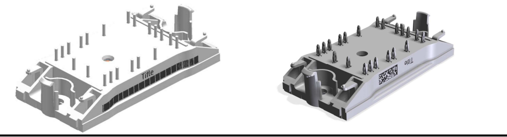
10-FZ06NRA060FU-P967F08
10-PZ06NRA060FU-P967F08Y
datasheet

flowNPC 0 **650 V / 60 A**

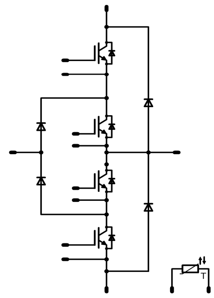
Features
- neutral point clamped inverter
- reactive power capability
- clip-in pcb mounting
- low inductance layout

flow0 12mm housing



Target Applications
- solar inverter
- UPS

Schematic



Types
- 10-FZ06NRA060FU-P967F08
- 10-PZ06NRA060FU-P967F08Y

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck & Boost Inv. Diode					
Repetitive peak reverse voltage	V_{RRM}			600	V
Forward current per diode	I_{FAV}	DC current	T_h=80°C T_c=80°C	15 20	A
Maximum repetitive forward current	I_{FRM}	tp limited by Tjmax	T_j=25°C	20	A
I^2t-value	I^2t			9,5	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	26 39	W
Maximum Junction Temperature	$T_j$max			175	°C
Buck IGBT					
Collector-emitter break down voltage	V_{CES}			650	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C T_c=80°C	53 70	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		180	A
Turn off safe operating area		$T_j \leq 150$°C $V_{CE} <= V_{CES}$		180	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	108 163	W
Gate-emitter peak voltage	V_{GE}			±20	V
Maximum Junction Temperature	$T_j$max			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck Diode					
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	27 36	A
Non-repetitive Peak Surge Current	I_{FSM}	60Hz Single Half-Sine Wave		300	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	40 60	W
Maximum Junction Temperature	$T_j$max			150	°C
Boost IGBT					
Collector-emitter break down voltage	V_{CES}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	46 63	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$max		225	A
Turn off safe operating area		T_j≤150°C V_{CE}<=V_{CES}		225	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	68 103	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 Diode					
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 21	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max 20kHz Square Wave		36	A
Power dissipation per Diode	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
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				9,15	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 & Boost Inv. Diode										
Forward voltage	V_F				10	Tj=25°C Tj=125°C	1,25	1,66 1,52	1,95	V
Threshold voltage (for power loss calc. only)	V_{to}				10	Tj=25°C Tj=125°C		1,16 1,00		V
Slope resistance (for power loss calc. only)	r_t				10	Tj=25°C Tj=125°C		0,05 0,05		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						3,66		K/W
Buck IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,00025	Tj=25°C Tj=125°C	3,9	4,5	5,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	Tj=25°C Tj=125°C		1,51 1,52	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=125°C			0,03	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			230	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					Tj=25°C Tj=125°C		49 50		
Rise time	t_r					Tj=25°C Tj=125°C		4 4		
Turn-off delay time	$t_{d(off)}$	Rgoff=4 Ω Rgon=4 Ω	±15	350	30	Tj=25°C Tj=125°C		90 115		ns
Fall time	t_f					Tj=25°C Tj=125°C		5 6		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,17 0,35		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,18 0,38		
Input capacitance	C_{ies}							2915		
Output capacitance	C_{oss}	f=1MHz	0	30		Tj=25°C		270		pF
Reverse transfer capacitance	C_{rss}							85		
Gate charge	Q_{Gate}		±15	400	60	Tj=25°C		189		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,88		K/W
Buck Diode										
Diode forward voltage	V_F				30	Tj=25°C Tj=125°C		2,15 1,61	2,8	V
Reverse leakage current	I_r			600		Tj=25°C Tj=125°C			100	µA
Peak reverse recovery current	I_{RRM}					Tj=25°C Tj=125°C		50 59		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		14 26		ns
Reverse recovered charge	Q_{rr}	Rgon=4 Ω	±15	350	30	Tj=25°C Tj=125°C		0,36 0,94		µC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25°C Tj=125°C		16743 8913		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		0,022 0,098		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,77		K/W

Characteristic Values

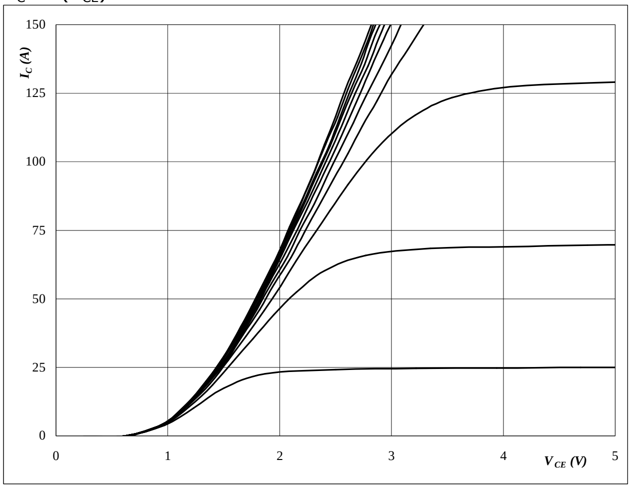
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	V_{CE}=V_{GE}			0,0012	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25°C Tj=125°C	1,05	1,31 1,40	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25°C Tj=125°C			0,0038	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			600	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	350	50	Tj=25°C Tj=125°C		87 88		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		177 204		
Fall time	t_f					Tj=25°C Tj=125°C		85 93		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,37 0,54		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		1,69 2,25		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		4620		pF
Output capacitance	C_{oss}							288		
Reverse transfer capacitance	C_{rss}							137		
Gate charge	Q_{Gate}		15	480	75	Tj=25°C		465		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,40		K/W
Boost Diode										
Diode forward voltage	V_F				18	Tj=25°C Tj=125°C		2,43 2,10	3,3	V
Reverse leakage current	I_r			1200		Tj=25°C Tj=125°C			100	µA
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	350	50	Tj=25°C Tj=125°C		69 77		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		25 123		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		3,42 6,27		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		9632 5392		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=125°C		1,04 1,97		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,21		K/W
Thermistor										
Rated resistance	R					T=25°C		21500		Ω
Deviation of R25	ΔR/R	R100=1486 Ω				T=100°C	-4,5		4,5	%
Power dissipation	P					T=25°C		210		mW
Power dissipation constant						T=25°C		3,5		mW/K
B-value	B(25/50)					T=25°C		3884		K
B-value	B(25/100)					T=25°C		3964		K
Vincotech NTC Reference									F	

Buck

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



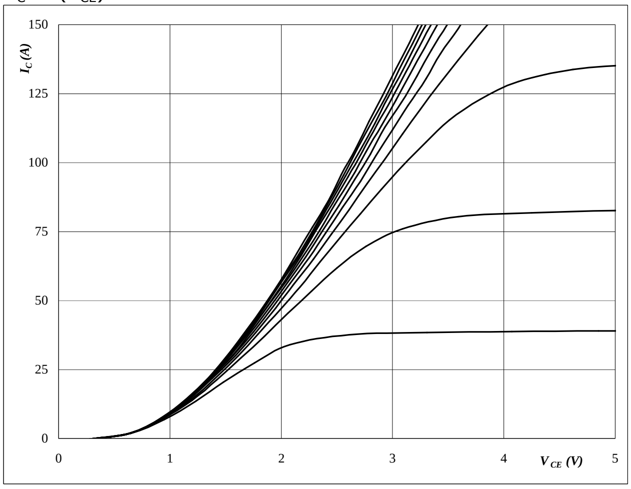
At

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

$I_C = f(V_{CE})$



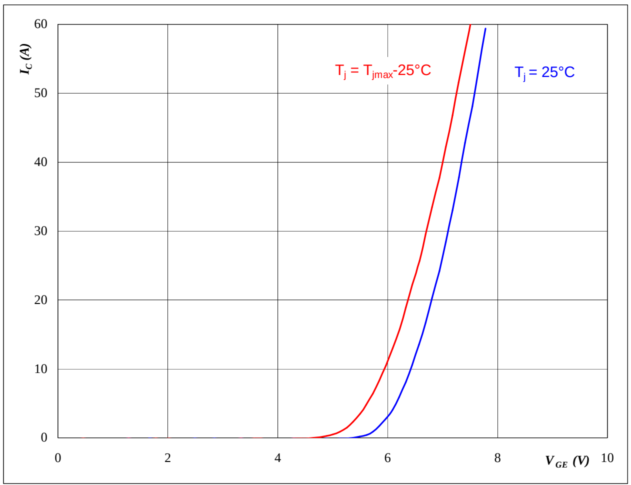
At

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

$I_C = f(V_{GE})$



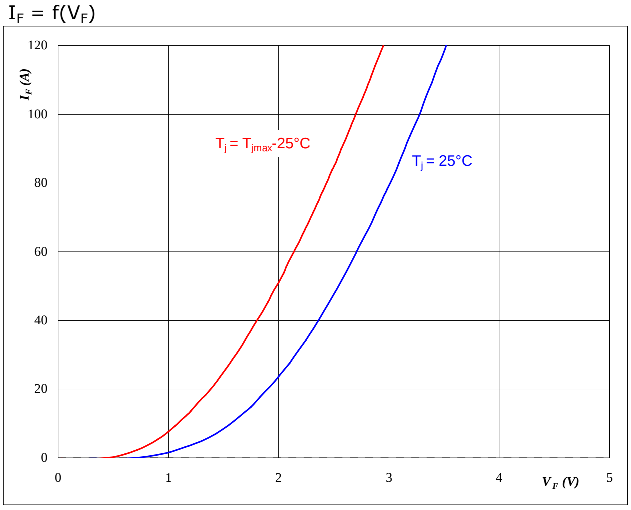
At

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

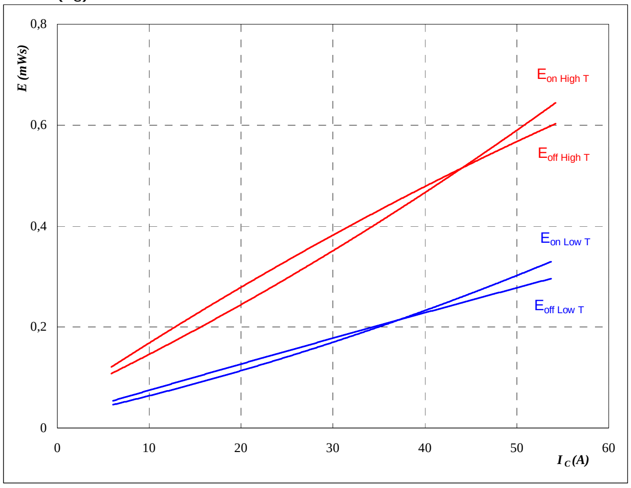
t_p =	250	µs

Buck

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



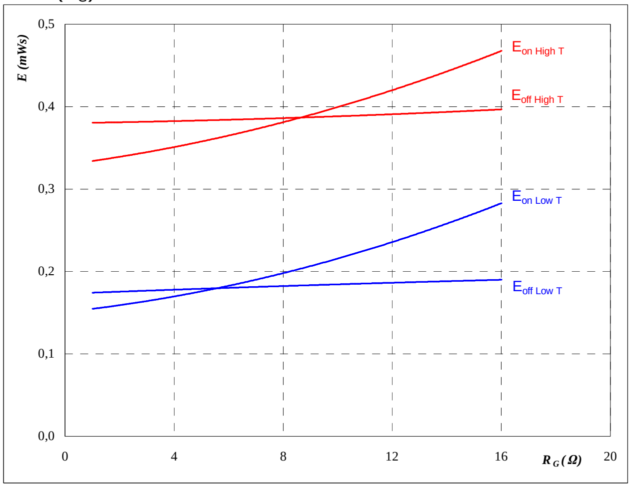
With an inductive load at

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

$E = f(R_G)$



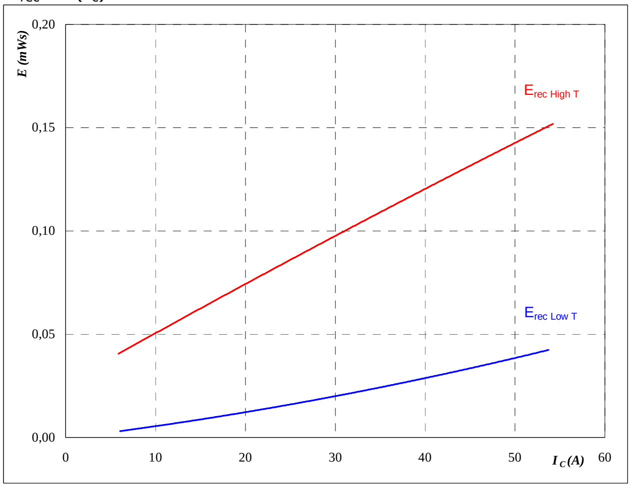
With an inductive load at

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

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



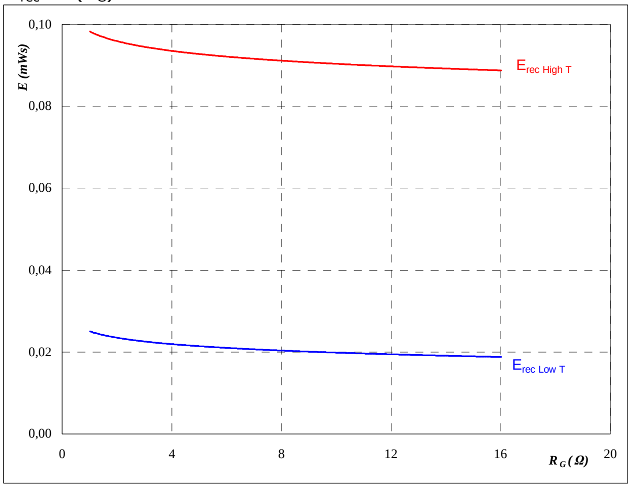
With an inductive load at

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

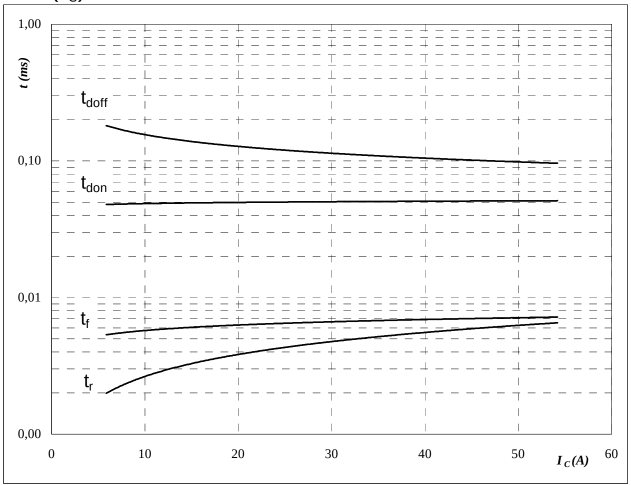
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	30	A

Buck

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



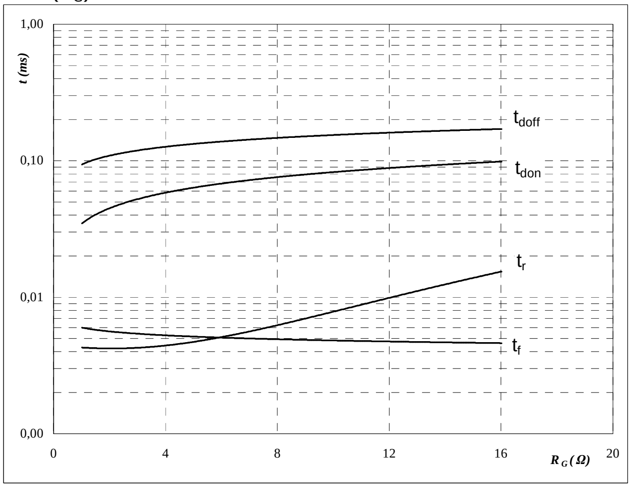
With an inductive load at

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

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



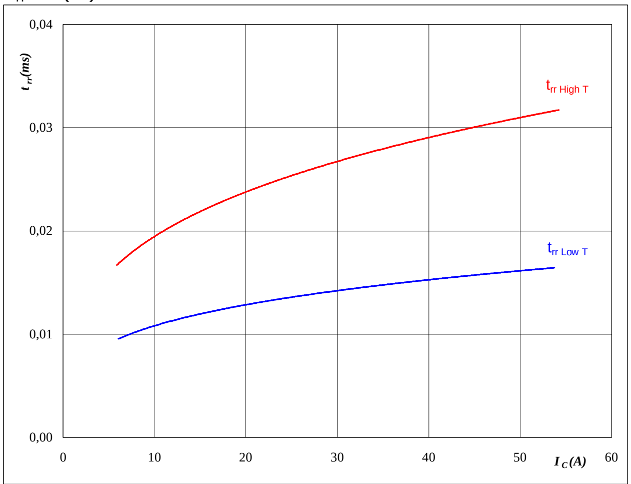
With an inductive load at

T_j =	125	°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)



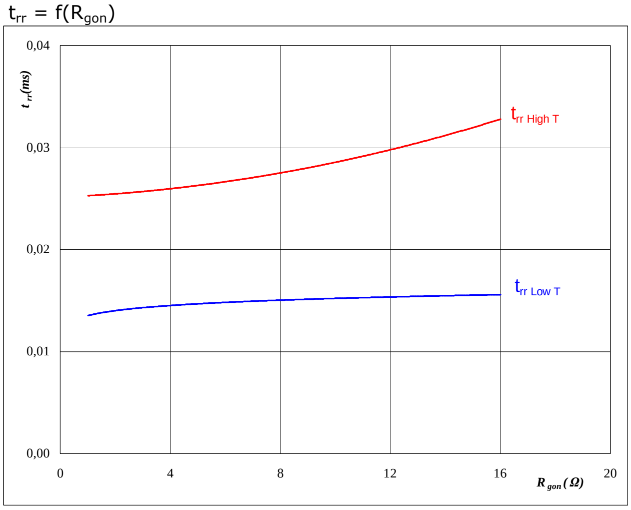
At

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

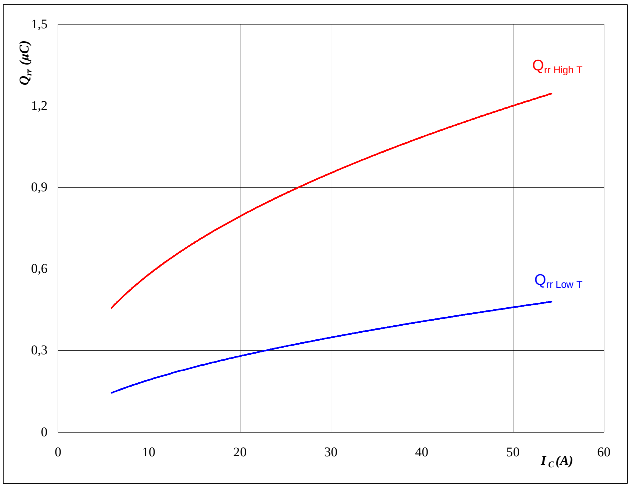
T_j =	25/125	°C
V_R =	350	V
I_F =	30	A
V_{GE} =	±15	V

Buck

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



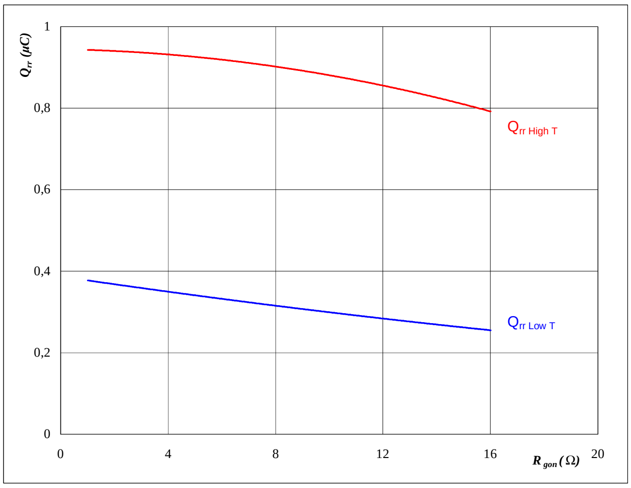
At

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

Figure 14 FWD

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

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



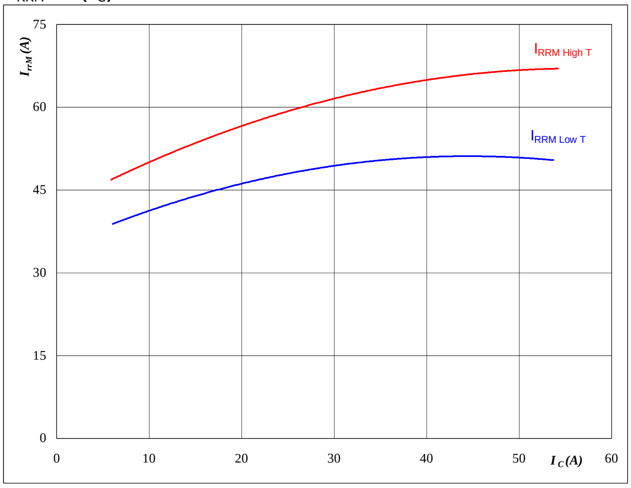
At

T_j =	25/125	°C
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

$I_{RRM} = f(I_C)$



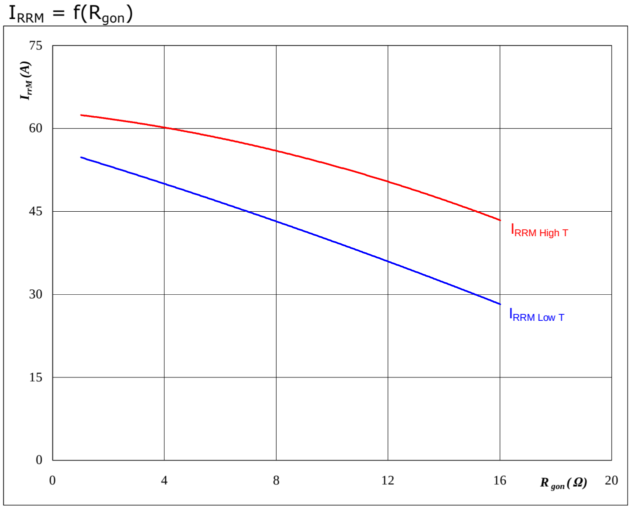
At

T_j =	25/125	°C
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

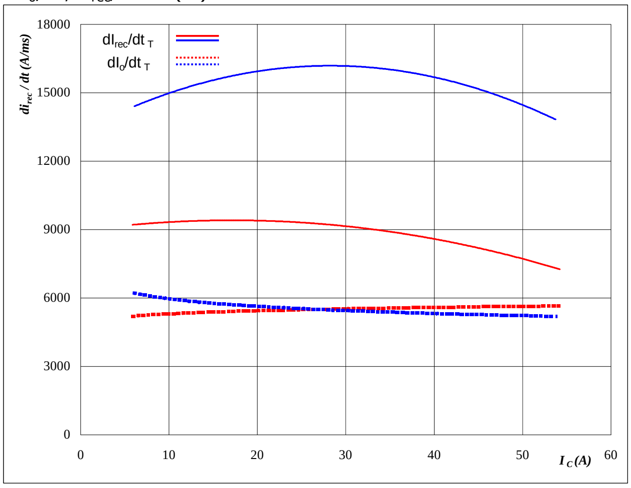
T_j =	25/125	°C
V_R =	350	V
I_F =	30	A
V_{GE} =	±15	V

Buck

Figure 17 FWD

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

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



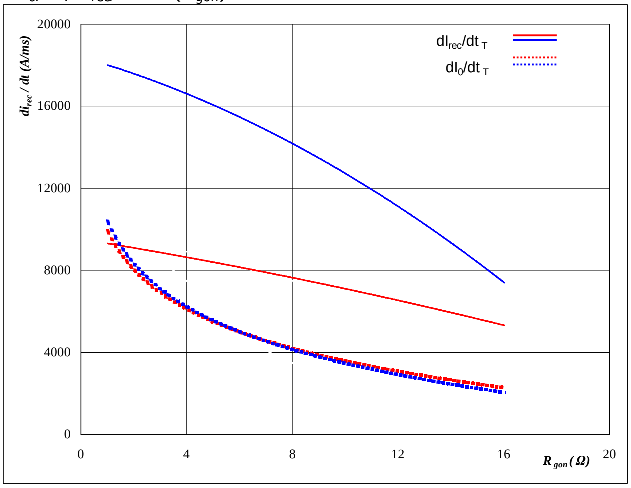
At

T_j =	25/125	°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 function of IGBT turn on gate resistor

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



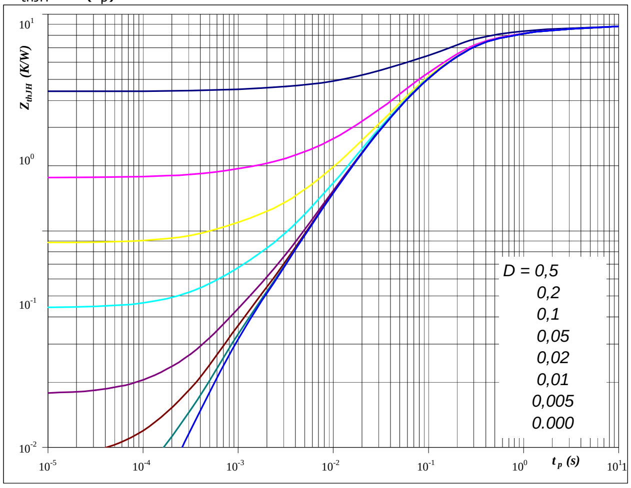
At

T_j =	25/125	°C
V_R =	350	V
I_F =	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 =	t_p / T				
R_{thJH} =	0,88	K/W	R_{thJH} =	0,59	K/W

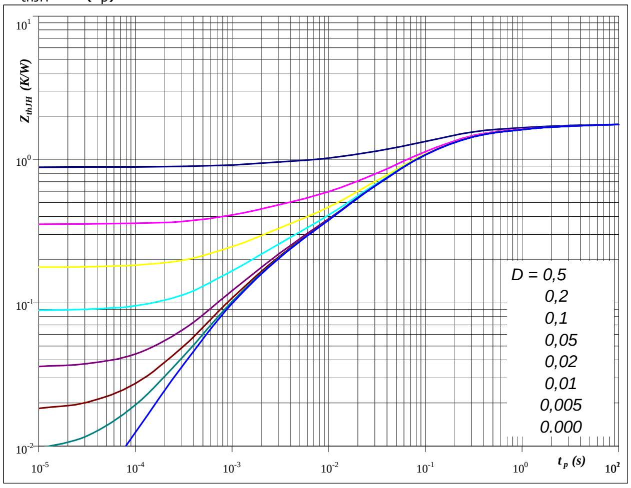
IGBT thermal model values

Thermal grease		Phase change interface	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,08	2,8E+00	0,05	1,87
0,20	3,7E-01	0,13	0,25
0,45	8,9E-02	0,30	0,06
0,13	1,2E-02	0,09	0,01
0,02	8,8E-04	0,02	0,00

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} =	1,77	K/W	R_{thJH} =	1,18	K/W

FWD thermal model values

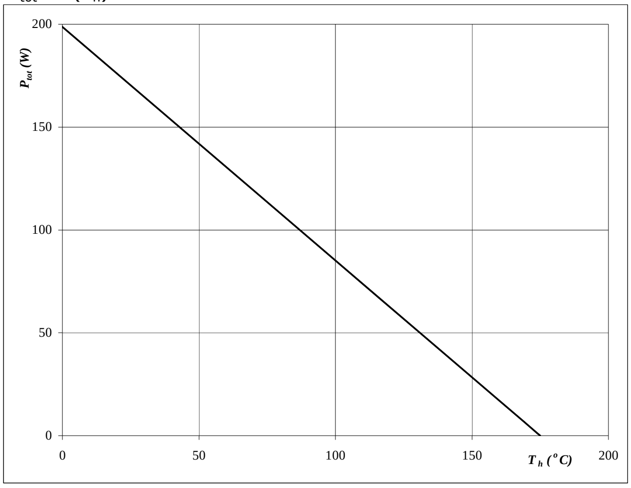
Thermal grease		Phase change interface	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,10	5,3E+00	0,06	3,54
0,23	8,1E-01	0,15	0,54
0,71	1,4E-01	0,48	0,10
0,45	4,0E-02	0,30	0,03
0,16	8,4E-03	0,11	0,01
0,12	1,3E-03	0,08	0,00

Buck

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



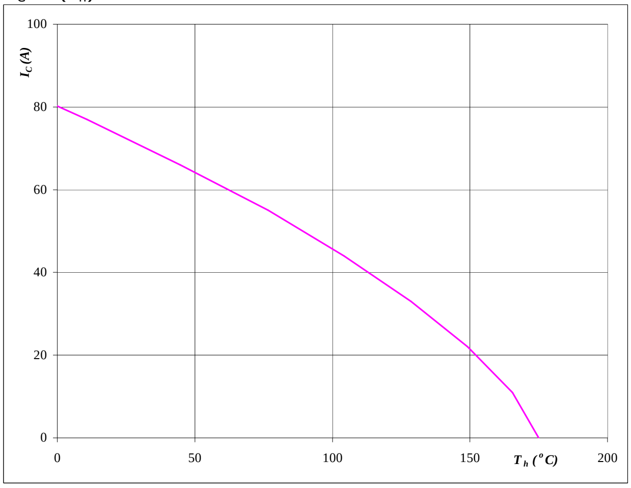
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

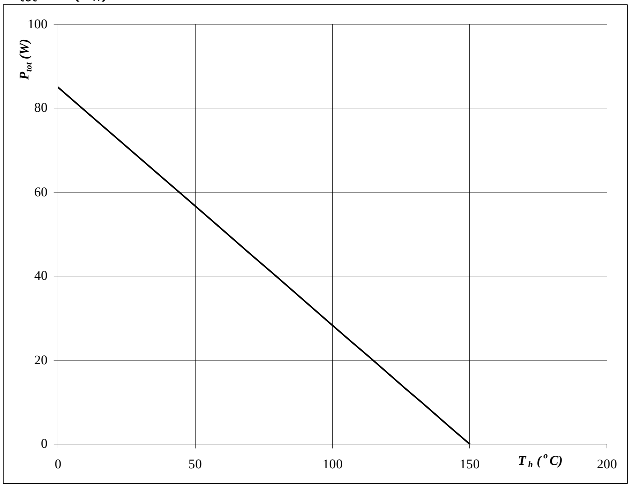
T_j = 175 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



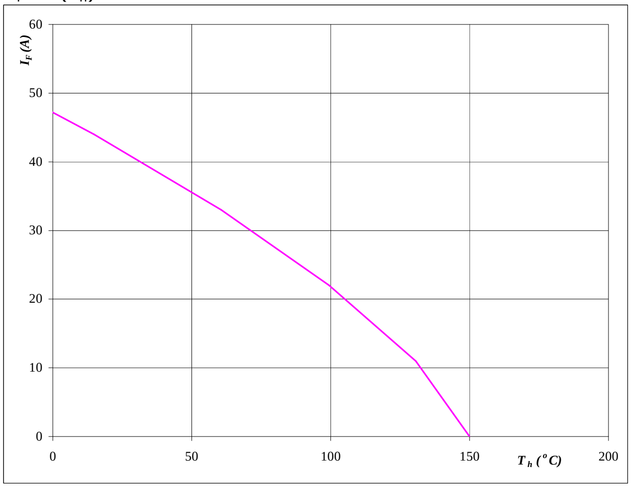
At

T_j = 150 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

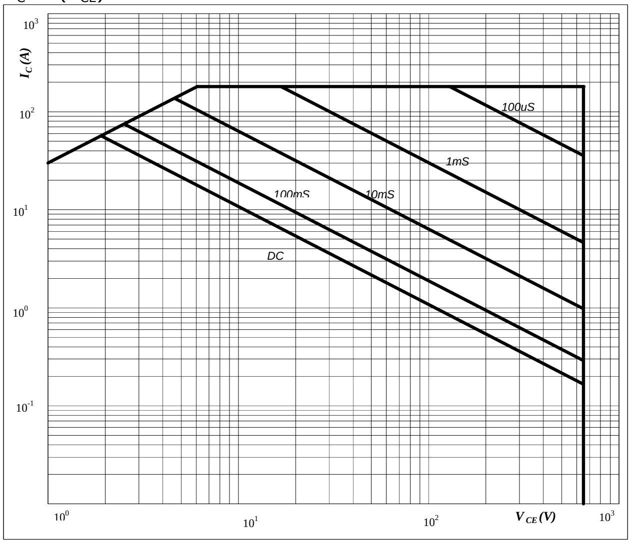
T_j = 150 °C

Buck

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



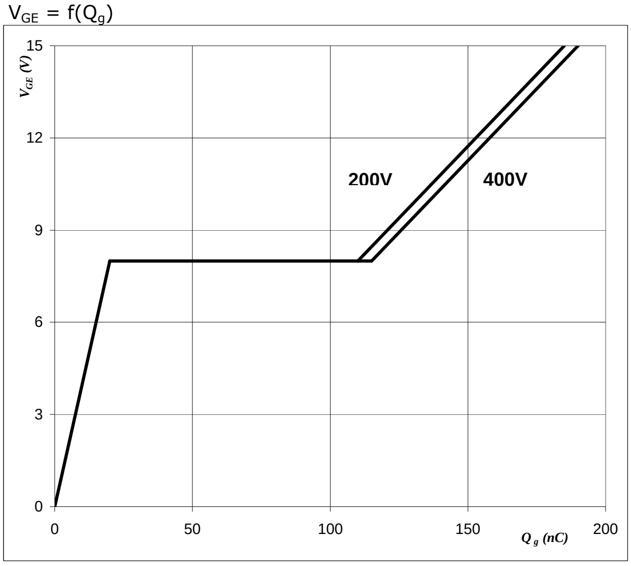
At

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

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

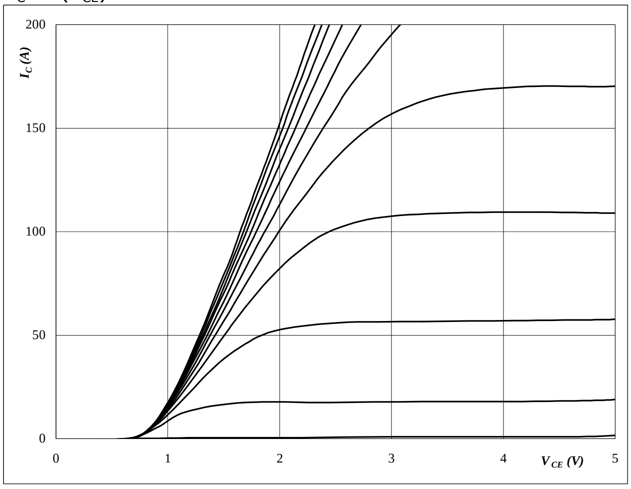
I_C =	60	A

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

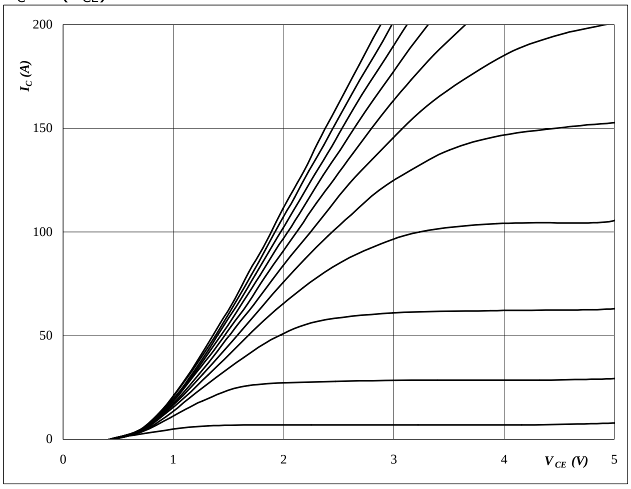
T_j = 25 °C

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

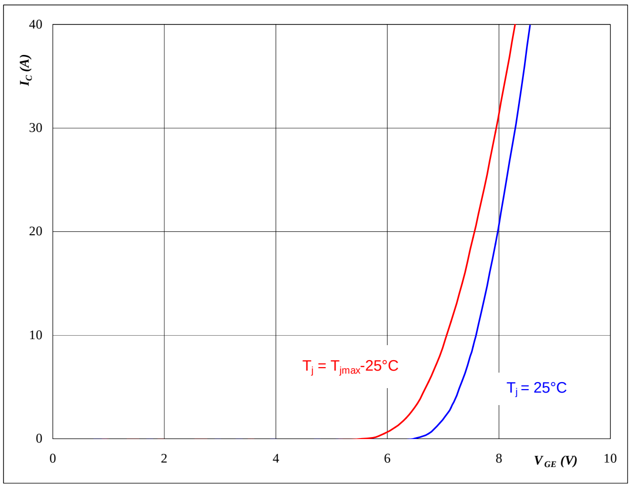
T_j = 125 °C

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

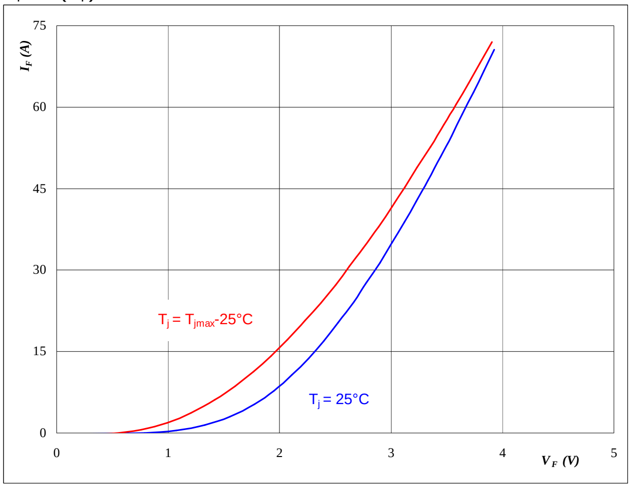
t_p = 250 µs

V_{CE} = 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

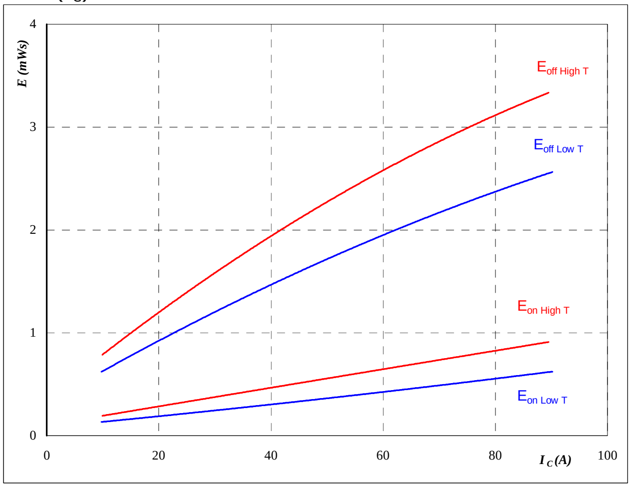
t_p = 250 µs

Boost

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



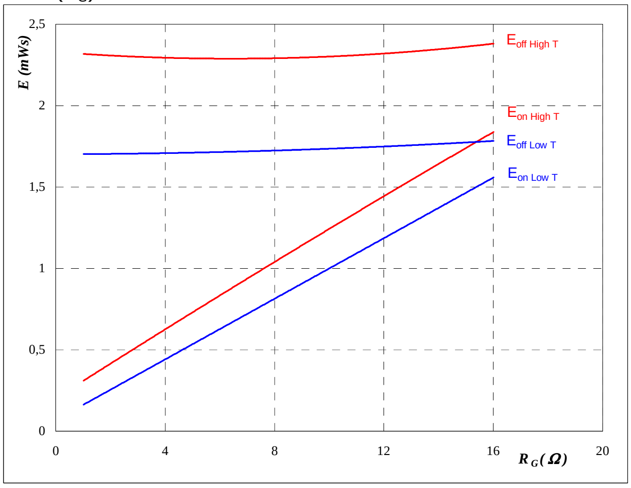
With an inductive load at

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

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



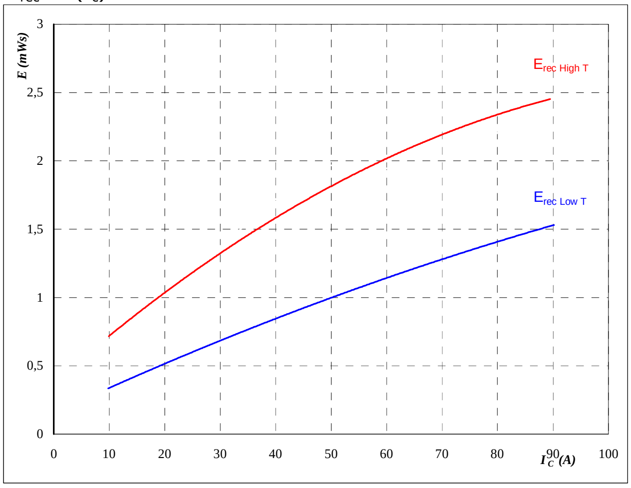
With an inductive load at

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

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



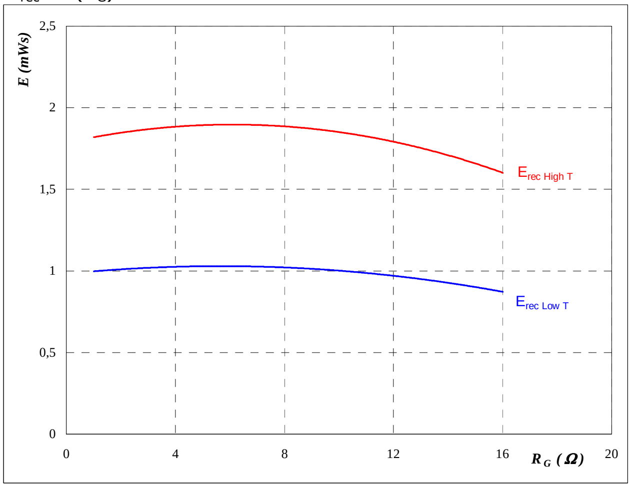
With an inductive load at

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

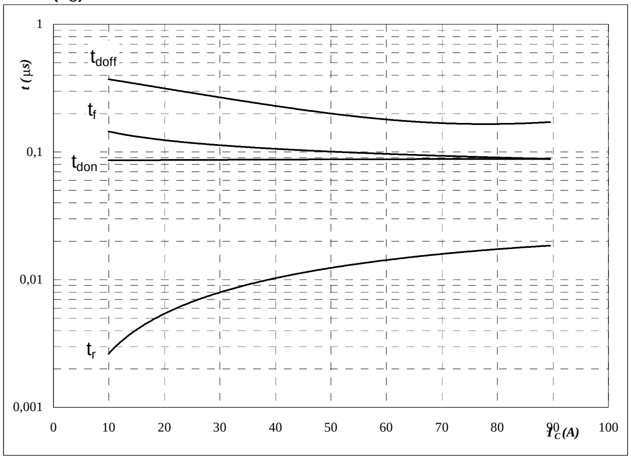
T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Boost

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



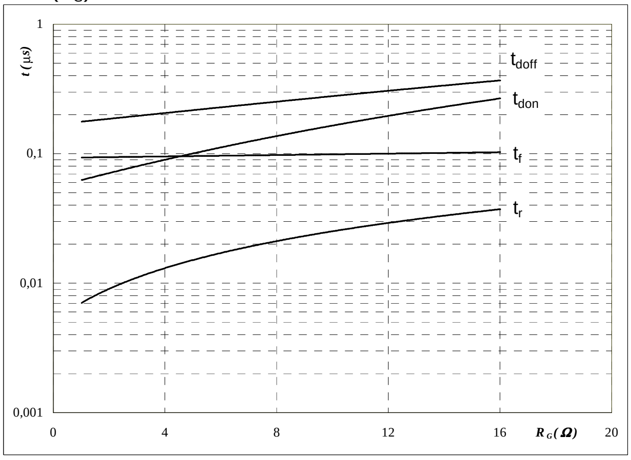
With an inductive load at

T_j =	125	°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

$t = f(R_G)$



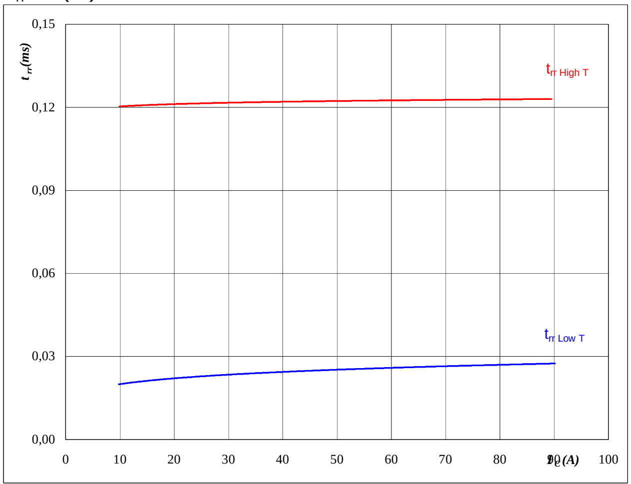
With an inductive load at

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

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



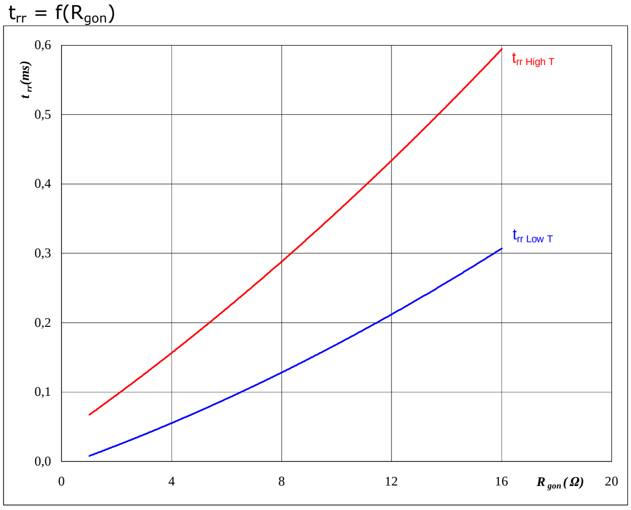
At

T_j =	25/125	°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

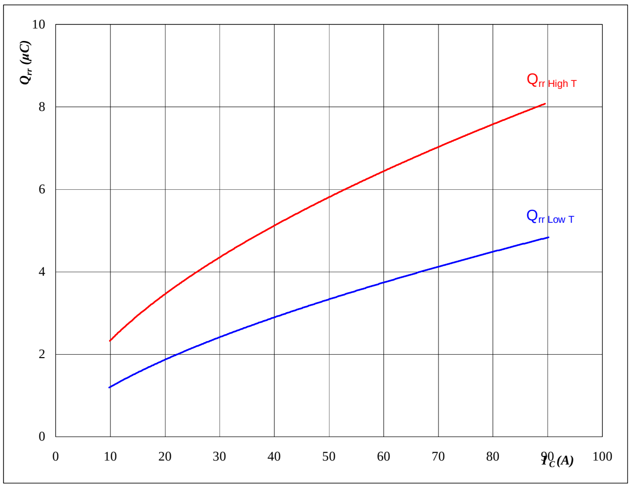
T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



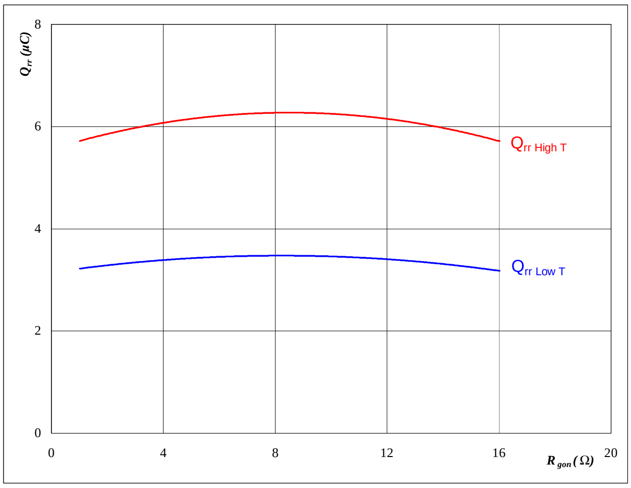
At

T_j =	25/125	°C
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

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



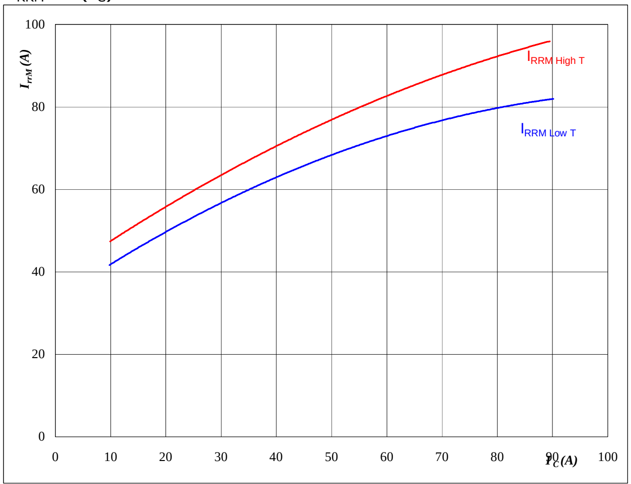
At

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

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



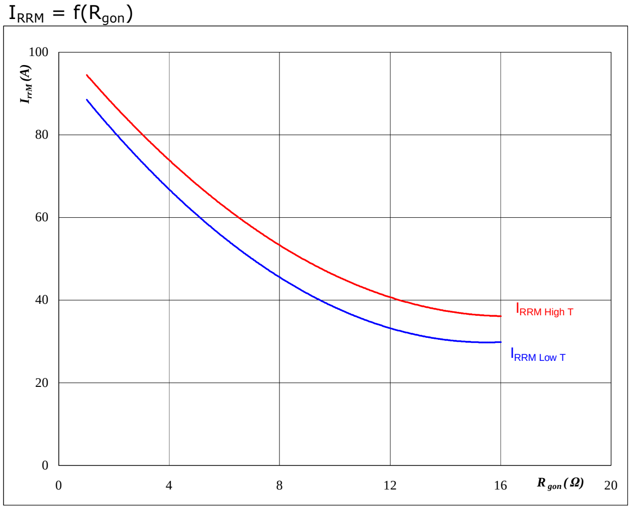
At

T_j =	25/125	°C
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

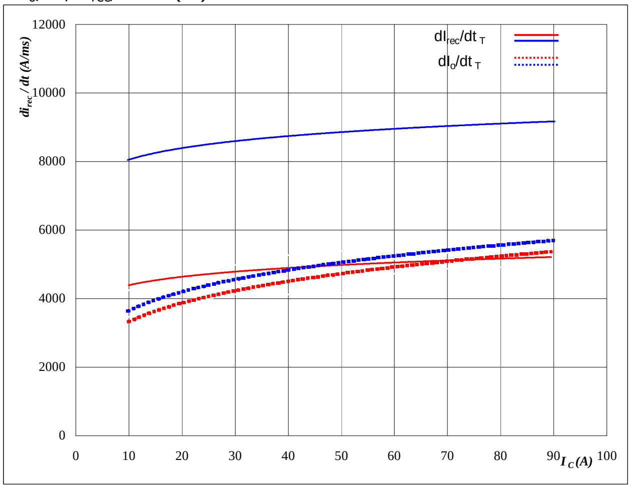
T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Boost

Figure 17 — FWD

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

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



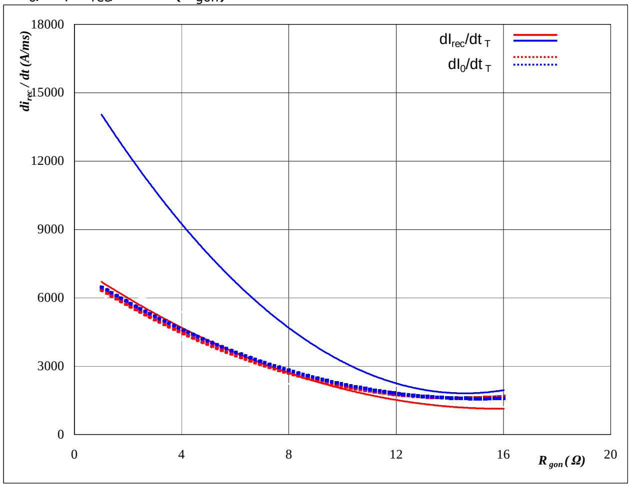
At

T_j =	25/125	°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 function of IGBT turn on gate resistor

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



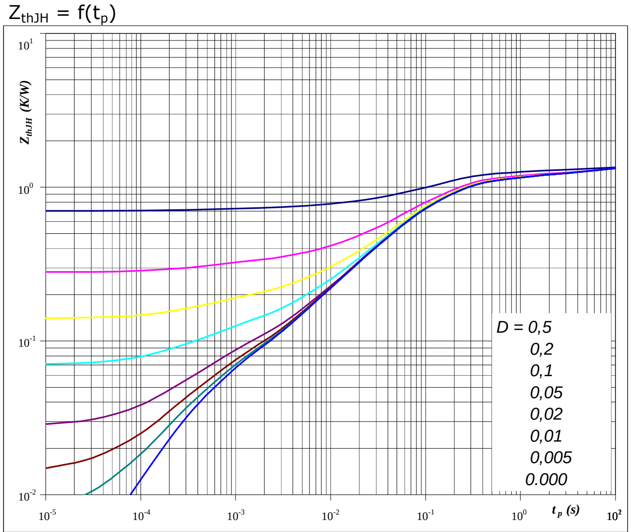
At

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

Figure 19 — IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T				
R_{thJH} =	1,40	K/W	R_{thJH} =	0,94	K/W

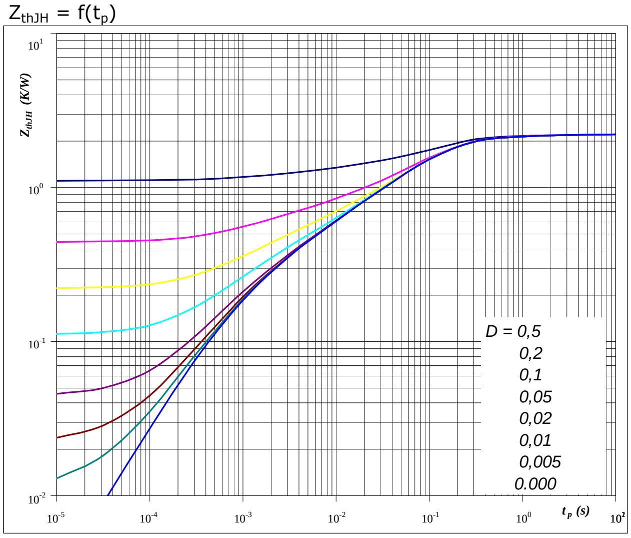
IGBT thermal model values

Thermal grease R (K/W)	Thermal grease Tau (s)	Phase change interface R (K/W)	Phase change interface Tau (s)
0,25	8,1E+00	0,17	5,45
0,22	4,7E-01	0,14	0,32
0,69	9,9E-02	0,47	0,07
0,14	2,0E-02	0,10	0,01
0,05	4,1E-03	0,03	0,00
0,05	4,0E-04	0,03	0,00

Figure 20 — FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T				
R_{thJH} =	2,21	K/W	R_{thJH} =	1,48	K/W

FWD thermal model values

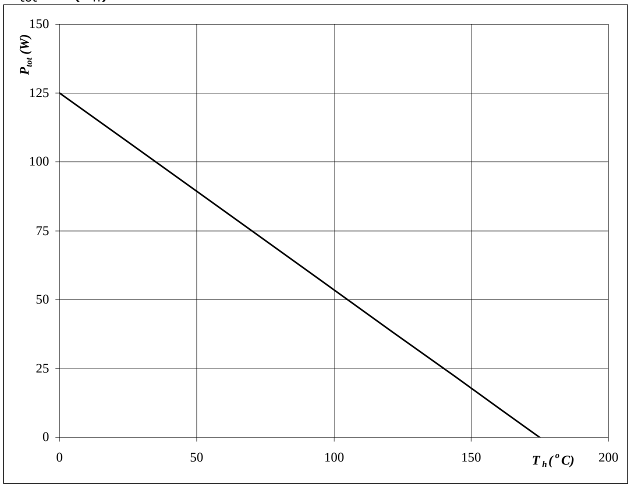
Thermal grease R (K/W)	Thermal grease Tau (s)	Phase change interface R (K/W)	Phase change interface Tau (s)
0,08	2,5E+00	0,05	1,64
0,32	3,3E-01	0,21	0,22
1,23	8,5E-02	0,82	0,06
0,32	1,1E-02	0,21	0,01
0,18	2,1E-03	0,12	0,00
0,09	5,7E-04	0,06	0,00

Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



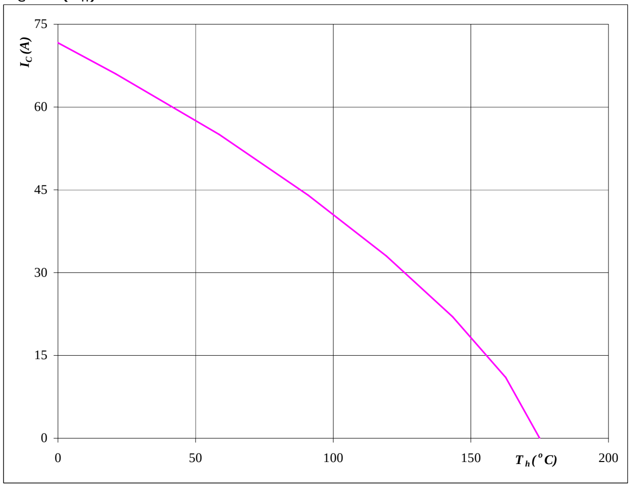
At

T_j = 175 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

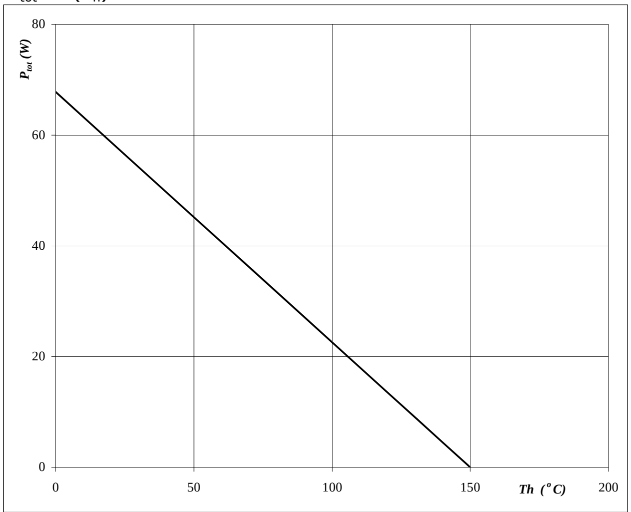
T_j = 175 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



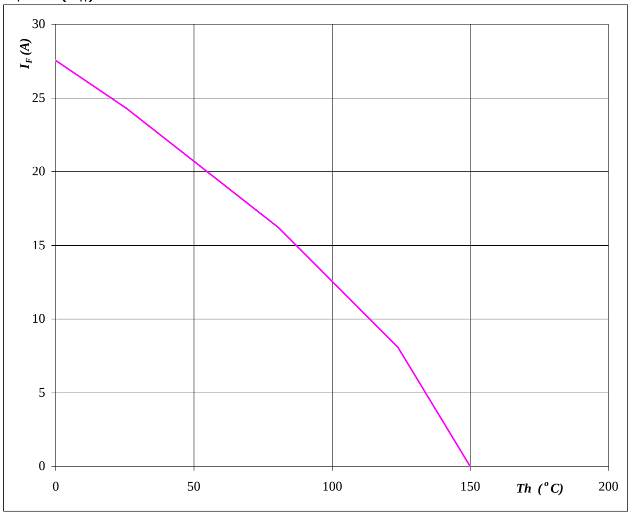
At

T_j = 150 ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

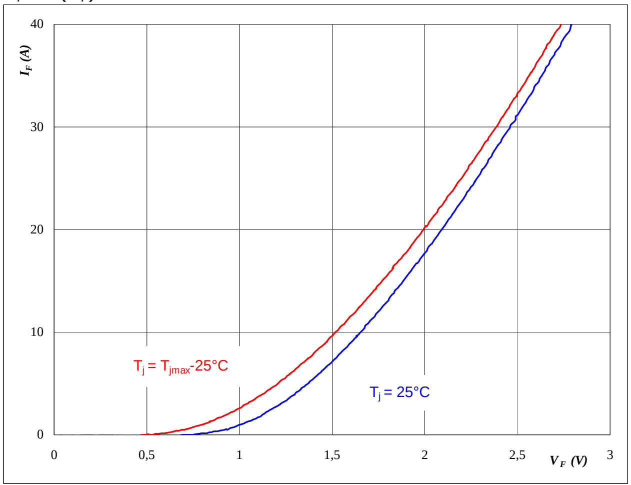
T_j = 150 ºC

Buck & Boost Inverse Diode

Figure 25 Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



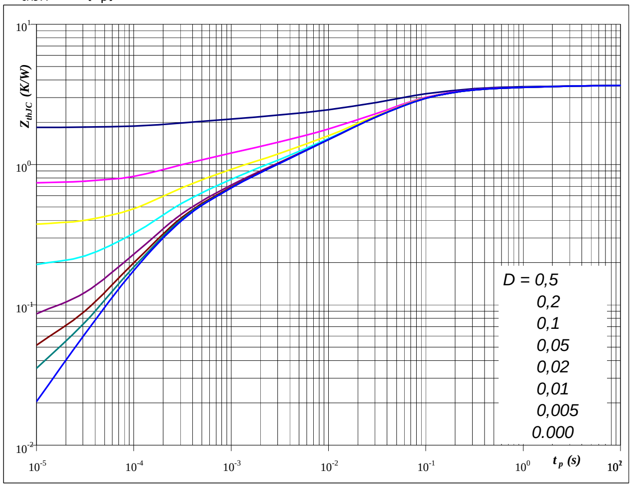
At

t_p = 250 µs

Figure 26 Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

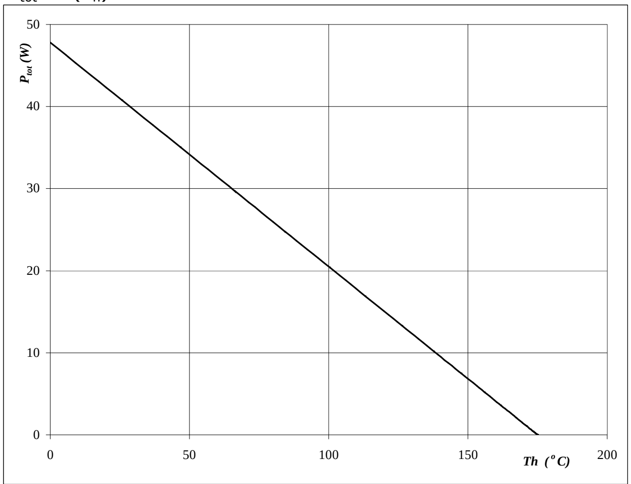
D = tp / T

R_{thJH} = 3,66 K/W

Figure 27 Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



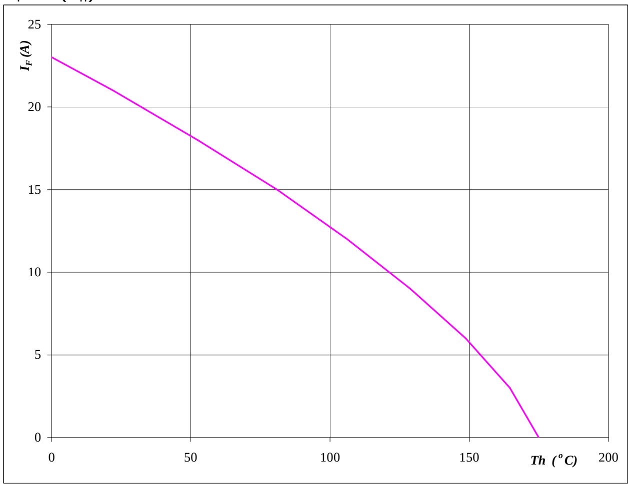
At

T_j = 175 ºC

Figure 28 Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



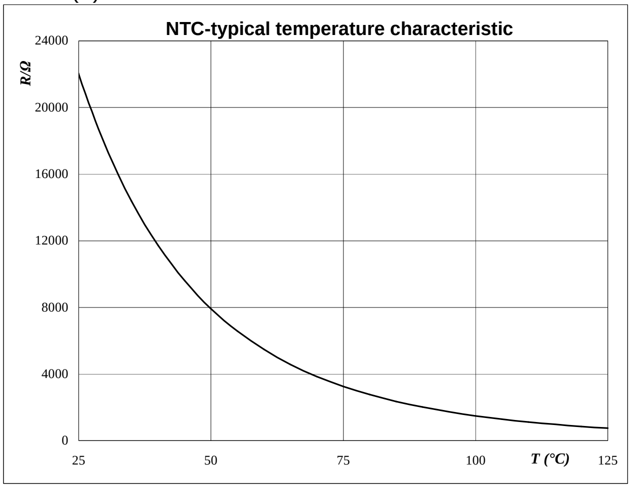
At

T_j = 175 ºC

Thermistor

Figure 1	Thermistor

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



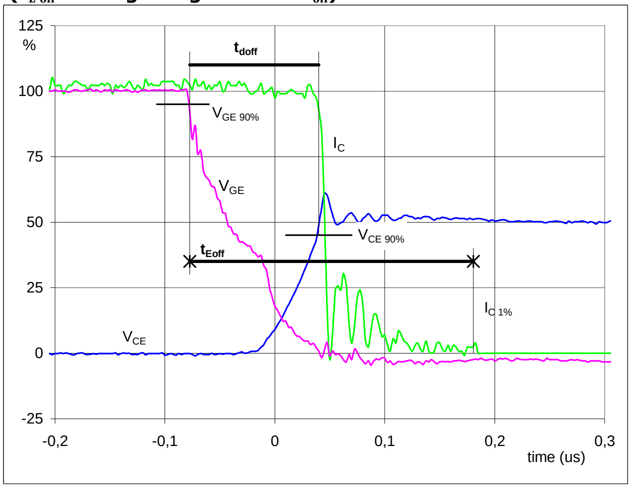
Switching Definitions BUCK IGBT

General conditions

Tj	**=**	**125 °C**
Rgon	**=**	**4 Ω**
Rgoff	**=**	**4 Ω**

Figure 1 BUCK IGBT

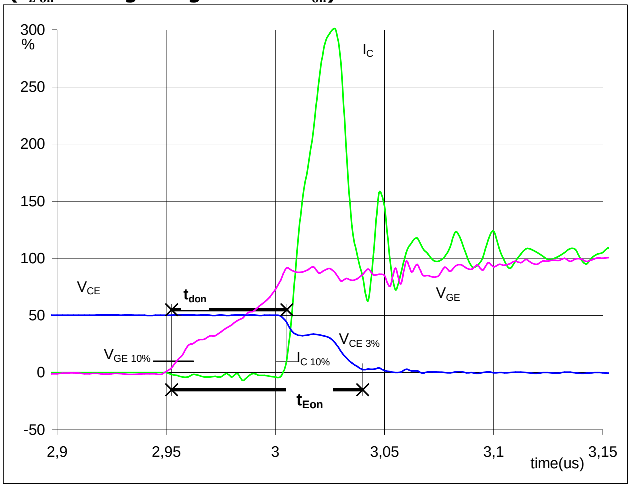
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



VGE (0%) =	-15	V
VGE (100%) =	15	V
VC (100%) =	700	V
IC (100%) =	30	A
tdoff =	0,12	μs
tE_{off} =	0,26	μs

Figure 2 BUCK IGBT

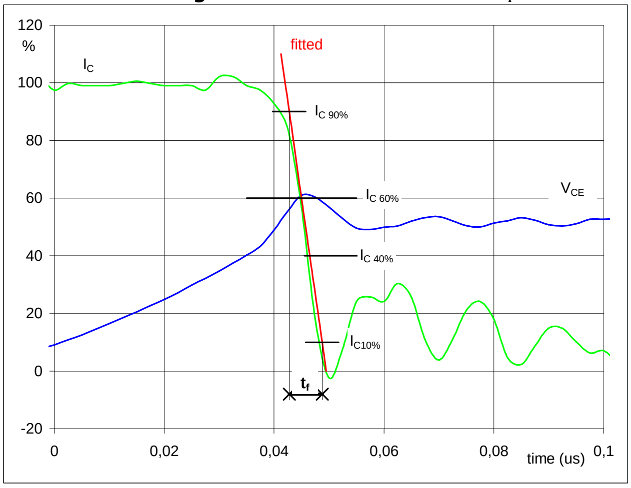
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



VGE (0%) =	-15	V
VGE (100%) =	15	V
VC (100%) =	700	V
IC (100%) =	30	A
tdon =	0,05	μs
tE_{on} =	0,09	μs

Figure 3 BUCK IGBT

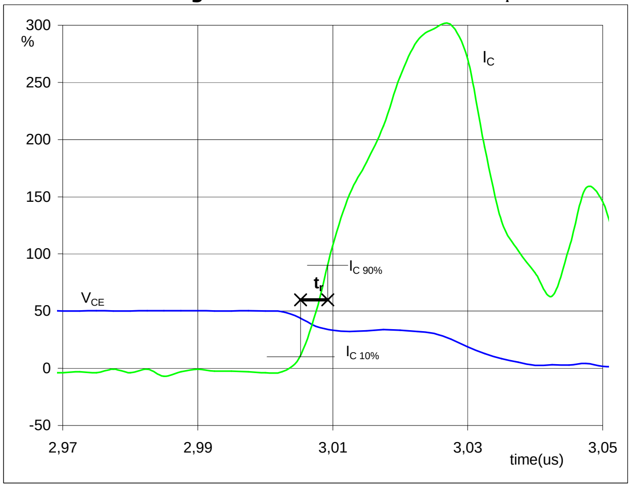
Turn-off Switching Waveforms & definition of t_f



VC (100%) =	700	V
IC (100%) =	30	A
tf =	0,006	μs

Figure 4 BUCK IGBT

Turn-on Switching Waveforms & definition of t_r

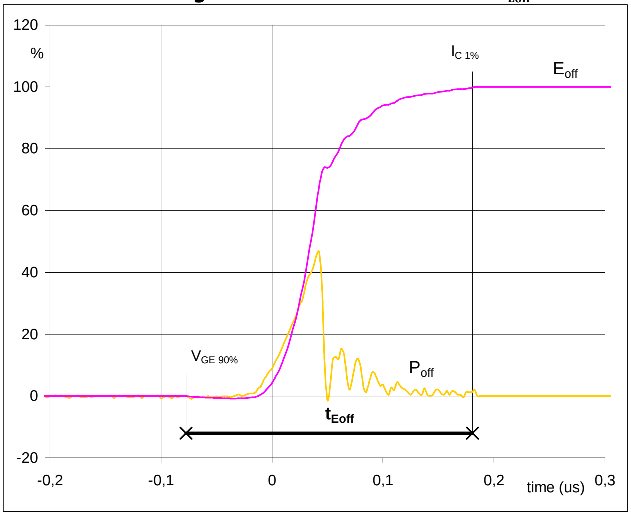


VC (100%) =	700	V
IC (100%) =	30	A
tr =	0,004	μs

Switching Definitions BUCK IGBT

Figure 5	BUCK IGBT

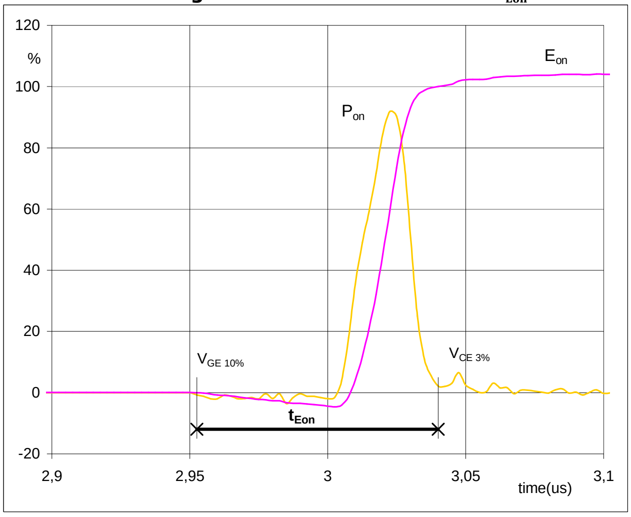
Turn-off Switching Waveforms & definition of t_{Eoff}



Poff (100%) =	21,01	kW
Eoff (100%) =	0,39	mJ
tE_{off} =	0,26	μs

Figure 6	BUCK IGBT

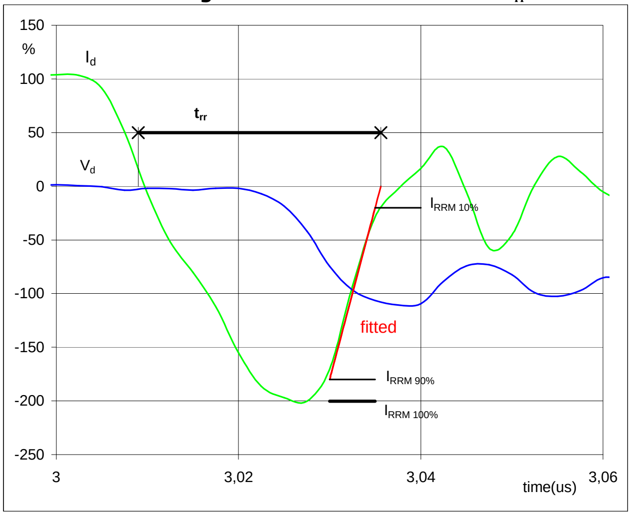
Turn-on Switching Waveforms & definition of t_{Eon}



Pon (100%) =	21,01	kW
Eon (100%) =	0,35	mJ
tE_{on} =	0,09	μs

Figure 7	BUCK FWD

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

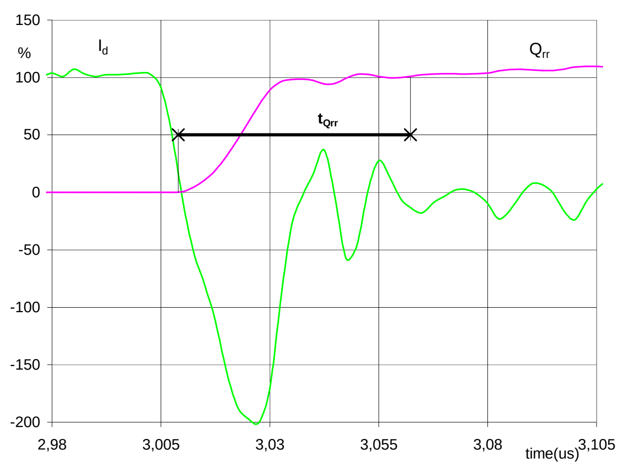


Vd (100%) =	700	V
Id (100%) =	30	A
IRRM (100%) =	10	A
trr =	0,026	μs

Switching Definitions BUCK IGBT

Figure 8 BUCK FWD

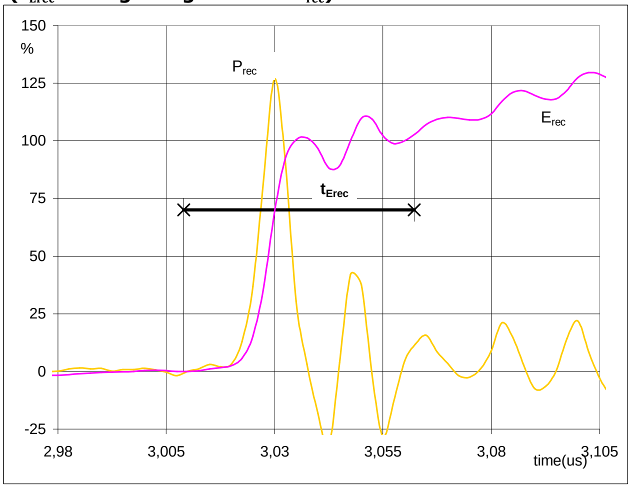
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



Id (100%) =	30	A
Qrr (100%) =	0,943	μC
tQrr =	0,05	μs

Figure 9 BUCK FWD

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



Prec (100%) =	21,01	kW
Erec (100%) =	0,098	mJ
tErec =	0,05	μs

Measurement circuits

Figure 10

BUCK stage switching measurement circuit

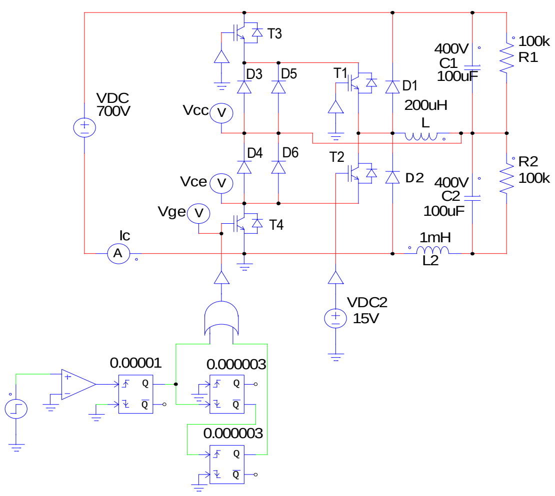
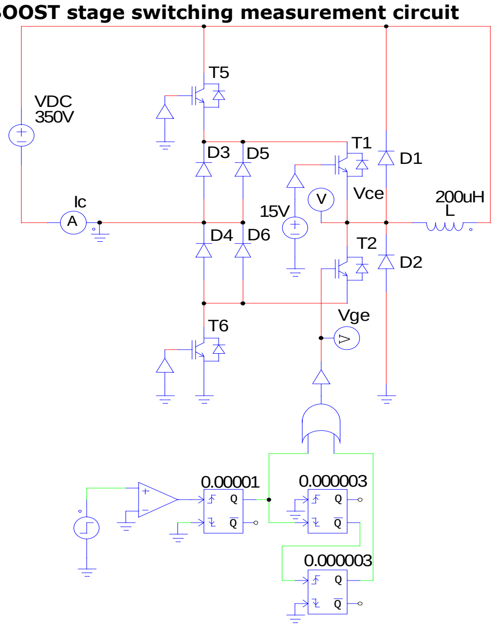


Figure 11

BOOST stage switching measurement circuit



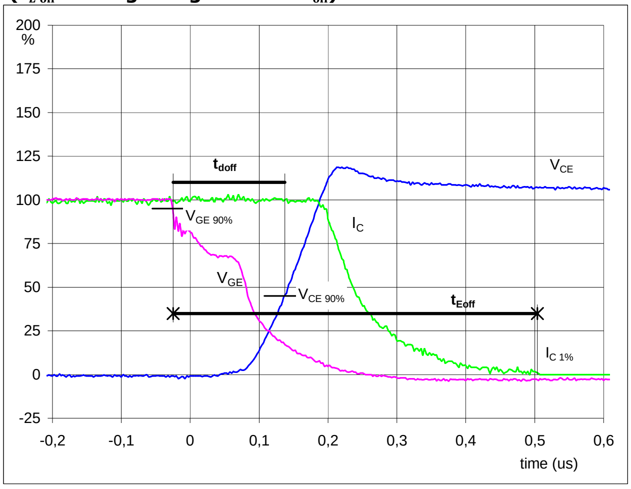
Switching Definitions BOOST IGBT

General conditions

Tj	=	124 °C
Rgon	=	4 Ω
Rgoff	=	4 Ω

Figure 1 BOOST IGBT

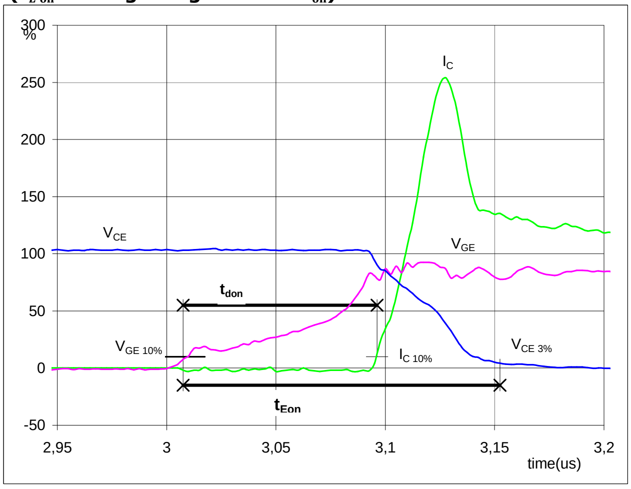
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



VGE (0%) =	-15	V
VGE (100%) =	15	V
VC (100%) =	350	V
IC (100%) =	50	A
tdoff =	0,20	μs
tE_{off} =	0,53	μs

Figure 2 BOOST IGBT

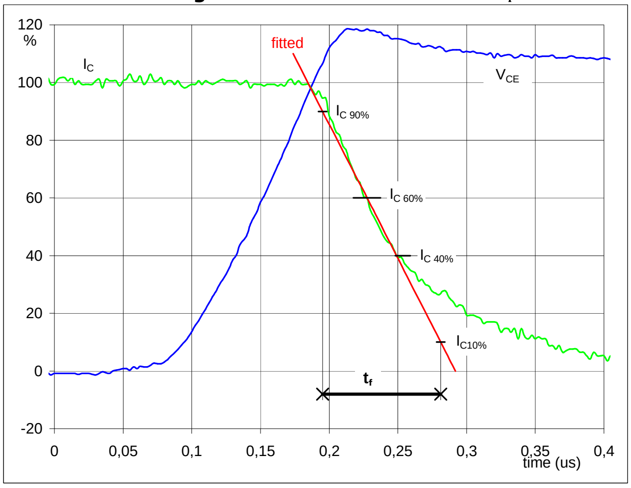
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



VGE (0%) =	-15	V
VGE (100%) =	15	V
VC (100%) =	350	V
IC (100%) =	50	A
tdon =	0,088	μs
tE_{on} =	0,14	μs

Figure 3 BOOST IGBT

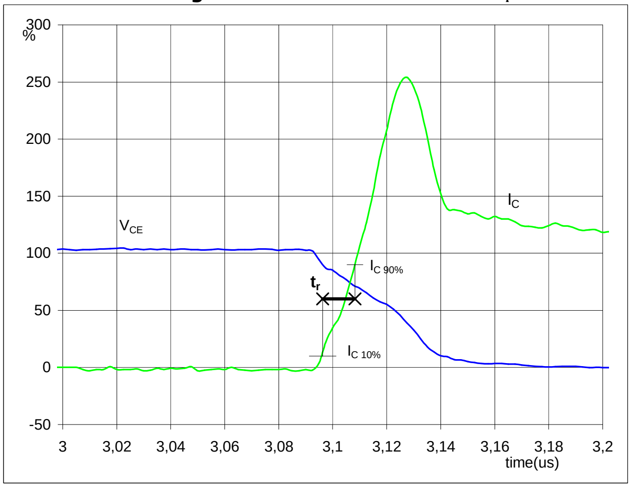
Turn-off Switching Waveforms & definition of t_f



VC (100%) =	350	V
IC (100%) =	50	A
tf =	0,093	μs

Figure 4 BOOST IGBT

Turn-on Switching Waveforms & definition of t_r

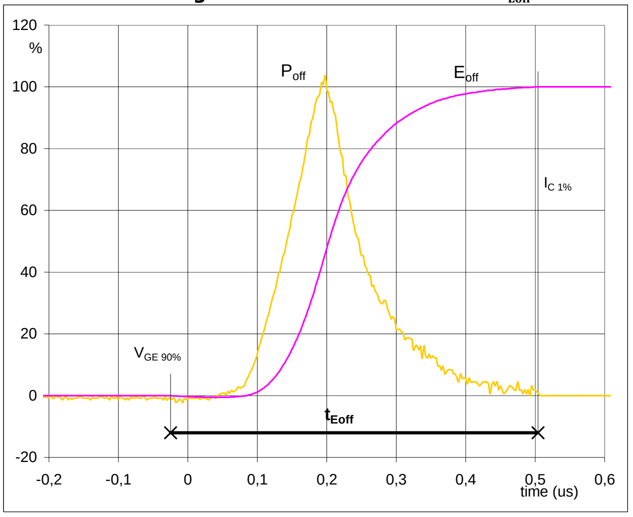


VC (100%) =	350	V
IC (100%) =	50	A
tr =	0,012	μs

Switching Definitions BOOST IGBT

Figure 5 BOOST IGBT

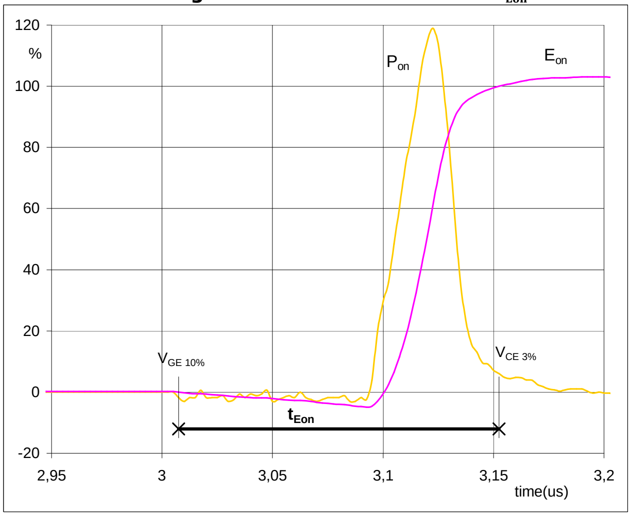
Turn-off Switching Waveforms & definition of t_{Eoff}



Poff (100%) =	17,48	kW
Eoff (100%) =	2,25	mJ
tE_{off} =	0,53	μs

Figure 6 BOOST IGBT

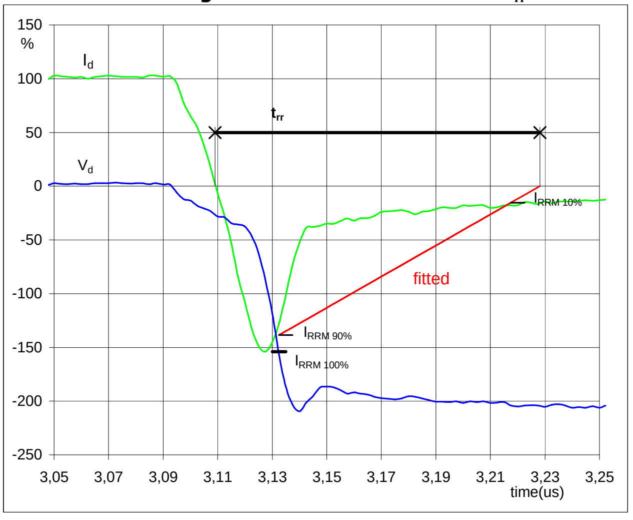
Turn-on Switching Waveforms & definition of t_{Eon}



Pon (100%) =	17,48	kW
Eon (100%) =	0,54	mJ
tE_{on} =	0,14	μs

Figure 7 BOOST FWD

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

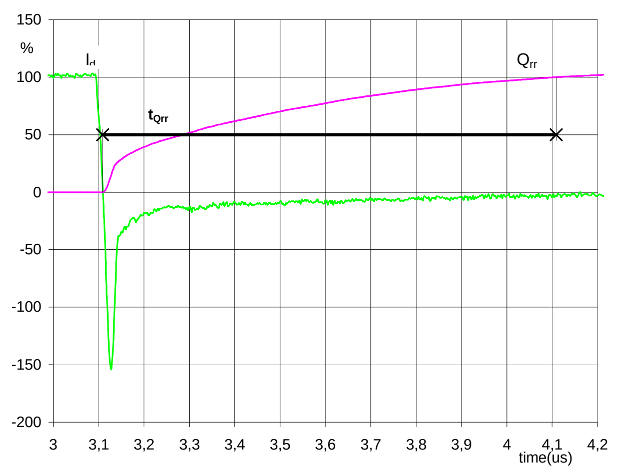


Vd (100%) =	350	V
Id (100%) =	50	A
IRRM (100%) =	10	A
trr =	0,123	μs

Switching Definitions BOOST IGBT

Figure 8 BOOST FWD

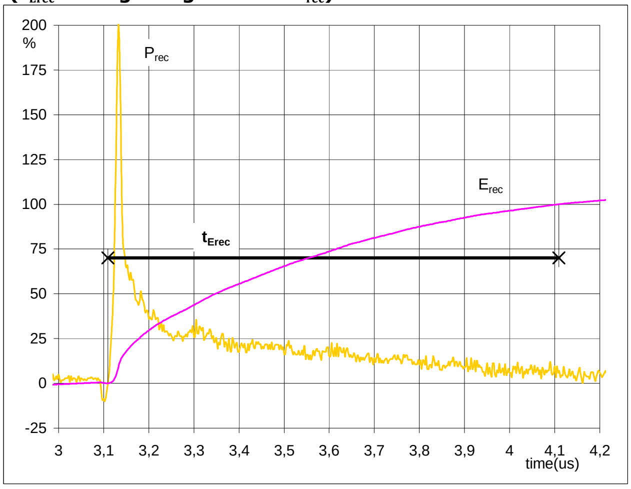
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



Id (100%) =	50	A
Qrr (100%) =	6,267	μC
tQrr =	1,00	μs

Figure 9 BOOST FWD

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



Prec (100%) =	17,48	kW
Erec (100%) =	1,966	mJ
tErec =	1,00	μs

Measurement circuits

Figure 10

BUCK stage switching measurement circuit

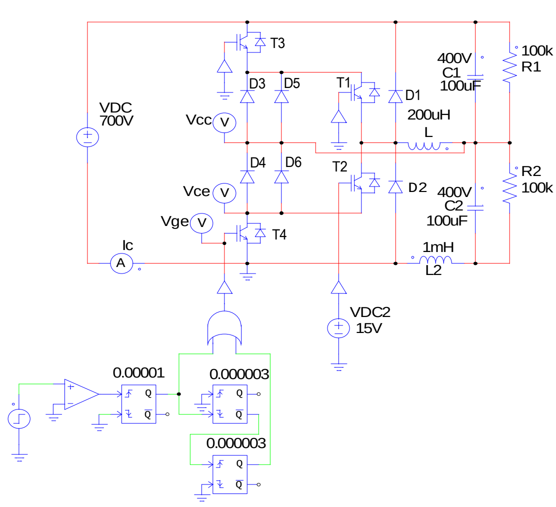
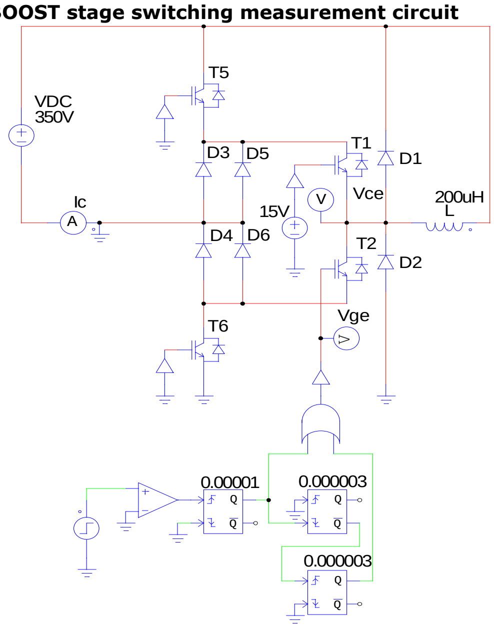


Figure 11

BOOST stage switching measurement circuit



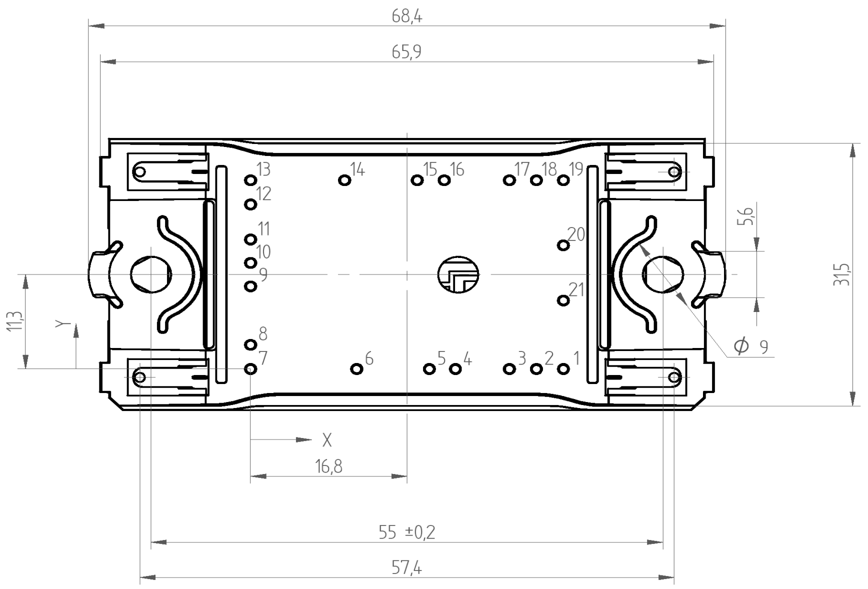
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
w/o thermal paste 12mm housing solder pin	10-FZ06NRA060FU-P967F08	P967F08	P967F08
w/o thermal paste 12mm housing Press-fit pin	10-PZ06NRA060FU-P967F08Y	P967F08Y	P967F08Y

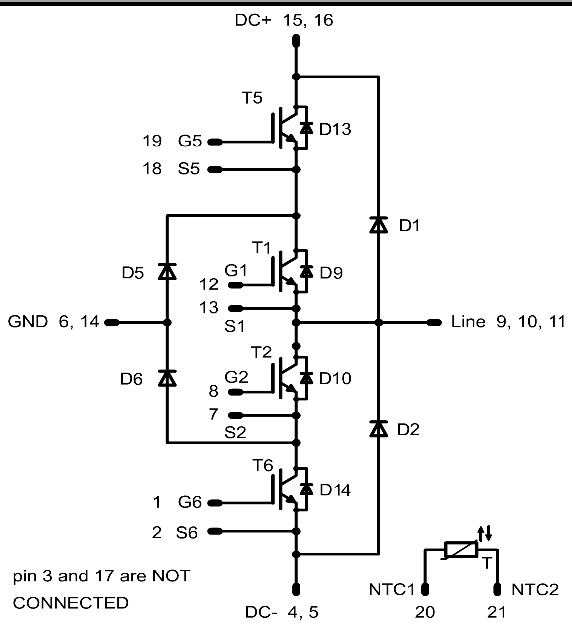
Outline

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



Identification

ID	Component	Voltage	Current	Function	Comment
T5,T6	IGBT	650V	30A	Buck switch	
D3,D4	FWD	600V	30A	Buck diode	
T1,T2	IGBT	600V	50A	Boost switch	
D1,D2	FWD	1200V	18A	Boost diode	
D13,D14	FWD	600V	10A	Buck inverse diode	
D9,D10	FWD	600V	10A	Boost inverse diode	
T	NTC				

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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.