Vincotech

30-F212R6A100SC*-M449E*-PM

flow PACK 2	1200 V/100 A

Features

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

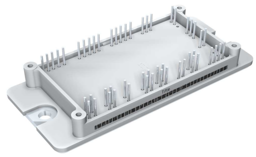
Target Applications

- Power Regeneration

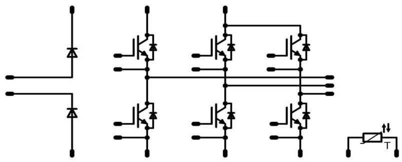
Types

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

flow 2 housing



Schematic



Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
D7a,b-D8a,b					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	154 208	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25℃	1270	A
I2t-value	I^2t			2400	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	189 287	W
Maximum Junction Temperature	T_jmax			150	℃
T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j=T_jmax$	T_h=80℃ T_c=80℃	116 148	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax		300	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		200	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	307 466	W
Gate-emitter peak voltage	V_{GE}			20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 800	µs V
Maximum Junction Temperature	T_jmax			175	℃

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
D1,D2,D3,D4,D5,D6					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80℃ T_c=80℃	64 84	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		100	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	127 192	W
Maximum Junction Temperature	$T_j$max			175	℃
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	℃
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative tracking index	CTI			>200	

Characteristic Values

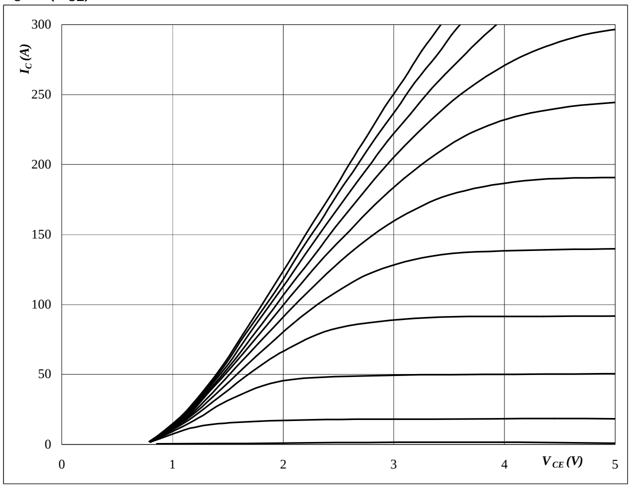
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
D7a,b-D8a,b										
Forward voltage	V_F				100	Tj=25℃ Tj=125℃		1,12 1,07	1,21	V
Threshold voltage (for power loss calc. only)	V_{to}				100	Tj=25℃ Tj=125℃		0,89 0,76		V
Slope resistance (for power loss calc. only)	r_t				100	Tj=25℃ Tj=125℃		2 3		mΩ
Reverse current	I_r			1600		Tj=25℃ Tj=125℃			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,37		K/W
Thermal resistance chip to heatsink per chip	R_{thJC}							0,24		
T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0034	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	Tj=25℃ Tj=150℃	1,6	1,88 2,26	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25℃ Tj=150℃			0,028	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			1200	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	600	100	Tj=25℃ Tj=150℃		105 109		ns
Rise time	t_r					Tj=25℃ Tj=150℃		23 27		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		220 301		
Fall time	t_f					Tj=25℃ Tj=150℃		49 117		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		4,67 6,78		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		5,28 9,38		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		5540		pF
Output capacitance	C_{oss}							410		
Reverse transfer capacitance	C_{rss}							320		
Gate charge	Q_{Gate}		±15	960	100	Tj=25℃		480		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,31		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,2		
D1,D2,D3,D4,D5,D6										
Diode forward voltage	V_F				50	Tj=25℃ Tj=150℃	1,1	1,74 1,77	2,3	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	600	100	Tj=25℃ Tj=150℃		103,19 118,1		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		131,1 289,8		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		7,03 13,9		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		4928 2403		A/µs
Reverse recovered energy	Erec					Tj=25℃ Tj=150℃		2,79 5,92		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,75		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,49		
Thermistor										
Rated resistance	R					Tj=25℃		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=100℃	-12		14	%
Power dissipation	P					Tc=100℃		200		mW
Power dissipation constant						Tj=25℃		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25℃		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25℃		3998		K
Vincotech NTC Reference						Tj=25℃			B	

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 1 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical output characteristics

$I_C = f(V_{CE})$



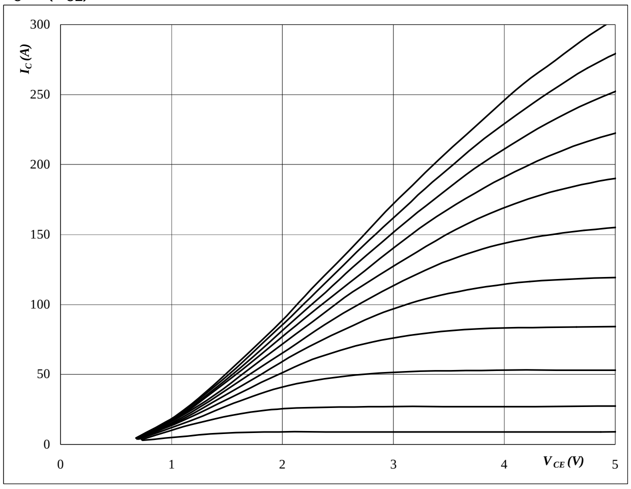
At

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

Figure 2 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical output characteristics

$I_C = f(V_{CE})$



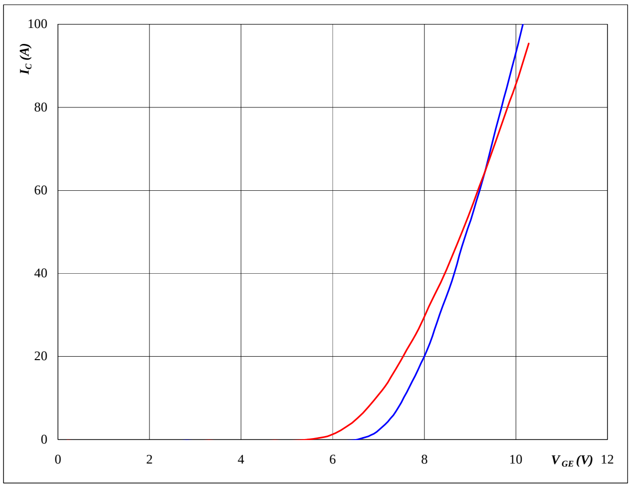
At

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

Figure 3 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



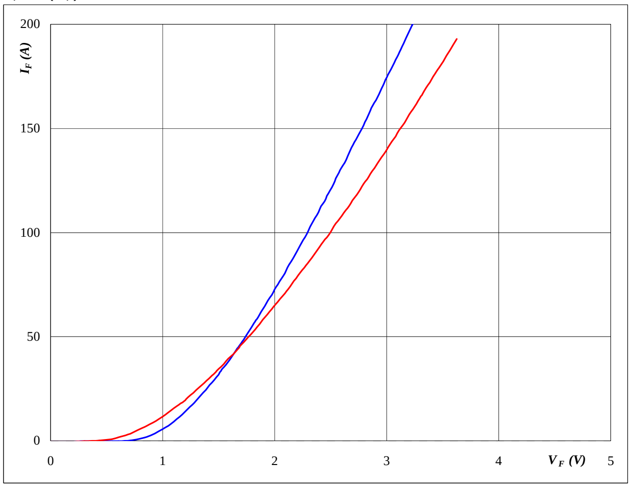
At

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

Figure 4 D1,D2,D3,D4,D5,D6 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

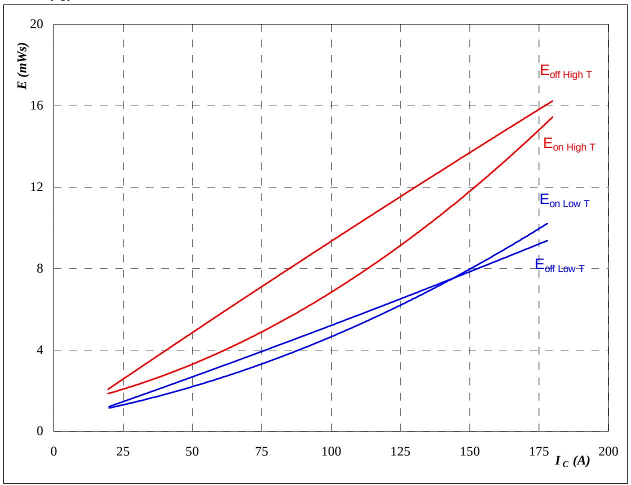
T_j =	25/150	℃
t_p =	250	μs

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 5 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



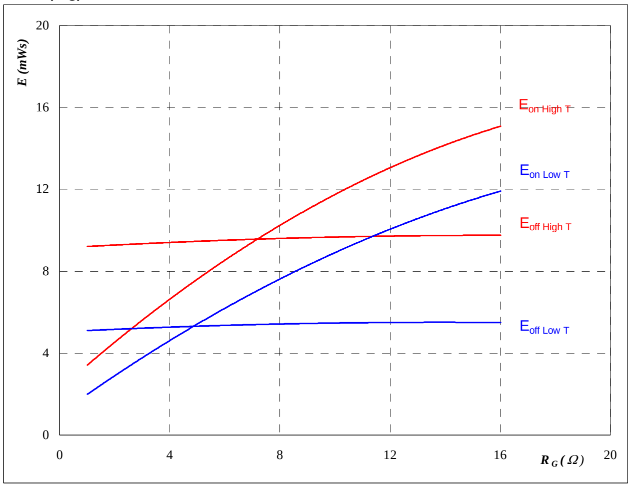
With an inductive load at

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

Figure 6 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



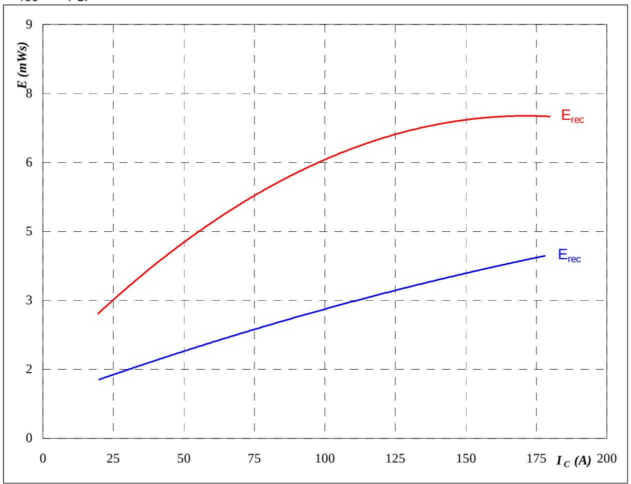
With an inductive load at

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

Figure 7 D1,D2,D3,D4,D5,D6 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



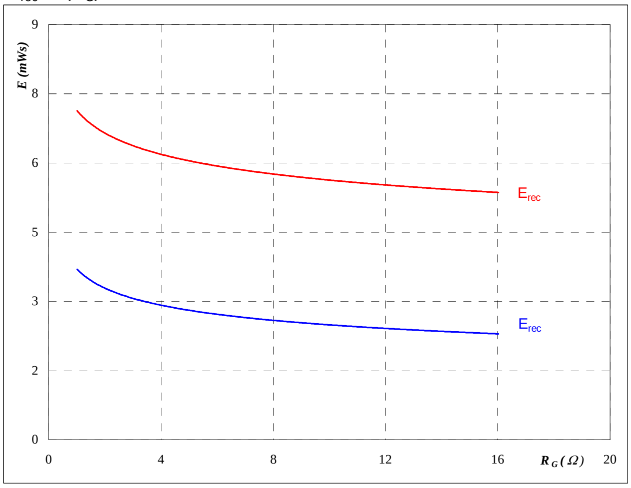
With an inductive load at

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

Figure 8 D1,D2,D3,D4,D5,D6 FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

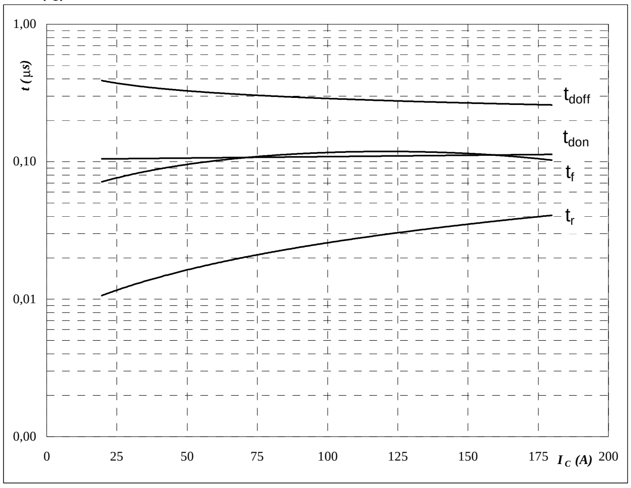
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	99	A

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 9 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical switching times as a function of collector current

t = f(I_C)



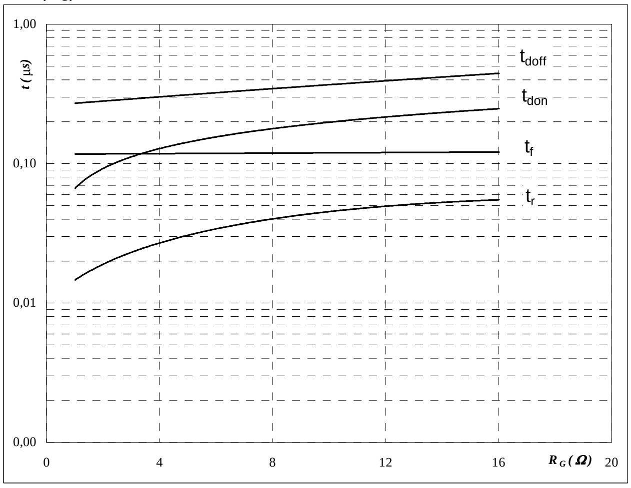
With an inductive load at

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

Figure 10 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



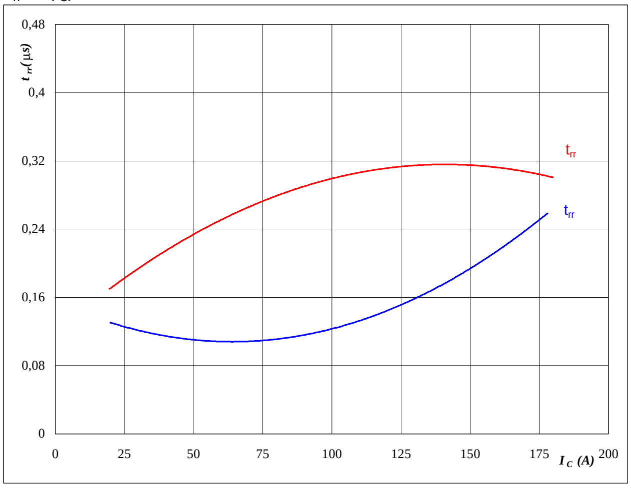
With an inductive load at

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

Figure 11 D1,D2,D3,D4,D5,D6 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



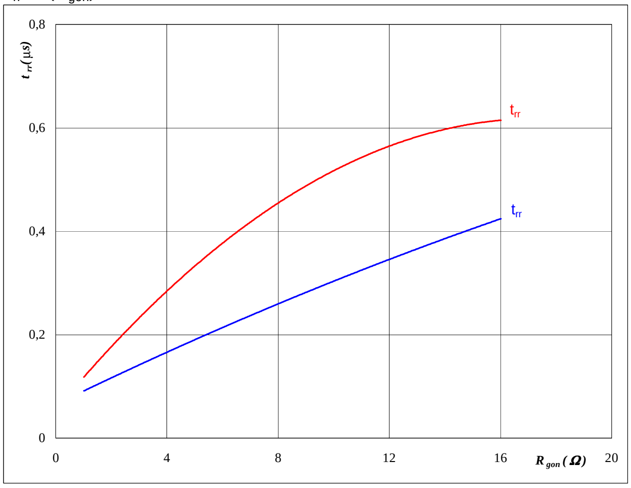
At

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

Figure 12 D1,D2,D3,D4,D5,D6 FWD

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

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



At

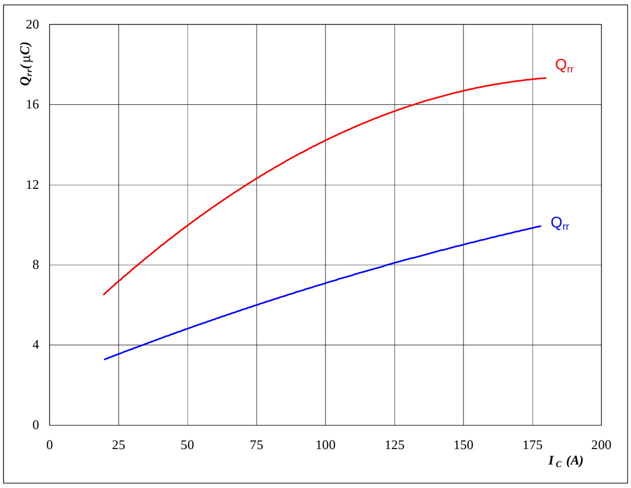
T_j =	25/150	°C
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 13 D1,D2,D3,D4,D5,D6 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



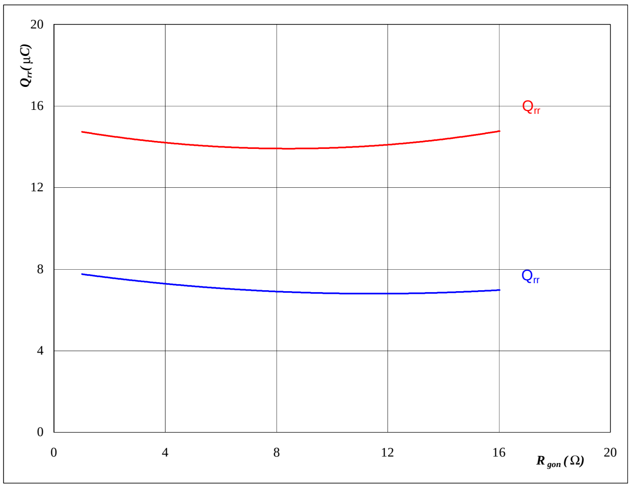
At

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

Figure 14 D1,D2,D3,D4,D5,D6 FWD

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

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



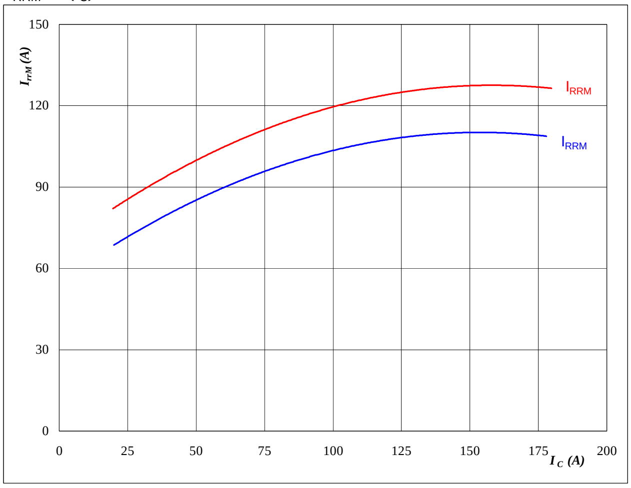
At

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

Figure 15 D1,D2,D3,D4,D5,D6 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



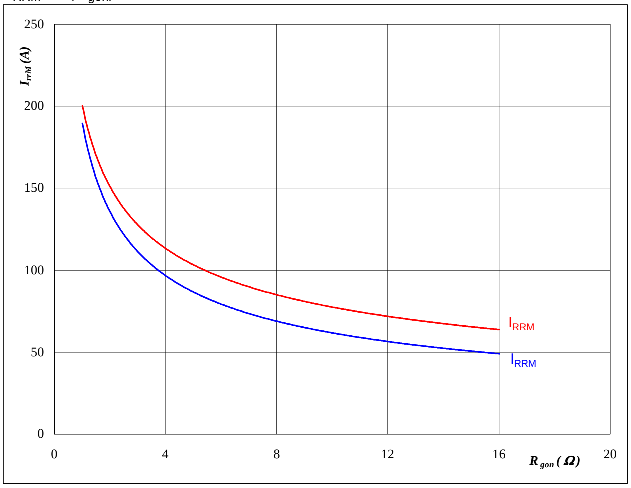
At

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

Figure 16 D1,D2,D3,D4,D5,D6 FWD

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

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



At

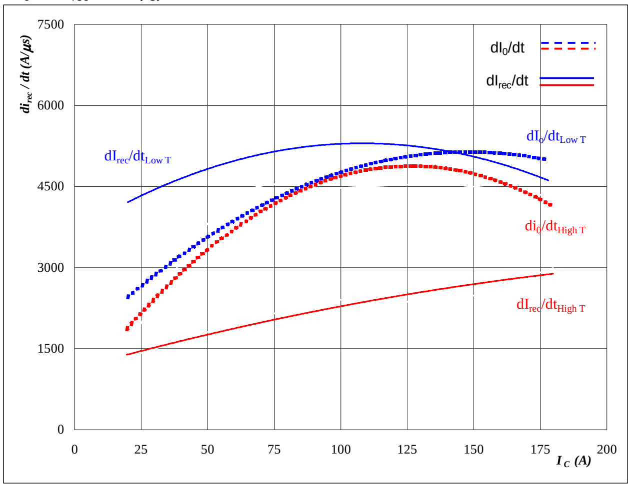
T_j =	25/150	℃
V_R =	600	V
I_F =	99	A
V_{GE} =	±15	V

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 17 D1,D2,D3,D4,D5,D6 FWD

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

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



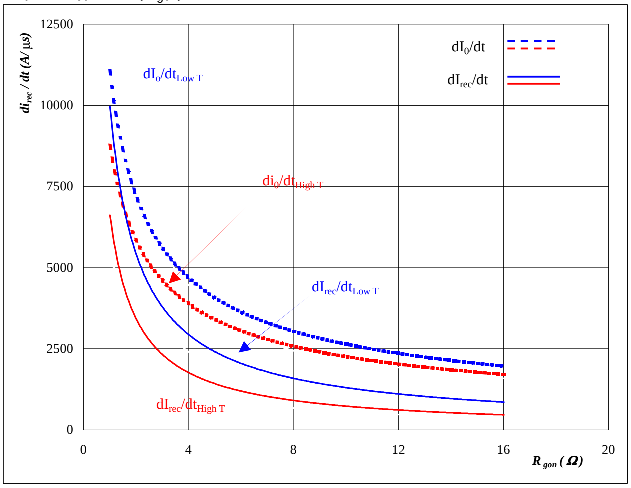
At

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

Figure 18 D1,D2,D3,D4,D5,D6 FWD

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

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



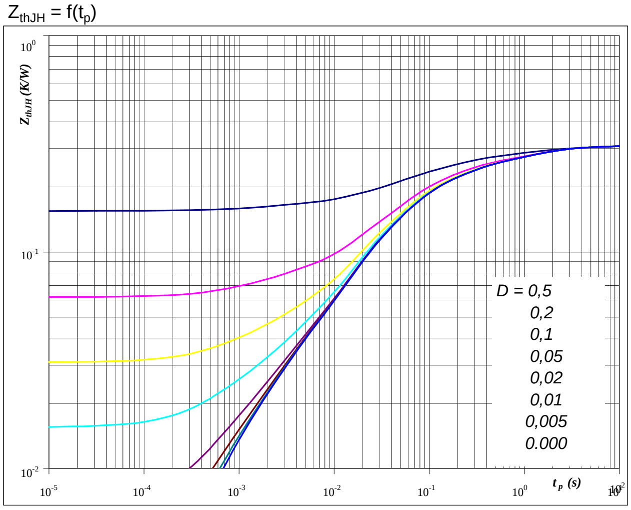
At

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

Figure 19 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b 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 RthJH = 0,30 K/W

IGBT thermal model values

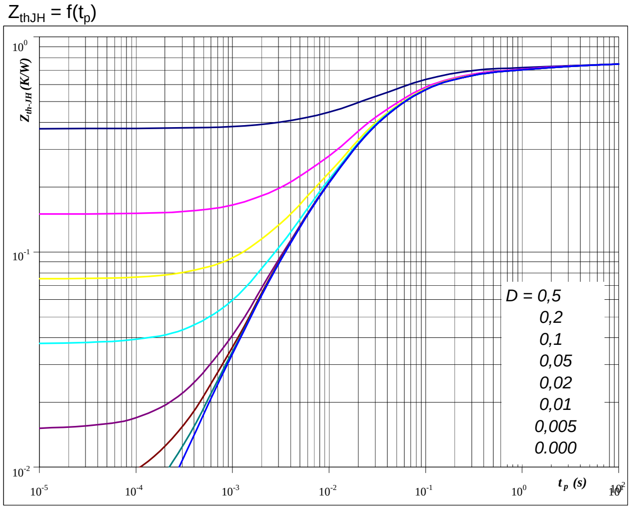
Phase-Change Material

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

Figure 20 D1,D2,D3,D4,D5,D6 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 RthJH = 0,73 K/W

FWD thermal model values

Phase-Change Material

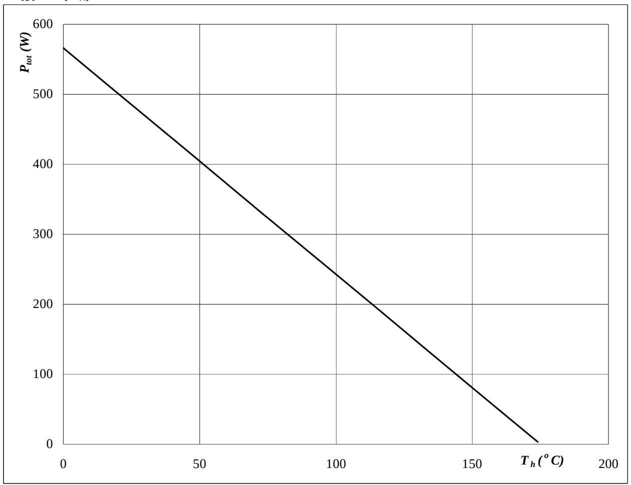
R (C/W)	Tau (s)
0,04	3,6E+00
0,07	6,2E-01
0,25	8,6E-02
0,32	2,1E-02
0,06	3,5E-03

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 21 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



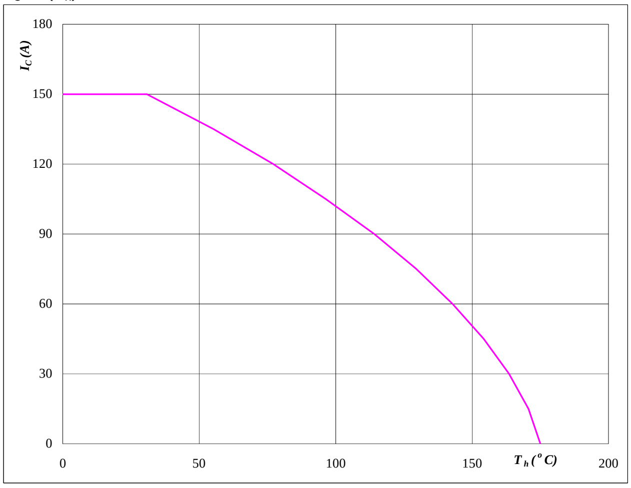
At

T_j = 175 ℃

Figure 22 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

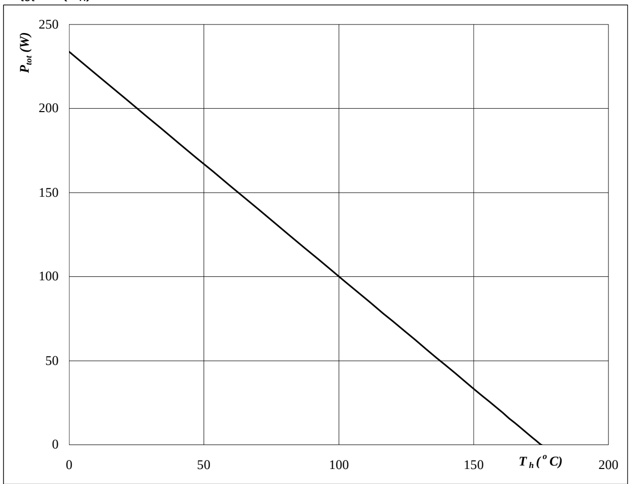
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 D1,D2,D3,D4,D5,D6 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



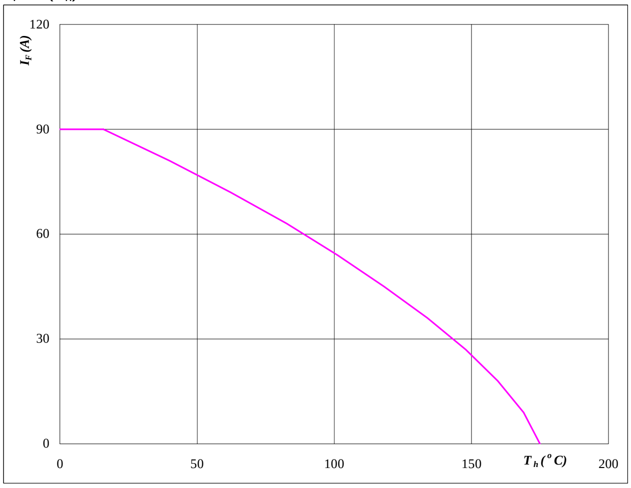
At

T_j = 175 ℃

Figure 24 D1,D2,D3,D4,D5,D6 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

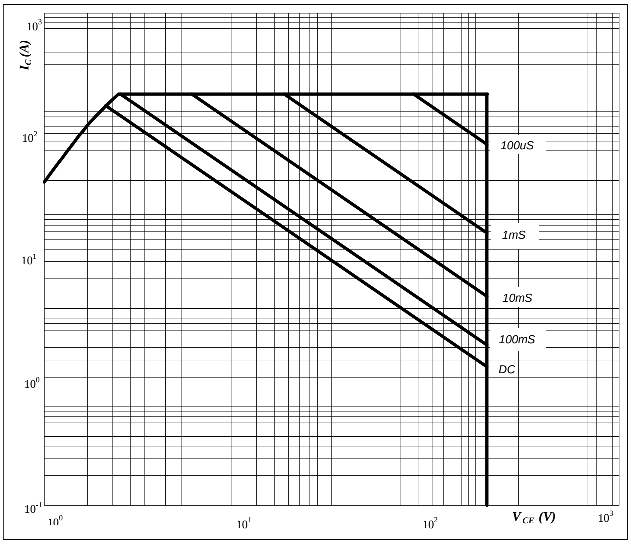
T_j = 175 ℃

T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b/D1,D2,D3,D4,D5,D6

Figure 25 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



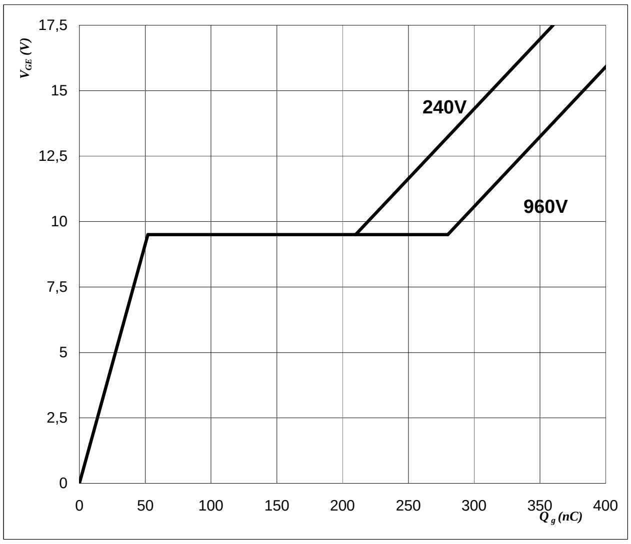
At

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

Figure 26 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Gate voltage vs Gate charge

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



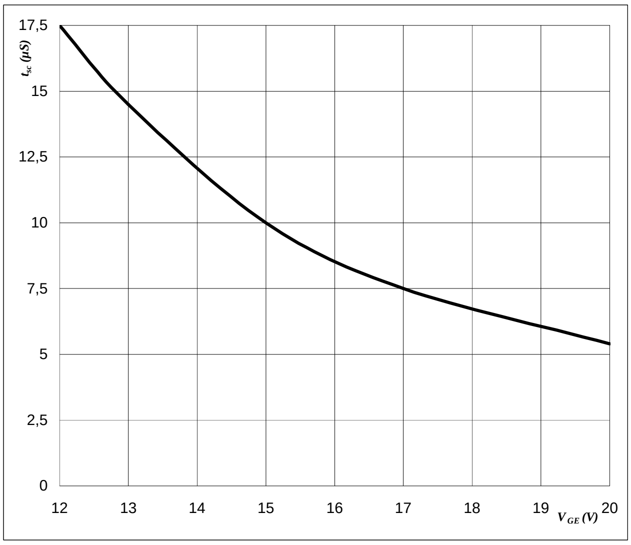
At

I_C =	99	A

Figure 27 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

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

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



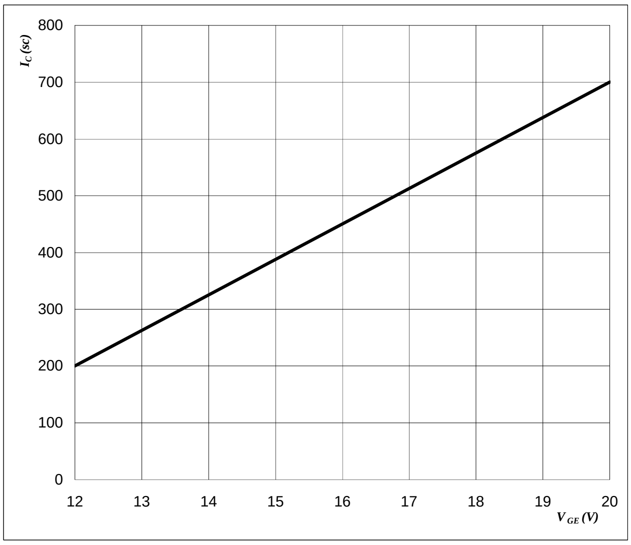
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

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

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



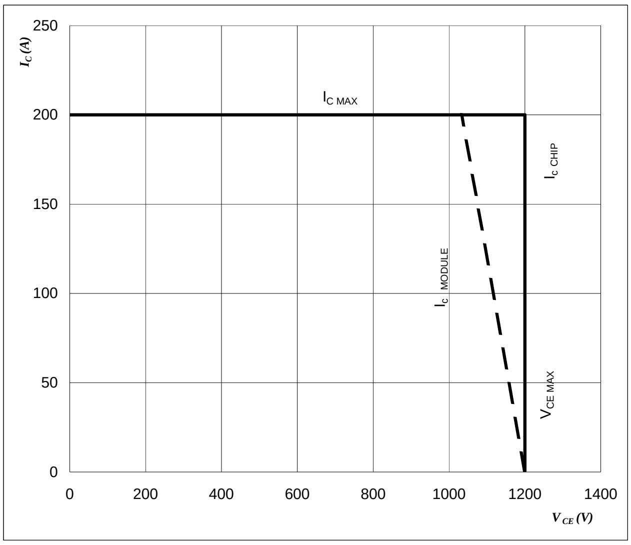
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = 151 ℃

Rgon = 4 Ω

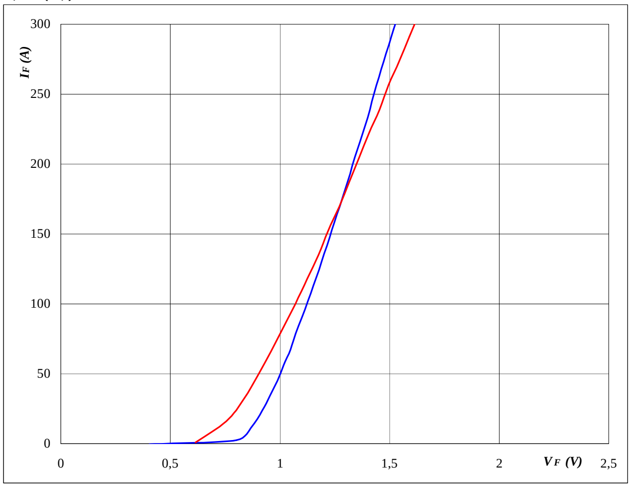
Rgoff = 4 Ω

D7a-b,D8a-b

Figure 1 D7a-b,D8a-b

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



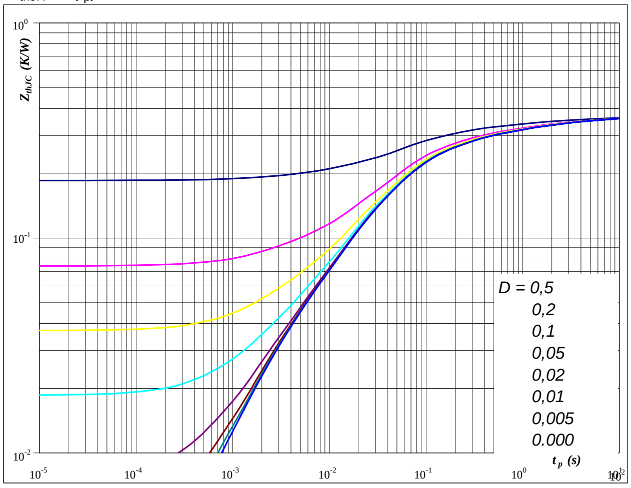
At

T_j =	25/125	℃
t_p =	250	μs

Figure 2 D7a-b,D8a-b

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



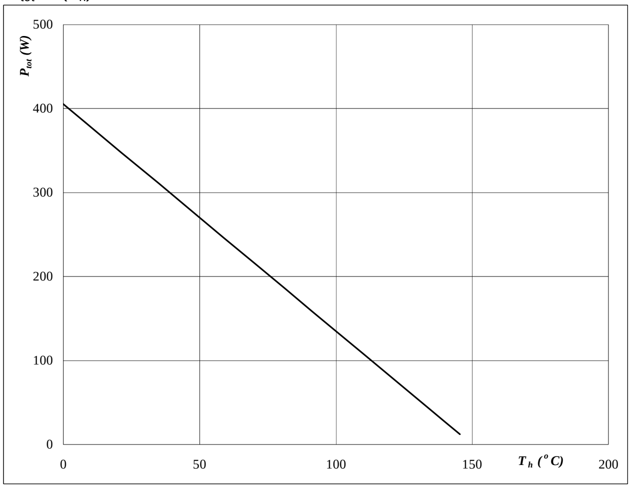
At

D =	t_p / T	
R_{thJH} =	0,37	K/W

Figure 3 D7a-b,D8a-b

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



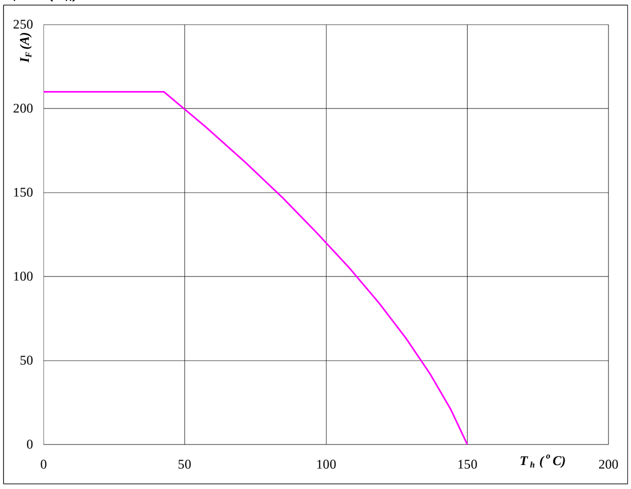
At

T_j =	150	ºC

Figure 4 D7a-b,D8a-b

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



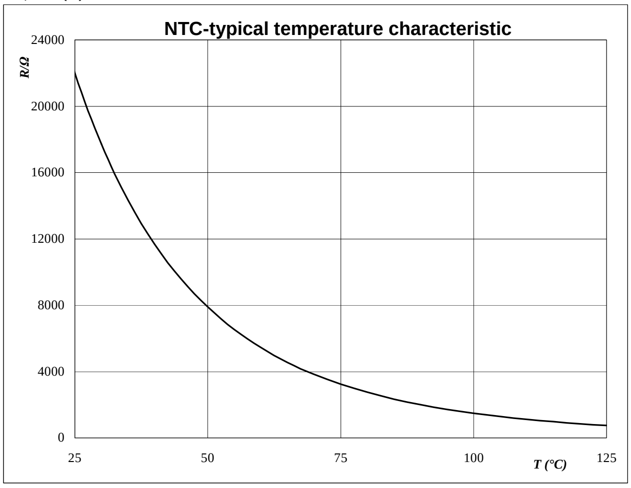
At

T_j =	150	ºC

Thermistor

Figure 1	Thermistor

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



Switching Definitions Output Inverter

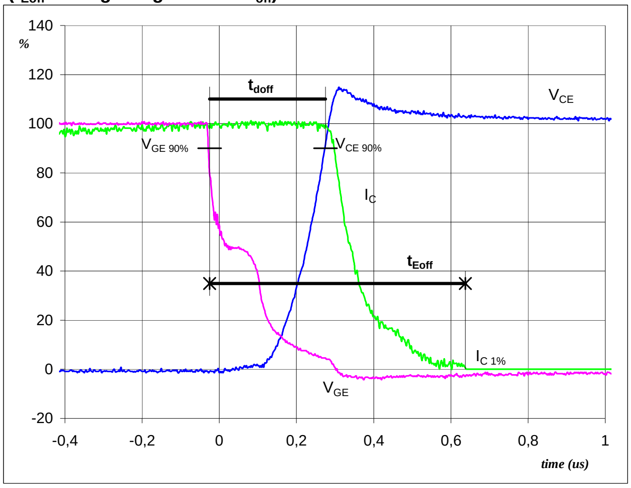
General conditions

T_j	=	151 ℃
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

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

(t_{Eoff} = integrating time for E_{off})

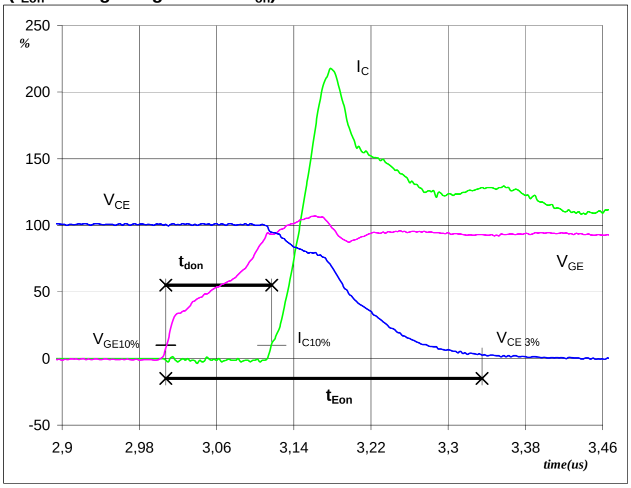


V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
t_{doff} =	0,30	µs
t_{Eoff} =	0,66	µs

Figure 2 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

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

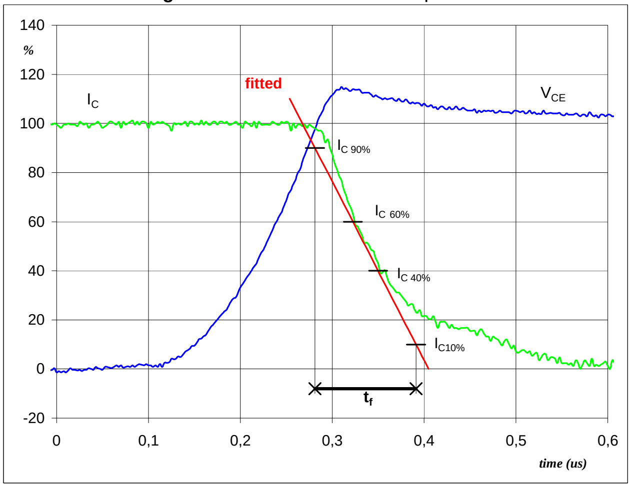
(t_{Eon} = integrating time for E_{on})



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 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

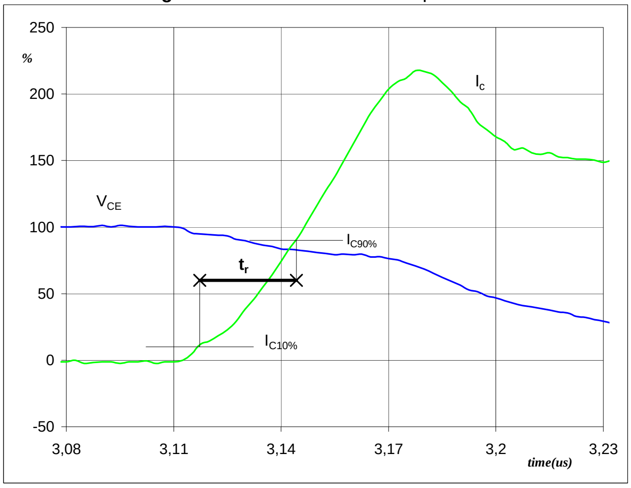
Turn-off Switching Waveforms & definition of t_f



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

Figure 4 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

Turn-on Switching Waveforms & definition of t_r

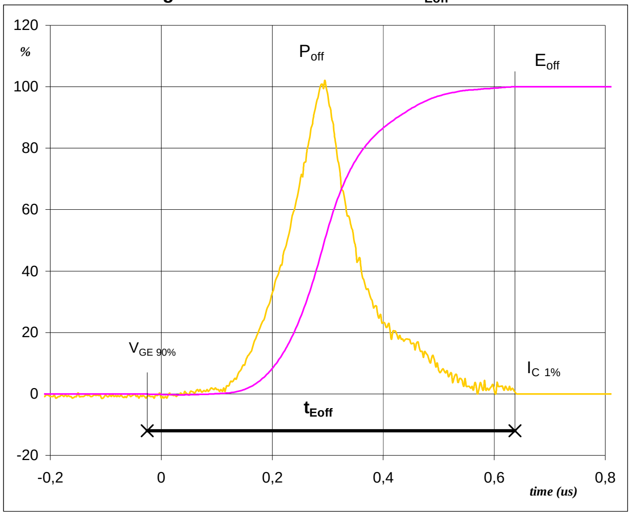


V_C (100%) =	600	V
I_C (100%) =	99	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

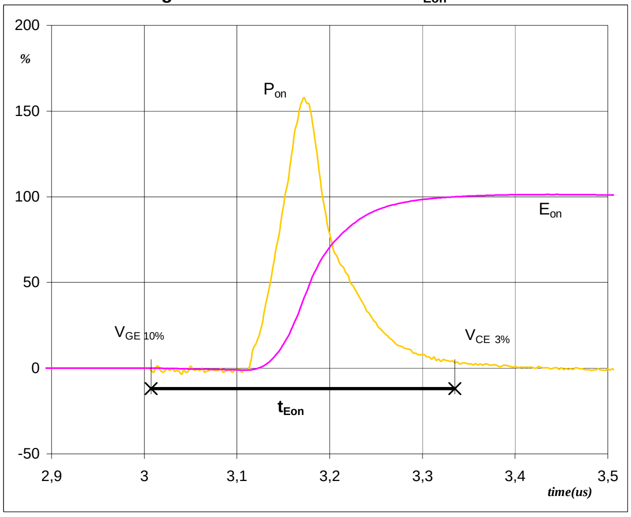
Turn-off Switching Waveforms & definition of t_{Eoff}



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

Figure 6 T1a-b,T2a-b,T3a-b,T4a-b,T5a-b,T6a-b IGBT

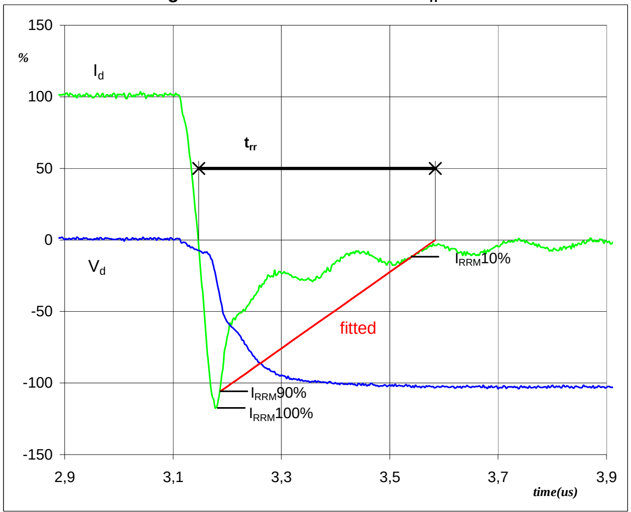
Turn-on Switching Waveforms & definition of t_{Eon}



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

Figure 7 D1,D2,D3,D4,D5,D6 FWD

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

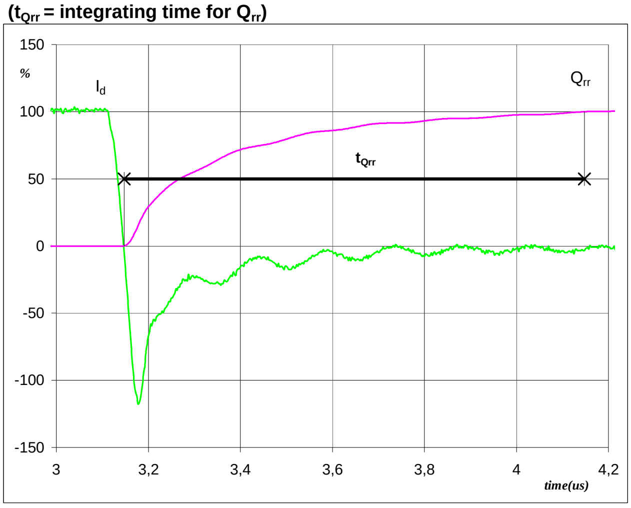


V_d (100%) =	600	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-118	A
t_{rr} =	0,29	μs

Switching Definitions Output Inverter

Figure 8 D1,D2,D3,D4,D5,D6 FWD

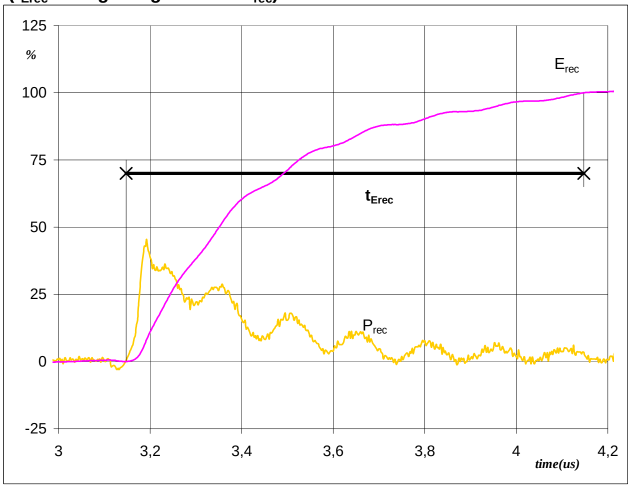
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



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

Figure 9 D1,D2,D3,D4,D5,D6 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

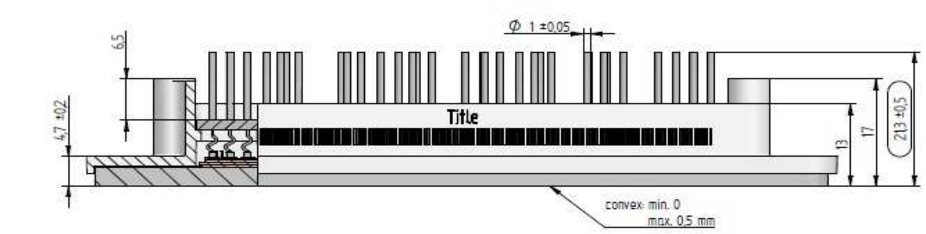
Ordering Code and Marking - Outline - Pinout

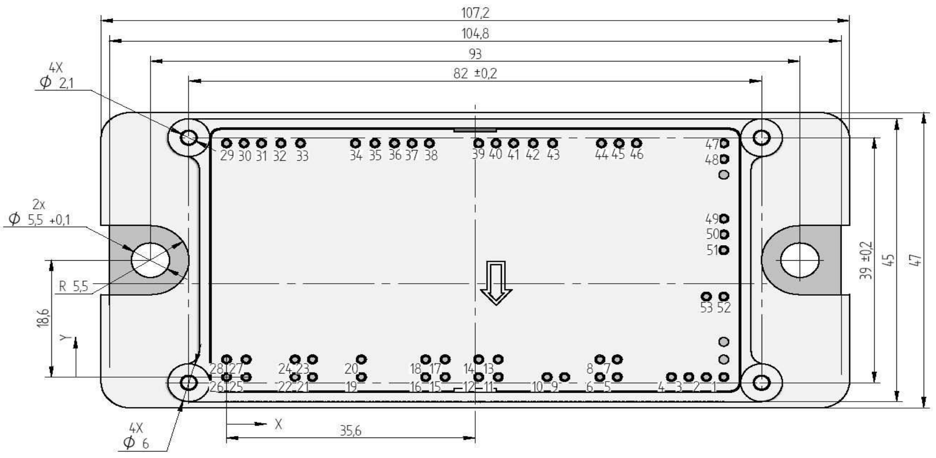
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
17mm housing	30-F212R6A100SC-M449E	M449-E	M449-E
17mm housing, without thermistor	30-F212R6A100SC01-M449E10	M449-E10	M449-E10

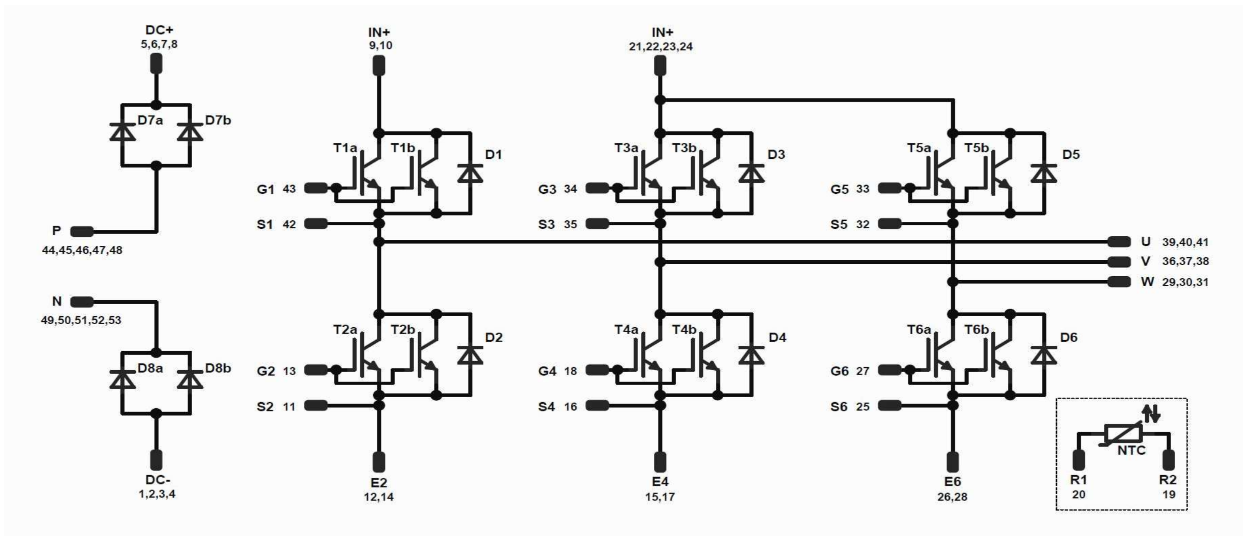
Outline

Pin	X	Y	Pin	X	Y
1	71,2	0	29	0	37,2
2	68,7	0	30	2,5	37,2
3	66,2	0	31	5	37,2
4	63,7	0	32	7,8	37,2
5	55,95	0	33	10,6	37,2
6	53,45	0	34	18,45	37,2
7	55,95	2,8	35	21,25	37,2
8	53,45	2,8	36	24,05	37,2
9	48,4	0	37	26,55	37,2
10	45,9	0	38	29,05	37,2
11	38,9	0	39	36,1	37,2
12	36,1	0	40	38,6	37,2
13	38,9	2,8	41	41,1	37,2
14	36,1	2,8	42	43,9	37,2
15	31,3	0	43	46,7	37,2
16	28,5	0	44	53,7	37,2
17	31,3	2,8	45	56,2	37,2
18	28,5	2,8	46	58,7	37,2
19	19,3	0	47	71,2	37,2
20	19,3	2,8	48	71,2	34,7
21	12,3	0	49	71,2	25,2
22	9,8	0	50	71,2	22,7
23	12,3	2,8	51	71,2	20,2
24	9,8	2,8	52	71,2	12,8
25	2,8	0	53	68,7	12,8
26	0	0			
27	2,8	2,8			
28	0	2,8			





Pinout



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