



**flowMNPC E3BP**

**1200 V / 400 A**

**Topology features**

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

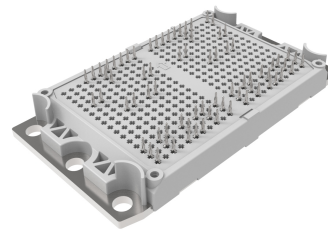
**Target applications**

- Energy Storage Systems
- Solar Inverters
- UPS

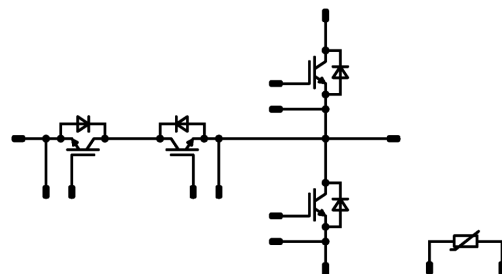
**Types**

- 30-EP12NMA400H7-PM19F07T

**flow E3BP 12 mm housing**



**Schematic**





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**30-EP12NMA400H7-PM19F07T**  
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 $T_{jmax}$	1200	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	1200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	523	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)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	304	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	1200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	429	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Switch

Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	282	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	800	A
Turn off safe operating area		$T_j = 150\text{ °C}$ , $V_{CE} = 1200\text{ V}$	800	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	457	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

**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)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	197	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	1200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	395	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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**30-EP12NMA400H7-PM19F07T**  
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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0064	25	4,7	5,5	6,2	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		400	25 125 150		1,78 1,94 1,98	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	$C_{ies}$							52000		pF
Output capacitance	$C_{oes}$	$f = 100$ kHz	0	25		25		960		pF
Reverse transfer capacitance	$C_{res}$							288		pF
Gate charge	$Q_g$	$V_{CC} = 960$ V	0/15		400	25		2856		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,18		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		163,54 166,53 167,08		ns
Rise time	$t_r$					25 125 150		23,35 25,4 26,18		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		150,59 175,22 181,85		ns
Fall time	$t_f$					25 125 150		35,83 59,96 65,61		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 9,33$ μC $Q_{tFWD} = 20,18$ μC $Q_{tFWD} = 23,36$ μC				25 125 150		7,84 9,58 10,03		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		6,26 11,39 12,76		mWs



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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		
<b>Buck Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$			400	25 125 150		1,65 1,6 1,58	1,92 <sup>(1)</sup>		V
Reverse leakage current	$I_R$	$V_r = 650$ V			25			21,2		μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)					0,22			K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$				25 125 150		252,33 369,87 396,69			A
Reverse recovery time	$t_{rr}$				25 125 150		71,69 98,02 109,2			ns
Recovered charge	$Q_r$	$di/dt=14181$ A/μs $di/dt=16927$ A/μs $di/dt=16036$ A/μs	±15	350	400	25 125 150	9,33 20,18 23,36			μC
Reverse recovered energy	$E_{rec}$				25 125 150		1,39 3,73 4,46			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		3908,85 4241,9 4306,97			A/μs



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### 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	

#### Boost Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,004	25	3,25	4	4,75	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		400	25 125 150	1,15	1,24 1,7 1,75	1,8 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			100	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			400	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							22800		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		660		pF
Reverse transfer capacitance	$C_{res}$							77,2		pF
Gate charge	$Q_g$	$V_{CC} = 400$ V	±15		400	25		1680		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,21		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		53,14 53,8 54,13		ns
Rise time	$t_r$	$R_{gon} = 2,13$ Ω $R_{goff} = 2$ Ω				25 125 150		11,9 13,63 13,92		ns
Turn-off delay time	$t_{d(off)}$		±15	350	400	25 125 150		68,03 83,55 87,89		ns
Fall time	$t_f$					25 125 150		10,82 27,24 32,85		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 8,88$ μC $Q_{tFWD} = 19,69$ μC $Q_{tFWD} = 22,54$ μC				25 125 150		2,59 4,02 4,42		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		3,49 5,92 6,65		mWs



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**30-EP12NMA400H7-PM19F07T**  
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	$V_F$			400	25 125 150		3,11 2,96 2,88	3 <sup>(1)</sup>		V
Reverse leakage current	$I_R$	$V_r = 1200$ V			25			16		μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)					0,24			K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$	$di/dt=32542$ A/μs $di/dt=27583$ A/μs $di/dt=26872$ A/μs	±15	350	400	25		533,44		A
Reverse recovery time	$t_{rr}$					125		639,85		
						150		663,43		
						25		30		
Recovered charge	$Q_r$					125		96,31		
						150		102,03		
		25		8,88						
Reverse recovered energy	$E_{rec}$	125		19,69						
		150		22,54						
		25		1,49						
Peak rate of fall of recovery current	$(di_r/dt)_{max}$	125		4,19						
		150		4,82						
		25		71583,58						
							49801,89		A/μs	
							43067,13			



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### Characteristic Values

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

### 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.



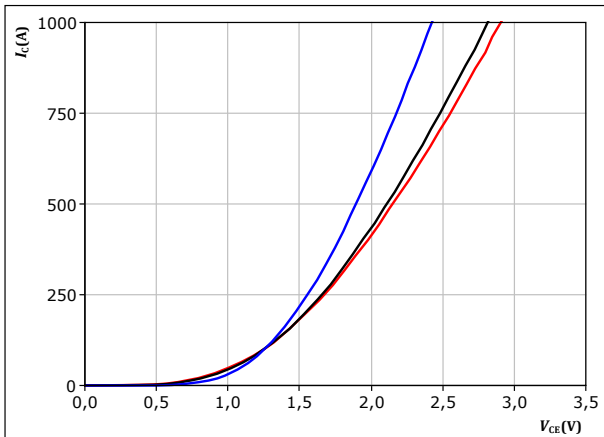


## Buck Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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



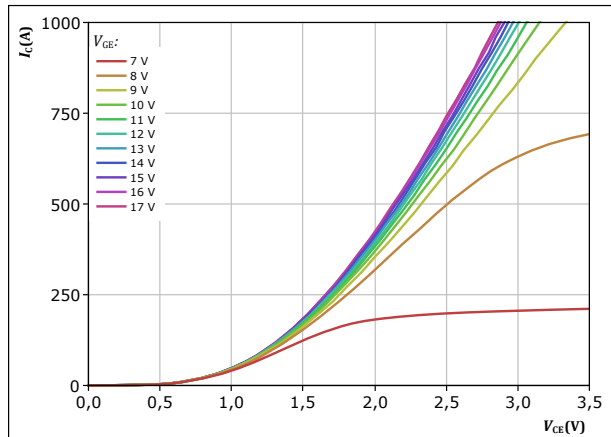
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

$T_j$ : 25 °C  
125 °C  
150 °C

**figure 2.** IGBT

Typical output characteristics

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



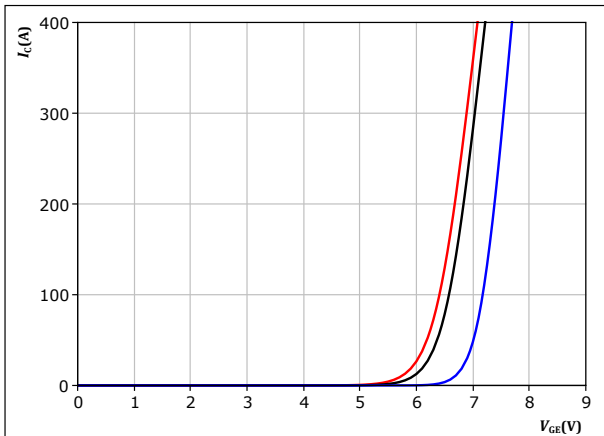
$t_p = 250 \mu s$   
 $T_j = 150 \text{ °C}$

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

**figure 3.** IGBT

Typical transfer characteristics

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



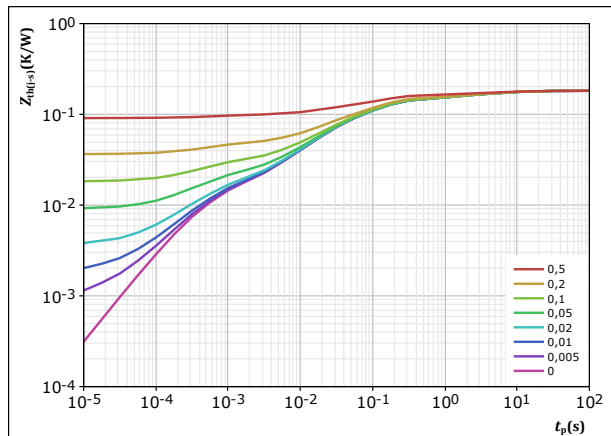
$t_p = 250 \mu s$   
 $V_{CE} = 48 V$

$T_j$ : 25 °C  
125 °C  
150 °C

**figure 4.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,182 K/W$

IGBT thermal model values

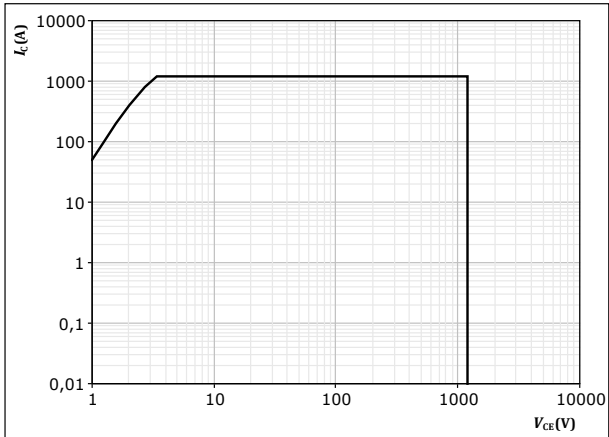
$R$ (K/W)	$\tau$ (s)
1,41E-02	9,72E+00
2,56E-02	1,95E+00
8,76E-02	1,03E-01
4,21E-02	1,58E-02
1,24E-02	4,42E-04



### Buck Switch Characteristics

figure 5. IGBT

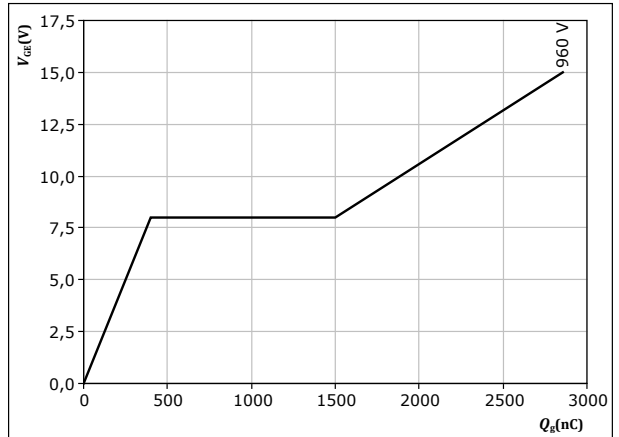
Safe operating area  
 $I_C = f(V_{CE})$



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> = 400 A  
T<sub>j</sub> = 25 °C



### Buck Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

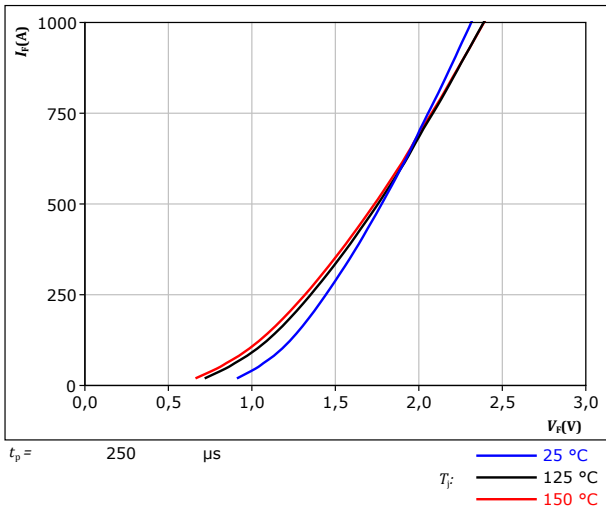
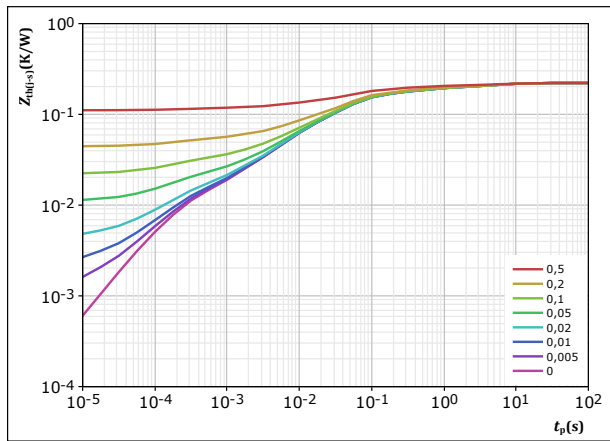


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,222 \text{ K/W}$   
 FWD thermal model values

$R$ (K/W)	$\tau$ (s)
2,97E-02	5,14E+00
3,36E-02	3,91E-01
1,15E-01	4,51E-02
3,29E-02	5,21E-03
1,08E-02	2,04E-04



### Boost Switch Characteristics

figure 9. IGBT

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

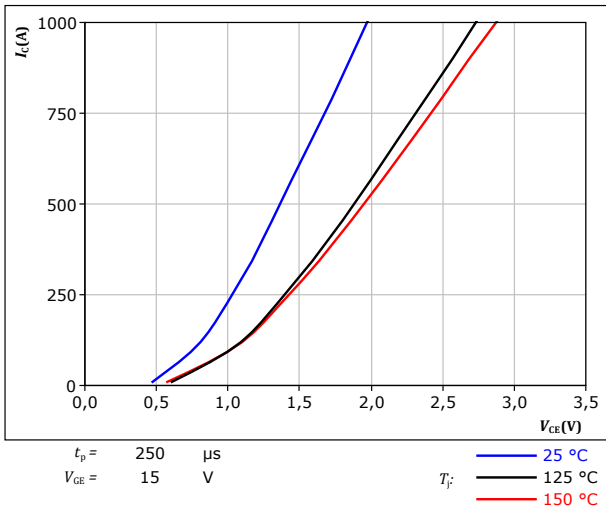


figure 10. IGBT

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

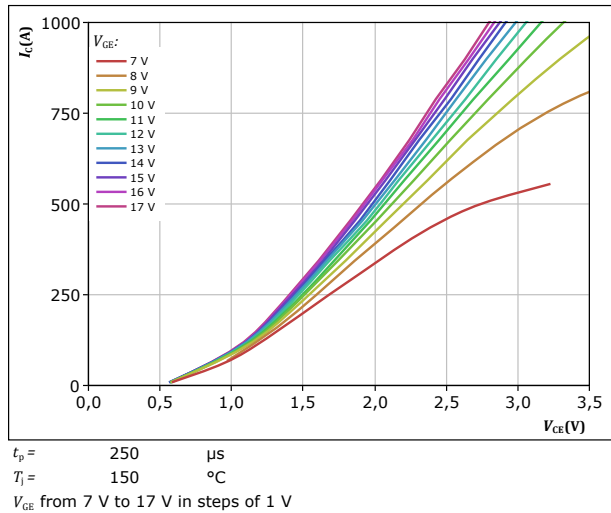


figure 11. IGBT

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

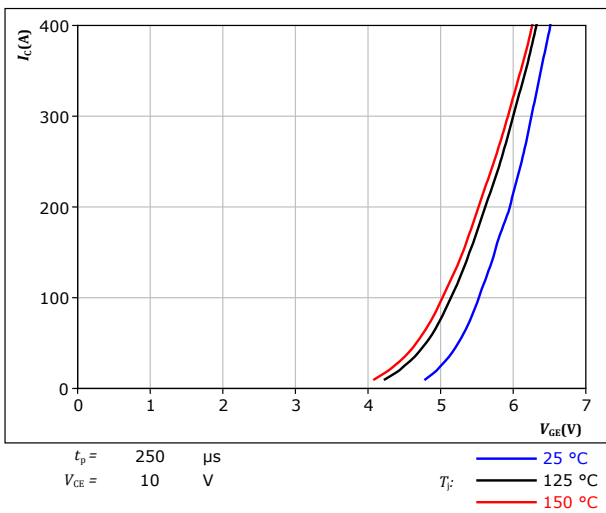
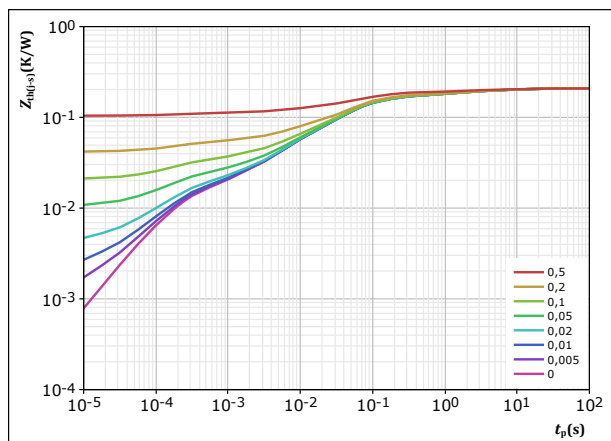


figure 12. IGBT

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)
1,97E-02	7,27E+00
2,56E-02	9,80E-01
1,18E-01	5,85E-02
3,10E-02	6,51E-03
1,44E-02	1,96E-04

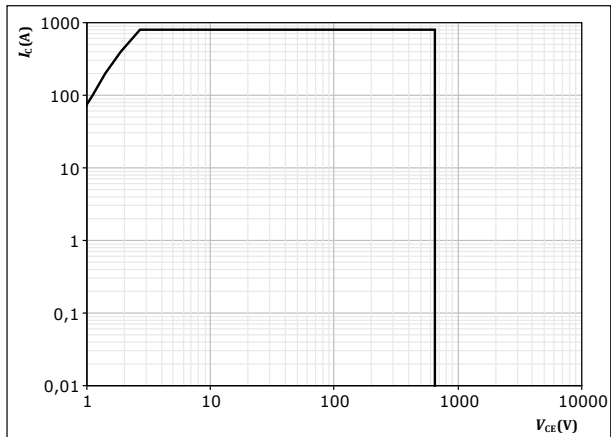


### Boost Switch Characteristics

figure 13. IGBT

Safe operating area

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



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



### Boost Diode Characteristics

figure 14. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

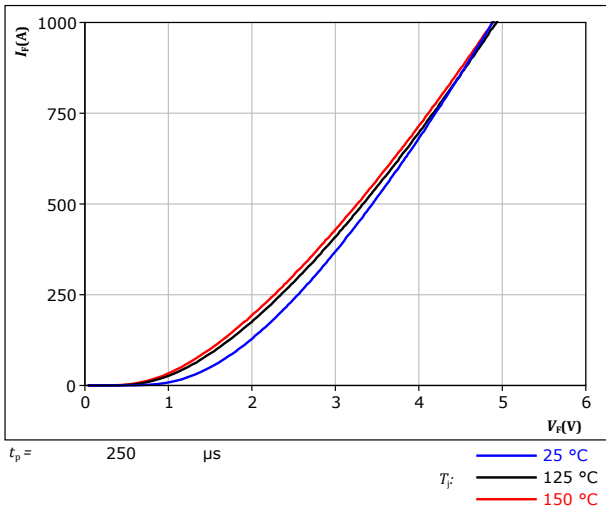
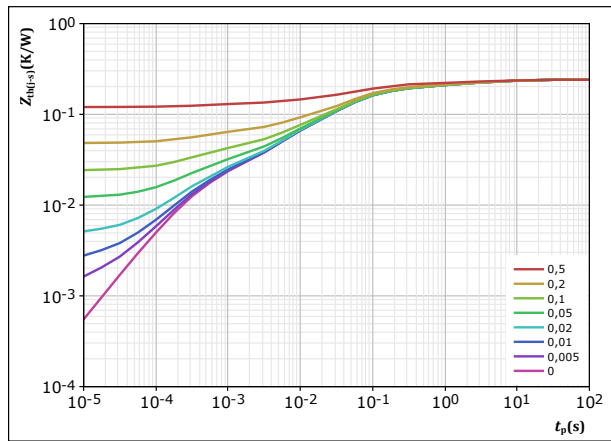


figure 15. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 0,24 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
2,57E-02	6,18E+00
3,31E-02	7,29E-01
1,25E-01	6,10E-02
3,91E-02	7,17E-03
1,76E-02	3,66E-04

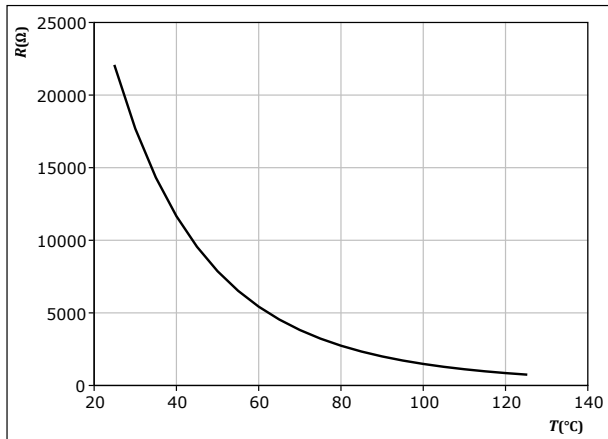


### Thermistor Characteristics

figure 16. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$



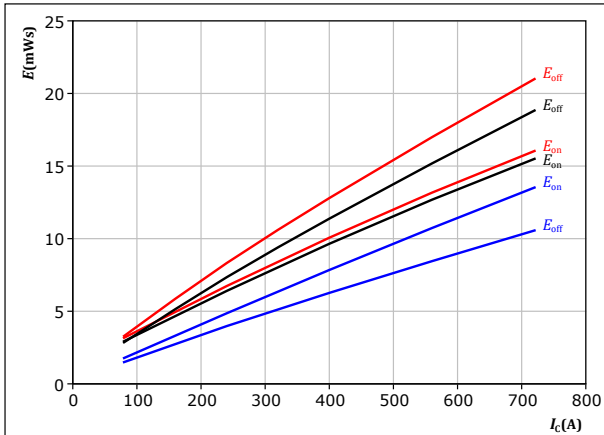


## Buck Switching Characteristics

**figure 17.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

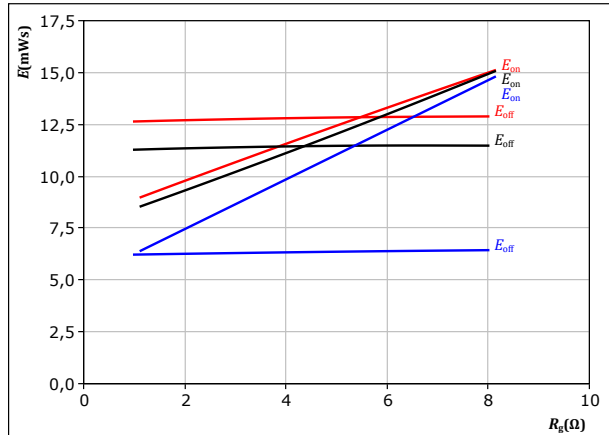
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$   
 $R_{goff} = 2$   $\Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 18.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

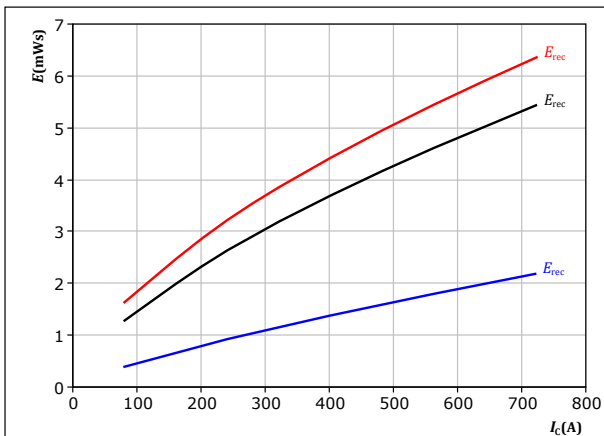
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 19.** FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

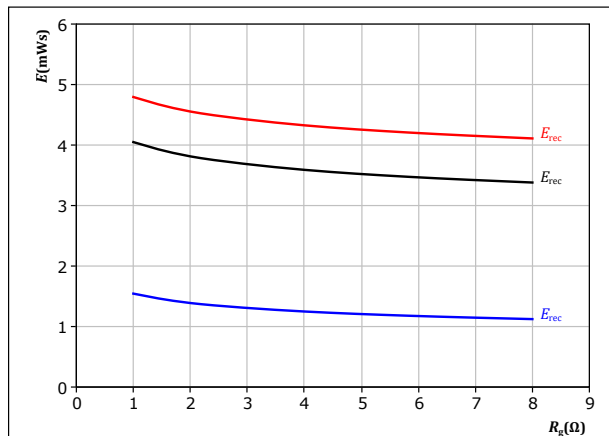
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 20.** 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  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

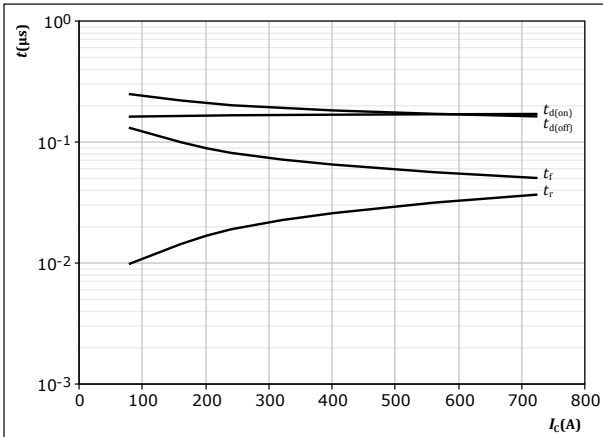




## Buck Switching Characteristics

**figure 21.** IGBT

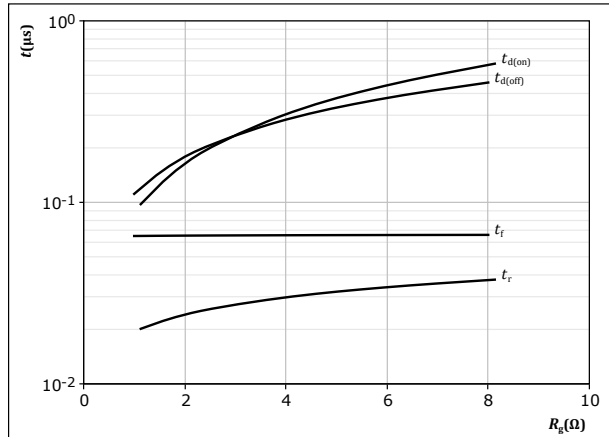
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2,13 \text{ } \Omega$   
 $R_{goff} = 2 \text{ } \Omega$

**figure 22.** IGBT

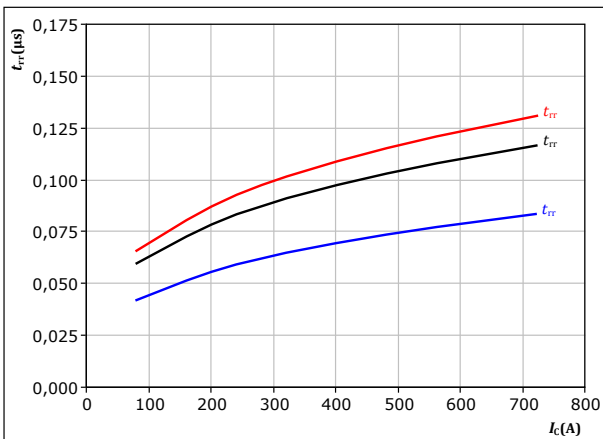
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 400 \text{ A}$

**figure 23.** FWD

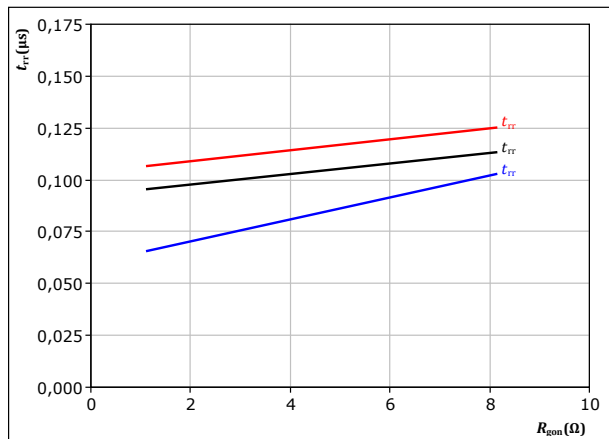
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2,13 \text{ } \Omega$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

**figure 24.** FWD

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



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j:$  — 25 °C  
 — 125 °C  
 — 150 °C

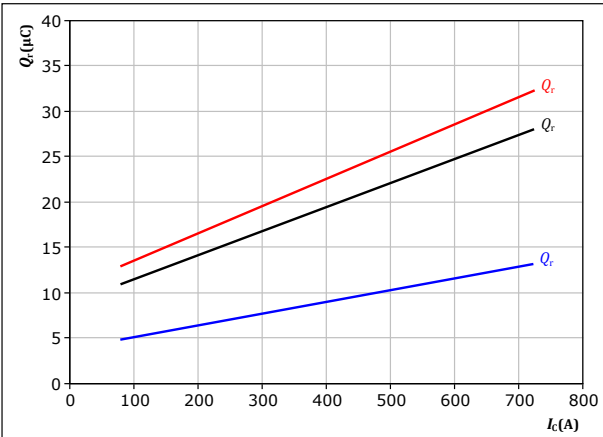


## Buck Switching Characteristics

**figure 25.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

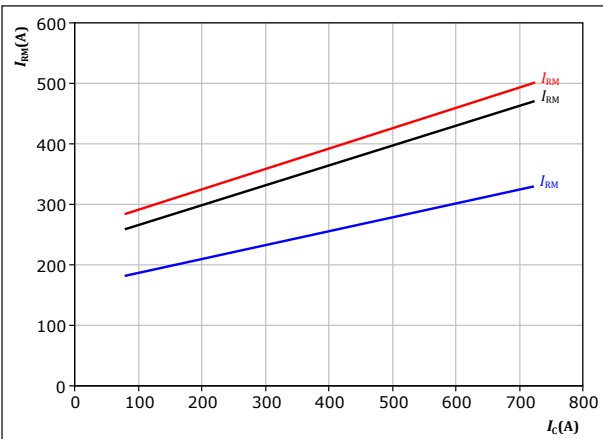
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$

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

**figure 27.** FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

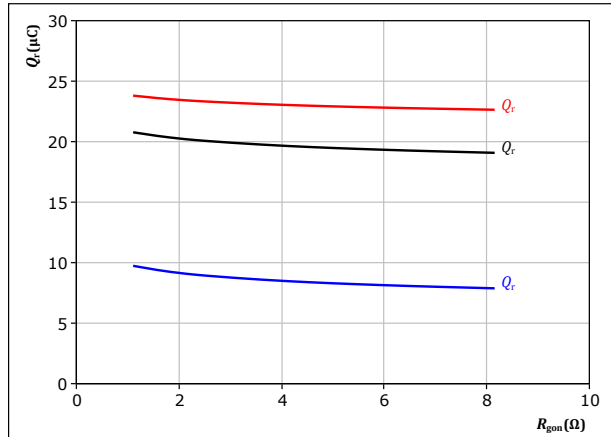
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$

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

**figure 26.** FWD

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

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



With an inductive load at

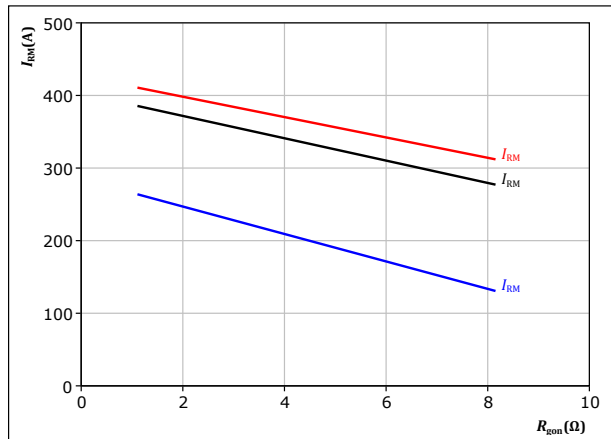
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

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

**figure 28.** 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  
 $I_c = 400$  A

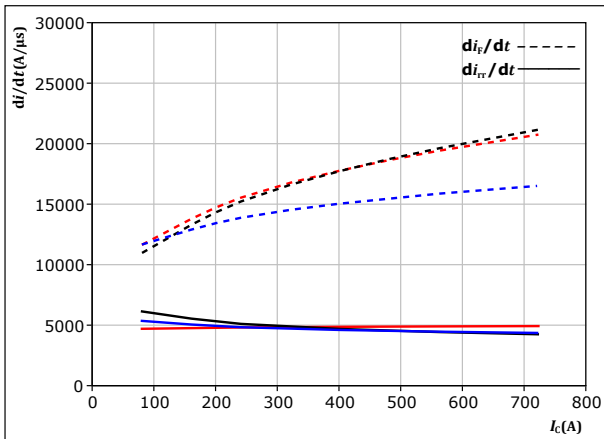
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C



## Buck Switching Characteristics

**figure 29.** FWD

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



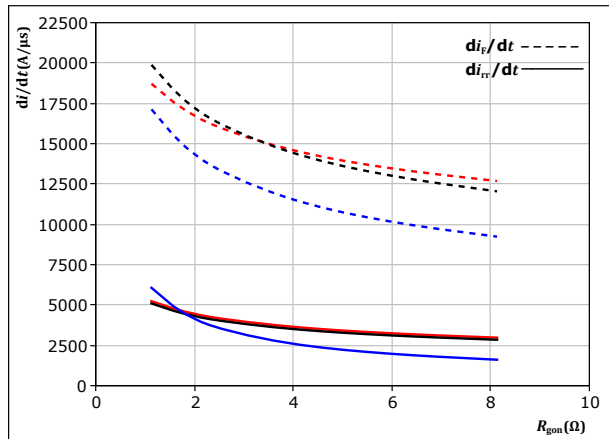
With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2,13 \ \Omega$

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

**figure 30.** 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

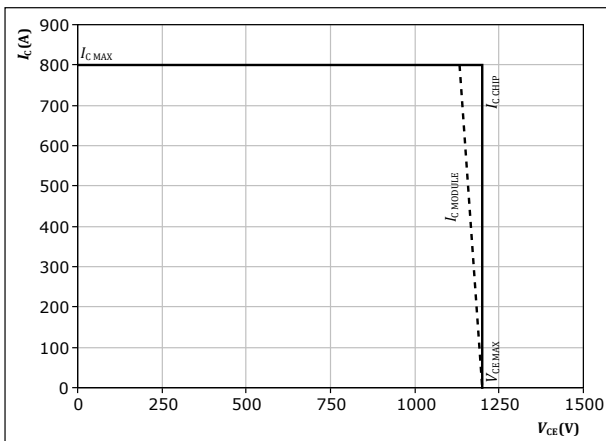
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

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

**figure 31.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 2,13 \ \Omega$   
 $R_{goff} = 2 \ \Omega$

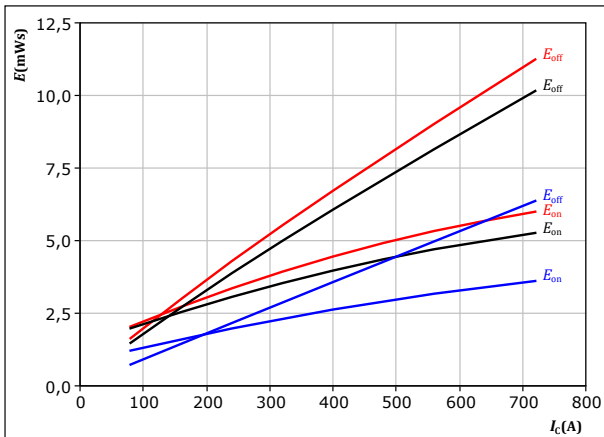


## Boost Switching Characteristics

figure 32. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



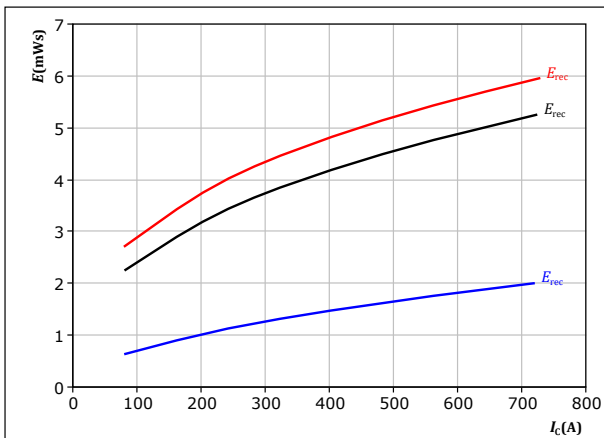
With an inductive load at

$V_{CE} =$	350	V	$T_j:$	— 25 °C
$V_{GE} =$	±15	V		— 125 °C
$R_{g(on)} =$	2,13	Ω		— 150 °C
$R_{g(off)} =$	2	Ω		

figure 34. FWD

Typical reverse recovered energy loss as a function of collector current

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



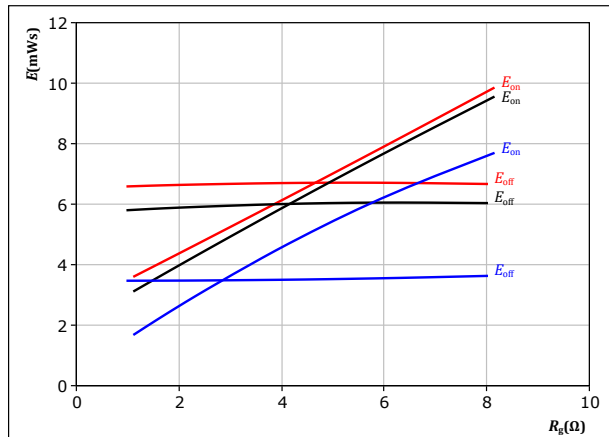
With an inductive load at

$V_{CE} =$	350	V	$T_j:$	— 25 °C
$V_{GE} =$	±15	V		— 125 °C
$R_{g(on)} =$	2,13	Ω		— 150 °C

figure 33. IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



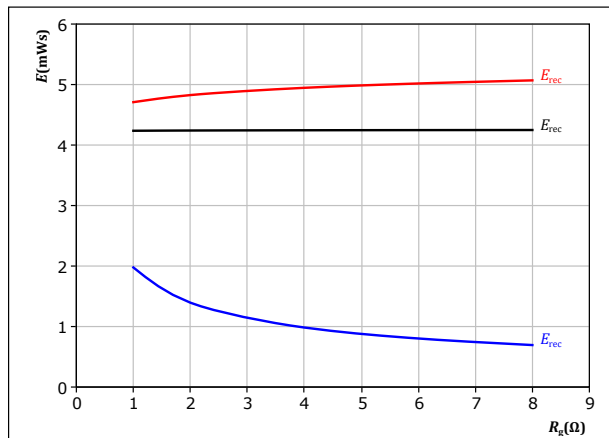
With an inductive load at

$V_{CE} =$	350	V	$T_j:$	— 25 °C
$V_{GE} =$	±15	V		— 125 °C
$I_c =$	400	A		— 150 °C

figure 35. 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

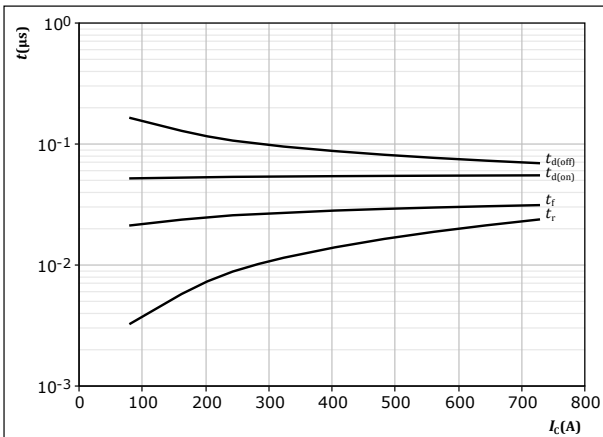
$V_{CE} =$	350	V	$T_j:$	— 25 °C
$V_{GE} =$	±15	V		— 125 °C
$I_c =$	400	A		— 150 °C



## Boost Switching Characteristics

**figure 36.** IGBT

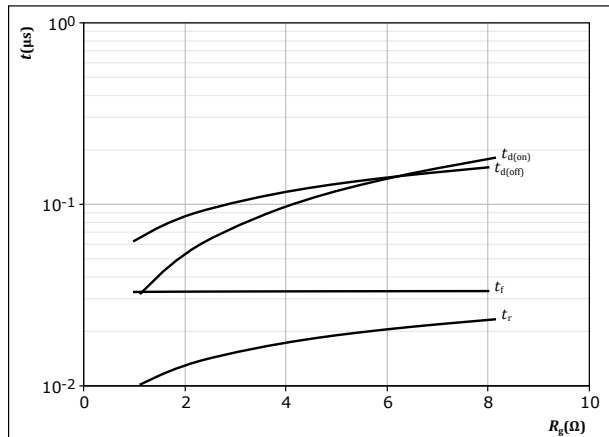
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g(on)} = 2,13 \text{ } \Omega$   
 $R_{g(off)} = 2 \text{ } \Omega$

**figure 37.** IGBT

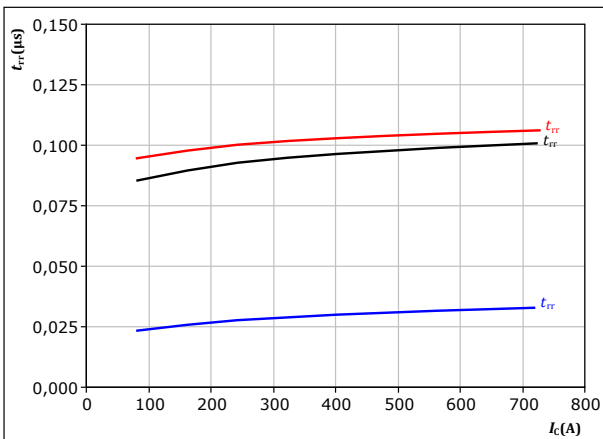
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 400 \text{ A}$

**figure 38.** FWD

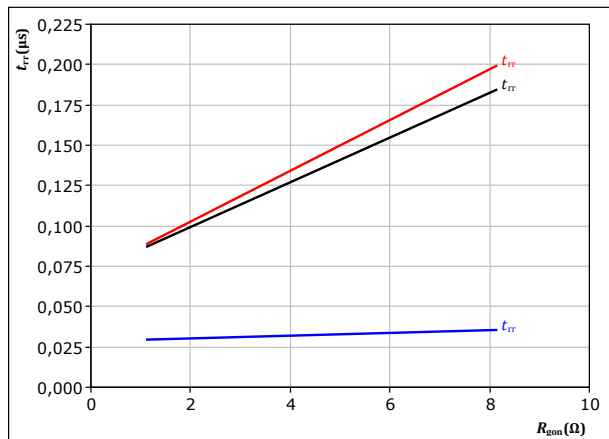
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{g(on)} = 2,13 \text{ } \Omega$   
 $T_j: \text{ } \text{---} 25 \text{ }^\circ\text{C}$   
 $\text{---} 125 \text{ }^\circ\text{C}$   
 $\text{---} 150 \text{ }^\circ\text{C}$

**figure 39.** 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  
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 400 \text{ A}$   
 $T_j: \text{ } \text{---} 25 \text{ }^\circ\text{C}$   
 $\text{---} 125 \text{ }^\circ\text{C}$   
 $\text{---} 150 \text{ }^\circ\text{C}$

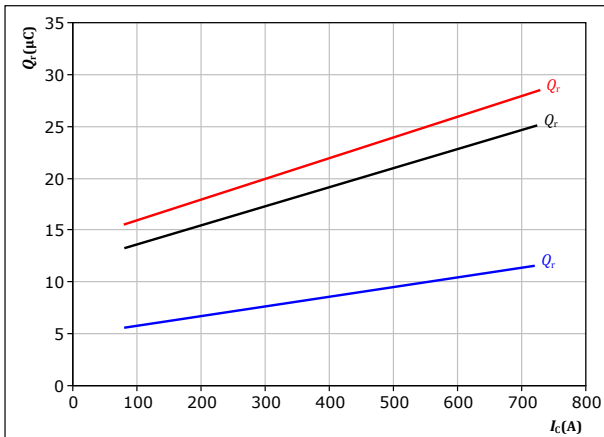


## Boost Switching Characteristics

figure 40. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

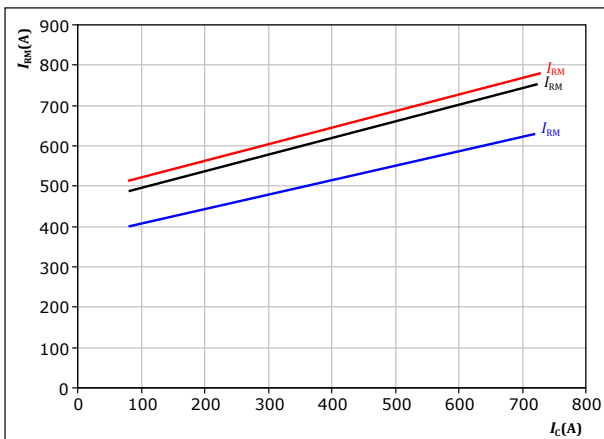
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$

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

figure 42. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

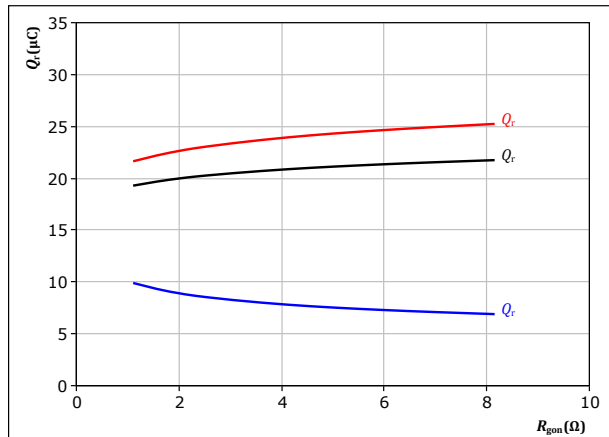
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2,13$   $\Omega$

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

figure 41. FWD

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

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



With an inductive load at

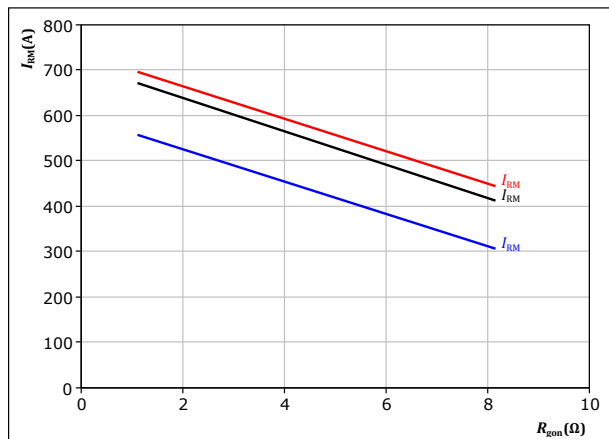
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

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

figure 43. 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  
 $I_c = 400$  A

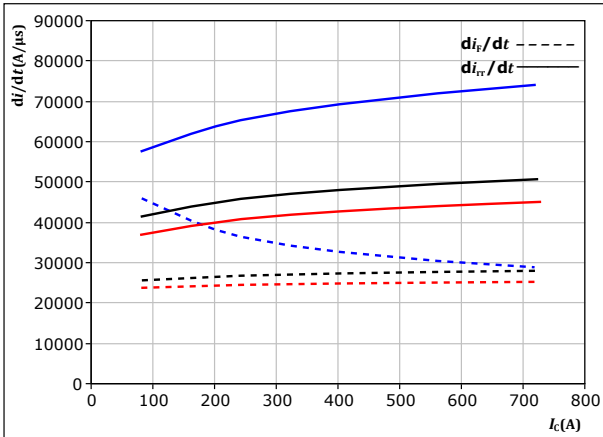
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C



## Boost Switching Characteristics

figure 44. FWD

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



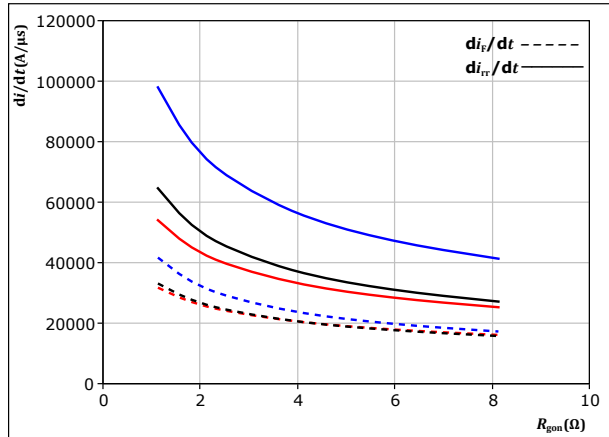
With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2,13 \ \Omega$

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

figure 45. 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

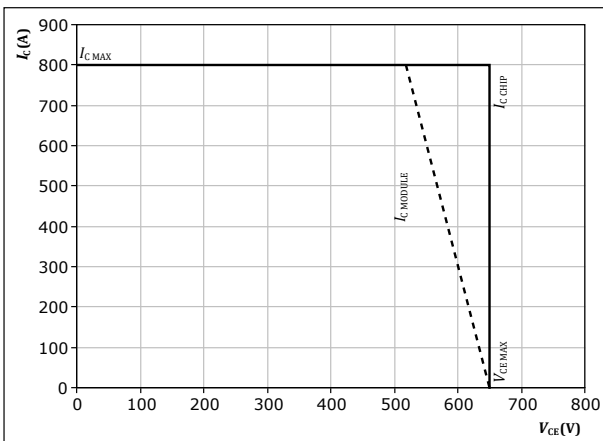
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 400 \text{ A}$

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

figure 46. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At  $T_j = 150 \text{ °C}$   
 $R_{gon} = 2,13 \ \Omega$   
 $R_{goff} = 2 \ \Omega$



## Switching Definitions

figure 47. IGBT

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

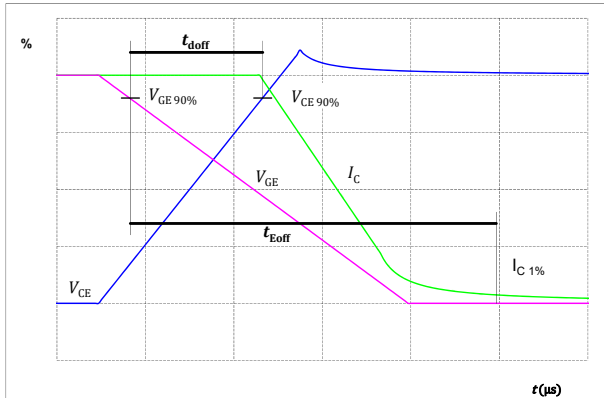


figure 48. IGBT

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

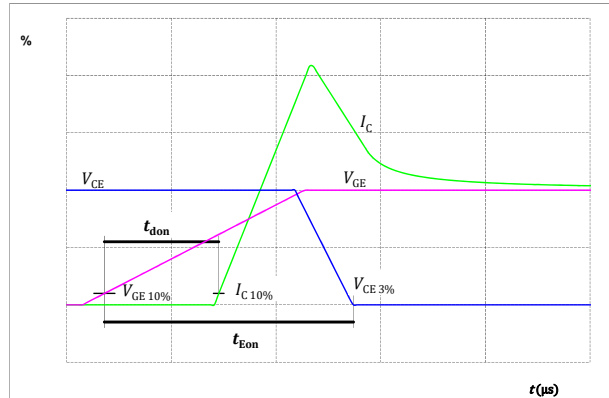


figure 49. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

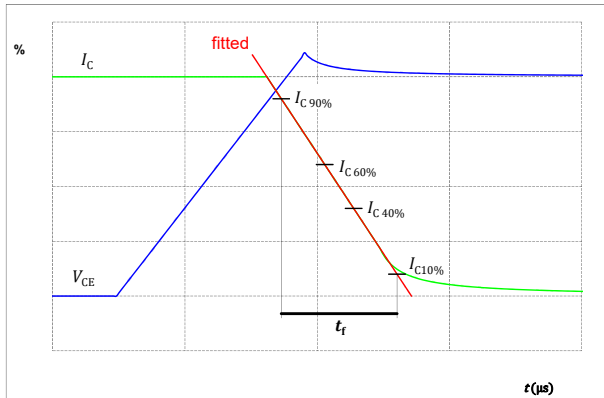
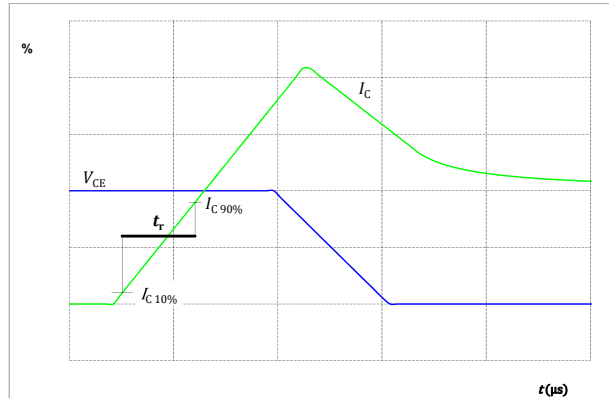


figure 50. IGBT

Turn-on Switching Waveforms & definition of  $t_r$







### Switching Definitions

figure 51. FWD

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

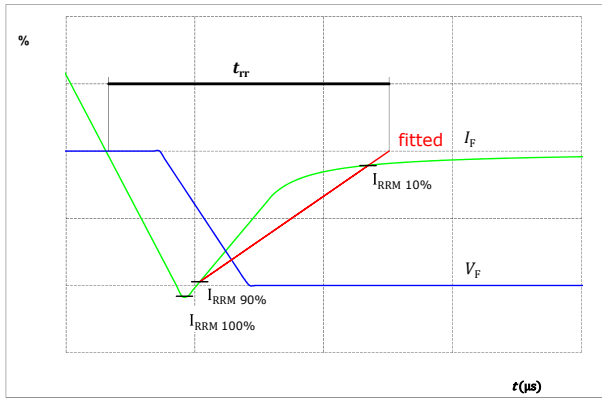
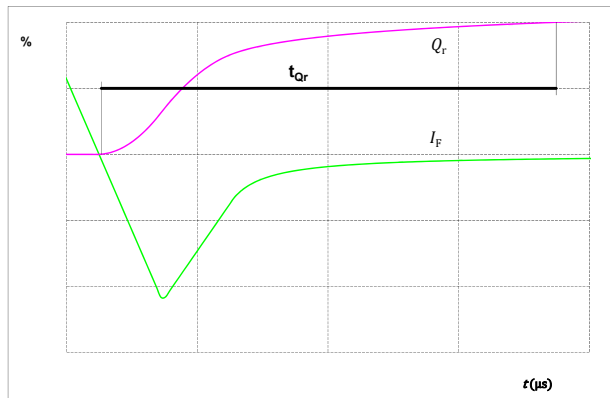


figure 52. FWD

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






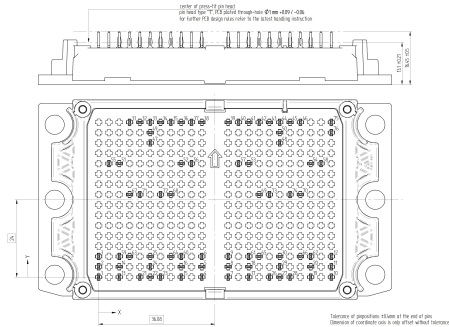
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**30-EP12NMA400H7-PM19F07T**  
datasheet

Ordering Code	
<b>Version</b>	<b>Ordering Code</b>
Without thermal paste	30-EP12NMA400H7-PM19F07T
With thermal paste (5,2 W/mK, PTM6000HV)	30-EP12NMA400H7-PM19F07T-/7/

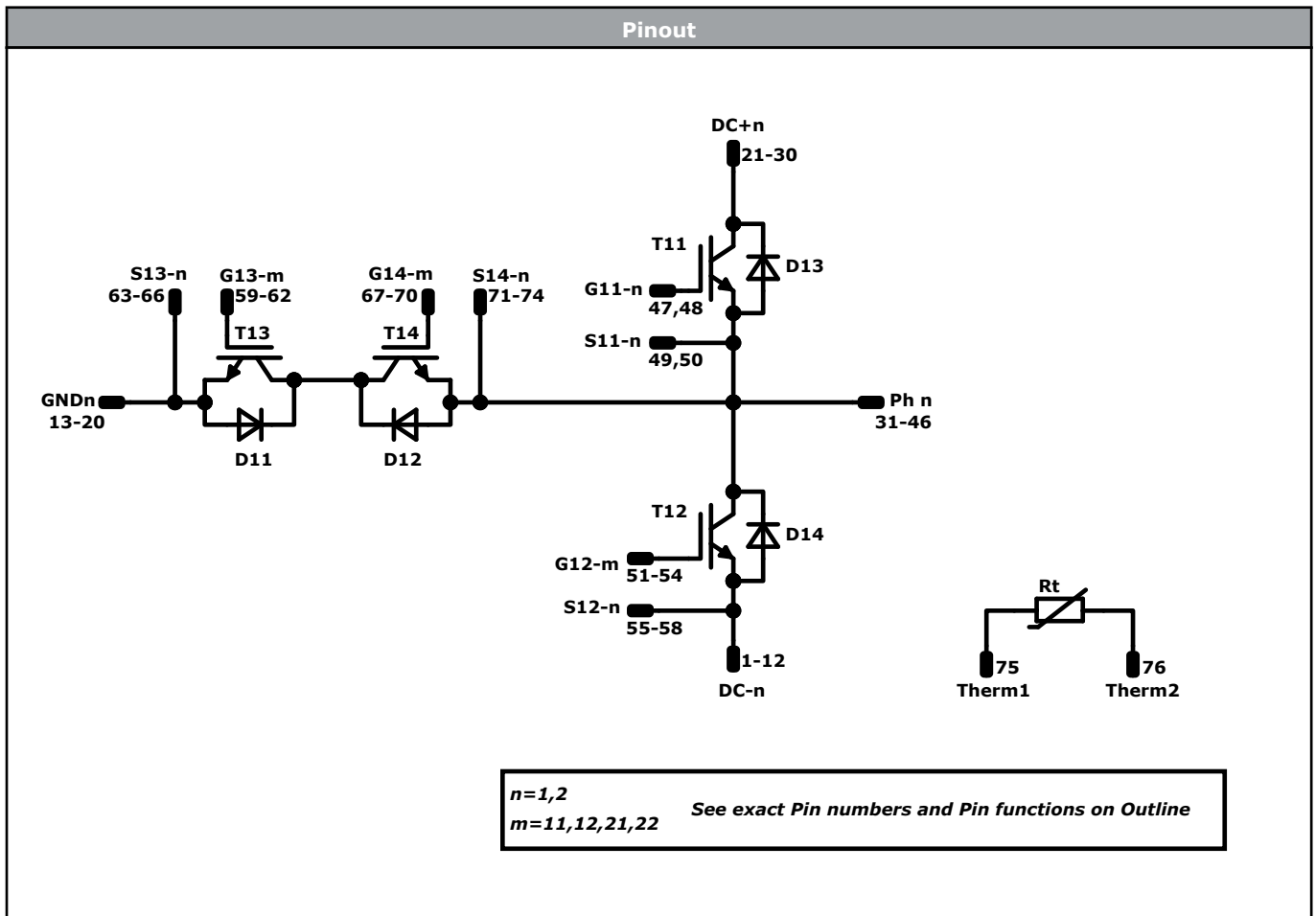
Marking						
	<b>Text</b>	<b>Name</b> NN-NNNNNNNNNNNNNN- TTTTTVV	<b>Date code</b> WWYY	<b>Logo</b> VIN	<b>Lot</b> LLLLL	<b>Serial</b> SSSS
	<b>Datamatrix</b>	<b>Type&amp;Ver</b> TTTTTVV	<b>Lot number</b> LLLLL	<b>Serial</b> SSSS	<b>Date code</b> WWYY	

Outline							
Pin table [mm]							
Pin	X	Y	Function	39	40,16	48	Ph2
1	0	0	DC-1	40	43,36	48	Ph2
2	0	3,2	DC-1	41	46,56	48	Ph2
3	0	6,4	DC-1	42	49,76	48	Ph2
4	32	0	DC-1	43	52,96	48	Ph2
5	32	3,2	DC-1	44	56,16	48	Ph2
6	32	6,4	DC-1	45	59,36	48	Ph2
7	40,16	0	DC-2	46	62,56	48	Ph2
8	40,16	3,2	DC-2	47	16	41,6	G11-1
9	40,16	6,4	DC-2	48	56,16	41,6	G11-2
10	72,16	0	DC-2	49	16	44,8	S11-1
11	72,16	3,2	DC-2	50	56,16	44,8	S11-2
12	72,16	6,4	DC-2	51	6,4	35,2	G12-11
13	6,4	0	GND1	52	25,6	35,2	G12-12
14	6,4	3,2	GND1	53	46,56	35,2	G12-21
15	25,6	0	GND1	54	65,76	35,2	G12-22
16	25,6	3,2	GND1	55	3,2	35,2	S12-1
17	46,56	0	GND2	56	28,8	35,2	S12-1
18	46,56	3,2	GND2	57	43,36	35,2	S12-2
19	65,76	0	GND2	58	68,96	35,2	S12-2
20	65,76	3,2	GND2	59	6,4	6,4	G13-11
21	12,8	0	DC+1	60	25,6	6,4	G13-12
22	16	0	DC+1	61	46,56	6,4	G13-21
23	19,2	0	DC+1	62	65,76	6,4	G13-22
24	16	3,2	DC+1	63	9,6	6,4	S13-1
25	16	6,4	DC+1	64	22,4	6,4	S13-1
26	52,96	0	DC+2	65	49,76	6,4	S13-2
27	56,16	0	DC+2	66	62,56	6,4	S13-2
28	59,36	0	DC+2	67	9,6	25,6	G14-11
29	56,16	3,2	DC+2	68	22,4	25,6	G14-12
30	56,16	6,4	DC+2	69	49,76	25,6	G14-21
31	9,6	48	Ph1	70	62,56	25,6	G14-22
32	12,8	48	Ph1	71	12,8	25,6	S14-1
33	16	48	Ph1	72	19,2	25,6	S14-1
34	19,2	48	Ph1	73	52,96	25,6	S14-2
35	22,4	48	Ph1	74	59,36	25,6	S14-2
36	25,6	48	Ph1	75	72,16	48	Therm1
37	28,8	48	Ph1	76	72,16	44,8	Therm2
38	32	48	Ph1				





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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	1200 V	400 A	Buck Switch	Parallel devices with separate control. Values apply to complete device.
D11, D12	FWD	650 V	400 A	Buck Diode	Parallel devices. Values apply to complete device.
T13, T14	IGBT	650 V	400 A	Boost Switch	Parallel devices with separate control. Values apply to complete device.
D13, D14	FWD	1200 V	400 A	Boost Diode	Parallel devices. Values apply to complete device.
Rt	Thermistor			Thermistor	



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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
Certification pending. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
30-EP12NMA400H7-PM19F07T-D1-14	3 Dec. 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.