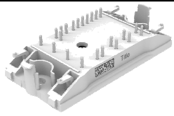
flow **PIM 0**	**600 V / 30 A**

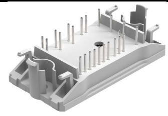
Features

- Vincotech clip-in housing
- Trench Fieldstop IGBT's for low saturation losses
- Optional w/o BRC

flow 0 housing



12mm

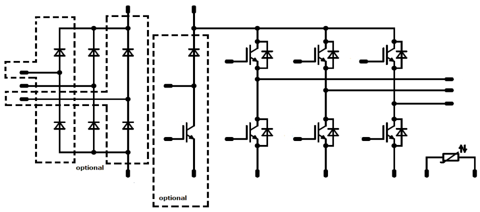


17mm

Target Applications

- Industrial drives
- Embedded drives

Schematic



Types

- V23990-P546-A28-PM
- V23990-P546-A29-PM
- V23990-P546-B28-PM
- V23990-P546-B128-PM
- V23990-P546-C28-PM
- V23990-P546-C29-PM
- V23990-P546-D28-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Repetitive peak reverse voltage	V_{RRM}		1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	41 55	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50 Hz half sine wave	200	A
I^2t-value	I^2t		200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	56 85	W
Maximum Junction Temperature	T_{jmax}		150	°C
Inverter Switch				
Collector-emitter break down voltage	V_{CE}		600	V
DC collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	32 42	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Turn off safe operating area		V_{CE} ≤ 1200 V, $T_j \le T_{op}$ max	90	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	70 106	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	6 360	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}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	29 37	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	50 76	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	26 32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_j ≤ T_{op} max		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	57 86	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	23 31	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		40	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	44 67	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance		12mm / 17mm housing		9,7 / min 12,7	mm
Comparative tracking index	CTI			>200	

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]	Value Min	Value Typ	Value Max	Unit
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,20 1,17	1,8	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,93 0,80		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		11 15		mΩ
Reverse current	I_r			1500		25			0,01	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,52		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00043	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		30	25 150	1,1	1,67 1,90	1,9	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			0,0016	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 8 Ω	±15	300	30	25 150		17 18		ns
Rise time	t_r					25 150		16 18		
Turn-off delay time	$t_{d(off)}$					25 150		156 172		
Fall time	t_f					25 150		88 101		
Turn-on energy loss	E_{on}					25 150		0,52 0,71		mWs
Turn-off energy loss	E_{off}					25 150		0,72 0,90		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1630		pF
Output capacitance	C_{oss}							108		
Reverse transfer capacitance	C_{rss}							50		
Gate charge	Q_G		±15	480	30	25		167		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,36		K/W
Inverter Diode										
Diode forward voltage	V_F				30	25 150	1,25	1,64 1,66	1,95	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 8 Ω	±15	300	30	25 150		25 28		A
Reverse recovery time	t_{rr}					25 150		176 256		ns
Reverse recovered charge	Q_{rr}					25 150		1,36 2,45		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		1521 932		A/μs
Reverse recovered energy	E_{rec}					25 150		0,27 0,51		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,89		K/W

Characteristic Values

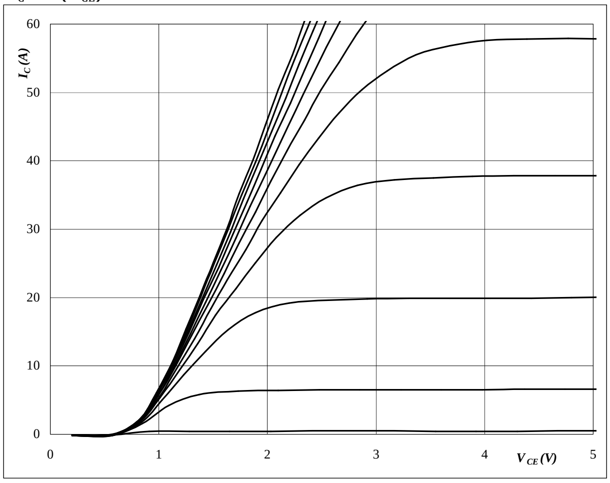
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 150	1	1,58 1,76	2,2	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	±15	300	20	25 150		15 14		ns
Rise time	t_r					25 150		12 15		ns
Turn-off delay time	$t_{d(off)}$					25 150		197 220		ns
Fall time	t_f					25 150		100 119		ns
Turn-on energy loss	E_{on}					25 150		0,31 0,43		mWs
Turn-off energy loss	E_{off}					25 150		0,53 0,67		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oss}							71		pF
Reverse transfer capacitance	C_{rss}							32		pF
Gate charge	Q_G		±15	480	20	25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,68		K/W
Brake Diode										
Diode forward voltage	V_F				20	25 150	1,25	1,83 1,76	1,95	V
Reverse leakage current	I_r			600		25			27	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	±15	300	20	25 150		18 21		A
Reverse recovery time	t_{rr}					25 150		31 197		ns
Reverse recovered charge	Q_{rr}					25 150		0,39 0,39		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		1762 927		A/µs
Reverse recovery energy	E_{rec}					25 150		0,05 0,25		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,16		K/W
Thermistor										
Rated resistance	R					25		21500		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-4,5		4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1%				25		3980		K
B-value	$B_{(25/100)}$	Tol. ±1%				25		3964		K
Vincotech NTC Reference									F	

Output Inverter

Figure 1 — **Output inverter IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



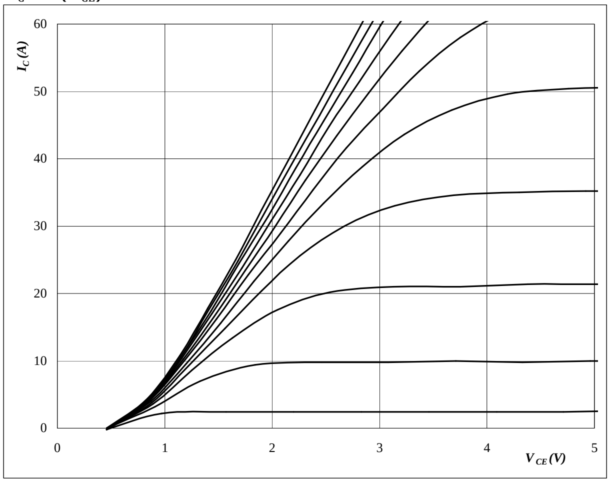
At

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

Figure 2 — **Output inverter IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



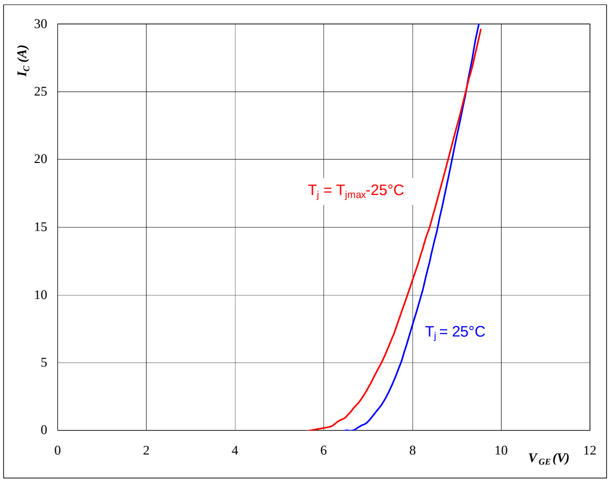
At

t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 — **Output inverter IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



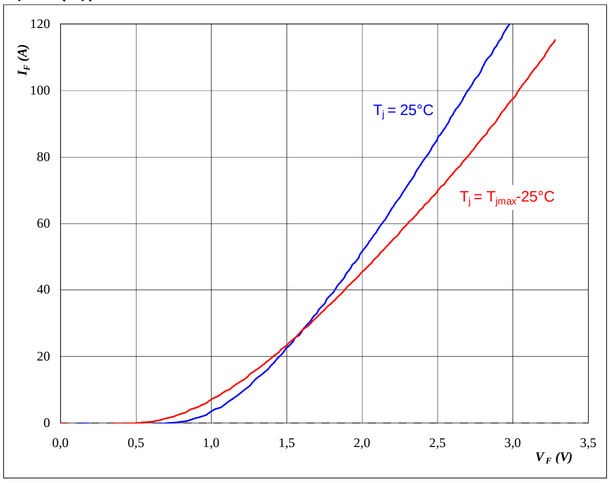
At

t_p = 250 µs
V_{CE} = 10 V

Figure 4 — **Output inverter FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

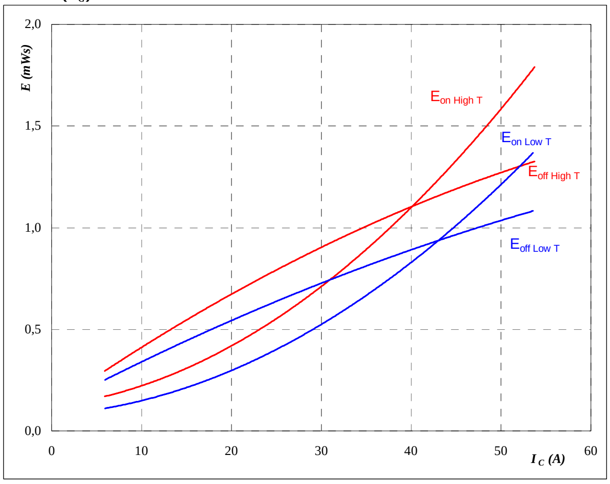
t_p = 250 µs

Output Inverter

Figure 5	Output inverter IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



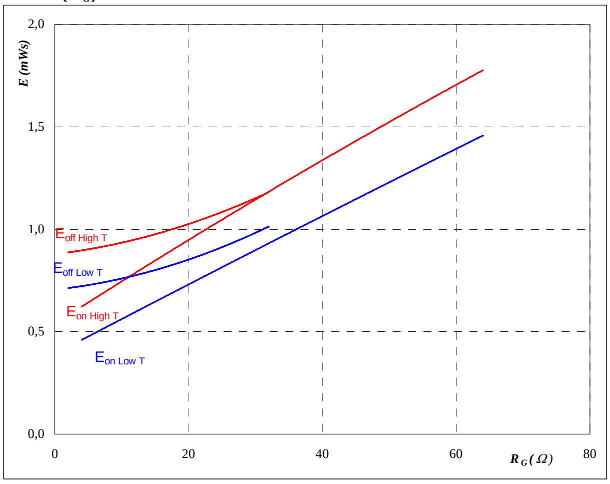
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω
R_{goff} =	4	Ω

Figure 6	Output inverter IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



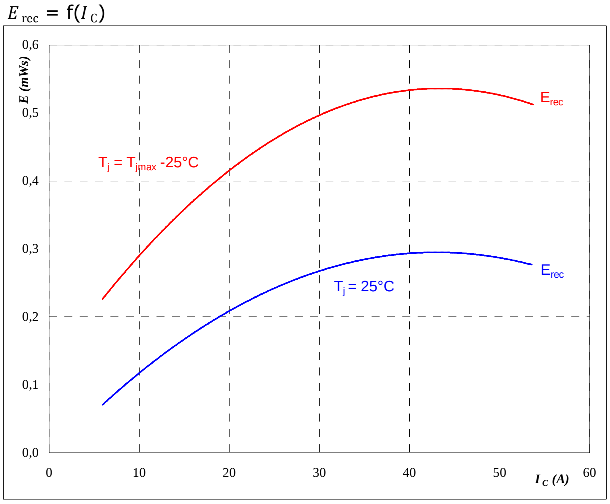
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

Figure 7	Output inverter FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



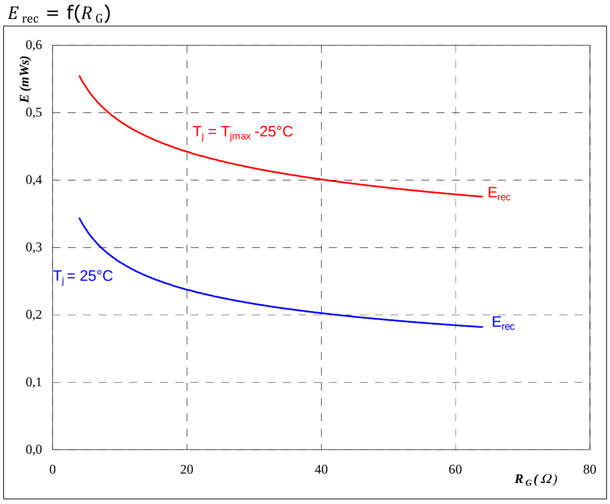
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 8	Output inverter FWD

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

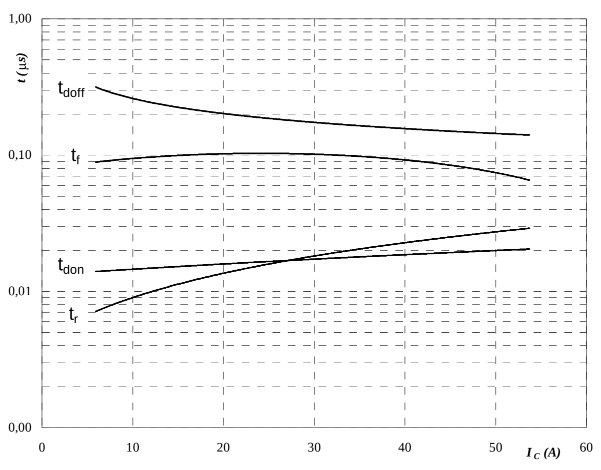
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

Output Inverter

Figure 9 — **Output inverter IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



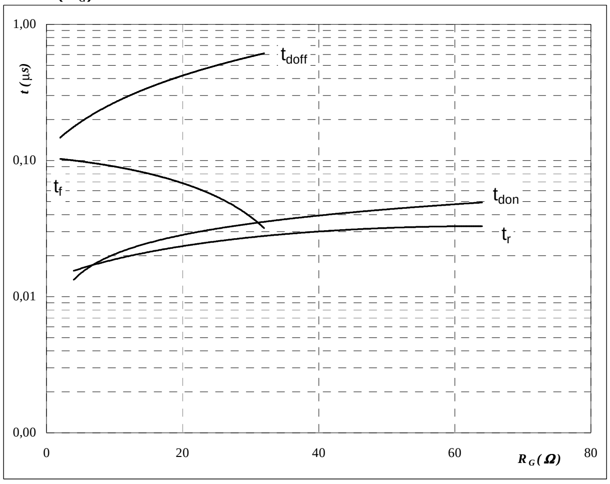
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω
R_{goff} =	4	Ω

Figure 10 — **Output inverter IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



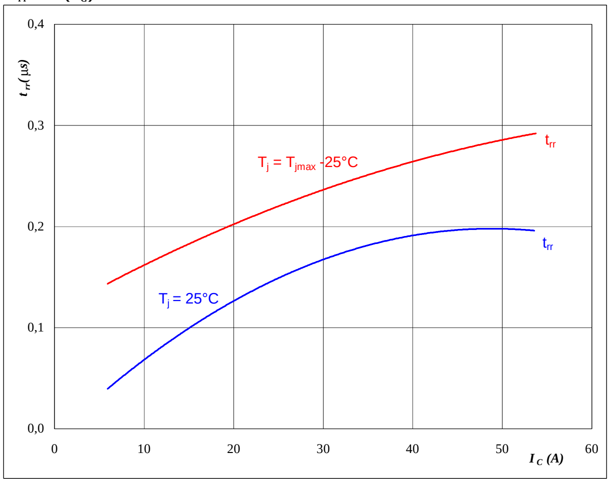
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

Figure 11 — **Output inverter FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



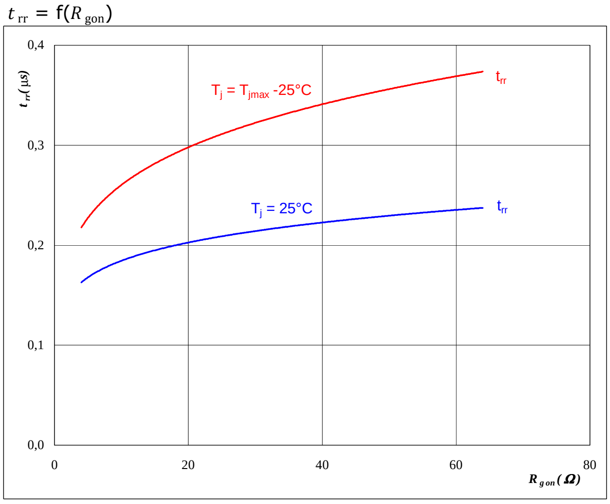
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	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

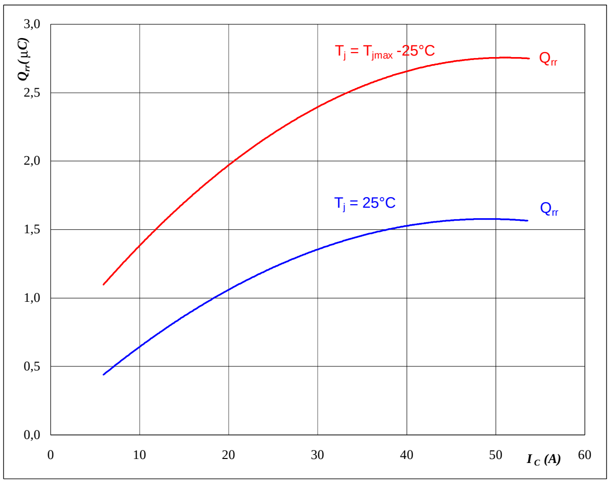
T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Output Inverter

Figure 13 **Output inverter FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



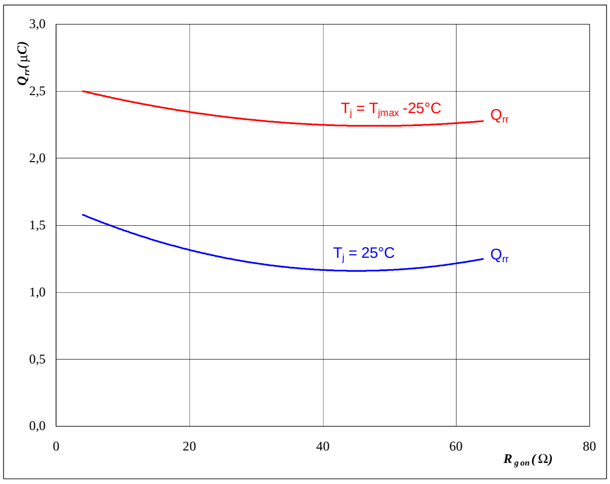
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 14 **Output inverter FWD**

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

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



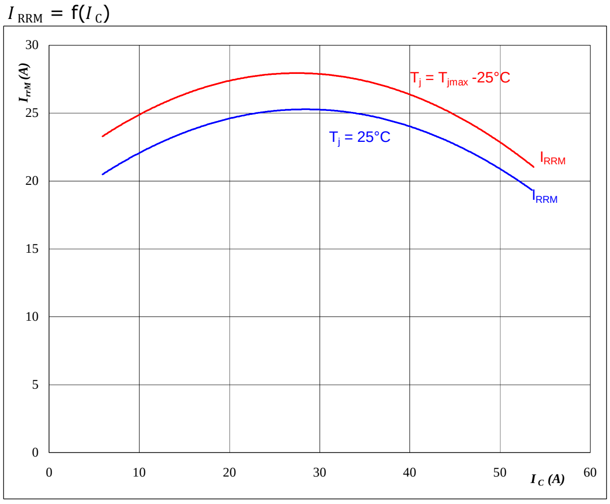
At

T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Figure 15 **Output inverter FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



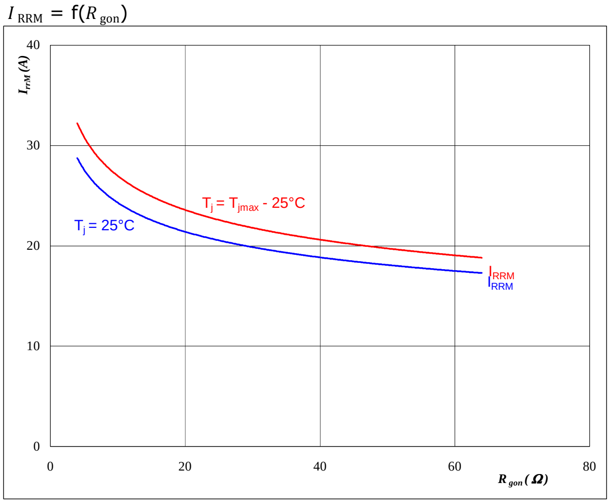
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	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

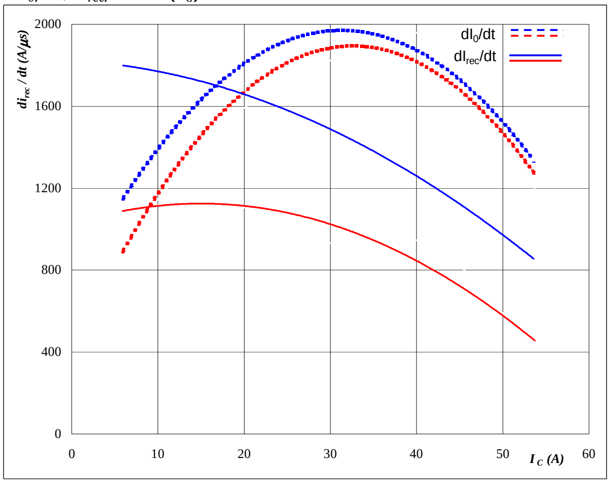
T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Output Inverter

Figure 17 — **Output inverter FWD**

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

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



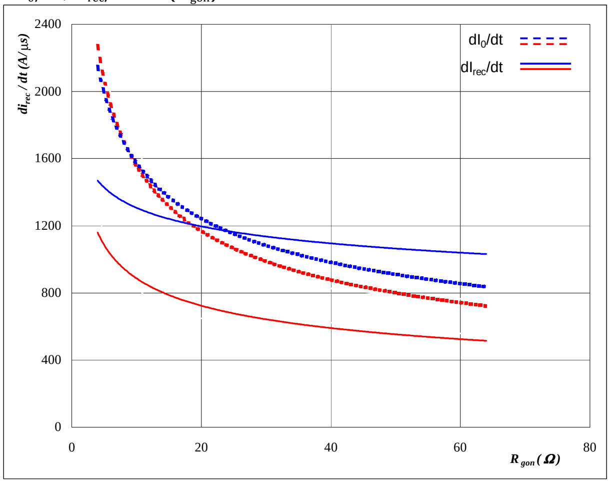
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	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

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



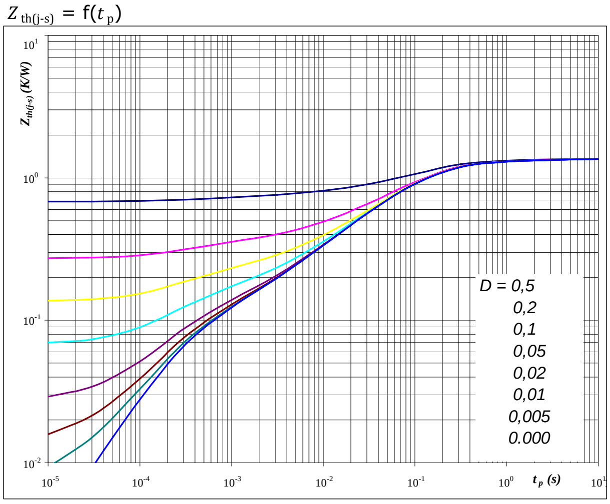
At

T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Figure 19 — **Output inverter IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,36	K/W

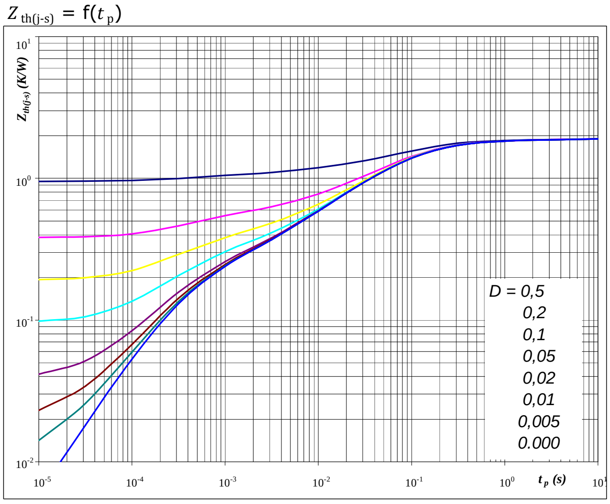
IGBT thermal model values

R (K/W)	Tau (s)
0,05	4,6E+00
0,17	5,4E-01
0,72	1,0E-01
0,26	2,0E-02
0,09	3,1E-03
0,08	3,0E-04

Figure 20 — **Output inverter FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,89	K/W

FWD thermal model values

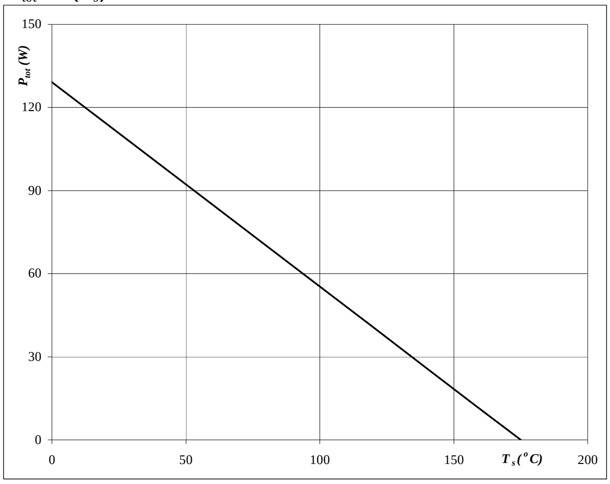
R (K/W)	Tau (s)
0,05	4,6E+00
0,22	4,8E-01
0,89	8,5E-02
0,41	2,0E-02
0,16	2,8E-03
0,17	3,3E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



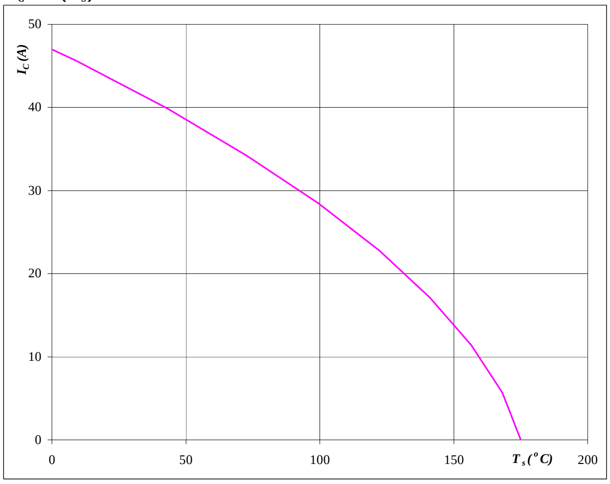
At

T_j = 175 °C

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

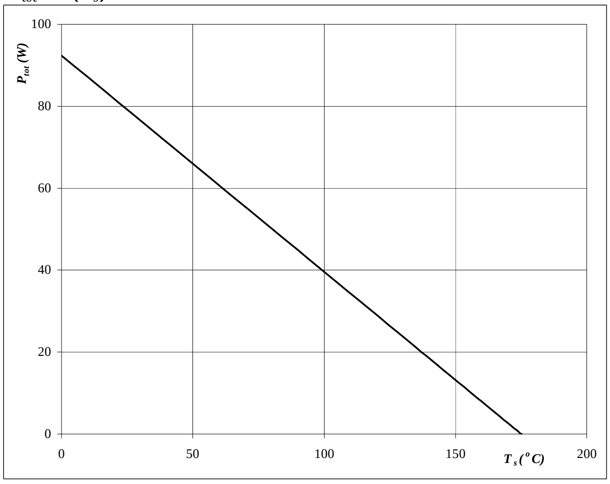
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



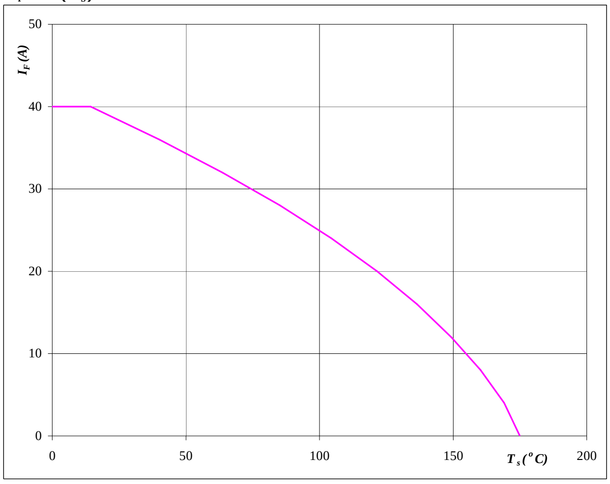
At

T_j = 175 °C

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

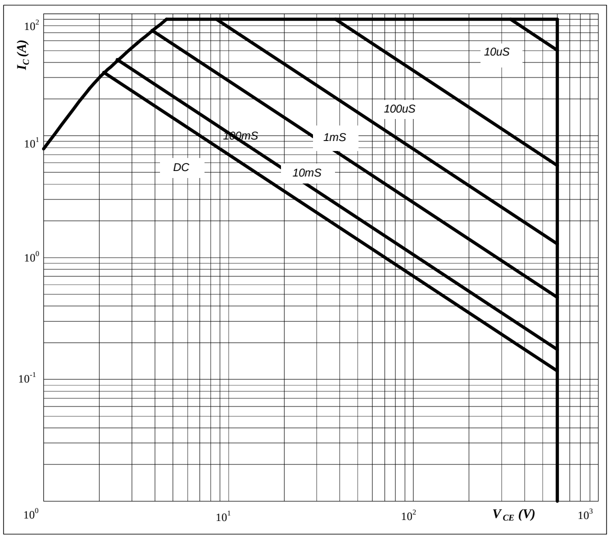
T_j = 175 °C

Output Inverter

Figure 25	**Output inverter IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



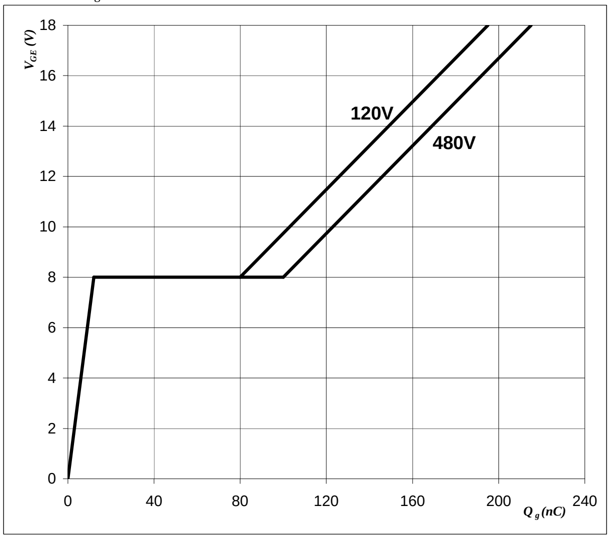
At

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

Figure 26	**Output inverter IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



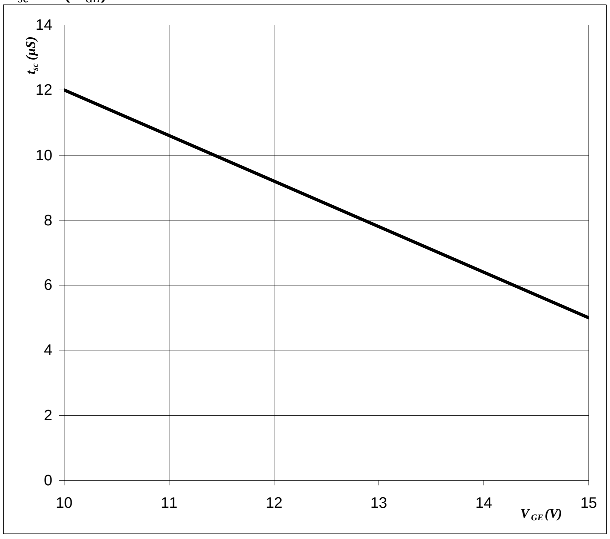
At

I_C =	30	A

Figure 27	**Output inverter IGBT**

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

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



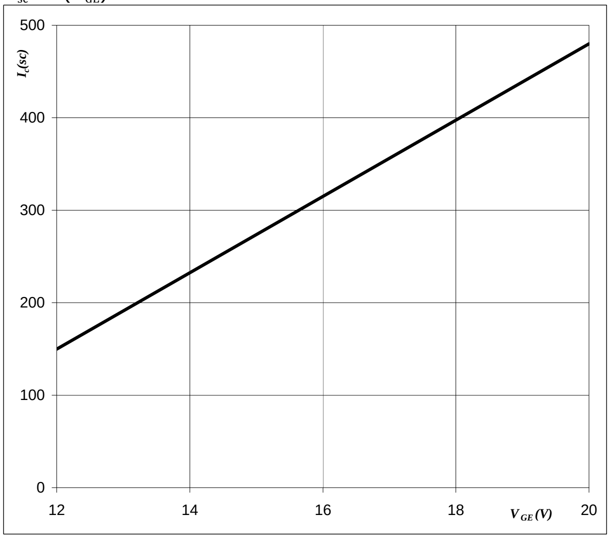
At

V_{CE} =	600	V
T_j ≤	175	ºC

Figure 28	**Output inverter IGBT**

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

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



At

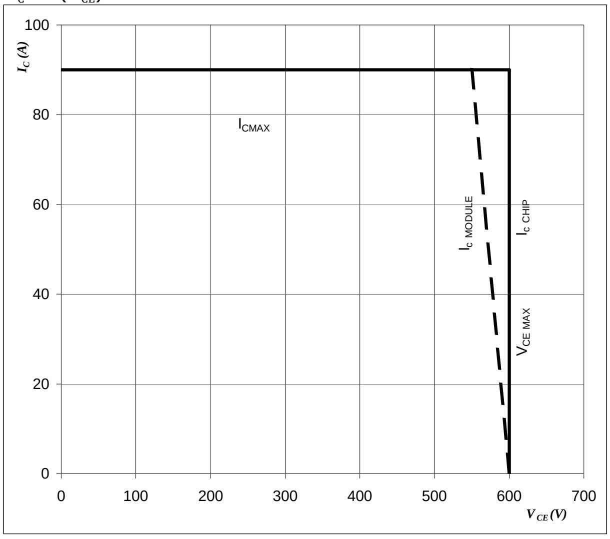
V_{CE} ≤	600	V
T_j =	175	ºC

Output Inverter

Figure 29 **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

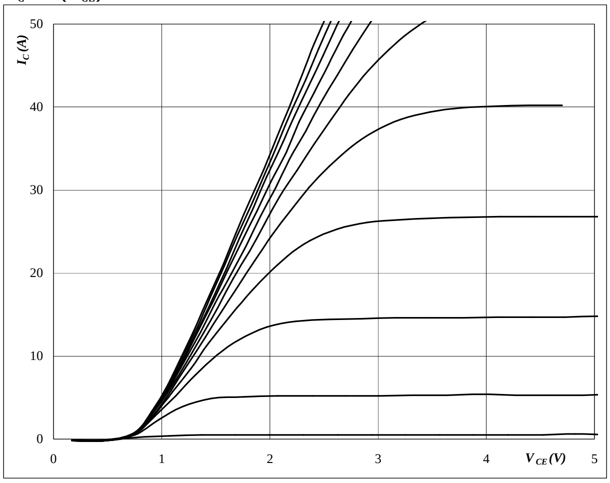
T_j = T_{jmax}-25 ºC

Brake

Figure 1 **Brake IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

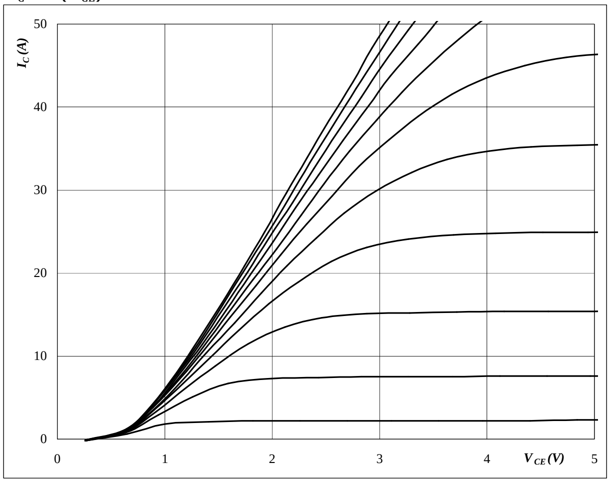
T_j = 25 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 **Brake IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

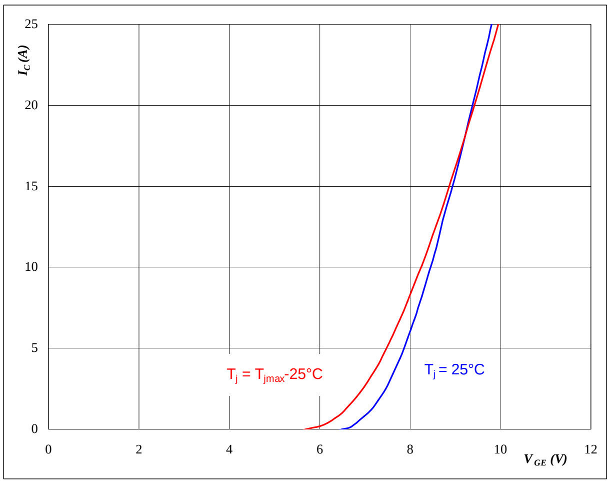
T_j = 125 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 **Brake IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

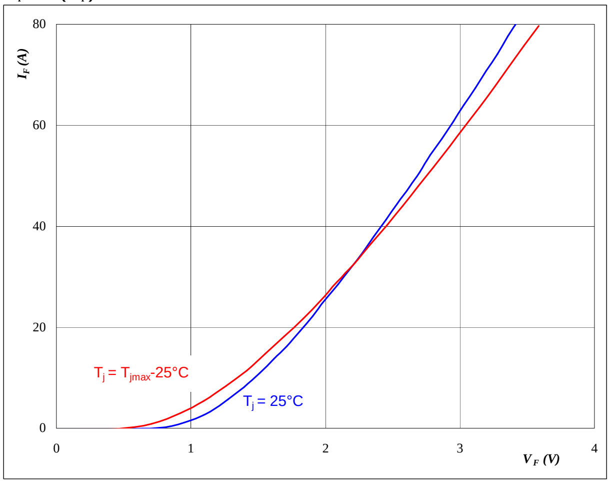
t_p = 250 µs

V_{CE} = 10 V

Figure 4 **Brake FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

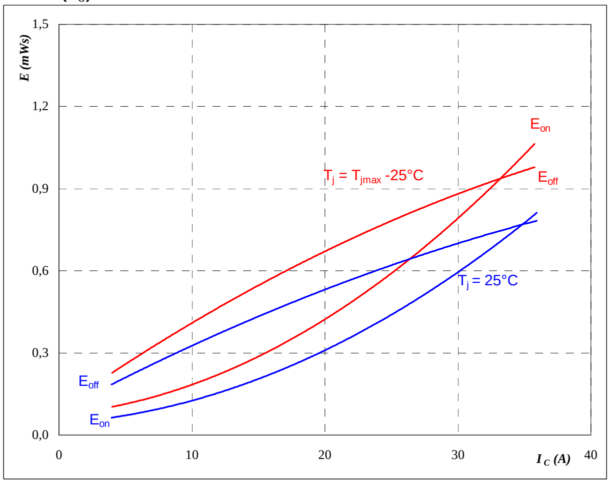
t_p = 250 µs

Brake

Figure 5 **Brake IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



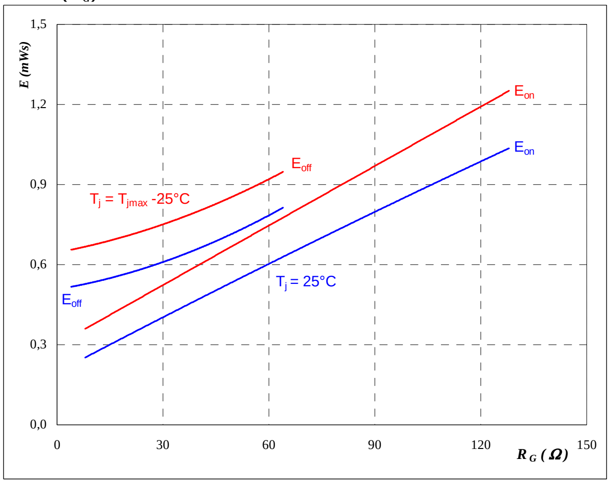
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 6 **Brake IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



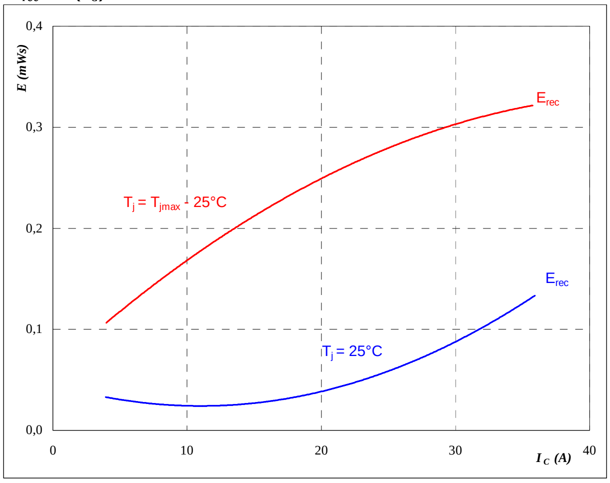
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Figure 7 **Brake FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



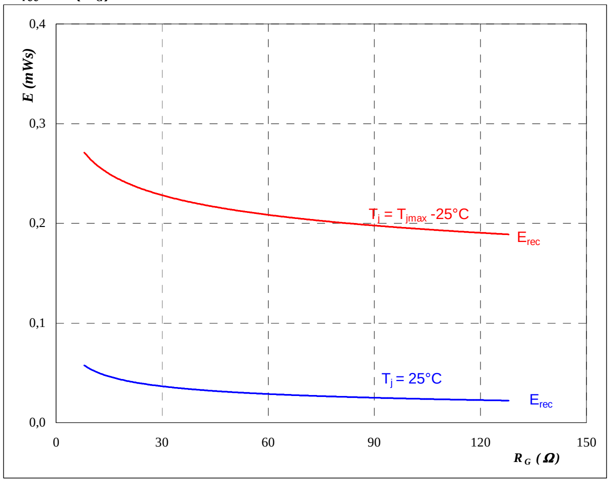
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 8 **Brake FWD**

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

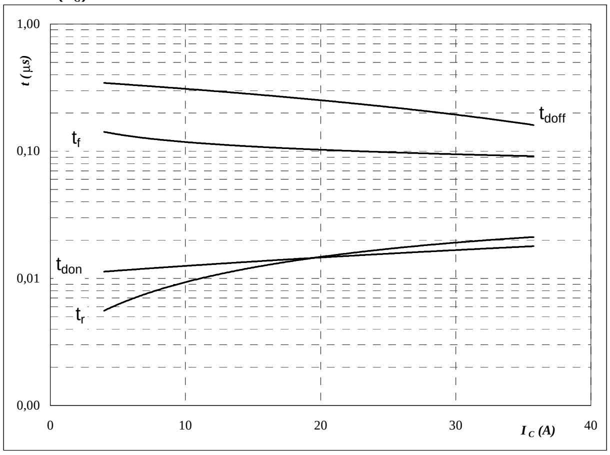
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Brake

Figure 9	**Brake IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



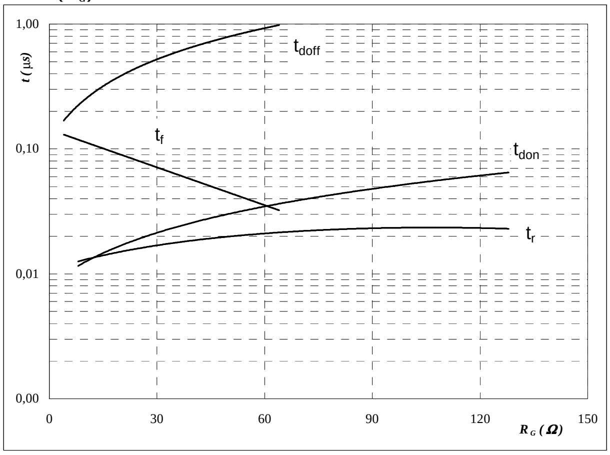
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 10	**Brake IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



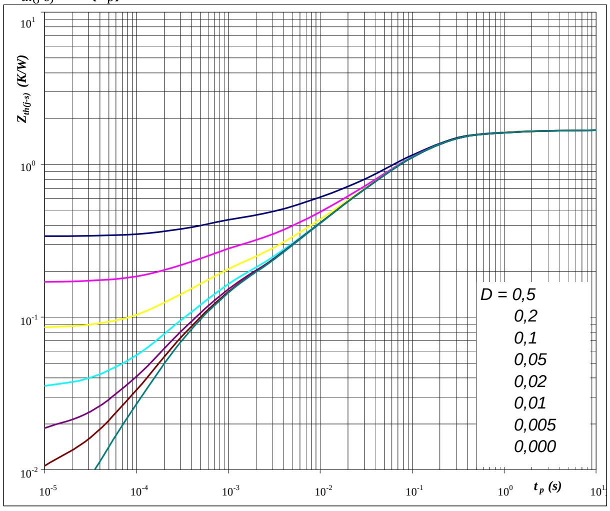
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Figure 11	**Brake IGBT**

IGBT transient thermal impedance as a function of pulse width

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



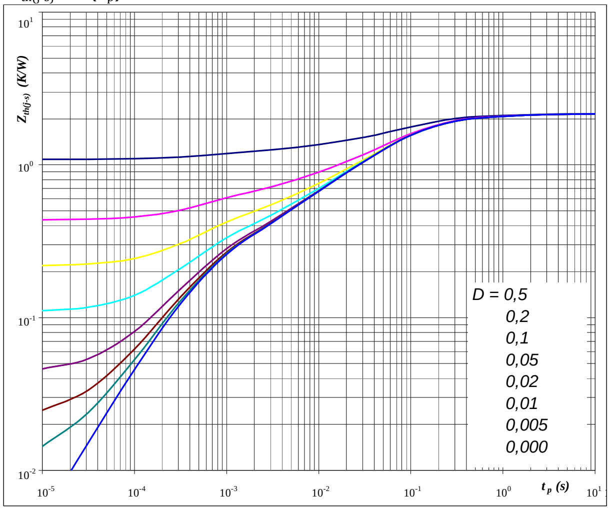
At $D = t_p / T$

$R_{th(j-s)}$ = 1,68 K/W

Figure 12	**Brake FWD**

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

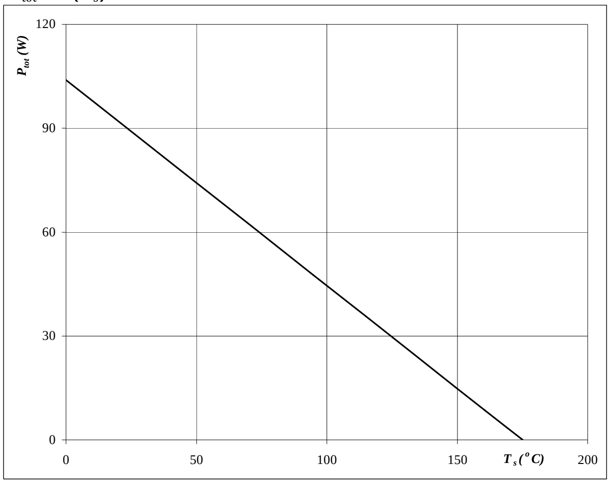
$R_{th(j-s)}$ = 2,16 K/W

Brake

Figure 13 **Brake IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



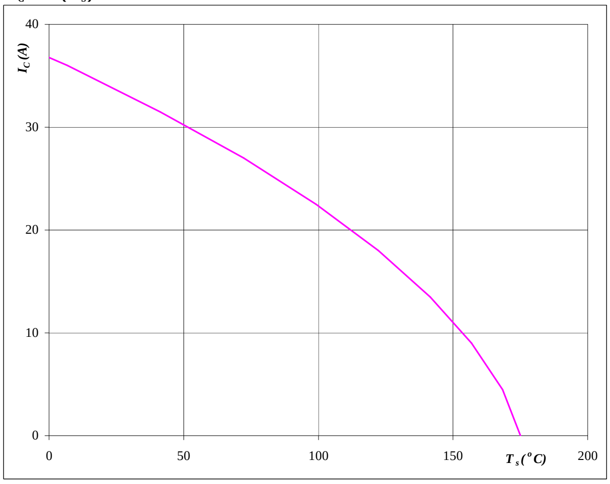
At

T_j = 175 ºC

Figure 14 **Brake IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

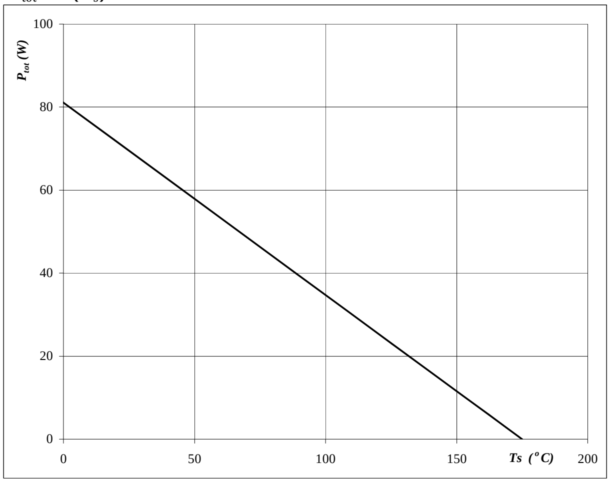
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 **Brake FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



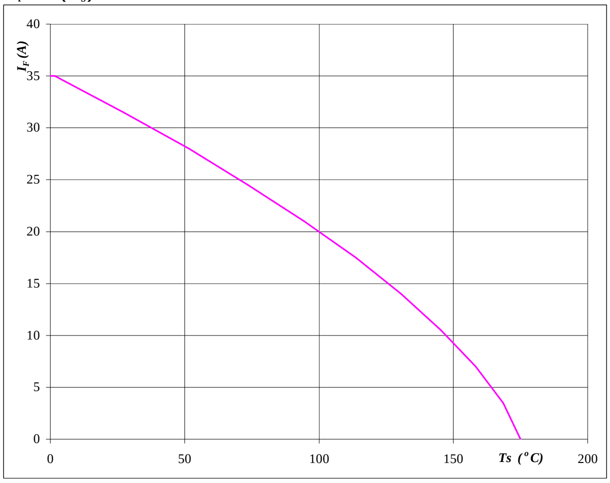
At

T_j = 175 ºC

Figure 16 **Brake FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

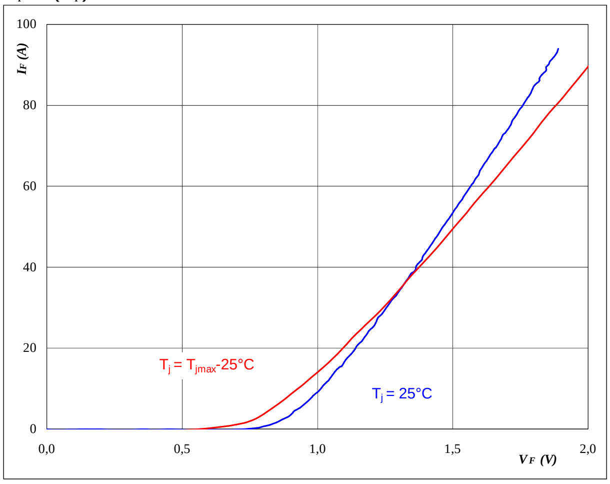
T_j = 175 ºC

Input Rectifier Bridge

Figure 1 — **Rectifier diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



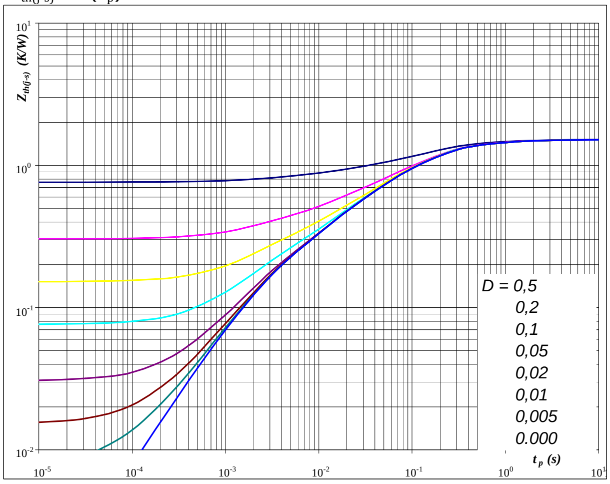
At

t_p = 250 µs

Figure 2 — **Rectifier diode**

Diode transient thermal impedance as a function of pulse width

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



At

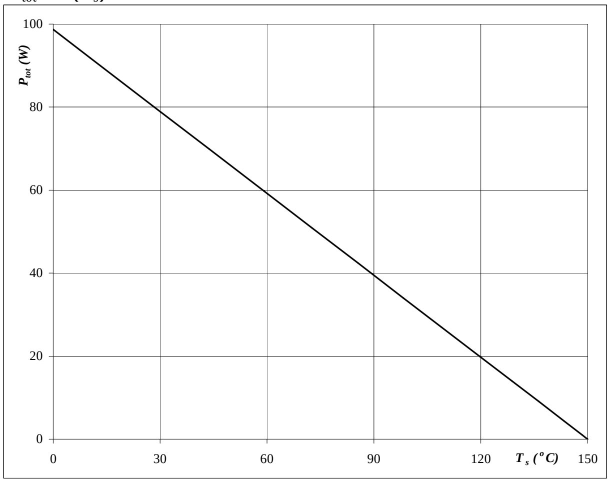
D = t_p / T

$R_{th(j\text{-}s)}$ = 1,52 K/W

Figure 3 — **Rectifier diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



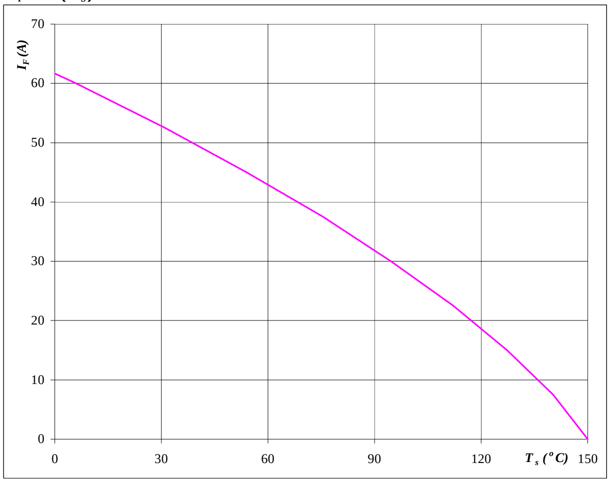
At

T_j = 150 ºC

Figure 4 — **Rectifier diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

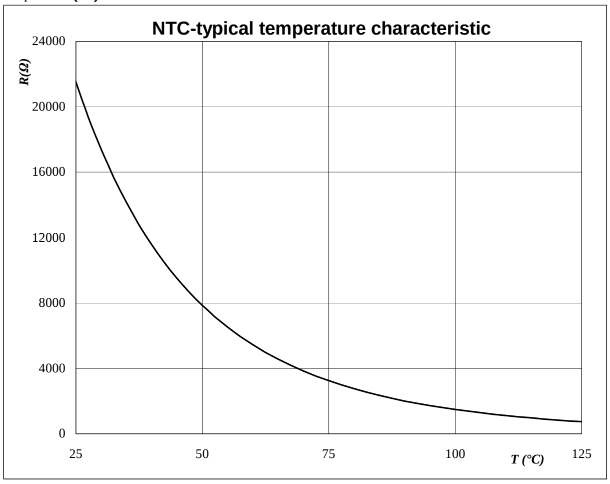
T_j = 150 ºC

Thermistor

Figure 1	**Thermistor**

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



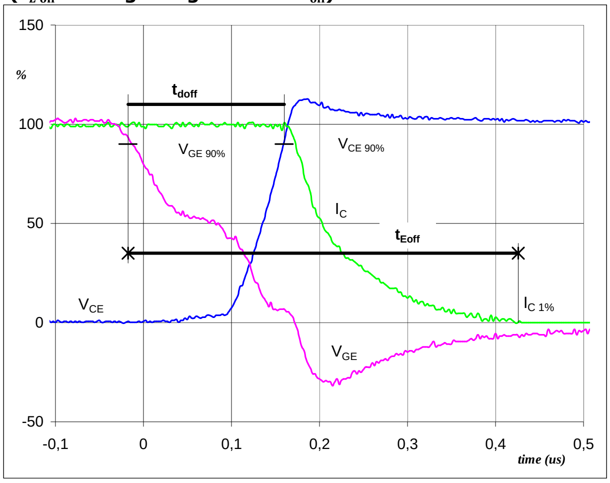
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	4 Ω

Figure 1 **Output inverter IGBT**

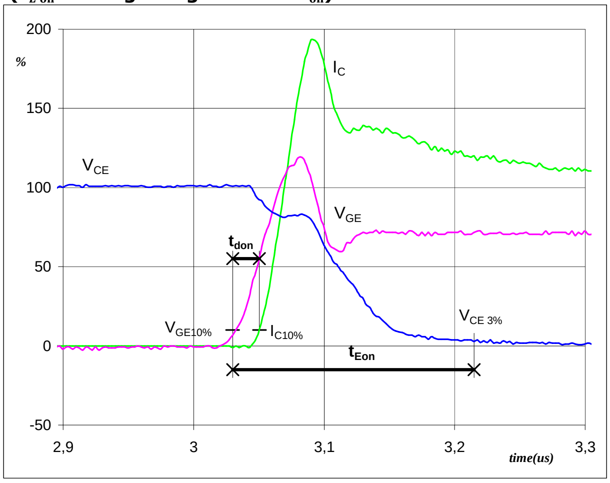
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	30	A
t_{doff} =	0,17	μs
$t_{E\,off}$ =	0,44	μs

Figure 2 **Output inverter IGBT**

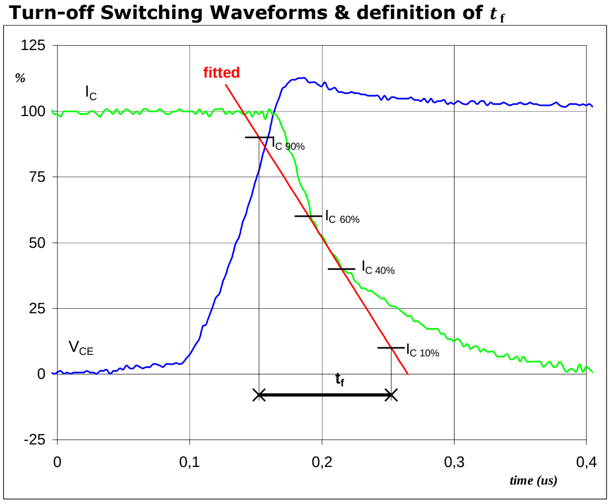
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	30	A
t_{don} =	0,02	μs
$t_{E\,on}$ =	0,18	μs

Figure 3 **Output inverter IGBT**

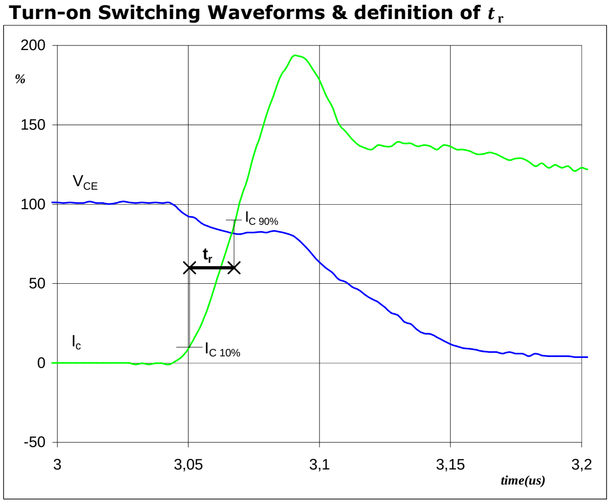
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	30	A
t_f =	0,10	μs

Figure 4 **Output inverter IGBT**

Turn-on Switching Waveforms & definition of t_r

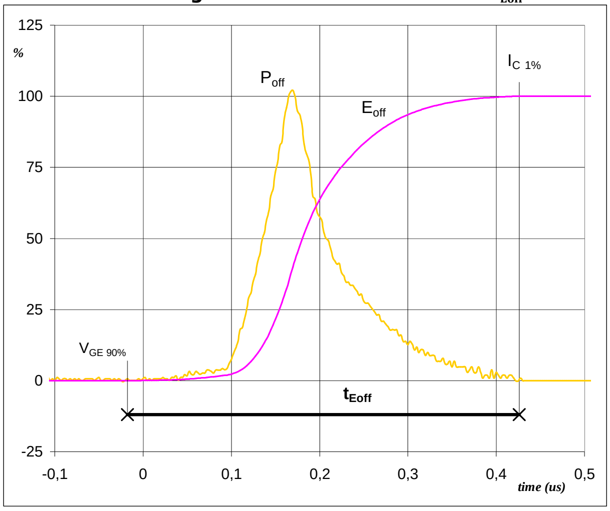


V_C (100%) =	300	V
I_C (100%) =	30	A
t_r =	0,02	μs

Switching Definitions Output Inverter

Figure 5 **Output inverter IGBT**

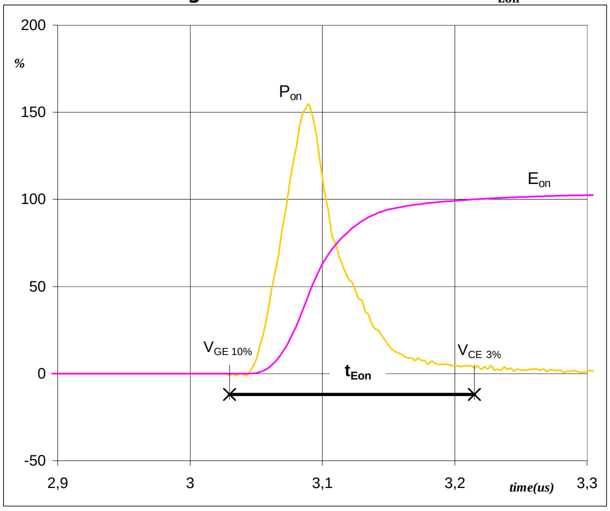
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	8,98	kW
E_{off} (100%) =	0,90	mJ
$t_{E\,off}$ =	0,44	μs

Figure 6 **Output inverter IGBT**

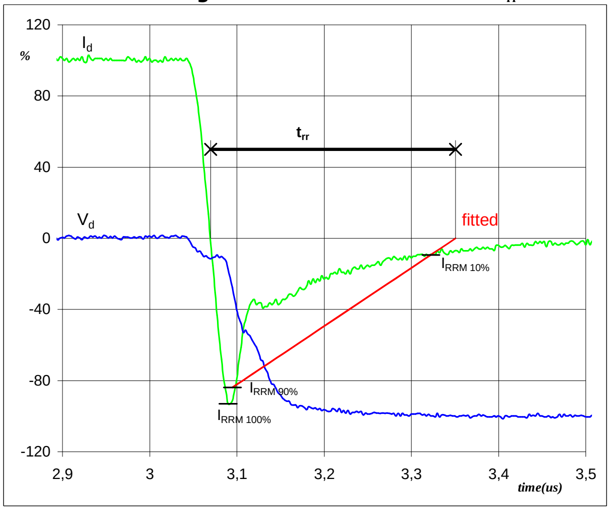
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	8,98	kW
E_{on} (100%) =	0,71	mJ
$t_{E\,on}$ =	0,18	μs

Figure 7 **Output inverter IGBT**

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

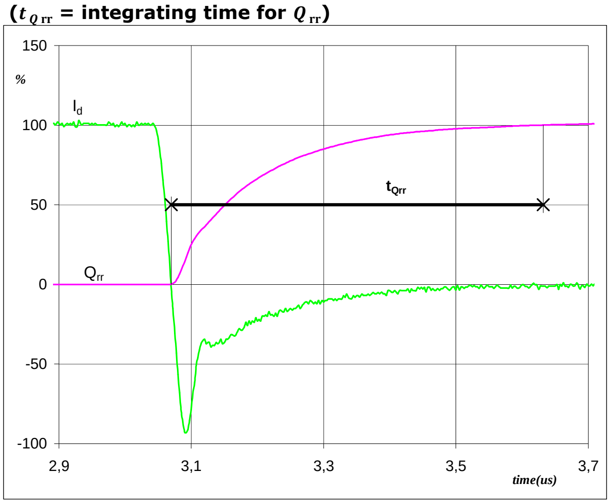


V_d (100%) =	300	V
I_d (100%) =	30	A
I_{RRM} (100%) =	28	A
t_{rr} =	0,26	μs

Switching Definitions Output Inverter

Figure 8	**Output inverter FWD**

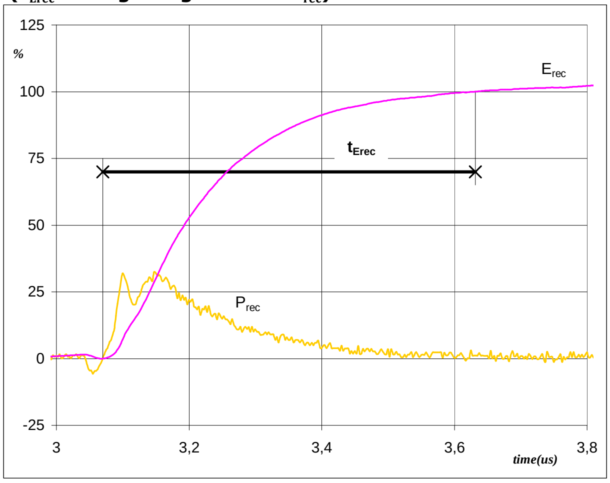
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



I_d (100%) =	30	A
Q_{rr} (100%) =	2,45	μC
$t_{Q rr}$ =	0,56	μs

Figure 9	**Output inverter FWD**

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



P_{rec} (100%) =	8,98	kW
E_{rec} (100%) =	0,51	mJ
$t_{E rec}$ =	0,56	μs

Ordering Code and Marking - Outline - Pinout

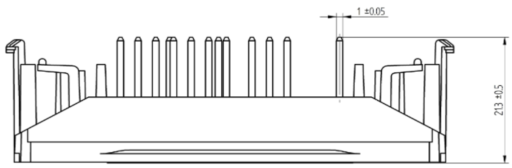
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing full configuration	V23990-P546-A28-PM
with thermal paste 12mm housing full configuration	V23990-P546-A28-/3/-PM
without thermal paste 17mm housing full configuration	V23990-P546-A29-PM
without thermal paste 12mm housing 1 phase rectifier	V23990-P546-B28-PM
with thermal paste 12mm housing 1 phase rectifier	V23990-P546-B28-/3/-PM
without thermal paste 12mm housing 1 phase rectifier	V23990-P546-B128-PM
with thermal paste 12mm housing without brake	V23990-P546-C28-/3/-PM
without thermal paste 17mm housing without brake	V23990-P546-C29-PM
without thermal paste 12mm housing without brake, 1 phase rectifier	V23990-P546-D28-PM
with thermal paste 12mm housing without brake, 1 phase rectifier	V23990-P546-D28-/3/-PM

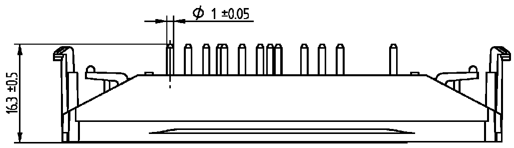
Text	**VIN**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	VIN	WWYY	NNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Name&Ver**	**Lot number**	**Serial**	**Date code**		
	NNNNNNVV	LLLLL	SSSS	WWYY		

Outline

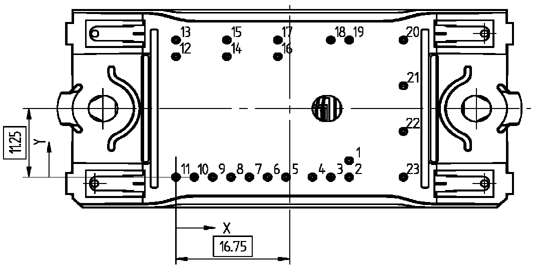
Pin table			
Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3



17mm housing



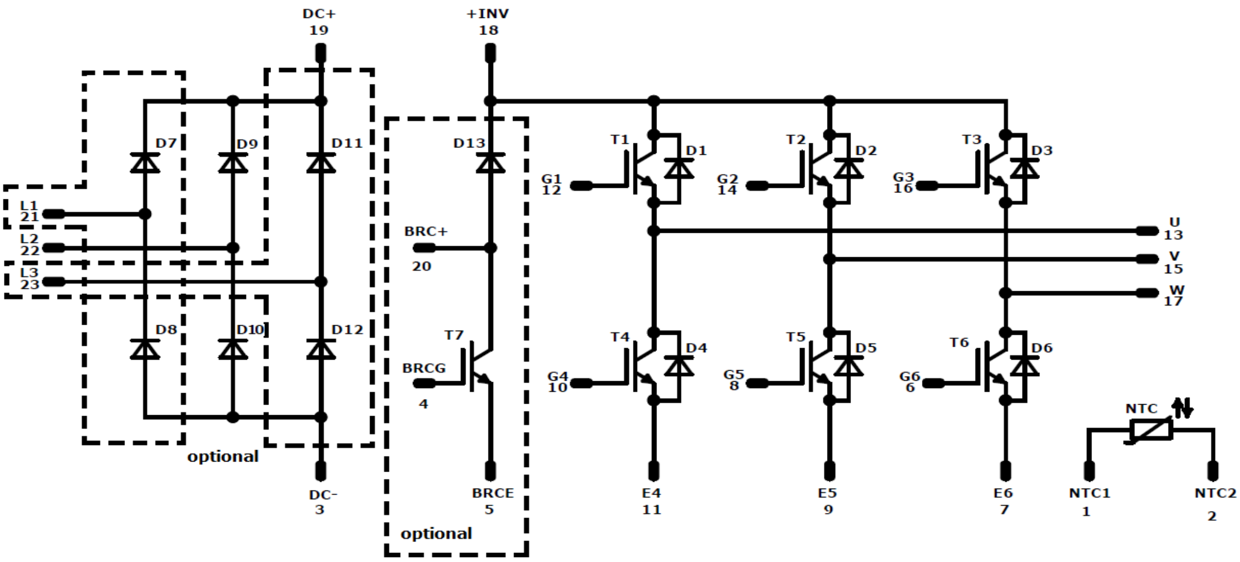
12mm housing



Pinout variation	
Modul subtype	Not assembled pins
V23990-P546-A28-PM	-
V23990-P546-A29-PM	-
V23990-P546-B28-PM	21
V23990-P546-B128-PM	23
V23990-P546-C28-PM	4, 5, 20
V23990-P546-C29-PM	4, 5, 20
V23990-P546-D28-PM	4, 5, 20, 21

Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1-T6	IGBT	600 V	30 A	Inverter Switch	
D1-D6	FWD	600 V	30 A	Inverter Diode	
T7	IGBT	600 V	20 A	Brake Switch	
D13	FWD	600 V	20 A	Brake Diode	
D7-D12	Diode	1600 V	25 A	Rectifier Diode	
NTC	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**135**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 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
V23990-P546-A28-D7-14	23 Apr. 2016	NTC values	