***flow* PIM 1** **1200 V / 15 A**

Features

- Three-phase rectifier, optional BRC, Inverter, NTC
- Very compact housing, easy to route
- IGBT4 / EmCon4 technology for low saturation losses and improved EMC behaviour

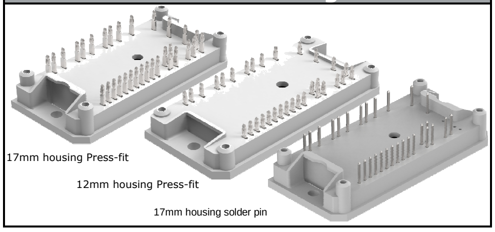
Target Applications

- Industrial drives
- Embedded drives

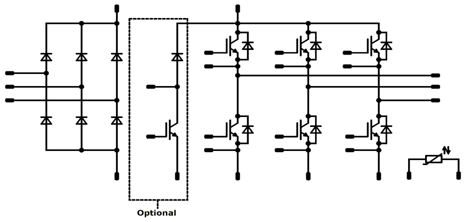
Types

- V23990-P588-A41-PM
- V23990-P588-A418-PM
- V23990-P588-A418Y-PM
- V23990-P588-C41-PM
- V23990-P588-C418-PM

flow 1 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}		35	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50Hz half sine wave	280	A
I2t-value	I^2t		380	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}		150	°C
Inverter Switch				
Collector-emitter breakdown voltage	V_{CE}		1200	V
DC collector current	I_C		15	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op}$ max,	30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	71	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	10 800	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}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	14	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	52	W
Maximum Junction Temperature	T_{jmax}		175	°C
Brake Switch				
Collector-emitter breakdown voltage	V_{CE}		1200	V
DC collector current	I_C		8	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	24	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op}$ max	16	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	61	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	10 800	μs V
Maximum Junction Temperature	T_{jmax}		175	°C
Brake Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F		10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	46	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 Test Voltage	4000	V
Creepage distance			min 12,7	mm
Clearance		12mm housing solder pins / press-fit pins	7,91 / 7,96	mm
		17mm housing	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]	Min	Typ	Max	Unit
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,16 1,13	1,6	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,90 0,78		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		8,00 11,00	20	mΩ
Reverse current	I_r			1600		25			2	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,25		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	0,8	1,84 2,25	2,25	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,005	mA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	600	15	25 125		85 85		ns
Rise time	t_r					25 125		17 22		
Turn-off delay time	$t_{d(off)}$					25 125		201 264		
Fall time	t_f					25 125		82 123		
Turn-on energy loss	E_{on}					25 125		0,817 1,255		mWs
Turn-off energy loss	E_{off}					25 125		0,878 1,358		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		900		pF
Output capacitance	C_{oss}							80		
Reverse transfer capacitance	C_{rss}							55		
Gate charge	Q_G		15	960		25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,35		K/W
Inverter Diode										
Diode forward voltage	V_F				15	25 125	1,35	1,61 1,50	2,05	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	15	25 125		25 26		A
Reverse recovery time	t_{rr}					25 125		153 313		ns
Reverse recovered charge	Q_{rr}					25 125		1,35 2,98		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1700 776		A/µs
Reverse recovered energy	E_{rec}					25 125		0,518 1,259		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,83		K/W

Characteristic Values

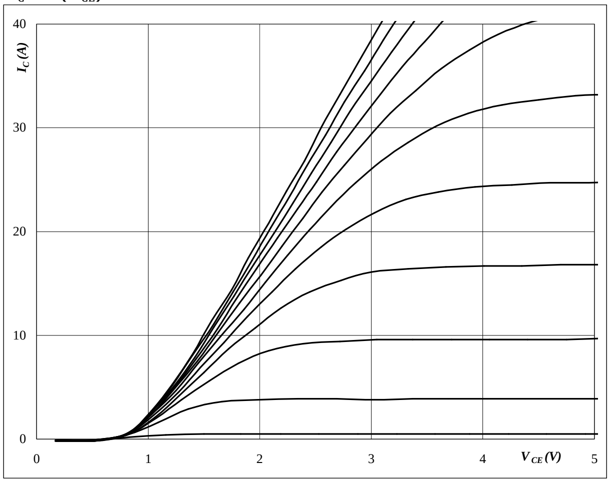
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Value Min	Value Typ	Value Max	Unit
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,3	1,82 2,23	2,15	V
Collector-emitter cut-off incl diode	I_{CES}		0			25			0,005	mA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	600	15	25 125		53 55		ns
Rise time	t_r					25 125		18 23		
Turn-off delay time	$t_{d(off)}$					25 125		169 231		
Fall time	t_f					25 125		82 119		
Turn-on energy loss	E_{on}					25 125		0,47 0,75		mWs
Turn-off energy loss	E_{off}					25 125		0,44 0,68		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		490		pF
Output capacitance	C_{oss}							50		
Reverse transfer capacitance	C_{rss}							30		
Gate charge	Q_G		15			25		50		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,57		K/W
Brake Diode										
Diode forward voltage	V_F				10	25 125	1,3	2,31 1,89	2,2	V
Reverse leakage current	I_r			1200		25			5	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω R_{gon} = 32 Ω	±15	600	15	25 125		8 10		A
Reverse recovery time	t_{rr}					25 125		273 415		ns
Reverse recovered charge	Q_{rr}					25 125		0,92 0,92		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		68 65		A/µs
Reverse recovery energy	E_{rec}					25 125		0,38 0,70		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,07		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$					25	-5		5	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$					25		3996		K
Vincotech NTC Reference									B	

Inverter Characteristics

Figure 1 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



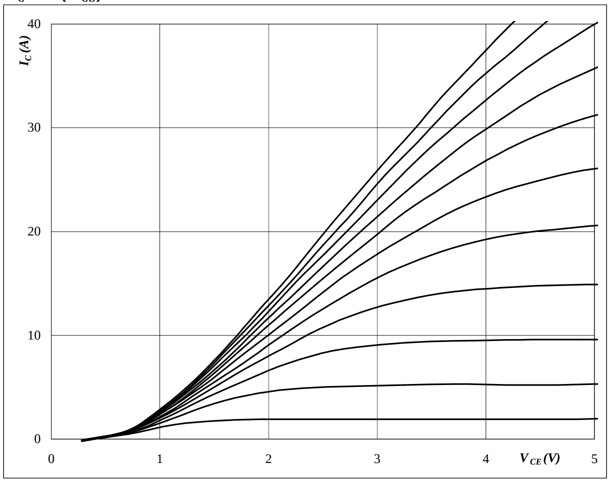
At

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

$I_C = f(V_{CE})$



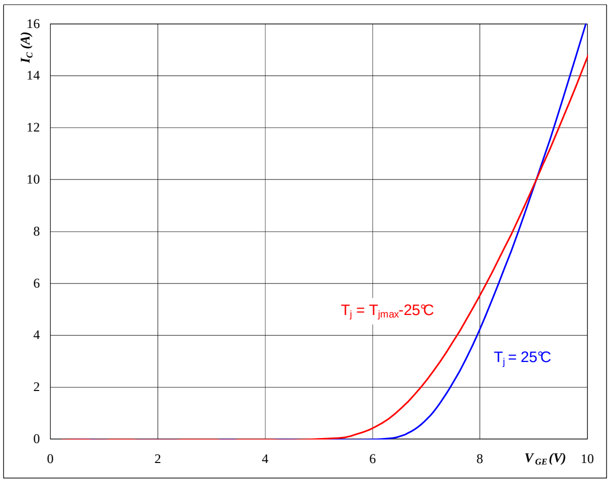
At

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

Figure 3 Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



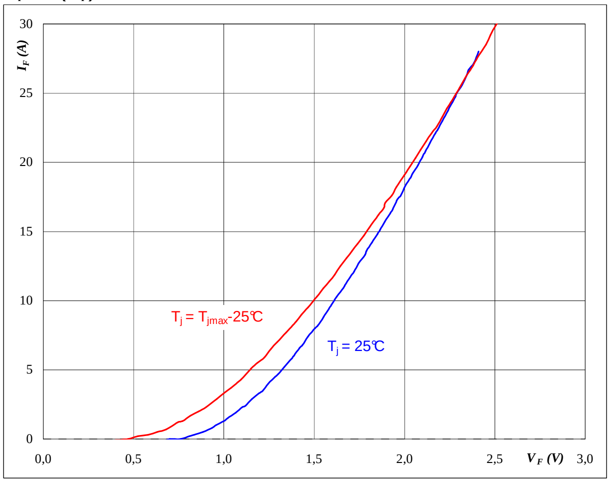
At

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

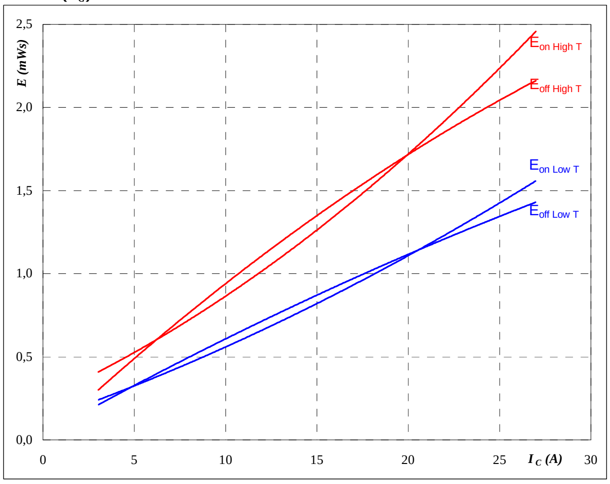
t_p =	250	µs

Inverter Characteristics

Figure 5 Inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



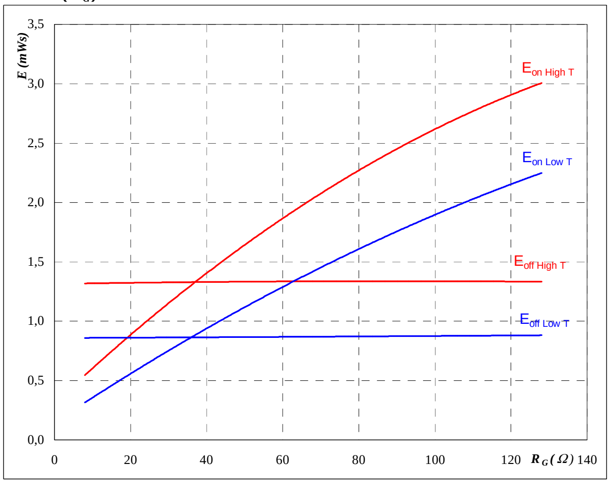
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6 Inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



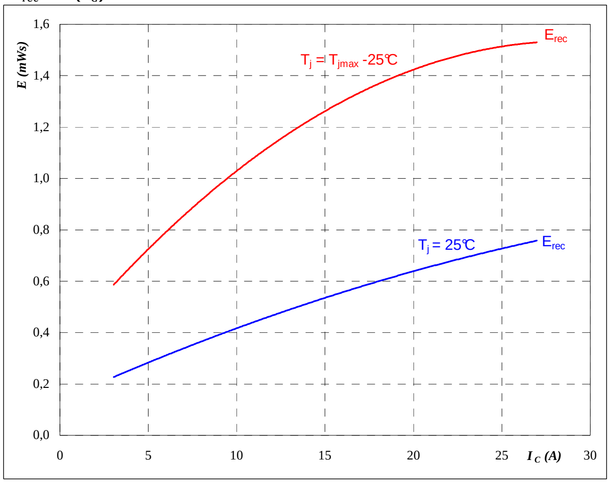
With an inductive load at

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

Figure 7 Inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



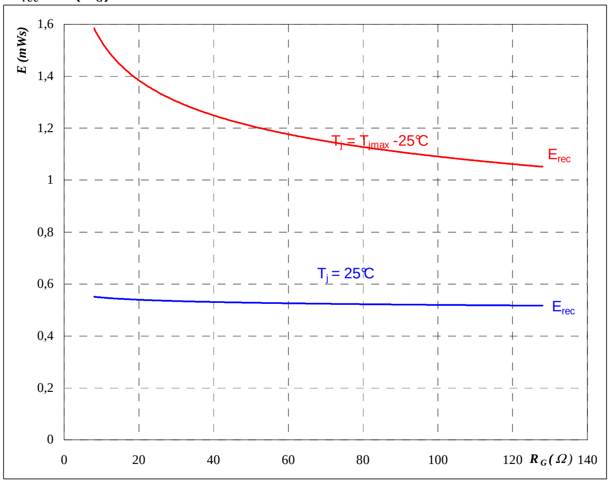
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	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

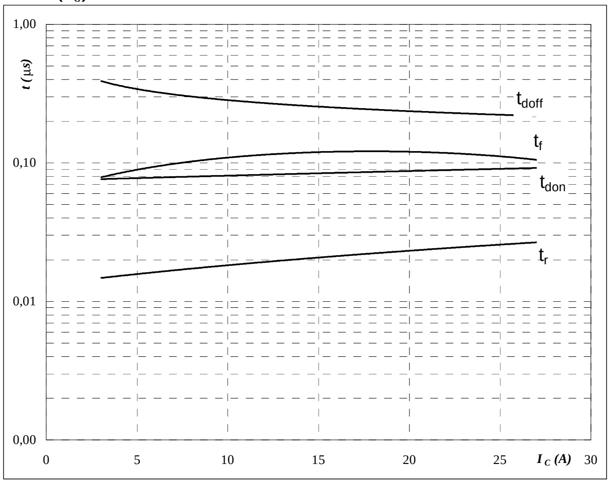
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Inverter Characteristics

Figure 9 Inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



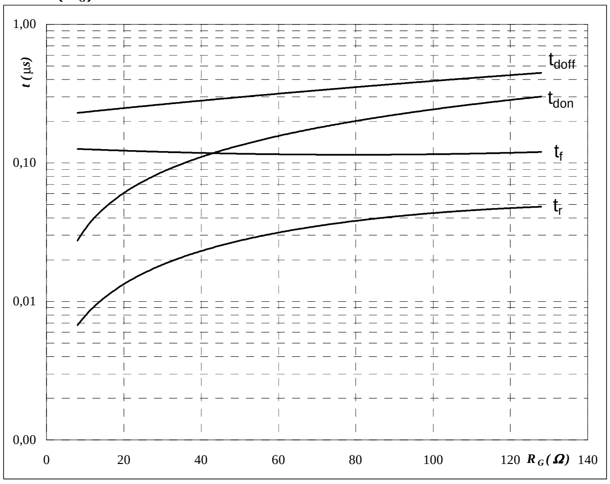
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 10 Inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



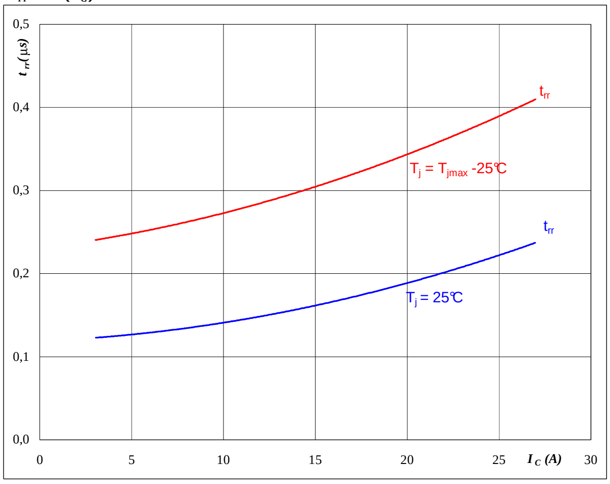
With an inductive load at

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

Figure 11 Inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



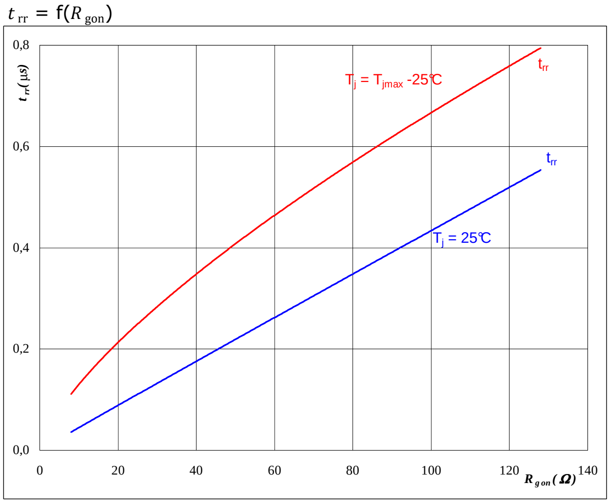
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 12 Inverter FWD

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

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



At

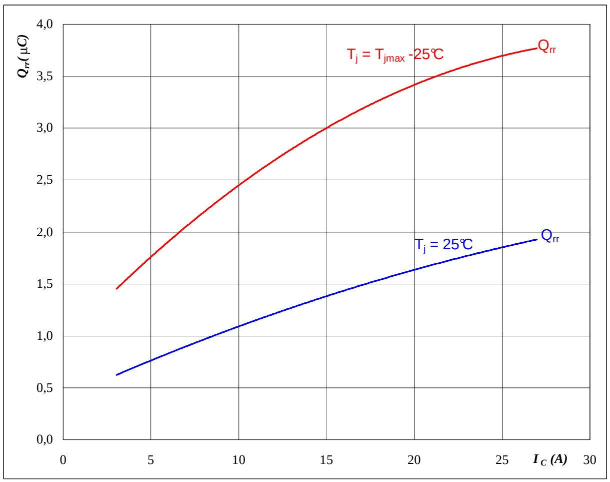
T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Inverter Characteristics

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



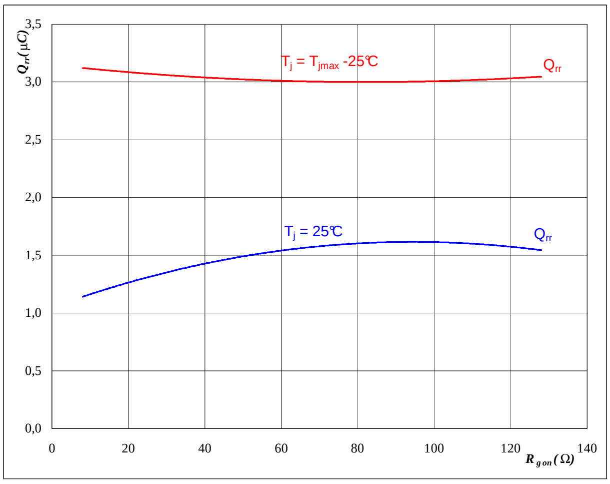
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 14 Inverter FWD

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

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



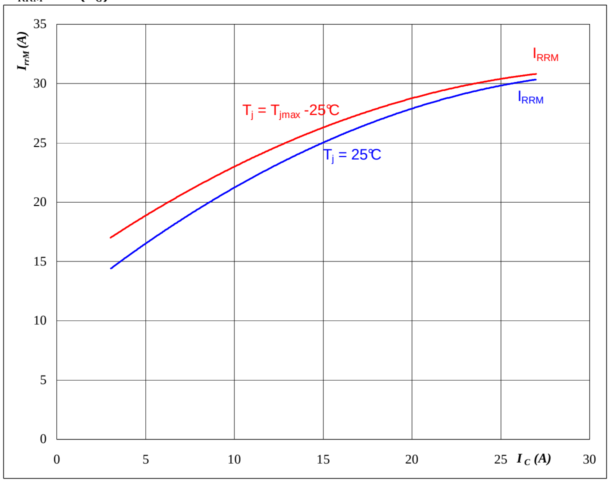
At

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

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



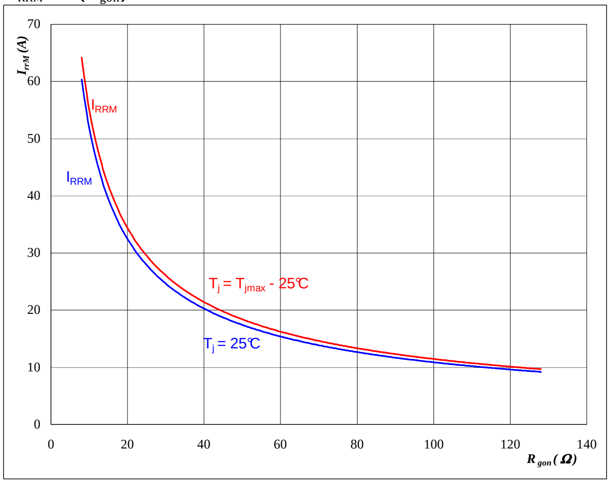
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 16 Inverter FWD

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

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



At

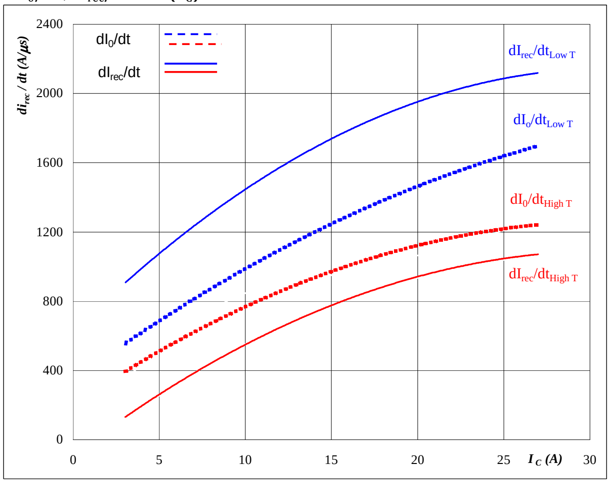
T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Inverter Characteristics

Figure 17 Inverter FWD

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

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



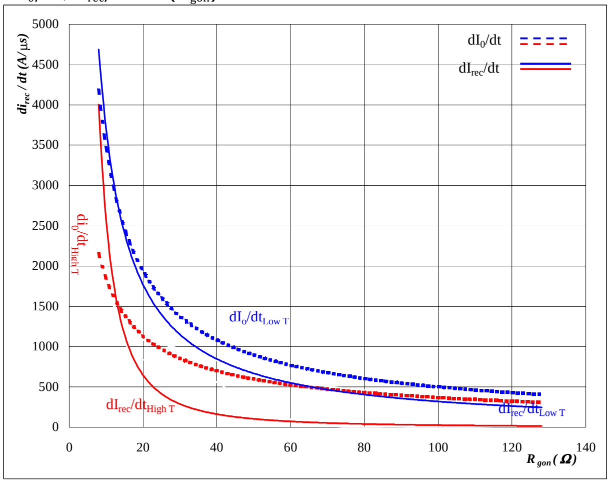
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 18 Inverter FWD

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

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



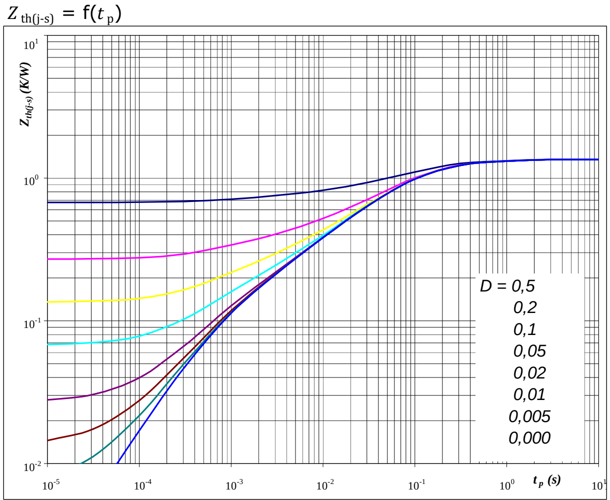
At

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

Figure 19 Inverter IGBT

IGBT transient thermal impedance as a function of pulse width

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



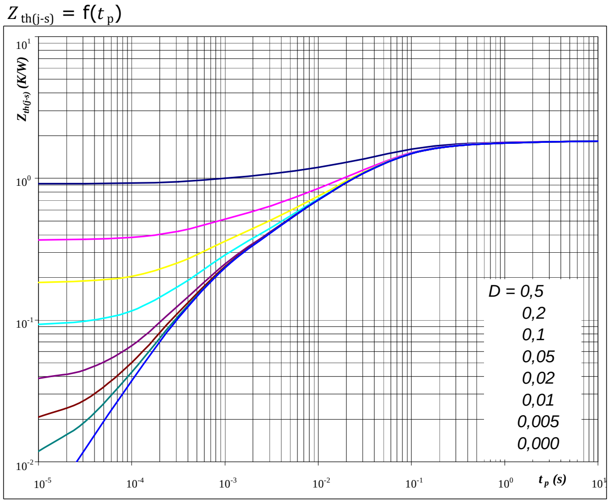
At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,35	K/W

Figure 20 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	
$R_{th(j\text{-}s)}$ =	1,83	K/W

IGBT thermal model values

R (K/W)	Tau (s)
1,62E-01	5,85E-01
6,34E-01	9,42E-02
2,82E-01	2,85E-02
1,64E-01	6,73E-03
8,75E-02	9,43E-04
1,75E-02	3,79E-04

FWD thermal model values

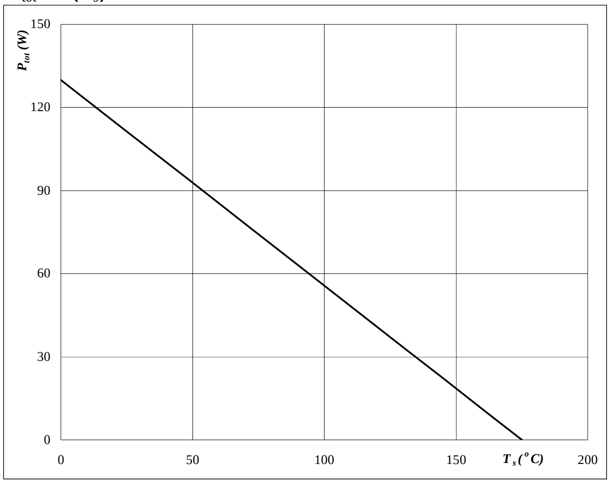
R (K/W)	Tau (s)
6,16E-02	2,79E+00
1,40E-01	3,93E-01
7,06E-01	6,76E-02
4,97E-01	1,96E-02
2,49E-01	4,04E-03
1,76E-01	5,86E-04

Inverter Characteristics

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



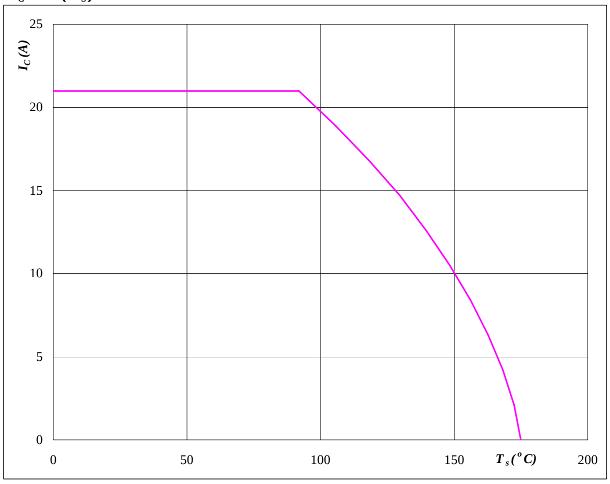
At

T_j = 175 °C

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

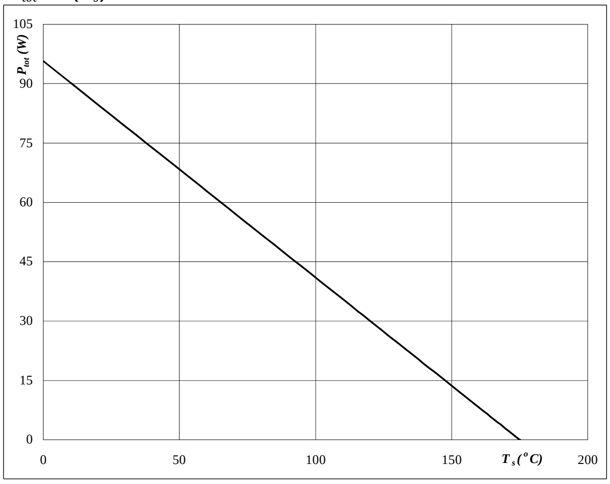
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



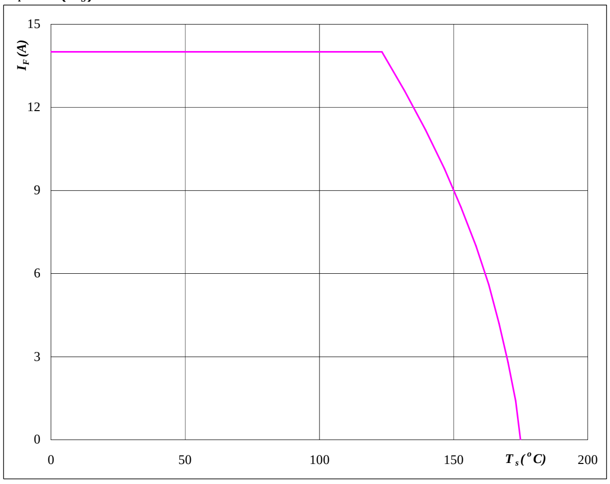
At

T_j = 175 °C

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

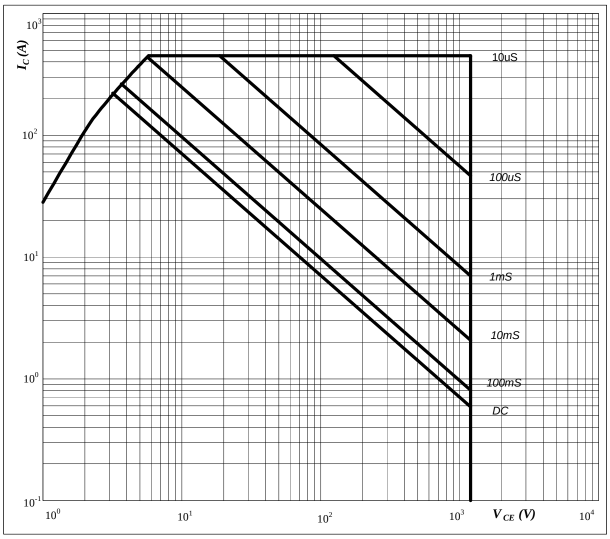
T_j = 175 °C

Inverter Characteristics

Figure 25 Inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



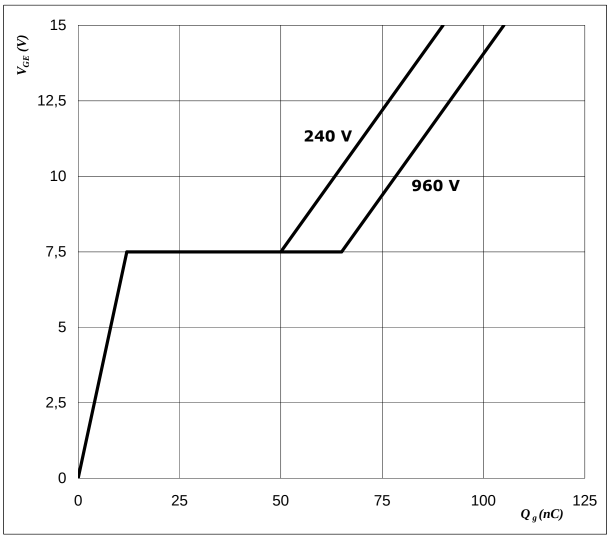
At

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

Figure 26 Inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



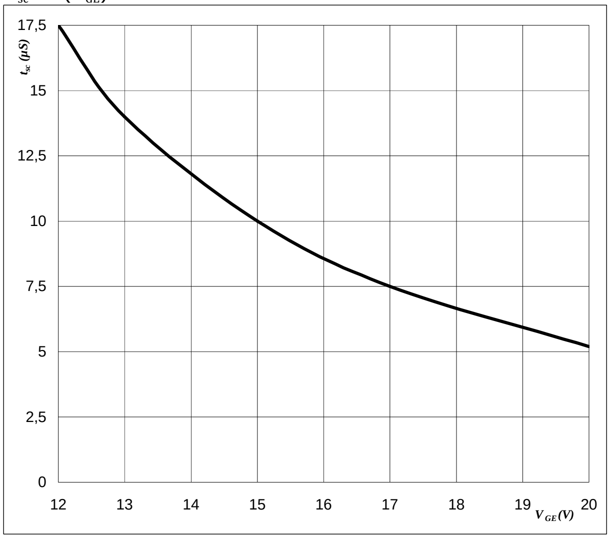
At

I_C =	15	A

Figure 27 Inverter IGBT

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

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



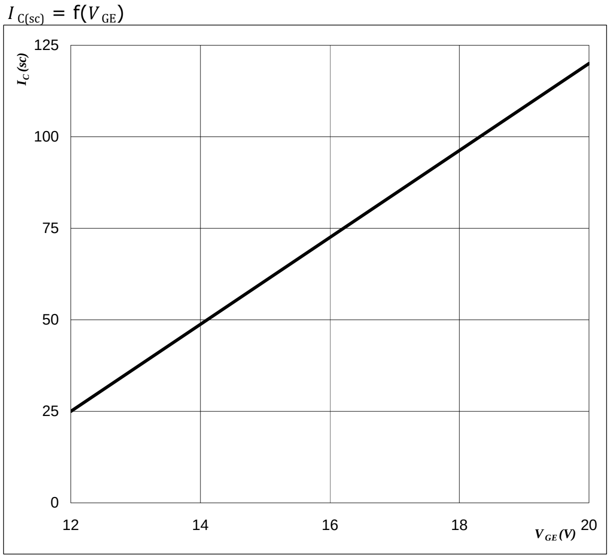
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Inverter IGBT

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

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



At

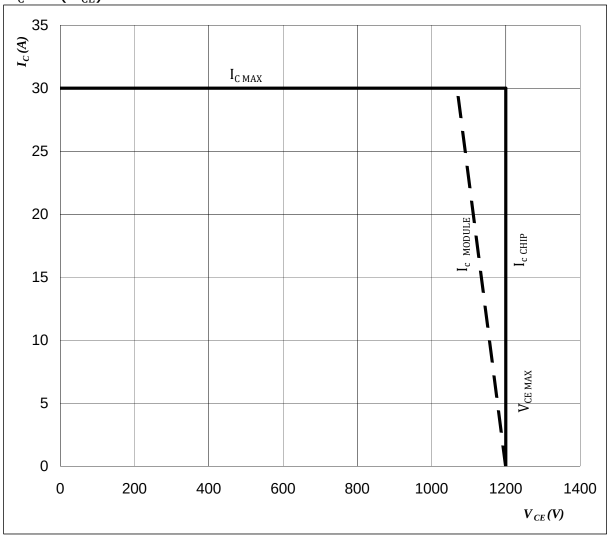
V_{CE} ≤	1200	V
T_j =	175	ºC

Inverter Characteristics

Figure 29 Inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

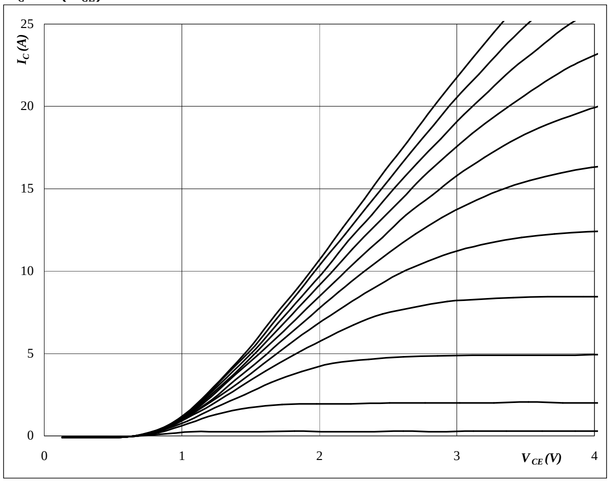
T_j = T_{jmax}-25 ºC

Brake Characteristics

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



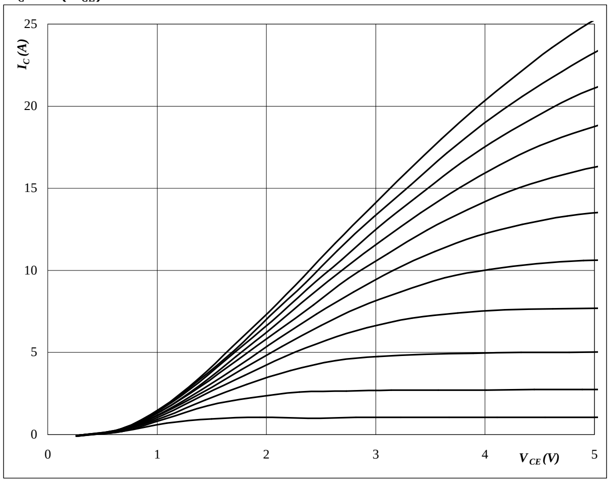
At

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

$I_C = f(V_{CE})$



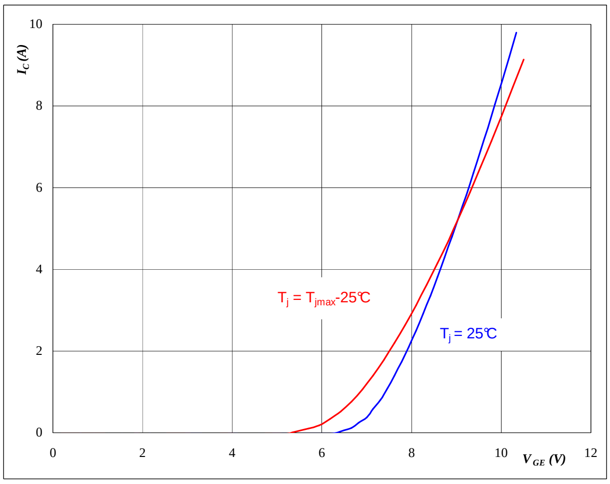
At

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

$I_C = f(V_{GE})$



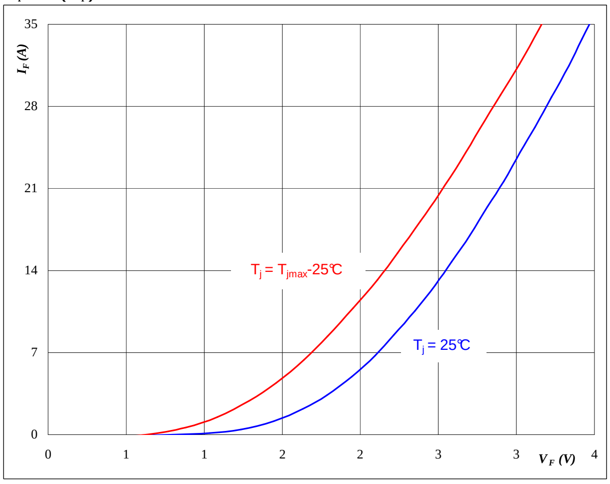
At

t_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

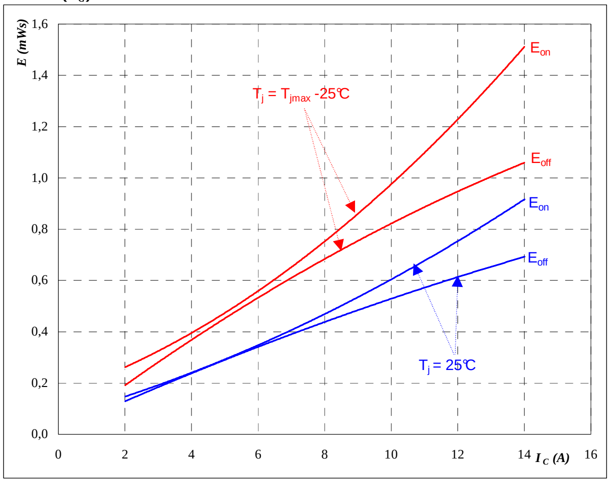
t_p =	250	μs

Brake Characteristics

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



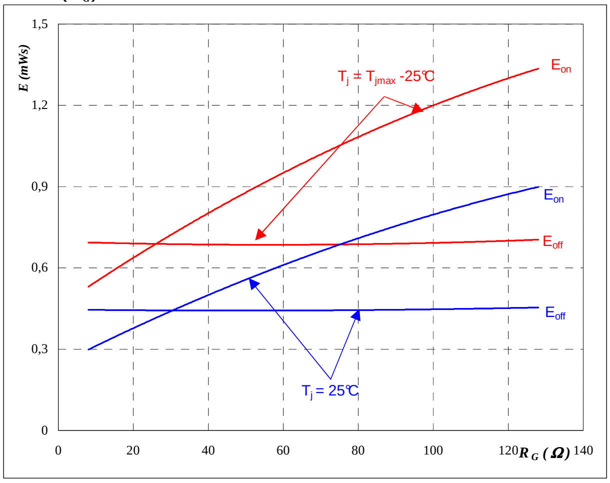
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



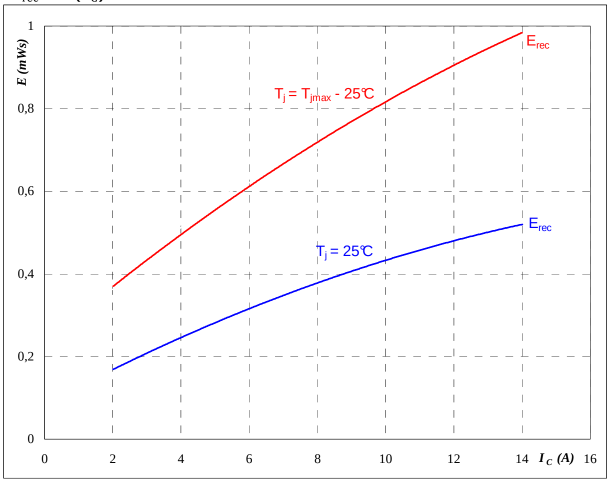
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Figure 7 Brake FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



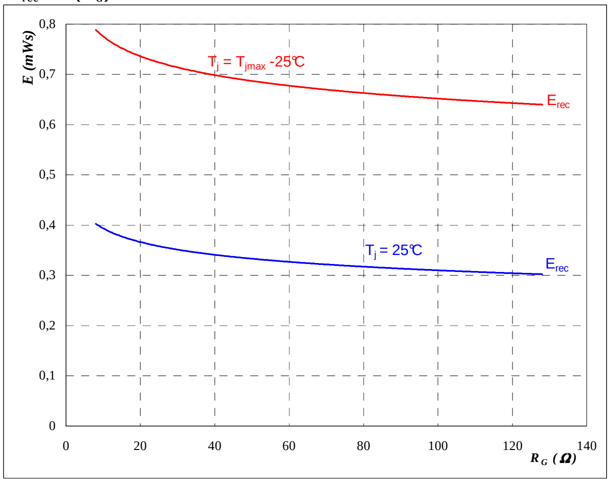
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	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

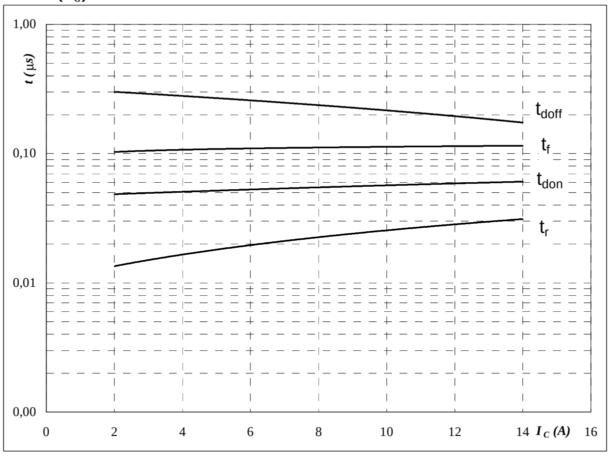
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Brake Characteristics

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



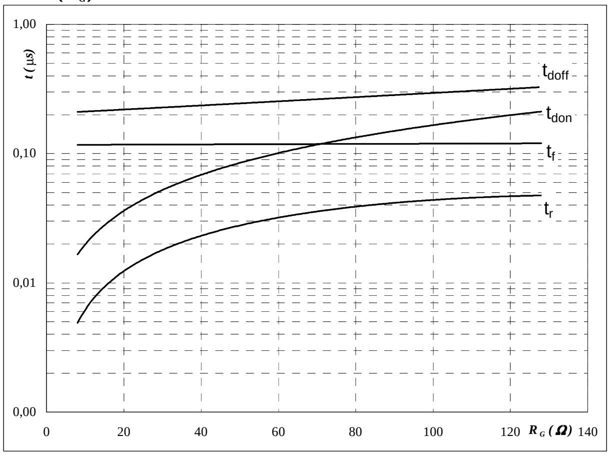
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



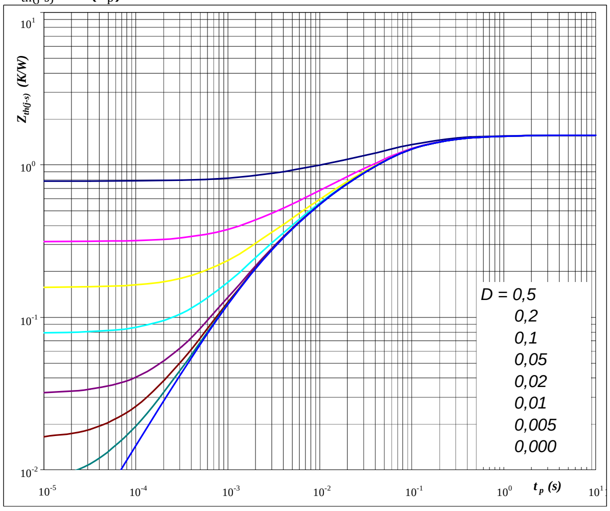
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

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



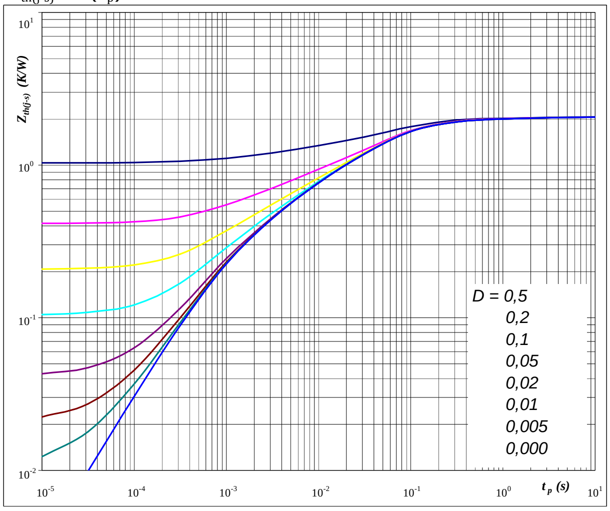
At $D = t_p / T$

$R_{th(j-s)}$ = 1,57 K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

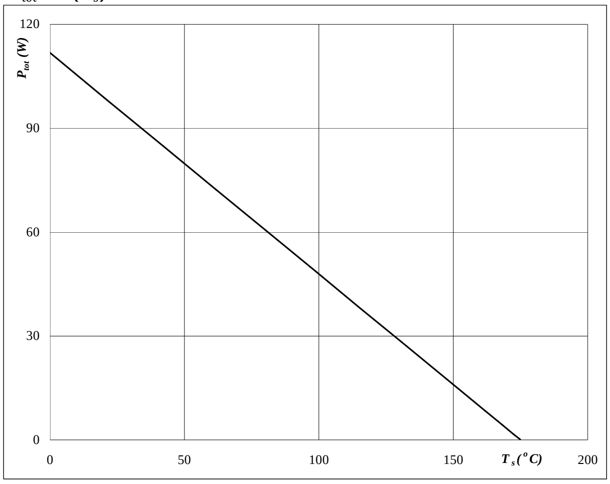
$R_{th(j-s)}$ = 2,07 K/W

Brake Characteristics

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



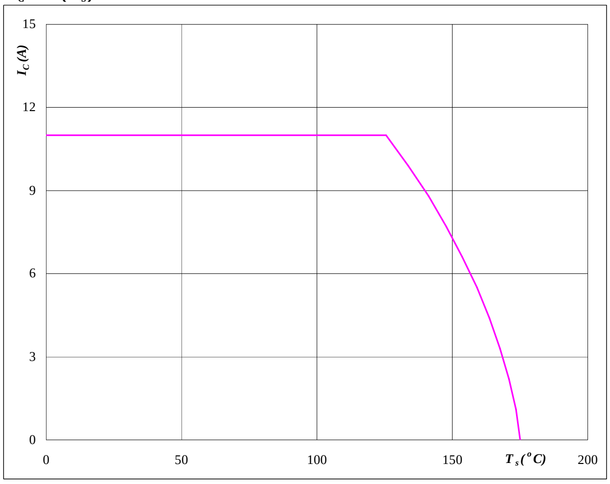
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

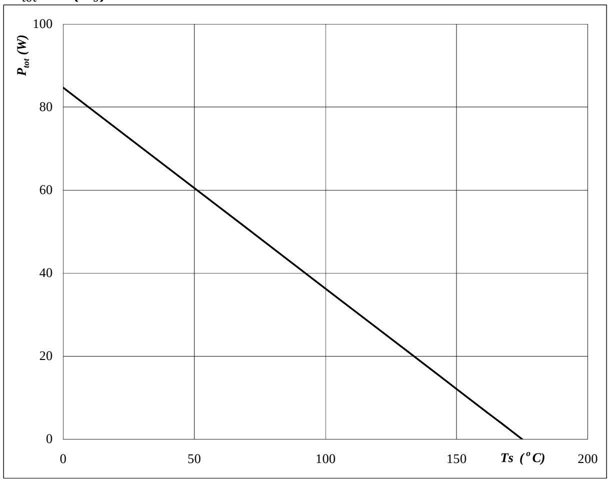
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



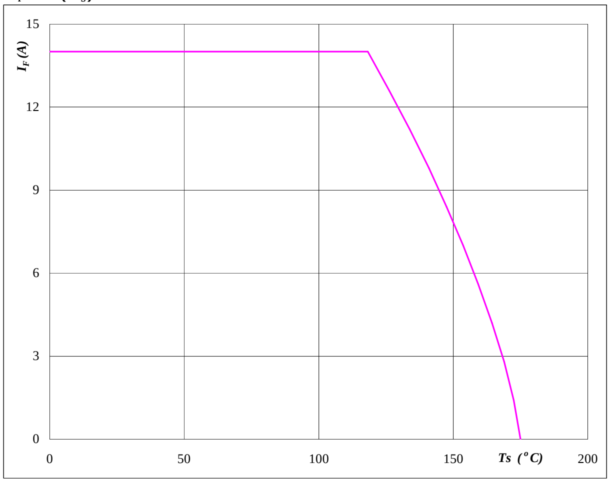
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

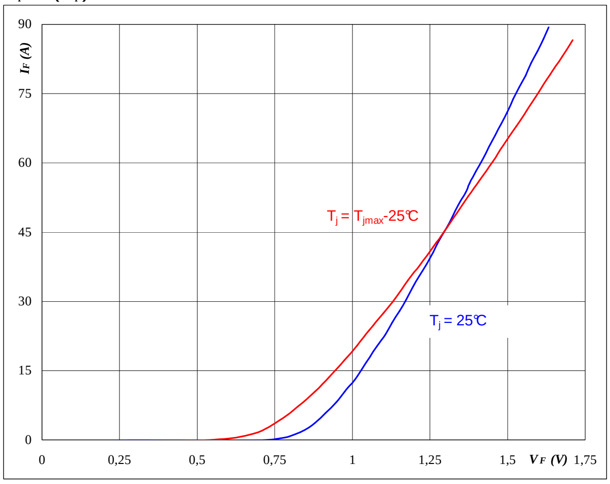
T_j = 175 ºC

Rectifier Diode

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



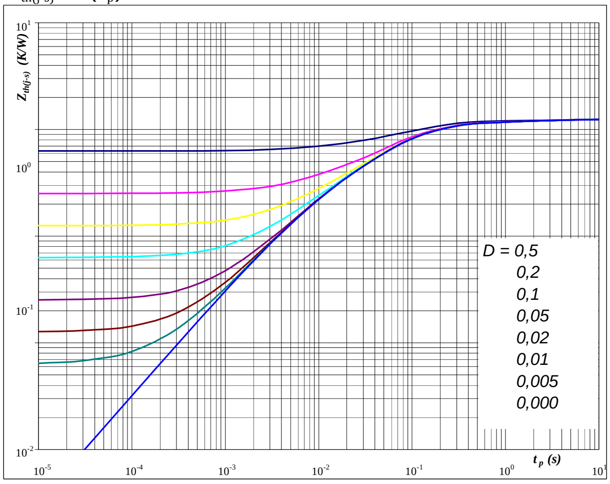
At

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

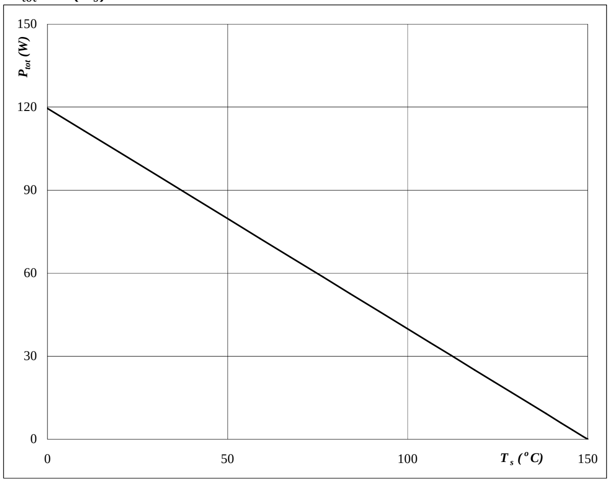
$D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,25 K/W

Figure 3 Rectifier Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



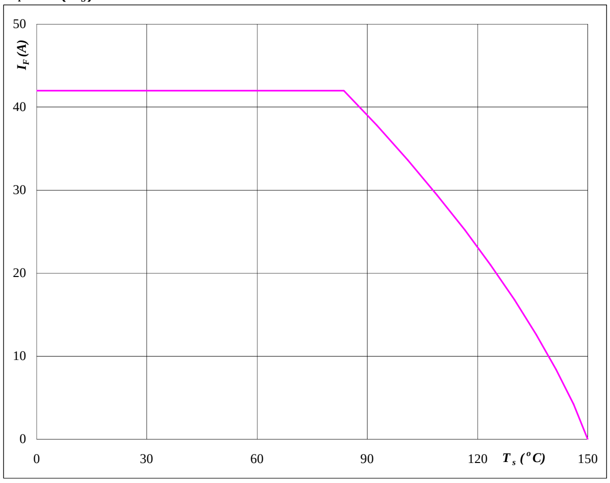
At

T_j = 150 ºC

Figure 4 Rectifier Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

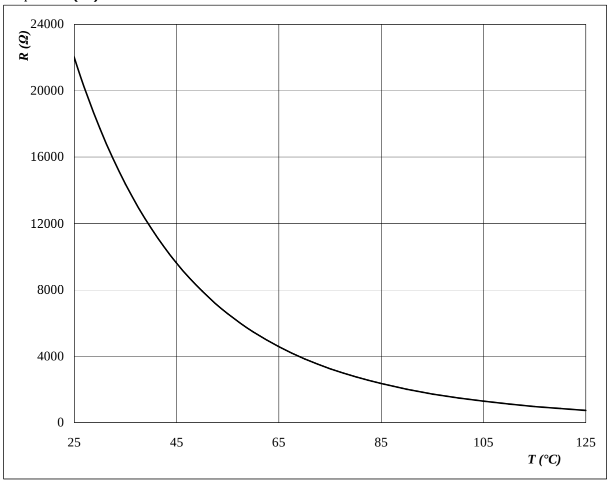
T_j = 150 ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



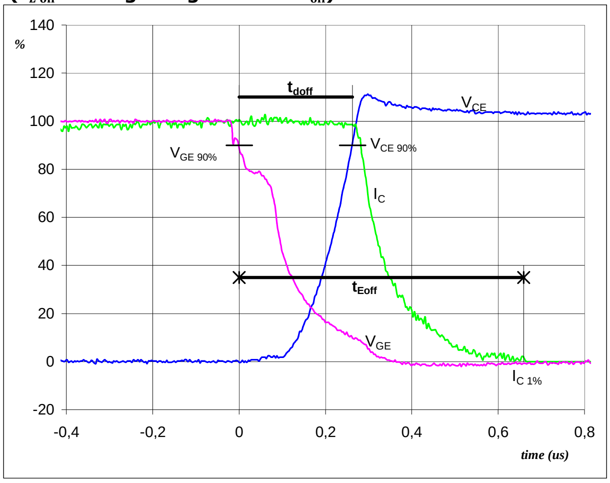
Switching Definitions Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

Figure 1 Inverter IGBT

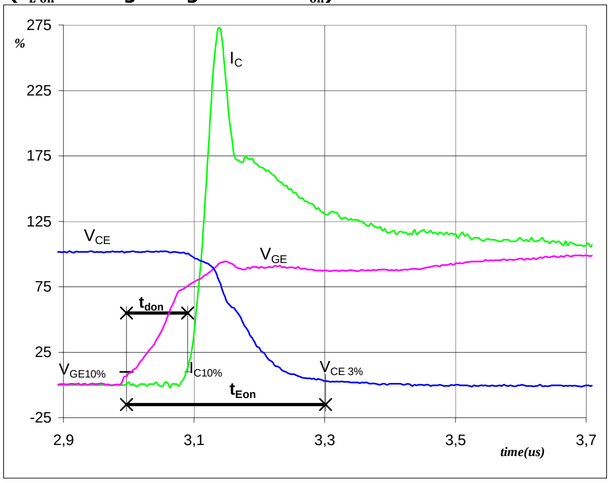
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,26	µs
$t_{E\,off}$ =	0,66	µs

Figure 2 Inverter IGBT

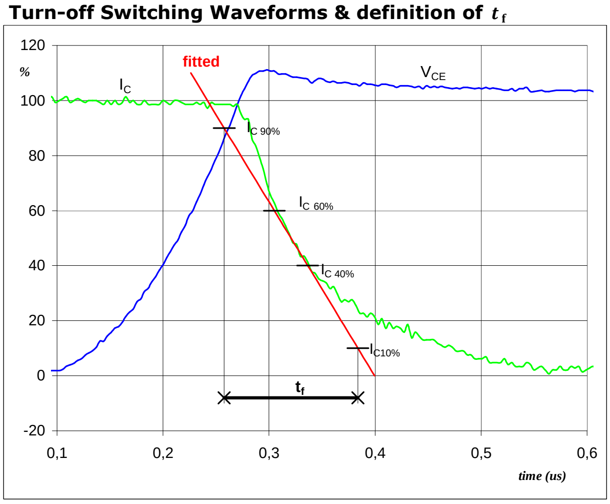
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,09	µs
$t_{E\,on}$ =	0,30	µs

Figure 3 Inverter IGBT

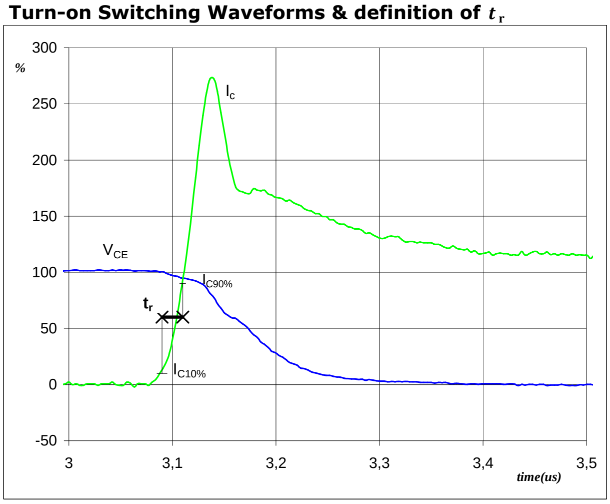
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,12	µs

Figure 4 Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

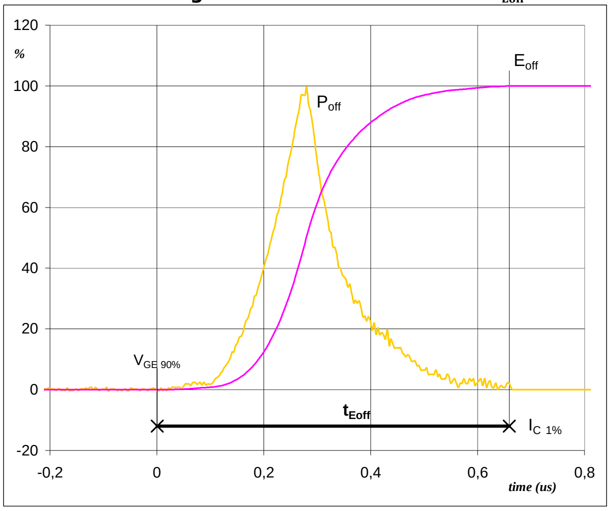


V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,02	µs

Switching Definitions Inverter

Figure 5 Inverter IGBT

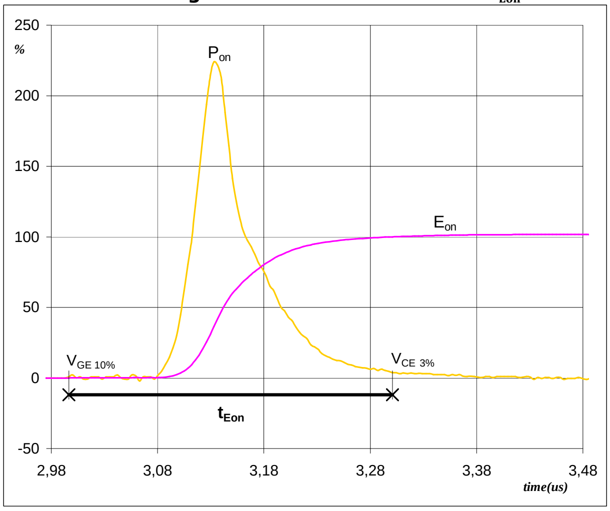
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	8,96	kW
E_{off} (100%) =	1,36	mJ
$t_{E\,off}$ =	0,66	μs

Figure 6 Inverter IGBT

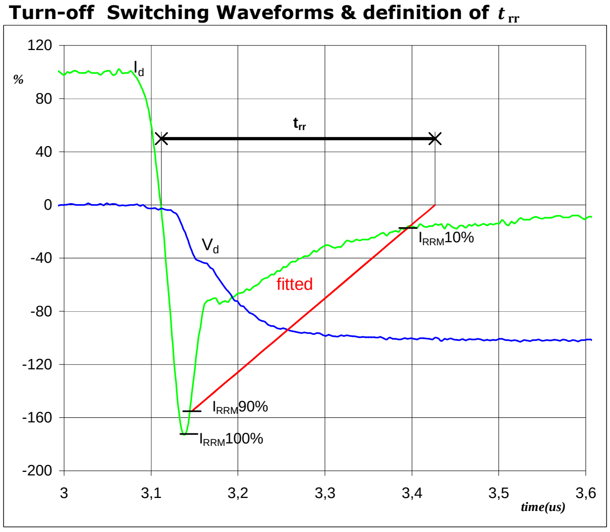
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	8,96	kW
E_{on} (100%) =	1,26	mJ
$t_{E\,on}$ =	0,30	μs

Figure 7 Inverter FWD

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

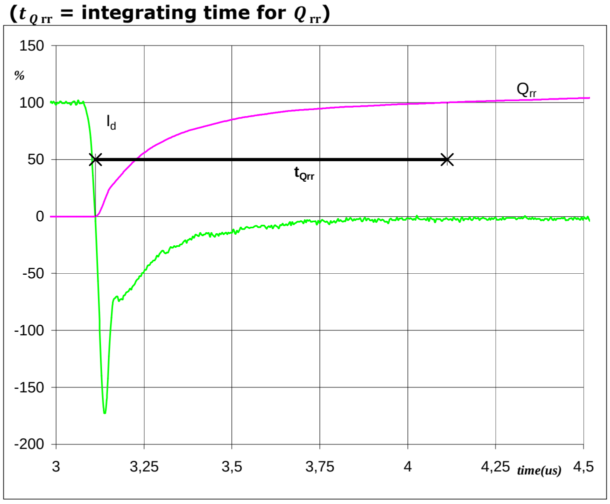


V_d (100%) =	600	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-26	A
t_{rr} =	0,31	μs

Switching Definitions Inverter

Figure 8 Inverter FWD

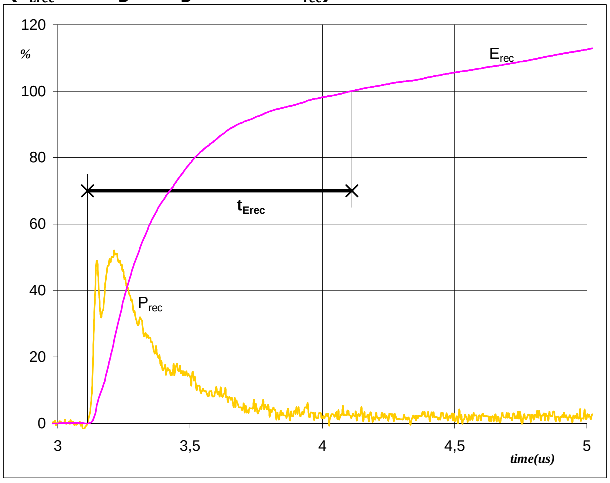
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	2,98	µC
$t_{Q\,rr}$ =	1,00	µs

Figure 9 Inverter FWD

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



P_{rec} (100%) =	8,96	kW
E_{rec} (100%) =	1,26	mJ
$t_{E\,rec}$ =	1,00	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code
Without thermal paste 17mm housing	V23990-P588-A41-PM
With thermal paste 17mm housing	V23990-P588-A41-/3/-PM
Without thermal paste 12mm housing	V23990-P588-A418-PM
With thermal paste 12mm housing with pressfit pins	V23990-P588-A418Y-PM
Without thermal paste 12mm housing with pressfit pins	V23990-P588-A418Y-/3/-PM
With thermal paste 12mm housing	V23990-P588-A418-/3/-PM
Without thermal paste 17mm housing without brake	V23990-P588-C41-PM
Without thermal paste 12mm housing without brake	V23990-P588-C418-PM
With thermal paste 12mm housing without brake	V23990-P588-C418-/3/-PM

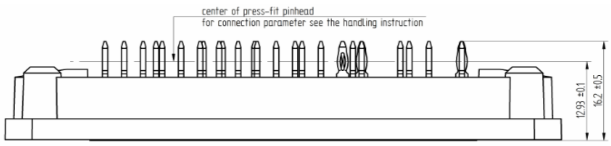
Text	VIN	Date code	Name&Ver	UL	Lot	Serial
	VIN	WWYY	NNNNNNVV	UL	LLLLL	SSSS
Datamatrix	Name&Ver	Lot number	Serial	Date code		
	NNNNNNVV	LLLLL	SSSS	WWYY		

Outline

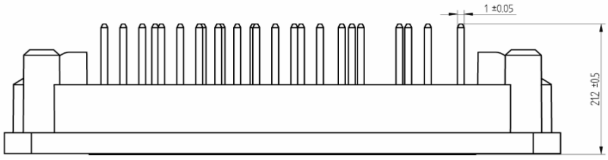
Pin table			
Pin	X	Y	Function
1	52,55	0	BrG
2	47,7	0	DC-
3	44,8	0	DC-
4	37,8	0	DC+
5	37,8	2,8	DC+
6	35	0	Inv+
7	35	2,8	Inv+
8	28	0	R1
9	25,2	0	R2
10	22,4	0	N6
11	19,6	0	G6
12	16,8	0	S6
13	14	0	N4
14	11,2	0	G4
15	8,4	0	S4
16	5,6	0	N2
17	2,8	0	G2
18	0	0	S2
19	0	28,5	U
20	2,8	28,5	G1
21	7,5	28,5	S1
22	14,5	28,5	V
23	17,3	28,5	G3
24	22	28,5	S3
25	29	28,5	W
26	31,8	28,5	G5
27	36,5	28,5	S5
28	43,5	28,5	L1
29	52,55	25	L2
30	52,55	16,9	L3
31	52,55	8,6	BrC
32	52,55	2,8	BrE

module	whitout pins
P589-C41	1, 31, 32
P589-C418	1, 31, 32

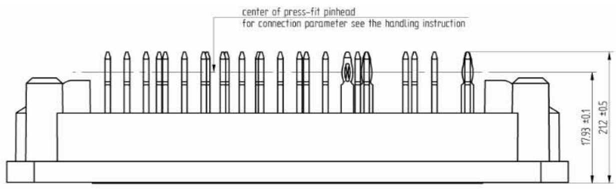
12mm housing, Press-fit

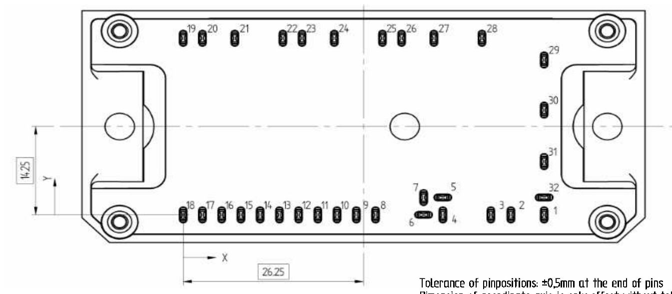


17mm housing, solder pin



17mm housing, Press-fit

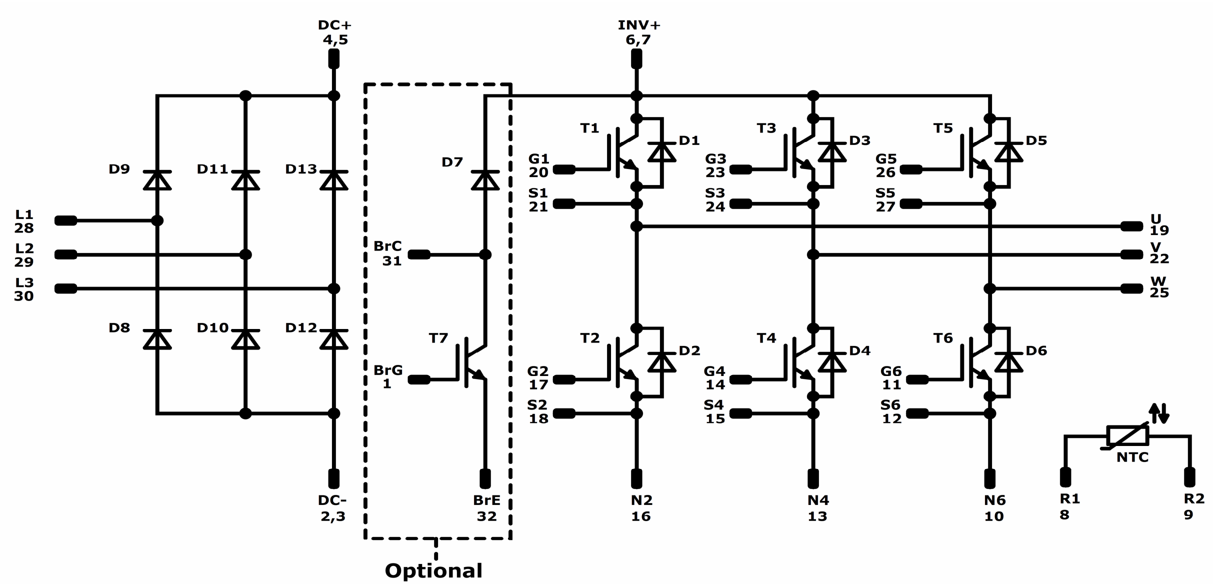




Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	1200 V	15 A	Inverter Switch	
D1,D2,D3,D4,D5,D6	FWD	1200 V	15 A	Inverter Diode	
T7	IGBT	1200 V	8 A	Brake Switch	
D7	FWD	1200 V	10 A	Brake Diode	
D8,D9,D10,D11,D12,D13	Rectifier	1600 V	35 A	Rectifier Diode	
NTC	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**100**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Package data for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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-P588-x4x-D6-14	11 Jul. 2018	Rectifier Rth updated	1 , 22

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.

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.