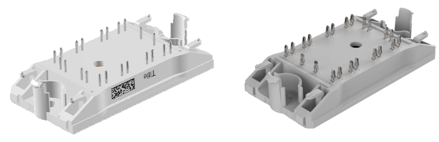
***flow* BOOST 0** — **1200 V / 40 A**

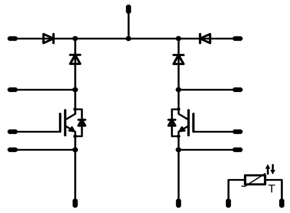
Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V SiC diode
- Antiparallel IGBT protection diode with high current

flow 0 12mm housing



Target Applications
- solar inverter

Schematic



Types
- V23990-P629-L63-PM
- V23990-P629-L63Y-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode\Input Boost Prot. Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Mean forward current	I_{FAV}	$T_j=T_{jmax}$	T_s=80°C T_c=80°C	38 45	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms	T_j=25°C	220	A
I2t-value	I^2t			200	A^2s
Power dissipation	P_{tot}	$T_j=T_{jmax}$	T_s=80°C T_c=80°C	47 71	W
Maximum Junction Temperature	T_{jmax}			150	°C
Input Boost IGBT					
Collector-emitter break down voltage	V_{CES}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s=80°C T_c=80°C	43 57	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		160	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s=80°C T_c=80°C	145 220	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 600	μs V
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Boost FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	T_j=T_{jmax}	T_s=80°C T_c=80°C	28 34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms	T_j=25°C	138	A
I2t-value	I^2t			95	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		78	A
Power dissipation	P_{tot}	T_j=T_{jmax}	T_s=80°C T_c=80°C	81 123	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage		t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				9,55	mm
Comparative Tracking Index	CTI			>200	

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 [°C]	Min	Typ	Max	
Bypass Diode\Input Boost Prot. Diode										
Forward voltage	V_F				25	25 125	0,8	1,14 1,10	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				25	25 125		0,92 0,80		V
Slope resistance (for power loss calc. only)	r_t				25	25 125		0,009 0,012		Ω
Reverse current	I_r			1600		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,49		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						1,73		K/W
Input Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00025	25 125	3,5	5,5	7,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125	1,5	2,89 3,09	3,2	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			1	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125	250		250	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff}=4 Ω R_{gon}=4 Ω	15	700	40	25 125		24 23		ns
Rise time	t_r					25 125		9 11		
Turn-off delay time	$t_{d(off)}$					25 125		178 208		
Fall time	t_f					25 125		11 39		
Turn-on energy loss	E_{on}					25 125		0,467 0,550		mWs
Turn-off energy loss	E_{off}					25 125		0,934 1,760		
Input capacitance	C_{ies}	f=1MHz	0	25		25		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G		15	600	40	25		220	330	nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						0,65		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						0,79		K/W
Input Boost FWD										
Forward voltage	V_F				15	25 125		1,43 1,69	2	V
Reverse leakage current	I_{rm}			1200		25 125			150	μA
Peak recovery current	I_{RRM}	R_{gon}=4 Ω	15	700	40	25 125		17 15		A
Reverse recovery time	t_{rr}					25 125		10 9		ns
Reverse recovery charge	Q_{rr}					25 125		0,116 0,109		μC
Reverse recovered energy	E_{rec}					25 125		0,016 0,014		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		6570 5559		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,17		K/W
Thermal resistance junction to case	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						1,36		K/W

Characteristic Values

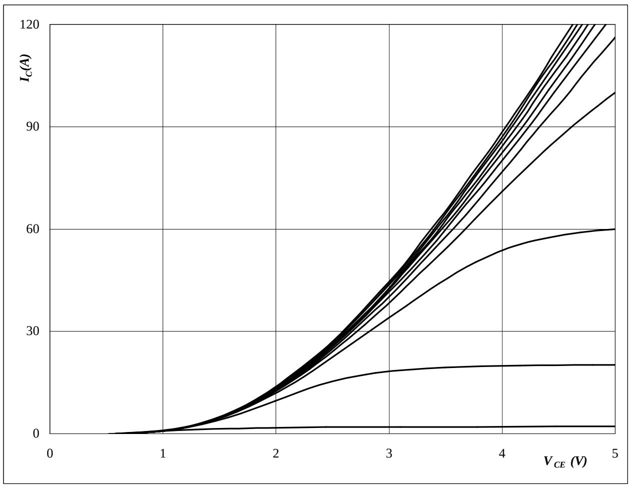
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					T=25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100}=1486 Ω				T=100	-12		+14	%
Power dissipation	P					T=25		200		mW
Power dissipation constant						T=25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				T=25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				T=25		3998		K
Vincotech NTC Reference									B	

Input Boost IGBT / Input Boost FWD

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 μs

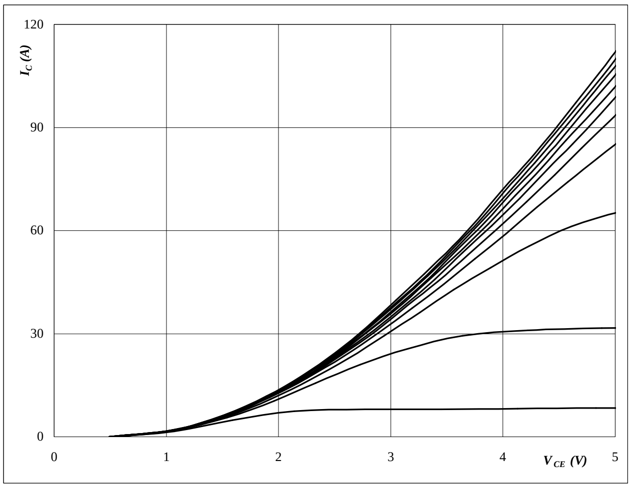
T_j = 25 °C

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

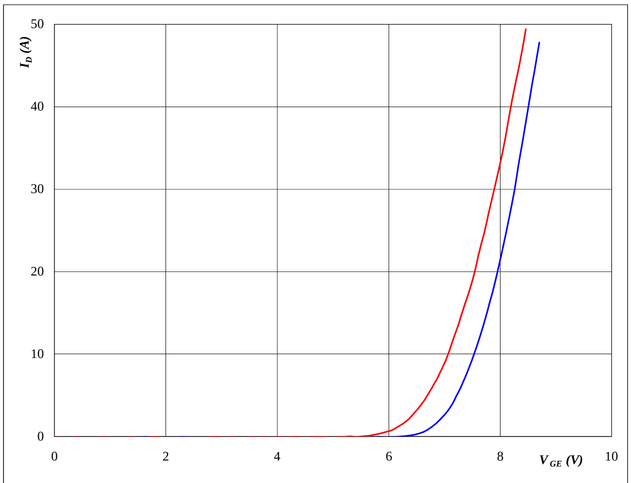
T_j = 126 °C

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

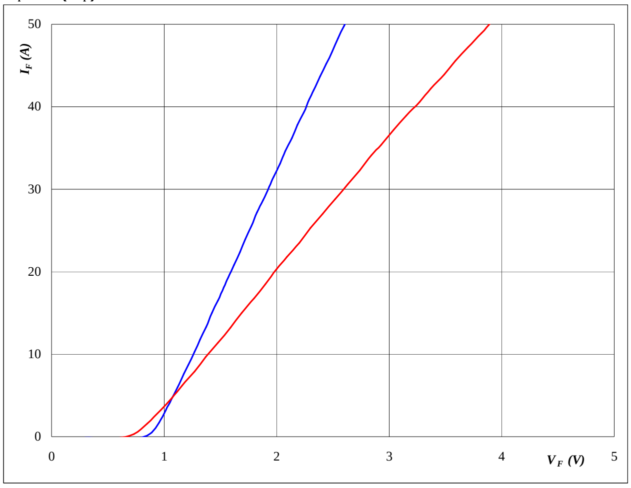
t_p = 100 μs T_j = 25/125 °C

V_{CE} = 10 V

Figure 4 IGBT

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

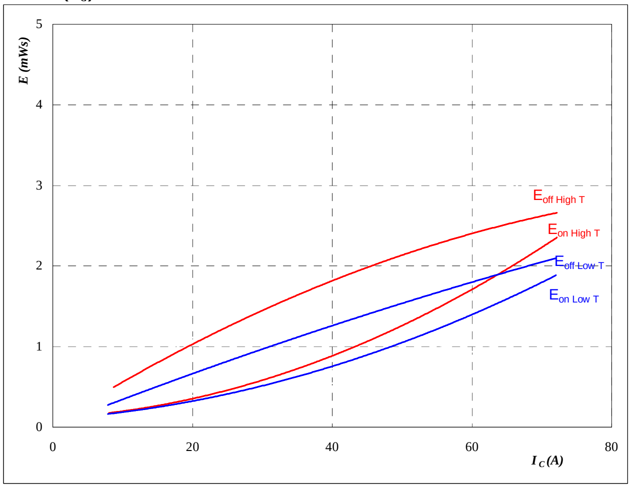
t_p = 250 μs T_j = 25/125 °C

Input Boost IGBT / Input Boost FWD

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



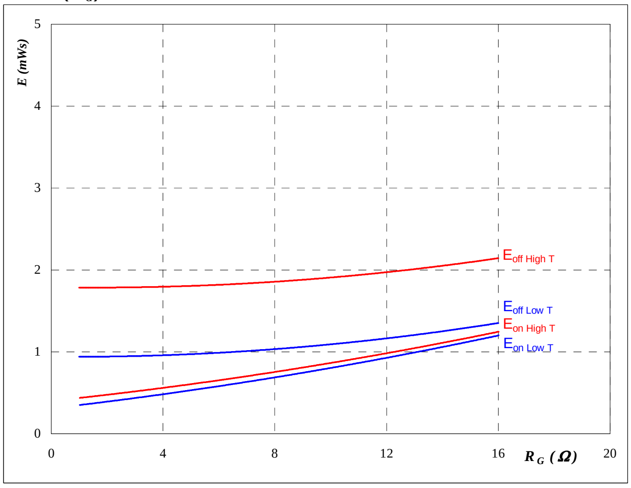
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	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

$E = f(R_G)$



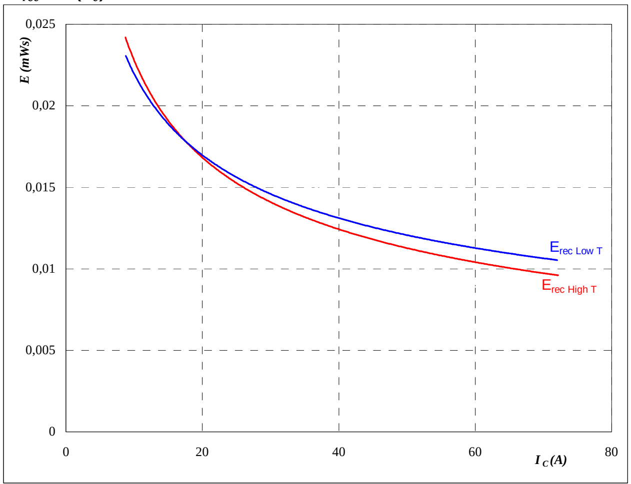
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



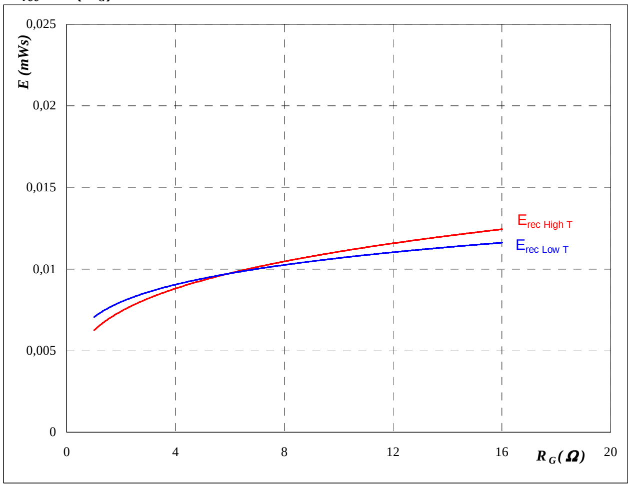
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	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

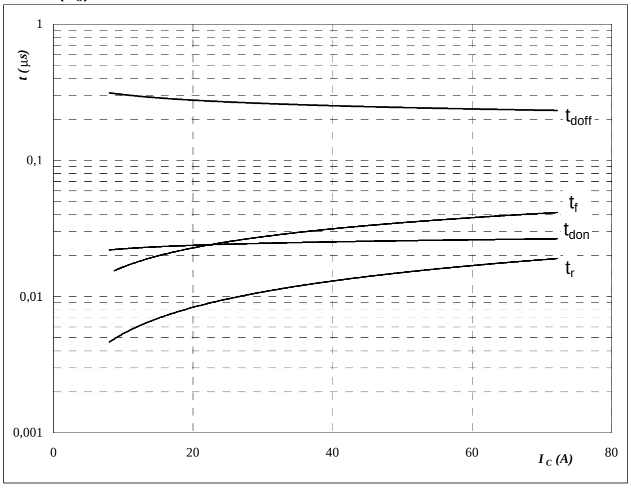
T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Input Boost IGBT / Input Boost FWD

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



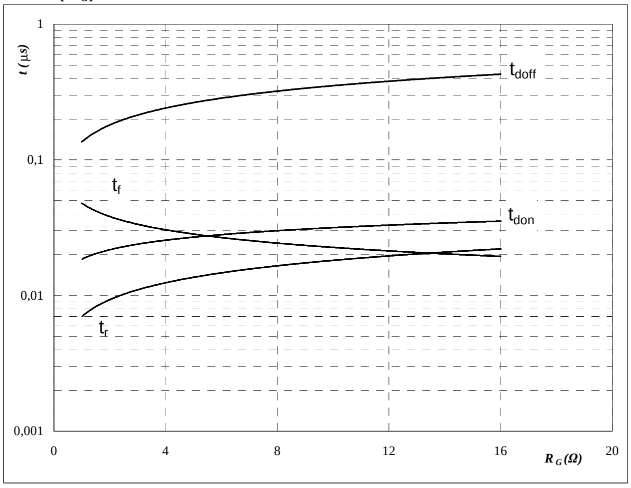
With an inductive load at

T_j =	125	°C
V_{CE} =	700	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

$t = f(R_G)$



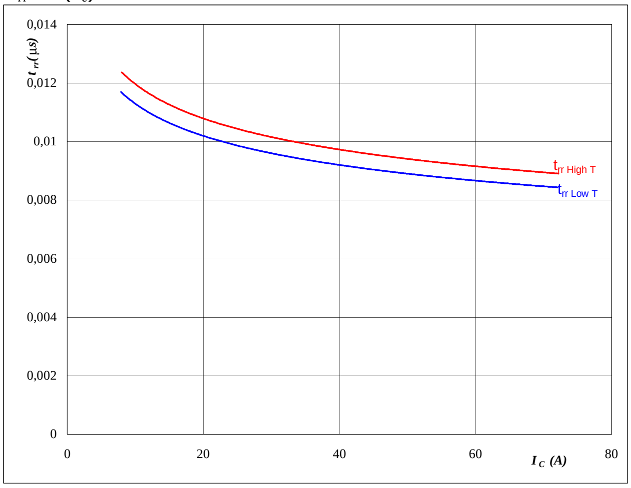
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



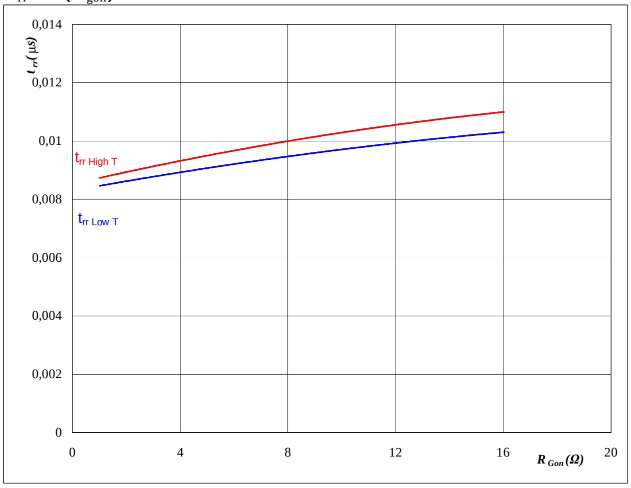
At

T_j =	25/125	°C
V_{CE} =	700	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

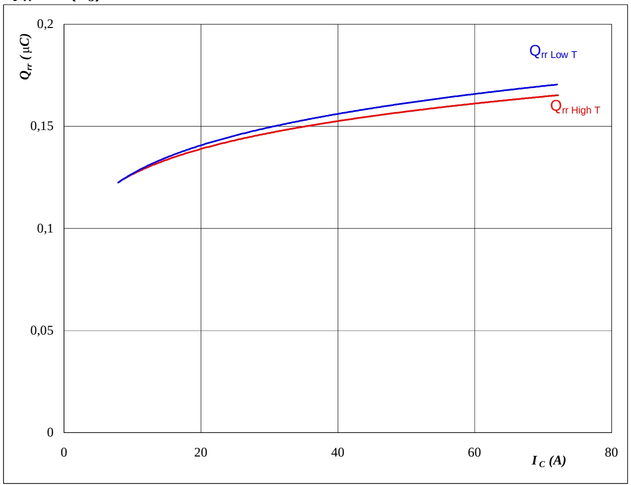
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Input Boost IGBT / Input Boost FWD

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



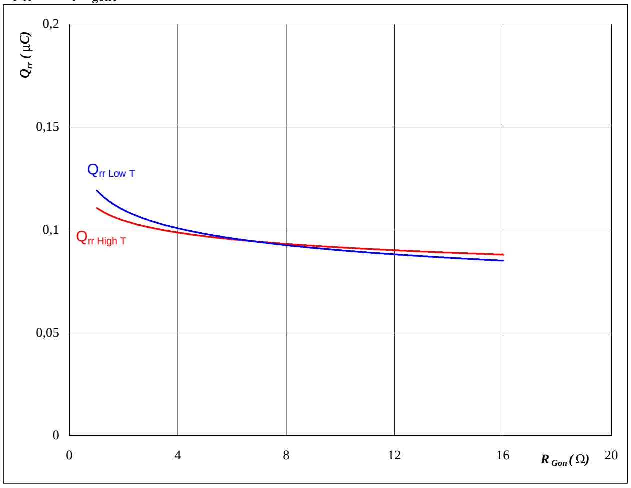
At

T_j =	25/125	°C
V_{CE} =	700	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

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



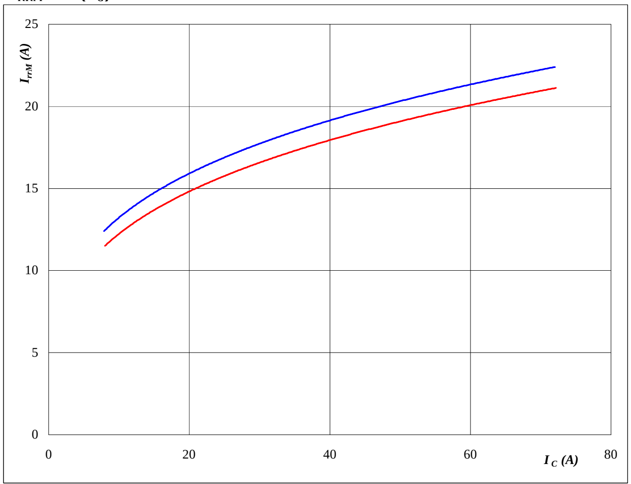
At

T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



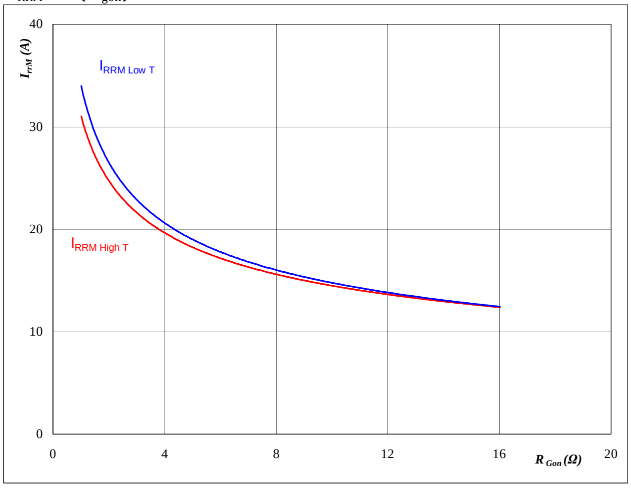
At

T_j =	25/125	°C
V_{CE} =	700	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

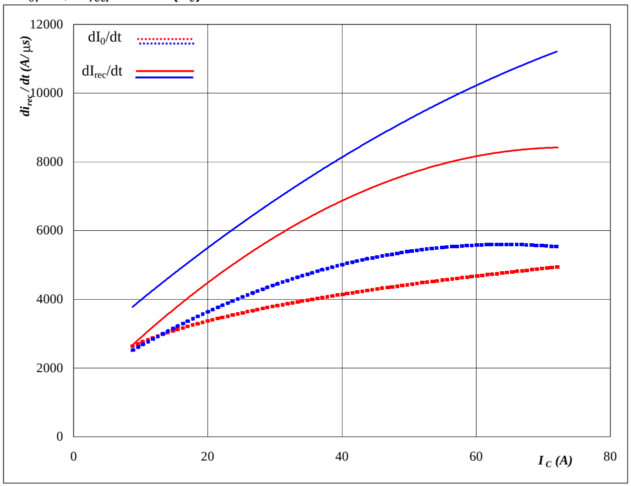
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Input Boost IGBT / Input Boost FWD

Figure 17 FWD

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

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



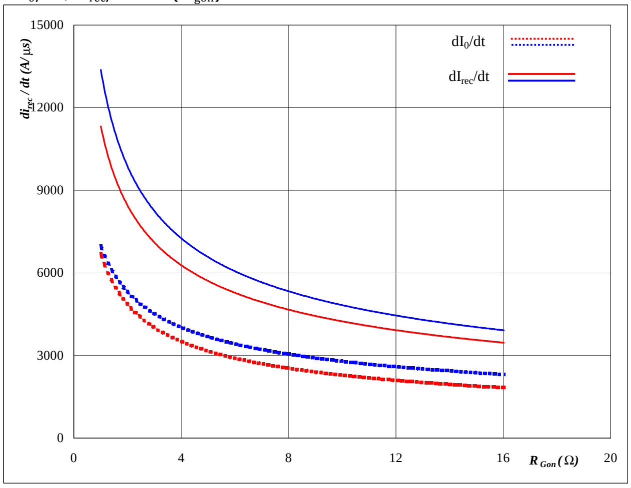
At

T_j =	25/125	°C
V_{CE} =	700	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

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



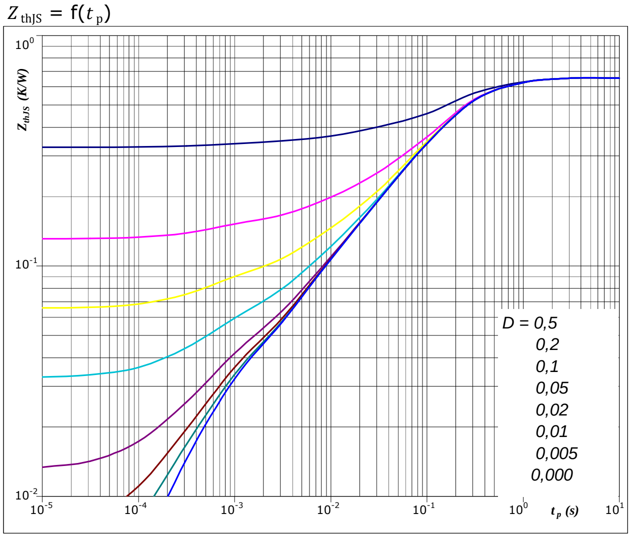
At

T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Figure 19 IGBT

IGBT/MOSFET transient thermal impedance as a function of pulse width

$Z_{thJS} = f(t_p)$



At

$D = t_p / T$

	phase-change material			Thermal grease	
R_{thJS} =	0,65	K/W	R_{thJS} =	0,79	K/W

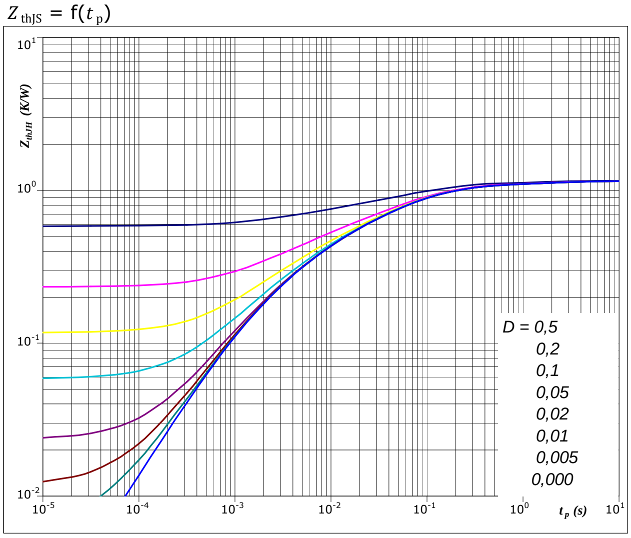
IGBT thermal model values

phase-change material		Thermal grease	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,173	0,561	0,208	0,561
0,381	0,125	0,459	0,125
0,078	0,010	0,094	0,010
-0,003	0,048	-0,004	0,048
0,026	0,001	0,032	0,001

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJS} = f(t_p)$



At

$D = t_p / T$

	phase-change material			Thermal grease	
R_{thJS} =	1,17	K/W	R_{thJS} =	1,36	K/W

FWD thermal model values

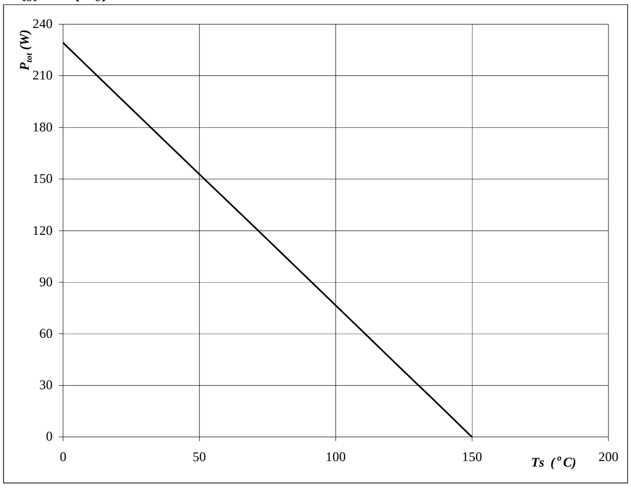
phase-change material		Thermal grease	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,043	9,803	0,050	9,803
0,101	0,815	0,118	0,815
0,383	0,098	0,445	0,098
0,308	0,026	0,358	0,026
0,233	0,005	0,271	0,005
0,098	0,001	0,114	0,001

Input Boost IGBT / Input Boost FWD

Figure 21 IGBT

Power dissipation as a function of sink temperature

$P_{tot} = f(T_s)$



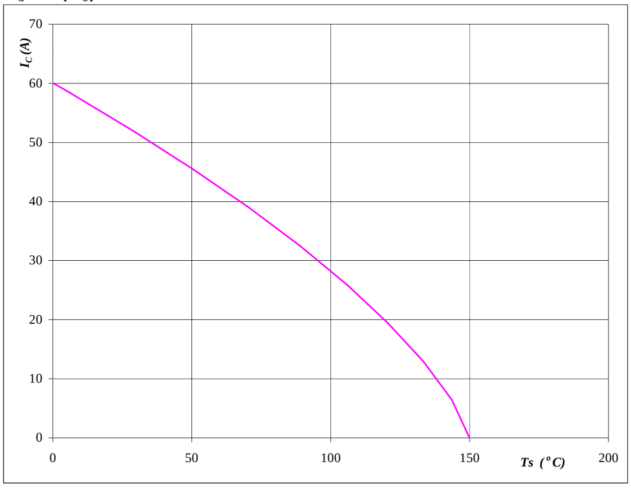
At

T_j = 150 ºC

Figure 22 IGBT

Collector/Drain current as a function of sink temperature

$I_C = f(T_s)$



At

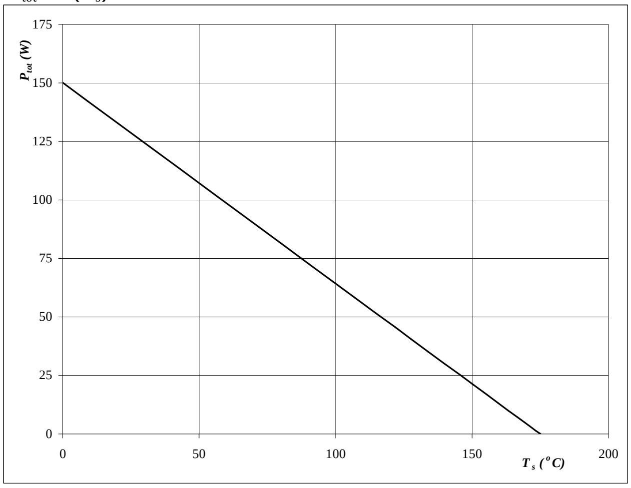
T_j = 150 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of sink temperature

$P_{tot} = f(T_s)$



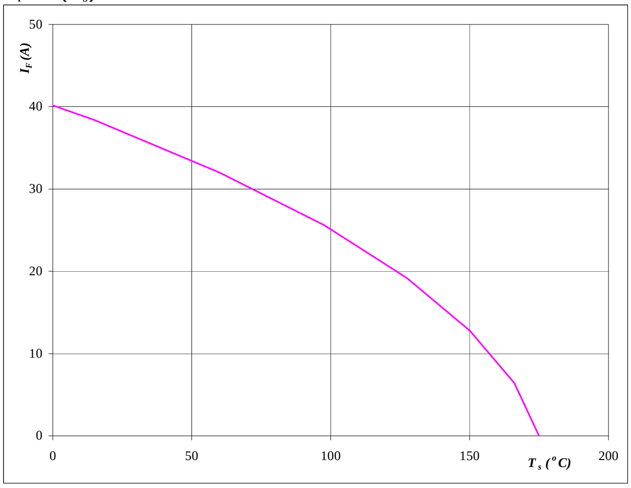
At

T_j = 175 ºC

Figure 24 FWD

Forward current as a function of sink temperature

$I_F = f(T_s)$



At

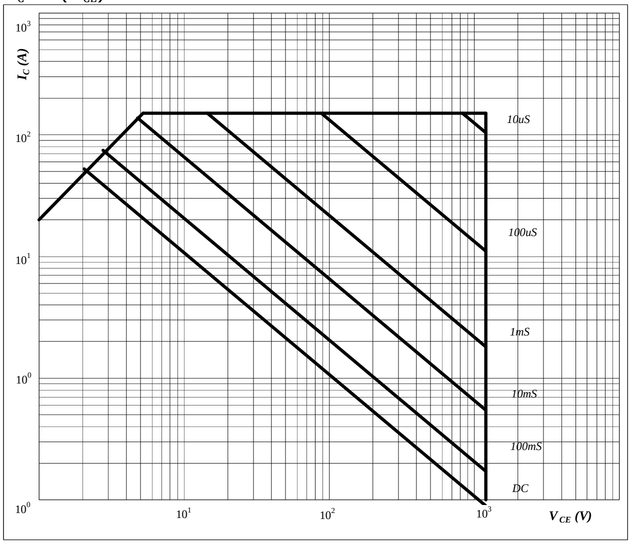
T_j = 175 ºC

Input Boost IGBT / Input Boost FWD

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



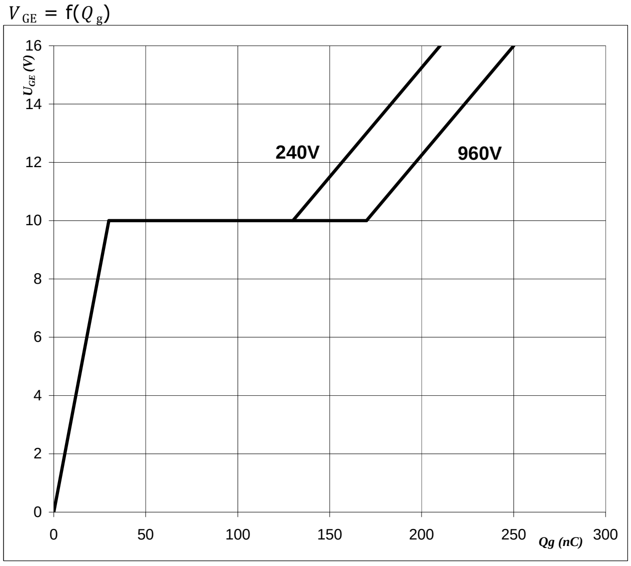
At

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

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



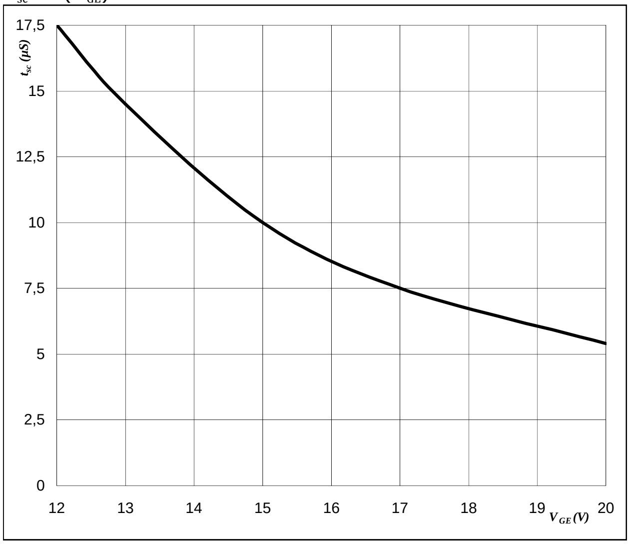
At

I_C =	40	A

Figure 27 IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



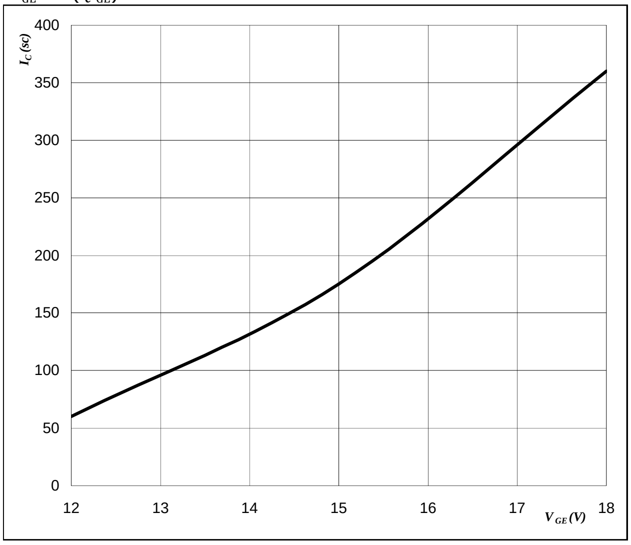
At

V_{CE} =	600	V
T_j ≤	150	ºC

Figure 28 IGBT

Typical short circuit collector current as a function of gate-emitter voltage

$V_{GE} = f(Q_{GE})$



At

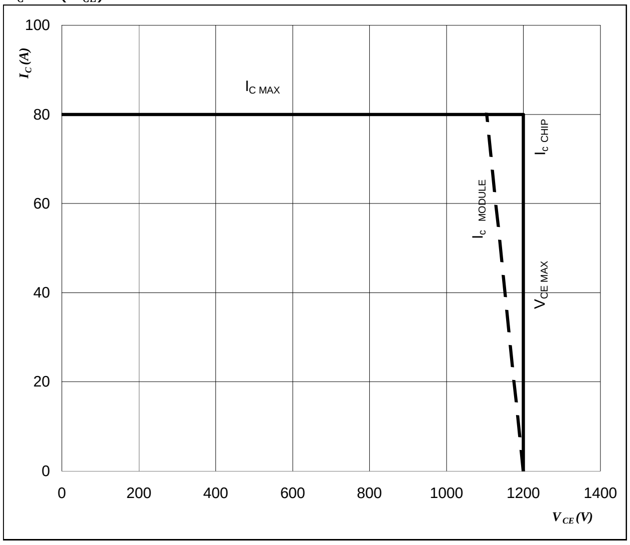
V_{CE} ≤	600	V
T_j =	25	ºC

Input Boost IGBT / Input Boost FWD

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

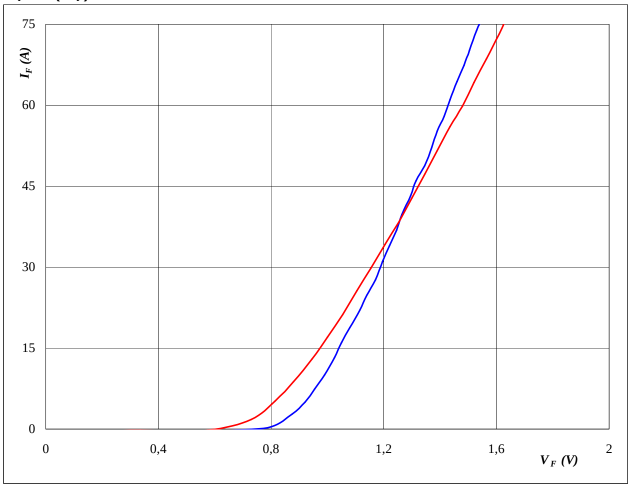
T_{vj} ≤	150	ºC
$I_{C\ MAX}$=	80	A
$U_{CE\ MAX}$=	1200	V

Bypass Diode\Input Boost Prot. Diode

Figure 1 Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

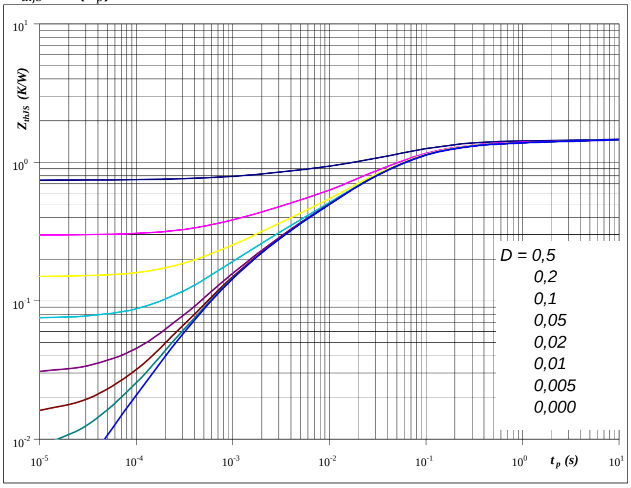
T_j = 25/125 °C

t_p = 250 µs

Figure 2 Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJS} = f(t_p)$



At

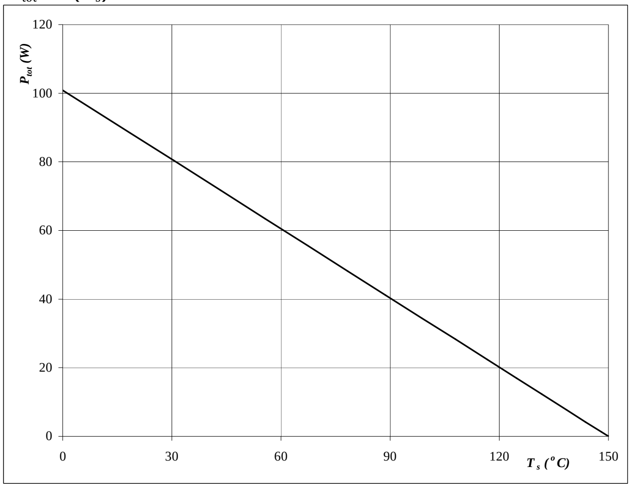
D = t_p / T

	phase-change material			Thermal grease	
R_{thJH} =	1,49	K/W	R_{thJH} =	1,73	K/W

Figure 3 Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



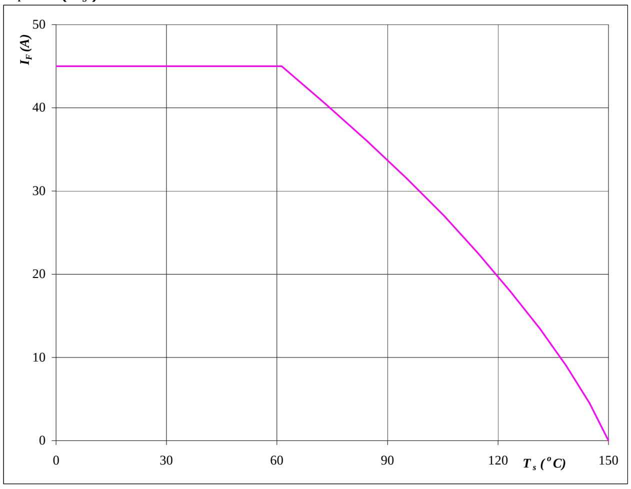
At

T_j = 150 ºC

Figure 4 Diode

Forward current as a function of sink temperature

$I_F = f(T_s)$



At

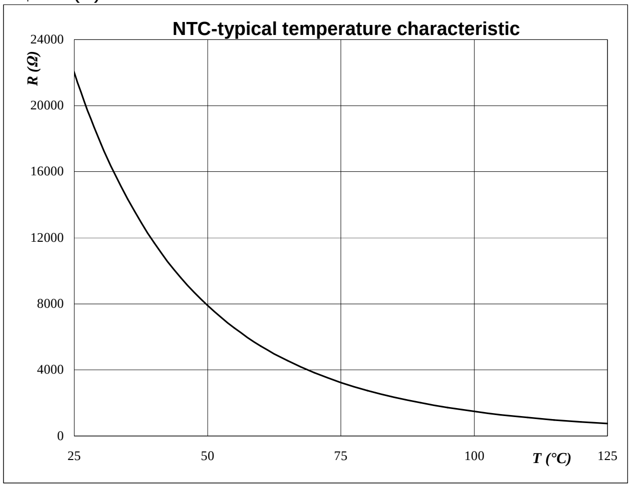
T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature

R_T = f(T)



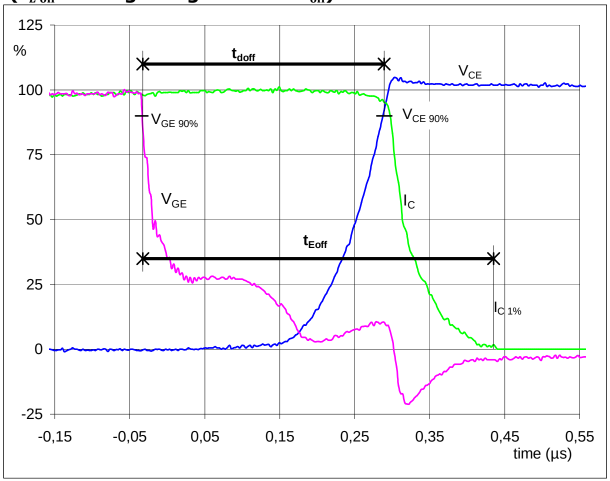
Switching Definitions Boost

General conditions

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

Figure 1 IGBT

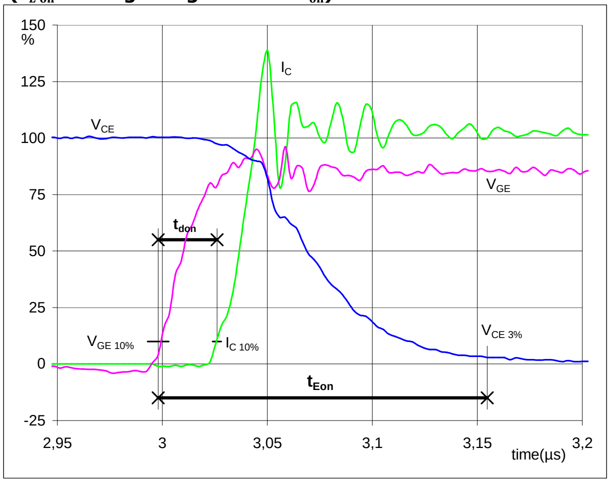
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{doff} =	0,320	µs
$t_{E\,off}$ =	0,468	µs

Figure 2 IGBT

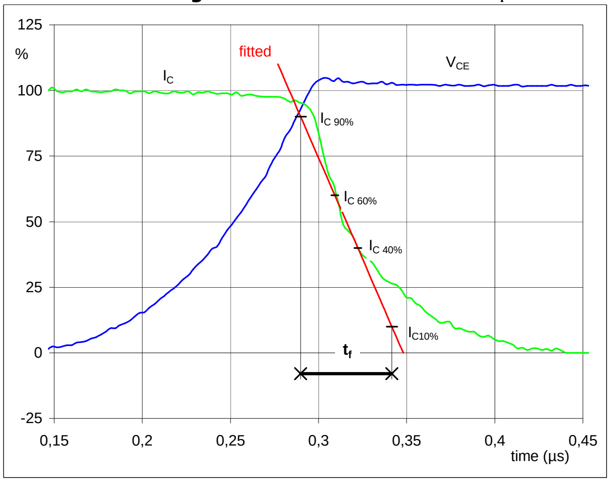
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{don} =	0,027	µs
$t_{E\,on}$ =	0,157	µs

Figure 3 IGBT

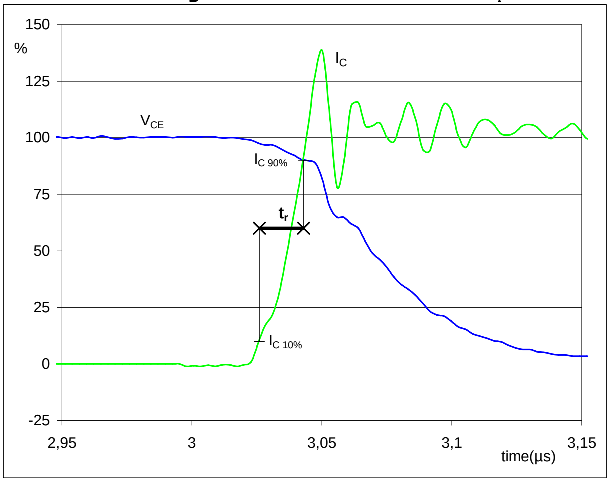
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	40	A
t_f =	0,057	µs

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

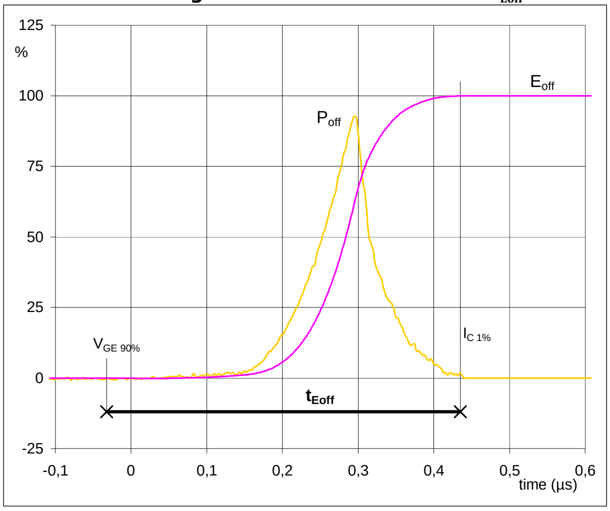


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,017	µs

Switching Definitions Boost

Figure 5 IGBT

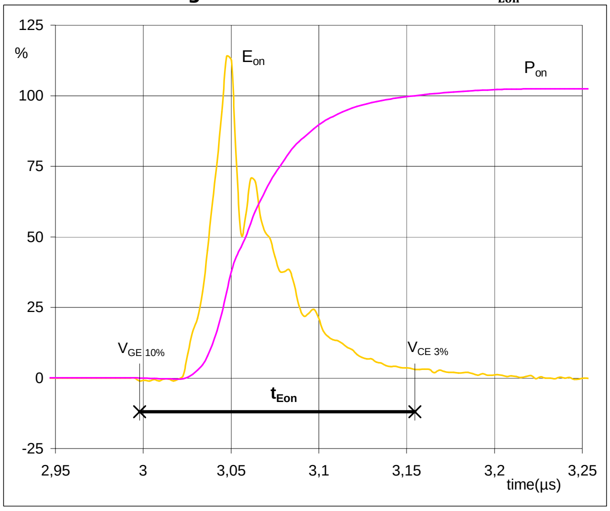
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	28,02	kW
E_{off} (100%) =	2,43	mJ
$t_{E\ off}$ =	0,468	µs

Figure 6 IGBT

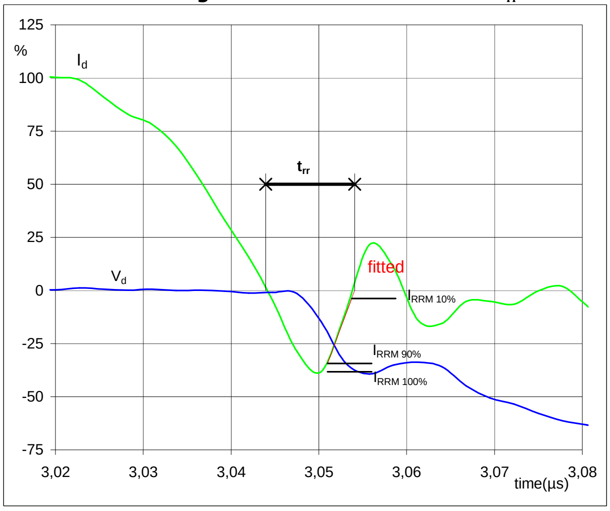
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	28,02	kW
E_{on} (100%) =	1,22	mJ
$t_{E\ on}$ =	0,1567	µs

Figure 7 IGBT

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

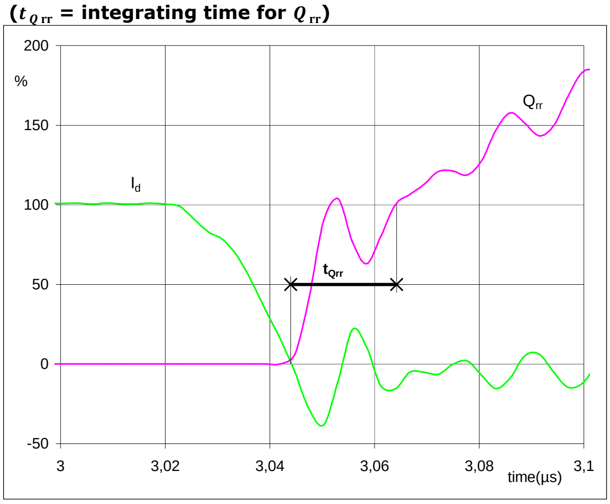


V_C (100%) =	700	V
I_C (100%) =	40	A
I_{RRM} (100%) =	-15	A
t_{rr} =	0,009	µs

Switching Definitions Boost

Figure 8 FWD

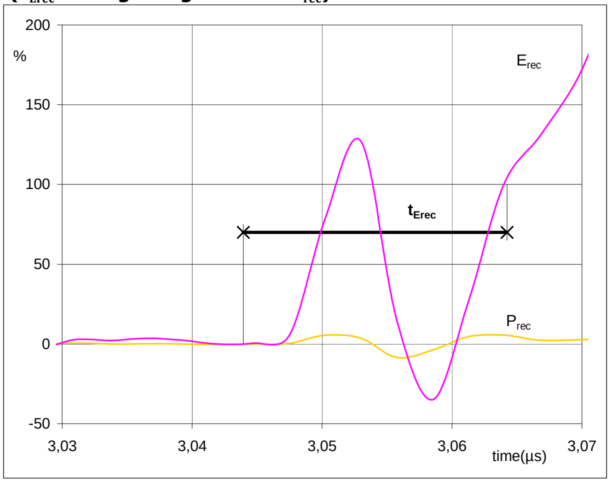
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	0,21	µC
$t_{Q\,rr}$ =	0,02	µs

Figure 9 FWD

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



P_{rec} (100%) =	28,02	kW
E_{rec} (100%) =	0,07	mJ
$t_{E\,rec}$ =	0,02	µs

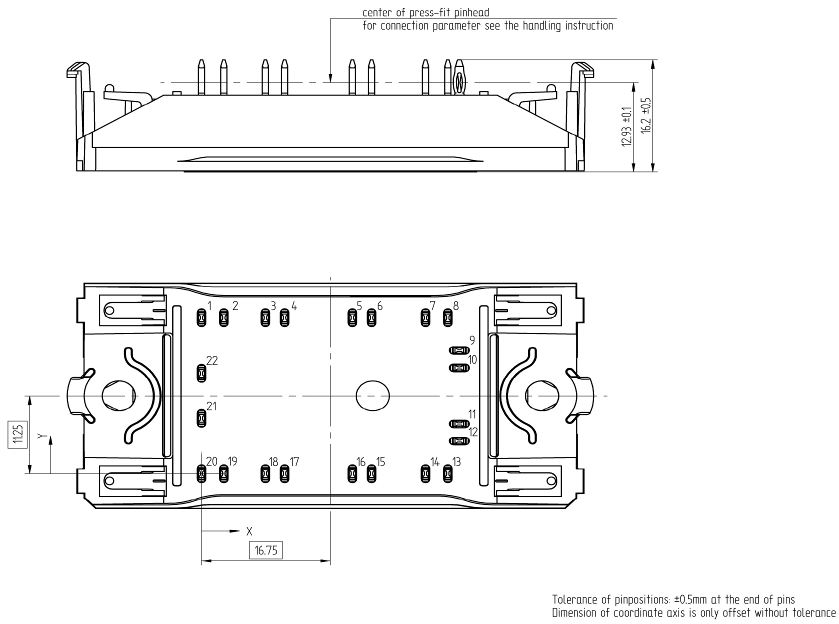
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

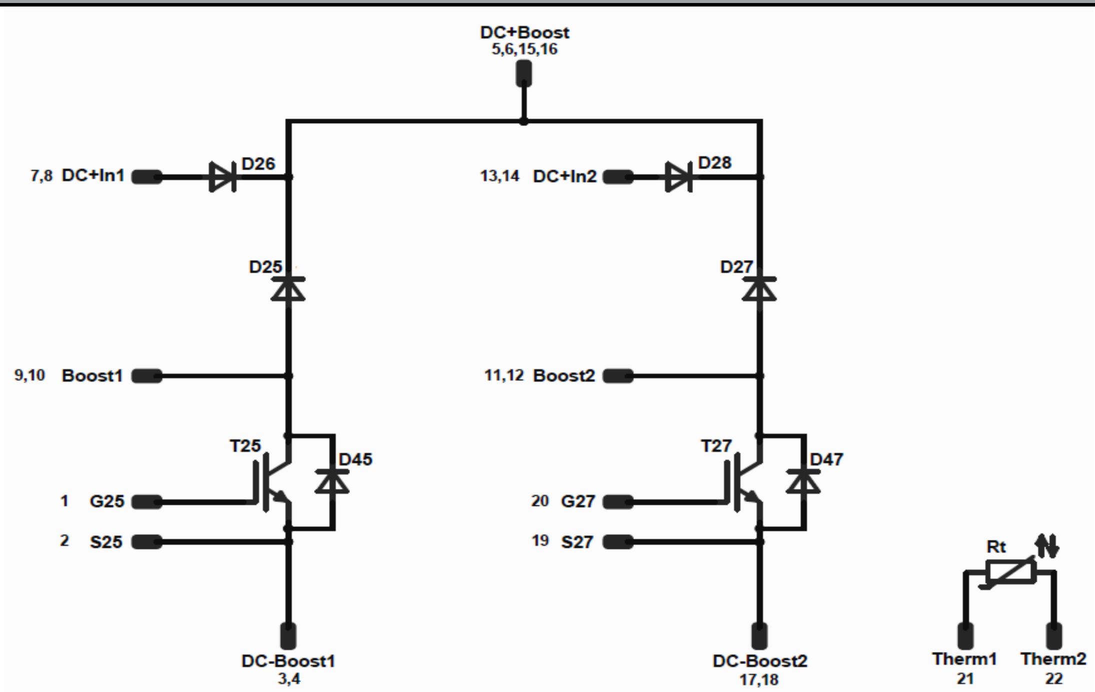
Version	Ordering Code	in DataMatrix as	in packaging barcode as
w\o thermal paste 12mm housing	V23990-P629-L63	P629-L63	P629-L63
w\o thermal paste 12mm housing with Press-fit pins	V23990-P629-L63Y	P629-L63Y	P629-L63Y

Outline

Pin table			
Pin	X	Y	Function
1	0	22,5	G25
2	2,9	22,5	S25
3	8,3	22,5	DC-
4	10,8	22,5	Boost1
5	19,6	22,5	DC+Boost
6	22,1	22,5	DC+Boost
7	29,1	22,5	DC+In1
8	32	22,5	DC+In1
9	33,5	17,8	Boost1
10	33,5	15,3	Boost1
11	33,5	7,2	Boost2
12	33,5	4,7	Boost2
13	32	0	DC+In2
14	29,1	0	DC+In2
15	22,1	0	DC+Boost
16	19,6	0	DC+Boost
17	10,8	0	DC-Boost2
18	8,3	0	DC-Boost2
19	2,9	0	S27
20	0	0	G27
21	0	8	Therm1
22	0	14,5	Therm2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T25,T27	IGBT	1200V	40A	Input Boost Switch	
D25,D27	FWD	1200V	15A	Input Boost Diode	
D26,D28,D45,D47	Rectifier	1600V	25A	Bypass Diode\Input Boost Prot. Diode	
Rt	NTC	-	-	Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**135**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-L63-D3-14	22 Sep. 2015		