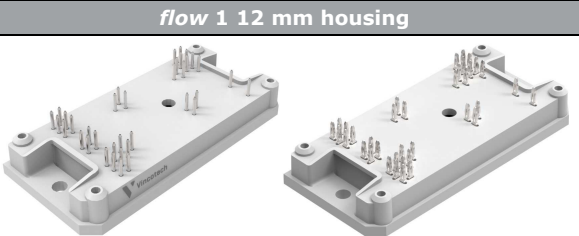
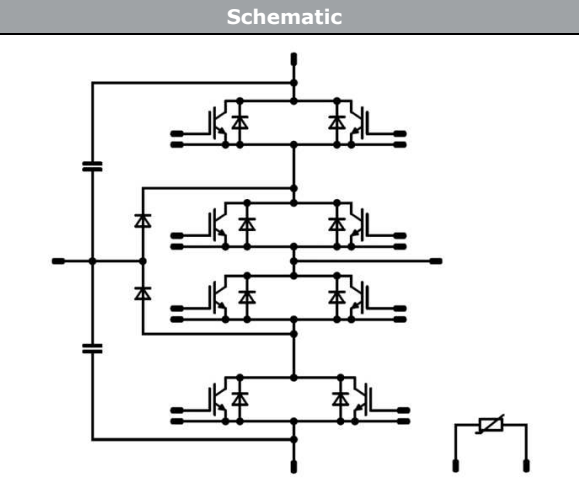




<i>flowNPC 1</i>	<b>1200 V / 200 A</b>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><b>Features</b></p> <ul style="list-style-type: none"> <li>NPC inverter topology</li> <li>Optimized for full rated bi-directional usage (4 quadrant)</li> <li>High-speed IGBT in all switch positions</li> <li>Integrated NTC</li> <li>Low inductive design with integrated DC capacitor</li> <li><i>flow 1</i> 12mm package</li> </ul> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Industrial Drives</li> <li>Solar Inverters</li> <li>UPS</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>10-FY07NPA200SM02-L366F08</li> <li>10-PY07NPA200SM02-L366F08Y</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><b><i>flow 1</i> 12 mm housing</b></p>  <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>solder pin</span> <span>press-fit pin</span> </div> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><b>Schematic</b></p>  </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Buck Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	94	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	600	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	145	W
Gate-emitter voltage	$V_{GES}$		±20	V
Maximum junction temperature	$T_{jmax}$		175	°C



Vincotech

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Buck Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	107	A
Repetitive peak forward current	$I_{FRM}$		400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	131	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Out. Boost Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	94	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	600	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	145	W
Gate-emitter voltage	$V_{GES}$		±20	V
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Out. Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	107	A
Repetitive peak forward current	$I_{FRM}$		400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	131	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Out. Boost Inverse Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	124	A
Repetitive peak forward current	$I_{FRM}$		400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	164	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>DC Link Capacitor</b>				
Maximum DC voltage	$V_{MAX}$		500	V
Operation Temperature	$T_{op}$		-55...+125	°C



### Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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#### Module Properties

##### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{top}$		-40...(T <sub>max</sub> - 25)	°C

##### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance		solder pin \ press-fit pin	8,07 \ 7,86	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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,002	25	3,2	4	4,8	V
Collector-emitter saturation voltage	$V_{CESat}$		15		200	25 125 150		1,69 1,86 1,96	2,1	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			200	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							13120		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		194		
Reverse transfer capacitance	$C_{res}$							42		
Gate charge	$Q_g$		15	520	200	25		420		

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,65		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω	-5 / 15	350	120	25		67		ns
Rise time	$t_r$					125		66		
Turn-off delay time	$t_{d(off)}$					25		11		
Fall time	$t_f$					125		12		
						25		158		
Turn-on energy (per pulse)	$E_{on}$	$Q_{i-FWD} = 4,6$ μC $Q_{i-FWD} = 9,1$ μC				25		1,101		mWs
Turn-off energy (per pulse)	$E_{off}$					125		1,637		
						25		0,576		
						125		0,922		



### Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max		

#### Buck Diode

##### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			200	25 125 150		1,65 1,60 1,58	2,65	V
Reverse leakage current	$I_R$		650		25			10,6	µA

##### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	0,73	K/W

##### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125		114 160		A
Reverse recovery time	$t_{rr}$				25 125		59 91		ns
Recovered charge	$Q_r$	$di/dt = 9293$ A/µs $di/dt = 7591$ A/µs	-5 / 15	350	120	25 125	4,639 9,105		µC
Reverse recovered energy	$E_{rec}$				25 125		0,966 1,930		mWs
Peak rate of fall of recovery current	$(di_{rt}/dt)_{max}$				25 125		3621 2111		A/µs



### Characteristic Values

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

#### Out. Boost Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,002	25	3,2	4	4,8	V
Collector-emitter saturation voltage	$V_{CESat}$		15		200	25 125 150		1,69 1,86 1,96	2,1	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			200	µA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							13120		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		194		
Reverse transfer capacitance	$C_{res}$							42		
Gate charge	$Q_g$		15	520	200	25		420		

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,65		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω	-5 / 15	350	120	25		76		ns
Rise time	$t_r$					125		62		
Turn-off delay time	$t_{d(off)}$					25		12		
Fall time	$t_f$					125		14		
						25		153		
Turn-on energy (per pulse)	$E_{on}$	$Q_{iFWD} = 4,5$ µC				25		1,709		mWs
Turn-off energy (per pulse)	$E_{off}$	$Q_{iFWD} = 9,2$ µC				125		2,573		
						25		0,542		
						125		1,009		



### Characteristic Values

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

#### Out. Boost Diode

##### Static

Forward voltage	$V_F$				200	25 125 150		1,65 1,60 1,58	2,65	V
Reverse leakage current	$I_R$			650		25			10,6	$\mu$ A

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,73		K/W
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##### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt = 6472$ A/ $\mu$ s $di/dt = 5169$ A/ $\mu$ s	-5 / 15	350	120	25		91		A
Reverse recovery time	$t_{rr}$					125		70		ns
Recovered charge	$Q_r$					25		4,495		$\mu$ C
Reverse recovered energy	$E_{rec}$					125		9,160		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25		2015		A/ $\mu$ s
						125		1571		

#### Out. Boost Inverse Diode

##### Static

Forward voltage	$V_F$				200	25 125 150		1,77 1,69 1,66	1,95	V
Reverse leakage current	$I_R$			650		25			2,4	$\mu$ A

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,58		K/W
-------------------------------------	---------------	------------------------------------	--	--	--	--	--	------	--	-----

#### DC Link Capacitor

Capacitance	C							300		nF
Tolerance							-10		+10	%
Dissipation factor		$f = 1$ kHz				25			2,5	%



Vincotech

**10-FY07NPA200SM02-L366F08 /**  
**10-PY07NPA200SM02-L366F08Y**  
 datasheet

## Characteristic Values

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

### Thermistor

Rated resistance	$R$					25		22		kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$				25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$				25		4000		K
Vincotech NTC Reference									I	



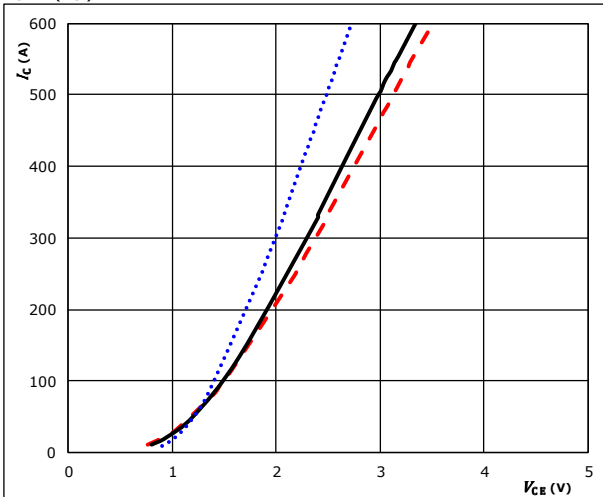


### Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

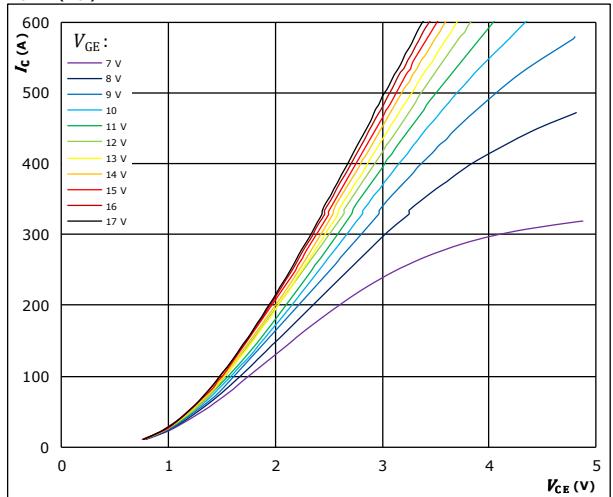


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

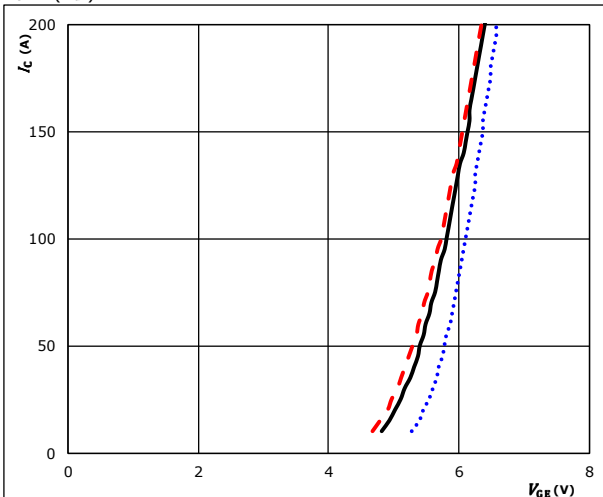


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

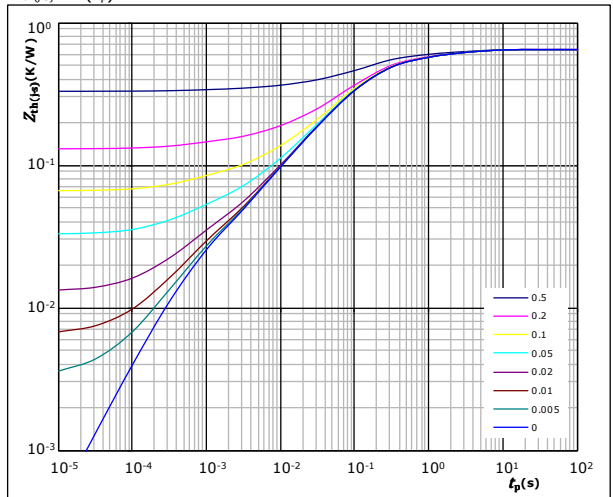


$t_p = 100 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{CE} = 0 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,65 \text{ K/W}$   
 IGBT thermal model values

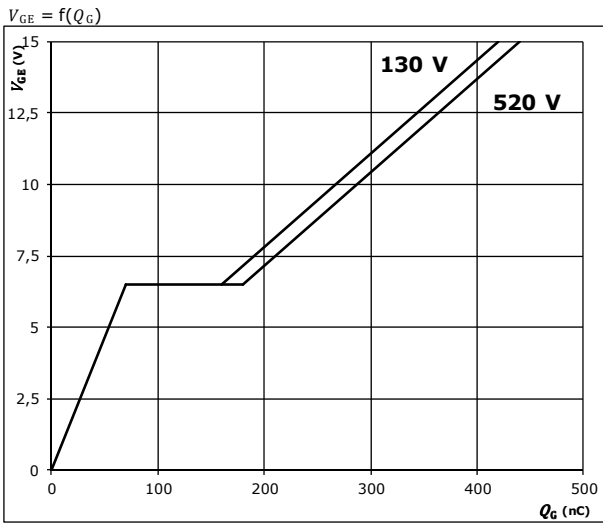
R (K/W)	$\tau$ (s)
7,51E-02	3,22E+00
1,27E-01	5,51E-01
3,27E-01	1,11E-01
7,19E-02	2,69E-02
3,44E-02	6,17E-03
1,81E-02	5,82E-04



## Buck Switch Characteristics

**figure 5. IGBT**

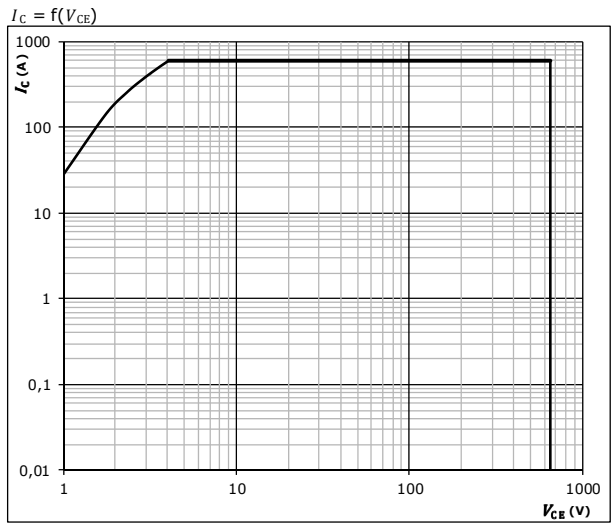
Gate voltage vs gate charge



$I_C = 200$  A

**figure 6. IGBT**

Safe operating area



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

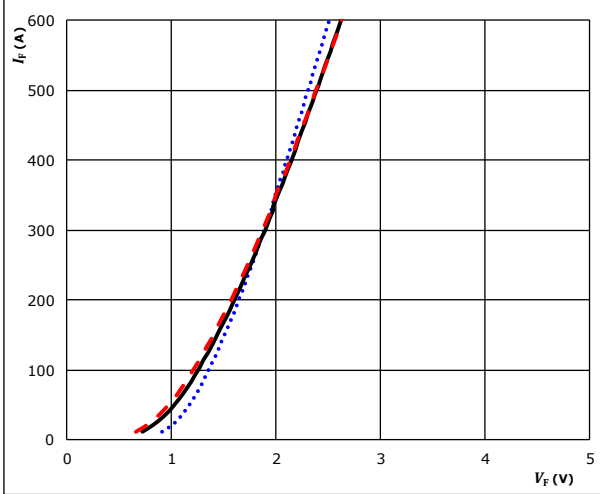


### Buck Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

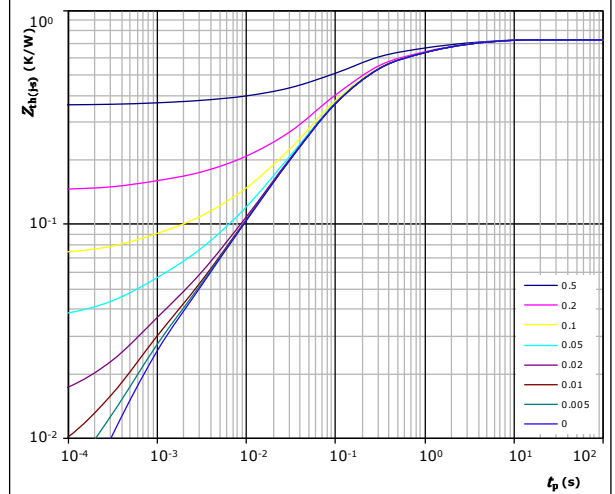


$t_p = 250 \mu s$   
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,73 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
8,64E-02	3,05E+00
1,38E-01	6,75E-01
3,34E-01	1,25E-01
1,06E-01	3,99E-02
4,34E-02	6,89E-03
1,90E-02	7,34E-04

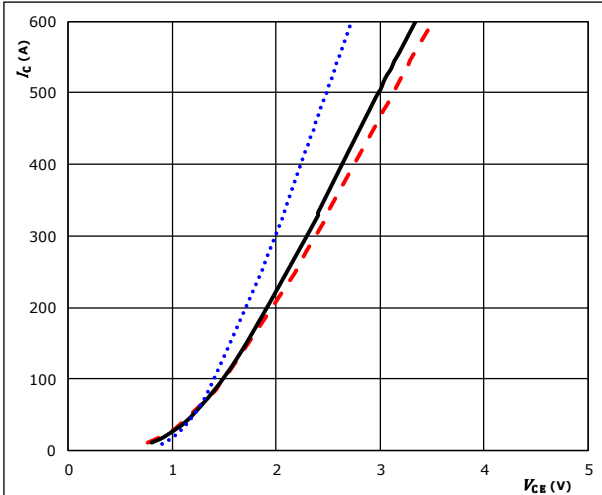


## Out. Boost Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

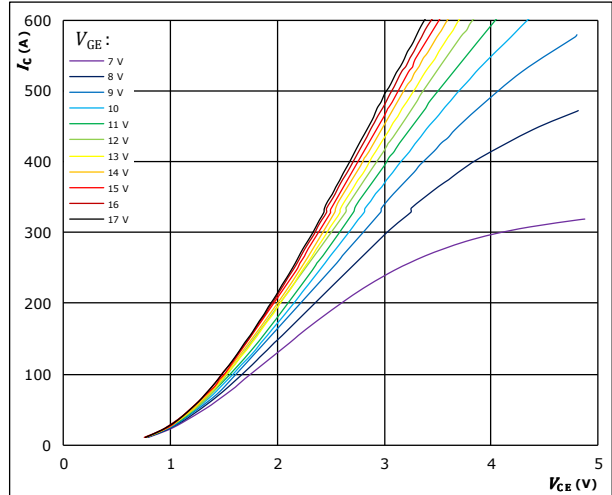


$t_p = 250 \mu\text{s}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 2.** IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

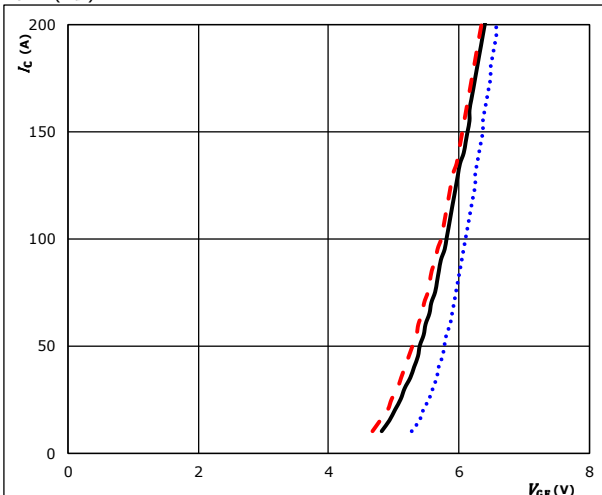


$t_p = 250 \mu\text{s}$   
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

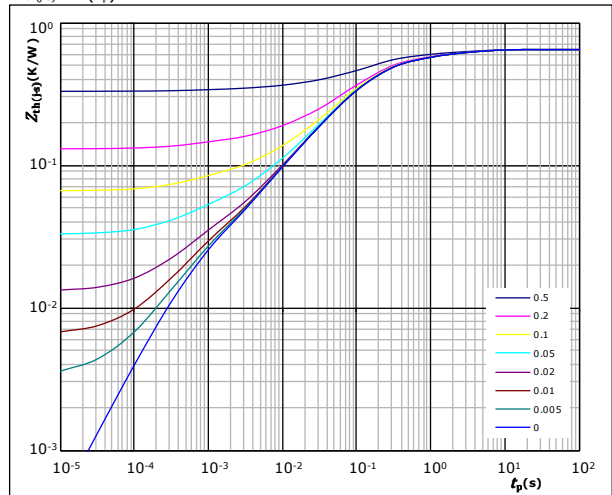


$t_p = 100 \mu\text{s}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{CE} = 0 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(\theta-s)} = 0,65 \text{ K/W}$   
 IGBT thermal model values

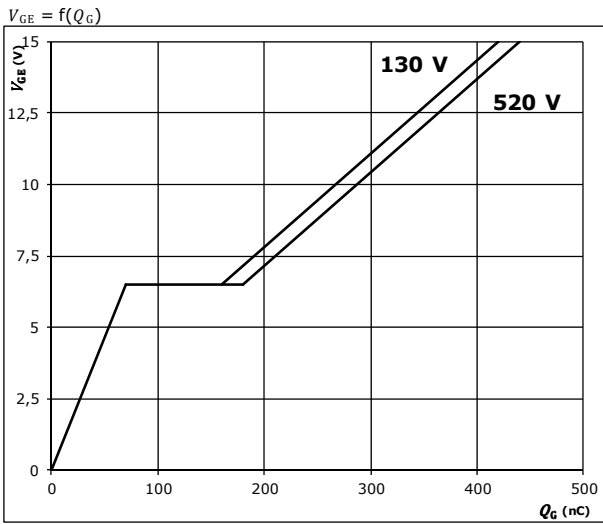
$R$ (K/W)	$\tau$ (s)
7,51E-02	3,22E+00
1,27E-01	5,51E-01
3,27E-01	1,11E-01
7,19E-02	2,69E-02
3,44E-02	6,17E-03
1,81E-02	5,82E-04



### Out. Boost Switch Characteristics

**figure 5. IGBT**

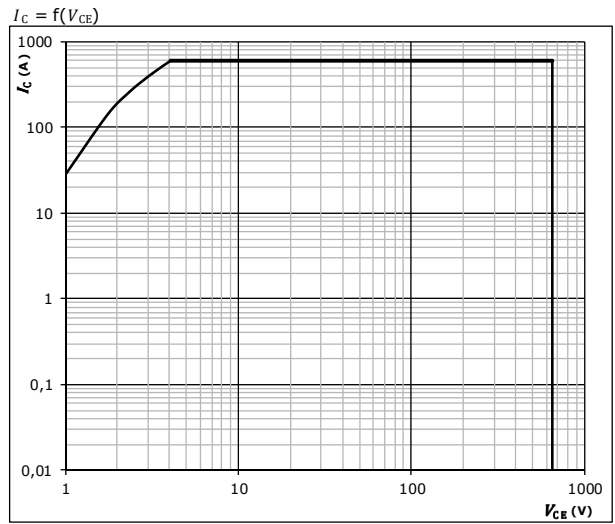
Gate voltage vs gate charge



$I_C = 200$  A

**figure 6. IGBT**

Safe operating area



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

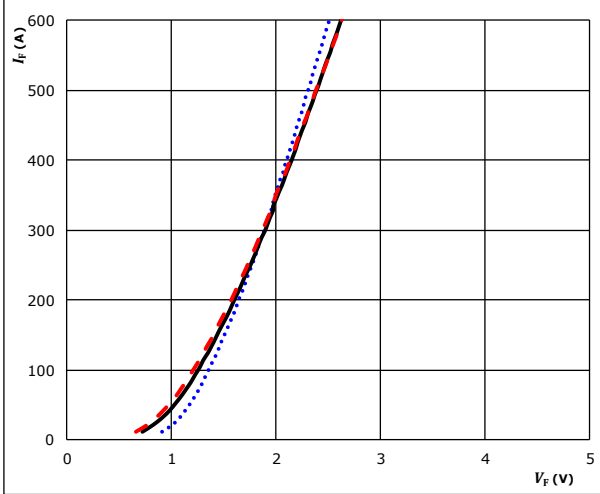


### Out. Boost Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

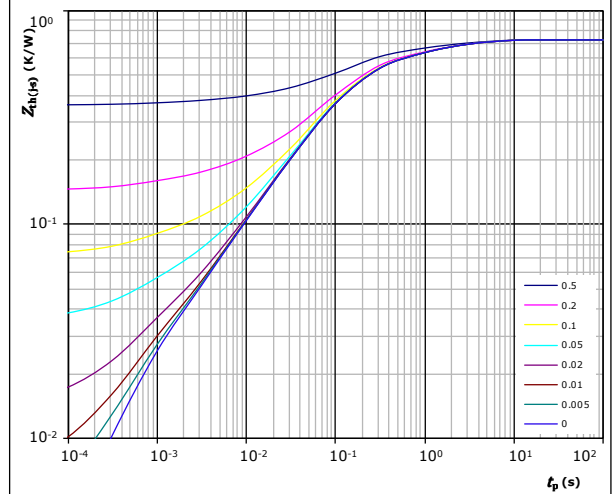


$t_p = 250 \mu s$   
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,73 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
8,64E-02	3,05E+00
1,38E-01	6,75E-01
3,34E-01	1,25E-01
1,06E-01	3,99E-02
4,34E-02	6,89E-03
1,90E-02	7,34E-04

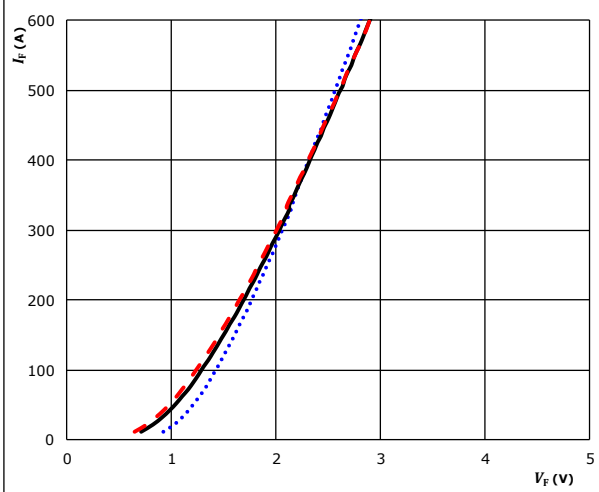


## Out. Boost Inverse Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

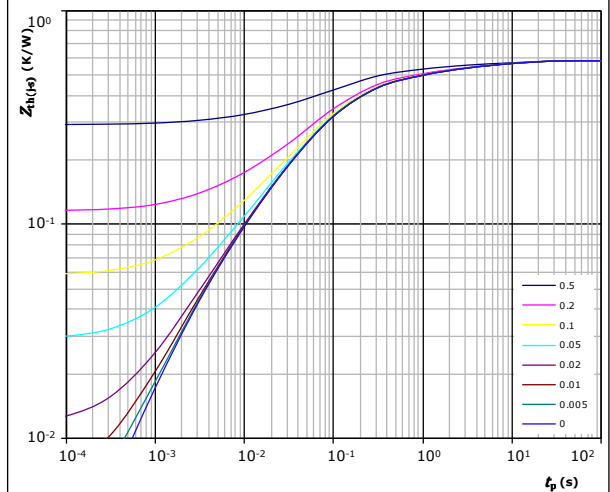


$t_p = 250 \mu s$   
 $T_j$ : 25 °C .....  
125 °C ———  
150 °C - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,58 \text{ K/W}$   
FWD thermal model values

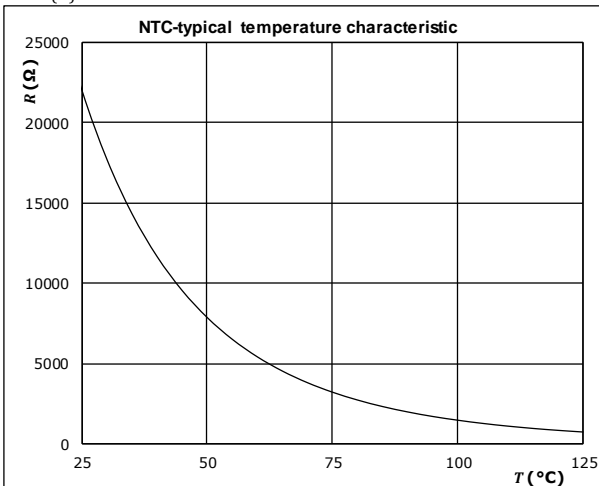
$R$ (K/W)	$\tau$ (s)
5,80E-02	8,20E+00
8,03E-02	1,08E+00
1,46E-01	1,95E-01
2,11E-01	6,41E-02
6,77E-02	1,10E-02
1,80E-02	2,03E-03

## Thermistor Characteristics

**figure 1.** Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$



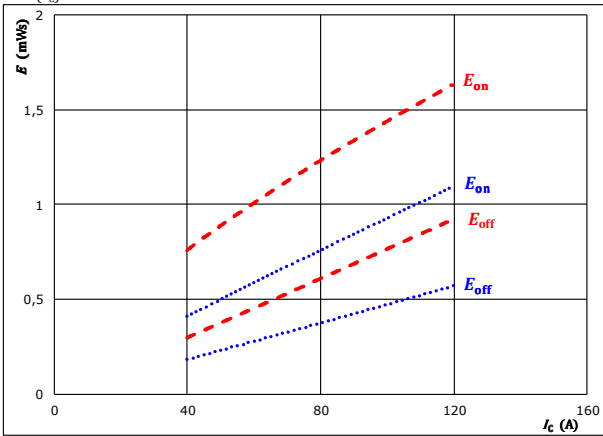


## Buck Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

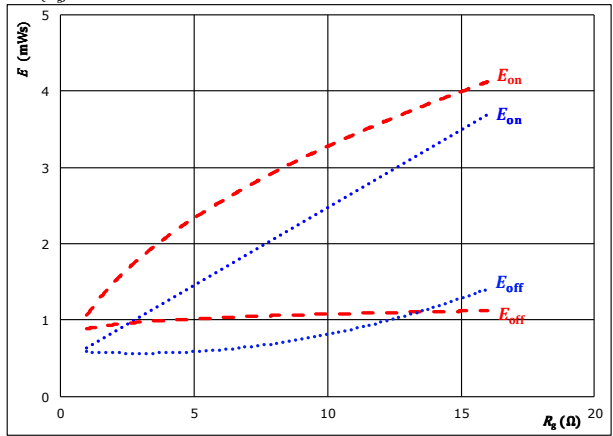
$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$

$T_j$ : 25 °C (blue dotted line)  
125 °C (red dashed line)

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

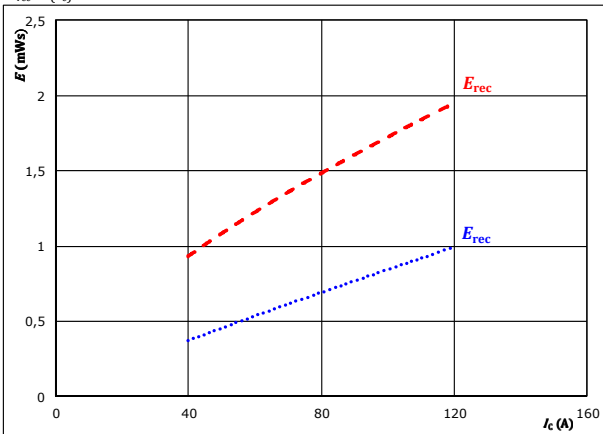
$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 120$  A

$T_j$ : 25 °C (blue dotted line)  
125 °C (red dashed line)

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

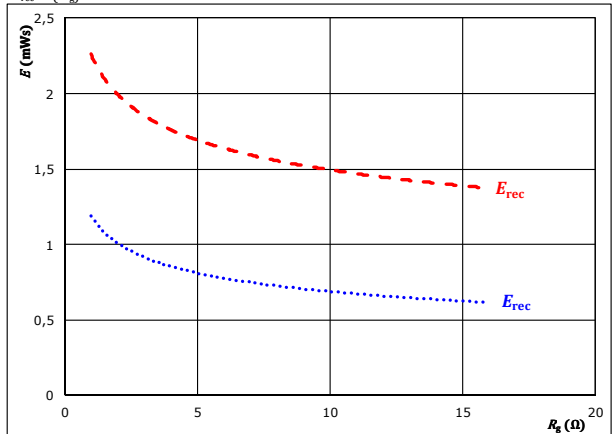
$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 4$   $\Omega$

$T_j$ : 25 °C (blue dotted line)  
125 °C (red dashed line)

**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  
 $V_{GE} = -5 / 15$  V  
 $I_c = 120$  A

$T_j$ : 25 °C (blue dotted line)  
125 °C (red dashed line)



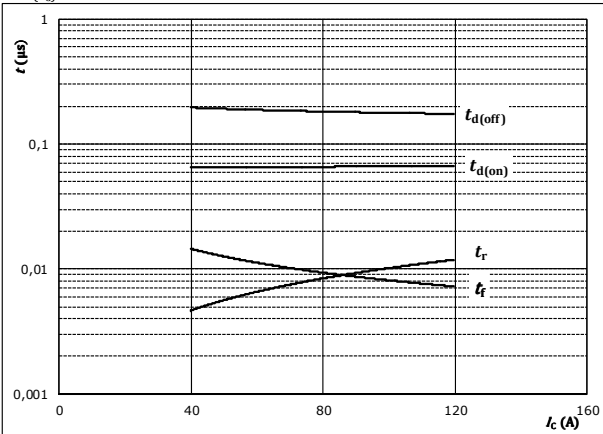


## Buck Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



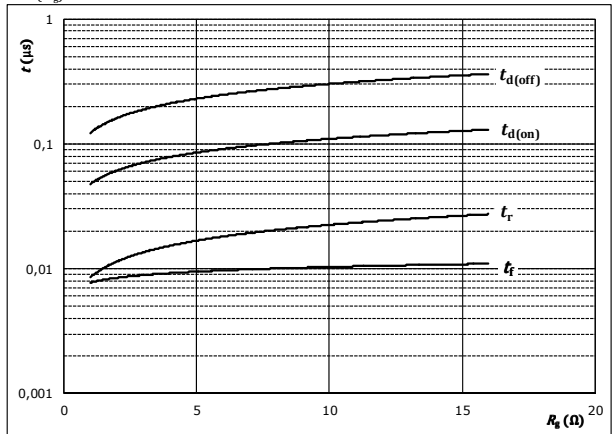
With an inductive load at

$T_j = 125$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{g(on)} = 4$   $\Omega$   
 $R_{g(off)} = 4$   $\Omega$

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



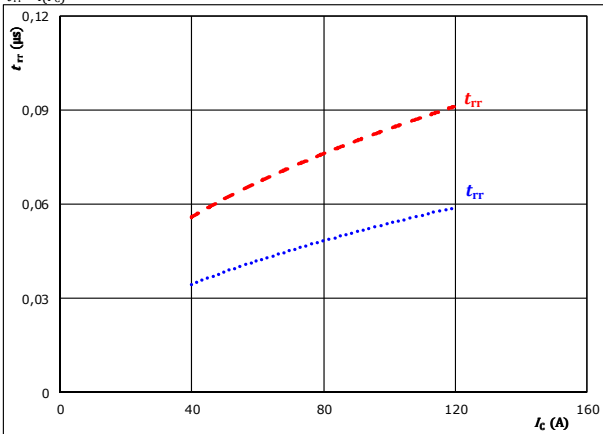
With an inductive load at

$T_j = 125$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 120$  A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$



With an inductive load at

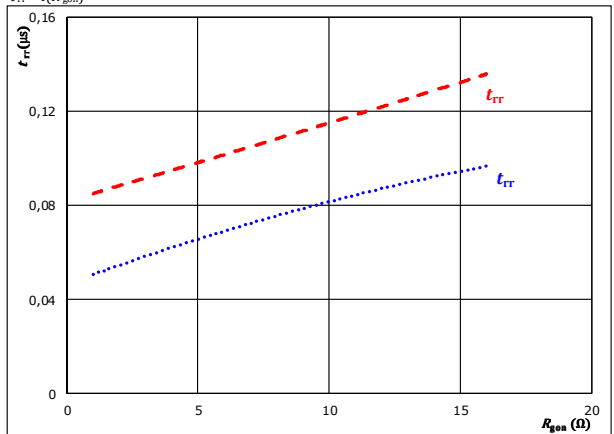
$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{g(on)} = 4$   $\Omega$

$T_j$ : 25 °C (dotted line)  
125 °C (dashed line)

**figure 8.** FWD

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

$$t_{rr} = f(R_{g(on)})$$



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 120$  A

$T_j$ : 25 °C (dotted line)  
125 °C (dashed line)

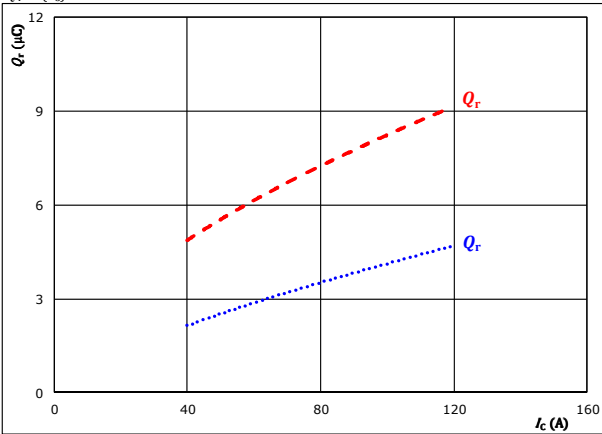


## Buck Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

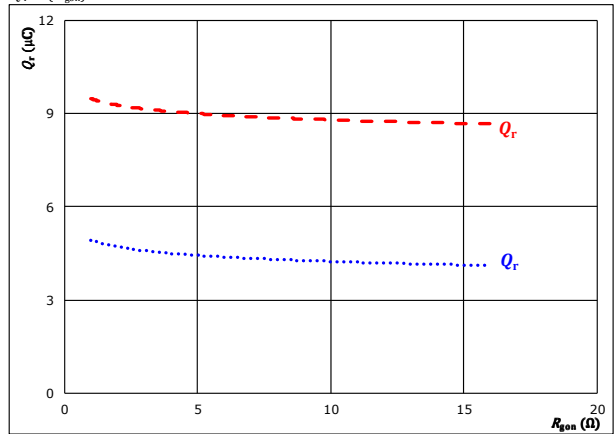


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{ggn} = 4$  Ω  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**figure 10.** FWD

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

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

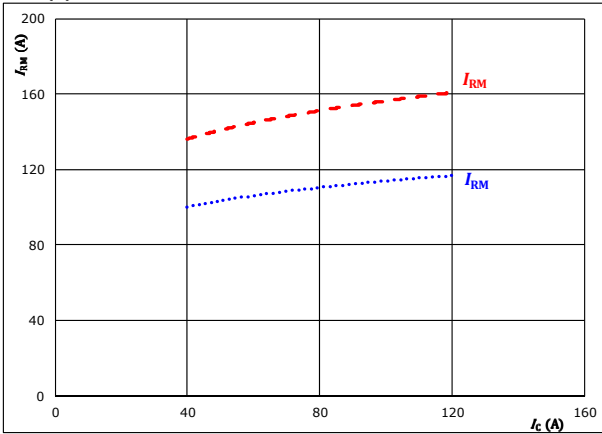


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 120$  A  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**figure 11.** FWD

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

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

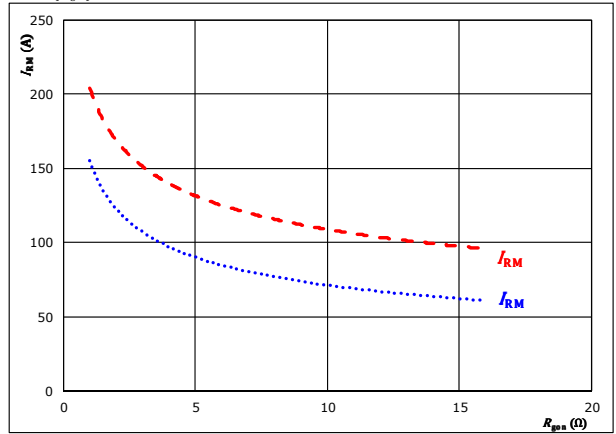


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{ggn} = 4$  Ω  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**figure 12.** FWD

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

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 120$  A  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

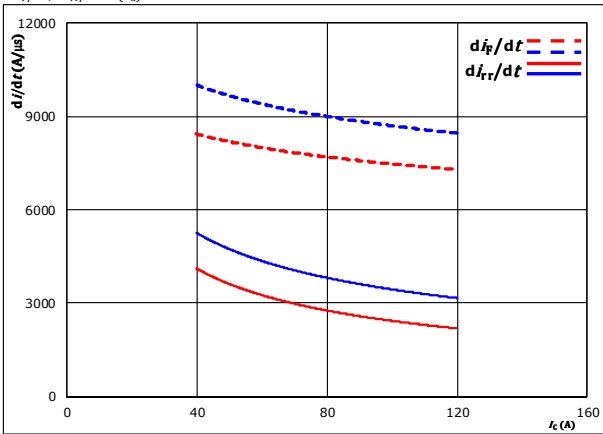


Vincotech

## Buck Switching Characteristics

**figure 13.** FWD

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



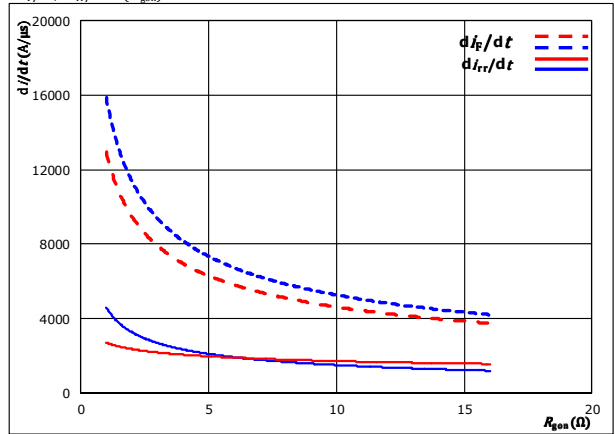
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 4$   $\Omega$

$T_j$ : 25 °C  
125 °C

**figure 14.** FWD

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



With an inductive load at

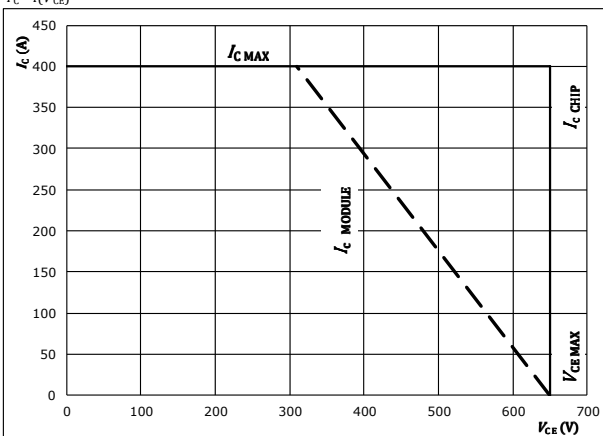
$V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 120$  A

$T_j$ : 25 °C  
125 °C

**figure 15.** IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At

$T_j = 125$  °C  
 $R_{gon} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$



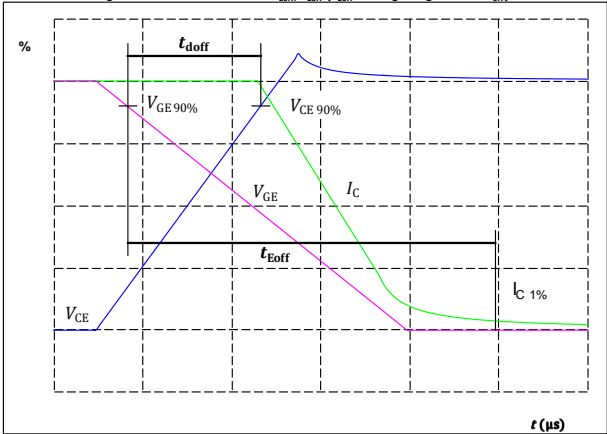
## Buck Switching Definitions

**General conditions**

$T_j$	=	125 °C
$R_{gon}$	=	4 $\Omega$
$R_{goff}$	=	4 $\Omega$

**figure 1.** IGBT

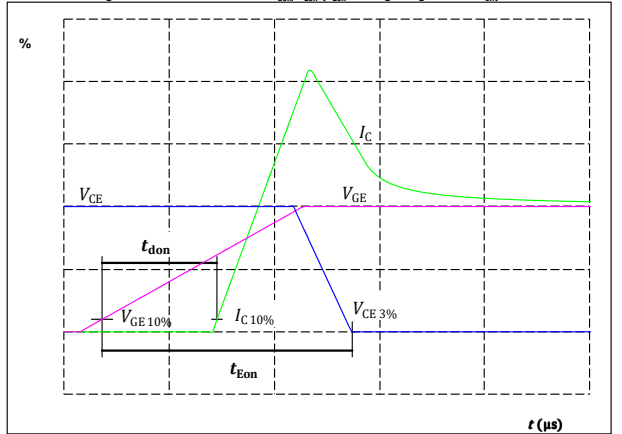
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_{doff} =$	174	ns

**figure 2.** IGBT

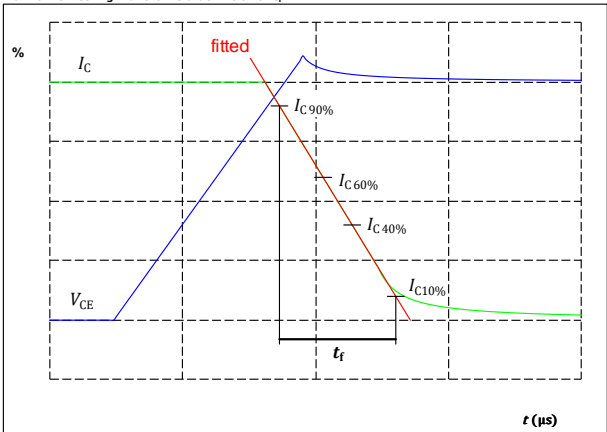
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{GE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_{don} =$	66	ns

**figure 3.** IGBT

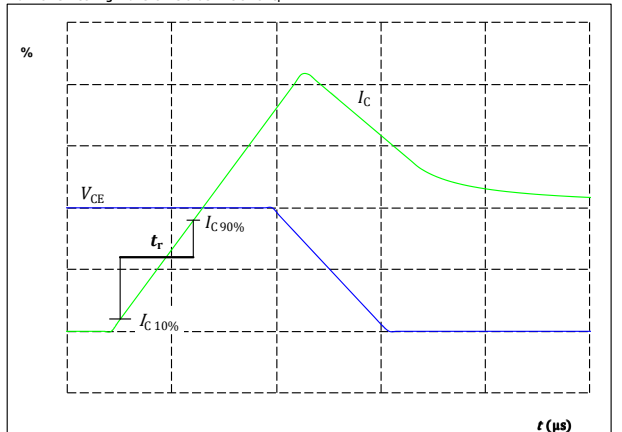
Turn-off Switching Waveforms & definition of  $t_r$



$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_r =$	9	ns

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$

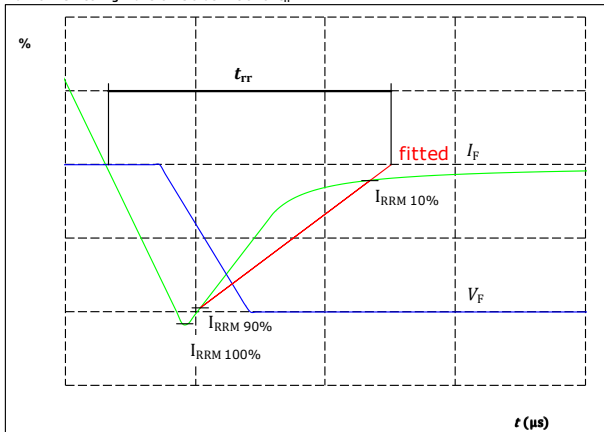


$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_r =$	12	ns



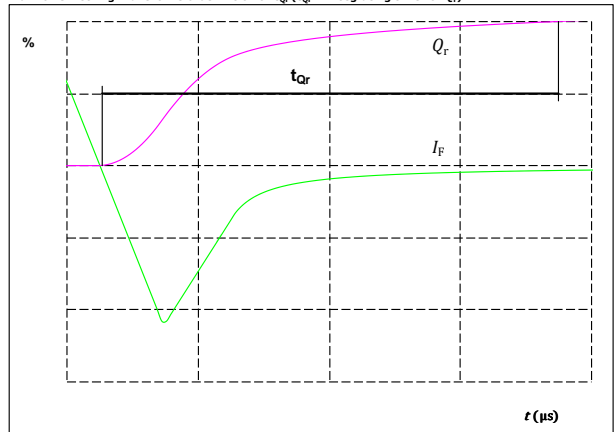
### Buck Switching Characteristics

figure 5. Turn-off Switching Waveforms & definition of  $t_{rr}$  FWD



$V_F(100\%) =$	350	V
$I_F(100\%) =$	120	A
$I_{RRM}(100\%) =$	160	A
$t_{rr} =$	91	ns

figure 6. Turn-on Switching Waveforms & definition of  $t_{qr}$  ( $t_{qr}$  = integrating time for  $Q_r$ ) FWD



$I_F(100\%) =$	120	A
$Q_r(100\%) =$	9,11	$\mu\text{C}$

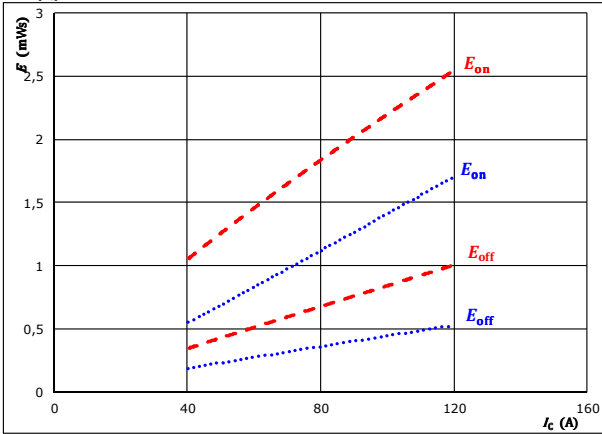


## Boost Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

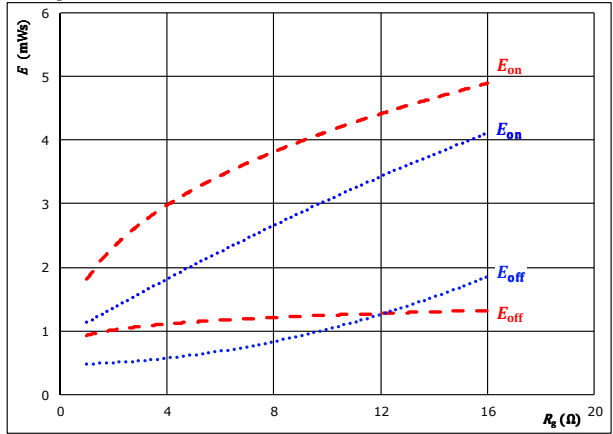


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$   
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$

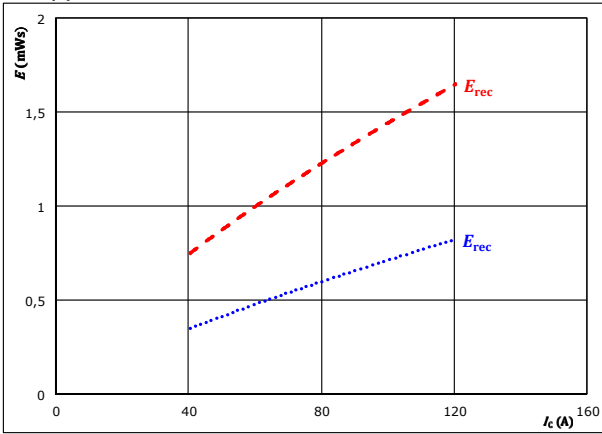


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 120$  A  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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

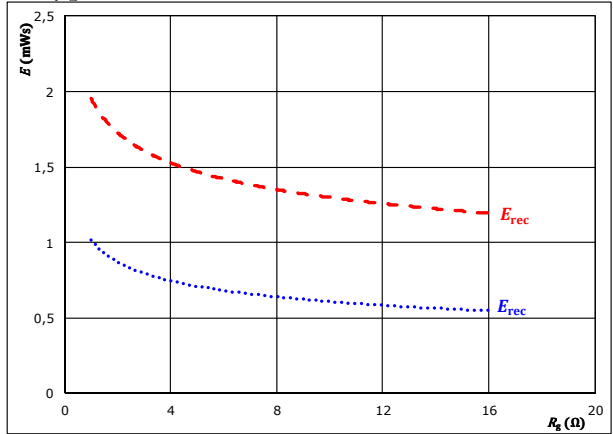


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 4$   $\Omega$   
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

**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  
 $V_{GE} = -5 / 15$  V  
 $I_C = 120$  A  
 $T_j: 25$  °C (blue dotted line)  
 $125$  °C (red dashed line)

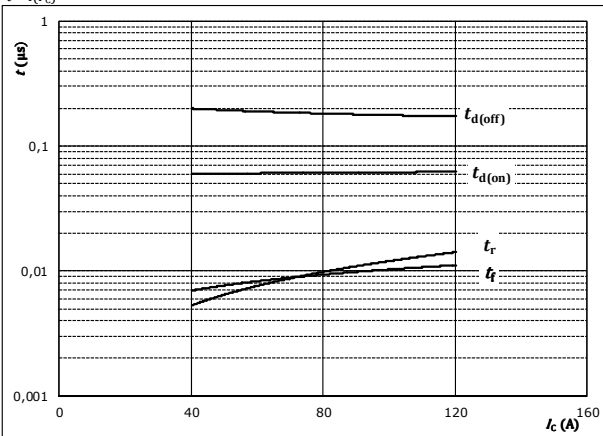


## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



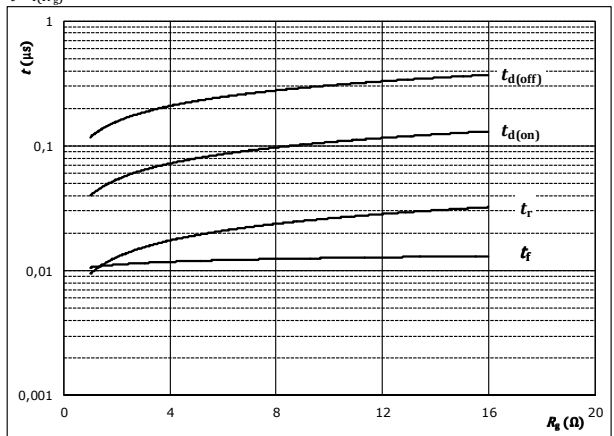
With an inductive load at

$T_j = 125 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{g\text{on}} = 4 \text{ } \Omega$   
 $R_{g\text{off}} = 4 \text{ } \Omega$

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



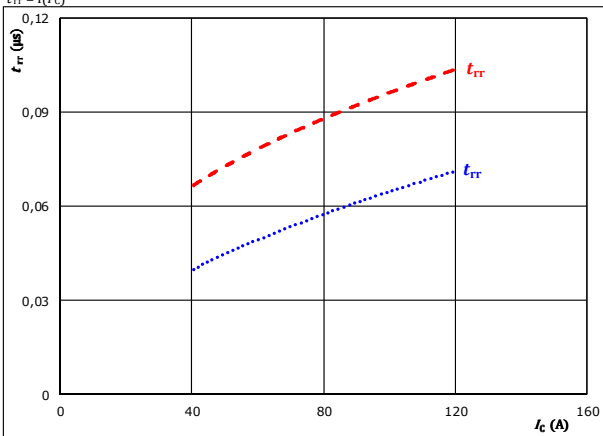
With an inductive load at

$T_j = 125 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_C = 120 \text{ A}$

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$



With an inductive load at

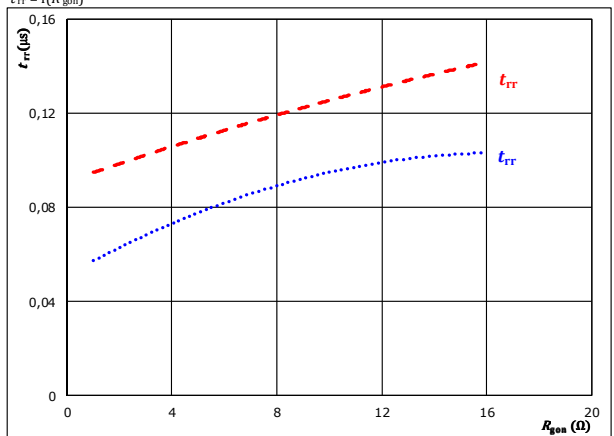
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{g\text{on}} = 4 \text{ } \Omega$

$T_j: 25 \text{ }^\circ\text{C}$  (dotted blue)  
 $125 \text{ }^\circ\text{C}$  (dashed red)

**figure 8.** FWD

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

$$t_{rr} = f(R_{g\text{on}})$$



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_C = 120 \text{ A}$

$T_j: 25 \text{ }^\circ\text{C}$  (dotted blue)  
 $125 \text{ }^\circ\text{C}$  (dashed red)

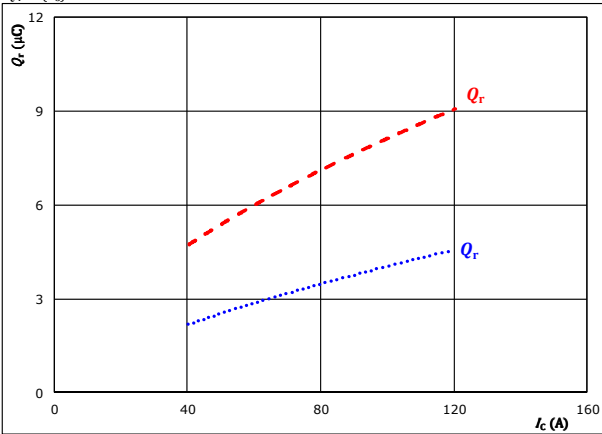


## Boost Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

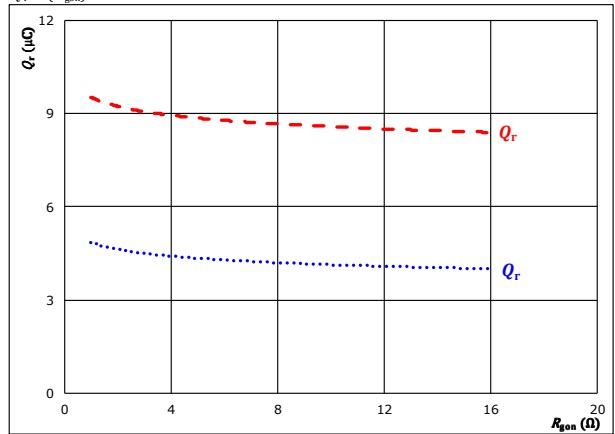


With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{gpn} = 4 \ \Omega$   
 $T_j: 25^\circ\text{C}$  (blue dotted line)  
 $125^\circ\text{C}$  (red dashed line)

**figure 10.** FWD

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

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

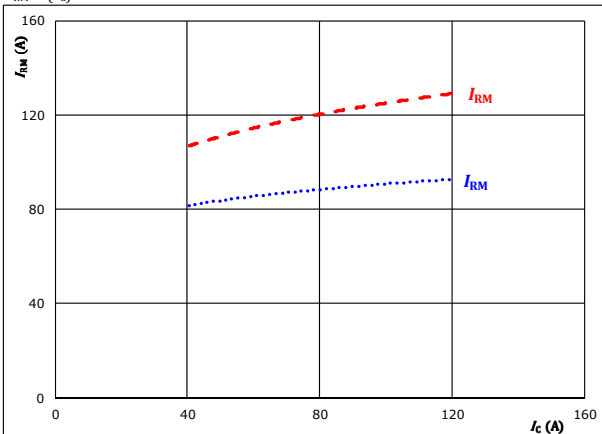


With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_c = 120 \text{ A}$   
 $T_j: 25^\circ\text{C}$  (blue dotted line)  
 $125^\circ\text{C}$  (red dashed line)

**figure 11.** FWD

Typical peak reverse recovery current as a function of collector current

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

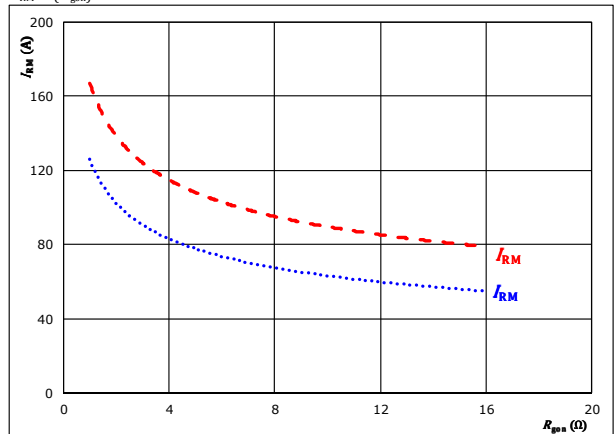


With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{gpn} = 4 \ \Omega$   
 $T_j: 25^\circ\text{C}$  (blue dotted line)  
 $125^\circ\text{C}$  (red dashed line)

**figure 12.** FWD

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

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



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_c = 120 \text{ A}$   
 $T_j: 25^\circ\text{C}$  (blue dotted line)  
 $125^\circ\text{C}$  (red dashed line)

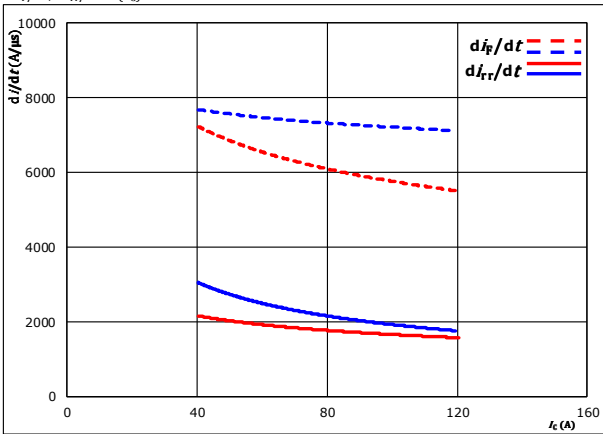




### Boost Switching Characteristics

**figure 13.** FWD

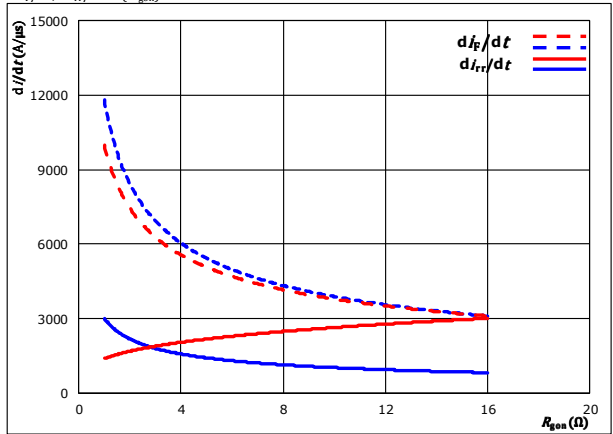
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $T_j: 25 \text{ } ^\circ\text{C}$   
 $125 \text{ } ^\circ\text{C}$

**figure 14.** FWD

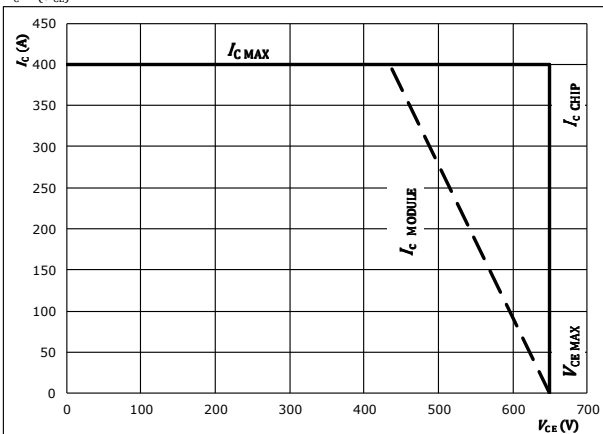
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_c = 120 \text{ A}$   
 $T_j: 25 \text{ } ^\circ\text{C}$   
 $125 \text{ } ^\circ\text{C}$

**figure 15.** IGBT

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



At  
 $T_j = 125 \text{ } ^\circ\text{C}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

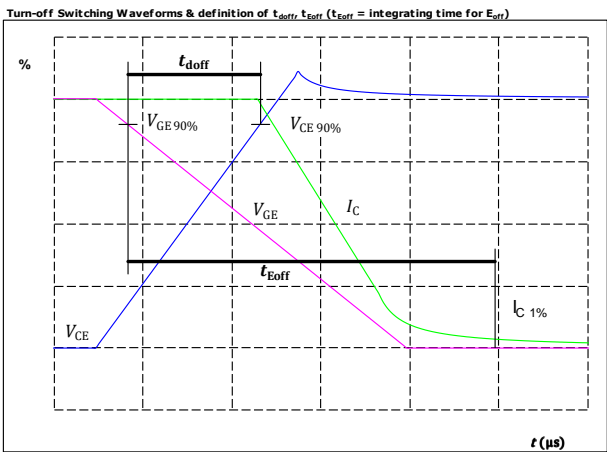


## Boost Switching Definitions

**General conditions**

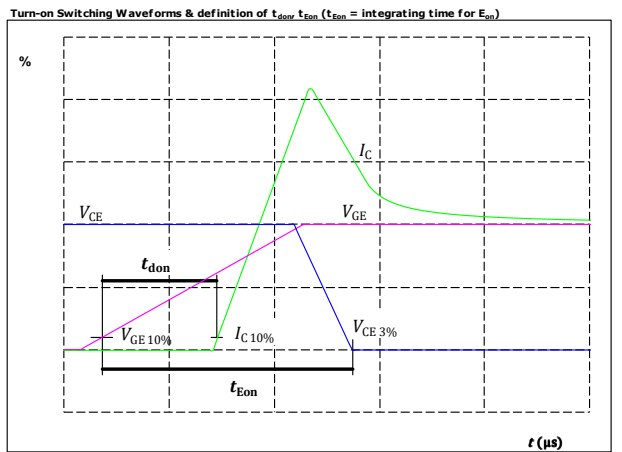
$T_j$	=	125 °C
$R_{gon}$	=	4 $\Omega$
$R_{goff}$	=	4 $\Omega$

**figure 1.** IGBT



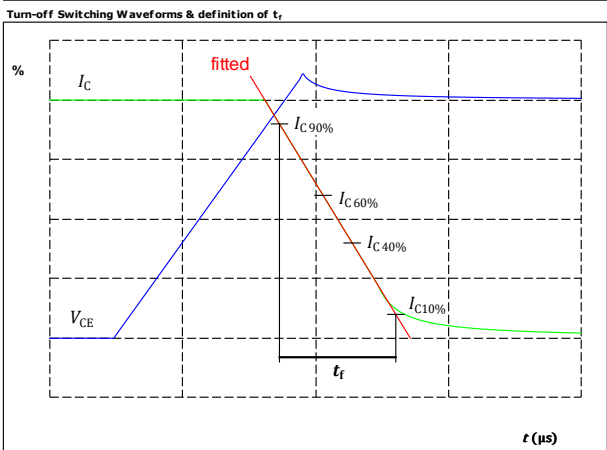
$V_{GE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_{doff} =$	171	ns

**figure 2.** IGBT



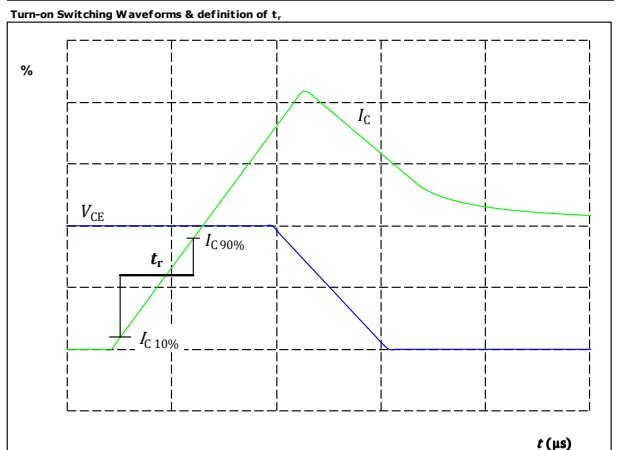
$V_{GE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_{don} =$	62	ns

**figure 3.** IGBT



$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_r =$	12	ns

**figure 4.** IGBT

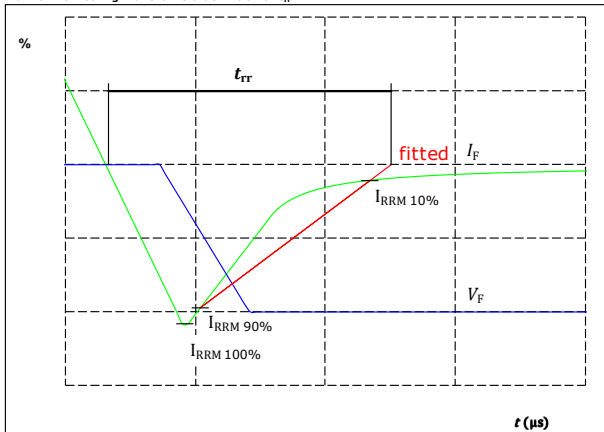


$V_C(100\%) =$	350	V
$I_C(100\%) =$	120	A
$t_r =$	14	ns



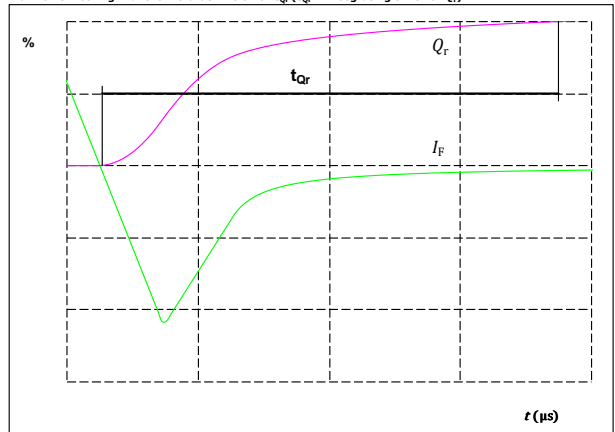
### Boost Switching Characteristics

figure 5. FWD  
Turn-off Switching Waveforms & definition of  $t_{rr}$



$V_F(100\%) =$	350	V
$I_F(100\%) =$	120	A
$I_{RRM}(100\%) =$	129	A
$t_{rr} =$	103	ns

figure 6. FWD  
Turn-on Switching Waveforms & definition of  $t_{qr}$  ( $t_{qr}$  = integrating time for  $Q_r$ )



$I_F(100\%) =$	120	A
$Q_r(100\%) =$	9,16	$\mu\text{C}$



# 10-FY07NPA200SM02-L366F08 / 10-PY07NPA200SM02-L366F08Y

datasheet

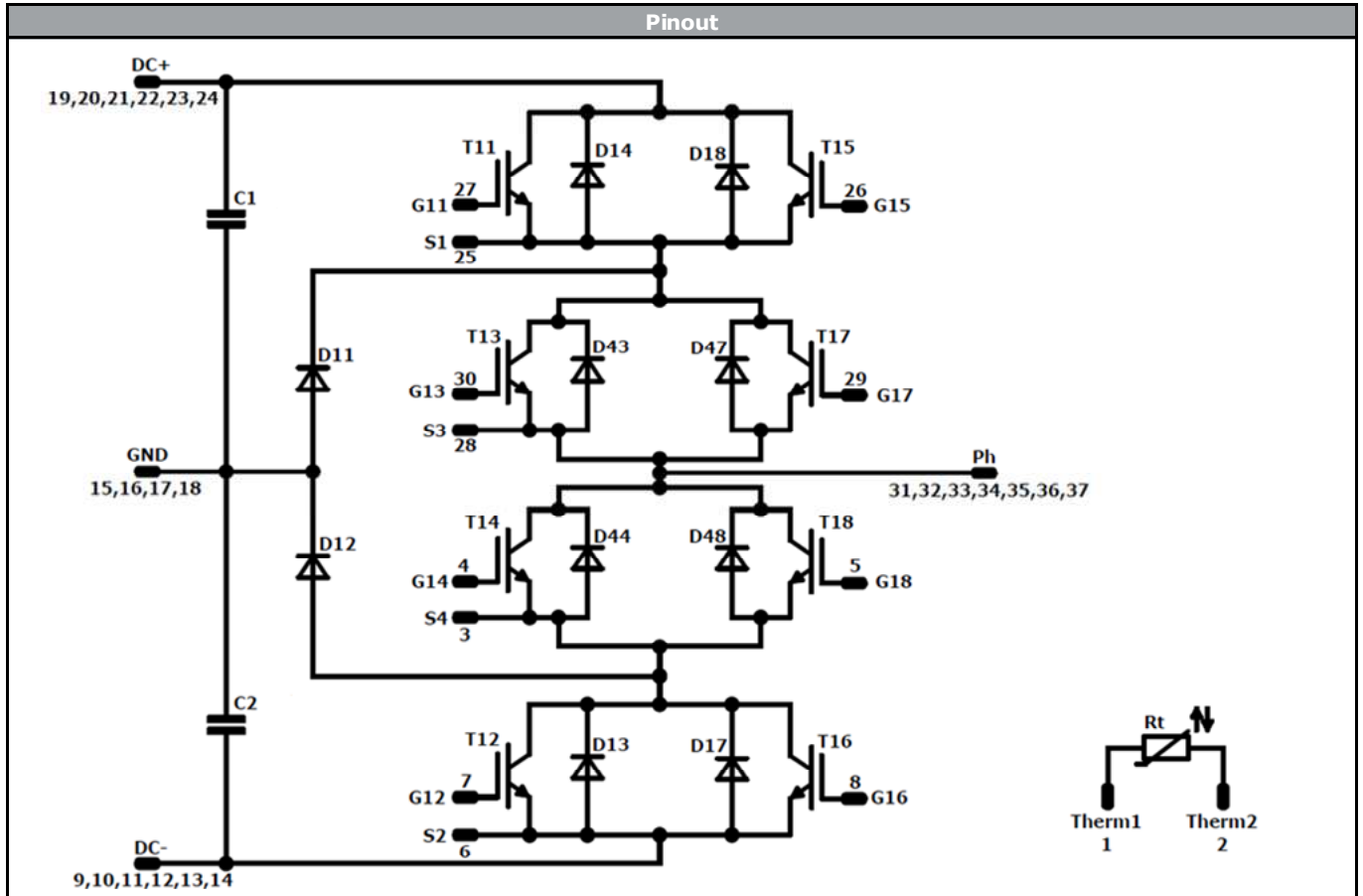
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Ordering Code & Marking								
Version			Ordering Code					
without thermal paste 12mm housing with solder pins			10-FY07NPA200SM02-L366F08					
without thermal paste 12mm housing with press-fit pins			10-PY07NPA200SM02-L366F08Y					
with thermal paste 12mm housing with solder pins			10-FY07NPA200SM02-L366F08-/3/					
with thermal paste 12mm housing with press-fit pins			10-PY07NPA200SM02-L366F08Y-/3/					
NN-NNNNNNNNNNNN TTTTWW WWYY UL VIN LLLLL SSSS			<b>Text</b>	<b>Name</b>	<b>Date code</b>	<b>UL &amp; VIN</b>	<b>Lot</b>	<b>Serial</b>
				NN-NNNNNNNNNNNN-TTTTWW	WWYY	UL VIN	LLLLL	SSSS
			<b>Datamatrix</b>	<b>Type&amp;Ver</b>	<b>Lot number</b>	<b>Serial</b>	<b>Date code</b>	
			TTTTTWW	LLLLL	SSSS	WWYY		

Pin table				Outline	
Pin	X	Y	Function	<p> <math>\phi \pm 0.05</math>  <math>15.23 \pm 0.05</math>  <math>22.93 \pm 0.1</math>  <math>16.2 \pm 0.05</math>  <math>4.1</math>  <math>26.1</math> </p> <p>           center of press-fit pinhead            for connection parameter see the handling instruction         </p> <p>           Tolerance of pinpositions: <math>\pm 0.5\text{mm}</math> at the end of pins            Dimension of coordinate axis is only offset without tolerance         </p>	
1	52,2	6,9	Therm1		
2	52,2	0	Therm2		
3	36,2	6,75	S4		
4	33,2	7,9	G14		
5	33,2	4,9	G18		
6	9,2	5,75	S2		
7	6,2	6,9	G12		
8	6,2	3,9	G16		
9	2,7	0	DC-		
10	0	0	DC-		
11	2,7	2,7	DC-		
12	0	2,7	DC-		
13	2,7	5,4	DC-		
14	0	5,4	DC-		
15	2,7	12,75	GND		
16	0	12,75	GND		
17	2,7	15,45	GND		
18	0	15,45	GND		
19	2,7	22,8	DC+		
20	0	22,8	DC+		
21	2,7	25,5	DC+		
22	0	25,5	DC+		
23	2,7	28,2	DC+		
24	0	28,2	DC+		
25	18,3	22,45	S1		
26	21,3	21,3	G15		
27	21,3	24,3	G11		
28	43	22,15	S3		
29	46	21	G17		
30	46	24	G13		
31	52,2	20,1	Ph		
32	49,5	22,8	Ph		
33	52,2	22,8	Ph		
34	49,5	25,5	Ph		
35	52,2	25,5	Ph		
36	49,5	28,2	Ph		
37	52,2	28,2	Ph		



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<b>Identification</b>					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T15, T16	IGBT	650V	100A	Buck Switch	
D11, D12	FWD	650V	200A	Buck Diode	
T13, T14, T17, T18	IGBT	650V	100A	Out. Boost Switch	
D13, D14, D17, D18	FWD	650V	100A	Out. Boost Diode	
D43, D44, D47, D48	FWD	650V	100A	Out. Boost Inverse Diode	
C1, C2	Capacitor	630V	-	DC Link Capacitor	
Rt	NTC	-	-	Thermistor	




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

Handling instruction
Handling instructions for if no series packaging available packages see vincotech.com website.

Package data
Package data for if no series packaging available 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-XY07NPA200SM02-L366F08x-D5-14	19 Dec. 2018	Thermistor type has been changed to Tateyama	8

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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.