***flow* PIM 0** — **600 V / 20 A**

Features

- Vincotech clip-in housing
- Trench Fieldstop IGBT's for low saturation losses
- Optional without brake

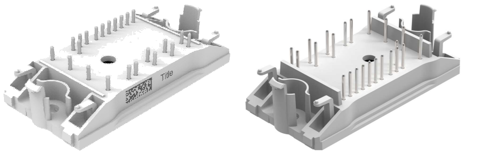
Target Applications

- Industrial drives
- Embedded drives

Types

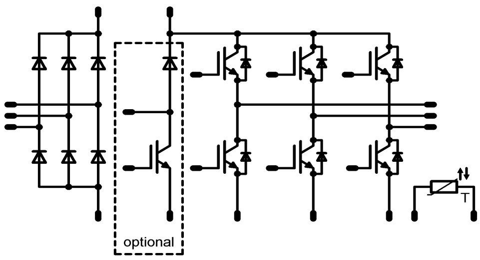
- V23990-P545-A38-PM
- V23990-P545-A39-PM
- V23990-P545-C38-PM
- V23990-P545-C39-PM

flow PIM 0 housing



12mm housing 17mm housing

Schematic



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	44 59	A
Surge (non-repetitive) forward current	I_{FSM}	$t_p = 10$ ms 50 Hz half sine wave	$T_j = 25$ °C	250	A
I2t-value	I^2t			310	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	26 33	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		$V_{CE} \leq$ 600V, $T_j \leq T_{op}$ max		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	$T_s = 80$ °C $T_c = 80$ °C	56 86	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150$ °C $V_{GE} = 15$V		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	21 35	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	37 67	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	21 26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Turn off safe operating area		V_{CE} ≤ 600V, T_j ≤ T_{op} max		45	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	52 77	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_{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	18 25	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	35 54	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		9,29 / min 12,7	mm
Comparative tracking index	CTI			>200	

Characteristic Values

Parameter	Symbol	Conditions	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 [°C]	Value Min	Value Typ	Value Max	Unit
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,14 1,11	1,6	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,92 0,78		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		8 11		mΩ
Reverse current	I_r			1600		25 145			0,05 1,1	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material λ = 3,4 W/mK						1,25		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00029	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,1	1,55 1,75	1,9	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25 125			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					25 125		15 14		
Rise time	t_r					25 125		12 16		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	±15	300	20	25 125		198 212		
Fall time	t_f					25 125		100 104		
Turn-on energy loss	E_{on}					25 125		0,31 0,43		mWs
Turn-off energy loss	E_{off}					25 125		0,55 0,65		
Input capacitance	C_{ies}							1100		
Output capacitance	C_{oss}	f = 1 MHz	0	25		25		71		pF
Reverse transfer capacitance	C_{rss}							32		
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						1,70		K/W
Inverter Diode										
Diode forward voltage	V_F				20	25 125	1,25	1,81 1,76	1,95	V
Peak reverse recovery current	I_{RRM}					25 125		19 21		A
Reverse recovery time	t_{rr}					25 125		33 192		ns
Reverse recovered charge	Q_{rr}	R_{gon} = 16 Ω	±15	300	20	25 125		0,45 1,35		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1454 1052		A/μs
Reverse recovered energy	E_{rec}					25 125		0,06 0,27		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material λ = 3,4 W/mK						2,60		K/W

Characteristic Values

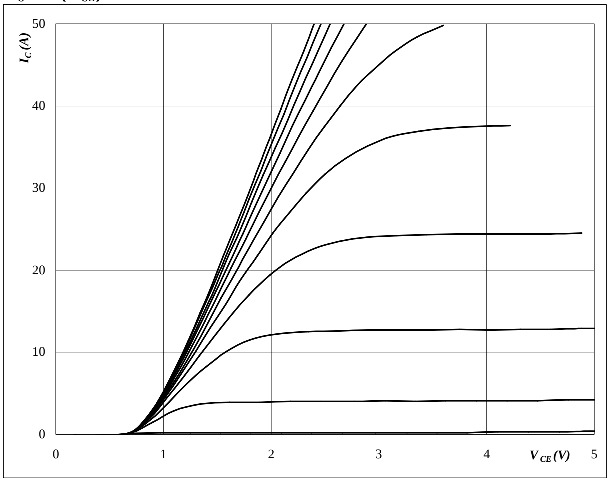
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Value Min	Value Typ	Value Max	Unit
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00029	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,1	1,64 1,86	1,9	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25 125			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125			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	15	25 125		15 14		ns
Rise time	t_r					25 125		11 14		
Turn-off delay time	$t_{d(off)}$					25 125		128 145		
Fall time	t_f					25 125		91 94		
Turn-on energy loss	E_{on}					25 125		0,20 0,28		mWs
Turn-off energy loss	E_{off}					25 125		0,32 0,40		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		860		pF
Output capacitance	C_{oss}							55		
Reverse transfer capacitance	C_{rss}							24		
Gate charge	Q_G		±15	480	15	25		87		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material λ = 3,4 W/mK						1,83		K/W
Brake Diode										
Diode forward voltage	V_F				15	25 125	1,25	1,86 1,75	1,95	V
Reverse leakage current	I_r			600		25 125			27	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	±15	300	15	25 125		14 15		A
Reverse recovery time	t_{rr}					25 125		128 201		ns
Reverse recovered charge	Q_{rr}					25 125		0,52 1,02		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1307 657		A/µs
Reverse recovery energy	E_{rec}					25 125		0,10 0,21		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material λ = 3,4 W/mK						2,75		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-5		5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25				K
B-value	$B_{(25/100)}$	Tol. ±3%				25		4000		K
Vincotech NTC Reference						25			A	

Inverter Charateristics

Figure 1 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



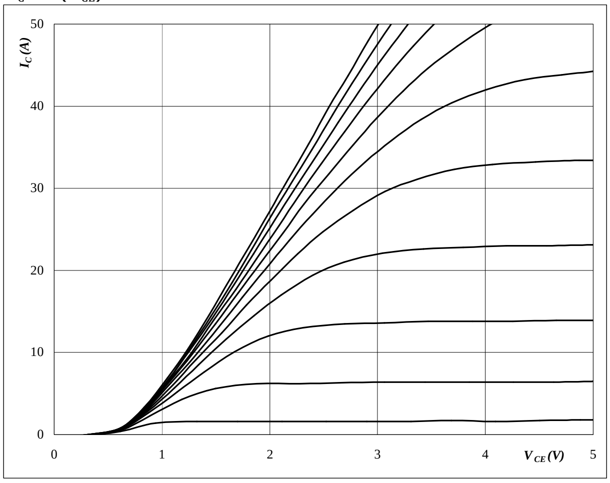
At

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

Figure 2 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



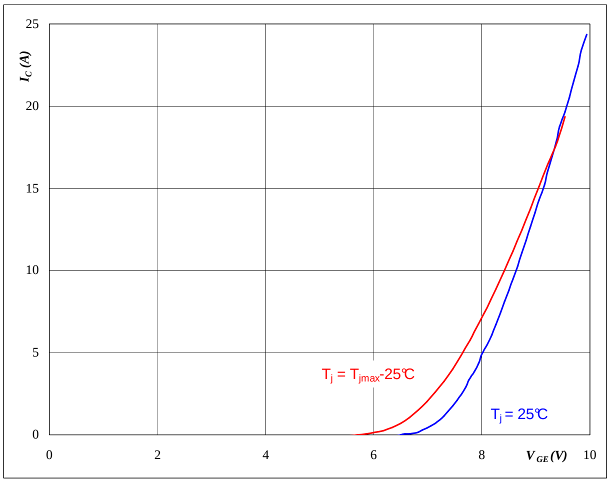
At

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

Figure 3 Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



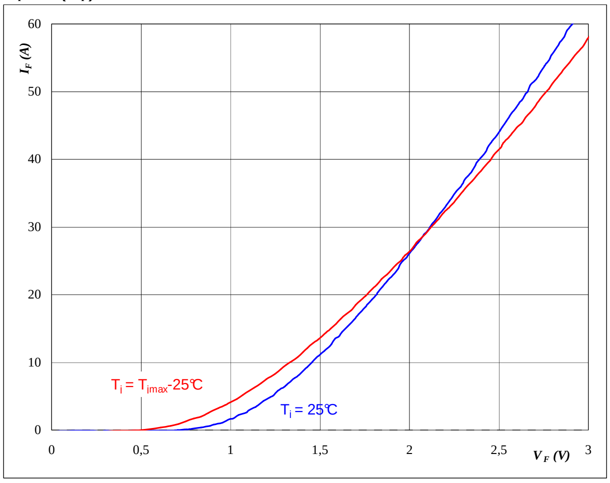
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 Inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

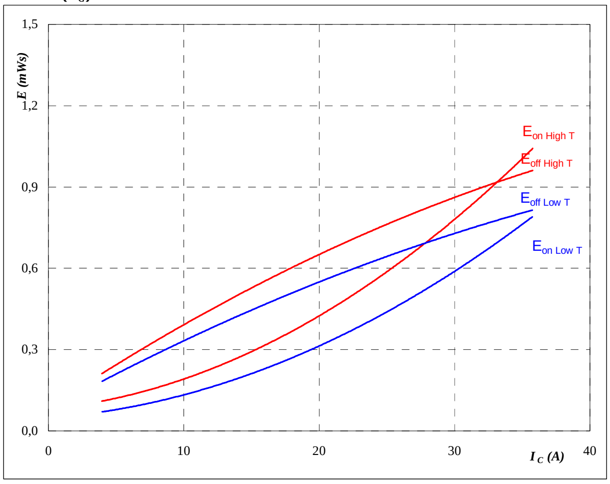
t_p =	250	µs

Inverter Charateristics

Figure 5 Inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



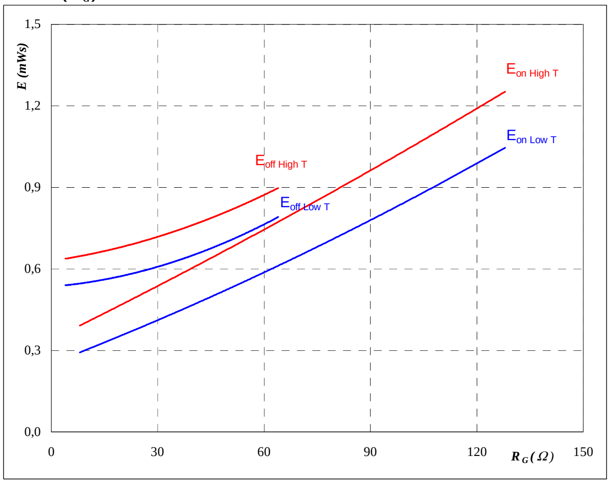
With an inductive load at

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

Figure 6 Inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



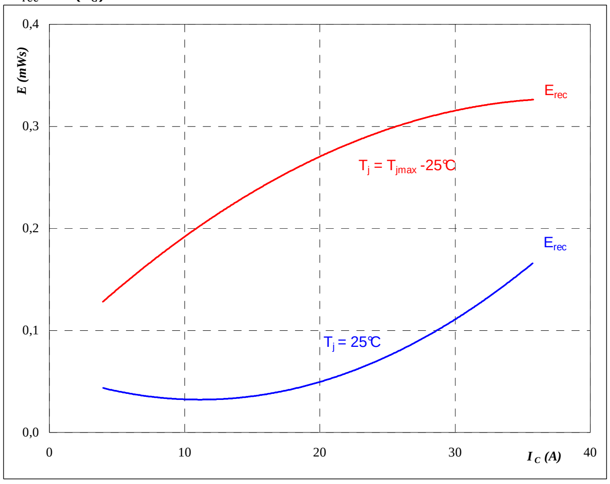
With an inductive load at

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

Figure 7 Inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



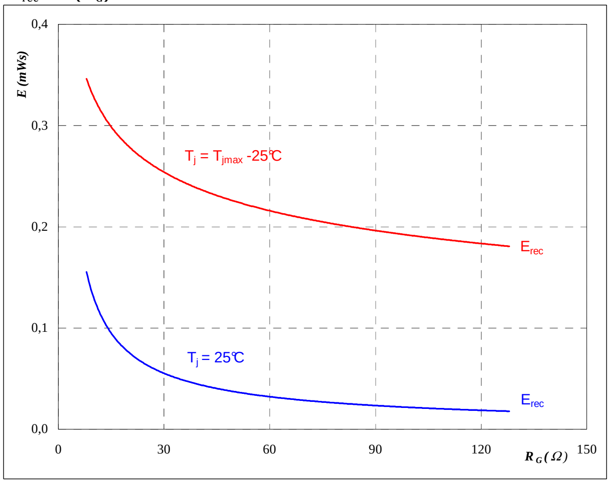
With an inductive load at

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

Figure 8 Inverter FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

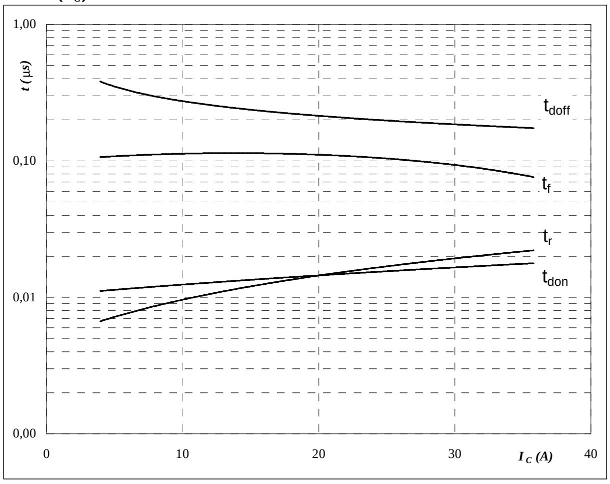
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Inverter Charateristics

Figure 9 Inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



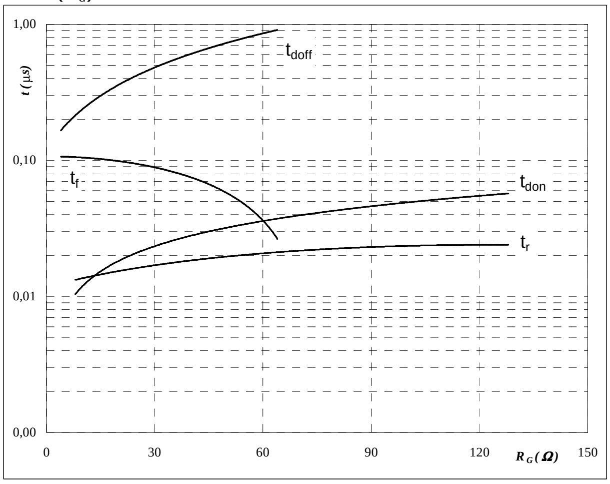
With an inductive load at

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

Figure 10 Inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



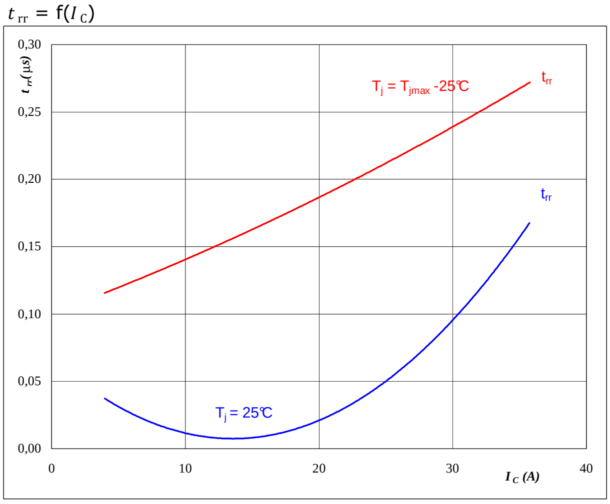
With an inductive load at

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

Figure 11 Inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



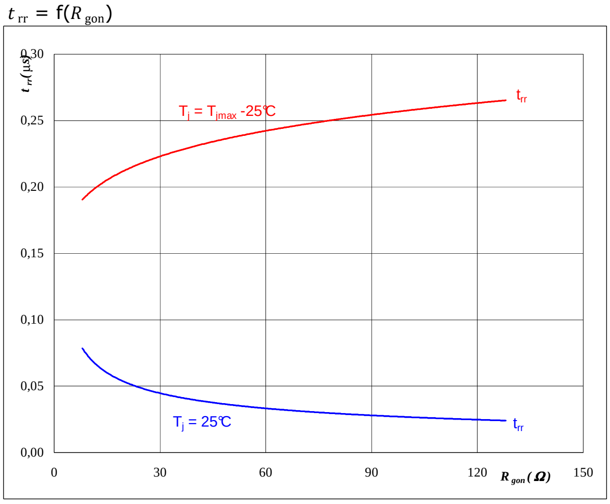
At

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

Figure 12 Inverter FWD

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

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



At

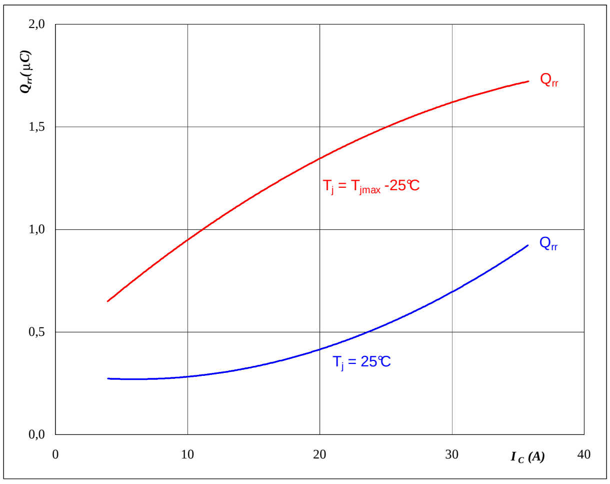
T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Inverter Charateristics

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



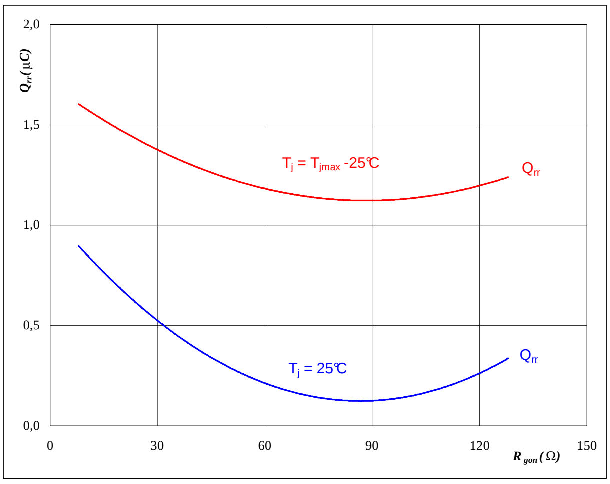
At

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

Figure 14 Inverter FWD

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

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



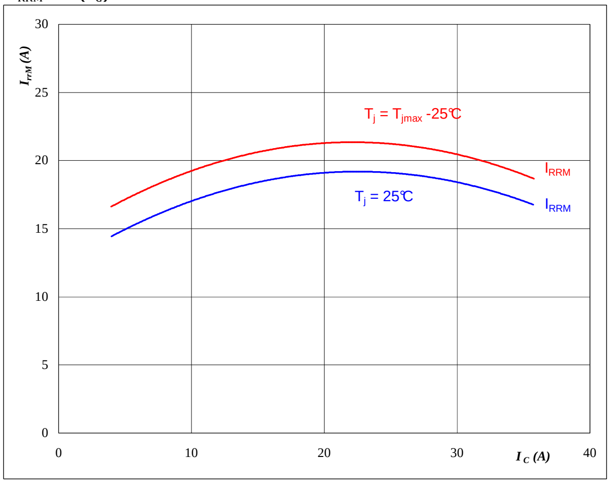
At

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

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



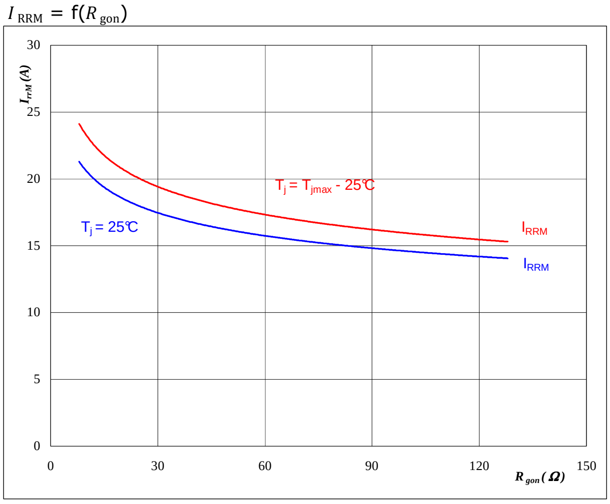
At

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

Figure 16 Inverter FWD

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

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



At

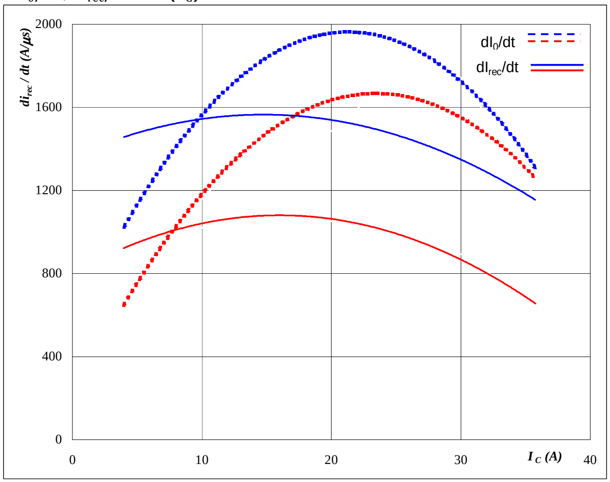
T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Inverter Charateristics

Figure 17 Inverter FWD

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

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



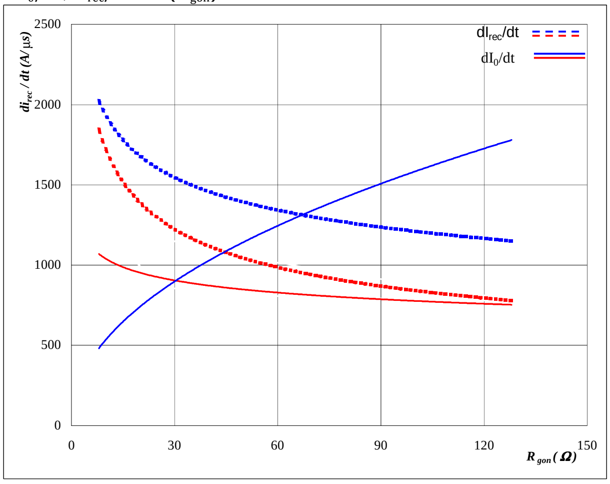
At

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

Figure 18 Inverter FWD

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

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



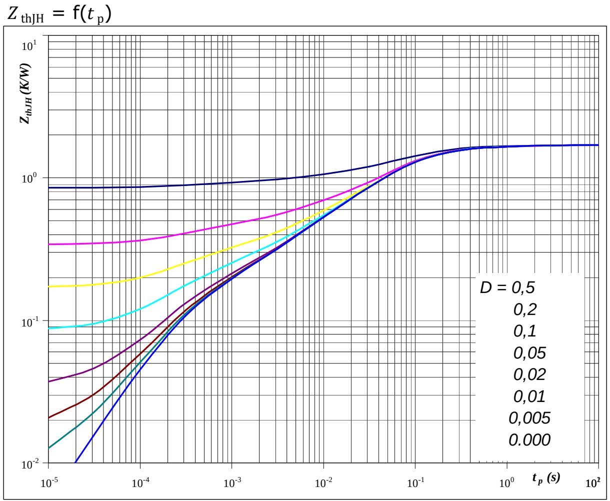
At

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

Figure 19 Inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



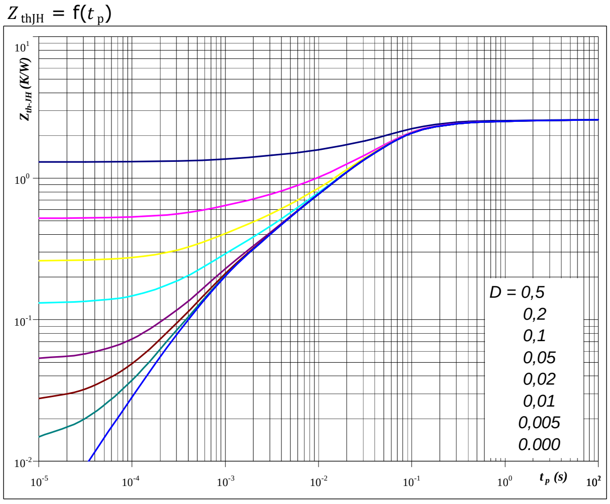
At

D =	t_p / T	
R_{thJH} =	1,70	K/W

Figure 20 Inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	2,60	K/W

IGBT thermal model values

Phase change interface

R (K/W)	Tau (s)
1,0E-01	1,3E+00
3,5E-01	1,7E-01
8,1E-01	5,3E-02
2,5E-01	7,7E-03
7,7E-02	1,3E-03
1,1E-01	2,6E-04

FWD thermal model values

Phase change interface

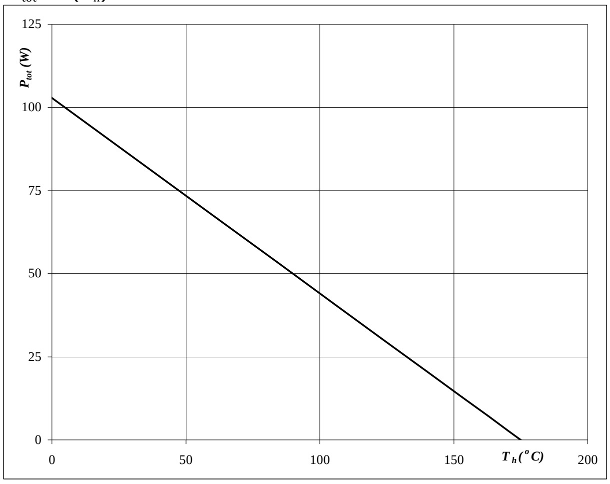
R (K/W)	Tau (s)
6,6E-02	4,6E+00
1,6E-01	5,7E-01
9,0E-01	8,4E-02
1,1E+00	3,3E-02
2,8E-01	5,0E-03
1,5E-01	7,7E-04

Inverter Charateristics

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



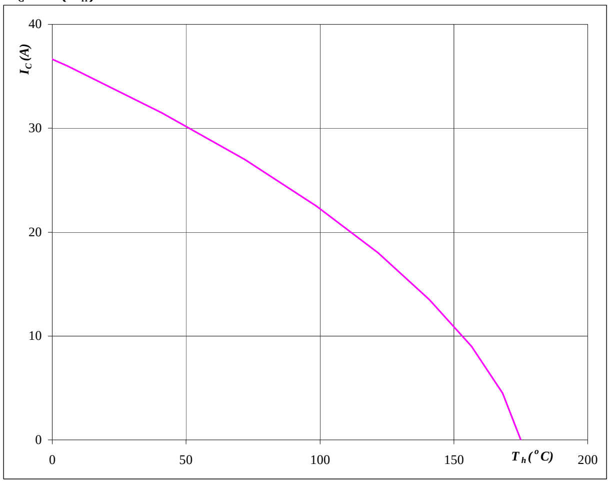
At

T_j = 175 °C

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

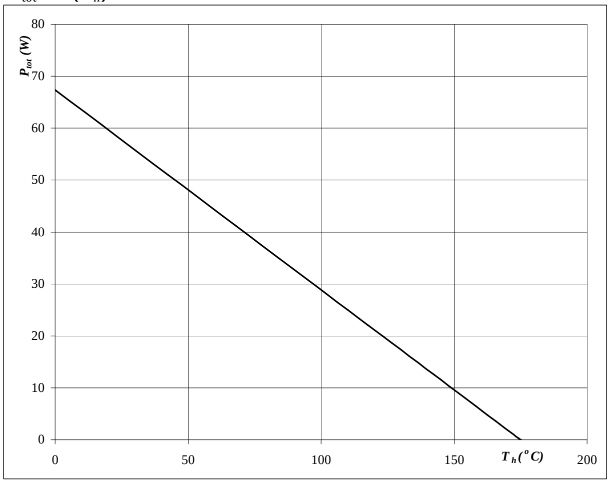
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



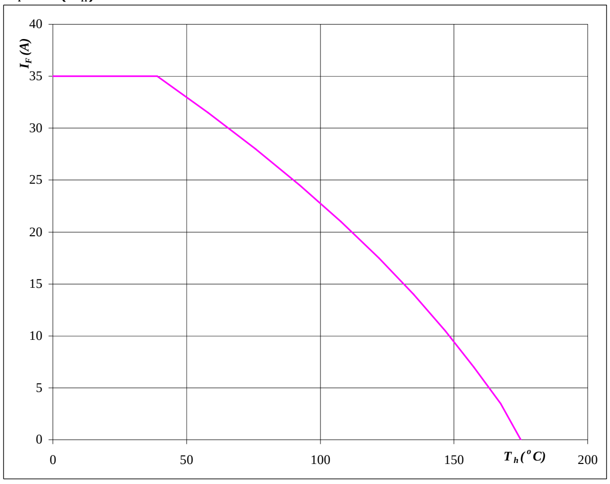
At

T_j = 175 °C

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

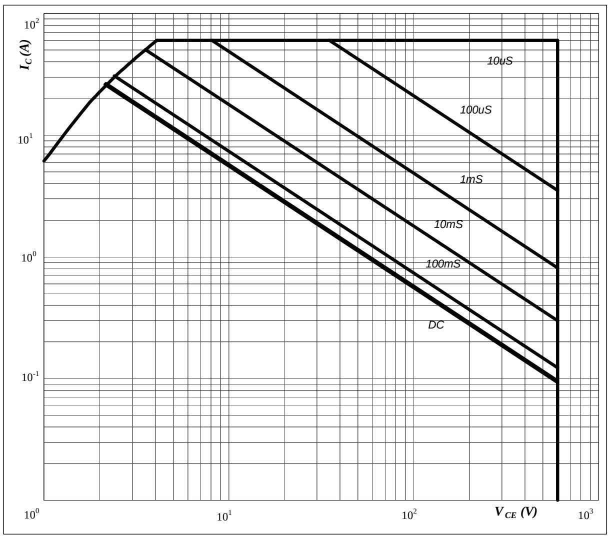
T_j = 175 °C

Inverter Charateristics

Figure 25 Inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



At

D = single pulse

T_h = 80 ºC

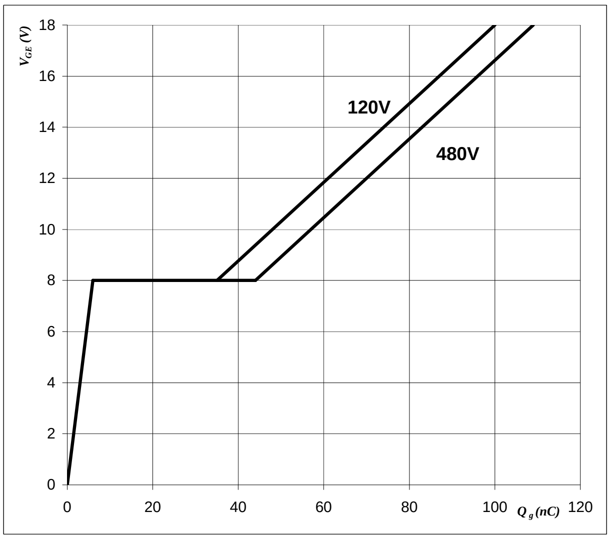
V_{GE} = 15 V

T_j = T_{jmax} ºC

Figure 26 Inverter IGBT

Gate voltage vs Gate charge

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



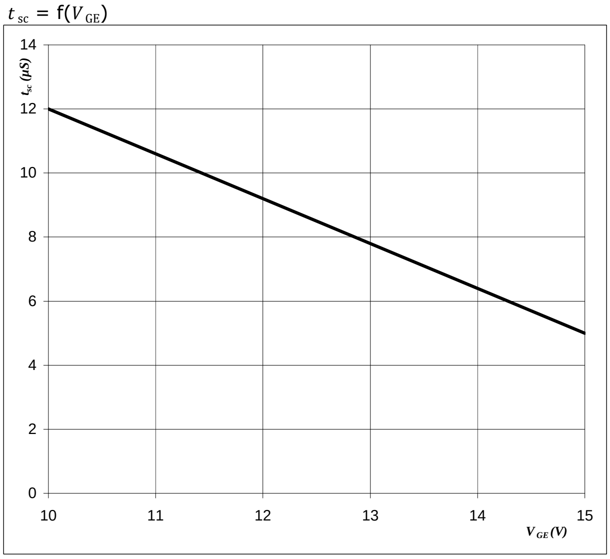
At

I_C = 20 A

Figure 27 Inverter IGBT

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

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



At

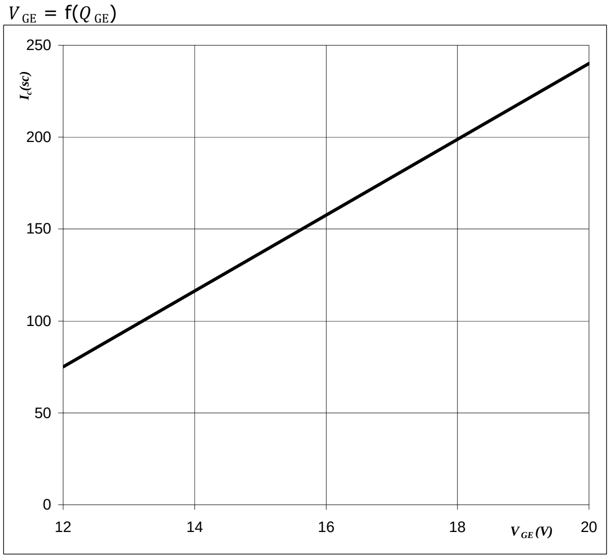
V_{CE} = 600 V

$T_j \leq$ 175 ºC

Figure 28 Inverter IGBT

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

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



At

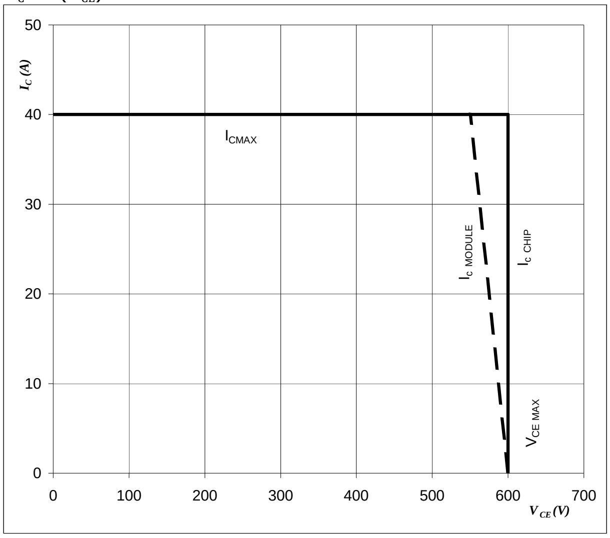
$V_{CE} \leq$ 600 V

T_j = 175 ºC

Figure 29 Inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

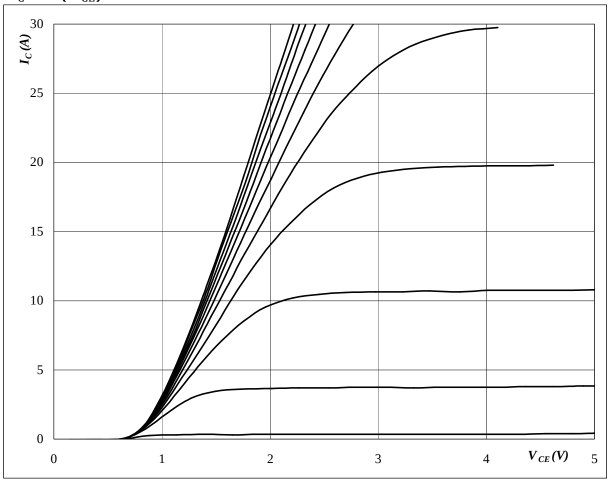
Switching mode : 3 level switching

Brake Charateristics

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

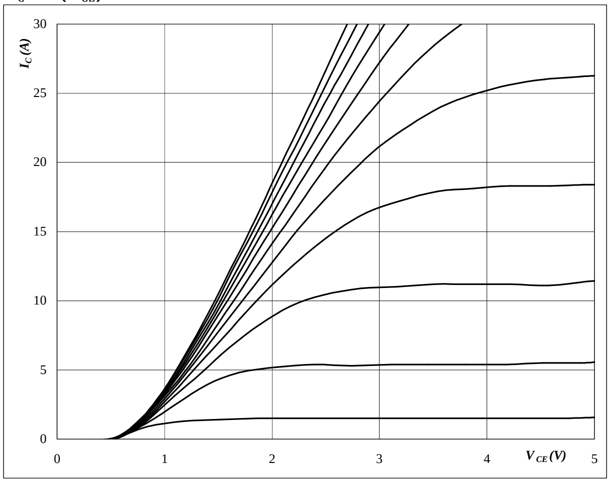
T_j = 25 °C

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

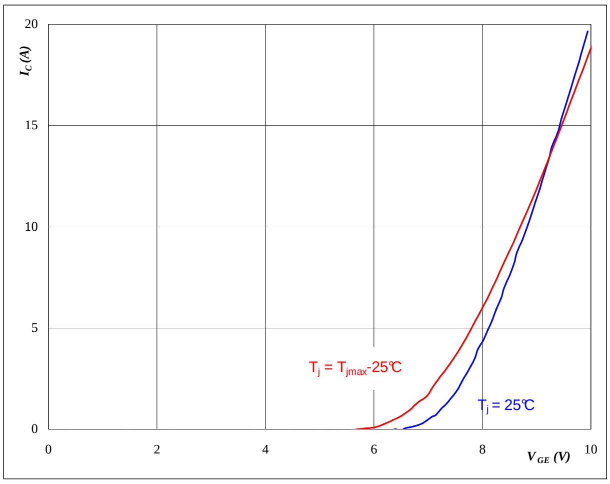
T_j = 125 °C

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

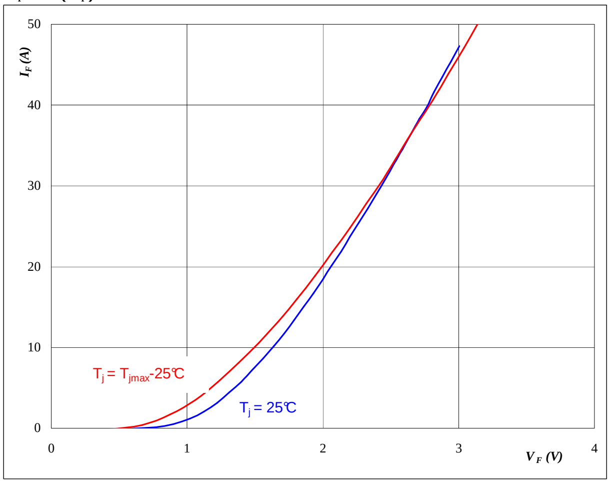
t_p = 250 µs

V_{CE} = 10 V

Figure 4 Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

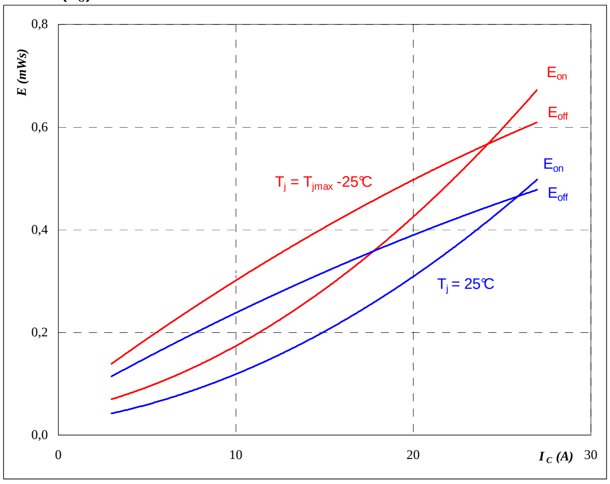
t_p = 250 µs

Brake Charateristics

Figure 5	Brake IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



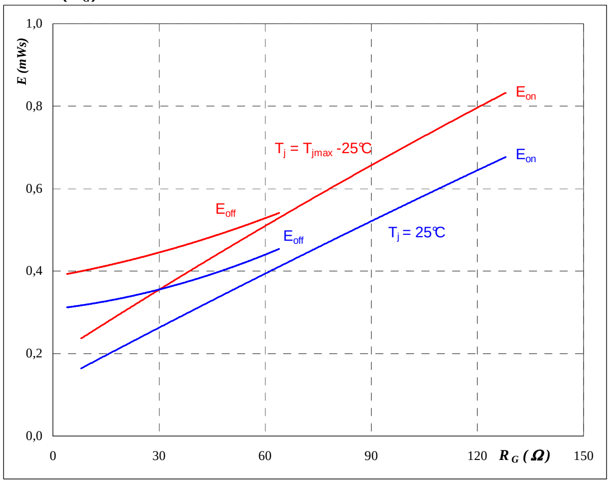
With an inductive load at

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

$E = f(R_G)$



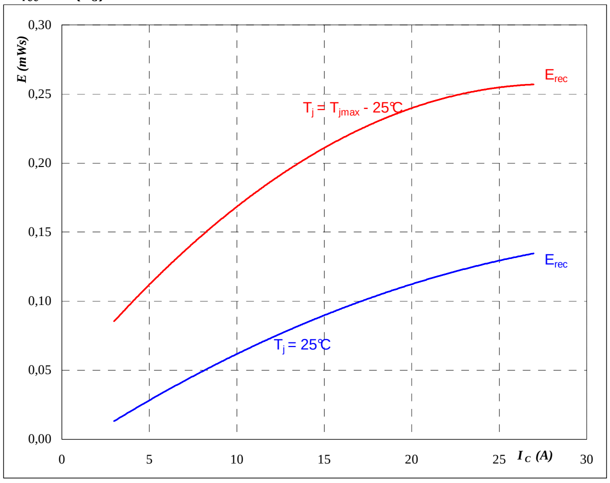
With an inductive load at

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

Figure 7	Brake FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



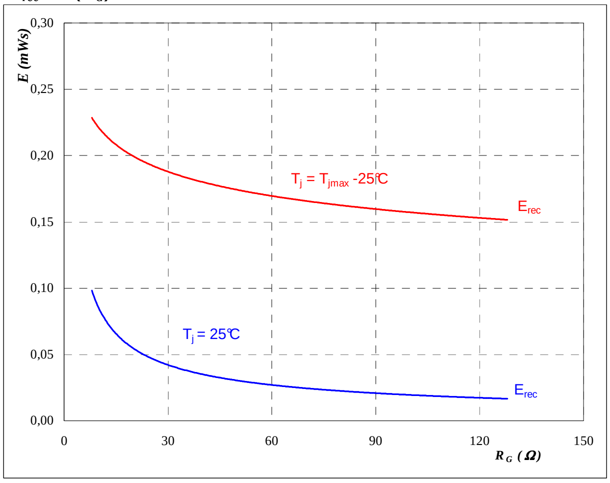
With an inductive load at

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

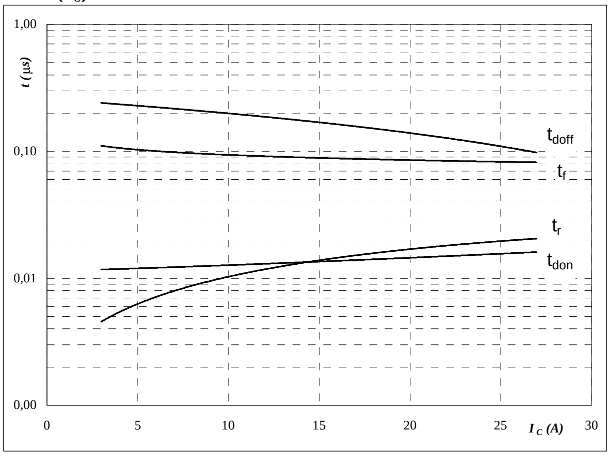
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	15	A

Brake Charateristics

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



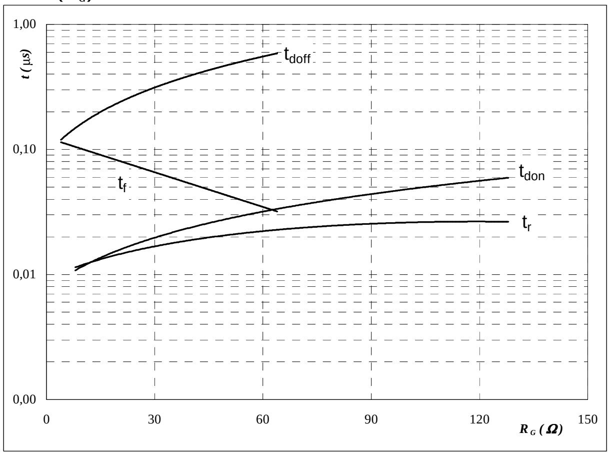
With an inductive load at

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

$t = f(R_G)$



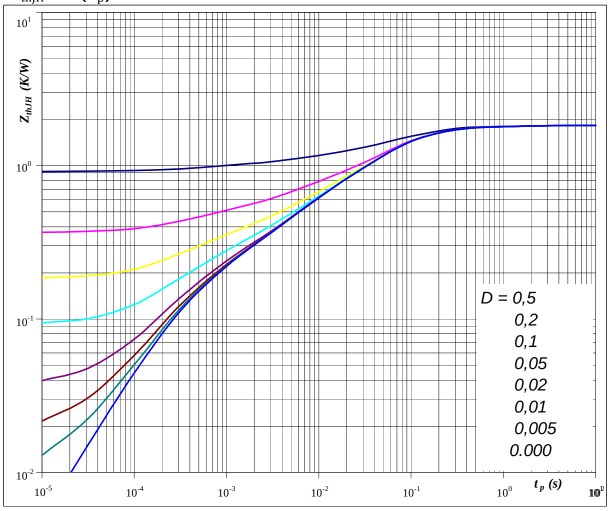
With an inductive load at

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

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At $D = t_p / T$

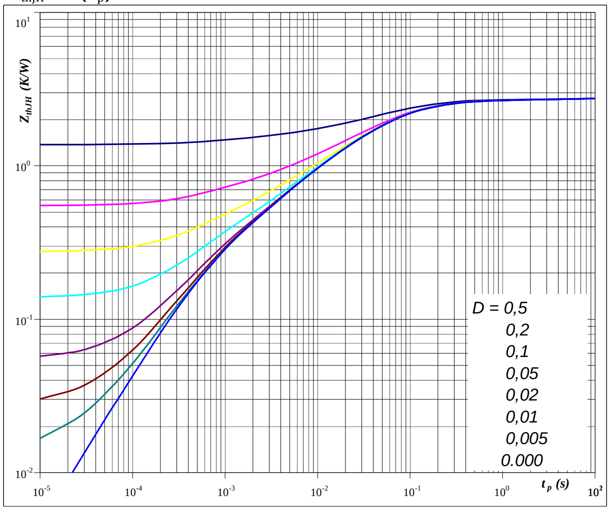
Phase change interface

R_{thJH} = 1,83 K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At $D = t_p / T$

Phase change interface

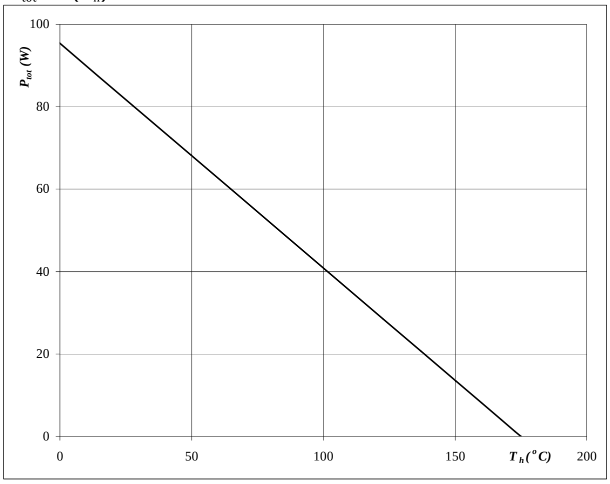
R_{thJH} = 2,75 K/W

Brake Charateristics

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



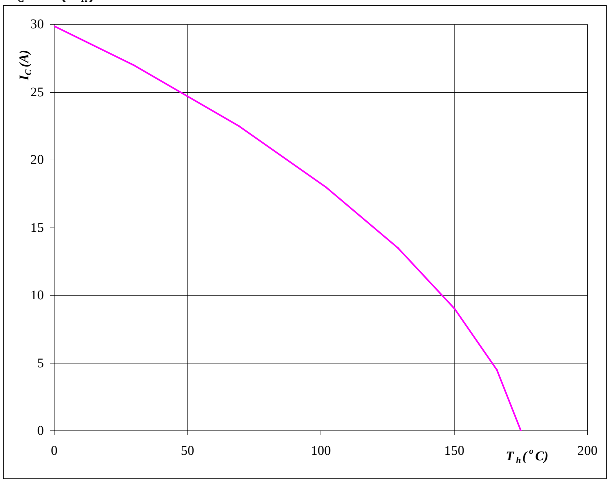
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

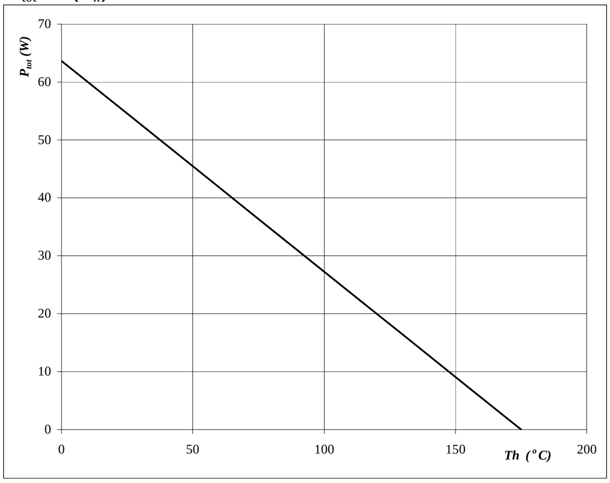
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



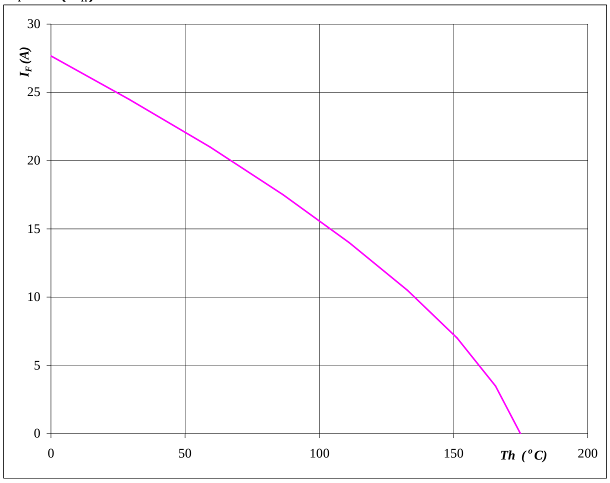
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

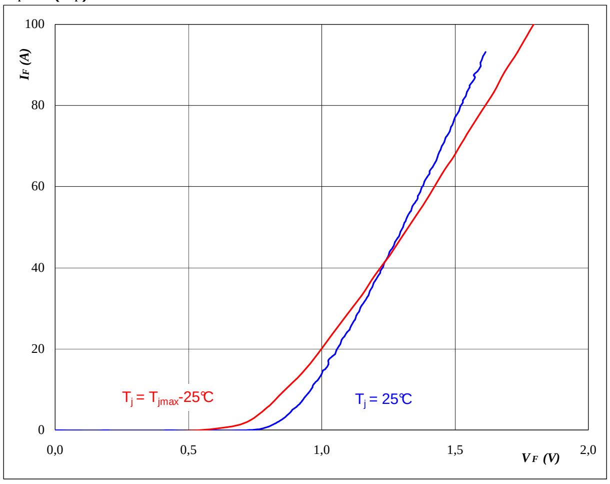
T_j = 175 ºC

Rectifier Diode Charateristics

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



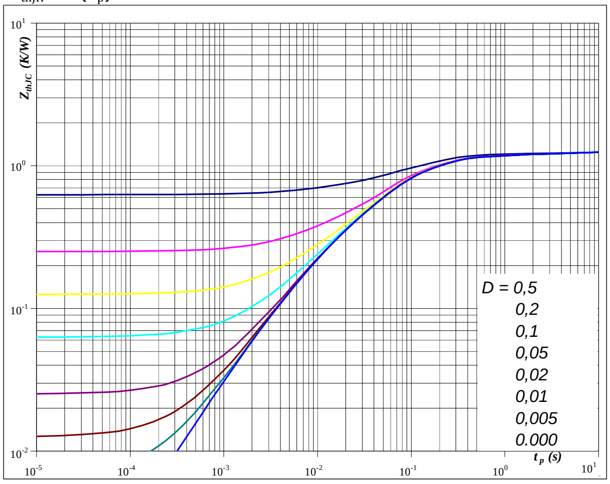
At

t_p = 250 µs

Figure 2 Rectifier Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

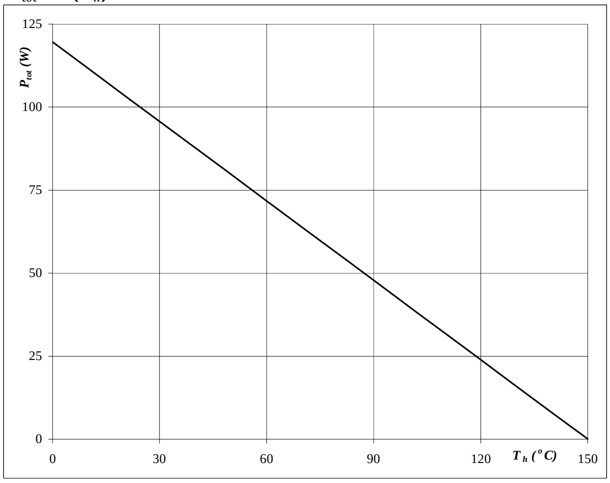
$D = t_p / T$

R_{thJH} = 1,25 K/W

Figure 3 Rectifier Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



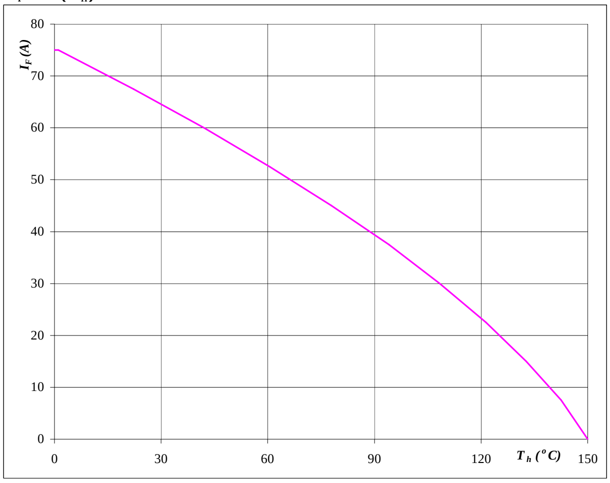
At

T_j = 150 ºC

Figure 4 Rectifier Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



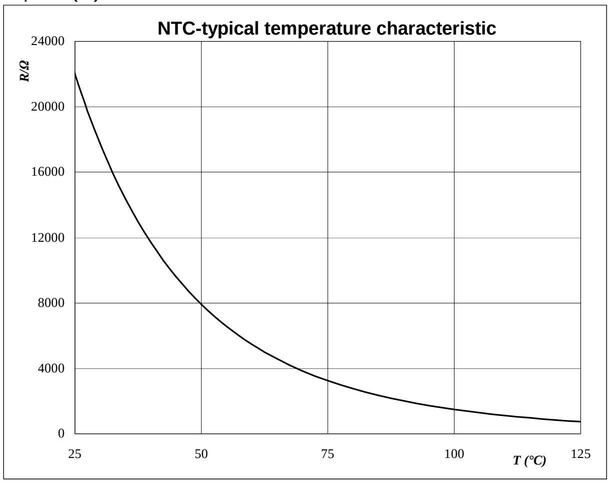
At

T_j = 150 ºC

Thermistor Charateristics

Figure 1	Thermistor

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



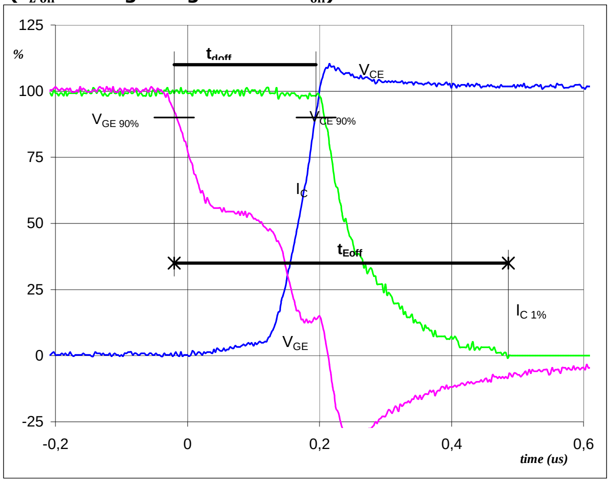
Switching Definitions Inverter

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	8 Ω

Figure 1 Inverter IGBT

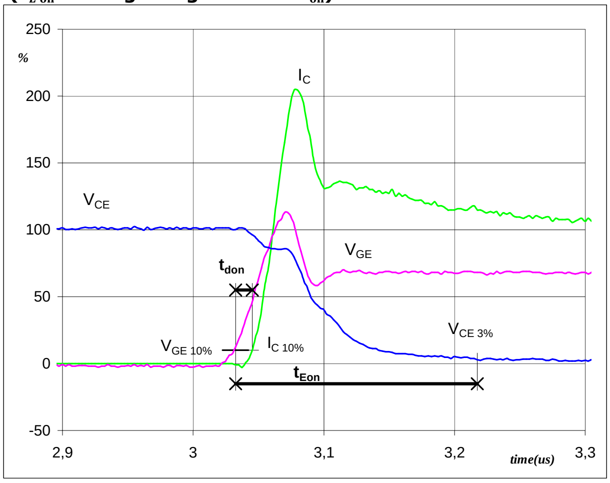
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{doff} =	0,21	µs
$t_{E off}$ =	0,51	µs

Figure 2 Inverter IGBT

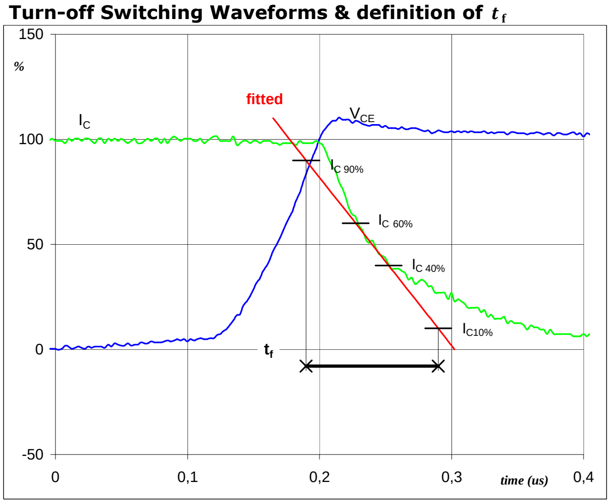
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{don} =	0,01	µs
$t_{E on}$ =	0,18	µs

Figure 3 Inverter IGBT

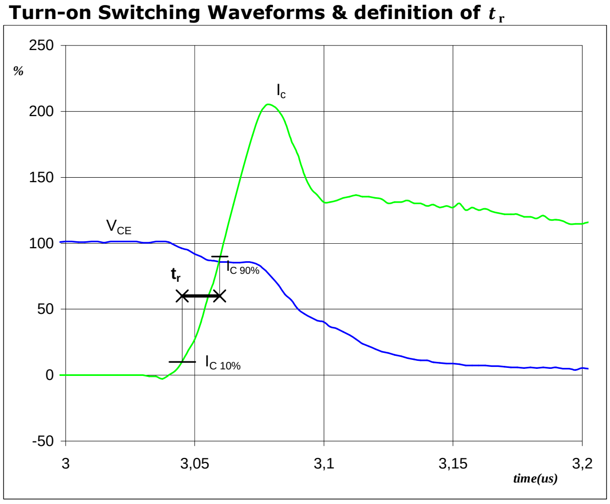
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	20	A
t_f =	0,10	µs

Figure 4 Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

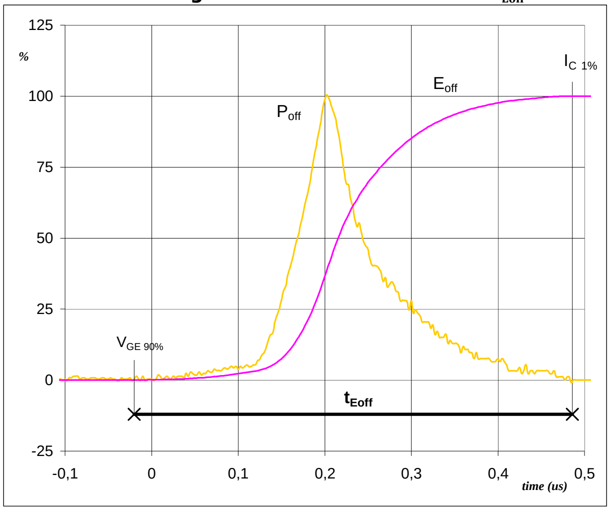


V_C (100%) =	300	V
I_C (100%) =	20	A
t_r =	0,02	µs

Switching Definitions Inverter

Figure 5 Inverter IGBT

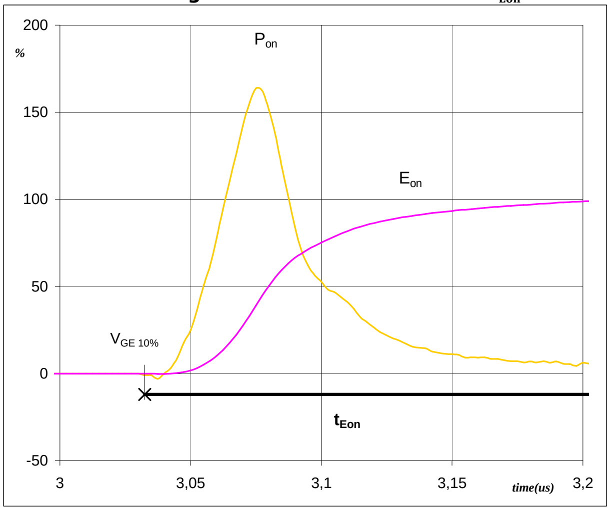
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	5,99	kW
E_{off} (100%) =	0,65	mJ
$t_{E\ off}$ =	0,51	μs

Figure 6 Inverter IGBT

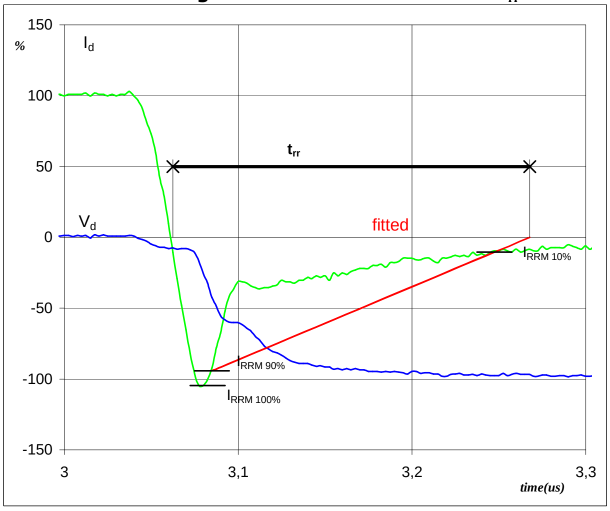
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	5,99	kW
E_{on} (100%) =	0,43	mJ
$t_{E\ on}$ =	0,18	μs

Figure 7 Inverter IGBT

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

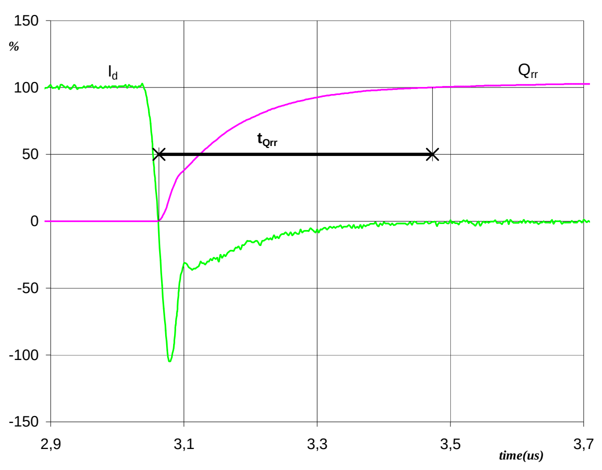


V_d (100%) =	300	V
I_d (100%) =	20	A
I_{RRM} (100%) =	21	A
t_{rr} =	0,19	μs

Switching Definitions Inverter

Figure 9	Inverter FWD

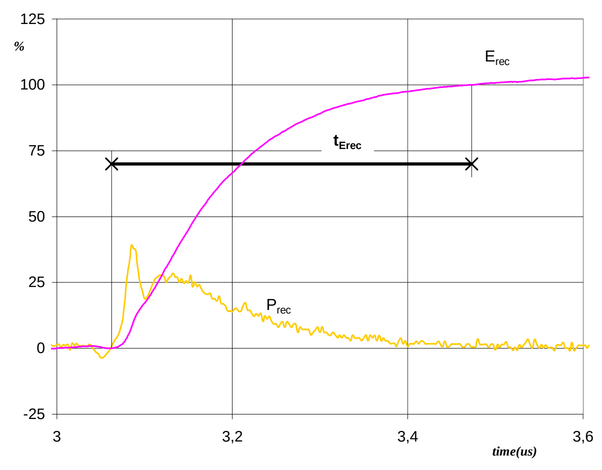
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	20	A
Q_{rr} (100%) =	1,35	μC
$t_{Q\,rr}$ =	0,41	μs

Figure 10	Inverter FWD

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



P_{rec} (100%) =	5,99	kW
E_{rec} (100%) =	0,27	mJ
$t_{E\,rec}$ =	0,41	μs

Ordering Code and Marking - Outline - Pinout

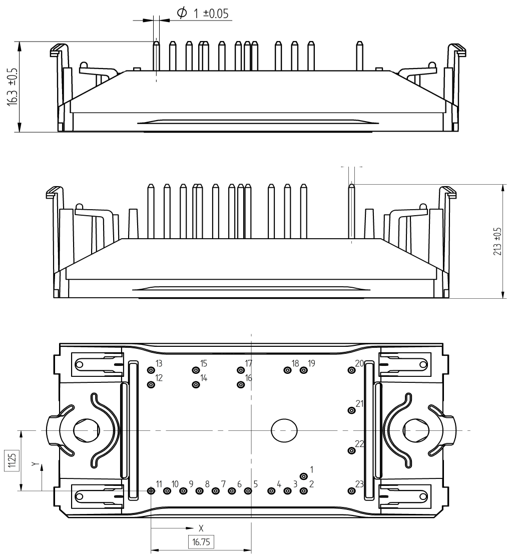
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing solder pins	V23990-P545-A38-PM
without thermal paste 17mm housing solder pins	V23990-P545-A39-PM
without thermal paste 12mm housing solder pins without brake	V23990-P545-C38-PM
without thermal paste 17mm housing solder pins without brake	V23990-P545-C39-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				module	without pins
Pin	X	Y	Function	C38, C39	4, 5, 20
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		



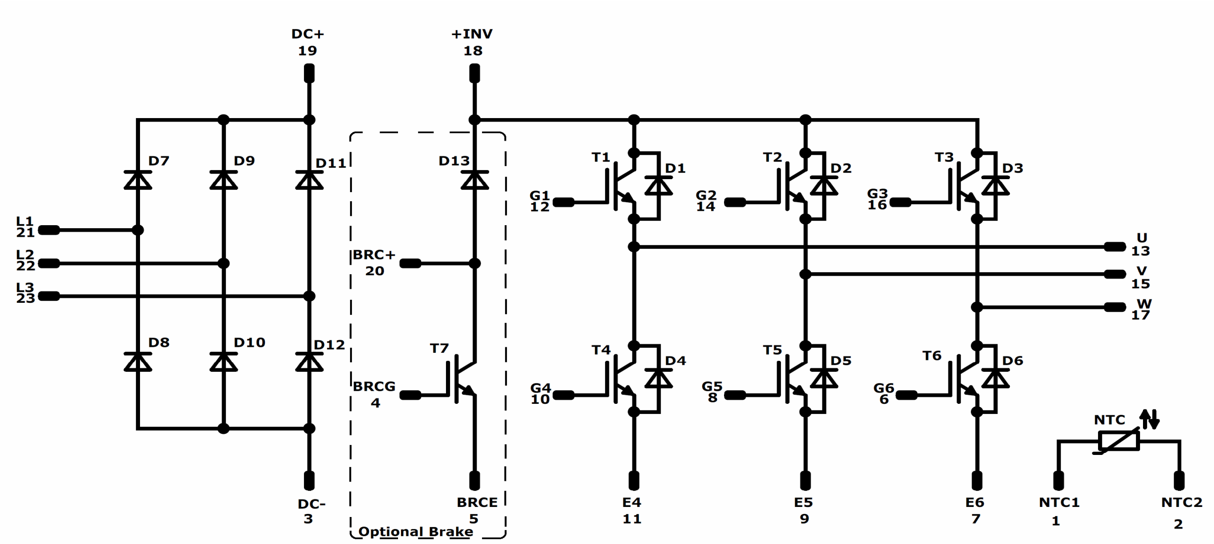
12 mm housing

17 mm housing

Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2, T3, T4, T5, T6	IGBT	600 V	20 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	20 A	Inverter Diode	
T7	IGBT	600 V	15 A	Brake Switch	
D13	FWD	600 V	15 A	Brake Diode	
D7, D8, D9, D10, D11, D12	Diode	1600 V	35 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-P545-*3*-D7-14	25 Nov. 2018	R_{th}, I_{max}, P_{tot} R_{gon}, R_{goff} values corrected	all

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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.