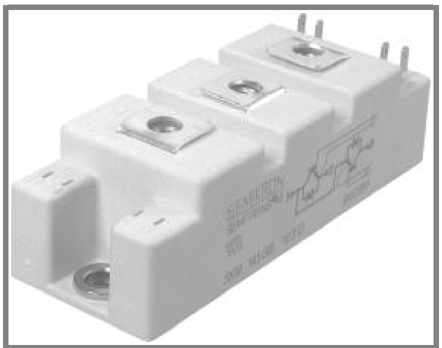


SEMITRANS® 2

Trench IGBT Modules

SKM 145GB176D

SKM 145GAL176D

Preliminary Data

Features

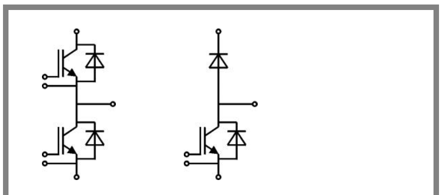
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_C

Typical Applications

- AC inverter drives mains 575 - 750 V AC
- Public transport (auxiliary systems

Remarks

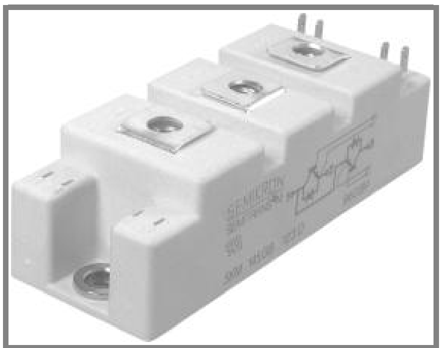
- Take care of over-voltage caused by stray inductances.
- Short circuit: Soft R_G necessary!



GB GAL

Absolute Maximum Ratings		T_{case} = 25°C, unless otherwise specified		
Symbol	**Conditions**		**Values**	**Units**
IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	T_j = 150 °C	T_{case} = 25 °C	160	A
		T_{case} = 80 °C	120	A
I_{CRM}	I_{CRM}=2xI_{Cnom}		200	A
V_{GES}			± 20	V
t_{psc}	V_{CC} = 1200 V; $V_{GE} \leq$ 20 V; V_{CES} < 1700 V	T_j = 125 °C	10	µs
Inverse Diode				
I_F	T_j = 150 °C	T_{case} = 25 °C	140	A
		T_{case} = 80 °C	100	A
I_{FRM}	I_{FRM}=2xI_{Fnom}		200	A
I_{FSM}	t_p = 10 ms; sin.	T_j = 150 °C	1400	A
Freewheeling Diode				
I_F	T_j = 150 °C	T_{case} = 25 °C	140	A
		T_{case} = 80 °C	100	A
I_{FRM}	I_{FRM}=2xI_{Fnom}		200	A
I_{FSM}	t_p = 10 ms; sin.	T_j = 150 °C	1400	A
Module				
$I_{t(RMS)}$			200	A
T_{vj}			- 40 ... +150	°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 = 3,5 mA		5,2	5,8	6,4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	T_j = 25 °C		0,1	0,3	mA
V_{CE0}		T_j = 25 °C		1	1,2	V
		T_j = 125 °C		0,9	1,1	V
r_{CE}	V_{GE} = 15 V	T_j = 25°C		10	12,5	mΩ
		T_j = 125°C		15		mΩ
$V_{CE(sat)}$	I_{Cnom} = 100 A, V_{GE} = 15 V	T_j = 25°$C_{chiplev.}$		2	2,45	V
		T_j = 125°$C_{chiplev.}$		2,4		V
C_{ies}	V_{CE} = 25, V_{GE} = 0 V	f = 1 MHz		7,1		nF
C_{oes}				0,37		nF
C_{res}				0,29		nF
Q_G	V_{GE} = -8V...+15V			800		nC
$t_{d(on)}$	R_{Gon} = 1 Ω	V_{CC} = 1200V		250		ns
t_r		I_{Cnom}= 100A		32		ns
E_{on}		T_j = 125 °C		60		mJ
$t_{d(off)}$	R_{Goff} = 1 Ω	V_{GE} = ± 15 V		630		ns
t_f				145		ns
E_{off}				38		mJ
$R_{th(j-c)}$	per IGBT				0,19	K/W



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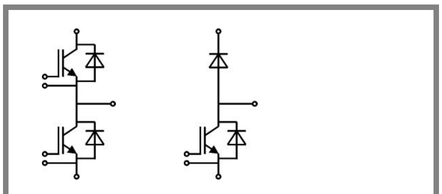
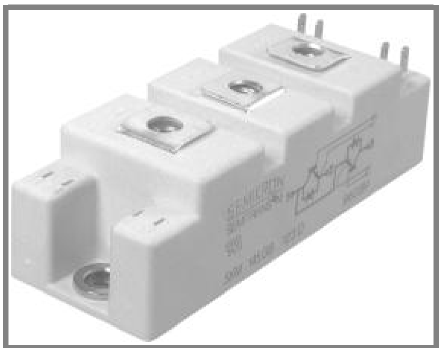


GB GAL

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
Inverse Diode						
$V_F = V_{EC}$	I_{Fnom} = 100 A; V_{GE} = 0 V	T_j = 25 °$C_{chiplev.}$		1,6	1,9	V
		T_j = 125 °$C_{chiplev.}$		1,6	1,9	V
V_{F0}		T_j = 25 °C		1,1	1,3	V
		T_j = 125 °C		0,9	1,1	V
r_F		T_j = 25 °C		5	6	mΩ
		T_j = 125 °C		7	8	mΩ
I_{RRM}	I_{Fnom} = 100 A	T_j = 125 °C		77		A
Q_{rr}	di/dt = 2450 A/µs			39,5		µC
E_{rr}	V_{GE} = -15 V; V_{CC} = 1200 V			27,5		mJ
$R_{th(j-c)D}$	per diode				0,36	K/W
Freewheeling Diode						
$V_F = V_{EC}$	I_{Fnom} = 100 A; V_{GE} = 0 V	T_j = 25 °$C_{chiplev.}$		1,6	1,9	V
		T_j = 125 °$C_{chiplev.}$		1,6	1,9	V
V_{F0}		T_j = 25 °C		1,1	1,3	V
		T_j = 125 °C		0,9	1,1	V
r_F		T_j = 25 °C		5	6	V
		T_j = 125 °C		7	8	V
I_{RRM}	I_{Fnom} = 100 A	T_j = 125 °C		77		A
Q_{rr}	di/dt = 2450 A/µs			39,5		µC
E_{rr}	V_{GE} = -15 V; V_{CC} = 1200 V			27,5		mJ
$R_{th(j-c)FD}$	per diode				0,36	K/W
Module						
L_{CE}					30	nH
$R_{CC'+EE'}$	res., terminal-chip	T_{case}= 25 °C		0,75		mΩ
		T_{case}= 125 °C		1		mΩ
$R_{th(c-s)}$	per module				0,05	K/W
M_s	to heat sink M6		3		5	Nm
M_t	to terminals M5		2,5		5	Nm
w					160	g

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



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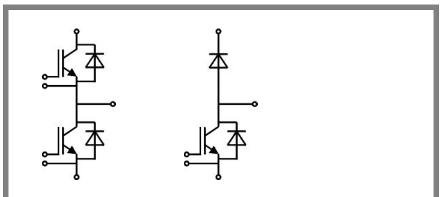

GB GAL

Z_{th} Symbol	Conditions	Values	Units
$Z_{th(j-c)I}$			
R_i	i = 1	115	mk/W
R_i	i = 2	38,5	mk/W
R_i	i = 3	5,7	mk/W
R_i	i = 4	0,8	mk/W
tau_i	i = 1	0,0306	s
tau_i	i = 2	0,0852	s
tau_i	i = 3	0,004	s
tau_i	i = 4	0,0003	s
$Z_{th(j-c)D}$			
R_i	i = 1	190	mk/W
R_i	i = 2	80	mk/W
R_i	i = 3	25	mk/W
R_i	i = 4	5	mk/W
tau_i	i = 1	0,0475	s
tau_i	i = 2	0,0163	s
tau_i	i = 3	0,0011	s
tau_i	i = 4	0,0002	s

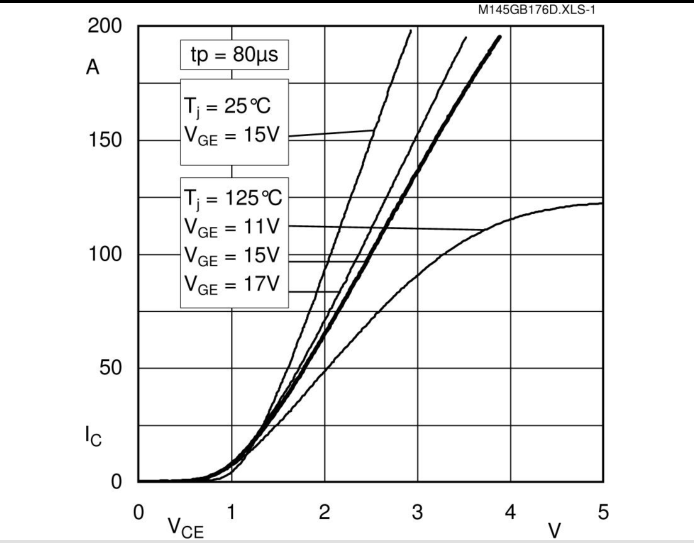

Fig. 1 Typ. output characteristic, inclusive $R_{CC'+ EE'}$

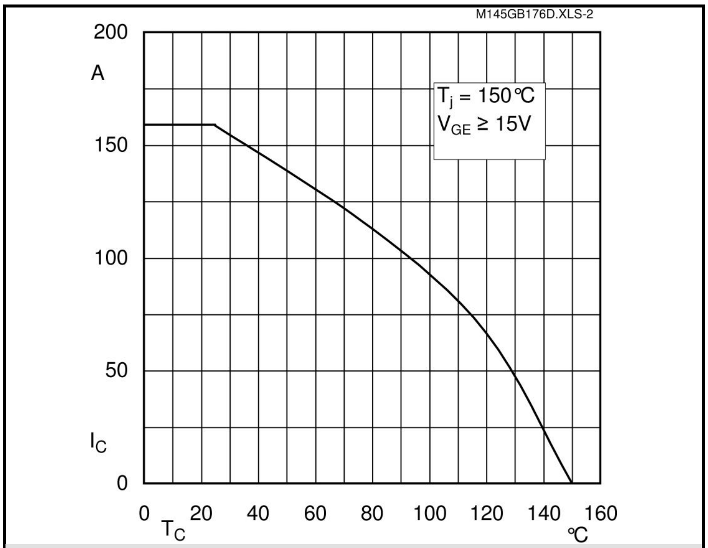

Fig. 2 Rated current vs. temperature $I_C = f (T_C)$

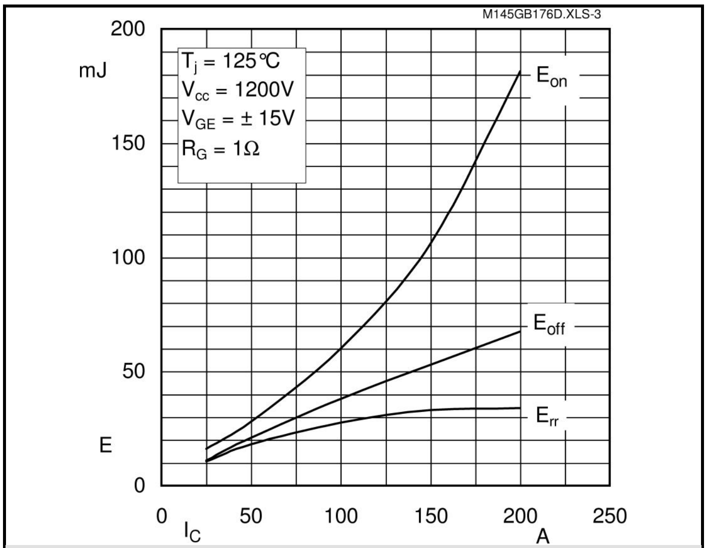

Fig. 3 Typ. turn-on /-off energy = f (I_C)

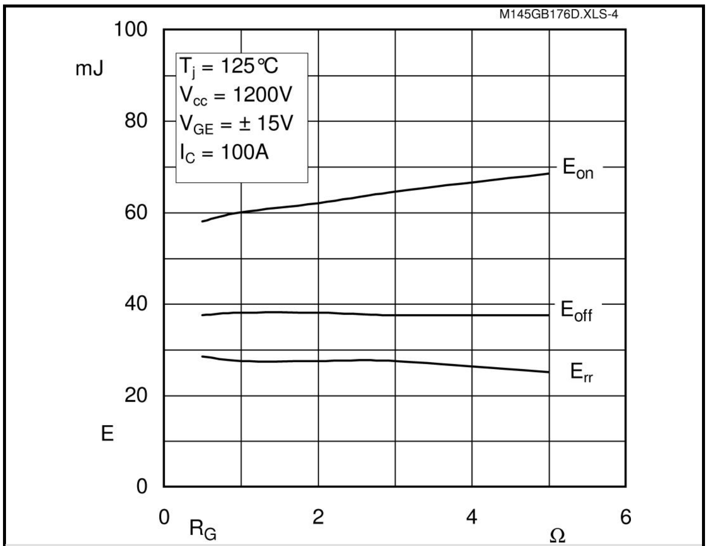

Fig. 4 Typ. turn-on /-off energy = f (R_G)

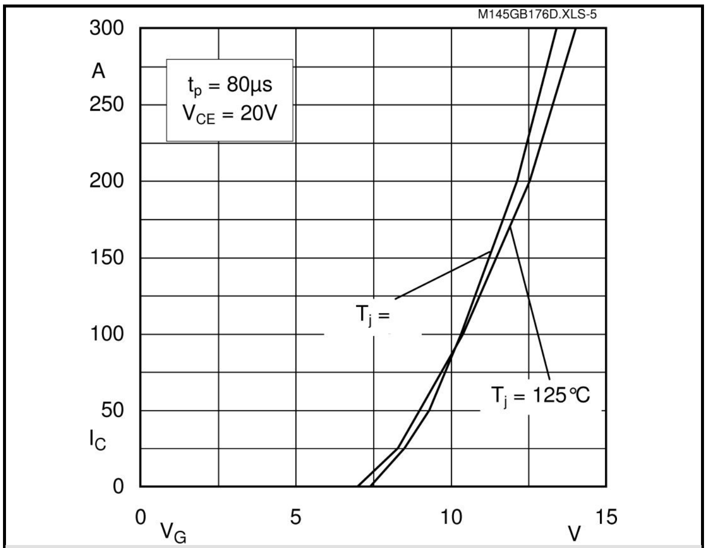

Fig. 5 Typ. transfer characteristic

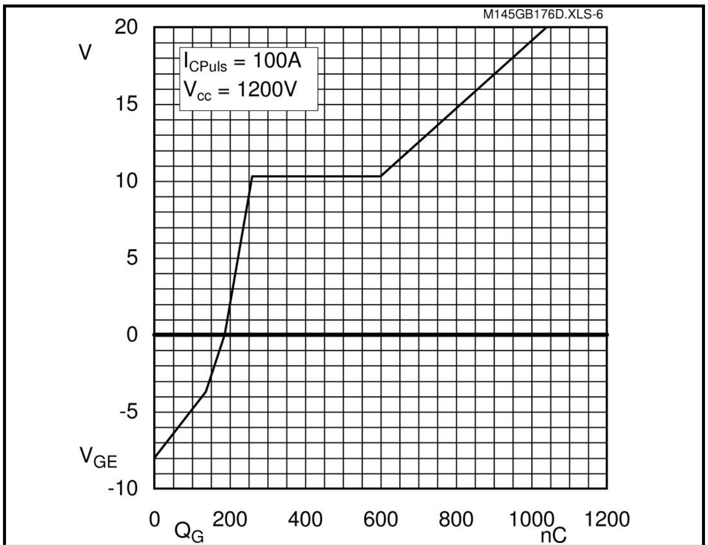

Fig. 6 Typ. gate charge characteristic

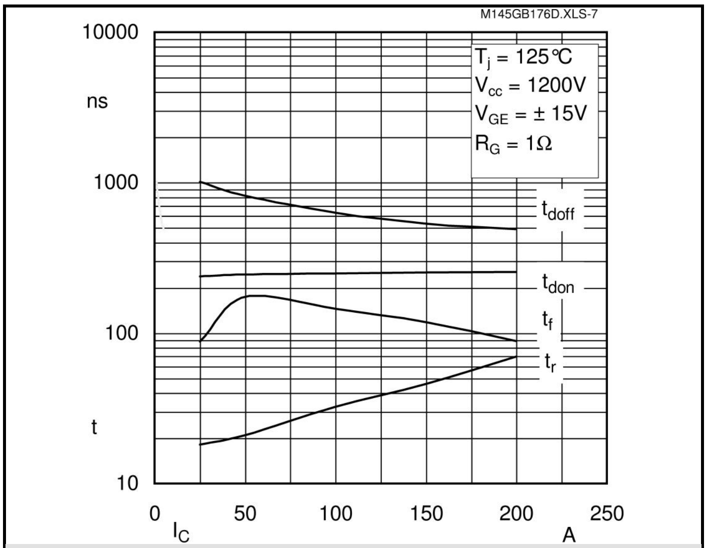

Fig. 7 Typ. switching times vs. I_C

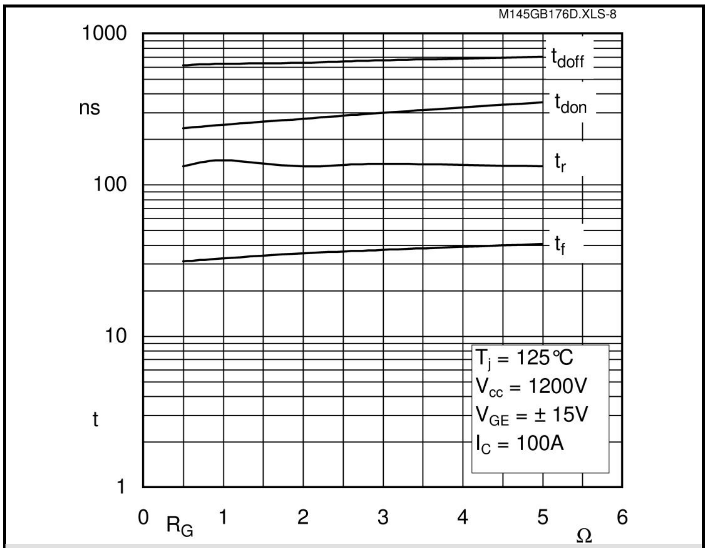

Fig. 8 Typ. switching times vs. gate resistor R_G

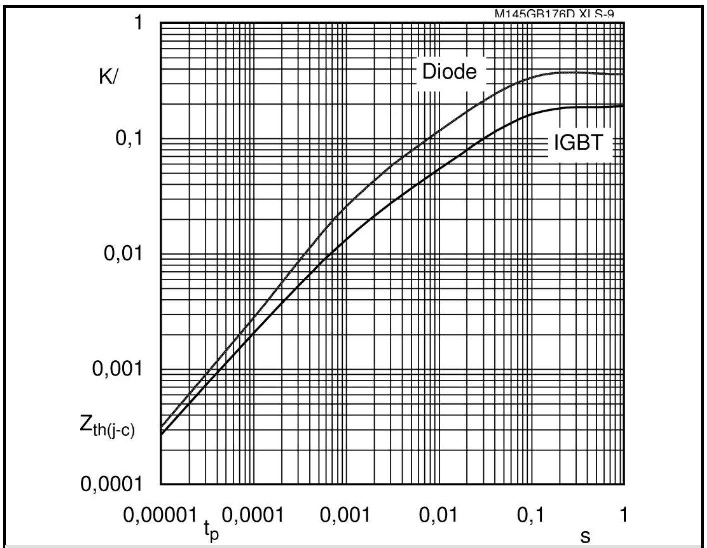

Fig. 9 Transient thermal impedance of IGBT and Diode

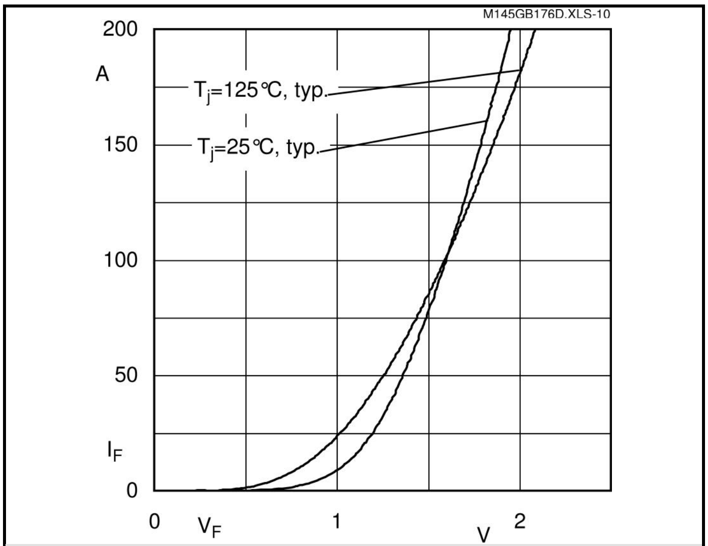

Fig. 10 CAL diode forward characteristic

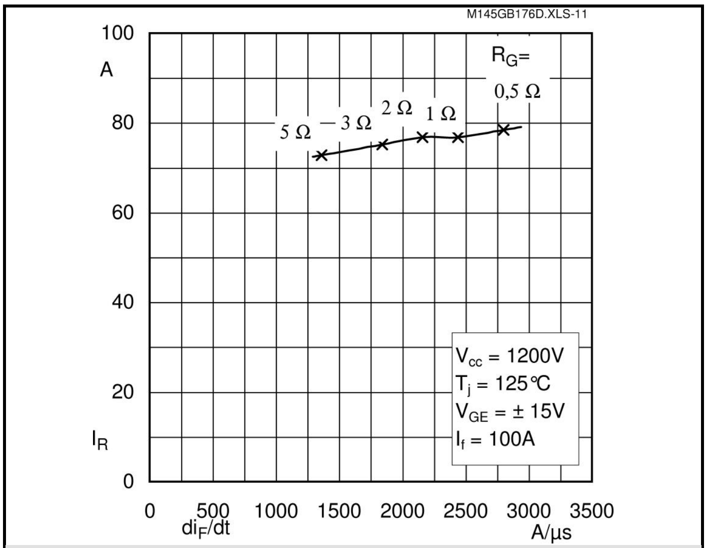

Fig. 11 Typ. CAL diode peak reverse recovery current

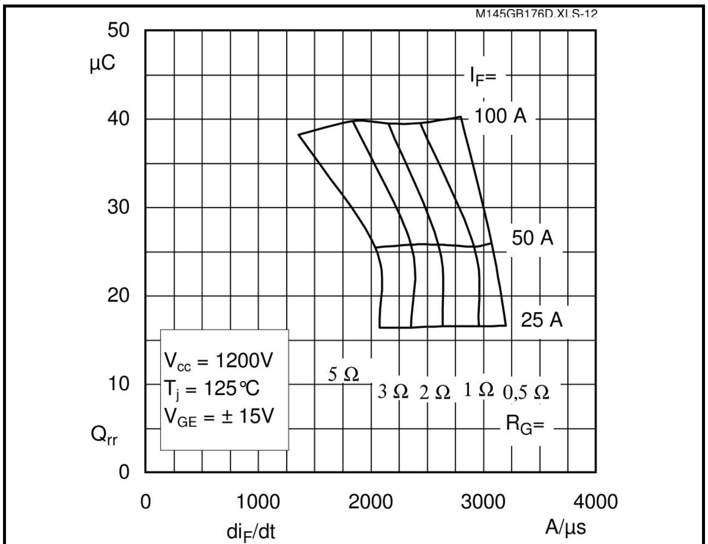

Fig. 12 Typ. CAL diode recovered charge

UL Recognized

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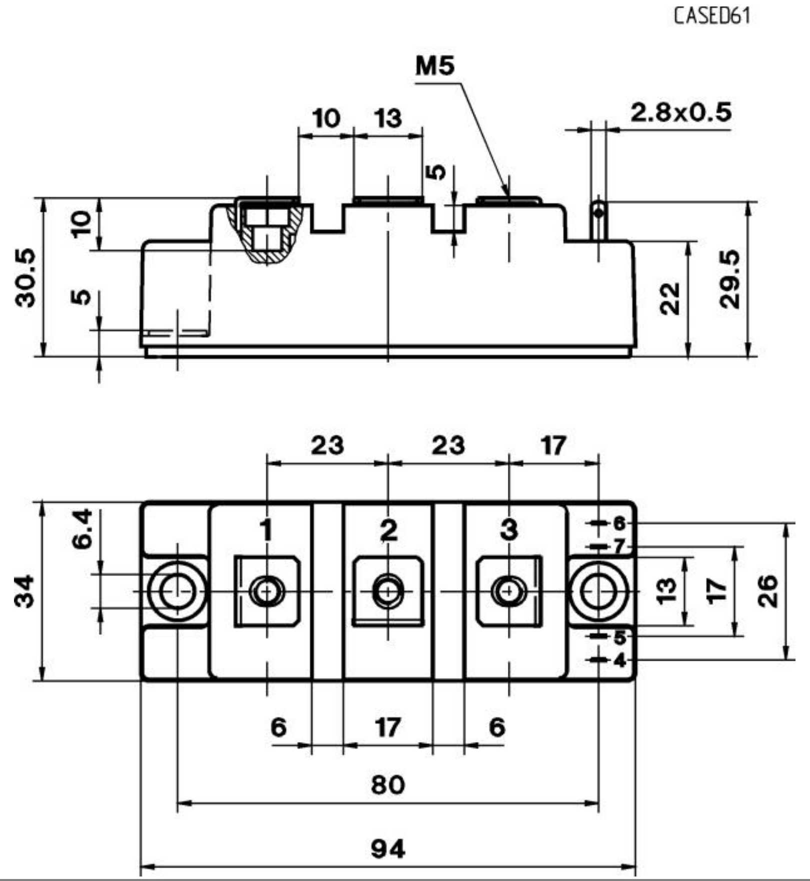
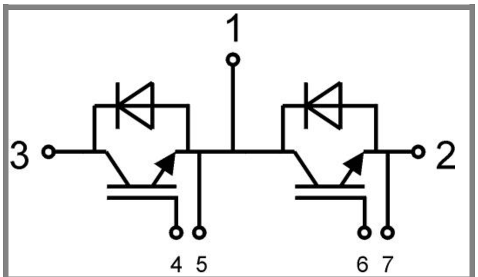
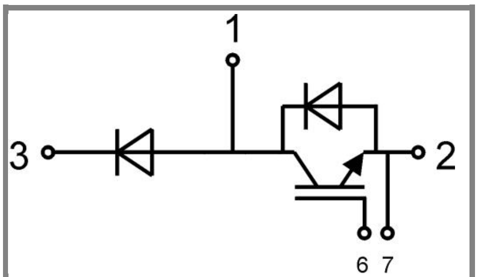


Case D 61



GB Case D 61



GAL Case D 62

