flowNPC1 | **600V/41mΩ**

Features

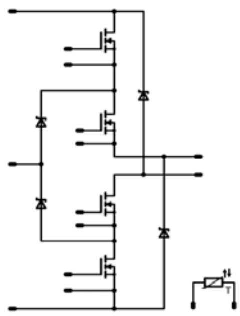
- neutral point clamped inverter (NPC)
- split output eliminates cross conduction
- Ultra fast switching with MOSFET and SiC diodes
- reactive power capability
- low inductance layout

flow1 12mm housing

Target Applications

- solar inverter
- UPS

Schematic



Types

- 10-PY06NRA041FS-M413FY

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
BOOST MOSFET					
Drain to source breakdown voltage	V_{DS}			600	V
DC drain current	I_D	$T_j=T_j max$	T_h=80°C T_c=80°C	29 37	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j max$		272	A
Power dissipation	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	89 135	W
Gate-source peak voltage	V_{GS}			±20	V
Maximum Junction Temperature	$T_j max$			150	°C
BOOST FWD					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	$T_j=T_j max$	T_h=80°C T_c=80°C	17 22	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j max$		36	A
Power dissipation	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	32 48	W
Maximum Junction Temperature	$T_j max$			150	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
BUCK FWD					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	26 33	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		114	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	70 106	W
Maximum Junction Temperature	$T_j$max			175	°C
BUCK MOSFET					
Drain to source breakdown voltage	V_{DS}			600	V
DC drain current	I_D	$T_j=T_j$max	T_h=80°C T_c=80°C	29 37	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max		272	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	89 135	W
Gate-source peak voltage	Vgs			±20	V
Maximum Junction Temperature	$T_j$max			150	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
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 MOSFET										
Static drain to source ON resistance	$R_{DS(on)}$				44	Tj=25°C Tj=125°C		0,04 0,09		Ω
Gate threshold voltage	$V_{(GS)th}$	$V_{GS}=V_{DS}$			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			5000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		19 18		ns
Rise Time	t_r					Tj=25°C Tj=125°C		8 9		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		225 244		
Fall time	t_f					Tj=25°C Tj=125°C		6 5		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,18 0,26		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,07 0,10		
Total gate charge	Q_g	Rgon=4 Ω	10	480	44	Tj=25°C Tj=125°C		290		nC
Gate to source charge	Q_{gs}					Tj=25°C Tj=125°C		36		
Gate to drain charge	Q_{gd}					Tj=25°C Tj=125°C		150		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6530		pF
Output capacitance	C_{oss}							360		
Reverse transfer capacitance	C_{rss}							tbd.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,79		K/W
BOOST FWD										
Forward voltage	V_F				18	Tj=25°C Tj=125°C	1,5	2,27 1,97	3,5	V
Reverse leakage current	I_{rm}		10	400	15	Tj=25°C Tj=125°C			100 1000	μA
Peak recovery current	I_{RRM}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		50 60		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		20 32		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		1,31 3,02		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,41 1,04		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		8338 5554		A/μs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,21		K/W
BUCK FWD										
Diode forward voltage	V_F				16	Tj=25°C Tj=125°C		1,15 1,18	1,8	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		14 13		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		12 12		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		0,11 0,08		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		3315 2992		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		0,02 0,01		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,35		K/W

Characteristic Values

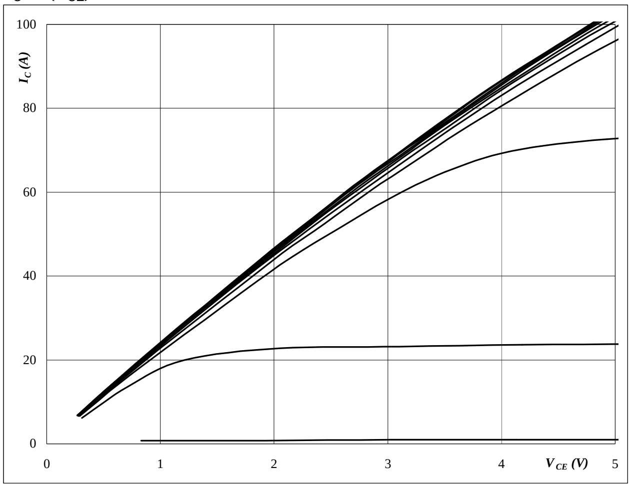
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Value Min	Typ	Max	Unit
BUCK MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$				44	Tj=25°C Tj=125°C		0,04 0,09		Ω
Gate threshold voltage	$V_{(GS)th}$			V_{DS}=V_{GS}	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			5000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		26 25		ns
Rise Time	t_r					Tj=25°C Tj=125°C		5 6		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		177 196		
Fall time	t_f					Tj=25°C Tj=125°C		9 12		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,09 0,10		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,03 0,04		
Total gate charge	Q_g		10	480	44	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		
Reverse transfer capacitance	C_{rss}							tbd.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,79		K/W
Thermistor										
Rated resistance	R					T=25°C		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=100°C	-5		+5	%
Power dissipation	P					T=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		1/K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3996		1/K
Vincotech NTC Reference									B	

BUCK

Figure 1 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



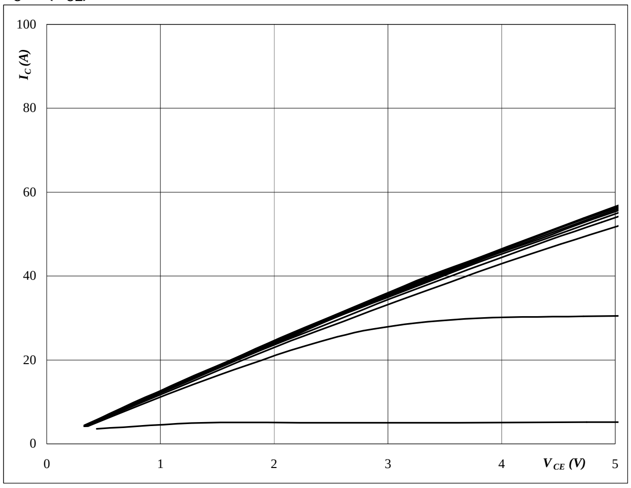
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	4 V to 14 V in steps of 1 V	

Figure 2 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



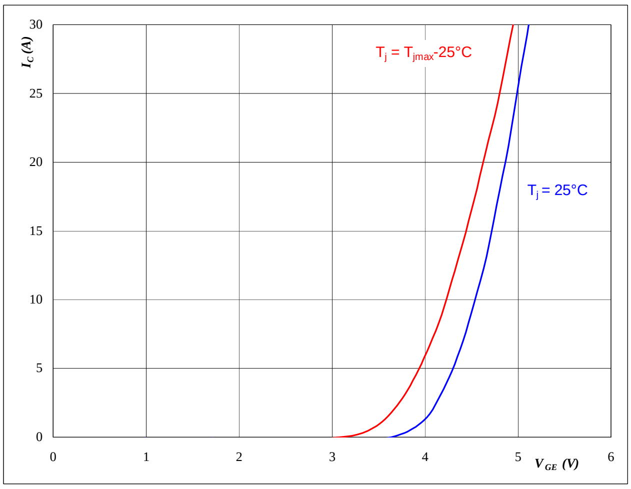
At

t_p =	250	μs
T_j =	125	°C
V_{GE} from	4 V to 14 V in steps of 1 V	

Figure 3 MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$



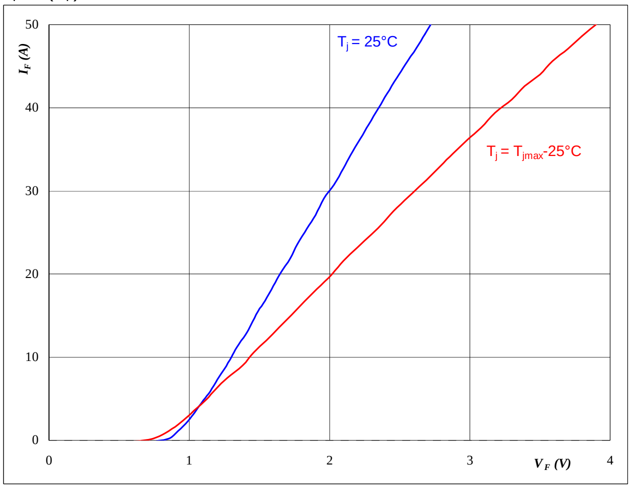
At

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

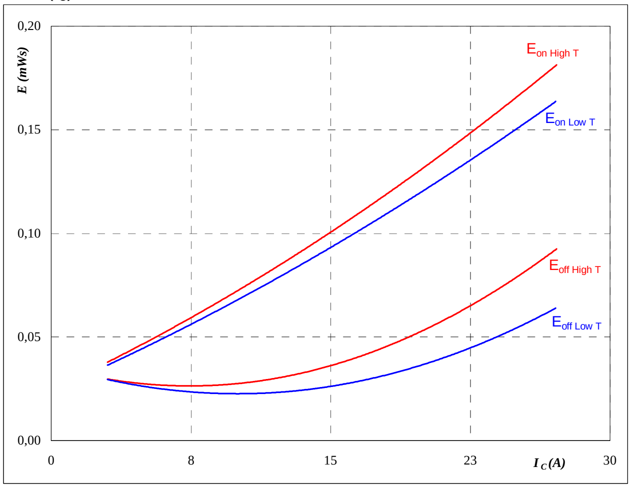
t_p =	250	μs

BUCK

Figure 5 MOSFET

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



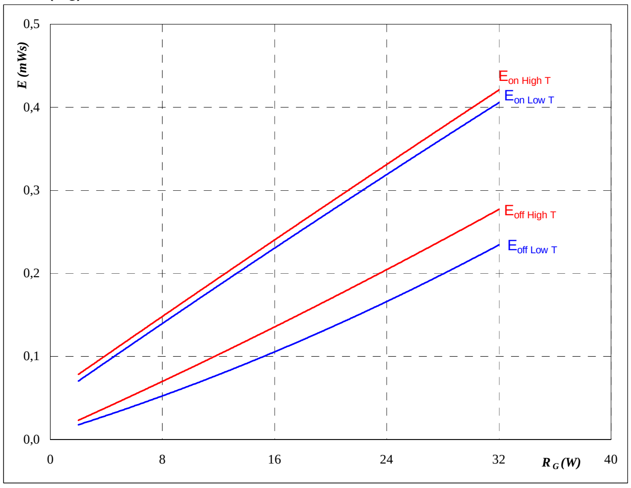
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 MOSFET

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



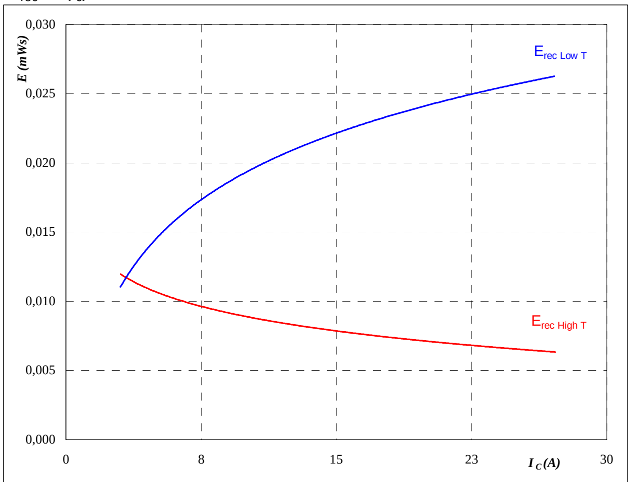
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
I_C =	15	A

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



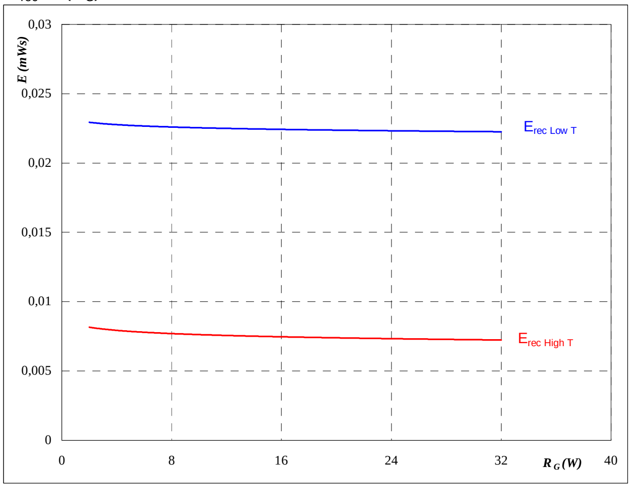
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	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

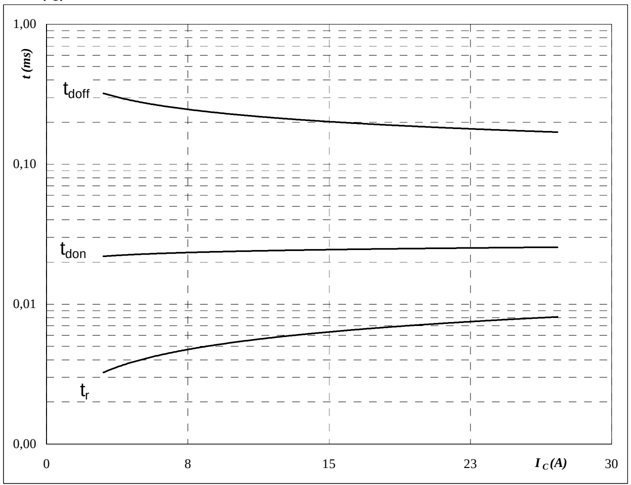
T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
I_C =	15	A

BUCK

Figure 9 MOSFET

Typical switching times as a function of collector current

t = f(I_C)



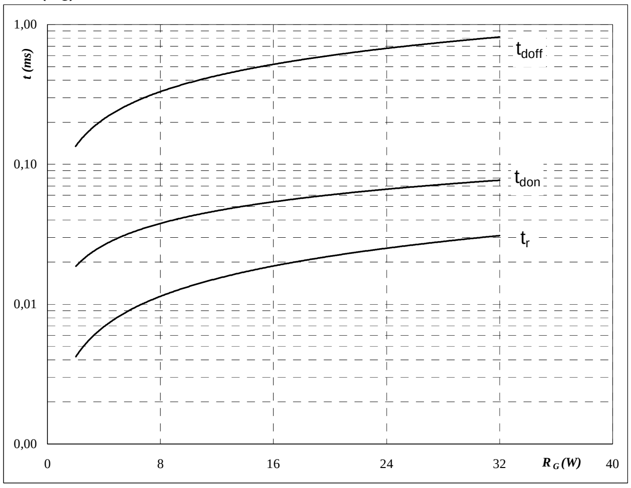
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 MOSFET

Typical switching times as a function of gate resistor

t = f(R_G)



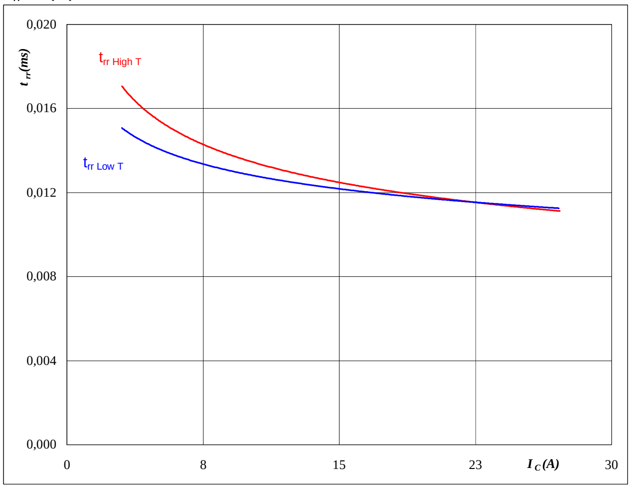
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	10	V
I_C =	15	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



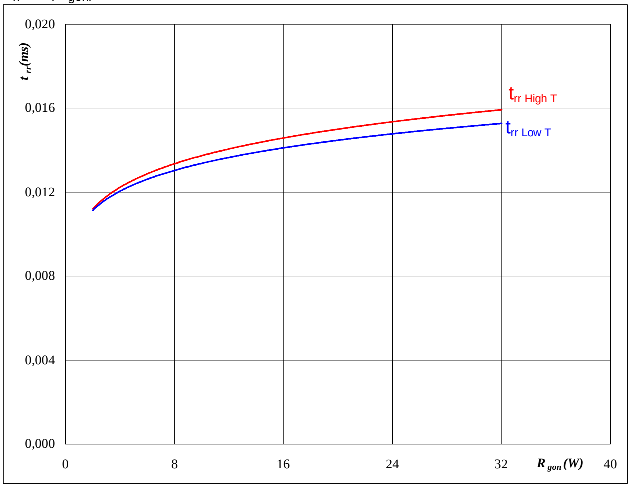
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 12 FWD

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

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



At

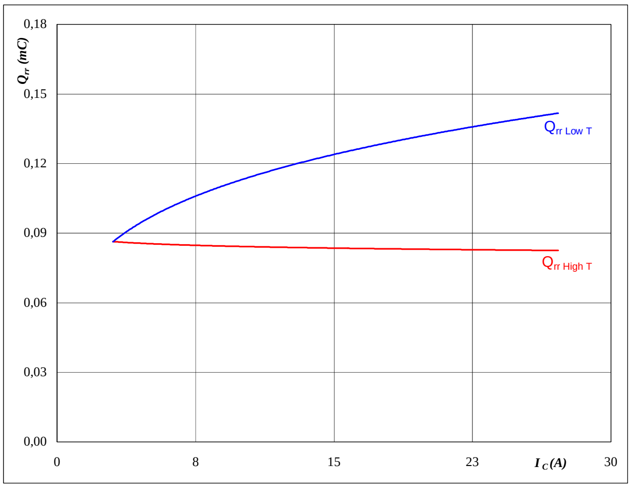
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

BUCK

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



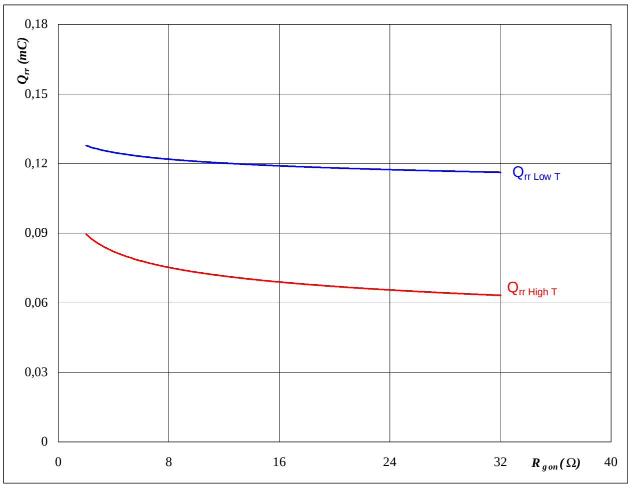
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 14 FWD

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

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



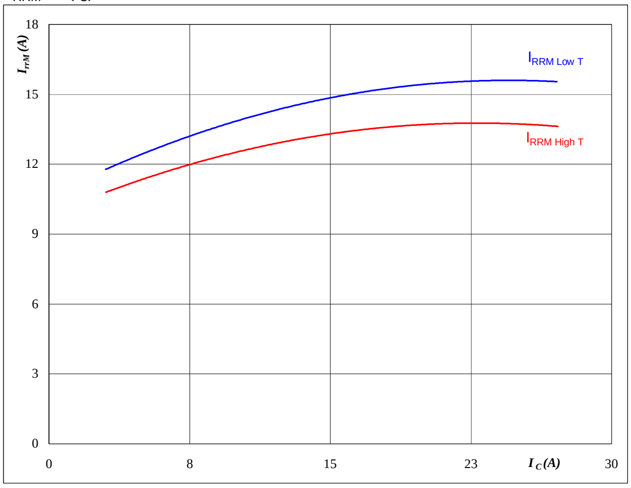
At

T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



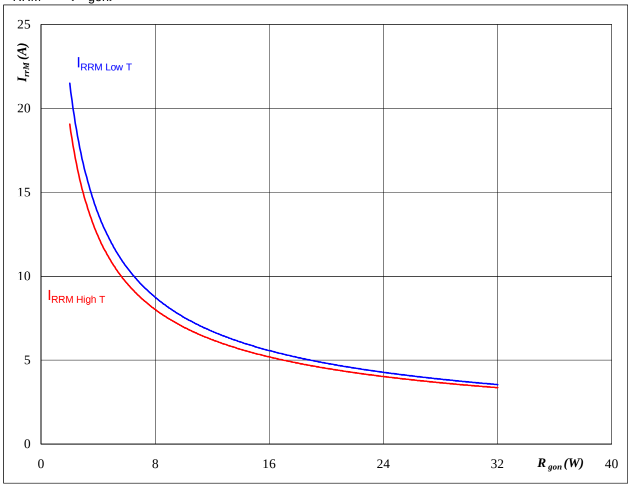
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 16 FWD

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

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



At

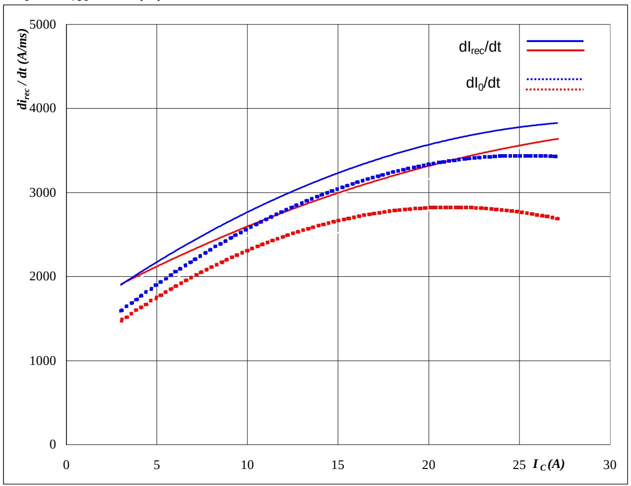
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

BUCK

Figure 17 FWD

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

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



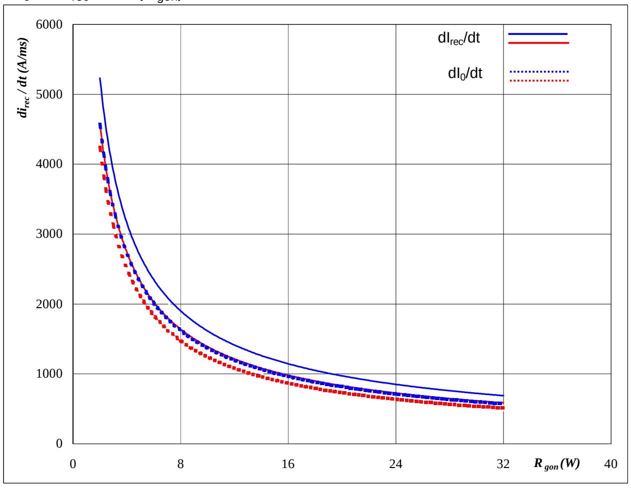
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 18 FWD

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

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



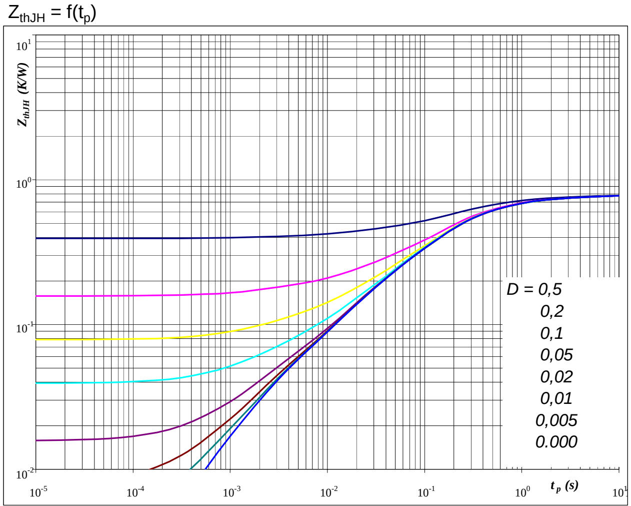
At

T_j =	25/125	°C
V_R =	400	V
I_F =	15	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} =	0,79	K/W

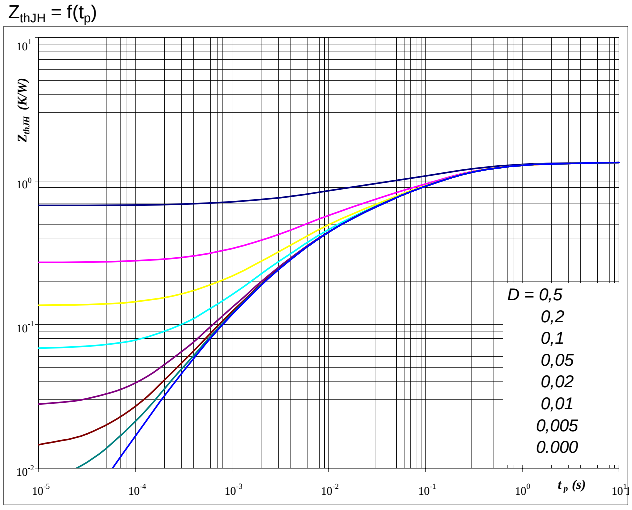
MOSFET thermal model values

R (C/W)	Tau (s)
0,02	9,8E+00
0,11	1,9E+00
0,24	3,6E-01
0,29	1,3E-01
0,09	2,1E-02
0,03	2,1E-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} =	1,35	K/W

FWD thermal model values

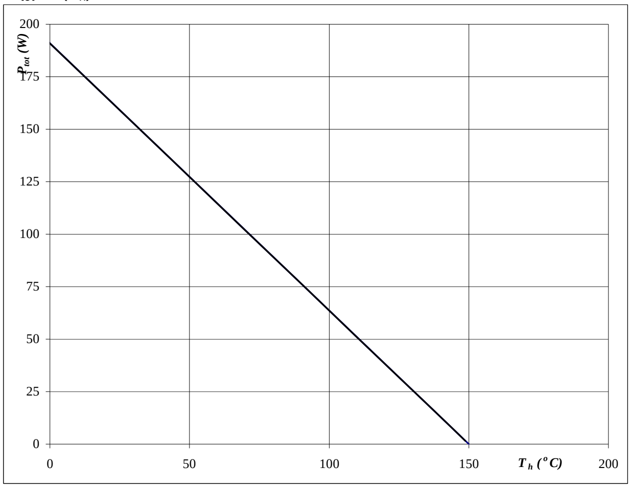
R (C/W)	Tau (s)
0,03	6,3E+00
0,08	1,2E+00
0,35	2,4E-01
0,36	7,7E-02
0,28	1,4E-02
0,21	3,2E-03

BUCK

Figure 21 MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



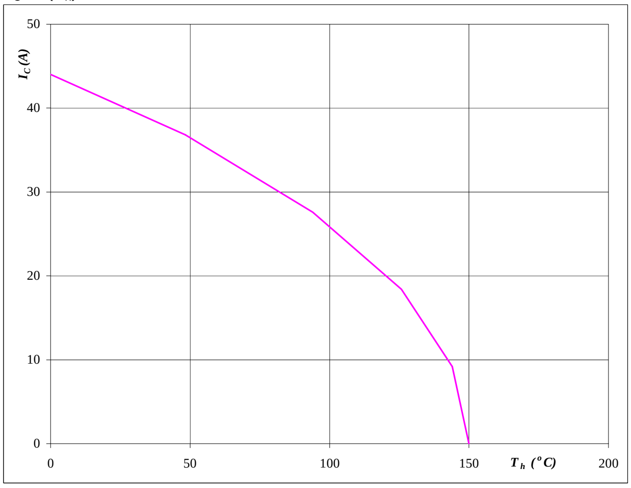
At

T_j = 150 °C

Figure 22 MOSFET

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

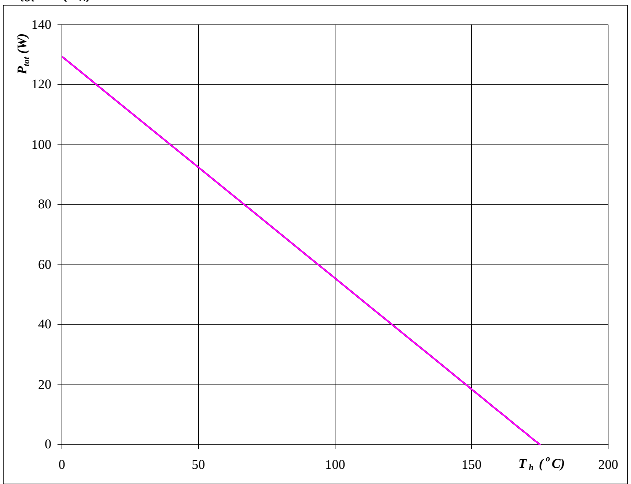
T_j = 150 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



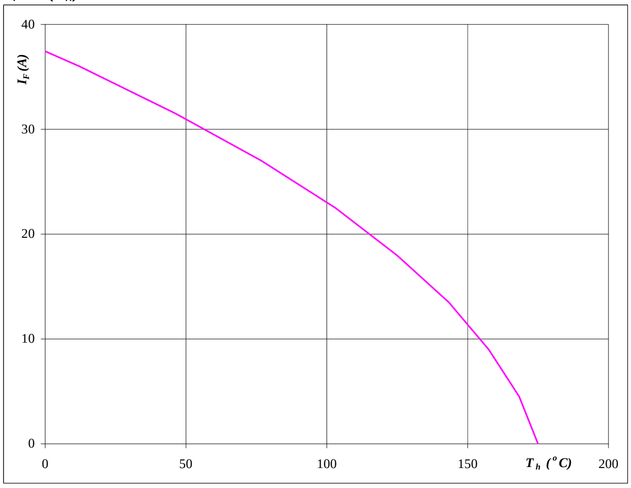
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

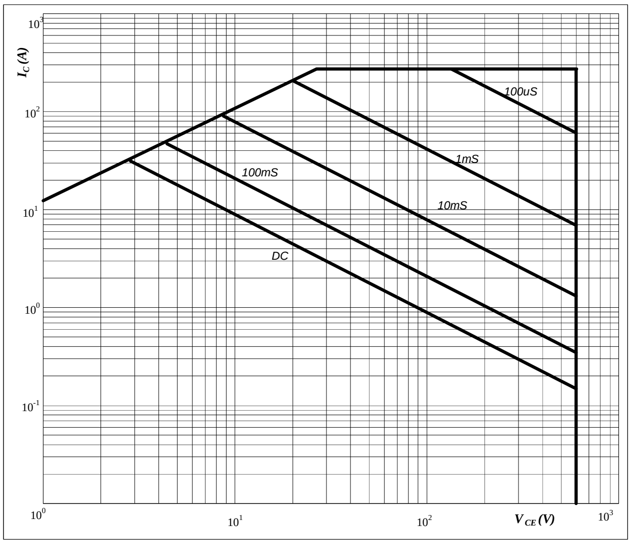
T_j = 175 °C

BUCK

Figure 25 MOSFET

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



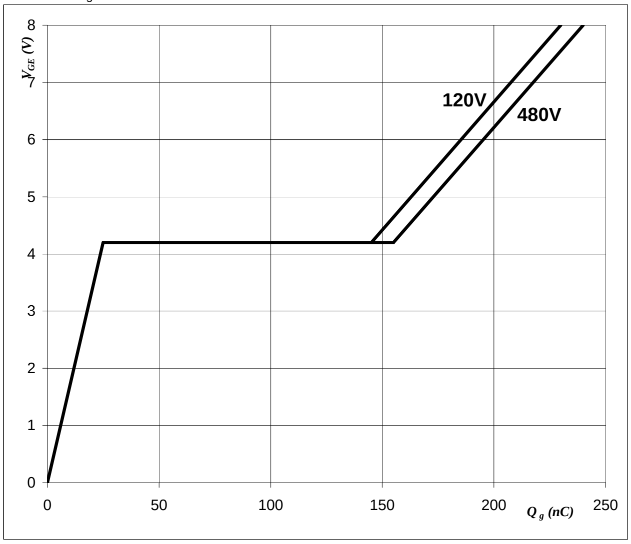
At

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

Figure 26 MOSFET

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

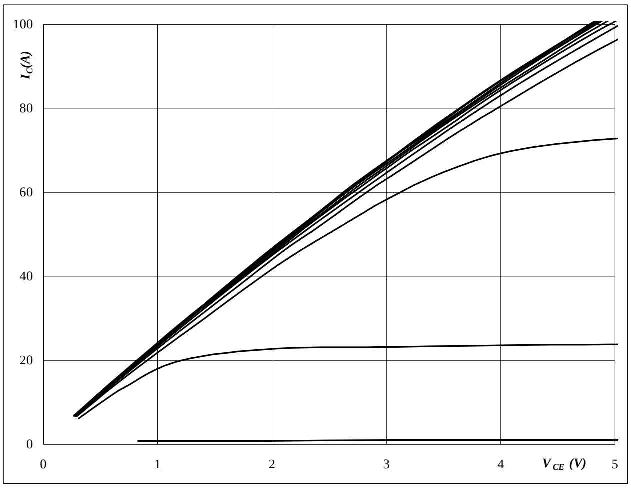
I_C =	44	A

BOOST

Figure 1 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



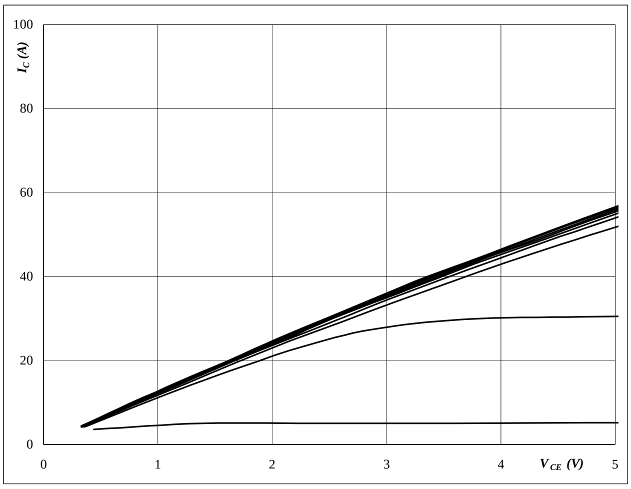
At

t_p =	250	µs
T_j =	25	°C
V_{GS} from	4 V to 14 V in steps of 1 V	

Figure 2 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



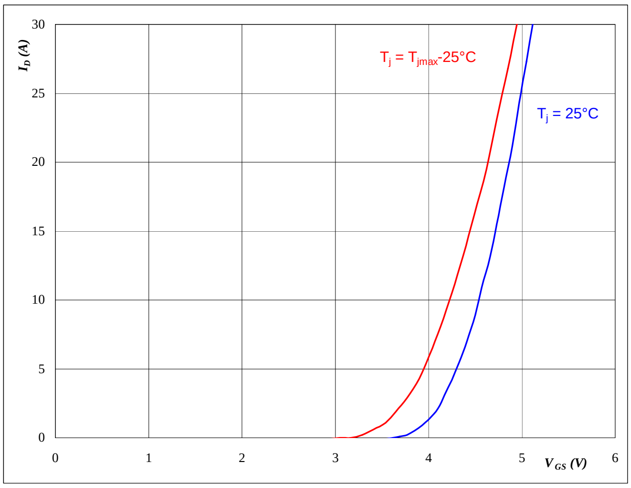
At

t_p =	250	µs
T_j =	125	°C
V_{GS} from	4 V to 14 V in steps of 1 V	

Figure 3 BOOST MOSFET

Typical transfer characteristics

$I_D = f(V_{GS})$



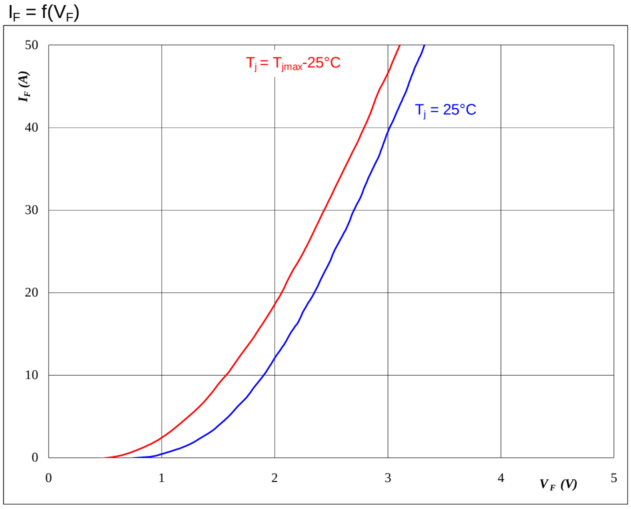
At

t_p =	250	µs
V_{DS} =	10	V

Figure 4 BOOST FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

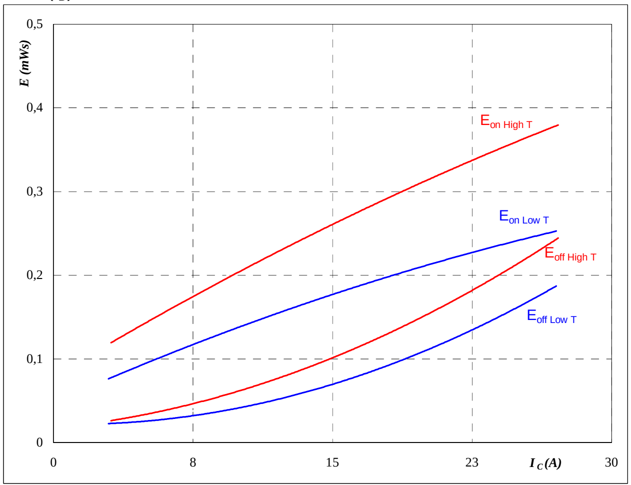
t_p =	250	µs

BOOST

Figure 5	BOOST MOSFET

Typical switching energy losses
as a function of collector current

$E = f(I_D)$



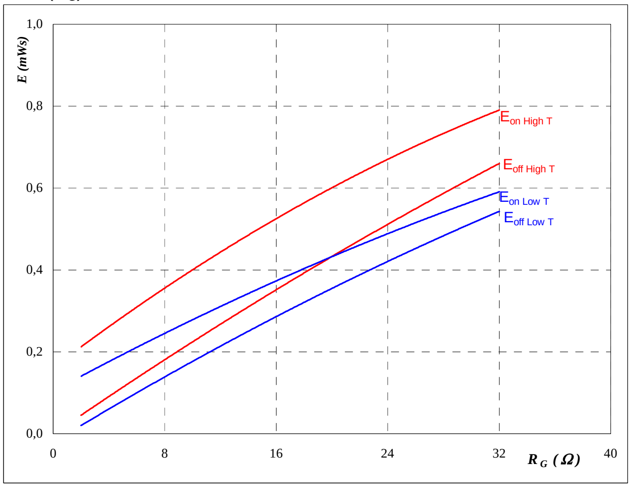
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6	BOOST MOSFET

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



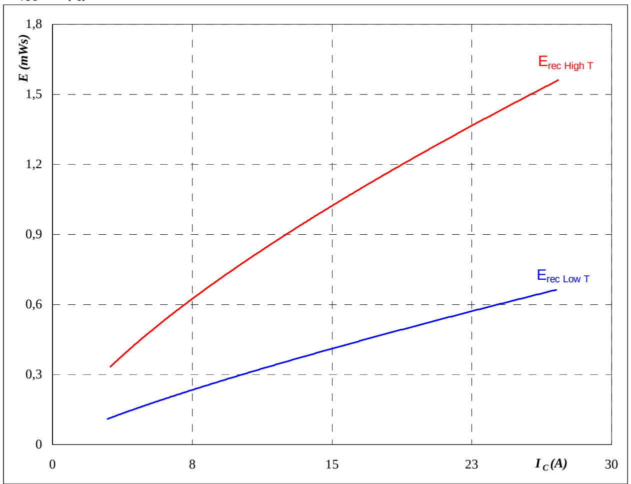
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
I_D =	15	A

Figure 7	BOOST FWD

Typical reverse recovery energy loss
as a function of collector (drain) current

$E_{rec} = f(I_c)$



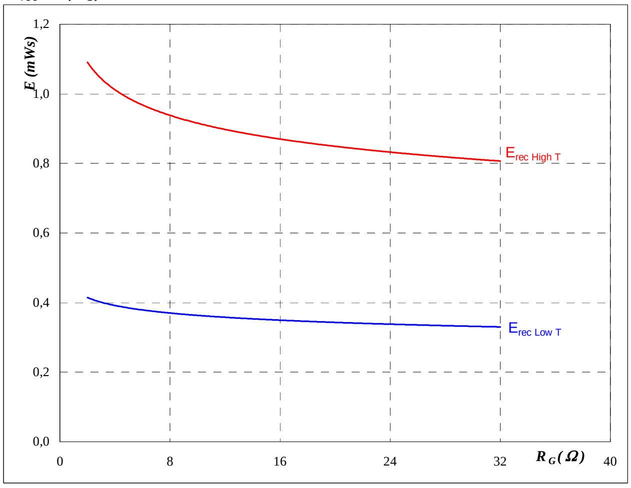
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8	BOOST FWD

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

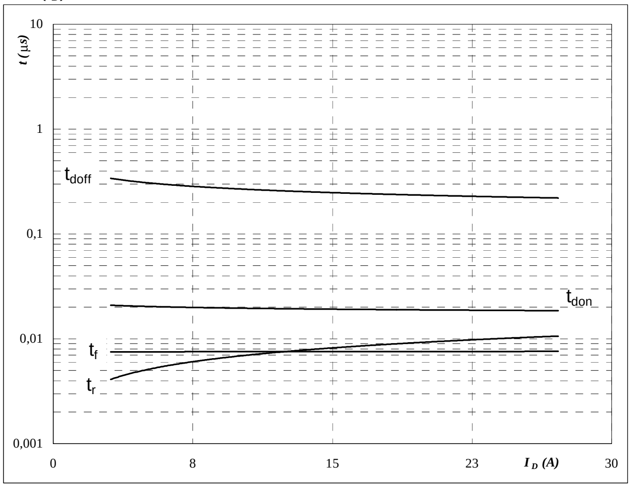
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
I_D =	15	A

BOOST

Figure 9	BOOST MOSFET

Typical switching times as a function of collector current

$t = f(I_D)$



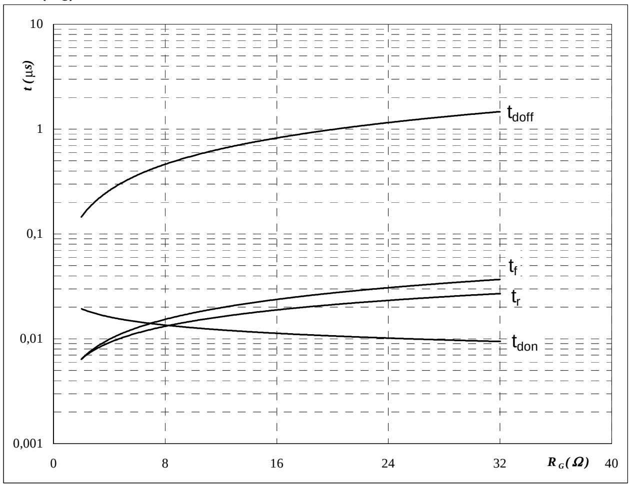
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10	BOOST MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



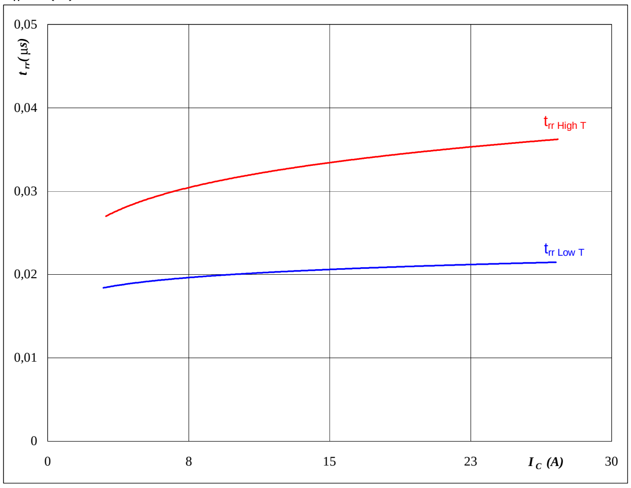
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	10	V
I_C =	15	A

Figure 11	BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



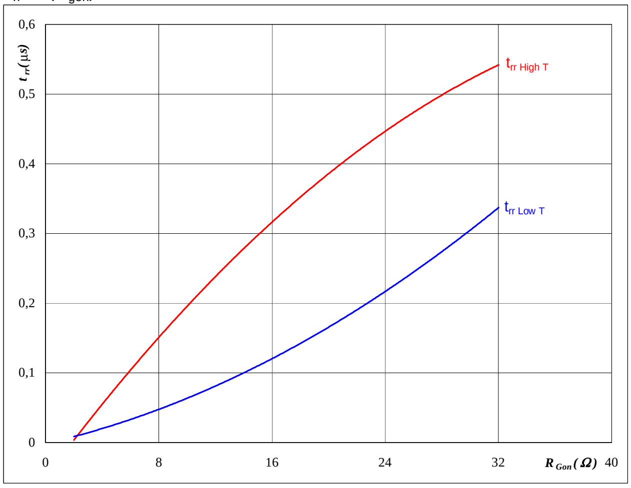
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 12	BOOST FWD

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

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



At

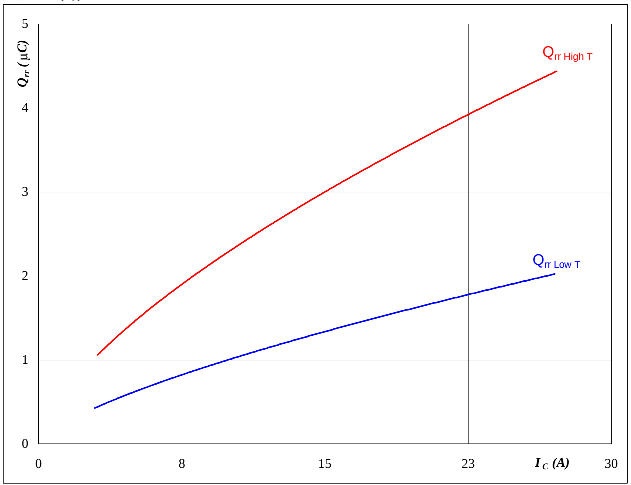
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



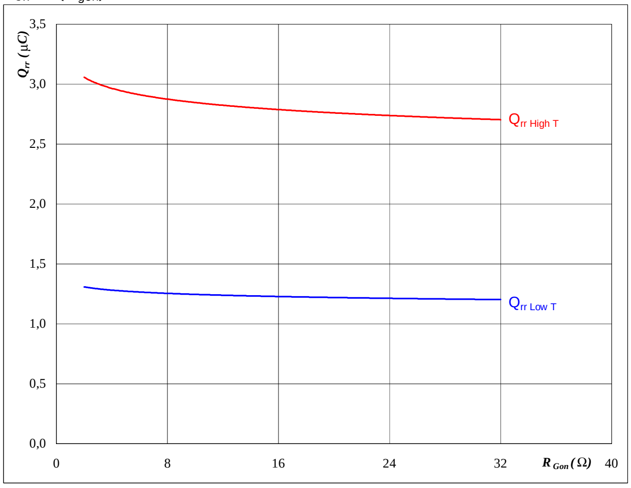
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 14 BOOST FWD

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

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



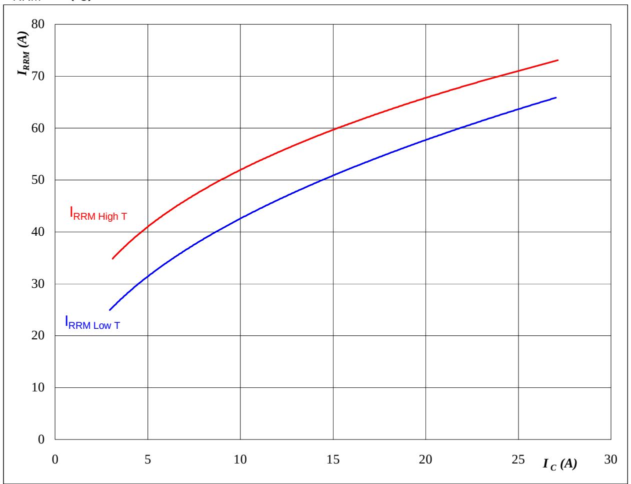
At

Tj =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



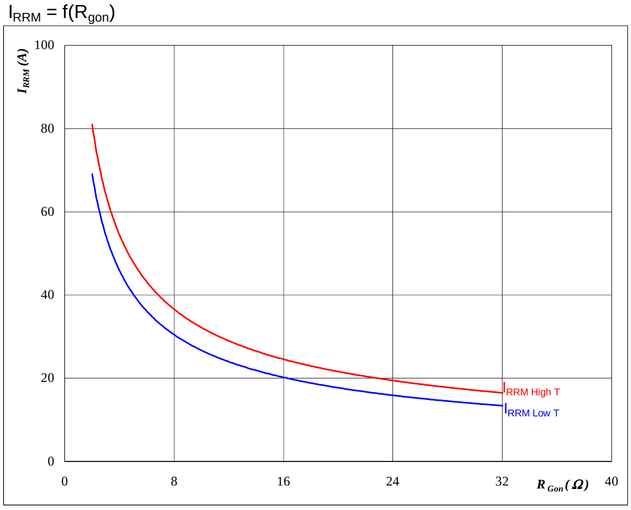
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 16 BOOST FWD

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

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



At

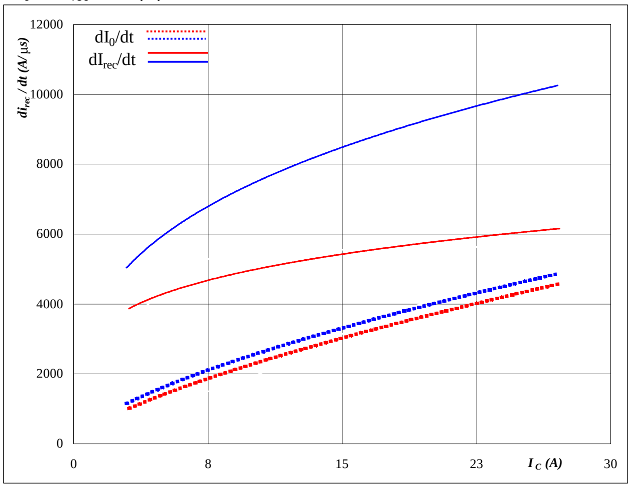
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

BOOST

Figure 17 BOOST FWD

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

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



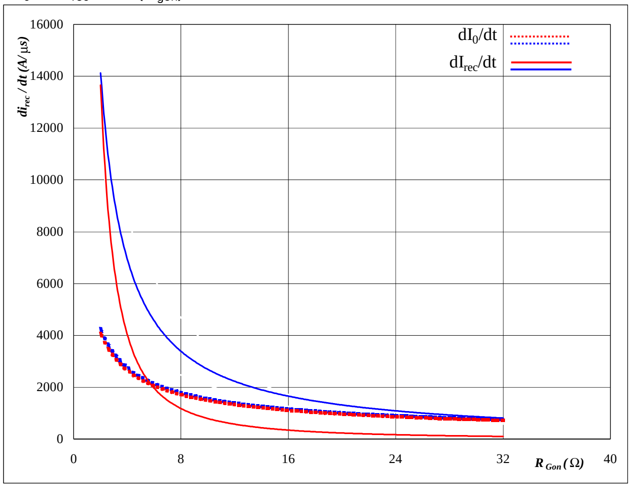
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 18 BOOST FWD

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

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



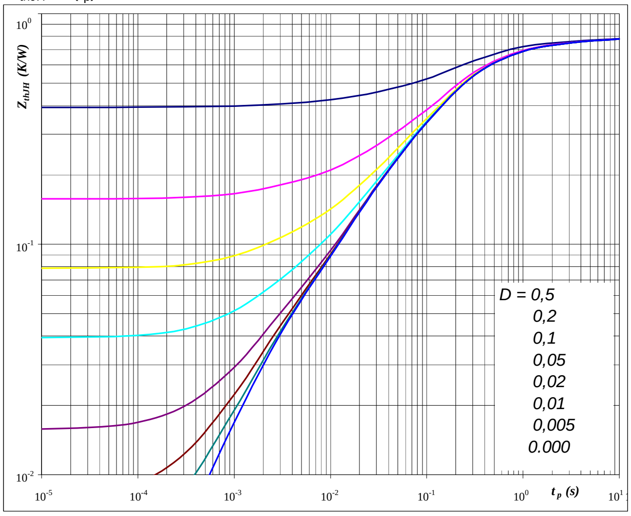
At

Tj =	25/125	°C
VR =	400	V
IF =	15	A
VGS =	10	V

Figure 19 BOOST MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,79	K/W

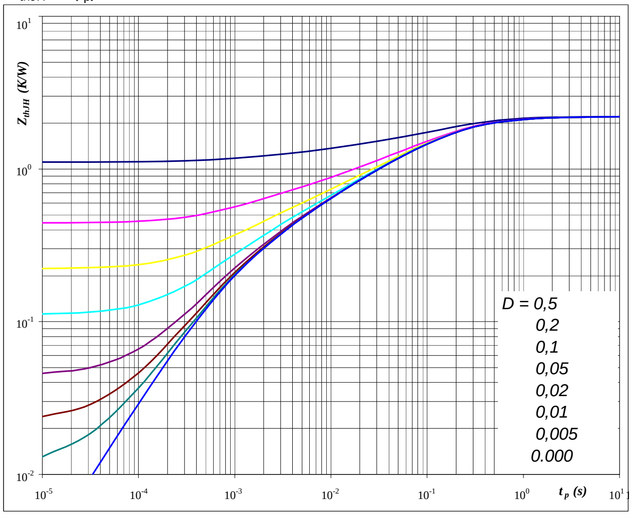
MOSFET thermal model values

R (C/W)	Tau (s)
2,44E-02	9,81E+00
1,06E-01	1,90E+00
2,44E-01	3,62E-01
2,92E-01	1,34E-01
9,32E-02	2,12E-02
2,59E-02	2,13E-03

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	2,21	K/W

FWD thermal model values

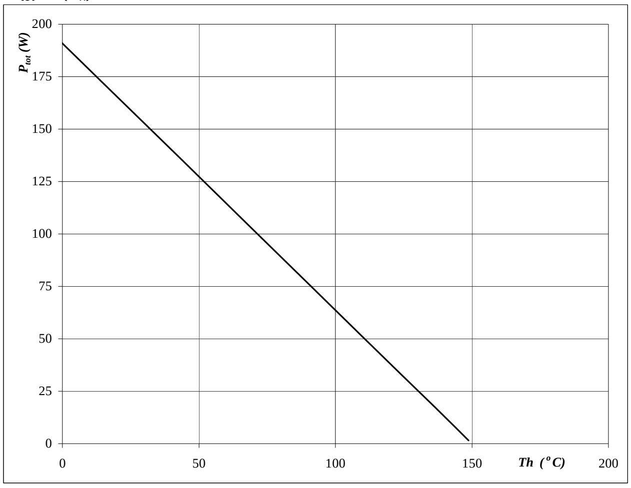
R (C/W)	Tau (s)
4,33E-02	7,21E+00
1,52E-01	1,08E+00
6,82E-01	2,18E-01
6,31E-01	6,79E-02
3,64E-01	1,40E-02
2,13E-01	2,82E-03

BOOST

Figure 21	BOOST MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



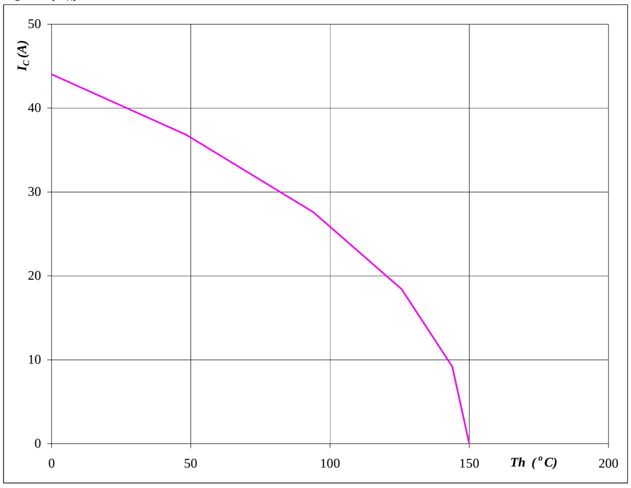
At

T_j = 150 ºC

Figure 22	BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

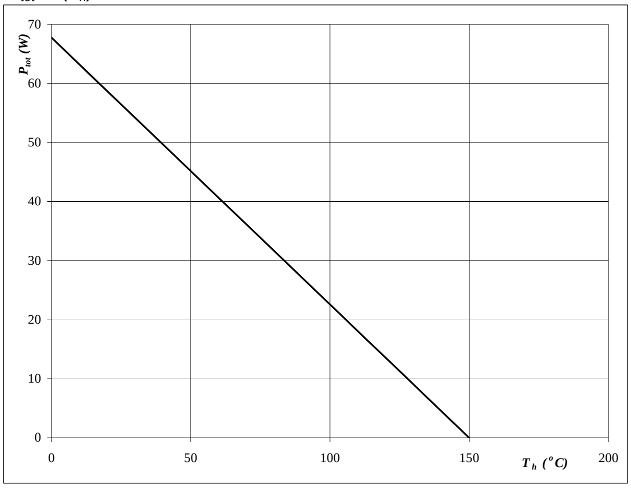
T_j = 150 ºC

V_{GS} = 10 V

Figure 23	BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



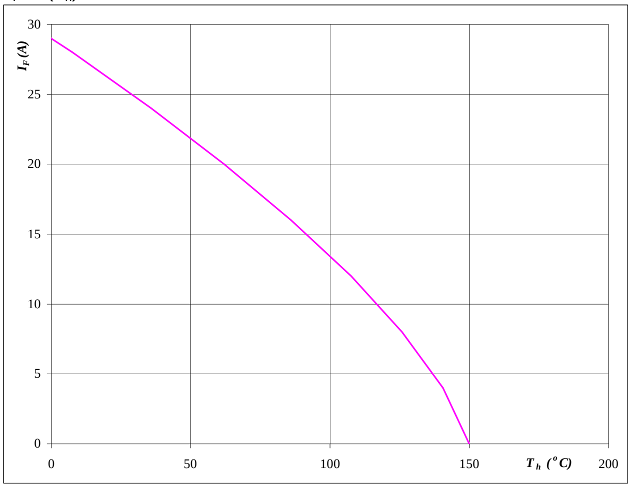
At

T_j = 150 ºC

Figure 24	BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

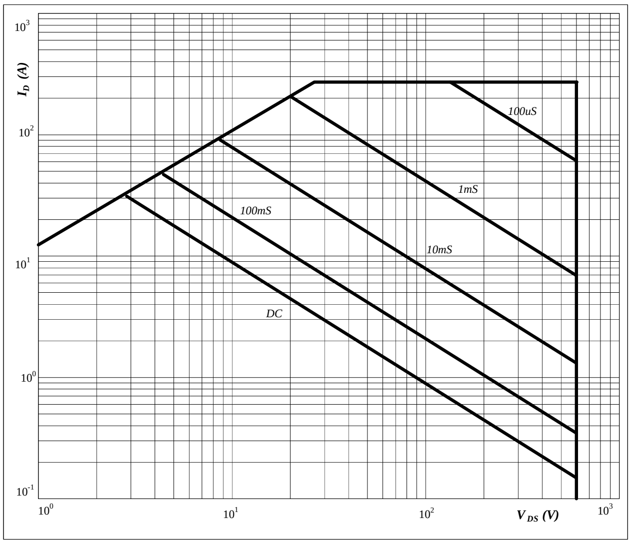
T_j = 150 ºC

BOOST

Figure 25 BOOST MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



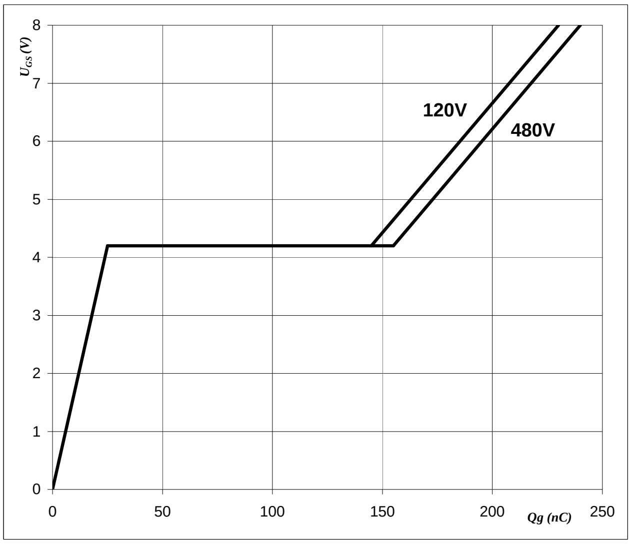
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	10	V
T_j =	T_{jmax}	ºC

Figure 26 BOOST MOSFET

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



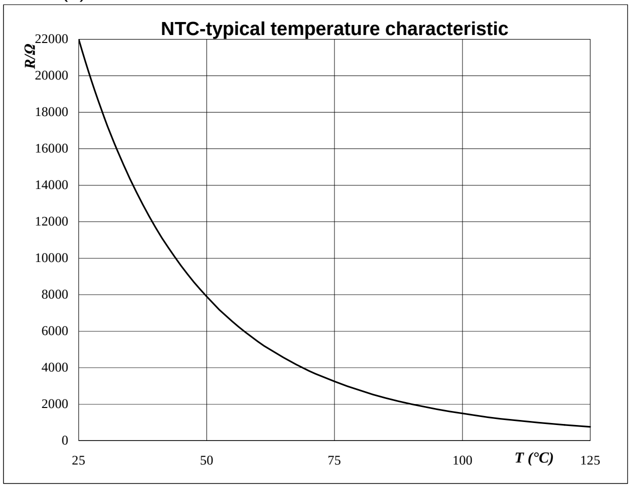
At

I_D =	44	A

Thermistor

Figure 1	Thermistor

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



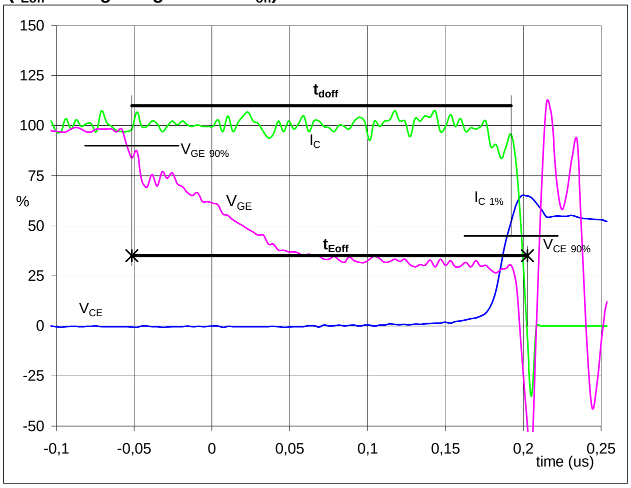
Switching Definitions BOOST MOSFET

General conditions

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

Figure 1 BOOST MOSFET

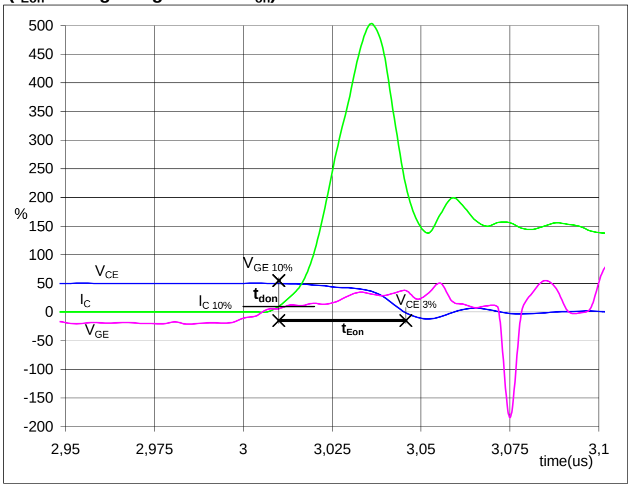
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
t_{doff} =	0,24	μs
t_{Eoff} =	0,25	μs

Figure 2 BOOST MOSFET

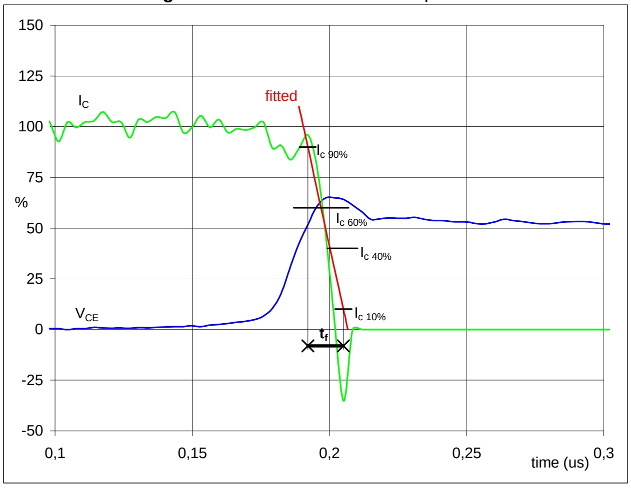
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
t_{don} =	0,02	μs
t_{Eon} =	0,04	μs

Figure 3 BOOST MOSFET

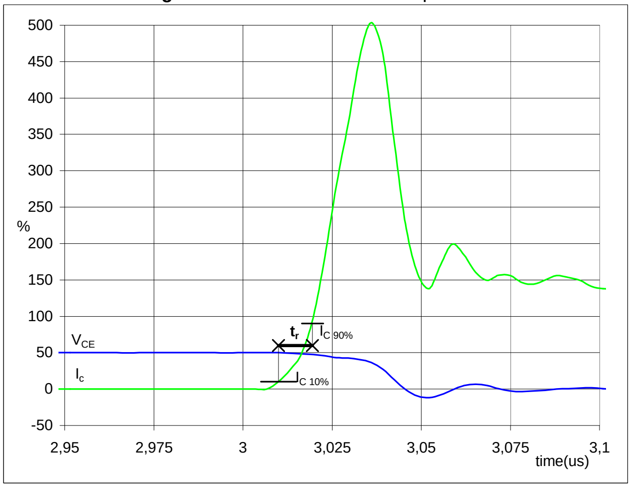
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	800	V
I_C (100%) =	15	A
t_f =	0,01	μs

Figure 4 BOOST MOSFET

Turn-on Switching Waveforms & definition of t_r

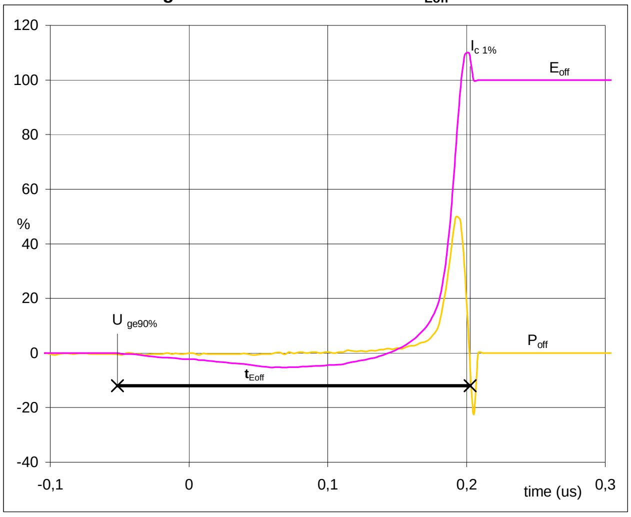


V_C (100%) =	800	V
I_C (100%) =	15	A
t_r =	0,01	μs

Switching Definitions BOOST MOSFET

Figure 5 BOOST MOSFET

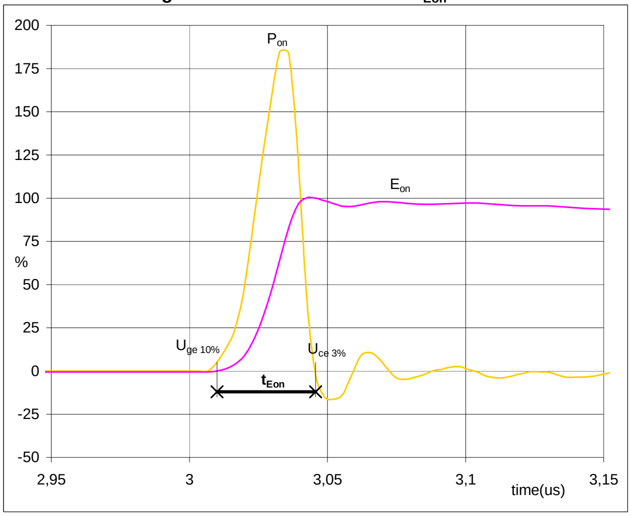
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	12,02	kW
E_{off} (100%) =	0,10	mJ
t_{Eoff} =	0,25	μs

Figure 6 BOOST MOSFET

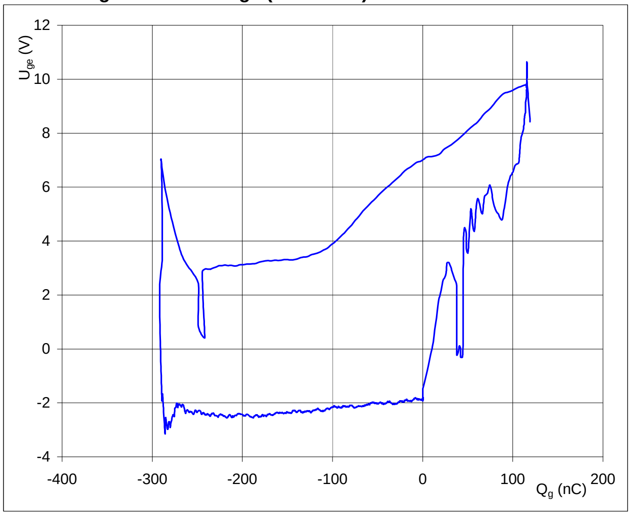
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	12,024	kW
E_{on} (100%) =	0,26	mJ
t_{Eon} =	0,03575	μs

Figure 7 BOOST MOSFET

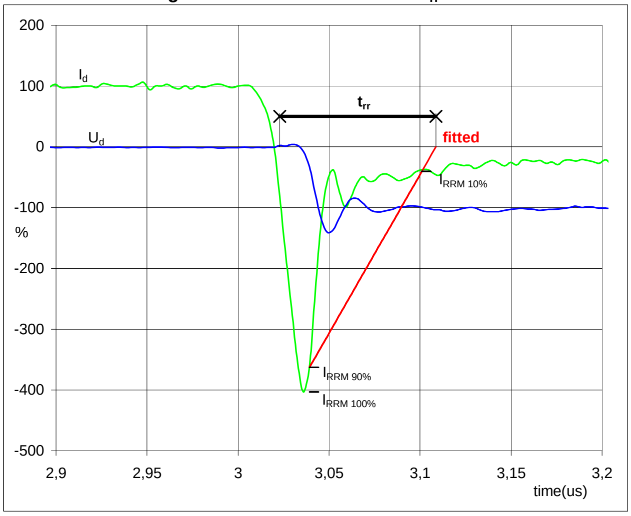
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
Q_g =	125,90	nC

Figure 8 BOOST FWD

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

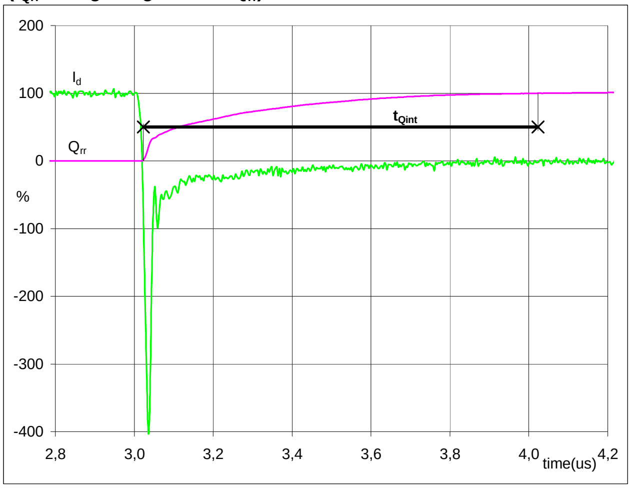


V_d (100%) =	800	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-60	A
t_{rr} =	0,03	μs

Switching Definitions BOOST MOSFET

Figure 9 BOOST FWD

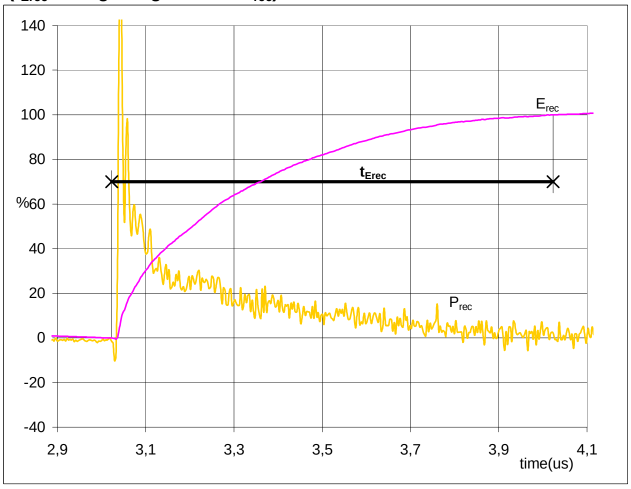
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	3,02	μC
t_{Qint} =	1,00	μs

Figure 10 BOOST FWD

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



P_{rec} (100%) =	12,02	kW
E_{rec} (100%) =	1,04	mJ
t_{Erec} =	1,00	μs

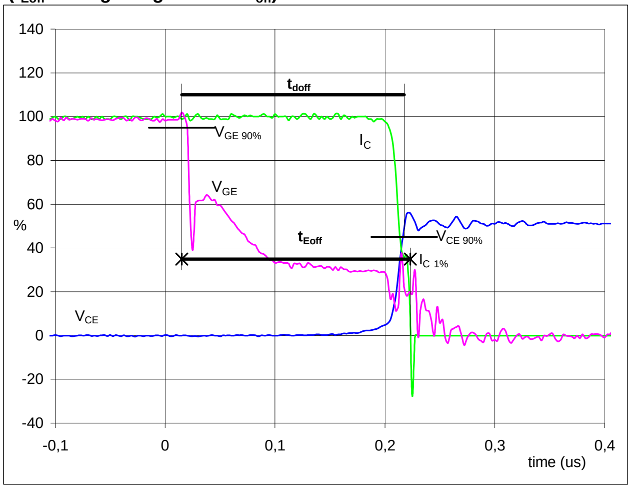
Switching Definitions BUCK MOSFET

General conditions

T_j	**=**	**125 °C**
R_{gon}	**=**	**4 Ω**
R_{goff}	**=**	**4 Ω**

Figure 1 BUCK MOSFET

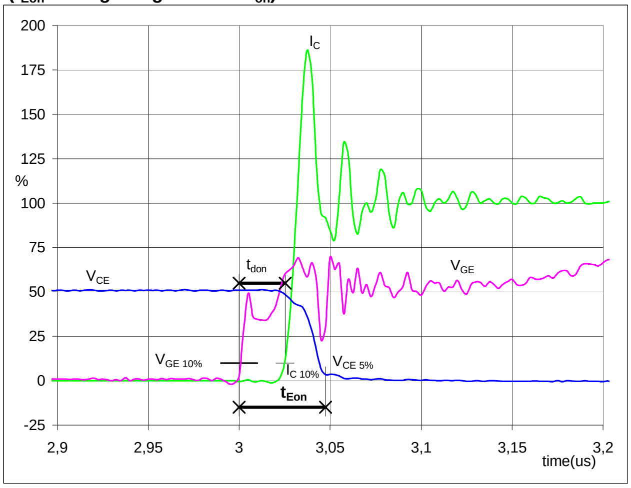
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
t_{doff} =	0,20	µs
t_{Eoff} =	0,21	µs

Figure 2 BUCK MOSFET

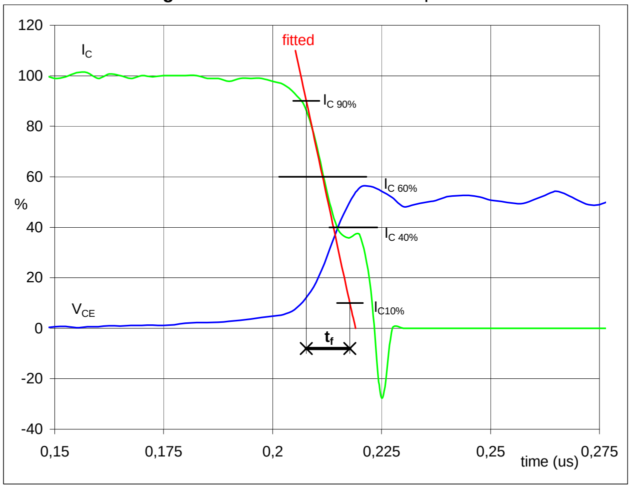
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
t_{don} =	0,03	µs
t_{Eon} =	0,05	µs

Figure 3 BUCK MOSFET

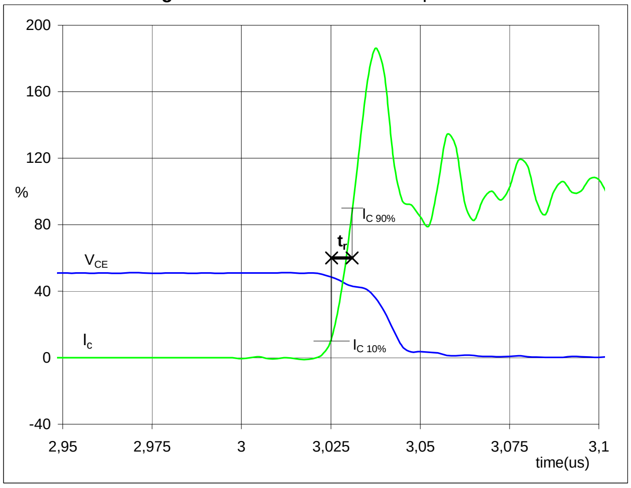
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	800	V
I_C (100%) =	15	A
t_f =	0,01	µs

Figure 4 BUCK MOSFET

Turn-on Switching Waveforms & definition of t_r

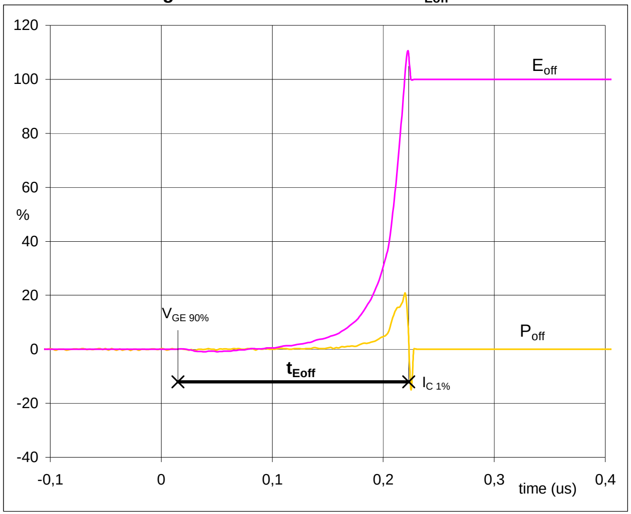


V_C (100%) =	800	V
I_C (100%) =	15	A
t_r =	0,01	µs

Switching Definitions BUCK MOSFET

Figure 5 BUCK MOSFET

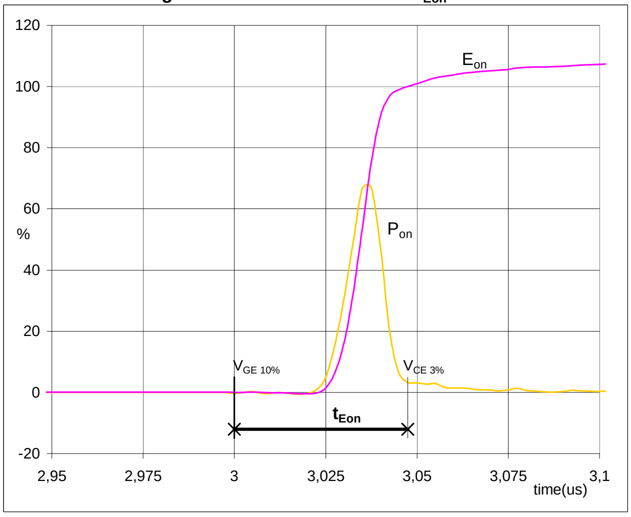
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	12,03	kW
E_{off} (100%) =	0,04	mJ
t_{Eoff} =	0,21	μs

Figure 6 BUCK MOSFET

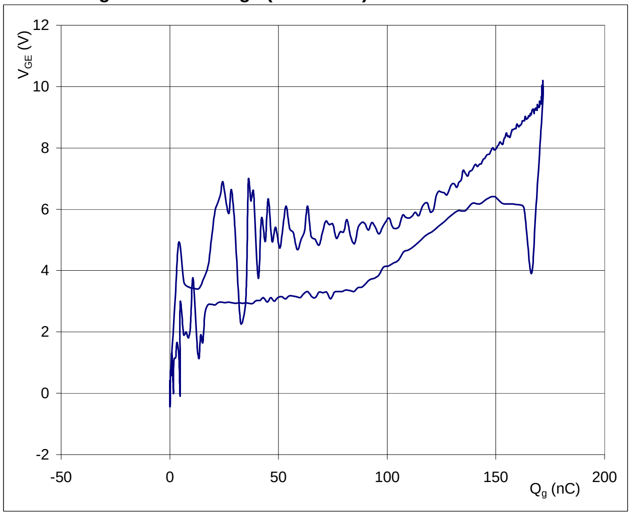
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	12,03	kW
E_{on} (100%) =	0,10	mJ
t_{Eon} =	0,05	μs

Figure 7 BUCK FWD

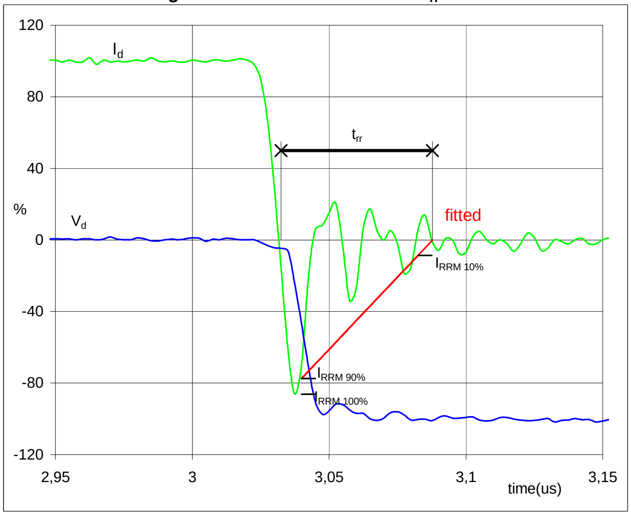
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	800	V
I_C (100%) =	15	A
Q_g =	171,57	nC

Figure 8 BUCK MOSFET

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

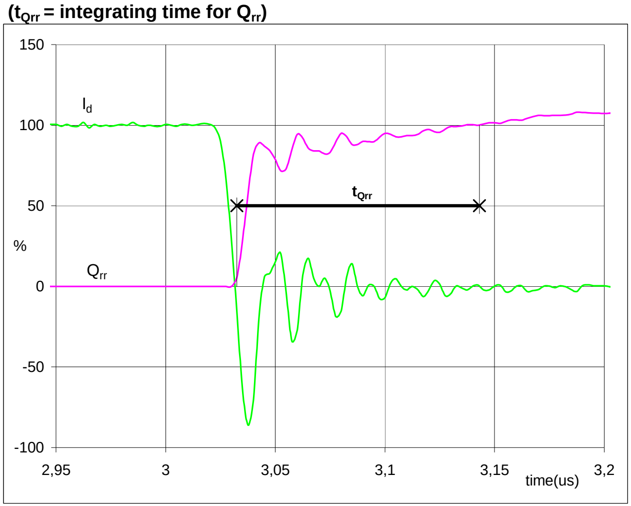


V_d (100%) =	800	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-13	A
t_{rr} =	0,01	μs

Switching Definitions BUCK MOSFET

Figure 9 BUCK FWD

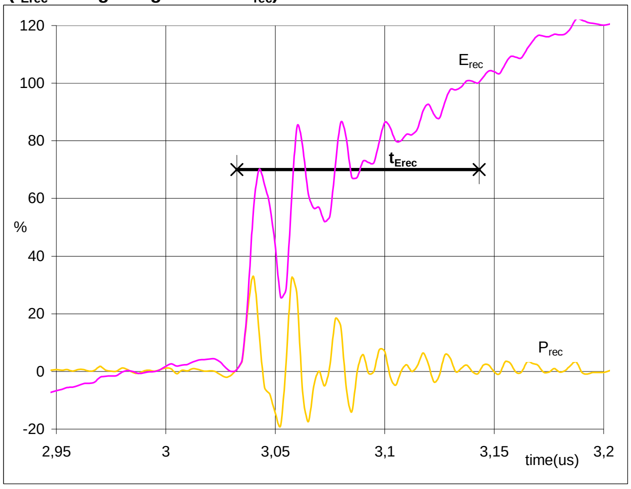
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,08	µC
t_{Qrr} =	0,11	µs

Figure 10 BUCK FWD

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



P_{rec} (100%) =	12,03	kW
E_{rec} (100%) =	0,01	mJ
t_{Erec} =	0,11	µs

Measurement circuits

Figure 11

BUCK stage switching measurement circuit

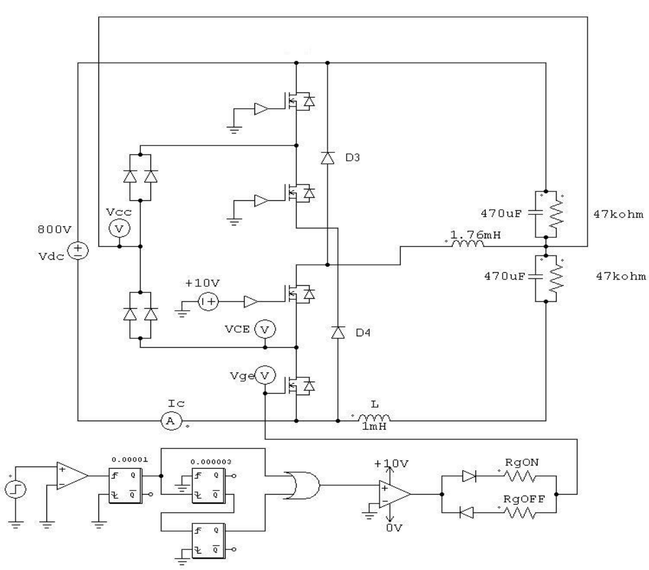
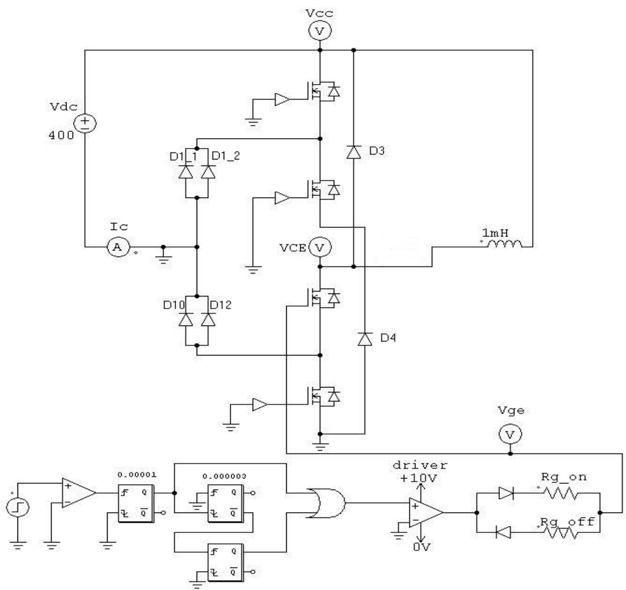


Figure 12

BOOST stage switching measurement circuit



Ordering Code and Marking - Outline - Pinout

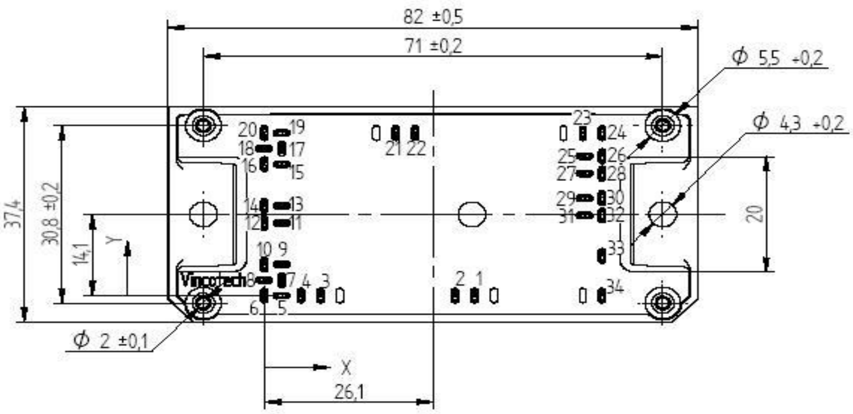
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-PY06NRA041FS-M413FY	M413FY	M413FY

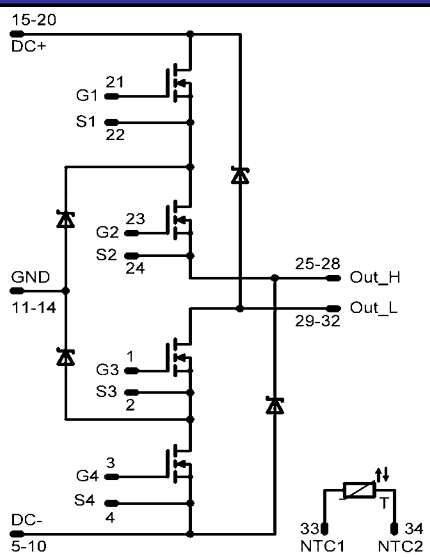
Outline

Hole Table		
Hole	X	Y
1	32,5	0
2	29,5	0
3	8,7	0
4	5,7	0
5	2,7	0
6	0	0
7	2,7	2,7
8	0	2,7
9	2,7	5,4
10	0	5,4
11	2,7	12,6
12	0	12,6
13	2,7	15,6
14	0	15,6
15	2,7	22,8
16	0	22,8
17	2,7	25,5
18	0	25,5
19	2,7	28,2
20	0	28,2
21	20,3	28,2
22	23,3	28,2
23	49,2	28,2
24	52,2	28,2
25	49,5	24,2
26	52,2	24,2
27	49,5	21,2
28	52,2	21,2

Hole Table		
Hole	X	Y
29	49,5	16,9
30	52,2	16,9
31	49,5	13,9
32	52,2	13,9
33	52,2	6,9
34	52,2	0



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.

DISCLAIMER

The information given in this datasheet describes the type of component and does not represent assured characteristics. For tested values please contact Vincotech.Vincotech reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Vincotech does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the rights of others.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.