



SEMITRANS® 2

V Series IGBT Module

SKM200GAL12VL2

Features*

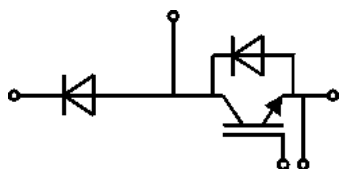
- V-IGBT = 6. Generation Trench V-IGBT (Fuji)
- CAL4 = Soft switching 4. Generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- UL recognized, file no. E63532
- Lowest switching losses at High di/dt

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 $T_j = 150^\circ\text{C}$



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 175 °C	T _c = 25 °C	299	A
		T _c = 80 °C	228	A
I _{Cnom}			200	A
I _{CRM}			600	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 720 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 125 °C	10	μs
T _j			-40 ... 175	°C

Inverse diode

V_{RRM}	$T_j = 25\text{ }^{\circ}\text{C}$		1200	V
I_F	$T_j = 175\text{ }^{\circ}\text{C}$	$T_c = 25\text{ }^{\circ}\text{C}$	189	A
		$T_c = 80\text{ }^{\circ}\text{C}$	141	A
I_{FRM}			450	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ }^{\circ}\text{C}$		900	A
T_j			-40 ... 175	$^{\circ}\text{C}$

Freewheeling diode

V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	229	A
		T _c = 80 °C	172	A
I _{FRM}			600	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		990	A
T _j			-40 ... 175	°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	$T_j = 25^\circ\text{C}$	1.86	2.30	V
		$T_j = 150^\circ\text{C}$	2.20	2.66	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.94	1.07	V
		$T_j = 150^\circ\text{C}$	0.88	0.98	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	4.6	6.2	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	6.6	8.4	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 8\text{ mA}$	5.5	6	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$			0.3	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	12.0		nF
C_{oes}		$f = 1\text{ MHz}$	1.18		nF
C_{res}		$f = 1\text{ MHz}$	1.18		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		2210		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		3.8		Ω



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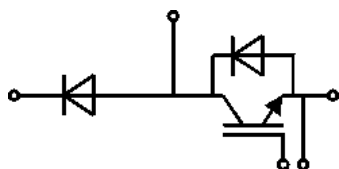
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- Product reliability results valid for $T_j = 150^\circ\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 600 V	T _j = 150 °C		305		ns
t _r	I _C = 200 A	T _j = 150 °C		51		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		24		mJ
t _{d(off)}	R _{G on} = 1 Ω	T _j = 150 °C		493		ns
t _f	di/dt _{on} = 4500 A/μs	T _j = 150 °C		88		ns
E _{off}	di/dt _{off} = 2060 A/μs dv/dt = 5400 V/μs	T _j = 150 °C		22		mJ
R _{th(j-c)}	per IGBT				0.14	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.056		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.038		K/W
Inverse diode						
V _F = V _{EC}	I _F = 150 A	T _j = 25 °C		2.14	2.46	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.04	2.38	V
V _{F0}	chiplevel	T _j = 25 °C		1.30	1.50	V
		T _j = 150 °C		0.90	1.10	V
r _F	chiplevel	T _j = 25 °C		5.6	6.4	mΩ
		T _j = 150 °C		7.6	8.7	mΩ
I _{RRM}	I _F = 150 A	T _j = 150 °C		92		A
Q _{rr}	di/dt _{off} = 2250 A/μs	T _j = 150 °C		25		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		8.5		mJ
R _{th(j-c)}	per diode				0.31	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.07		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.063		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		2.20	2.52	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.16	2.47	V
V _{F0}	chiplevel	T _j = 25 °C		1.30	1.50	V
		T _j = 150 °C		0.90	1.10	V
r _F	chiplevel	T _j = 25 °C		4.5	5.1	mΩ
		T _j = 150 °C		6.3	6.9	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		170		A
Q _{rr}	di/dt _{off} = 3950 A/μs	T _j = 150 °C		33		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		13		mJ
R _{th(j-c)}	per diode				0.26	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.068		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.061		K/W



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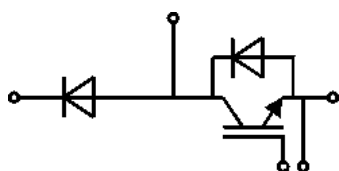
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}			30			nH
R _{CC'+EE'}	measured per switch	T _C = 25 °C	0.65			mΩ
		T _C = 125 °C	1.09			mΩ
R _{th(c-s)1}	calculated without thermal coupling (λ _{grease} =0.81 W/(m*K))		0.0311			K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module (λ _{grease} =0.81 W/(m*K))		0.034			K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module, pre-applied phase change material		0.026			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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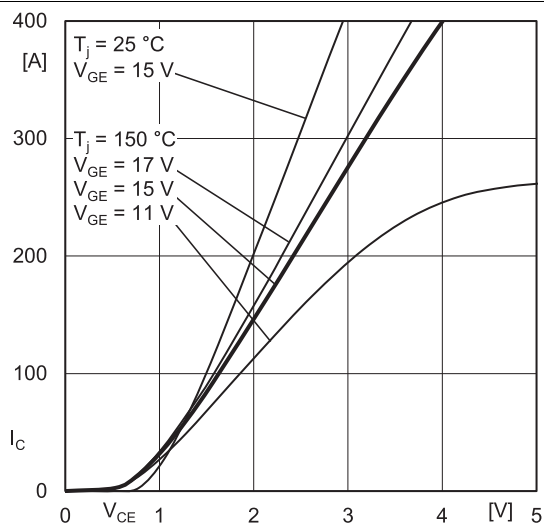


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

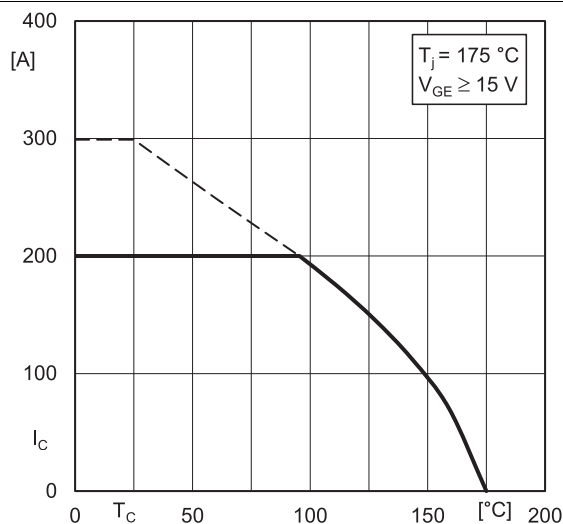


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

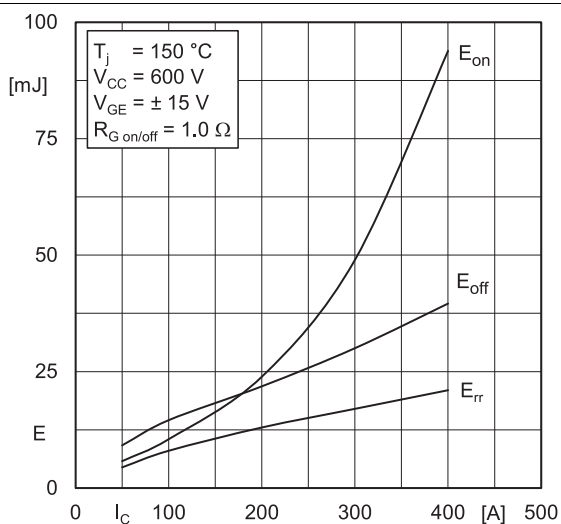


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

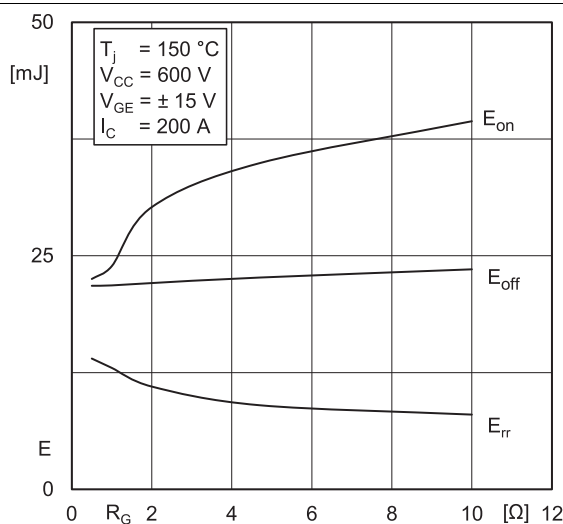


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

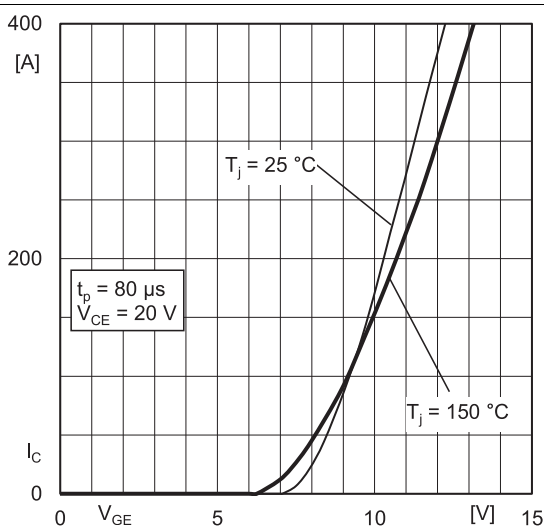


Fig. 5: Typ. transfer characteristic

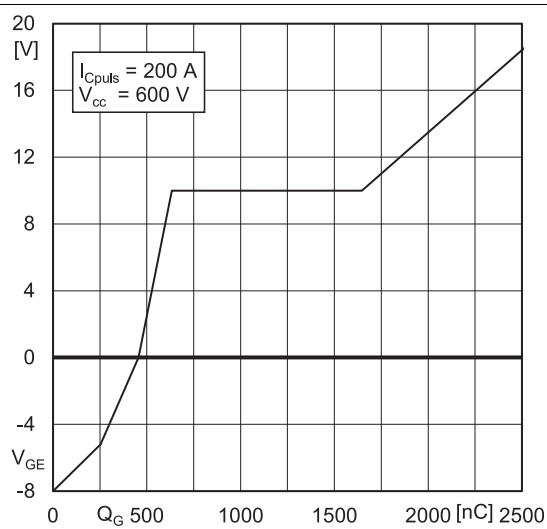
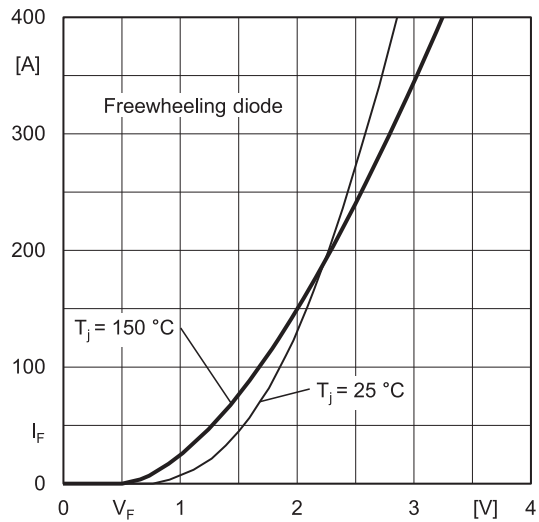
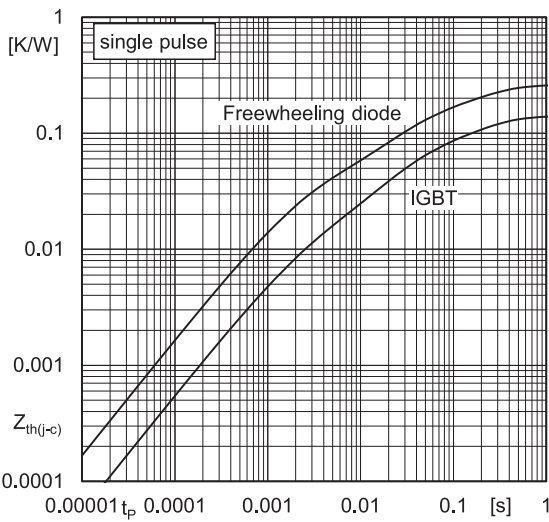
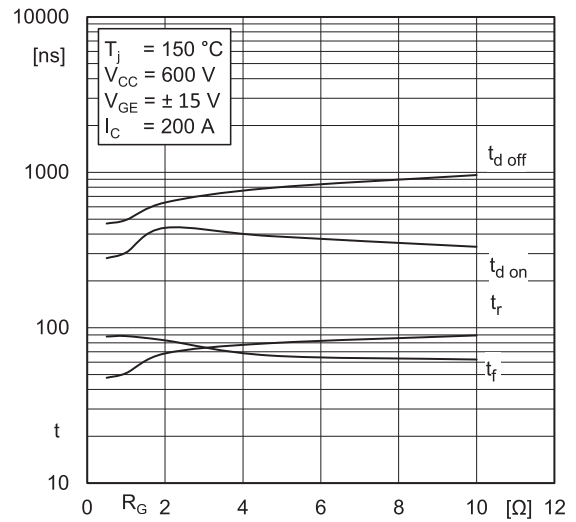
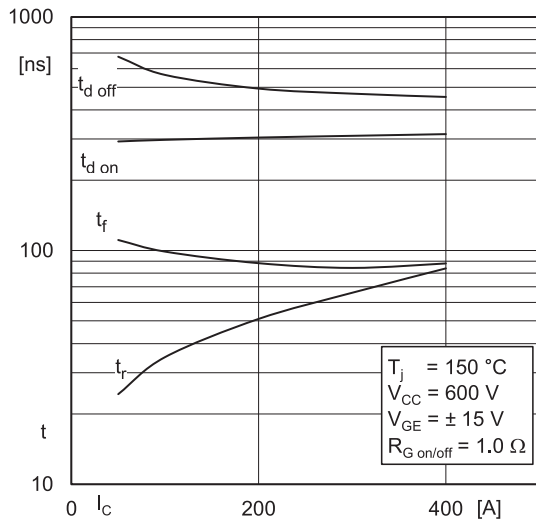


Fig. 6: Typ. gate charge characteristic



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

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