



**flow3xMNPC E3**

**1200 V / 150 A**

**Topology features**

- Kelvin Emitter for improved switching performance
- Temperature sensor
- Three-phase Mixed Voltage Neutral Point Clamped Topology (T-Type)

**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>
- CTI600 housing material
- Compact, baseplate-less housing
- VINcoPress Technology
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

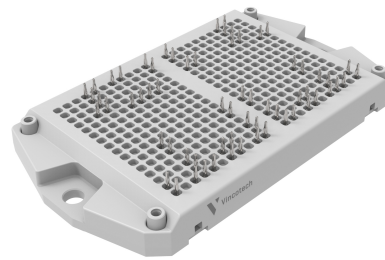
**Target applications**

- Charging Stations
- Energy Storage Systems
- Solar Inverters
- UPS

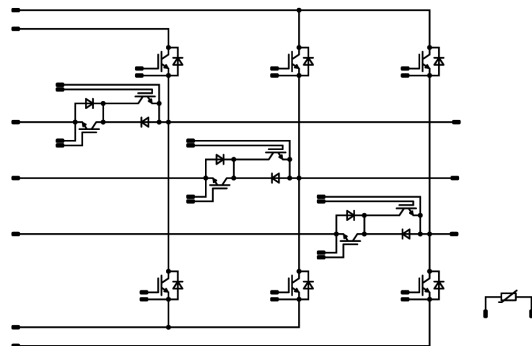
**Types**

- B0-EP12M3A150H702-PH09F48T

**flow E3 12 mm housing**



**Schematic**





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**B0-EP12M3A150H702-PH09F48T**  
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)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	136	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	450	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	450	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	251	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

## Buck Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	127	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	360	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	175	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Switch

Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	106	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	450	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	168	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C



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datasheet

## 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)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	95	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	600	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	161	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* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

\*100 % tested in production



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### 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		

#### Buck Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0024	25	4,7	5,5	6,2	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		150	25 125 150		1,64 1,81 1,86	2,15 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			8	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							19200		pF
Output capacitance	$C_{oes}$	$f = 100$ kHz	0	25		25		368		pF
Reverse transfer capacitance	$C_{res}$							108		pF
Gate charge	$Q_g$	$V_{CC} = 960$ V	0/15		150	25		1100		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,38		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		242,29 243,07 243,85		ns
Rise time	$t_r$	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω				25 125 150		14,36 17,44 18,3		ns
Turn-off delay time	$t_{d(off)}$		±15	350	100	25 125 150		220,01 249,72 257,88		ns
Fall time	$t_f$					25 125 150		33,17 67,74 74,88		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 2,87$ μC $Q_{tFWD} = 6,34$ μC $Q_{tFWD} = 7,44$ μC				25 125 150		2,24 2,92 3,04		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,78 2,95 3,26		mWs



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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	$V_F$				120	25 125 150		1,48 1,4 1,37	1,92 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V				25			6,4	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,54		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$					25 125 150		76,75 112,9 123,62		A
Reverse recovery time	$t_{rr}$					25 125 150		72,35 99,49 109,99		ns
Recovered charge	$Q_r$	$di/dt=6268$ A/μs $di/dt=5343$ A/μs $di/dt=4951$ A/μs	±15	350	100	25 125 150		2,87 6,34 7,44		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,436 1,15 1,41		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		1668,98 1199,4 1182,5		A/μs



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datasheet

### Characteristic Values

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

#### Boost Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,002	25	5	6	7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		150	25 125 150		1,55 1,7 1,74	2 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			50	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25	-500		500	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							8714		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		528		pF
Reverse transfer capacitance	$C_{res}$							234		pF
Gate charge	$Q_g$	$V_{CC} = 520$ V	0/15		150	25		414		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,57		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		92,04 91,5 91,11		ns
Rise time	$t_r$					25 125 150		22,93 24,83 25,13		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		97,14 116,69 119,62		ns
Fall time	$t_f$					25 125 150		17,53 32,53 35,68		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 3,41$ μC $Q_{tFWD} = 9,57$ μC $Q_{tFWD} = 11,45$ μC				25 125 150		1,8 3,08 3,36		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,22 1,82 1,99		mWs



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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	$V_F$				200	25 125 150		2,72 2,42 2,34	3 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25			8	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,59		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$					25 125 150		76,54 122,51 131,7		A
Reverse recovery time	$t_{rr}$					25 125 150		131,32 199,37 231,11		ns
Recovered charge	$Q_r$	$di/dt=3683$ A/μs $di/dt=3577$ A/μs $di/dt=3424$ A/μs	±15	350	100	25 125 150		3,41 9,57 11,45		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,742 2,15 2,6		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		2846,01 3270,82 3296,67		A/μs



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### Characteristic Values

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

### Thermistor

#### Static

Rated resistance	$R$					25		22		kΩ
Deviation of R100	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$					25		130		mW
Power dissipation constant	$d$					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						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.



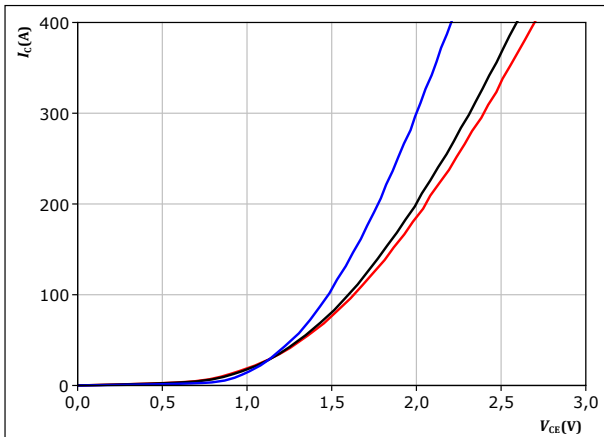


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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



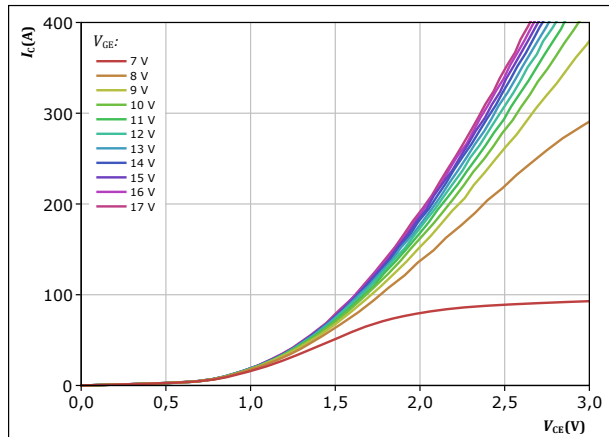
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

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

**figure 2.** IGBT

Typical output characteristics

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



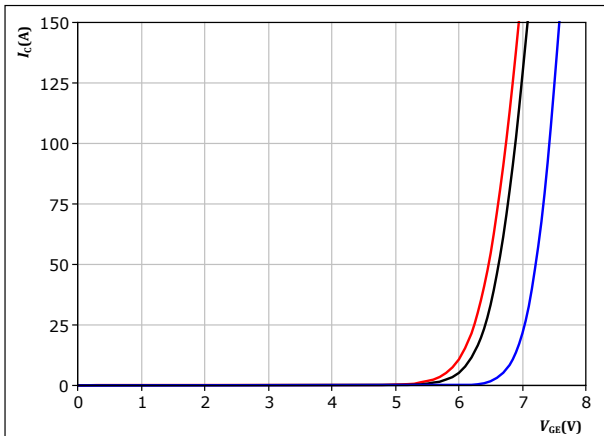
$t_p = 250 \mu s$   
 $T_j = 150 \text{ } ^\circ C$

$V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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



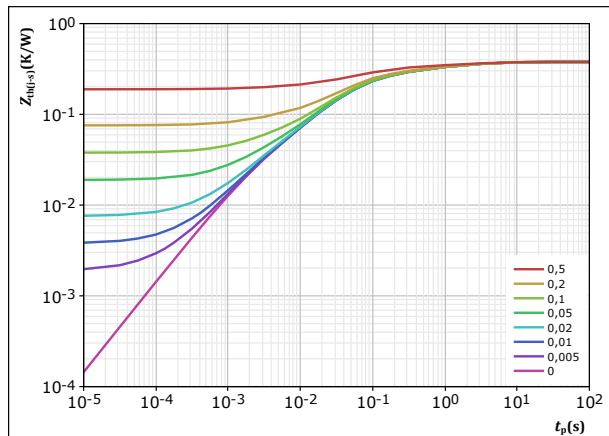
$t_p = 250 \mu s$   
 $V_{CE} = 29 V$

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

**figure 4.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,378 \text{ K/W}$

IGBT thermal model values

$R$ (K/W)	$\tau$ (s)
4,27E-02	3,54E+00
7,58E-02	5,68E-01
1,73E-01	6,75E-02
6,98E-02	1,82E-02
1,67E-02	2,12E-03

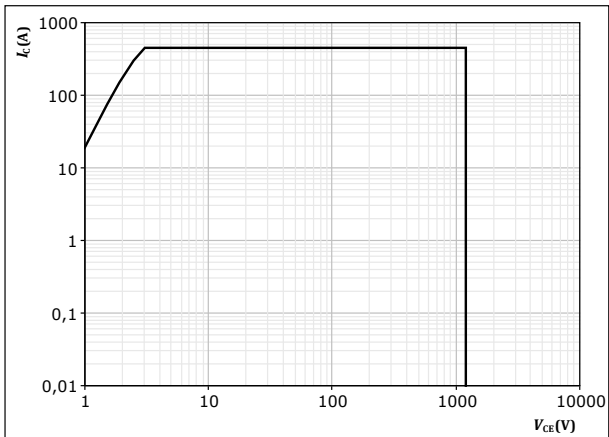


### Buck Switch Characteristics

**figure 5.** IGBT

Safe operating area

$I_C = f(V_{CE})$

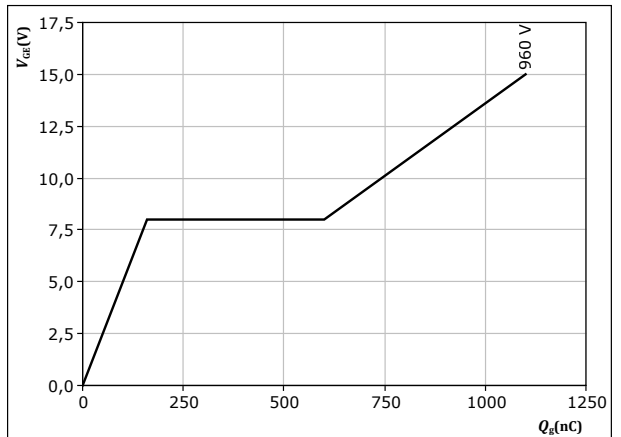


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = 15$  V  
 $T_j = T_{jmax}$

**figure 6.** IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



$I_C = 75$  A  
 $T_j = 25$  °C

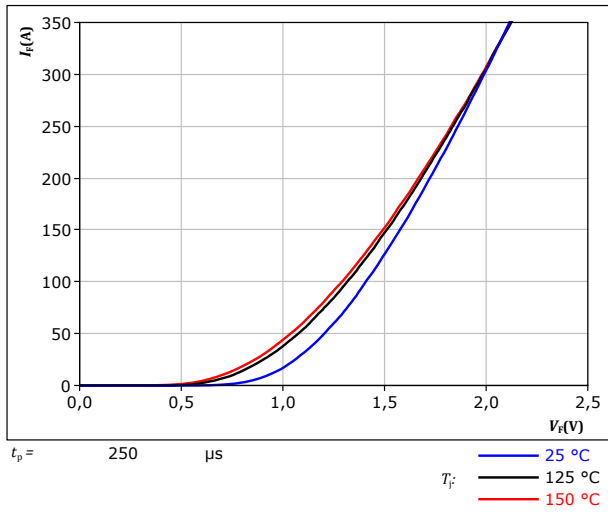


### Buck Diode Characteristics

**figure 7.** FWD

Typical forward characteristics

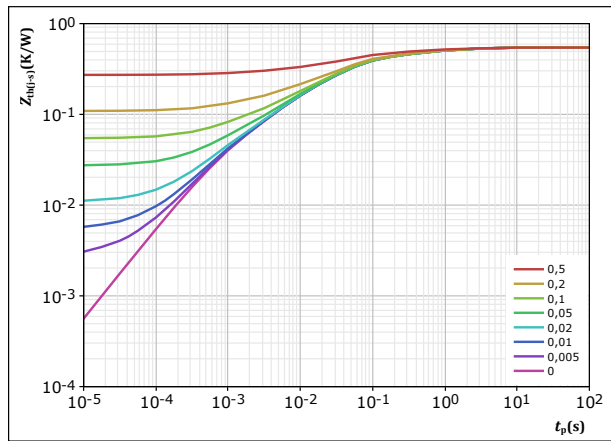
$$I_F = f(V_F)$$



**figure 8.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 0,544 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
5,50E-02	2,12E+00
9,86E-02	3,16E-01
2,64E-01	4,45E-02
9,74E-02	6,83E-03
2,98E-02	8,33E-04

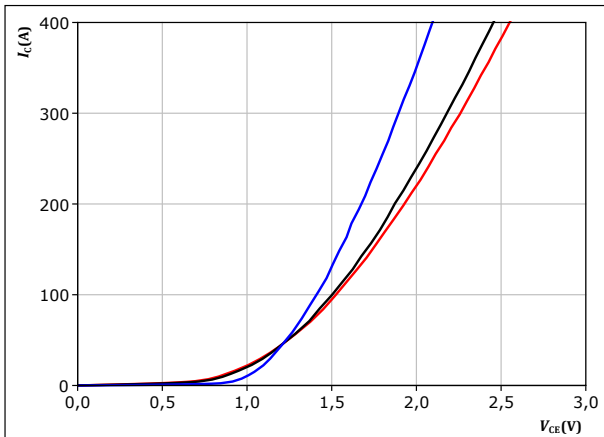


## Boost Switch Characteristics

**figure 9.** IGBT

Typical output characteristics

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



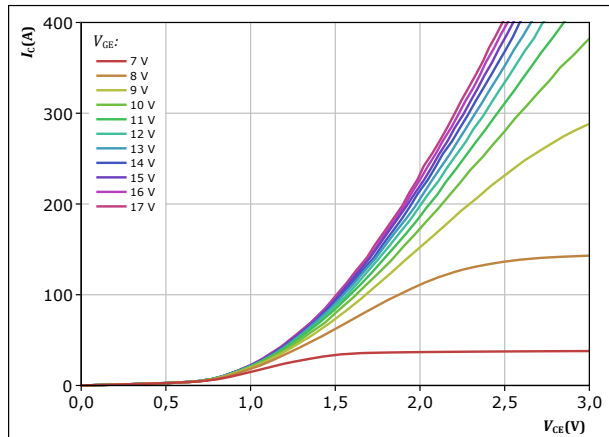
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

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

**figure 10.** IGBT

Typical output characteristics

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

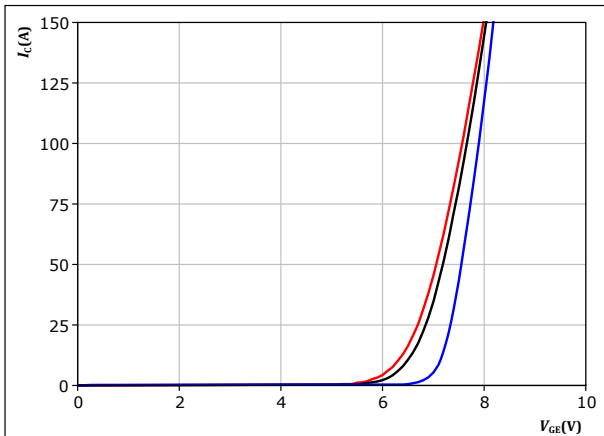


$t_p = 250 \mu s$   
 $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 11.** IGBT

Typical transfer characteristics

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



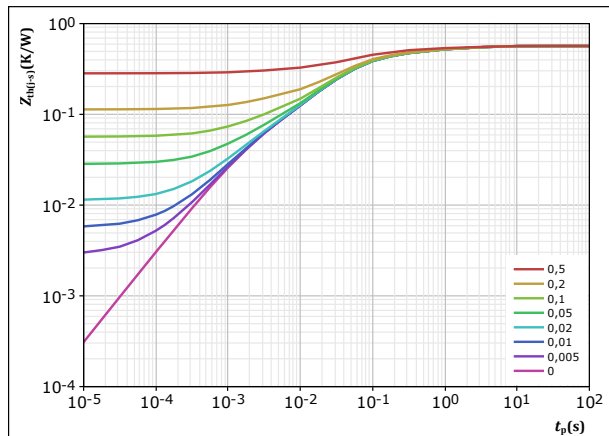
$t_p = 250 \mu s$   
 $V_{CE} = 14 V$

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

**figure 12.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,566 \text{ K/W}$

IGBT thermal model values

$R$ (K/W)	$\tau$ (s)
5,93E-02	2,50E+00
9,59E-02	3,59E-01
2,82E-01	5,76E-02
9,38E-02	1,70E-02
3,58E-02	1,77E-03

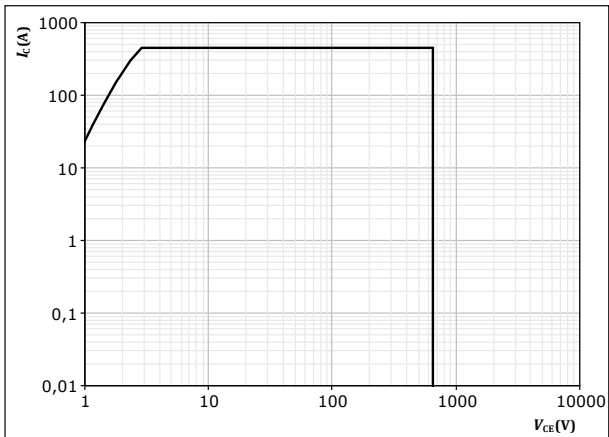


### Boost Switch Characteristics

**figure 13.** IGBT

Safe operating area

$I_C = f(V_{CE})$

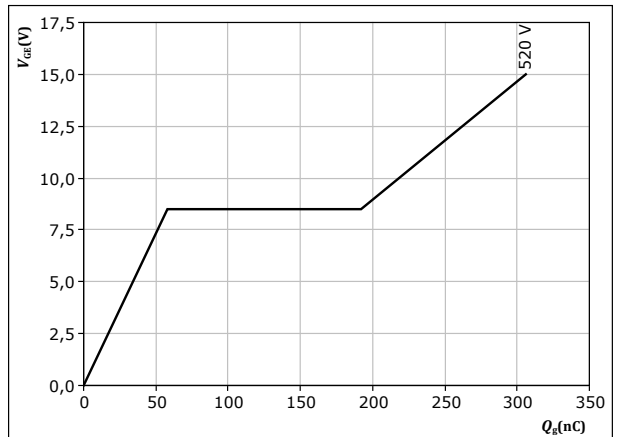


$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = 15$  V  
 $T_j = T_{jmax}$

**figure 14.** IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



$I_C = 40$  A  
 $T_j = 25$  °C

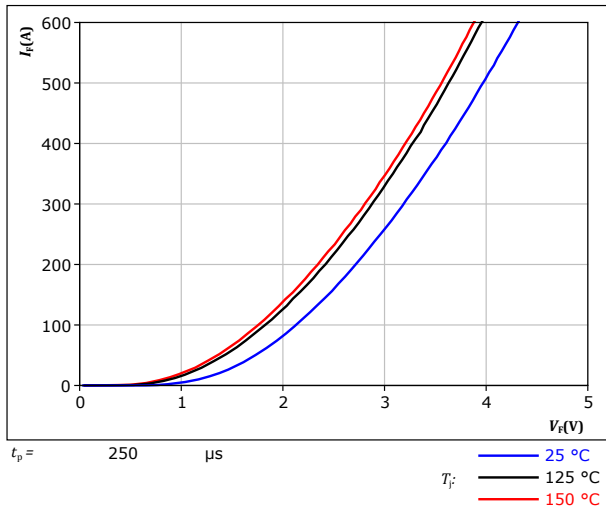


## Boost Diode Characteristics

**figure 15.** FWD

Typical forward characteristics

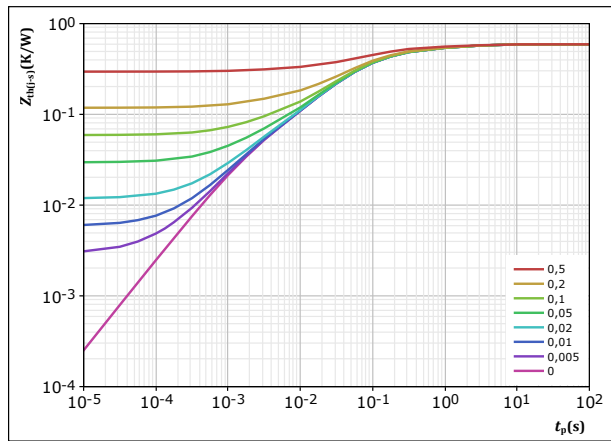
$$I_F = f(V_F)$$



**figure 16.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,591 \text{ K/W}$   
 FWD thermal model values

$R$ (K/W)	$\tau$ (s)
6,39E-02	2,37E+00
9,91E-02	3,99E-01
3,04E-01	7,69E-02
9,53E-02	1,78E-02
2,90E-02	1,86E-03

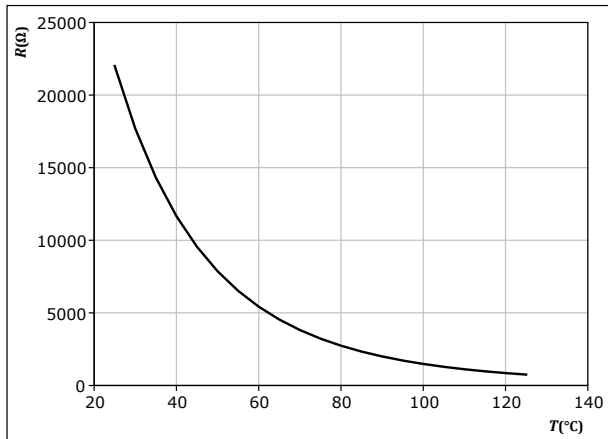


## Thermistor Characteristics

**figure 17.** Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

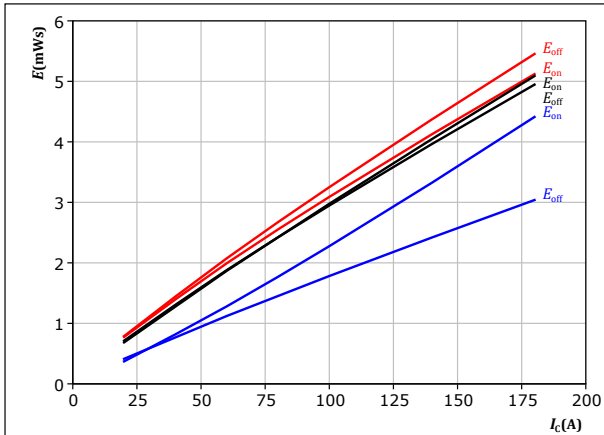




## Buck Switching Characteristics

**figure 18.** IGBT

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

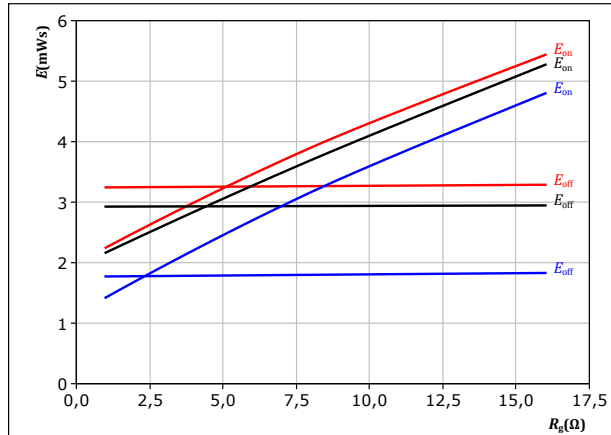


With an inductive load at

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

**figure 19.** IGBT

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

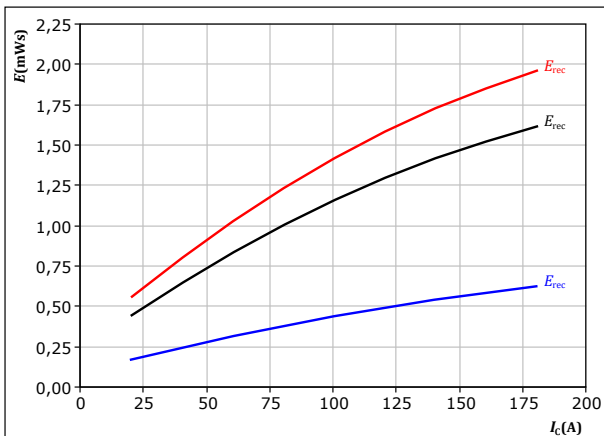


With an inductive load at

$V_{CE} = 350$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$I_c = 100$ A	150 °C

**figure 20.** FWD

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

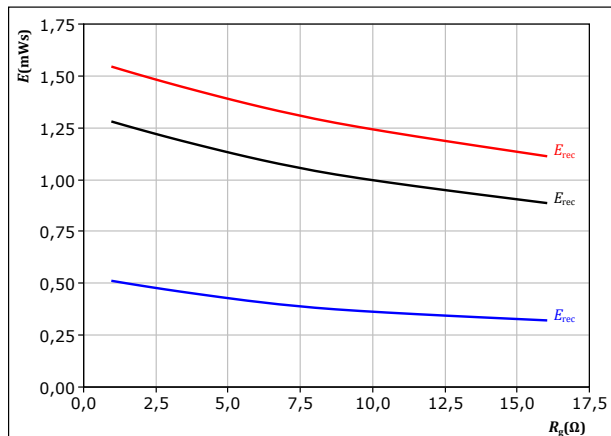


With an inductive load at

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

**figure 21.** 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

$V_{CE} = 350$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$I_c = 100$ A	150 °C

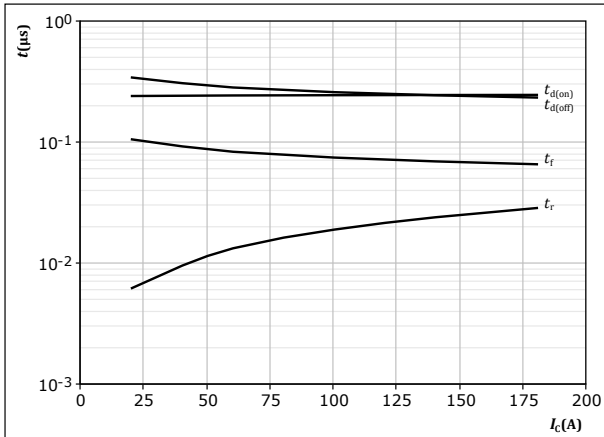




## Buck Switching Characteristics

**figure 22.** IGBT

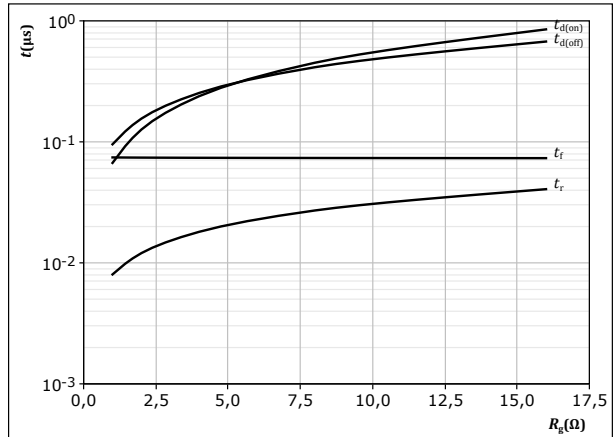
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

**figure 23.** IGBT

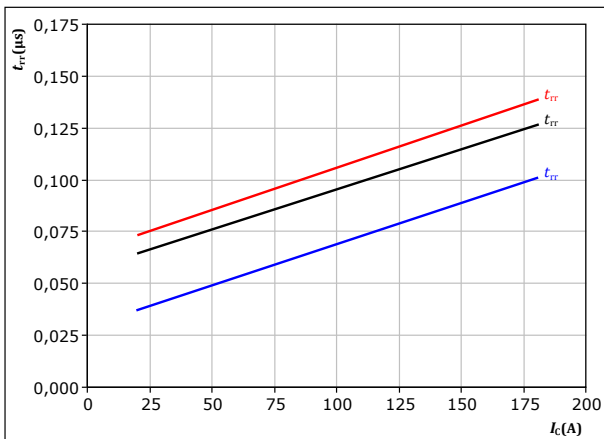
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 100 \text{ A}$

**figure 24.** FWD

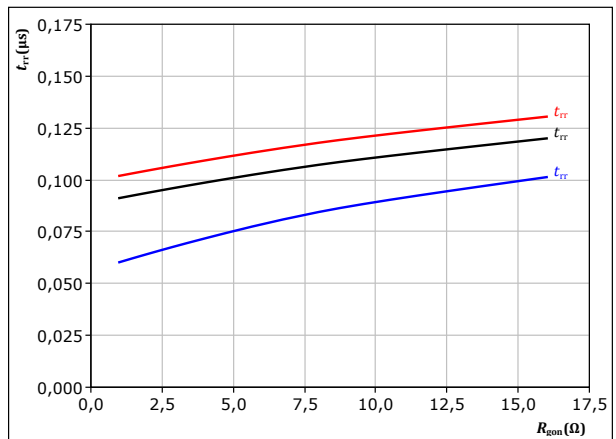
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

**figure 25.** FWD

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



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 100 \text{ A}$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

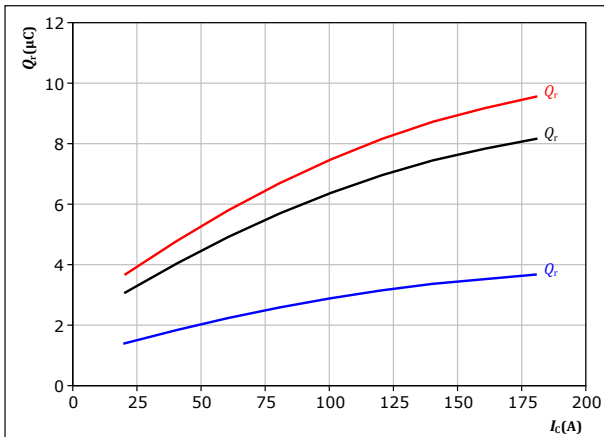


## Buck Switching Characteristics

**figure 26.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

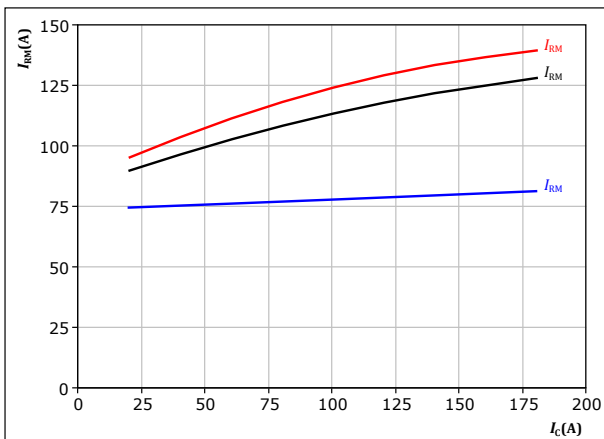
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 4$   $\Omega$

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

**figure 28.** FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

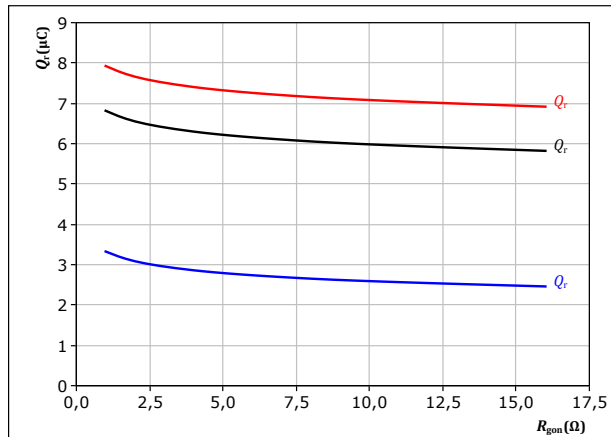
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 4$   $\Omega$

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

**figure 27.** FWD

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

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



With an inductive load at

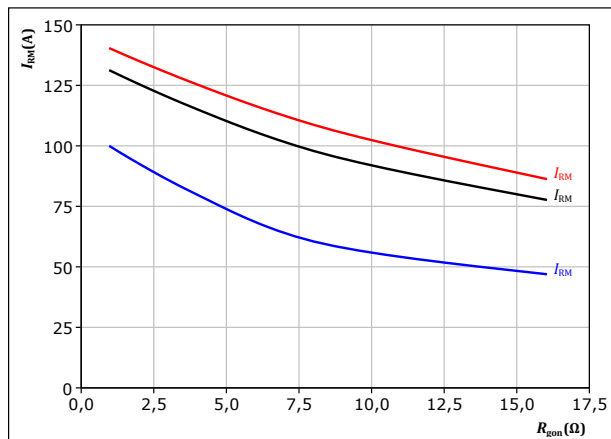
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 100$  A

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

**figure 29.** 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

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 100$  A

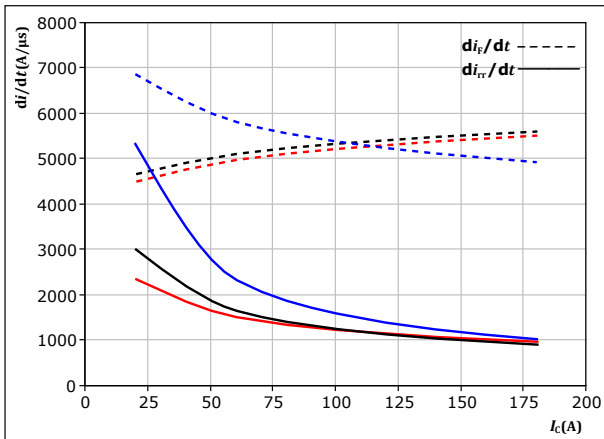
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C



## Buck Switching Characteristics

**figure 30.** FWD

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



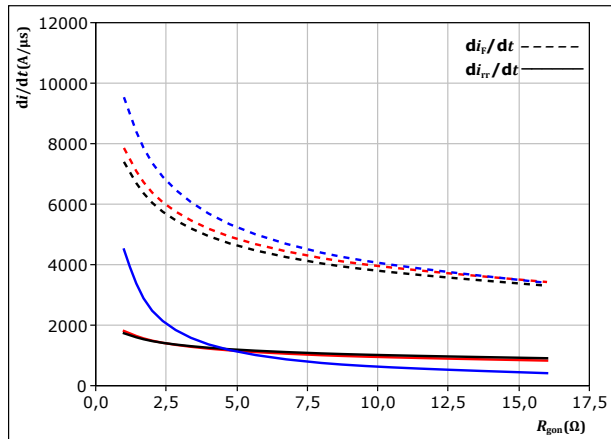
With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 4 \ \Omega$

$T_j$ : 25 °C  
 125 °C  
 150 °C

**figure 31.** FWD

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



With an inductive load at

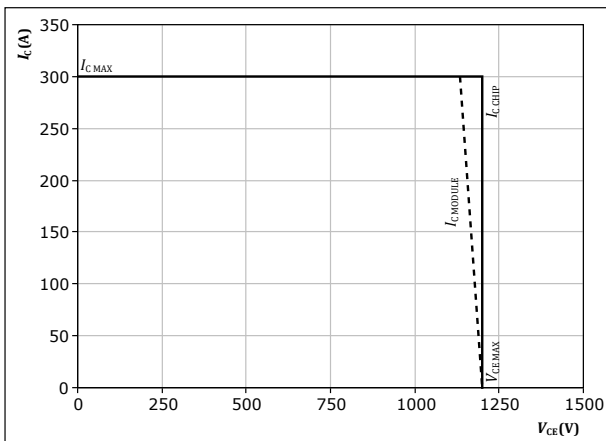
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 100 \text{ A}$

$T_j$ : 25 °C  
 125 °C  
 150 °C

**figure 32.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



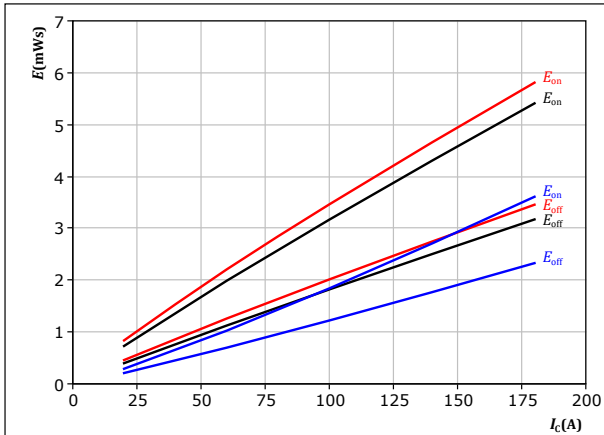
At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 4 \ \Omega$   
 $R_{goff} = 4 \ \Omega$



## Boost Switching Characteristics

**figure 33.** IGBT

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

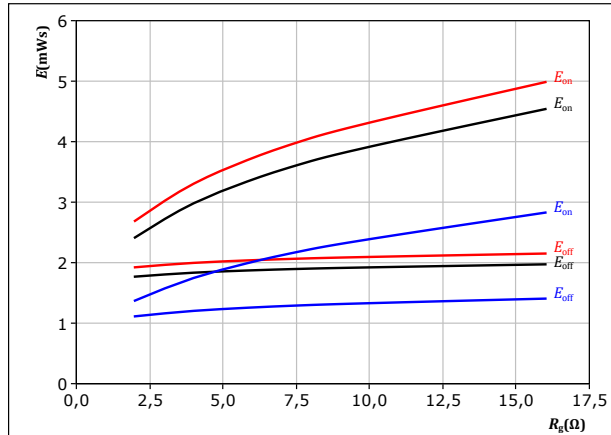


With an inductive load at

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

**figure 34.** IGBT

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

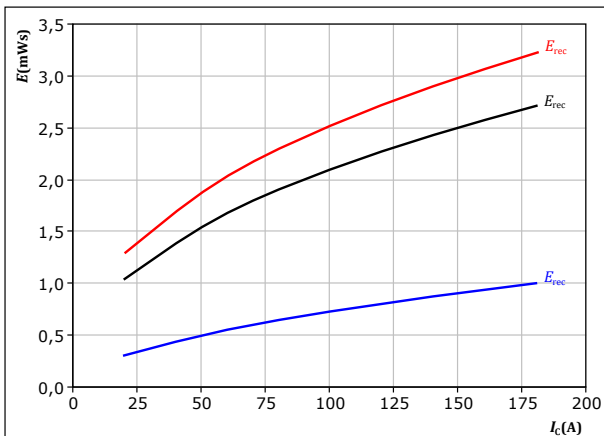


With an inductive load at

$V_{CE} = 350$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C
$I_c = 100$ A	$T_j = 150$ °C

**figure 35.** FWD

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

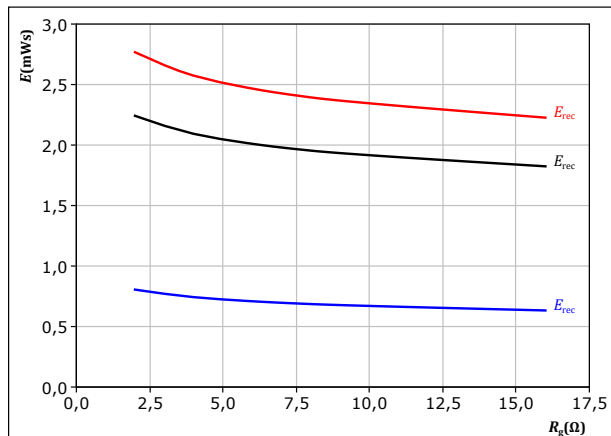


With an inductive load at

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

**figure 36.** 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

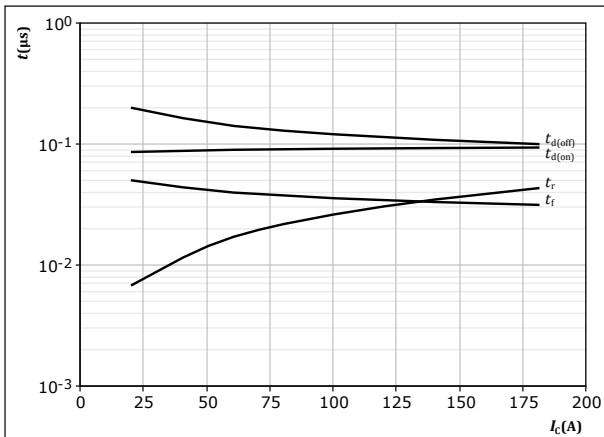
$V_{CE} = 350$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C
$I_c = 100$ A	$T_j = 150$ °C



## Boost Switching Characteristics

**figure 37.** IGBT

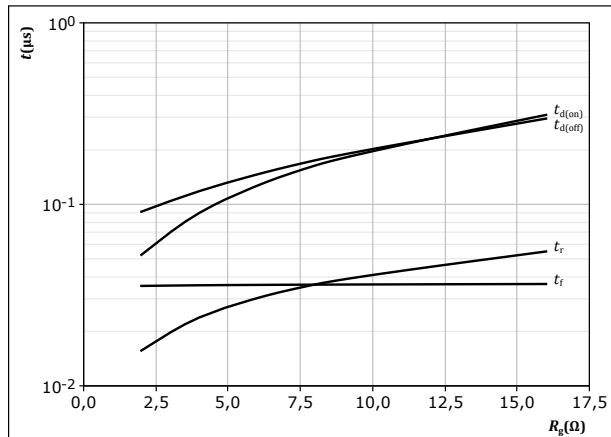
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 4$  Ω  
 $R_{goff} = 4$  Ω

**figure 38.** IGBT

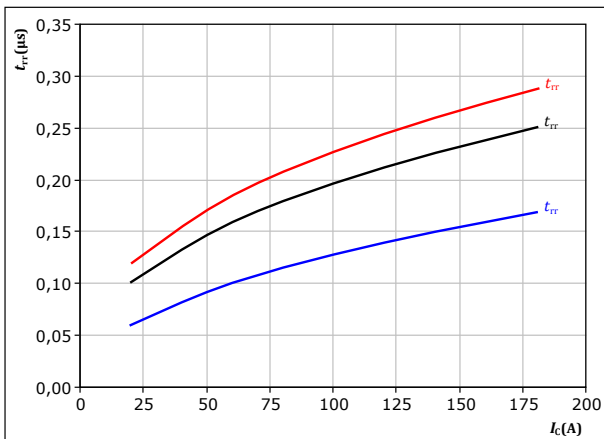
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 100$  A

**figure 39.** FWD

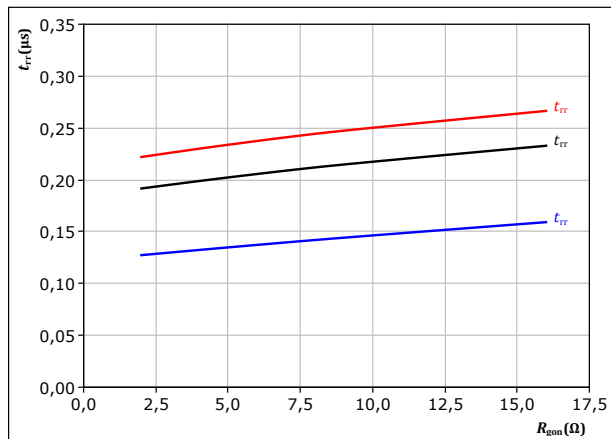
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 4$  Ω  
 $T_j:$  — 25 °C  
— 125 °C  
— 150 °C

**figure 40.** FWD

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 100$  A  
 $T_j:$  — 25 °C  
— 125 °C  
— 150 °C

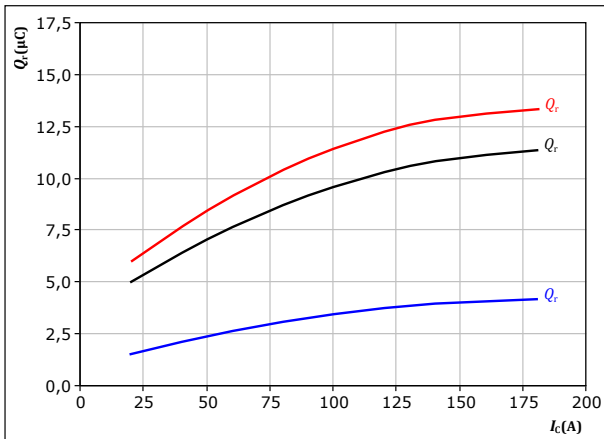


## Boost Switching Characteristics

**figure 41.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

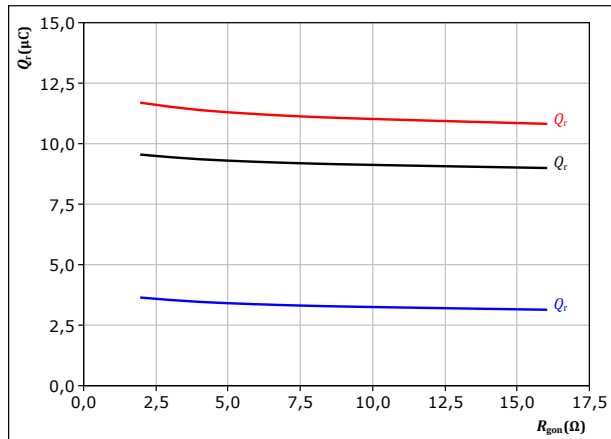
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 4 \ \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 42.** FWD

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

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



With an inductive load at

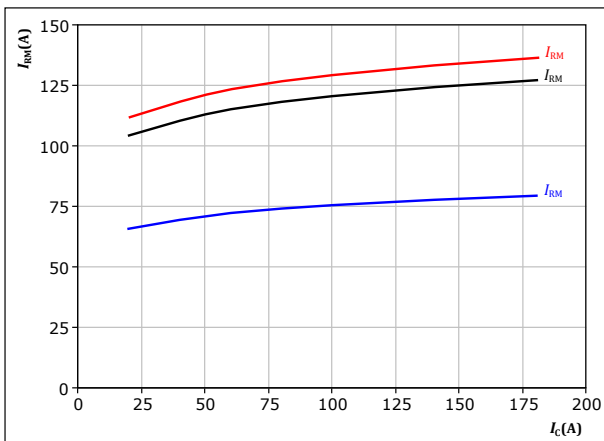
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 100 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 43.** FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

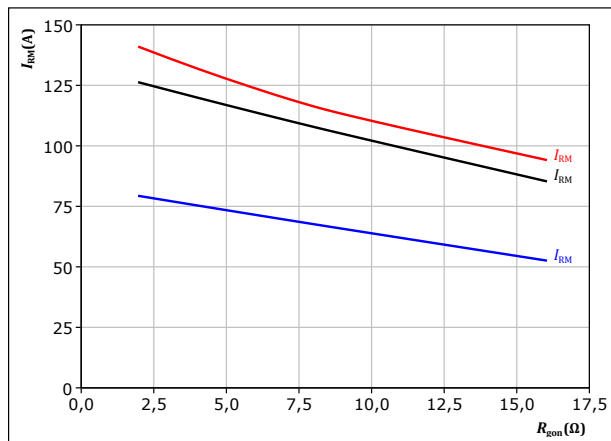
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 4 \ \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 44.** 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

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 100 \text{ A}$

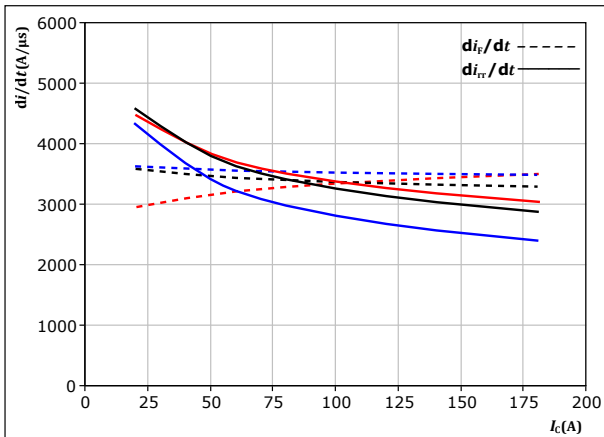
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



## Boost Switching Characteristics

**figure 45.** FWD

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



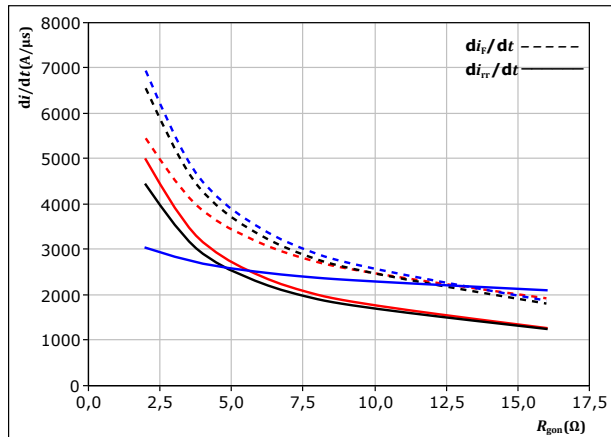
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 4$   $\Omega$

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

**figure 46.** 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

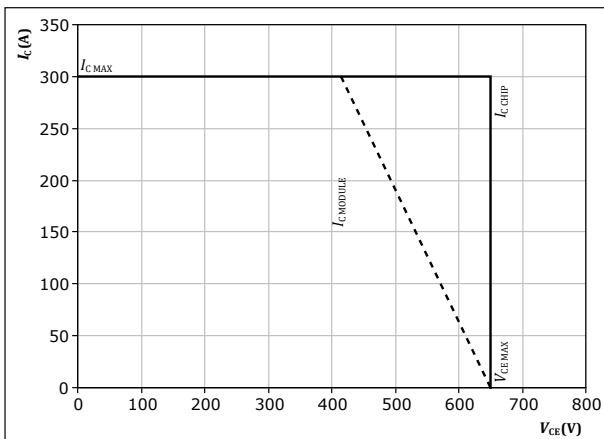
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 100$  A

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

**figure 47.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 150$  °C  
 $R_{gon} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$



## Switching Definitions

figure 48. IGBT

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

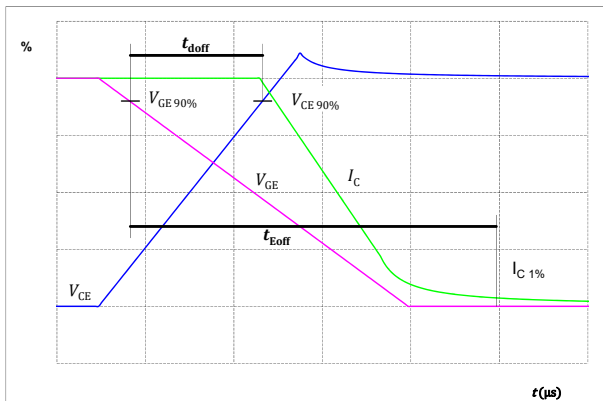


figure 49. IGBT

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

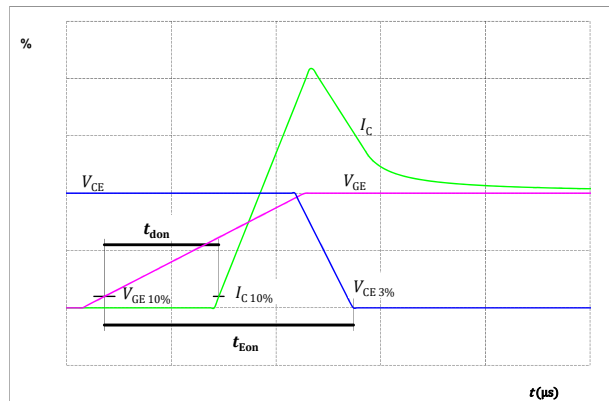


figure 50. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

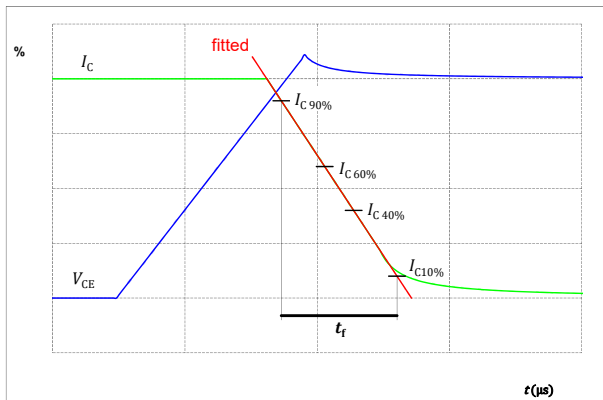
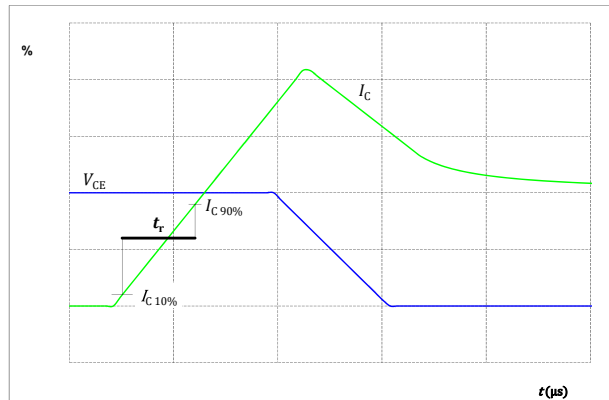


figure 51. IGBT

Turn-on Switching Waveforms & definition of  $t_r$







### Switching Definitions

figure 52. FWD

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

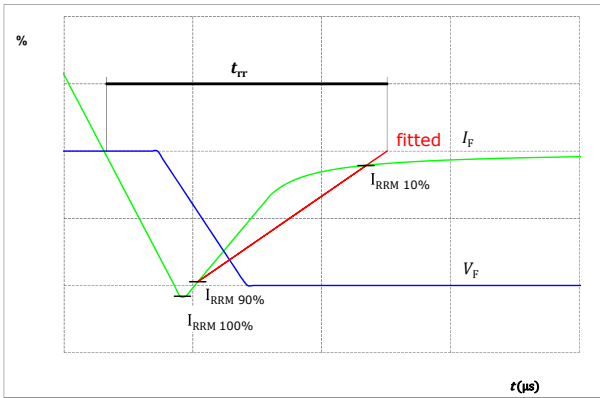
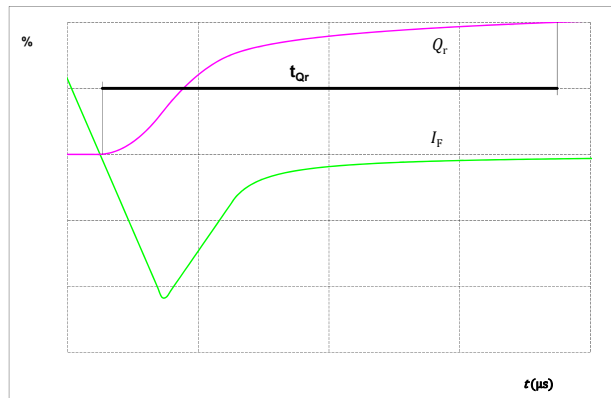


figure 53. FWD

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






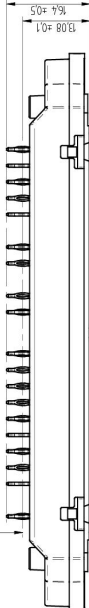
Vincotech

**B0-EP12M3A150H702-PH09F48T**  
datasheet

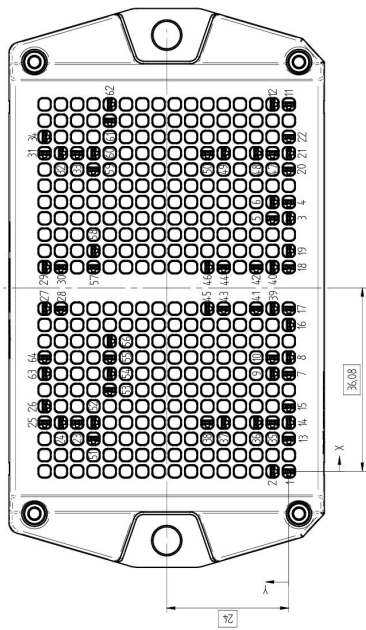
Ordering Code	
<b>Version</b>	<b>Ordering Code</b>
Without thermal paste	B0-EP12M3A150H702-PH09F48T
With thermal paste (5,2 W/mK, PTM6000HV)	B0-EP12M3A150H702-PH09F48T-/7/

Marking						
	<b>Text</b>	<b>Name</b> NN-NNNNNNNNNNNNNN- TTTTTVV	<b>Date code</b> WWYY	<b>UL &amp; VIN</b> UL VIN	<b>Lot</b> LLLLL	<b>Serial</b> SSSS
	<b>Datamatrix</b>	<b>Type&amp;Ver</b> TTTTTTVV	<b>Lot number</b> LLLLL	<b>Serial</b> SSSS	<b>Date code</b> WWYY	

Outline							
Pin table [mm]							
Pin	X	Y	Function	33	62,56	41,6	Ph3
1	0	0	DC+1	34	65,76	48	Ph3
2	0	3,2	DC+1	35	9,6	3,2	S13
3	49,76	0	DC+23	36	9,6	6,4	G13
4	52,96	0	DC+23	37	9,6	12,8	G14
5	49,76	3,2	DC+23	38	9,6	16	S14
6	52,96	3,2	DC+23	39	32	3,2	S23-1
7	19,2	0	DC-12	40	40,16	3,2	S23-2
8	22,4	0	DC-12	41	32	6,4	G23-1
9	19,2	3,2	DC-12	42	40,16	6,4	G23-2
10	22,4	3,2	DC-12	43	32	12,8	G24-1
11	72,16	0	DC-3	44	40,16	12,8	G24-2
12	72,16	3,2	DC-3	45	32	16	S24-1
13	6,4	0	GND1	46	40,16	16	S24-2
14	9,6	0	GND1	47	62,56	3,2	S33
15	12,8	0	GND1	48	62,56	6,4	G33
16	28,8	0	GND2-1	49	62,56	12,8	G34
17	32	0	GND2-1	50	62,56	16	S34
18	40,16	0	GND2-2	51	6,4	38,4	G11
19	43,36	0	GND2-2	52	9,6	38,4	S11
20	59,36	0	GND3	53	16	35,2	G12
21	62,56	0	GND3	54	19,2	35,2	S12
22	65,76	0	GND3	55	22,4	35,2	S22
23	9,6	41,6	Ph1	56	25,6	35,2	G22
24	9,6	44,8	Ph1	57	40,16	38,4	S21
25	9,6	48	Ph1	58	43,36	38,4	G21
26	12,8	48	Ph1	59	59,36	38,4	G31
27	32	48	Ph2-1	60	62,56	38,4	S31
28	32	44,8	Ph2-1	61	68,96	35,2	G32
29	40,16	48	Ph2-2	62	72,16	35,2	S32
30	40,16	44,8	Ph2-2	63	19,2	48	Therm1
31	62,56	48	Ph3	64	22,4	48	Therm2
32	62,56	44,8	Ph3				



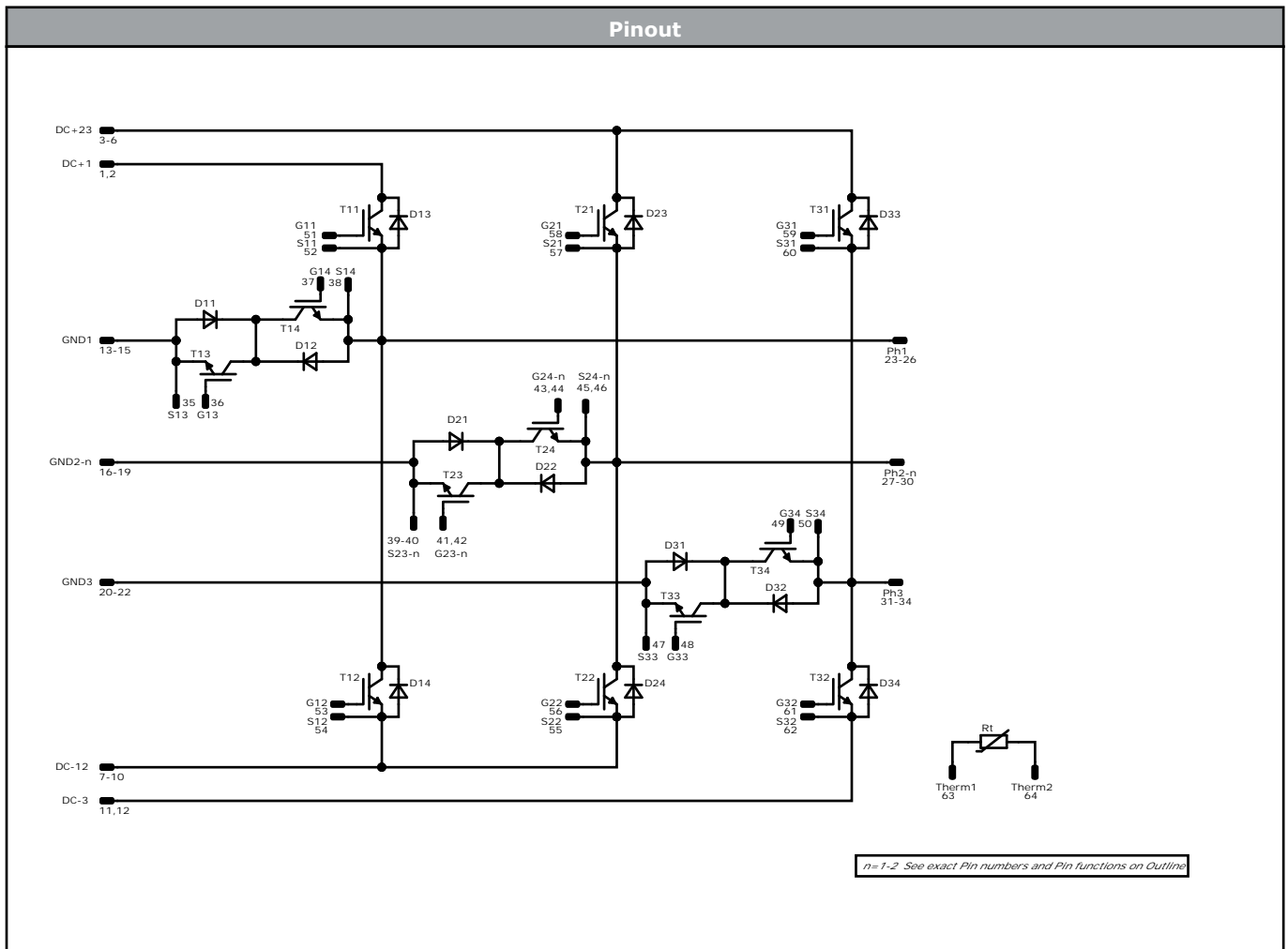
center of press-fit pin head  
pin head type "T", PCB plated through-hole  $\phi_{\text{th}} = 0,09 - 0,06$   
for further PCB design rules refer to the latest handling instruction



Tolerance of propositions: ±0,1mm at the end of the pins  
Dimension of coordinate axis is only offset without tolerance



Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T21, T22, T31, T32	IGBT	1200 V	150 A	Buck Switch	
D11, D12, D21, D22, D31, D32	FWD	650 V	120 A	Buck Diode	
T13, T14, T23, T24, T33, T34	IGBT	650 V	150 A	Boost Switch	
D13, D14, D23, D24, D33, D34	FWD	1200 V	200 A	Boost Diode	
Rt	Thermistor			Thermistor	



Packaging instruction				
Standard packaging quantity (SPQ) 40	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow</i> E3 packages see vincotech.com website.

Package data
Package data for <i>flow</i> E3 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 $T_{j,op}=150^{\circ}\text{C}$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
B0-EP12M3A150H702-PH09F48T-D1-14	5 Jun. 2024	Initial Release	

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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.