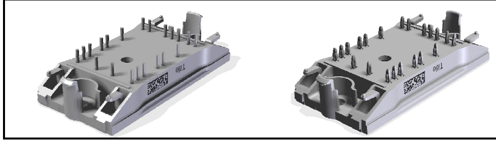
10-FZ06NRA084FP02-P969F78
10-PZ06NRA084FP02-P969F78Y

flow **NPC 0** **600V/75A & 99mΩ PS***

Features

- *PS: 75A parallel switch (75A and 99mΩ MOSFET)
- neutral point clamped inverter
- reactive power capability
- low inductance layout

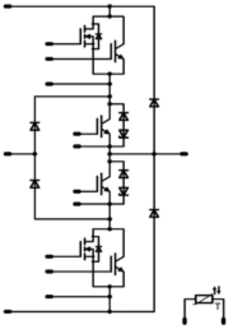
flow 0 12mm housing



Target Applications

- solar inverter
- UPS

Schematic



Types

- 10-FZ06NRA084FP03-P969F78
- 10-PZ06NRA084FP03-P969F78Y

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Inv. Diode					
Repetitive peak reverse voltage	V_{RRM}			600	V
Forward current per diode	I_{FAV}	DC current	T_h=80℃ T_c=80℃	7 11	A
Maximum repetitive forward current	I_{FRM}	t_p=10ms	T_j=25℃	20	A
I2t-value	I^2t			9,5	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	44 66	W
Maximum Junction Temperature	$T_j$max			175	℃
Buck IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	61 80	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		225	A
Turn off safe operating area				225	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	108 163	W
Gate-emitter peak voltage	V_{GE}			±20	V
Maximum Junction Temperature	$T_j$max			175	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Buck Diode				
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃	600	V
DC forward current	I_F	T_j=$T_j$max T_h=80℃ T_c=80℃	25 34	A
Non-repetitive Peak Surge Current	I_{FSM}	60Hz Single Half-Sine Wave	300	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max T_h=80℃ T_c=80℃	40 61	W
Maximum Junction Temperature	$T_j$max		150	℃
Buck MOSFET				
Drain to source breakdown voltage	V_{DS}		600	V
DC drain current	I_D	T_j=$T_j$max T_h=80℃ T_c=80℃	17 21	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max	112	A
Power dissipation	P_{tot}	T_j=$T_j$max T_h=80℃ T_c=80℃	60 91	W
Gate-source peak voltage	Vgs		±20	V
Maximum Junction Temperature	$T_j$max		150	℃
Boost IGBT				
Collector-emitter break down voltage	V_{CE}		600	V
DC collector current	I_C	T_j=$T_j$max T_h=80℃ T_c=80℃	58 75	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$ma	225	A
Turn off safe operating area			225	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max T_h=80℃ T_c=80℃	93 141	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V	6 360	µs V
Maximum Junction Temperature	$T_j$max		175	℃
Boost Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	T_j=$T_j$max T_h=80℃ T_c=80℃	22 29	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max, 20 kHz Square Wave	70	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max T_h=80℃ T_c=80℃	51 77	W
Maximum Junction Temperature	$T_j$max		175	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	℃
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost Inv. Diode										
Forward voltage	V_F				10	Tj=25℃ Tj=125℃		9,44 7,24		V
Threshold voltage (for power loss calc. only)	V_{to}				10	Tj=25℃ Tj=125℃		8,32 6,62		V
Slope resistance (for power loss calc. only)	r_t				10	Tj=25℃ Tj=125℃		0,11 0,06		Ω
Reverse current	I_r			600		Tj=25℃ Tj=125℃			0,027	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,17		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,43		
Buck IGBT *										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,00025	Tj=25℃ Tj=125℃	3,5	4,5	6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	Tj=25℃ Tj=125℃		1,69 1,87	2,5	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25℃ Tj=125℃			250	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃			±400	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance **	C_{ies}	f=1MHz	0	25		Tj=25℃		4+4,7		nF
Output capacitance	C_{oss}							400		pF
Reverse transfer capacitance	C_{rss}							115		
Gate charge**	Q_{Gate}		15	480	75	Tj=25℃		248+70		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,88		K/W

* see dinamic characteristic at **Buck MosFET**
**additional value stands for built-in capacitor

Buck Diode										
Diode forward voltage	V_F				30	Tj=25℃ Tj=125℃		2,67 1,86	2,7	V
Reverse leakage current	I_r			600		Tj=25℃ Tj=125℃			100	µA
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	350	40	Tj=25℃ Tj=125℃		80 90		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		13 22		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		0,59 1,18		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		22422 14099		A/µs
Reverse recovered energy	Erec					Tj=25℃ Tj=125℃		0,13 0,19		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,73		K/W

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Value**			**Unit**
			V_{GE} [V] or **V_{GS} [V]**	**V_r [V] or** **V_{CE} [V] or** **V_{DS} [V]**	**I_C [A] or** **I_F [A] or** **I_D [A]**	**T_j**	**Min**	**Typ**	**Max**	
Buck MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$		10		16	Tj=25℃ Tj=125℃		108 214		mΩ
Gate threshold voltage	$V_{(GS)th}$			V_{DS}=V_{GS}	0,00121	Tj=25℃ Tj=125℃	2,4	3	3,6	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25℃ Tj=125℃			100	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25℃ Tj=125℃			5	uA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	±15	350	40	Tj=25℃ Tj=125℃		36 37		ns
Rise Time	t_r					Tj=25℃ Tj=125℃		3 3		
Turn off delay time	$t_{d(OFF)}$					Tj=25℃ Tj=125℃		399 414		
Fall time	t_f					Tj=25℃ Tj=125℃		3 4		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,06 0,28		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,06 0,23		
Total gate charge	Q_g		10	480	18,1	Tj=25℃		119		nC
Gate to source charge	Q_{gs}							14		
Gate to drain charge	Q_{gd}							61		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25℃		2660		pF
Output capacitance	C_{oss}							154		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,16		K/W

** see schematic of the Gate-complex at characteristic figures

Parameter	**Symbol**	**Conditions**	**V_{GE} [V] or** **V_{GS} [V]**	**V_r [V] or** **V_{CE} [V] or** **V_{DS} [V]**	**I_C [A] or** **I_F [A] or** **I_D [A]**	**T_j**	**Min**	**Typ**	**Max**	**Unit**
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	V_{CE}=V_{GE}			0,0012	Tj=25℃ Tj=125℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	Tj=25℃ Tj=125℃	1,05	1,12 1,13	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25℃ Tj=125℃			0,0038	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃			600	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	350	50	Tj=25℃ Tj=125℃		85 87		ns
Rise time	t_r					Tj=25℃ Tj=125℃		11 13		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		177 209		
Fall time	t_f					Tj=25℃ Tj=125℃		78 102		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,39 0,66		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		1,56 2,18		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		4620		pF
Output capacitance	C_{oss}							288		
Reverse transfer capacitance	C_{rss}							137		
Gate charge	Q_{Gate}		15	480	75	Tj=25℃		470		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,02		K/W

Characteristic Values

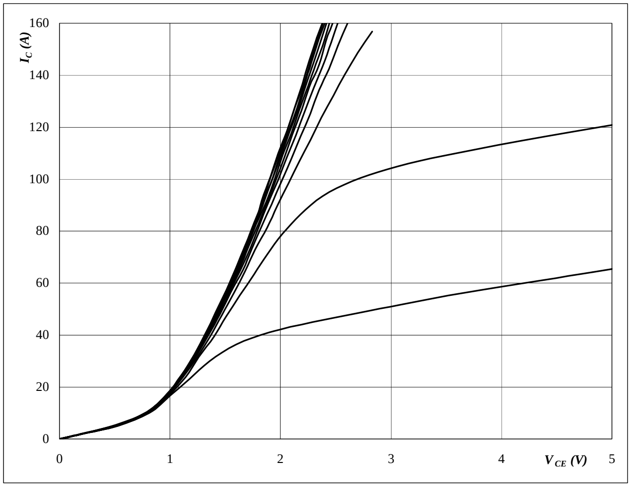
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost Diode										
Diode forward voltage	V_F				18	Tj=25℃ Tj=125℃		2,23 2,04	3,3	V
Reverse leakage current	I_r			1200		Tj=25℃ Tj=125℃			100	µA
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	350	50	Tj=25℃ Tj=125℃		79 104		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		26 105		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		3,00 6,55		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		11365 7906		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=125℃		0,87 1,86		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,87		K/W
Thermistor										
Rated resistance	R					Tj=25℃		21511		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				Tc=100℃	-4,5		+4,5	%
R100	P					Tj=25℃		210		mW
Power dissipation constant						Tj=25℃		3,5		mW/K
A-value	$B_{(25/50)}$					Tj=25℃		3884		K
B-value	$B_{(25/100)}$					Tj=25℃		3964		K
Vincotech NTC Reference						Tj=25℃			F	

Buck

Figure 1 MOSFET+IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

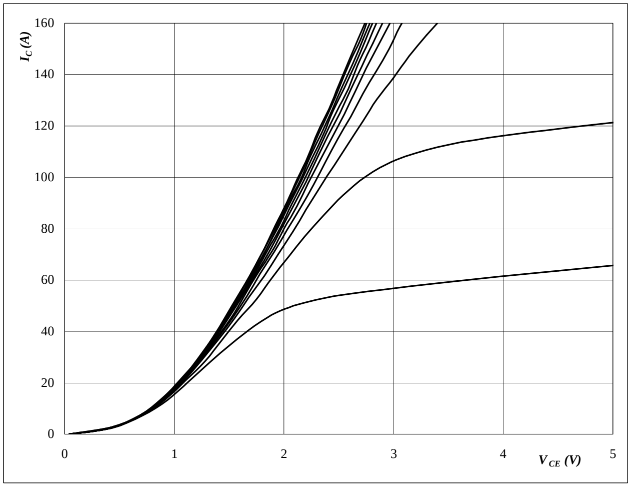
T_j = 25 ℃

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

Figure 2 MOSFET+IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

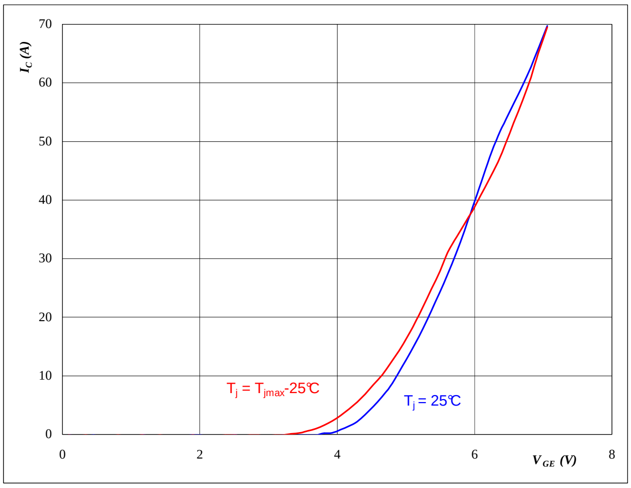
T_j = 125 ℃

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

Figure 3 MOSFET+IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

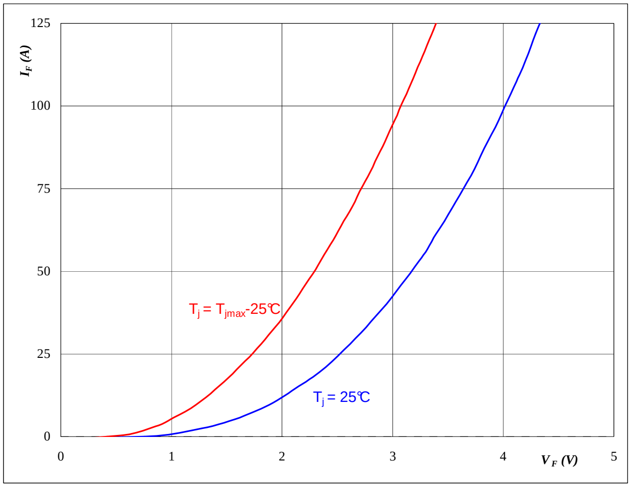
t_p = 250 µs

V_{CE} = 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

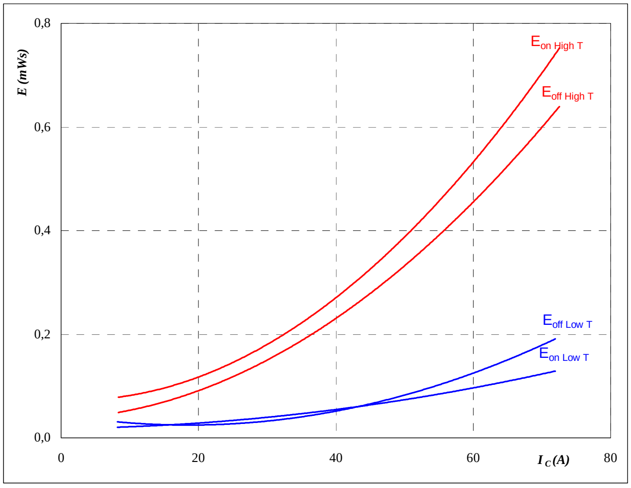
t_p = 250 µs

Buck

Figure 5 MOSFET+IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



With an inductive load at

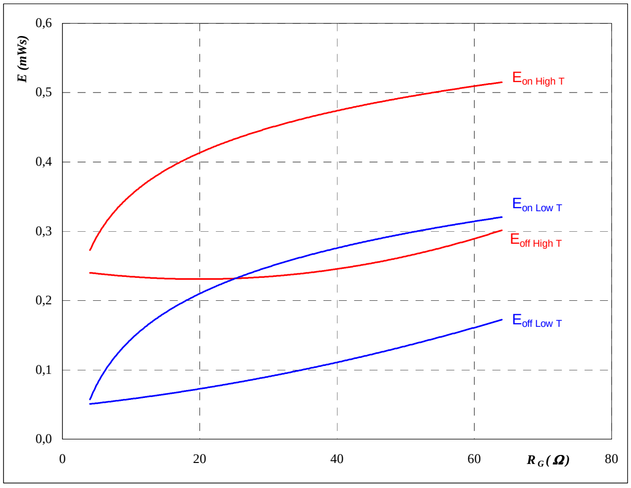
T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

Gate on/off resistor of IGBT is fix 4Ω
MOSFET turn off delayed with 350 nS

Figure 6 MOSFET+IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



With an inductive load at

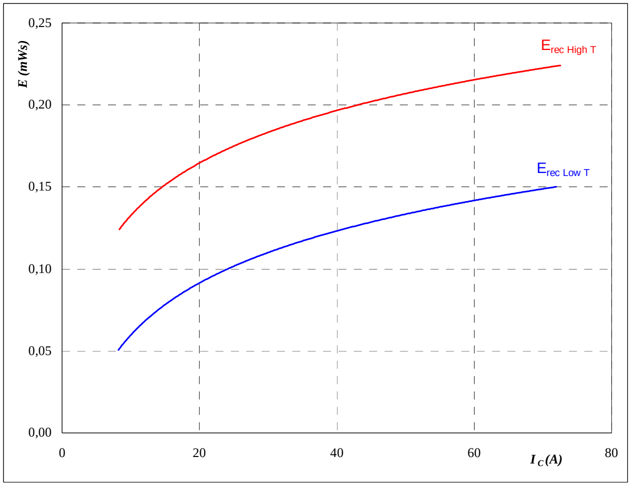
T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 40 A

Gate on/off resistor of IGBT is fix 4Ω
MOSFET turn off delayed with 350 nS

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

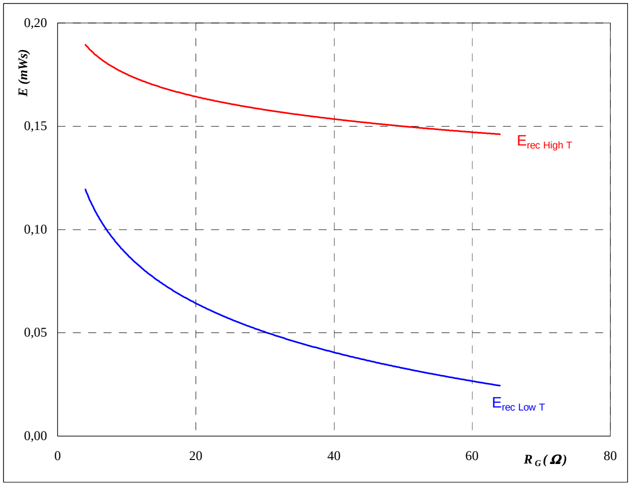
T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω

Gate on/off resistor of IGBT is fix 4Ω
MOSFET turn off delayed with 350 nS

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 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 40 A

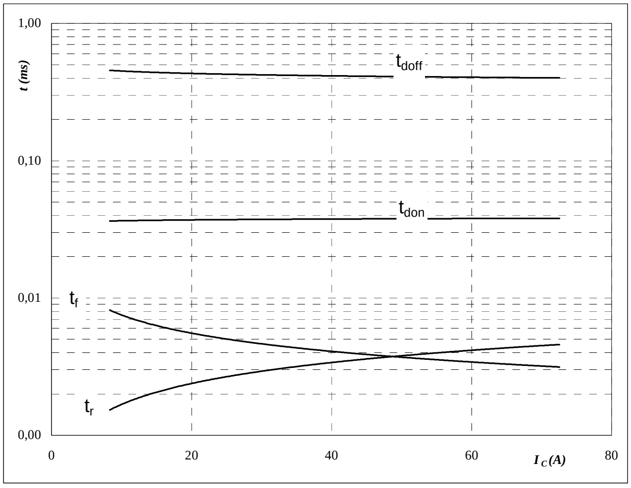
Gate on/off resistor of IGBT is fix 4Ω
MOSFET turn off delayed with 350 nS

Buck

Figure 9 MOSFET+IGBT

Typical switching times as a function of collector current

t = f(I_C)



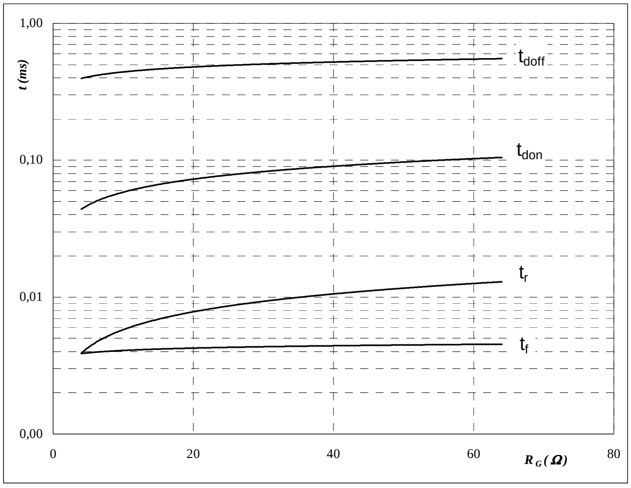
With an inductive load at

T_j =	125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_{CE} =	350	V	MOSFET turn off delayed with 350 nS
V_{GE} =	±15	V	
R_{gon} =	4	Ω	
R_{goff} =	4	Ω	

Figure 10 MOSFET+IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



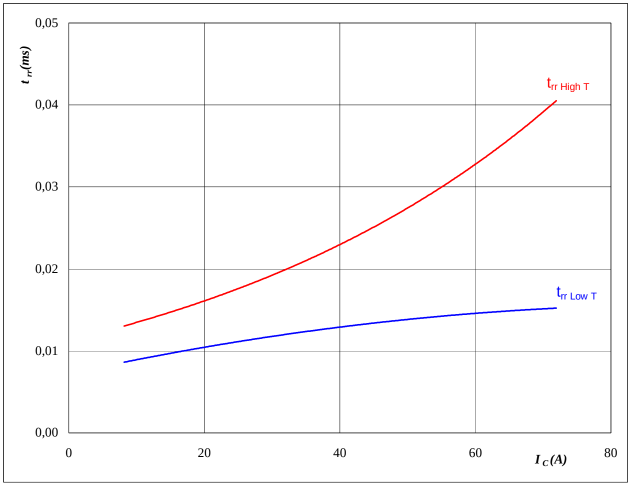
With an inductive load at

T_j =	125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_{CE} =	350	V	MOSFET turn off delayed with 350 nS
V_{GE} =	±15	V	
I_C =	40	A	

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



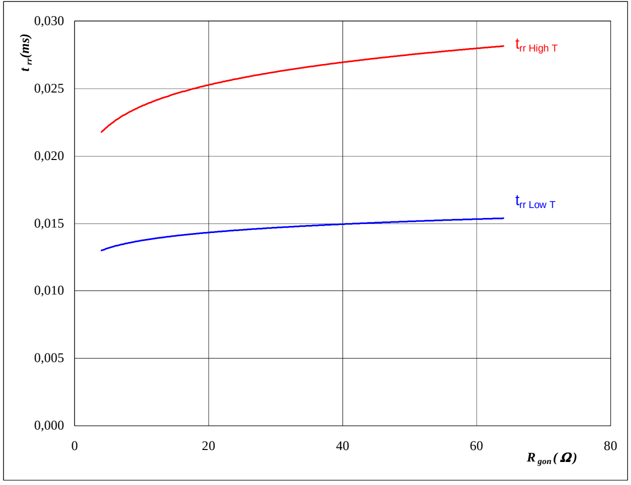
At

T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_{CE} =	350	V	MOSFET turn off delayed with 350 nS
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

Figure 12 FWD

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

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



At

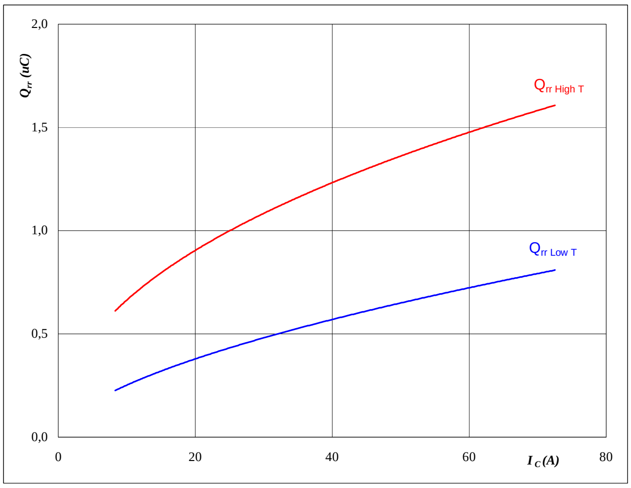
T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_R =	350	V	MOSFET turn off delayed with 350 nS
I_F =	40	A	
V_{GE} =	±15	V	

Buck

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



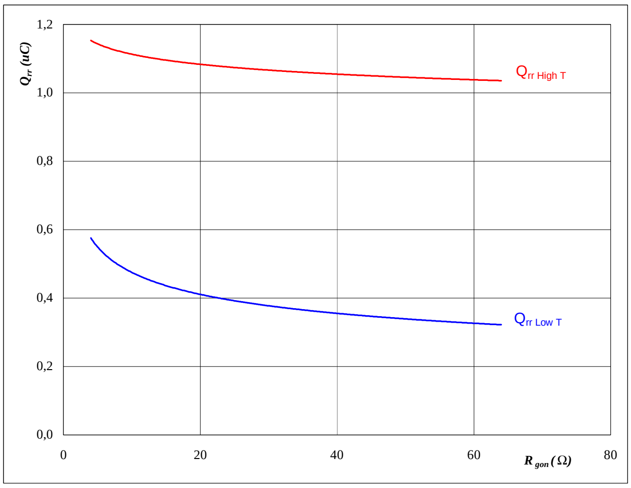
At

T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_{CE} =	350	V	MOSFET turn off delayed with 350 nS
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

Figure 14 FWD

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

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



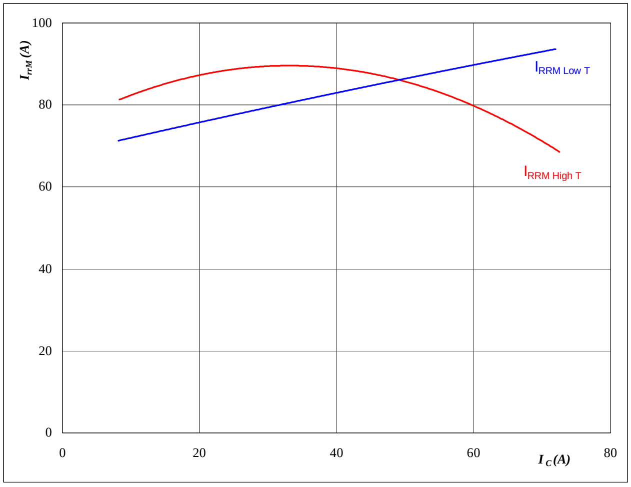
At

T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_R =	350	V	MOSFET turn off delayed with 350 nS
I_F =	40	A	
V_{GE} =	±15	V	

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



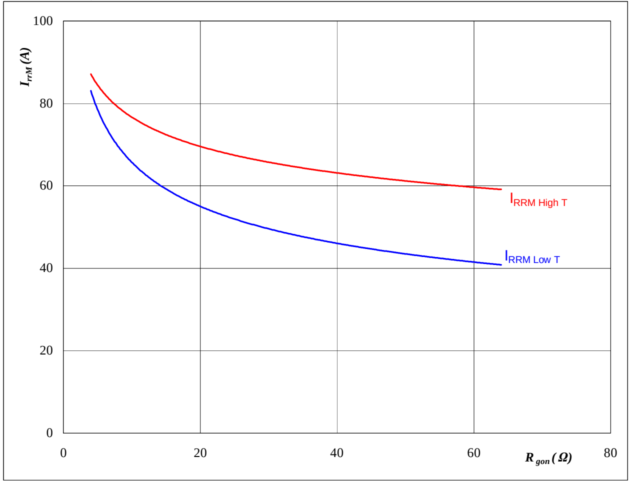
At

T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_{CE} =	350	V	MOSFET turn off delayed with 350 nS
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

Figure 16 FWD

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

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



At

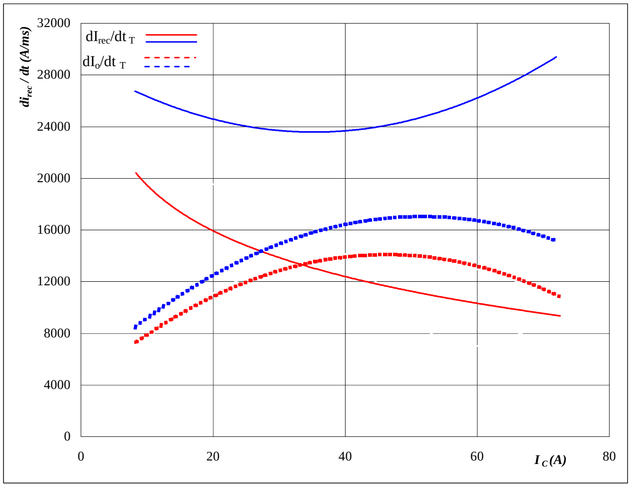
T_j =	25/125	℃	Gate on/off resistor of IGBT is fix 4Ω
V_R =	350	V	MOSFET turn off delayed with 350 nS
I_F =	40	A	
V_{GE} =	±15	V	

Buck

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 ℃ Gate on/off resistor of IGBT is fix 4Ω

V_{CE} = 350 V MOSFET turn off delayed with 350 nS

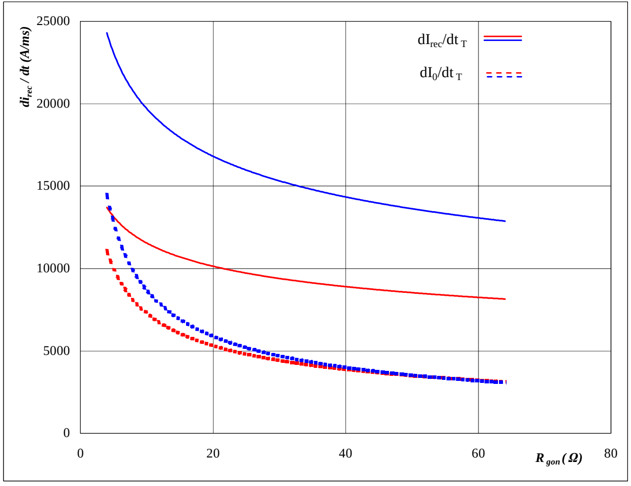
V_{GE} = ±15 V

R_{gon} = 4 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 ℃ Gate on/off resistor of IGBT is fix 4Ω

V_R = 350 V MOSFET turn off delayed with 350 nS

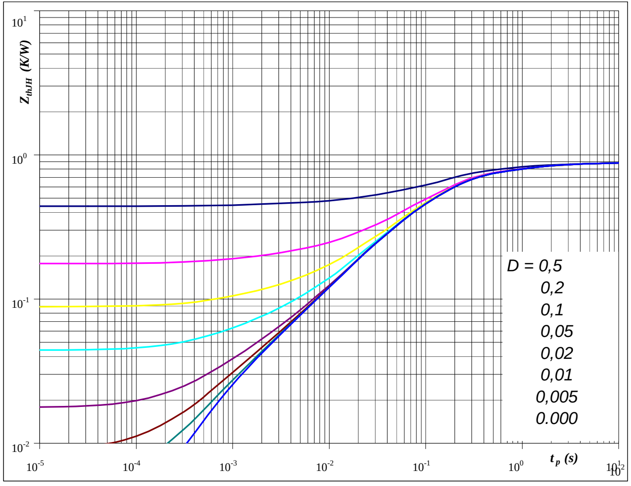
I_F = 40 A

V_{GE} = ±15 V

Figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 0,88 K/W

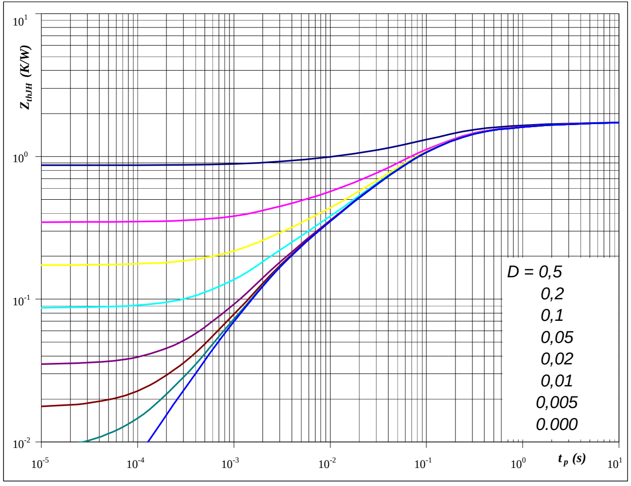
IGBT thermal model values

R (C/W)	Tau (s)
0,14	1,8E+00
0,36	2,1E-01
0,28	7,5E-02
0,08	1,2E-02
0,02	1,1E-03

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 1,73 K/W

FWD thermal model values

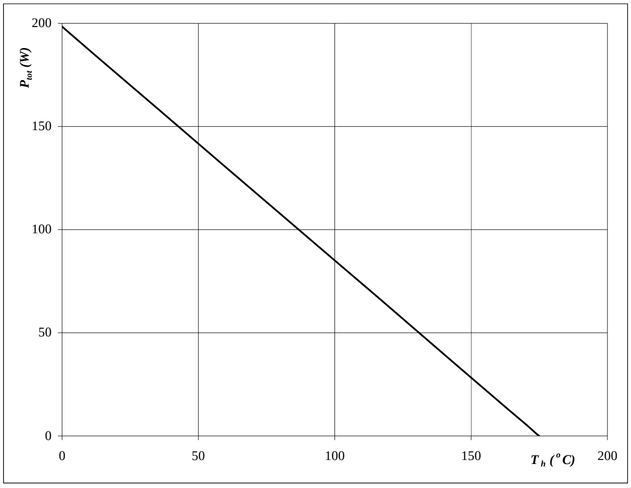
R (C/W)	Tau (s)
0,08	4,5E+00
0,17	9,6E-01
0,63	1,6E-01
0,53	5,6E-02
0,20	1,2E-02
0,12	2,3E-03

Buck

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



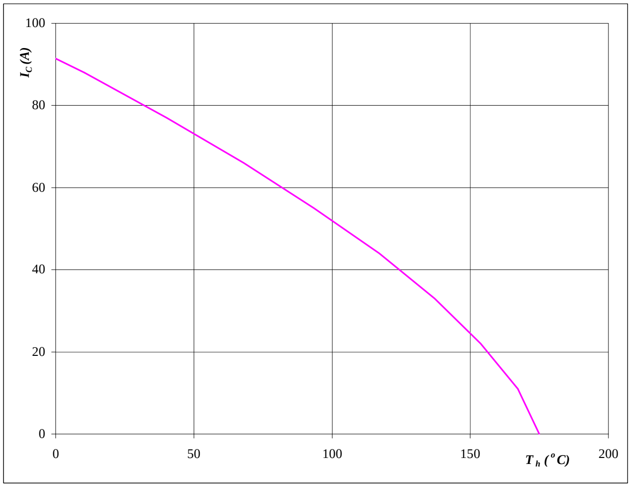
At

T_j = 175 ℃

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

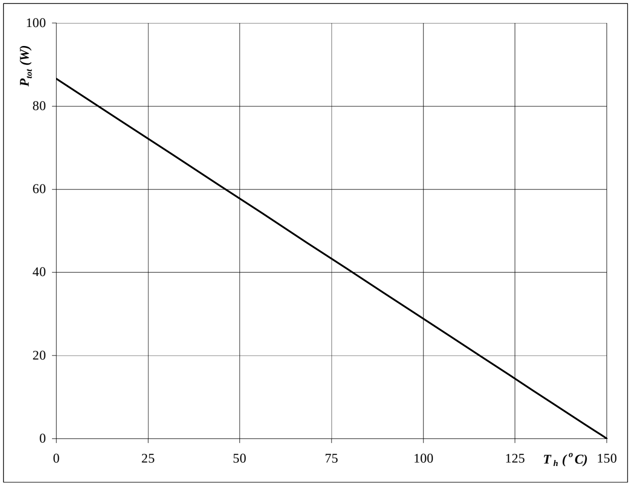
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



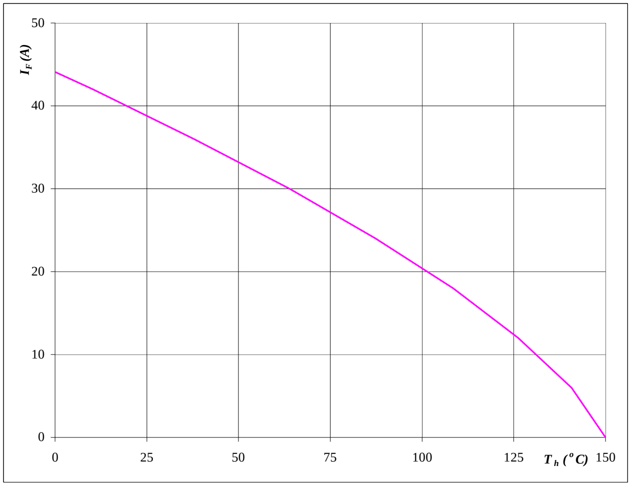
At

T_j = 150 ℃

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

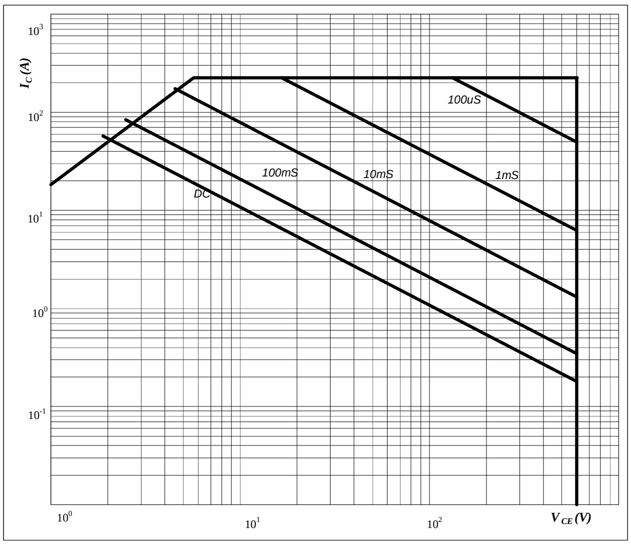
T_j = 150 ℃

Buck

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



At

D = single pulse

Th = 80 ºC

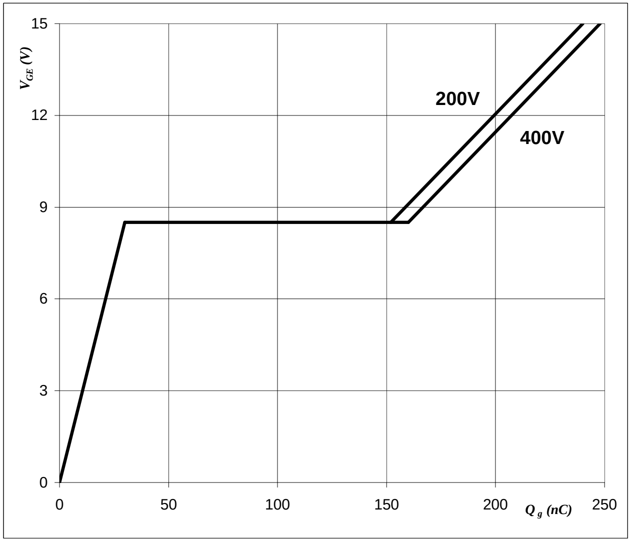
V_{GE} = ±15 V

T_j = T_{jmax} ºC

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



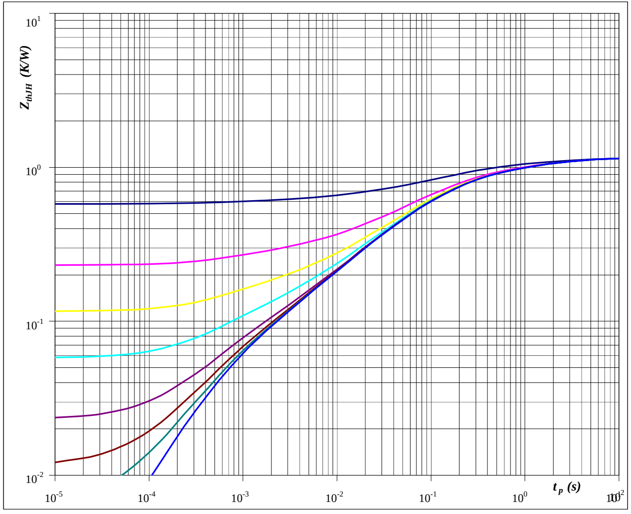
At

I_C= 75

Figure 27 MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



D = t_p / T

R_{thJH} = 1,16 K/W

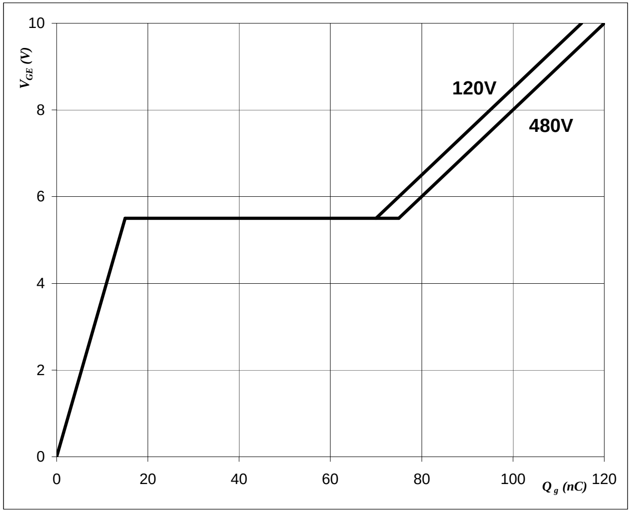
MOSFET thermal model values

R (C/W)	Tau (s)
0,11	4,7E+00
0,22	9,0E-01
0,39	1,7E-01
0,25	4,8E-02
0,10	1,3E-02
0,05	2,5E-03

Figure 28 MOSFET

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

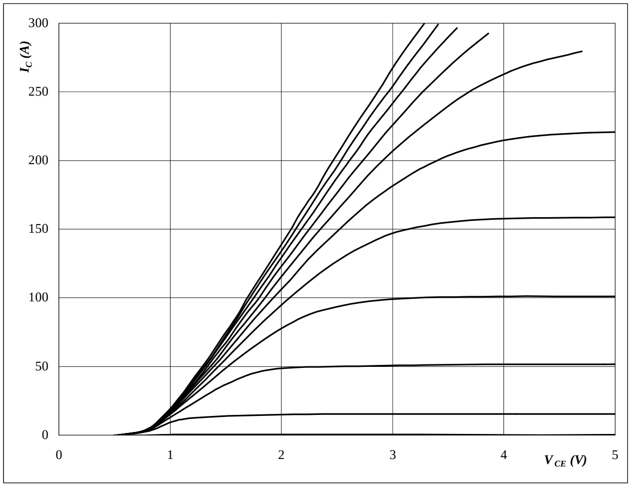
I_C = 38 A

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



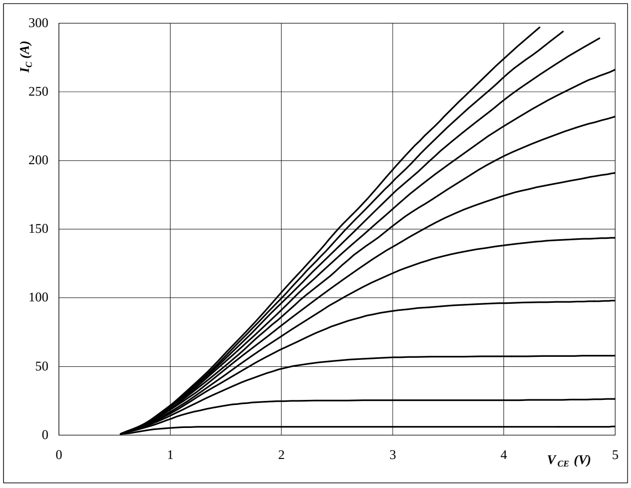
At

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

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



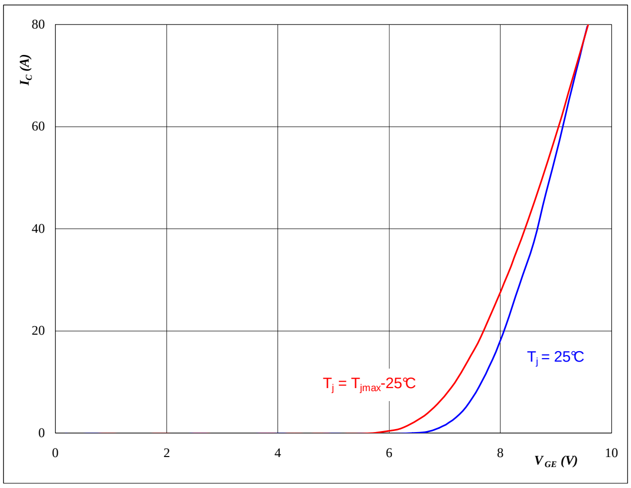
At

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

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



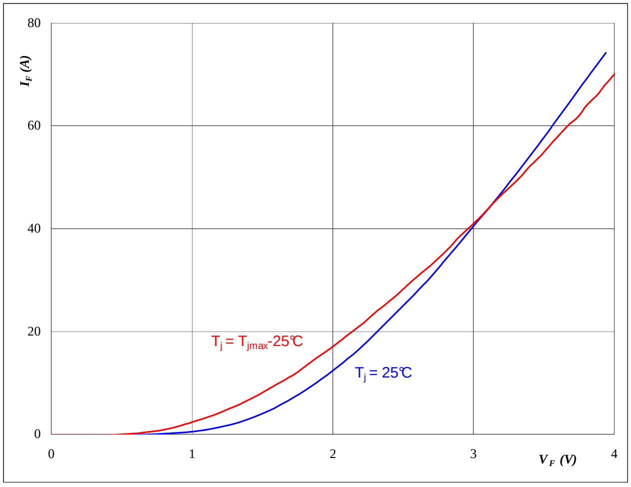
At

t_p = 250 µs
V_{CE} = 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

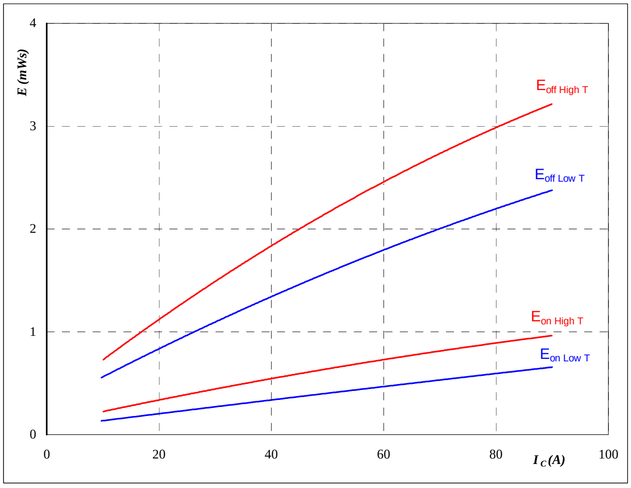
t_p = 250 µs

Boost

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



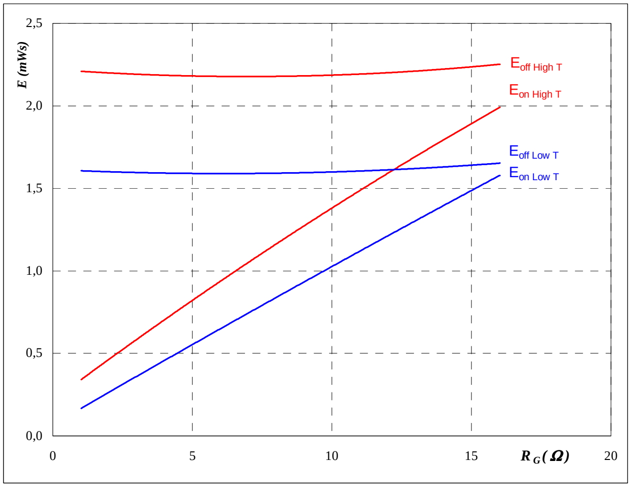
With an inductive load at

T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



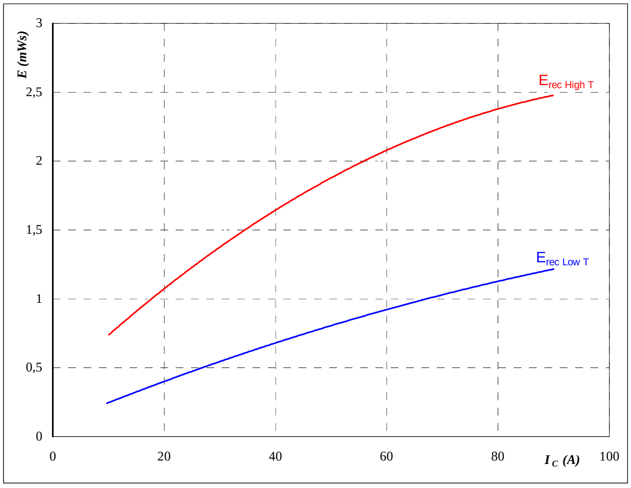
With an inductive load at

T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 50 A

Figure 7 IGBT

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_c)



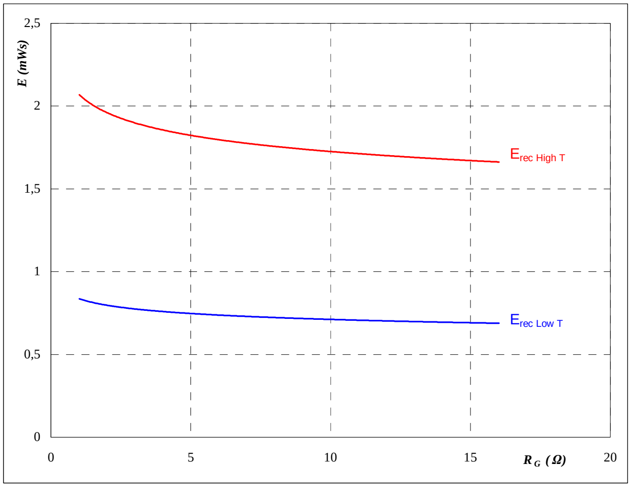
With an inductive load at

T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω

Figure 8 IGBT

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

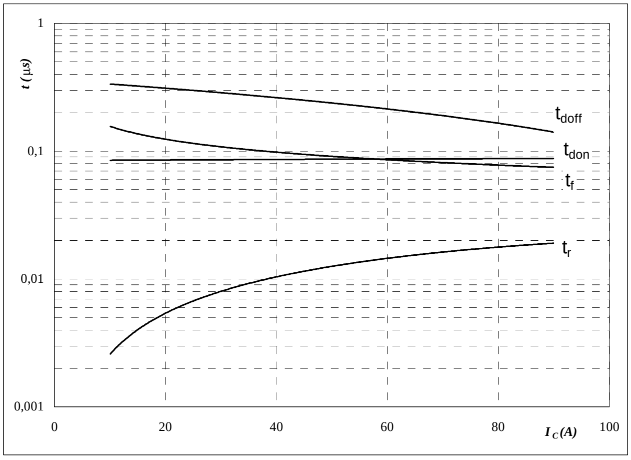
T_j = 25/125 ℃
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 50 A

Boost

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



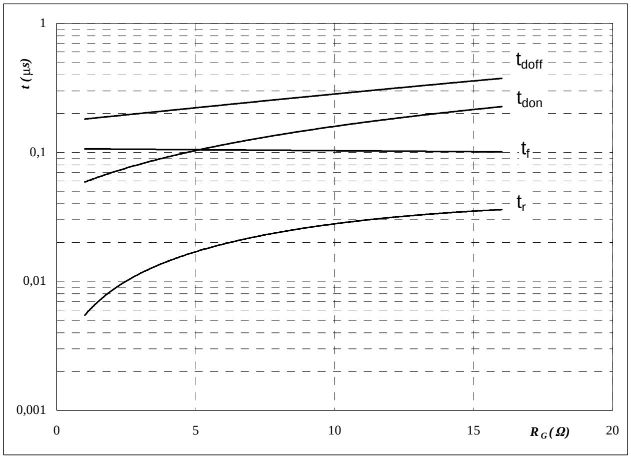
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



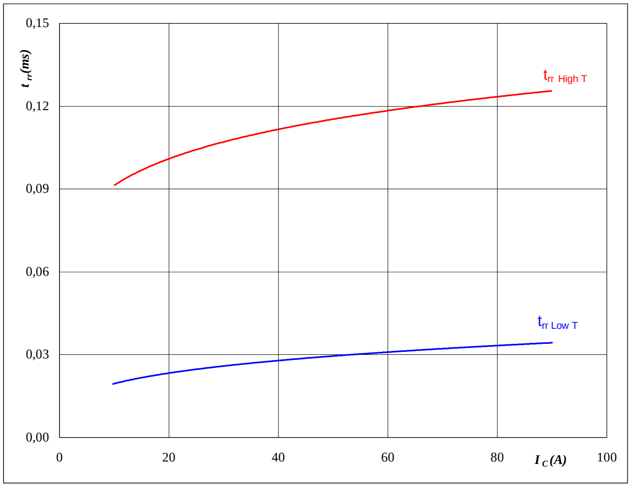
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



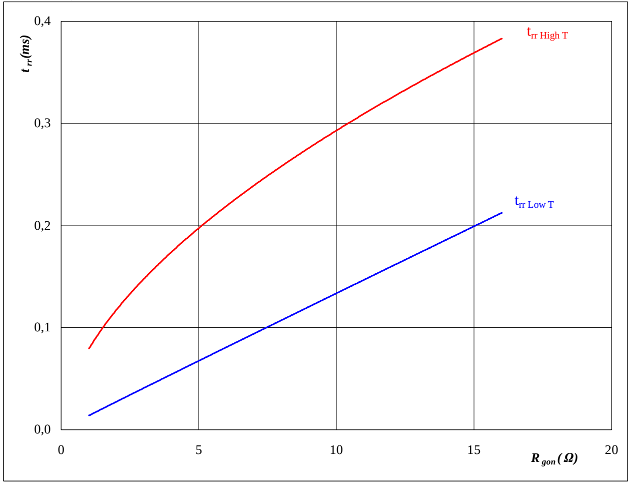
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 12 FWD

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

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



At

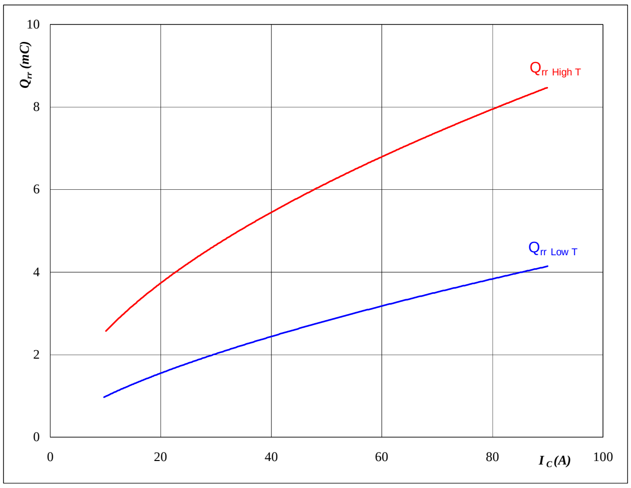
T_j =	25/125	℃
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



At

T_j = 25/125 ℃

V_{CE} = 350 V

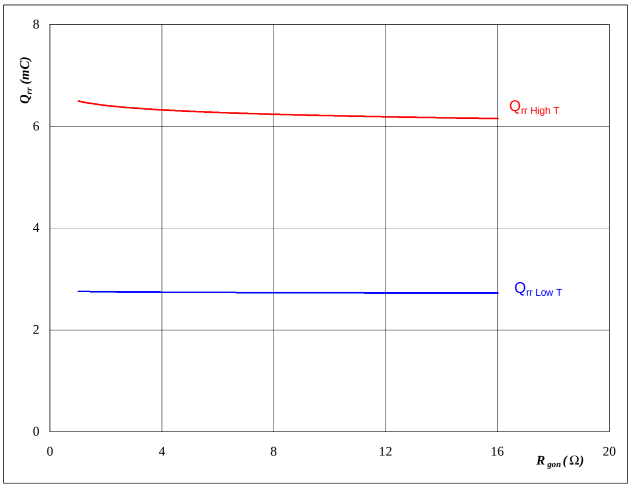
V_{GE} = ±15 V

R_{gon} = 4 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 ℃

V_R = 350 V

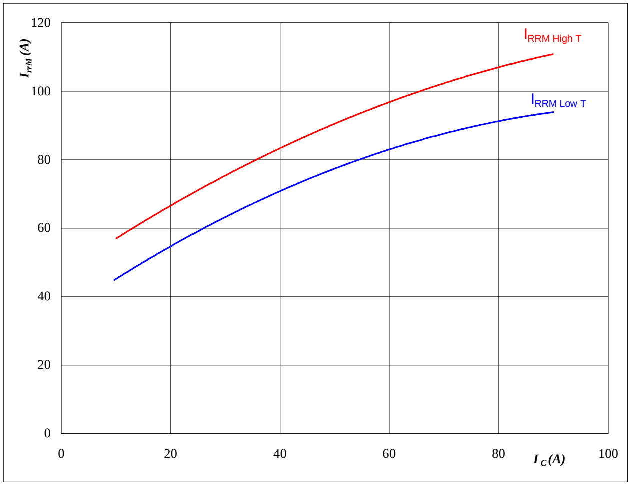
I_F = 50 A

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 ℃

V_{CE} = 350 V

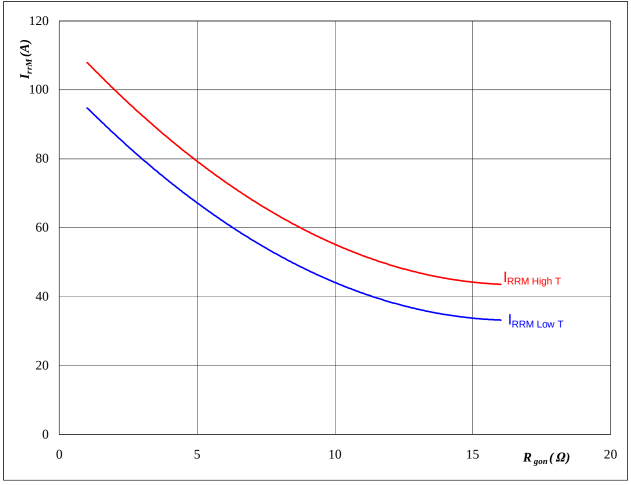
V_{GE} = ±15 V

R_{gon} = 4 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 ℃

V_R = 350 V

I_F = 50 A

V_{GE} = ±15 V

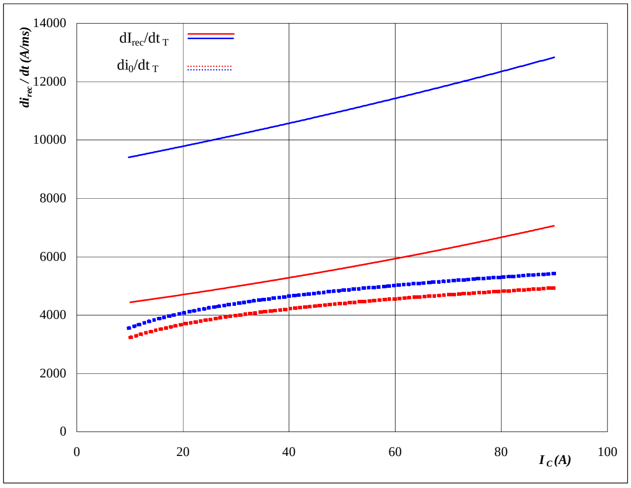
Boost

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 ℃

V_{CE} = 350 V

V_{GE} = ±15 V

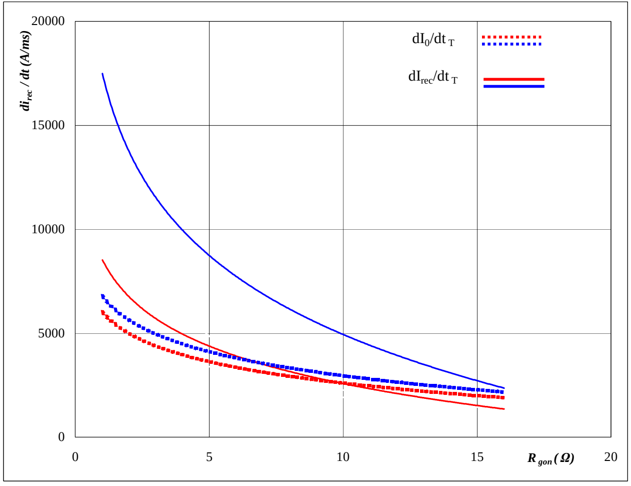
R_{gon} = 4 Ω

Figure 18

FWD

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

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



At

T_j = 25/125 ℃

V_R = 350 V

I_F = 50 A

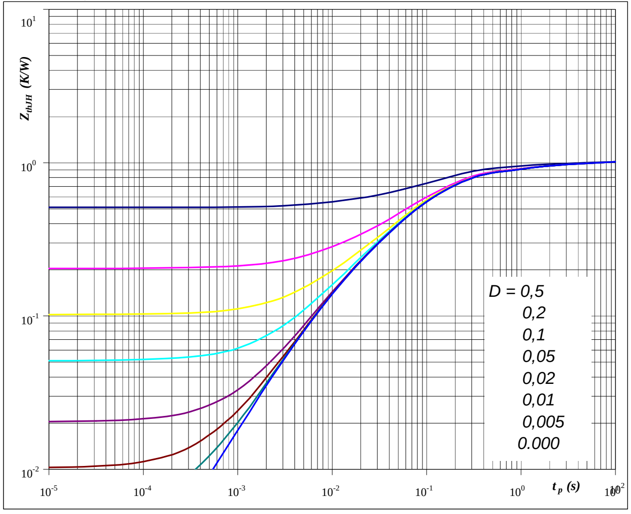
V_{GE} = ±15 V

Figure 19

IGBT

IGBT transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = tp / T

R_{thJH} = 1,02 K/W

IGBT thermal model values

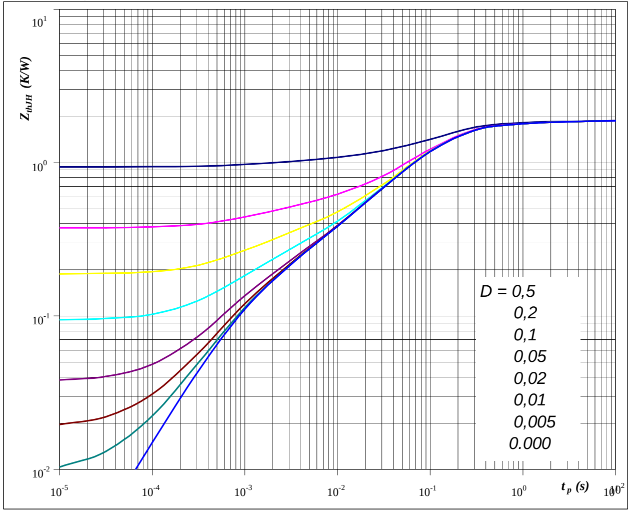
R (C/W)	Tau (s)
0,08	4,3E+00
0,12	1,0E+00
0,47	1,5E-01
0,26	4,9E-02

Figure 20

FWD

FWD transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = tp / T

R_{thJH} = 1,87 K/W

FWD thermal model values

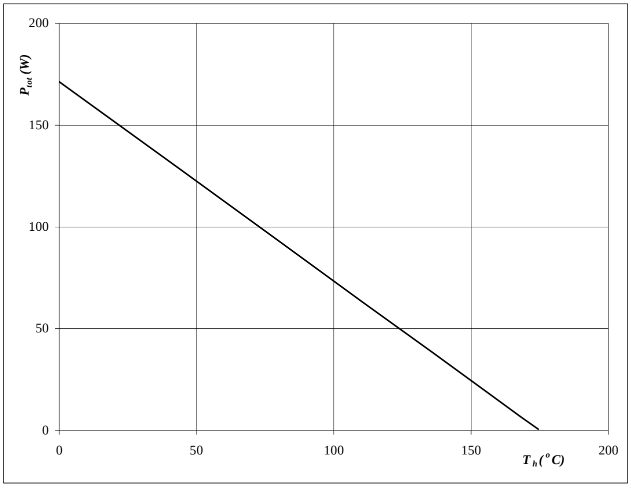
R (C/W)	Tau (s)
0,08	2,9E+00
0,22	4,4E-01
1,10	1,1E-01
0,21	3,3E-02
0,15	7,2E-03
0,12	1,0E-03

Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



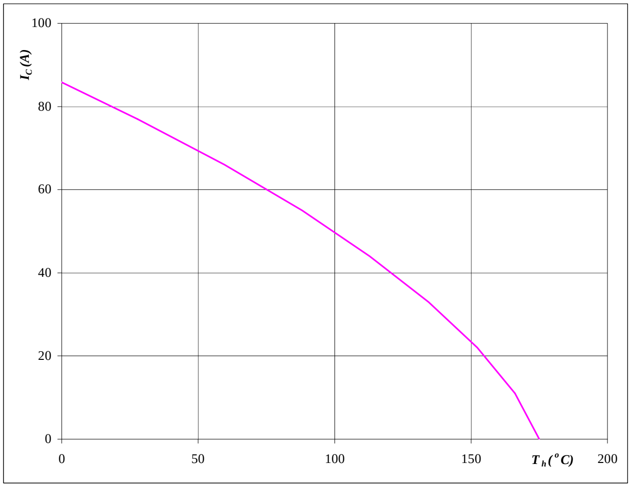
At

T_j = 175 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

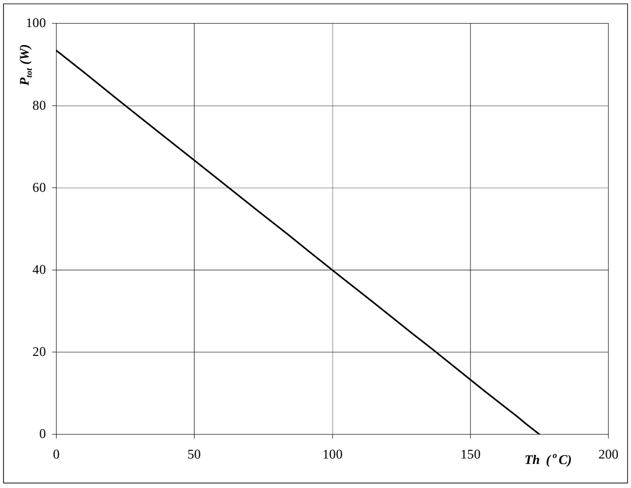
T_j = 175 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



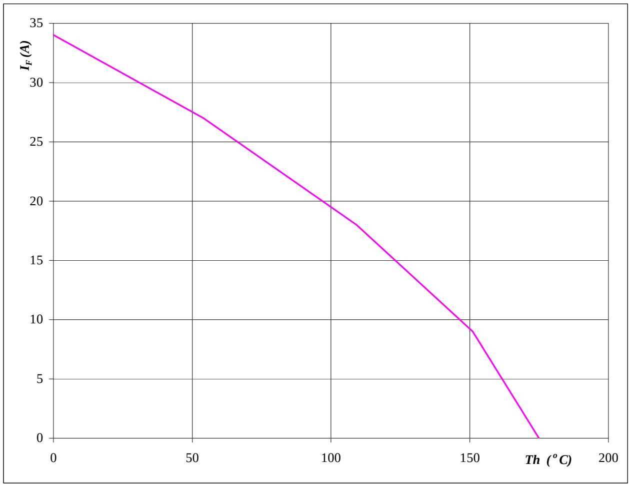
At

T_j = 175 ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

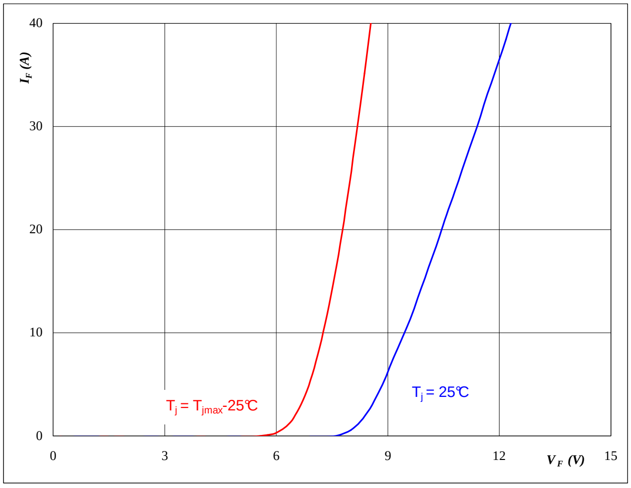
T_j = 175 ºC

Boost Inv.

Figure 25 IGBT Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



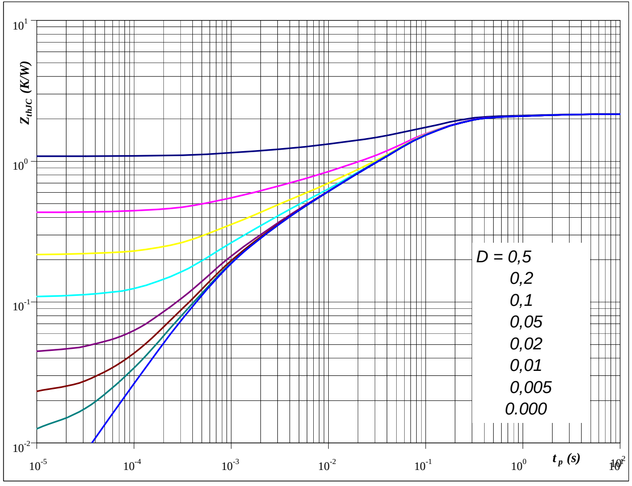
At

t_p = 250 µs

Figure 26 IGBT Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

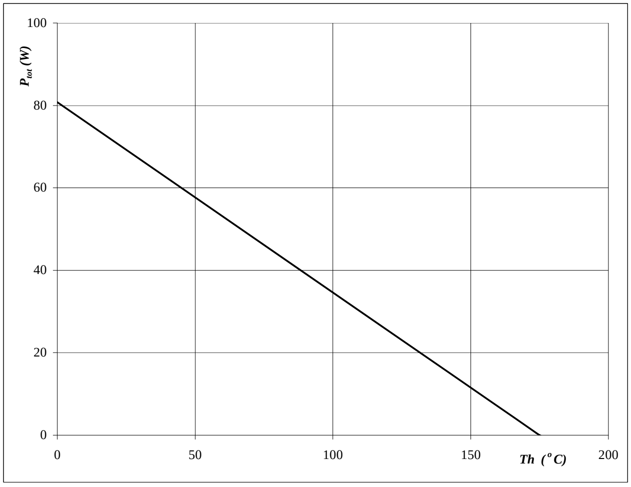
D = tp / T

R_{thJH} = 2,17 K/W

Figure 27 IGBT Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



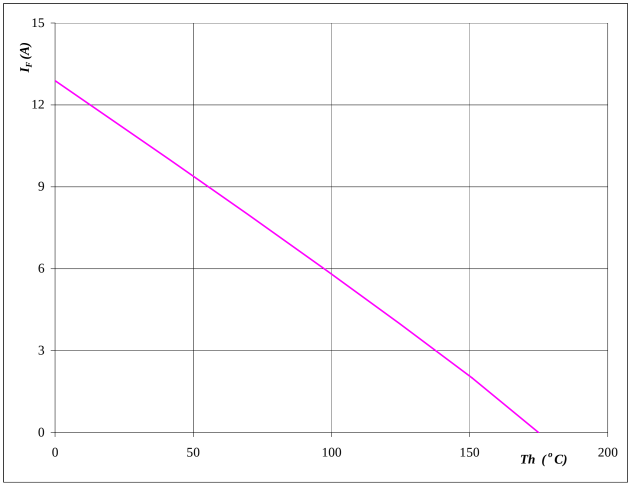
At

T_j = 175 ºC

Figure 28 IGBT Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



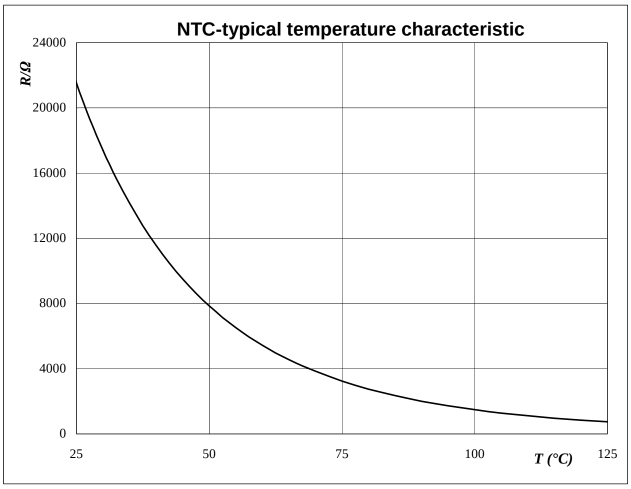
At

T_j = 175 ºC

Thermistor

Figure 1 Thermistor

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



Switching Definitions BUCK IGBT&MOSFET

General conditions

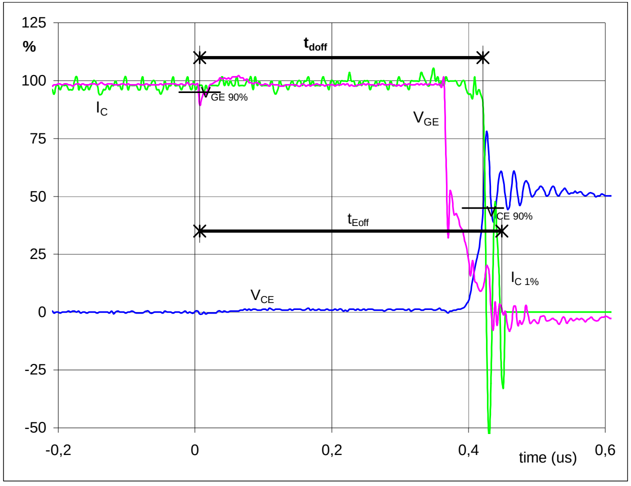
		T_j =	125℃		
$R_{gon\ IGBT}$	=	4 Ω	$R_{gon\ MOSFET}$	=	4 Ω
$R_{goff\ IGBT}$	=	4 Ω	$R_{goff\ MOSFET}$	=	4 Ω

MOSFET turn off delayed time with 350 nS

Figure 1 BUCK IGBT&MOSFET

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

(t_{Eoff} = integrating time for E_{off})

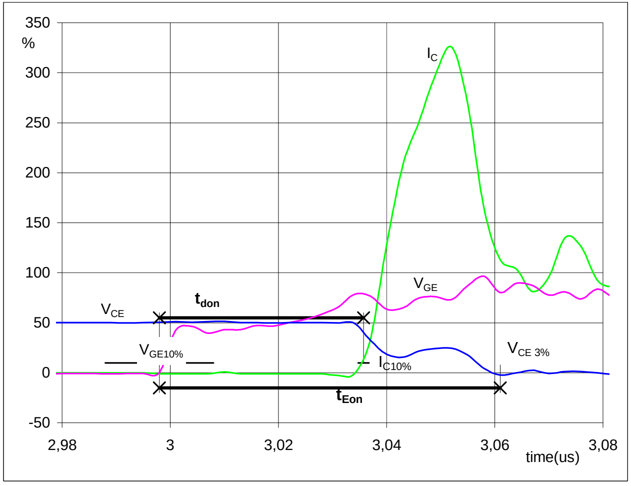


V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_C (100%) = 700 V
I_C (100%) = 40 A
t_{doff} = 0,41 µs
t_{Eoff} = 0,44 µs

Figure 2 BUCK IGBT&MOSFET

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

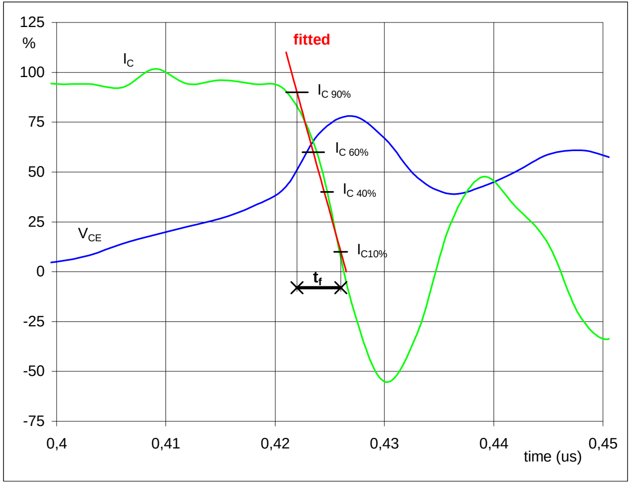
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_C (100%) = 700 V
I_C (100%) = 40 A
t_{don} = 0,04 µs
t_{Eon} = 0,06 µs

Figure 3 BUCK IGBT&MOSFET

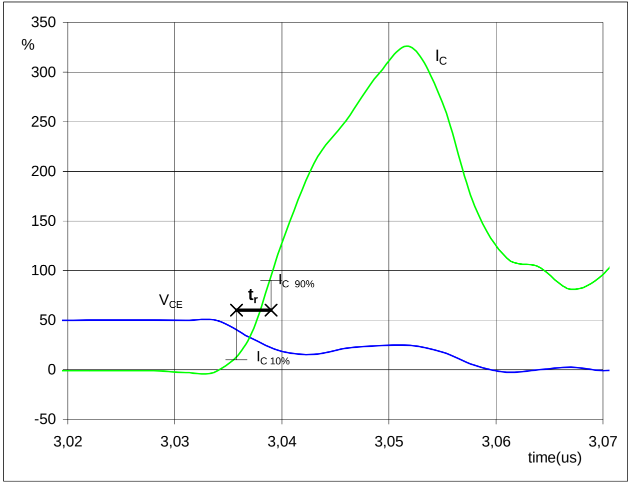
Turn-off Switching Waveforms & definition of t_f



V_C (100%) = 700 V
I_C (100%) = 40 A
t_f = 0,004 µs

Figure 4 BUCK IGBT&MOSFET

Turn-on Switching Waveforms & definition of t_r

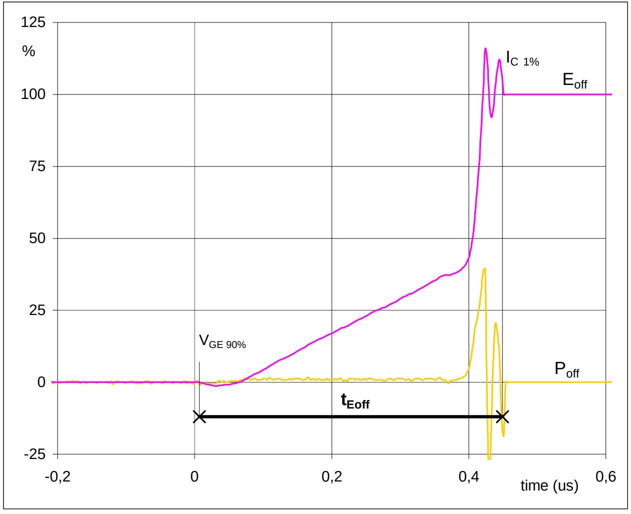


V_C (100%) = 700 V
I_C (100%) = 40 A
t_r = 0,003 µs

Switching Definitions BUCK IGBT&MOSFET

Figure 5 BUCK IGBT&MOSFET

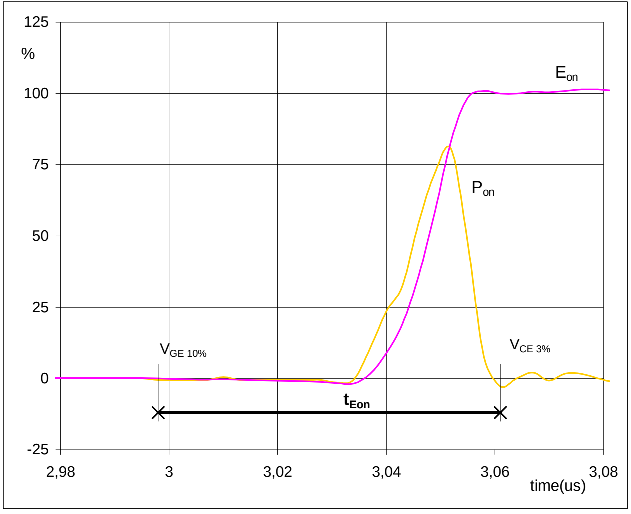
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 28,07 kW
E_{off} (100%) = 0,23 mJ
t_{Eoff} = 0,44 µs

Figure 6 BUCK IGBT&MOSFET

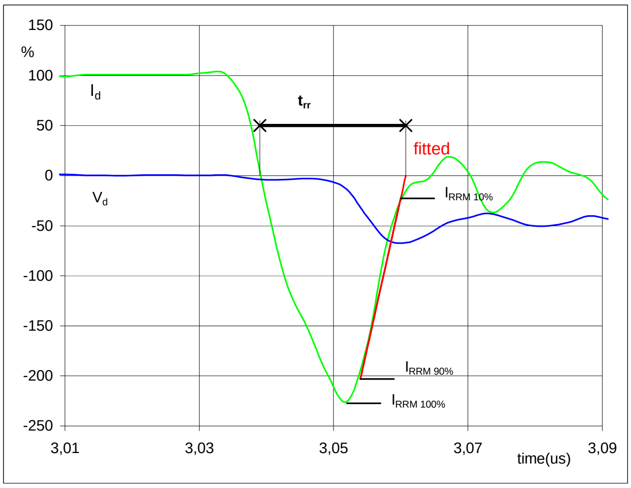
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 28,07 kW
E_{on} (100%) = 0,28 mJ
t_{Eon} = 0,06 µs

Figure 7 BUCK IGBT&MOSFET

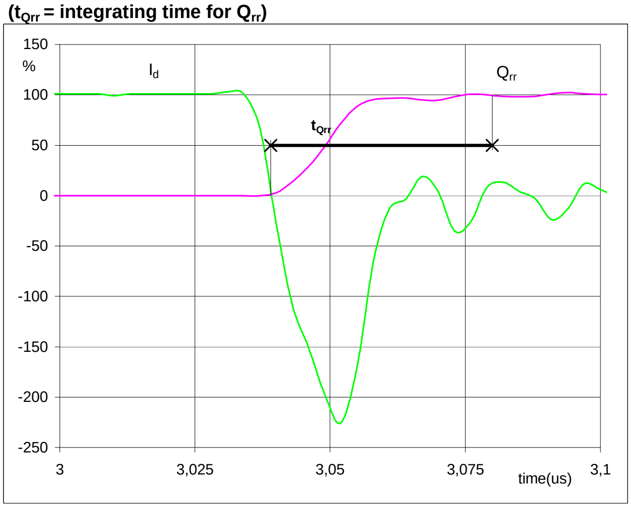
Turn-off Switching Waveforms & definition of t_{rr}



V_d (100%) = 700 V
I_d (100%) = 40 A
I_{RRM} (100%) = -90 A
t_{rr} = 0,02 µs

Figure 8 BUCK FWD

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

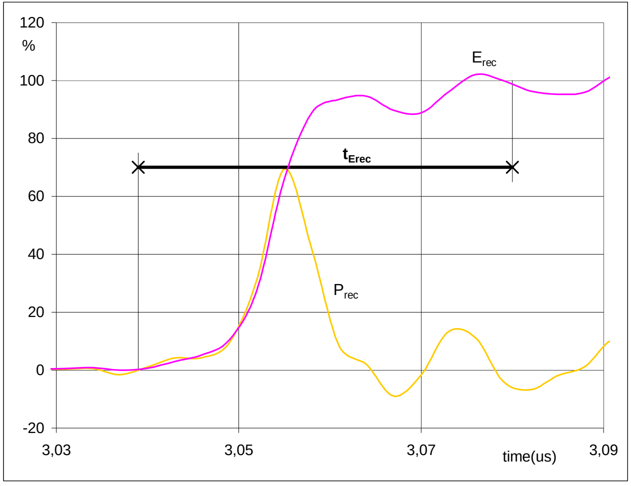


I_d (100%) = 40 A
Q_{rr} (100%) = 1,18 µC
t_{Qrr} = 0,04 µs

Switching Definitions BUCK IGBT&MOSFET

Figure 9 BUCK FWD

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



P_{rec} (100%) =	28,07	kW
E_{rec} (100%) =	0,19	mJ
t_{Erec} =	0,04	µs

Measurement circuits

Figure 11

BUCK stage switching measurement circuit

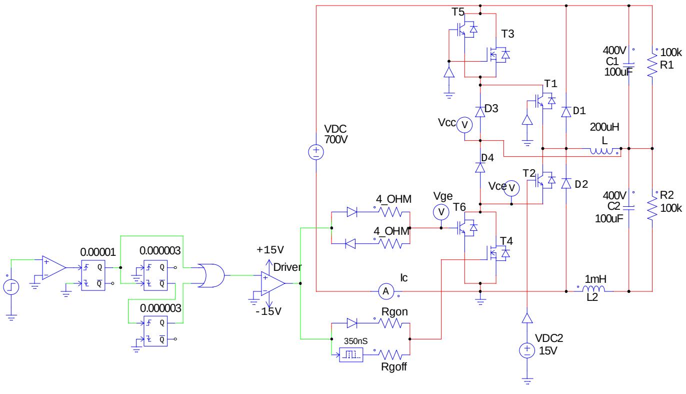
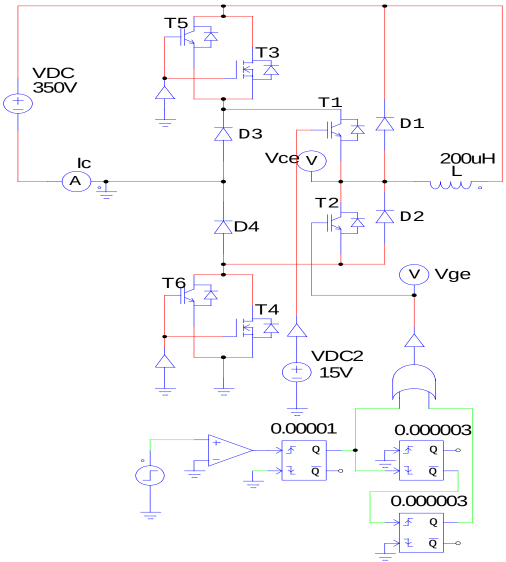


Figure 12

BOOST stage switching measurement circuit



Cg is included in the module (T5,T6)

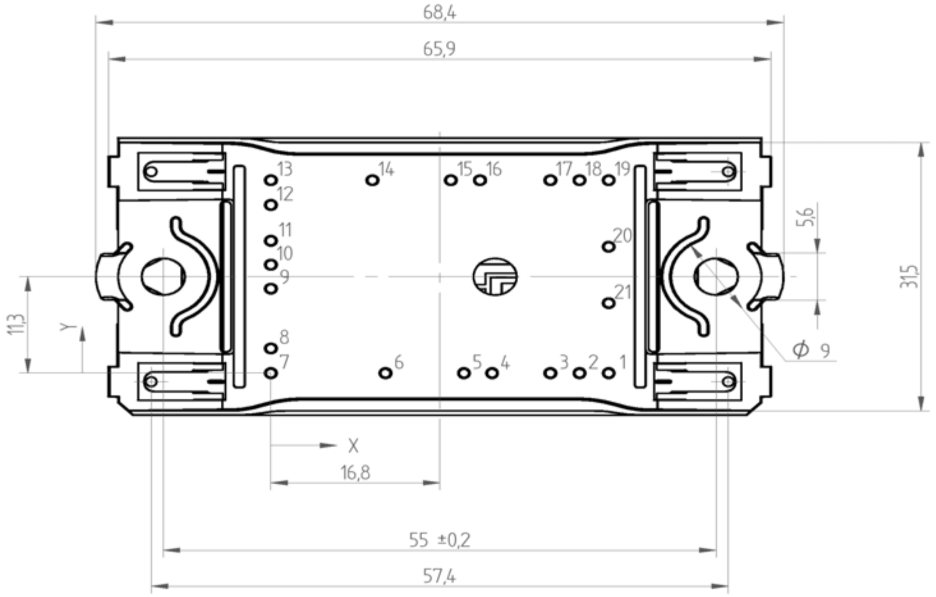
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

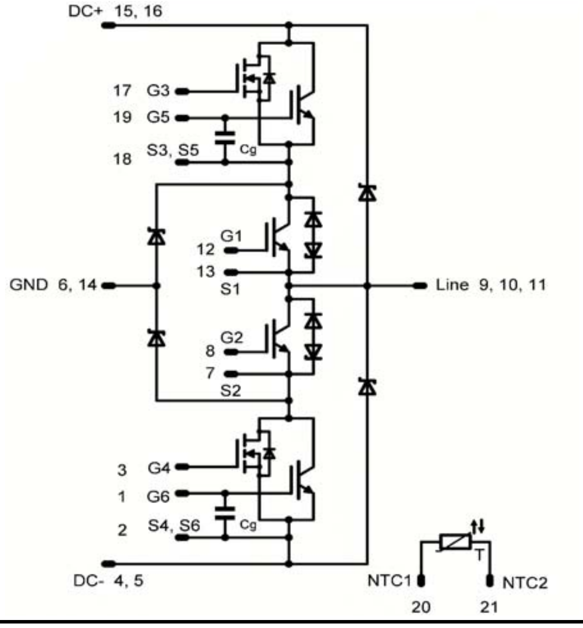
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing with PressFiT	10-PZ06NRA084FP03-P969F78Y	P969F78Y	P969F78Y
without thermal paste 12mm housing	10-FZ06NRA084FP03-P969F78	P969F78	P969F78

Outline

Pin	X	Y
1	33,6	0
2	30,7	0
3	27,8	0
4	22	0
5	19,2	0
6	11,4	0
7	0	0
8	0	2,9
9	0	9,9
10	0	12,7
11	0	15,5
12	0	19,7
13	0	22,6
14	10,1	22,6
15	17,9	22,6
16	20,8	22,6
17	27,8	22,6
18	30,7	22,6
19	33,6	22,6
20	33,6	14,8
21	33,6	8,2



Pinout



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