



SEMITRANS® 2

Trench IGBT Modules

SKM195GAR07E3

Features

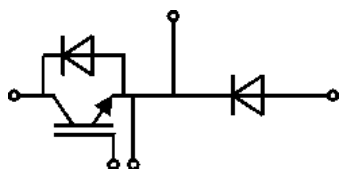
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_{Cnom}
- Fast & soft inverse CAL diodes
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated gate resistor

Typical Applications*

- Electronic welders
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$
- Use of soft R_G necessary



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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	650	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	266
		$T_c = 80^\circ\text{C}$	201
I_{Cnom}		200	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	600	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 650\text{ V}$	$T_j = 150^\circ\text{C}$	6
T_j		-40 ... 175	$^\circ\text{C}$

Inverse diode

V_{RRM}	$T_j = 25^\circ\text{C}$	650	V
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	217
		$T_c = 80^\circ\text{C}$	157
I_{Fnom}		200	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	400	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	1470	A
T_j		-40 ... 175	$^\circ\text{C}$

Freewheeling diode

V_{RRM}	$T_j = 25^\circ\text{C}$	650	V
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	217
		$T_c = 80^\circ\text{C}$	157
I_{Fnom}		200	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	400	A
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T_j		-40 ... 175	$^\circ\text{C}$

Module

$I_{t(RMS)}$		200	A
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 200\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.46	1.90	V
		$T_j = 150^\circ\text{C}$	1.70	2.10	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.90	1.00	V
		$T_j = 150^\circ\text{C}$	0.82	0.90	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.8	4.5	m Ω
		$T_j = 150^\circ\text{C}$	4.4	6.0	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 3.2\text{ mA}$	5.1	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 650\text{ V}$	$T_j = 25^\circ\text{C}$		0.3	mA
		$T_j = 150^\circ\text{C}$	-		mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	12.3		nF
C_{oes}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.77		nF
C_{res}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.37		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1600		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		2.0		Ω



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- With integrated gate resistor

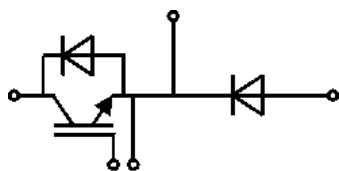
Typical Applications*

- Electronic welders
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Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 300 V	T _j = 150 °C		122		ns
t _r	I _C = 200 A	T _j = 150 °C		52		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		6.3		mJ
t _{d(off)}	R _{G on} = 1 Ω	T _j = 150 °C		650		ns
t _f	R _{G off} = 5.6 Ω	T _j = 150 °C		62		ns
E _{off}	di/dt _{on} = 3810 A/μs di/dt _{off} = 3260 A/μs du/dt = 2090 V/μs	T _j = 150 °C		8.3		mJ
R _{th(j-c)}	per IGBT				0.22	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.064		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.054		K/W
Inverse diode						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		1.39	1.75	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.38	1.76	V
V _{F0}	chiplevel	T _j = 25 °C		1.04	1.24	V
		T _j = 150 °C		0.85	0.99	V
r _F	chiplevel	T _j = 25 °C		1.76	2.6	mΩ
		T _j = 150 °C		2.6	3.9	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		200		A
Q _{rr}	di/dt _{off} = 3885 A/μs	T _j = 150 °C		22		μC
E _{rr}	V _{GE} = ±15 V V _{CC} = 300 V	T _j = 150 °C		4.5		mJ
R _{th(j-c)}	per diode				0.4	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.069		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.061		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		1.39	1.75	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.38	1.76	V
V _{F0}	chiplevel	T _j = 25 °C		1.04	1.24	V
		T _j = 150 °C		0.85	0.99	V
r _F	chiplevel	T _j = 25 °C		1.76	2.6	mΩ
		T _j = 150 °C		2.6	3.9	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		200		A
Q _{rr}	di/dt _{off} = 3885 A/μs	T _j = 150 °C		22		μC
E _{rr}	V _{GE} = ±15 V V _{CC} = 300 V	T _j = 150 °C		4.5		mJ
R _{th(j-c)}	per diode				0.4	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.069		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.061		K/W



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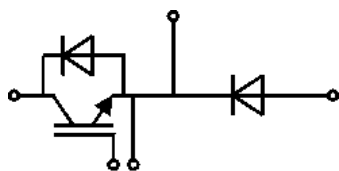
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}				30		nH
R _{CC'+EE'}	measured per switch	T _C = 25 °C		0.65		mΩ
		T _C = 125 °C		1.09		mΩ
R _{th(c-s)1}	calculated without thermal coupling (λ _{grease} =0.81 W/(m²K))			0.033		K/W
R _{th(c-s)2}	including thermal coupling, Ts underneath module (λ _{grease} =0.81 W/(m²K))			0.037		K/W
R _{th(c-s)2}	including thermal coupling, Ts underneath module, pre-applied phase change material			0.032		K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M5	2.5		5	Nm
						Nm
w					160	g



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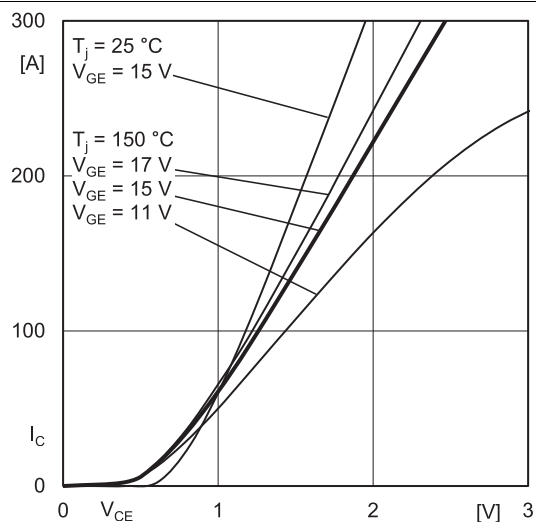


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

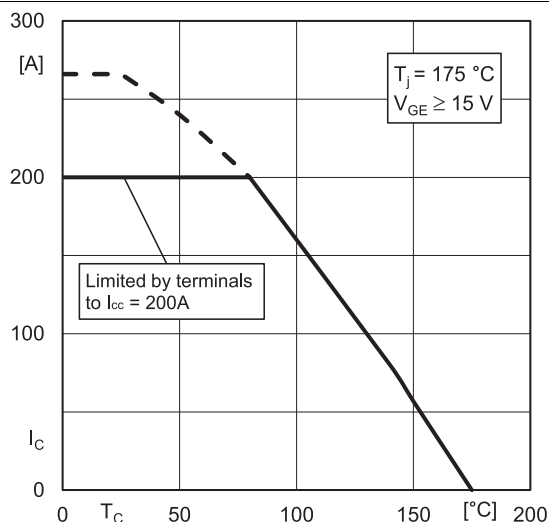


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

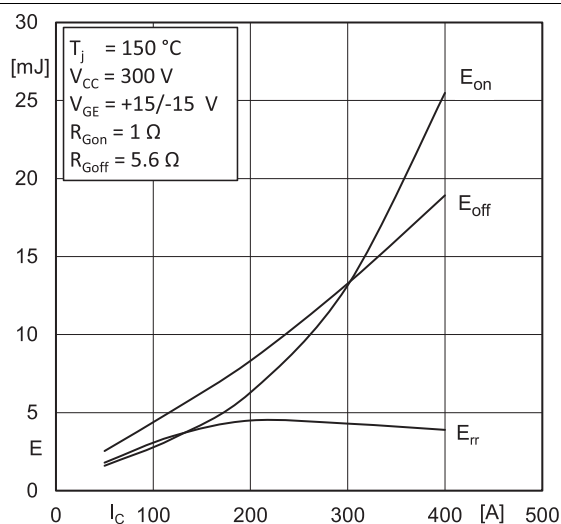


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

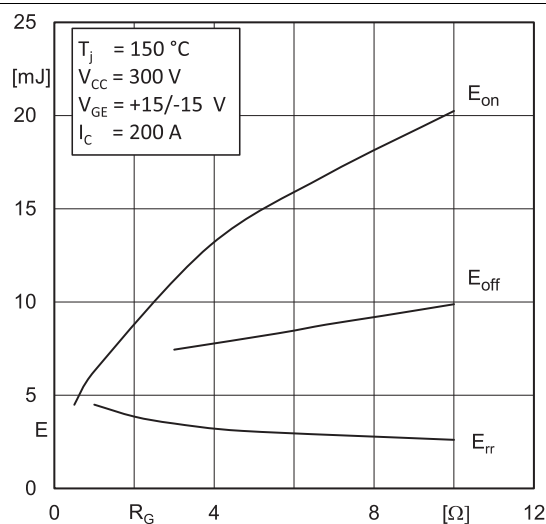


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

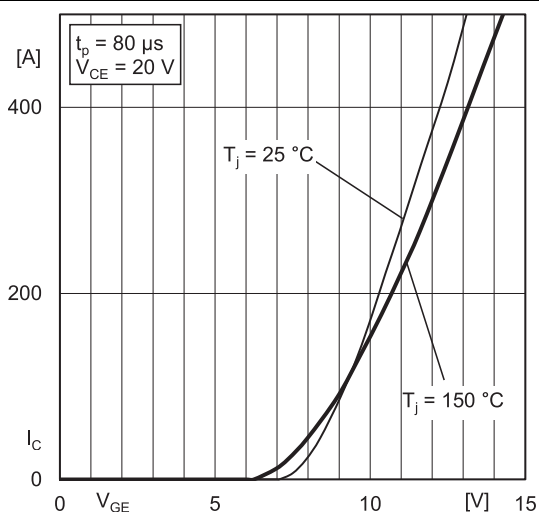


Fig. 5: Typ. transfer characteristic

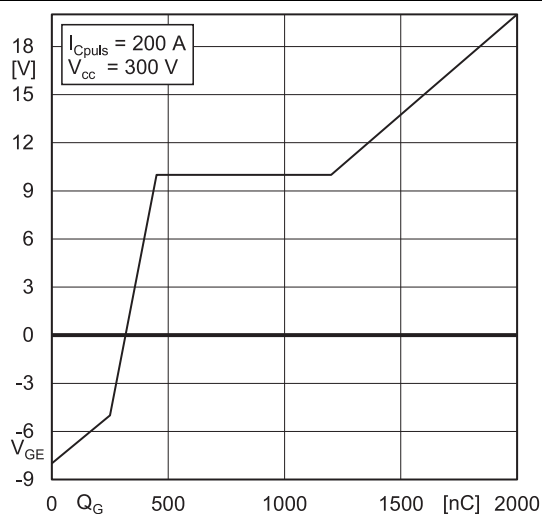


Fig. 6: Typ. gate charge characteristic

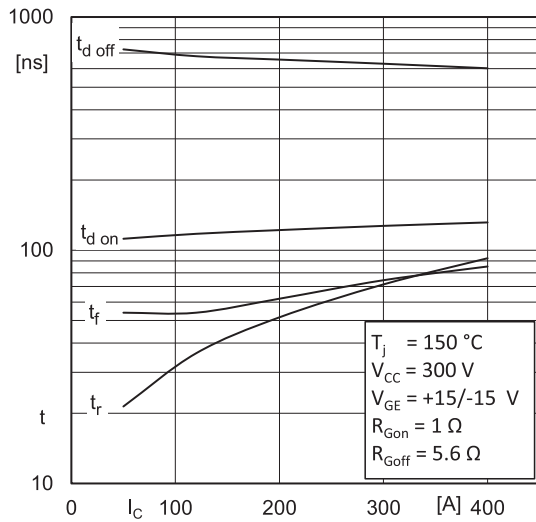


Fig. 7: Typ. switching times vs. I_C

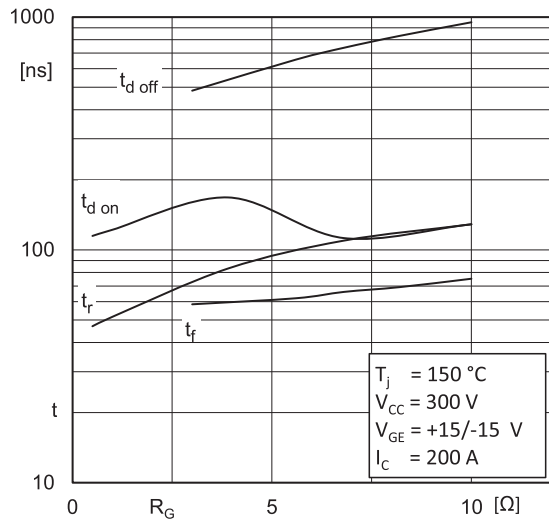


Fig. 8: Typ. switching times vs. gate resistor R_G

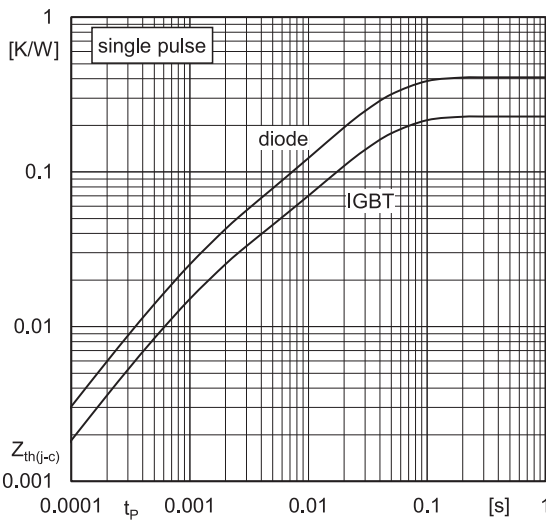


Fig. 9: Transient thermal impedance

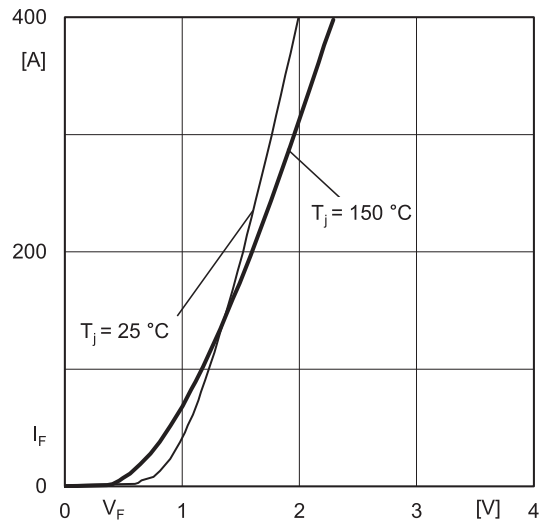


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'} + EE'$

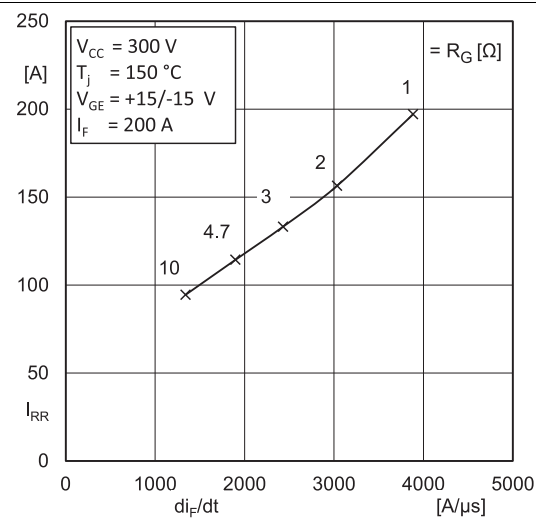


Fig. 11: CAL diode peak reverse recovery current

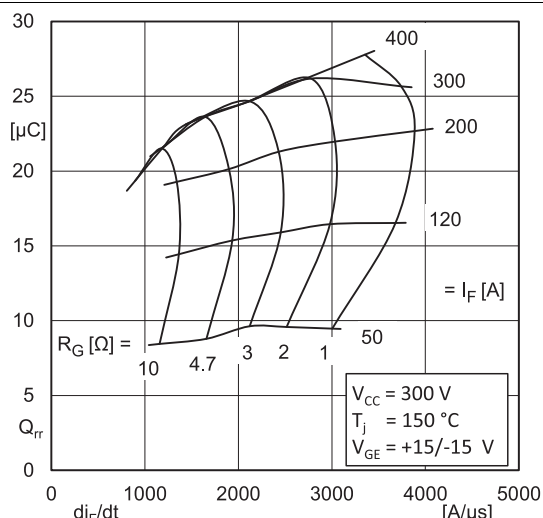


Fig. 12: Typ. CAL diode peak reverse recovery charge

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

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