Vincotech

10-E112PMA060MS-L928A76Z
datasheet

***flow*PIM E1** **1200 V / 60 mΩ**

Topology features

- Converter+Brake+Inverter
- Open Emitter configuration
- SiC MOSFET
- Temperature sensor

Component features

- High Blocking Voltage with low drain source on state resistance
- High speed SiC-MOSFET technology
- Resistant to Latch-up

Housing features

- Base isolation: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Compact housing
- CTI600 housing material
- Thermo-mechanical push-and-pull force relief
- Solder pin

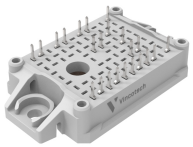
Target applications

- Embedded Drives
- HVAC
- Industrial Drives

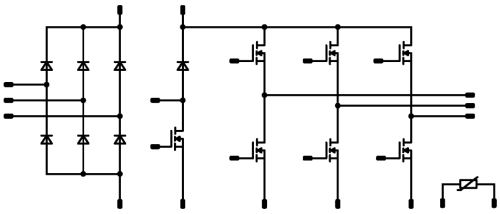
Types

- 10-E112PMA060MS-L928A76Z

flow E1 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	27	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		80	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	66	W
Gate-source voltage	V_{GSS}	static		-5 / 18	V
		dynamic		-10 / 22	V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	27	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		80	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	66	W
Gate-source voltage	V_{GSS}	static		-5 / 18	V
		dynamic		-10 / 22	V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	44	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	62	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	T_j = T_{jmax}, T_s = 80 °C	44	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms, T_j = 150 °C	200	A
Surge current capability	I^2t		200	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax}, T_s = 80 °C	62	W
Maximum junction temperature	T_{jmax}		175	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…+(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage*, t_p = 2 s	6000	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		18		20	25 125 150		66,7 81,3 88,7	90(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$				0,002	25	1,7	2,25	2,75	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			10	µA
Internal gate resistance	r_g							2		Ω
Gate charge	Q_g		-5/18	800	20	25		57		nC
Short-circuit input capacitance	C_{iss}	f = 500 kHz	0	800	0	25		1330		pF
Short-circuit output capacitance	C_{oss}							74		
Reverse transfer capacitance	C_{rss}							3		
Diode forward voltage	V_{SD}		0		20	25		4,1		V
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,44		K/W

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-5/18	600	20	25 125 150		9,62 9,04 8,97		ns
Rise time	t_r					25 125 150		4,27 4,27 4,13		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		20,83 21,8 22,66		ns
Fall time	t_f					25 125 150		3,37 3,36 3,5		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,17 µC Q_{rFWD}=0,371 µC Q_{rFWD}=0,426 µC				25 125 150		0,3 0,421 0,425		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,021 0,021 0,022		mWs
Peak recovery current	I_{RRM}	di/dt=4020 A/µs di/dt=4170 A/µs di/dt=4019 A/µs				25 125 150		11,85 19,08 21,07		A
Reverse recovery time	t_{rr}					25 125 150		26,88 33,45 33,91		ns
Recovered charge	Q_r					25 125 150		0,17 0,371 0,426		µC
Reverse recovered energy	E_{rec}					25 125 150		0,041 0,096 0,103		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1999,64 2237,93 3469,86		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		18		20	25 125 150		66,7 81,3 88,7	90(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$				0,002	25	1,7	2,25	2,75	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			10	µA
Internal gate resistance	r_g							2		Ω
Gate charge	Q_g		-5/18	800	20	25		57		nC
Short-circuit input capacitance	C_{iss}	f = 500 kHz	0	800	0	25		1330		pF
Short-circuit output capacitance	C_{oss}							74		
Reverse transfer capacitance	C_{rss}							3		
Diode forward voltage	V_{SD}		0		20	25		4,1		V
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,44		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	0/18	700	16	25 125 150		9,15 7,99 7,97		ns
Rise time	t_r					25 125 150		4 3,93 4,65		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		22,45 24,64 25,34		ns
Fall time	t_f					25 125 150		9,76 10,78 11,82		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=23,95 µC Q_{rFWD}=25,53 µC Q_{rFWD}=25,8 µC				25 125 150		9,76 10,23 10,28		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,056 0,071 0,076		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Diode										
Static										
Forward voltage	V_F				18	25 125 150		1,12 1,06 1,05	1,5(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			50 1000	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,52		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=2747 A/µs di/dt=2962 A/µs di/dt=3591 A/µs	0/18	700	16	25 125 150		81,8 97,87 100,99		A
Reverse recovery time	t_{rr}					25 125 150		722,34 631,65 613,52		ns
Recovered charge	Q_r					25 125 150		23,95 25,53 25,8		µC
Reverse recovered energy	E_{rec}					25 125 150		8,42 8,69 8,79		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1072,46 1307,27 1267,84		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				18	25 125 150		1,12 1,06 1,05	1,5(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			50 1000	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,52		K/W
Thermistor										
Static										
Rated resistance	R					25		5		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 499 Ω				100	3,2		3,3	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3380		K
Vincotech Thermistor Reference									V	

(1) Value at chip level

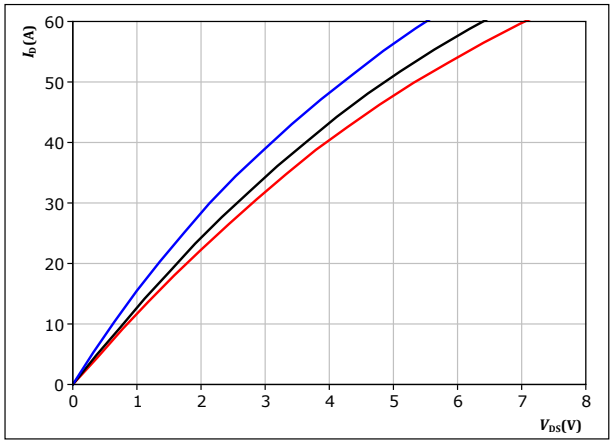
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

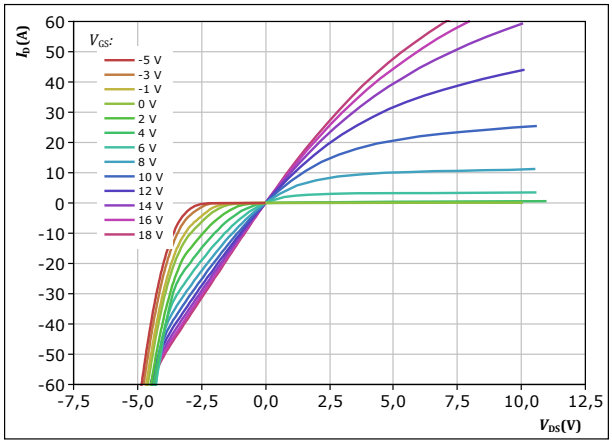


t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



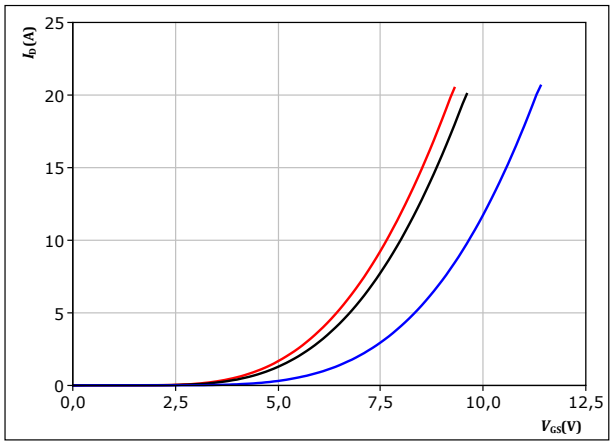
t_p =	250	µs
T_j =	150	°C

V_{GS} from -5 V to 18 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

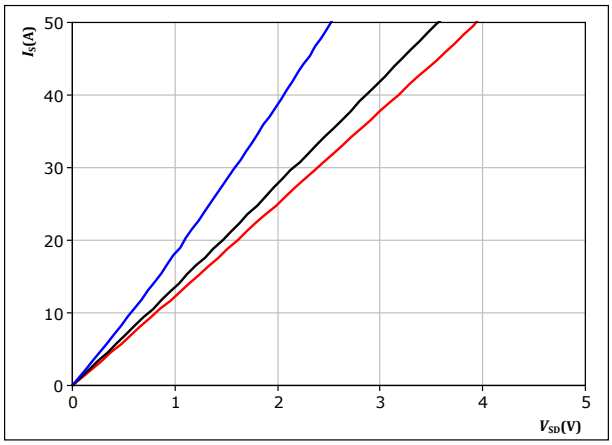


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Typical reverse drain current characteristics

$I_{SD} = f(V_{SD})$



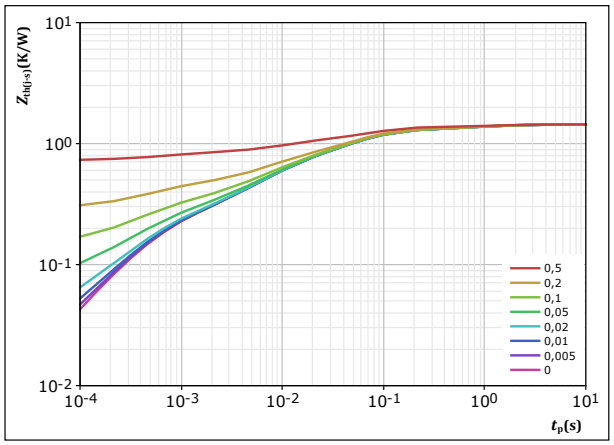
t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

Inverter Switch Characteristics

figure 5. **MOSFET**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D =	t_p / T	
$R_{th(j-s)}$ =	1,442	K/W

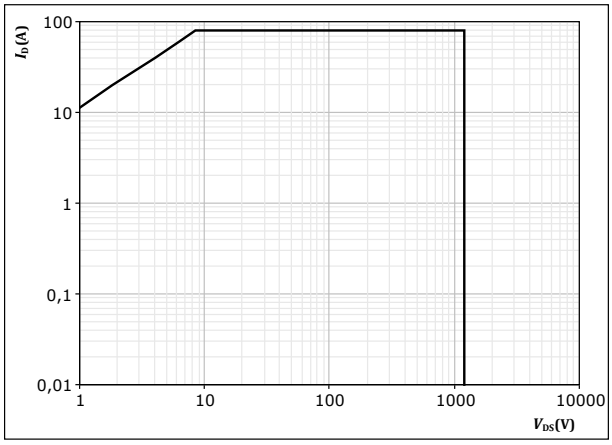
MOSFET thermal model values

R (K/W)	τ (s)
2,00E-02	8,17E+00
1,58E-01	8,06E-01
7,00E-01	5,19E-02
3,82E-01	7,07E-03
1,86E-01	4,65E-04

figure 6. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



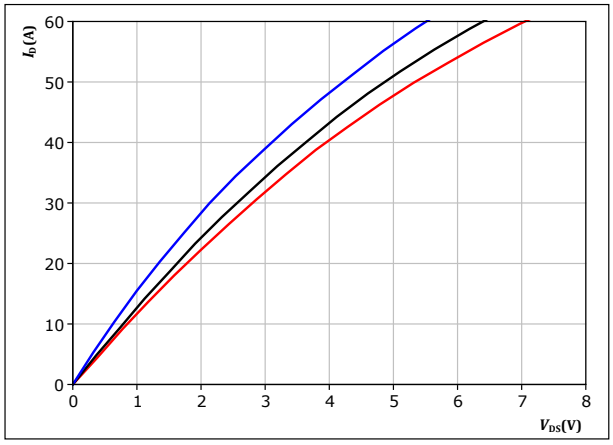
D =	single pulse	
T_s =	80	°C
V_{GS} =	18	V
T_j =	T_{jmax}	

Brake Switch Characteristics

figure 7. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

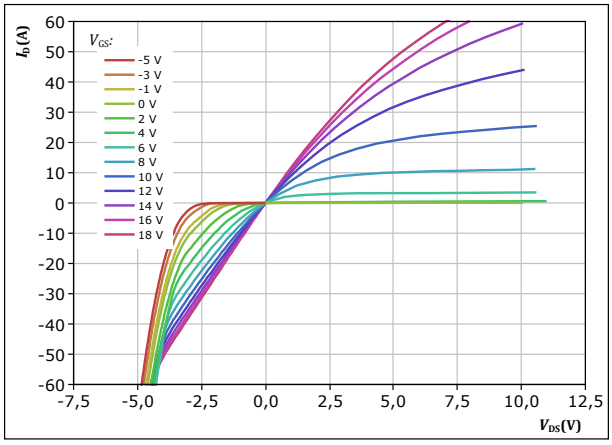


t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

figure 8. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



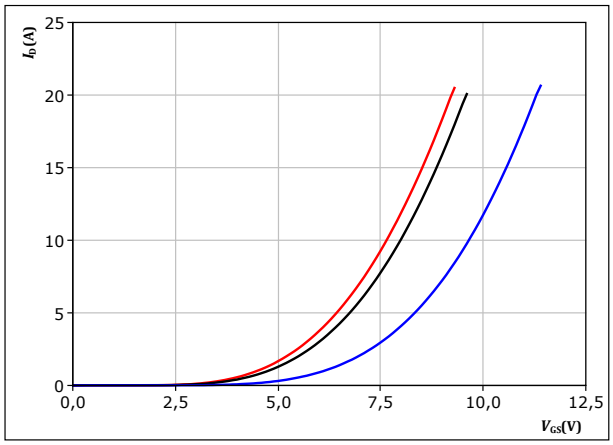
t_p =	250	µs
T_j =	150	°C

V_{GS} from -5 V to 18 V in steps of 2 V

figure 9. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

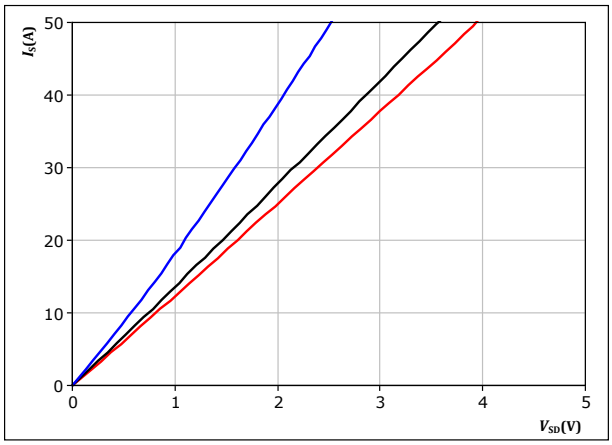


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 10. **MOSFET**

Typical reverse drain current characteristics

$I_{SD} = f(V_{SD})$



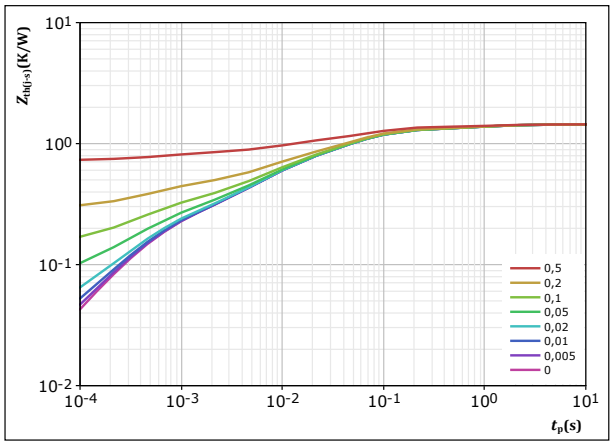
t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

Brake Switch Characteristics

figure 11. **MOSFET**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



$D =$ t_p / T

$R_{th(j-s)} =$ 1,442 K/W

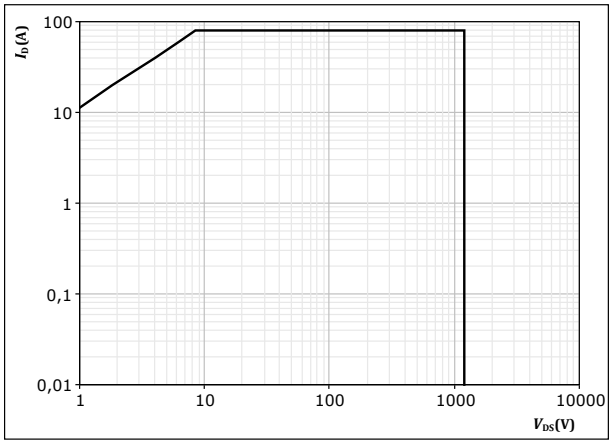
MOSFET thermal model values

R (K/W)	τ (s)
2,00E-02	8,17E+00
1,58E-01	8,06E-01
7,00E-01	5,19E-02
3,82E-01	7,07E-03
1,86E-01	4,65E-04

figure 12. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



$D =$ single pulse

$T_s =$ 80 °C

$V_{GS} =$ 18 V

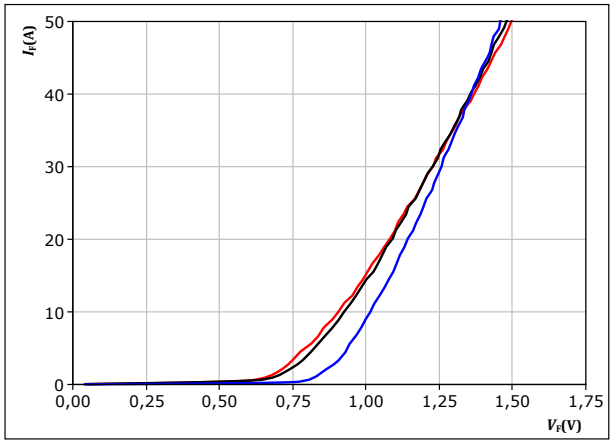
$T_j =$ T_{jmax}

Brake Diode Characteristics

figure 13. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



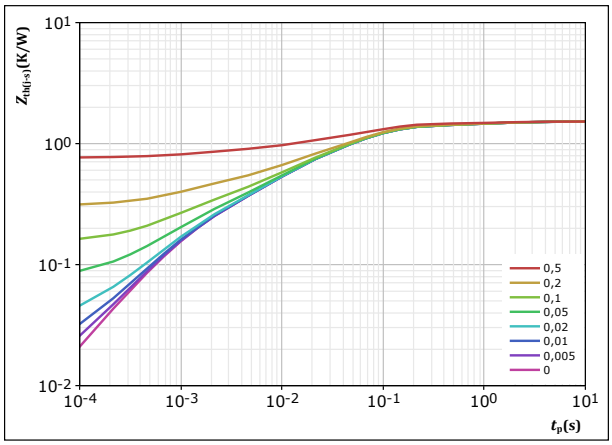
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 14. **Rectifier**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,522 K/W

Rectifier thermal model values

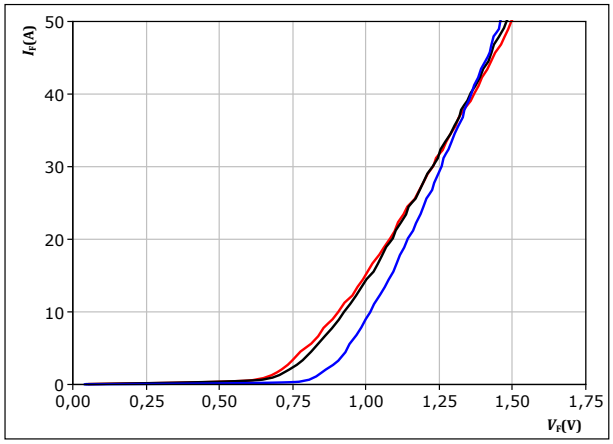
R (K/W)	τ (s)
2,07E-02	8,03E+00
1,31E-01	9,55E-01
8,36E-01	6,23E-02
3,68E-01	9,71E-03
1,71E-01	1,03E-03

Rectifier Diode Characteristics

figure 15. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



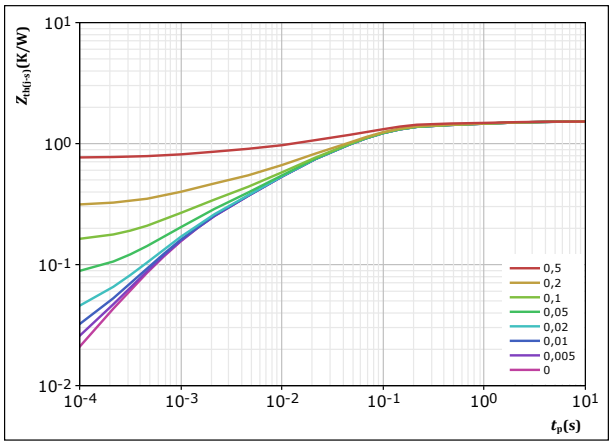
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **Rectifier**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,522 K/W

Rectifier thermal model values

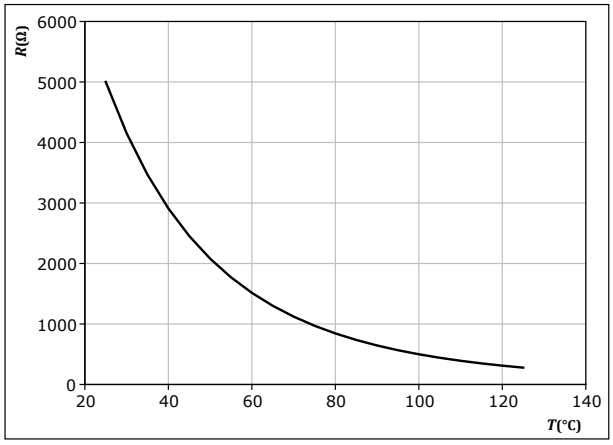
R (K/W)	τ (s)
2,07E-02	8,03E+00
1,31E-01	9,55E-01
8,36E-01	6,23E-02
3,68E-01	9,71E-03
1,71E-01	1,03E-03

Thermistor Characteristics

figure 17. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

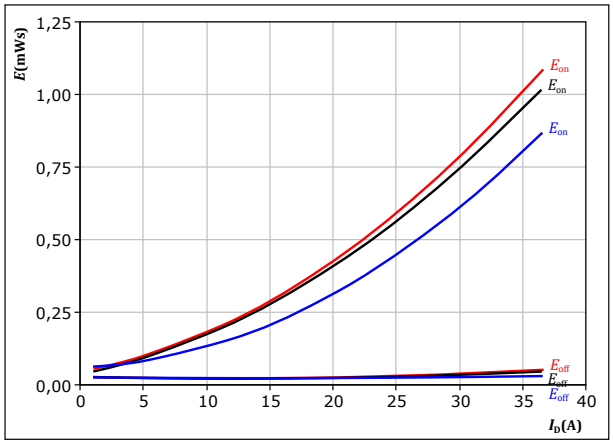


Inverter Switching Characteristics

figure 18. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

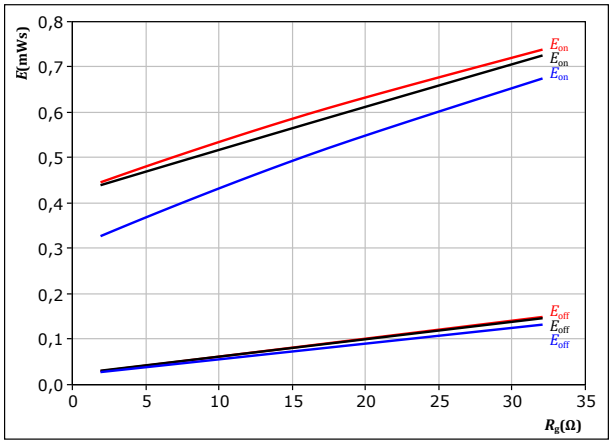
V_{DS} =	600	V	
V_{GS} =	-5/18	V	
R_{gon} =	2	Ω	
R_{goff} =	2	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 19. **MOSFET**

Typical switching energy losses as a function of MOSFET turn on gate resistor

$E = f(R_g)$



With an inductive load at

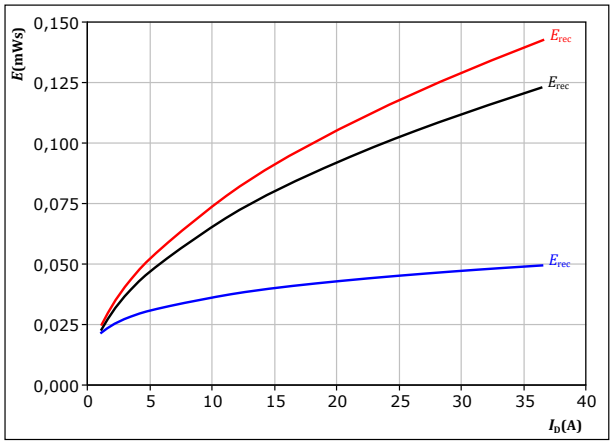
V_{DS} =	600	V	
V_{GS} =	-5/18	V	
I_D =	20	A	

T_j: 25 °C, 125 °C, 150 °C

figure 20. **MOSFET**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

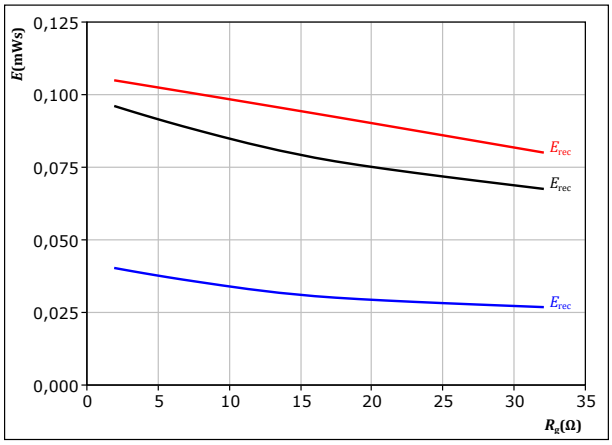
V_{DS} =	600	V	
V_{GS} =	-5/18	V	
R_{gon} =	2	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 21. **MOSFET**

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	600	V	
V_{GS} =	-5/18	V	
I_D =	20	A	

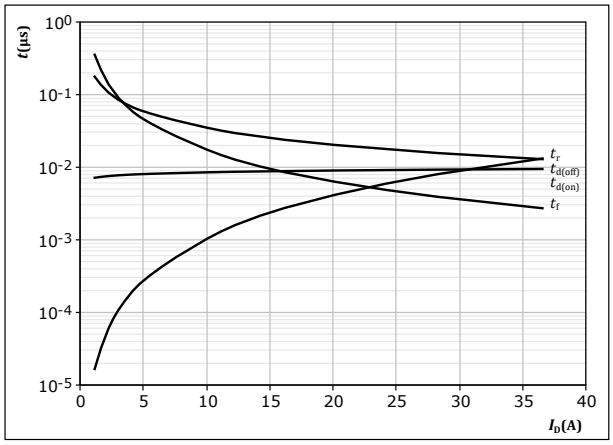
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 22. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



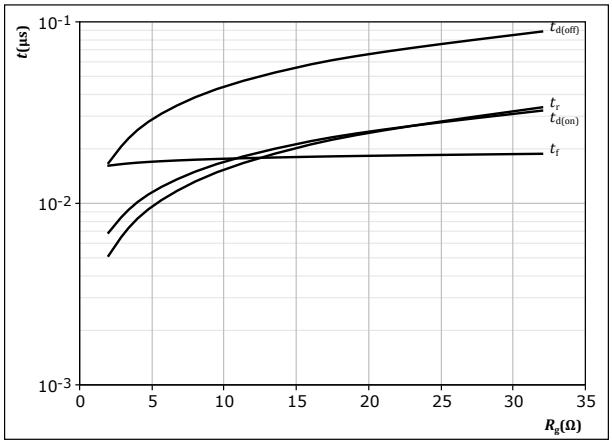
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-5/18	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 23. **MOSFET**

Typical switching times as a function of MOSFET turn on gate resistor

$t = f(R_g)$



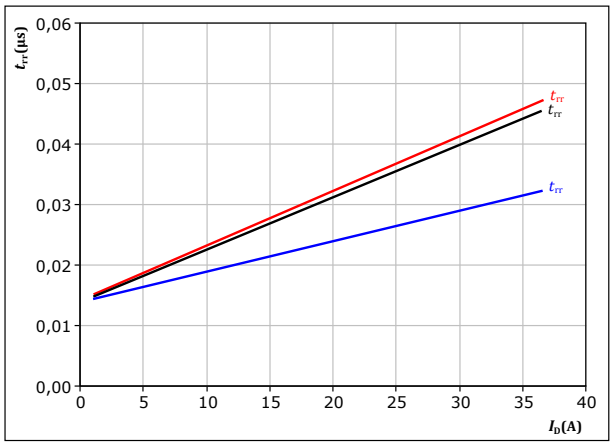
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-5/18	V
I_D =	20	A

figure 24. **MOSFET**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

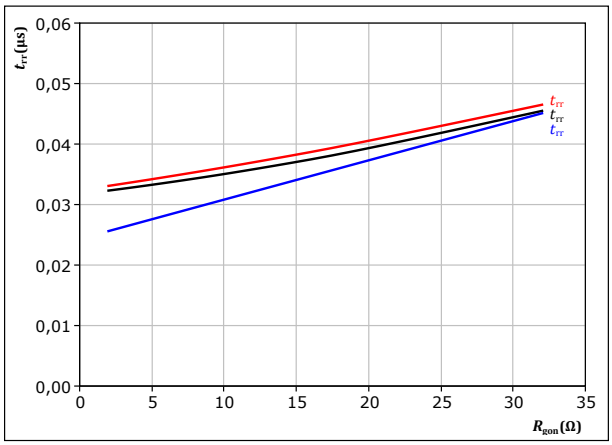
V_{DS} =	600	V
V_{GS} =	-5/18	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 25. **MOSFET**

Typical reverse recovery time as a function of MOSFET turn on gate resistor

$t_{rr} = f(R_{gon})$



At

V_{DS} =	600	V
V_{GS} =	-5/18	V
I_D =	20	A

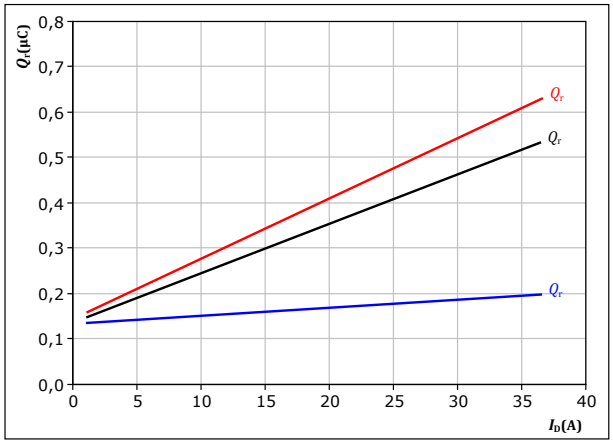
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 26. **MOSFET**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

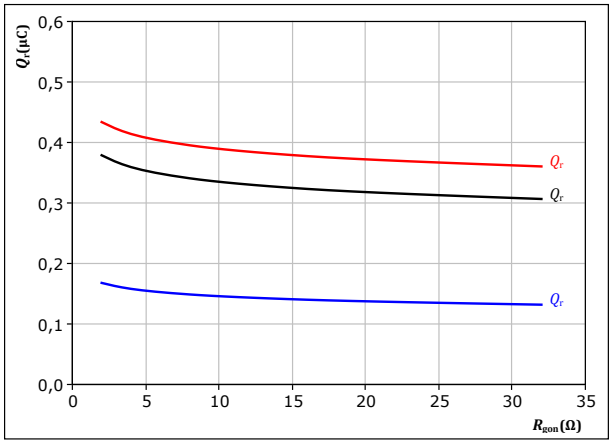


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-5/18	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 27. **MOSFET**

Typical recovered charge as a function of MOSFET turn on gate resistor

$Q_r = f(R_{gon})$

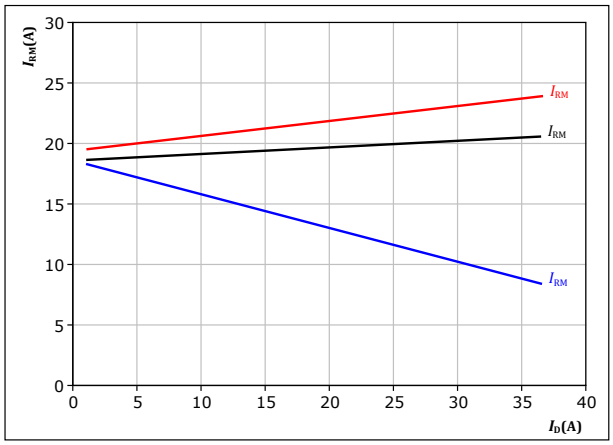


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-5/18	V		125 °C
I_D =	20	A		150 °C

figure 28. **MOSFET**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

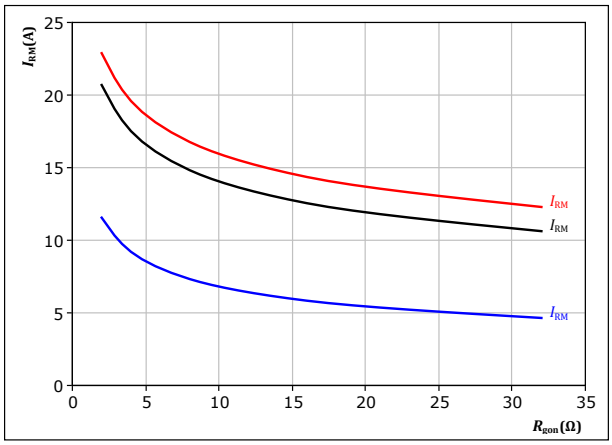


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-5/18	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 29. **MOSFET**

Typical peak reverse recovery current as a function of MOSFET turn on gate resistor

$I_{RM} = f(R_{gon})$



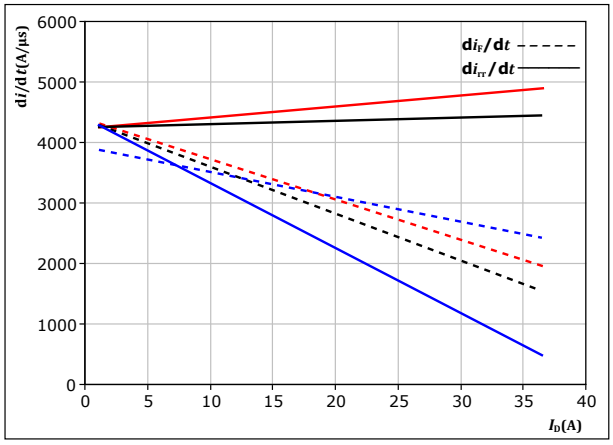
At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-5/18	V		125 °C
I_D =	20	A		150 °C

Inverter Switching Characteristics

figure 30. **MOSFET**

Typical rate of fall of forward and reverse recovery current as a function of drain current

di_F/dt, di_{rr}/dt = f(I_D)

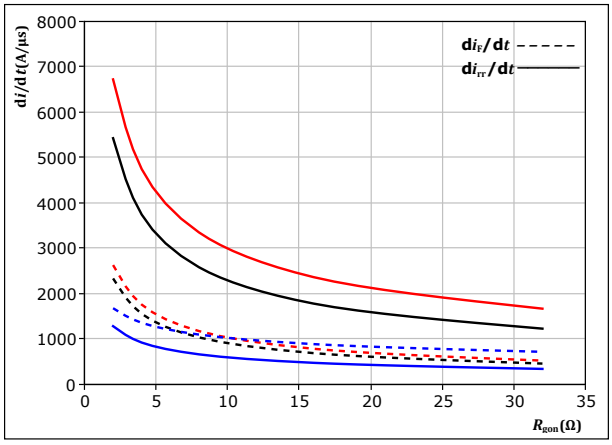


At				
V_{DS} =	600	V		
V_{GS} =	-5/18	V	T_j:	25 °C
R_{gon} =	2	Ω		125 °C
				150 °C

figure 31. **MOSFET**

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor

di_F/dt, di_{rr}/dt = f(R_{gon})

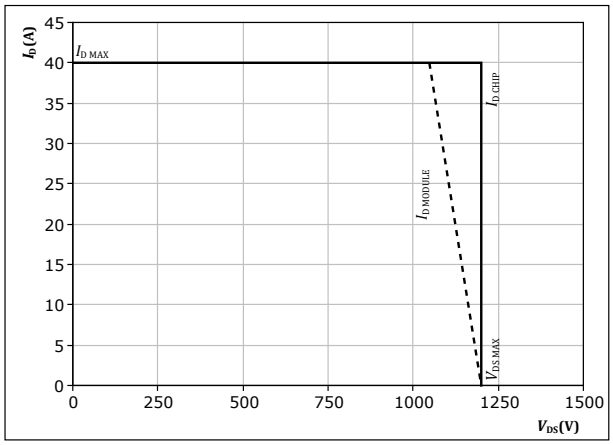


At				
V_{DS} =	600	V		
V_{GS} =	-5/18	V	T_j:	25 °C
I_D =	20	A		125 °C
				150 °C

figure 32. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



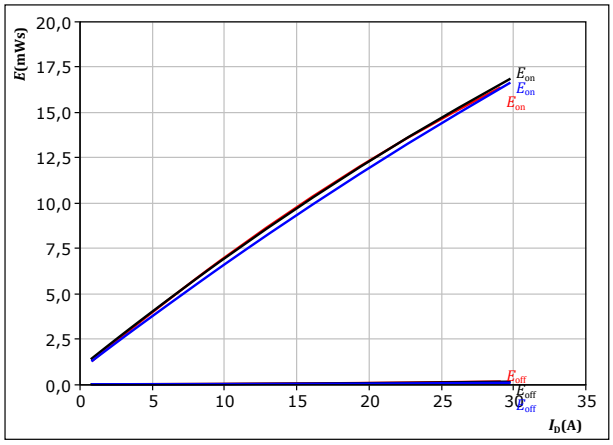
At			
T_j =	150	°C	
R_{gon} =	2	Ω	
R_{goff} =	2	Ω	

Brake Switching Characteristics

figure 33. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

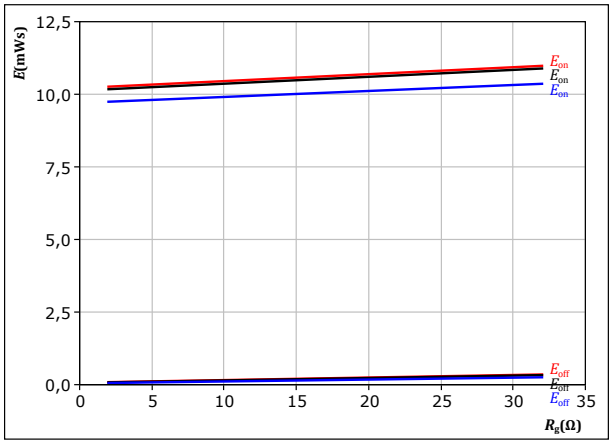
V_{DS} =	700	V	
V_{GS} =	0/18	V	
R_{gon} =	2	Ω	
R_{goff} =	2	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 34. **MOSFET**

Typical switching energy losses as a function of MOSFET turn on gate resistor

$E = f(R_g)$



With an inductive load at

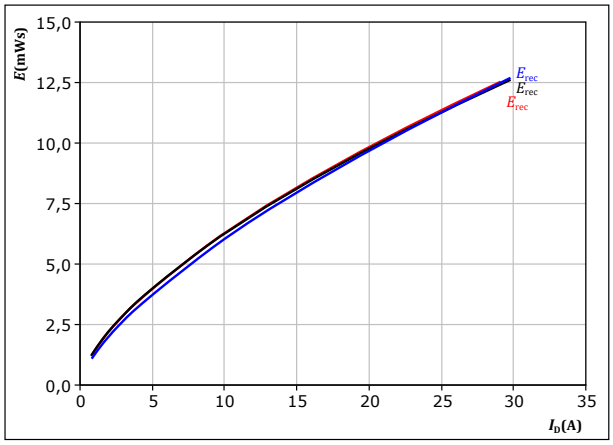
V_{DS} =	700	V	
V_{GS} =	0/18	V	
I_D =	16	A	

T_j: 25 °C, 125 °C, 150 °C

figure 35. **Rectifier**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

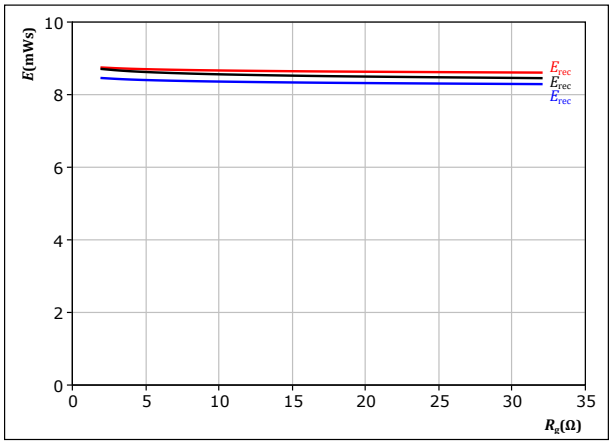
V_{DS} =	700	V	
V_{GS} =	0/18	V	
R_{gon} =	2	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 36. **Rectifier**

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	700	V	
V_{GS} =	0/18	V	
I_D =	16	A	

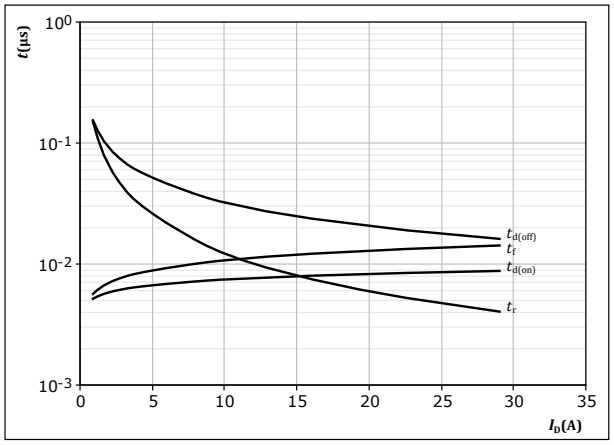
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 37. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



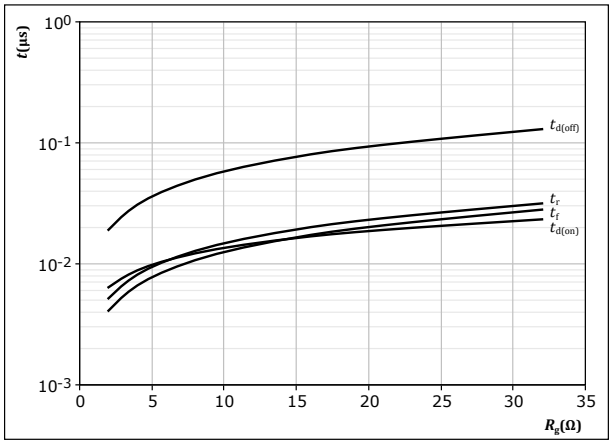
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	0/18	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 38. **MOSFET**

Typical switching times as a function of MOSFET turn on gate resistor

$t = f(R_g)$



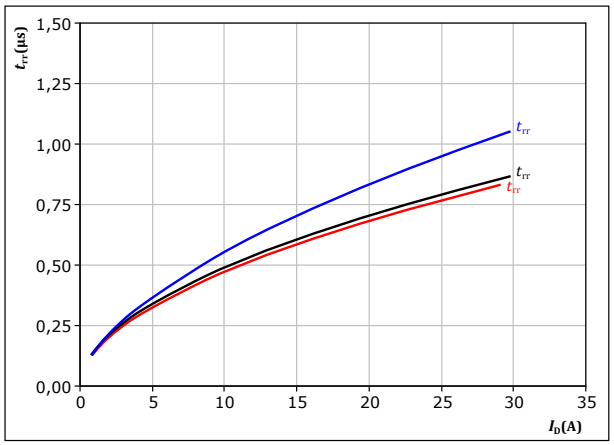
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	0/18	V
I_D =	16	A

figure 39. **Rectifier**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

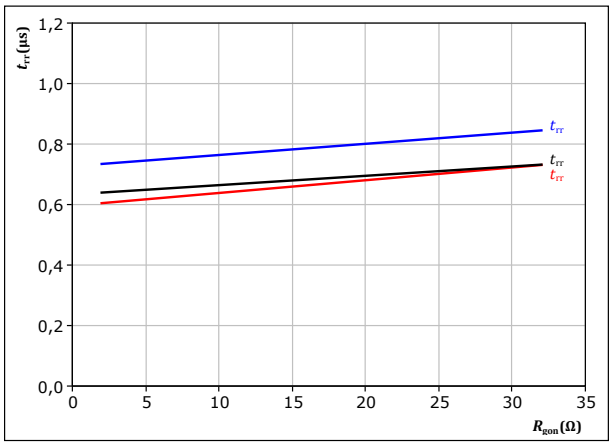
V_{DS} =	700	V
V_{GS} =	0/18	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 40. **Rectifier**

Typical reverse recovery time as a function of MOSFET turn on gate resistor

$t_{rr} = f(R_{gon})$



At

V_{DS} =	700	V
V_{GS} =	0/18	V
I_D =	16	A

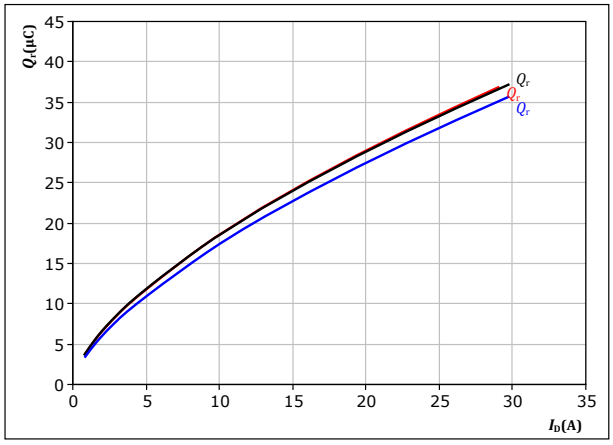
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 41. **Rectifier**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

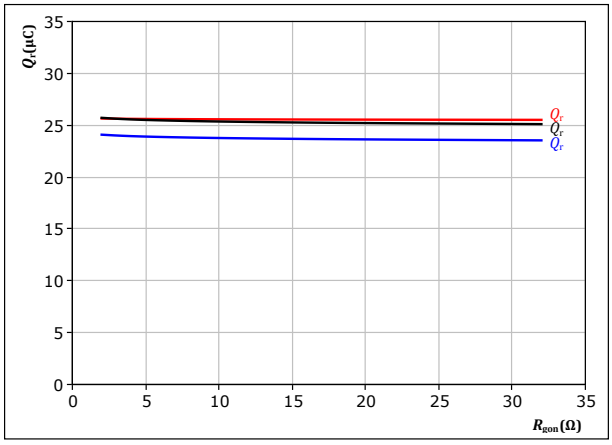


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	R_{gon} =	2	Ω		125 °C
					150 °C

figure 42. **Rectifier**

Typical recovered charge as a function of MOSFET turn on gate resistor

$Q_r = f(R_{gon})$

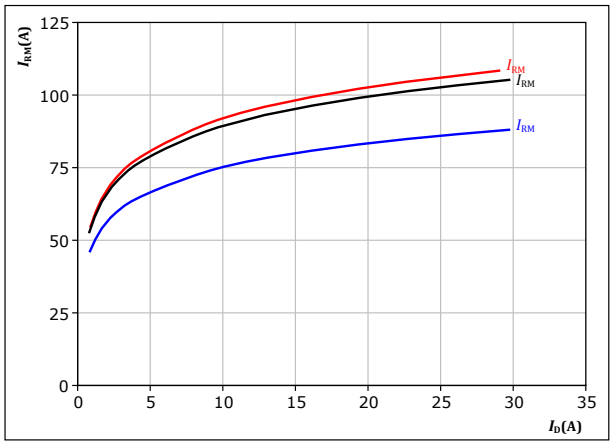


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	I_D =	16	A		125 °C
					150 °C

figure 43. **Rectifier**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

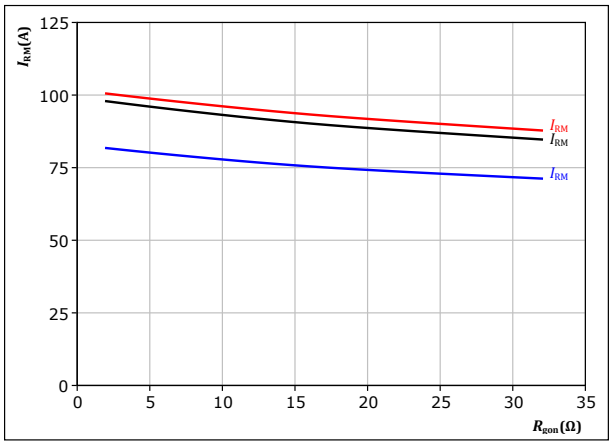


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	R_{gon} =	2	Ω		125 °C
					150 °C

figure 44. **Rectifier**

Typical peak reverse recovery current as a function of MOSFET turn on gate resistor

$I_{RM} = f(R_{gon})$



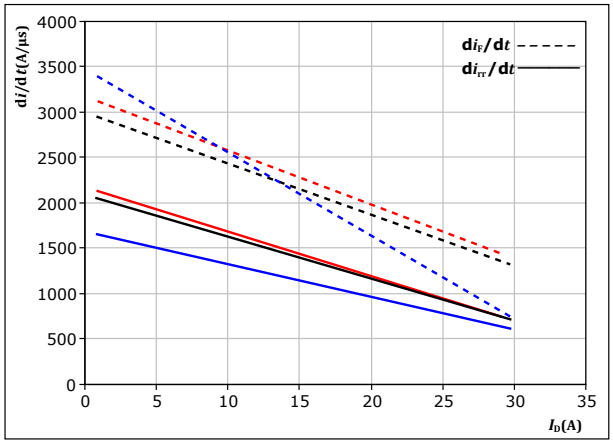
At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	I_D =	16	A		125 °C
					150 °C

Brake Switching Characteristics

figure 45. **Rectifier**

Typical rate of fall of forward and reverse recovery current as a function of drain current

di_F/dt, di_{rr}/dt = f(I_D)

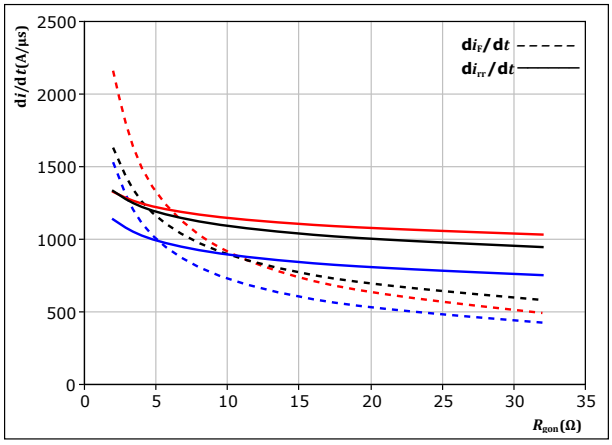


At				
V_{DS} =	700	V		
V_{GS} =	0/18	V	T_j:	25 °C
R_{gon} =	2	Ω		125 °C
				150 °C

figure 46. **Rectifier**

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor

di_F/dt, di_{rr}/dt = f(R_{gon})

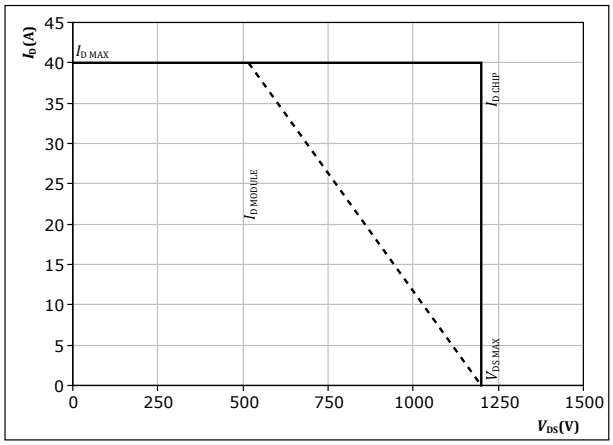


At				
V_{DS} =	700	V		
V_{GS} =	0/18	V	T_j:	25 °C
I_D =	16	A		125 °C
				150 °C

figure 47. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
T_j =	150	°C	
R_{gon} =	2	Ω	
R_{goff} =	2	Ω	

Switching Definitions

figure 48. MOSFET

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})

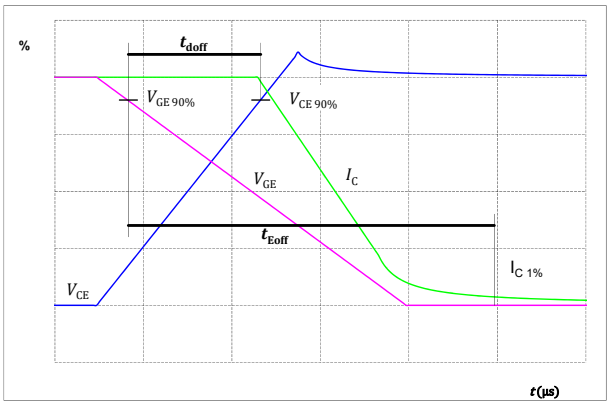


figure 49. MOSFET

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})

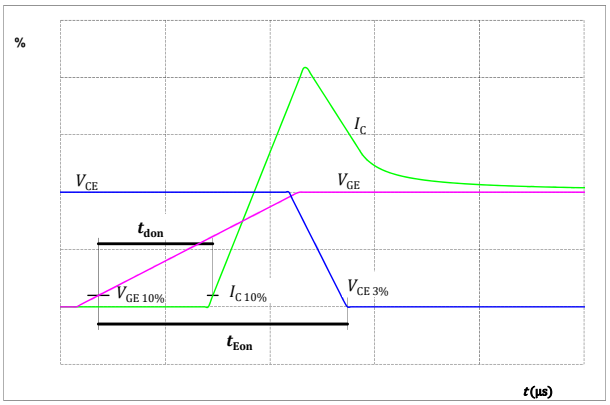


figure 50. MOSFET

Turn-off Switching Waveforms & definition of t_f

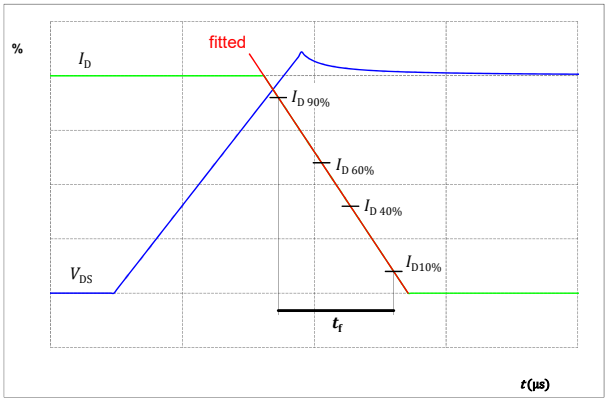
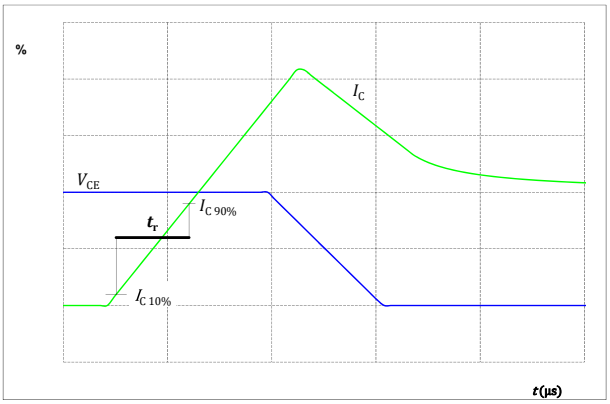


figure 51. MOSFET

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 52. **FWD**

Turn-off Switching Waveforms & definition of t_{trr}

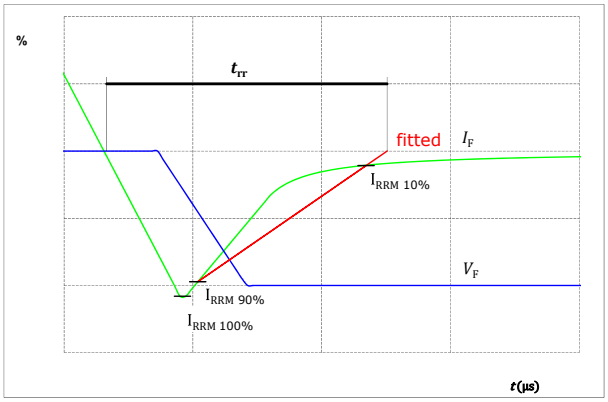


figure 53. **FWD**

Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})

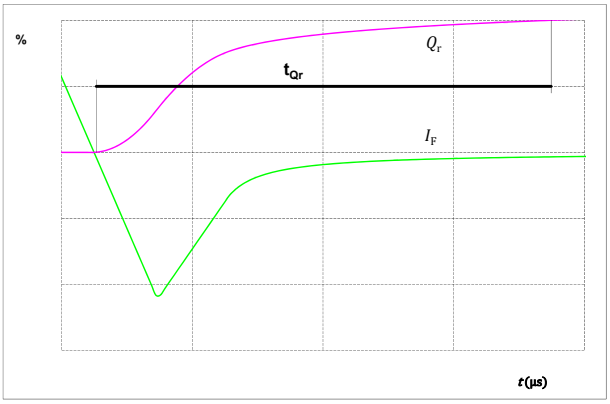
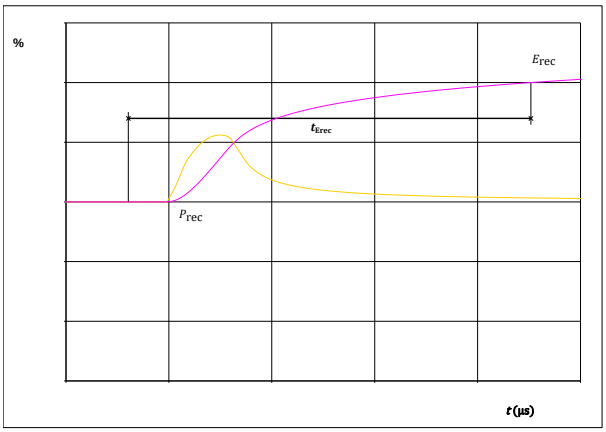


figure 54. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



Ordering Code

Version	Ordering Code
Without thermal paste	10-E112PMA060MS-L928A76Z
With thermal paste (5,2 W/mK, PTM6000HV)	10-E112PMA060MS-L928A76Z-/7/

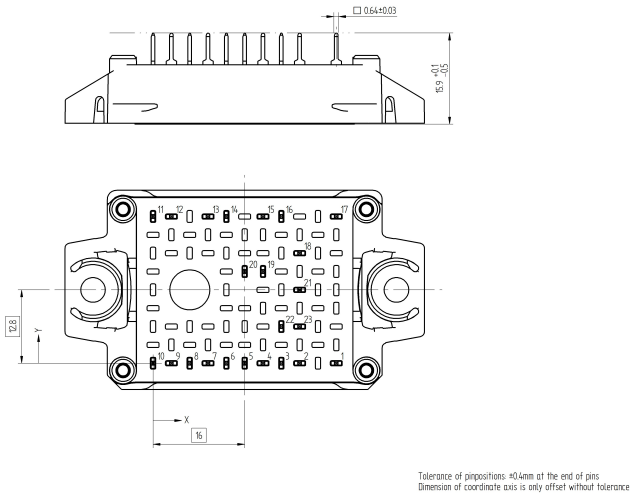
Marking

	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTVV	LLLLL	SSSS	WWYY		

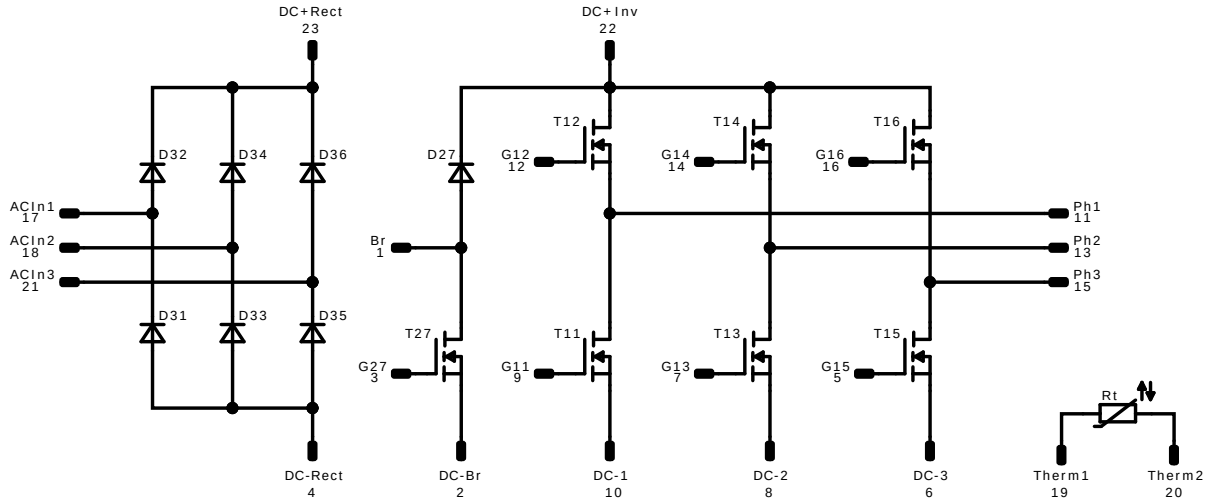
Outline

Pin table [mm]

Pin	X	Y	Function
1	32	0	Br
2	25,6	0	DC-Br
3	22,4	0	G27
4	19,2	0	DC-Rect
5	16	0	G15
6	12,8	0	DC-3
7	9,6	0	G13
8	6,4	0	DC-2
9	3,2	0	G11
10	0	0	DC-1
11	0	25,6	Ph1
12	3,2	25,6	G12
13	9,6	25,6	Ph2
14	12,8	25,6	G14
15	19,2	25,6	Ph3
16	22,4	25,6	G16
17	32	25,6	ACIn1
18	25,6	19,2	ACIn2
19	19,2	16	Therm1
20	16	16	Therm2
21	25,6	12,8	ACIn3
22	22,4	6,4	DC+Inv
23	25,6	6,4	DC+Rect



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	MOSFET	1200 V	60 mΩ	Inverter Switch	
T27	MOSFET	1200 V	60 mΩ	Brake Switch	
D27	Rectifier	1600 V	18 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	18 A	Rectifier Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction

Handling instructions for *flow* E1 packages see vincotech.com website.

Package data

Package data for *flow* E1 packages see vincotech.com website.

Vincotech thermistor reference

See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number

This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-E112PMA060MS-L928A76Z-D1-14	17 Feb. 2026	Initial Release	