flow PIM 1 — 1200 V / 25 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

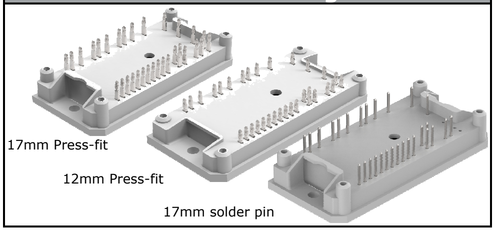
Target Applications

- Industrial drives
- Embedded Drives

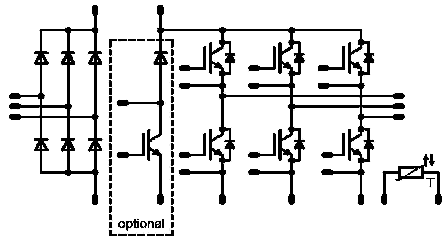
Types

- V23990-P589-A41-PM
- V23990-P589-A41Y-PM
- V23990-P589-A418-PM
- V23990-P589-A418Y-PM
- V23990-P589-C41-PM
- V23990-P589-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}	$T_j = T_{jmax}$	T_s = 80 °C	42	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms half sine wave	T_j=150°C	280	A
I^2t-value	I^2t			390	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	68	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		75	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_j ≤ T_{op} max		50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	94	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	29	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	60	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \leq T_{op}$ max		50	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
Brake 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}		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	8,06	mm
			17mm housing	min 12,7	mm
Comparative tracking index	CTI			>200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
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 11		mΩ
Reverse current	I_r			1600		25 150			0,002 2,0	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,03		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125	1,58	1,94 2,40	2,07	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,0024	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	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	25	25 125		126 126		ns
Rise time	t_r					25 125		21 28		
Turn-off delay time	$t_{d(off)}$					25 125		220 284		
Fall time	t_f					25 125		74 100		
Turn-on energy loss	E_{on}					25 125		1,64 2,53		mWs
Turn-off energy loss	E_{off}					25 125		1,38 2,17		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1430		pF
Output capacitance	C_{oss}							115		
Reverse transfer capacitance	C_{rss}							85		
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,01		K/W
Inverter Diode										
Diode forward voltage	V_F				25	25 125	1,35	1,97 1,94	2,05	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	25	25 125		32 34		A
Reverse recovery time	t_{rr}					25 125		265 436		ns
Reverse recovered charge	Q_{rr}					25 125		2,50 4,81		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1722 580		A/μs
Reverse recovered energy	E_{rec}					25 125		0,98 1,94		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,59		K/W

Characteristic Values

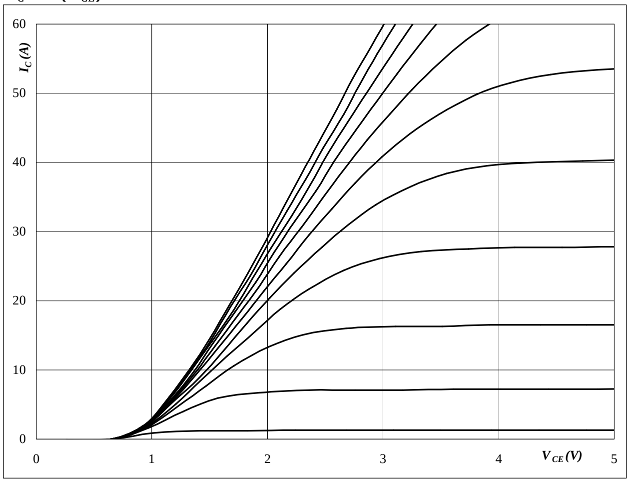
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,58	1,88 2,30	2,07	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		25			0,002	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	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		87 88		ns
Rise time	t_r					25 125		24 29		
Turn-off delay time	$t_{d(off)}$					25 125		194 258		
Fall time	t_f					25 125		77 111		
Turn-on energy loss	E_{on}					25 125		0,950 1,381		mWs
Turn-off energy loss	E_{off}					25 125		0,824 1,273		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		890		pF
Output capacitance	C_{oss}							80		
Reverse transfer capacitance	C_{rss}							30		
Gate charge	Q_G		15			25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,35		K/W
Brake Diode										
Diode forward voltage	V_F				10	25 125	1,35	1,85 1,76	2,05	V
Reverse leakage current	I_r			1200		25			2,7	μA
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	15	25 125		10 12		A
Reverse recovery time	t_{rr}					25 125		324 538		ns
Reverse recovered charge	Q_{rr}					25 125		1,38 1,38		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		46 44		A/μs
Reverse recovery energy	E_{rec}					25 125		0,581 1,081		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,07		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$					100	-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	$B_{(25/100)}$	Tol. ±3%				25		3996		K
Vincotech NTC Reference									B	

Inverter Charateristics

Figure 1 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



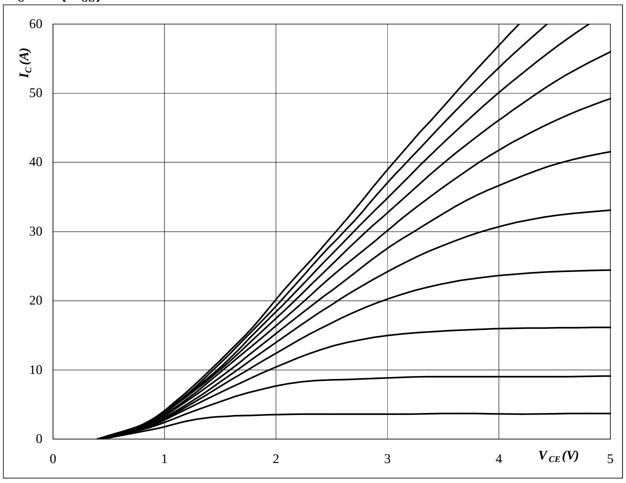
At

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

$I_C = f(V_{CE})$



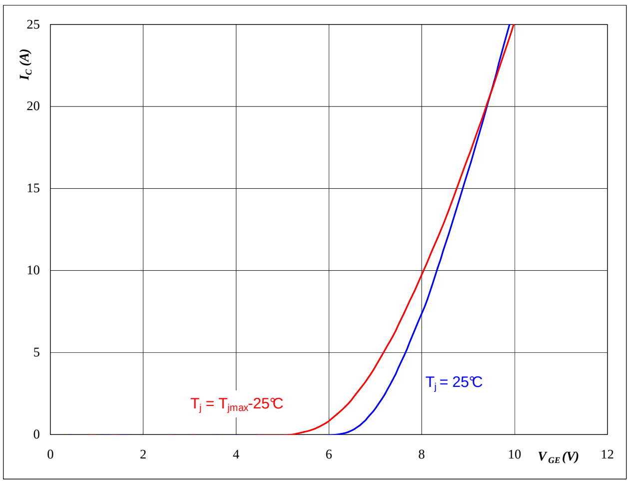
At

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

Figure 3 Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



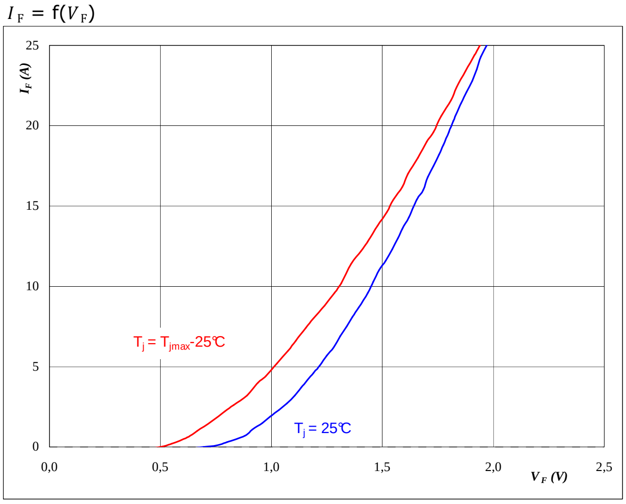
At

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

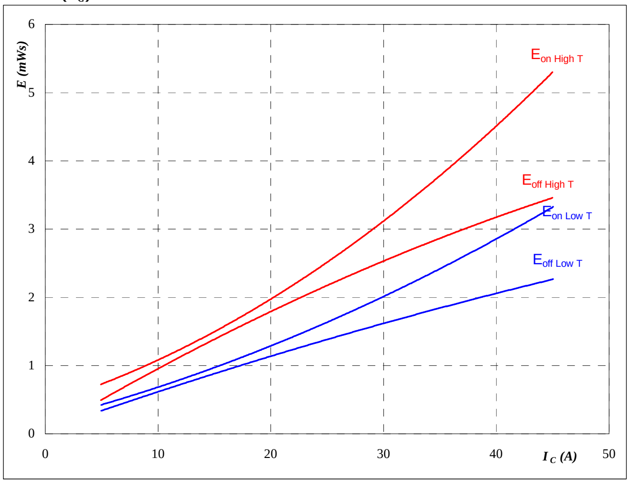
t_p =	250	μs

Inverter Charateristics

Figure 5 Inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



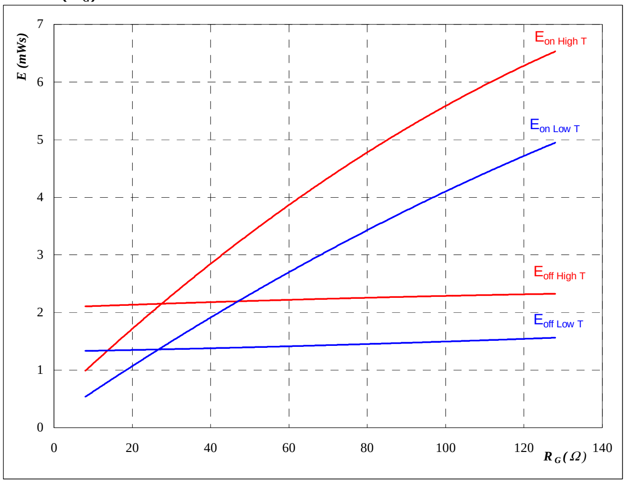
With an inductive load at

T_j =	25/150	°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

$E = f(R_G)$



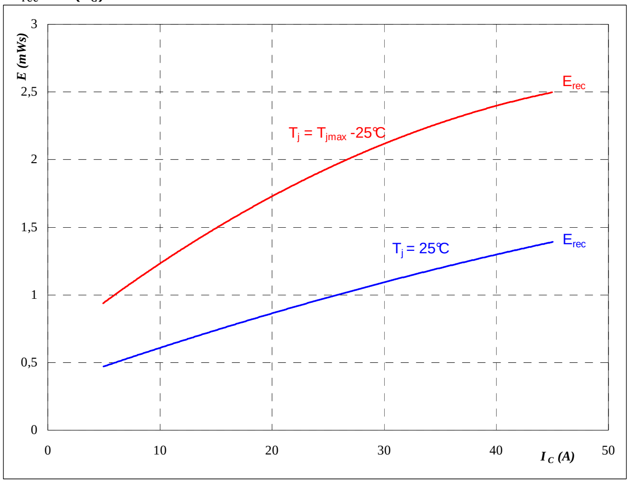
With an inductive load at

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

Figure 7 Inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



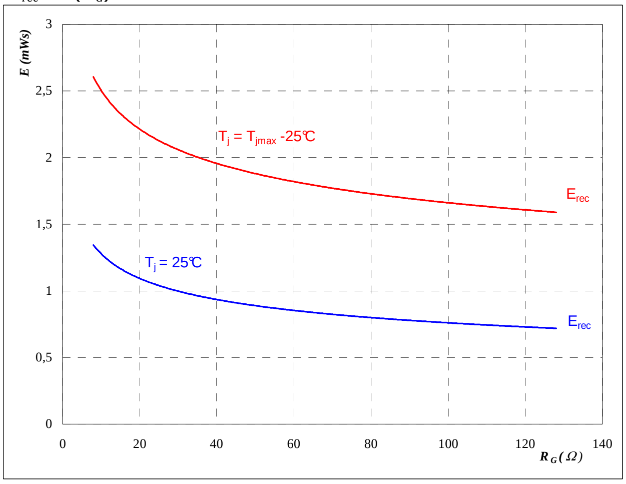
With an inductive load at

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

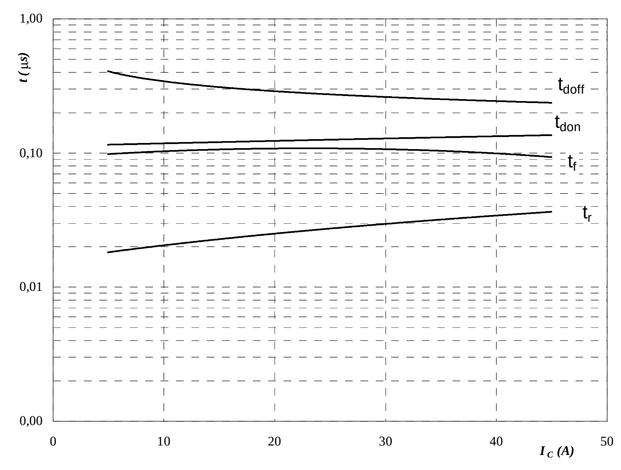
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

Inverter Charateristics

Figure 9	Inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



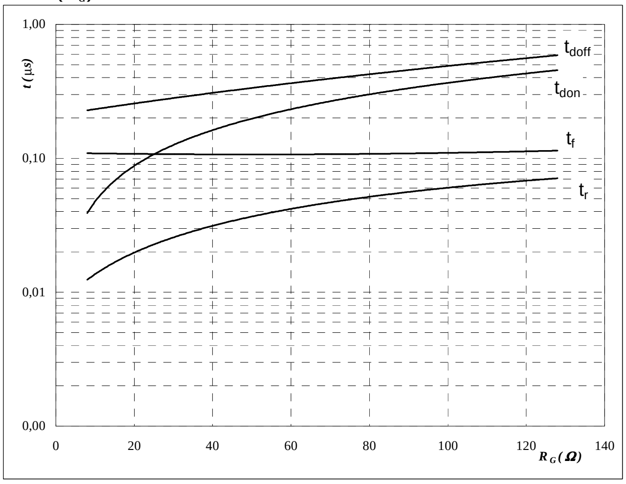
With an inductive load at

T_j =	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

$t = f(R_G)$



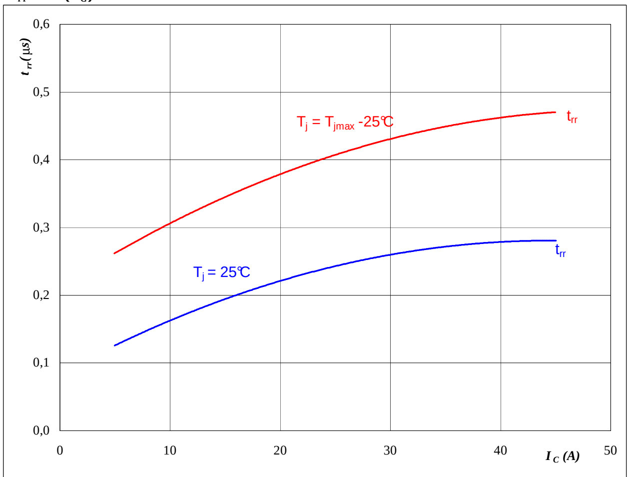
With an inductive load at

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

Figure 11	Inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



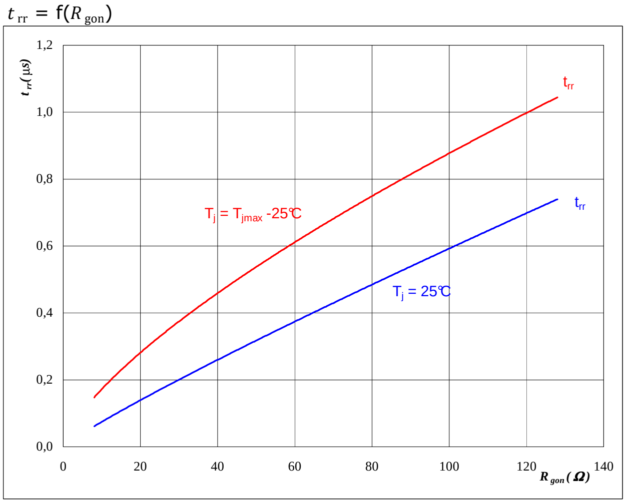
At

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

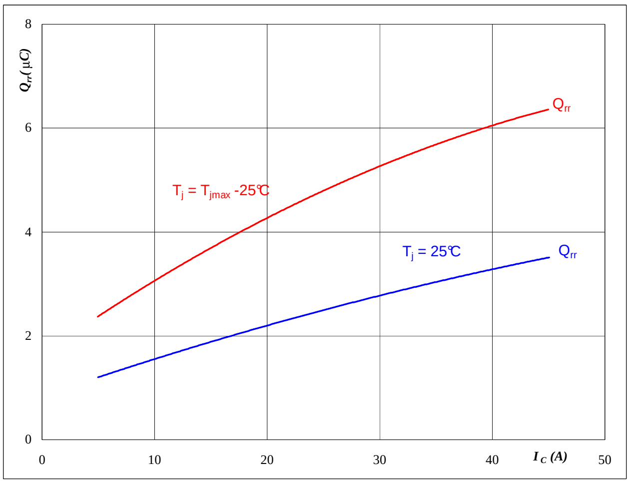
T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±15	V

Inverter Charateristics

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



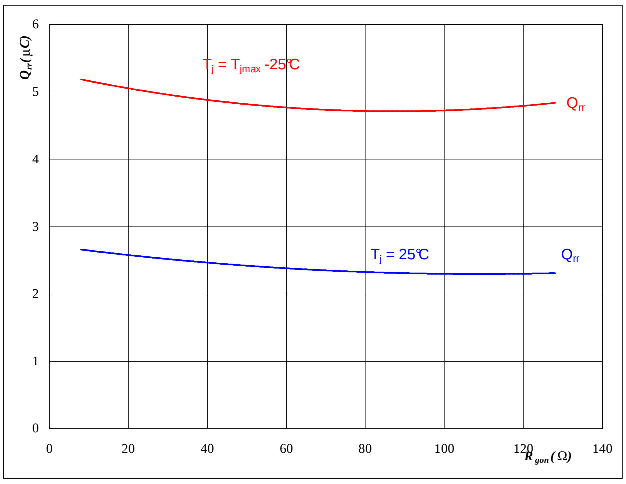
At

T_j =	25/150	°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

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



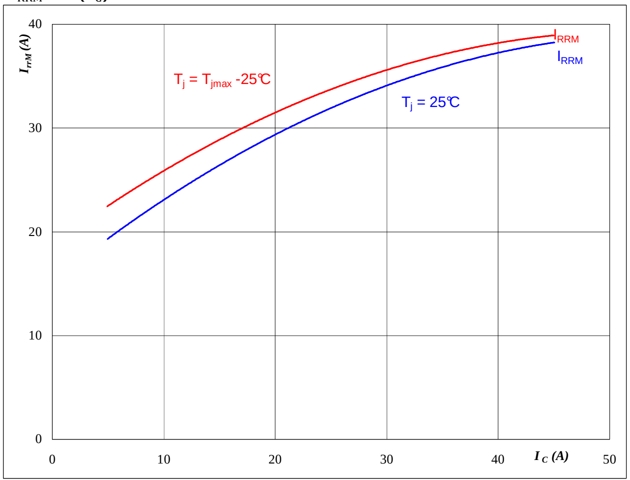
At

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

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



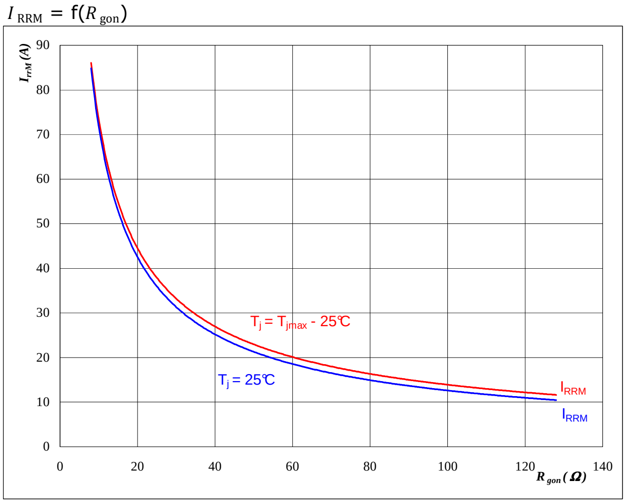
At

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

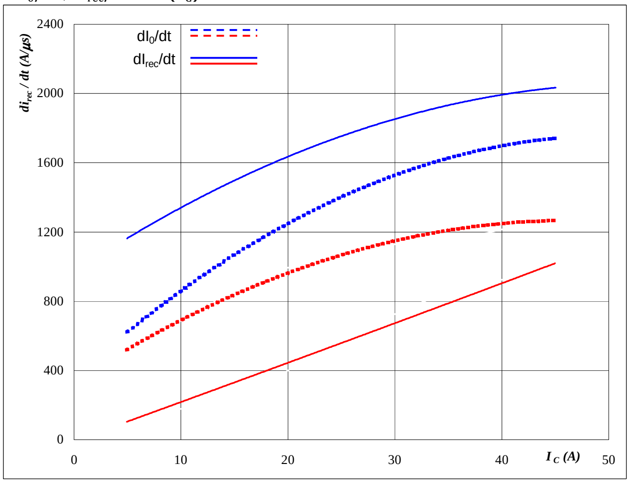
T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±15	V

Inverter Charateristics

Figure 17 Inverter FWD

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

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



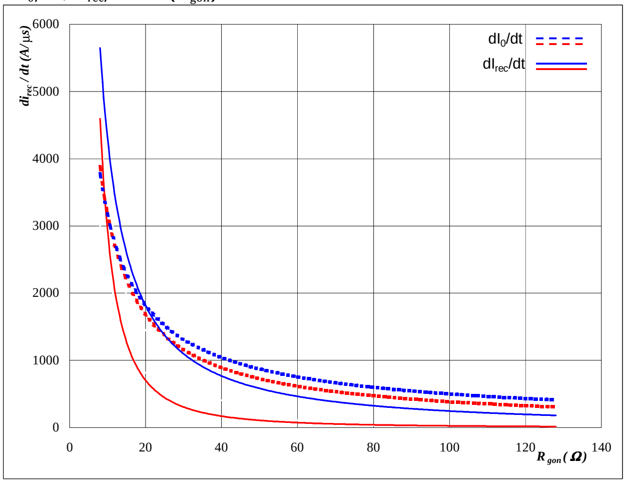
At

T_j =	25/150	°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

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



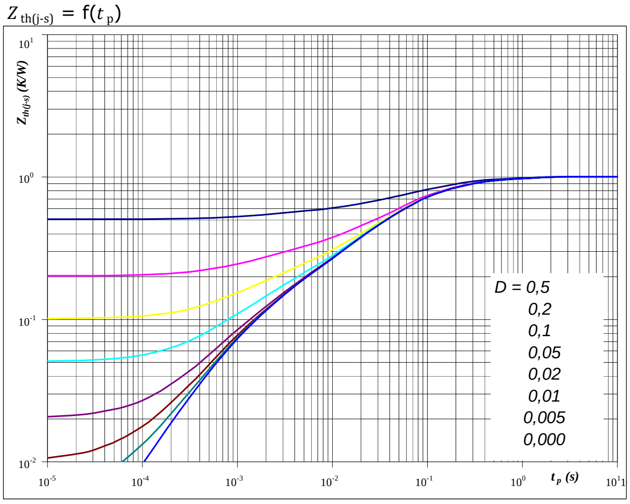
At

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

Figure 19 Inverter IGBT

IGBT transient thermal impedance as a function of pulse width

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



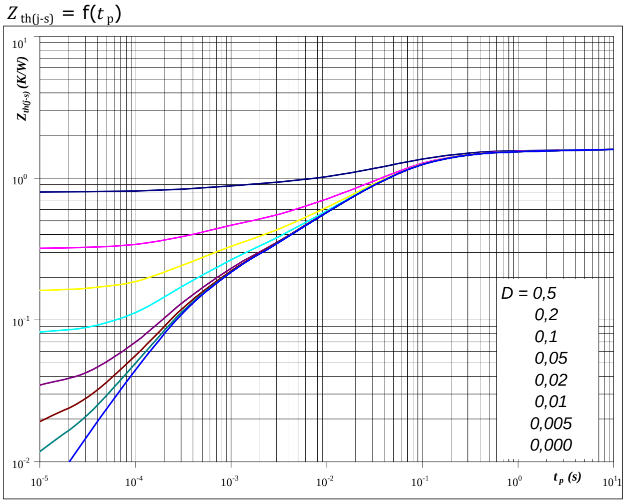
At

D =	t_p / T	
$R_{th(j-s)}$ =	1,01	K/W

Figure 20 Inverter FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	1,59	K/W

IGBT thermal model values

R (K/W)	Tau (s)
8,44E-02	1,03E+00
2,46E-01	1,79E-01
4,48E-01	5,38E-02
1,38E-01	1,04E-02
5,48E-02	1,66E-03
3,85E-02	8,73E-04

FWD thermal model values

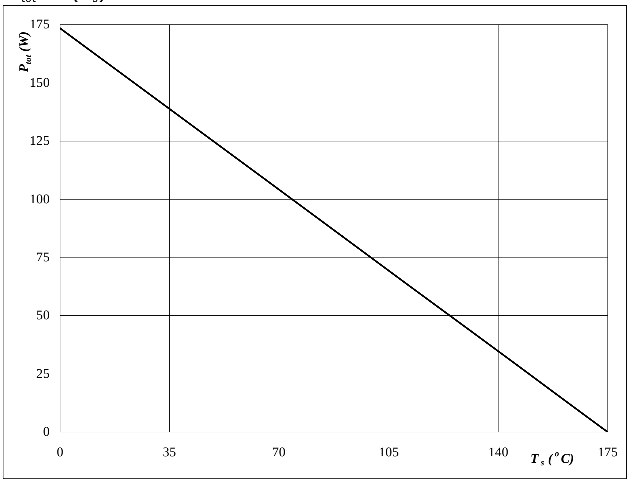
R (C/W)	Tau (s)
7,80E-02	2,61E+00
3,11E-01	2,04E-01
6,92E-01	4,64E-02
2,79E-01	8,74E-03
9,99E-02	1,79E-03
1,35E-01	3,39E-04

Inverter Charateristics

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



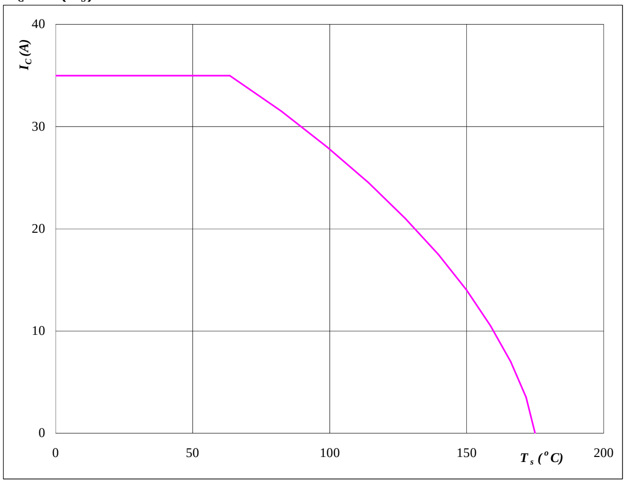
At

T_j = 175 °C

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

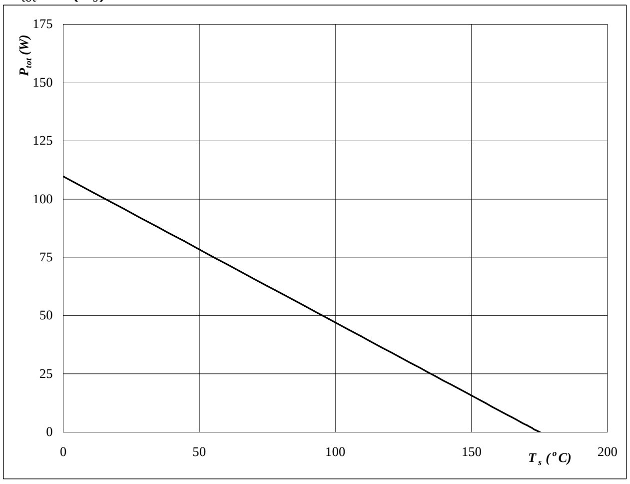
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



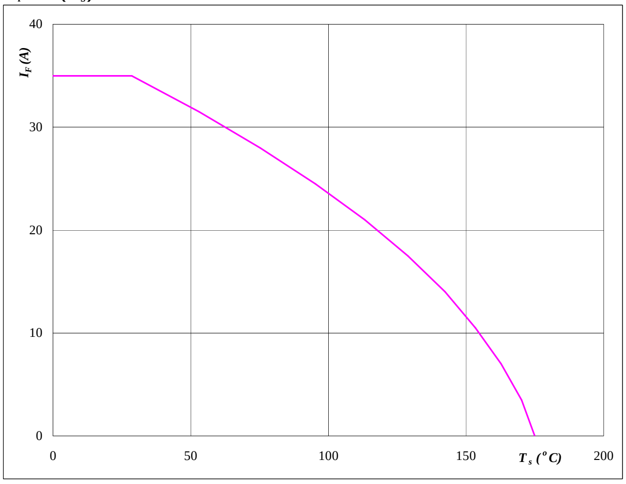
At

T_j = 175 °C

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

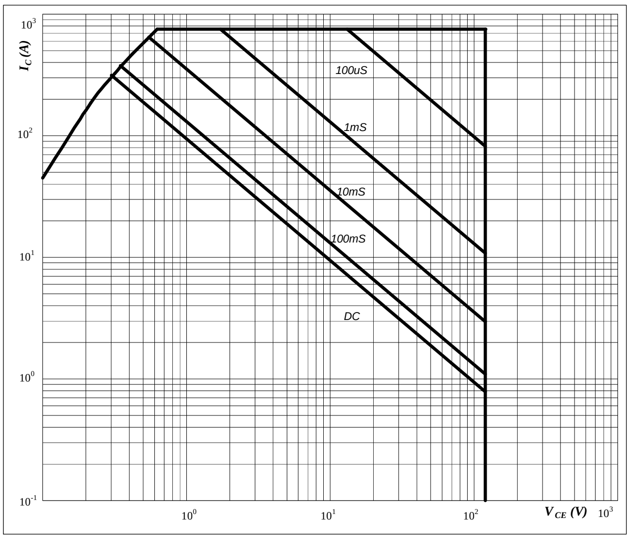
T_j = 175 °C

Inverter Charateristics

Figure 25 Inverter IGBT

Safe operating area as a function of collector-emitter voltage

I_C = f(V_{CE})



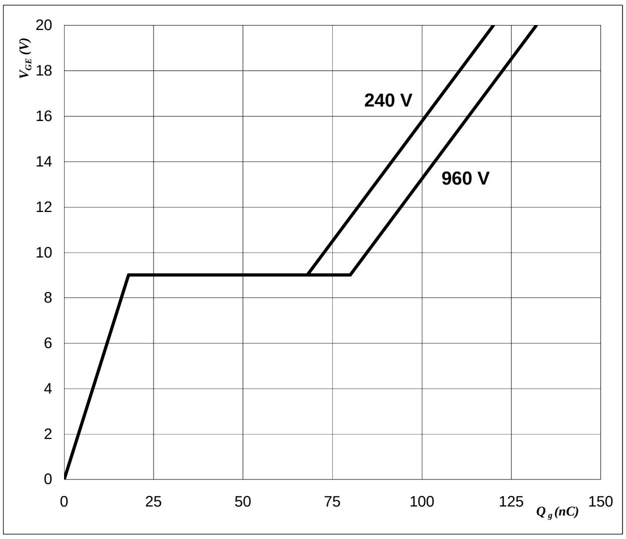
At

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

Figure 26 Inverter IGBT

Gate voltage vs Gate charge

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



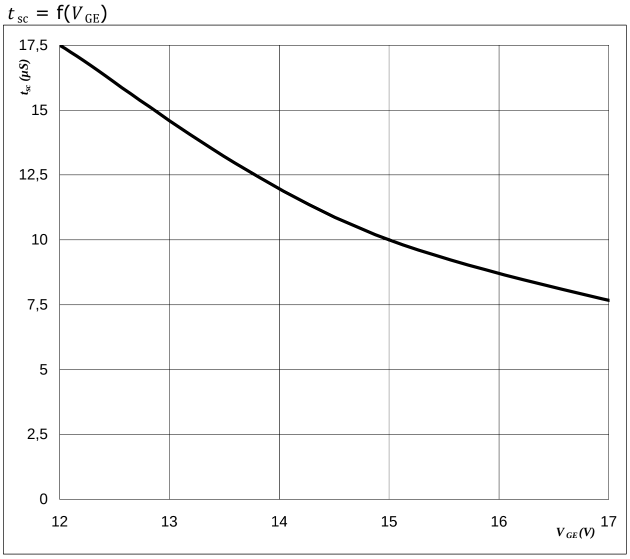
At

I_C =	25	A

Figure 27 Inverter IGBT

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

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



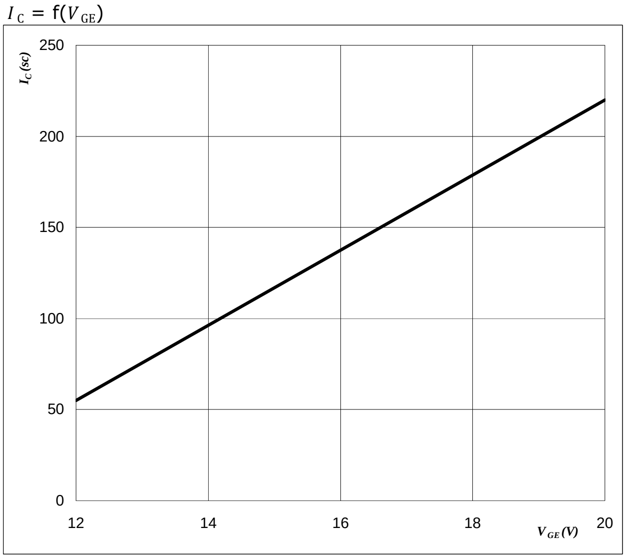
At

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 = f(V_{GE})



At

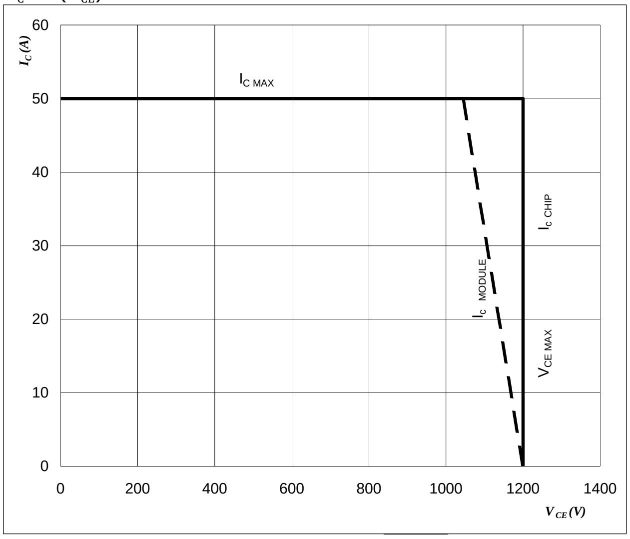
V_{CE} ≤	1200	V
T_j =	175	ºC

Inverter Charateristics

Figure 29	Inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

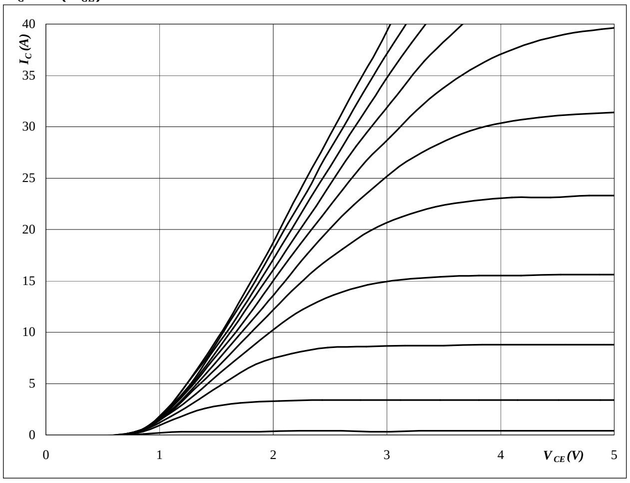
T_j = T_{jmax}-25 ºC

Brake Charateristics

Figure 1 Brake IGBT

Typical output characteristics

I_C = f(V_{CE})



At

t_p = 250 μs

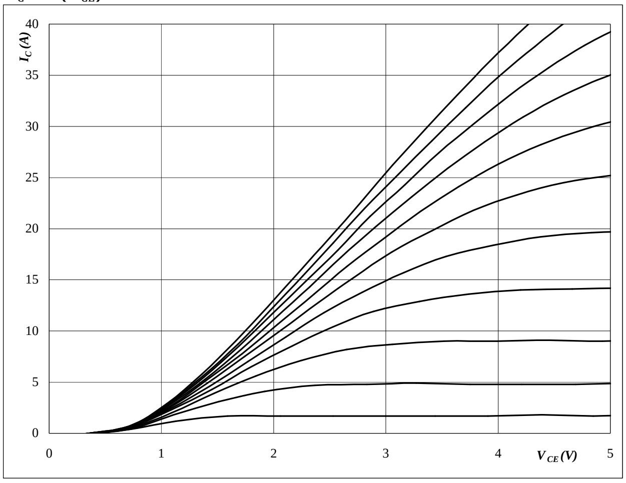
T_j = 25 °C

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

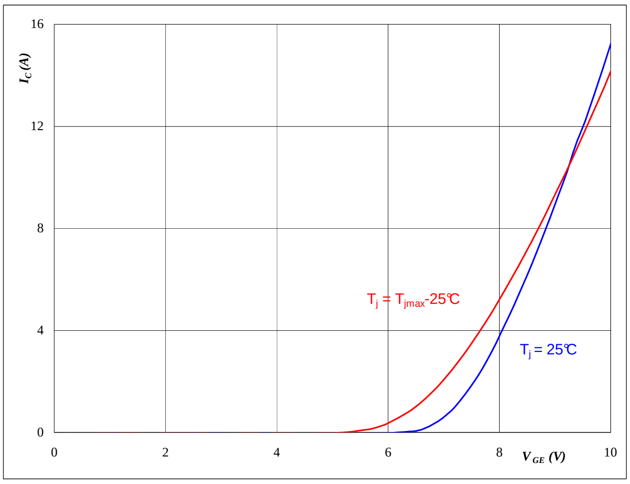
T_j = 150 °C

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

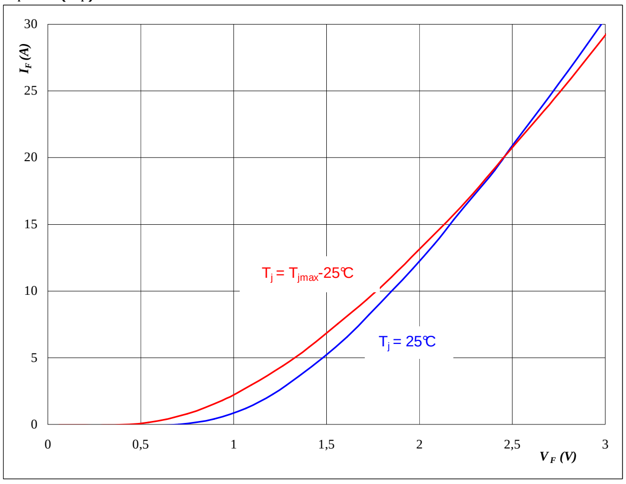
t_p = 250 μs

V_{CE} = 10 V

Figure 4 Brake FWD

Typical diode forward current as a function of forward voltage

I_F = f(V_F)



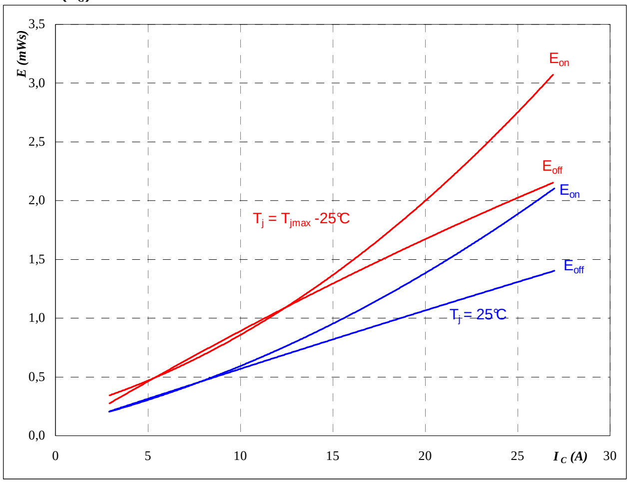
At

t_p = 250 μs

Brake Charateristics

Figure 5	Brake IGBT

Typical switching energy losses
as a function of collector current
$E = f(I_C)$

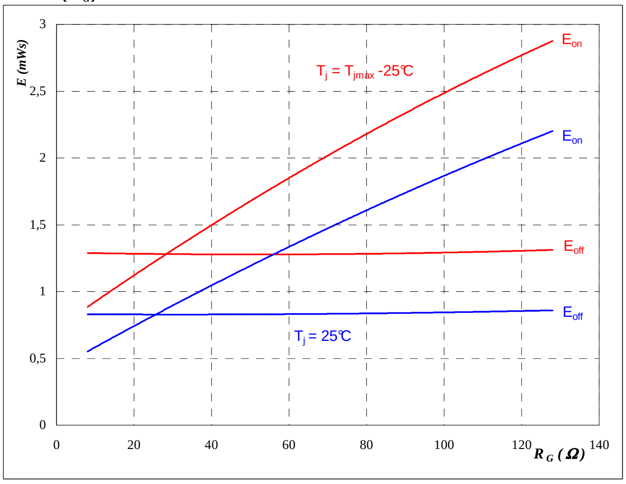


With an inductive load at

T_j =	25/150	°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
$E = f(R_G)$

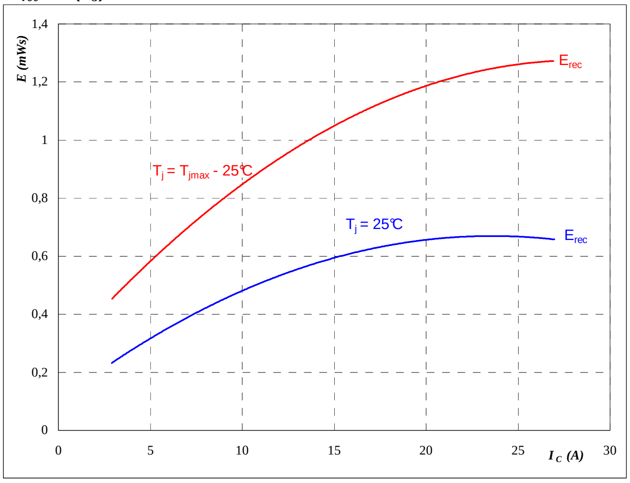


With an inductive load at

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

Figure 7	Brake FWD

Typical reverse recovery energy loss
as a function of collector current
$E_{rec} = f(I_C)$

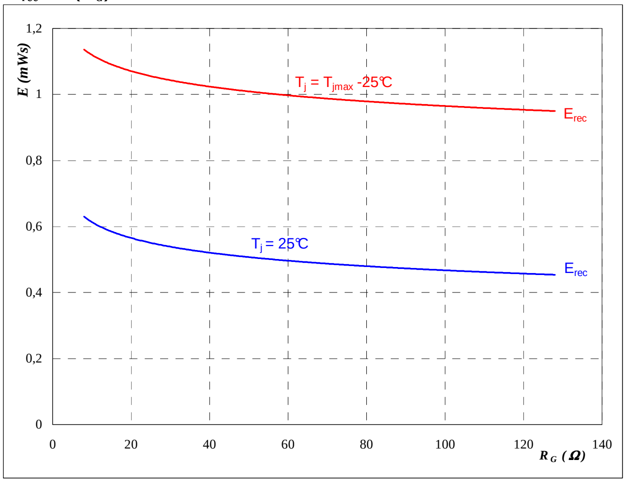


With an inductive load at

T_j =	25/150	°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

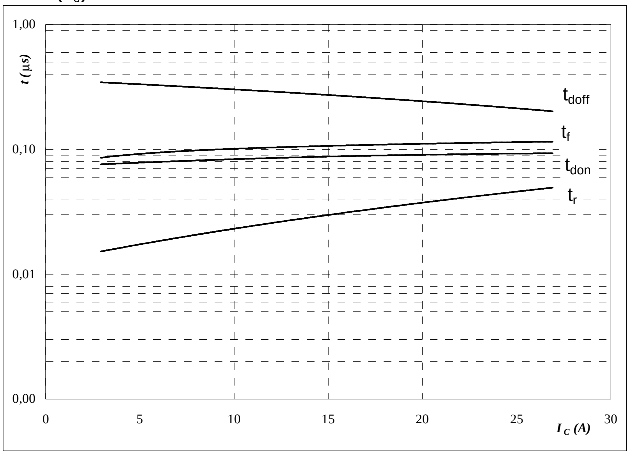
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Brake Charateristics

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



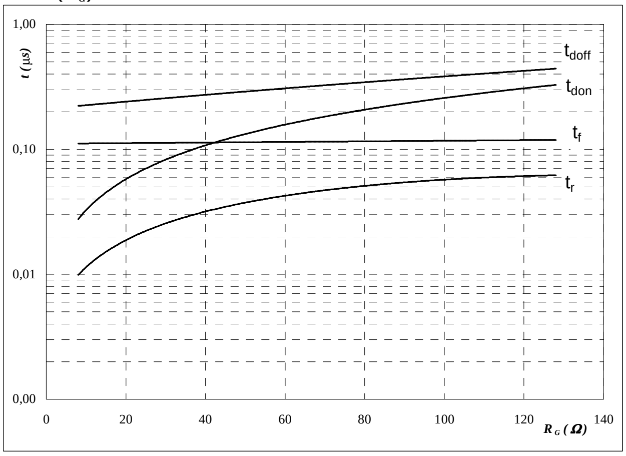
With an inductive load at

T_j =	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

$t = f(R_G)$



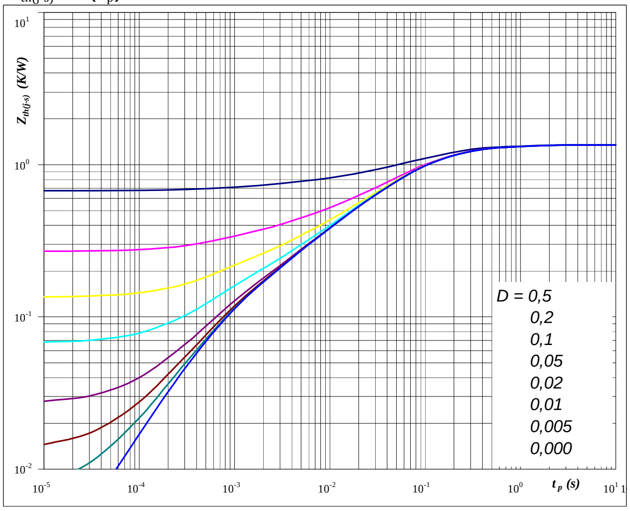
With an inductive load at

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

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

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



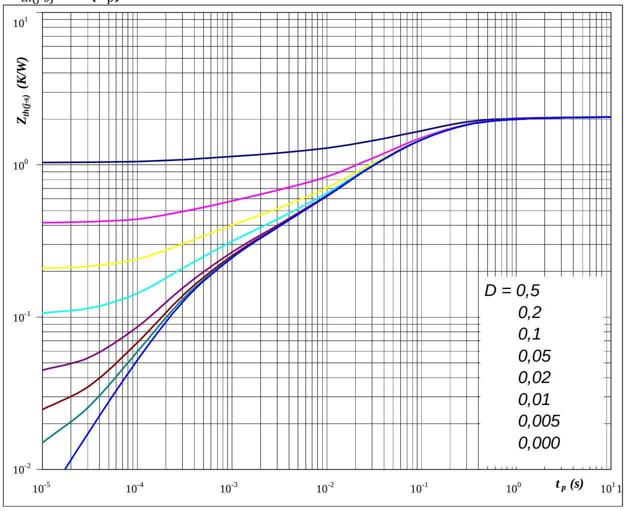
At $D = t_p / T$

$R_{th(j-s)}$ = 1,35 K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

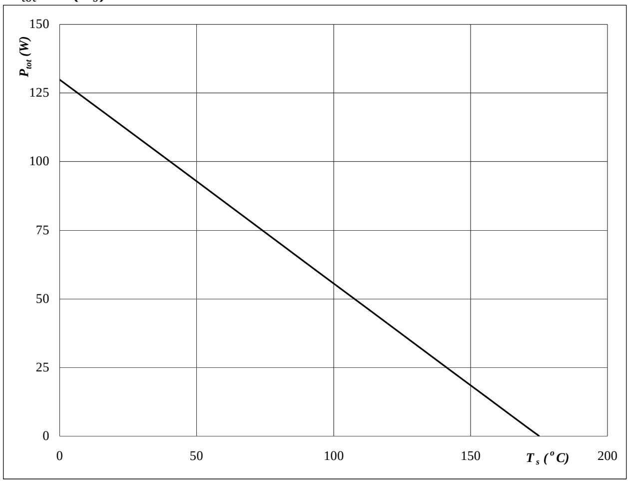
$R_{th(j-s)}$ = 2,07 K/W

Brake Charateristics

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



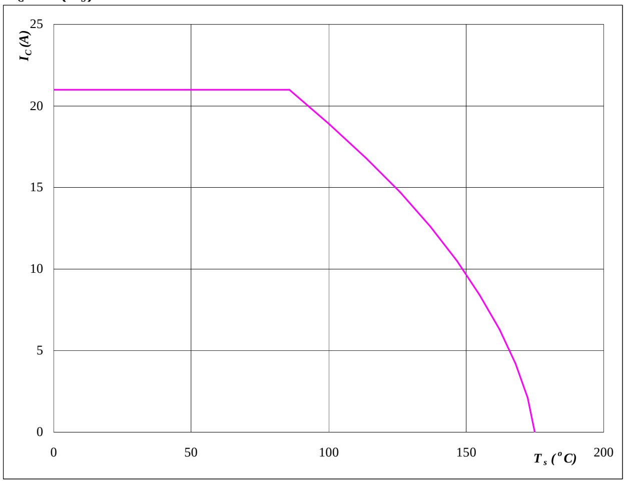
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

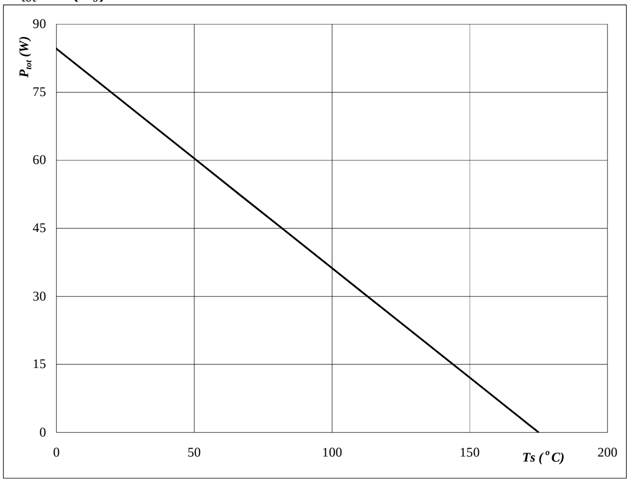
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



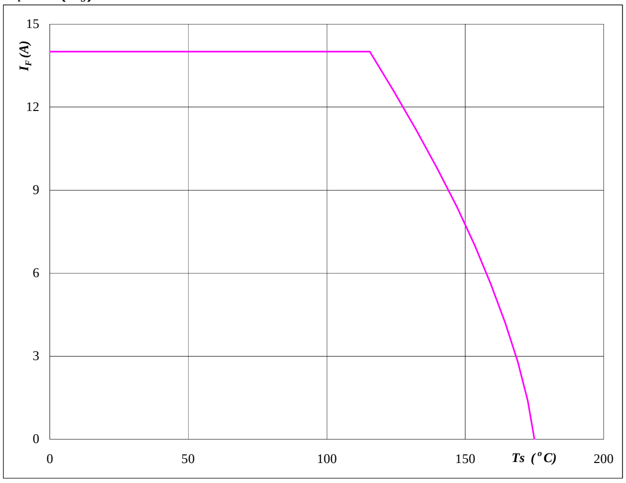
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

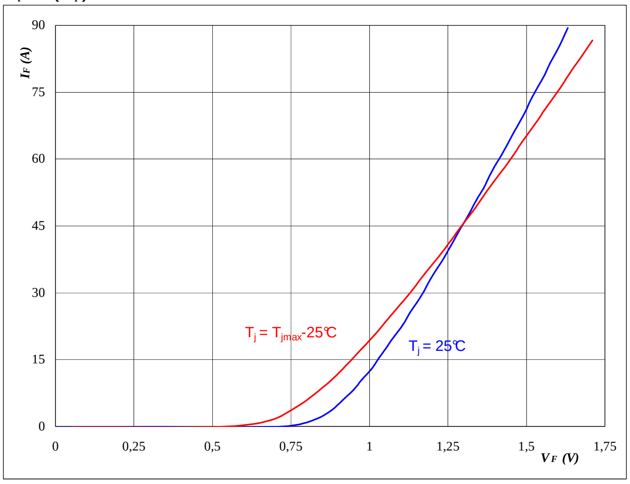
T_j = 175 ºC

Rectifier Diode Charaterisitcs

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



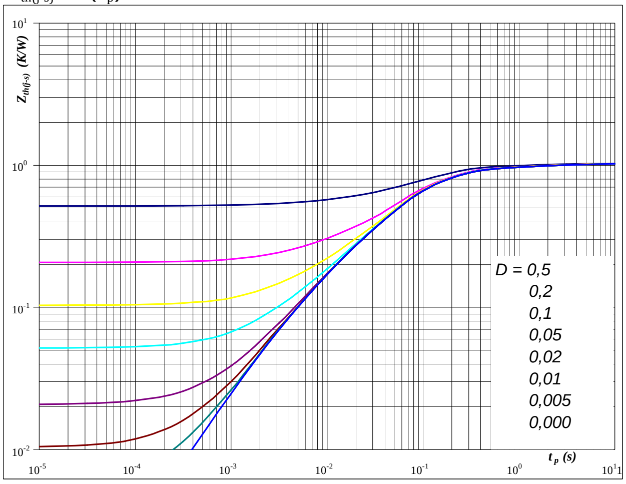
At

t_p = 250 µs

Figure 2 Rectifier Diode

Diode transient thermal impedance as a function of pulse width

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



At

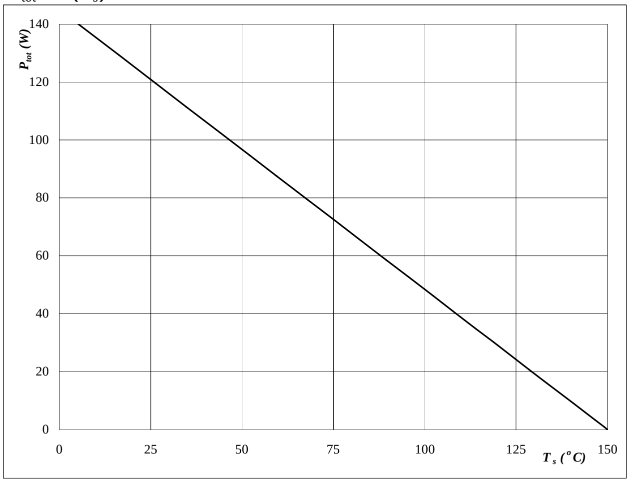
$D = t_p / T$

$R_{th(j-s)}$ = 1,03 K/W

Figure 3 Rectifier Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



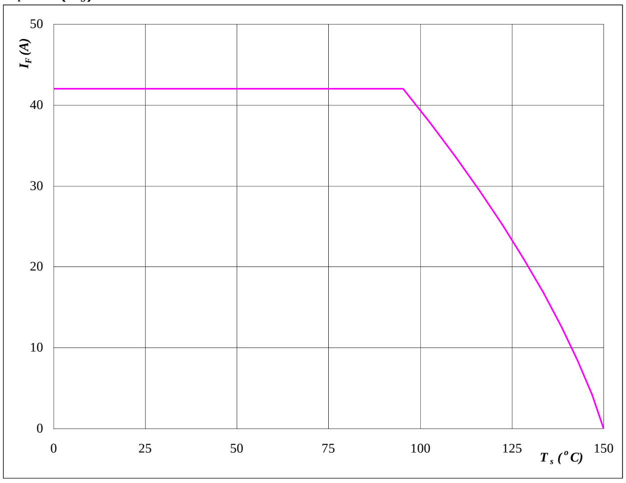
At

T_j = 150 ºC

Figure 4 Rectifier Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



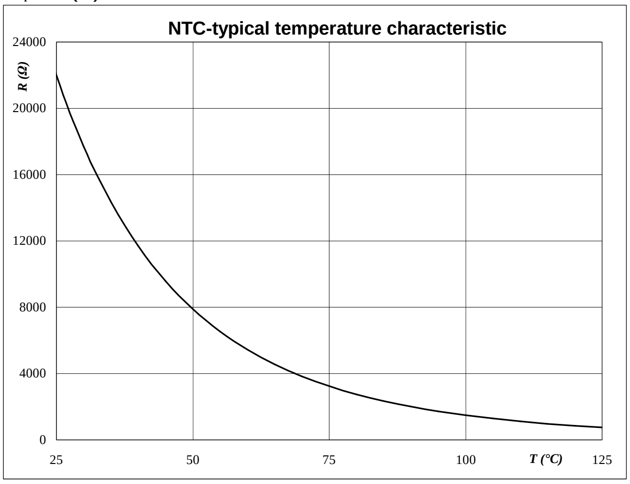
At

T_j = 150 ºC

Thermistor Charateristics

Figure 1	Thermistor

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



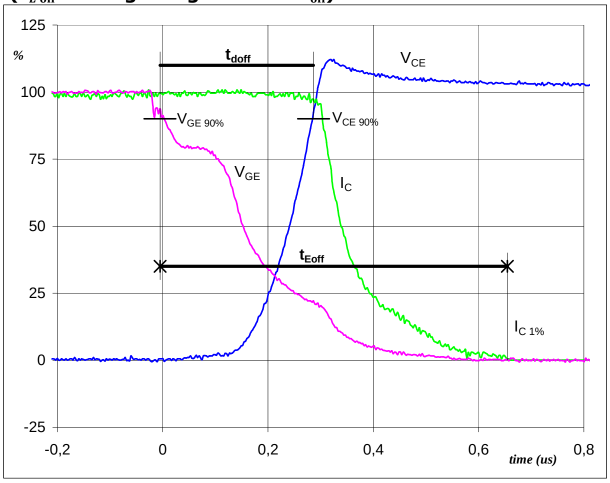
Switching Definitions Inverter

General conditions

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

Figure 1 Inverter Switch

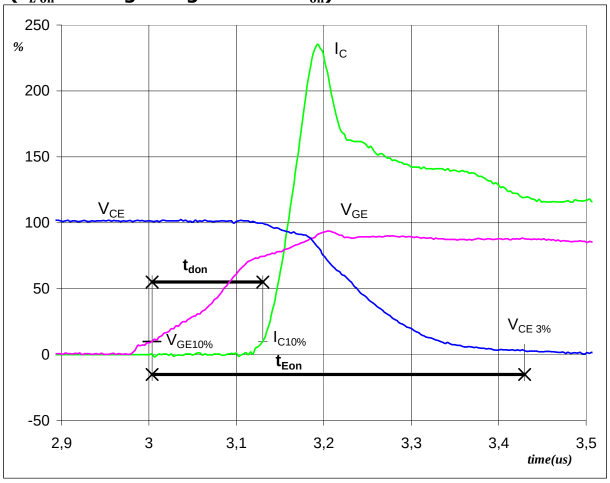
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{doff} =	0,28	μs
$t_{E\,off}$ =	0,66	μs

Figure 2 Inverter Switch

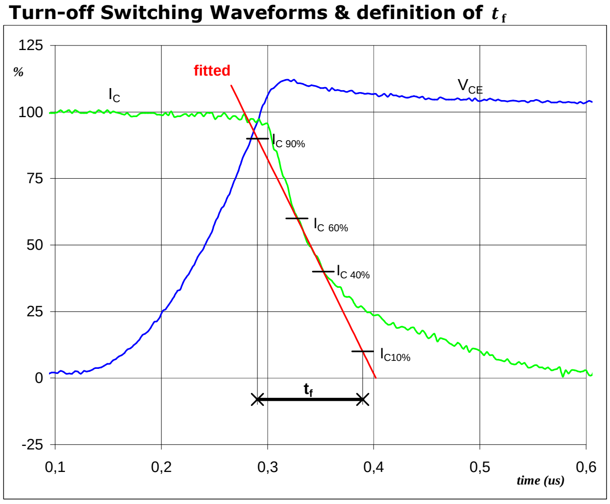
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{don} =	0,13	μs
$t_{E\,on}$ =	0,43	μs

Figure 3 Inverter Switch

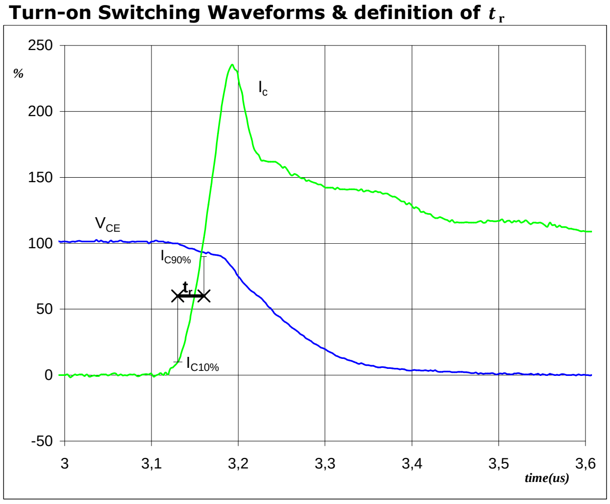
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	25	A
t_f =	0,10	μs

Figure 4 Inverter Switch

Turn-on Switching Waveforms & definition of t_r

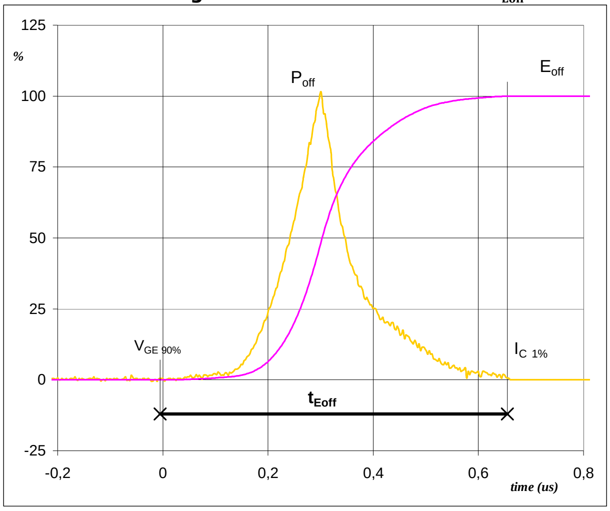


V_C (100%) =	600	V
I_C (100%) =	25	A
t_r =	0,03	μs

Switching Definitions Inverter

Figure 5 Inverter Switch

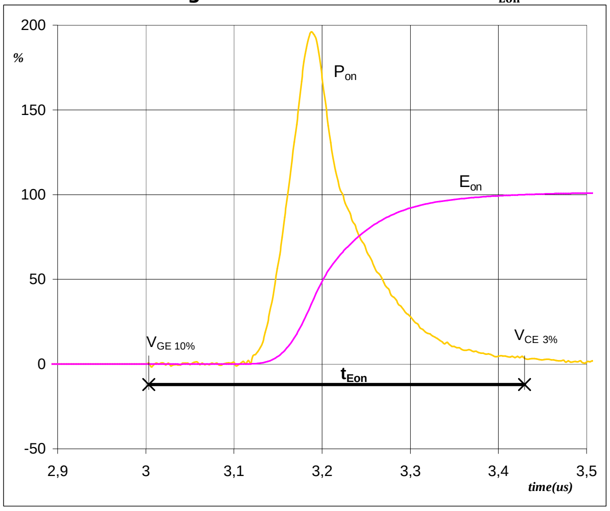
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 15,01 kW
E_{off} (100%) = 2,17 mJ
$t_{E\,off}$ = 0,66 μs

Figure 6 Inverter Switch

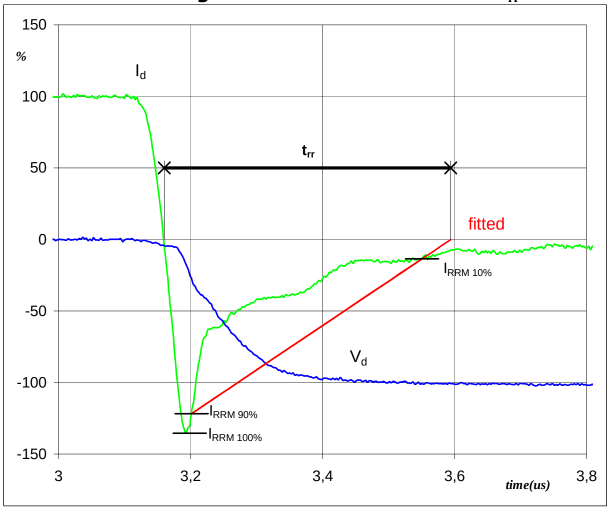
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 15,01 kW
E_{on} (100%) = 2,53 mJ
$t_{E\,on}$ = 0,43 μs

Figure 7 Inverter Switch

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

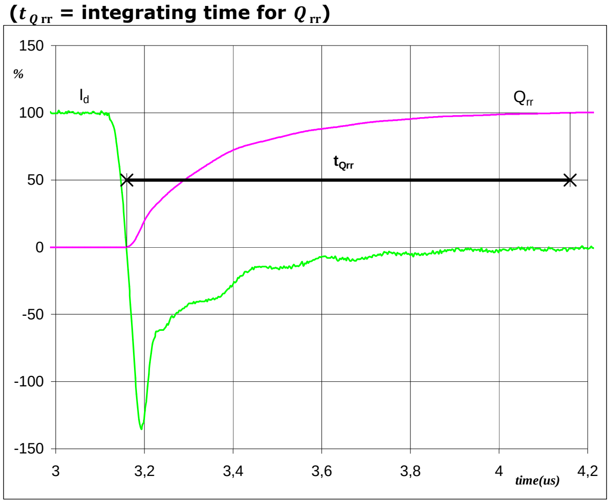


V_d (100%) = 600 V
I_d (100%) = 25 A
I_{RRM} (100%) = 10 A
t_{rr} = 0,10 μs

Switching Definitions Inverter

Figure 8 Inverter FWD

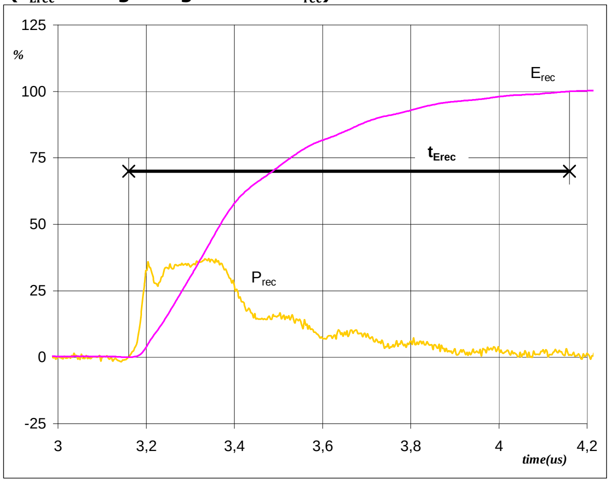
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



I_d (100%) =	25	A
Q_{rr} (100%) =	4,81	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%) =	15,01	kW
E_{rec} (100%) =	1,94	mJ
$t_{E rec}$ =	1,00	µs

Vincotech

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm housing solder pins	V23990-P589-A41-PM
with thermal paste 17mm housing solder pins	V23990-P589-A41-/3/-PM
with thermal paste 17mm housing Press-fit pins	V23990-P589-A41Y-/3/-PM
without thermal paste 12mm housing solder pins	V23990-P589-A418-PM
without thermal paste 12mm housing Press-fit	V23990-P589-A418Y-PM
without thermal paste 17mm housing solder pins without brake	V23990-P589-C41-PM
with thermal paste 12mm housing solder pins without brake	V23990-P589-C418-/3/-PM

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

Outline

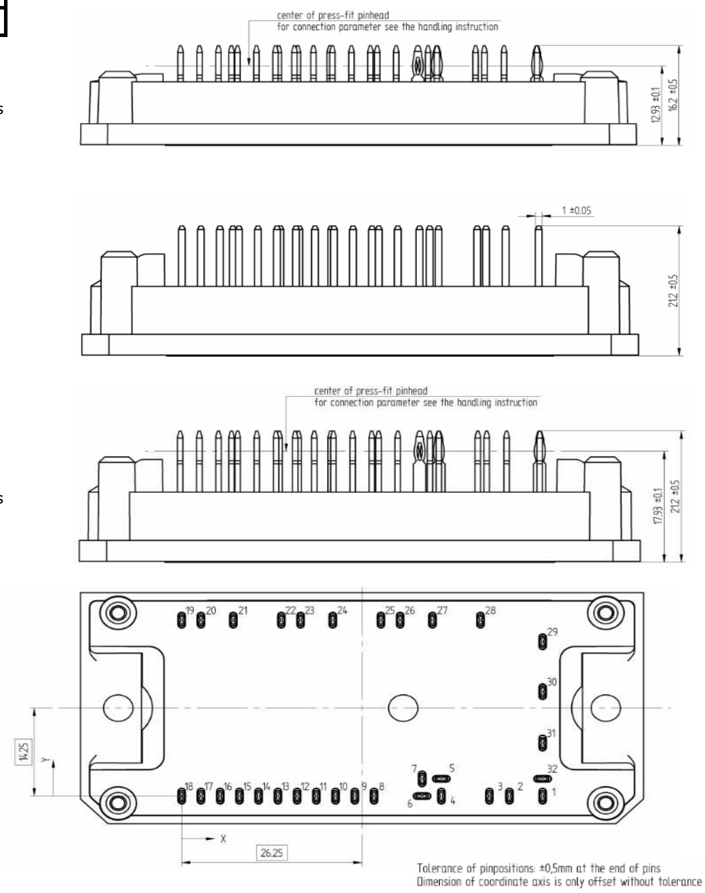
Pin table			
Pin	X	Y	Function
1	52,55	0	BrG
2	47,7	0	DC-
3	44,8	0	DC-
4	37,8	0	DC+
5	37,8	2,8	DC+
6	35	0	Inv+
7	35	2,8	Inv+
8	28	0	R1
9	25,2	0	R2
10	22,4	0	N6
11	19,6	0	G6
12	16,8	0	S6
13	14	0	N4
14	11,2	0	G4
15	8,4	0	S4
16	5,6	0	N2
17	2,8	0	G2
18	0	0	S2
19	0	28,5	U
20	2,8	28,5	G1
21	7,5	28,5	S1
22	14,5	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 pins

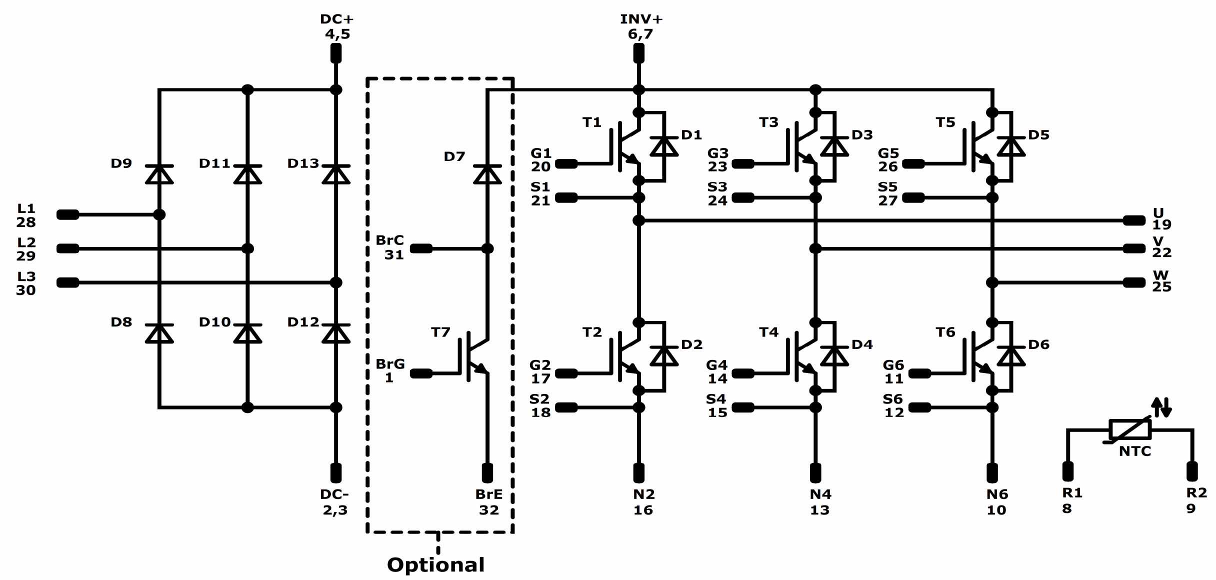
17mm housing, solder pins

17mm housing, Press-fit pins



Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D8, D9, D10 D11, D12, D13	Diode	1600 V	30 A	Rectifier Diode	
T1, T2, T3, T4, T5, T6	IGBT	1200 V	25 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	25 A	Inverter Diode	
T7	IGBT	1200 V	15 A	Brake Switch	
D7	FWD	1200 V	10 A	Brake Diode	
NTC	Thermistor			Thermistor	

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

Handling instruction
Handling instructions 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-P589-x4x-D4-14	04 Jan. 2018	Inverter diode Rth corrected to PSX-P7	3 , 9