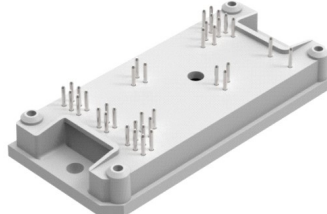
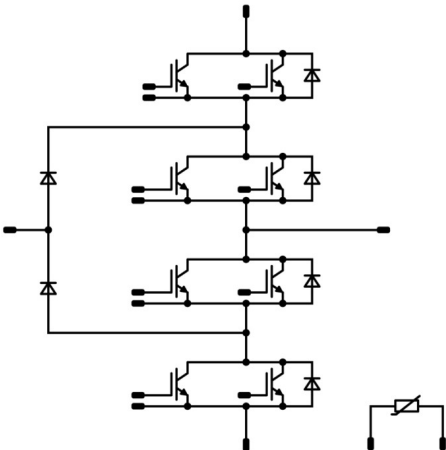




# Vincotech

<i>flow NPC 1</i>	650 V / 150 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Features</b></div> <ul style="list-style-type: none"> <li>Three-level high efficient topology</li> <li>Latest chip generation</li> <li>Low inductive package</li> </ul>	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><i>flow 1 12 mm housing</i></div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Target applications</b></div> <ul style="list-style-type: none"> <li>Solar Inverters</li> </ul>	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Schematic</b></div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Types</b></div> <ul style="list-style-type: none"> <li>10-FY07NIA150S5-M516F58</li> </ul>	

## 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	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	104	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	450	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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
-----------	--------	-----------	-------	------

### Buck Diode

Peak Repetitive Reverse Voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	101	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	300	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	127	W
Maximum Junction Temperature	$T_{jmax}$		175	°C

### Boost Switch

Collector-emitter voltage	$V_{CES}$		650	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	128	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	450	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	133	W
Gate-emitter voltage	$V_{GES}$		±20	V
Maximum Junction Temperature	$T_{jmax}$		175	°C

### Boost Diode

Peak Repetitive Reverse Voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	85	A
Repetitive peak forward current	$I_{FRM}$		200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	122	W
Maximum Junction Temperature	$T_{jmax}$		175	°C

### Boost Sw.Inv.Diode

Peak Repetitive Reverse Voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	85	A
Repetitive peak forward current	$I_{FRM}$		200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	122	W
Maximum Junction Temperature	$T_{jmax}$		175	°C



Vincotech

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
-----------	--------	-----------	-------	------

### Module Properties

#### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{top}$		-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			7,92	mm
Comparative Tracking Index	CTI		> 200	

\*100 % tested in production



Vincotech

### 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	

#### Buck Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0015	25	3,2	4	4,8	V
Collector-emitter saturation voltage	$V_{CESat}$		15		150	25 125 150		1,43 1,52 1,55	1,75	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			100	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							9000		pF
Output capacitance	$C_{oes}$	$f = 1$ MHz	0	25		25		260		
Reverse transfer capacitance	$C_{res}$							34		
Gate charge	$Q_g$		15	520	150	25		328		nC

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						0,65		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		48 50 49		ns	
Rise time	$t_r$	$R_{goff} = 2 \Omega$ $R_{gon} = 2 \Omega$				25 125 150		9 10 10			
Turn-off delay time	$t_{d(off)}$		+15/-5	350	90	25 125 150		147 170 176			
Fall time	$t_f$					25 125 150		11 19 22			
Turn-on energy (per pulse)	$E_{on}$	$Q_{t-FWD} = 3,3 \mu C$ $Q_{t-FWD} = 6,8 \mu C$ $Q_{t-FWD} = 7,8 \mu C$				25 125 150		0,346 0,608 0,705			mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,066 1,561 1,737			



Vincotech

### Characteristic Values

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

#### Buck Diode

##### Static

Forward voltage	$V_F$				150	25 125 150		1,56 1,50 1,48	1,92	V
Reverse leakage current	$I_r$			650		25			7,6	μA

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						0,75		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

##### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt = 7165$ A/μs $di/dt = 8521$ A/μs $di/dt = 7698$ A/μs	+15/-5	350	90	25		124		A
Reverse recovery time	$t_{rr}$					125		158		
						150		167		
						25		44		
Recovered charge	$Q_r$					125		74		
						150		85		
		25		3,349						
Reverse recovered energy	$E_{rec}$	125		6,779						
		150		7,785						
		25		0,870						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	125		1,722						
		150		1,922						
		25		3889						
						125		3024		A/μs
						150		3127		



Vincotech

## 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	

### Boost Switch

#### Static

Parameter	Symbol	$V_{GE}=V_{CE}$	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$				0,002	25	4,2	5	5,8	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		150	25 150		1,10 1,09	1,45	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			80	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$	$f = 1 \text{ MHz}$	0	25		25		23250		pF
Reverse transfer capacitance	$C_{res}$							60		
Gate charge	$Q_g$		15	520	75	25		872		nC

#### Thermal

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4 \text{ W/mK}$				0,72 K/W

#### Dynamic

Parameter	Symbol	Conditions	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit	
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 4 \Omega$ $R_{gon} = 4 \Omega$	±15	350	89	25 125 150		183		ns	
Rise time	$t_r$						25 125 150	11 12 13			
Turn-off delay time	$t_{d(off)}$						25 125 150	299 349 357			
Fall time	$t_f$						25 125 150	67 83 87			
Turn-on energy (per pulse)	$E_{on}$						$Q_{t-FWD} = 4,3 \mu\text{C}$ $Q_{t-FWD} = 8,5 \mu\text{C}$ $Q_{t-FWD} = 9,7 \mu\text{C}$	25 125 150	0,471 0,607 0,639		mWs
Turn-off energy (per pulse)	$E_{off}$						25 125 150	4,177 6,264 6,774			



Vincotech

### Characteristic Values

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

#### Boost Diode

##### Static

Forward voltage	$V_F$				100	25 150		1,77 1,57	1,82	V
Reverse leakage current	$I_r$			650		25			1,2	μA

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						0,78		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

##### Dynamic

Peak recovery current	$I_{RRM}$					25 125 150		107 132 139		A
Reverse recovery time	$t_{rr}$					25 125 150		129 184 193		ns
Recovered charge	$Q_r$	$di/dt = 10752$ A/μs $di/dt = 9000$ A/μs $di/dt = 8249$ A/μs	±15	350	89	25 125 150		4,327 8,481 9,651		μC
Reverse recovered energy	$E_{rec}$					25 125 150		1,157 2,415 2,753		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5512 3231 3015		A/μs

#### Boost Sw.Inv.Diode

##### Static

Forward voltage	$V_F$				100	25 150		1,77 1,57	1,82	V
Reverse leakage current	$I_r$			650		25			1,2	μA

##### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						0,78		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----



Vincotech

## Characteristic Values

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

### Thermistor

Rated resistance	$R$				25		22		k $\Omega$
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	



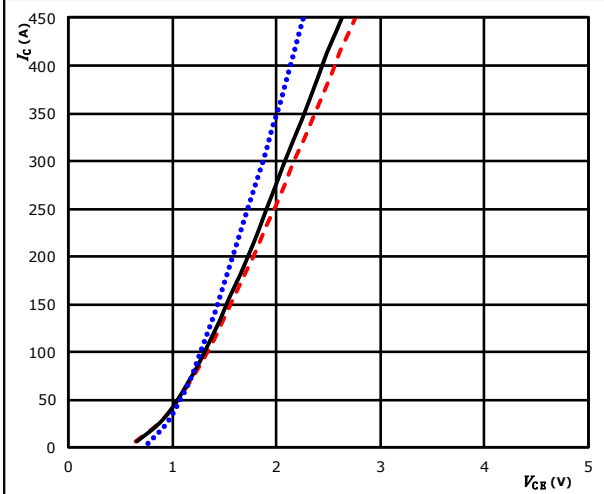


### Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

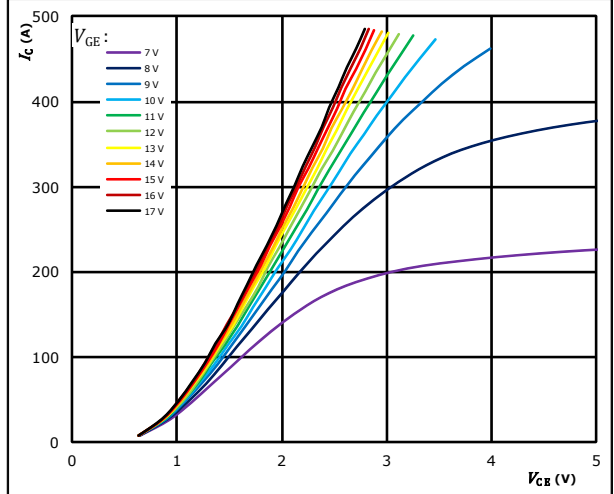


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

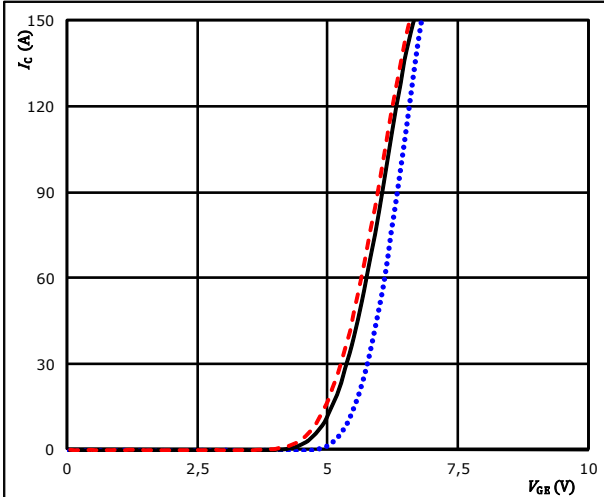


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

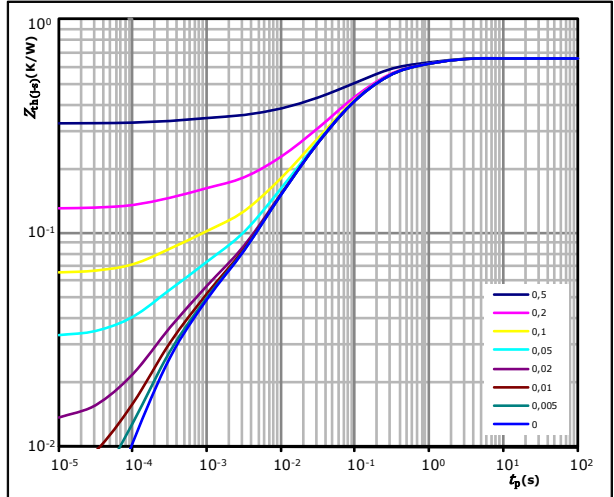


$t_p = 100 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{CE} = 10 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**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)
1,13E-01	8,46E-01
2,91E-01	1,23E-01
1,38E-01	3,33E-02
6,68E-02	8,32E-03
1,32E-02	2,63E-03
3,21E-02	3,23E-04

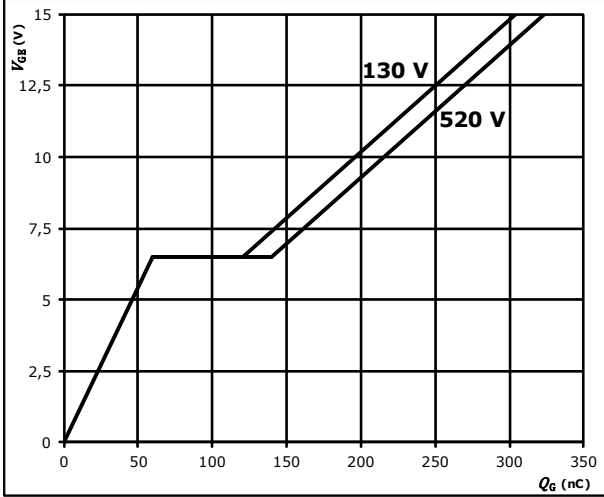


### Buck Switch Characteristics

**figure 5.** IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

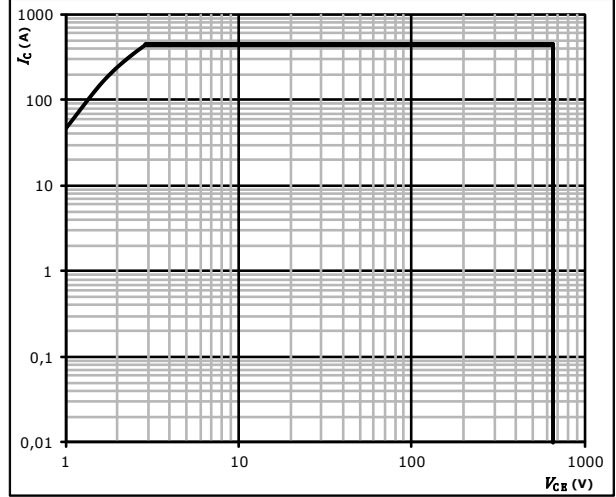


$I_C = 150$  A

**figure 6.** IGBT

Safe operating area

$I_C = f(V_{CE})$



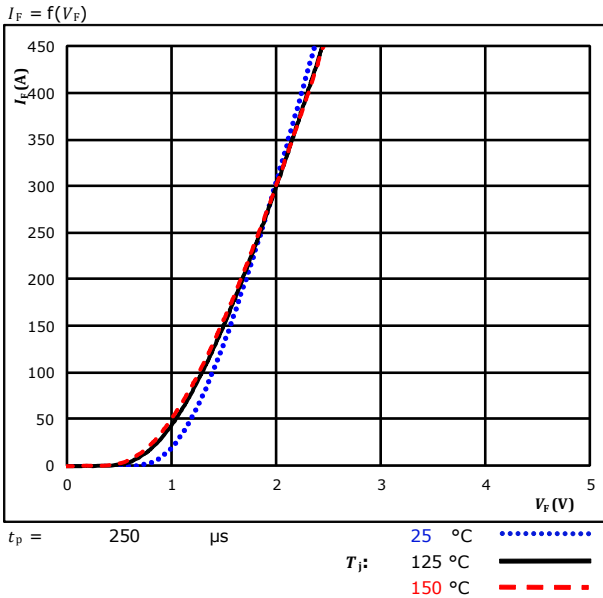
$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = \pm 15$  V  
 $T_j = T_{jmax}$



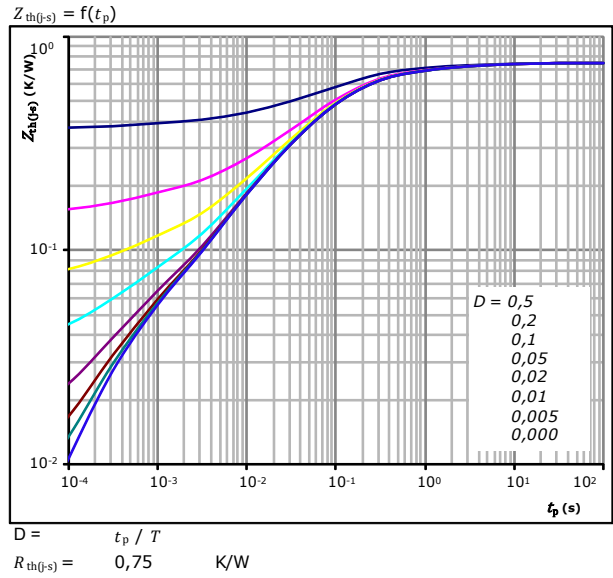
Vincotech

## Buck Diode Characteristics

**figure 1.** FWD  
Typical forward characteristics



**figure 2.** FWD  
Transient thermal impedance as a function of pulse width



FWD thermal model values

$R$ (K/W)	$\tau$ (s)
2,88E-02	7,46E+00
7,02E-02	1,27E+00
1,95E-01	2,04E-01
2,65E-01	6,33E-02
1,21E-01	1,27E-02
3,39E-02	3,05E-03
3,36E-02	3,74E-04

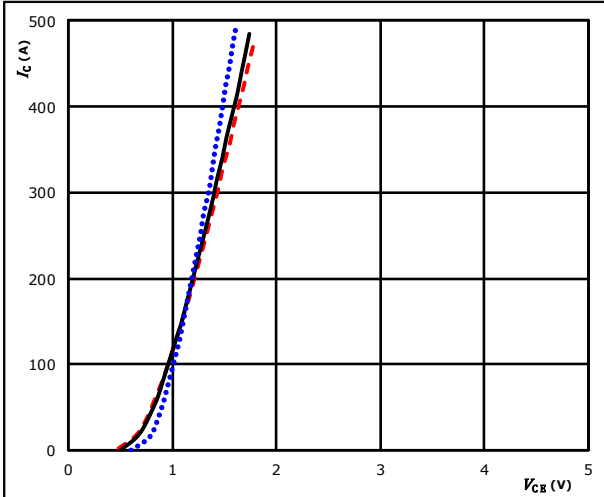


### Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

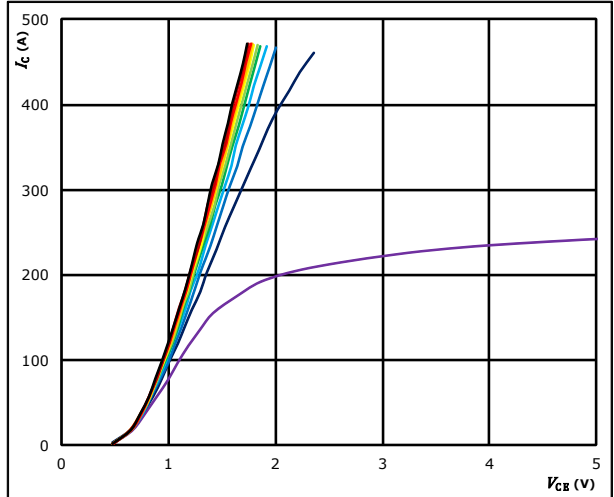


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 \text{ }^\circ C$  (blue dotted)  
 $125 \text{ }^\circ C$  (black solid)  
 $150 \text{ }^\circ C$  (red dashed)

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

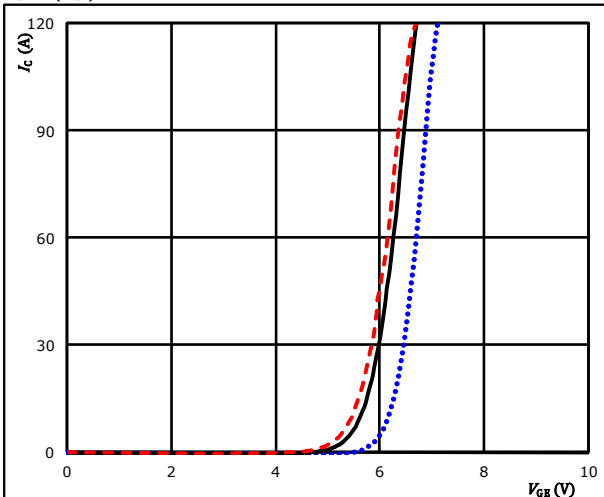


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

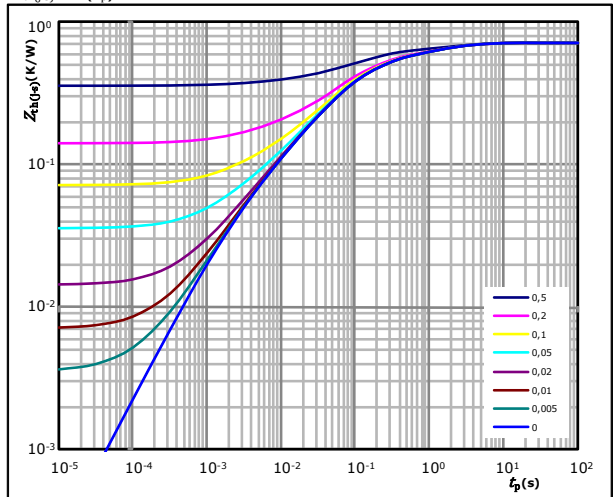


$t_p = 100 \mu s$   
 $V_{CE} = 10 V$   
 $T_j: 25 \text{ }^\circ C$  (blue dotted)  
 $125 \text{ }^\circ C$  (black solid)  
 $150 \text{ }^\circ C$  (red dashed)

figure 4. IGBT

Transient Thermal Impedance as function of Pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,72 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
1,29E-01	2,09E+00
1,33E-01	4,46E-01
3,21E-01	8,45E-02
6,42E-02	2,97E-02
5,12E-02	7,88E-03
1,68E-02	1,62E-03

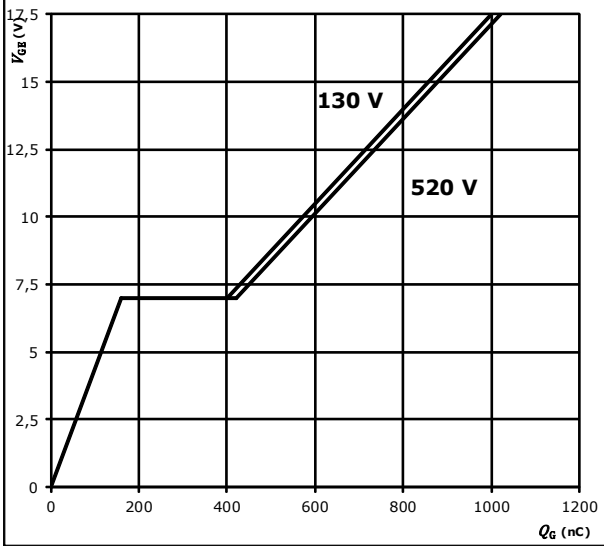


### Boost Switch Characteristics

figure 5. IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$

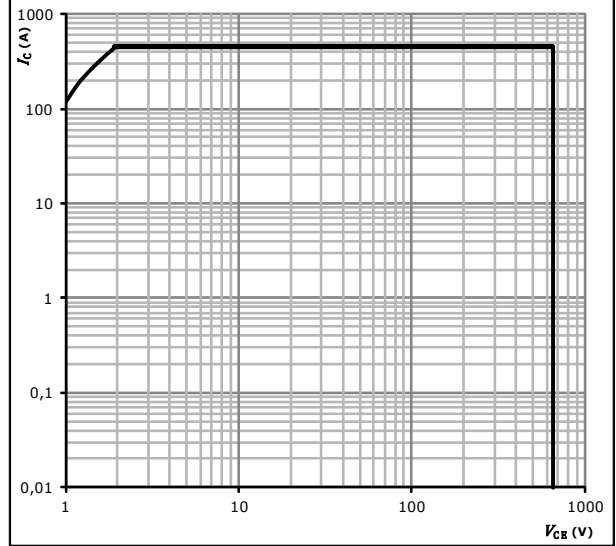


At  
I<sub>C</sub> = 150 A

figure 6. IGBT

Safe operating area

$I_C = f(V_{CE})$

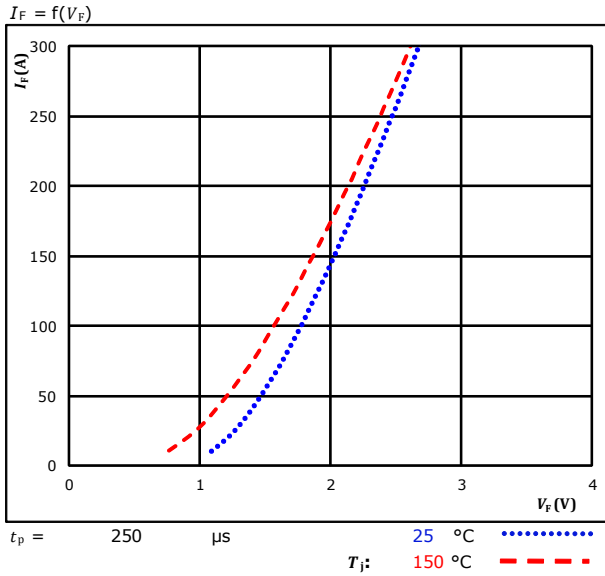


At  
D = single pulse  
T<sub>s</sub> = 80 °C  
V<sub>GE</sub> = ±15 V  
T<sub>j</sub> = T<sub>jmax</sub>

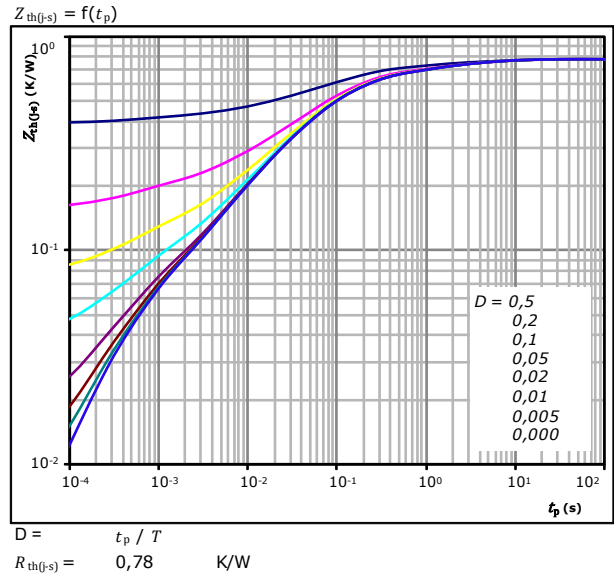


### Boost Diode Characteristics

**figure 1.** FWD  
Typical forward characteristics



**figure 2.** FWD  
Transient thermal impedance as a function of pulse width



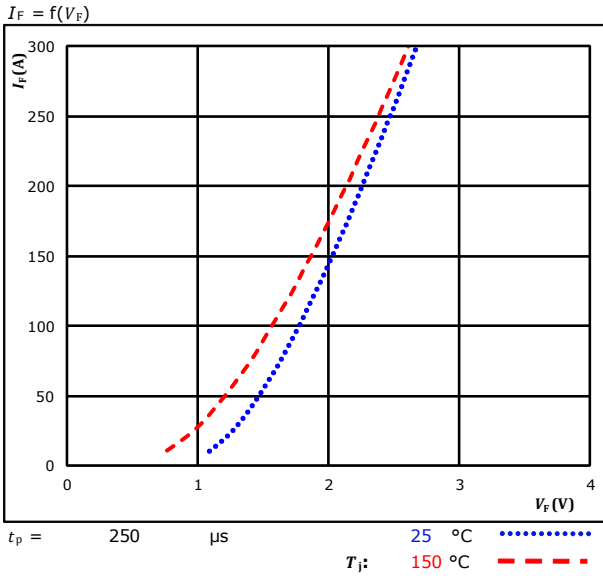
FWD thermal model values

$R$ (K/W)	$\tau$ (s)
5,76E-02	5,42E+00
8,79E-02	1,09E+00
2,14E-01	1,59E-01
2,31E-01	4,95E-02
1,16E-01	1,05E-02
3,20E-02	2,39E-03
4,19E-02	4,10E-04

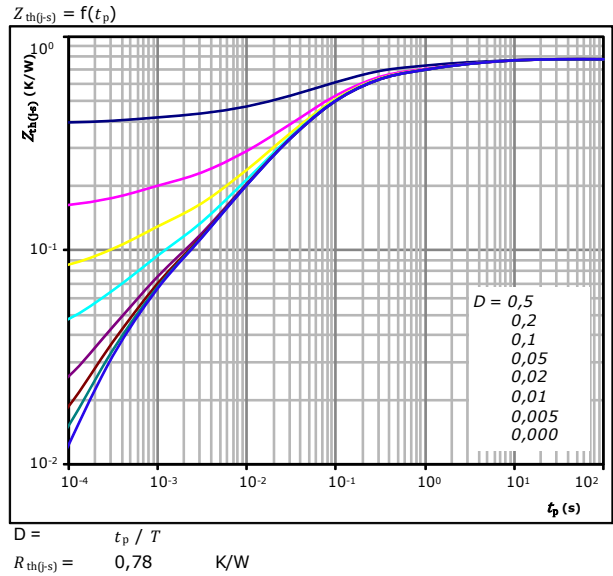


### Boost Sw.Inv.Diode Characteristics

**figure 1.** FWD  
Typical forward characteristics



**figure 2.** FWD  
Transient thermal impedance as a function of pulse width



FWD thermal model values

$R$ (K/W)	$\tau$ (s)
5,76E-02	5,42E+00
8,79E-02	1,09E+00
2,14E-01	1,59E-01
2,31E-01	4,95E-02
1,16E-01	1,05E-02
3,20E-02	2,39E-03
4,19E-02	4,10E-04

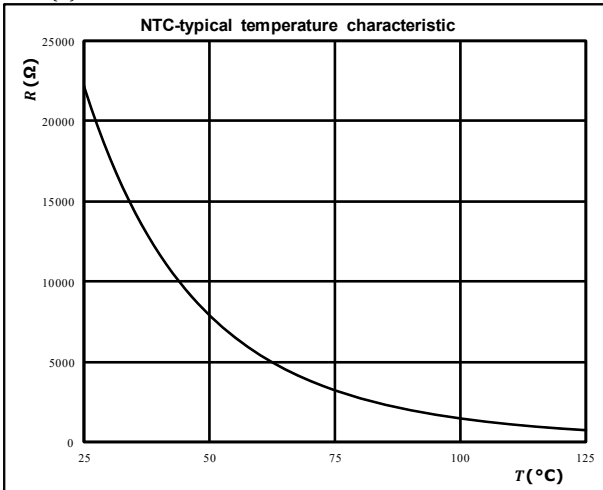


### NTC Characteristics

figure 1. Thermistor

Typical NTC characteristic  
as a function of temperature

$$R = f(T)$$

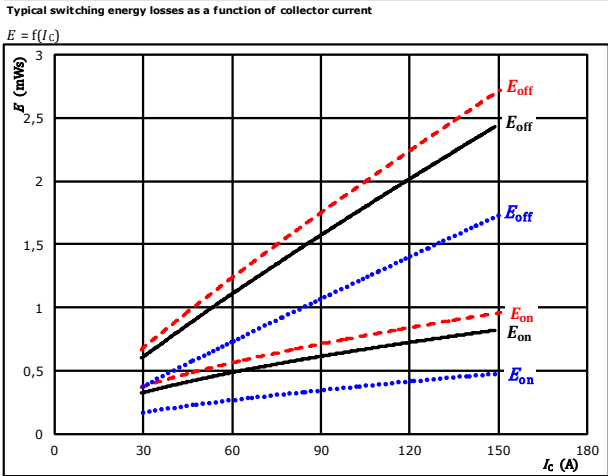






## Buck Switching Characteristics

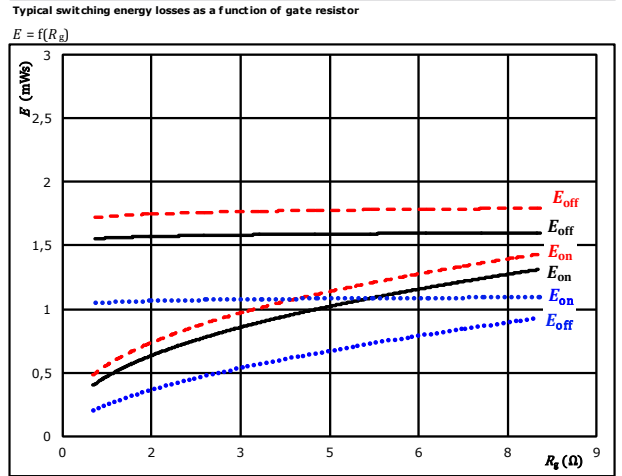
**figure 1.** IGBT  
Typical switching energy losses as a function of collector current



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = +15/-5$  V  
 $R_{gon} = 2$   $\Omega$   
 $R_{goff} = 2$   $\Omega$

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

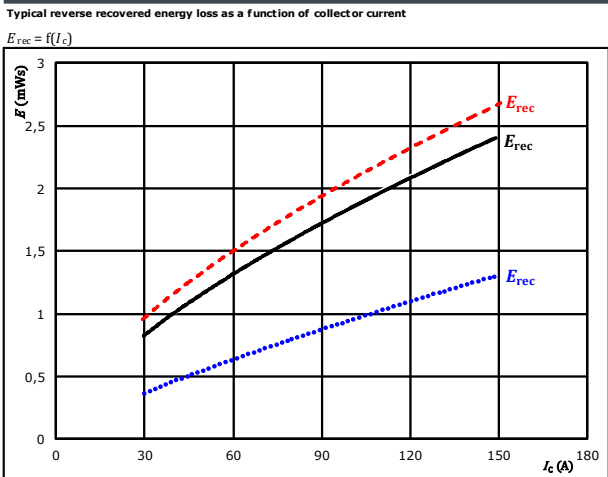
**figure 2.** IGBT  
Typical switching energy losses as a function of gate resistor



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = +15/-5$  V  
 $I_C = 90$  A

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

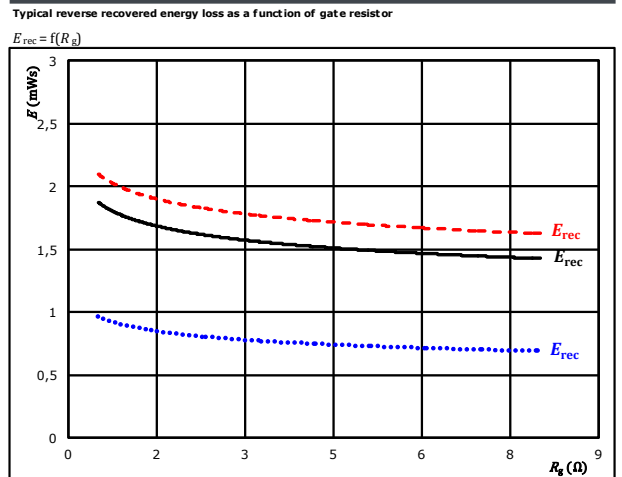
**figure 3.** FWD  
Typical reverse recovered energy loss as a function of collector current



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = +15/-5$  V  
 $R_{gon} = 2$   $\Omega$

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

**figure 4.** FWD  
Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = +15/-5$  V  
 $I_C = 90$  A

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

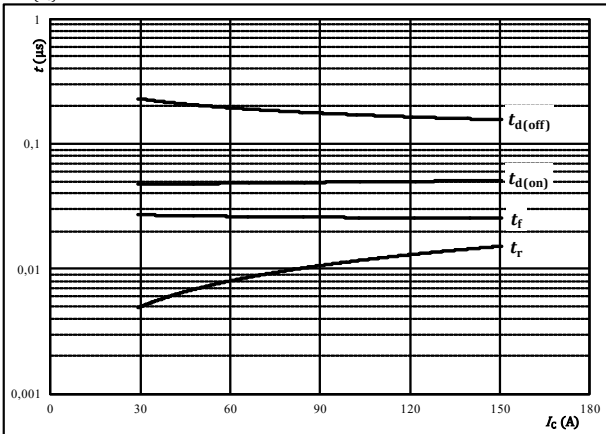


## Buck Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



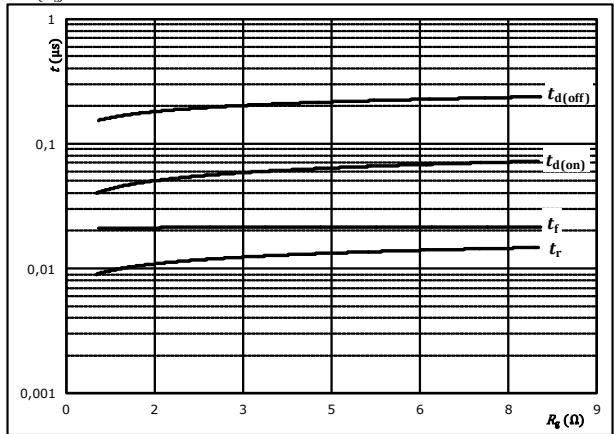
With an inductive load at

$T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = +15/-5 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$   
 $R_{goff} = 2 \text{ } \Omega$

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



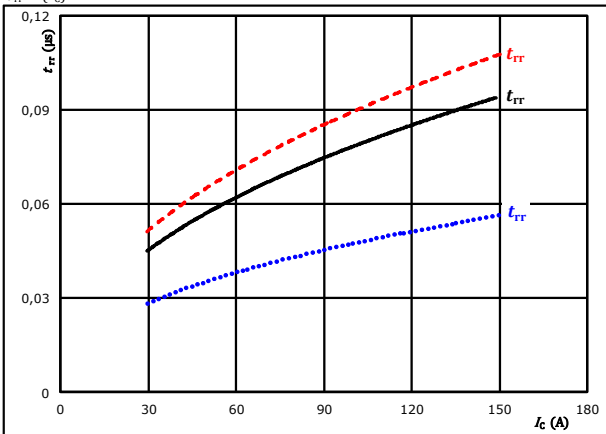
With an inductive load at

$T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = +15/-5 \text{ V}$   
 $I_c = 90 \text{ A}$

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

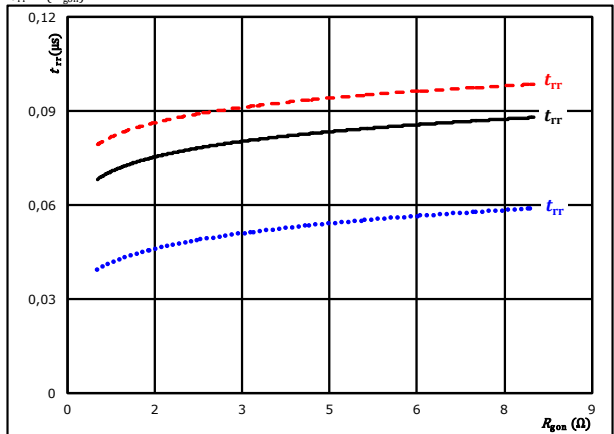


At  $V_{CE} = 350 \text{ V}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{GE} = +15/-5 \text{ V}$   $125 \text{ }^\circ\text{C}$  ———  
 $R_{gon} = 2 \text{ } \Omega$   $150 \text{ }^\circ\text{C}$  - - - - -

**figure 8.** FWD

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

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



At  $V_{CE} = 350 \text{ V}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{GE} = +15/-5 \text{ V}$   $125 \text{ }^\circ\text{C}$  ———  
 $I_c = 90 \text{ A}$   $150 \text{ }^\circ\text{C}$  - - - - -

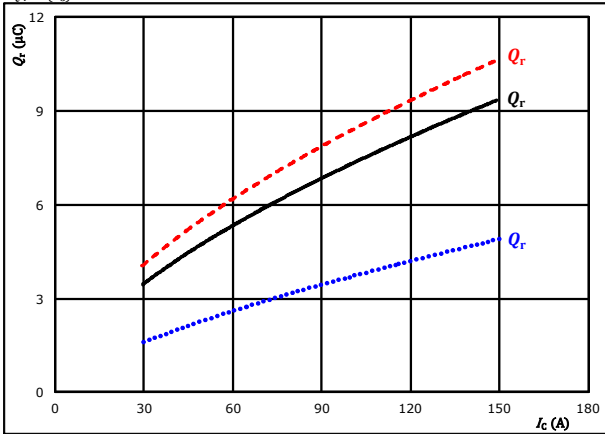


## Buck Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

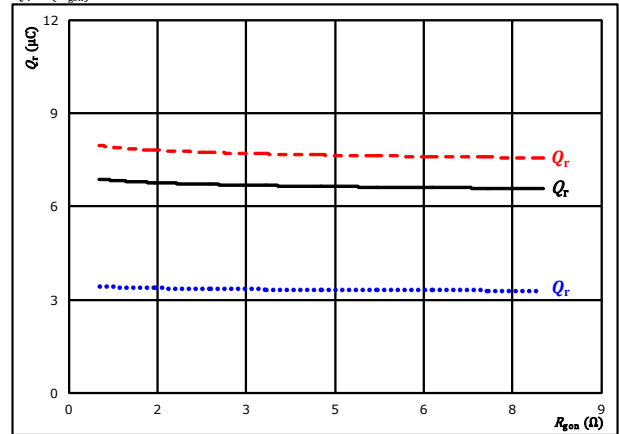


At  $V_{CE} = 350$  V  $T_j = 25$  °C (dotted blue line)  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C (solid black line)  
 $R_{gdn} = 2$  Ω  $T_j = 150$  °C (dashed red line)

figure 10. FWD

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

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

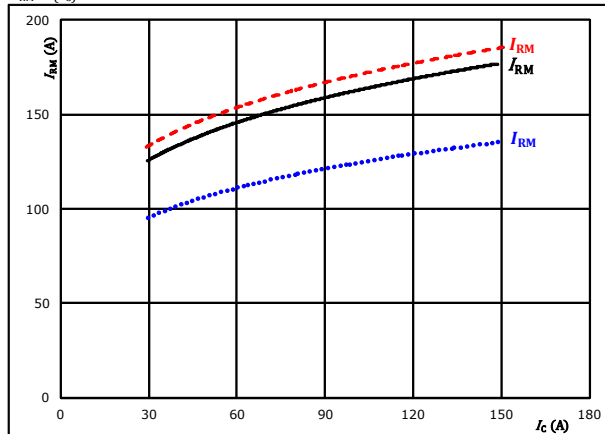


At  $V_{CE} = 350$  V  $T_j = 25$  °C (dotted blue line)  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C (solid black line)  
 $I_c = 90$  A  $T_j = 150$  °C (dashed red line)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

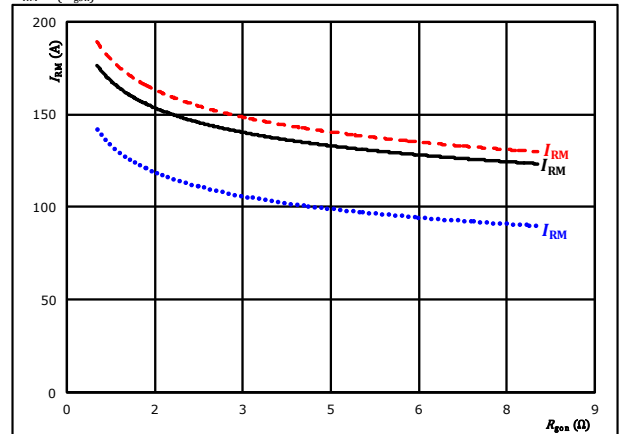


At  $V_{CE} = 350$  V  $T_j = 25$  °C (dotted blue line)  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C (solid black line)  
 $R_{gdn} = 2$  Ω  $T_j = 150$  °C (dashed red line)

figure 12. FWD

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

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



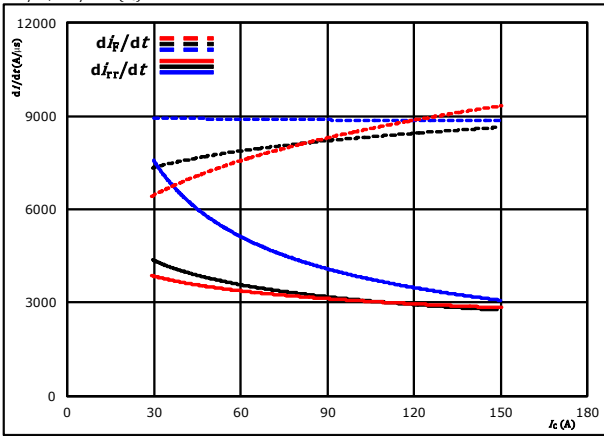
At  $V_{CE} = 350$  V  $T_j = 25$  °C (dotted blue line)  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C (solid black line)  
 $I_c = 90$  A  $T_j = 150$  °C (dashed red line)



## Buck Switching Characteristics

**figure 13.** FWD

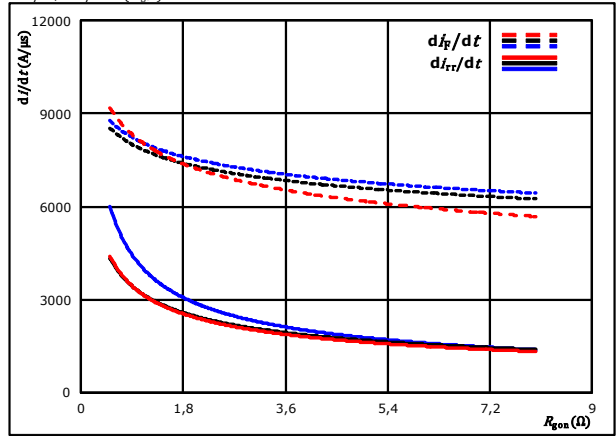
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C ———  
 $R_{g(on)} = 2$  Ω  $T_j = 150$  °C - - - - -

**figure 14.** FWD

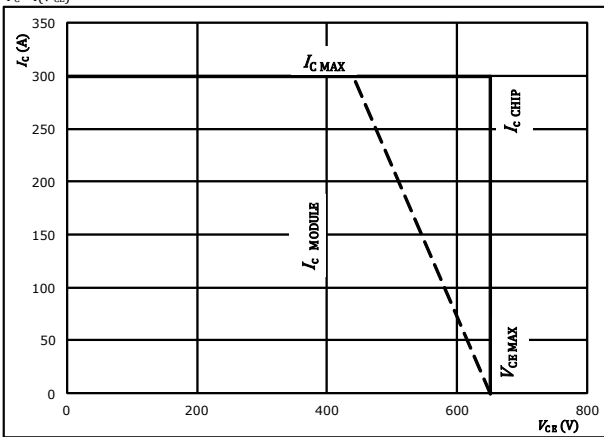
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = +15/-5$  V  $T_j = 125$  °C ———  
 $I_c = 90$  A  $T_j = 150$  °C - - - - -

**figure 15.** IGBT

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



At  $T_j = 175$  °C  
 $R_{g(on)} = 2$  Ω  
 $R_{g(off)} = 2$  Ω



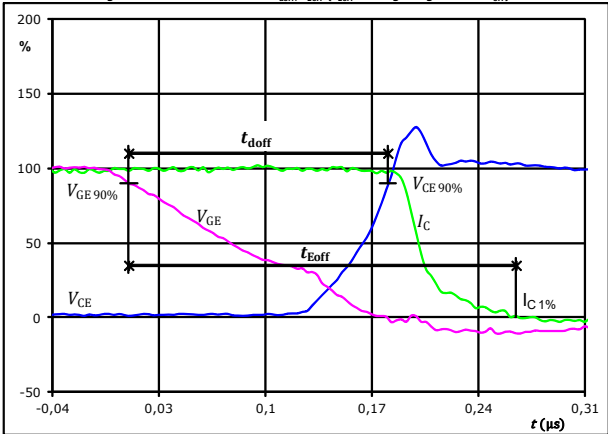
## Buck Switching Definitions

**General conditions**

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

**figure 1.** IGBT

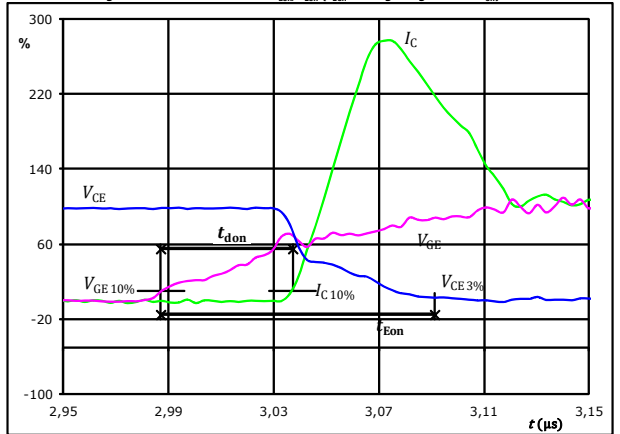
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	20	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{doff} =$	0,170	μs
$t_{Eoff} =$	0,254	μs

**figure 2.** IGBT

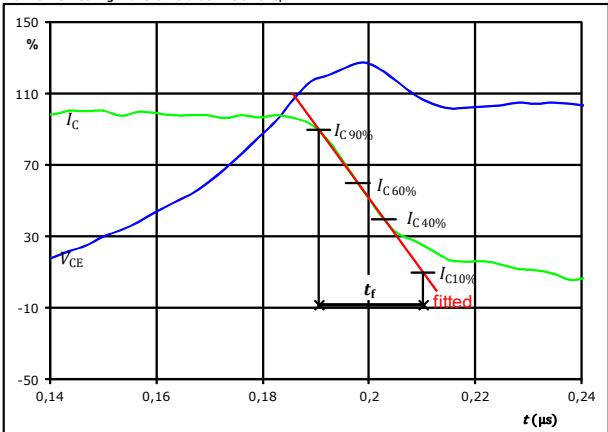
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	0	V
$V_{CE}(100\%) =$	20	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{don} =$	0,050	μs
$t_{Eon} =$	0,104	μs

**figure 3.** IGBT

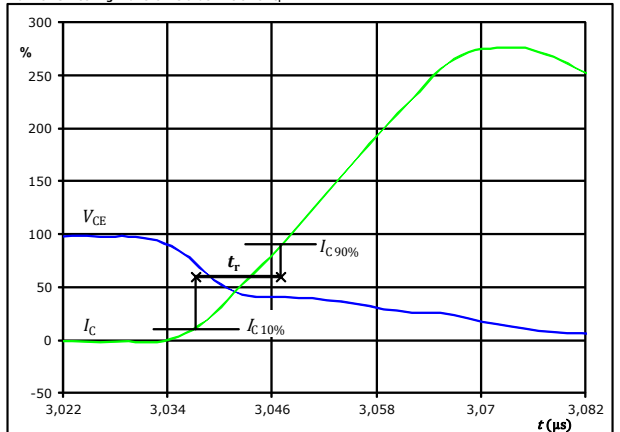
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_f =$	0,019	μs

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



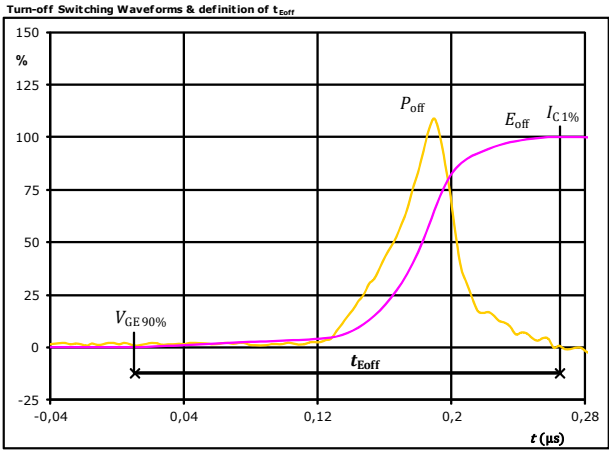
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_r =$	0,010	μs



Vincotech

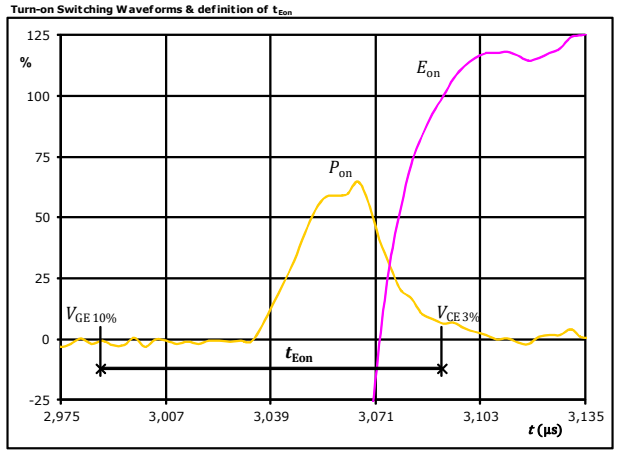
## Buck Switching Characteristics

figure 5. IGBT



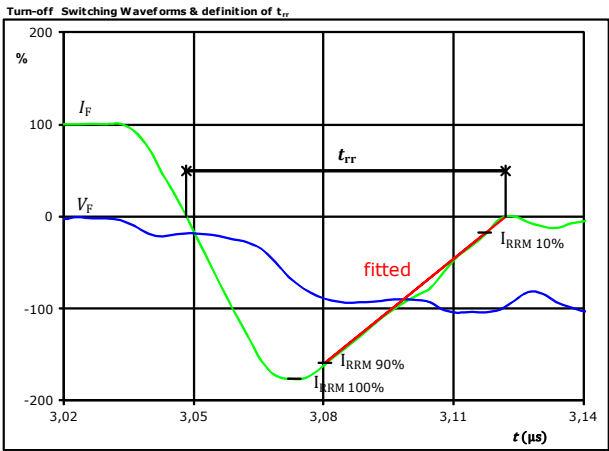
$P_{off}(100\%) = 31,31$  kW  
 $E_{off}(100\%) = 1,56$  mJ  
 $t_{Eoff} = 0,25$  μs

figure 6. IGBT



$P_{on}(100\%) = 31,31$  kW  
 $E_{on}(100\%) = 0,61$  mJ  
 $t_{Eon} = 0,10$  μs

figure 7. FWD



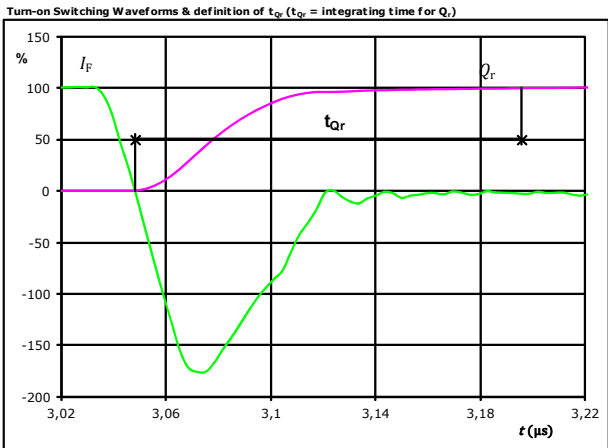
$V_F(100\%) = 350$  V  
 $I_F(100\%) = 89$  A  
 $I_{RRM}(100\%) = -158$  A  
 $t_{rr} = 0,074$  μs



Vincotech

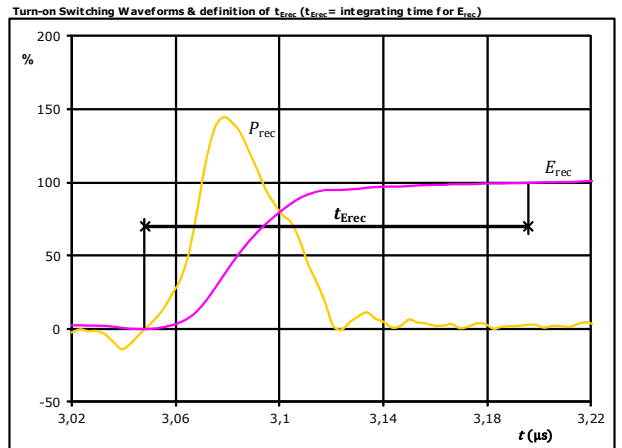
## Buck Switching Characteristics

**figure 8.** FWD



$I_F(100\%) =$	89	A
$Q_r(100\%) =$	6,78	$\mu\text{C}$
$t_{Qr} =$	0,15	$\mu\text{s}$

**figure 9.** FWD



$P_{rec}(100\%) =$	31,31	kW
$E_{rec}(100\%) =$	1,72	mJ
$t_{Erec} =$	0,15	$\mu\text{s}$

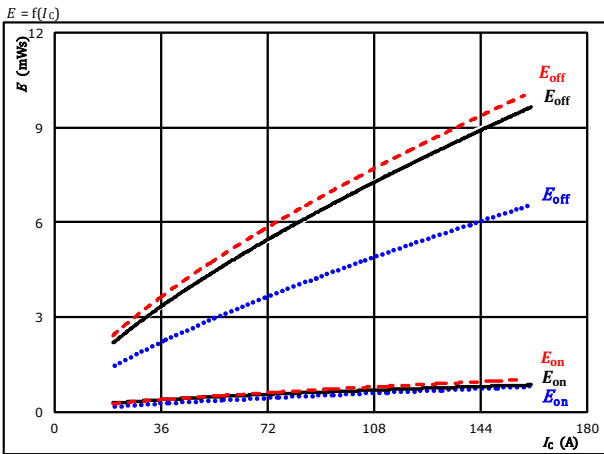


Vincotech

## Boost Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

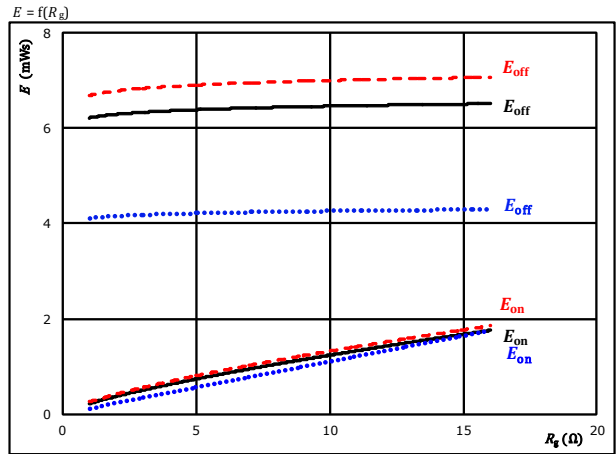


With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C	.....
$V_{GE} = \pm 15$ V	$125$ °C	————
$R_{gon} = 4$ Ω	$150$ °C	-----
$R_{goff} = 4$ Ω		

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

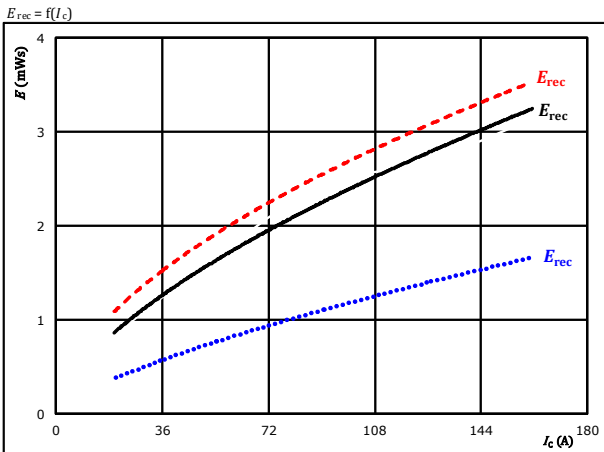


With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C	.....
$V_{GE} = \pm 15$ V	$125$ °C	————
$I_C = 89$ A	$150$ °C	-----

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

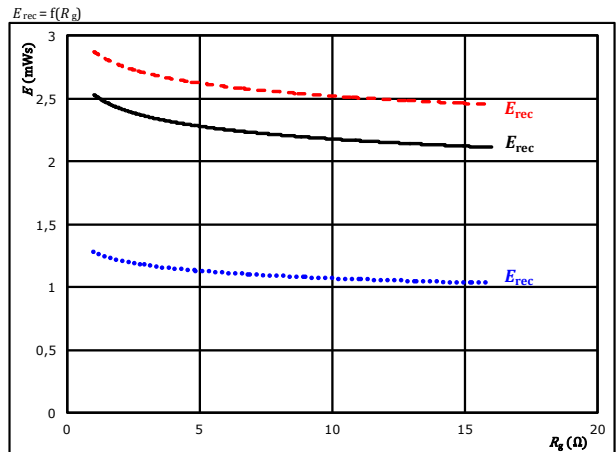


With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C	.....
$V_{GE} = \pm 15$ V	$125$ °C	————
$R_{gon} = 4$ Ω	$150$ °C	-----

**figure 4.** FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C	.....
$V_{GE} = \pm 15$ V	$125$ °C	————
$I_C = 89$ A	$150$ °C	-----





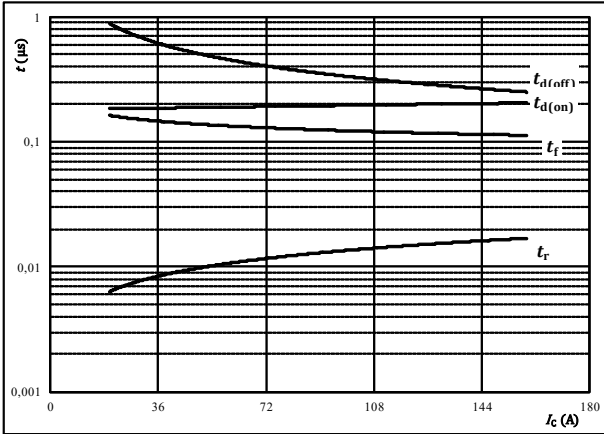
Vincotech

## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



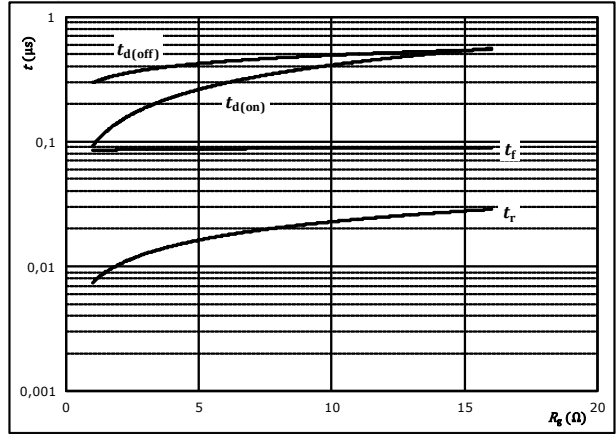
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



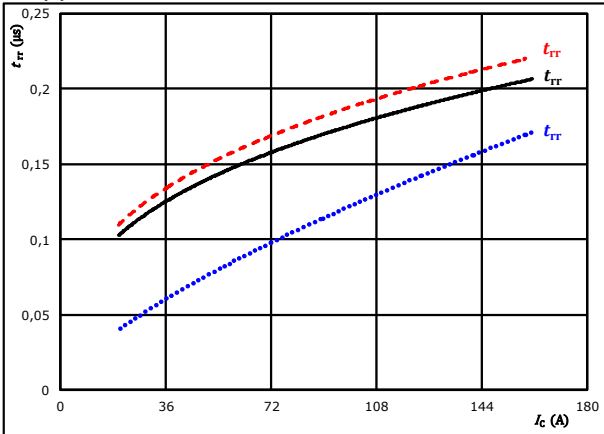
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_c =$	89	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

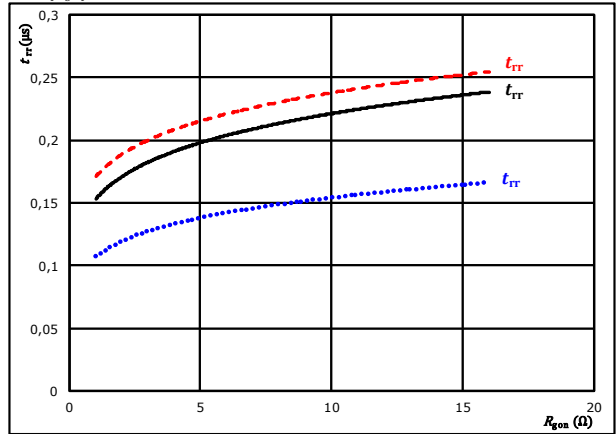


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	4	Ω		150 °C	- - - -

**figure 8.** FWD

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

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

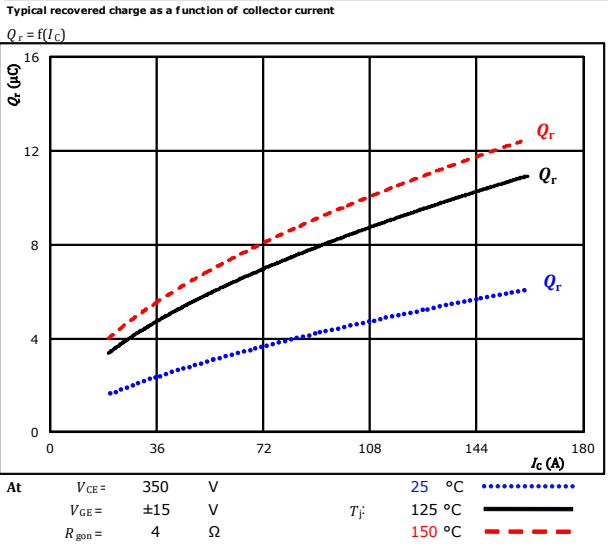


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	±15	V		125 °C	————
	$I_c =$	89	A		150 °C	- - - -

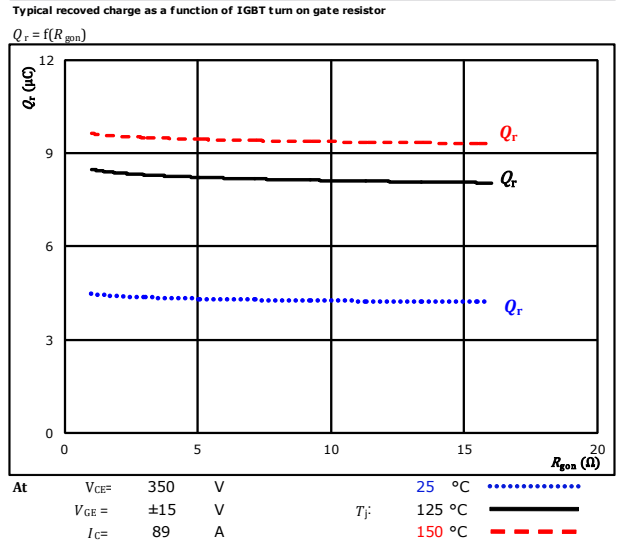


### Boost Switching Characteristics

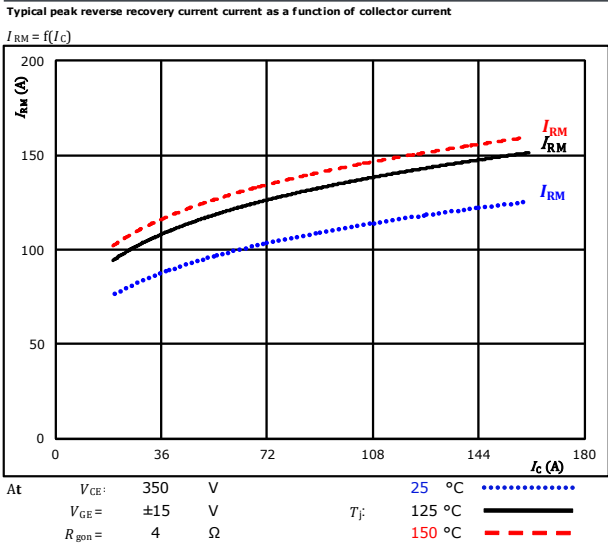
**figure 9.** FWD  
Typical recovered charge as a function of collector current



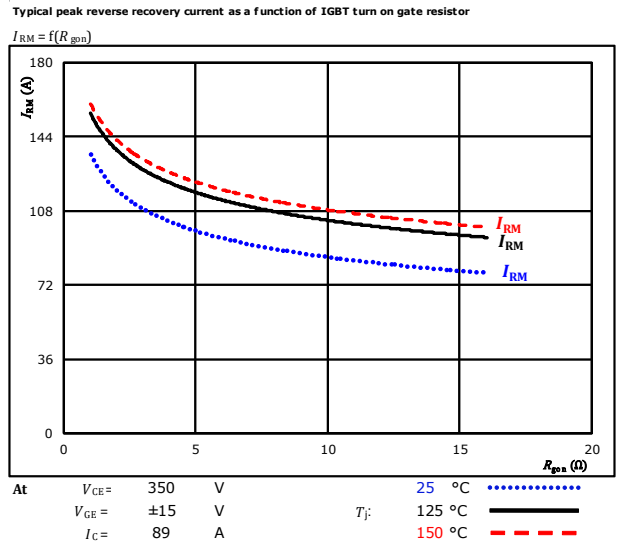
**figure 10.** FWD  
Typical recovered charge as a function of IGBT turn on gate resistor



**figure 11.** FWD  
Typical peak reverse recovery current current as a function of collector current



**figure 12.** FWD  
Typical peak reverse recovery current current as a function of IGBT turn on gate resistor

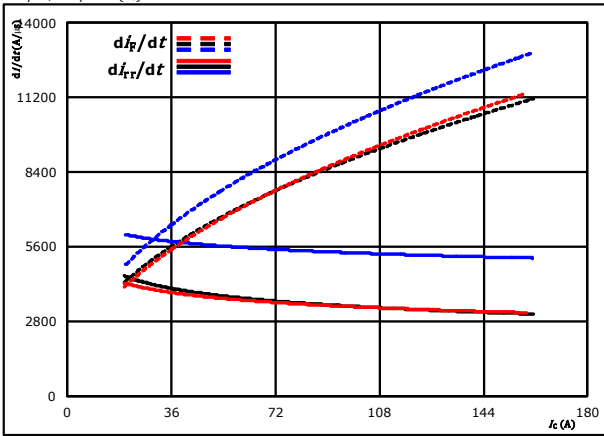




### Boost Switching Characteristics

**figure 13.** FWD

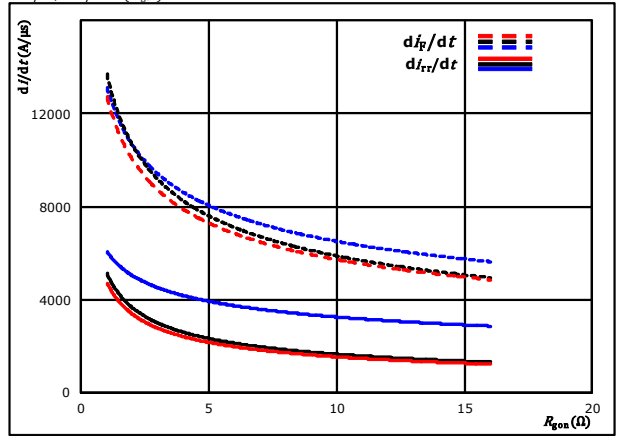
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_F/dt, di_{rr}/dt = f(I_C)$



At  $V_{CE} = 350$  V  $T_j = 25$  °C (.....)  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C (—)  
 $R_{g(on)} = 4$  Ω  $T_j = 150$  °C (---)

**figure 14.** FWD

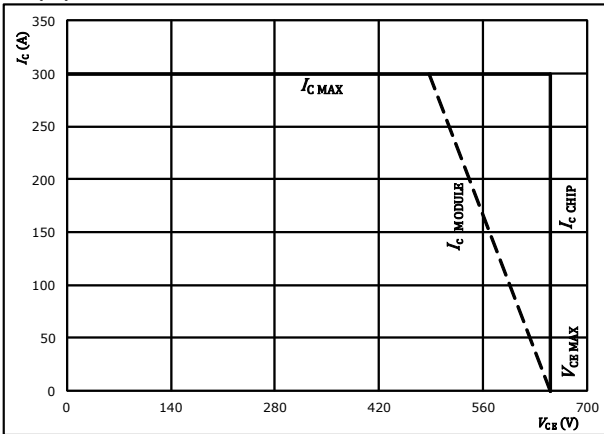
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_F/dt, di_{rr}/dt = f(R_{g(on)})$



At  $V_{CE} = 350$  V  $T_j = 25$  °C (.....)  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C (—)  
 $I_C = 89$  A  $T_j = 150$  °C (---)

**figure 15.** IGBT

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



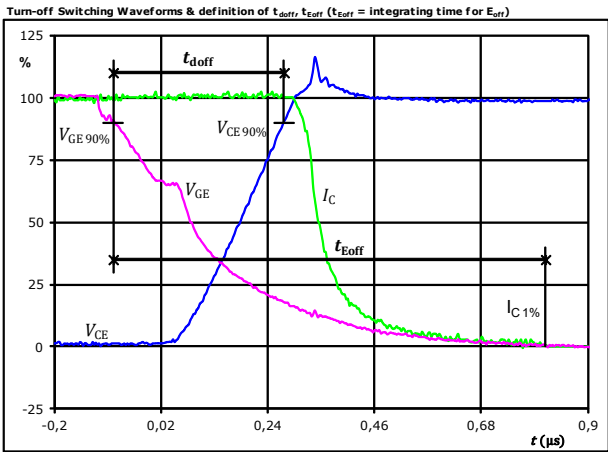
At  $T_j = 175$  °C  
 $R_{g(on)} = 4$  Ω  
 $R_{g(off)} = 4$  Ω



Vincotech

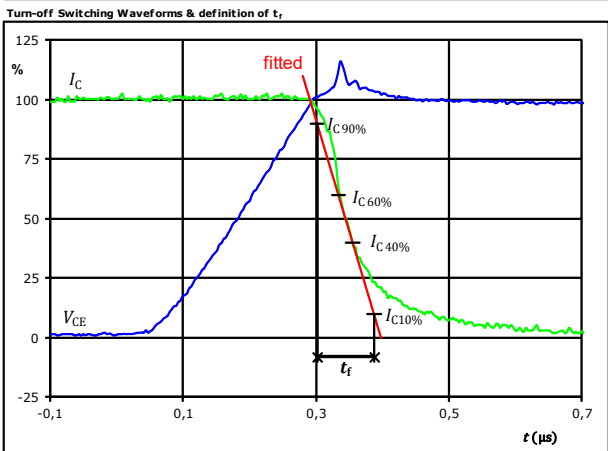
## Boost Switching Definitions

figure 1. IGBT



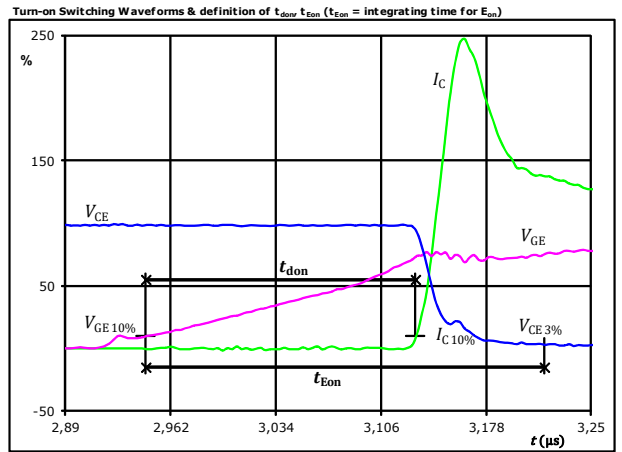
$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{doff} =$	0,349	$\mu s$
$t_{Eoff} =$	0,892	$\mu s$

figure 3. IGBT



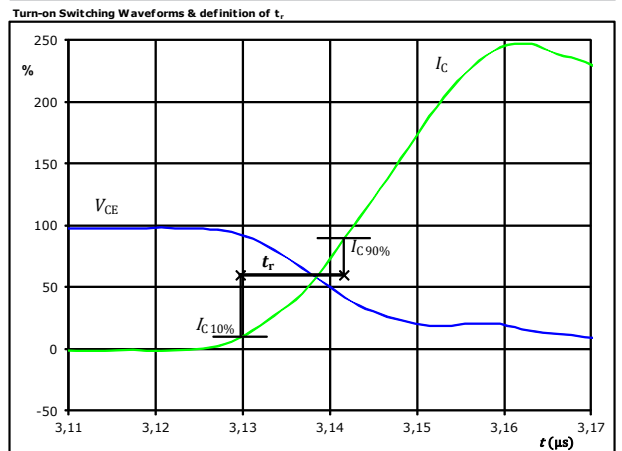
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_f =$	0,083	$\mu s$

figure 2. IGBT



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{don} =$	0,184	$\mu s$
$t_{Eon} =$	0,273	$\mu s$

figure 4. IGBT



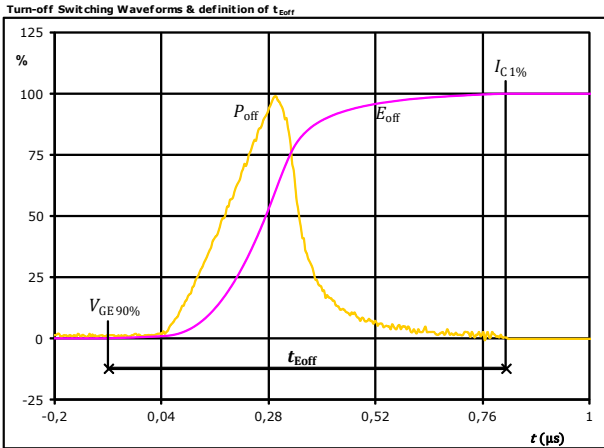
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_r =$	0,012	$\mu s$



Vincotech

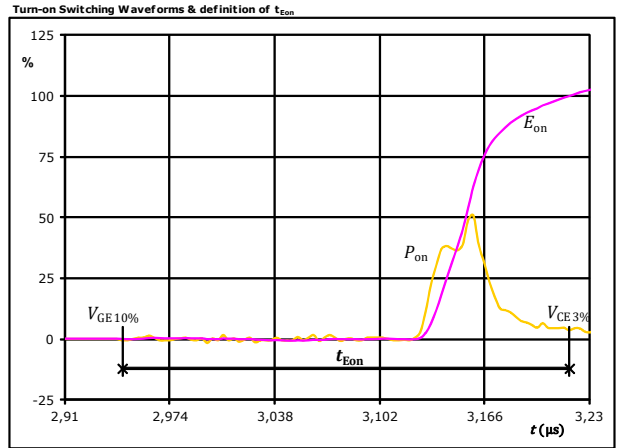
## Boost Switching Characteristics

figure 5. IGBT



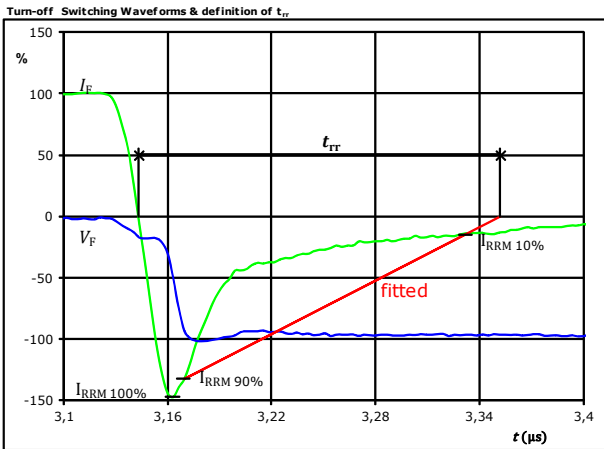
$P_{off}(100\%) = 31,19$  kW  
 $E_{off}(100\%) = 6,30$  mJ  
 $t_{Eoff} = 0,89$  µs

figure 6. IGBT



$P_{on}(100\%) = 31,19$  kW  
 $E_{on}(100\%) = 0,61$  mJ  
 $t_{Eon} = 0,27$  µs

figure 7. FWD



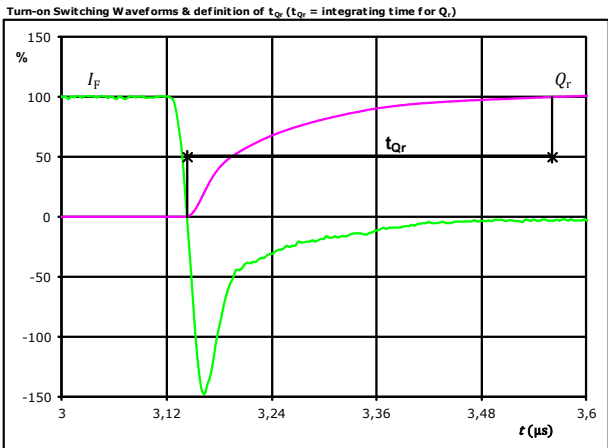
$V_F(100\%) = 350$  V  
 $I_F(100\%) = 89$  A  
 $I_{RRM}(100\%) = -132$  A  
 $t_{rr} = 0,184$  µs



Vincotech

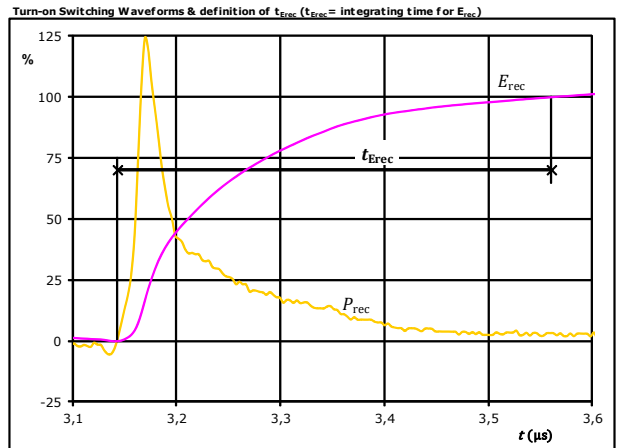
### Boost Switching Characteristics

figure 8. FWD



$I_F(100\%) =$	89	A
$Q_r(100\%) =$	8,48	$\mu\text{C}$
$t_{Qr} =$	0,42	$\mu\text{s}$

figure 9. FWD



$P_{rec}(100\%) =$	31,19	kW
$E_{rec}(100\%) =$	2,42	mJ
$t_{Erec} =$	0,42	$\mu\text{s}$



Vincotech

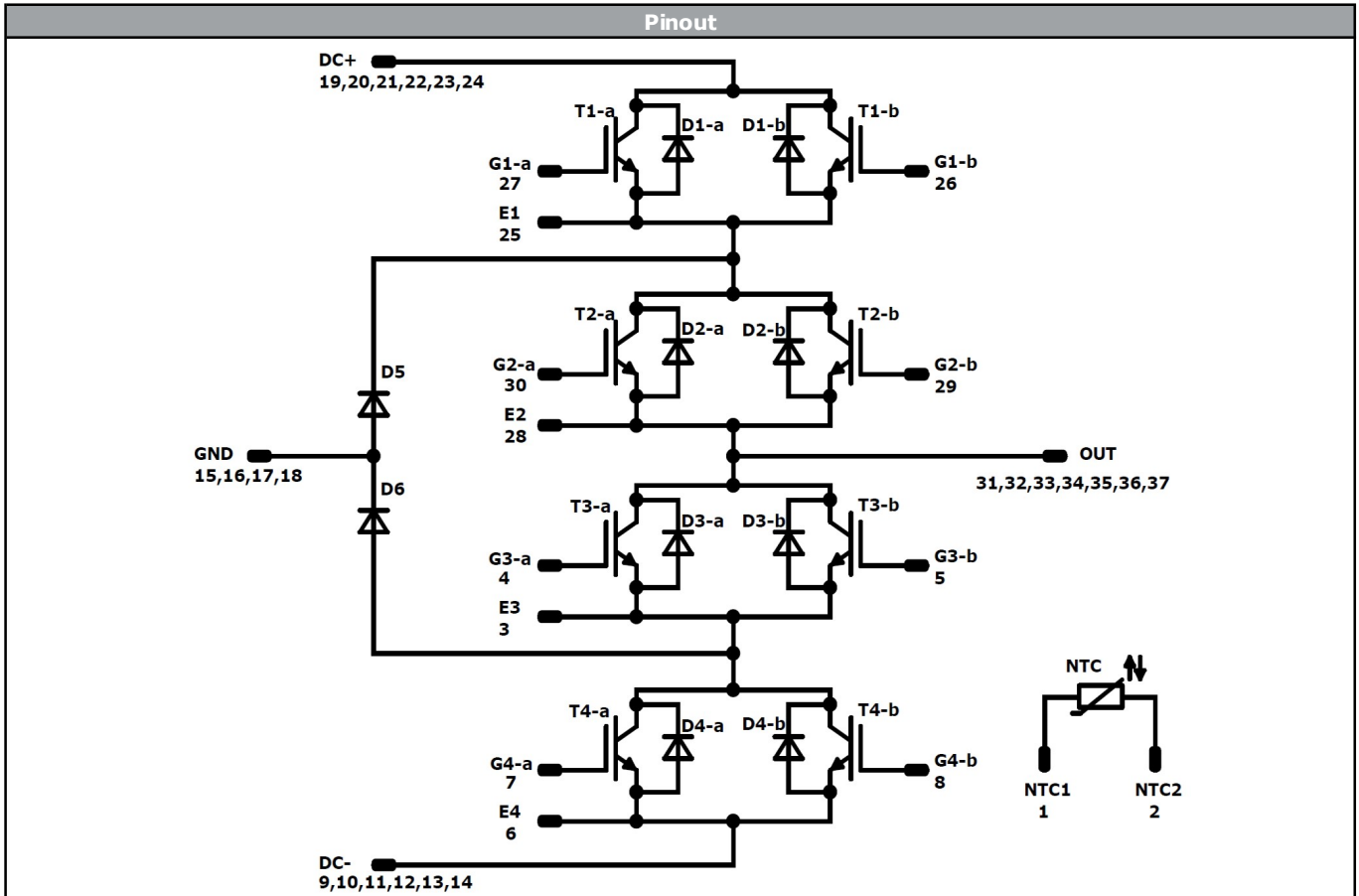
Ordering Code & Marking						
Version			Ordering Code			
without thermal paste 12mm housing with solder pins			10-FY07NIA150S5-M516F58			
with thermal paste 12mm housing with solder pins			10-FY07NIA150S5-M516F58-/3/			
NN-NNNNNNNNNNNN TTTTUVVWWYY UL VIN LLLLL SSSS						
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNN-TTTTUVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
	TTTTTUVV	LLLLL	SSSS	WWYY		

Pin table [mm]				Outline	
Pin	X	Y	Function		
1	52,2	6,9	NTC1		
2	52,2	0	NTC2		
3	36,2	6,75	E3		
4	33,2	7,9	G3-a		
5	33,2	4,9	G3-b		
6	9,2	5,75	E4		
7	6,2	6,9	G4-a		
8	6,2	3,9	G4-b		
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	E1		
26	21,3	21,3	G1-b		
27	21,3	24,3	G1-a		
28	43	22,15	E2		
29	46	21	G2-b		
30	46	24	G2-a		
31	52,2	20,1	OUT		
32	49,5	22,8	OUT		
33	52,2	22,8	OUT		
34	49,5	25,5	OUT		
35	52,2	25,5	OUT		
36	49,5	28,2	OUT		
37	52,2	28,2	OUT		

Tolerance of pinpositions ±0,5mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance



Vincotech



<b>Identification</b>					
<b>ID</b>	<b>Component</b>	<b>Voltage</b>	<b>Current</b>	<b>Function</b>	<b>Comment</b>
T1-a, T1-b, T4-a, T4-b	IGBT	650 V	150 A	Buck Switch	Parallel devices with separate control. Values apply to complete device.
D5, D6	FWD	650 V	150 A	Buck Diode	
T2-a, T2-b, T3-a, T3-b	IGBT	650 V	150 A	Boost Switch	Parallel devices with separate control. Values apply to complete device.
D1, D4	FWD	650 V	200 A	Boost Diode	
D2, D3	FWD	650 V	200 A	Boost Sw.Inv.Diode	
NTC	NTC			Thermistor	






Vincotech

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

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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-FY07NIA150S5-M516F58-D1-14	12 Aug. 2017		

**DISCLAIMER**

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

**LIFE SUPPORT POLICY**

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.

单击下面可查看定价，库存，交付和生命周期等信息

[>>Vincotech\(威科\)](#)