

SK10DGD12T7ETE1s



SEMITOP®E1 Solder

3-phase Converter-Inverter (CI)

SK10DGD12T7ETE1s

Features*

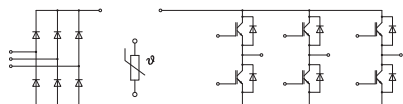
- Optimized design for superior thermal performance
- Low inductive design
- Solder contact technology
- 1200V Generation 7 IGBT (T7)
- Robust and soft switching CAL4F diode technology
- PEP rectifier diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- 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	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_C	HPTP / HP-PCM	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_{Cnom}		10	A
I_{CRM}		20	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800 \text{ V}$ $V_{GE} \leq 15 \text{ V}$ $V_{CES} \leq 1200 \text{ V}$	$T_j = 175 \text{ }^{\circ}\text{C}$	μs
T_j		-40 ... 175	$^{\circ}\text{C}$
Inverse - Diode			
V_{RRM}	$T_j = 25 \text{ }^{\circ}\text{C}$	1200	V
I_F	P12	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_F	HPTP / HP-PCM	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_{FRM}		20	A
I_{FSM}	$t_p = 10 \text{ ms, sin } 180^{\circ}, T_j = 150 \text{ }^{\circ}\text{C}$	36	A
T_j		-40 ... 175	$^{\circ}\text{C}$
Rectifier - Diode			
V_{RRM}	$T_j = 25 \text{ }^{\circ}\text{C}$	1600	V
I_F	P12	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_F	HPTP / HP-PCM	$T_s = 70 \text{ }^{\circ}\text{C}$	A
	$T_j = 175 \text{ }^{\circ}\text{C}$	$T_s = 100 \text{ }^{\circ}\text{C}$	A
I_{FSM}	$t_p = 10 \text{ ms}$	$T_j = 25 \text{ }^{\circ}\text{C}$	A
	$\sin 180^{\circ}$	$T_j = 150 \text{ }^{\circ}\text{C}$	A
i^2t	$t_p = 10 \text{ ms}$	$T_j = 25 \text{ }^{\circ}\text{C}$	A^2s
	$\sin 180^{\circ}$	$T_j = 150 \text{ }^{\circ}\text{C}$	A^2s
T_j		-40 ... 175	$^{\circ}\text{C}$
Module			
$I_t(\text{RMS})$	$\Delta T_{\text{terminal}}$ at PCB joint = 30 K, per pin	30	A
T_{stg}	module without TIM	-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC, sinusoidal, 1 min	2500	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(sat)}$	$I_C = 10 \text{ A}$	$T_j = 25 \text{ }^{\circ}\text{C}$	1.60	1.75	V
	$V_{GE} = 15 \text{ V}$	$T_j = 150 \text{ }^{\circ}\text{C}$	1.78	1.93	V
	chiplevel	$T_j = 175 \text{ }^{\circ}\text{C}$	1.82	1.97	V
V_{CE0}		$T_j = 25 \text{ }^{\circ}\text{C}$	1.00	1.05	V
	chiplevel	$T_j = 150 \text{ }^{\circ}\text{C}$	0.80	0.85	V
		$T_j = 175 \text{ }^{\circ}\text{C}$	0.75	0.80	V
r_{CE}	$V_{GE} = 15 \text{ V}$	$T_j = 25 \text{ }^{\circ}\text{C}$	60	70	$\text{m}\Omega$
	chiplevel	$T_j = 150 \text{ }^{\circ}\text{C}$	98	108	$\text{m}\Omega$
		$T_j = 175 \text{ }^{\circ}\text{C}$	107	117	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 0.22 \text{ mA}$	5.15	5.8	6.45	V

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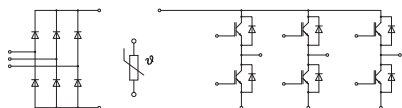
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DGD-ET

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 1200 \text{ V}$, $T_j = 25 \text{ }^{\circ}\text{C}$			1	mA
C_{ies}	$f = 1 \text{ MHz}$		1.90		nF
C_{oes}	$V_{CE} = 25 \text{ V}$, $f = 1 \text{ MHz}$		0.02		nF
C_{res}	$V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$		0.01		nF
Q_G	$V_{GE} = -15 \text{ V} \dots +15 \text{ V}$		140		nC
R_{Gint}	$T_j = 25 \text{ }^{\circ}\text{C}$		0		Ω
$t_{d(on)}$	$T_j = 25 \text{ }^{\circ}\text{C}$		13		ns
	$T_j = 150 \text{ }^{\circ}\text{C}$		16		ns
	$T_j = 175 \text{ }^{\circ}\text{C}$		17		ns
t_r	$T_j = 25 \text{ }^{\circ}\text{C}$		18		ns
	$T_j = 150 \text{ }^{\circ}\text{C}$		19		ns
	$T_j = 175 \text{ }^{\circ}\text{C}$		20		ns
E_{on}	$V_{CC} = 600 \text{ V}$ $I_C = 10 \text{ A}$ $R_{G on} = 8.2 \text{ } \Omega$ $R_{G off} = 8.2 \text{ } \Omega$		0.42		mJ
	$T_j = 25 \text{ }^{\circ}\text{C}$		0.74		mJ
	$T_j = 150 \text{ }^{\circ}\text{C}$		0.81		mJ
$t_{d(off)}$	$V_{GE} = +15/-15 \text{ V}$ $(T_j = 150 \text{ }^{\circ}\text{C})$ $di/dt_{on} = 700 \text{ A}/\mu\text{s}$ $di/dt_{off} = 120 \text{ A}/\mu\text{s}$		199		ns
	$T_j = 25 \text{ }^{\circ}\text{C}$		270		ns
	$T_j = 150 \text{ }^{\circ}\text{C}$		293		ns
t_f	$dv/dt = 3700 \text{ V}/\mu\text{s}$		52		ns
	$T_j = 25 \text{ }^{\circ}\text{C}$		69		ns
	$T_j = 150 \text{ }^{\circ}\text{C}$		95		ns
E_{off}	$T_j = 25 \text{ }^{\circ}\text{C}$		0.75		mJ
	$T_j = 150 \text{ }^{\circ}\text{C}$		1.26		mJ
	$T_j = 175 \text{ }^{\circ}\text{C}$		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					
$V_F = V_{EC}$	$I_F = 10 \text{ A}$	$T_j = 25 \text{ }^{\circ}\text{C}$	2.59	2.94	V
		$T_j = 150 \text{ }^{\circ}\text{C}$	2.71	3.08	V
	chiplevel	$T_j = 175 \text{ }^{\circ}\text{C}$	2.53	2.89	V
V_{F0}		$T_j = 25 \text{ }^{\circ}\text{C}$	1.30	1.50	V
	chiplevel	$T_j = 150 \text{ }^{\circ}\text{C}$	0.90	1.10	V
		$T_j = 175 \text{ }^{\circ}\text{C}$	0.82	0.98	V
r_F		$T_j = 25 \text{ }^{\circ}\text{C}$	129	144	m Ω
	chiplevel	$T_j = 150 \text{ }^{\circ}\text{C}$	181	198	m Ω
		$T_j = 175 \text{ }^{\circ}\text{C}$	171	191	m Ω
I_{RRM}		$T_j = 25 \text{ }^{\circ}\text{C}$	8		A
		$T_j = 150 \text{ }^{\circ}\text{C}$	14		A
		$T_j = 175 \text{ }^{\circ}\text{C}$	16		A
Q_{rr}	$I_F = 10 \text{ A}$ $V_{GE} = -15 \text{ V}$ $V_{CC} = 600 \text{ V}$ $(T_j = 150 \text{ }^{\circ}\text{C})$	$T_j = 25 \text{ }^{\circ}\text{C}$	0.58		μC
		$T_j = 150 \text{ }^{\circ}\text{C}$	2.01		μC
		$T_j = 175 \text{ }^{\circ}\text{C}$	2.37		μC
E_{rr}	$di/dt_{off} = 790 \text{ A}/\mu\text{s}$	$T_j = 25 \text{ }^{\circ}\text{C}$	0.36		mJ
		$T_j = 150 \text{ }^{\circ}\text{C}$	0.91		mJ
		$T_j = 175 \text{ }^{\circ}\text{C}$	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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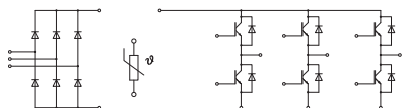
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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Rectifier - Diode					
V _F = V _{EC}	I _F = 10 A chiplevel	T _j = 25 °C	0.99	1.23	V
		T _j = 150 °C	0.87	1.11	V
		T _j = 175 °C	0.85	1.09	V
V _{F0}	chiplevel	T _j = 25 °C	0.89	1.09	V
		T _j = 150 °C	0.73	0.92	V
		T _j = 175 °C	0.69	0.88	V
r _F	chiplevel	T _j = 25 °C	10	14	mΩ
		T _j = 150 °C	14	19	mΩ
		T _j = 175 °C	16	21	mΩ
I _R	T _j = 150 °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°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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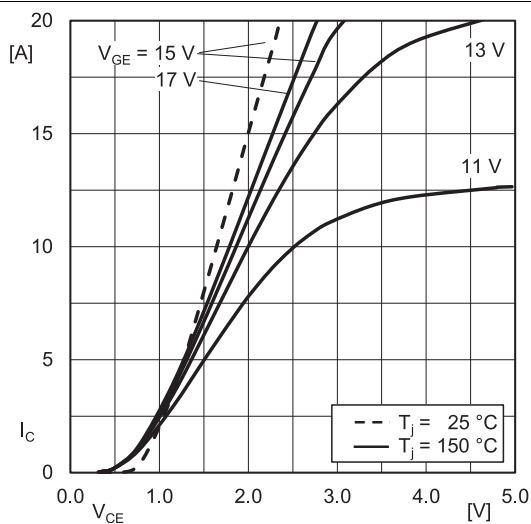


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+EE'}$

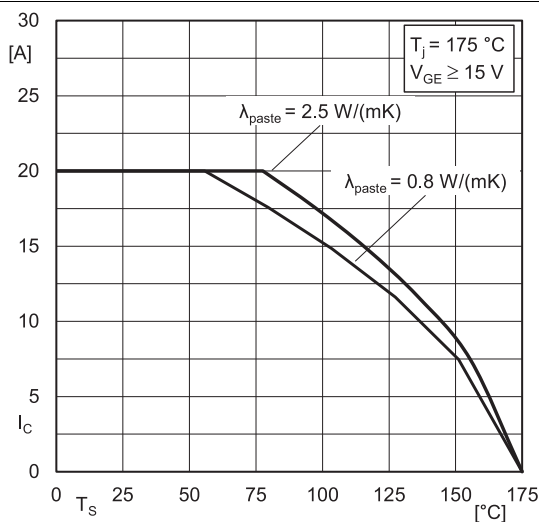


Fig. 2: IGBT rated current vs. temperature $I_C=f(T_s)$

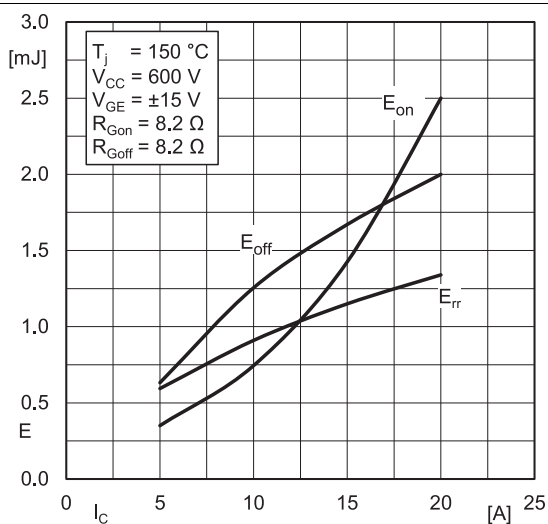


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

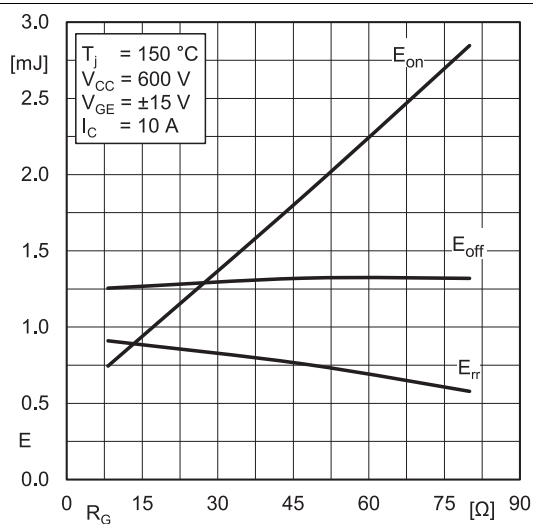


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

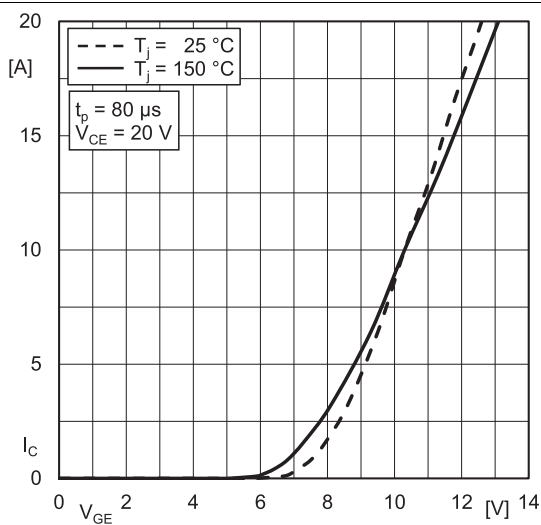


Fig. 5: Typ. IGBT transfer characteristic

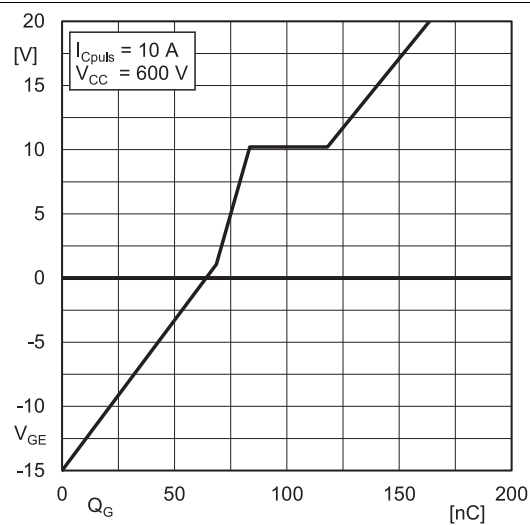


Fig. 6: Typ. IGBT gate charge characteristic

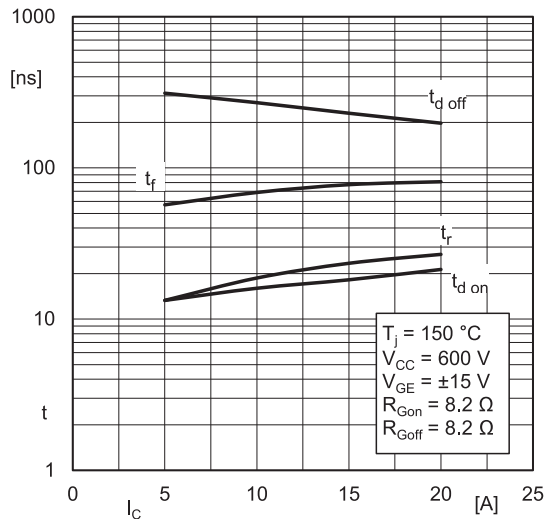


Fig. 7: Typ. switching times = f(I_C)

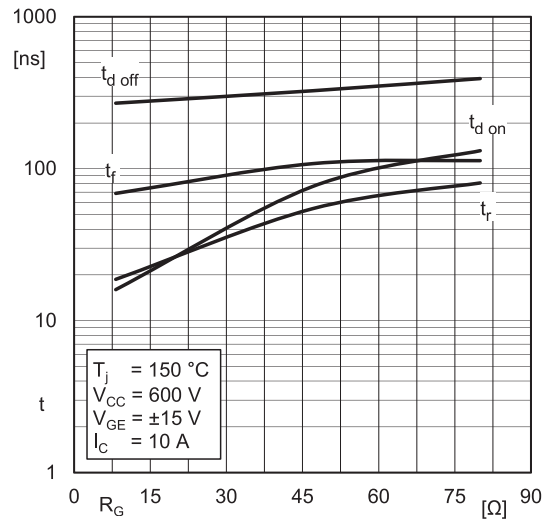


Fig. 8: Typ. switching times = f(R_G)

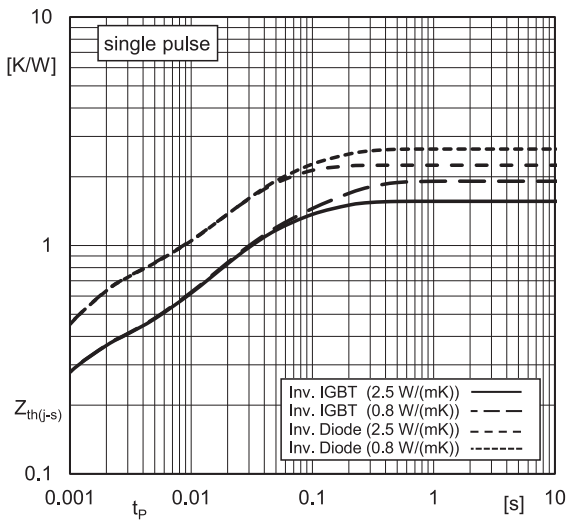


Fig. 9: Typ. transient thermal impedance

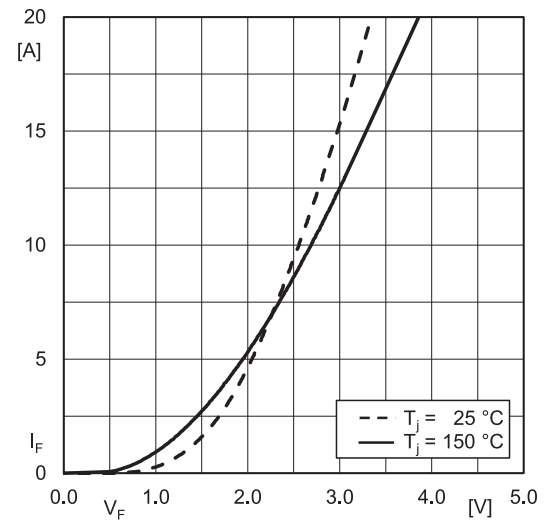


Fig. 10: Typ. Inv. diode forward charact., incl. R_{CC}+EE'

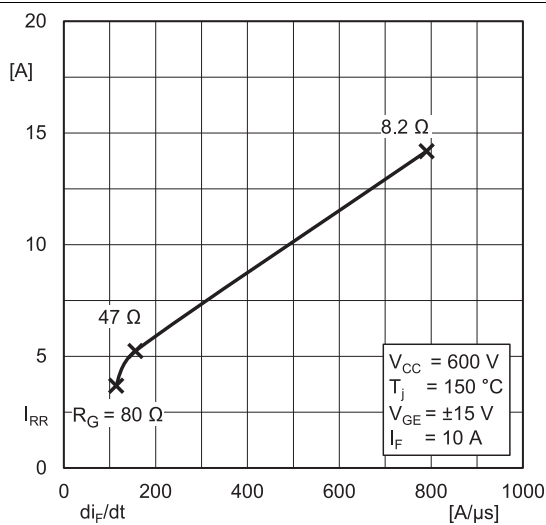


Fig. 11: Typ. Inv. diode peak reverse recovery current

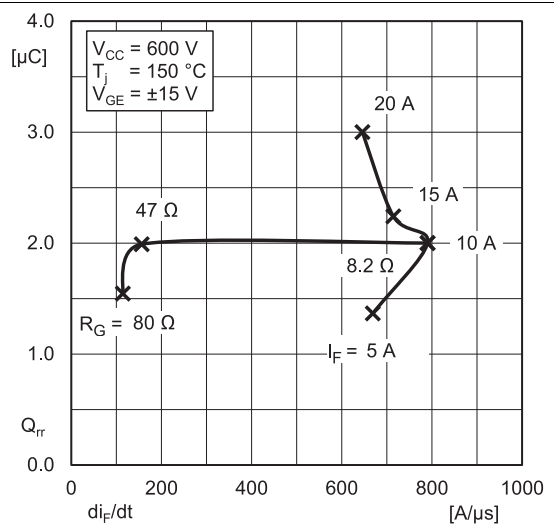


Fig. 12: Typ. Inv. diode reverse recovery charge

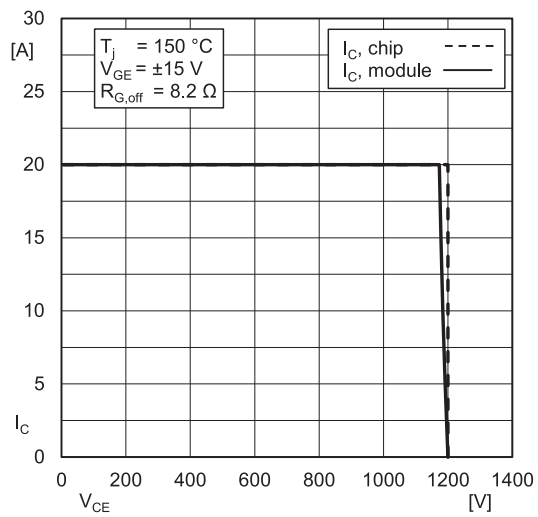


Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

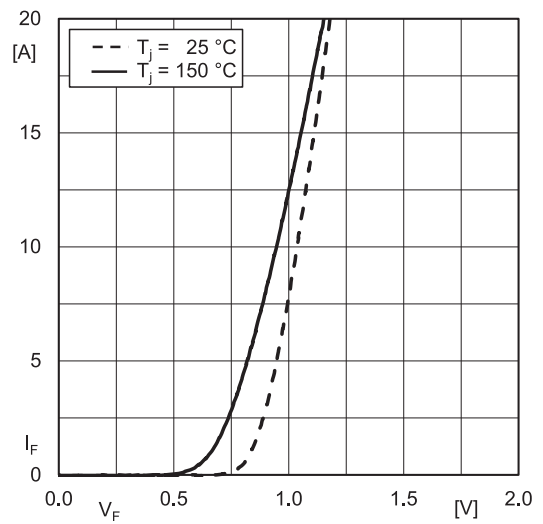
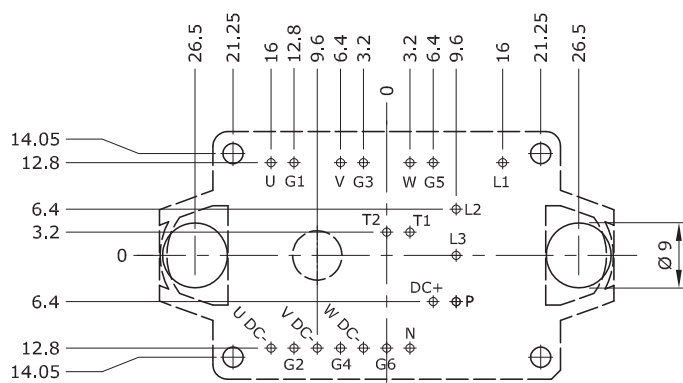
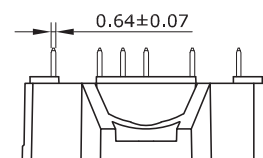
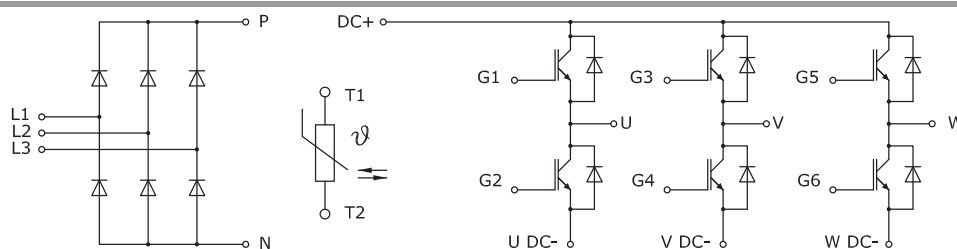


Fig. 14: Typ. Rect. diode forward charact., incl. $R_{CC'+EE'}$



- Pin-Grid 3.2 mm
- Tolerance of pinpositions $\boxed{\oplus \overline{\ominus}} \varnothing 0.4$



DGD-ET

IMPORTANT INFORMATION AND WARNINGS

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

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