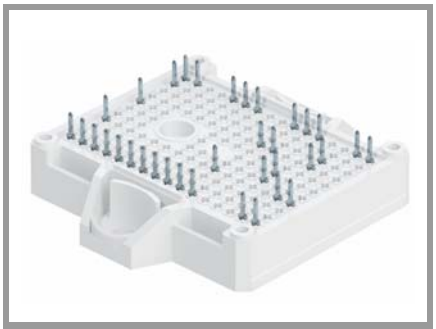
SK35DGDL12T7ETE2s



SEMITOP®E2 Solder

3-phase
Converter-Inverter-Brake
(CIB)

Engineering Sample

SK35DGDL12T7ETE2s

Target Data

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

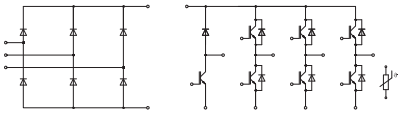
- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C

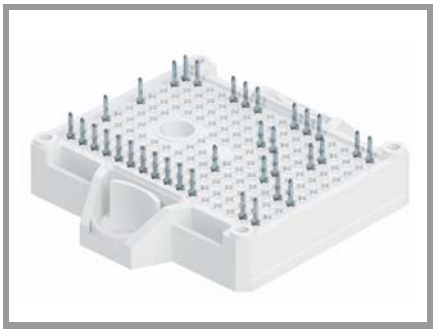
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	51	A
	T_j = 175 °C	T_s = 70 °C	41	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	61	A
	T_j = 175 °C	T_s = 70 °C	50	A
I_{Cnom}			35	A
I_{CRM}			70	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 1200 V	T_j = 175 °C	7	µs
T_j			-40 ... 175	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	51	A
	T_j = 175 °C	T_s = 70 °C	41	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	61	A
	T_j = 175 °C	T_s = 70 °C	50	A
I_{Cnom}			35	A
I_{CRM}			70	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 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 = 25 °C	41	A
	T_j = 175 °C	T_s = 70 °C	33	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	49	A
	T_j = 175 °C	T_s = 70 °C	39	A
I_{FRM}			70	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		170	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	15	A
	T_j = 175 °C	T_s = 70 °C	12	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	16	A
	T_j = 175 °C	T_s = 70 °C	13	A
I_{FRM}			20	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		36	A
T_j			-40 ... 175	°C



DGDL-ET

SK35DGDL12T7ETE2s



SEMITOP®E2 Solder

3-phase
Converter-Inverter-Brake
(CIB)

Engineering Sample

SK35DGDL12T7ETE2s

Target Data

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

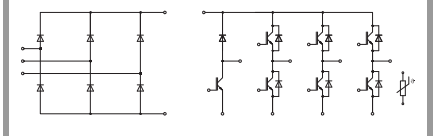
- Recommended $T_{j,op}$=-40 ...+150 °C

Absolute Maximum Ratings

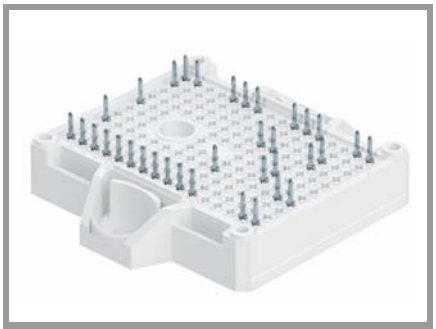
Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1600	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	61	A
	T_j = 175 °C	T_s = 70 °C	47	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	72	A
	T_j = 175 °C	T_s = 70 °C	57	A
I_{FSM}	t_p = 10 ms	T_j = 25 °C	370	A
	sin 180°	T_j = 150 °C	270	A
i^2t	t_p = 10 ms	T_j = 25 °C	685	A^2s
	sin 180°	T_j = 150 °C	365	A^2s
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	, $\Delta T_{terminal}$ 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 = 35 A	T_j = 25 °C		1.60	1.75	V
	V_{GE} = 15 V	T_j = 150 °C		1.82	1.96	V
	chiplevel	T_j = 175 °C		1.86	2.00	V
V_{CE0}		T_j = 25 °C		0.90	1.00	V
	chiplevel	T_j = 150 °C		0.75	0.83	V
		T_j = 175 °C		0.72	0.80	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		20	21	mΩ
	chiplevel	T_j = 150 °C		31	32	mΩ
		T_j = 175 °C		33	34	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	f = 1 MHz		6.6		nF
C_{oes}	V_{GE} = 0 V	f = 1 MHz		0.0853		nF
C_{res}		f = 1 MHz		0.024		nF
Q_G	V_{GE} = -15V...+15V			487		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V	T_j = 25 °C		43		ns
	I_C = 35 A	T_j = 150 °C		45		ns
	$R_{G\,on}$ = 5.6 Ω	T_j = 175 °C		46		ns
t_r	$R_{G\,off}$ = 5.6 Ω	T_j = 25 °C		30		ns
	V_{GE} = +15/-15 V	T_j = 150 °C		35		ns
	(T_j = 150 °C)	T_j = 175 °C		37		ns
E_{on}	di/dt_{on} = 1160 A/µs	T_j = 25 °C		2.51		mJ
	di/dt_{off} = 620 A/µs	T_j = 150 °C		3.52		mJ
	dv/dt = 4600 V/µs	T_j = 175 °C		3.96		mJ



DGDL-ET



SEMITOP®E2 Solder

3-phase
Converter-Inverter-Brake
(CIB)

Engineering Sample

SK35DGDL12T7ETE2s

Target Data

Features*

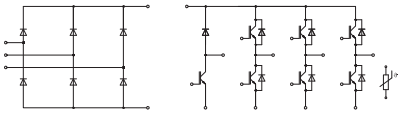
- Optimized design for superior thermal performance
- Low inductive design
- Solder contact technology
- 1200V Generation 7 IGBT (T7)
- Robust and soft switching CAL4F diode technology
- PEP rectifier diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor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

Typical Applications

- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C

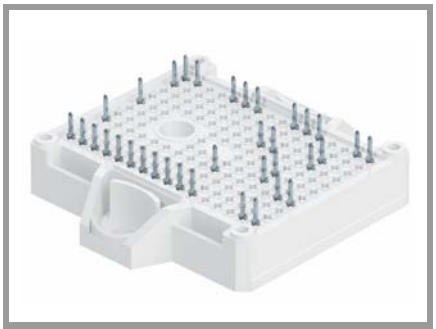


DGDL-ET

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$t_{d(off)}$	V_{CC} = 600 V I_C = 35 A $R_{G\ on}$ = 5.6 Ω $R_{G\ off}$ = 5.6 Ω V_{GE} = +15/-15 V (T_j = 150 °C) di/dt_{on} = 1160 A/µs di/dt_{off} = 620 A/µs dv/dt = 4600 V/µs	T_j = 25 °C		183		ns
		T_j = 150 °C		254		ns
		T_j = 175 °C		274		ns
t_f		T_j = 25 °C		62		ns
		T_j = 150 °C		95		ns
		T_j = 175 °C		102		ns
E_{off}		T_j = 25 °C		2.83		mJ
		T_j = 150 °C		3.74		mJ
		T_j = 175 °C		4.29		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.17		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.85		K/W
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 35 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.60	1.75	V
		T_j = 150 °C		1.82	1.96	V
		T_j = 175 °C		1.86	2.00	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.75	0.83	V
		T_j = 175 °C		0.72	0.80	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		20	21	mΩ
		T_j = 150 °C		31	32	mΩ
		T_j = 175 °C		33	34	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		6.6		nF
C_{oes}		f = 1 MHz		0.0853		nF
C_{res}		f = 1 MHz		0.024		nF
Q_G	V_{GE} = -15V...+15V			487		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 35 A $R_{G\ on}$ = 5.6 Ω $R_{G\ off}$ = 5.6 Ω V_{GE} = +15/-15 V (T_j = 150 °C) di/dt_{on} = 1160 A/µs di/dt_{off} = 620 A/µs dv/dt = 4600 V/µs	T_j = 25 °C		43		ns
		T_j = 150 °C		45		ns
		T_j = 175 °C		46		ns
t_r		T_j = 25 °C		30		ns
		T_j = 150 °C		35		ns
		T_j = 175 °C		37		ns
E_{on}		T_j = 25 °C		2.51		mJ
		T_j = 150 °C		3.52		mJ
		T_j = 175 °C		3.96		mJ
$t_{d(off)}$		T_j = 25 °C		183		ns
		T_j = 150 °C		254		ns
		T_j = 175 °C		274		ns
t_f		T_j = 25 °C		62		ns
		T_j = 150 °C		95		ns
		T_j = 175 °C		102		ns
E_{off}		T_j = 25 °C		2.83		mJ
		T_j = 150 °C		3.74		mJ
		T_j = 175 °C		4.29		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.17		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.85		K/W

SK35DGDL12T7ETE2s



SEMITOP®E2 Solder

3-phase
Converter-Inverter-Brake
(CIB)

Engineering Sample

SK35DGDL12T7ETE2s

Target Data

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

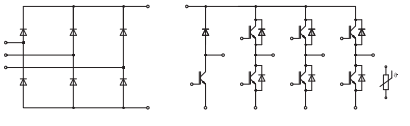
- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C

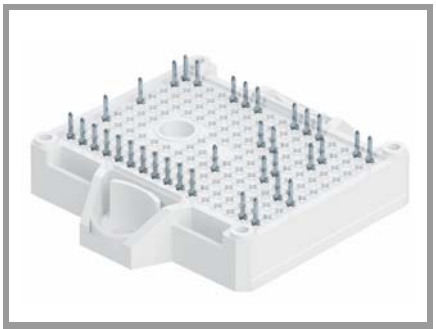
Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse - Diode						
$V_F = V_{EC}$	I_F = 35 A	T_j = 25 °C		2.30	2.62	V
		T_j = 150 °C		2.29	2.62	V
	chiplevel	T_j = 175 °C		2.14	2.46	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		29	32	mΩ
	chiplevel	T_j = 150 °C		40	43	mΩ
		T_j = 175 °C		38	42	mΩ
I_{RRM}		T_j = 25 °C		25		A
		T_j = 150 °C		31		A
	V_{CC} = 600 V	T_j = 175 °C		37		A
Q_{rr}	I_F = 35 A	T_j = 25 °C		2.15		µC
	V_{GE} = -15 V	T_j = 150 °C		4.85		µC
	(T_j = 150 °C)	T_j = 175 °C		5.48		µC
E_{rr}	di/dt_{off} = 1030 A/µs	T_j = 25 °C		1.46		mJ
		T_j = 150 °C		2.39		mJ
		T_j = 175 °C		3.65		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.34		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.01		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 10 A	T_j = 25 °C		2.59	2.94	V
		T_j = 150 °C		2.71	3.08	V
	chiplevel	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
		T_j = 150 °C		14		A
	V_{CC} = 600 V	T_j = 175 °C		16		A
Q_{rr}	I_F = 10 A	T_j = 25 °C		0.58		µC
	V_{GE} = -15 V	T_j = 150 °C		2.01		µC
	(T_j = 150 °C)	T_j = 175 °C		2.37		µC
E_{rr}	di/dt_{off} = 790 A/µs	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, λ_{paste}=0.8 W/(mK)			2.64		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			2.24		K/W



DGDL-ET

SK35DGDL12T7ETE2s



SEMITOP®E2 Solder

3-phase
Converter-Inverter-Brake
(CIB)

Engineering Sample

SK35DGDL12T7ETE2s

Target Data

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

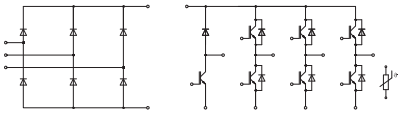
- Motor drives
- Air conditioning
- Auxiliary Inverters

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
V_F	I_F = 35 A chiplevel	T_j = 25 °C		1.10	1.39	V
		T_j = 150 °C		1.04	1.33	V
		T_j = 175 °C		1.04	1.34	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		6.2	8.5	mΩ
		T_j = 150 °C		8.8	12	mΩ
		T_j = 175 °C		10.0	13	mΩ
I_R	T_j = 150 °C, V_{RRM}				2	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.48		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.14		K/W
Module						
M_s	to heatsink		1.6		2.3	Nm
w				35		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



DGDL-ET

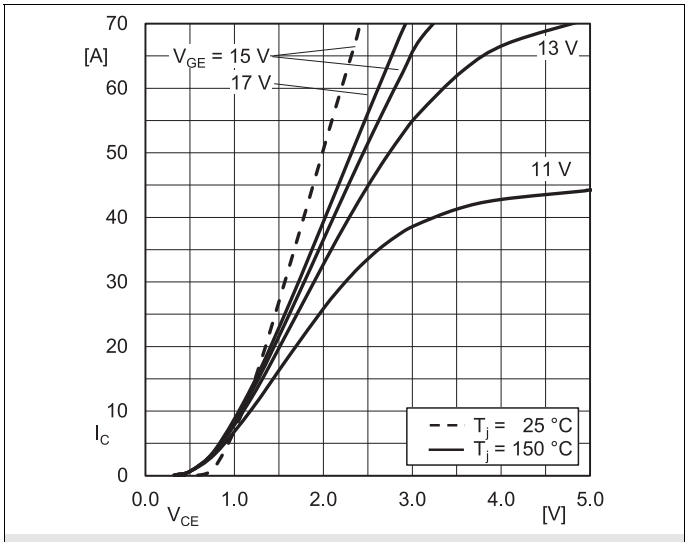


Fig. 1: Typ. IGBT output characteristic, incl. $R_{CC+\ EE'}$

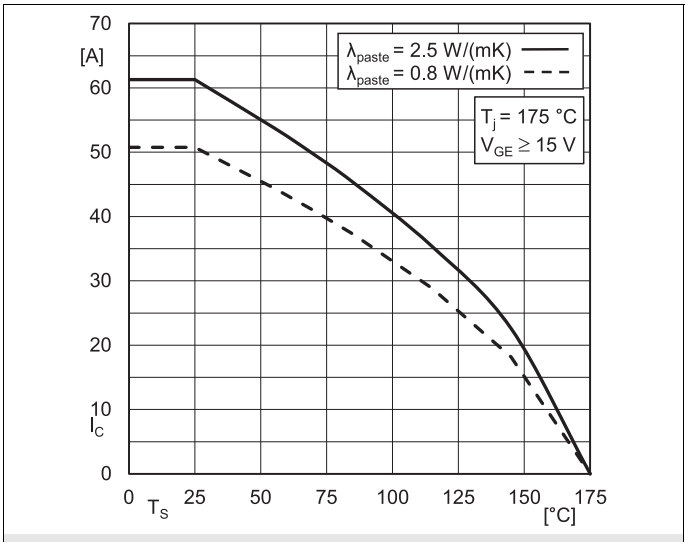


Fig. 2: IGBT rated current vs. temperature $I_c=f(T_s)$

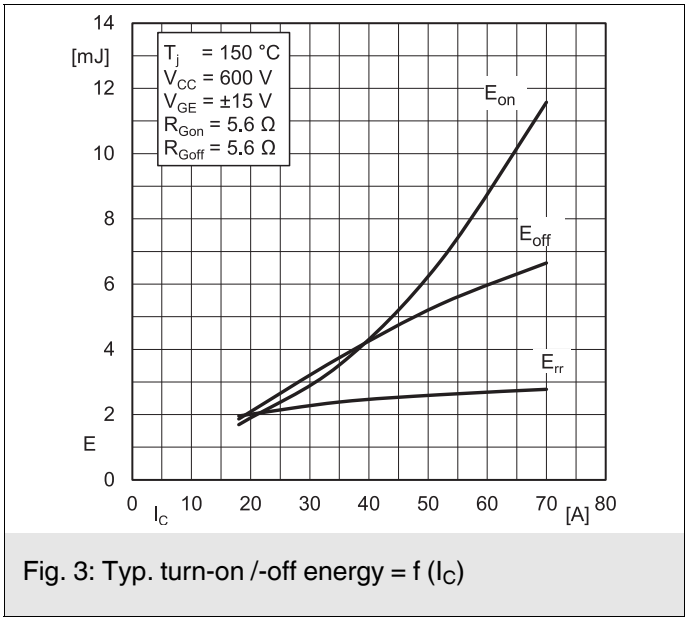


Fig. 3: Typ. turn-on /-off energy = f (I_C)

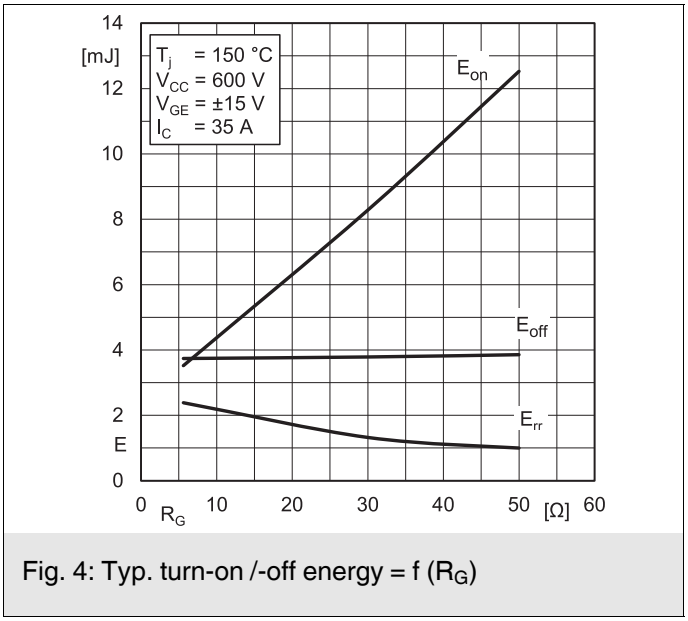


Fig. 4: Typ. turn-on /-off energy = f (R_G)

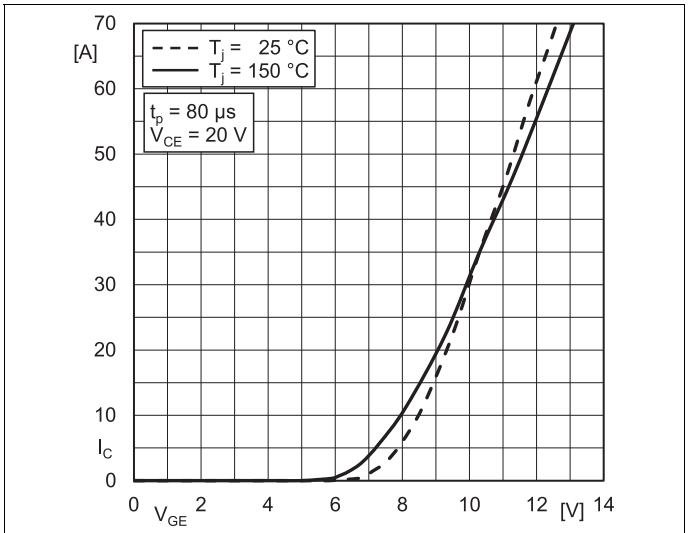


Fig. 5: Typ. IGBT transfer characteristic

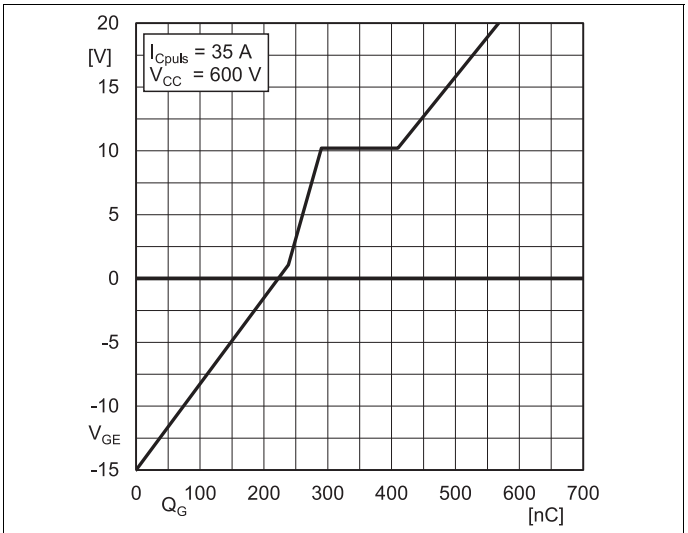


Fig. 6: Typ. IGBT gate charge characteristic

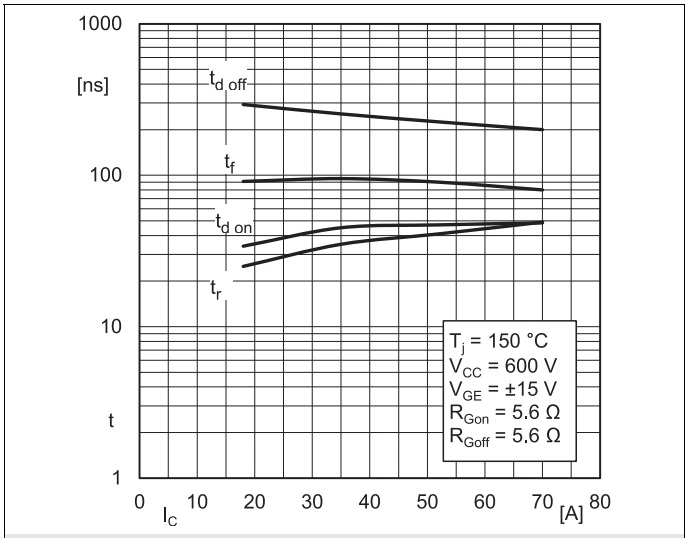


Fig. 7: Typ. switching times = f (I_C)

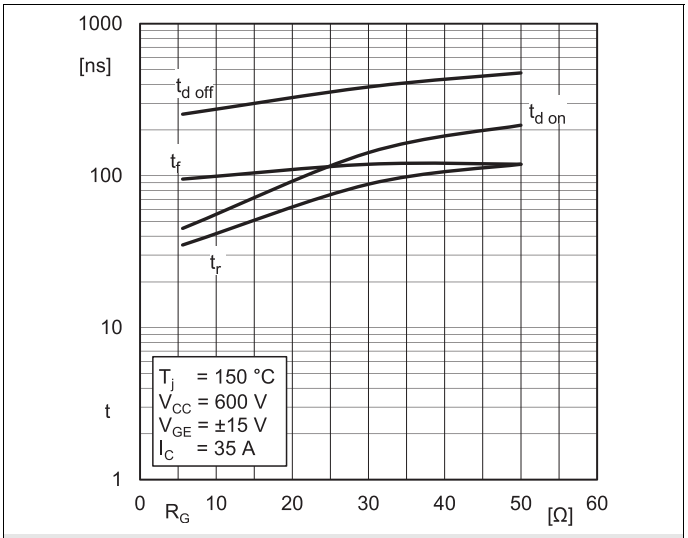


Fig. 8: Typ. switching times = f (R_G)

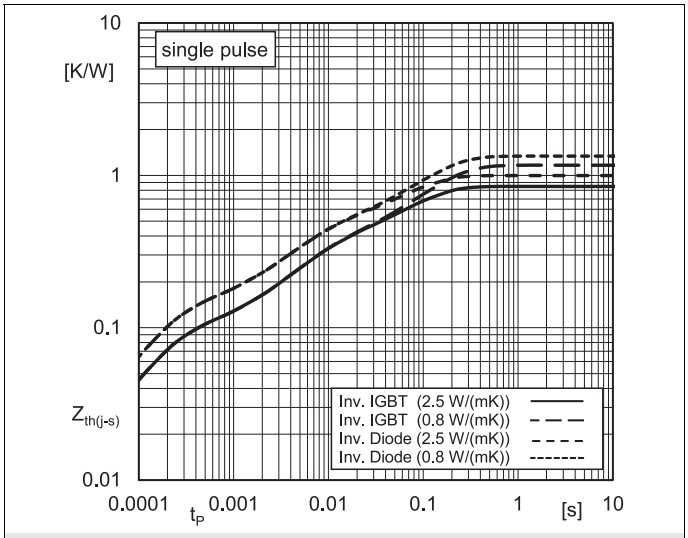


Fig. 9: Typ. transient thermal impedance

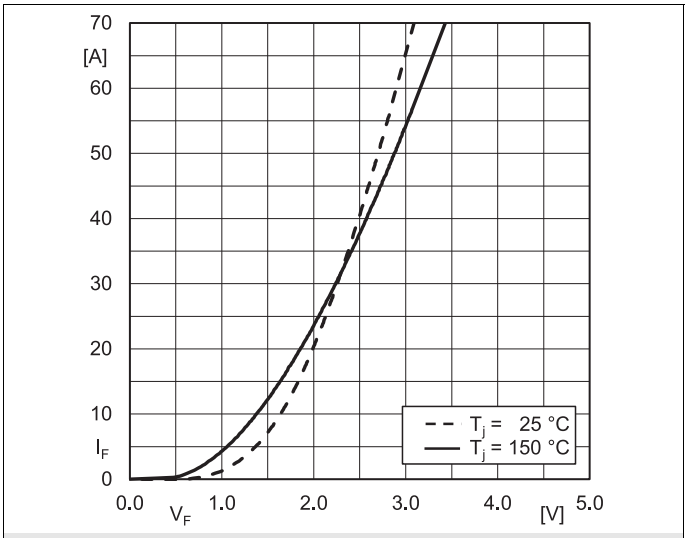


Fig. 10: Typ. Inv. diode forward charact., incl. $R_{CC'+EE'}$

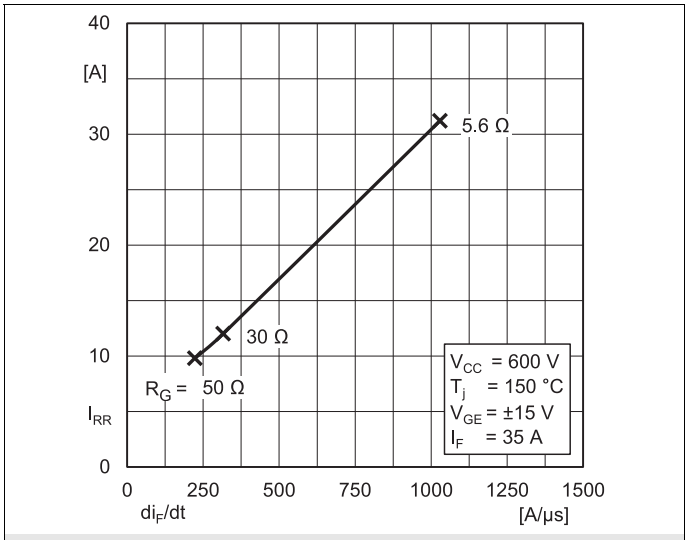


Fig. 11: Typ. Inv. diode peak reverse recovery current

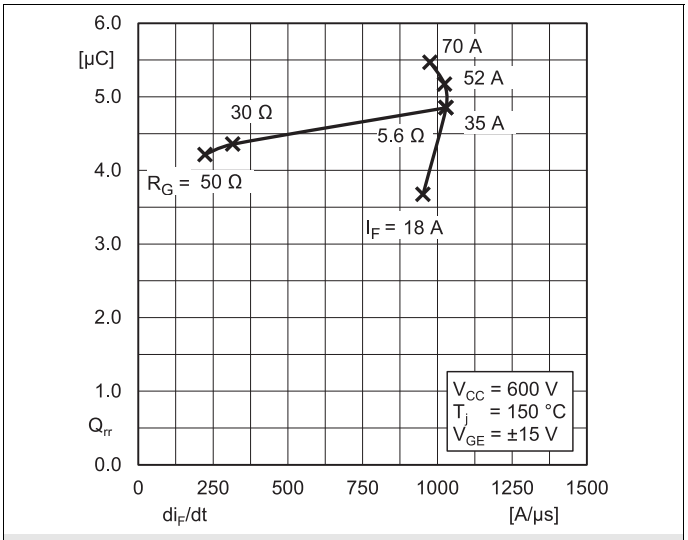


Fig. 12: Typ. Inv. diode reverse recovery charge

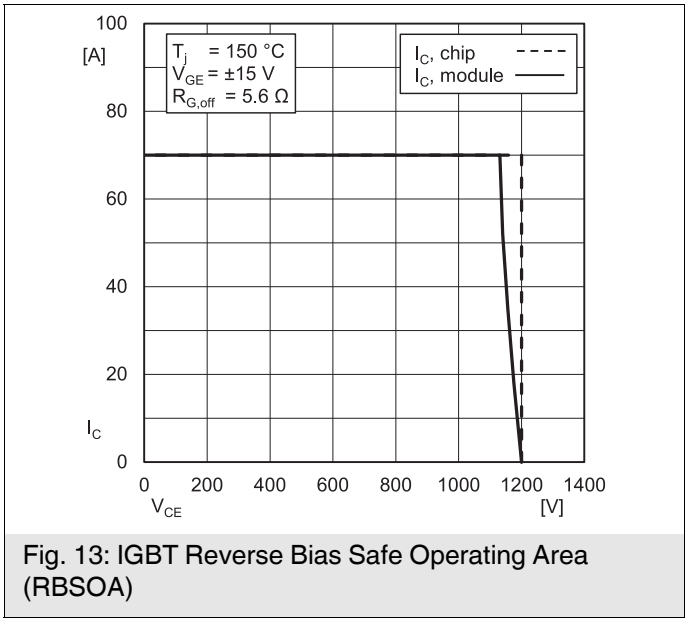


Fig. 13: IGBT Reverse Bias Safe Operating Area (RBSOA)

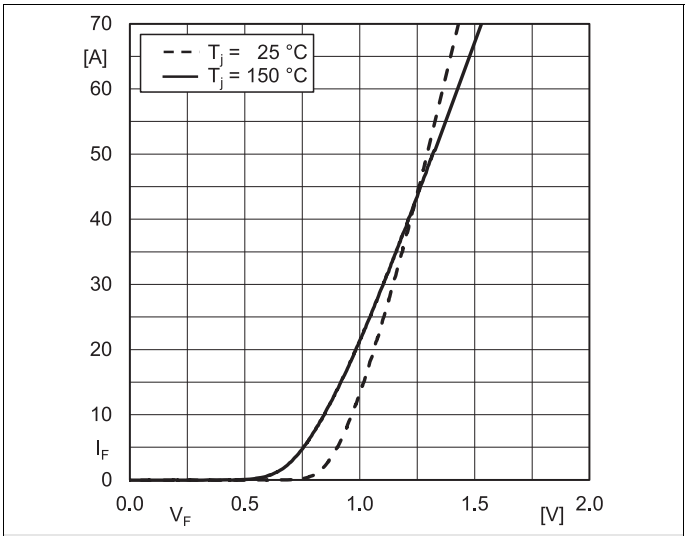
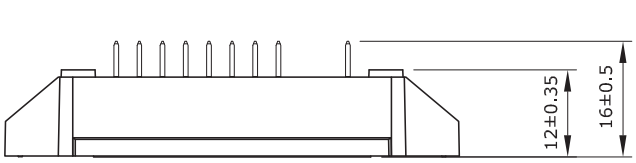
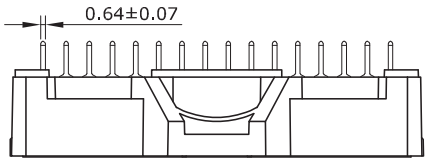
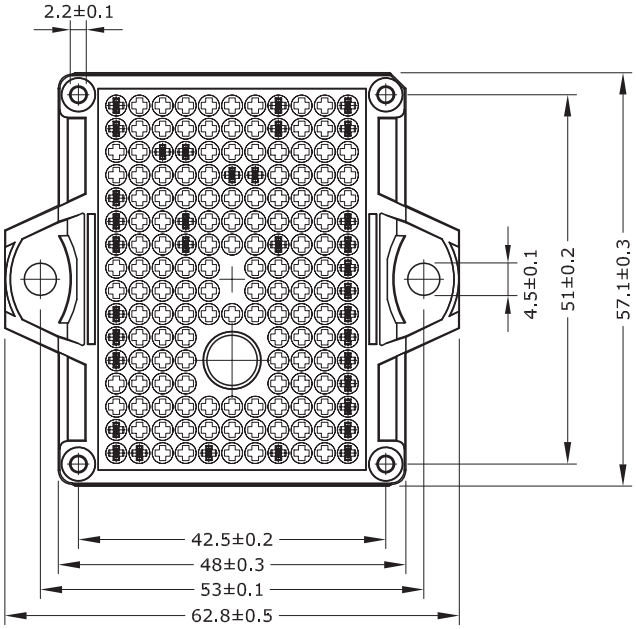
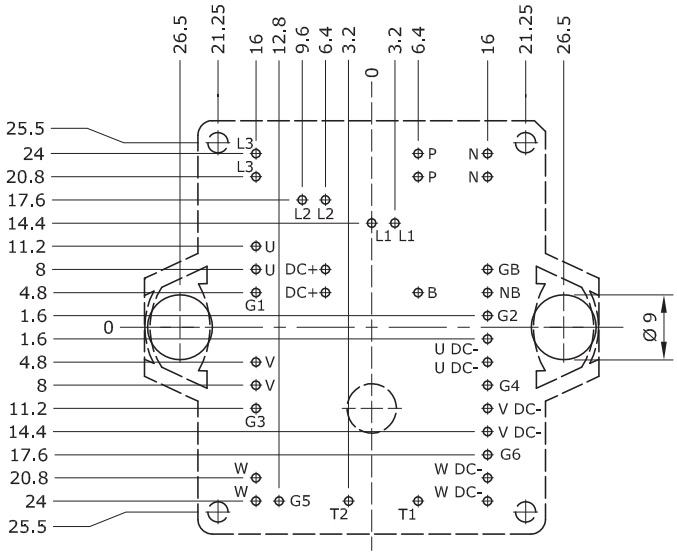


Fig. 14: Typ. Rect. diode forward charact., incl. $R_{CC'+EE'}$



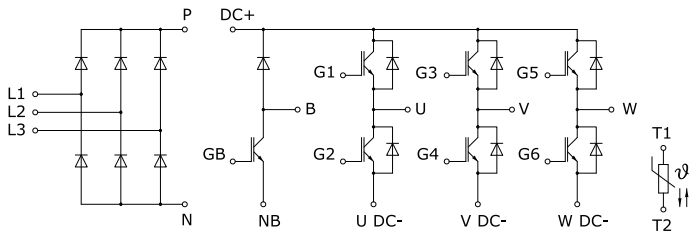






- Pin-Grid 3.2 mm

SEMITOP®E2 Solder



DGDL-ET

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

***IMPORTANT INFORMATION AND WARNINGS**

The specifications of SEMIKRON products may not be considered as guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of SEMIKRON products describe only the usual characteristics of products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Application adjustments may be necessary. The user of SEMIKRON products is responsible for the safety of their applications embedding SEMIKRON products and must take adequate safety measures to prevent the applications from causing a physical injury, fire or other problem if any of SEMIKRON products become faulty. The user is responsible to make sure that the application design is compliant with all applicable laws, regulations, norms and standards. Except as otherwise explicitly approved by SEMIKRON in a written document signed by authorized representatives of SEMIKRON, SEMIKRON products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury. No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. SEMIKRON does not assume any liability arising out of the applications or use of any product; neither does it convey any license under its patent rights, copyrights, trade secrets or other intellectual property rights, nor the rights of others. SEMIKRON makes no representation or warranty of non-infringement or alleged non-infringement of intellectual property rights of any third party which may arise from applications. Due to technical requirements our products may contain dangerous substances. For information on the types in question please contact the nearest SEMIKRON sales office. This document supersedes and replaces all information previously supplied and may be superseded by updates. SEMIKRON reserves the right to make changes.

In accordance with the quality guidelines of SEMIKRON, we would like to point out that the products are engineering samples. These engineering samples are not yet produced under quality conditions approaching those of series production, and are at the present time not included in the SEMIKRON quality monitoring and control process. Neither the product nor the production process has to date gone completely through the SEMIKRON internal authorization procedure. SEMIKRON may make any amendments without any prior notification. SEMIKRON cannot and shall not promise or commit itself to release and/or make available a final version or series product after the development phase. SEMIKRON cannot and will not assume any responsibility with regard to freedom from defects, functionality, and adaptation to and interaction with possible applications of the user or with regard to any other potential risks resulting from the use of engineering samples. Therefore SEMIKRON explicitly excludes any warranty and liability; as far as legally possible. The customer shall fully indemnify and hold harmless SEMIKRON from any and all risks, damages, losses, expenses and costs directly or indirectly resulting out of or in connection with the commissioning, operation, system integration, sale, dissemination or any other kind of use of engineering samples by the customer and/or any third party, which has come into possession of engineering samples through or because of the customer. All know-how and all registerable and non-registerable copyrights and industrial property rights arising from or in connection with these engineering samples remain the exclusive property of SEMIKRON.