Vincotech

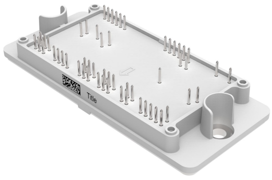
30-FT12NMA200SH01-M660F18
30-PT12NMA200SH01-M660F18Y
datasheet

***flow* MNPC 2** | **1200 V / 200 A**

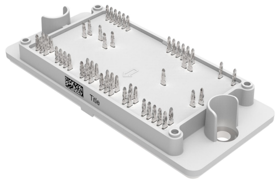
Features

- Three-level MNPC topology
- Reactive power capability
- High speed IGBTs
- Low inductive layout

flow 2 13 mm housing



Solder pin

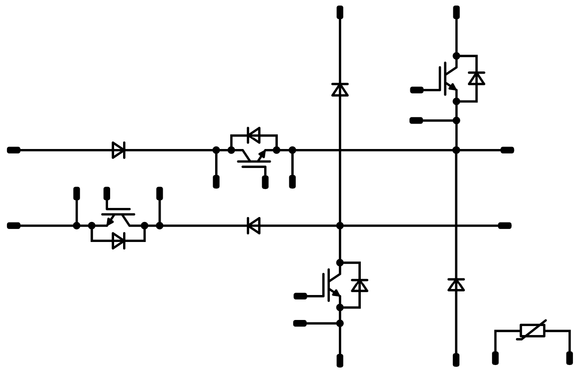


press-fit pin

Target applications

- Industrial Drives
- Solar Inverters
- UPS

Schematic



Types

- 30-FT12NMA200SH01-M660F18
- 30-PT12NMA200SH01-M660F18Y

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	171	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	434	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}		700	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	87	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	109	W
Maximum junction temperature	T_{jmax}		150	°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	15	A
Repetitive peak forward current	I_{FRM}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}		150	°C
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	125	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	450	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	198	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V V_{cc} = 360 V T_j = 150 °C	6	µs
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	84	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	540	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	186	W
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	50	A
Repetitive peak forward current	I_{FRM}			100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	82	W
Maximum junction temperature	T_{jmax}			175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition		Value	Unit
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition		Value	Unit
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	4000	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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0068	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125	2	2,17 2,58	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			24	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Internal gate resistance	r_g							1		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		11080		pF
Reverse transfer capacitance	C_{res}							640		
Gate charge	Q_g		±15	600	200	25		1,52		µC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						0,22		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	350	200	25 125		124 126		ns
Rise time	t_r					25 125		27 32		
Turn-off delay time	$t_{d(off)}$					25 125		190 234		
Fall time	t_f					25 125		41 61		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,5 µC Q_{rFWD} = 11 µC				25 125		2,38 4,20		mWs
Turn-off energy (per pulse)	E_{off}					25 125		5,02 7,97		

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				150	25 125	1,4	1,79 1,61	3,3	V
Reverse leakage current	I_R			700		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						0,64		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 7630 A/µs di/dt = 6381 A/µs	±15	350	200	25 125		130 169		A
Reverse recovery time	t_{rr}					25 125		93 118		ns
Recovered charge	Q_r					25 125		4,47 11,00		µC
Reverse recovered energy	E_{rec}					25 125		0,905 2,39		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		5241 1766		A/µs
Buck Sw. Protection Diode										
Static										
Forward voltage	V_F				15	25 125	1,6	2,13 1,74	2,6	V
Reverse leakage current	I_R			1200		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						1,35		K/W

Characteristic Values

Boost Switch

Static

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
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0024	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125	1,05	1,57 1,68	1,85	V
Collector-emitter cut-off current	I_{CES}		0	650		25			7,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1200	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		9240		pF
Output capacitance	C_{oes}	f = 1 Mhz	0	25		25		376		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		274		pF
Gate charge	Q_g		15	480	150	25		940		nC

Thermal

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
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						0,48		K/W

Dynamic

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
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	350	150	25 125		123 114		ns
Rise time	t_r	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	350	150	25 125		21 21		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	350	150	25 125		168 177		ns
Fall time	t_f	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	350	150	25 125		38 59		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 6,6 µC Q_{rFWD} = 12,9 µC	±15	350	150	25 125		1,19 1,72		mWs
Turn-off energy (per pulse)	E_{off}		±15	350	150	25 125		3,59 5,13		mWs

Characteristic Values

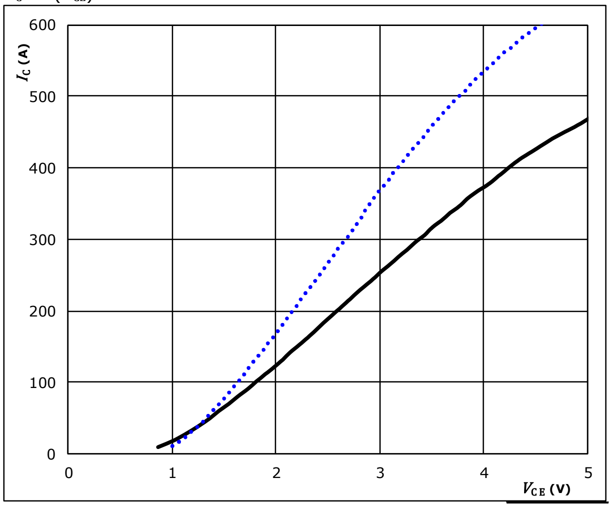
Parameter	Symbol	Conditions	V_{GE} [V] / V_{GS} [V]	V_{CE} [V] / V_{DS} [V] / V_F [V]	I_C [A] / I_D [A] / I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Boost Diode										
Static										
Forward voltage	V_F				100	25 125	1,5	2,23 2,34	2,54	V
Reverse leakage current	I_R			1200		25 150			120 17600	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						0,51		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 9114 A/µs di/dt = 8387 A/µs	±15	350	150	25 125		184 216		A
Reverse recovery time	t_{rr}					25 125		48 114		ns
Recovered charge	Q_r					25 125		6,619 12,94		µC
Reverse recovered energy	E_{rec}					25 125		1,62 3,42		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		11659 9489		A/µs
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				50	25 125	1,20	1,78 1,70	1,90	V
Reverse leakage current	I_R			650		25			0,6	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						1,16		K/W
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

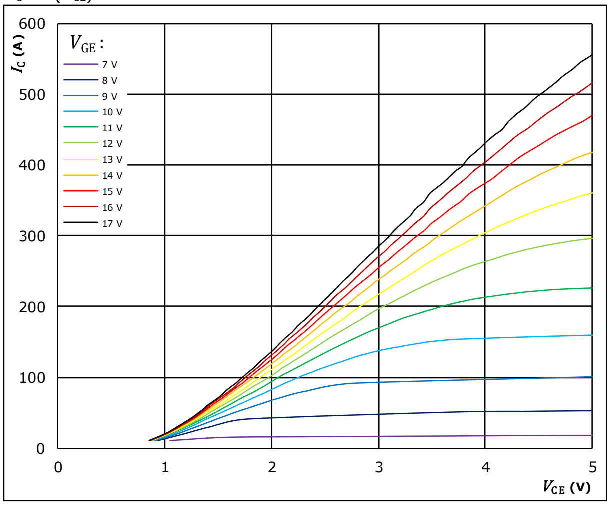


t_p =	250	µs	T_j:	25 °C	dotted
V_{GE} =	15	V		125 °C	solid

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

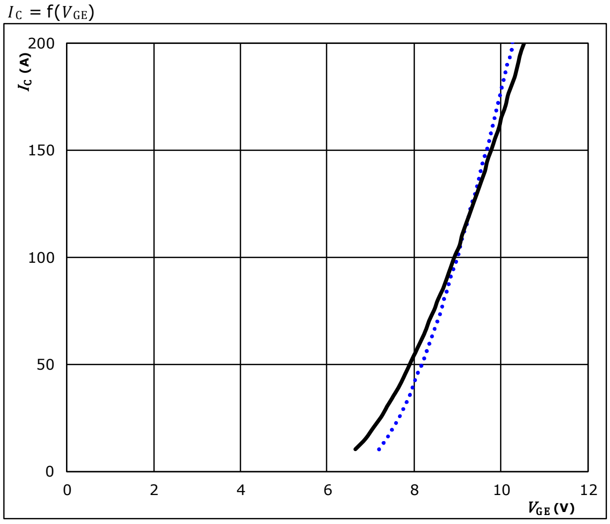


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

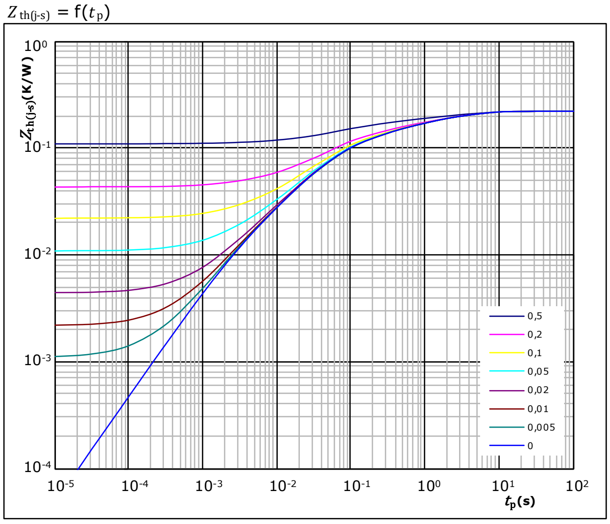


t_p =	100	µs	T_j:	25 °C	dotted
V_{CE} =	10	V		125 °C	solid

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,22 K/W

IGBT thermal model values

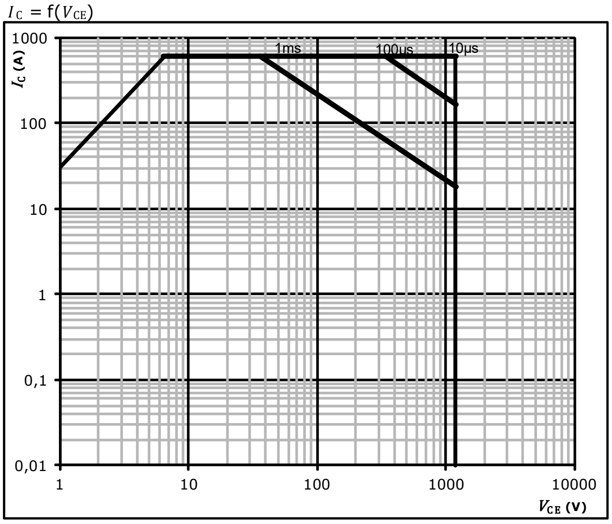
R (K/W)	τ (s)
4,22E-02	3,98E+00
4,51E-02	9,40E-01
4,08E-02	2,28E-01
6,82E-02	5,37E-02
1,62E-02	1,58E-02
6,17E-03	2,79E-03

Buck Switch Characteristics

figure 5.	**IGBT**

Safe operating area

$I_C = f(V_{CE})$



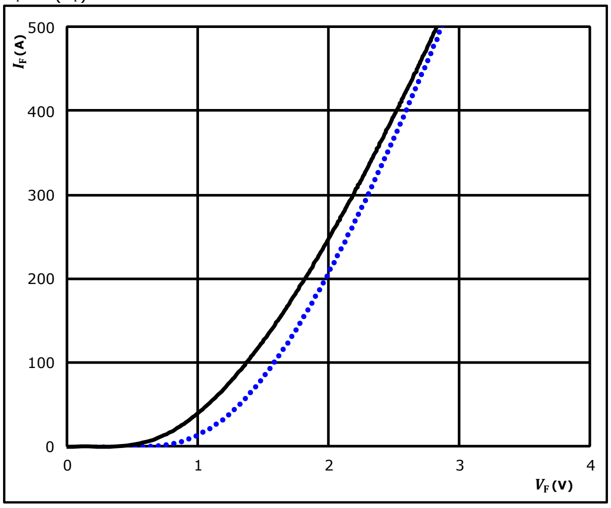
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Buck Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



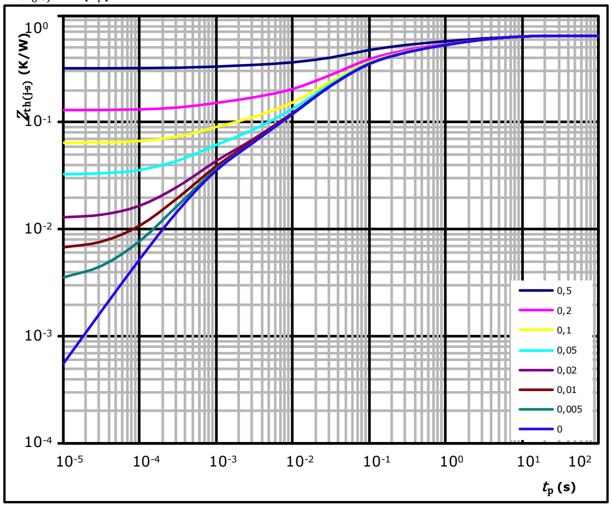
t_p = 250 µs

T_j: 25 °C (dotted); 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,64 K/W

FWD thermal model values

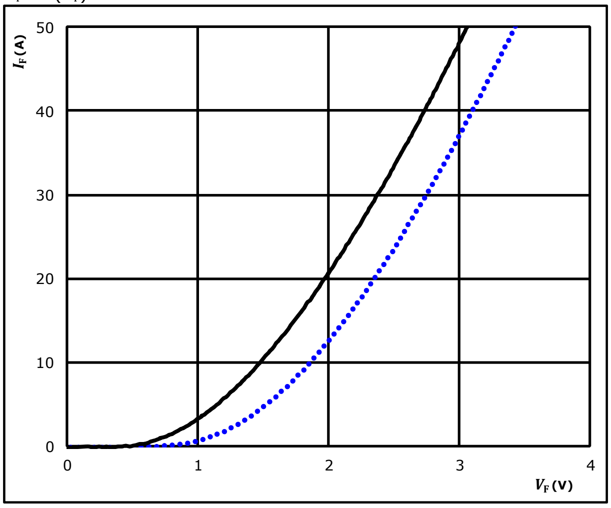
R (K/W)	τ (s)
8,64E-02	4,57E+00
1,07E-01	1,16E+00
1,60E-01	1,83E-01
2,26E-01	3,83E-02
3,16E-02	5,84E-03
3,18E-02	7,41E-04

Buck Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



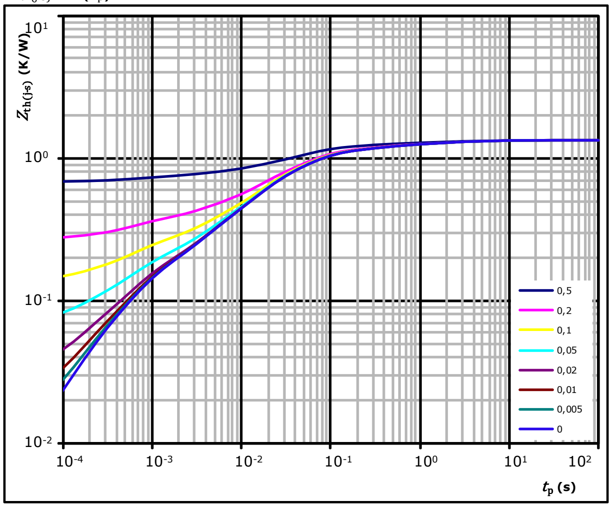
t_p = 250 µs

T_j: 25 °C (dotted); 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,35 K/W

FWD thermal model values

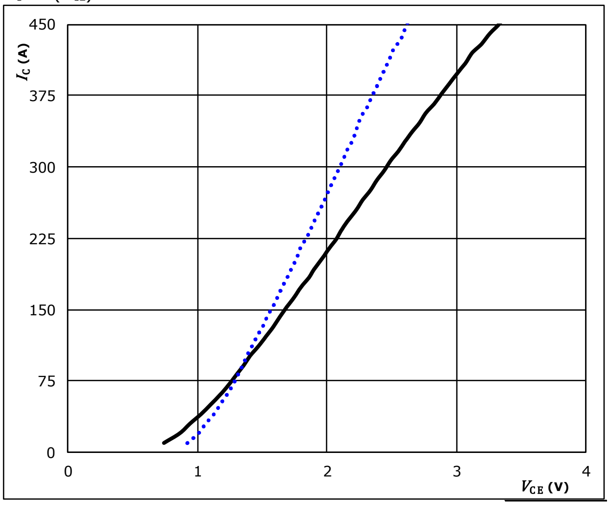
R (K/W)	τ (s)
6,28E-02	4,29E+00
1,37E-01	7,41E-01
2,22E-01	1,16E-01
6,61E-01	2,97E-02
1,45E-01	5,97E-03
1,19E-01	5,93E-04

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

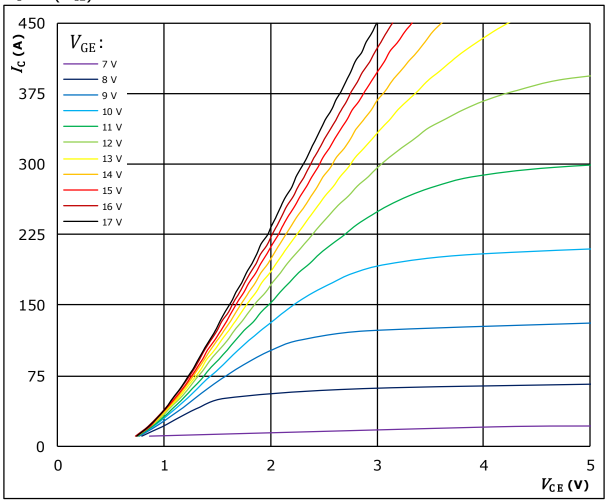


t_p =	250	µs	T_j:	25 °C	....
V_{GE} =	15	V		125 °C	———

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

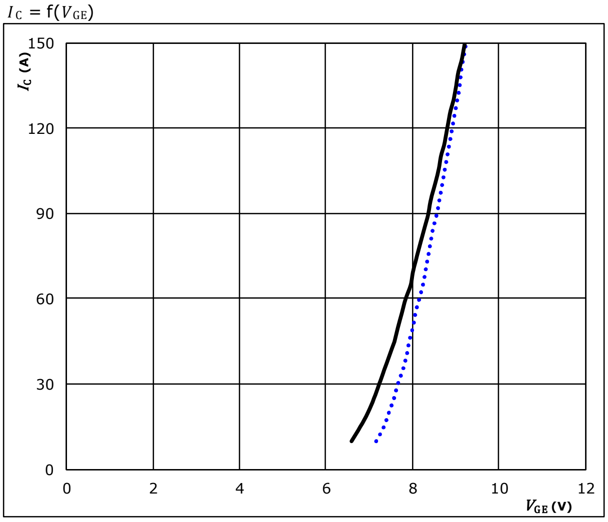


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

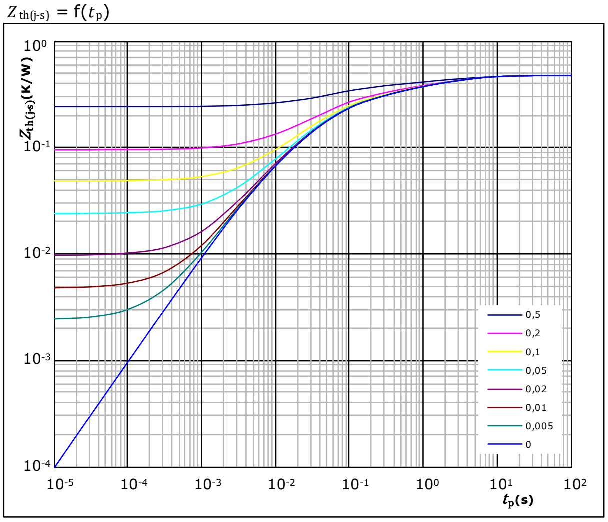


t_p =	100	µs	T_j:	25 °C	....
V_{CE} =	10	V		125 °C	———

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,48 K/W

IGBT thermal model values

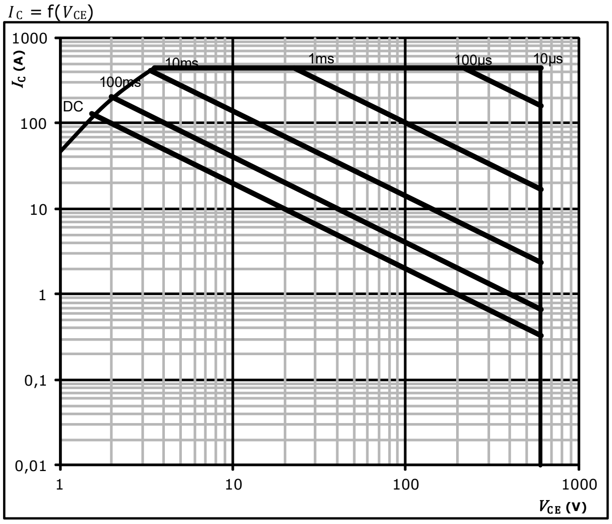
R (K/W)	τ (s)
8,90E-02	4,40E+00
1,10E-01	7,62E-01
1,05E-01	1,32E-01
1,51E-01	3,41E-02
2,43E-02	5,47E-03

Boost Switch Characteristics

figure 5. IGBT

Safe operating area

$I_C = f(V_{CE})$



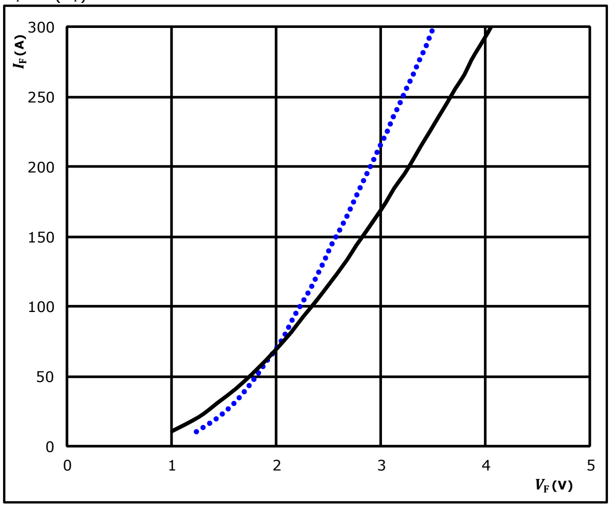
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



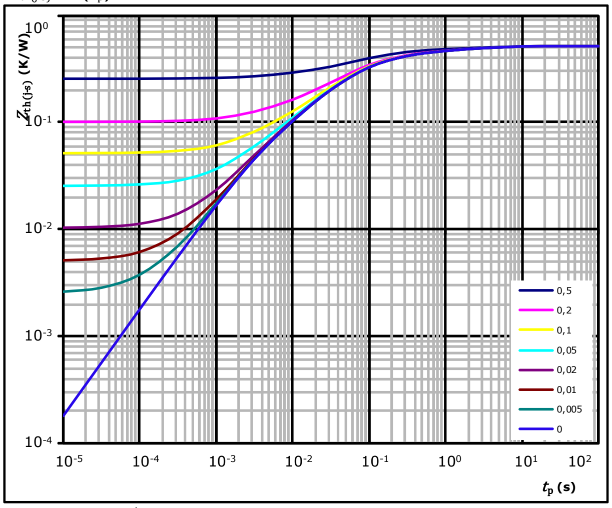
t_p = 250 µs

T_j: 25 °C (dotted line), 125 °C (solid line)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,51 K/W

FWD thermal model values

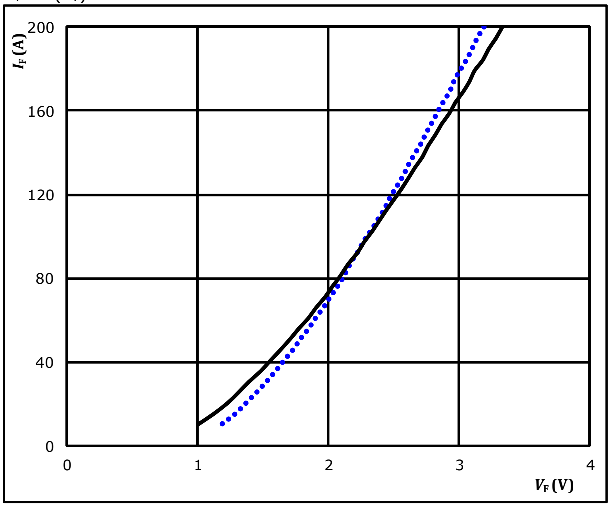
R (K/W)	τ (s)
5,62E-02	3,05E+00
8,02E-02	4,55E-01
1,97E-01	8,90E-02
1,39E-01	2,65E-02
3,83E-02	3,64E-03

Boost Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



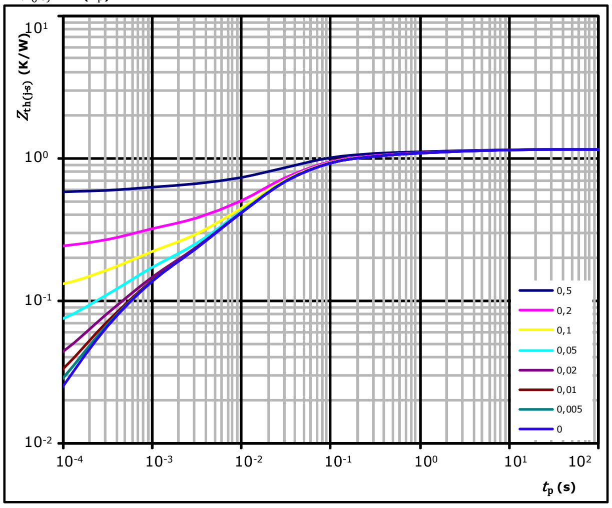
t_p = 250 μs

T_j: 25 °C ············
125 °C ———

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,16 K/W

FWD thermal model values

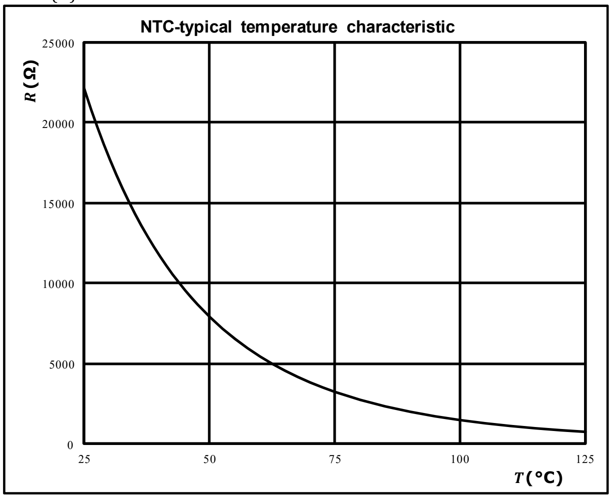
R (K/W)	τ (s)
5,64E-02	5,13E+00
1,01E-01	6,20E-01
2,54E-01	8,75E-02
5,53E-01	2,26E-02
9,80E-02	3,72E-03
9,63E-02	4,43E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

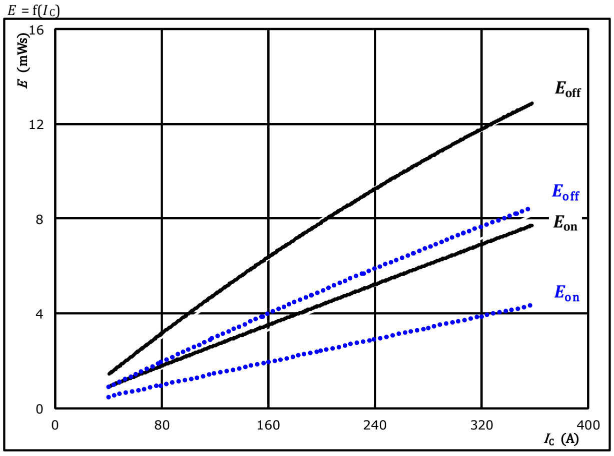


Buck Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



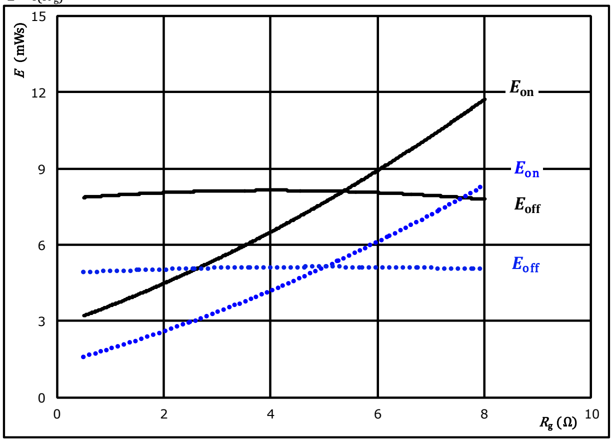
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	··········
V_{GE} =	±15	V	125 °C	——
R_{gon} =	2	Ω		
R_{goff} =	2	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



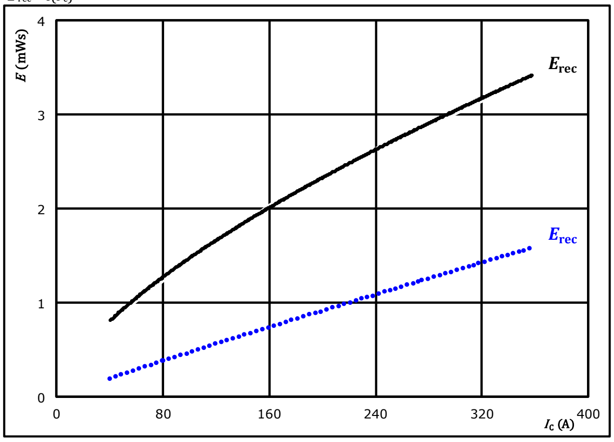
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	··········
V_{GE} =	±15	V	125 °C	——
I_C =	200	A		

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



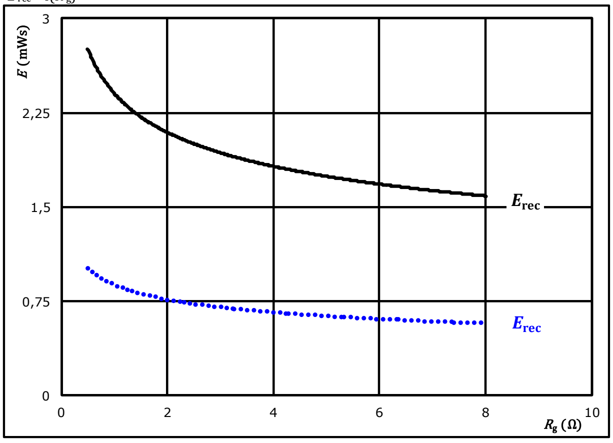
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	··········
V_{GE} =	±15	V	125 °C	——
R_{gon} =	2	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

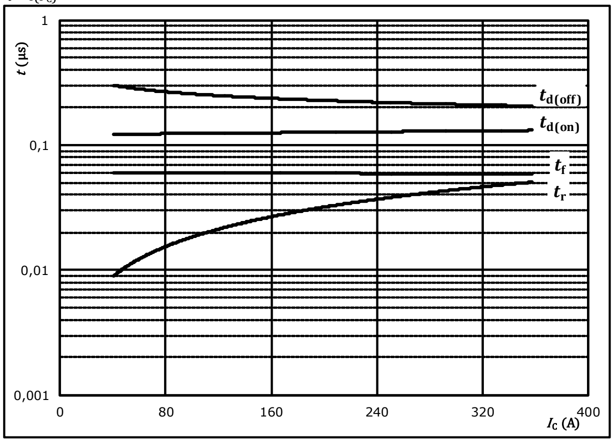
V_{CE} =	350	V	T_j: 25 °C	··········
V_{GE} =	±15	V	125 °C	——
I_C =	200	A		

Buck Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



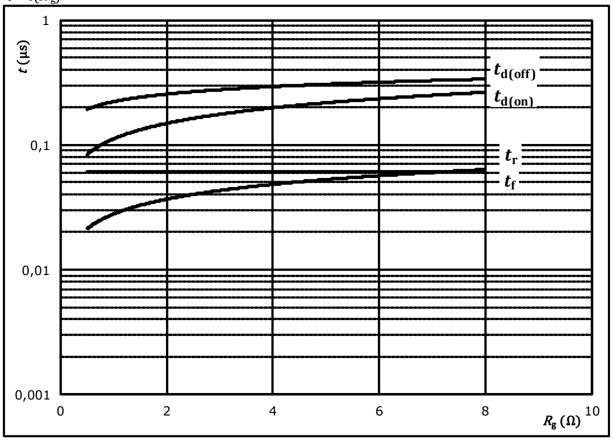
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



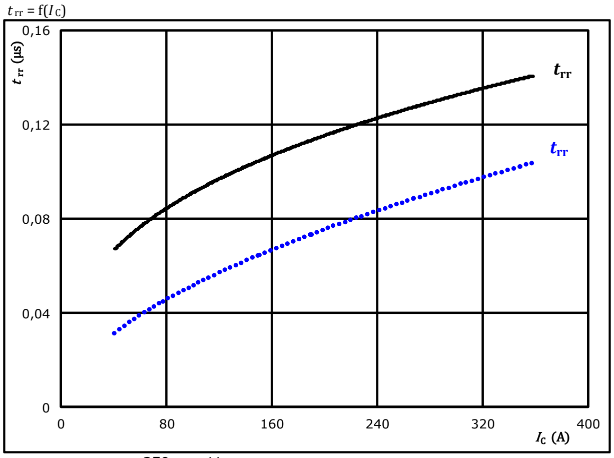
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	200	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

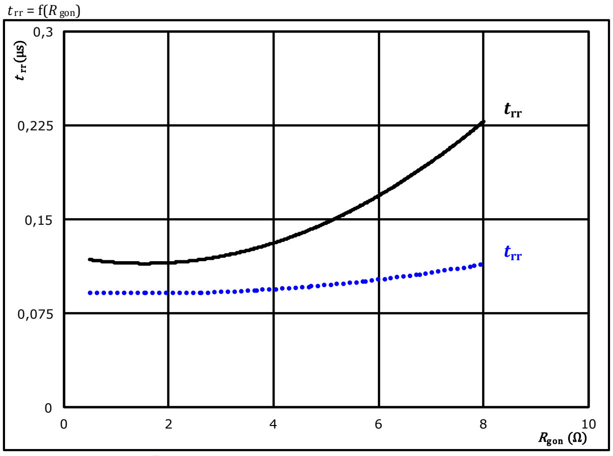


At						
V_{CE}=	350	V	T_j:	25 °C	············
V_{GE} =	±15	V		125 °C	————
R_{gon} =	2	Ω			

figure 8. **FWD**

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

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



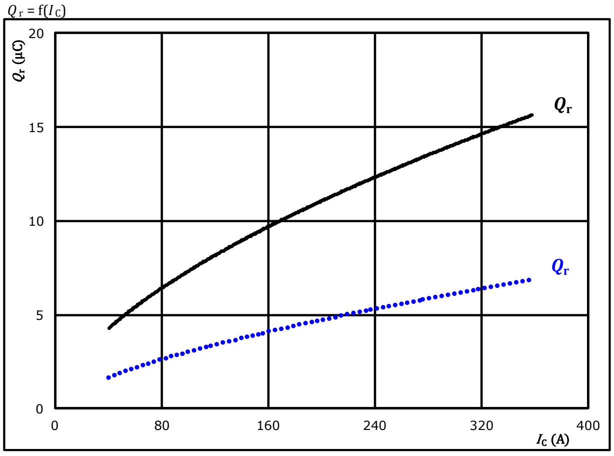
At					
V_{CE}=	350	V	T_j:	25 °C	············
V_{GE} =	±15	V		125 °C	————
I_C =	200	A			

Buck Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

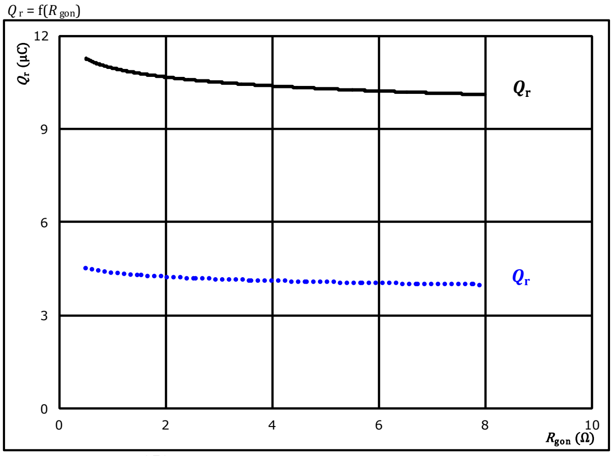


At				
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
R_{gon} =	2	Ω		

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

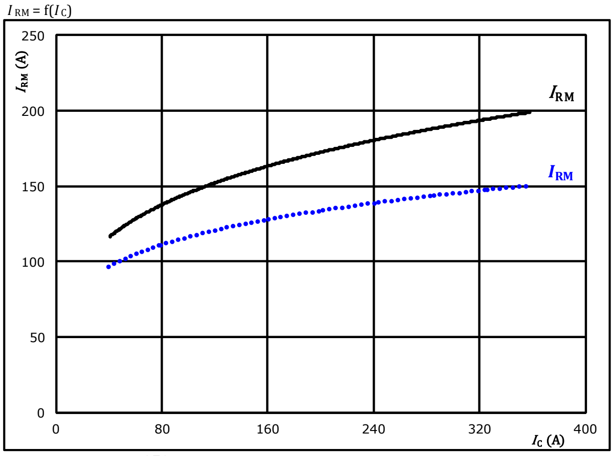


At				
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	200	A		

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

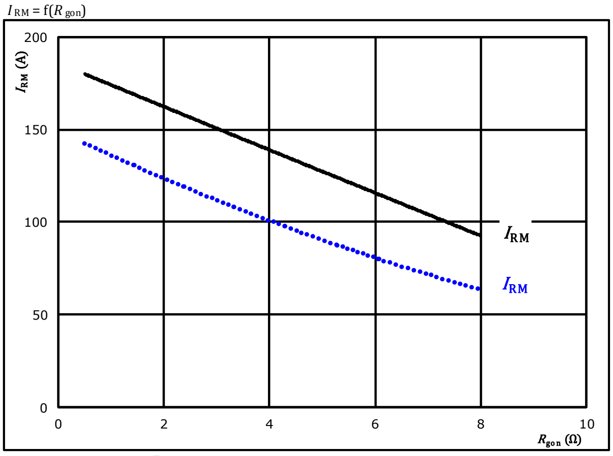


At				
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
R_{gon} =	2	Ω		

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} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	200	A		

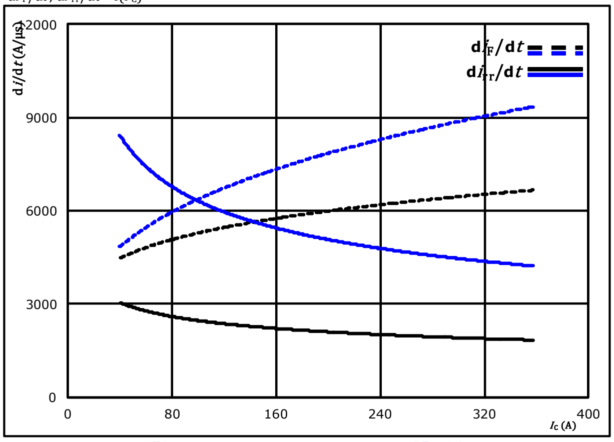
Vincotech

Buck Switching Characteristics

figure 13. **FWD**

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

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



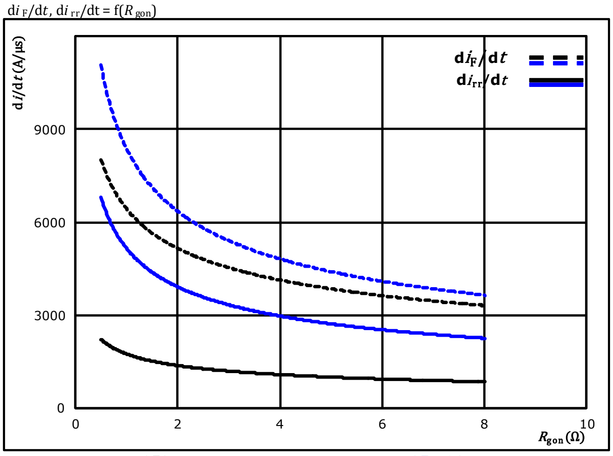
At

V_{CE} =	350	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	2	Ω			

figure 14. **FWD**

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

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



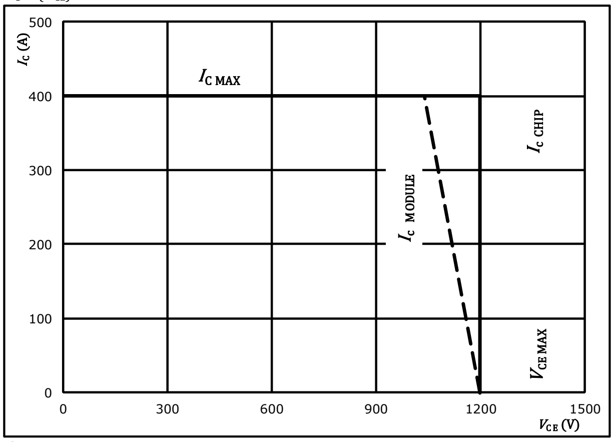
At

V_{CE} =	350	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	200	A			

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

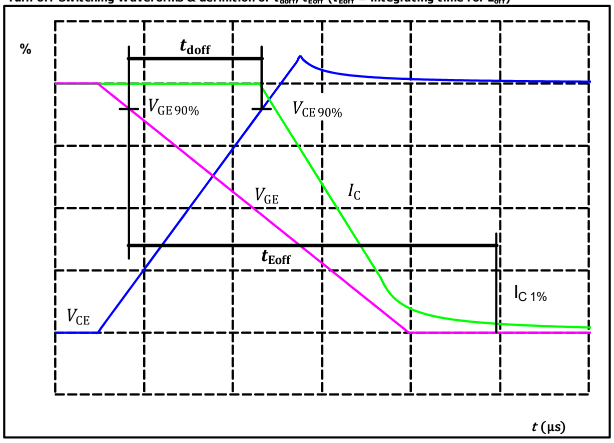
Buck Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. **IGBT**

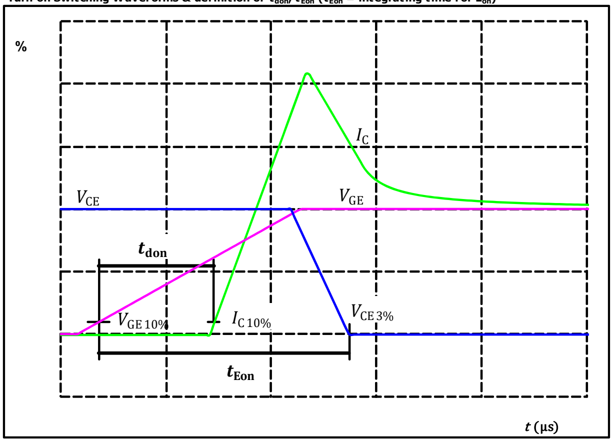
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	200	A
t_{doff} =	234	ns

figure 2. **IGBT**

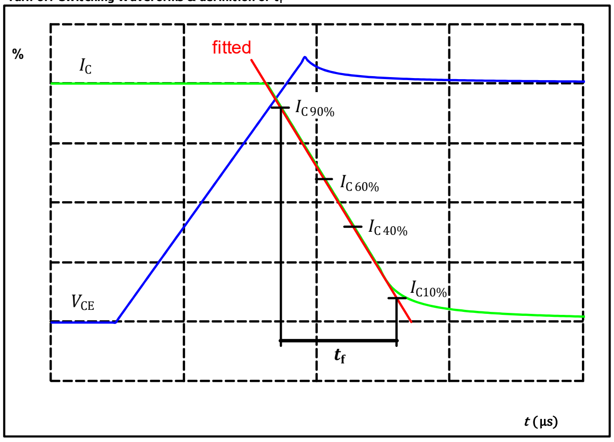
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	200	A
t_{don} =	126	ns

figure 3. **IGBT**

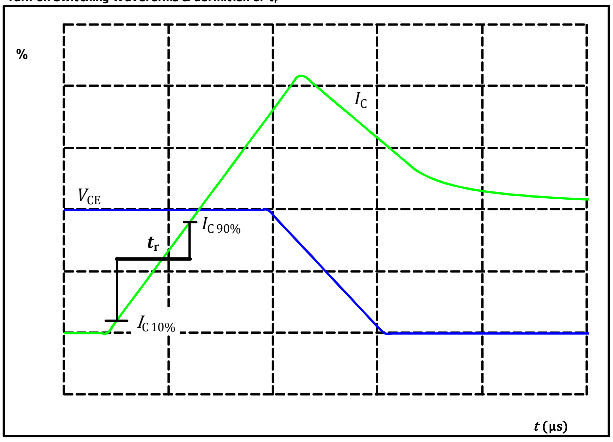
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	200	A
t_f =	61	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

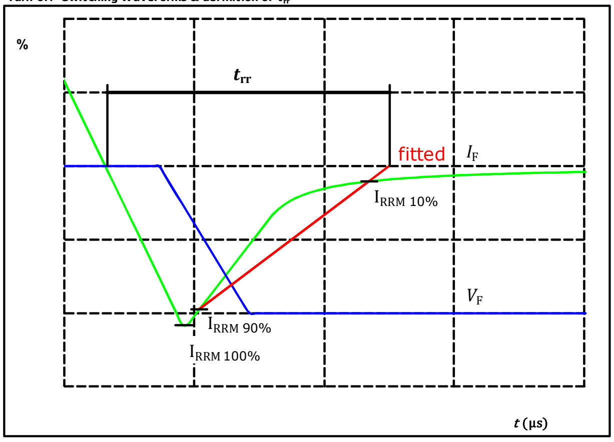


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	200	A
t_r =	32	ns

Buck Switching Characteristics

figure 5. **FWD**

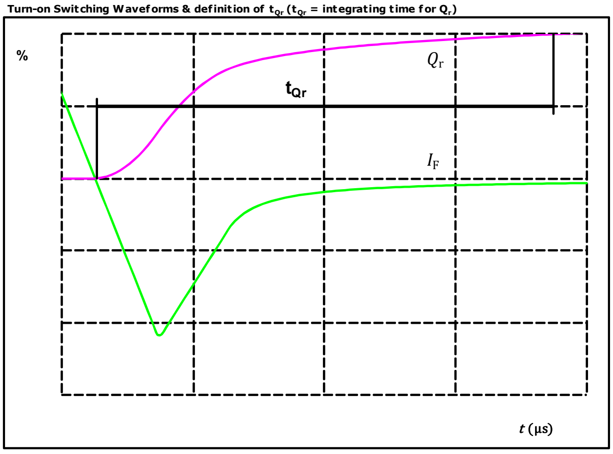
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	200	A
I_{RRM} (100%) =	169	A
t_{rr} =	118	ns

figure 6. **FWD**

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



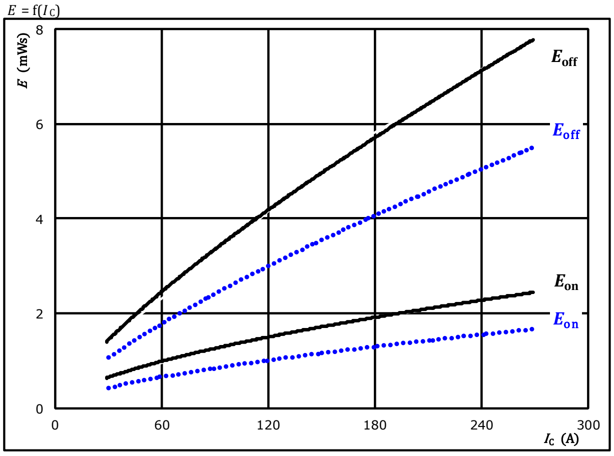
I_F (100%) =	200	A
Q_r (100%) =	11,00	µC

Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



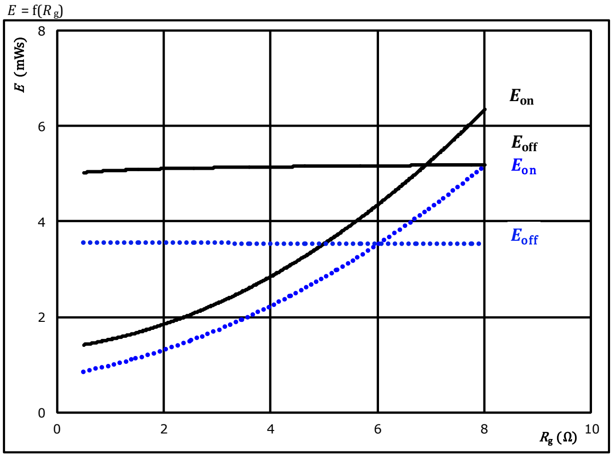
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		
R_{goff} =	2	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



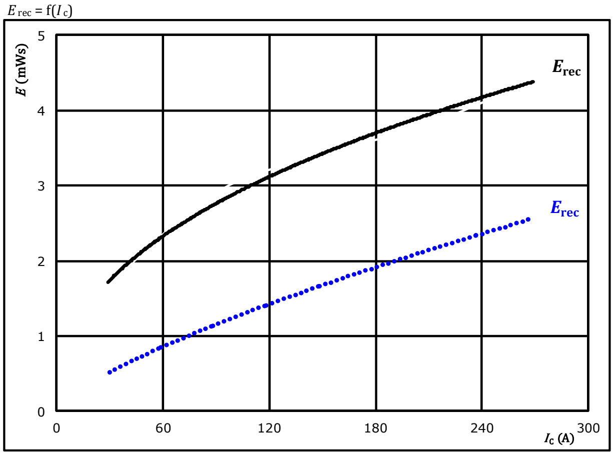
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	150	A		

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



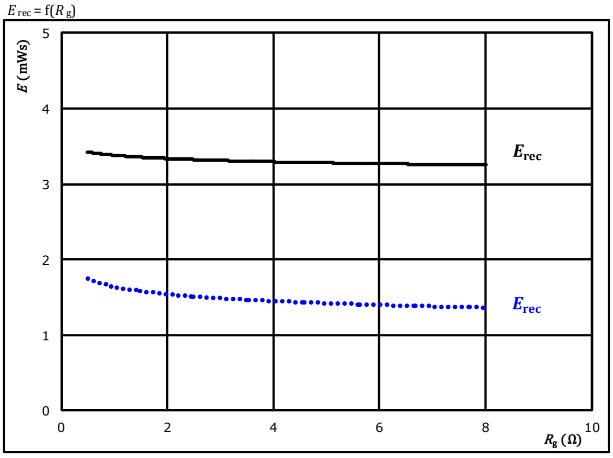
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	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

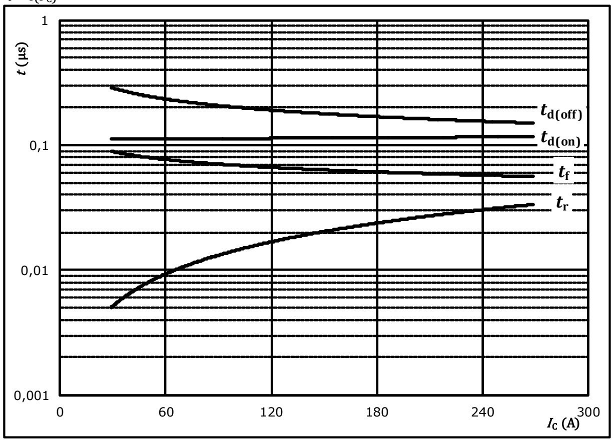
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	150	A		

Boost Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



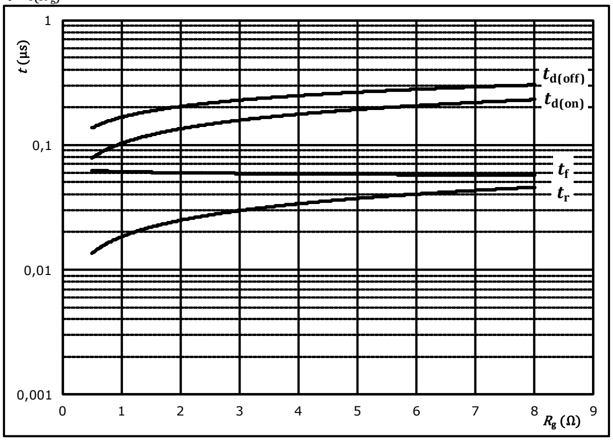
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



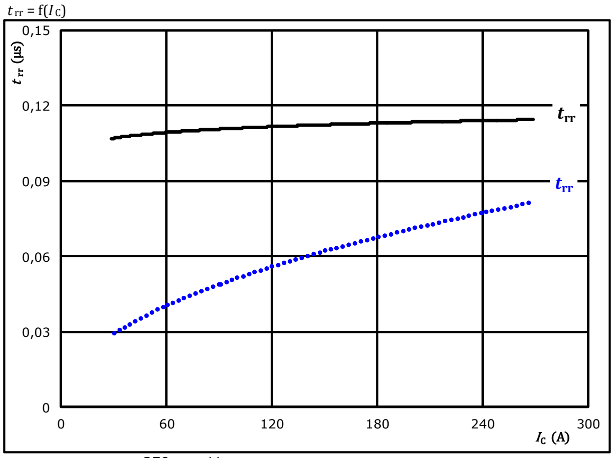
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	150	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

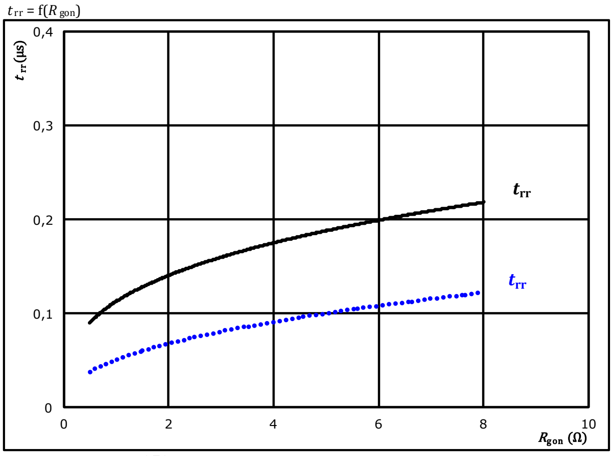


At	V_{CE} =	350	V	T_j:	25 °C (dotted)
	V_{GE} =	±15	V		125 °C (solid)
	R_{gon} =	2	Ω		

figure 8. **FWD**

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

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



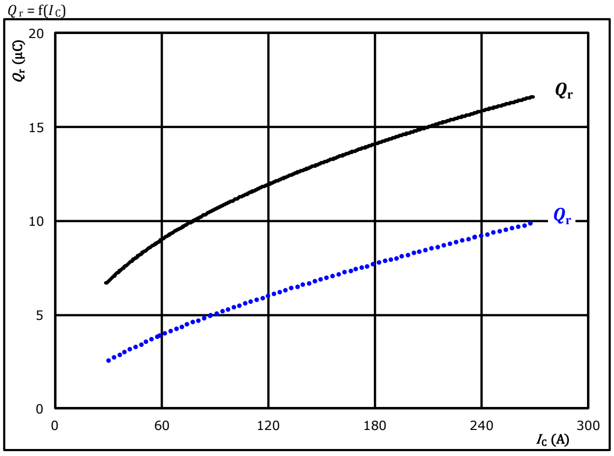
At	V_{CE} =	350	V	T_j:	25 °C (dotted)
	V_{GE} =	±15	V		125 °C (solid)
	I_C =	150	A		

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

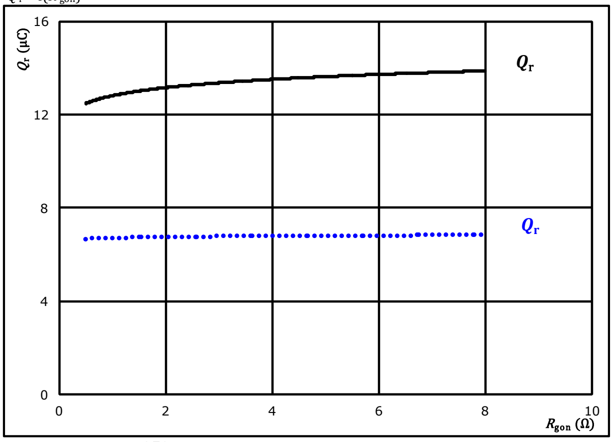


At	V_{CE} =	350	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	R_{gon} =	2	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

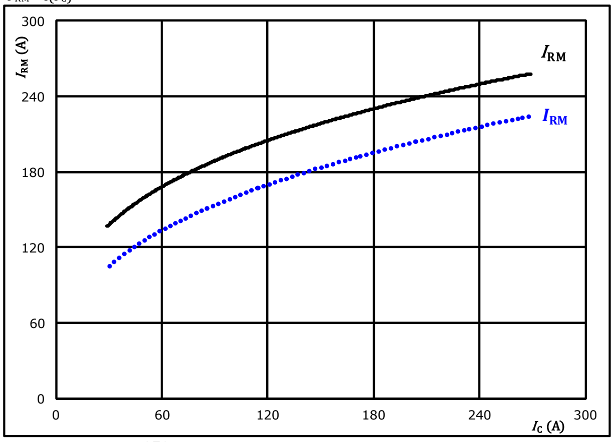


At	V_{CE}=	350	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	I_C=	150	A			

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

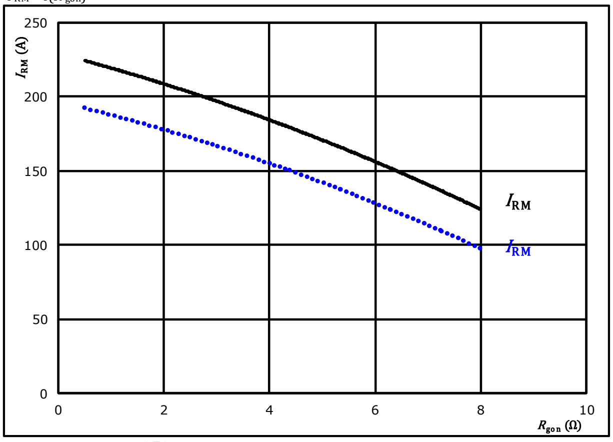


At	V_{CE}:	350	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	R_{gon} =	2	Ω			

figure 12. **FWD**

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

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



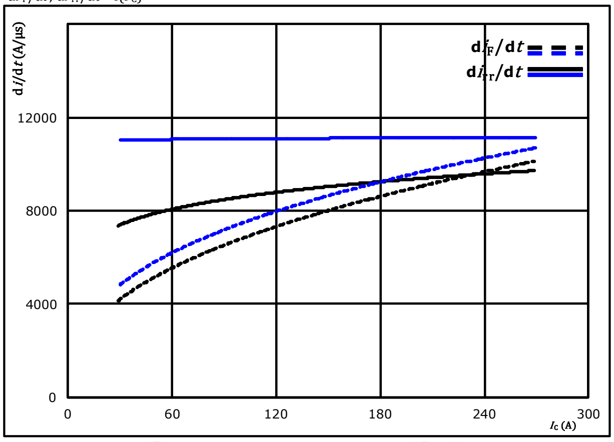
At	V_{CE} =	350	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	I_C =	150	A			

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

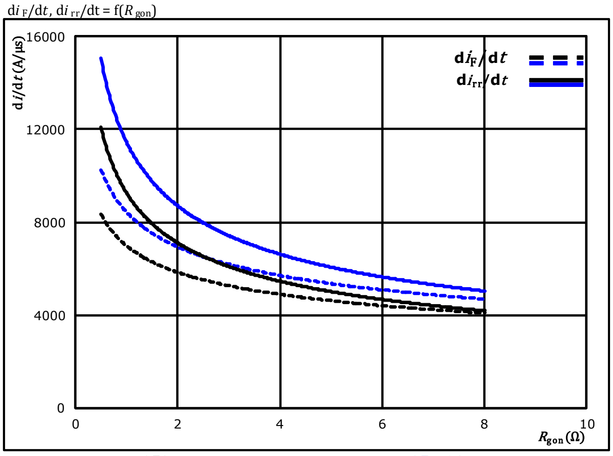


At					
	V_{CE} =	350	V	T_j:	25 °C
	V_{GE} =	±15	V		125 °C
	R_{gon} =	2	Ω		

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

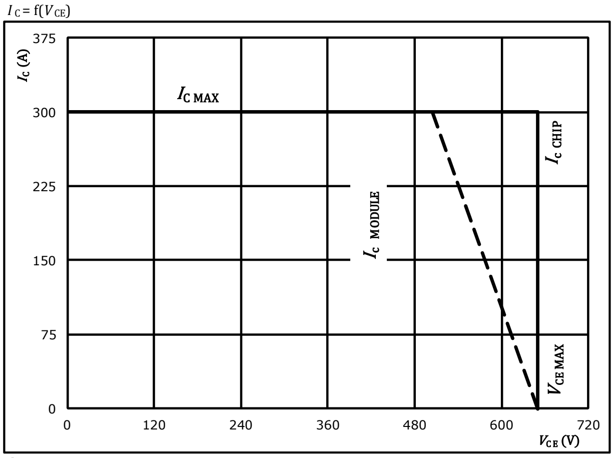


At					
	V_{CE} =	350	V	T_j:	25 °C
	V_{GE} =	±15	V		125 °C
	I_C =	150	A		

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At			
	T_j =	175	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

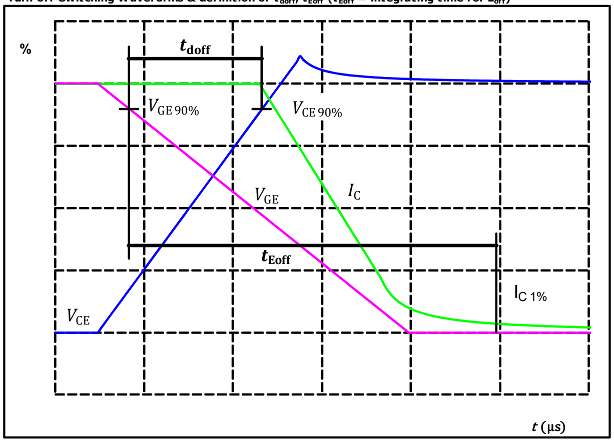
Boost Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. IGBT

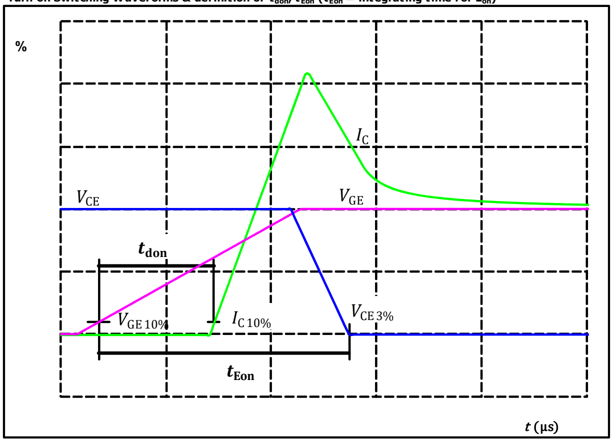
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	150	A
t_{doff} =	177	ns

figure 2. IGBT

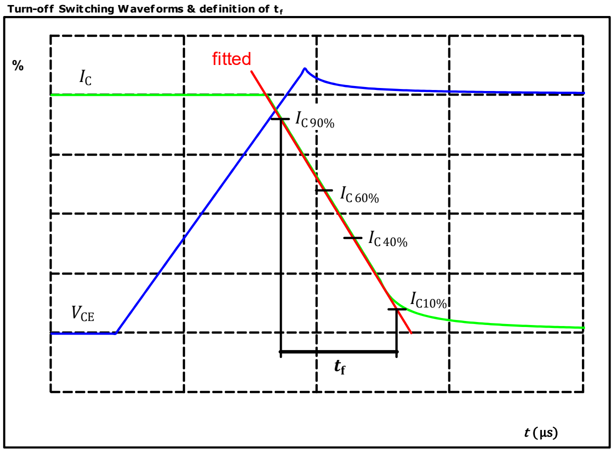
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	150	A
t_{don} =	114	ns

figure 3. IGBT

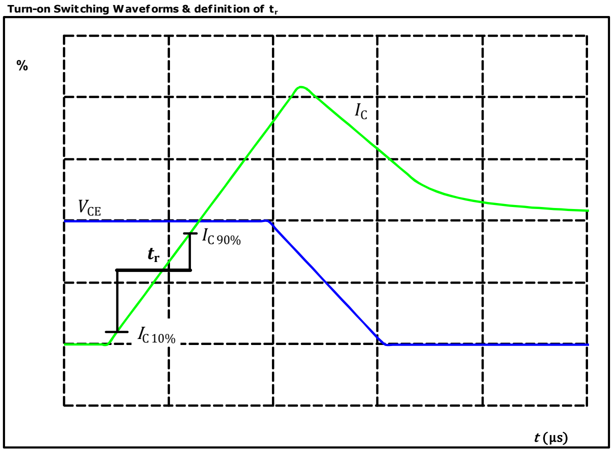
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	150	A
t_f =	59	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

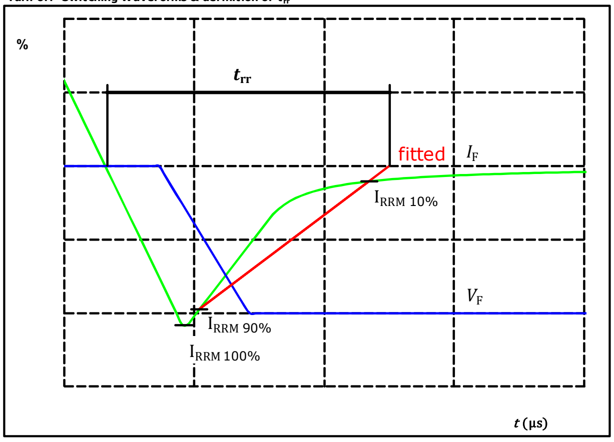


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	150	A
t_r =	21	ns

Boost Switching Characteristics

figure 5.	FWD

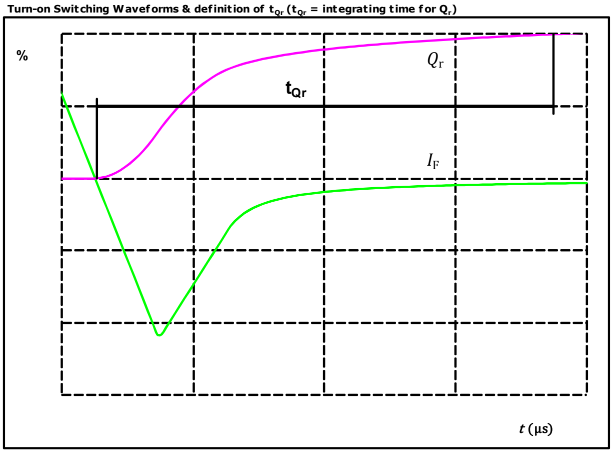
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	150	A
I_{RRM} (100%) =	216	A
t_{rr} =	114	ns

figure 6.	FWD

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



I_F (100%) =	150	A
Q_r (100%) =	12,94	µC

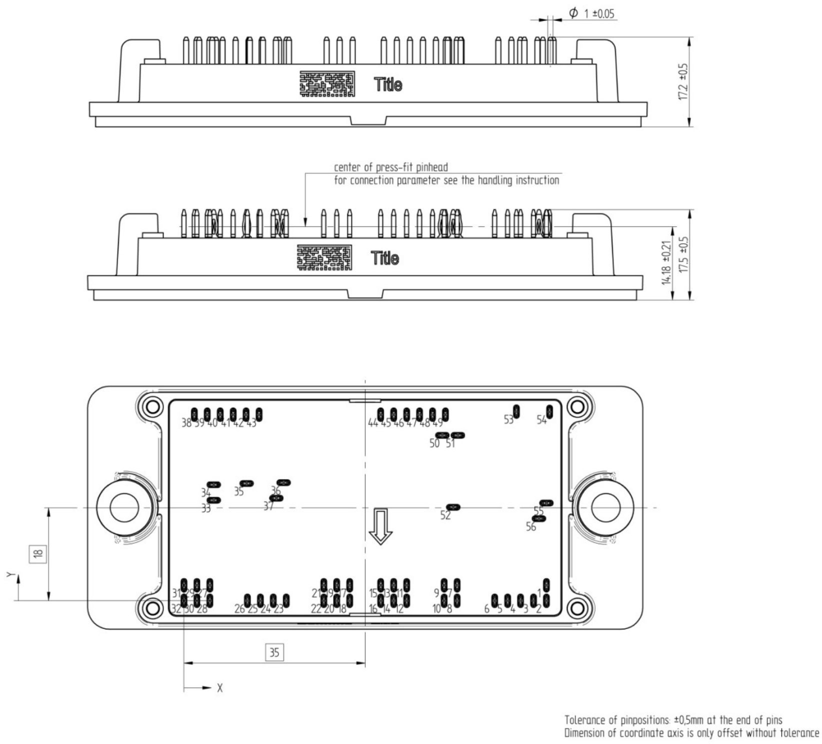
Ordering Code & Marking

Version	Ordering Code
without thermal paste 13 mm housing with solder pins	30-FT12NMA200SH01-M660F18
with thermal paste 13 mm housing with solder pins	30-FT12NMA200SH01-M660F18-/3/
without thermal paste 13 mm housing with press-fit pins	30-PT12NMA200SH01-M660F18Y
with thermal paste 13 mm housing with press-fit pins	30-PT12NMA200SH01-M660F18Y-/3/

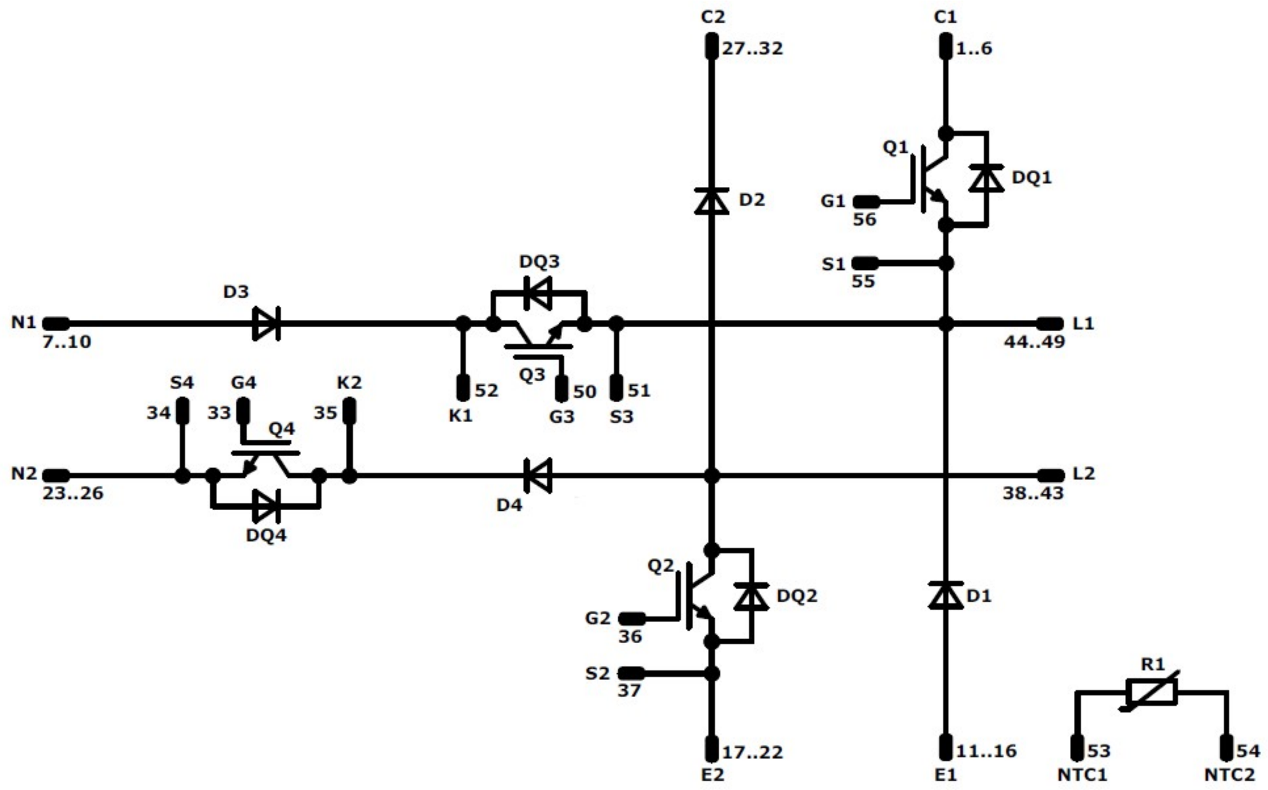
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin	X	Y	Function	Pin	X	Y	Function
1	70	3	C1	52	52	18,1	K1
2	70	0	C1	53	64,2	36,6	NTC1
3	67,5	0	C1	54	70,6	36,55	NTC2
4	65	0	C1	55	70	18,9	S1
5	62,5	0	C1	56	68,55	15,9	G1
6	60	0	C1				
7	52,75	3	N1				
8	52,75	0	N1				
9	50,25	3	N1				
10	50,25	0	N1				
11	43	3	E1				
12	43	0	E1				
13	40,5	3	E1				
14	40,5	0	E1				
15	38	3	E1				
16	38	0	E1				
17	32	3	E2				
18	32	0	E2				
19	29,5	3	E2				
20	29,5	0	E2				
21	27	3	E2				
22	27	0	E2				
23	19,75	0	N2				
24	17,25	0	N2				
25	14,75	0	N2				
26	12,25	0	N2				
27	5	3	C2				
28	5	0	C2				
29	2,5	3	C2				
30	2,5	0	C2				
31	0	3	C2				
32	0	0	C2				
33	5,75	19,45	G4				
34	5,75	22,45	S4				
35	12,1	22,7	K2				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
Q1, Q2	IGBT	1200 V	200 A	Buck Switch	
D3, D4	FWD	700 V	150 A	Buck Diode	
DQ1 , DQ2	FWD	1200 V	15 A	Buck Sw. Protection Diode	
Q3, Q4	IGBT	650 V	150 A	Boost Switch	
D1, D2	FWD	1200 V	100 A	Boost Diode	
DQ3, DQ4	FWD	650 V	50 A	Boost Sw. Protection Diode	
R1	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 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**
30-xT12NMA200SH01-M660F18x-D3-14	19 Mar. 2019	Correction of I_c/I_f values	2