



STE50DE100

HYBRID EMITTER SWITCHED BIPOLAR TRANSISTOR ESBT™ 1000 V - 50 A - 0.026 Ω POWER MODULE

Table 1: General Features

$V_{CS(ON)}$	I_c	$R_{CS(ON)}$
1.3 V	50 A	0.026 Ω

- HIGH VOLTAGE / HIGH CURRENT CASCODE CONFIGURATION
- ULTRA LOW EQUIVALENT ON RESISTANCE
- VERY FAST-SWITCH, UP TO 150 kHz
- ULTRA LOW C_{ISS}
- LOW DYNAMIC $V_{CS(ON)}$

APPLICATION

- INDUSTRIAL CONVERTERS
- WELDING

DESCRIPTION

The STE50DE100 is manufactured in a hybrid structure, using dedicated high voltage Bipolar and low voltage MOSFET technologies, aimed to providing the best performance in ESBT topology. The STE50DE100 is designed for use in industrial converters and/or welding equipment.

Figure 1: Package

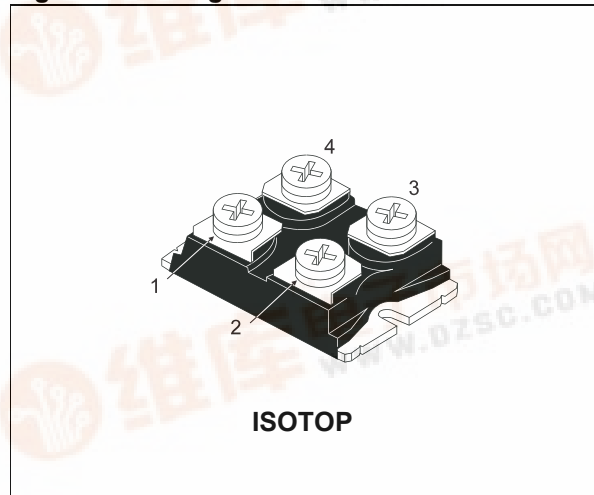


Figure 2: Internal Schematic Diagram

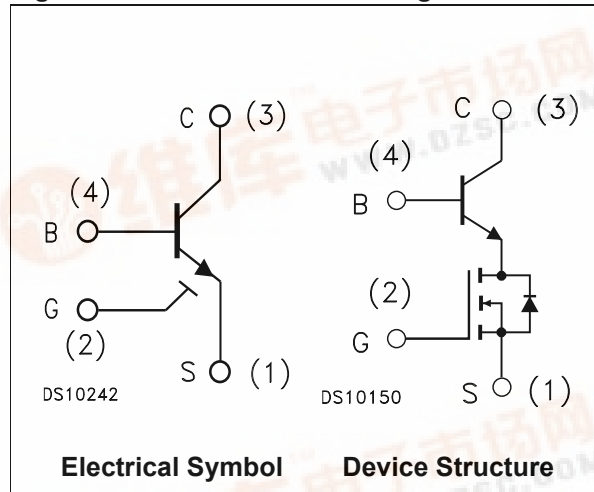


Table 2: Order Code

Part Number	Marking	Package	Packaging
STE50DE100	STE50DE100	ISOTOP	TUBE



STE50DE100

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
$V_{CS(SS)}$	Collector-Source Voltage ($V_{BS} = V_{GS} = 0\text{ V}$)	1000	V
$V_{BS(OS)}$	Base-Source Voltage ($I_C = 0, V_{GS} = 0\text{ V}$)	40	V
$V_{SB(OS)}$	Source-Base Voltage ($I_C = 0, V_{GS} = 0\text{ V}$)	12	V
V_{GS}	Gate-Source Voltage	± 20	V
I_C	Collector Current	50	A
I_{CM}	Collector Peak Current ($t_p < 5\text{ ms}$)	150	A
I_B	Base Current	10	A
I_{BM}	Base Peak Current ($t_p < 1\text{ ms}$)	50	A
P_{tot}	Total Dissipation at $T_C \leq 25\text{ °C}$	160	W
T_{stg}	Storage Temperature	-65 to 150	°C
T_J	Max. Operating Junction Temperature	150	°C
V_{ISO}	Insulation Withstand Voltage (AC-RMS) from All Four Leads to External Heatsink	2500	V

Table 4: Thermal Data

$R_{thj-case}$	Thermal Resistance Junction-Case	Max	0.78	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink with Conductive Grease Applied	Max	0.05	°C/W

Table 5: Electrical Characteristics ($T_{case} = 25\text{ °C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CS(SS)}$	Collector-Source Current ($V_{BS} = V_{GS} = 0\text{ V}$)	$V_{CS(SS)} = 1000\text{ V}$			100	μA
$I_{BS(OS)}$	Base-Source Current ($I_C = 0, V_{GS} = 0\text{ V}$)	$V_{BS(OS)} = 40\text{ V}$			10	μA
$I_{SB(OS)}$	Source-Base Current ($I_C = 0, V_{GS} = 0\text{ V}$)	$V_{SB(OS)} = 10\text{ V}$			100	μA
$I_{GS(OS)}$	Gate-Source Leakage	$V_{GS} = \pm 20\text{ V}$			500	nA
$V_{CS(ON)}$	Collector-Source ON Voltage	$I_C = 50\text{ A}$ $I_B = 10\text{ A}$ $V_{GS} = 10\text{ V}$ $I_C = 30\text{ A}$ $I_B = 3\text{ A}$ $V_{GS} = 10\text{ V}$ (see figure 14)		1.3 1.1		V V
h_{FE}	DC Current Gain	$I_C = 50\text{ A}$ $V_{CS} = 1\text{ V}$ $V_{GS} = 10\text{ V}$ $I_C = 30\text{ A}$ $V_{CS} = 1\text{ V}$ $V_{GS} = 10\text{ V}$	3 6		7 13	
$V_{BS(ON)}$	Base-Source ON Voltage	$I_C = 50\text{ A}$ $I_B = 10\text{ A}$ $V_{GS} = 10\text{ V}$ $I_C = 30\text{ A}$ $I_B = 3\text{ A}$ $V_{GS} = 10\text{ V}$		2.2 1.4		V V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{BS} = V_{GS}$ $I_B = 250\text{ }\mu\text{A}$	3	3.7	4.5	V
C_{iss}	Input Capacitance	$V_{CS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = V_{CB} = 0$		2500		pF
$Q_{GS(tot)}$	Gate-Source Charge	$V_{CS} = 25\text{ V}$ $V_{GS} = 10\text{ V}$ $V_{CB} = 0$ $I_C = 50\text{ A}$		60		nC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s t_f	INDUCTIVE LOAD Storage Time Fall Time	$V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_C = 25\text{ A}$ $I_B = 5\text{ A}$ $V_{Clamp} = 800\text{ V}$ $t_p = 4\ \mu\text{s}$ (see figure 15)		0.65 10		μs ns
t_s t_f	INDUCTIVE LOAD Storage Time Fall Time	$V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_C = 25\text{ A}$ $I_B = 2.5\text{ A}$ $V_{Clamp} = 800\text{ V}$ $t_p = 4\ \mu\text{s}$ (see figure 15)		0.43 6		μs ns
V_{CSW}	Maximum Collector-Source Voltage without Snubber	$R_G = 47\ \Omega$ $h_{FE} = 5$ $I_C = 35\text{ A}$	1000			V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (500 ns)	$V_{CC} = V_{Clamp} = 300\text{ V}$ $R_G = 47\ \Omega$ $I_{Bpeak} = I_C = 25\text{ A}$ $V_{GS} = 10\text{ V}$ $I_B = 5\text{ A}$ $t_{peak} = 500\text{ ns}$		5.5		V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (1 μs)	$V_{CC} = V_{Clamp} = 300\text{ V}$ $R_G = 47\ \Omega$ $I_{Bpeak} = I_C = 25\text{ A}$ $V_{GS} = 10\text{ V}$ $I_B = 5\text{ A}$ $t_{peak} = 500\text{ ns}$		4.8		V

Figure 3: Output Characteristics

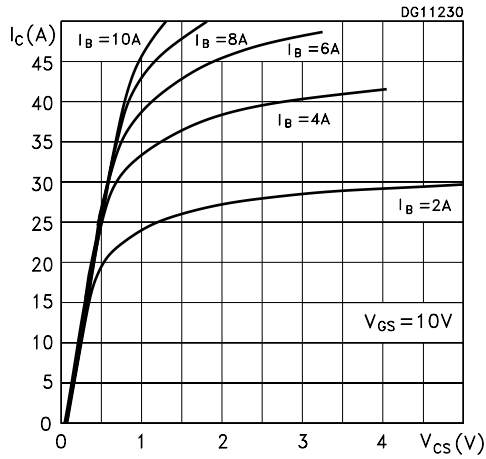


Figure 4: Reverse Biased Safe Operating Area

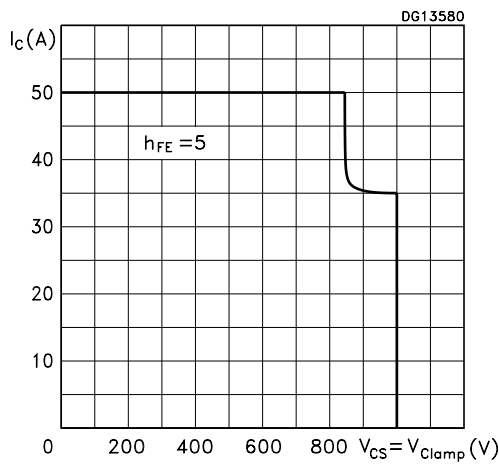


Figure 5: DC Current Gain

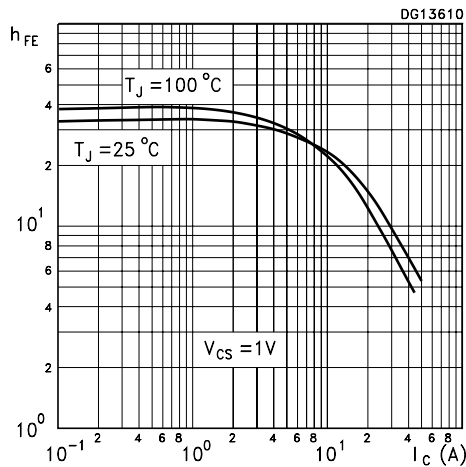


Figure 6: Gate Threshold Voltage vs Temperature

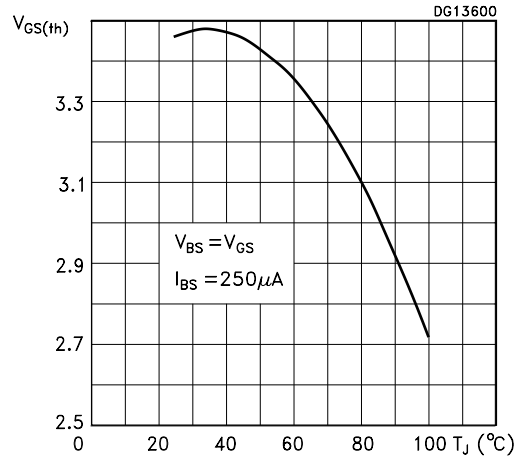


Figure 7: Dynamic Collector-Emitter Saturation Voltage

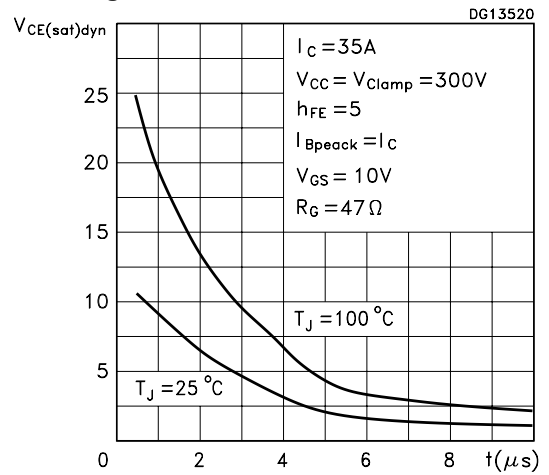


Figure 8: Collector-Source On Voltage

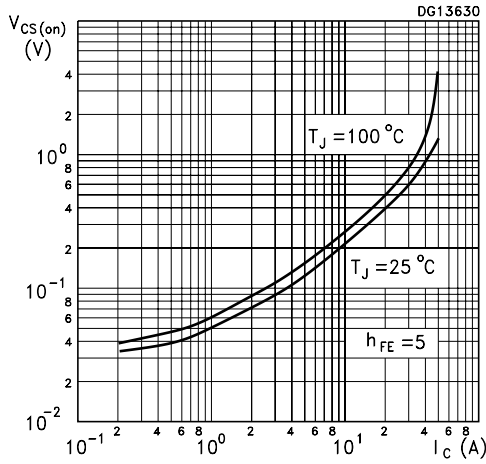


Figure 9: Base-Source On Voltage

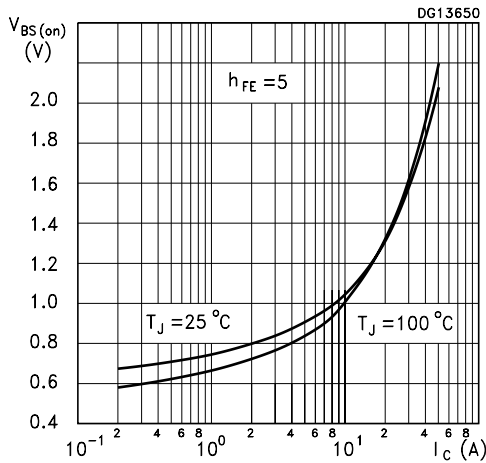


Figure 10: Inductive Load Switching Time

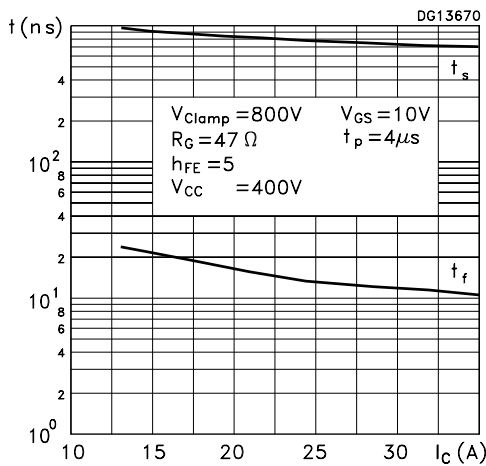


Figure 11: Collector-Source On Voltage

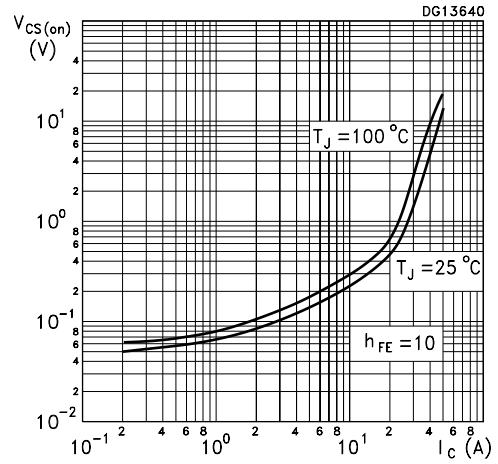


Figure 12: Base-Source On Voltage

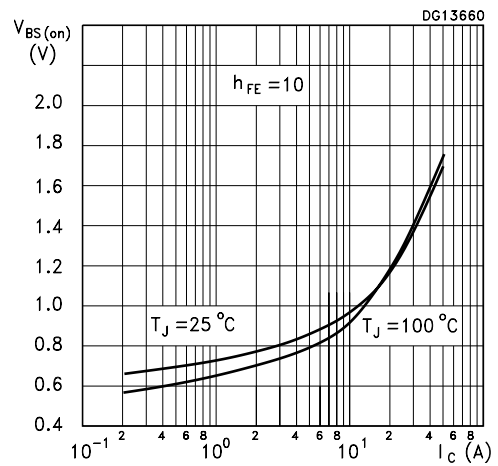


Figure 13: Inductive Load Switching Time

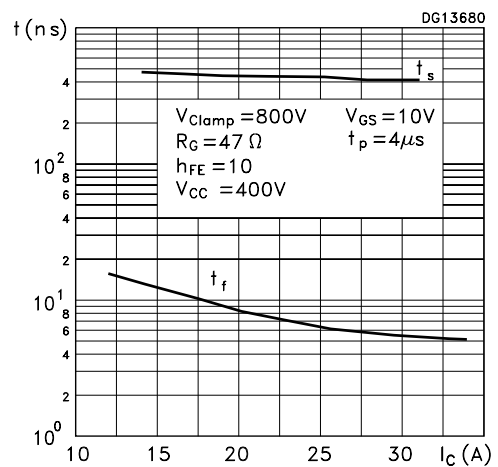


Figure 14: Static $V_{CS(ON)}$ Test Circuit

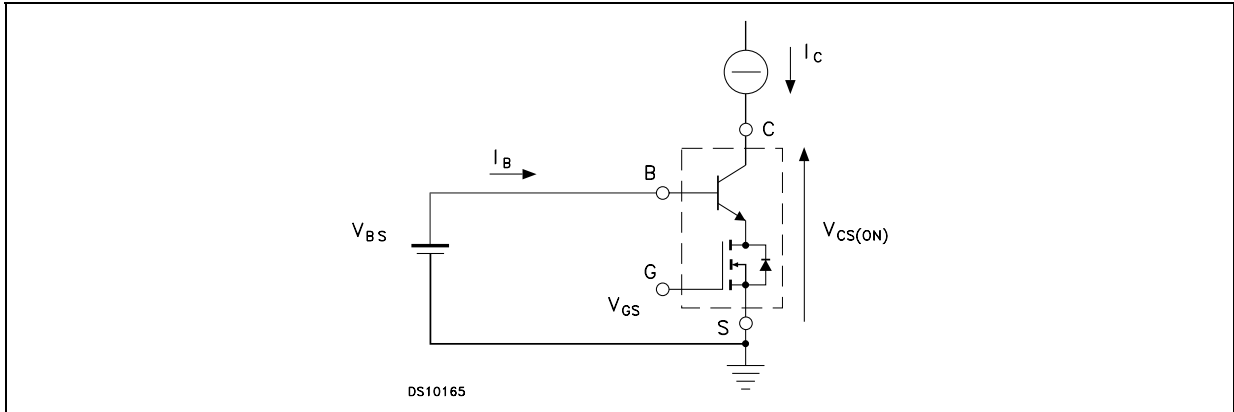


Figure 15: Inductive Load Switching and RBSOA Test Circuit

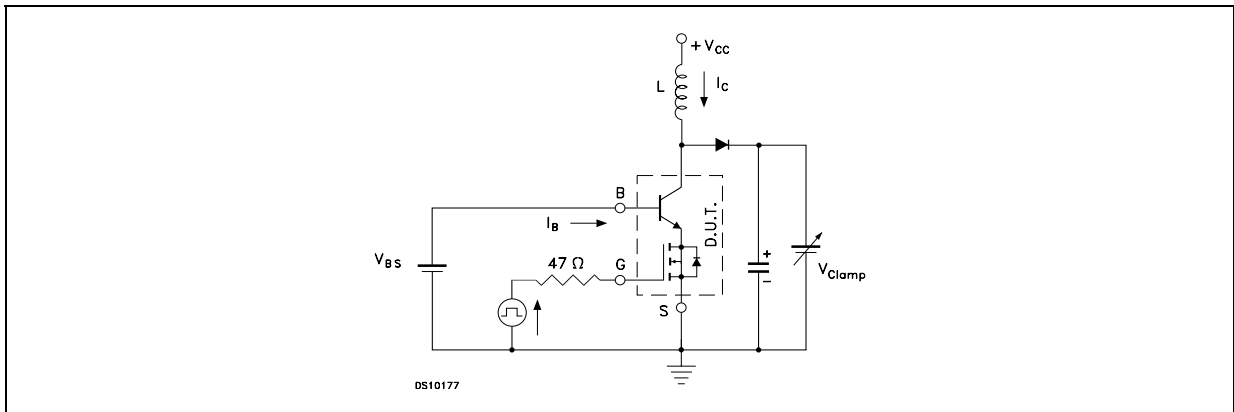
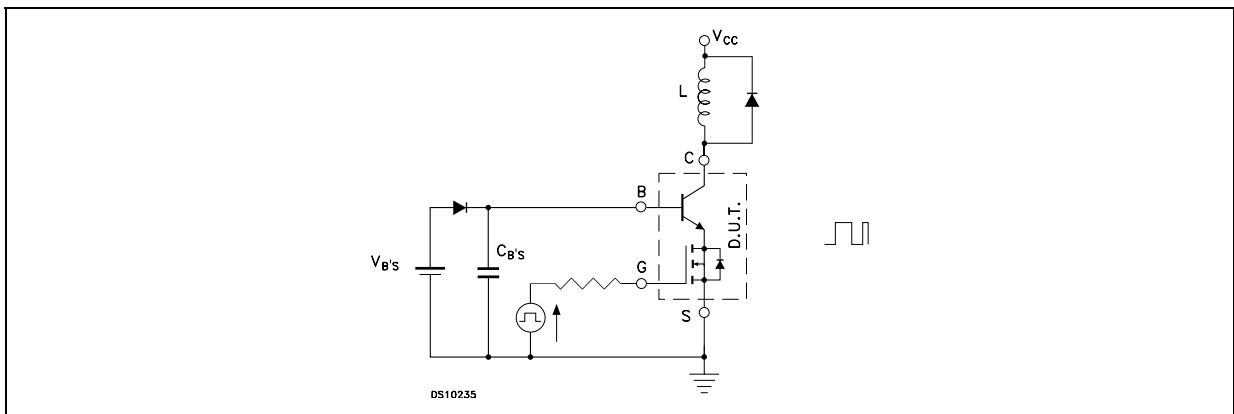
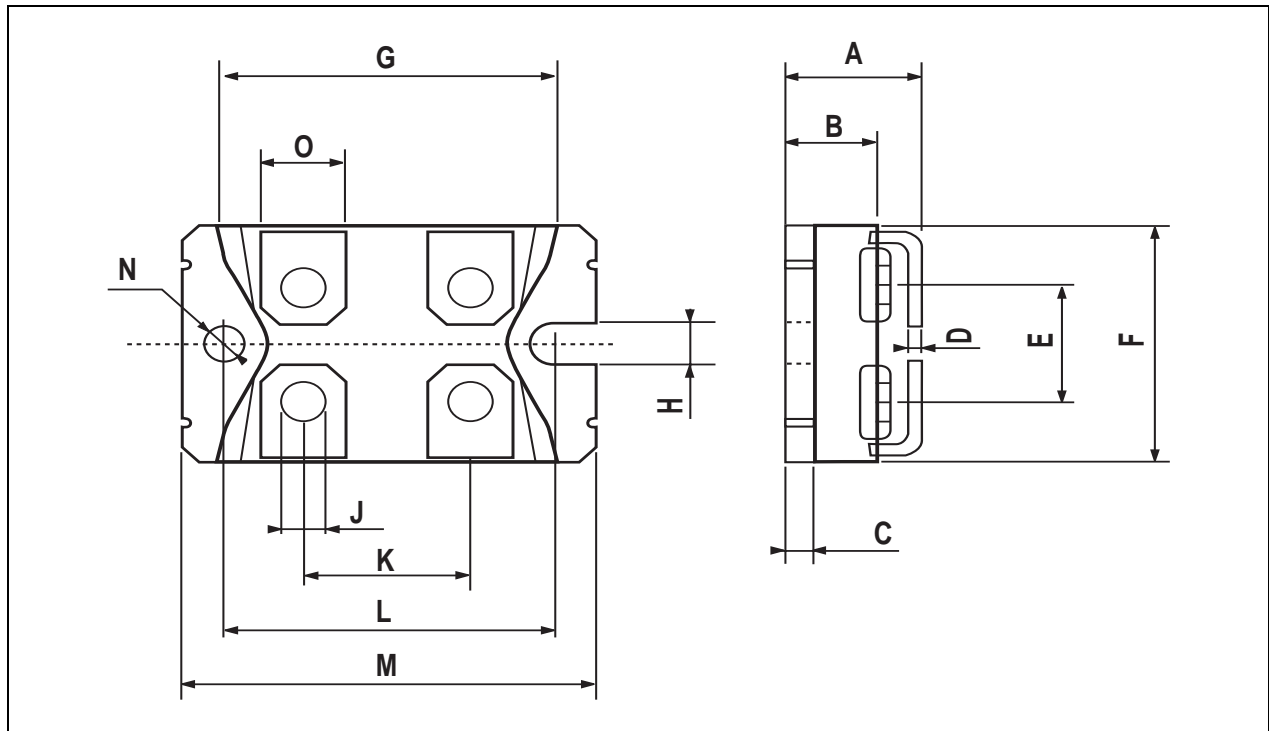


Figure 16: Inductive Load Turn-on Switching and Dynamic $V_{CS(ON)}$ Test Circuit



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



STE50DE100

Table 6: Revision History

Date	Release	Change Designator
06-Oct-2004	1	First Release.

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