B0-SP12VPA025M702-LR28A13T
datasheet

***flow*PIM S3 + PFC** | **1200 V / 25 A**

Topology features

- Open Emitter configuration
- Temperature sensor
- Inverter
- 3ph Vienna rectifier

Component features

- Commutation rugged
- Easy to use / drive
- Suitable for hard and soft switching

Housing features

- Base isolation: Al_2O_3
- CTI600 housing material
- Compact, baseplate-less housing
- VINcoPress Technology
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

Target applications

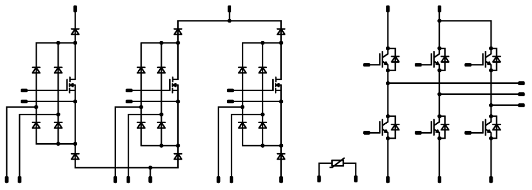
- Embedded Drives
- Heat Pumps
- HVAC
- Industrial Drives

Types

- B0-SP12VPA025M702-LR28A13T

flow S3 12 mm housing

Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	36	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	89	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	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	61	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Drain-source voltage	V_{DSS}			600	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	23	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		151	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 0 A	159	mJ
Avalanche energy, repetitive	E_{AR}	V_{DD} = 50 V	I_D = 0 A	0,8	mJ
MOSFET dv/dt ruggedness	dv/dt	V_{DS}= 0..400 V	T_s = 25 °C	80	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	70	W
Gate-source voltage	V_{GSS}			±20	V
Reverse diode dv/dt	dv/dt			50	V/ns
Maximum Junction Temperature	T_{jmax}			150	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	36	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	58	W
Maximum junction temperature	T_{jmax}			175	°C
Negative Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	36	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	58	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	44	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	230	A
Surge current capability	I^2t	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	260	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	63	W
Maximum junction temperature	T_{jmax}			150	°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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				9,87	mm
Clearance				7,99	mm
Comparative Tracking Index	CTI			≥ 600	

*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
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0025	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150		1,64 1,89 1,95	2,1(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			70	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							4800		pF
Output capacitance	C_{oes}		0	10		25		170		pF
Reverse transfer capacitance	C_{res}							57		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		25	25		180		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,06		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125 150		163,52 160,64 159,68		ns
Rise time	t_r	R_{gon} = 16 Ω R_{goff} = 16 Ω				25 125 150		41,92 47,36 47,68		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		169,6 193,92 200,96		ns
Fall time	t_f		±15	600	25	25 125 150		100,02 125,44 129,58		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,23 μC Q_{rFWD}=3,53 μC Q_{rFWD}=3,96 μC				25 125 150		2,18 2,85 3		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,62 2,3 2,49		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	
Inverter Diode										
Static										
Forward voltage	V_F				25	25 125 150		1,63 1,7 1,69	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			35	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,55		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=464 A/µs d*i*/d*t*=417 A/µs d*i*/d*t*=409 A/µs	±15	600	25	25 125 150		17,98 19,68 20,33		A
Reverse recovery time	t_{rr}					25 125 150		246,56 369,18 411,23		ns
Recovered charge	Q_r					25 125 150		2,23 3,53 3,96		µC
Reverse recovered energy	E_{rec}					25 125 150		0,765 1,3 1,48		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		163,44 106,12 100,3		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	
Boost Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		15,9	25 125		63,3 115	60(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$			0,0008	25	3	3,5	4	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			1	µA
Internal gate resistance	r_g							2,8		Ω
Gate charge	Q_g		0/10	400	15,9	25		67		nC
Short-circuit input capacitance	C_{iss}	f = 250 kHz	0	400	0	25		2895		pF
Short-circuit output capacitance	C_{oss}							48		
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/10	400	20	25 125		40,99 37,27		ns
Rise time	t_r					25 125		13,75 14,57		ns
Turn-off delay time	$t_{d(off)}$					25 125		172,72 189,04		ns
Fall time	t_f					25 125		14,7 13,41		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,408 µC Q_{rFWD}=1,14 µC				25 125		0,193 0,39		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,131 0,152		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				30	25 125 150		2,33 1,76 1,65	3(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			7	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,63		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=1747 A/µs d*i*/d*t*=1422 A/µs	0/10	400	20	25 125		23,21 35,98		A
Reverse recovery time	t_{rr}					25 125		32,8 52,82		ns
Recovered charge	Q_r					25 125		0,408 1,14		µC
Reverse recovered energy	E_{rec}					25 125		0,101 0,269		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1138,77 1436,3		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	
Negative Boost Diode										
Static										
Forward voltage	V_F				30	25 125 150		2,33 1,76 1,65	3(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			7	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,63		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				30	25 125		1,25 1,24	1,29(1) 1,31(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			10 1	µA mA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,11		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

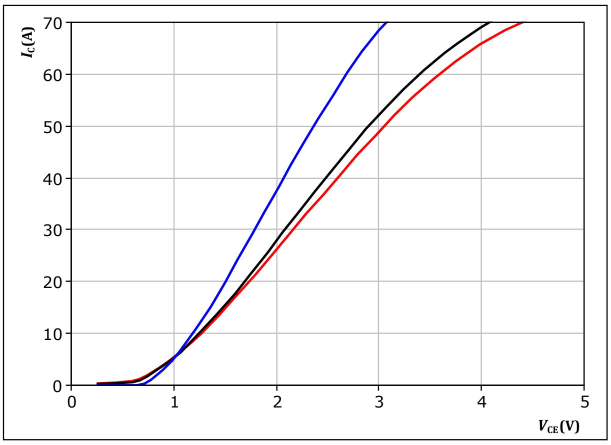
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



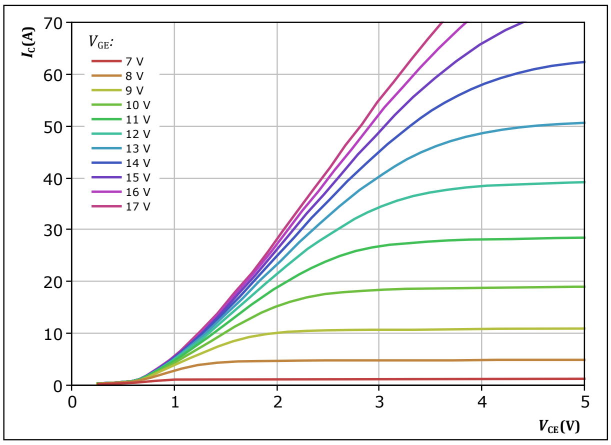
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



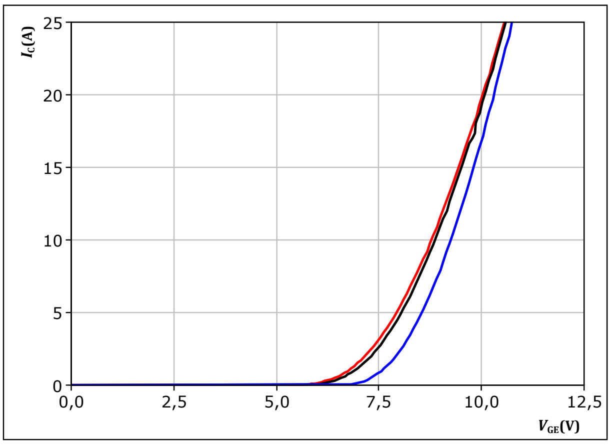
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



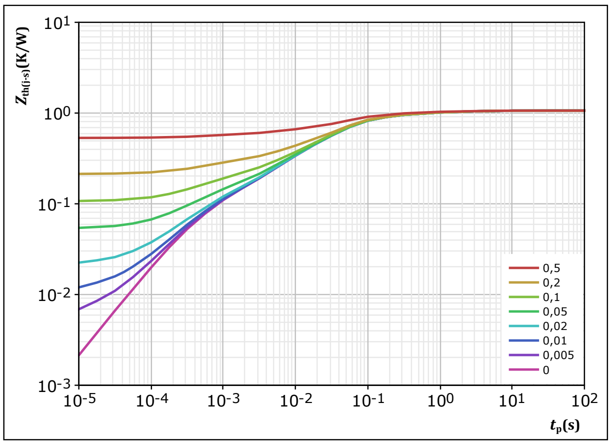
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,064 K/W

IGBT thermal model values

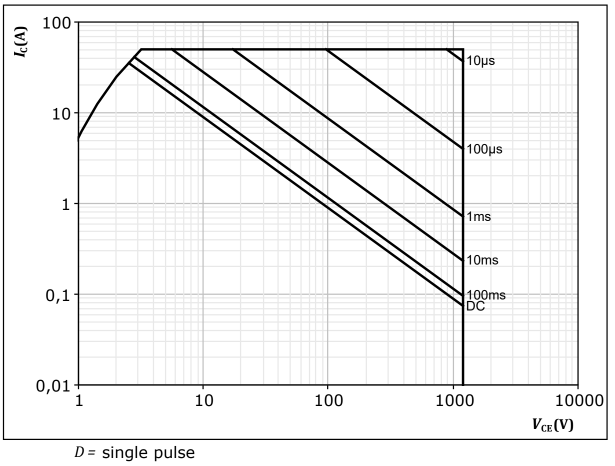
R (K/W)	τ (s)
7,43E-02	2,04E+00
1,91E-01	2,18E-01
5,73E-01	4,01E-02
1,48E-01	5,24E-03
7,80E-02	4,52E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

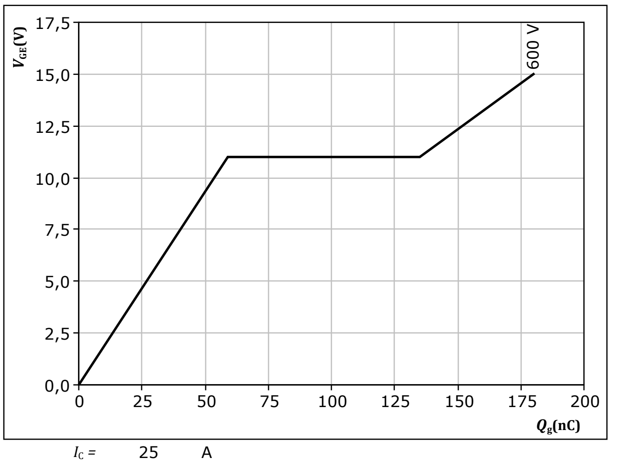


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



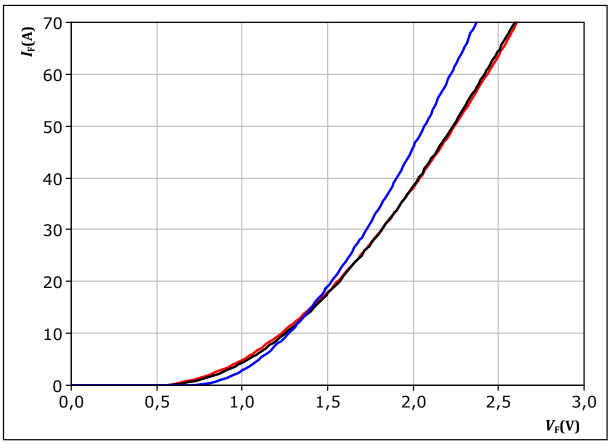
I_C =	25	A
T_j =	25	°C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



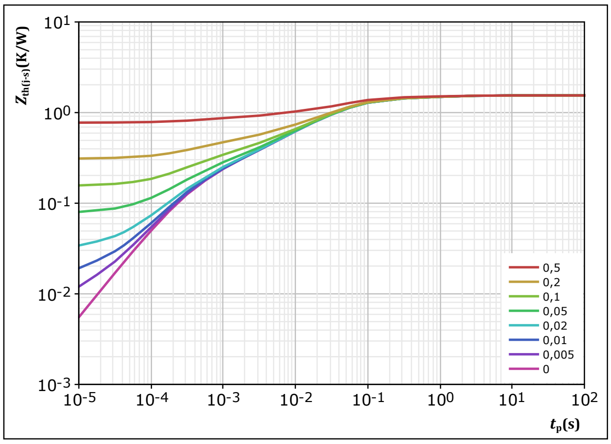
t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,546 K/W

FWD thermal model values

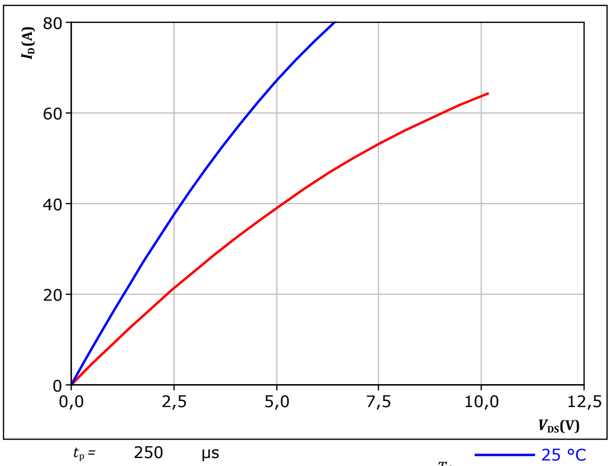
R (K/W)	τ (s)
1,04E-01	1,45E+00
2,93E-01	1,31E-01
7,45E-01	3,01E-02
2,42E-01	3,52E-03
1,62E-01	3,50E-04

Boost Switch Characteristics

figure 9. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



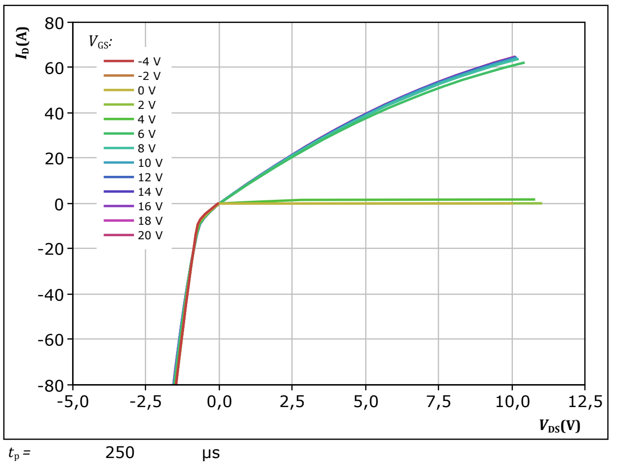
t_p =	250	μs
V_{GS} =	10	V

T_j: 25 °C (blue), 125 °C (red)

figure 10. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



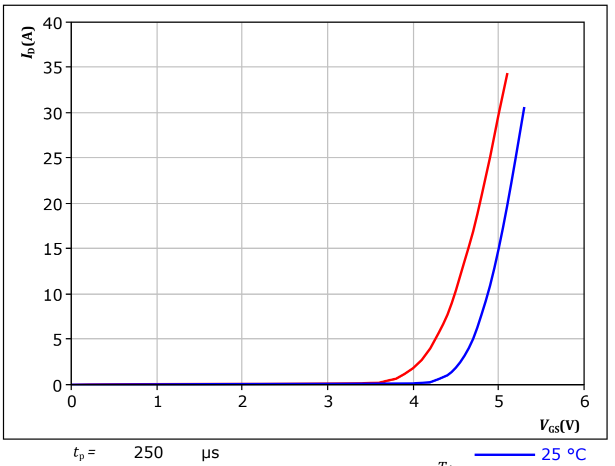
t_p =	250	μs
T_j =	125	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 11. **MOSFET**

Typical transfer characteristics

I_D = f(V_{GS})



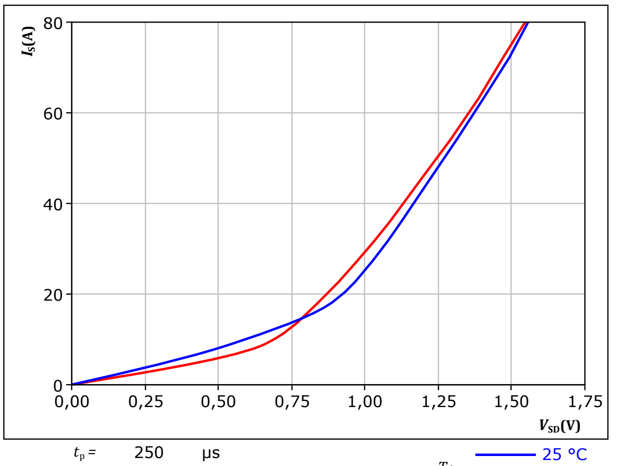
t_p =	250	μs
V_{DS} =	10	V

T_j: 25 °C (blue), 125 °C (red)

figure 12. **MOSFET**

Typical reverse drain current characteristics

I_{SD} = f(V_{SD})



t_p =	250	μs
V_{GS} =	10	V

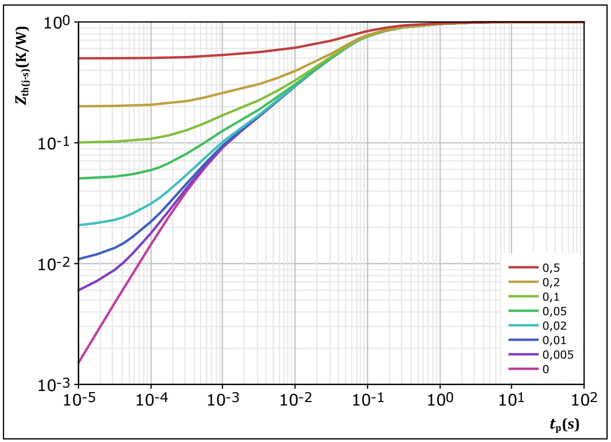
T_j: 25 °C (blue), 125 °C (red)

Boost Switch Characteristics

figure 13. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 1 K/W

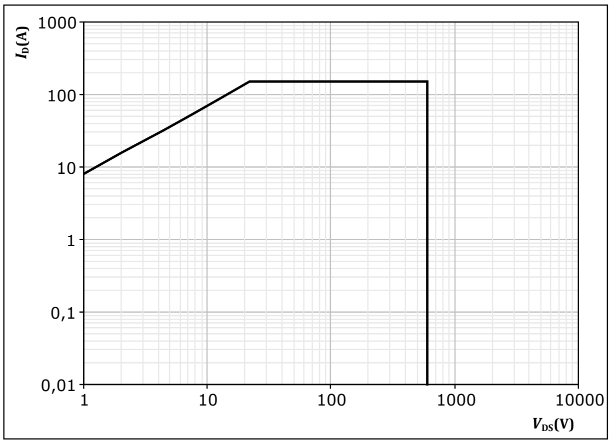
MOSFET thermal model values

R (K/W)	τ (s)
6,37E-02	1,67E+00
1,67E-01	2,31E-01
5,49E-01	4,89E-02
1,43E-01	7,12E-03
7,78E-02	6,47E-04

figure 14. **MOSFET**

Safe operating area

I_D = f(V_{DS})



D = single pulse

T_s = 80 °C

V_{GS} = 10 V

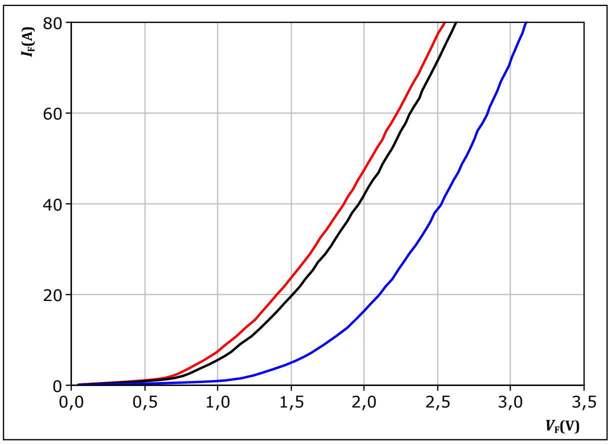
T_j = T_{jmax}

Boost Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

I_F = f(V_F)



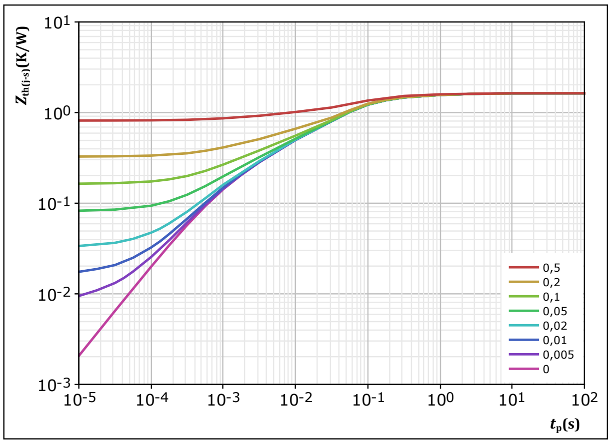
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,633 K/W

FWD thermal model values

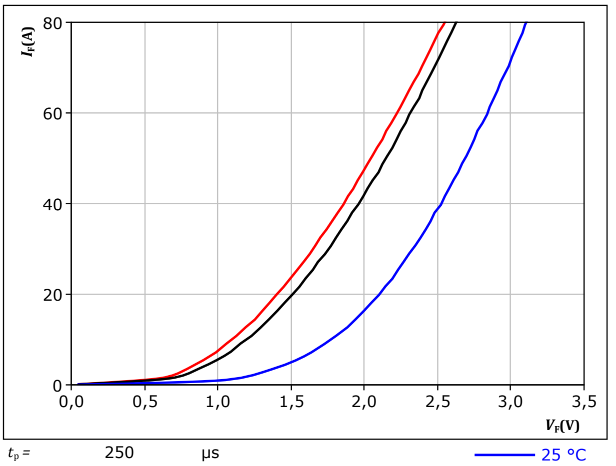
R (K/W)	τ (s)
1,04E-01	1,98E+00
2,66E-01	2,44E-01
8,96E-01	5,30E-02
2,60E-01	4,95E-03
1,07E-01	7,81E-04

Negative Boost Diode Characteristics

figure 17. **FWD**

Typical forward characteristics

I_F = f(V_F)



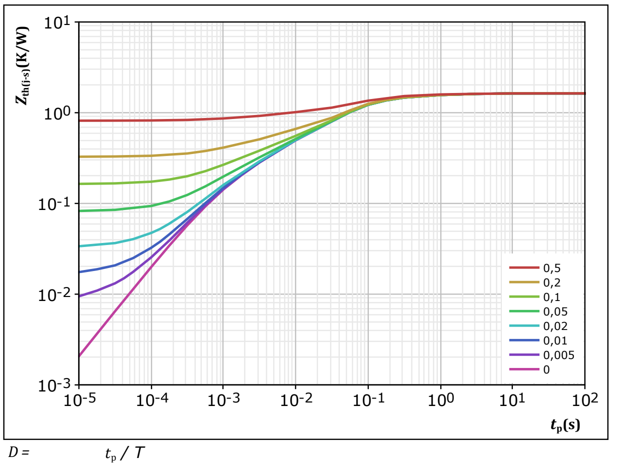
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,633 K/W

FWD thermal model values

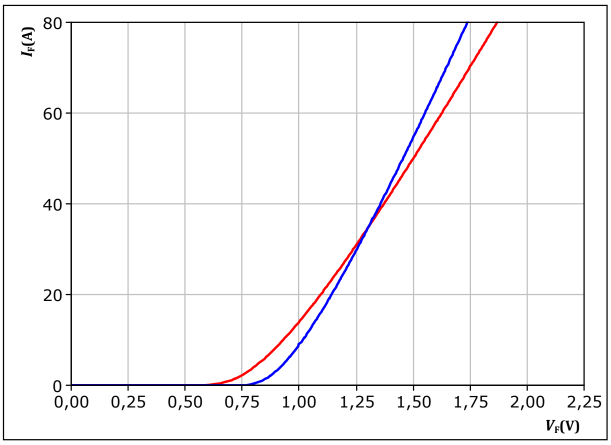
R (K/W)	τ (s)
1,04E-01	1,98E+00
2,66E-01	2,44E-01
8,96E-01	5,30E-02
2,60E-01	4,95E-03
1,07E-01	7,81E-04

Rectifier Diode Characteristics

figure 19. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



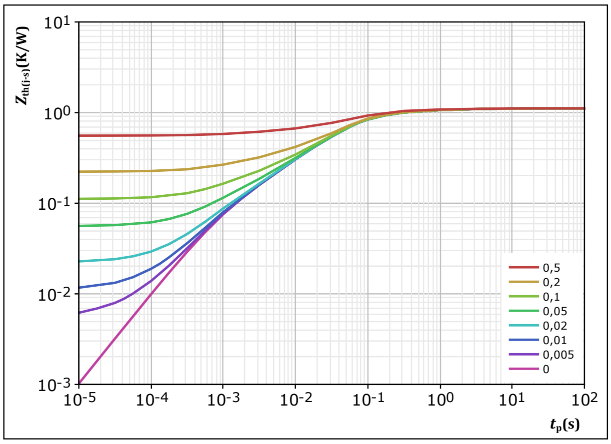
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 20. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,113 K/W

Rectifier thermal model values

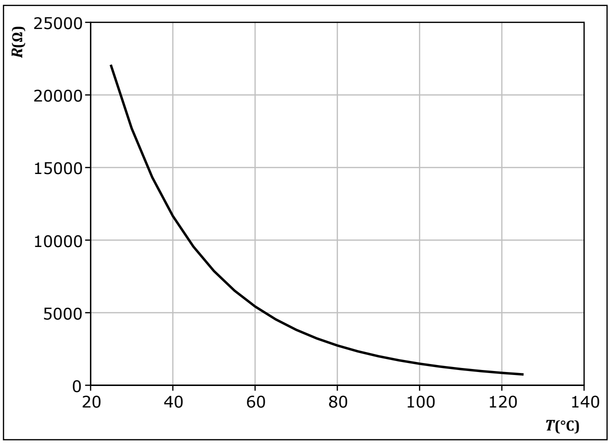
R (K/W)	τ (s)
5,54E-02	2,93E+00
1,47E-01	3,46E-01
6,70E-01	5,55E-02
1,72E-01	8,20E-03
6,87E-02	9,95E-04

Thermistor Characteristics

figure 21. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

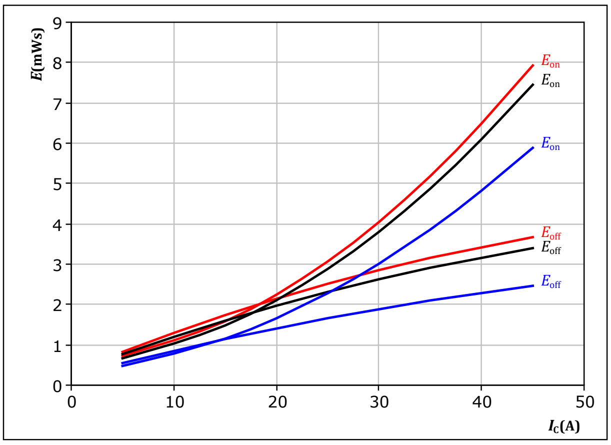


Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

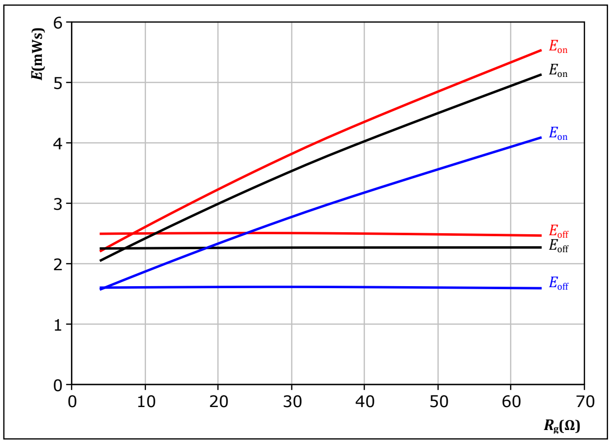
V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

T_j: 25 °C, 125 °C, 150 °C

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

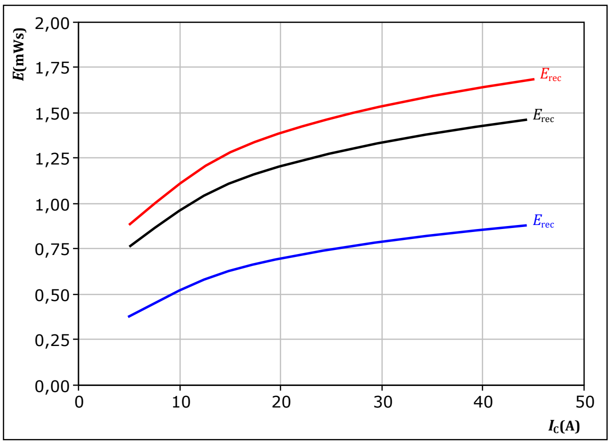
V_{CE} =	600	V	
V_{GE} =	±15	V	
I_C =	25	A	

T_j: 25 °C, 125 °C, 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

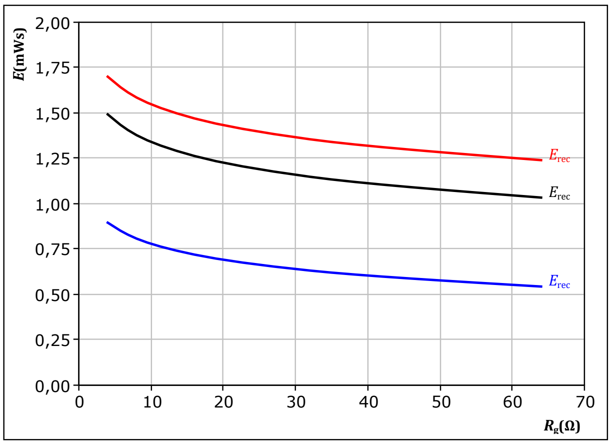
V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	16	Ω	

T_j: 25 °C, 125 °C, 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	
V_{GE} =	±15	V	
I_C =	25	A	

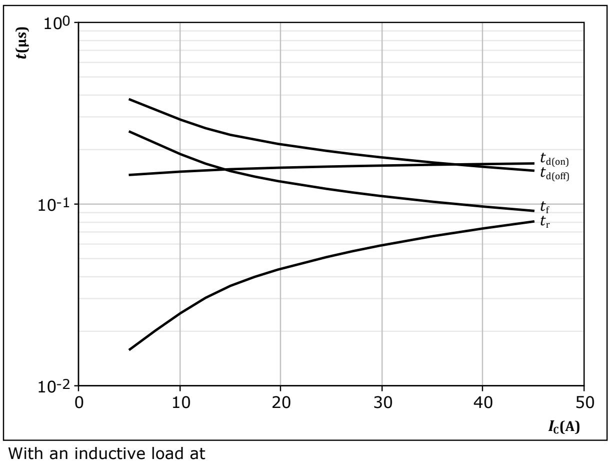
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 26. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



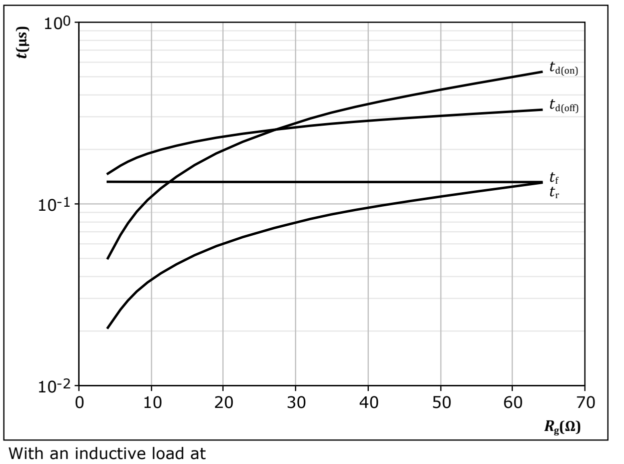
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 27. **IGBT**

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

$t = f(R_g)$



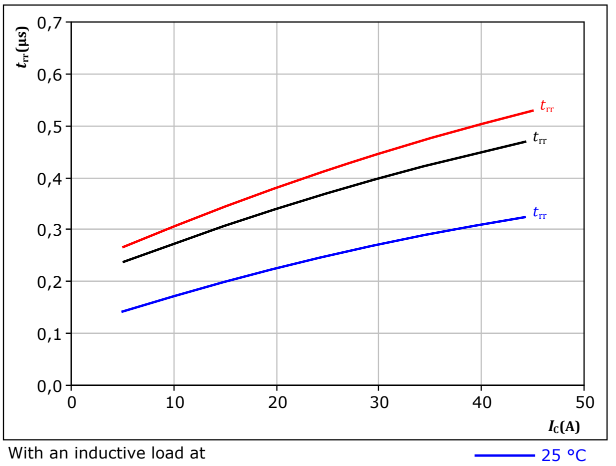
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

figure 28. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

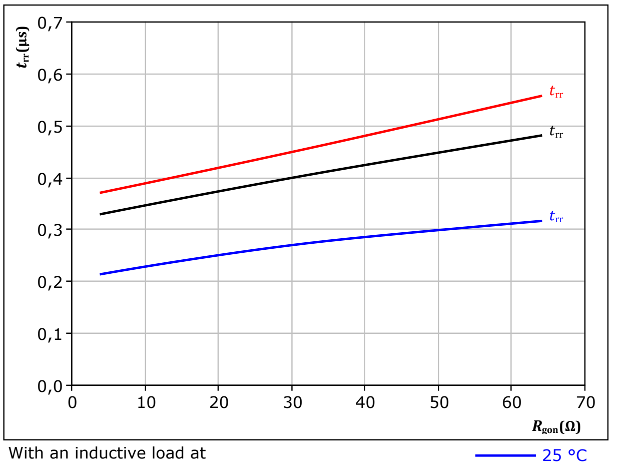
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

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} =	±15	V
I_C =	25	A

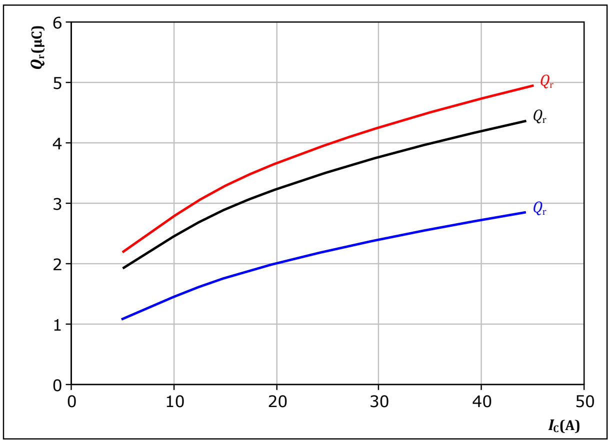
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 30. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



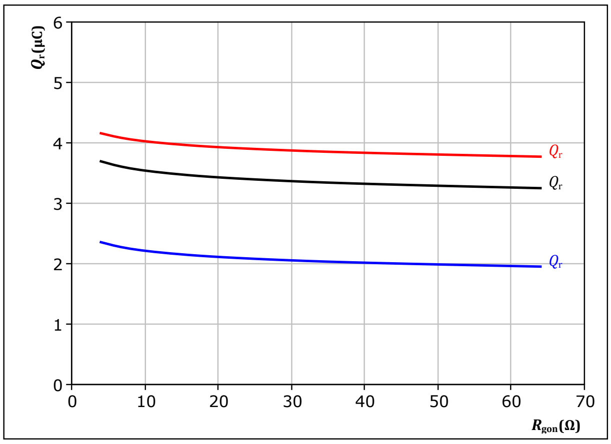
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 31. **FWD**

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

Q_r = f(R_{gon})



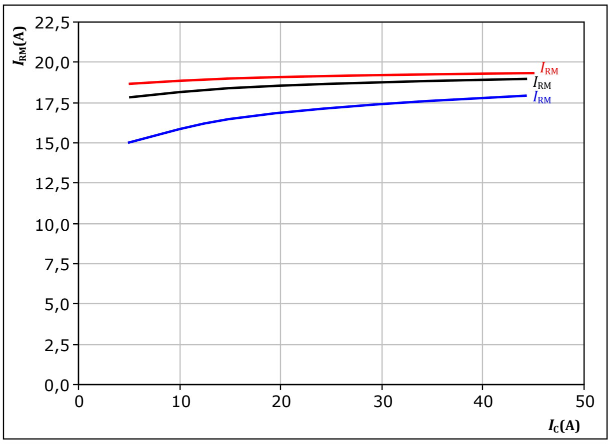
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

figure 32. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



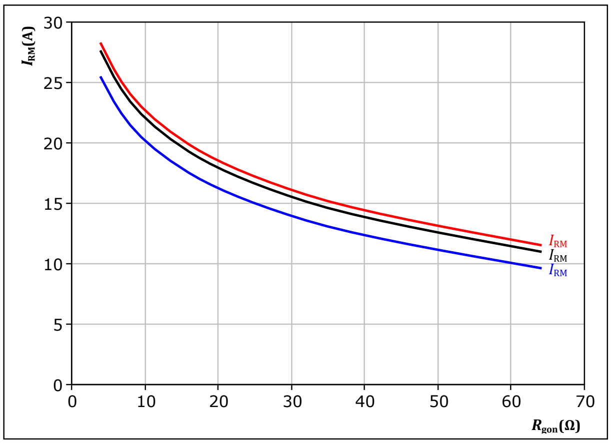
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	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

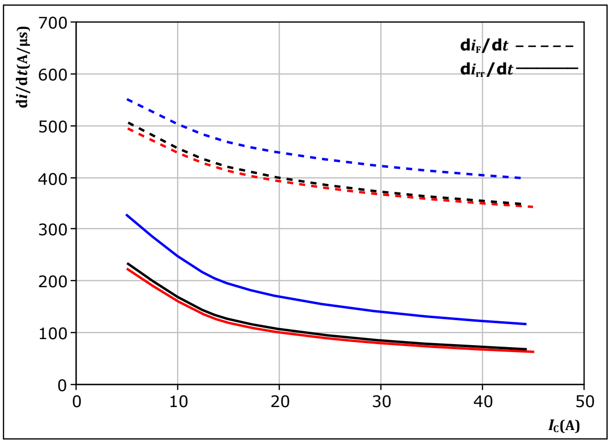
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

Inverter 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)



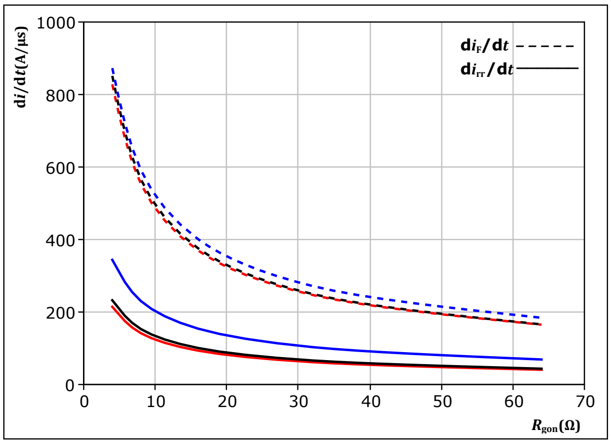
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	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})



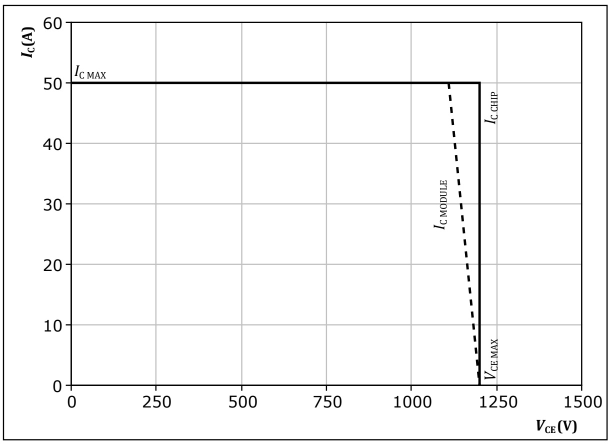
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

figure 36. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



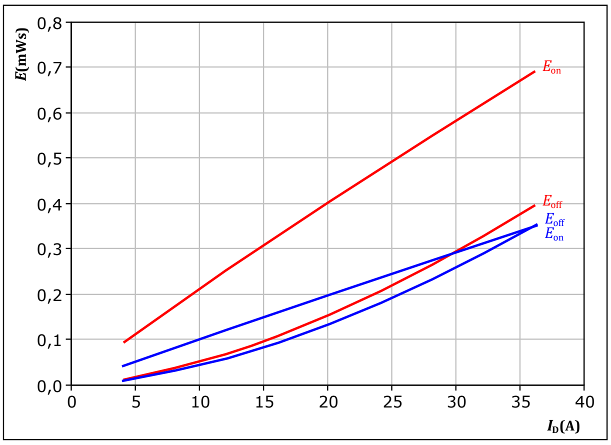
At	T_j =	150	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

Boost Switching Characteristics

figure 37. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



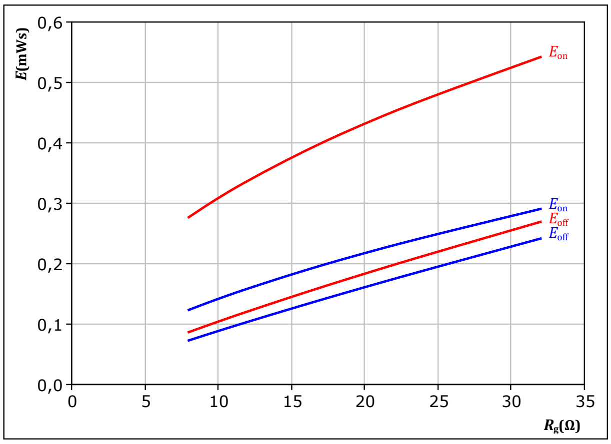
With an inductive load at

			T_j:	
V_{DS} =	400	V		25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	16	Ω		
R_{goff} =	16	Ω		

figure 38. **MOSFET**

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

$E = f(R_g)$



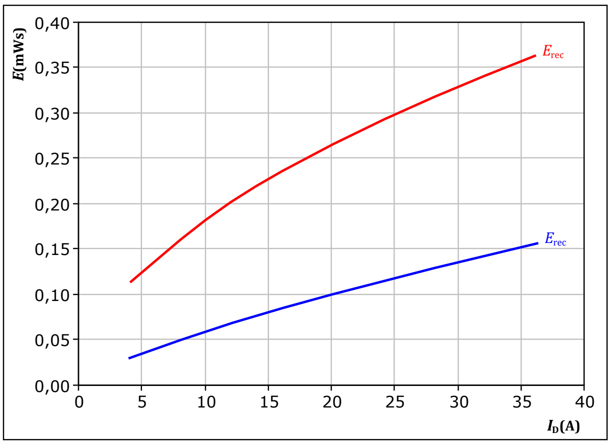
With an inductive load at

			T_j:	
V_{DS} =	400	V		25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

figure 39. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



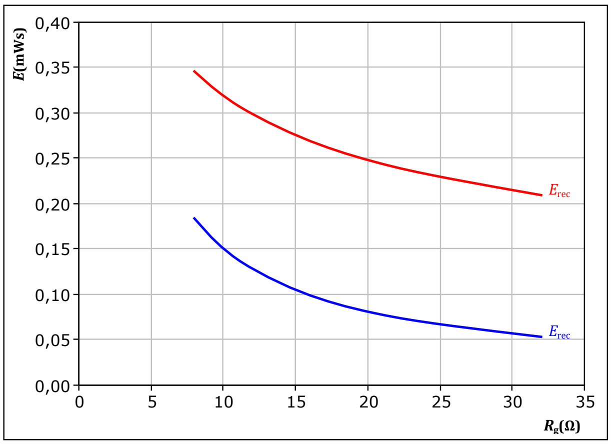
With an inductive load at

			T_j:	
V_{DS} =	400	V		25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	16	Ω		

figure 40. **FWD**

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

$E_{rec} = f(R_g)$



With an inductive load at

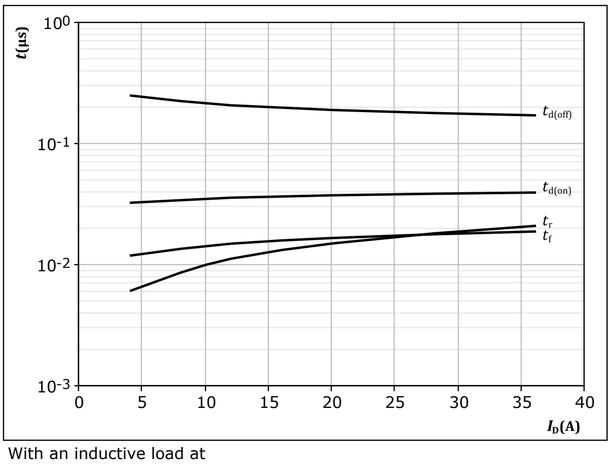
			T_j:	
V_{DS} =	400	V		25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

Boost Switching Characteristics

figure 41. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



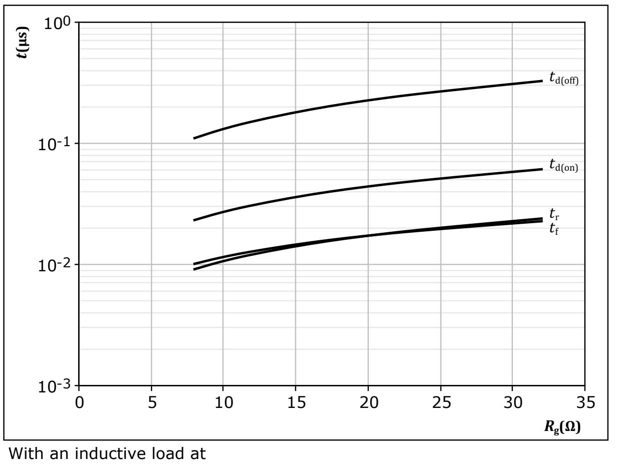
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 42. **MOSFET**

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

t = f(R_g)



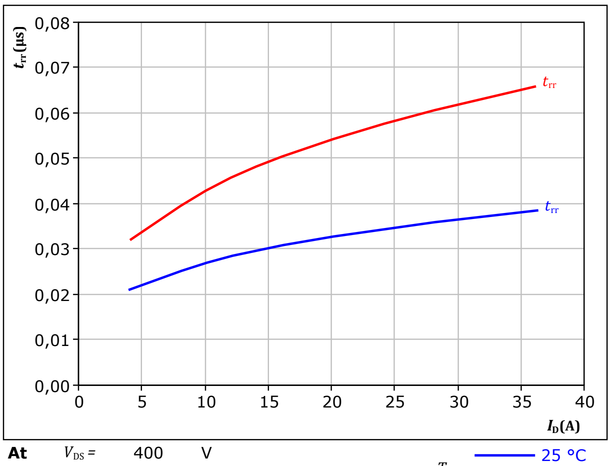
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

figure 43. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)



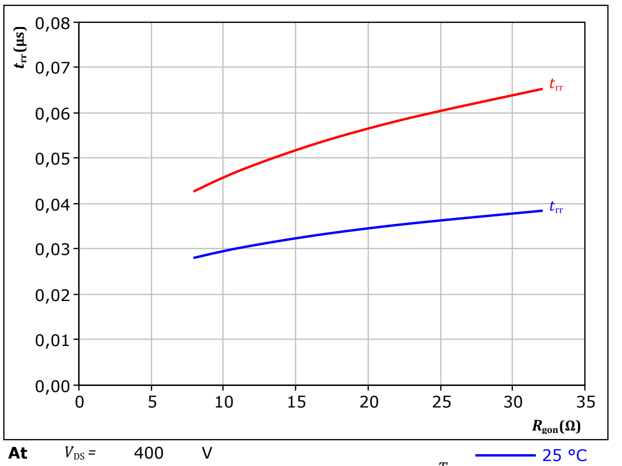
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 44. **FWD**

Typical reverse recovery time as a function of MOSFET turn on gate resistor

t_{rr} = f(R_{gon})



At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	I_D =	20	A

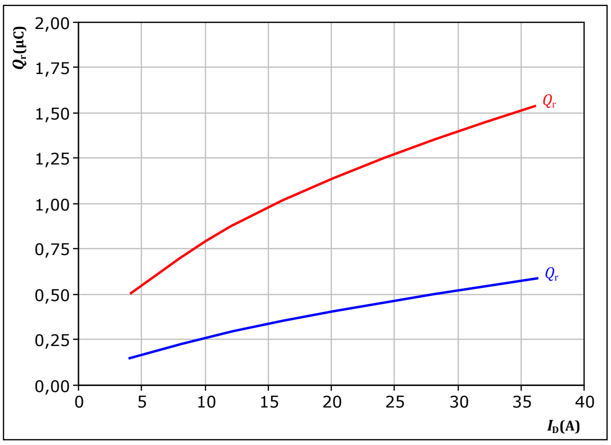
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 45. **FWD**

Typical recovered charge as a function of drain current

Q_r = f(I_D)

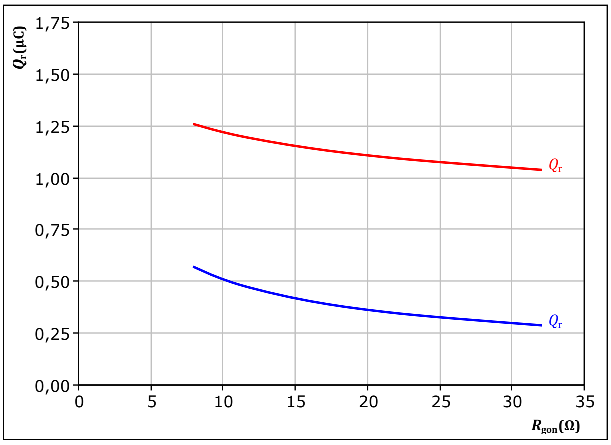


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	16	Ω		

figure 46. **FWD**

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

Q_r = f(R_{gon})

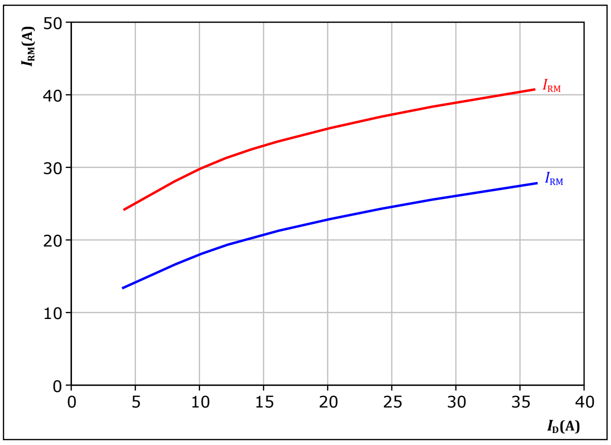


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

figure 47. **FWD**

Typical peak reverse recovery current as a function of drain current

I_{RM} = f(I_D)

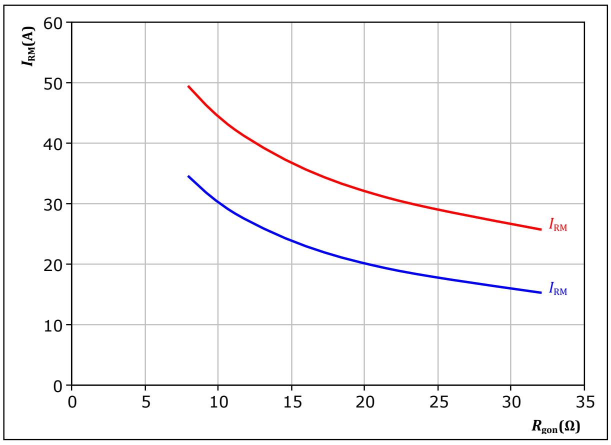


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	16	Ω		

figure 48. **FWD**

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

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



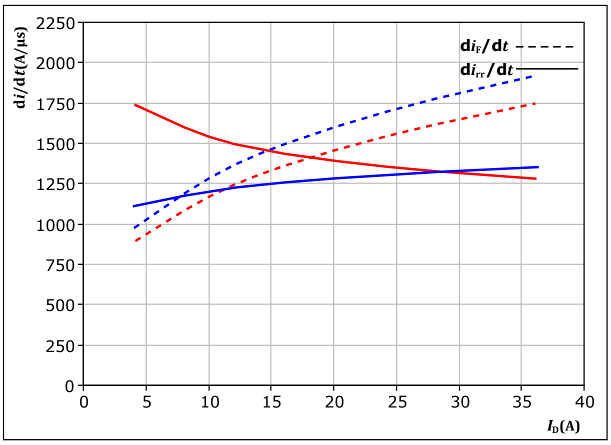
At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

Boost Switching Characteristics

figure 49. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of drain current

di_F/dt, di_{rr}/dt = f(I_D)

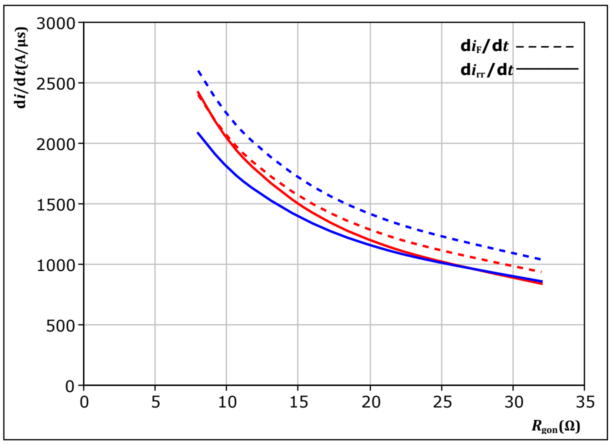


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	16	Ω		

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})

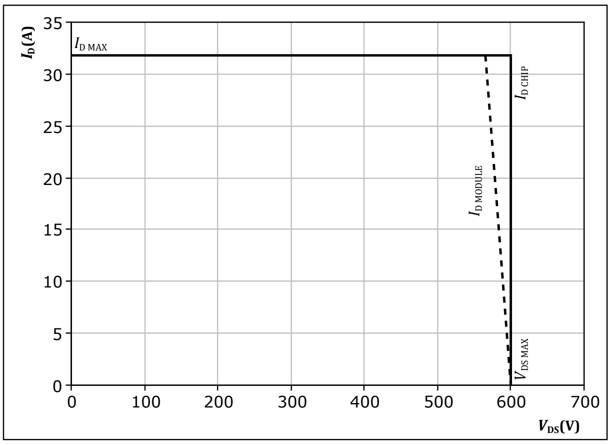


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

figure 51. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At		
T_j =	125	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Vincotech

Inverter Switching Definitions

figure 52. **IGBT**

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

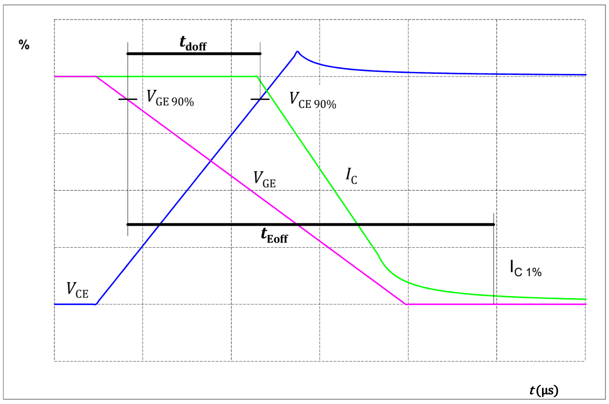


figure 53. **IGBT**

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

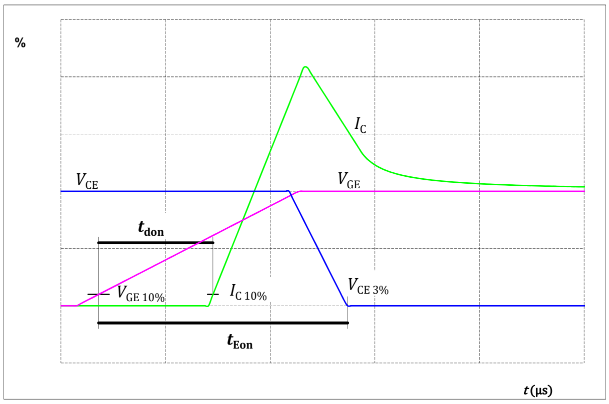


figure 54. **IGBT**

Turn-off Switching Waveforms & definition of t_f

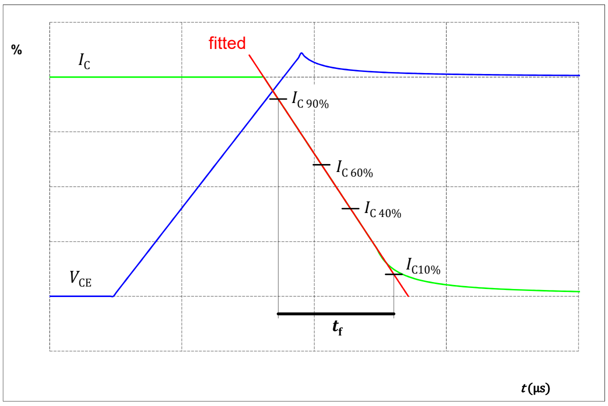
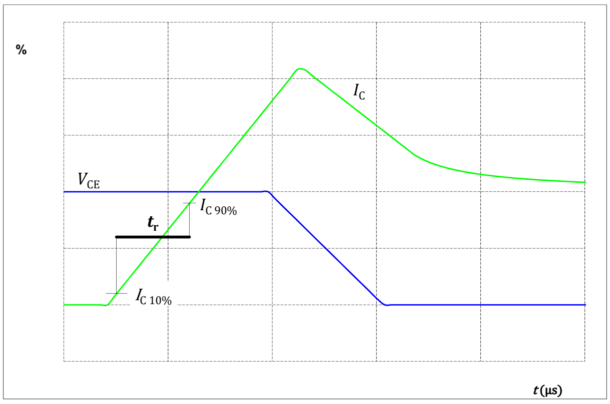


figure 55. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 56. **FWD**

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

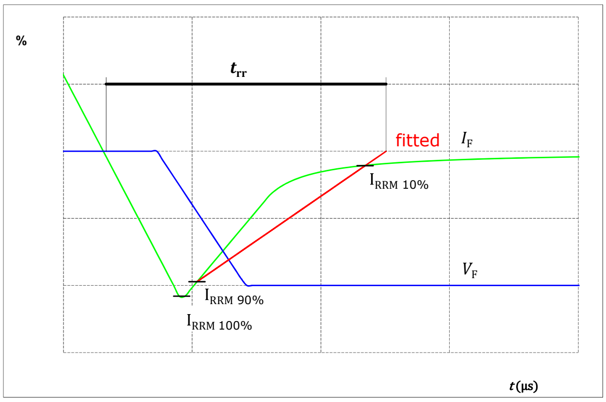
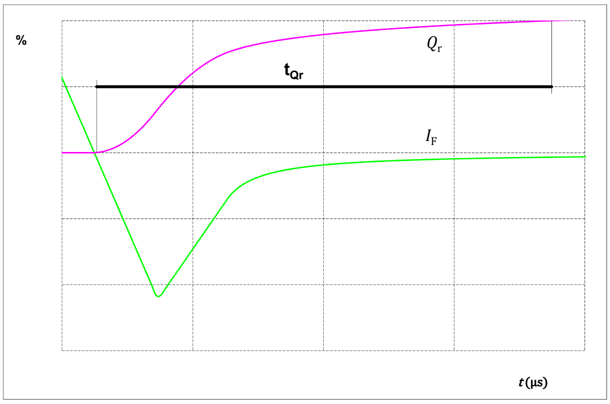


figure 57. **FWD**

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



Boost Switching Definitions

figure 52. **MOSFET**

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

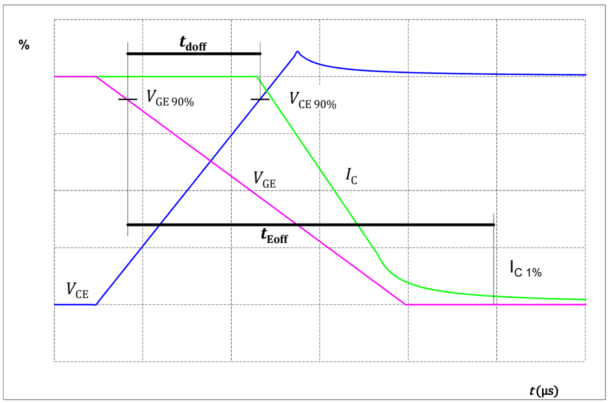


figure 53. **MOSFET**

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

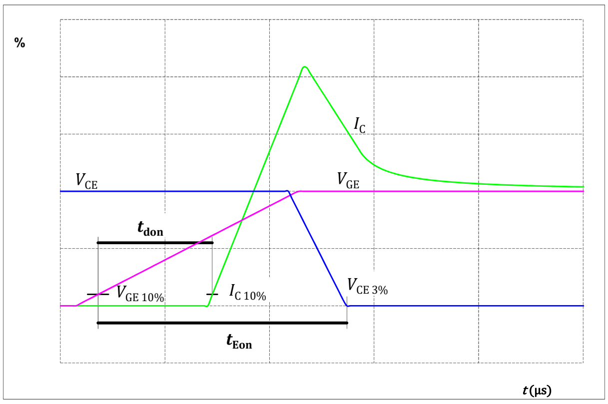


figure 54. **MOSFET**

Turn-off Switching Waveforms & definition of t_f

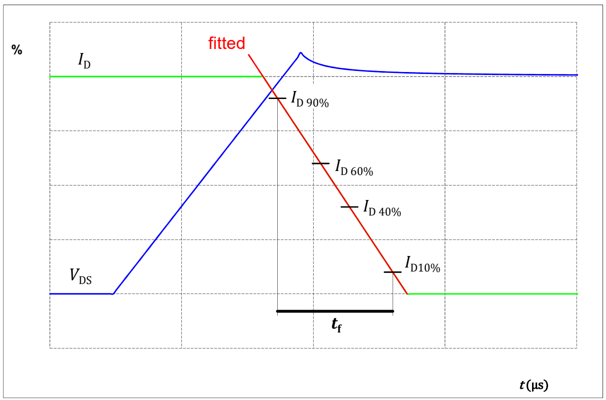
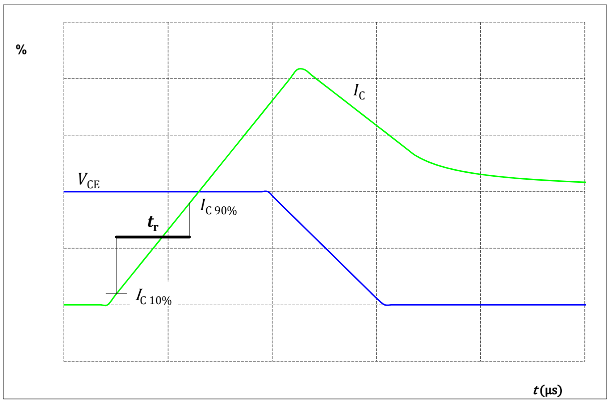


figure 55. **MOSFET**

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 56. **FWD**

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

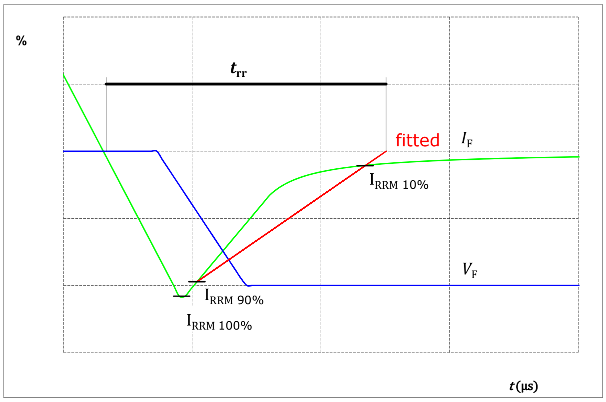


figure 57. **FWD**

Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})

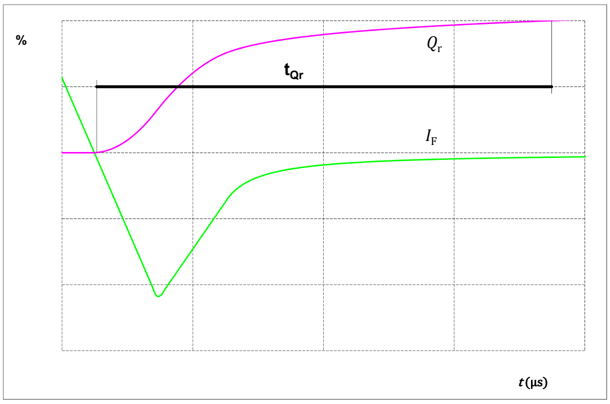
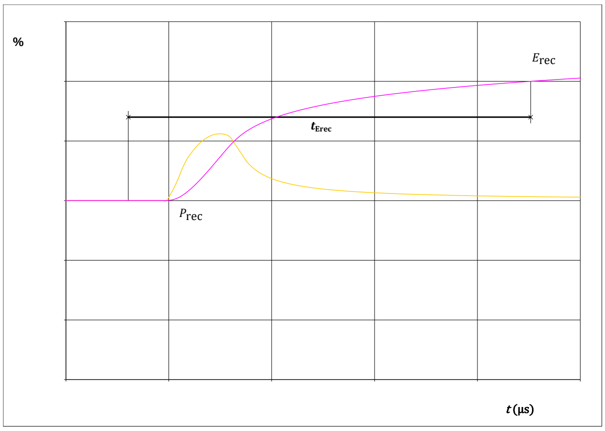


figure 58. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



Ordering Code

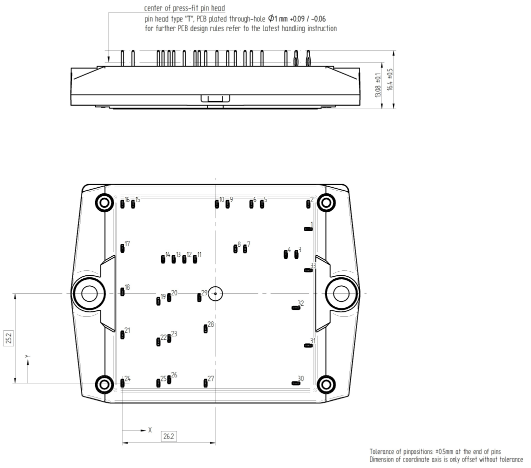
Version	Ordering Code
Without thermal paste	B0-SP12VPA025M702-LR28A13T
With thermal paste (5,2 W/mK, PTM6000HV)	B0-SP12VPA025M702-LR28A13T-/7/
With thermal paste (5,2 W/mK, PTM6000HV) and Protection Foil	B0-SP12VPA025M702-LR28A13T-/7F/

Marking

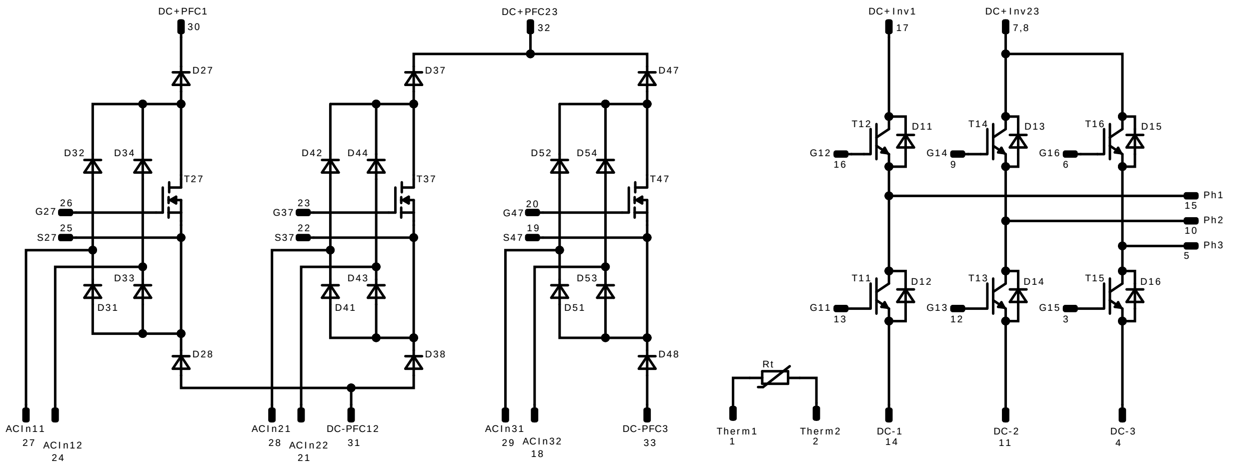
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNN-TTTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	52,4	43,4	Therm1
2	52,4	50,4	Therm2
3	49,05	36,25	G15
4	46,05	36,25	DC-3
5	39,35	50,4	Ph3
6	36,35	50,4	G16
7	34,55	37,8	DC+Inv23
8	31,85	37,8	DC+Inv23
9	29,65	50,4	G14
10	26,65	50,4	Ph2
11	20,45	34,9	DC-2
12	17,45	34,9	G13
13	14,45	34,9	G11
14	11,45	34,9	DC-1
15	3	50,4	Ph1
16	0	50,4	G12
17	0	37,95	DC+Inv1
18	0	25,7	ACIn32
19	10,15	23,1	S47
20	13,15	24,1	G47
21	0	13,6	ACIn22
22	10,15	11,6	S37
23	13,15	12,6	G37
24	0	0	ACIn12
25	10,15	0	S27
26	13,15	1	G27
27	23,45	0	ACIn11
28	23,45	15,3	ACIn21
29	21,65	24,1	ACIn31
30	48,9	0	DC+PFC1
31	52,4	10,6	DC-PFC12
32	48,9	21,2	DC+PFC23
33	52,4	31,8	DC-PFC3



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	25 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	25 A	Inverter Diode	
T27, T37, T47	MOSFET	600 V	49 mΩ	Boost Switch	
D27, D37, D47	FWD	650 V	30 A	Boost Diode	
D28, D38, D48	FWD	650 V	30 A	Negative Boost Diode	
D31, D32, D33, D34, D41, D42, D43, D44, D51, D52, D53, D54	Rectifier	1600 V	30 A	Rectifier Diode	
Rt	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ) 45	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* S3 packages see vincotech.com website.

Package data
Package data for *flow* S3 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
B0-SP12VPA025M702-LR28A13T-D3-14	15 Aug. 2023	New ordering code	