

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  $6 \times I_C$

## Typical Applications\*

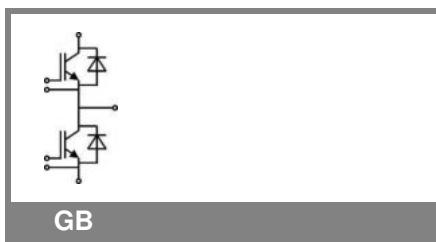
- AC inverter drives
- UPS
- Electronic welders

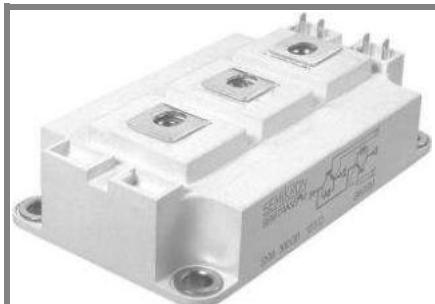
## Remarks

- Case temperature limited to  $T_c = 125^\circ\text{C}$  max, recommended  $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results are valid for  $T_j \leq 150^\circ\text{C}$
- Short circuit data:  $t_p \leq 6 \text{ s}$ ;  $V_{GE} \leq 15\text{V}$ ;  $T_j = 150^\circ\text{C}$ ;  $V_{CC} \leq 360\text{V}$ , use of soft  $R_G$  necessary!
- Take care of over-voltage caused by stray inductances

Absolute Maximum Ratings		$T_{case} = 25^\circ\text{C}$ , unless otherwise specified		
Symbol	Conditions	Values		Units
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	600		V
$I_C$	$T_j = 175^\circ\text{C}$ $T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	500 380		A A
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	800		A
$V_{GES}$		$\pm 20$		V
$t_{psc}$	$V_{CC} = 360\text{V}$ ; $V_{GE} \leq 15\text{V}$ ; $T_j = 150^\circ\text{C}$ $V_{CES} < 600\text{V}$	6		$\mu\text{s}$
<b>Inverse Diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$ $T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	450 320		A A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800		A
<b>Module</b>				
$I_{t(RMS)}$		500		A
$T_{vj}$		$-40 \dots +175$		$^\circ\text{C}$
$T_{stg}$		$-40 \dots +125$		$^\circ\text{C}$
$V_{isol}$	AC, 1 min.	4000		V

Characteristics		$T_{case} = 25^\circ\text{C}$ , unless otherwise specified		
Symbol	Conditions	min.	typ.	max.
<b>IGBT</b>				
$V_{GE(th)}$	$V_{GE} = V_{CE}$ , $I_C = 6,4 \text{ mA}$	5	5,8	6,5
$I_{CES}$	$V_{GE} = 0\text{V}$ , $V_{CE} = V_{CES}$	$T_j = 25^\circ\text{C}$	0,25	0,75
$V_{CEO}$		$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	0,9 0,85	1 0,9
$r_{CE}$	$V_{GE} = 15\text{V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1,4 2,1	2,3 3
$V_{CE(sat)}$	$I_{Cnom} = 400\text{A}$ , $V_{GE} = 15\text{V}$	$T_j = 25^\circ\text{C}_{\text{chilev.}}$ $T_j = 150^\circ\text{C}_{\text{chilev.}}$	1,45 1,7	1,9 2,1
$C_{ies}$ $C_{oes}$ $C_{res}$	$V_{CE} = 25$ , $V_{GE} = 0\text{V}$	$f = 1 \text{ MHz}$	24,7 1,54 0,73	nF nF nF
$Q_G$	$V_{GE} = -8\text{V} \dots +15\text{V}$		3000	nC
$R_{Gint}$	$T_j = 0^\circ\text{C}$		2	$\Omega$
$t_{d(on)}$ $t_r$ $E_{on}$	$R_{Gon} = 1,5 \Omega$	$V_{CC} = 300\text{V}$ $I_C = 400\text{A}$	200 60 8	ns ns mJ
$t_{d(off)}$ $t_f$ $E_{off}$	$R_{Goff} = 1,5 \Omega$	$T_j = 150^\circ\text{C}$ $V_{GE} = -8\text{V} \dots +15\text{V}$	560 53 16	ns ns mJ
$R_{th(j-c)}$	per IGBT		0,12	K/W





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### SKM 400GB066D

Symbol	Conditions	min.	typ.	max.	Units
<b>Inverse Diode</b>					
$V_F = V_{EC}$	$I_{Fnom} = 400 \text{ A}; V_{GE} = 0 \text{ V}$ $T_j = 25 \text{ }^\circ\text{C}_{\text{chiplev.}}$		1,4	1,6	V
$V_{FO}$	$T_j = 25 \text{ }^\circ\text{C}$		0,95	1	V
$r_F$	$T_j = 25 \text{ }^\circ\text{C}$		1,1	1,5	$\text{m}\Omega$
$I_{RRM}$	$I_F = 400 \text{ A}$	$T_j = 150 \text{ }^\circ\text{C}$	410		A
$Q_{rr}$	$\text{di/dt} = 7250 \text{ A/s}$		62		C
$E_{rr}$	$V_{GE} = -8 \text{ V}; V_{CC} = 300 \text{ V}$		14		$\text{mJ}$
$R_{th(j-c)D}$	per diode			0,2	K/W
<b>Module</b>					
$L_{CE}$		15	20		$\text{nH}$
$R_{CC' + EE'}$	res., terminal-chip $T_{case} = 25 \text{ }^\circ\text{C}$ $T_{case} = 125 \text{ }^\circ\text{C}$	0,35			$\text{m}\Omega$
$R_{th(c-s)}$	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

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## Typical Applications\*

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- Electronic welders

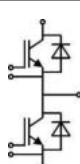
## Remarks

- Case temperature limited to  $T_c = 125 \text{ }^\circ\text{C}$  max, recommended  $T_{op} = -40 \dots +150 \text{ }^\circ\text{C}$
- Product reliability results are valid for  $T_j \leq 150 \text{ }^\circ\text{C}$
- Short circuit data:  $t_p \leq 6 \text{ s}$ ;  $V_{GE} \leq 15 \text{ V}$ ;  $T_j = 150 \text{ }^\circ\text{C}$ ;  $V_{CC} \leq 360 \text{ V}$ , use of soft  $R_G$  necessary!
- Take care of over-voltage caused by stray inductances

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

## \*IMPORTANT INFORMATION AND WARNINGS

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GB



$Z_{th}$ 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

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$Z_{th(j-c)D}$			
$R_i$	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

## Features

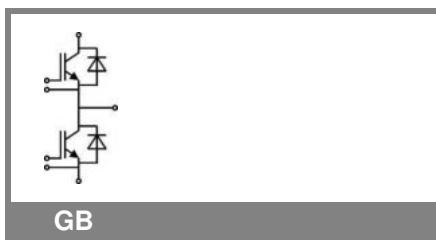
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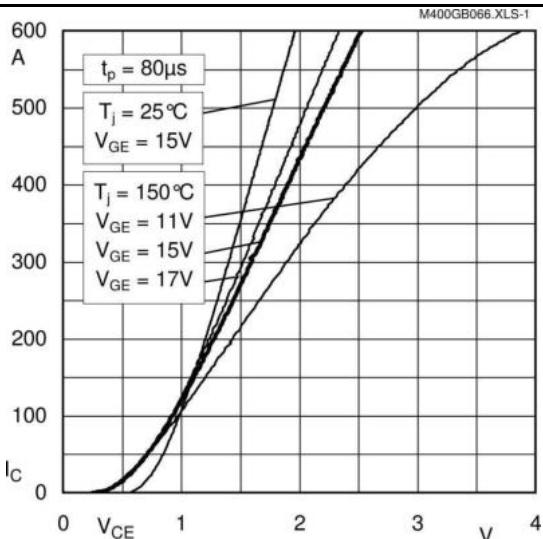


Fig. 1 Typ. output characteristic, inclusive  $R_{CC} + EE'$

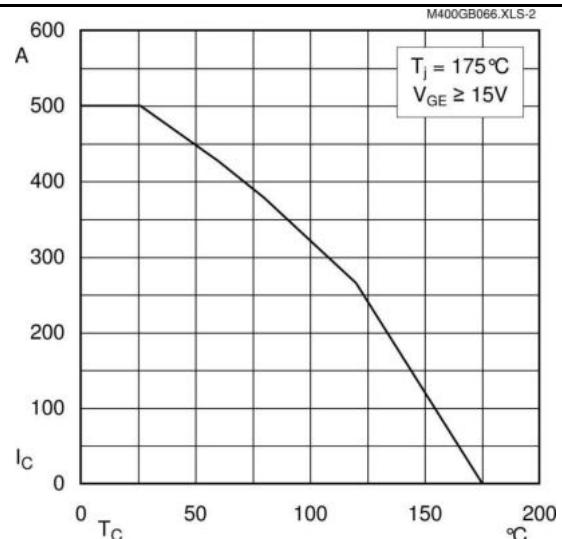


Fig. 2 Rated current vs. temperature  $I_C = f (T_C)$

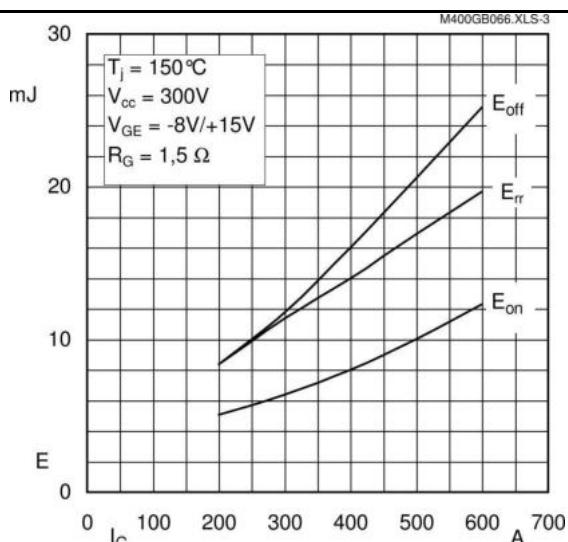


Fig. 3 Typ. turn-on /-off energy = f (I<sub>C</sub>)

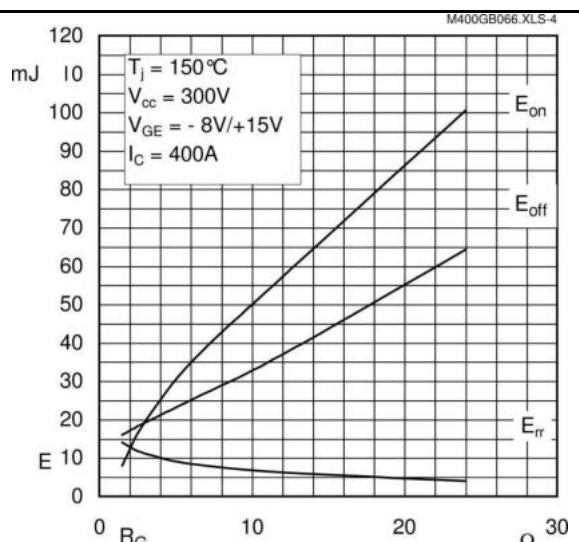


Fig. 4 Typ. turn-on /-off energy = f (R<sub>G</sub>)

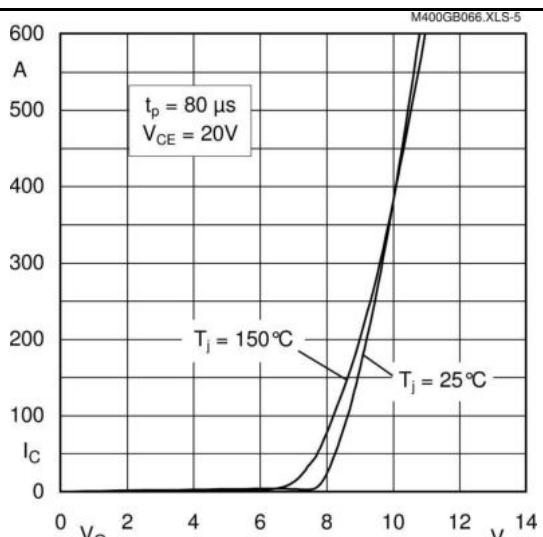


Fig. 5 Typ. transfer characteristic

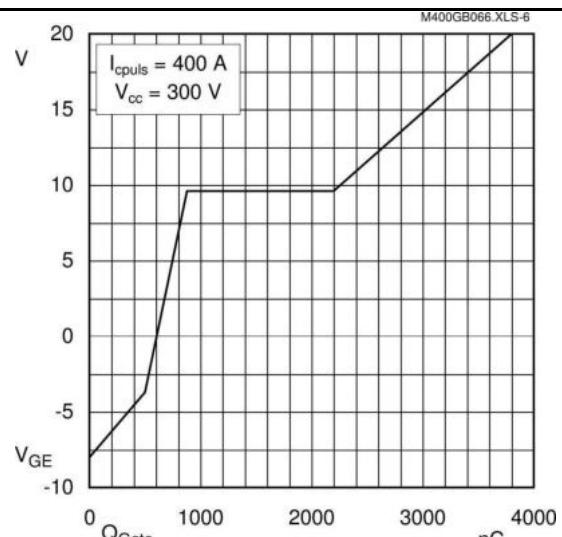


Fig. 6 Typ. gate charge characteristic

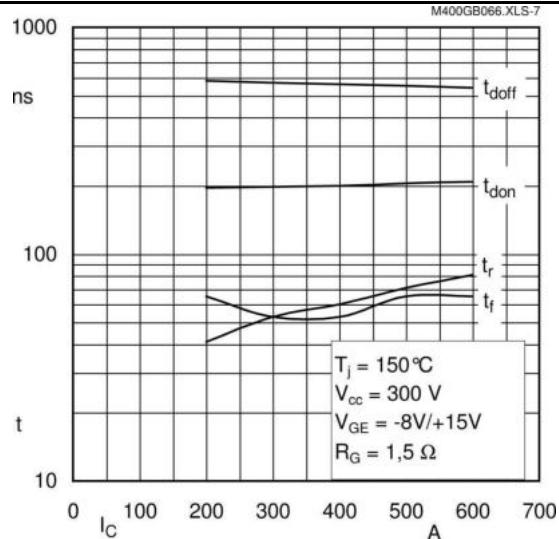


Fig. 7 Typ. switching times vs.  $I_C$

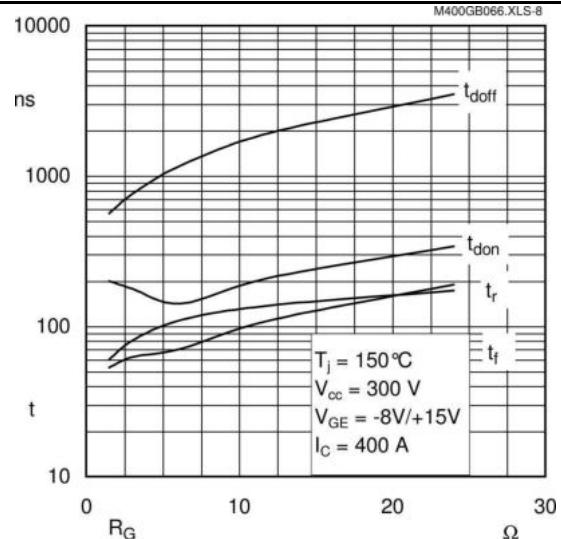


Fig. 8 Typ. switching times vs. gate resistor  $R_G$

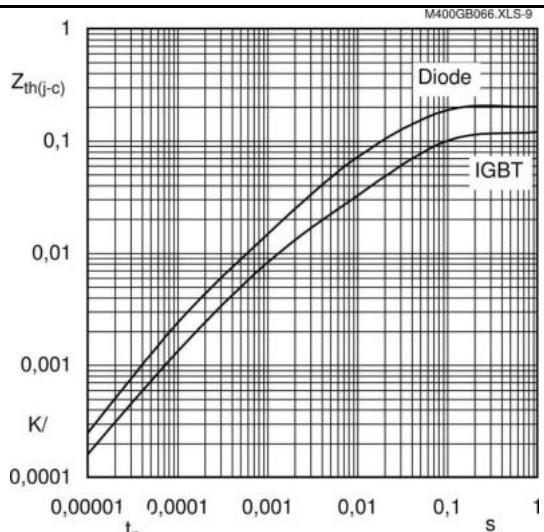


Fig. 9 Transient thermal impedance of IGBT and Diode

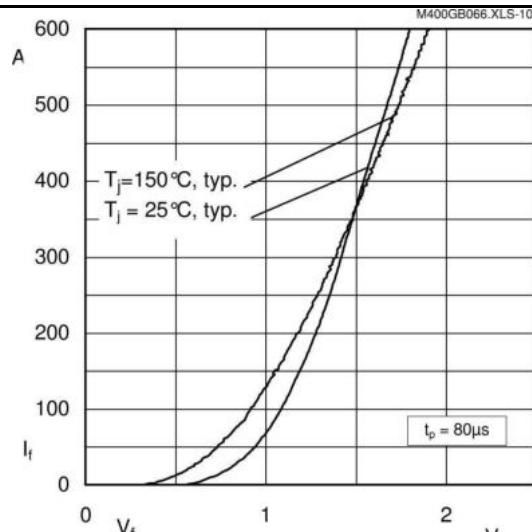


Fig. 10 CAL diode forward characteristic

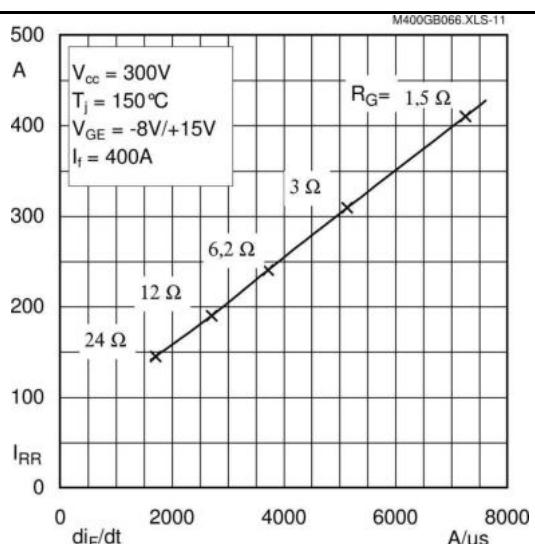


Fig. 11 Typ. CAL diode peak reverse recovery current

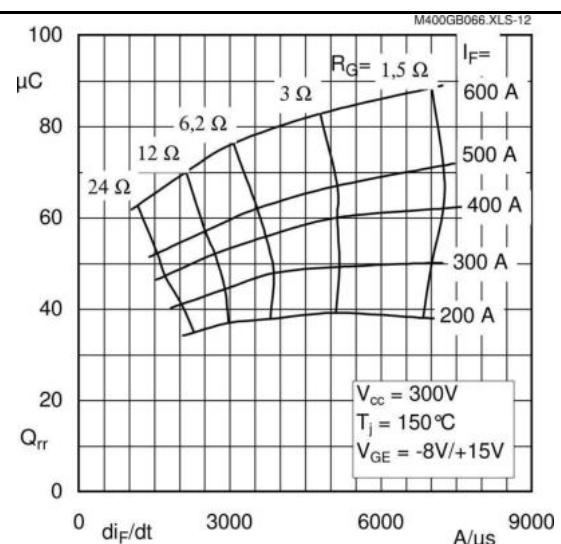
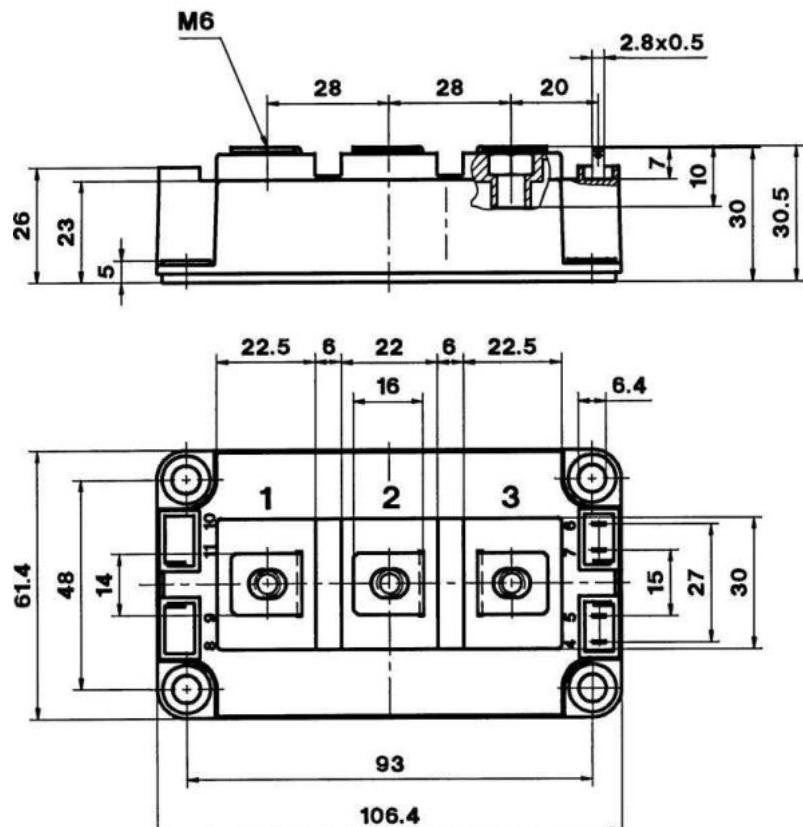


Fig. 12 Typ. CAL diode recovered charge

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UL recognized, file no. E 63 532

CASED56



Case D 56

