



**flowNPC 2**

**650 V / 450 A**

**Topology features**

- Integrated DC capacitor
- Kelvin Emitter for improved switching performance
- Neutral Point Clamped Topology (I-Type)
- Split topology
- Temperature sensor

**Component features**

- High speed and smooth switching
- Low gate charge
- Very low collector emitter saturation voltage

**Housing features**

- Base isolation: Al<sub>2</sub>O<sub>3</sub>
- Convex shaped baseplate for superior thermal contact
- Cu baseplate
- Thermo-mechanical push-and-pull force relief
- Solder pin

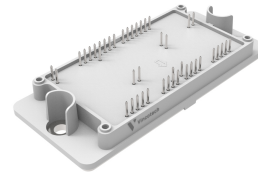
**Target applications**

- Industrial Drives
- Solar Inverters
- UPS

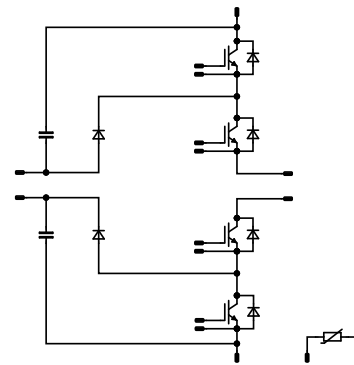
**Types**

- 30-FT07NIA450S501-PD68F58

**flow 2 13 mm housing**



**Schematic**





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## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
<b>Buck Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	298	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	1350	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	404	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Buck Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	204	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	600	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	255	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Boost Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	235	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	900	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	900	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	352	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 400\text{ V}$ $T_j = 150\text{ °C}$	3	$\mu\text{s}$
Maximum junction temperature	$T_{jmax}$		175	°C



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**30-FT07NIA450S501-PD68F58**  
datasheet

## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
<b>Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	159	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	229	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Sw. Inv. Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	159	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	229	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Capacitor (DC)

Maximum DC voltage	$V_{MAX}$		630	V
Operation Temperature	$T_{op}$		-55 ... 150	°C

## Module Properties

### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{jop}$		-40...+( $T_{jmax} - 25$ )	°C

### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Isolation voltage	$V_{isol}$	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

\*100 % tested in production



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### Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	

#### Buck Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0045	25	3,2	4	4,8	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		450	25 125 150		1,41 1,52 1,55	1,75 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			300	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			600	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							27000		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		780		pF
Reverse transfer capacitance	$C_{res}$							102		pF
Gate charge	$Q_g$	$V_{CC} = 520$ V	15		450	25		984		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,24		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		525,12 521,49 520,49		ns
Rise time	$t_r$	$R_{gon} = 10,67$ Ω $R_{goff} = 21,33$ Ω				25 125 150		76,89 81,75 82,38		ns
Turn-off delay time	$t_{d(off)}$		±15	350	360	25 125 150		717,65 752,28 759,81		ns
Fall time	$t_f$					25 125 150		46,57 38,1 37,29		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 5,2$ μC $Q_{tFWD} = 12,96$ μC $Q_{tFWD} = 15,49$ μC				25 125 150		8,74 9,22 9,42		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		13,16 13,94 14,52		mWs





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### Characteristic Values

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

#### Buck Diode

##### Static

Forward voltage	$V_F$				300	25 125 150		1,53 1,49 1,46	1,92 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V				25			15,2	μA

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,37		K/W
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##### Dynamic

Peak recovery current	$I_{RM}$					25 125 150		97,87 161,9 176,47		A
Reverse recovery time	$t_{rr}$					25 125 150		81,42 120,63 132,03		ns
Recovered charge	$Q_r$	$di/dt=3843$ A/μs $di/dt=3713$ A/μs $di/dt=3914$ A/μs	±15	350	360	25 125 150		5,2 12,96 15,49		μC
Reverse recovered energy	$E_{rec}$					25 125 150		1,06 2,82 3,46		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		3118,41 3996,27 3743,88		A/μs



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### Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	

#### Boost Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,003	25	4,35	5	5,65	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		300	25 125 150		1,46 1,61 1,66	1,65 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			120	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			600	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							18300		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		552		pF
Reverse transfer capacitance	$C_{res}$							186		pF
Gate charge	$Q_g$	$V_{CC} = 520$ V	15		300	25		1740		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,27		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		599,33 602,2 606,32		ns
Rise time	$t_r$	$R_{gon} = 10,67$ Ω $R_{goff} = 21,33$ Ω				25 125 150		181,7 179,72 177,48		ns
Turn-off delay time	$t_{d(off)}$		±15	350	360	25 125 150		1106,97 1156,67 1165,36		ns
Fall time	$t_f$					25 125 150		126,03 109,67 100,66		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 2,86$ μC $Q_{tFWD} = 7,85$ μC $Q_{tFWD} = 9,43$ μC				25 125 150		22,84 25,34 26,09		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		27,44 25,81 25,77		mWs



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datasheet

### Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		$V_{GE}$ [V] $V_{GS}$ [V]	$V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V]	$I_C$ [A] $I_D$ [A] $I_F$ [A]	$T_j$ [°C]	Min	Typ	Max		
<b>Boost Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$			200	25 125 150		1,65 1,6 1,58	1,92 <sup>(1)</sup>		V
Reverse leakage current	$I_R$	$V_T = 650$ V			25			10,6		μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,42			K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$				25 125 150		45,39 77,27 85,24			A
Reverse recovery time	$t_{rr}$				25 125 150		106,11 161,42 179,99			ns
Recovered charge	$Q_r$	$di/dt=1735$ A/μs $di/dt=1506$ A/μs $di/dt=1660$ A/μs	±15	350	360	25 125 150	2,86 7,85 9,43			μC
Reverse recovered energy	$E_{rec}$				25 125 150		0,372 1,09 1,34			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		632,74 770,41 642,09			A/μs



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### Characteristic Values

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

#### Boost Sw. Inv. Diode

##### Static

Forward voltage	$V_F$			200	25 125 150		1,65 1,6 1,58	1,92 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_T = 650$ V			25			10,6	µA

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,42		K/W
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#### Capacitor (DC)

##### Static

Capacitance	$C$	DC bias voltage = 0 V			25		33		nF
Tolerance						-5		5	%

#### Thermistor

##### Static

Rated resistance	$R$				25		22		kΩ
Deviation of $R_{100}$	$A_{R/R}$	$R_{100} = 1484$ Ω			100	-5		5	%
Power dissipation	$P$				25		130		mW
Power dissipation constant	$d$				25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %					3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %					4000		K
Vincotech Thermistor Reference								I	

<sup>(1)</sup> Value at chip level

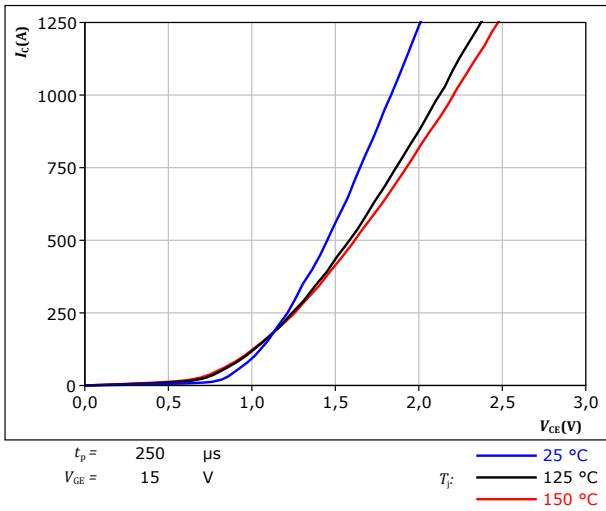
<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



### Buck Switch Characteristics

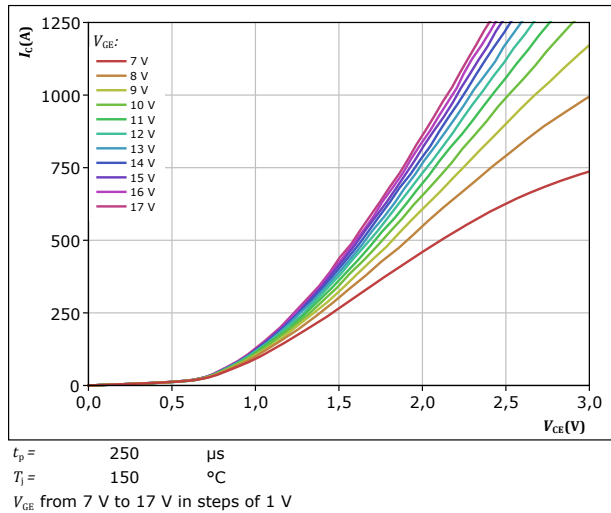
**figure 1.** IGBT

Typical output characteristics  
 $I_C = f(V_{CE})$



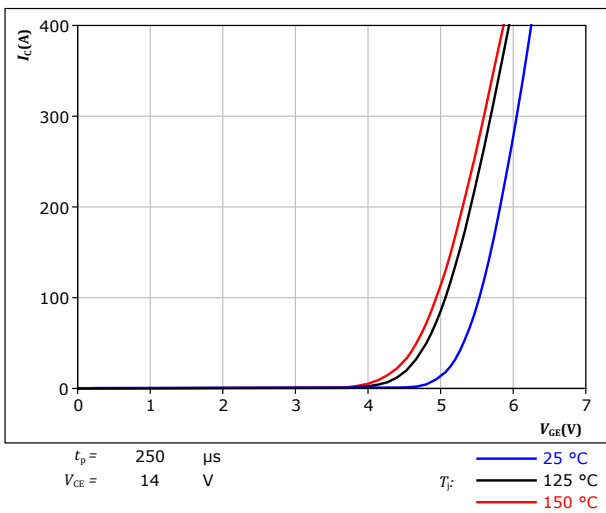
**figure 2.** IGBT

Typical output characteristics  
 $I_C = f(V_{CE})$



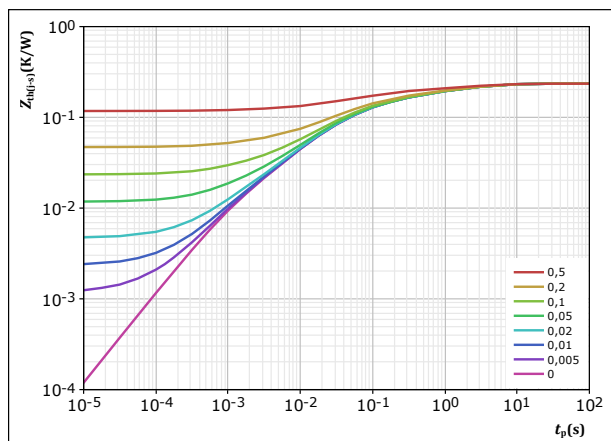
**figure 3.** IGBT

Typical transfer characteristics  
 $I_C = f(V_{GE})$



**figure 4.** IGBT

Transient thermal impedance as a function of pulse width  
 $Z_{th(j-s)} = f(t_p)$



$D = t_p / T$   
 $R_{th(j-s)} = 0,235 \text{ K/W}$

IGBT thermal model values

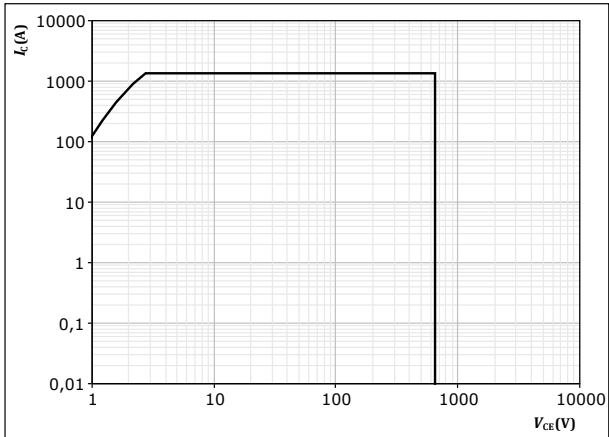
R (K/W)	$\tau$ (s)
3,75E-02	3,95E+00
5,54E-02	6,35E-01
8,92E-02	7,22E-02
4,47E-02	1,29E-02
8,19E-03	1,16E-03



### Buck Switch Characteristics

figure 5. IGBT

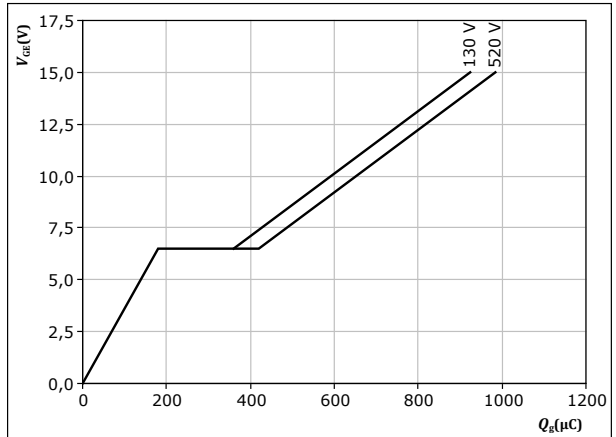
Safe operating area  
 $I_C = f(V_{CE})$



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

figure 6. IGBT

Gate voltage vs gate charge  
 $V_{GE} = f(Q_g)$



$I_C = 75$  A  
 $T_j = 25$  °C



### Buck Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

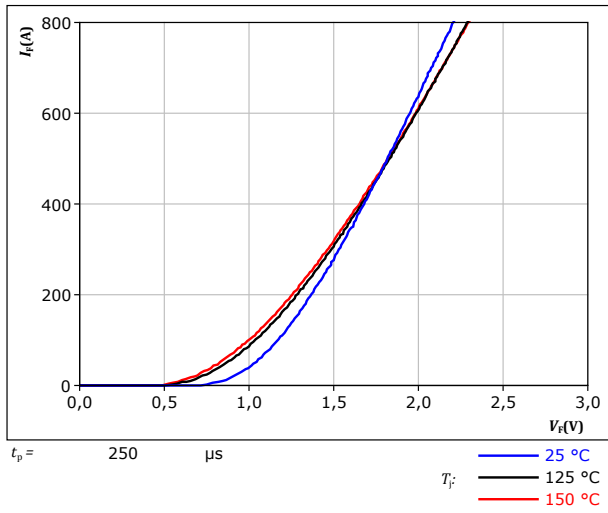
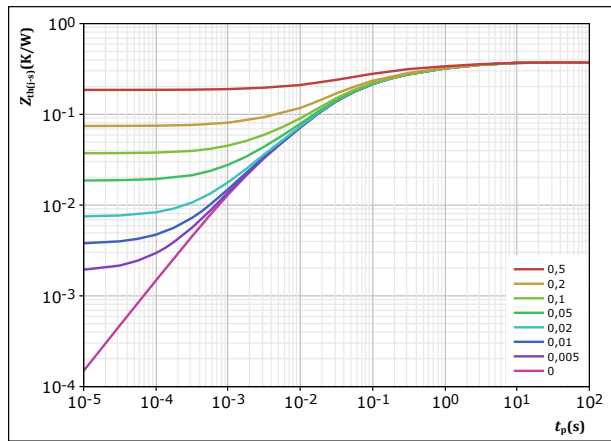


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,372 \text{ K/W}$   
 FWD thermal model values

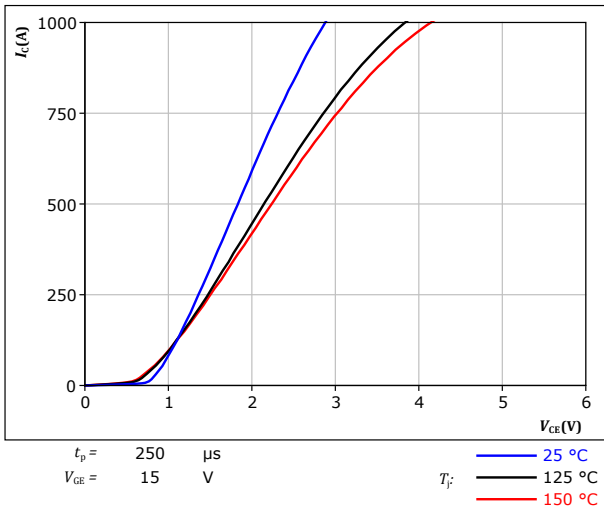
R (K/W)	$\tau$ (s)
4,80E-02	3,48E+00
8,21E-02	5,95E-01
1,26E-01	8,65E-02
9,93E-02	1,93E-02
1,63E-02	1,99E-03



### Boost Switch Characteristics

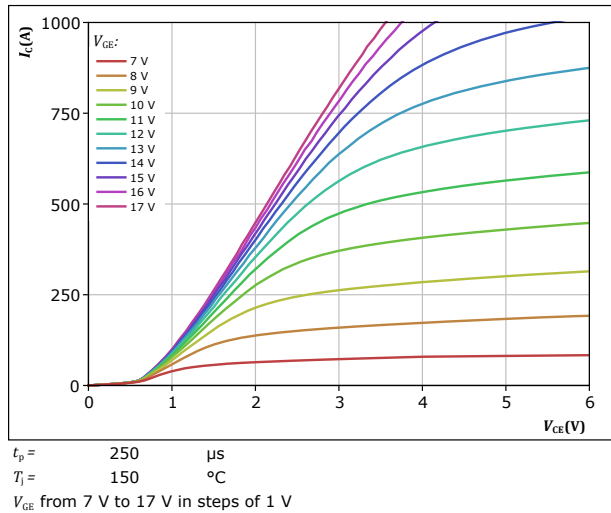
**figure 9.** IGBT

Typical output characteristics  
 $I_C = f(V_{CE})$



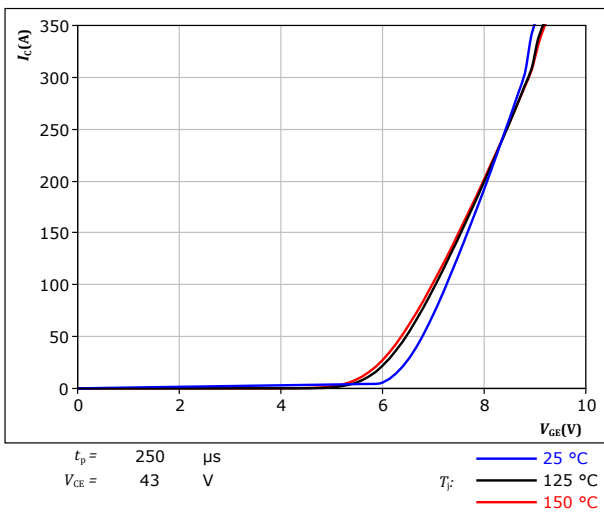
**figure 10.** IGBT

Typical output characteristics  
 $I_C = f(V_{CE})$



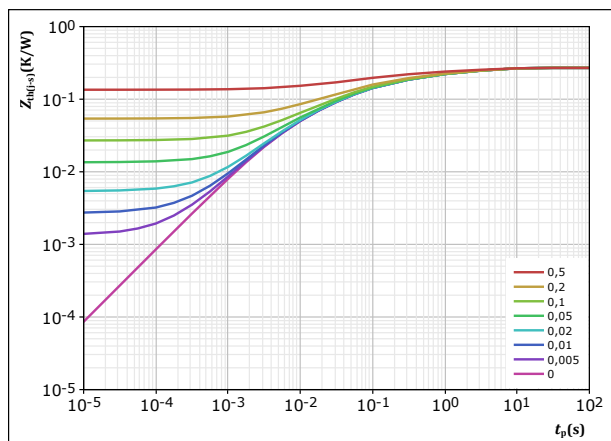
**figure 11.** IGBT

Typical transfer characteristics  
 $I_C = f(V_{GE})$



**figure 12.** IGBT

Transient thermal impedance as a function of pulse width  
 $Z_{th(j-s)} = f(t_p)$



$D = t_p / T$   
 $R_{th(j-s)} = 0,27 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
5,16E-02	3,77E+00
6,52E-02	4,94E-01
6,77E-02	9,16E-02
5,89E-02	2,68E-02
2,67E-02	4,84E-03

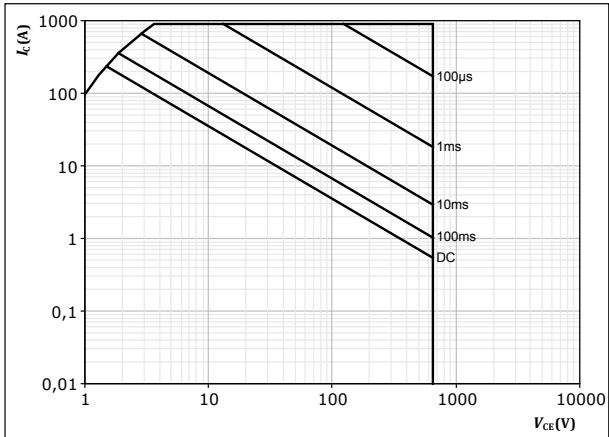




### Boost Switch Characteristics

figure 13. IGBT

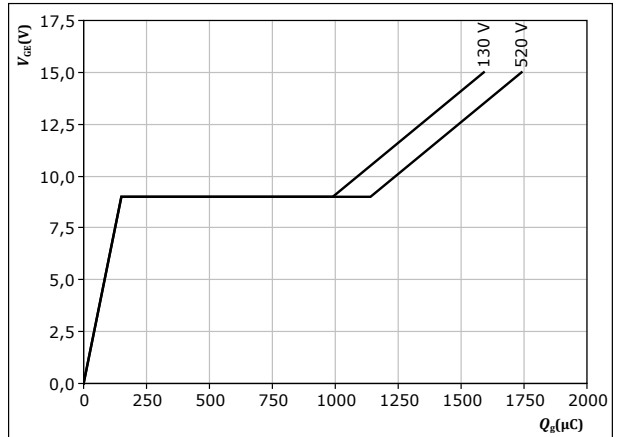
Safe operating area  
 $I_C = f(V_{CE})$



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

figure 14. IGBT

Gate voltage vs gate charge  
 $V_{GE} = f(Q_g)$



$I_C = 50$  A  
 $T_j = 25$  °C



### Boost Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

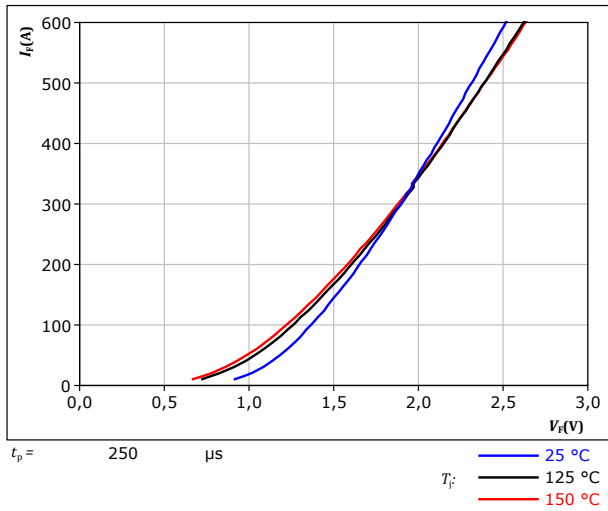
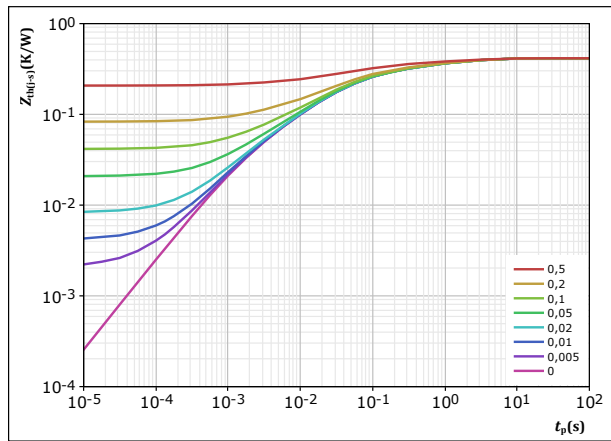


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,415 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
5,37E-02	3,07E+00
8,61E-02	4,99E-01
1,65E-01	6,22E-02
8,66E-02	1,17E-02
2,36E-02	1,55E-03



### Boost Sw. Inv. Diode Characteristics

figure 17. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

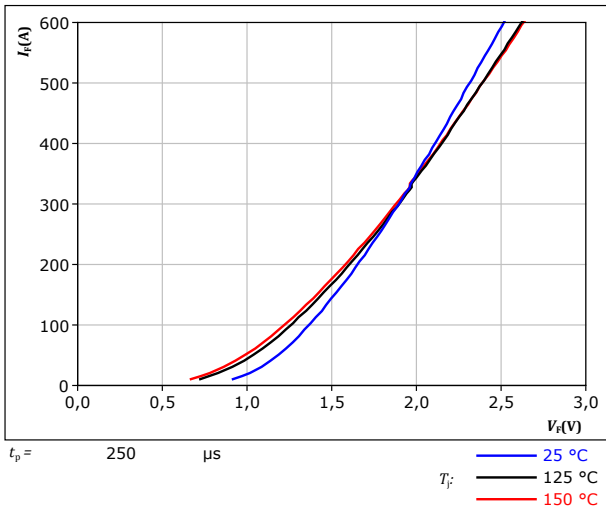
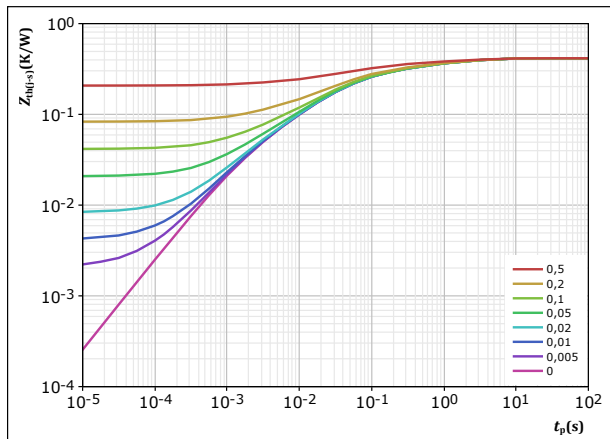


figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,415 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
5,37E-02	3,07E+00
8,61E-02	4,99E-01
1,65E-01	6,22E-02
8,66E-02	1,17E-02
2,36E-02	1,55E-03

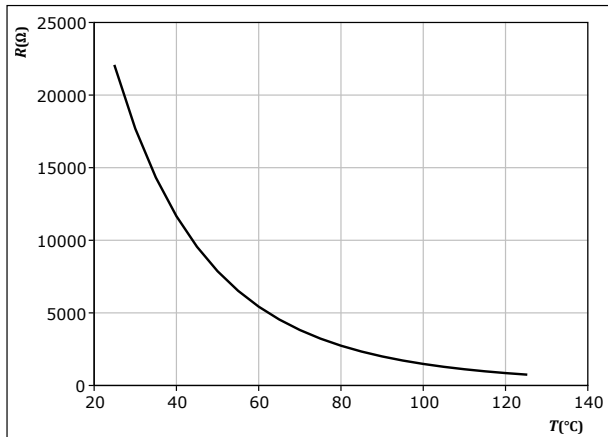


### Thermistor Characteristics

figure 19. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$



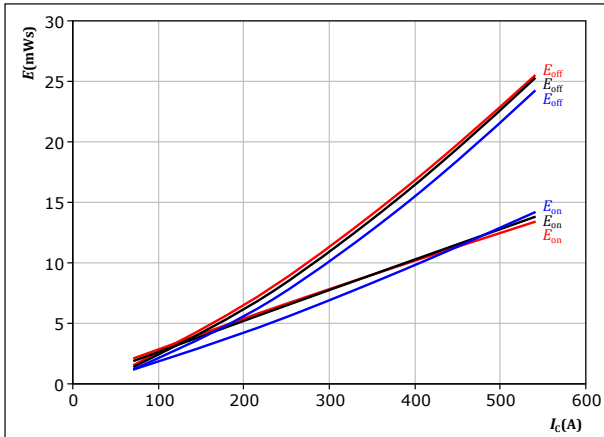


## Buck Switching Characteristics

**figure 20.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

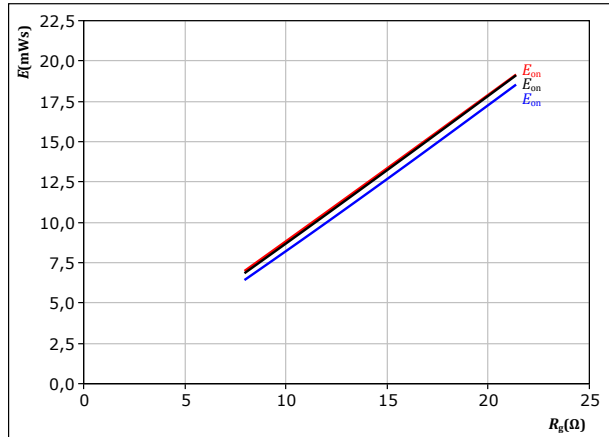
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g\text{on}} = 10,67 \ \Omega$   
 $R_{g\text{off}} = 21,33 \ \Omega$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 21.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

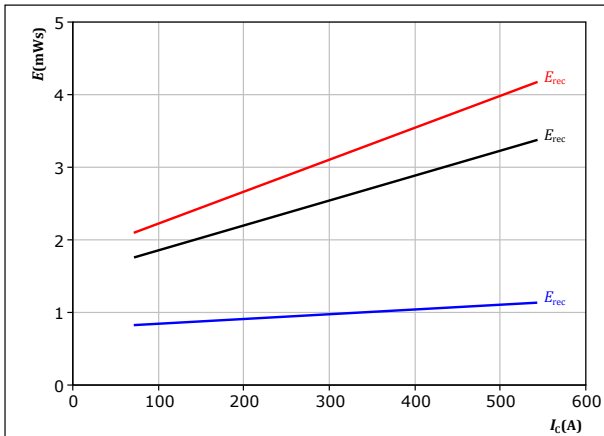
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 360 \text{ A}$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 22.** FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g\text{on}} = 10,67 \ \Omega$

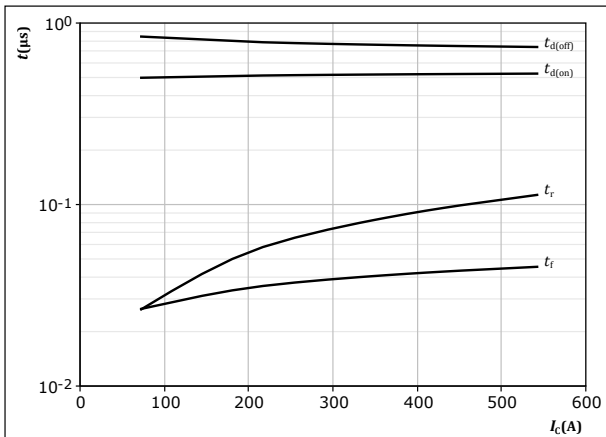
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C



## Buck Switching Characteristics

**figure 24.** IGBT

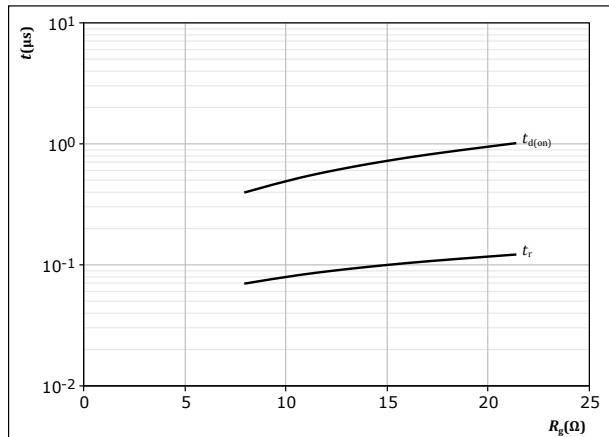
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$  Ω  
 $R_{goff} = 21,33$  Ω

**figure 25.** IGBT

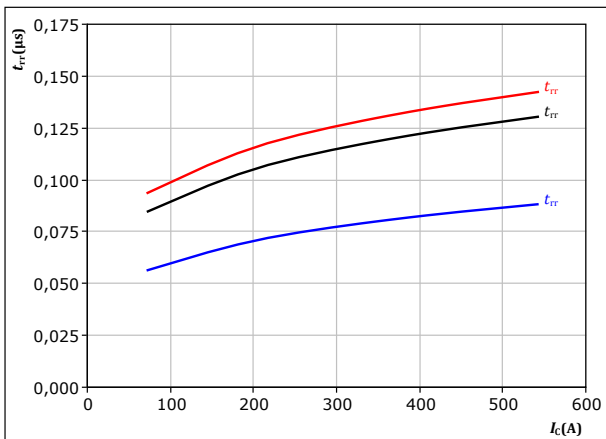
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A

**figure 26.** FWD

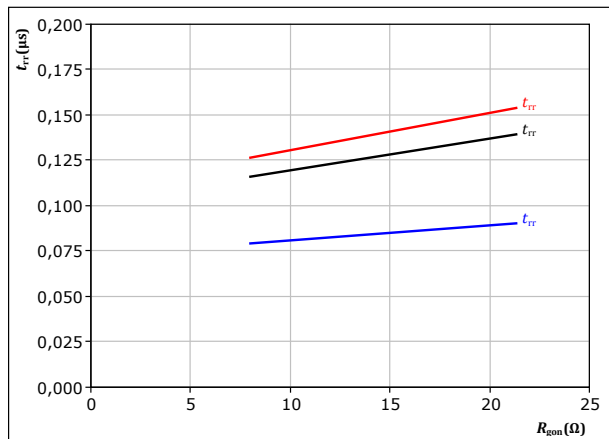
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$  Ω  
 $T_j:$  — 25 °C  
— 125 °C  
— 150 °C

**figure 27.** FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor  
 $t_{rr} = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A  
 $T_j:$  — 25 °C  
— 125 °C  
— 150 °C

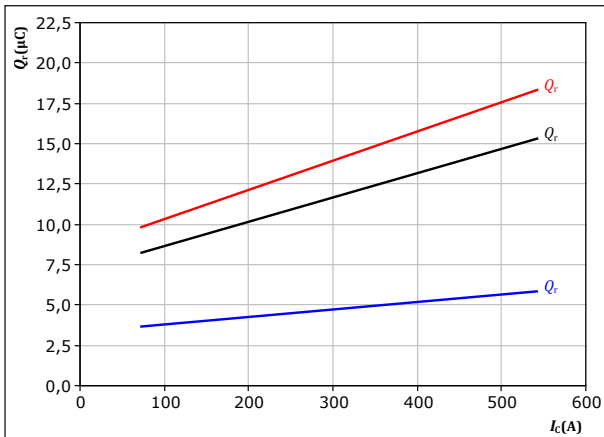


## Buck Switching Characteristics

**figure 28.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



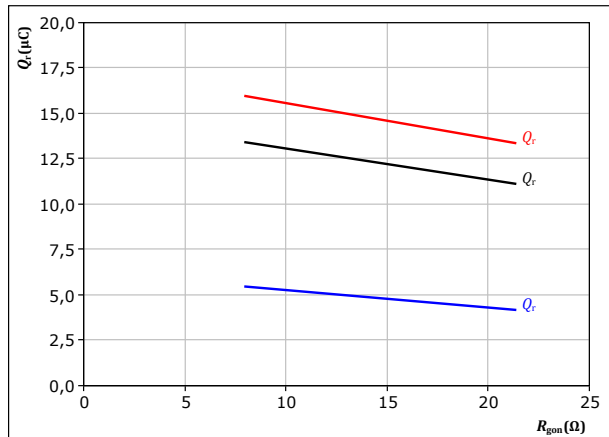
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$  Ω  
 $T_j: 25$  °C (blue),  $125$  °C (black),  $150$  °C (red)

**figure 29.** FWD

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

$$Q_r = f(R_{gon})$$



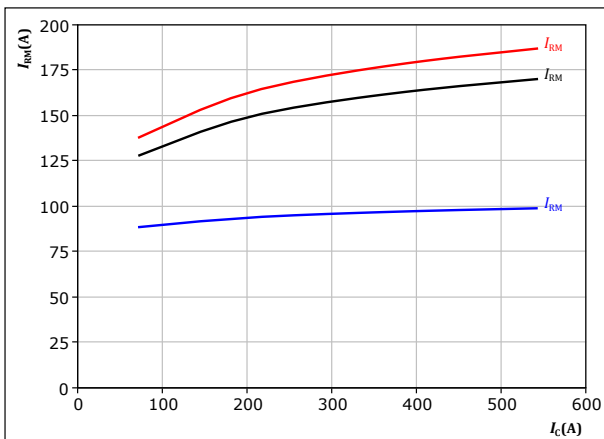
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A  
 $T_j: 25$  °C (blue),  $125$  °C (black),  $150$  °C (red)

**figure 30.** FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



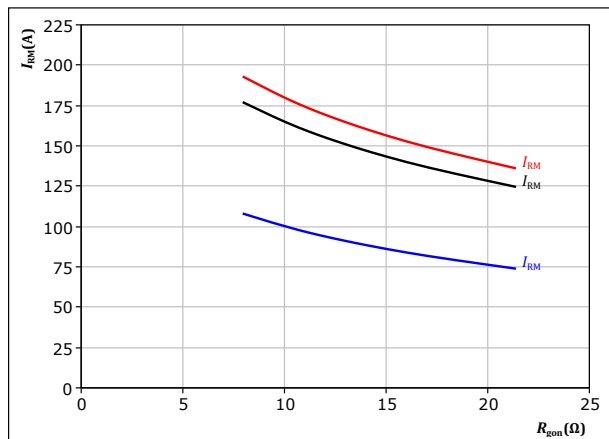
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$  Ω  
 $T_j: 25$  °C (blue),  $125$  °C (black),  $150$  °C (red)

**figure 31.** FWD

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

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



With an inductive load at

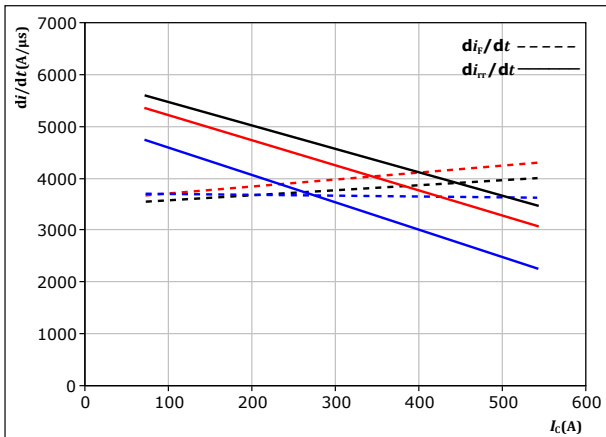
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A  
 $T_j: 25$  °C (blue),  $125$  °C (black),  $150$  °C (red)



## Buck Switching Characteristics

**figure 32.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_C)$

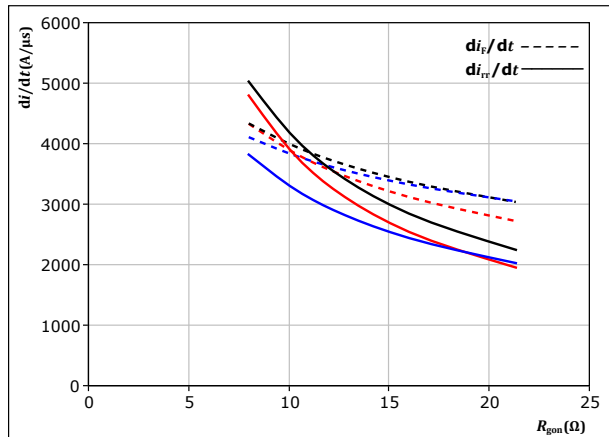


With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 10,67 \ \Omega$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

**figure 33.** FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$

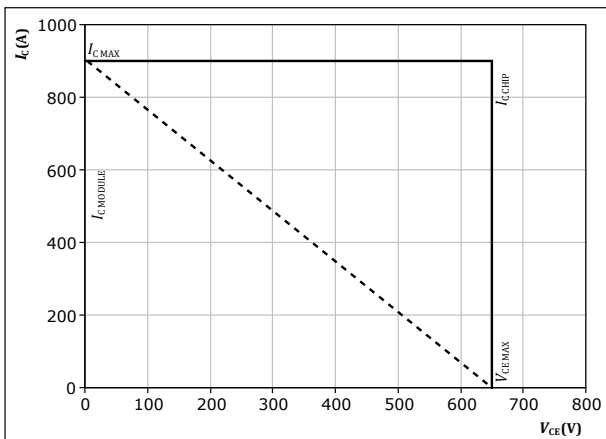


With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 360 \text{ A}$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

**figure 34.** IGBT

Reverse bias safe operating area  
 $I_C = f(V_{CE})$



At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 10,67 \ \Omega$   
 $R_{goff} = 21,33 \ \Omega$



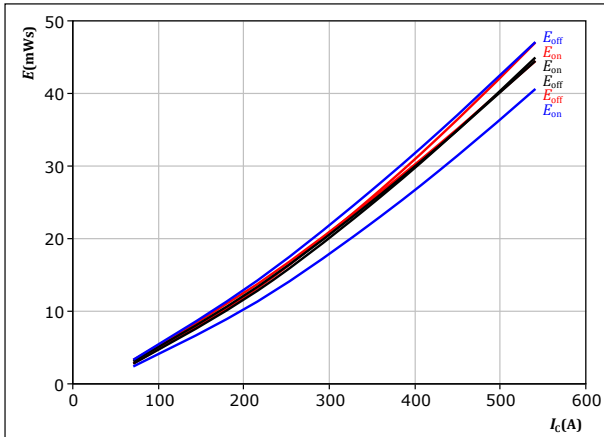


## Boost Switching Characteristics

**figure 35.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

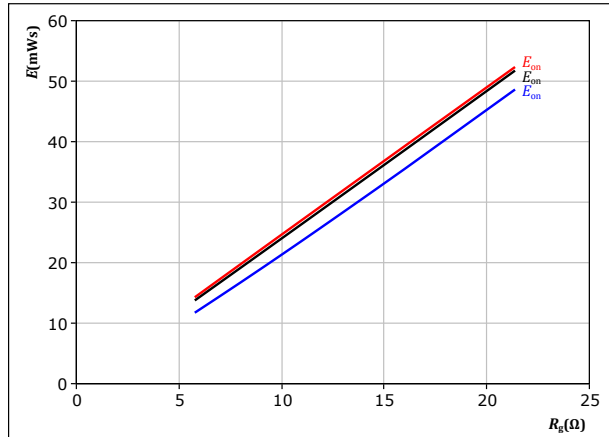
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g\text{on}} = 10,67 \ \Omega$   
 $R_{g\text{off}} = 21,33 \ \Omega$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 36.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

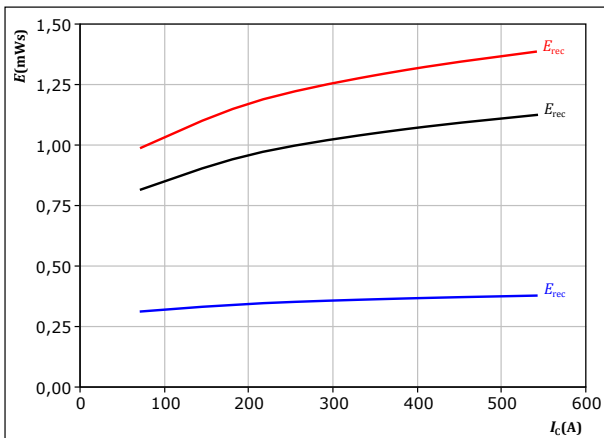
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 360 \text{ A}$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 37.** FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g\text{on}} = 10,67 \ \Omega$

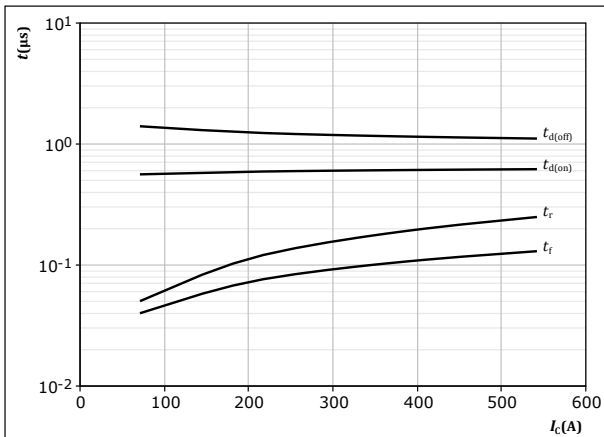
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C



## Boost Switching Characteristics

**figure 39.** IGBT

Typical switching times as a function of collector current  
 $t = f(I_c)$

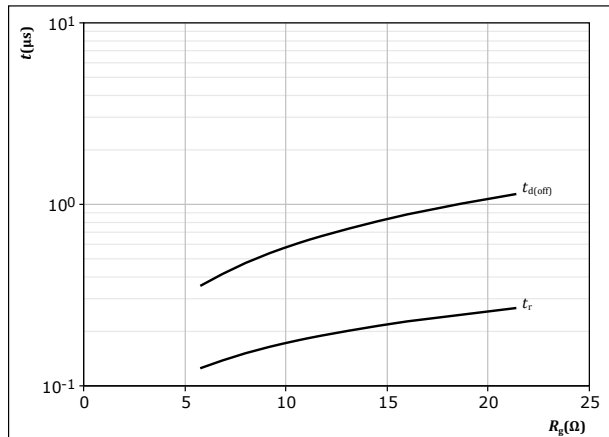


With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$   $\Omega$   
 $R_{goff} = 21,33$   $\Omega$

**figure 40.** IGBT

Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$

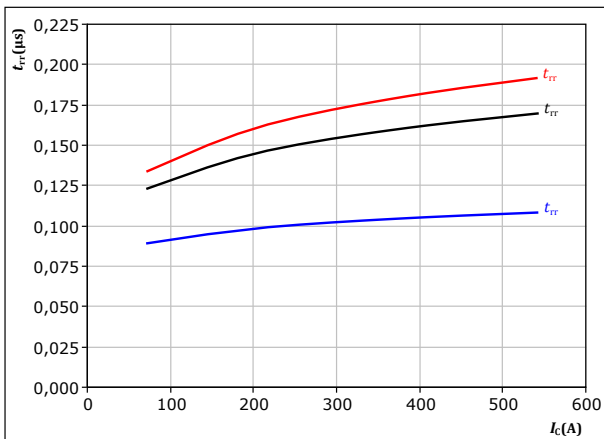


With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A

**figure 41.** FWD

Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



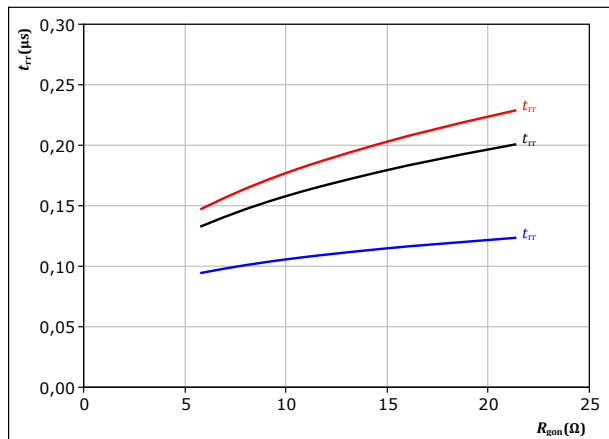
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$   $\Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 42.** FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor  
 $t_{rr} = f(R_{gon})$



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

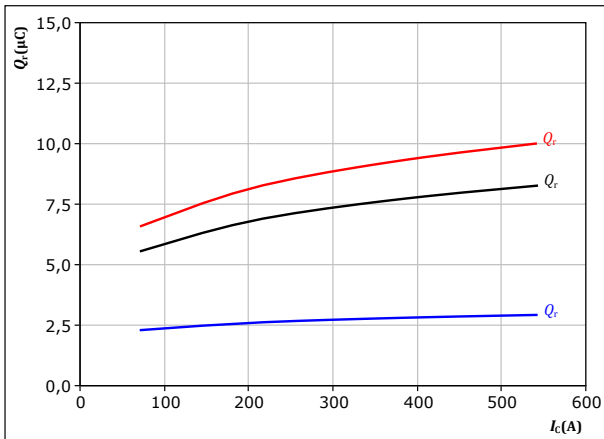


## Boost Switching Characteristics

**figure 43.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

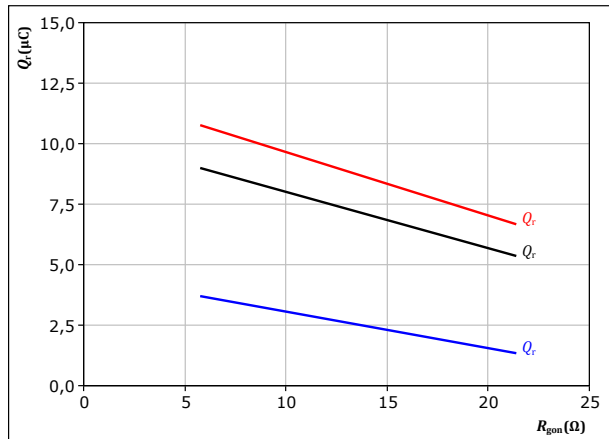
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$   $\Omega$

$T_j$ : 25 °C (blue)  
 125 °C (black)  
 150 °C (red)

**figure 44.** FWD

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

$$Q_r = f(R_{gon})$$



With an inductive load at

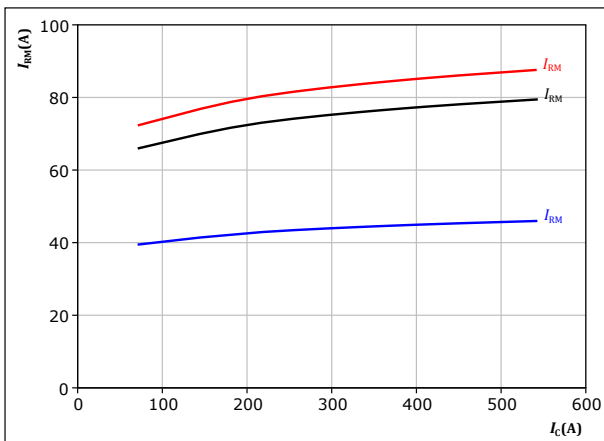
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A

$T_j$ : 25 °C (blue)  
 125 °C (black)  
 150 °C (red)

**figure 45.** FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

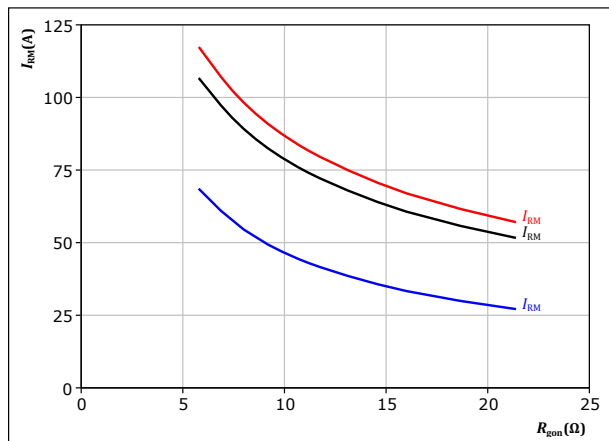
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 10,67$   $\Omega$

$T_j$ : 25 °C (blue)  
 125 °C (black)  
 150 °C (red)

**figure 46.** FWD

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

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 360$  A

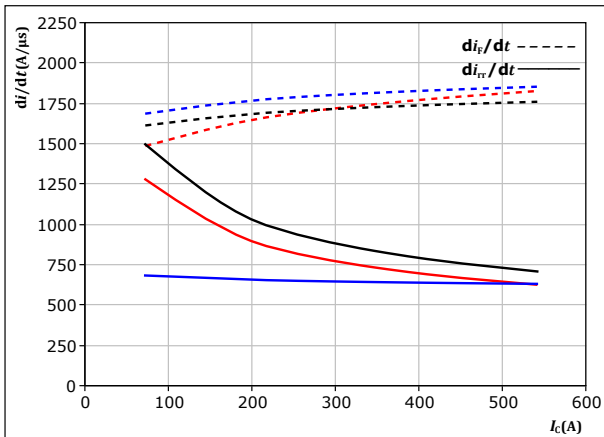
$T_j$ : 25 °C (blue)  
 125 °C (black)  
 150 °C (red)



### Boost Switching Characteristics

**figure 47.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_r/dt = f(I_c)$



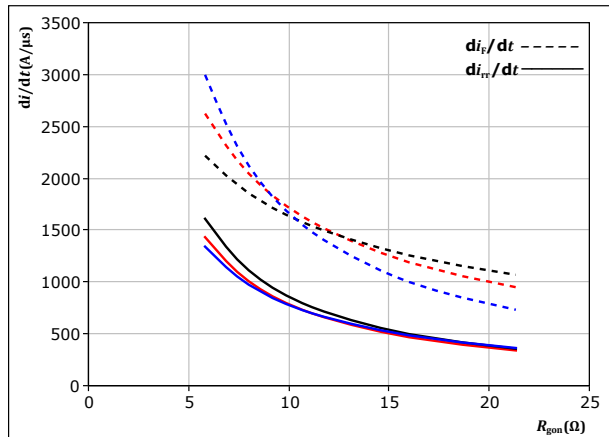
With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 10,67 \ \Omega$

$T_j =$   
— 25 °C  
— 125 °C  
— 150 °C

**figure 48.** FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor  
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

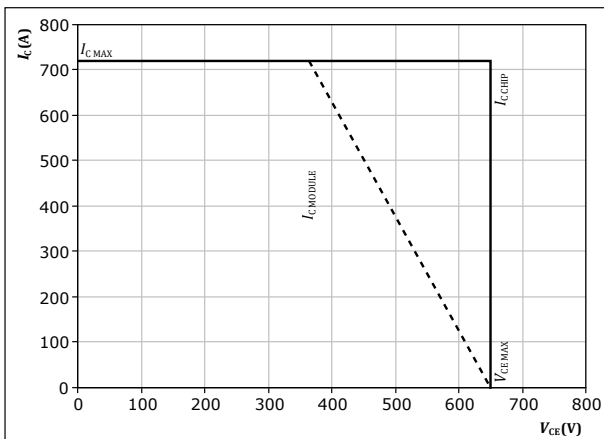
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 360 \text{ A}$

$T_j =$   
— 25 °C  
— 125 °C  
— 150 °C

**figure 49.** IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 10,67 \ \Omega$   
 $R_{goff} = 21,33 \ \Omega$



## Switching Definitions

figure 50. IGBT

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

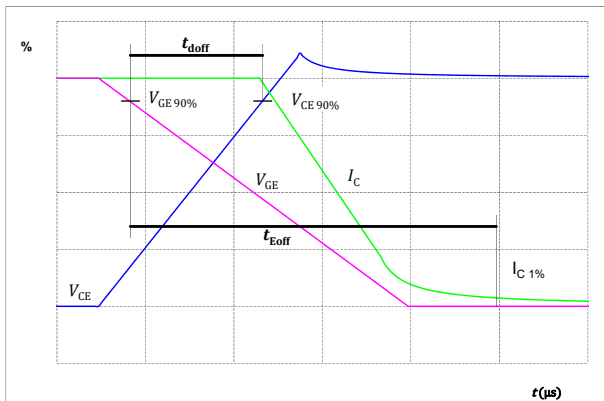


figure 51. IGBT

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

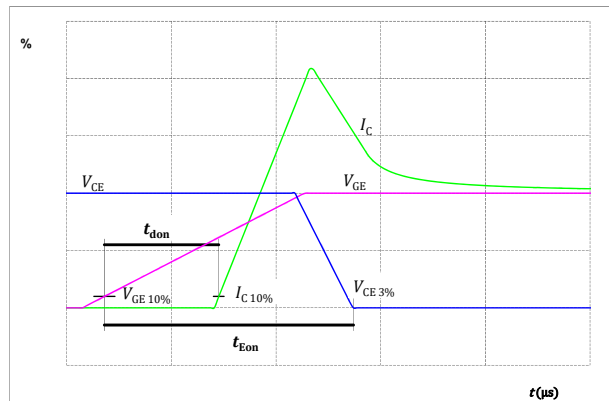


figure 52. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

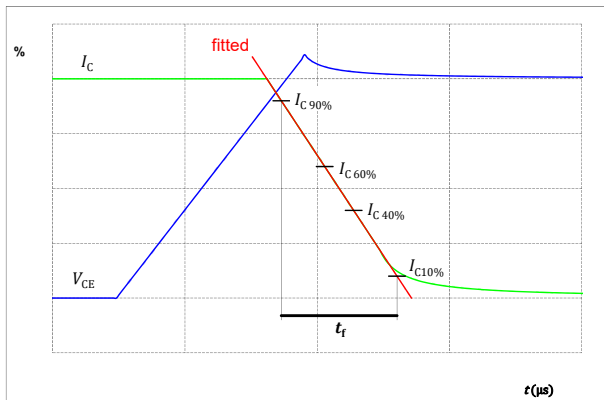
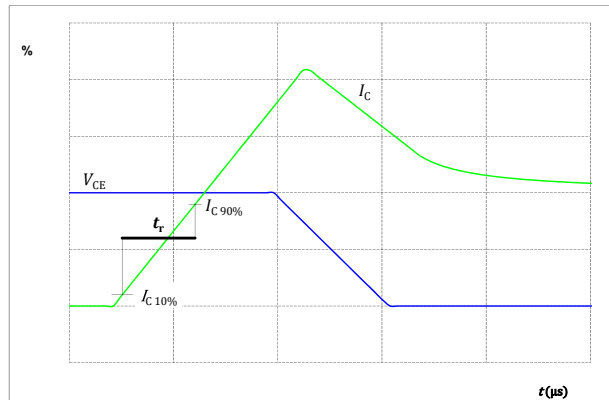


figure 53. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





### Switching Definitions

figure 54. FWD

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

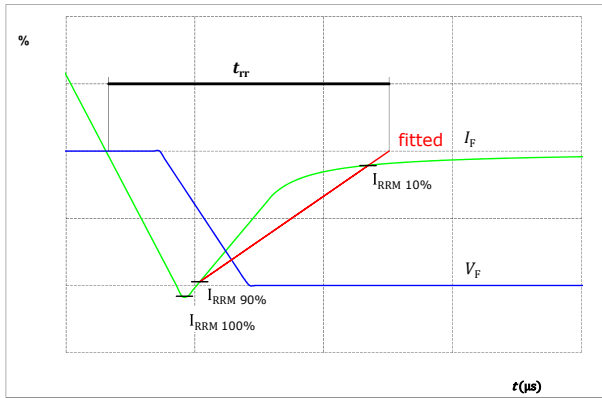
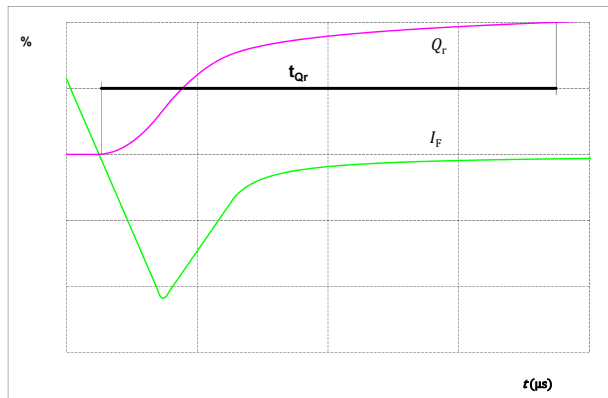


figure 55. FWD

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





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Ordering Code	
<b>Version</b>	<b>Ordering Code</b>
Without thermal paste	30-FT07NIA450S501-PD68F58
With thermal paste (3,4 W/mK, PSX-P7)	30-FT07NIA450S501-PD68F58-/3/

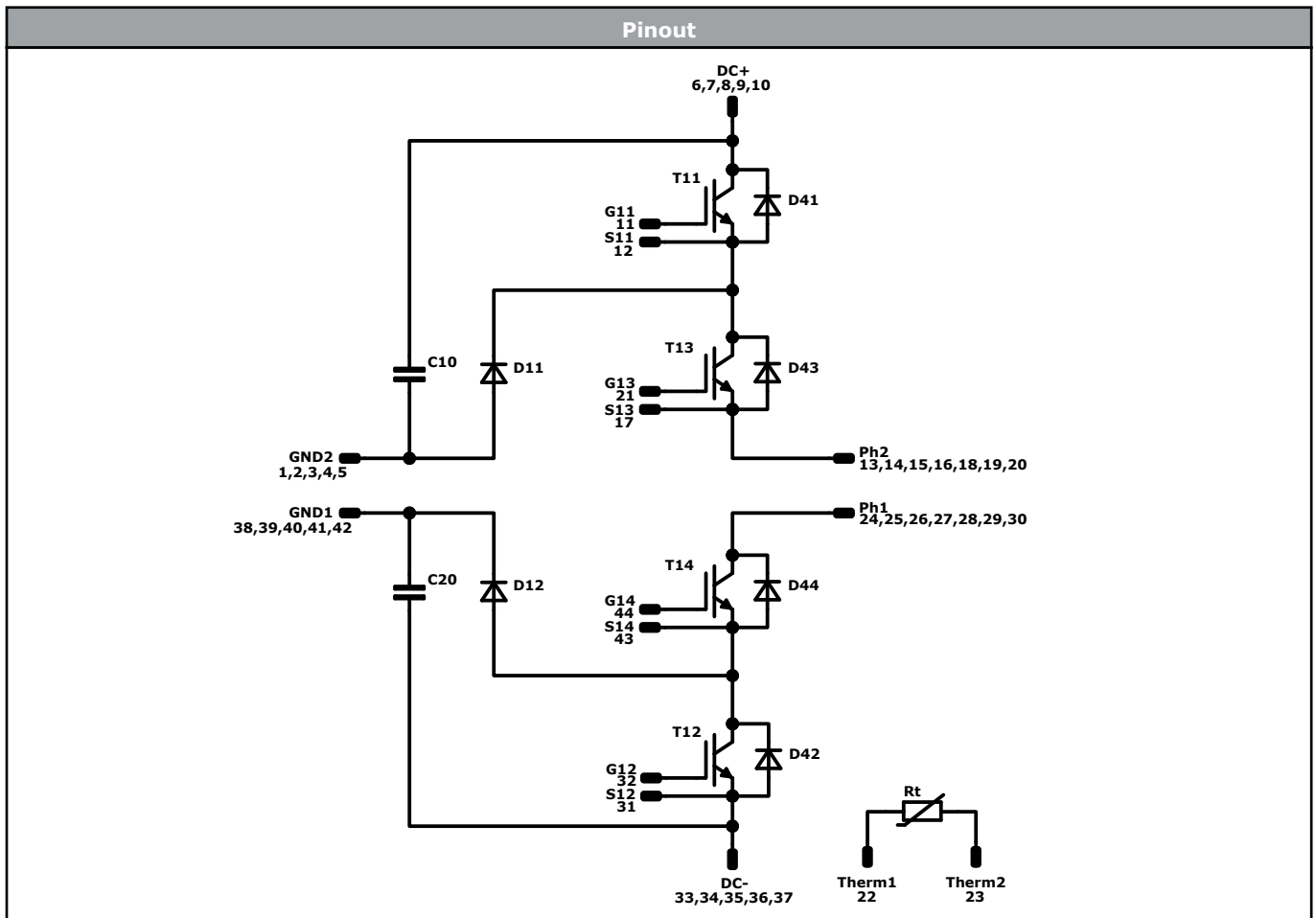
Marking						
	<b>Text</b>	<b>Name</b> NN-NNNNNNNNNNNNNN- TTTTTWWYY UL VIN LLLL SSSS	<b>Date code</b> WWYY	<b>UL &amp; VIN</b> UL VIN	<b>Lot</b> LLLLL	<b>Serial</b> SSSS
	<b>Datamatrix</b>	<b>Type&amp;Ver</b> TTTTTTTV	<b>Lot number</b> LLLLL	<b>Serial</b> SSSS	<b>Date code</b> WWYY	

Pin table [mm]				Outline
Pin	X	Y	Function	
1	32,9	2,7	GND2	
2	32,9	0	GND2	
3	30,2	0	GND2	
4	27,5	0	GND2	
5	24,8	0	GND2	
6	16,4	0	DC+	
7	13,7	0	DC+	
8	11	0	DC+	
9	8,3	0	DC+	
10	5,6	0	DC+	
11	20,8	12,2	G11	
12	23,8	12,2	S11	
13	32,9	36,9	Ph2	
14	30,2	36,9	Ph2	
15	27,5	36,9	Ph2	
16	24,8	36,9	Ph2	
17	22,1	36,9	S13	
18	19,4	36,9	Ph2	
19	16,7	36,9	Ph2	
20	14	36,9	Ph2	
21	22,1	33,9	G13	
22	0	36,9	Therm1	
23	0	33,9	Therm2	
24	38	36,9	Ph1	
25	40,7	36,9	Ph1	
26	43,4	36,9	Ph1	
27	46,1	36,9	Ph1	
28	48,8	36,9	Ph1	
29	51,5	36,9	Ph1	
30	54,2	36,9	Ph1	
31	70,9	25,35	S12	
32	67,9	25,35	G12	
33	65,3	0	DC-	
34	62,6	0	DC-	
35	59,9	0	DC-	
36	57,2	0	DC-	
37	54,5	0	DC-	
38	46,1	0	GND1	
39	43,4	0	GND1	
40	40,7	0	GND1	
41	38	0	GND1	
42	38	2,7	GND1	
43	48,25	20,75	S14	
44	48,25	23,75	G14	

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



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**Identification**

ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	650 V	450 A	Buck Switch	
D11, D12	FWD	650 V	300 A	Buck Diode	
T13, T14	IGBT	650 V	360 A	Boost Switch	
D42, D41	FWD	650 V	200 A	Boost Diode	
D43, D44	FWD	650 V	200 A	Boost Sw. Inv. Diode	
C10, C20	Capacitor	630 V		Capacitor (DC)	
Rt	Thermistor			Thermistor	






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

Handling instruction
Handling instructions for <i>flow 2</i> packages see vincotech.com website.

Package data
Package data for <i>flow 2</i> packages see vincotech.com website.

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

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

Document No.:	Date:	Modification:	Pages
30-FT07NIA450S501-PD68F58-D1-14	1 Jul. 2022		
30-FT07NIA450S501-PD68F58-D2-14	12 Aug. 2022	Boost Switch Rth corrected. Module unchanged.	

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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.

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