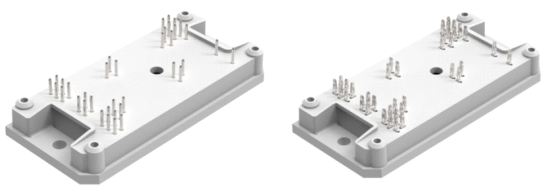
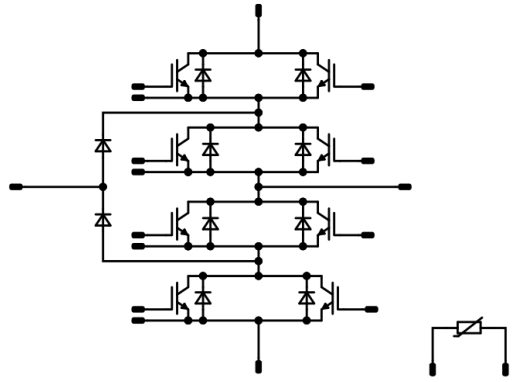




# Vincotech

<i>flow NPC 1</i>	1200 V / 150 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Features</b></p> <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> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Solar Inverters</li> <li>UPS</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>10-FY07NIA150S502-L365F58</li> <li>10-PY07NIA150S502-L365F58Y</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><i>flow 1 12 mm housing</i></p>  </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Schematic</b></p>  </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Buck Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	104	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	450	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	145	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	$^\circ\text{C}$



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



Vincotech

## 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



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

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

#### Dynamic

Parameter	Symbol	$R_{gon}$	$R_{goff}$	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$						25 125 150		48 50 49		ns
Rise time	$t_r$	$R_{gon} = 2 \Omega$	$R_{goff} = 2 \Omega$				25 125 150		9 10 10		
Turn-off delay time	$t_{d(off)}$			-5/+15	350	90	25 125 150		147 170 176		
Fall time	$t_f$						25 125 150		11 19 22		
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 3,3 \mu C$					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

**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]	$I_F$ [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	Value	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	$R_{gon} = 2 \Omega$ $R_{goff} = 2 \Omega$	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		52 52 52		ns
Rise time	$t_r$					25 125 150		10 11 11		
Turn-off delay time	$t_{d(off)}$					25 125 150		131 153 160		
Fall time	$t_f$					25 125 150		13 19 22		
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 3,5 \mu C$ $Q_{tFWD} = 6,8 \mu C$ $Q_{tFWD} = 7,8 \mu C$				25 125 150		0,666 1,225 1,391		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,140 1,685 1,855		



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## 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]	$I_F$ [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	$di/dt$	$V_{GS}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$I_F$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				150		25 125 150		101 127 133		A
Reverse recovery time	$t_{rr}$						25 125 150		54 88 101		ns
Recovered charge	$Q_r$	$di/dt = 9576$ A/μs $di/dt = 6720$ A/μs $di/dt = 7333$ A/μs	-5 / 15	350	90		25 125 150		3,474 6,778 7,836		μC
Reverse recovered energy	$E_{rec}$						25 125 150		0,807 1,467 1,668		mWs
Peak rate of fall of recovery current	$(di_{ef}/dt)_{max}$						25 125 150		2283 1335 1270		A/μs

### Boost Sw.Inv.Diode

#### Static

Parameter	Symbol	$V_{GS}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$I_F$ [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



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## Characteristic Values

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

### 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	



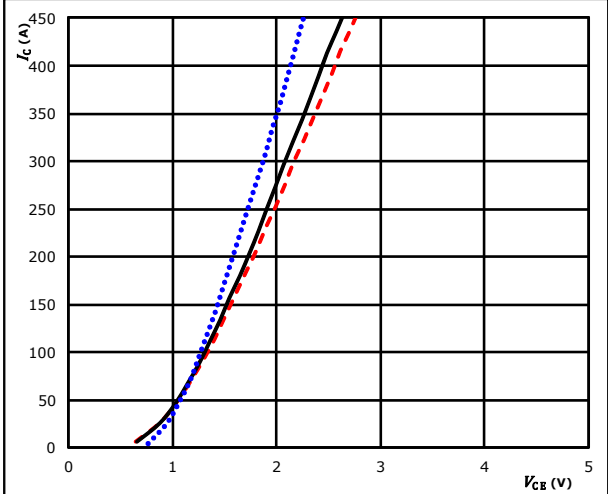


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

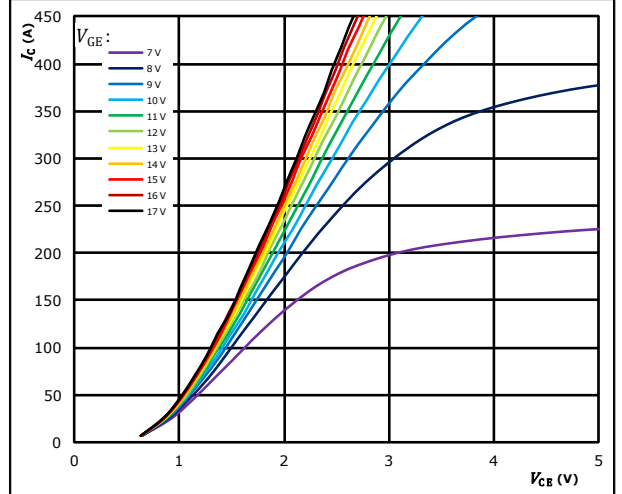


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

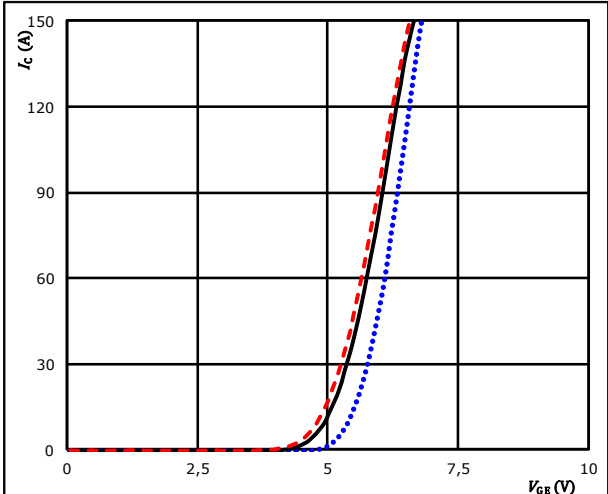


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

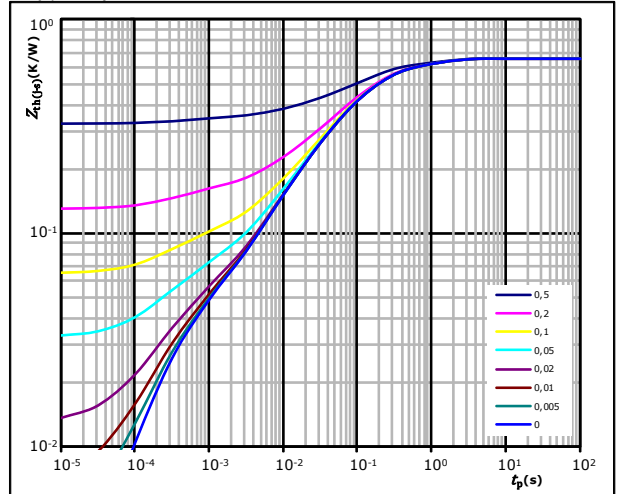


$t_p = 100 \mu s$   $T_j: 25 \text{ }^\circ C$  .....  
 $V_{CE} = 10 \text{ V}$   $T_j: 125 \text{ }^\circ C$  ———  
 $T_j: 150 \text{ }^\circ C$  - - - - -

**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

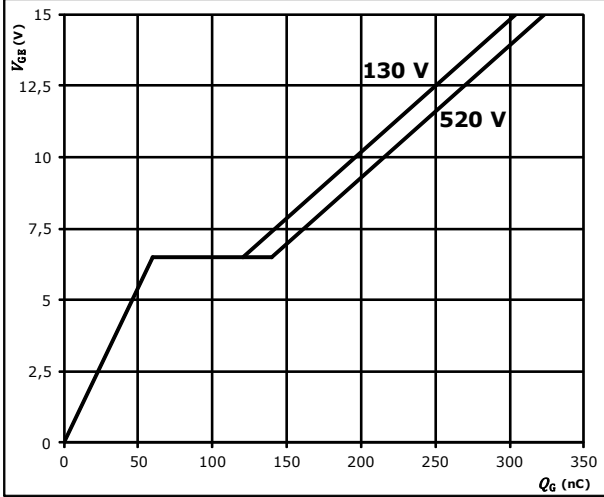


### Buck Switch Characteristics

**figure 5.** IGBT

Gate voltage vs gate charge

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

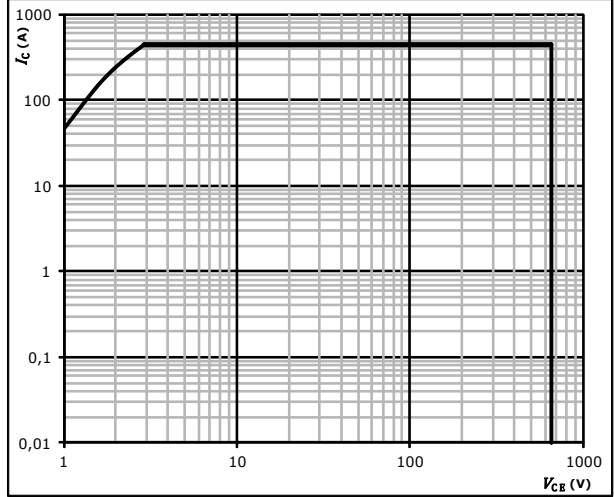


$I_C = 150$  A

**figure 6.** IGBT

Safe operating area

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

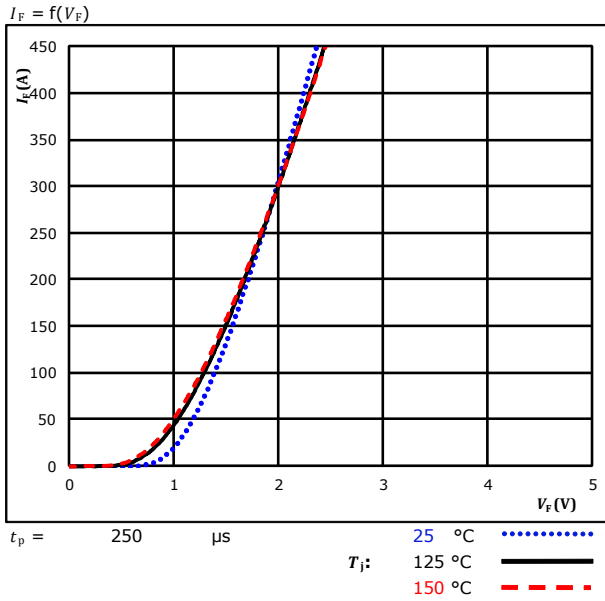


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = \pm 15$  V  
 $T_j = T_{jmax}$

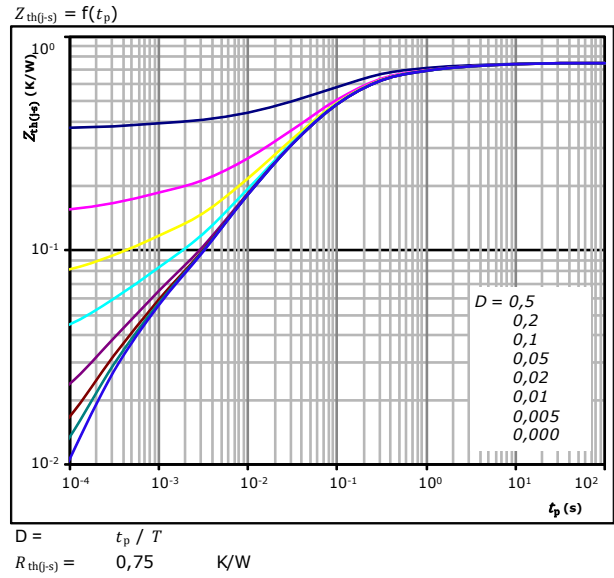


## Buck Diode Characteristics

**figure 1.** FWD  
**Typical forward characteristics**



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



FWD thermal model values

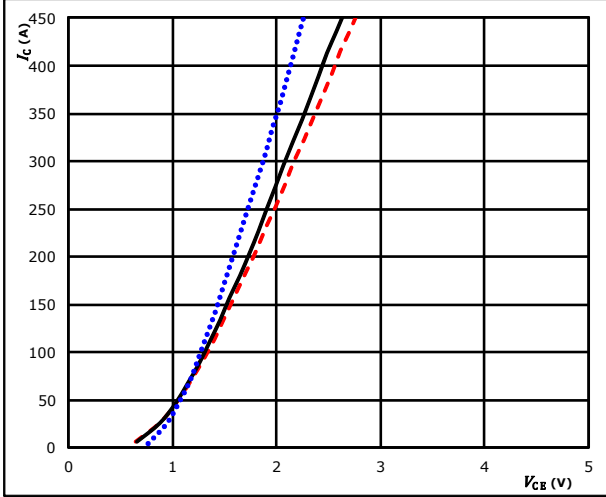
$R$ (K/W)	$\tau$ (s)
2,88E-02	7,46E+00
7,02E-02	1,27E+00
1,95E-01	2,04E-01
2,65E-01	6,33E-02
1,21E-01	1,27E-02
3,39E-02	3,05E-03
3,36E-02	3,74E-04



## Boost Switch Characteristics

**figure 1.** IGBT

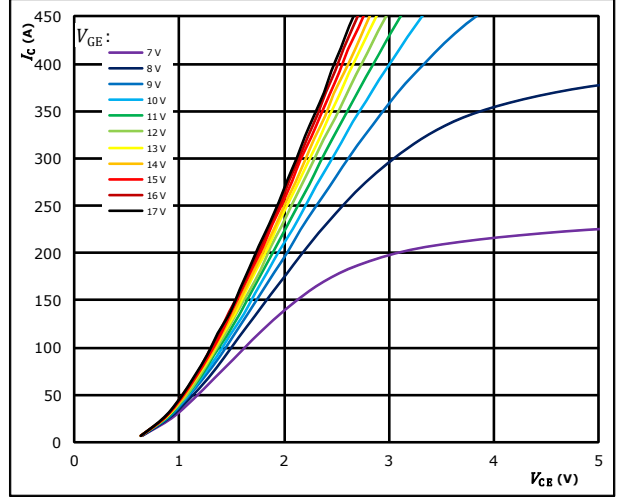
Typical output characteristics  
 $I_C = f(V_{CE})$



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

**figure 2.** IGBT

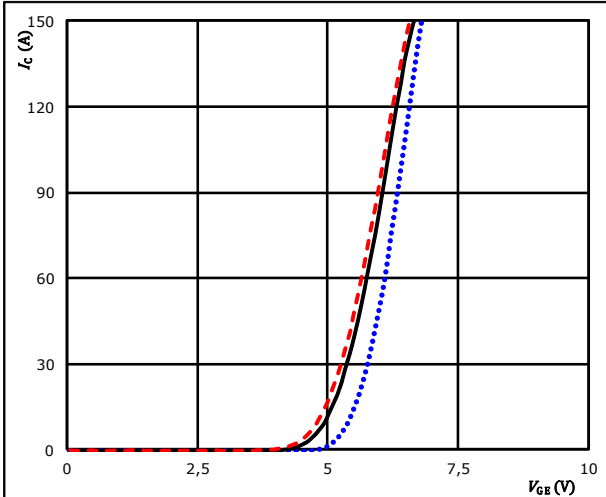
Typical output characteristics  
 $I_C = f(V_{CE})$



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

**figure 3.** IGBT

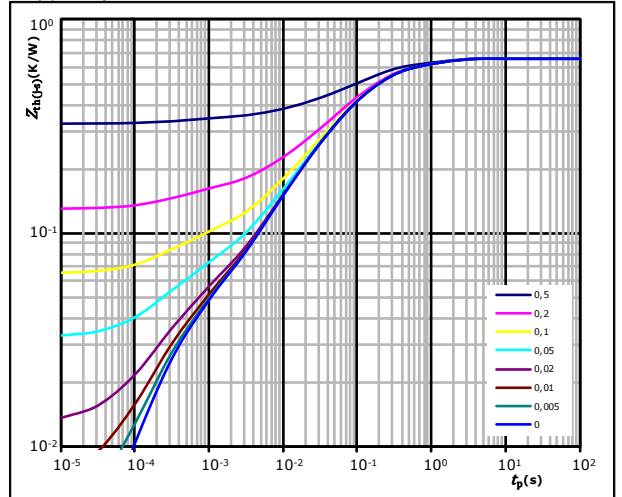
Typical transfer characteristics  
 $I_C = f(V_{GE})$



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

**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

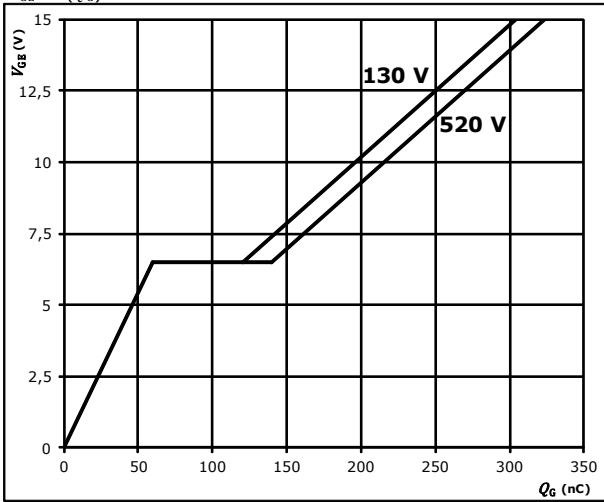


### Boost Switch Characteristics

**figure 5. IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

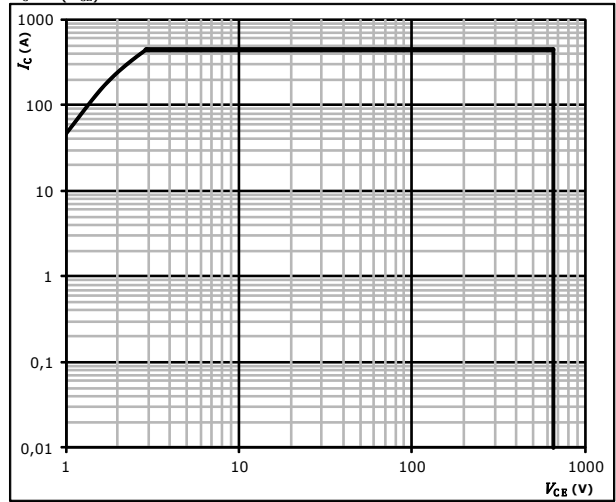


$I_C = 150$  A

**figure 6. IGBT**

Safe operating area

$I_C = f(V_{CE})$

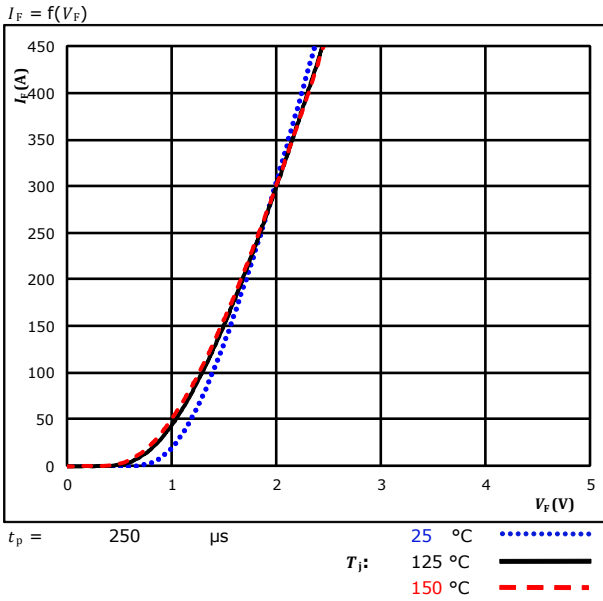


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = \pm 15$  V  
 $T_j = T_{jmax}$

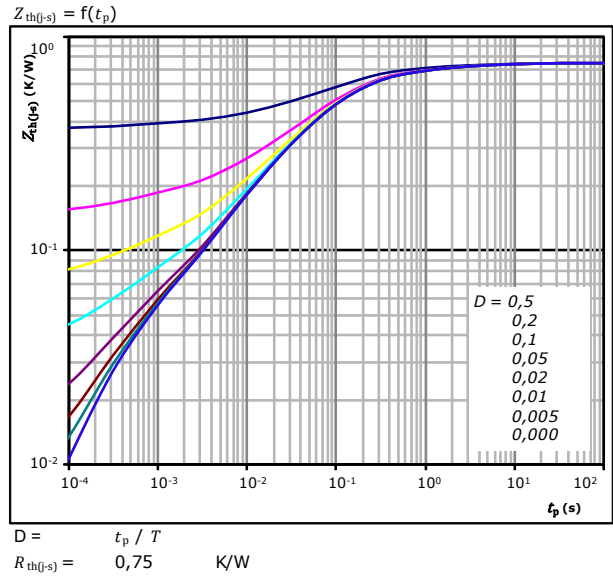


## Boost Diode Characteristics

**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

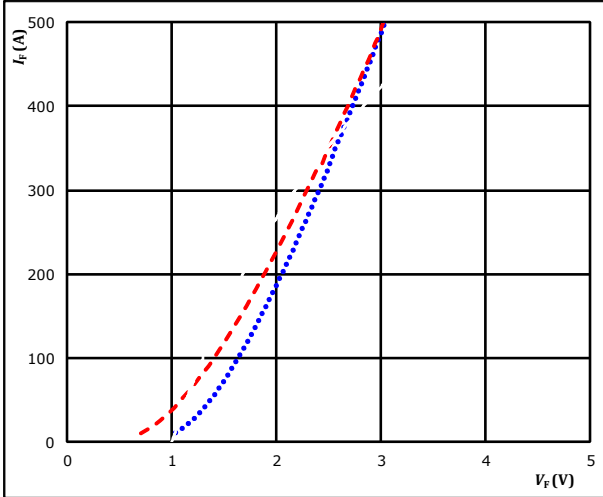


## Boost Sw.Inv.Diode Characteristics

**figure 1.** FWD

**Typical forward characteristics**

$I_F = f(V_F)$

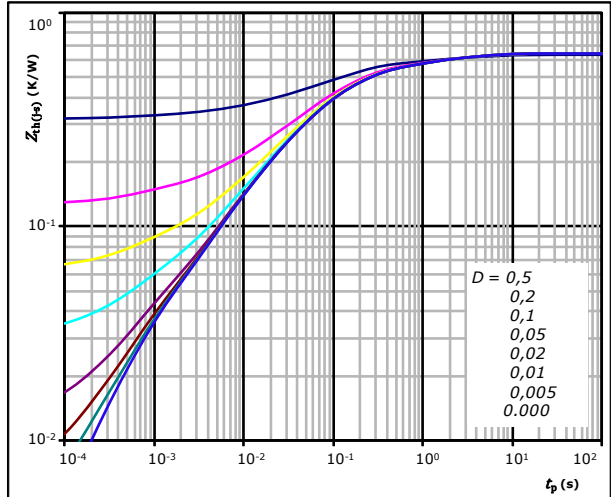


$t_p = 250 \mu s$   
 $T_j: 25 \text{ } ^\circ C$  (blue dotted line)  
 $150 \text{ } ^\circ C$  (red dashed line)

**figure 2.** FWD

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

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



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

FWD thermal model values

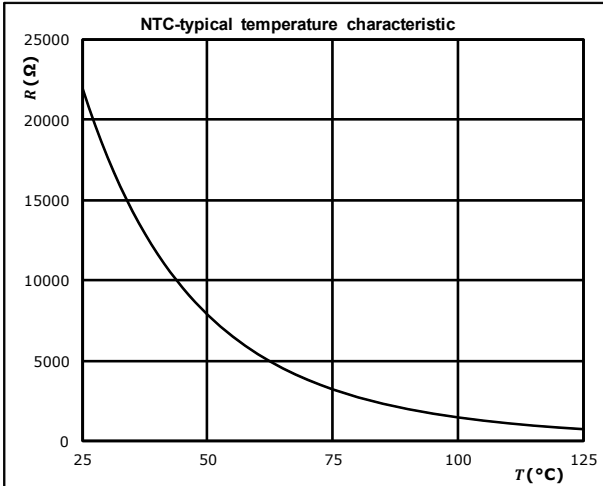
$R$ (K/W)	$\tau$ (s)
6,14E-02	3,48E+00
1,03E-01	5,85E-01
2,81E-01	9,46E-02
1,21E-01	2,14E-02
4,83E-02	5,07E-03
2,26E-02	5,92E-04

## Thermistor Characteristics

**figure 1.** Thermistor

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

$R = f(T)$





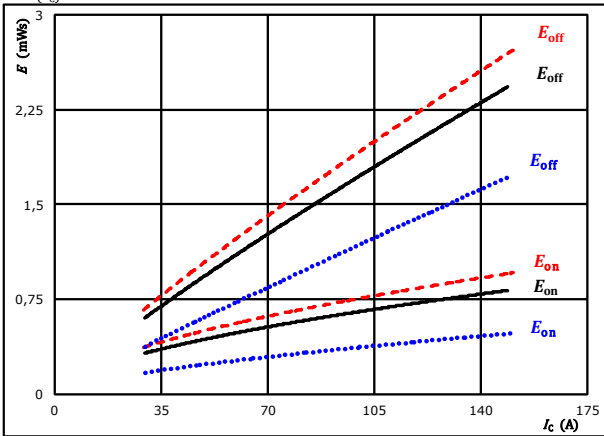
Vincotech

## Buck Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

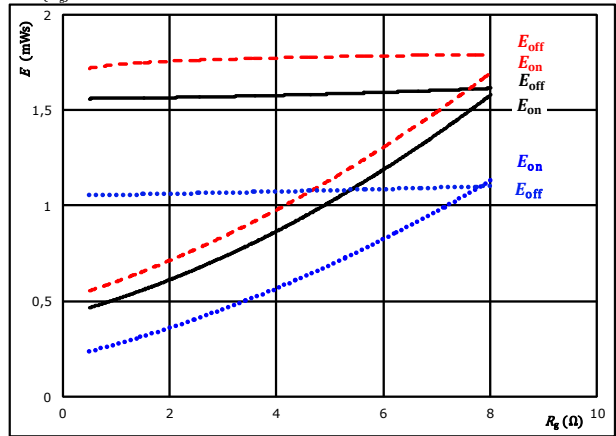


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 2$   $\Omega$   
 $R_{goff} = 2$   $\Omega$   
 $T_j: 25$  °C (dotted),  $125$  °C (solid),  $150$  °C (dashed)

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$

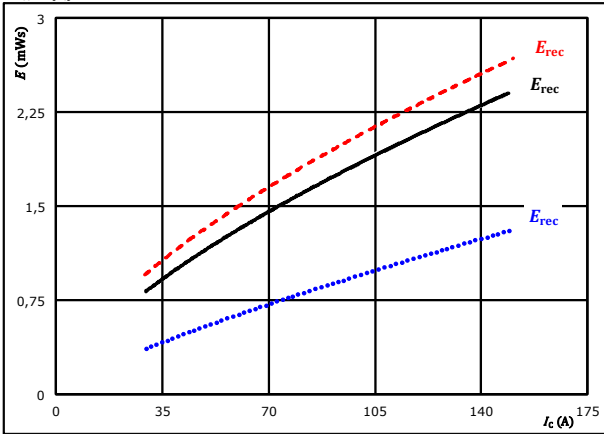


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 90$  A  
 $T_j: 25$  °C (dotted),  $125$  °C (solid),  $150$  °C (dashed)

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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

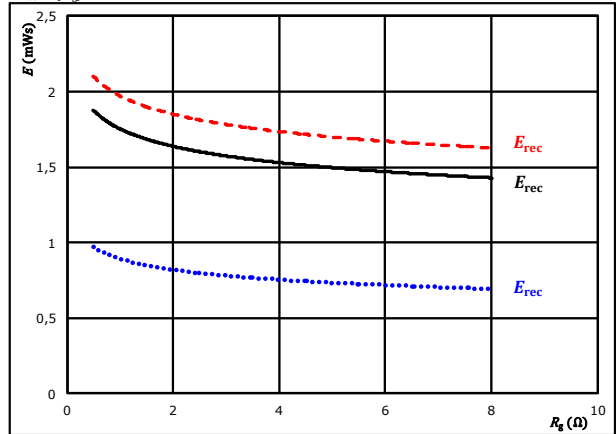


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 2$   $\Omega$   
 $T_j: 25$  °C (dotted),  $125$  °C (solid),  $150$  °C (dashed)

**figure 4.** FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 90$  A  
 $T_j: 25$  °C (dotted),  $125$  °C (solid),  $150$  °C (dashed)





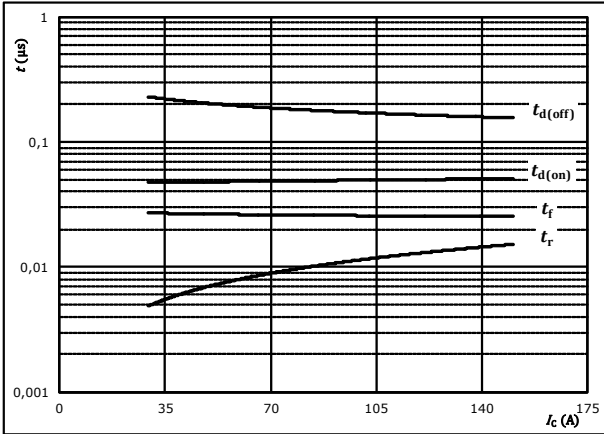
Vincotech

## Buck Switching Characteristics

**figure 5. IGBT**

Typical switching times as a function of collector current

$$t = f(I_C)$$



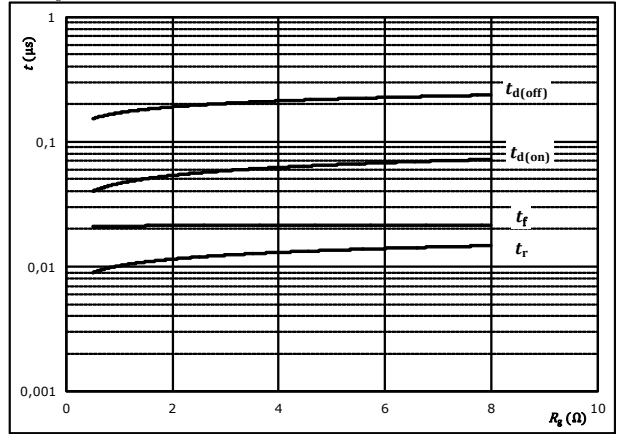
With an inductive load at

$T_j =$	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

$$t = f(R_g)$$



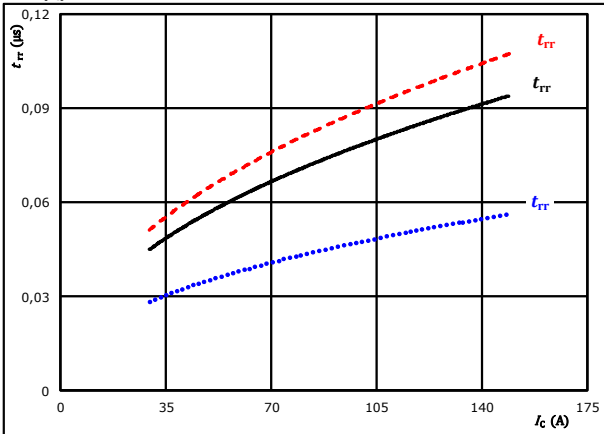
With an inductive load at

$T_j =$	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

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

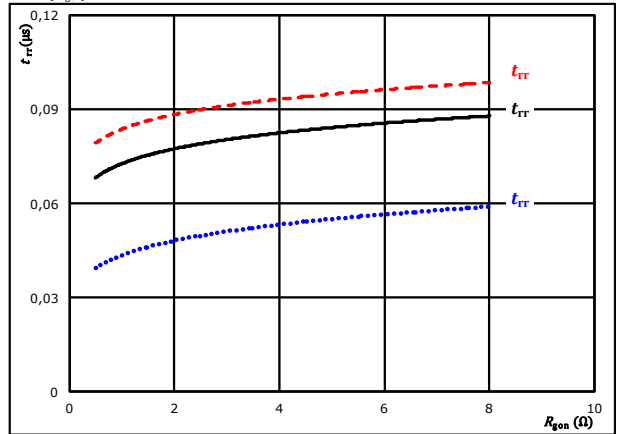


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	-5 / 15	V		125 °C	————
	$R_{gon} =$	2	Ω		150 °C	-----

**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	-----

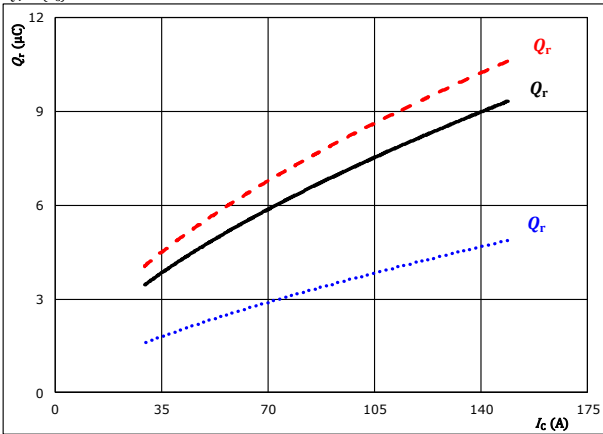


## Buck Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

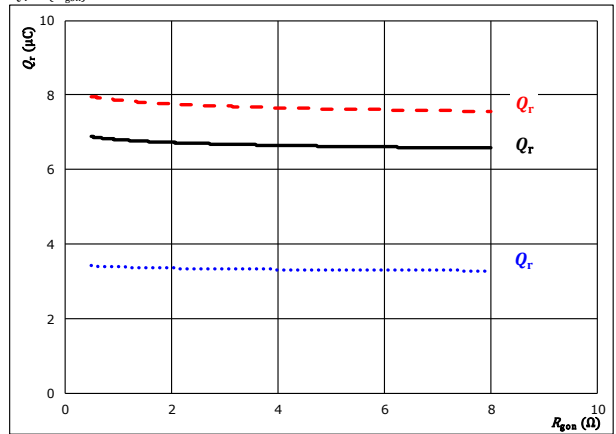


At  $V_{CE} = 350$  V  $T_j = 25$  °C  $R_{gdn} = 2$  Ω  
 $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  
 $T_j = 150$  °C

**figure 10.** FWD

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

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

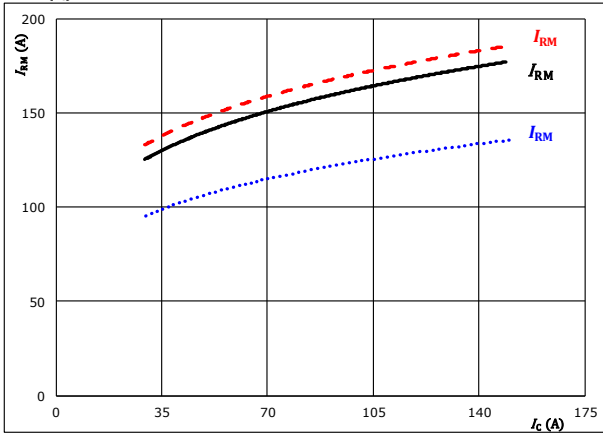


At  $V_{CE} = 350$  V  $T_j = 25$  °C  
 $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  
 $I_c = 90$  A  $T_j = 150$  °C

**figure 11.** FWD

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

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

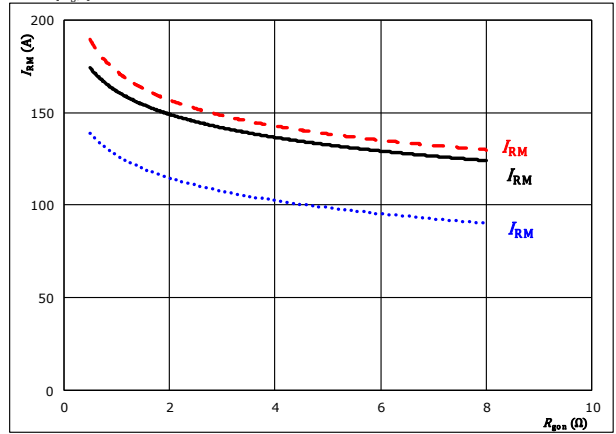


At  $V_{CE} = 350$  V  $T_j = 25$  °C  
 $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  
 $R_{gdn} = 2$  Ω  $T_j = 150$  °C

**figure 12.** FWD

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

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



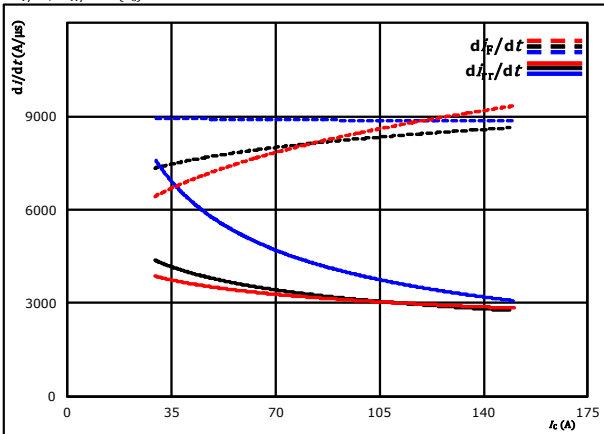
At  $V_{CE} = 350$  V  $T_j = 25$  °C  
 $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  
 $I_c = 90$  A  $T_j = 150$  °C



## Buck Switching Characteristics

**figure 13.** FWD

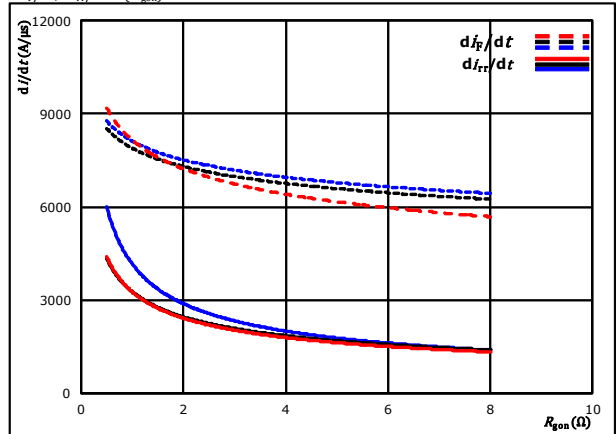
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_{f}/dt, di_{rr}/dt = f(I_c)$



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

**figure 14.** FWD

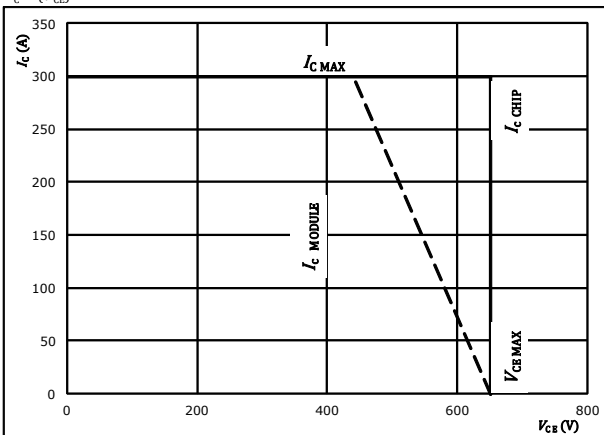
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_{f}/dt, di_{rr}/dt = f(R_{gon})$



At  $V_{CE} = 350$  V  $T_j = 25$  °C  
 $V_{GE} = -5 / 15$  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  
 $R_{gon} = 2$  Ω  
 $R_{goff} = 2$  Ω



Vincotech

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

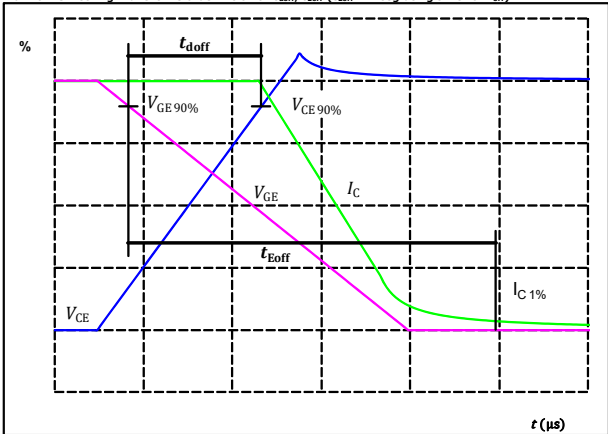
## Buck Switching Definitions

### General conditions

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

**figure 1.** IGBT

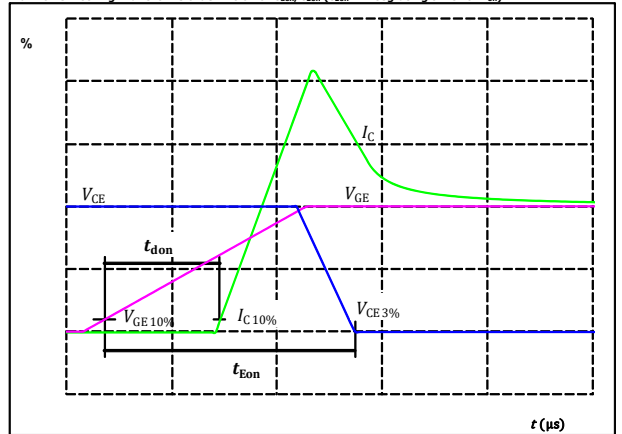
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{doff} =$	170	ns

**figure 2.** IGBT

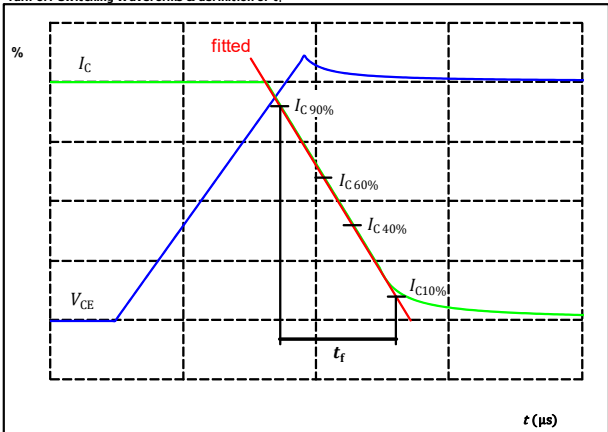
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{don} =$	50	ns

**figure 3.** IGBT

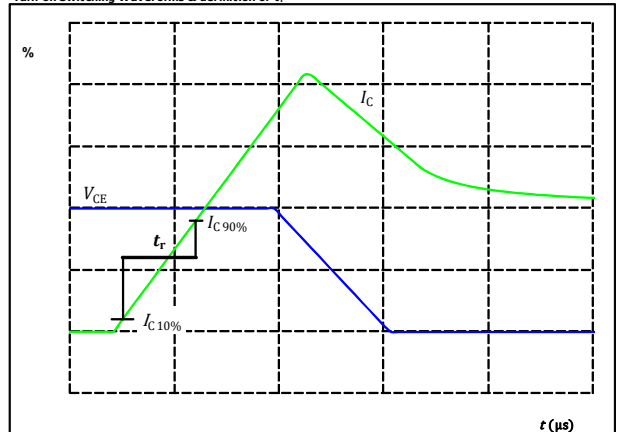
Turn-off Switching Waveforms & definition of  $t_r$



$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_r =$	19	ns

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



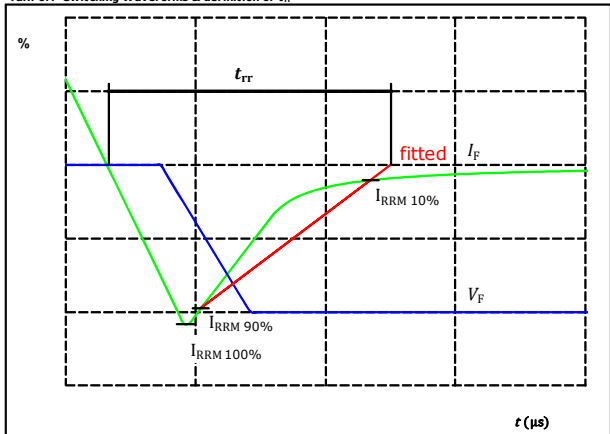
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_r =$	10	ns



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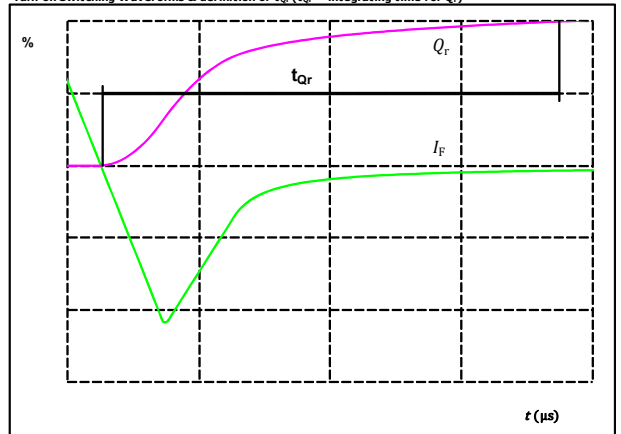
## Buck Switching Characteristics

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



$V_F(100\%) =$	350	V
$I_F(100\%) =$	90	A
$I_{RRM}(100\%) =$	158	A
$t_{rr} =$	74	ns

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



$I_F(100\%) =$	90	A
$Q_r(100\%) =$	6,78	$\mu\text{C}$



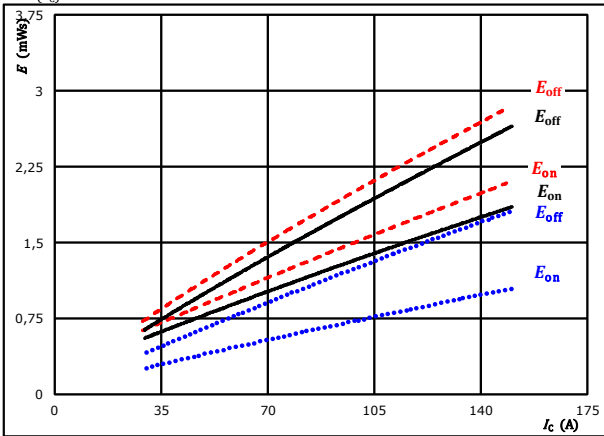
Vincotech

## Boost Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



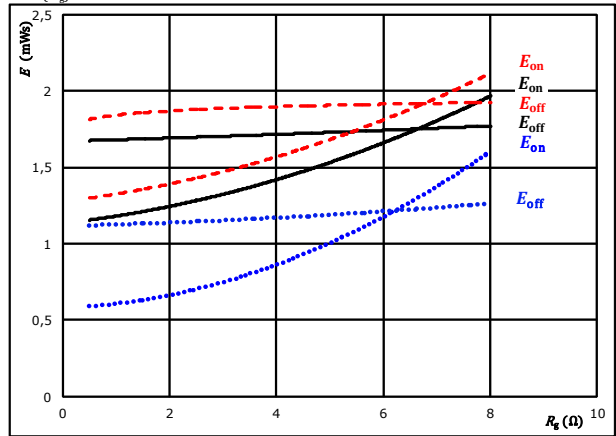
With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 2$   $\Omega$   
 $R_{goff} = 2$   $\Omega$

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

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



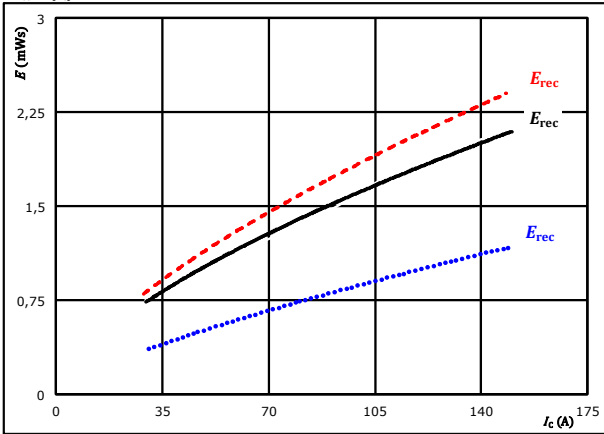
With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 90$  A

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

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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



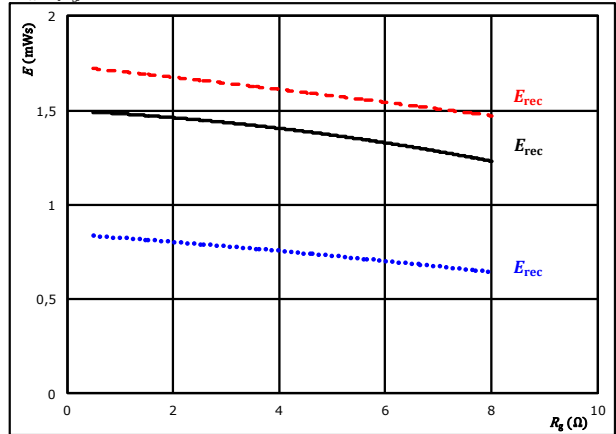
With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 2$   $\Omega$

$T_j$ : 25 °C (dotted line)  
 125 °C (solid line)  
 150 °C (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  
 $I_C = 90$  A

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

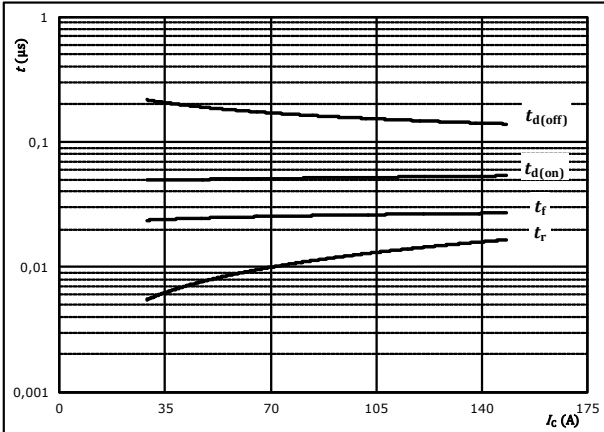


## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



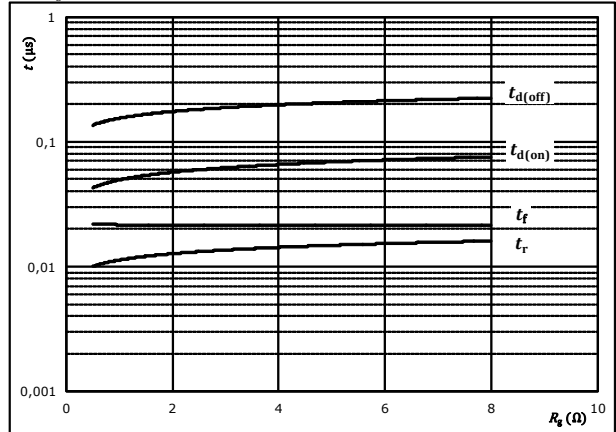
With an inductive load at

$T_j =$	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

$$t = f(R_g)$$



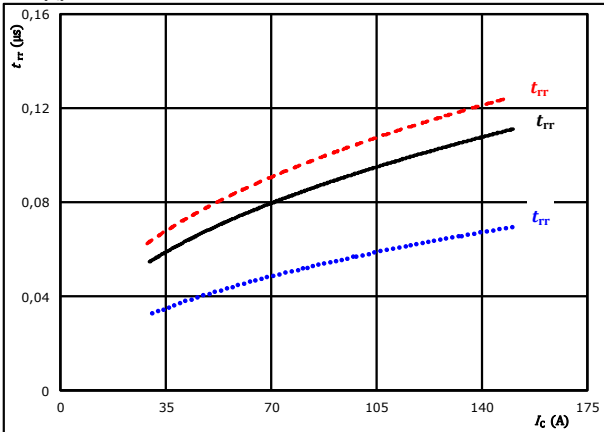
With an inductive load at

$T_j =$	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

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

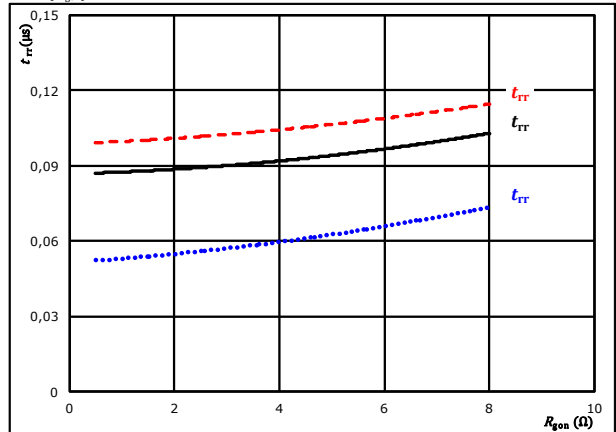


At	$V_{CE} =$	350	V	$T_j:$	25 °C	.....
	$V_{GE} =$	-5 / 15	V		125 °C	————
	$R_{gon} =$	2	Ω		150 °C	- - - -

**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	- - - -



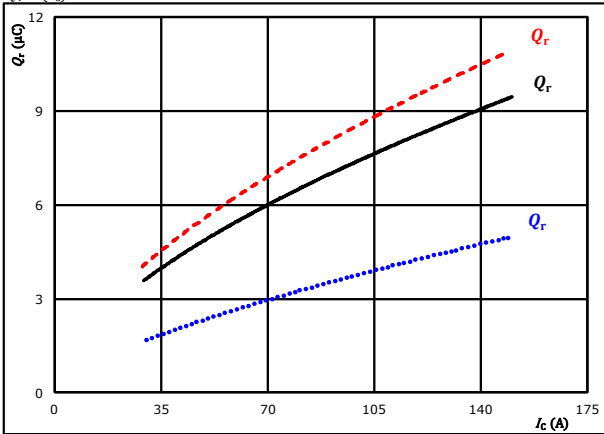
Vincotech

## Boost Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

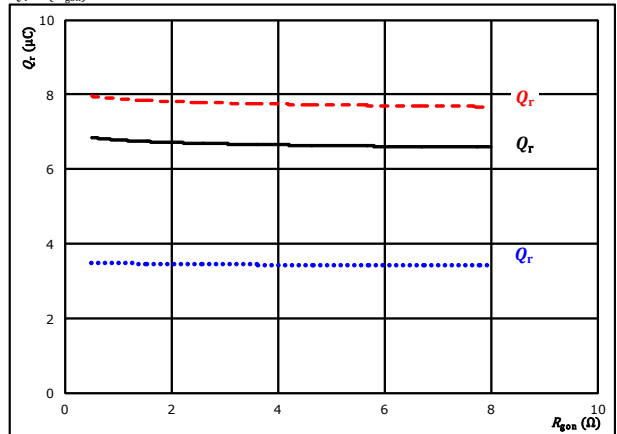


At  $V_{CE} = 350$  V  $T_j = 25$  °C  $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  $R_{gon} = 2$  Ω  $T_j = 150$  °C

**figure 10.** FWD

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

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

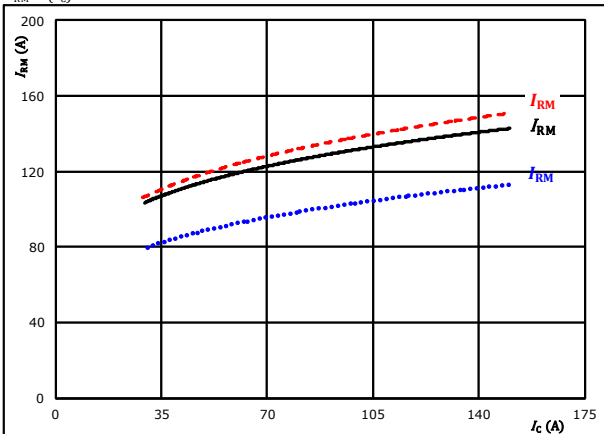


At  $V_{CE} = 350$  V  $T_j = 25$  °C  $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  $I_c = 90$  A  $T_j = 150$  °C

**figure 11.** FWD

Typical peak reverse recovery current as a function of collector current

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

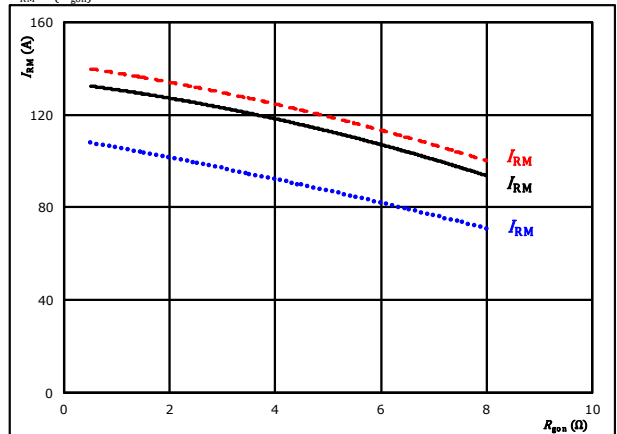


At  $V_{CE} = 350$  V  $T_j = 25$  °C  $V_{GE} = -5 / 15$  V  $T_j = 125$  °C  $R_{gon} = 2$  Ω  $T_j = 150$  °C

**figure 12.** FWD

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

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



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



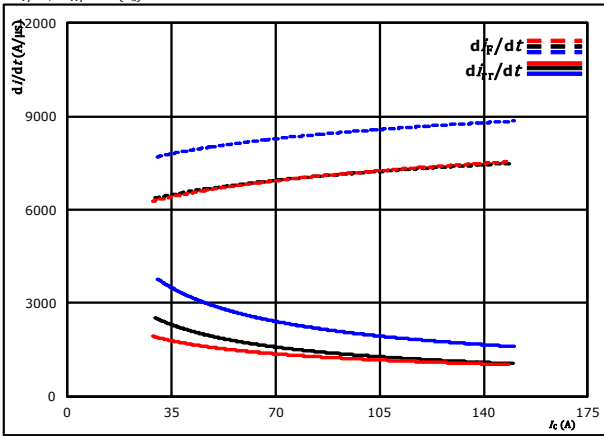


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## Boost Switching Characteristics

**figure 13.** FWD

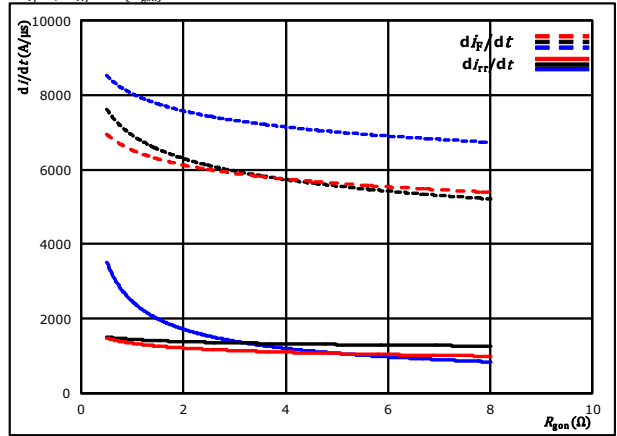
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



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

**figure 14.** FWD

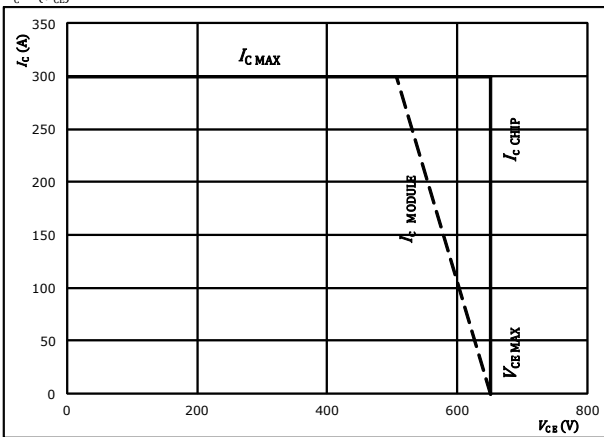
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



At  $V_{CE} = 350$  V  $T_j = 25$  °C  
 $V_{GE} = -5 / 15$  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  
 $R_{gon} = 2$  Ω  
 $R_{goff} = 2$  Ω



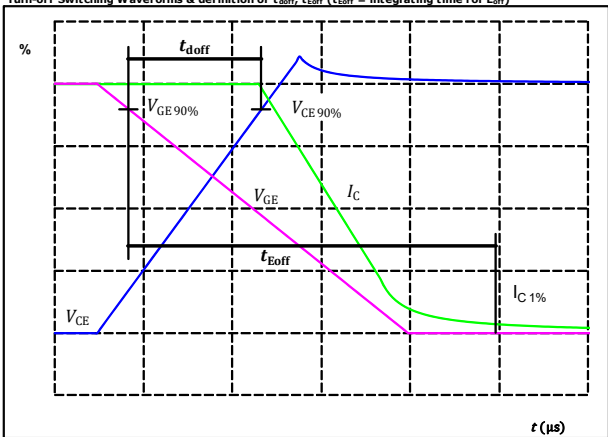
## Boost Switching Definitions

**General conditions**

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

**figure 1. IGBT**

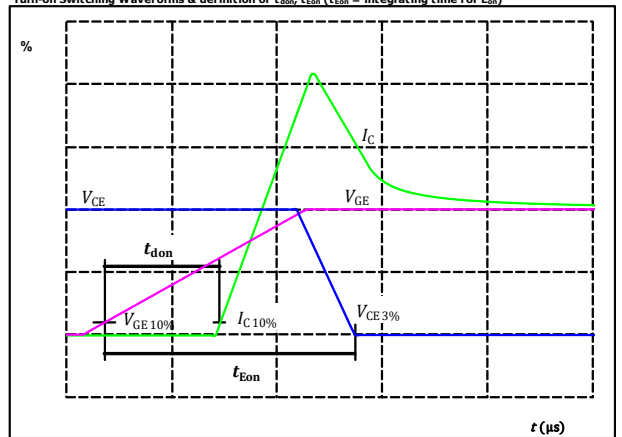
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{doff} =$	153	ns

**figure 2. IGBT**

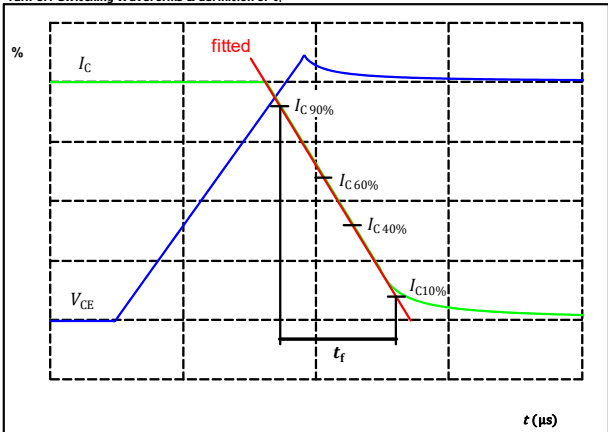
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_{don} =$	52	ns

**figure 3. IGBT**

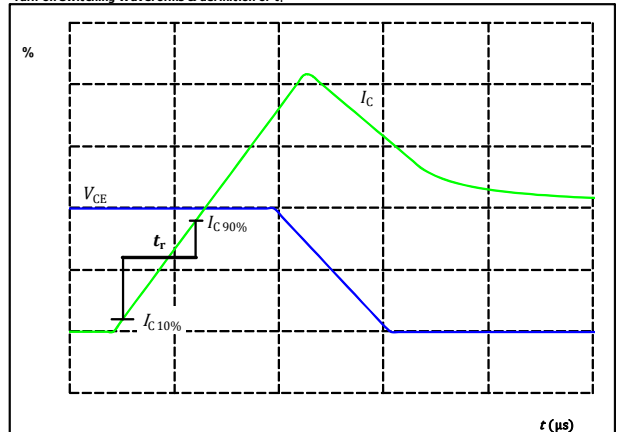
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_f =$	19	ns

**figure 4. IGBT**

Turn-on Switching Waveforms & definition of  $t_r$



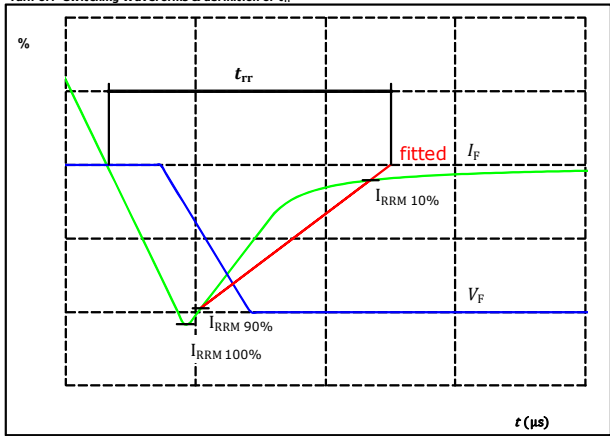
$V_C(100\%) =$	350	V
$I_C(100\%) =$	90	A
$t_r =$	11	ns



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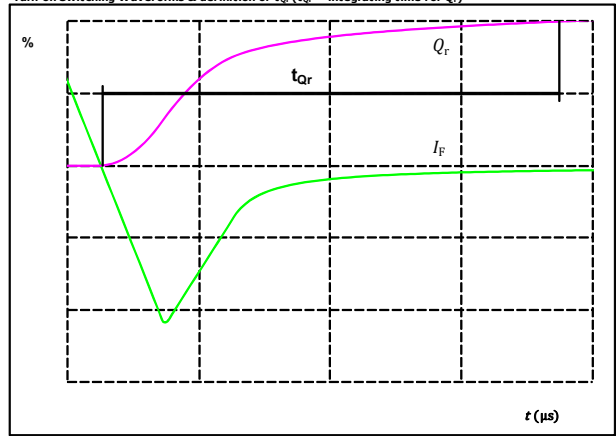
## Boost Switching Characteristics

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



$V_F(100\%) =$	350	V
$I_F(100\%) =$	90	A
$I_{RRM}(100\%) =$	127	A
$t_{rr} =$	88	ns

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



$I_F(100\%) =$	90	A
$Q_r(100\%) =$	6,78	$\mu\text{C}$



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Ordering Code & Marking																																
<b>Version</b>				<b>Ordering Code</b>																												
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																												
<table border="1"> <thead> <tr> <th rowspan="2">Text</th> <th colspan="2">Name</th> <th>Date code</th> <th>UL &amp; VIN</th> <th>Lot</th> <th>Serial</th> </tr> <tr> <td colspan="2">NN-NNNNNNNNNNNNNN-TTTTTTVV</td> <td>WWYY</td> <td>UL VIN</td> <td>LLLLL</td> <td>SSSS</td> </tr> </thead> <tbody> <tr> <td rowspan="2">Datamatrix</td> <td>Type&amp;Ver</td> <td>Lot number</td> <td>Serial</td> <td>Date code</td> <td></td> <td></td> </tr> <tr> <td>TTTTTTVV</td> <td>LLLLL</td> <td>SSSS</td> <td>WWYY</td> <td></td> <td></td> </tr> </tbody> </table>							Text	Name		Date code	UL & VIN	Lot	Serial	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS	Datamatrix	Type&Ver	Lot number	Serial	Date code			TTTTTTVV	LLLLL	SSSS	WWYY		
Text	Name		Date code	UL & VIN	Lot	Serial																										
	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS																										
Datamatrix	Type&Ver	Lot number	Serial	Date code																												
	TTTTTTVV	LLLLL	SSSS	WWYY																												

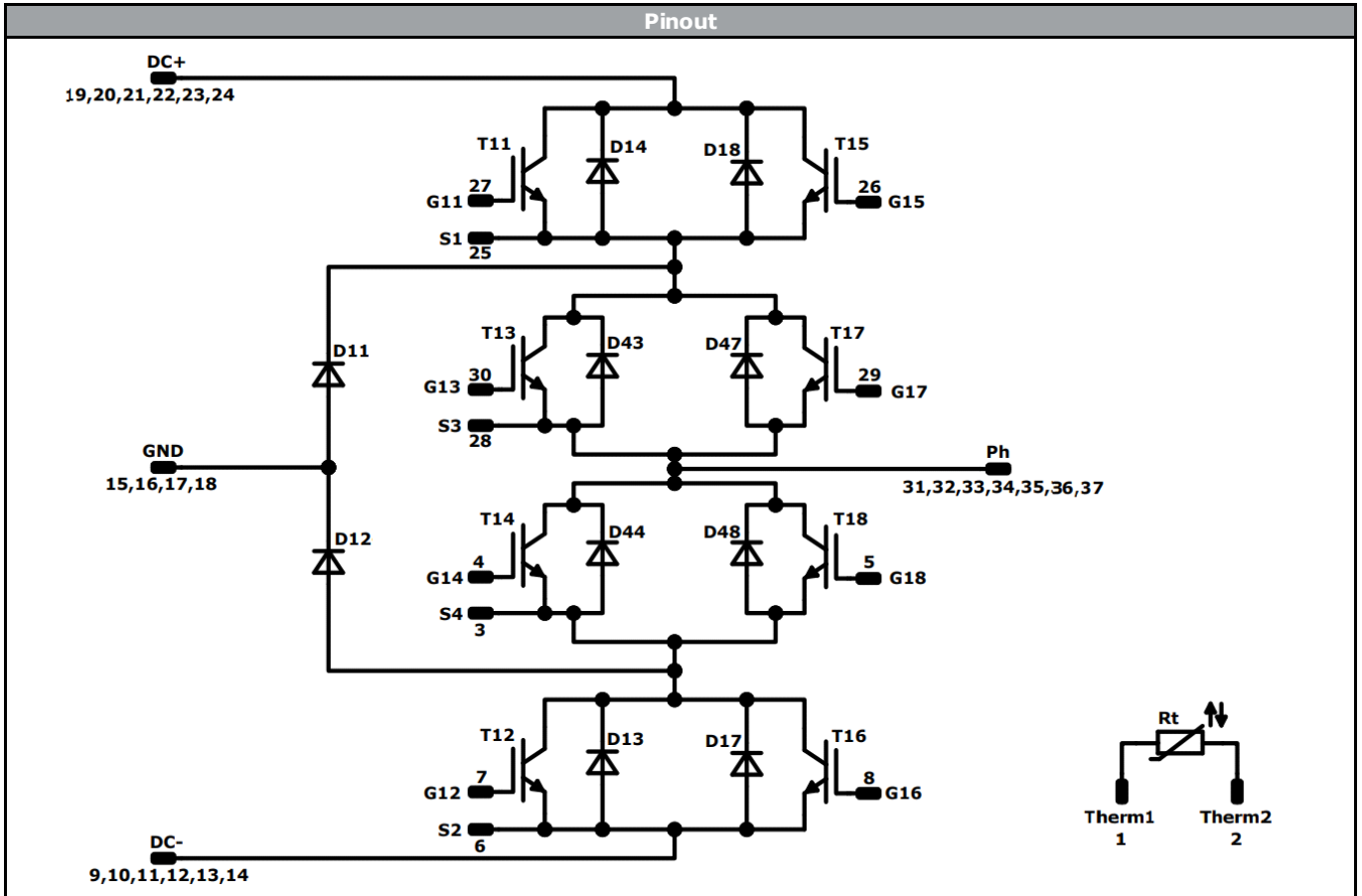
Pin table			
Pin	X	Y	Function
1	52,2	6,9	Therm1
2	52,2	0	Therm2
3	36,2	6,75	S4
4	33,2	7,9	G14
5	33,2	4,9	G18
6	9,2	5,75	S2
7	6,2	6,9	G12
8	6,2	3,9	G16
9	2,7	0	DC-
10	0	0	DC-
11	2,7	2,7	DC-
12	0	2,7	DC-
13	2,7	5,4	DC-
14	0	5,4	DC-
15	2,7	12,75	GND
16	0	12,75	GND
17	2,7	15,45	GND
18	0	15,45	GND
19	2,7	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

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

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>					
<b>ID</b>	<b>Component</b>	<b>Voltage</b>	<b>Current</b>	<b>Function</b>	<b>Comment</b>
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-D2-14	21 Jun. 2018	Correct Boost switch and diode switching values	22-27

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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