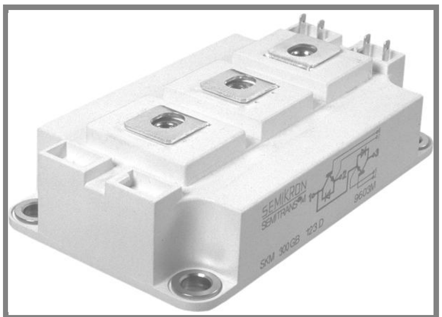
SKM 400GB176D ...



SEMITRANS™ 3

Trench IGBT Modules

SKM 400GB176D

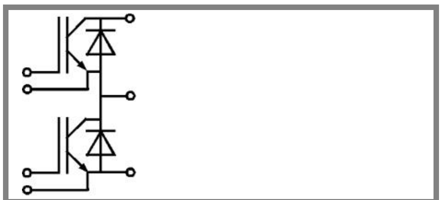
Preliminary Data

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 syst.)
- Wind power



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Absolute Maximum Ratings		T_{case} = 25°C, unless otherwise specified	
Symbol	**Conditions**	**Values**	**Units**
IGBT			
V_{CES}		1700	V
I_C	T_{case} = 25 (80) °C	490 (350)	A
I_{CRM}	T_{case} = 25 (80) °C, t_p = 1 ms	980 (700)	A
V_{GES}		± 20	V
T_{vj}, (T_{stg})	$T_{OPERATION} \leq T_{stg}$	- 40 ... + 125	°C
V_{isol}	AC, 1 min.	4000	V
Inverse diode			
I_F = - I_C	T_{case} = 25 (80) °C	420 (280)	A
I_{FRM}	T_{case} = 25 (80) °C, t_p = 1 ms	980 (700)	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 25 °C		A
Freewheeling diode			
I_F = - I_C	T_{case} = °C		A
I_{FRM}	T_{case} = () °C, t_p = ms		A
I_{FSM}	t_p = ms; ; T_j = °C		A

Characteristics			T_{case} = 25°C, unless otherwise specified		
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Units**
IGBT					
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 12 mA	5,2	5,8	6,4	V
I_{CES}	V_{GE} = 0, V_{CE} = V_{CES}, T_j = 25 (125) °C			2,4	mA
$V_{CE(TO)}$	T_j = 25 (125) °C		1 (0,9)	1,2 (1,1)	V
r_{CE}	V_{GE} = V, T_j = 25 (125) °C		3,3 (5,2)	4,2 (6)	mΩ
$V_{CE(sat)}$	I_C = 300 A, V_{GE} = 15 V, chip level		2 (2,45)	2,45 (2,9)	V
C_{ies}	under following conditions		13,2		nF
C_{oes}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz		0,6		nF
C_{res}			0,5		nF
L_{CE}				20	nH
$R_{CC'+EE'}$	resistance, terminal-chip T_c= 25 (125) °C		0,35 (0,5)		mΩ
$t_{d(on)}$	V_{CC} = 1200 V, I_C = 300 A		330		ns
t_r	R_{Gon} = R_{Goff} = 4 Ω, T_j = 125 °C		55		ns
$t_{d(off)}$	V_{GE} ± 15 V		880		ns
t_f			145		ns
E_{on} (E_{off})			170 (118)		mJ
Inverse diode					
V_F = V_{EC}	I_F = 300 A; V_{GE} = 0 V; T_j = 125 () °C		1,7 (1,8)	1,9 (2)	V
$V_{T(TO)}$	T_j = 25 (125) °C		1,2 (0,9)	1,4 (1,1)	V
r_T	T_j = 25 (125) °C		1,7 (3)	1,7 (3)	mΩ
I_{RRM}	I_F = 300 A; T_j = 125 ( ) °C		418		A
Q_{rr}	di/dt = A/µs		117		µC
E_{rr}	V_{GE} = 0 V		78		mJ
FWD					
V_F = V_{EC}	I_F = A; V_{GE} = V, T_j = () °C				V
V_{TO}	T_j = () °C				V
r_T	T_j = () °C				mΩ
I_{RRM}	I_F = A; T_j = ( ) °C				A
Q_{rr}	V_{GE} = V				µC
E_{rr}					mJ
Thermal characteristics					
$R_{th(j-c)}$	per IGBT			0,06	K/W
$R_{th(j-c)D}$	per Inverse Diode			0,125	K/W
$R_{th(j-c)FD}$	per FWD				K/W
$R_{th(c-s)}$	per module			0,038	K/W
Mechanical data					
M_s	to heatsink (M6)	3		5	Nm
M_t	for terminals (M5)	2,5		5	Nm
w				325	g

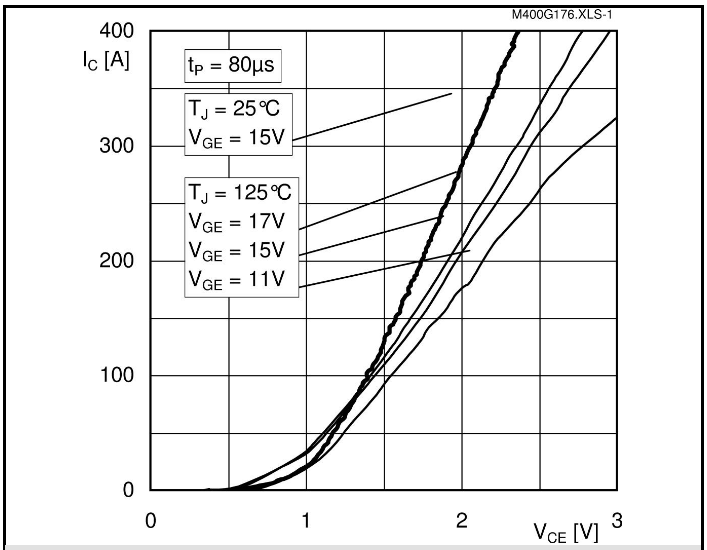


Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

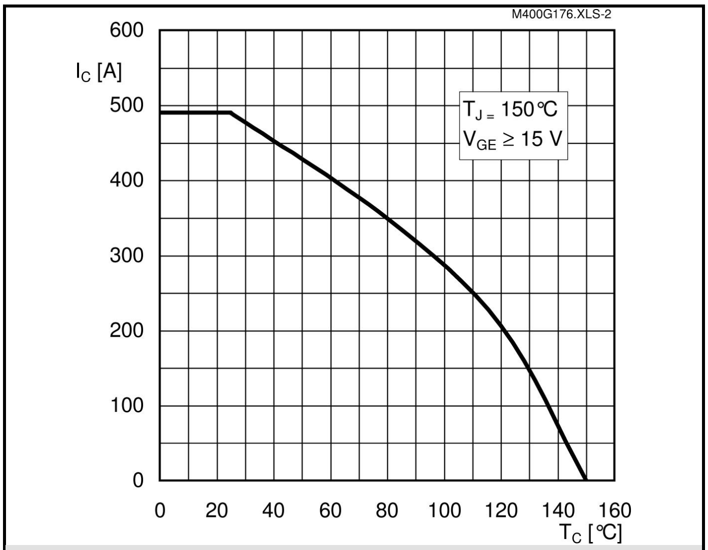


Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

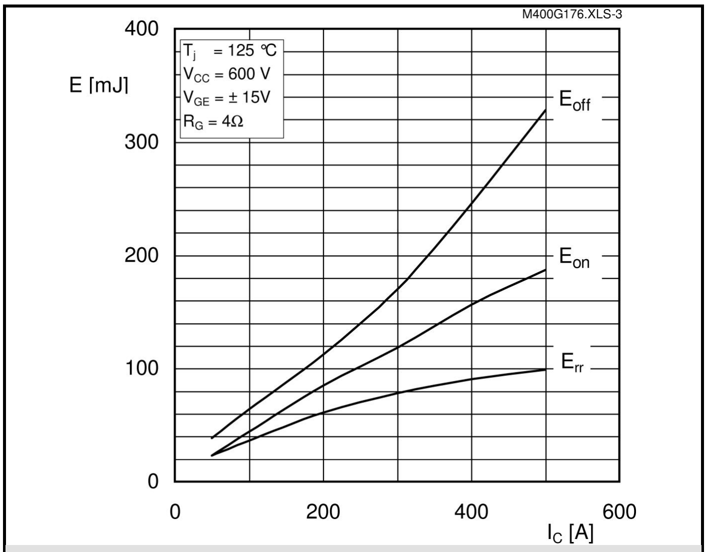


Fig. 3 Typ. turn-on /-off energy = f (I_C)

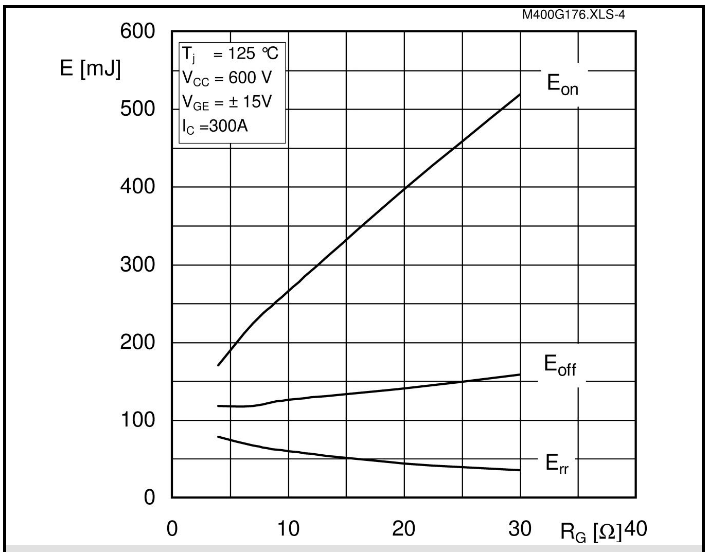


Fig. 4 Typ. turn-on /-off energy = f (R_G)

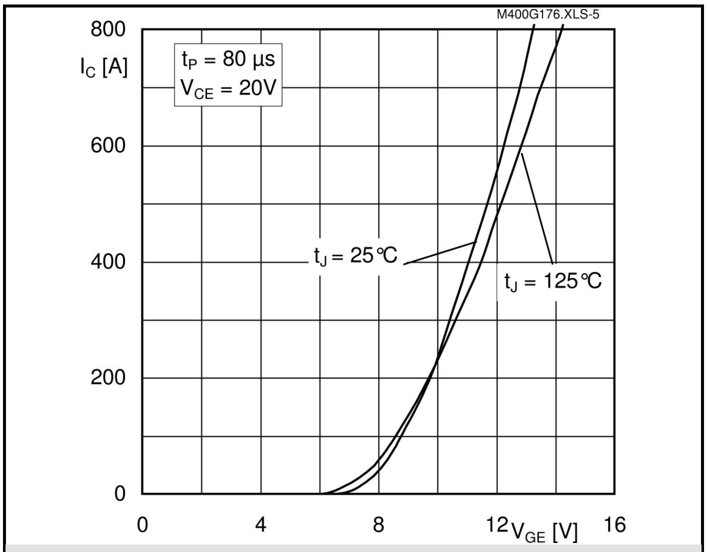


Fig. 5 Typ. transfer characteristic

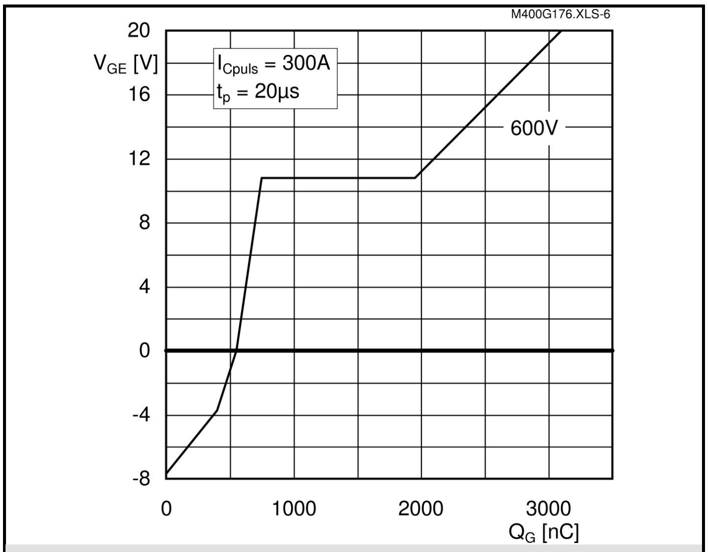


Fig. 6 Typ. gate charge characteristic

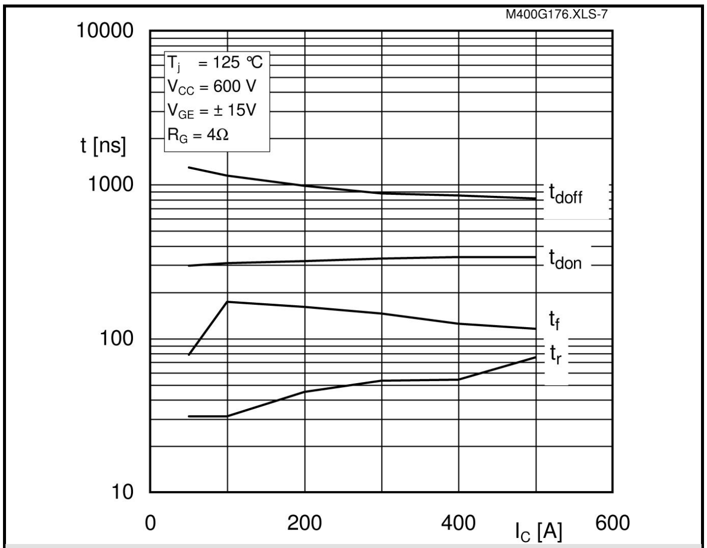


Fig. 7 Typ. switching times vs. I_C

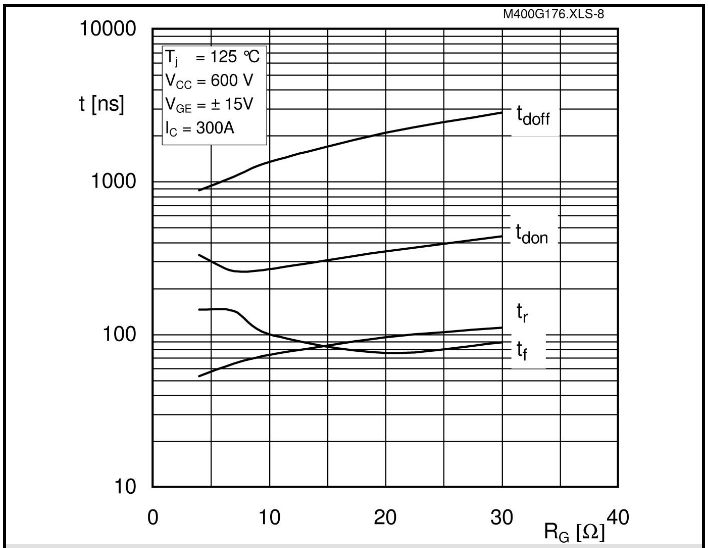


Fig. 8 Typ. switching times vs. gate resistor R_G

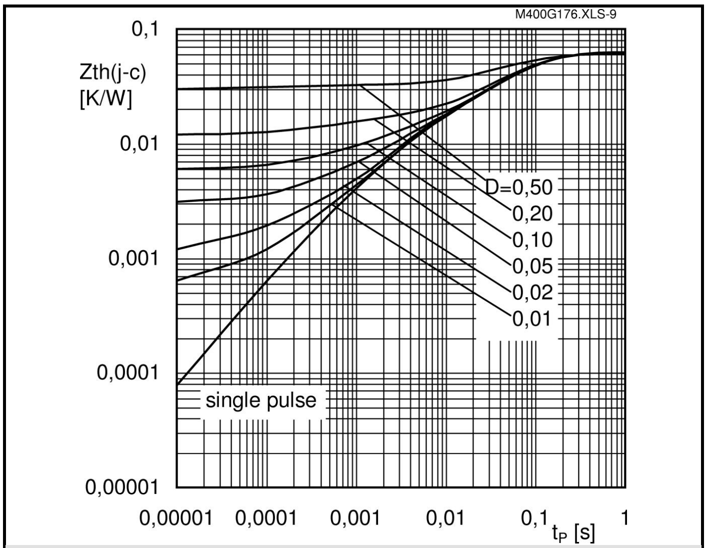


Fig. 9 Transient thermal impedance of IGBT

$Z_{thp(j-c)} = f(t_p)$; $D = t_p/t_c = t_p$*f

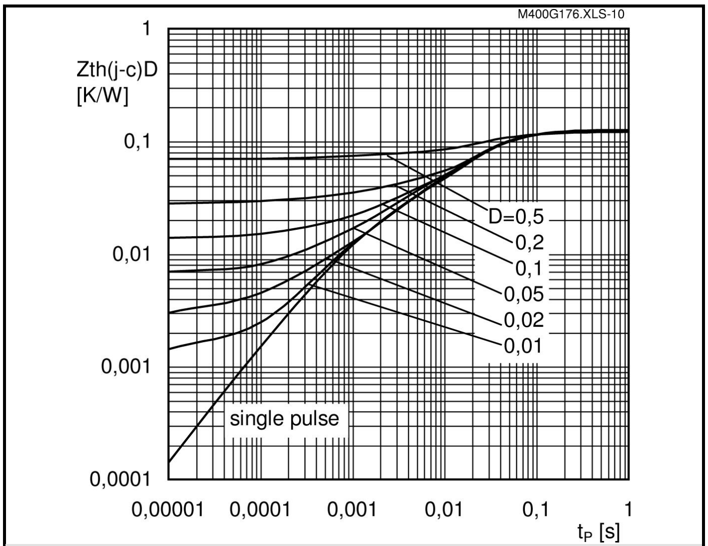


Fig. 10 Transient thermal impedance of FWD

$Z_{thp(j-c)} = f(t_p)$; $D = t_p/t_c = t_p$*f

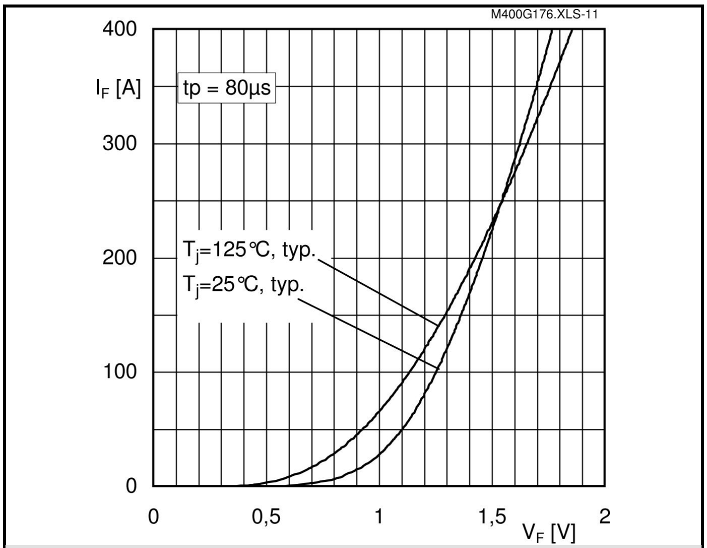


Fig. 11 CAL diode forward characteristic

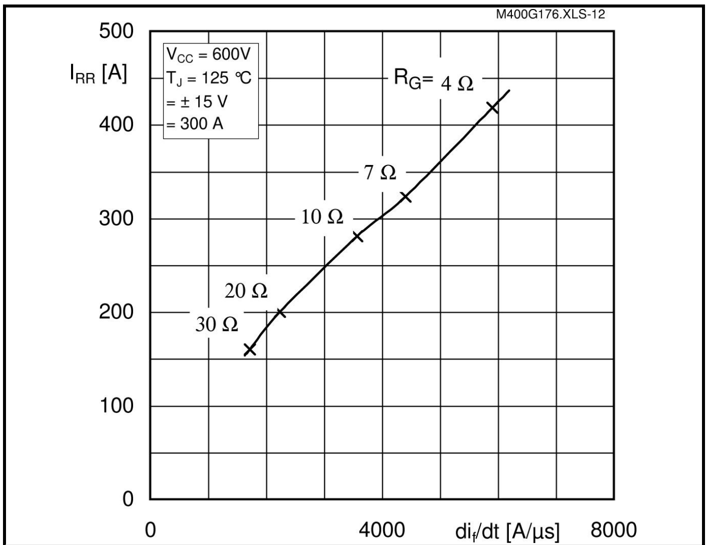


Fig. 12 Typ. CAL diode peak reverse recovery current

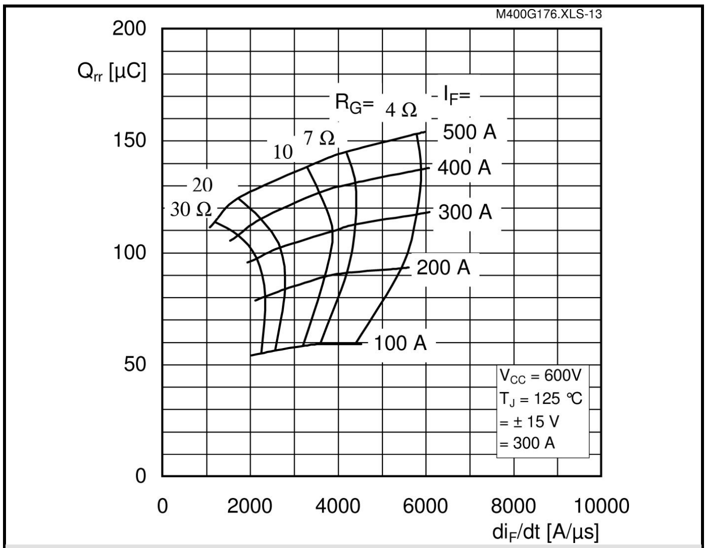
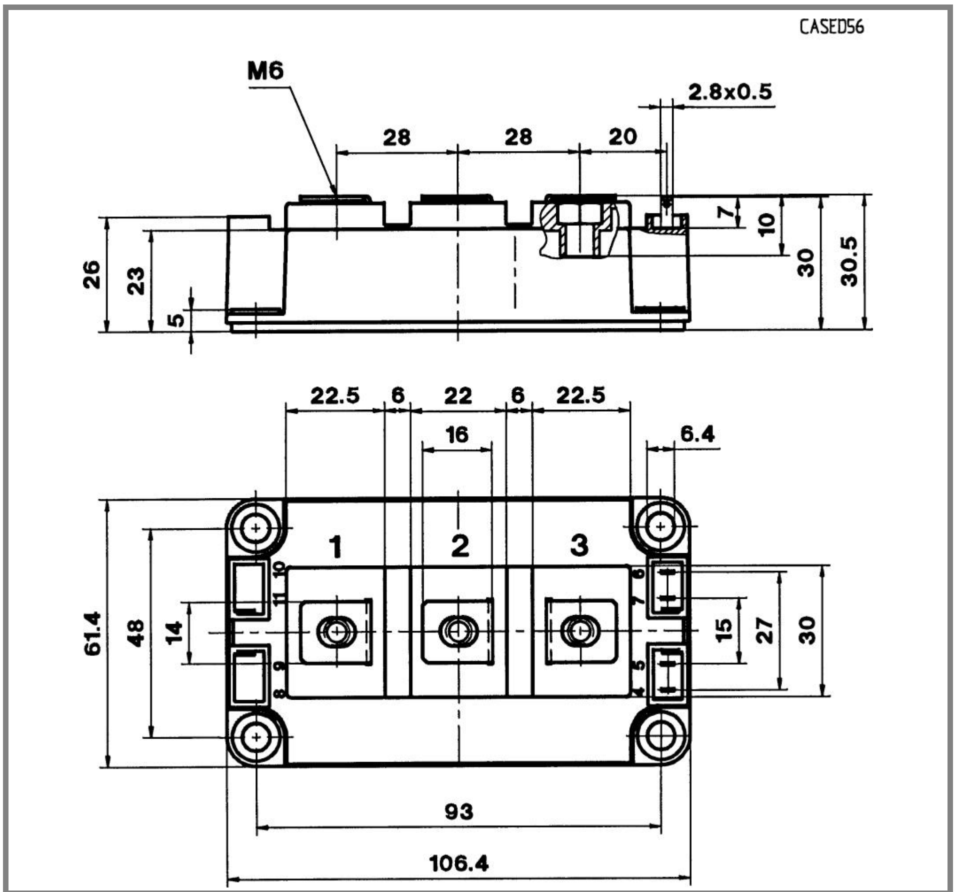
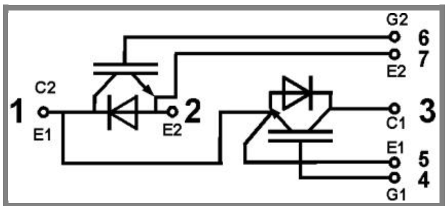


Fig. 13 Typ. CAL diode recovered charge



Case D 56



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

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