

SK10DGDLO7E3ETE1



SEMITOP®E1

3-phase Converter-Inverter-Brake (CIB)

SK10DGDLO7E3ETE1

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

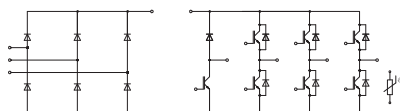
Typical Applications

- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op} = -40 \dots +150 \text{ }^{\circ}\text{C}$

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 _s = 70 °C	15	A
	T _j = 175 °C	T _s = 100 °C	13	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	17	A
	T _j = 175 °C	T _s = 100 °C	14	A
I _{Cnom}			10	A
I _{CRM}			20	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 _s = 70 °C	15	A
	T _j = 175 °C	T _s = 100 °C	13	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	17	A
	T _j = 175 °C	T _s = 100 °C	14	A
I _{Cnom}			10	A
I _{CRM}			20	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 _s = 70 °C	29	A
	T _j = 175 °C	T _s = 100 °C	23	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	34	A
	T _j = 175 °C	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 _s = 70 °C	29	A
	T _j = 175 °C	T _s = 100 °C	23	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	34	A
	T _j = 175 °C	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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Typical Applications

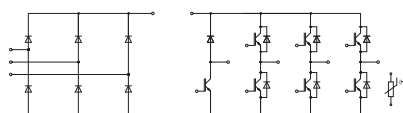
- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op} = -40 \dots +150 \text{ }^{\circ}\text{C}$

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 _s = 70 °C	33	A
		T _s = 100 °C	26	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	38	A
		T _s = 100 °C	30	A
I _{FSM}	t _p = 10 ms sin 180°	T _j = 25 °C	220	A
		T _j = 150 °C	200	A
i ² t	t _p = 10 ms sin 180°	T _j = 25 °C	242	A ² s
		T _j = 150 °C	200	A ² s
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}	, ΔT _{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 = 10 A	T _j = 25 °C		1.45	1.87	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		1.70	2.10	V
V _{CE0}	chipelevel	T _j = 25 °C		0.90	1.00	V
		T _j = 150 °C		0.82	0.90	V
r _{CE}	V _{GE} = 15 V chipelevel	T _j = 25 °C		55	87	mΩ
		T _j = 150 °C		88	120	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.15 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		0.55		nF
C _{oes}		f = 1 MHz		0.04		nF
C _{res}		f = 1 MHz		0.02		nF
Q _G	V _{GE} = -15 V ... +15 V			102		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 300 V	T _j = 150 °C		5		ns
t _r	I _C = 10 A	T _j = 150 °C		30		ns
E _{on}	R _{G on} = 30 Ω	T _j = 150 °C		0.39		mJ
	R _{G off} = 30 Ω	T _j = 150 °C				
t _{d(off)}	di/dt _{on} = 270 A/μs	T _j = 150 °C		139		ns
t _f	di/dt _{off} = 300 A/μs	T _j = 150 °C		37		ns
E _{off}	dv/dt = 4300 V/μs V _{GE} = +15/-15 V	T _j = 150 °C		0.31		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			2.42		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			2.07		K/W



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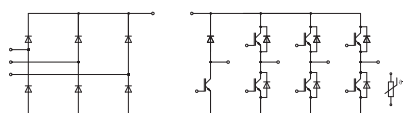
Typical Applications

- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op} = -40 \dots +150 \text{ }^{\circ}\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
V _{CE(sat)}	I _C = 10 A	T _j = 25 °C		1.45	1.87	V
	V _{GE} = 15 V chiplevel	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	T _j = 25 °C		55	87	mΩ
	chiplevel	T _j = 150 °C		88	120	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.15 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		0.55		nF
C _{oes}		f = 1 MHz		0.04		nF
C _{res}		f = 1 MHz		0.02		nF
Q _G	V _{GE} = -15 V ... +15 V			102		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 300 V	T _j = 150 °C		5		ns
t _r	I _C = 10 A	T _j = 150 °C		30		ns
E _{on}	R _{G on} = 30 Ω	T _j = 150 °C		0.39		mJ
	R _{G off} = 30 Ω	T _j = 150 °C				
t _{d(off)}	di/dt _{on} = 270 A/μs	T _j = 150 °C		139		ns
t _f	di/dt _{off} = 300 A/μs	T _j = 150 °C		37		ns
	dv/dt = 4300 V/μs	T _j = 150 °C				
E _{off}	V _{GE} = +15/-15 V		0.31		mJ	
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			2.42		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			2.07		K/W
Inverse - Diode						
V _F = V _{EC}	I _F = 10 A	T _j = 25 °C		1.23	1.51	V
	chiplevel	T _j = 150 °C		1.13	1.40	V
V _{F0}		T _j = 25 °C		1.04	1.24	V
	chiplevel	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 = 10 A	T _j = 150 °C		10		A
Q _{rr}	di/dt _{off} = 270 A/μs	T _j = 150 °C		1.7		μC
E _{rr}	V _{GE} = -15 V	T _j = 150 °C		0.23		mJ
	V _{CC} = 300 V					
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 = 10 A	T _j = 25 °C		1.23	1.51	V
	chiplevel	T _j = 150 °C		1.13	1.40	V
V _{F0}		T _j = 25 °C		1.04	1.24	V
	chiplevel	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 = 10 A	T _j = 150 °C		10		A
Q _{rr}	di/dt _{off} = 270 A/μs	T _j = 150 °C		1.7		μC
E _{rr}	V _{GE} = -15 V	T _j = 150 °C		0.23		mJ
	V _{CC} = 300 V					
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



DGDL-ET



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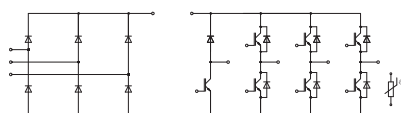
Typical Applications

- Motor drives
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- Auxiliary Inverters

Remarks

- Recommended $T_{j,op} = -40 \dots +150 \text{ }^{\circ}\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
V _F	I _F = 10 A	T _j = 25 °C		0.99	1.23	V
	chiplevel	T _j = 150 °C		0.87	1.11	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		10	14	mΩ
		T _j = 150 °C		14	19	mΩ
I _R	T _j = 150 °C, V _{RRM}				2	mA
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.99		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.64		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



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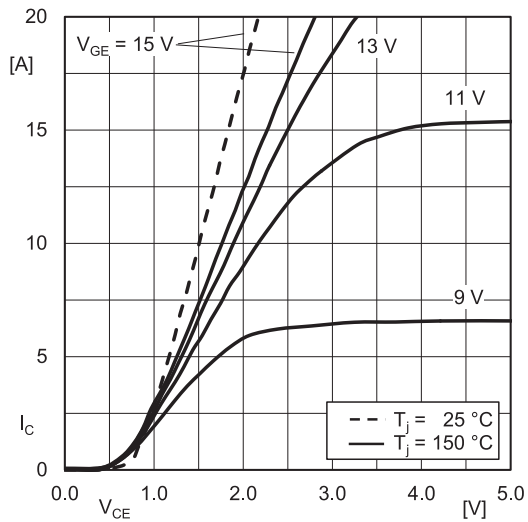


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+EE'}$

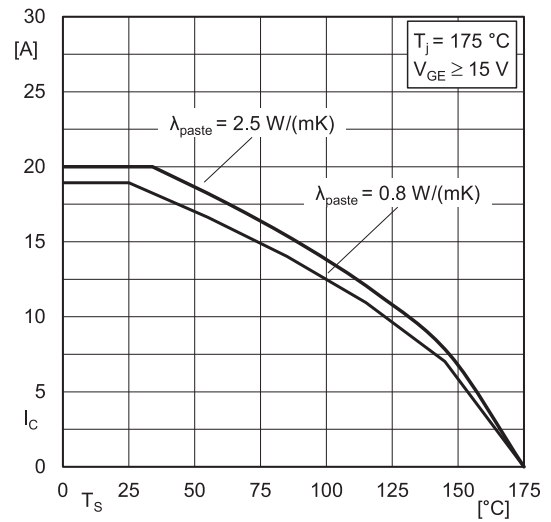


Fig. 2: IGBT rated current vs. temperature $I_C=f(T_s)$

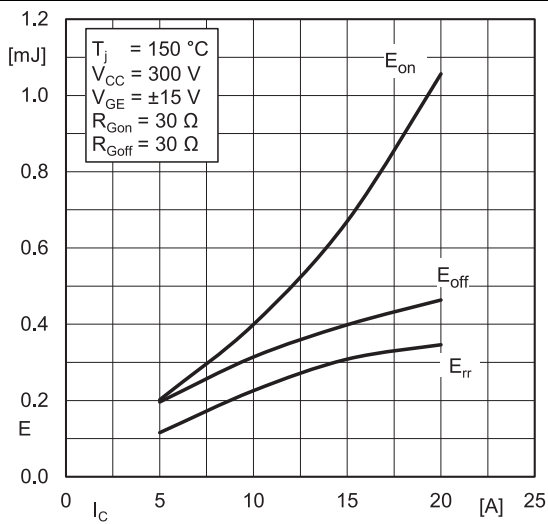


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

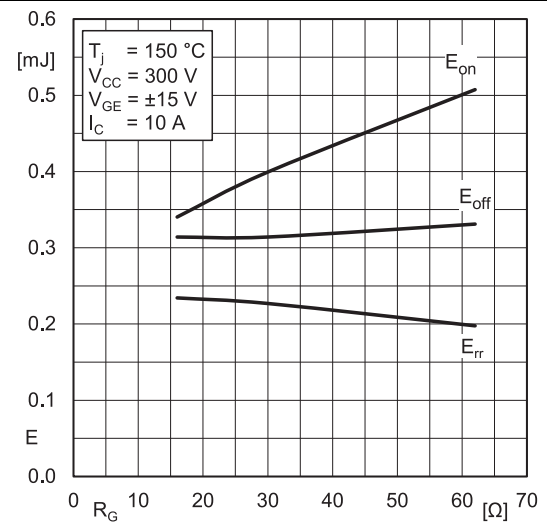


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

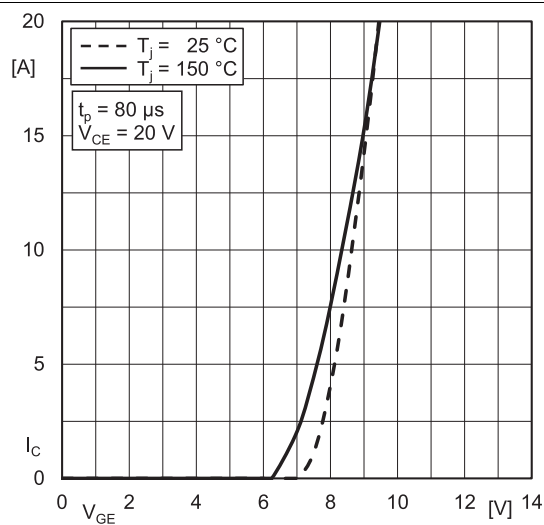


Fig. 5: Typ. IGBT transfer characteristic

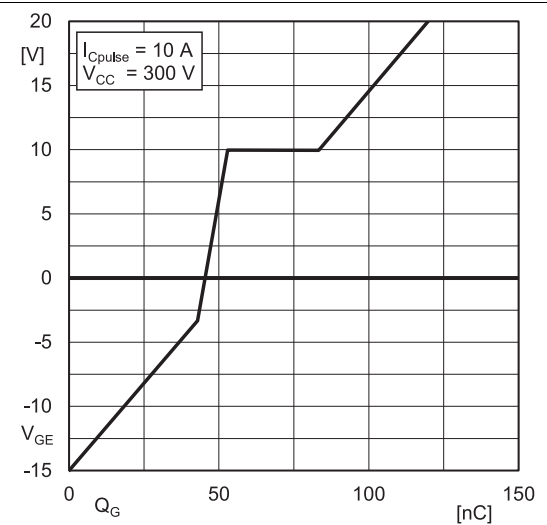


Fig. 6: Typ. IGBT gate charge characteristic

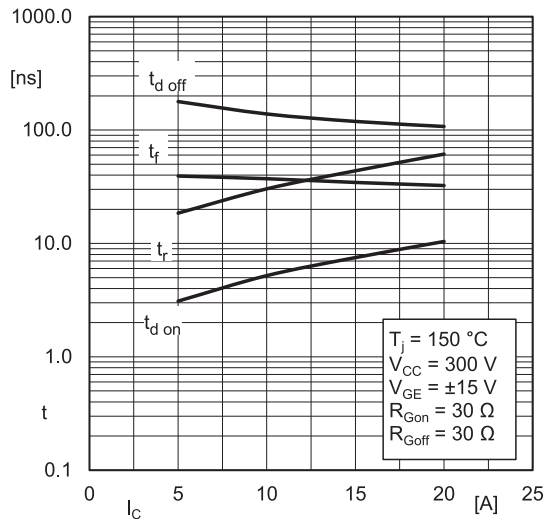


Fig. 7: Typ. switching times = $f(I_C)$

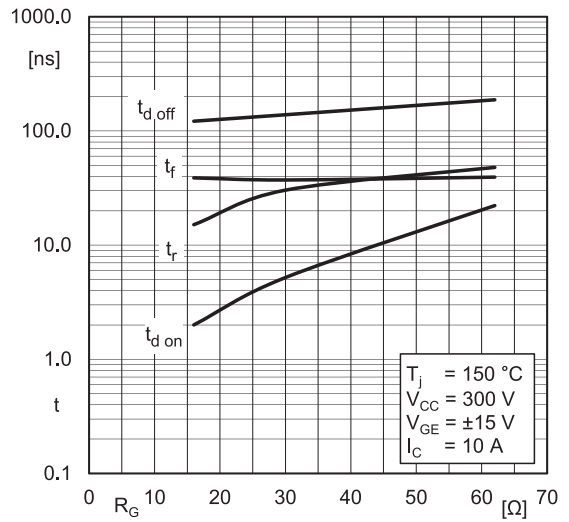


Fig. 8: Typ. switching times = $f(R_G)$

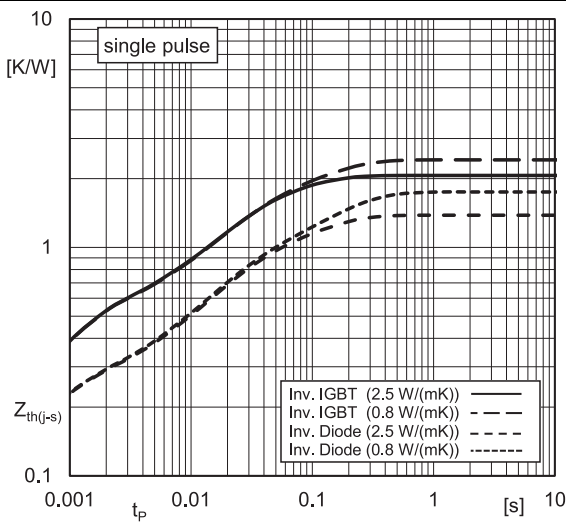


Fig. 9: Typ. transient thermal impedance

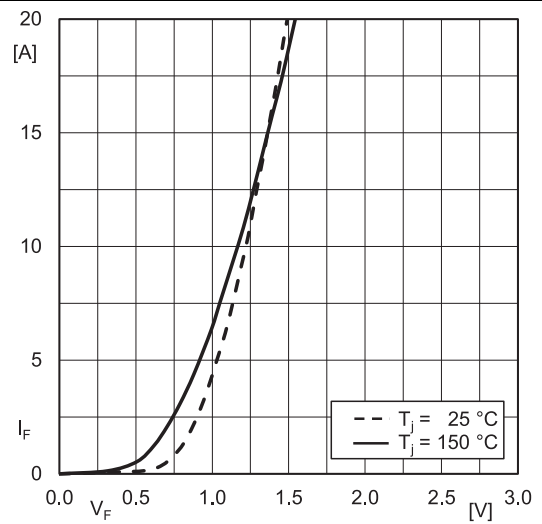


Fig. 10: Typ. Inv. diode forward charact., incl. $R_{CC}+EE$

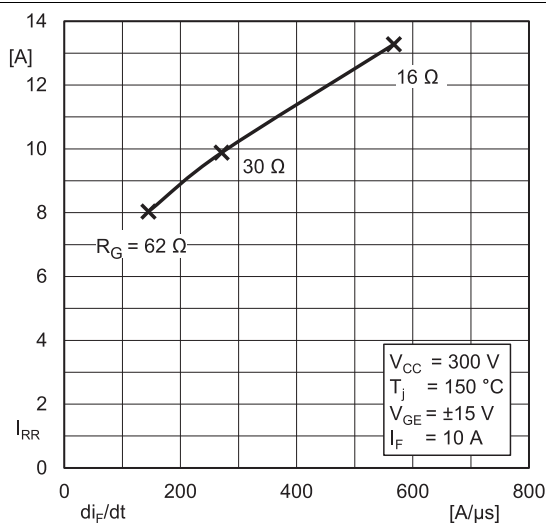


Fig. 11: Typ. Inv. diode peak reverse recovery current

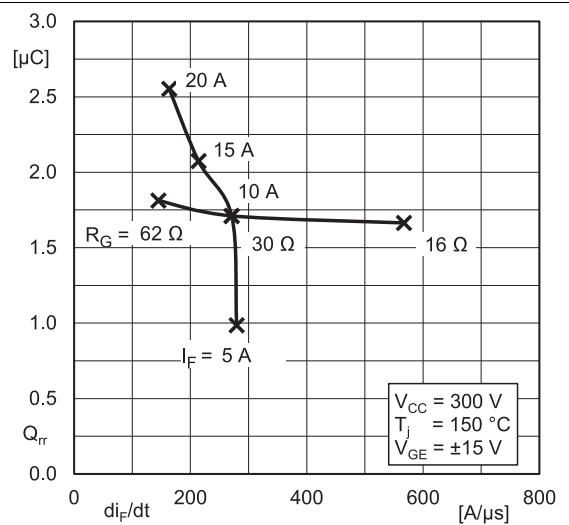


Fig. 12: Typ. Inv. diode reverse recovery charge

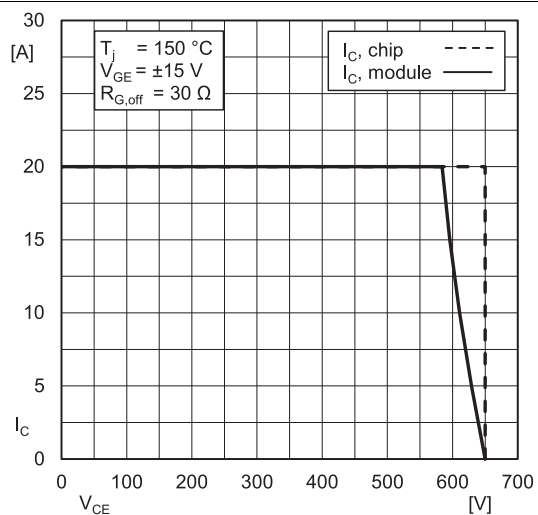


Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

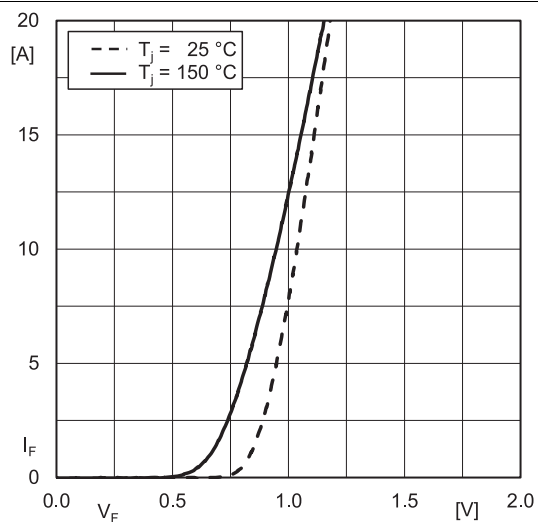
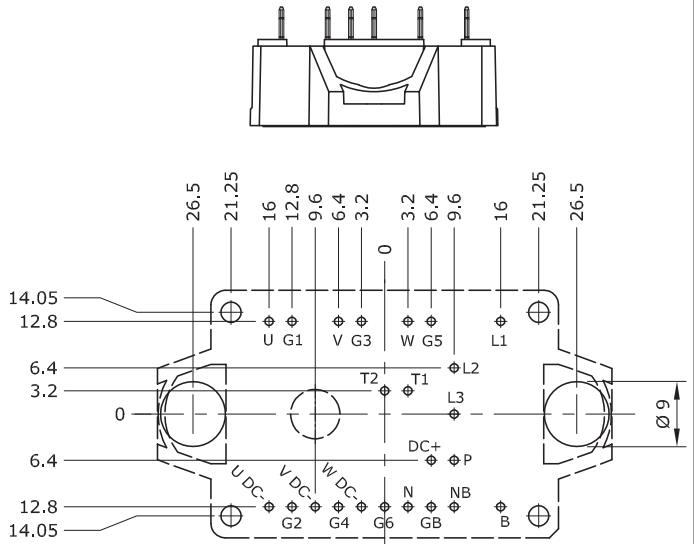
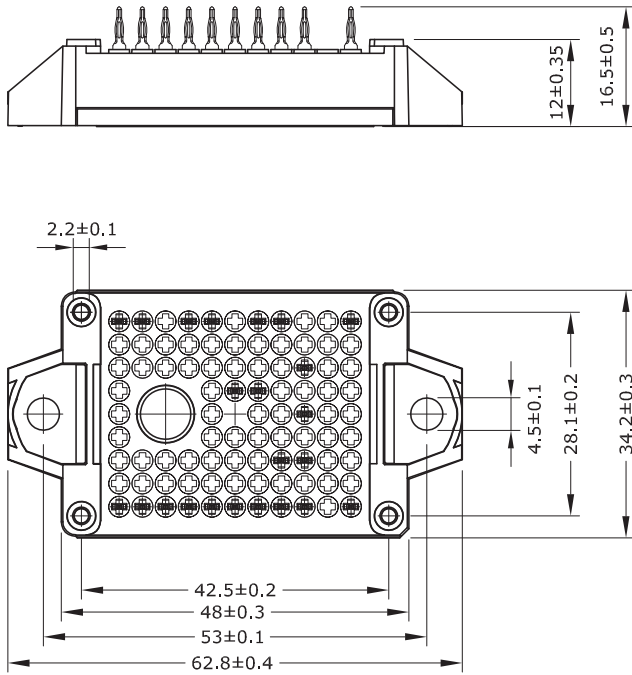
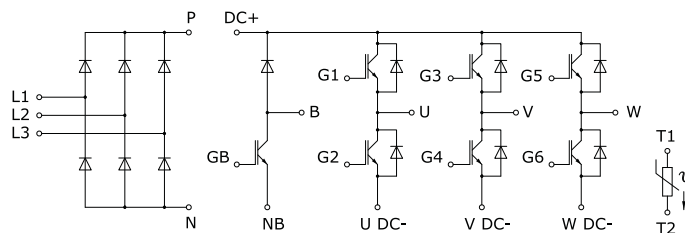


Fig. 14: Typ. Rect. diode forward charact., incl. $R_{CC'+EE'}$



- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern $\varnothing \pm 0.1$
- Diameters of drill $\varnothing 1.15$ mm
- Copper thickness in hole $25 - 50 \mu\text{m}$
- Hole specification for contacts:
refer to SEMITOP E1/E2 Mounting Instruction

SEMITOP®E1



DGDLE-ET

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

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