



SKiM® 93

Trench IGBT Modules

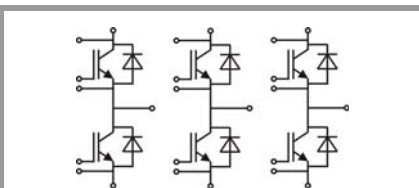
SKiM459GD12E4

Features

- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts and electrical contacts
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Typical Applications

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives



GD

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			1200	V
I _C	T _j = 175 °C	T _s = 25 °C	554	A
		T _s = 70 °C	450	A
I _{Cnom}			450	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1350	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse diode				
I _F	T _j = 175 °C	T _s = 25 °C	438	A
		T _s = 70 °C	347	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 3xI _{Fnom}		1350	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2430	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			700	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC sinus 50 Hz, t = 1 min		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V _{CE(sat)}	I _C = 450 A	T _j = 25 °C		1.85	2.10	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		2.25	2.45	V
V _{CE0}		T _j = 25 °C		0.8	0.9	V
		T _j = 150 °C		0.7	0.8	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		2.3	2.7	mΩ
		T _j = 150 °C		3.4	3.7	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 18 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _j = 25 °C		0.1	0.3	mA
	V _{CE} = 1200 V					mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		26.4		nF
C _{oes}		f = 1 MHz		1.74		nF
C _{res}		f = 1 MHz		1.41		nF
Q _G	V _{GE} = - 8 V...+ 15 V			2550		nC
R _{Gint}	T _j = 25 °C			1.7		Ω
t _{d(on)}	V _{CC} = 600 V I _C = 450 A	T _j = 150 °C		276		ns
t _r		T _j = 150 °C		55		ns
E _{on}	R _{G on} = 1.3 Ω	T _j = 150 °C		22		mJ
t _{d(off)}	R _{G off} = 1.3 Ω	T _j = 150 °C		538		ns
t _f	di/dt _{on} = 8340 A/μs	T _j = 150 °C		114		ns
E _{off}	di/dt _{off} = 3660 A/μs	T _j = 150 °C		57		mJ
R _{th(i-s)}	per IGBT				0.092	K/W



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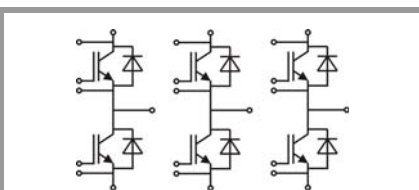
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$	$T_j = 25\text{ }^{\circ}\text{C}$		2.1	2.5	V
	$V_{GE} = 0\text{ V}$ chip	$T_j = 150\text{ }^{\circ}\text{C}$		2.1	2.4	V
V_{F0}		$T_j = 25\text{ }^{\circ}\text{C}$		1.3	1.5	V
		$T_j = 150\text{ }^{\circ}\text{C}$		0.9	1.1	V
r_F		$T_j = 25\text{ }^{\circ}\text{C}$		1.9	2.1	mΩ
		$T_j = 150\text{ }^{\circ}\text{C}$		2.6	2.8	mΩ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		570		A
Q_{rr}	$di/dt_{off} = 8880\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		80		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		40		mJ
$R_{th(j-s)}$	per diode				0.155	K/W
Module						
L_{CE}				10	15	nH
$R_{CC'+EE'}$	terminal-chip	$T_s = 25\text{ }^{\circ}\text{C}$		0.3		mΩ
		$T_s = 125\text{ }^{\circ}\text{C}$		0.5		mΩ
M_s	to heat sink (M4)		2.5		4	Nm
M_t		to terminals (M6)	3		5	Nm
						Nm
w					1100	g
Temperature sensor						
R_{100}	$T_{Sensor} = 100\text{ }^{\circ}\text{C}$ ($R_{25} = 5\text{ k}\Omega$)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100}\text{exp}[B_{100/125}(1/T-1/373)]$; $T[\text{K}]$;			4096		K



GD

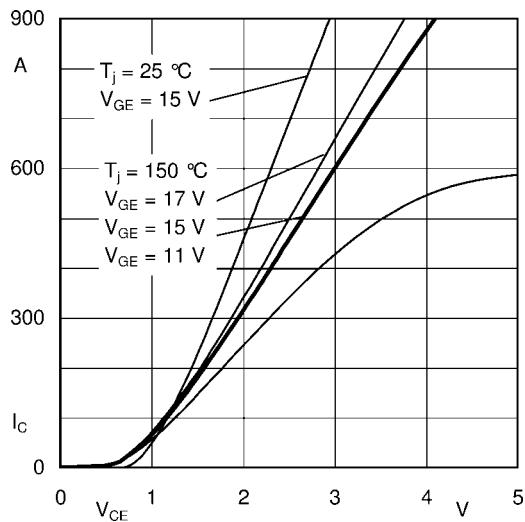


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_E$

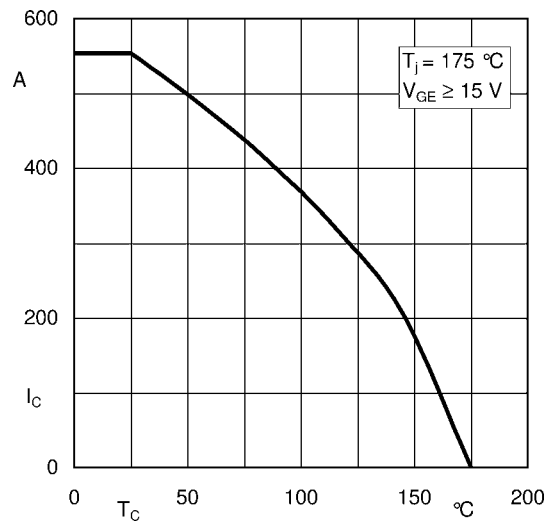


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

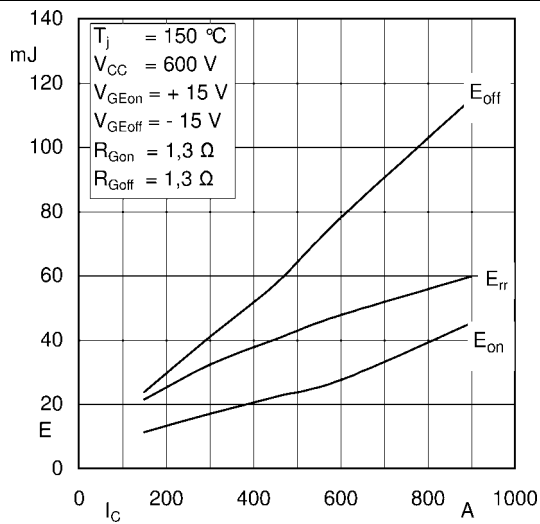


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

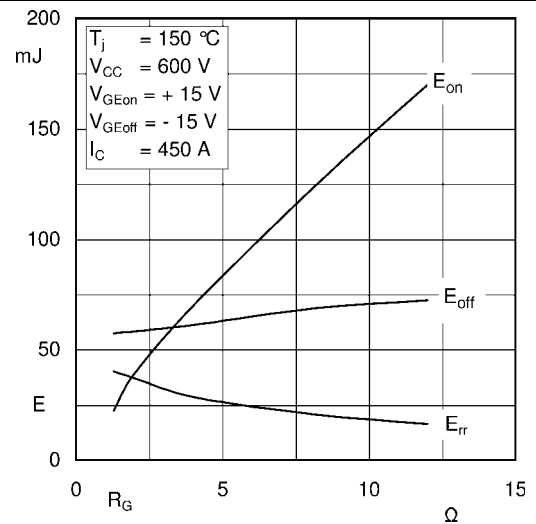


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

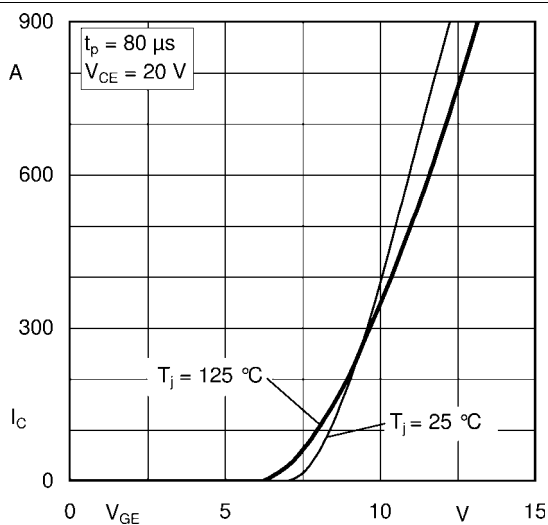


Fig. 5: Typ. transfer characteristic

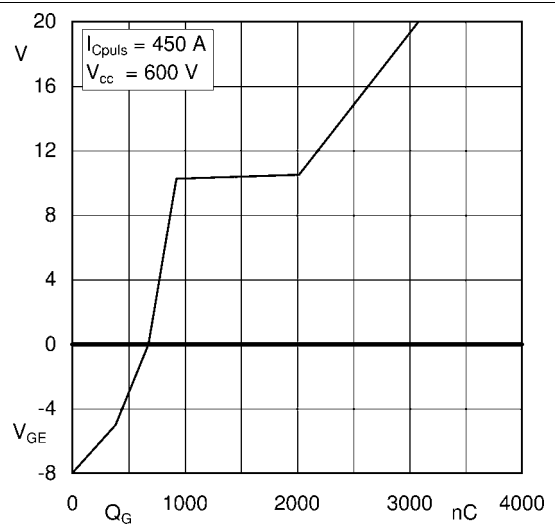


Fig. 6: Typ. gate charge characteristic

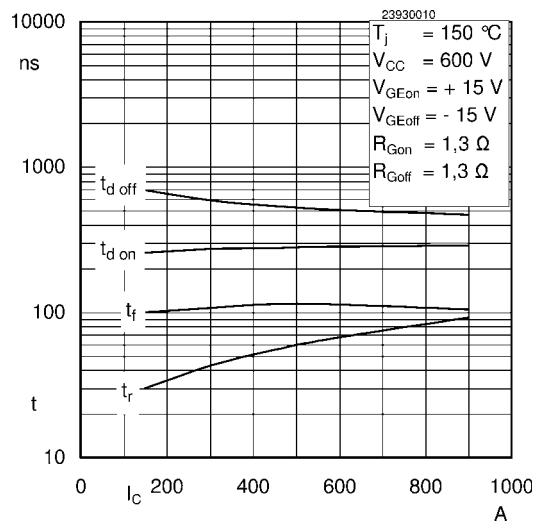


Fig. 7: Typ. switching times vs. I_C

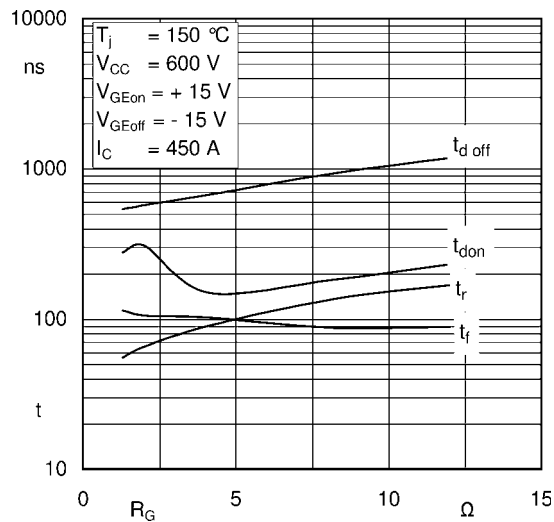


Fig. 8: Typ. switching times vs. gate resistor R_G

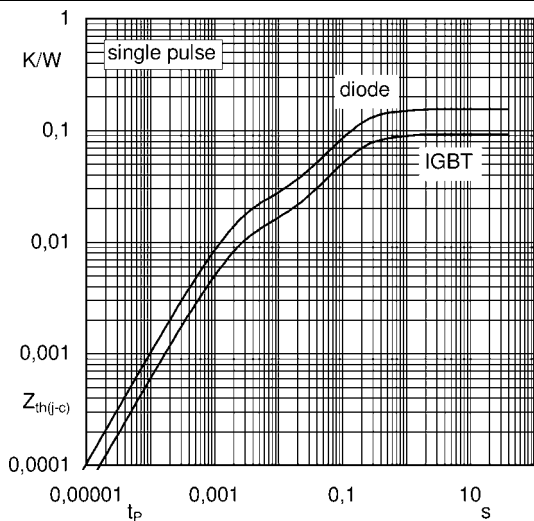


Fig. 9: Typ. transient thermal impedance

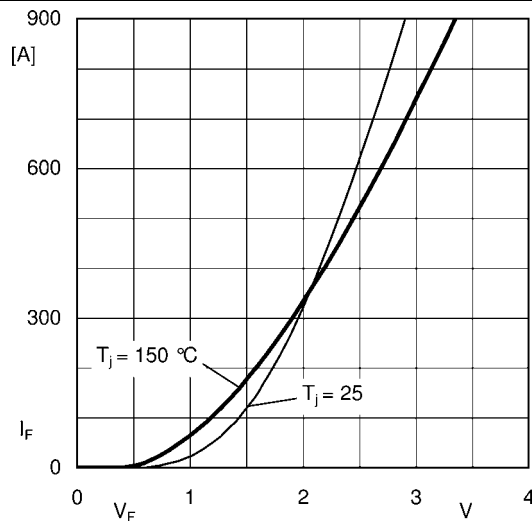


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

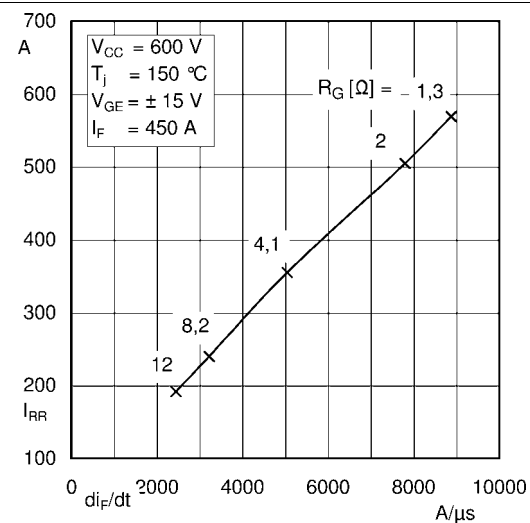


Fig. 11: Typ. CAL diode peak reverse recovery current

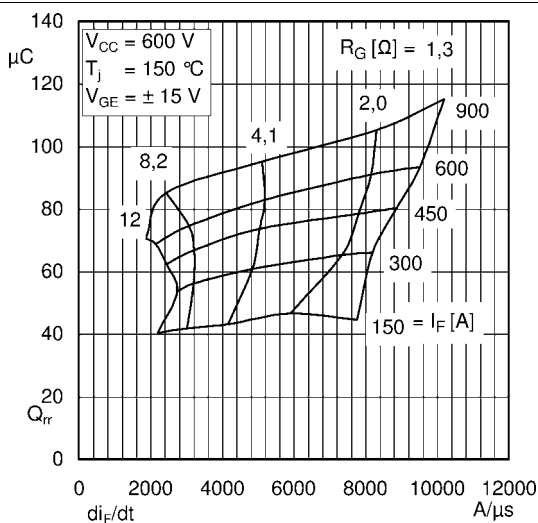


Fig. 12: Typ. CAL diode recovery charge

