

# SK40MB120CR03TE1



**SEMITOP®E1**

## Half-Bridge (Full SiC)

### Engineering Sample SK40MB120CR03TE1

#### Target Data

#### 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
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

#### Typical Applications

- Switched Mode Power Supplies
- Energy Storage Systems
- Electric Vehicle charging
- UPS
- Solar
- Motor Drives

#### Remarks

- Recommended  $T_{j,op} = -40 \dots +150 \text{ °C}$
- Recommended turn-off / turn-on gate voltage  $V_{GS} = -4 \dots 0 / +15 \text{ V}$

#### Footnotes

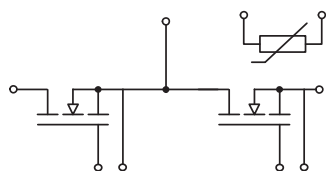
<sup>1)</sup> SEMIKRON Exclusive High Performance Thermal Paste (HPTP), available as pre-applied

#### Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
<b>MOSFET 1</b>			
$V_{DSS}$		1200	V
$I_D$	$T_j = 175 \text{ °C}$	$T_s = 25 \text{ °C}$ $T_s = 70 \text{ °C}$	A
$I_{DM}$	Pulse width $t_p$ limited by $T_{jmax}$	120	A
$I_{DM,replicative}$		60	A
$V_{GS}$	Max. transient gate - source voltage	-8 ... 19	V
$T_j$		-55 ... 175	°C
<b>Integrated body diode</b>			
$I_{FM}$	Pulse width $t_p$ limited by $T_{jmax}$	120	A
$I_{FM,replicative}$		60	A

#### Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
<b>Module</b>			
$I_{t(RMS)}$	$\Delta T_{terminal}$ at PCB joint = 30 K, per pin	30	A
$T_{stg}$		-40 ... 125	°C
$V_{isol}$	AC, sinusoidal, $t = 1 \text{ min}$	2500	V



**MB-T**

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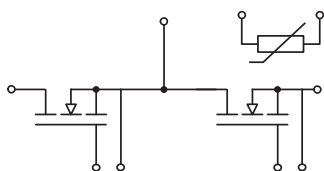
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>MOSFET 1</b>					
$V_{(BR)DSS}$	$V_{GS} = 0 \text{ V}, I_D = 0.1 \text{ mA}, T_j = 25 \text{ }^{\circ}\text{C}$	1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 11.5 \text{ mA}, T_j = 25 \text{ }^{\circ}\text{C}$	1.8	2.5	3.6	V
$I_{DSS}$	$V_{GS} = 0 \text{ V}, V_{DS} = 1200 \text{ V}, T_j = 25 \text{ }^{\circ}\text{C}$			1	mA
$I_{GSS}$	$V_{DS} = 0 \text{ V}, V_{GS} = 15 \text{ V}, T_j = 25 \text{ }^{\circ}\text{C}$			100	nA
$R_{DS(on)}$	$V_{GS} = 15 \text{ V}$				
	$I_D = 41 \text{ A}$				
	$T_j = 25 \text{ }^{\circ}\text{C}$		32	43	mΩ
	chiplevel		50		mΩ
$C_{iss}$	$V_{GS} = 0 \text{ V}, V_{DS} = 1000 \text{ V}, f = 0.1 \text{ MHz}$		3400		pF
$C_{oss}$	$V_{GS} = 0 \text{ V}, V_{DS} = 1000 \text{ V}, f = 0.1 \text{ MHz}$		130		pF
$C_{rss}$	$V_{GS} = 0 \text{ V}, V_{DS} = 1000 \text{ V}, f = 0.1 \text{ MHz}$		10		pF
$R_{Gint}$	$T_j = 25 \text{ }^{\circ}\text{C}$		1.7		Ω
$Q_G$	$V_{DD} = 800 \text{ V}, V_{GS} = -4 \text{ V} \dots 15 \text{ V}, I_D = 41 \text{ A}$		118		nC
$t_{d(on)}$	$V_{DD} = 600 \text{ V}$		21		ns
$t_{d(off)}$	$V_{GS} = 15/-4 \text{ V}$		56		ns
$t_r$	$I_D = 40 \text{ A}$				
$t_f$	$R_{Gon} = 10 \text{ }^{\circ}\Omega$		10		ns
$E_{on}$	$R_{Goff} = 4.2 \text{ }^{\circ}\Omega$		6		ns
$E_{off}$	$di/dt_{off} = 6.5 \text{ kA}/\mu\text{s}$		0.57		mJ
	$di/dt_{on} = 5.0 \text{ kA}/\mu\text{s}$				
	$dv/dt = 52 \text{ kV}/\mu\text{s}$		0.26		mJ
$R_{th(j-s)}$	per MOSFET, $\lambda_{paste} = 2.5 \text{ W}/(\text{mK})$ <sup>1)</sup>		1.02		K/W
<b>Integrated body diode</b>					
$V_F = V_{SD}$	$-I_D = 21 \text{ A}$			4.6	V
	$V_{GS} = -4 \text{ V}$				
	chiplevel			4.3	V
$V_{F0} = V_{SD0}$	$T_j = 25 \text{ }^{\circ}\text{C}$		3.8		V
	$T_j = 150 \text{ }^{\circ}\text{C}$		3.6		V
$r_F = r_{SD}$	chiplevel		39		mΩ
	$T_j = 150 \text{ }^{\circ}\text{C}$		34		mΩ
$t_{rr}$	$V_{DD} = 600 \text{ V}$		32		ns
$Q_{rr}$	$-I_D = 40 \text{ A}$		0.8		μC
$I_{rr}$	$V_{GS} = -4 \text{ V}$				
$E_{rr}$	$R_{Gon} = 10 \text{ }^{\circ}\Omega$		50		A
	$di/dt_{off} = 5.0 \text{ kA}/\mu\text{s}$		0.18		mJ

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Module</b>					
$L_{CE}$			9		nH
$M_s$	to heatsink	1.6		2.3	Nm
$w$	weight		25		g

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Temperature Sensor</b>					
$R_{100}$	$T_r = 100 \text{ }^{\circ}\text{C}$		$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$ ; $T[K]$		$3550 \pm 2\%$		K



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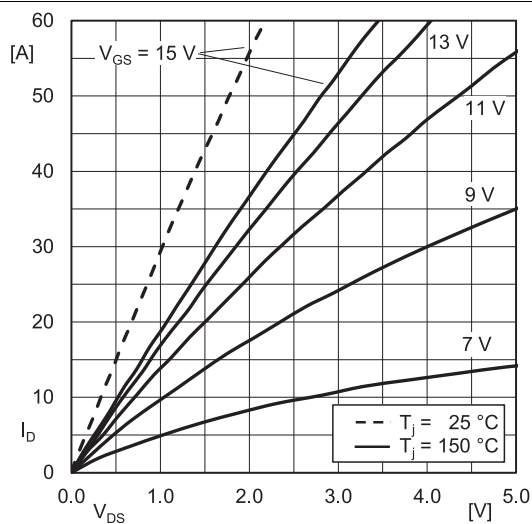


Fig. 1: Typ. MOSFET forward output characteristic, incl.  $R_{DS(on)} + SS'$

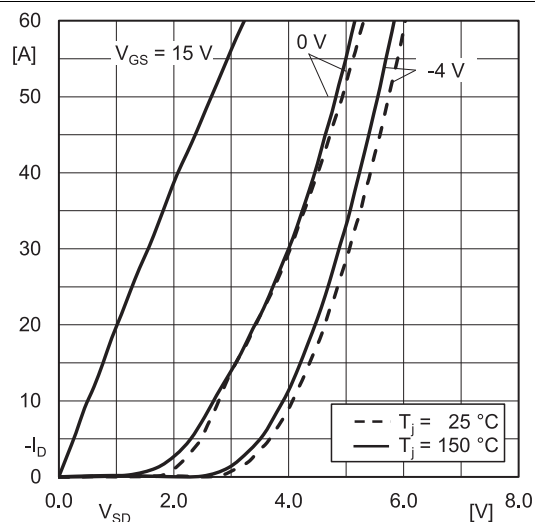


Fig. 2: Typ. MOSFET reverse output characteristics, incl.  $R_{DS(on)} + SS'$

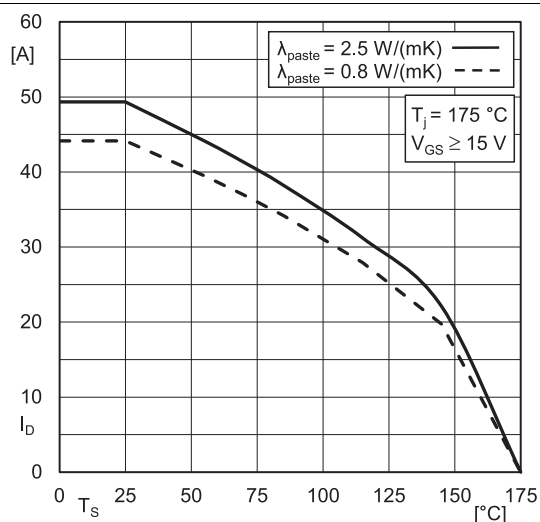


Fig. 3: Rated current vs. temperature  $I_D = f(T_S)$

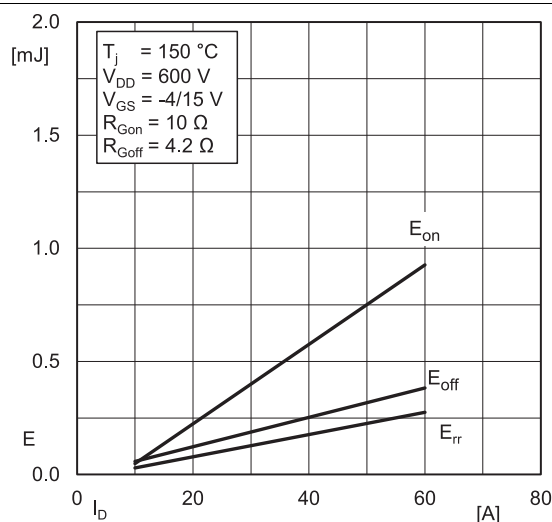


Fig. 4: Typ. turn-on/-off energy  $E = f(I_D)$

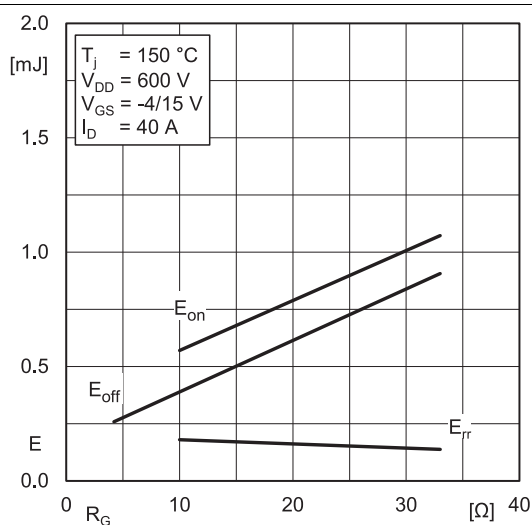


Fig. 5: Typ. turn-on /-off energy  $E = f(R_G)$

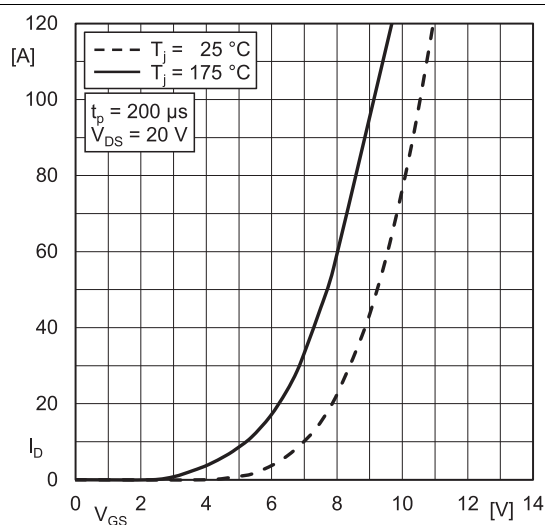
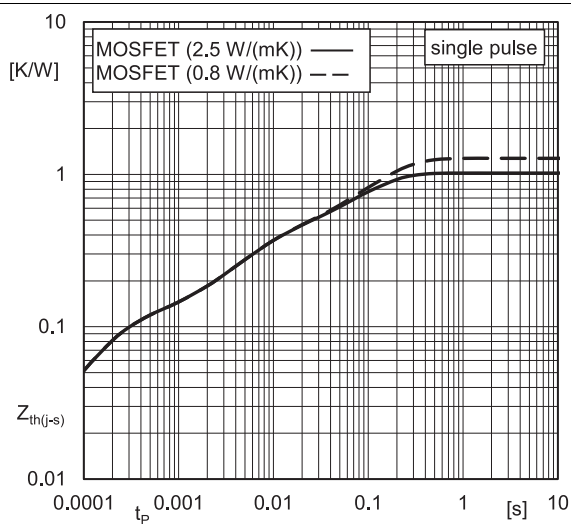
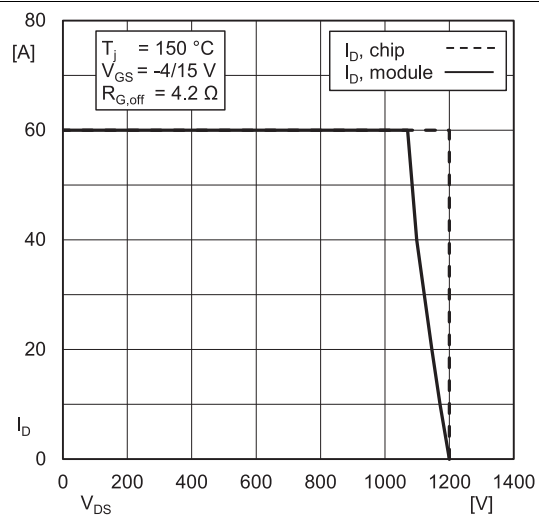
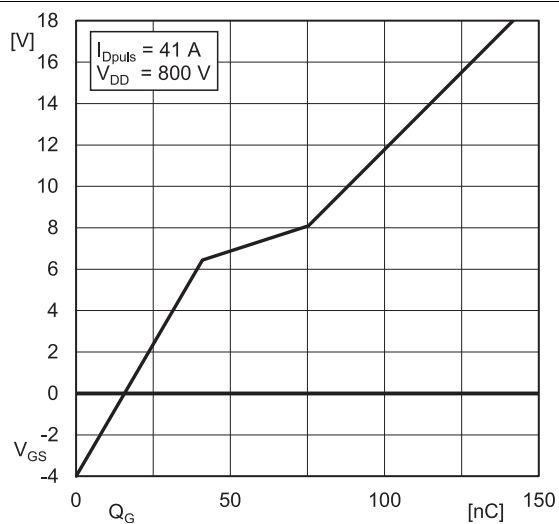
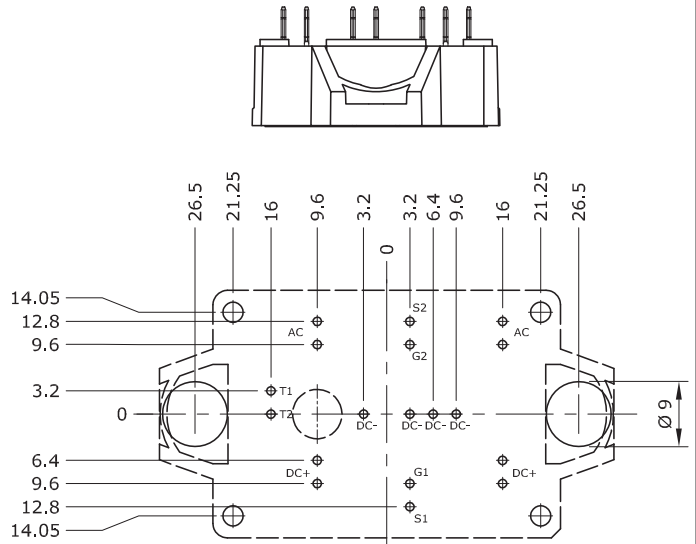
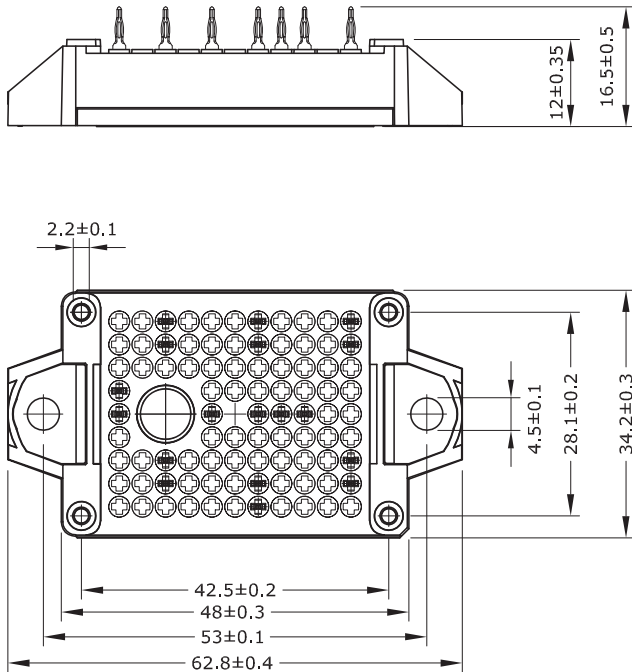


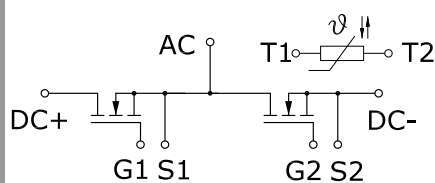
Fig. 6: Typ. MOSFET transfer characteristic





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

SEMITOP®E1



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

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

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