

**SEMITRANS® 2**

## Trench IGBT Modules

**SKM 145GB176D**

**SKM 145GAL176D**

Preliminary Data

### Features

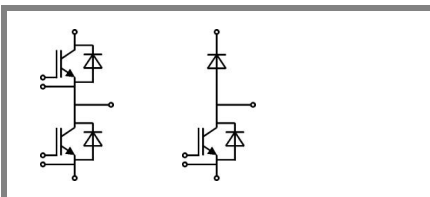
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability, self limiting to  $6 \times I_C$

### 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		$T_{case} = 25^\circ\text{C}$ , unless otherwise specified			
Symbol	Conditions	Values		Units	
<b>IGBT</b>					
$V_{CES}$	$T_j = 25^\circ\text{C}$	1700		V	
$I_C$	$T_j = 150^\circ\text{C}$	$T_{case} = 25^\circ\text{C}$	160		A
		$T_{case} = 80^\circ\text{C}$	120		A
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	200		A	
$V_{GES}$		$\pm 20$		V	
$t_{psc}$	$V_{CC} = 1200\text{ V}; V_{GE} \leq 20\text{ V}; T_j = 125^\circ\text{C}$ $V_{CES} < 1700\text{ V}$	10		$\mu\text{s}$	
<b>Inverse Diode</b>					
$I_F$	$T_j = 150^\circ\text{C}$	$T_{case} = 25^\circ\text{C}$	140		A
		$T_{case} = 80^\circ\text{C}$	100		A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	200		A	
$I_{FSM}$	$t_p = 10\text{ ms}; \sin.$	$T_j = 150^\circ\text{C}$	1400		A
<b>Freewheeling Diode</b>					
$I_F$	$T_j = 150^\circ\text{C}$	$T_{case} = 25^\circ\text{C}$	140		A
		$T_{case} = 80^\circ\text{C}$	100		A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	200		A	
$I_{FSM}$	$t_p = 10\text{ ms}; \sin.$	$T_j = 150^\circ\text{C}$	1400		A
<b>Module</b>					
$I_{t(RMS)}$		200		A	
$T_{vj}$		- 40 ... +150		$^\circ\text{C}$	
$T_{stg}$		- 40 ... +125		$^\circ\text{C}$	
$V_{isol}$	AC, 1 min.	4000		V	

Characteristics		$T_{case} = 25^\circ\text{C}$ , unless otherwise specified			
Symbol	Conditions	min.	typ.	max.	Units
<b>IGBT</b>					
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 3,5\text{ mA}$	5,2	5,8	6,4	V
$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = V_{CES}$		0,1	0,3	mA
$V_{CE0}$		$T_j = 25^\circ\text{C}$	1		V
		$T_j = 125^\circ\text{C}$	0,9		V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	10		$\text{m}\Omega$
		$T_j = 125^\circ\text{C}$	15		$\text{m}\Omega$
$V_{CE(sat)}$	$I_{Cnom} = 100\text{ A}, V_{GE} = 15\text{ V}$		2	2,45	V
			2,4		V
$C_{ies}$	$V_{CE} = 25, V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	7,1		nF
$C_{oes}$			0,37		nF
$C_{res}$			0,29		nF
$Q_G$	$V_{GE} = -8\text{V}...+15\text{V}$		800		nC
$t_{d(on)}$	$R_{Gon} = 1\ \Omega$	$V_{CC} = 1200\text{V}$ $I_{Cnom} = 100\text{A}$	250		ns
$t_r$			32		ns
$E_{on}$	$R_{Goff} = 1\ \Omega$	$T_j = 125^\circ\text{C}$ $V_{GE} = \pm 15\text{ V}$	60		mJ
$t_{d(off)}$			630		ns
$t_f$			145		ns
$E_{off}$			38		mJ
$R_{th(j-c)}$	per IGBT		0,19		K/W



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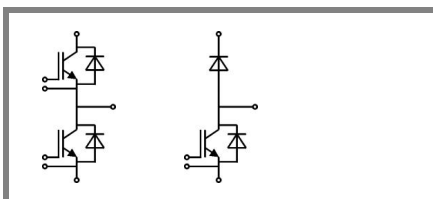
### Remarks

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

Characteristics		min.	typ.	max.	Units
<b>Inverse Diode</b>					
$V_F = V_{EC}$	$I_{Fnom} = 100 \text{ A}; V_{GE} = 0 \text{ V}$		1,6	1,9	V
			1,6	1,9	V
$V_{F0}$			1,1	1,3	V
			0,9	1,1	V
$r_F$			5	6	mΩ
			7	8	mΩ
$I_{RRM}$	$I_{Fnom} = 100 \text{ A}$		77		A
$Q_{rr}$	$di/dt = 2450 \text{ A}/\mu\text{s}$		39,5		μC
$E_{rr}$	$V_{GE} = -15 \text{ V}; V_{CC} = 1200 \text{ V}$		27,5		mJ
$R_{th(j-c)D}$	per diode			0,36	K/W
<b>Freewheeling Diode</b>					
$V_F = V_{EC}$	$I_{Fnom} = 100 \text{ A}; V_{GE} = 0 \text{ V}$		1,6	1,9	V
			1,6	1,9	V
$V_{F0}$			1,1	1,3	V
			0,9	1,1	V
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$I_{RRM}$	$I_{Fnom} = 100 \text{ A}$		77		A
$Q_{rr}$	$di/dt = 2450 \text{ A}/\mu\text{s}$		39,5		μC
$E_{rr}$	$V_{GE} = -15 \text{ V}; V_{CC} = 1200 \text{ V}$		27,5		mJ
$R_{th(j-c)FD}$	per diode			0,36	K/W
<b>Module</b>					
$L_{CE}$				30	nH
$R_{CC'+EE'}$	res., terminal-chip	$T_{case} = 25 \text{ °C}$	0,75		mΩ
		$T_{case} = 125 \text{ °C}$	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.

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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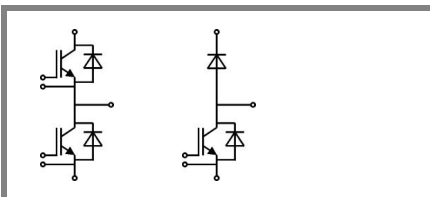
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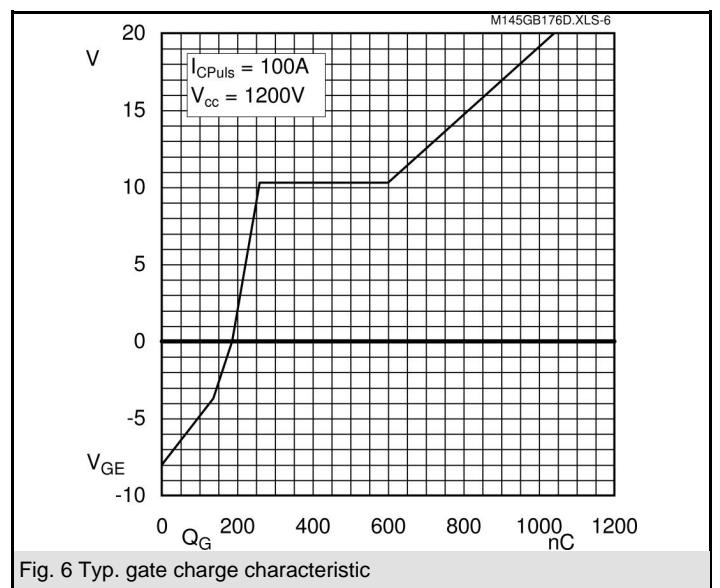
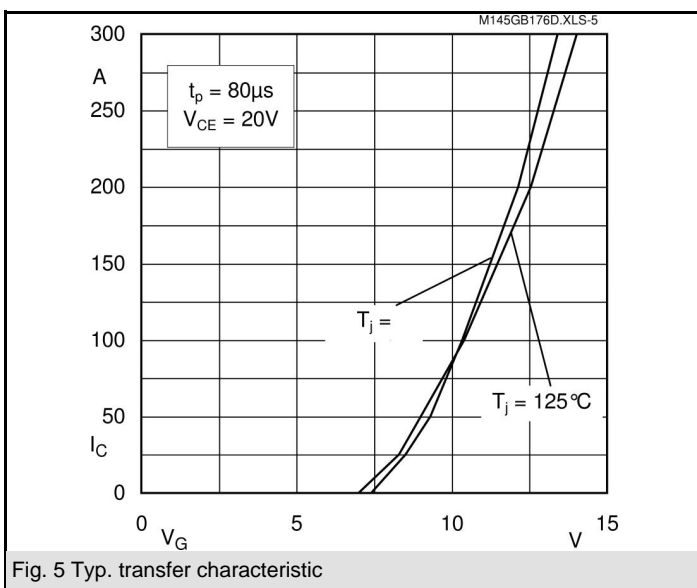
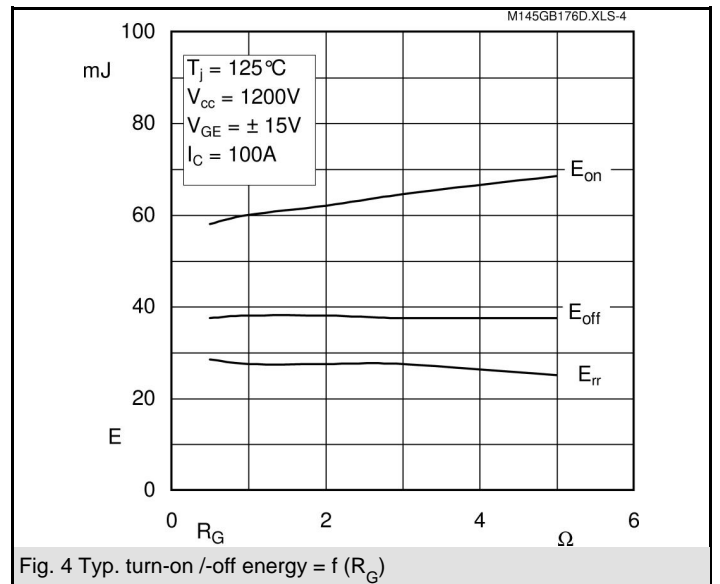
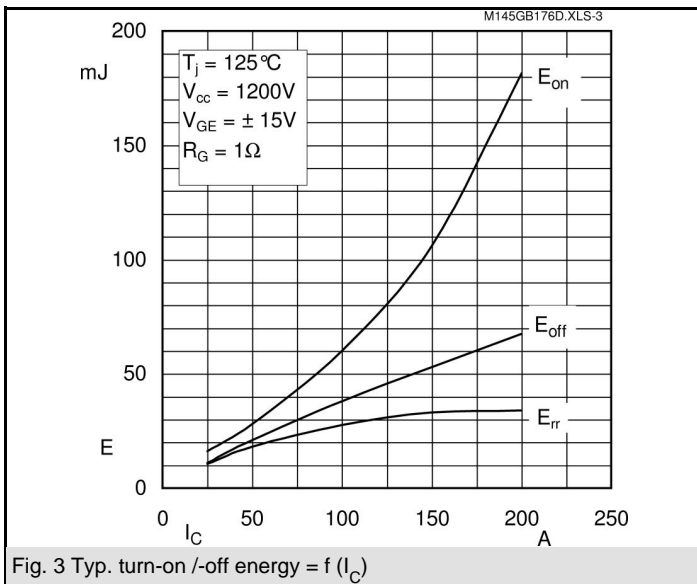
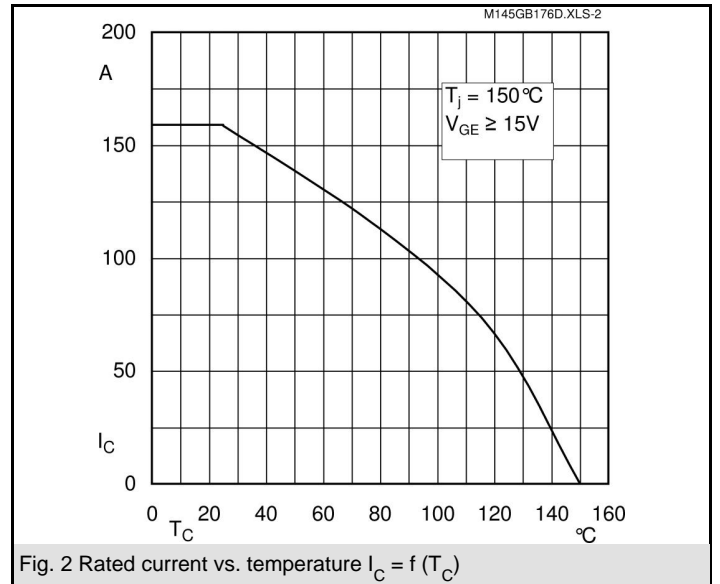
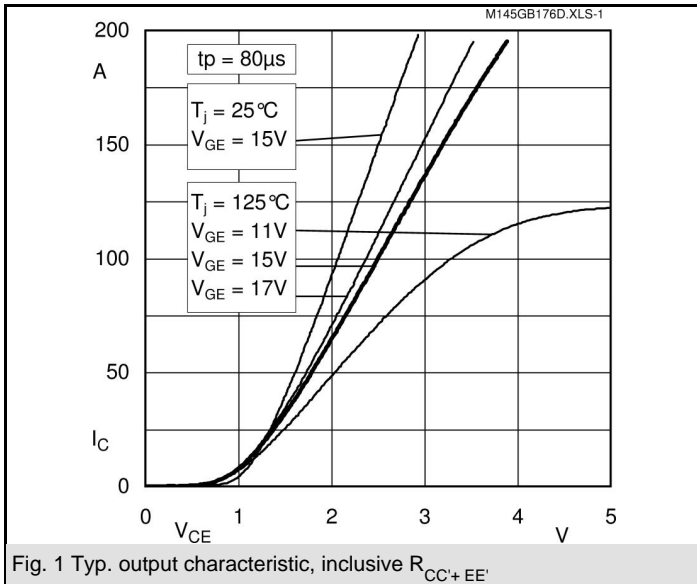
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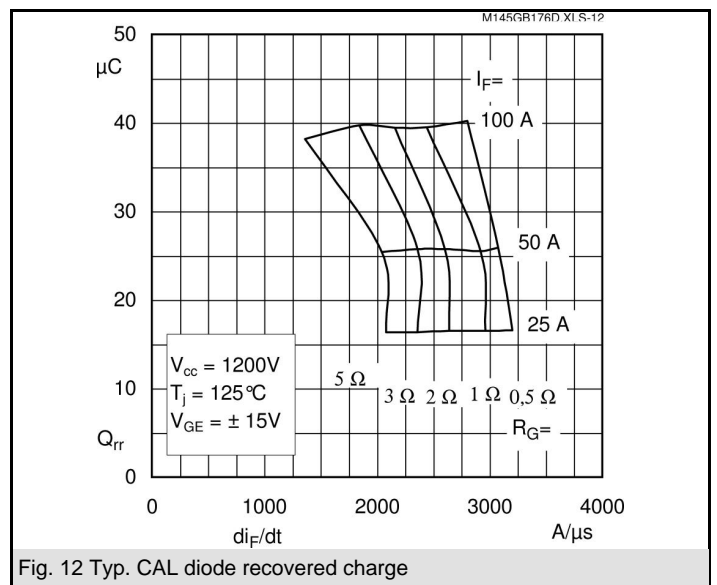
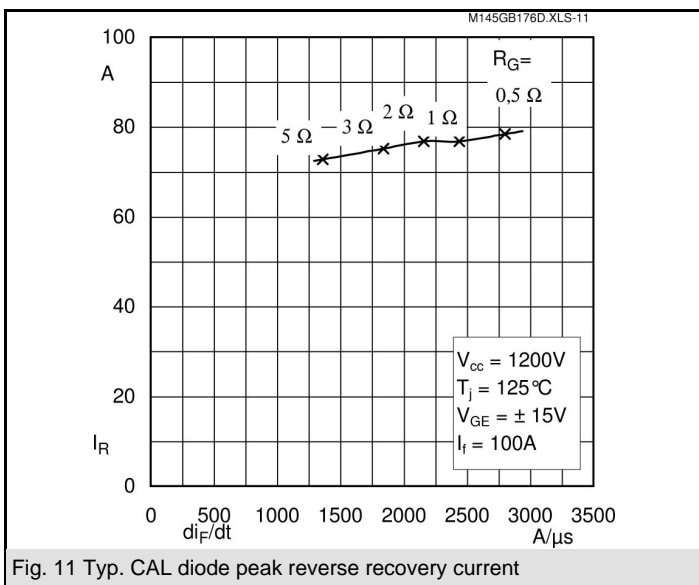
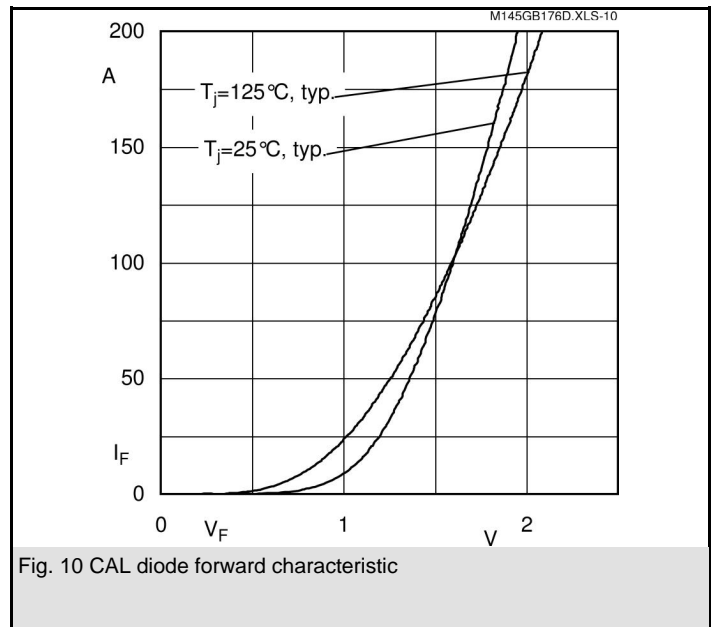
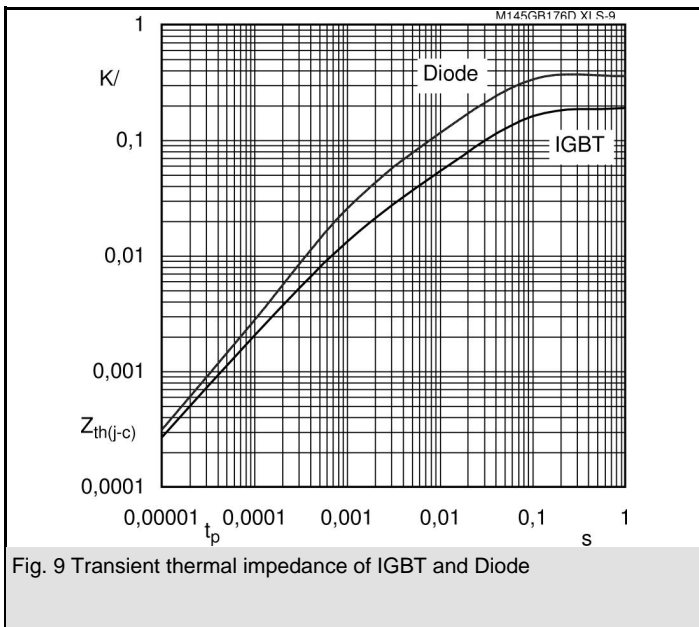
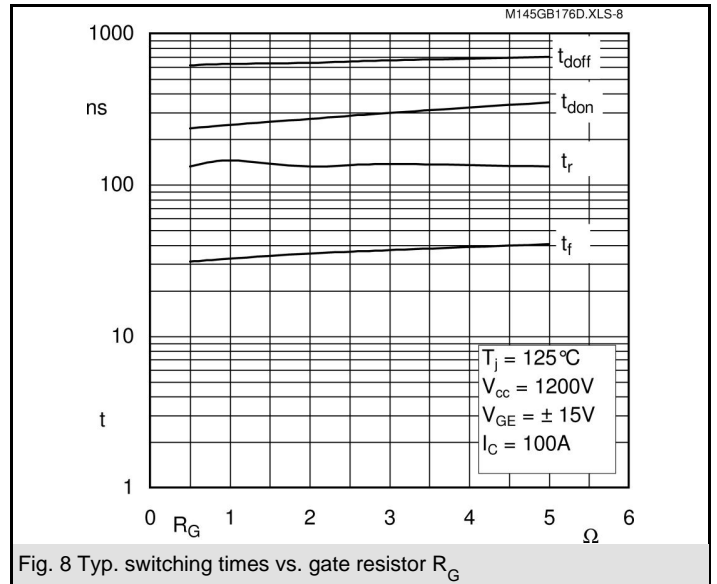
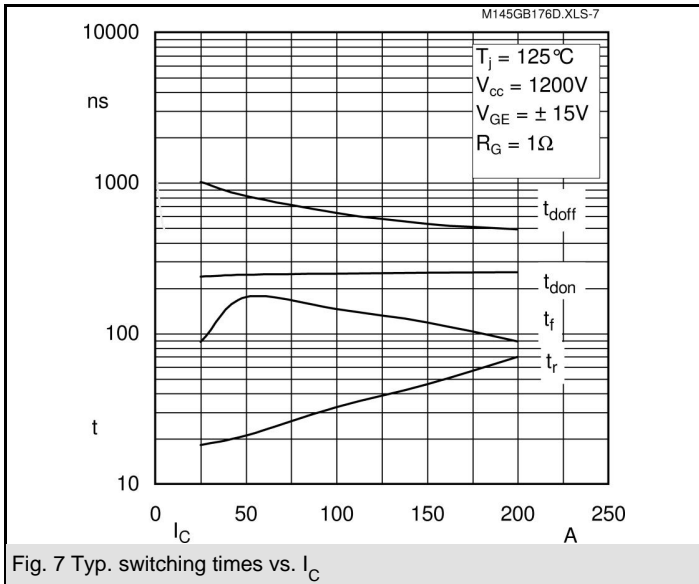
$Z_{th}$		Conditions	Values	Units
<b><math>Z_{th(j-c)I}</math></b>				
$R_{\theta j-c}$		$i = 1$	115	mk/W
$R_{\theta j-c}$		$i = 2$	38,5	mk/W
$R_{\theta j-c}$		$i = 3$	5,7	mk/W
$R_{\theta j-c}$		$i = 4$	0,8	mk/W
$\tau_{th(j-c)}$		$i = 1$	0,0306	s
$\tau_{th(j-c)}$		$i = 2$	0,0852	s
$\tau_{th(j-c)}$		$i = 3$	0,004	s
$\tau_{th(j-c)}$		$i = 4$	0,0003	s
<b><math>Z_{th(j-c)D}</math></b>				
$R_{\theta j-cD}$		$i = 1$	190	mk/W
$R_{\theta j-cD}$		$i = 2$	80	mk/W
$R_{\theta j-cD}$		$i = 3$	25	mk/W
$R_{\theta j-cD}$		$i = 4$	5	mk/W
$\tau_{th(j-c)D}$		$i = 1$	0,0475	s
$\tau_{th(j-c)D}$		$i = 2$	0,0163	s
$\tau_{th(j-c)D}$		$i = 3$	0,0011	s
$\tau_{th(j-c)D}$		$i = 4$	0,0002	s

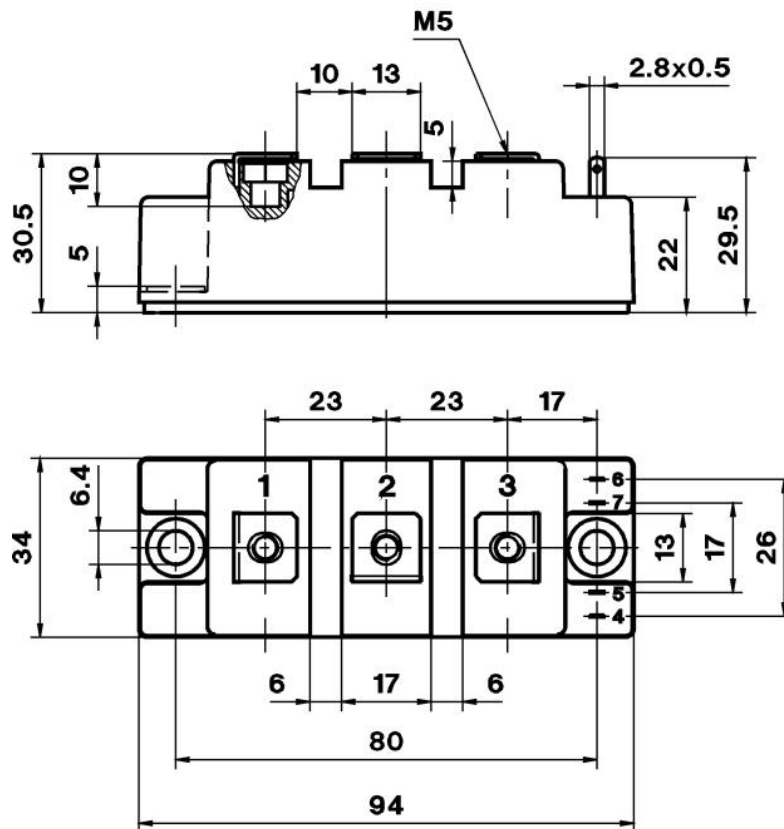


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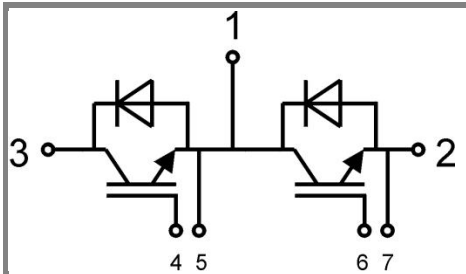
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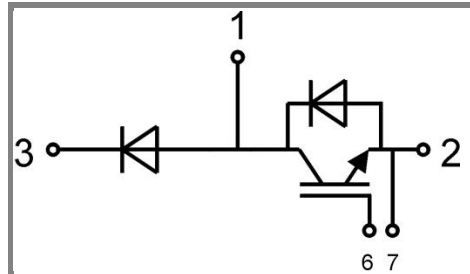


Case D 61



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Case D 61



GAL

Case D 62