Vincotech

flow PIM 2 3rd	600 V / 100 A

Features

- 3~rectifier,BRC,Inverter, NTC
- Very Compact housing, easy to route
- IGBT3/ EmCon3 technology for low saturation losses and improved EMC behavior

Target Applications

- Motor Drives
- Power Generation

Types

- V23990-P765-A-PM

flow 2 housing

Schematic
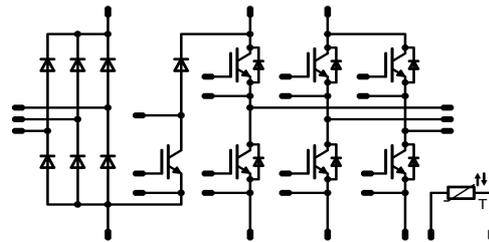
Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Forward current	I_{FAV}	DC current	T_h=80°C T_c=80°C	100 100	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	1000	A
I2t-value	I^2t			5000	A^2s
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	130 196	W
Maximum Junction Temperature	$T_j$max			150	°C
Inverter IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	100 120	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		200	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	189 287	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		6 360	μs V
Maximum Junction Temperature	$T_j$max			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	80 108	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		200	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	121 183	W
Maximum Junction Temperature	$T_j$max			175	°C
Brake IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C T_c=80°C	75 80	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		225	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	137 208	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		6 360	µs V
Maximum Junction Temperature	$T_j$max			175	°C
Brake Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	20 20	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		40	A
Brake Inverse Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	52 79	W
Maximum Junction Temperature	$T_j$max			175	°C
Brake FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	35 40	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		90	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	60 91	W
Maximum Junction Temperature	$T_j$max			175	°C
Thermal properties					
Storage temperature	T_{stg}			-40...+125	°C
Operation temperature under switching condition	T_{op}			-40...+Tjmax-25	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Insulation properties				
Insulation voltage	V_{is}	t=1min	4000	V_{DC}
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

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	
Input Rectifier Diode									
Forward voltage	V_F			100	Tj=25°C Tj=125°C		1,2 1,16	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				Tj=25°C Tj=125°C		0,91 0,77		V
Slope resistance (for power loss calc. only)	r_t				Tj=25°C Tj=125°C		0,003 0,004		Ω
Reverse current	I_r		1500		Tj=25°C Tj=125°C			0,05 1,1	mA
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					0,54		K/W
Thermal resistance chip to case	R_{thJC}						0,36		
Inverter IGBT									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,0016	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		100	Tj=25°C Tj=150°C		1,48 1,73	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}	0	600		Tj=25°C Tj=150°C			0,25	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25°C Tj=150°C			700	nA
Integrated Gate resistor	R_{gint}						none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C	137 138		ns
Rise time	t_r					Tj=25°C Tj=150°C	16 19		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C	188 217		
Fall time	t_f					Tj=25°C Tj=150°C	84 104		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C	0,54 0,93		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C	2,5 3,48		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C	6280		pF
Output capacitance	C_{oss}						400		
Reverse transfer capacitance	C_{rss}						108		
Gate charge	Q_{Gate}	±15	480	100	Tj=25°C		620		nC
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					0,5		K/W
Thermal resistance chip to case	R_{thJC}						0,33		
Coupled thermal resistance transistor-transistor	$R_{thJHT-T}$						0,09		
Coupled thermal resistance diode-transistor	$R_{thJHD-T}$						0,14		
Inverter FWD									
Diode forward voltage	V_F			100	Tj=25°C Tj=150°C		1,62 1,63	2,3	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C	128 152		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C	106 127		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C	4,64 9,2		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C	9459 5303		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C	1,13 2,25		mWs
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					0,78		K/W
Thermal resistance chip to case	R_{thJC}						0,52		
Coupled thermal resistance diode-diode	$R_{thJHD-D}$								
Coupled thermal resistance transistor-diode	$R_{thJHT-D}$						0,11		

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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	
Brake IGBT									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,0012	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		75	Tj=25°C Tj=150°C		1,45 1,69	2,1	V
Collector-emitter cut-off incl diode	I_{CES}	0	600		Tj=25°C Tj=150°C			0,66	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25°C Tj=150°C			700	nA
Integrated Gate resistor	R_{gint}						none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	75	Tj=25°C Tj=150°C	111 113		ns
Rise time	t_r					Tj=25°C Tj=150°C	12 15		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C	173 202		
Fall time	t_f					Tj=25°C Tj=150°C	53 74		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C	0,3 0,46		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C	1,52 2,14		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C	4620		pF
Output capacitance	C_{oss}						288		
Reverse transfer capacitance	C_{rss}						137		
Gate charge	Q_{Gate}	±15	480	75	Tj=25°C		470		nC
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					0,69		K/W
Thermal resistance chip to case	R_{thJC}						0,46		
Brake Inverse Diode									
Diode forward voltage	V_F			10	Tj=25°C Tj=150°C	1,2	1,78 1,76	2,1	V
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					1,83		K/W
Thermal resistance chip to case	R_{thJC}						1,20		K/W
Brake FWD									
Diode forward voltage	V_F			30	Tj=25°C Tj=150°C		1,62 1,58	2,1	V
Reverse leakage current	I_r	±15	300	75	Tj=25°C Tj=150°C			140	µA
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	75	Tj=25°C Tj=150°C	82 84		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C	22,7 116		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C	2,14 3,82		µC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25°C Tj=150°C	10578 6820		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C	0,52 0,97		mWs
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50µm λ = 0,61 W/m·K					1,59		K/W
Thermal resistance chip to case	R_{thJC}						1,05		
Thermistor									
Rated resistance	R_{25}	Tol. ±5%			Tj=25°C	20,9	22	23,1	kΩ
Deviation of R100	$D_{R/R}$	R100=1486.1Ω			Tc=100°C		2,9		%/K
Power dissipation given Epcos-Typ	P				Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%			Tj=25°C		4000		K

Output Inverter

Figure 1	Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At

$t_p =$	250	µs
$T_j =$	25	°C
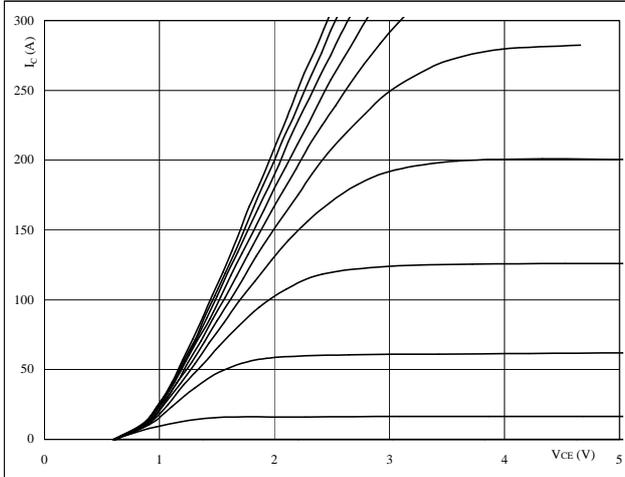
VGE from 7 V to 17 V in steps of 1 V

Figure 2	Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At

$t_p =$	250	µs
$T_j =$	150	°C
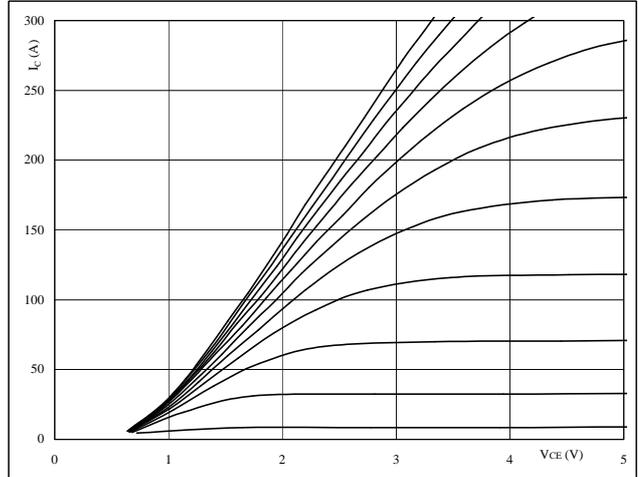
VGE from 7 V to 17 V in steps of 1 V

Figure 3	Output inverter IGBT

Typical transfer characteristics

$Ic = f(V_{GE})$

Tj = Tj$_{max}$-25℃

Tj = 25℃

At
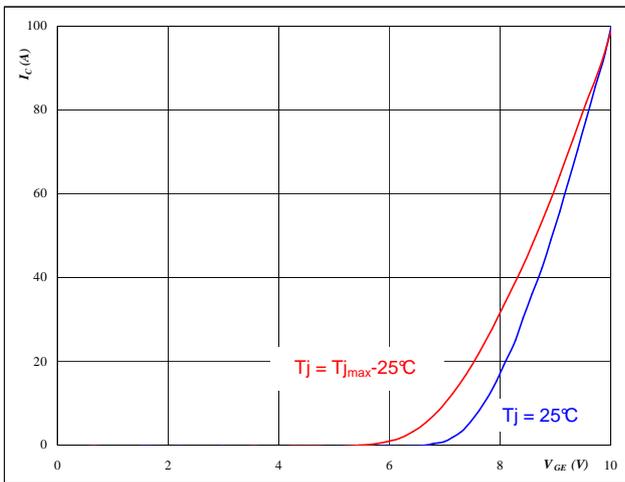
$t_p =$	250	µs
$V_{CE} =$	10	V

Figure 4	Output inverter FWD

Typical diode forward current as a function of forward voltage
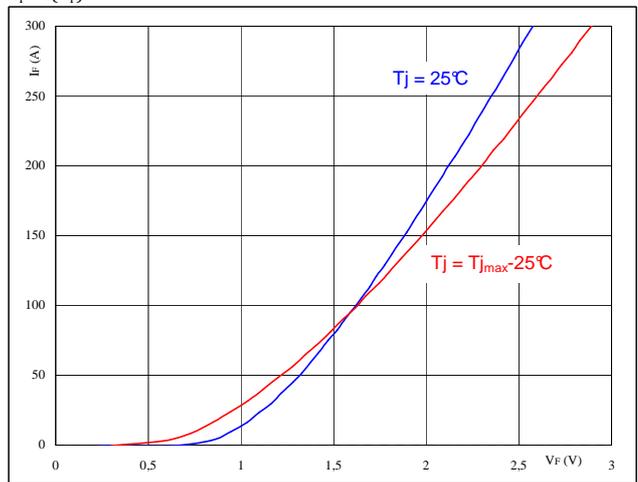
$I_F = f(V_F)$

Tj = 25℃

Tj = Tj$_{max}$-25℃

At

$t_p =$	250	µs

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Output Inverter

Figure 5	Output inverter IGBT

**Typical switching energy losses
as a function of collector current**

$E = f(I_c)$
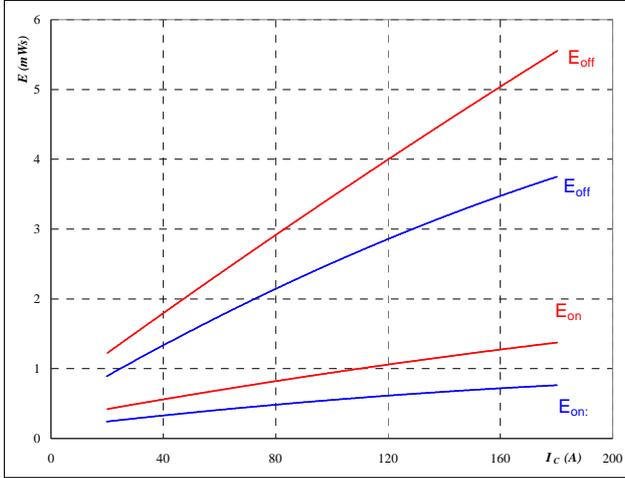
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6	Output inverter IGBT

**Typical switching energy losses
as a function of gate resistor**

$E = f(R_G)$
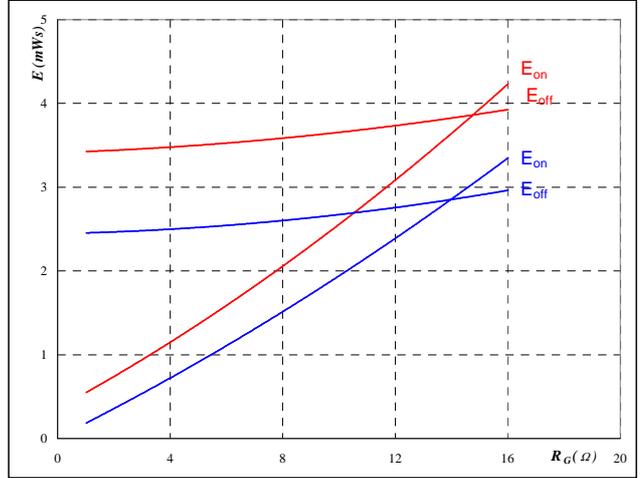
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 7	Output inverter IGBT

**Typical reverse recovery energy loss
as a function of collector current**

$E_{rec} = f(I_c)$
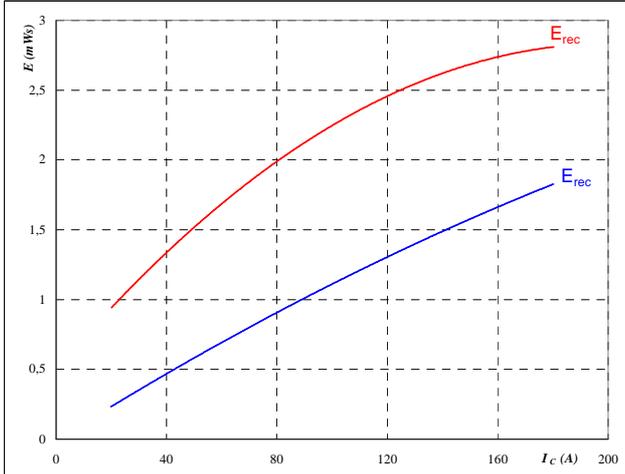
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 8	Output inverter IGBT

**Typical reverse recovery energy loss
as a function of gate resistor**

$Erec = f(R_G)$
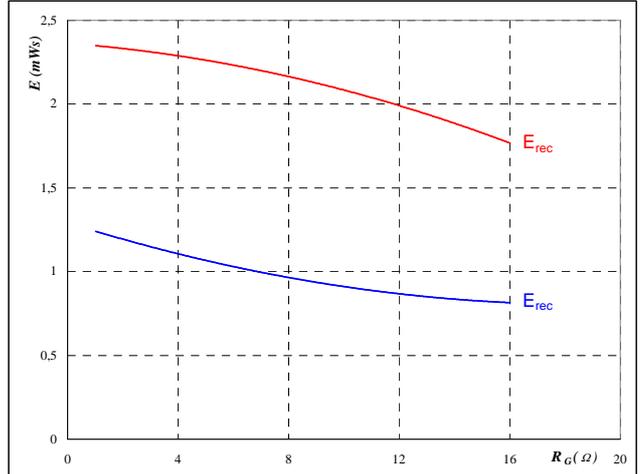
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Output Inverter

Figure 9	Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$
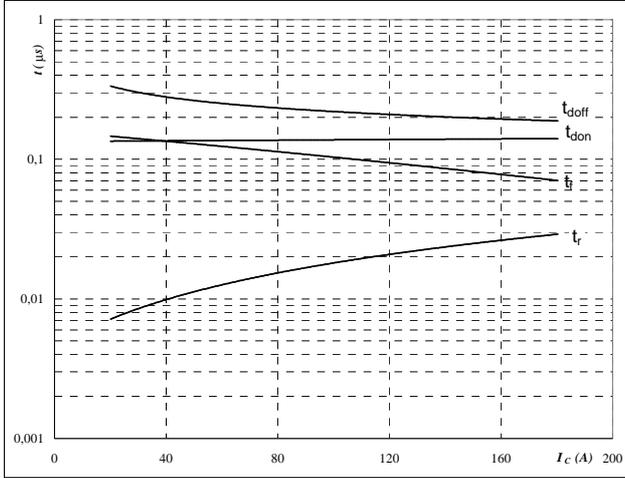
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10	Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$
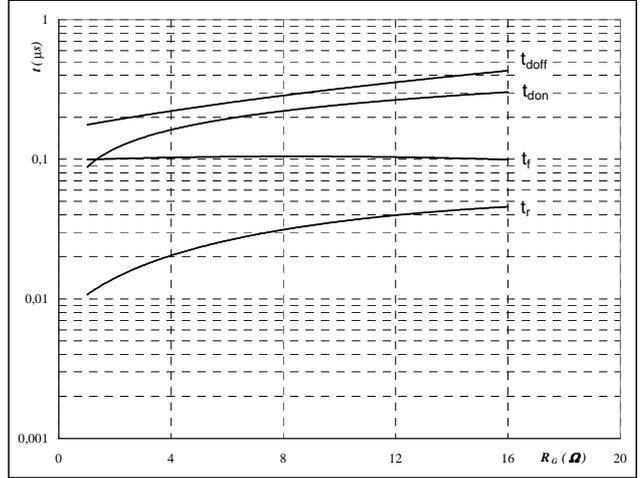
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 11	Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$

At
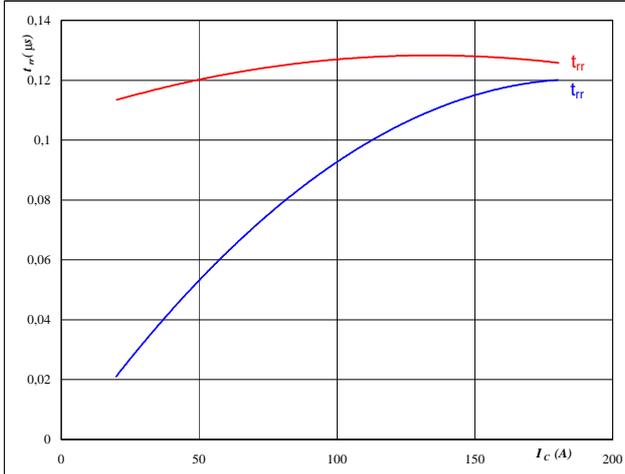
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 12	Output inverter FWD

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

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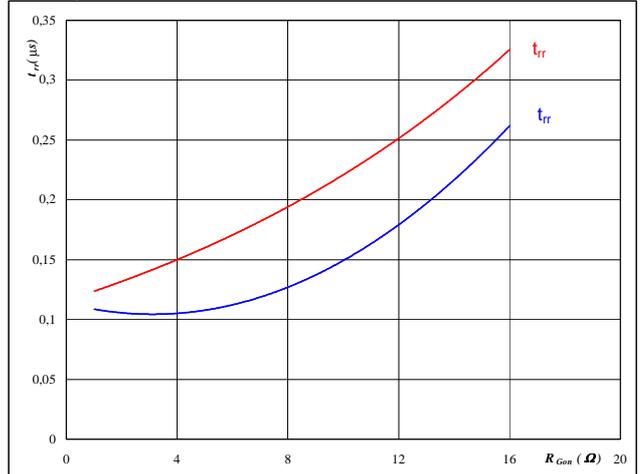
At

T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Output inverter FWD

**Typical reverse recovery charge as a
function of collector current**

$Q_{rr} = f(Ic)$

At
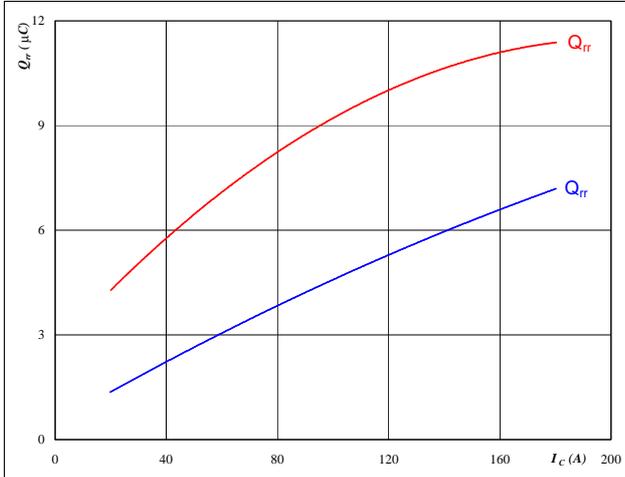
$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

Figure 14 Output inverter FWD

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

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

At
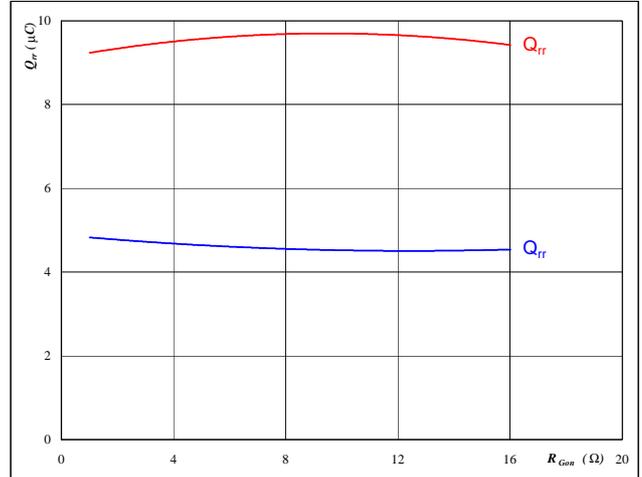
$T_j =$	25/150	°C
$V_R =$	300	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Figure 15 Output inverter FWD

**Typical reverse recovery current as a
function of collector current**

$I_{RRM} = f(Ic)$

At
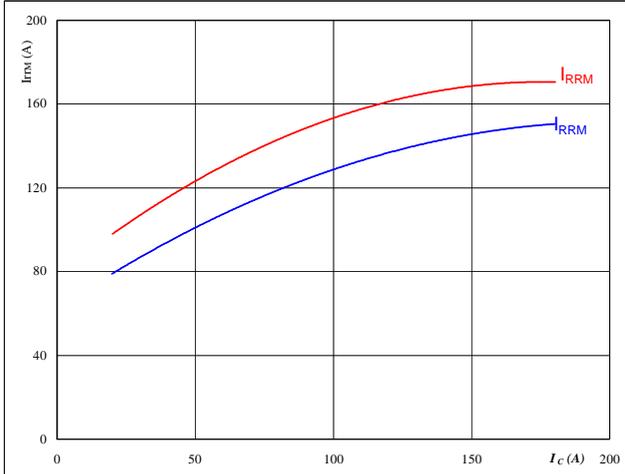
$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

Figure 16 Output inverter FWD

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

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

At
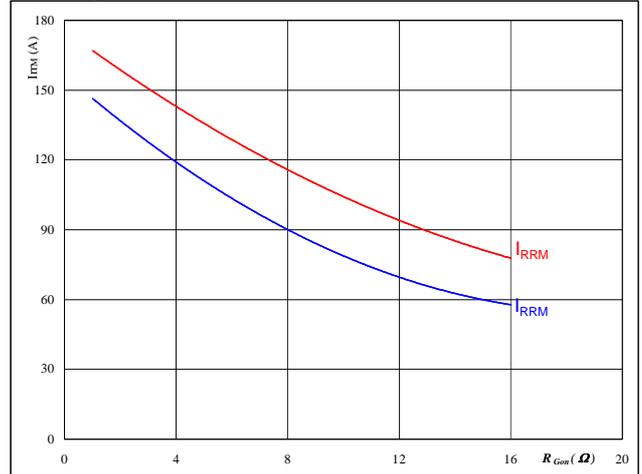
$T_j =$	25/150	°C
$V_R =$	300	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Output Inverter

Figure 17	Output inverter FWD

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

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

At
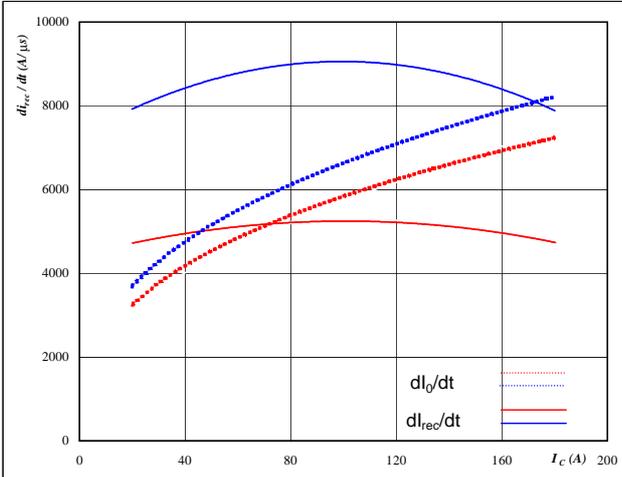
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 18	Output 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
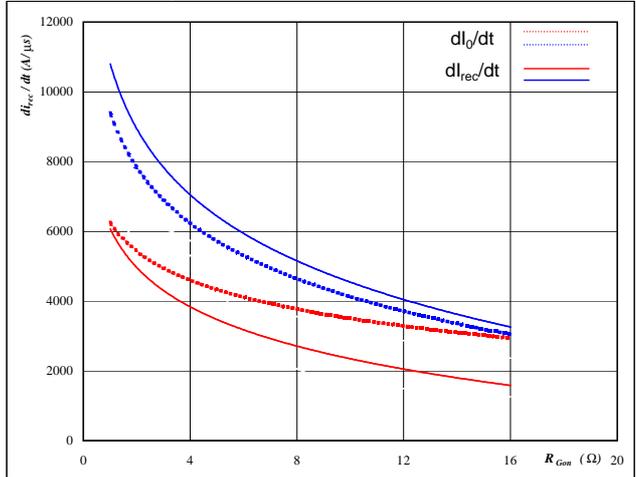
T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Figure 19	Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$
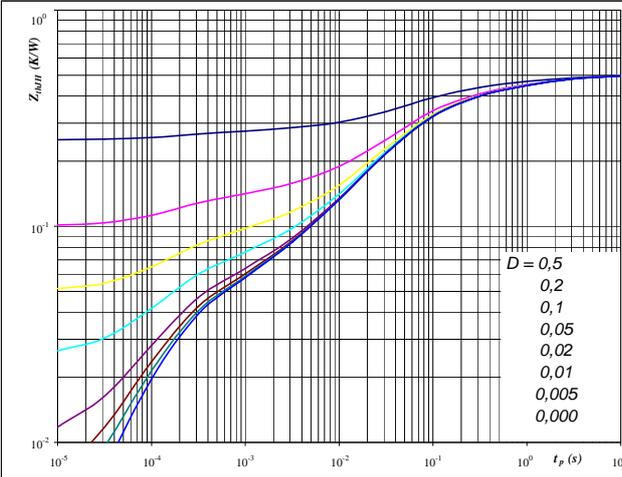
At

D =	tp / T			
R_{thJH} =	0,502	K/W	R_{thJH} = 0,60	K/W
Single device heated			All devices heated	

IGBT thermal model values

R (K/W)	Tau (s)	R (K/W)
0,01	1,0E+01	0,11
0,07	1,7E+00	0,07
0,11	2,3E-01	0,11
0,19	4,9E-02	0,19
0,06	9,5E-03	0,06
0,02	1,0E-03	0,02
0,03	1,5E-04	0,03

Figure 20	Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$
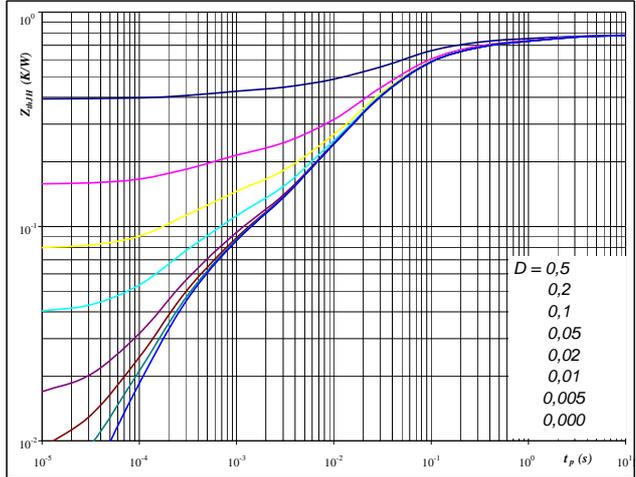
At

D =	tp / T			
R_{thJH} =	0,79	K/W	R_{thJH} = 0,79	K/W
Single device heated			All devices heated	

FWD thermal model values

R (K/W)	Tau (s)	R (K/W)
0,02	7,9E+00	0,02
0,08	1,2E+00	0,08
0,21	1,3E-01	0,21
0,35	2,8E-02	0,35
0,07	4,4E-03	0,07
0,06	3,4E-04	0,06

Output Inverter

Figure 21   Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$
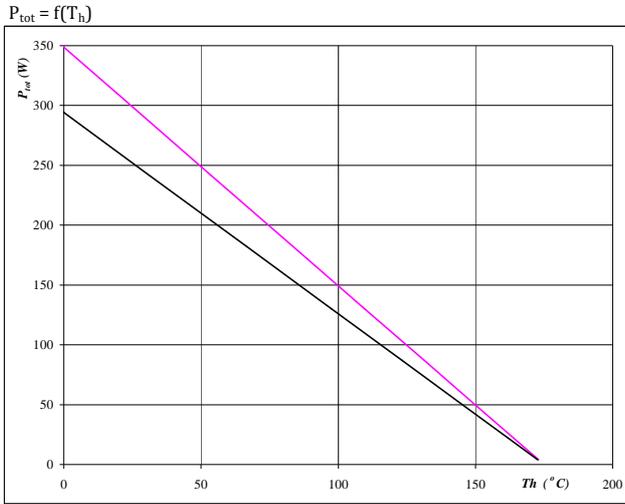
At

T_j =	175	°C

— single heating
— overall heating

Figure 22   Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$
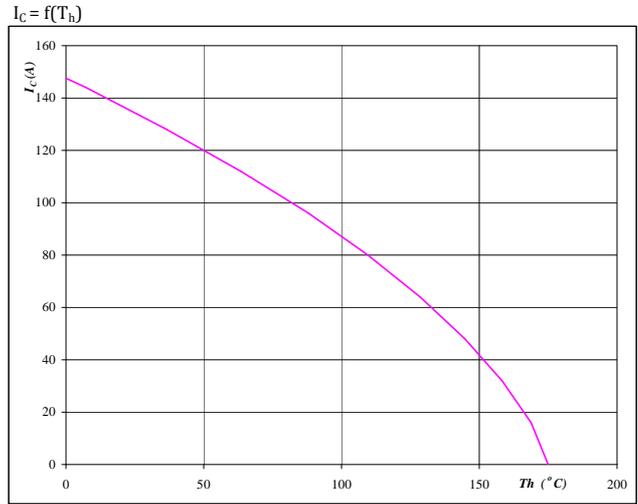
At

T_j =	175	°C
VGE =	15	V

Figure 23   Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$
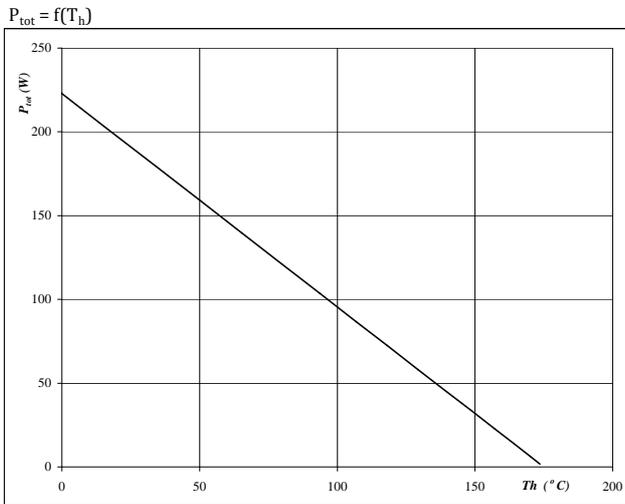
At

T_j =	175	°C

Figure 24   Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$
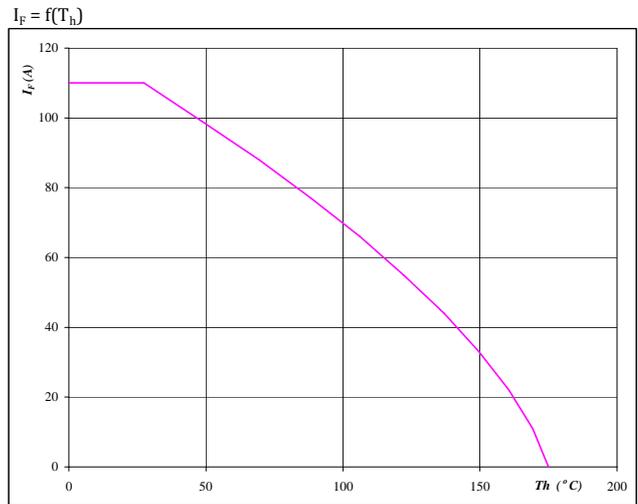
At

T_j =	175	°C

Output Inverter

Figure 25 | Output inverter IGBT

**Safe operating area as a function
of collector-emitter voltage**

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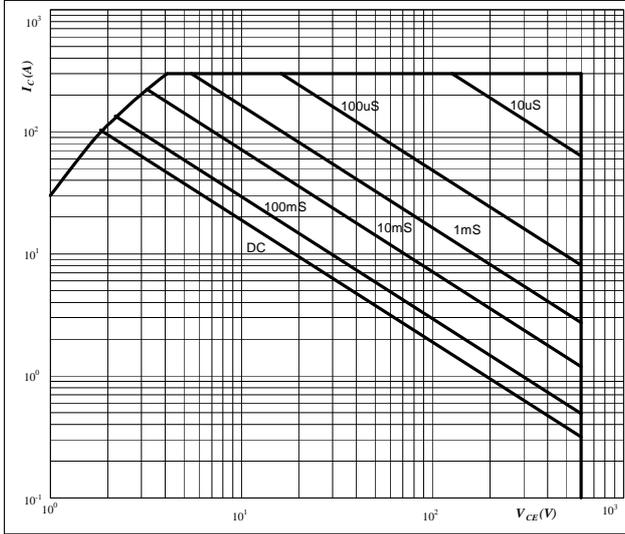
At

D = single pulse
Th = 80 °C
V_{GE} = ±15 V
Tj = T_{jmax} °C

Figure 26 | Output inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$
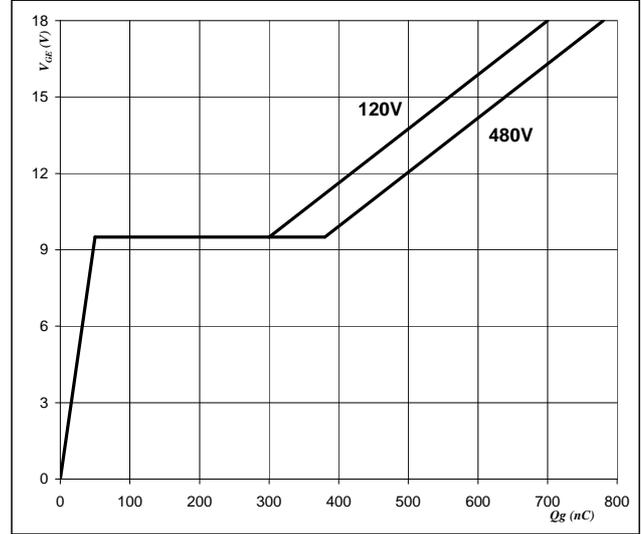
At

I_C = 100 A

Brake

Figure 1   Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At

t_p =	250	µs
T_j =	25	°C
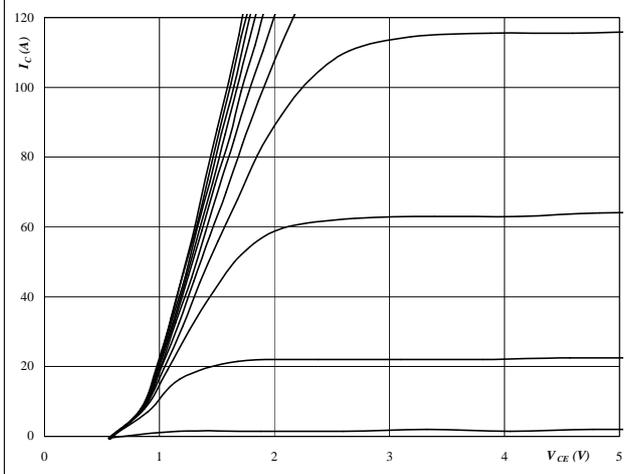
VGE from 7 V to 17 V in steps of 1 V

Figure 2   Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At

t_p =	250	µs
T_j =	150	°C
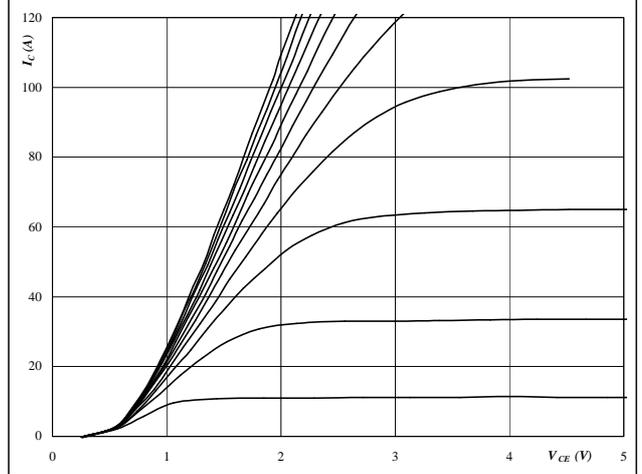
VGE from 7 V to 17 V in steps of 1 V

Figure 3   Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

At
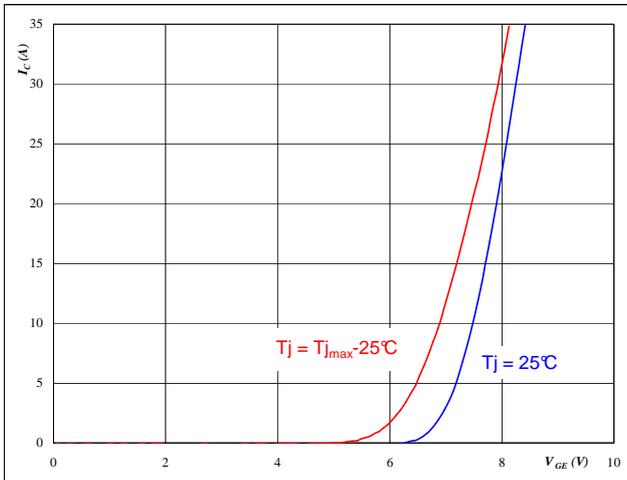
t_p =	250	µs
V_{CE} =	10	V

Figure 4   Brake FWD

**Typical diode forward current as
a function of forward voltage**

$I_F = f(V_F)$

At
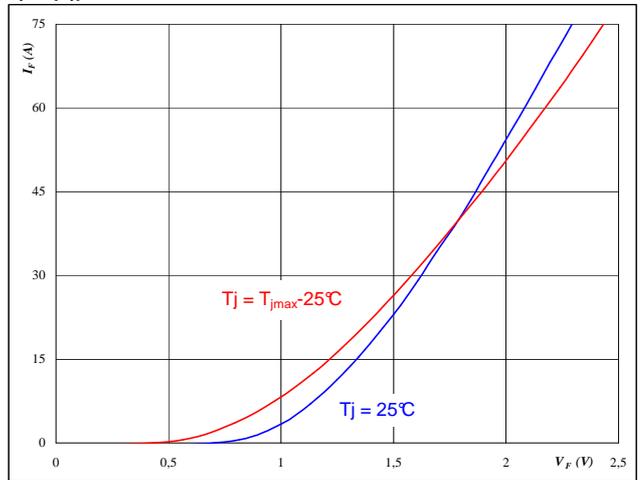
t_p =	250	µs

Brake

Figure 5	Brake IGBT

**Typical switching energy losses
as a function of collector current**

$E = f(I_C)$
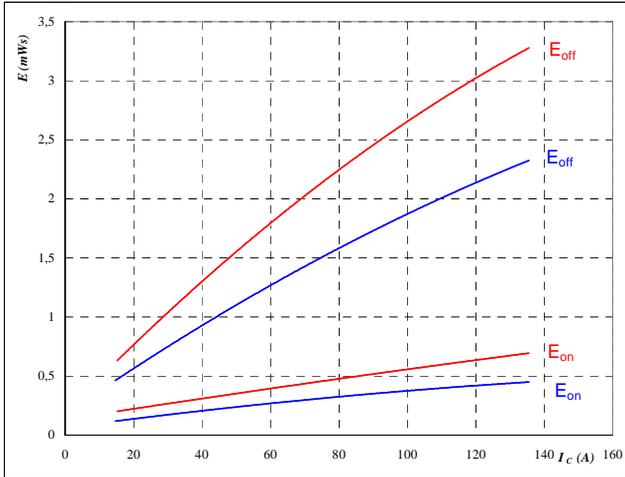
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

Figure 6	Brake IGBT

**Typical switching energy losses
as a function of gate resistor**

$E = f(R_G)$
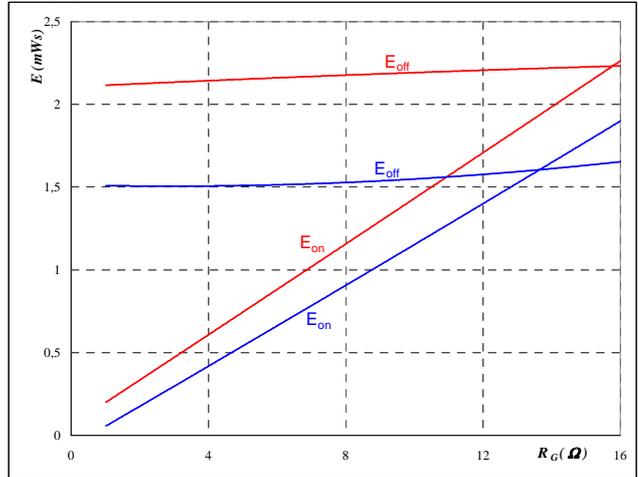
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	75	A

Figure 7	Brake IGBT

**Typical reverse recovery energy loss
as a function of collector current**

$E_{rec} = f(I_c)$
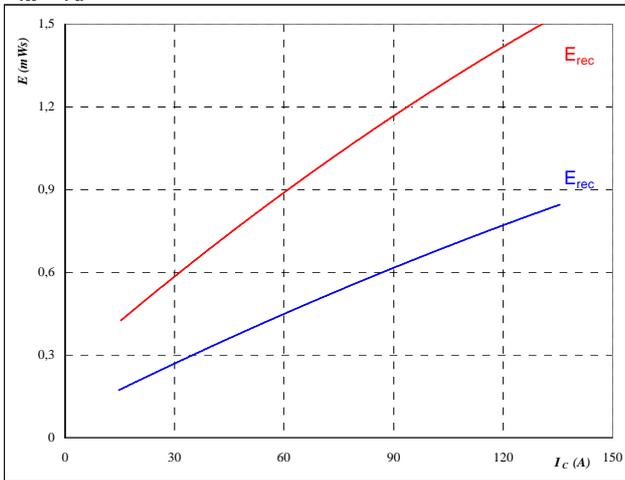
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

Figure 8	Brake IGBT

**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
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	75	A

23 Dec 2014 / Revision: 4
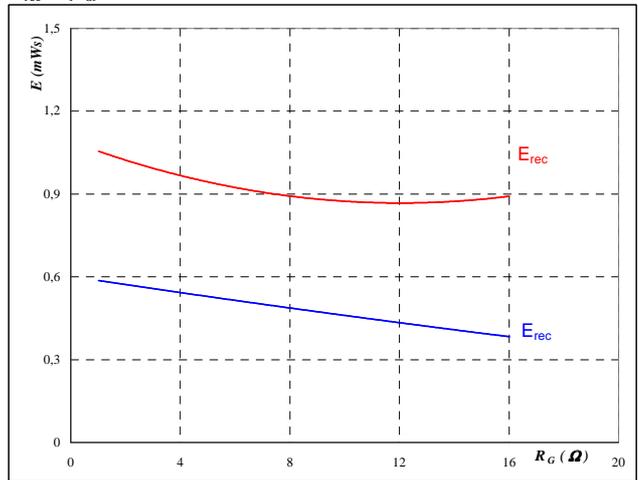
Brake

Figure 9	Brake IGBT

**Typical switching times as a
function of collector current**

t = f(I_C)
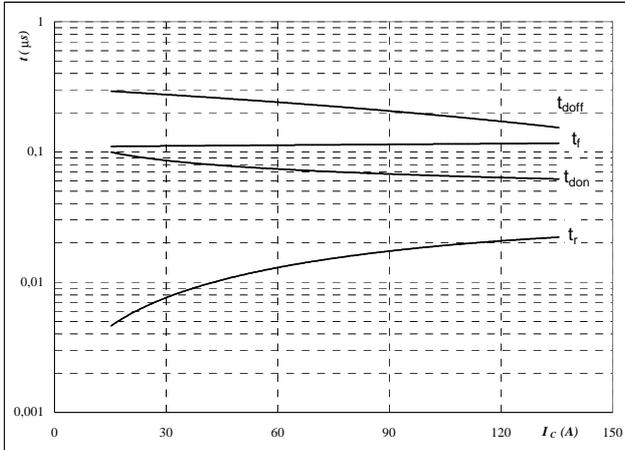
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10	Brake IGBT

**Typical switching times as a
function of gate resistor**

t = f(R_G)
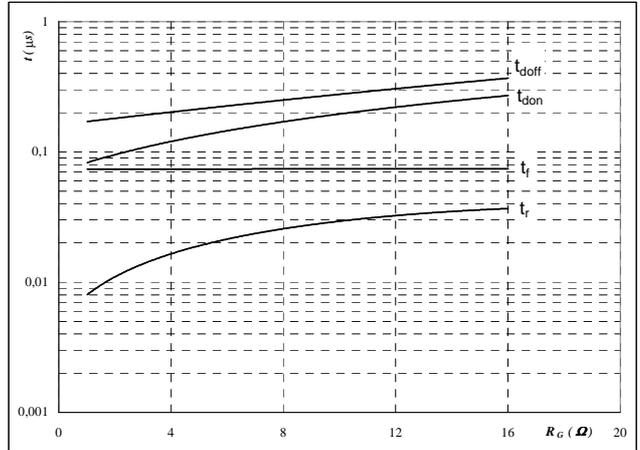
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

Figure 11	Brake IGBT

**IGBT transient thermal impedance
as a function of pulse width**
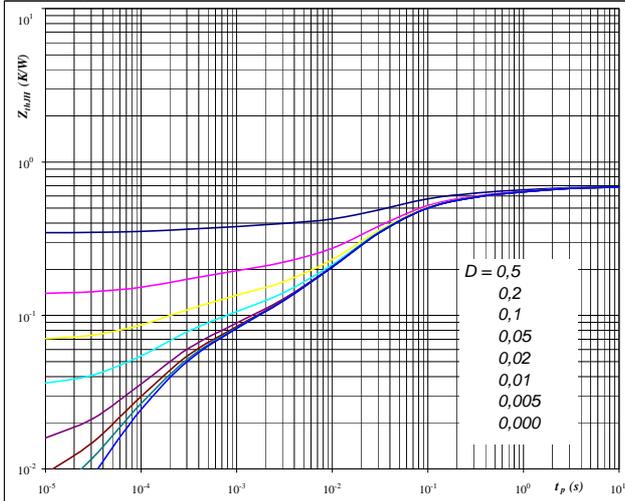
Z_{thJH} = f(t_p)

At

D =	tp / T	
R_{thJH} =	0,69	K/W

Figure 12	Brake IGBT

**FWD transient thermal impedance
as a function of pulse width**

Z_{thJH} = f(t_p)
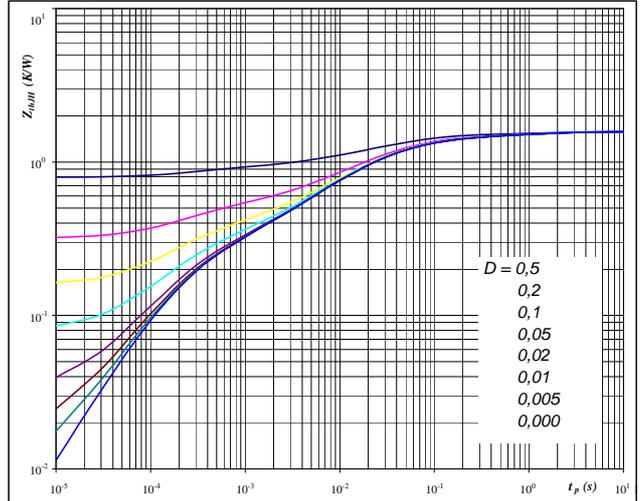
At

D =	tp / T	
R_{thJH} =	1,59	K/W

Brake

Figure 13 — Brake IGBT

**Power dissipation as a
function of heatsink temperature**

$P_{tot} = f(T_h)$

**At**
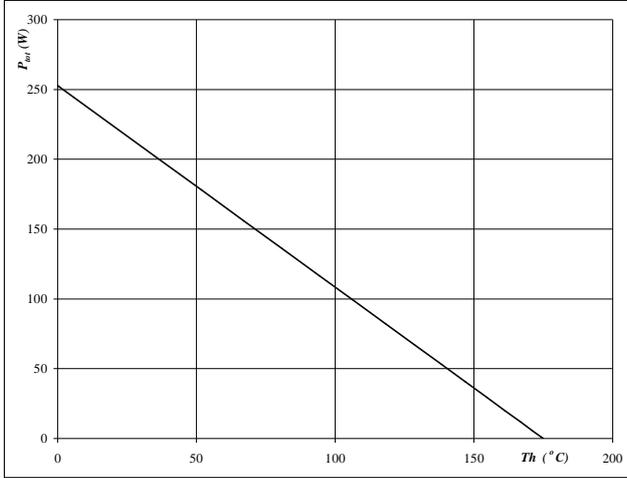
$T_j =$ 175   ºC

Figure 14 — Brake IGBT

**Collector current as a
function of heatsink temperature**

$I_C = f(T_h)$

At
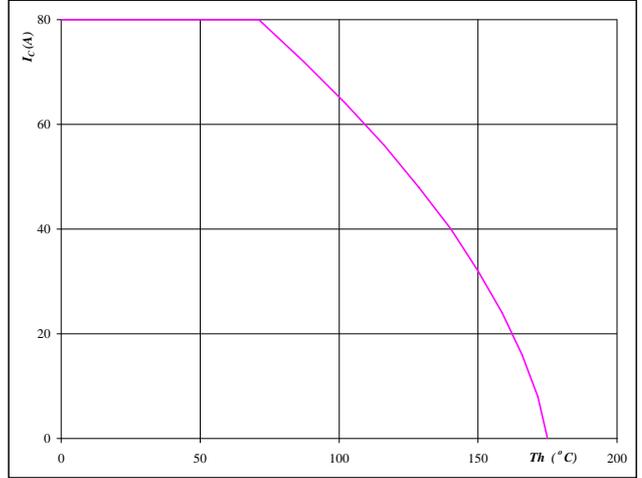
$T_j =$ 175   ºC
$V_{GE} =$ 15   V

Figure 15 — Brake FWD

**Power dissipation as a
function of heatsink temperature**

$P_{tot} = f(T_h)$

At
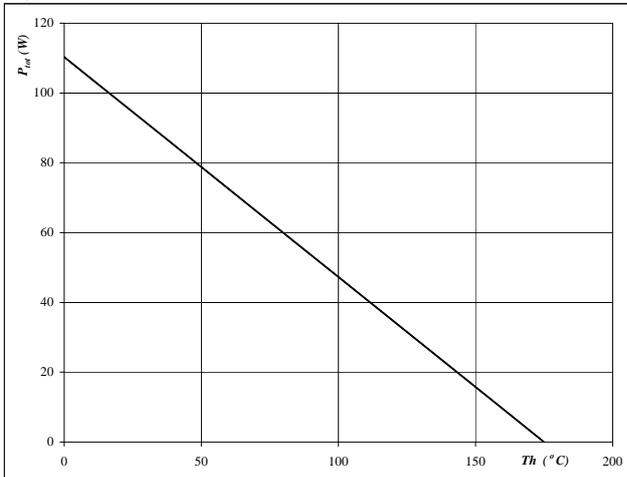
$T_j =$ 175   ºC

Figure 16 — Brake FWD

**Forward current as a
function of heatsink temperature**

$I_F = f(T_h)$

At

$T_j =$ 175   ºC
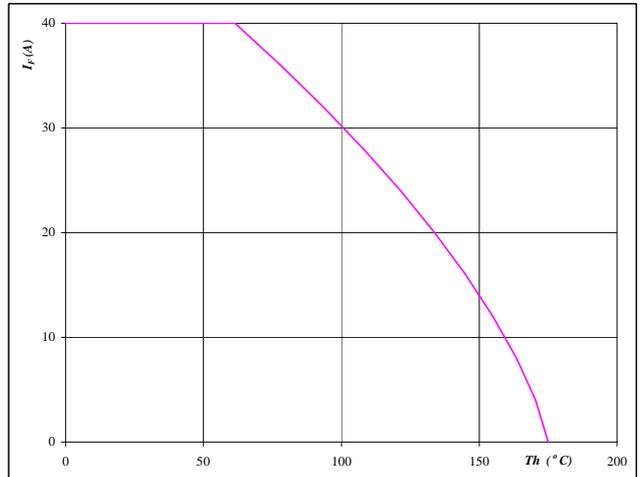
Brake Inverse Diode

Figure 1

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

At

$t_p =$ 250 µs

Figure 2

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

At

$D =$ tp / T

$R_{thJH} =$ 1,83 K/W

Figure 3

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At

$T_j =$ 175 ºC

Figure 4

Forward current as a function of heatsink temperature

$I_F = f(T_h)$

At

$T_j =$ 175 ºC

Input Rectifier Bridge

Figure 1	Rectifier diode

**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$

At
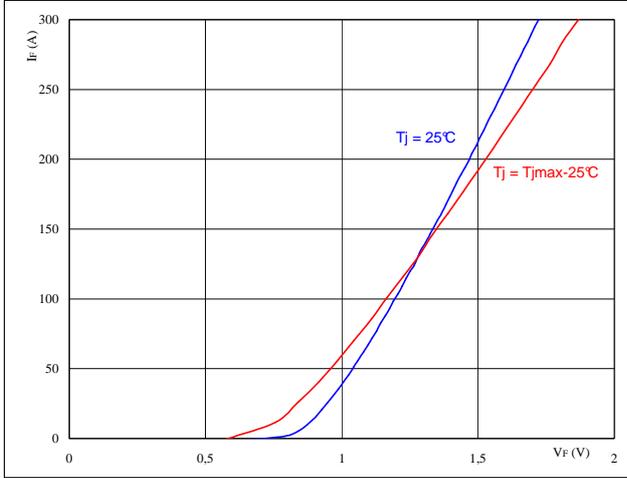
$t_p =$ 250 µs

Figure 2	Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$
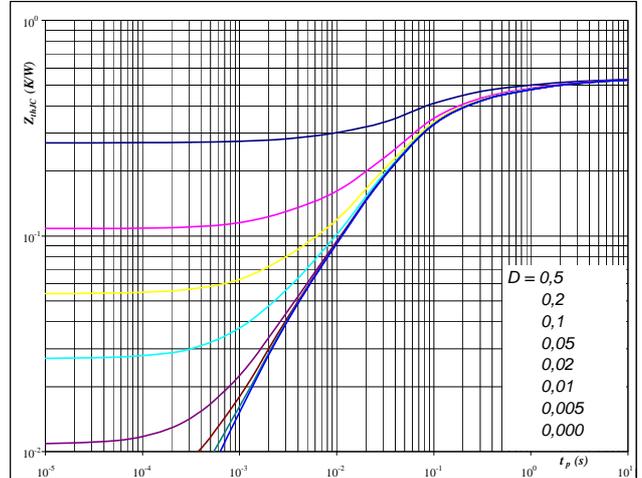
At

$D =$ tp / T

$R_{thJH} =$ 0,54 K/W

Figure 3	Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At
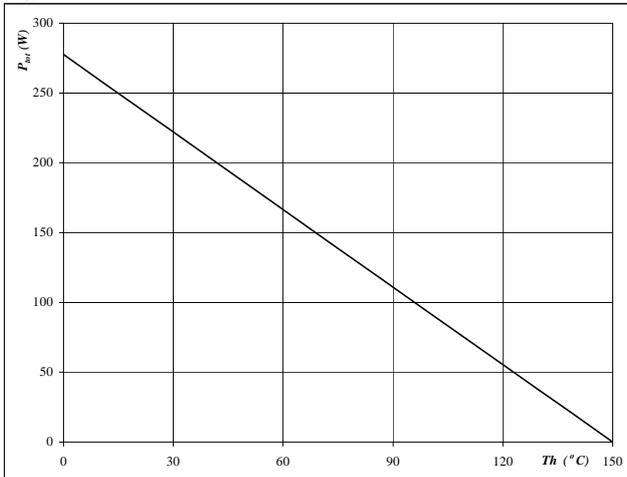
$T_j =$ 150 ºC

Figure 4	Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$

At
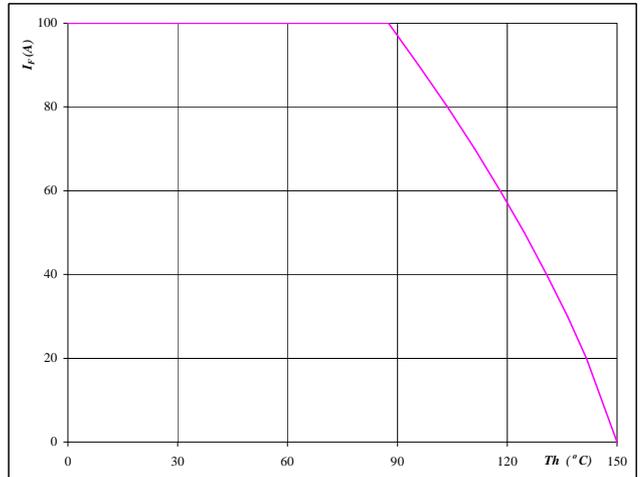
$T_j =$ 150 ºC

Thermistor

Figure 1   Thermistor

**Typical NTC characteristic
as a function of temperature**

$R_T = f(T)$

NTC-typical temperature characteristic
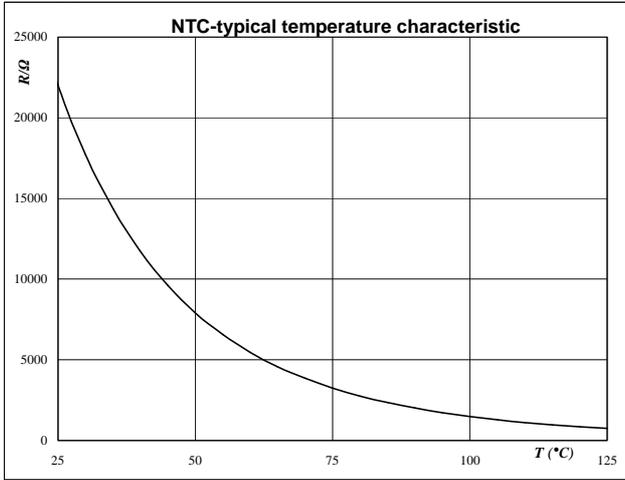
Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1	Output inverter IGBT

Turn-off Switching Waveforms & definition of tdoff, tEoff
(t_{Eoff} = integrating time for E_{off})
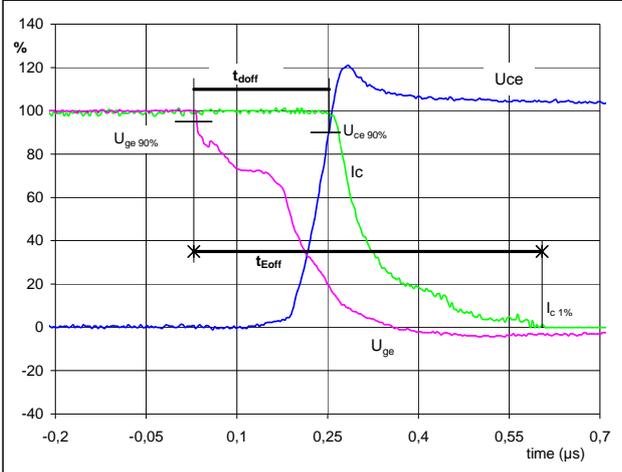
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	100	A
t_{doff} =	0,22	µs
t_{Eoff} =	0,58	µs

Figure 2	Output inverter IGBT

Turn-on Switching Waveforms & definition of tdon, tEon
(t_{Eon} = integrating time for E_{on})
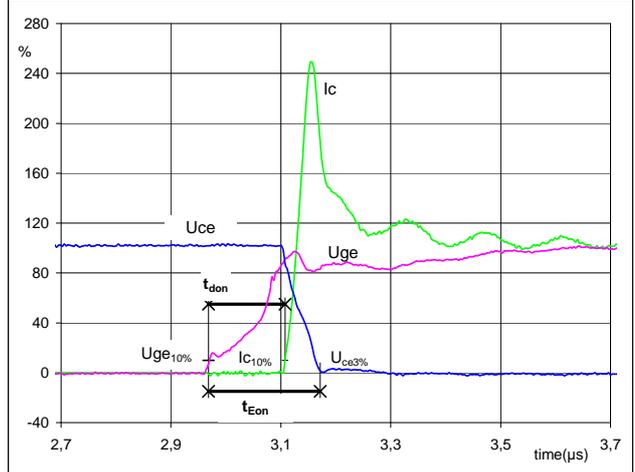
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	100	A
t_{don} =	0,14	µs
t_{Eon} =	0,20	µs

Figure 3	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_f
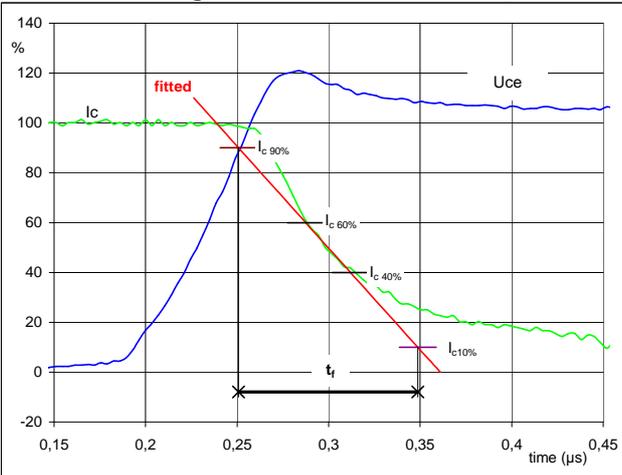
V_C (100%) =	300	V
I_C (100%) =	100	A
t_f =	0,10	µs

Figure 4	Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r
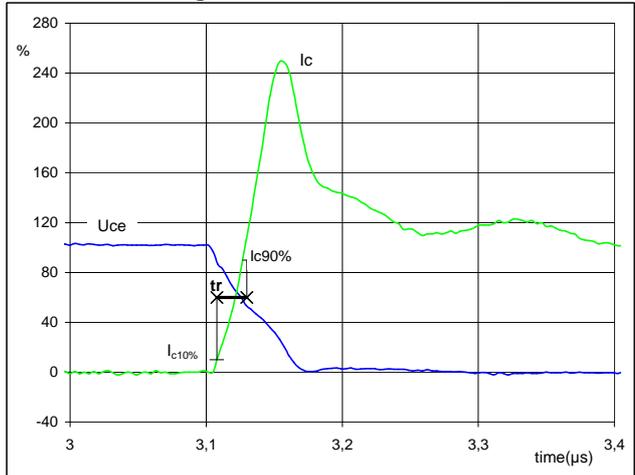
V_C (100%) =	300	V
I_C (100%) =	100	A
t_r =	0,02	µs

Switching Definitions Output Inverter

Figure 5	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_{Eoff}
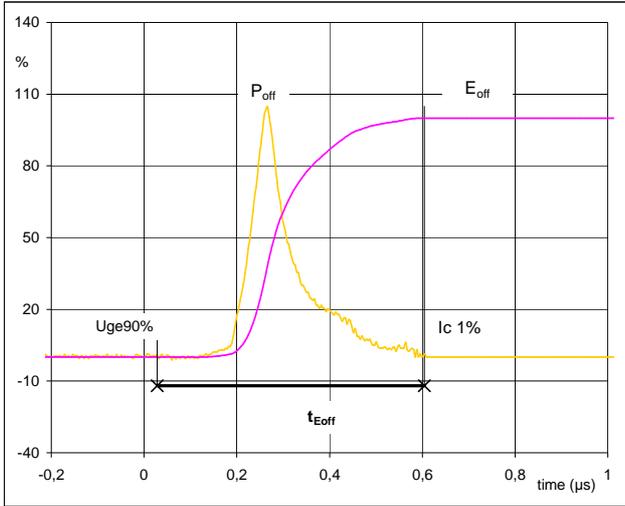
P_{off} (100%) =	30,01	kW
E_{off} (100%) =	3,48	mJ
t_{Eoff} =	0,58	µs

Figure 6	Output inverter IGBT

Turn-on Switching Waveforms & definition of t_{Eon}
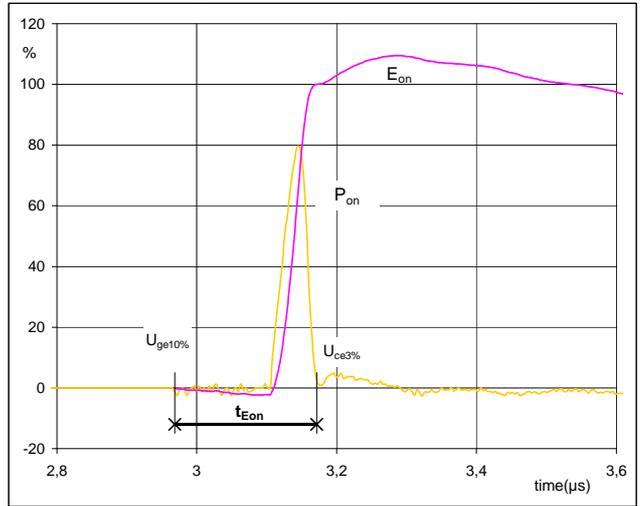
P_{on} (100%) =	30,01	kW
E_{on} (100%) =	0,93	mJ
t_{Eon} =	0,20	µs

Figure 7	Output inverter FWD

Turn-off Switching Waveforms & definition of t_{rr}
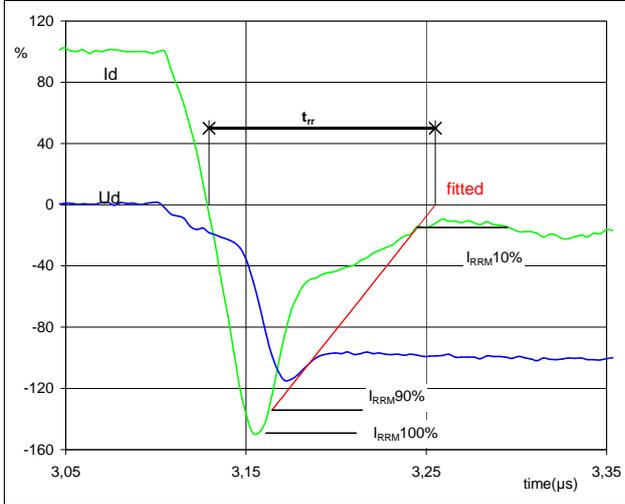
V_d (100%) =	300	V
I_d (100%) =	100	A
I_{RRM} (100%) =	-152	A
t_{rr} =	0,13	µs

Switching Definitions Output Inverter

Figure 8	Output inverter FWD

Turn-on Switching Waveforms & definition of t$_{Qrr}$
(t$_{Qrr}$ = integrating time for Q$_{rr}$)
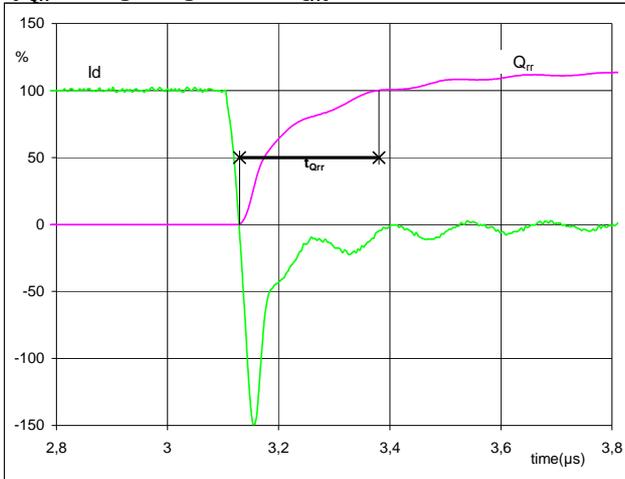
I$_d$ (100%) =	100	A
Q$_{rr}$ (100%) =	9,20	µC
t$_{Qint}$ =	0,25	µs

Figure 9	Output inverter FWD

Turn-on Switching Waveforms & definition of t$_{Erec}$
(t$_{Erec}$= integrating time for E$_{rec}$)
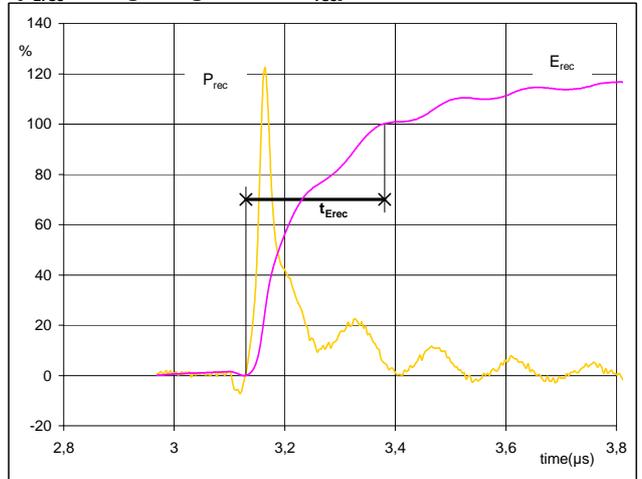
P$_{rec}$ (100%) =	30,01	kW
E$_{rec}$ (100%) =	2,25	mJ
t$_{Erec}$ =	0,25	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P765-A-PM	P765-A	P765-A

Outline

| Pin		X	Y	Pin		X	Y
1	DC-	71,2	0	33	G	10,6	37,2
2	DC-	68,7	0	34	G	18,45	37,2
3	DC-	66,2	0	35	E	21,25	37,2
4	DC-	63,7	0	36	V	24,05	37,2
5	DC+	55,95	0	37	V	26,55	37,2
6	DC+	53,45	0	38	V	29,05	37,2
7	DC+	55,95	2,8	39	W	36,1	37,2
8	DC+	53,45	2,8	40	W	38,6	37,2
9	DC+	48,4	0	41	W	41,1	37,2
10	DC+	45,9	0	42	E	43,9	37,2
11	E	38,9	0	43	G	46,7	37,2
12	DC-	36,1	0	44	L1	53,7	37,2
13	G	38,9	2,8	45	L1	56,2	37,2
14	DC-	36,1	2,8	46	L1	58,7	37,2
15	DC-	31,3	0	47	L2	71,2	37,2
16	E	28,5	0	48	L2	71,2	34,7
17	DC-	31,3	2,8	49	L2	71,2	32,2
18	G	28,5	2,8	50	L3	71,2	25,2
19	R2	19,3	0	51	L3	71,2	22,7
20	R1	19,3	2,8	52	L3	71,2	20,2
21	DC+	12,3	0	53	BrC	71,2	12,8
22	DC+	9,8	0	54	BrC	68,7	12,8
23	DC+	12,3	2,8	55	BrG	71,2	5,6
24	DC+	9,8	2,8	56	BrE	71,2	2,8
25	E	2,8	0				
26	DC-	0	0				
27	G	2,8	2,8				
28	DC-	0	2,8				
29	U	0	37,2				
30	U	2,5	37,2				
31	U	5	37,2				
32	E	7,8	37,2				

Pinout
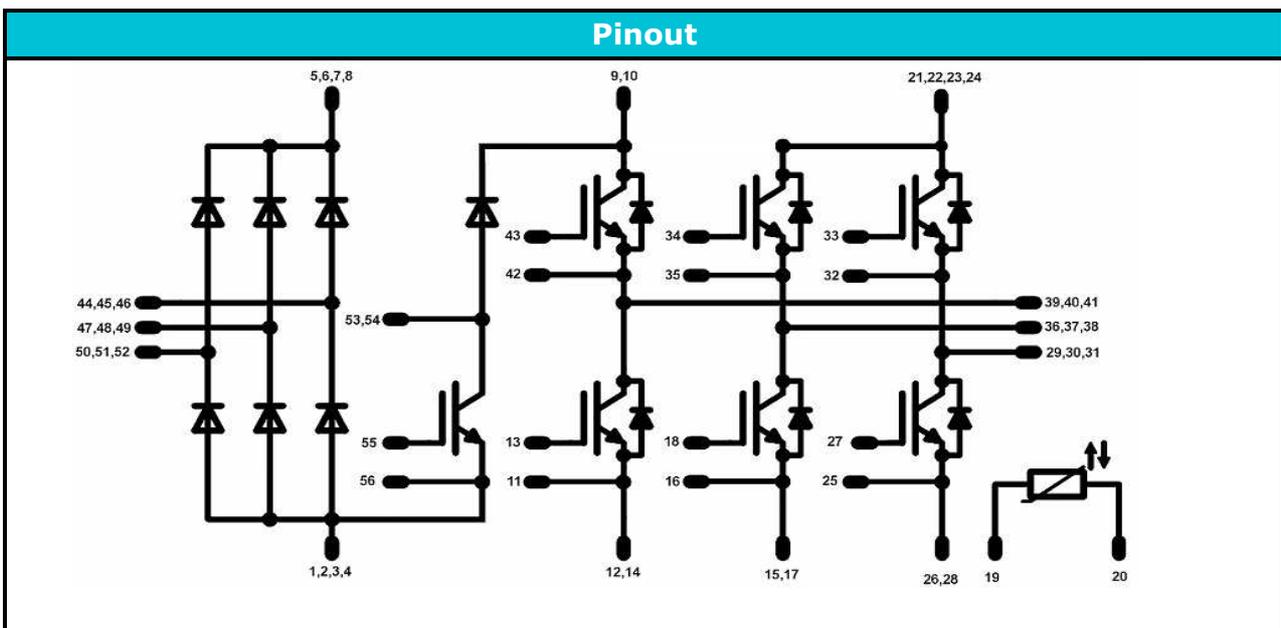
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.