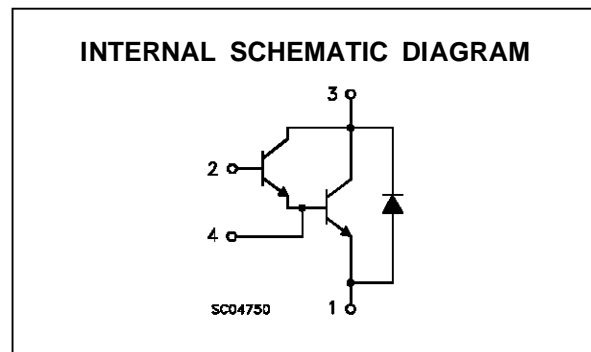
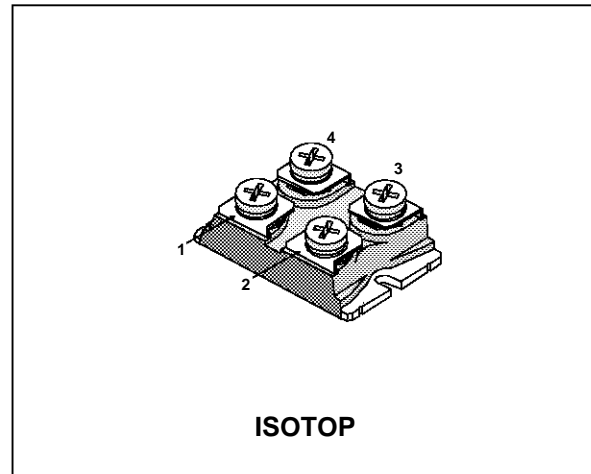


NPN DARLINGTON POWER MODULE

- 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
- 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	60	A
I_{CM}	Collector Peak Current ($t_p = 10$ ms)	90	A
I_B	Base Current	6	A
I_{BM}	Base Peak Current ($t_p = 10$ ms)	12	A
P_{tot}	Total Dissipation at $T_C = 25$ °C	175	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

ESM5045DV

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (transistor)	Max	0.71	°C/W
$R_{thj-case}$	Thermal Resistance Junction-case (diode)	Max	1.2	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CEr\#}$	Collector Cut-off Current ($R_{BE} = 5\ \Omega$)	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$			1.5 20	mA mA
$I_{CEV\#}$	Collector Cut-off Current ($V_{BE} = -5$)	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$			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	$I_C = 0.2\text{ A}$ $L = 25\text{ mH}$ $V_{clamp} = 450\text{ V}$	450			V
h_{FE*}	DC Current Gain	$I_C = 50\text{ A}$ $V_{CE} = 5\text{ V}$		150		
$V_{CE(sat)*}$	Collector-Emitter Saturation Voltage	$I_C = 35\text{ A}$ $I_B = 0.7\text{ A}$ $I_C = 35\text{ A}$ $I_B = 0.7\text{ A}$ $T_j = 100\text{ °C}$ $I_C = 50\text{ A}$ $I_B = 2.8\text{ A}$ $I_C = 50\text{ A}$ $I_B = 2.8\text{ A}$ $T_j = 100\text{ °C}$		1.2 1.4 1.4 1.6	2 2	V V V V
$V_{BE(sat)*}$	Base-Emitter Saturation Voltage	$I_C = 50\text{ A}$ $I_B = 2.8\text{ A}$ $I_C = 50\text{ A}$ $I_B = 2.8\text{ A}$ $T_j = 100\text{ °C}$		2.3 2.3	3	V V
di_C/dt	Rate of Rise of On-state Collector	$V_{CC} = 300\text{ V}$ $R_C = 0$ $t_p = 3\ \mu s$ $I_{B1} = 1.05\text{ A}$ $T_j = 100\text{ °C}$	300	400		A/ μs
$V_{CE(3\ \mu s)}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 8.5\ \Omega$ $I_{B1} = 1.05\text{ A}$ $T_j = 100\text{ °C}$		4.5	8	V
$V_{CE(5\ \mu s)}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 8.5\ \Omega$ $I_{B1} = 1.05\text{ A}$ $T_j = 100\text{ °C}$		2.5	4.5	V
t_s	Storage Time	$I_C = 35\text{ A}$ $V_{CC} = 50\text{ V}$		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	$V_{clamp} = 450\text{ V}$ $I_{B1} = 0.7\text{ A}$ $L = 0.07\text{ mH}$ $T_j = 100\text{ °C}$		0.75	1.5	μs
V_{CEW}	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 60\text{ A}$ $I_{B1} = 2.8\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{CC} = 50\text{ V}$ $L = 42\ \mu H$ $R_{BB} = 0.6\ \Omega$ $T_j = 125\text{ °C}$	450			V
V_F*	Diode Forward Voltage	$I_F = 50\text{ A}$ $T_j = 100\text{ °C}$		1.5	1.8	V
I_{RM}	Reverse Recovery Current	$V_{CC} = 200\text{ V}$ $I_F = 50\text{ A}$ $di_F/dt = -300\text{ A}/\mu s$ $L < 0.05\ \mu H$ $T_j = 100\text{ °C}$		32	38	A

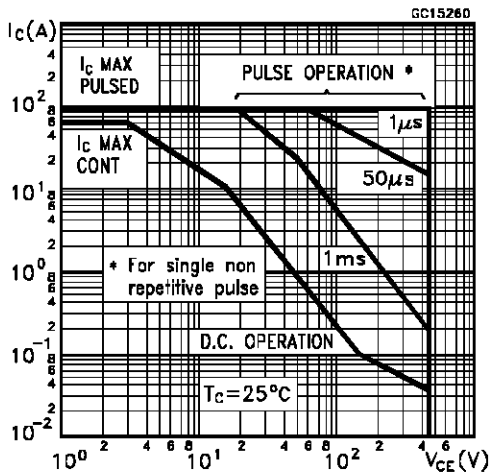
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

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

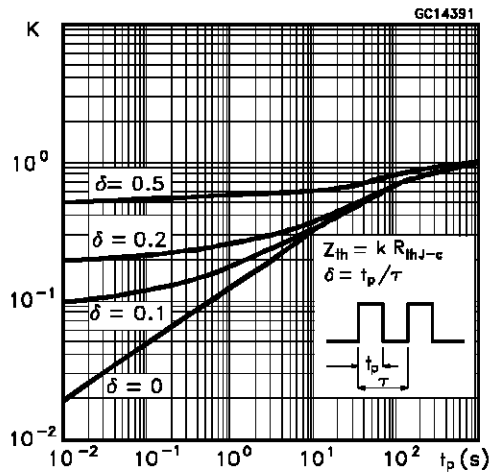
$$V_F = 1.5 + 0.0055 I_F \quad P = 1.5 I_{F(AV)} + 0.0055 I_{F(RMS)}^2$$

See test circuits in databook introduction

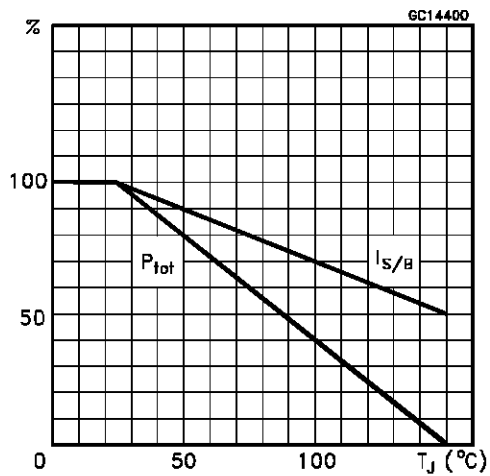
Safe Operating Areas



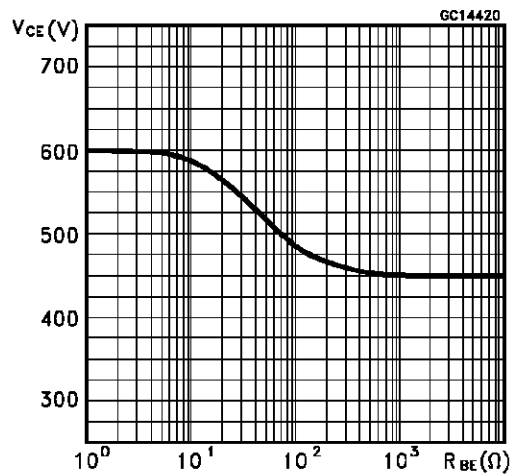
Thermal Impedance



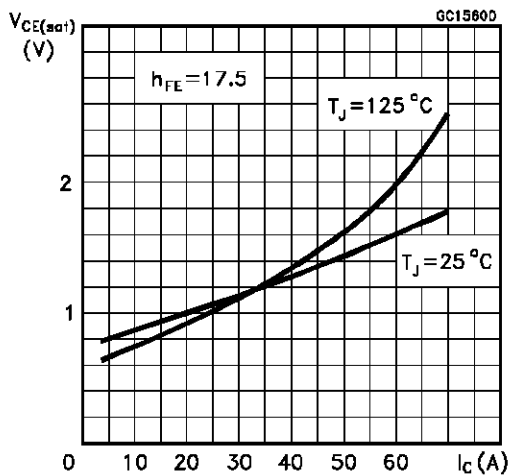
Derating Curve



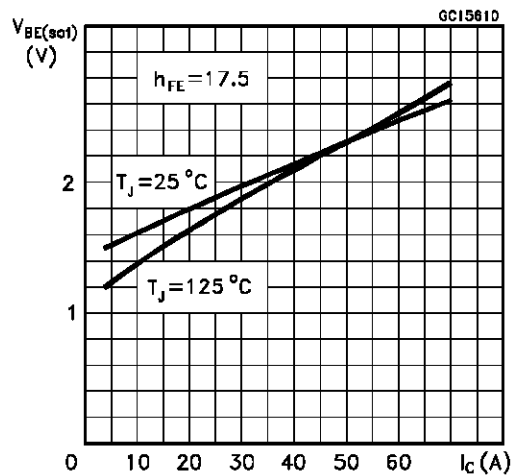
Collector-Emitter Voltage Versus Base-Emitter Resistance



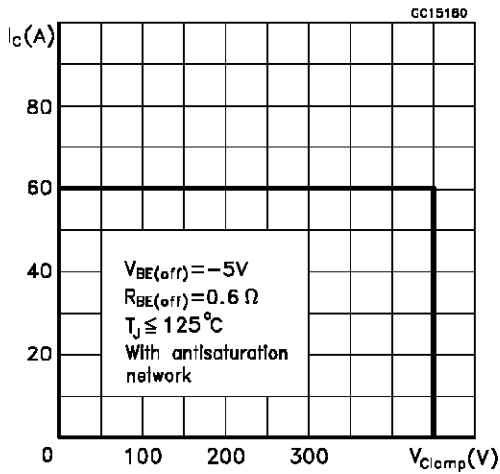
Collector-Emitter Saturation Voltage



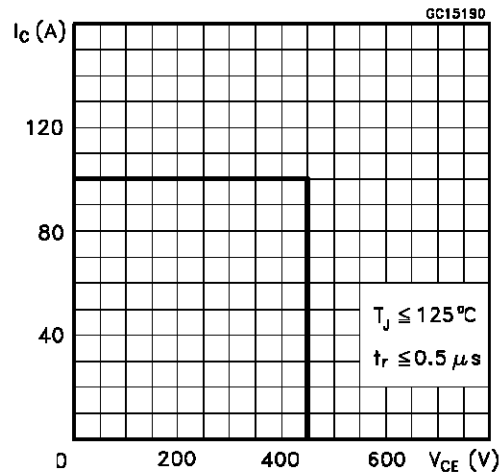
Base-Emitter Saturation Voltage



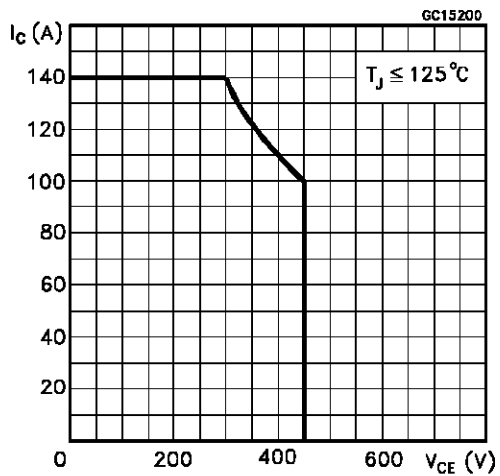
Reverse Biased SOA



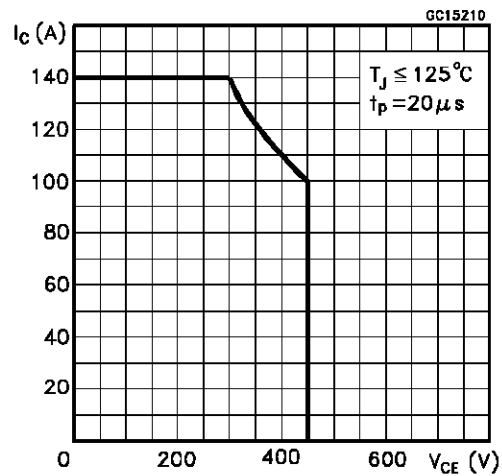
Forward Biased SOA



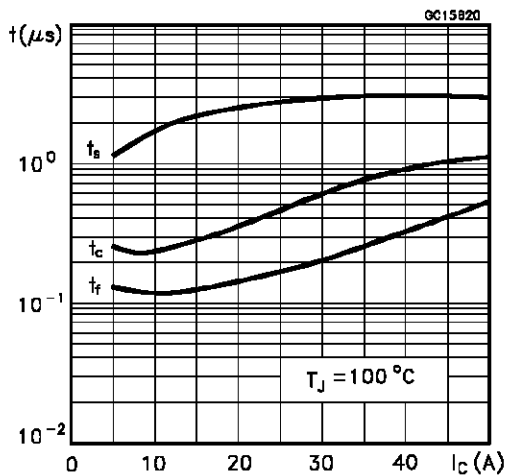
Reverse Biased AOA



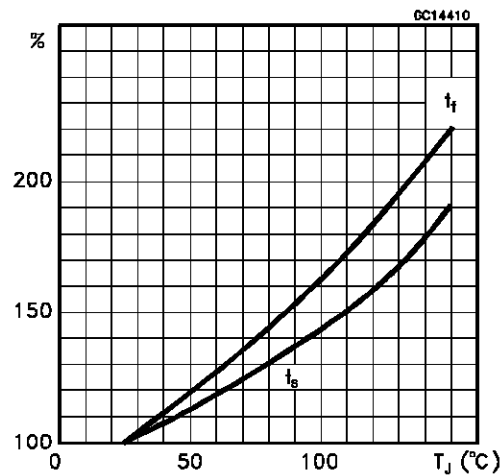
Forward Biased AOA



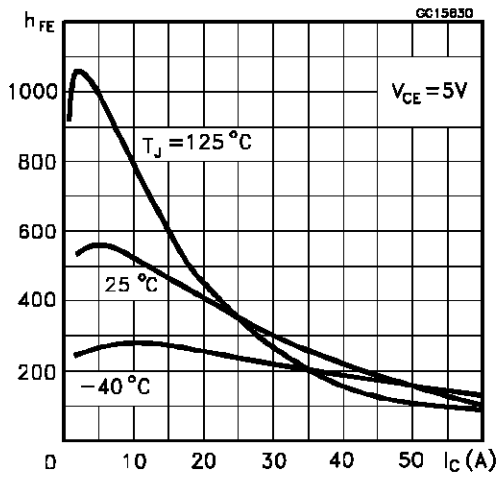
Switching Times Inductive Load



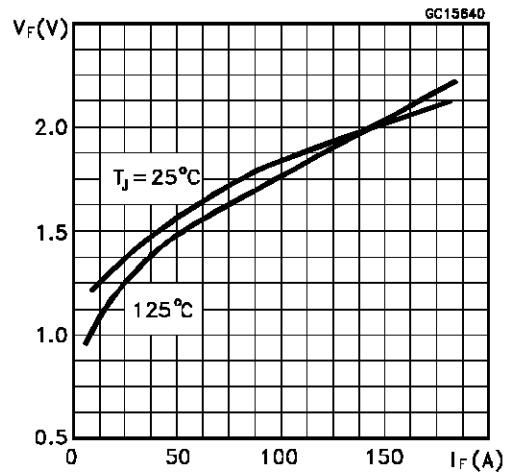
Switching Times Inductive Load Versus Temperature



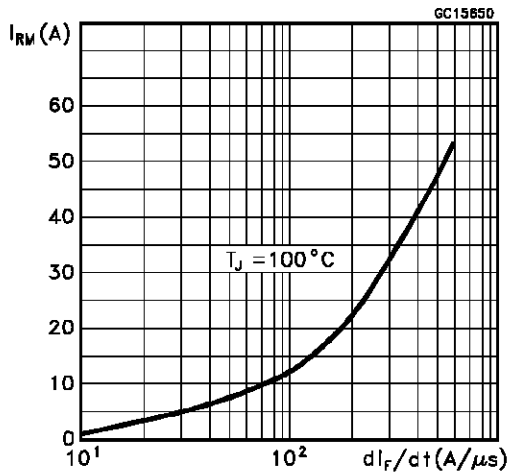
DC Current Gain



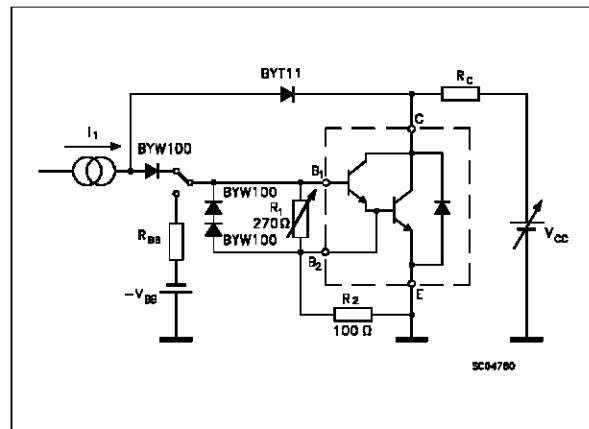
Typical V_F Versus I_F



Peak Reverse Current Versus di_F/dt

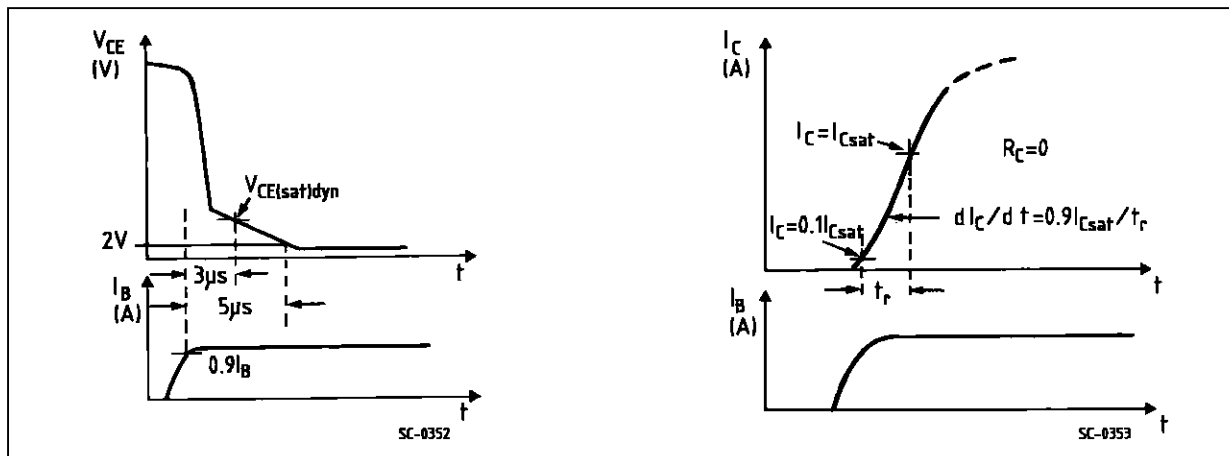


Turn-on Switching Test Circuit

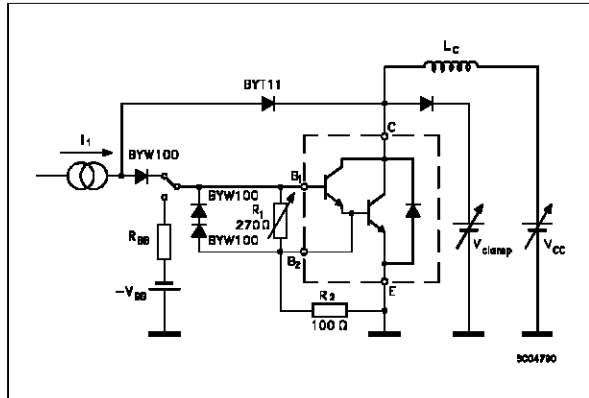


(1) Fast electronic switch (2) Non-inductive load

Turn-on Switching Waveforms

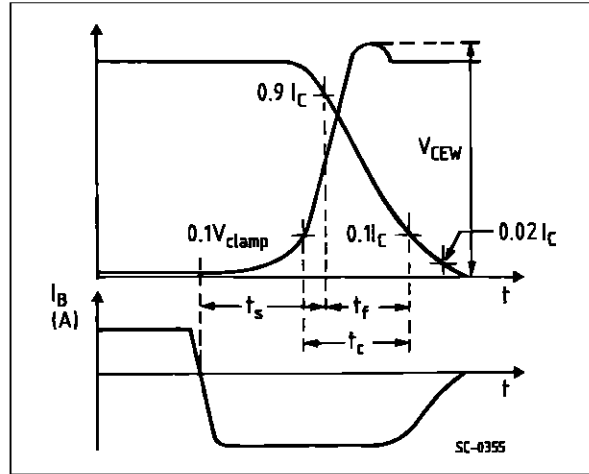


Turn-off Switching Test Circuit

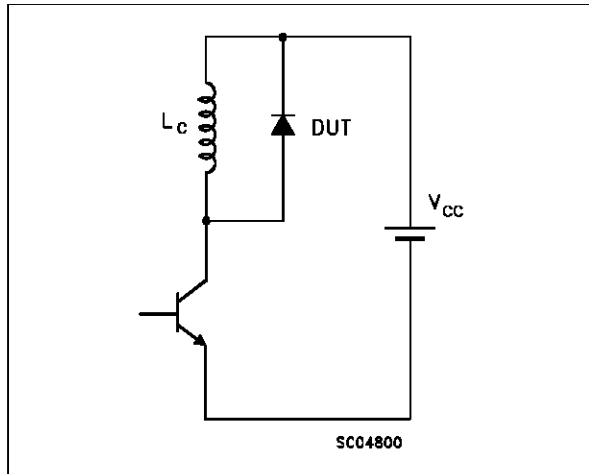


- (1) Fast electronic switch
- (2) Non-inductive load
- (3) Fast recovery rectifier

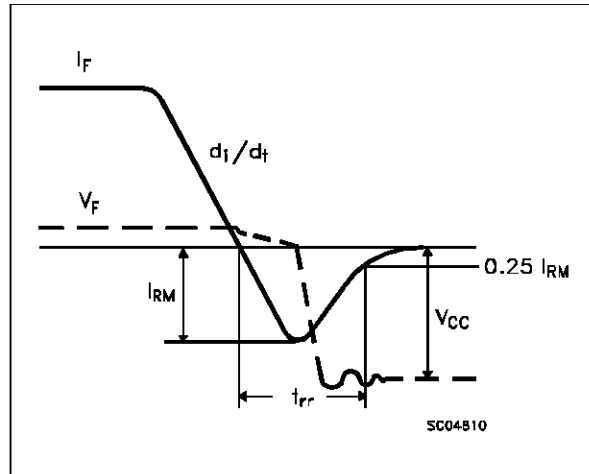
Turn-off Switching Waveforms



Turn-off Switching Test Circuits of Diode

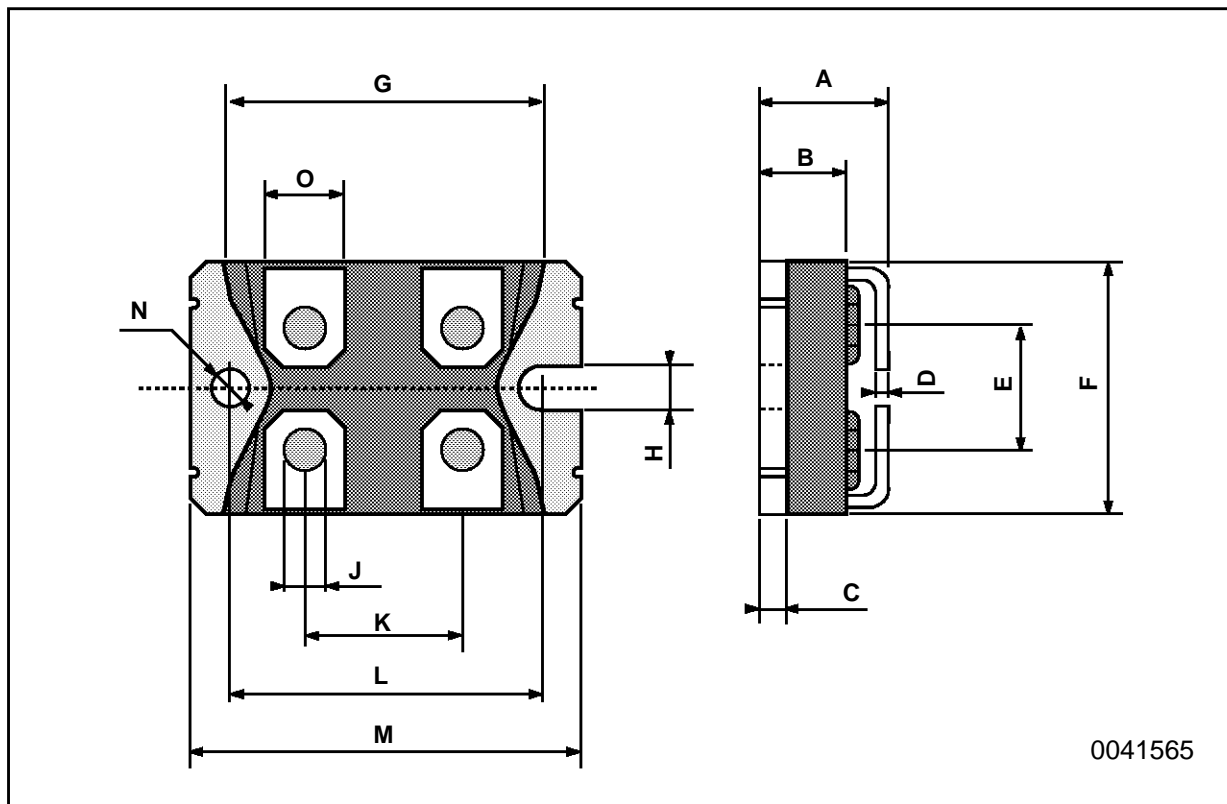


Turn-off Switching Waveform of Diode



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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