

SKiM® 63

Trench IGBT Modules

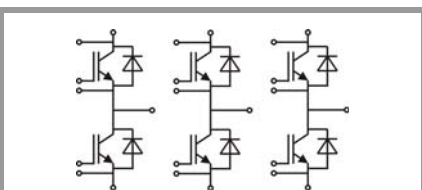
SKiM306GD12E4

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

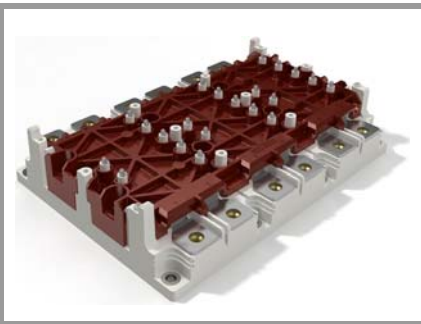
- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives



GD

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
IGBT				
V_{CES}		1200	V	
I_C	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	365	A
		$T_s = 70\text{ °C}$	296	A
I_{Cnom}		300	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	900	A	
V_{GES}		-20 ... 20	V	
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150\text{ °C}$	10	μs
T_j		-40 ... 175	$^{\circ}\text{C}$	
Inverse diode				
I_F	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	285	A
		$T_s = 70\text{ °C}$	225	A
I_{Fnom}		300	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	900	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$	1620	A	
T_j		-40 ... 175	$^{\circ}\text{C}$	
Module				
$I_{t(RMS)}$		700	A	
T_{stg}		-40 ... 125	$^{\circ}\text{C}$	
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	2500	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 300\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	1.85	2.10	V
		$T_j = 150\text{ °C}$	2.25	2.45	V
V_{CE0}		$T_j = 25\text{ °C}$	0.8	0.9	V
		$T_j = 150\text{ °C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$	3.5	4.0	$\text{m}\Omega$
		$T_j = 150\text{ °C}$	5.2	5.5	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 12\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25\text{ °C}$	0.1	0.3	mA
					mA
C_{ies}	$V_{CE} = 25\text{ V}$	$f = 1\text{ MHz}$	17.6		nF
C_{oes}	$V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	1.16		nF
C_{res}		$f = 1\text{ MHz}$	0.94		nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$		1700		nC
R_{Gint}	$T_j = 25\text{ °C}$		2.5		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150\text{ °C}$	252		ns
t_r	$I_C = 300\text{ A}$	$T_j = 150\text{ °C}$	44		ns
E_{on}	$R_{Gon} = 1\text{ }\Omega$	$T_j = 150\text{ °C}$	19		mJ
$t_{d(off)}$	$R_{Goff} = 1\text{ }\Omega$	$T_j = 150\text{ °C}$	506		ns
t_f	$di/dt_{on} = 6590\text{ A}/\mu\text{s}$ $di/dt_{off} = 4000\text{ A}/\mu\text{s}$	$T_j = 150\text{ °C}$	70		ns
E_{off}		$T_j = 150\text{ °C}$	39		mJ
$R_{th(j-s)}$	per IGBT			0.142	K/W



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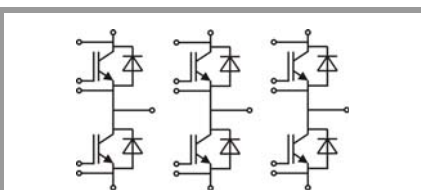
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 300\text{ A}$ $V_{GE} = 0\text{ V}$ chip	$T_j = 25\text{ °C}$		2.1	2.5	V
		$T_j = 150\text{ °C}$		2.1	2.4	V
V_{F0}		$T_j = 25\text{ °C}$		1.3	1.5	V
		$T_j = 150\text{ °C}$		0.9	1.1	V
r_F		$T_j = 25\text{ °C}$		2.8	3.2	mΩ
		$T_j = 150\text{ °C}$		3.9	4.3	mΩ
I_{RRM}	$I_F = 300\text{ A}$ $di/dt_{off} = 8000\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150\text{ °C}$		448		A
Q_{rr}		$T_j = 150\text{ °C}$		47		μC
E_{rr}		$T_j = 150\text{ °C}$			21	
$R_{th(j-s)}$	per diode				0.239	K/W
Module						
L_{CE}				9	13	nH
$R_{CC'+EE'}$	terminal-chip	$T_s = 25\text{ °C}$		0.3		mΩ
		$T_s = 125\text{ °C}$		0.5		mΩ
M_s	to heat sink (M4)			2.5	4	Nm
M_t		to terminals (M6)		3	5	Nm
						Nm
w					750	g
Temperature sensor						
R_{100}	$T_{Sensor} = 100\text{ °C}$ ($R_{25} = 5\text{ k}\Omega$)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/373)]$; $T[K]$;			4096		K

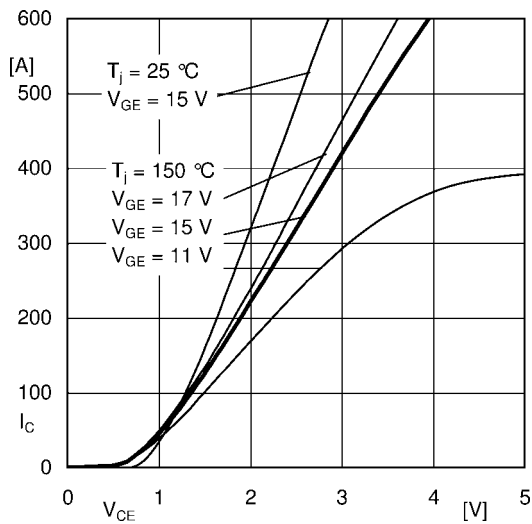


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

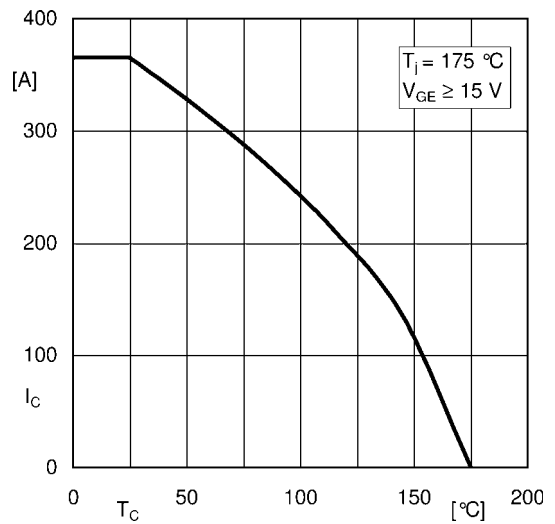


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

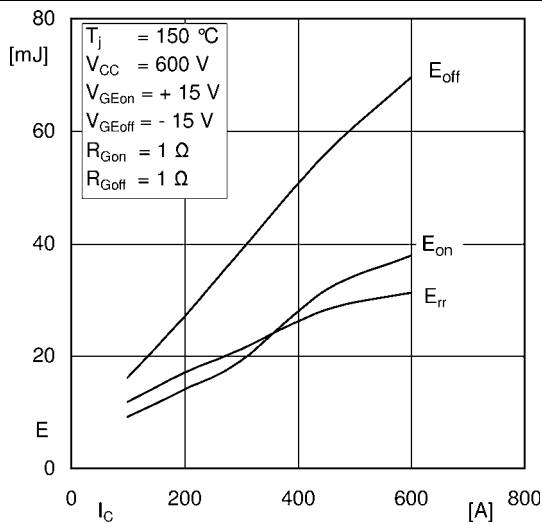


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

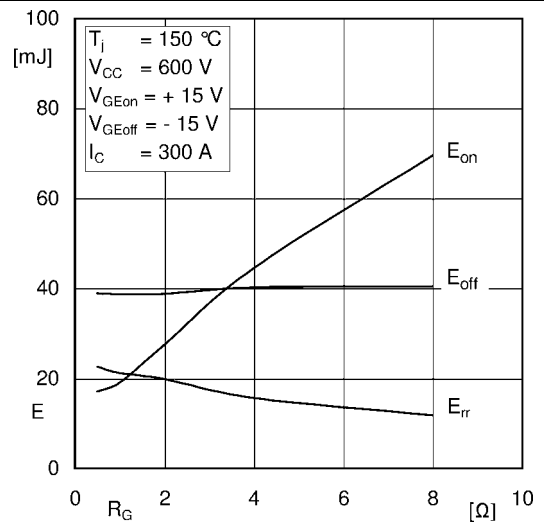


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

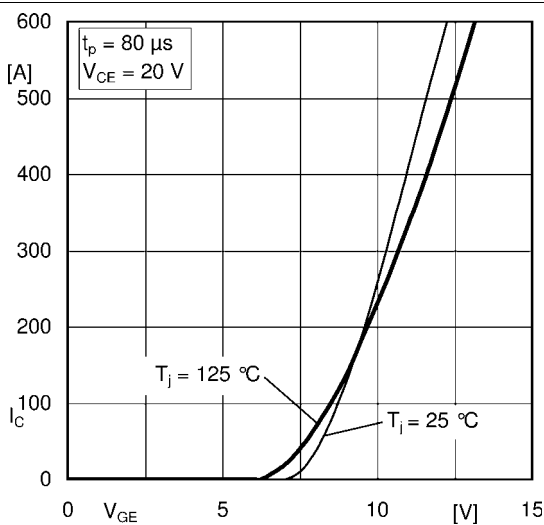


Fig. 5: Typ. transfer characteristic

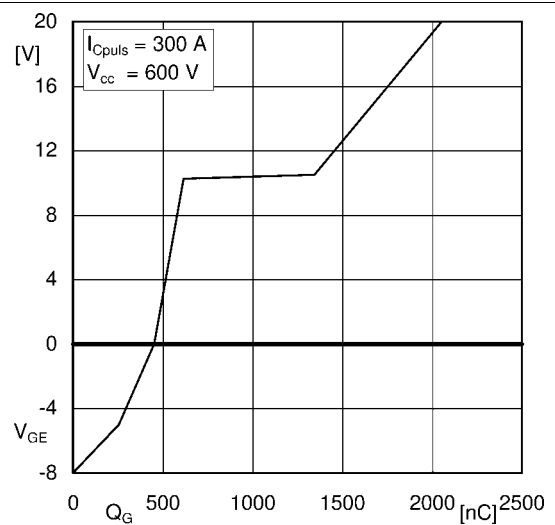


Fig. 6: Typ. gate charge characteristic

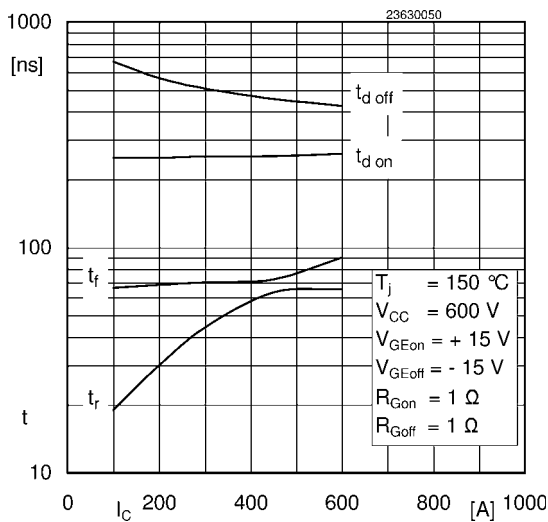


Fig. 7: Typ. switching times vs. I_C

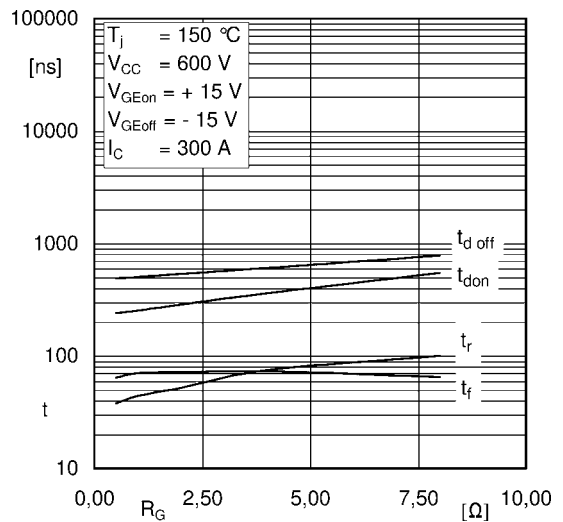


Fig. 8: Typ. switching times vs. gate resistor R_G

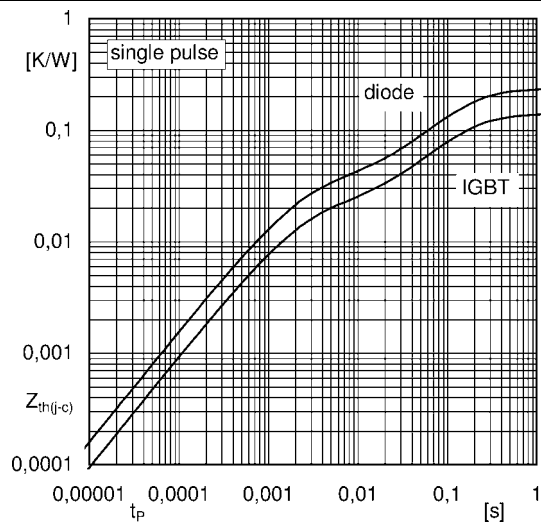


Fig. 9: Typ. transient thermal impedance

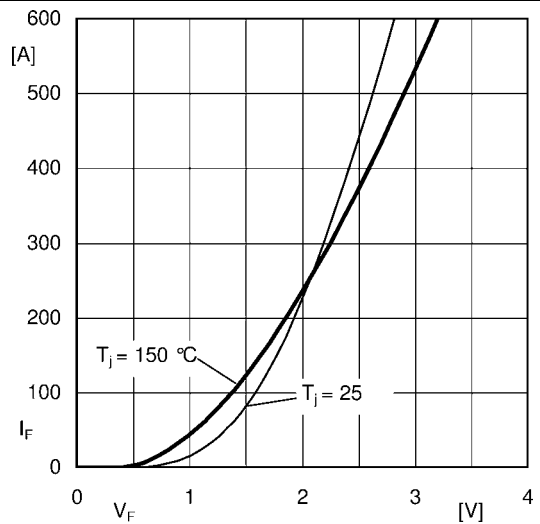


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

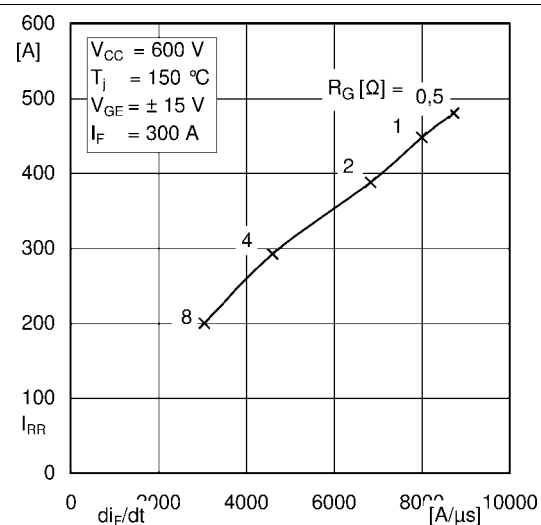


Fig. 11: Typ. CAL diode peak reverse recovery current

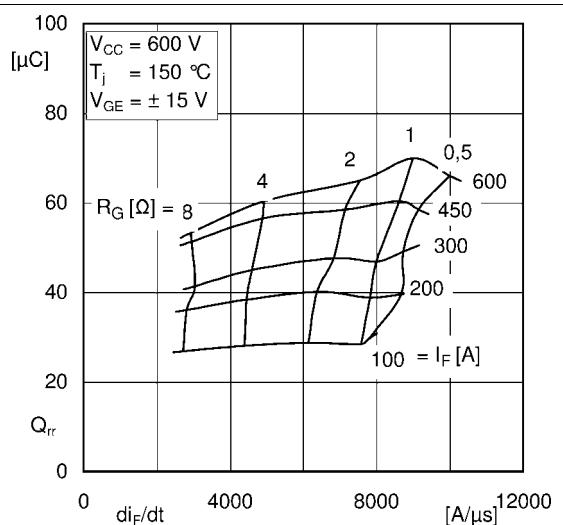


Fig. 12: Typ. CAL diode recovery charge

