



SEMITOP®E1

Sixpack Open Emitter

SK35GD12T7ETE1

Features*

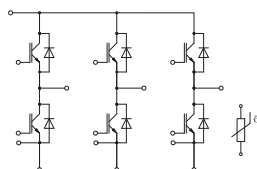
- Optimized design for superior thermal performance
- Low inductive design
- Press-Fit contact technology
- 1200V Generation 7 IGBT (T7)
- Robust and soft switching CAL4F diode technology
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Motor drives
- Servo drives
- Air conditioning
- Auxiliary Inverters
- UPS

Remarks

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



GD-ET

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	41	A
	T _j = 175 °C	T _s = 100 °C	34	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	50	A
	T _j = 175 °C	T _s = 100 °C	41	A
I _{Cnom}			35	A
I _{CRM}			70	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	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	33	A
	T _j = 175 °C	T _s = 100 °C	27	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	39	A
	T _j = 175 °C	T _s = 100 °C	32	A
I _{FRM}			70	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		170	A
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, t = 1 min		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
V _{CE(sat)}	I _C = 35 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}		T _j = 25 °C		17	20	mΩ
	V _{GE} = 15 V	T _j = 150 °C		28	31	mΩ
	chiplevel	T _j = 175 °C		31	33	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.75 mA		5.15	5.8	6.45	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C				1	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		6.60		nF
C _{oes}		f = 1 MHz		0.09		nF
C _{res}		f = 1 MHz		0.02		nF
Q _G	V _{GE} = -15 V ... +15 V			487		nC
R _{Gint}	T _j = 25 °C			0		Ω



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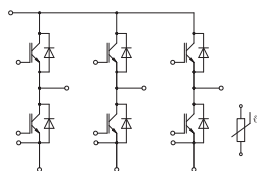
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- $T_{j,op} > 150 \text{ }^{\circ}\text{C}$ during overload (details on AN19-002)



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Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
Inverter - IGBT					
$t_{d(on)}$		$T_j = 25 \text{ }^{\circ}\text{C}$		43	ns
		$T_j = 150 \text{ }^{\circ}\text{C}$		45	ns
		$T_j = 175 \text{ }^{\circ}\text{C}$		46	ns
t_r		$T_j = 25 \text{ }^{\circ}\text{C}$		30	ns
		$T_j = 150 \text{ }^{\circ}\text{C}$		35	ns
		$T_j = 175 \text{ }^{\circ}\text{C}$		37	ns
E_{on}	$V_{CC} = 600 \text{ V}$ $I_C = 35 \text{ A}$ $R_{G on} = 5.6 \text{ } \Omega$ $R_{G off} = 5.6 \text{ } \Omega$ $V_{GE} = +15/-15 \text{ V}$	$T_j = 25 \text{ }^{\circ}\text{C}$		2.51	mJ
		$T_j = 150 \text{ }^{\circ}\text{C}$		3.52	mJ
		$T_j = 175 \text{ }^{\circ}\text{C}$		3.96	mJ
$t_{d(off)}$	$(T_j = 150 \text{ }^{\circ}\text{C})$ $di/dt_{on} = 1160 \text{ A}/\mu\text{s}$ $di/dt_{off} = 620 \text{ A}/\mu\text{s}$ $dv/dt = 4600 \text{ V}/\mu\text{s}$	$T_j = 25 \text{ }^{\circ}\text{C}$		183	ns
		$T_j = 150 \text{ }^{\circ}\text{C}$		254	ns
		$T_j = 175 \text{ }^{\circ}\text{C}$		274	ns
t_f		$T_j = 25 \text{ }^{\circ}\text{C}$		62	ns
		$T_j = 150 \text{ }^{\circ}\text{C}$		95	ns
		$T_j = 175 \text{ }^{\circ}\text{C}$		102	ns
E_{off}		$T_j = 25 \text{ }^{\circ}\text{C}$		2.83	mJ
		$T_j = 150 \text{ }^{\circ}\text{C}$		3.74	mJ
		$T_j = 175 \text{ }^{\circ}\text{C}$		4.29	mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$			1.17	K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$			0.85	K/W

Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
Inverse - Diode					
$V_F = V_{EC}$	$I_F = 35 \text{ A}$ chiplevel	$T_j = 25 \text{ }^{\circ}\text{C}$		2.30	2.62 V
		$T_j = 150 \text{ }^{\circ}\text{C}$		2.29	2.62 V
		$T_j = 175 \text{ }^{\circ}\text{C}$		2.14	2.46 V
V_{F0}	chiplevel	$T_j = 25 \text{ }^{\circ}\text{C}$		1.30	1.50 V
		$T_j = 150 \text{ }^{\circ}\text{C}$		0.90	1.10 V
		$T_j = 175 \text{ }^{\circ}\text{C}$		0.82	0.98 V
r_F	chiplevel	$T_j = 25 \text{ }^{\circ}\text{C}$		29	32 m Ω
		$T_j = 150 \text{ }^{\circ}\text{C}$		40	43 m Ω
		$T_j = 175 \text{ }^{\circ}\text{C}$		38	42 m Ω
I_{RRM}		$T_j = 25 \text{ }^{\circ}\text{C}$		25	A
		$T_j = 150 \text{ }^{\circ}\text{C}$		31	A
		$T_j = 175 \text{ }^{\circ}\text{C}$		37	A
Q_{rr}	$I_F = 35 \text{ A}$ $V_{GE} = +15/-15 \text{ V}$ $V_{CC} = 600 \text{ V}$ $(T_j = 150 \text{ }^{\circ}\text{C})$ $di/dt_{off} = 1030 \text{ A}/\mu\text{s}$	$T_j = 25 \text{ }^{\circ}\text{C}$		2.15	μC
		$T_j = 150 \text{ }^{\circ}\text{C}$		4.85	μC
		$T_j = 175 \text{ }^{\circ}\text{C}$		5.48	μC
E_{rr}		$T_j = 25 \text{ }^{\circ}\text{C}$		1.46	mJ
		$T_j = 150 \text{ }^{\circ}\text{C}$		2.39	mJ
		$T_j = 175 \text{ }^{\circ}\text{C}$		3.65	mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$			1.34	K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$			1.01	K/W
Module					
L_{CE}				30	nH
M_s	to heatsink		1.6	2.3	Nm
w				25	g

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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Temperature Sensor					
R_{100}	$T_c=100^{\circ}\text{C}$ ($R_{25}=5\text{ k}\Omega$)		$493 \pm 5\%$		Ω
$B_{25/85}$	$R(T)=R_{25} \cdot \exp[B_{25/85} \cdot (1/T - 1/298)]$, $T[\text{K}]$		3420		K

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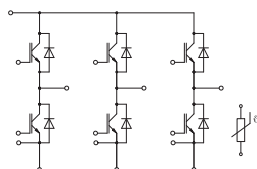
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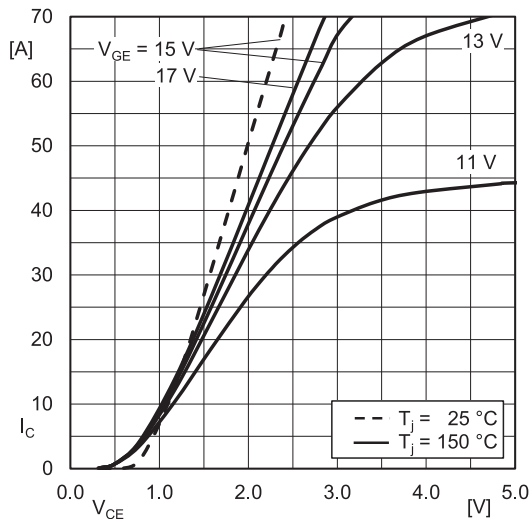


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+EE'}$

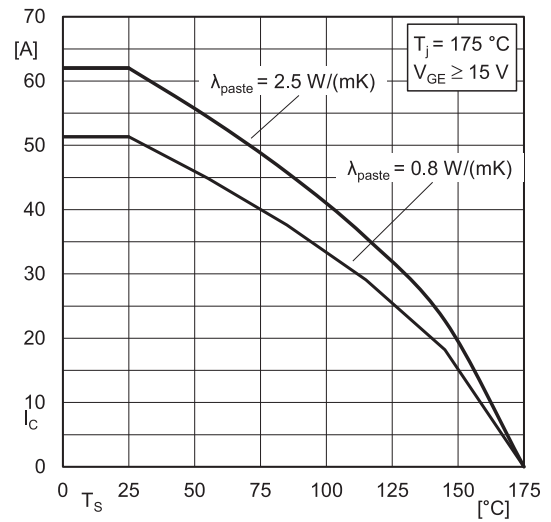


Fig. 2: IGBT rated current vs. temperature $I_C=f(T_s)$

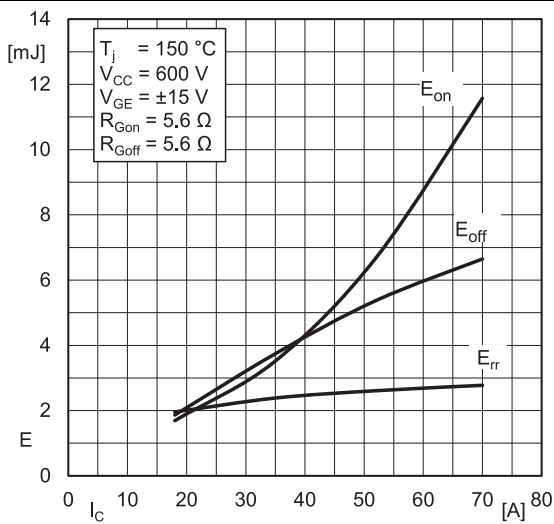


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

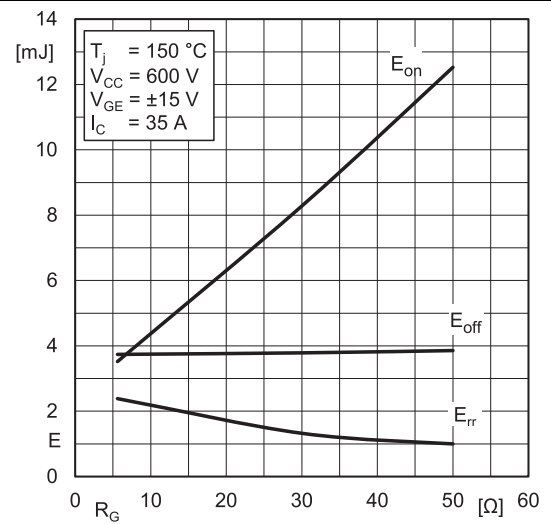


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

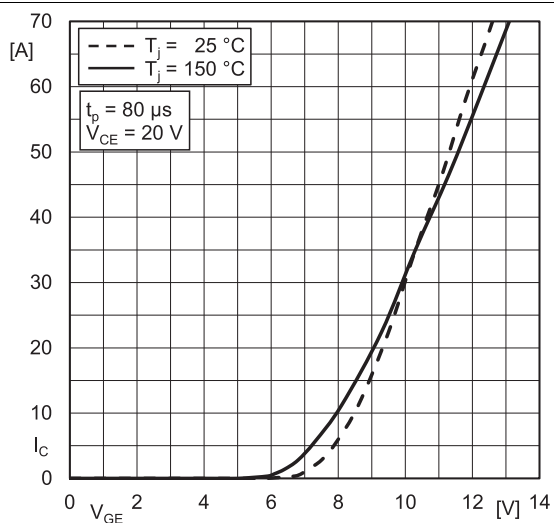


Fig. 5: Typ. IGBT transfer characteristic

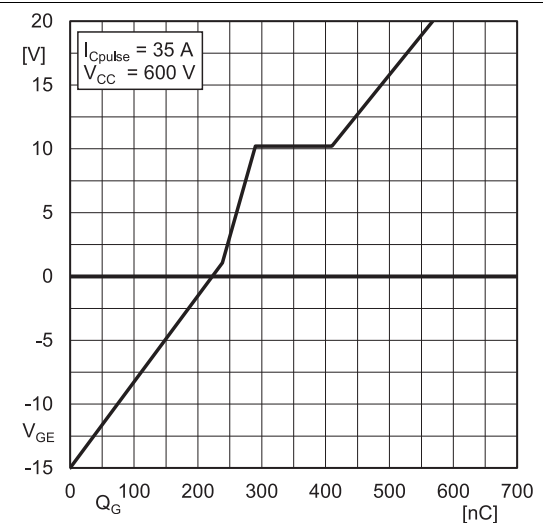


Fig. 6: Typ. IGBT gate charge characteristic

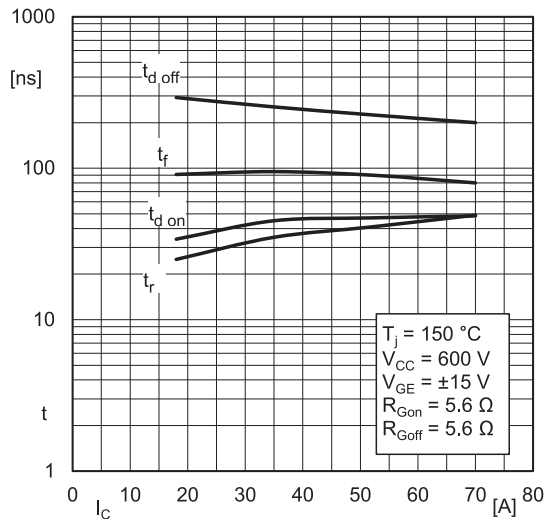


Fig. 7: Typ. switching times = f (I_C)

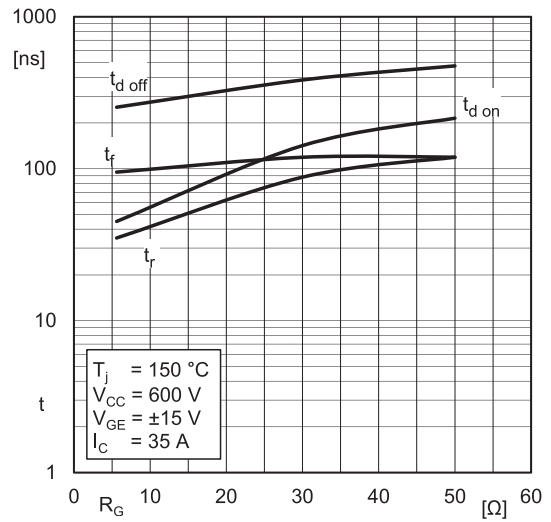


Fig. 8: Typ. switching times = f (R_G)

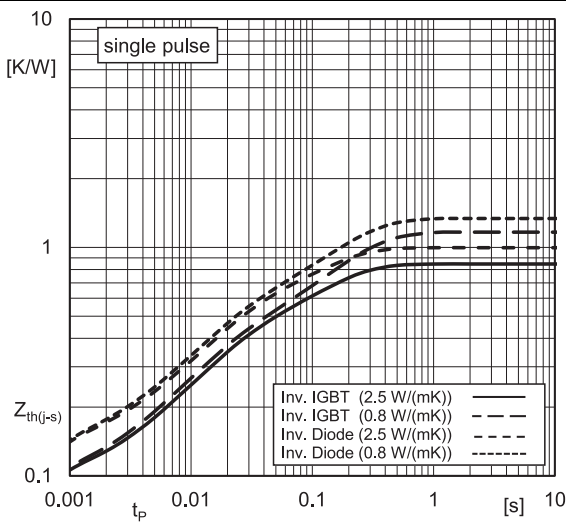


Fig. 9: Typ. transient thermal impedance

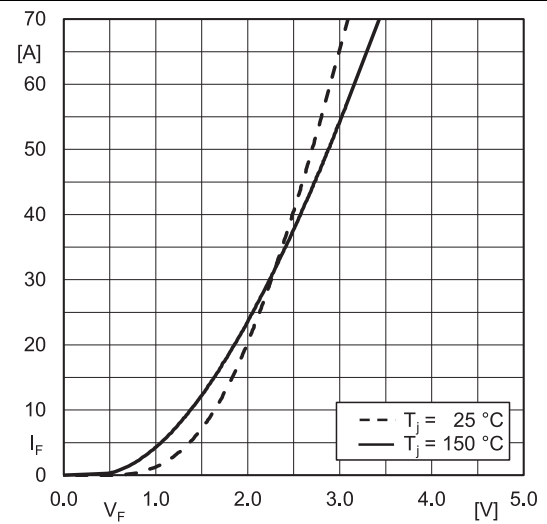


Fig. 10: Typ. Inv. diode forward charact., incl. R_{CC'+EE'}

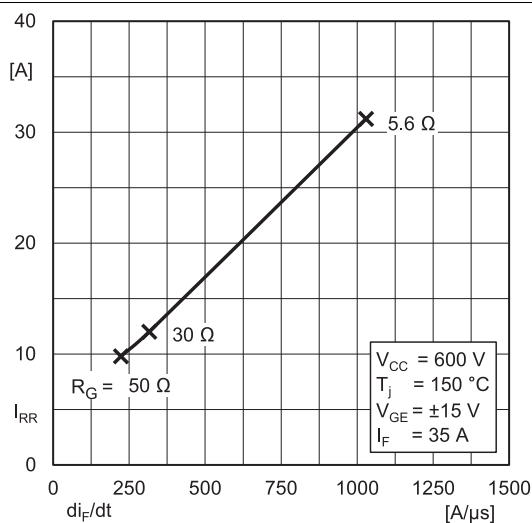


Fig. 11: Typ. Inv. diode peak reverse recovery current

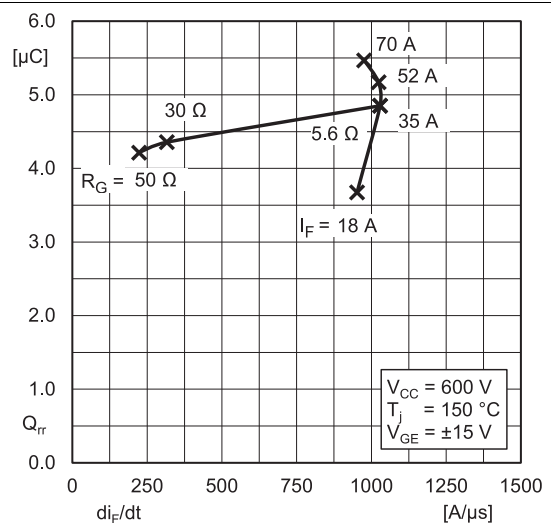


Fig. 12: Typ. Inv. diode reverse recovery charge

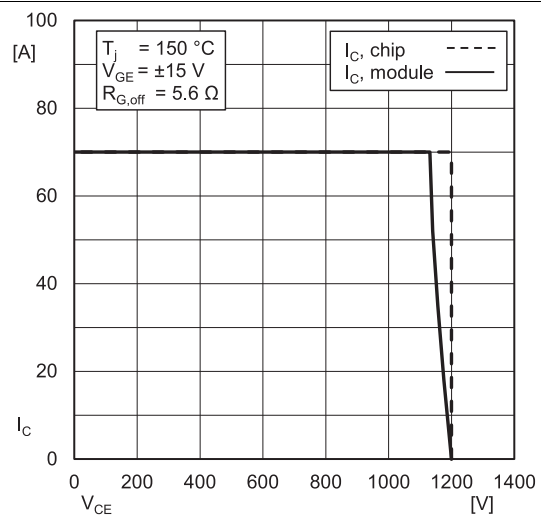
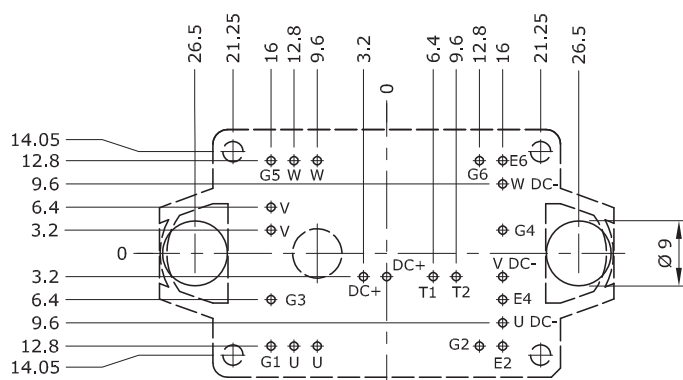
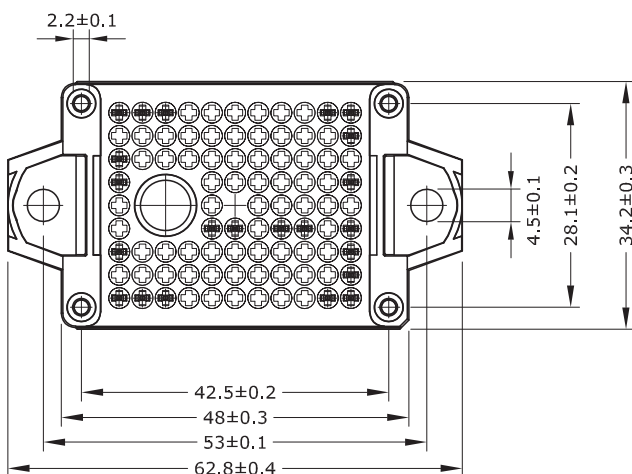
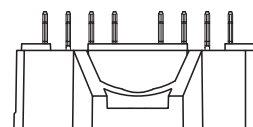
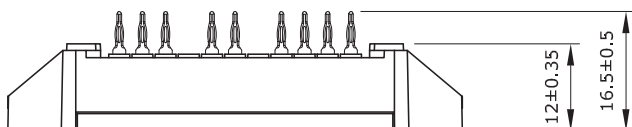


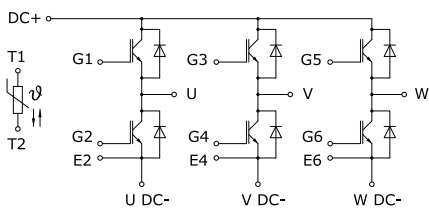
Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

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- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern ± 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

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

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