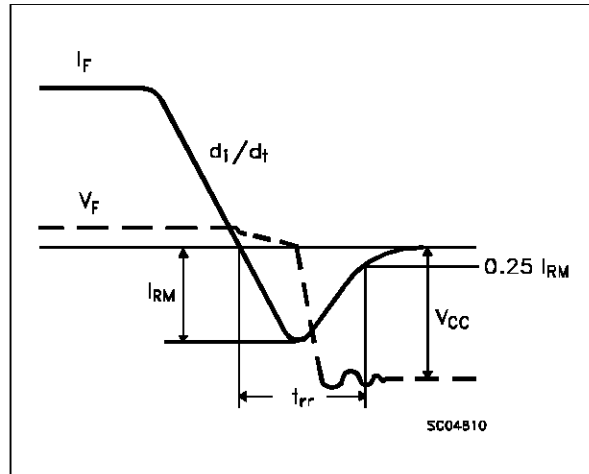
Turn-off Switching Waveforms



Turn-off Switching Test Circuits of Diode

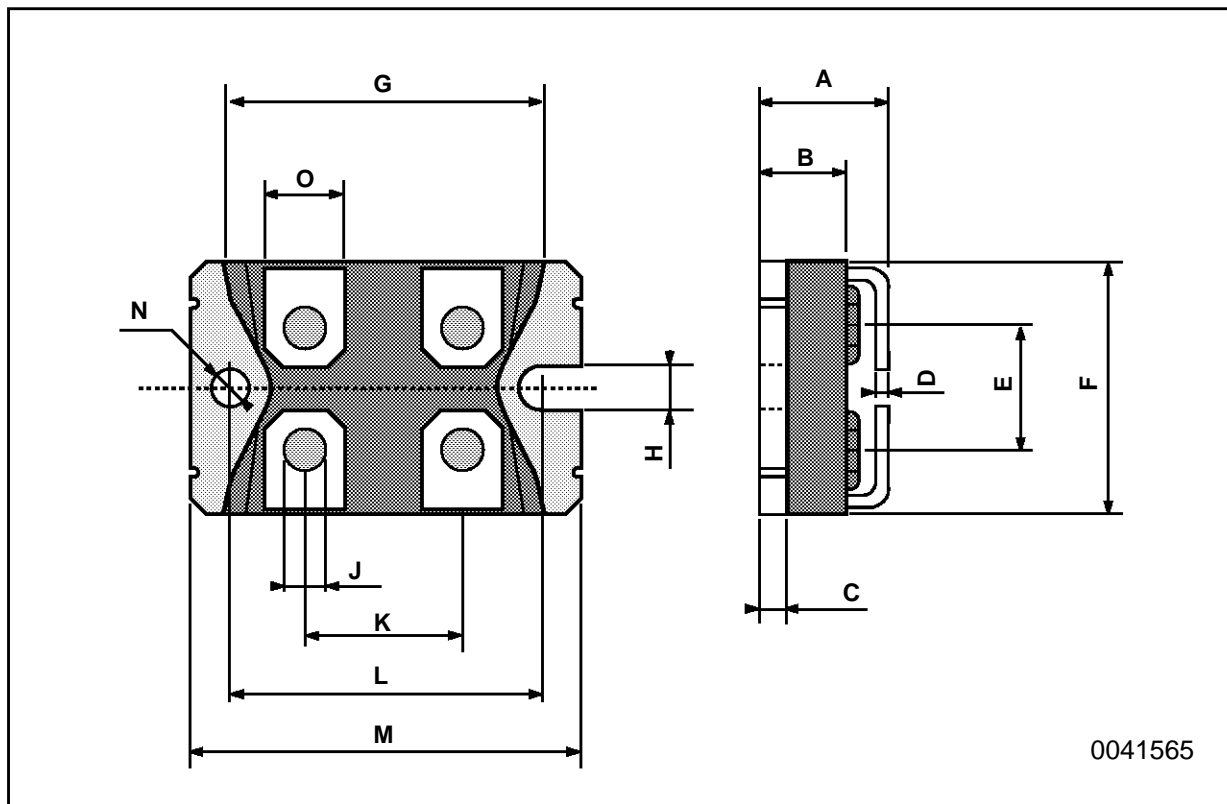


Turn-off Switching Waveform of Diode



**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
P	5.5			0.216		



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