Vincotech

70-W224NIA400SH-M400P

datasheet

VINcoNPC X4 **1500 V / 400 A**

Topology features

- Neutral Point Clamped Topology (I-Type)
- Kelvin Emitter for improved switching performance
- Optional snubber diode for switching loss reduction with asymmetrical inductance feature
- Temperature sensor

Component features

- Easy paralleling
- High speed switching
- Low switching losses

Housing features

- Base isolation: Al_2O_3
- Optimized for three-level topologies
- Enables high switching frequencies
- Low inductive package
- Easy paralleling
- Optimal current sharing
- Thermo-mechanical push-and-pull force relief
- M6 High Power Screw Contact
- M4 Low Inductive Interface
- Press-fit connection to driver PCB

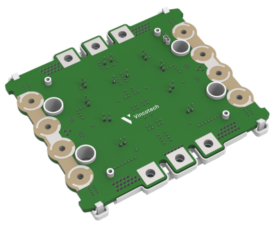
Target applications

- UPS

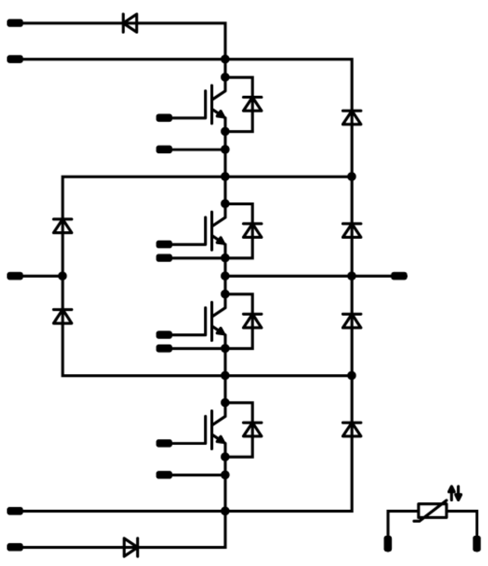
Types

- 70-W224NIA400SH-M400P

VINco X4 12 mm housing



Schematic



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	306	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	784	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	10	µs
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	255	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	2200	A
Surge current capability	I^2t			24208	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	483	W
Maximum junction temperature	T_{jmax}			175	°C
Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	36	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 25 °C	130	A
Surge current capability	I^2t			84	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	98	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	362	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	773	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	10	μs
Maximum junction temperature	T_{jmax}			175	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	253	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 °C	425	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	253	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 °C	425	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Snubber Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	84	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	540	A
Surge current capability	I^2t	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	1460	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	178	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 s	6000	V
Creepage distance				>12,7	mm
Clearance				>12,7	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Buck Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0136	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		400	25 125 150	1,78	2,37 2,78 2,88	2,42(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			8	µA
Gate-emitter leakage current	I_{GES}		20	0		25			960	nA
Internal gate resistance	r_g							0,5		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		22160		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		1280		pF
Gate charge	Q_g		±15		0	25		3040		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,12		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-8/15	600	280	25 125 150		60,05 61,93 62,44		ns
Rise time	t_r	R_{gon} = 2 Ω R_{goff} = 2 Ω	-8/15	600	280	25 125 150		25,48 28,14 28,93		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-8/15	600	280	25 125 150		232,04 303,85 321,09		ns
Fall time	t_f	R_{gon} = 2 Ω R_{goff} = 2 Ω	-8/15	600	280	25 125 150		30,77 56,66 65,74		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=13,38 µC Q_{rFWD}=36,88 µC Q_{rFWD}=44,9 µC	-8/15	600	280	25 125 150		10,38 16,22 18,49		mWs
Turn-off energy (per pulse)	E_{off}		-8/15	600	280	25 125 150		11,11 19,94 21,62		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										
Forward voltage	V_F				400	25 125 150		2,33 2,38 2,29	2,52(1) 2,47(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 35200	480 70800	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,2		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=10685 A/µs d*i*/d*t*=9938 A/µs d*i*/d*t*=9830 A/µs	-8/15	600	280	25 125 150		322,28 405,01 444,59		A
Reverse recovery time	t_{rr}					25 125 150		76,73 285,27 305,3		ns
Recovered charge	Q_r					25 125 150		13,38 36,88 44,9		µC
Reverse recovered energy	E_{rec}					25 125 150		3,94 14,85 18,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		9720,1 8423,63 7440,66		A/µs

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	
Protection Diode										
Static										
Forward voltage	V_F				30	25 125 150		2,37 2,47	2,71(1) 2,77(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 1800	120 3600	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,97		K/W

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0152	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		400	25 125 150	1,53	1,91 2,13 2,21	1,97(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5,2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Internal gate resistance	r_g							1,88		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		25200		pF
Reverse transfer capacitance	C_{res}							1080		pF
Gate charge	Q_g		±15		0	25		3200		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,12		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-8/15	600	280	25 125 150		107,03 112,63 113,98		ns
Rise time	t_r					25 125 150		39,12 42,2 43,08		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		365,86 472,72 506,04		ns
Fall time	t_f					25 125 150		56,08 124,27 154,24		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=21,38 µC Q_{rFWD}=41,75 µC Q_{rFWD}=47,63 µC				25 125 150		14,73 20,89 22,53		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		18,92 30,83 35,06		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	
Boost Diode										
Static										
Forward voltage	V_F				300	25 125 150	1,35	1,9 1,85 1,83	2,05[1]	V
Reverse leakage current	I_R	V_r = 1200 V				25			56	µA
Thermal										
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,22		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=6962 A/µs d*i*/d*t*=6504 A/µs d*i*/d*t*=6774 A/µs	-8/15	600	280	25 125 150		241,09 285,83 297,79		A
Reverse recovery time	t_{rr}					25 125 150		226,47 373,42 411,22		ns
Recovered charge	Q_r					25 125 150		21,38 41,75 47,63		µC
Reverse recovered energy	E_{rec}					25 125 150		7,59 15,8 17,98		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5460,51 978,46 996,95		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Boost Sw. Inv. Diode										
Static										
Forward voltage	V_F				300	25 125 150	1,35	1,9 1,85 1,83	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			56	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,22		K/W
Snubber Diode										
Static										
Forward voltage	V_F				100	25 125 150		2,22 2,31 2,21	2,54(1) 2,5(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 8800	120 17600	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,53		K/W

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

(1) Value at chip level

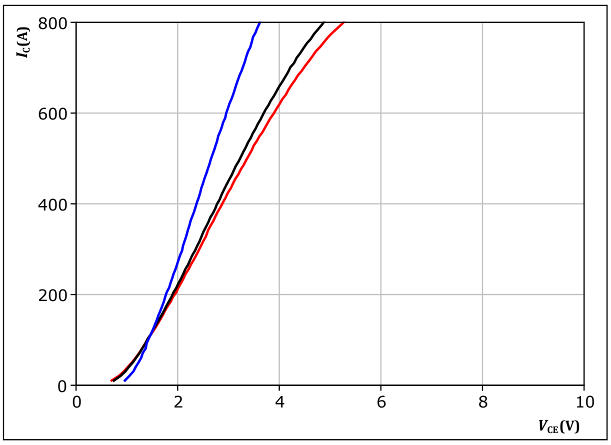
(2) Only valid with pre-applied Vincotech thermal interface material.

Buck Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

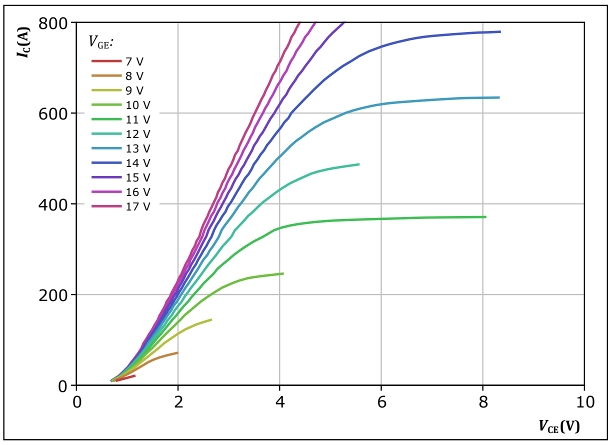


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

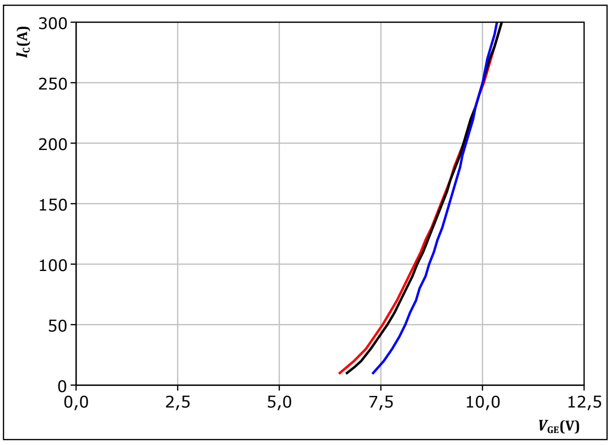


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

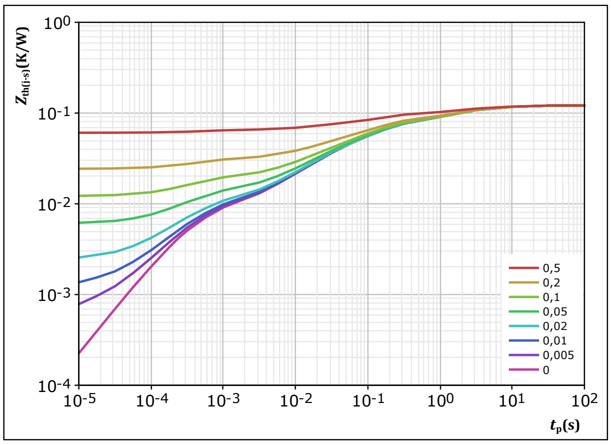


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
$R_{th(j-s)}$ = 0,121 K/W

IGBT thermal model values

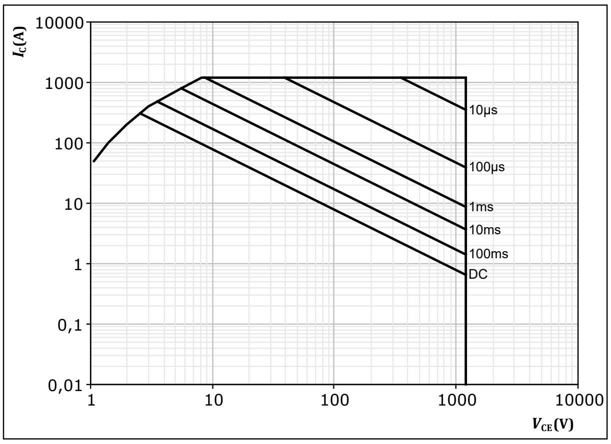
R (K/W)	τ (s)
1,29E-02	8,99E+00
3,70E-02	1,48E+00
4,55E-02	1,08E-01
1,78E-02	1,38E-02
7,98E-03	3,79E-04

Buck Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



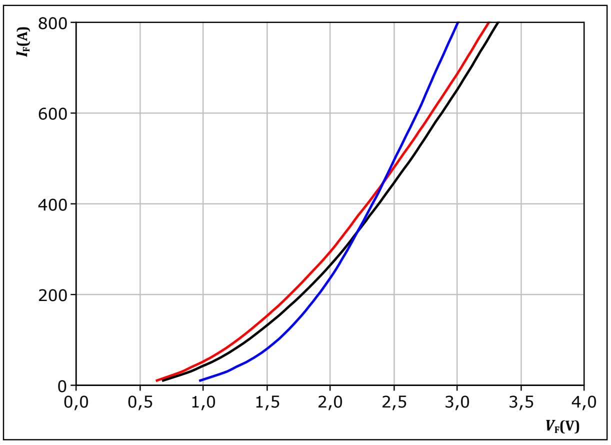
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Buck Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



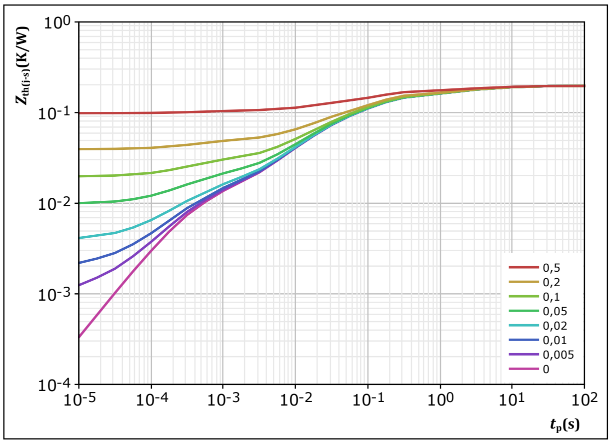
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,197 K/W

FWD thermal model values

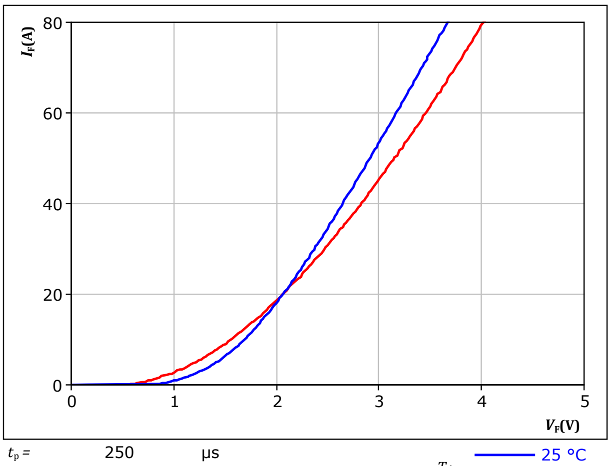
R (K/W)	τ (s)
1,58E-02	9,60E+00
3,61E-02	1,71E+00
9,10E-02	1,08E-01
4,34E-02	1,41E-02
1,05E-02	3,52E-04

Protection Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



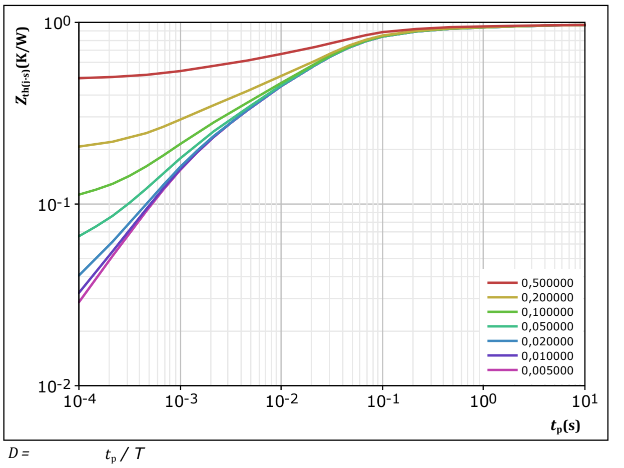
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,968 K/W

FWD thermal model values

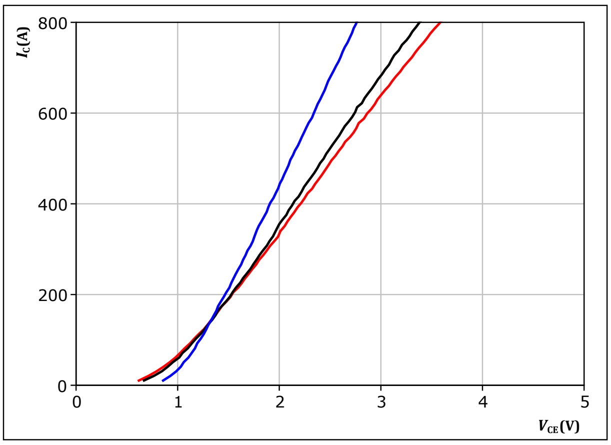
R (K/W)	τ (s)
1,95E-02	5,74E+00
4,03E-02	1,10E+00
1,37E-01	1,35E-01
4,48E-01	2,90E-02
1,88E-01	4,59E-03
1,29E-01	8,12E-04
8,45E-03	9,28E-05

Boost Switch Characteristics

figure 10. IGBT

Typical output characteristics

I_C = f(V_{CE})

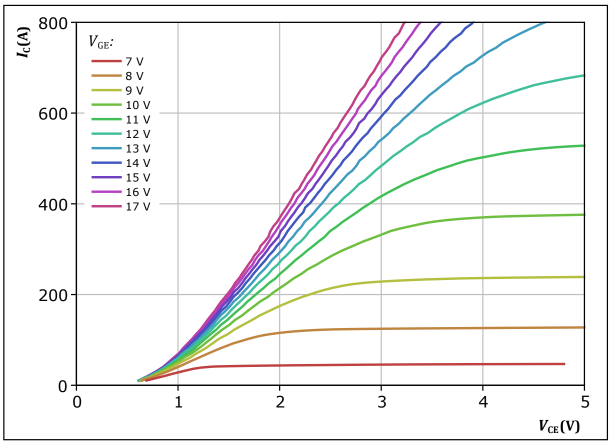


t_p =	250	µs	
V_{GE} =	15	V	
T_j:			25 °C
			125 °C
			150 °C

figure 11. IGBT

Typical output characteristics

I_C = f(V_{CE})



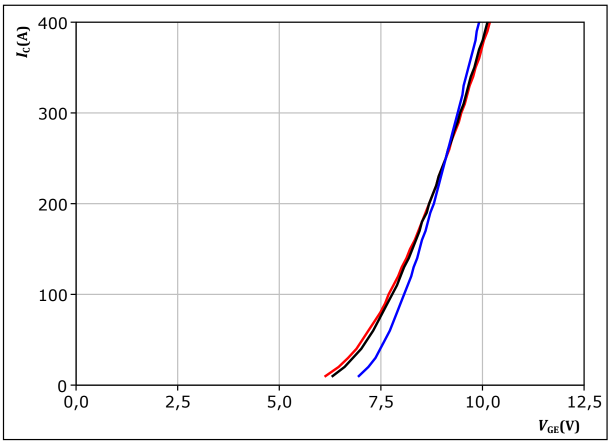
t_p =	250	µs
T_j =	150	°C

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

figure 12. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

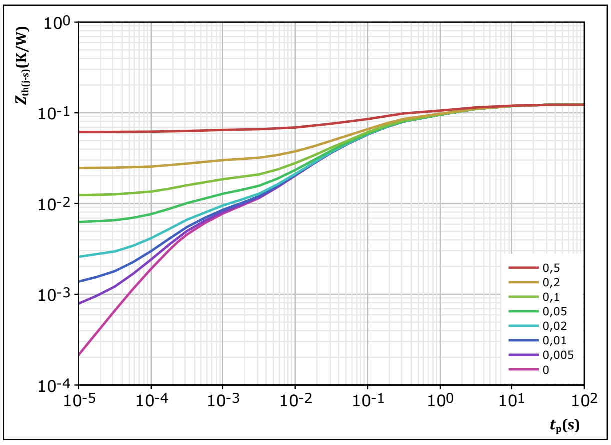


t_p =	250	µs	
V_{CE} =	10	V	
T_j:			25 °C
			125 °C
			150 °C

figure 13. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,123	K/W

IGBT thermal model values

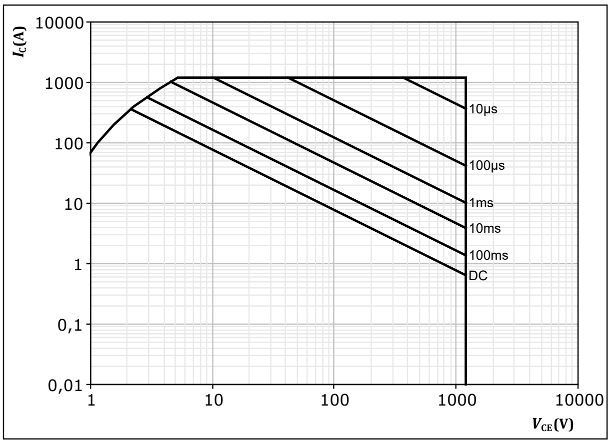
R (K/W)	τ (s)
1,52E-02	7,53E+00
3,31E-02	1,20E+00
4,96E-02	1,09E-01
1,87E-02	1,43E-02
6,30E-03	3,14E-04

Boost Switch Characteristics

figure 14. **IGBT**

Safe operating area

I_C = f(V_{CE})



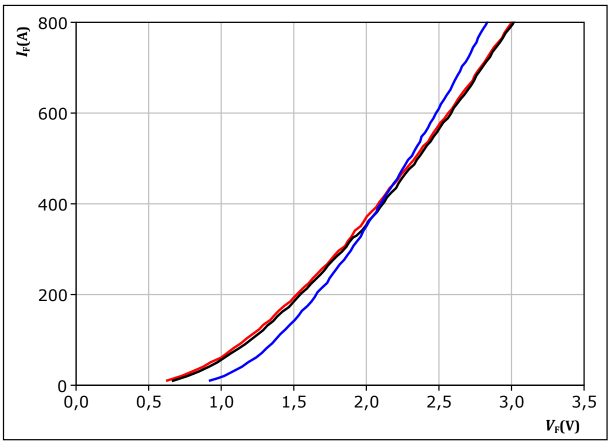
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

I_F = f(V_F)

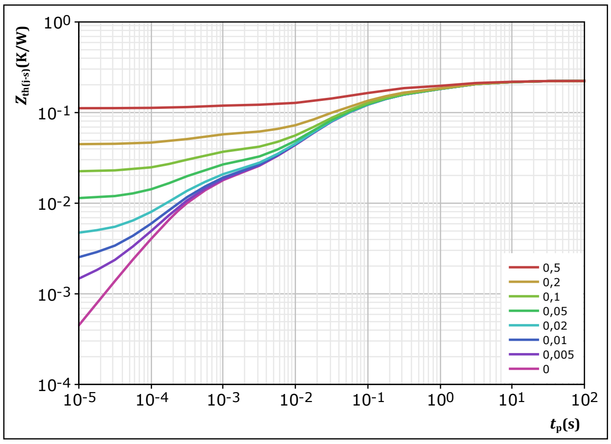


t_p =	250	µs	
		T_j:	25 °C
			125 °C
			150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,223	K/W

FWD thermal model values

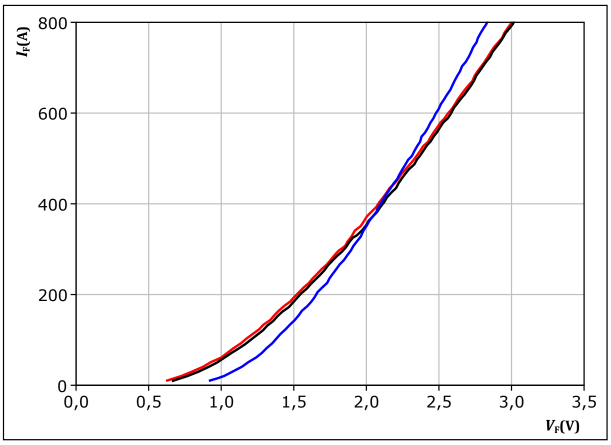
R (K/W)	τ (s)
1,92E-02	8,60E+00
5,74E-02	1,16E+00
8,18E-02	9,75E-02
4,93E-02	1,93E-02
1,57E-02	3,73E-04

Boost Sw. Inv. Diode Characteristics

figure 17. **FWD**

Typical forward characteristics

I_F = f(V_F)



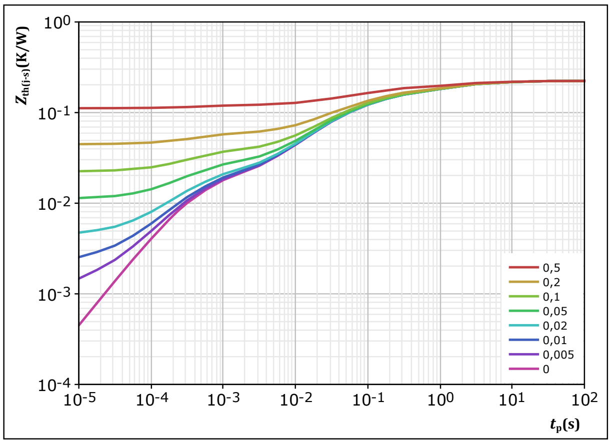
t_p = 250 µs

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)



D = t_p / T

$R_{th(j-s)}$ = 0,223 K/W

FWD thermal model values

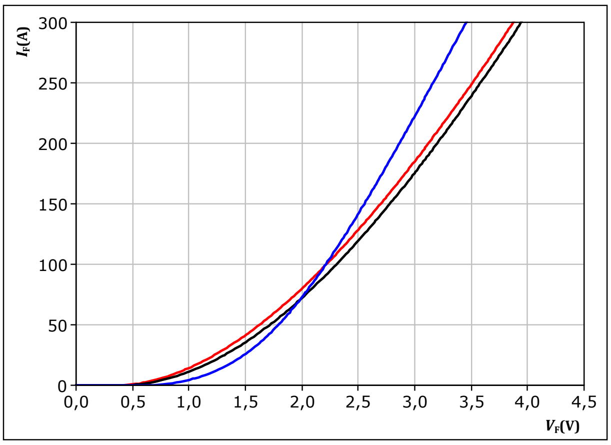
R (K/W)	τ (s)
1,92E-02	8,60E+00
5,74E-02	1,16E+00
8,18E-02	9,75E-02
4,93E-02	1,93E-02
1,57E-02	3,73E-04

Snubber Diode Characteristics

figure 19. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



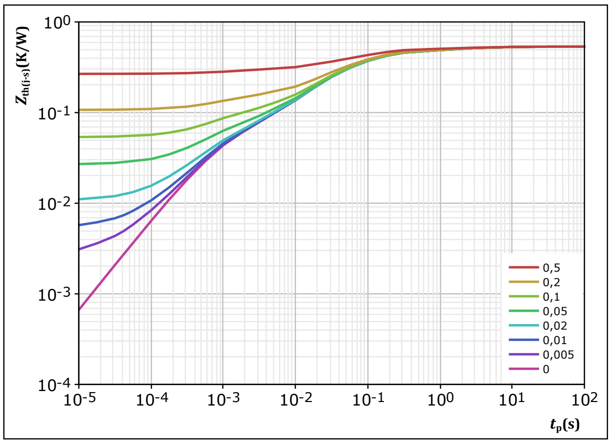
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 20. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,534 K/W

FWD thermal model values

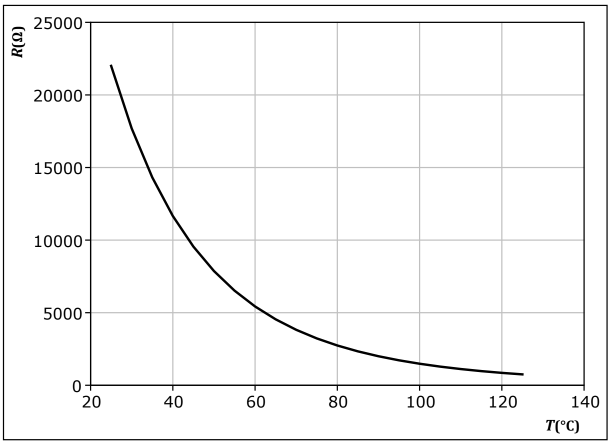
R (K/W)	τ (s)
2,56E-02	6,24E+00
5,52E-02	1,16E+00
2,34E-01	9,86E-02
1,71E-01	2,07E-02
4,81E-02	8,56E-04

Thermistor Characteristics

figure 21. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

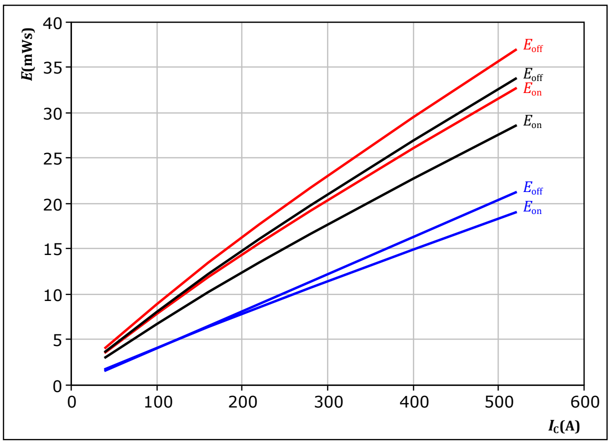


Buck Switching Characteristics

figure 22. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



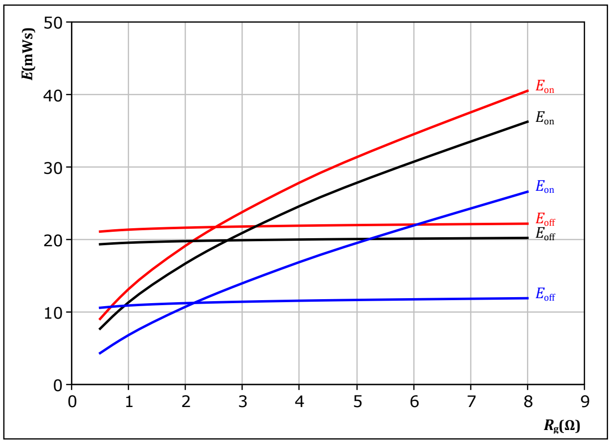
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 23. **IGBT**

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

$E = f(R_g)$



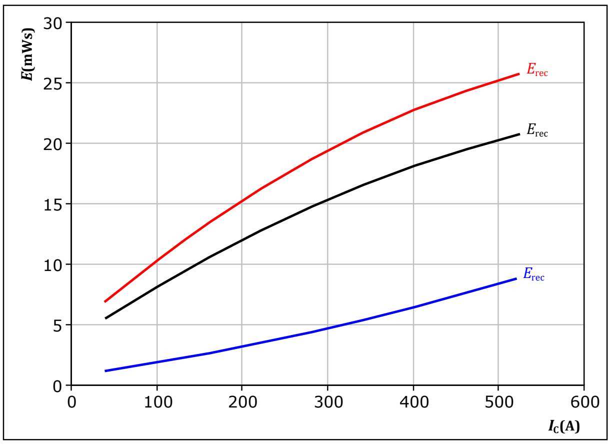
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

figure 24. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



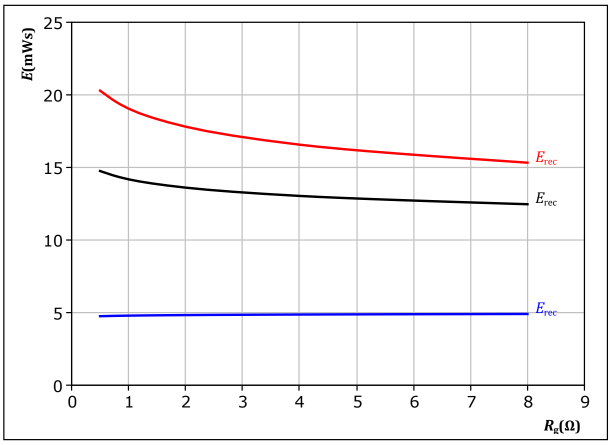
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 25. **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

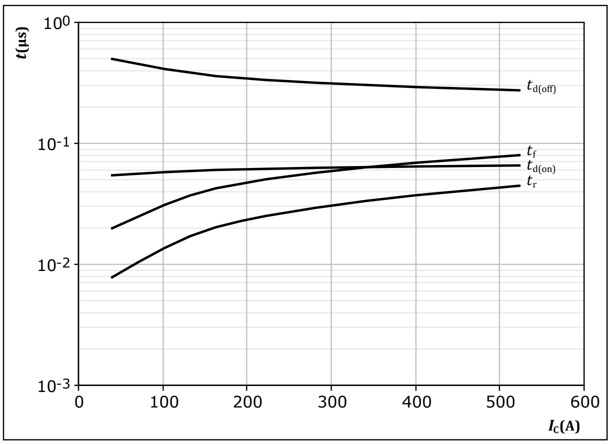
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

Buck Switching Characteristics

figure 26. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



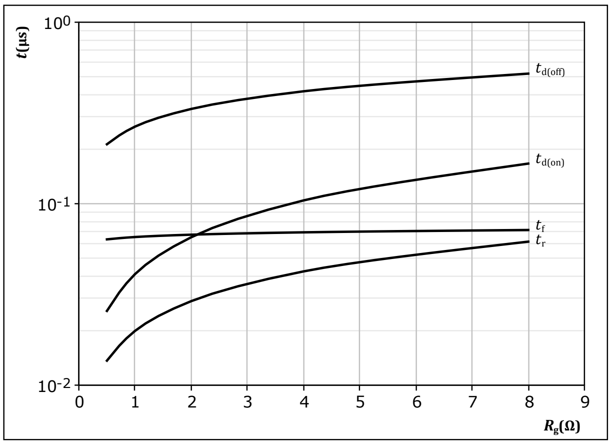
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-8/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 27. **IGBT**

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

t = f(R_g)



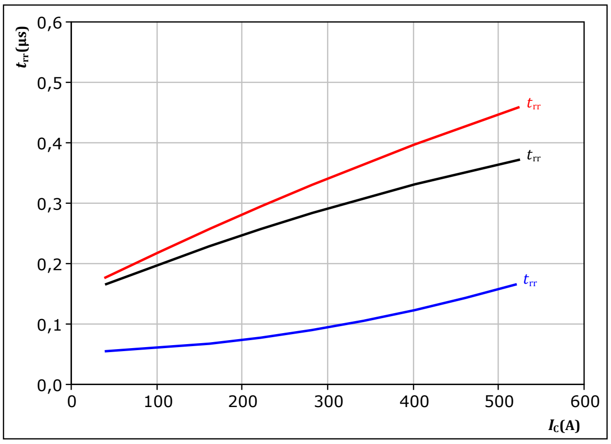
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-8/15	V
I_C =	280	A

figure 28. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

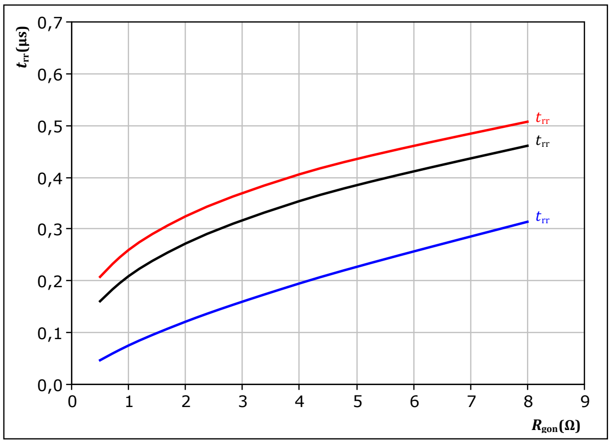
V_{CE} =	600	V
V_{GE} =	-8/15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 29. **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} =	-8/15	V
I_C =	280	A

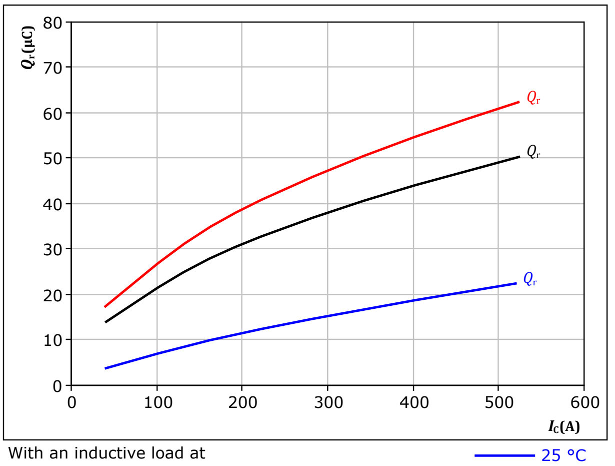
T_j: 25 °C, 125 °C, 150 °C

Buck Switching Characteristics

figure 30. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



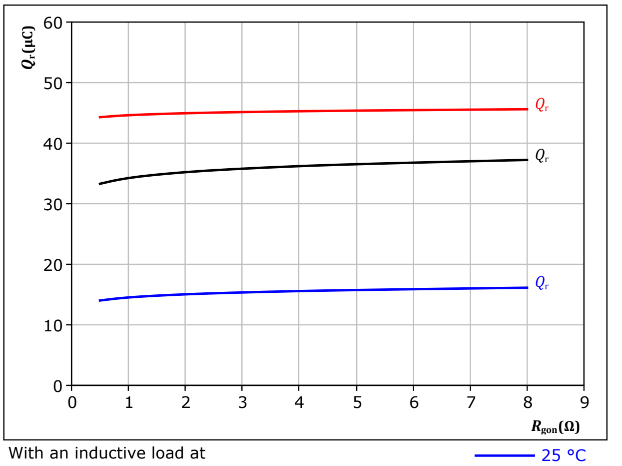
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 31. **FWD**

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

Q_r = f(R_{gon})



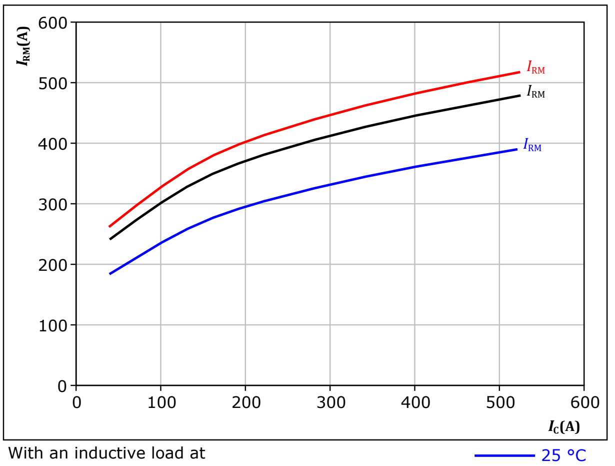
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

figure 32. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



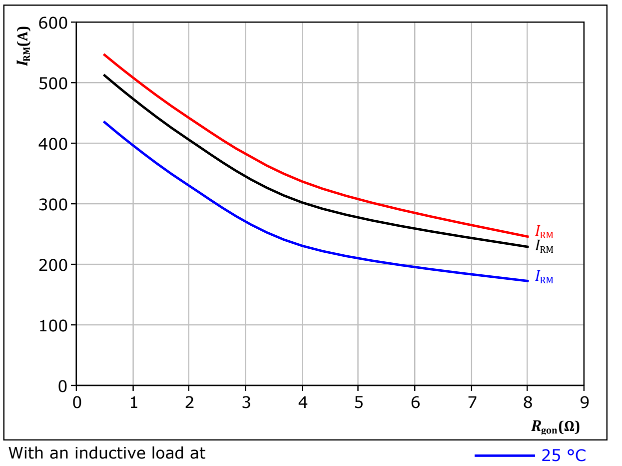
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 33. **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

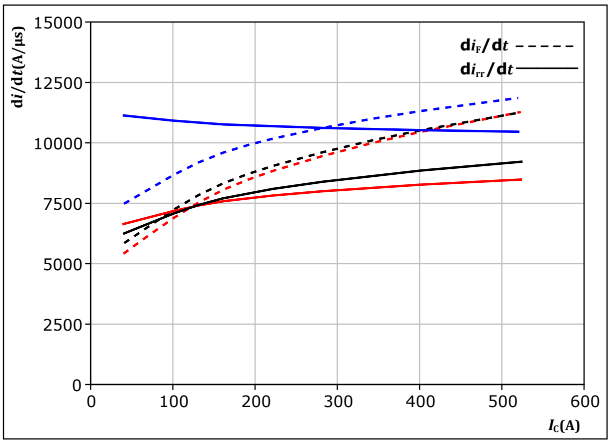
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

Buck Switching Characteristics

figure 34. **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)



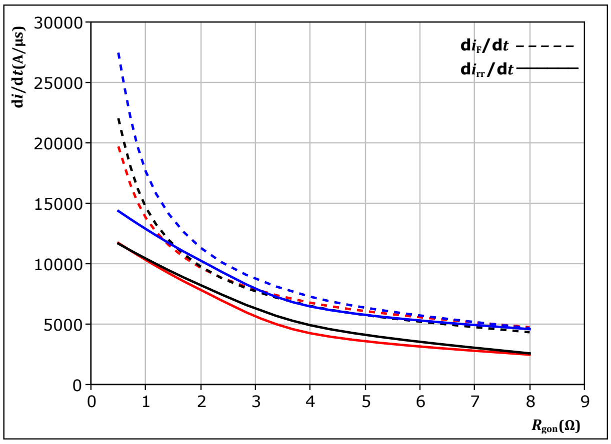
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	-8/15	V	125 °C
R_{gon} =	2	Ω	150 °C

figure 35. **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})



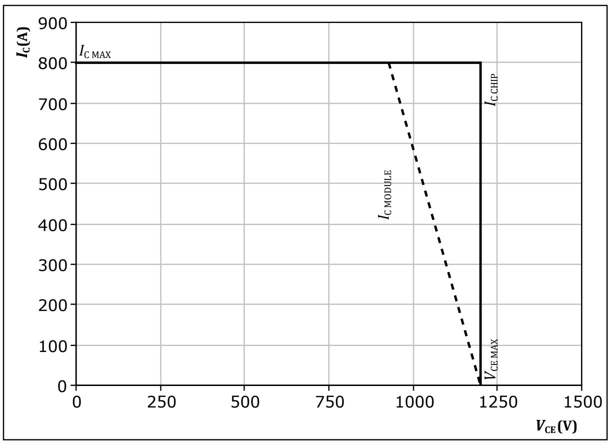
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	-8/15	V	125 °C
I_C =	280	A	150 °C

figure 36. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



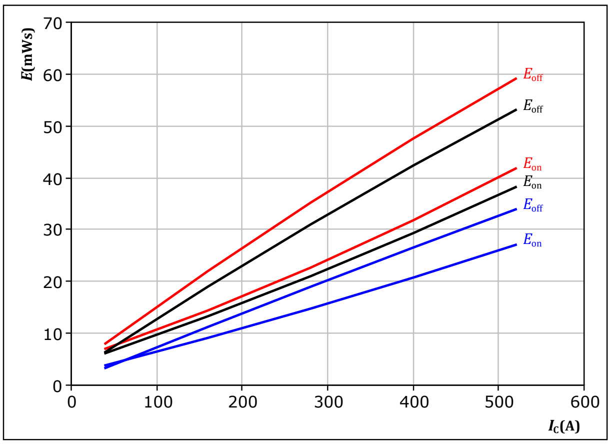
At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

Boost Switching Characteristics

figure 37. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



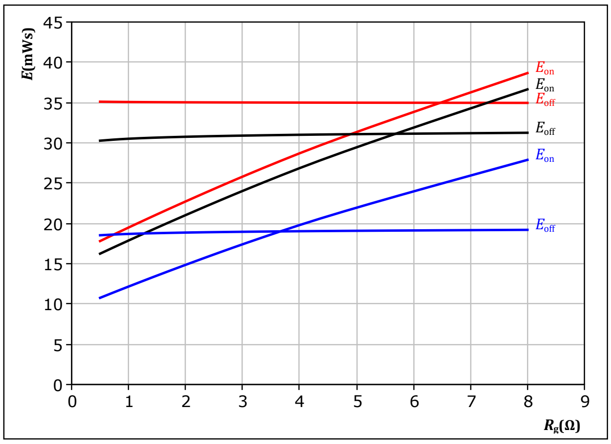
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 38. IGBT

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

$E = f(R_g)$



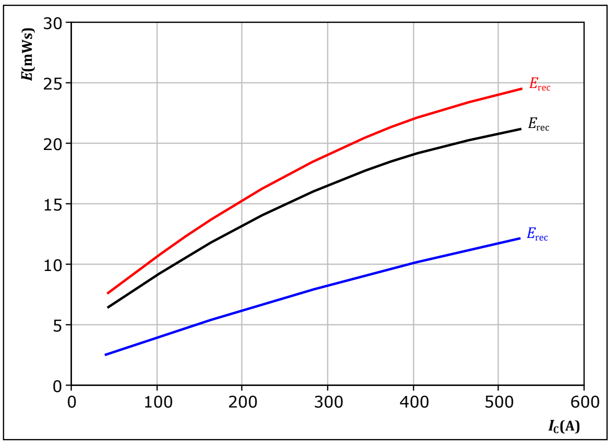
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

figure 39. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



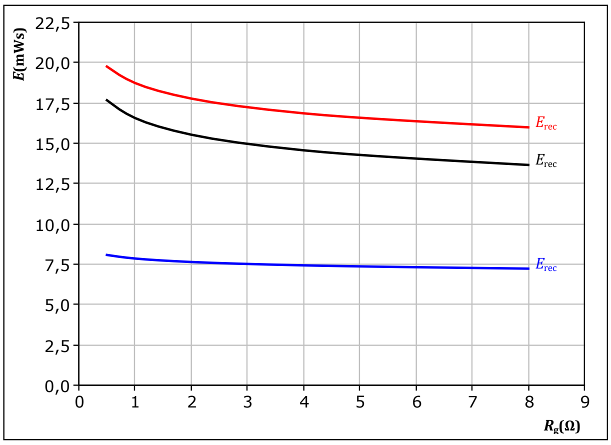
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 40. 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

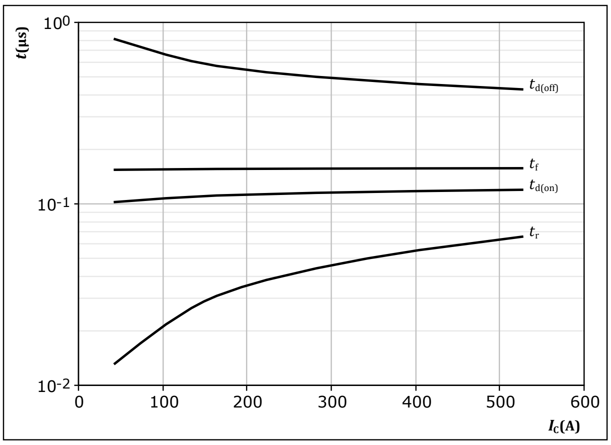
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

Boost Switching Characteristics

figure 41.	IGBT

Typical switching times as a function of collector current

t = f(I_C)



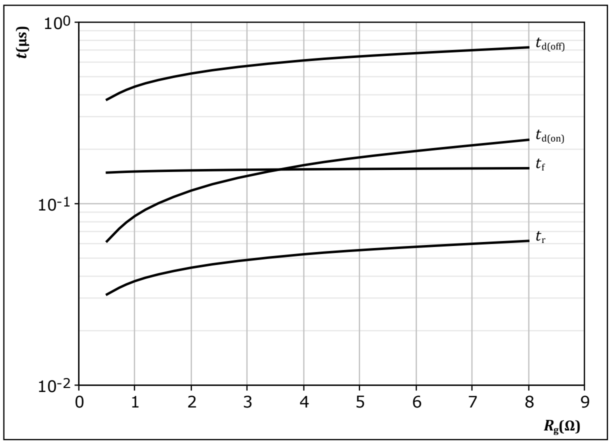
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-8/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 42.	IGBT

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

t = f(R_g)



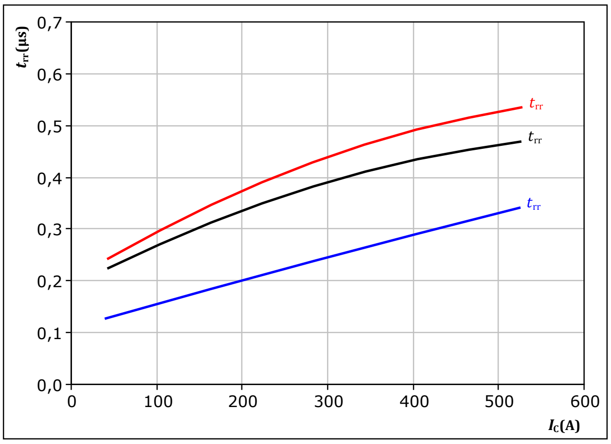
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	-8/15	V
I_C =	280	A

figure 43.	FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

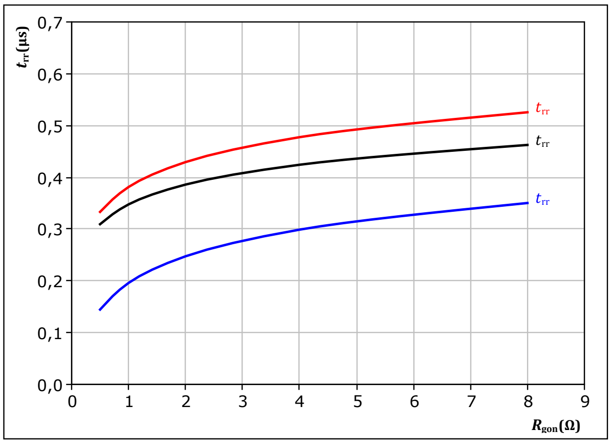
V_{CE} =	600	V
V_{GE} =	-8/15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 44.	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} =	-8/15	V
I_C =	280	A

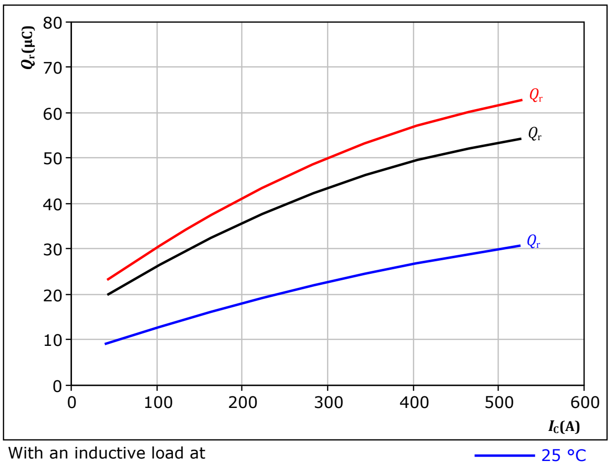
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 45. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



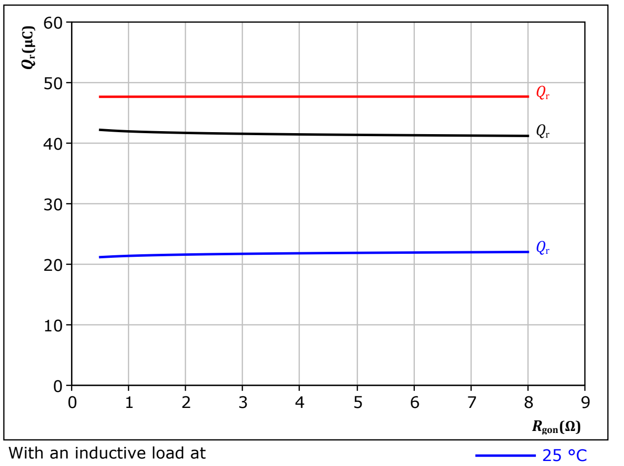
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 46. **FWD**

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

$Q_r = f(R_{gon})$



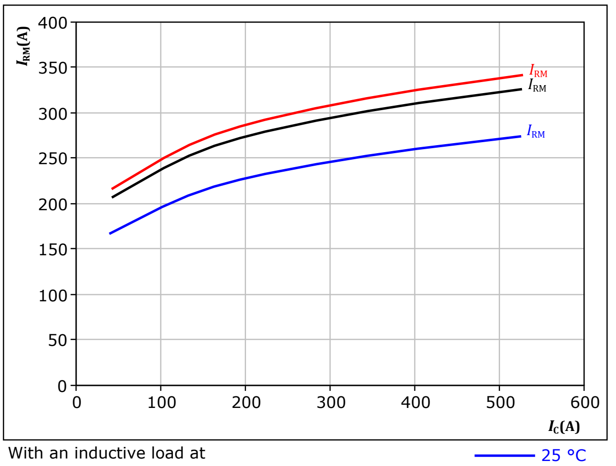
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

figure 47. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



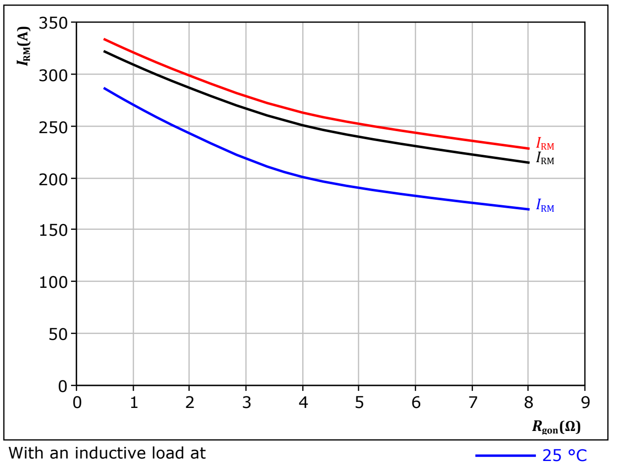
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 48. **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

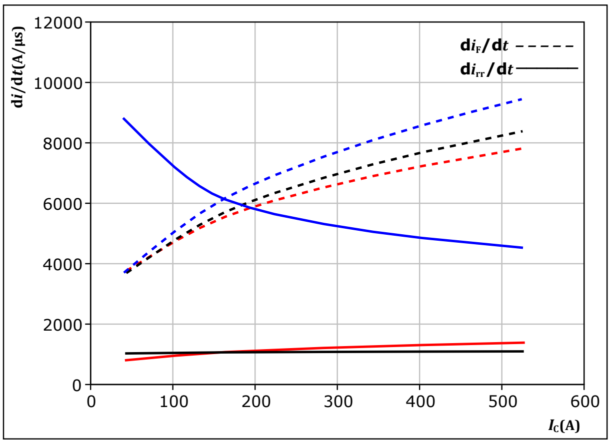
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

Boost Switching Characteristics

figure 49. **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)



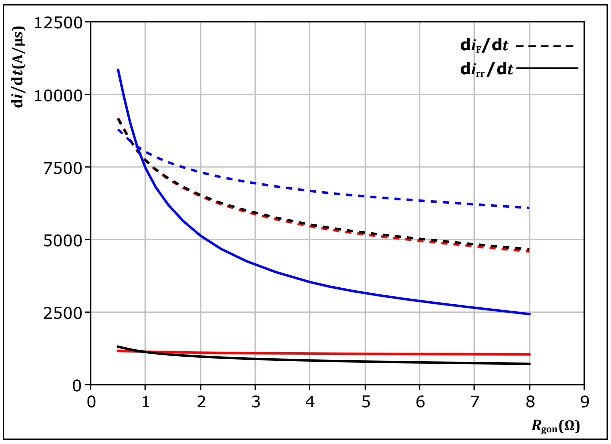
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 50. **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})



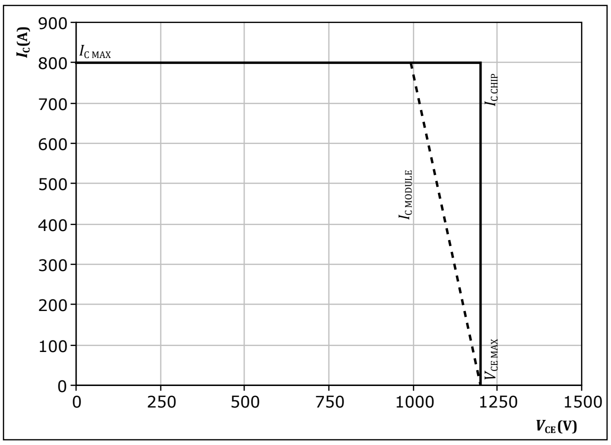
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	-8/15	V		125 °C
I_C =	280	A		150 °C

figure 51. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

Switching Definitions

figure 52. **IGBT**

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

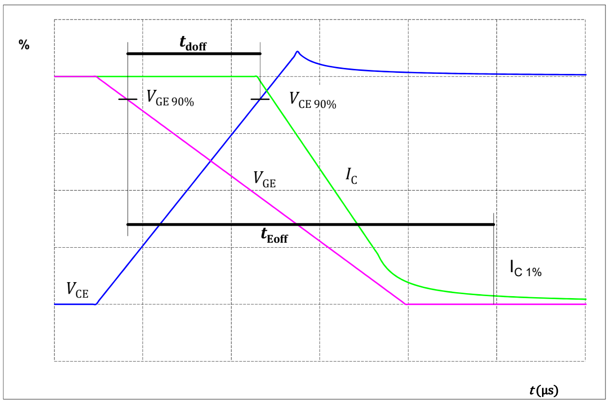


figure 53. **IGBT**

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

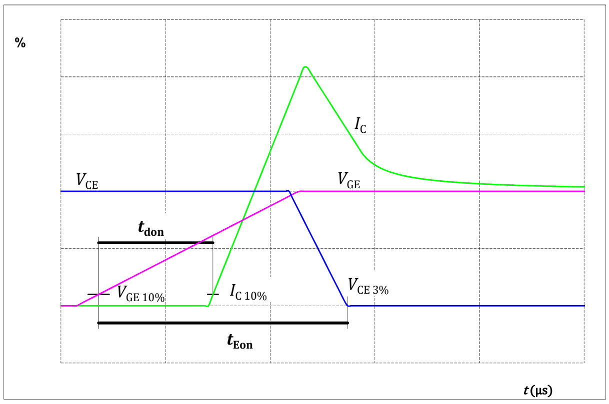


figure 54. **IGBT**

Turn-off Switching Waveforms & definition of t_f

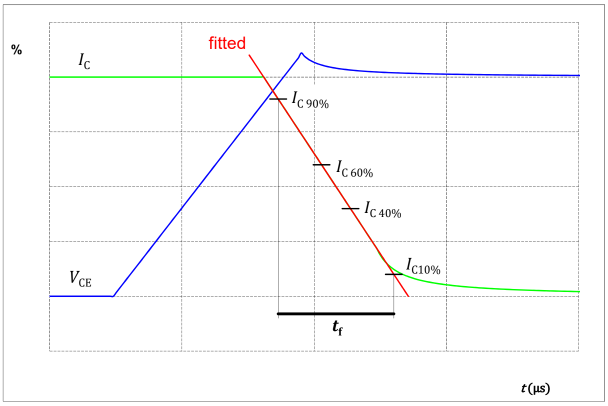
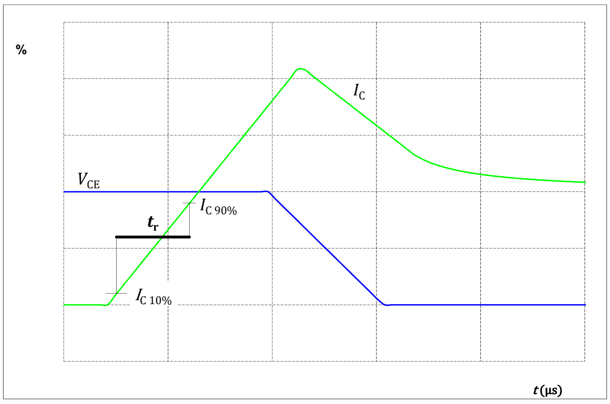


figure 55. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 56. **FWD**

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

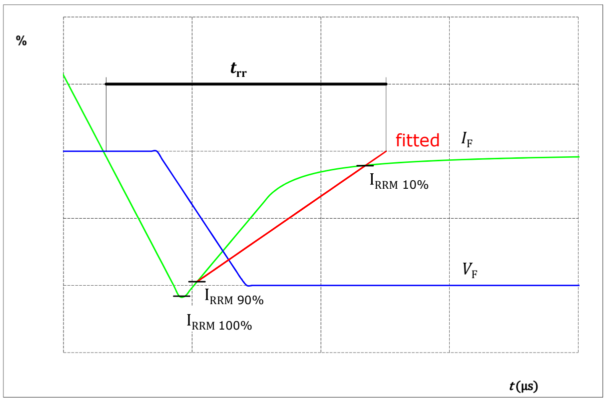
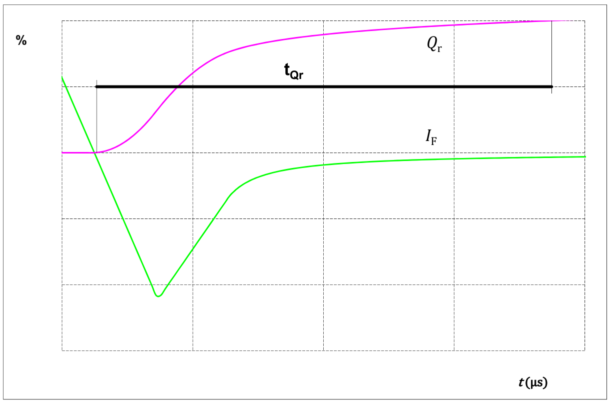


figure 57. **FWD**

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



70-W224NIA400SH-M400P
datasheet

Vincotech

Ordering Code

Version	Ordering Code
Without thermal paste	70-W224NIA400SH-M400P
With thermal paste (3,4 W/mK, PSX-P7)	70-W224NIA400SH-M400P-/3/

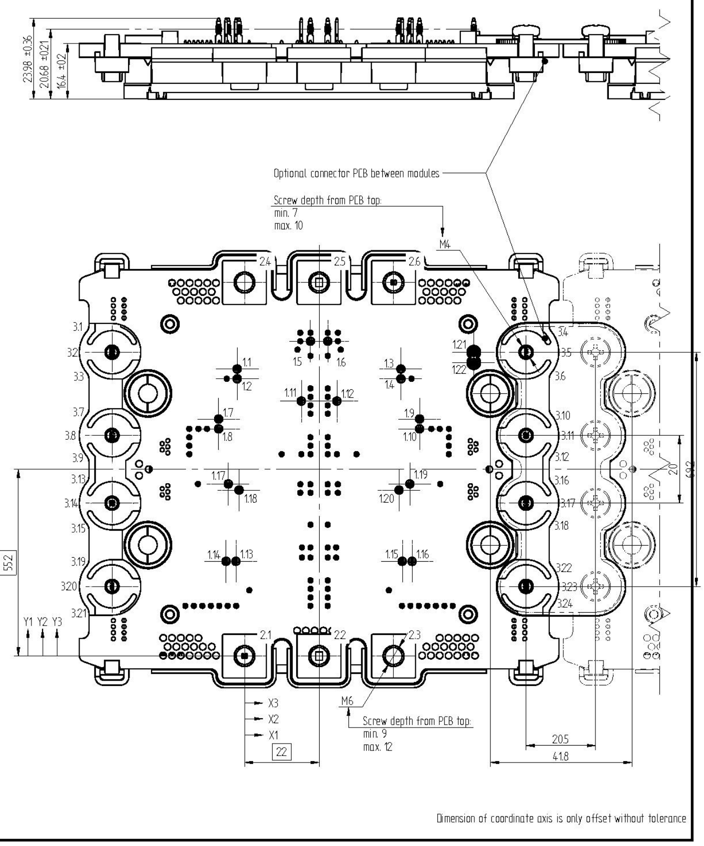
Marking

Name Date code Lot Serial Vincotech						
	Text	Name	Date code	Lot	Serial	
		NN-NNNNNNNNNNNNNN-TTTTTTVV	WWYY	LLLLL	SSSS	
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
		TTTTTTTVV	LLLLL	SSSS	WWYY	

Outline

Pin table [mm]

Pin	X	Y	Function	2.5	22	110,4	GND
1.1	-2,15	84,85	G11-1	2.6	44	110,4	DC-
1.2	-2,15	81,95	S11-1	3.1	-39,1	89,8	TR+
1.3	46,15	84,85	G11-2	3.2	-39,1	89,8	GND
1.4	46,15	81,95	S11-2	3.3	-39,1	89,8	DC+
1.5	19,45	93,05	DC+ desat	3.4	83,1	89,8	TR+
1.6	24,55	93,05	DC+ desat	3.5	83,1	89,8	GND
1.7	-7,65	70,05	G13-1	3.6	83,1	89,8	DC+
1.8	-7,65	67,15	S13-1	3.7	-39,1	65,2	T2C
1.9	51,65	70,05	G13-2	3.8	-39,1	65,2	GND
1.10	51,65	67,15	S13-2	3.9	-39,1	65,2	Phase
1.11	16,75	75,35	GND desat	3.10	83,1	65,2	T2C
1.12	27,25	75,35	GND desat	3.11	83,1	65,2	GND
1.13	-2,55	28	G14-1	3.12	83,1	65,2	Phase
1.14	-5,45	28	S14-1	3.13	-39,1	45,2	Phase
1.15	46,55	28	G14-2	3.14	-39,1	45,2	GND
1.16	49,45	28	S14-2	3.15	-39,1	45,2	DK
1.17	-4,8	50,85	G12-1	3.16	83,1	45,2	Phase
1.18	-1,6	49,05	S12-1	3.17	83,1	45,2	GND
1.19	48,8	50,85	G12-2	3.18	83,1	45,2	DK
1.20	45,6	49,05	S12-2	3.19	-39,1	20,6	DC-
1.21	67,65	89,8	Therm1	3.20	-39,1	20,6	GND
1.22	67,65	86,7	Therm2	3.21	-39,1	20,6	TR-
2.1	0	0	Ph	3.22	83,1	20,6	DC-
2.2	22	0	Ph	3.23	83,1	20,6	GND
2.3	44	0	Ph	3.24	83,1	20,6	TR-
2.4	0	110,4	DC+				



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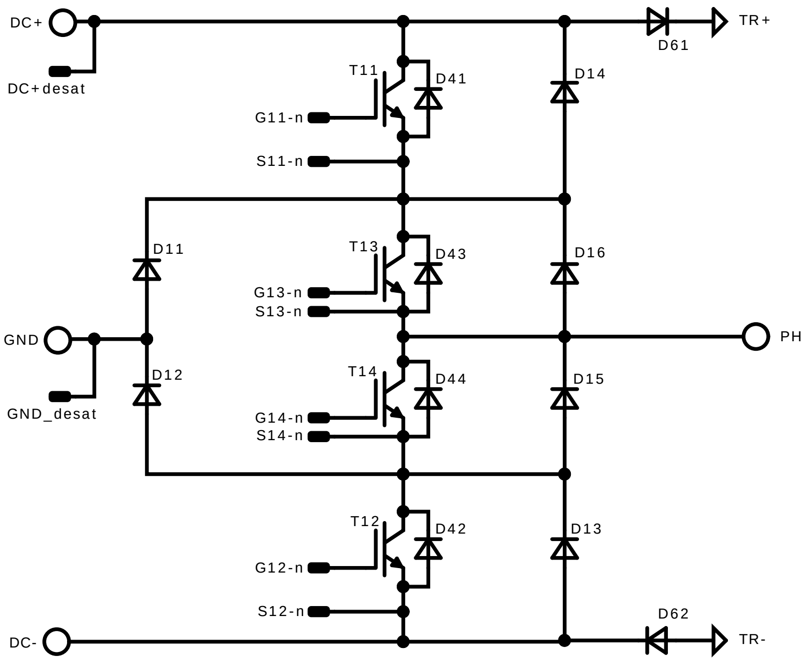
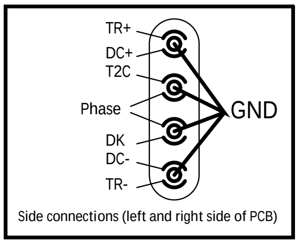
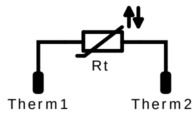
Pinout



n = 1-2





NOTE: Driver pins for parallel devices are not connected inside the module!

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	1200 V	400 A	Buck Diode	
D41, D42, D43, D44	FWD	1200 V	30 A	Protection Diode	
T13, T14	IGBT	1200 V	400 A	Boost Switch	Parallel devices with separate control. Values apply to complete device.
D13, D14	FWD	1200 V	300 A	Boost Diode	
D15, D16	FWD	1200 V	300 A	Boost Sw. Inv. Diode	
D61, D62	FWD	1200 V	100 A	Snubber Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 8	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for VINco X4 packages see vincotech.com website.

Package data
Package data for VINco X4 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
70-W224NIA400SH-M400P-D8-14	25 Oct. 2024	Remeasure Datasheet characteristics No change in Module	