flowNPC 0 **600V/30A**

Features

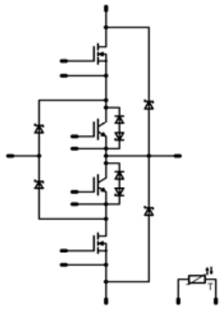
- neutral point clamped inverter
- reactive power capability
- low inductance layout

flow0 12mm housing

Target Applications

- solar inverter
- UPS

Schematic



Types

- 10-FZ06NRA041FS02-P965F68
- 10-PZ06NRA041FS02-P965F68Y

Maximum Ratings

Tj=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℃	17 17	A
Maximum repetitive forward current	I_{FRM}	Tjmax		20	A
I2t-value	I^2t	t_p=10ms	T_j=25℃	9,5	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	44 61	W
Maximum Junction Temperature	$T_j$max			175	℃
Buck Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃ T_c=80℃	19 24	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		66	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	32 49	W
Maximum Junction Temperature	$T_j$max			150	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
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℃	29 35	A
Pulsed drain current	$I_{D\ pulse}$	t_p limited by $T_j$max	Tc=25℃	272	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	78 118	W
Gate-source peak voltage	V_{GS}			±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 77	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$max		225	A
Turn off safe operating area		T_j≤175℃ V_{CE}<=V_{CES}		225	A
Power dissipation per IGBT	P_{tot}		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℃	17 23	A
Repetitive peak surge current	I_{FRM}	20kHz Square Wave		36	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	33 50	W
Maximum Junction Temperature	$T_j$max			150	℃
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	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 Inv. Diode										
Forward voltage	V_F				10	Tj=25°C Tj=125°C	1,25	1,88 1,22	1,95	V
Threshold voltage (for power loss calc. only)	V_{to}				10	Tj=25°C Tj=125°C		1,37 0,70		V
Slope resistance (for power loss calc. only)	r_t				10	Tj=25°C Tj=125°C		0,04 0,04		Ω
Reverse current	I_r			600		Tj=25°C Tj=125°C			0,027	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,17		K/W
Buck Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=125°C		1,61 1,88	1,7	V
Reverse leakage current	I_r			600		Tj=25°C Tj=125°C			320	µA
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	10	350	20	Tj=25°C Tj=125°C		10 10		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		12 23		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		0,11 0,12		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		2333 1808		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		0,02 0,02		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,16		K/W
Buck MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$		10		30	Tj=25°C Tj=125°C		41 82		mΩ
Gate threshold voltage	$V_{(GS)th}$	$V_{DS}=V_{GS}$			0,00296	Tj=25°C Tj=125°C	2,4	3	3,6	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			100	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			5	uA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=8 Ω Rgon=8 Ω	10	350	20	Tj=25°C Tj=125°C		34 32		ns
Rise Time	t_r					Tj=25°C Tj=125°C		11 12		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		270 293		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,13 0,15		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,07 0,07		
Total gate charge	Q_g		10	480	44,4	Tj=25°C		290		nC
Gate to source charge	Q_{gs}							36		
Gate to drain charge	Q_{gd}							150		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6530		pF
Output capacitance	C_{oss}							360		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,90		K/W

Characteristic Values

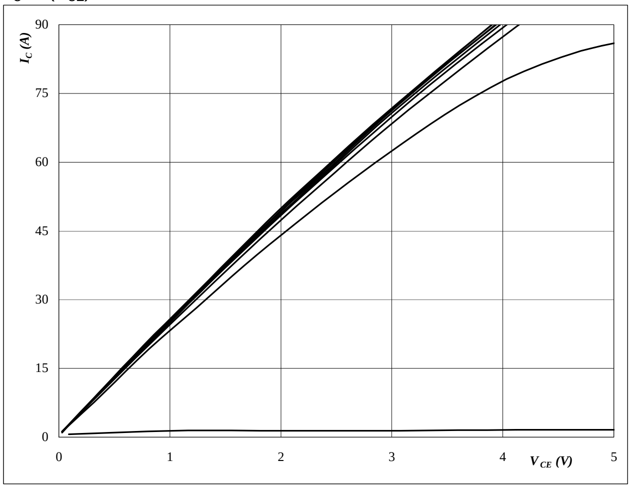
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0012	Tj=25℃ Tj=125℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	Tj=25℃ Tj=125℃	1,05	1,22 1,29	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	30	Tj=25℃ Tj=125℃		84 84		ns
Rise time	t_r					Tj=25℃ Tj=125℃		7 8		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		204 242		
Fall time	t_f					Tj=25℃ Tj=125℃		55 90		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,26 0,39		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,99 1,36		
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
Boost Diode										
Diode forward voltage	V_F				18	Tj=25℃ Tj=125℃		2,23 2,04	3,3	V
Reverse leakage current	I_r			600		Tj=25℃ Tj=125℃			100	µA
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	350	30	Tj=25℃ Tj=125℃		59 67		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		21 102		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		2,53 4,72		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		9919 5374		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=125℃		0,75 1,45		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,11		K/W
Thermistor										
Rated resistance	R					Tj=25℃		21511		Ω
Deviation of R25	ΔR/R					Tj=25℃	-4,5		+4,5	%
Power dissipation	P					Tj=25℃		210		mW
Power dissipation constant						Tj=25℃		4		mW/K
B-value	$B_{(25/50)}$					Tj=25℃		3884		K
B-value	$B_{(25/100)}$					Tj=25℃		3964		K
Vincotech NTC Reference									F	

Buck

Figure 1 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



At

$t_p =$ 250 µs

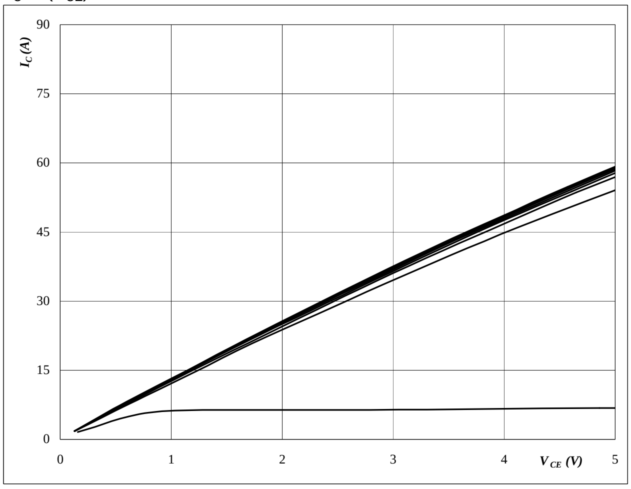
$T_j =$ 25 ℃

V_{GE} from 0 V to 20 V in steps of 2 V

Figure 2 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



At

$t_p =$ 250 µs

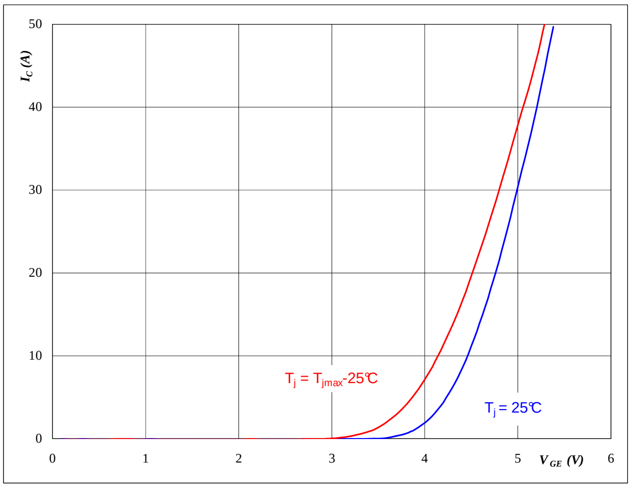
$T_j =$ 125 ℃

V_{GE} from 0 V to 20 V in steps of 2 V

Figure 3 MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$



At

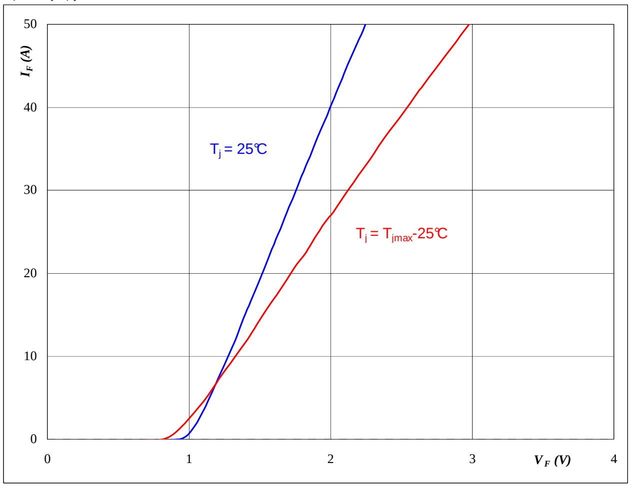
$t_p =$ 250 µs

$V_{CE} =$ 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

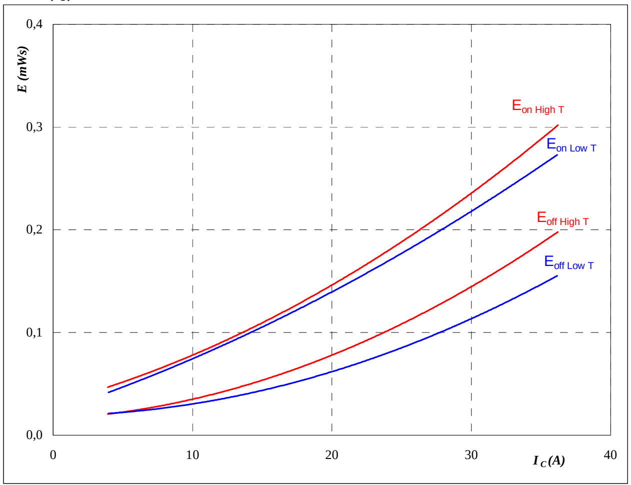
$t_p =$ 250 µs

Buck

Figure 5 MOSFET

Typical switching energy losses as a function of collector current

E = f(I_C)



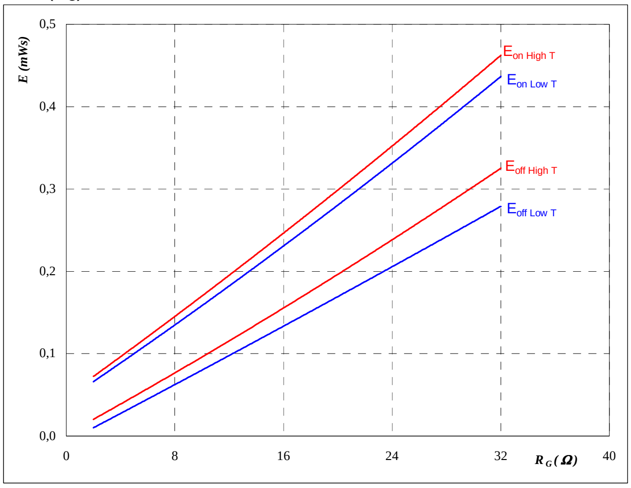
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 MOSFET

Typical switching energy losses as a function of gate resistor

E = f(R_G)



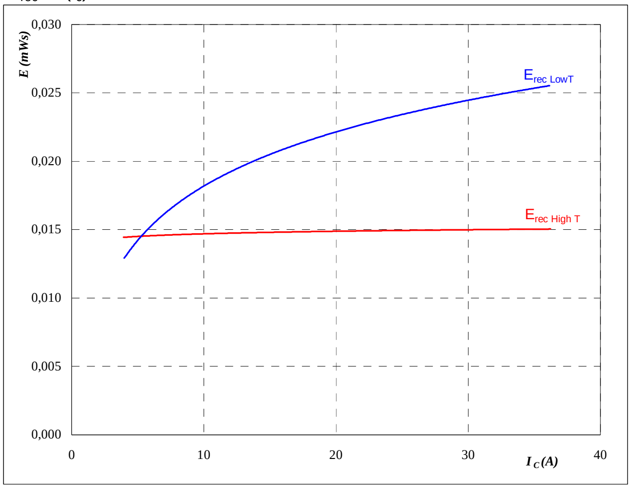
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	10	V
I_C =	20	A

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

E_{rec} = f(I_c)



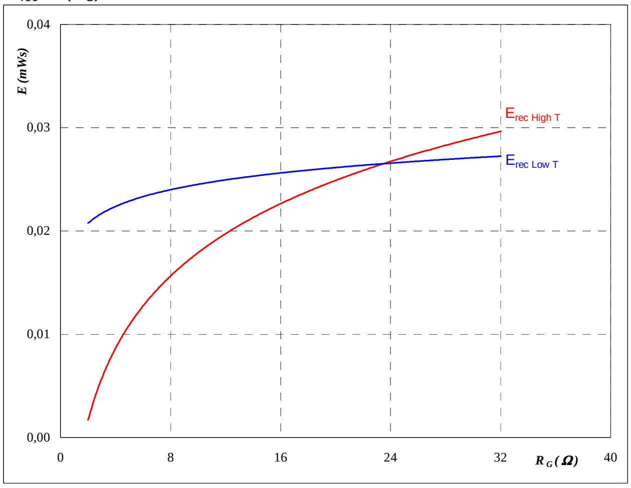
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	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

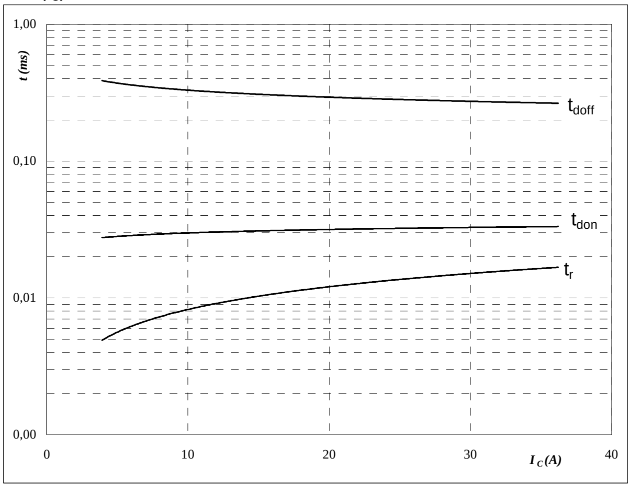
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	10	V
I_C =	20	A

Buck

Figure 9 MOSFET

Typical switching times as a function of collector current

$t = f(I_C)$



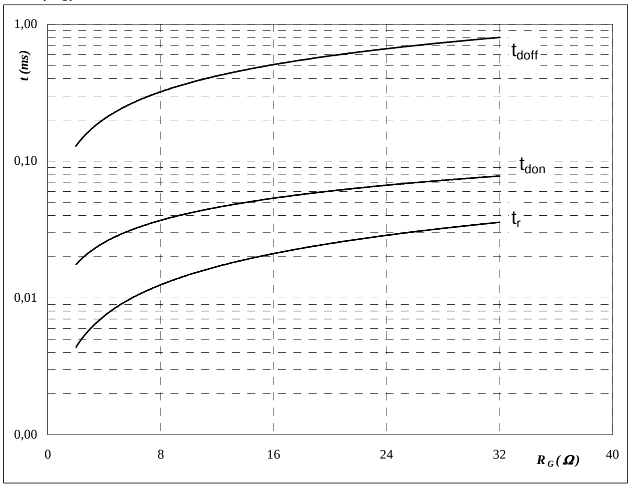
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



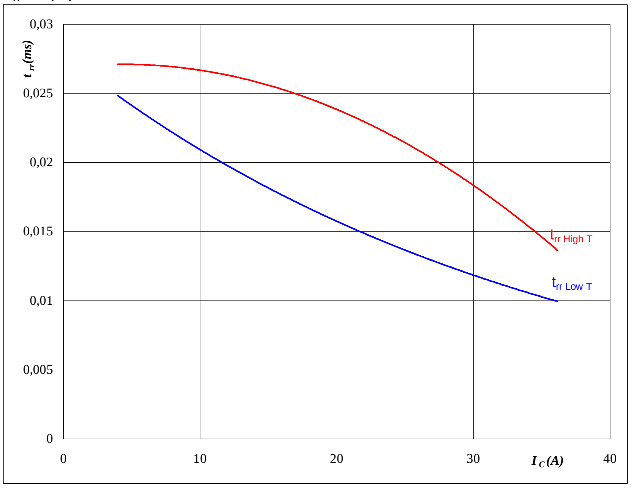
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	10	V
I_C =	20	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



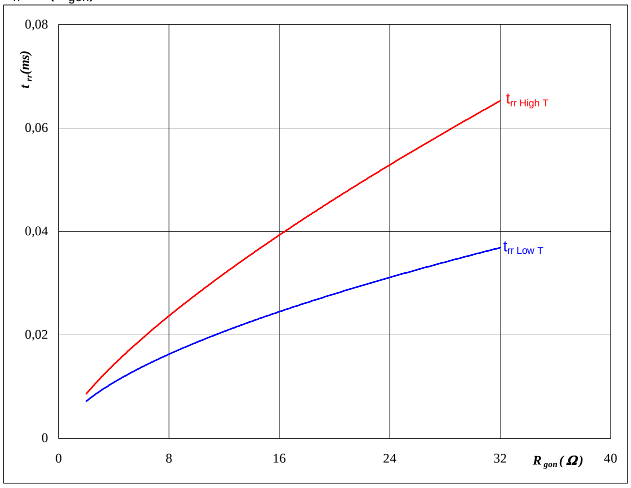
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 12 FWD

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

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



At

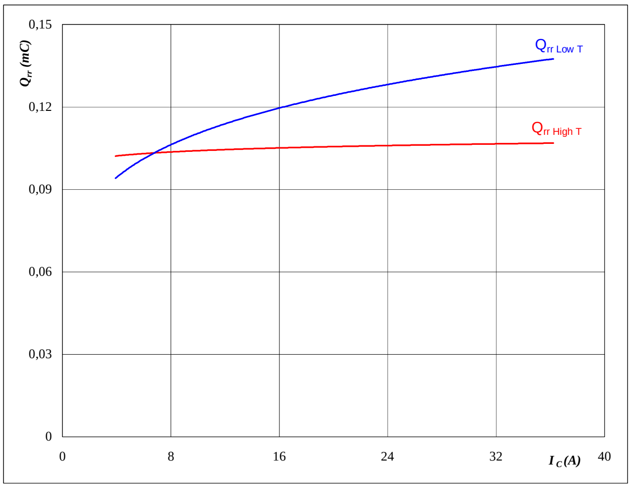
T_j =	25/125	℃
V_R =	350	V
I_F =	20	A
V_{GE} =	10	V

Buck

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



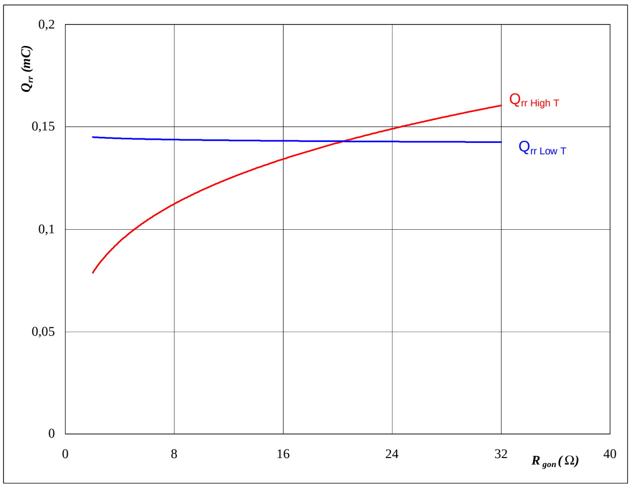
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 14 FWD

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

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



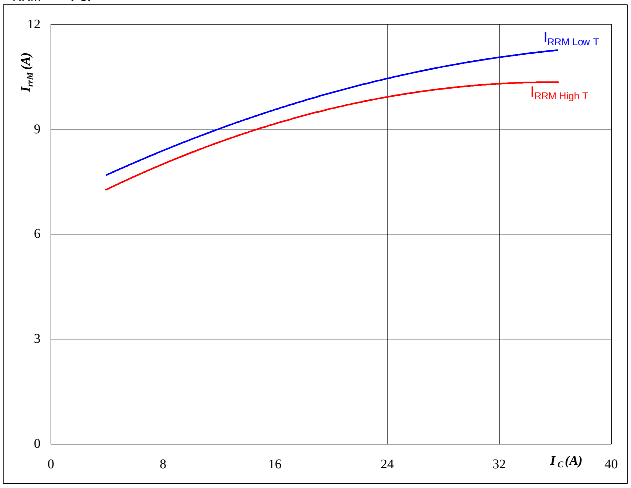
At

T_j =	25/125	℃
V_R =	350	V
I_F =	20	A
V_{GE} =	10	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



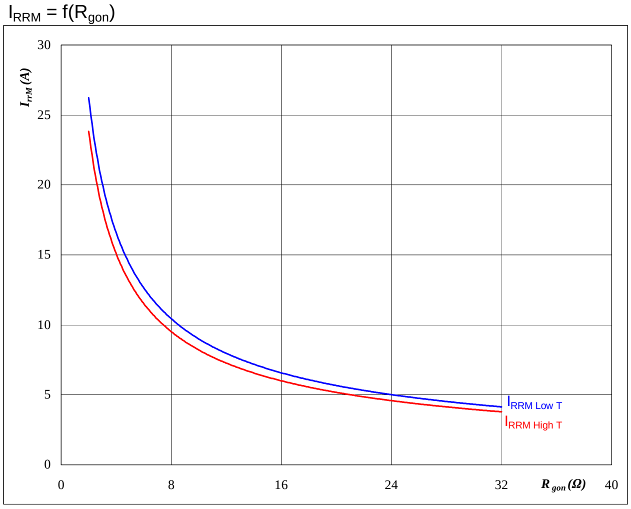
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 16 FWD

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

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



At

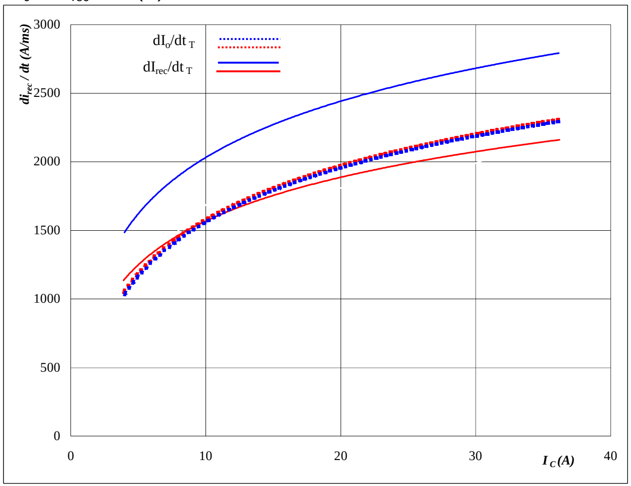
T_j =	25/125	℃
V_R =	350	V
I_F =	20	A
V_{GE} =	10	V

Buck

Figure 17 FWD

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

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



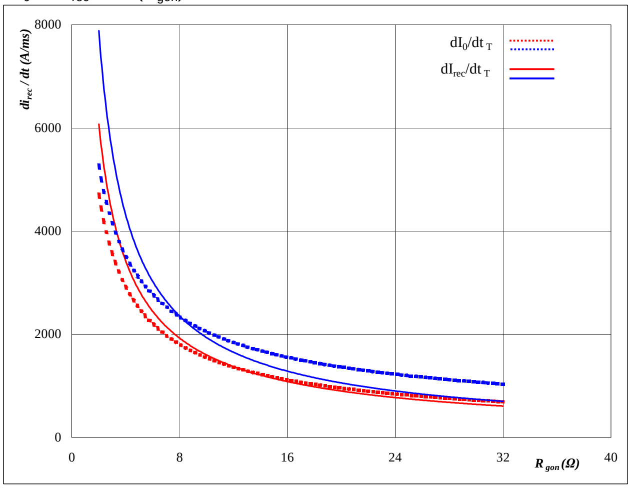
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 18 FWD

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

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



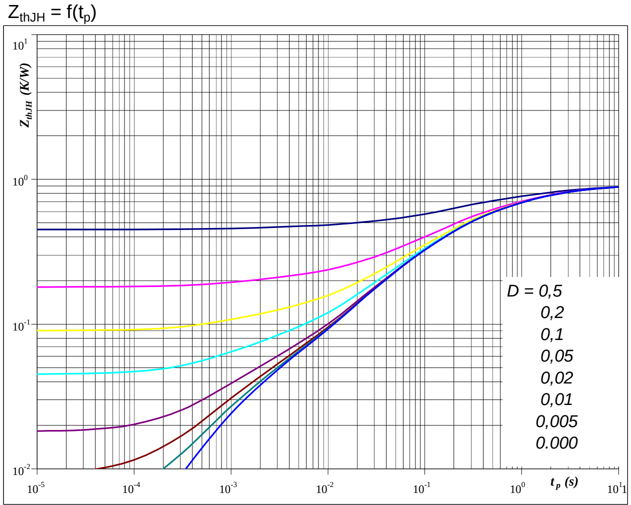
At

T_j =	25/125	℃
V_R =	350	V
I_F =	20	A
V_{GE} =	10	V

Figure 19 MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,90	K/W

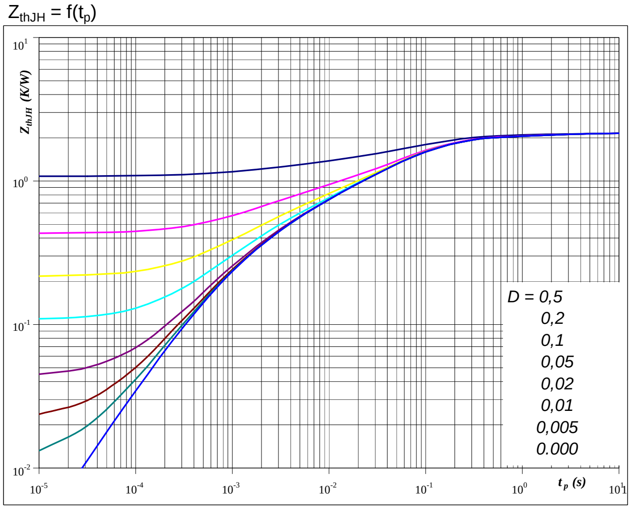
MOSFET thermal model values

R (C/W)	Tau (s)
0,13	4,5E+00
0,26	1,1E+00
0,25	2,4E-01
0,18	8,4E-02
0,07	1,5E-02
0,03	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} =	2,16	K/W

FWD thermal model values

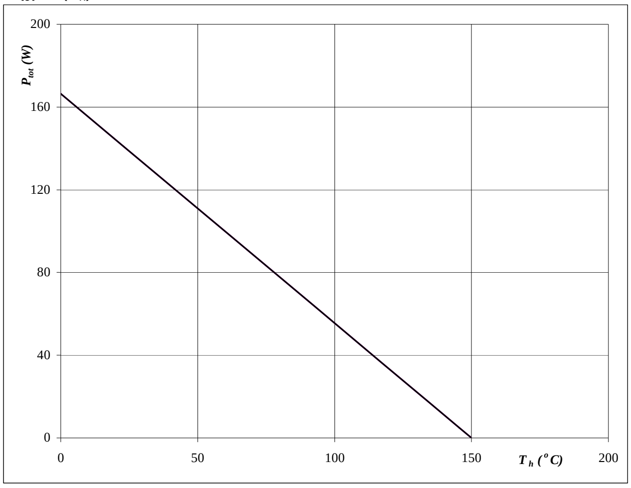
R (C/W)	Tau (s)
0,08	4,4E+00
0,13	8,2E-01
0,62	1,3E-01
0,67	4,6E-02
0,32	8,2E-03
0,25	1,9E-03
0,09	5,1E-04

Buck

Figure 21 MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



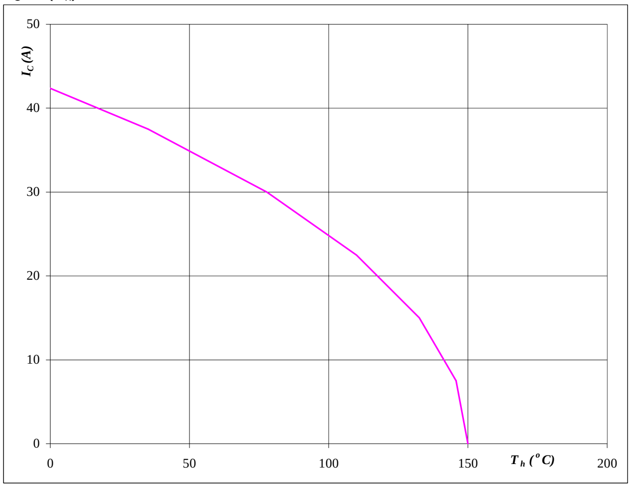
At

T_j = 150 ℃

Figure 22 MOSFET

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

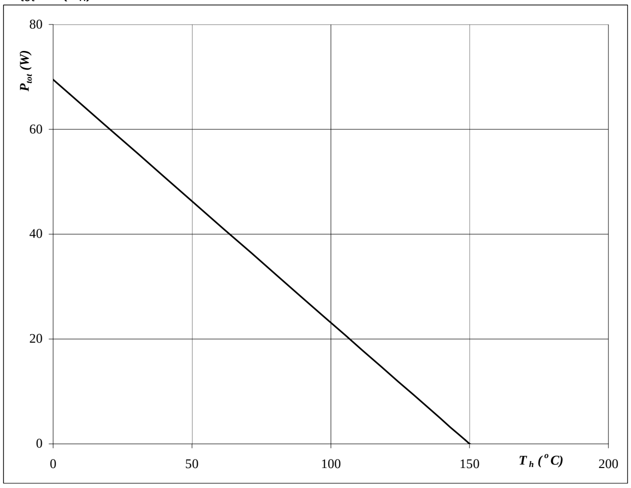
T_j = 150 ℃

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



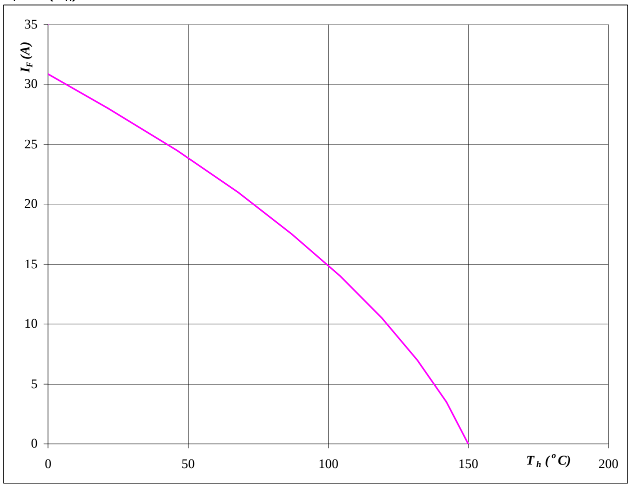
At

T_j = 150 ℃

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

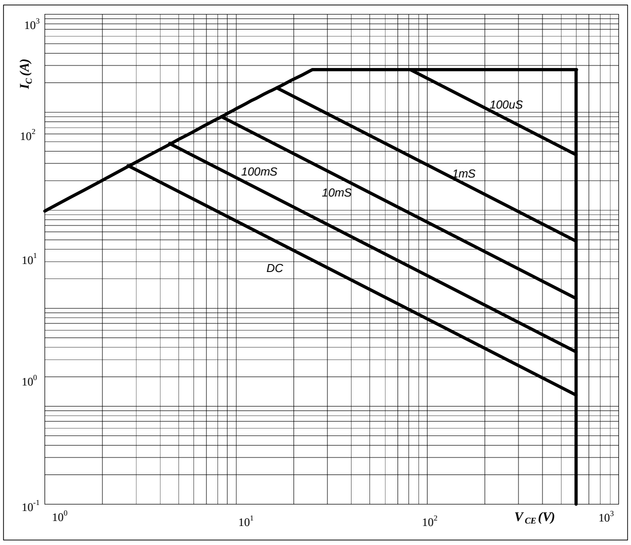
T_j = 150 ℃

Buck

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



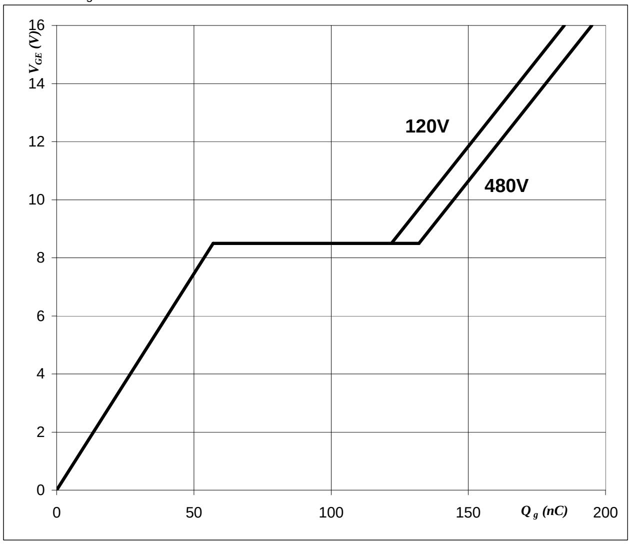
At

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

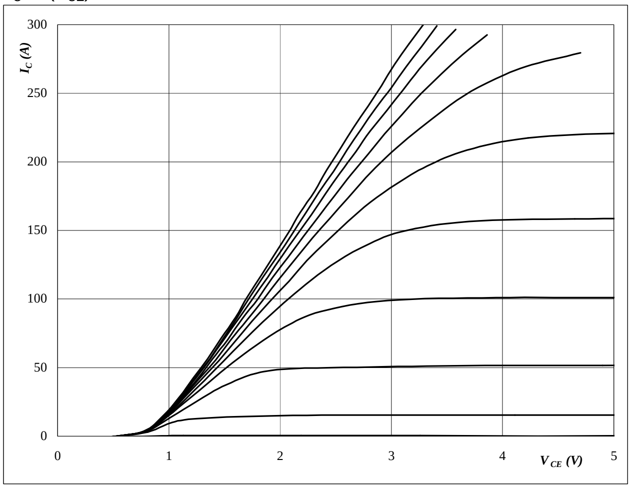
$I_{G(REF)}$=1mA, R_L=15Ω

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

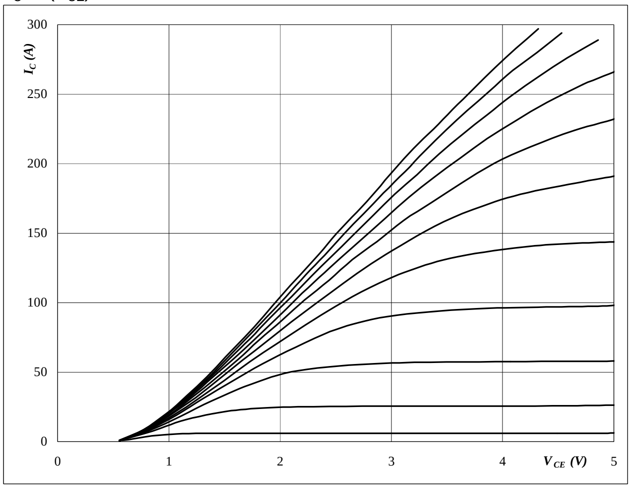
T_j = 25 °C

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

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

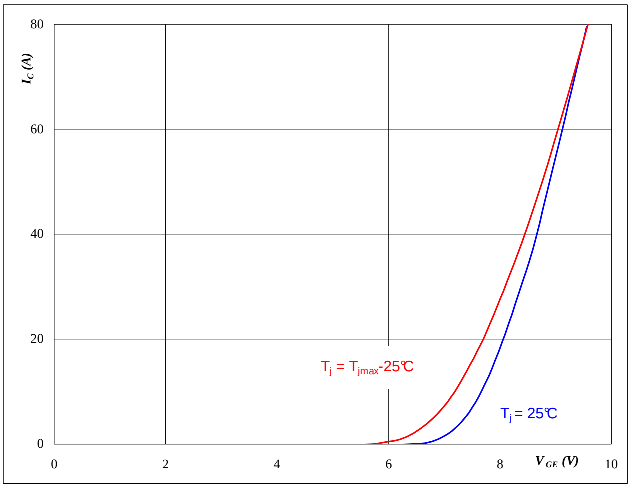
T_j = 125 °C

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

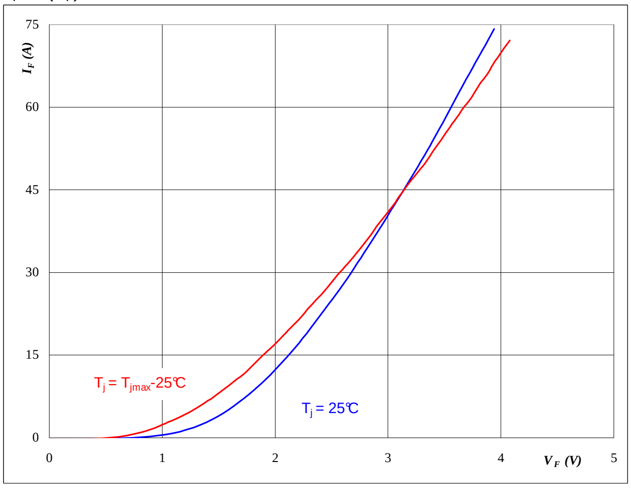
t_p = 250 µs

V_{CE} = 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

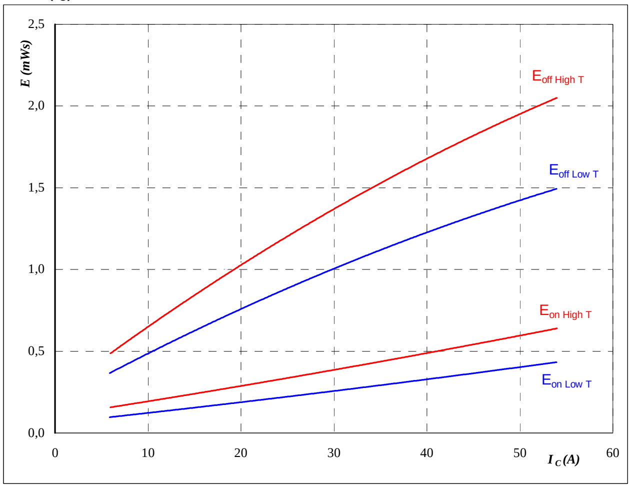
t_p = 250 µs

Boost

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



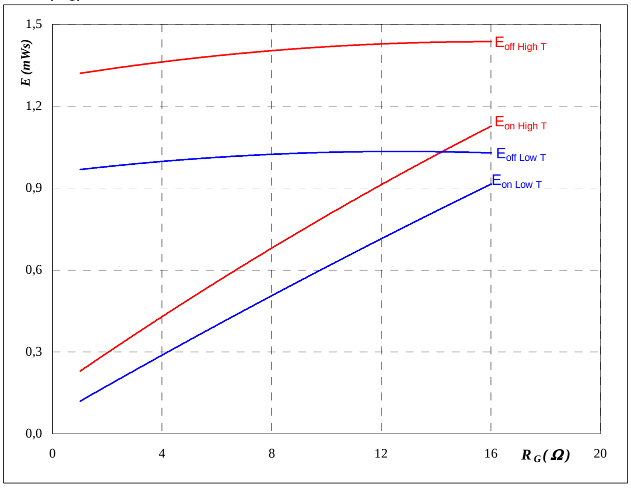
With an inductive load at

T_j =	25/125	°C
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

$E = f(R_G)$



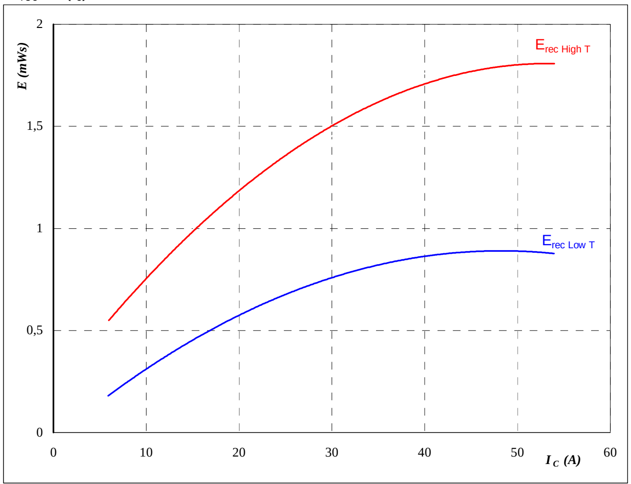
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	30	A

Figure 7 IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



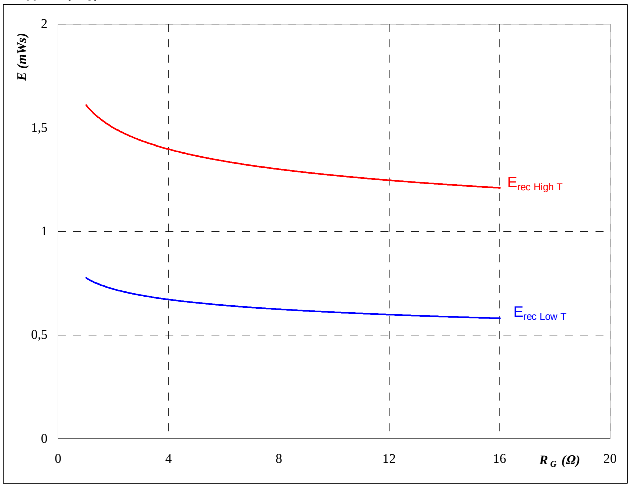
With an inductive load at

T_j =	25/125	°C
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

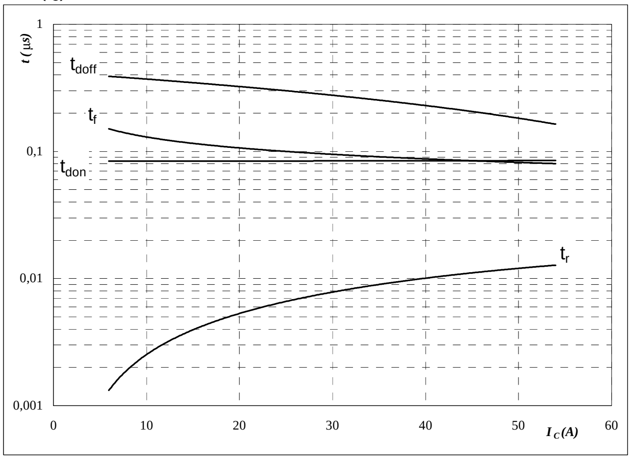
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	30	A

Boost

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



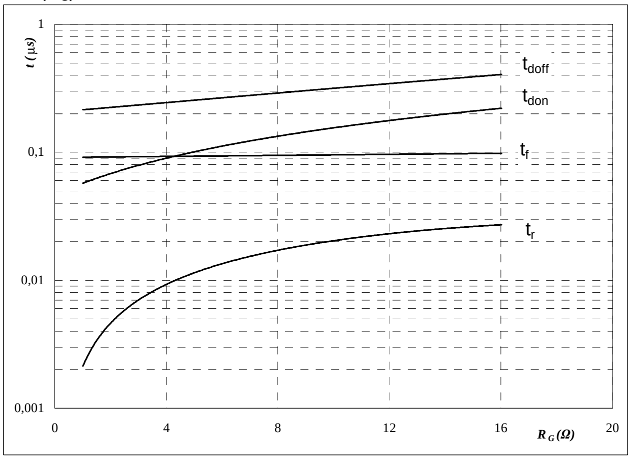
With an inductive load at

T_j =	25/125	°C
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)



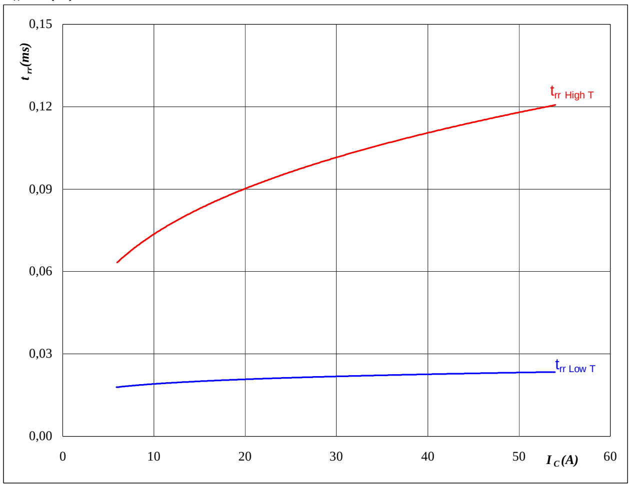
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	30	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



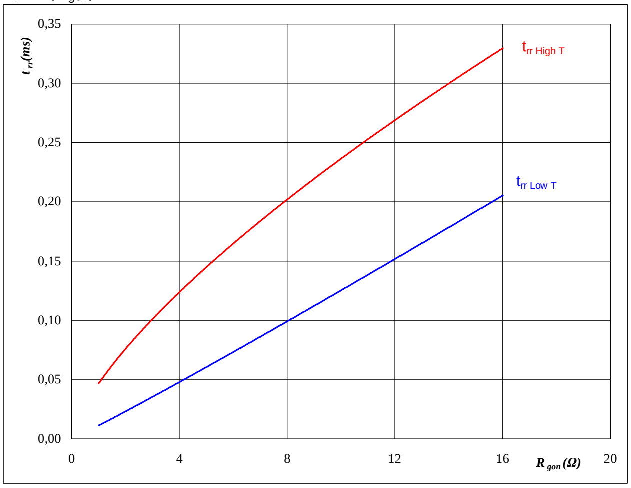
At

T_j =	25/125	°C
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

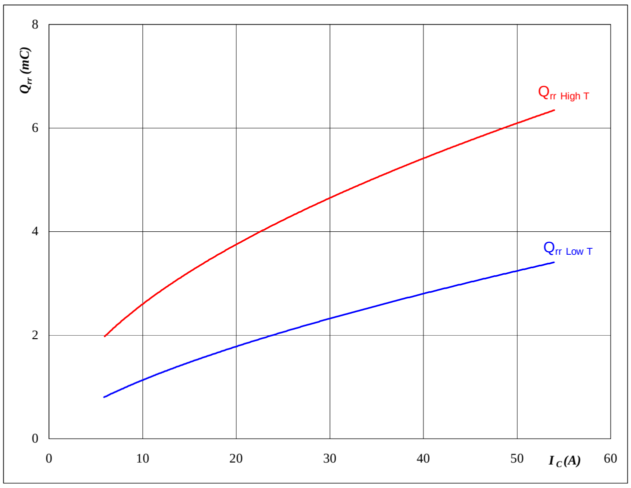
T_j =	25/125	°C
V_R =	350	V
I_F =	30	A
V_{GE} =	±15	V

Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



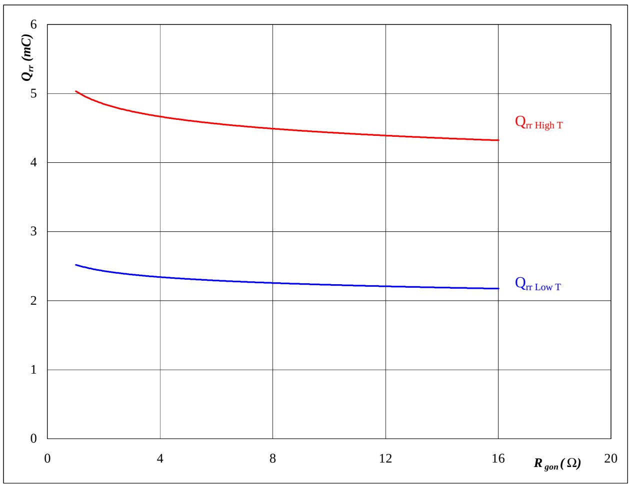
At

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

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



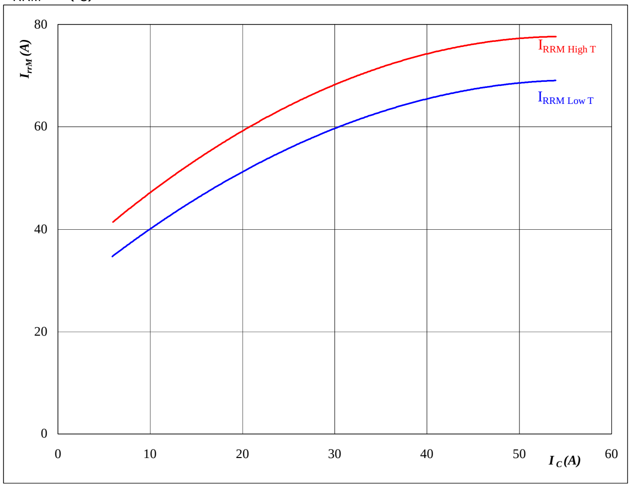
At

T_j =	25/125	℃
V_R =	350	V
I_F =	30	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



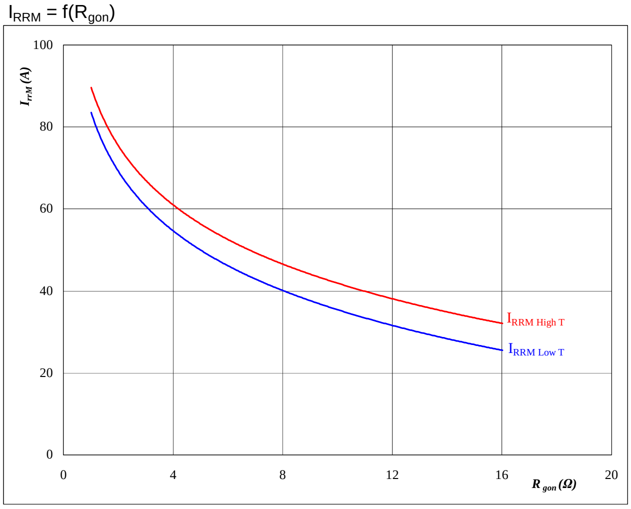
At

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

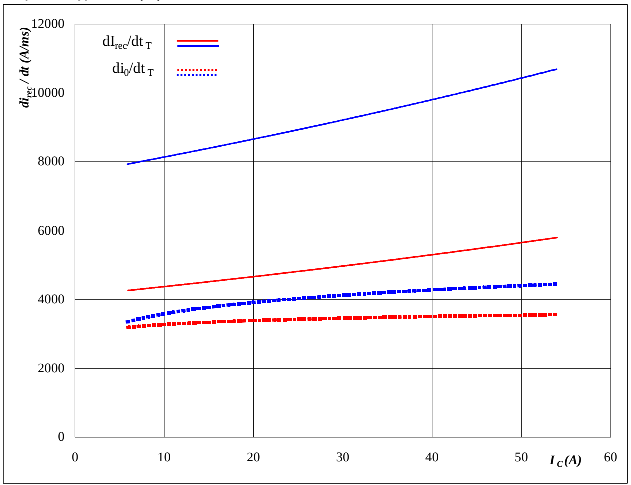
T_j =	25/125	℃
V_R =	350	V
I_F =	30	A
V_{GE} =	±15	V

Boost

Figure 17 FWD

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

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



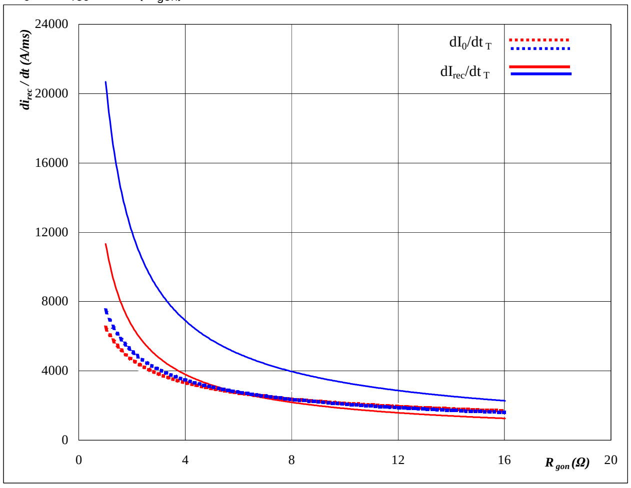
At

T_j =	25/125	°C
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

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



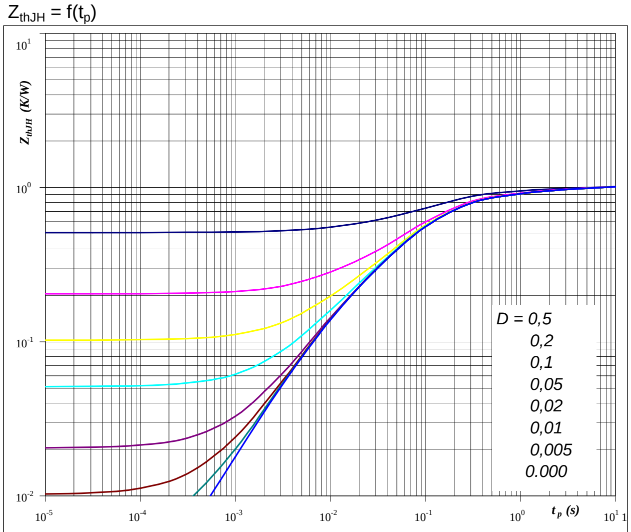
At

T_j =	25/125	°C
V_R =	350	V
I_F =	30	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

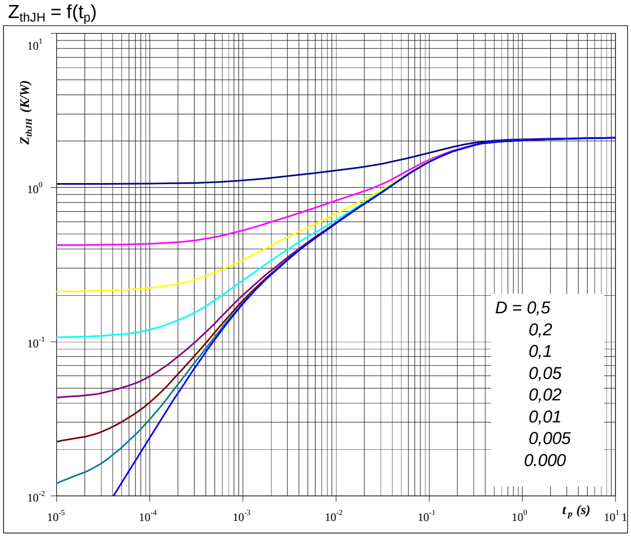
IGBT thermal model values

R (C/W)	Tau (s)
0,08	4,30
0,12	1,00
0,47	0,15
0,26	0,05
0,08	0,01

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	2,11	K/W

FWD thermal model values

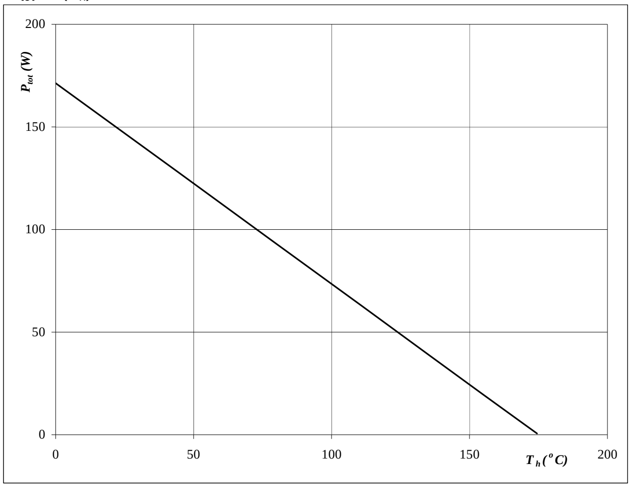
R (C/W)	Tau (s)
0,04	6,53
0,11	1,19
0,53	0,18
0,96	0,06
0,30	0,01
0,17	0,00

Boost

Figure 21	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



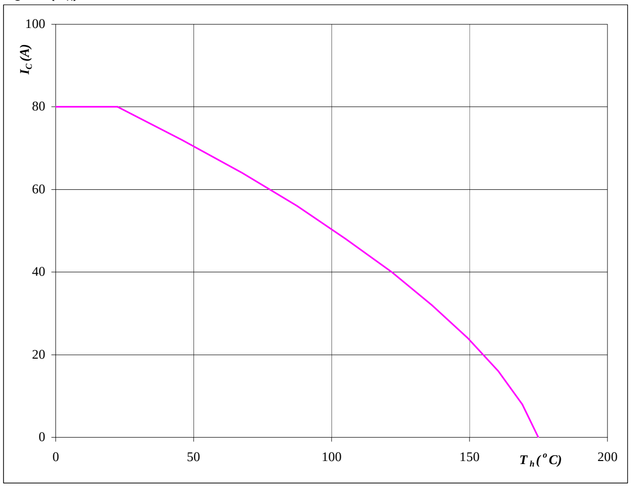
At

T_j = 175 ºC

Figure 22	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

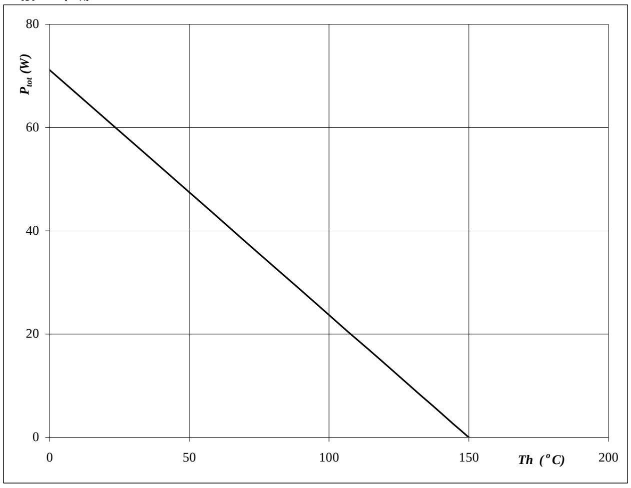
T_j = 175 ºC

V_{GE} = 15 V

Figure 23	FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



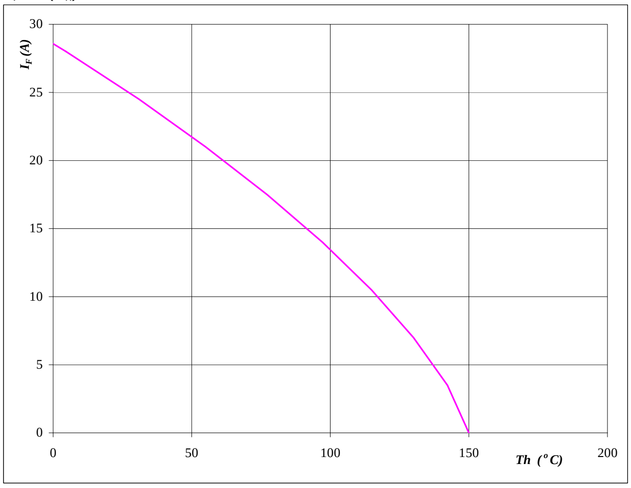
At

T_j = 150 ºC

Figure 24	FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

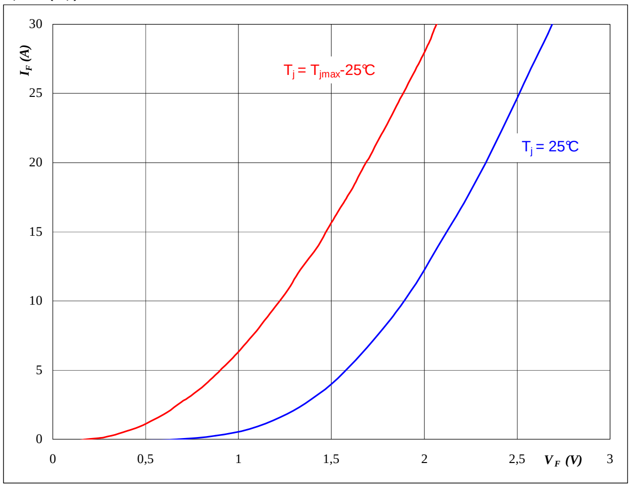
T_j = 150 ºC

Boost Inverse Diode

Figure 25 IGBT Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



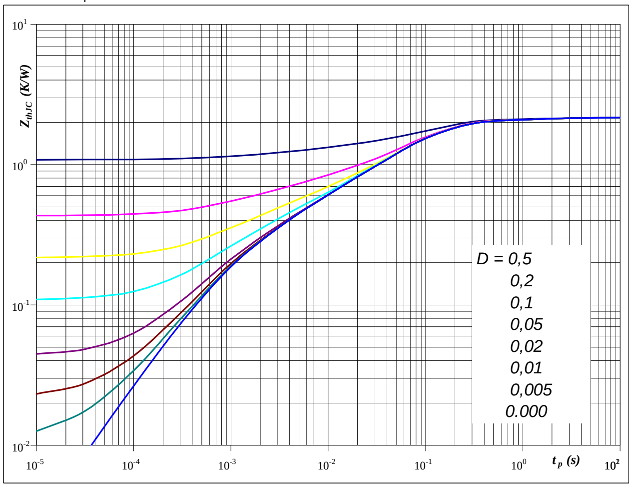
At

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

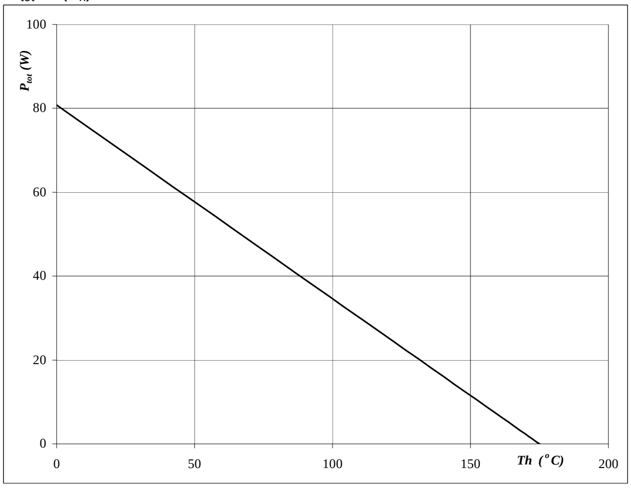
D = tp / T

R_{thJH} = 2,17 K/W

Figure 27 IGBT Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



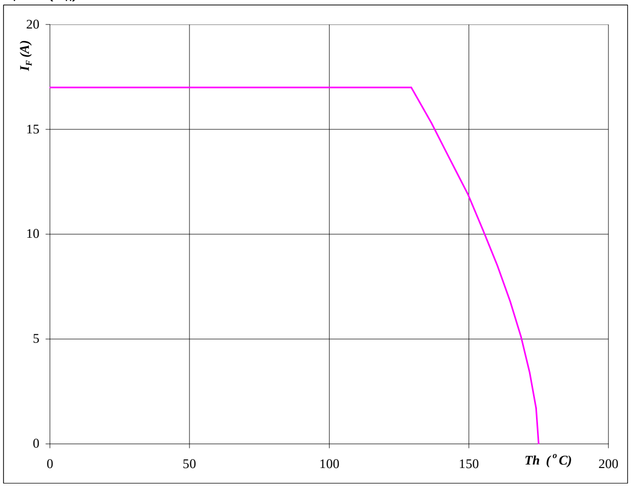
At

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
$R_T = f(T)$

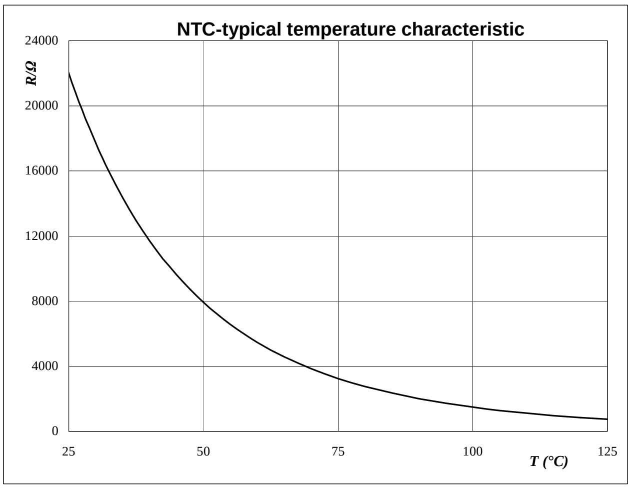


Figure 2 Thermistor

Typical NTC resistance values

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

T [°C]	R_soll [Ω]	R_min [Ω]	R_max [Ω]	△R/R [+-%]
-50	1458070,6	1069249,3	1846891,9	26,7
0	71804,2	59724,4	83884	16,8
10	43780,4	37094,4	50466,5	15,3
20	27484,6	23684,6	31284,7	13,8
25	22000	19109,3	24890,7	13,1
30	17723,3	15512,2	19934,4	12,5
60	5467,9	4980,6	5955,1	8,9
70	3848,6	3546	4151,1	7,9
80	2757,7	2568,2	2947,1	6,9
90	2008,9	1889,7	2128,2	5,9
100	**1486,1**	**1411,8**	**1560,4**	**5**
150	400,2	364,8	435,7	8,8

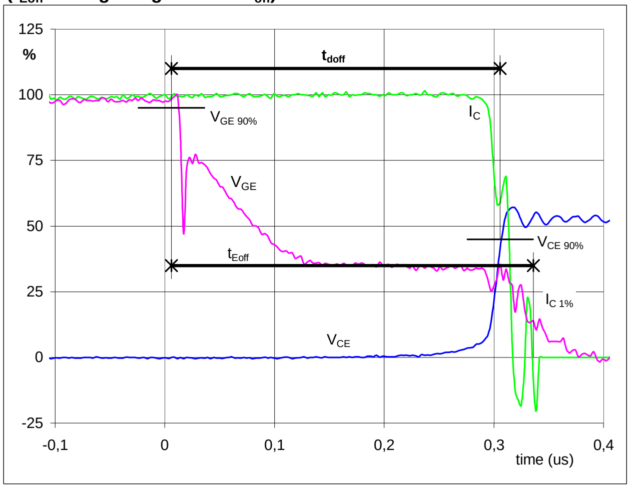
Switching Definitions BUCK

General conditions

T_j	=	125 °C
$R_{gon\ IGBT}$	=	8 Ω
$R_{goff\ IGBT}$	=	8 Ω

Figure 1 BUCK MOSFET

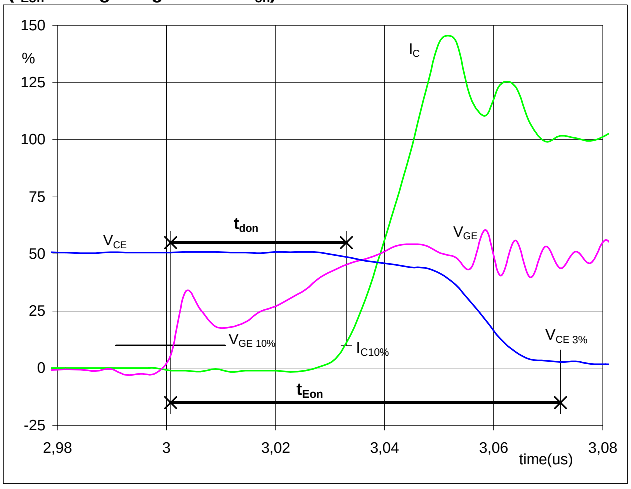
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	20	A
t_{doff} =	0,29	μs
t_{Eoff} =	0,33	μs

Figure 2 BUCK MOSFET

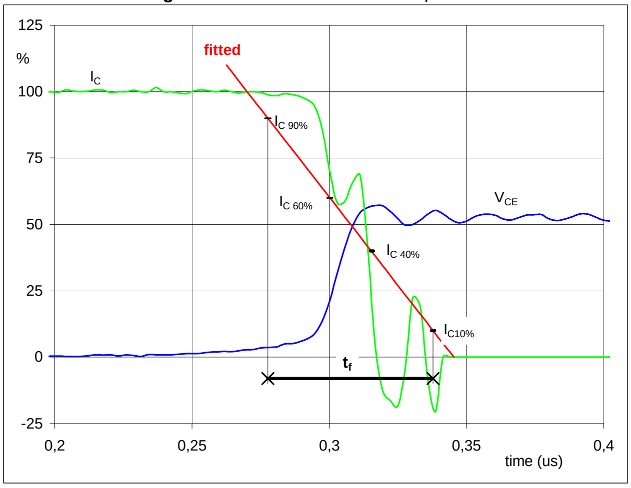
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	20	A
t_{don} =	0,03	μs
t_{Eon} =	0,07	μs

Figure 3 BUCK MOSFET

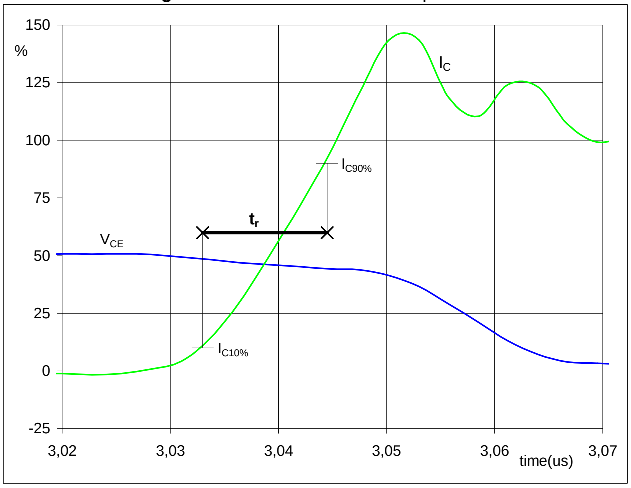
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	20	A
t_f =	2,756	μs

Figure 4 BUCK MOSFET

Turn-on Switching Waveforms & definition of t_r

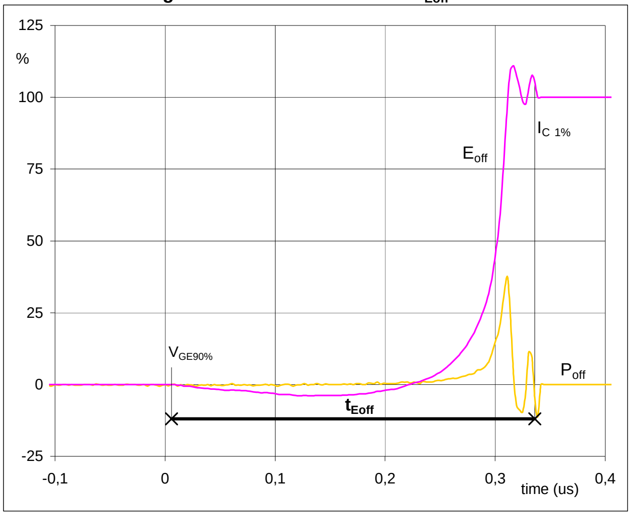


V_C (100%) =	700	V
I_C (100%) =	20	A
t_r =	0,01	μs

Switching Definitions BUCK

Figure 5 BUCK MOSFET

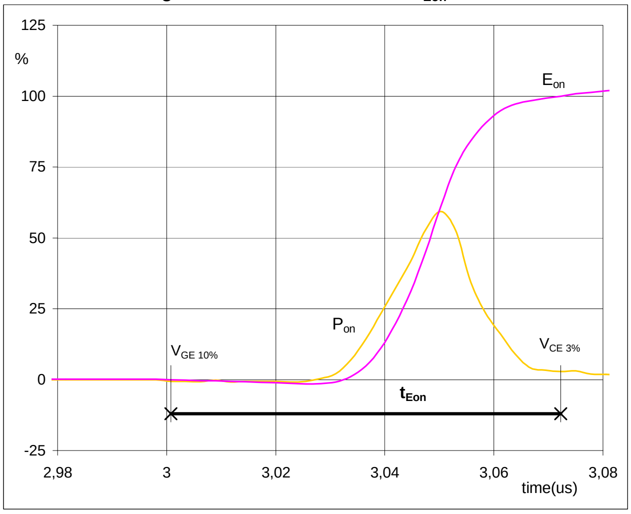
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	13,98	kW
E_{off} (100%) =	0,07	mJ
t_{Eoff} =	0,33	µs

Figure 6 BUCK MOSFET

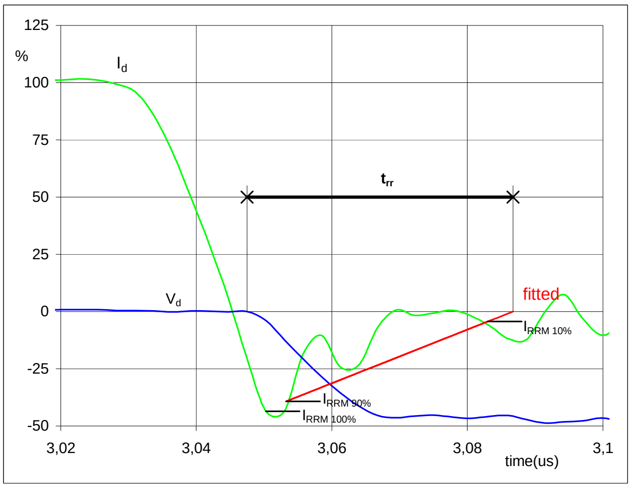
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	13,98	kW
E_{on} (100%) =	0,15	mJ
t_{Eon} =	0,07	µs

Figure 7 BUCK MOSFET

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

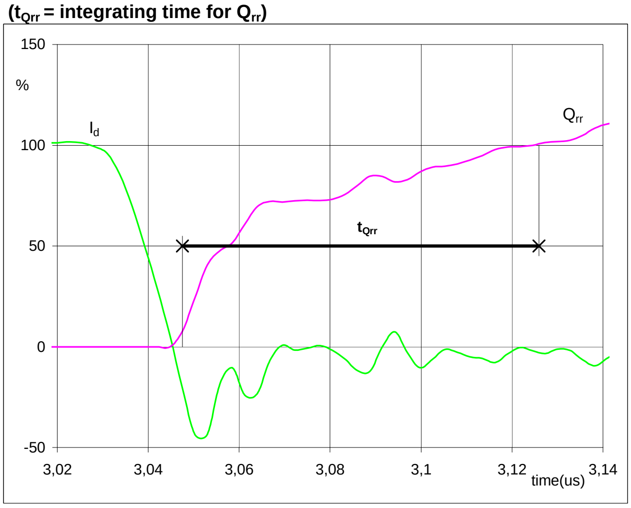


V_d (100%) =	700	V
I_d (100%) =	20	A
I_{RRM} (100%) =	-10	A
t_{rr} =	0,02	µs

Figure 8 BUCK FWD

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

(t_{Qrr} = integrating time for Q_{rr})

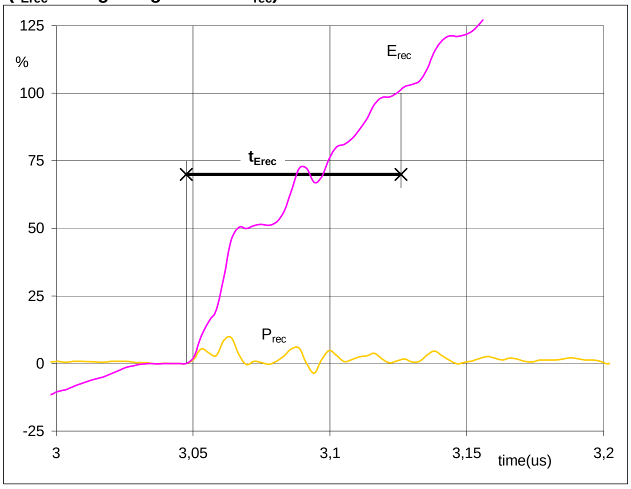


I_d (100%) =	20	A
Q_{rr} (100%) =	0,12	µC
t_{Qrr} =	0,08	µs

Switching Definitions BUCK

Figure 9 BUCK FWD

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



P_{rec} (100%) =	13,98	kW
E_{rec} (100%) =	0,02	mJ
t_{Erec} =	0,08	µs

Measurement circuits

Figure 11
BUCK stage switching measurement circuit

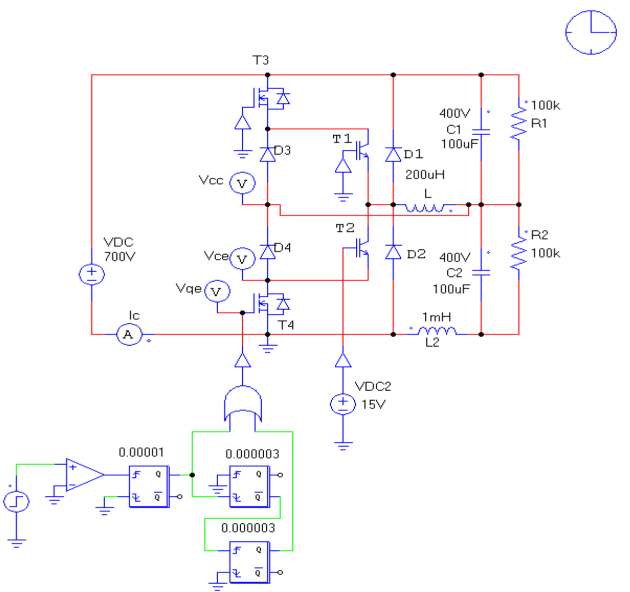
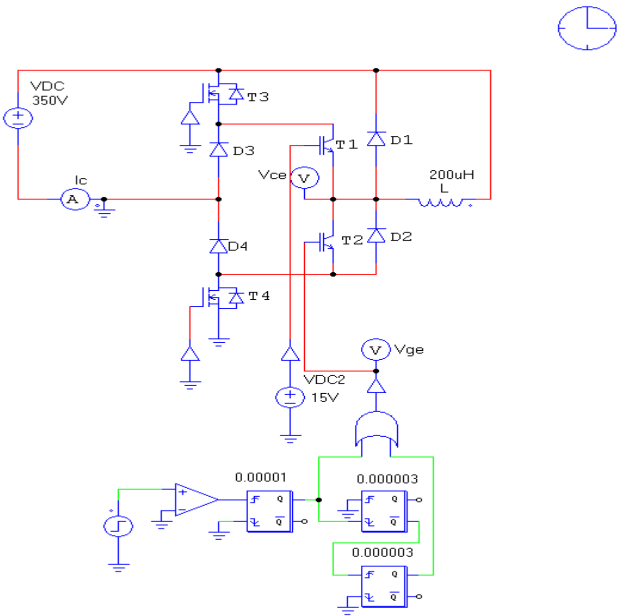


Figure 12
BOOST stage switching measurement circuit



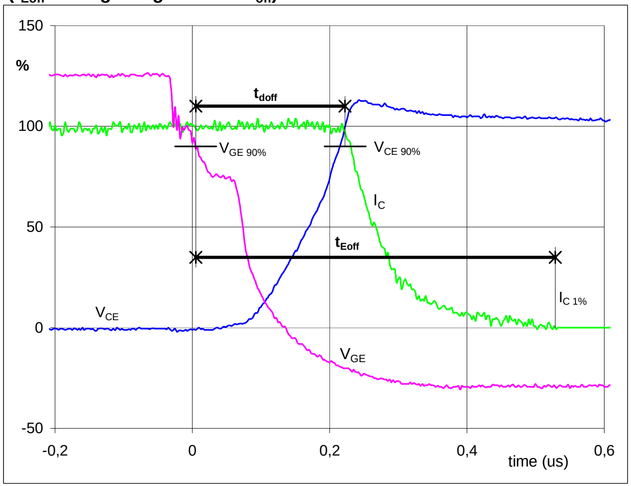
Switching Definitions BOOST

General conditions

T_j	=	125 °C
$R_{gon\ IGBT}$	=	4 Ω
$R_{goff\ IGBT}$	=	4 Ω

Figure 1 Output inverter IGBT

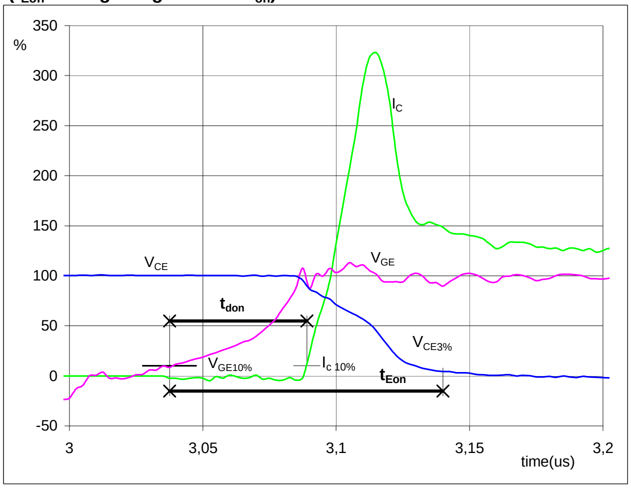
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	30	A
t_{doff} =	0,24	µs
t_{Eoff} =	0,52	µs

Figure 2 Output inverter IGBT

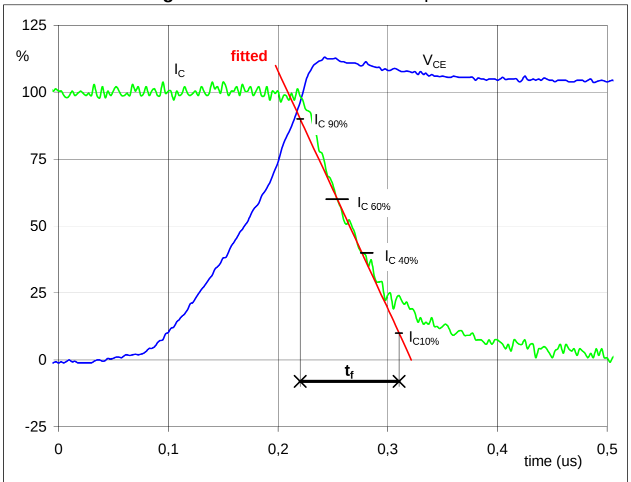
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	30	A
t_{don} =	0,08	µs
t_{Eon} =	0,10	µs

Figure 3 Output inverter IGBT

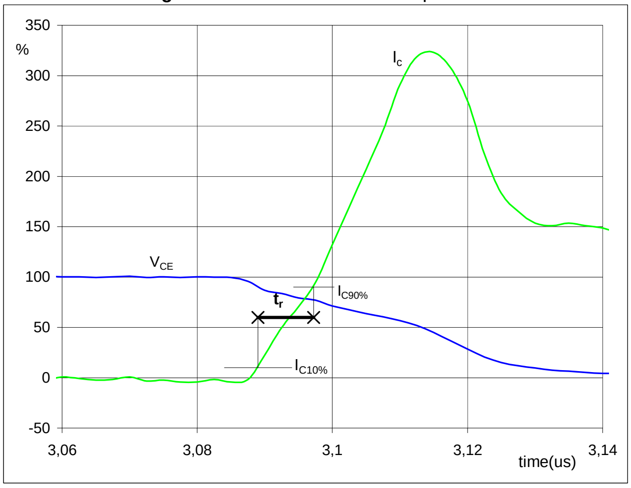
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	30	A
t_f =	0,090	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

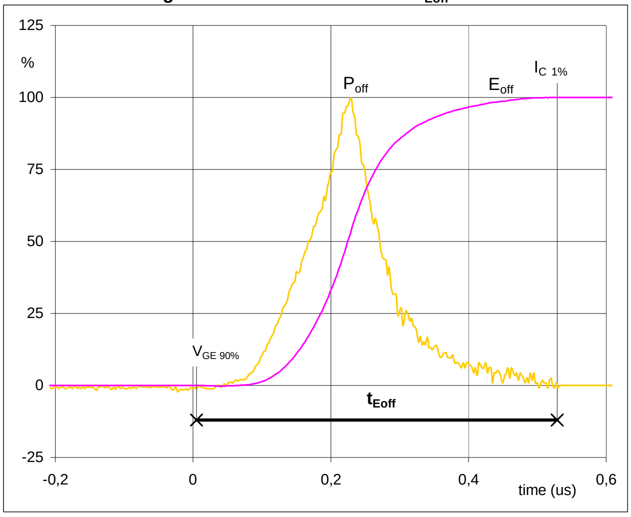


V_C (100%) =	350	V
I_C (100%) =	30	A
t_r =	0,01	µs

Switching Definitions BOOST

Figure 5 Output inverter IGBT

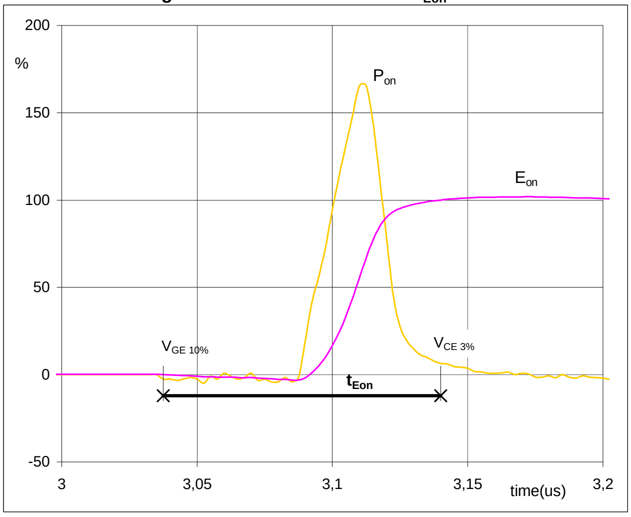
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	10,46	kW
E_{off} (100%) =	1,36	mJ
t_{Eoff} =	0,52	μs

Figure 6 Output inverter IGBT

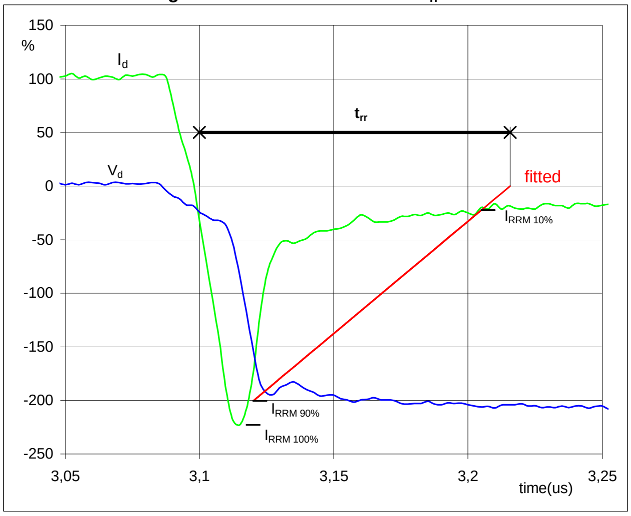
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	10,46	kW
E_{on} (100%) =	0,39	mJ
t_{Eon} =	0,10	μs

Figure 7 Output inverter IGBT

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

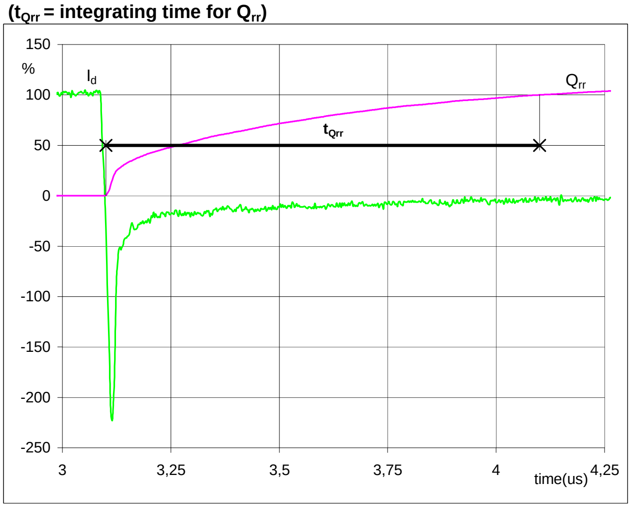


V_d (100%) =	350	V
I_d (100%) =	30	A
I_{RRM} (100%) =	-67	A
t_{rr} =	0,10	μs

Figure 8 Output inverter FWD

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

(t_{Qrr} = integrating time for Q_{rr})

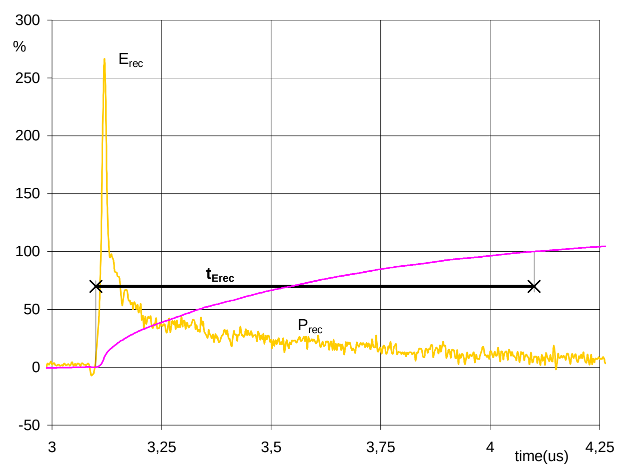


I_d (100%) =	30	A
Q_{rr} (100%) =	4,72	μC
t_{Qrr} =	1,00	μs

Switching Definitions BOOST

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	10,46	kW
E_{rec} (100%) =	1,45	mJ
t_{Erec} =	1,00	µs

Measurement circuits

Figure 11
BUCK stage switching measurement circuit

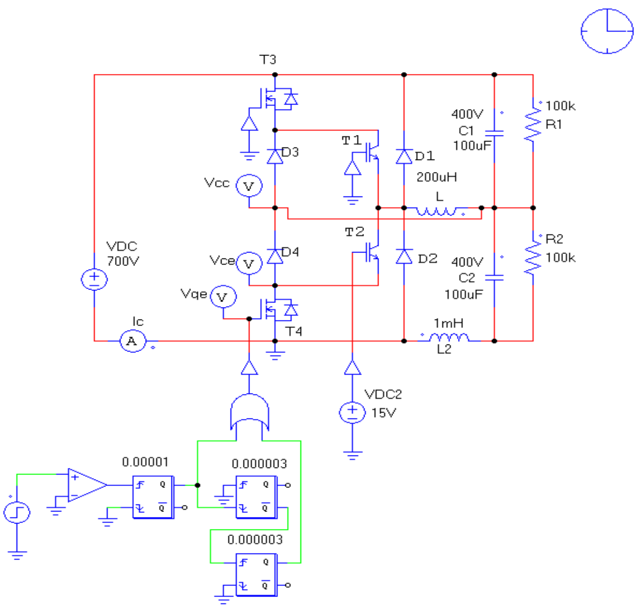
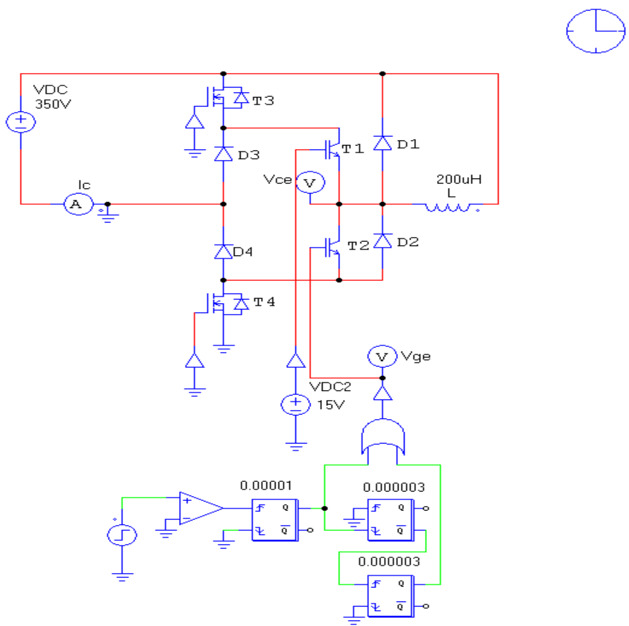


Figure 12
BOOST stage switching measurement circuit



Ordering Code and Marking - Outline - Pinout

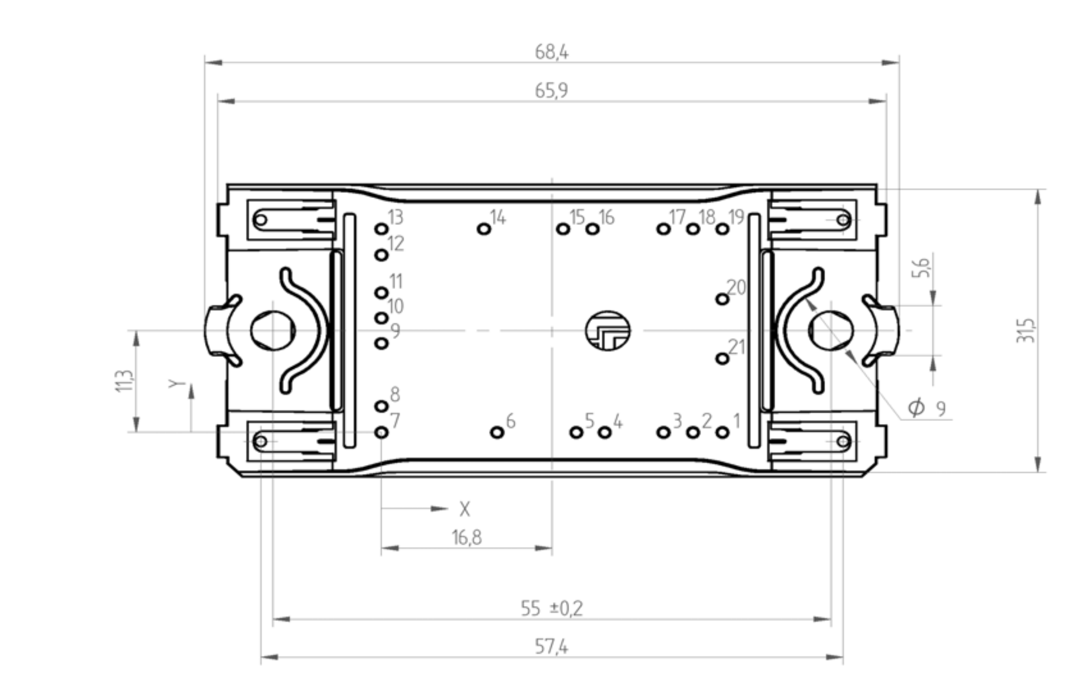
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
w/o thermal paste 12mm housing solder pin	10-FZ06NRA041FS02-P965F68	P965F68	P965F68
w/o thermal paste 12mm housing Press-fit pin	10-FZ06NRA041FS02-P965F68	P965F68Y	P965F68Y

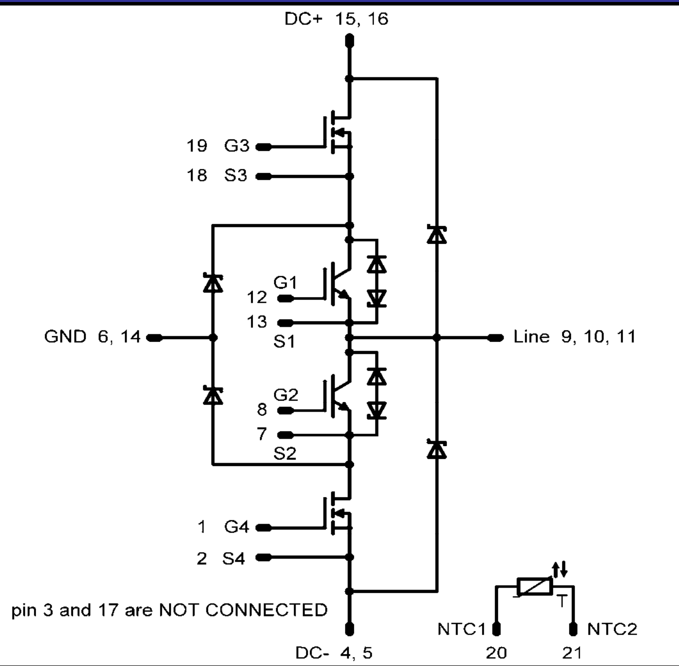
Outline

Pin table

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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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.