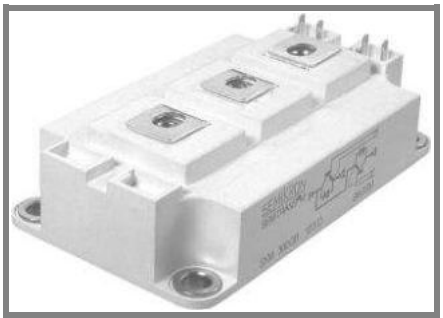


SEMITRANS® 3

Trench IGBT Modules

SKM 400GB066D

Features

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

Typical Applications*

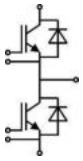
- AC inverter drives
- UPS
- Electronic welders

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: $t_p \leq 6$ 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_C= 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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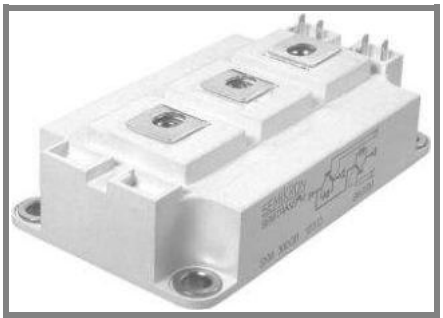
SKM 400GB066D



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SKM 400GB066D

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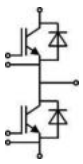

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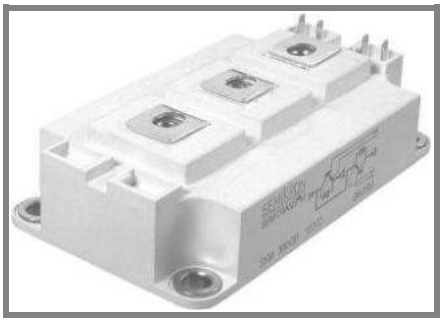
Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
Inverse Diode						
$V_F = V_{EC}$	I_{Fnom} = 400 A; V_{GE} = 0 V	T_j = 25 °C$_{chiplev.}$		1,4	1,6	V
V_{F0}		T_j = 25 °C		0,95	1	V
r_F		T_j = 25 °C		1,1	1,5	mΩ
I_{RRM}	I_F = 400 A	T_j = 150 °C		410		A
Q_{rr}	di/dt = 7250 A/ s			62		C
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.



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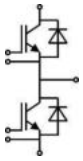

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Z_{th} Symbol	Conditions	Values	Units
$Z_{th(j-c)I}$			
R_i	i = 1	80	mk/W
R_i	i = 2	22,5	mk/W
R_i	i = 3	6,4	mk/W
R_i	i = 4	1,1	mk/W
tau_i	i = 1	0,0447	s
tau_i	i = 2	0,0223	s
tau_i	i = 3	0,0015	s
tau_i	i = 4	0,0002	s
$Z_{th(j-c)D}$			
R_i	i = 1	130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

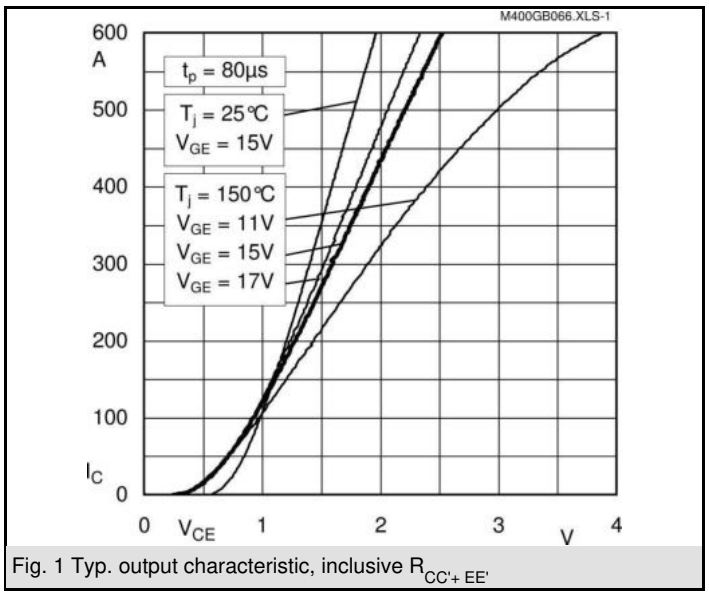


Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

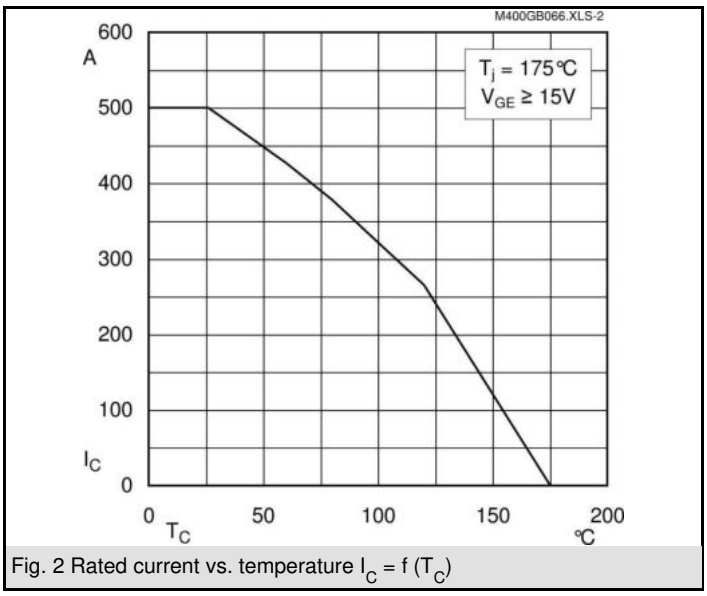


Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

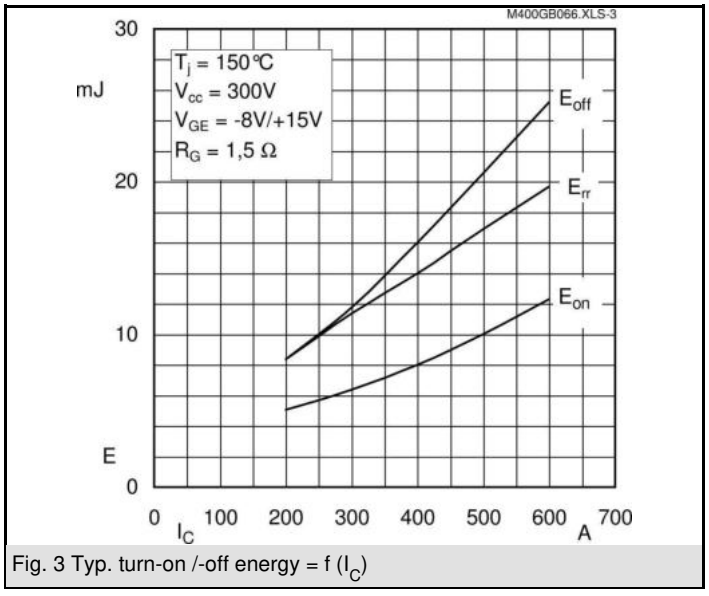


Fig. 3 Typ. turn-on /-off energy = f (I_C)

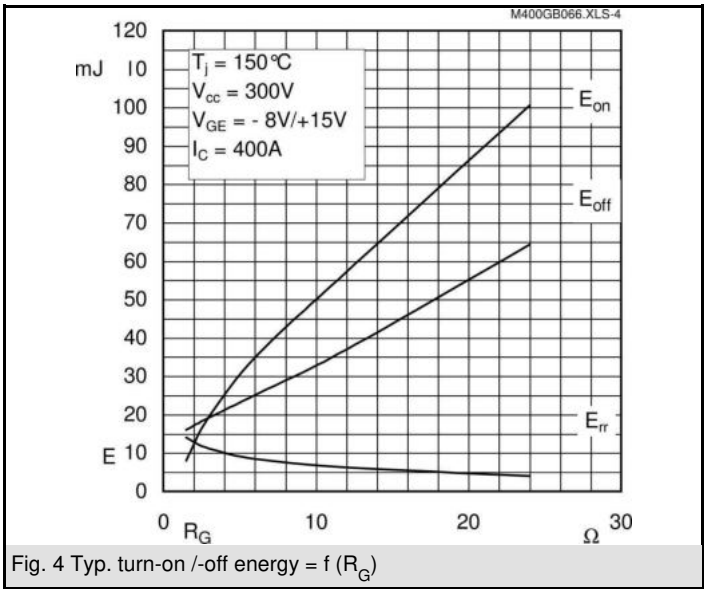


Fig. 4 Typ. turn-on /-off energy = f (R_G)

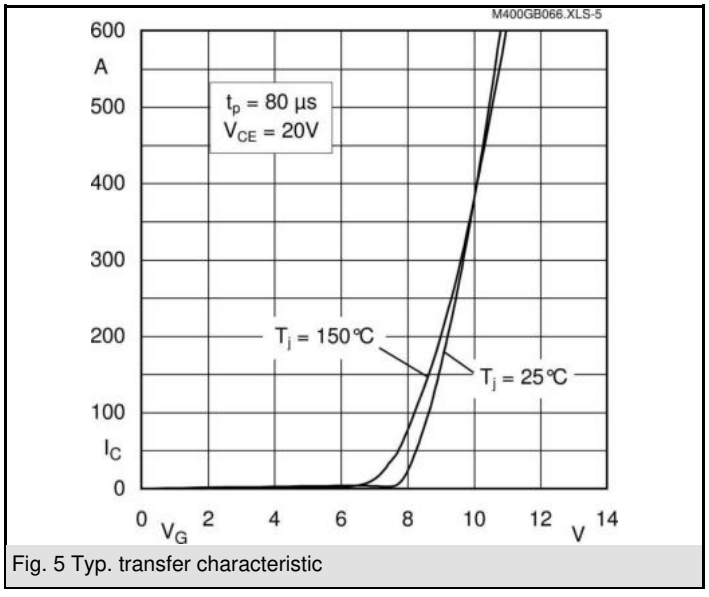


Fig. 5 Typ. transfer characteristic

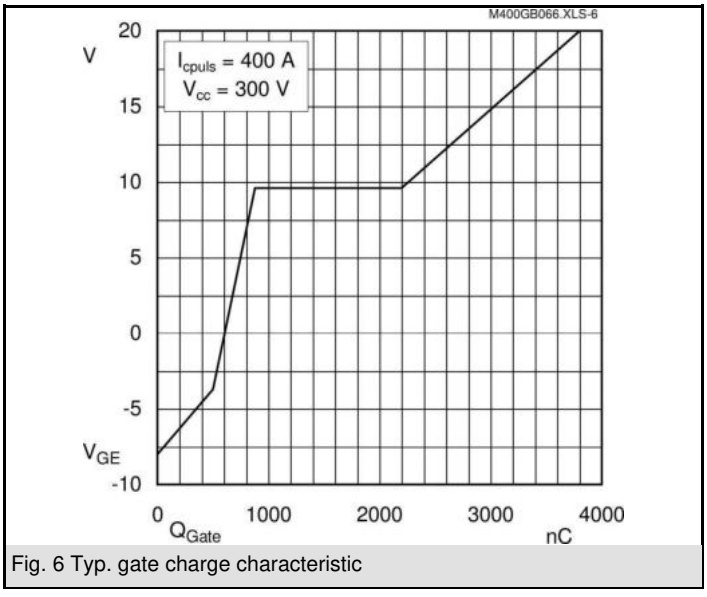


Fig. 6 Typ. gate charge characteristic

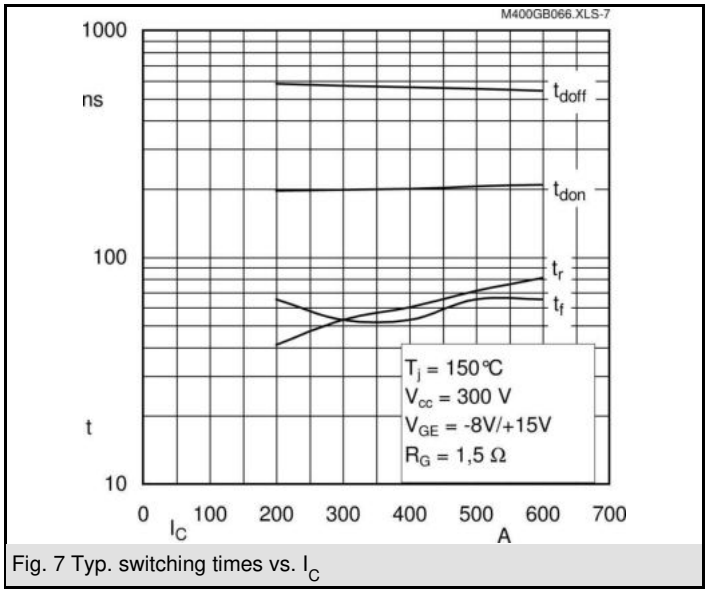


Fig. 7 Typ. switching times vs. I_C

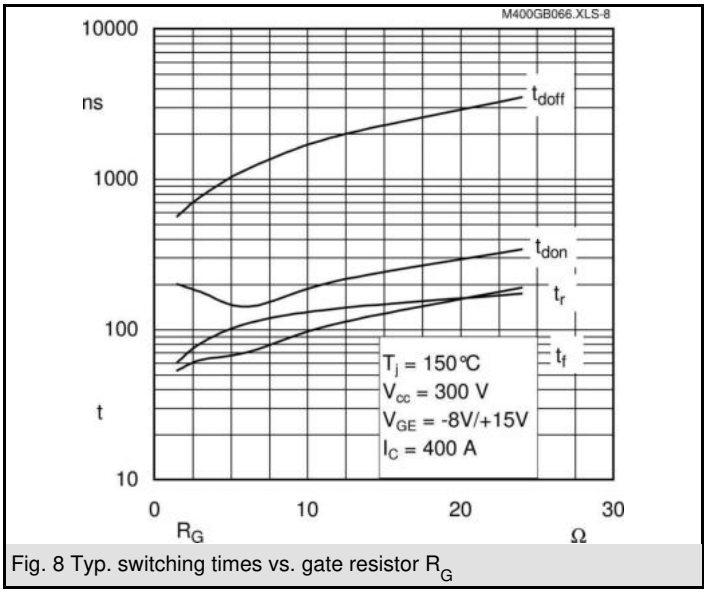


Fig. 8 Typ. switching times vs. gate resistor R_G

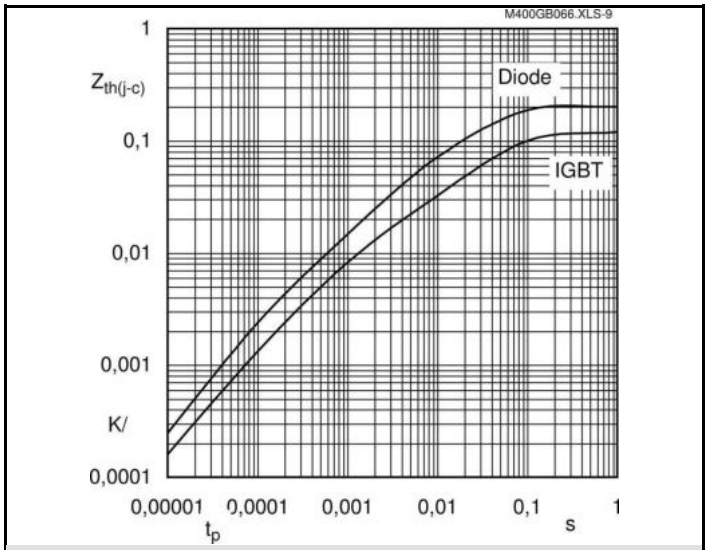


Fig. 9 Transient thermal impedance of IGBT and Diode

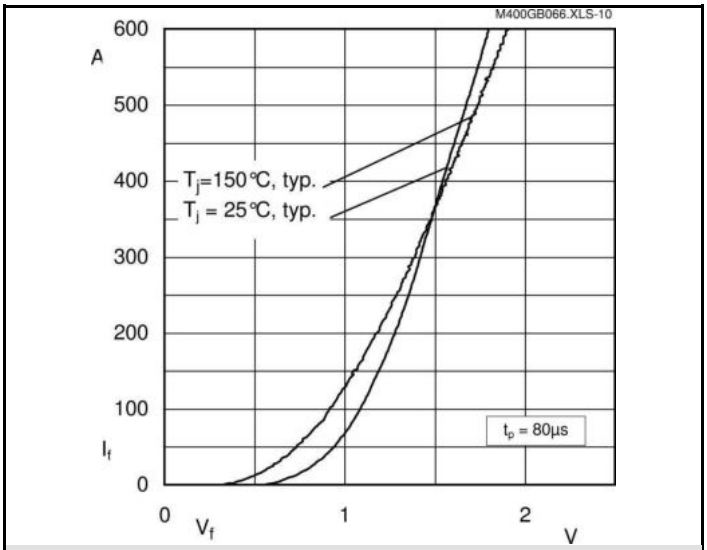


Fig. 10 CAL diode forward characteristic

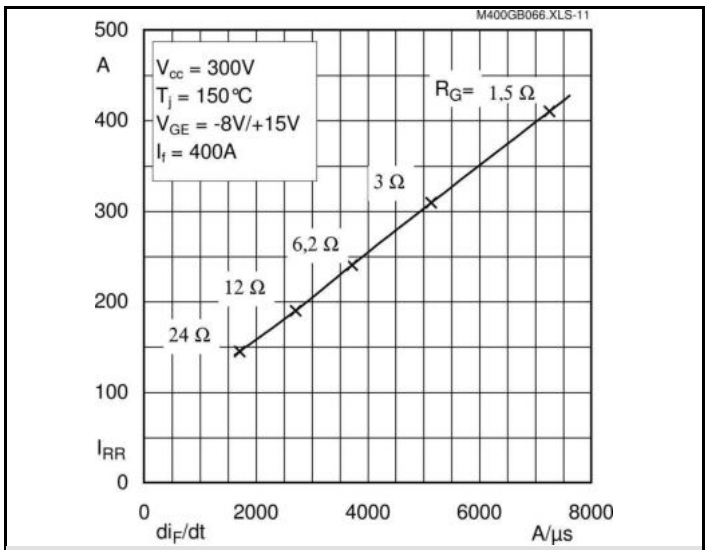


Fig. 11 Typ. CAL diode peak reverse recovery current

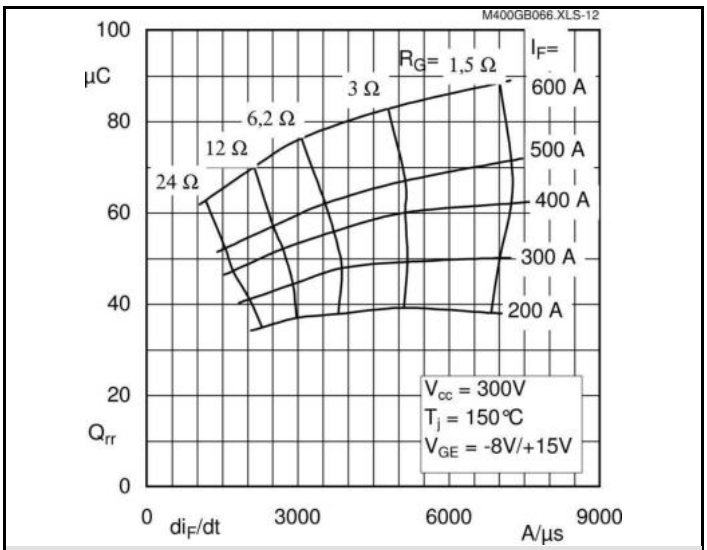
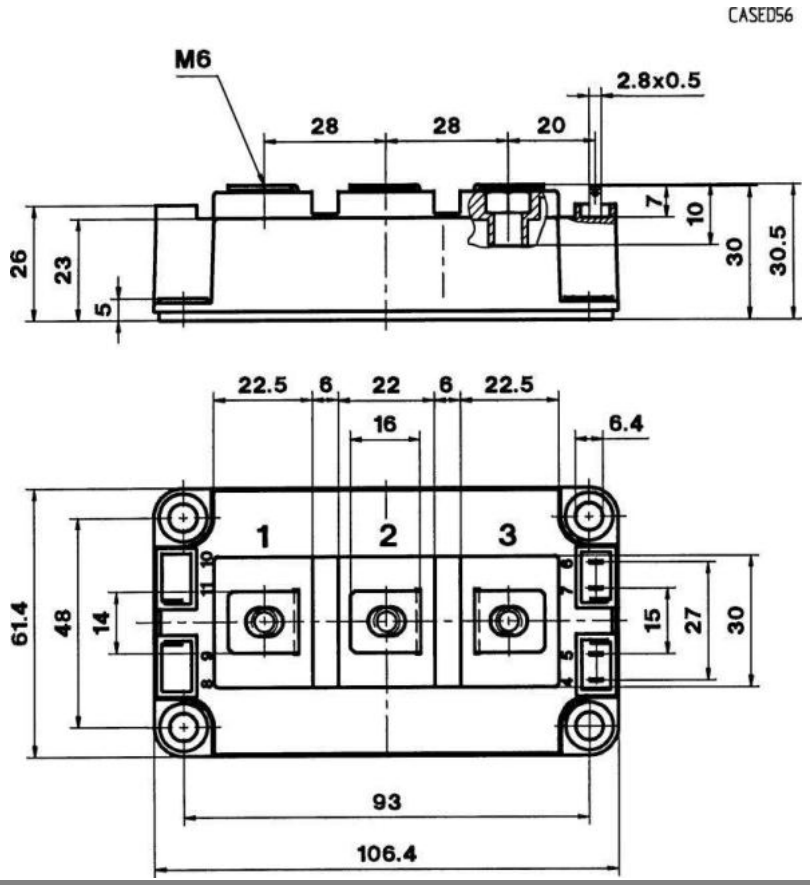


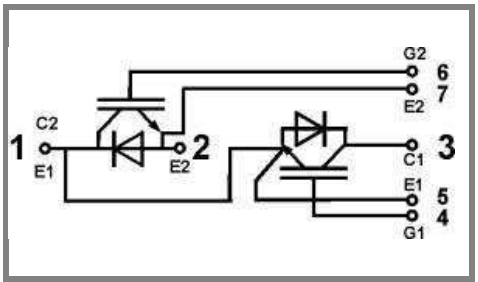
Fig. 12 Typ. CAL diode recovered charge

SKM 400GB066D

UL recognized, file no. E 63 532



Case D 56



GB Case D56

