Vincotech

10-FY086PA023MR-L222F48
datasheet

***flow*PACK 1 SiC** **750 V / 23 mΩ**

Topology features

- 3xHalf Bridge
- 3xIntegrated DC capacitor
- Kelvin Emitter for improved switching performance
- MOSFET
- Open Emitter configuration
- Temperature sensor

Component features

- Easy paralleling
- Low on-resistance
- Fast switching speed
- Fast recovery body diode

Housing features

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

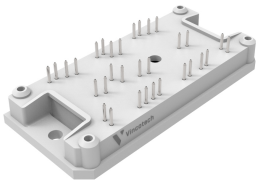
Target applications

- Elevator Drives
- Servo Drives
- Special Application

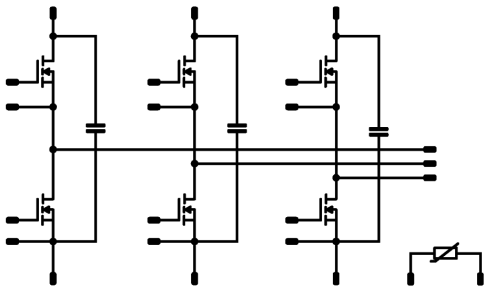
Types

- 10-FY086PA023MR-L222F48

flow 1 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}		750	V
Drain current (DC current)	I_D	T_j = T_{jmax} T_s = 80 °C	45	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	122	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	83	W
Gate-source voltage	V_{GSS}		-4 / 21	V
		dynamic	-4 / 23	
Maximum Junction Temperature	T_{jmax}		175	°C
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		630	V
Operation Temperature	T_{op}		-55 ... 150	°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
Isolation voltage	V_{isol}	AC Voltage t_p = 1 min	2500	V
Creepage distance			>12,7	mm
Clearance			12,12	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		34	25 125 150		21 32,3 37	28,5[1]	mΩ
Gate-source threshold voltage	$V_{GS(th)}$				0,01778	25	2,8	3,5	4,8	V
Gate to Source Leakage Current	I_{GSS}		21	0		25	-200		200	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	750		25		2	160	µA
Internal gate resistance	r_g							2		Ω
Gate charge	Q_g		18	500	34	25		126		nC
Gate to source charge	Q_{GS}							28		
Gate to drain charge	Q_{GD}							38		
Short-circuit input capacitance	C_{iss}	f = 1 Mhz	0	500	0	25		2920		pF
Short-circuit output capacitance	C_{oss}							138		
Reverse transfer capacitance	C_{rss}							10		
Diode forward voltage	V_{SD}		0		34	25		3,3		V
Thermal										
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,15		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} = 8 Ω R_{goff} = 8 Ω	-1,5/18	500	51	25 125 150		27,12 25,2 24,66		ns
Rise time	t_r					25 125 150		14,45 13,19 12,94		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		69,35 77,68 79,69		ns
Fall time	t_f					25 125 150		10,46 10,63 10,67		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,185 µC Q_{rFWD}=0,259 µC Q_{rFWD}=0,321 µC				25 125 150		0,434 0,413 0,427		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,216 0,226 0,227		mWs
Peak recovery current	I_{RRM}	di/dt=3788 A/µs di/dt=4321 A/µs di/dt=4595 A/µs				25 125 150		25,26 28,8 31,82		A
Reverse recovery time	t_{rr}					25 125 150		12,8 14,61 15,79		ns
Recovered charge	Q_r					25 125 150		0,185 0,259 0,321		µC
Reverse recovered energy	E_{rec}					25 125 150		0,034 0,058 0,077		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5147,28 5825,31 4806,51		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	
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		33		nF
Tolerance							-5		5	%
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

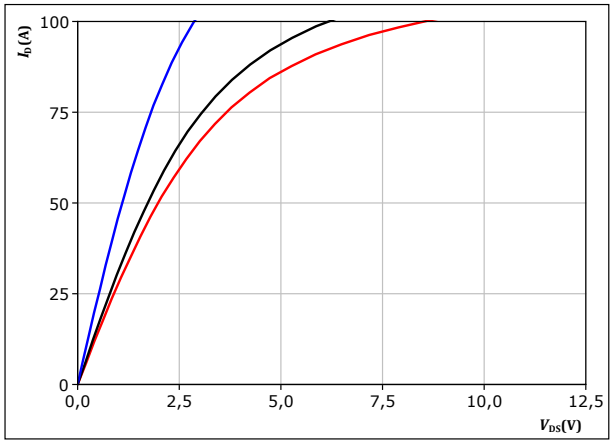
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

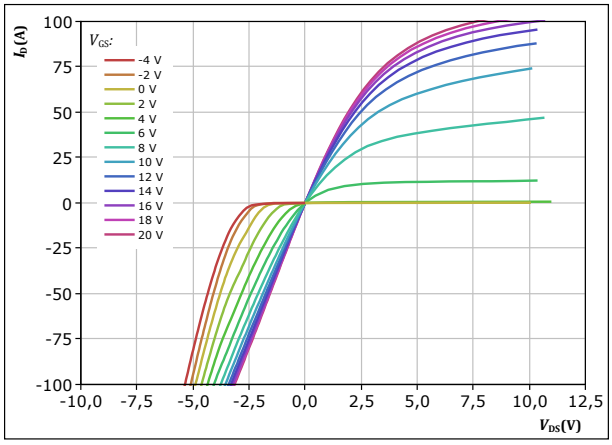


t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



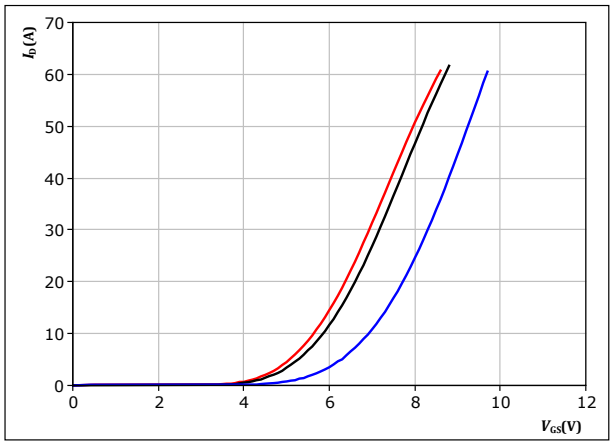
t_p =	250	µs
T_j =	150	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

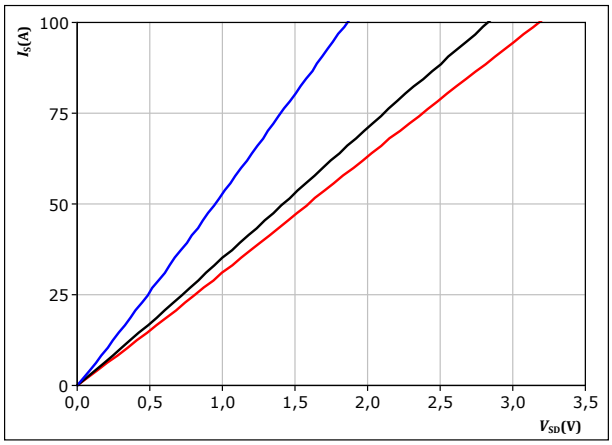


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Typical reverse drain current characteristics

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



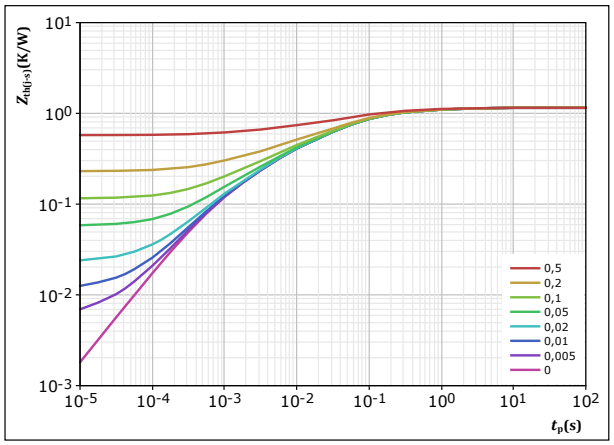
t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

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

$R_{th(j-s)} =$ 1,151 K/W

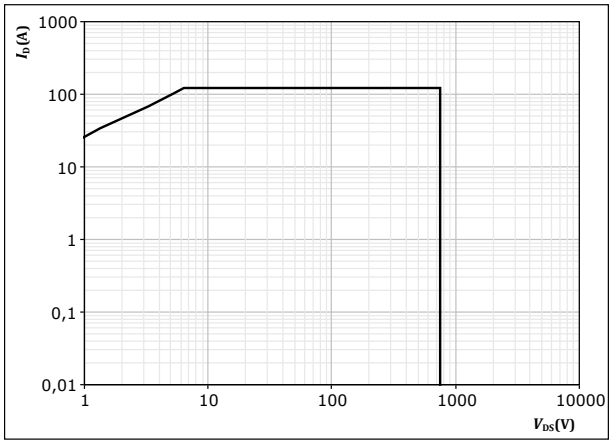
MOSFET thermal model values

R (K/W)	τ (s)
8,76E-02	1,74E+00
3,12E-01	1,74E-01
4,40E-01	3,51E-02
2,33E-01	4,75E-03
7,91E-02	6,68E-04

figure 6. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



$D =$ single pulse

$T_s =$ 80 °C

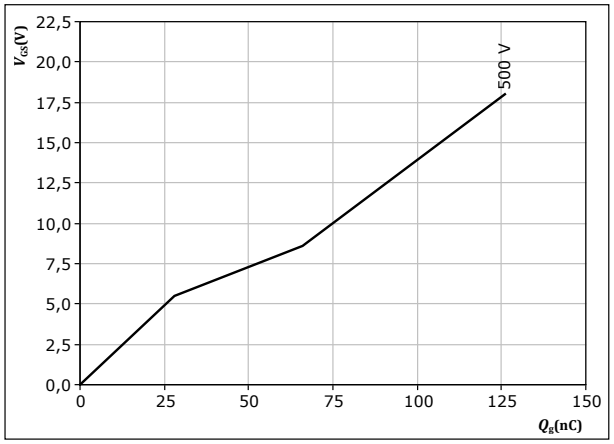
$V_{GS} =$ 18 V

$T_j =$ T_{jmax}

figure 7. **MOSFET**

Gate voltage vs gate charge

$V_{GS} = f(Q_g)$



$I_D =$ 17 A

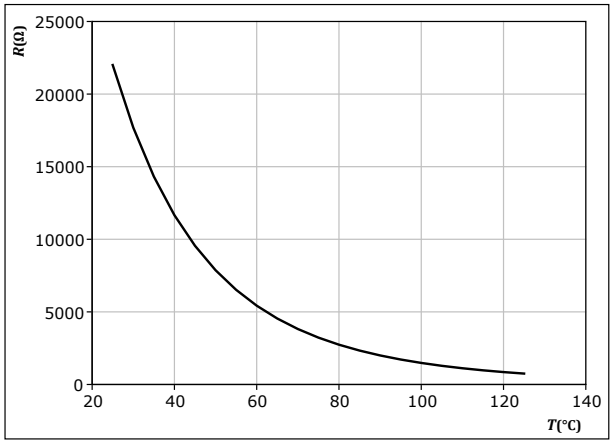
$T_j =$ 25 °C

Thermistor Characteristics

figure 8. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

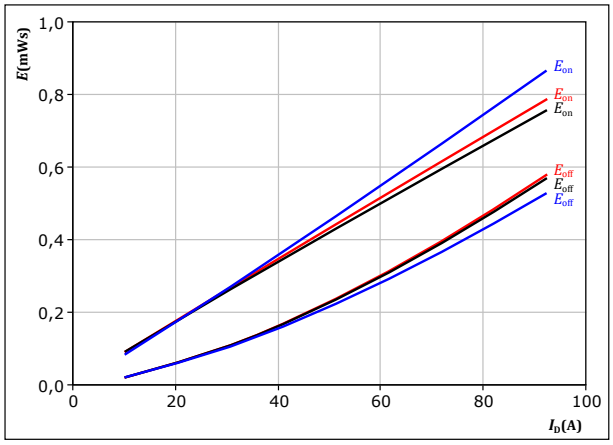


Inverter Switching Characteristics

figure 9. MOSFET

Typical switching energy losses as a function of drain current

$E = f(I_D)$



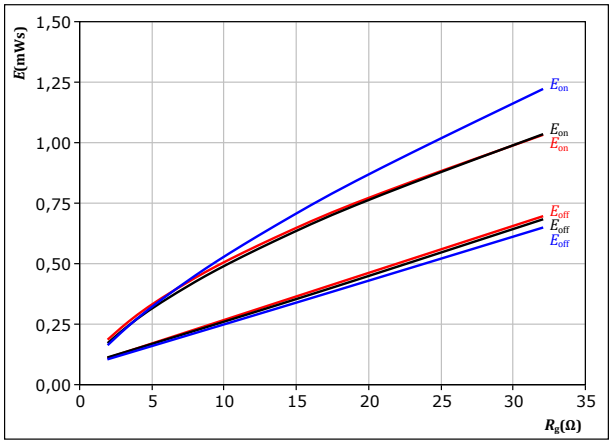
With an inductive load at

V_{DS} =	500	V	T_j:	25 °C
V_{GS} =	-1/18	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 10. MOSFET

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

$E = f(R_g)$



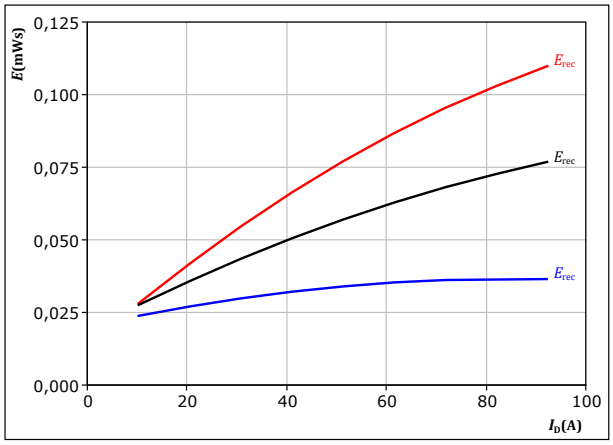
With an inductive load at

V_{DS} =	500	V	T_j:	25 °C
V_{GS} =	-1/18	V		125 °C
I_D =	51	A		150 °C

figure 11. MOSFET

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



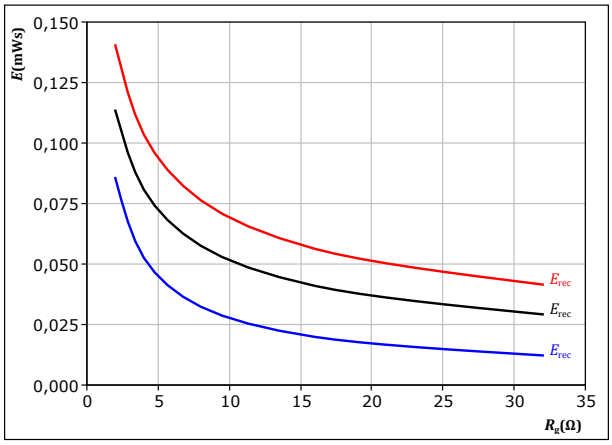
With an inductive load at

V_{DS} =	500	V	T_j:	25 °C
V_{GS} =	-1/18	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 12. 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

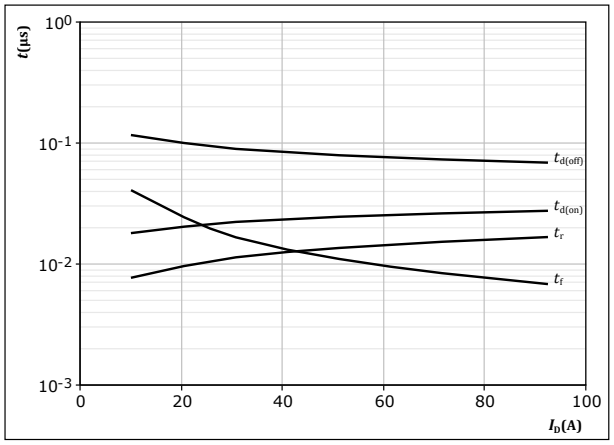
V_{DS} =	500	V	T_j:	25 °C
V_{GS} =	-1/18	V		125 °C
I_D =	51	A		150 °C

Inverter Switching Characteristics

figure 13. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



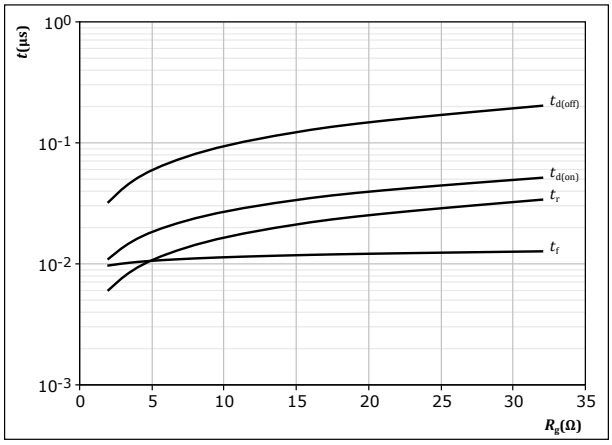
With an inductive load at

T_j =	150	°C
V_{DS} =	500	V
V_{GS} =	-1/18	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 14. **MOSFET**

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

$t = f(R_g)$



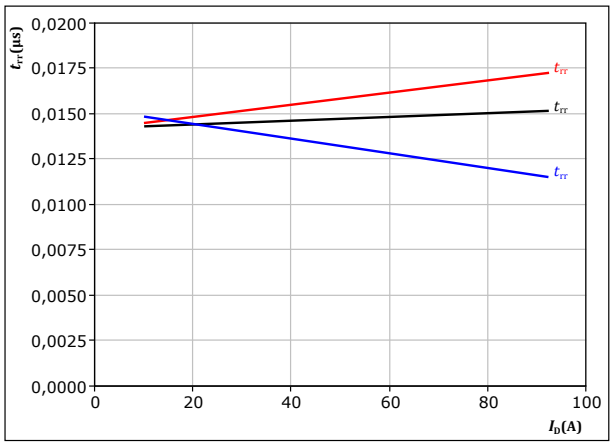
With an inductive load at

T_j =	150	°C
V_{DS} =	500	V
V_{GS} =	-1/18	V
I_D =	51	A

figure 15. **MOSFET**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

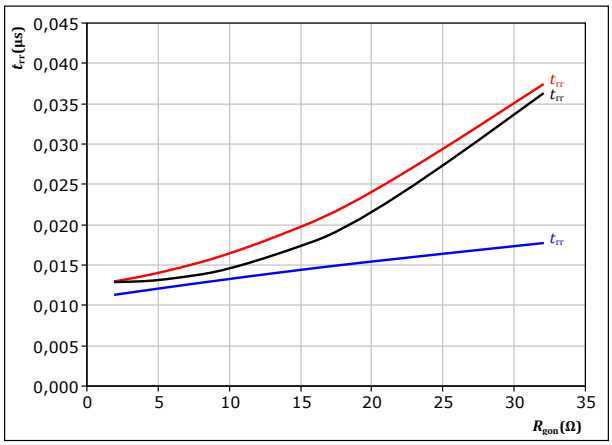
V_{DS} =	500	V
V_{GS} =	-1/18	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 16. **MOSFET**

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

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



At

V_{DS} =	500	V
V_{GS} =	-1/18	V
I_D =	51	A

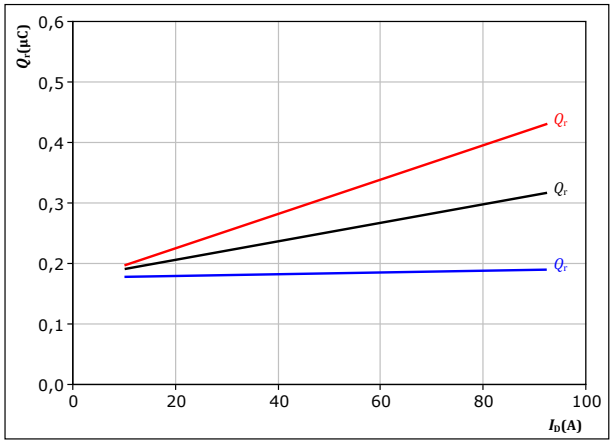
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 17. **MOSFET**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

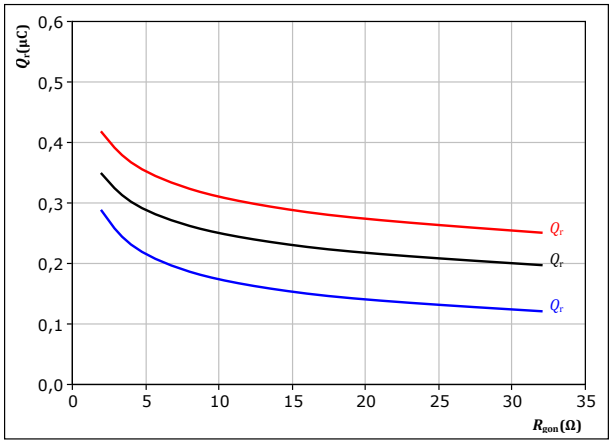


At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	R_{gon} =	8	Ω		125 °C
					150 °C

figure 18. **MOSFET**

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

$Q_r = f(R_{gon})$

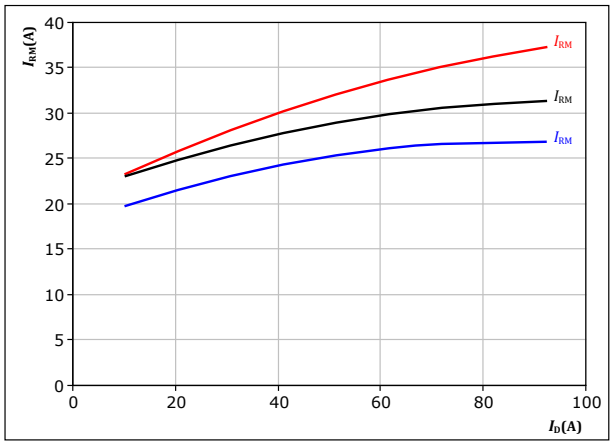


At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	I_D =	51	A		125 °C
					150 °C

figure 19. **MOSFET**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

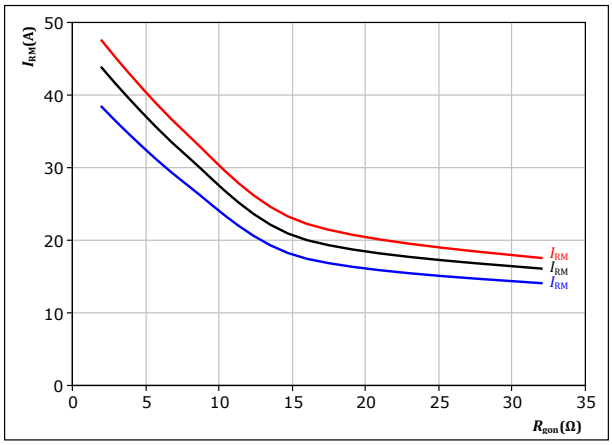


At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	R_{gon} =	8	Ω		125 °C
					150 °C

figure 20. **MOSFET**

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

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



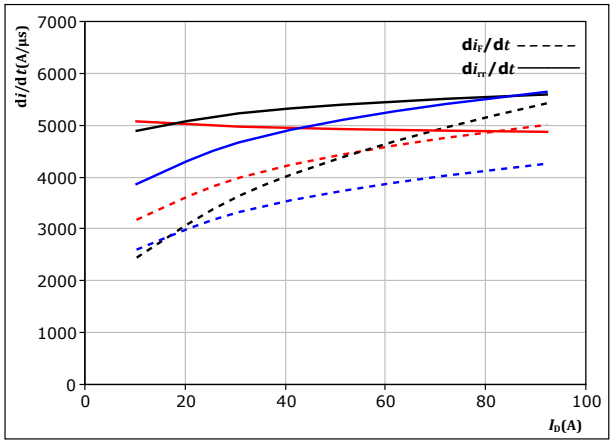
At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	I_D =	51	A		125 °C
					150 °C

Inverter Switching Characteristics

figure 21. **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)

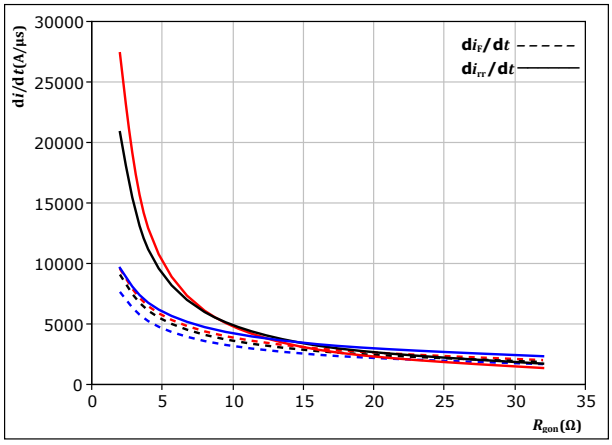


At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	R_{gon} =	8	Ω		125 °C
					150 °C

figure 22. **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})

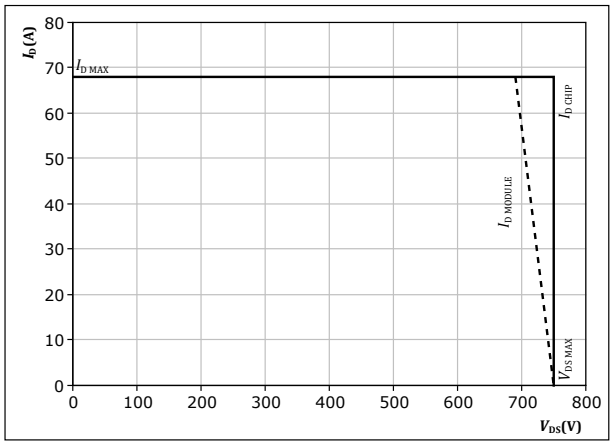


At					
	V_{DS} =	500	V		
	V_{GS} =	-1/18	V	T_j:	25 °C
	I_D =	51	A		125 °C
					150 °C

figure 23. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Inverter Switching Definitions

figure 24. **MOSFET**

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

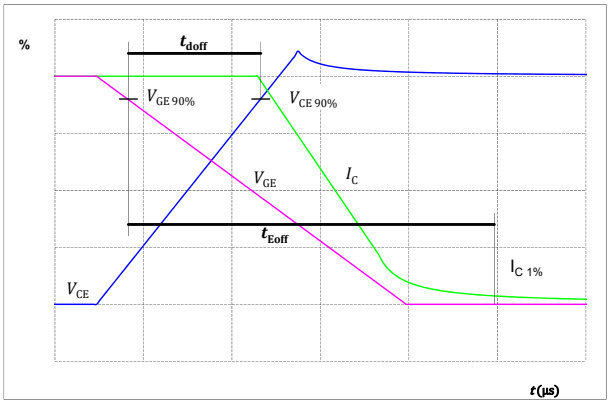


figure 25. **MOSFET**

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

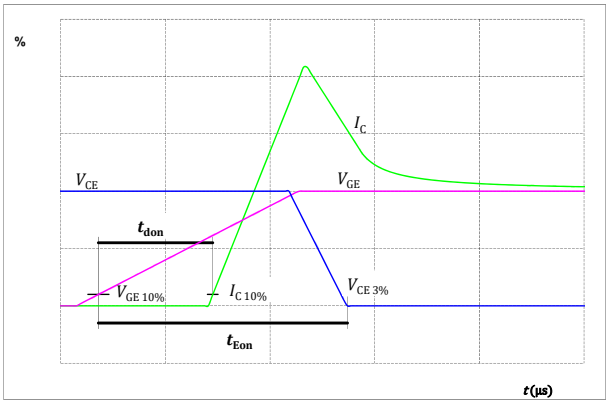


figure 26. **MOSFET**

Turn-off Switching Waveforms & definition of t_f

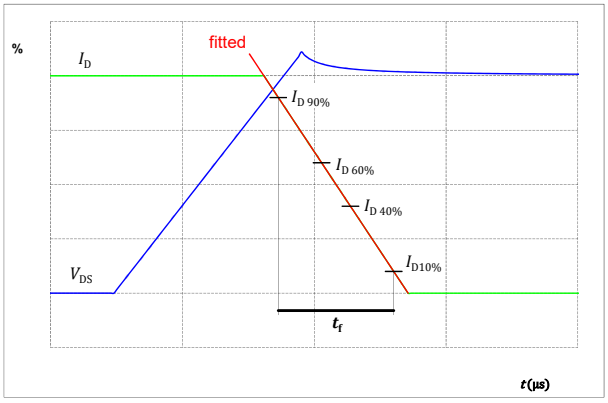
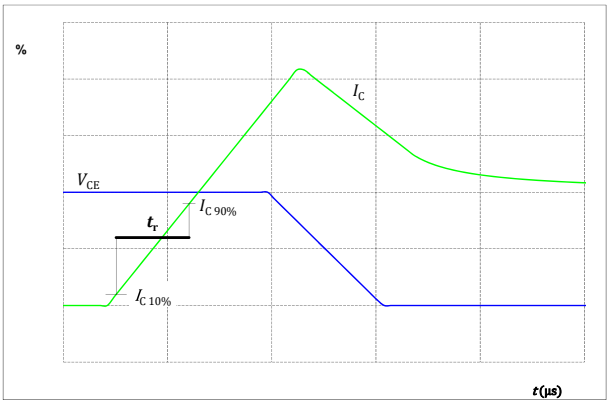


figure 27. **MOSFET**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 28. **FWD**

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

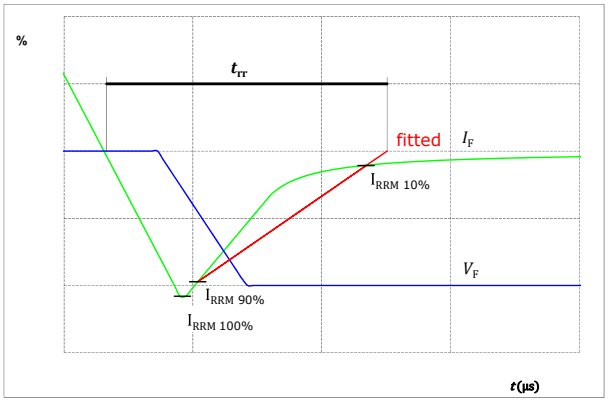


figure 29. **FWD**

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

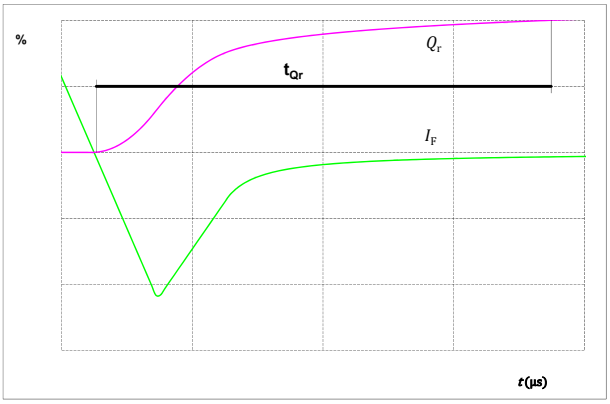
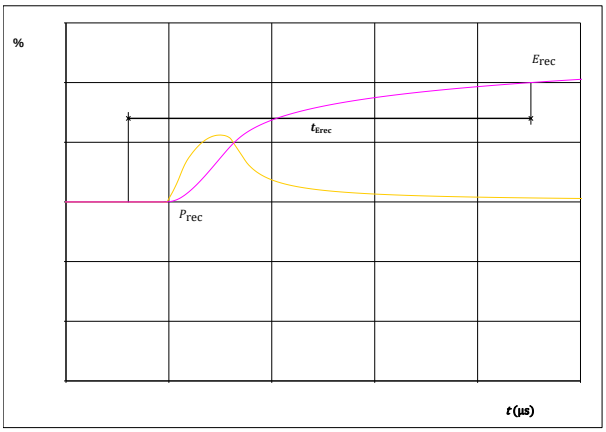


figure 30. **FWD**

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



Ordering Code

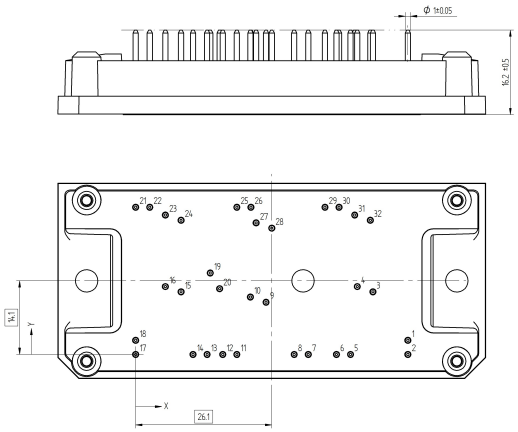
Version	Ordering Code
Without thermal paste	10-FY086PA023MR-L222F48
With thermal paste (5,2 W/mK, PTM6000HV)	10-FY086PA023MR-L222F48-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FY086PA023MR-L222F48-/3/

Marking

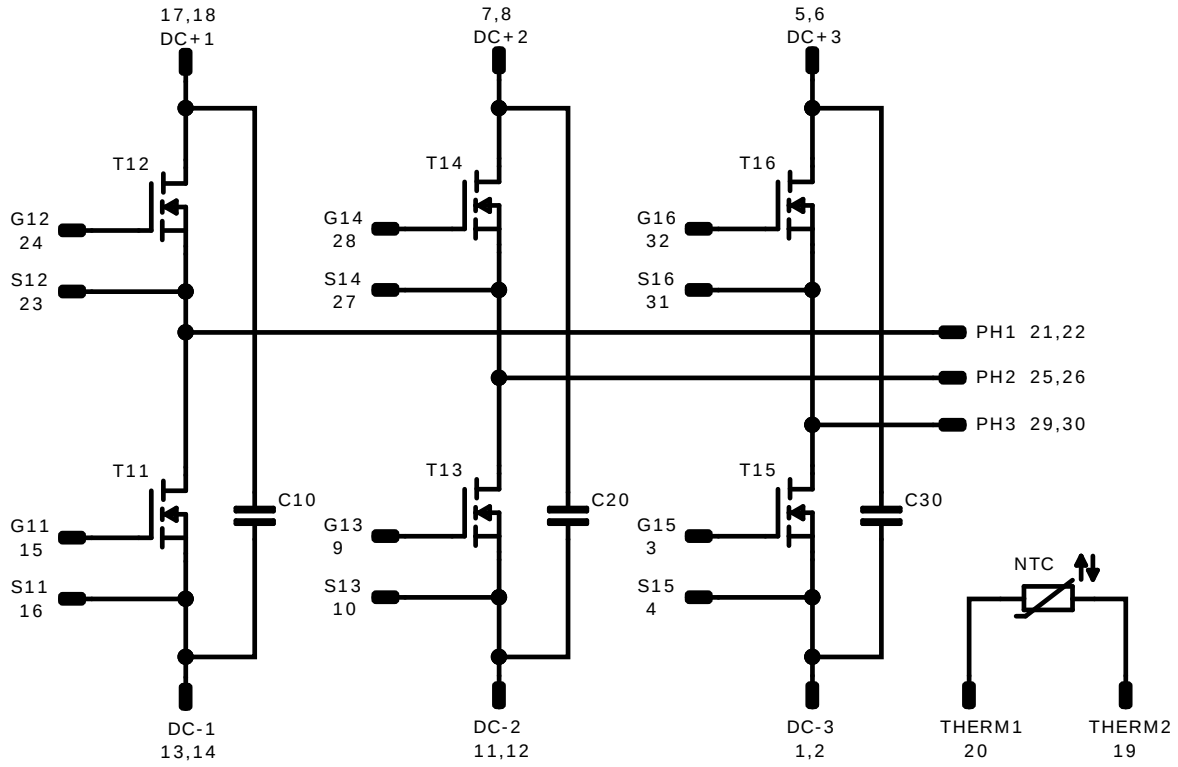
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	52,2	2,7	DC-3
2	52,2	0	DC-3
3	45,5	12	G15
4	42,5	13	S15
5	41,2	0	DC+3
6	38,5	0	DC+3
7	33,1	0	DC+2
8	30,4	0	DC+2
9	25	10	G13
10	22	11	S13
11	19,4	0	DC-2
12	16,7	0	DC-2
13	13,7	0	DC-1
14	11	0	DC-1
15	8,7	12	G11
16	5,7	13	S11
17	0	0	DC+1
18	0	2,7	DC+1
19	14,3	15,6	THERM2
20	16,1	12,6	THERM1
21	0	28,2	PH1
22	2,7	28,2	PH1
23	5,7	26,7	S12
24	8,7	25,7	G12
25	19,4	28,2	PH2
26	22,1	28,2	PH2
27	23,1	25,2	S14
28	26,1	24,2	G14
29	36,3	28,2	PH3
30	39	28,2	PH3
31	42	26,7	S16
32	45	25,7	G16



Pinout



Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T11, T12, T13, T14, T15, T16	MOSFET	750 V	22,5 mΩ	Inverter Switch	
C10, C20, C30	Capacitor	630 V		Capacitor (DC)	
Rt	Thermistor			Thermistor	

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

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-FY086PA023MR-L222F48-D1-14	14 Sep. 2023		