
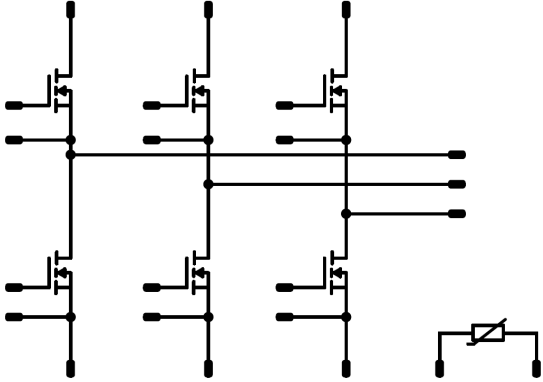




# Vincotech

<i>flow</i> PACK 1	900 V / 70 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Features</b></div> <ul style="list-style-type: none"> <li>Wolfspeed(Cree)<sup>™</sup> Silicon Carbide Power MOSFET, C3M<sup>™</sup> MOSFET Technology</li> <li>Sixpack with three separated legs</li> <li>Solderless Press-fit Mounting Technology</li> </ul>	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><i>flow</i> 1 12 mm housing</div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Target applications</b></div> <ul style="list-style-type: none"> <li>Power Supply</li> </ul>	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Schematic</b></div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Types</b></div> <ul style="list-style-type: none"> <li>10-PY096PA035ME-L224F18Y</li> </ul>	

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Inverter Switch</b>				
Drain-source voltage	$V_{DSS}$		900	V
Drain current	$I_D$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	42	A
Peak drain current	$I_{DM}$	$t_p$ limited by $T_{jmax}$	180	A
Avalanche energy, single pulse	$E_{AS}$	$I_D = 22\text{ A}$ $V_{DD} = 50\text{ V}$	110	mJ
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	85	W
Gate-source voltage	$V_{GSS}$	Dynamic*	-8/+19	V
Maximum Junction Temperature	$T_{jmax}$		175	°C

\* See figure 8. at page 14



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## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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### Module Properties

#### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{top}$		-40...(T <sub>max</sub> - 25)	°C

#### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			11,89	mm
Comparative Tracking Index	CTI		> 200	

\*100 % tested in production



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## Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	

### Inverter Switch

#### Static

Parameter	Symbol	$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Drain-source on-state resistance	$r_{DS(on)}$	10			76	25 125 150		35 43 47	39	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,01	25	1,7	2,4	3,5	V
Gate to Source Leakage Current	$I_{GSS}$	-8/+19	0			25			500	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	0	900			25			200	μA
Internal gate resistance	$r_g$							2,35		Ω
Gate charge	$Q_g$							61		nC
Gate to source charge	$Q_{GS}$	-4/15	400	40	25			15		
Gate to drain charge	$Q_{GD}$							24		
Short-circuit input capacitance	$C_{iss}$							1320		pF
Short-circuit output capacitance	$C_{oss}$	$f = 1$ MHz	0	600	25			120		
Reverse transfer capacitance	$C_{rss}$							8		

#### Thermal

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK		1,12		K/W

#### Dynamic

Parameter	Symbol	$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		13 13 14		ns
Rise time	$t_r$					25 125 150		5 5 5		
Turn-off delay time	$t_{d(off)}$					25 125 150		43 43 43		
Fall time	$t_f$					25 125 150		11 12 11		
Turn-on energy (per pulse)	$E_{on}$					25 125 150		0,459 0,447 0,471		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,082 0,055 0,048		



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## Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}$ [V] $V_{GS}$ [V]	$V_{CE}$ [V] $V_{DS}$ [V]	$I_C$ [A] $I_D$ [A]	$I_F$ [A]	$T_j$ [°C]	Min	Typ	Max	

### Inverter Switch

#### Dynamic

Parameter	Symbol	Conditions					Value			Unit
Peak recovery current	$I_{RRM}$	$di/dt = 7344$ A/ $\mu$ s $di/dt = 7855$ A/ $\mu$ s $di/dt = 8439$ A/ $\mu$ s	+15/-5	600	40	25		54		A
						125		58		
						150		63		
Reverse recovery time	$t_{rr}$					25		15		
						125		15		
		150		15						
Recovered charge	$Q_r$					25		0,455		$\mu$ C
						125		0,875		
						150		0,825		
Reverse recovered energy	$E_{rec}$					25		0,028		mWs
						125		0,196		
						150		0,106		
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25		11049		A/ $\mu$ s
						125		13683		
						150		15876		

### Thermistor

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

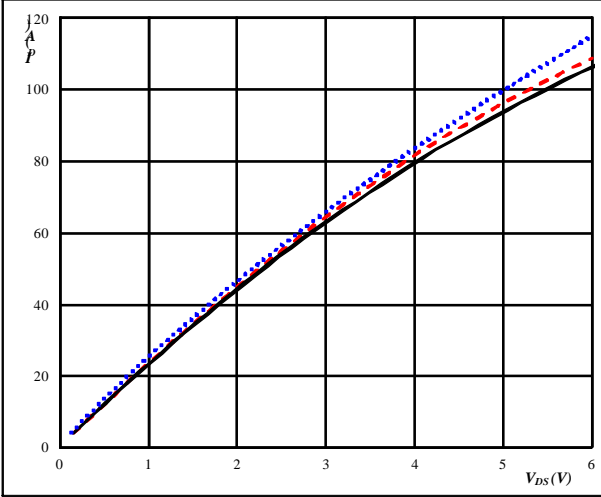


### Inverter Switch Characteristics

**figure 1. MOSFET**

Typical output characteristics

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

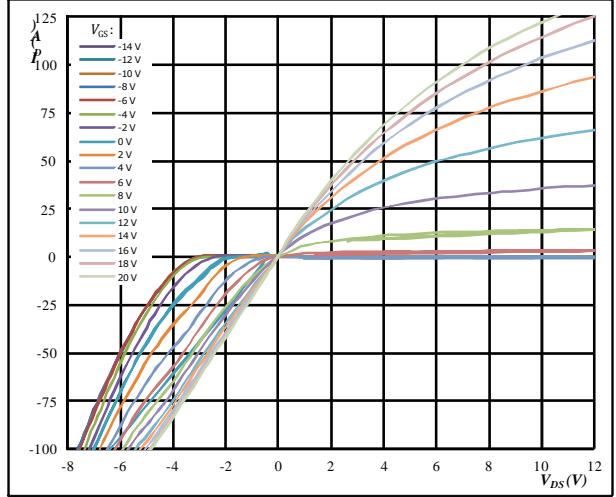


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{GS} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 2. MOSFET**

Typical output characteristics

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

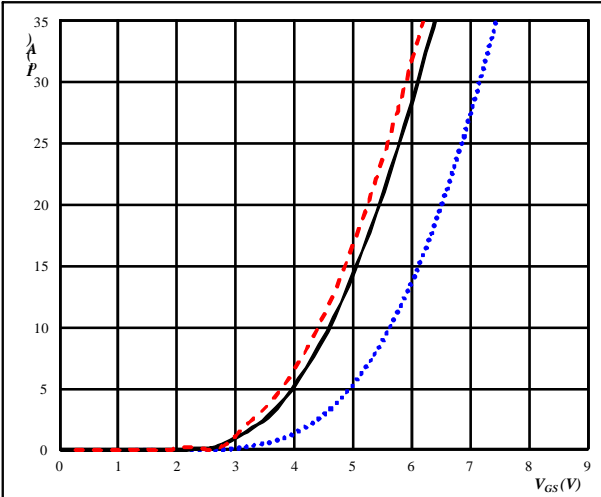


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$

**figure 3. MOSFET**

Typical transfer characteristics

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

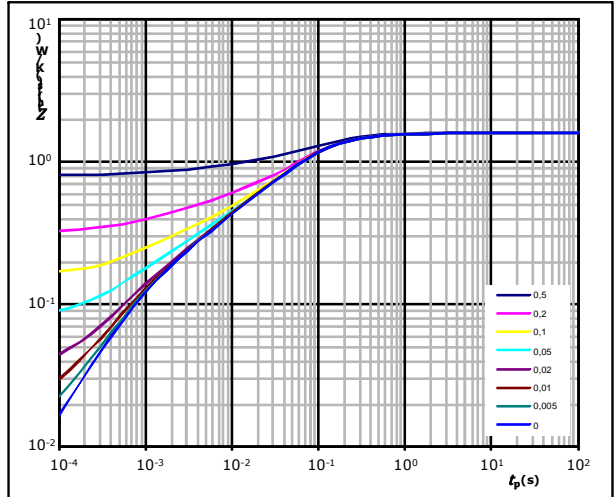


$t_p = 100 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{DS} = 10 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 4. MOSFET**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,12 \text{ K/W}$   
MOSFET thermal model values

R (K/W)	$\tau$ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

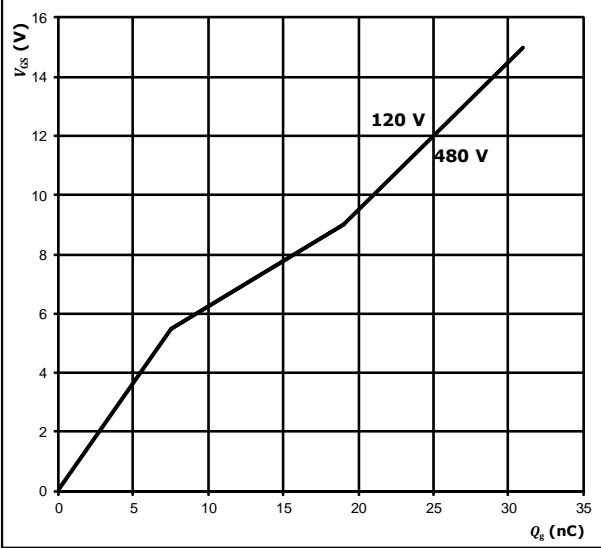


### Inverter Switch Characteristics

figure 5. MOSFET

Gate voltage vs Gate charge

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



At

$I_D =$	40	A	$V_{DS} =$	400	V
$T_j =$	25	°C	$I_{GS} =$	200	mA

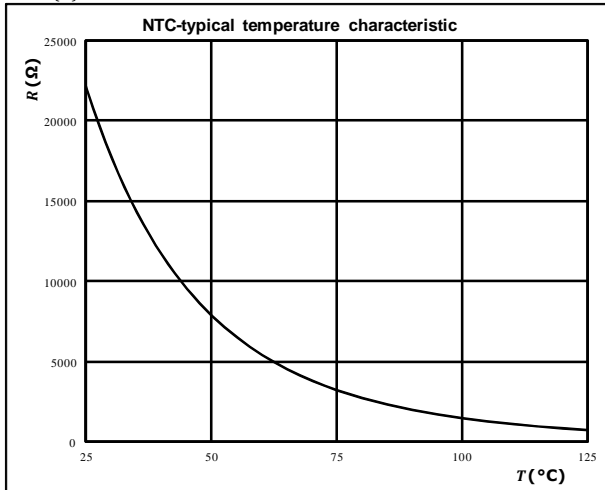


### Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic  
as a function of temperature

$$R = f(T)$$

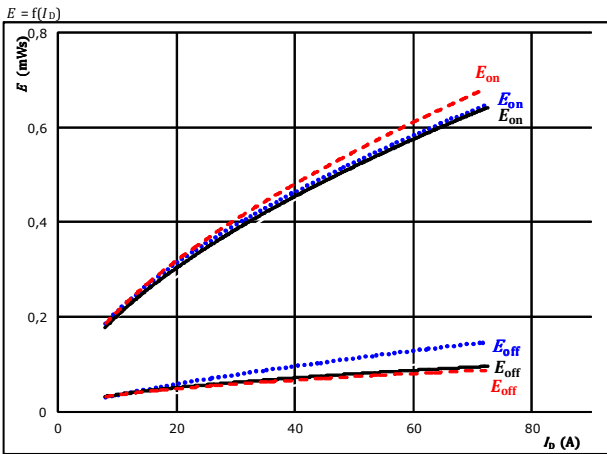




## Inverter Switching Characteristics

**figure 1.** MOSFET

Typical switching energy losses as a function of drain current

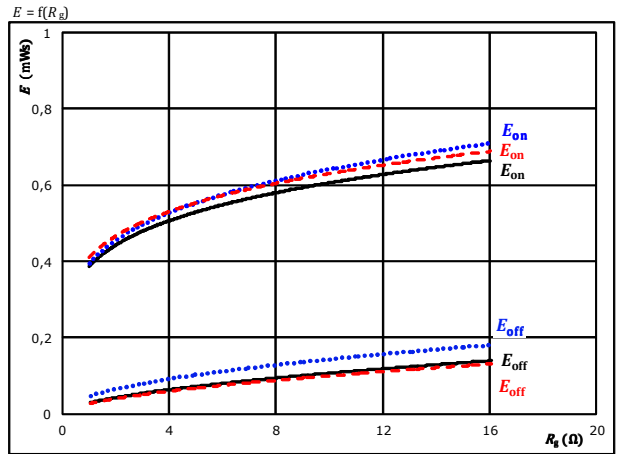


With an inductive load at  
 $V_{DS} = 600$  V  
 $V_{GS} = +15/-5$  V  
 $R_{gon} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$

$T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 2.** MOSFET

Typical switching energy losses as a function of gate resistor

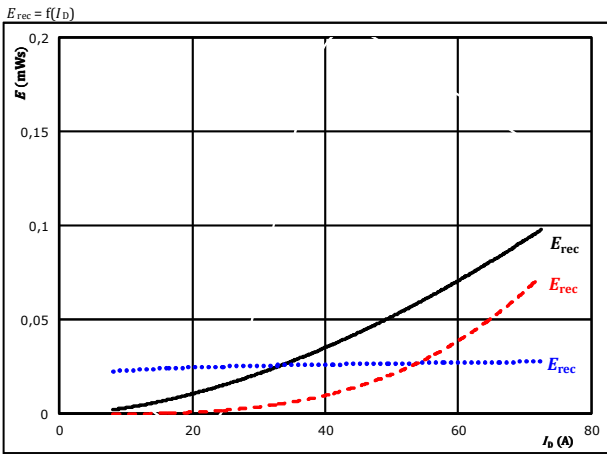


With an inductive load at  
 $V_{DS} = 600$  V  
 $V_{GS} = +15/-5$  V  
 $I_D = 40$  A

$T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 3.** FWD

Typical reverse recovered energy loss as a function of drain current

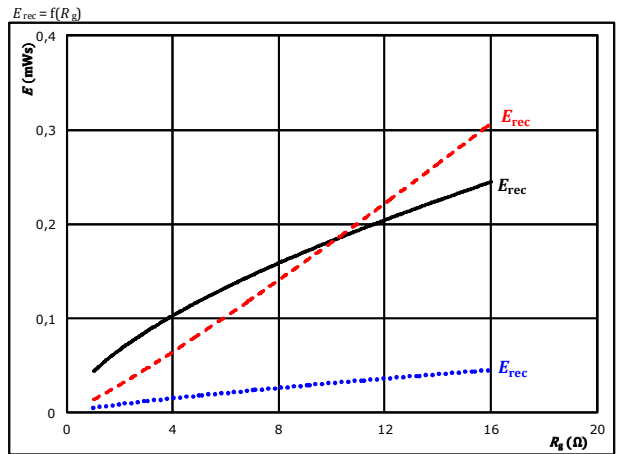


With an inductive load at  
 $V_{DS} = 600$  V  
 $V_{GS} = +15/-5$  V  
 $R_{gon} = 4$   $\Omega$

$T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 4.** FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at  
 $V_{DS} = 600$  V  
 $V_{GS} = +15/-5$  V  
 $I_D = 40$  A

$T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)



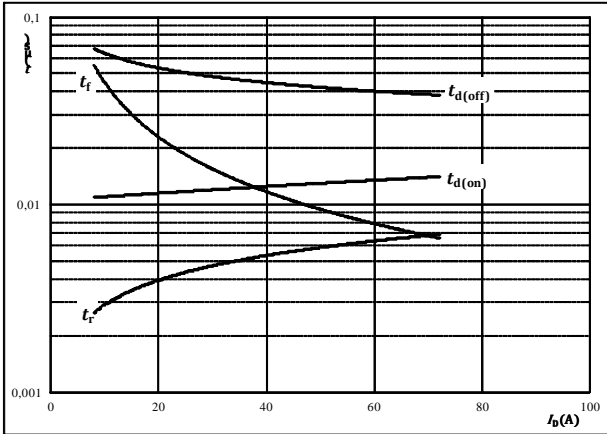


## Inverter Switching Characteristics

**figure 5.** MOSFET

Typical switching times as a function of drain current

$$t = f(I_D)$$



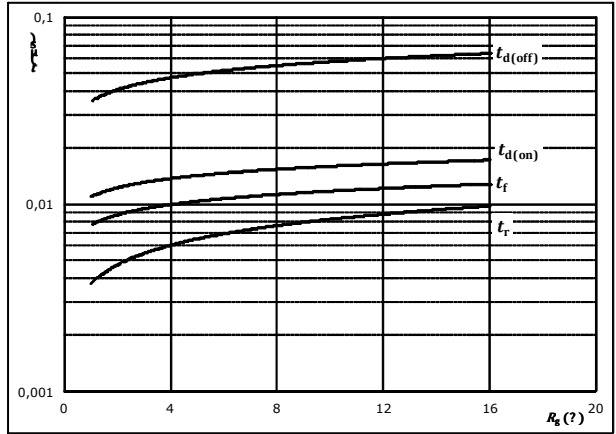
With an inductive load at

- $T_j = 150 \text{ } ^\circ\text{C}$
- $V_{DS} = 600 \text{ V}$
- $V_{GS} = +15/-5 \text{ V}$
- $R_{g\text{on}} = 4 \text{ } \Omega$
- $R_{g\text{off}} = 4 \text{ } \Omega$

**figure 6.** MOSFET

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



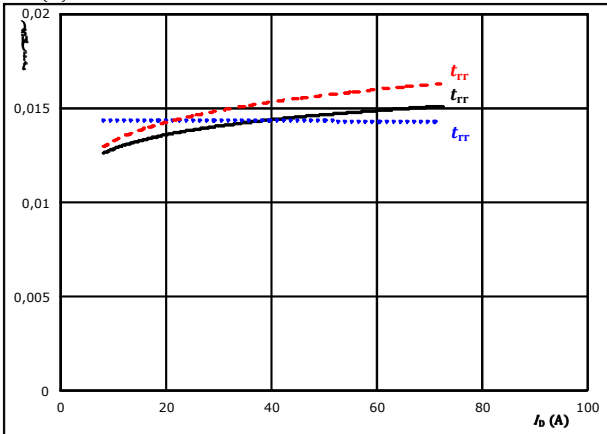
With an inductive load at

- $T_j = 150 \text{ } ^\circ\text{C}$
- $V_{DS} = 600 \text{ V}$
- $V_{GS} = +15/-5 \text{ V}$
- $I_D = 40 \text{ A}$

**figure 7.** FWD

Typical reverse recovery time as a function of drain current

$$t_{rr} = f(I_D)$$

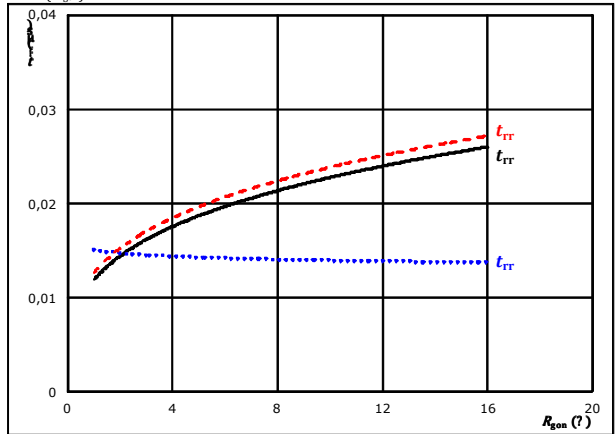


- At  $V_{DS} = 600 \text{ V}$   $V_{GS} = +15/-5 \text{ V}$   $R_{g\text{on}} = 4 \text{ } \Omega$   $T_j: 25 \text{ } ^\circ\text{C}$  (dotted blue),  $125 \text{ } ^\circ\text{C}$  (solid black),  $150 \text{ } ^\circ\text{C}$  (dashed red)

**figure 8.** FWD

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

$$t_{rr} = f(R_{g\text{on}})$$



- At  $V_{DS} = 600 \text{ V}$   $V_{GS} = +15/-5 \text{ V}$   $I_D = 40 \text{ A}$   $T_j: 25 \text{ } ^\circ\text{C}$  (dotted blue),  $125 \text{ } ^\circ\text{C}$  (solid black),  $150 \text{ } ^\circ\text{C}$  (dashed red)

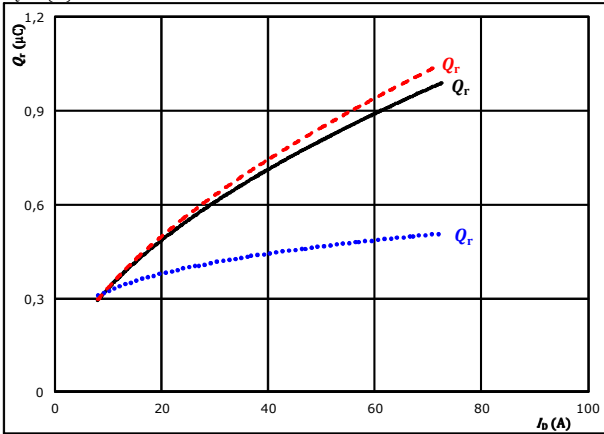


## Inverter Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of drain current

$$Q_r = f(I_D)$$

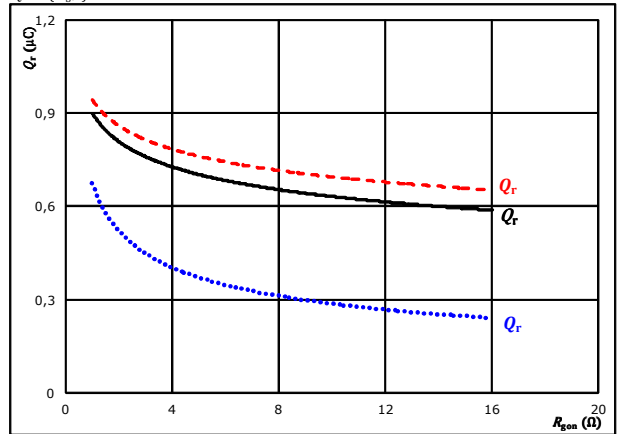


At  $V_{DS} = 600$  V  $T_j: 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j: 125$  °C ———  
 $R_{gpn} = 4$  Ω  $T_j: 150$  °C - - - - -

**figure 10.** FWD

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

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

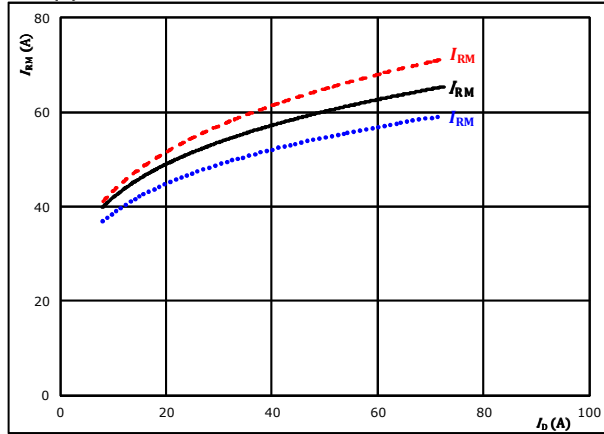


At  $V_{DS} = 600$  V  $T_j: 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j: 125$  °C ———  
 $I_D = 40$  A  $T_j: 150$  °C - - - - -

**figure 11.** FWD

Typical peak reverse recovery current current as a function of drain current

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

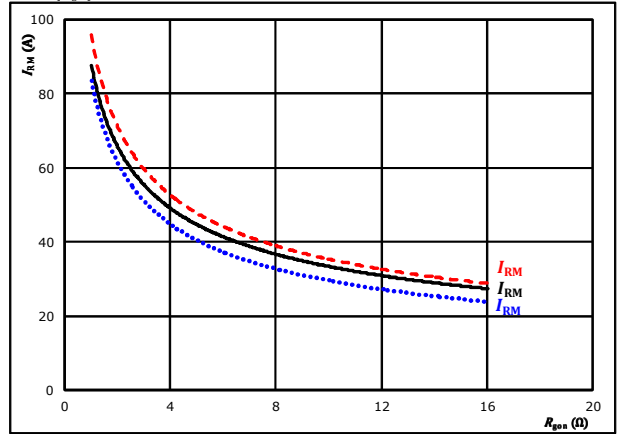


At  $V_{DS} = 600$  V  $T_j: 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j: 125$  °C ———  
 $R_{gpn} = 4$  Ω  $T_j: 150$  °C - - - - -

**figure 12.** FWD

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

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



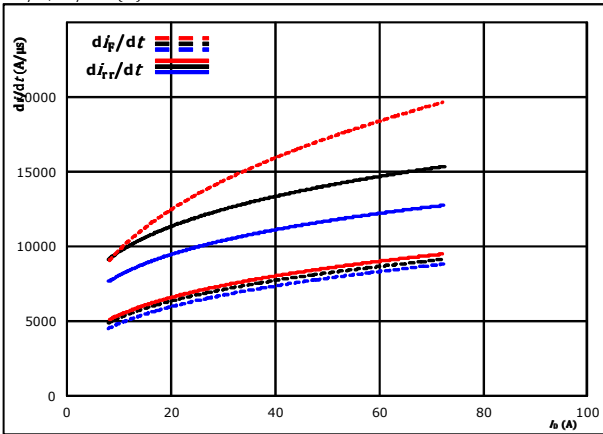
At  $V_{DS} = 600$  V  $T_j: 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j: 125$  °C ———  
 $I_D = 40$  A  $T_j: 150$  °C - - - - -



## Inverter Switching Characteristics

**figure 13.** FWD

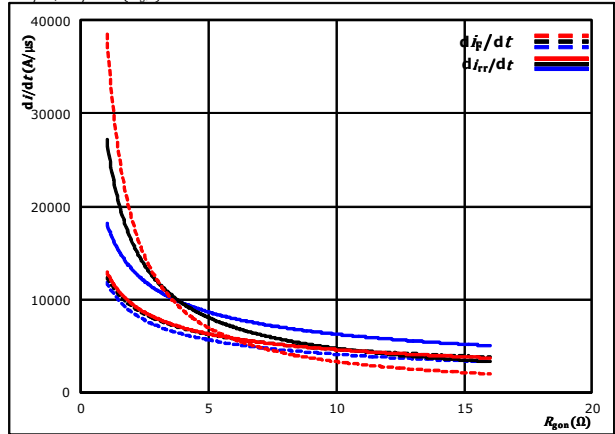
Typical rate of fall of forward and reverse recovery current as a function of drain current  
 $di_f/dt, di_{rr}/dt = f(I_D)$



At  $V_{DS} = 600$  V  $T_j = 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j = 125$  °C ———  
 $R_{gon} = 4$  Ω  $T_j = 150$  °C - - - - -

**figure 14.** FWD

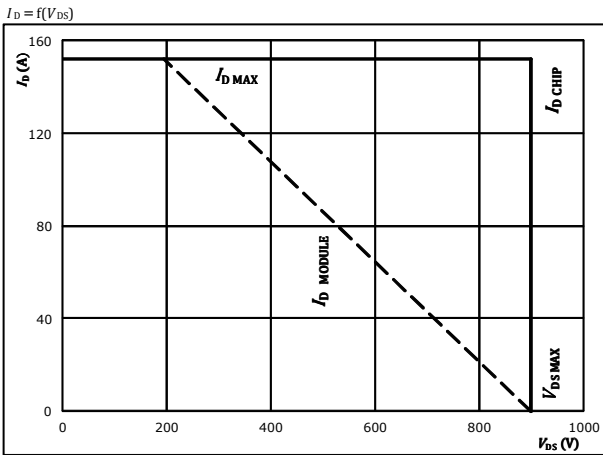
Typical rate of fall of forward and reverse recovery current as a function of MOSFET turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



At  $V_{DS} = 600$  V  $T_j = 25$  °C .....  
 $V_{GS} = +15/-5$  V  $T_j = 125$  °C ———  
 $I_D = 40$  A  $T_j = 150$  °C - - - - -

**figure 15.** MOSFET

Reverse bias safe operating area



At  $T_j = 175$  °C  
 $R_{gon} = 4$  Ω  
 $R_{goff} = 4$  Ω



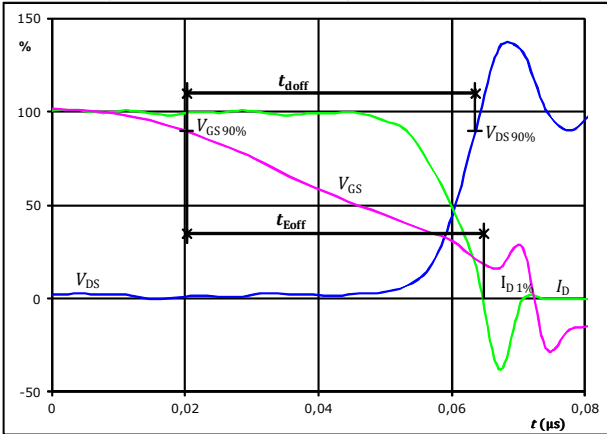
## Inverter Switching Characteristics

**General conditions**

$T_j$	=	125 °C
$R_{gon}$	=	4 $\Omega$
$R_{goff}$	=	4 $\Omega$

**figure 1.** MOSFET

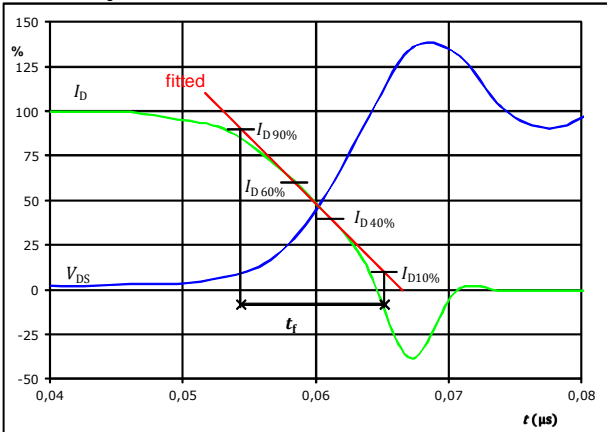
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GS}(0\%) =$	0	V
$V_{GS}(100\%) =$	20	V
$V_{DS}(100\%) =$	600	V
$I_D(100\%) =$	40	A
$t_{doff} =$	0,043	$\mu s$
$t_{Eoff} =$	0,045	$\mu s$

**figure 3.** MOSFET

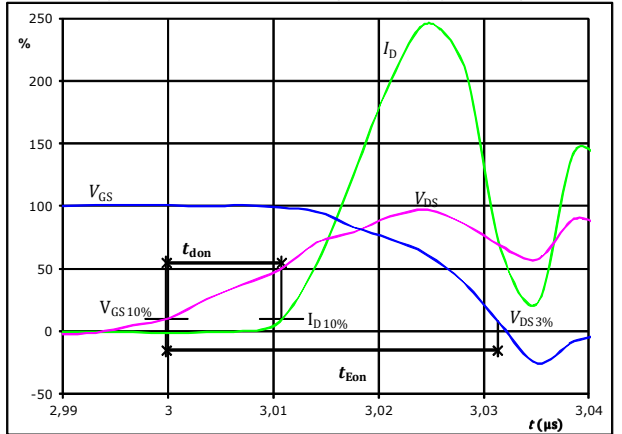
Turn-off Switching Waveforms & definition of  $t_f$



$V_{DS}(100\%) =$	600	V
$I_D(100\%) =$	40	A
$t_f =$	0,012	$\mu s$

**figure 2.** MOSFET

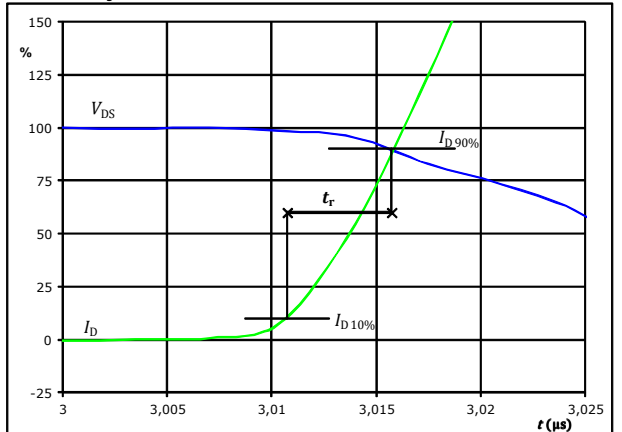
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{GS}(0\%) =$	0	V
$V_{GS}(100\%) =$	20	V
$V_{DS}(100\%) =$	600	V
$I_D(100\%) =$	40	A
$t_{don} =$	0,013	$\mu s$
$t_{Eon} =$	0,031	$\mu s$

**figure 4.** MOSFET

Turn-on Switching Waveforms & definition of  $t_r$



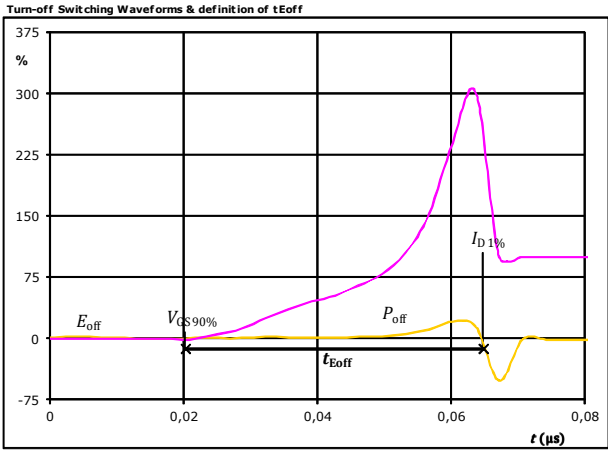
$V_{DS}(100\%) =$	600	V
$I_D(100\%) =$	40	A
$t_r =$	0,005	$\mu s$



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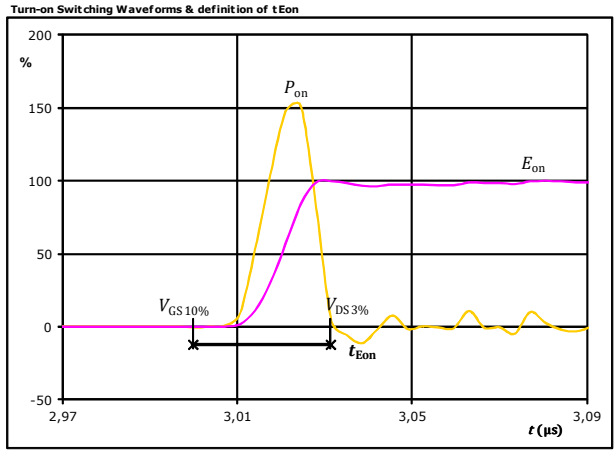
## Inverter Switching Characteristics

figure 5. MOSFET



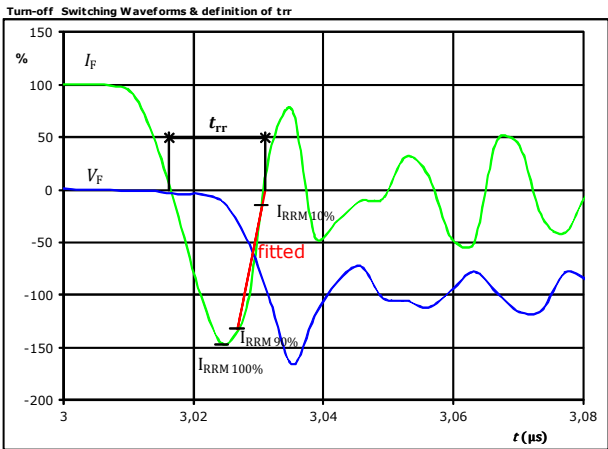
$P_{off}(100\%) = 23,94$  kW  
 $E_{off}(100\%) = 0,06$  mJ  
 $t_{Eoff} = 0,04$  μs

figure 6. MOSFET



$P_{on}(100\%) = 23,94$  kW  
 $E_{on}(100\%) = 0,45$  mJ  
 $t_{Eon} = 0,03$  μs

figure 7. FWD

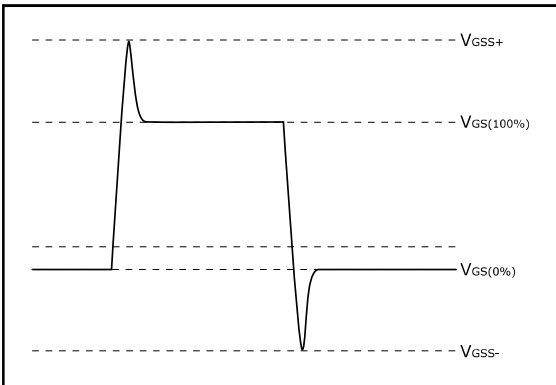


$V_F(100\%) = 600$  V  
 $I_F(100\%) = 40$  A  
 $I_{RRM}(100\%) = -58$  A  
 $t_{rr} = 0,015$  μs



### Inverter Switching Characteristics

figure 8.  
Gate maximum operating boundaries



$V_{GSS+} =$	19 V
$V_{GS(100\%)} =$	15 V
$V_{GS(0\%)} =$	-4 V
$V_{GSS-} =$	-8 V

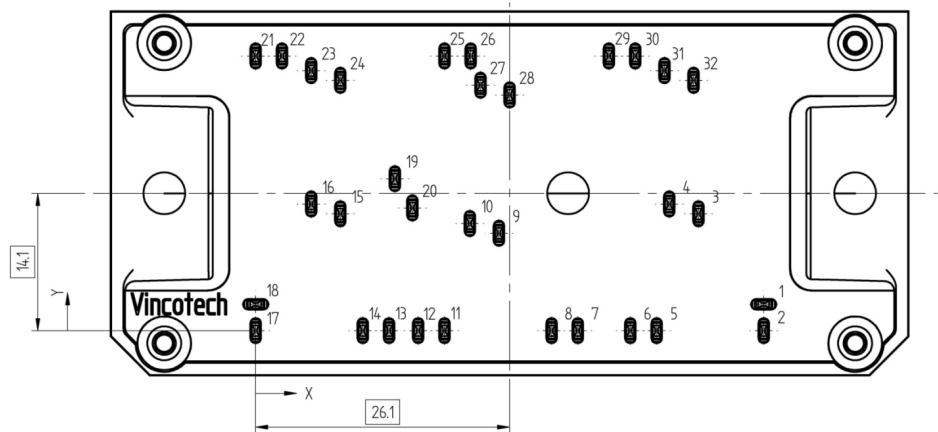
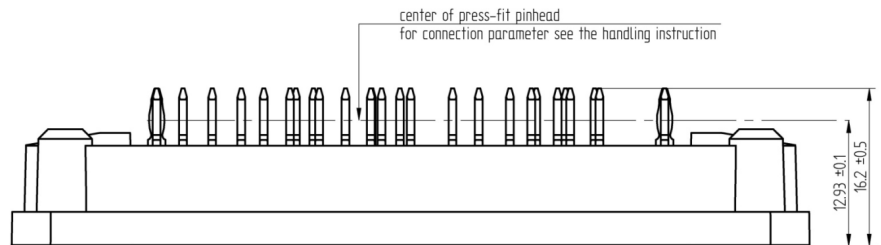


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Ordering Code & Marking								
Version			Ordering Code					
without thermal paste			10-PY096PA035ME-L224F18Y					
with thermal paste			10-PY096PA035ME-L224F18Y-/3/					
NN-NNNNNNNNNNNN TTTTIVVWWYY UL VIN LLLLL SSSS			Name		Date code	UL & VIN	Lot	Serial
			NN-NNNNNNNNNNNN-TTTTIVV		WWYY	UL VIN	LLLLL	SSSS
			Type&Ver	Lot number	Serial	Date code		
Datamatrix			TTTTTIVV	LLLLL	SSSS	WWYY		

**Outline**

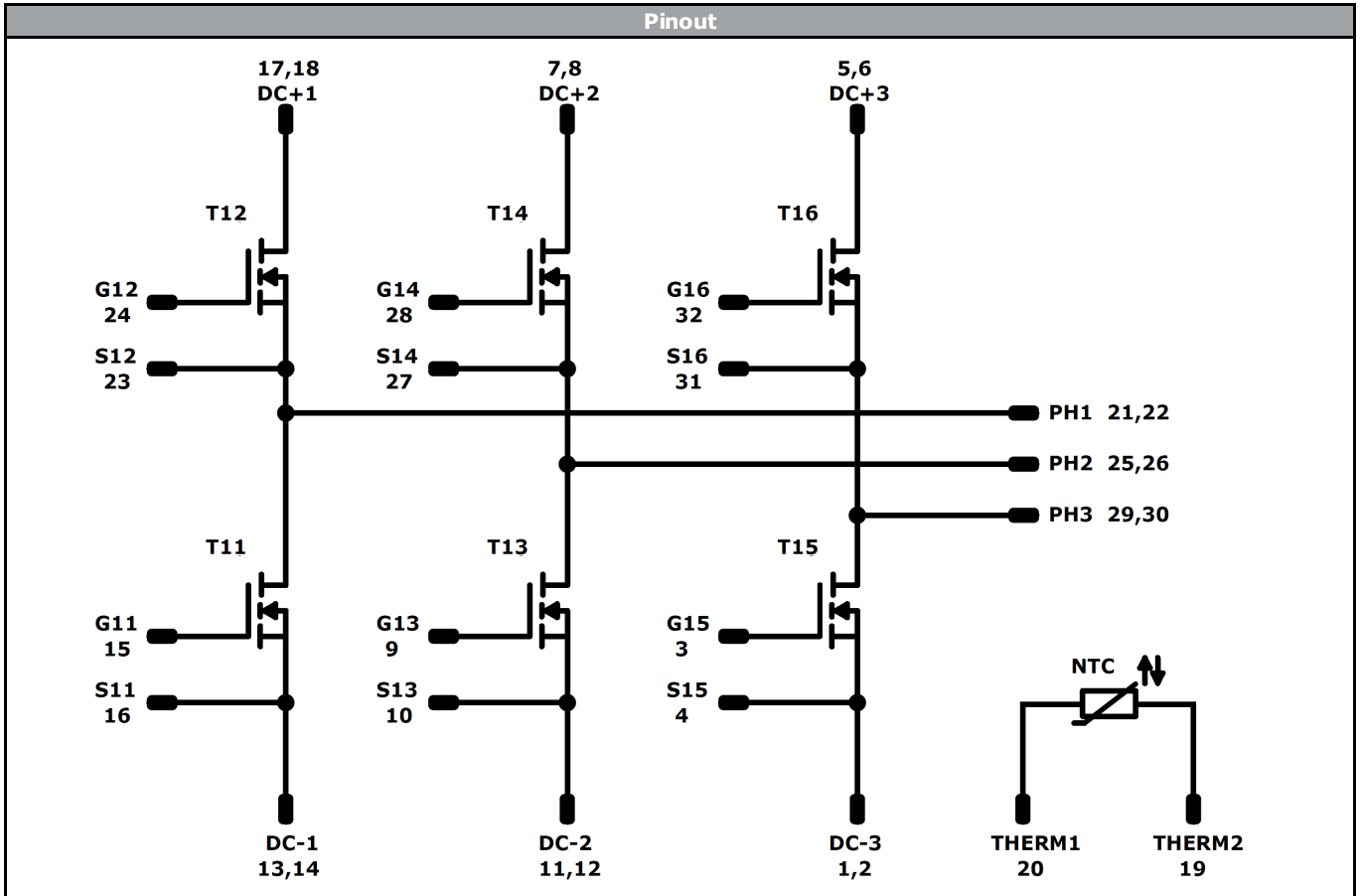
Pin table			
Pin	X	Y	Functions
1	52,2	2,7	DC-3
2	52,2	0	DC-3
3	45,5	12	G15
4	42,5	13	S15
5	41,2	0	DC+3
6	38,5	0	DC+3
7	33,1	0	DC+2
8	30,4	0	DC+2
9	25	10	G13
10	22	11	S13
11	19,4	0	DC-2
12	16,7	0	DC-2
13	13,7	0	DC-1
14	11	0	DC-1
15	8,7	12	G11
16	5,7	13	S11
17	0	0	DC+1
18	0	2,7	DC+1
19	14,3	15,6	THERM2
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 pinpositions: ±0,5mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance



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<b>Identification</b>					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	MOSFET	900 V	39 mΩ	Inverter Switch	
NTC	NTC			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.

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-PY096PA035ME-L224F18Y-D1-14	13 Jul. 2017		

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.

单击下面可查看定价，库存，交付和生命周期等信息

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