

SEMITOP® 3 Press-Fit

SiC MOSFET Module

SK45MLET12SCp

Features*

- One screw mounting module
- Fully compatible with other SEMITOP® Press-Fit types
- Improved thermal performance by aluminum oxide substrate
- Three separated Boost legs in very compact solution
- Ultra Low inductance design
- SiC 1200V Planar MOSFET
- SiC 1200V Schottky FWD
- By-pass Rectifier diodes
- Extremely high switching frequency
- UL recognized, file no. E63 532

Typical Applications

- Interleaved PFC
- Solar inverter
- UPS
- Power Supply

Remarks

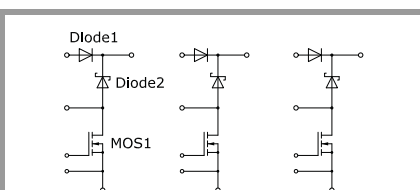
By-pass diode = Diode1
FWD = Diode2

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
MOSFET 1				
V _{DSS}			1200	V
I _D	T _j = 175 °C	T _s = 25 °C	39	A
		T _s = 70 °C	32	A
I _{DM}	PW ≤ 10μs, Duty cycle ≤ 1%		160	A
I _{DM,repetitive}			113	A
V _{GS}			-6 ... 22	V
T _j			-40 ... 175	°C
Integrated body diode				
I _{FM}	PW ≤ 10μs, Duty cycle ≤ 1%		160	A
I _{FM,repetitive}			113	A

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Diode 1				
V _{RRM}	T _j = 25 °C		1600	V
I _F	T _j = 150 °C	T _s = 25 °C	43	A
		T _s = 70 °C	32	A
I _{FSM}	10 ms, T _j = 150 °C		270	A
i ² t	10 ms, T _j = 150 °C		364	A ² s
T _j			-40 ... 150	°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	56	A
		T _s = 70 °C	44	A
I _{FRM}			113	A
I _{FSM}	10 ms	T _j = 25 °C	190	A
	sin 180°	T _j = 150 °C	140	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	35	A
T_{stg}	module without TIM	-40 ... 125	°C
V_{isol}	AC, sinusoidal, t = 1 min	2500	V



MLET



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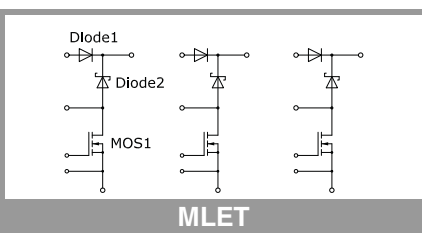
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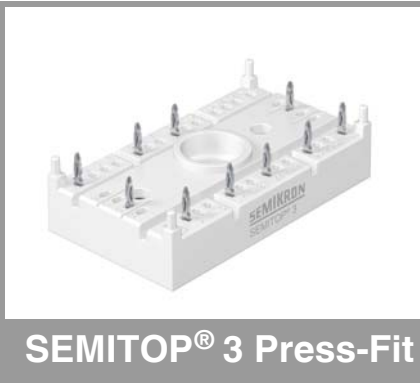
Remarks

By-pass diode = Diode1
FWD = Diode2

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
MOSFET 1					
$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_j = 25\text{ °C}$	1200			V
$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 8.9\text{ mA}, T_j = 25\text{ °C}$	1.6		4	V
I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_j = 25\text{ °C}$			1	mA
I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 22\text{ V}, T_j = 25\text{ °C}$			100	nA
$R_{DS(on)}$	$V_{GS} = 18\text{ V}$				
	$I_D = 22\text{ A}$				
	$T_j = 25\text{ °C}$		45	56	mΩ
	chiplevel		76		mΩ
C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}, f = 1\text{ MHz}$		4310		pF
C_{oss}	$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}, f = 1\text{ MHz}$		137		pF
C_{rss}	$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}, f = 1\text{ MHz}$		19		pF
R_{Gint}	$T_j = 25\text{ °C}$		4.7		Ω
Q_G	$V_{DS}=600\text{ V}, V_{GS}=-5\text{ V}...+20\text{ V}, I_D = 45\text{ A}$		215		nC
$t_{d(on)}$	$V_{DD} = 600\text{ V}$		12		ns
$t_{d(off)}$	$V_{GS} = 20/-5\text{ V}$				
	$I_D = 45\text{ A}$		64		ns
t_r	$R_{Gon} = 0.5\text{ Ω}$		17		ns
t_f	$R_{Goff} = 0.5\text{ Ω}$		16		ns
E_{on}	$di/dt_{off} = 2.2\text{ kA/μs}$		0.16		mJ
E_{off}	$di/dt_{on} = 3.9\text{ kA/μs}$		0.37		mJ
$R_{th(j-s)}$	per MOSFET		1.04		K/W
Integrated body diode					
$V_F = V_{SD}$	$-I_D = 22\text{ A}$				
	$V_{GS} = 0\text{ V}$				
	chiplevel		4.10		V
$V_{F0} = V_{SD0}$					
	chiplevel		3.90		V
			2.60		V
			2.10		V
$r_F = r_{SD}$					
	chiplevel		68		mΩ
			82		mΩ
t_{rr}	$V_{DD} = 600\text{ V}$		-		ns
Q_{rr}	$-I_D = 45\text{ A}$		-		μC
I_{rr}	$V_{GS} = -5\text{ V}$		-		A
E_{rr}	$R_{Gon} = 0.5\text{ Ω}$		-		mJ

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Diode 1					
V_F	$I_F = 35\text{ A}$		1.20	1.60	V
	chiplevel		1.19	1.56	V
V_{F0}					
	chiplevel		0.88	0.98	V
			0.73	0.83	V
r_F					
	chiplevel		9.2	18	mΩ
			13	21	mΩ
I_R	$T_j = 145\text{ °C}, V_{RRM}$			1.1	mA
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W/(mK)}$		1.7		K/W





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Typical Applications

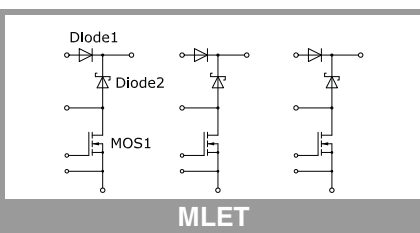
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Remarks

By-pass diode = Diode1
FWD = Diode2

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode 2						
V _F	I _F = 50 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		0.80	0.90	V
r _F	chiplevel	T _j = 25 °C		9.0	11	mΩ
		T _j = 150 °C		20	24	mΩ
C _j	V _R = 800 V, f = 1 MHz, T _j = 25 °C			0.210		nF
Q _c	V _R = 800 V, di/dt _{off} = 500 A/μs, T _j = 25 °C			0.088		μC
R _{th(j-s)}	per Diode			1.14		K/W

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Module					
M _s	to heatsink	2.25		2.5	Nm
w	weight	30			g



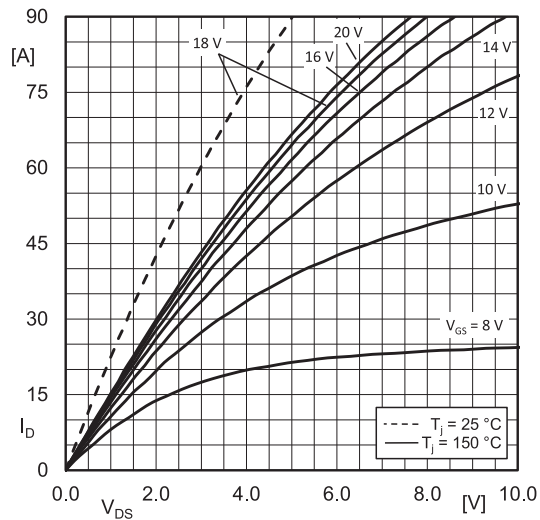


Fig. 1: Typ. MOSFET forward output characteristic, incl. $R_{DS(on)}$

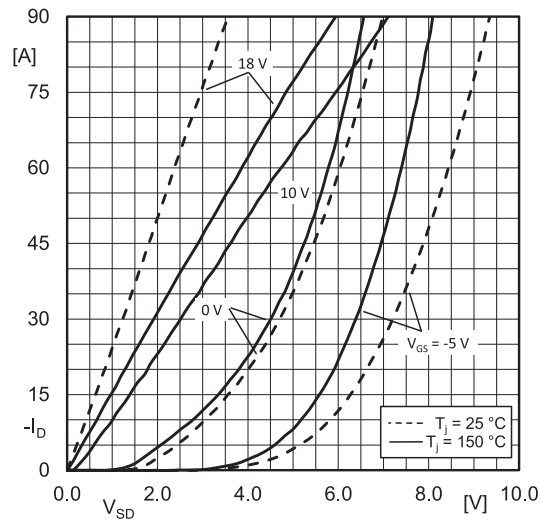


Fig. 2: Typ. reverse output characteristic, incl. $R_{DS(on)}$

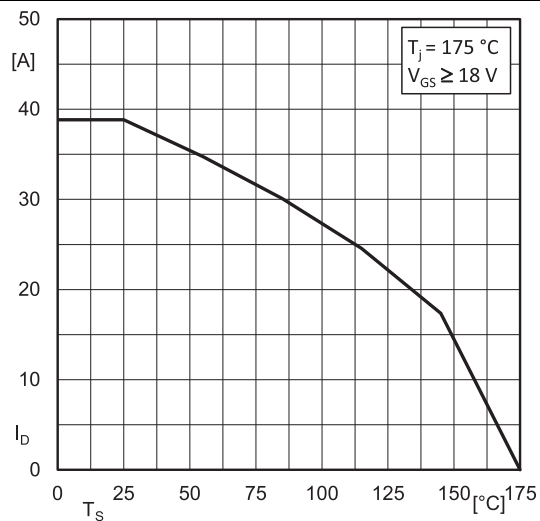


Fig. 3: Rated current vs. temperature $I_D = f(T_S)$

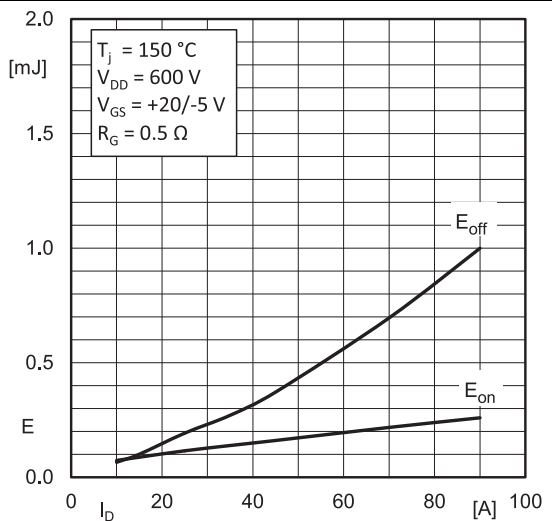


Fig. 4: Typ. turn-on/-off energy $E = f(I_D)$

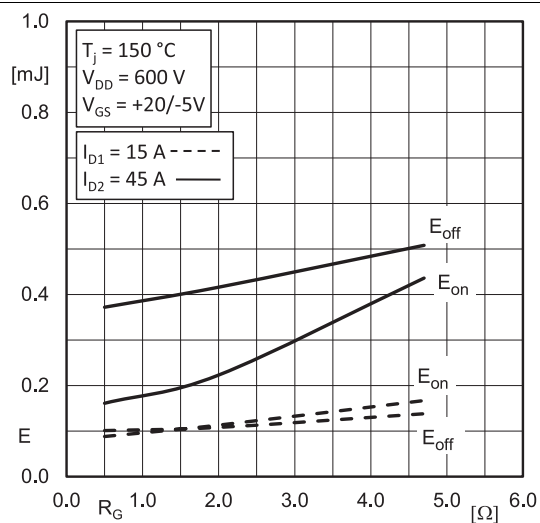


Fig. 5: Typ. turn-on /-off energy $E = f(R_G)$

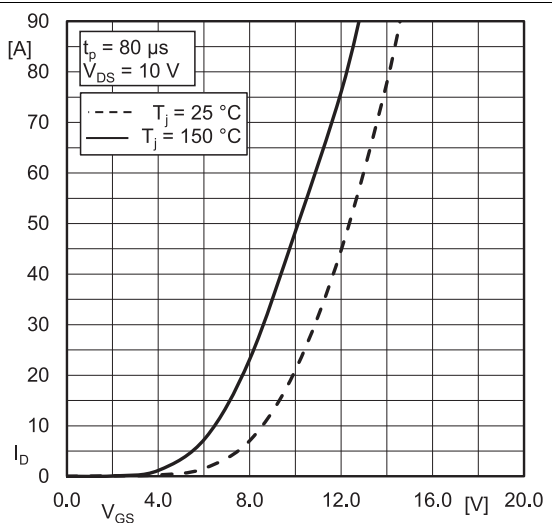


Fig. 6: Typ. MOSFET transfer characteristic

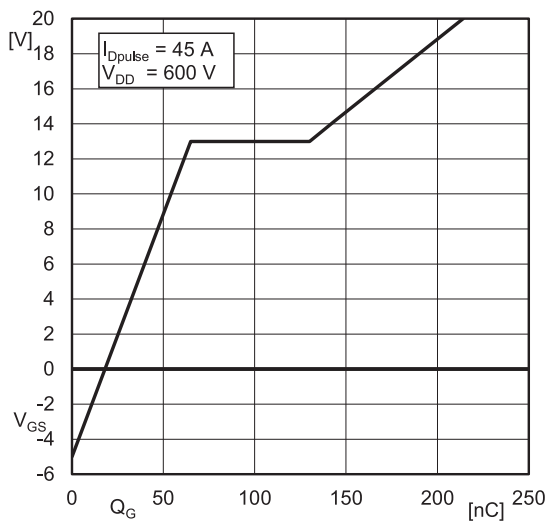


Fig 7: Typ. MOSFET gate charge characteristic

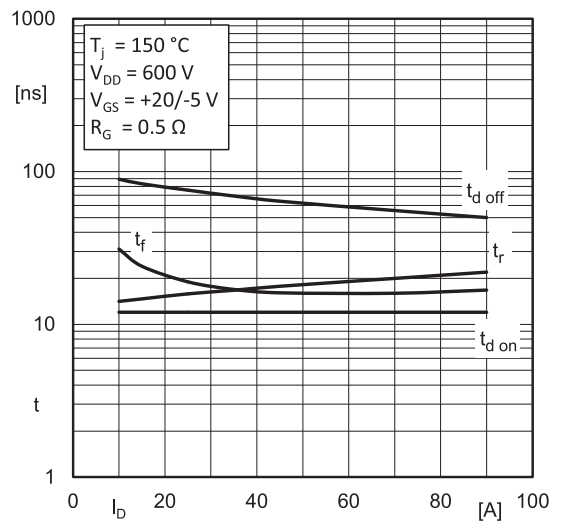


Fig. 8: Typ. switching times vs. I_D

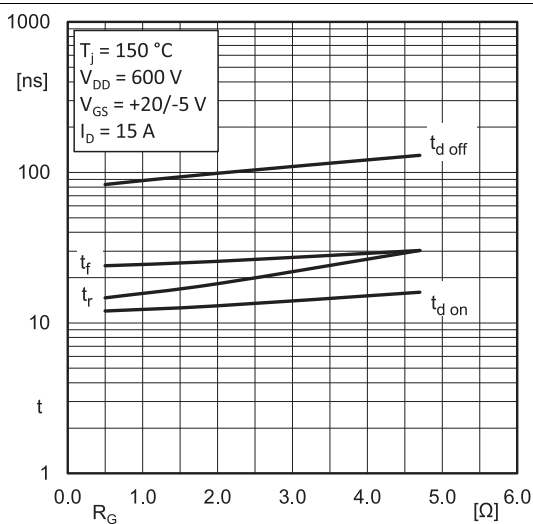


Fig. 9: Typ. switching times vs. gate resistor R_G at I_{D1}

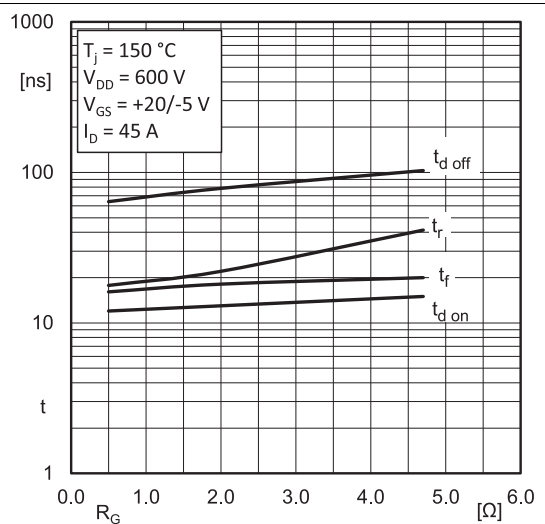


Fig. 10: Typ. switching times vs. gate resistor R_G at I_{D2}

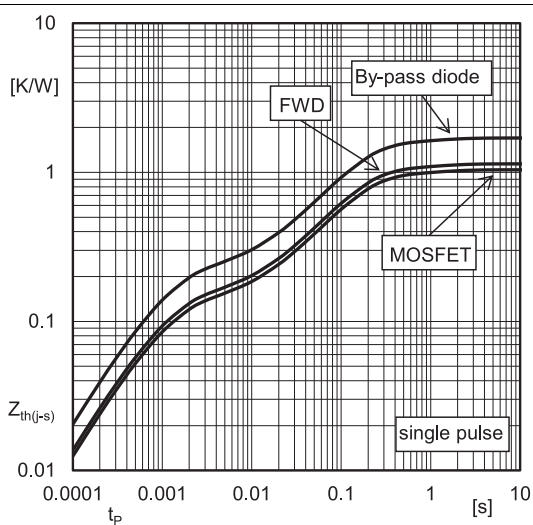


Fig. 11: Typ. transient thermal impedances

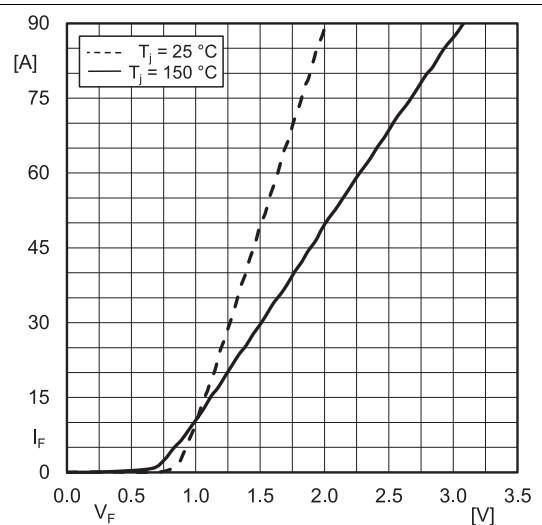


Fig. 12: Typ. FWD output characteristic, incl. $R_{DD'+ss'}$

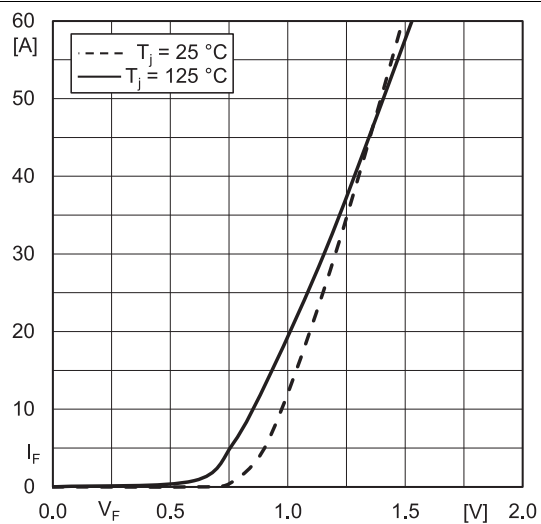


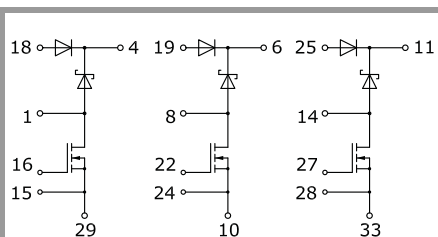
Fig. 13: Typ. by-pass diode output characteristic, inclusive $R_{DD'+SS'}$

Tolerance system: ISO 2768-m



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SEMITOP 3 Press-Fit



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

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