



## 3-phase Bridge Rectifier with Chopper

### SK150DGL12T4TE1

#### Features\*

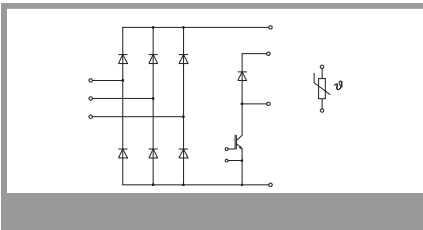
- Optimized design for superior thermal performance
- Low inductive design
- Press-Fit contact technology
- 1200V Trench IGBT4 (T4)
- Robust and soft switching CAL4F diode technology
- PEP rectifier diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- 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
<b>Chopper - IGBT</b>				
$V_{CES}$	$T_j = 25 \text{ } ^\circ\text{C}$		1200	V
$I_C$	P12	$T_s = 70 \text{ } ^\circ\text{C}$	53	A
		$T_s = 100 \text{ } ^\circ\text{C}$	43	A
$I_C$	HPTP / HP-PCM	$T_s = 70 \text{ } ^\circ\text{C}$	66	A
		$T_s = 100 \text{ } ^\circ\text{C}$	55	A
$I_{Chom}$			50	A
$I_{CRM}$			100	A
$V_{GES}$			-20 ... 20	V
$t_{psc}$	$V_{CC} = 800 \text{ V}$ $V_{GE} = V_{GE} \leq 15 \text{ V}$ $V_{CES} = V_{CES} \leq 1200 \text{ V}$	$T_j = 150 \text{ } ^\circ\text{C}$	10	$\mu\text{s}$
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Freewheeling - Diode</b>				
$V_{RRM}$	$T_j = 25 \text{ } ^\circ\text{C}$		1200	V
$I_F$	P12	$T_s = 70 \text{ } ^\circ\text{C}$	17	A
		$T_s = 100 \text{ } ^\circ\text{C}$	14	A
$I_F$	HPTP / HP-PCM	$T_s = 70 \text{ } ^\circ\text{C}$	20	A
		$T_s = 100 \text{ } ^\circ\text{C}$	16	A
$I_{FRM}$			30	A
$I_{FSM}$	10 ms sin 180°	$T_j = 25 \text{ } ^\circ\text{C}$	65	A
		$T_j = 150 \text{ } ^\circ\text{C}$	65	A
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Rectifier - Diode</b>				
$V_{RRM}$	$T_j = 25 \text{ } ^\circ\text{C}$		1600	V
$I_D$	P12	$T_s = 70 \text{ } ^\circ\text{C}$	158	A
		$T_s = 100 \text{ } ^\circ\text{C}$	127	A
$I_D$	HPTP / HP-PCM	$T_s = 70 \text{ } ^\circ\text{C}$	196	A
		$T_s = 100 \text{ } ^\circ\text{C}$	158	A
$I_{FSM}$	10 ms sin 180°	$T_j = 25 \text{ } ^\circ\text{C}$	635	A
		$T_j = 150 \text{ } ^\circ\text{C}$	490	A
$i^2t$	10 ms sin 180°	$T_j = 25 \text{ } ^\circ\text{C}$	2020	$\text{A}^2\text{s}$
		$T_j = 150 \text{ } ^\circ\text{C}$	1200	$\text{A}^2\text{s}$
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Module</b>				
$I_t(\text{RMS})$	$\Delta T_{\text{terminal}}$ 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	
<b>IGBT - Chopper</b>						
$V_{CE(\text{sat})}$	$I_C = 50 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipllevel	$T_j = 25 \text{ } ^\circ\text{C}$	1.85	2.10	V	
		$T_j = 150 \text{ } ^\circ\text{C}$	2.20	2.40	V	
$V_{CE0}$	chipllevel	$T_j = 25 \text{ } ^\circ\text{C}$	0.80	0.90	V	
		$T_j = 150 \text{ } ^\circ\text{C}$	0.70	0.80	V	
$r_{CE}$	$V_{GE} = 15 \text{ V}$ chipllevel	$T_j = 25 \text{ } ^\circ\text{C}$	21	24	$\text{m}\Omega$	
		$T_j = 150 \text{ } ^\circ\text{C}$	30	32	$\text{m}\Omega$	
$V_{GE(\text{th})}$	$V_{GE} = V_{CE}, I_C = 1.7 \text{ mA}$		5	5.8	6.5	V



**SEMITOP®E1**

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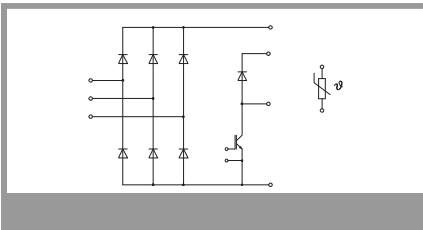
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>IGBT - Chopper</b>					
$I_{CES}$	$V_{GE} = 0 \text{ V}, V_{CE} = 1200 \text{ V}, T_j = 25 \text{ } ^\circ\text{C}$		-	1	mA
$C_{ies}$	$V_{CE} = 25 \text{ V}$		2.77		nF
$C_{oes}$	$V_{GE} = 0 \text{ V}$		0.21		nF
$C_{res}$			0.16		nF
$Q_G$	$V_{GE} = -15 \text{ V} \dots +15 \text{ V}$		366		nC
$R_{Gint}$	$T_j = 25 \text{ } ^\circ\text{C}$		4.0		$\Omega$
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 150 \text{ } ^\circ\text{C}$	129		ns
$t_r$	$I_C = 50 \text{ A}$	$T_j = 150 \text{ } ^\circ\text{C}$	42		ns
$E_{on}$	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150 \text{ } ^\circ\text{C}$	4.8		mJ
$t_{d(off)}$	$R_{G on} = 15 \text{ } \Omega$	$T_j = 150 \text{ } ^\circ\text{C}$	333		ns
$t_f$	$R_{G off} = 15 \text{ } \Omega$	$T_j = 150 \text{ } ^\circ\text{C}$	65		ns
$E_{off}$	$di/dt_{on} = 2100 \text{ A}/\mu\text{s}$ $di/dt_{off} = 530 \text{ A}/\mu\text{s}$ $dv/dt = 4000 \text{ V}/\mu\text{s}$	$T_j = 150 \text{ } ^\circ\text{C}$	5		mJ
$R_{th(j-s)}$	per IGBT, P12		0.77		K/W
$R_{th(j-s)}$	per IGBT, HPTP / HP-PCM		0.52		K/W
<b>Freewheeling - Diode</b>					
$V_F = V_{EC}$	$I_F = 15 \text{ A}$	$T_j = 25 \text{ } ^\circ\text{C}$	2.38	2.71	V
	chiplevel	$T_j = 150 \text{ } ^\circ\text{C}$	2.44	2.77	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
$r_F$	chiplevel	$T_j = 25 \text{ } ^\circ\text{C}$	72	81	m $\Omega$
		$T_j = 150 \text{ } ^\circ\text{C}$	103	111	m $\Omega$
$I_{RRM}$	$I_F = 15 \text{ A}$	$T_j = 150 \text{ } ^\circ\text{C}$	16		A
$Q_{rr}$	$di/dt_{off} = 890 \text{ A}/\mu\text{s}$	$T_j = 150 \text{ } ^\circ\text{C}$	2.3		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15 \text{ V}$ $V_R = 600 \text{ V}$	$T_j = 150 \text{ } ^\circ\text{C}$	0.97		mJ
$R_{th(j-s)}$	per Diode, P12		2.13		K/W
$R_{th(j-s)}$	per Diode, HPTP / HP-PCM		1.74		K/W
<b>Rectifier - Diode</b>					
$V_F = V_{EC}$	$I_F = 26 \text{ A}$	$T_j = 25 \text{ } ^\circ\text{C}$	0.97	1.20	V
	chiplevel	$T_j = 150 \text{ } ^\circ\text{C}$	0.84	1.07	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
$r_F$	chiplevel	$T_j = 25 \text{ } ^\circ\text{C}$	3.1	4.2	m $\Omega$
		$T_j = 150 \text{ } ^\circ\text{C}$	4.4	5.9	m $\Omega$
$I_R$	$T_j = 150 \text{ } ^\circ\text{C}, V_{RRM}$			2	mA
$R_{th(j-s)}$	per Diode, P12		1.06		K/W
$R_{th(j-s)}$	per Diode, HPTP / HP-PCM		0.76		K/W
<b>Module</b>					
$L_{CE}$			-		nH
$M_s$	to heatsink		1.6	2.3	Nm
w	weight		25		g
<b>Temperature Sensor</b>					
$R_{100}$	$T_c = 100^\circ\text{C} (R_{25} = 5 \text{ k}\Omega)$		493 $\pm$ 5%		$\Omega$
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$ ; T[K];		3550 $\pm$ 2%		K

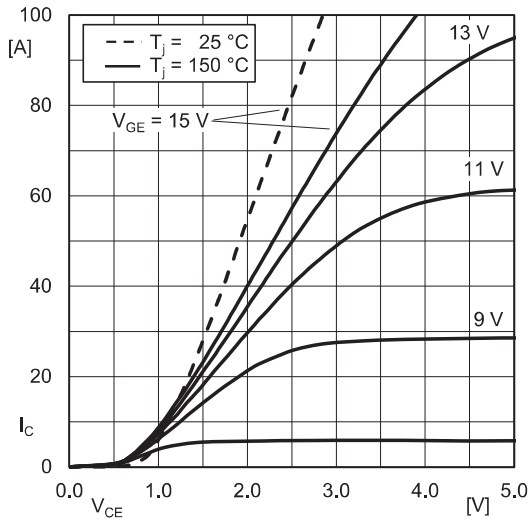


Fig. 1: Typ. IGBT output characteristic, incl.  $R_{CC+EE'}$

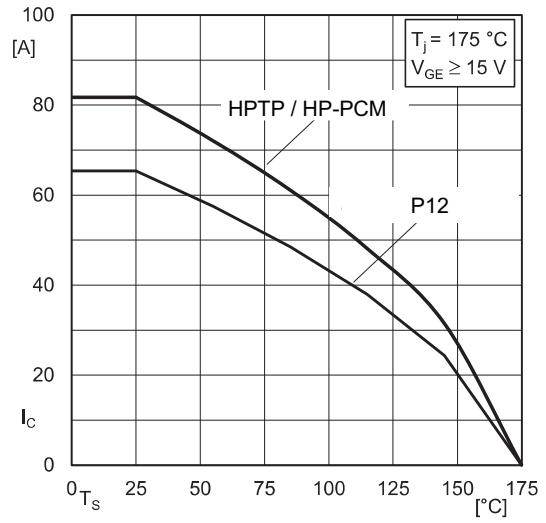


Fig. 2: IGBT rated current vs. temperature  $I_c=f(T_s)$

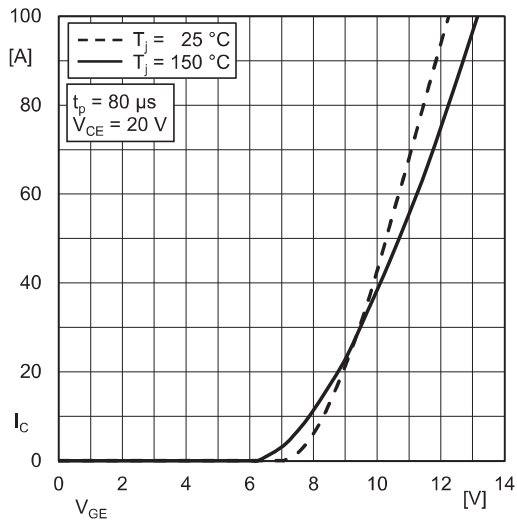


Fig. 5: Typ. IGBT transfer characteristic

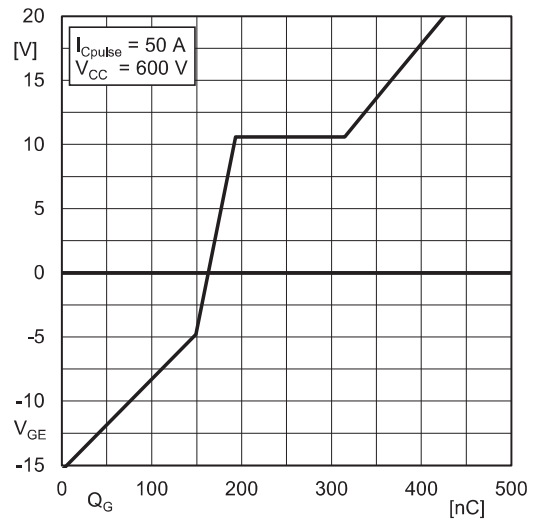


Fig. 6: Typ. IGBT gate charge characteristic

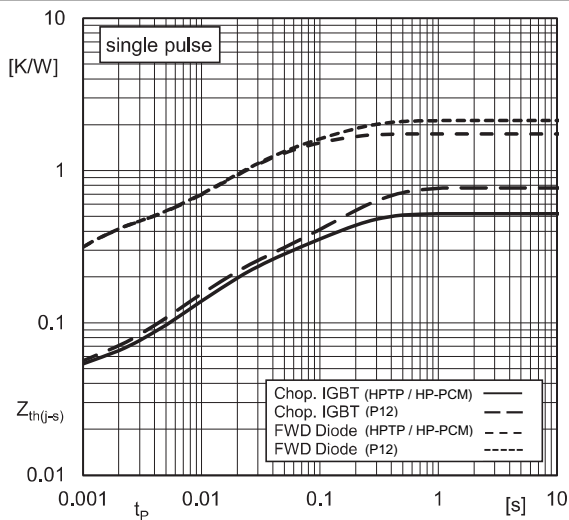


Fig. 9: Typ. transient thermal impedance

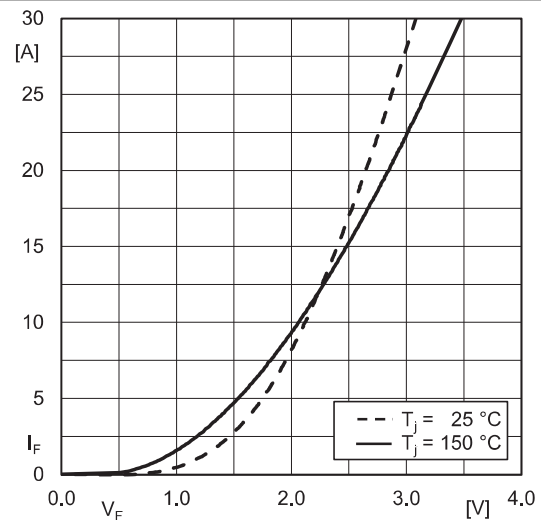


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE'}$

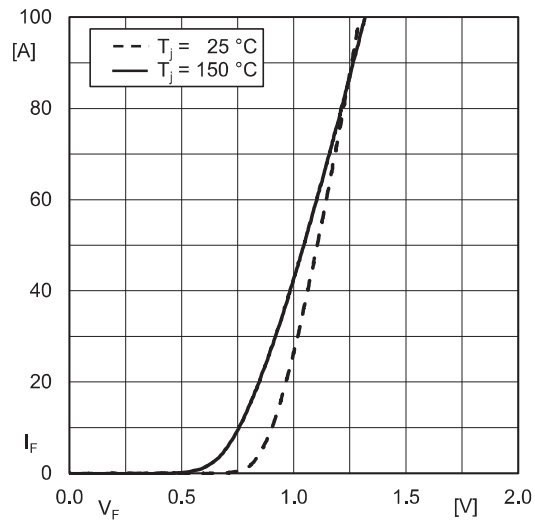
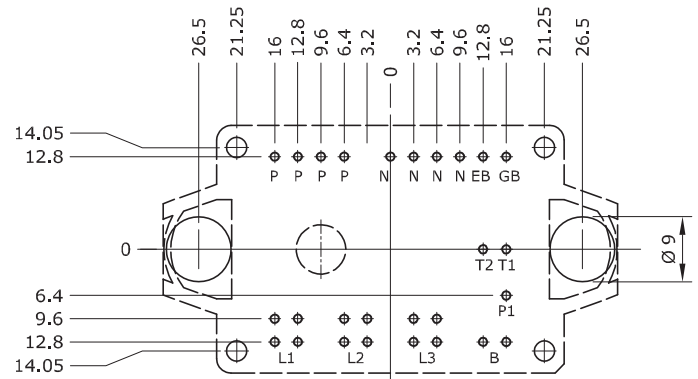
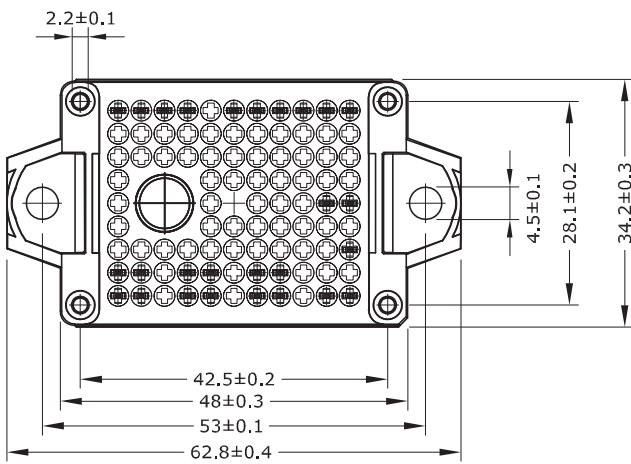
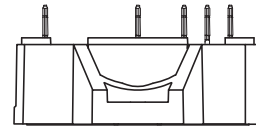
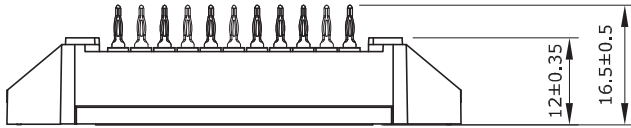
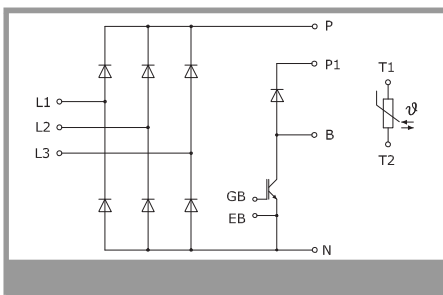


Fig. 14: Typ. Rect. diode forward charact., incl.  $R_{CC+EE}$



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

## SEMITOP® E1



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

## **\*IMPORTANT INFORMATION AND WARNINGS**

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