V23990-P768-A60-PM
V23990-P768-A60Y-PM

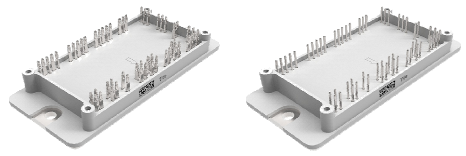
datasheet

flow PIM 2 — 1200 V / 50 A

Features

- 3~rectifier, BRC, Inverter, NTC
- Very Compact housing, easy to route
- Mitsubishi IGBT and FWD

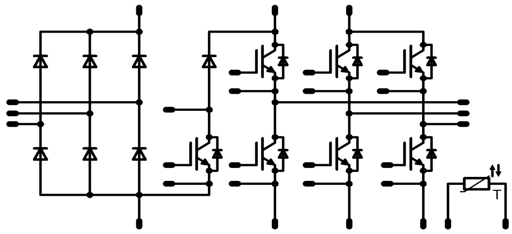
flow 2 17mm housing



Target Applications

- Motor Drives
- Power Generation

Schematic



Types

- V23990-P768-A60-PM
- V23990-P768-A60Y-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1800	V
DC forward current	I_{FAV}	T_j=Tjmax	T_h=80°C	75	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=150°C	490	A
I2t-value	I^2t			1200	A2s
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C	106	W
Maximum Junction Temperature	T_{jmax}			150	°C

Parameter	Symbol	Condition		Value	Unit
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=Tjmax	T_h=80°C	60	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		100	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		100	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C	144	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 850	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}	T_j=25°C		1200	V
DC forward current	I_F	T_j=Tjmax	T_h=80°C	100	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		100	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C	115	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=Tjmax	T_h=80°C	48	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		135	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_j ≤ T_{op} max		70	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C	151	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=Tjmax	T_h=80°C	16	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Brake Inverse Diode	P_{tot}	T_j=Tjmax	T_h=80°C	69	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=Tjmax	T_h=80°C	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		50	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C	69	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance			with Press-fit pins / with Solder pins	11,96 / 12,03	mm
Comparative tracking index	CTI			>200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Input Rectifier Diode										
Forward voltage	V_F				40	Tj=25°C Tj=125°C	1	1,19 1,12	1,5	V
Threshold voltage (for power loss calc. only)	V_{to}				40	Tj=25°C Tj=125°C		0,9 0,76		V
Slope resistance (for power loss calc. only)	r_t				40	Tj=25°C Tj=125°C		7 9		mΩ
Reverse current	I_r			1600		Tj=25°C Tj=125°C			0,1	mA
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,66		K/W
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		10	0,005	Tj=25°C Tj=150°C	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	Tj=25°C Tj=150°C	1,2	1,73 2,00	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			150	µA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			500	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=16 Ω Rgon=16 Ω	±15	600	50	Tj=25°C Tj=150°C		106 106		ns
Rise time	t_r					Tj=25°C Tj=150°C		28 46		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		157 200		
Fall time	t_f					Tj=25°C Tj=150°C		58 89		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		2,61 5,10		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		2,49 4,08		
Input capacitance	C_{ies}	f=1MHz	0	10		Tj=25°C		3100		pF
Output capacitance	C_{oss}							340		
Reverse transfer capacitance	C_{rss}							37		
Gate charge	Q_G		15	600	50	Tj=25°C		105		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,66		K/W
Inverter Diode										
Diode forward voltage	V_F				50	Tj=25°C Tj=150°C		2,73 2,18	3,3	V
Peak reverse recovery current	I_{RRM}	Rgon=16 Ω	±15	600	50	Tj=25°C Tj=150°C		33 45		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		388 727		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		4,01 10,81		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		1018 295		A/µs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		1,842 5,141		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,83		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	Min	Typ	Max	Unit
Brake Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0012	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	Tj=25°C Tj=125°C	1,5	1,92 2,37	2,3	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		Tj=25°C Tj=125°C			250	μA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					Tj=25°C Tj=150°C		83 89		
Rise time	t_r					Tj=25°C Tj=150°C		27 27		
Turn-off delay time	$t_{d(off)}$	Rgoff=16 Ω Rgon=16 Ω	±15	600	35	Tj=25°C Tj=150°C		191 269		ns
Fall time	t_f					Tj=25°C Tj=150°C		54 125		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		2,00 2,92		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		1,74 3,18		
Input capacitance	C_{ies}							1950		
Output capacitance	C_{oss}	f=1MHz	0	25		Tj=25°C		155		pF
Reverse transfer capacitance	C_{rss}							115		
Gate charge	Q_G		15	960	35	Tj=25°C		160		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						0,63		K/W
Brake Inverse Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=150°C	1,2	1,80 1,76	2,2	V
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,38		K/W
Brake Diode										
Diode forward voltage	V_F				25	Tj=25°C Tj=125°C	1	2,40 3,16	2,9	V
Reverse leakage current	I_r			1200		Tj=25°C Tj=150°C			60	μA
Peak reverse recovery current	I_{RRM}					Tj=25°C Tj=150°C		31 39		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		146 423		ns
Reverse recovered charge	Q_{rr}	Rgon=16 Ω Rgon=16 Ω	±15	600	35	Tj=25°C Tj=150°C		2,32 4,84		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		1749 917		A/μs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C		0,909 1,982		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,37		K/W

Characteristic Values

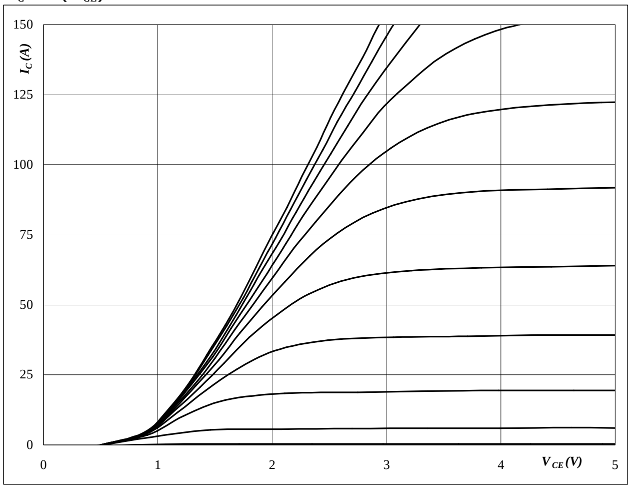
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					T=25°C		21,5		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				T=100°C	-4,5		+4,5	%
Power dissipation	P					T=25°C		210		mW
Power dissipation constant						T=25°C		3,5		mW/K
B-value	$B_{(25/50)}$					T=25°C		3884		K
B-value	$B_{(25/100)}$					T=25°C		3964		K
Vincotech NTC Reference									F	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



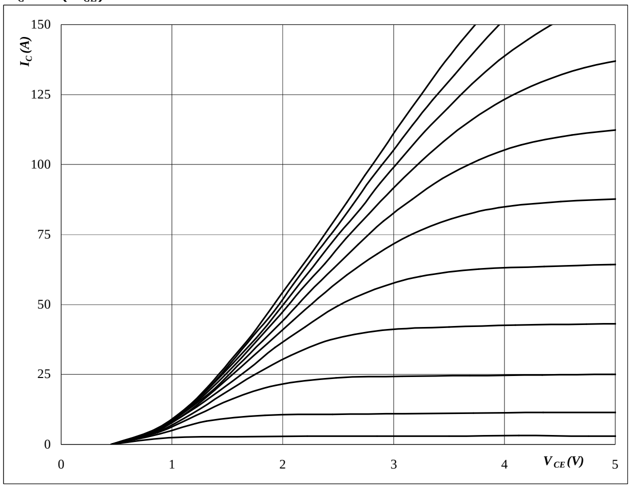
At

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

$I_C = f(V_{CE})$



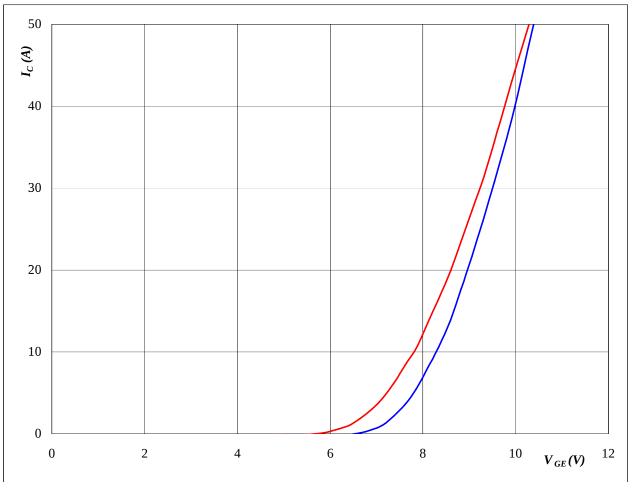
At

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



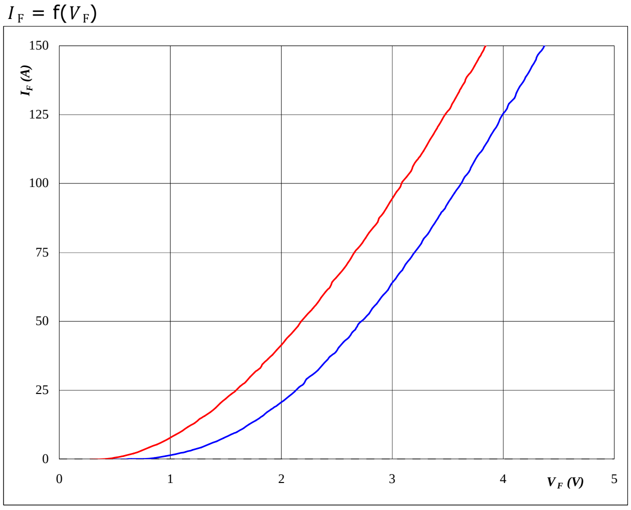
At

T_j =	25/150	°C
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

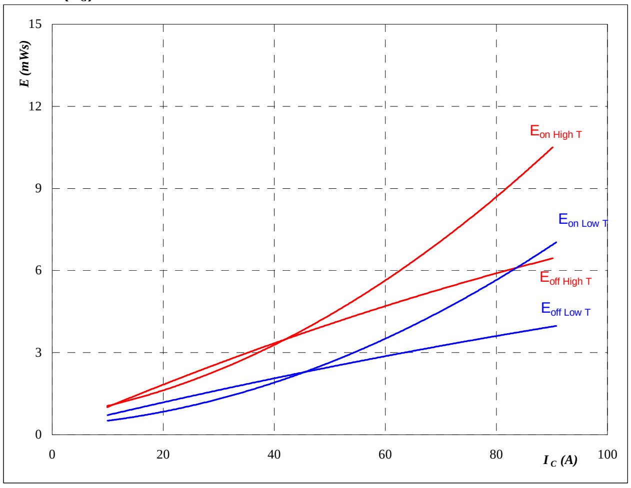
t_p =	250	µs

Output Inverter

Figure 5 — Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



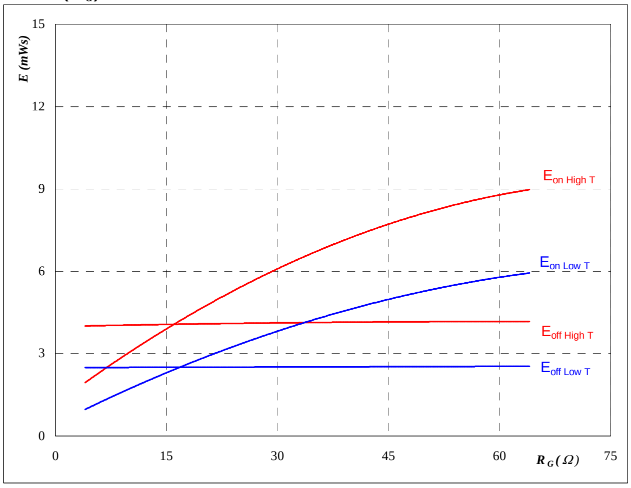
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6 — Output inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



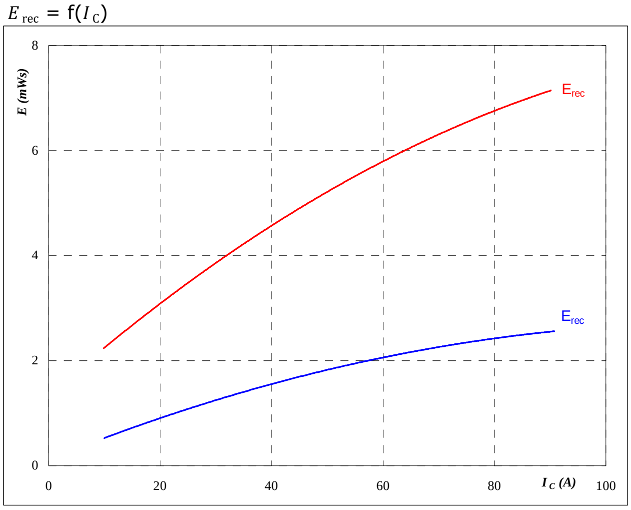
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 — Output inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



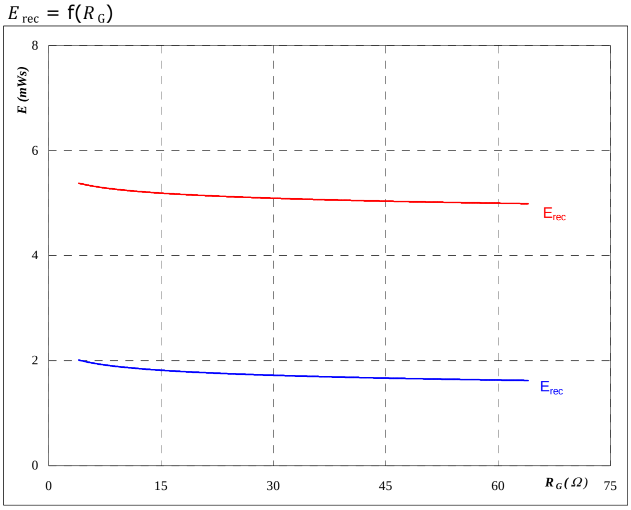
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	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

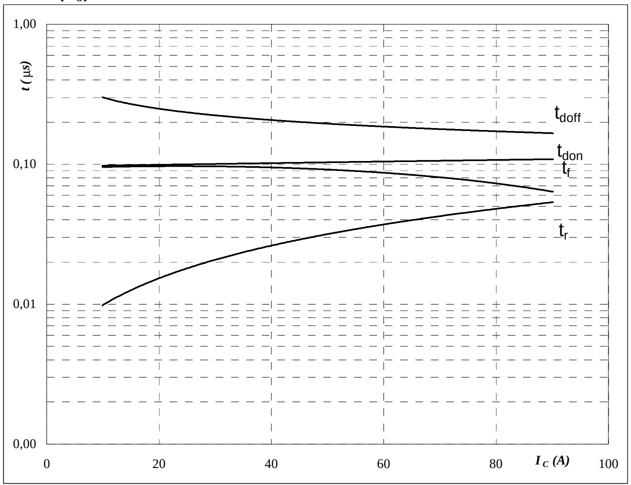
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



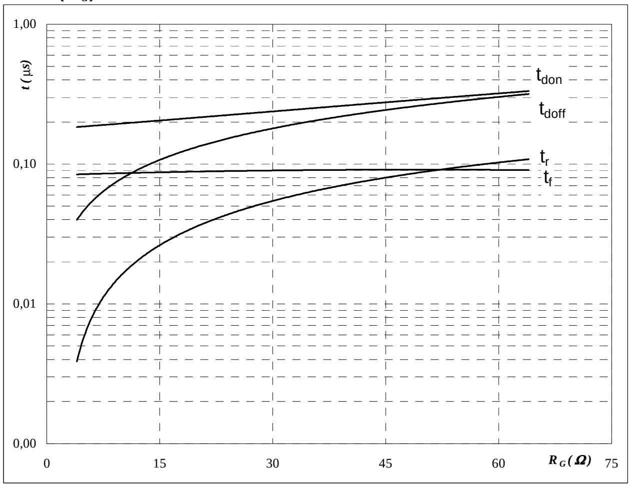
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



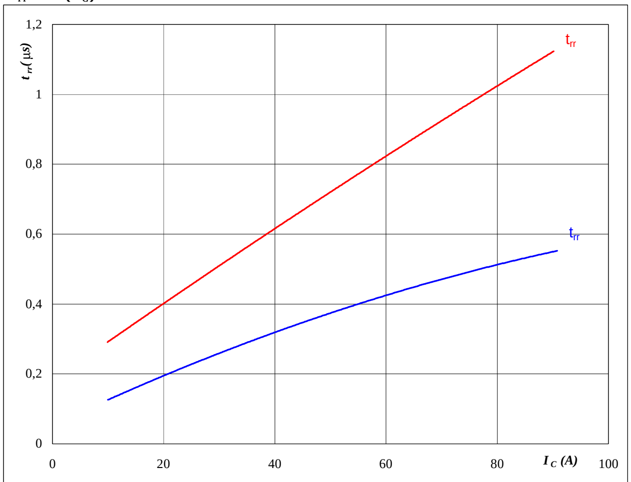
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



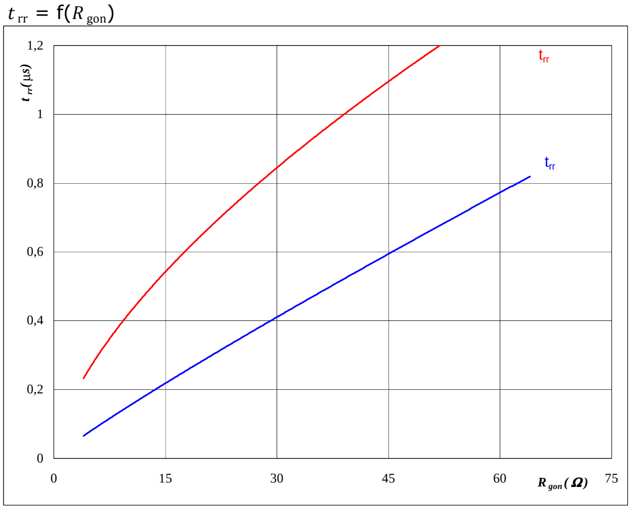
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	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

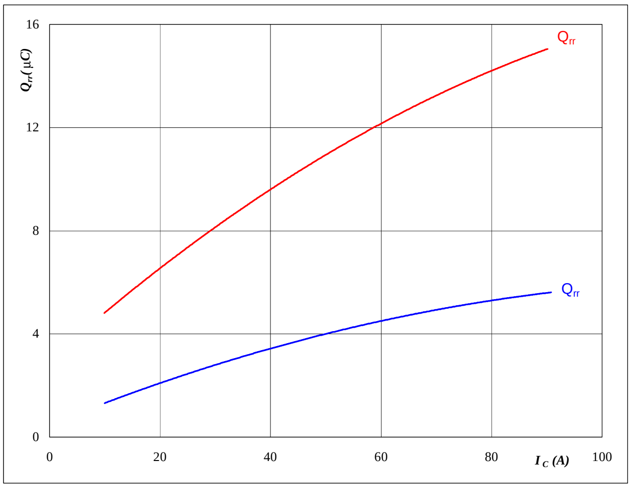
T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



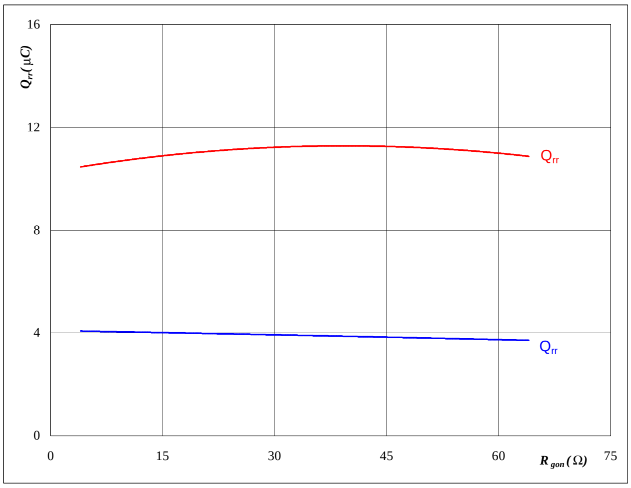
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 14 Output inverter FWD

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

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



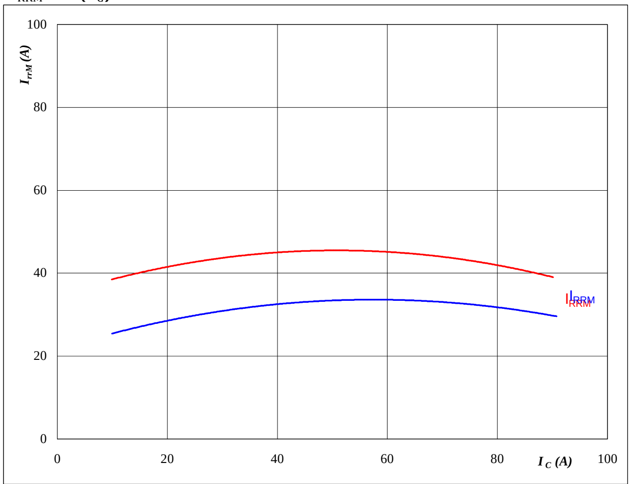
At

T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



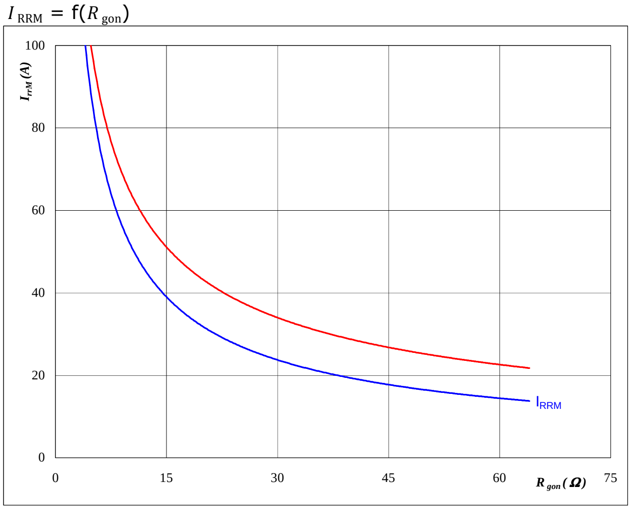
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	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

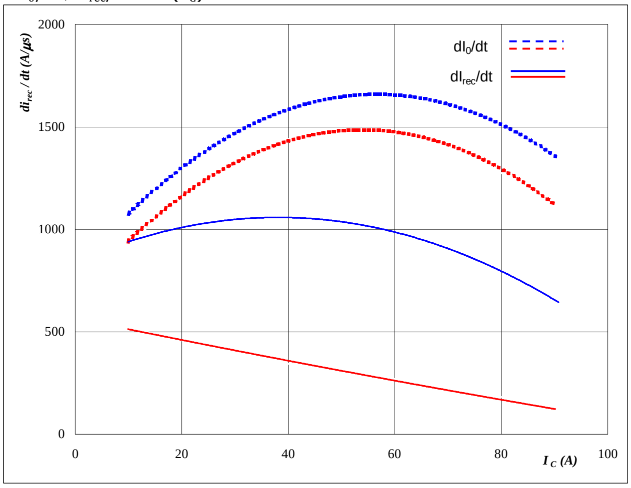
T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

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



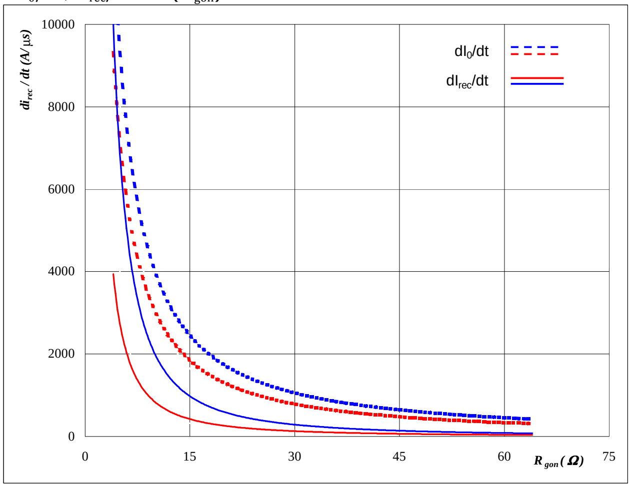
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	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

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



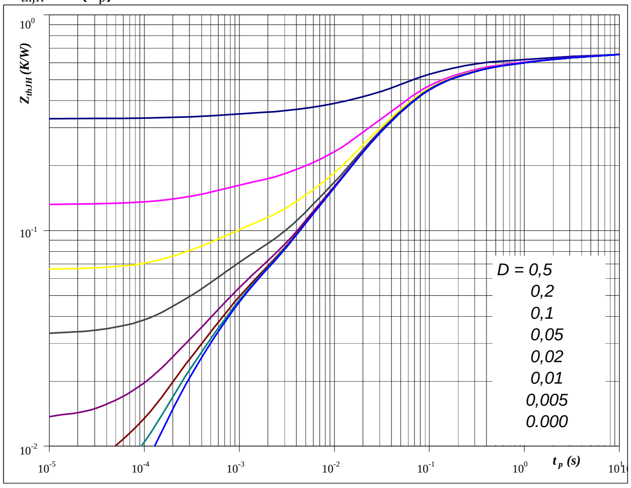
At

T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,66	K/W

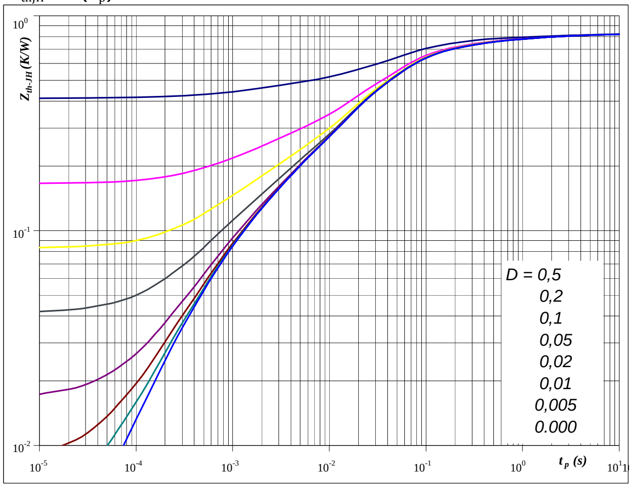
IGBT thermal model values

R (K/W)	Tau (s)
0,05	4,1E+00
0,08	6,8E-01
0,20	1,1E-01
0,25	3,2E-02
0,04	4,9E-03
0,03	4,9E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,83	K/W

FWD thermal model values

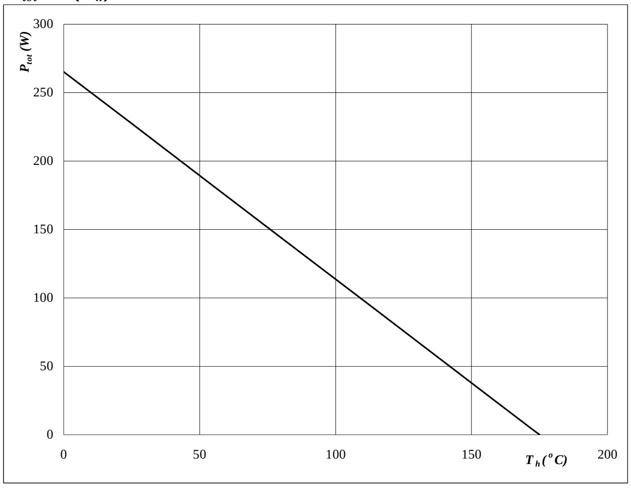
R (K/W)	Tau (s)
0,03	6,5E+00
0,06	1,1E+00
0,15	1,6E-01
0,35	3,9E-02
0,12	1,1E-02
0,08	1,8E-03
0,03	4,4E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



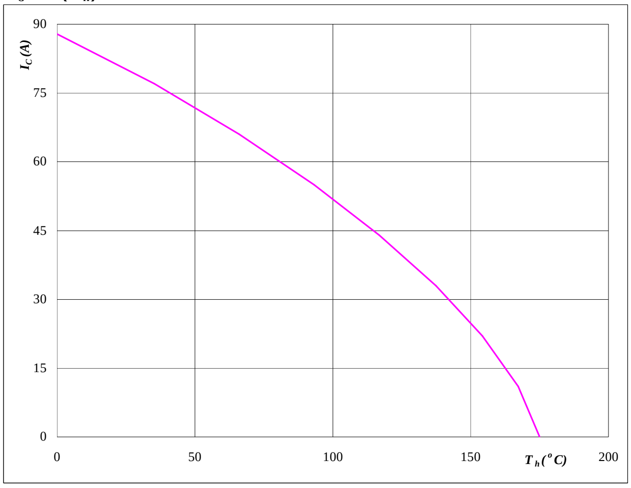
At

T_j = 175 °C

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

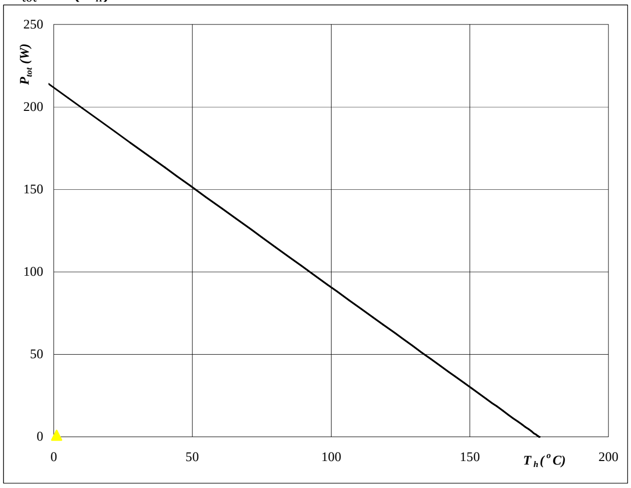
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



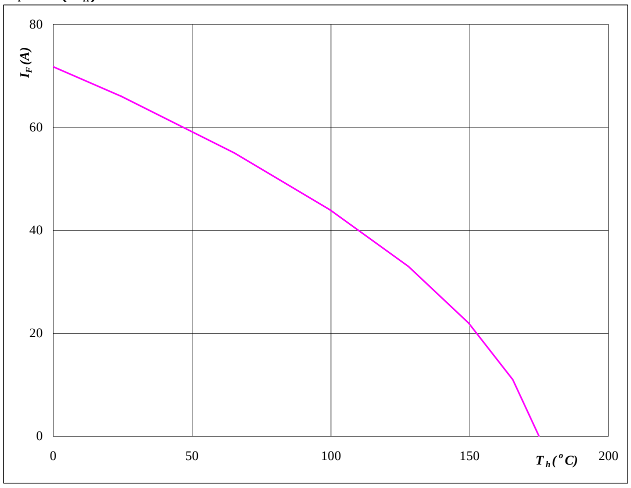
At

T_j = 175 °C

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

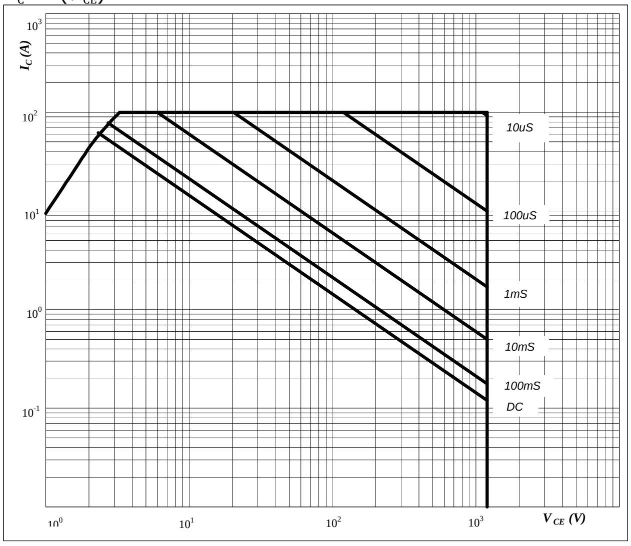
T_j = 175 °C

Output Inverter

Figure 25 — Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



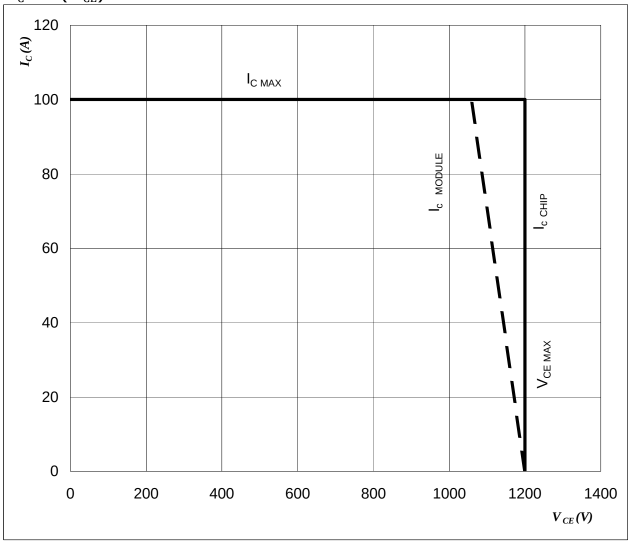
At

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

Figure 26 — IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

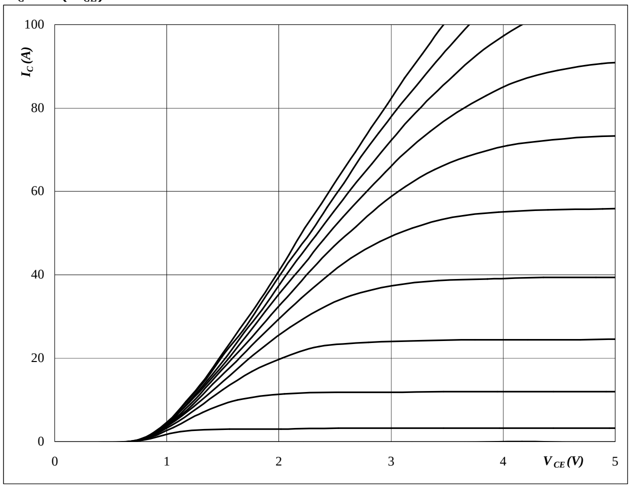
T_j =	150 °C
R_{gon} =	16 Ω
R_{goff} =	16 Ω

Brake

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



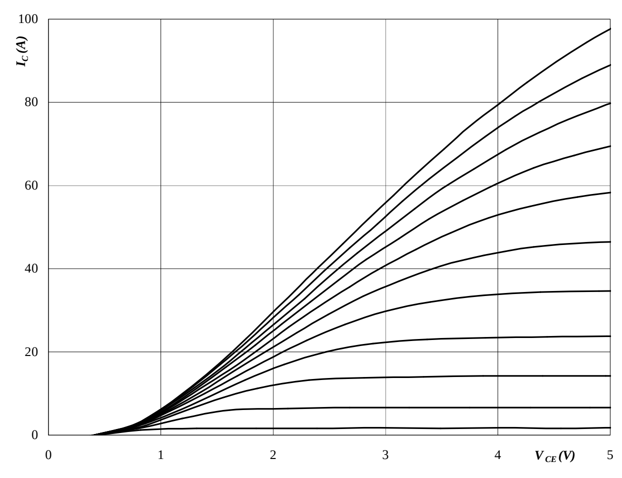
At

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

$I_C = f(V_{CE})$



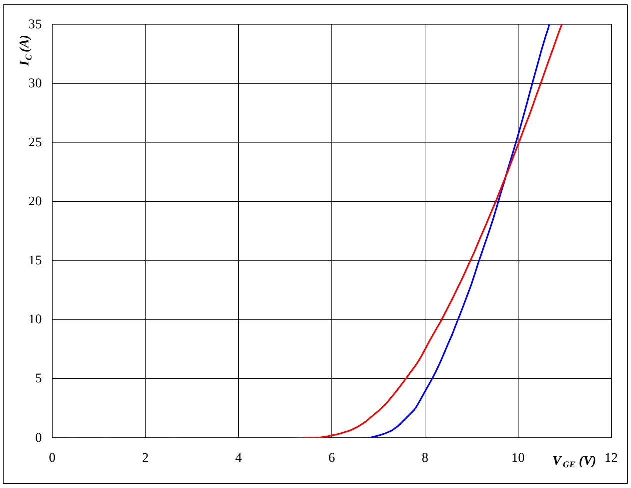
At

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

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



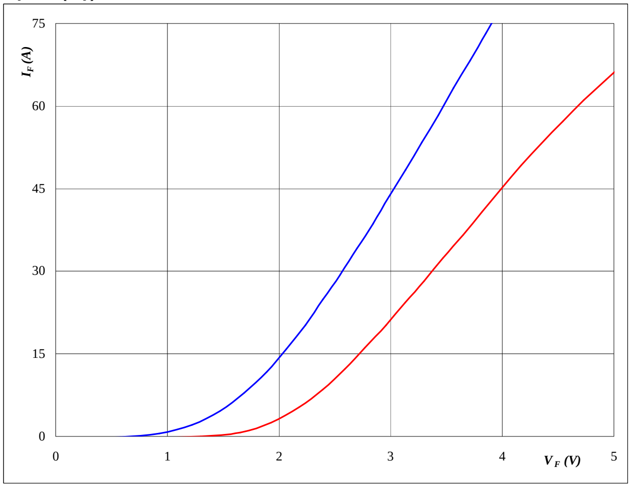
At

T_j =	25/150	°C
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

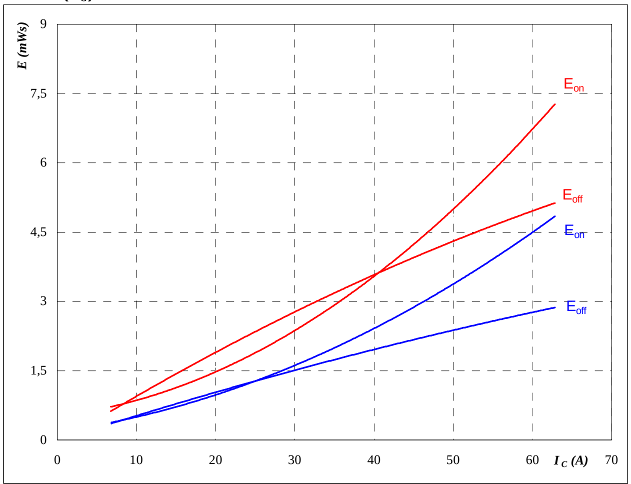
t_p =	250	μs

Brake

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



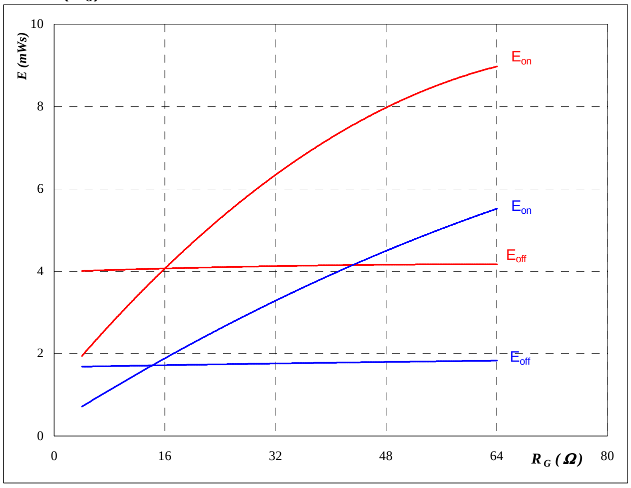
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



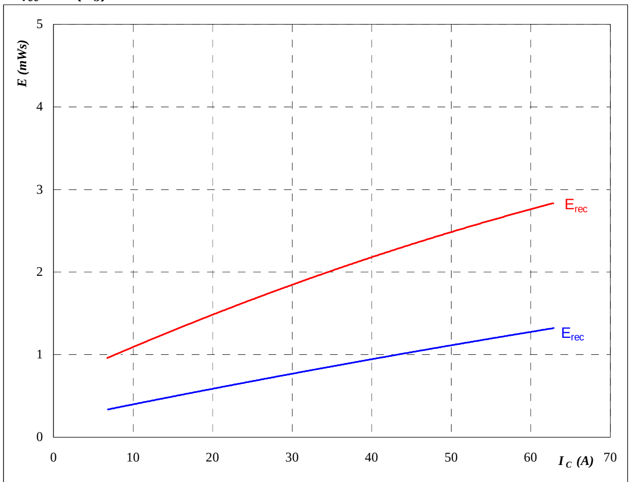
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 Brake FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



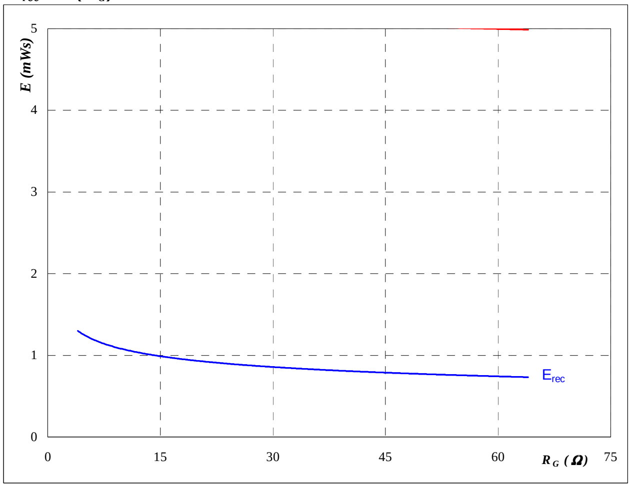
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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

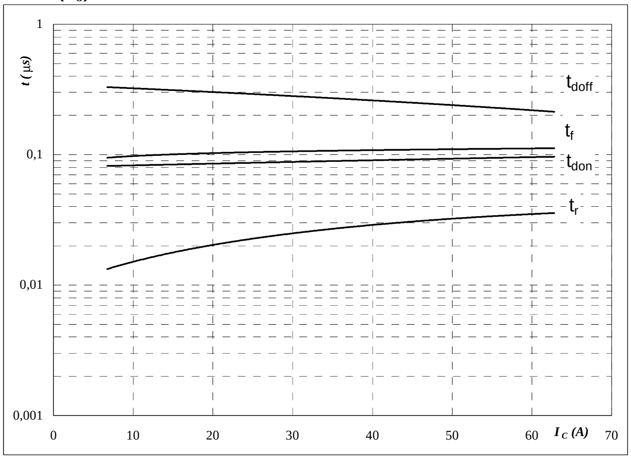
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Brake

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



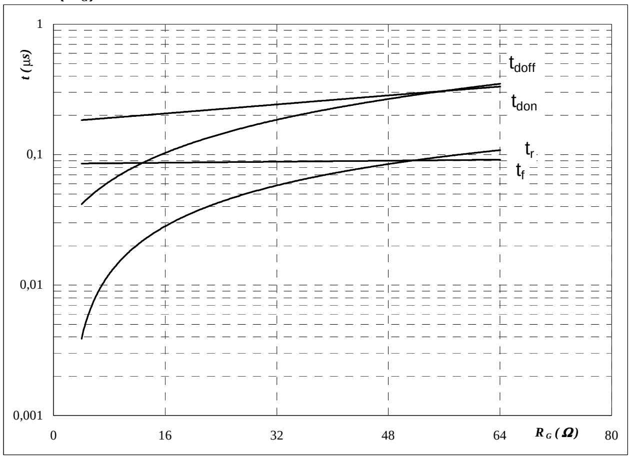
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



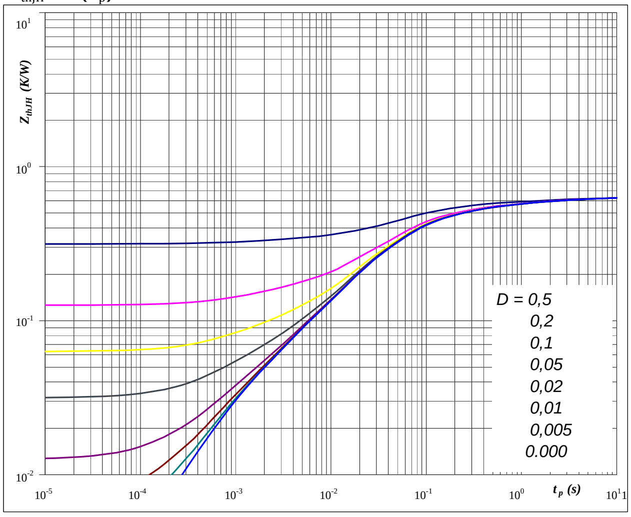
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

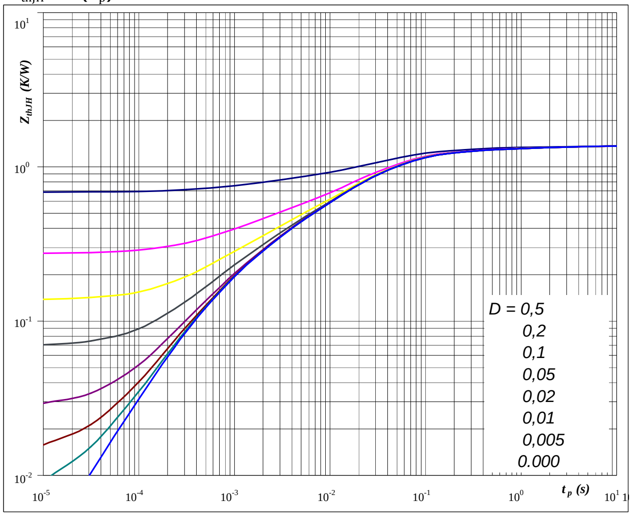


At	D =	t_p / T
Psx7p		
R_{thJH} =	0,63	K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



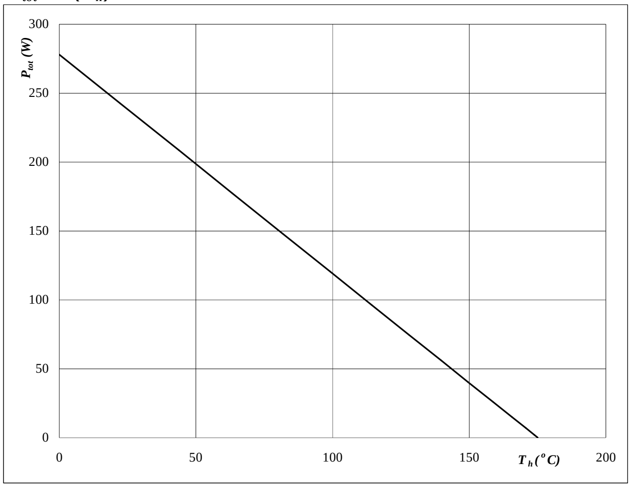
At	D =	t_p / T
Psx7p		
R_{thJH} =	1,37	K/W

Brake

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



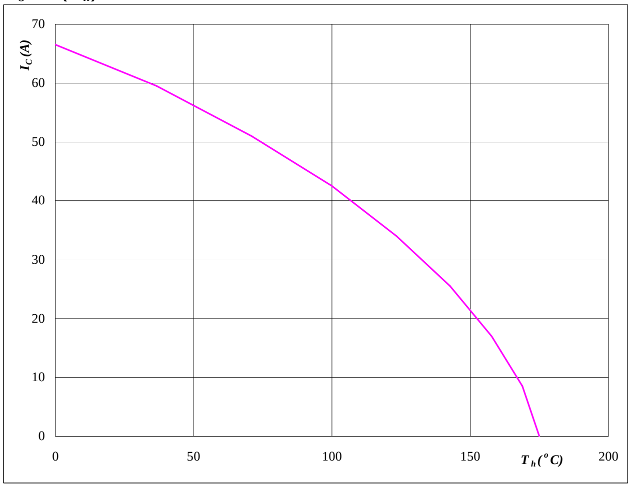
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

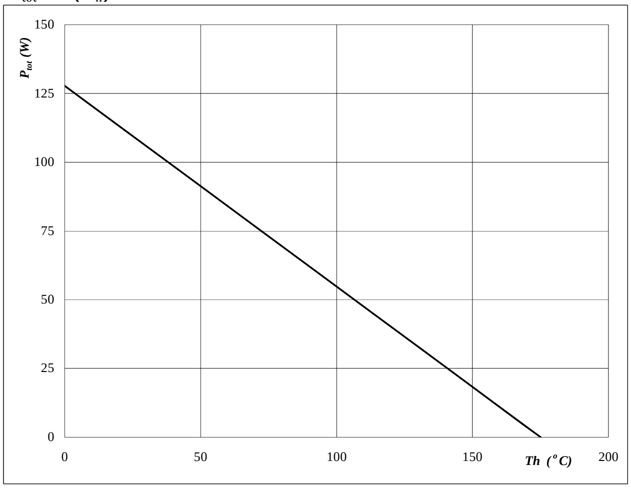
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



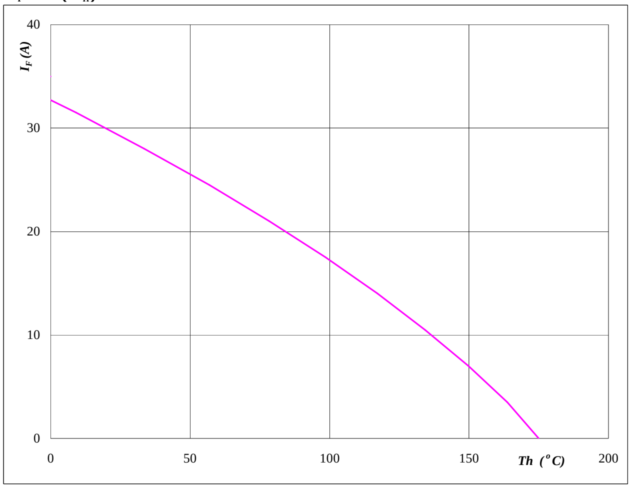
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

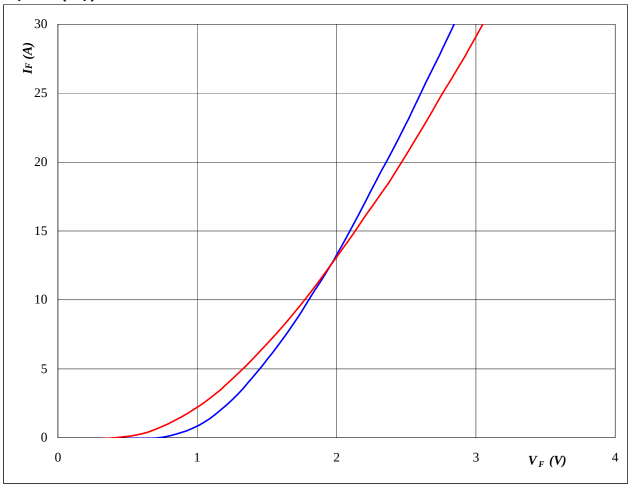
T_j = 175 ºC

Brake Inverse Diode

Figure 1 Brake inverse diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

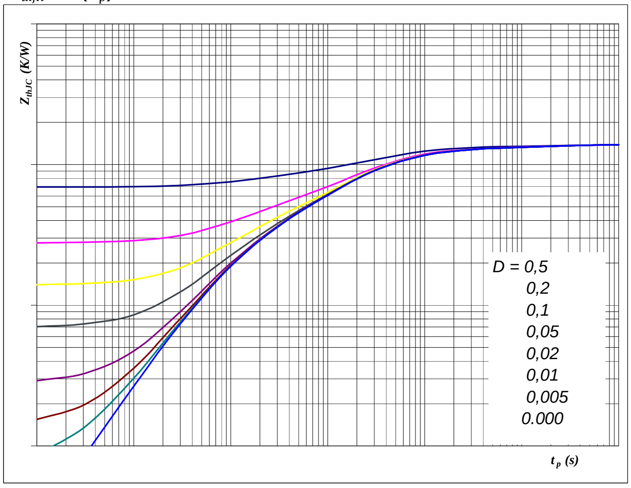
T_j = 25/150 °C

t_p = 250 µs

Figure 2 Brake inverse diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At $D = t_p / T$

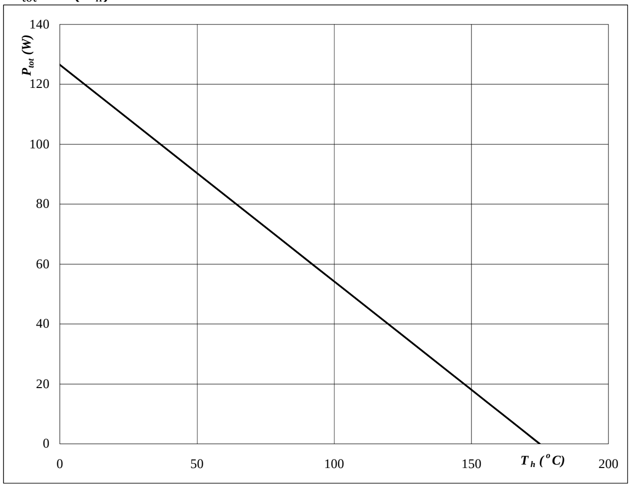
Psx7p

R_{thJH} = 1,38 K/W

Figure 3 Brake inverse diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



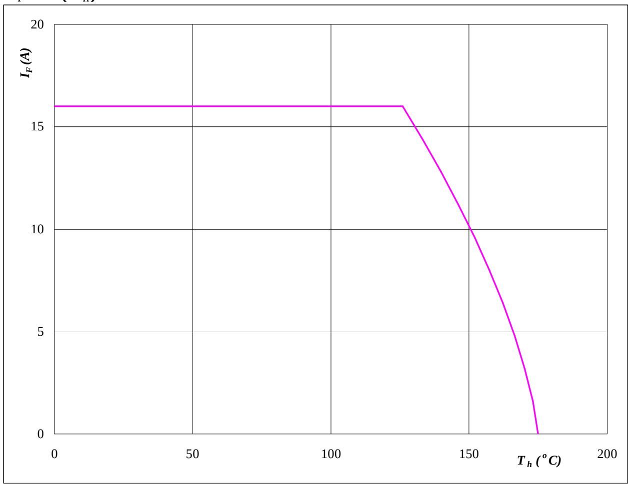
At

T_j = 150 ºC

Figure 4 Brake inverse diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

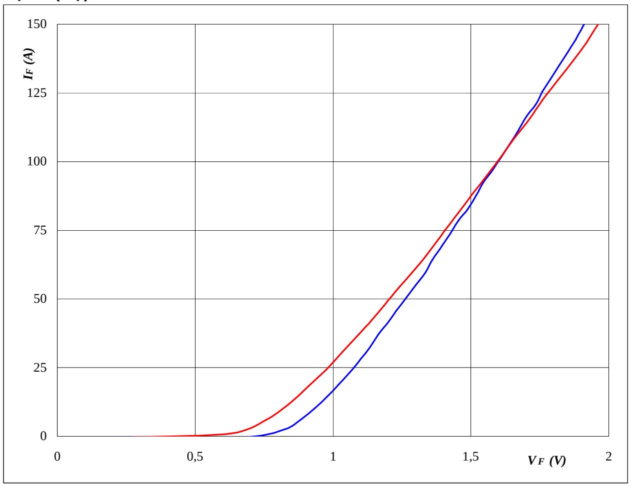
T_j = 150 ºC

Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

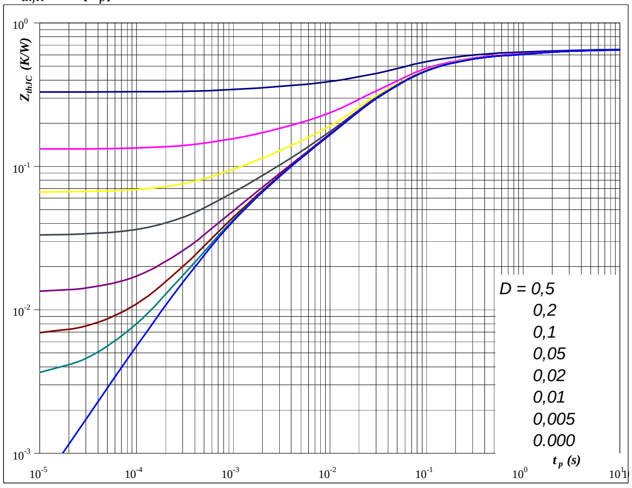
T_j = 25/125 °C

t_p = 250 µs

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

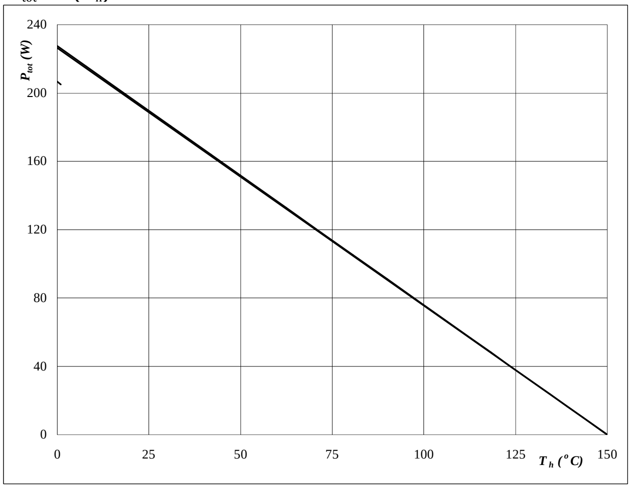
D = t_p / T

R_{thJH} = 0,66 K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



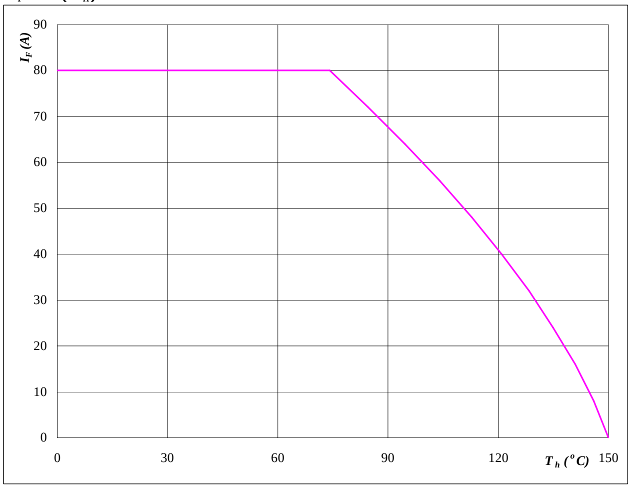
At

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

$R_T = f(T)$

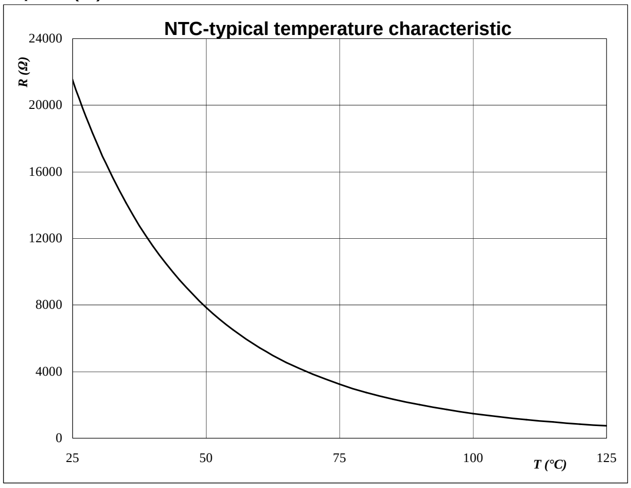


Figure 2 Thermistor

Typical NTC resistance values

$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

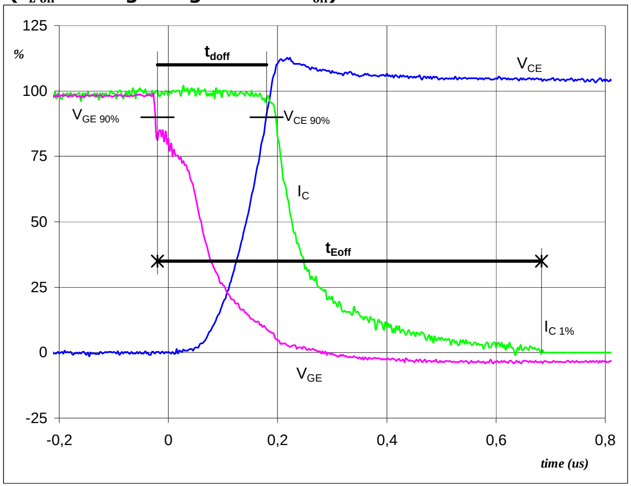
Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1 Output inverter IGBT

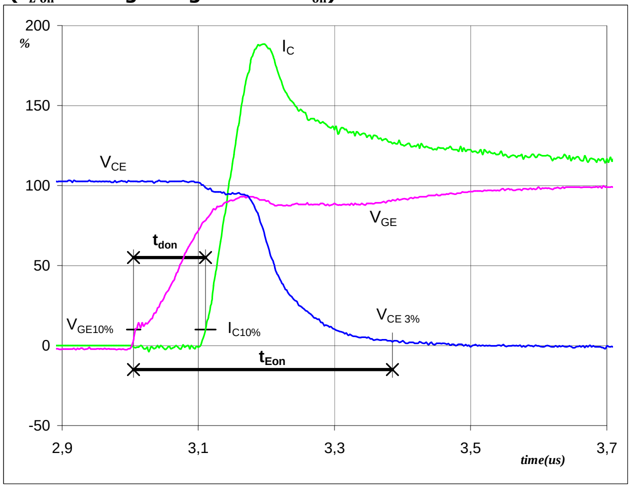
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{doff} =	0,21	µs
$t_{E\,off}$ =	0,70	µs

Figure 2 Output inverter IGBT

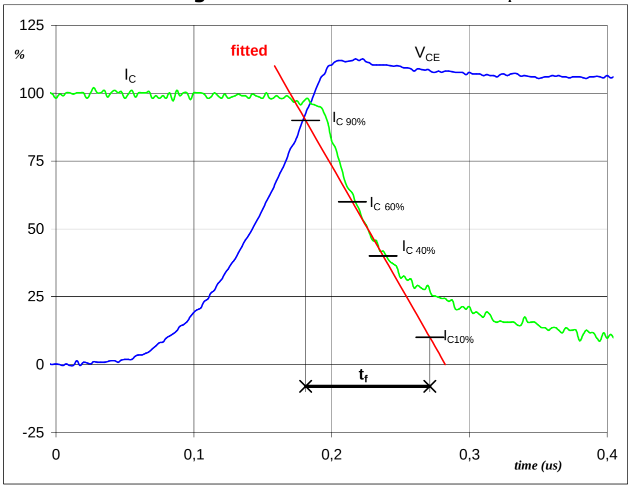
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{don} =	0,10	µs
$t_{E\,on}$ =	0,38	µs

Figure 3 Output inverter IGBT

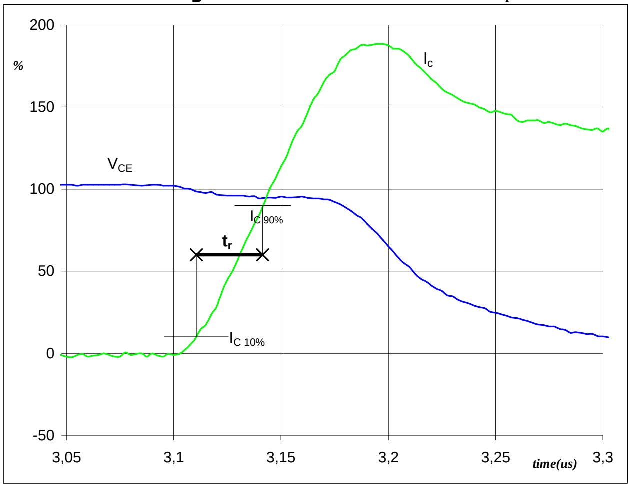
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	50	A
t_f =	0,09	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

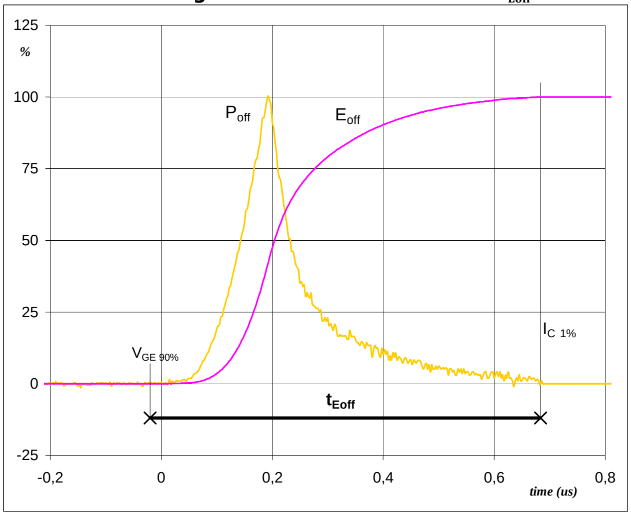


V_C (100%) =	600	V
I_C (100%) =	50	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

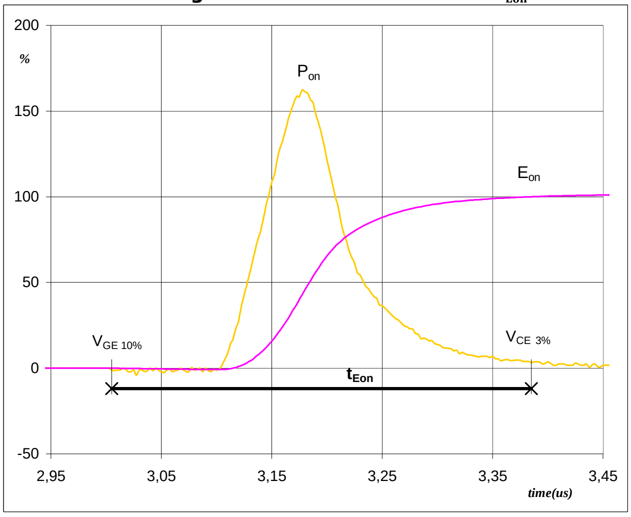
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	30,14	kW
E_{off} (100%) =	4,09	mJ
$t_{E\,off}$ =	0,70	µs

Figure 6 Output inverter IGBT

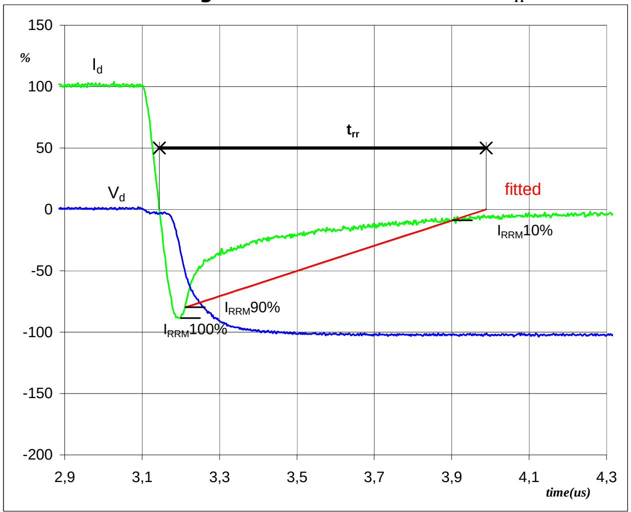
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	30,14	kW
E_{on} (100%) =	4,39	mJ
$t_{E\,on}$ =	0,38	µs

Figure 7 Output inverter FWD

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

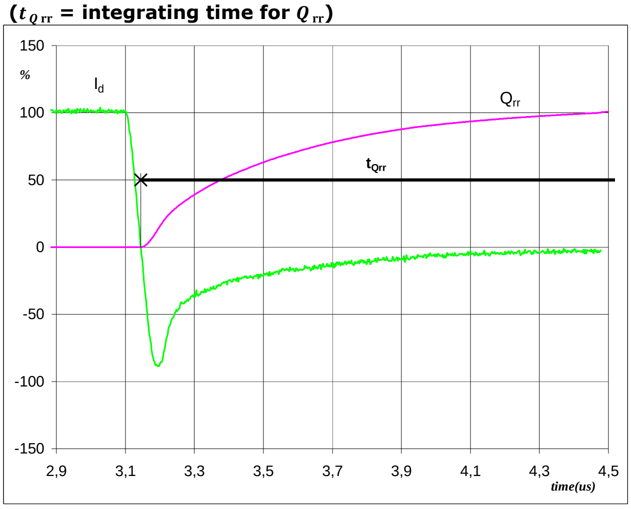


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-45	A
t_{rr} =	0,73	µs

Switching Definitions Output Inverter

Figure 8 Output inverter FWD

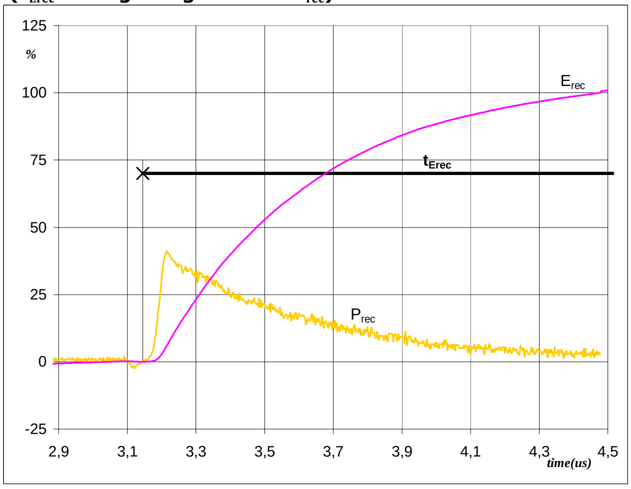
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	10,81	μC
$t_{Q\,rr}$ =	2,00	μs

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	30,14	kW
E_{rec} (100%) =	5,14	mJ
$t_{E\,rec}$ =	2,00	μs

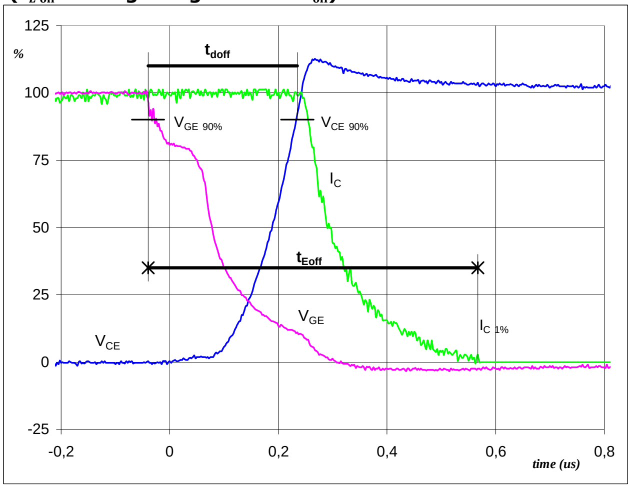
Switching Definitions Brake

General conditions

T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1 IGBT

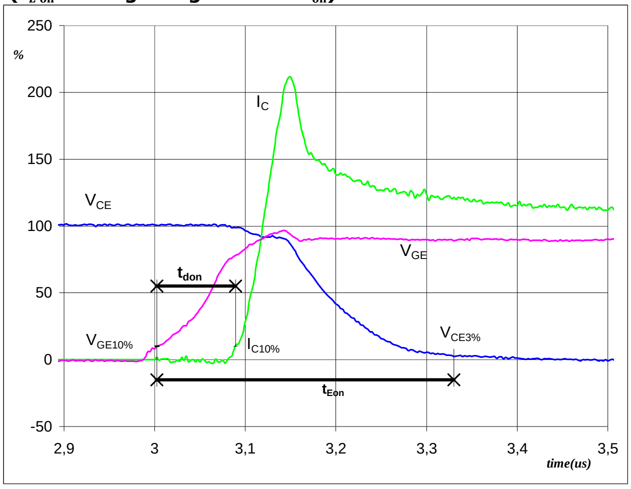
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{doff} =	0,27	µs
$t_{E\,off}$ =	0,61	µs

Figure 2 IGBT

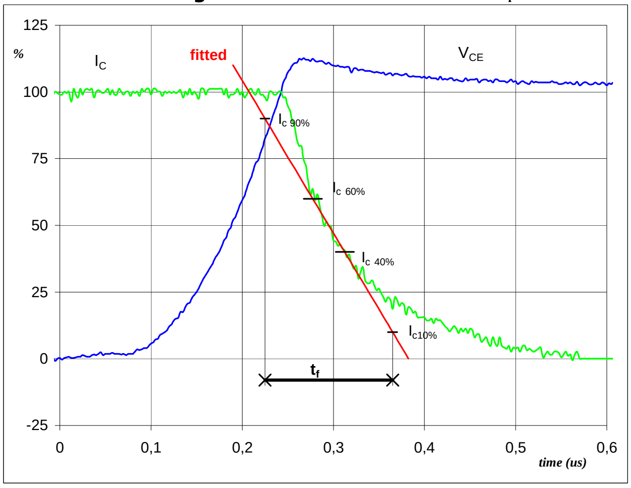
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{don} =	0,09	µs
$t_{E\,on}$ =	0,33	µs

Figure 3 IGBT

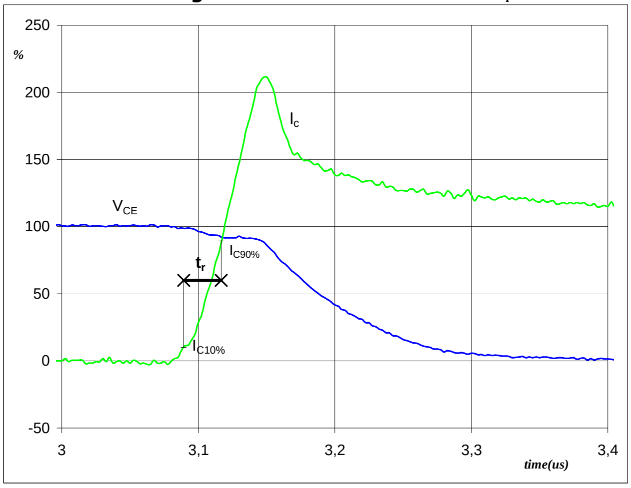
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	35	A
t_f =	0,13	µs

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

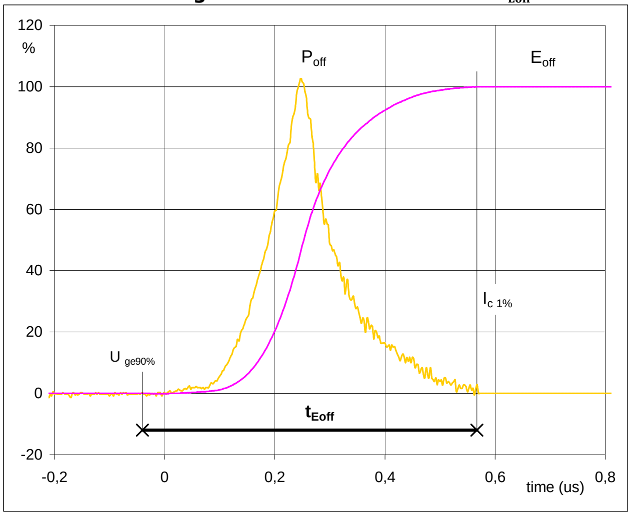


V_C (100%) =	600	V
I_C (100%) =	35	A
t_r =	0,03	µs

Switching Definitions Brake

Figure 5 IGBT

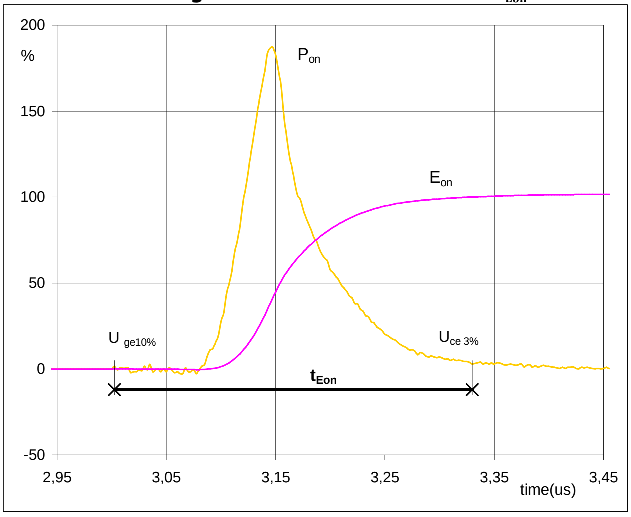
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	20,96	kW
E_{off} (100%) =	3,18	mJ
$t_{E\,off}$ =	0,61	μs

Figure 6 IGBT

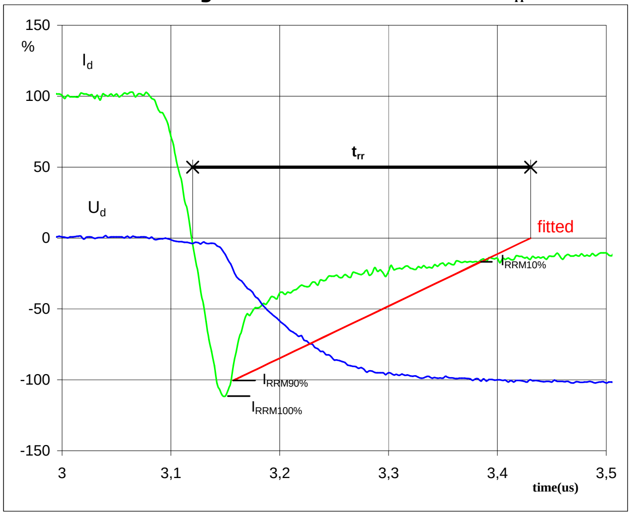
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	20,9586	kW
E_{on} (100%) =	2,92	mJ
$t_{E\,on}$ =	0,33	μs

Figure 7 FWD

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

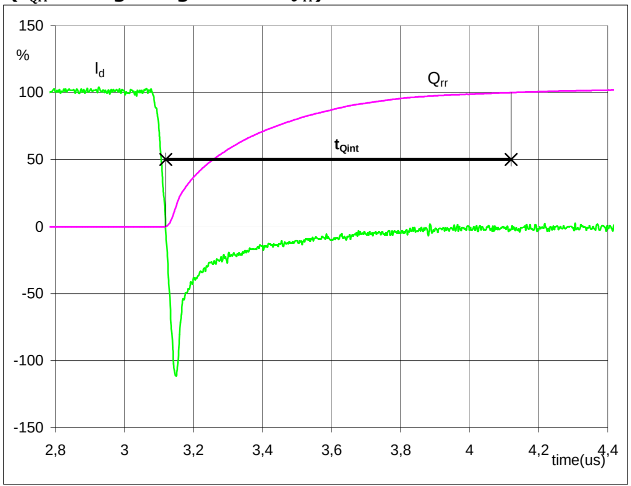


V_d (100%) =	600	V
I_d (100%) =	35	A
I_{RRM} (100%) =	-39	A
t_{rr} =	0,42	μs

Switching Definitions Brake

Figure 8 FWD

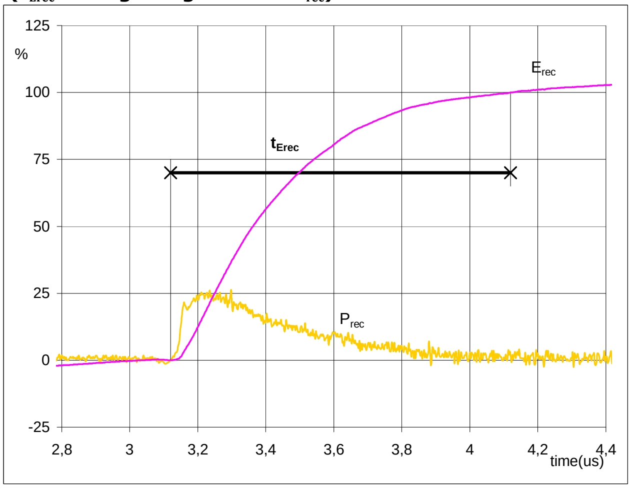
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	35	A
Q_{rr} (100%) =	4,84	µC
t_{Qint} =	1,00	µs

Figure 9 FWD

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



P_{rec} (100%) =	20,96	kW
E_{rec} (100%) =	1,98	mJ
$t_{E\ rec}$ =	1,00	µs

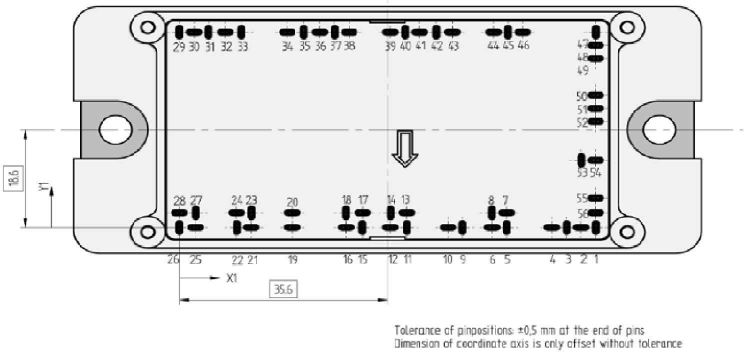
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

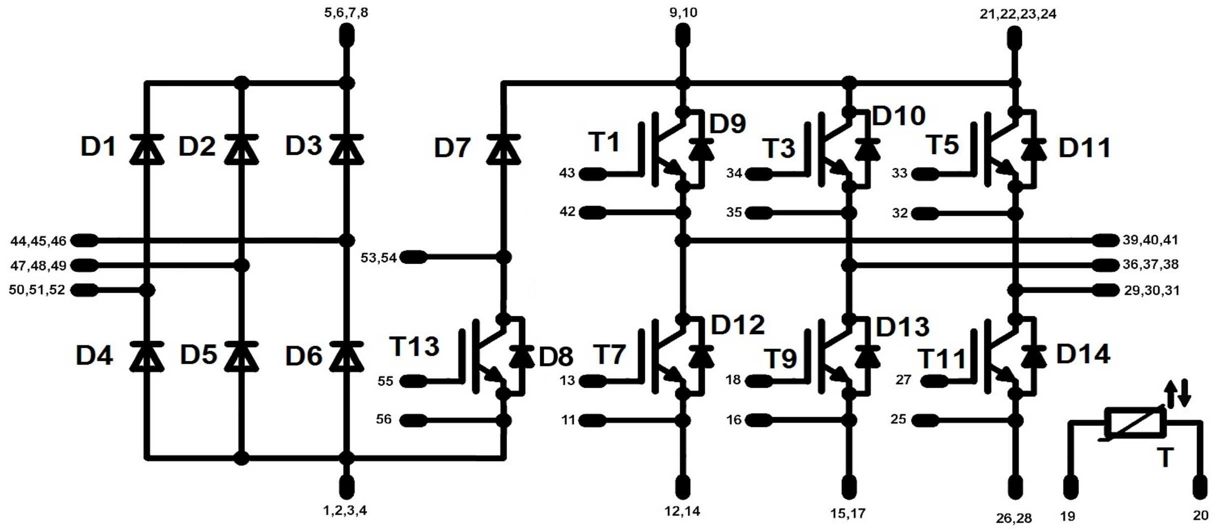
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste with Solder pins	V23990-P768-A60-PM	P768-A60	P768-A60
without thermal paste with Press-fit pins	V23990-P768-A60Y-PM	P768-A60Y	P768-A60Y
with thermal paste and Solder pins	V23990-P768-A60-/3/-PM	P768-A60	P768-A60-/3/
with thermal paste and Press-fit pins	V23990-P768-A60Y-/3/-PM	P768-A60Y	P768-A60Y-/3/

Outline

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



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T3, T5, T7, T9, T11	IGBT	1200V	50A	Inverter Switch	
D9-D14	FWD	1200V	50A	Inverter Diode	
T13	IGBT	1200V	35A	Brake Switch	
D7	FWD	1200V	25A	Brake Diode	
D8	FWD	1200V	10A	Brake Inverse Diode	
D1-D6	Rectifier	1800V	40A	Rectifier Diode	
T	NTC	-	-	Thermistor	

Package data
Package data for *flow* 2 packages see vincotech.com website.

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