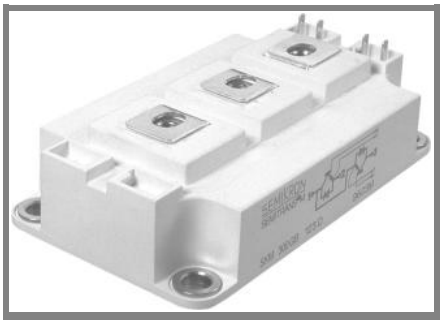
SKM 400GB066D



SEMITRANS® 3

Trench IGBT Modules

SKM 400GB066D

Preliminary Data

Features

- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_C

Typical Applications

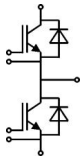
- AC inverter drives
- UPS
- Electronic welders

Remarks

- Case temperature limited to T_c = 125°C max, recommended T_{op} = -40 ... +150°C
- Product reliability results are valid for $T_j \leq 150°C$
- Short circuit data: $t_p \leq 6\mu s$; $V_{GE} \leq 15V$; $T_j = 150°C$; $V_{cc} \leq 360V$, use of soft R_G necessary !
- Take care of over-voltage caused by stray inductances

Absolute Maximum Ratings	T_{case} = 25°C, unless otherwise specified			
Symbol	**Conditions**		**Values**	**Units**
IGBT				
V_{CES}	T_j = 25 °C		600	V
I_C	T_j = 175 °C	T_c = 25 °C	500	A
		T_c = 80 °C	380	A
I_{CRM}	I_{CRM}=2xI_{Cnom}		800	A
V_{GES}			± 20	V
t_{psc}	V_{CC} = 360 V; $V_{GE} \leq$ 15 V; V_{CES} < 600 V	T_j = 150 °C	6	µs
Inverse Diode				
I_F	T_j = 175 °C	T_c = 25 °C	450	A
		T_c = 80 °C	320	A
I_{FRM}	I_{FRM}=2xI_{Fnom}		800	A
Module				
$I_{t(RMS)}$			500	A
T_{vj}			- 40 ... +175	°C
T_{stg}			- 40 ... +125	°C
V_{isol}	AC, 1 min.		4000	V

Characteristics	T_{case} = 25°C, unless otherwise specified					
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
IGBT						
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 6,4 mA		5	5,8	6,5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	T_j = 25 °C		0,25	0,75	mA
V_{CE0}		T_j = 25 °C		0,9	1	V
		T_j = 150 °C		0,85	0,9	V
r_{CE}	V_{GE} = 15 V	T_j = 25°C		1,4	2,3	mΩ
		T_j = 150°C		2,1	3	mΩ
$V_{CE(sat)}$	I_{Cnom} = 400 A, V_{GE} = 15 V	T_j = 25°C$_{chiplev.}$		1,45	1,9	V
		T_j = 150°C$_{chiplev.}$		1,7	2,1	V
C_{ies}	V_{CE} = 25, V_{GE} = 0 V	f = 1 MHz		24,7		nF
C_{oes}				1,54		nF
C_{res}				0,73		nF
Q_G	V_{GE} = -8V...+15V			3000		nC
R_{Gint}	T_j = °C			2		Ω
$t_{d(on)}$	R_{Gon} = 1,5 Ω	V_{CC} = 300V		200		ns
t_r		I_{Cnom}= 400A		60		ns
E_{on}		T_j = 150 °C		8		mJ
$t_{d(off)}$	R_{Goff} = 1,5 Ω	V_{GE} = -8V/+15V		560		ns
t_f				53		ns
E_{off}				16		mJ
$R_{th(j-c)}$	per IGBT				0,12	K/W



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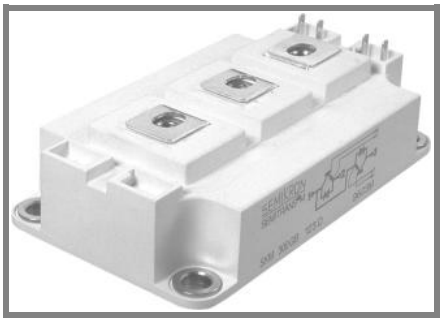

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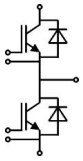

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
Inverse Diode						
$V_F = V_{EC}$	I_{Fnom} = 400 A; V_{GE} = 0 V	T_j = 25 °C$_{chiplev.}$		1,4	1,6	V
V_{F0}		T_j = 25 °C		0,95	1	V
r_F		T_j = 25 °C		1,1	1,5	mΩ
I_{RRM}	I_{Fnom} = 400 A	T_j = 150 °C		410		A
Q_{rr}	di/dt = 7250 A/µs			62		µC
E_{rr}	V_{GE} = -8 V; V_{CC} = 300 V			14		mJ
$R_{th(j-c)D}$	per diode				0,2	K/W
Module						
L_{CE}				15	20	nH
$R_{CC'+EE'}$	res., terminal-chip	T_{case}= 25 °C		0,35		mΩ
		T_{case}= 125 °C		0,5		mΩ
$R_{th(c-s)}$	per module				0,038	K/W
M_s	to heat sink M6		3		5	Nm
M_t	to terminals M6		2,5		5	Nm
w					325	g

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX.

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.

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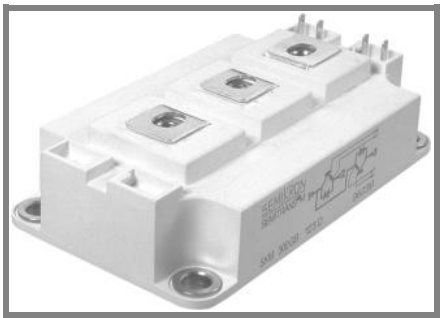

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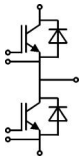

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Z_{th} Symbol	Conditions	Values	Units
$Z_{th(j-c)I}$			
R_i	i = 1	80	mk/W
R_i	i = 2	22,5	mk/W
R_i	i = 3	6,4	mk/W
R_i	i = 4	1,1	mk/W
tau_i	i = 1	0,0447	s
tau_i	i = 2	0,0223	s
tau_i	i = 3	0,0015	s
tau_i	i = 4	0,0002	s
$Z_{th(j-c)D}$			
R_i	i = 1	130	mk/W
R_i	i = 2	55	mk/W
R_i	i = 3	12,5	mk/W
R_i	i = 4	2,5	mk/W
tau_i	i = 1	0,054	s
tau_i	i = 2	0,01	s
tau_i	i = 3	0,0015	s
tau_i	i = 4	0,1	s

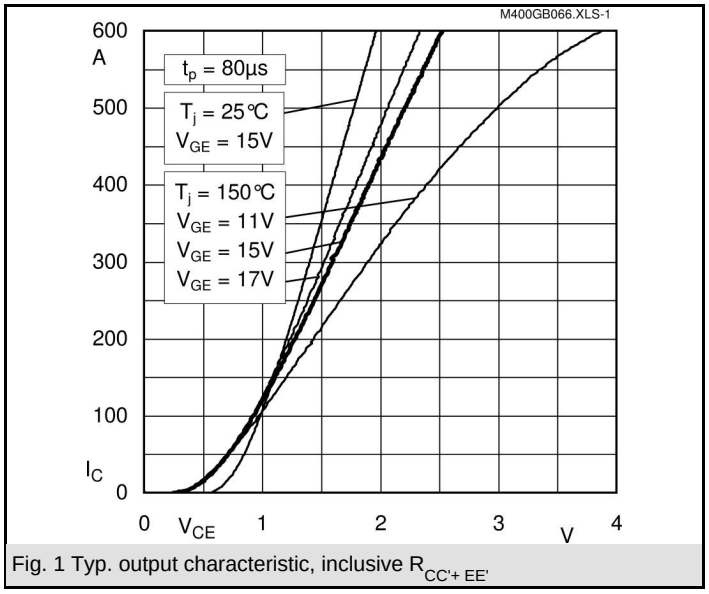

Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

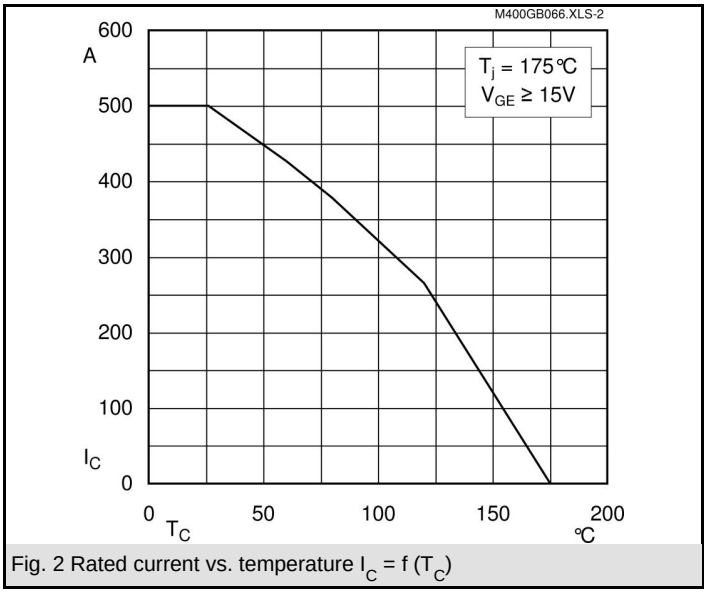

Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

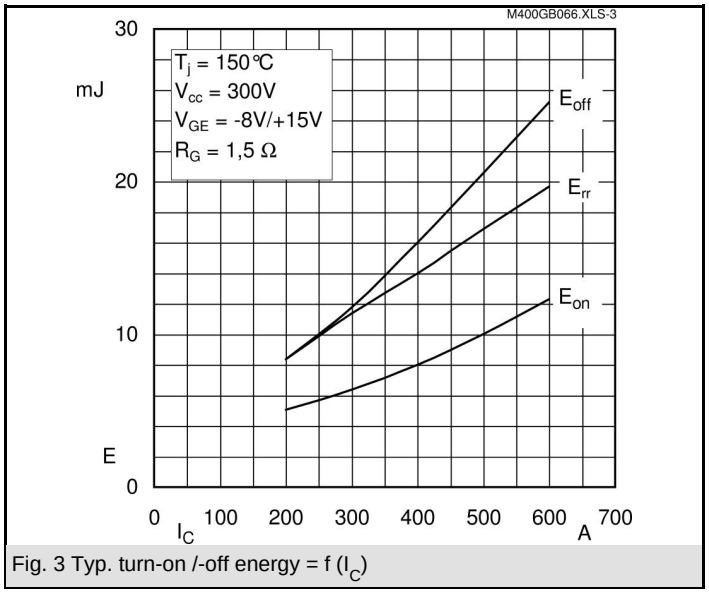

Fig. 3 Typ. turn-on /-off energy = f (I_C)

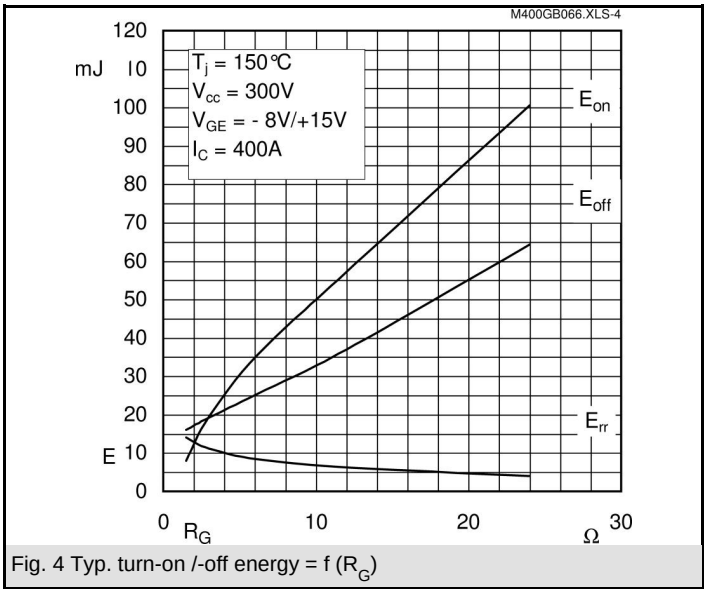

Fig. 4 Typ. turn-on /-off energy = f (R_G)

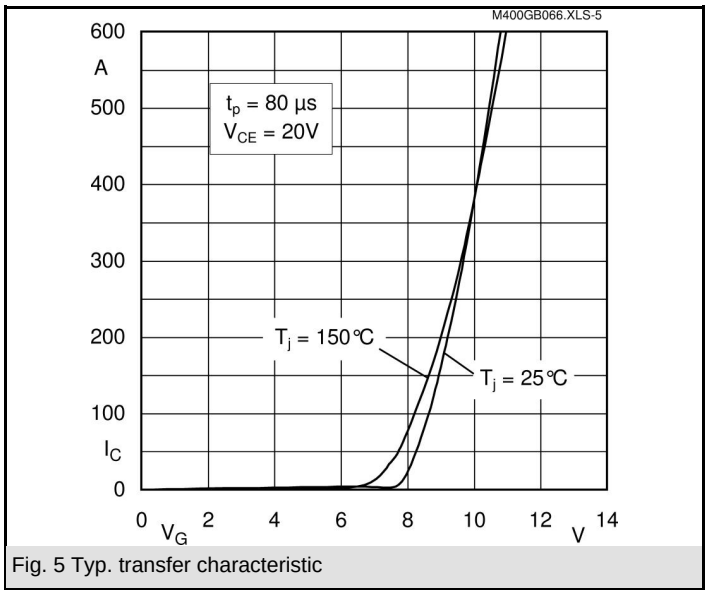

Fig. 5 Typ. transfer characteristic

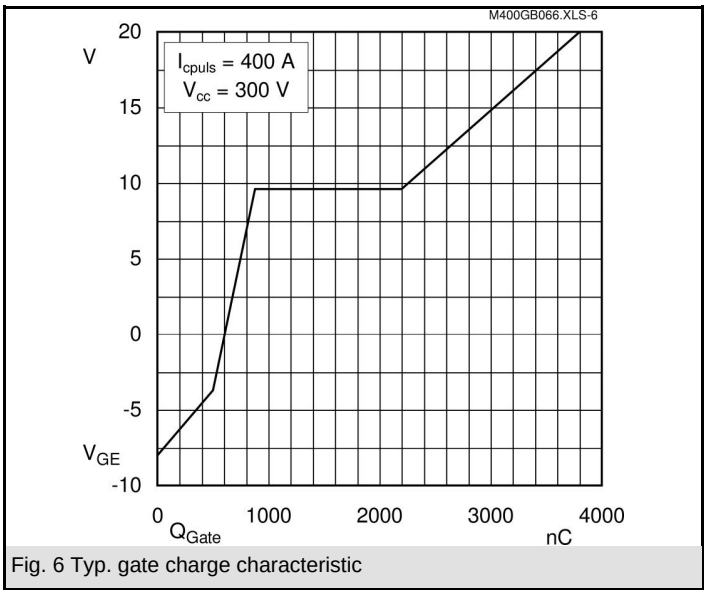

Fig. 6 Typ. gate charge characteristic

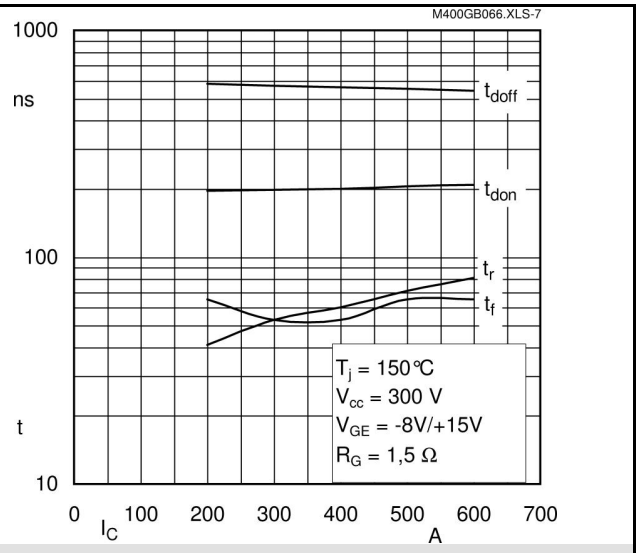

Fig. 7 Typ. switching times vs. I_C

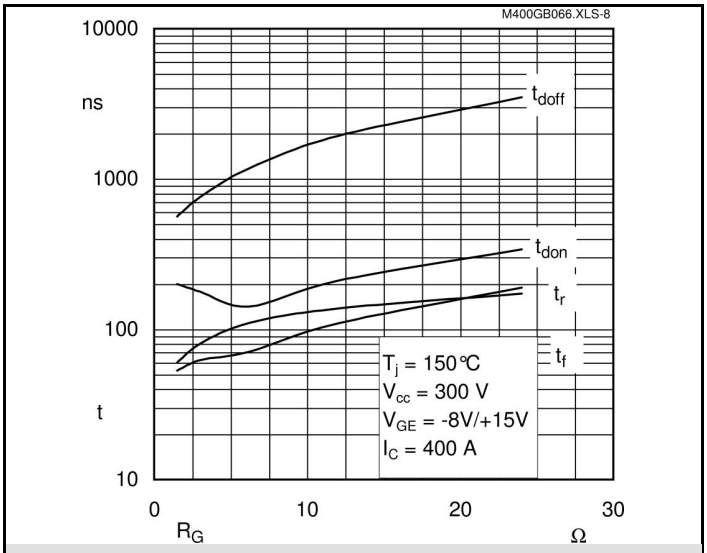

Fig. 8 Typ. switching times vs. gate resistor R_G

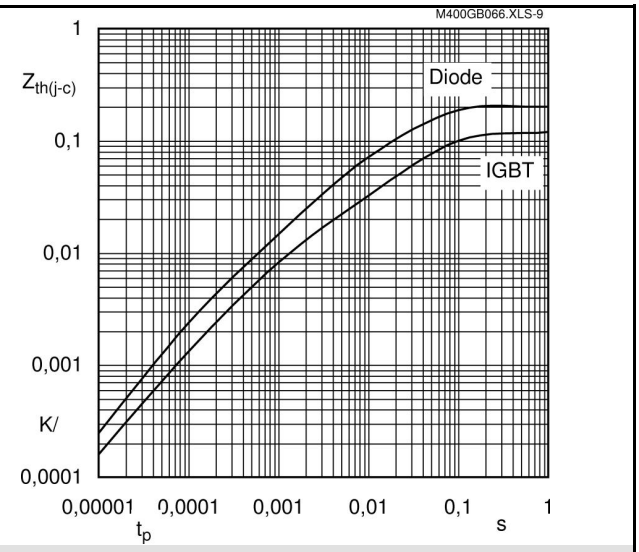

Fig. 9 Transient thermal impedance of IGBT and Diode

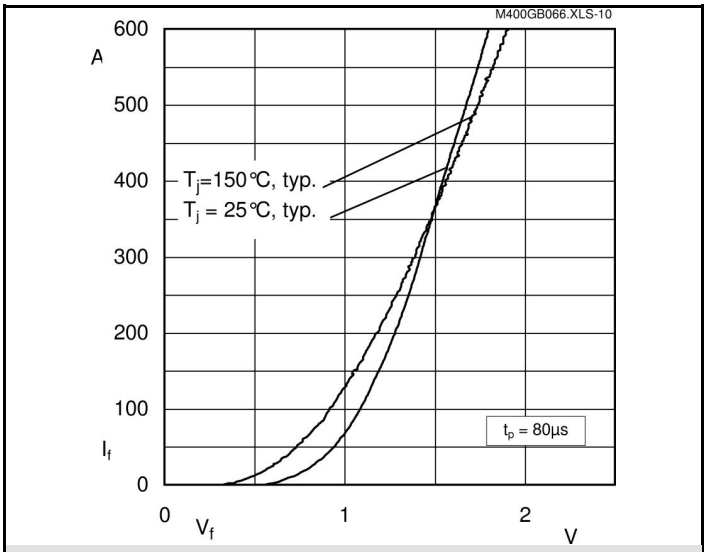

Fig. 10 CAL diode forward characteristic

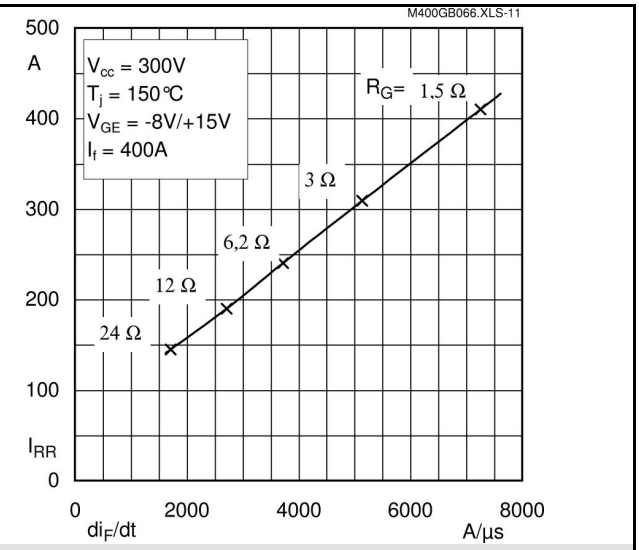

Fig. 11 Typ. CAL diode peak reverse recovery current

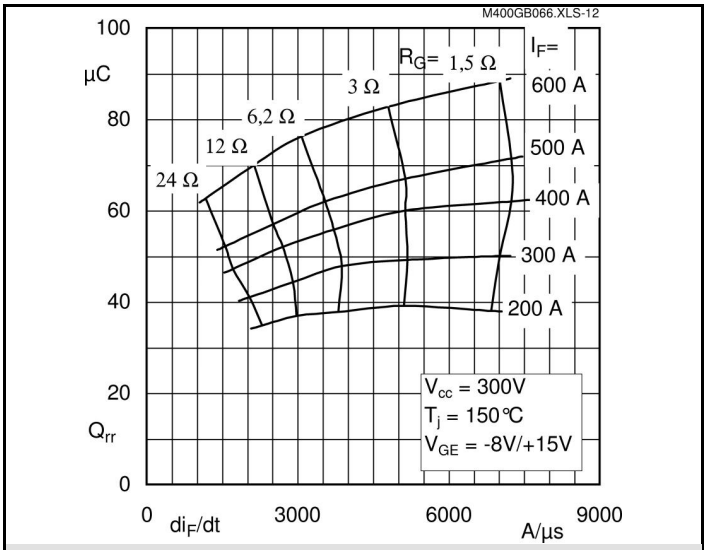

Fig. 12 Typ. CAL diode recovered charge

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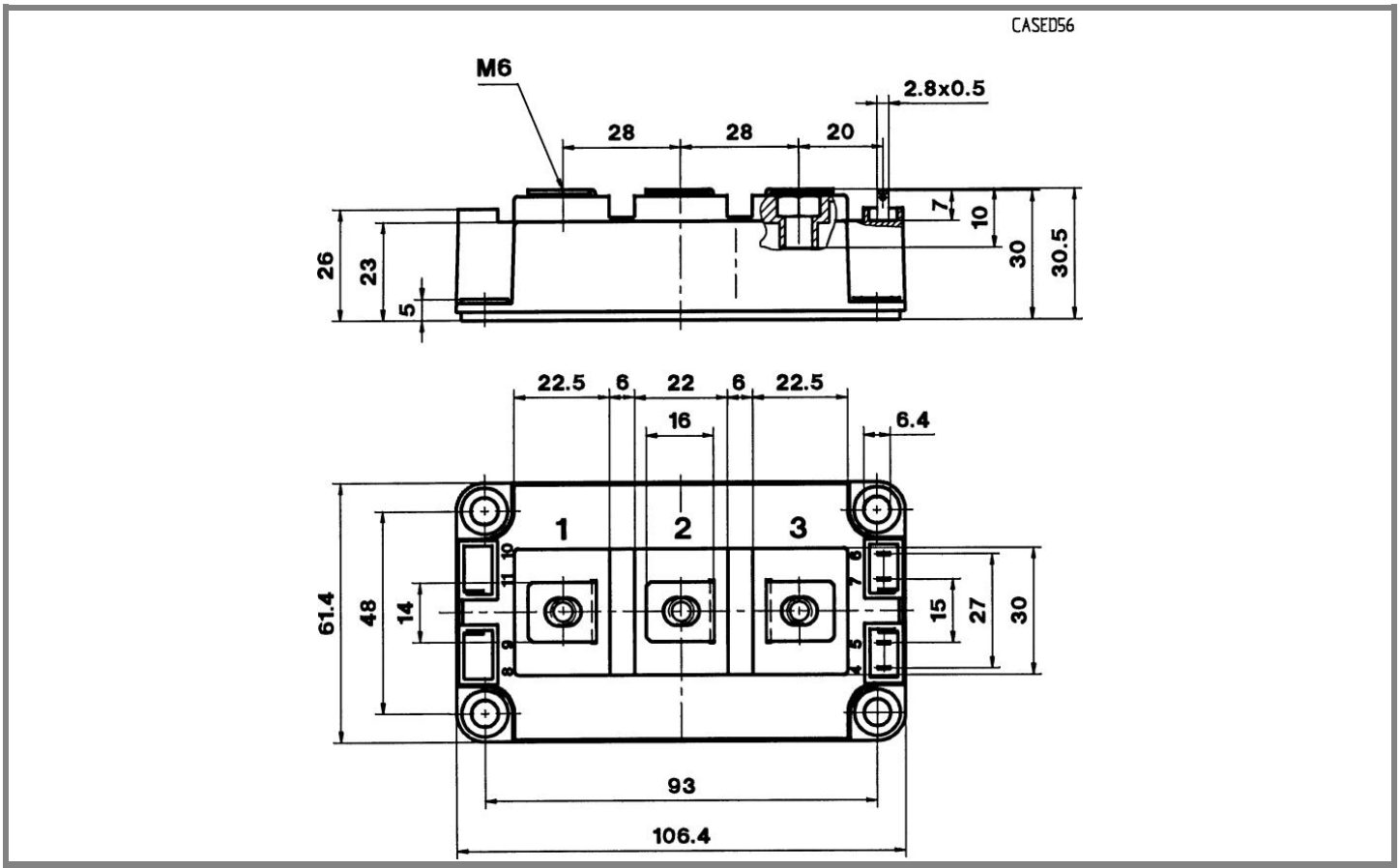
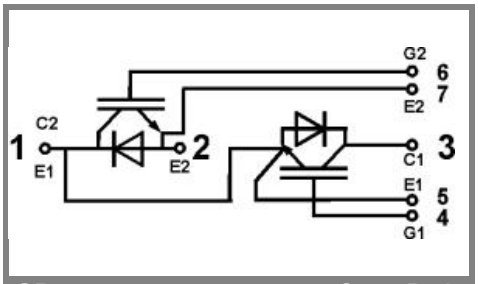


Case D 56



GB Case D56

