



# 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

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

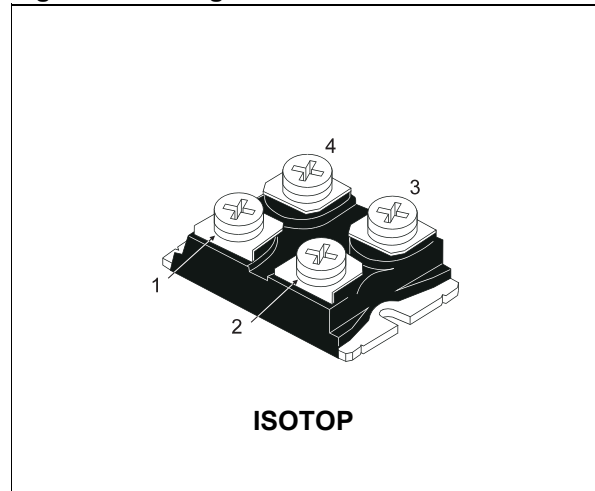
### APPLICATION

- n INDUSTRIAL CONVERTERS
- n WELDING

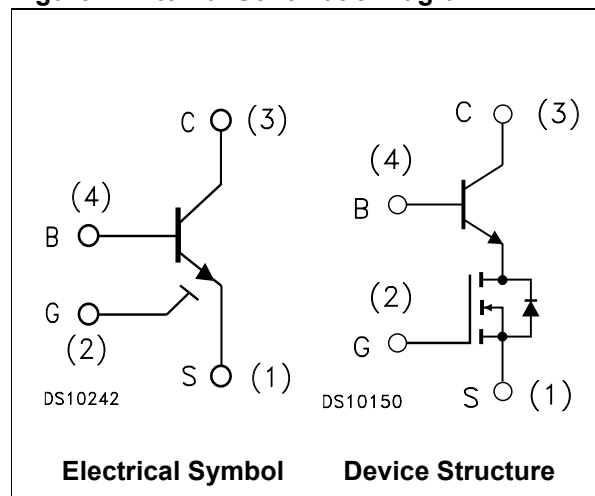
### DESCRIPTION

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

**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	$\pm 20$	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	$\mu\text{A}$
$I_{BS(OS)}$	Base-Source Current ( $I_C = 0, V_{GS} = 0\text{ V}$ )	$V_{BS(OS)} = 40\text{ V}$			10	$\mu\text{A}$
$I_{SB(OS)}$	Source-Base Current ( $I_C = 0, V_{GS} = 0\text{ V}$ )	$V_{SB(OS)} = 10\text{ V}$			100	$\mu\text{A}$
$I_{GS(OS)}$	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	$V_{GS} = 10\text{ V}$ $V_{Clamp} = 800\text{ V}$ $R_G = 47\ \Omega$ $t_p = 4\ \mu\text{s}$		0.65		$\mu\text{s}$
	Fall Time	$I_C = 25\text{ A}$ $I_B = 5\text{ A}$ (see figure 15)		10		ns
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time	$V_{GS} = 10\text{ V}$ $V_{Clamp} = 800\text{ V}$ $R_G = 47\ \Omega$ $t_p = 4\ \mu\text{s}$		0.43		$\mu\text{s}$
	Fall Time	$I_C = 25\text{ A}$ $I_B = 2.5\text{ A}$ (see figure 15)		6		ns
$V_{CSW}$	Maximum Collector-Source Voltage without Snubber	$R_G = 47\ \Omega$ $h_{FE} = 5\text{ A}$ $I_C = 35\text{ A}$	1000			V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (500 ns)	$V_{CC} = V_{Clamp} = 300\text{ V}$ $V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_B = 5\text{ A}$ $I_{Bpeak} = I_C = 25\text{ A}$ $t_{peak} = 500\text{ ns}$		5.5		V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (1 $\mu\text{s}$ )	$V_{CC} = V_{Clamp} = 300\text{ V}$ $V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_B = 5\text{ A}$ $I_{Bpeak} = I_C = 25\text{ A}$ $t_{peak} = 500\text{ ns}$		4.8		V

Figure 3: Output Characteristics

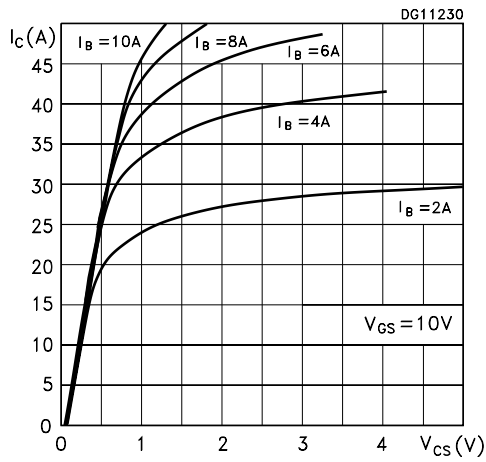


Figure 4: Reverse Biased Safe Operating Area

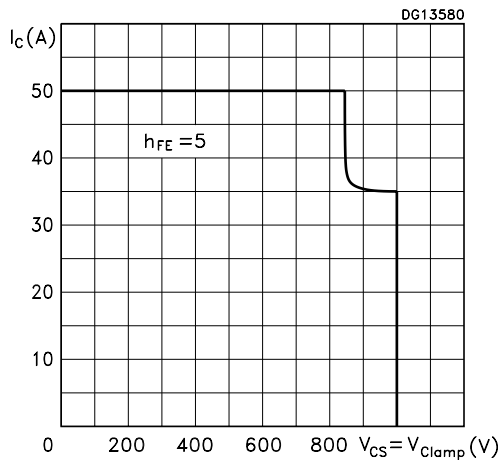


Figure 5: DC Current Gain

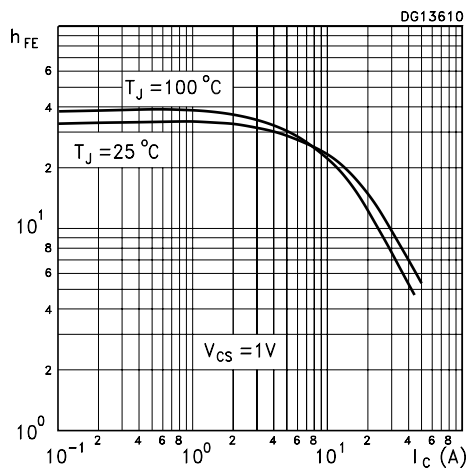


Figure 6: Gate Threshold Voltage vs Temperature

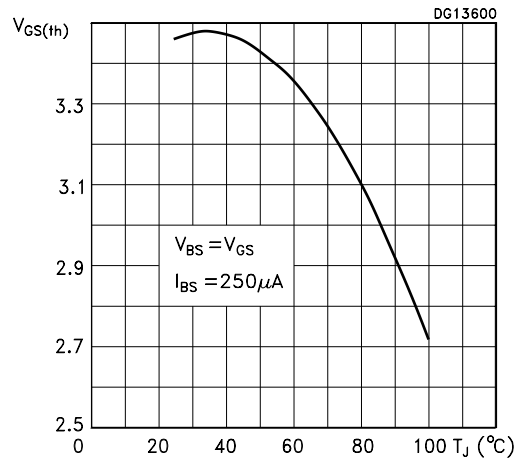


Figure 7: Dynamic Collector-Emitter Saturation Voltage

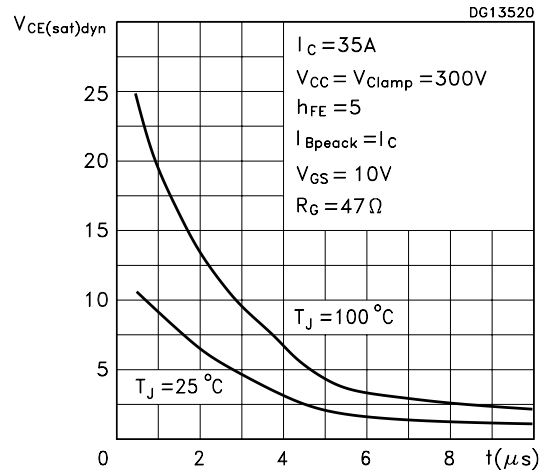


Figure 8: Collector-Source On Voltage

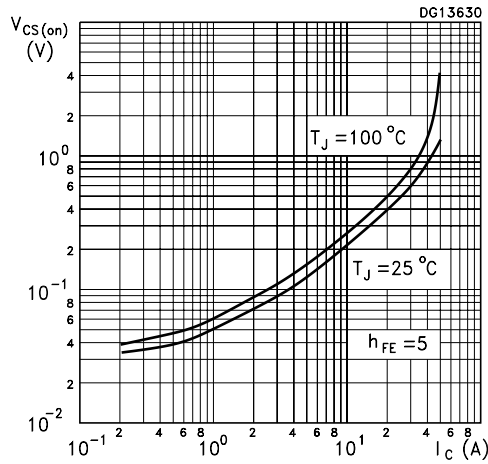


Figure 9: Base-Source On Voltage

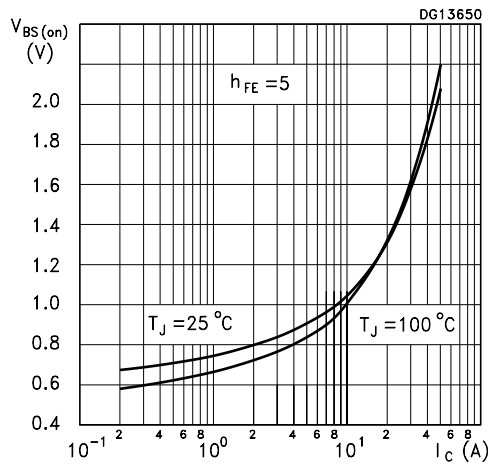


Figure 10: Inductive Load Switching Time

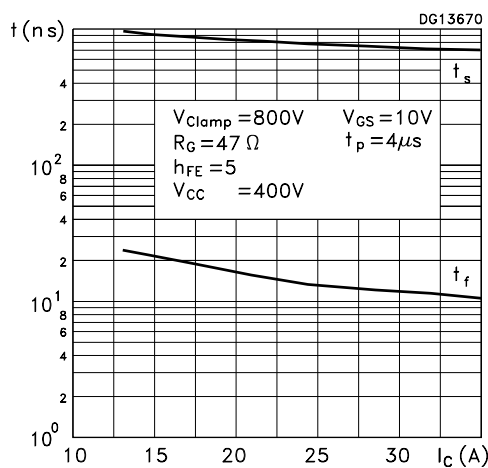


Figure 11: Collector-Source On Voltage

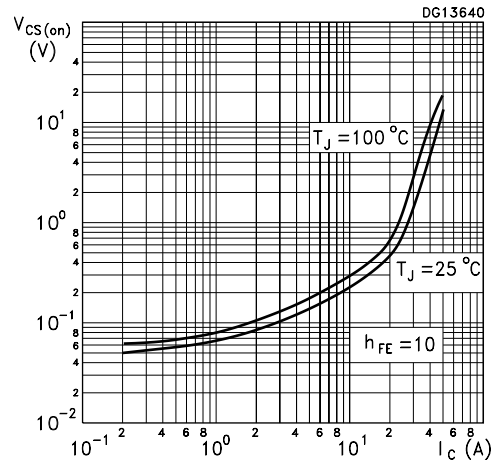


Figure 12: Base-Source On Voltage

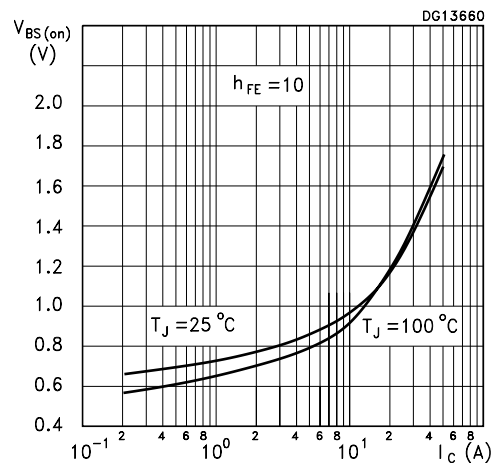


Figure 13: Inductive Load Switching Time

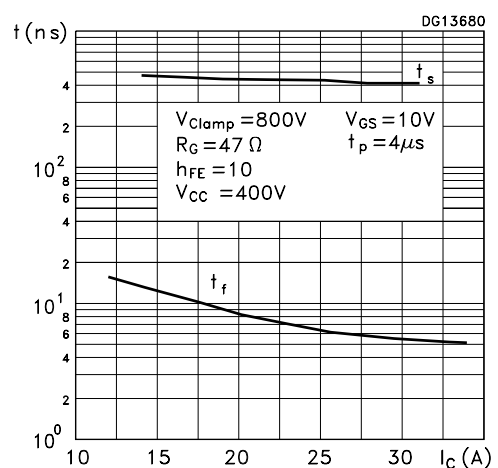


Figure 14: Static  $V_{CS(ON)}$  Test Circuit

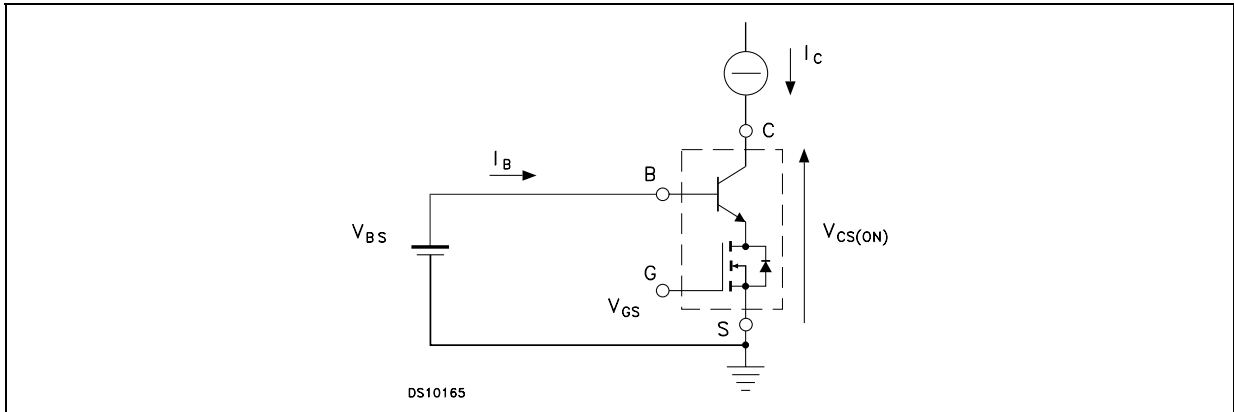


Figure 15: Inductive Load Switching and RBSOA Test Circuit

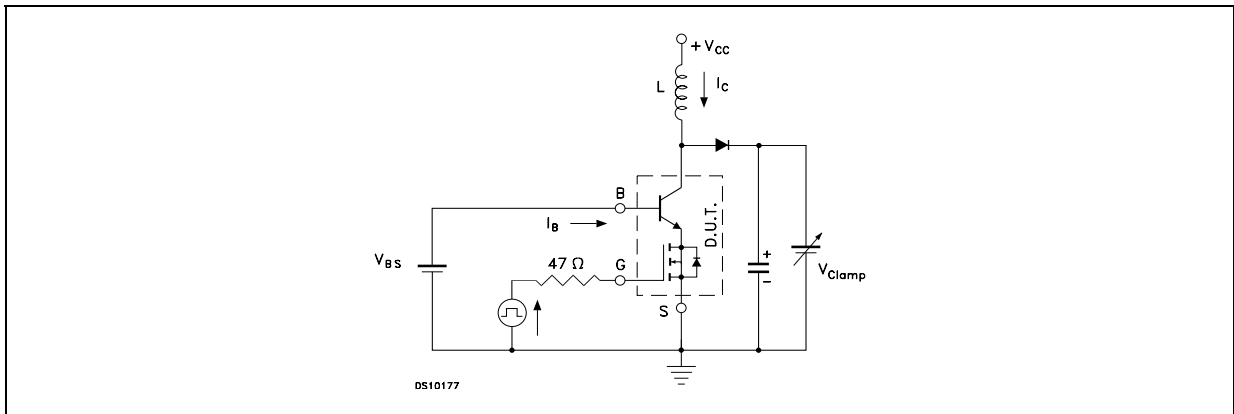
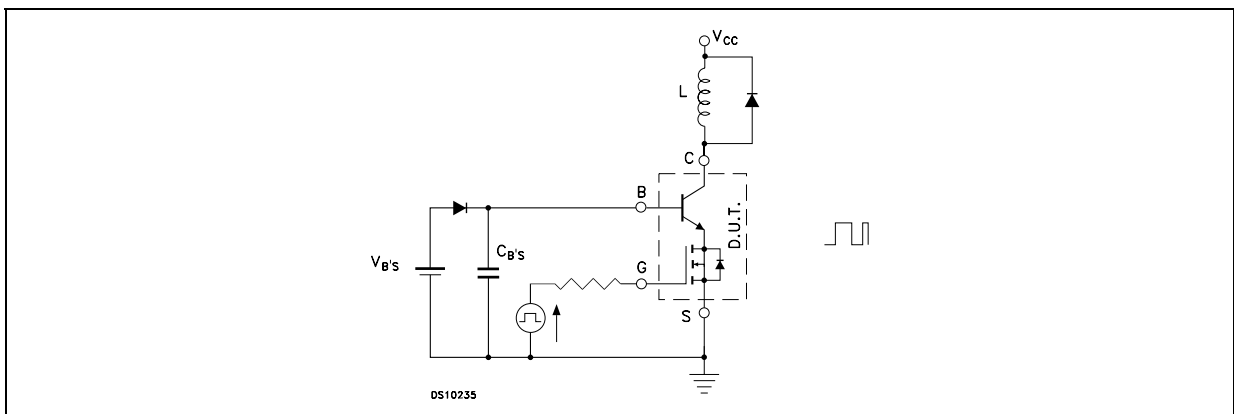
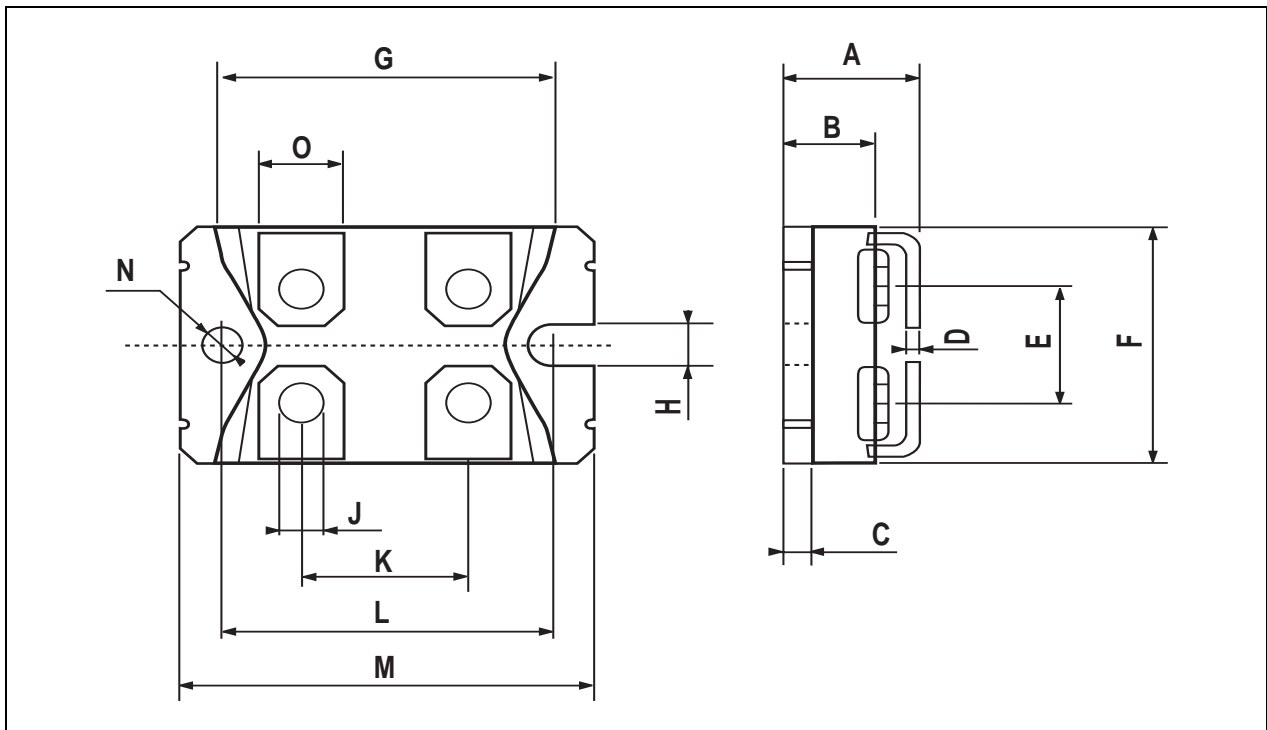


Figure 16: Inductive Load Turn-on Switching and Dynamic  $V_{CS(ON)}$  Test Circuit



**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



**Table 6: Revision History**

<b>Date</b>	<b>Release</b>	<b>Change Designator</b>
06-Oct-2004	1	First Release.



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