

# SKM 500GA123D



**SEMITRANS® 4**

## IGBT Modules

**SKM 500GA123D**

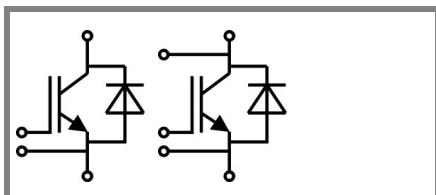
**SKM 500GA123DS**

### Features

- MOS input (voltage controlled)
- N channel, homogeneous Si
- Low inductance case
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to  $6 \times I_{Cnom}$
- Latch-up free
- Fast & soft CAL diodes
- Isolated copper baseplate using DBC Direct Copper Bonding Technology
- Large clearance (12 mm) and creepage distances (20 mm)

### Typical Applications

- AC inverter drives
- UPS



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Absolute Maximum Ratings		$T_c = 25^\circ\text{C}$ , unless otherwise specified			
Symbol	Conditions	Values		Units	
<b>IGBT</b>					
$V_{CES}$	$T_j = 25^\circ\text{C}$	1200		V	
$I_C$	$T_j = 150^\circ\text{C}$	$T_{case} = 25^\circ\text{C}$	500	A	
		$T_{case} = 80^\circ\text{C}$	420	A	
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	800		A	
$V_{GES}$		$\pm 20$		V	
$t_{psc}$	$V_{CC} = 600\text{ V}; V_{GE} \leq 20\text{ V}; T_j = 125^\circ\text{C}$ $V_{CES} < 1200\text{ V}$	10		$\mu\text{s}$	
<b>Inverse Diode</b>					
$I_F$	$T_j = 150^\circ\text{C}$	$T_{case} = 25^\circ\text{C}$	500	A	
		$T_{case} = 80^\circ\text{C}$	350	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800		A	
$I_{FSM}$	$t_p = 10\text{ ms}; \text{sin.}$	$T_j = 150^\circ\text{C}$	3600		A
<b>Module</b>					
$I_{t(RMS)}$		500		A	
$T_{vj}$		- 40 ... + 150		$^\circ\text{C}$	
$T_{stg}$		- 40 ... + 125		$^\circ\text{C}$	
$V_{isol}$	AC, 1 min.	2500		V	

Characteristics		$T_c = 25^\circ\text{C}$ , unless otherwise specified					
Symbol	Conditions	min.	typ.	max.	Units		
<b>IGBT</b>							
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 16\text{ mA}$	4,5	5,5	6,5	V		
$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = V_{CES}$	$T_j = 25^\circ\text{C}$		0,1	0,3	mA	
$V_{CE0}$		$T_j = 25^\circ\text{C}$		1,4	1,6	V	
		$T_j = 125^\circ\text{C}$		1,6	1,8	V	
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$		2,75	3,5	$\text{m}\Omega$	
		$T_j = 125^\circ\text{C}$		3,75	4,75	$\text{m}\Omega$	
$V_{CE(sat)}$	$I_{Cnom} = 400\text{ A}, V_{GE} = 15\text{ V}$	$T_j = ^\circ\text{C}_{chiplev.}$		2,5	3	V	
$C_{ies}$	$V_{CE} = 25, V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		26	40	nF	
$C_{oes}$				4	5,2	nF	
$C_{res}$				2	2,6	nF	
$R_{Gint}$	$T_j = ^\circ\text{C}$			1,25		$\Omega$	
$t_{d(on)}$	$R_{Gon} = 3,3\ \Omega$	$V_{CC} = 600\text{ V}$ $I_{Cnom} = 400\text{ A}$			250	600	ns
$t_r$					170	340	ns
$E_{on}$	$R_{Goff} = 3,3\ \Omega$	$T_j = 125^\circ\text{C}$ $V_{GE} = \pm 15\text{ V}$			45		mJ
$t_{d(off)}$					900	1100	ns
$t_f$					100	125	ns
$E_{off}$							mJ
$R_{th(j-c)}$	per IGBT			0,041		K/W	



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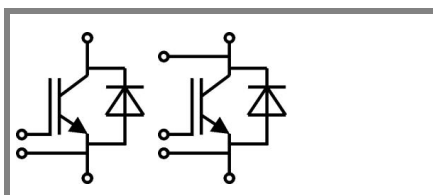
SKM 500GA123DS

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Characteristics			min.	typ.	max.	Units
<b>Inverse Diode</b>						
$V_F = V_{EC}$	$I_{Fnom} = 400 \text{ A}; V_{GE} = 0 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}_{\text{chiplev.}}$ $T_j = 125 \text{ }^\circ\text{C}_{\text{chiplev.}}$		2 1,8	2,5	V V
$V_{F0}$		$T_j = 25 \text{ }^\circ\text{C}$ $T_j = 125 \text{ }^\circ\text{C}$		1,1	1,2	V V
$r_F$		$T_j = 25 \text{ }^\circ\text{C}$ $T_j = 125 \text{ }^\circ\text{C}$		2,3	3,3	mΩ mΩ
$I_{RRM}$ $Q_{rr}$ $E_{rr}$	$I_{Fnom} = 400 \text{ A}$ $di/dt = 2000 \text{ A}/\mu\text{s}$ $V_{GE} = 0 \text{ V}; V_{CC} = 600 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$		90 15		A μC mJ
$R_{th(j-c)D}$	per diode				0,09	K/W
<b>Freewheeling Diode</b>						
$V_F = V_{EC}$	$I_{Fnom} = \text{A}; V_{GE} = \text{V}$	$T_j = \text{ }^\circ\text{C}_{\text{chiplev.}}$				V
$V_{F0}$		$T_j = 25 \text{ }^\circ\text{C}$ $T_j = 125 \text{ }^\circ\text{C}$				V V
$r_F$		$T_j = 25 \text{ }^\circ\text{C}$ $T_j = 125 \text{ }^\circ\text{C}$				V V
$I_{RRM}$ $Q_{rr}$ $E_{rr}$	$I_{Fnom} = \text{A}$ $V_{GE} = 0 \text{ V}; V_{CC} = 600 \text{ V}$	$T_j = \text{ }^\circ\text{C}$				A μC mJ
	per diode					K/W
<b>Module</b>						
$L_{CE}$				15	20	nH
$R_{CC+EE}$	res., terminal-chip	$T_{case} = 25 \text{ }^\circ\text{C}$ $T_{case} = 125 \text{ }^\circ\text{C}$		0,18 0,22		mΩ 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 (M4)			2,5 (1,1)	5 (2)	Nm
w					330	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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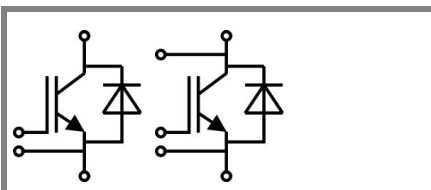
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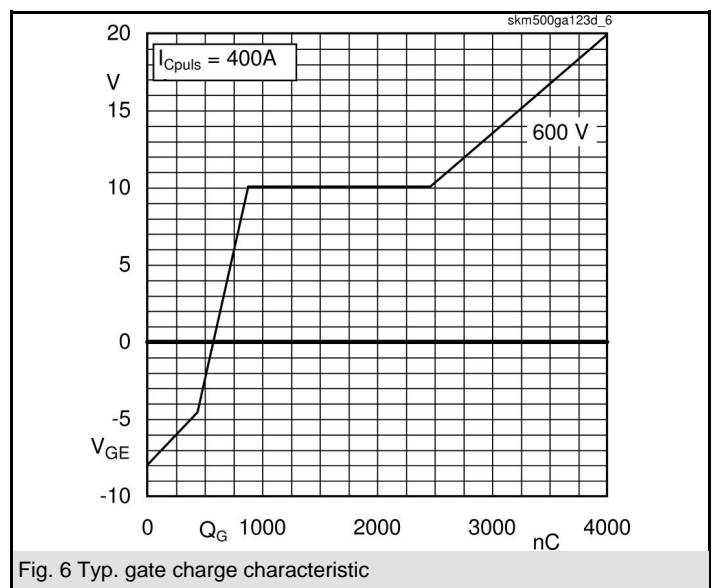
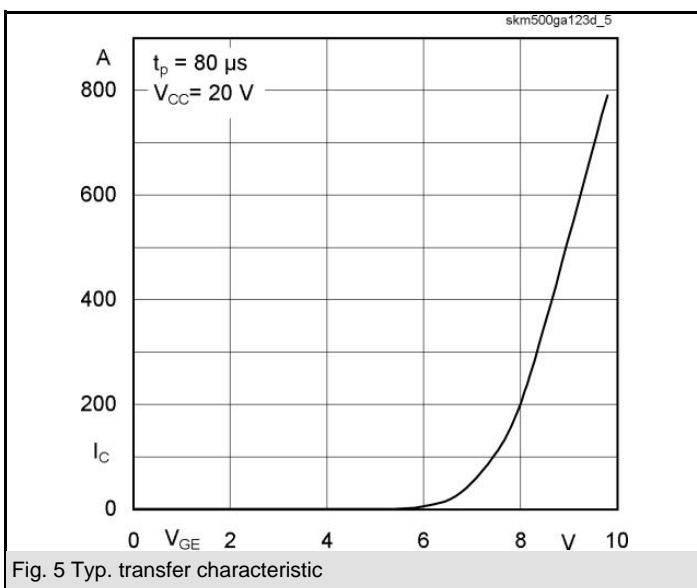
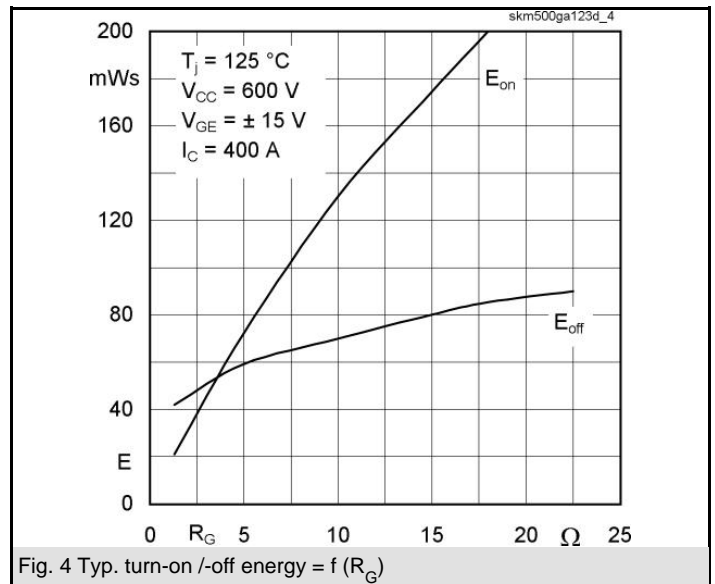
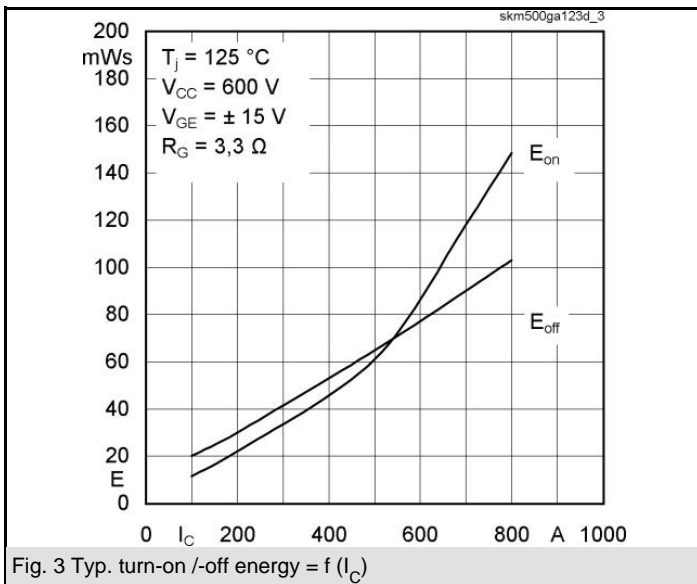
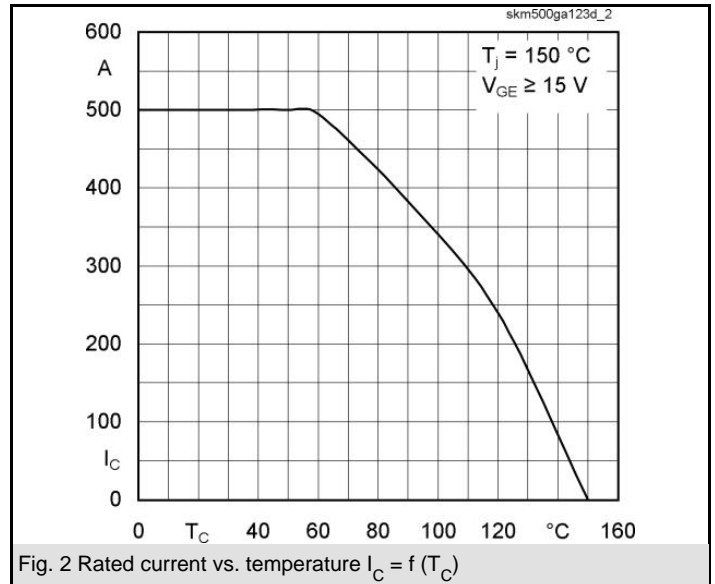
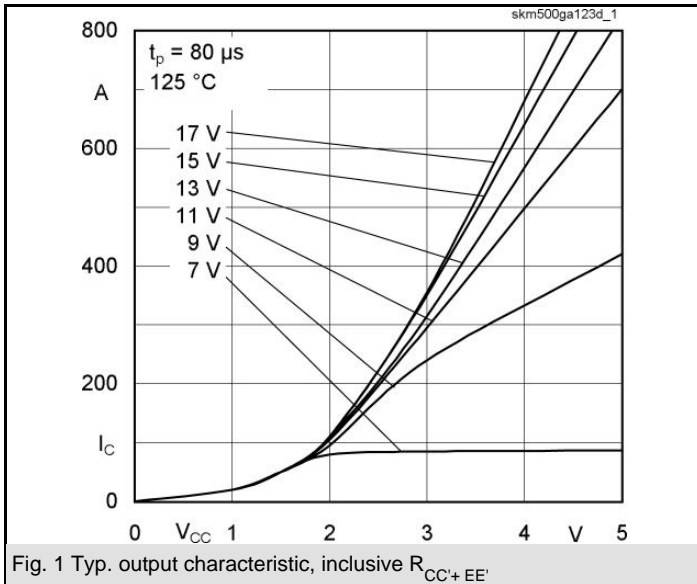
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$Z_{th}$		Conditions	Values	Units
<b>Symbol</b>				
$Z_{th(j-c)I}$				
$R_{\theta j-c1}$	$i = 1$		29	mk/W
$R_{\theta j-c2}$	$i = 2$		10	mk/W
$R_{\theta j-c3}$	$i = 3$		1,8	mk/W
$R_{\theta j-c4}$	$i = 4$		0,2	mk/W
$\tau_{i1}$	$i = 1$		0,04	s
$\tau_{i2}$	$i = 2$		0,0189	s
$\tau_{i3}$	$i = 3$		0,0017	s
$\tau_{i4}$	$i = 4$		0,001	s
<b>Symbol</b>				
$Z_{th(j-c)D}$				
$R_{\theta j-c1D}$	$i = 1$		60	mk/W
$R_{\theta j-c2D}$	$i = 2$		23	mk/W
$R_{\theta j-c3D}$	$i = 3$		6,2	mk/W
$R_{\theta j-c4D}$	$i = 4$		0,8	mk/W
$\tau_{i1D}$	$i = 1$		0,0366	s
$\tau_{i2D}$	$i = 2$		0,042	s
$\tau_{i3D}$	$i = 3$		0,0009	s
$\tau_{i4D}$	$i = 4$		0,002	s



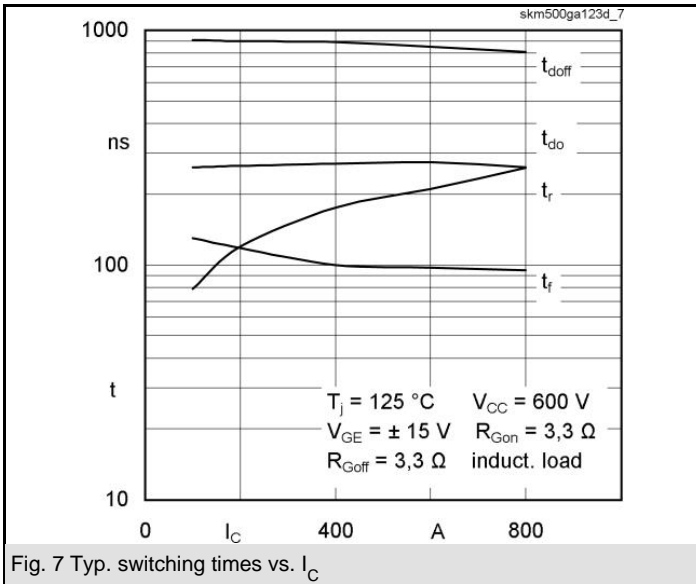


Fig. 7 Typ. switching times vs.  $I_C$

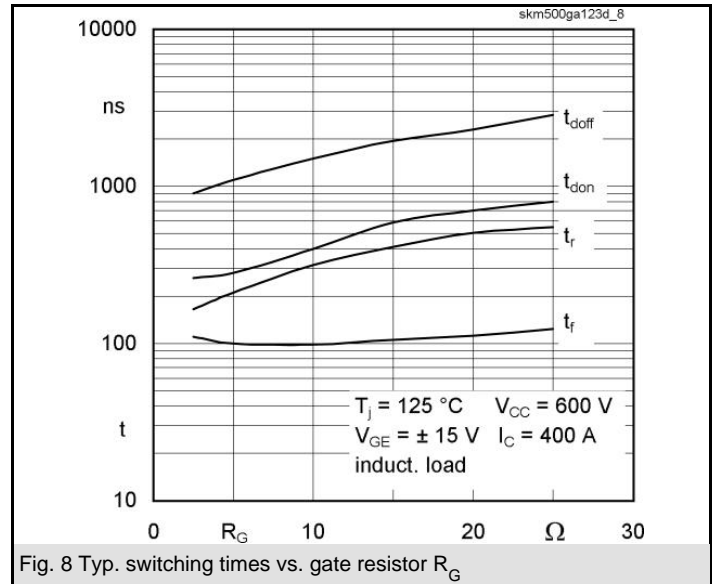


Fig. 8 Typ. switching times vs. gate resistor  $R_G$

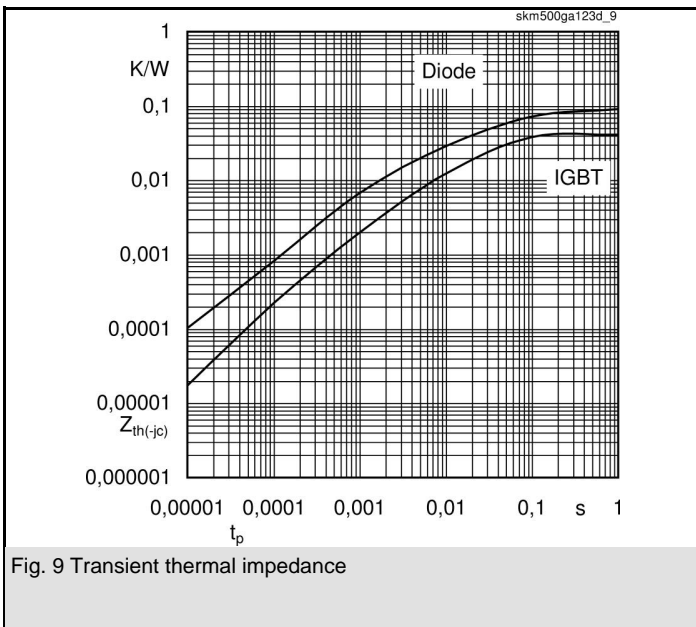


Fig. 9 Transient thermal impedance

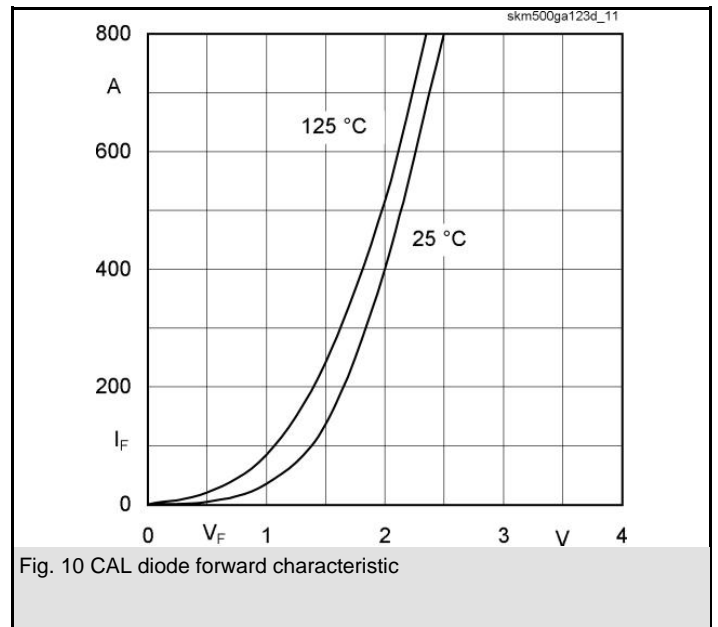


Fig. 10 CAL diode forward characteristic

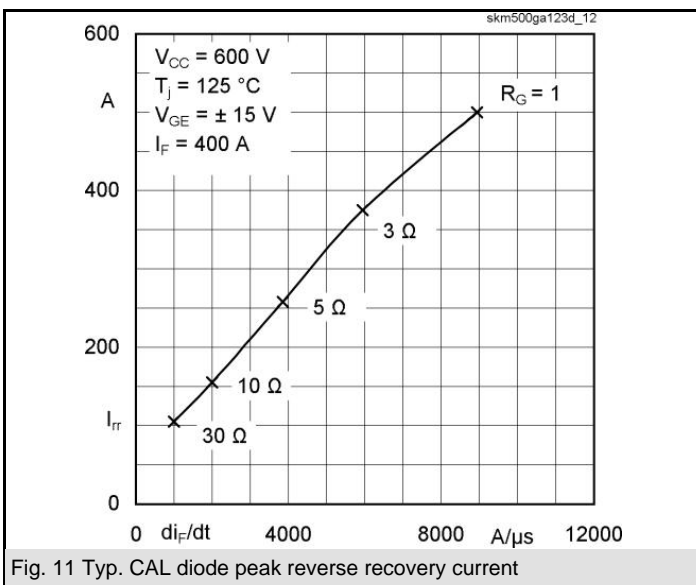


Fig. 11 Typ. CAL diode peak reverse recovery current

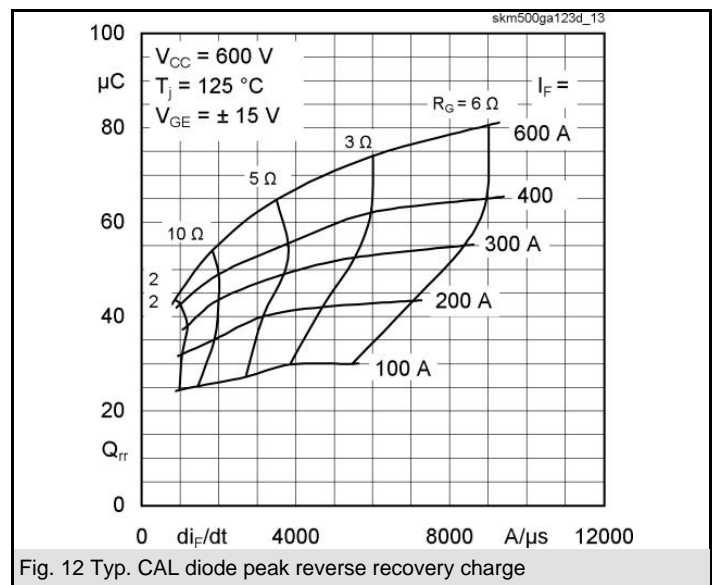


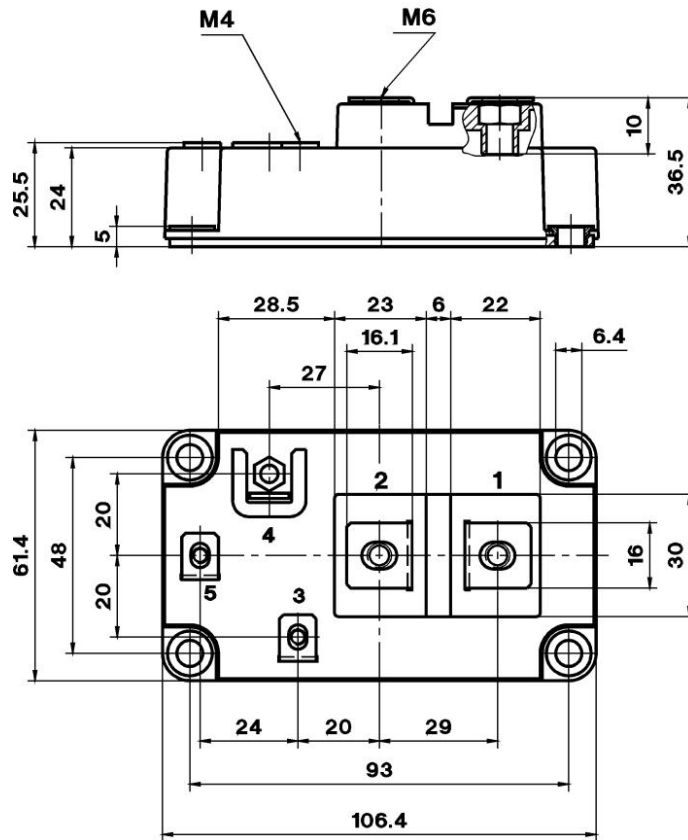
Fig. 12 Typ. CAL diode peak reverse recovery charge

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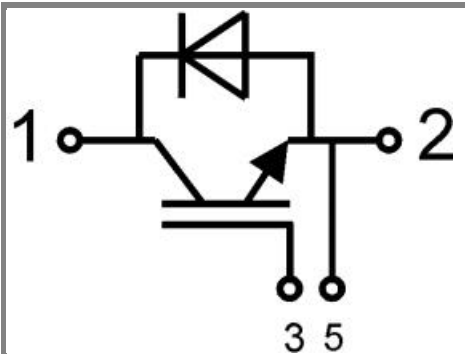
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CASED59

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Case D 60



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Case D 60

