



flowNPC E3BP

1200 V / 560 A

### Topology features

- Low side Kelvin Emitter for improved switching performance
- Neutral Point Clamped Topology (I-Type)
- Split topology
- Temperature sensor

### Component features

- High speed switching
- Low collector emitter saturation voltage
- Low turn-off losses
- Optimized for hard switching topologies
- Positive temperature coefficient

### Housing features

- Base isolation: Al<sub>2</sub>O<sub>3</sub>
- Cu baseplate
- Convex shaped baseplate for superior thermal contact
- CTI600 housing material
- Baseplate with rough surface
- Press-fit pin
- Reliable cold welding connection
- Thermo-mechanical push-and-pull force relief

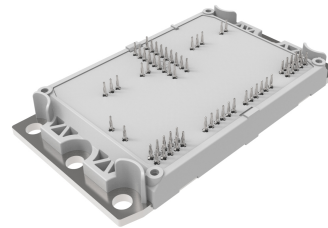
### Target applications

- Energy Storage Systems
- Solar Inverters

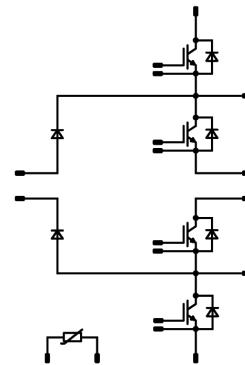
### Types

- 30-EP12NIC560H7-PU10F57T

### flow E3BP 12 mm housing



### Schematic





Vincotech

**30-EP12NIC560H7-PU10F57T**  
datasheet

## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Buck Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	290	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	1680	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	1680	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	495	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

## Buck Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	176	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	480	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 25\text{ °C}$	1920	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	316	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Switch

Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	290	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	1680	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	1680	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	495	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C



Vincotech

## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	176	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	480	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 25\text{ °C}$	1920	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	316	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Sw. Inv. Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	187	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	600	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	287	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Module Properties

### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{jop}$		-40...+( $T_{jmax} - 25$ )	°C

### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6800	V
Creepage distance			>12,7	mm
Clearance			11,76	mm
Comparative Tracking Index	CTI		≥ 200	

\*100 % tested in production



Vincotech

**30-EP12NIC560H7-PU10F57T**  
datasheet

### Characteristic Values

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

#### Buck Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0048	25	4,7	5,5	6,2	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		560	25 125 150		1,79 2,03 2,08	2,15 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			16	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			400	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							74000		pF
Output capacitance	$C_{oes}$	$f = 100$ kHz	0	25		25		1268		pF
Reverse transfer capacitance	$C_{res}$							376		pF
Gate charge	$Q_g$	$V_{CC} = 960$ V	0/15		560	25		4128		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,19		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		898,65 884,64 880,98		ns
Rise time	$t_r$	$R_{gon} = 5,82$ Ω $R_{goff} = 12,8$ Ω				25 125 150		71,63 72,78 72,42		ns
Turn-off delay time	$t_{d(off)}$		-10/15	600	400	25 125 150		2323,65 2425,91 2453,67		ns
Fall time	$t_f$					25 125 150		32,89 27,47 35,46		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 0,989$ μC $Q_{tFWD} = 1,05$ μC $Q_{tFWD} = 1,08$ μC				25 125 150		26,5 24,78 25,49		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		27,56 32,02 33,09		mWs



Vincotech

**30-EP12NIC560H7-PU10F57T**  
datasheet

### Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		$V_{GE}$ [V] $V_{GS}$ [V]	$V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V]	$I_C$ [A] $I_D$ [A] $I_F$ [A]	$T_j$ [°C]	Min	Typ	Max		
<b>Buck Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$				240	25 125 150		1,53 1,89 2,03	1,65 <sup>(1)</sup> 2,3 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25		12	1200	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,3		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$					25 125 150		63,1 64,91 67,37		A
Reverse recovery time	$t_{rr}$					25 125 150		26,37 26,44 26,44		ns
Recovered charge	$Q_r$	$di/dt=5360$ A/μs $di/dt=5475$ A/μs $di/dt=9003$ A/μs	-10/15	600	400	25 125 150		0,989 1,05 1,08		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,162 0,176 0,183		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		7550,84 6972,25 6345,25		A/μs



Vincotech

**30-EP12NIC560H7-PU10F57T**  
datasheet

### Characteristic Values

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

#### Boost Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0048	25	4,7	5,5	6,2	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		560	25 125 150		1,79 2,03 2,08	2,15 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			16	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			400	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							74000		pF
Output capacitance	$C_{oes}$	$f = 100$ kHz	0	25		25		1268		pF
Reverse transfer capacitance	$C_{res}$							376		pF
Gate charge	$Q_g$	$V_{CC} = 960$ V	0/15		560	25		4128		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,19		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		905,93 893,43 888,36		ns
Rise time	$t_r$					25 125 150		75,42 76,44 76,97		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		1967,21 2075,04 2123,22		ns
Fall time	$t_f$					25 125 150		36,03 24,71 28,48		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 0,852$ μC $Q_{tFWD} = 0,873$ μC $Q_{tFWD} = 0,916$ μC				25 125 150		27,67 27,22 27,32		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		23,24 31,15 33,98		mWs



Vincotech

**30-EP12NIC560H7-PU10F57T**  
datasheet

### Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		$V_{GE}$ [V] $V_{GS}$ [V]	$V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V]	$I_C$ [A] $I_D$ [A] $I_F$ [A]	$T_j$ [°C]	Min	Typ	Max		
<b>Boost Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$				240	25 125 150		1,53 1,89 2,03	1,65 <sup>(1)</sup> 2,3 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25		12	1200	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,3		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$					25 125 150		54,56 56,48 58,29		A
Reverse recovery time	$t_{rr}$					25 125 150		26 26,15 26,03		ns
Recovered charge	$Q_r$	$di/dt=4299$ A/μs $di/dt=4575$ A/μs $di/dt=4865$ A/μs	-10/15	600	400	25 125 150		0,852 0,873 0,916		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,111 0,115 0,122		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		5853,1 5752,72 4772,82		A/μs



Vincotech

### Characteristic Values

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

#### Boost Sw. Inv. Diode

##### Static

Forward voltage	$V_F$				300	25 125 150	1,45	1,91 1,93 1,91	1,95 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25			3	μA

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,33		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

#### Thermistor

##### Static

Rated resistance	$R$					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484$ Ω				100	-5		5	%
Power dissipation	$P$					25		130		mW
Power dissipation constant	$d$					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.

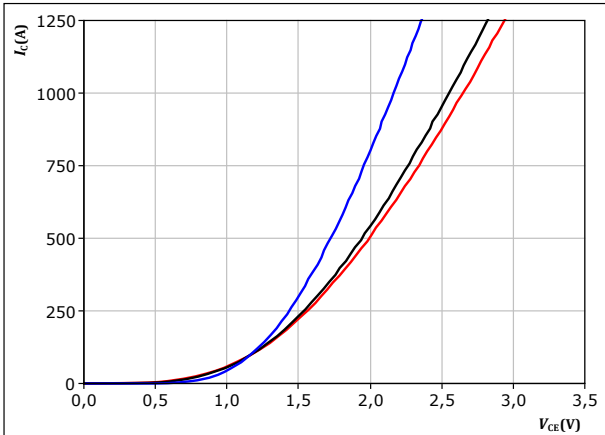


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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



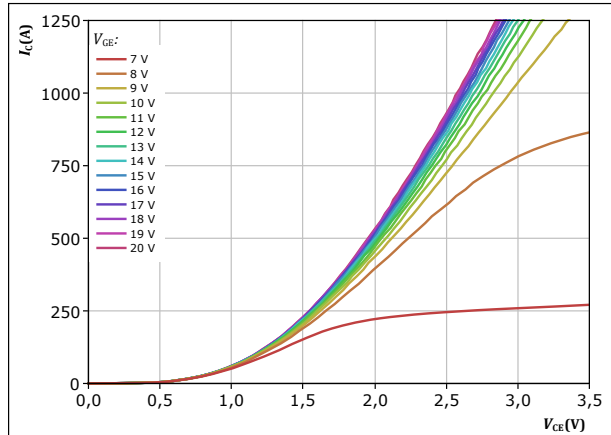
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

$T_j$ : 25 °C (blue)  
125 °C (black)  
150 °C (red)

**figure 2.** IGBT

Typical output characteristics

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

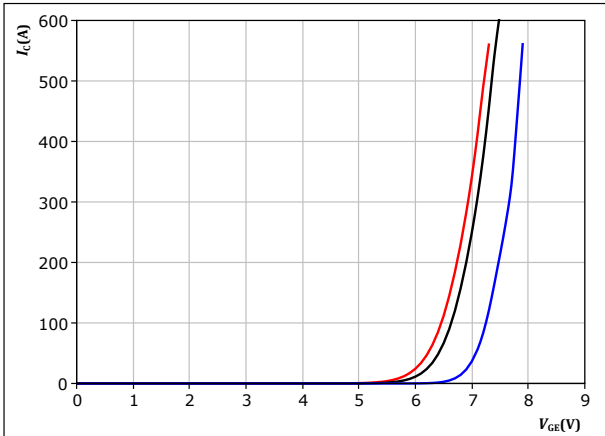


$t_p = 250 \mu s$   
 $T_j = 150 \text{ °C}$   
 $V_{GE}$  from 7 V to 20 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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



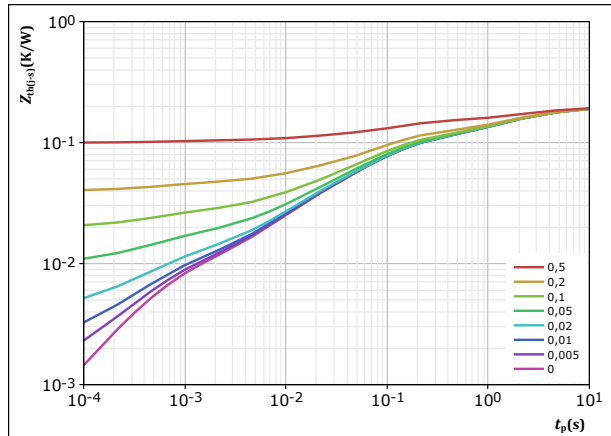
$t_p = 250 \mu s$   
 $V_{CE} = 30 V$

$T_j$ : 25 °C (blue)  
125 °C (black)  
150 °C (red)

**figure 4.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,192 \text{ K/W}$

IGBT thermal model values

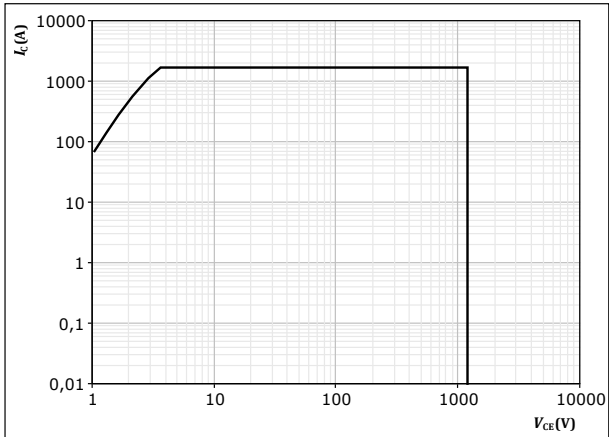
$R$ (K/W)	$\tau$ (s)
3,88E-02	6,87E+00
6,56E-02	1,33E+00
7,12E-02	8,85E-02
1,67E-02	1,12E-02
7,15E-03	5,40E-04



### Buck Switch Characteristics

figure 5. IGBT

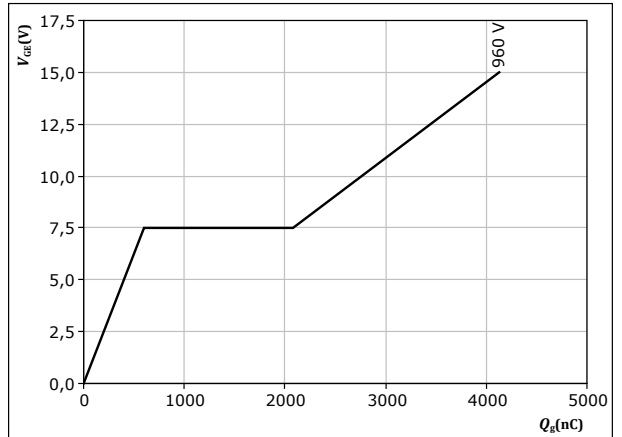
Safe operating area  
 $I_C = f(V_{CE})$



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

figure 6. IGBT

Gate voltage vs gate charge  
 $V_{GE} = f(Q_g)$



I<sub>C</sub> = 560 A  
T<sub>j</sub> = 25 °C



### Buck Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

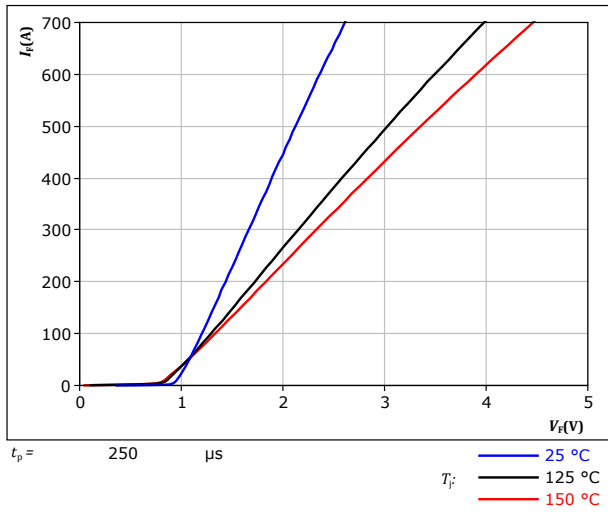
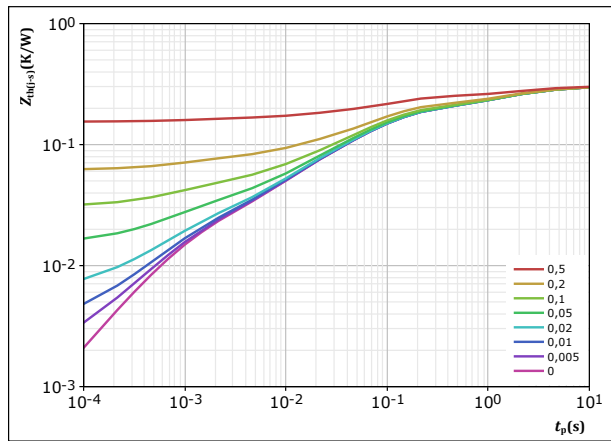


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



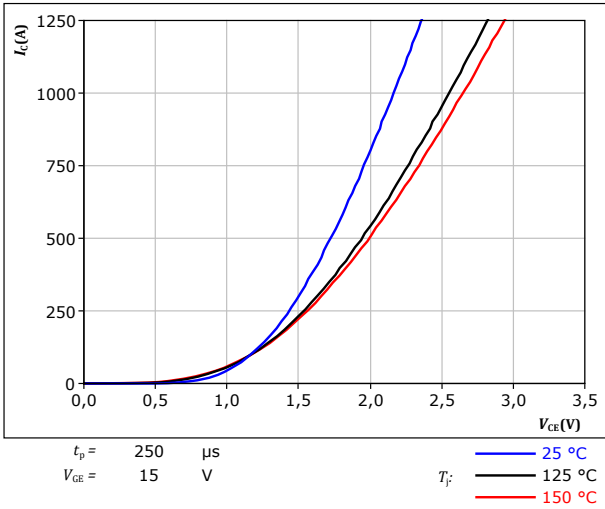
$D =$	$t_p / T$	
$R_{th(j-s)} =$	0,3	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
3,83E-02	8,10E+00	
8,96E-02	1,32E+00	
1,33E-01	8,16E-02	
3,22E-02	1,19E-02	
1,60E-02	9,15E-04	



### Boost Switch Characteristics

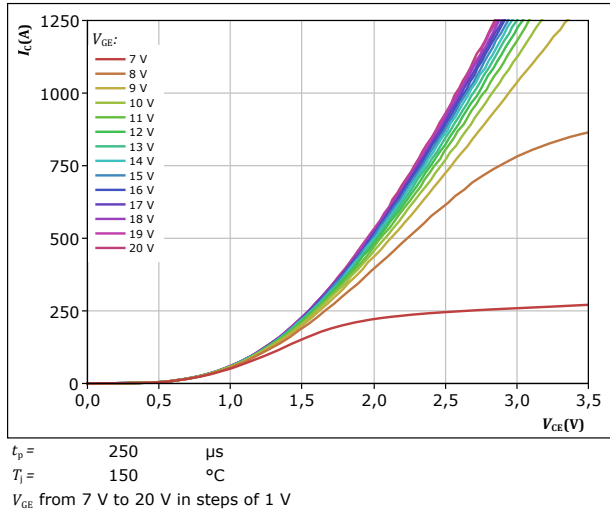
**figure 9.** IGBT

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



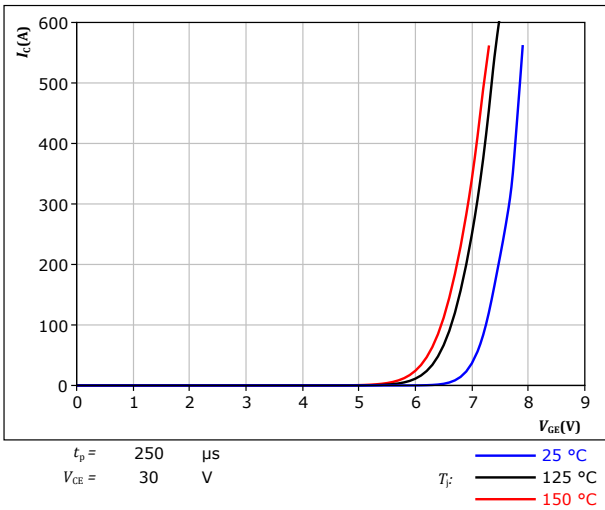
**figure 10.** IGBT

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



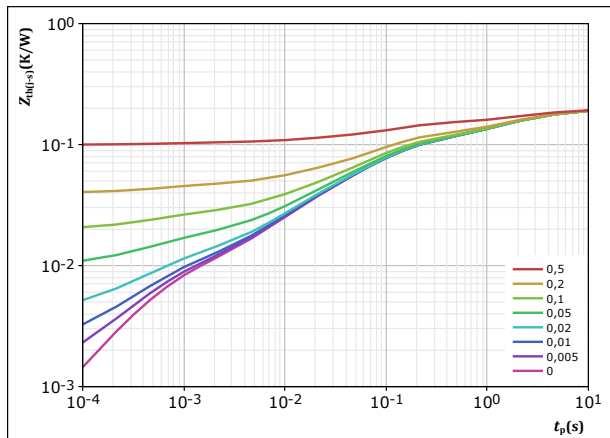
**figure 11.** IGBT

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



**figure 12.** IGBT

Transient thermal impedance as a function of pulse width  
 $Z_{th(j-s)} = f(t_p)$



IGBT thermal model values

R (K/W)	$\tau$ (s)
3,88E-02	6,87E+00
6,56E-02	1,33E+00
7,12E-02	8,85E-02
1,67E-02	1,12E-02
7,15E-03	5,40E-04

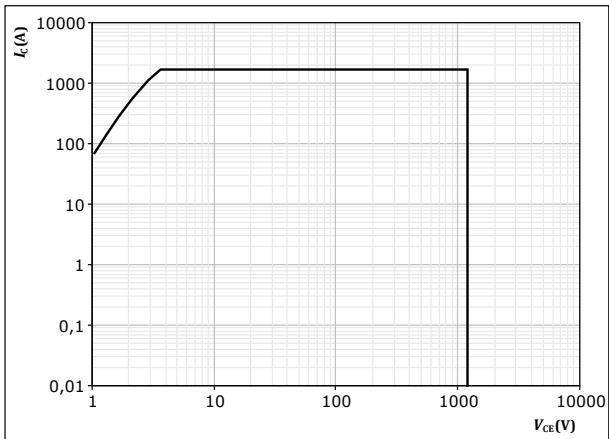


### Boost Switch Characteristics

figure 13. IGBT

Safe operating area

$I_C = f(V_{CE})$

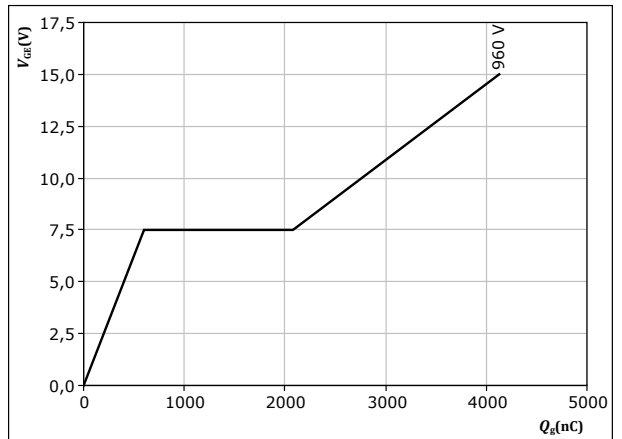


D = single pulse  
 T<sub>s</sub> = 80 °C  
 V<sub>GE</sub> = 15 V  
 T<sub>j</sub> = T<sub>jmax</sub>

figure 14. IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



I<sub>C</sub> = 560 A  
 T<sub>j</sub> = 25 °C



### Boost Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

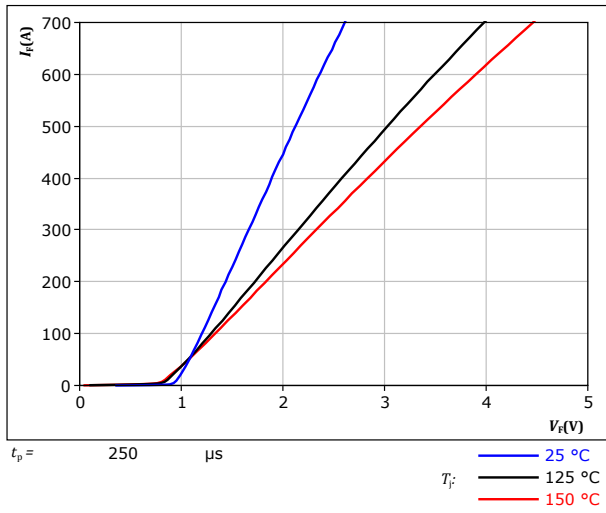
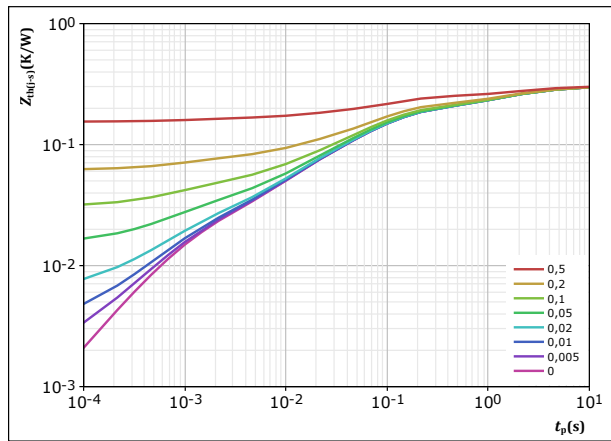


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	0,3	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
3,83E-02	8,10E+00	
8,96E-02	1,32E+00	
1,33E-01	8,16E-02	
3,22E-02	1,19E-02	
1,60E-02	9,15E-04	



### Boost Sw. Inv. Diode Characteristics

figure 17. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

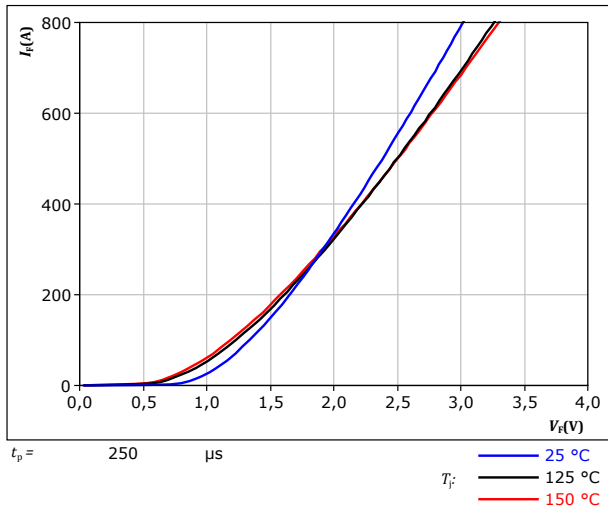
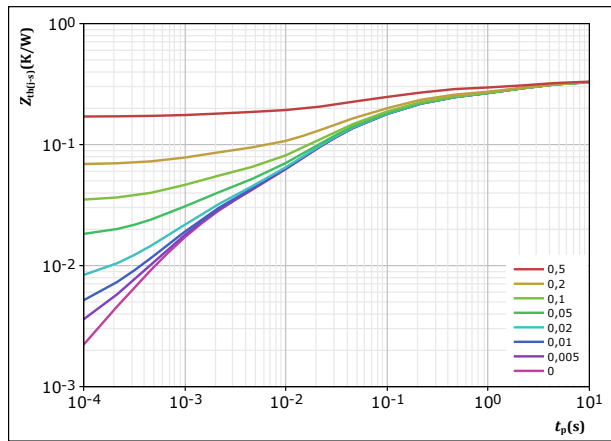


figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,331 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
3,16E-02	1,00E+01
7,88E-02	1,75E+00
1,21E-01	1,25E-01
8,68E-02	2,27E-02
2,22E-02	1,23E-03

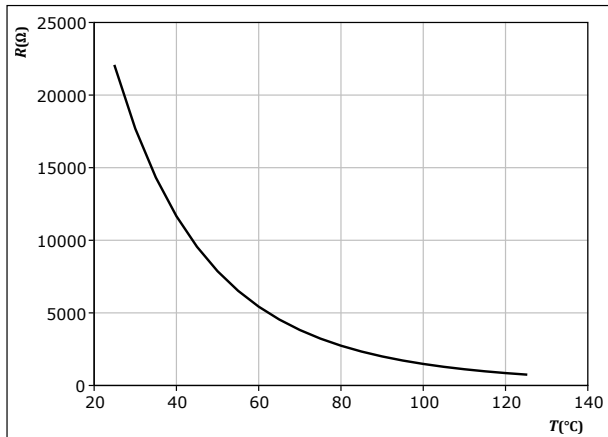


### Thermistor Characteristics

figure 19. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

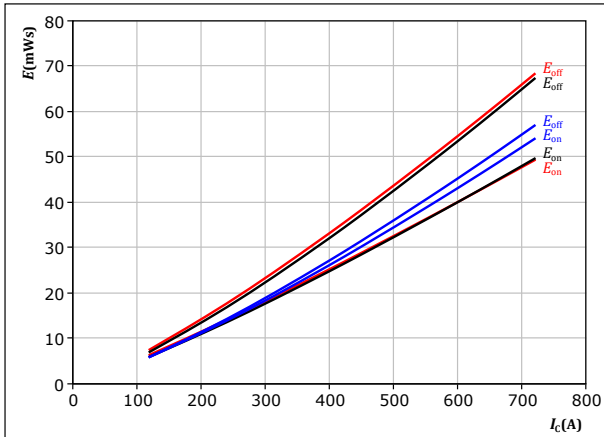




## Buck Switching Characteristics

**figure 20.** IGBT

Typical switching energy losses as a function of collector current  
 $E = f(I_c)$

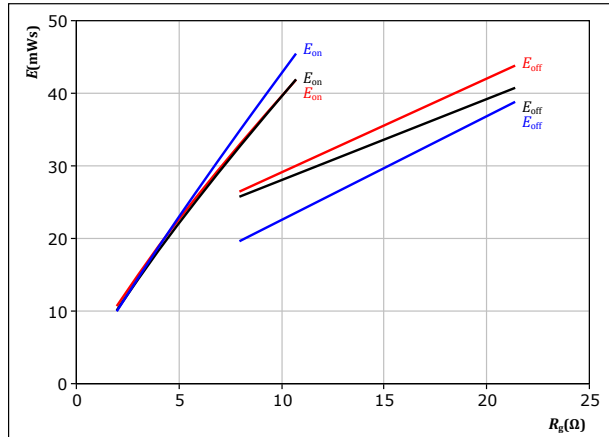


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$   
 $R_{goff} = 12,8 \ \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 21.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor  
 $E = f(R_g)$

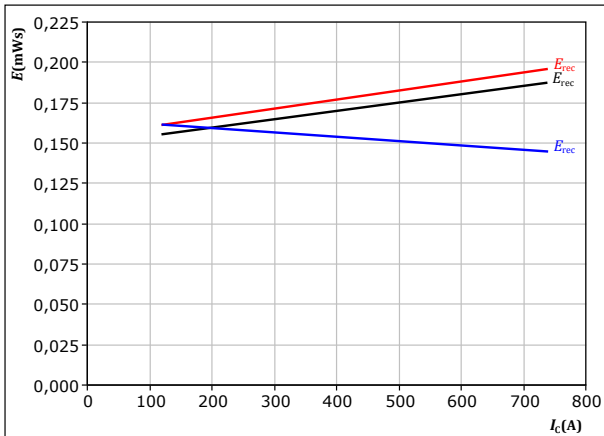


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 22.** FWD

Typical reverse recovered energy loss as a function of collector current  
 $E_{rec} = f(I_c)$

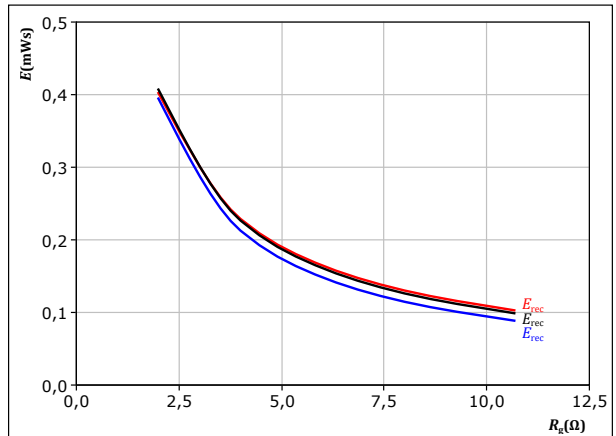


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 23.** FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor  
 $E_{rec} = f(R_g)$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

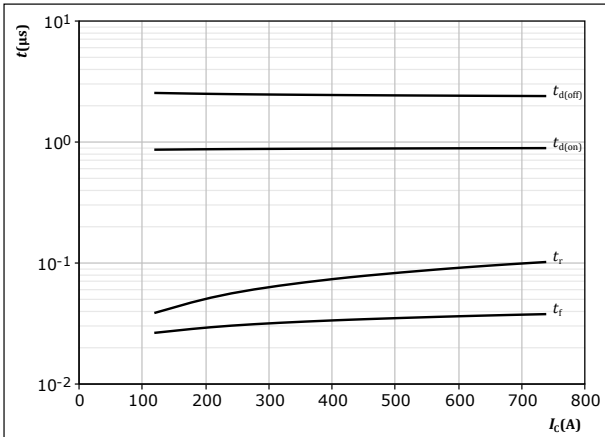
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



## Buck Switching Characteristics

**figure 24.** IGBT

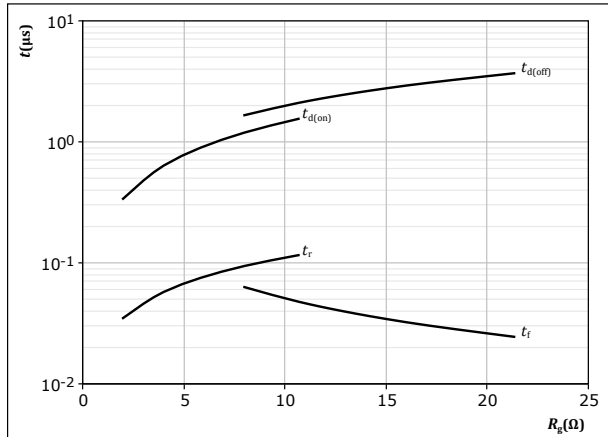
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \text{ } \Omega$   
 $R_{goff} = 12,8 \text{ } \Omega$

**figure 25.** IGBT

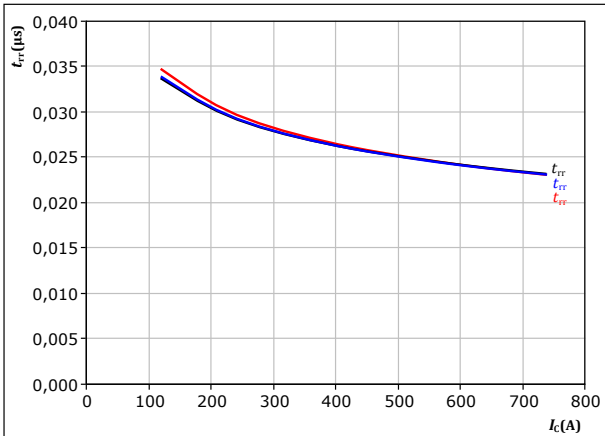
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

**figure 26.** FWD

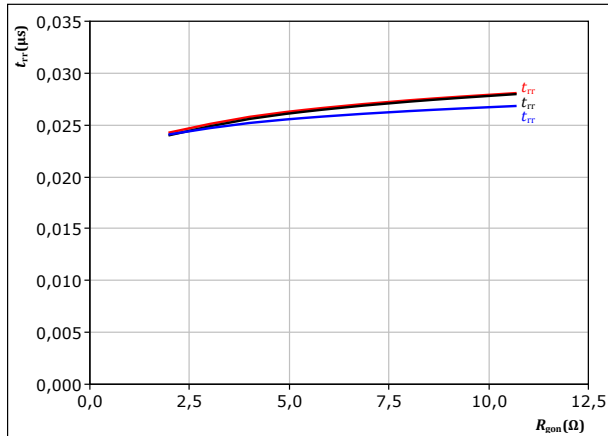
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \text{ } \Omega$   
 $T_j: \text{ — } 25 \text{ }^\circ\text{C}$   
 $\text{ — } 125 \text{ }^\circ\text{C}$   
 $\text{ — } 150 \text{ }^\circ\text{C}$

**figure 27.** FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor  
 $t_{rr} = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j: \text{ — } 25 \text{ }^\circ\text{C}$   
 $\text{ — } 125 \text{ }^\circ\text{C}$   
 $\text{ — } 150 \text{ }^\circ\text{C}$

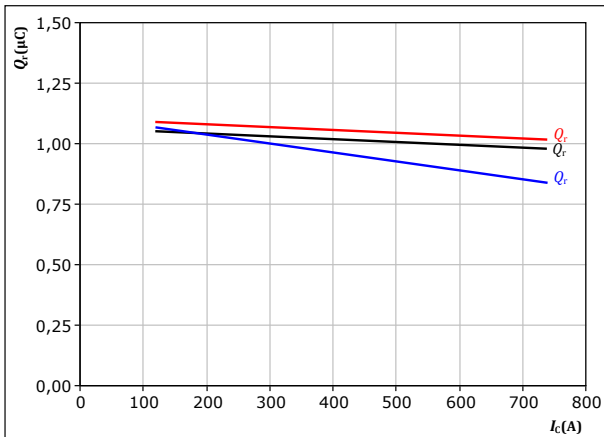


## Buck Switching Characteristics

**figure 28.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

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

**figure 29.** FWD

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

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



With an inductive load at

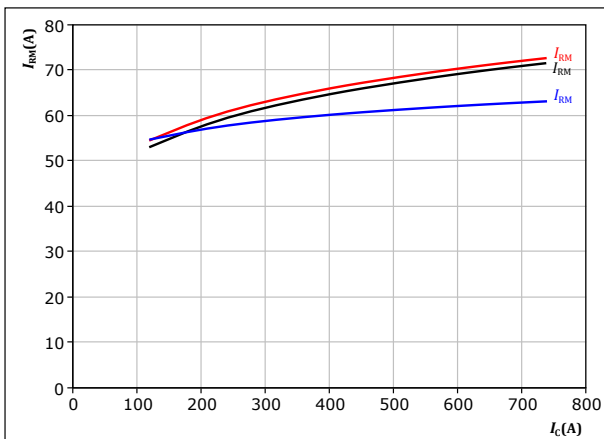
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

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

**figure 30.** FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

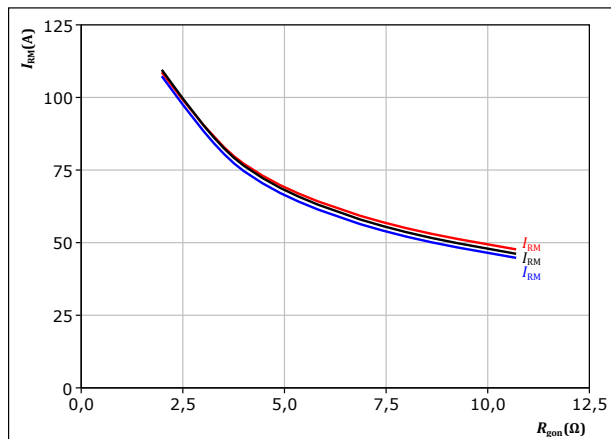
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

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

**figure 31.** FWD

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

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

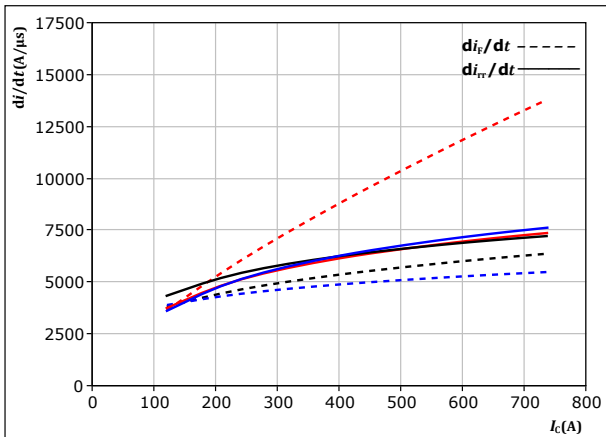
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



## Buck Switching Characteristics

**figure 32.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_i/dt, di_r/dt = f(I_c)$

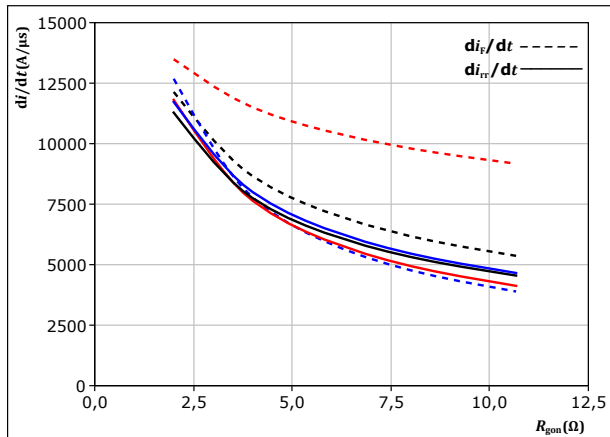


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

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

**figure 33.** FWD

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

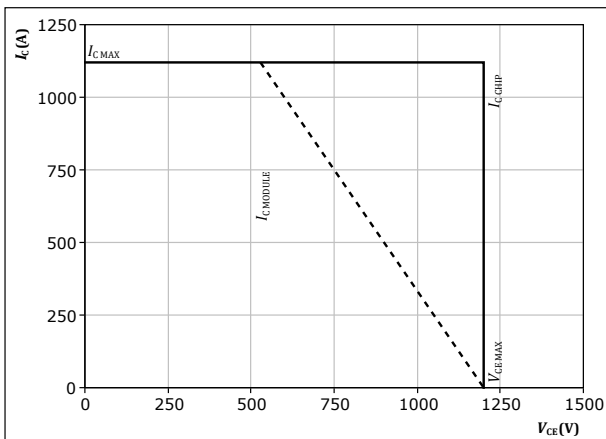


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

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

**figure 34.** IGBT

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



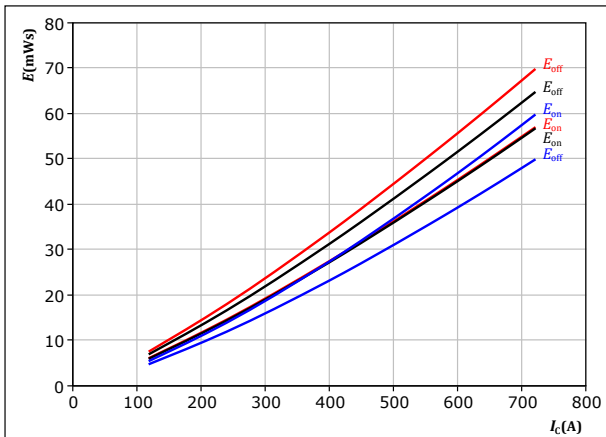
At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 5,82 \ \Omega$   
 $R_{goff} = 12,8 \ \Omega$



## Boost Switching Characteristics

**figure 35.** IGBT

Typical switching energy losses as a function of collector current  
 $E = f(I_c)$

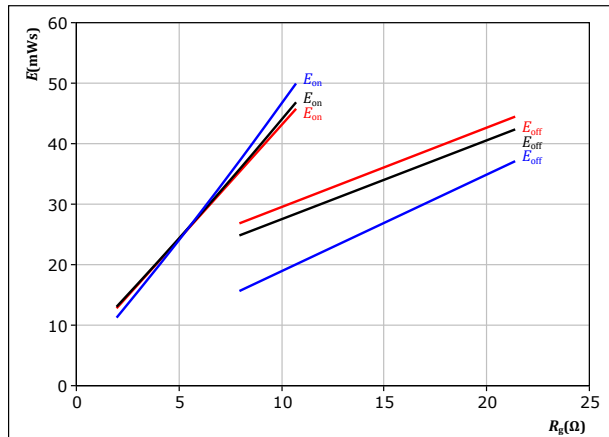


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$   
 $R_{goff} = 12,8 \ \Omega$

$T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

**figure 36.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor  
 $E = f(R_g)$

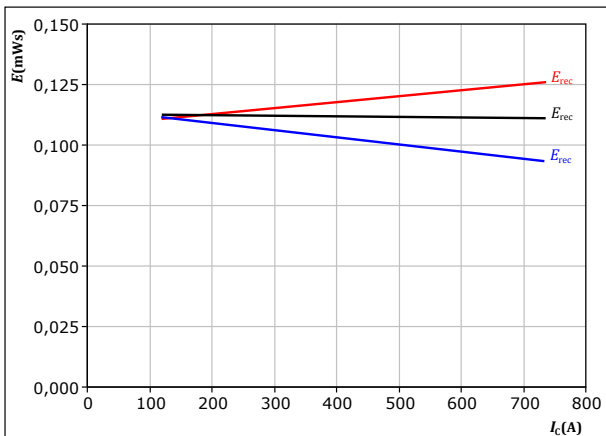


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

$T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

**figure 37.** FWD

Typical reverse recovered energy loss as a function of collector current  
 $E_{rec} = f(I_c)$

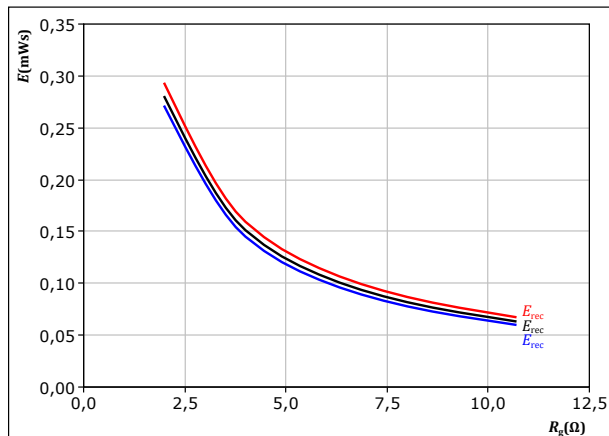


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

$T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

**figure 38.** FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor  
 $E_{rec} = f(R_g)$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

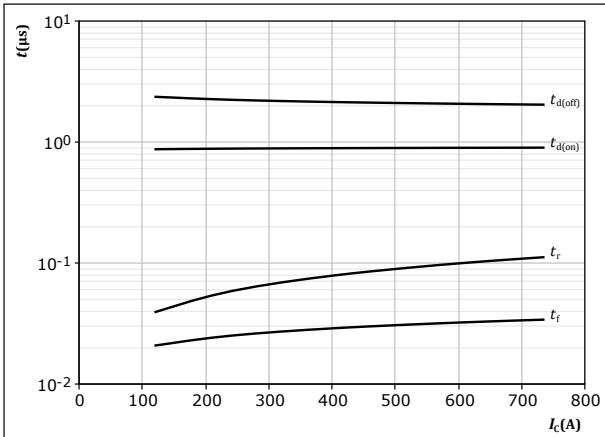
$T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)



## Boost Switching Characteristics

**figure 39.** IGBT

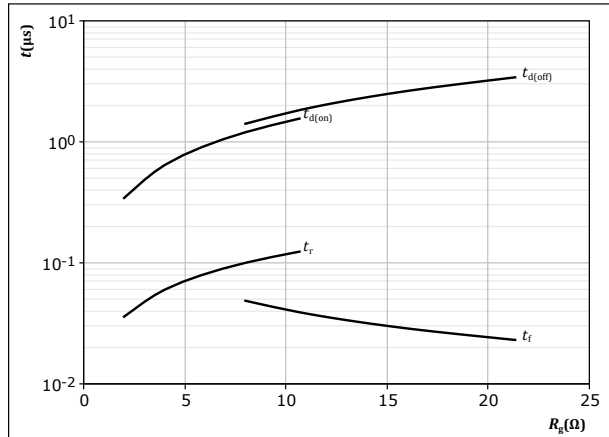
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \text{ } \Omega$   
 $R_{goff} = 12,8 \text{ } \Omega$

**figure 40.** IGBT

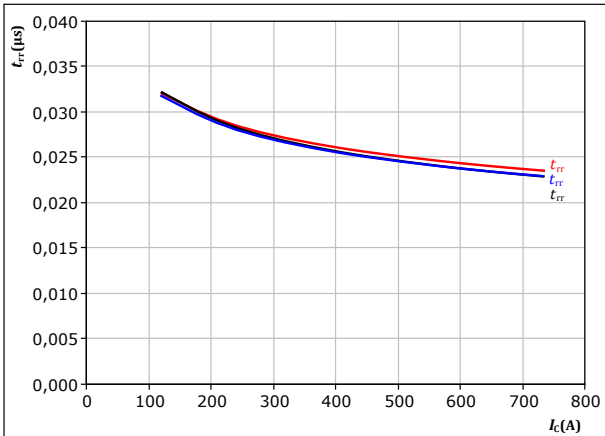
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

**figure 41.** FWD

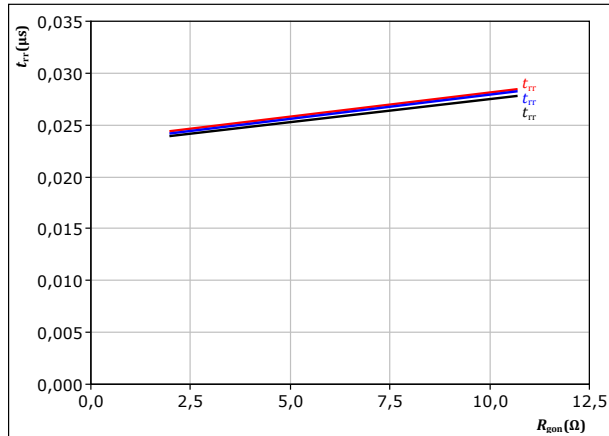
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \text{ } \Omega$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

**figure 42.** FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor  
 $t_{rr} = f(R_{gon})$



With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

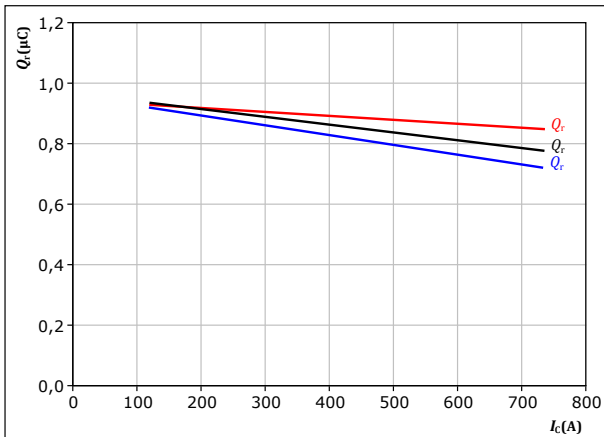


## Boost Switching Characteristics

figure 43. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



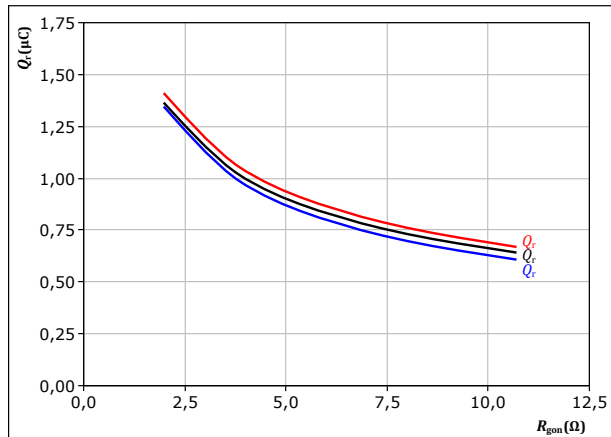
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$   
 $T_j: 25 \text{ °C}$   
 $125 \text{ °C}$   
 $150 \text{ °C}$

figure 44. FWD

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

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



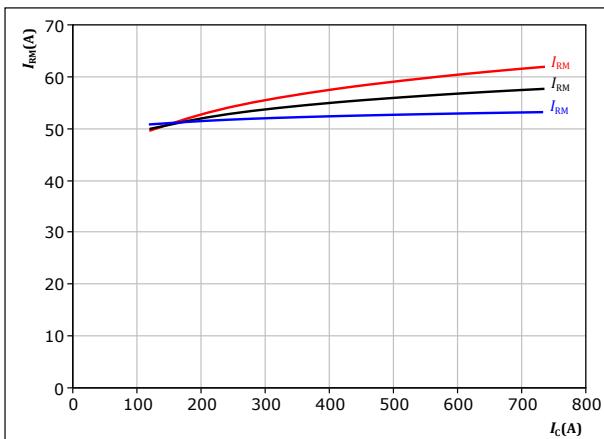
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j: 25 \text{ °C}$   
 $125 \text{ °C}$   
 $150 \text{ °C}$

figure 45. FWD

Typical peak reverse recovery current as a function of collector current

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



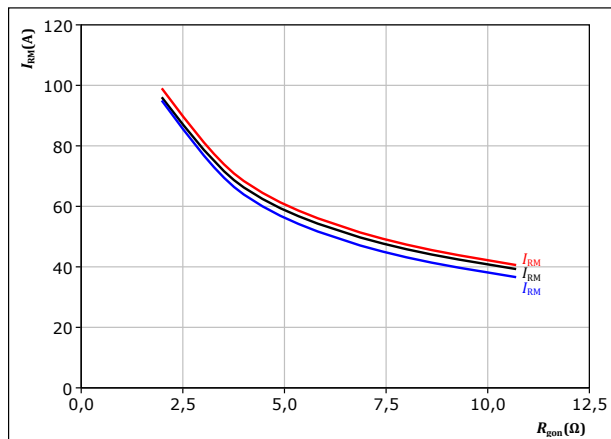
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$   
 $T_j: 25 \text{ °C}$   
 $125 \text{ °C}$   
 $150 \text{ °C}$

figure 46. FWD

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

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



With an inductive load at

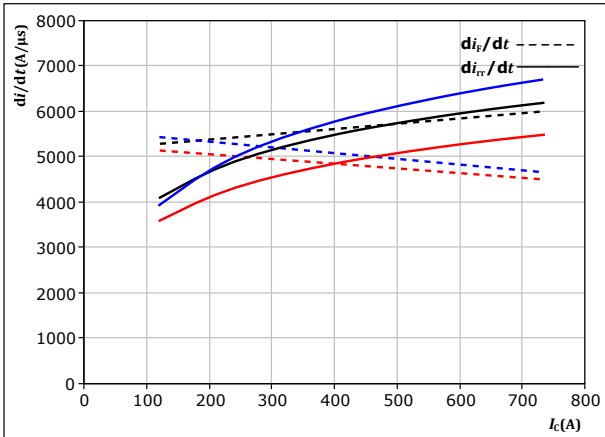
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j: 25 \text{ °C}$   
 $125 \text{ °C}$   
 $150 \text{ °C}$



### Boost Switching Characteristics

**figure 47.** FWD

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

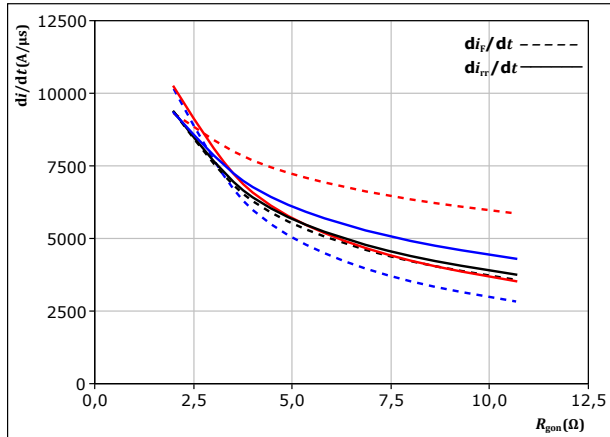


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $R_{gon} = 5,82 \ \Omega$

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

**figure 48.** FWD

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

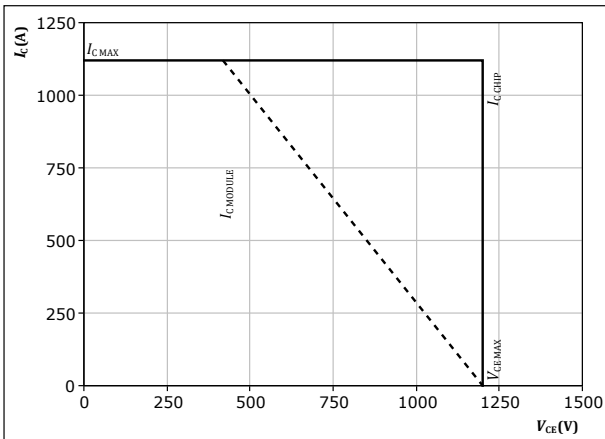


With an inductive load at  
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = -10/15 \text{ V}$   
 $I_c = 400 \text{ A}$

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

**figure 49.** IGBT

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



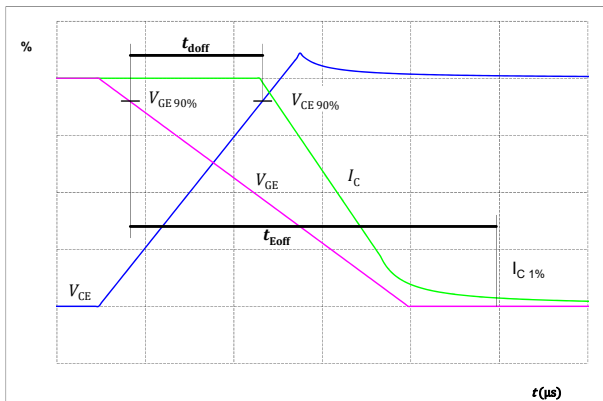
At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 5,82 \ \Omega$   
 $R_{goff} = 12,8 \ \Omega$



## Switching Definitions

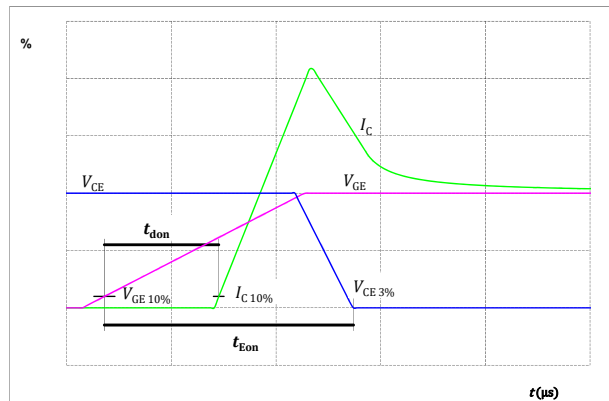
**figure 50.** IGBT

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



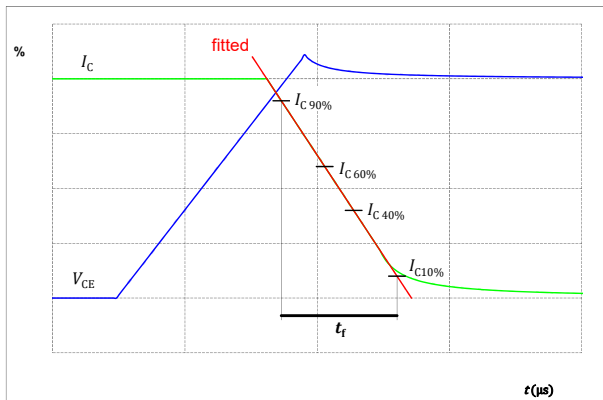
**figure 51.** IGBT

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



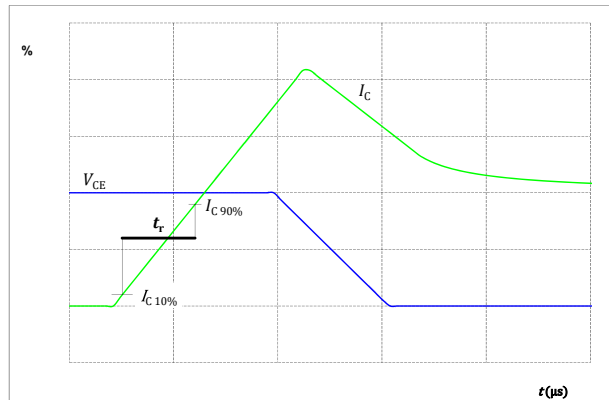
**figure 52.** IGBT

Turn-off Switching Waveforms & definition of  $t_f$



**figure 53.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$





### Switching Definitions

figure 54. FWD

Turn-off Switching Waveforms & definition of  $t_{rr}$

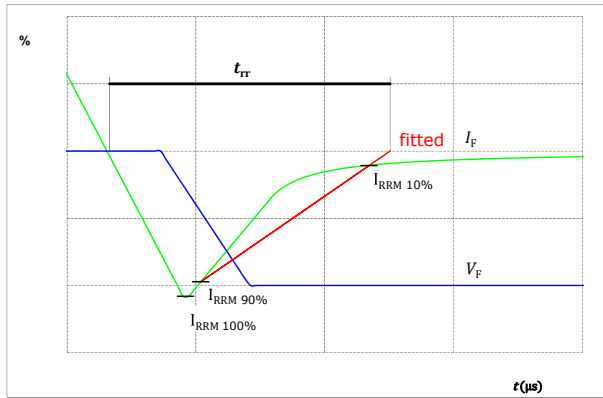
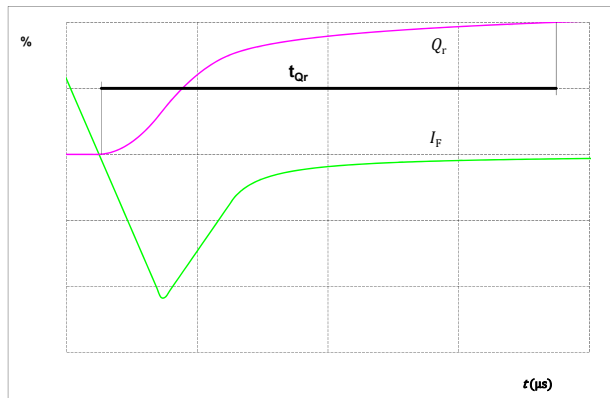
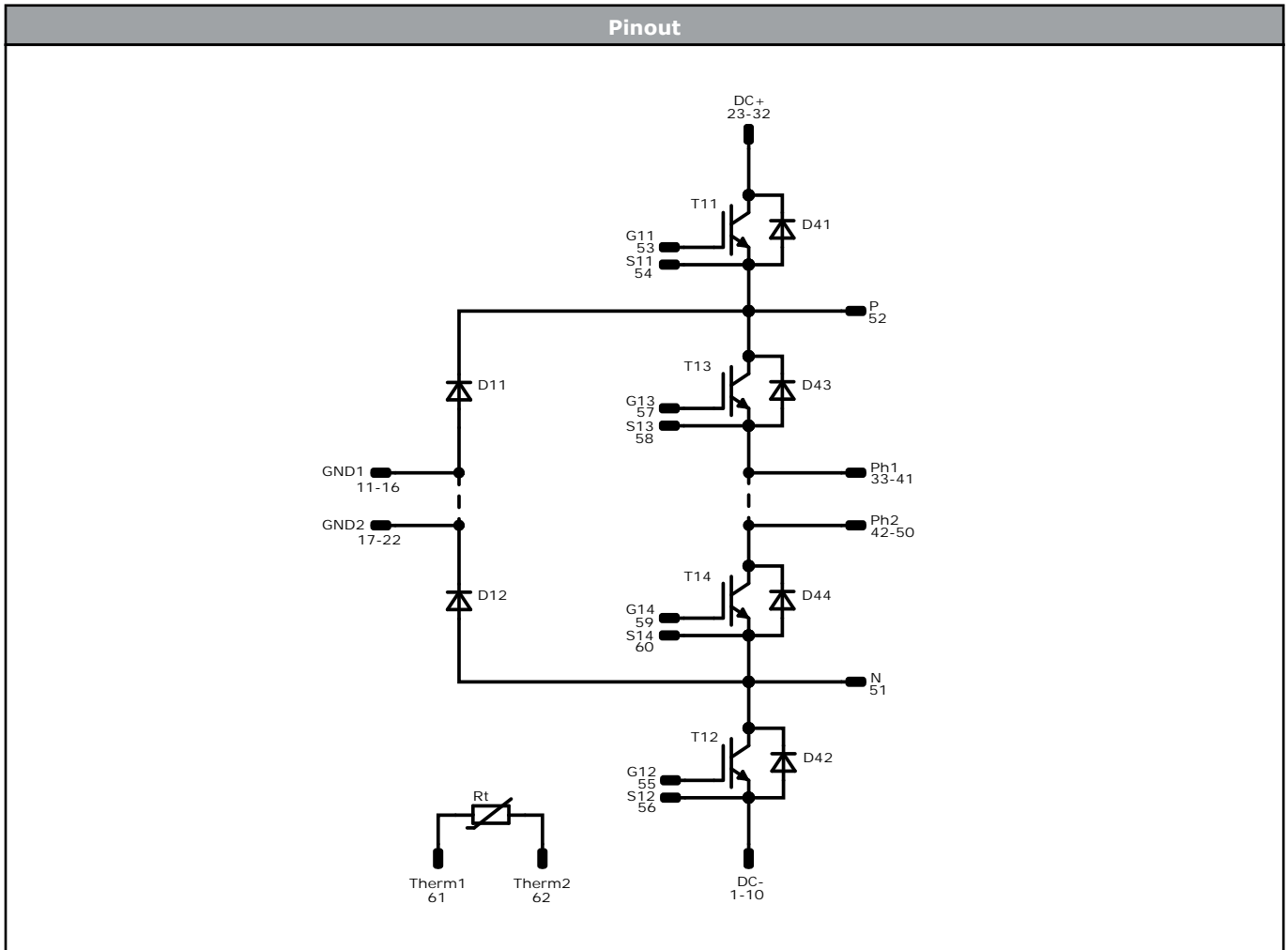


figure 55. FWD

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







Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	1200 V	560 A	Buck Switch	
D11, D12	FWD	1200 V	240 A	Buck Diode	
T13, T14	IGBT	1200 V	560 A	Boost Switch	
D42, D41	FWD	1200 V	240 A	Boost Diode	
D43, D44	FWD	1200 V	300 A	Boost Sw. Inv. Diode	
Rt	Thermistor			Thermistor	



Packaging instruction				
Standard packaging quantity (SPQ) 24	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow</i> E3BP packages see vincotech.com website.

Package data
Package data for <i>flow</i> E3BP packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}=175^{\circ}C$ and up to 4000VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
30-EP12NIC560H7-PU10F57T-D1-14	27 Mar. 2026	Initial Release	

**DISCLAIMER**

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

**LIFE SUPPORT POLICY**

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

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.