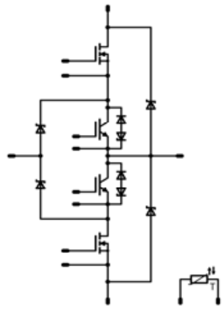
flowNPC 0 600V/18A

Features
- neutral point clamped inverter
- reactive power capability
- C6 CoolMOS™ and SiC buck diode
- clip-in pcb mounting
- low inductance layout
- LVRT capability

flow0 12mm housing

Target Applications
- solar inverter
- UPS

Schematic



Types
- 10-FZ06NRA099FS-P963F68

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	15 19	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	T_c=100°C	82	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	32 49	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	15 19	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max	Tc=25°C	112	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	62 93	W
Gate-source peak voltage	Vgs			±20	V
Maximum Junction Temperature	$T_j$max			150	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C T_c=80°C	49 56	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		150	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	83 126	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		6 360	µs V
Maximum Junction Temperature	$T_j$max			175	°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	16 22	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		36	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	31 47	W
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					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 FWD										
Diode forward voltage	V_F				12	Tj=25°C Tj=150°C	1	1,57 1,87	1,8	V
Peak reverse recovery current	I_{RRM}	Rgon=2 Ω	±15	350	18	Tj=25°C Tj=150°C		21 18		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		9,5 10,4		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		0,08 0,08		μC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25°C Tj=150°C		5560 4224		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		0,004 0,005		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,18		K/W
Buck MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$	VGS=VDS	10		18	Tj=25°C Tj=125°C		90		mΩ
Gate threshold voltage	$V_{(GS)th}$			$V_{DS}=V_{GS}$	0,0012	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			200	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			5000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgon=2 Ω Rgoff=2 Ω	±15	350	18	Tj=25°C Tj=125°C		20 20		ns
Rise Time	t_r					Tj=25°C Tj=125°C		4 4		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		89 93		
Fall time	t_f					Tj=25°C Tj=125°C		3 3		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,05 0,06		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,01 0,02		
Total gate charge	Q_g		10/0	480	18	Tj=25°C		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°C		2660		pF
Output capacitance	C_{oss}							154		
Reverse transfer capacitance	C_{rss}							tbd.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,14		K/W

Characteristic Values

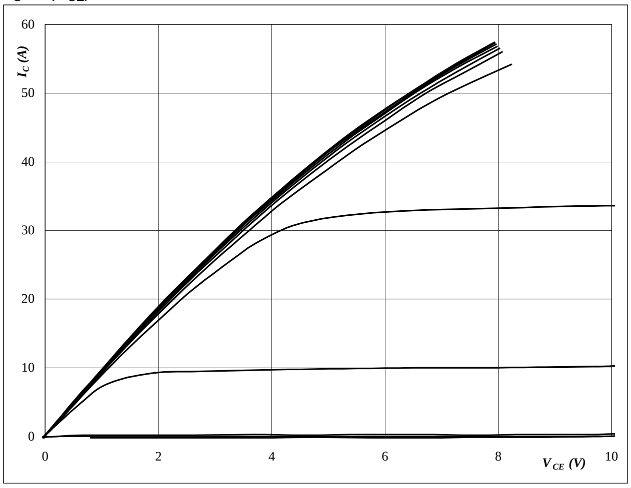
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0008	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25°C Tj=150°C	1,05	1,46 1,61	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,0026	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			600	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgon=8 Ω Rgoff=8 Ω				Tj=25°C Tj=150°C		95 96		ns
Rise time	t_r					Tj=25°C Tj=150°C		11 11		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		225 267		
Fall time	t_f					Tj=25°C Tj=150°C		64 100		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		0,56 0,71		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		0,65 0,89		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		3140		pF
Output capacitance	C_{oss}							200		
Reverse transfer capacitance	C_{rss}							93		
Gate charge	Q_{Gate}		±15	480	50	Tj=25°C		310		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,15		K/W
Boost FWD										
Diode forward voltage	V_F				18	Tj=25°C Tj=125°C	1,5	2,37 2,04	3,3	V
Reverse leakage current	I_r			1200		Tj=25°C Tj=125°C			1000	μA
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	350	18	Tj=25°C Tj=125°C		69 76		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		43 56		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		1,71 4,09		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		11874 9394		A/μs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=125°C		0,25 0,98		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,25		K/W
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				Tc=100°C	-5		+5	%
Power dissipation	P					Tj=25°C		210		mW
Power dissipation constant						Tj=25°C		3,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tc=25°C				K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		4000		K
Vincotech NTC Reference									A	

Buck

Figure 1	MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



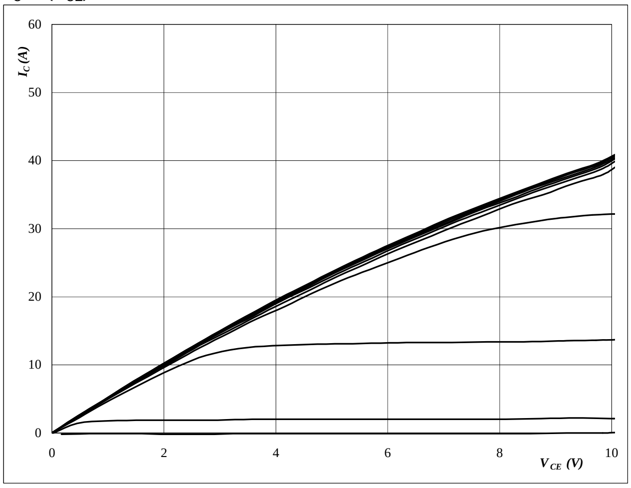
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	3 V to 13 V in steps of 1 V	

Figure 2	MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



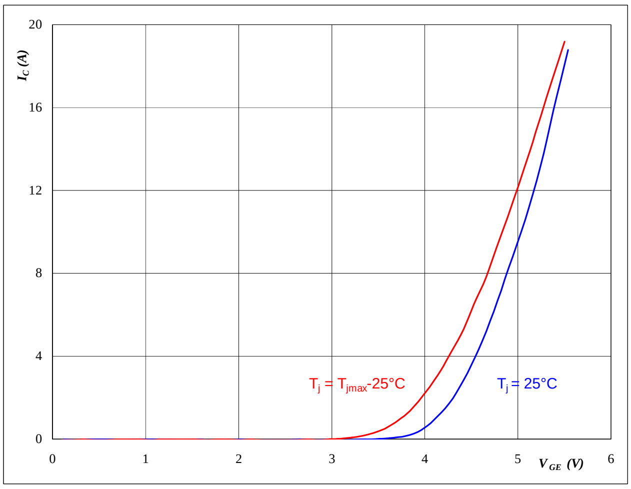
At

t_p =	250	µs
T_j =	125	°C
V_{GE} from	3 V to 13 V in steps of 1 V	

Figure 3	MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$



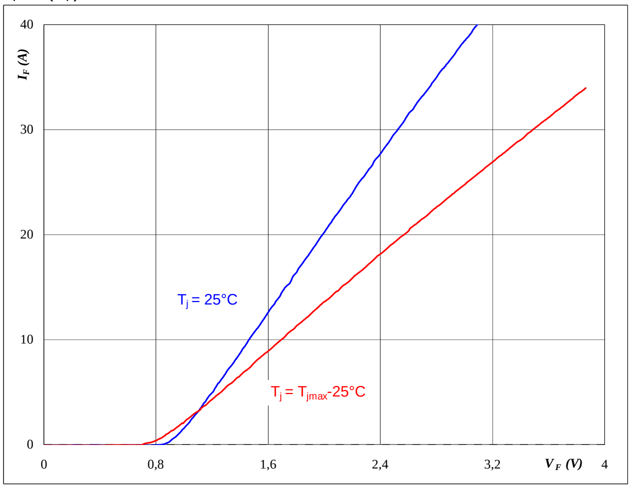
At

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

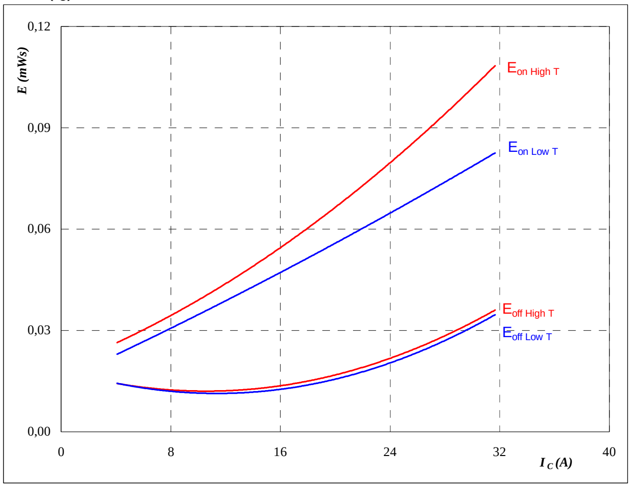
t_p =	250	µs

Buck

Figure 5 MOSFET

Typical switching energy losses as a function of collector current

$E = f(I_C)$



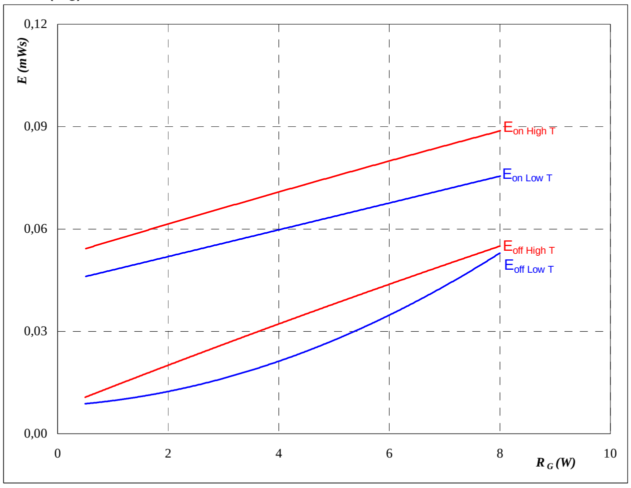
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 6 MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



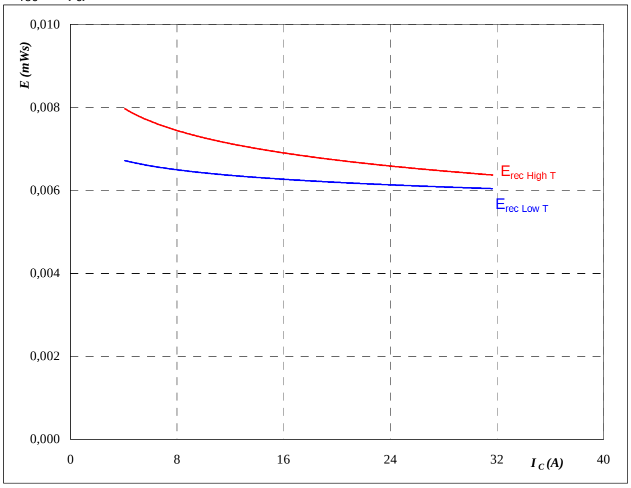
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



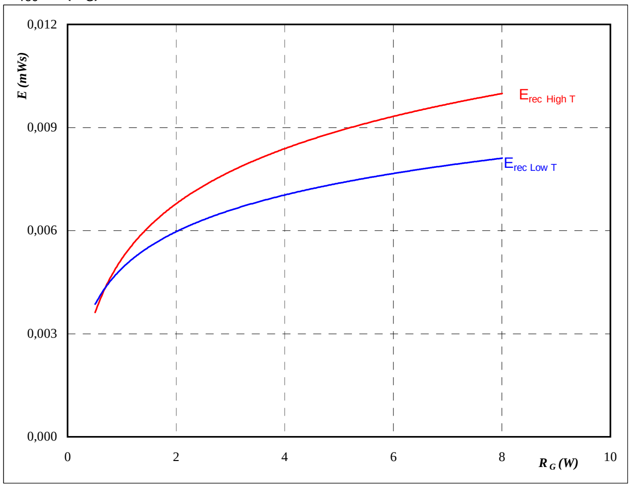
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 8 FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

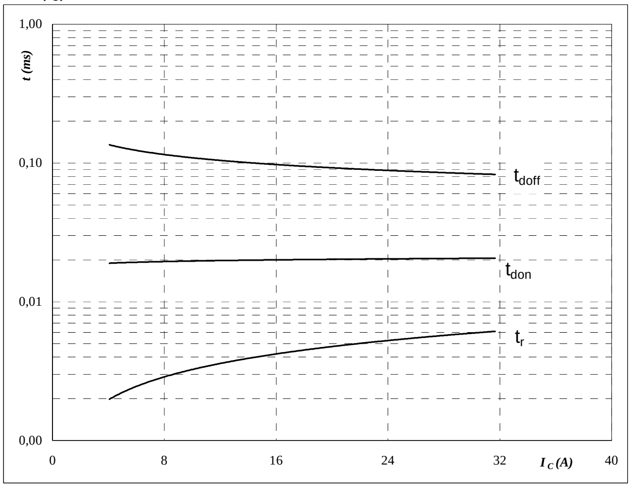
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Buck

Figure 9 MOSFET

Typical switching times as a function of collector current

t = f(I_C)



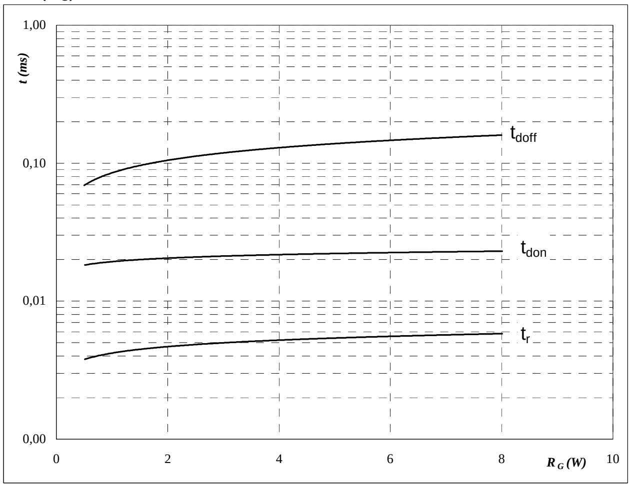
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 10 MOSFET

Typical switching times as a function of gate resistor

t = f(R_G)



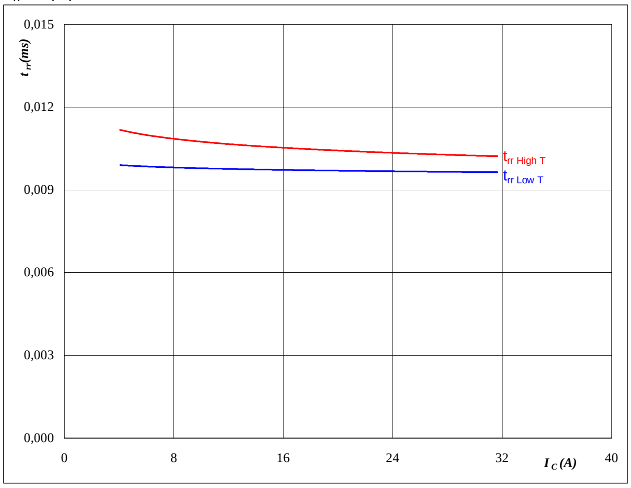
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



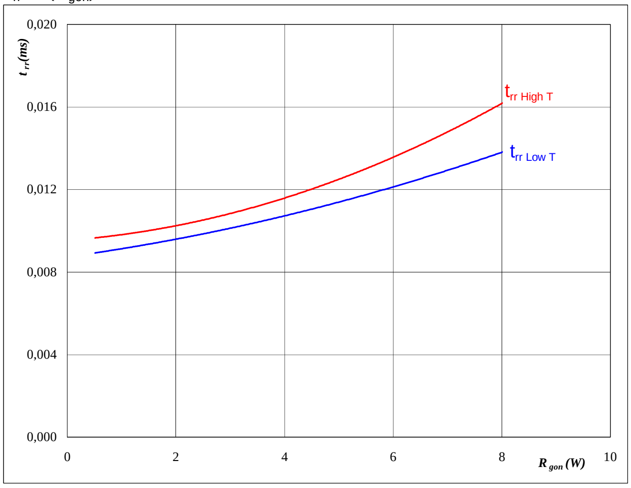
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 12 FWD

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

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



At

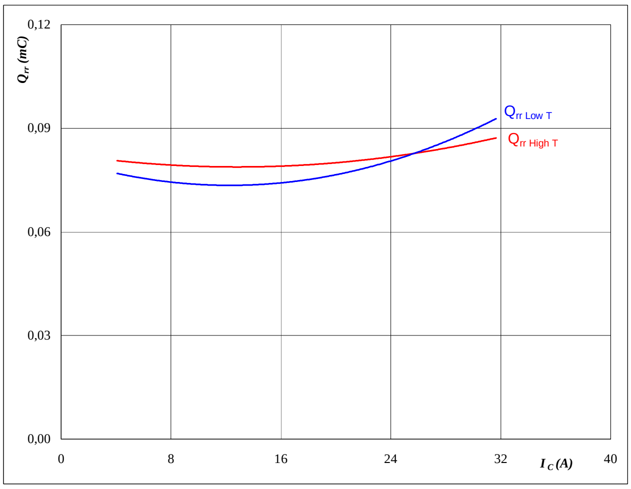
T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Buck

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



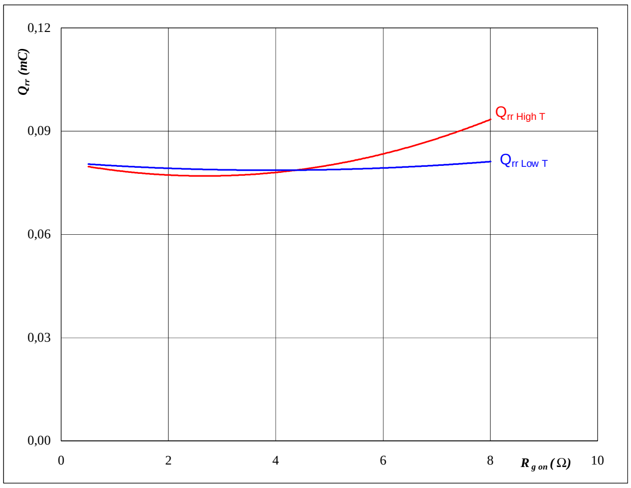
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 14 FWD

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

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



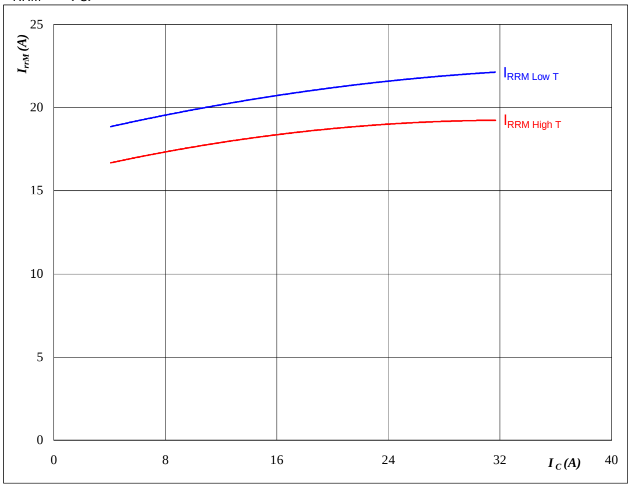
At

T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



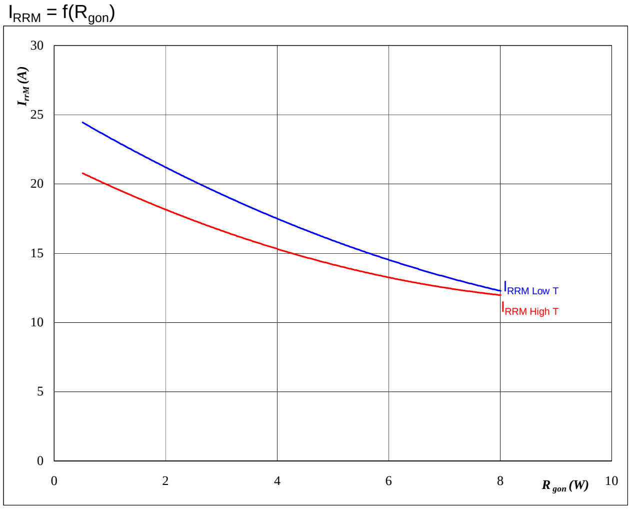
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 16 FWD

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

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



At

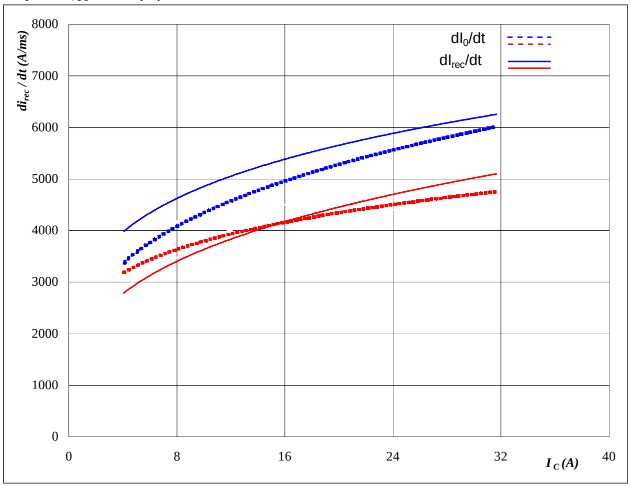
T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Buck

Figure 17 FWD

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

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



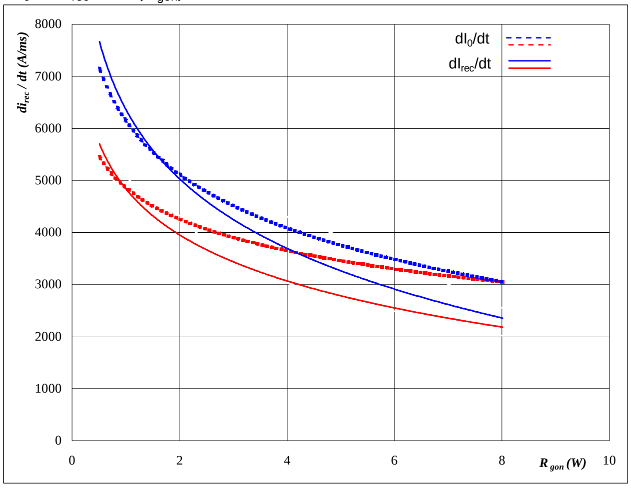
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 18 FWD

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

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



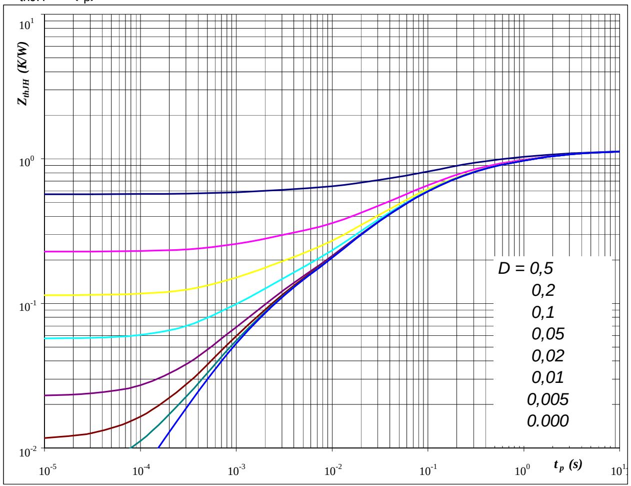
At

T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Figure 19 MOSFET

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,14	K/W

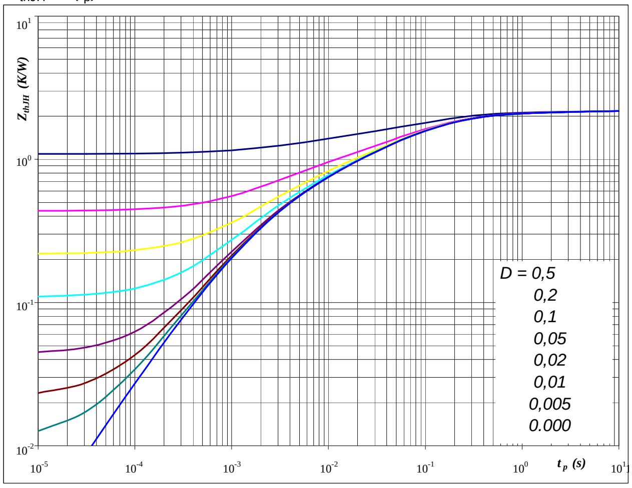
IGBT thermal model values

R (C/W)	Tau (s)
0,07	7,2E+00
0,22	1,3E+00
0,32	2,3E-01
0,32	6,3E-02
0,14	1,3E-02
0,07	1,4E-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} =	2,18	K/W

FWD thermal model values

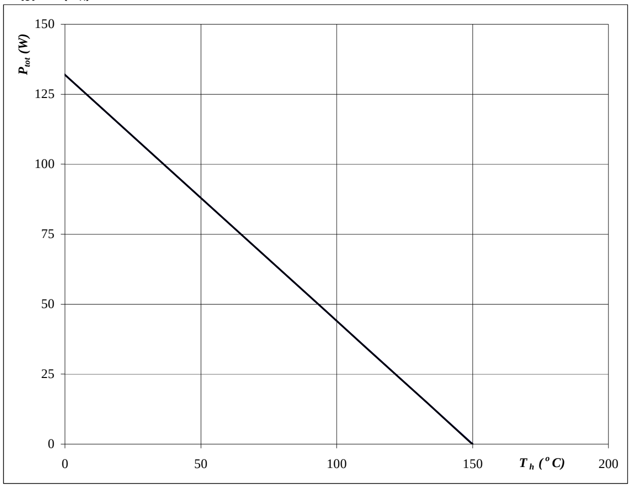
R (C/W)	Tau (s)
0,09	3,6E+00
0,36	3,7E-01
0,91	7,3E-02
0,43	1,2E-02
0,32	2,5E-03
0,06	5,8E-04

Buck

Figure 21 MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



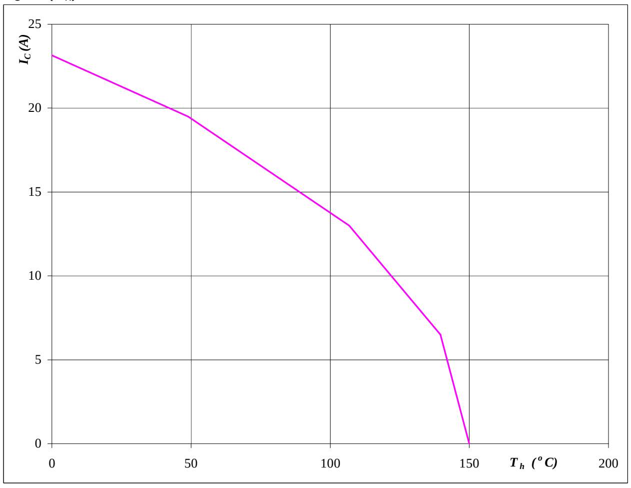
At

T_j = 150 °C

Figure 22 MOSFET

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

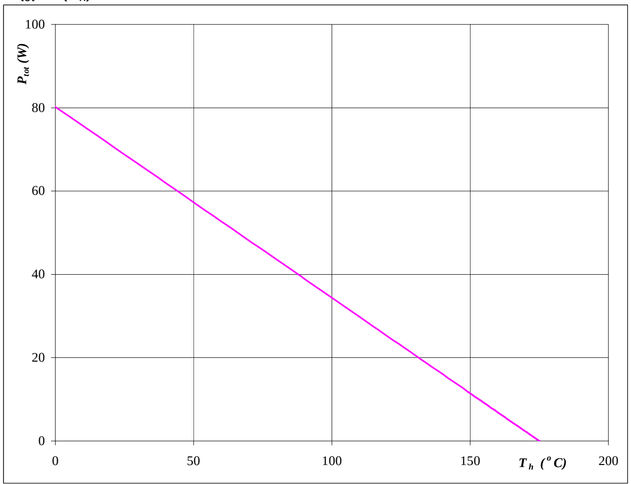
T_j = 150 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



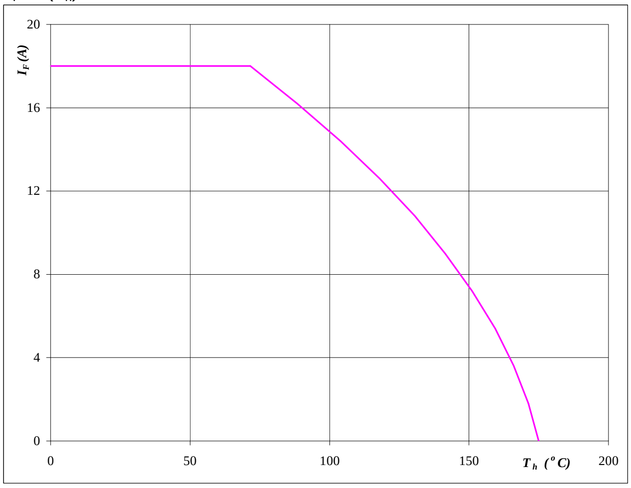
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

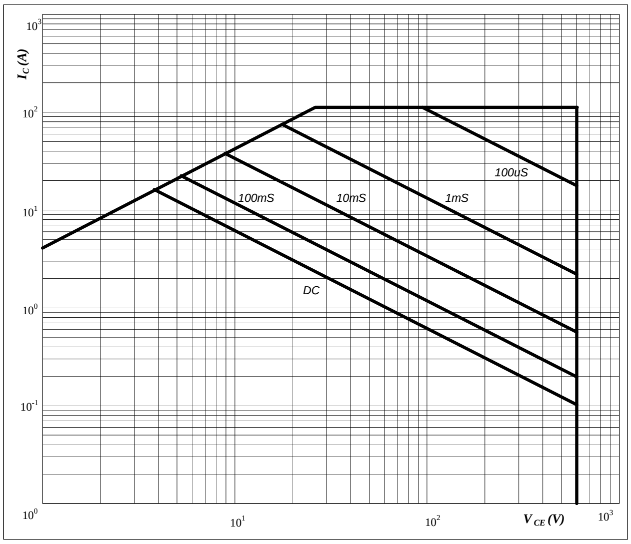
T_j = 175 °C

Buck

Figure 25	MOSFET

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



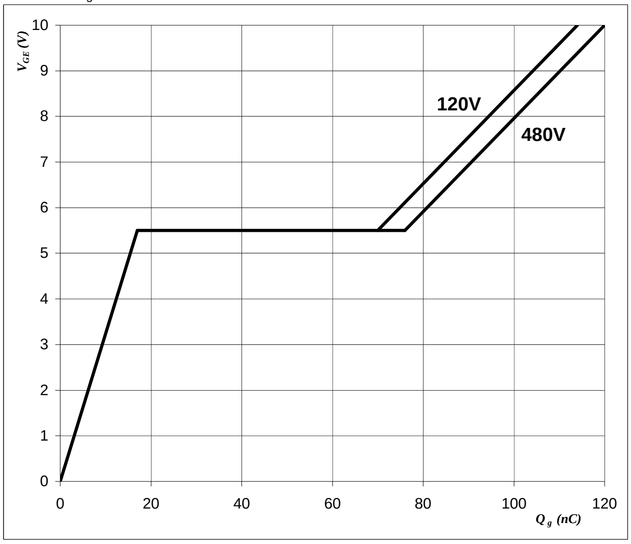
At

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

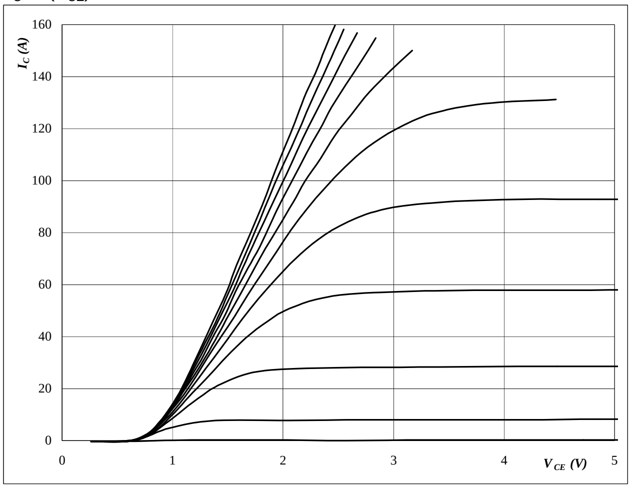
I_C =	18	A

Boost

Figure 1	IGBT

Typical output characteristics

$I_C = f(V_{CE})$



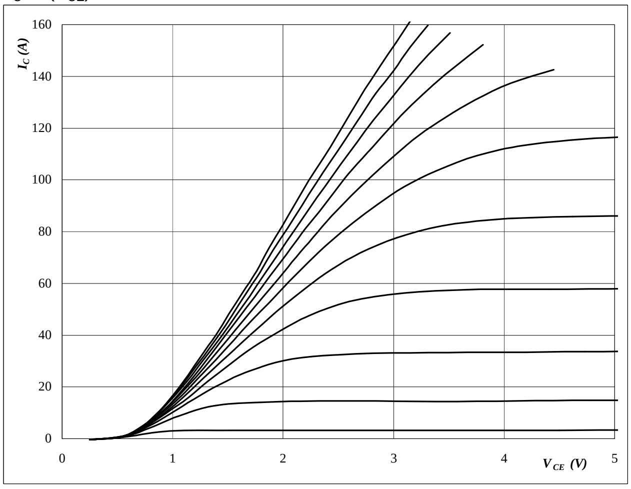
At

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

$I_C = f(V_{CE})$



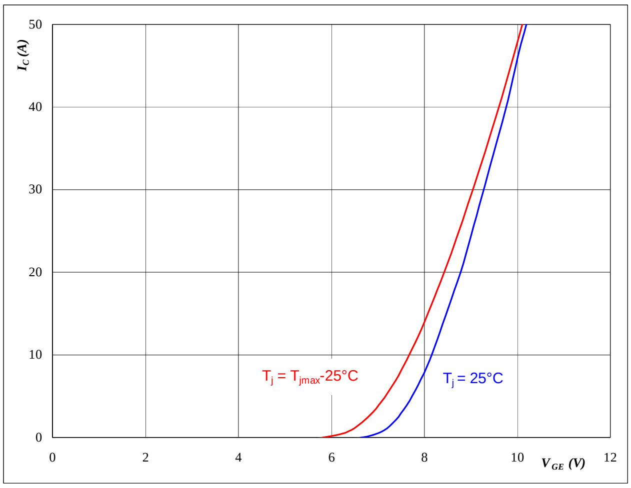
At

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

$I_C = f(V_{GE})$



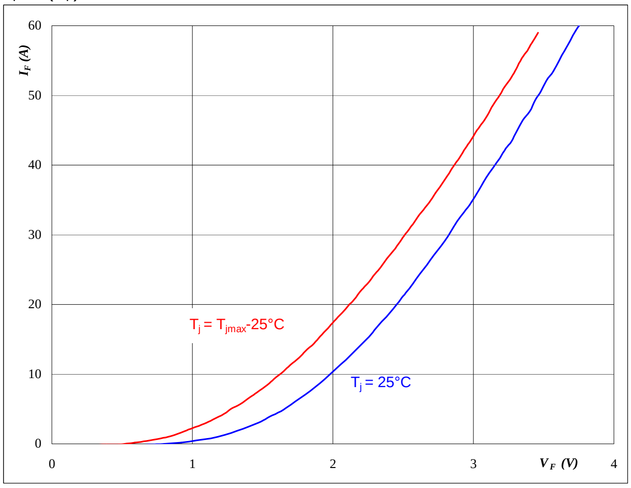
At

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

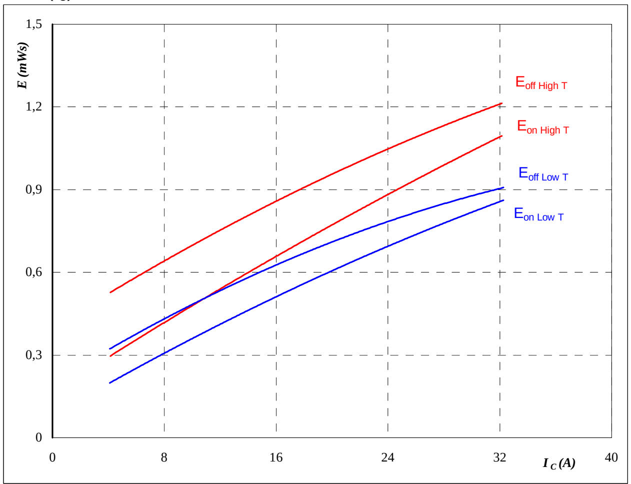
t_p =	250	µs

Boost

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



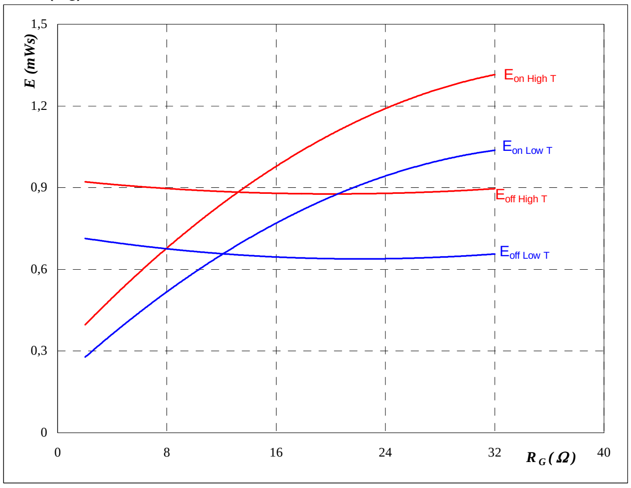
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



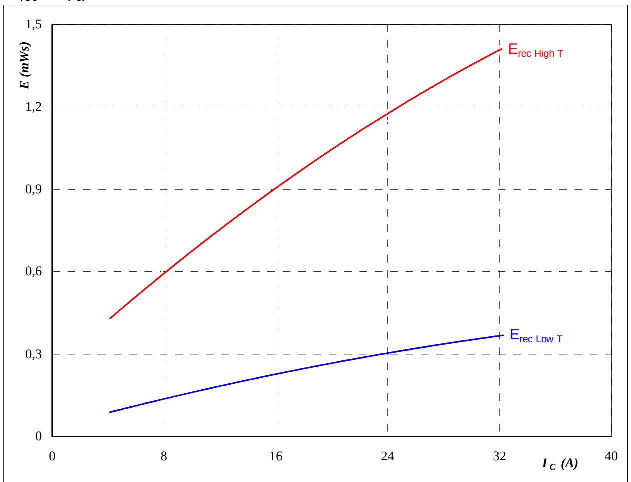
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



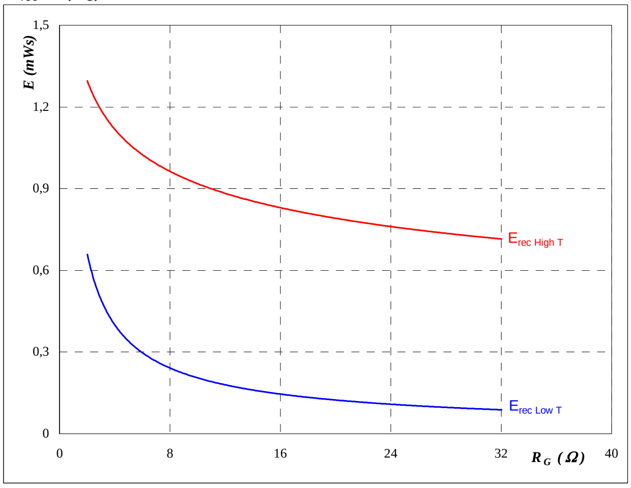
With an inductive load at

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

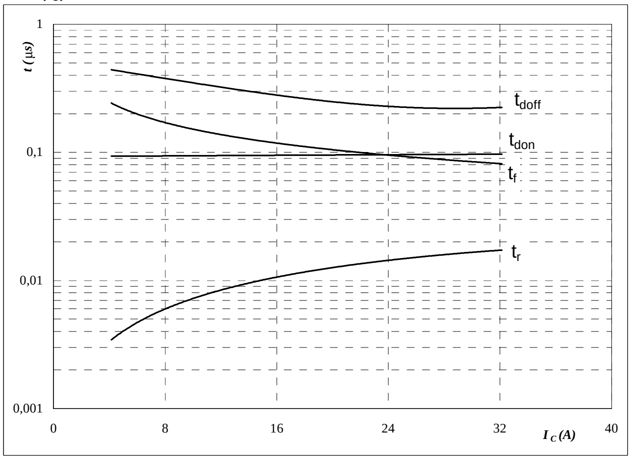
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Boost

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



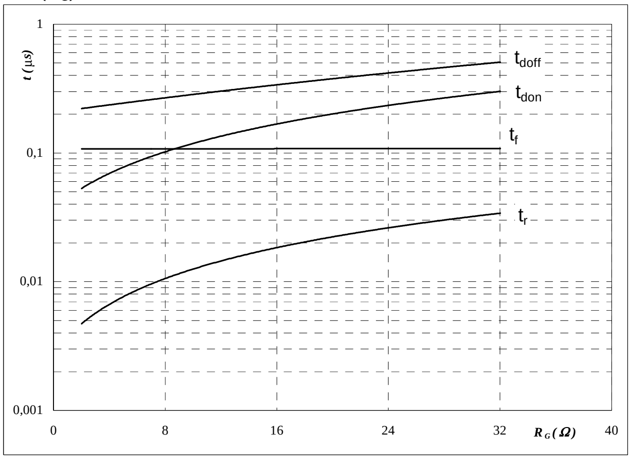
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



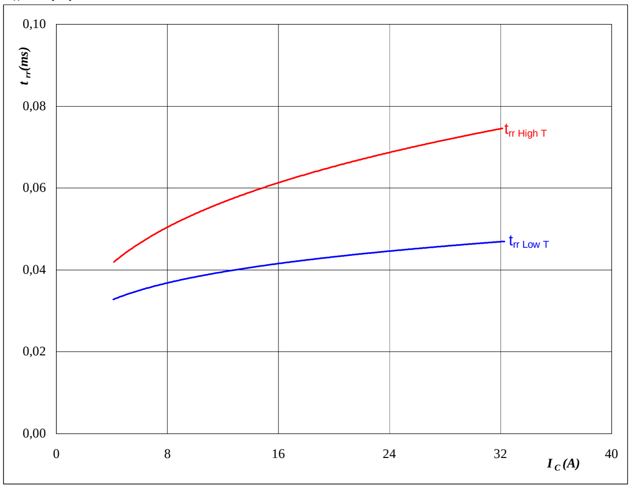
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	18	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



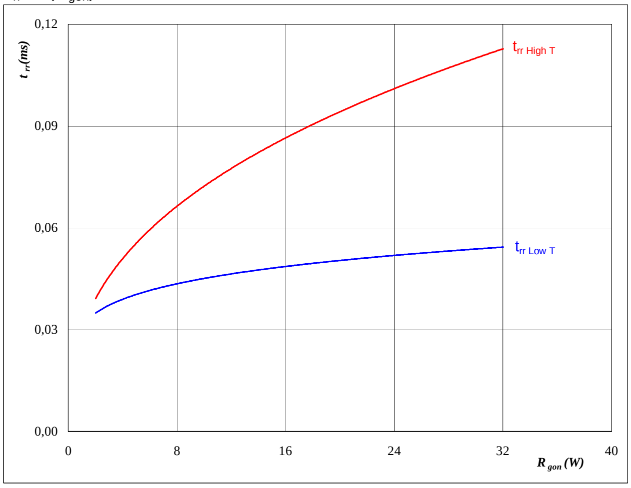
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 FWD

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

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



At

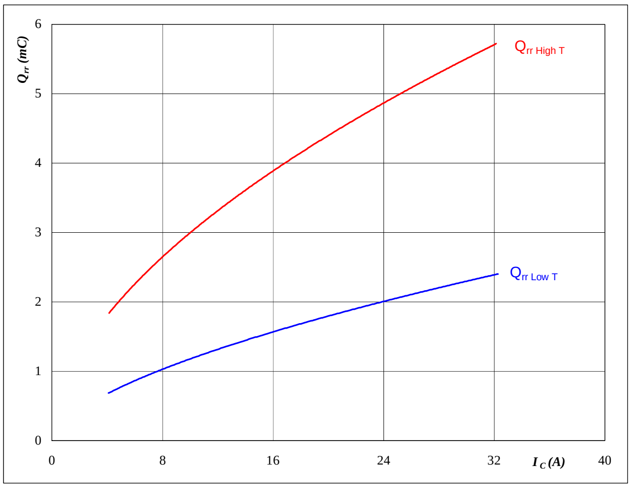
T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



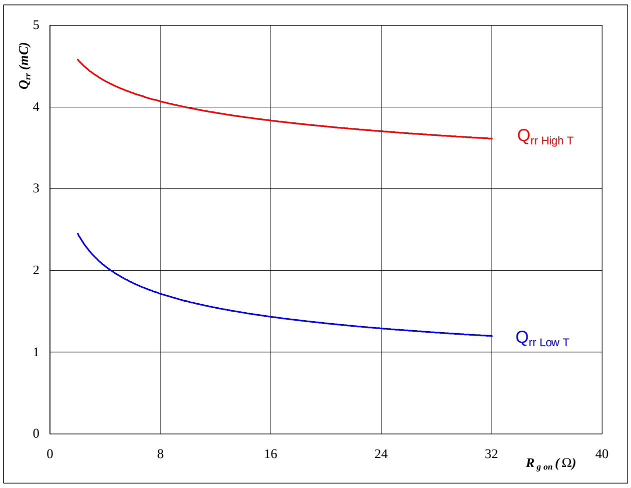
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 FWD

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

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



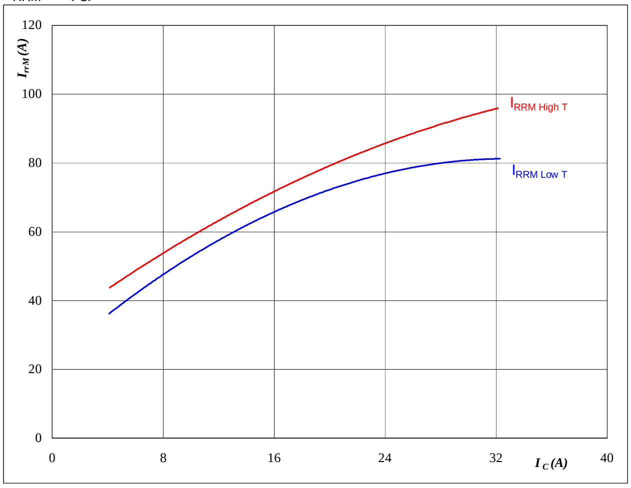
At

T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



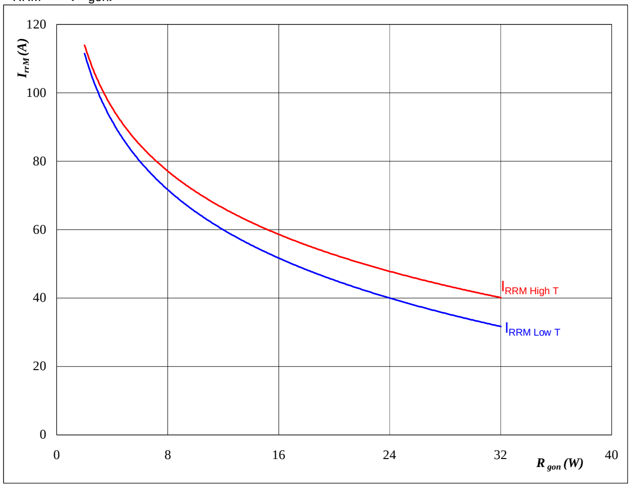
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 FWD

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

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



At

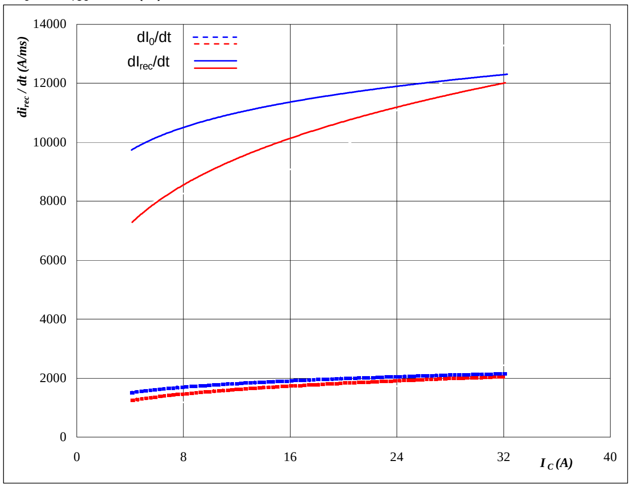
T_j =	25/125	°C
V_R =	350	V
I_F =	18	A
V_{GE} =	±15	V

Boost

Figure 17 FWD

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

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



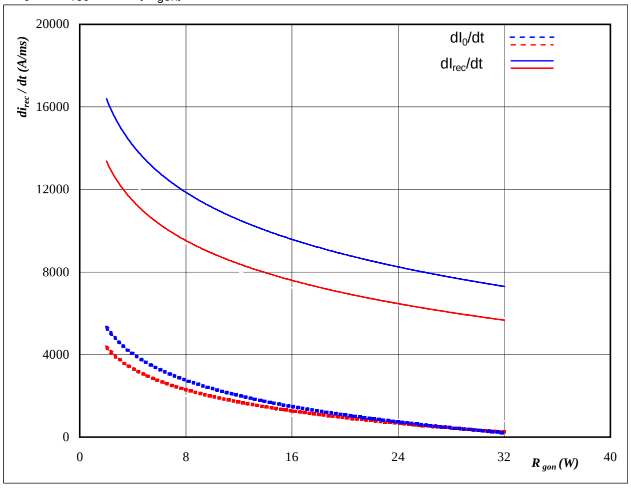
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18 FWD

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

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



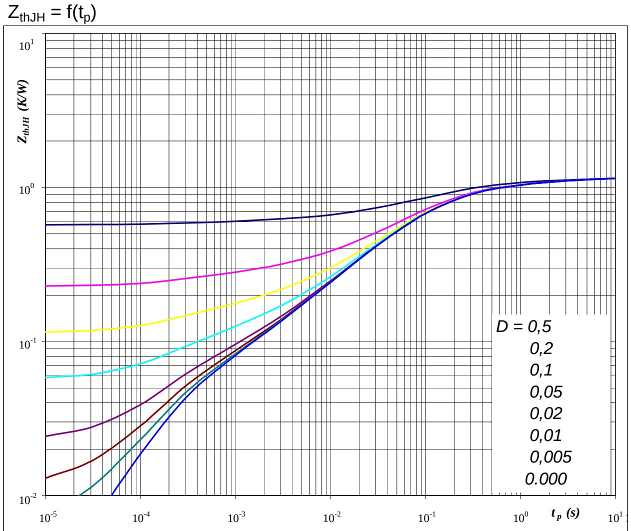
At

T_j =	25/125	°C
V_R =	350	V
I_F =	18	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} =	1,15	K/W

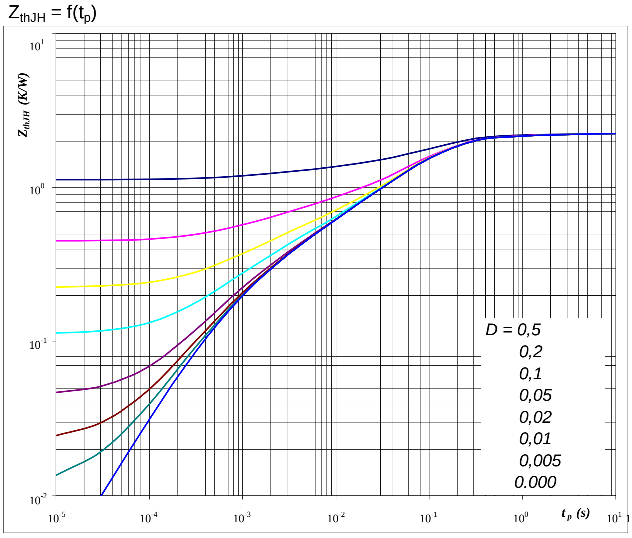
IGBT thermal model values

R (C/W)	Tau (s)
0,17	2,0E+00
0,32	2,5E-01
0,42	6,8E-02
0,15	1,2E-02
0,05	1,7E-03
0,04	2,5E-04

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	2,25	K/W

FWD thermal model values

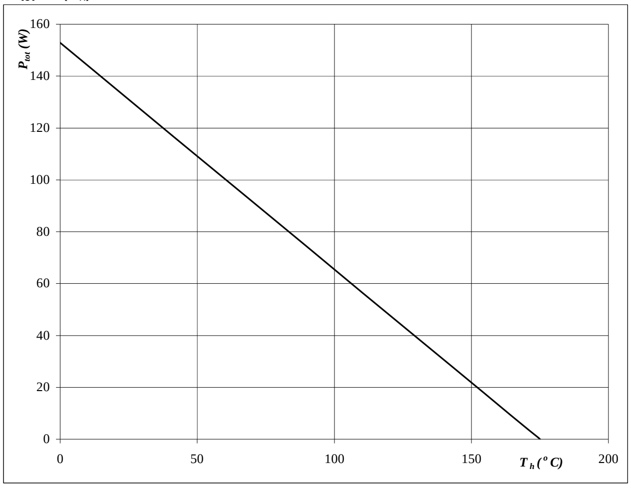
R (C/W)	Tau (s)
0,07	4,4E+00
0,19	5,6E-01
1,10	1,1E-01
0,39	4,1E-02
0,26	7,7E-03
0,18	1,6E-03

Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



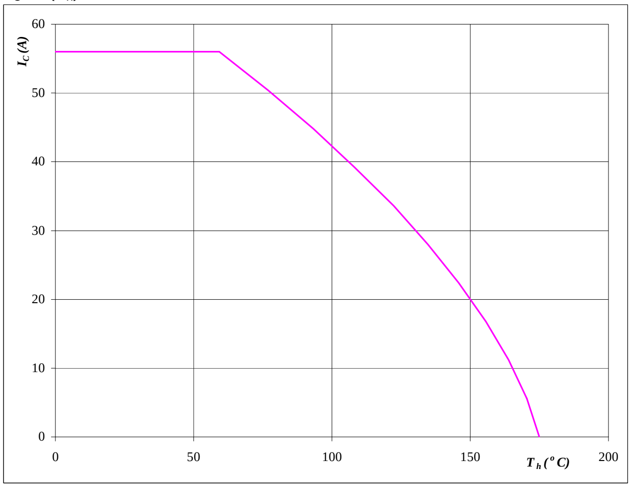
At

T_j = 175 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

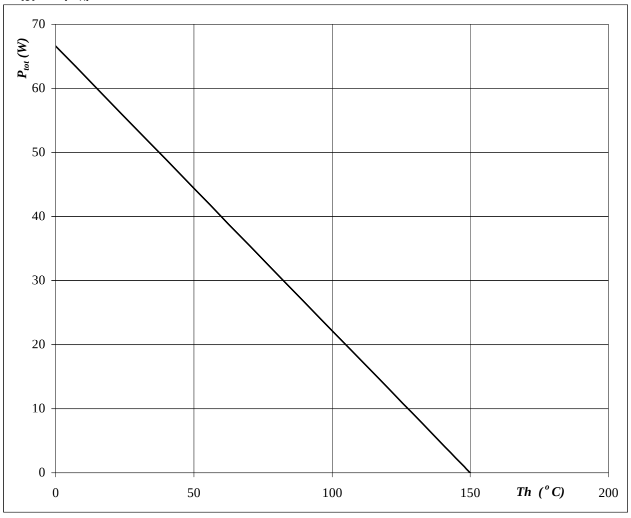
T_j = 175 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



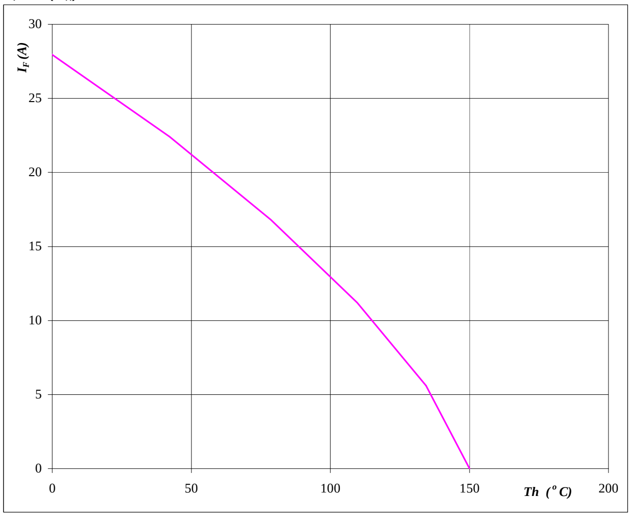
At

T_j = 150 ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



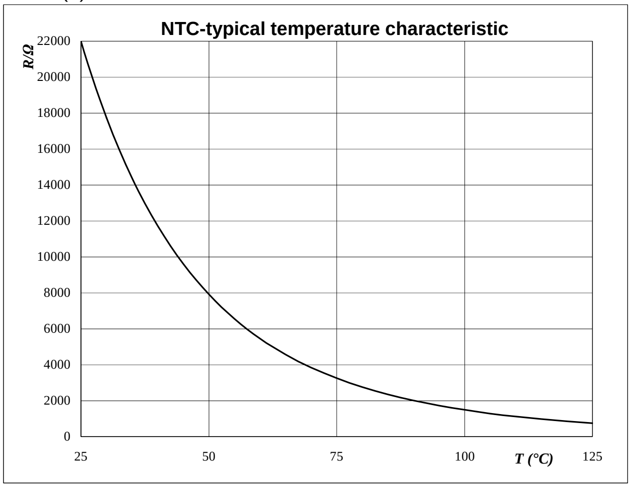
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

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



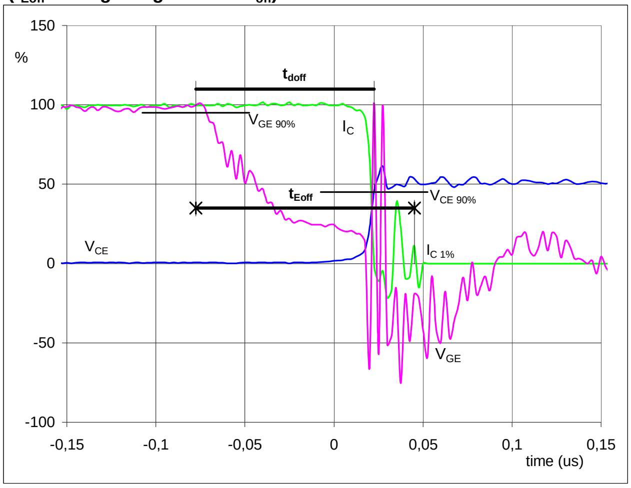
Switching Definitions BUCK MOSFET

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

Figure 1 Output inverter MOSFET

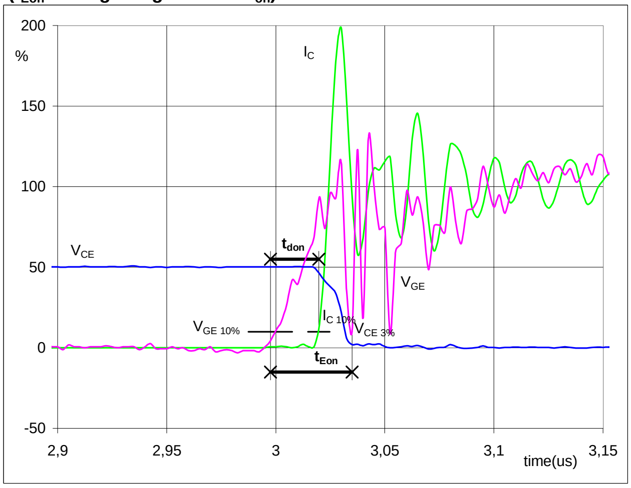
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	18	A
t_{doff} =	0,09	μs
t_{Eoff} =	0,12	μs

Figure 2 Output inverter MOSFET

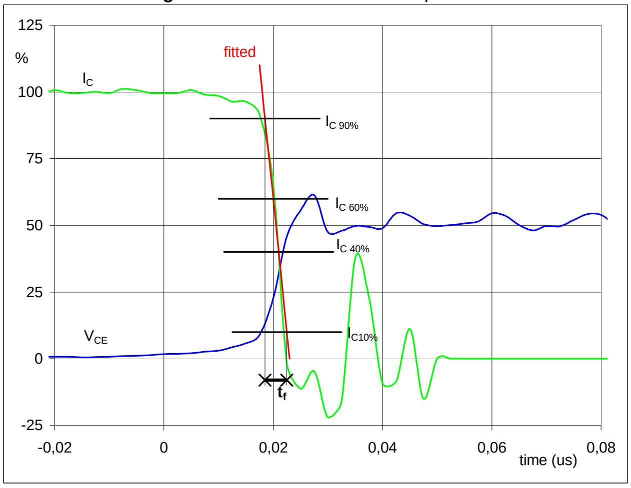
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	18	A
t_{don} =	0,02	μs
t_{Eon} =	0,04	μs

Figure 3 Output inverter MOSFET

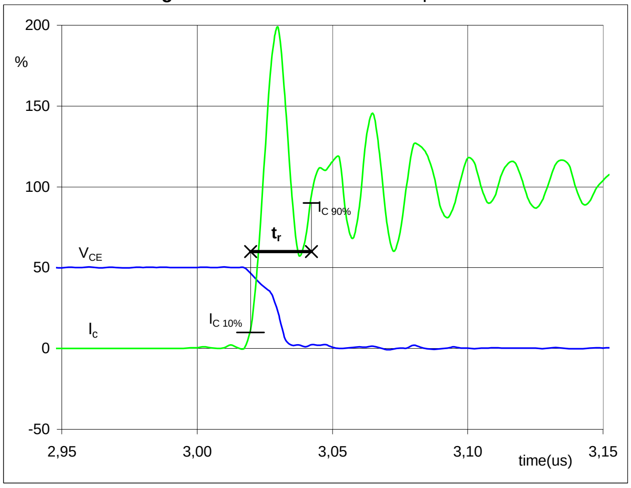
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	18	A
t_f =	0,00	μs

Figure 4 Output inverter MOSFET

Turn-on Switching Waveforms & definition of t_r

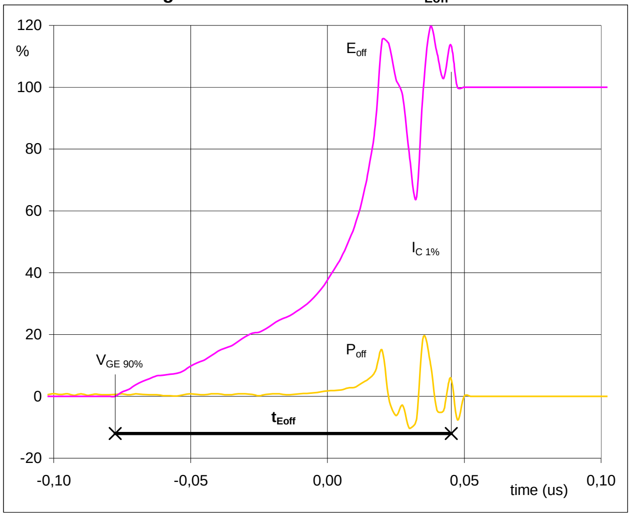


V_C (100%) =	700	V
I_C (100%) =	18	A
t_r =	0,00	μs

Switching Definitions BUCK MOSFET

Figure 5 Output inverter IGBT

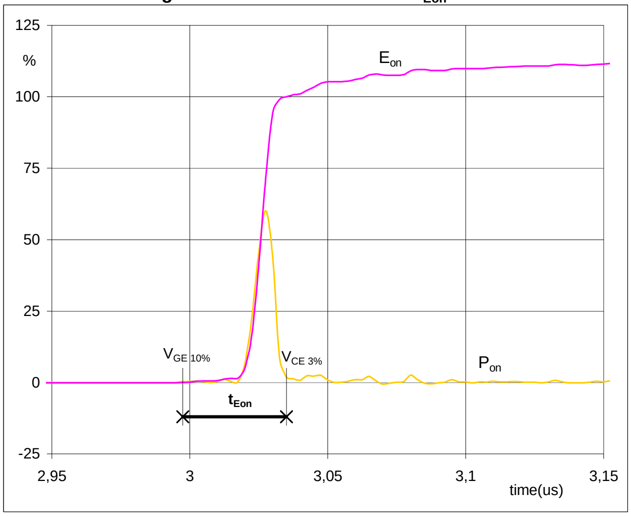
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	12,62	kW
E_{off} (100%) =	0,02	mJ
t_{Eoff} =	0,12	μs

Figure 6 Output inverter MOSFET

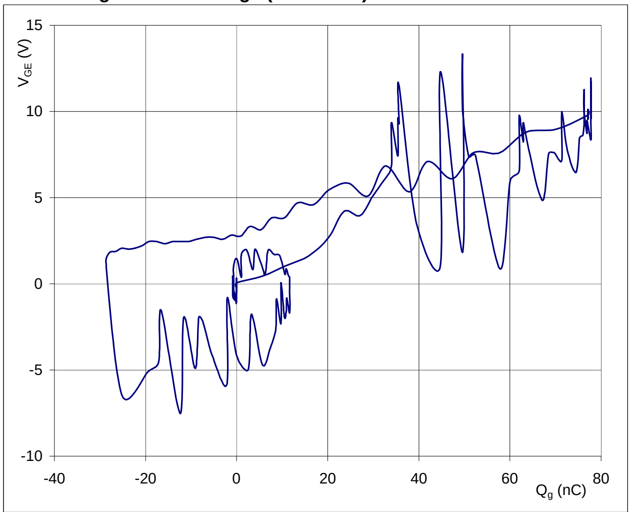
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	12,62	kW
E_{on} (100%) =	0,06	mJ
t_{Eon} =	0,04	μs

Figure 7 Output inverter FWD

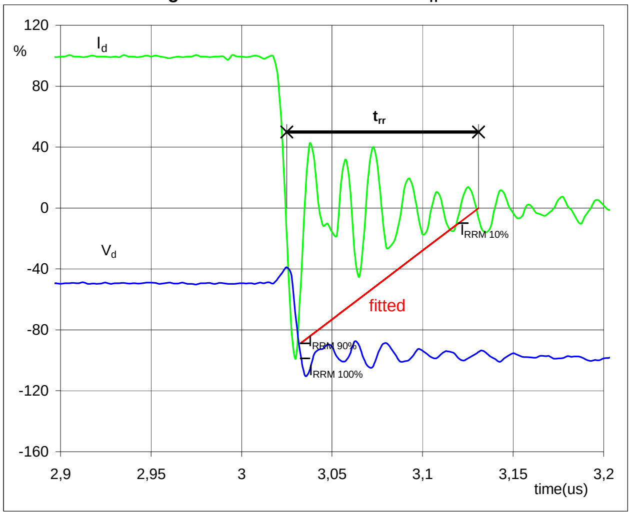
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	700	V
I_C (100%) =	18	A
Q_g =	77,73	nC

Figure 8 Output inverter MOSFET

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

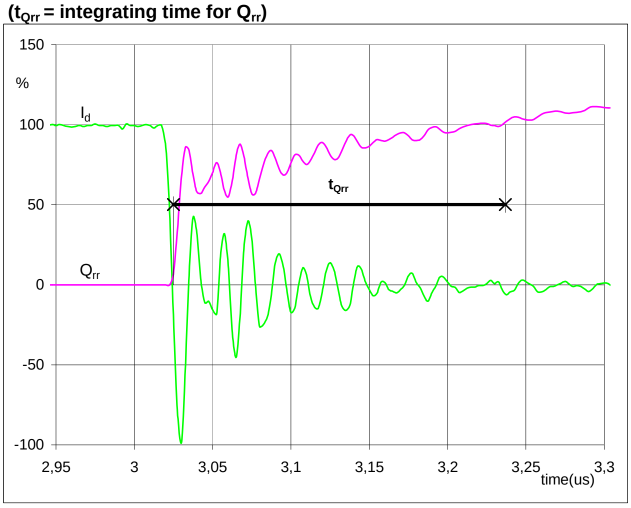


V_d (100%) =	700	V
I_d (100%) =	18	A
I_{RRM} (100%) =	-18	A
t_{rr} =	0,01	μs

Switching Definitions BUCK MOSFET

Figure 9 Output inverter FWD

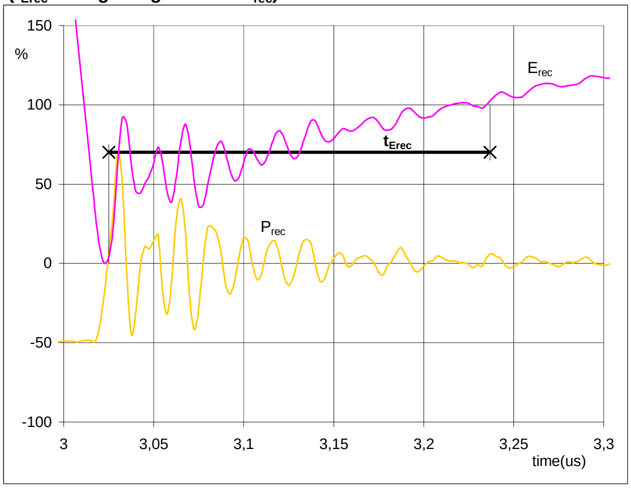
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	18	A
Q_{rr} (100%) =	0,13	µC
t_{Qrr} =	0,21	µs

Figure 10 Output inverter FWD

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



P_{rec} (100%) =	12,62	kW
E_{rec} (100%) =	0,02	mJ
t_{Erec} =	0,21	µs

Measurement circuits

Figure 11

BUCK stage switching measurement circuit

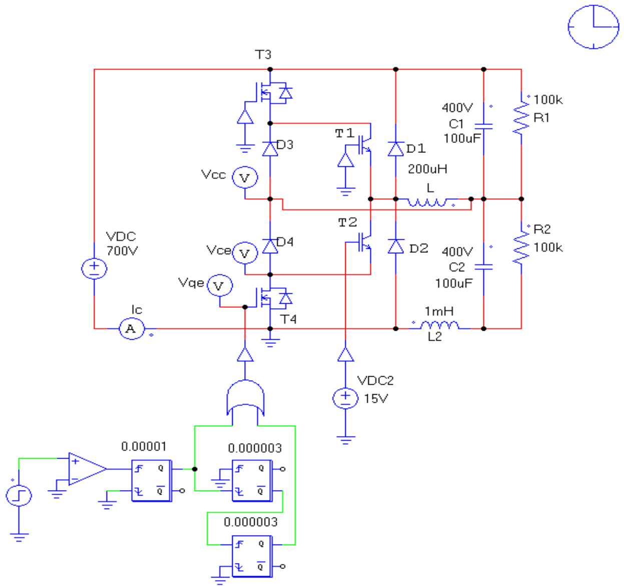
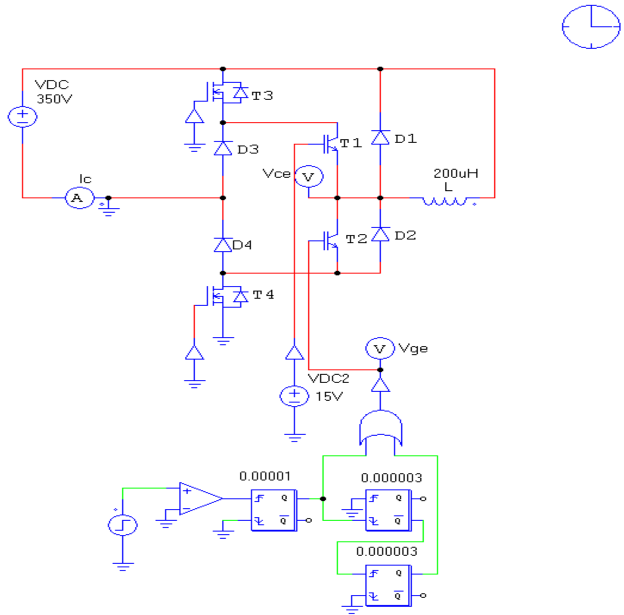


Figure 12

BOOST stage switching measurement circuit



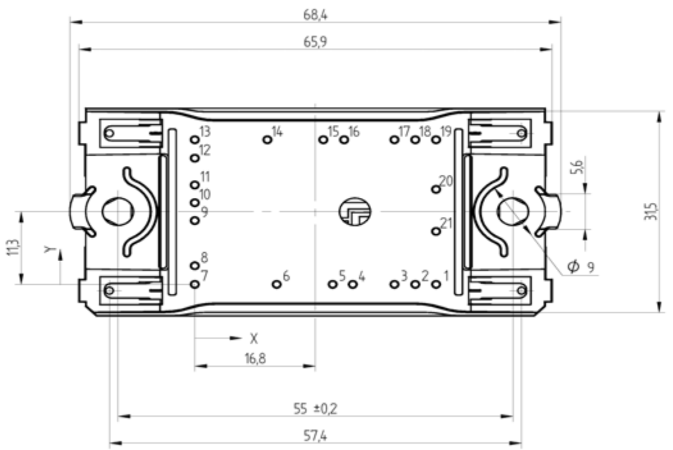
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

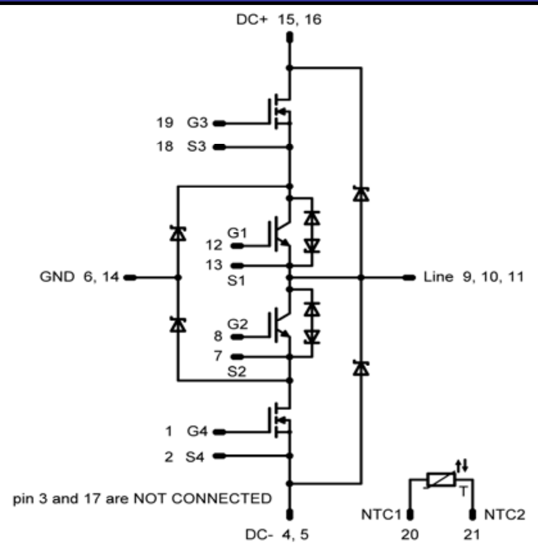
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FZ06NRA099FS-P963F68	P963F68	P963F68

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



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.

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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.