B0-SP10S3A100S710-LR69L03T

datasheet

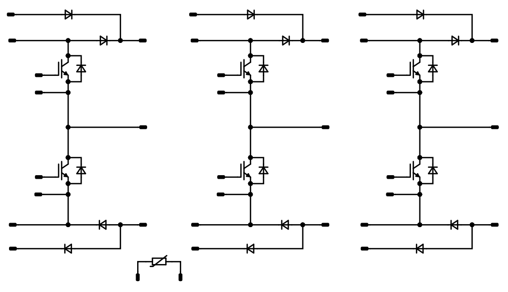
***flow*BOOST S3 symmetric triple** **950 V / 100 A**

Features

- Triple Symmetric Booster
- Latest IGBT & SiC technology
- Low inductance housing
- Integrated NTC

flow S3 12 mm housing

Schematic



Target applications

- Solar Inverters

Types

- B0-SP10S3A100S710-LR69L03T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Collector-emitter voltage	V_{CES}			950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	77	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	145	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	55	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		188	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 25 °C	284	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	152	W
Maximum junction temperature	T_{jmax}			175	°C
Boost Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	64	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	400	A
Surge current capability	I^2t			800	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	77	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
ByPass Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	64	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	400	A
Surge current capability	I^2t			800	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	77	W
Maximum junction temperature	T_{jmax}			150	°C
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
Creepage distance				8,83	mm
Clearance				7,54	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Values Min	Values Typ	Values Max	Unit
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00167	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125 150		1,67 1,94 2,01	2,35(1)	V
Collector-emitter cut-off current	I_{CES}		0	950		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			100	nA
Internal gate resistance	r_g							1,5		Ω
Input capacitance	C_{ies}	f = 100 kHz	0	25		25		6500		pF
Output capacitance	C_{oes}	f = 100 kHz	0	25		25		139		pF
Reverse transfer capacitance	C_{res}	f = 100 kHz	0	25		25		20		pF
Gate charge	Q_g		15		0	25		230		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,66		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	65	25 125 150		36,16 34,88 34,56		ns
Rise time	t_r	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	65	25 125 150		11,2 12,16 12,16		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	65	25 125 150		185,6 228,8 243,52		ns
Fall time	t_f	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	65	25 125 150		24,78 59,43 73,97		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,133 µC Q_{rFWD}=0,155 µC Q_{rFWD}=0,159 µC	0/15	600	65	25 125 150		1,28 1,46 1,48		mWs
Turn-off energy (per pulse)	E_{off}		0/15	600	65	25 125 150		1,89 3,16 3,37		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Diode										
Static										
Forward voltage	V_F				40	25 125 150		1,51 2,03 2,13	1,8(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25		120	1000	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,62		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=4635 A/µs d*i*/d*t*=4437 A/µs d*i*/d*t*=4492 A/µs	0/15	600	65	25 125 150		28,6 30,38 30,41		A
Reverse recovery time	t_{rr}					25 125 150		15,25 16,18 16,52		ns
Recovered charge	Q_r					25 125 150		0,133 0,155 0,159		µC
Reverse recovered energy	E_{rec}					25 125 150		0,047 0,057 0,058		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5333 5331 5091		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				35	25 125 150		1,09 1,02 1,02	1,5[1]	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 2000	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,91		K/W
ByPass Diode										
Static										
Forward voltage	V_F				35	25 125 150		1,09 1,02 1,02	1,5[1]	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 2000	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,91		K/W

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_{j} [°C]	Min	Typ	Max	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

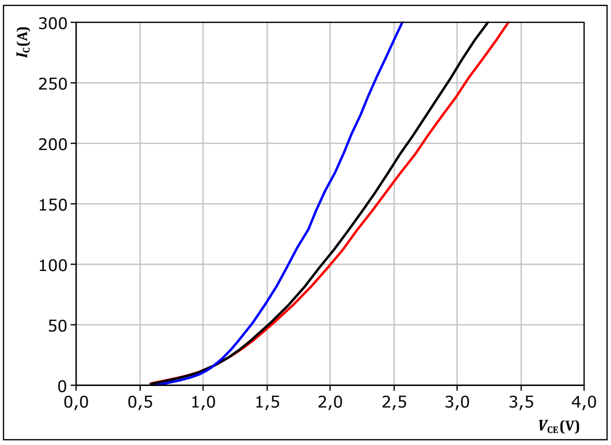
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



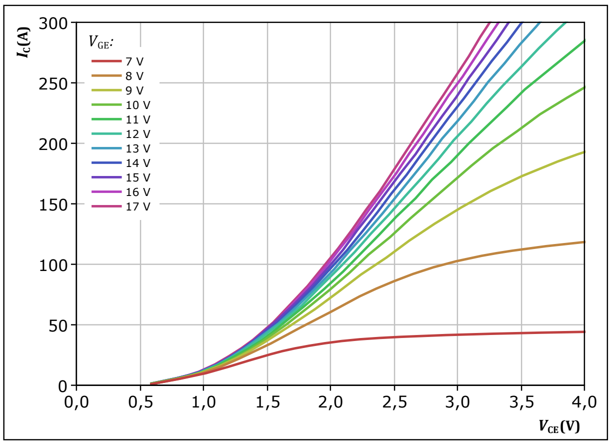
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



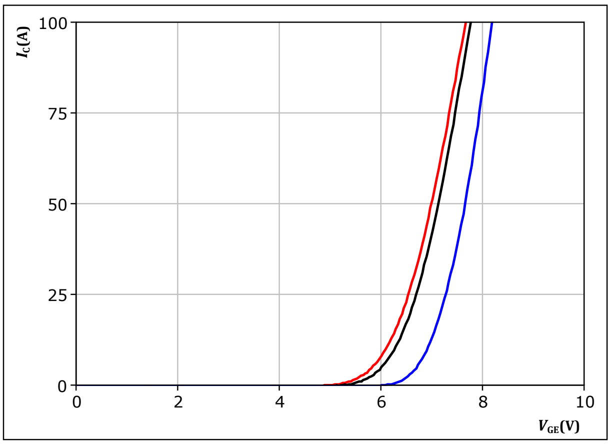
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



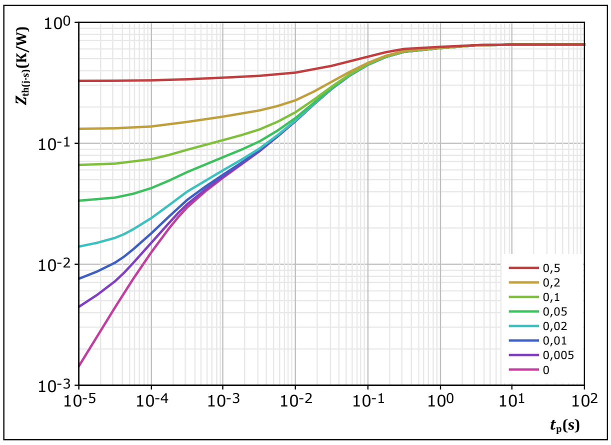
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,656	K/W

IGBT thermal model values

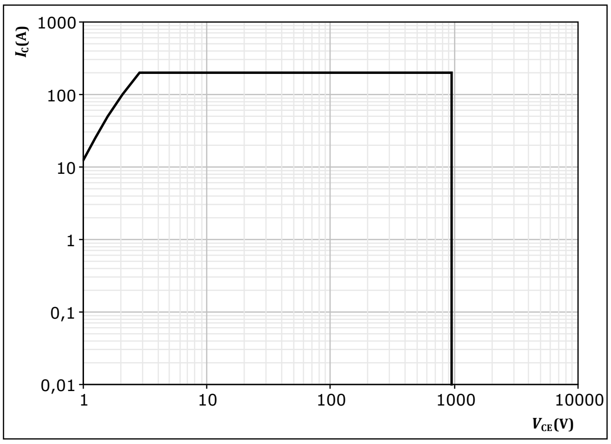
R (K/W)	τ (s)
8,75E-02	1,42E+00
3,39E-01	1,02E-01
1,74E-01	2,16E-02
2,53E-02	1,80E-03
3,08E-02	2,55E-04

Boost Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



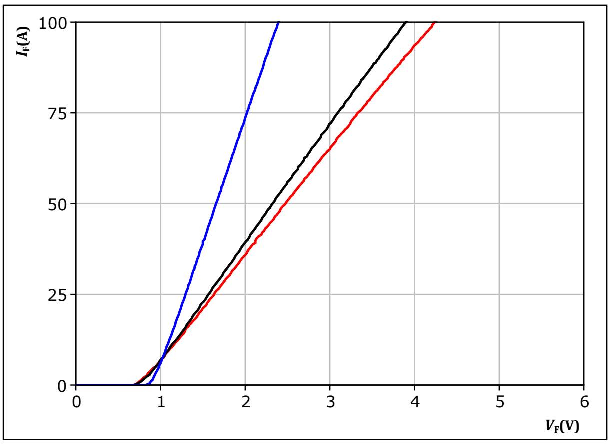
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



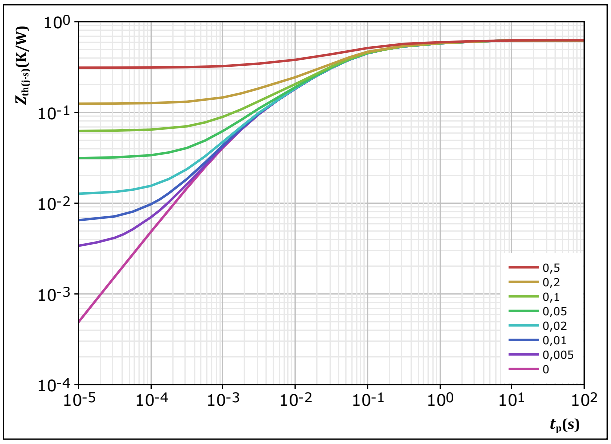
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,624 K/W

FWD thermal model values

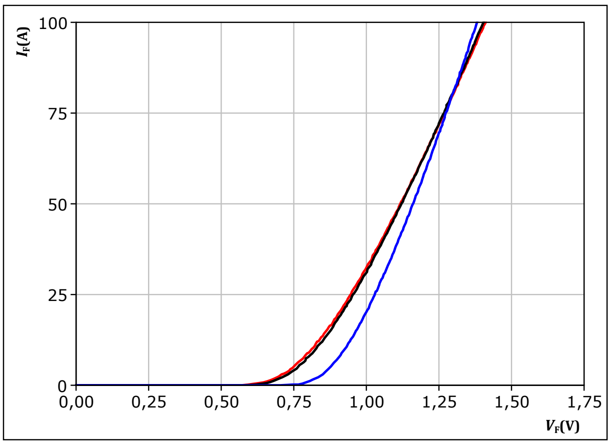
R (K/W)	τ (s)
4,85E-02	3,13E+00
8,72E-02	4,67E-01
2,96E-01	6,09E-02
1,32E-01	1,18E-02
6,05E-02	1,84E-03

Boost Sw. Protection Diode Characteristics

figure 8. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



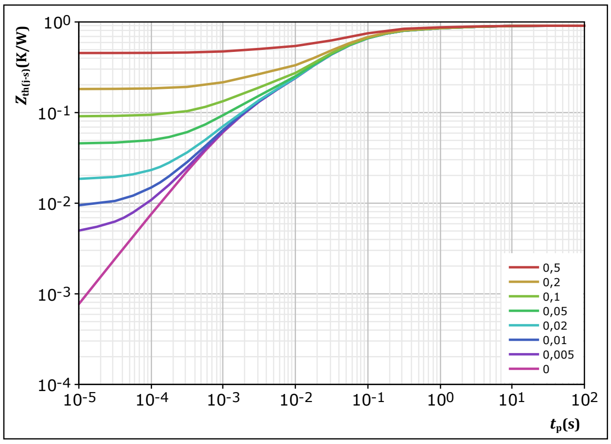
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 9. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,908 K/W

Rectifier thermal model values

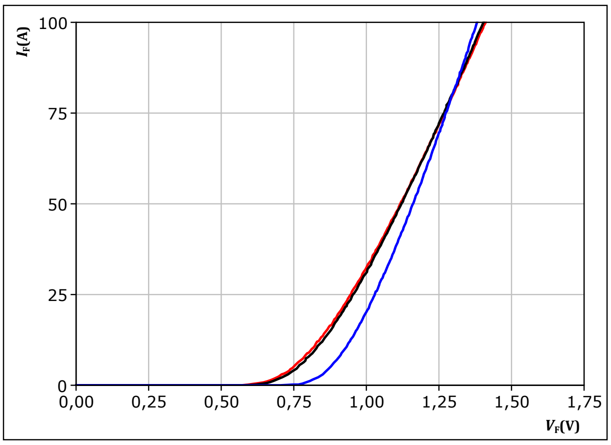
R (K/W)	τ (s)
4,71E-02	4,22E+00
8,03E-02	6,88E-01
3,52E-01	9,74E-02
3,38E-01	2,41E-02
9,09E-02	1,52E-03

ByPass Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



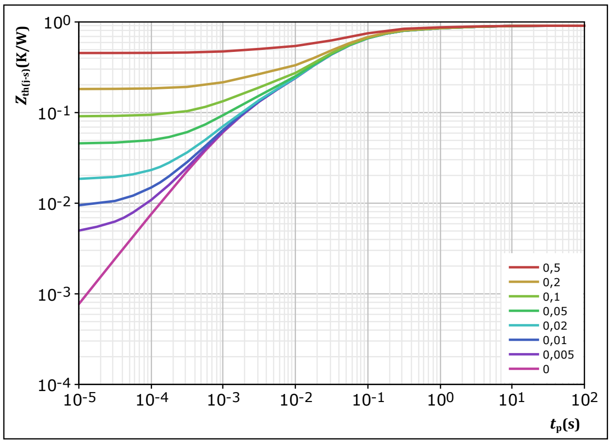
$t_p =$ 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 11. **Rectifier**

Transient thermal impedance as a function of pulse width

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



$D =$ t_p / T

$R_{th(j-s)} =$ 0,908 K/W

Rectifier thermal model values

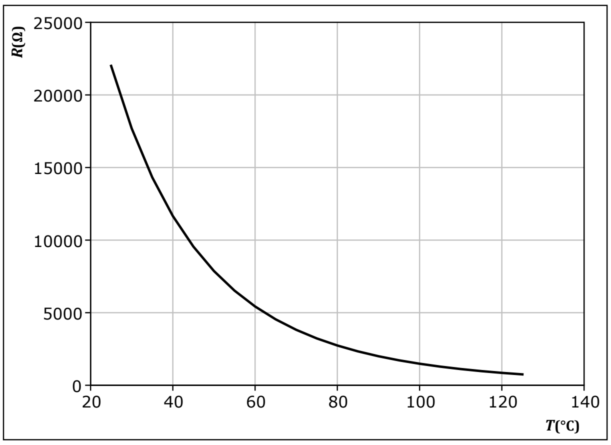
R (K/W)	τ (s)
4,71E-02	4,22E+00
8,03E-02	6,88E-01
3,52E-01	9,74E-02
3,38E-01	2,41E-02
9,09E-02	1,52E-03

Thermistor Characteristics

figure 12.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

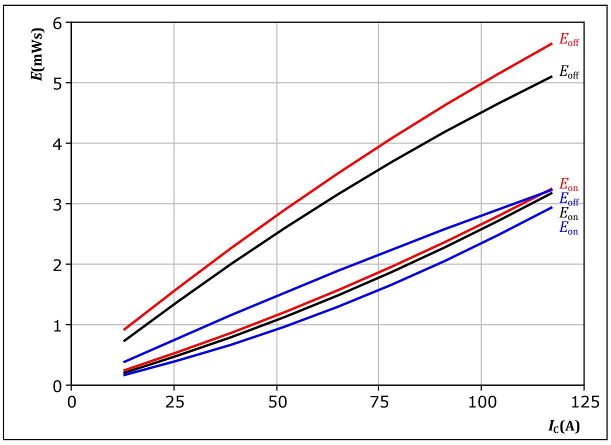


Boost Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



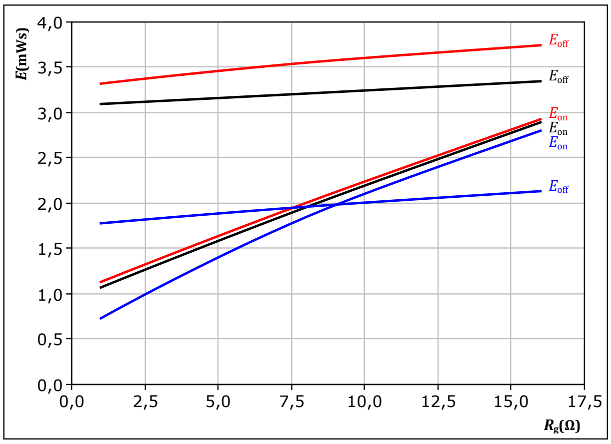
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 14. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



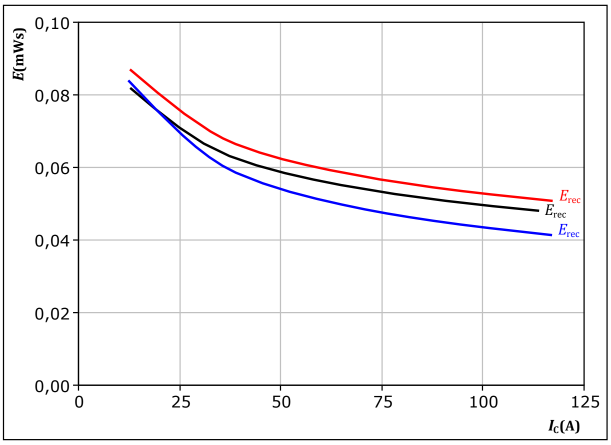
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	65	A		150 °C

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



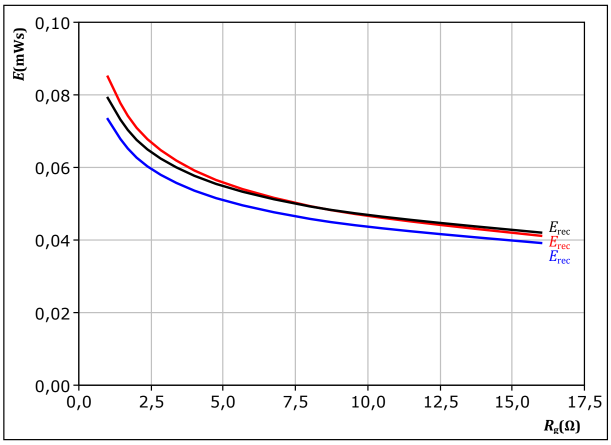
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 16. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

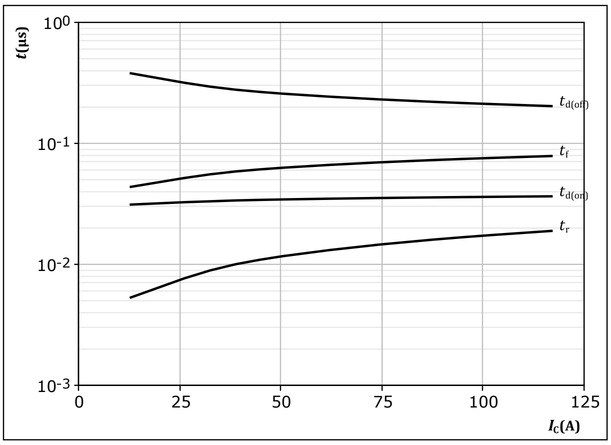
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	65	A		150 °C

Boost Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



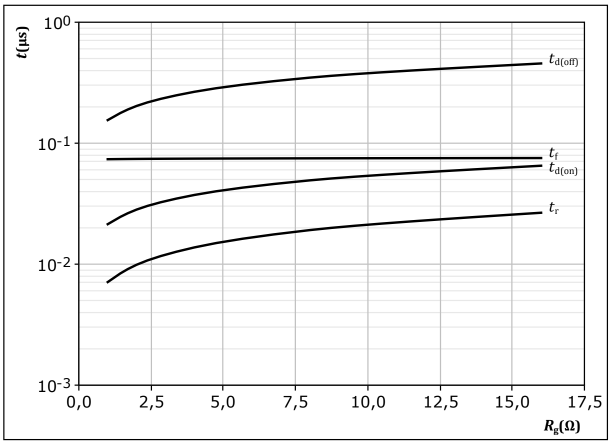
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 18. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



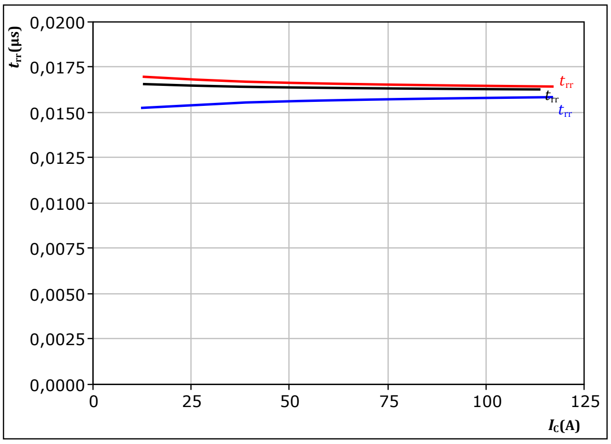
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	0/15	V
I_C =	65	A

figure 19. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

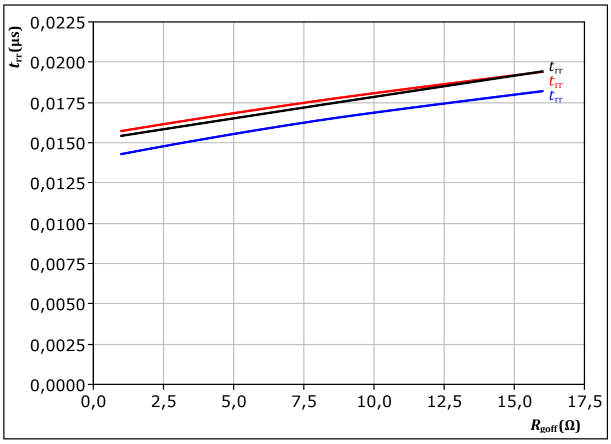
V_{CE} =	600	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 20. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	0/15	V
I_C =	65	A

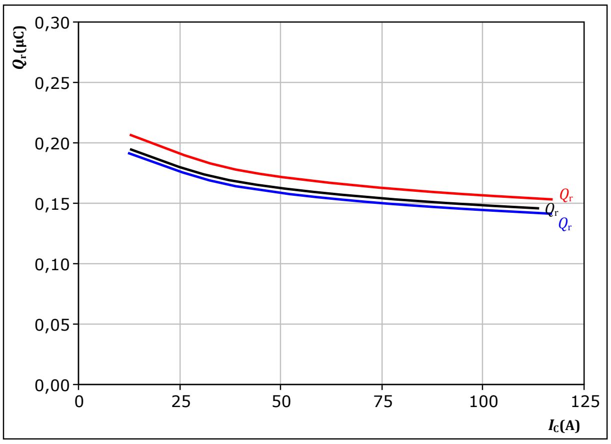
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



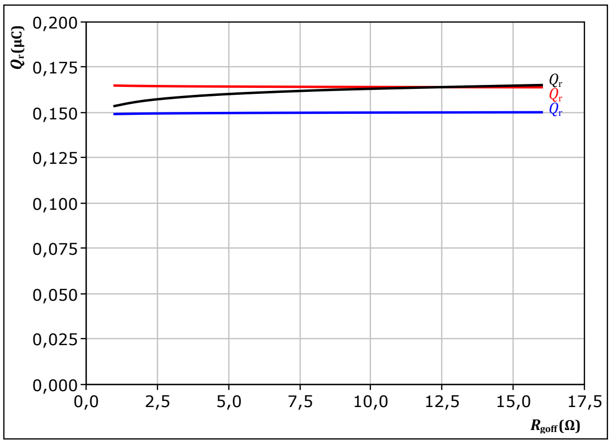
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 22. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



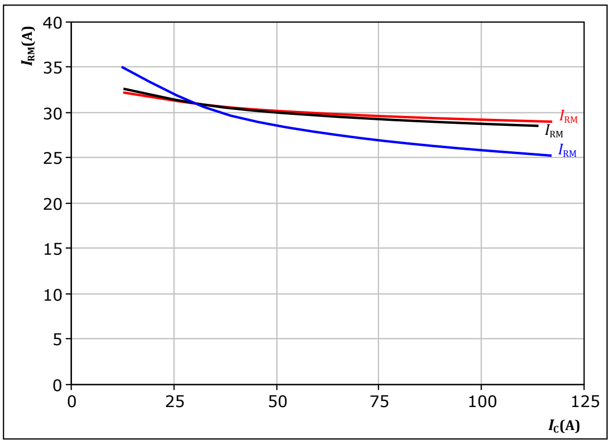
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	65	A		150 °C

figure 23. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



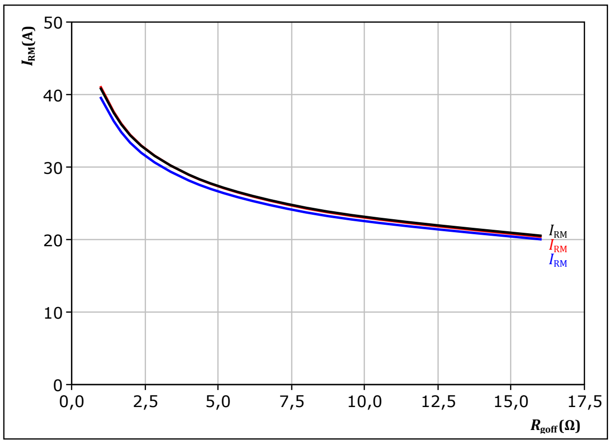
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 24. **FWD**

Typical peak reverse recovery current as a function of turn off gate resistor

I_{RM} = f(R_{goff})



With an inductive load at

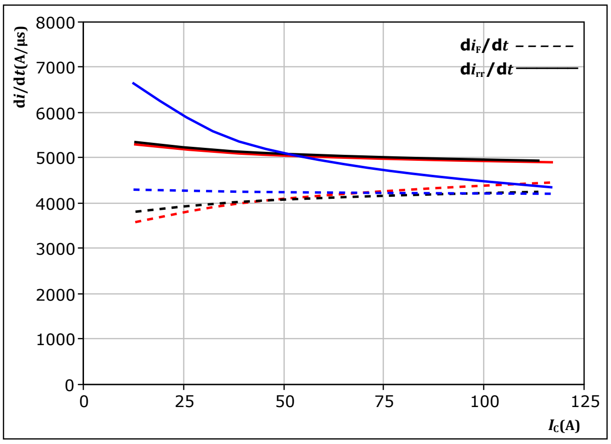
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	65	A		150 °C

Boost Switching Characteristics

figure 25. **FWD**

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

di_F/dt, di_{rr}/dt = f(I_C)



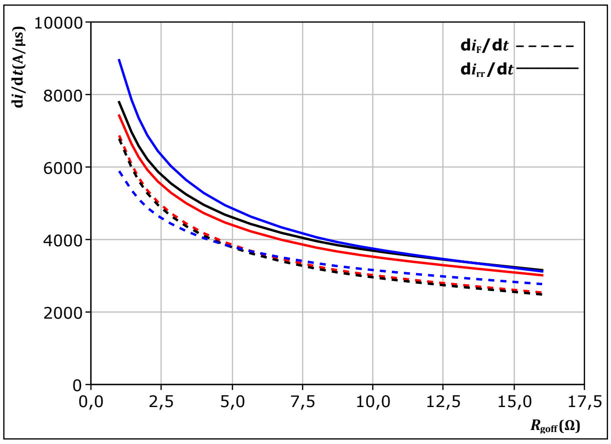
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 26. **FWD**

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

di_F/dt, di_{rr}/dt = f(R_{goff})



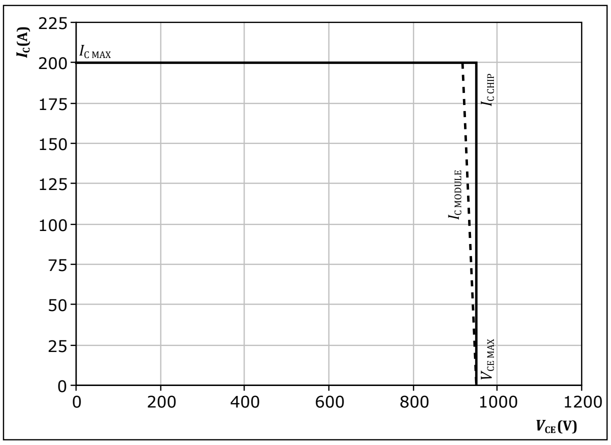
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	65	A		150 °C

figure 27. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Boost Switching Definitions

figure 28. **IGBT**

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

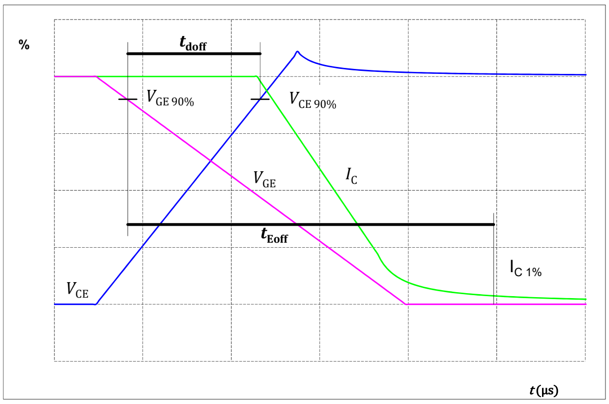


figure 29. **IGBT**

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

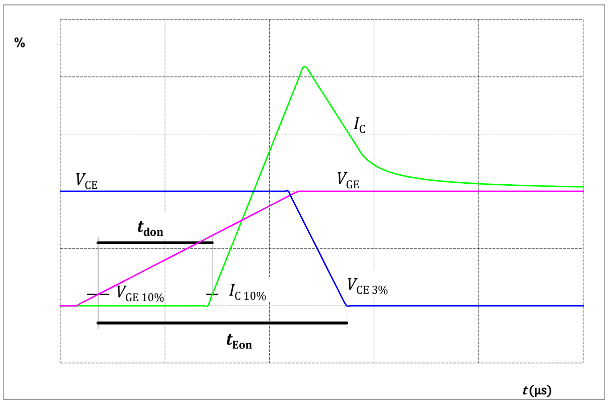


figure 30. **IGBT**

Turn-off Switching Waveforms & definition of t_f

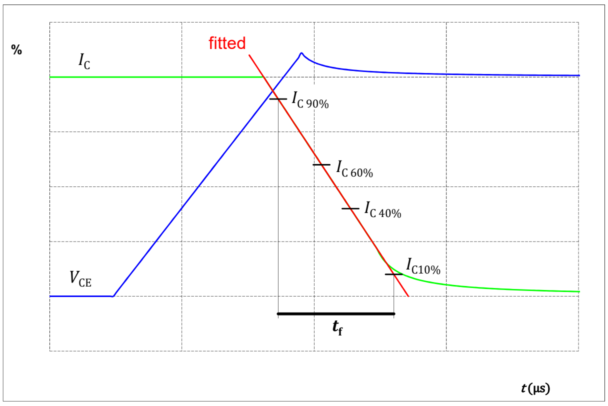
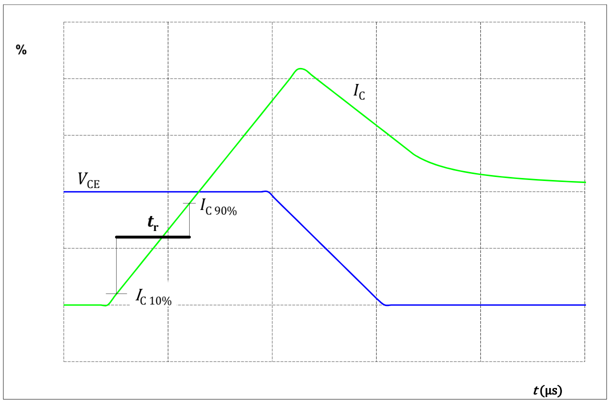


figure 31. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 32.	FWD

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

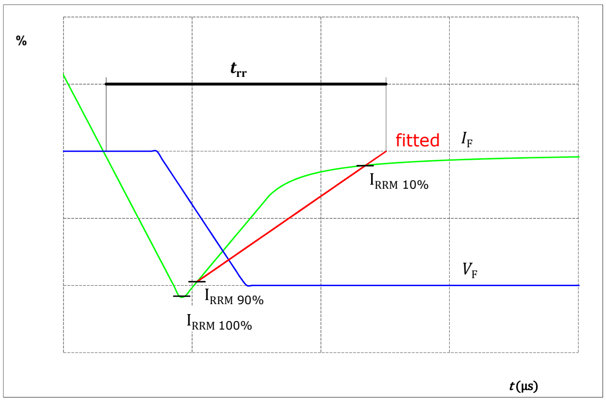
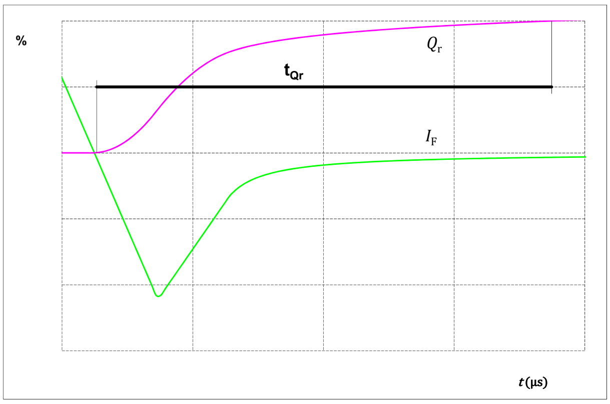


figure 33.	FWD

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



Ordering Code

Version	Ordering Code
With thermal paste (4,4 W/mK, PTM6000)	B0-SP10S3A100S710-LR69L03T-/7/

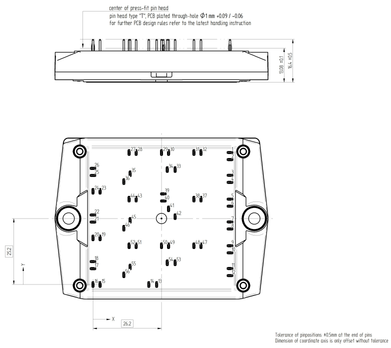
Marking

	**Text**	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
		NN-NNNNNNNNNNNNNN-TTTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

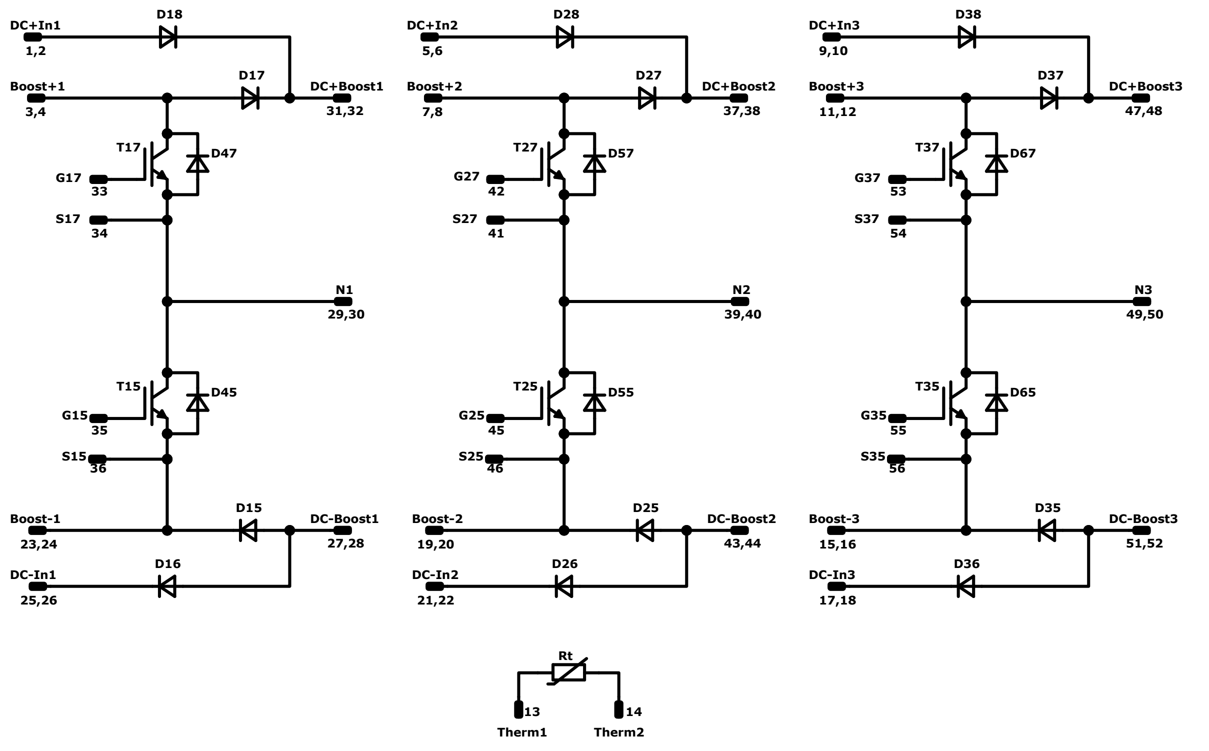
Outline

Pin table [mm]

Pin	X	Y	Function	29	26,2	50,4	N1
1	52,4	50,4	DC+In1	30	28,9	50,4	N1
2	52,4	47,7	DC+In1	31	38,6	50,4	DC+Boost1
3	52,4	41,7	Boost+1	32	41,3	50,4	DC+Boost1
4	52,4	39	Boost+1	33	31,4	43,9	G17
5	52,4	32,6	DC+In2	34	28,4	43,9	S17
6	52,4	29,9	DC+In2	35	14,2	42,3	G15
7	52,4	23,9	Boost+2	36	11,8	39,3	S15
8	52,4	21,2	Boost+2	37	41,3	32,6	DC+Boost2
9	52,4	14,8	DC+In3	38	38,6	32,6	DC+Boost2
10	52,4	12,1	DC+In3	39	26,9	34,6	N2
11	52,4	6,1	Boost+3	40	26,9	31,9	N2
12	52,4	3,4	Boost+3	41	28,9	28,9	S27
13	24,35	0	Therm1	42	31,4	25,9	G27
14	21,35	0	Therm2	43	16,5	32,6	DC-Boost2
15	2,7	0	Boost-3	44	13,8	32,6	DC-Boost2
16	0	0	Boost-3	45	14,2	24,5	G25
17	0	6,05	DC-In3	46	11,8	21,5	S25
18	0	8,75	DC-In3	47	41,3	14,8	DC+Boost3
19	2,7	17,8	Boost-2	48	38,6	14,8	DC+Boost3
20	0	17,8	Boost-2	49	28,9	14,8	N3
21	0	23,85	DC-In2	50	26,2	14,8	N3
22	0	26,55	DC-In2	51	16,5	14,8	DC-Boost3
23	2,7	35,6	Boost-1	52	13,8	14,8	DC-Boost3
24	0	35,6	Boost-1	53	31,4	8,3	G37
25	0	41,65	DC-In1	54	28,4	8,3	S37
26	0	44,35	DC-In1	55	14,2	6,7	G35
27	13,8	50,4	DC+Boost1	56	11,8	3,7	S35
28	16,5	50,4	DC-Boost1				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T15, T17, T25, T27, T35, T37	IGBT	950 V	100 A	Boost Switch	
D15, D17, D25, D27, D35, D37	FWD	1200 V	40 A	Boost Diode	
D45, D47, D57, D55 , D65, D67	Rectifier	1600 V	35 A	Boost Sw. Protection Diode	
D16, D18, D26, D28, D36, D38	Rectifier	1600 V	35 A	ByPass Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 45	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* S3 packages see vincotech.com website.

Package data
Package data for *flow* S3 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
B0-SP10S3A100S710-LR69L03T-D1-14	21 Jul. 2021		