Vincotech

10-F124NID200SH03-LG19F98
10-F124NIE200SH03-LG29F98
datasheet

***flow*NPC 1 split** **1500 V / 200 A**

Features

- Enhanced efficiency
- Low inductive package
- Tandem diodes
- Enables 1500 V_{DC}

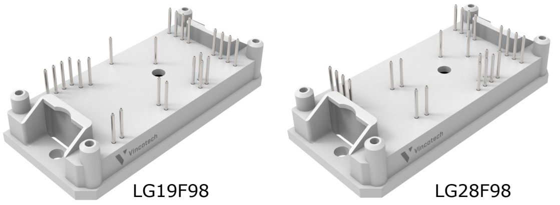
Target applications

- Solar Inverters

Types

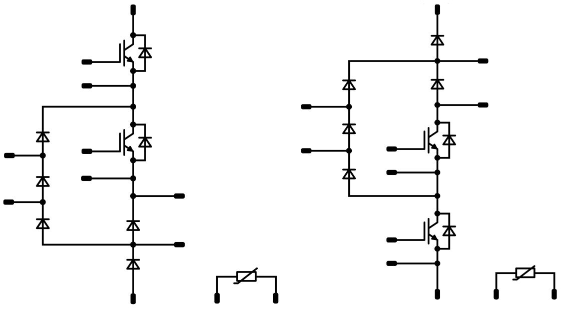
- 10-F124NID200SH03-LG19F98
- 10-F124NIE200SH03-LG29F98

flow 1 housing



LG19F98 LG28F98

Schematic



LG19F98 LG28F98

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Buck Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	147	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	600	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	306	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V V_{cc} = 800 V T_j = 150 °C	10	µs
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}		1300	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	128	A
Repetitive peak forward current	I_{FRM}		400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	317	W
Maximum junction temperature	T_{jmax}		175	°C
Buck Sw. Protection Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	57	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150°C	430	A
Surge current capability	I^2t		925	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	109	W
Maximum Junction Temperature	T_{jmax}		175	°C
Boost Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C		154	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	247	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
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	57	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150°C	430	A
Surge current capability	I^2t		925	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	109	W
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost Sw.Inv.Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F		75	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	890	A
Surge current capability	I^2t		3960	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	95	W
Maximum junction temperature	T_{jmax}		150	°C
Boost Sw. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F		75	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	890	A
Surge current capability	I^2t		3960	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	95	W
Maximum junction temperature	T_{jmax}		150	°C
Boost D. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	32	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	170	A
Surge current capability	I^2t		145	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	71	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_{jop}			-40…(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				min. 12,7	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Value**			**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**	
Buck Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0076	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125 150	1,78	1,99 2,29 2,37	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,6	μA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		12300		pF
Reverse transfer capacitance	C_{res}							690		
Gate charge	Q_g		15			25		1600		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,31		K/W
Dynamic*										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	600	200	25 125 150		159 159 159		ns
Rise time	t_r					25 125 150		26 28 29		
Turn-off delay time	$t_{d(off)}$					25 125 150		248 305 315		
Fall time	t_f					25 125 150		28 55 64		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 5 μC Q_{rFWD} = 10,6 μC Q_{rFWD} = 12,4 μC				25 125 150		9,72 12,47 13,46		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		6,64 11,26 12,53		

* Values are given with the measurment ciruit on page 25

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Value**			**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**	
Buck Diode										
Static										
Forward voltage	V_F				200	25 125 150		3,36 3,14 3,04	3,54	V
Reverse leakage current	I_R			650		25			10,6	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,30		K/W
Dynamic*										
Peak recovery current	I_{RRM}	di/dt = 7960 A/µs di/dt = 7739 A/µs di/dt = 7503 A/µs	±15	600	200	25 125 150		114 166 178		A
Reverse recovery time	t_{rr}					25 125 150		82 112 126		ns
Recovered charge	Q_r					25 125 150		5,03 10,61 12,39		µC
Reverse recovered energy	E_{rec}					25 125 150		1,42 3,38 4,01		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3849 1256 1375		A/µs
* Values are given with the measurment ciruit on page 25										
Buck Sw. Protection Diode										
Static										
Forward voltage	V_F				75	25 150		2,16 2,24	2,49	V
Reverse leakage current	I_r			1200		25 150			120 14000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,87		K/W

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Value**			**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 Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,02	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125 150		1,53 1,70 1,75	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			200	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1000	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		42000		pF
Output capacitance	C_{oes}							1400		
Reverse transfer capacitance	C_{res}							560		
Gate charge	Q_g		15	600	200	25		1400		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,38		K/W
Dynamic*										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	200	25 125 150		642 630 626		ns
Rise time	t_r					25 125 150		97 110 114		
Turn-off delay time	$t_{d(off)}$					25 125 150		454 485 495		
Fall time	t_f					25 125 150		79 107 121		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 8,8 µC Q_{rFWD} = 19,4 µC Q_{rFWD} = 23,9 µC				25 125 150		25,512 32,545 35,643		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		12,871 17,623 19,323		

* Values are given with the measurment ciruit on page 31

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Value**			**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				75	25 150		2,16 2,24	2,49	V
Reverse leakage current	I_r			1200		25 150			120 14000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,87		K/W
Dynamic*										
Peak recovery current	I_{RRM}	di/dt = 739 A/µs di/dt = 968 A/µs di/dt = 1147 A/µs	±15	600	200	25 125 150		58 77 84		A
Reverse recovery time	t_{rr}					25 125 150		396 587 670		ns
Recovered charge	Q_r					25 125 150		8,801 19,433 23,921		µC
Reverse recovered energy	E_{rec}					25 125 150		2,962 6,978 8,630		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		262 137 168		A/µs

* Values are given with the measurment ciruit on page 31

Parameter	**Symbol**	**Conditions**					**Value**			**Unit**
Boost Sw.Inv.Diode										
Static										
Forward voltage	V_F				75	25 125		1,10 1,04		V
Reverse leakage current	I_R			1600		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,74		K/W
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				75	25 125		1,10 1,04		V
Reverse leakage current	I_R			1600		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,74		K/W

Characteristic Values

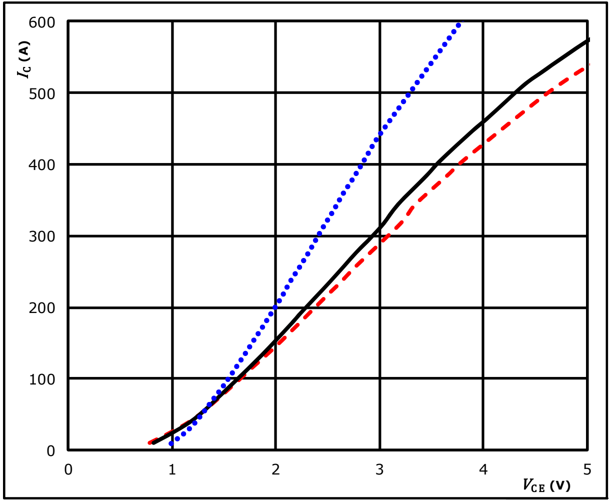
Parameter	**Symbol**	**Conditions**					**Value**			**Unit**
			V_{GE} **[V]** V_{GS} **[V]**	V_{CE} **[V]** V_{DS} **[V]** V_{F} **[V]**	I_{C} **[A]** I_{D} **[A]** I_{F} **[A]**	T_{j} **[°C]**	**Min**	**Typ**	**Max**	
Boost D. Protection Diode										
Static										
Forward voltage	V_{F}				35	25 150		2,37 2,35	2,62	V
Reverse leakage current	I_{R}			1200		25 150			60 5500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,34		K/W
Thermistor										
Rated resistance	R					25		22		kΩ
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	

Buck Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

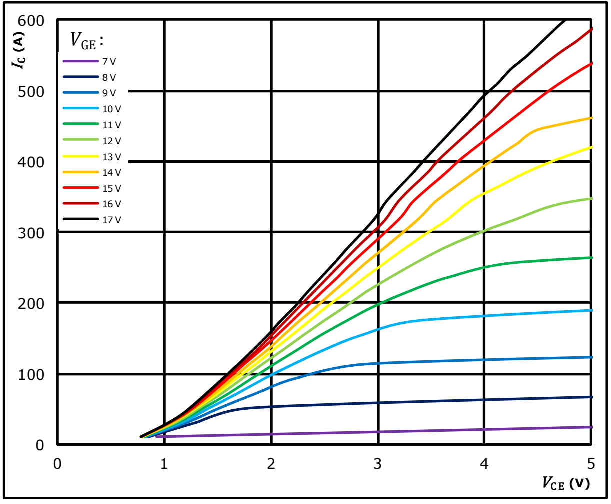


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C ••••••••••••
125 °C ━━━━━
150 °C ━ ━ ━ ━

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

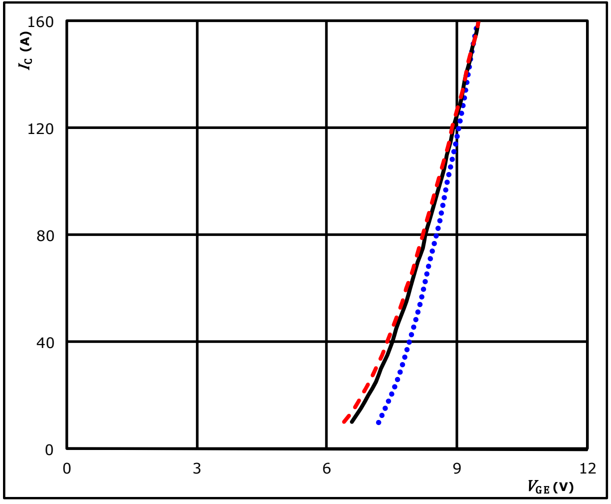


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

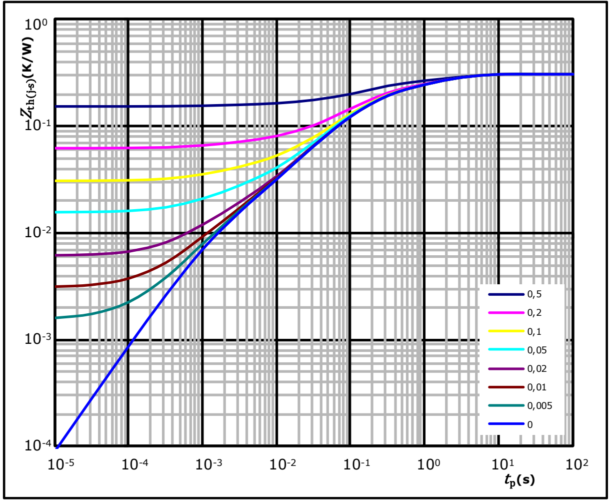


t_p = 100 µs
V_{CE} = 10 V
T_j: 25 °C ••••••••••••
125 °C ━━━━━
150 °C ━ ━ ━ ━

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T
$R_{th(j-s)}$ = 0,31 K/W

IGBT thermal model values

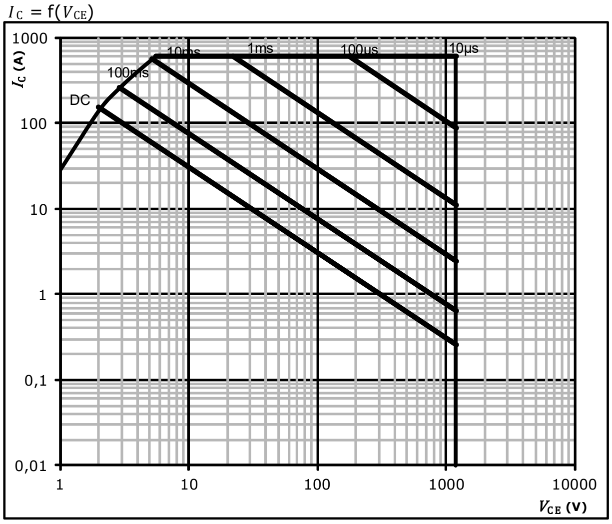
R (K/W)	τ (s)
9,35E-02	2,07E+00
7,50E-02	3,51E-01
1,16E-01	9,41E-02
1,89E-02	1,25E-02
7,76E-03	1,26E-03

Buck Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



D = single pulse

T_s = 80 ºC

V_{GE} = ±15 V

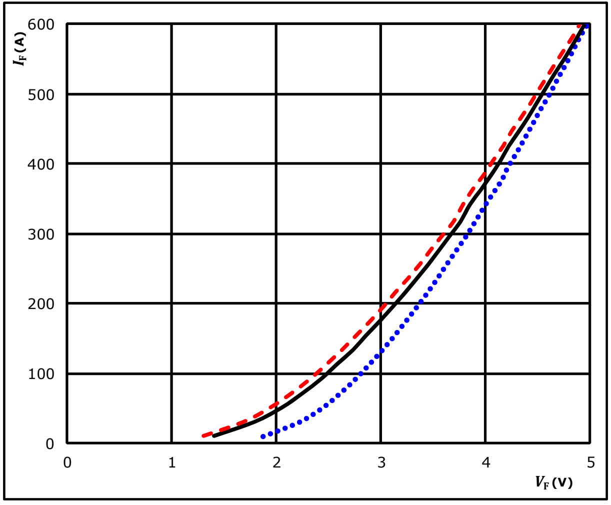
T_j = T_{jmax}

Buck Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



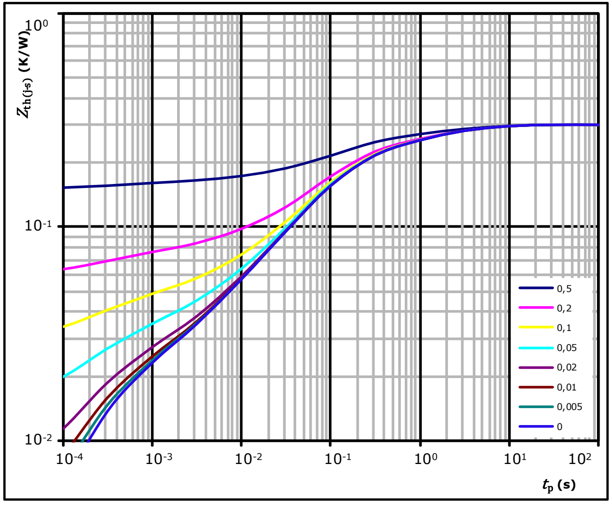
t_p = 250 µs

T_j:
25 °C ••••••••••••
125 °C ▬▬▬▬
150 °C ▬ ▬ ▬ ▬

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,30 K/W

FWD thermal model values

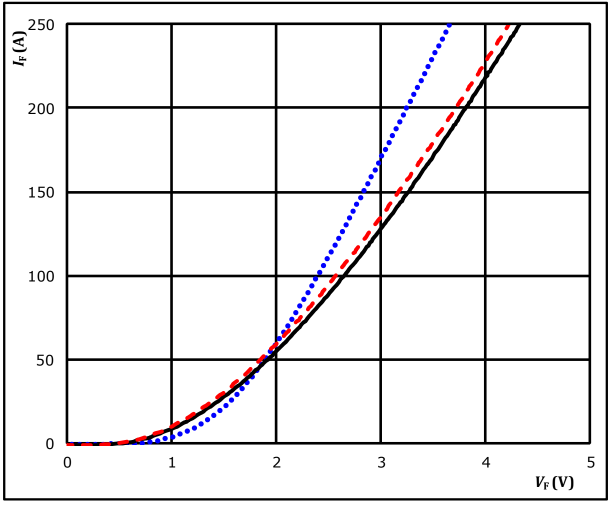
R (K/W)	τ (s)
2,63E-02	5,38E+00
5,41E-02	1,20E+00
9,07E-02	1,90E-01
8,31E-02	5,93E-02
2,35E-02	8,54E-03
8,59E-03	1,18E-03
1,38E-02	2,37E-04

Buck Sw. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



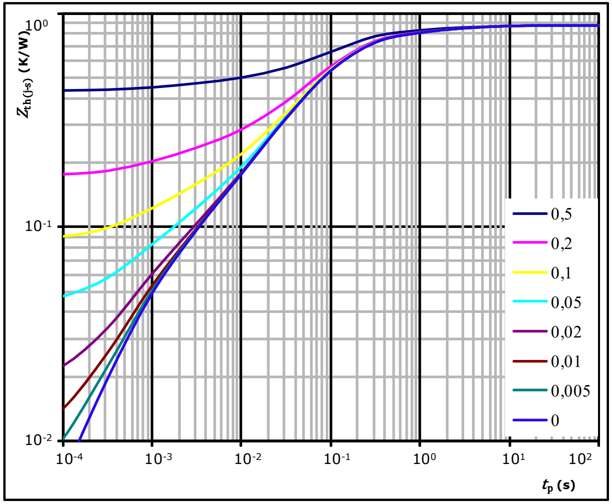
t_p = 250 µs

T_j:
25 °C ••••••••••
125 °C ▬▬▬
150 °C - - - -

figure 2. **Prot. Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,87 K/W

Prot. Diode thermal model values

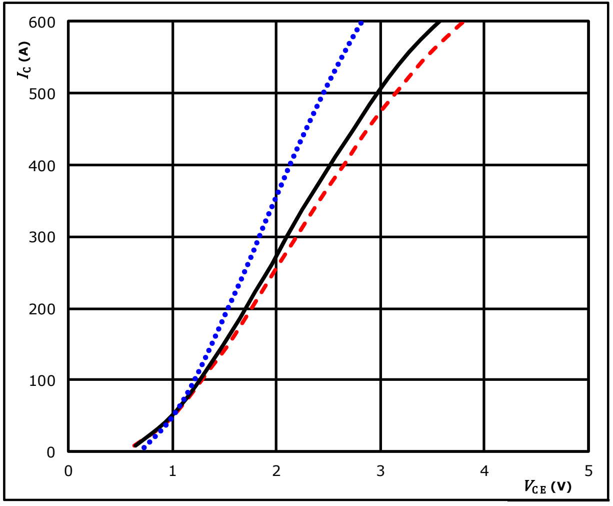
R (K/W)	τ (s)
5,30E-02	3,91E+00
1,18E-01	6,14E-01
4,44E-01	1,10E-01
1,61E-01	2,86E-02
5,06E-02	5,08E-03
4,44E-02	8,90E-04

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

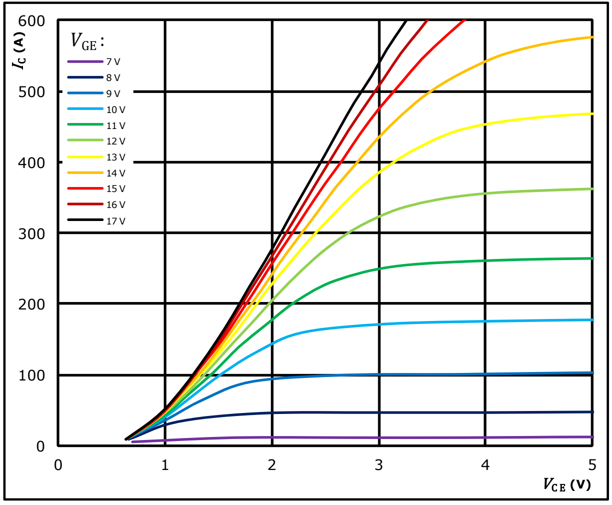
V_{GE} = 15 V

T_j:
25 °C ••••••••••
125 °C ▬▬▬
150 °C – – – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

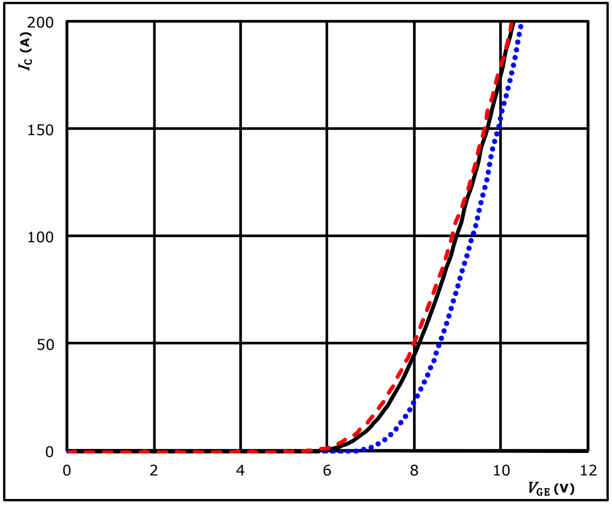
T_j = 150 °C

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 = 100 µs

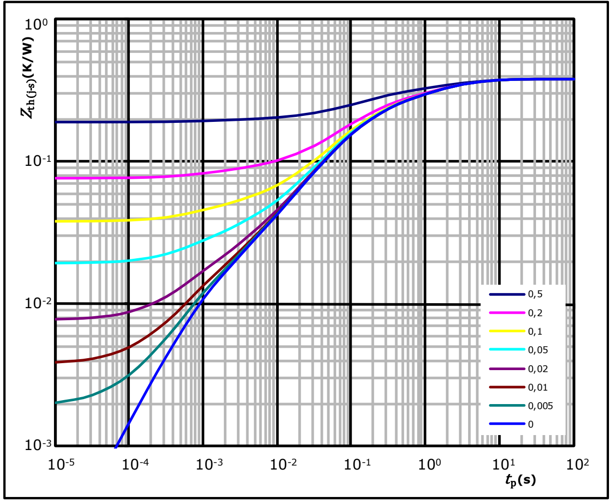
V_{CE} = 10 V

T_j:
25 °C ••••••••••
125 °C ▬▬▬
150 °C – – – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,38 K/W

IGBT thermal model values

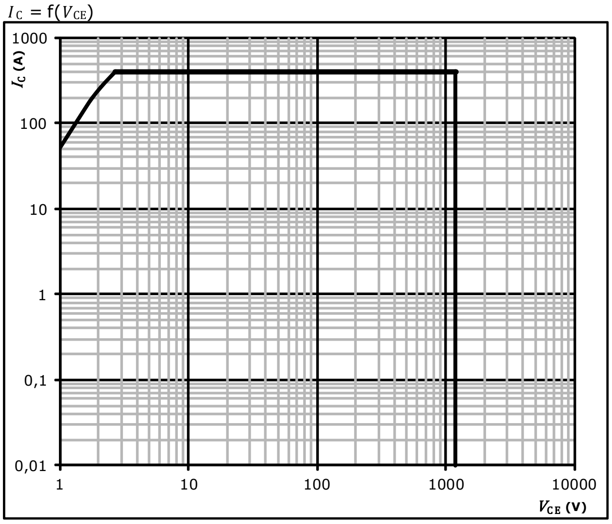
R (K/W)	τ (s)
5,41E-02	4,17E+00
9,46E-02	1,11E+00
9,45E-02	2,29E-01
1,11E-01	6,87E-02
1,98E-02	1,02E-02
1,09E-02	9,51E-04

Boost Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



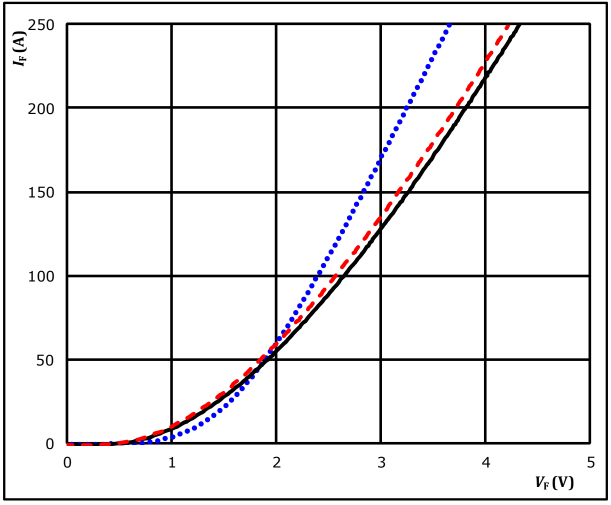
D = single pulse
T_s = 80 ºC
V_{GE} = ±15 V
T_j = T_{jmax}

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

I_F = f(V_F)



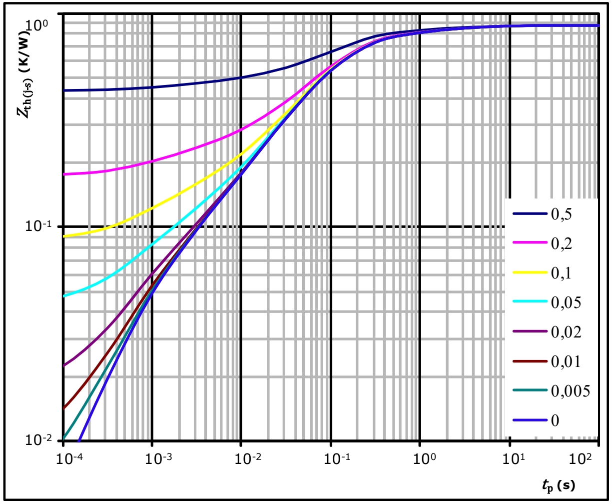
t_p = 250 μs

T_j: 25 °C ••••••••
125 °C ——
150 °C – – –

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,87 K/W

FWD thermal model values

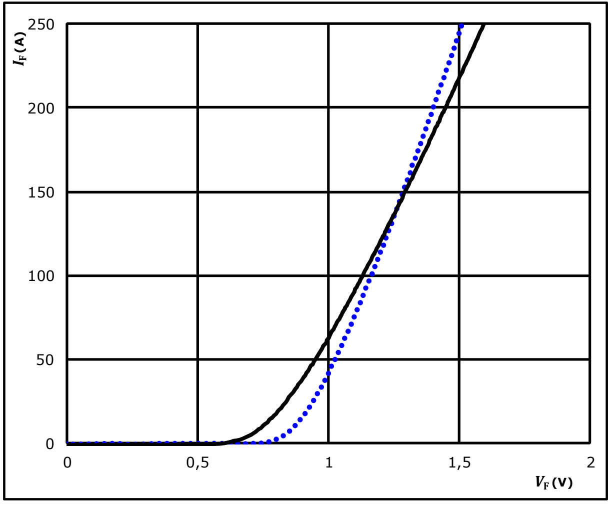
R (K/W)	τ (s)
5,30E-02	3,91E+00
1,18E-01	6,14E-01
4,44E-01	1,10E-01
1,61E-01	2,86E-02
5,06E-02	5,08E-03
4,44E-02	8,90E-04

Boost Sw.Inv.Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



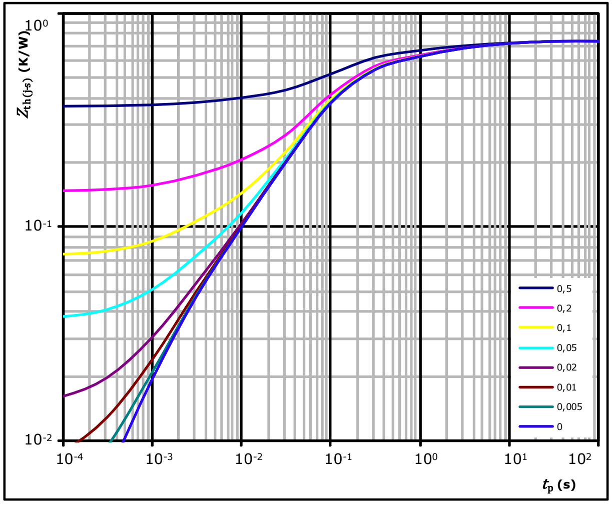
t_p = 250 µs

T_j: 25 °C ••••••••••••
125 °C ▬▬▬

figure 2. **Prot. Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,74 K/W

Prot. Diode thermal model values

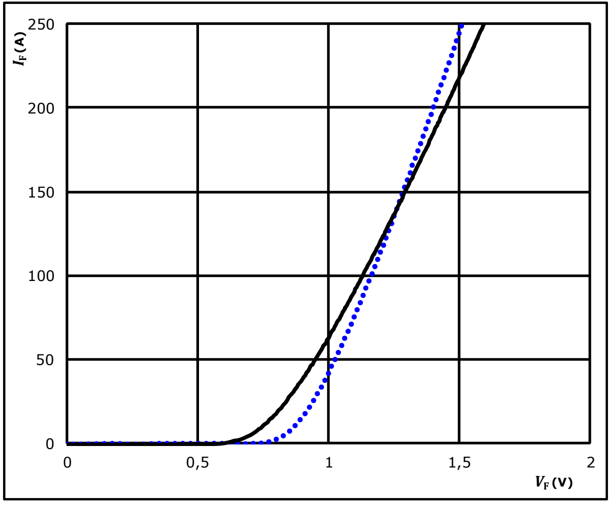
R (K/W)	τ (s)
6,95E-02	7,08E+00
1,21E-01	1,15E+00
2,75E-01	1,52E-01
2,24E-01	5,48E-02
3,60E-02	4,07E-03
1,01E-02	1,33E-03

Boost Sw. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

I_F = f(V_F)



t_p = 250 µs

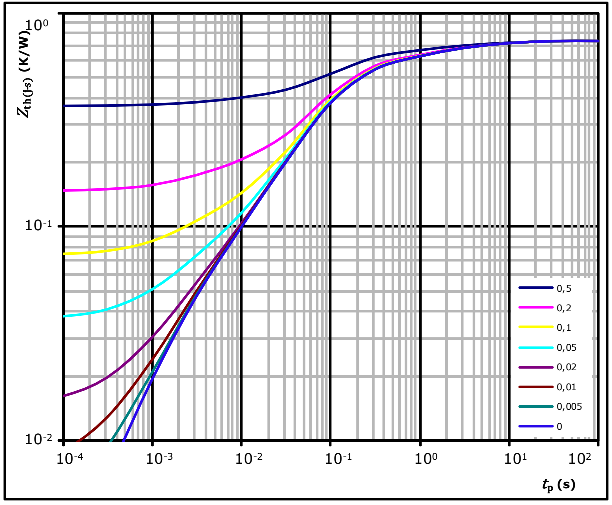
T_j: 25 °C ············

125 °C ———

figure 2. **Prot. Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,74 K/W

Prot. Diode thermal model values

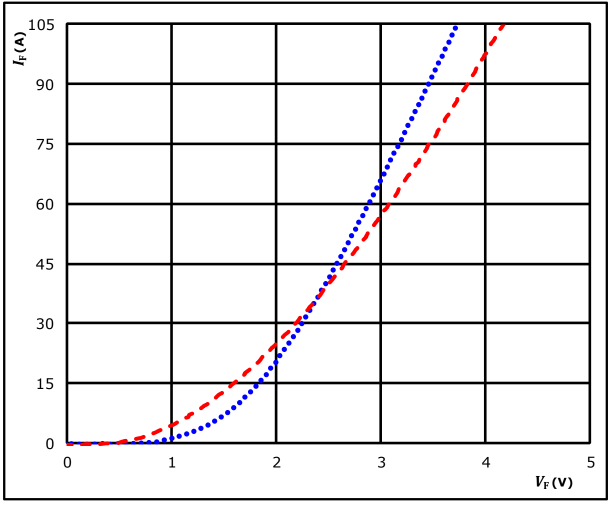
R (K/W)	τ (s)
6,95E-02	7,08E+00
1,21E-01	1,15E+00
2,75E-01	1,52E-01
2,24E-01	5,48E-02
3,60E-02	4,07E-03
1,01E-02	1,33E-03

Boost D. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



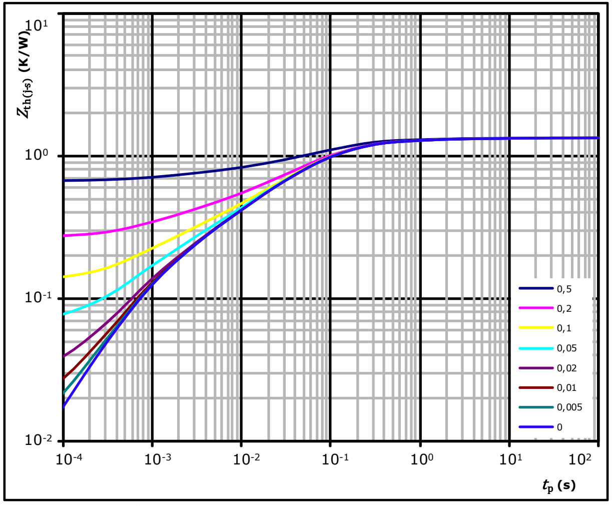
t_p = 250 µs

T_j:
25 °C ••••••••••••
150 °C – – – –

figure 2. **Prot. Diode**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,34 K/W

Prot. Diode thermal model values

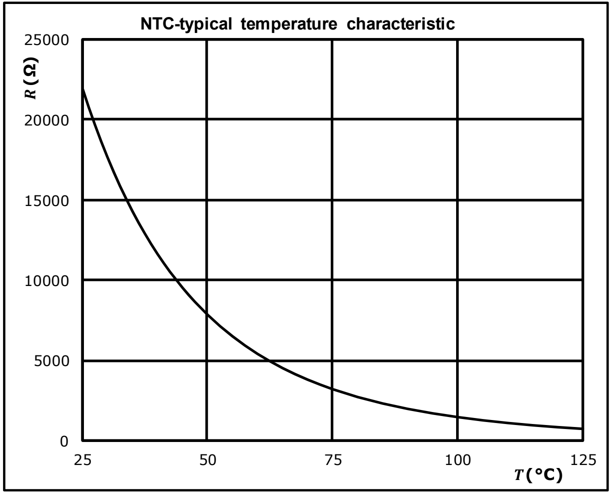
R (K/W)	τ (s)
3,06E-02	9,16E+00
1,47E-01	6,10E-01
6,10E-01	8,89E-02
2,96E-01	2,14E-02
1,39E-01	5,05E-03
1,19E-01	9,19E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

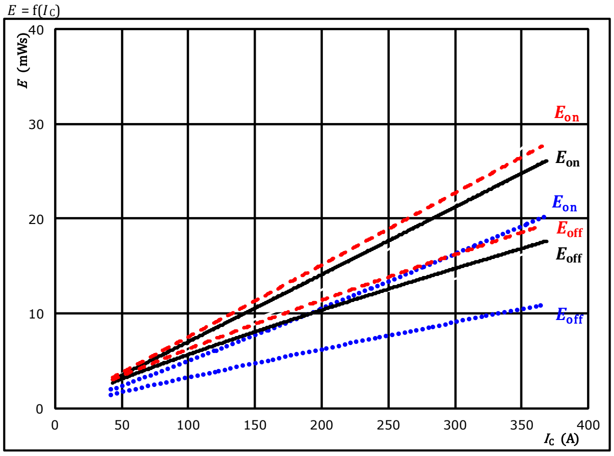


Buck Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

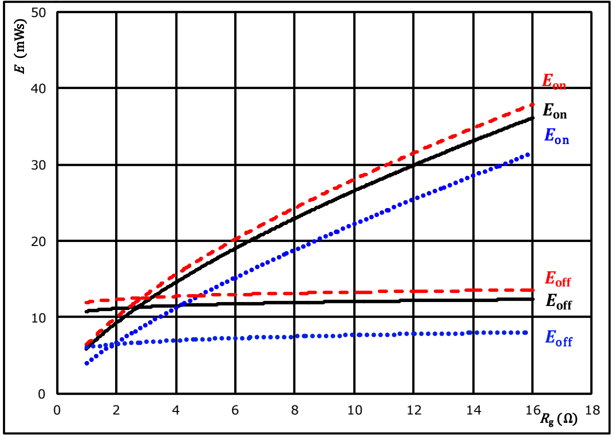
T_j: 25 °C ••••••••• ; 125 °C ━━━━ ; 150 °C ‒ ‒ ‒ ‒

V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

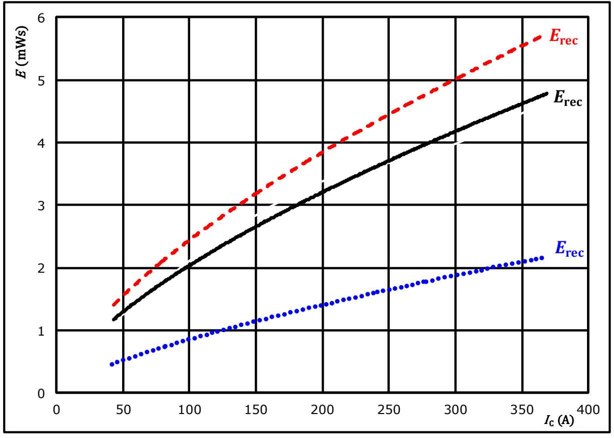
T_j: 25 °C ••••••••• ; 125 °C ━━━━ ; 150 °C ‒ ‒ ‒ ‒

V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 200 A

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

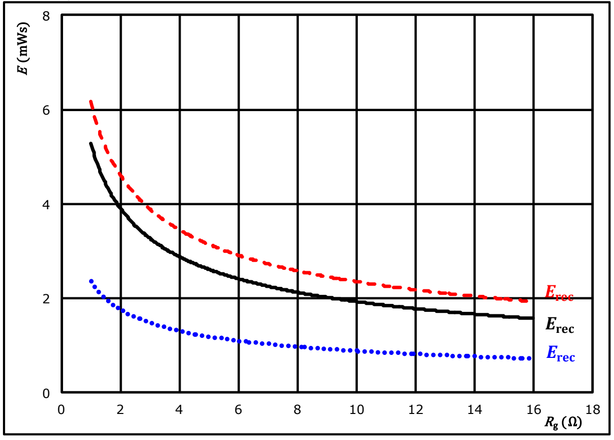
T_j: 25 °C ••••••••• ; 125 °C ━━━━ ; 150 °C ‒ ‒ ‒ ‒

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

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

T_j: 25 °C ••••••••• ; 125 °C ━━━━ ; 150 °C ‒ ‒ ‒ ‒

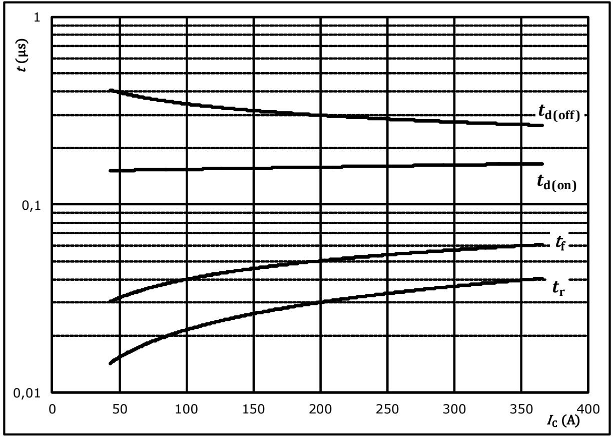
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 200 A

Buck Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



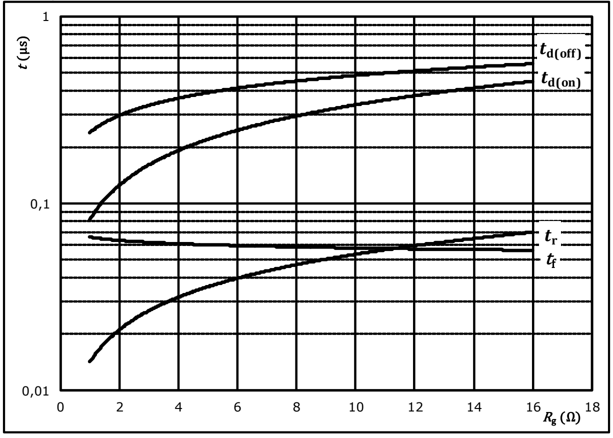
With an inductive load at

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

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



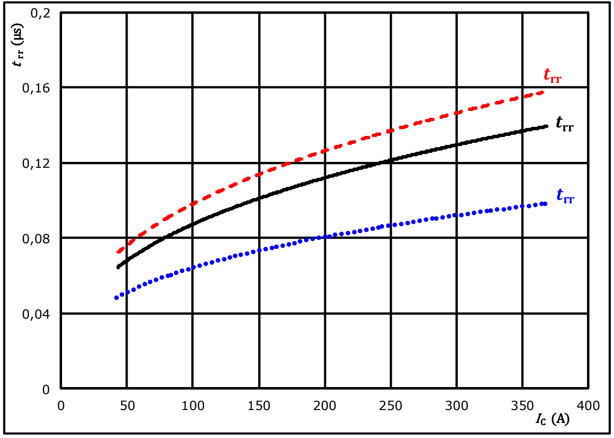
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	200	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

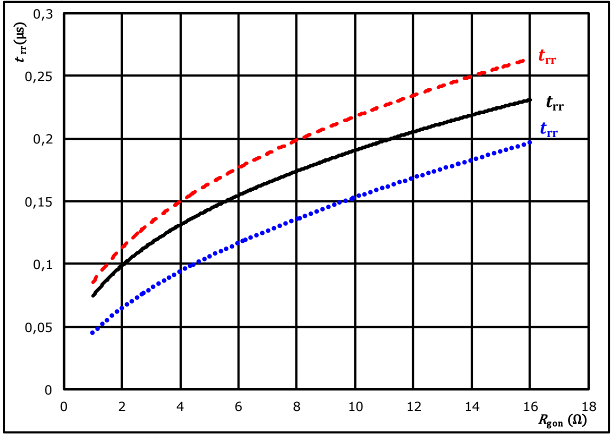


At						
V_{CE}=	600	V			25 °C	•••••••••••••
V_{GE} =	±15	V		T_j:	125 °C	━━━━━━
R_{gon} =	4	Ω			150 °C	‒ ‒ ‒ ‒

figure 8. **FWD**

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

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



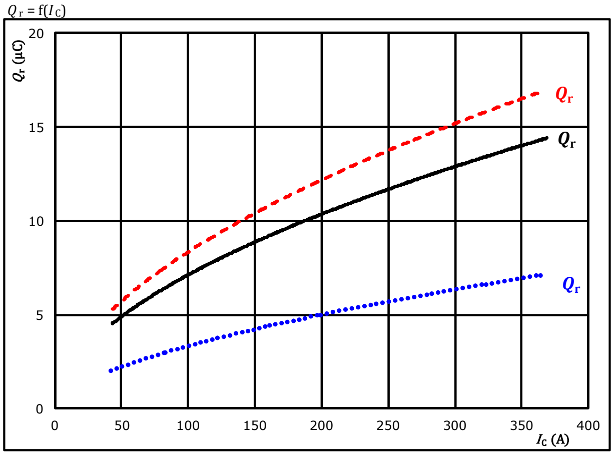
At						
V_{CE} =	600	V			25 °C	•••••••••••••
V_{GE} =	±15	V		T_j:	125 °C	━━━━━━
I_C =	200	A			150 °C	‒ ‒ ‒ ‒

Buck Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

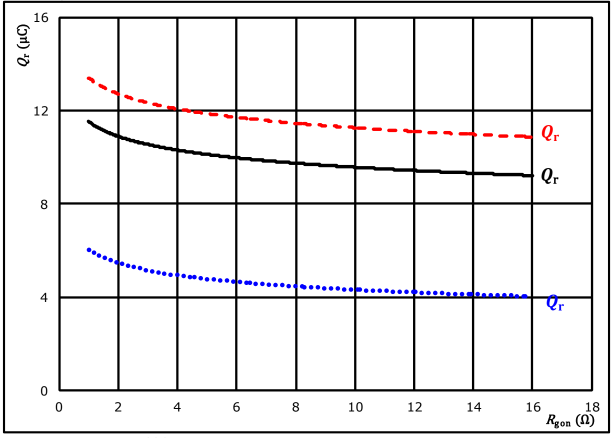


At	V_{CE} =	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	R_{gon} =	4	Ω		150 °C	‒ ‒ ‒ ‒

figure 10. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

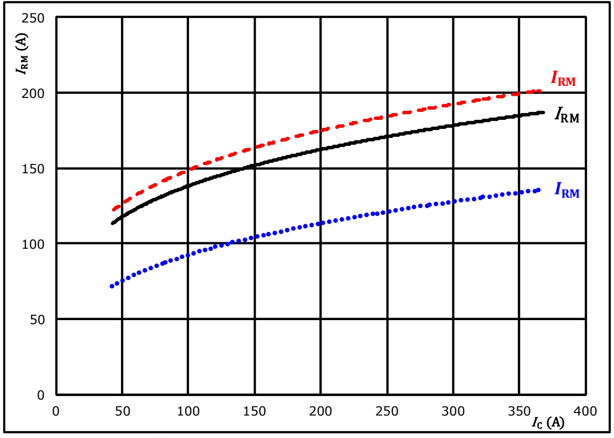


At	V_{CE}=	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	I_C=	200	A		150 °C	‒ ‒ ‒ ‒

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

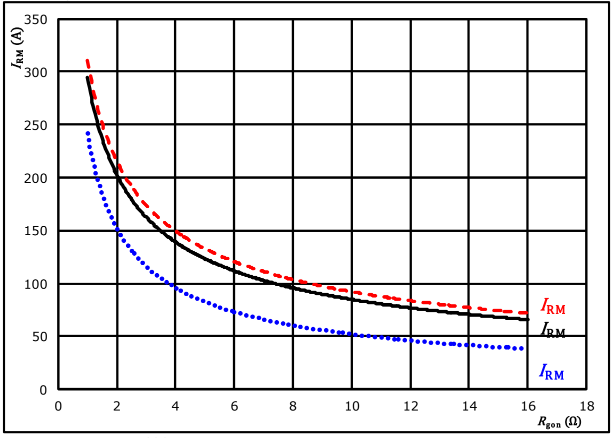


At	V_{CE}:	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	R_{gon} =	4	Ω		150 °C	‒ ‒ ‒ ‒

figure 12. **FWD**

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

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



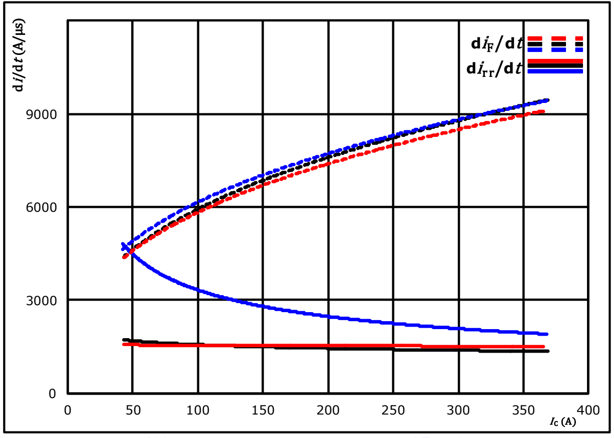
At	V_{CE} =	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	I_C =	200	A		150 °C	‒ ‒ ‒ ‒

Buck Switching Characteristics

figure 13. **FWD**

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

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

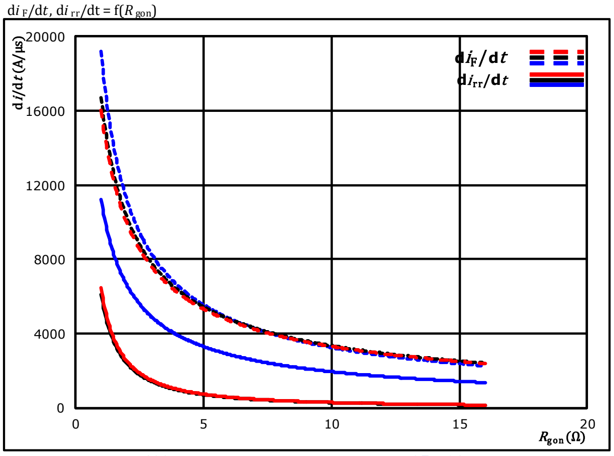


At
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 4 Ω
T_j: 25 °C, 125 °C, 150 °C

figure 14. **FWD**

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

$di_F/dt,\ di_{rr}/dt = f(R_{gon})$

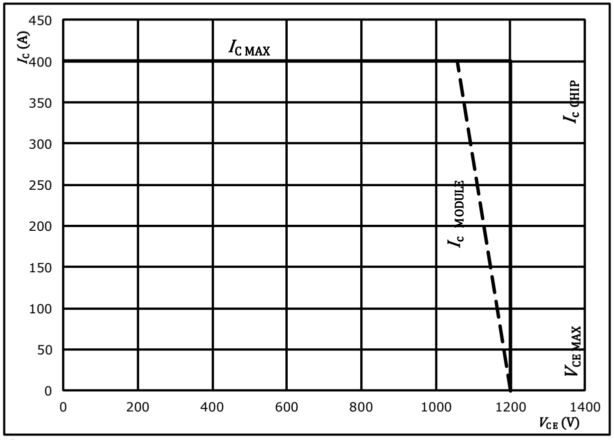


At
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 200 A
T_j: 25 °C, 125 °C, 150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



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

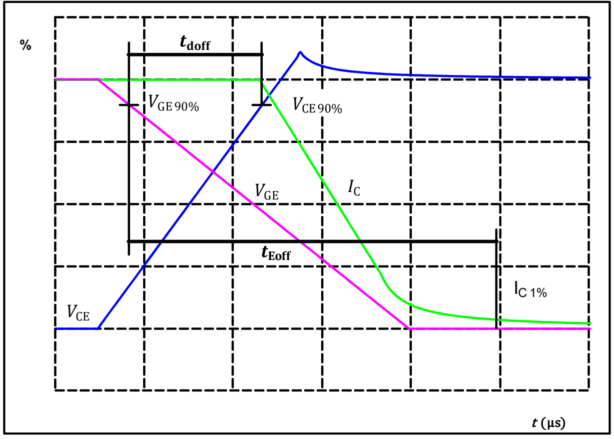
Buck Switching Definitions

General conditions

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

figure 1. **IGBT**

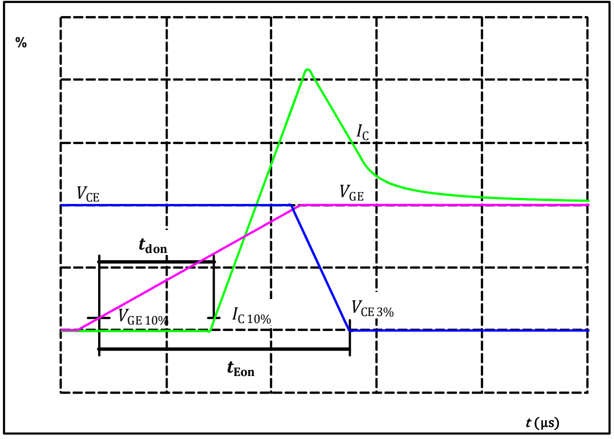
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE}(0%) =	-15	V
V_{GE}(100%) =	15	V
V_C(100%) =	600	V
I_C(100%) =	200	A
t_{doff} =	305	ns

figure 2. **IGBT**

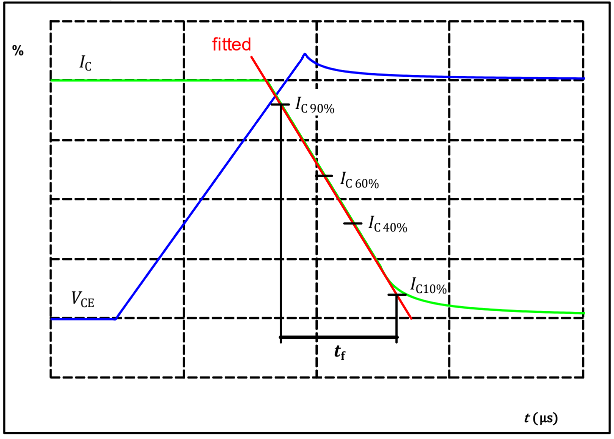
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE}(0%) =	-15	V
V_{GE}(100%) =	15	V
V_C(100%) =	600	V
I_C(100%) =	200	A
t_{don} =	159	ns

figure 3. **IGBT**

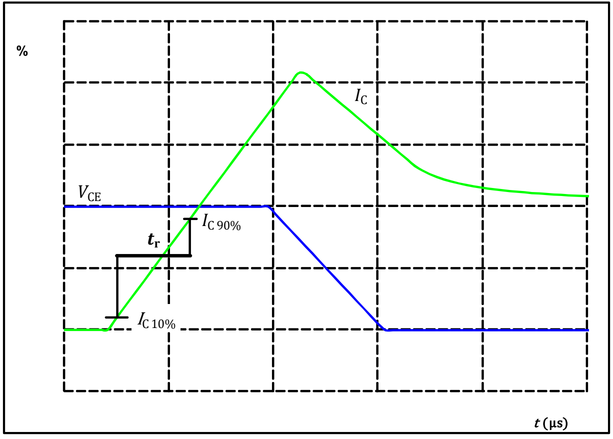
Turn-off Switching Waveforms & definition of t_f



V_C(100%) =	600	V
I_C(100%) =	200	A
t_f =	55	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

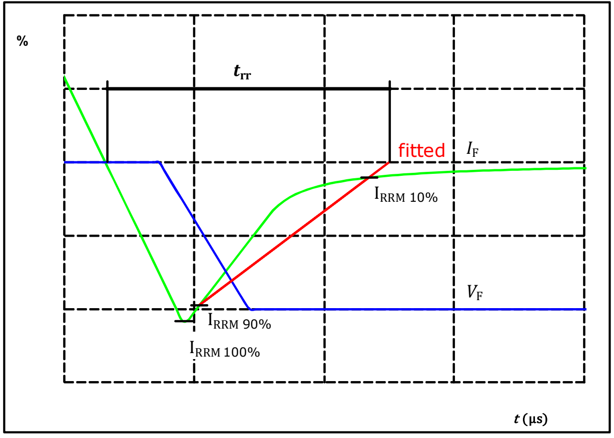


V_C(100%) =	600	V
I_C(100%) =	200	A
t_r =	28	ns

Buck Switching Characteristics

figure 5. **FWD**

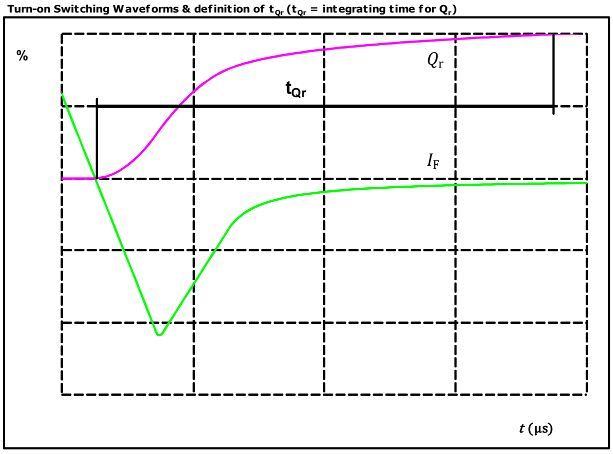
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	200	A
I_{RRM} (100%) =	166	A
t_{rr} =	112	ns

figure 6. **FWD**

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

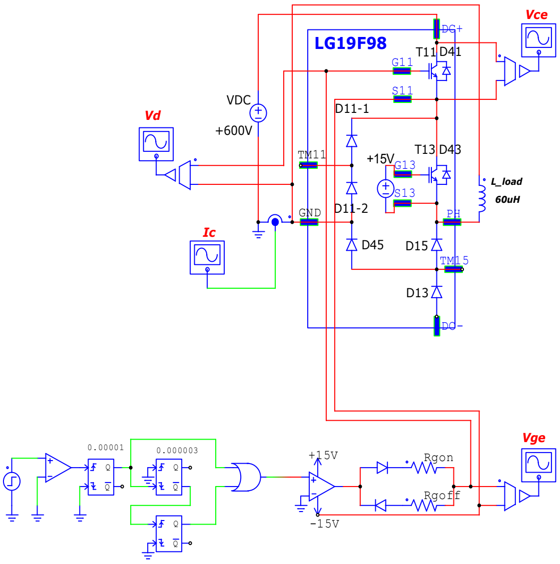


I_F (100%) =	200	A
Q_r (100%) =	10,61	µC

Buck Switching Measurment circuit

figure 1.

BUCK IGBT SW MEASUREMENT

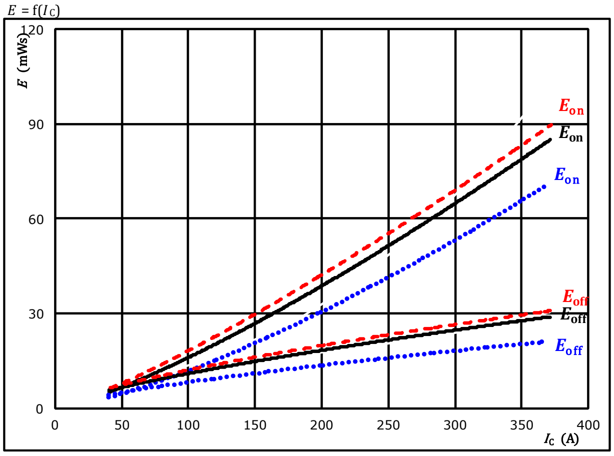


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$

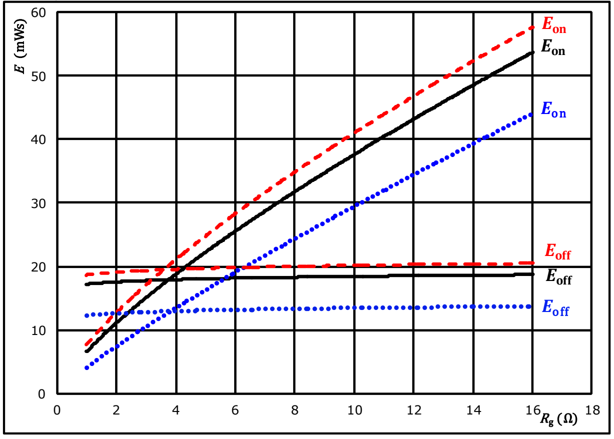


With an inductive load at				25 °C	••••••••••••
V_{CE} =	600	V	T_j:	125 °C	———
V_{GE} =	±15	V		150 °C	– – – –
R_{gon} =	8	Ω			
R_{goff} =	8	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$

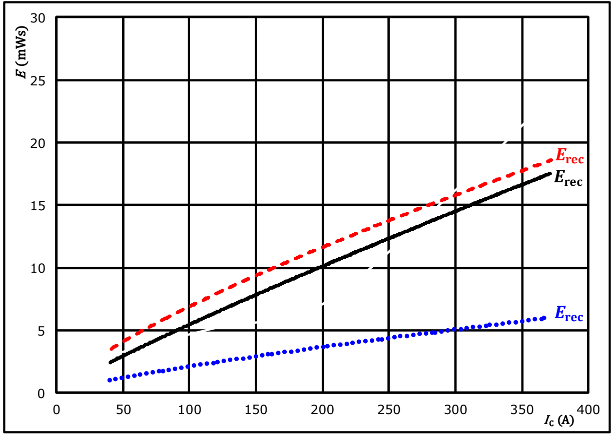


With an inductive load at				25 °C	••••••••••••
V_{CE} =	600	V	T_j:	125 °C	———
V_{GE} =	±15	V		150 °C	– – – –
I_C =	200	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$

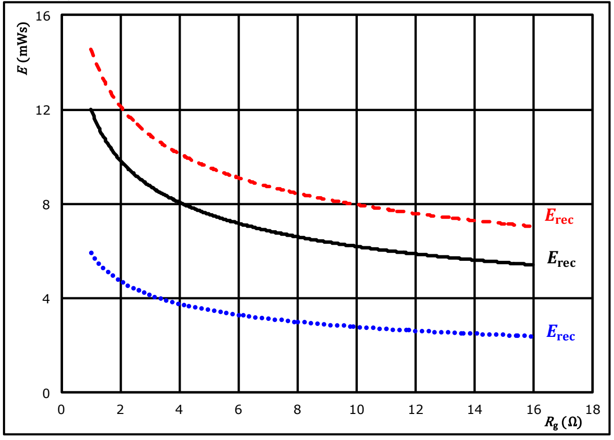


With an inductive load at				25 °C	••••••••••••
V_{CE} =	600	V	T_j:	125 °C	———
V_{GE} =	±15	V		150 °C	– – – –
R_{gon} =	8	Ω			

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



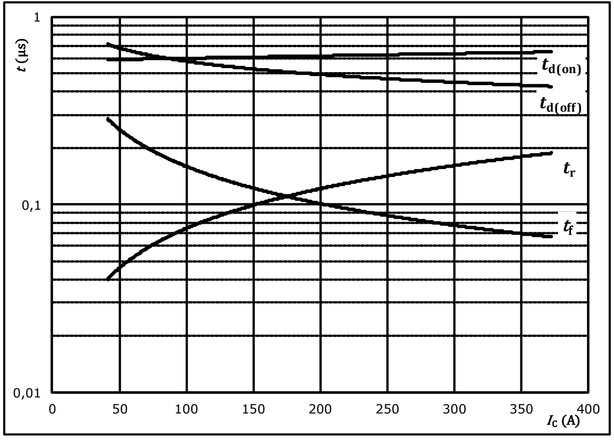
With an inductive load at				25 °C	••••••••••••
V_{CE} =	600	V	T_j:	125 °C	———
V_{GE} =	±15	V		150 °C	– – – –
I_C =	200	A			

Boost Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



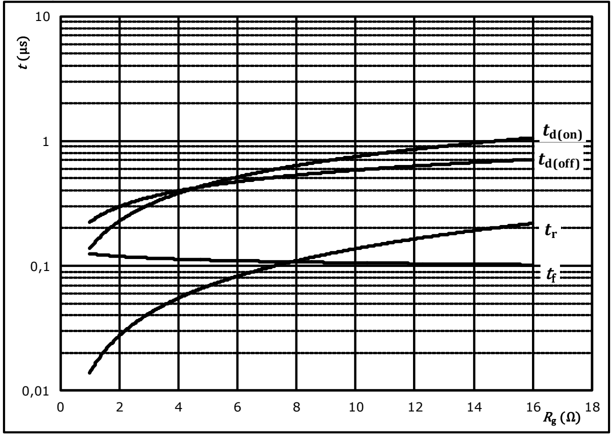
With an inductive load at

T_j = 150 °C
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 8 Ω
R_{goff} = 8 Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



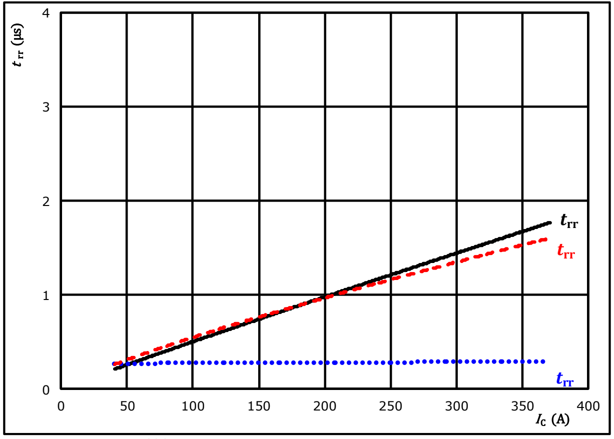
With an inductive load at

T_j = 150 °C
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 200 A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



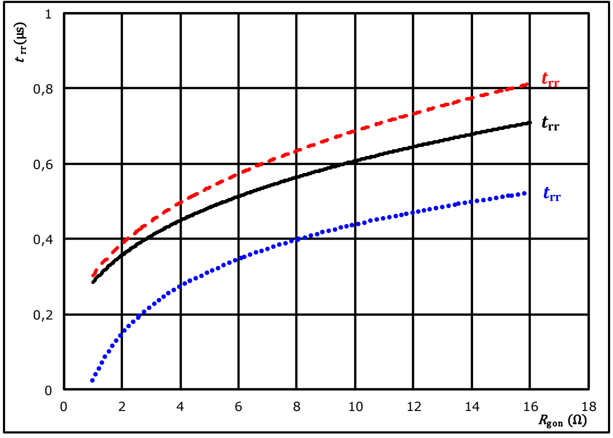
At
V_{CE}= 600 V
V_{GE} = ±15 V
R_{gon} = 8 Ω

T_j:
25 °C ••••••••••••
125 °C ━━━━━
150 °C ▬ ▬ ▬ ▬

figure 8. **FWD**

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

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



At
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 200 A

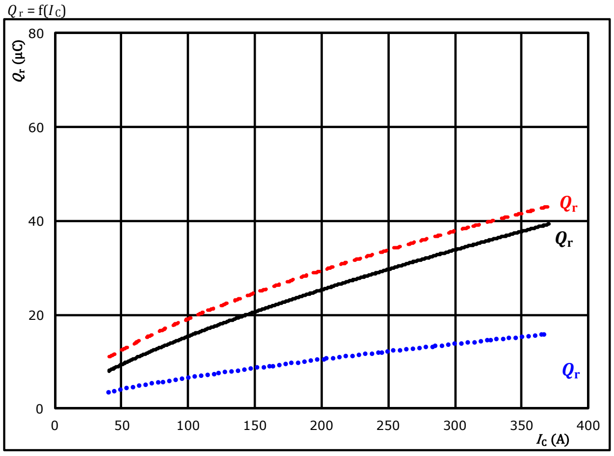
T_j:
25 °C ••••••••••••
125 °C ━━━━━
150 °C ▬ ▬ ▬ ▬

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

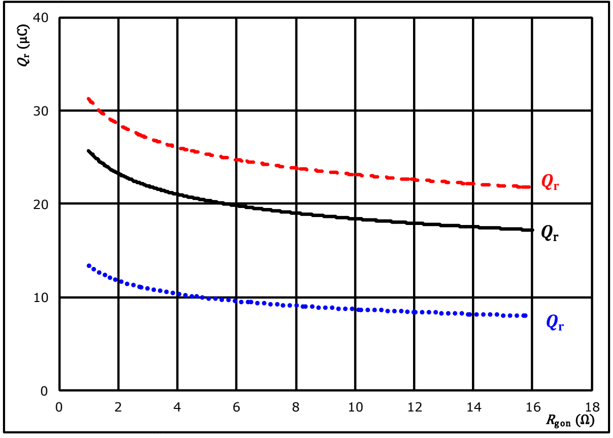


At	V_{CE} =	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	R_{gon} =	8	Ω		150 °C	‒ ‒ ‒ ‒

figure 10. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

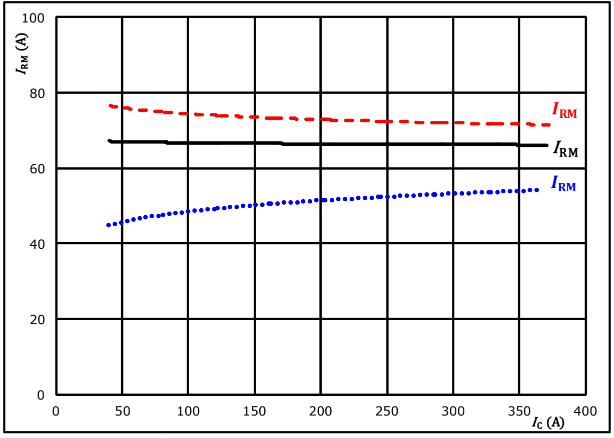


At	V_{CE}=	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	I_C=	200	A		150 °C	‒ ‒ ‒ ‒

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

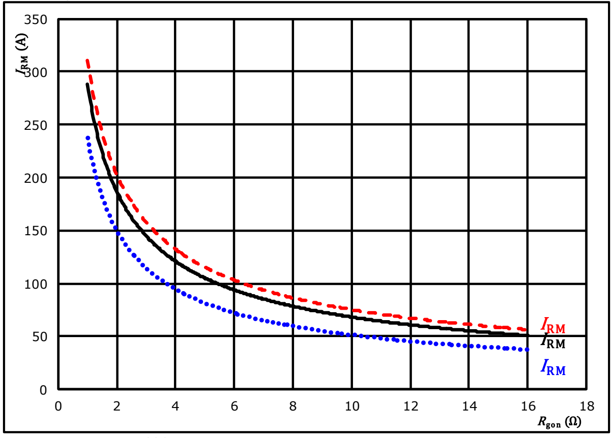


At	V_{CE}:	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	R_{gon} =	8	Ω		150 °C	‒ ‒ ‒ ‒

figure 12. **FWD**

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

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



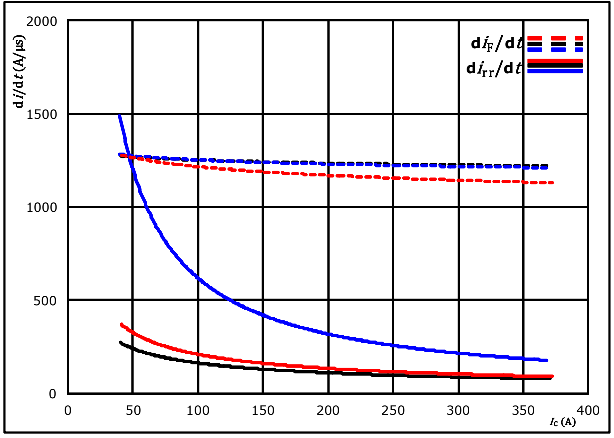
At	V_{CE} =	600	V		25 °C	••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	▬▬▬
	I_C =	200	A		150 °C	‒ ‒ ‒ ‒

Boost Switching Characteristics

figure 13. **FWD**

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

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



At

V_{CE} = 600 V

V_{GE} = ±15 V

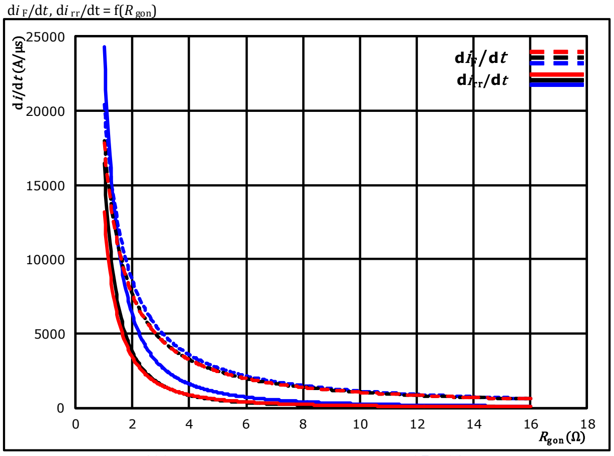
R_{gon} = 8 Ω

T_j: 25 °C / 125 °C / 150 °C

figure 14. **FWD**

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

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



At

V_{CE} = 600 V

V_{GE} = ±15 V

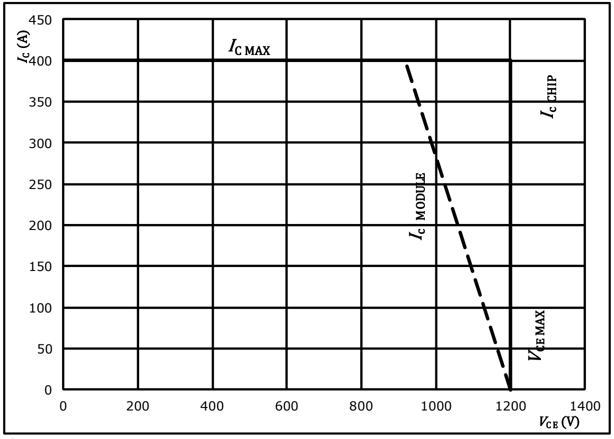
I_C = 200 A

T_j: 25 °C / 125 °C / 150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = 125 °C

R_{gon} = 8 Ω

R_{goff} = 8 Ω

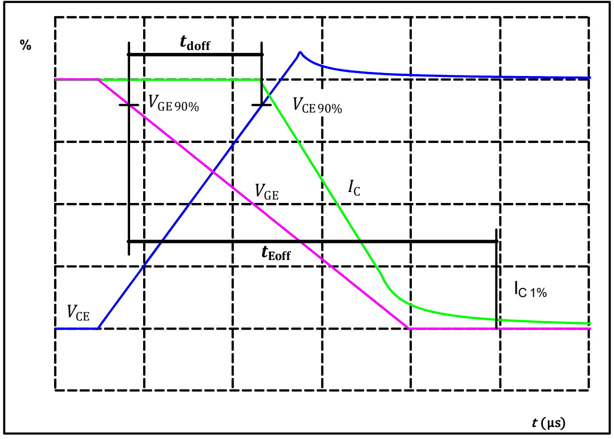
Boost Switching Definitions

General conditions

T_j = **125 °C**
R_{gon} = **8 Ω**
R_{goff} = **8 Ω**

figure 1. **IGBT**

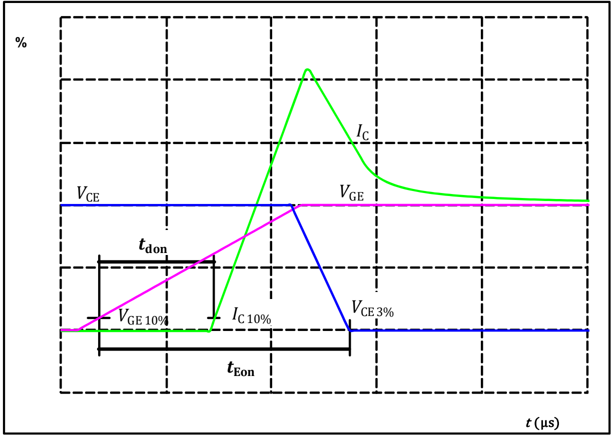
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ = -15 V
$V_{GE}(100\%)$ = 15 V
$V_C(100\%)$ = 600 V
$I_C(100\%)$ = 200 A
t_{doff} = 485 ns

figure 2. **IGBT**

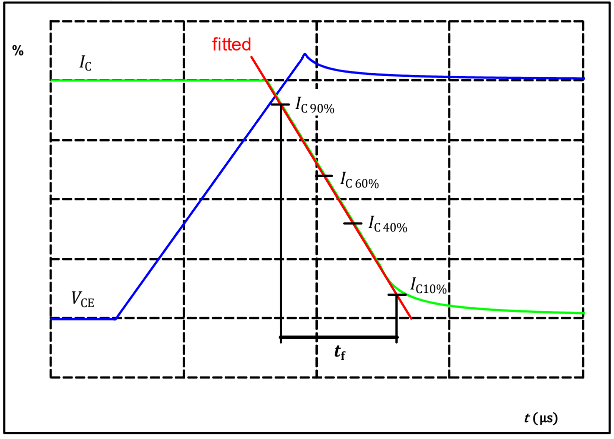
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ = -15 V
$V_{GE}(100\%)$ = 15 V
$V_C(100\%)$ = 600 V
$I_C(100\%)$ = 200 A
t_{don} = 630 ns

figure 3. **IGBT**

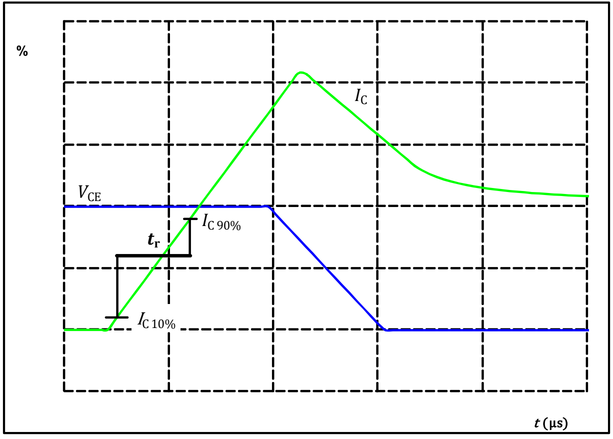
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ = 600 V
$I_C(100\%)$ = 200 A
t_f = 107 ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

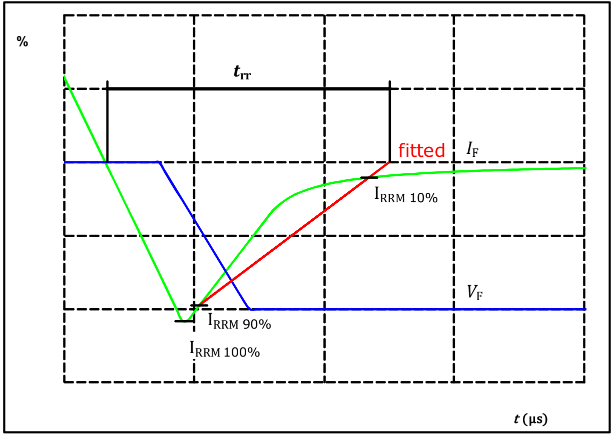


$V_C(100\%)$ = 600 V
$I_C(100\%)$ = 200 A
t_r = 110 ns

Boost Switching Characteristics

figure 5. **FWD**

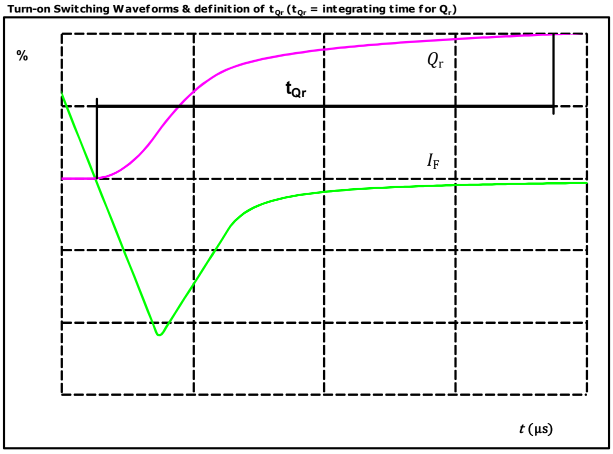
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	200	A
I_{RRM} (100%) =	77	A
t_{rr} =	587	ns

figure 6. **FWD**

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

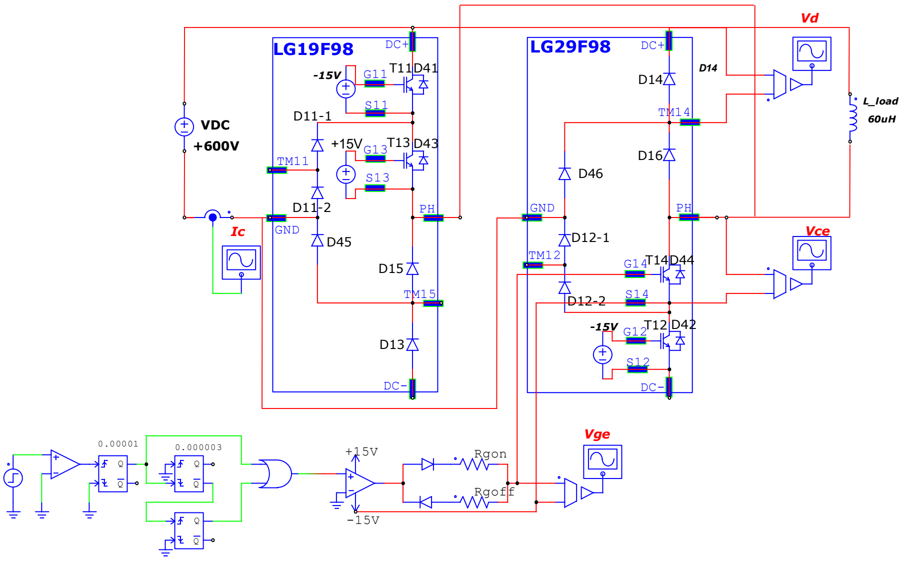


I_F (100%) =	200	A
Q_r (100%) =	19,43	µC

Boost Switching Measurment circuit

figure 1.

BOOST IGBT SW MEASUREMENT



Ordering Code & Marking

Version	Ordering Code
without thermal paste 17 mm housing with solder pins	10-F124NID200SH03-LG19F98
with thermal paste 17 mm housing with solder pins	10-F124NID200SH03-LG19F98-/3/

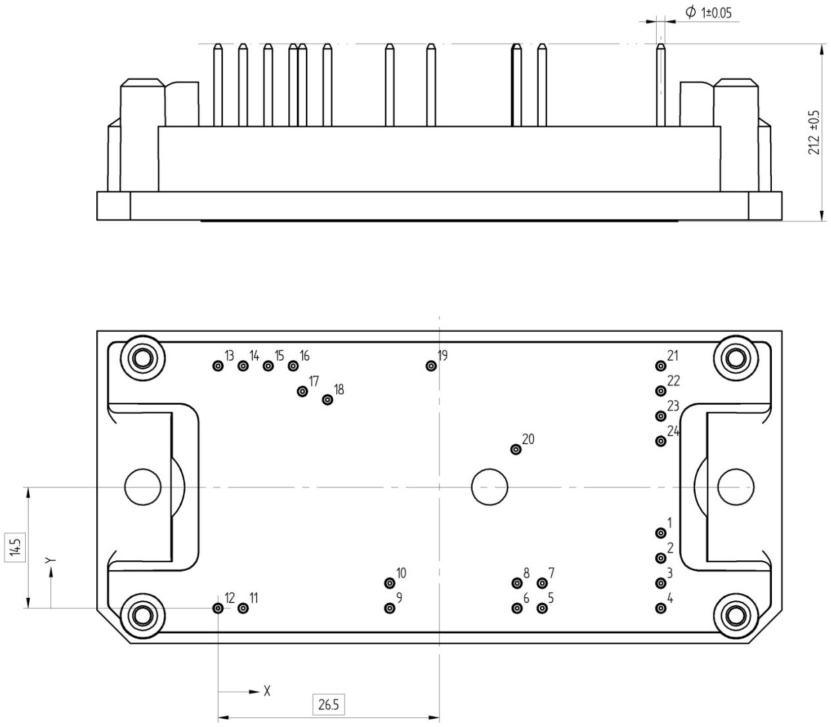
	**Text**	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
		NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

High Side Module 10-F124NID200SH03-LG19F98

Outline

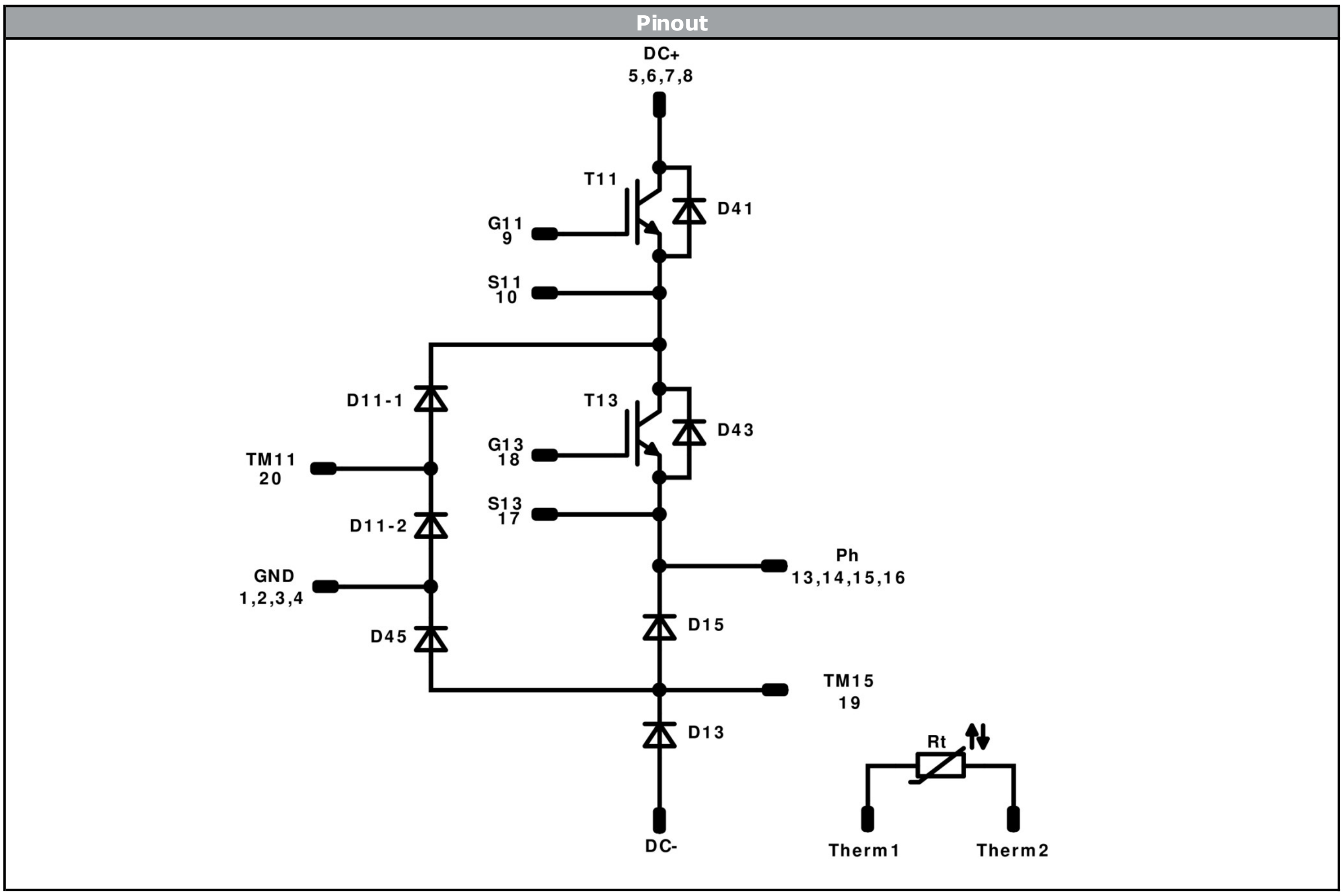
Pin table

Pin	X	Y	Function
1	53	9	GND
2	53	6	GND
3	53	3	GND
4	53	0	GND
5	38,8	0	DC+
6	35,8	0	DC+
7	38,8	3	DC+
8	35,8	3	DC+
9	20,55	0	G11
10	20,55	3	S11
11	3	0	Therm1
12	0	0	Therm2
13	0	29	Ph
14	3	29	Ph
15	6	29	Ph
16	9	29	Ph
17	10,1	25,95	S13
18	13,1	24,95	G13
19	25,5	29	TM15
20	35,65	19	TM11
21	53	29	DC-
22	53	26	DC-
23	53	23	DC-
24	53	20	DC-



Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11	IGBT	1200 V	200 A	Buck Switch	
D11-1, D11-2	FWD	1300 V	200 A	Buck Diode	Serial devices. Values apply to complete device.
D41	FWD	1200 V	75 A	Buck Sw. Protection Diode	
T13	IGBT	1200 V	200 A	Boost Switch	
D13	FWD	1200 V	75 A	Boost Diode	
D15	FWD	1600 V	75 A	Boost Sw.Inv.Diode	
D43	FWD	1600 V	75 A	Boost Sw. Protection Diode	
D45	FWD	1200 V	35 A	Boost D. Protection Diode	
Rt	NTC			Thermistor	

Ordering Code & Marking

Version	Ordering Code
without thermal paste 17 mm housing with solder pins	10-F124NIE200SH03-LG29F98
with thermal paste 17 mm housing with solder pins	10-F124NIE200SH03-LG29F98-/3/

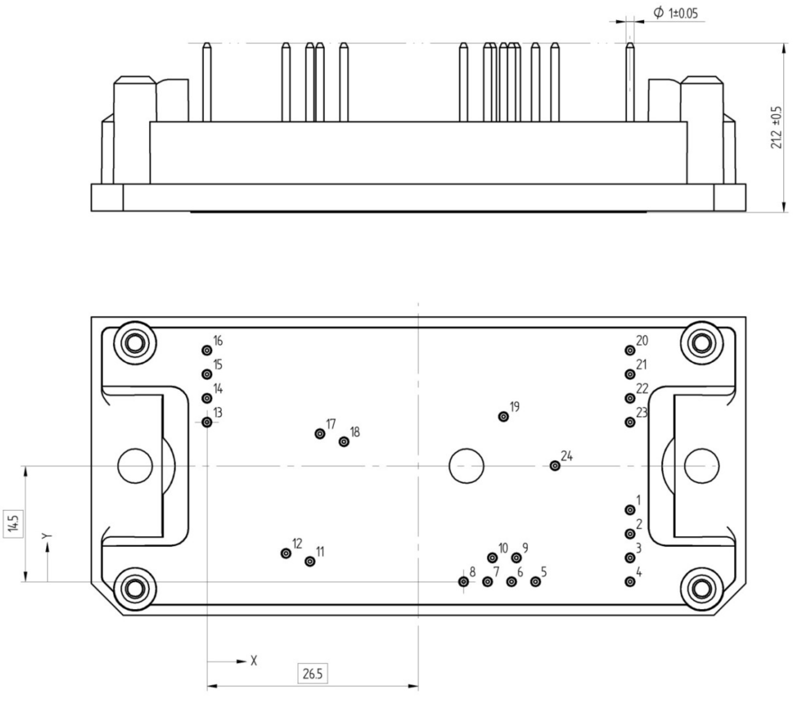
 NN-NNNNNNNNNNNNNN TTTTTTVV WWYY UL VIN LLLLL SSSS	**Text**	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
		NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Low Side Module 10-F124NIE200SH03-LG29F98

Outline

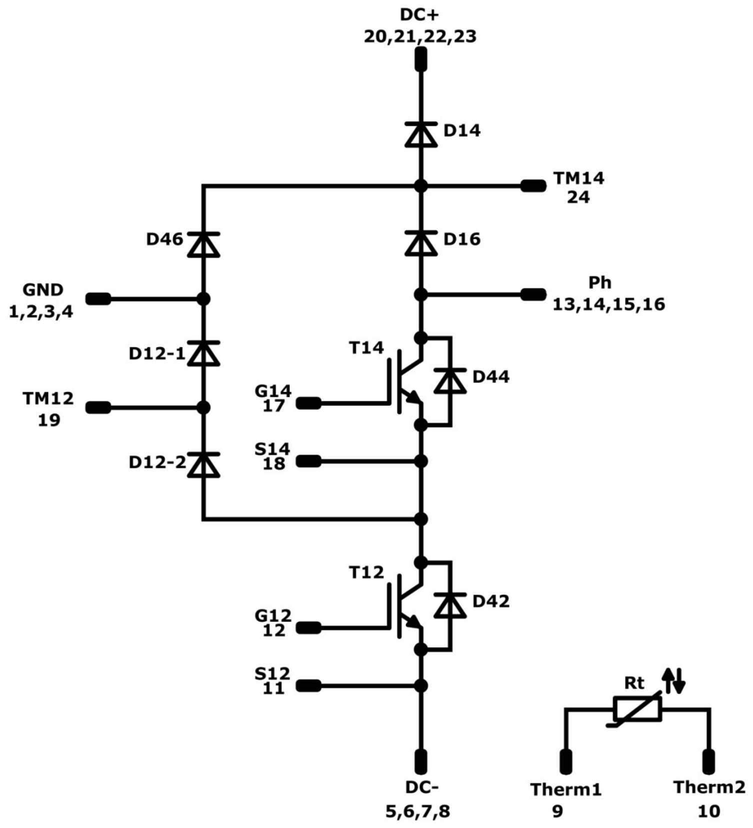
Pin table

Pin	X	Y	Function
1	53	9	GND
2	53	6	GND
3	53	3	GND
4	53	0	GND
5	41,15	0	DC-
6	38,15	0	DC-
7	35,15	0	DC-
8	32,15	0	DC-
9	38,75	3	Therm1
10	35,75	3	Therm2
11	12,9	2,55	S12
12	9,9	3,55	G12
13	0	20	Ph
14	0	23	Ph
15	0	26	Ph
16	0	29	Ph
17	14,15	18,55	G14
18	17,15	17,55	S14
19	37,15	20,7	TM12
20	53	29	DC+
21	53	26	DC+
22	53	23	DC+
23	53	20	DC+
24	43,6	14,55	TM14



Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T12	IGBT	1200 V	200 A	Buck Switch	
D12-1,D12-2	FWD	1300 V	200 A	Buck Diode	Serial devices. Values apply to complete device.
D42	FWD	1200 V	75 A	Buck Sw. Protection Diode	
T14	IGBT	1200 V	200 A	Boost Switch	
D14	FWD	1200 V	75 A	Boost Diode	
D16	FWD	1600 V	75 A	Boost Sw.Inv.Diode	
D44	FWD	1600 V	75 A	Boost Sw. Protection Diode	
D46	FWD	1200 V	35 A	Boost D. Protection Diode	
Rt	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see 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
10-F124NIx200SH03-LGx9F98-D2-14	08 Jul. 2019	Marketing application voltage modified	1

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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.