

SKM200GBD126D



SEMITRANS® 3

Trench IGBT Modules

SKM200GBD126D

Features

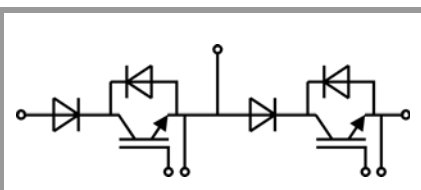
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to $6 \times I_C$
- UL recognized, file no. E63532

Typical Applications*

- Current source inverter

Remarks

- The Fig.1 to Fig.9 are based on measurements of the SKM200GB126D
- The series diodes (FWD) have the data of the inverse diodes of the SKM300GB126D



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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_j = 25\text{ °C}$	1200	V
I_C	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	264
		$T_c = 80\text{ °C}$	186
I_{Cnom}		150	A
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$	300	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 900\text{ V}$	$T_j = 125\text{ °C}$	10
	$V_{GE} \leq 15\text{ V}$		
	$V_{CES} \leq 1200\text{ V}$		
T_j		-40 ... 150	°C
Inverse diode			
V_{RRM}	$T_j = 25\text{ °C}$	1200	V
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	34
		$T_c = 80\text{ °C}$	23
I_{Fnom}		30	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	60	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25\text{ °C}$	414	A
T_j		-40 ... 150	°C
Freewheeling diode			
V_{RRM}	$T_j = 25\text{ °C}$	1200	V
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	250
		$T_c = 80\text{ °C}$	169
I_{Fnom}		200	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	400	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25\text{ °C}$	1656	A
T_j		-40 ... 150	°C
Module			
$I_{t(RMS)}$		500	A
T_{stg}	module without TIM	-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	1.71	2.10	V
		$T_j = 125\text{ °C}$	2.00	2.45	V
V_{CE0}	chipelevel	$T_j = 25\text{ °C}$	1.00	1.20	V
		$T_j = 125\text{ °C}$	0.90	1.10	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	4.7	6.0	mΩ
		$T_j = 125\text{ °C}$	7.3	9.0	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25\text{ °C}$			2.0	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	10.7		nF
C_{oes}		$f = 1\text{ MHz}$	0.56		nF
C_{res}		$f = 1\text{ MHz}$	0.48		nF
Q_G	$V_{GE} = -8\text{ V...} + 20\text{ V}$		1530		nC
R_{Gint}	$T_j = 25\text{ °C}$		5.0		Ω



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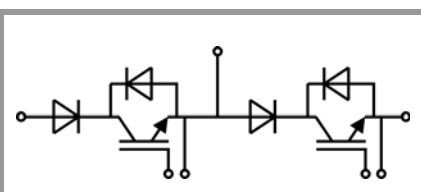
Typical Applications*

- Current source inverter

Remarks

- The Fig.1 to Fig.9 are based on measurements of the SKM200GB126D
- The series diodes (FWD) have the data of the inverse diodes of the SKM300GB126D

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 125\text{ °C}$		260		ns
t_r	$I_C = 150\text{ A}$	$T_j = 125\text{ °C}$		40		ns
E_{on}	$V_{GE} = +15/-15\text{ V}$	$T_j = 125\text{ °C}$		18		mJ
$t_{d(off)}$	$R_{G\ on} = 1.5\ \Omega$	$T_j = 125\text{ °C}$		540		ns
t_f	$R_{G\ off} = 1.5\ \Omega$	$T_j = 125\text{ °C}$		110		ns
E_{off}		$T_j = 125\text{ °C}$		24		mJ
$R_{th(j-c)}$	per IGBT				0.13	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$)			0.036		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material			0.033		K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 30\text{ A}$	$T_j = 25\text{ °C}$		2.00	2.50	V
	$V_{GE} = 0\text{ V}$	$T_j = 125\text{ °C}$		1.80	2.30	V
	chipelevel					
V_{F0}		$T_j = 25\text{ °C}$		1.10	1.45	V
	chipelevel	$T_j = 125\text{ °C}$		0.85	1.20	V
r_F		$T_j = 25\text{ °C}$		30	35	m Ω
	chipelevel	$T_j = 125\text{ °C}$		32	37	m Ω
I_{RRM}	$I_F = 15\text{ A}$	$T_j = 125\text{ °C}$		12		A
Q_{rr}	$di/dt_{off} = 150\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		1		μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$	$T_j = 125\text{ °C}$		-		mJ
	$V_{CC} = 600\text{ V}$					
$R_{th(j-c)}$	per diode				1.5	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$)			0.078		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.076		K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 200\text{ A}$	$T_j = 25\text{ °C}$		1.60	1.80	V
	$V_{GE} = 0\text{ V}$	$T_j = 125\text{ °C}$		1.60	1.80	V
	chipelevel					
V_{F0}		$T_j = 25\text{ °C}$		1.00	1.10	V
	chipelevel	$T_j = 125\text{ °C}$		0.80	0.90	V
r_F		$T_j = 25\text{ °C}$		3.0	3.5	m Ω
	chipelevel	$T_j = 125\text{ °C}$		4.0	4.5	m Ω
I_{RRM}	$I_F = 200\text{ A}$	$T_j = 125\text{ °C}$		290		A
Q_{rr}	$di/dt_{off} = 6200\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		44		μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$	$T_j = 125\text{ °C}$		18		mJ
	$V_{CC} = 600\text{ V}$					
$R_{th(j-c)}$	per diode				0.25	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$)			0.043		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.041		K/W



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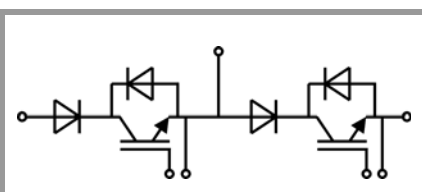
Typical Applications*

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Remarks

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Characteristics				min.	typ.	max.	Unit
Symbol	Conditions						
Module							
L_{CE}				15			nH
$R_{CC'+EE'}$	measured per switch	$T_C = 25\text{ °C}$		0.35			mΩ
		$T_C = 125\text{ °C}$		0.5			mΩ
$R_{th(c-s)1}$	per module			0.01			K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$)			0.015			K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material			0.014			K/W
M_s	to heat sink M6			3		5	Nm
M_t			to terminals M6	2.5		5	Nm
							Nm
w						325	g



GBD

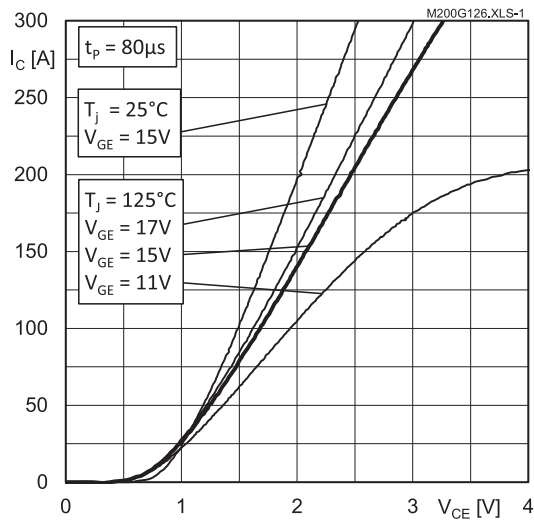


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

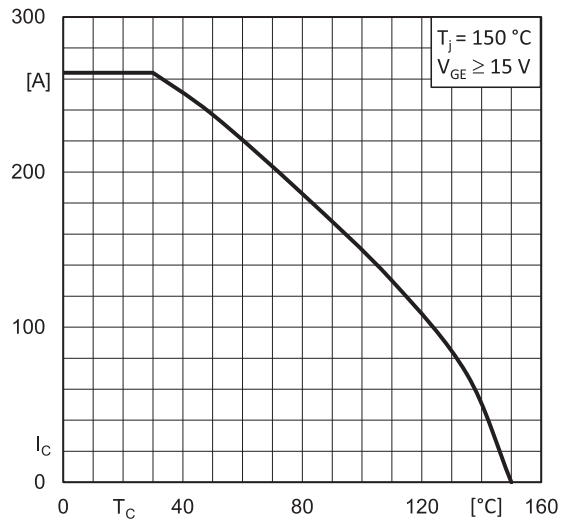


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

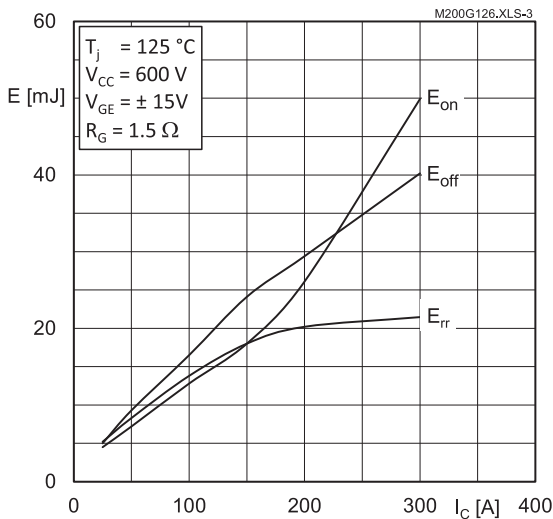


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

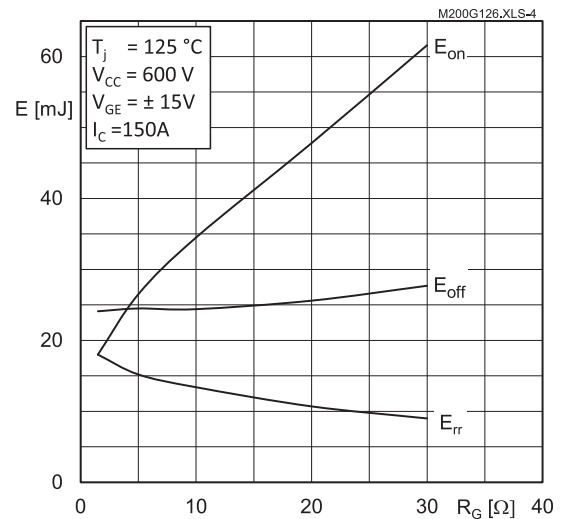


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

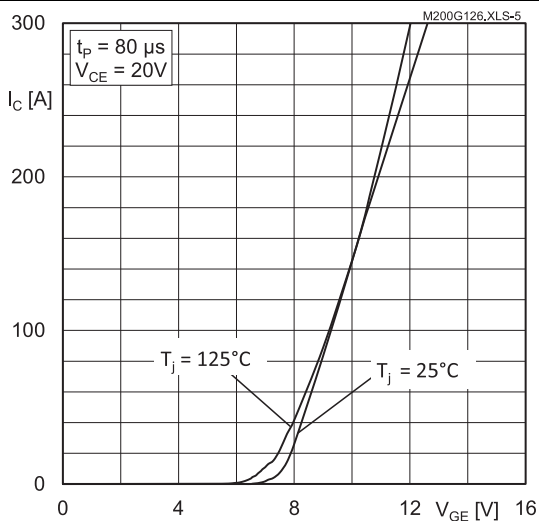


Fig. 5: Typ. transfer characteristic

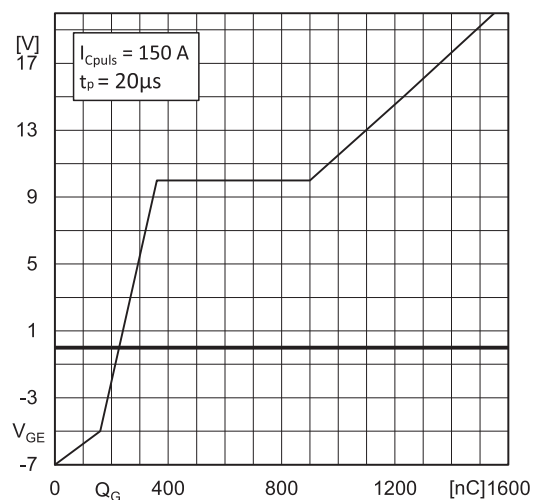


Fig. 6: Typ. gate charge characteristic

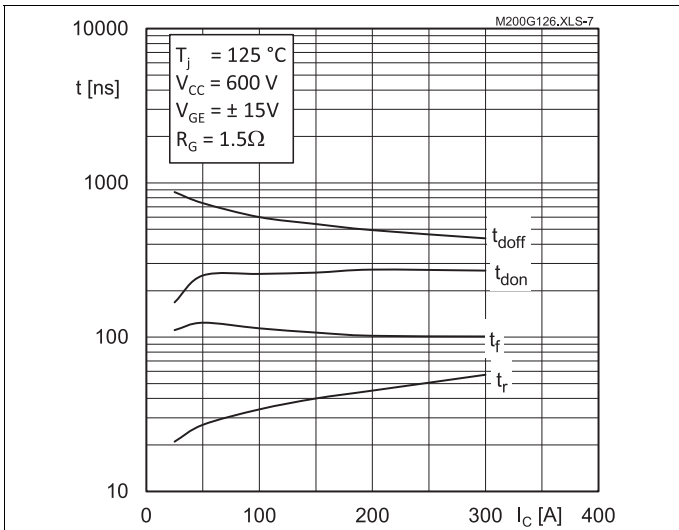


Fig. 7: Typ. switching times vs. I_C

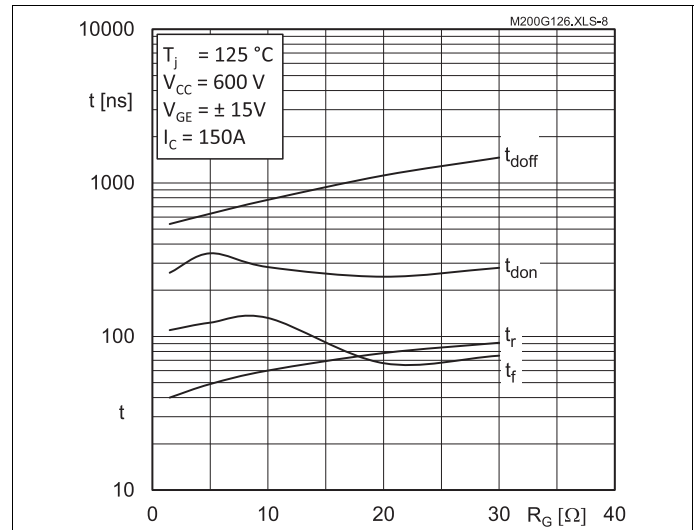


Fig. 8: Typ. switching times vs. gate resistor R_G

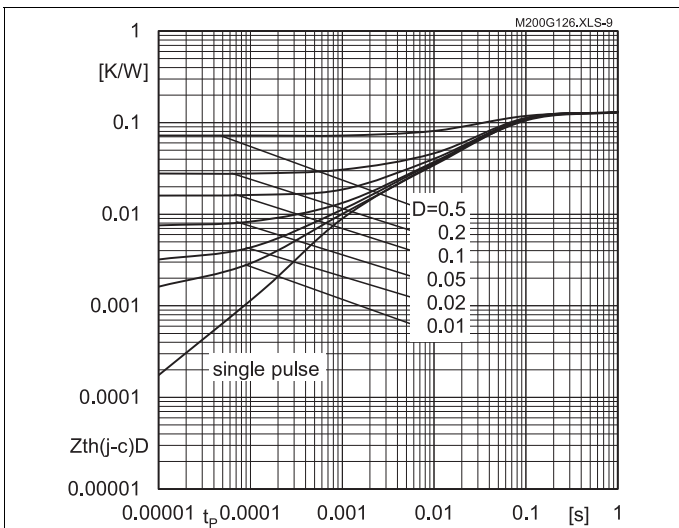


Fig. 9: Transient thermal impedance of IGBT
 $Z_{th(j-c)} = f(t_p)$; $D = t_p/t_c = t_p * f$

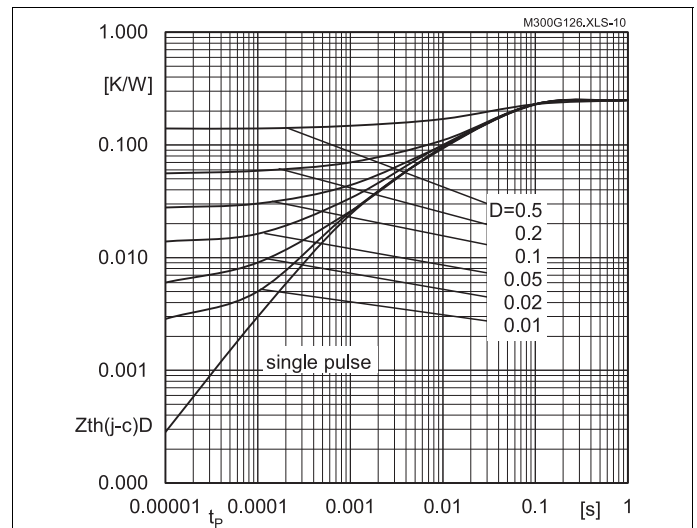


Fig. 10: Transient thermal impedance of FWD
 $Z_{th(j-c)} = f(t_p)$; $D = t_p/t_c = t_p * f$

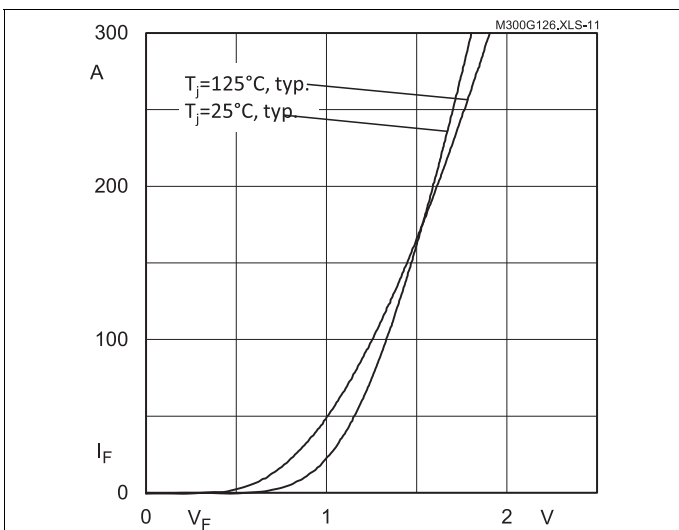


Fig. 11: CAL diode forward charact., incl. $R_{CC'+EE}$

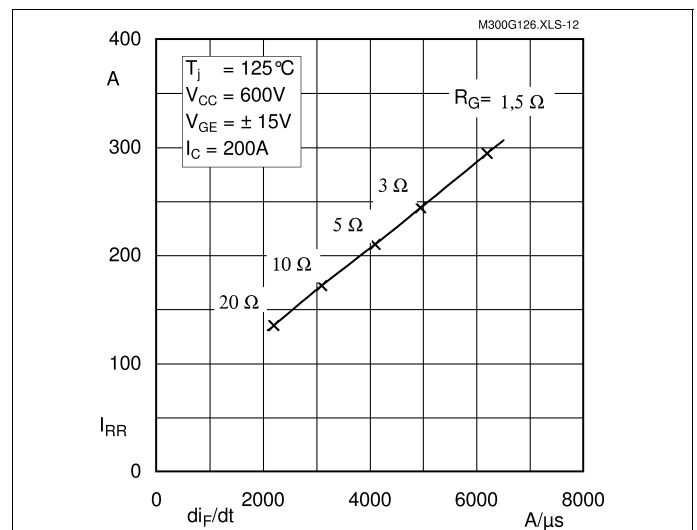


Fig. 12: Typ. CAL diode peak reverse recovery current

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

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