

SK10DGD12T7ETE1



SEMITOP®E1

3-phase Converter-Inverter (CI)

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Features*

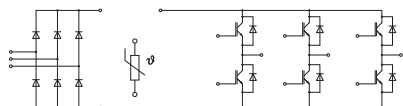
- Optimized design for superior thermal performance
- Low inductive design
- Press-Fit contact technology
- 1200V Generation 7 IGBT (T7)
- Robust and soft switching CAL4F diode technology
- PEP rectifier diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op} = -40 \dots +150 \text{ }^{\circ}\text{C}$
- $T_{j,op} > 150 \text{ }^{\circ}\text{C}$ during overload (details in AN19-002)



DGD-ET

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}			1200	V
I _C	P12	T _s = 70 °C	19	A
	T _j = 175 °C	T _s = 100 °C	15	A
I _C	HPTP / HP-PCM	T _s = 70 °C	20	A
	T _j = 175 °C	T _s = 100 °C	17	A
I _{Cnom}			10	A
I _{CRM}			20	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 175 °C	7	µs
T _j			-40 ... 175	°C
Inverse - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	P12	T _s = 70 °C	12	A
	T _j = 175 °C	T _s = 100 °C	10	A
I _F	HPTP / HP-PCM	T _s = 70 °C	13	A
	T _j = 175 °C	T _s = 100 °C	11	A
I _{FRM}			20	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		36	A
T _j			-40 ... 175	°C
Rectifier - Diode				
V _{RRM}	T _j = 25 °C		1600	V
I _F	P12	T _s = 70 °C	36	A
	T _j = 175 °C	T _s = 100 °C	29	A
I _F	HPTP / HP-PCM	T _s = 70 °C	40	A
	T _j = 175 °C	T _s = 100 °C	32	A
I _{FSM}	t _p = 10 ms	T _j = 25 °C	220	A
	sin 180°	T _j = 150 °C	200	A
i ² t	t _p = 10 ms	T _j = 25 °C	242	A ² s
	sin 180°	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		1.60	1.75	V
	V _{GE} = 15 V	T _j = 150 °C		1.78	1.93	V
	chiplevel	T _j = 175 °C		1.82	1.97	V
V _{CE0}		T _j = 25 °C		1.00	1.05	V
	chiplevel	T _j = 150 °C		0.80	0.85	V
		T _j = 175 °C		0.75	0.80	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		60	70	mΩ
	chiplevel	T _j = 150 °C		98	108	mΩ
		T _j = 175 °C		107	117	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.22 mA		5.15	5.8	6.45	V



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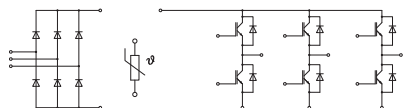
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C			1		mA
C _{ies}		f = 1 MHz		1.90		nF
C _{oes}	V _{CE} = 25 V	f = 1 MHz		0.02		nF
C _{res}	V _{GE} = 0 V	f = 1 MHz		0.01		nF
Q _G	V _{GE} = -15 V ... +15 V			140		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 600 V I _C = 10 A R _{G on} = 8.2 Ω R _{G off} = 8.2 Ω V _{GE} = +15/-15 V (T _j = 150 °C) di/dt _{on} = 700 A/μs di/dt _{off} = 120 A/μs dv/dt = 3700 V/μs	T _j = 25 °C		13		ns
		T _j = 150 °C		16		ns
		T _j = 175 °C		17		ns
t _r		T _j = 25 °C		18		ns
		T _j = 150 °C		19		ns
		T _j = 175 °C		20		ns
E _{on}		T _j = 25 °C		0.42		mJ
		T _j = 150 °C		0.74		mJ
		T _j = 175 °C		0.81		mJ
t _{d(off)}		T _j = 25 °C		199		ns
		T _j = 150 °C		270		ns
		T _j = 175 °C		293		ns
t _f		T _j = 25 °C		52		ns
		T _j = 150 °C		69		ns
		T _j = 175 °C		95		ns
E _{off}	T _j = 25 °C		0.75		mJ	
	T _j = 150 °C		1.26		mJ	
	T _j = 175 °C		1.37		mJ	
R _{th(j-s)}	per IGBT, P12 (Reference)			1.91		K/W
R _{th(j-s)}	per IGBT, HPTP / HP-PCM			1.56		K/W
Inverse - Diode						
V _F = V _{EC}	I _F = 10 A	T _j = 25 °C		2.59	2.94	V
	chiplevel	T _j = 150 °C		2.71	3.08	V
		T _j = 175 °C		2.53	2.89	V
V _{F0}		T _j = 25 °C		1.30	1.50	V
	chiplevel	T _j = 150 °C		0.90	1.10	V
		T _j = 175 °C		0.82	0.98	V
r _F		T _j = 25 °C		129	144	mΩ
	chiplevel	T _j = 150 °C		181	198	mΩ
		T _j = 175 °C		171	191	mΩ
I _{RRM}		T _j = 25 °C		8		A
	I _F = 10 A V _{GE} = -15 V V _{CC} = 600 V (T _j = 150 °C) di/dt _{off} = 790 A/μs	T _j = 150 °C		14		A
		T _j = 175 °C		16		A
Q _{rr}		T _j = 25 °C		0.58		μC
		T _j = 150 °C		2.01		μC
		T _j = 175 °C		2.37		μC
E _{rr}		T _j = 25 °C		0.36		mJ
		T _j = 150 °C		0.91		mJ
		T _j = 175 °C		1.16		mJ
R _{th(j-s)}	per Diode, P12 (Reference)			2.64		K/W
R _{th(j-s)}	per Diode, HPTP / HP-PCM			2.24		K/W

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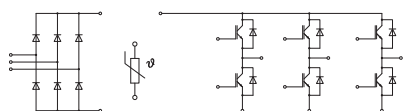
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
$V_F = V_{EC}$	$I_F = 10\text{ A}$ chiplevel	$T_j = 25\text{ }^{\circ}\text{C}$		0.99	1.23	V
		$T_j = 150\text{ }^{\circ}\text{C}$		0.87	1.11	V
		$T_j = 175\text{ }^{\circ}\text{C}$		0.85	1.09	V
V_{F0}	chiplevel	$T_j = 25\text{ }^{\circ}\text{C}$		0.89	1.09	V
		$T_j = 150\text{ }^{\circ}\text{C}$		0.73	0.92	V
		$T_j = 175\text{ }^{\circ}\text{C}$		0.69	0.88	V
r_F	chiplevel	$T_j = 25\text{ }^{\circ}\text{C}$		10	14	mΩ
		$T_j = 150\text{ }^{\circ}\text{C}$		14	19	mΩ
		$T_j = 175\text{ }^{\circ}\text{C}$		16	21	mΩ
I_R	$T_j = 150\text{ }^{\circ}\text{C}, V_{RRM}$				2	mA
$R_{th(j-s)}$	per Diode, P12 (Reference)			1.75		K/W
$R_{th(j-s)}$	per Diode, HPTP / HP-PCM			1.51		K/W
Module						
M_s	to heatsink			1.6	2.3	Nm
w				25		g
L_{CE}				30		nH
Temperature Sensor						
R_{100}	$T_c=100^{\circ}\text{C}$ ($R_{25}=5\text{ k}\Omega$)			493 ± 5%		Ω
$B_{25/85}$	$R_{(T)}=R_{25}*\exp[B_{25/85}*(1/T-1/298)]$, T[K]			3420		K



DGD-ET

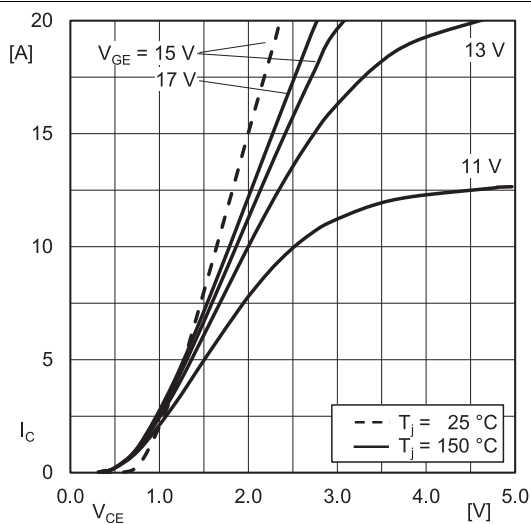


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+EE'}$

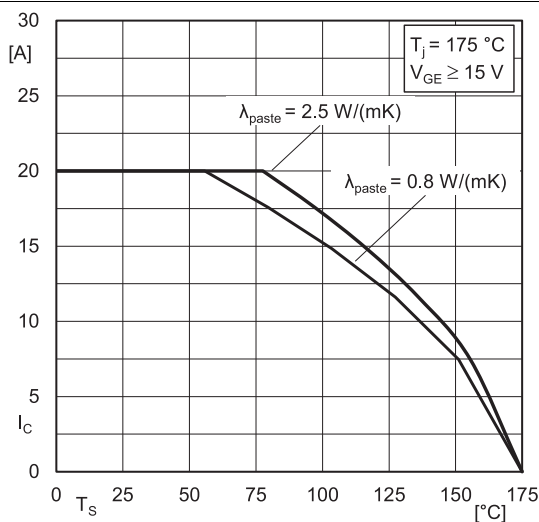


Fig. 2: IGBT rated current vs. temperature $I_C=f(T_s)$

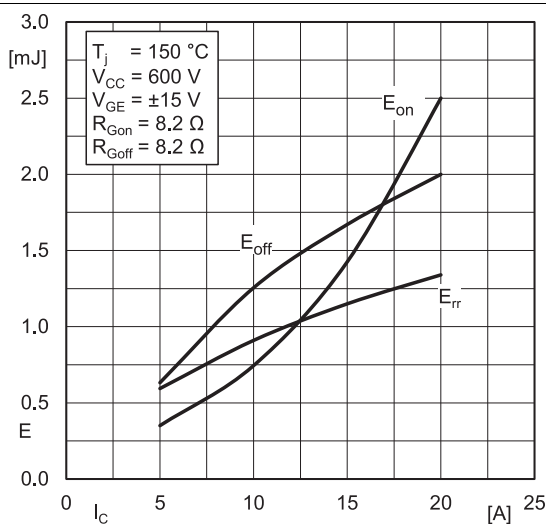


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

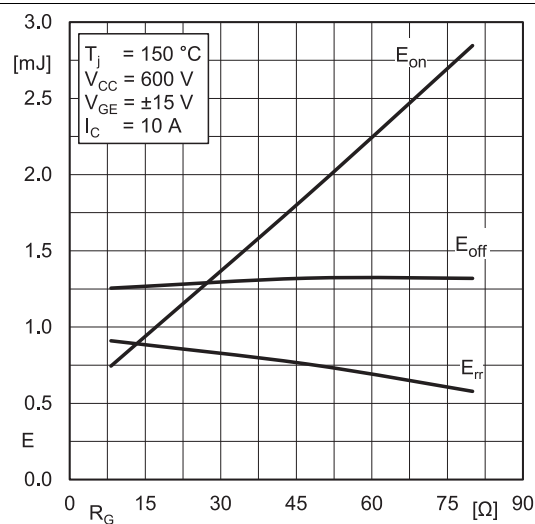


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

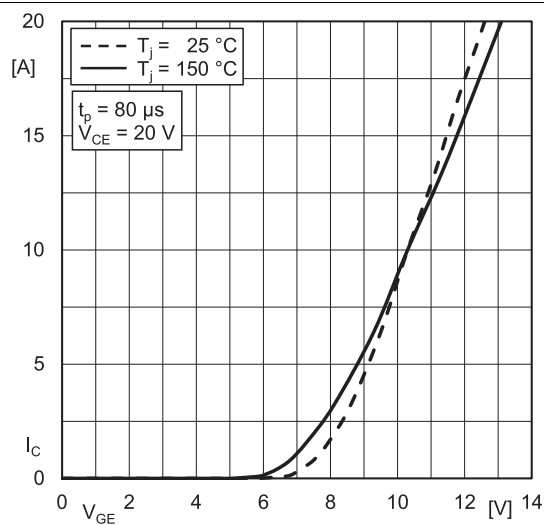


Fig. 5: Typ. IGBT transfer characteristic

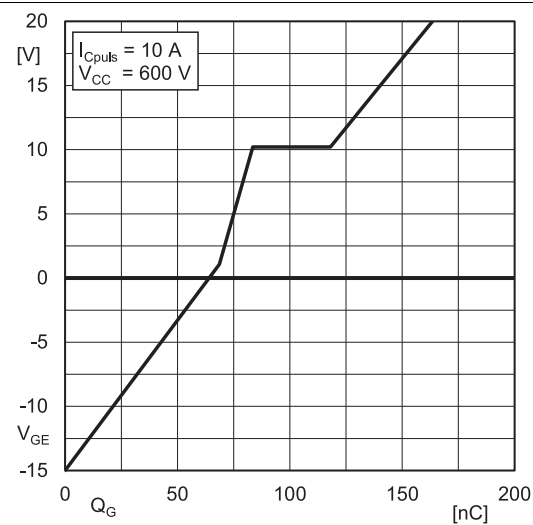


Fig. 6: Typ. IGBT gate charge characteristic

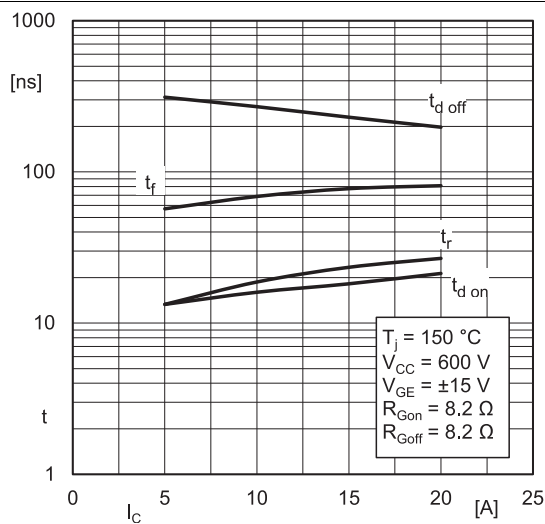


Fig. 7: Typ. switching times = $f(I_C)$

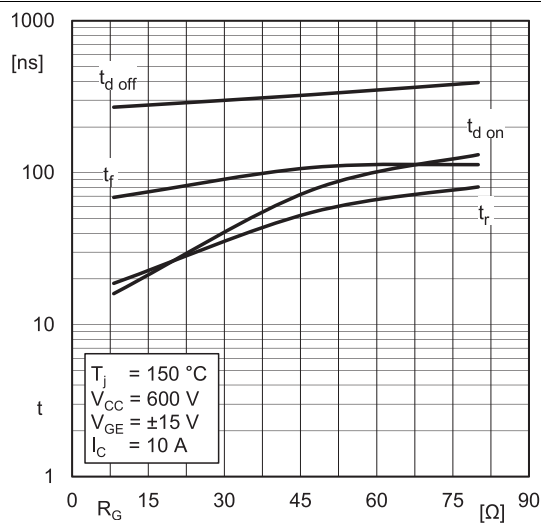


Fig. 8: Typ. switching times = $f(R_G)$

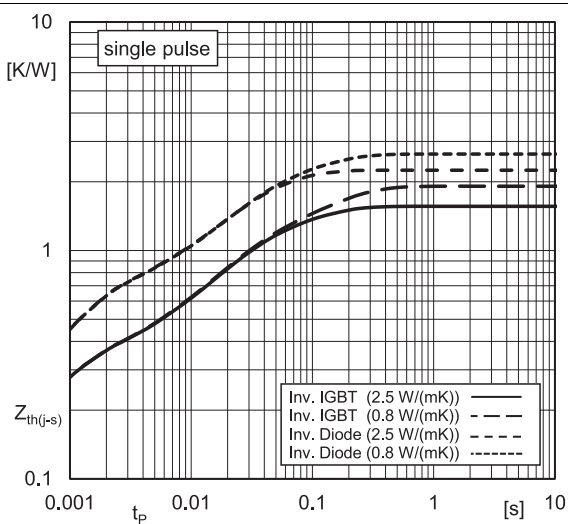


Fig. 9: Typ. transient thermal impedance

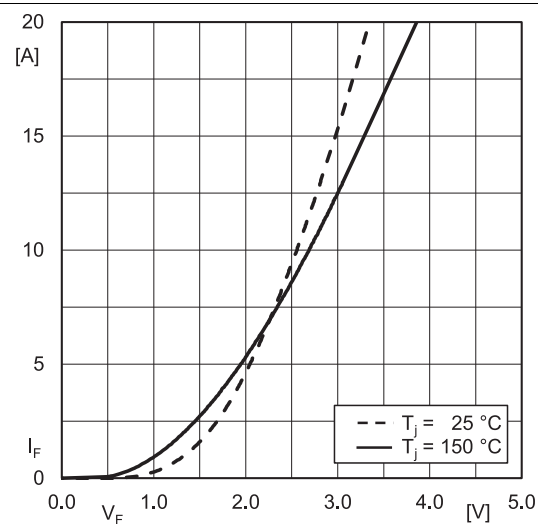


Fig. 10: Typ. Inv. diode forward charact., incl. $R_{GG}+EE'$

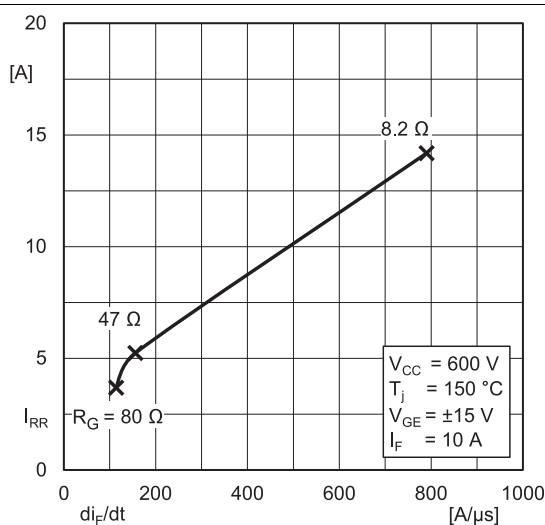


Fig. 11: Typ. Inv. diode peak reverse recovery current

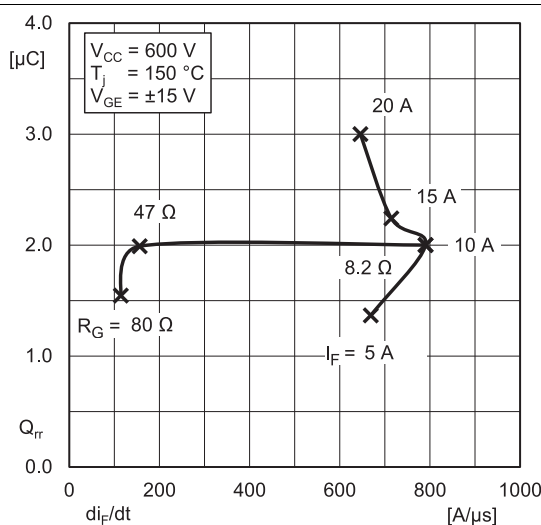


Fig. 12: Typ. Inv. diode reverse recovery charge

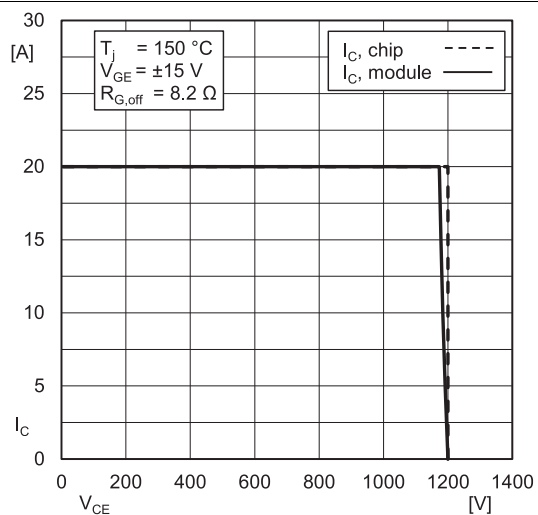


Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

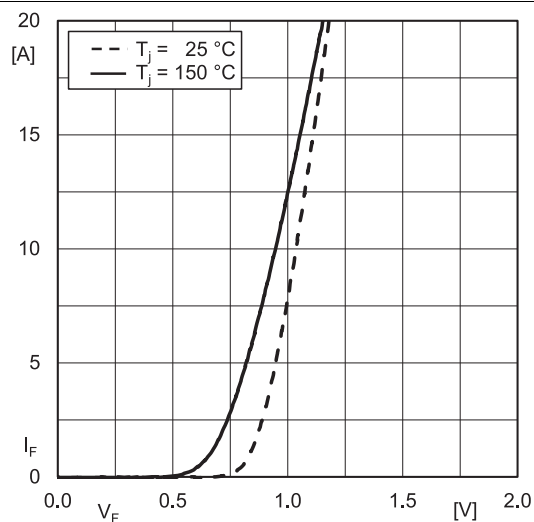
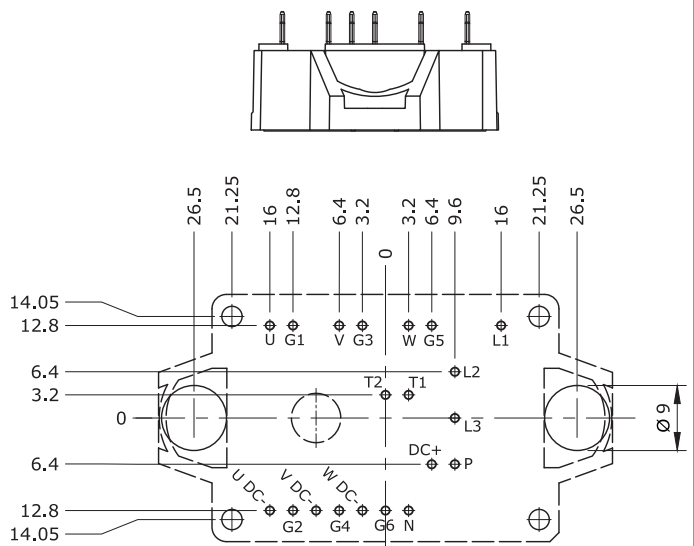
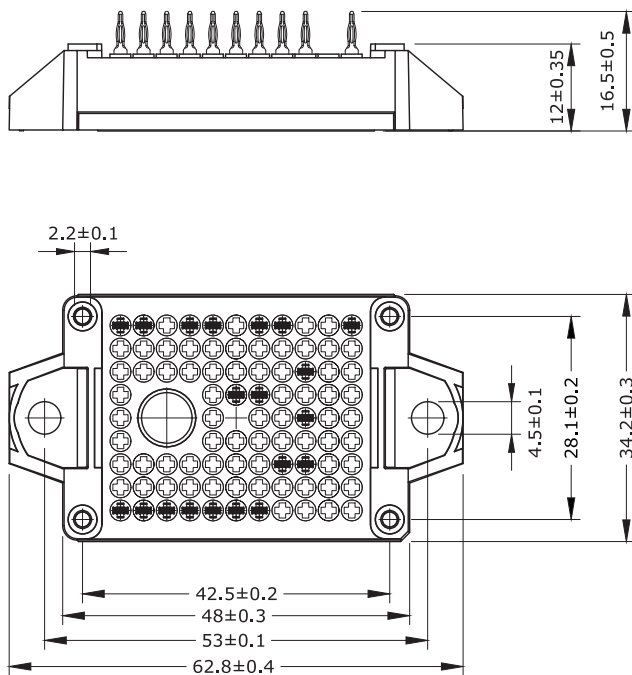
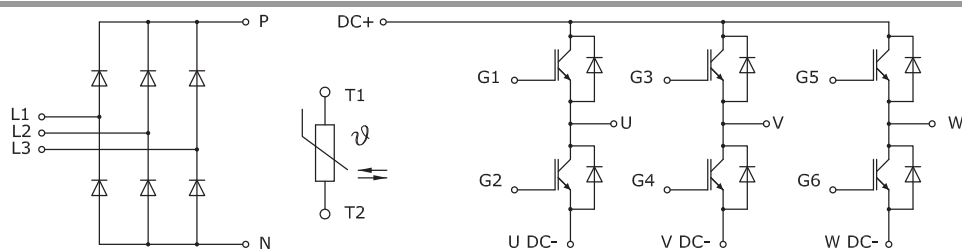


Fig. 14: Typ. Rect. diode forward charact., incl. $R_{CC'+EE'}$



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

SEMITOP®E1



DGD-ET

IMPORTANT INFORMATION AND WARNINGS

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

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