30-E312NIB560H710-PR40F07Z
datasheet

| *flow*NPC 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_2O_3
- Cu baseplate
- Convex shaped baseplate for superior thermal contact
- CTI600 housing material
- Baseplate with rough surface
- Thermo-mechanical push-and-pull force relief
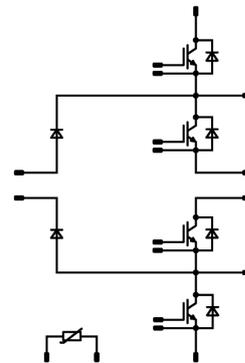- Solder pin

Target applications

- Energy Storage Systems

Types

- 30-E312NIB560H710-PR40F07Z

flow E3BP 12 mm housing

Schematic

Vincotech

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Buck Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	313	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1680	A
Turn off safe operating area		T_j = 150°C, V_{CE} = 1200 V		1680	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	484	W
Gate-emitter voltage	V_{GES}			±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 °C	203	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		1680	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	358	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 °C	313	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1680	A
Turn off safe operating area		T_j = 150°C, V_{CE} = 1200 V		1680	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	484	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Vincotech

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	203	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		1680	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	358	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 °C	203	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		1680	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	358	W
Maximum junction temperature	T_{jmax}			175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Conditions		Value	Unit
Storage temperature	T_{stg}			-40...+125	°C
Operation temperature under switching condition	T_{jop}			-40...+(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Conditions		Value	Unit
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6800	V
Creepage distance				>12,7	mm
Clearance				>12,7	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

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**	

Buck Switch

Static

Parameter	Symbol	Conditions				Values			Unit
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_{CEsat}		15		560	25 125 150		1,62 1,76 1,78	2,15[1]	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}	f = 100 kHz	0	25		25		74000		pF
Output capacitance	C_{oes}							1268		pF
Reverse transfer capacitance	C_{res}							376		pF
Gate charge	Q_g	V_{CC} = 960 V	0/15		560	25		4128		nC

Thermal

Parameter	Symbol	Conditions				Values			Unit
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						0,2		K/W

Dynamic

Parameter	Symbol	Conditions				Values			Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		504,47 500,27 498,53		ns
Rise time	t_r					25 125 150		41,71 42,29 43,43		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 3,05 Ω R_{goff} = 8 Ω	-10/15	600	400	25 125 150		1510,46 1586,75 1611,36		ns
Fall time	t_f					25 125 150		18,47 44,73 56,54		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=11,62 μC Q_{rFWD}=26,81 μC Q_{rFWD}=31,94 μC				25 125 150		17,35 19,12 19,73		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		14,6 21,68 23,12		mWs

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 Diode

Static

Parameter	Symbol	Conditions				Values			Unit
Forward voltage	V_{F}			144	25		1,88	$2^{(1)}$	V
					125		1,63		
					150		1,55		
Reverse leakage current	I_{R}	V_{r} = 1200 V			25			16	µA

Thermal

Parameter	Symbol	Conditions				Values			Unit
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)					0,27		K/W

Dynamic

Parameter	Symbol	Conditions				Values			Unit
Peak recovery current	I_{RM}				25		226,54		A
					125		388,46		
					150		430,86		
Reverse recovery time	t_{rr}				25		128,04		ns
					125		166,76		
					150		180,8		
Recovered charge	Q_{r}	di/dt=9366 A/µs di/dt=10912 A/µs di/dt=10739 A/µs	-10/15	600	400	25		11,62		µC
						125		26,81		
						150		31,94		
Reverse recovered energy	E_{rec}				25		3,86		mWs
					125		9,7		
					150		11,74		
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25		6584,87		A/µs
					125		8162,86		
					150		8962,84		

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 Switch

Static

Parameter	Symbol								Unit
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_{CEsat}	15		560	25 125 150		1,62 1,76 1,78	2,15[1]	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

Parameter	Symbol								Unit
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)					0,2		K/W

Dynamic

Parameter	Symbol								Unit
Turn-on delay time	$t_{d(on)}$				25 125 150		503,9 500,08 498,7		ns
Rise time	t_{r}				25 125 150		44,13 46,02 46,24		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 3,05 Ω R_{goff} = 16 Ω, -10/15	600	400	25 125 150		2884,75 3037,22 3073,06		ns
Fall time	t_{f}				25 125 150		56,25 29,42 32,13		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=11,01 µC Q_{rFWD}=28,75 µC Q_{rFWD}=34,54 µC			25 125 150		14,38 15,64 16,31		mWs
Turn-off energy (per pulse)	E_{off}				25 125 150		21,51 25,37 27,3		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**	

Boost Diode

Static

Parameter	Symbol	Conditions				Values			Unit
Forward voltage	V_{F}			144	25 125 150		1,88 1,63 1,55	2[1]	V
Reverse leakage current	I_{R}	V_{r} = 1200 V			25			16	µA

Thermal

Parameter	Symbol	Conditions				Values			Unit
Thermal resistance junction to sink[2]	$R_{th(j\text{-}s)}$	λ_{paste} = 5,2 W/mK (PTM)					0,27		K/W

Dynamic

Parameter	Symbol	Conditions				Values			Unit
Peak recovery current	I_{RM}				25 125 150		246,58 402,81 435,67		A
Reverse recovery time	t_{rr}				25 125 150		86,52 158,63 178		ns
Recovered charge	Q_{r}	di/dt=7873 A/µs di/dt=9116 A/µs di/dt=8929 A/µs	-10/15	600	400 (25) (125) (150)		11,01 28,75 34,54		µC
Reverse recovered energy	E_{rec}				25 125 150		4 11,01 13,11		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		5803,26 7066,79 7180,34		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

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Forward voltage	V_F			144	25 125 150		1,88 1,63 1,55	2[1]	V
Reverse leakage current	I_R	V_r = 1200 V			25			16	µA

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)					0,27		K/W

Thermistor

Static

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
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	

[1] Value at chip level

[2] Only valid with pre-applied Vincotech thermal interface material.

Buck Switch Characteristics

figure 1. IGBT

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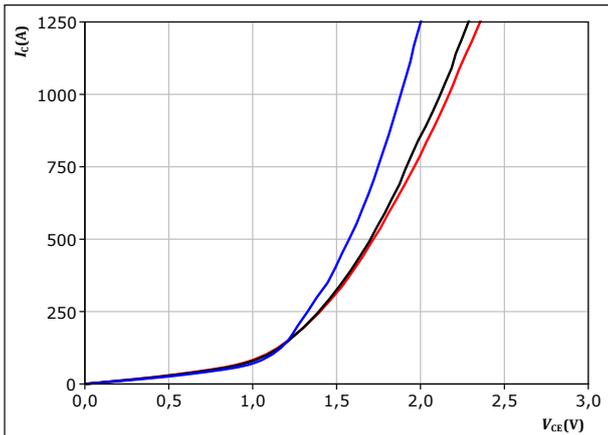
$I_C = f(V_{CE})$

$t_p =$	250	µs		
$V_{GE} =$	15	V		25 °C
			T_j:	125 °C
				150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

V_{GE}:
- 7 V
- 8 V
- 9 V
- 10 V
- 11 V
- 12 V
- 13 V
- 14 V
- 15 V
- 16 V
- 17 V
- 18 V
- 19 V
- 20 V

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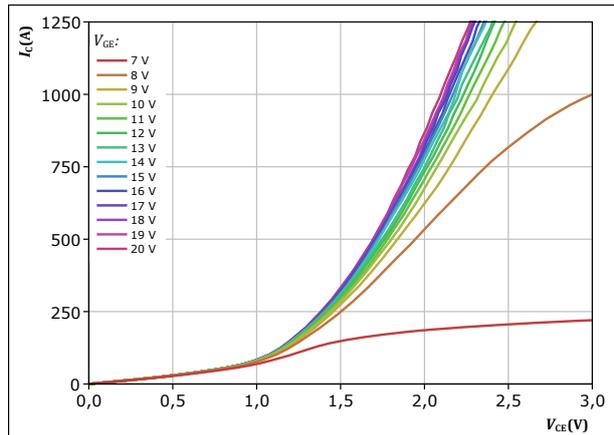
V_{GE} from 7 V to 20 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$
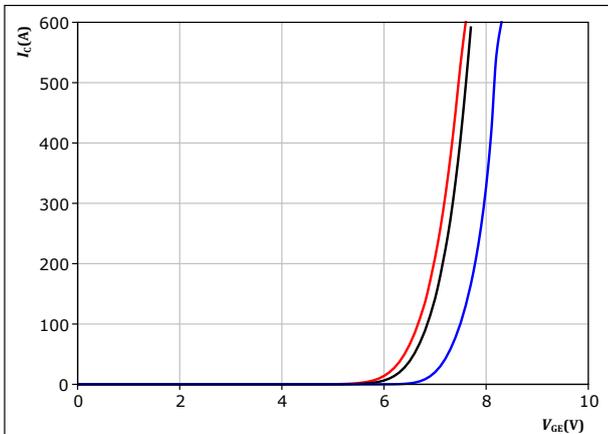
$t_p =$	250	µs		
$V_{CE} =$	10	V		25 °C
			T_j:	125 °C
				150 °C

figure 4. IGBT

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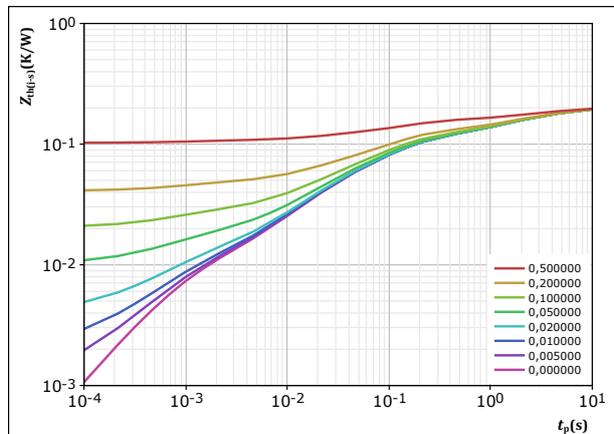
$Z_{th(j-s)} = f(t_p)$

- 0,500000
- 0,200000
- 0,100000
- 0,050000
- 0,020000
- 0,010000
- 0,005000
- 0,000000

$D =$	t_p / T	
$R_{th(j-s)} =$	0,196	K/W

IGBT thermal model values

R (K/W)	τ (s)
4,60E-02	6,73E+00
5,45E-02	1,39E+00
7,18E-02	1,04E-01
2,52E-02	1,75E-02
7,38E-03	8,20E-04

Buck Switch Characteristics

figure 5.   IGBT

Safe operating area

$I_C = f(V_{CE})$
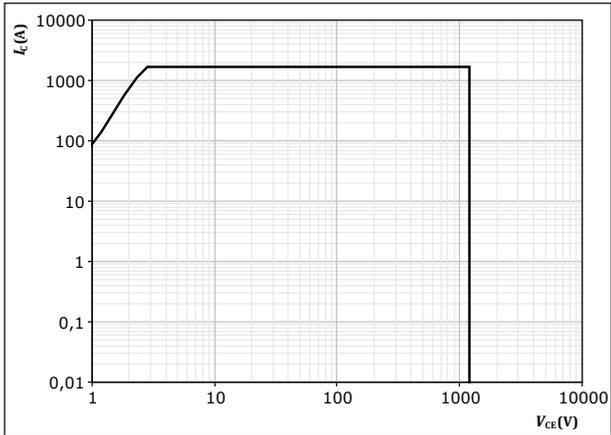
D = single pulse
T_s =   80   °C
V_{GE} =   15   V
T_j = T_{jmax}

figure 6.   IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$
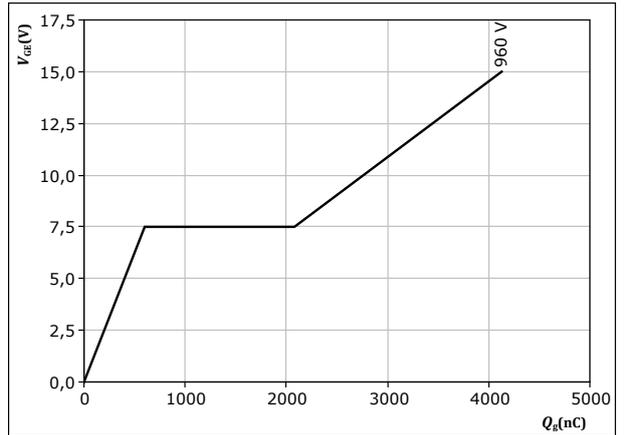
I_C =   560   A
T_j =   25   °C

Buck Diode Characteristics

figure 7.   **FWD**

Typical forward characteristics

$I_F = f(V_F)$

$t_p =$ 250   µs

		25 °C
T_j:		125 °C
		150 °C
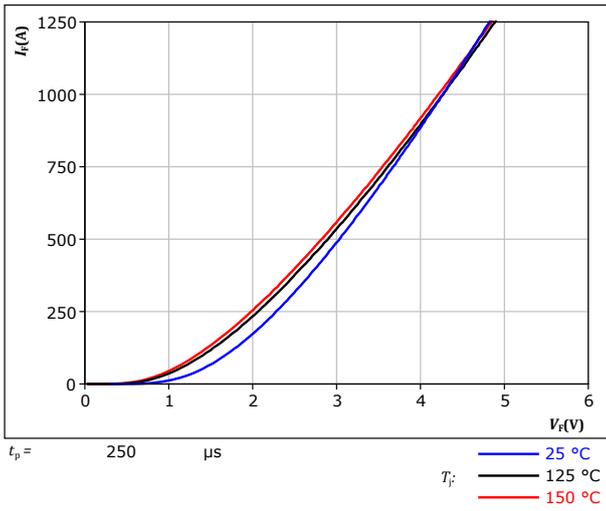
figure 8.   **FWD**

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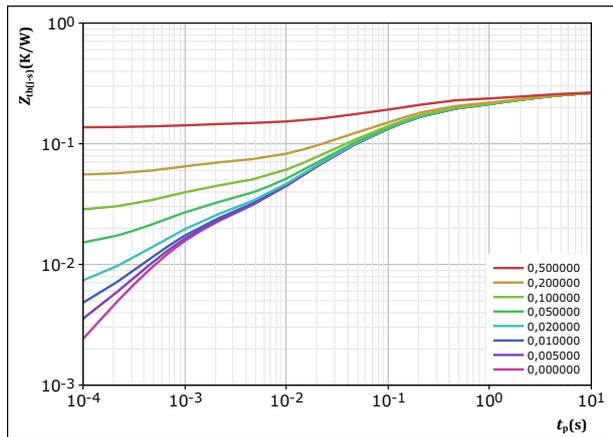
$Z_{th(j-s)} = f(t_p)$

0,500000		
0,200000		
0,100000		
0,050000		
0,020000		
0,010000		
0,005000		
0,000000		

$D =$ t_p / T

$R_{th(j-s)} =$ 0,265   K/W

FWD thermal model values

R (K/W)	τ (s)
3,59E-02	7,45E+00
5,48E-02	1,48E+00
1,14E-01	1,30E-01
5,06E-02	2,16E-02
1,71E-02	7,68E-04

Boost Switch Characteristics

figure 9. **IGBT**

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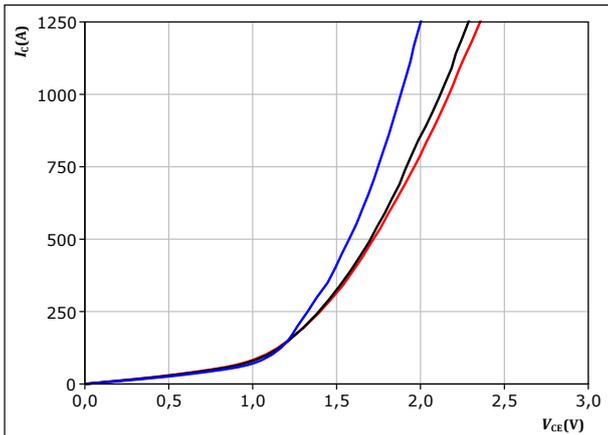
$I_C = f(V_{CE})$

t_p =	250	µs		
V_{GE} =	15	V		25 °C
			T_j:	125 °C
				150 °C

figure 10. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

V_{GE}:
- 7 V
- 8 V
- 9 V
- 10 V
- 11 V
- 12 V
- 13 V
- 14 V
- 15 V
- 16 V
- 17 V
- 18 V
- 19 V
- 20 V

| t_p = | 250 | µs |
| T_j = | 150 | °C |
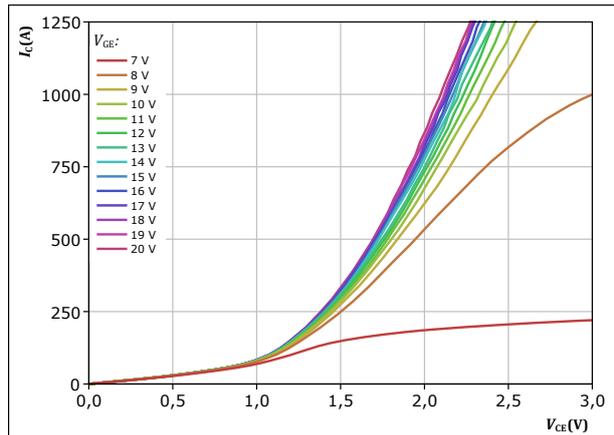
V_{GE} from 7 V to 20 V in steps of 1 V

figure 11. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$
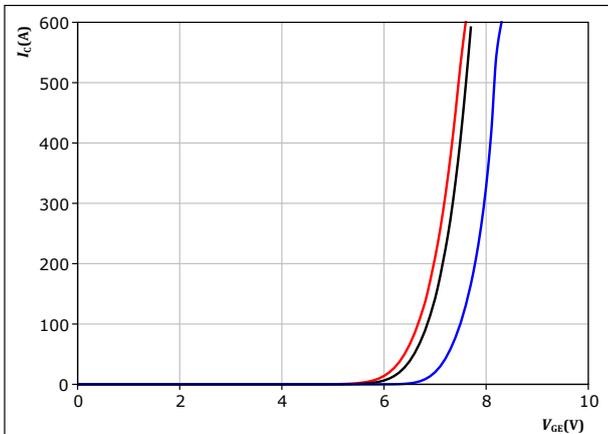
t_p =	250	µs		
V_{CE} =	10	V		25 °C
			T_j:	125 °C
				150 °C

figure 12. **IGBT**

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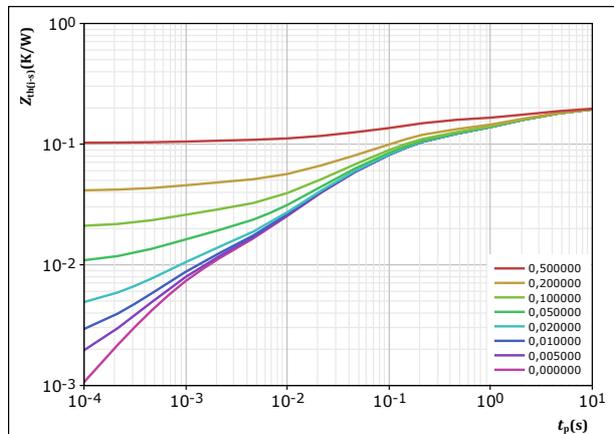
$Z_{th(j-s)} = f(t_p)$

- 0,500000
- 0,200000
- 0,100000
- 0,050000
- 0,020000
- 0,010000
- 0,005000
- 0,000000

$D = \qquad t_p / T$

$R_{th(j-s)} = \quad 0,196 \quad$ K/W

IGBT thermal model values

R (K/W)	τ (s)
4,60E-02	6,73E+00
5,45E-02	1,39E+00
7,18E-02	1,04E-01
2,52E-02	1,75E-02
7,38E-03	8,20E-04

Boost Switch Characteristics

figure 13. **IGBT**

Safe operating area

$I_C = f(V_{CE})$
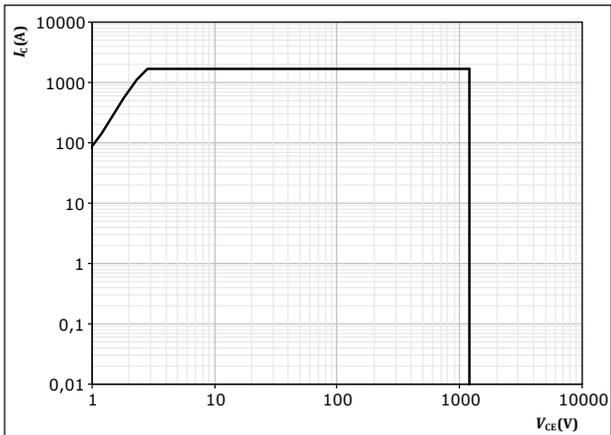
D = single pulse

T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 14. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$
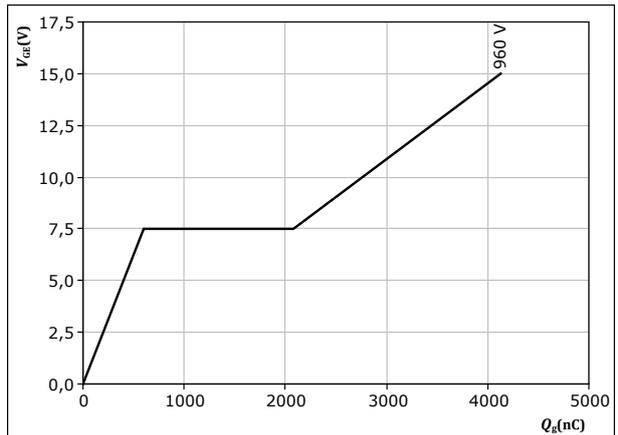
I_C =	560	A
T_j =	25	°C

Boost Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

$t_p =$ 250 µs

T_j:
— 25 °C
— 125 °C
— 150 °C
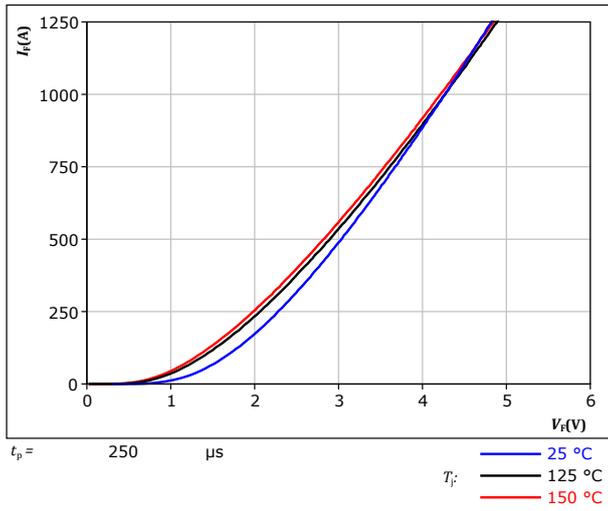
figure 16. **FWD**

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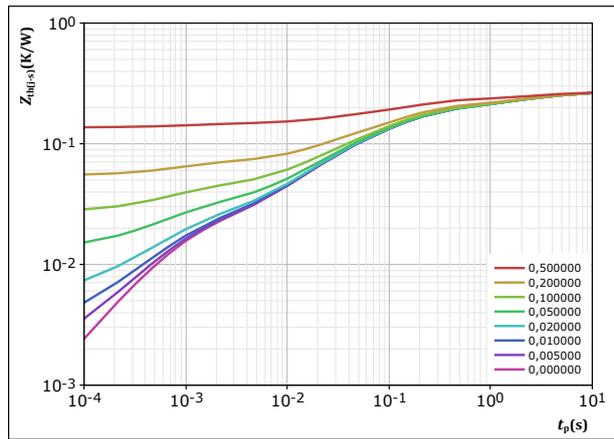
$Z_{th(j-s)} = f(t_p)$

	0,500000
	0,200000
	0,100000
	0,050000
	0,020000
	0,010000
	0,005000
	0,000000

$D =$ t_p / T

$R_{th(j-s)} =$ 0,265 K/W

FWD thermal model values

R (K/W)	τ (s)
3,59E-02	7,45E+00
5,48E-02	1,48E+00
1,14E-01	1,30E-01
5,06E-02	2,16E-02
1,71E-02	7,68E-04

Boost Sw. Inv. Diode Characteristics

figure 17.	FWD

Typical forward characteristics

I_F = f(V_F)

t_p =   250   μs

T_j: ── 25 °C
             ── 125 °C
             ── 150 °C
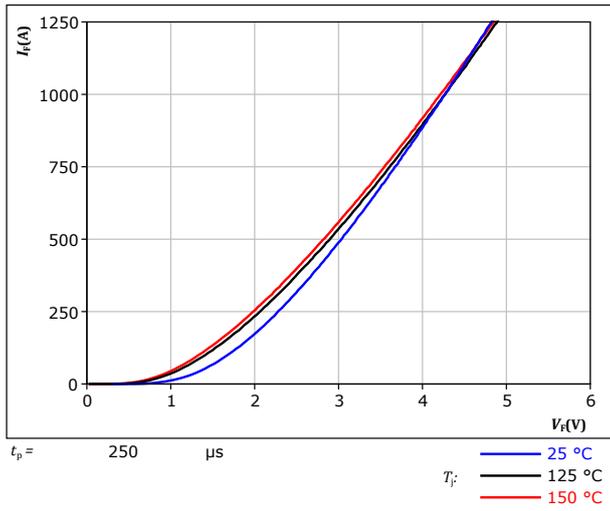
figure 18.	FWD

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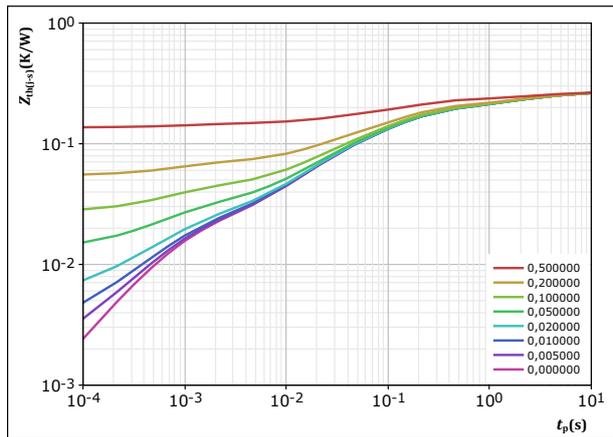
$Z_{th(j-s)}$ = f(t_p)

	0,500000
	0,200000
	0,100000
	0,050000
	0,020000
	0,010000
	0,005000
	0,000000

D = t_p / T

$R_{th(j-s)}$ =   0,265   K/W

FWD thermal model values

R (K/W)	τ (s)
3,59E-02	7,45E+00
5,48E-02	1,48E+00
1,14E-01	1,30E-01
5,06E-02	2,16E-02
1,71E-02	7,68E-04

Thermistor Characteristics

figure 19.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$
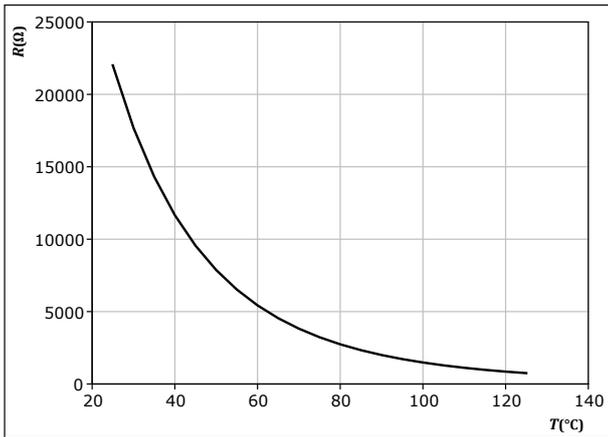
Buck Switching Characteristics

figure 20. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$
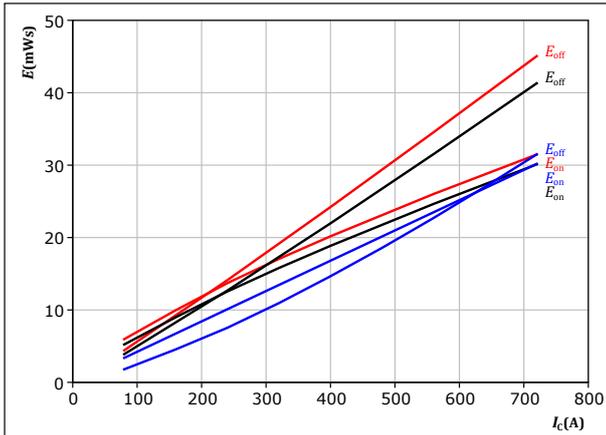
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω
R_{goff} =	8	Ω

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 21. IGBT

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

$E = f(R_g)$
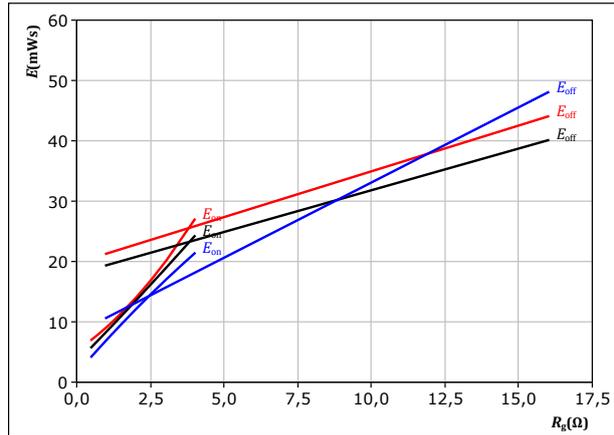
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 22. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$
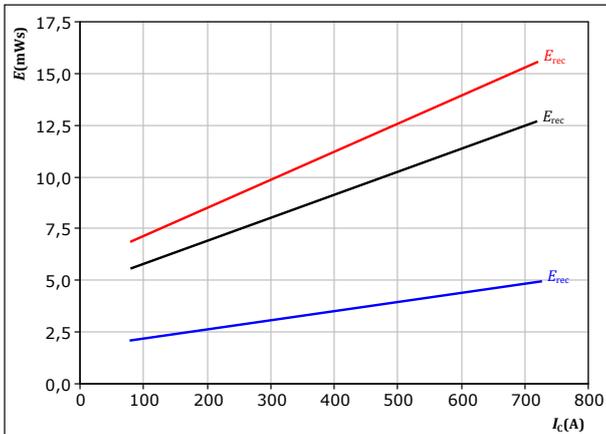
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω

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	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j:
- 25 °C
- 125 °C
- 150 °C
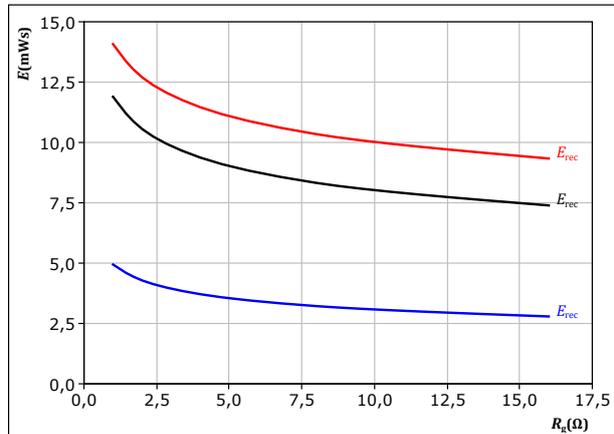
Buck Switching Characteristics

figure 24. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$
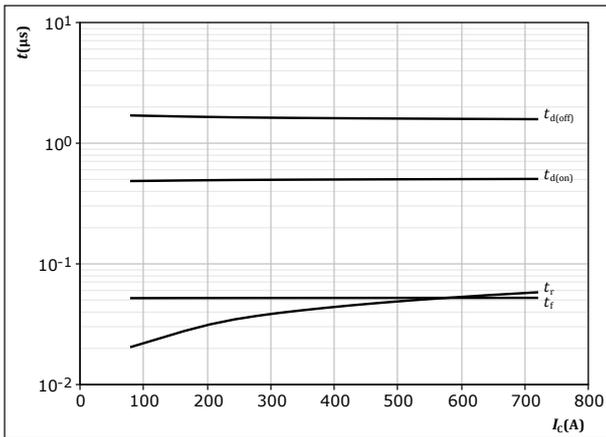
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω
R_{goff} =	8	Ω

figure 25. IGBT

Typical switching times as a function of IGBT turn on gate resistor

$t = f(R_g)$
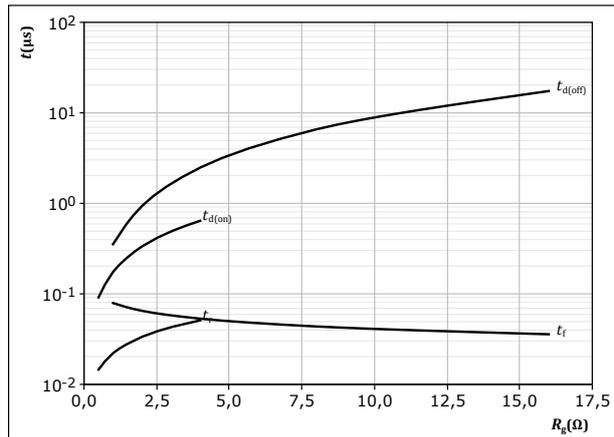
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	A

figure 26. FWD

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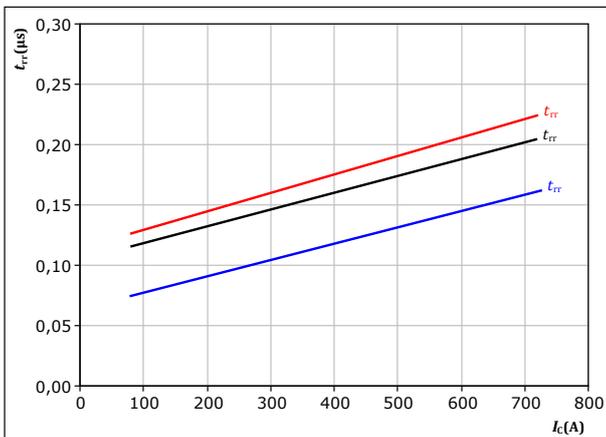
$t_{rr} = f(I_C)$

With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω

T_j: — 25 °C — 125 °C — 150 °C

figure 27. FWD

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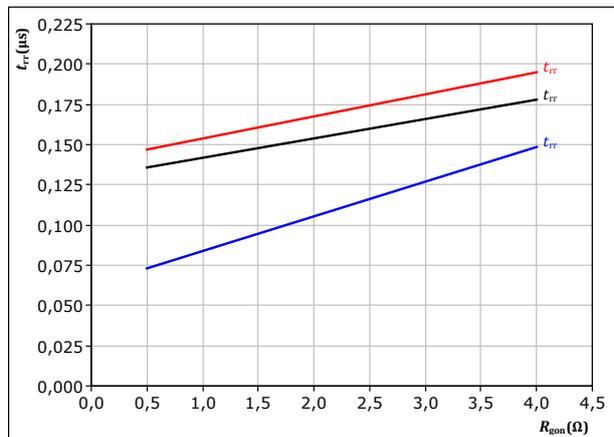
$t_{rr} = f(R_{gon})$

With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j: — 25 °C — 125 °C — 150 °C

Buck Switching Characteristics

figure 28.　　　　　　　　　　　　　　　　　　**FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_c)
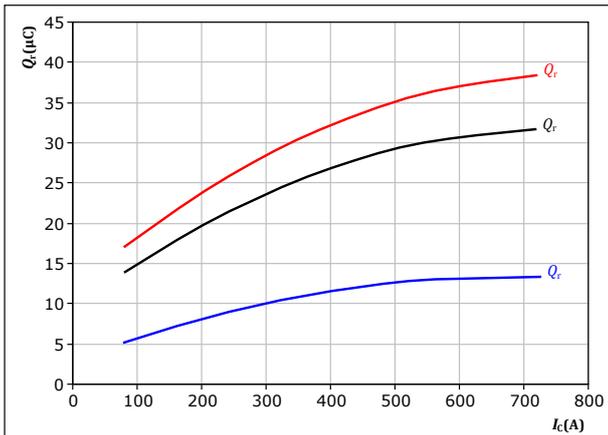
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω

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})
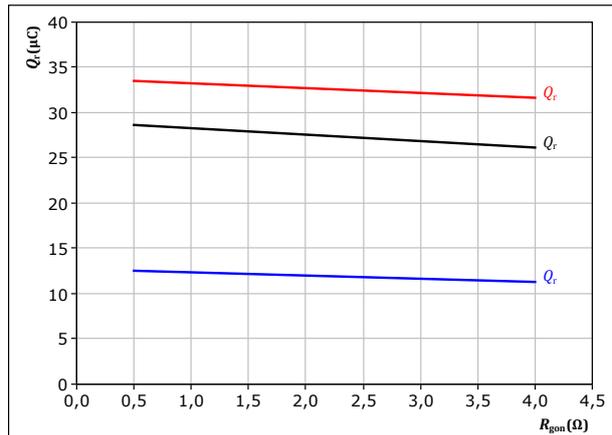
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	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)
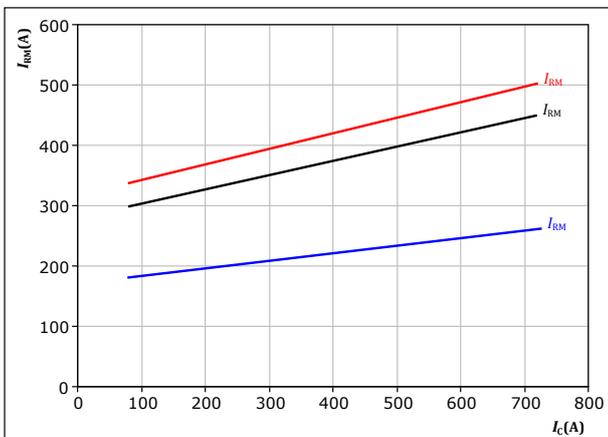
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω

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	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j:
— 25 °C
— 125 °C
— 150 °C
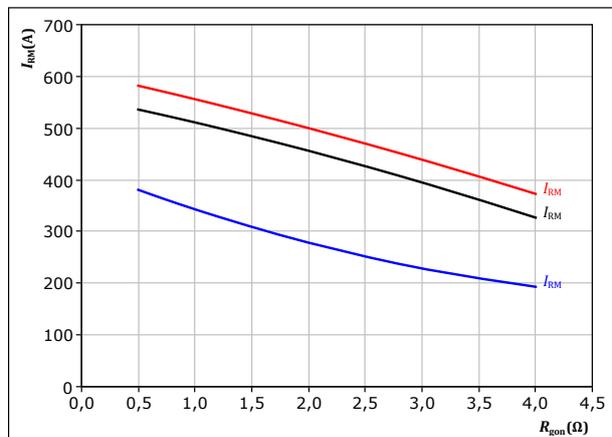
Buck Switching Characteristics

figure 32.   **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current
di_F/dt, di_{rr}/dt = f(I_c)
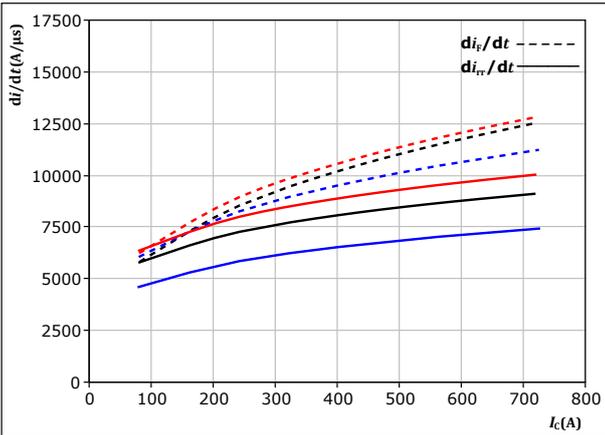
With an inductive load at

V_{CE} =	600	V		━━	25 °C
V_{GE} =	-10/15	V	T_j:	━━	125 °C
R_{gon} =	3,05	Ω		━━	150 °C

figure 33.   **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})
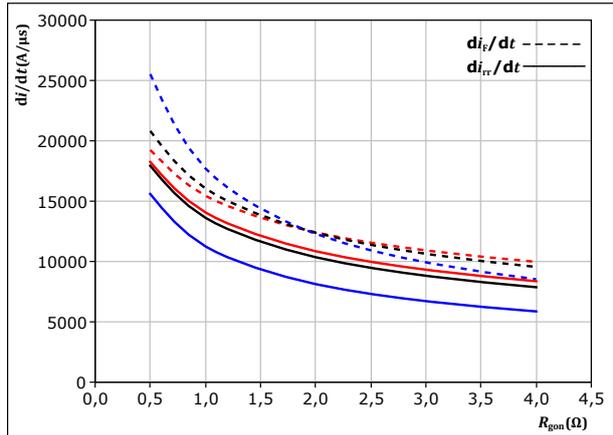
With an inductive load at

V_{CE} =	600	V		━━	25 °C
V_{GE} =	-10/15	V	T_j:	━━	125 °C
I_C =	400	A		━━	150 °C

figure 34.   **IGBT**

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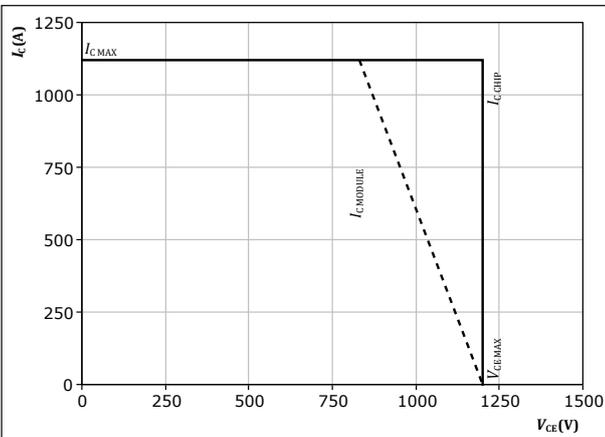
At

T_j =	150	°C
R_{gon} =	3,05	Ω
R_{goff} =	8	Ω

Boost Switching Characteristics

Typical switching energy losses as a function of collector current

$E = f(I_C)$
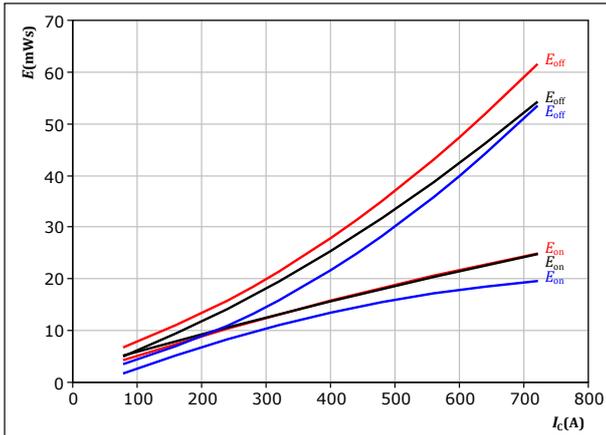
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω
R_{goff} =	16	Ω

T_j: — 25 °C — 125 °C — 150 °C

figure 36.   **IGBT**

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

$E = f(R_g)$
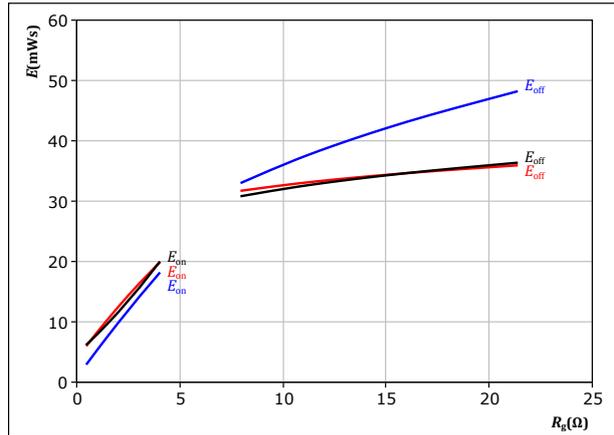
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j: — 25 °C — 125 °C — 150 °C

figure 37.   **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$
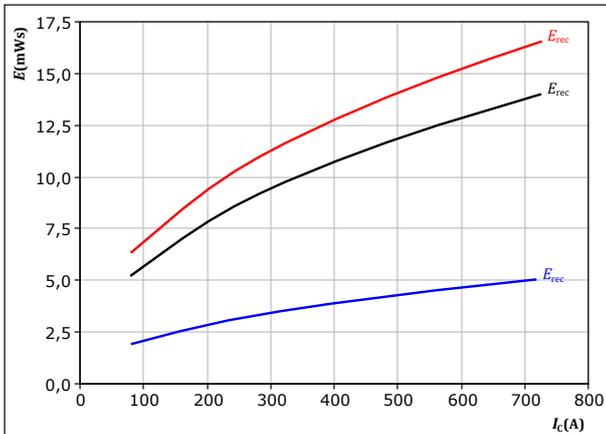
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
R_{gon} =	3,05	Ω

T_j: — 25 °C — 125 °C — 150 °C

figure 38.   **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$
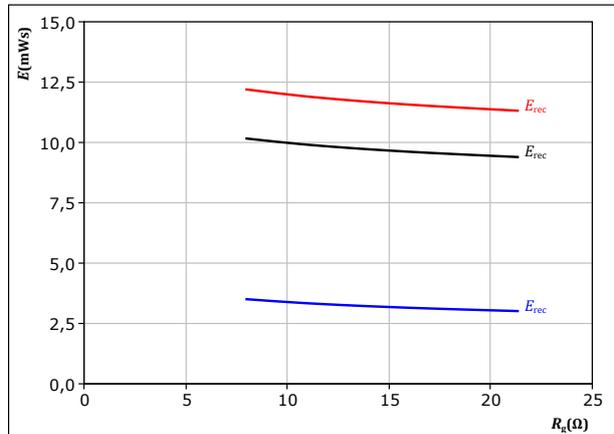
With an inductive load at

V_{CE} =	600	V
V_{GE} =	-10/15	V
I_C =	400	A

T_j: — 25 °C — 125 °C — 150 °C

Boost Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$
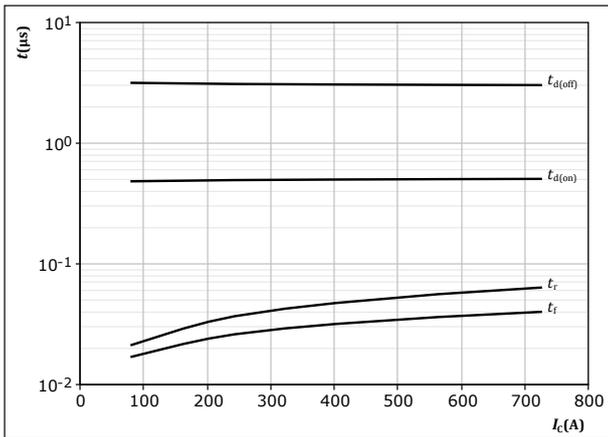
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	-10/15	V
$R_{gon} =$	3,05	Ω
$R_{goff} =$	16	Ω

figure 40. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

$t = f(R_g)$
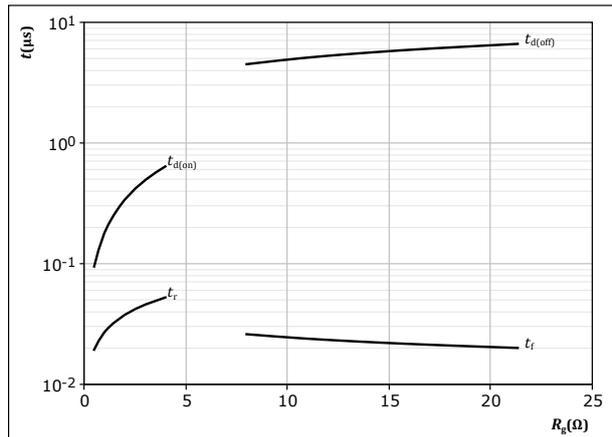
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	-10/15	V
$I_C =$	400	A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$
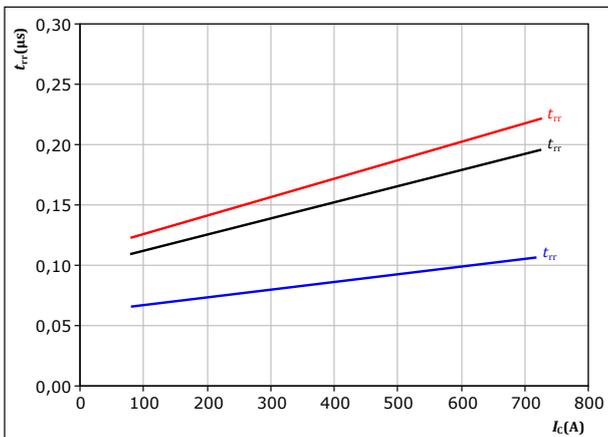
With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	-10/15	V
$R_{gon} =$	3,05	Ω

T_j:
- — 25 °C
- — 125 °C
- — 150 °C

figure 42. **FWD**

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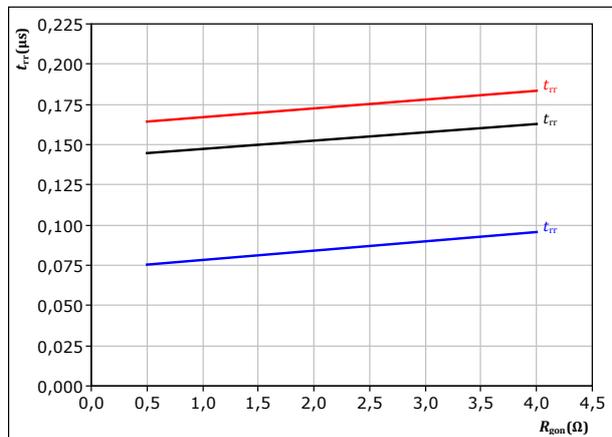
$t_{rr} = f(R_{gon})$

With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	-10/15	V
$I_C =$	400	A

T_j:
- — 25 °C
- — 125 °C
- — 150 °C

Boost Switching Characteristics

figure 43. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$
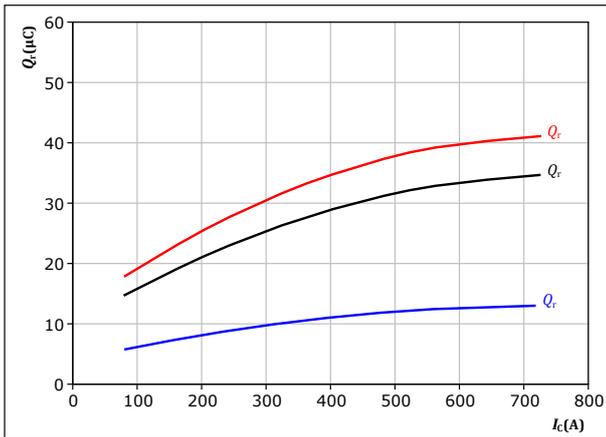
With an inductive load at

			T_j:	25 °C
$V_{CE} =$	600	V		125 °C
$V_{GE} =$	-10/15	V		150 °C
$R_{gon} =$	3,05	Ω		

figure 44. **FWD**

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

$Q_r = f(R_{gon})$
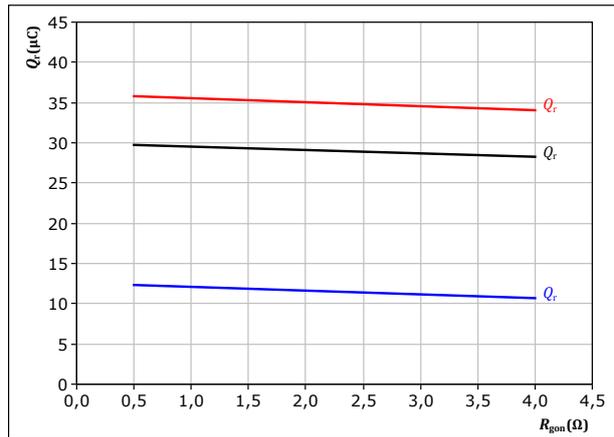
With an inductive load at

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

figure 45. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$
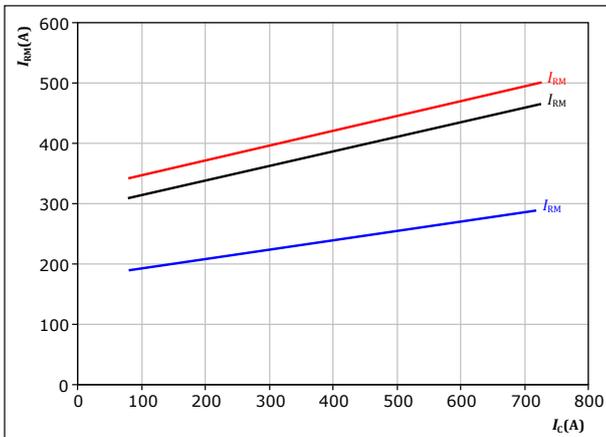
With an inductive load at

			T_j:	25 °C
$V_{CE} =$	600	V		125 °C
$V_{GE} =$	-10/15	V		150 °C
$R_{gon} =$	3,05	Ω		

figure 46. **FWD**

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

$I_{RM} = f(R_{gon})$
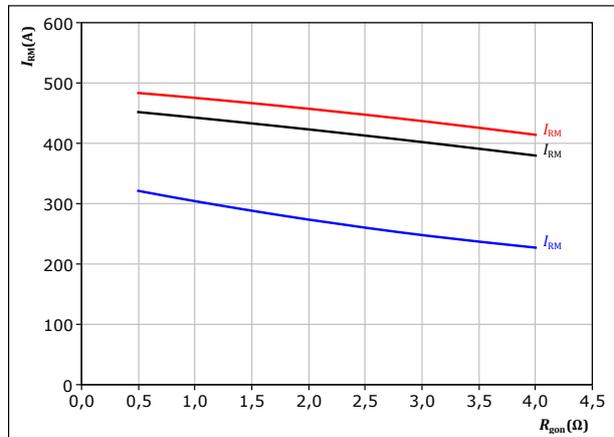
With an inductive load at

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

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)
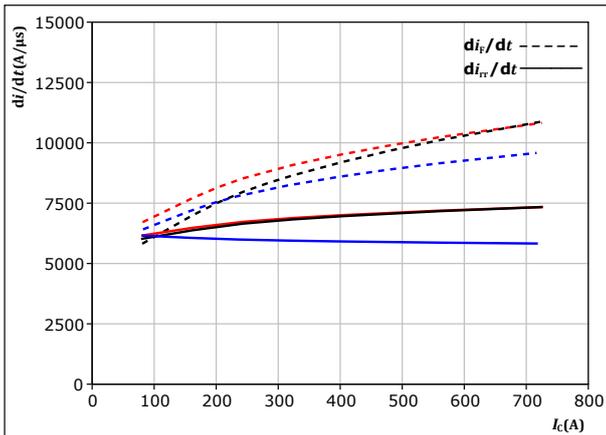
With an inductive load at

			T_j:	25 °C
V_{CE} =	600	V		125 °C
V_{GE} =	-10/15	V		150 °C
R_{gon} =	3,05	Ω		

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})
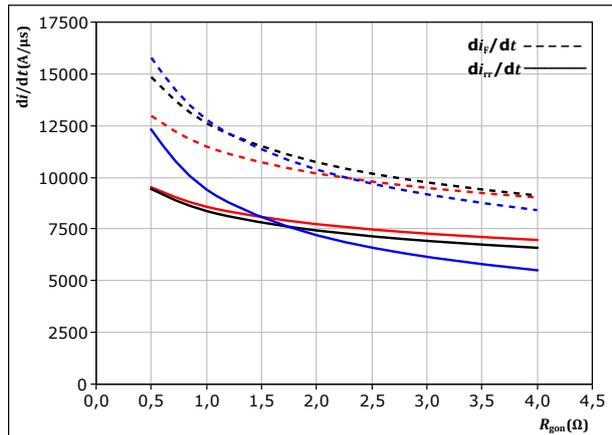
With an inductive load at

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

figure 49. IGBT

Reverse bias safe operating area

I_C = f(V_{CE})

At
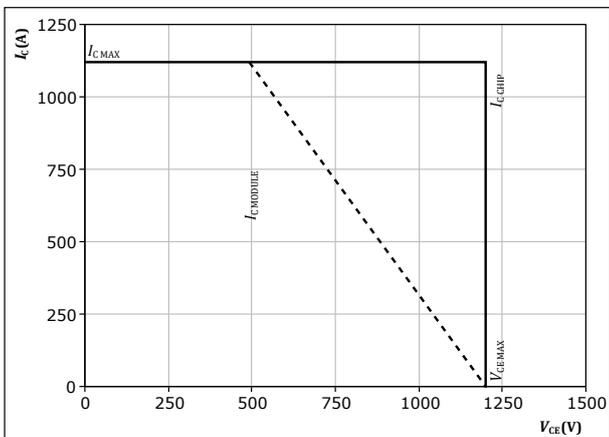
	T_j =	150	°C
	R_{gon} =	3,05	Ω
	R_{goff} =	16	Ω

Switching Definitions

figure 50. IGBT

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{tEoff} = integrating time for E_{off})
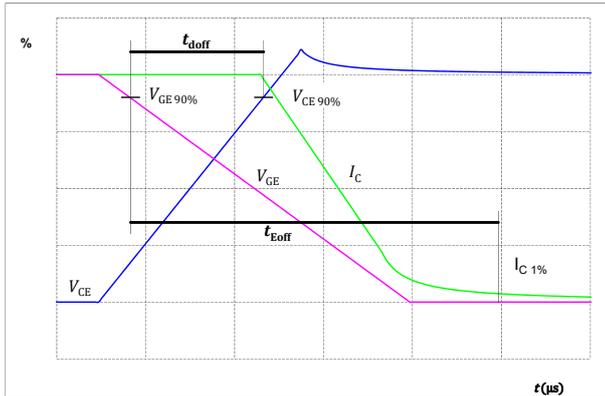
figure 51. IGBT

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})
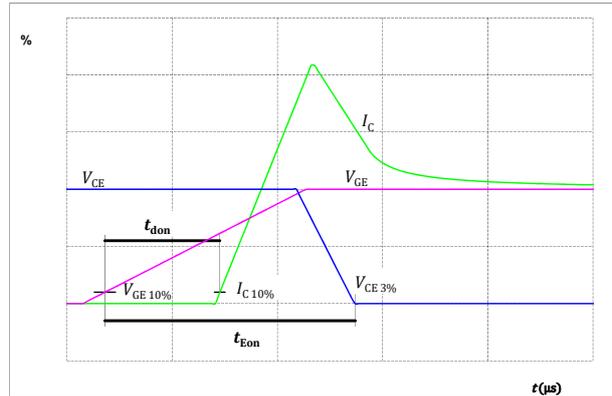
figure 52. IGBT

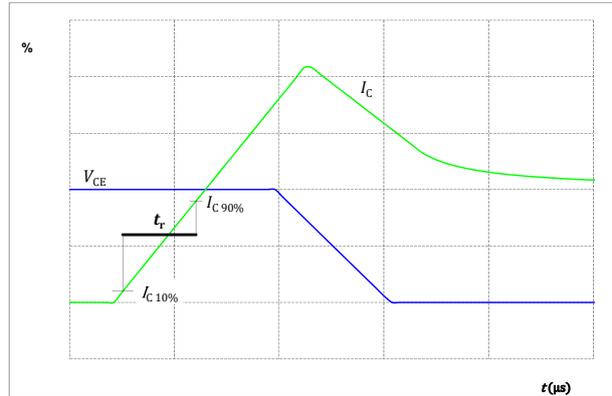Turn-off Switching Waveforms & definition of t_f
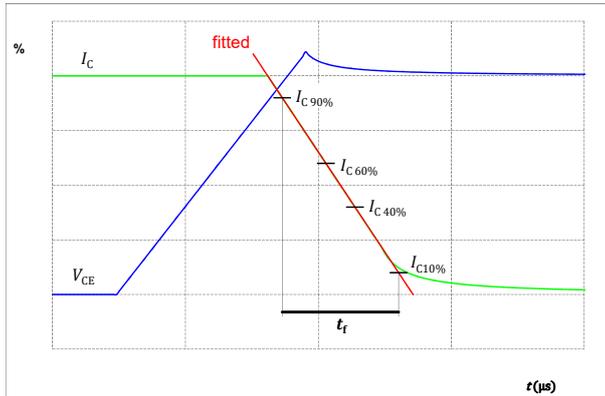
figure 53. IGBT

Turn-on Switching Waveforms & definition of t_r

Switching Definitions

figure 54.	FWD

Turn-off Switching Waveforms & definition of t_{rr}
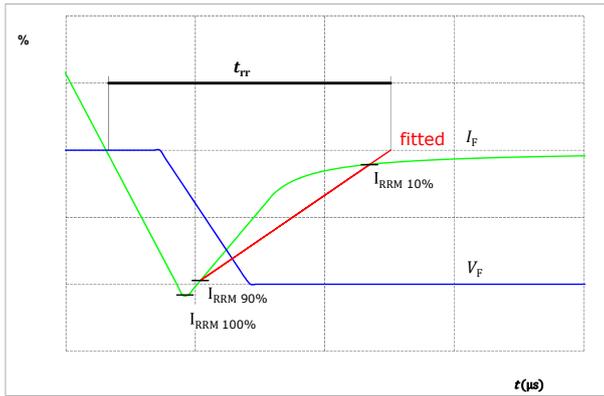
figure 55.	FWD

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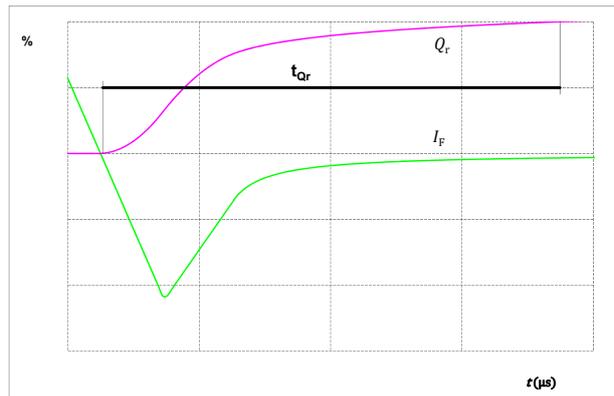
Ordering Code

Version	Ordering Code
Without thermal paste	30-E312NIB560H710-PR40F07Z
With thermal paste (5,2 W/mK, PTM6000HV)	30-E312NIB560H710-PR40F07Z-/7/

Marking

		Name	Date code	UL & VIN	Lot	Serial
	Text	NN-NNNNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
		Type&Ver	Lot number	Serial	Date code	
	Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY	

Outline

Pin table [mm]

Pin	X	Y	Function
1	56,16	0	DC-
2	59,36	0	DC-
3	62,56	0	DC-
4	65,76	0	DC-
5	68,96	0	DC-
6	72,16	0	DC-
7	25,6	0	GND1
8	28,8	0	GND1
9	32	0	GND1
10	40,16	0	GND2
11	43,36	0	GND2
12	46,56	0	GND2
13	0	0	DC+
14	3,2	0	DC+
15	6,4	0	DC+
16	9,6	0	DC+
17	12,8	0	DC+
18	16	0	DC+
19	16	48	Ph1
20	19,2	48	Ph1
21	22,4	48	Ph1
22	25,6	48	Ph1
23	28,8	48	Ph1
24	32	48	Ph1
25	40,16	44,8	Ph2
26	43,36	44,8	Ph2
27	46,56	44,8	Ph2
28	40,16	48	Ph2
29	43,36	48	Ph2
30	46,56	48	Ph2
31	62,56	28,8	N
32	9,6	25,6	P
33	9,6	19,2	G11
34	9,6	22,4	S11
35	62,56	9,6	G12
36	62,56	6,4	S12
37	0	44,8	G13
38	0	48	S13
39	72,16	48	G14
40	68,96	48	S14
41	56,16	48	Therm1
42	59,36	48	Therm2

□ 0.64±0.03
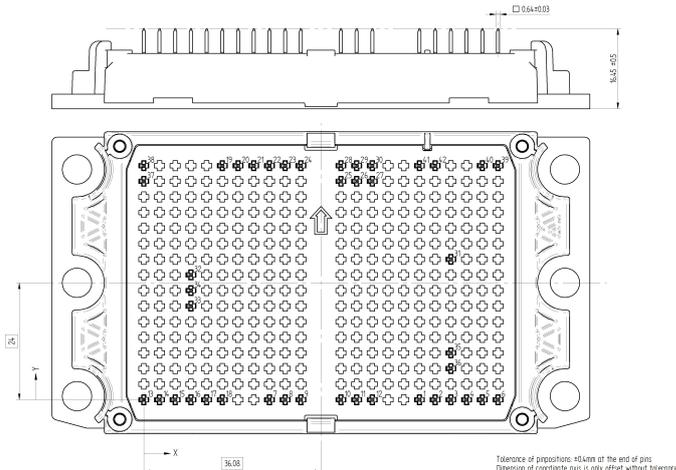
Tolerance of pinposition: ±0.4mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout
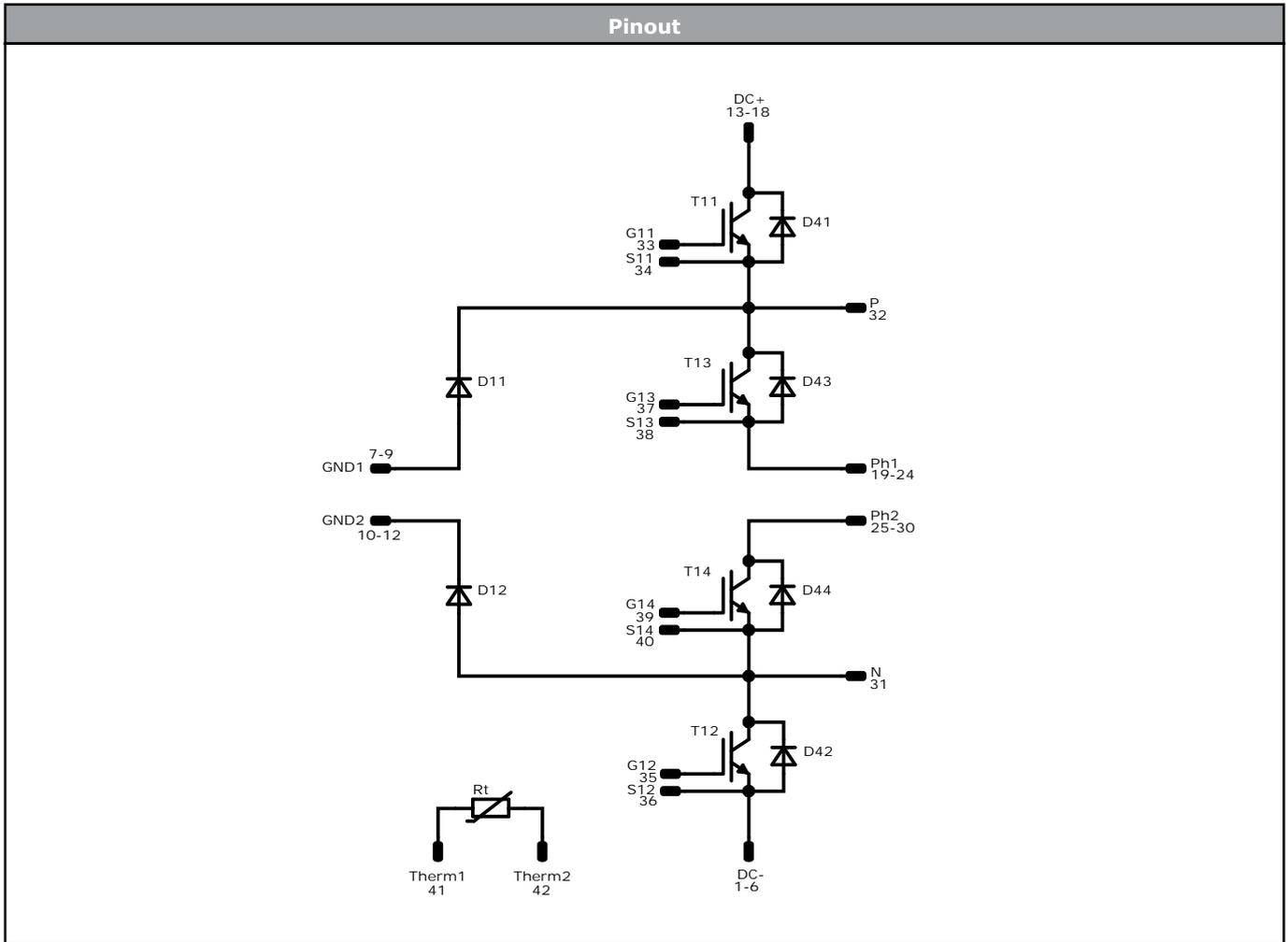
Identification

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

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

Handling instruction
Handling instructions for *flow* E3BP packages see vincotech.com website.

Package data
Package data for *flow* 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°C and up to 4000VAC/1min isolation voltage. For more information see vincotech.com website.	**UL**

Document No.:	**Date:**	**Modification:**	**Pages**
30-E312NIB560H710-PR40F07Z-D1-14	30 May. 2025	Initial Release	
30-E312NIB560H710-PR40F07Z-D2-14	10 Jun. 2025	Update Dynamic Characteristic Values table of Buck Switch Update Dynamic Characteristic Values table of Buck Diode Update Buck Switching Characteristics charts	
30-E312NIB560H710-PR40F07Z-D3-14	20 Jun. 2025	Update Dynamic Characteristic Values table of Buck and Boost Switch Update Dynamic Characteristic Values table of Buck and Boost Diode Update Buck and Boost Switching Characteristics charts	