



Vincotech

# 10-FY126PA032ME-L226F13

datasheet

flowPACK 1 SiC

1200 V / 32 mΩ

## Topology features

- 3xHalf Bridge
- Open Emitter configuration
- Kelvin Emitter for improved switching performance
- 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<sub>2</sub>O<sub>3</sub>
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

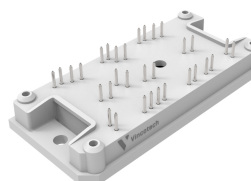
## Target applications

- Elevator Drives

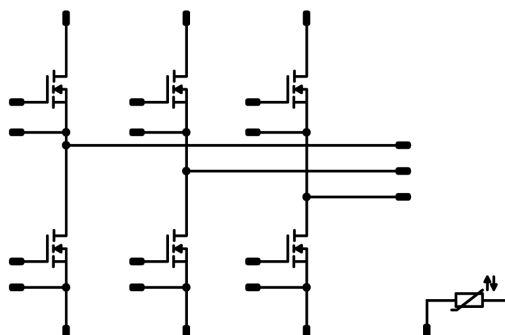
## Types

- 10-FY126PA032ME-L226F13

## flow 1 12 mm housing



## Schematic





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## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
<b>Inverter Switch</b>				
Drain-source voltage	$V_{DS}$		1200	V
Drain current (DC current)	$I_D$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Peak drain current	$I_{DM}$	$t_p$ limited by $T_{jmax}$	120	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	70	W
Gate-source voltage	$V_{GSS}$		-4 / 15	V
		dynamic	-8 / 19	
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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	$V_{isol}$	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			12,12	mm
Comparative Tracking Index	CTI		≥ 600	

\*100 % tested in production



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## 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	$r_{DS(on)}$		15		40	25 125 150	22,4	34,2 42,1 46,4	41,6 <sup>(1)</sup>	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$			0,0115	25	1,8	2,5	3,6	V
Gate to Source Leakage Current	$I_{GSS}$		15	0		25		10	250	nA
Zero Gate Voltage Drain Current	$I_{DSS}$		0	1200		25		1	19	μA
Internal gate resistance	$r_g$							1,7		Ω
Gate charge	$Q_g$		-4/15	800	40	25		118		nC
Short-circuit input capacitance	$C_{iss}$	$f = 100 \text{ kHz}$	0	1000	0	25		3357		pF
Short-circuit output capacitance	$C_{oss}$							129		
Reverse transfer capacitance	$C_{rss}$							8		
Diode forward voltage	$V_{SD}$		0		20	25		4,6		V

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,36		K/W
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## 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	$t_{d(on)}$	$R_{gon} = 8\ \Omega$ $R_{goff} = 8\ \Omega$	-4/15	600	32	25		27,56		ns	
						125		25,55			
						150		25,05			
Rise time	$t_r$					25		9,71			ns
						125		9,25			
						150		9,23			
Turn-off delay time	$t_{d(off)}$					25		67,34			ns
						125		73,52			
						150		74,87			
Fall time	$t_f$					25		18			ns
						125		19,57			
						150		17,83			
Turn-on energy (per pulse)	$E_{on}$	$Q_{rFWD}=0,282\ \mu C$ $Q_{rFWD}=0,615\ \mu C$ $Q_{rFWD}=0,74\ \mu C$	25		0,423			mWs			
			125		0,524						
			150		0,557						
Turn-off energy (per pulse)	$E_{off}$		25		0,1			mWs			
			125		0,097						
			150		0,096						
Peak recovery current	$I_{RRM}$	$di/dt=3826\ A/\mu s$ $di/dt=5090\ A/\mu s$ $di/dt=4568\ A/\mu s$	25		33,41			A			
			125		47,81						
			150		53,9						
Reverse recovery time	$t_{rr}$		25		14,79			ns			
			125		20,15						
			150		21,28						
Recovered charge	$Q_r$		25		0,282			$\mu C$			
			125		0,615						
			150		0,74						
Reverse recovered energy	$E_{rec}$		25		0,034			mWs			
			125		0,126						
			150		0,162						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$		25		6999,43			A/ $\mu s$			
			125		6764,78						
			150		8618,49						



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## 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	

### Thermistor

#### Static

Rated resistance	$R$					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$					25		130		mW
Power dissipation constant	$d$					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



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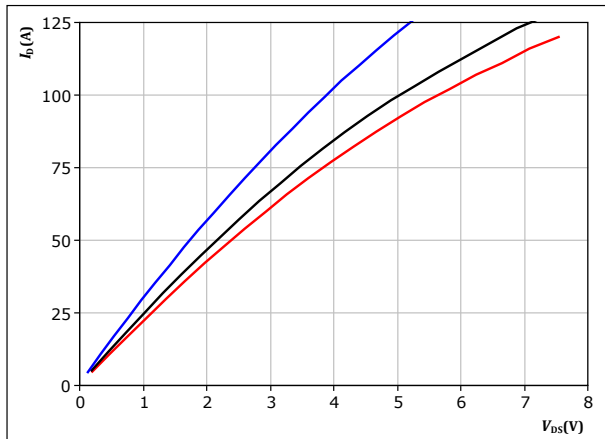
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datasheet

## Inverter Switch Characteristics

figure 1. MOSFET

Typical output characteristics

$$I_D = f(V_{DS})$$



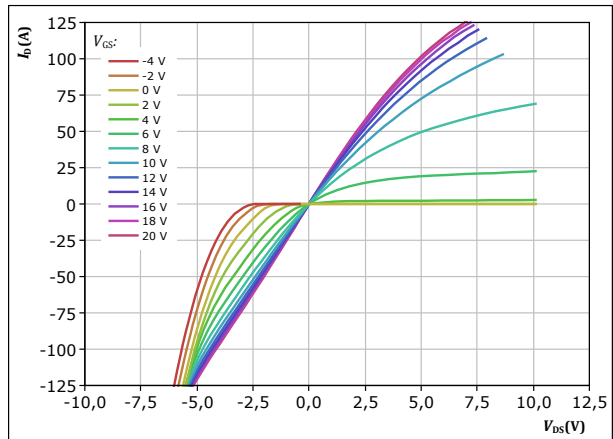
$t_p = 250 \mu s$   
 $V_{GS} = 14 V$

$T_j:$   
— 25 °C  
— 125 °C  
— 150 °C

figure 2. MOSFET

Typical output characteristics

$$I_D = f(V_{DS})$$

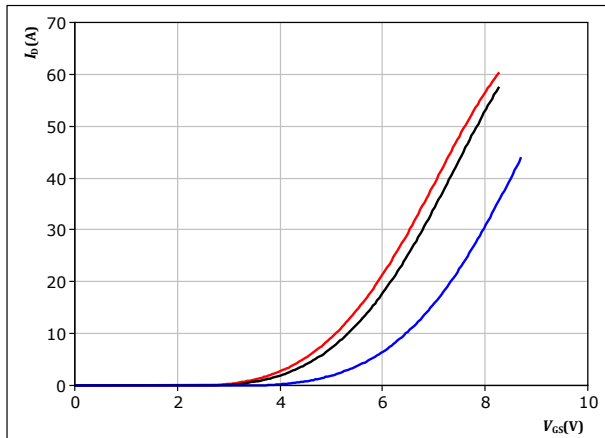


$t_p = 250 \mu s$   
 $T_j = 150 ^\circ C$   
 $V_{GS}$  from -4 V to 20 V in steps of 2 V

figure 3. MOSFET

Typical transfer characteristics

$$I_D = f(V_{GS})$$



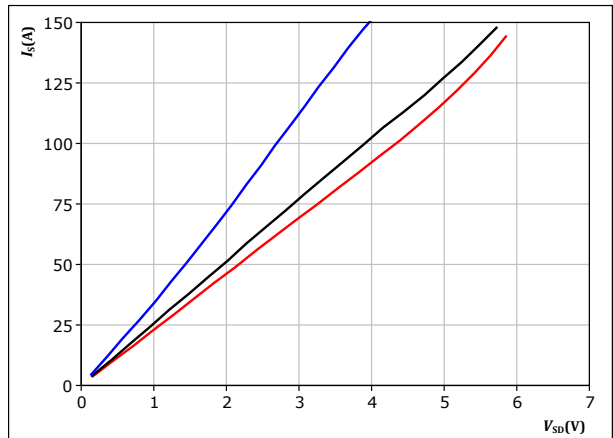
$t_p = 250 \mu s$   
 $V_{DS} = 10 V$

$T_j:$   
— 25 °C  
— 125 °C  
— 150 °C

figure 4. MOSFET

Typical reverse drain current characteristics

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



$t_p = 250 \mu s$   
 $V_{GS} = 14 V$

$T_j:$   
— 25 °C  
— 125 °C  
— 150 °C

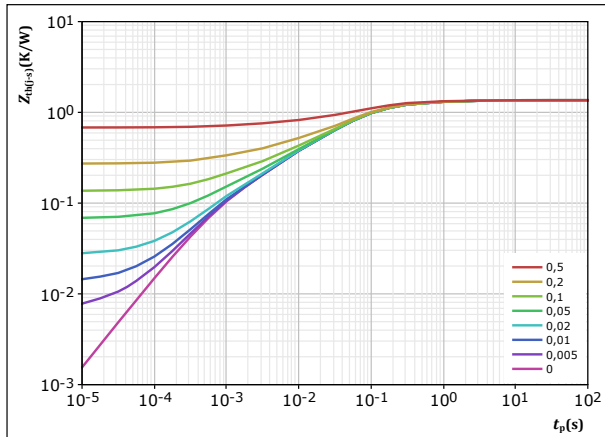


## Inverter Switch Characteristics

figure 5. MOSFET

Transient thermal impedance as a function of pulse width

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

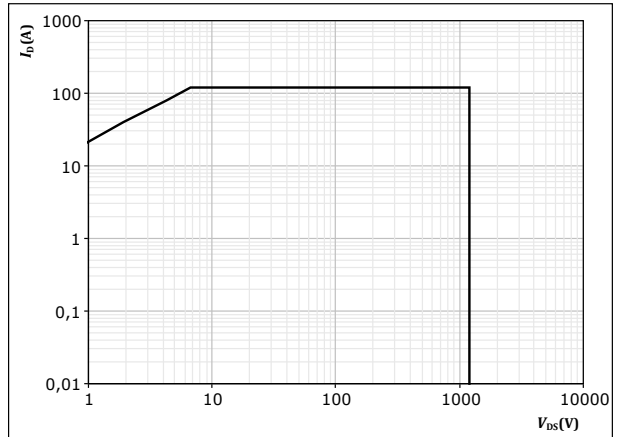


$D =$	$t_p / T$
$R_{th(j-s)} =$	1,362 K/W
MOSFET thermal model values	
$R$ (K/W)	$\tau$ (s)
7,53E-02	2,27E+00
2,27E-01	2,80E-01
7,32E-01	6,31E-02
2,40E-01	7,73E-03
8,78E-02	7,83E-04

figure 6. MOSFET

Safe operating area

$$I_D = f(V_{DS})$$



$D =$	single pulse
$T_s =$	80 °C
$V_{GS} =$	14 V
$T_j =$	$T_{jmax}$



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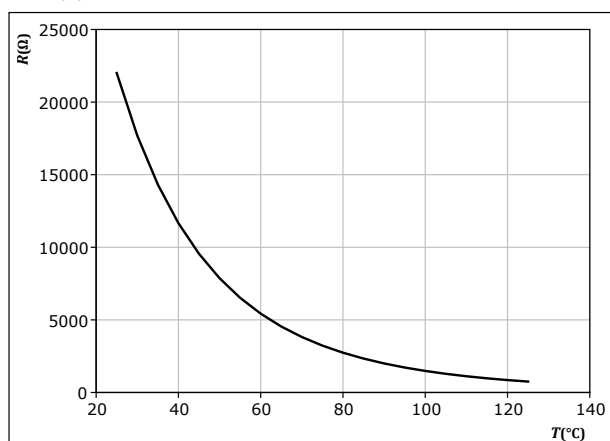
## Thermistor Characteristics

figure 7.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$







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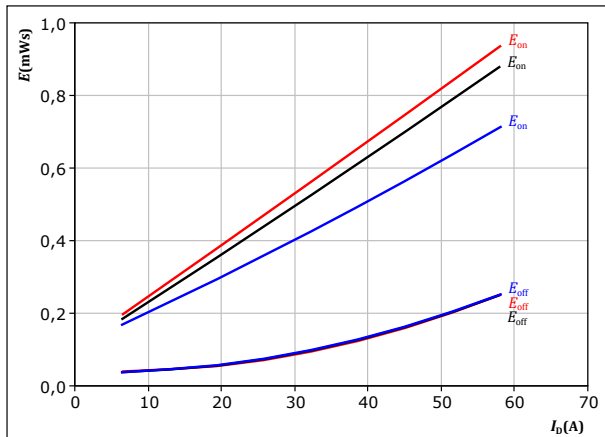
## Inverter Switching Characteristics

figure 8.

MOSFET

Typical switching energy losses as a function of drain current

$$E = f(I_D)$$



With an inductive load at

$V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

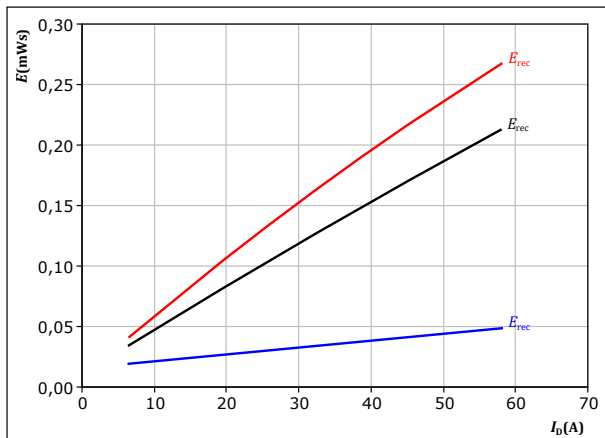
$T_j$ : 25 °C  
125 °C  
150 °C

figure 10.

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  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$   $\Omega$

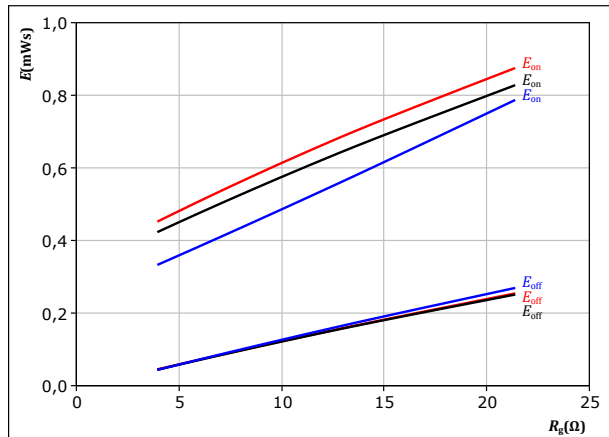
$T_j$ : 25 °C  
125 °C  
150 °C

figure 9.

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  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A

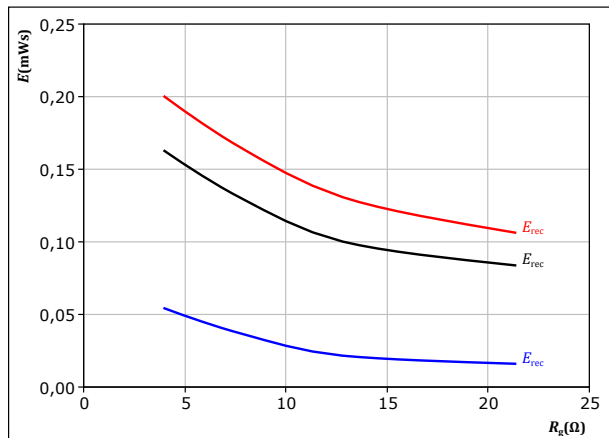
$T_j$ : 25 °C  
125 °C  
150 °C

figure 11.

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  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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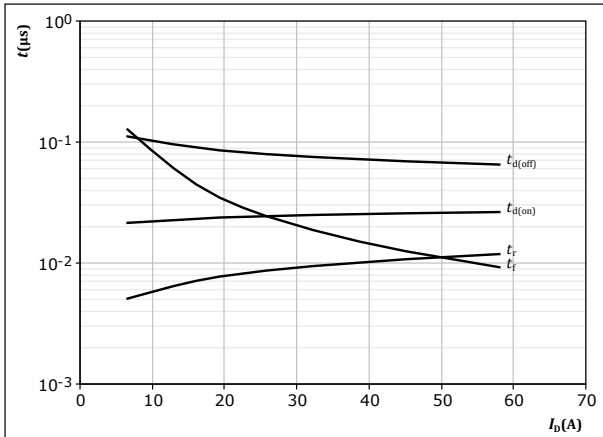
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datasheet

## Inverter Switching Characteristics

figure 12.

MOSFET

Typical switching times as a function of drain current  
 $t = f(I_D)$



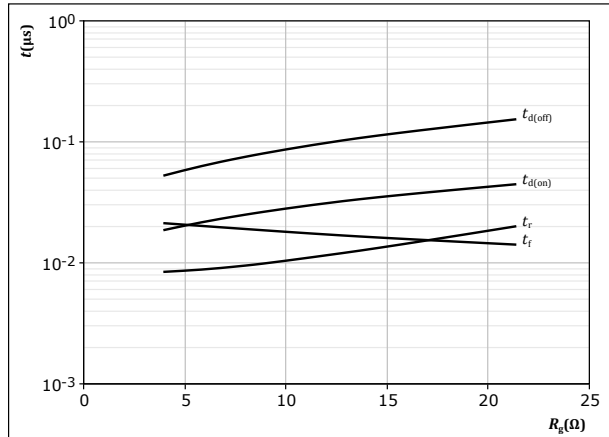
With an inductive load at

$T_j = 150$  °C  
 $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$  Ω  
 $R_{goff} = 8$  Ω

figure 13.

MOSFET

Typical switching times as a function of MOSFET turn on gate resistor  
 $t = f(R_g)$



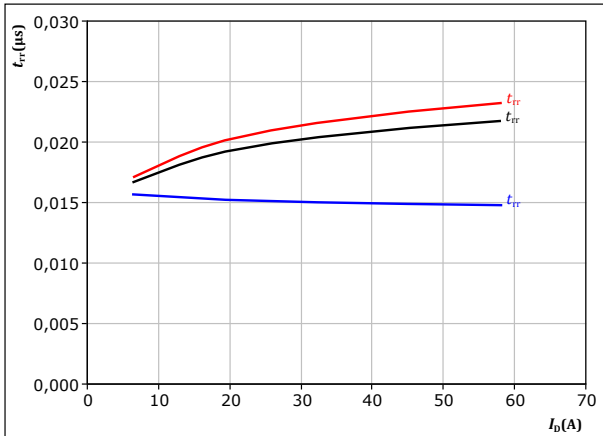
With an inductive load at

$T_j = 150$  °C  
 $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A

figure 14.

MOSFET

Typical reverse recovery time as a function of drain current  
 $t_{rr} = f(I_D)$

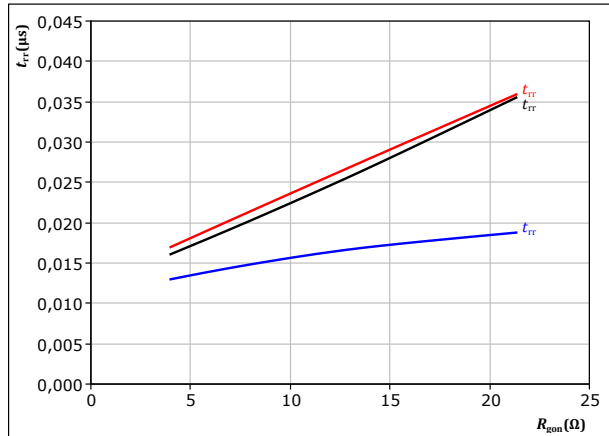


At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 15.

MOSFET

Typical reverse recovery time as a function of MOSFET turn on gate resistor  
 $t_{rr} = f(R_{gon})$



At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)



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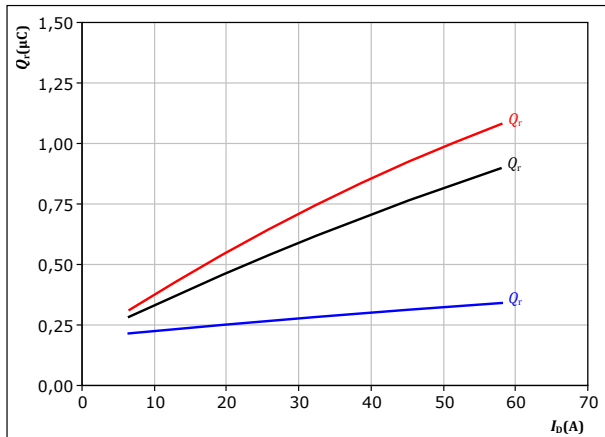
## Inverter Switching Characteristics

figure 16.

MOSFET

Typical recovered charge as a function of drain current

$$Q_r = f(I_D)$$



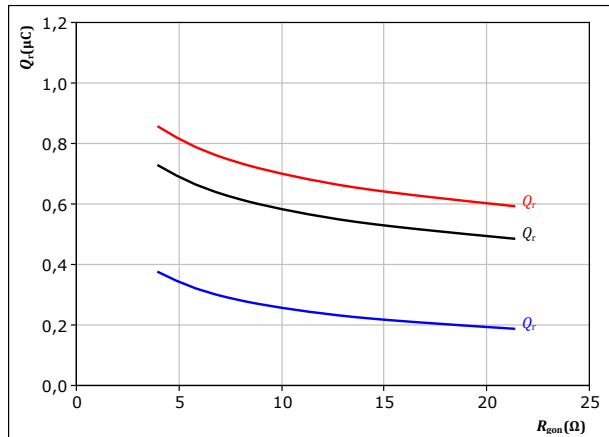
At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : 25 °C  
125 °C  
150 °C

figure 17.

MOSFET

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

$$Q_r = f(R_{gon})$$



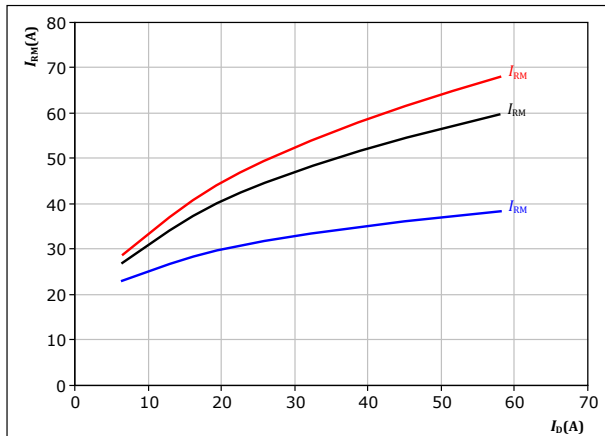
At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A  
 $T_j$ : 25 °C  
125 °C  
150 °C

figure 18.

MOSFET

Typical peak reverse recovery current as a function of drain current

$$I_{RM} = f(I_D)$$



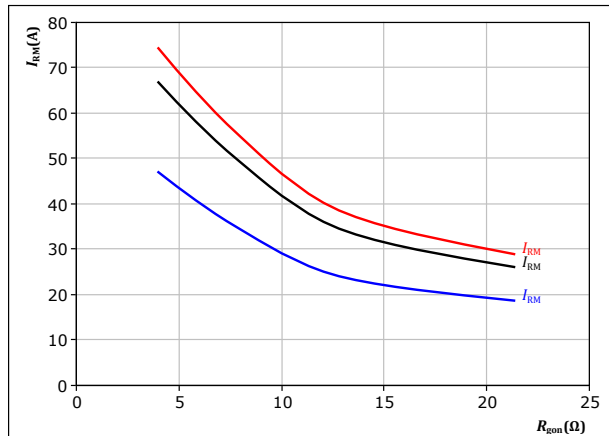
At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : 25 °C  
125 °C  
150 °C

figure 19.

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  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A  
 $T_j$ : 25 °C  
125 °C  
150 °C



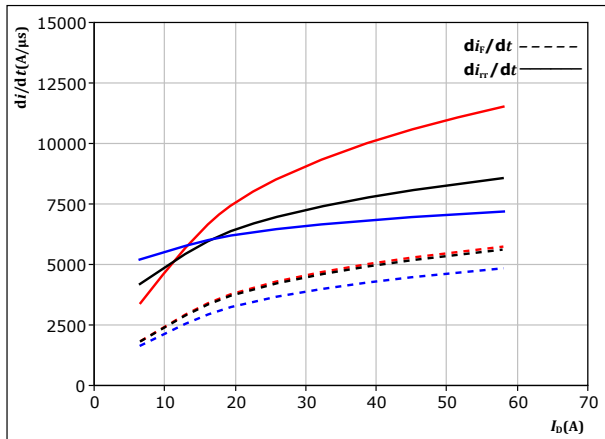
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## Inverter Switching Characteristics

figure 20. MOSFET

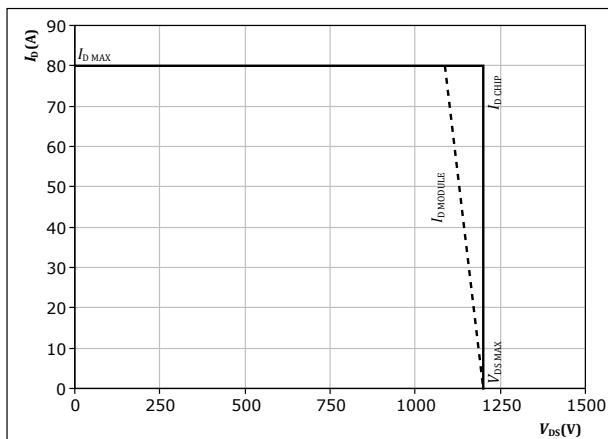
Typical rate of fall of forward and reverse recovery current as a function of drain current  
 $di_f/dt, di_r/dt = f(I_D)$



At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j = 25$  °C  
 $125$  °C  
 $150$  °C

figure 22. MOSFET

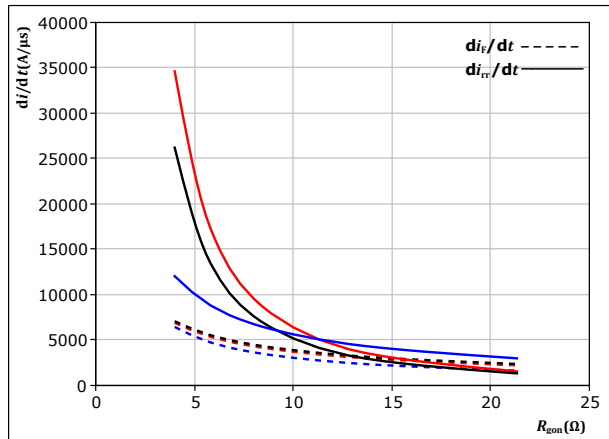
Reverse bias safe operating area  
 $I_D = f(V_{DS})$



At  $T_j = 150$  °C  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

figure 21. MOSFET

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor  
 $di_f/dt, di_r/dt = f(R_{gon})$



At  $V_{DS} = 600$  V  
 $V_{GS} = -4/15$  V  
 $I_D = 32$  A  
 $T_j = 25$  °C  
 $125$  °C  
 $150$  °C



## Inverter Switching Definitions

figure 23. MOSFET

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



figure 24. MOSFET

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



figure 25. MOSFET

Turn-off Switching Waveforms & definition of  $t_f$

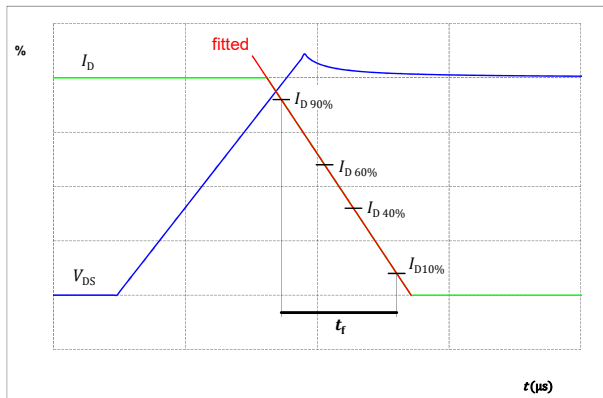
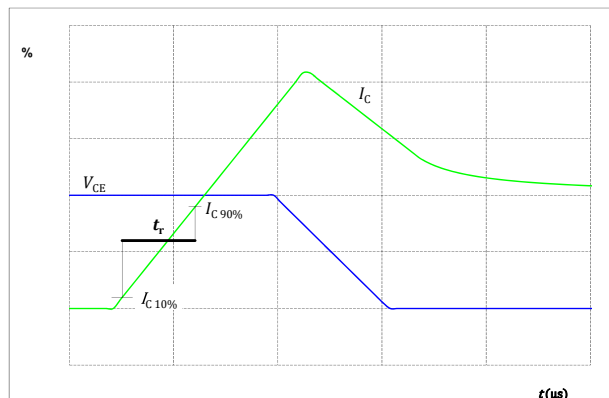


figure 26. MOSFET

Turn-on Switching Waveforms & definition of  $t_r$





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## Inverter Switching Definitions

figure 27.

FWD

Turn-off Switching Waveforms & definition of  $t_{tr}$

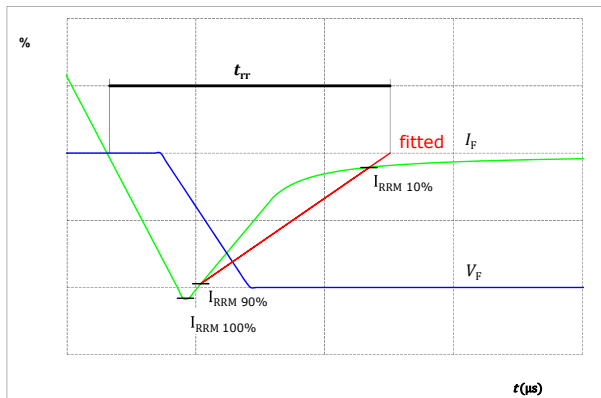


figure 28.

FWD

Turn-on Switching Waveforms & definition of  $t_{Qr}$  ( $t_{Qr}$  = integrating time for  $Q_r$ )

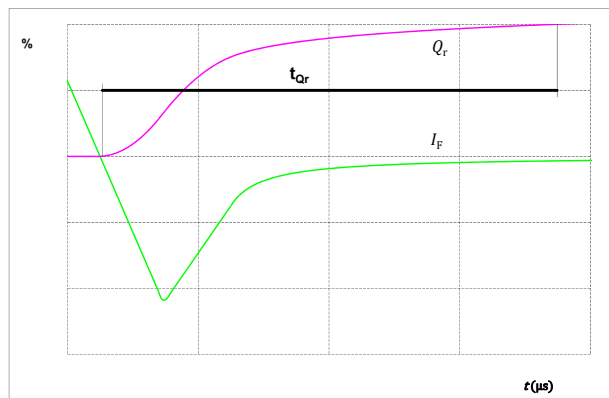
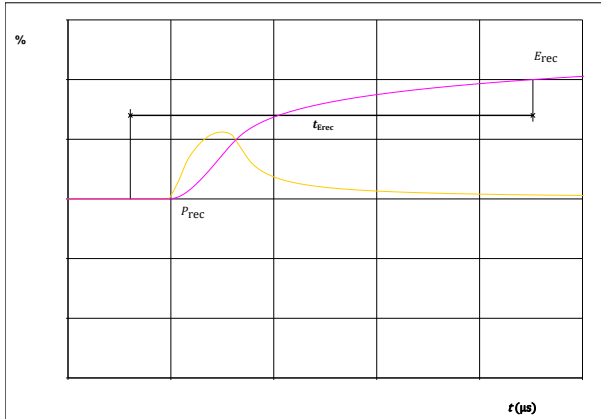


figure 29.

FWD

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






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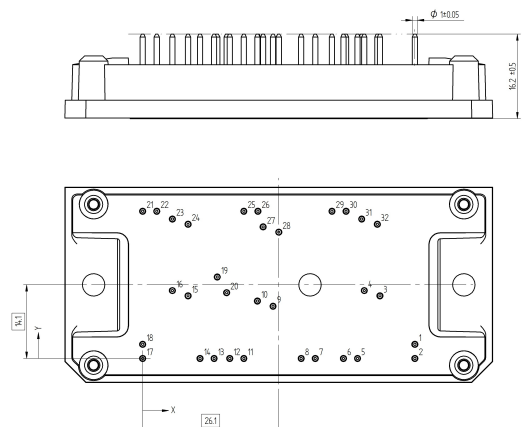
# 10-FY126PA032ME-L226F13

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-FY126PA032ME-L226F13
With thermal paste (5,2 W/mK, PTM6000HV)	10-FY126PA032ME-L226F13-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FY126PA032ME-L226F13-/3/

Marking							
	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN- TTTTTVV		WWYY	UL VIN	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTVV	LLLL	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	

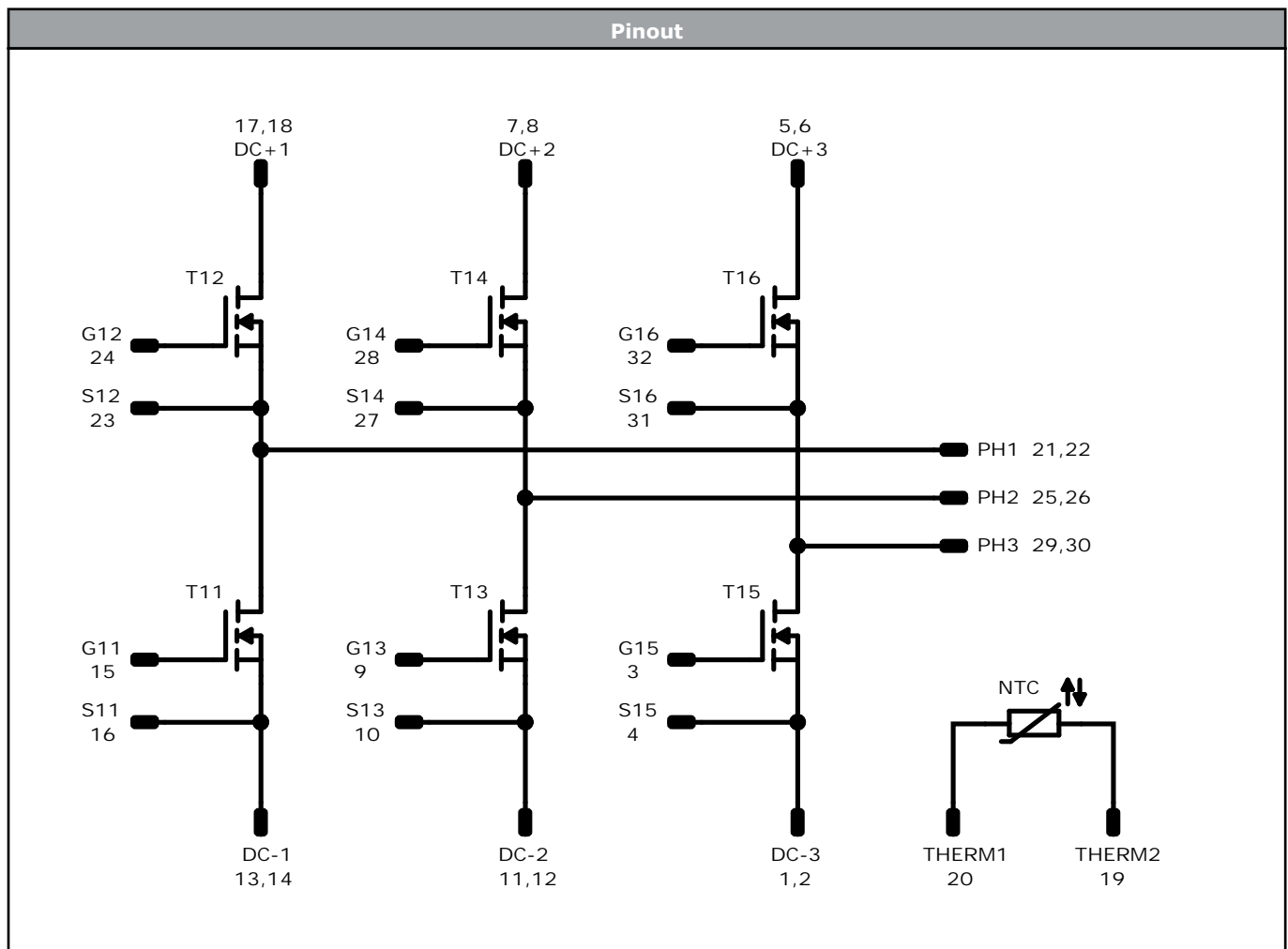


Tolerance of preposition:  $\pm 0,5$ mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance



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datasheet



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	MOSFET	1200 V	32 mΩ	Inverter Switch	
Rt	Thermistor			Thermistor	





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

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.