flow PACK 2 + R — 1200 V / 100 A

Features

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

Target Applications

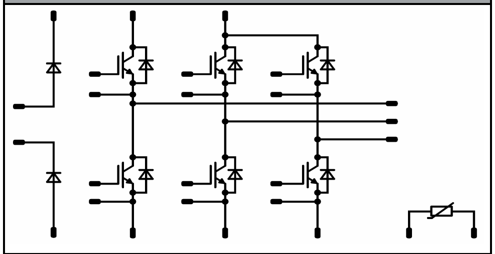
- Industrial Drives

Types

- 30-F212R6A100SC-M449E (with thermistor)
- 30-F212R6A100SC01-M449E10 (without thermistor)

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
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} ≤ 1200V, $T_j \le T_{op}$ 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 ≤ 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				12,1	mm
Comparative tracking index	CTI			>200	

* 100 % Tested in production

Characteristic Values

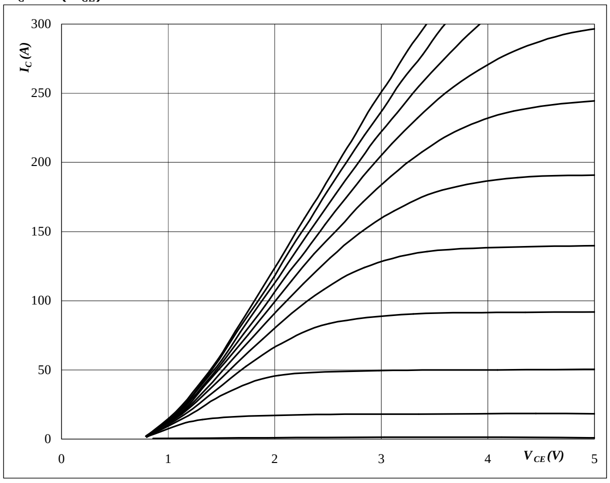
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
DC Blocking Diode										
Forward voltage	V_F				100	25 125		1,12 1,07	1,4	V
Threshold voltage (for power loss calc. only)	V_{to}				100	25 125		0,89 0,76		V
Slope resistance (for power loss calc. only)	r_t				100	25 125		2 3		mΩ
Reverse current	I_r			1500		25			0,1	mA
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						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	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						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	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						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. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



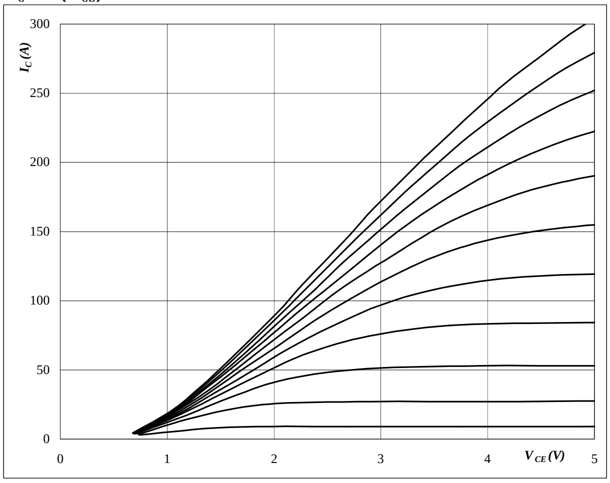
At

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

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



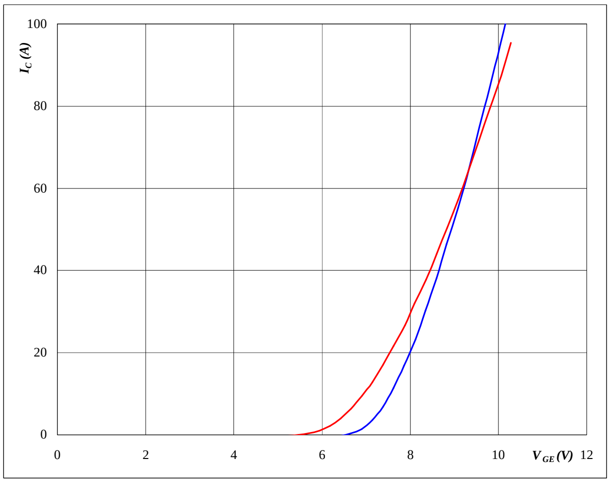
At

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



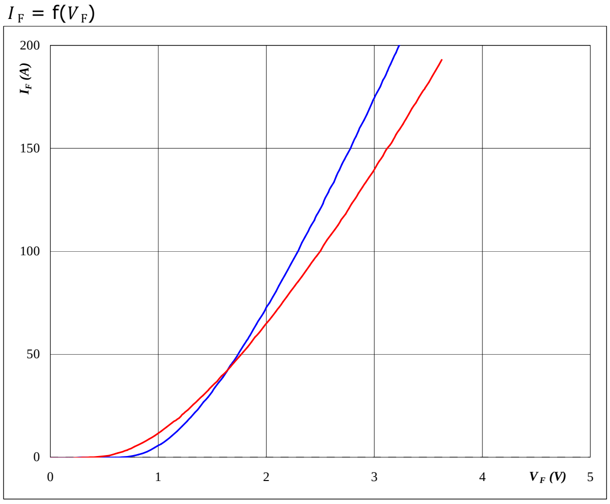
At

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

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

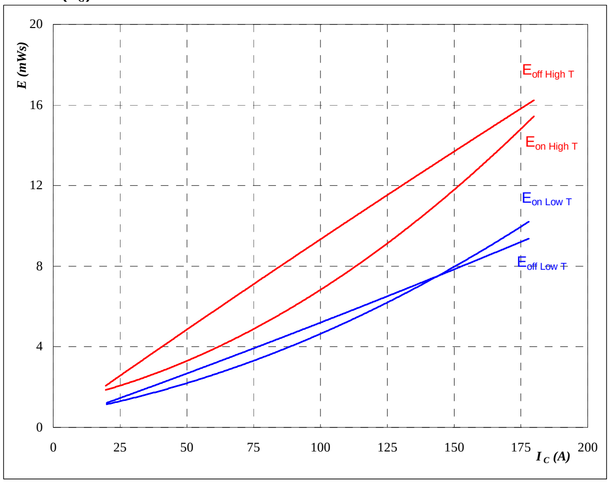
T_j =	25/150	°C
t_p =	250	µs

Inverter Switch/Inverter Diode

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



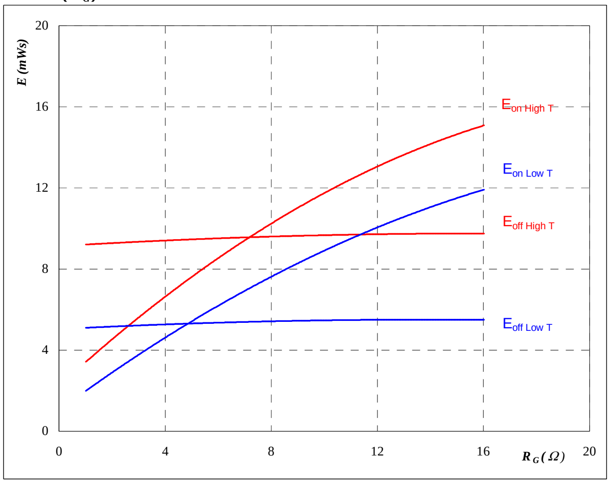
With an inductive load at

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

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



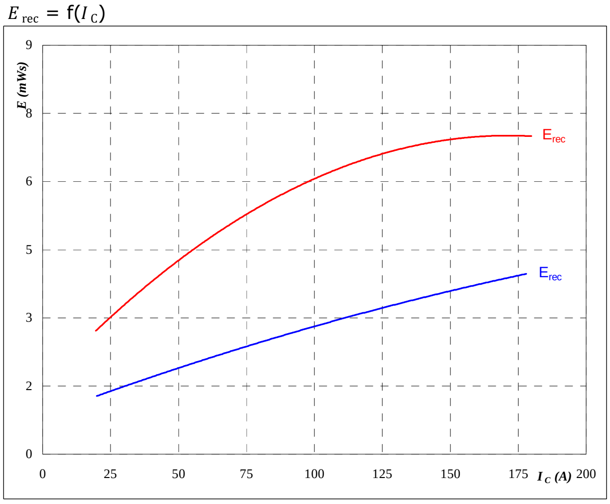
With an inductive load at

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

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



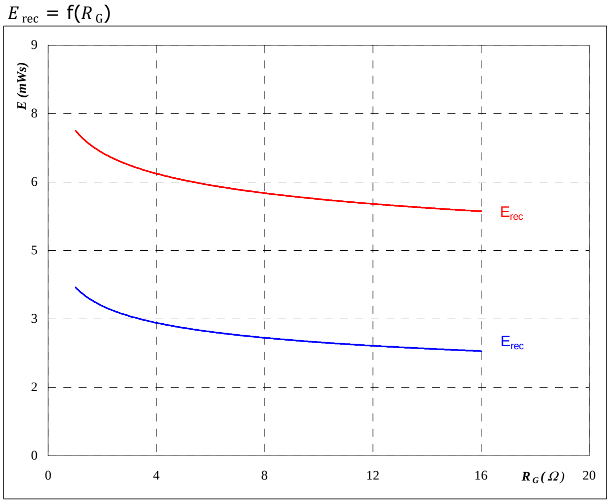
With an inductive load at

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

Figure 8 FWD

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

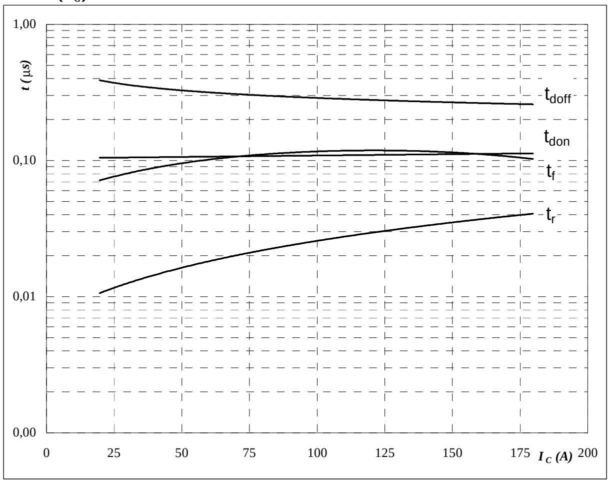
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	99	A

Inverter Switch/Inverter Diode

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



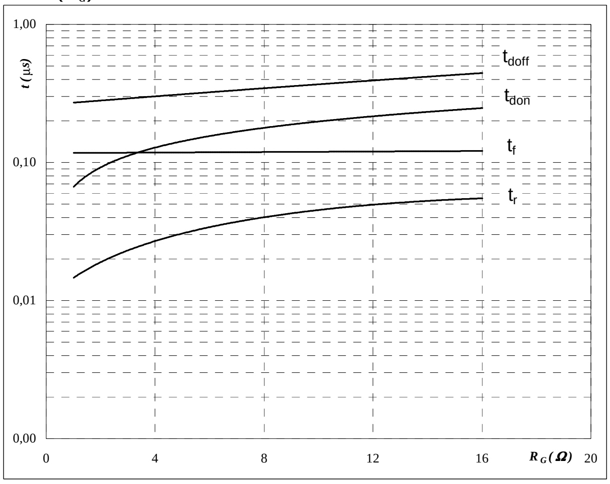
With an inductive load at

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

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



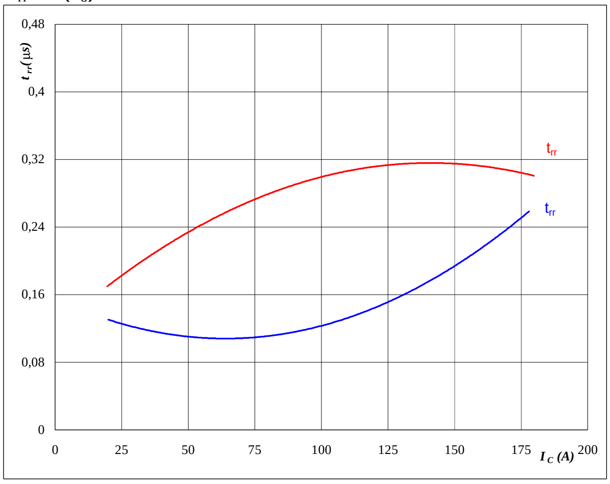
With an inductive load at

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

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



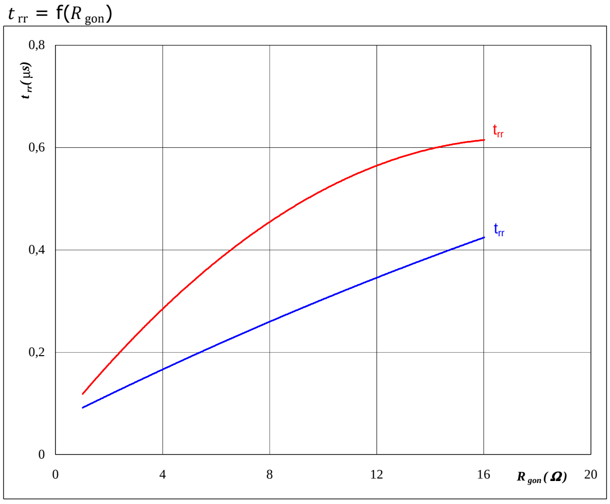
At

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

Figure 12 FWD

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

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



At

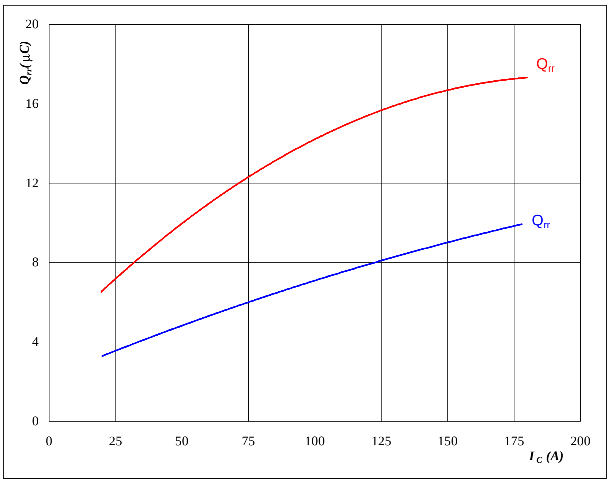
T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Inverter Switch/Inverter Diode

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



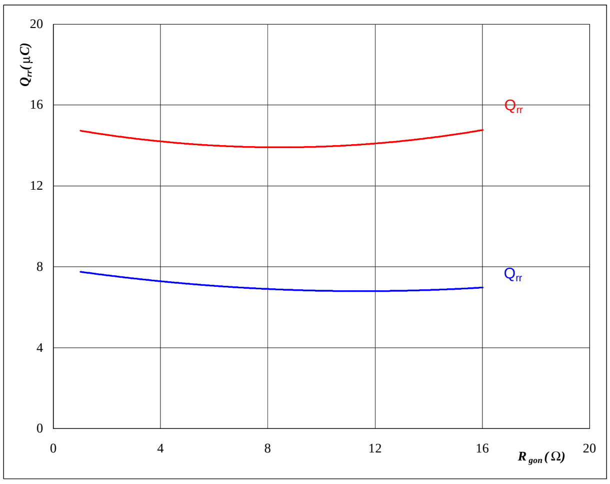
At

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

Figure 14 FWD

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

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



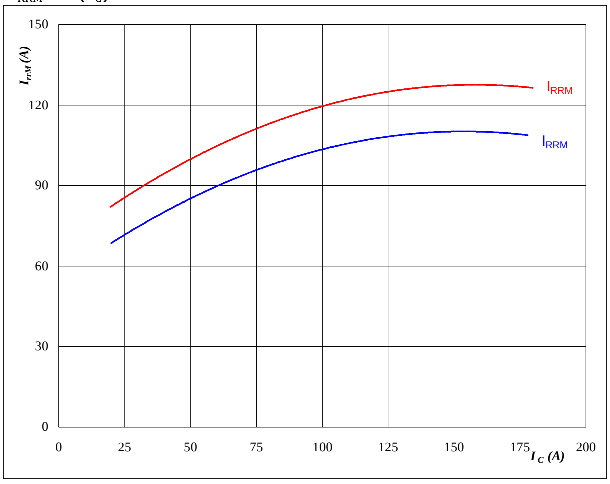
At

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

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



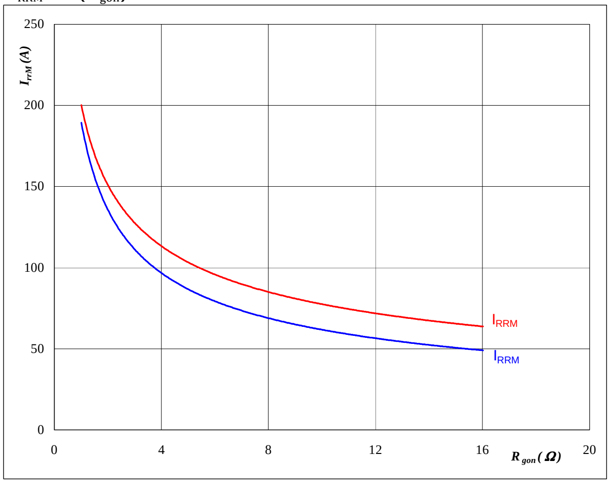
At

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

Figure 16 FWD

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

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



At

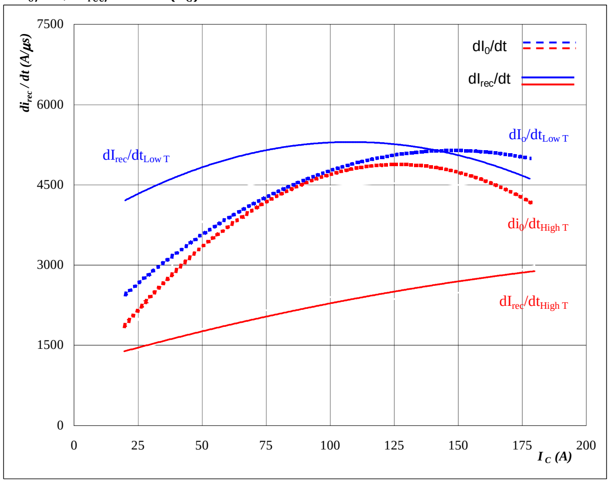
T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

Inverter Switch/Inverter Diode

Figure 17 FWD

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

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



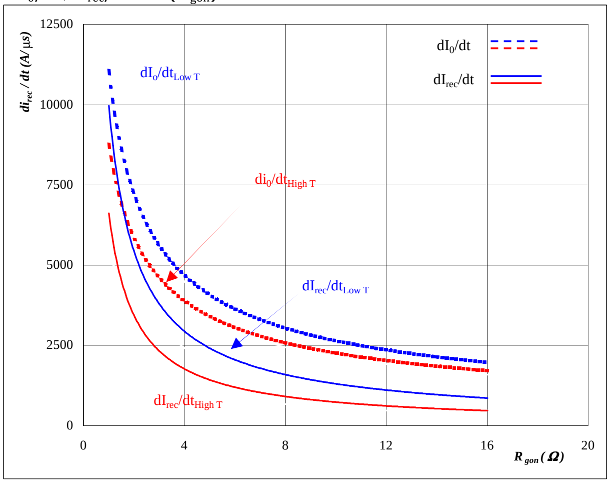
At

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

Figure 18 FWD

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

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



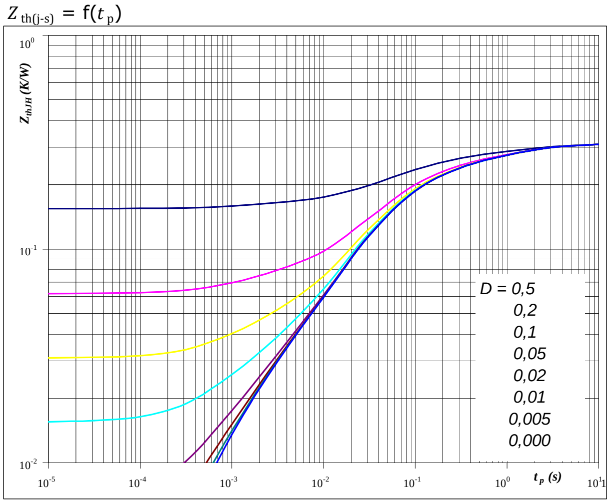
At

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

Figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,31	K/W

IGBT thermal model values

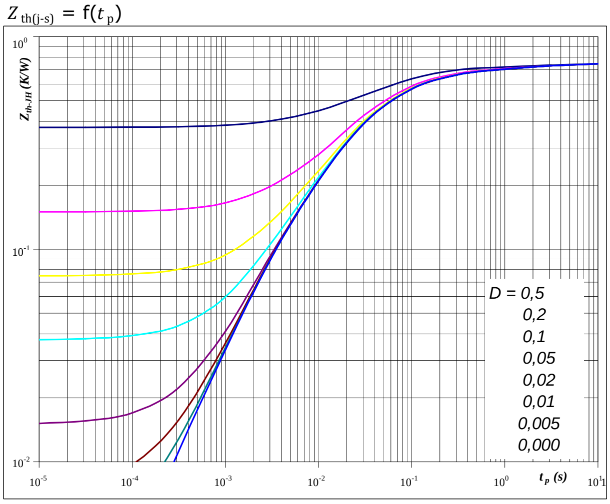
Phase-Change Material

R (K/W)	Tau (s)
6,00E-02	1,67E+00
7,30E-02	2,35E-01
1,19E-01	5,35E-02
4,31E-02	1,45E-02
1,45E-02	1,21E-03

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,75	K/W

FWD thermal model values

Phase-Change Material

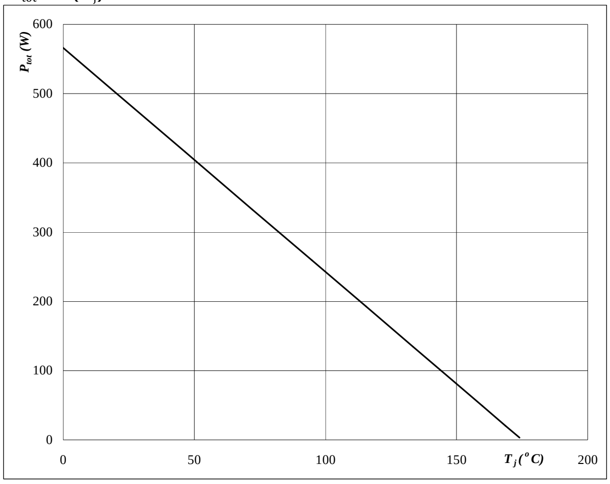
R (K/W)	Tau (s)
4,26E-02	3,64E+00
6,76E-02	6,18E-01
2,53E-01	8,65E-02
3,23E-01	2,11E-02
6,24E-02	3,47E-03

Inverter Switch/Inverter Diode

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



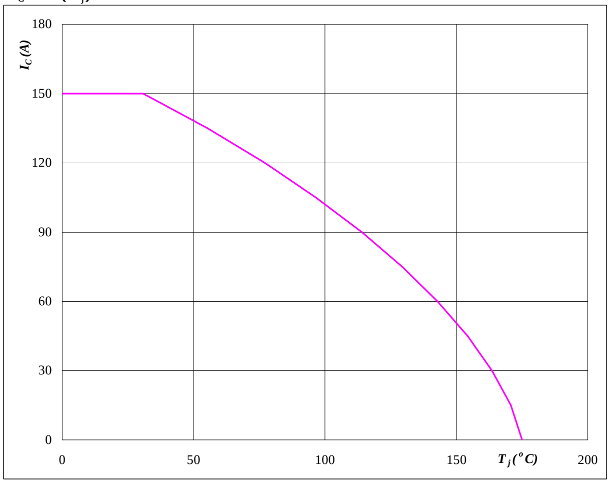
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_j)$



At

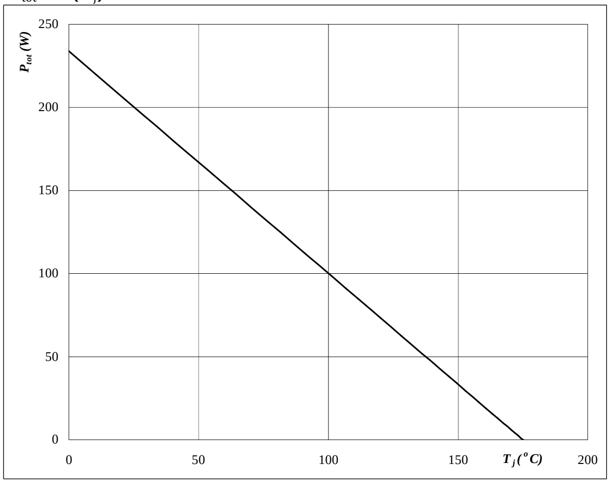
T_j = 175 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



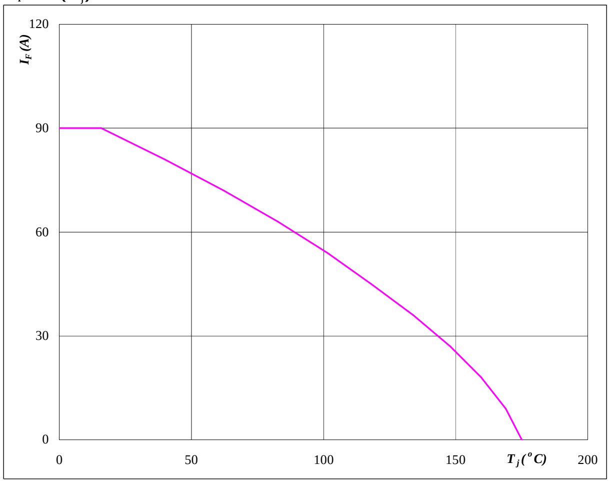
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_j)$



At

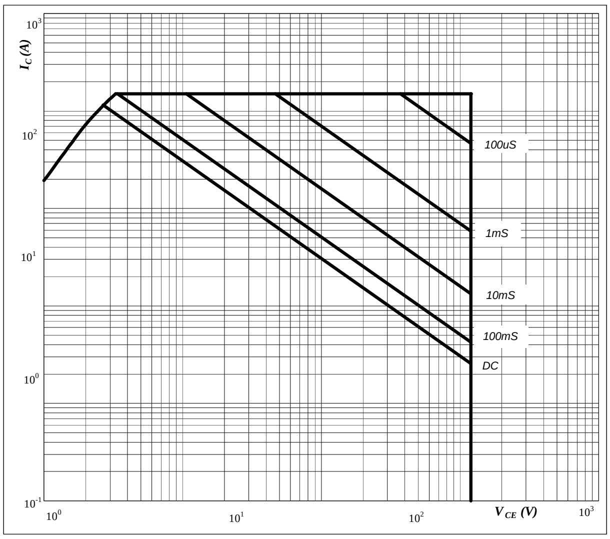
T_j = 175 °C

Inverter Switch/Inverter Diode

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



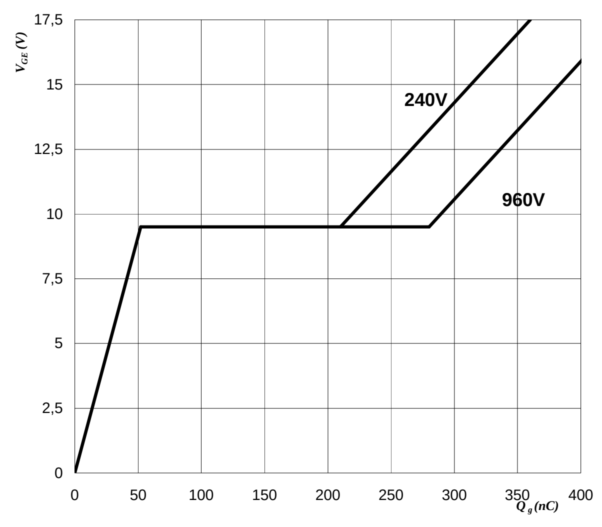
At

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

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



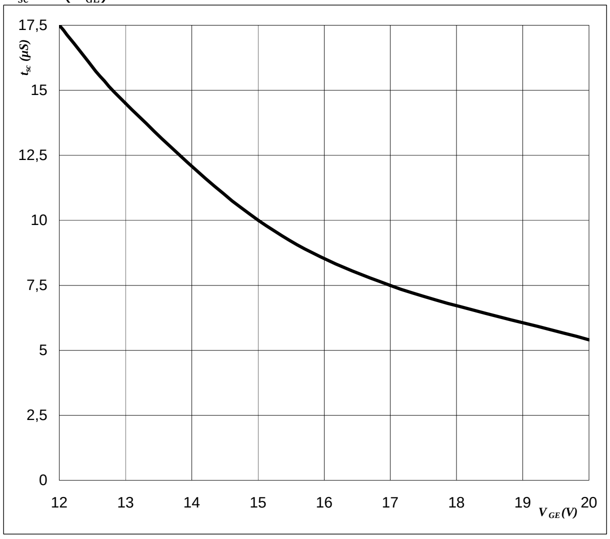
At

I_C =	99	A

Figure 27 IGBT

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

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



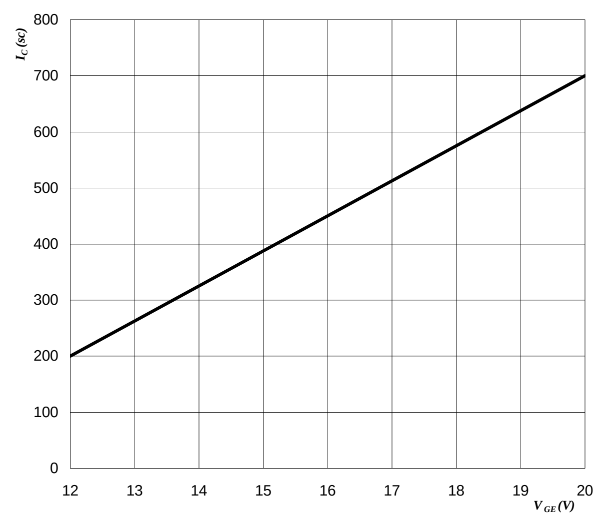
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 IGBT

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

$V_{GE} = f(Q_g)$



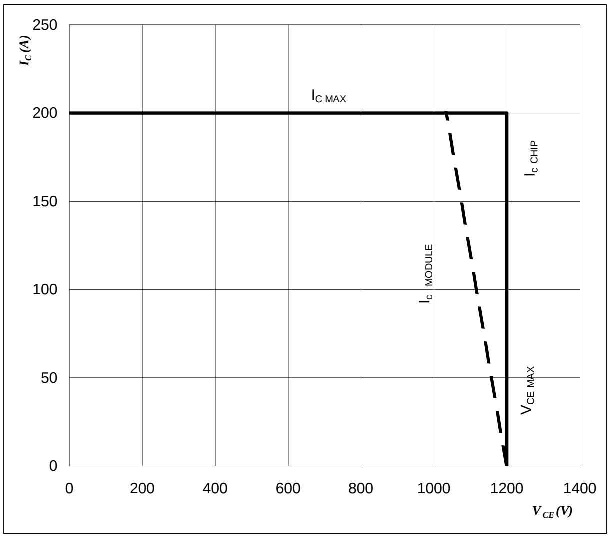
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

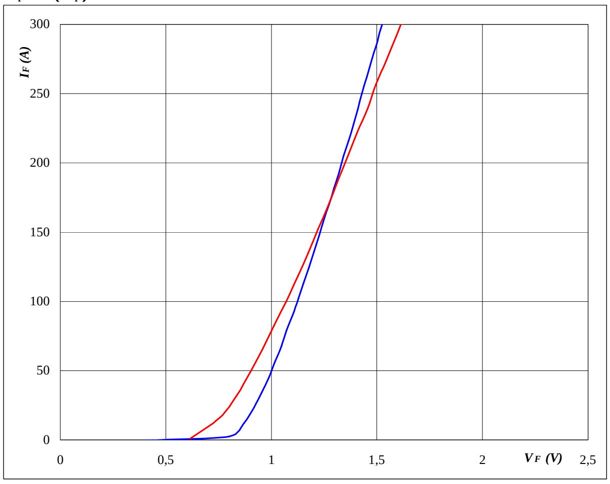
T_j =	151 °C
R_{gon} =	4 Ω
R_{goff} =	4 Ω

DC Blocking Diode

Figure 1 DC Blocking Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

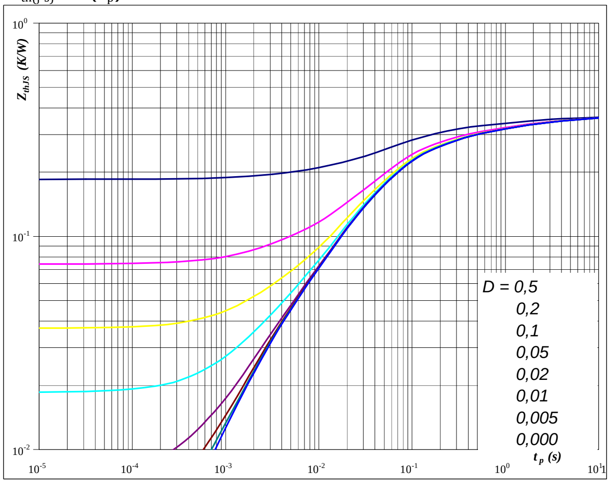
T_j = 25/125 °C

t_p = 250 µs

Figure 2 DC Blocking Diode

Diode transient thermal impedance as a function of pulse width

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



At

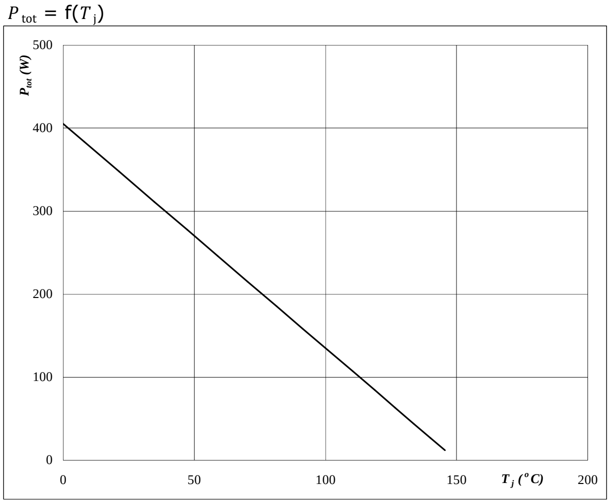
$D = t_p / T$

$R_{th(j\text{-}s)}$ = 0,37 K/W

Figure 3 DC Blocking Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_j)$



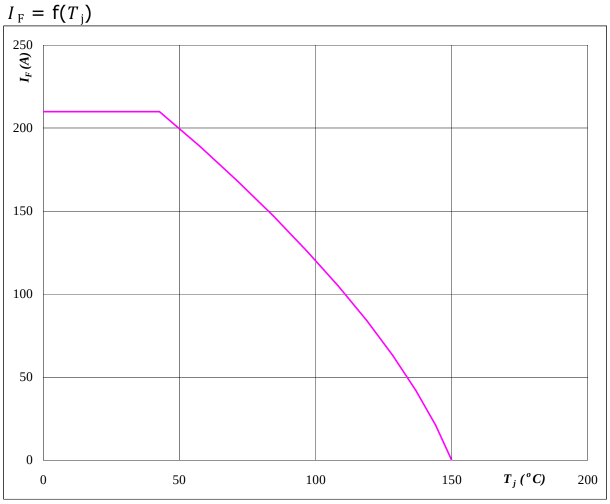
At

T_j = 150 ºC

Figure 4 DC Blocking Diode

Forward current as a function of heatsink temperature

$I_F = f(T_j)$



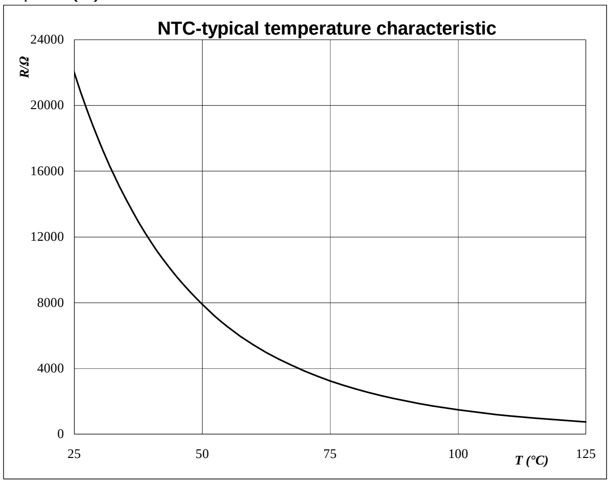
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

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



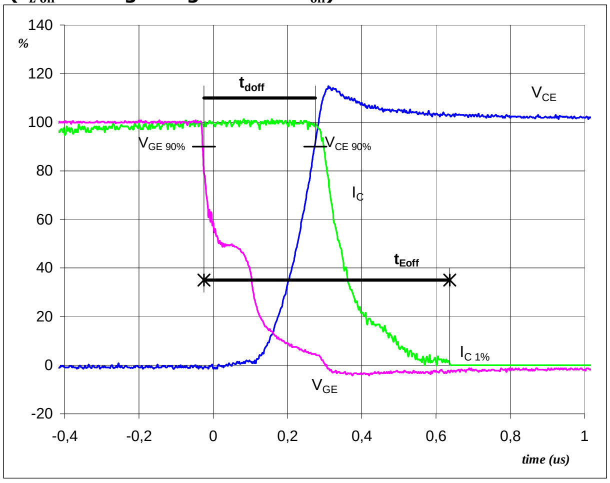
Switching Definitions Inverter

General conditions

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

Figure 1 IGBT

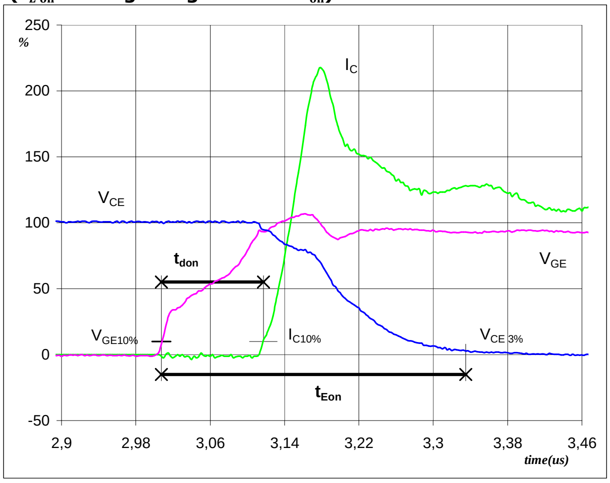
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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
$t_{E\,off}$ =	0,66	μs

Figure 2 IGBT

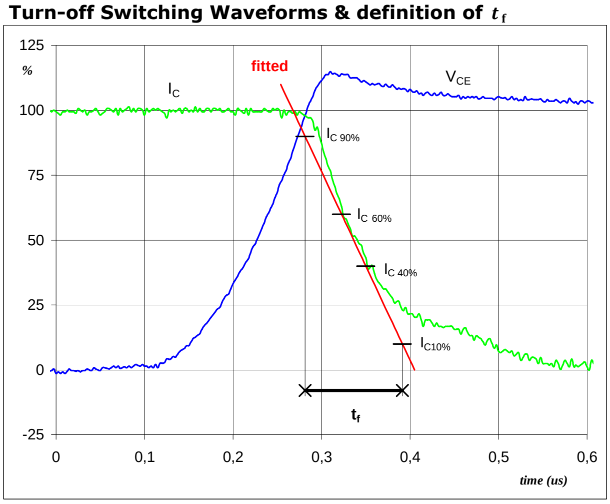
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



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
$t_{E\,on}$ =	0,33	μs

Figure 3 IGBT

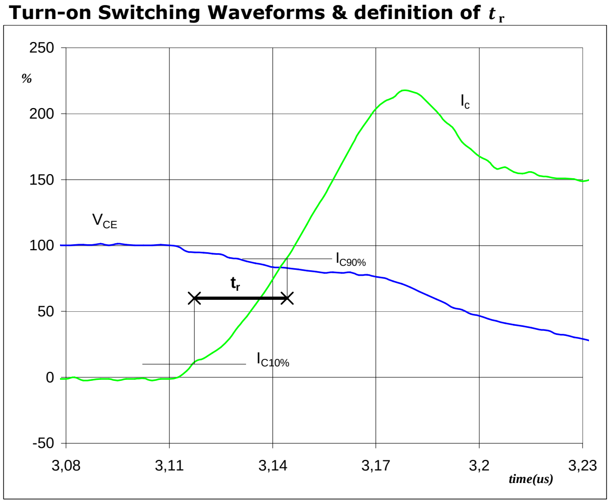
Turn-off Switching Waveforms & definition of t_f



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

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

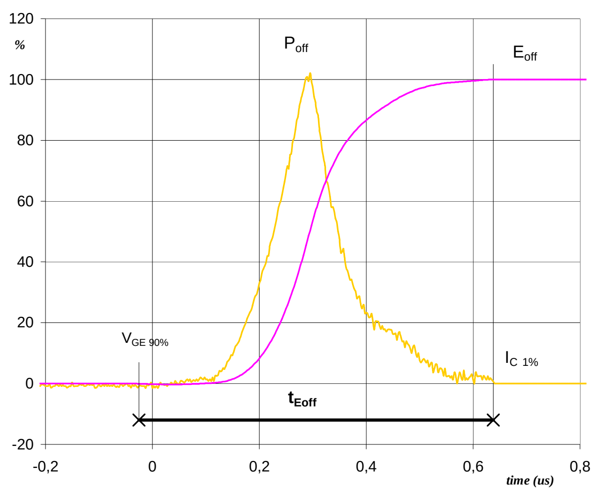


V_C (100%) =	600	V
I_C (100%) =	99	A
t_r =	0,03	μs

Switching Definitions Inverter

Figure 5	IGBT

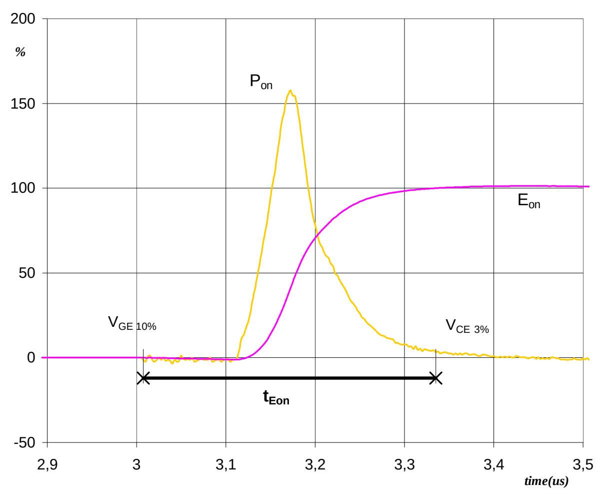
Turn-off Switching Waveforms & definition of t_{Eoff}



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

Figure 6	IGBT

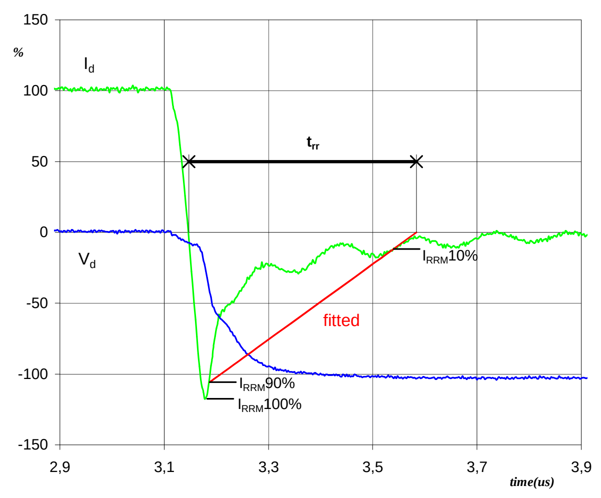
Turn-on Switching Waveforms & definition of t_{Eon}



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

Figure 7	FWD

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

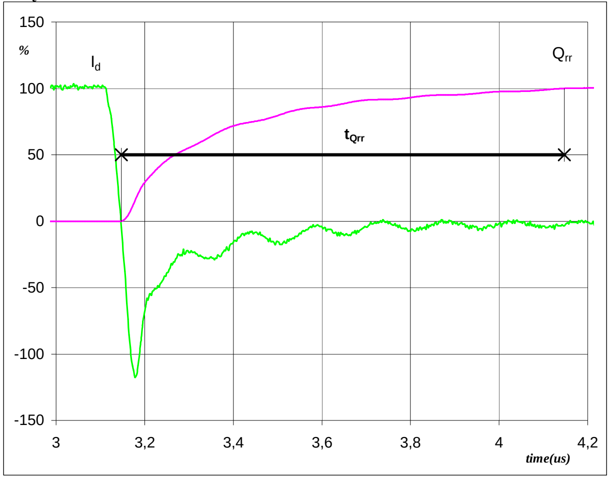


V_d (100%) =	600	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-118	A
t_{rr} =	0,29	μs

Switching Definitions Inverter

Figure 8 FWD

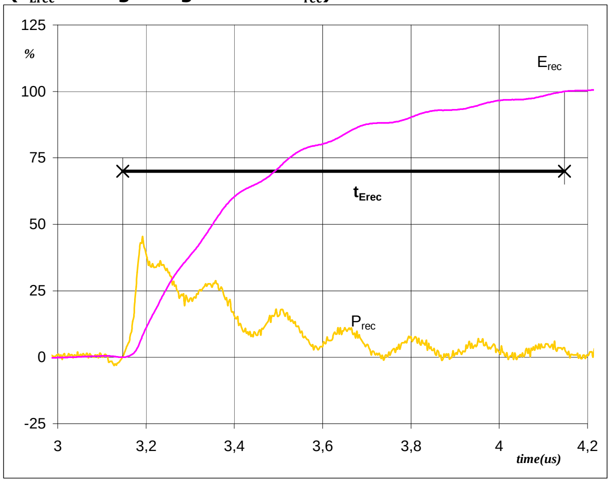
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



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

Figure 9 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
$t_{E\,rec}$ =	1,00	μs

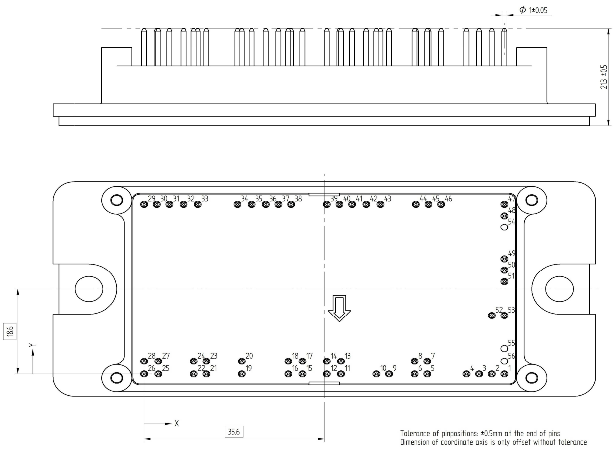
Ordering Code & Marking

Version	Ordering Code
without thermal paste 17 mm housing with solder pins with thermistor	30-F212R6A100SC-M449E
with thermal paste 17 mm housing with solder pins with thermistor	30-F212R6A100SC-M449E-/3/
without thermal paste 17 mm housing with solder pins without thermistor	30-F212R6A100SC01-M449E10
with thermal paste 17 mm housing with solder pins without thermistor	30-F212R6A100SC01-M449E10-/3/

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

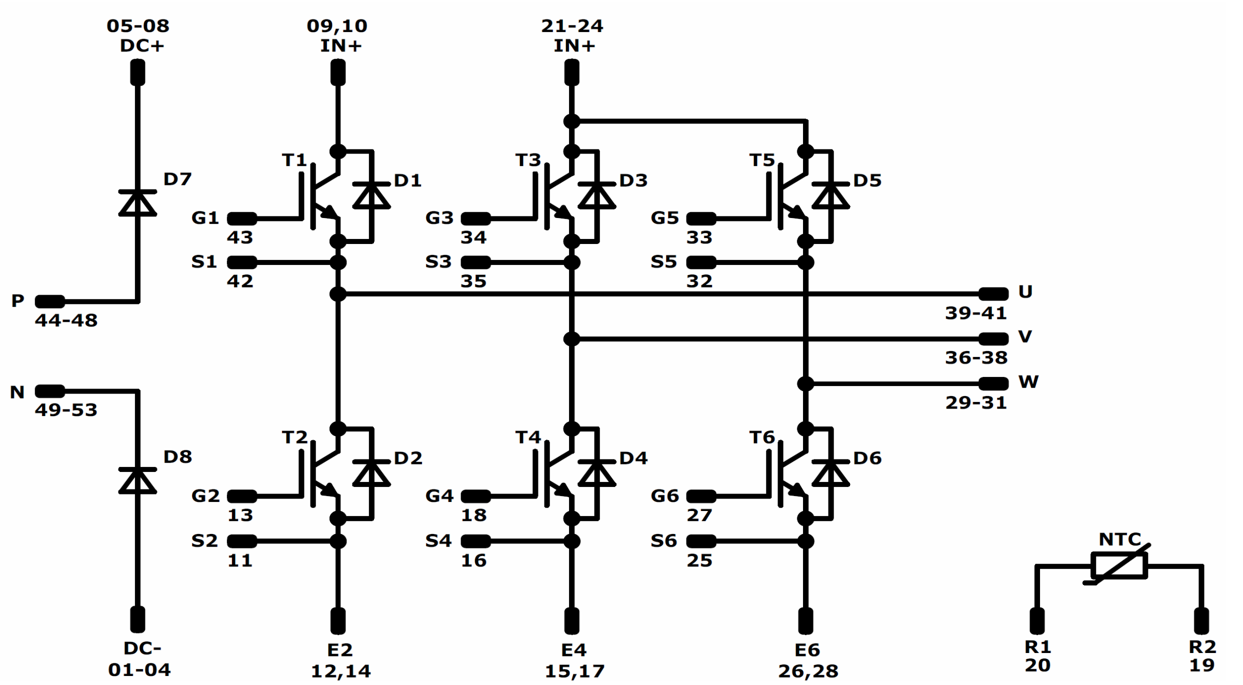
Outline

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*	19,3	0	R2	50	71,2	22,7	N
20*	19,3	2,8	R1	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				



* Not assebled in30-F212R6A100SC01-M449E10

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	NTC			Thermistor	Not assebled in 30-F212R6A100SC01-M449E10

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-F212R6A100SCx-M449Ex-D4-14	17 Oct. 2017	Logo,SPQ corrected	All

Product status definition