VINcoNPC X12 | **1500 V / 1200 A**

Features

- 1500V NPC-topology
- Low inductive
- High power screw interface

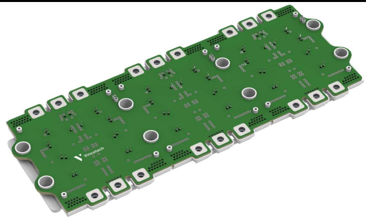
Target Applications

- Solar inverter
- Wind Power
- Motor Drive

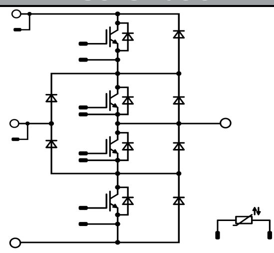
Types

- 70-W624N3A1K2SC-L400FP

VINco X12 housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck Switch					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	940	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		3600	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \leq T_{op}$ max		2400	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	2470	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	744	A
Repetitive peak forward current	I_{FRM}	t_p=10ms, sin 180°		2400	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	1490	W
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Switch					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	922	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		3600	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \leq T_{op}$ max		2400	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	2192	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	µs V
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	634	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		1800	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	1069	W
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	648	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		1800	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	1069	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Maximum allowed PCB temperature	T_{PCB}			125	°C
Insulation Properties					
Insulation voltage	V_{isol}	t = 2 s	DC Test Voltage*	4000	V
		t = 1 min	AC Voltage	2500	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Competative Tracking Index	CTI			>200	

* 100 % Tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Buck Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0408	25	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		1200	25 125	1,7	2,37 2,78	2,4	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,024	mA
Gate-emitter leakage current	I_{GES}		20	0		25			2880	nA
Integrated Gate resistor	R_{gint}							0,166667		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 0,42 Ω R_{gon} = 0,42 Ω	-10/+15	600	1200	25 125		113 115		ns
Rise time	t_r					25 125		43 45		
Turn-off delay time	$t_{d(off)}$					25 125		183 229		
Fall time	t_f					25 125		38 68		
Turn-on energy loss per pulse	E_{on}					25 125		44,08 48,91		mWs
Turn-off energy loss per pulse	E_{off}					25 125		49,18 86,78		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		66480		pF
Output capacitance	C_{oss}							4560		
Reverse transfer capacitance	C_{rss}							3840		
Gate charge	Q_G		±15	960	960	25		9120		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,038		K/W
Buck Diode										
Diode forward voltage	V_F				1200	25 125		2,34 2,38	2,52	V
Reverse leakage current	I_R			1200		25			1440	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 0,42 Ω	-10/+15	600	1200	25 125		1075 1355		A
Reverse recovery time	t_{rr}					25 125		169 214		ns
Reverse recovered charge	Q_{rr}					25 125		73,24 136,71		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		26252 24254		A/µs
Reverse recovered energy	E_{rec}					25 125		28,02 61,41		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,06		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Boost Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0456	25	5	5,80	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		1200	25 125		1,91 2,14	2,05	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		25			0,0156	mA
Gate-emitter leakage current	I_{GES}		20	0		25			1440	nA
Integrated Gate resistor	R_{gint}					25		0,625		Ω
Turn-on delay time	$t_{d(on)}$							158 174		ns
Rise time	t_r					25 125		64 66		
Turn-off delay time	$t_{d(off)}$	R_{goff} = 0,42 Ω R_{gon} = 0,42 Ω	-10/+15	600	1200	25 125		273 342		
Fall time	t_f					25 125		57 92		
Turn-on energy loss per pulse	E_{on}					25 125		84,6 104,7		mWs
Turn-off energy loss per pulse	E_{off}					25 125		68,3 120,0		
Input capacitance	C_{ies}							73800		pF
Output capacitance	C_{oss}	f = 1 MHz	0	25	1200	25		4860		
Reverse transfer capacitance	C_{rss}							4140		
Gate charge	Q_G		15	960	1200	25		9600		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,04		K/W
Boost Inverse Diode										
Diode forward voltage	V_F				900	25 125	1,35	1,90 1,84	2,05	V
Reverse leakage current	I_R					25			168	µA
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,09		K/W
Boost Diode										
Diode forward voltage	V_F				900	25 125	1,35	1,90 1,84	2,05	V
Reverse leakage current	I_r			1200		25			168	µA
Peak reverse recovery current	I_{RRM}					25 125		696 903		A
Reverse recovery time	t_{rr}					25 125		296 451		ns
Reverse recovered charge	Q_{rr}	R_{gon} = 0,42 Ω	-10/+15	600	1200	25 125		89 173		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		5538 4822		A/µs
Reverse recovery energy	E_{rec}					125 125		31,66 69,81		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,09		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		+5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1%				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1%				25		4000		K
Vincotech NTC Reference									I	
Module Properties										
Module inductance (from chips to PCB)	$L_{sCE\ C\text{-}PCB}$	Buck Boost						5 9		nH
Weight	m								1930	g

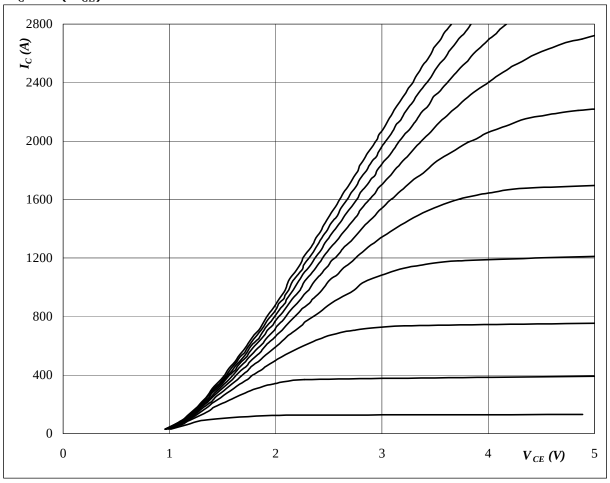
Buck

Buck IGBT and Buck FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

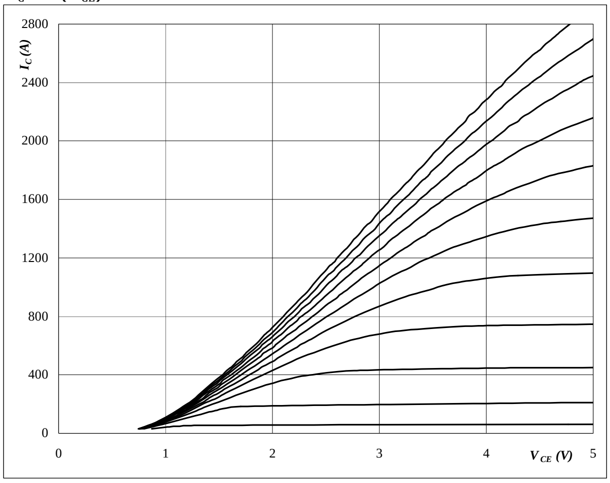
T_j = 25 °C

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 = 350 µs

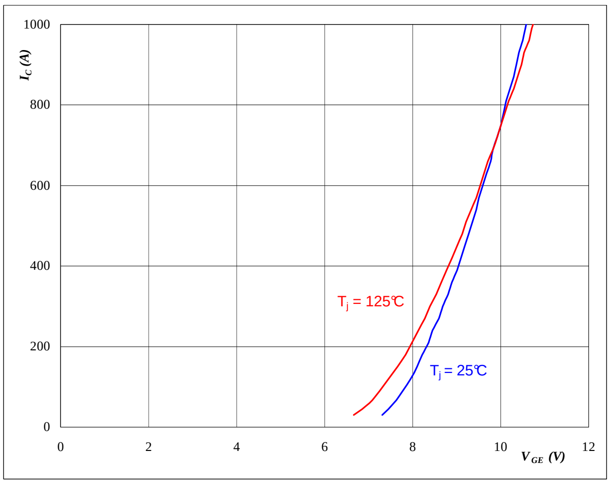
T_j = 125 °C

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

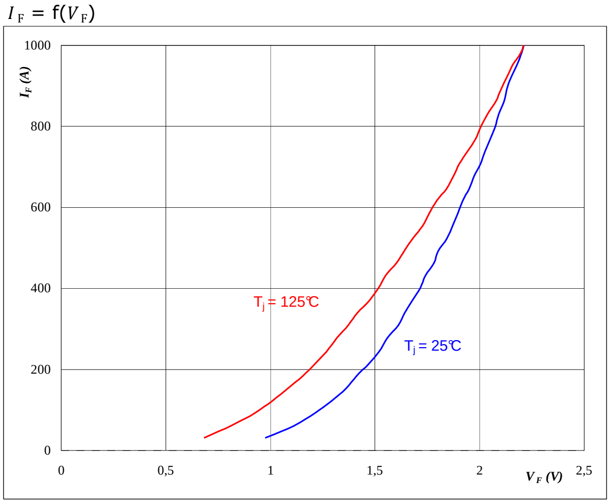
t_p = 350 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

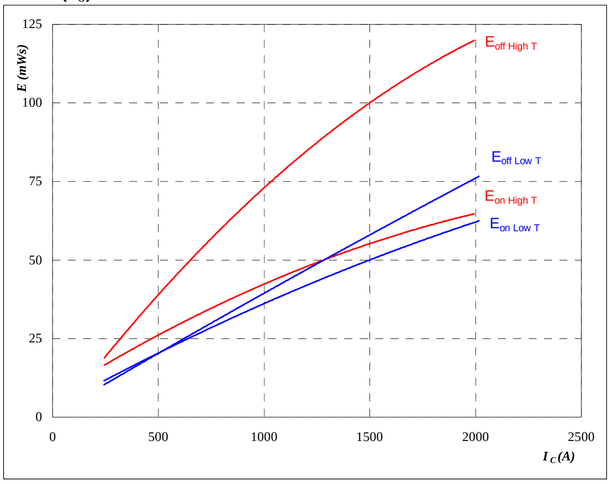
Buck

Buck IGBT and Buck FWD

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



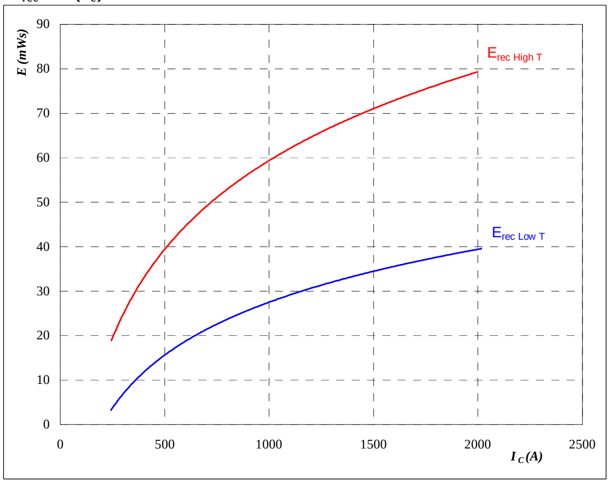
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω
R_{goff} =	0,42	Ω

figure 6. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



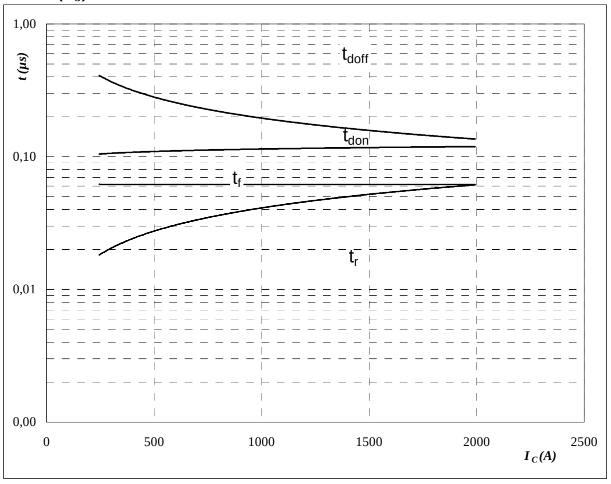
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω

figure 7. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



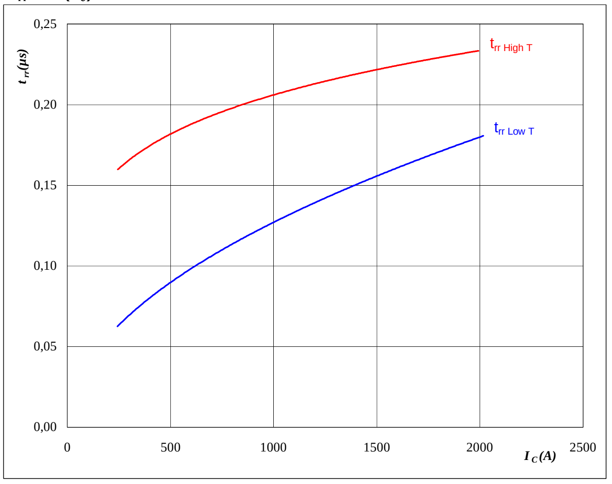
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω
R_{goff} =	0,42	Ω

figure 8. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω

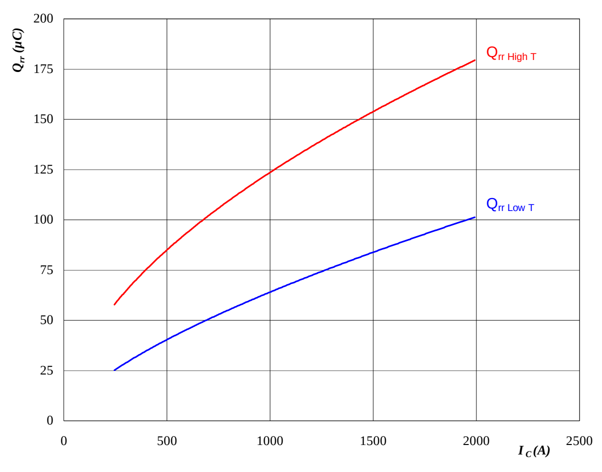
Buck

Buck IGBT and Buck FWD

figure 9. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



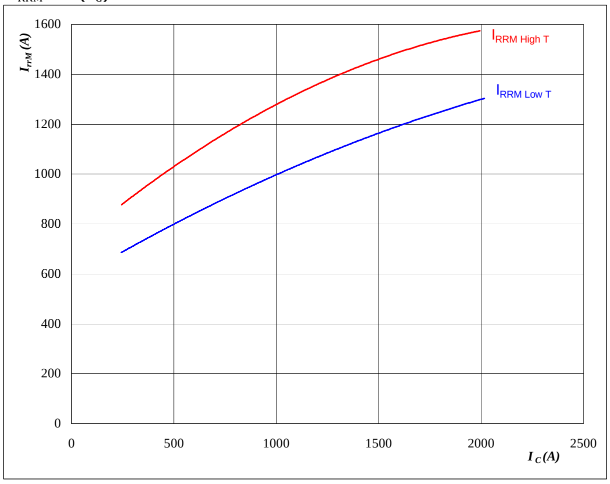
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω

figure 10. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



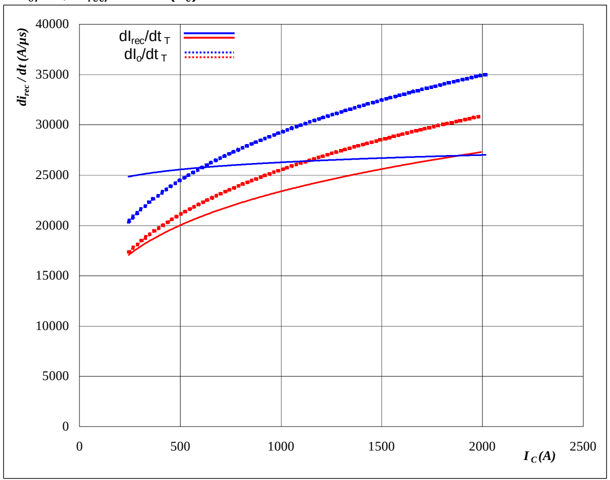
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω

figure 11. **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} =	600	V
V_{GE} =	-10/+15	V
R_{gon} =	0,42	Ω

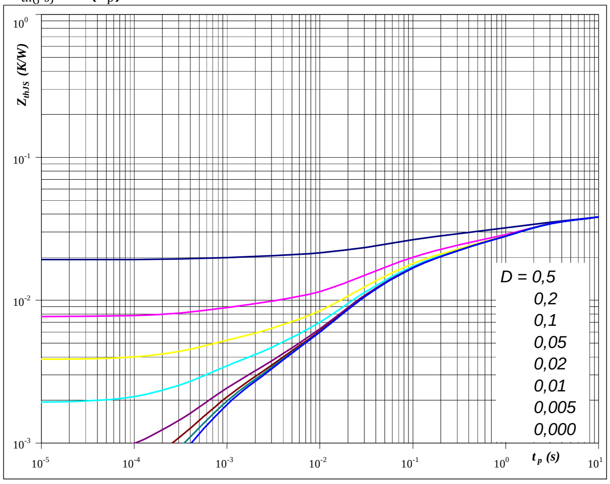
Buck

Buck IGBT and Buck FWD

figure 12.	IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



At

D = t_p / T

IGBT thermal model values with phase-change material

$R_{th(j\text{-}s)}$ = 0,038 K/W

IGBT thermal model values

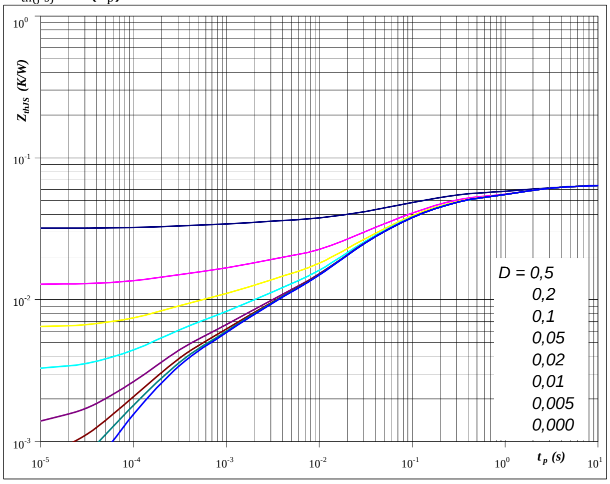
With phase change material

R (K/W)	Tau (s)
1,56E-02	2,31E+00
6,86E-03	3,15E-01
8,33E-03	6,36E-02
5,40E-03	1,92E-02
1,08E-03	2,08E-03
1,24E-03	5,82E-04

figure 13.	FWD

FWD transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



At

D = t_p / T

FWD thermal model values with phase-change material

$R_{th(j\text{-}s)}$ = 0,064 K/W

FWD thermal model values

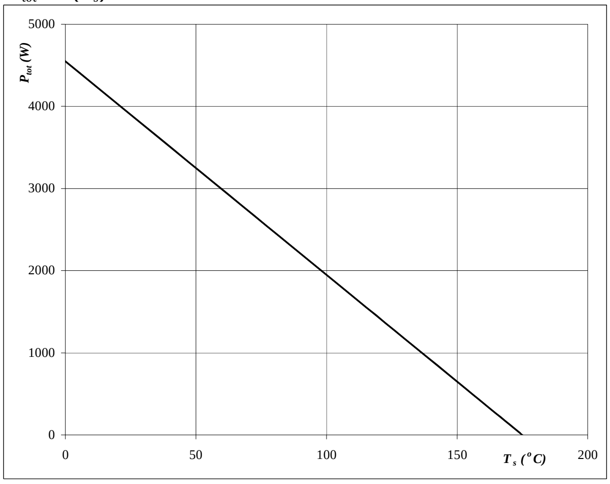
With phase change material

R (K/W)	Tau (s)
1,54E-02	1,70E+00
2,39E-02	1,27E-01
1,70E-02	2,50E-02
4,58E-03	1,61E-03
2,91E-03	1,90E-04

figure 14.	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



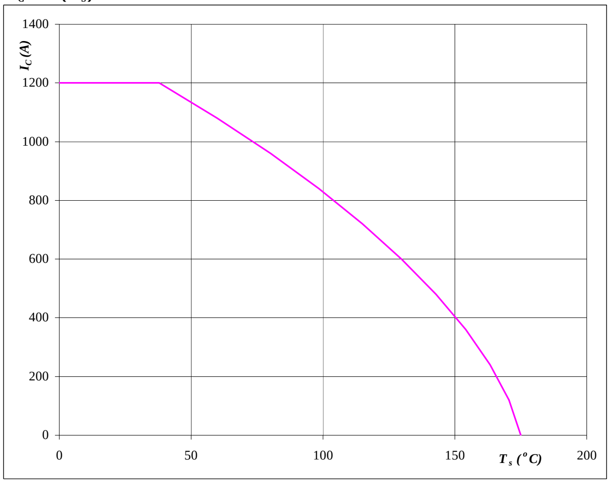
At

T_j = 175 °C

figure 15.	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

T_j = 175 °C

V_{GE} = 15 V

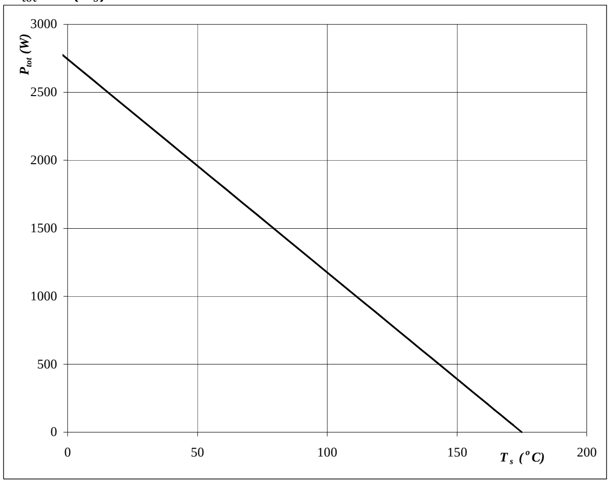
Buck

Buck IGBT and Buck FWD

figure 16. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



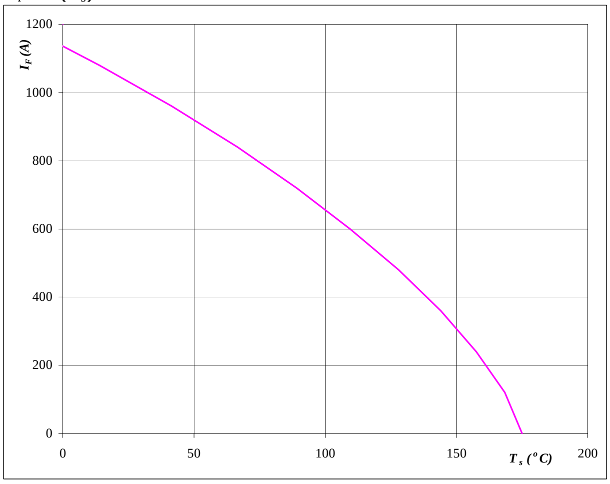
At

T_j = 175 °C

figure 17. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



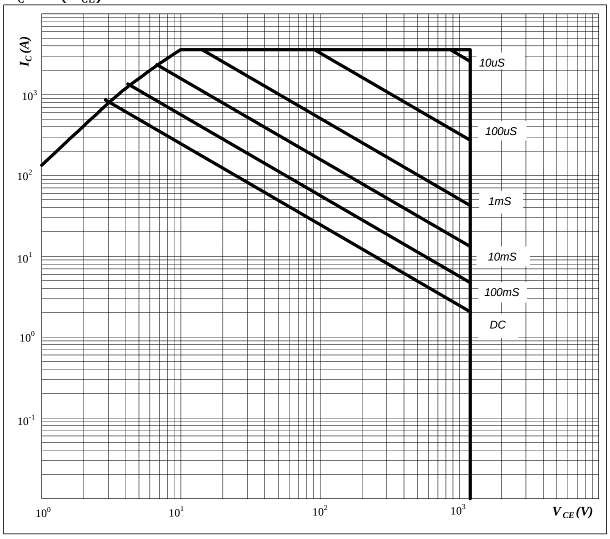
At

T_j = 175 °C

figure 18. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



At

D =	single pulse	V_{GE} =	15	V
T_s =	80 °C	T_j =	T_{jmax}	

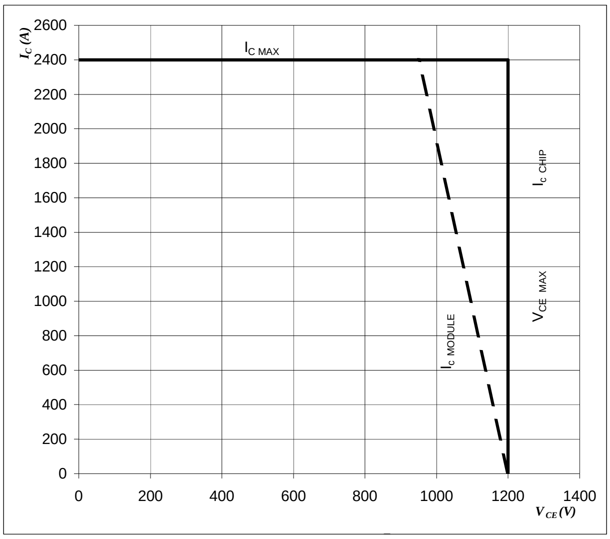
Buck

Buck IGBT and Buck FWD

figure 20.	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

$U_{ccminus}=U_{ccplus}$

Switching mode : 3 level switching

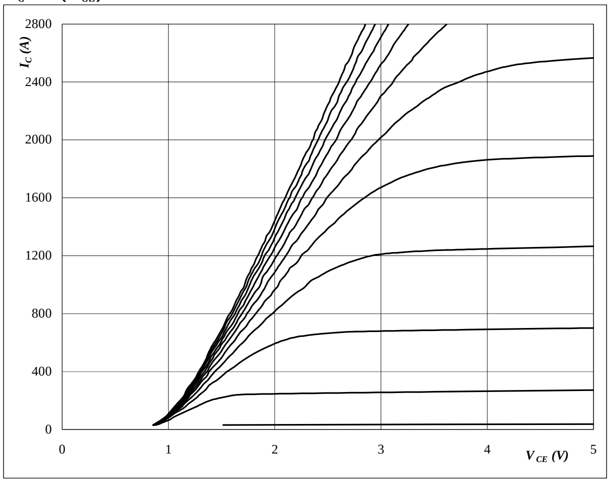
Boost

Boost IGBT and Boost FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

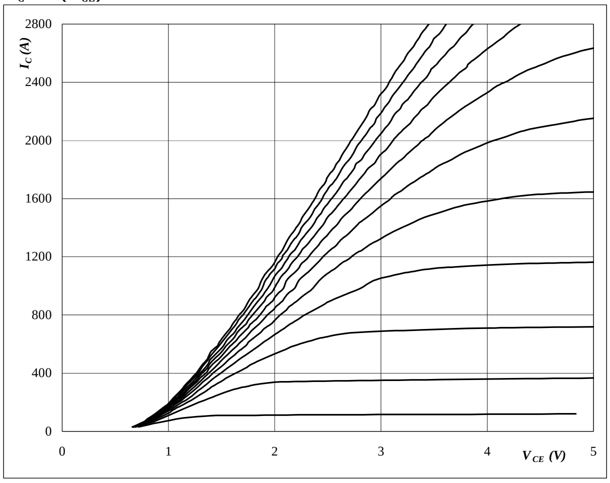
T_j = 25 °C

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 = 350 µs

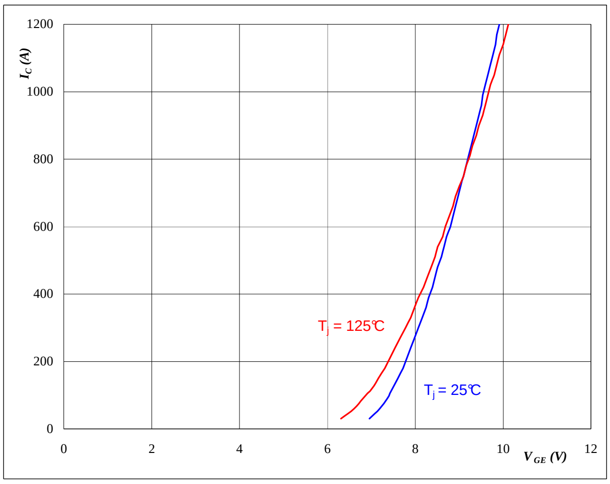
T_j = 125 °C

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

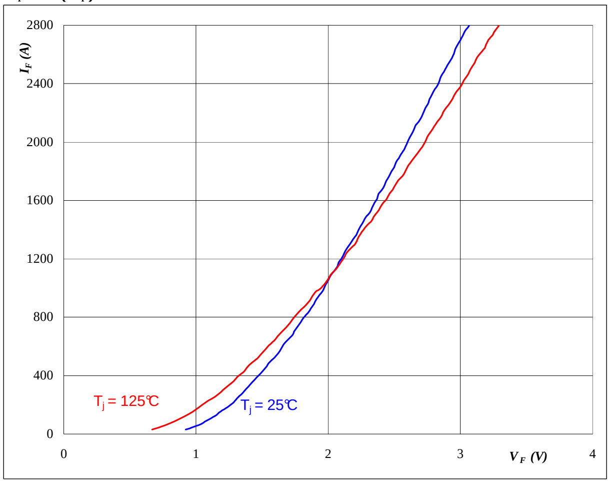
t_p = 350 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

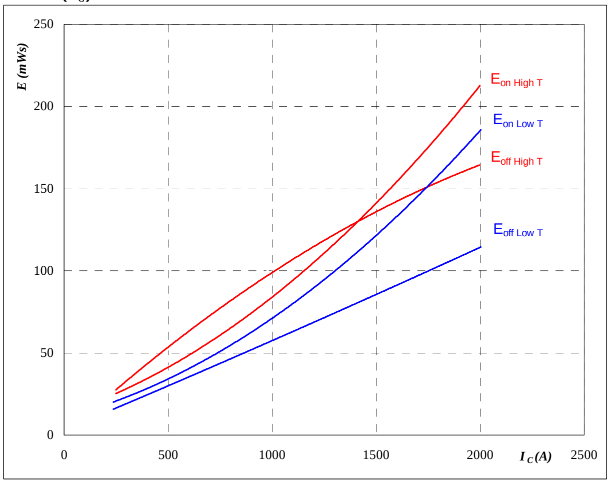
Boost

Boost IGBT and Boost FWD

figure 5.	**IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



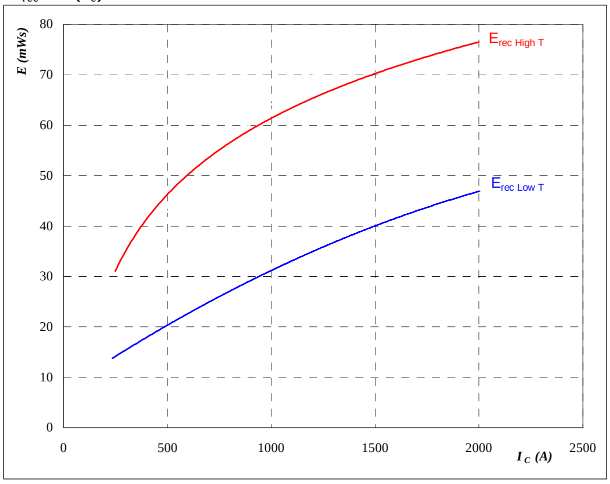
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,42	Ω
R_{goff} =	0,42	Ω

figure 6.	**FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



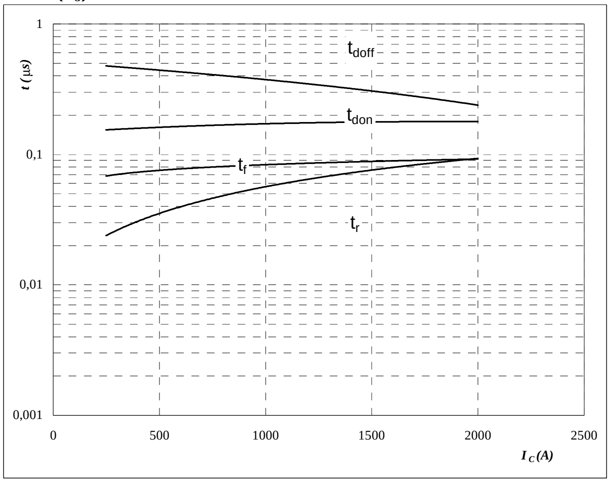
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,42	Ω

figure 7.	**IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



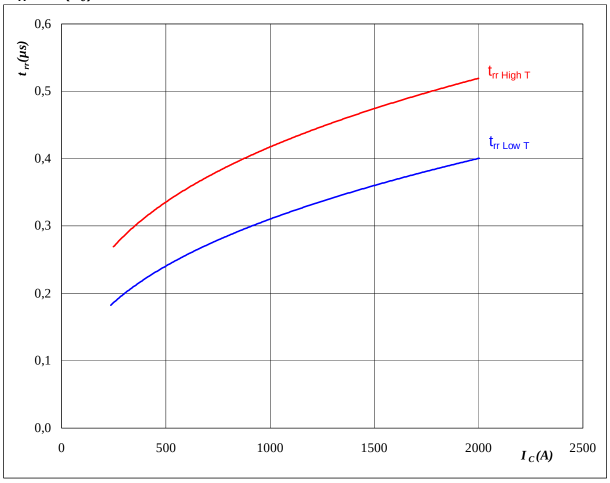
With an inductive load at

T_j =	125	°C	R_{gon} =	0,42	Ω
V_{CE} =	600	V	R_{goff} =	0,42	Ω
V_{GE} =	-10/ +15	V			

figure 8.	**FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,42	Ω

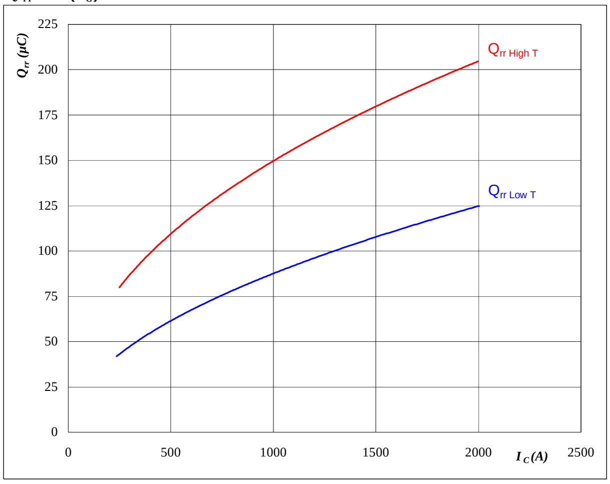
Boost

Boost IGBT and Boost FWD

figure 9. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



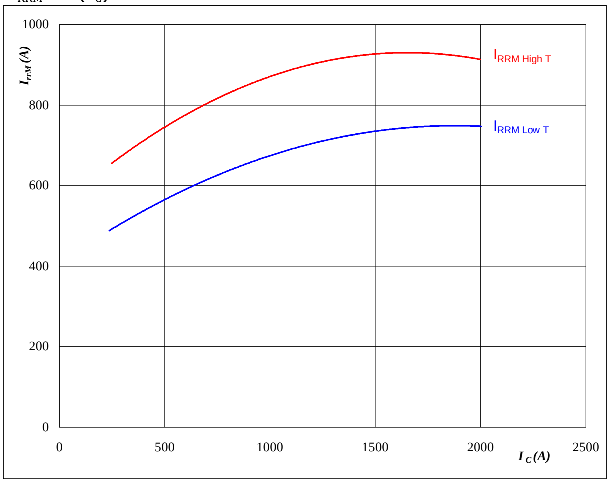
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,42	Ω

figure 10. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



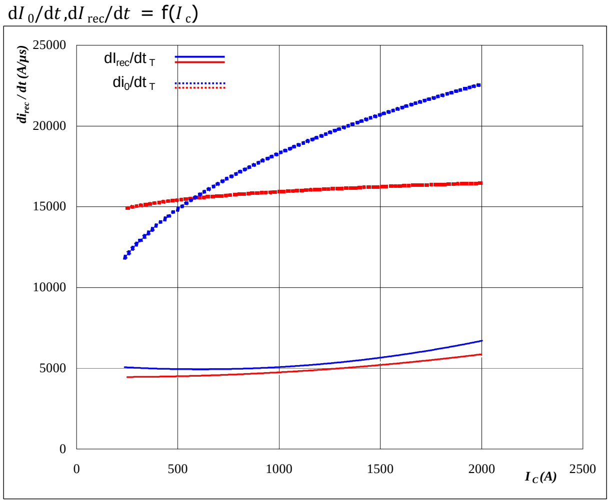
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,42	Ω

figure 11. **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} =	600	V
V_{GE} =	-10/ +15	V
R_{gon} =	0,4	Ω

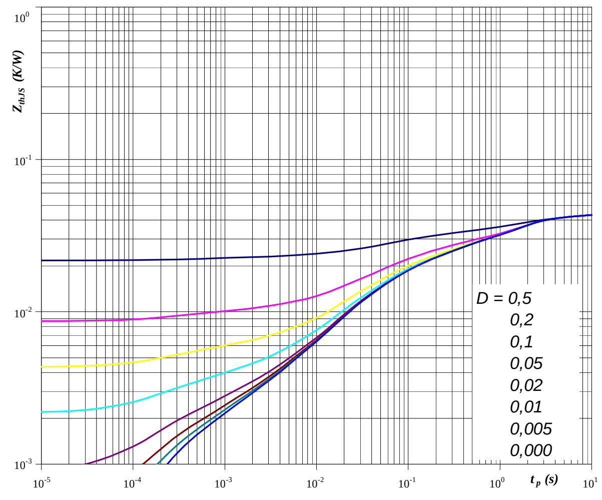
Boost

Boost IGBT and Boost FWD

figure 12.	**IGBT**

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

$D = t_p / T$

IGBT thermal model values with phase-change material

$R_{th(j-s)} =$ 0,043 K/W

IGBT thermal model values

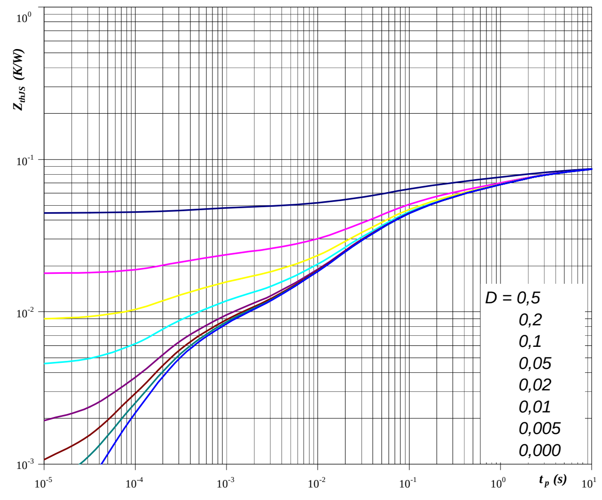
With phase-change material

R (K/W)	Tau (s)
1,98E-02	1,78E+00
1,01E-02	1,66E-01
1,07E-02	3,06E-02
1,43E-03	2,59E-03
1,32E-03	2,69E-04

figure 13.	**FWD**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

$D = t_p / T$

FWD thermal model values with phase-change material

$R_{th(j-s)} =$ 0,089 K/W

FWD thermal model values

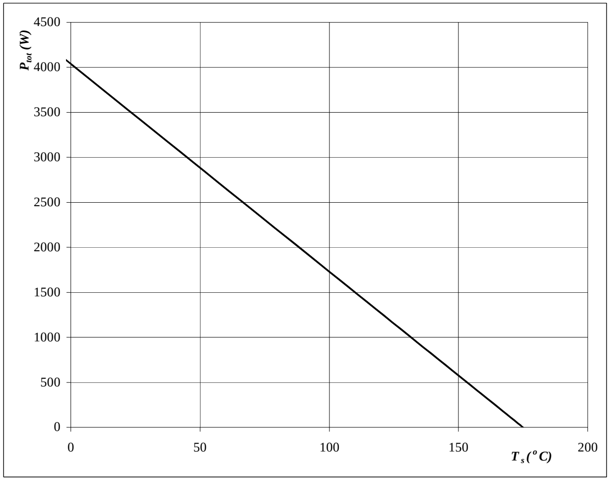
With phase-change material

R (K/W)	Tau (s)
1,39E-02	5,78E+00
1,77E-02	1,38E+00
1,62E-02	2,57E-01
2,22E-02	5,31E-02
9,23E-03	1,60E-02
3,35E-03	2,27E-03
6,26E-03	2,74E-04

figure 14.	**IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



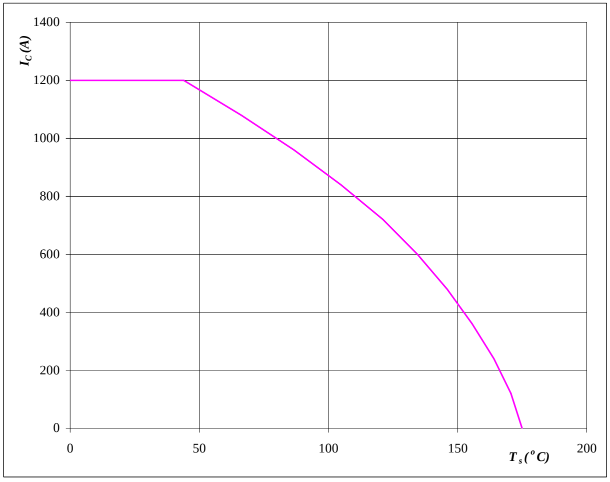
At

$T_j =$ 175 ºC

figure 15.	**IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

$T_j =$ 175 ºC

$V_{GE} =$ 15 V

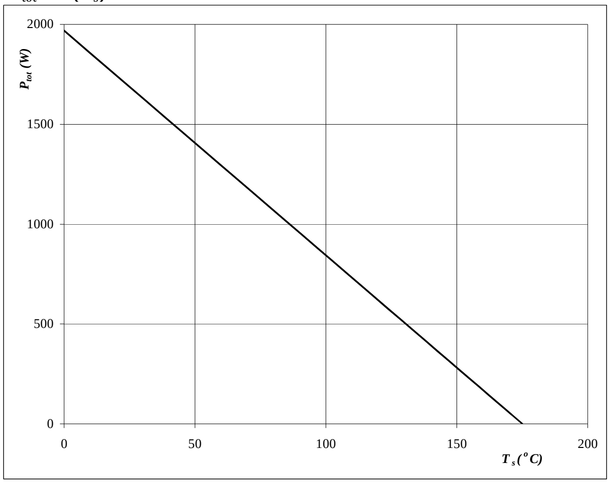
Boost

Boost IGBT and Boost FWD

figure 16.	**FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



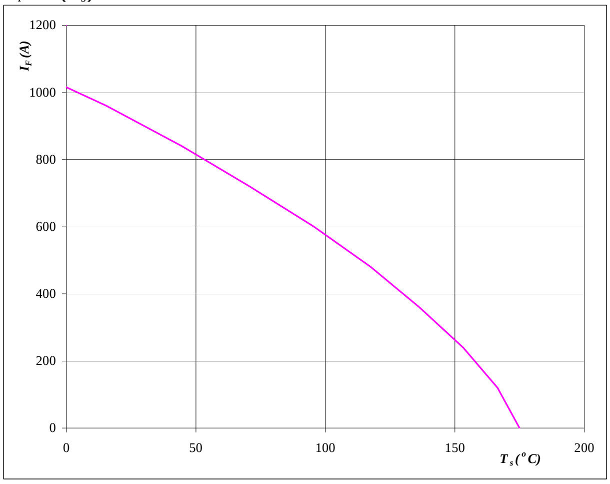
At

T_j = 175 ºC

figure 17.	**FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



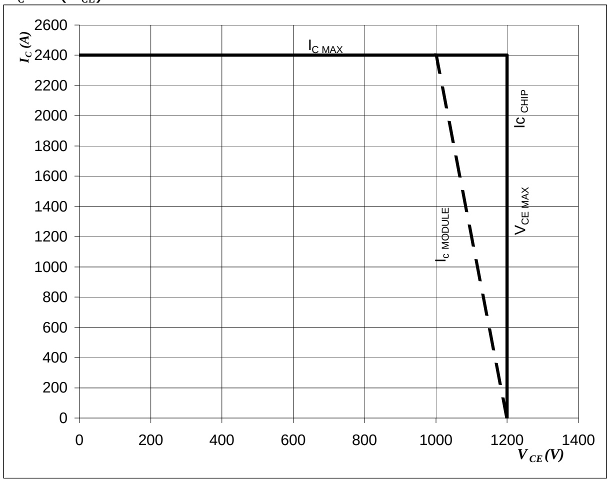
At

T_j = 175 ºC

figure 18.	**IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

$U_{ccminus}$=U_{ccplus}

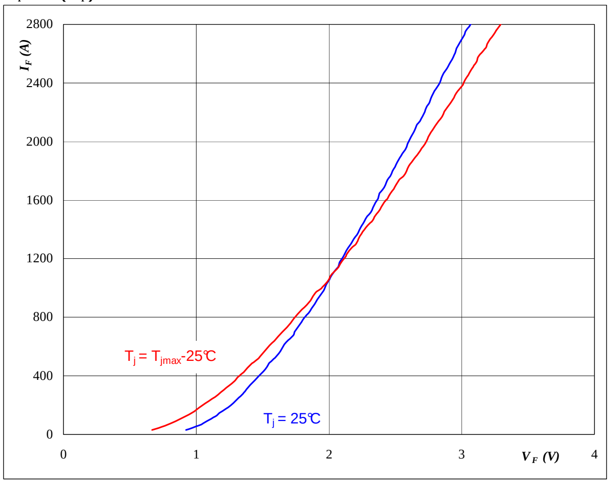
Switching mode : 3 level switching

Boost Inverse Diode

figure 19. **Boost Inverse Diode**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



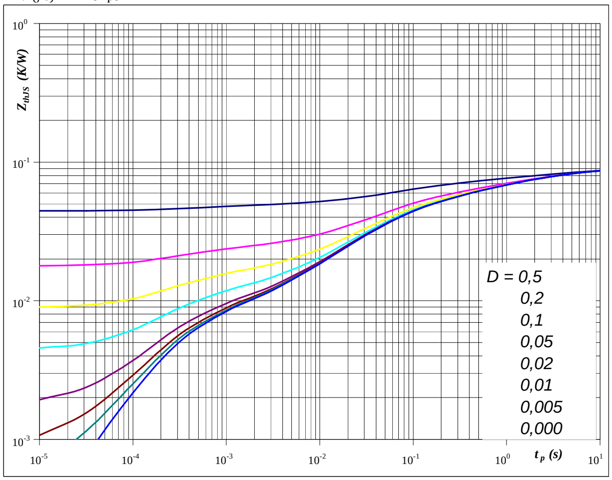
At

t_p = 250 µs

figure 20. **Boost Inverse Diode**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

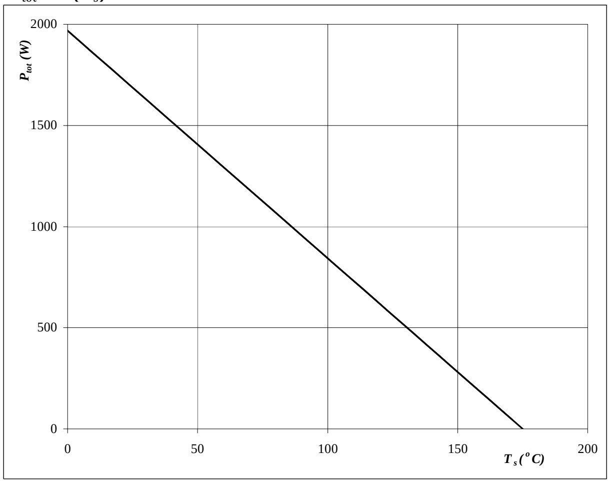
$D = t_p / T$

$R_{th(j-s)}$ = 0,09 K/W

figure 21. **Boost Inverse Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



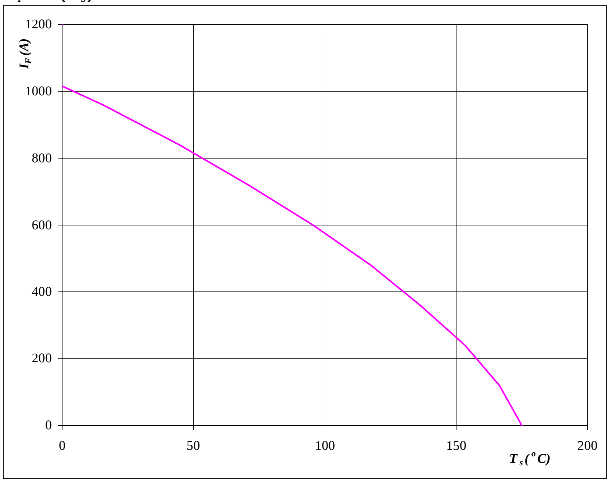
At

T_j = 175 ºC

figure 22. **Boost Inverse Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



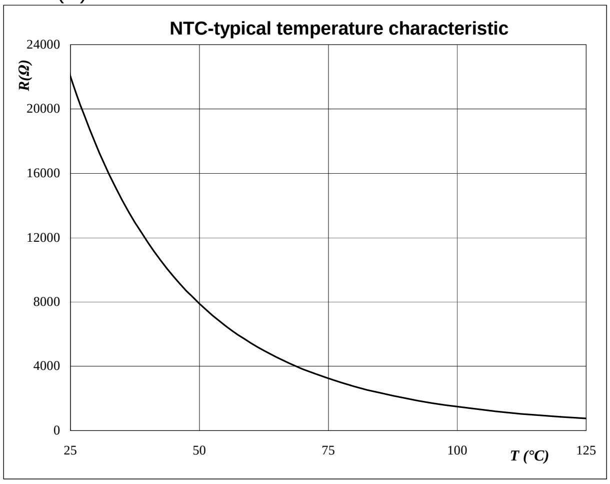
At

T_j = 175 ºC

Thermistor

figure 1.	Thermistor

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



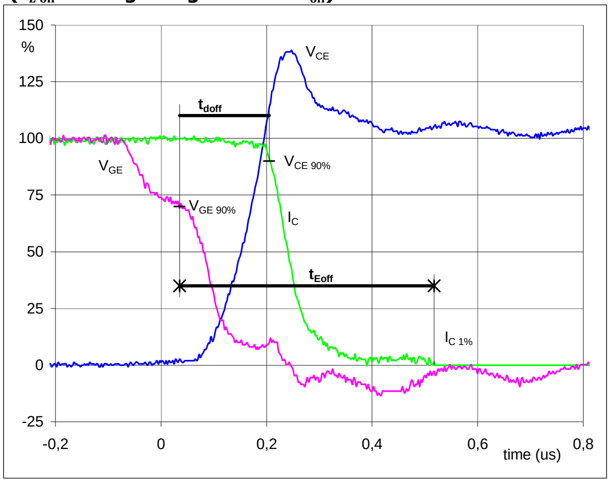
Switching Definitions Buck

General conditions

T_j	=	125 °C
R_{gon}	=	0,42 Ω
R_{goff}	=	0,42 Ω

figure 1. **IGBT**

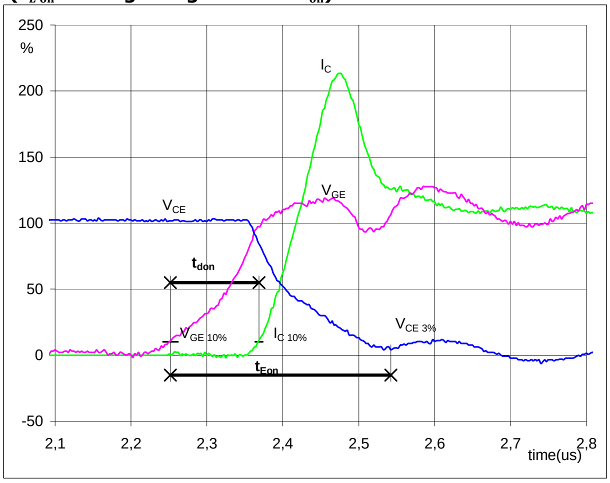
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-10	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	1201	A
t_{doff} =	0,23	μs
$t_{E\,off}$ =	0,48	μs

figure 2. **IGBT**

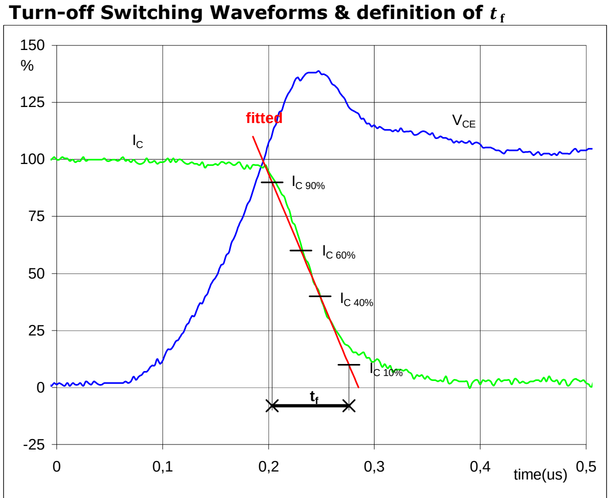
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-10	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	1201	A
t_{don} =	0,11	μs
$t_{E\,on}$ =	0,29	μs

figure 3. **IGBT**

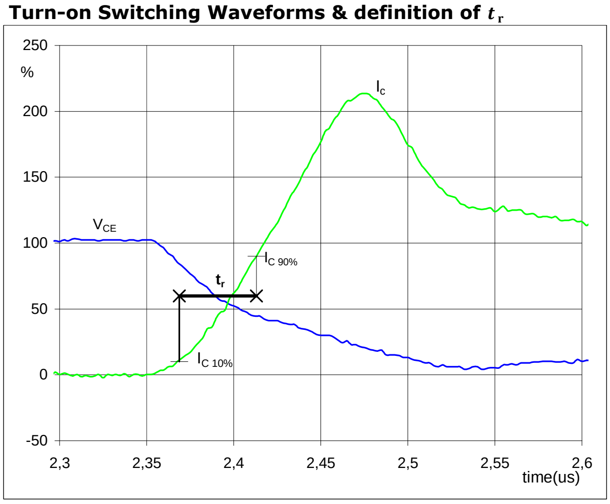
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	1201	A
t_f =	0,07	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

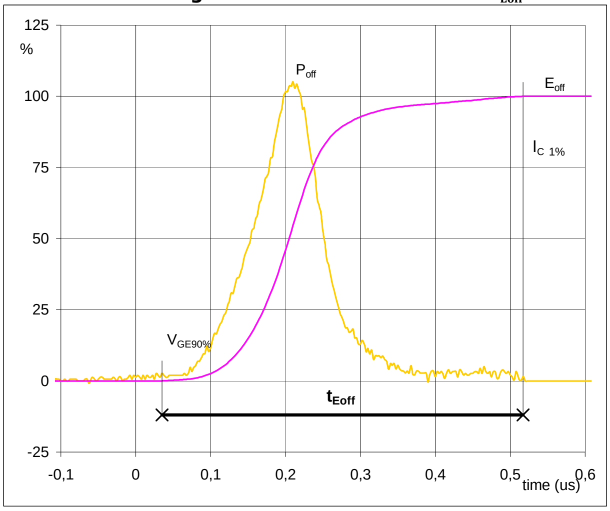


V_C (100%) =	600	V
I_C (100%) =	1201	A
t_r =	0,04	μs

Switching Definitions Buck

figure 5. **IGBT**

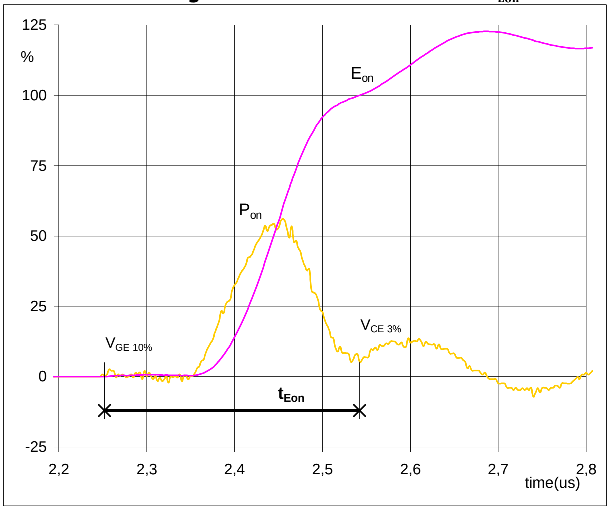
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 720,80 kW
E_{off} (100%) = 86,78 mJ
$t_{E off}$ = 0,48 μs

figure 6. **IGBT**

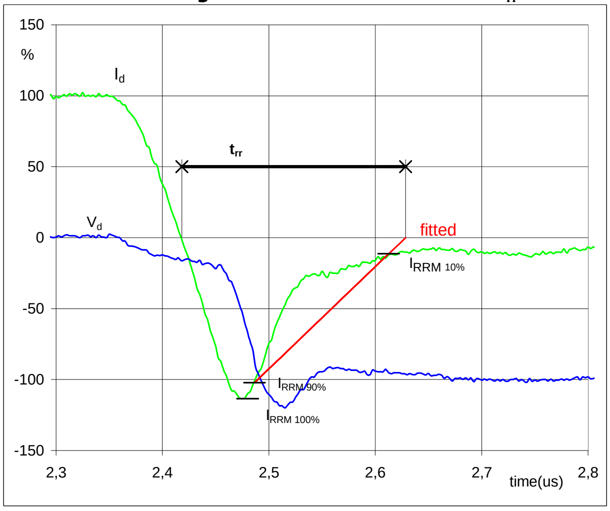
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 720,80 kW
E_{on} (100%) = 48,91 mJ
$t_{E on}$ = 0,29 μs

figure 7. **FWD**

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

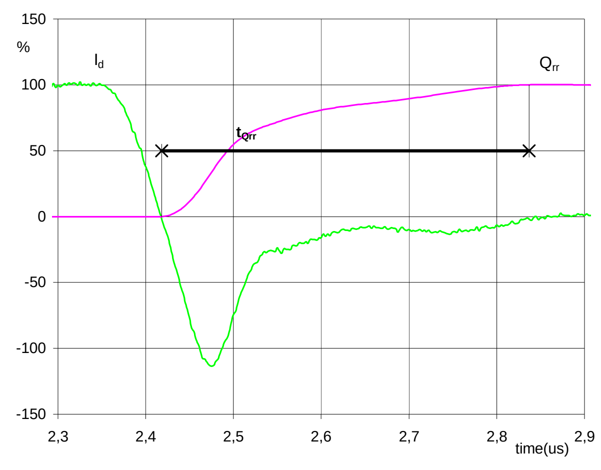


V_d (100%) = 600 V
I_d (100%) = 1201 A
I_{RRM} (100%) = -1355 A
t_{rr} = 0,21 μs

Switching Definitions Buck

figure 8. **FWD**

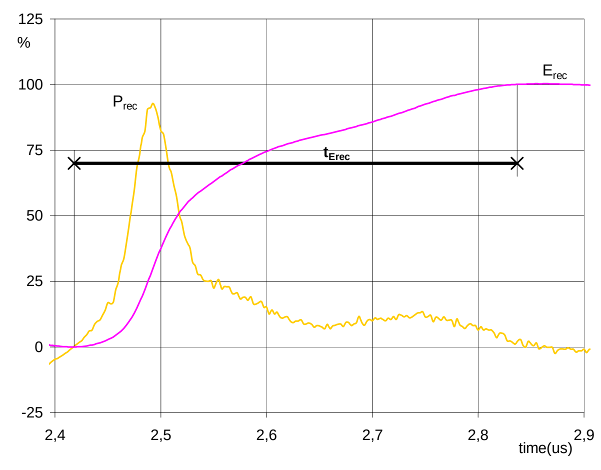
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	1201	A
Q_{rr} (100%) =	136,71	µC
$t_{Q\,rr}$ =	0,42	µs

figure 9. **FWD**

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



P_{rec} (100%) =	720,80	kW
E_{rec} (100%) =	61,41	mJ
$t_{E\,rec}$ =	0,42	µs

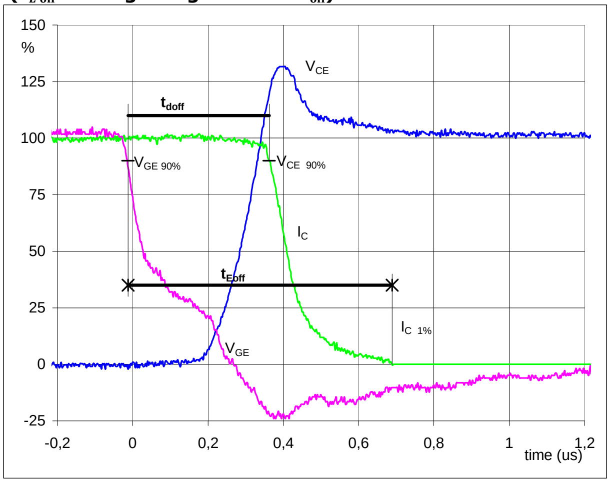
Switching Definitions Boost

General conditions

T_j	=	125 °C
R_{gon}	=	0,42 Ω
R_{goff}	=	0,42 Ω

figure 1. **IGBT**

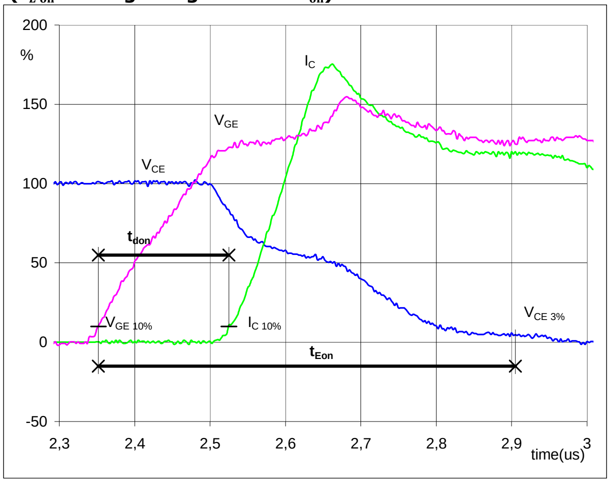
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-10	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	1200	A
t_{doff} =	0,34	μs
$t_{E\,off}$ =	0,70	μs

figure 2. **IGBT**

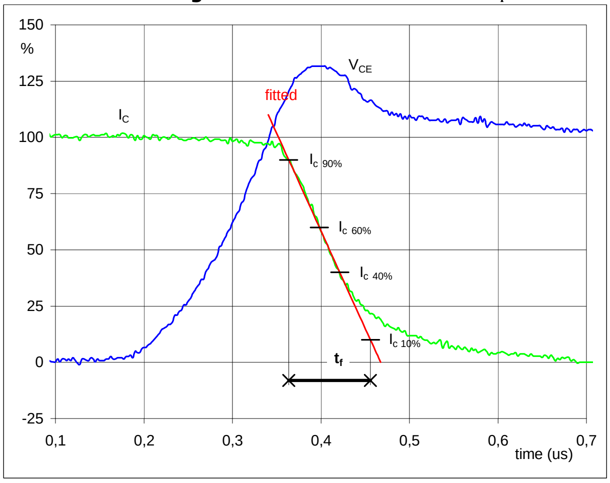
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-10	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	1200	A
t_{don} =	0,17	μs
$t_{E\,on}$ =	0,55	μs

figure 3. **IGBT**

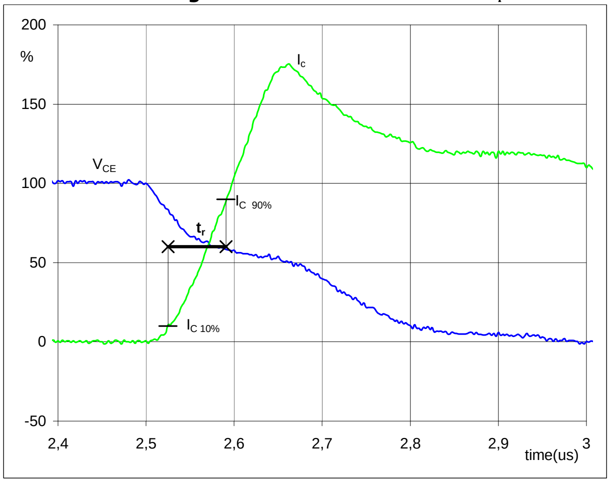
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	1200	A
t_f =	0,092	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

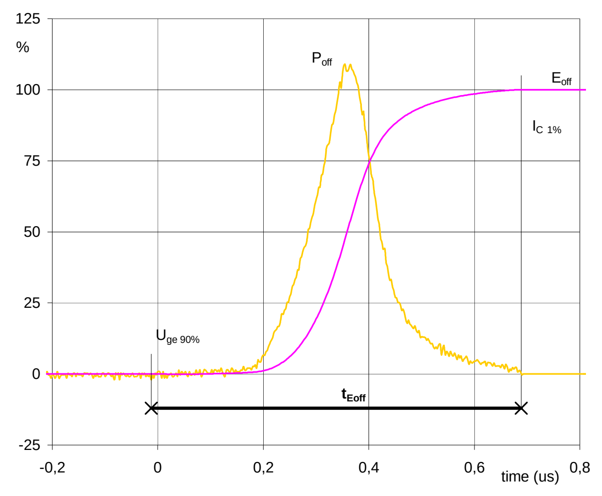


V_C (100%) =	600	V
I_C (100%) =	1200	A
t_r =	0,065	μs

Switching Definitions Boost

figure 5. **IGBT**

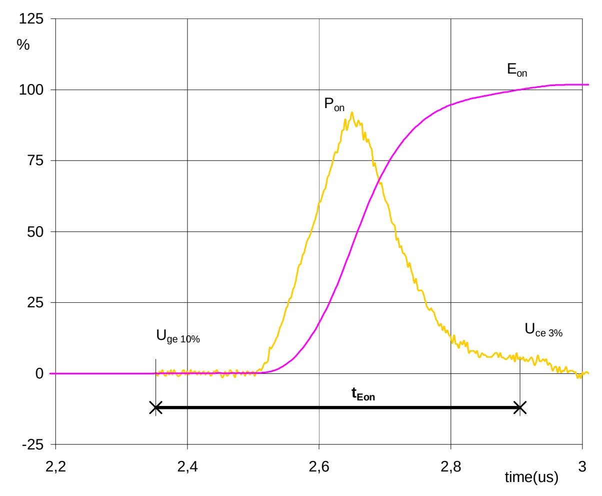
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	719,72	kW
E_{off} (100%) =	119,96	mJ
$t_{E\,off}$ =	0,70	µs

figure 6. **IGBT**

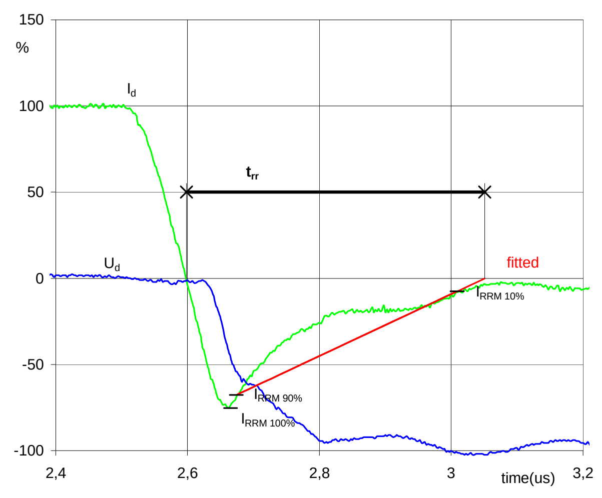
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	719,724	kW
E_{on} (100%) =	104,74	mJ
$t_{E\,on}$ =	0,55	µs

figure 7. **FWD**

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

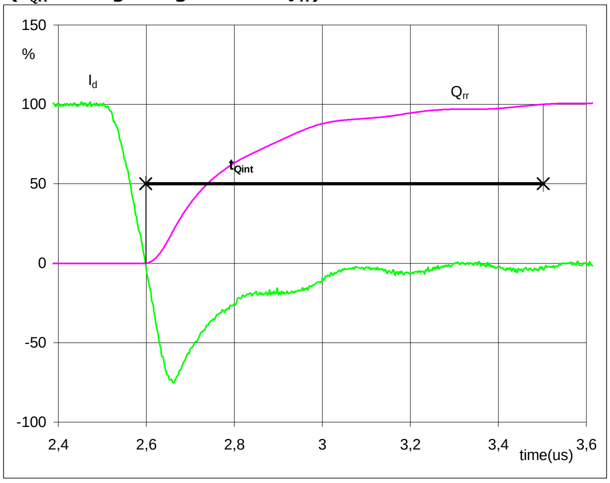


V_d (100%) =	600	V
I_d (100%) =	1200	A
I_{RRM} (100%) =	-903	A
t_{rr} =	0,45	µs

Switching Definitions Boost

figure 8. **FWD**

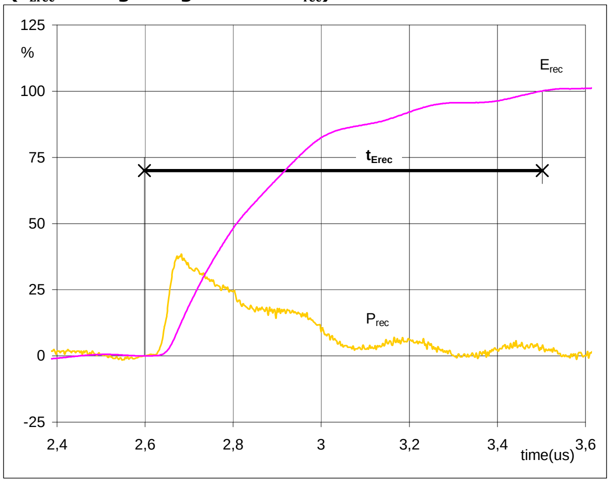
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	1200	A
Q_{rr} (100%) =	172,55	µC
t_{Qint} =	0,90	µs

figure 9. **FWD**

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

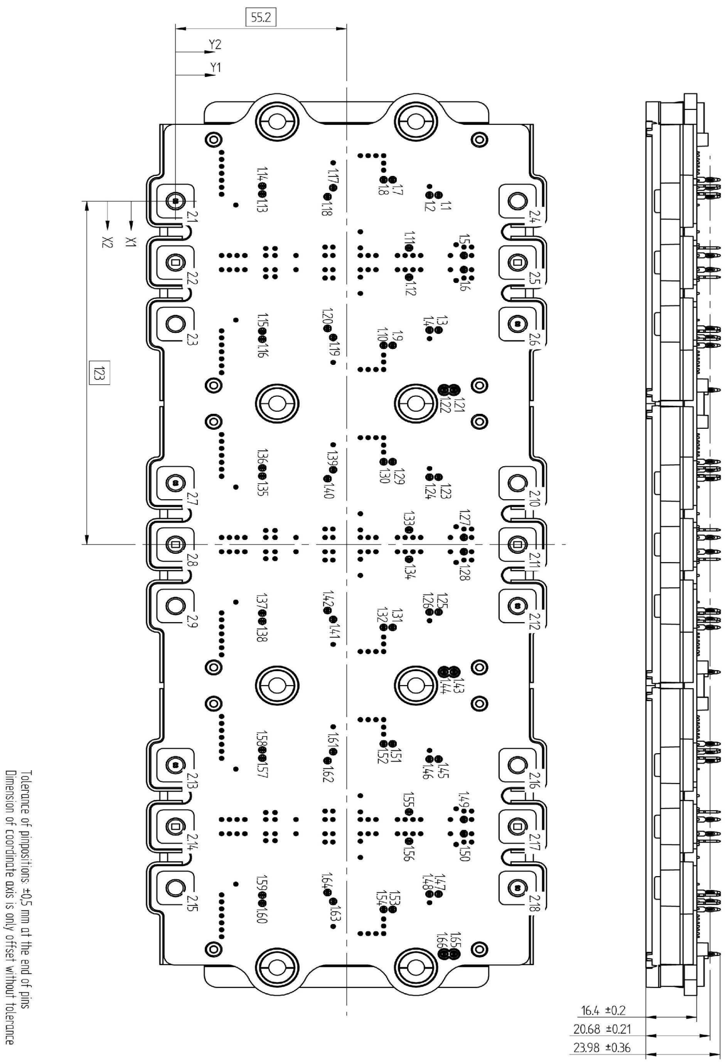


P_{rec} (100%) =	719,72	kW
E_{rec} (100%) =	69,81	mJ
$t_{E\,rec}$ =	0,90	µs

Outline

Driver pins			
Pin	X1	Y1	Function
1.1	-2,15	84,85	G11-1
1.2	-2,15	81,95	E11-1
1.3	46,15	84,85	G13-2
1.4	46,15	81,95	E13-2
1.5	19,45	93,05	DC+desat
1.6	24,55	93,05	DC+desat
1.7	-7,65	70,05	G13-1
1.8	-7,65	67,15	E13-1
1.9	51,65	70,05	G13-2
1.10	51,65	67,15	E13-2
1.11	16,75	75,35	GND_desat
1.12	27,25	75,35	GND_desat
1.13	-2,55	28	G14-1
1.14	-5,45	28	E14-1
1.15	46,55	28	G14-2
1.16	49,45	28	E14-2
1.17	-4,8	50,85	G12-1
1.18	-1,6	49,05	E12-1
1.19	48,8	50,85	G12-2
1.20	45,6	49,05	E12-2
1.21	67,65	89,8	Therm1-1
1.22	67,65	86,7	Therm2-1
1.23	98,85	84,85	G11-3
1.24	98,85	81,95	E11-3
1.25	147,15	84,85	G13-4
1.26	147,15	81,95	E13-4
1.27	120,45	93,05	DC+desat
1.28	125,55	93,05	DC+desat
1.29	93,35	70,05	G13-3
1.30	93,35	67,15	E13-3
1.31	152,65	70,05	G13-4
1.32	152,65	67,15	E13-4
1.33	117,75	75,35	GND_desat
1.34	128,25	75,35	GND_desat
1.35	98,45	28	G14-3
1.36	95,55	28	E14-3
1.37	147,55	28	G14-4
1.38	150,45	28	E14-4
1.39	96,2	50,85	G12-3
1.40	99,4	49,05	E12-3
1.41	149,8	50,85	G12-4
1.42	146,6	49,05	E12-4
1.43	168,65	89,8	Therm1-2
1.44	168,65	86,7	Therm2-2
1.45	199,85	84,85	G11-5
1.46	199,85	81,95	E11-5
1.47	248,15	84,85	G13-6
1.48	248,15	81,95	E13-6
1.49	221,45	93,05	DC+desat
1.50	226,55	93,05	DC+desat
1.51	194,35	70,05	G13-5
1.52	194,35	67,15	E13-5
1.53	253,65	70,05	G13-6
1.54	253,65	67,15	E13-6
1.55	218,75	75,35	GND_desat
1.56	229,25	75,35	GND_desat
1.57	199,45	28	G14-5
1.58	196,55	28	E14-5
1.59	248,55	28	G14-6
1.60	251,45	28	E14-6
1.61	197,2	50,85	G12-5
1.62	200,4	49,05	E12-5
1.63	250,8	50,85	G12-6
1.64	247,6	49,05	E12-6
1.65	269,7	89,8	Therm1-3
1.66	269,7	86,7	Therm2-3

Low current connections			
M6 screw	X2	Y2	Function
2.1	0	0	PH
2.2	22	0	PH
2.3	44	0	PH
2.4	0	110,4	DC+
2.5	22	110,4	GND
2.6	44	110,4	DC-
2.7	101	0	PH
2.8	123	0	PH
2.9	145	0	PH
2.10	101	110,4	DC+
2.11	123	110,4	GND
2.12	145	110,4	DC-
2.13	202	0	PH
2.14	224	0	PH
2.15	246	0	PH
2.16	202	110,4	DC+
2.17	224	110,4	GND
2.18	246	110,4	DC-



Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	in DataMatrix as
Standard	70-W624N3A1K2SC-L400FP
Standard with thermal paste	70-W624N3A1K2SC-L400FP-/3/

<table>
<tr><td rowspan="4">Name
Date code
Lot
Serial
Vincotech UL</td><td rowspan="2">Text</td><td>Name</td><td>Date code</td><td>UL & Vinco</td><td>Lot</td><td>Serial</td></tr>
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<tr><td rowspan="2">Datamatrix</td><td>Type&Ver</td><td>Lot number</td><td>Serial</td><td>Date code</td><td></td></tr>
<tr><td>TTTT-TTT</td><td>LLLLL</td><td>SSSS</td><td>WWYY</td><td></td></tr>
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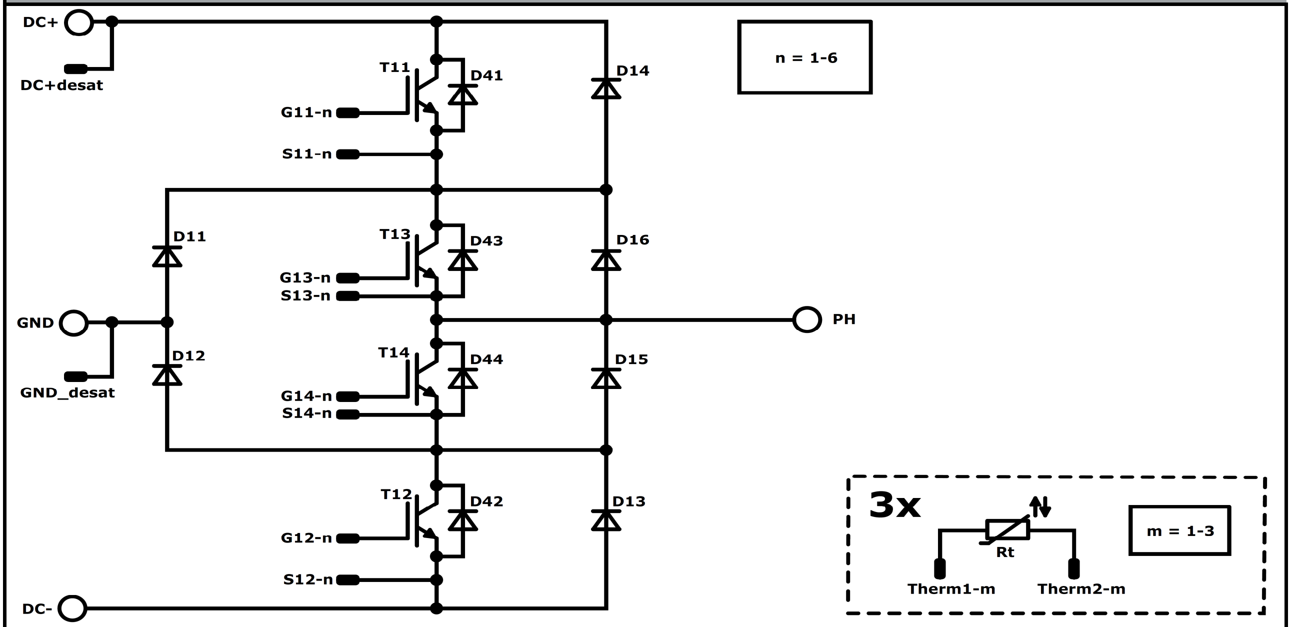
Pinout



NOTE: Driver pins for parallel devices are not connected inside the module!

Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	1200 V	1200 A	Buck Switch	
D11, D12	FWD	1200 V	1200 A	Buck Diode	
T13, T14	IGBT	1200 V	1200 A	Boost Switch	
D13, D14	FWD	1200 V	900 A	Boost Diode	
D15, D16	FWD	1200 V	900 A	Boost Inverse Diode	
D41, D42	FWD	1200 V	90 A	Buck sw. Prot. Diode	
D43, D44	FWD	1200 V	90 A	Boost sw. Prot. Diode	
Rt	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**4**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for VINco X12 packages see vincotech.com website.

Package data
Package data for VINco X12 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
70-W624N3A1K2SC-L400FP-D3-14	10 Jul. 2019	Marketing application voltage modified	1