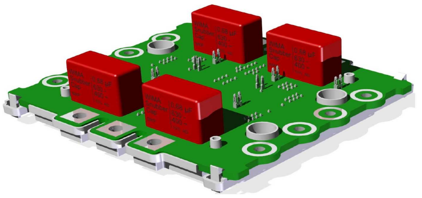
VINcoMNPC X4 1200 V / 300 A

Features

- Mixed-voltage NPC
- Low inductive
- High power screw interface
- Integrated DC-snubber capacitors

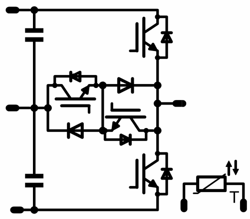
VINco X4 housing



Target Applications

- Solar inverter
- UPS
- High speed motor drive

Schematic



Types

- 70-W212NMA300SC-M208P

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck Switch (T1 , T4)					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	270	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		900	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	646	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
Turn off safe operating area (RBSOA)	I_{cmax}	V_{CE} max = 1200V T_{vj} max= 150°C		600	A
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Diode (D2 , D3)					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	244	A
Surge forward current	I_{FSM}	t_p = 10 ms, sine halfwave	T_{vj} < 150°C	698	A
I^2t-value	I^2t			2440	A^2s
Repetitive peak forward current	I_{FRM}	tP = 1 ms	T_{vj} < 150°C	600	A
Power dissipation per FWD	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	357	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Switch (T2 , T3)					
Collector-emitter breakdown voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	252	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		900	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	476	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	µs V
Turn off safe operating area (RBSOA)	I_{cmax}	V_{CE} max = 1200V T_{vj} max= 150°C		600	A
Maximum Junction Temperature	T_{jmax}			175	°C
Buck Diode (D1 , D4)					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	222	A
Surge forward current	I_{FSM}	t_p=10ms , sin 180°	T_j=150°C	1720	A
I^2t-value	I^2t			3700	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		900	A
Power dissipation per FWD	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	476	W
Maximum Junction Temperature	T_{jmax}			175	°C
DC link Capacitor					
Max.DC voltage	V_{MAX}		T_c=25°C	630	V
General Module Properties					
Material of module baseplate				Cu	
Material of internal isulation				Al2O3	
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_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative Tracking Index	CTI			>200	

*100% tested in production

Characteristic Values

Buck Switch (T1 , T4)

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
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,012	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		300	25 125	1,6	2,03 2,29	2,4	V
Collector-emitter cut-off current incl.	I_{CES}		0	1200		25			0,6	mA
Gate-emitter leakage current	I_{GES}		20	0		25			3000	nA
Integrated Gate resistor	R_{gint}							2,5		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 1 Ω R_{gon} = 1 Ω	±15	350	300	25 125		201 212		ns
Rise time	t_r					25 125		42 50		
Turn-off delay time	$t_{d(off)}$					25 125		260 318		
Fall time	t_f					25 125		50 82		
Turn-on energy loss	E_{on}					25 125		8 11		mWs
Turn-off energy loss	E_{off}					25 125		9 16		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		17600		pF
Output capacitance	C_{oss}							1160		
Reverse transfer capacitance	C_{rss}							940		
Gate charge	Q_G		15	960	300	25		1400		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						0,15		K/W

Boost Diode (D2 , D3)

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
FWD forward voltage	V_F				300	25 125	1,2	1,61 1,58	2,2	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 1 Ω	±15	350	300	25 125		180 217		A
Reverse recovery time	t_{rr}					25 125		154 274		ns
Reverse recovered charge	Q_{rr}					25 125		14 25		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		2014 1364		A/μs
Reverse recovered energy	E_{rec}					25 125		3 5		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						0,27		K/W

Boost Switch (T2 , T3)

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
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0048	25	5	5,8	6	V
Collector-emitter saturation voltage	V_{CEsat}		15		300	25 125	1	1,59 1,82	2,2	V
Collector-emitter cut-off incl.	I_{CES}		0	600		25			0,1	mA
Gate-emitter leakage current	I_{GES}		20	0		25			3000	nA
Integrated Gate resistor	R_{gint}							1		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 1 Ω R_{gon} = 1 Ω	±15	350	300	25 125		179 185		ns
Rise time	t_r					25 125		29 34		
Turn-off delay time	$t_{d(off)}$					25 125		231 258		
Fall time	t_f					25 125		43 65		
Turn-on energy loss	E_{on}					25 125		4 7		mWs
Turn-off energy loss	E_{off}					25 125		8 12		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		18800		pF
Output capacitance	C_{oss}							1200		
Reverse transfer capacitance	C_{rss}							580		
Gate charge	Q_G		15	480	75	25		1860		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						0,20		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	
Buck Diode (D1 , D4)										
FWD forward voltage	V_F				300	25 125	1	2,28 2,40	2,9	V
Reverse leakage current	I_r			1200		25			480	µA
Peak reverse recovery current	I_{RRM}					25 125		309 384		A
Reverse recovery time	t_{rr}					25 125		62 152		ns
Reverse recovered charge	Q_{rr}	R_{gon} = 1 Ω	±15	350	300	25 125		18 36		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		14916 10204		A/µs
Reverse recovery energy	E_{rec}					25 125		4 9		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						0,20		K/W
DC link Capacitor										
C value	C							2 * 0,68		µF
Stray inductance of on board capacitors	ESL							26/2		nH
Series resistance of on board capacitors	ESR							14/2		mΩ
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
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						25			B	
Module Properties										
Module inductance (from chips to PCB)	L_{sCE}							5		nH
Module inductance (from PCB to PCB using Intercon	L_{sCE}							3		nH
Resistance of Intercon boards (from PCB to PCB usir	$Rcc'_{1+EE'}$	Tc=25°C, per switch						1,5		mΩ
Mounting torque	M	Screw M4 - mounting according to valid application note VINcoX-*-HI					2		2,2	Nm
Mounting torque	M	Screw M5 - mounting according to valid application note VINcoX-*-HI					4		6	Nm
Terminal connection torque	M	Screw M6 - mounting according to valid application note VINcoX-*-HI					2,5		5	Nm
Weight	G								710	g

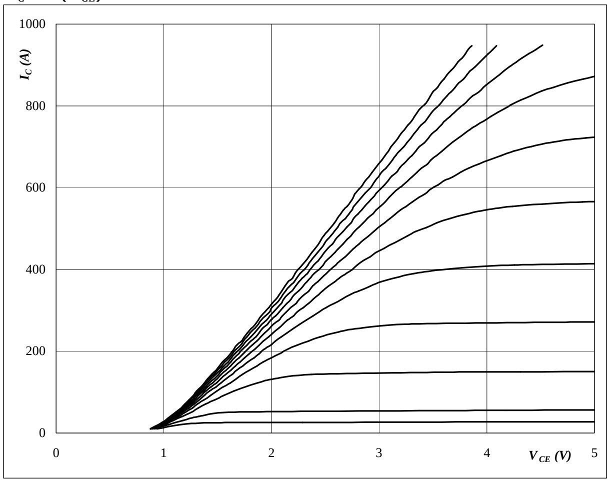
Buck

half bridge IGBT and neutral point FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

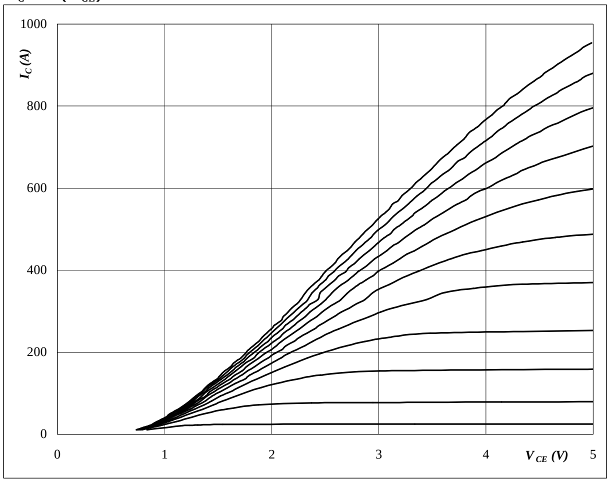
T_j = 25 °C

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

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

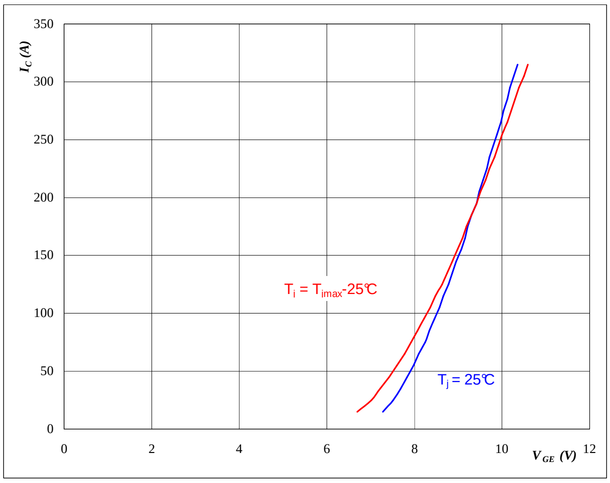
T_j = 125 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

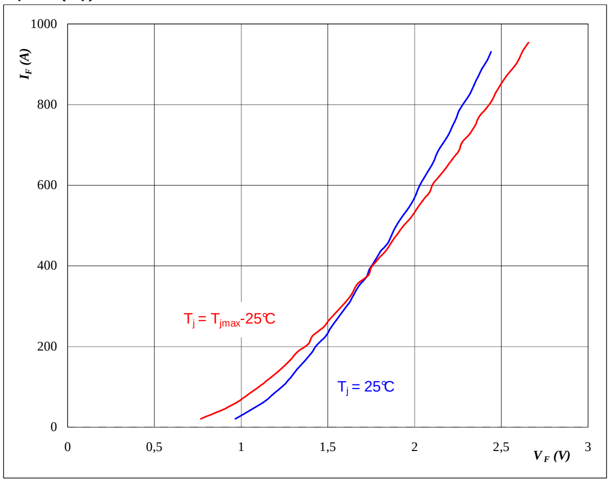
t_p = 350 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

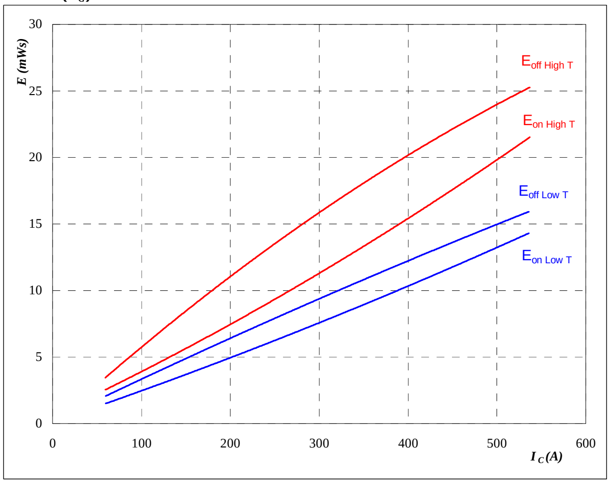
Buck

half bridge IGBT and neutral point FWD

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



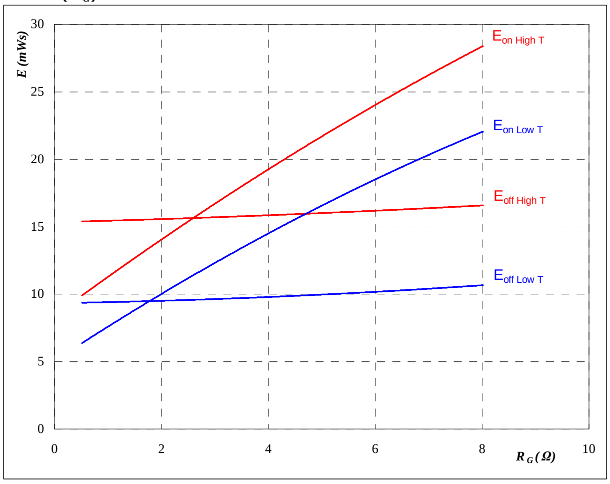
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



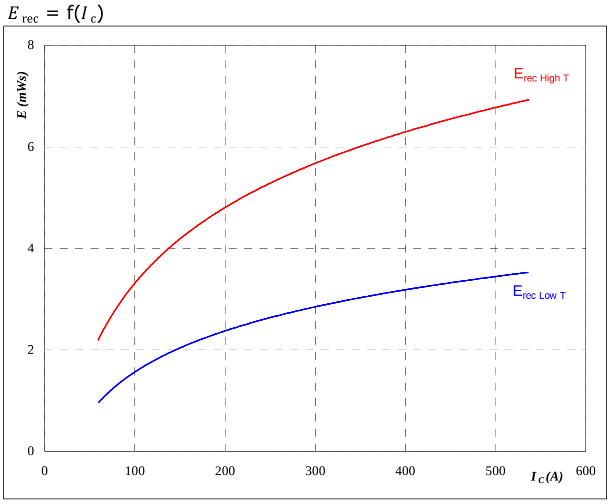
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

figure 7. **FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



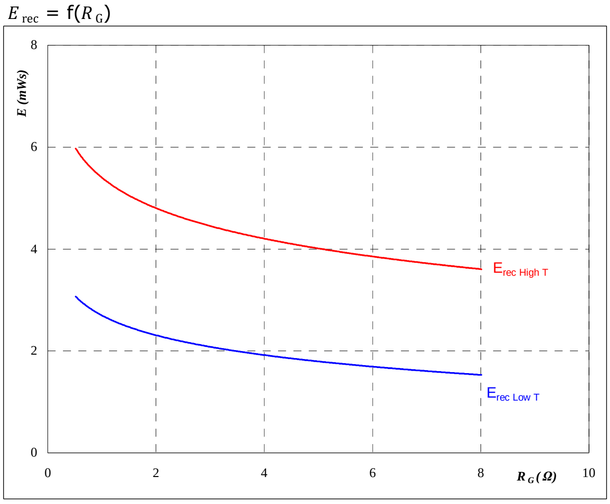
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 8. **FWD**

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

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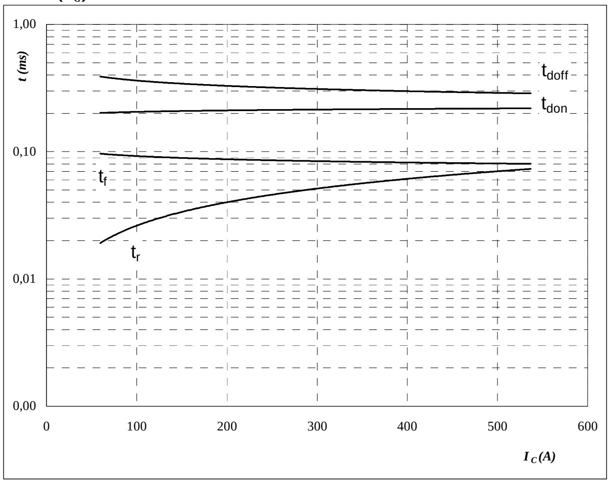
Buck

half bridge IGBT and neutral point FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



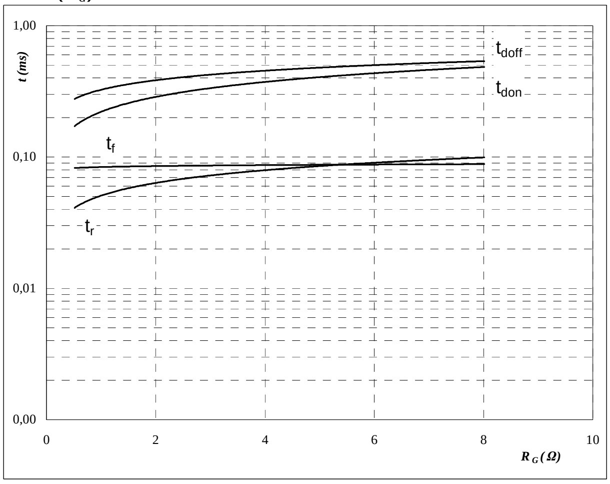
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



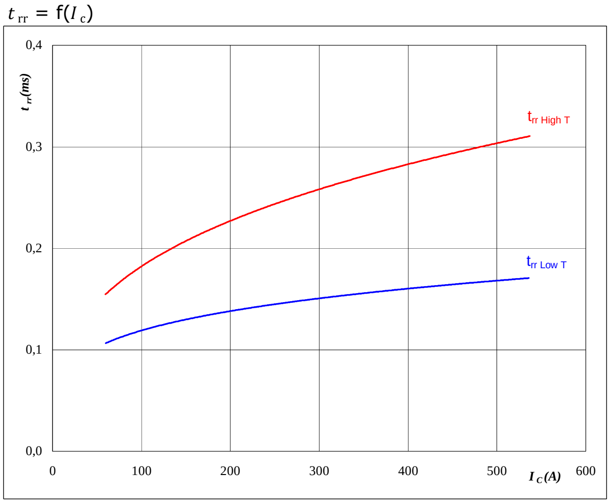
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



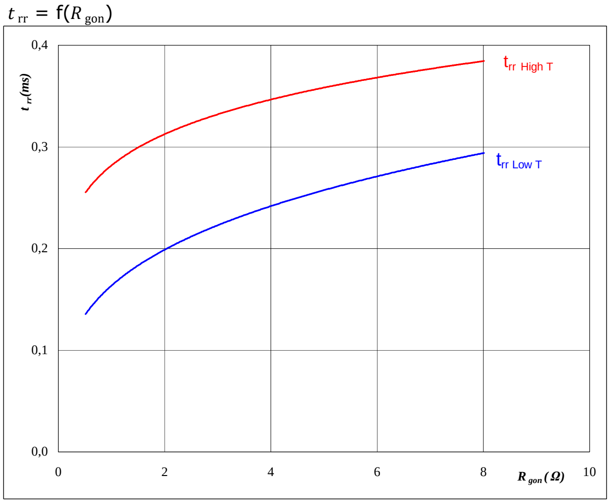
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 12. **FWD**

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

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



At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

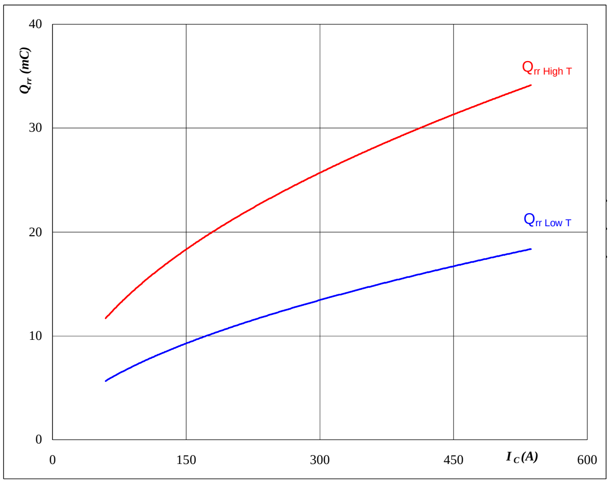
Buck

half bridge IGBT and neutral point FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



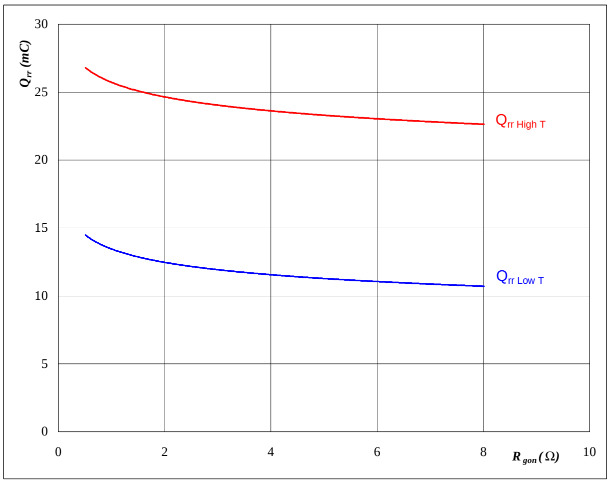
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 14. **FWD**

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

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



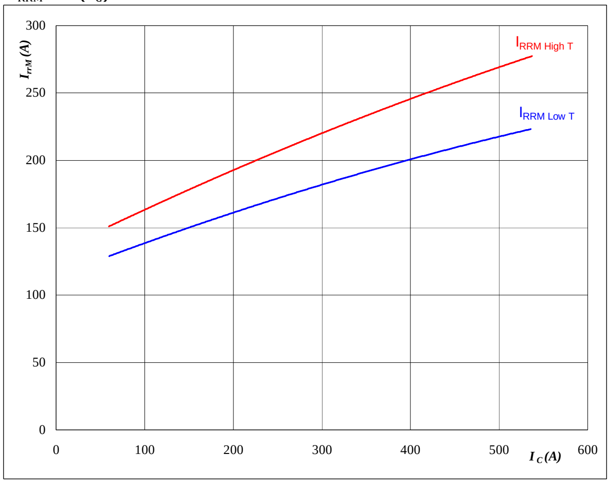
At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



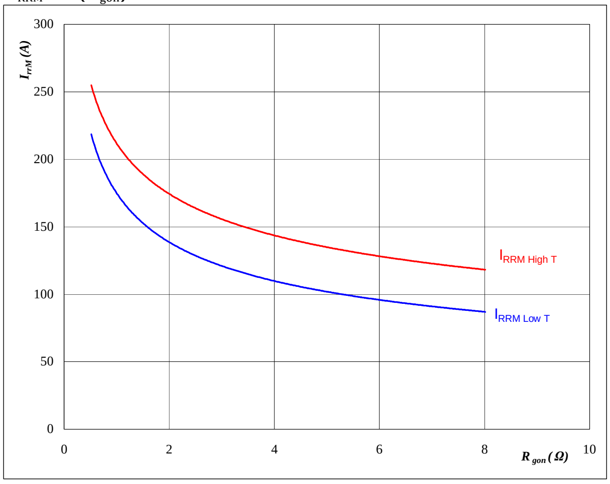
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 16. **FWD**

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

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



At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

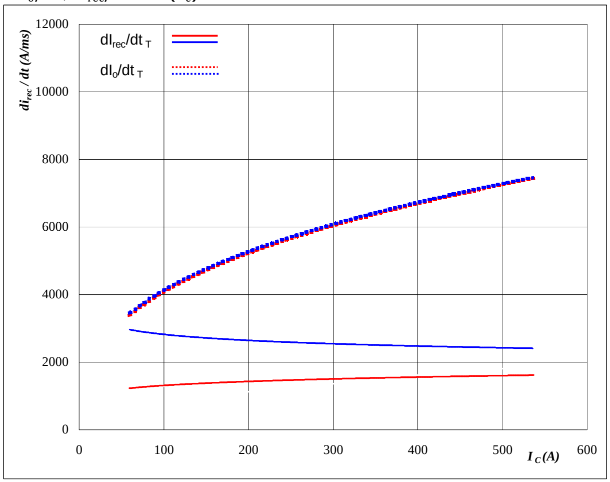
Buck

half bridge IGBT and neutral point FWD

figure 17. FWD

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

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



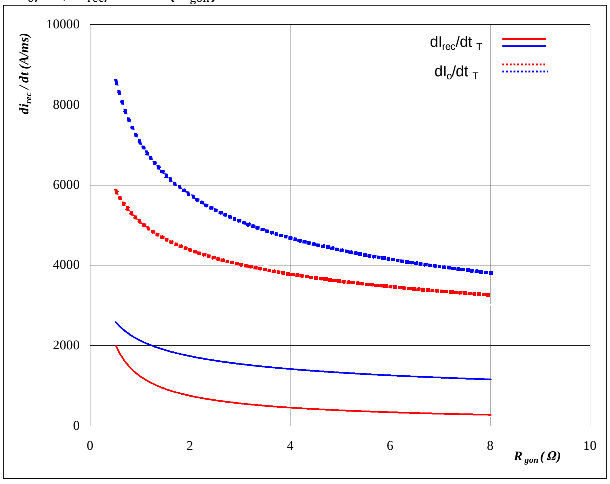
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 18. FWD

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

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



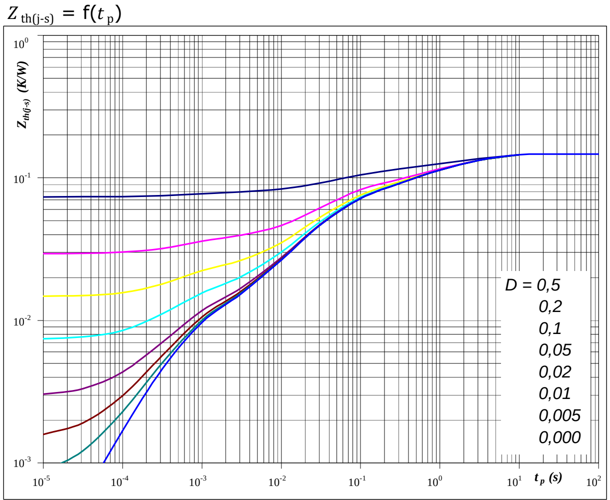
At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

figure 19. IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,15	K/W

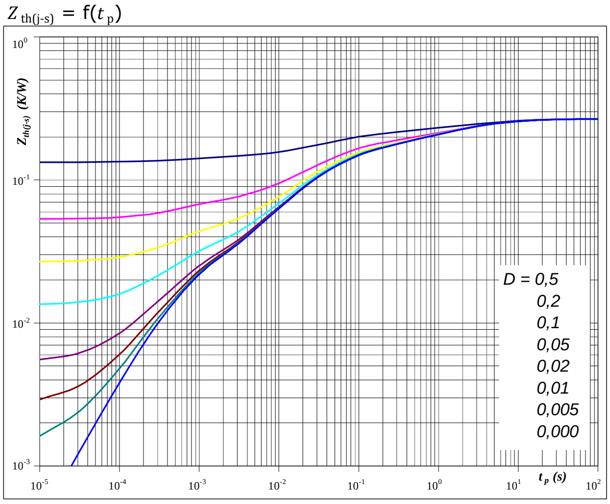
IGBT thermal model values

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

figure 20. FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,27	K/W

FWD thermal model values

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

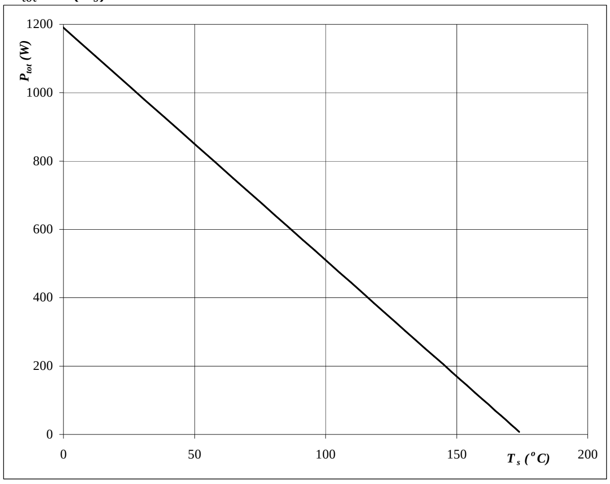
Buck

half bridge IGBT and neutral point FWD

figure 21.	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



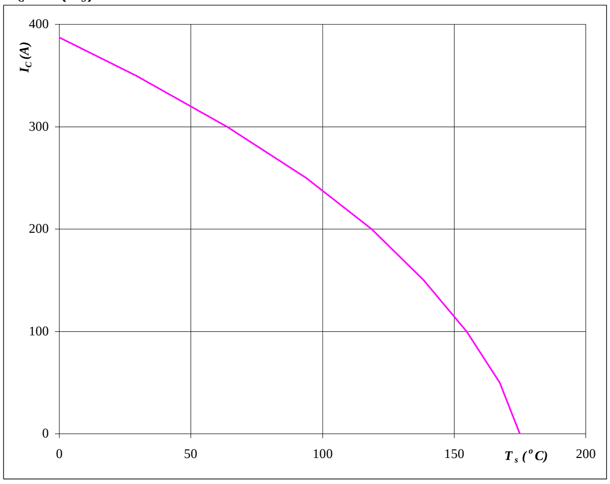
At

T_j = 175 °C

figure 22.	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

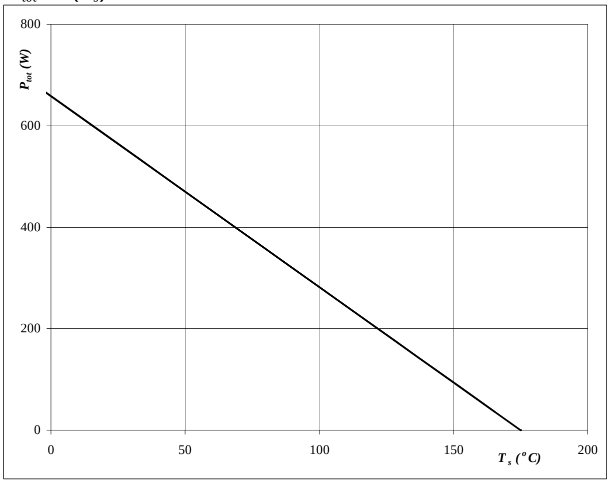
T_j = 175 °C

V_{GE} = 15 V

figure 23.	FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



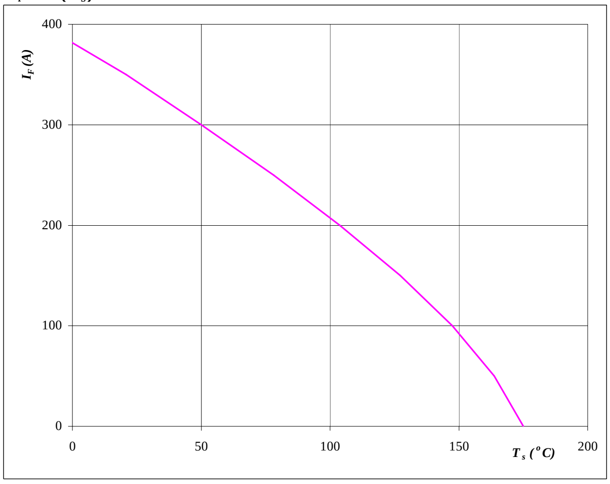
At

T_j = 175 °C

figure 24.	FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

T_j = 175 °C

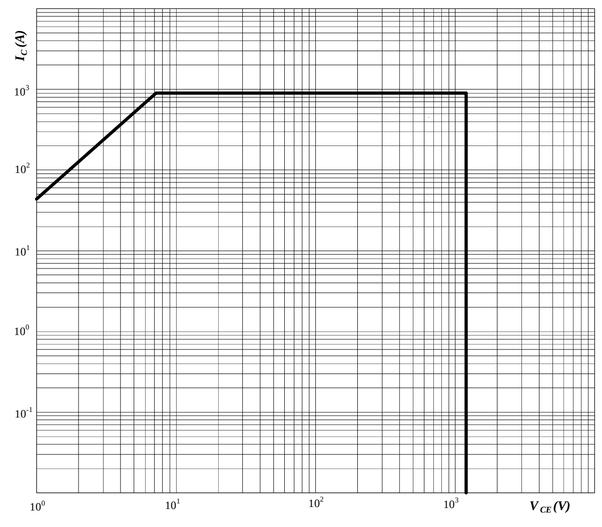
Buck

half bridge IGBT and neutral point FWD

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



At

D = single pulse

T_s = 80 ºC

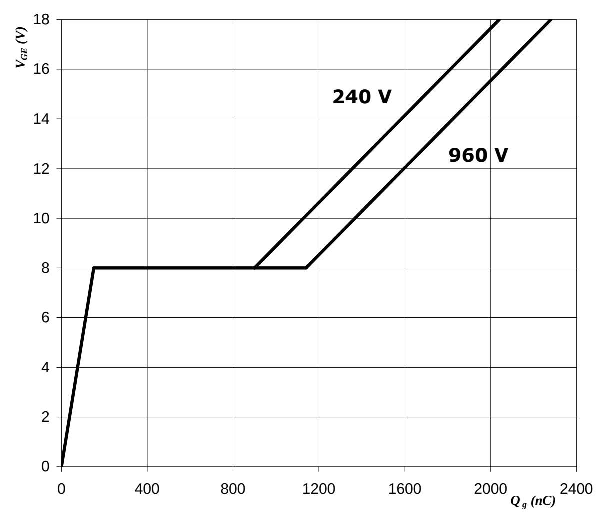
V_{GE} = ±15 V

T_j = T_{jmax}

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



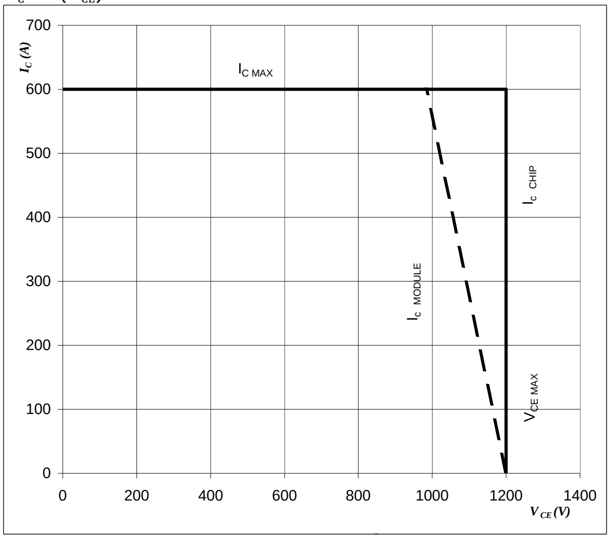
At

I_C = 300 A

figure 27. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

Switching mode : 3 level switching

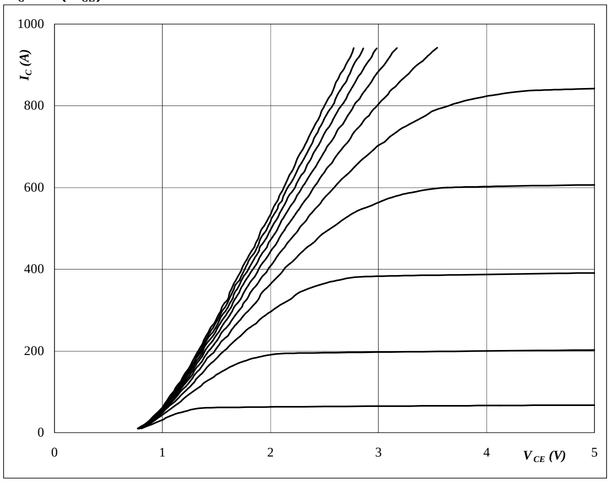
Boost

neutral point IGBT and half bridge FWD

figure 1.	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

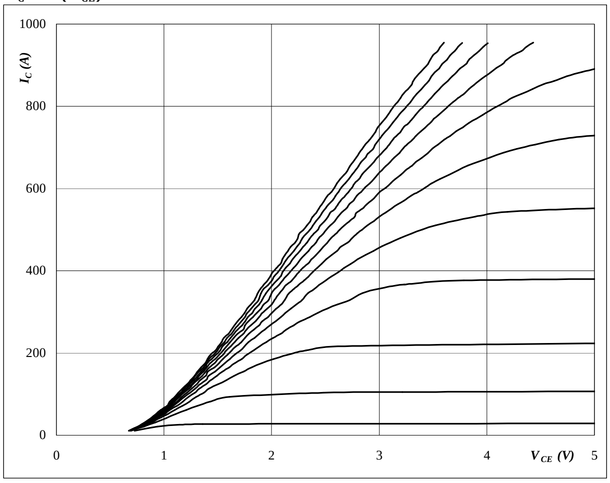
T_j = 25 °C

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

figure 2.	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

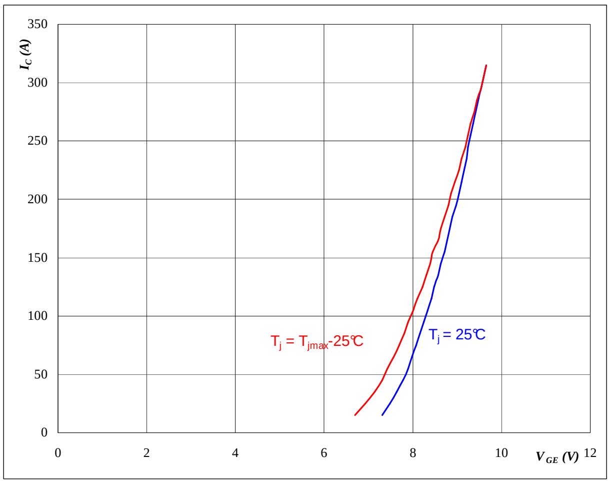
T_j = 125 °C

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

figure 3.	**IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

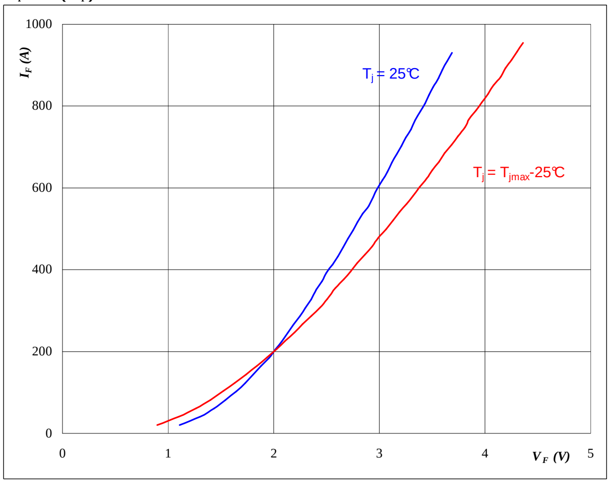
t_p = 350 µs

V_{CE} = 10 V

figure 4.	**FWD**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

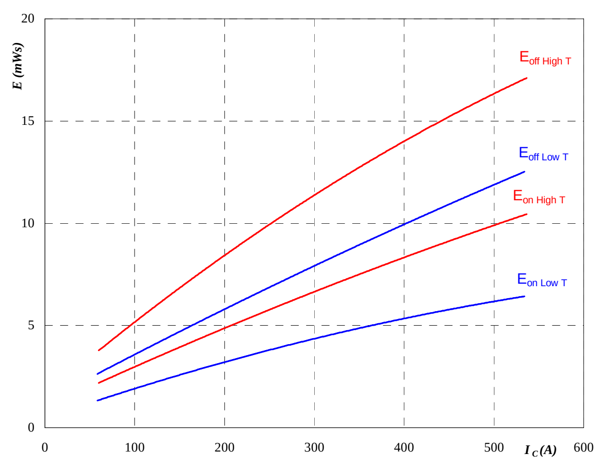
Boost

neutral point IGBT and half bridge FWD

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



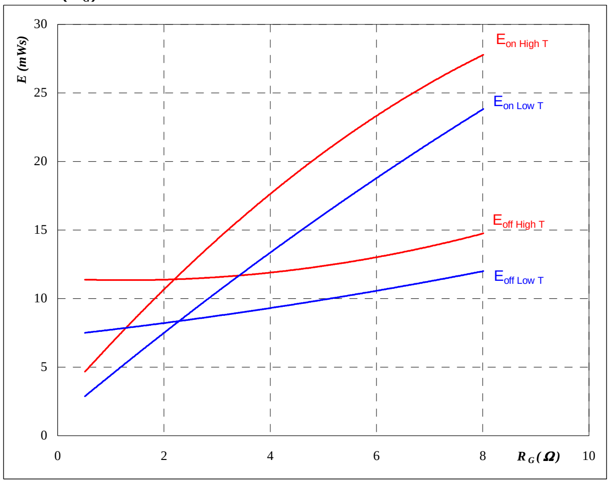
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



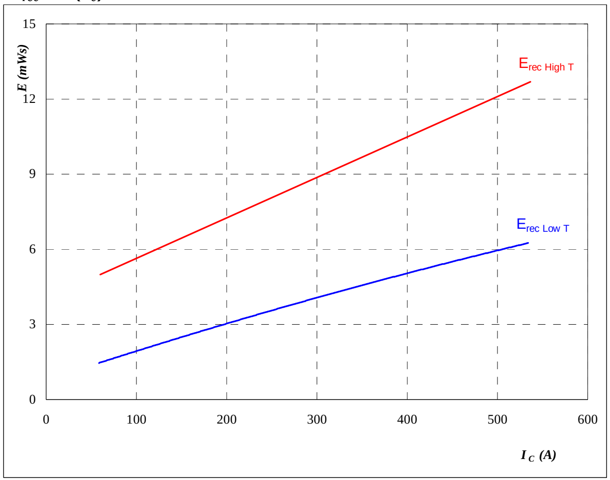
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



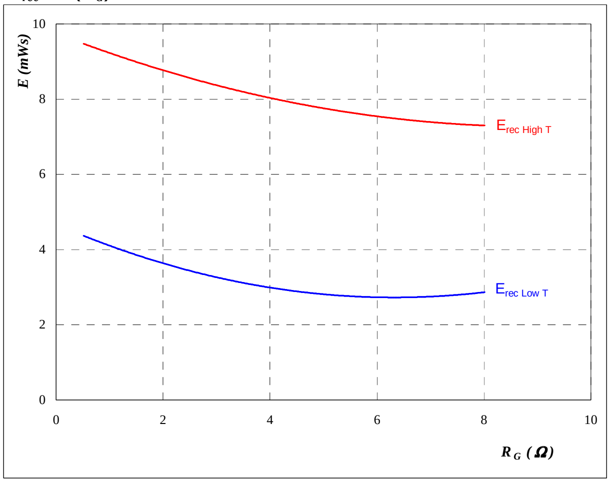
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 8. **FWD**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

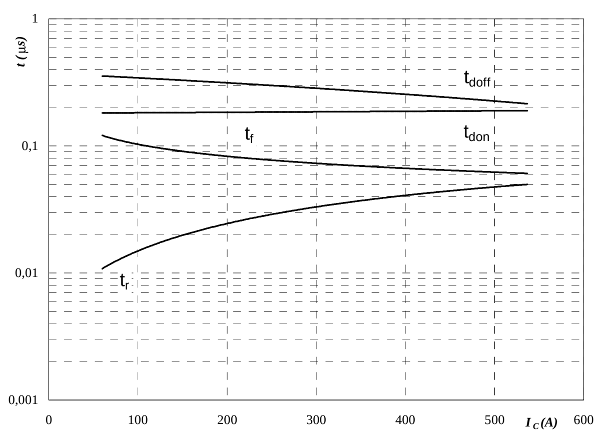
Boost

neutral point IGBT and half bridge FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



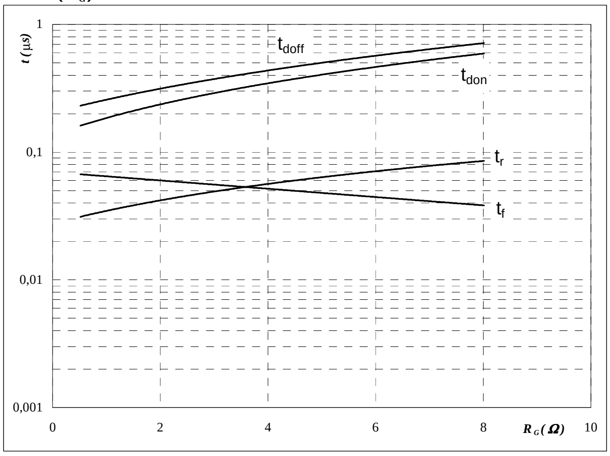
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



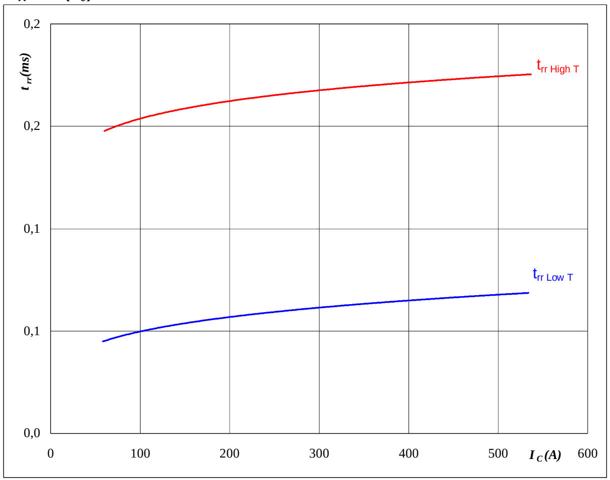
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



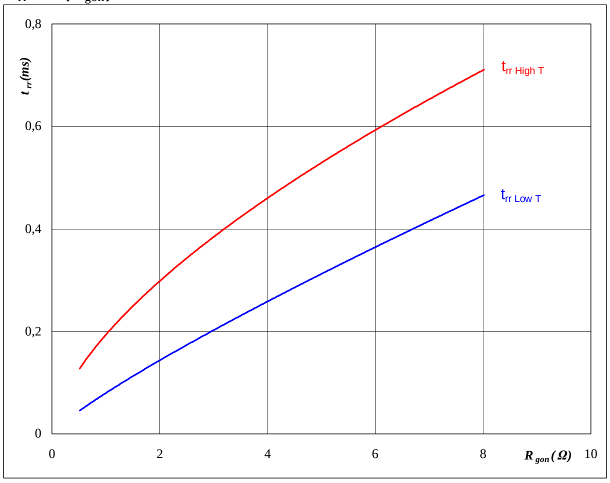
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 12. **FWD**

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

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



At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

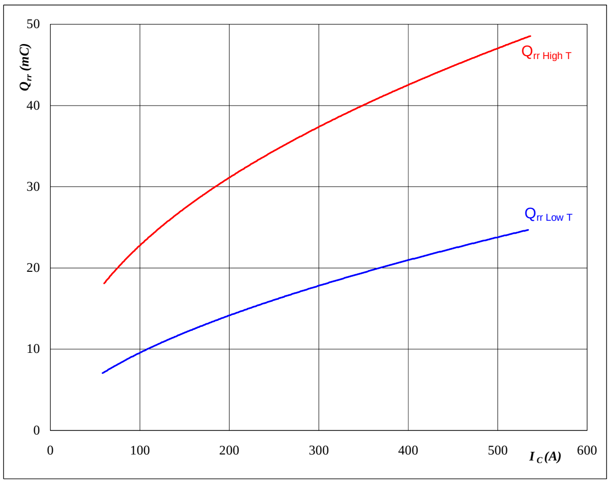
Boost

neutral point IGBT and half bridge FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



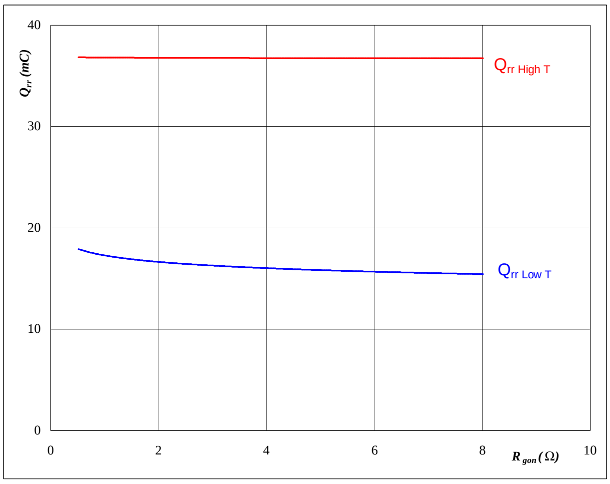
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 14. **FWD**

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

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



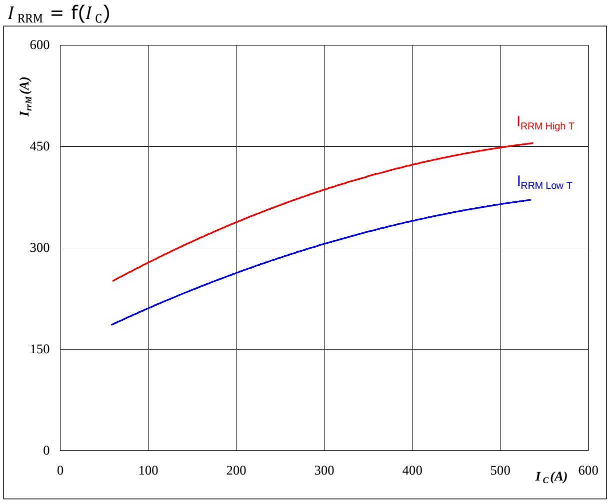
At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



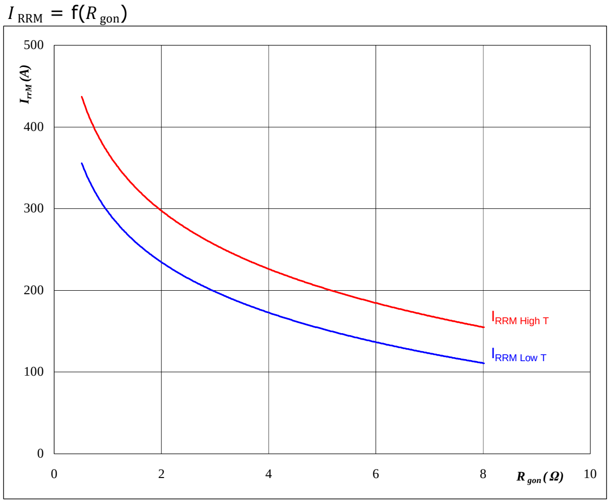
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 16. **FWD**

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

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



At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

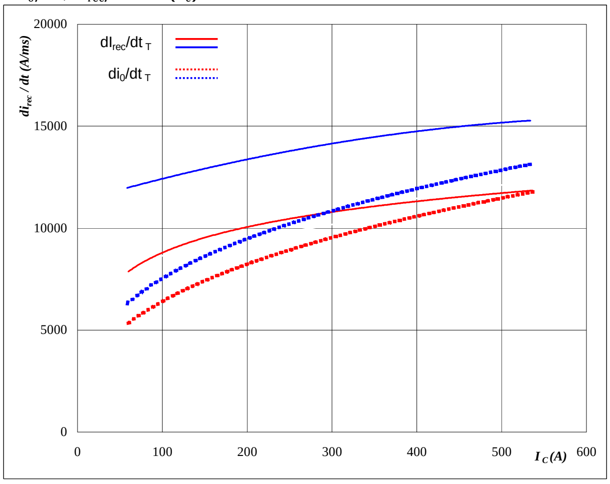
Boost

neutral point IGBT and half bridge FWD

figure 17.	FWD

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

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



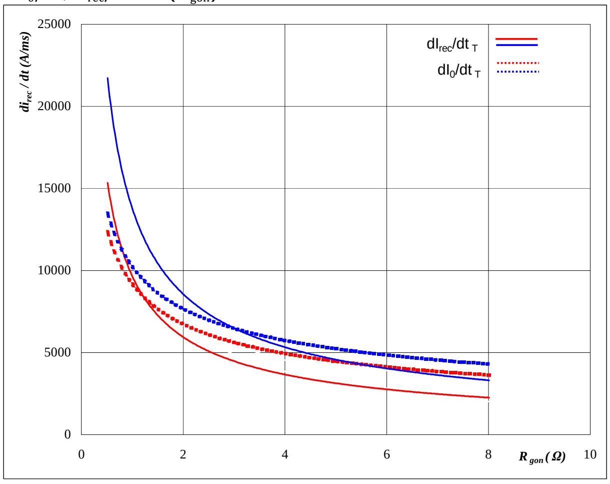
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	1	Ω

figure 18.	FWD

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

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



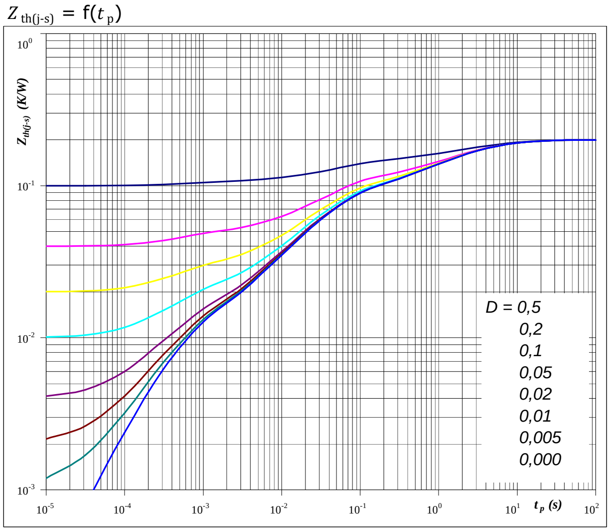
At

T_j =	25/125	°C
V_R =	350	V
I_F =	300	A
V_{GE} =	±15	V

figure 19.	IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,20	K/W

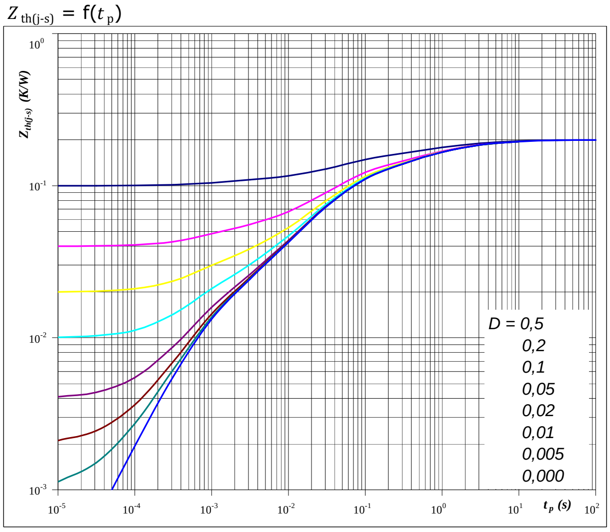
IGBT thermal model values

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

figure 20.	FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,20	K/W

FWD thermal model values

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

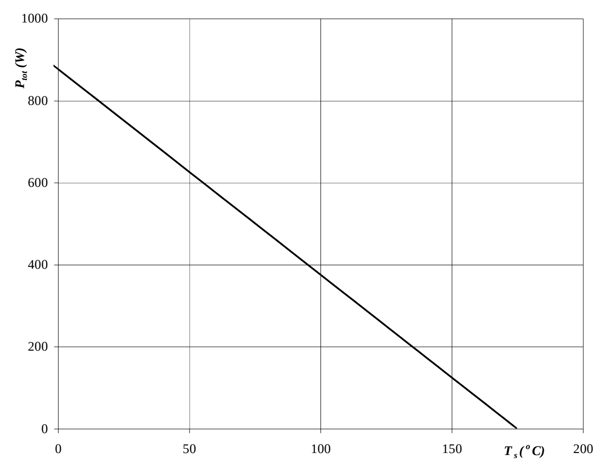
Boost

neutral point IGBT and half bridge FWD

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



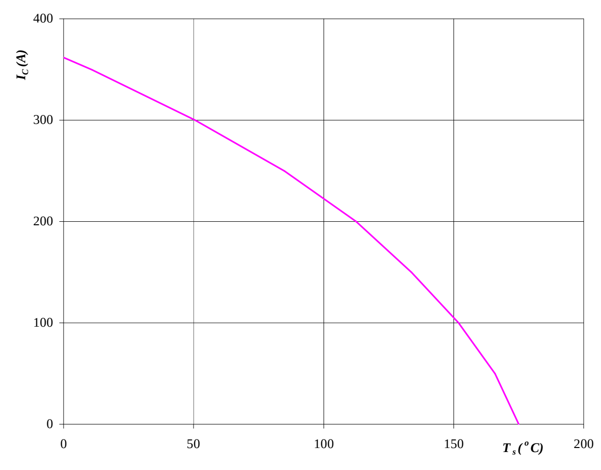
At

T_j = 175 ºC

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

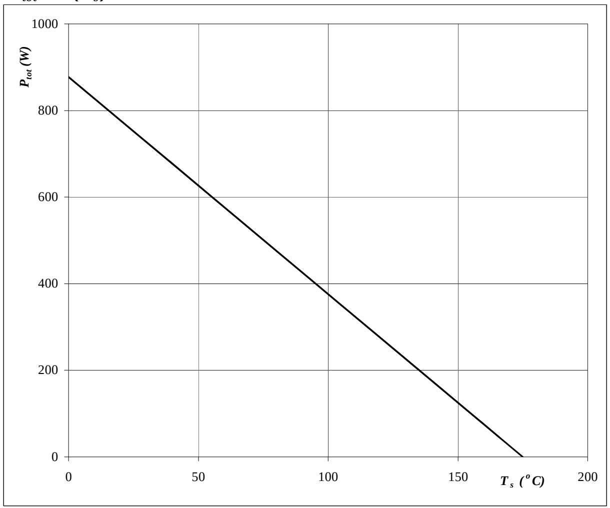
T_j = 175 ºC

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



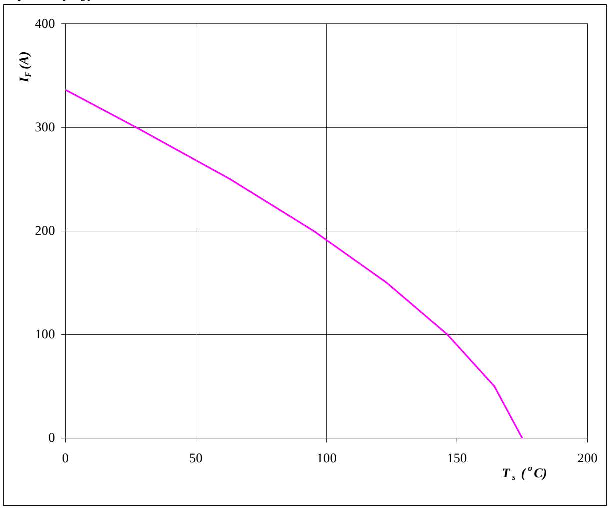
At

T_j = 175 ºC

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

T_j = 175 ºC

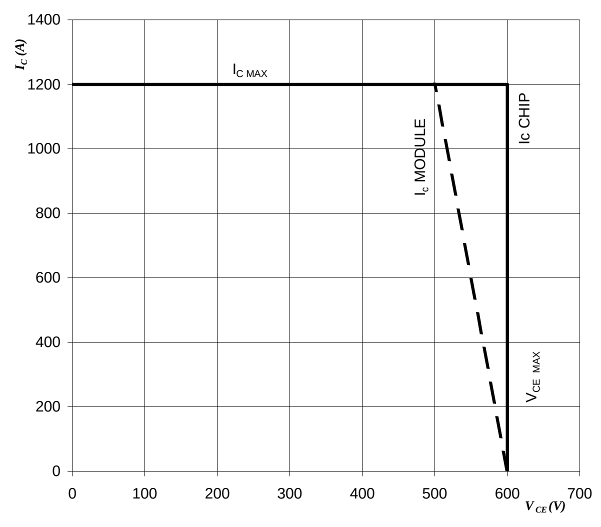
Boost

neutral point IGBT

figure 25. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

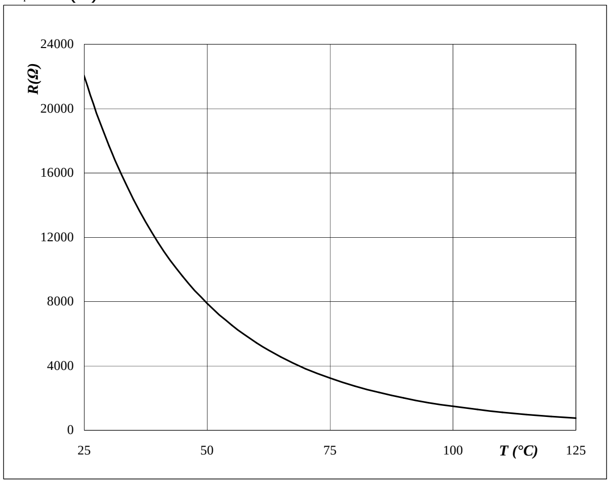
Switching mode : 3 level switching

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

R_T = f(T)



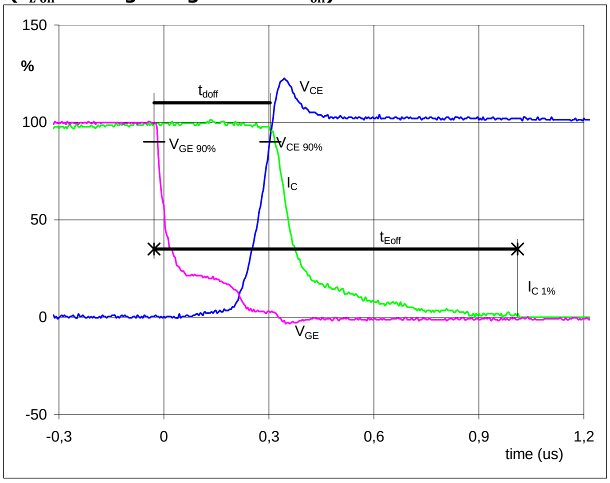
Switching Definitions Buck IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1. **IGBT**

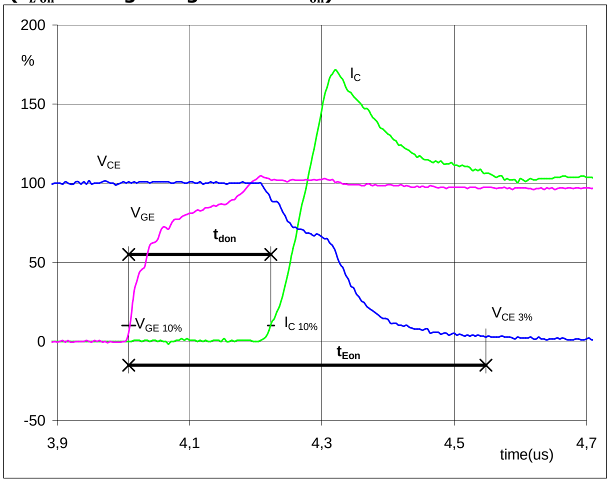
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	400	A
t_{doff} =	0,32	μs
$t_{E\,off}$ =	1,04	μs

figure 2. **IGBT**

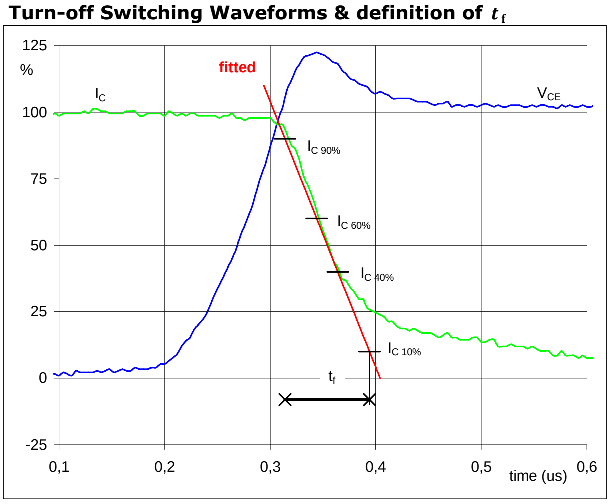
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	400	A
t_{don} =	0,21	μs
$t_{E\,on}$ =	0,54	μs

figure 3. **IGBT**

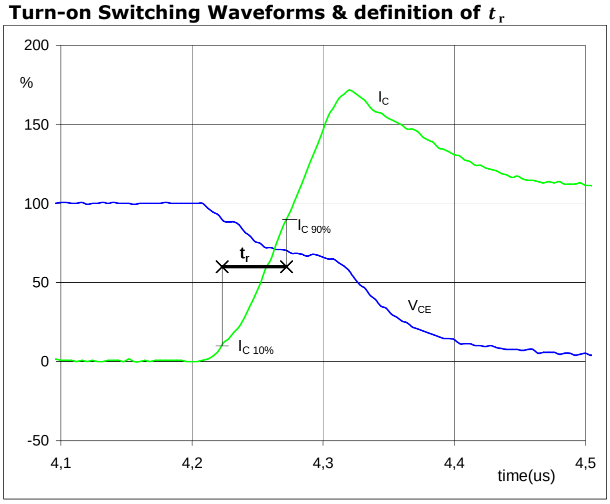
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	400	A
t_f =	0,08	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

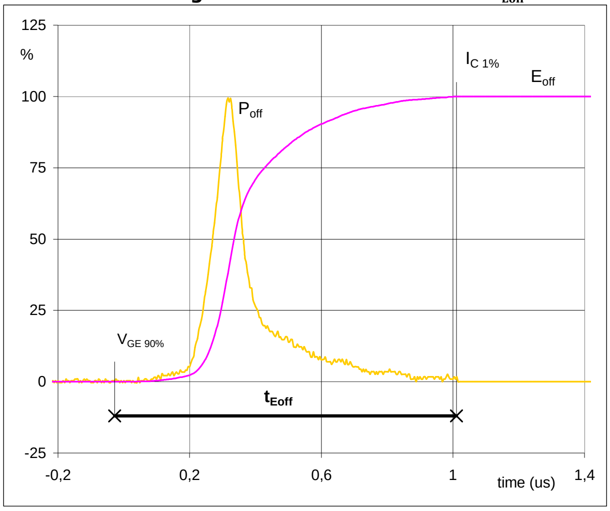


V_C (100%) =	350	V
I_C (100%) =	400	A
t_r =	0,05	μs

Switching Definitions Buck IGBT

figure 5. **IGBT**

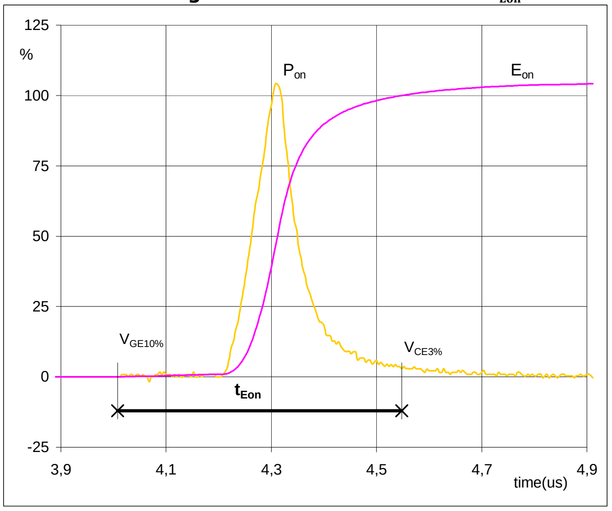
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	140	kW
E_{off} (100%) =	15,62	mJ
$t_{E\,off}$ =	1,04	μs

figure 6. **IGBT**

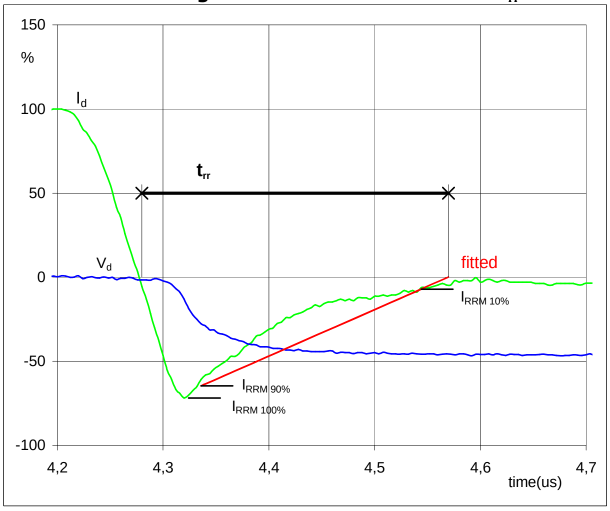
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	140	kW
E_{on} (100%) =	11,38	mJ
$t_{E\,on}$ =	0,54	μs

figure 7. **FWD**

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

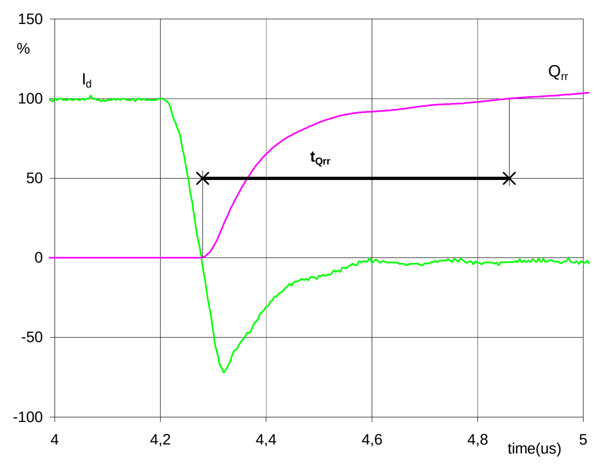


V_d (100%) =	350	V
I_d (100%) =	400	A
I_{RRM} (100%) =	-217	A
t_{rr} =	0,27	μs

Switching Definitions Buck IGBT

figure 8. **FWD**

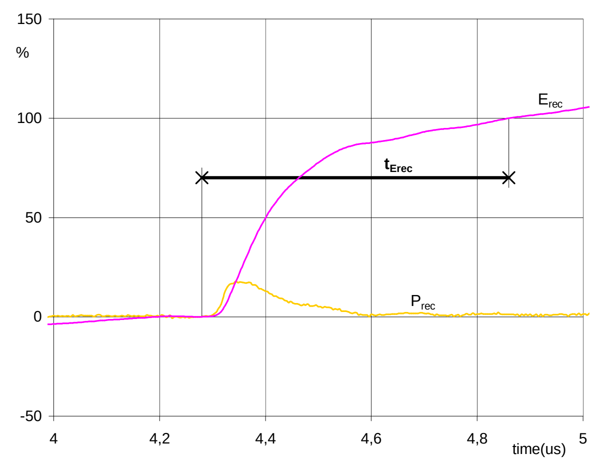
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	400	A
Q_{rr} (100%) =	25,32	μC
t_{Qrr} =	0,58	μs

figure 9. **FWD**

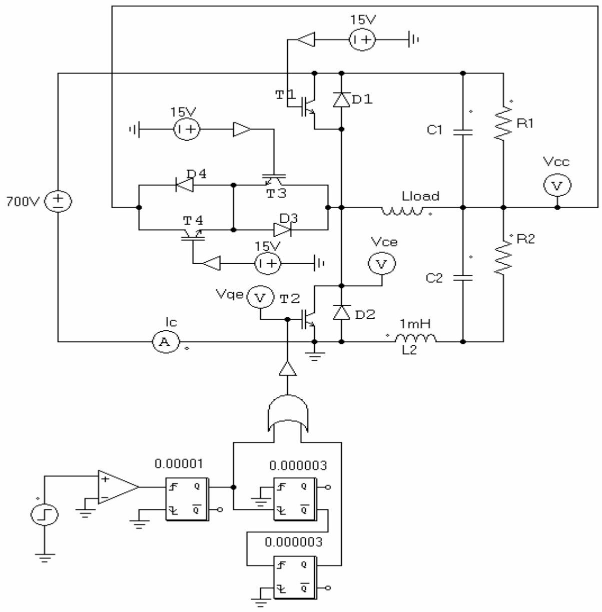
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	140	kW
E_{rec} (100%) =	5,33	mJ
t_{Erec} =	0,58	μs

Buck IGBT switching measurement circuit

figure 10.



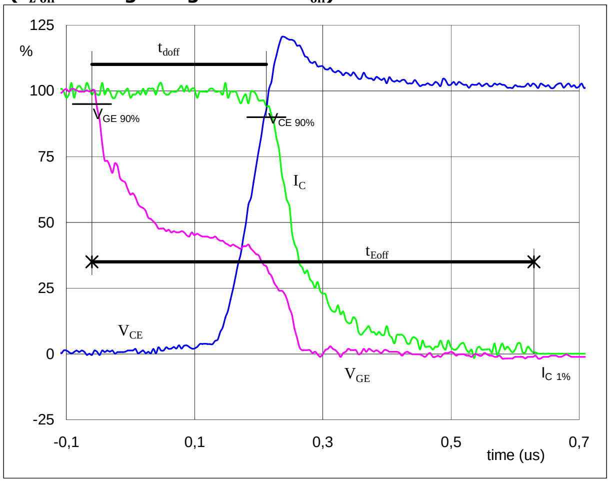
Switching Definitions Boost IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1. **IGBT**

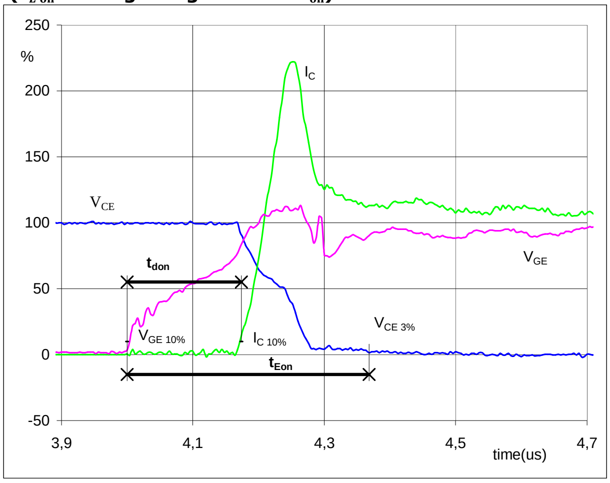
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	302	A
t_{doff} =	0,23	μs
$t_{E off}$ =	0,58	μs

figure 2. **IGBT**

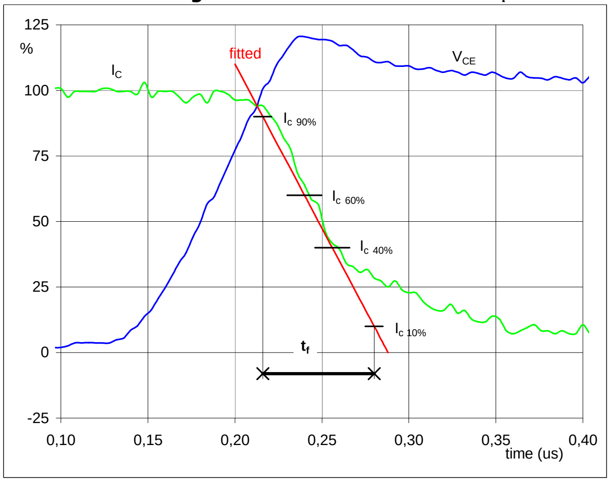
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	302	A
t_{don} =	0,19	μs
$t_{E on}$ =	0,38	μs

figure 3. **IGBT**

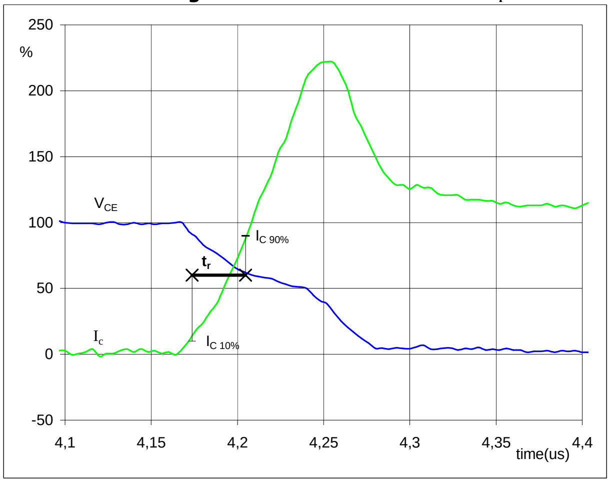
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	302	A
t_f =	0,065	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

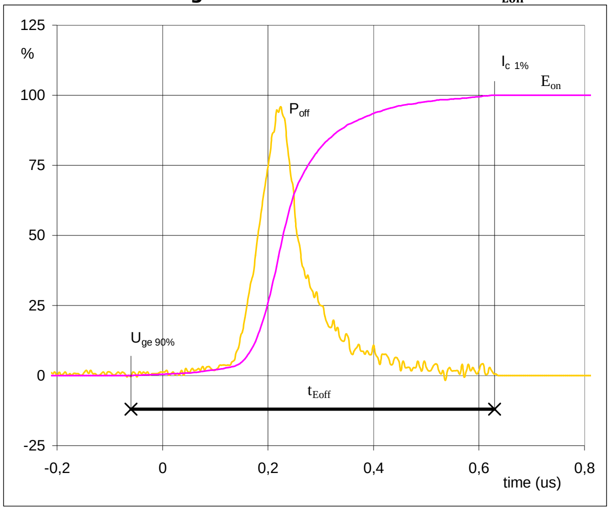


V_C (100%) =	350	V
I_C (100%) =	302	A
t_r =	0,034	μs

Switching Definitions Boost IGBT

figure 5. **IGBT**

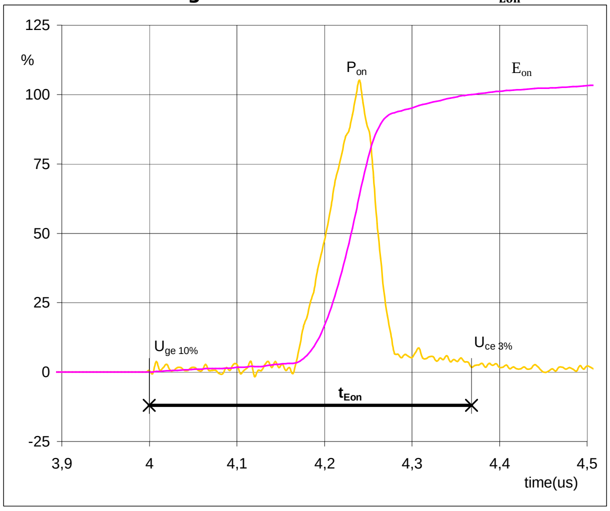
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	106	kW
E_{off} (100%) =	11,52	mJ
$t_{E\,off}$ =	0,58	μs

figure 6. **IGBT**

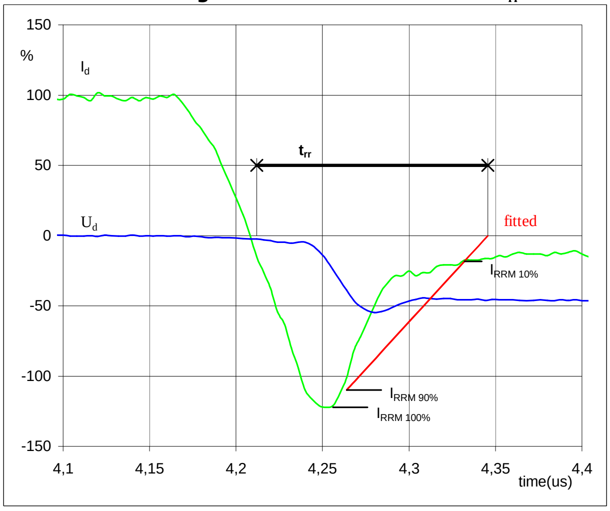
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	106	kW
E_{on} (100%) =	13,39	mJ
$t_{E\,on}$ =	0,38	μs

figure 7. **FWD**

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

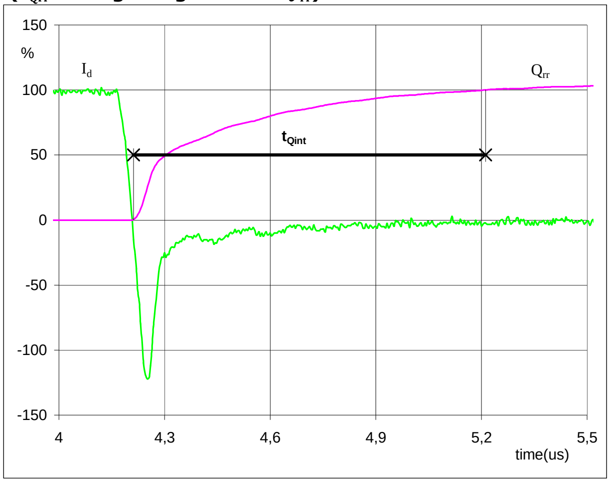


V_d (100%) =	350	V
I_d (100%) =	302	A
I_{RRM} (100%) =	-384	A
t_{rr} =	0,15	μs

Switching Definitions Boost IGBT

figure 8.	FWD

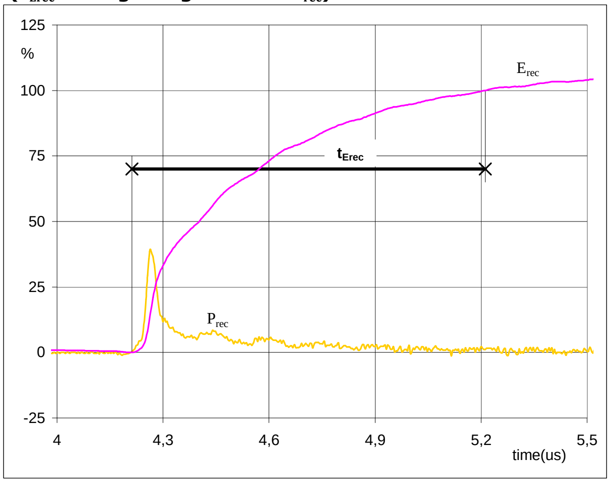
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	302	A
Q_{rr} (100%) =	35,60	µC
t_{Qint} =	0,33	µs

figure 9.	FWD

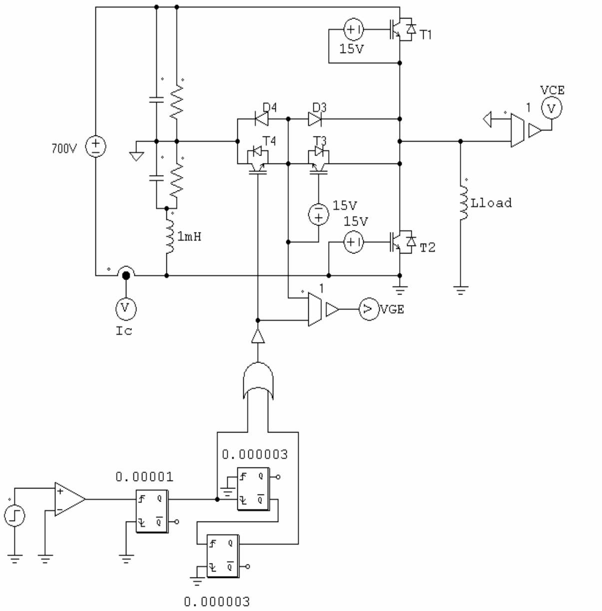
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	106	kW
E_{rec} (100%) =	8,89	mJ
$t_{E\,rec}$ =	0,33	µs

Boost IGBT switching measurement circuit

figure 10.



Ordering Code & Marking

Version	Ordering Code
without PCM	70-W612M3A300SC-M208P
with PCM	70-W612M3A300SC-M208P-/3/

Marking							
Name Date code Lot Serial Vincotech UL	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

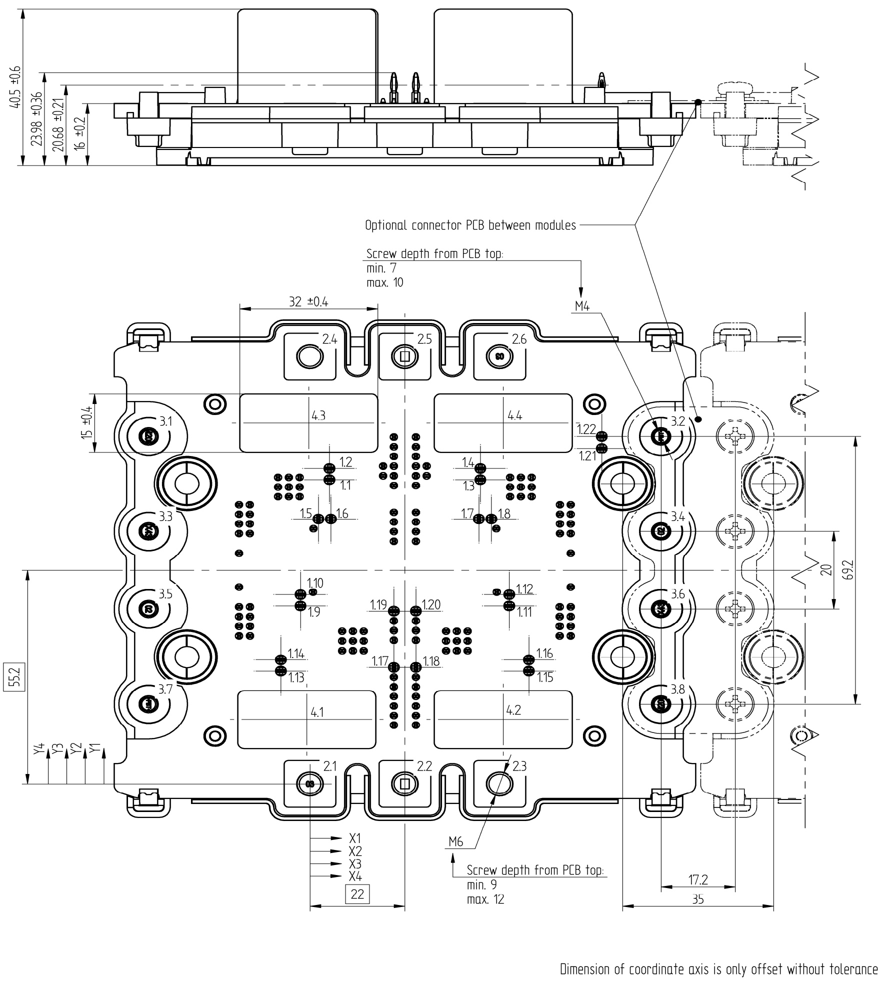
Outline

Driver pins			
Pin	X1	Y1	Function
1.1	4,5	78,65	G1-1
1.2	4,5	81,55	E1-1
1.3	39,5	78,65	G1-2
1.4	39,5	81,55	E1-2
1.5	1,95	68,4	E2-1
1.6	4,85	68,4	G2-1
1.7	39,15	68,4	G2-2
1.8	42,05	68,4	E2-2
1.9	-2,2	46	G3-1
1.10	-2,2	48,9	E3-1
1.11	46,2	46	G3-2
1.12	46,2	48,9	E3-2
1.13	-6,75	29,2	E4-1
1.14	-6,75	32,1	G4-1
1.15	50,75	29,2	E4-2
1.16	50,75	32,1	G4-2
1.17	19,45	30,15	Desat-DC+
1.18	24,55	30,15	Desat-DC+
1.19	19,45	44,65	Desat-GND
1.20	24,55	44,65	Desat-GND
1.21	67,65	86,7	NTC
1.22	67,65	89,8	NTC

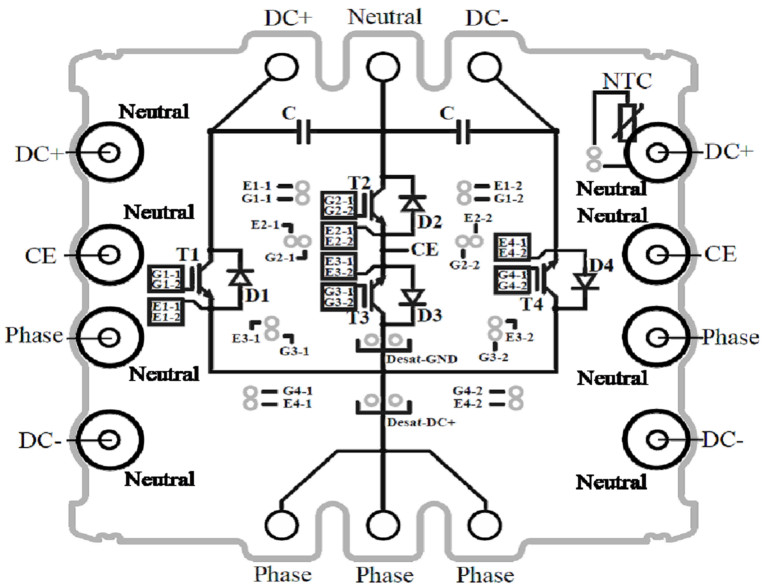
Capacitor positions		
Capacitor	X4	Y4
4.1	-0,75	16,65
4.2	44,8	16,65
4.3	-0,3	93,25
4.4	44,8	93,25

Power interconnections			
M6 screw	X2	Y2	Function
2.1	0	0	Phase
2.2	22	0	Phase
2.3	44	0	Phase
2.4	0	110,4	DC+
2.5	22	110,4	Neutral
2.6	44	110,4	DC-

Low current connections			
M4 screw	X3	Y3	Function
3.1	-37,4	89,8	DC+
3.2	81,4	89,8	DC+
3.3	-37,4	65,2	CE
3.4	81,4	65,2	CE
3.5	-37,4	45,2	Phase
3.6	81,4	45,2	Phase
3.7	-37,4	20,6	DC-
3.8	81,4	20,6	DC-



Pinout



NOTE: Driver pins for parallel devices are not connectedinside the module!
Gx-1 to Gx-2 and Ex-1 to Ex-2 shall br connected on customer PCB!
Where x = 1 to 4

Identification

ID	Component	Voltage	Current	Function	Comment
T1, T4	IGBT	1200 V	300 A	Buck Switch	
T2, T3	IGBT	600 V	300 A	Boost Switch	
D2, D3	FWD	600 V	300 A	Buck Diode	
D1, D4	FWD	1200 V	300 A	Boost Diode	
C	Capacitor	630 V		DC Link Capacitor	
NTC	NTC			Thermistor	

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

Handling instruction
Handling instructions for VINco X4 packages see vincotech.com website.

Package data
Package data for VINco X4 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.

*10 without PCM
6 with PCM

Document No.:	Date:	Modification:	Pages
70-W612M3A300SC-M208P-D6-14	18 Jan. 2018		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.