SK40MLLE120CR03TE1

SEMITOP®E1

Double Boost + Bypass (Full SiC)

SK40MLLE120CR03TE1

Features*

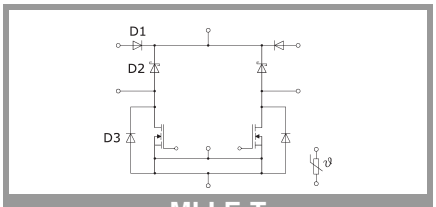
- Optimized design for superior thermal performance
- Extremely low inductance design
- Press-Fit contact technology
- 1200V Planar Gen3 SiC MOS
- Simple to drive with +15V gate voltage
- SiC Schottky diode
- New PEP diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Solar

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C
- Recommended turn-off / turn-on gate voltage V_{GS} = -4...0/+15V
- Diode1: Bypass and Protection Diodes D1 & D3
- Diode2: Boost SiC Diode D2



MLLE-T

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
MOSFET 1				
V_{DSS}			1200	V
I_D	T_j = 175 °C	T_s = 25 °C	51	A
		T_s = 70 °C	43	A
I_{DM}	t_p limited by T_{vjmax}		120	A
V_{GS}	Transient Gate - Source voltage (t < 100ns)		-8 ... 19	V
T_j			-40 ... 175	°C
Integrated body diode				
I_{SM}	t_p limited by T_{vjmax}		120	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150°C		220	A

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Diode 1				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	69	A
		T_s = 70 °C	55	A
I_{FSM}	10 ms, sin 180°, T_j = 150 °C		270	A
i^2t	10 ms, sin 180°, T_j = 150 °C		364	A^2s
T_j			-40 ... 175	°C

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Diode 2				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	37	A
		T_s = 70 °C	30	A
I_{FRM}			40	A
I_{FSM}	8.3 ms sin 180°	T_j = 25 °C	80	A
		T_j = 150 °C	62	A
T_j			-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	**Conditions**	**Values**	**Unit**
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, t = 1 min	2500	V

SK40MLLE120CR03TE1

SEMITOP®E1

Double Boost + Bypass
(Full SiC)

SK40MLLE120CR03TE1

Features*

- Optimized design for superior thermal performance
- Extremely low inductance design
- Press-Fit contact technology
- 1200V Planar Gen3 SiC MOS
- Simple to drive with +15V gate voltage
- SiC Schottky diode
- New PEP diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Solar

Remarks

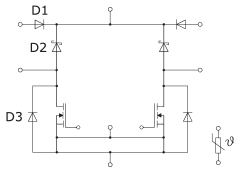
- Recommended $T_{j,op}$=-40 ...+150 °C
- Recommended turn-off / turn-on gate voltage V_{GS} = -4...0/+15V
- Diode1: Bypass and Protection Diodes D1 & D3
- Diode2: Boost SiC Diode D2

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
MOSFET 1						
$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 11.5 mA, T_j = 25 °C		1.8	2.5	3.6	V
I_{DSS}	V_{GS} = 0 V, V_{DS} = 1200 V, T_j = 25 °C				0.2	mA
I_{GSS}	V_{DS} = 0 V, V_{GS} = 15 V, T_j = 25 °C				400	nA
$R_{DS(on)}$	V_{GS} = 15 V, I_D = 41 A, chiplevel	T_j = 25 °C		32	43	mΩ
		T_j = 150 °C		50		mΩ
C_{iss}	V_{GS} = 0 V, V_{DS} = 1000 V, f = 0.1 MHz			3400		pF
C_{oss}	V_{GS} = 0 V, V_{DS} = 1000 V, f = 0.1 MHz			130		pF
C_{rss}	V_{GS} = 0 V, V_{DS} = 1000 V, f = 0.1 MHz			10		pF
R_{Gint}	T_j = 25 °C			1.7		Ω
Q_G	V_{DD} = 800 V, V_{GS} = -4 V ... 15 V, I_D = 41 A			118		nC
$t_{d(on)}$	V_{DD} = 600 V, V_{GS} = 15/-4 V, I_D = 40 A, R_{Gon} = 9.1 Ω, R_{Goff} = 9.1 Ω, di/dt$_{off}$ = 2.9 kA/µs, di/dt$_{on}$ = 2.7 kA/µs, dv/dt = 67 kV/µs	T_j = 150 °C		33		ns
$t_{d(off)}$		T_j = 150 °C		76		ns
t_r		T_j = 150 °C		16		ns
t_f		T_j = 150 °C		16		ns
E_{on}		T_j = 150 °C		0.28		mJ
E_{off}		T_j = 150 °C		0.28		mJ
$R_{th(j-s)}$	per MOSFET, HPTP / HP-PCM			0.92		K/W
Integrated body diode						
$V_F = V_{SD}$	$-I_D$ = 21 A, V_{GS} = -4 V, chiplevel	T_j = 25 °C		4.62		V
		T_j = 150 °C		4.31		V
$V_{F0} = V_{SD0}$	chiplevel	T_j = 25 °C		3.80		V
		T_j = 150 °C		3.60		V
$r_F = r_{SD}$	chiplevel	T_j = 25 °C		39		mΩ
		T_j = 150 °C		34		mΩ
t_{rr}	V_{DD} = 600 V, $-I_D$ = 40 A, V_{GS} = -4 V	T_j = 150 °C		-		ns
Q_{rr}		T_j = 150 °C		-		µC
I_{rr}		T_j = 150 °C		-		A
E_{rr}	di/dt$_{off}$ = 2.9 kA/µs	T_j = 150 °C		-		mJ

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode 1						
V_F	I_F = 20 A	T_j = 25 °C		1.01	1.26	V
	chiplevel	T_j = 150 °C		0.91	1.15	V
V_{F0}	chiplevel	T_j = 25 °C		0.89	1.09	V
		T_j = 150 °C		0.73	0.92	V
r_F	chiplevel	T_j = 25 °C		6.2	8.5	mΩ
		T_j = 150 °C		8.8	12	mΩ
I_R	T_j = 150 °C, V_{RRM}				2	mA
$R_{th(j-s)}$	per Diode, HPTP / HP-PCM			1.21		K/W



MLLE-T

SK40MLLE120CR03TE1

SEMITOP®E1

Double Boost + Bypass
(Full SiC)

SK40MLLE120CR03TE1

Features*

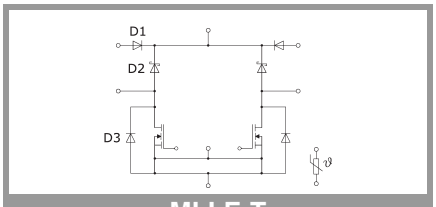
- Optimized design for superior thermal performance
- Extremely low inductance design
- Press-Fit contact technology
- 1200V Planar Gen3 SiC MOS
- Simple to drive with +15V gate voltage
- SiC Schottky diode
- New PEP diode technology for enhanced power and environmental robustness
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- Solar

Remarks

- Recommended $T_{j,op}$=-40 ...+150 °C
- Recommended turn-off / turn-on gate voltage V_{GS} = -4...0/+15V
- Diode1: Bypass and Protection Diodes D1 & D3
- Diode2: Boost SiC Diode D2



MLLE-T

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Diode 2						
V_F	I_F = 20 A	T_j = 25 °C		1.40	1.60	V
	chiplevel	T_j = 150 °C		1.80	2.10	V
V_{F0}	chiplevel	T_j = 25 °C		0.95	1.05	V
		T_j = 150 °C		0.83	0.90	V
r_F	chiplevel	T_j = 25 °C		23	28	mΩ
		T_j = 150 °C		49	60	mΩ
C_j	V_R = 800 V, f = 1 MHz, T_j = 25 °C			0.085		nF
Q_c	V_R = 800 V, di/dt_{off} = 500 A/µs, T_j = 25 °C			0.066		µC
$R_{th(j-s)}$	per Diode, HPTP / HP-PCM			1.19		K/W

Characteristics					
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
Module					
L_{CE}			10		nH
M_s	to heatsink	1.6		2.3	Nm
w	weight		25		g

Characteristics					
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
Temperature Sensor					
R_{100}	T_c=100°C (R_{25}=5 kΩ)		493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K];		3550 ±2%		K

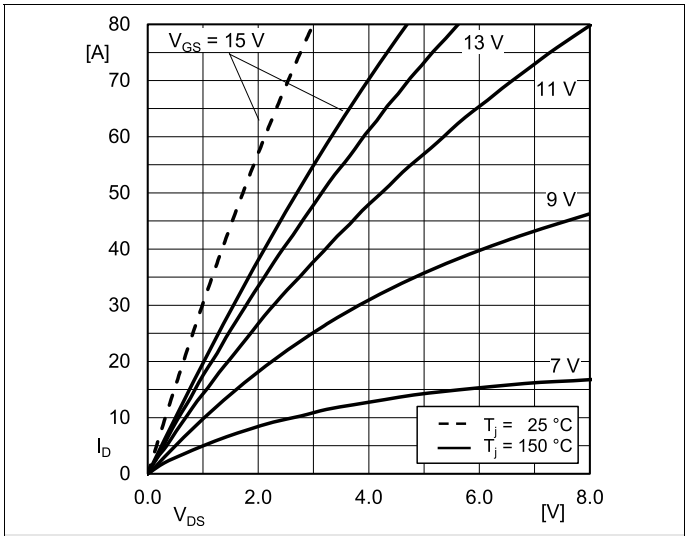


Fig.1: Typ. MOSFET forward output characteristic, incl. $R_{DD'+SS'}$

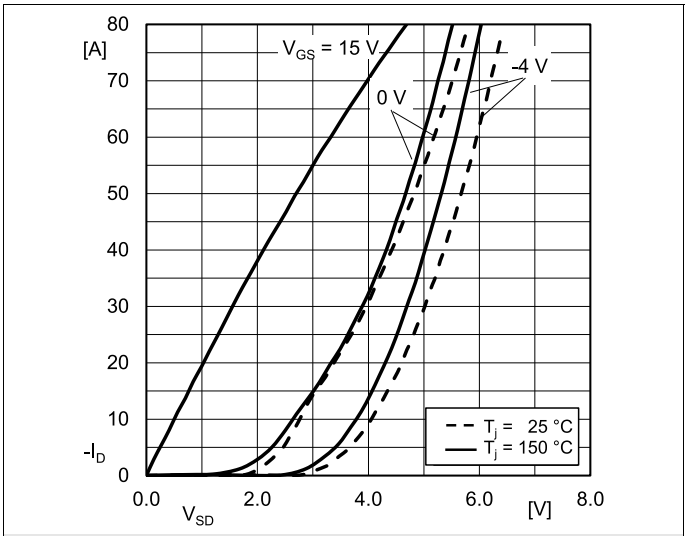


Fig. 1a: Typ. MOSFET reverse output characteristics, incl. $R_{DD'+SS'}$

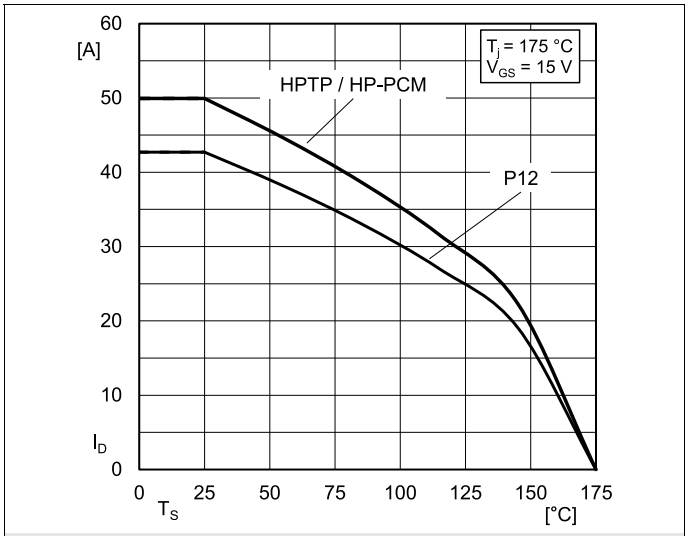


Fig. 2: MOSFET Rated current vs. Temperature $I_c=f(T_s)$

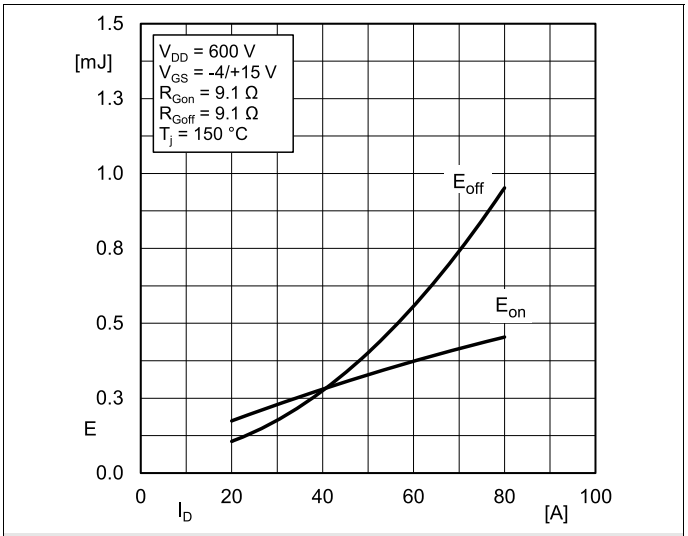


Fig. 3: Typ. MOSFET switching energy E = f (I_D)

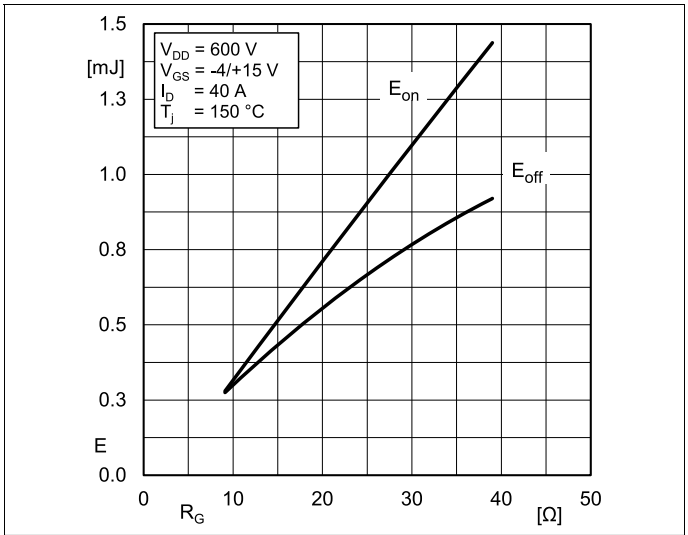


Fig. 4a: Typ. MOSFET switching energy E = f (R_G)

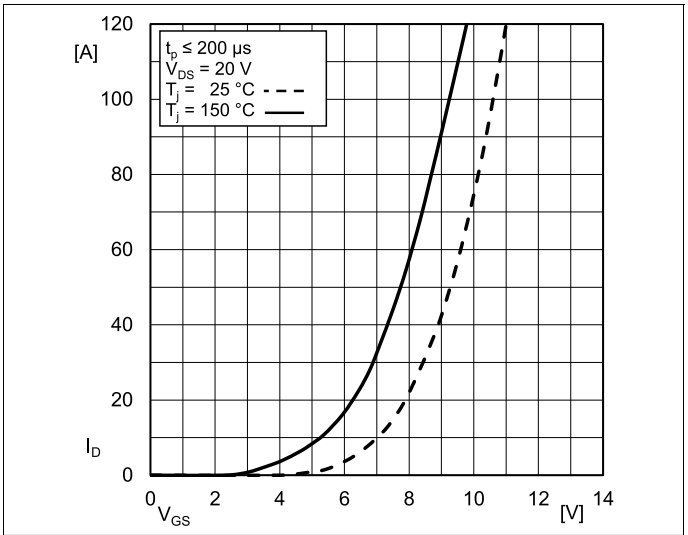


Fig. 5: Typ. MOSFET transfer characteristic

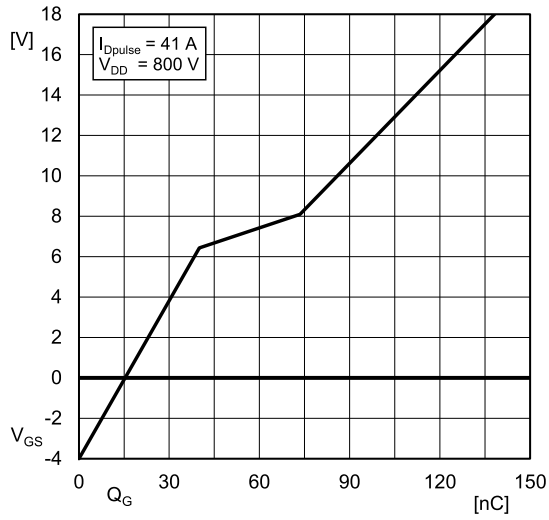


Fig. 6: Typ. MOSFET gate charge characteristic

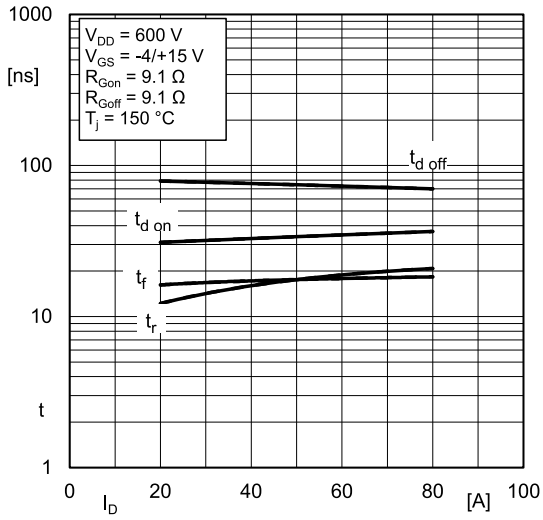


Fig. 7: Typ. MOSFET switching times t = f (I_D)

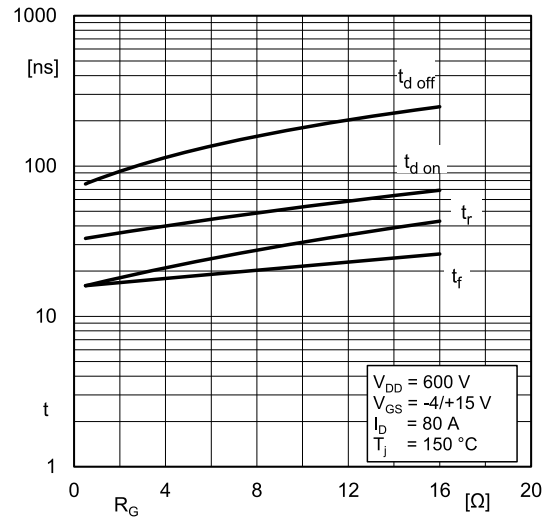


Fig. 8: Typ. MOSFET switching times t = f (R_G)

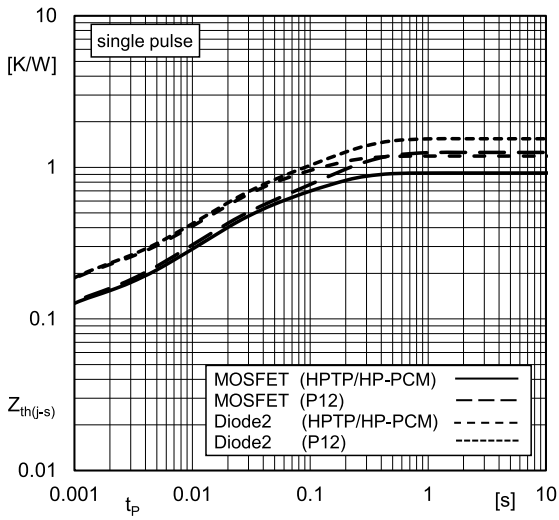


Fig. 9: Typ. transient thermal impedance

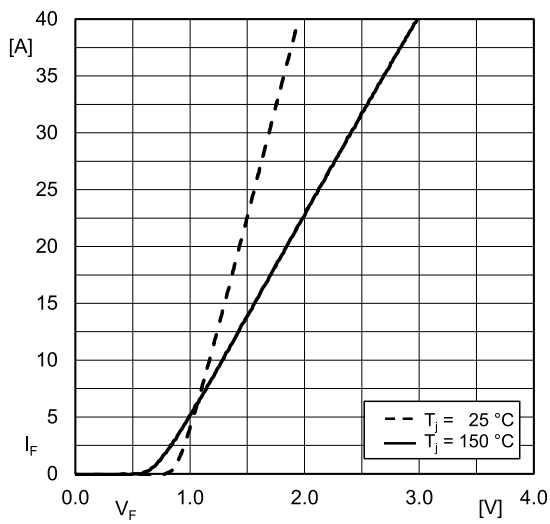


Fig. 10: Typ. Diode2 forward characteristic, incl. $R_{CC'+EE'}$

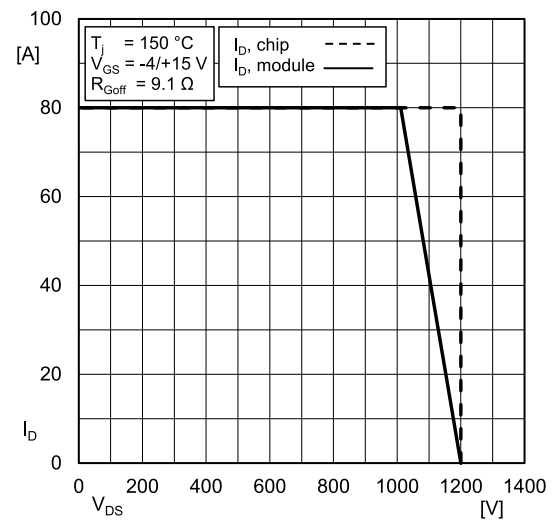


Fig. 13: MOSFET Reverse Bias Safe Operating Area (RBSOA)

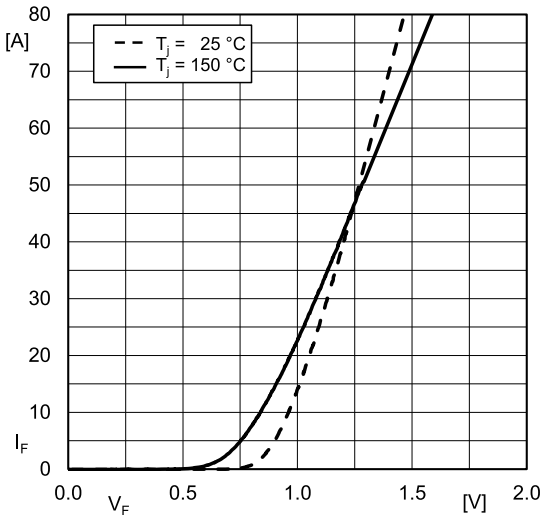
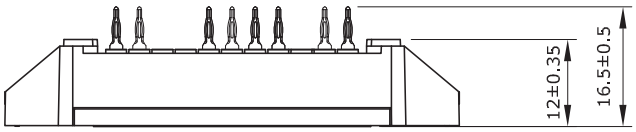
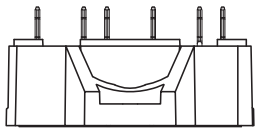
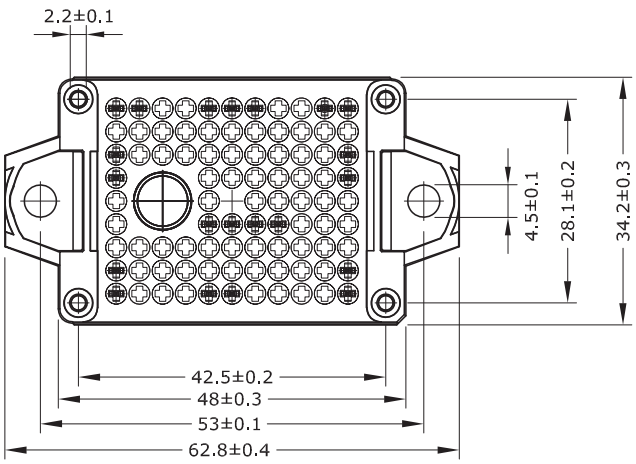
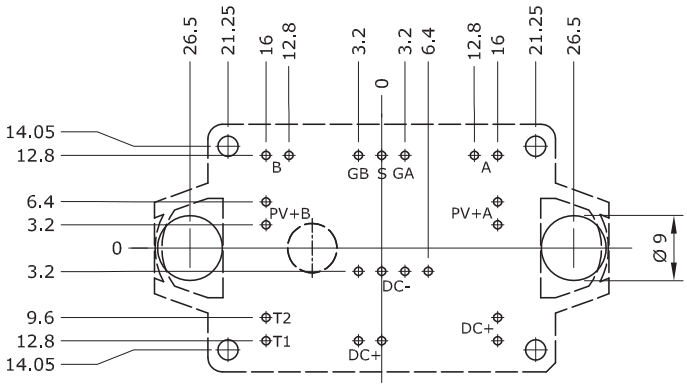


Fig. 14: Typ. Diode1 forward characteristic, incl. $R_{CC'+EE'}$



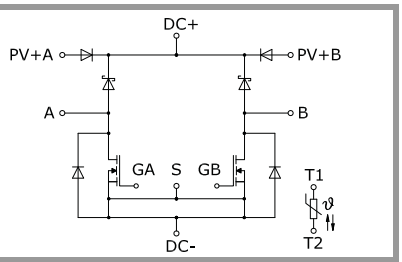






- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern ⌖ Ø0.1
- Diameters of drill ∅ 1.15mm
- Copper thickness in hole 25 - 50 µm
- Hole specification for contacts:
  refer to SEMITOP E1/E2 Mounting Instruction

SEMITOP®E1



MLLE-T

IMPORTANT INFORMATION AND WARNINGS

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

*The specifications of Semikron Danfoss products may not be considered as any guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of Semikron Danfoss products describe only the usual characteristics of Semikron Danfoss 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. Resulting from this, application adjustments of any kind may be necessary. Any user of Semikron Danfoss products is responsible for the safety of their applications embedding Semikron Danfoss products and must take adequate safety measures to prevent the applications from causing any physical injury, fire or other problem, also if any Semikron Danfoss product becomes faulty. Any user is responsible for making sure that the application design and realization are compliant with all laws, regulations, norms and standards applicable to the scope of application. Unless otherwise explicitly approved by Semikron Danfoss in a written document signed by authorized representatives of Semikron Danfoss, Semikron Danfoss 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 Danfoss does not convey any license under its or a third party's patent rights, copyrights, trade secrets or other intellectual property rights, neither does it make any representation or warranty of non-infringement of intellectual property rights of any third party which may arise from a user's applications.

