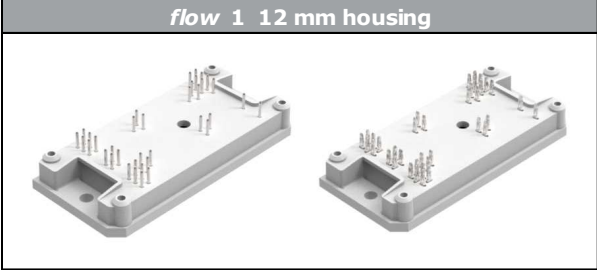
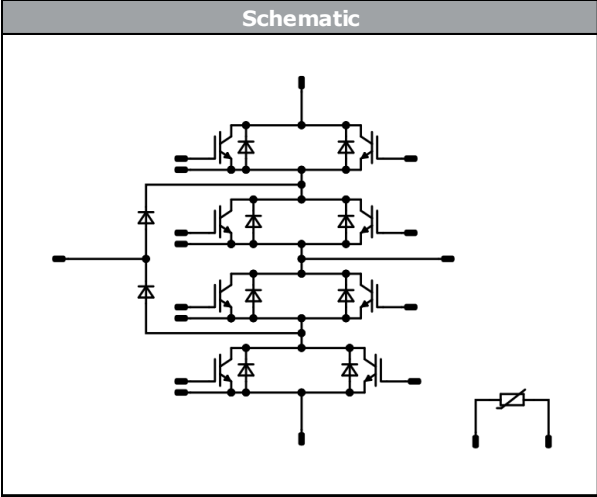




# Vincotech

<i>flow NPC 1</i>	1200 V / 150 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;"><b>Features</b></div> <ul style="list-style-type: none"> <li>High efficiency</li> <li>Low inductive package</li> <li>Ultra fast IGBTs</li> <li>four-quadrant operation</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> <li>UPS</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-FY07NIA150S502-L365F58</li> <li>10-PY07NIA150S502-L365F58Y</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
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### 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	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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

### Boost Diode

Peak Repetitive Reverse Voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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 Sw.Inv.Diode

Peak Repetitive Reverse Voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	106	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	300	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	149	W
Maximum Junction Temperature	$T_{jmax}$		175	°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		solder pins / press-fit pins	min. 12,7 / min. 12,7	mm
Clearance		solder pins / press-fit pins	8,07 / 11,83	mm
Comparative Tracking Index	CTI		> 200	

\*100 % tested in production



## 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

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	$V_{GE(th)}$				0,0015	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

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

#### Dynamic

Parameter	Symbol	$R_{goff} = 2 \Omega$ $R_{gon} = 2 \Omega$	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		48 50 49		ns
Rise time	$t_r$					25 125 150		9 10 10		
Turn-off delay time	$t_{d(off)}$					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		
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,066 1,561 1,737		



Vincotech

**10-FY07NIA150S502-L365F58**  
**10-PY07NIA150S502-L365F58Y**  
 datasheet

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

### Boost Switch

#### Static

Parameter	Symbol	$V_{GE} = V_{CE}$	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$				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

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

#### Dynamic

Parameter	Symbol	$R_{goff} = 2$ Ω $R_{gon} = 2$ Ω	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		31 31 30		ns
Rise time	$t_r$					25 125 150		8 9 10		
Turn-off delay time	$t_{d(off)}$					25 125 150		159 185 191		
Fall time	$t_f$					25 125 150		9 12 15		
Turn-on energy (per pulse)	$E_{on}$	$Q_{t-FWD} = 3,5$ μC $Q_{t-FWD} = 6,2$ μC $Q_{t-FWD} = 6,2$ μC				25 125 150		1,024 1,397 1,482		
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,889 1,439 1,616		



## Characteristic Values

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

### Boost Diode

#### Static

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

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

#### Dynamic

Parameter	Symbol	$dI/dt$	$V_{DS}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125 150		134 167 176		A
Reverse recovery time	$t_{rr}$				25 125 150		47 70 79		ns
Recovered charge	$Q_r$	$dI/dt = 11492$ A/ $\mu s$ $dI/dt = 9832$ A/ $\mu s$ $dI/dt = 9832$ A/ $\mu s$	15/0	350	93	25 125 150	3,546 6,226 7,093		μC
Reverse recovered energy	$E_{rec}$				25 125 150		0,879 1,565 1,823		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		5766 3242 3097		A/ $\mu s$

### Boost Sw.Inv.Diode

#### Static

Parameter	Symbol	$V_{GS}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			150	25 150		1,85 1,66	2	V
Reverse leakage current	$I_r$		650		25 150			1,8	μA

#### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK	0,64	K/W



Vincotech

**10-FY07NIA150S502-L365F58**  
**10-PY07NIA150S502-L365F58Y**  
 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	



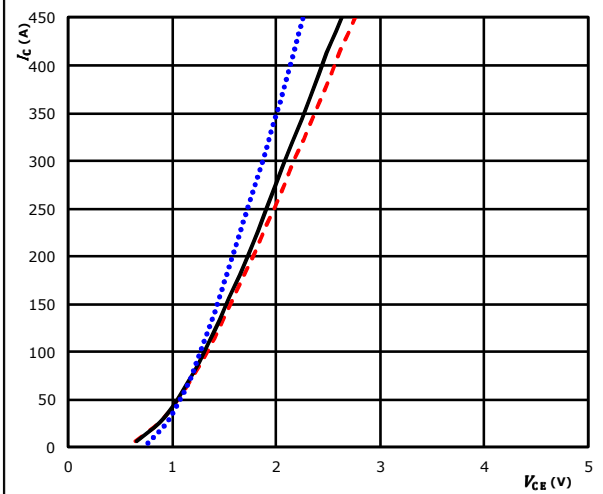


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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

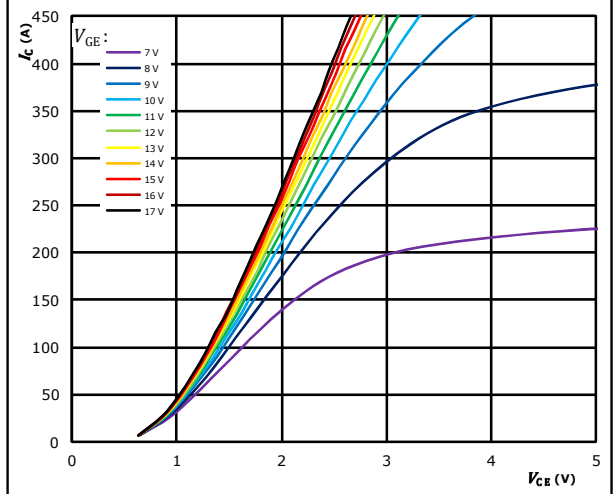


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 2.** IGBT

Typical output characteristics

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

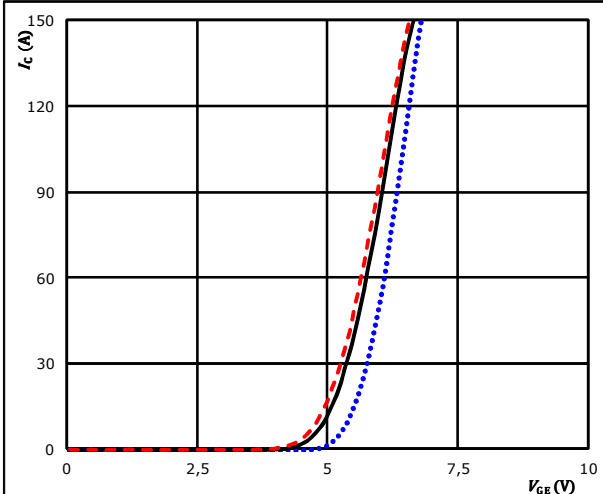


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

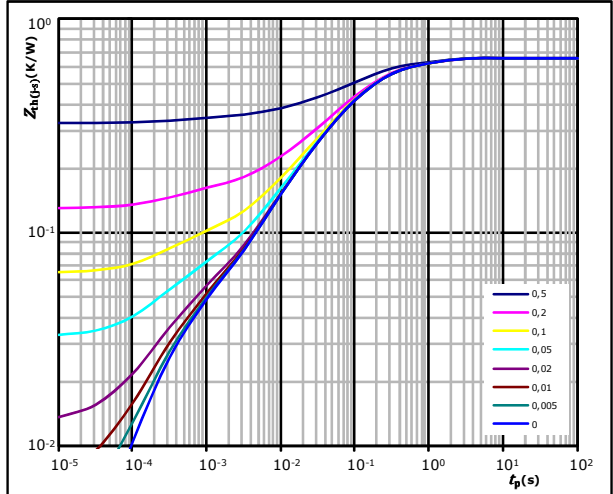


$t_p = 100 \mu s$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{CE} = 10 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



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

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

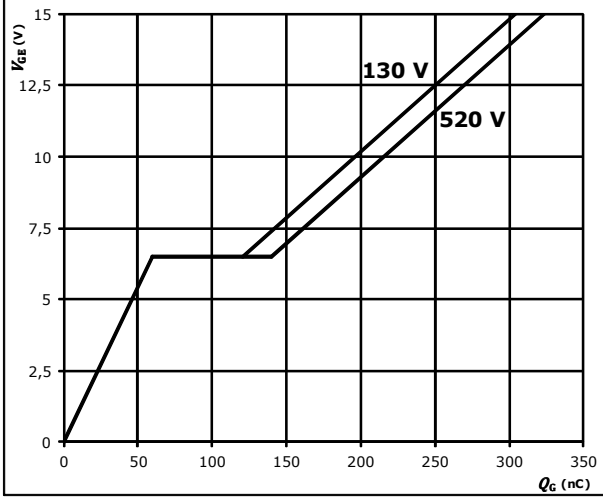


### Buck Switch Characteristics

**figure 5. IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

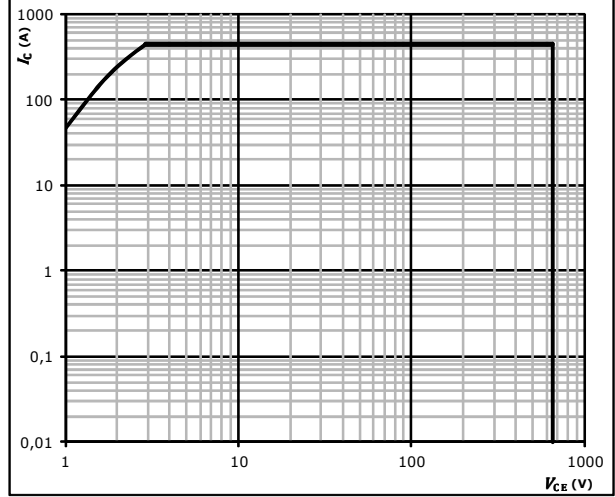


$I_C = 150$  A

**figure 6. IGBT**

Safe operating area

$I_C = f(V_{CE})$

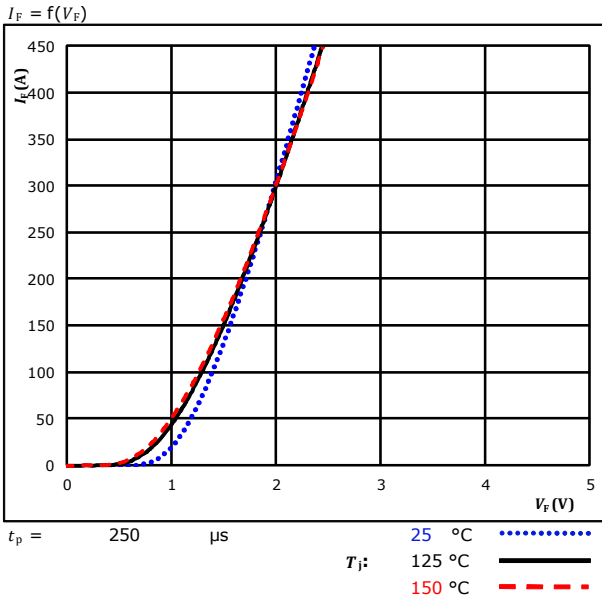


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = \pm 15$  V  
 $T_j = T_{jmax}$

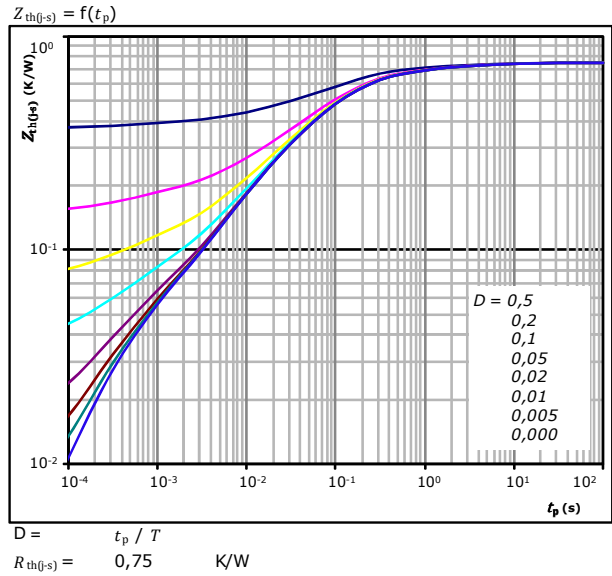


### Buck Diode Characteristics

**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

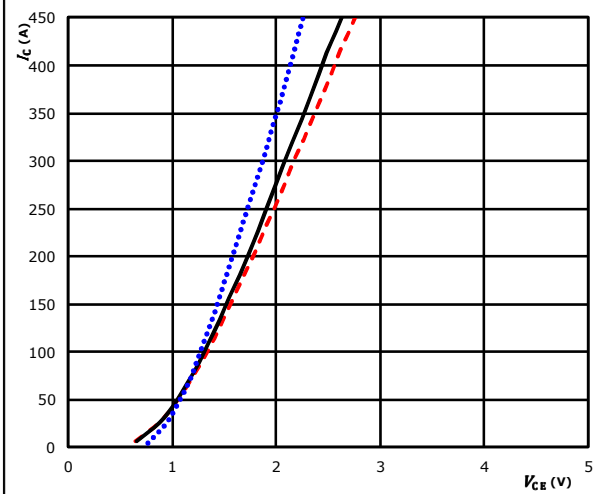


### Boost Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

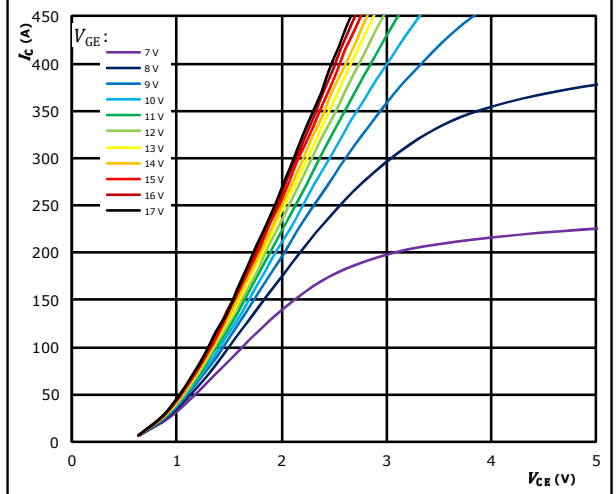


$t_p = 250 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{GE} = 15 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                           $T_j: 150 \text{ }^\circ C$       - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

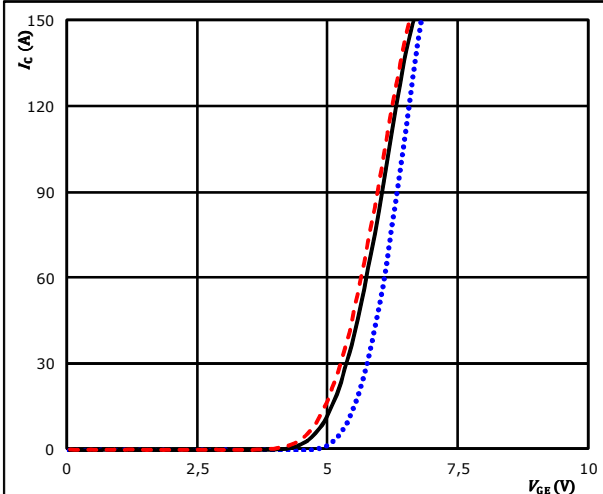


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

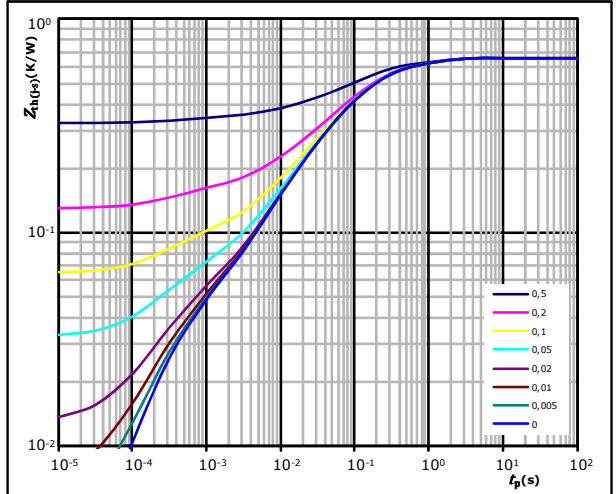


$t_p = 100 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{CE} = 10 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                           $T_j: 150 \text{ }^\circ C$       - - - -

**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

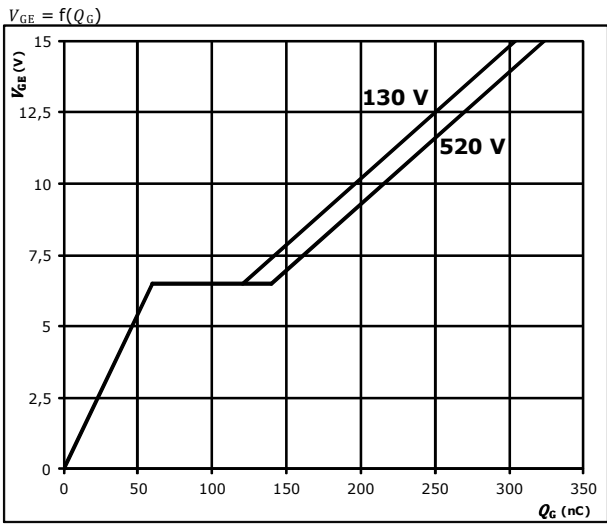
R (K/W)	$\tau$ (s)
1,13E-01	8,46E-01
2,91E-01	1,23E-01
1,38E-01	3,33E-02
6,68E-02	8,32E-03
1,32E-02	2,63E-03
3,21E-02	3,23E-04



### Boost Switch Characteristics

**figure 5. IGBT**

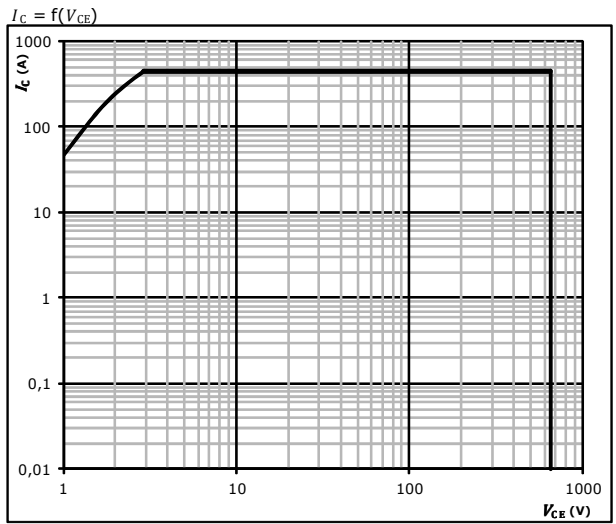
Gate voltage vs gate charge



$I_C = 150$  A

**figure 6. IGBT**

Safe operating area

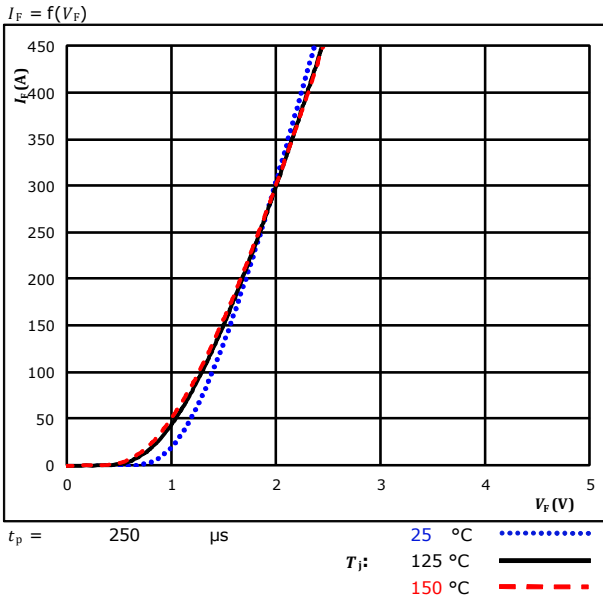


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = \pm 15$  V  
 $T_j = T_{jmax}$

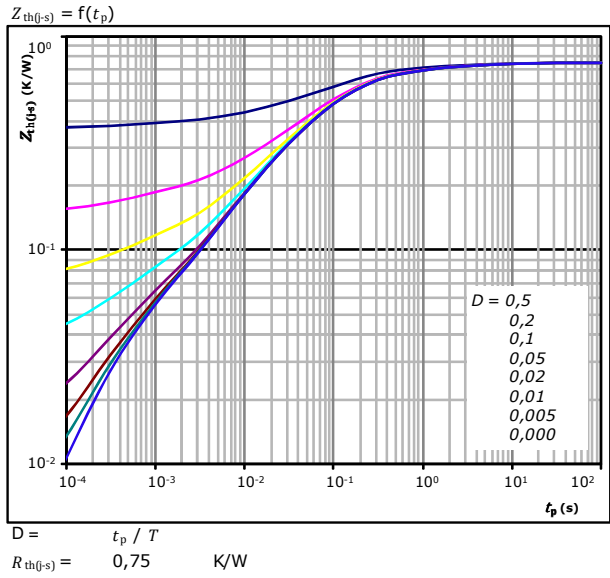


### Boost Diode Characteristics

**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)
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

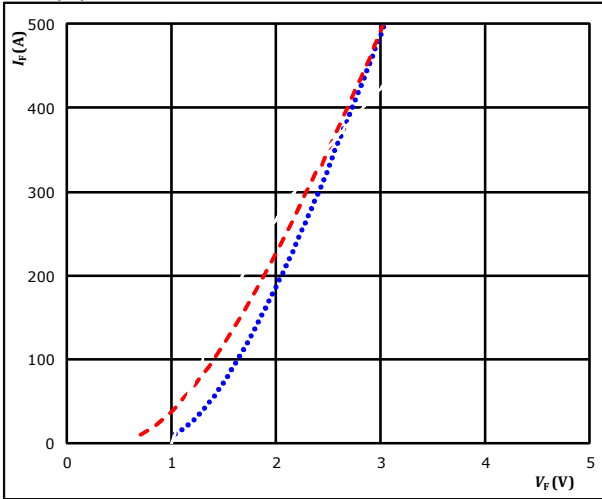


## Boost Sw.Inv.Diode Characteristics

**figure 1.** FWD

**Typical forward characteristics**

$I_F = f(V_F)$

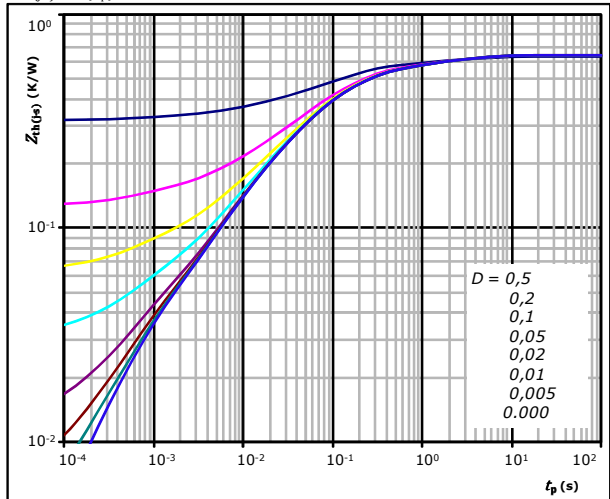


$t_p = 250 \mu s$   
 $T_j: 25 \text{ } ^\circ\text{C}$  (blue dotted line)  
 $150 \text{ } ^\circ\text{C}$  (red dashed line)

**figure 2.** FWD

**Transient thermal impedance as a function of pulse width**

$Z_{th(0-s)} = f(t_p)$



$D = t_p / T$   
 $R_{th(0-s)} = 0,64 \text{ K/W}$

FWD thermal model values

$R$ (K/W)	$\tau$ (s)
6,14E-02	3,48E+00
1,03E-01	5,85E-01
2,81E-01	9,46E-02
1,21E-01	2,14E-02
4,83E-02	5,07E-03
2,26E-02	5,92E-04

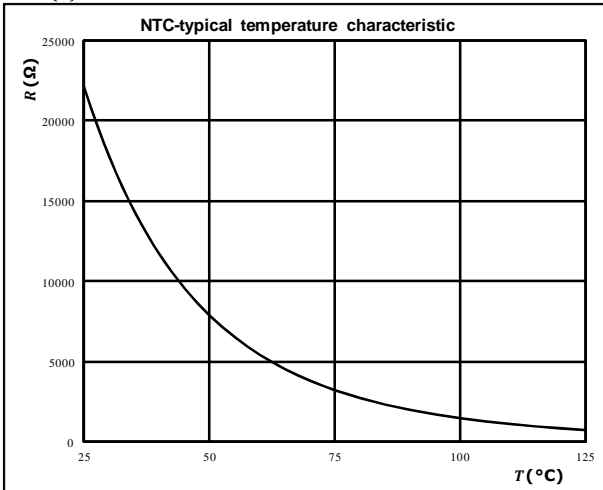


## Thermistor Characteristics

**figure 1.** Thermistor

**Typical NTC characteristic  
as a function of temperature**

$$R = f(T)$$



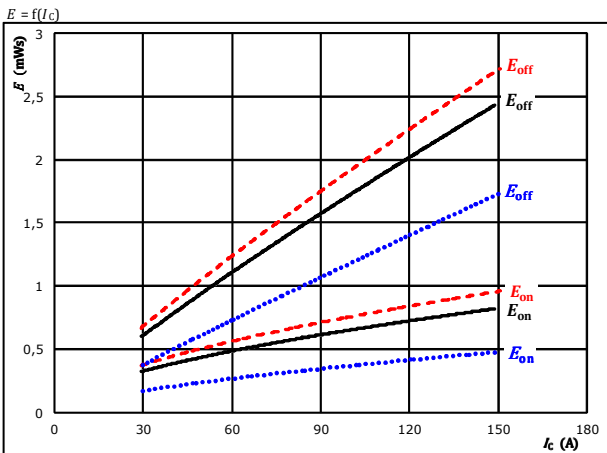




## Buck Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

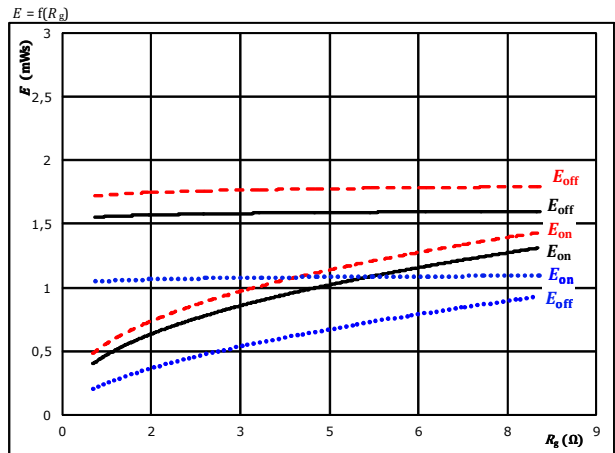


With an inductive load at

$V_{CE} = 350$ V	$T_j:$ 25 °C	.....
$V_{GE} = -5/+15$ V	125 °C	————
$R_{gon} = 2$ Ω	150 °C	- - - -
$R_{goff} = 2$ Ω		

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

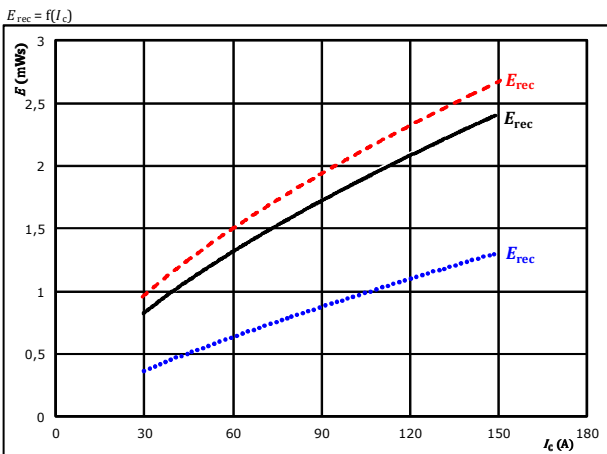


With an inductive load at

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

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

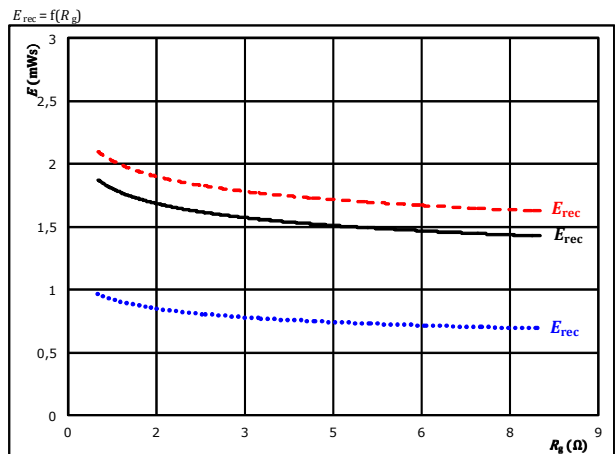


With an inductive load at

$V_{CE} = 350$ V	$T_j:$ 25 °C	.....
$V_{GE} = -5/+15$ V	125 °C	————
$R_{gon} = 2$ 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	.....
$V_{GE} = -5/+15$ V	125 °C	————
$I_c = 90$ A	150 °C	- - - -

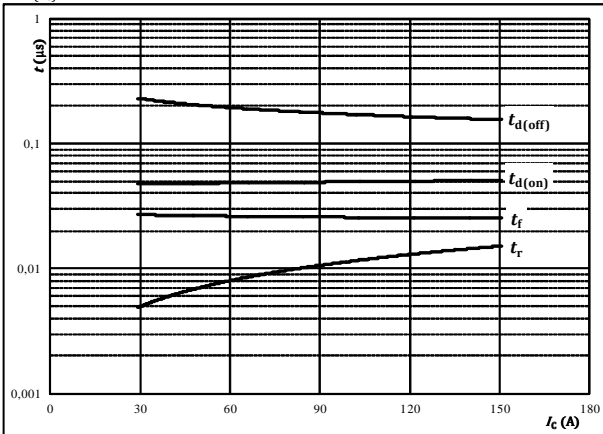


## Buck Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



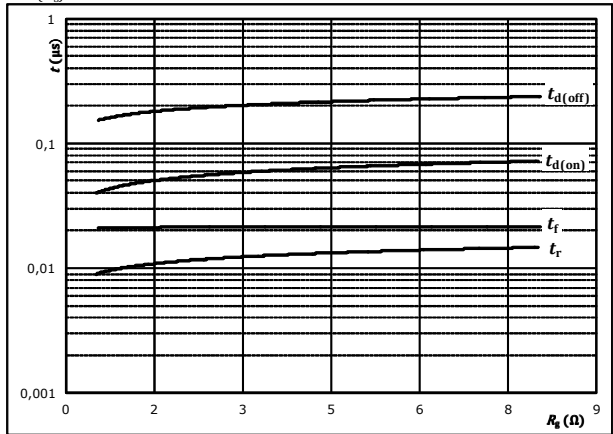
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	-5/+15	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



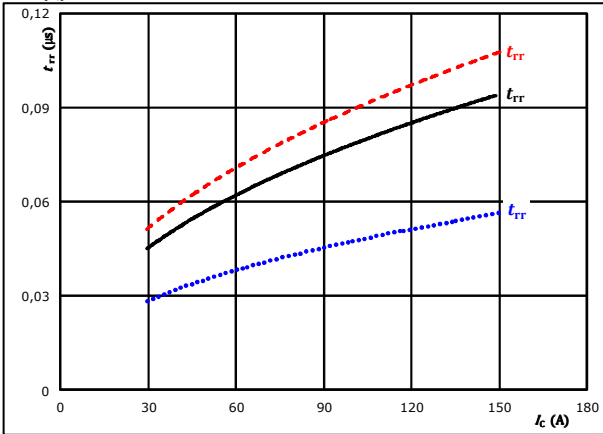
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	-5/+15	V
$I_C =$	90	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

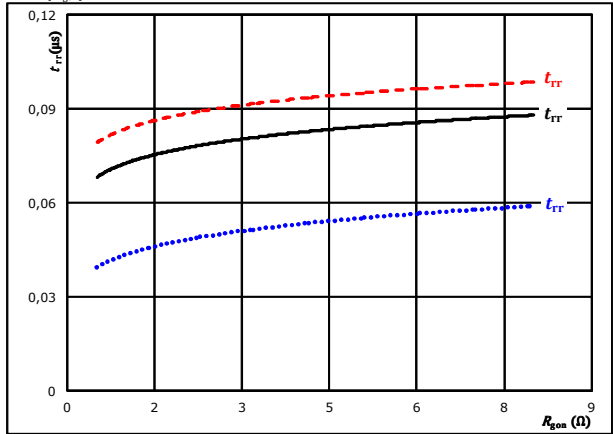


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	-5/+15	V		125 °C	————
	$R_{gon} =$	2	Ω		150 °C	- - - -

**figure 8.** FWD

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

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

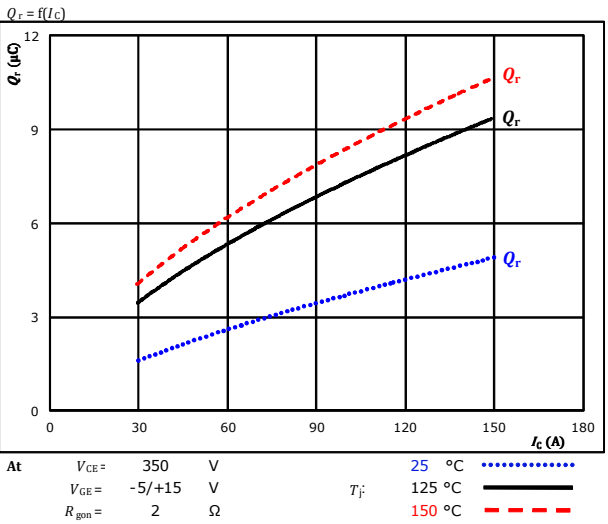


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	-5/+15	V		125 °C	————
	$I_C =$	90	A		150 °C	- - - -

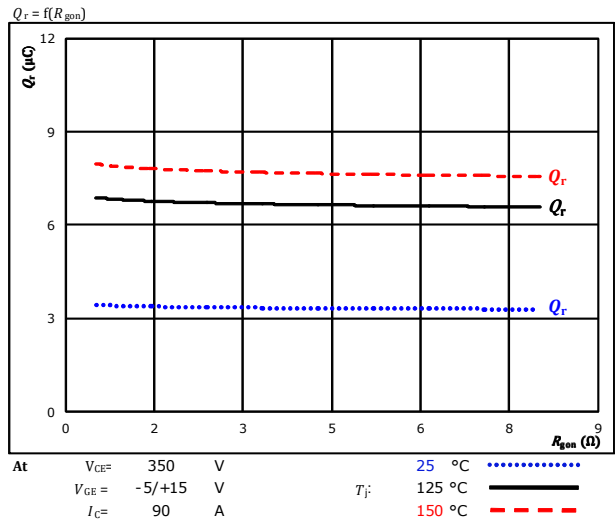


## Buck Switching Characteristics

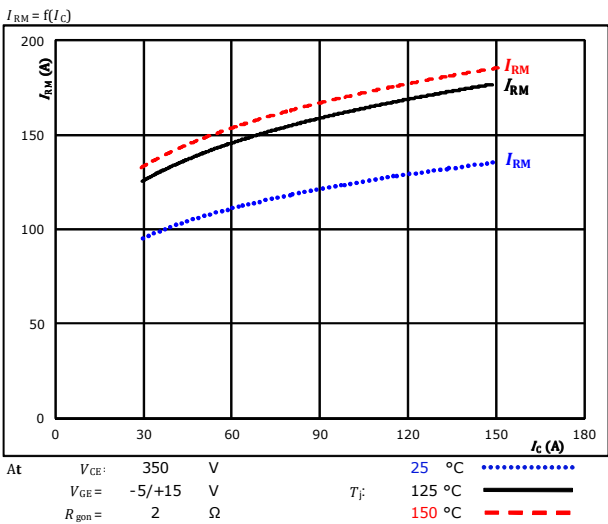
**figure 9.** FWD  
 Typical recovered charge as a function of collector current



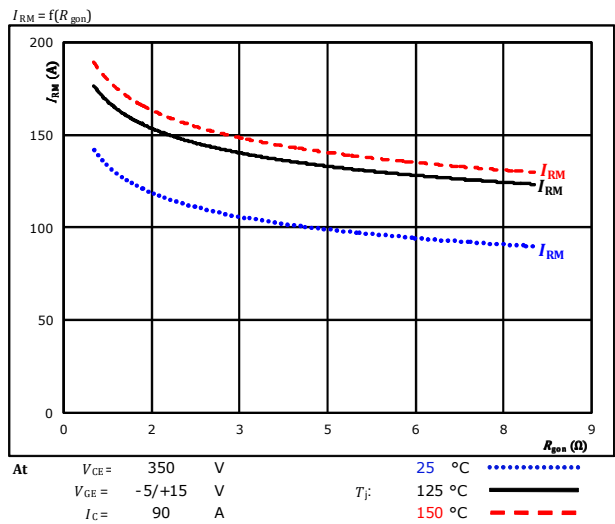
**figure 10.** FWD  
 Typical recovered charge as a function of IGBT turn on gate resistor



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



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



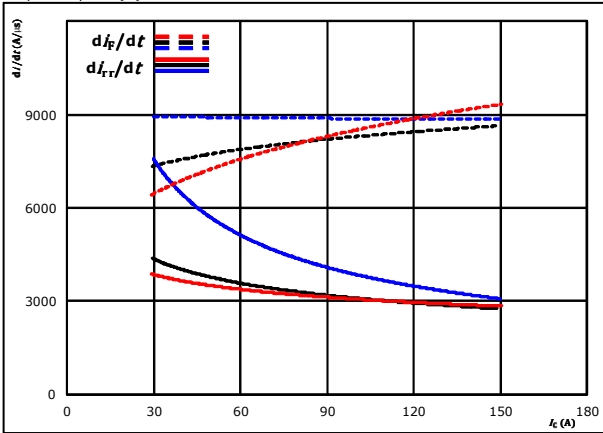


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## Buck Switching Characteristics

**figure 13.** FWD

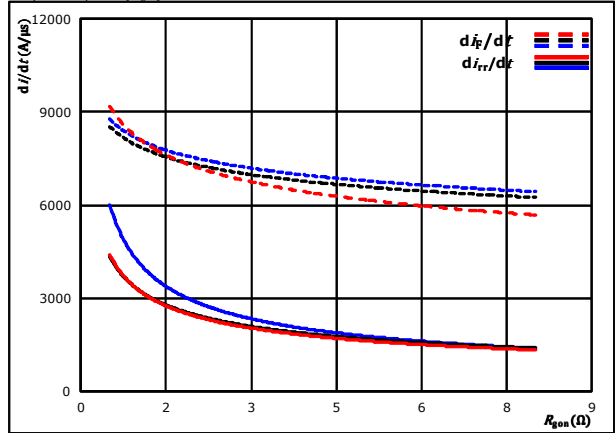
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_F/dt, di_{rr}/dt = f(I_C)$



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

**figure 14.** FWD

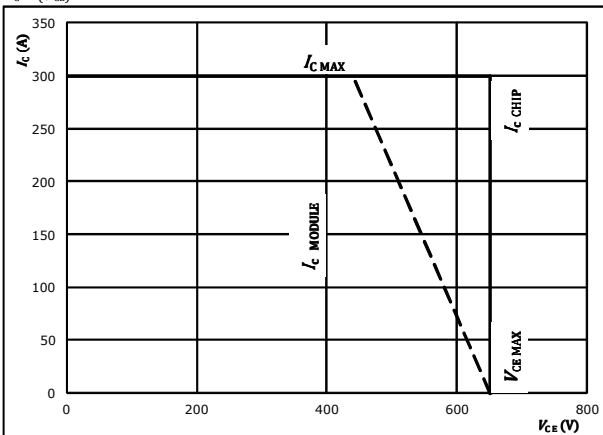
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_F/dt, di_{rr}/dt = f(R_{\theta n})$



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

**figure 15.** IGBT

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



At  $T_j = 175$  °C  
 $R_{\theta n} = 2$  Ω  
 $R_{\theta nF} = 2$  Ω



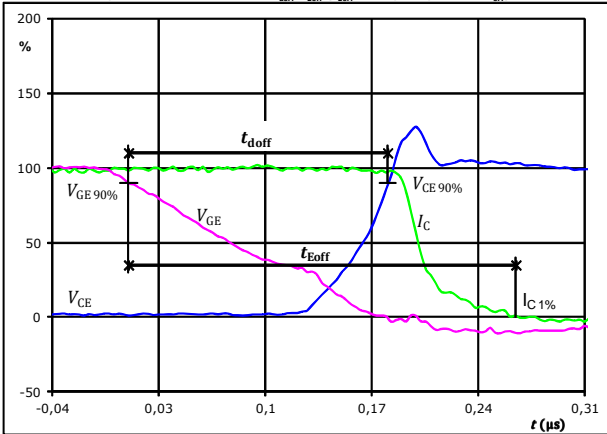
## Buck Switching Definitions

**General conditions**

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

**figure 1.** IGBT

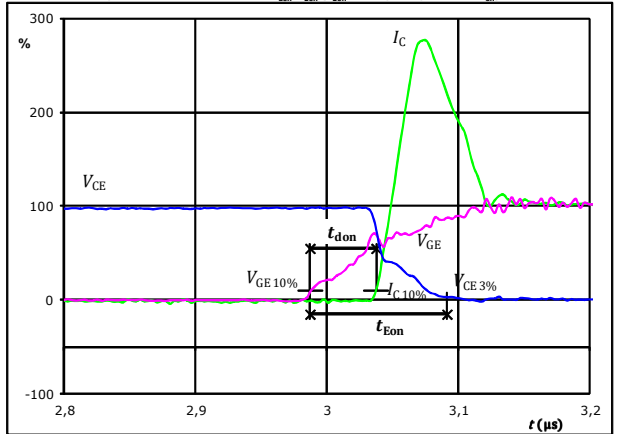
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$ , ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{doff} =$	0,170	$\mu s$
$t_{Eoff} =$	0,254	$\mu s$

**figure 2.** IGBT

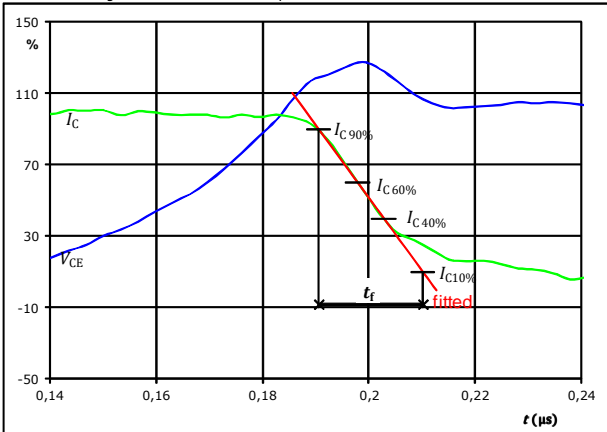
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_{don} =$	0,050	$\mu s$
$t_{Eon} =$	0,104	$\mu s$

**figure 3.** IGBT

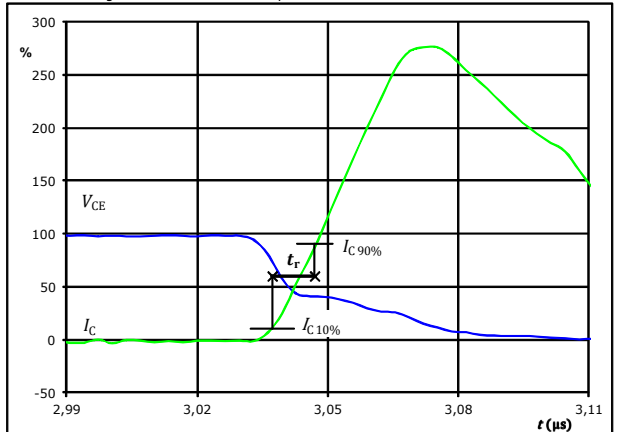
Turn-off Switching Waveforms & definition of  $t_f$



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

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



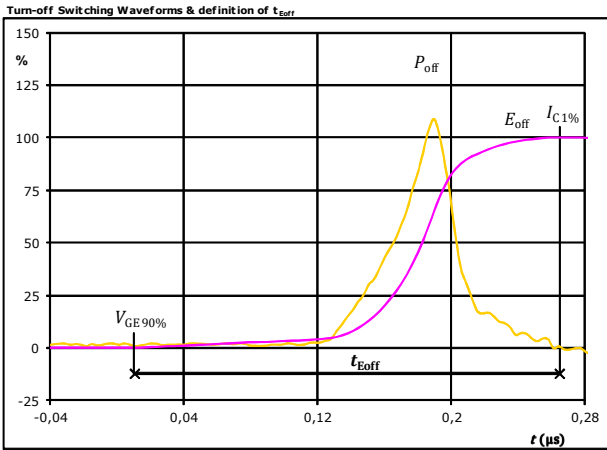
$V_C(100\%) =$	350	V
$I_C(100\%) =$	89	A
$t_r =$	0,010	$\mu s$



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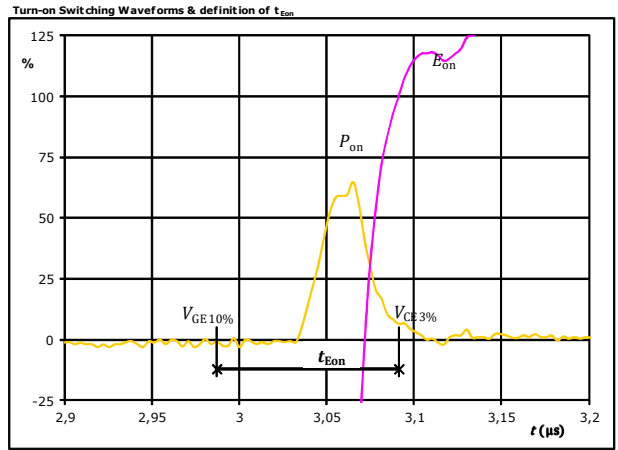
## Buck Switching Characteristics

**figure 5.** IGBT



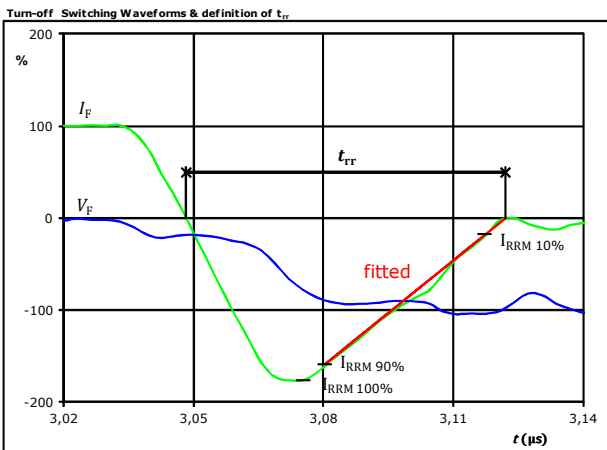
$P_{off}(100\%) =$	31,31	kW
$E_{off}(100\%) =$	1,56	mJ
$t_{Eoff} =$	0,25	$\mu$ s

**figure 6.** IGBT



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

**figure 7.** FWD

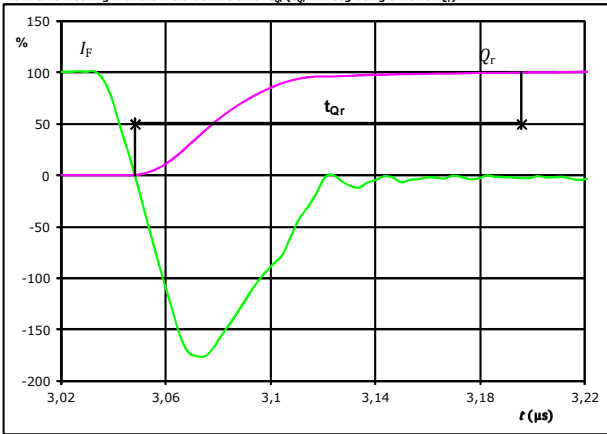


$V_F(100\%) =$	350	V
$I_F(100\%) =$	89	A
$I_{RRM}(100\%) =$	-158	A
$t_{rr} =$	0,074	$\mu$ s



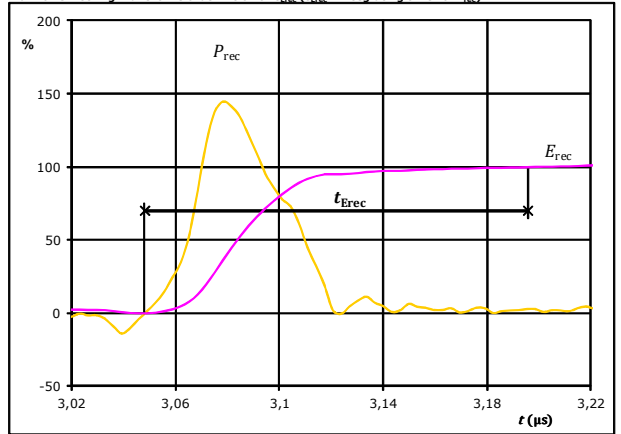
### Buck Switching Characteristics

**figure 8.** FWD  
 Turn-on Switching Waveforms & definition of  $t_{Qr}$  ( $t_{Qr}$  = integrating time for  $Q_r$ )



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

**figure 9.** FWD  
 Turn-on Switching Waveforms & definition of  $t_{Erec}$  ( $t_{Erec}$  = integrating time for  $E_{rec}$ )

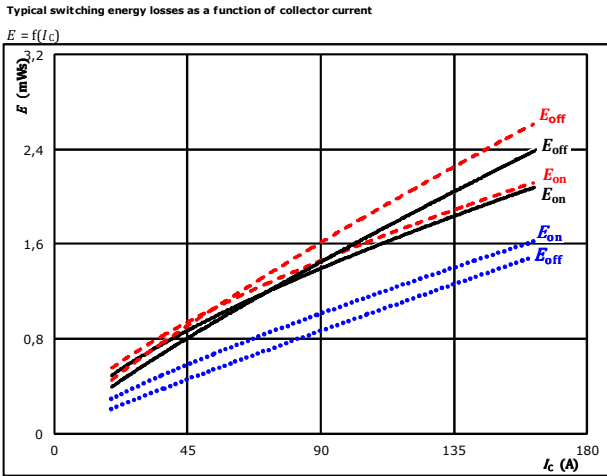


$P_{rec}$ (100%) =	31,31	kW
$E_{rec}$ (100%) =	1,72	mJ
$t_{Erec}$ =	0,15	$\mu\text{s}$

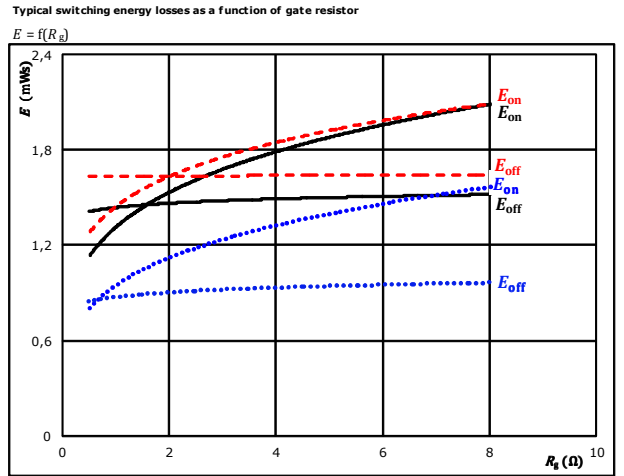


## Boost Switching Characteristics

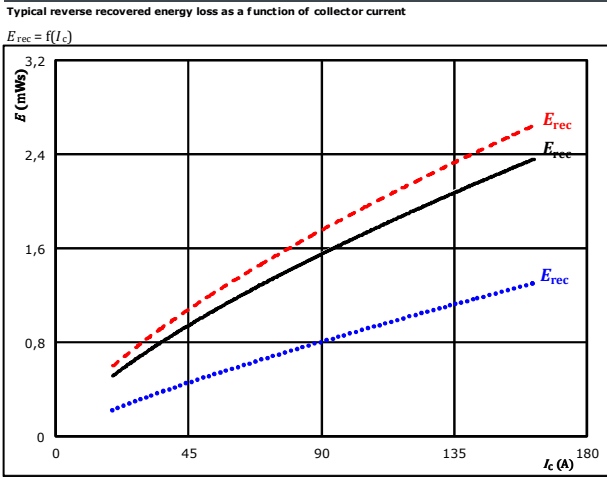
**figure 1.** IGBT



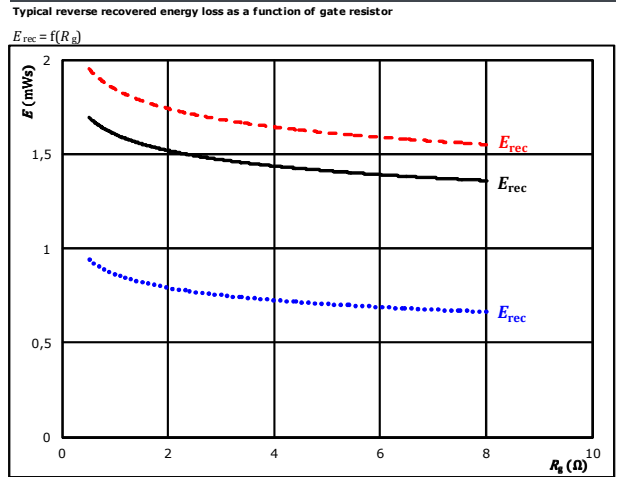
**figure 2.** IGBT



**figure 3.** FWD



**figure 4.** FWD





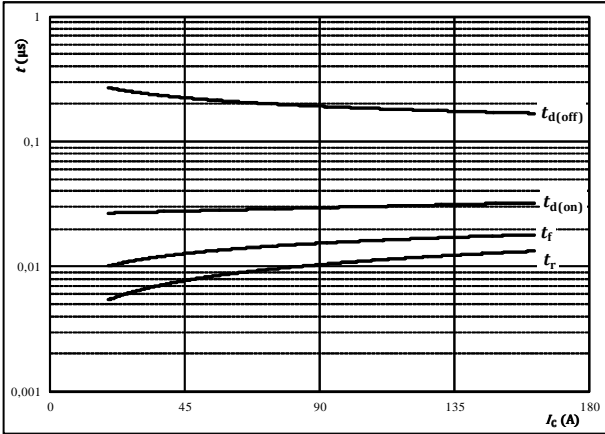


## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



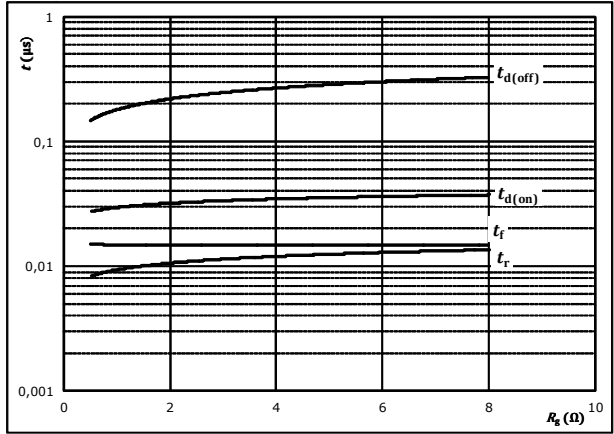
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	15/0	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



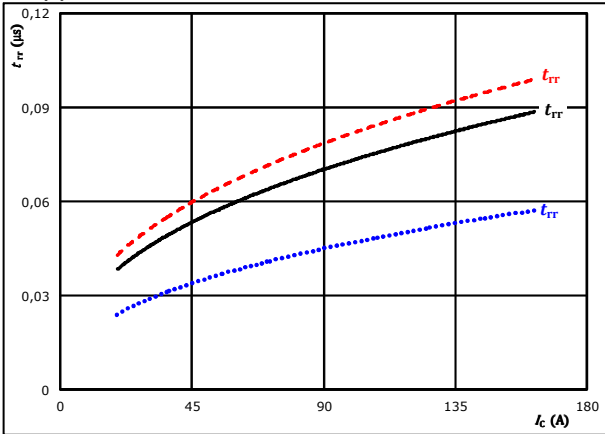
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	15/0	V
$I_C =$	93	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

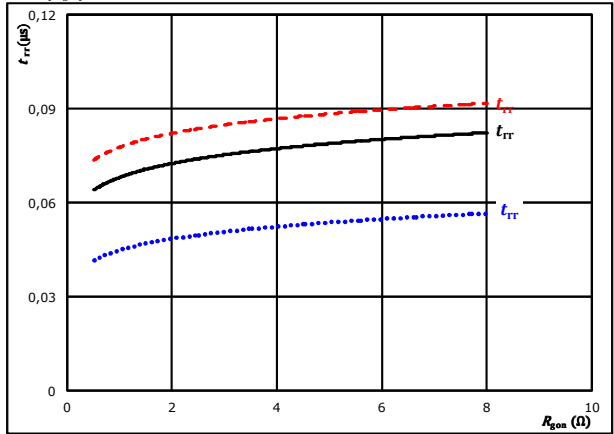


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	15/0	V		125 °C	————
	$R_{gon} =$	2	Ω		150 °C	- - - -

**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	.....
	$V_{GE} =$	15/0	V		125 °C	————
	$I_C =$	93	A		150 °C	- - - -

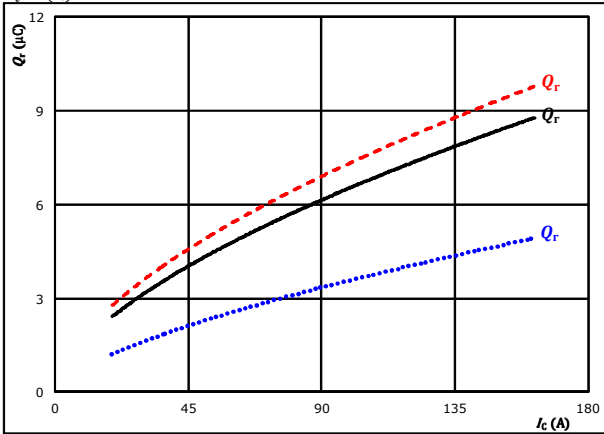


## Boost Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

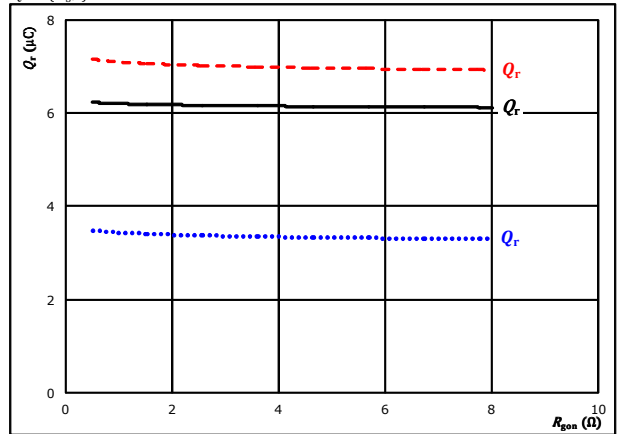


At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 2$  Ω  $T_j = 150$  °C - - - -

**figure 10.** FWD

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

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

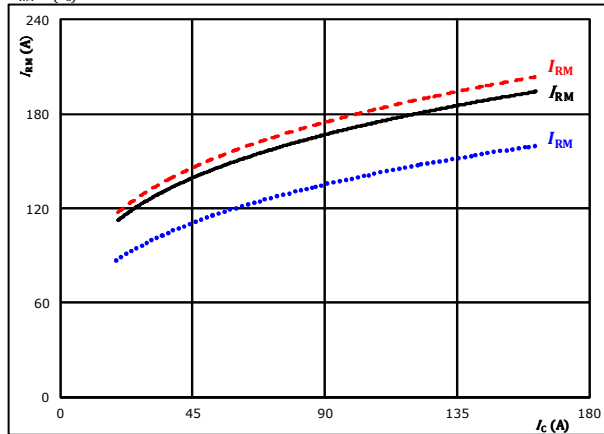


At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 93$  A  $T_j = 150$  °C - - - -

**figure 11.** FWD

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

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

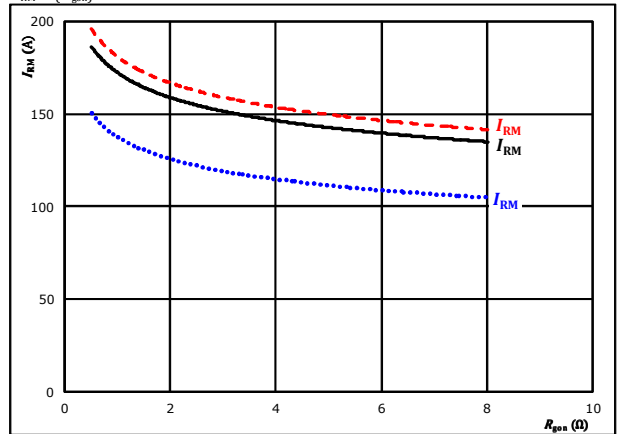


At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 2$  Ω  $T_j = 150$  °C - - - -

**figure 12.** FWD

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

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



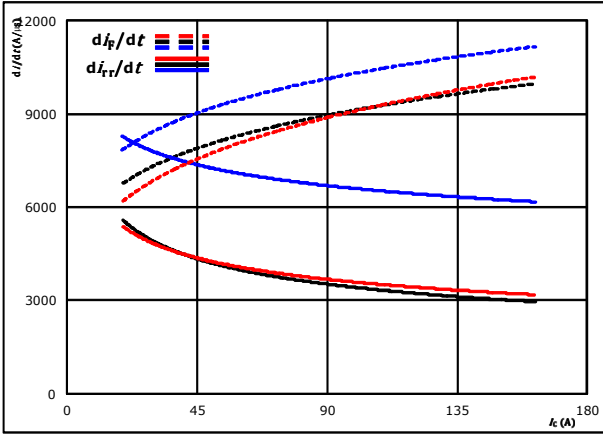
At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 93$  A  $T_j = 150$  °C - - - -



## Boost Switching Characteristics

**figure 13.** FWD

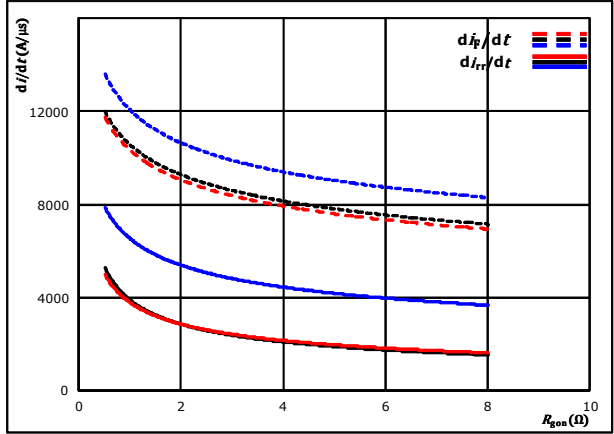
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{g(on)} = 2$  Ω  $T_j = 150$  °C - - - - -

**figure 14.** FWD

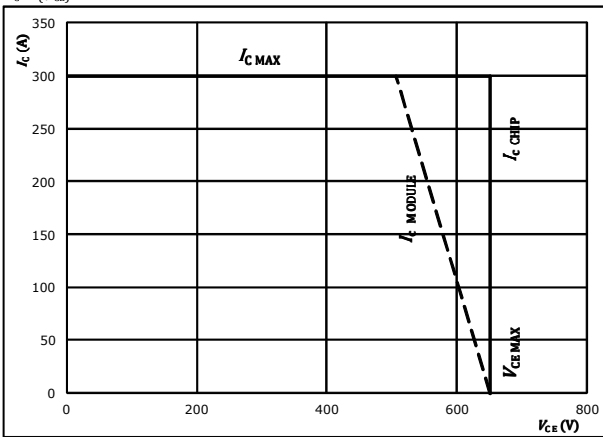
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At  $V_{CE} = 350$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 93$  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

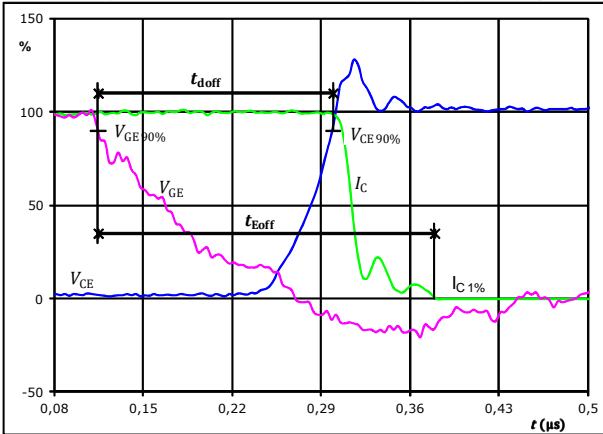


## Boost Switching Definitions

**General conditions**

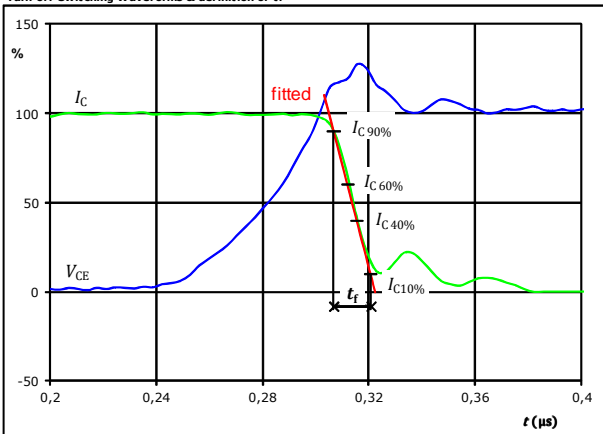
$T_j$	=	125 °C
$R_{gon}$	=	2 $\Omega$
$R_{goff}$	=	2 $\Omega$

**figure 1.** IGBT  
 Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



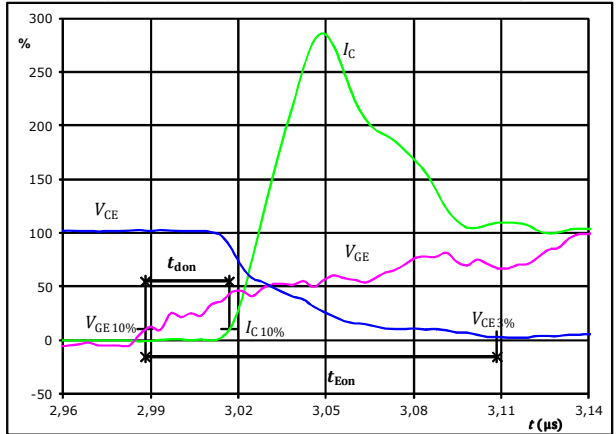
$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{doff} =$	0,185	$\mu s$
$t_{Eoff} =$	0,265	$\mu s$

**figure 3.** IGBT  
 Turn-off Switching Waveforms & definition of  $t_f$



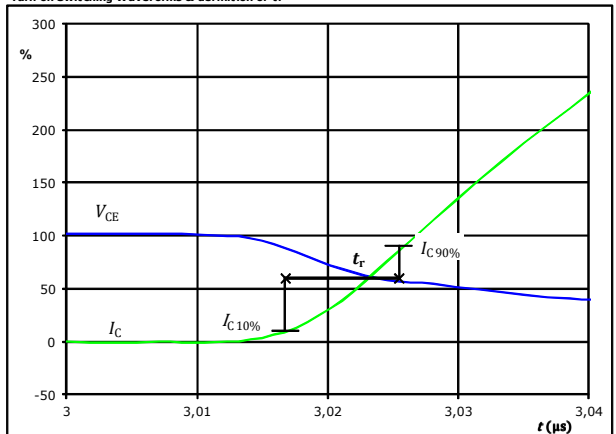
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_f =$	0,012	$\mu s$

**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
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{don} =$	0,031	$\mu s$
$t_{Eon} =$	0,120	$\mu s$

**figure 4.** IGBT  
 Turn-on Switching Waveforms & definition of  $t_r$



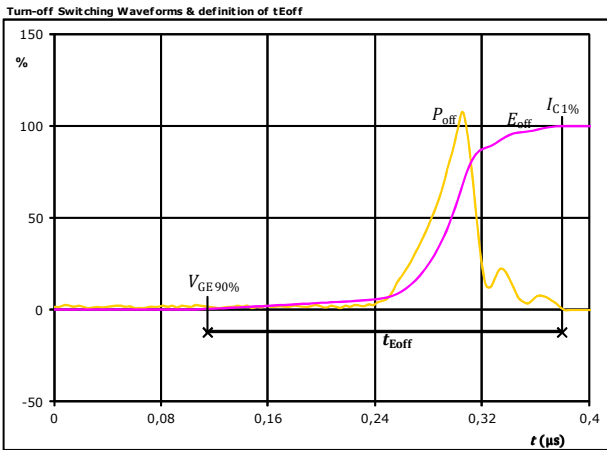
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_r =$	0,009	$\mu s$



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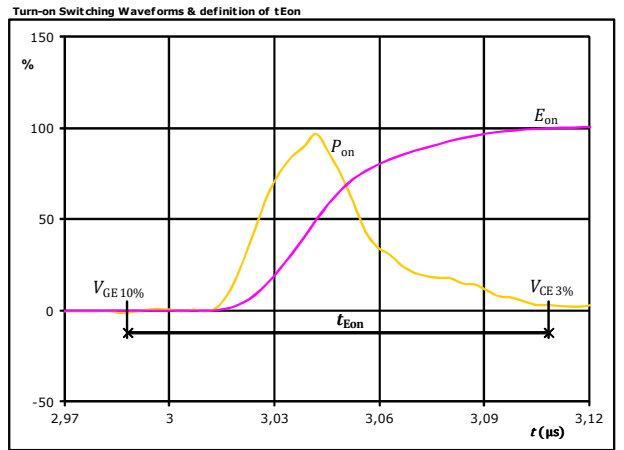
## Boost Switching Characteristics

**figure 5.** IGBT



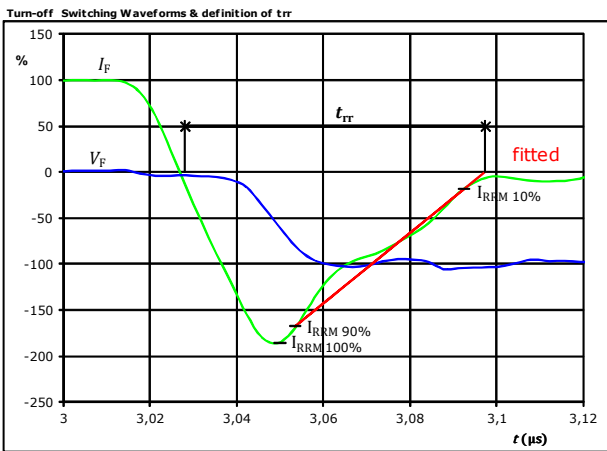
$P_{off}(100\%) = 31,58$  kW  
 $E_{off}(100\%) = 1,44$  mJ  
 $t_{Eoff} = 0,26$  µs

**figure 6.** IGBT



$P_{on}(100\%) = 31,58$  kW  
 $E_{on}(100\%) = 1,40$  mJ  
 $t_{Eon} = 0,12$  µs

**figure 7.** FWD



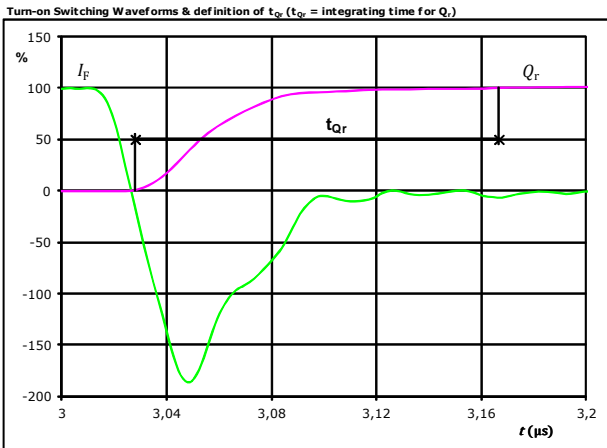
$V_F(100\%) = 350$  V  
 $I_F(100\%) = 90$  A  
 $I_{RRM}(100\%) = -167$  A  
 $t_{tr} = 0,070$  µs



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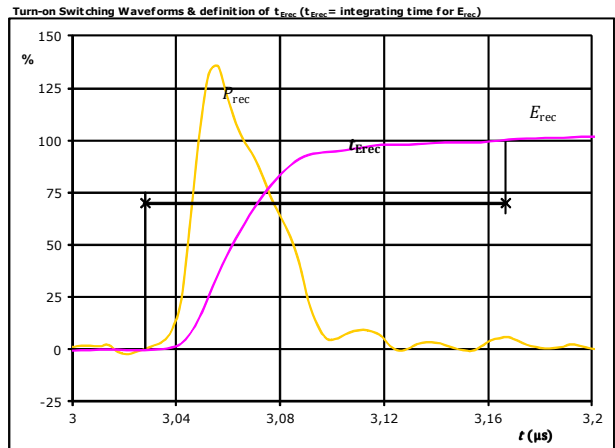
### Boost Switching Characteristics

**figure 8.** FWD



$I_F$ (100%) =	90	A
$Q_r$ (100%) =	6,23	$\mu\text{C}$
$t_{Qr}$ =	0,14	$\mu\text{s}$

**figure 9.** FWD



$P_{rec}$ (100%) =	31,58	kW
$E_{rec}$ (100%) =	1,57	mJ
$t_{Erec}$ =	0,14	$\mu\text{s}$



**10-FY07NIA150S502-L365F58**  
**10-PY07NIA150S502-L365F58Y**  
 datasheet

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Ordering Code & Marking						
Version			Ordering Code			
without thermal paste with 12 mm housing with solder pins			10-FY07NIA150S502-L365F58			
without thermal paste with 12 mm housing with Press-fit pins			10-PY07NIA150S502-L365F58Y			
NN-NNNNNNNNNNNN TTTTWWWWYY UL VIN LLLLL SSSS						
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNN-TTTTWW		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTWW	LLLLL	SSSS	WWYY		

Pin table			
Pin	X	Y	Function
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

### Outline

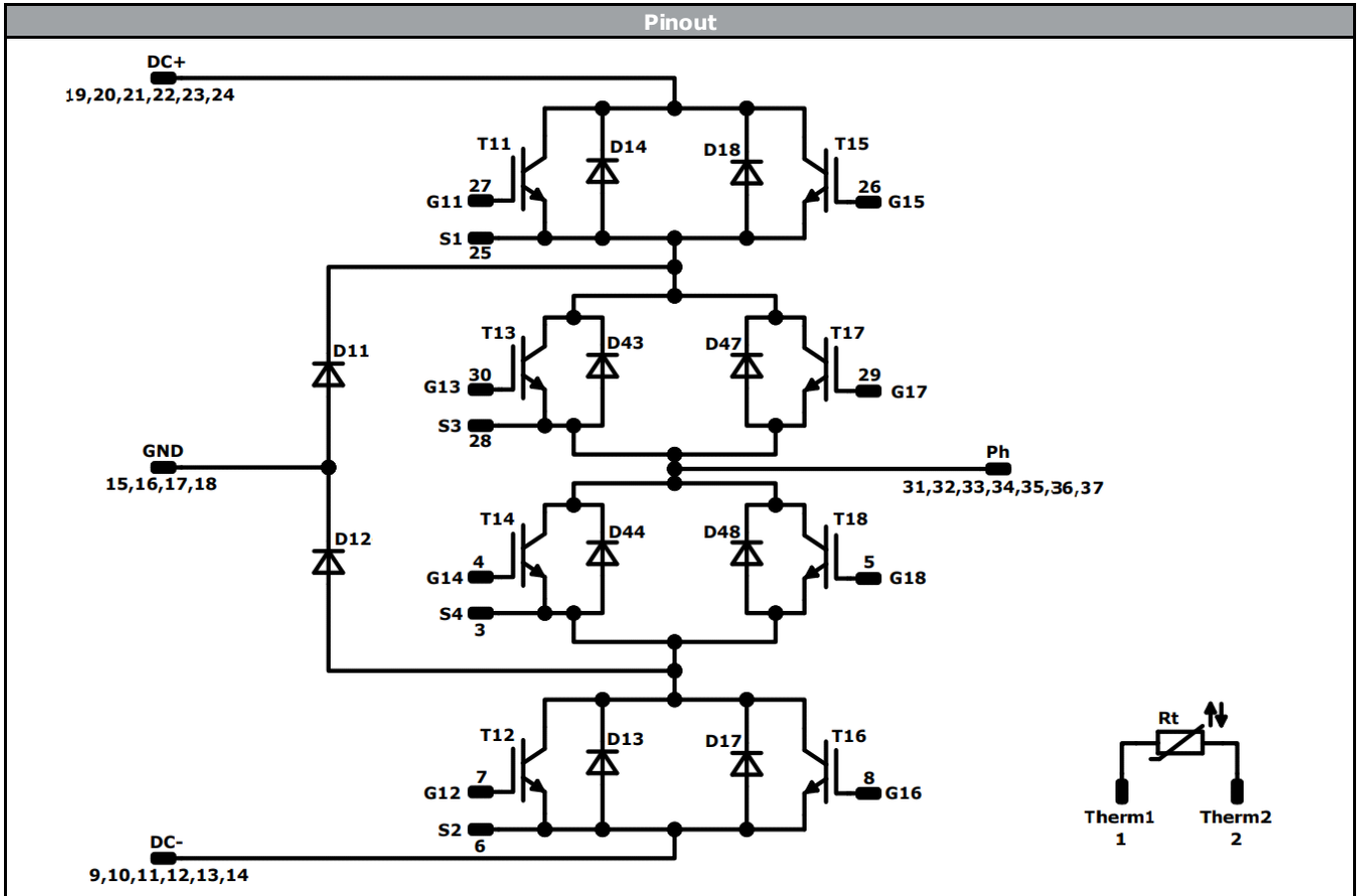
Tolerance of pinpositions: ±0.5mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance

center of press-fit pinhead  
for connection parameter see the handling instruction

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



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<b>Identification</b>					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T15, T16	IGBT	650 V	150 A	Buck Switch	Parallel devices with separate control. Values apply to complete device.
D11, D12	FWD	650 V	150 A	Buck Diode	
T13, T14, T17, T18	IGBT	650 V	150 A	Boost Switch	Parallel devices with separate control. Values apply to complete device.
D13, D14, D17, D18	FWD	650 V	150 A	Boost Diode	
D44, D43, D48, D47	FWD	650 V	150 A	Boost Sw.Inv.Diode	
Rt	NTC			Thermistor	






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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-xY07NIA150S502-L365F58x-D1-14	11 Aug. 2017		

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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.