***flow* PACK 2 + R** **1200 V / 100 A**

Features

- Inverter, blocking diodes
- Built-in thermistor
- IGBT4 technology for low saturation losses

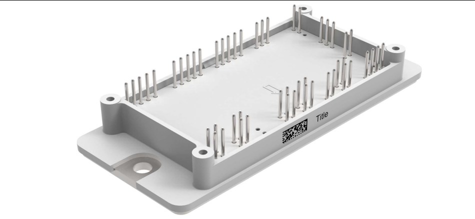
Target Applications

- Industrial Drives

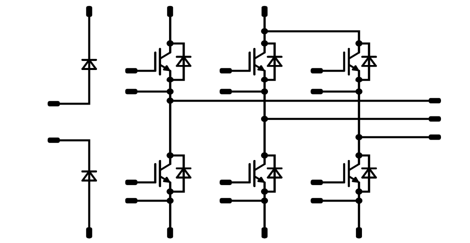
Types

- 30-F212R6A100SC-M449E
- 30-F212R6A100SC01-M449E10

flow 2 17 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
DC Blocking Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	154	A
Surge forward current	I_{FSM}	t_p = 10 ms		1270	A
I^2t-value	I^2t			2400	A^2s
Power dissipation per Diode	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	189	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Switch					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	116	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Turn off safe operating area		$V_{CE} \leq$ 1200V, $T_j \leq T_{op}$ max		200	A
Power dissipation per IGBT	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	307	W
Gate-emitter peak voltage	V_{GE}			20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	64	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		100	A
Power dissipation per Diode	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	127	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_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	DC Test Voltage*	t_p = 2 s	4000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative tracking index	CTI			>200	

* 100 % Tested in production

Characteristic Values

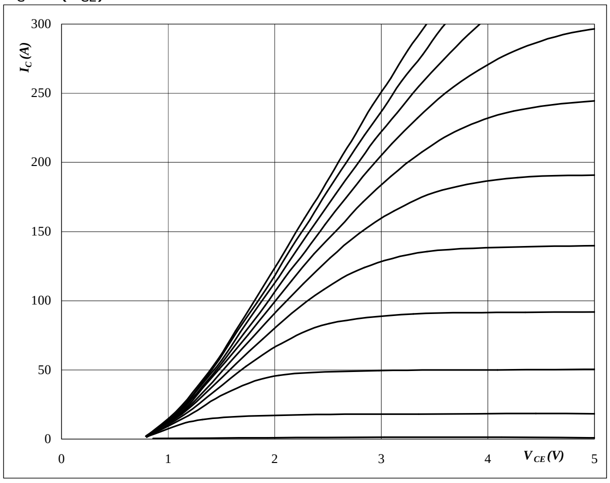
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
DC Blocking Diode										
Forward voltage	V_F				100	25 125		1,12 1,07	1,21	V
Threshold voltage (for power loss calc. only)	V_{to}				100	25 125		0,89 0,76		V
Slope resistance (for power loss calc. only)	r_t				100	25 125		2 3		mΩ
Reverse current	I_r			1600		25			0,05	mA
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,37		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0034	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 150	1,6	1,88 2,26	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,028	mA
Gate-emitter leakage current	I_{GES}		20	0		25			1200	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	±15	600	100	25 150		105 109		ns
Rise time	t_r					25 150		23 27		
Turn-off delay time	$t_{d(off)}$					25 150		220 301		
Fall time	t_f					25 150		49 117		
Turn-on energy loss per pulse	E_{on}					25 150		4,67 6,78		mWs
Turn-off energy loss per pulse	E_{off}					25 150		5,28 9,38		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		5540		pF
Output capacitance	C_{oss}							410		
Reverse transfer capacitance	C_{rss}							320		
Gate charge	Q_G		±15	960	100	25		480		nC
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,31		K/W
Inverter Diode										
Diode forward voltage	V_F				50	25 150	1,1	1,74 1,77	2,3	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 4 Ω	±15	600	100	25 150		103,19 118,1		A
Reverse recovery time	t_{rr}					25 150		131,1 289,8		ns
Reverse recovered charge	Q_{rr}					25 150		7,03 13,9		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		4928 2403		A/µs
Reverse recovered energy	E_{rec}					25 150		2,79 5,92		mWs
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,75		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference						25			B	

Inverter Switch/Inverter Diode

Figure 1 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



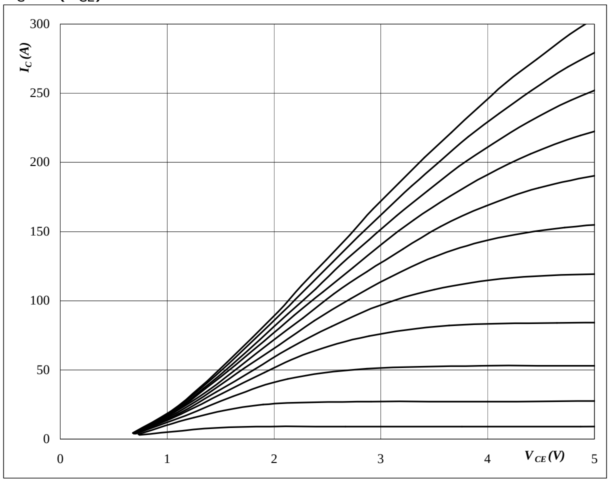
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



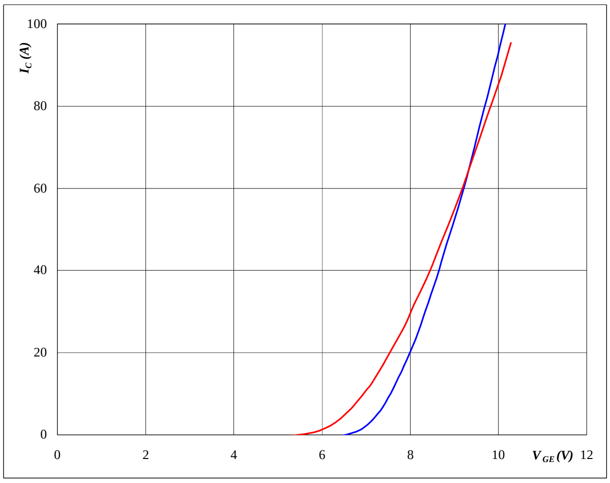
At

t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



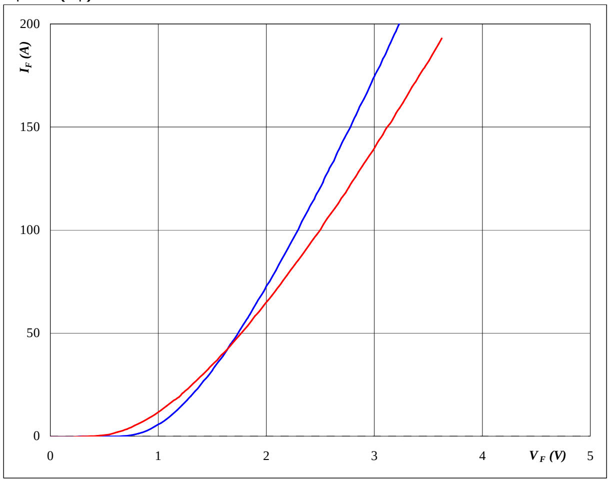
At

Tj =	25/150	°C
t_p =	250	µs
V_{CE} =	10	V

Figure 4 Inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

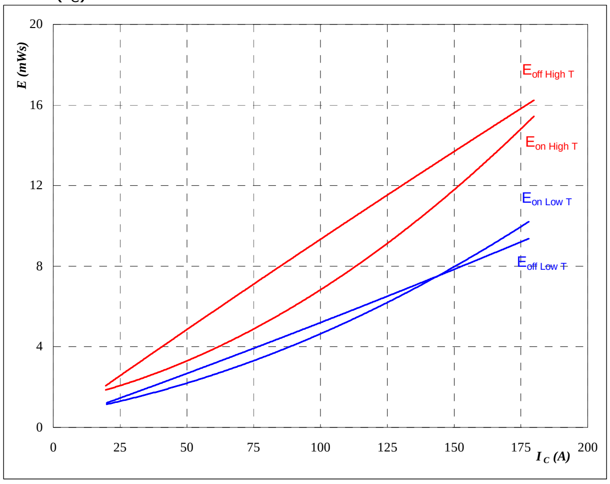
T_j =	25/150	°C
t_p =	250	µs

Inverter Switch/Inverter Diode

Figure 5 Inverter IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



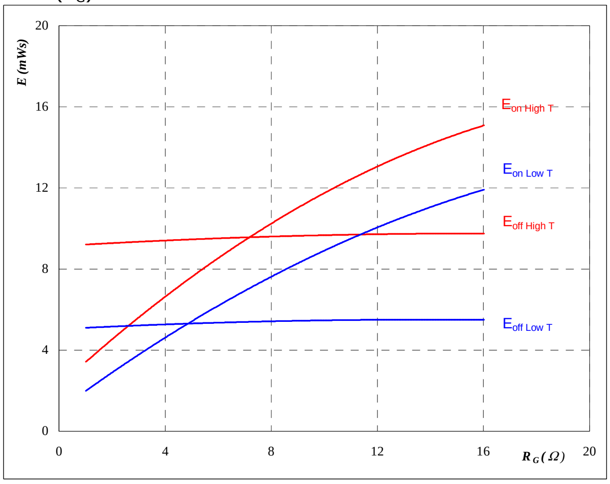
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 Inverter IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



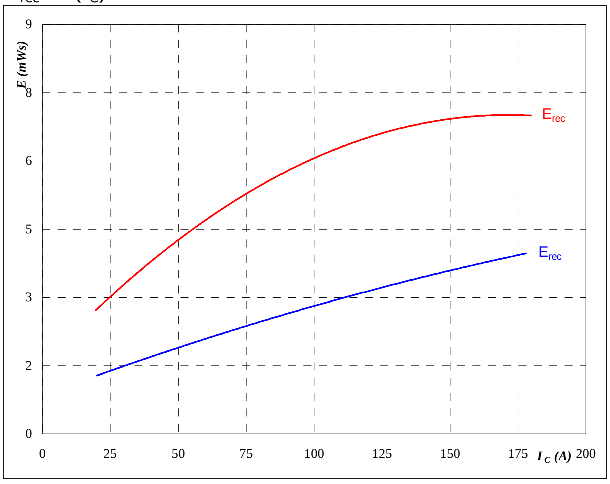
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	99	A

Figure 7 Inverter FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



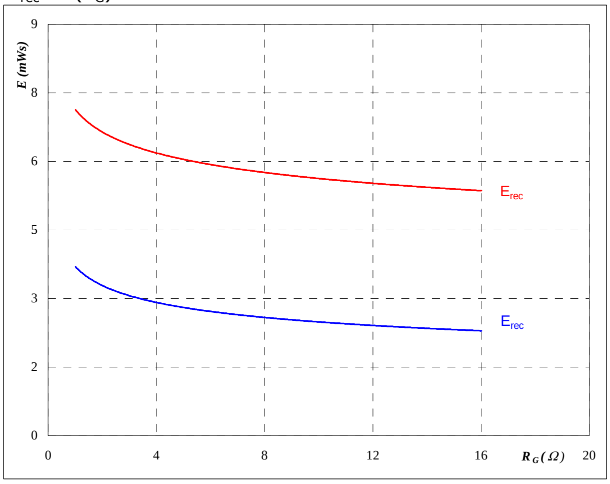
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 8 Inverter FWD

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

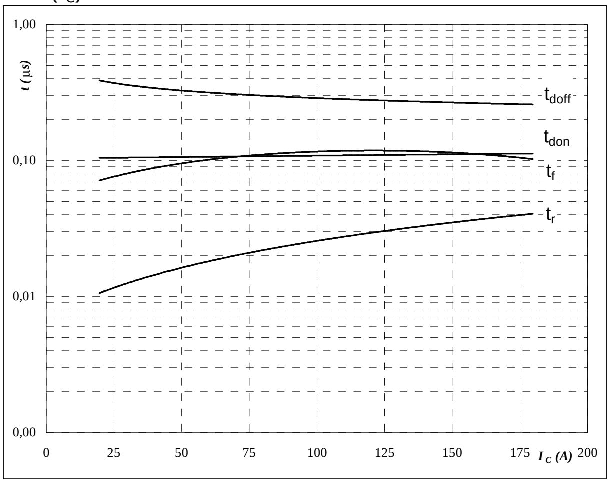
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	99	A

Inverter Switch/Inverter Diode

Figure 9 Inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



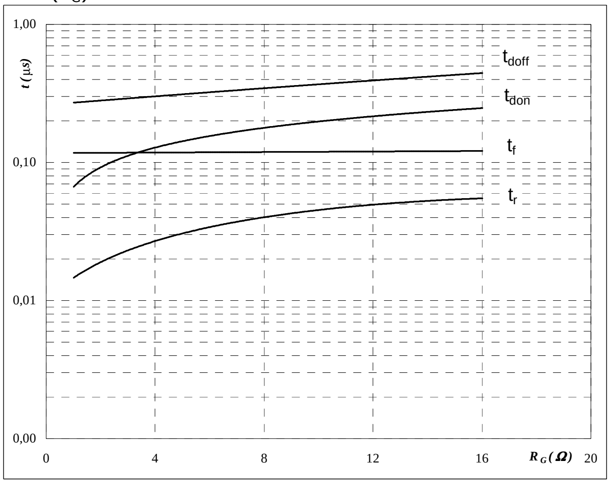
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 Inverter IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



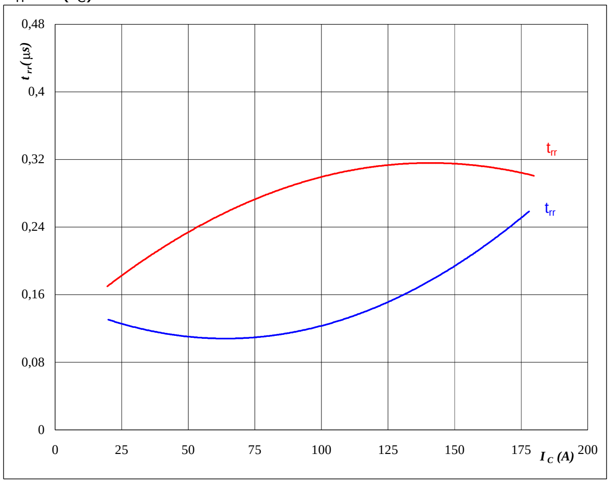
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	99	A

Figure 11 Inverter FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



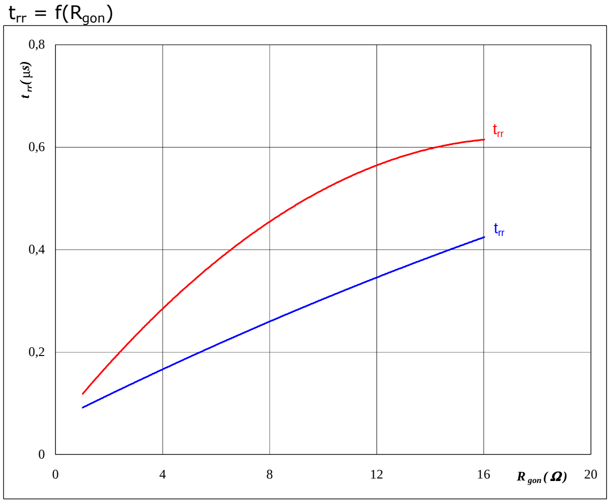
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 12 Inverter FWD

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

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



At

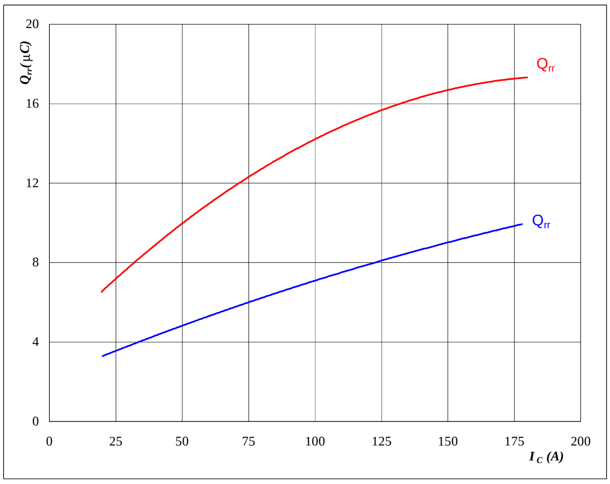
T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Inverter Switch/Inverter Diode

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



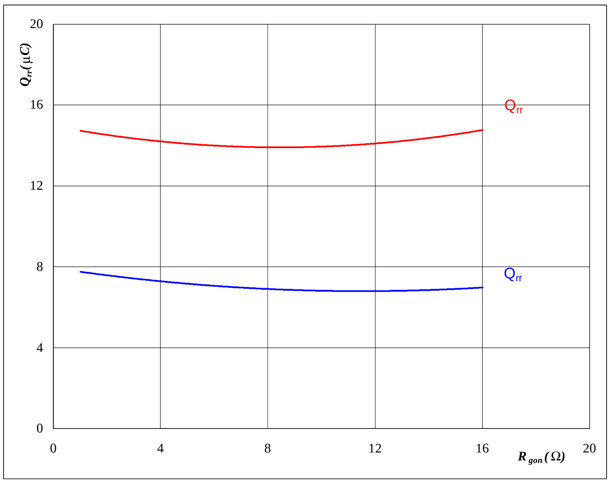
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 14 Inverter FWD

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

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



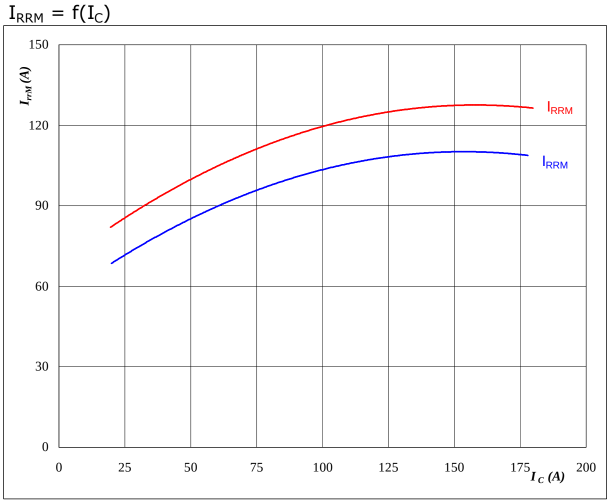
At

T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



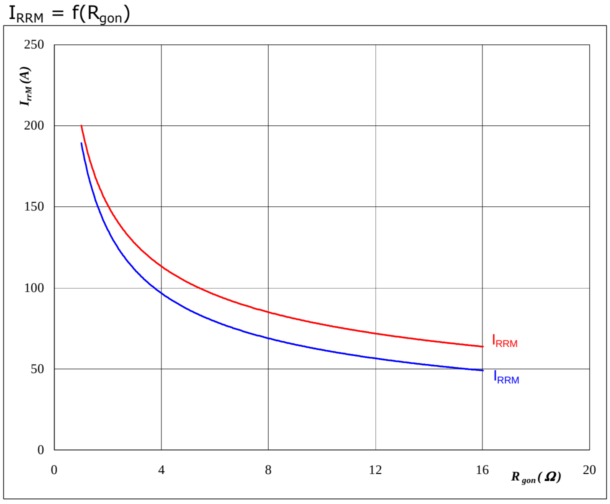
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 16 Inverter FWD

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

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



At

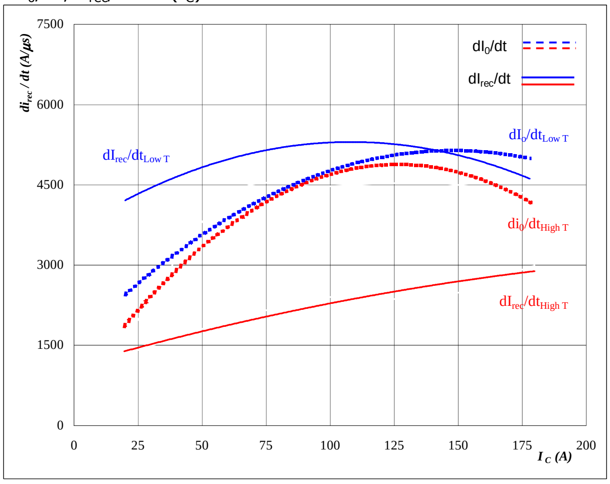
T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Inverter Switch/Inverter Diode

Figure 17 Inverter FWD

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

$dI_0/dt, dI_{rec}/dt = f(I_C)$



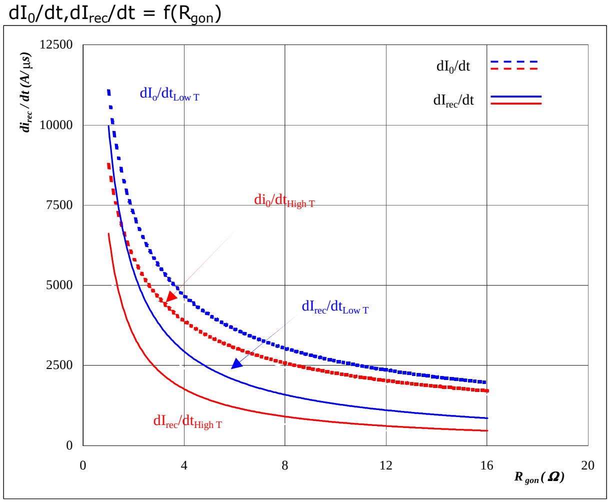
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 18 Inverter FWD

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



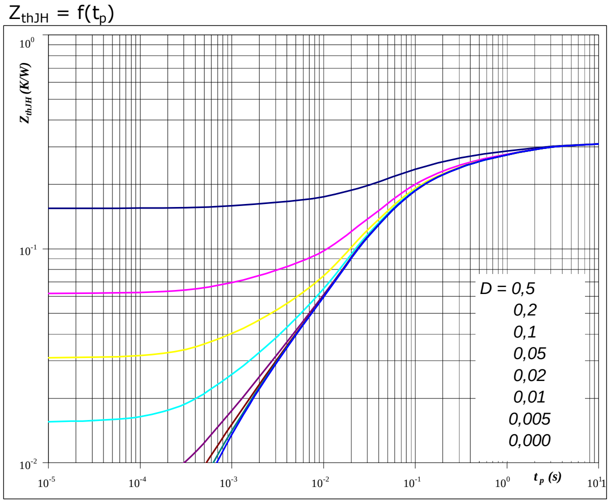
At

T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Figure 19 Inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



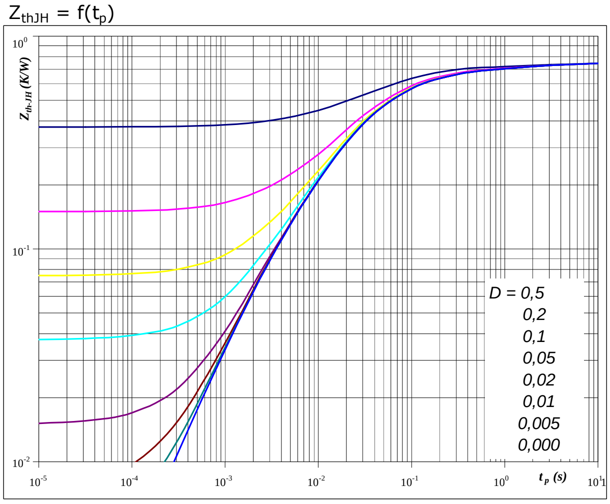
At

D =	t_p / T	
R_{thJH} =	0,31	K/W

Figure 20 Inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,75	K/W

IGBT thermal model values

Phase-Change Material

R (C/W)	Tau (s)
0,06	1,7E+00
0,07	2,3E-01
0,12	5,4E-02
0,04	1,4E-02
0,01	1,2E-03

FWD thermal model values

Phase-Change Material

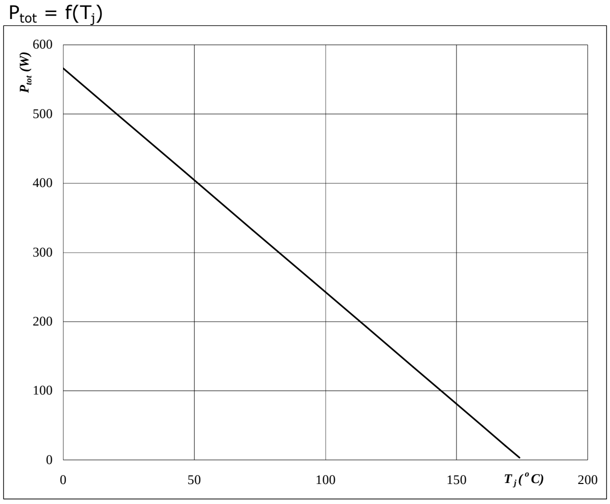
R (C/W)	Tau (s)
0,04	3,6E+00
0,07	6,2E-01
0,25	8,6E-02
0,32	2,1E-02
0,06	3,5E-03

Inverter Switch/Inverter Diode

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



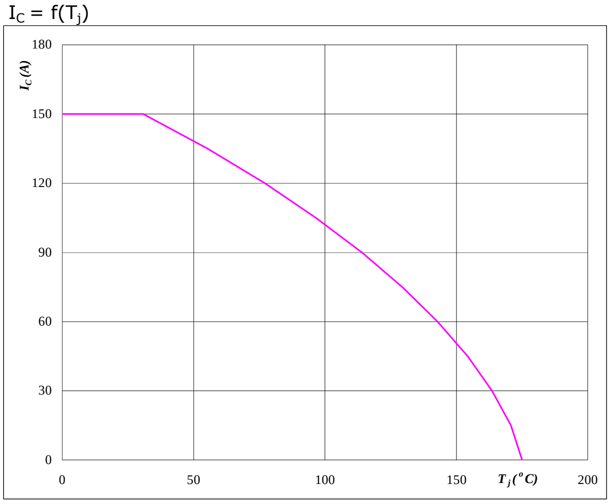
At

T_j = 175 °C

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_j)$



At

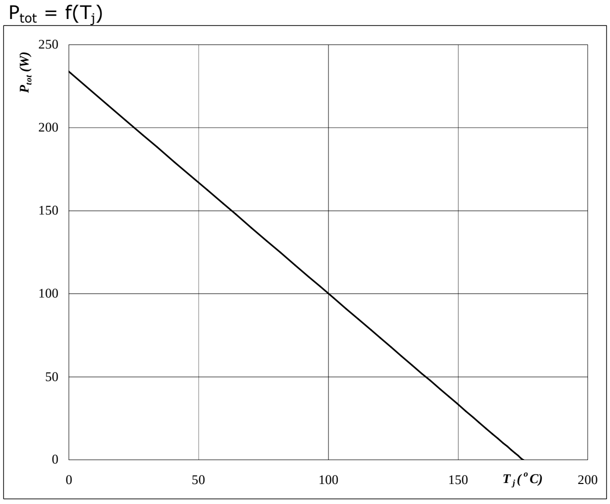
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



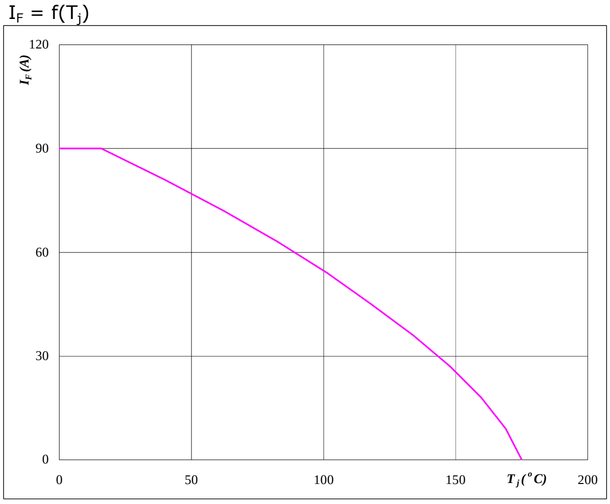
At

T_j = 175 °C

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_j)$



At

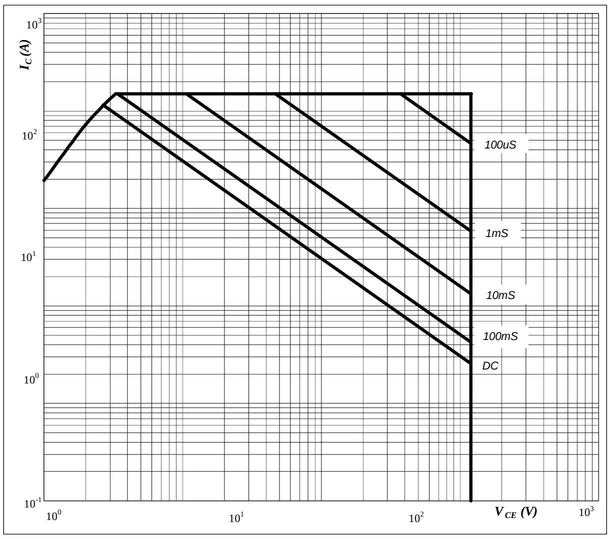
T_j = 175 °C

Inverter Switch/Inverter Diode

Figure 25 Inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



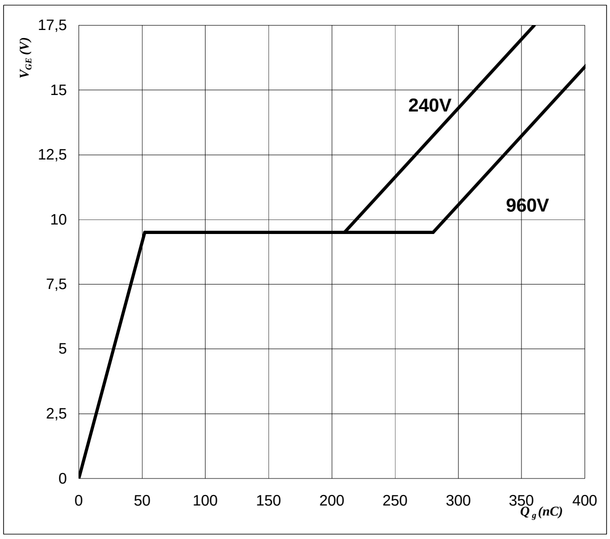
At

D =	single pulse	
T_h =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Figure 26 Inverter IGBT

Gate voltage vs Gate charge

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



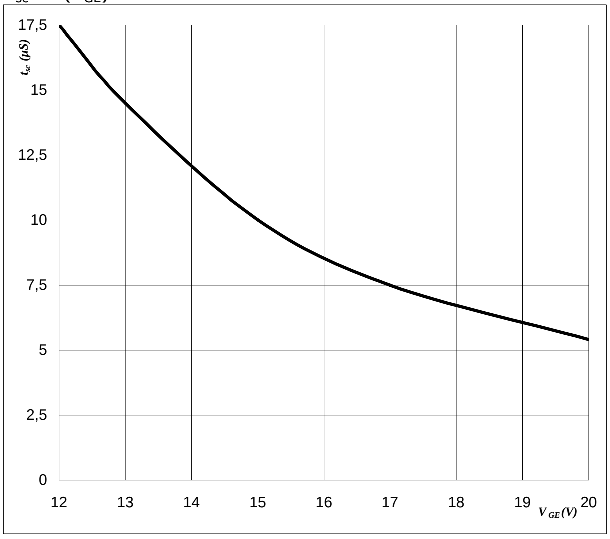
At

I_C =	99	A

Figure 27 Inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



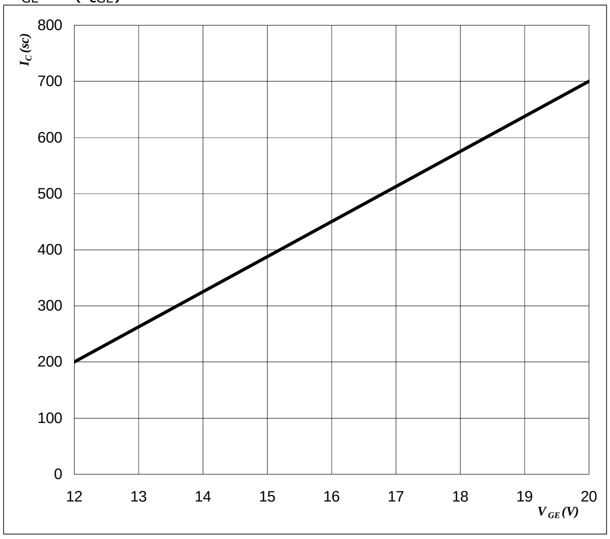
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

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



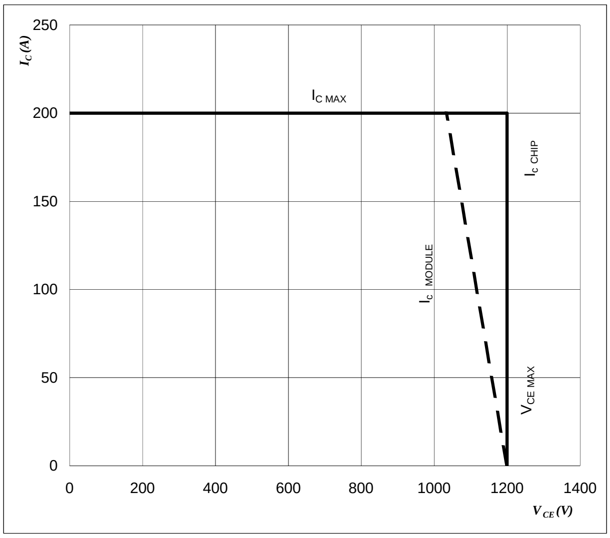
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29	Inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

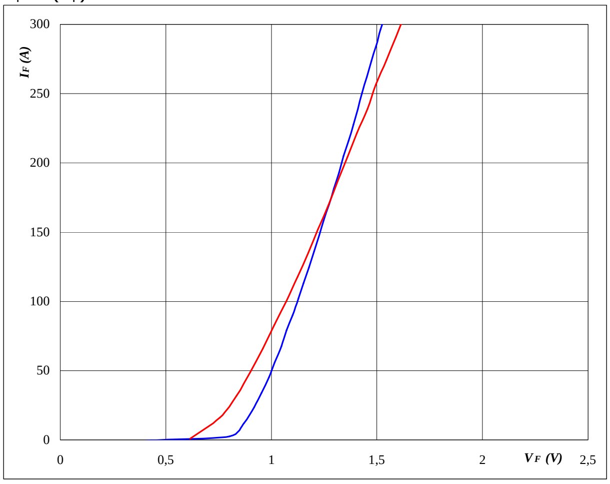
T_j = 151 °C
Rgon = 4 Ω
Rgoff = 4 Ω

DC Blocking Diode

Figure 1 DC Blocking Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

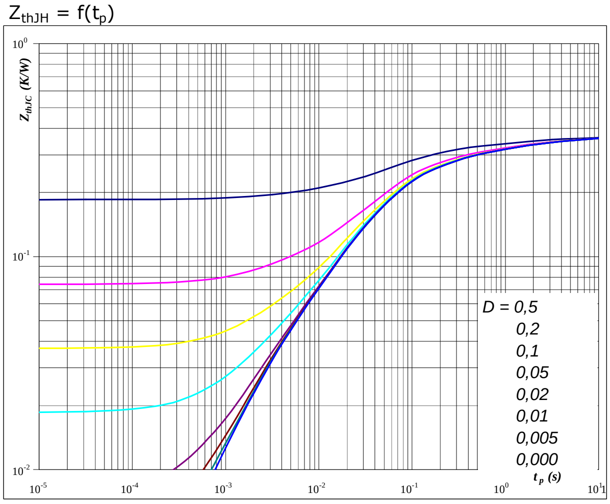
T_j = 25/125 °C

t_p = 250 µs

Figure 2 DC Blocking Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

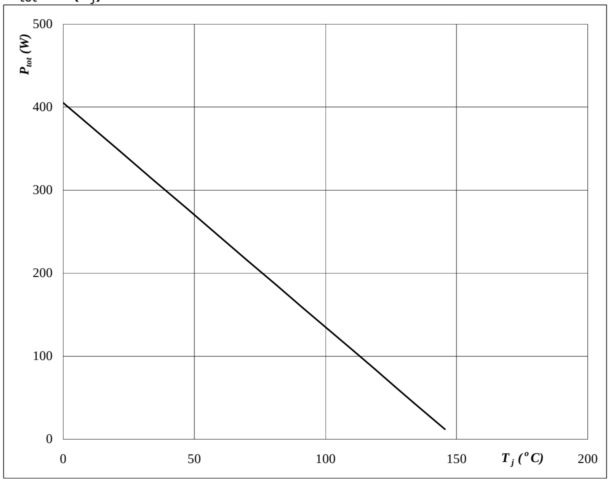
D = t_p / T

R_{thJH} = 0,37 K/W

Figure 3 DC Blocking Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



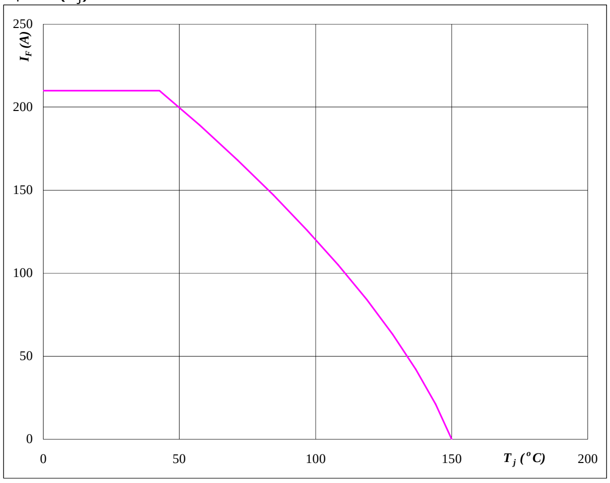
At

T_j = 150 ºC

Figure 4 DC Blocking Diode

Forward current as a function of heatsink temperature

$I_F = f(T_j)$



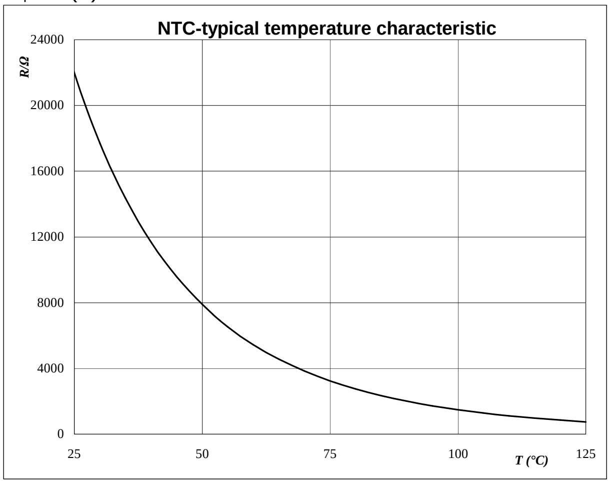
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$



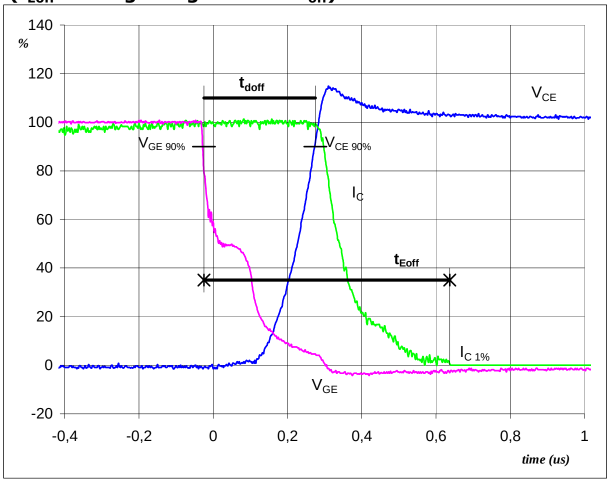
Switching Definitions Inverter

General conditions

T_j	=	151 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Inverter IGBT

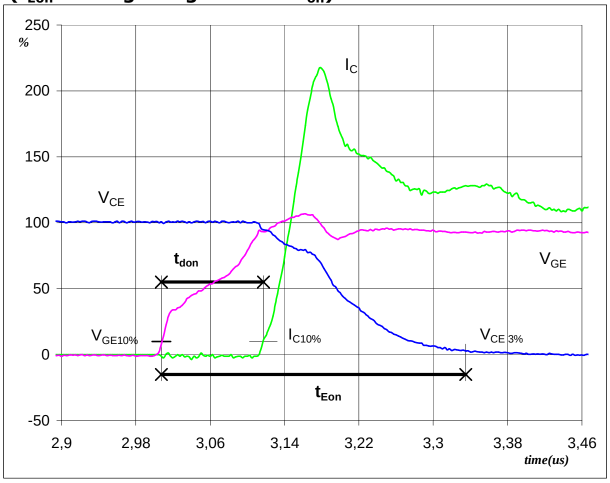
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
t_{doff} =	0,30	μs
t_{Eoff} =	0,66	μs

Figure 2 Inverter IGBT

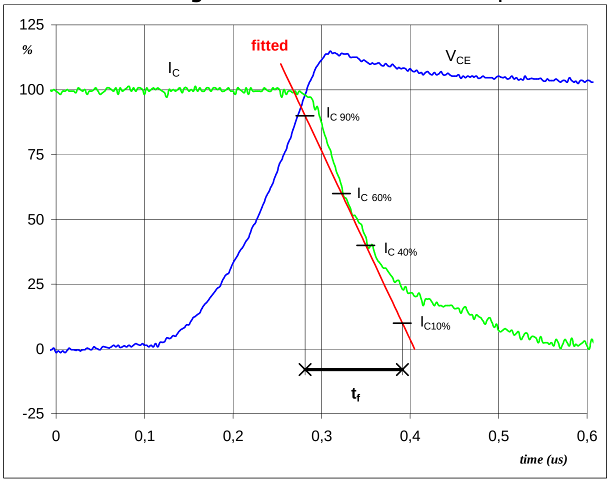
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
t_{don} =	0,11	μs
t_{Eon} =	0,33	μs

Figure 3 Inverter IGBT

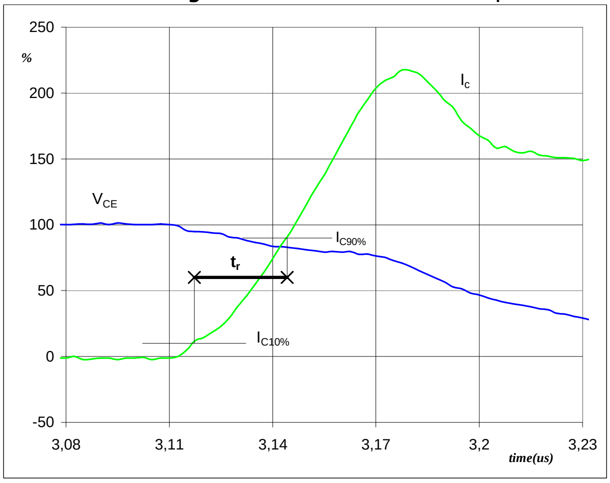
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	99	A
t_f =	0,12	μs

Figure 4 Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

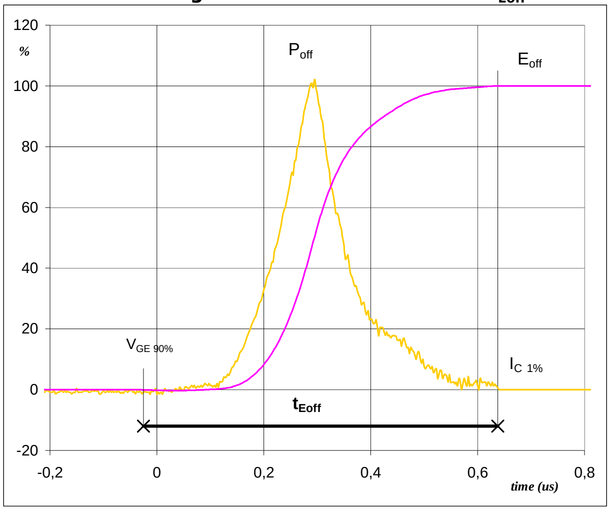


V_C (100%) =	600	V
I_C (100%) =	99	A
t_r =	0,03	μs

Switching Definitions Inverter

Figure 5 Inverter IGBT

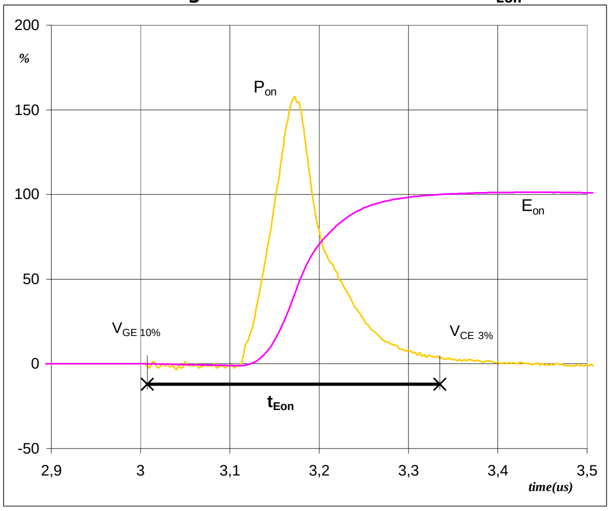
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	59,69	kW
E_{off} (100%) =	9,38	mJ
t_{Eoff} =	0,66	µs

Figure 6 Inverter IGBT

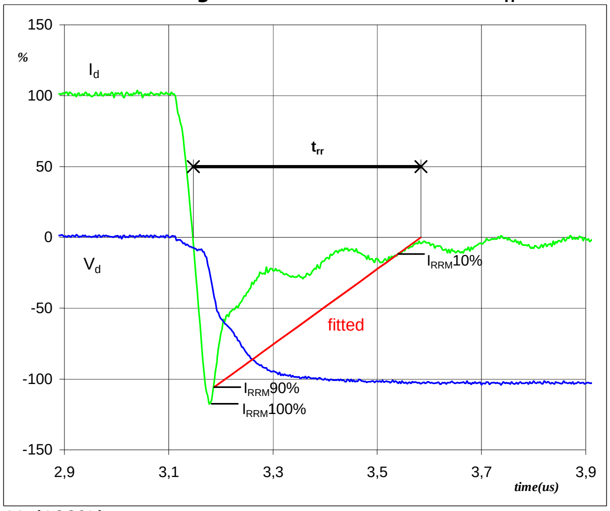
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	59,69	kW
E_{on} (100%) =	6,78	mJ
t_{Eon} =	0,33	µs

Figure 7 Inverter FWD

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

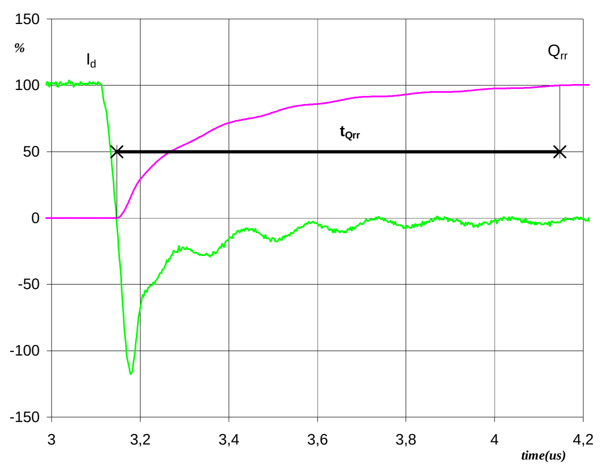


V_d (100%) =	600	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-118	A
t_{rr} =	0,29	µs

Switching Definitions Inverter

Figure 8 Inverter FWD

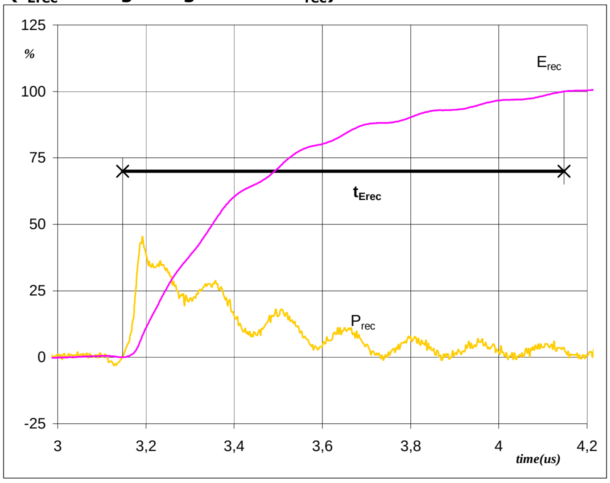
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	99	A
Q_{rr} (100%) =	13,90	µC
t_{Qrr} =	1,00	µs

Figure 9 Inverter FWD

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



P_{rec} (100%) =	59,69	kW
E_{rec} (100%) =	5,92	mJ
t_{Erec} =	1,00	µs

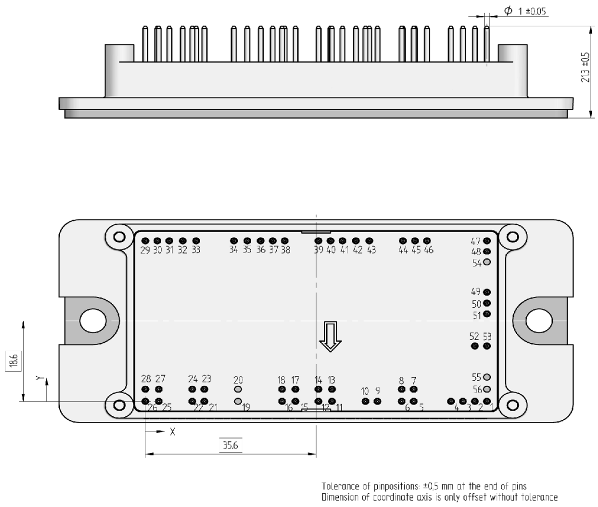
Ordering Code & Marking

Version	Ordering Code
without thermal paste 17 mm housing with solder pins	30-F212R6A100SC-M449E
without thermal paste 17 mm housing with solder pins	30-F212R6A100SC01-M449E10

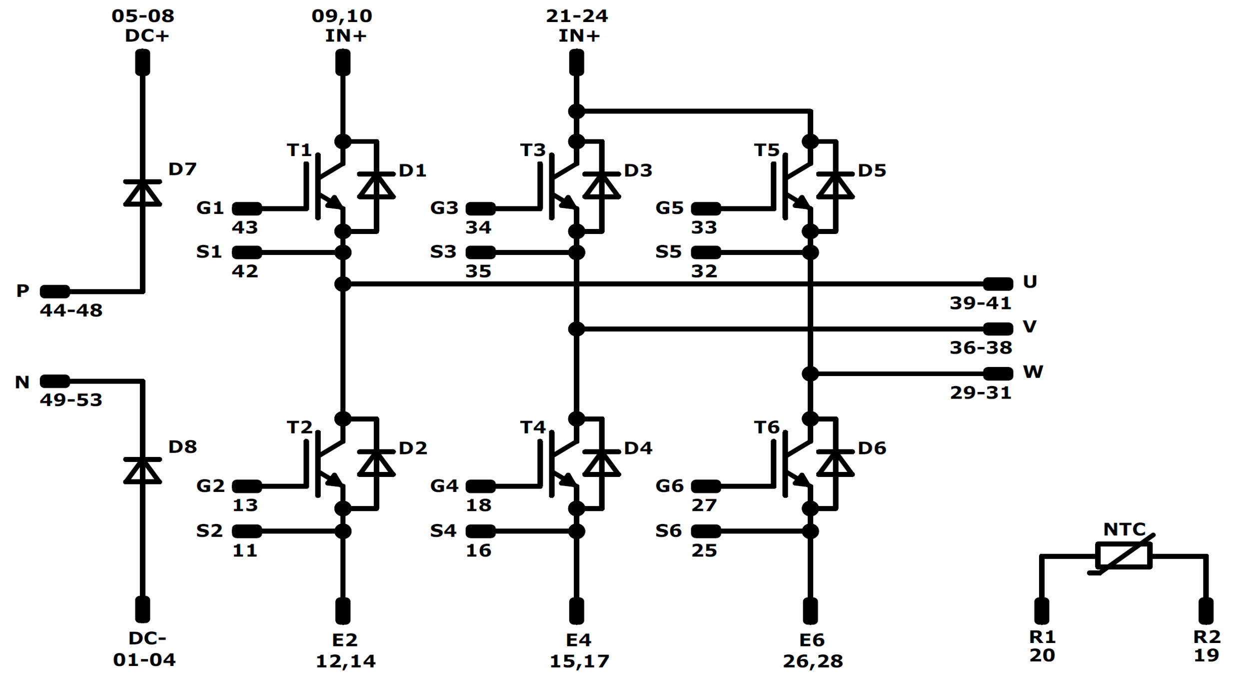
	Name	Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
	Type&Ver	Lot number	Serial	Date code	
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY	

Outline

Pin table [mm]				Pin table [mm]			
Pin	X	Y	Function	Pin	X	Y	Function
1	71,2	0	DC-	32	7,8	37,2	S5
2	68,7	0	DC-	33	10,6	37,2	G5
3	66,2	0	DC-	34	18,45	37,2	G3
4	63,7	0	DC-	35	21,25	37,2	G3
5	55,95	0	DC+	36	24,05	37,2	V
6	53,45	0	DC+	37	26,55	37,2	V
7	55,95	2,8	DC+	38	29,05	37,2	V
8	53,45	2,8	DC+	39	36,1	37,2	U
9	48,4	0	IN+	40	38,6	37,2	U
10	45,9	0	IN+	41	41,1	37,2	U
11	38,9	0	S2	42	43,9	37,2	S1
12	36,1	0	E2	43	46,7	37,2	G1
13	38,9	2,8	G2	44	53,7	37,2	P
14	36,1	2,8	E2	45	56,2	37,2	P
15	31,3	0	E4	46	58,7	37,2	P
16	28,5	0	S4	47	71,2	37,2	P
17	31,3	2,8	E4	48	71,2	34,7	P
18	28,5	2,8	G4	49	71,2	25,2	N
19	Not assembled			50	71,2	22,7	N
20				51	71,2	20,2	N
21	12,3	0	IN+	52	68,7	12,8	N
22	9,8	0	IN+	53	71,2	12,8	N
23	12,3	2,8	IN+	54	Not assembled		
24	9,8	2,8	IN+	55			
25	2,8	0	S6	56			
26	0	0	E6				
27	2,8	2,8	G6				
28	0	2,8	E6				
29	0	37,2	W				
30	2,5	37,2	W				
31	5	37,2	W				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D7 , D8	FWD	1600 V	100 A	DC Blocking Diode	
T1 - T6	IGBT	1200 V	100 A	Inverter Switch	
D1 - D6	FWD	1200 V	50 A	Inverter Diode	
NTC	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**36**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 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
30-F212R6A100SC-M449E-D3-14	27 Jun. 2017	Logo,SPQ corrected	All

Product status definition

DISCLAIMER

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

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.