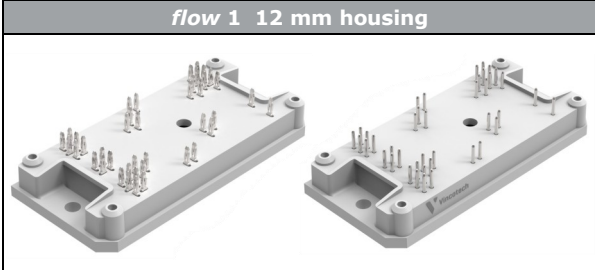
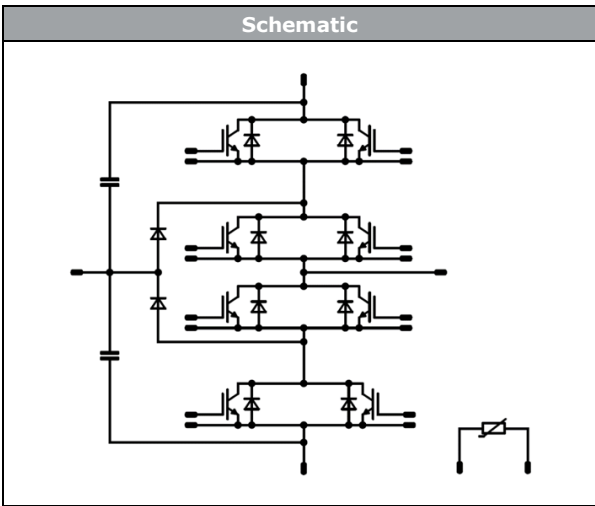




<b>flowNPC 1</b>	<b>650 V / 80 A</b>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; margin: 0;"><b>Features</b></p> <ul style="list-style-type: none"> <li>Neutral Point Clamped Topology (I-Type)</li> <li>4 quadrant operation, very high speed</li> <li>Integrated DC capacitor and temperature sensor</li> <li>Kelvin Emitter for improved switching performance</li> <li>Press-fit pins and solder pins</li> </ul> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Power Supply</li> <li>Solar Inverters</li> <li>UPS</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>10-FY07NIB080SM03-L095F03</li> <li>10-PY07NIB080SM03-L095F03Y</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; margin: 0;"><b>flow 1 12 mm housing</b></p>  </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;"><b>Schematic</b></p>  </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Buck Switch / Boost Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	60	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	240	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	109	W
Gate-emitter voltage	$V_{GES}$		±20	V
Maximum junction temperature	$T_{jmax}$		175	°C



## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Buck Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	74	A
Repetitive peak forward current	$I_{FRM}$		160	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	103	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	A
Repetitive peak forward current	$I_{FRM}$		240	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	140	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Boost Sw. Protection Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	63	A
Repetitive peak forward current	$I_{FRM}$		120	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	98	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Capacitor (DC)</b>				
Maximum DC voltage	$V_{MAX}$		630	V
Operation Temperature	$T_{op}$		-55...+125	°C



### Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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#### Module Properties

##### Thermal Properties

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

##### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance		Solder Pin	8,33	mm
		Press-fit Pin	8,15	
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]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$				0,0008	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		80	25 125 150		1,64 1,89 1,95	2,22	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			80	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			240	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							5000		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		80		
Reverse transfer capacitance	$C_{res}$							18		
Gate charge	$Q_g$		15	520	80	25		190		nC

#### Thermal

Parameter	Symbol	$\lambda_{paste} = 3,4$ W/mK (PSX)	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$							0,87		K/W

#### Dynamic

Parameter	Symbol	$R_{gon} = 8$ Ω $R_{goff} = 8$ Ω	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit	
Turn-on delay time	$t_{d(on)}$					25 125 150		46 47 48		ns	
Rise time	$t_r$					25 125 150		7 8 9			
Turn-off delay time	$t_{d(off)}$					25 125 150		125 147 151			
Fall time	$t_f$					25 125 150		6 7 7			
Turn-on energy (per pulse)	$E_{on}$	$Q_{t-FWD} = 1,7$ μC $Q_{t-FWD} = 3,3$ μC $Q_{t-FWD} = 3,8$ μC				25 125 150		0,461 0,686 0,735			mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,250 0,364 0,394			



### Characteristic Values

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

#### Buck Diode

##### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			80	25 125 150		1,52 1,47 1,45	1,92	V
Reverse leakage current	$I_R$		650		25			4,2	µA

##### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	0,92	K/W

##### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125 150		50 68 73		A
Reverse recovery time	$t_{rr}$				25 125 150		52 79 90		ns
Recovered charge	$Q_r$	$di/dt = 3712$ A/µs $di/dt = 3734$ A/µs $di/dt = 3515$ A/µs	-5 / 15	350	40	25 125 150	1,693 3,313 3,815		µC
Reverse recovered energy	$E_{rec}$				25 125 150		0,360 0,765 0,884		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$				25 125 150		1317 1064 1003		A/µs



Vincotech

**10-FY07NIB080SM03-L095F03 /**  
**10-PY07NIB080SM03-L095F03Y**  
 datasheet

### 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	$V_{GE(th)}$				0,0008	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CESat}$		15		80	25 125 150		1,64 1,89 1,95	2,22	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			80	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			240	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							5000		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		80		
Reverse transfer capacitance	$C_{res}$							18		
Gate charge	$Q_g$		15	520	80	25		190		nC

##### Thermal

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)			0,87	K/W

##### Dynamic

Parameter	Symbol	Conditions	$V_{GS}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit		
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$				25 125 150		25 24 45		ns		
Rise time	$t_r$					25 125 150		8 9 9				
Turn-off delay time	$t_{d(off)}$					25 125 150		173 203 152				
Fall time	$t_f$		-5 / 15	350	40	25 125 150		4 5 8				
Turn-on energy (per pulse)	$E_{on}$		$Q_{t-FWD} = 1,8 \mu C$ $Q_{t-FWD} = 3,8 \mu C$ $Q_{t-FWD} = 4,3 \mu C$				25 125 150		0,593 0,857 0,879			mWs
Turn-off energy (per pulse)	$E_{off}$						25 125 150		0,232 0,379 0,418			



Vincotech

**10-FY07NIB080SM03-L095F03 /**  
**10-PY07NIB080SM03-L095F03Y**  
 datasheet

## 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	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			120	25 125 150		1,48 1,40 1,37	1,92	V
Reverse leakage current	$I_R$		650		25			6,4	µA

#### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	0,68	K/W

#### Dynamic

Parameter	Symbol	$dI/dt$	$V_{CE}$	$I_C$	$T_j$	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125 150		44 54 60		A
Reverse recovery time	$t_{rr}$				25 125 150		65 86 95		ns
Recovered charge	$Q_r$	$dI/dt = 5704$ A/µs $dI/dt = 4474$ A/µs $dI/dt = 4573$ A/µs	-5 / 15	350	40	25 125 150	1,795 3,814 4,331		µC
Reverse recovered energy	$E_{rec}$				25 125 150		0,351 0,824 0,951		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		413 3324 2033		A/µs

### Boost Sw. Protection Diode

#### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			60	25 125	1,23	1,70 1,59	1,87	V
Reverse leakage current	$I_R$		650		25			0,72	µA

#### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	0,96	K/W

### Capacitor (DC)

Parameter	Symbol	Value	Unit
Capacitance	$C$	47	nF
Tolerance		-10	+10 %
Climatic category		55/125/56	



### 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		kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1486 \Omega$			100	-12		+14	%
Power dissipation	$P$				25		200		mW
Power dissipation constant					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 3\%$			25		3950		K
B-value	$B_{(25/100)}$	Tol. $\pm 3\%$			25		3998		K
Vincotech NTC Reference								B	



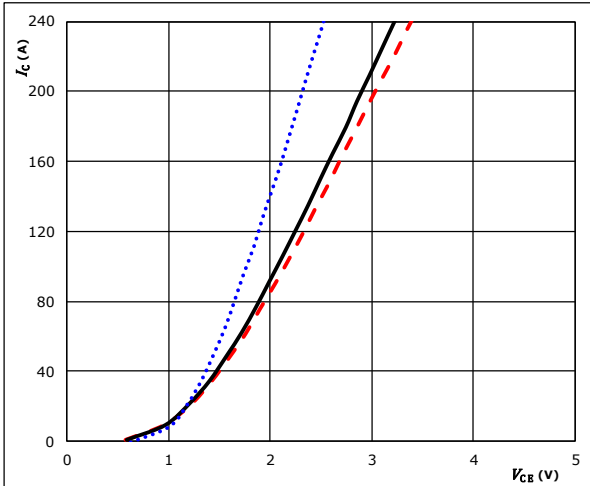


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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

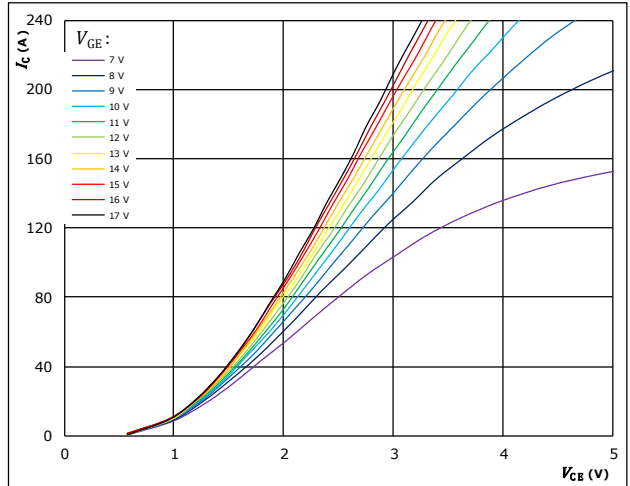


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 \text{ }^\circ C$  (dotted blue)  
 $125 \text{ }^\circ C$  (solid black)  
 $150 \text{ }^\circ C$  (dashed red)

**figure 2.** IGBT

Typical output characteristics

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

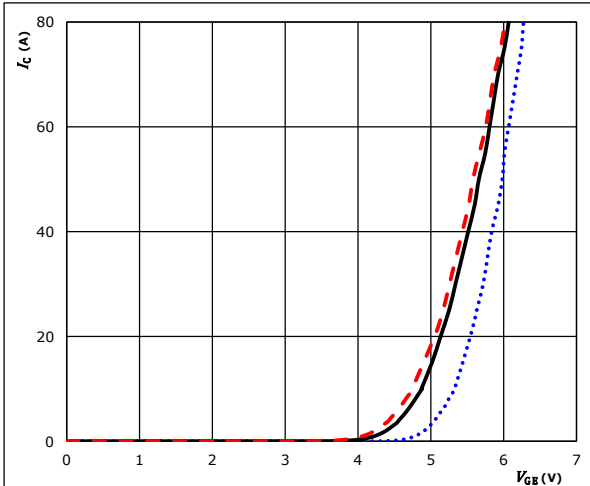


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

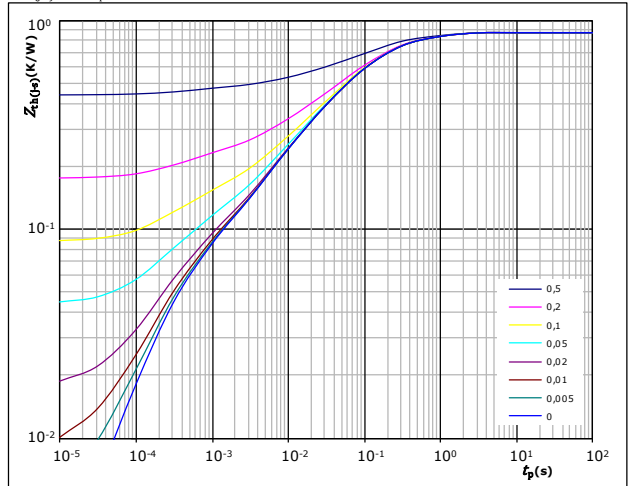


$t_p = 100 \mu s$   
 $V_{CE} = 3634 V$   
 $T_j: 25 \text{ }^\circ C$  (dotted blue)  
 $125 \text{ }^\circ C$  (solid black)  
 $150 \text{ }^\circ C$  (dashed red)

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,87 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
1,42E-01	7,24E-01
3,44E-01	1,23E-01
1,79E-01	3,69E-02
1,18E-01	9,05E-03
3,80E-02	2,24E-03
5,36E-02	3,22E-04

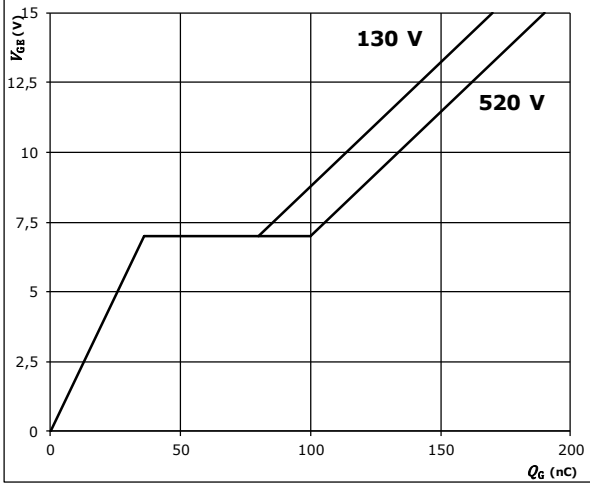


### Buck Switch Characteristics

**figure 5.** IGBT

Gate voltage vs gate charge

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

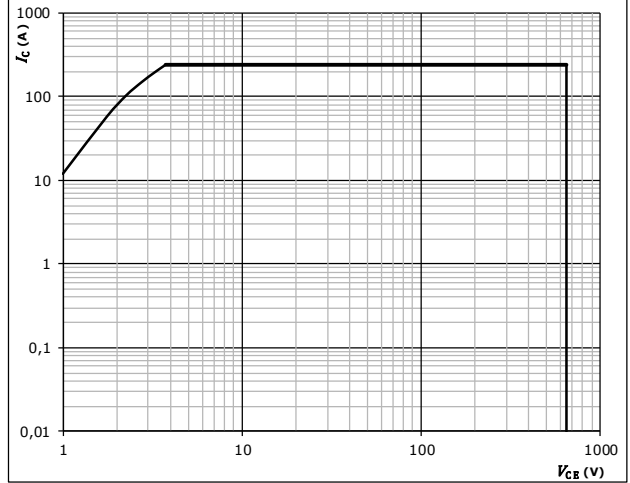


$I_C = 80$  A

**figure 6.** IGBT

Safe operating area

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



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

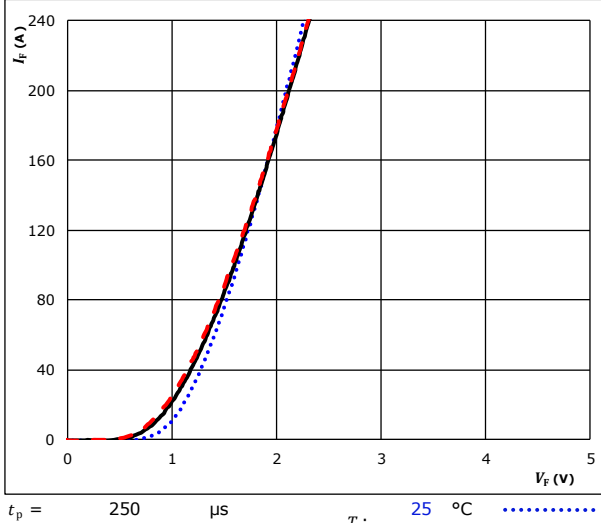


### Buck Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

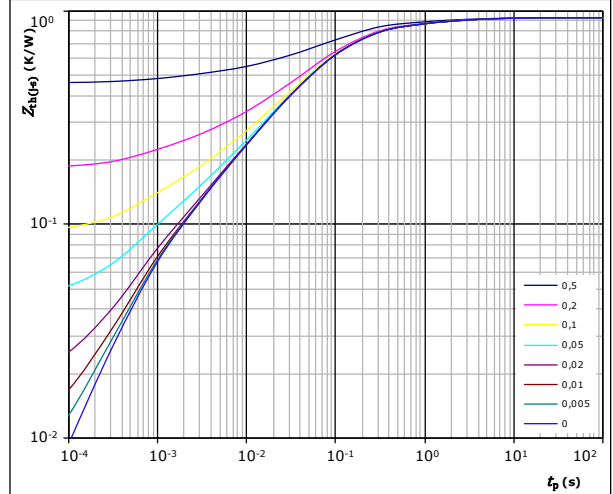
$$I_F = f(V_F)$$



**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$$D = \frac{t_p}{T}$$

$$R_{th(j-s)} = 0,92 \text{ K/W}$$

FWD thermal model values

R (K/W)	$\tau$ (s)
4,25E-02	4,35E+00
1,12E-01	6,58E-01
3,86E-01	1,10E-01
2,10E-01	3,30E-02
1,09E-01	7,30E-03
6,17E-02	8,74E-04

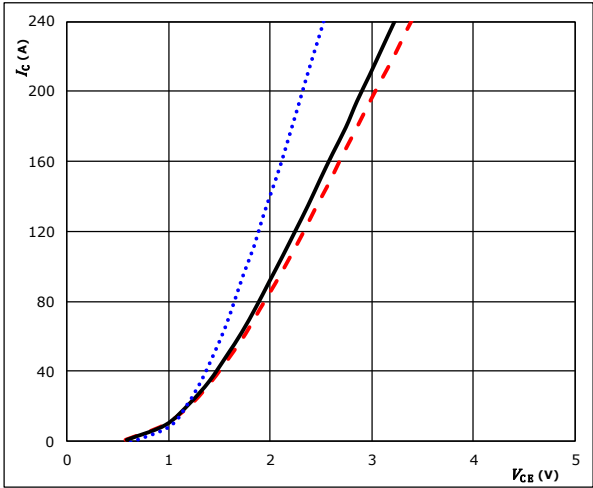


### Boost Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

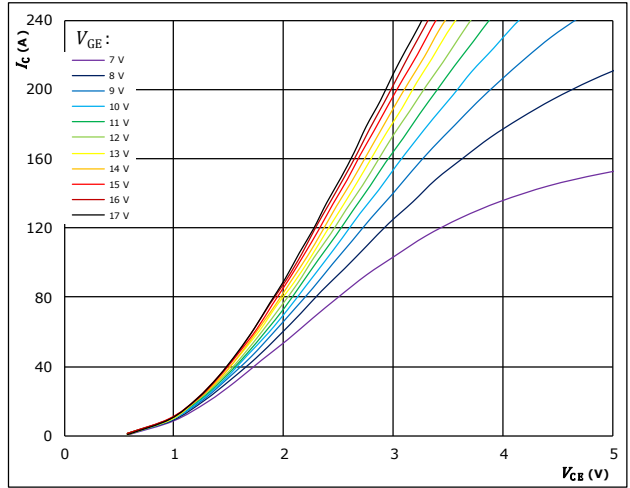


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 \text{ }^\circ C$  (dotted blue line)  
 $125 \text{ }^\circ C$  (dashed red line)  
 $150 \text{ }^\circ C$  (solid black line)

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

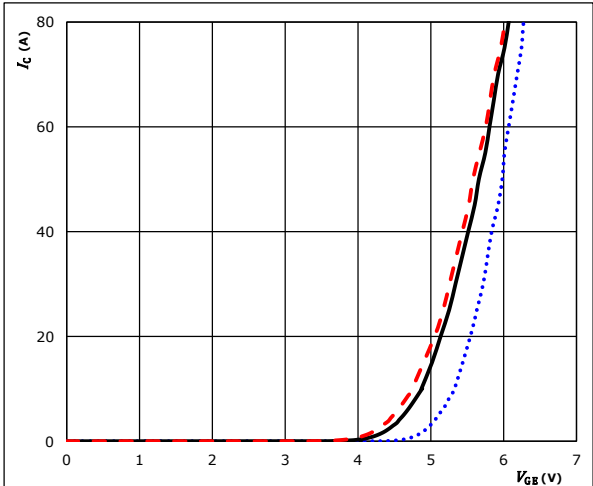


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

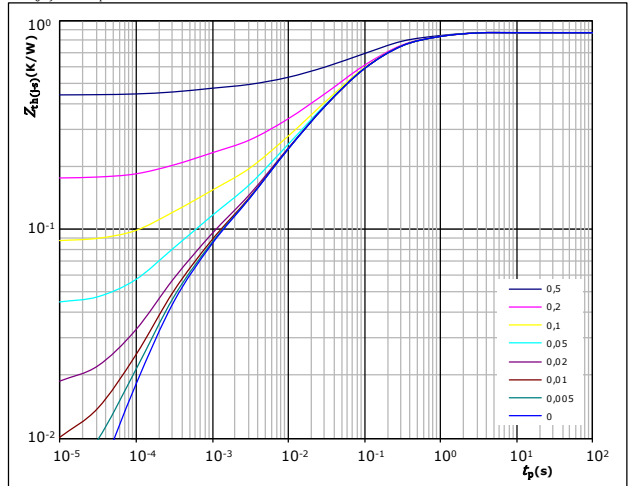


$t_p = 100 \mu s$   
 $V_{CE} = 3634 V$   
 $T_j: 25 \text{ }^\circ C$  (dotted blue line)  
 $125 \text{ }^\circ C$  (dashed red line)  
 $150 \text{ }^\circ C$  (solid black line)

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,87 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
1,42E-01	7,24E-01
3,44E-01	1,23E-01
1,79E-01	3,69E-02
1,18E-01	9,05E-03
3,80E-02	2,24E-03
5,36E-02	3,22E-04

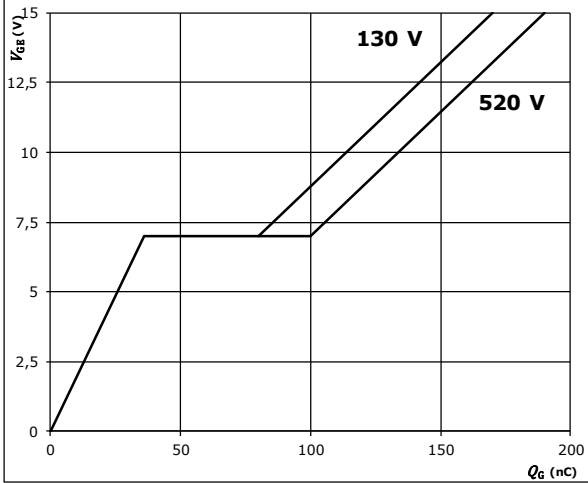


### Boost Switch Characteristics

**figure 5.** IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

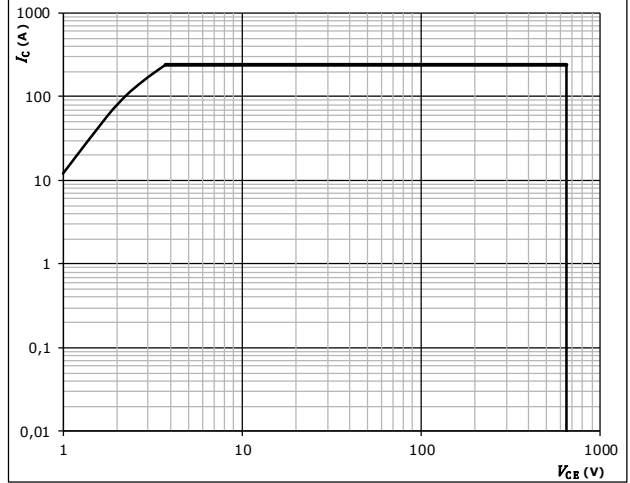


$I_C = 80$  A

**figure 6.** IGBT

Safe operating area

$I_C = f(V_{CE})$



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

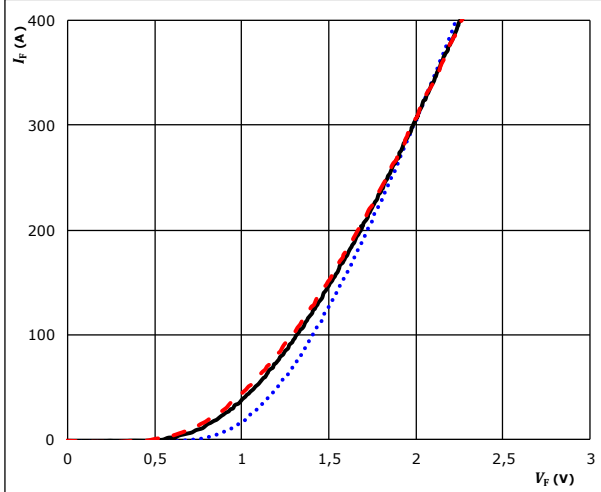


### Boost Diode Characteristics

**figure 1.** **FWD**

Typical forward characteristics

$$I_F = f(V_F)$$

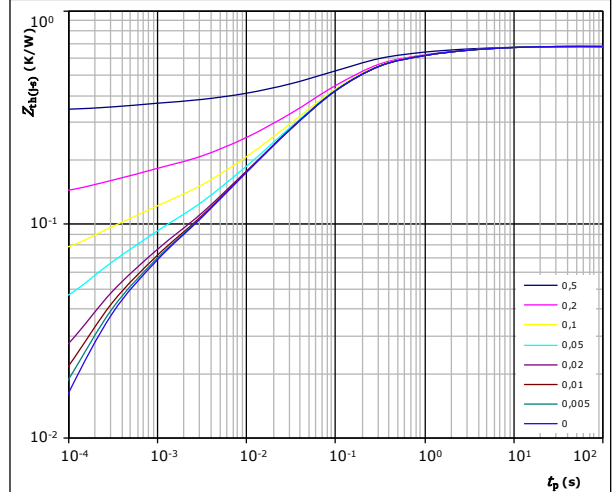


$t_p =$  250  $\mu$ s  
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** **FWD**

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 0,68$  K/W

FWD thermal model values

R (K/W)	$\tau$ (s)
3,92E-02	5,75E+00
8,22E-02	9,83E-01
2,55E-01	1,51E-01
1,58E-01	4,02E-02
7,12E-02	8,23E-03
2,99E-02	1,81E-03
4,25E-02	2,74E-04

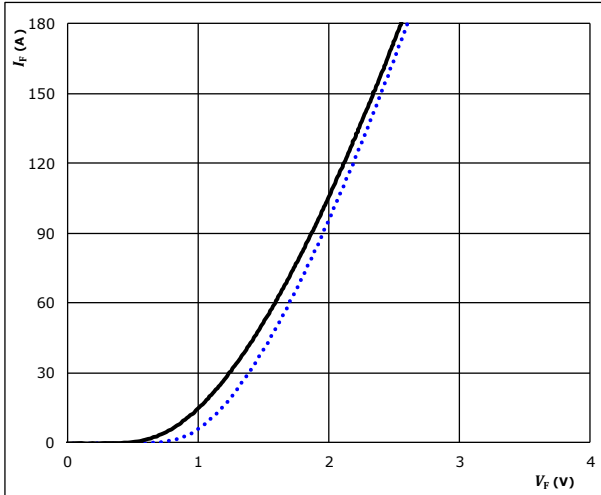


## Boost Sw. Protection Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

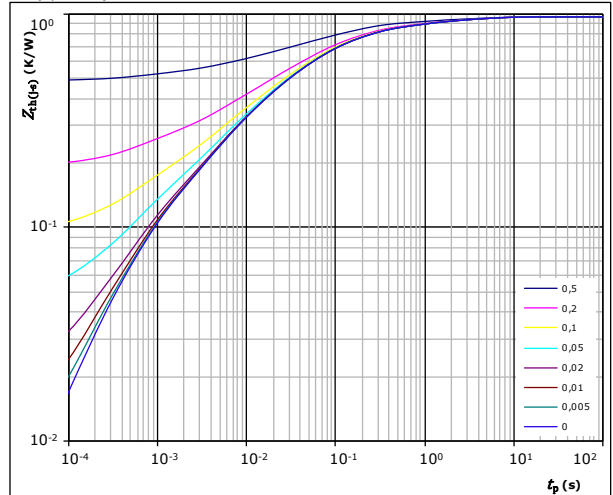


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ\text{C}$  (dotted blue line)  $125 \text{ }^\circ\text{C}$  (solid black line)

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,96 \text{ K/W}$

FWD thermal model values

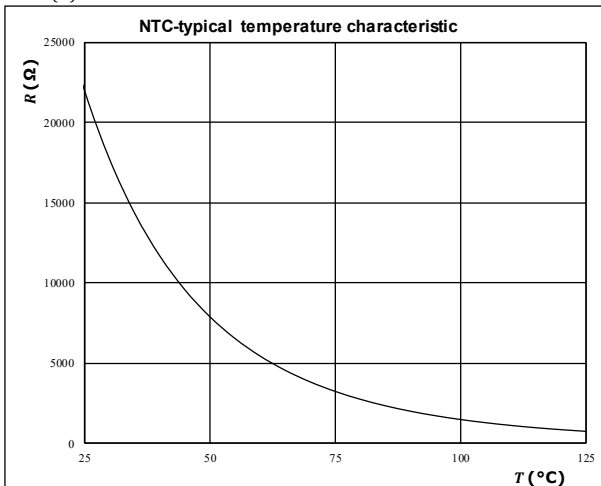
$R \text{ (K/W)}$	$\tau \text{ (s)}$
7,25E-02	3,37E+00
1,28E-01	5,13E-01
3,41E-01	8,29E-02
2,28E-01	1,76E-02
1,27E-01	3,85E-03
6,83E-02	5,32E-04

## Thermistor Characteristics

**figure 1.** Thermistor

Typical NTC characteristic  
as a function of temperature

$$R = f(T)$$



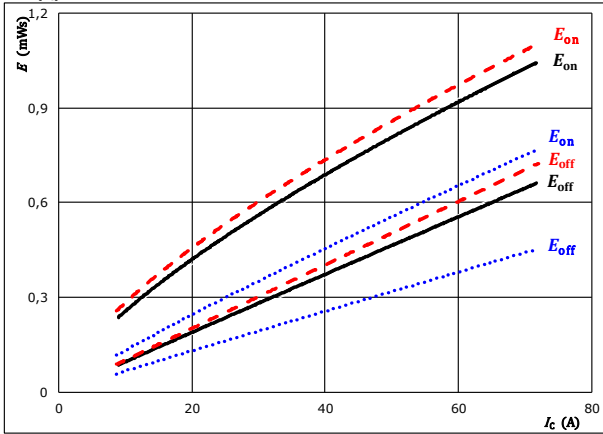


## Buck Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

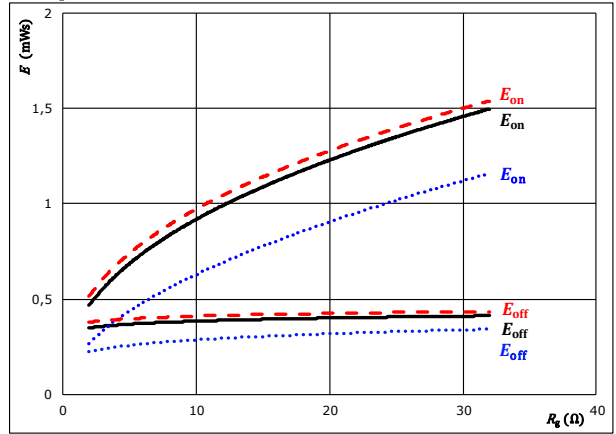


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{g(on)} = 8$   $\Omega$   
 $R_{g(off)} = 8$   $\Omega$   
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$

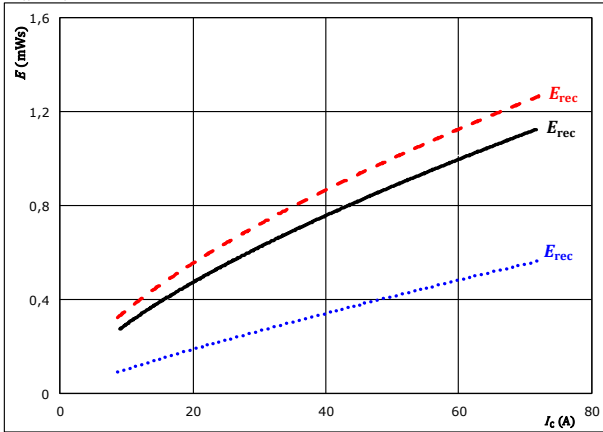


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 40$  A  
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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

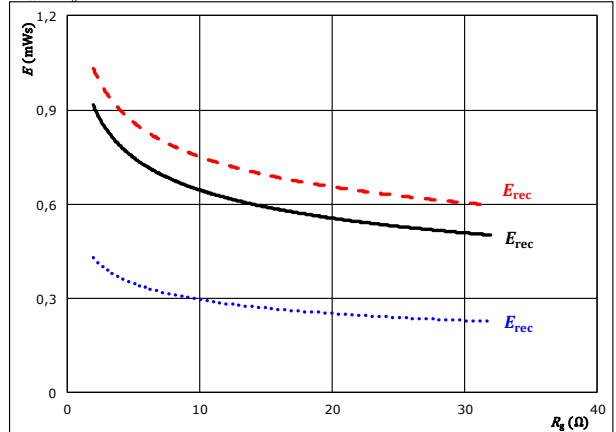


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{g(on)} = 8$   $\Omega$   
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

**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  
 $I_C = 40$  A  
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C



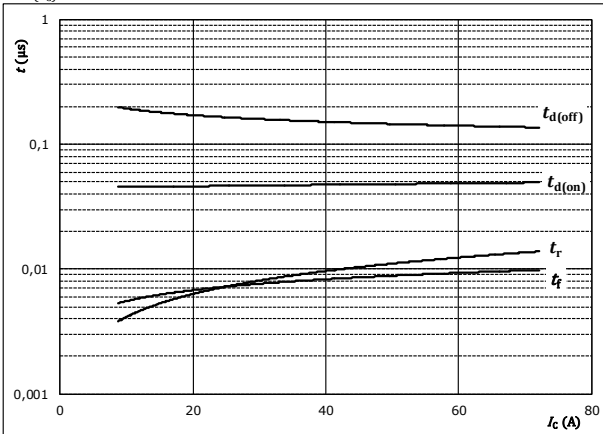


## Buck Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



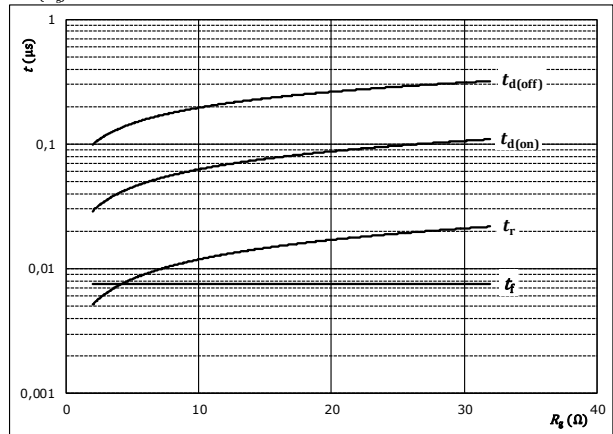
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	-5 / 15	V
$R_{g(on)} =$	8	Ω
$R_{g(off)} =$	8	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



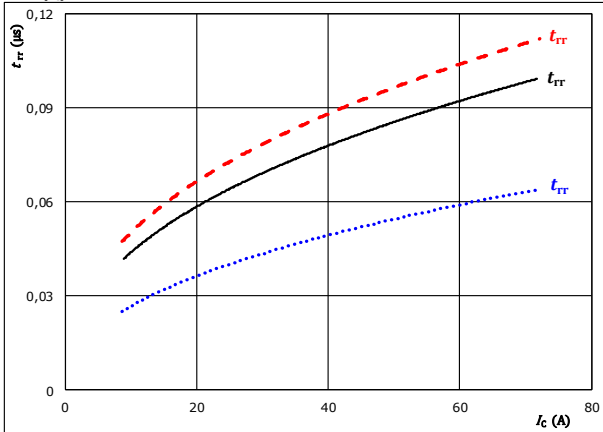
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	-5 / 15	V
$I_C =$	40	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

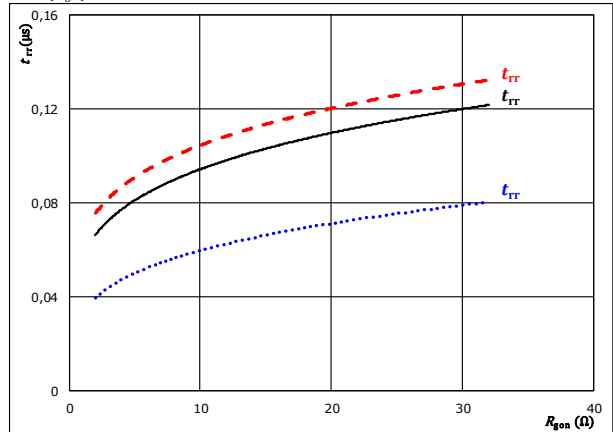
$V_{CE} =$	350	V
$V_{GE} =$	-5 / 15	V
$R_{g(on)} =$	8	Ω

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

**figure 8.** FWD

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

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



With an inductive load at

$V_{CE} =$	350	V
$V_{GE} =$	-5 / 15	V
$I_C =$	40	A

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

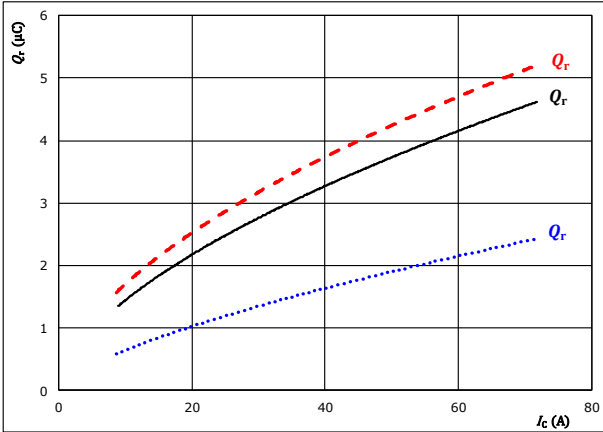


## Buck Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

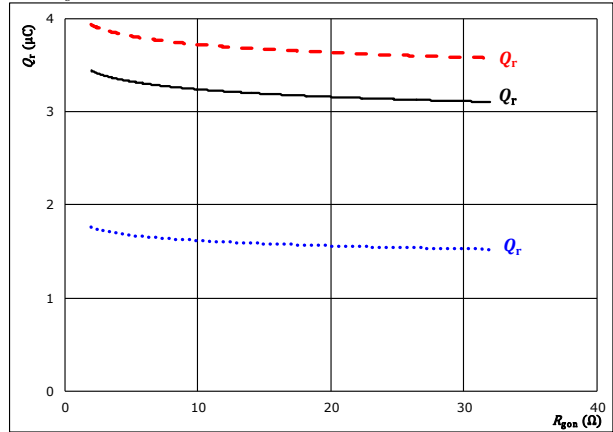


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gpn} = 8$   $\Omega$   
 $T_j: 25$  °C (dotted blue),  $125$  °C (solid black),  $150$  °C (dashed red)

figure 10. FWD

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

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

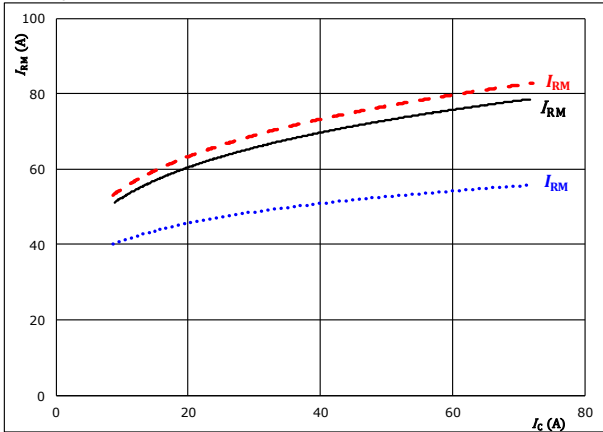


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 40$  A  
 $T_j: 25$  °C (dotted blue),  $125$  °C (solid black),  $150$  °C (dashed red)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

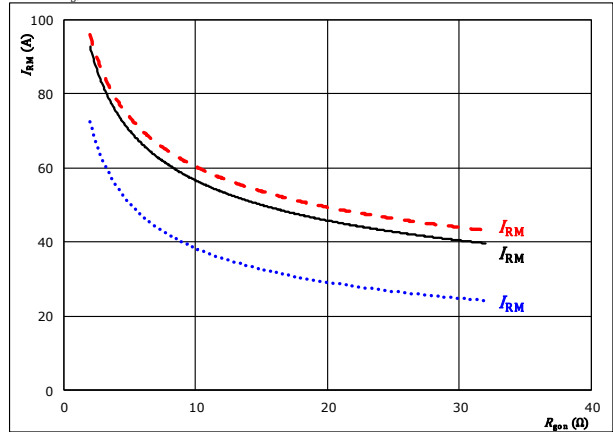


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gpn} = 8$   $\Omega$   
 $T_j: 25$  °C (dotted blue),  $125$  °C (solid black),  $150$  °C (dashed red)

figure 12. FWD

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

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 40$  A  
 $T_j: 25$  °C (dotted blue),  $125$  °C (solid black),  $150$  °C (dashed red)

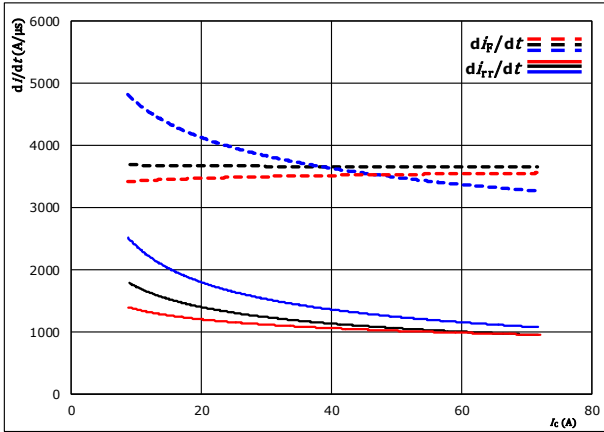


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## Buck Switching Characteristics

figure 13. FWD

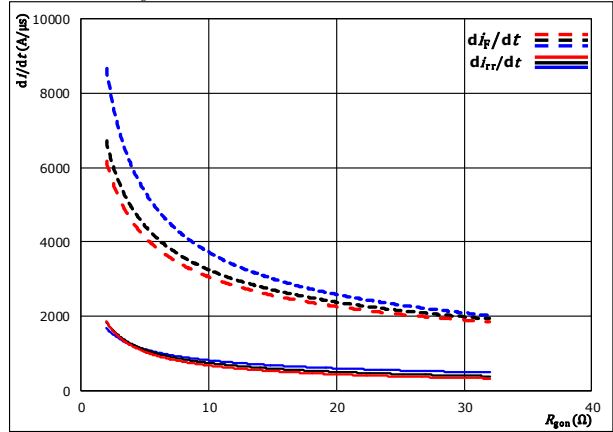
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j = 25$  °C  
 $150$  °C

figure 14. FWD

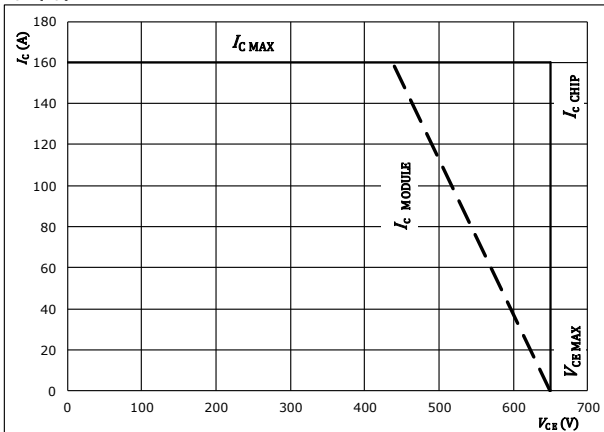
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 40$  A  
 $T_j = 25$  °C  
 $150$  °C

figure 15. IGBT

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



At  
 $T_j = 125$  °C  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

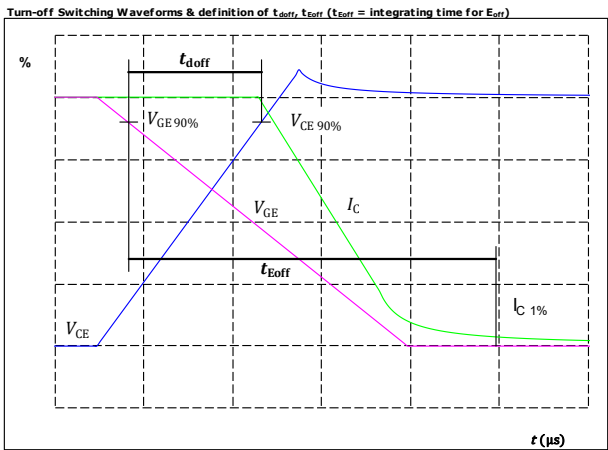


## Buck Switching Definitions

**General conditions**

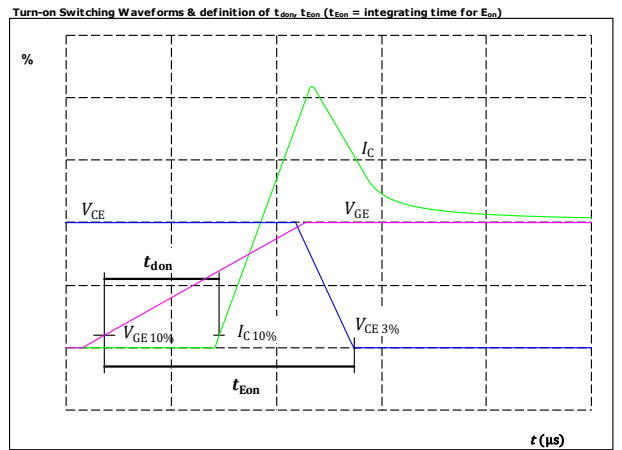
$T_j$	=	125 °C
$R_{gon}$	=	8 $\Omega$
$R_{goff}$	=	8 $\Omega$

**figure 1.** IGBT



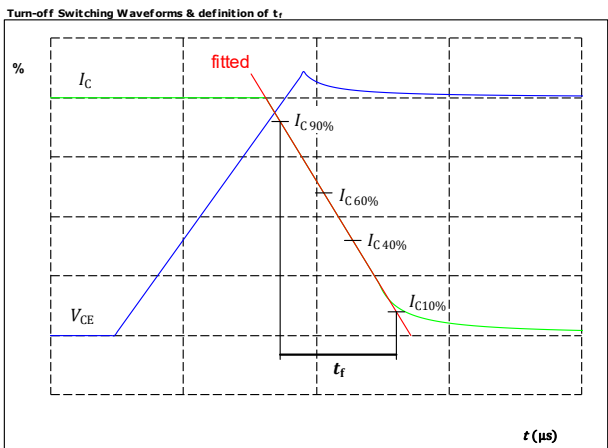
$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_{doff} =$	147	ns

**figure 2.** IGBT



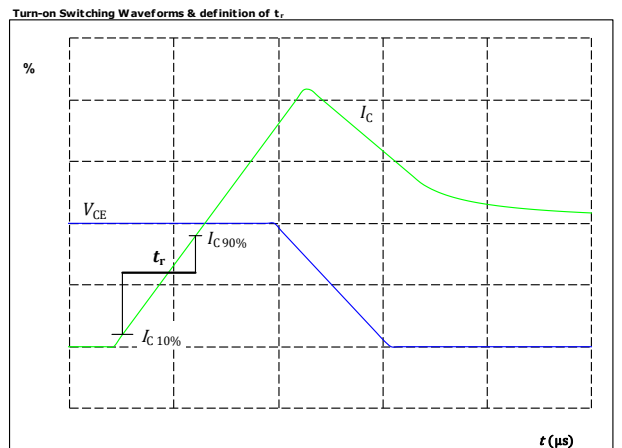
$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_{don} =$	47	ns

**figure 3.** IGBT



$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_r =$	7	ns

**figure 4.** IGBT



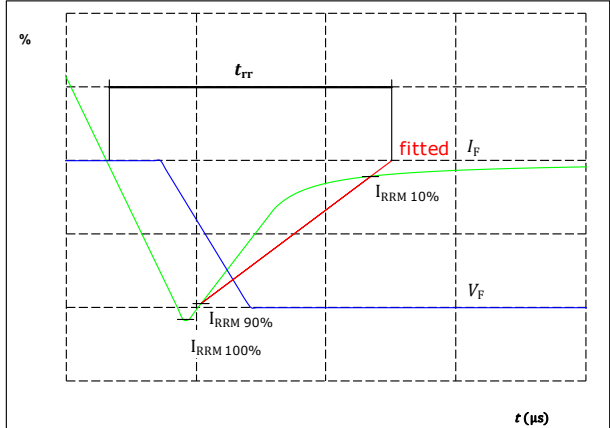
$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_r =$	8	ns



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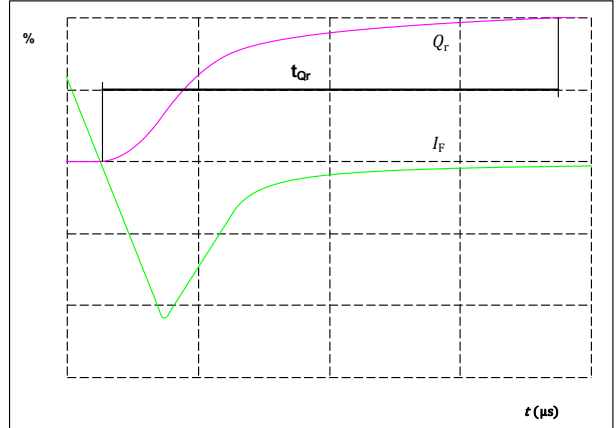
### Buck Switching Characteristics

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



$V_F(100\%) =$	350	V
$I_F(100\%) =$	40	A
$I_{RRM}(100\%) =$	68	A
$t_{rr} =$	79	ns

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



$I_F(100\%) =$	40	A
$Q_r(100\%) =$	3	$\mu\text{C}$

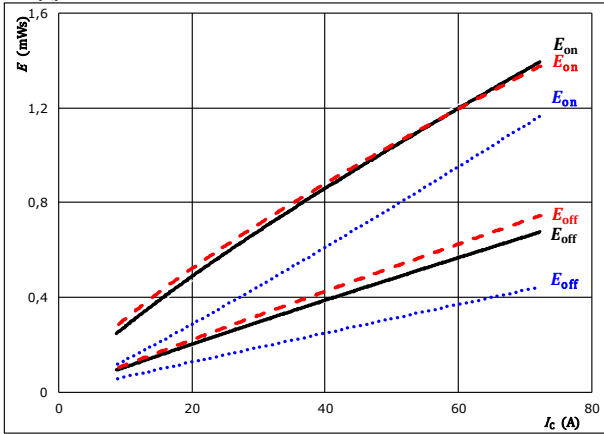


## Boost Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



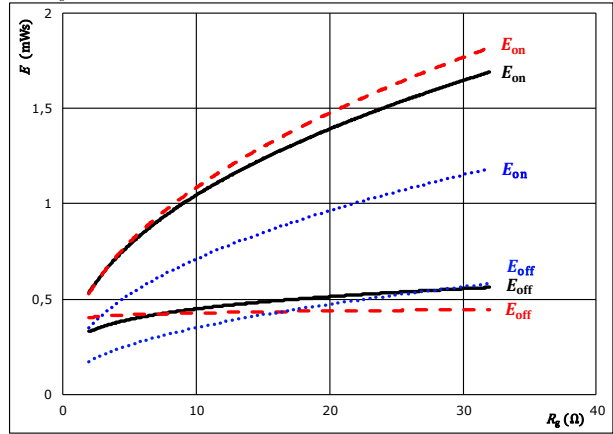
With an inductive load at

$V_{CE} =$	350 V	$T_j:$	25 °C	.....
$V_{GE} =$	-5 / 15 V		125 °C	————
$R_{g(on)} =$	8 Ω		150 °C	-----
$R_{g(off)} =$	8 Ω			

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



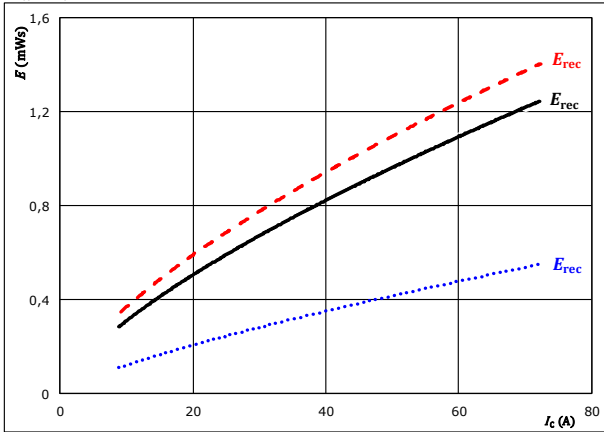
With an inductive load at

$V_{CE} =$	350 V	$T_j:$	25 °C	.....
$V_{GE} =$	-5 / 15 V		125 °C	————
$I_c =$	40 A		150 °C	-----

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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



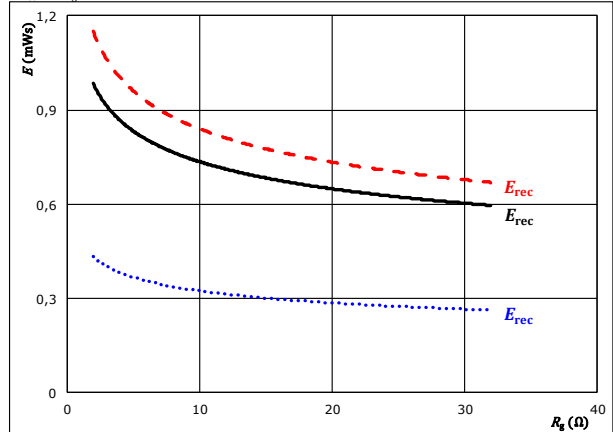
With an inductive load at

$V_{CE} =$	350 V	$T_j:$	25 °C	.....
$V_{GE} =$	-5 / 15 V		125 °C	————
$R_{g(on)} =$	8 Ω		150 °C	-----

**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	$T_j:$	25 °C	.....
$V_{GE} =$	-5 / 15 V		125 °C	————
$I_c =$	40 A		150 °C	-----

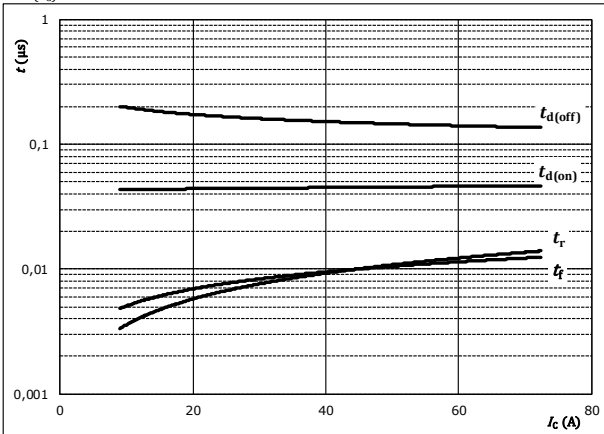


## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



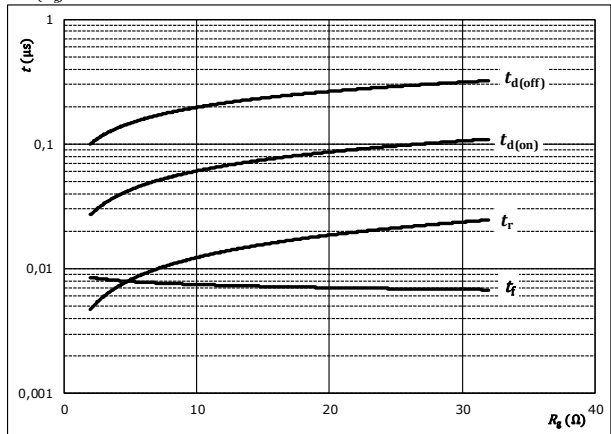
With an inductive load at

$T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{g\text{on}} = 8 \text{ } \Omega$   
 $R_{g\text{off}} = 8 \text{ } \Omega$

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



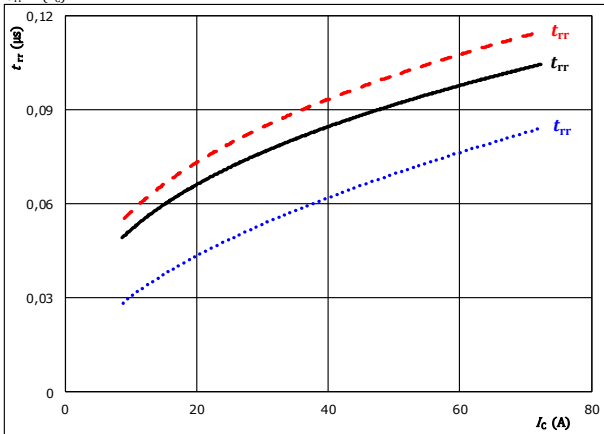
With an inductive load at

$T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_C = 40 \text{ A}$

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

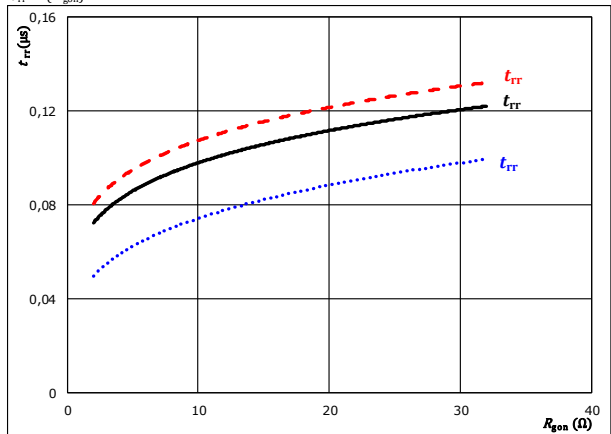
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $R_{g\text{on}} = 8 \text{ } \Omega$

$T_j: 25 \text{ }^\circ\text{C}$  (dotted blue)  
 $125 \text{ }^\circ\text{C}$  (solid black)  
 $150 \text{ }^\circ\text{C}$  (dashed red)

**figure 8.** FWD

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

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



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5 / 15 \text{ V}$   
 $I_C = 40 \text{ A}$

$T_j: 25 \text{ }^\circ\text{C}$  (dotted blue)  
 $125 \text{ }^\circ\text{C}$  (solid black)  
 $150 \text{ }^\circ\text{C}$  (dashed red)

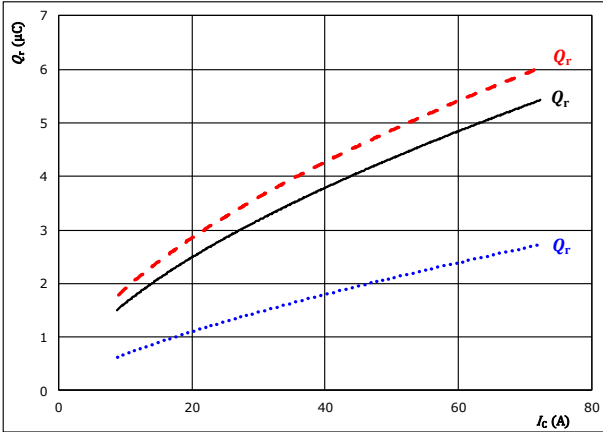


## Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

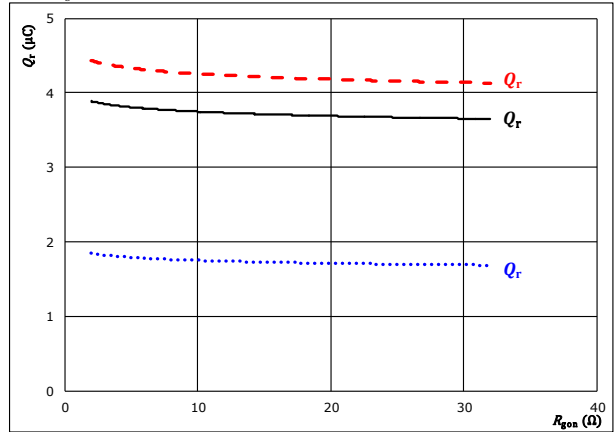


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gpn} = 8$  Ω  
 $T_j$ : 25 °C (dotted blue line), 125 °C (solid black line), 150 °C (dashed red line)

figure 10. FWD

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

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

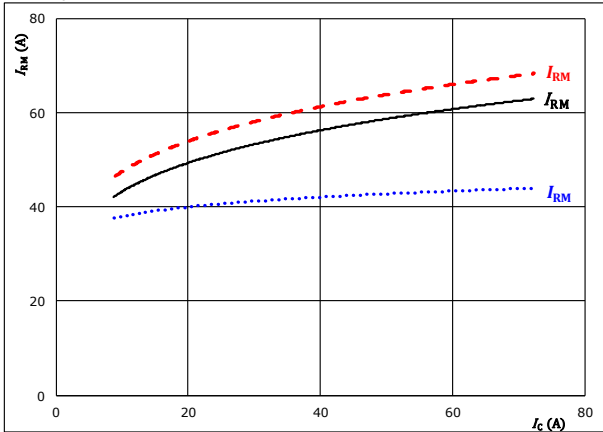


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 40$  A  
 $T_j$ : 25 °C (dotted blue line), 125 °C (solid black line), 150 °C (dashed red line)

figure 11. FWD

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

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

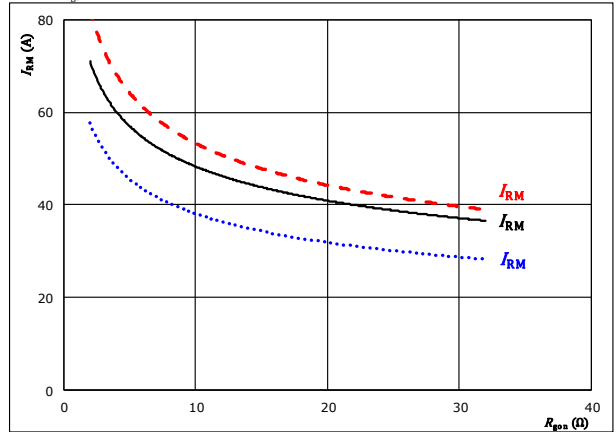


With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gpn} = 8$  Ω  
 $T_j$ : 25 °C (dotted blue line), 125 °C (solid black line), 150 °C (dashed red line)

figure 12. FWD

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

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_c = 40$  A  
 $T_j$ : 25 °C (dotted blue line), 125 °C (solid black line), 150 °C (dashed red line)



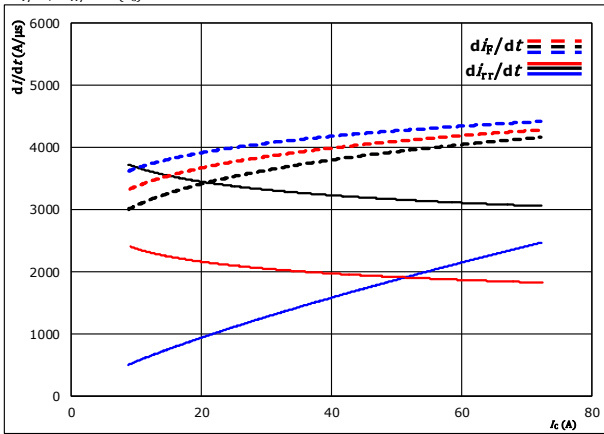


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## Boost Switching Characteristics

**figure 13.** FWD

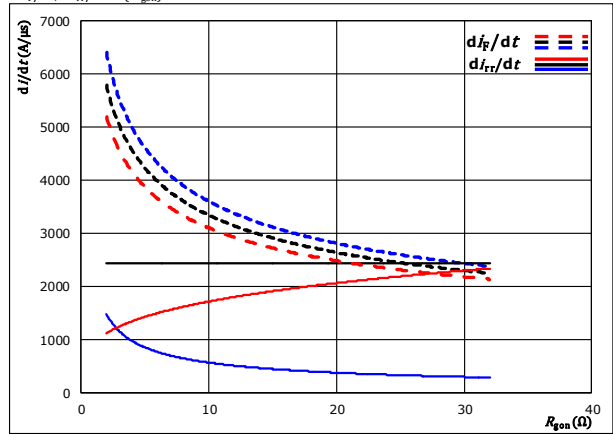
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_C)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j: 125$  °C  
 $150$  °C

**figure 14.** FWD

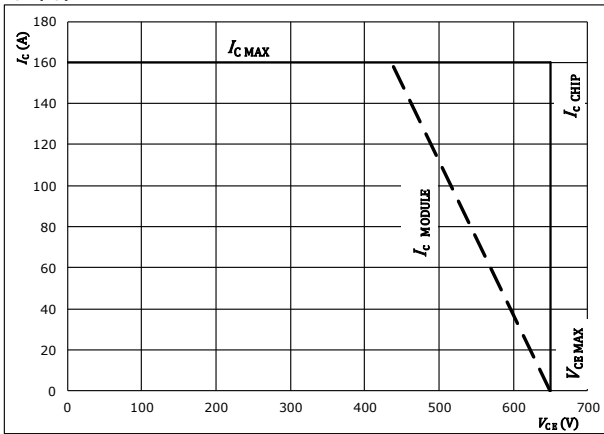
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = -5 / 15$  V  
 $I_C = 40$  A  
 $T_j: 125$  °C  
 $150$  °C

**figure 15.** IGBT

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



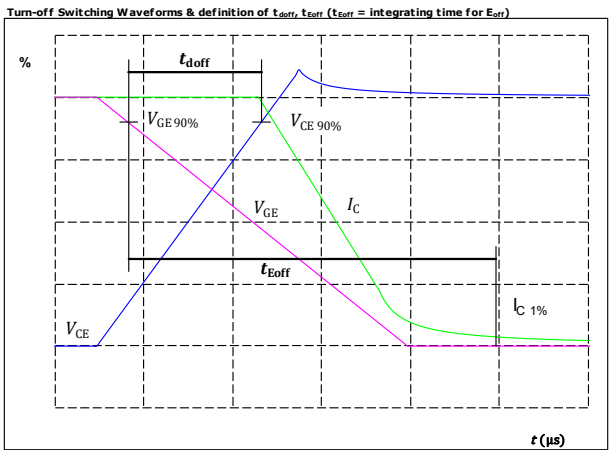
At  
 $T_j = 125$  °C  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$



### Boost Switching Definitions

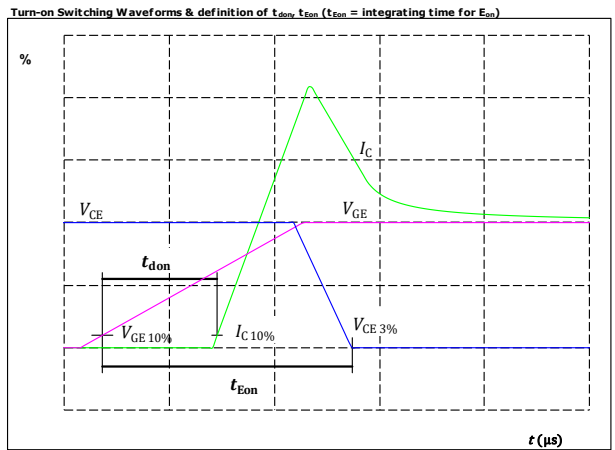
General conditions		
$T_j$	=	125 °C
$R_{gon}$	=	8 $\Omega$
$R_{goff}$	=	8 $\Omega$

figure 1. IGBT



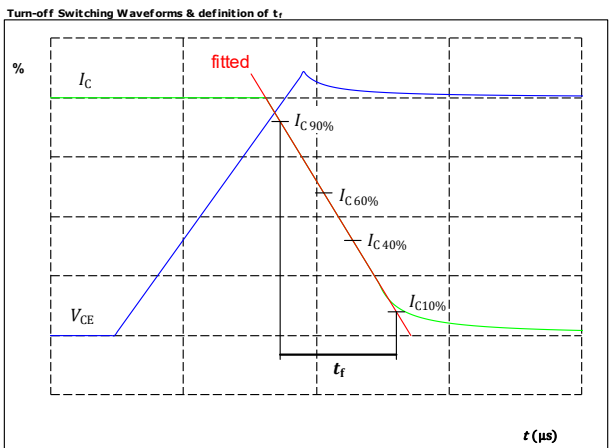
$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_{doff} =$	203	ns

figure 2. IGBT



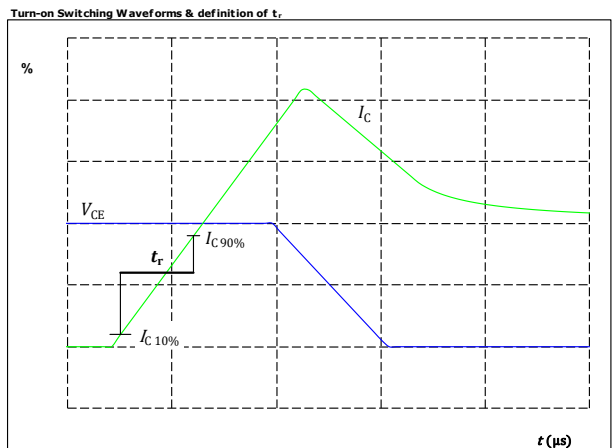
$V_{CE}(0\%) =$	-5	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_{don} =$	24	ns

figure 3. IGBT



$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_r =$	5	ns

figure 4. IGBT

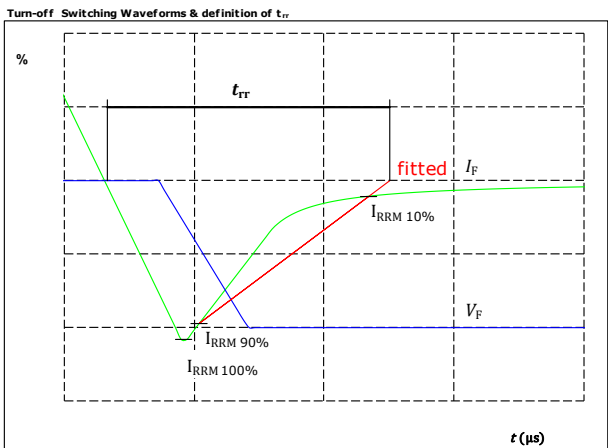


$V_C(100\%) =$	350	V
$I_C(100\%) =$	40	A
$t_r =$	9	ns



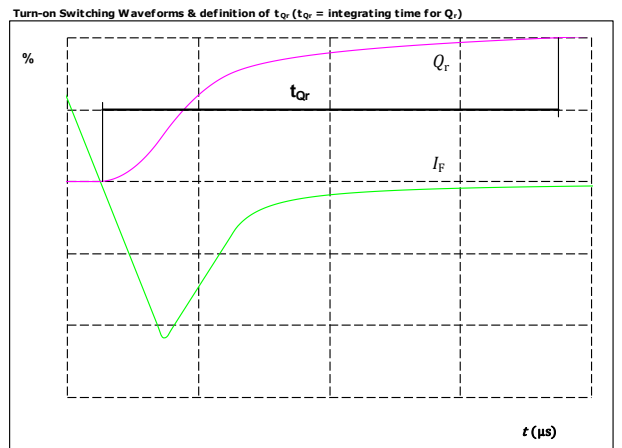
### Boost Switching Characteristics

figure 5. FWD



$V_F(100\%) =$	350	V
$I_F(100\%) =$	40	A
$I_{RRM}(100\%) =$	54	A
$t_{rr} =$	86	ns

figure 6. FWD



$I_F(100\%) =$	40	A
$Q_r(100\%) =$	4	$\mu\text{C}$



**10-FY07NIB080SM03-L095F03 /  
10-PY07NIB080SM03-L095F03Y**  
datasheet

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Ordering Code & Marking									
Version			Ordering Code						
without thermal paste 12mm housing with Solder pins			10-FY07NIB080SM03-L095F03						
with thermal paste 12mm housing with Solder pins			10-FY07NIB080SM03-L095F03-/3/						
without thermal paste 12mm housing with Pressfit pins			10-PY07NIB080SM03-L095F03Y						
with thermal paste 12mm housing with Pressfit pins			10-PY07NIB080SM03-L095F03Y-/3/						
NN-NNNNNNNNNNNN TTTTITVV WWYY UL VIN LLLLL SSSS			<b>Text</b>	<b>Name</b>	<b>Date code</b>	<b>UL &amp; VIN</b>	<b>Lot</b>	<b>Serial</b>	
				NN-NNNNNNNNNNNNNN-TTTTITVV	WWYY	UL VIN	LLLLL	SSSS	
			<b>Datamatrix</b>	<b>Type&amp;Ver</b>	<b>Lot number</b>	<b>Serial</b>	<b>Date code</b>		
			TTTTITVV	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	3	12,75	GND
16	0,3	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
38	18,6	0	T12C
39	21,3	0	T12C
40	24,75	28,2	T11E
41	27,45	28,2	T11E

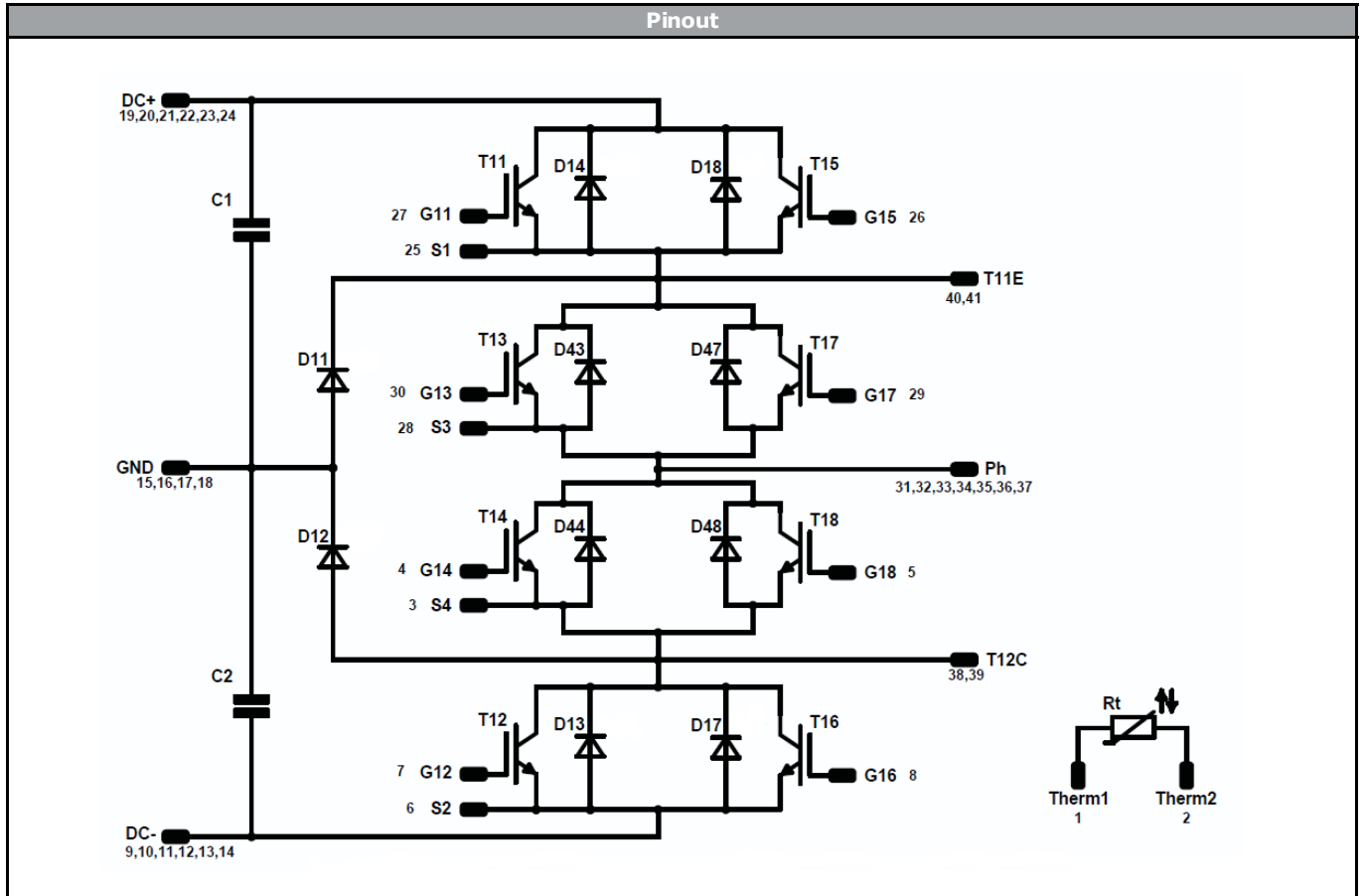
**Outline**

Technical drawings showing the component's outline and dimensions. The top view shows the component with dimensions 16.1 (width) and 26.1 (length). Pin locations are marked with numbers 1 through 41. Dimensions for pin heights and positions are provided, such as 16.2 ±0.5 for the main body height and 12.93 ±0.1 for the pin height. A note indicates: "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>					
<b>ID</b>	<b>Component</b>	<b>Voltage</b>	<b>Current</b>	<b>Function</b>	<b>Comment</b>
T11IT15, T12IT16	IGBT	650 V	80 A	Buck Switch	Parallel devices with separate control. Values refer to complete device.
D11, D12	FWD	650 V	80 A	Buck Diode	
T13IT17, T14IT18	IGBT	650 V	80 A	Boost Switch	Parallel devices with separate control. Values refer to complete device.
D13ID17, D14ID18	FWD	650 V	120 A	Boost Diode	Parallel devices with separate control. Values refer to complete device.
D43ID47, D44ID48	FWD	650 V	60 A	Boost Sw. Protection Diode	Parallel devices with separate control. Values refer to complete device.
C10, C20	Capacitor	630 V		Capacitor (DC)	
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-FY07NIB080SM03-L095F03-D6-14	21 Feb. 2019	Change of Buck and Boost diode and their switching characteristic	1-2, 4-7, 11, 14, 16-27

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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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