10-F124NID200SH03-LG19F98
10-F124NIE200SH03-LG29F98
datasheet

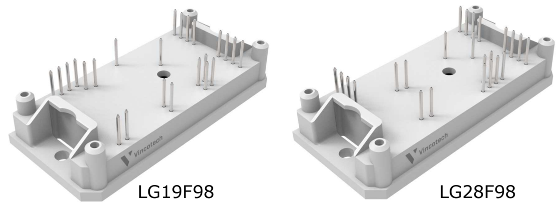
Vincotech

***flow*NPC 1 split** | **2400 V / 200 A**

Features

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

flow 1 housing

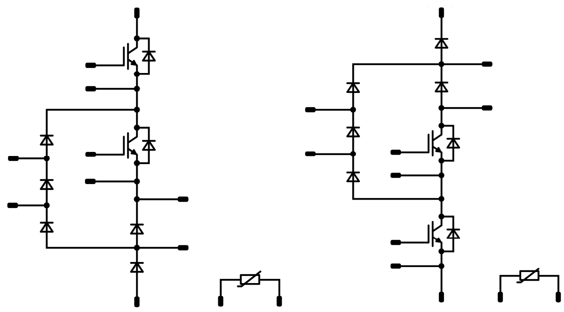


LG19F98 LG28F98

Target applications

- Solar Inverters

Schematic



LG19F98 LG28F98

Types

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

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

Vincotech

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	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	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	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	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	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	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	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	Unit
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	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]	Value Min	Value Typ	Value Max	Unit

Buck Diode

Static

Parameter	Symbol	Conditions	V_{GE} / V_{GS} [V]	V_{CE} / V_{DS} / V_F [V]	I_C / I_D / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
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

Parameter	Symbol	Conditions	V_{GE} / V_{GS} [V]	V_{CE} / V_{DS} / V_F [V]	I_C / I_D / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,30		K/W

Dynamic*

Parameter	Symbol	Conditions	V_{GE} / V_{GS} [V]	V_{CE} / V_{DS} / V_F [V]	I_C / I_D / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
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

Parameter	Symbol	Conditions	V_{GE} / V_{GS} [V]	V_{CE} / V_{DS} / V_F [V]	I_C / I_D / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
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

Parameter	Symbol	Conditions	V_{GE} / V_{GS} [V]	V_{CE} / V_{DS} / V_F [V]	I_C / I_D / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,87		K/W

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]	Min	Typ	Max	Unit
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}		0	10		25		1400		pF
Reverse transfer capacitance	C_{res}		0	10		25		560		pF
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	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	200	25 125 150		97 110 114		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	200	25 125 150		454 485 495		ns
Fall time	t_f	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	200	25 125 150		79 107 121		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 8,8 µC Q_{rFWD} = 19,4 µC Q_{rFWD} = 23,9 µC	±15	600	200	25 125 150		25,512 32,545 35,643		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	200	25 125 150		12,871 17,623 19,323		mWs

* 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	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	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

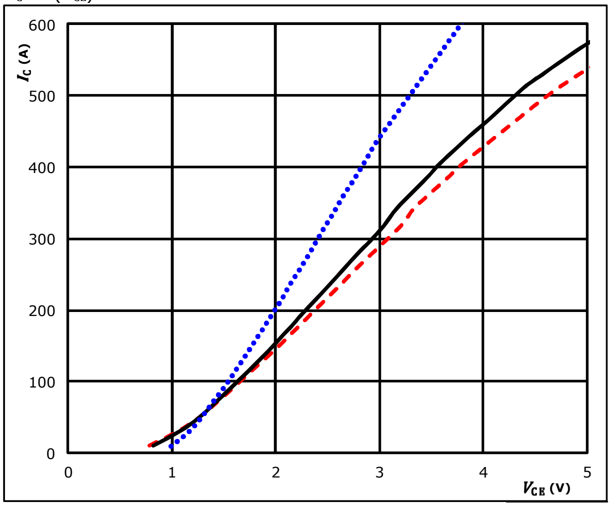
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost D. Protection Diode										
Static										
Forward voltage	V_F				35	25 150		2,37 2,35	2,62	V
Reverse leakage current	I_R			1200		25 150			60 5500	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

$I_C = f(V_{CE})$

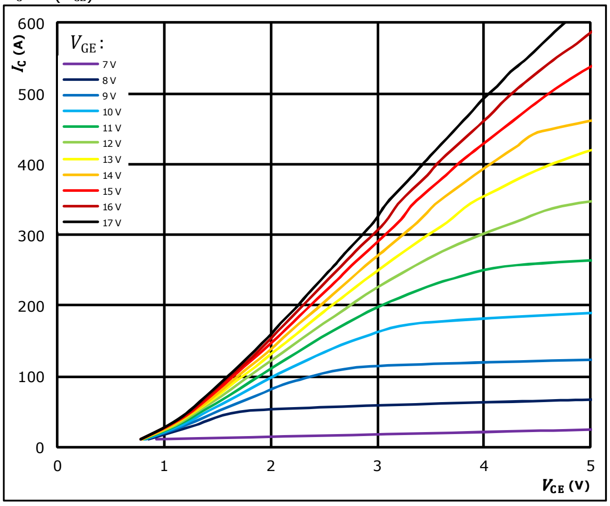


t_p =	250	μs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

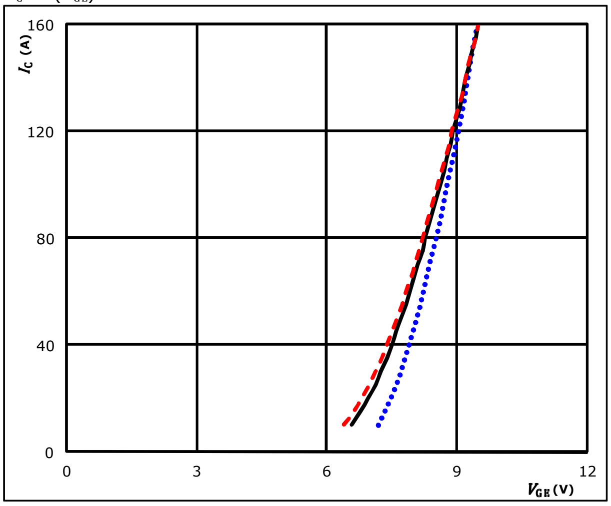


t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

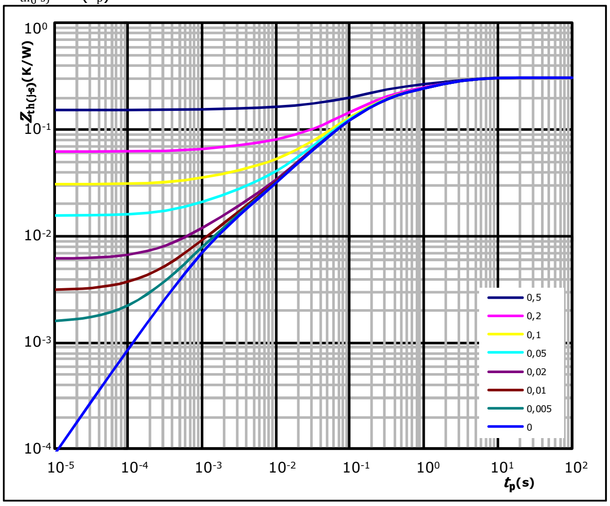


t_p =	100	μs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – –

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

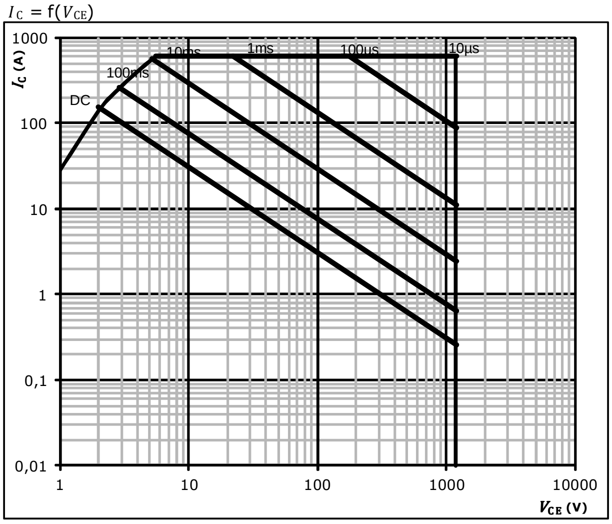
R (K/W)	τ (s)
9,35E-02	2,07E+00
7,50E-02	3,51E-01
1,16E-01	9,41E-02
1,89E-02	1,25E-02
7,76E-03	1,26E-03

Buck Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



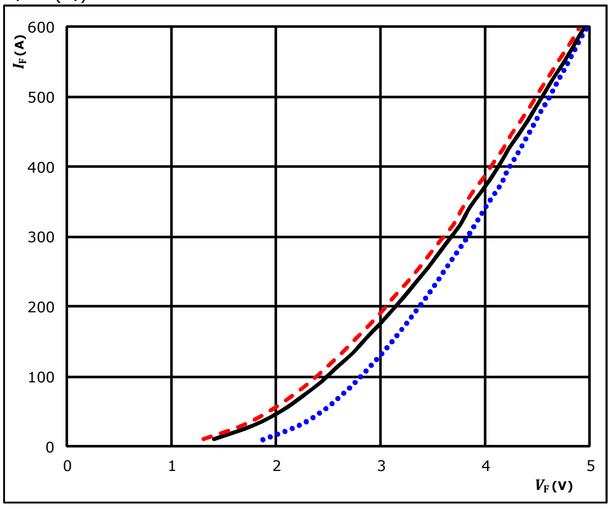
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Buck Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



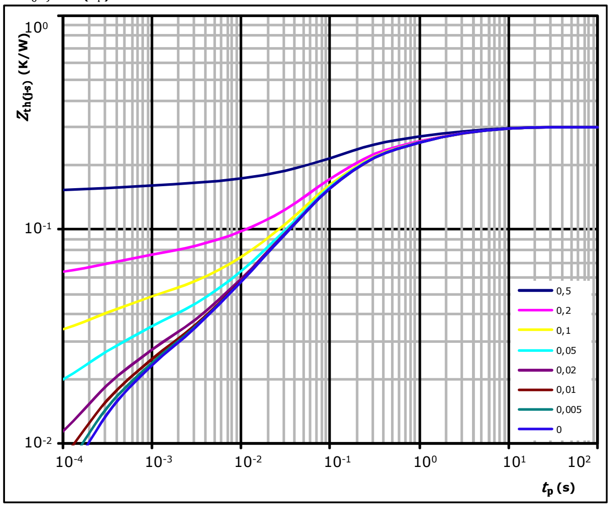
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

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

FWD thermal model values

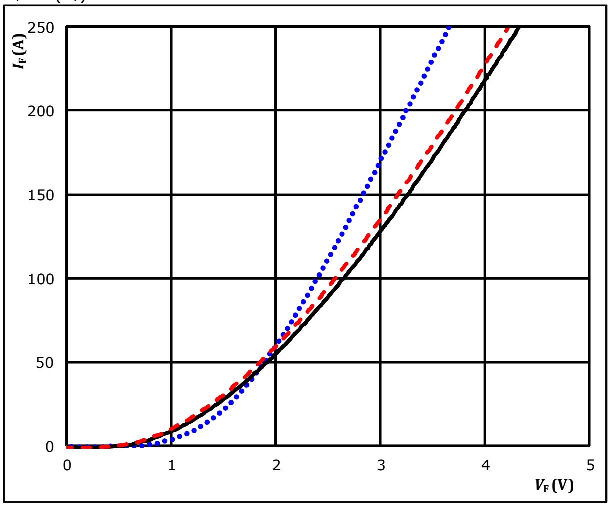
R (K/W)	τ (s)
2,63E-02	5,38E+00
5,41E-02	1,20E+00
9,07E-02	1,90E-01
8,31E-02	5,93E-02
2,35E-02	8,54E-03
8,59E-03	1,18E-03
1,38E-02	2,37E-04

Buck Sw. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



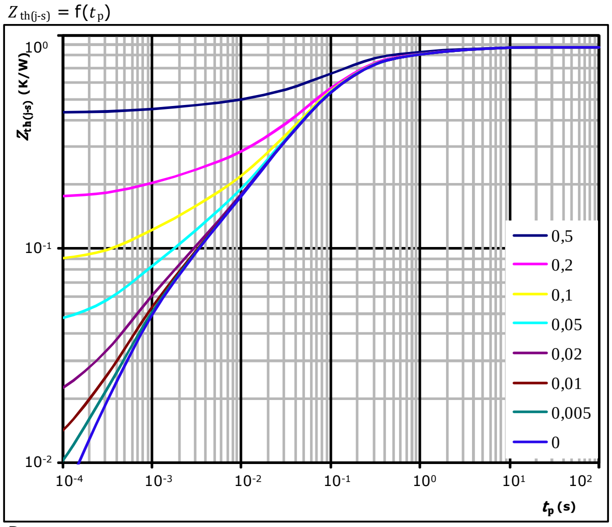
t_p = 250 µs

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

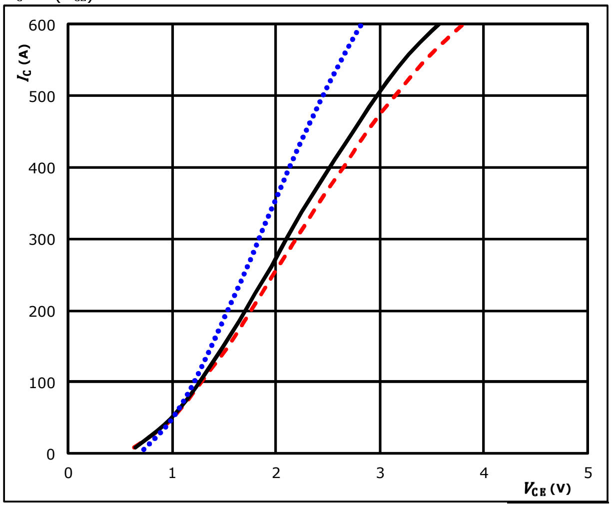
R (K/W)	τ (s)
5,30E-02	3,91E+00
1,18E-01	6,14E-01
4,44E-01	1,10E-01
1,61E-01	2,86E-02
5,06E-02	5,08E-03
4,44E-02	8,90E-04

Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

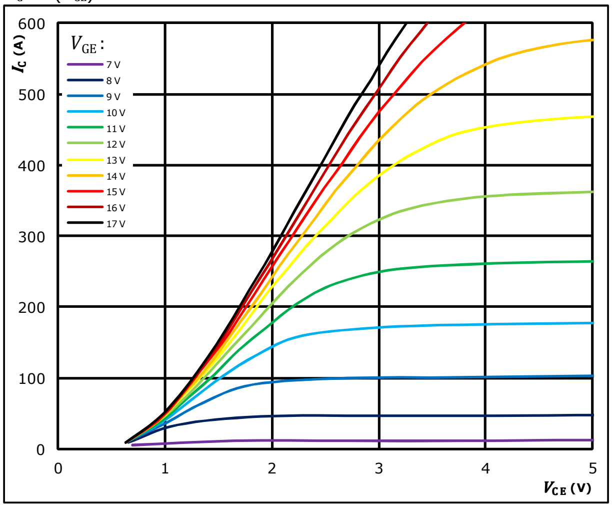


t_p =	250	μs		25 °C	dotted
V_{GE} =	15	V	T_j:	125 °C	solid
				150 °C	dashed

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

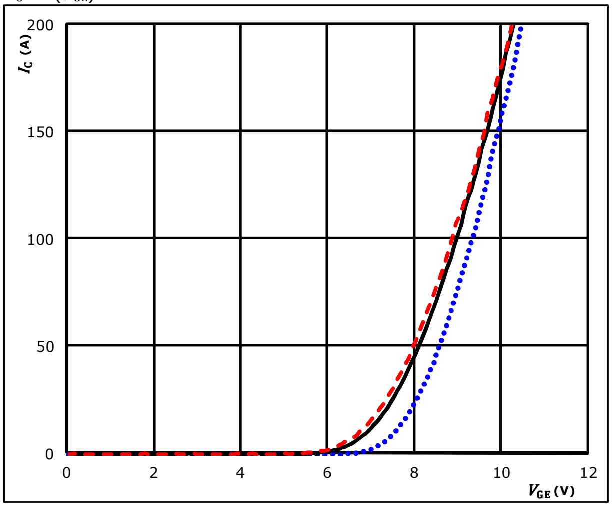
T_j = 150 °C

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

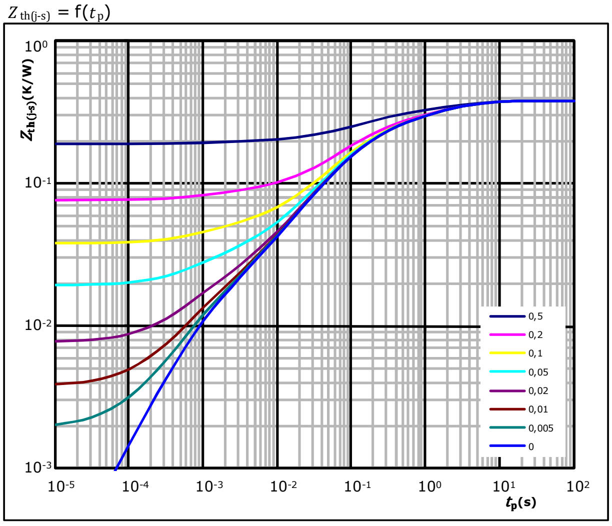


t_p =	100	μs		25 °C	dotted
V_{CE} =	10	V	T_j:	125 °C	solid
				150 °C	dashed

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



D = t_p / T

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

IGBT thermal model values

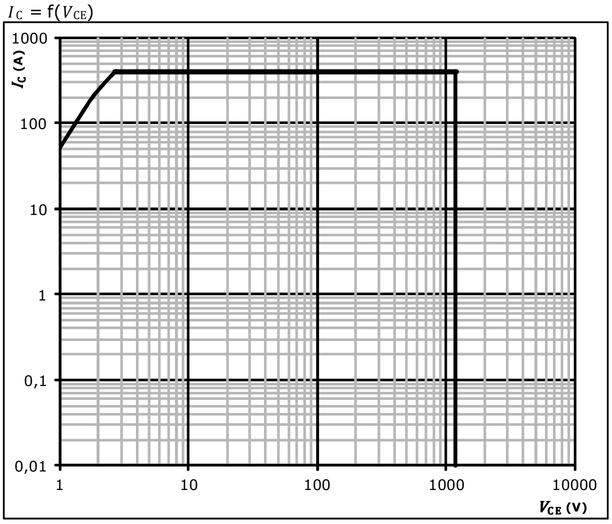
R (K/W)	τ (s)
5,41E-02	4,17E+00
9,46E-02	1,11E+00
9,45E-02	2,29E-01
1,11E-01	6,87E-02
1,98E-02	1,02E-02
1,09E-02	9,51E-04

Boost Switch Characteristics

figure 5.	**IGBT**

Safe operating area

$I_C = f(V_{CE})$



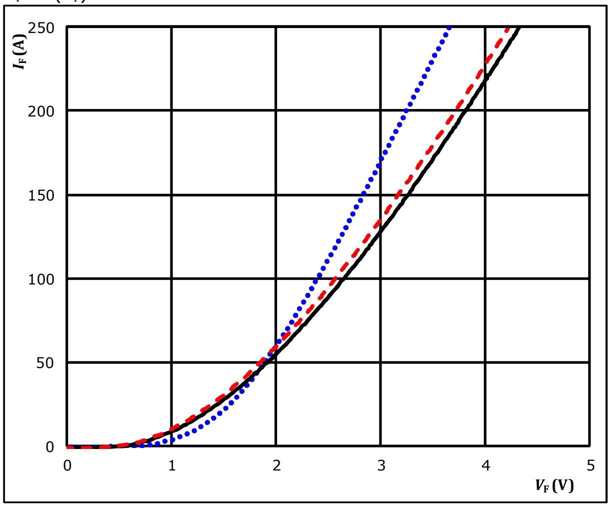
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



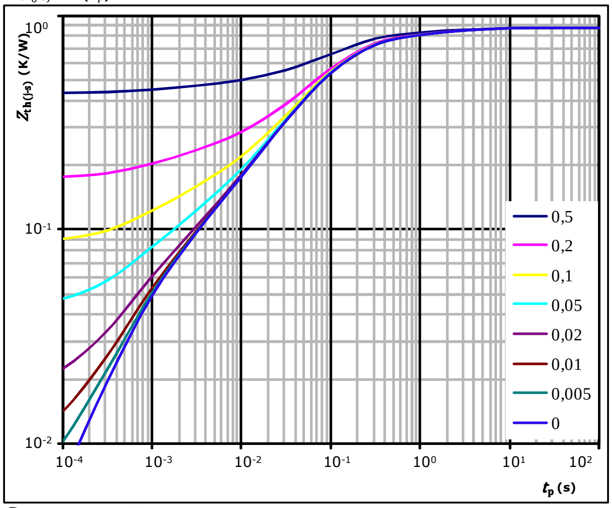
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

FWD thermal model values

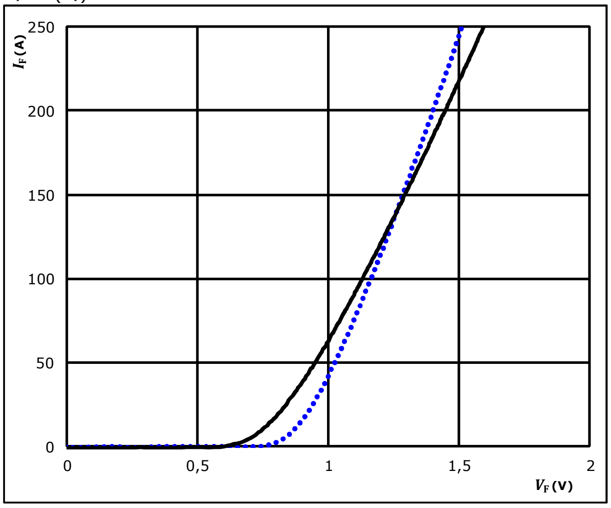
R (K/W)	τ (s)
5,30E-02	3,91E+00
1,18E-01	6,14E-01
4,44E-01	1,10E-01
1,61E-01	2,86E-02
5,06E-02	5,08E-03
4,44E-02	8,90E-04

Boost Sw.Inv.Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



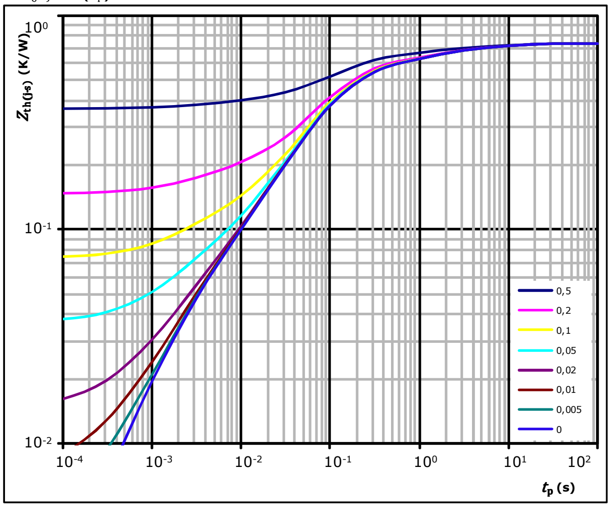
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid)

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

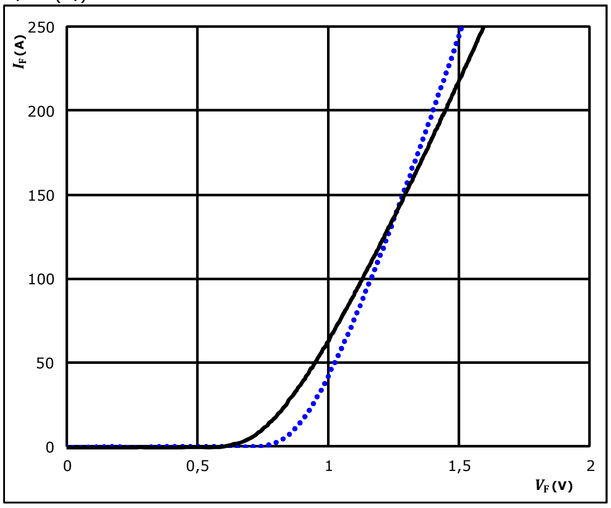
R (K/W)	τ (s)
6,95E-02	7,08E+00
1,21E-01	1,15E+00
2,75E-01	1,52E-01
2,24E-01	5,48E-02
3,60E-02	4,07E-03
1,01E-02	1,33E-03

Boost Sw. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



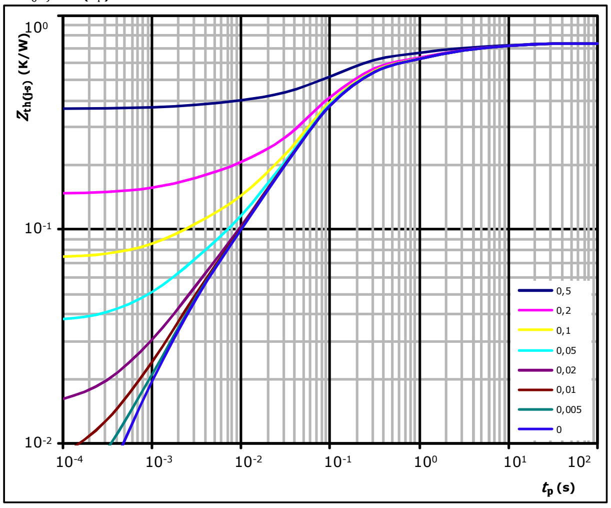
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid)

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

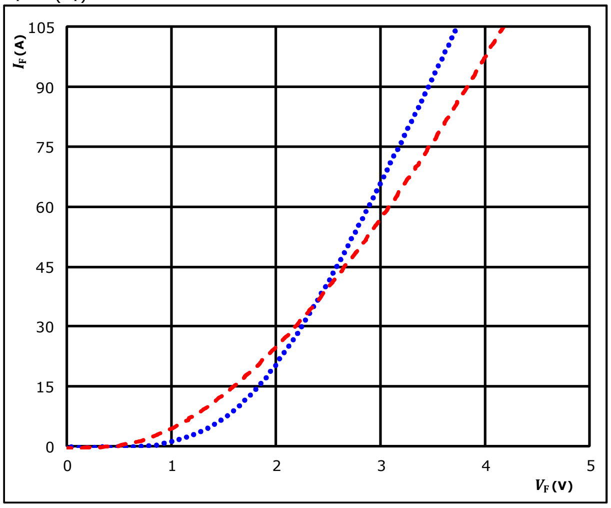
R (K/W)	τ (s)
6,95E-02	7,08E+00
1,21E-01	1,15E+00
2,75E-01	1,52E-01
2,24E-01	5,48E-02
3,60E-02	4,07E-03
1,01E-02	1,33E-03

Boost D. Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



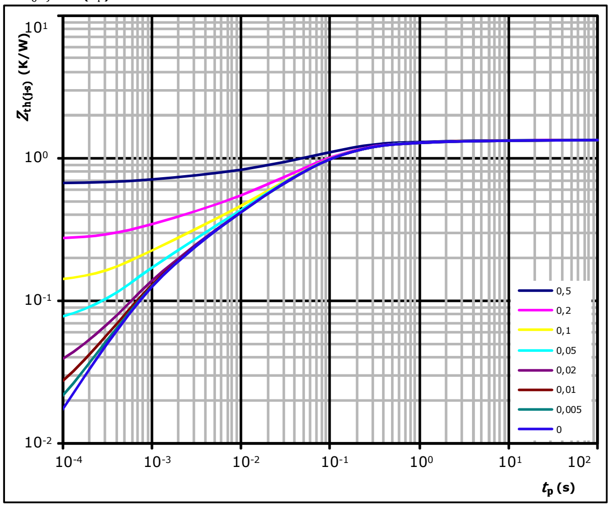
t_p = 250 μs

T_j: 25 °C (dotted), 150 °C (dashed)

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

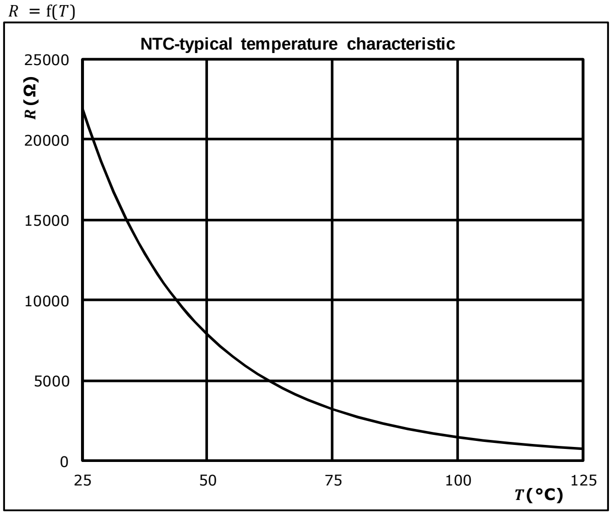
R (K/W)	τ (s)
3,06E-02	9,16E+00
1,47E-01	6,10E-01
6,10E-01	8,89E-02
2,96E-01	2,14E-02
1,39E-01	5,05E-03
1,19E-01	9,19E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

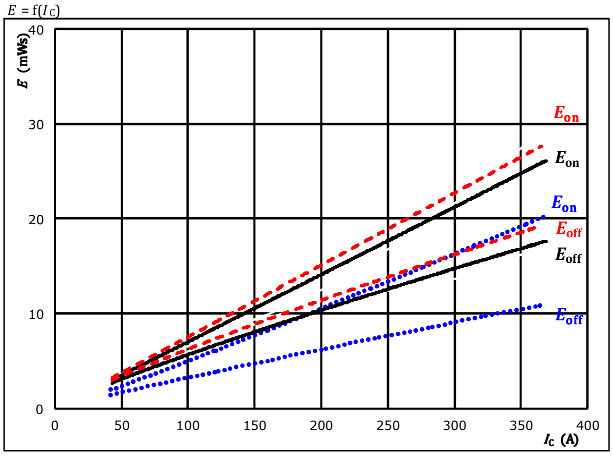


Buck Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



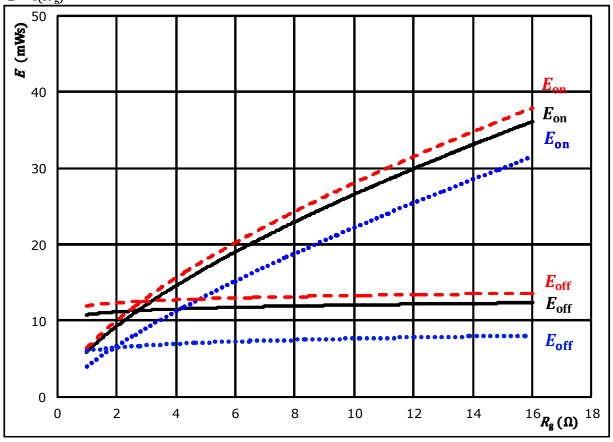
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	....
V_{GE} =	±15	V		125 °C	———
R_{gon} =	4	Ω		150 °C	– – –
R_{goff} =	4	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



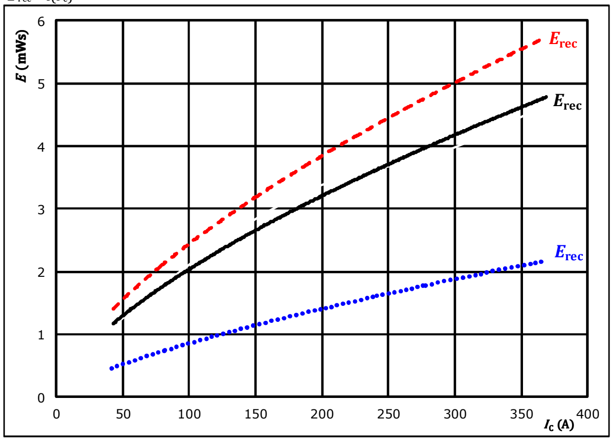
With an inductive load at

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



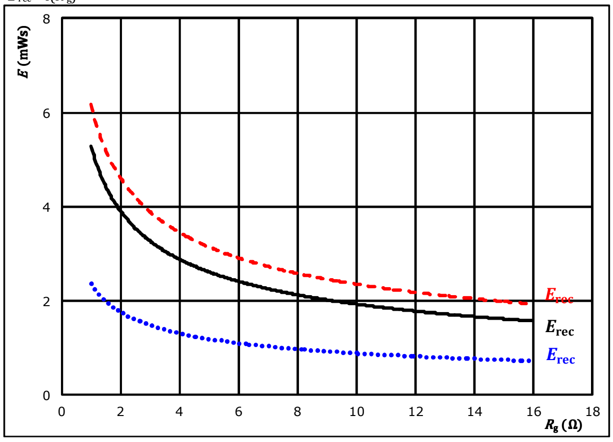
With an inductive load at

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

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

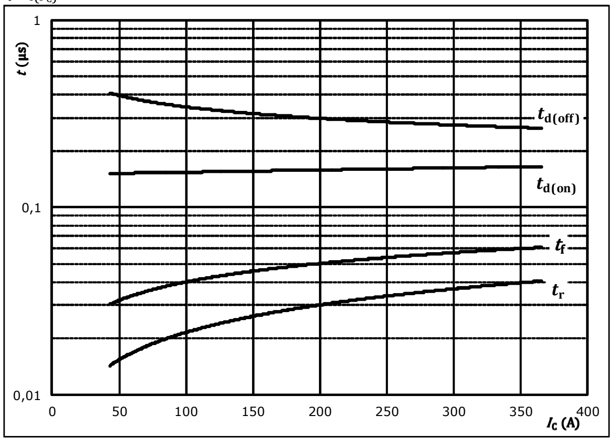
V_{CE} =	600	V	T_j:	25 °C	....
V_{GE} =	±15	V		125 °C	———
I_C =	200	A		150 °C	– – –

Buck Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



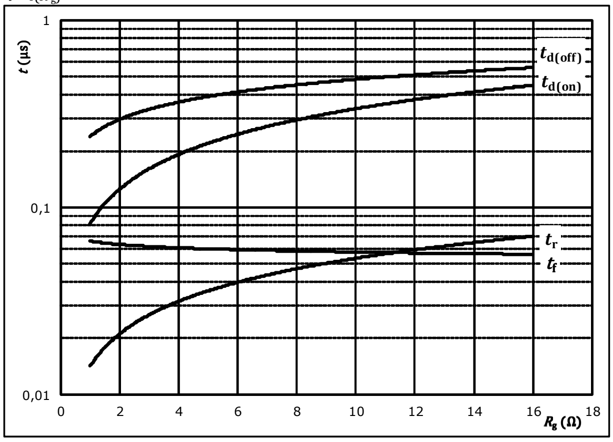
With an inductive load at

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

$t = f(R_g)$



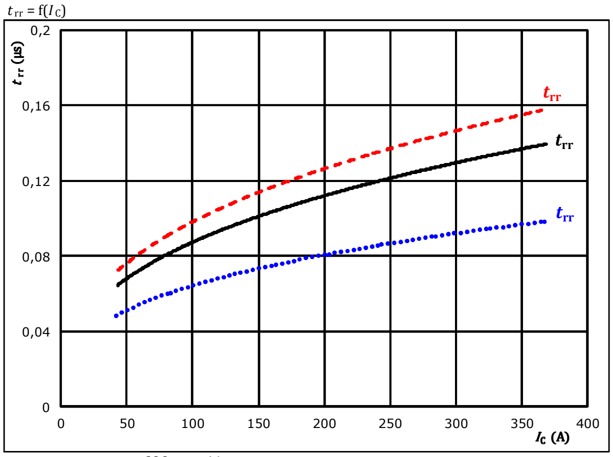
With an inductive load at

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

$t_{rr} = f(I_C)$

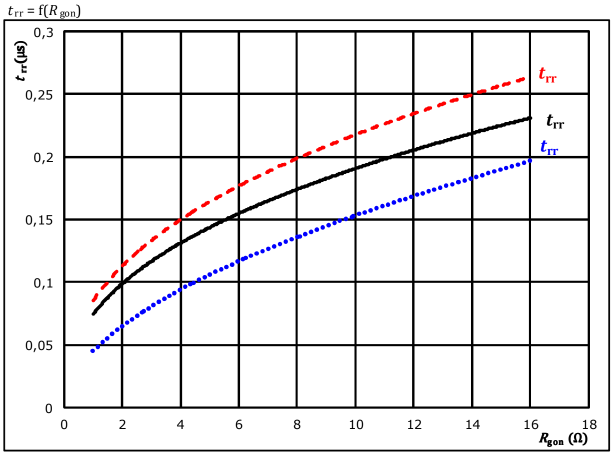


At					
V_{CE}=	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	4	Ω		150 °C	dashed

figure 8. FWD

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

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



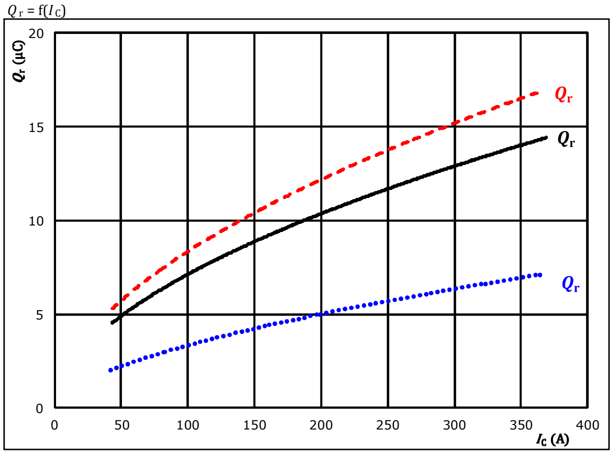
At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	200	A		150 °C	dashed

Buck Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

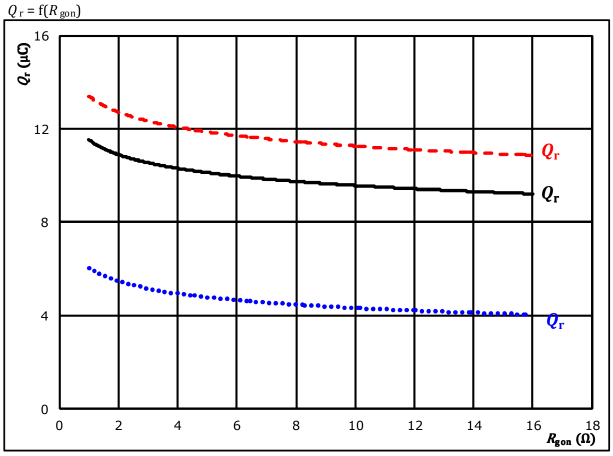


At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	4	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

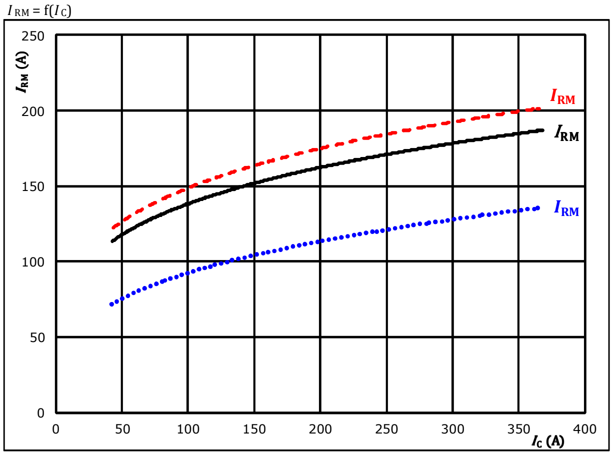


At					
V_{CE}=	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C=	200	A		150 °C	dashed

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

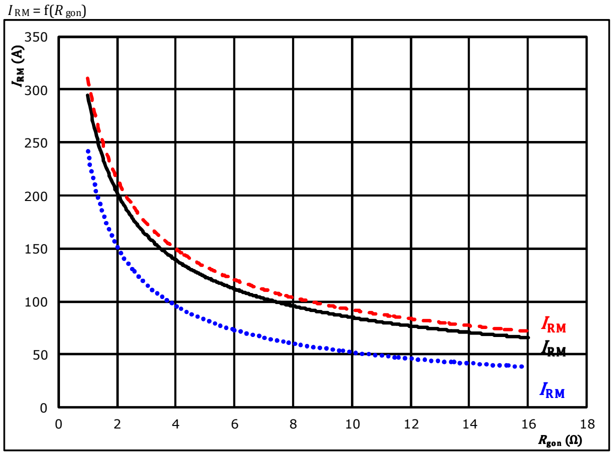


At					
V_{CE}:	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	4	Ω		150 °C	dashed

figure 12. **FWD**

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

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



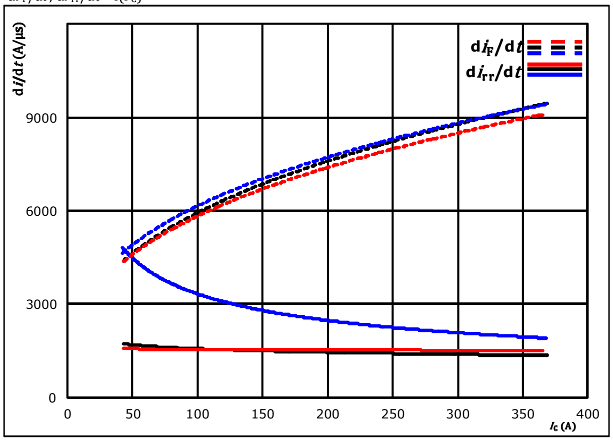
At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	200	A		150 °C	dashed

Buck Switching Characteristics

figure 13. **FWD**

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

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

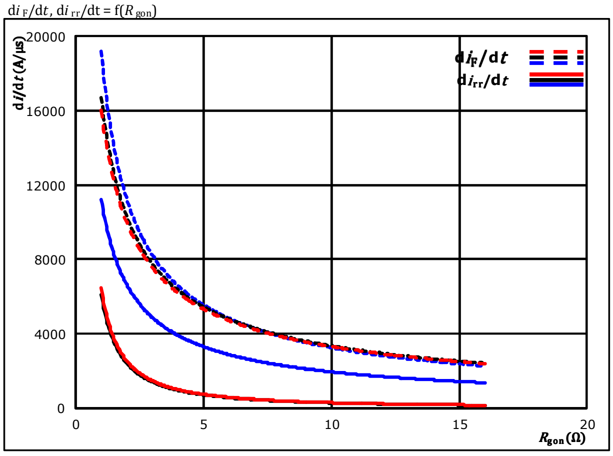


At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	±15	V		125	°C
R_{gon} =	4	Ω		150	°C

figure 14. **FWD**

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

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

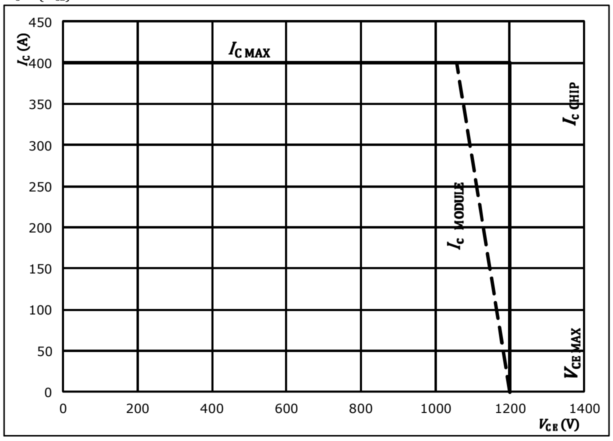


At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	±15	V		125	°C
I_C=	200	A		150	°C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



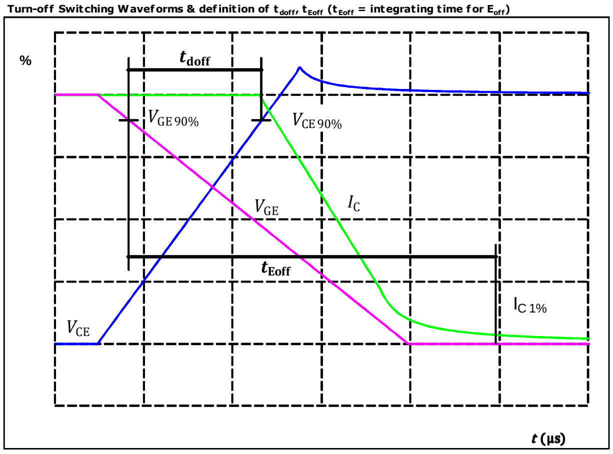
At		
T_j =	125	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Buck Switching Definitions

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

figure 1. IGBT

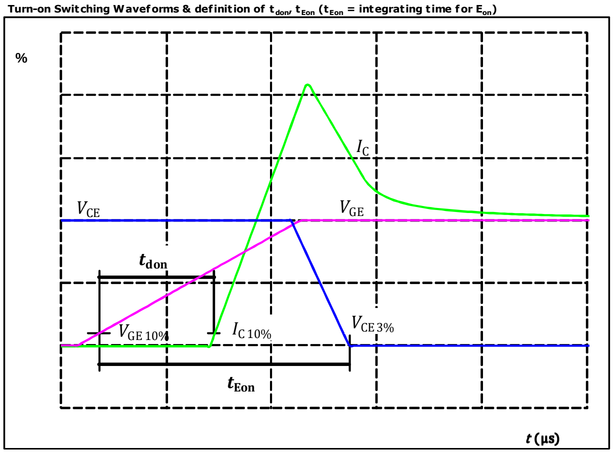
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



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

figure 2. IGBT

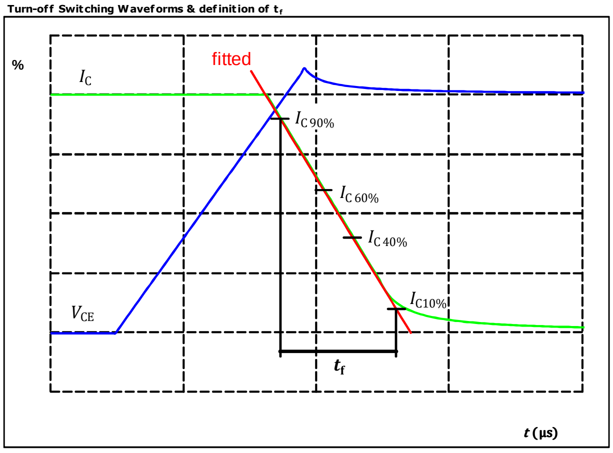
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



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

figure 3. IGBT

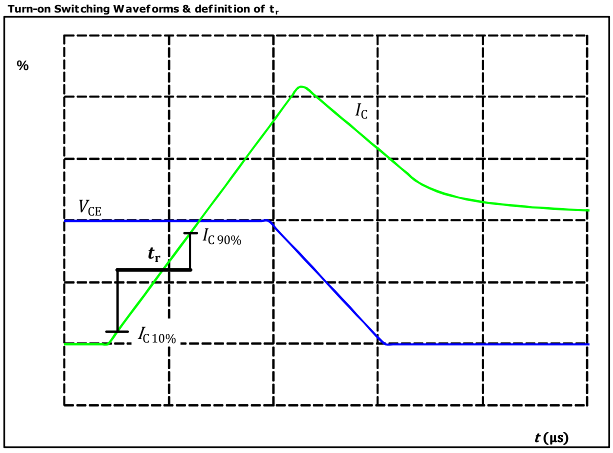
Turn-off Switching Waveforms & definition of t_f



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

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

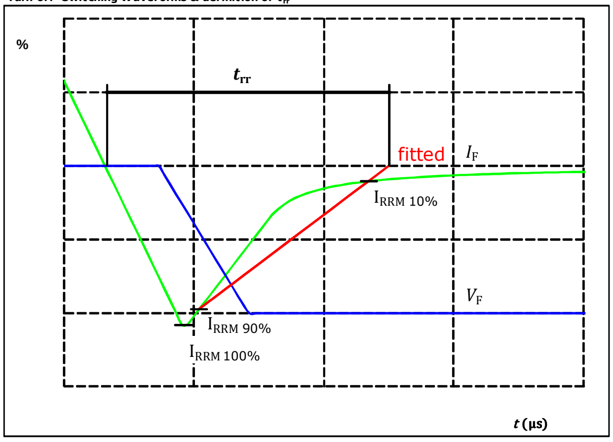


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_r =	28	ns

Buck Switching Characteristics

figure 5. FWD

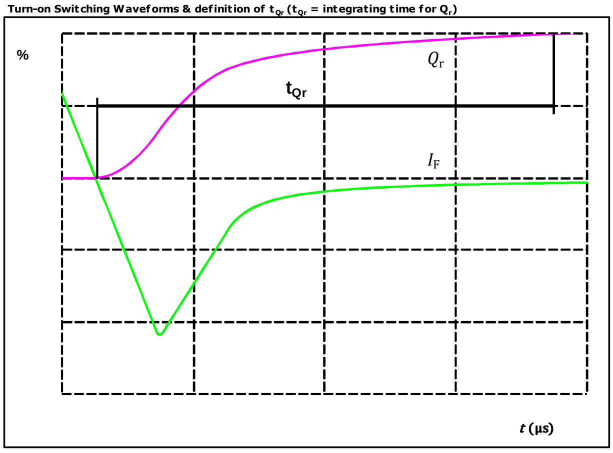
Turn-off Switching Waveforms & definition of t_{rr}



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)

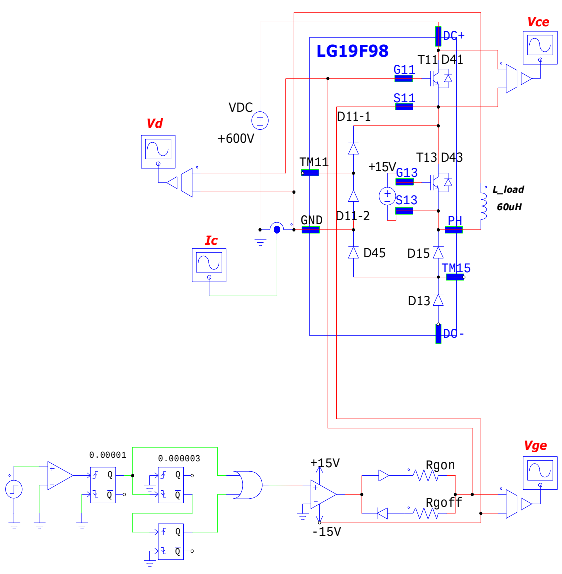


I_F (100%) =	200	A
Q_r (100%) =	10,61	µC

Buck Switching Measurment circuit

figure 1.

BUCK IGBT SW MEASUREMENT

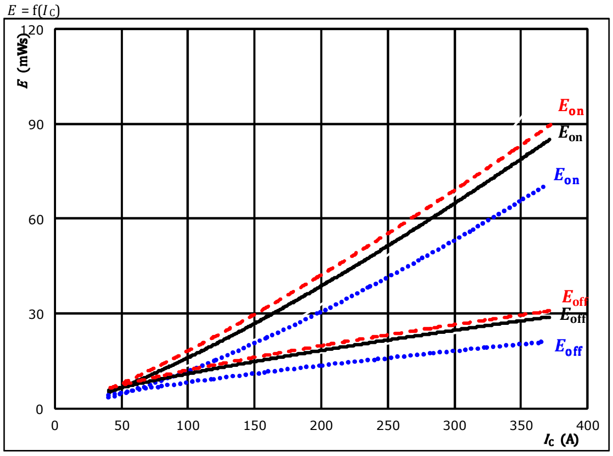


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



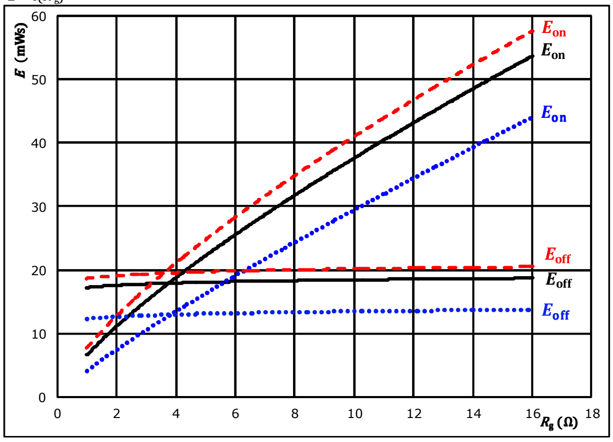
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
R_{gon} =	8	Ω		150 °C	dashed (red)
R_{goff} =	8	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



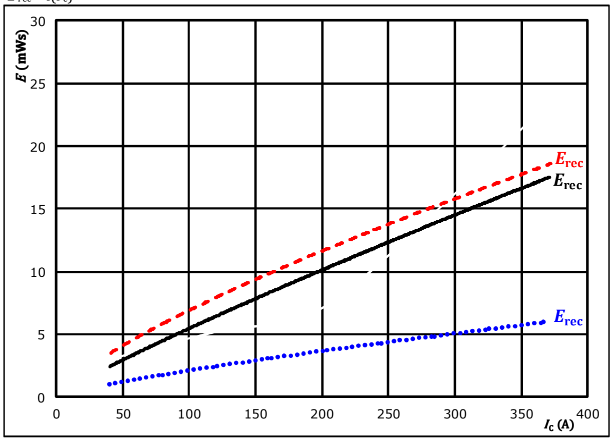
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
I_C =	200	A		150 °C	dashed (red)

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



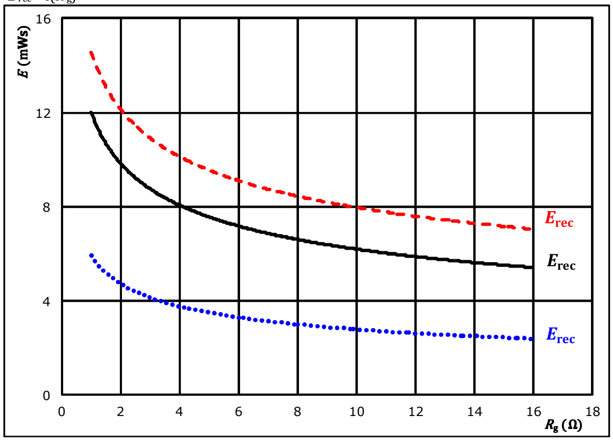
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
R_{gon} =	8	Ω		150 °C	dashed (red)

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

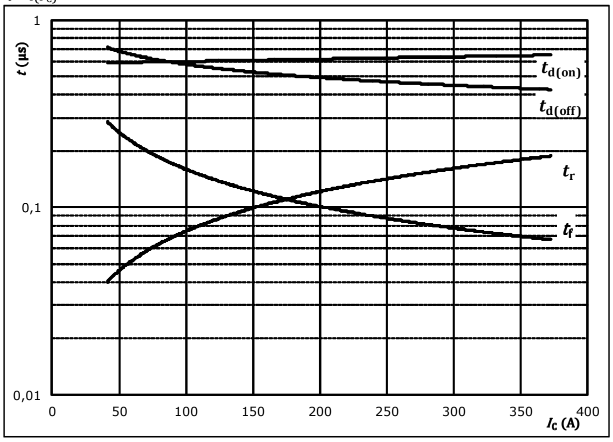
V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
I_C =	200	A		150 °C	dashed (red)

Boost Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



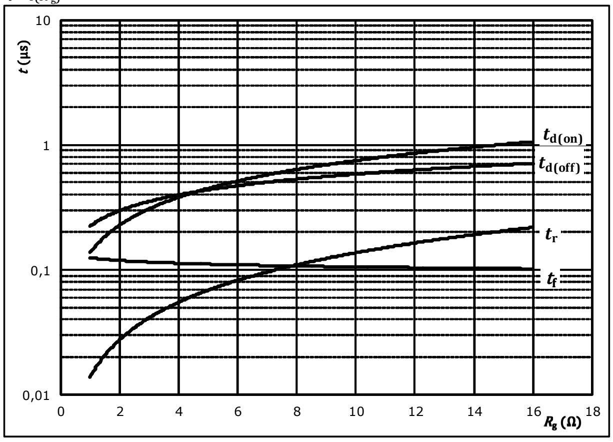
With an inductive load at

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

$t = f(R_g)$



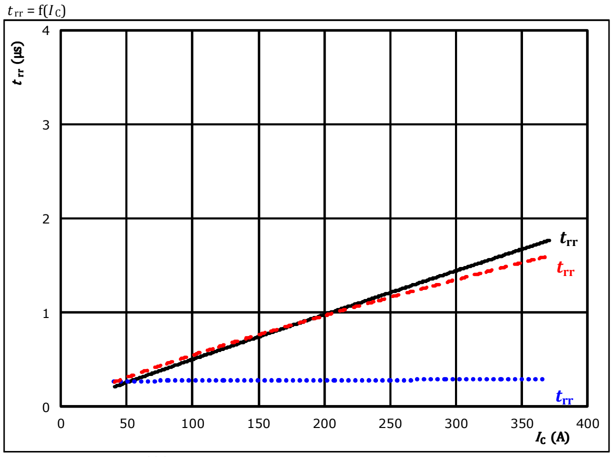
With an inductive load at

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

$t_{rr} = f(I_C)$

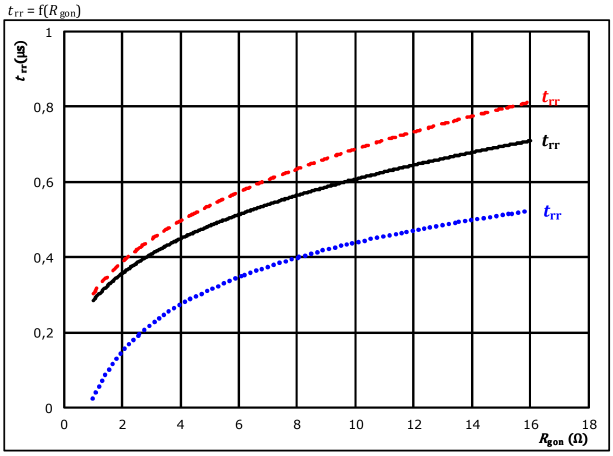


At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	8	Ω		150 °C	dashed

figure 8. **FWD**

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

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



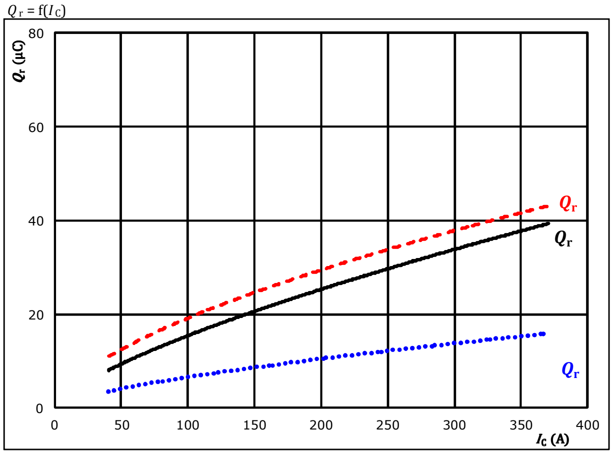
At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	200	A		150 °C	dashed

Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

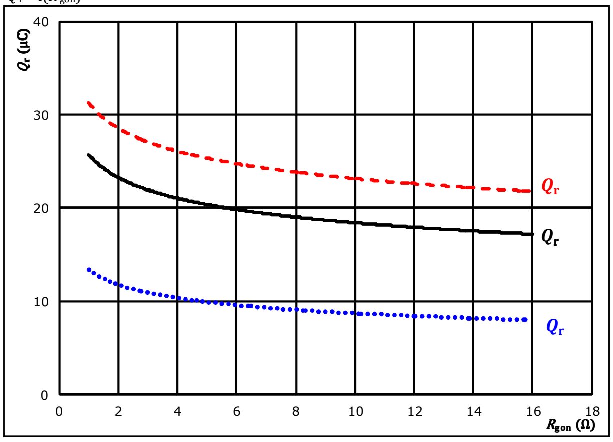


At V_{CE} = 600 V, V_{GE} = ±15 V, R_{gon} = 8 Ω; T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 10. FWD

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

$Q_r = f(R_{gon})$

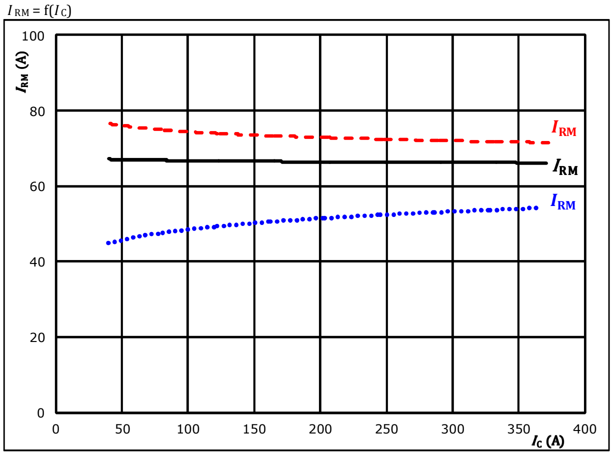


At V_{CE} = 600 V, V_{GE} = ±15 V, I_C = 200 A; T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 11. FWD

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

$I_{RM} = f(I_C)$

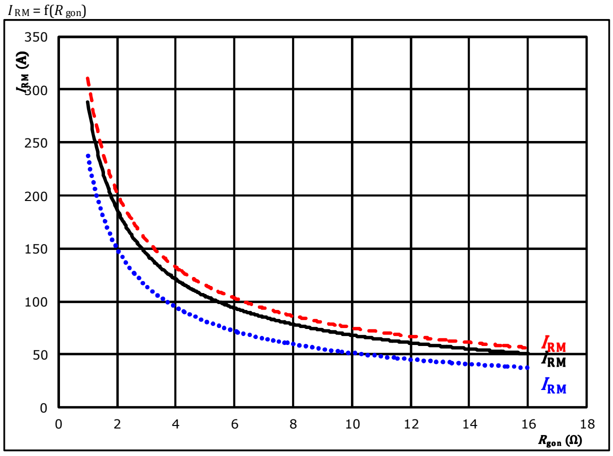


At V_{CE} = 600 V, V_{GE} = ±15 V, R_{gon} = 8 Ω; T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 12. FWD

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

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



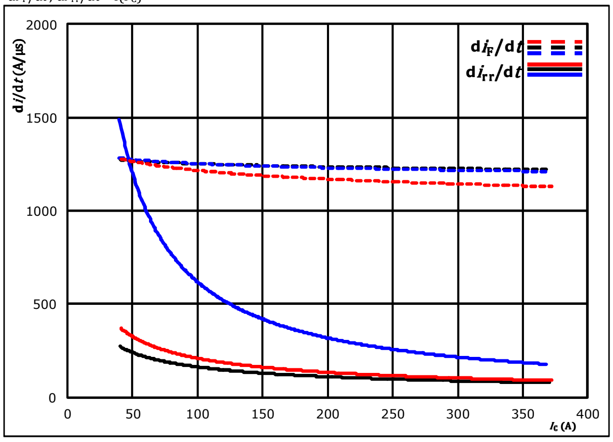
At V_{CE} = 600 V, V_{GE} = ±15 V, I_C = 200 A; T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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

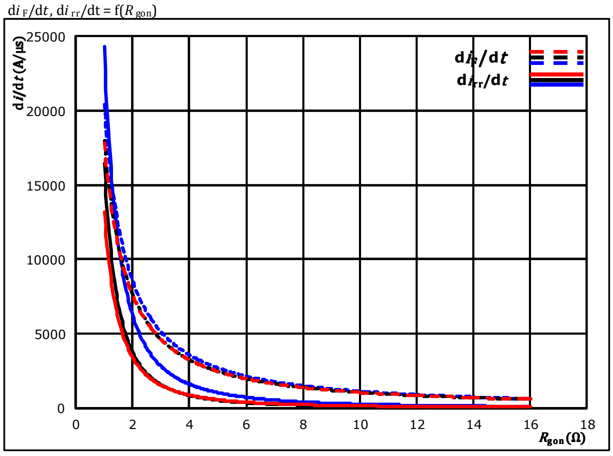


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

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

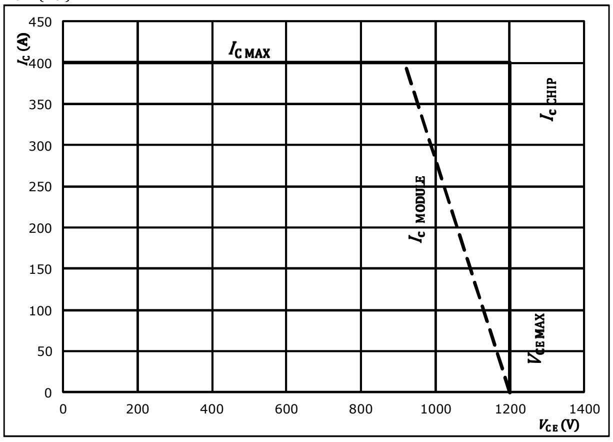


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

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

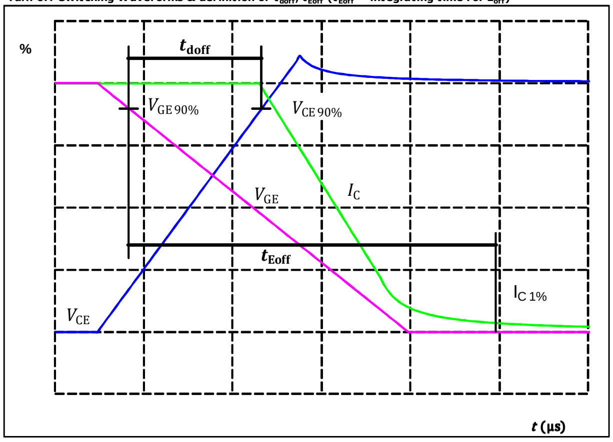
Boost Switching Definitions

General conditions

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

figure 1. **IGBT**

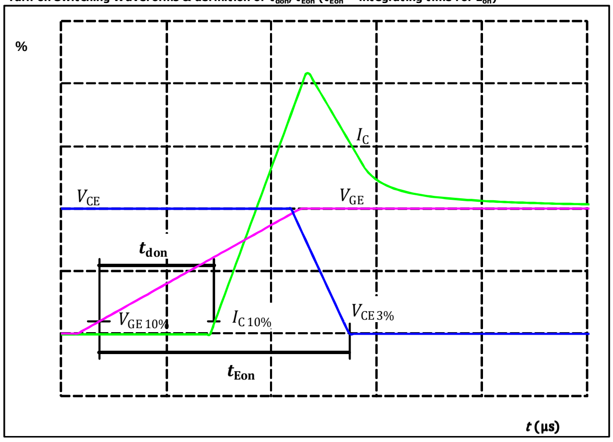
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



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

figure 2. **IGBT**

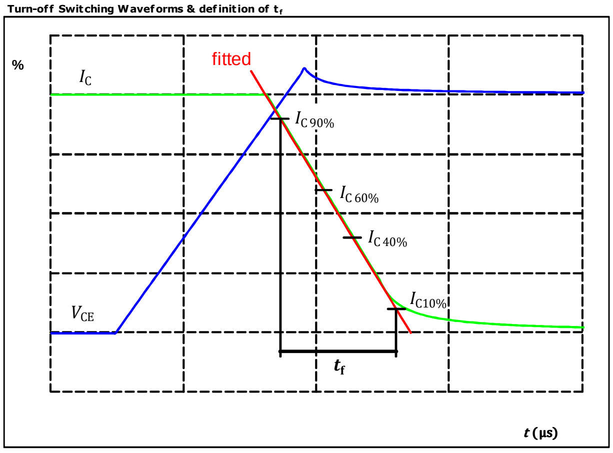
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



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

figure 3. **IGBT**

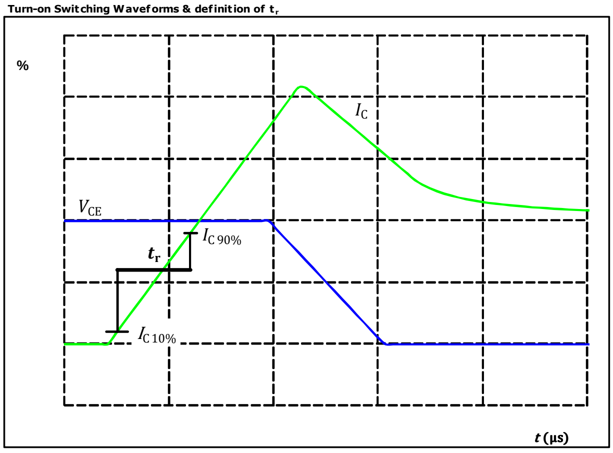
Turn-off Switching Waveforms & definition of t_f



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

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

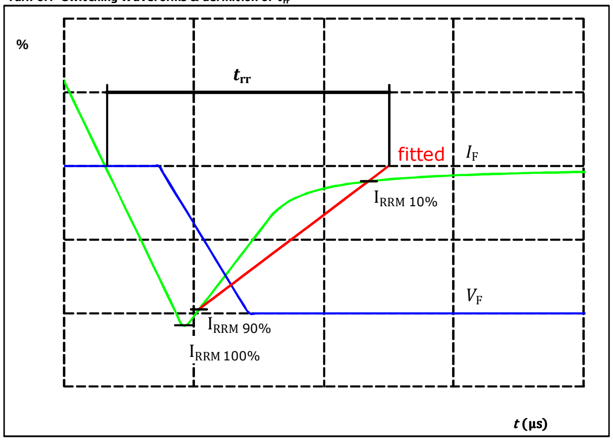


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_r =	110	ns

Boost Switching Characteristics

figure 5. FWD

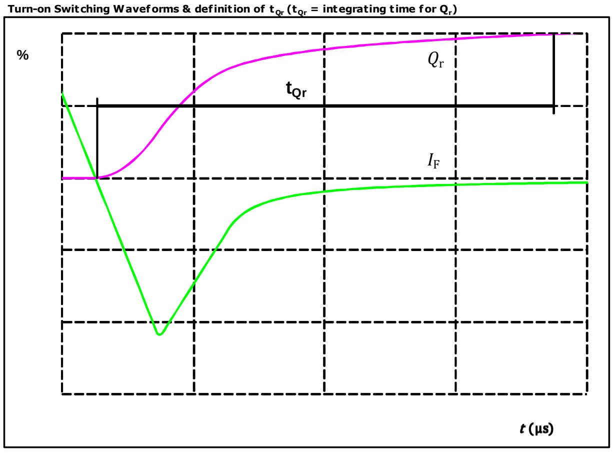
Turn-off Switching Waveforms & definition of t_{rr}



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)

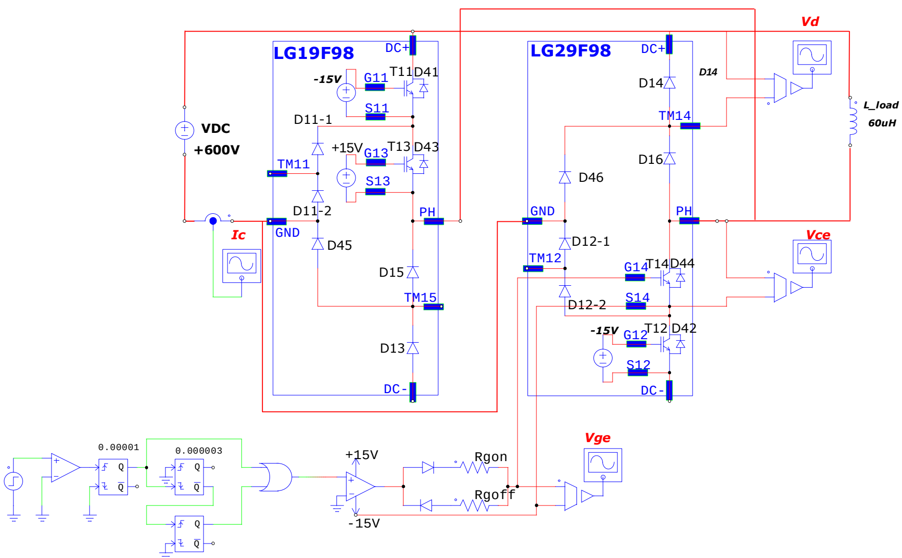


I_F (100%) =	200	A
Q_r (100%) =	19,43	µC

Boost Switching Measurment circuit

figure 1.

BOOST IGBT SW MEASUREMENT



Ordering Code & Marking

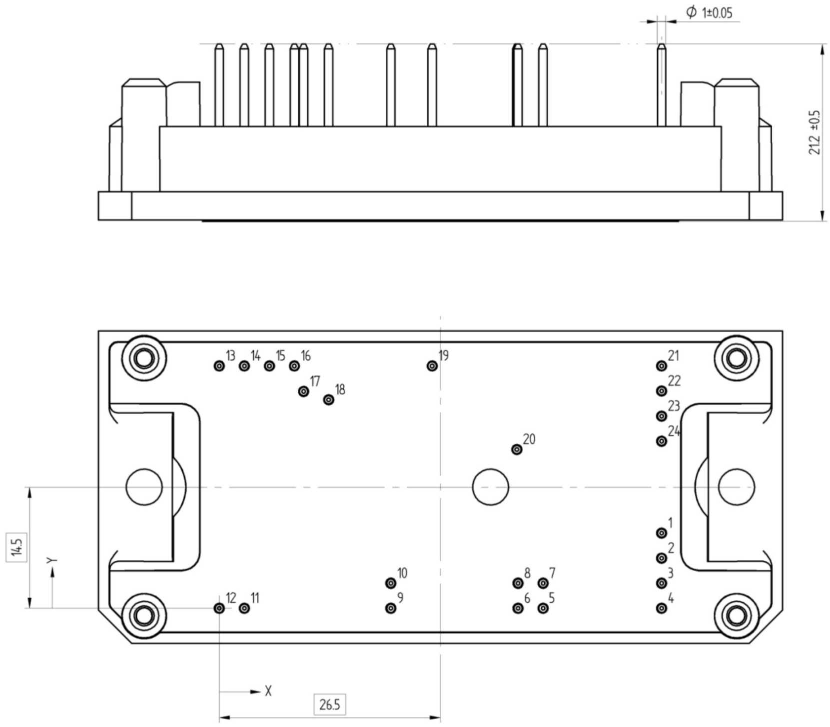
Version	Ordering Code
without thermal paste 17 mm housing with solder pins	10-F124NID200SH03-LG19F98
with thermal paste 17 mm housing with solder pins	10-F124NID200SH03-LG19F98-/3/

	Name		Date code	UL & VIN	Lot	Serial
Text	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

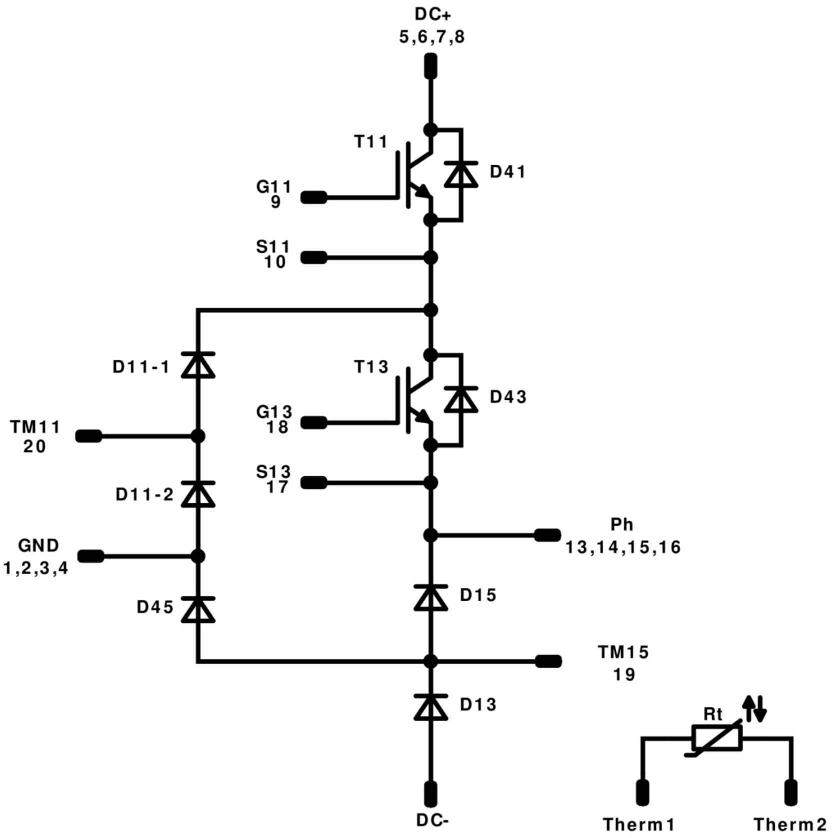
Outline

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	

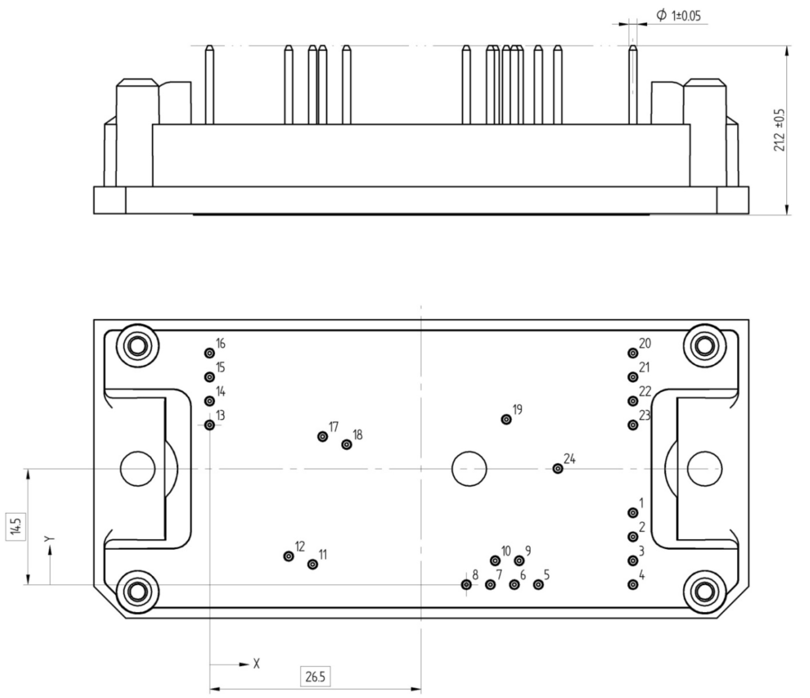
Ordering Code & Marking						
Version			**Ordering Code**			
without thermal paste 17 mm housing with solder pins			10-F124NIE200SH03-LG29F98			
with thermal paste 17 mm housing with solder pins			10-F124NIE200SH03-LG29F98-/3/			
NN-NNNNNNNNNNNNNN TTTTTTVV WWYY UL VIN LLLLL SSSS	**Text**	**Name**	**Date 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

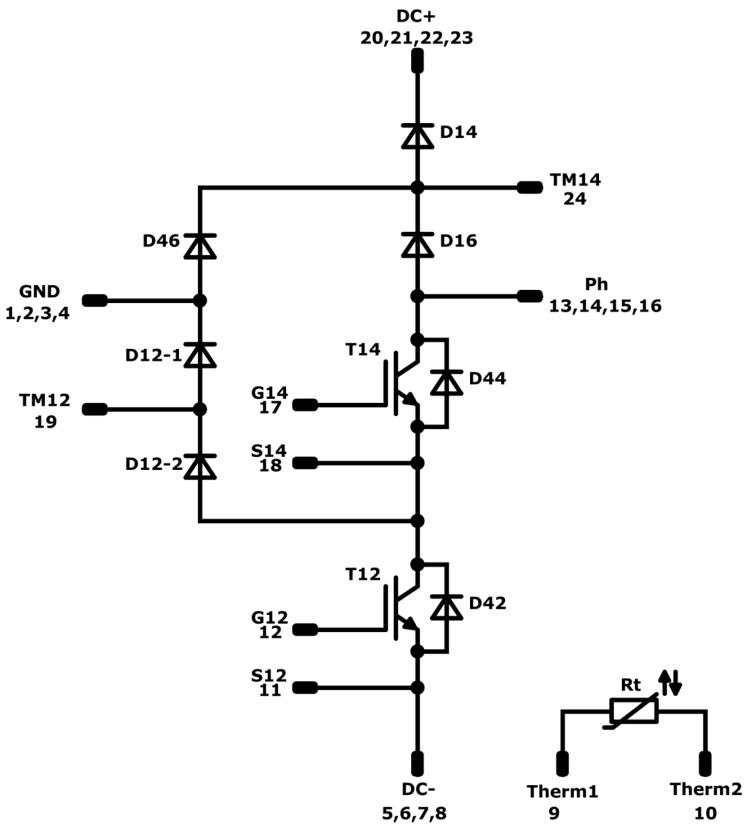
Pin table

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-D1-14	03 May. 2018		