SEMITOP®E1

3-phase Converter-Inverter-Brake (CIB)

SK30DGDL07E3ETE1

Features*

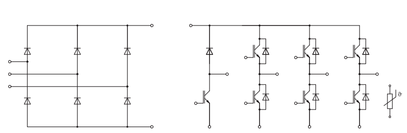
- Optimized design for superior thermal performance
- Low inductive design
- Press-Fit contact technology
- 650V Trench IGBT3 (E3)
- Robust and soft switching CAL4F diode technology
- PEP rectifier diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C



DGDL-ET

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		650	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 70 °C	32	A
		T_s = 100 °C	26	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	39	A
		T_s = 100 °C	31	A
I_{Cnom}			30	A
I_{CRM}			60	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 650 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		650	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 70 °C	32	A
		T_s = 100 °C	26	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	39	A
		T_s = 100 °C	31	A
I_{Cnom}			30	A
I_{CRM}			60	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 650 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse - Diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 70 °C	29	A
		T_s = 100 °C	23	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	34	A
		T_s = 100 °C	27	A
I_{FRM}			60	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		150	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 70 °C	29	A
		T_s = 100 °C	23	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	34	A
		T_s = 100 °C	27	A
I_{FRM}			60	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		150	A
T_j			-40 ... 175	°C

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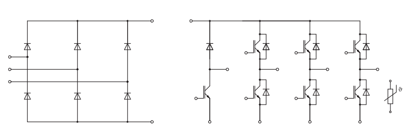
Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1600	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 70 °C	46	A
		T_s = 100 °C	36	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	54	A
		T_s = 100 °C	43	A
I_{FSM}	t_p = 10 ms sin 180°	T_j = 25 °C	370	A
		T_j = 150 °C	270	A
i^2t	t_p = 10 ms sin 180°	T_j = 25 °C	685	A^2s
		T_j = 150 °C	365	A^2s
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	, $\Delta T_{terminal}$ at PCB joint = 30 K, per pin		30	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC, sinusoidal, 1 min		2500	V

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverter - IGBT						
$V_{CE(sat)}$	I_C = 30 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.45	1.87	V
		T_j = 150 °C		1.70	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.82	0.90	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		18	29	mΩ
		T_j = 150 °C		29	40	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 0.43 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		1.63		nF
C_{oes}		f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.05		nF
Q_G	V_{GE} = -15V ...15V			301		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 300 V I_C = 30 A $R_{G\,on}$ = 10 Ω $R_{G\,off}$ = 10 Ω di/dt_{on} = 820 A/µs di/dt_{off} = 680 A/µs dv/dt = 4900 V/µs V_{GE} = +15/-15 V	T_j = 150 °C		5		ns
t_r		T_j = 150 °C		30		ns
E_{on}		T_j = 150 °C		1.04		mJ
$t_{d(off)}$		T_j = 150 °C		139		ns
t_f		T_j = 150 °C		37		ns
E_{off}		T_j = 150 °C		0.81		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.45		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			1.09		K/W



DGDL-ET

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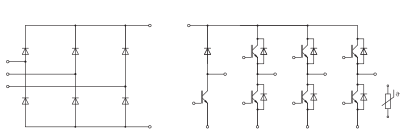

DGDL-ET

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 30 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.45	1.87	V
		T_j = 150 °C		1.70	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.82	0.90	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		18	29	mΩ
		T_j = 150 °C		29	40	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.43 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		1.63		nF
C_{oes}		f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.05		nF
Q_G	V_{GE} = -15 V ... +15 V			301		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 300 V, I_C = 30 A, $R_{G\,on}$ = 10 Ω, $R_{G\,off}$ = 10 Ω, di/dt$_{on}$ = 820 A/µs, di/dt$_{off}$ = 680 A/µs, dv/dt = 4900 V/µs, V_{GE} = +15/-15 V	T_j = 150 °C		5		ns
t_r		T_j = 150 °C		30		ns
E_{on}		T_j = 150 °C		1.04		mJ
$t_{d(off)}$		T_j = 150 °C		139		ns
t_f		T_j = 150 °C		37		ns
E_{off}		T_j = 150 °C		0.81		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.45		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			1.09		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 30 A, chiplevel	T_j = 25 °C		1.60	2.06	V
		T_j = 150 °C		1.69	2.21	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		19	27	mΩ
		T_j = 150 °C		28	41	mΩ
I_{RRM}	I_F = 30 A, di/dt$_{off}$ = 810 A/µs, V_{GE} = -15 V, V_{CC} = 300 V	T_j = 150 °C		20		A
Q_{rr}		T_j = 150 °C		3		µC
E_{rr}		T_j = 150 °C		0.51		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.75		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.38		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 30 A, chiplevel	T_j = 25 °C		1.60	2.06	V
		T_j = 150 °C		1.69	2.21	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		19	27	mΩ
		T_j = 150 °C		28	41	mΩ
I_{RRM}	I_F = 30 A, di/dt$_{off}$ = 810 A/µs, V_{GE} = -15 V, V_{CC} = 300 V	T_j = 150 °C		20		A
Q_{rr}		T_j = 150 °C		3		µC
E_{rr}		T_j = 150 °C		0.51		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.75		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.38		K/W

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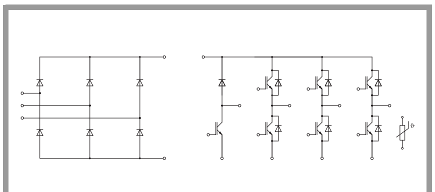


DGDL-ET

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
V_F	I_F = 30 A chiplevel	T_j = 25 °C		1.07	1.34	V
		T_j = 150 °C		0.99	1.27	V
V_{F0}	chiplevel	T_j = 25 °C		0.89	1.09	V
		T_j = 150 °C		0.73	0.92	V
r_F	chiplevel	T_j = 25 °C		6.2	8.5	mΩ
		T_j = 150 °C		8.8	12	mΩ
I_R	T_j = 150 °C, V_{RRM}				2	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.56		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.21		K/W
Module						
M_s	to heatsink		1.6		2.3	Nm
w				25		g
L_{CE}				30		nH
Temperature Sensor						
R_{100}	T_c=100°C (R_{25}=5 kΩ)			493 ± 5%		Ω
$B_{25/85}$	$R_{(T)}$=R_{25}*exp[$B_{25/85}$*(1/T-1/298)], T[K]			3420		K

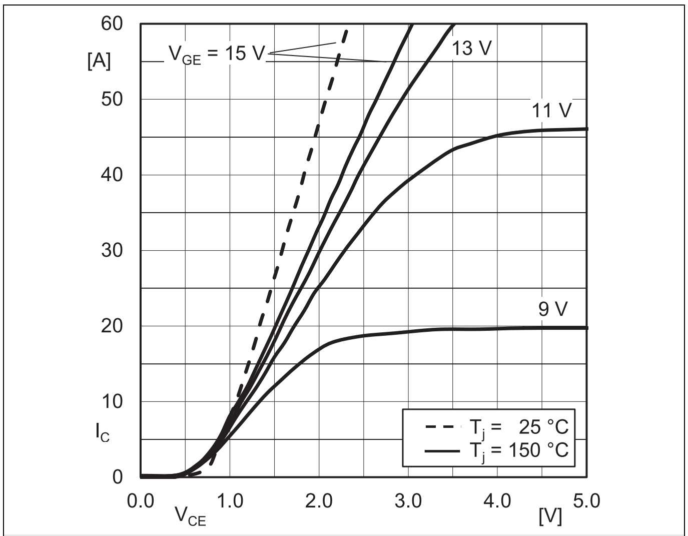


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+ EE'}$

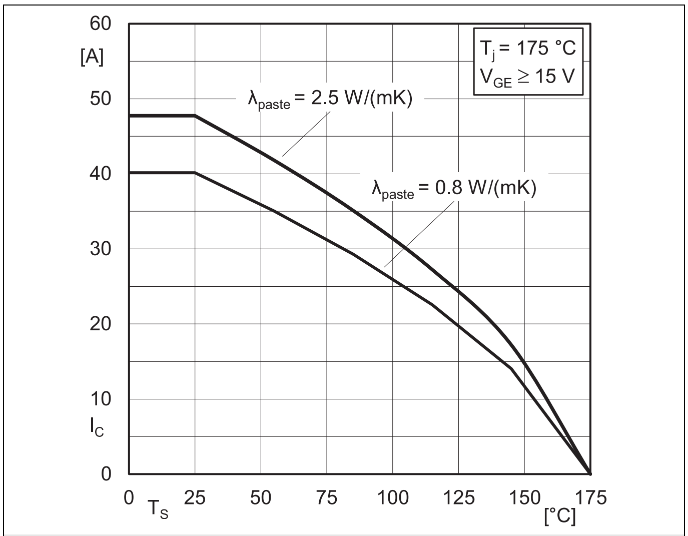


Fig. 2: IGBT rated current vs. temperature $I_c = f(T_s)$

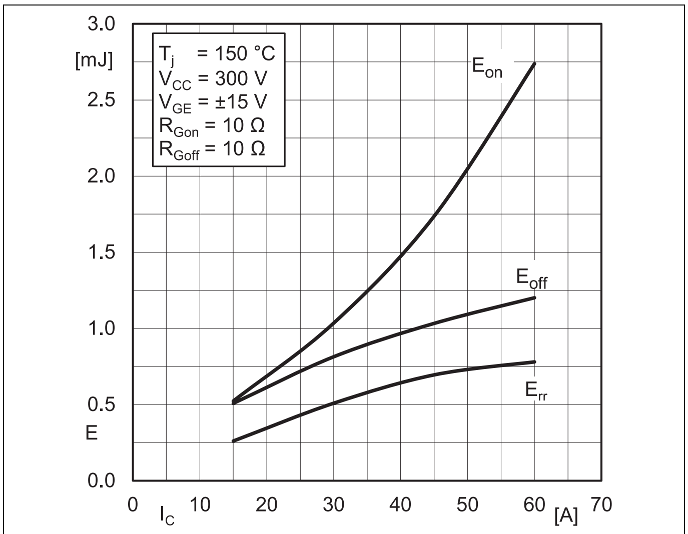


Fig. 3: Typ. turn-on /-off energy = f (I_C)

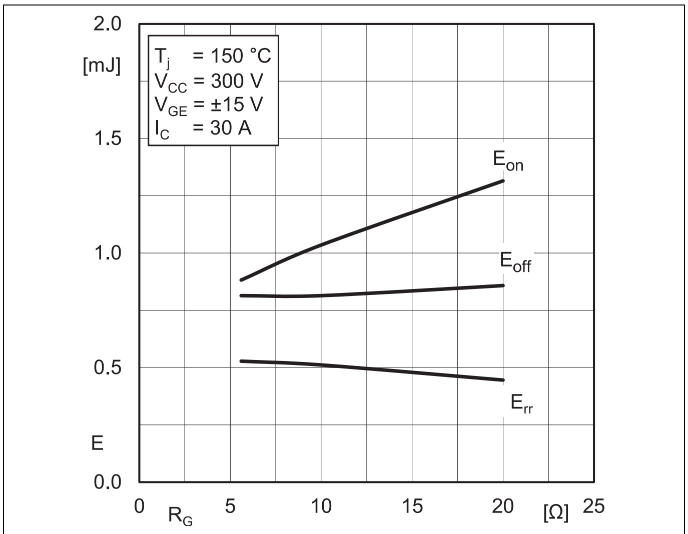


Fig. 4: Typ. turn-on /-off energy = f (R_G)

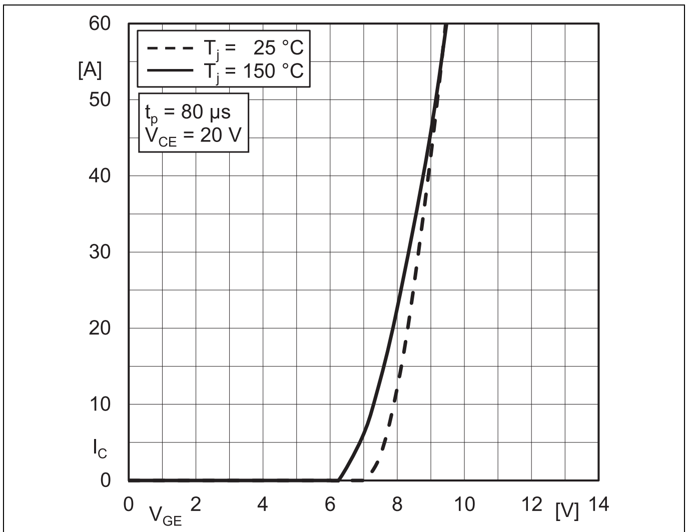


Fig. 5: Typ. IGBT transfer characteristic

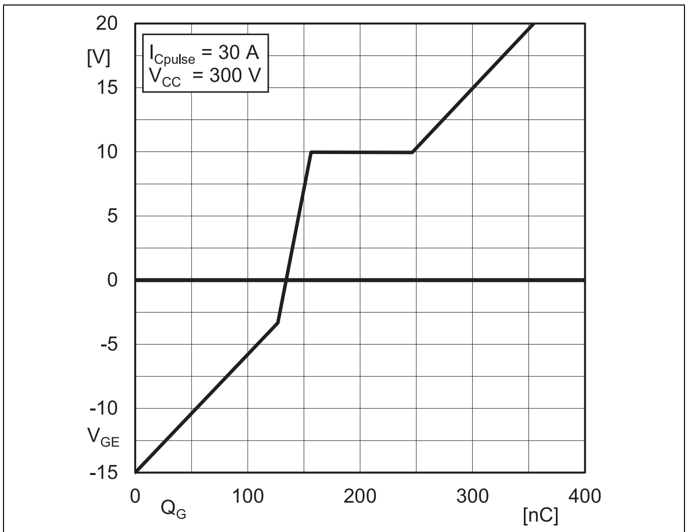


Fig. 6: Typ. IGBT gate charge characteristic

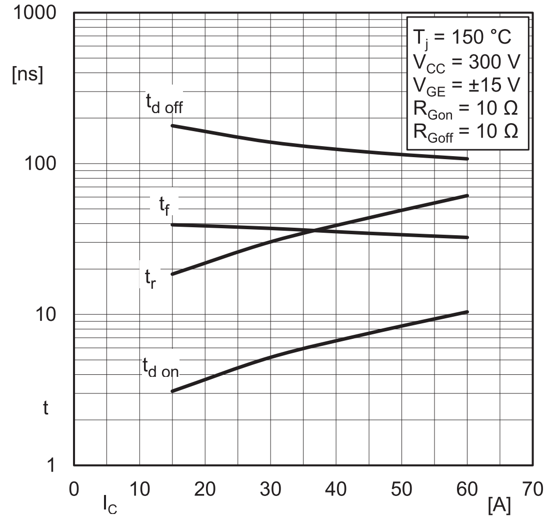


Fig. 7: Typ. switching times = f (I_C)

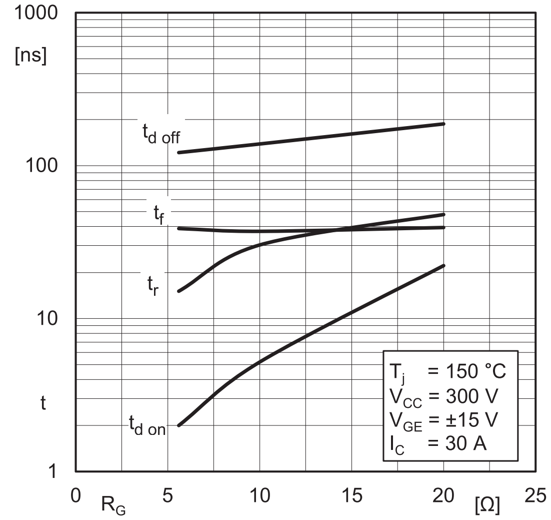


Fig. 8: Typ. switching times = f (R_G)

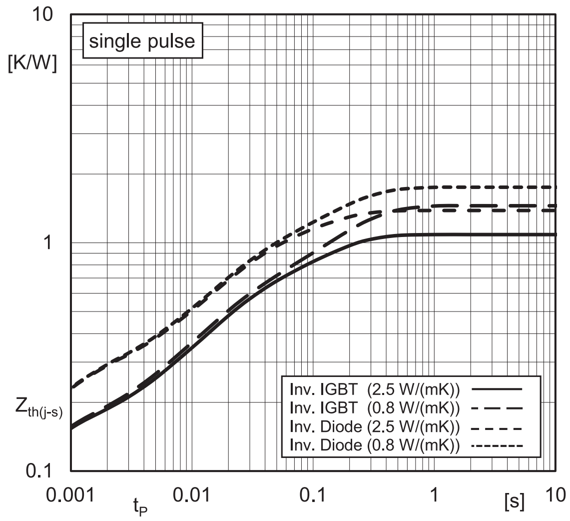


Fig. 9: Typ. transient thermal impedance

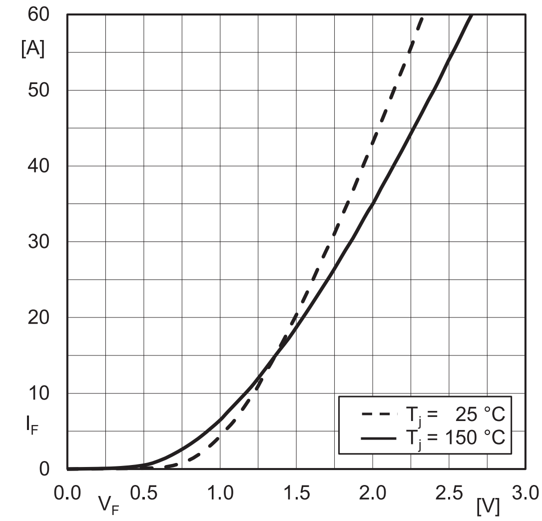


Fig. 10: Typ. Inv. diode forward charact., incl. $R_{CC'+EE'}$

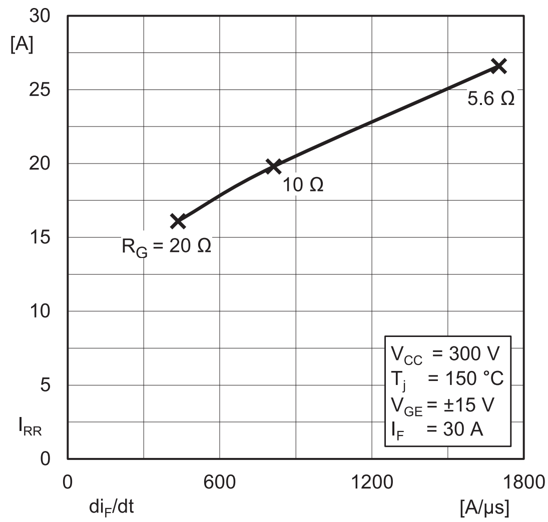


Fig. 11: Typ. Inv. diode peak reverse recovery current

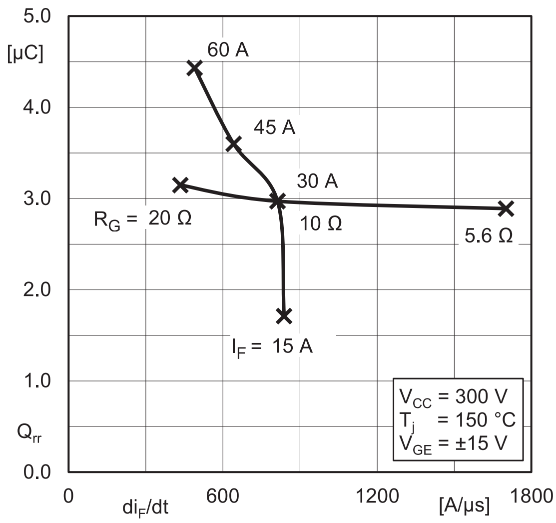


Fig. 12: Typ. Inv. diode reverse recovery charge

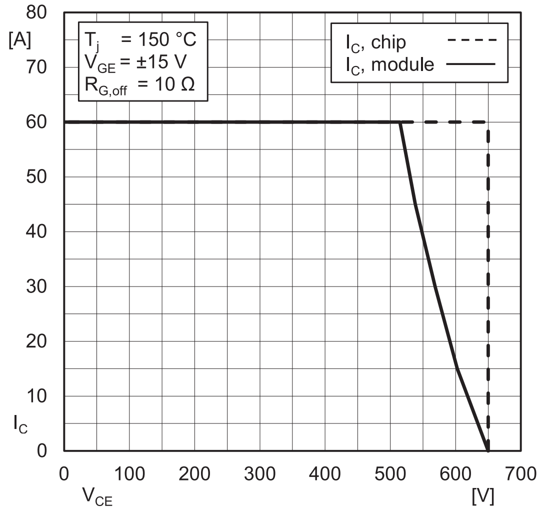


Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

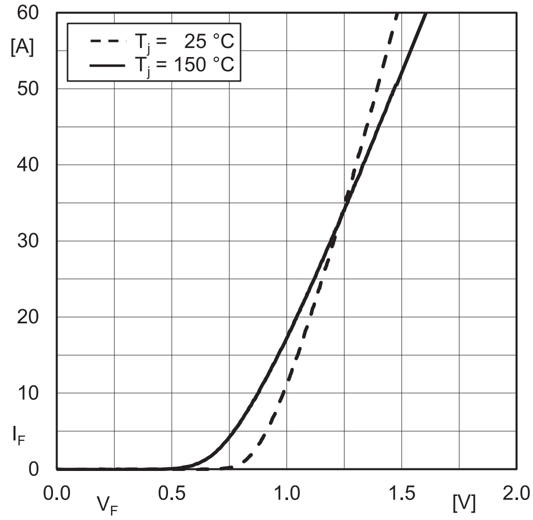
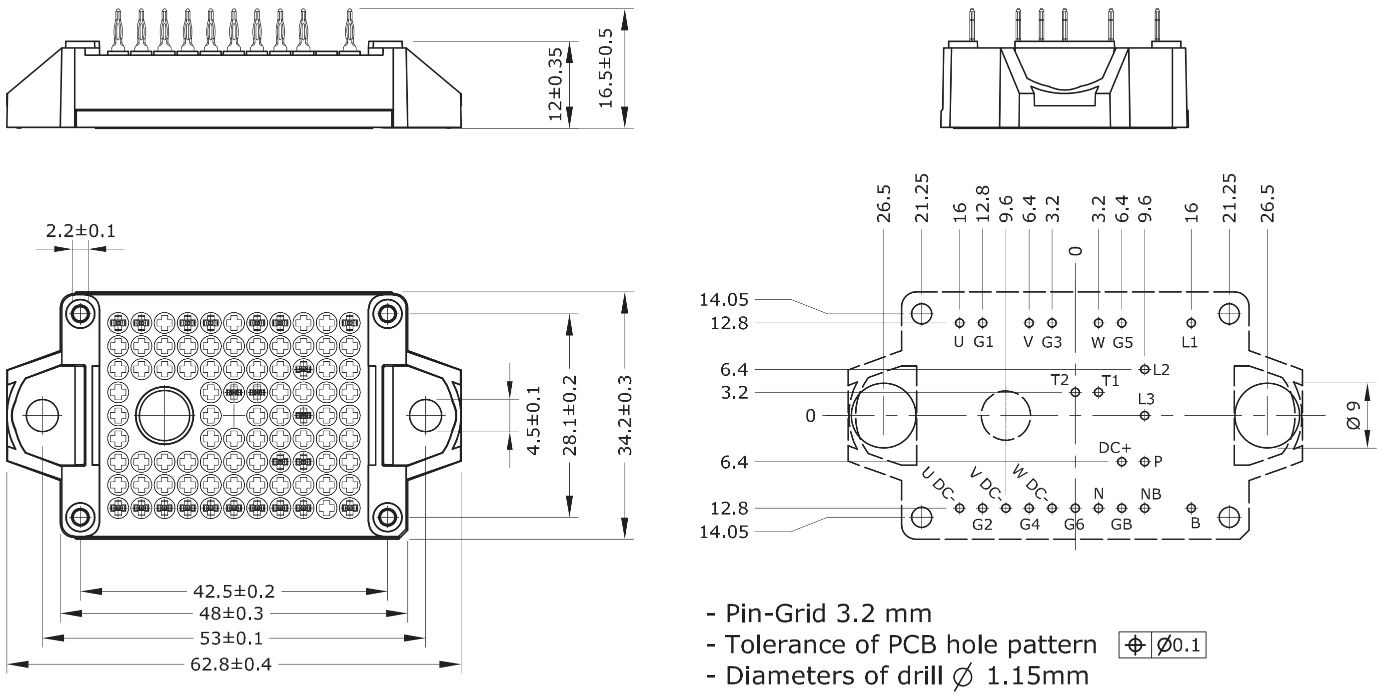
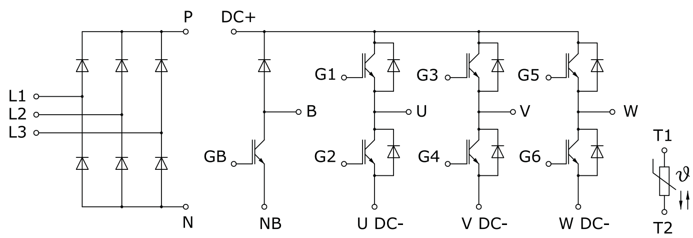


Fig. 14: Typ. Rect. diode forward charact., incl. $R_{CC'+EE'}$



- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern ⌖ Ø0.1
- Diameters of drill Ø 1.15mm
- Copper thickness in hole 25 - 50 µm
- Hole specification for contacts:
  refer to SEMITOP E1/E2 Mounting Instruction

SEMITOP®E1



DGDL-ET

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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