



Vincotech

10-F012PNA010M7-P849C29

datasheet

flowPIM 0

1200 V / 10 A

Topology features

- Converter+Inverter
- Open Emitter configuration
- Temperature sensor

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

Housing features

- Base isolation: Al_2O_3
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

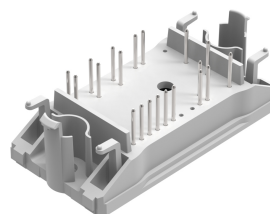
Target applications

- Industrial Drives

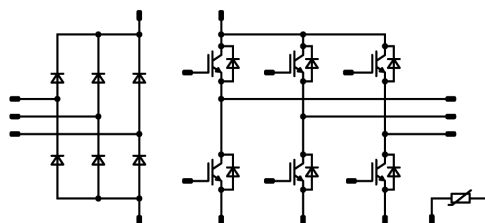
Types

- 10-F012PNA010M7-P849C29

flow 0 17 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	20 ⁽¹⁾	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	55	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	°C

⁽¹⁾ limited by I_{CRM}

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	20 ⁽²⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Maximum junction temperature	T_{jmax}		175	°C

⁽²⁾ limited by I_{FRM}

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Maximum junction temperature	T_{jmax}		150	°C



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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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
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 200	

*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

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,001	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,9 1,96	2,1 ⁽³⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			35	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		2000		pF
Output capacitance	C_{oes}							86		pF
Reverse transfer capacitance	C_{res}							23		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		10	25		80		nC

Thermal

Thermal resistance junction to sink ⁽⁴⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,72		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32$ Ω $R_{goff} = 32$ Ω	±15	600	10	25 125 150		127,8 125,6 123,4		ns
Rise time	t_r					25 125 150		29 32,2 33,8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		145,2 179,2 182		ns
Fall time	t_f					25 125 150		98,1 107,57 116,71		ns
Turn-on energy (per pulse)	E_{on}					25 125 150		0,883 1,12 1,19		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,656 0,86 0,908		mWs



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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 Diode

Static

Forward voltage	V_F				10	25 125 150		1,61 1,69 1,7	1,9 ⁽³⁾	V
Reverse leakage current	I_R	$V_i = 1200$ V				25			25	μA

Thermal

Thermal resistance junction to sink ⁽⁴⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,16		K/W
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Dynamic

Peak recovery current	I_{RM}	$di/dt=278$ A/μs $di/dt=270$ A/μs $di/dt=272$ A/μs	± 15	600	10	25 125 150		8,67 9,25 9,34		A
Reverse recovery time	t_{rr}					25 125 150		254,4 372,9 409		ns
Recovered charge	Q_r					25 125 150		1,09 1,66 1,81		μC
Reverse recovered energy	E_{rec}					25 125 150		0,374 0,62 0,68		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		84,75 53,58 49,28		A/μs



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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	

Rectifier Diode

Static

Forward voltage	V_F				8	25 125		0,996 0,907	1,21 ⁽³⁾ 1,1 ⁽³⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25			50	μA

Thermal

Thermal resistance junction to sink ⁽⁴⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,59		K/W
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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	

⁽³⁾ Value at chip level

⁽⁴⁾ Only valid with pre-applied Vincotech thermal interface material.



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Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

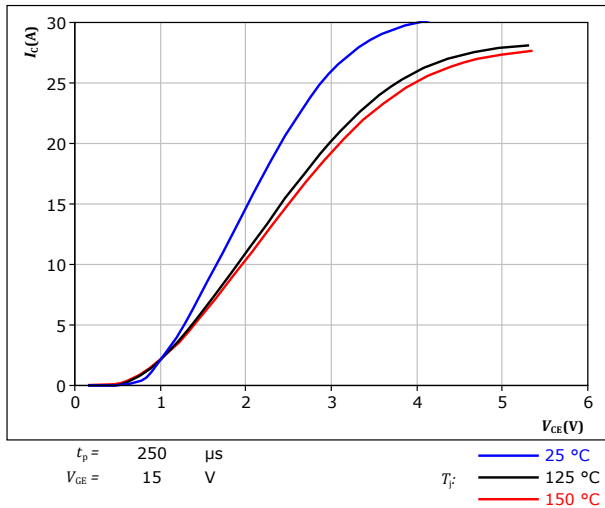


figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

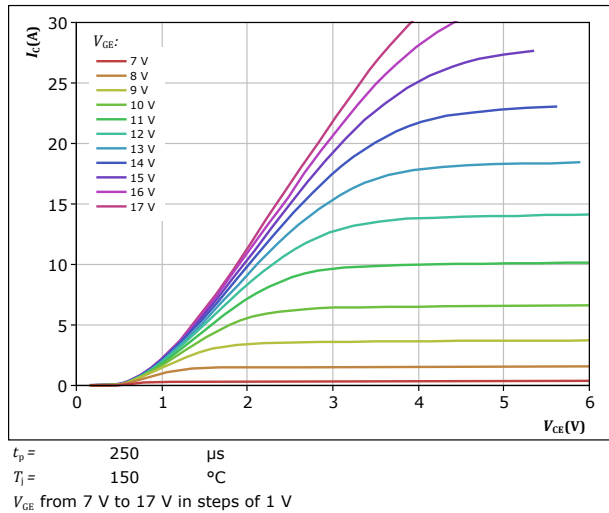


figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

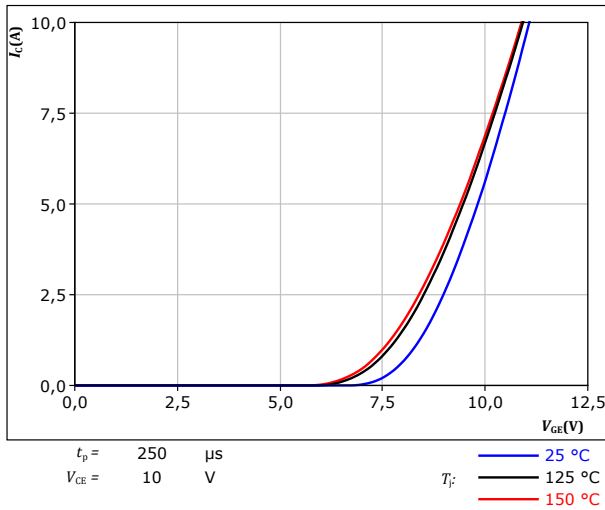
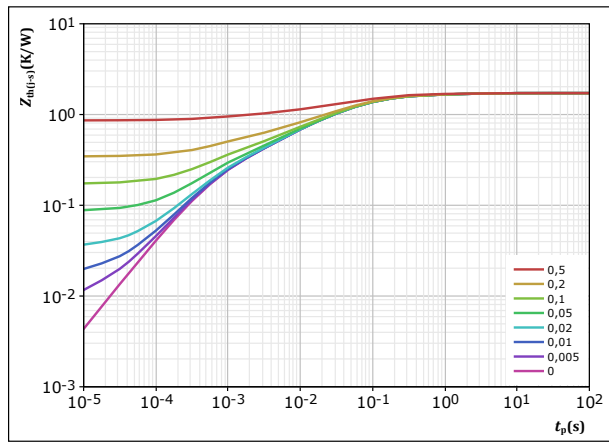


figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



IGBT thermal model values	
R (K/W)	τ (s)
8,08E-02	2,32E+00
2,21E-01	2,45E-01
6,51E-01	6,03E-02
3,93E-01	1,33E-02
1,95E-01	3,15E-03
1,82E-01	5,45E-04



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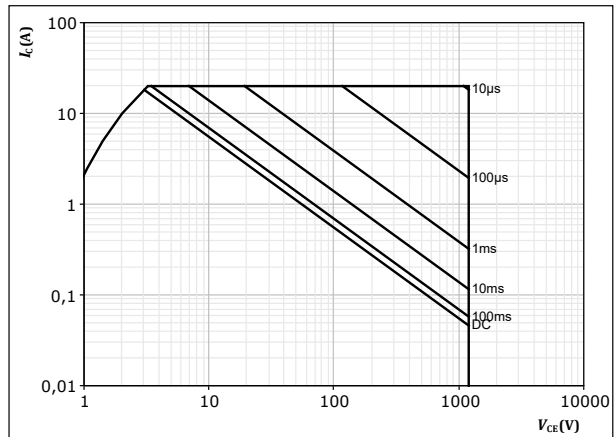
datasheet

Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$

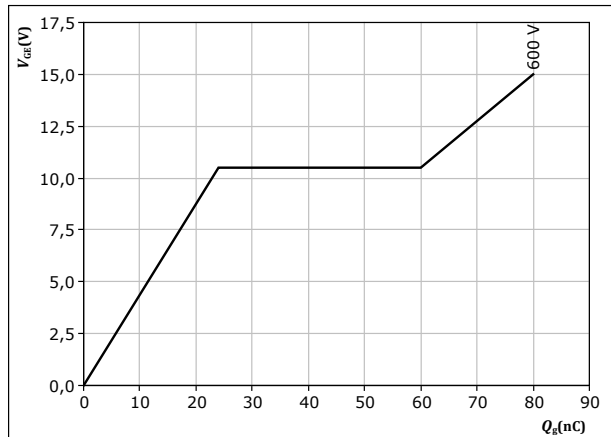


$D =$ single pulse
 $T_s = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 6. IGBT

Gate voltage vs gate charge

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



$I_C = 10$ A
 $T_j = 25$ °C



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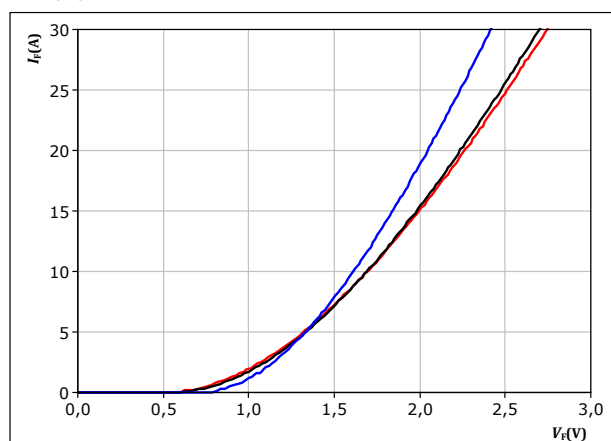
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Inverter Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$



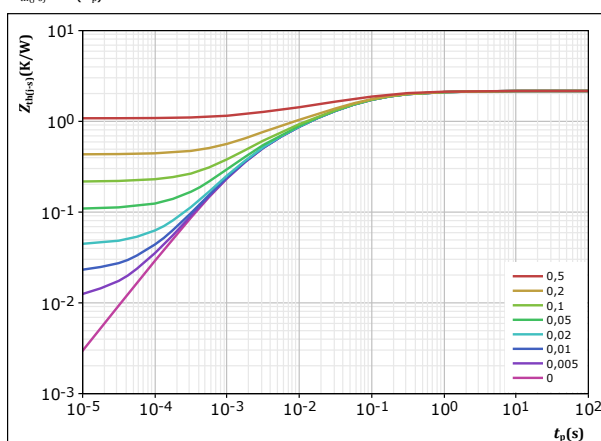
$t_p = 250 \mu s$

T_j : 25 °C, 125 °C, 150 °C

figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 2,162 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
9,29E-02	2,25E+00
3,88E-01	2,05E-01
7,75E-01	5,06E-02
5,89E-01	8,88E-03
3,17E-01	1,48E-03



Rectifier Diode Characteristics

figure 9.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

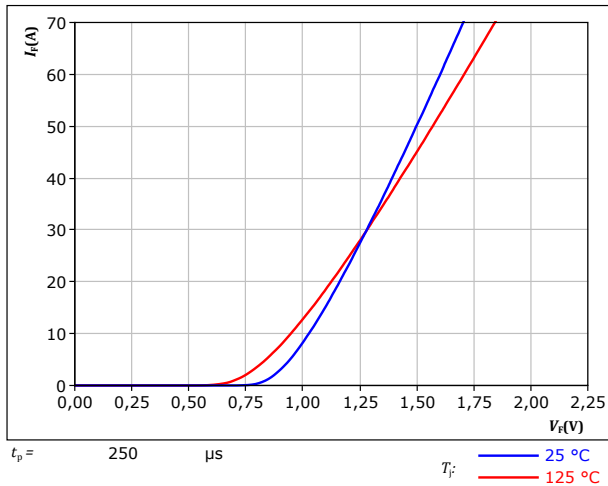
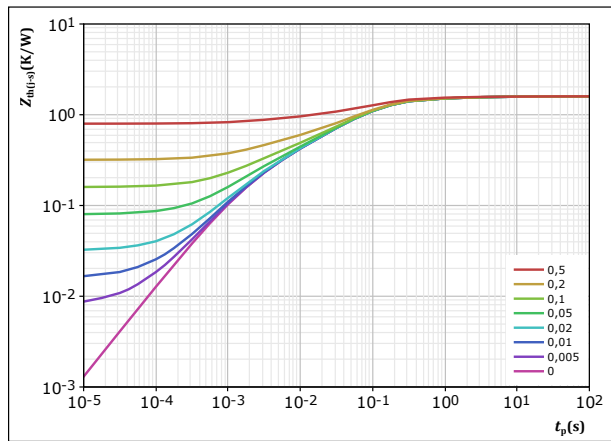


figure 10.

Rectifier

Transient thermal impedance as a function of pulse width

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



Rectifier thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04



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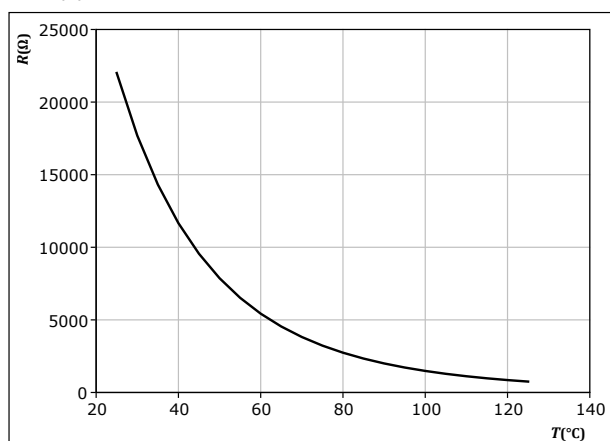
Thermistor Characteristics

figure 11.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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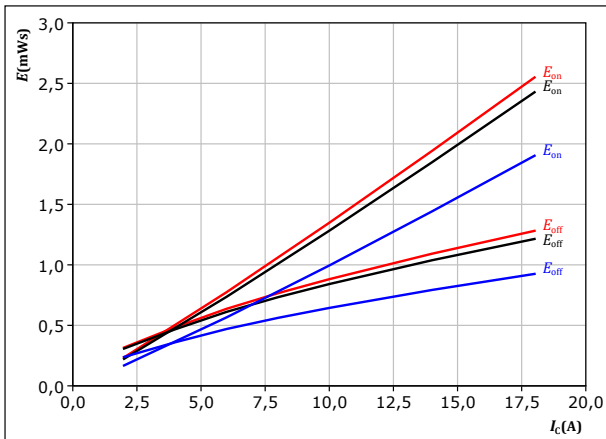
Inverter Switching Characteristics

figure 12.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 32 \text{ } \Omega$

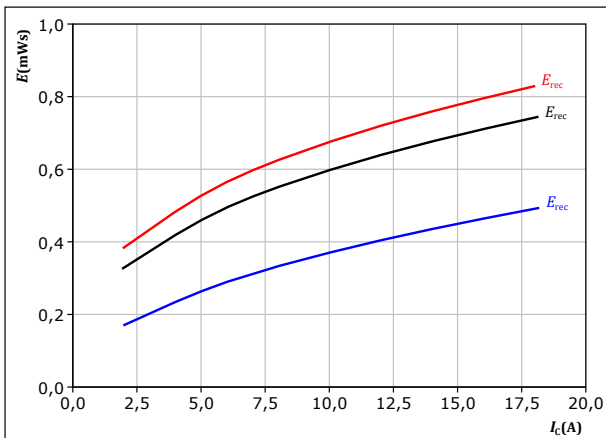
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 14.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$

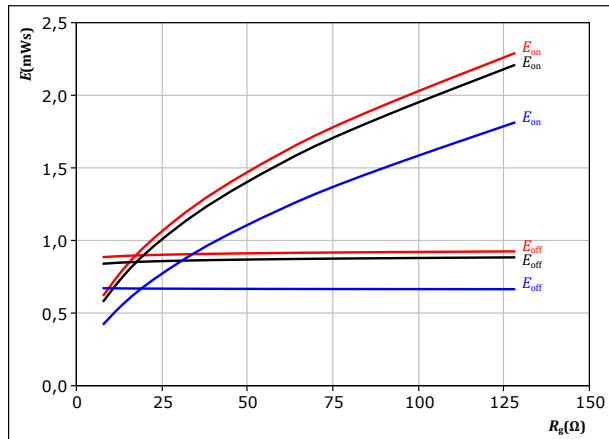
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 13.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 10 \text{ A}$

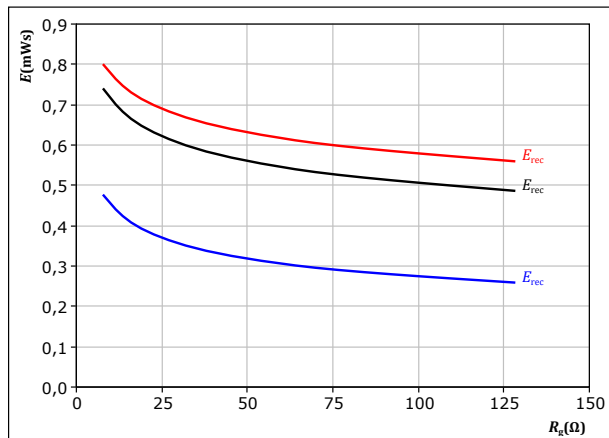
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 15.

FWD

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

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 10 \text{ A}$

T_j :
— 25 °C
— 125 °C
— 150 °C



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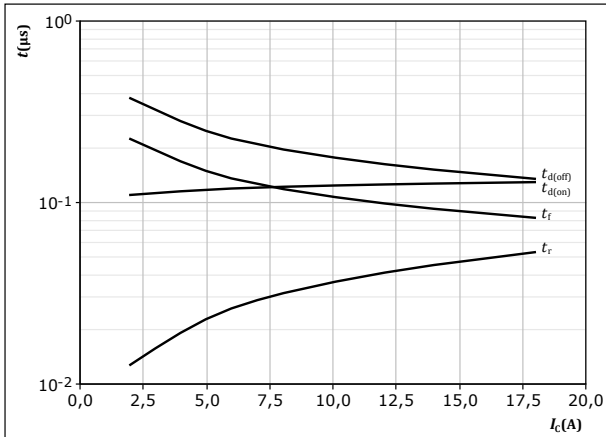
Inverter Switching Characteristics

figure 16.

IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



With an inductive load at

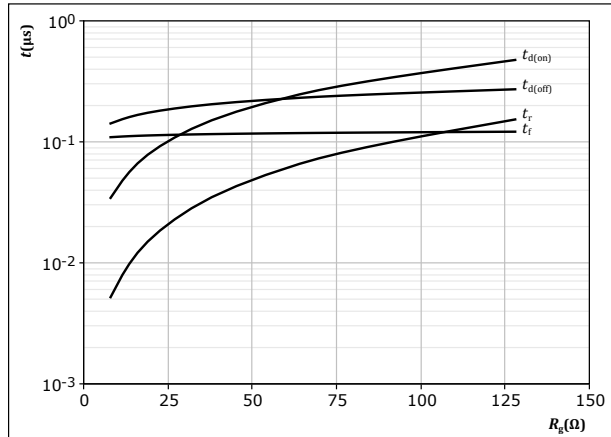
$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

figure 17.

IGBT

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

$$t = f(R_g)$$



With an inductive load at

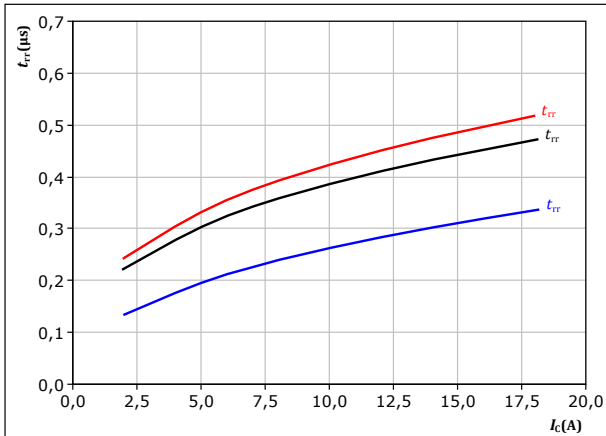
$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_c =$	10	A

figure 18.

FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

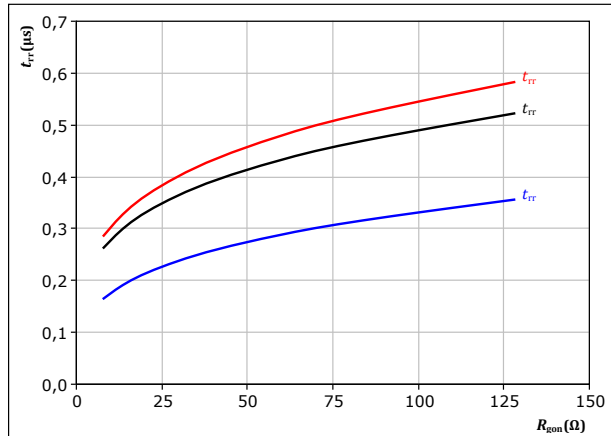
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 19.

FWD

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

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



With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_c =$	10	A

T_j :
— 25 °C
— 125 °C
— 150 °C



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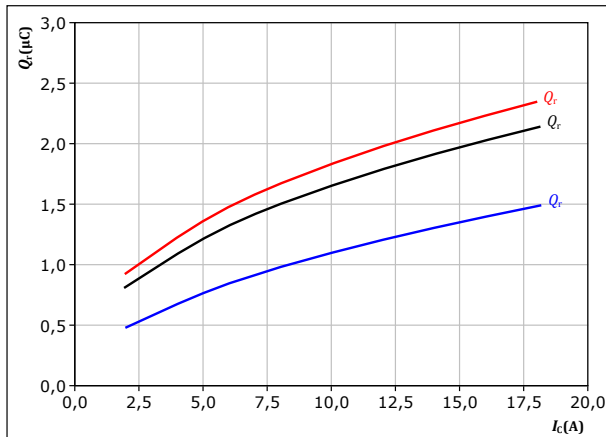
Inverter Switching Characteristics

figure 20.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

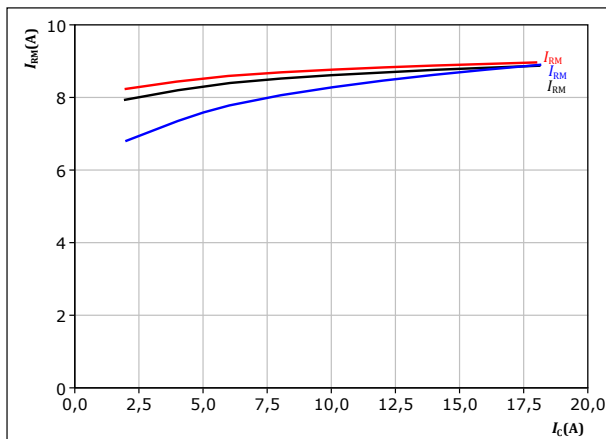
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 22.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

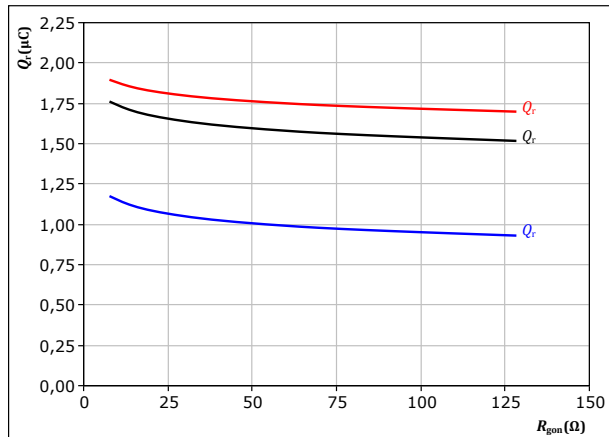
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 21.

FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

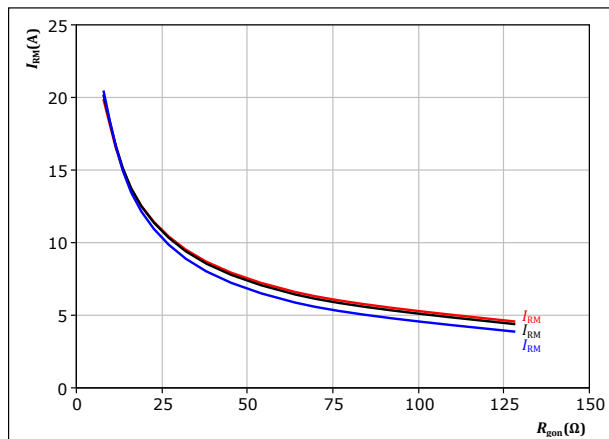
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 23.

FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



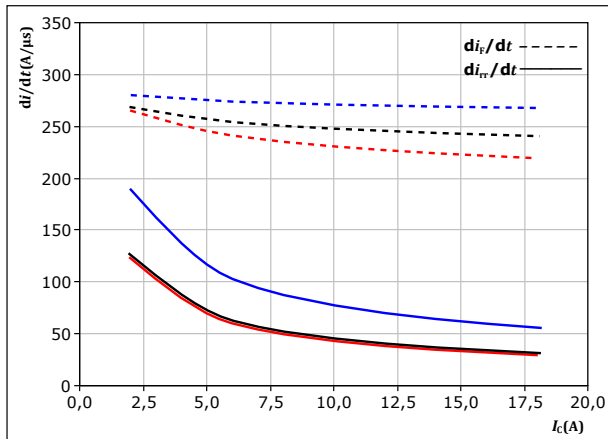
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Inverter Switching Characteristics

figure 24. FWD

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

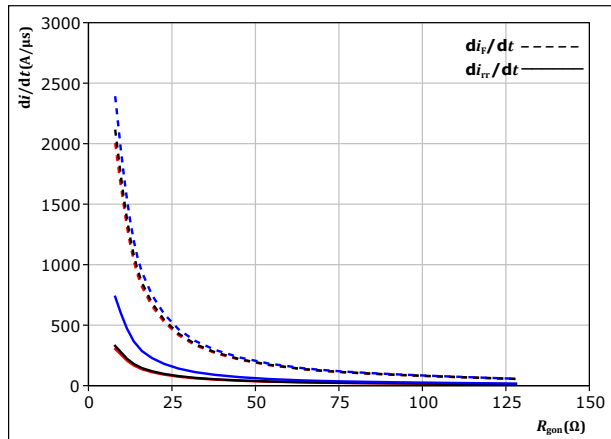


With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $T_j: 25^\circ\text{C}$ (blue), 125°C (black), 150°C (red)

figure 25. FWD

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



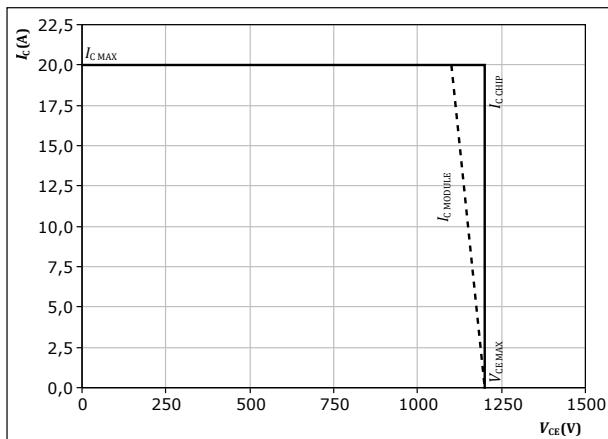
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A
 $T_j: 25^\circ\text{C}$ (blue), 125°C (black), 150°C (red)

figure 26. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 150^\circ\text{C}$
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω



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Inverter Switching Definitions

figure 27. IGBT

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

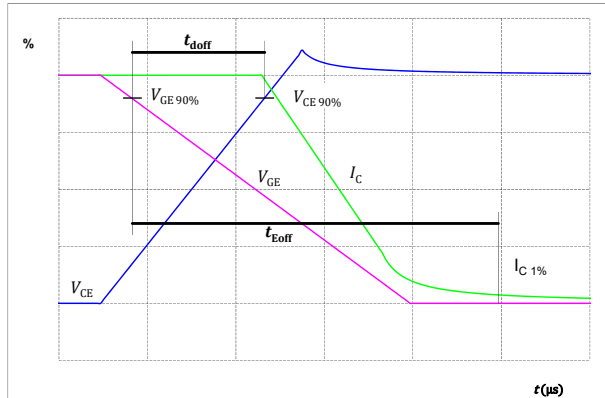


figure 28. IGBT

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

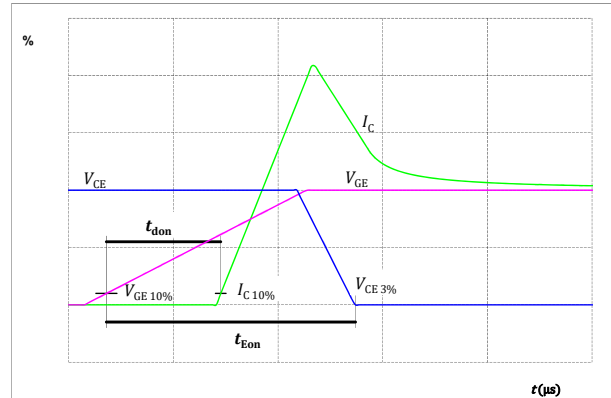


figure 29. IGBT

Turn-off Switching Waveforms & definition of t_f

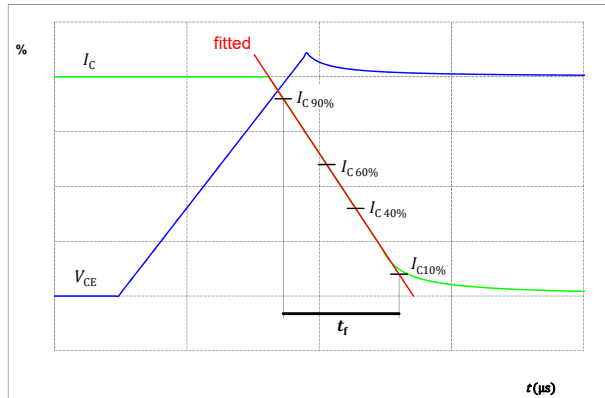
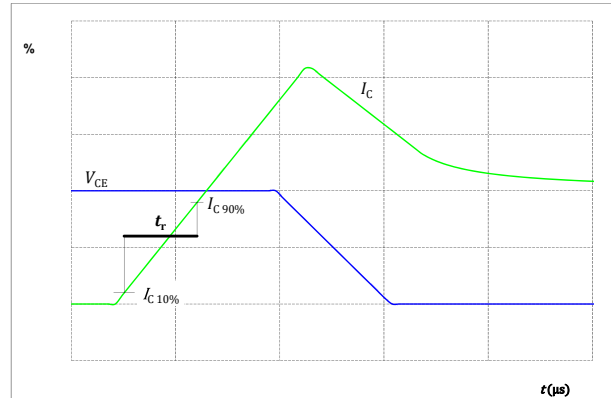


figure 30. IGBT

Turn-on Switching Waveforms & definition of t_r





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Inverter Switching Definitions

figure 31.

FWD

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

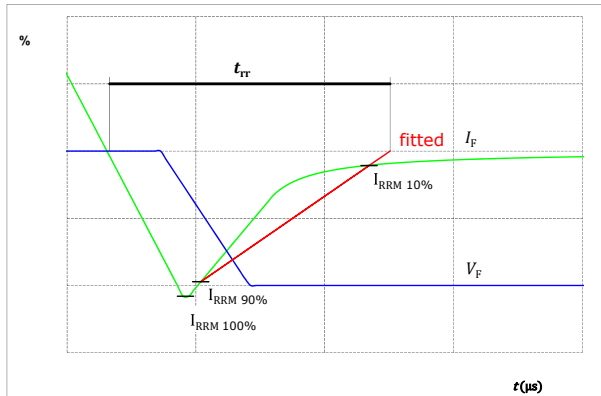
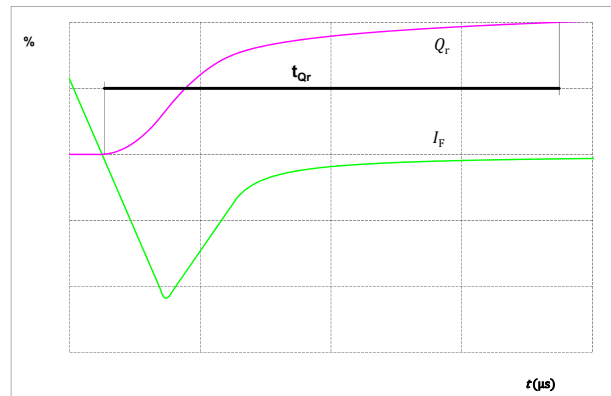


figure 32.

FWD

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





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10-F012PNA010M7-P849C29

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-F012PNA010M7-P849C29
With thermal paste (5,2 W/mK, PTM6000HV)	10-F012PNA010M7-P849C29-/7/

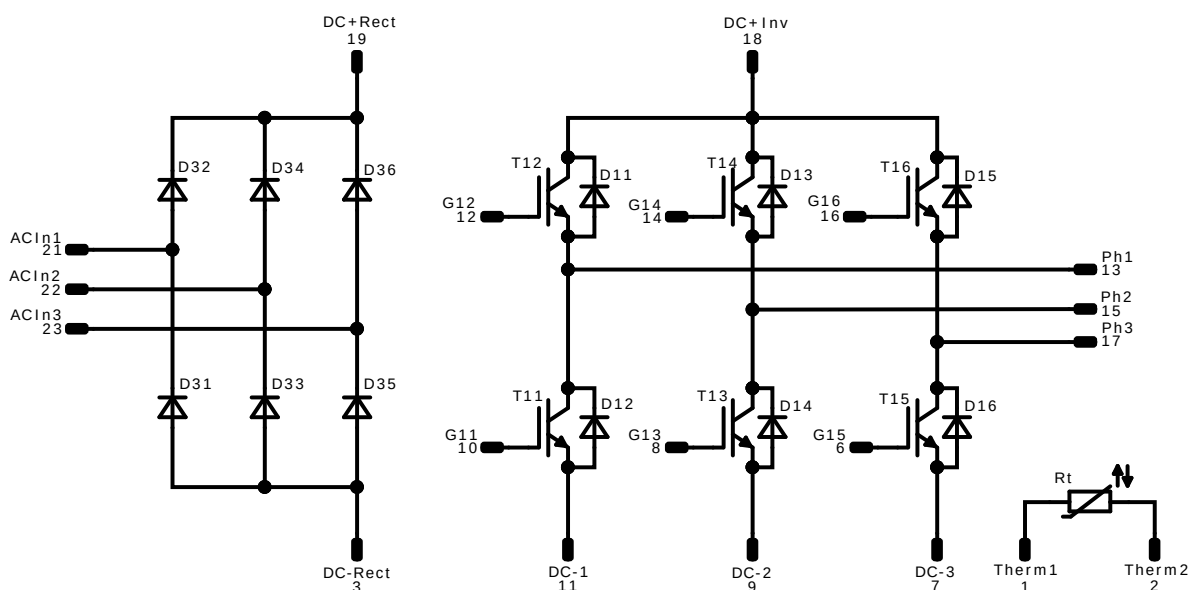
Marking						
	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNNNN- TTTTIVV	WWYY	UL VIN	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
		TTTTTIVV	LLLL	SSSS	WWYY	

Outline																																																																																																			
Pin table [mm] <table><tr><th>Pin</th><th>X</th><th>Y</th><th>Function</th></tr><tr><td>1</td><td>25,5</td><td>2,7</td><td>Therm1</td></tr><tr><td>2</td><td>25,5</td><td>0</td><td>Therm2</td></tr><tr><td>3</td><td>22,8</td><td>0</td><td>DC-Rect</td></tr><tr><td>4</td><td colspan="3">not assembled</td></tr><tr><td>5</td><td colspan="3">not assembled</td></tr><tr><td>6</td><td>13,5</td><td>0</td><td>G15</td></tr><tr><td>7</td><td>10,8</td><td>0</td><td>DC-3</td></tr><tr><td>8</td><td>8,1</td><td>0</td><td>G13</td></tr><tr><td>9</td><td>5,4</td><td>0</td><td>DC-2</td></tr><tr><td>10</td><td>2,7</td><td>0</td><td>G11</td></tr><tr><td>11</td><td>0</td><td>0</td><td>DC-1</td></tr><tr><td>12</td><td>0</td><td>19,8</td><td>G12</td></tr><tr><td>13</td><td>0</td><td>22,5</td><td>Ph1</td></tr><tr><td>14</td><td>7,5</td><td>19,8</td><td>G14</td></tr><tr><td>15</td><td>7,5</td><td>22,5</td><td>Ph2</td></tr><tr><td>16</td><td>15</td><td>19,8</td><td>G16</td></tr><tr><td>17</td><td>15</td><td>22,5</td><td>Ph3</td></tr><tr><td>18</td><td>22,8</td><td>22,5</td><td>DC+Inv</td></tr><tr><td>19</td><td>25,5</td><td>22,5</td><td>DC+Rect</td></tr><tr><td>20</td><td colspan="3">not assembled</td></tr><tr><td>21</td><td>33,5</td><td>15</td><td>ACIn1</td></tr><tr><td>22</td><td>33,5</td><td>7,5</td><td>ACIn2</td></tr><tr><td>23</td><td>33,5</td><td>0</td><td>ACIn3</td></tr></table>				Pin	X	Y	Function	1	25,5	2,7	Therm1	2	25,5	0	Therm2	3	22,8	0	DC-Rect	4	not assembled			5	not assembled			6	13,5	0	G15	7	10,8	0	DC-3	8	8,1	0	G13	9	5,4	0	DC-2	10	2,7	0	G11	11	0	0	DC-1	12	0	19,8	G12	13	0	22,5	Ph1	14	7,5	19,8	G14	15	7,5	22,5	Ph2	16	15	19,8	G16	17	15	22,5	Ph3	18	22,8	22,5	DC+Inv	19	25,5	22,5	DC+Rect	20	not assembled			21	33,5	15	ACIn1	22	33,5	7,5	ACIn2	23	33,5	0	ACIn3
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10	2,7	0	G11																																																																																																
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23	33,5	0	ACIn3																																																																																																
Tolerance of pinpositions: ±0.5mm at the end of pins Dimension of coordinate axis is only offset without tolerance																																																																																																			



Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	10 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	10 A	Inverter Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	25 A	Rectifier Diode	
Rt	NTC			Thermistor	



Vincotech

10-F012PNA010M7-P849C29
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow 0</i> packages see vincotech.com website.				
Package data				
Package data for <i>flow 0</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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,sp}=175^{\circ}\text{C}$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.				

Document No.:	Date:	Modification:	Pages
10-F012PNA010M7-P849C29-D1-14	17 Aug. 2026	Initial Release	

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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.