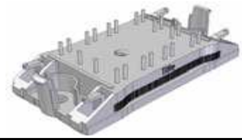
flow BOOST — 1200 V / 40 A

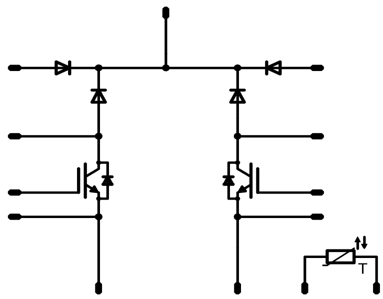
Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200 V IGBT and 1200 V Si diode

flow 0 12mm housing



Target Applications
- solar inverter

Schematic



Types
- V23990-P629-F72-PM

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms		220	A
I2t-value	I^2t			200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	41	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost IGBT					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	36	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		80	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	108	W
Gate-emitter peak voltage	V_{GE}			±25	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V		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
Boost IGBT Protection Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	34	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		220	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	41	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j = 150 °C	T_s = 80 °C	27	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		70	A
Power dissipation	P_{tot}	T_j = 150 °C	T_s = 80 °C	47	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
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC Test Voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 9,55	mm

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Bypass Diode										
Forward voltage	V_F				8	25 125		1,13 1,09	1,21	V
Threshold voltage (for power loss calc. only)	V_{to}				40	25 125		0,93 0,80		V
Slope resistance (for power loss calc. only)	r_t				40	25 125		0,008 0,011		Ω
Reverse current	I_r			1600		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,71		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							1,13		
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00025	25 125	3,5	5,5	7,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125		2,74 3,01	3,2	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			1	mA
Gate-emitter leakage current	I_{GES}		25	0		25 125			±250	nA
Integrated Gate resistor	R_{gint}							tbd.		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 4\ \Omega$ $R_{gon} = 4\ \Omega$	±15	600	40	25 125		27 26		ns
Rise time	t_r					25 125		10 11		
Turn-off delay time	$t_{d(off)}$					25 125		166 193		
Fall time	t_f					25 125		17 35		
Turn-on energy loss	E_{on}					25 125		1,02 1,65		mWs
Turn-off energy loss	E_{off}					25 125		0,85 1,53		
Input capacitance	C_{ies}	f = 1 MHz	0	30		25		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G		15	600	40	25		220		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						0,65		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,43		
Boost IGBT Protection Diode										
Diode forward voltage	V_F				25	25 125		1,13 1,08	1,21	V
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,71		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							1,13		
Boost FWD										
Forward voltage	V_F				30	25 150		2,17 1,87	3,4	V
Reverse leakage current	I_{rm}			1200		25 150			100	μA
Peak recovery current	I_{RRM}	$R_{gon} = 4\ \Omega$	±15	600	40	25 150		79 91		A
Reverse recovery time	t_{rr}					25 150		116 270		ns
Reverse recovery charge	Q_{rr}					25 150		3,57 6,92		μC
Reverse recovered energy	E_{rec}					25 150		1,67 3,36		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		7485 3663		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,48		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,98		

Characteristic Values

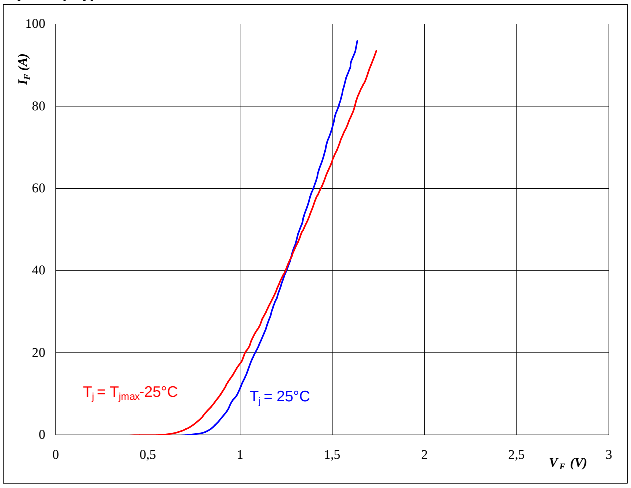
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+12	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mw/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

Boost IGBT Protection Diode

figure 1. **Boost IGBT Protection Diode**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



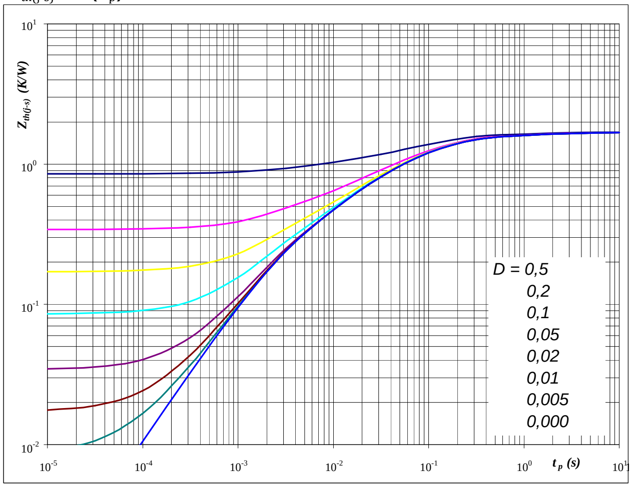
At

t_p = 250 µs

figure 2. **Boost IGBT Protection Diode**

Diode transient thermal impedance as a function of pulse width

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



At

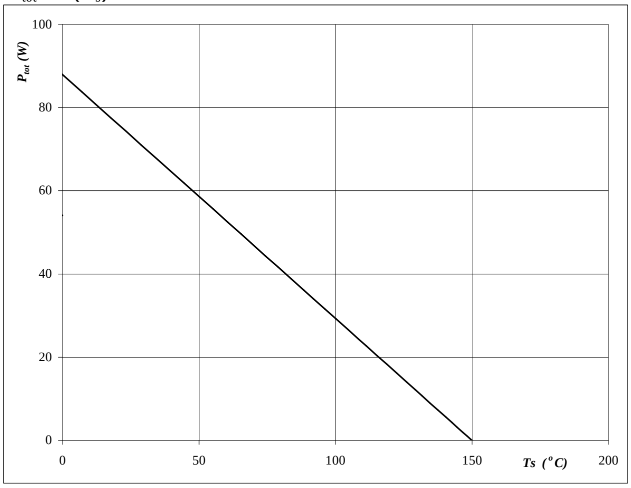
$D = t_p / T$

$R_{th(j-s)}$ = 1,71 K/W

figure 3. **Boost IGBT Protection Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



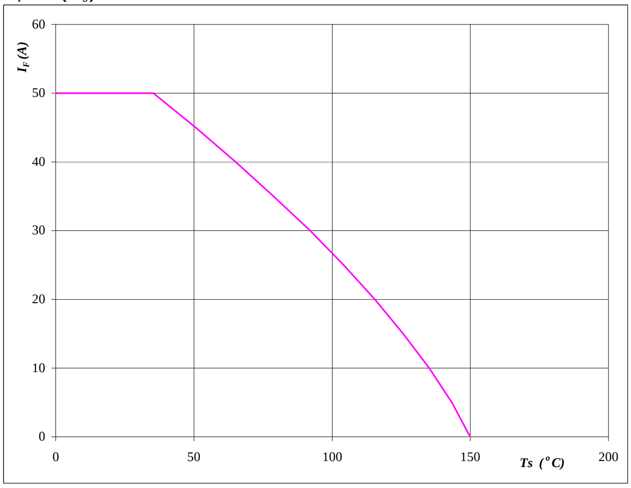
At

T_j = 150 ºC

figure 4. **Boost IGBT Protection Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

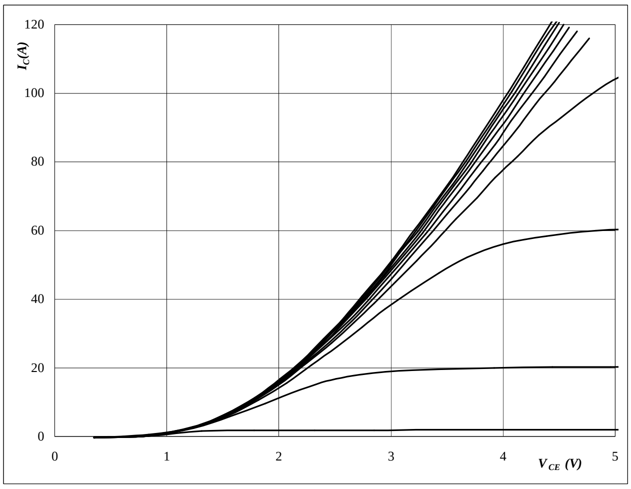
T_j = 150 ºC

INPUT BOOST

figure 3. **BOOST IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



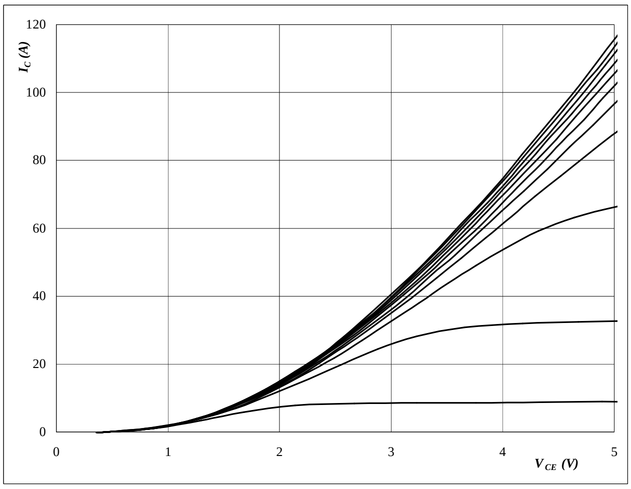
At

t_p = 250 µs
T_j = 25 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 4. **BOOST FWD**

Typical output characteristics

$I_C = f(V_{CE})$



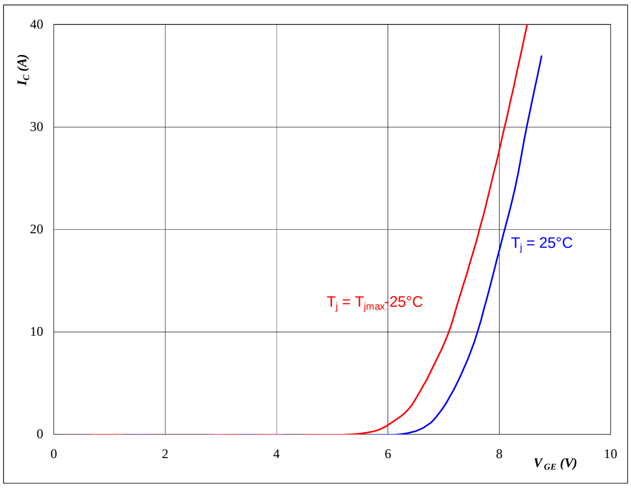
At

t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **BOOST IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



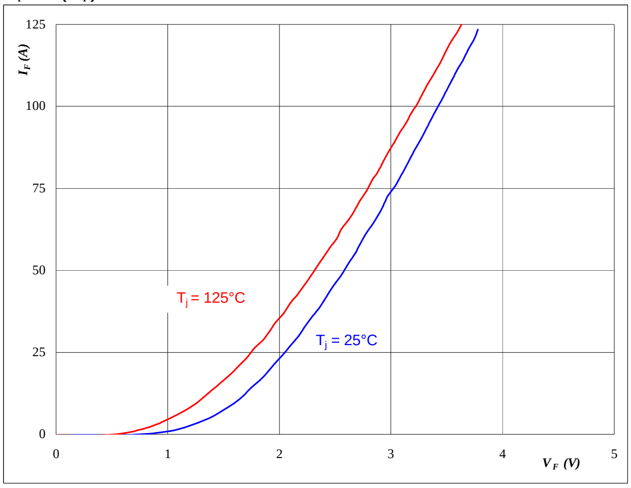
At

t_p = 250 µs
V_{CE} = 10 V

figure 4. **BOOST FWD**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

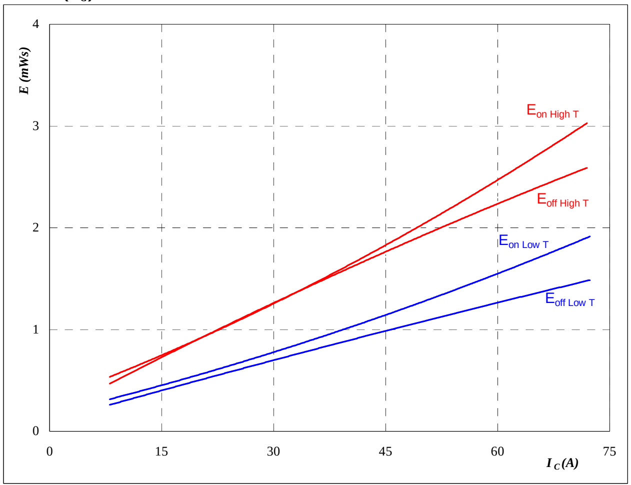
t_p = 250 µs

INPUT BOOST

figure 5. **BOOST IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



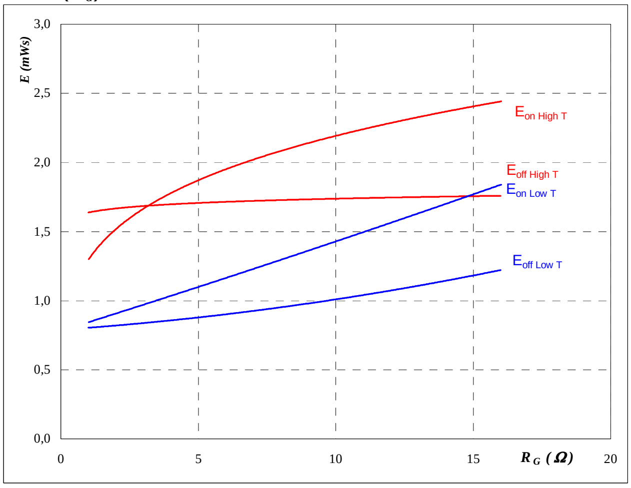
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **BOOST IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



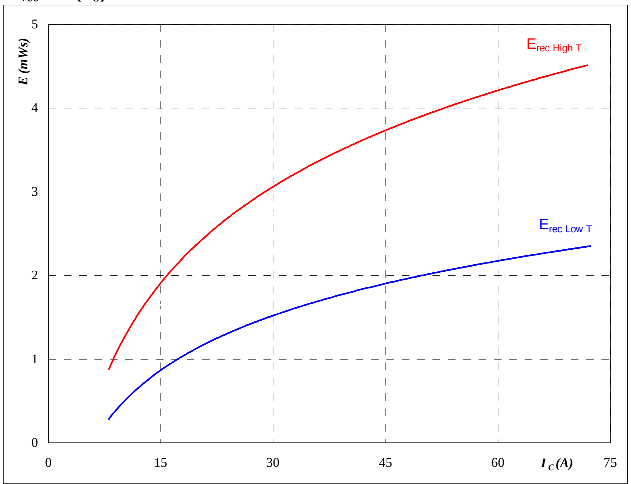
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

figure 7. **BOOST IGBT**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



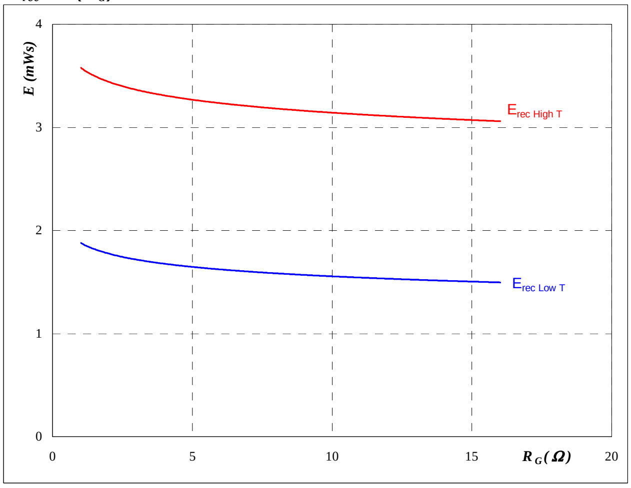
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

figure 8. **BOOST IGBT**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

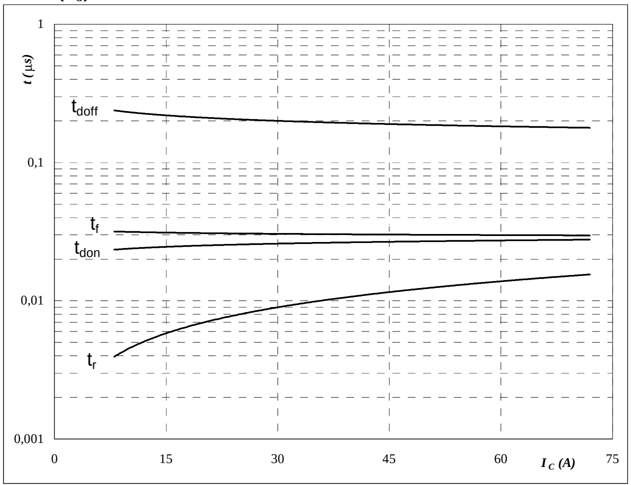
T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

INPUT BOOST

figure 9. **BOOST IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



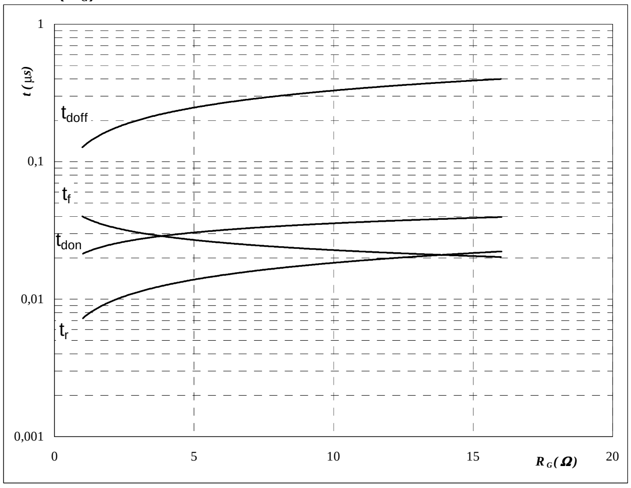
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 10. **BOOST IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



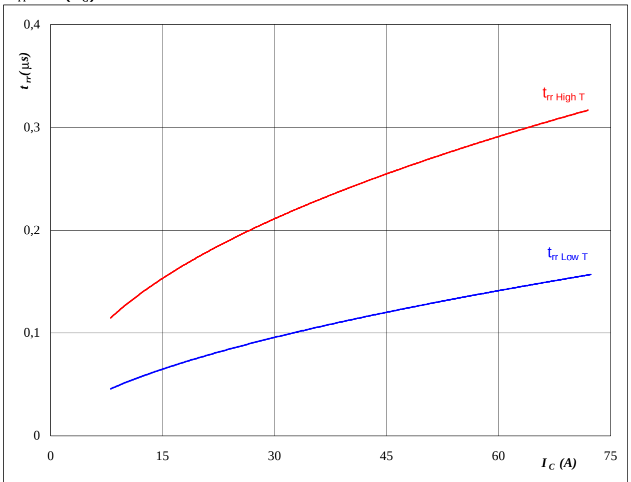
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

figure 11. **BOOST FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



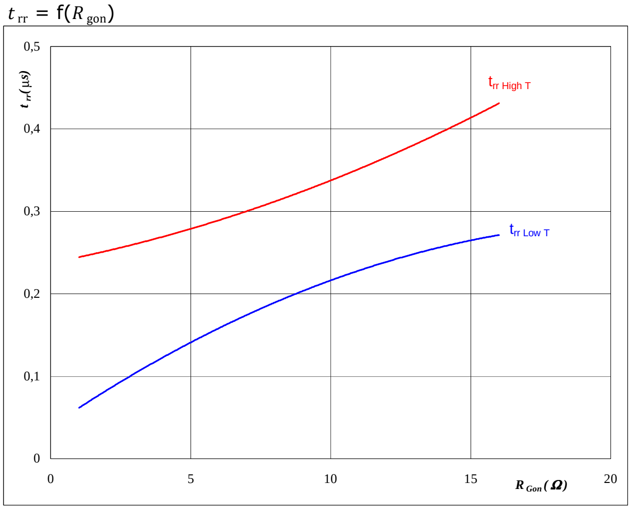
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

figure 12. **BOOST FWD**

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

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



At

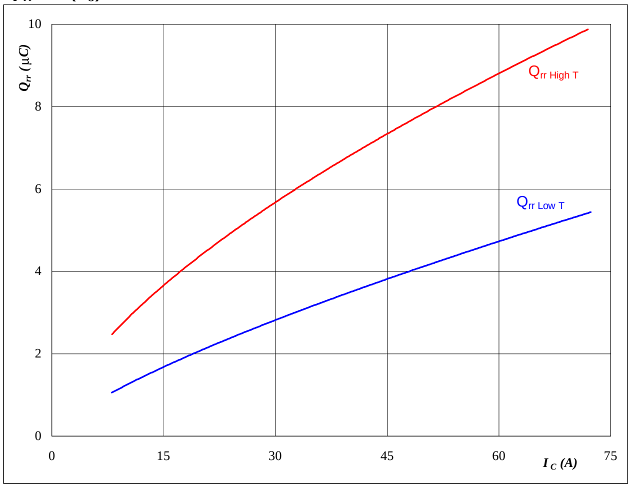
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

INPUT BOOST

figure 13. **BOOST FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



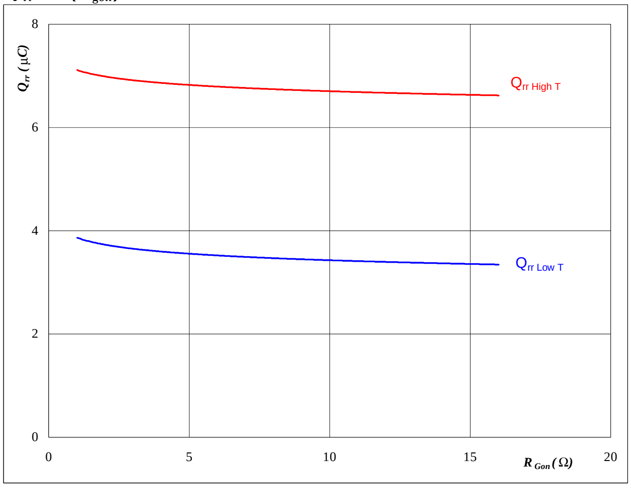
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

figure 14. **BOOST FWD**

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

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



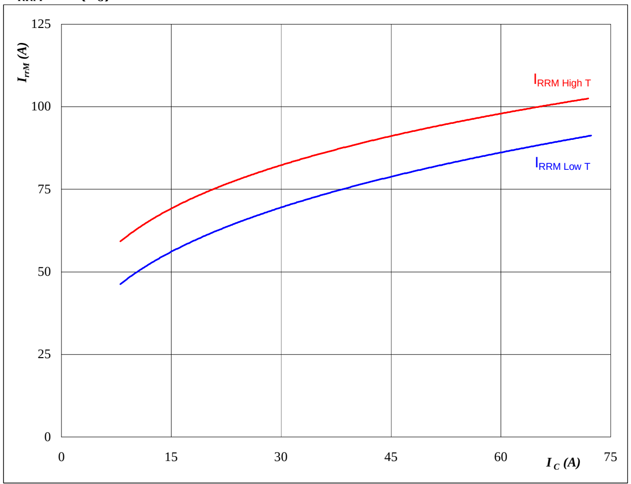
At

T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

figure 15. **BOOST FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



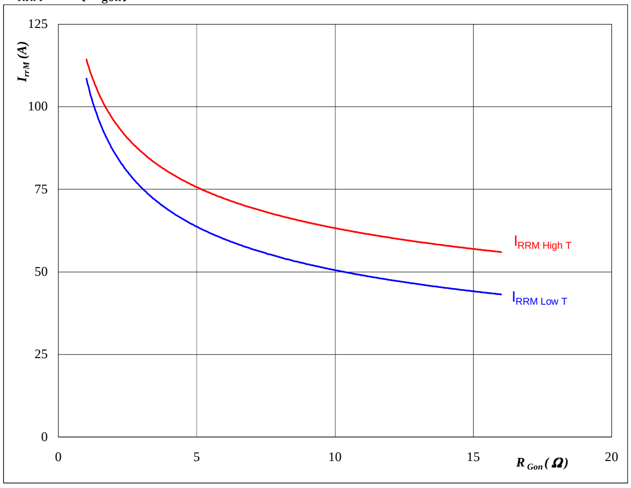
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

figure 16. **BOOST FWD**

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

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



At

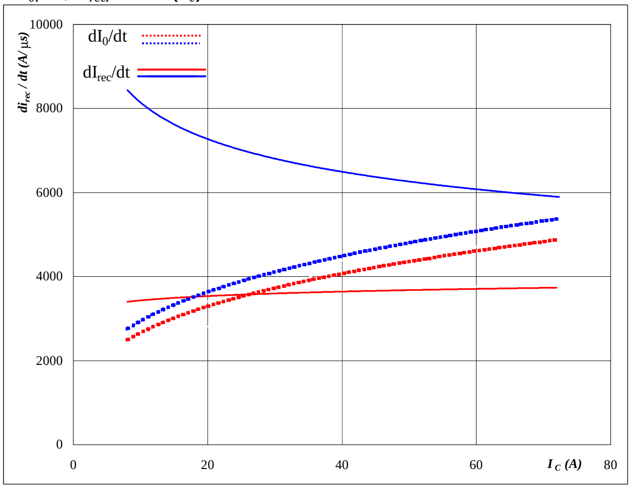
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

INPUT BOOST

figure 17. **BOOST FWD**

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

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



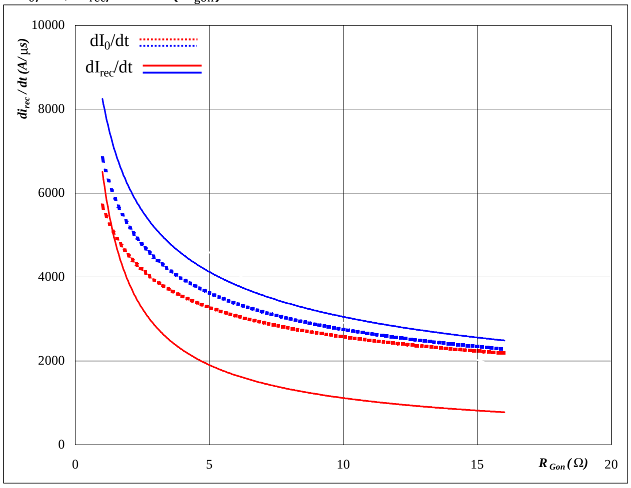
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

figure 18. **BOOST FWD**

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

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



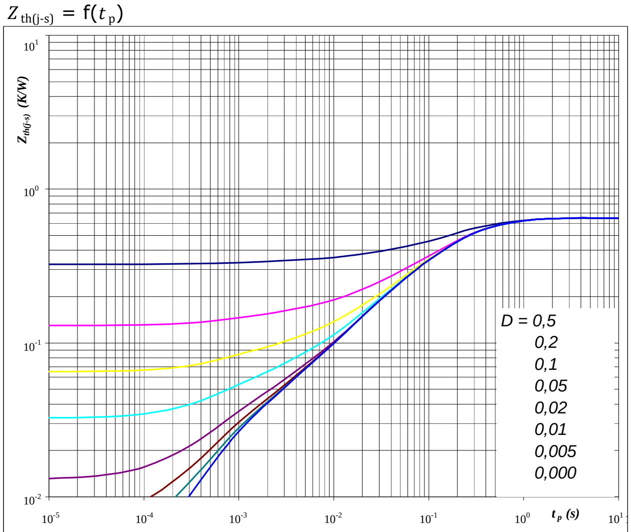
At

T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

figure 19. **BOOST IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,65	K/W

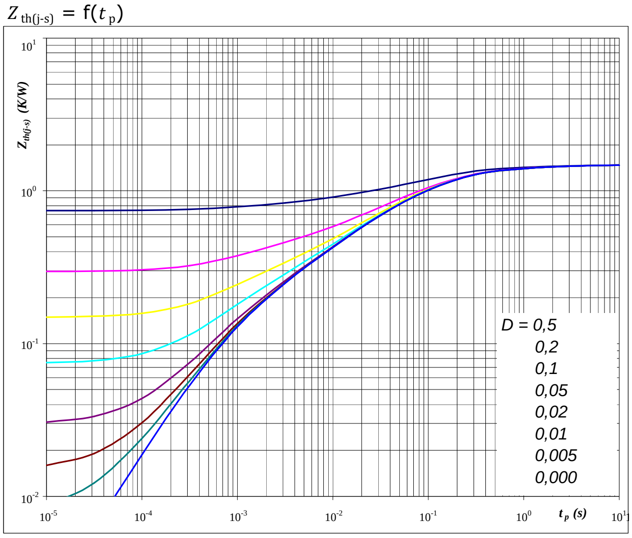
IGBT thermal model values

R (K/W)	Tau (s)
1,98E-01	4,95E-01
3,47E-01	1,11E-01
7,54E-02	1,46E-02
2,80E-02	9,60E-04

figure 20. **BOOST FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,48	K/W

FWD thermal model values

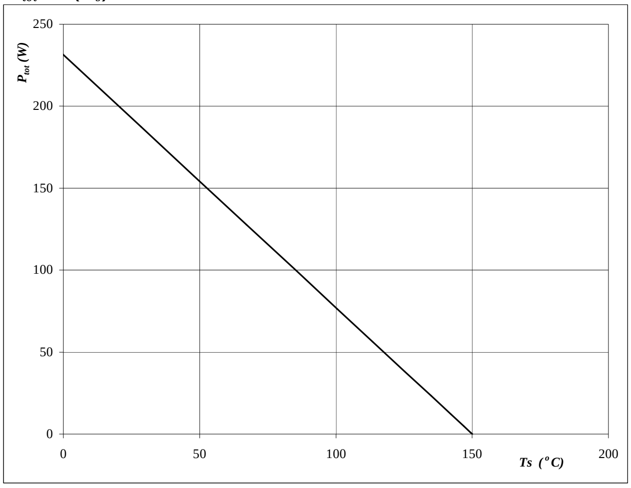
R (K/W)	Tau (s)
5,00E-02	5,60E+00
1,21E-01	9,13E-01
3,35E-01	1,95E-01
4,89E-01	6,74E-02
2,83E-01	1,48E-02
1,23E-01	2,67E-03
8,13E-02	6,64E-04

INPUT BOOST

figure 21. **BOOST IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



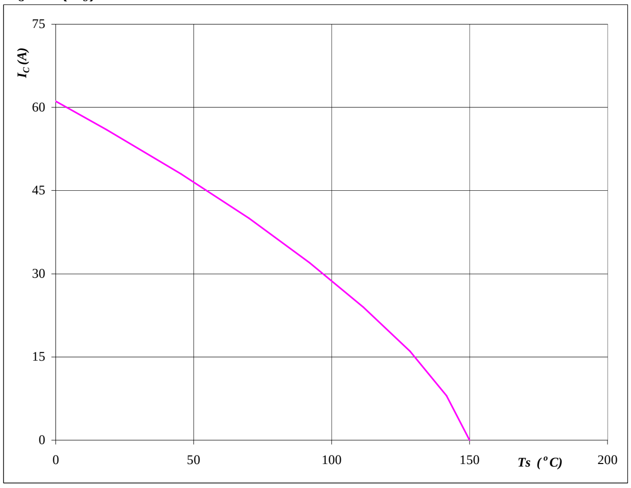
At

T_j = 150 ºC

figure 22. **BOOST IGBT**

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_s)$



At

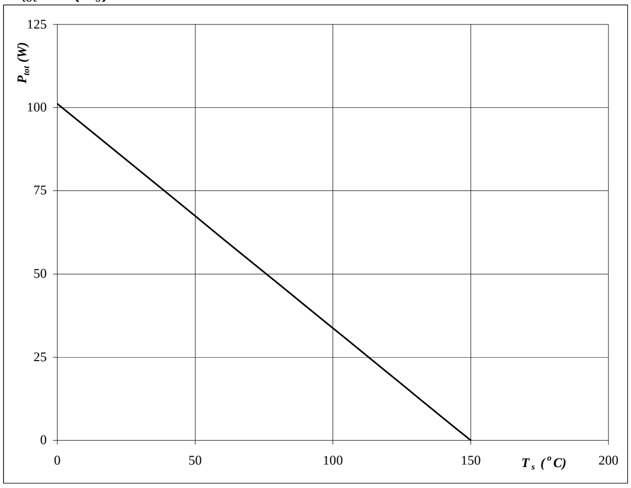
T_j = 150 ºC

V_{GE} = 15 V

figure 23. **BOOST FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



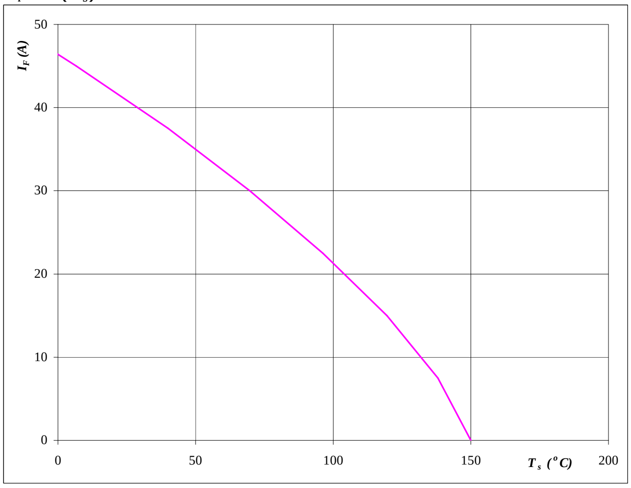
At

T_j = 150 ºC

figure 24. **BOOST FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

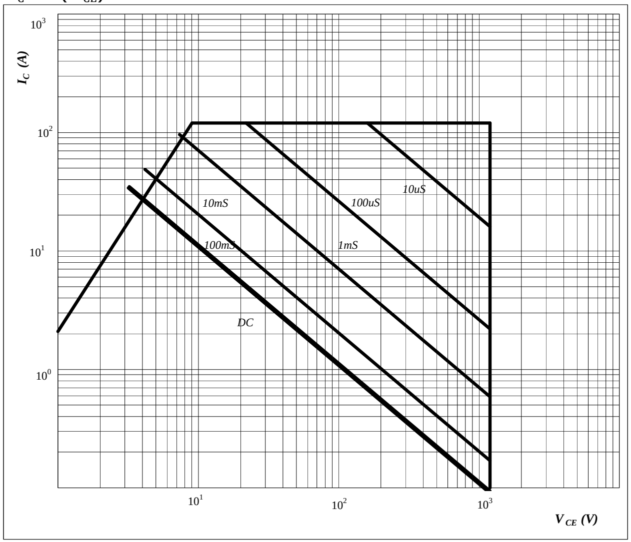
T_j = 150 ºC

INPUT BOOST

figure 25.	BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



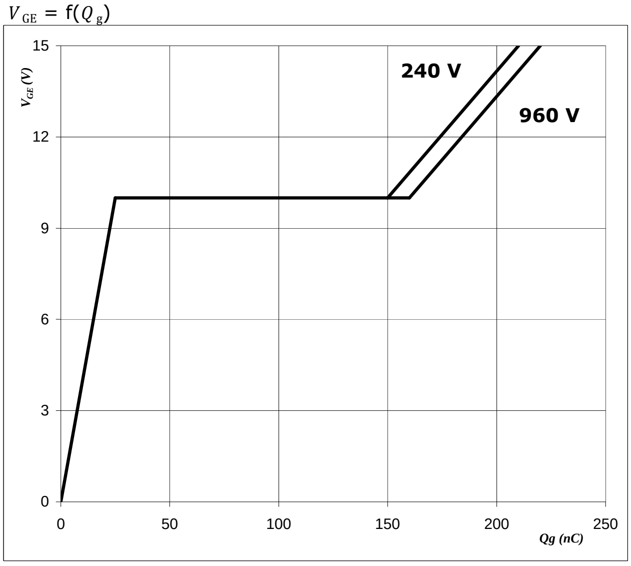
At

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

figure 26.	BOOST IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

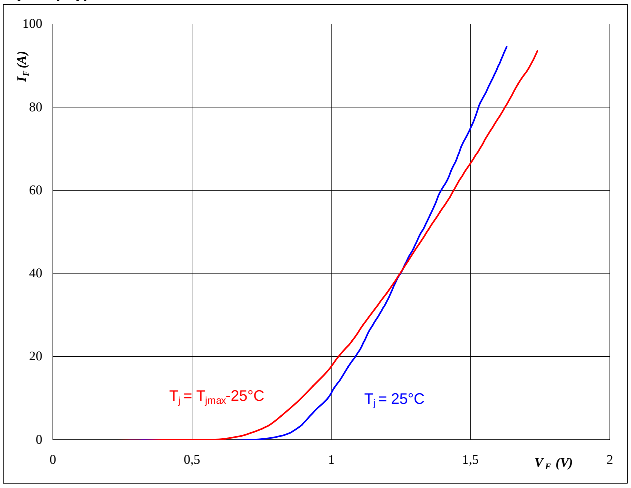
I_C =	40	A

Bypass Diode

figure 1. **Bypass Diode**

Typical Diode forward current as a function of forward voltage

$I_F = f(V_F)$



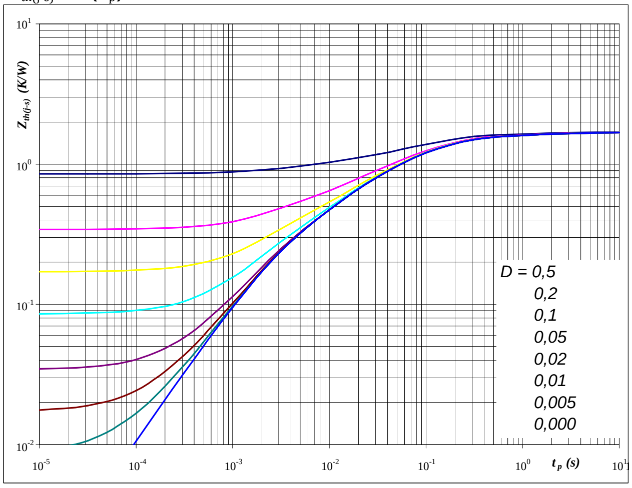
At

t_p = 250 µs

figure 2. **Bypass Diode**

Diode transient thermal impedance as a function of pulse width

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



At

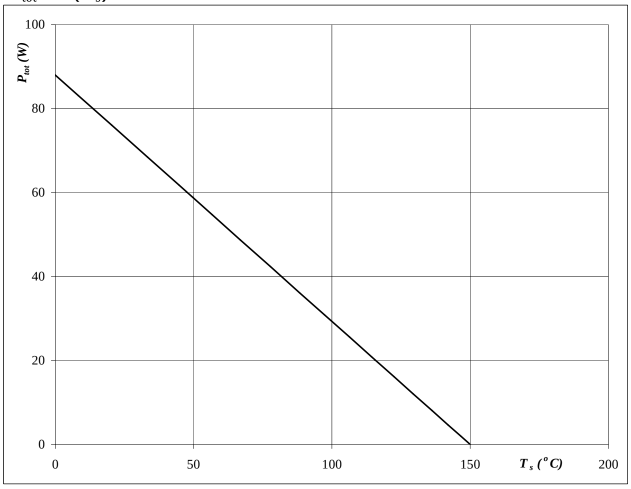
$D = t_p / T$

$R_{th(j-s)}$ = 1,71 K/W

figure 3. **Bypass Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



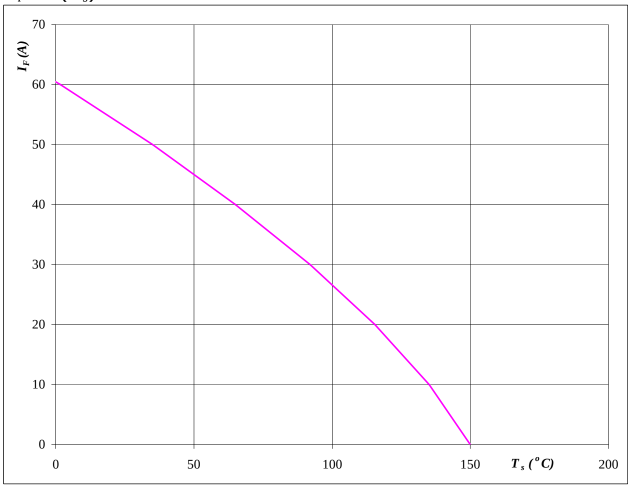
At

T_j = 150 ºC

figure 4. **Bypass Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

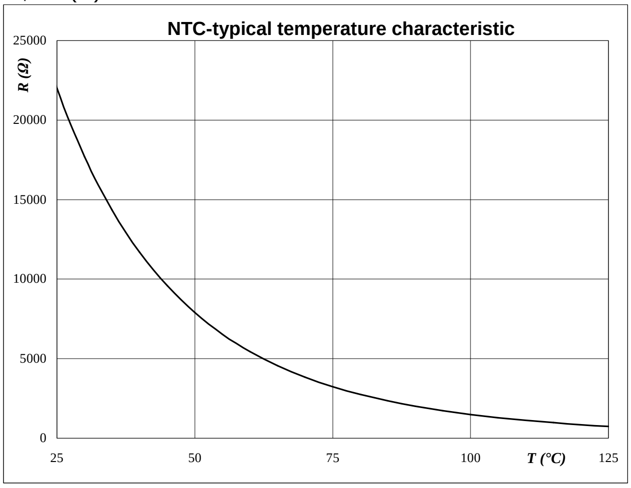
T_j = 150 ºC

Thermistor

figure 1.	Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



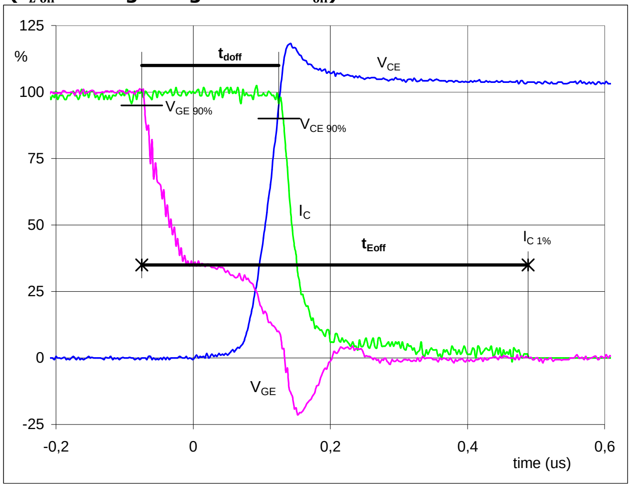
Switching Definitions BOOST IGBT

General conditions

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

figure 1. **Boost IGBT**

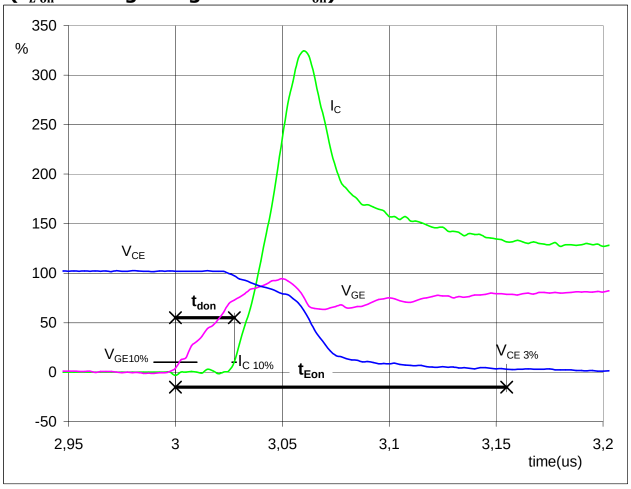
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{doff} =	0,19	µs
$t_{E\,off}$ =	0,56	µs

figure 2. **Boost IGBT**

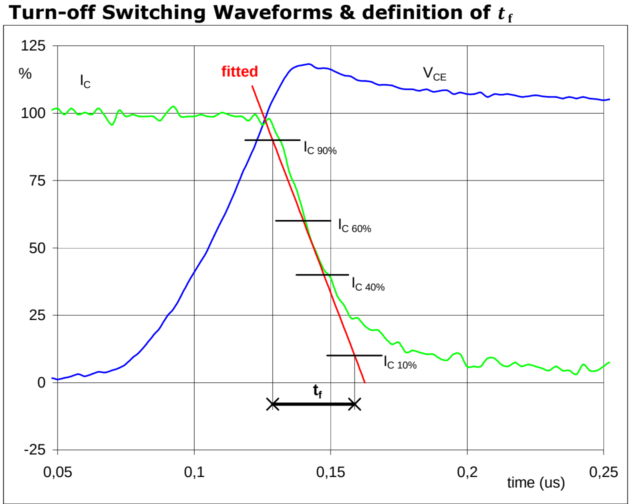
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{don} =	0,03	µs
$t_{E\,on}$ =	0,15	µs

figure 3. **Boost IGBT**

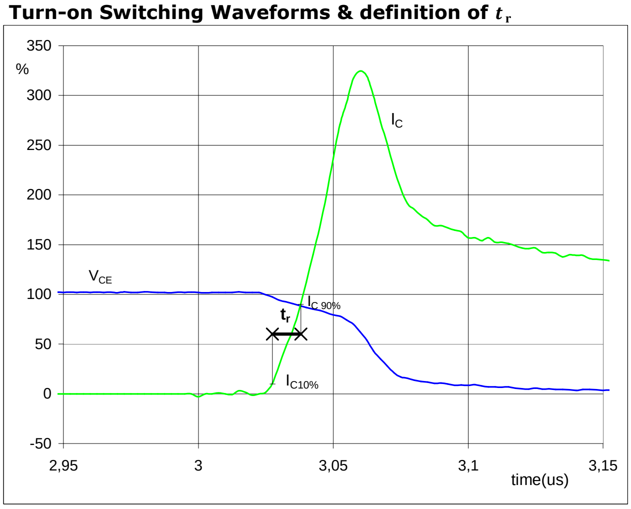
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	40	A
t_f =	0,04	µs

figure 4. **Boost IGBT**

Turn-on Switching Waveforms & definition of t_r

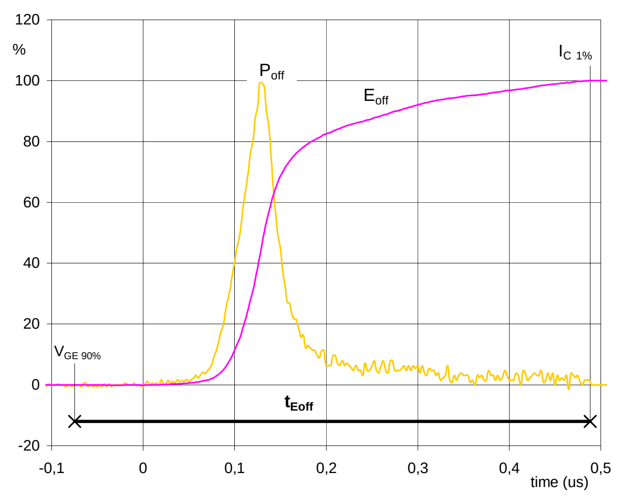


V_C (100%) =	600	V
I_C (100%) =	40	A
t_r =	0,01	µs

Switching Definitions BOOST IGBT

figure 5. **Boost IGBT**

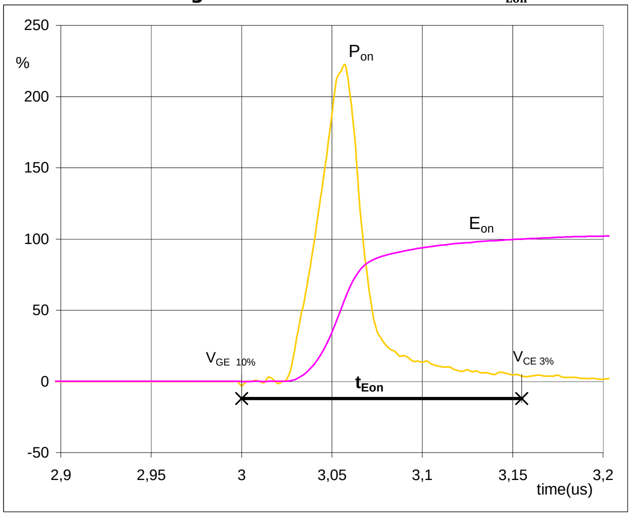
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	24,23	kW
E_{off} (100%) =	1,53	mJ
$t_{E\,off}$ =	0,56	μs

figure 6. **Boost IGBT**

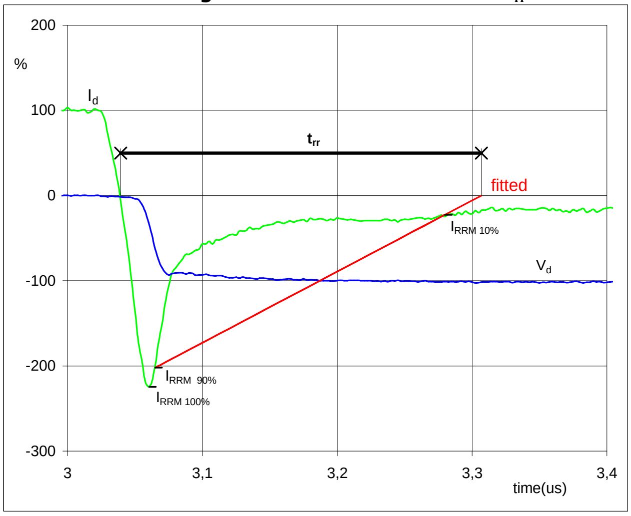
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	24,23	kW
E_{on} (100%) =	1,65	mJ
$t_{E\,on}$ =	0,15	μs

figure 7. **Boost FWD**

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

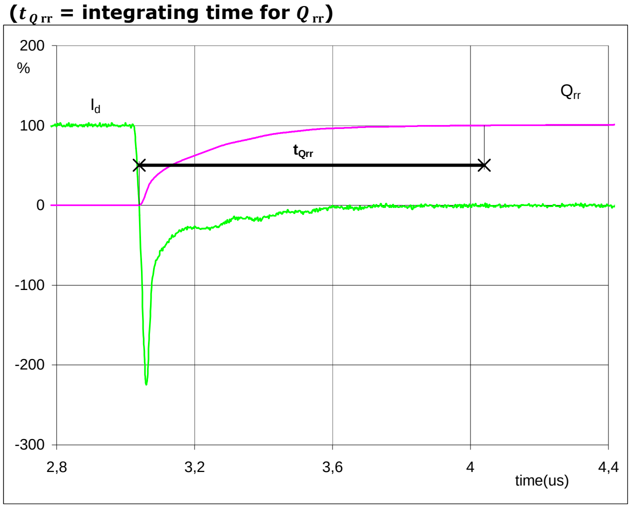


V_d (100%) =	600	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-91	A
t_{rr} =	0,27	μs

Switching Definitions BOOST FWD

figure 9.	Boost FWD

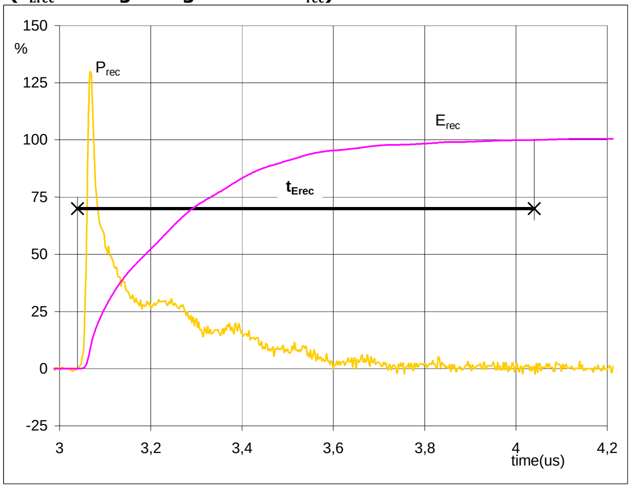
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	6,92	µC
$t_{Q\,rr}$ =	1,00	µs

figure 10.	Boost FWD

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



P_{rec} (100%) =	24,23	kW
E_{rec} (100%) =	3,36	mJ
$t_{E\,rec}$ =	1,00	µs

Ordering Code and Marking - Outline - Pinout

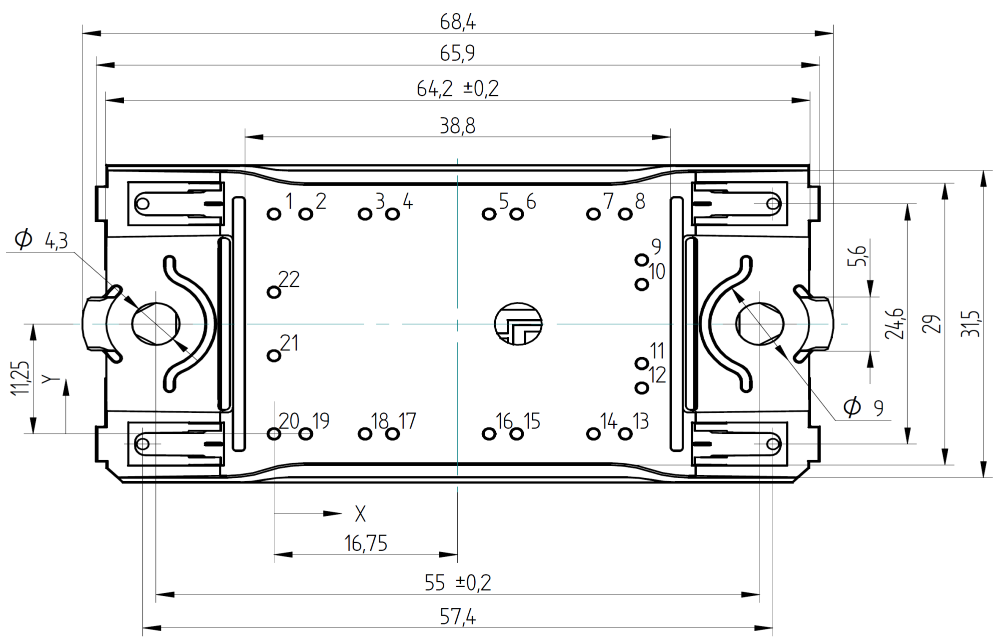
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P629-F72-PM	P629-F72-PM	P629-F72-PM

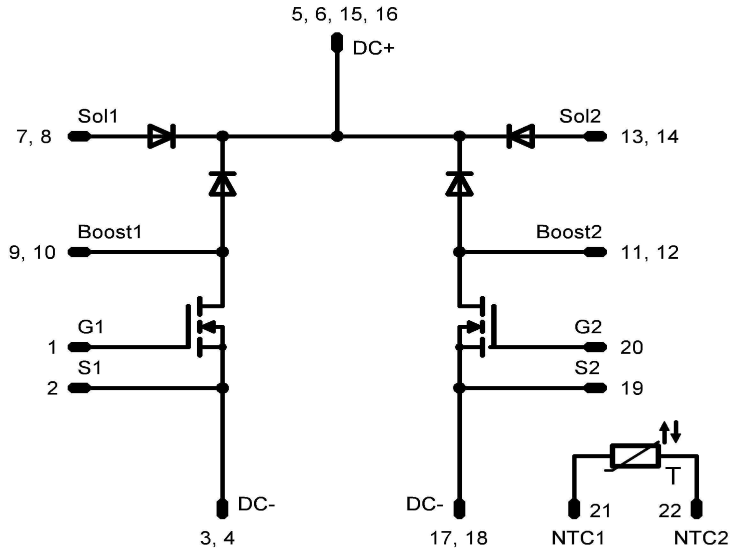
Outline

Pin table

Pin	X	Y
1	0	22,5
2	2,9	22,5
3	8,3	22,5
4	10,8	22,5
5	19,6	22,5
6	22,1	22,5
7	29,1	22,5
8	32	22,5
9	33,5	17,8
10	33,5	15,3
11	33,5	7,2
12	33,5	4,7
13	32	0
14	29,1	0
15	22,1	0
16	19,6	0
17	10,8	0
18	8,3	0
19	2,9	0
20	0	0
21	0	8
22	0	14,5



Pinout



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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.