10-PG12NAB008ME-LC59F66T
10-PG12NAC008ME-LC69F66T

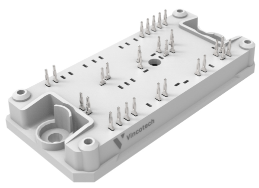
datasheet

***flow*ANPC 1 split** **1200 V / 8 mΩ**

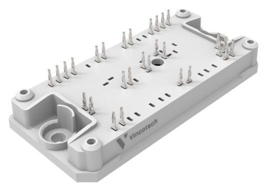
Features

- Split Advanced NPC topology
- Ultra-high switching frequency with SiC MOSFETs
- Optimized for 1500 Vdc applications
- Split topology for better thermal performance
- No cross-conduction at high frequencies

flow 1 12 mm housing



LC59F66T

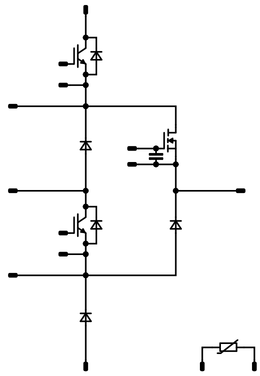


LC69F66T

Target applications

- Solar Inverters

Schematic



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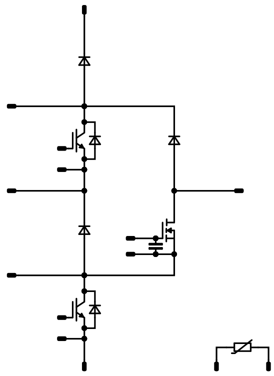


LC69F66T

Types

- 10-PG12NAB008ME-LC59F66T
- 10-PG12NAC008ME-LC69F66T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
AC Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	147	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		480	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	274	W
Gate-source voltage	V_{GSS}			-4 / 15	V
		dynamic		-8 / 19	
Maximum Junction Temperature	T_{jmax}			175	°C
AC Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	74	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		183	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms		330	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	185	W
Maximum junction temperature	T_{jmax}			175	°C
Neutral Point Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	150	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	288	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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
DC-Link Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	86	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	158	W
Maximum junction temperature	T_{jmax}			175	°C
Neutral Point Switch Prot. Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 25 °C	65	A
Surge current capability	I^2t			21	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	70	W
Maximum junction temperature	T_{jmax}			175	°C
Neutral Point Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	111	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	183	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
DC-Link Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	150	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	288	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
DC-Link Switch Prot. Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	86	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	158	W
Maximum junction temperature	T_{jmax}			175	°C
Capacitor (GS)					
Maximum DC voltage	V_{MAX}			25	V
Operation Temperature	T_{op}			0 … 125	°C

Module Properties

Parameter	Symbol	Conditions		Value	Unit
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				min. 12,7	mm
Clearance				8,33	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]	Values Min	Typ	Max	Unit
AC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		15		150	25 125 150	5,6	9 11 12	10,4[(1)]	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,046	25	1,8	2,5	3,6	V
Gate to Source Leakage Current	I_{GSS}		15	0		25		40	1000	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25		4	76	µA
Internal gate resistance	r_g							0,425		Ω
Gate charge	Q_g		-4/15	800	160	25		472		nC
Short-circuit input capacitance	C_{iss}	f = 100 kHz	0	1000	0	25		13428		pF
Short-circuit output capacitance	C_{oss}							516		
Reverse transfer capacitance	C_{rss}							32		
Diode forward voltage	V_{SD}		0		80	25		4,6		V
Thermal										
Thermal resistance junction to sink [(2)]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,35		K/W
AC Diode										
Static										
Forward voltage	V_F				60	25 125 150		1,5 1,86 2,01	1,8[(1)]	V
Reverse leakage current	I_R	V_r = 1200 V				25		105	600	µA
Thermal										
Thermal resistance junction to sink [(2)]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,51		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
AC Real Open Configuration										
Switch Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-2/15	600	100	25 125 150		40 38,08 37,76		ns
Rise time	t_r					25 125 150		12,48 11,52 11,2		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		85,76 94,08 96,32		ns
Fall time	t_f					25 125 150		39,13 47,46 50,62		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,471 μC Q_{rFWD}=0,525 μC Q_{rFWD}=0,559 μC				25 125 150		0,445 0,384 0,361		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,878 0,947 0,96		mWs
Diode Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=10208 A/μs d*i*/d*t*=11198 A/μs d*i*/d*t*=11243 A/μs	-2/15	600	100	25 125 150		65,93 70,99 73,39		A
Reverse recovery time	t_{rr}					25 125 150		16,66 16,68 17		ns
Recovered charge	Q_r					25 125 150		0,471 0,525 0,559		μC
Reverse recovered energy	E_{rec}					25 125 150		0,355 0,424 0,451		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		10019 10682 10883		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
AC Reactive Open Configuration										
Switch Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-2/15	600	100	25 125 150		42,56 38,4 38,4		ns
Rise time	t_r					25 125 150		12,8 11,2 10,88		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		86,4 96,64 99,52		ns
Fall time	t_f					25 125 150		30,88 38,7 16,89		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,17 µC Q_{rFWD}=1,32 µC Q_{rFWD}=1,41 µC				25 125 150		0,636 0,428 0,404		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,948 1,07 1,1		mWs
Diode Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=9714 A/µs d*i*/d*t*=12076 A/µs d*i*/d*t*=12388 A/µs	-2/15	600	100	25 125 150		86,09 90,12 86,31		A
Reverse recovery time	t_{rr}					25 125 150		26,49 27,89 29,04		ns
Recovered charge	Q_r					25 125 150		1,17 1,32 1,41		µC
Reverse recovered energy	E_{rec}					25 125 150		0,658 0,761 0,883		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		6691 2403 2216		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
AC Real Short Configuration										
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-2/15	600	100	25 125 150		40 38,08 37,76		ns
Rise time	t_r					25 125 150		12,16 11,2 10,88		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		86,4 94,72 97,28		ns
Fall time	t_f					25 125 150		18,62 20,72 21,14		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,25 μC Q_{rFWD}=1,4 μC Q_{rFWD}=1,54 μC				25 125 150		0,495 0,351 0,29		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,731 0,793 0,805		mWs
AC Reactive Short Configuration										
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	-2/15	600	100	25 125 150		42,56 38,4 37,76		ns
Rise time	t_r					25 125 150		12,16 10,56 10,56		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		88 98,88 101,44		ns
Fall time	t_f					25 125 150		21,17 22,06 23,75		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,29 μC Q_{rFWD}=1,39 μC Q_{rFWD}=1,55 μC				25 125 150		0,579 0,366 0,342		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,783 0,866 0,889		mWs

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
Neutral Point Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,57 1,8 1,86	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	μA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}		0	10		25		30000		pF
Output capacitance	C_{oes}							880		pF
Reverse transfer capacitance	C_{res}							320		pF
Gate charge	Q_g	V_{CC} = 600 V	15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,33		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	100	25 125 150		335 349 351		ns
Rise time	t_r					25 125 150		38 47 49		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		304 351 363		ns
Fall time	t_f					25 125 150		100,62 139,03 142,44		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=10,4 μC Q_{rFWD}=15,02 μC Q_{rFWD}=16,24 μC				25 125 150		8,92 11,15 11,84		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		7,89 10,42 10,95		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	
DC-Link Diode										
Static										
Forward voltage	V_F				100	25 125 150		1,82 1,96 1,96	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,6		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2662 A/µs d*i*/d*t*=2286 A/µs d*i*/d*t*=2159 A/µs	±15	600	100	25 125 150		82,7 86,13 88,3		A
Reverse recovery time	t_{rr}					25 125 150		309,71 419,43 452,63		ns
Recovered charge	Q_r					25 125 150		10,4 15,02 16,24		µC
Reverse recovered energy	E_{rec}					25 125 150		3,99 5,94 6,43		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		506,5 512,55 504,33		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	
Neutral Point Switch Prot. Diode										
Static										
Forward voltage	V_F				15	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		 900	60 1800	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,35		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	
Neutral Point Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,8 1,9 1,89	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,52		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2578 A/µs d*i*/d*t*=2565 A/µs d*i*/d*t*=2545 A/µs	±15	600	100	25 125 150		116,53 119,59 117,81		A
Reverse recovery time	t_{rr}					25 125 150		268,1 406,33 453,74		ns
Recovered charge	Q_r					25 125 150		12,79 20,79 22,27		µC
Reverse recovered energy	E_{rec}					25 125 150		4,36 7,63 8,66		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		864,58 625,78 631,91		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
DC-Link Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,57 1,8 1,86	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}		0	10		25		30000		pF
Output capacitance	C_{oes}		0	10		25		880		pF
Reverse transfer capacitance	C_{res}		0	10		25		320		pF
Gate charge	Q_g	V_{CC} = 600 V	15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,33		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	100	25 125 150		317 335 350		ns
Rise time	t_r	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	100	25 125 150		36 41 45		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	100	25 125 150		306 351 368		ns
Fall time	t_f	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	100	25 125 150		96,77 136,13 145,76		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=12,79 µC Q_{rFWD}=20,79 µC Q_{rFWD}=22,27 µC	±15	600	100	25 125 150		9,56 13,18 13,42		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	100	25 125 150		7,12 9,9 11,12		mWs

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
DC-Link Switch Prot. Diode										
Static										
Forward voltage	V_F				100	25 125 150		1,82 1,96 1,96	2,1[1]	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,6		K/W
Capacitor (GS)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		10		nF
Tolerance							-10		10	%
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		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	

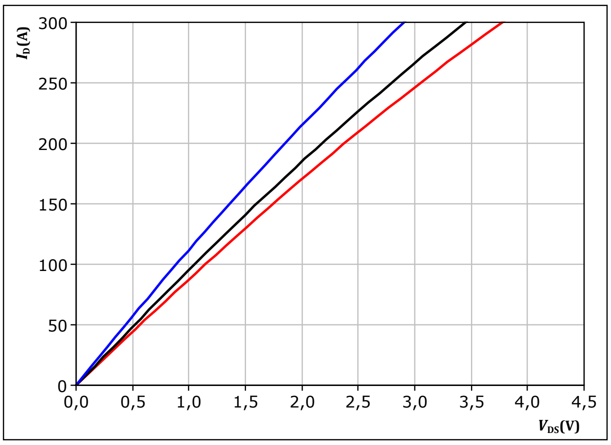
[1] Value at chip level
[2] Only valid with pre-applied Vincotech thermal interface material.

AC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



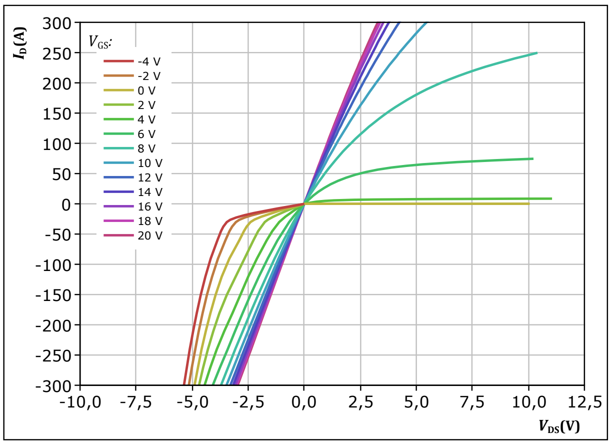
t_p = 250 µs
V_{GS} = 14 V

T_j: 25 °C / 125 °C / 150 °C

figure 2. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})

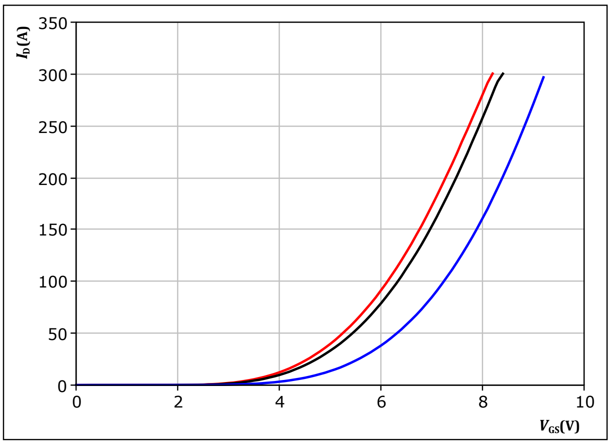


t_p = 250 µs
T_j = 150 °C
V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

I_D = f(V_{GS})



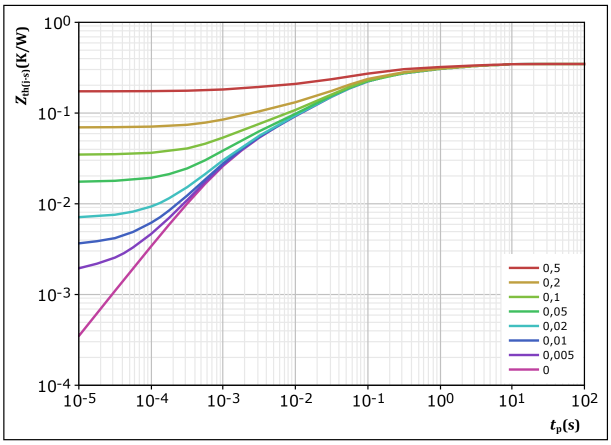
t_p = 250 µs
V_{DS} = 10 V

T_j: 25 °C / 125 °C / 150 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,347 K/W

MOSFET thermal model values

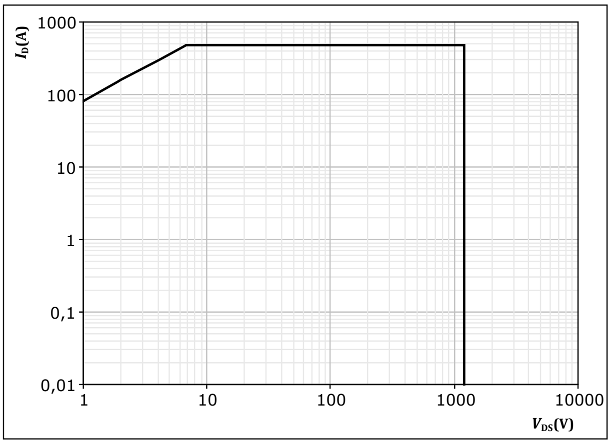
R (K/W)	τ (s)
4,51E-02	3,13E+00
5,88E-02	4,93E-01
1,53E-01	6,43E-02
5,77E-02	9,86E-03
3,26E-02	1,22E-03

AC Switch Characteristics

figure 5.	MOSFET

Safe operating area

I_D = f(V_{DS})



D =	single pulse	
T_s =	80	°C
V_{GS} =	14	V
T_j =	T_{jmax}	

10-PG12NAB008ME-LC59F66T
10-PG12NAC008ME-LC69F66T

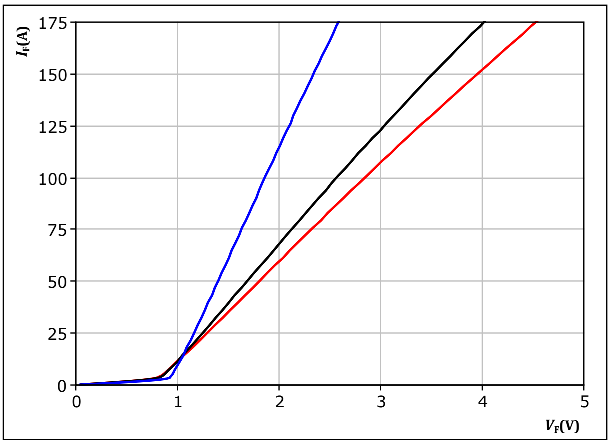
datasheet

AC Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



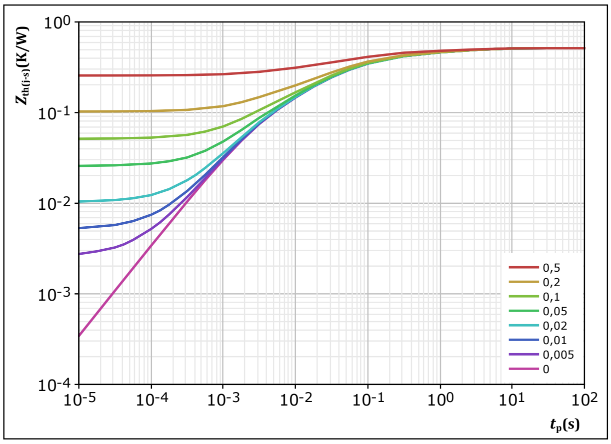
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,513 K/W

FWD thermal model values

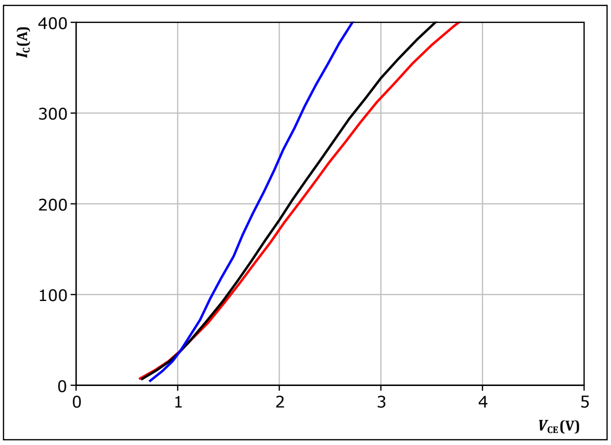
R (K/W)	τ (s)
5,36E-02	3,23E+00
7,62E-02	5,23E-01
1,86E-01	7,69E-02
1,35E-01	1,65E-02
6,26E-02	2,65E-03

Neutral Point Switch Characteristics

figure 8. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

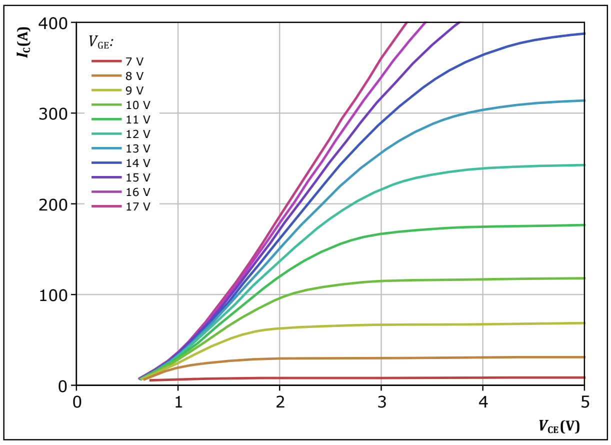


t_p =	250	μs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 9. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



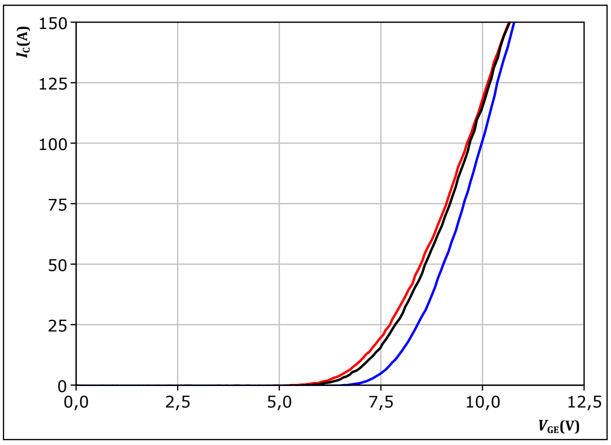
t_p =	250	μs
T_j =	150	°C

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

figure 10. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

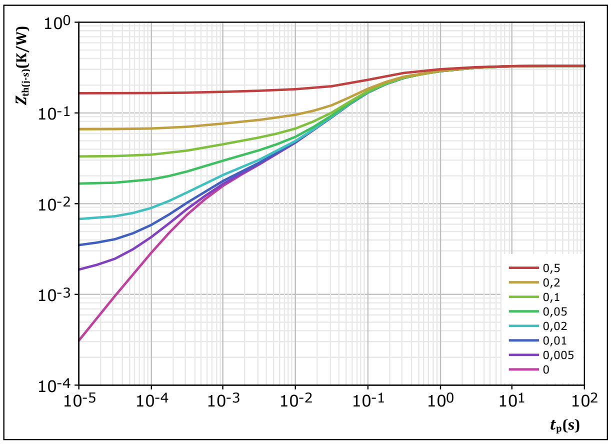


t_p =	250	μs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 11. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,33	K/W

IGBT thermal model values

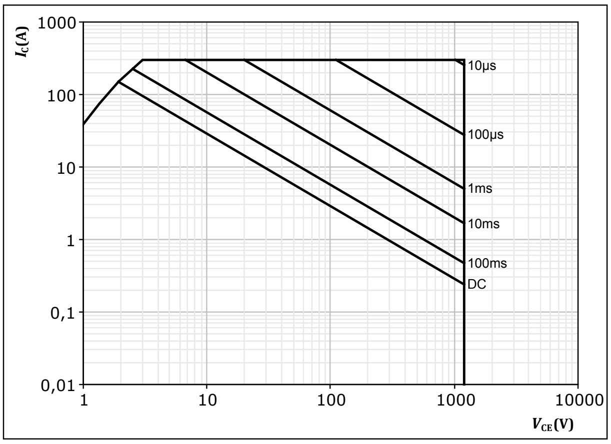
R (K/W)	τ (s)
1,65E-02	5,52E+00
5,74E-02	1,28E+00
8,95E-02	2,47E-01
1,41E-01	6,93E-02
9,15E-03	5,43E-03
7,29E-03	1,62E-03
9,29E-03	4,10E-04

Neutral Point Switch Characteristics

figure 12.	IGBT

Safe operating area

I_C = f(V_{CE})



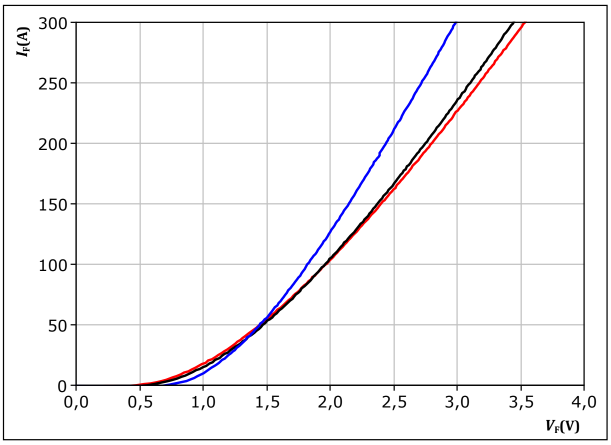
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

DC-Link Diode Characteristics

figure 13. FWD

Typical forward characteristics

$I_F = f(V_F)$



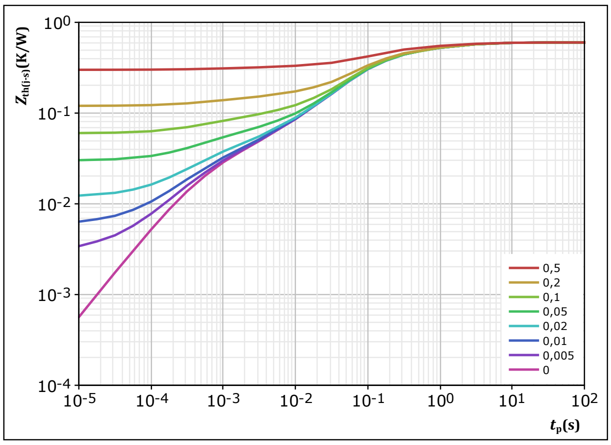
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 14. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,6 K/W

FWD thermal model values

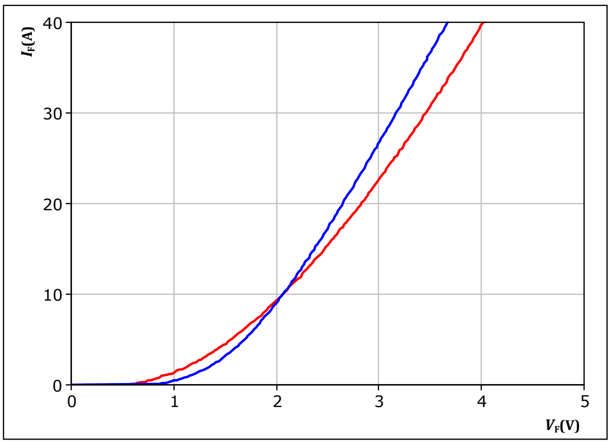
R (K/W)	τ (s)
2,99E-02	5,52E+00
1,04E-01	1,28E+00
1,63E-01	2,47E-01
2,56E-01	6,93E-02
1,66E-02	5,43E-03
1,33E-02	1,62E-03
1,69E-02	4,10E-04

Neutral Point Switch Prot. Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

I_F = f(V_F)



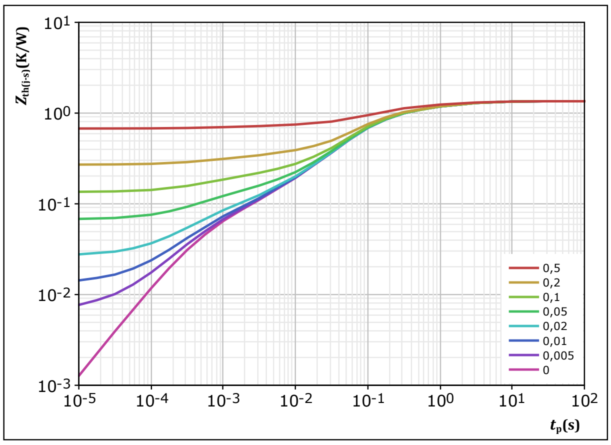
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,351 K/W

FWD thermal model values

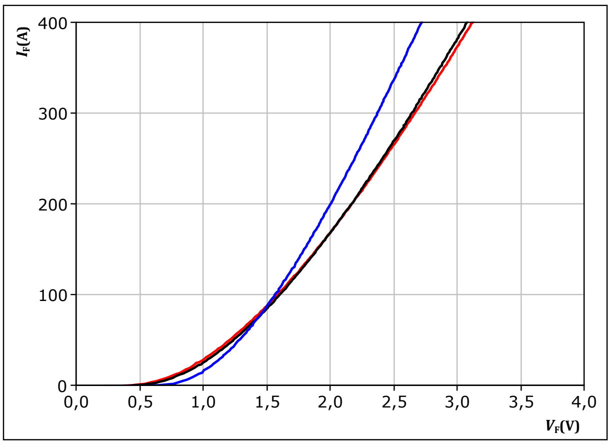
R (K/W)	τ (s)
6,74E-02	5,52E+00
2,35E-01	1,28E+00
3,66E-01	2,47E-01
5,77E-01	6,93E-02
3,75E-02	5,43E-03
2,98E-02	1,62E-03
3,80E-02	4,10E-04

Neutral Point Diode Characteristics

figure 17. FWD

Typical forward characteristics

$I_F = f(V_F)$



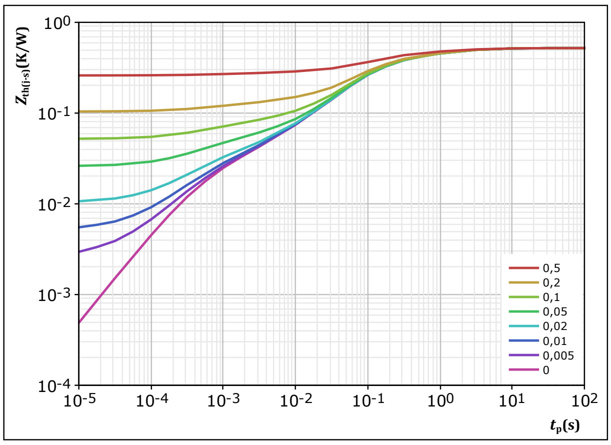
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,52 K/W

FWD thermal model values

R (K/W)	τ (s)
2,59E-02	5,52E+00
9,05E-02	1,28E+00
1,41E-01	2,47E-01
2,22E-01	6,93E-02
1,44E-02	5,43E-03
1,15E-02	1,62E-03
1,46E-02	4,10E-04

10-PG12NAB008ME-LC59F66T
10-PG12NAC008ME-LC69F66T

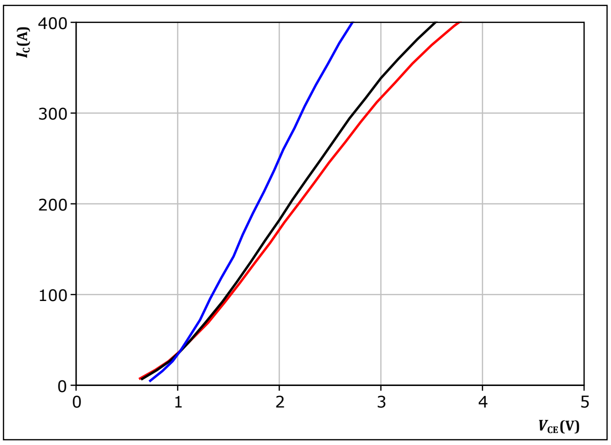
datasheet

DC-Link Switch Characteristics

figure 19. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



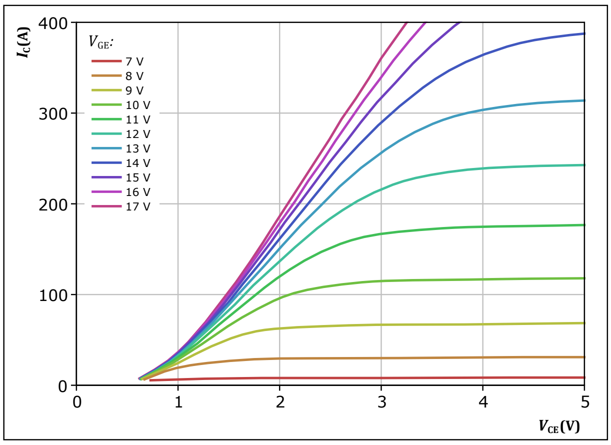
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 20. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



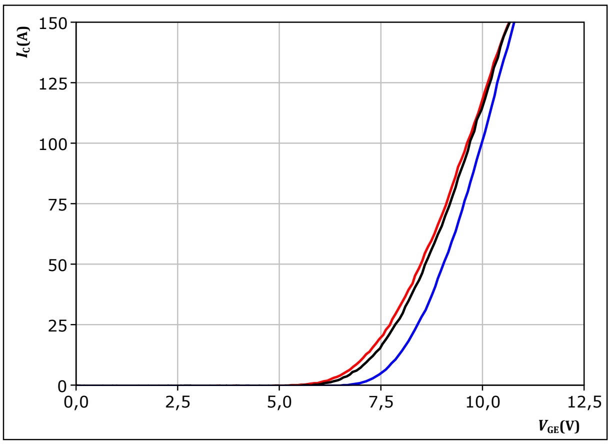
t_p =	250	µs
T_j =	150	°C

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

figure 21. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



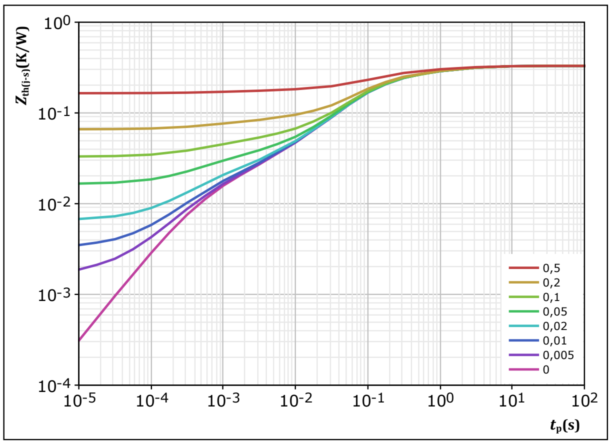
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 22. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,33	K/W

IGBT thermal model values

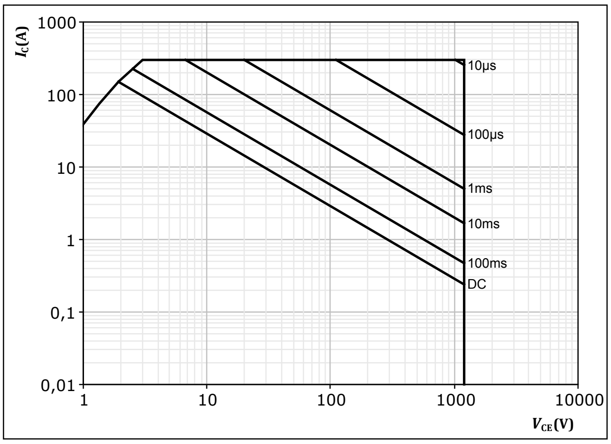
R (K/W)	τ (s)
1,65E-02	5,52E+00
5,74E-02	1,28E+00
8,95E-02	2,47E-01
1,41E-01	6,93E-02
9,15E-03	5,43E-03
7,29E-03	1,62E-03
9,29E-03	4,10E-04

DC-Link Switch Characteristics

figure 23.	IGBT

Safe operating area

I_C = f(V_{CE})



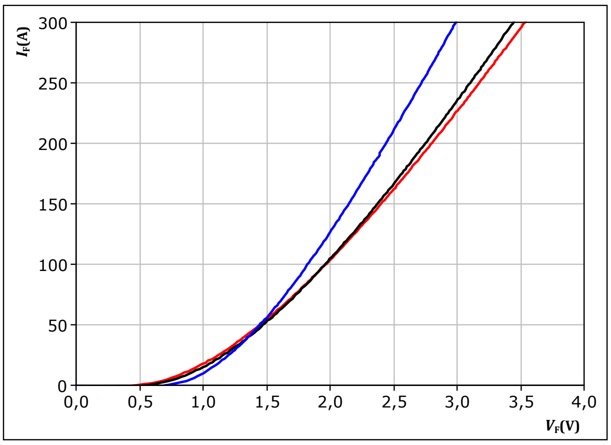
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

DC-Link Switch Prot. Diode Characteristics

figure 24. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



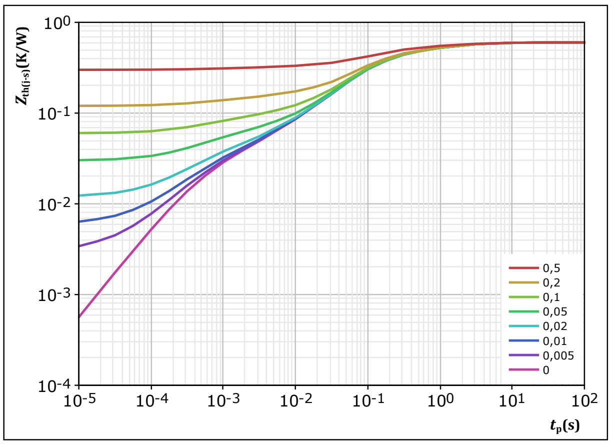
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 25. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,6 K/W

FWD thermal model values

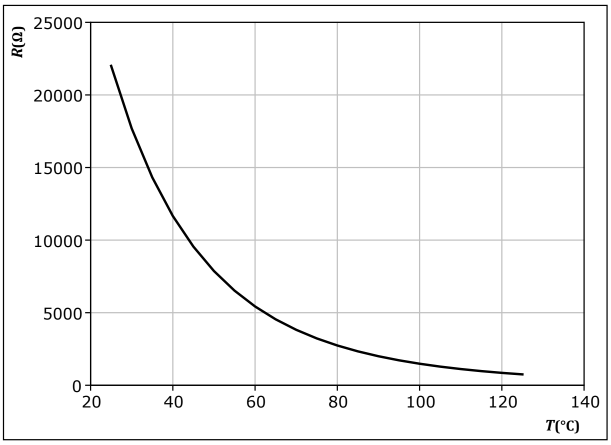
R (K/W)	τ (s)
2,99E-02	5,52E+00
1,04E-01	1,28E+00
1,63E-01	2,47E-01
2,56E-01	6,93E-02
1,66E-02	5,43E-03
1,33E-02	1,62E-03
1,69E-02	4,10E-04

Thermistor Characteristics

figure 26.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

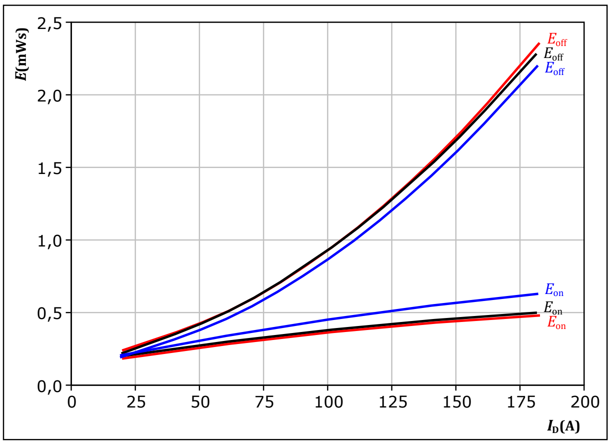


AC Real Open Switching Characteristics

figure 27. MOSFET

Typical switching energy losses as a function of drain current

$E = f(I_D)$



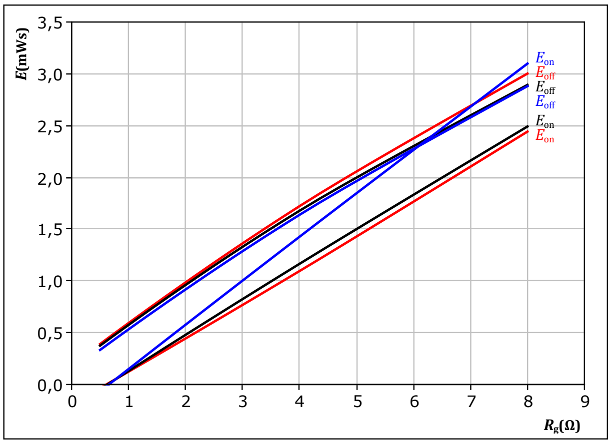
With an inductive load at

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

figure 28. MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



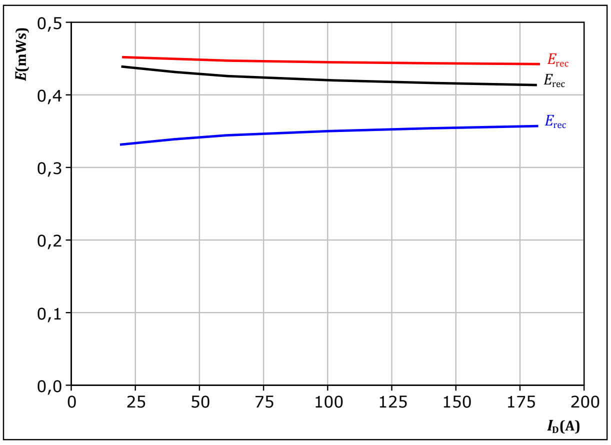
With an inductive load at

			T_j:
V_{DS} =	600	V	25 °C
V_{GS} =	-2/15	V	125 °C
I_D =	100	A	150 °C

figure 29. FWD

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



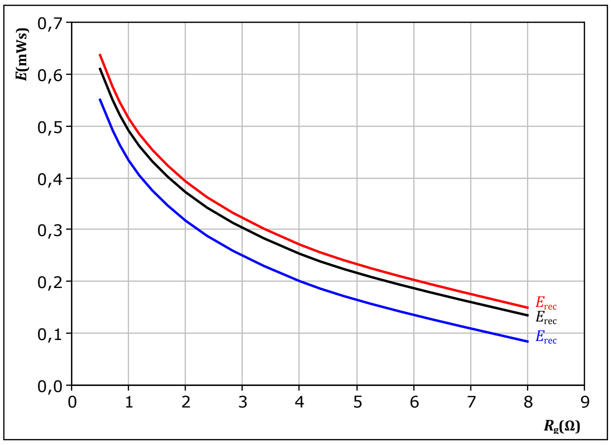
With an inductive load at

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

figure 30. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

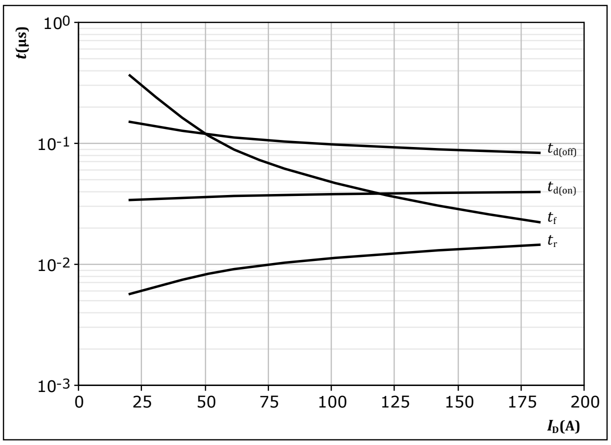
			T_j:
V_{DS} =	600	V	25 °C
V_{GS} =	-2/15	V	125 °C
I_D =	100	A	150 °C

AC Real Open Switching Characteristics

figure 31. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



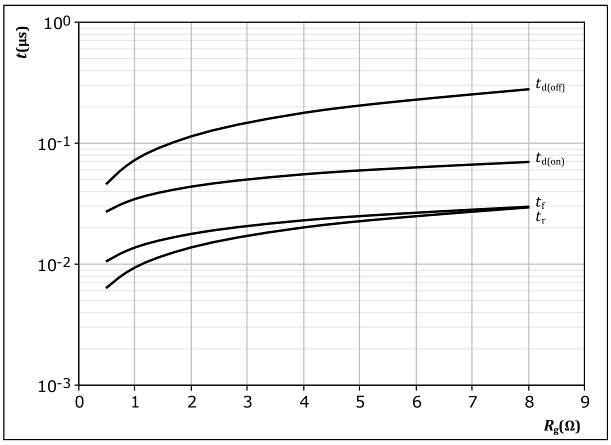
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 32. **MOSFET**

Typical switching times as a function of gate resistor

t = f(R_g)



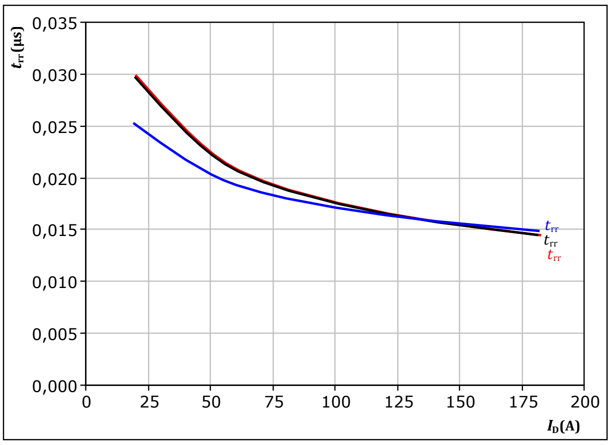
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
I_D =	100	A

figure 33. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)



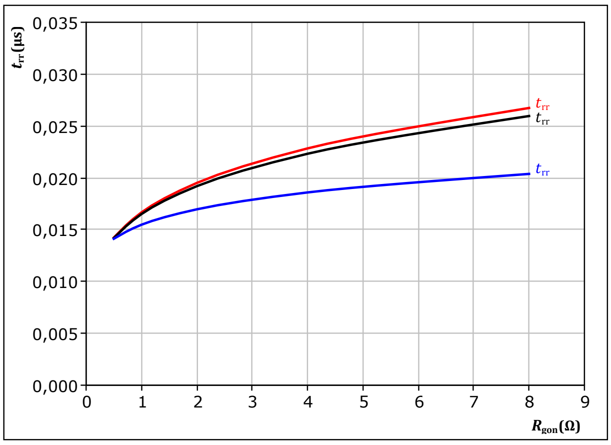
At	V_{DS} =	600	V
	V_{GS} =	-2/15	V
	R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 34. **FWD**

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

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



At	V_{DS} =	600	V
	V_{GS} =	-2/15	V
	I_D =	100	A

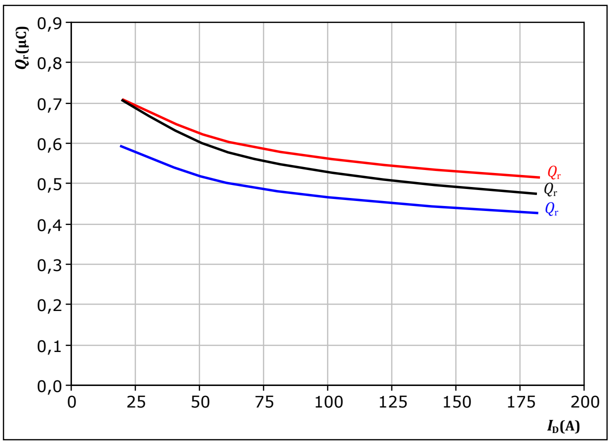
T_j: 25 °C, 125 °C, 150 °C

AC Real Open Switching Characteristics

figure 35. FWD

Typical recovered charge as a function of drain current

Q_r = f(I_D)

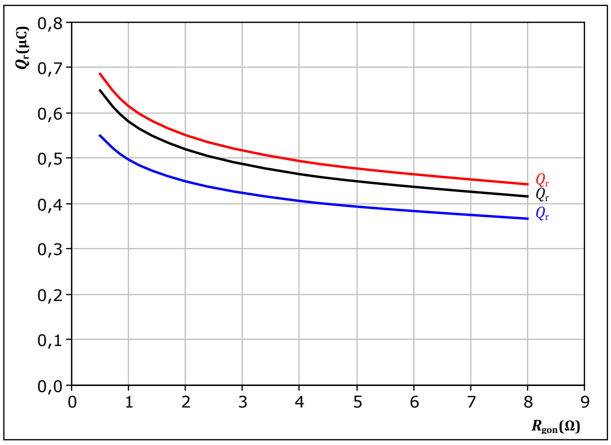


At				Tj:
V_{DS} =	600	V		25 °C
V_{GS} =	-2/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 36. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})

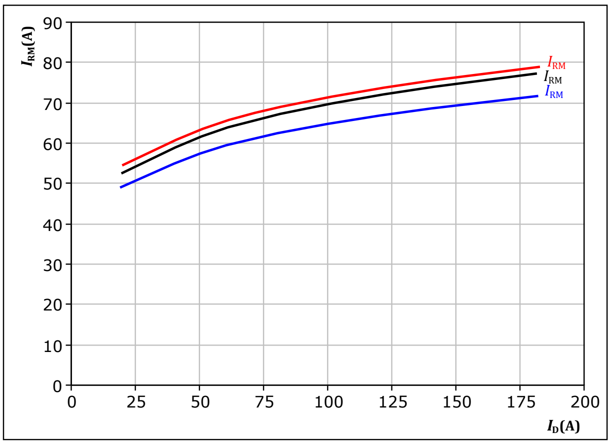


At				Tj:
V_{DS} =	600	V		25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

figure 37. FWD

Typical peak reverse recovery current as a function of drain current

I_{RM} = f(I_D)

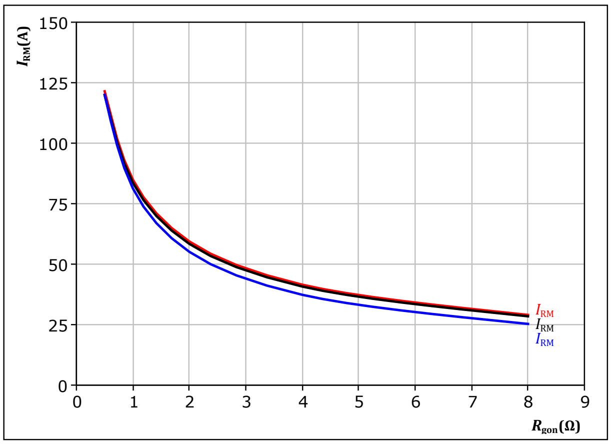


At				Tj:
V_{DS} =	600	V		25 °C
V_{GS} =	-2/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 38. FWD

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

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



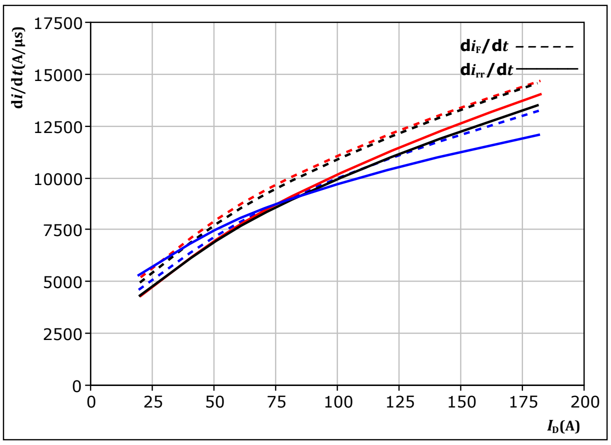
At				Tj:
V_{DS} =	600	V		25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

AC Real Open Switching Characteristics

figure 39. **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)

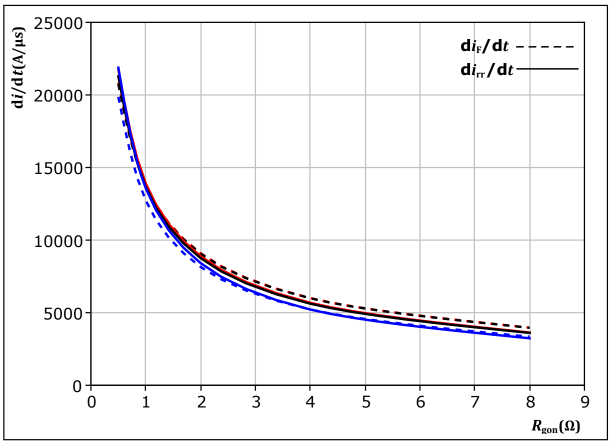


At				
	V_{DS} =	600	V	T_j: 25 °C
	V_{GS} =	-2/15	V	125 °C
	R_{gon} =	2	Ω	150 °C

figure 40. **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})

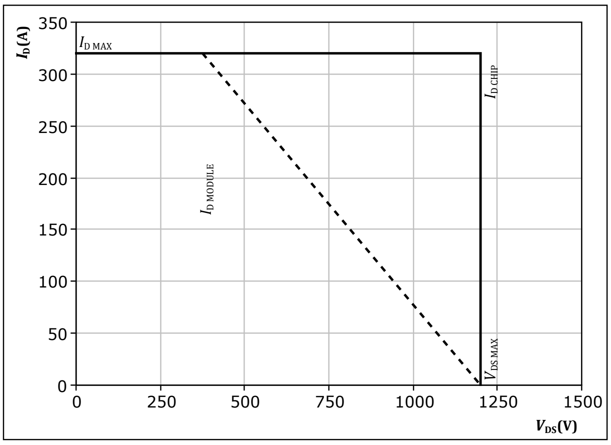


At				
	V_{DS} =	600	V	T_j: 25 °C
	V_{GS} =	-2/15	V	125 °C
	I_D =	100	A	150 °C

figure 41. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})

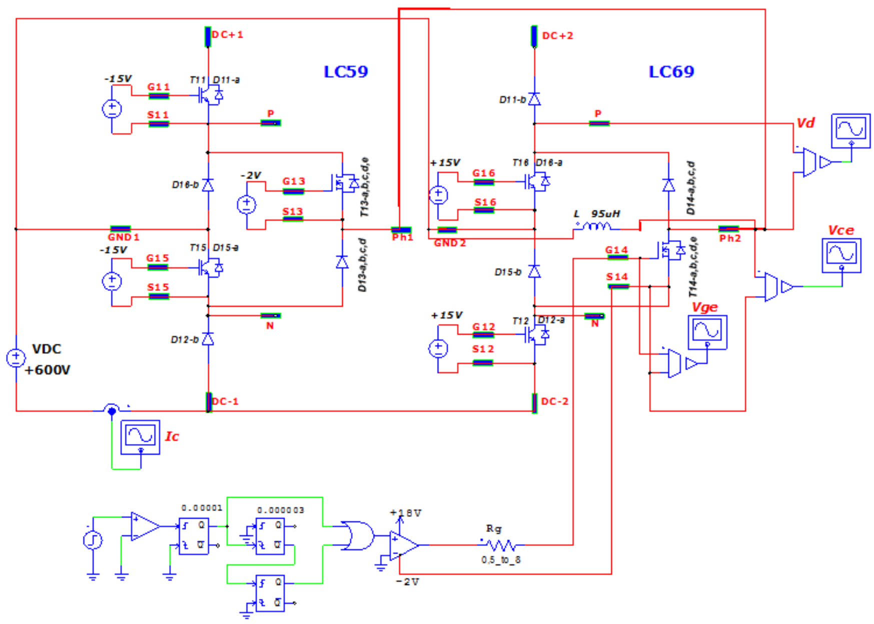


At			
	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC Real Open Measurement Circuit

figure 1.

AC Real PN Open Configuration

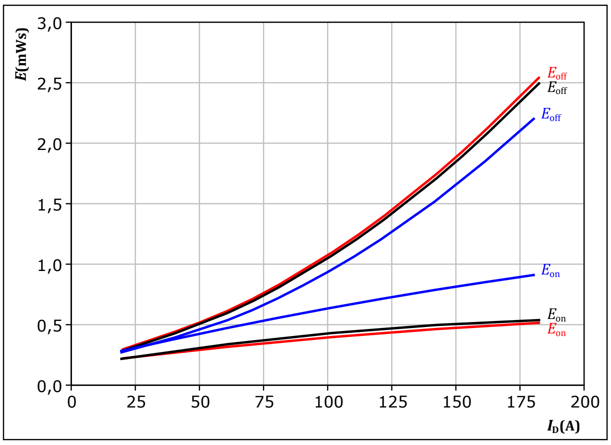


AC Reactive Open Switching Characteristics

figure 27. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



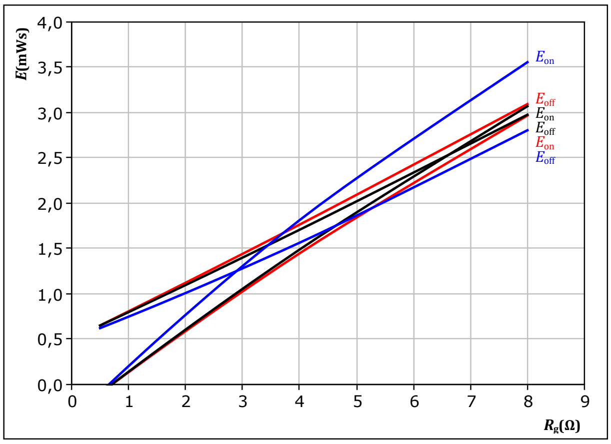
With an inductive load at

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

figure 28. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



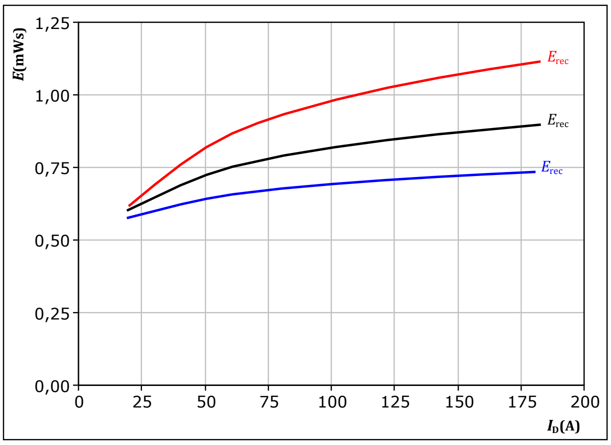
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

figure 29. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



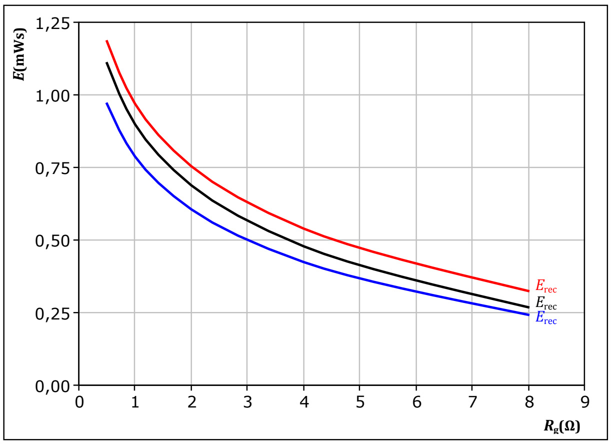
With an inductive load at

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

figure 30. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

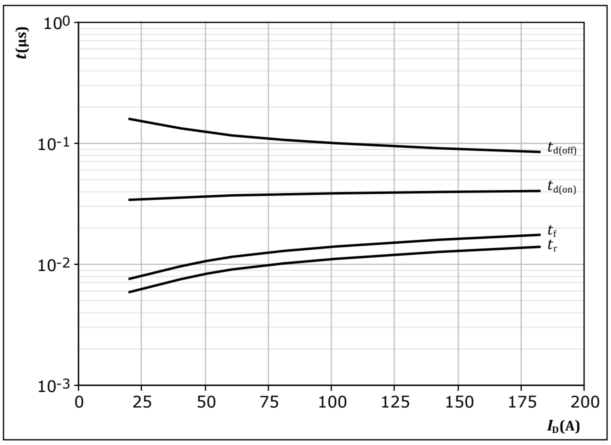
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

AC Reactive Open Switching Characteristics

figure 31. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



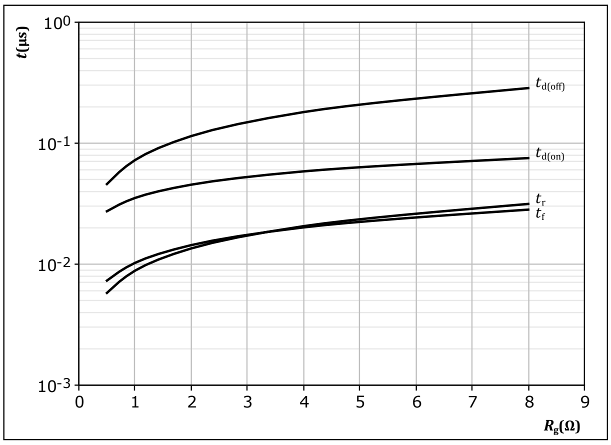
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 32. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



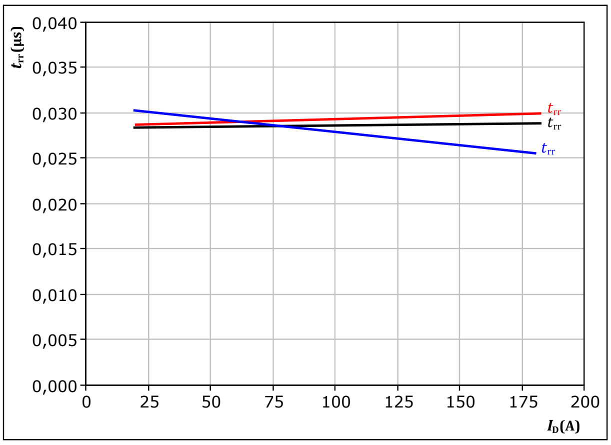
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
I_D =	100	A

figure 33. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



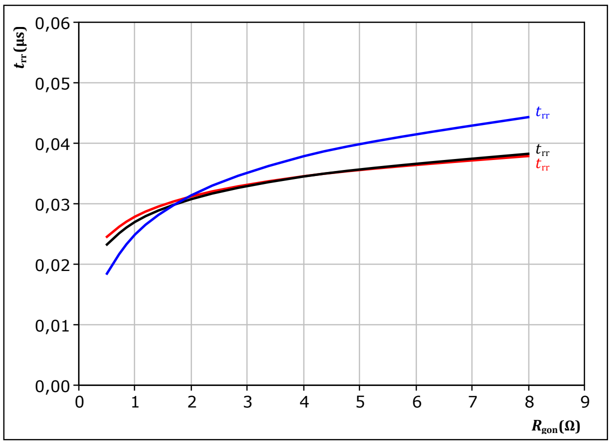
At			
	V_{DS} =	600	V
	V_{GS} =	-2/15	V
	R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 34. **FWD**

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

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



At			
	V_{DS} =	600	V
	V_{GS} =	-2/15	V
	I_D =	100	A

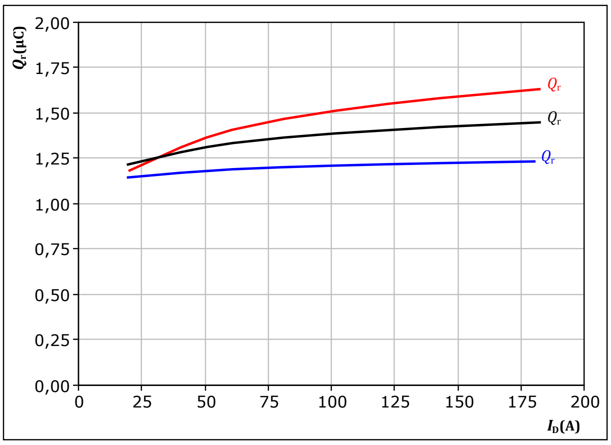
T_j: 25 °C, 125 °C, 150 °C

AC Reactive Open Switching Characteristics

figure 35. FWD

Typical recovered charge as a function of drain current

Q_r = f(I_D)

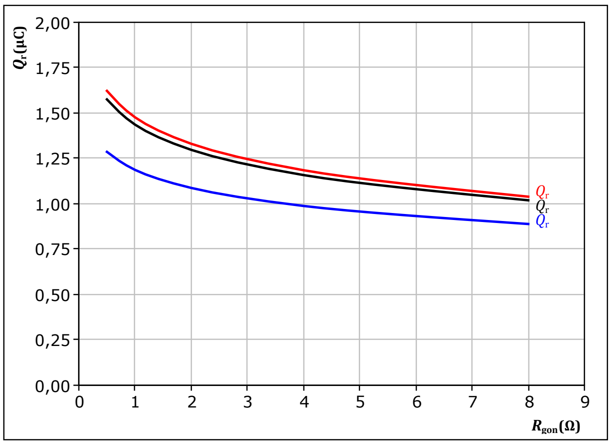


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V		125 °C
	R_{gon} =	2	Ω		150 °C

figure 36. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})

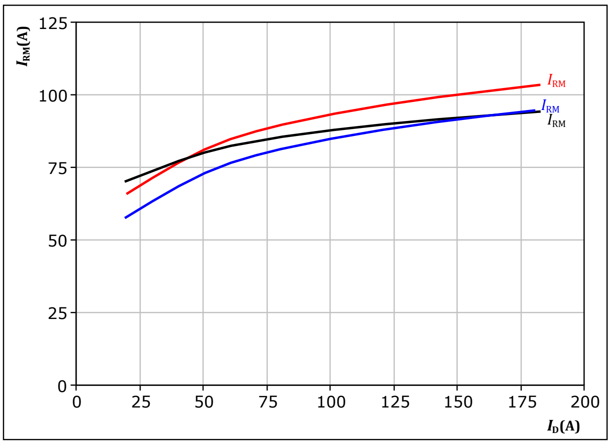


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V		125 °C
	I_D =	100	A		150 °C

figure 37. FWD

Typical peak reverse recovery current as a function of drain current

I_{RM} = f(I_D)

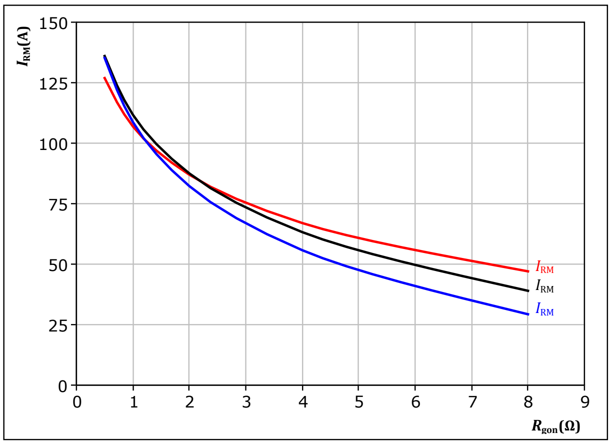


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V		125 °C
	R_{gon} =	2	Ω		150 °C

figure 38. FWD

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

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



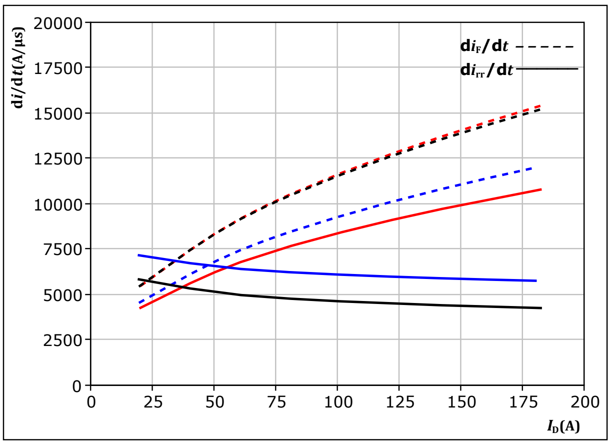
At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V		125 °C
	I_D =	100	A		150 °C

AC Reactive Open Switching Characteristics

figure 39. **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)



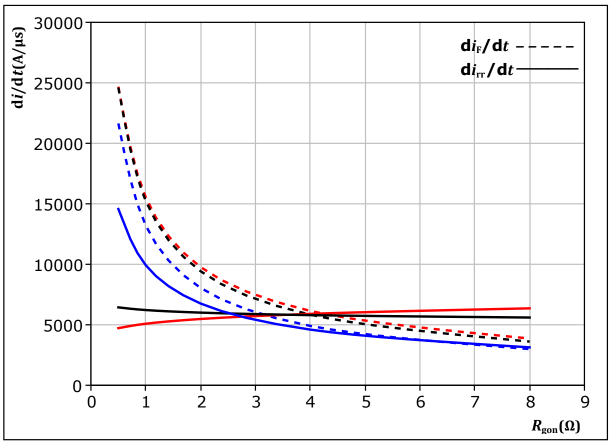
At				
	V_{DS} =	600	V	
	V_{GS} =	-2/15	V	
	R_{gon} =	2	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 40. **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})



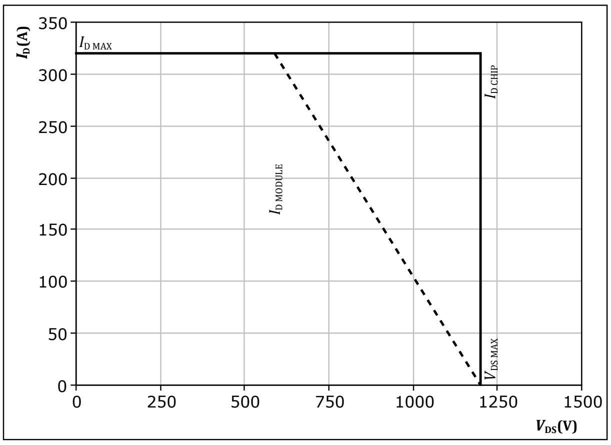
At				
	V_{DS} =	600	V	
	V_{GS} =	-2/15	V	
	I_D =	100	A	

T_j: 25 °C, 125 °C, 150 °C

figure 41. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})

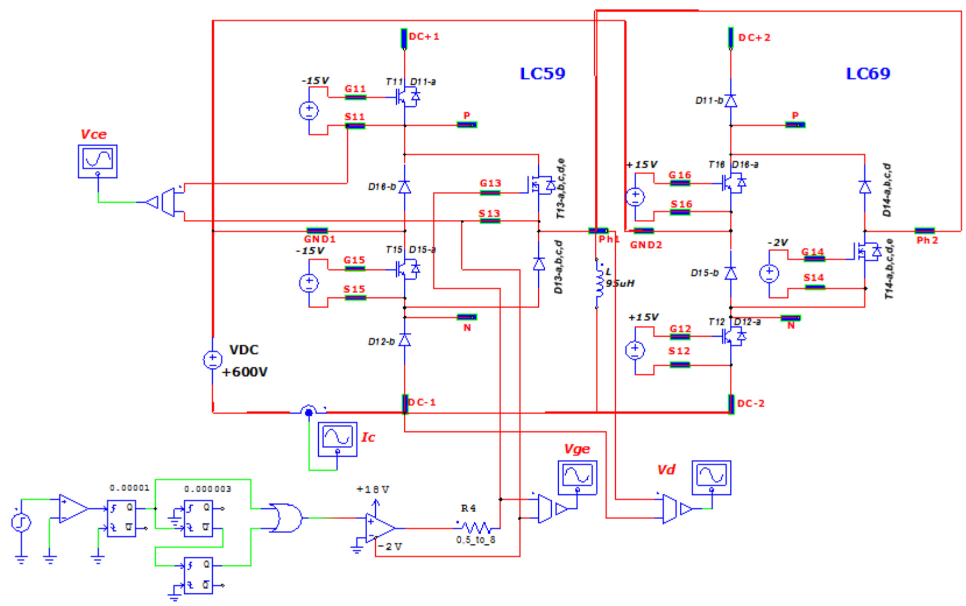


At			
	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC Reactive Open Measurement Circuit

figure 1.

AC Reactive PN Open Configuration

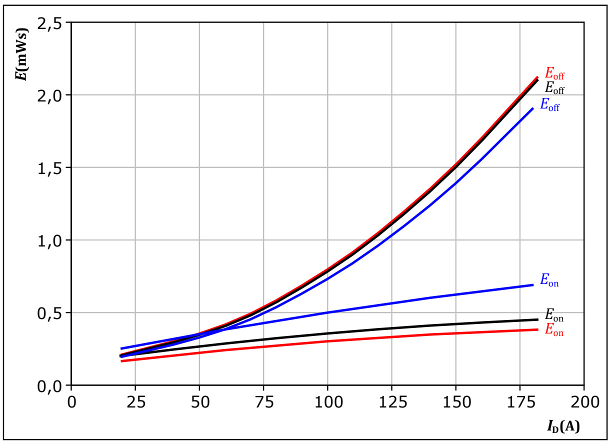


AC Real Short Switching Characteristics

figure 27. **MOSFET**

Typical switching energy losses as a function of drain current

E = f(I_D)



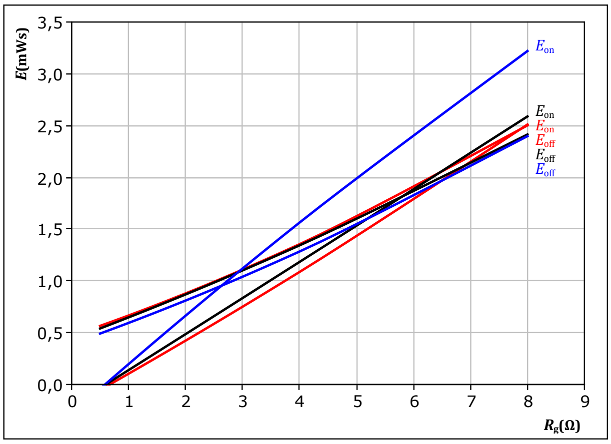
With an inductive load at

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

figure 28. **MOSFET**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



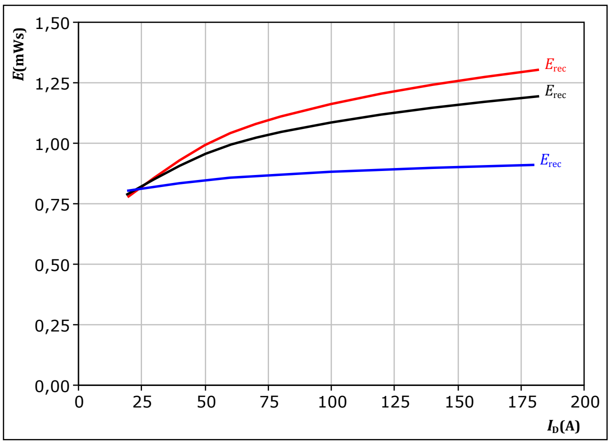
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

figure 29. **FWD**

Typical reverse recovered energy loss as a function of drain current

E_{rec} = f(I_D)



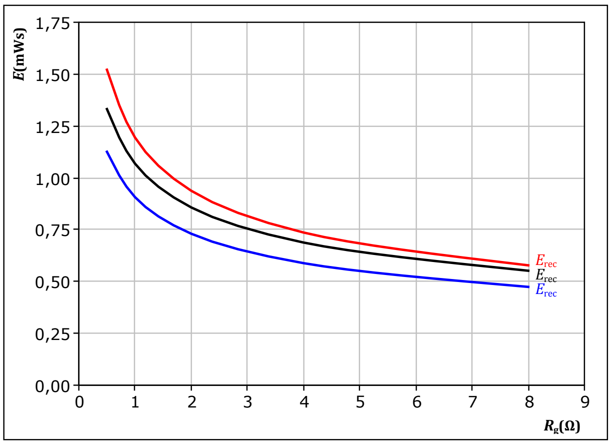
With an inductive load at

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

figure 30. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

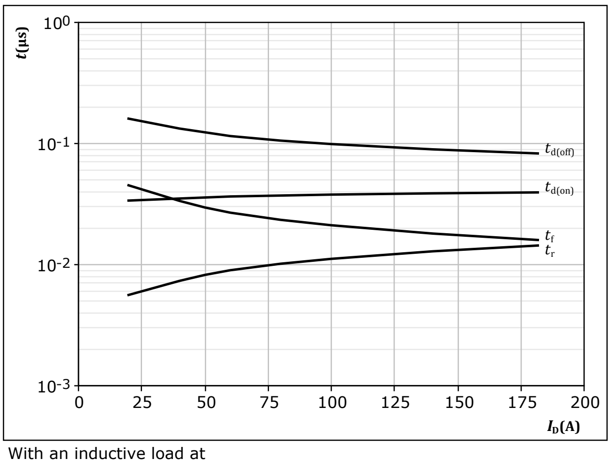
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

AC Real Short Switching Characteristics

figure 31. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



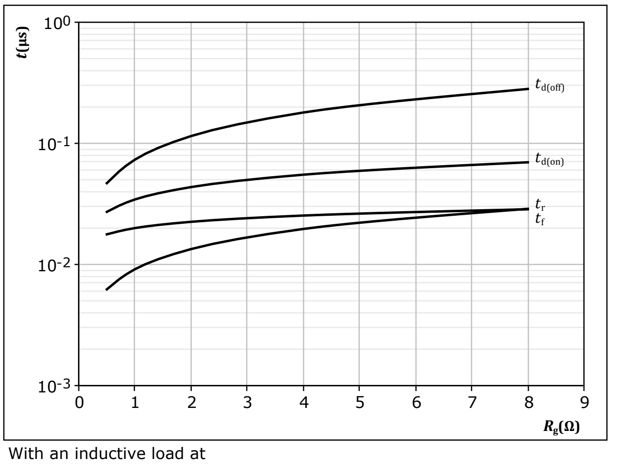
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 32. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



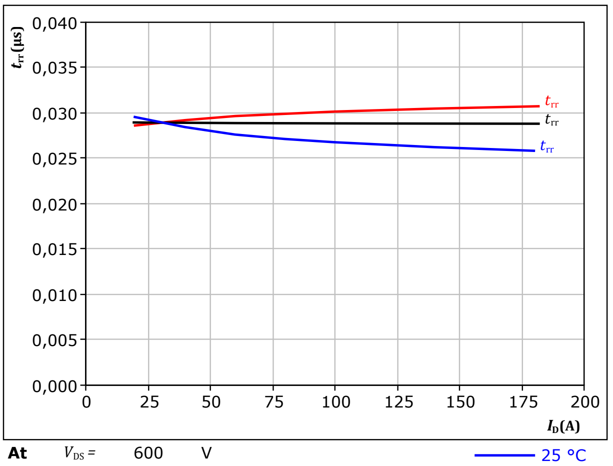
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
I_D =	100	A

figure 33. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

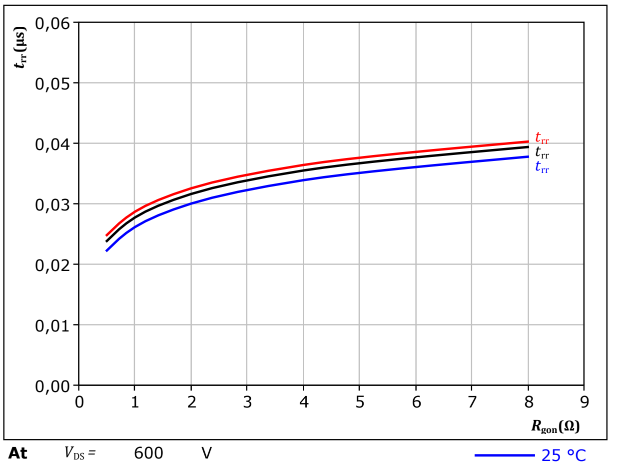


At	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V	T_j:	125 °C
	R_{gon} =	2	Ω		150 °C

figure 34. **FWD**

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

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



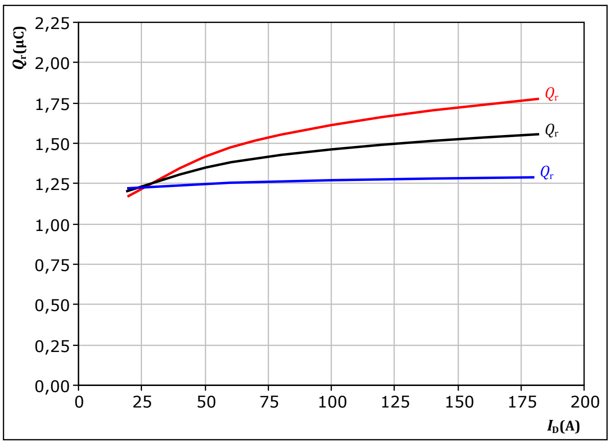
At	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V	T_j:	125 °C
	I_D =	100	A		150 °C

AC Real Short Switching Characteristics

figure 35. **FWD**

Typical recovered charge as a function of drain current

Q_r = f(I_D)

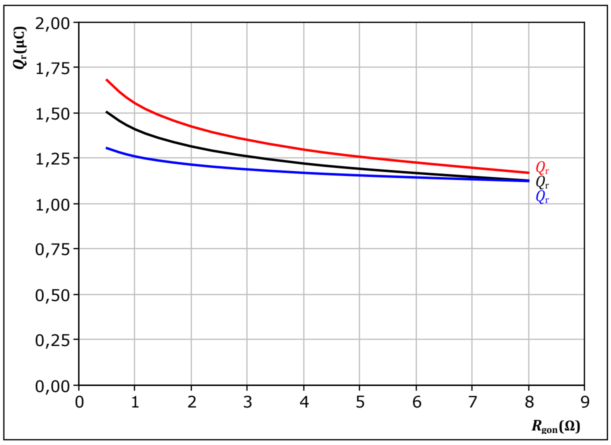


At					
V_{DS} =	600	V			25 °C
V_{GS} =	-2/15	V	T_j:		125 °C
R_{gon} =	2	Ω			150 °C

figure 36. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})

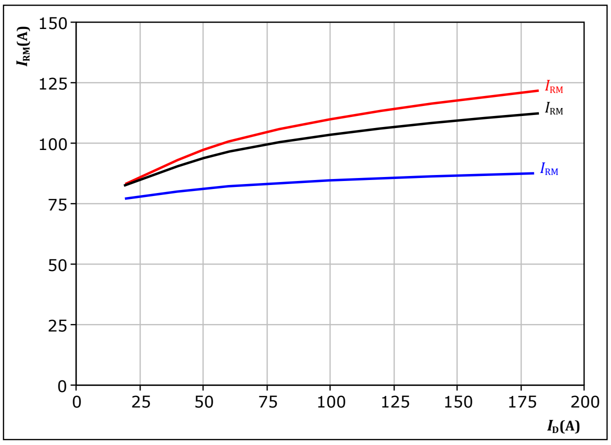


At					
V_{DS} =	600	V			25 °C
V_{GS} =	-2/15	V	T_j:		125 °C
I_D =	100	A			150 °C

figure 37. **FWD**

Typical peak reverse recovery current as a function of drain current

I_{RM} = f(I_D)

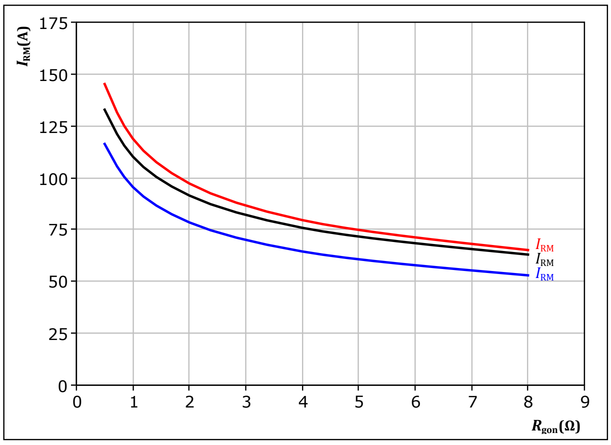


At					
V_{DS} =	600	V			25 °C
V_{GS} =	-2/15	V	T_j:		125 °C
R_{gon} =	2	Ω			150 °C

figure 38. **FWD**

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

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



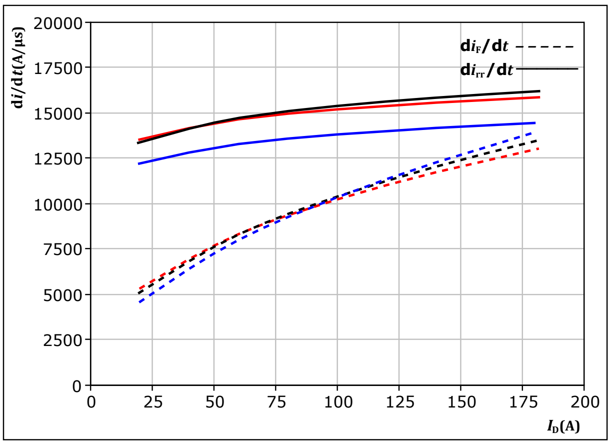
At					
V_{DS} =	600	V			25 °C
V_{GS} =	-2/15	V	T_j:		125 °C
I_D =	100	A			150 °C

AC Real Short Switching Characteristics

figure 39. **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)

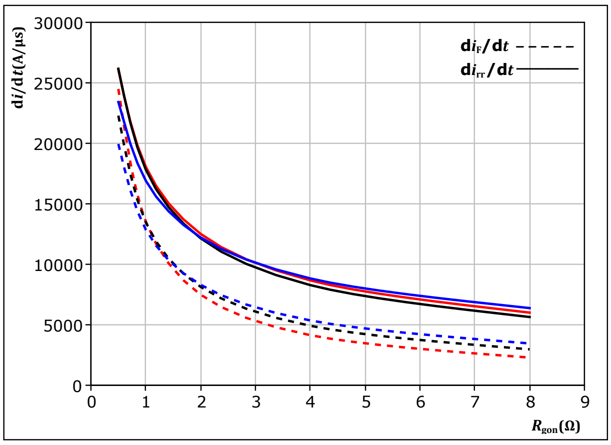


At					
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V	T_j:	125 °C
	R_{gon} =	2	Ω		150 °C

figure 40. **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})

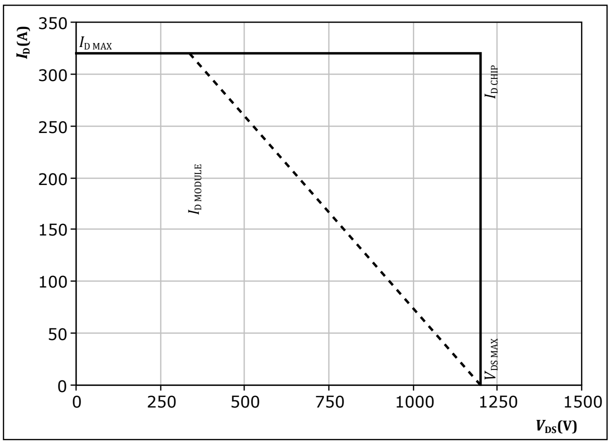


At					
	V_{DS} =	600	V		25 °C
	V_{GS} =	-2/15	V	T_j:	125 °C
	I_D =	100	A		150 °C

figure 41. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})

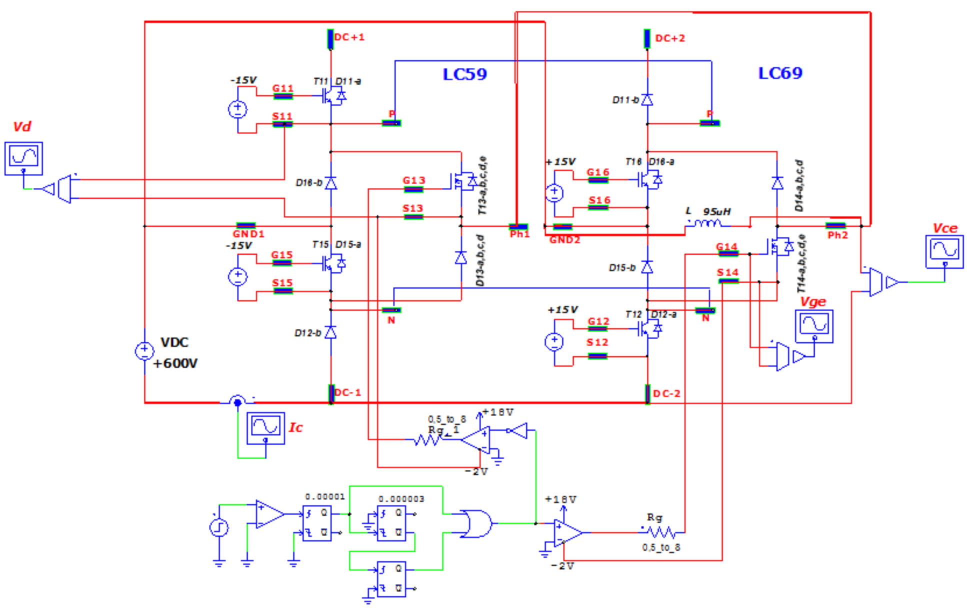


At			
	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC Real Short Measurement Circuit

figure 1.

AC Real PN Short Configuration

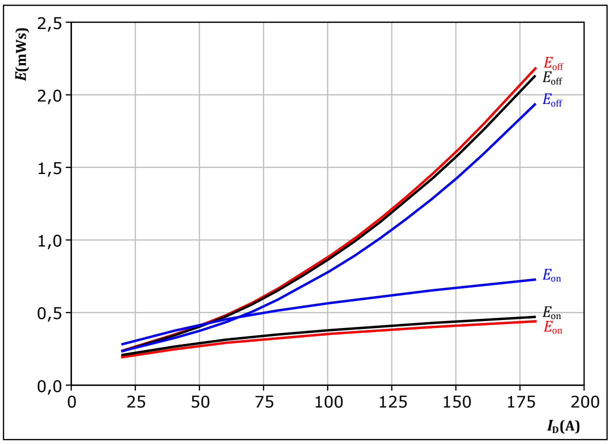


AC Reactive Short Switching Characteristics

figure 27. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



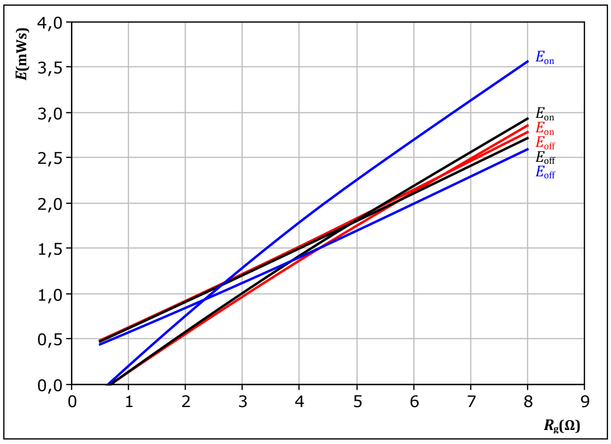
With an inductive load at

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

figure 28. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



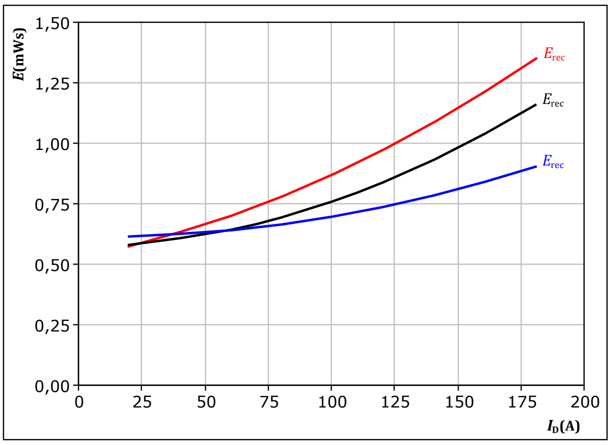
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

figure 29. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



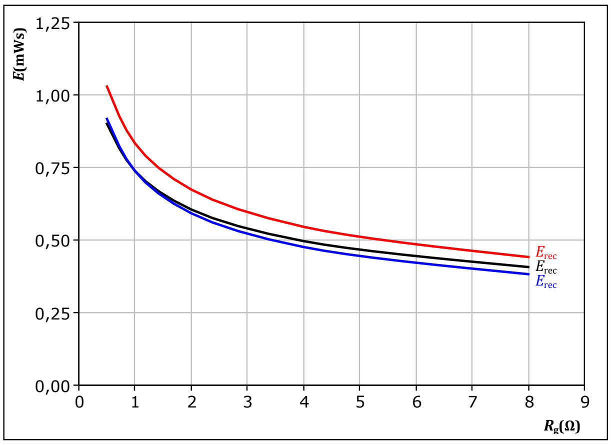
With an inductive load at

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

figure 30. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

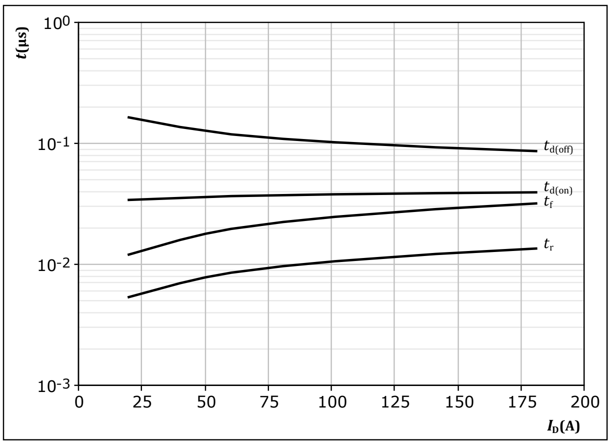
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

AC Reactive Short Switching Characteristics

figure 31. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



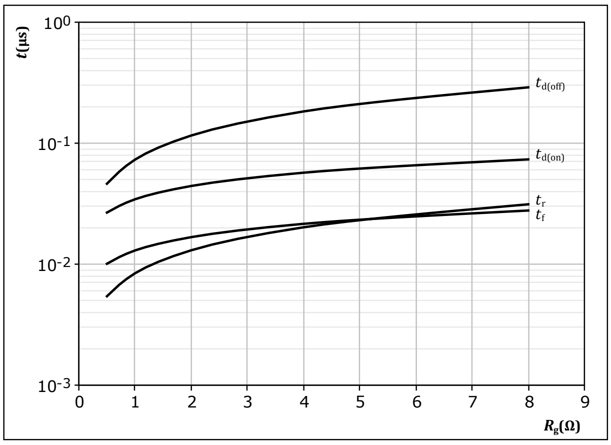
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 32. **MOSFET**

Typical switching times as a function of gate resistor

t = f(R_g)



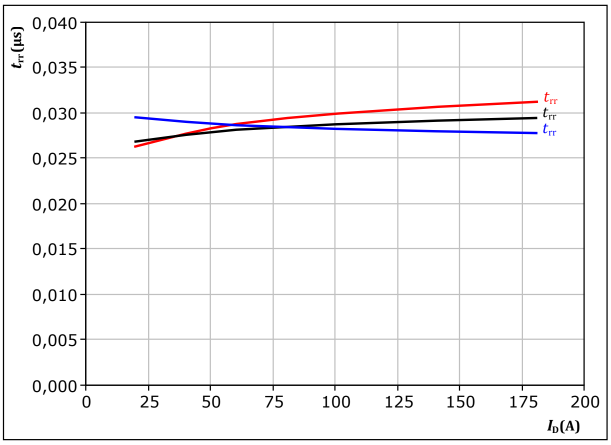
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-2/15	V
I_D =	100	A

figure 33. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)

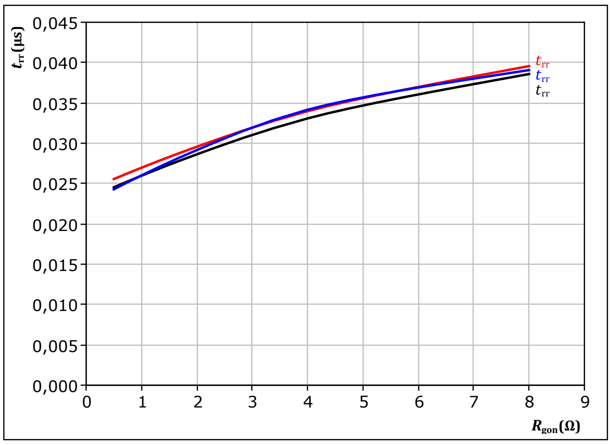


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 34. **FWD**

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

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



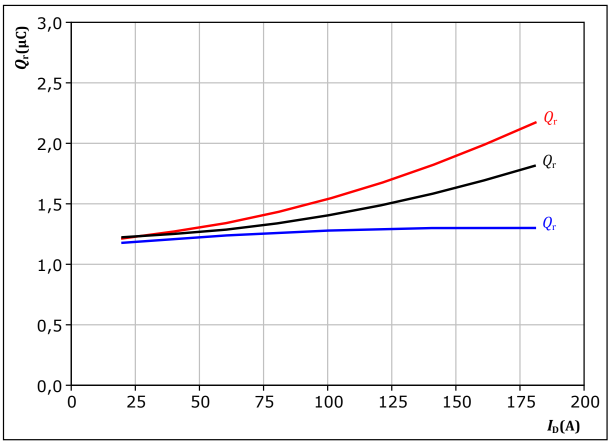
At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	-2/15	V		125 °C
I_D =	100	A		150 °C

AC Reactive Short Switching Characteristics

figure 35. **FWD**

Typical recovered charge as a function of drain current

Q_r = f(I_D)

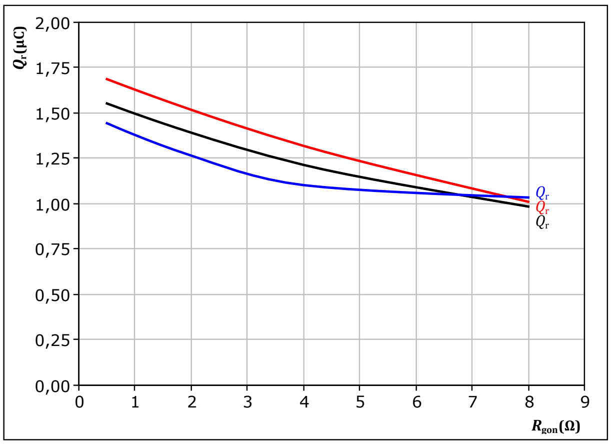


At				
	V_{DS} =	600	V	25 °C
	V_{GS} =	-2/15	V	T_j: 125 °C
	R_{gon} =	2	Ω	150 °C

figure 36. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})

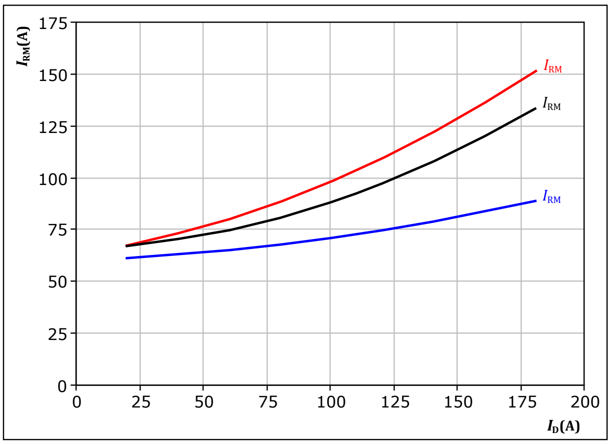


At				
	V_{DS} =	600	V	25 °C
	V_{GS} =	-2/15	V	T_j: 125 °C
	I_D =	100	A	150 °C

figure 37. **FWD**

Typical peak reverse recovery current as a function of drain current

I_{RM} = f(I_D)

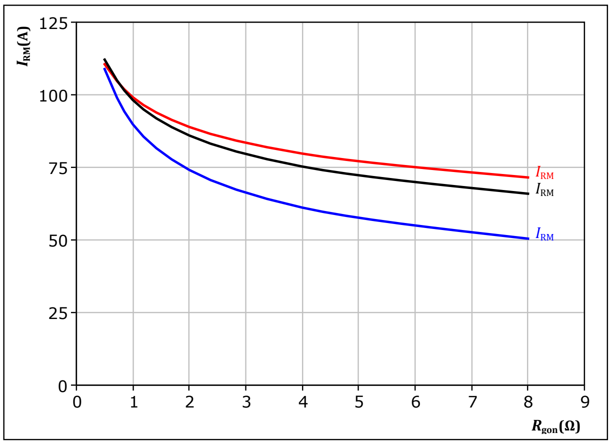


At				
	V_{DS} =	600	V	25 °C
	V_{GS} =	-2/15	V	T_j: 125 °C
	R_{gon} =	2	Ω	150 °C

figure 38. **FWD**

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

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



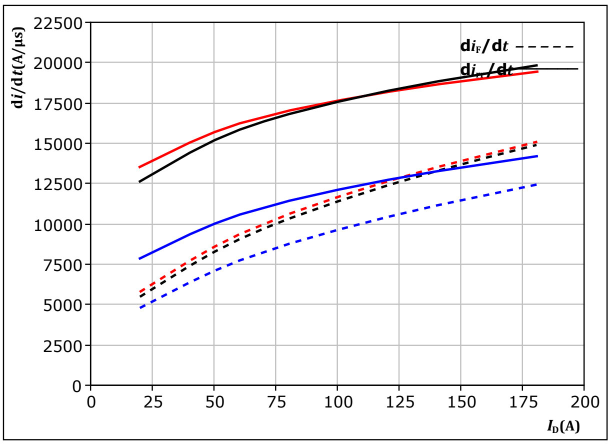
At				
	V_{DS} =	600	V	25 °C
	V_{GS} =	-2/15	V	T_j: 125 °C
	I_D =	100	A	150 °C

AC Reactive Short Switching Characteristics

figure 39. **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)

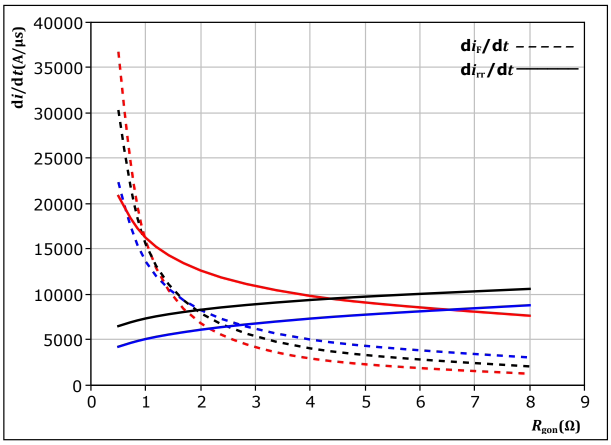


At V_{DS} = 600 V, V_{GS} = -2/15 V, R_{gon} = 2 Ω; T_j: 25 °C, 125 °C, 150 °C

figure 40. **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})

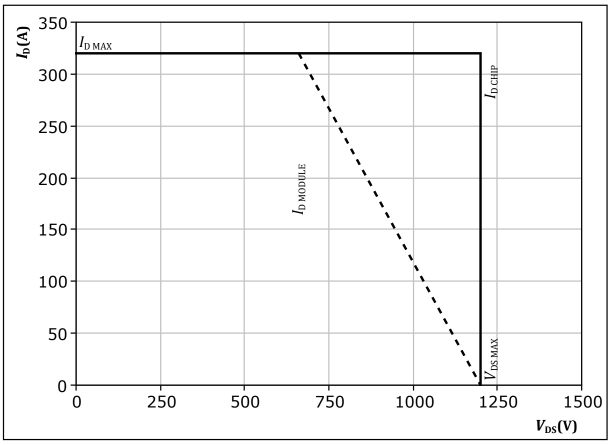


At V_{DS} = 600 V, V_{GS} = -2/15 V, I_D = 100 A; T_j: 25 °C, 125 °C, 150 °C

figure 41. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})

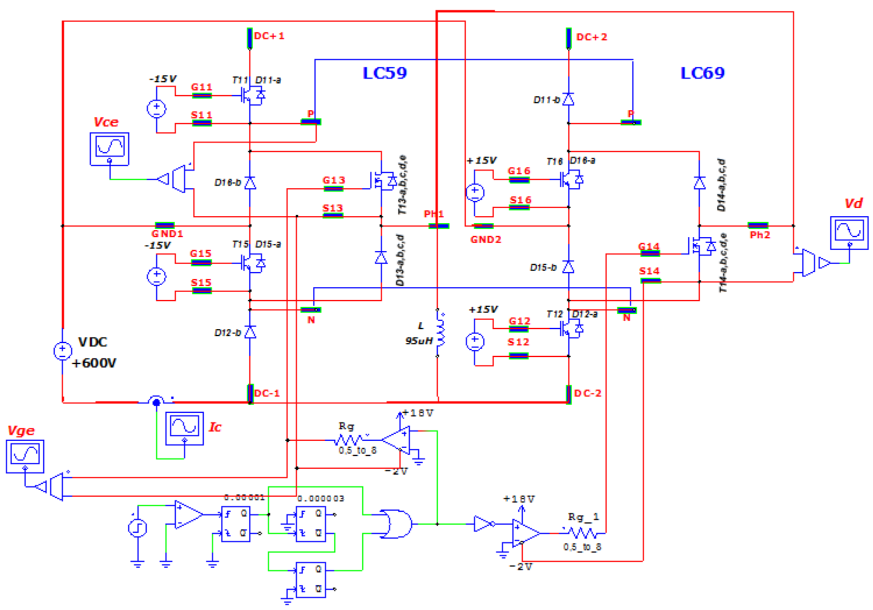


At T_j = 150 °C, R_{gon} = 2 Ω, R_{goff} = 2 Ω

AC Reactive Short Measurement Circuit

figure 1.

AC Reactive PN Short Configuration



AC Switching Definitions

figure 1. **MOSFET**

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

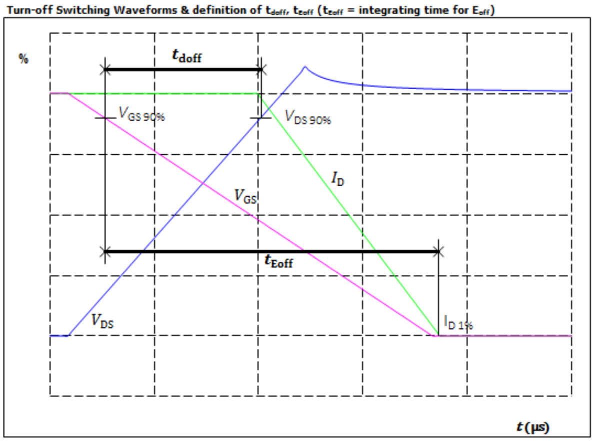


figure 2. **MOSFET**

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

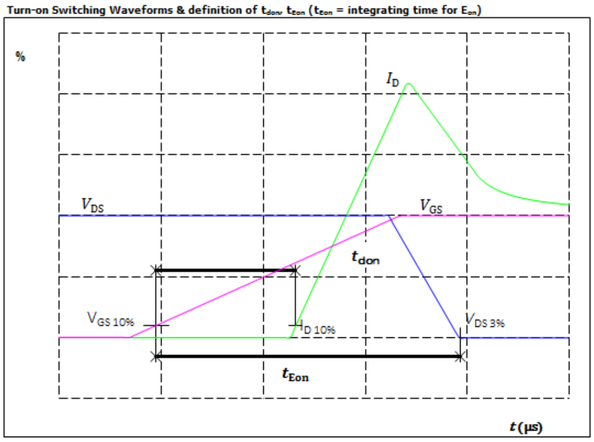


figure 3. **MOSFET**

Turn-off Switching Waveforms & definition of t_f

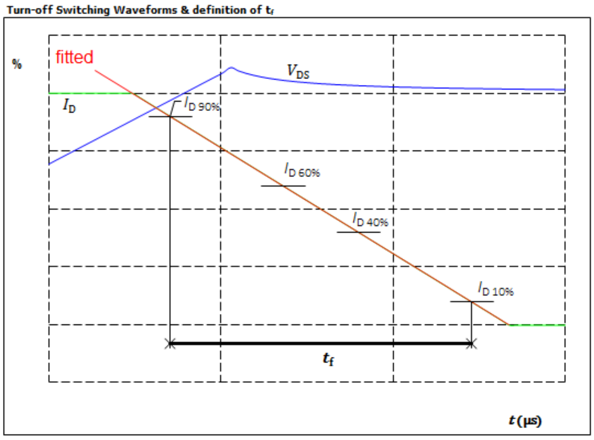
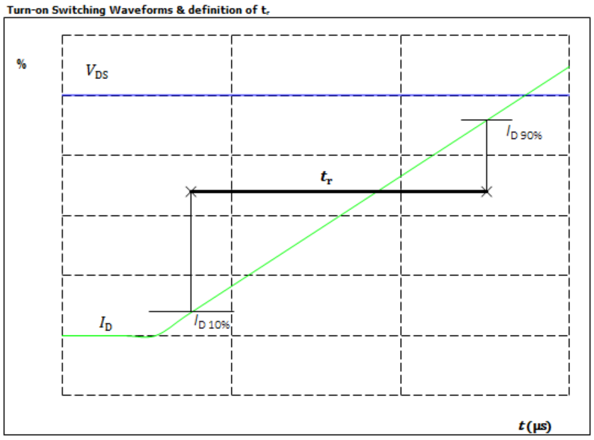


figure 4. **MOSFET**

Turn-on Switching Waveforms & definition of t_r



AC Switching Definitions

figure 5. **FWD**

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

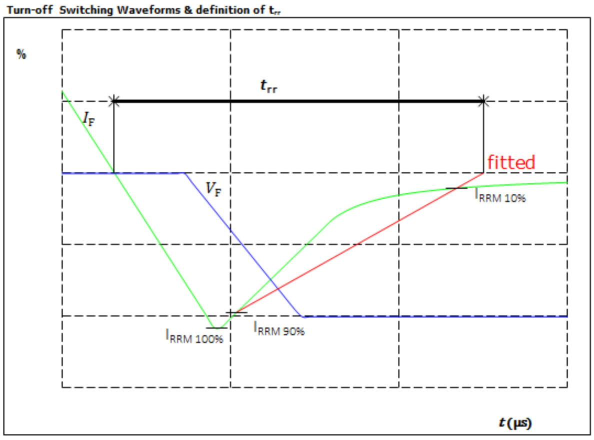
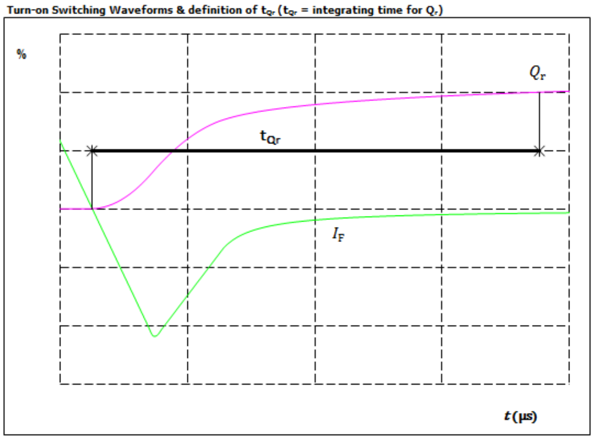


figure 6. **FWD**

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

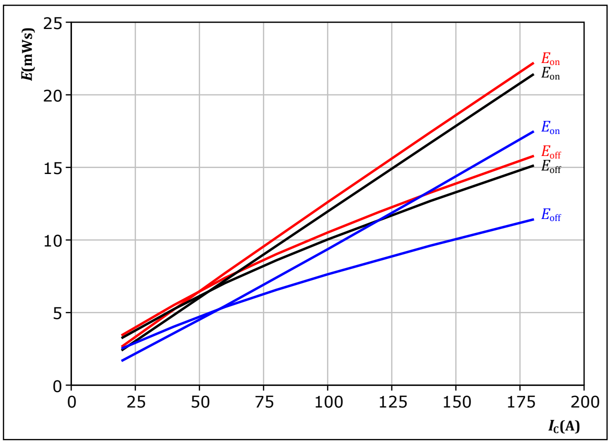


Neutral Point Switching Characteristics

figure 42.	IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

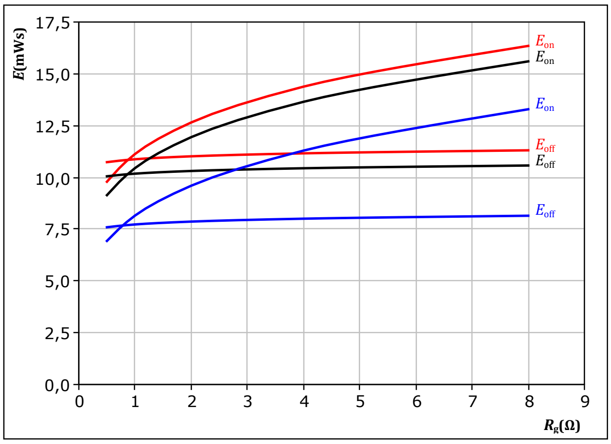
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 2 Ω
R_{goff} = 2 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 43.	IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

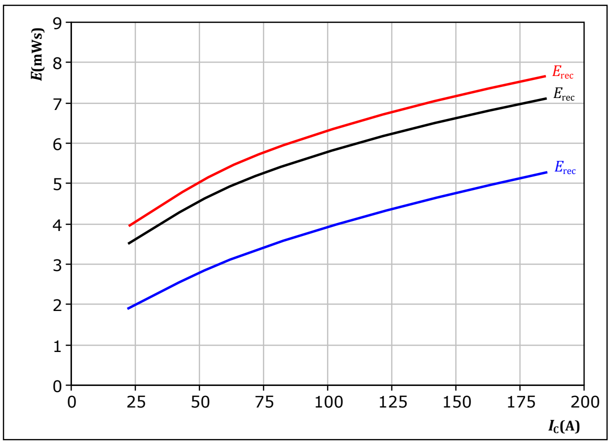
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 100 A

T_j: 25 °C, 125 °C, 150 °C

figure 44.	IGBT

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

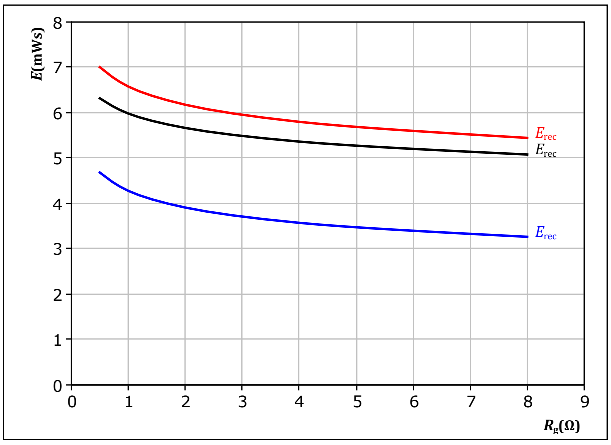
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 2 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 45.	IGBT

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 100 A

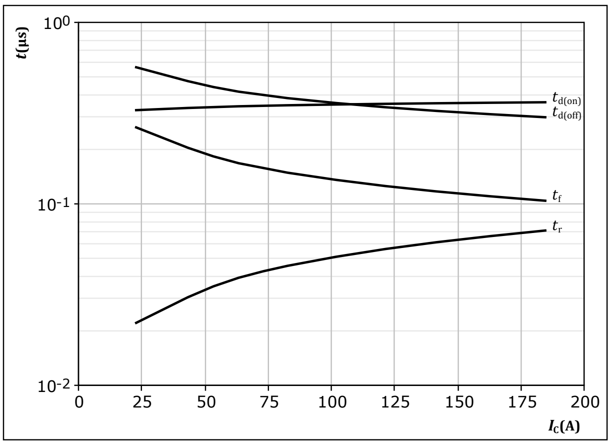
T_j: 25 °C, 125 °C, 150 °C

Neutral Point Switching Characteristics

figure 46. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



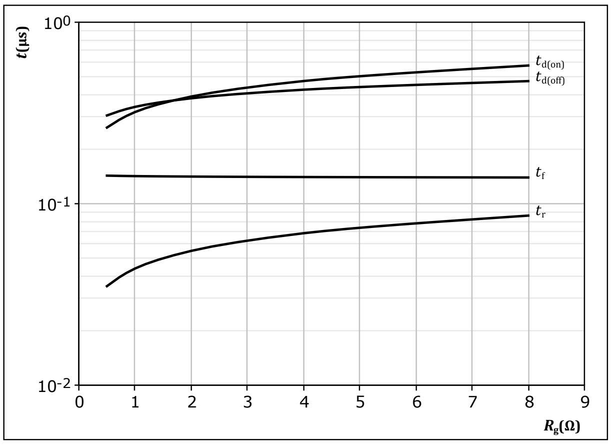
With an inductive load at

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

figure 47. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



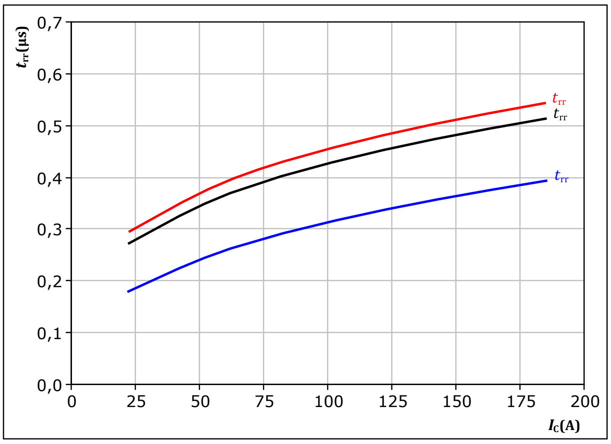
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

figure 48. **IGBT**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

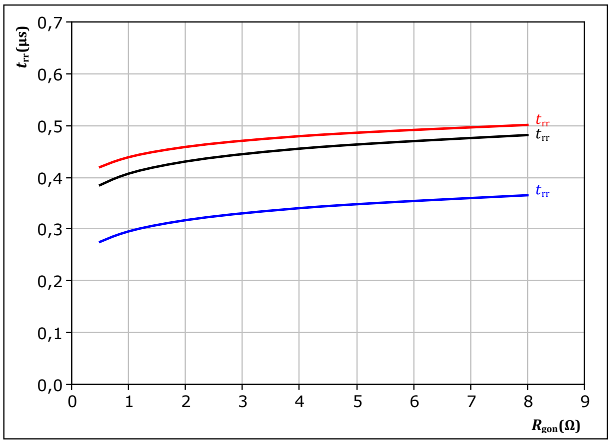
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 49. **IGBT**

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 =	100	A

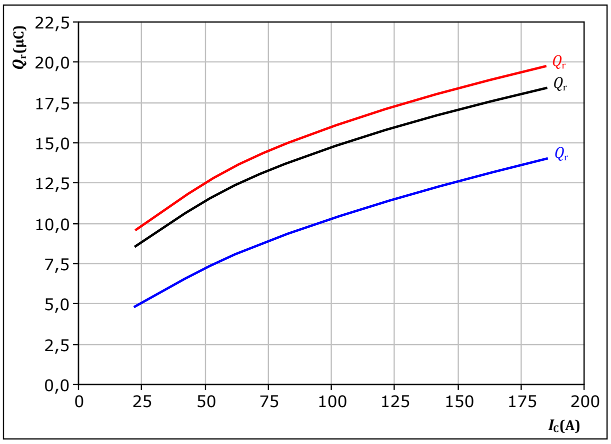
T_j: 25 °C, 125 °C, 150 °C

Neutral Point Switching Characteristics

figure 50. **IGBT**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



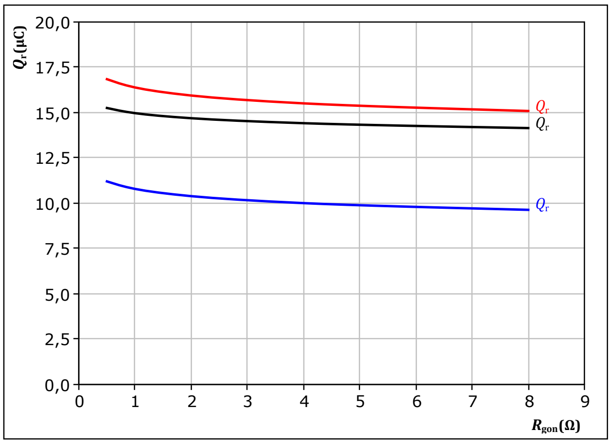
With an inductive load at

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

figure 51. **IGBT**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



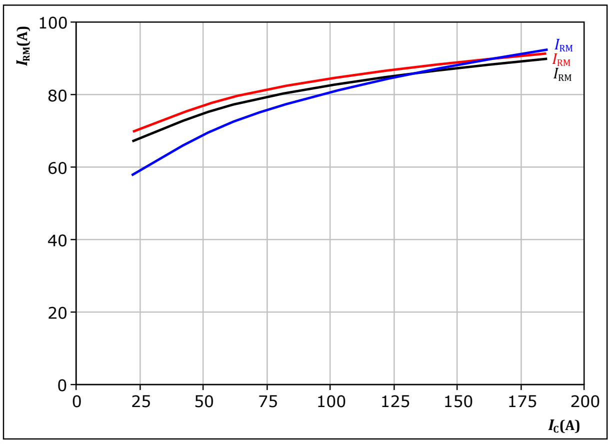
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 52. **IGBT**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



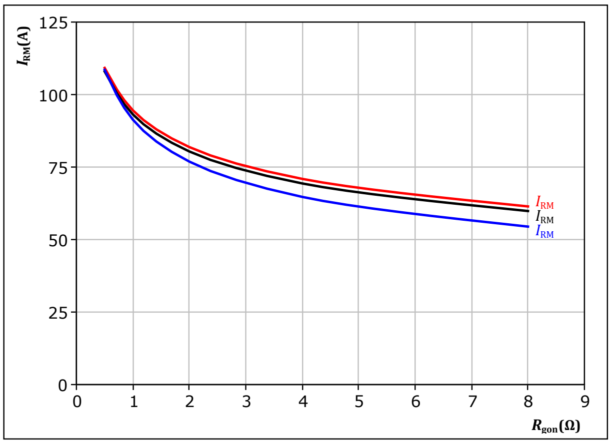
With an inductive load at

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

figure 53. **IGBT**

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

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



With an inductive load at

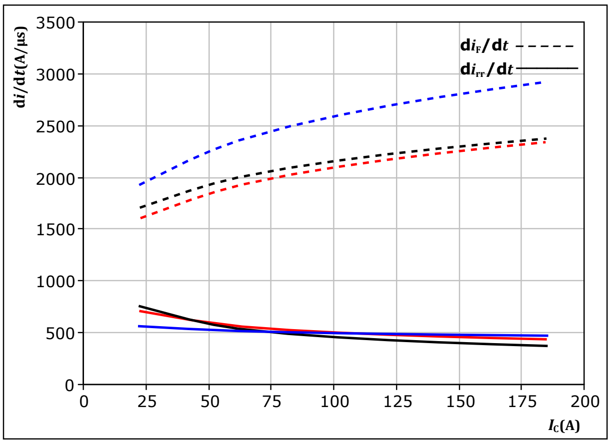
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

Neutral Point Switching Characteristics

figure 54. **IGBT**

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)



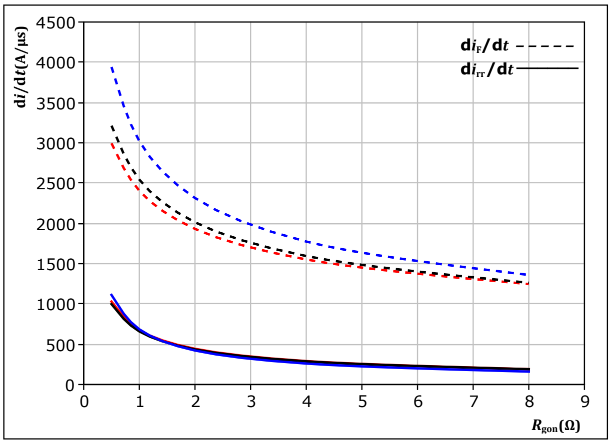
With an inductive load at

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

figure 55. **IGBT**

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})



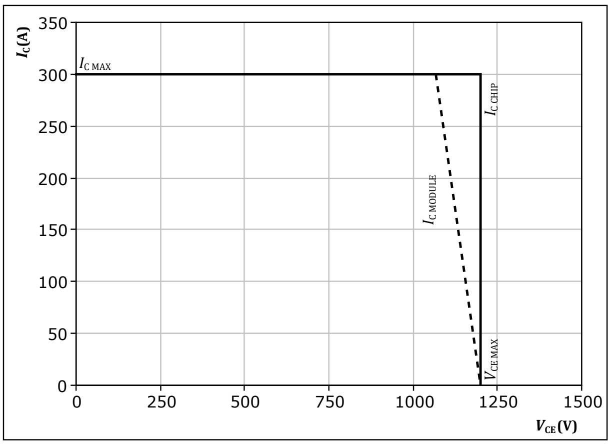
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 56. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})

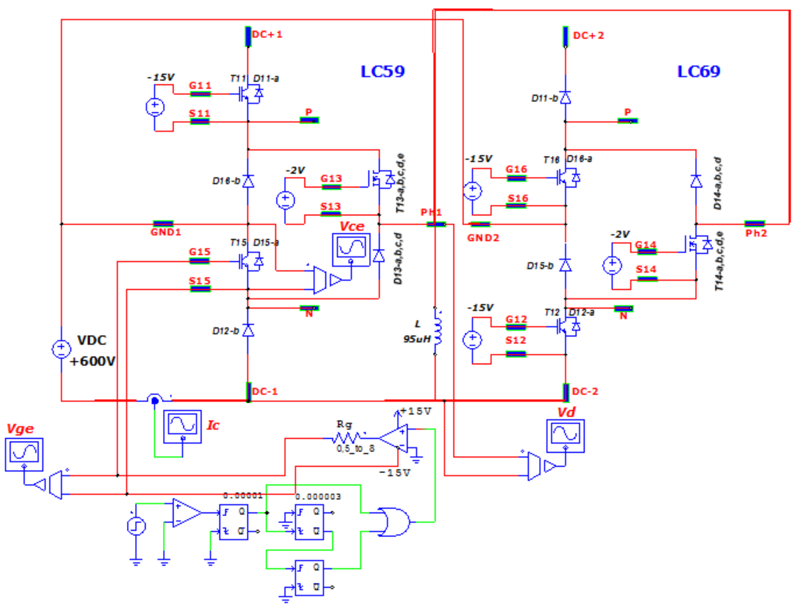


At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

Neutral Point Measurement Circuit

figure 1.

NEUTRAL POINT SWITCH

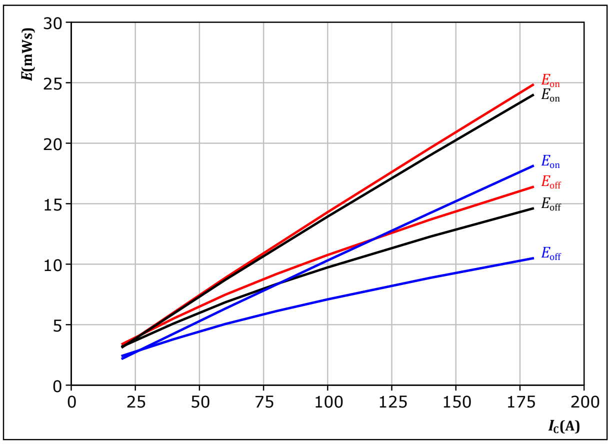


DC-Link Switching Characteristics

figure 57. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



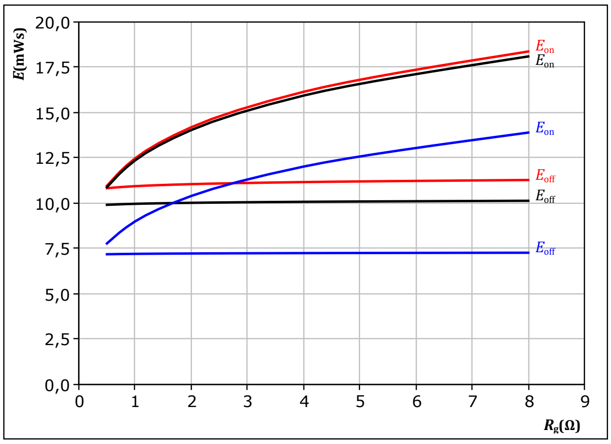
With an inductive load at

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

figure 58. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



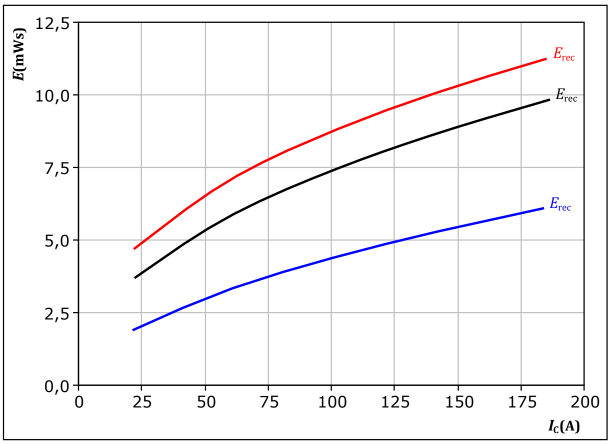
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 59. **IGBT**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



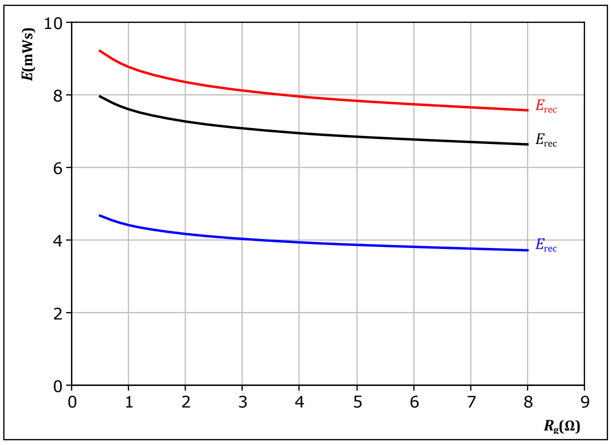
With an inductive load at

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

figure 60. **IGBT**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

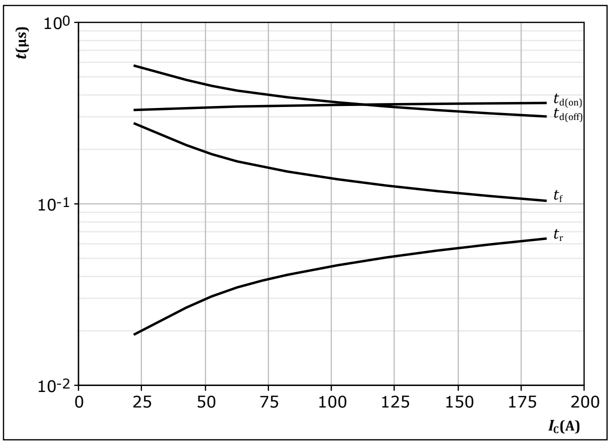
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

DC-Link Switching Characteristics

figure 61. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



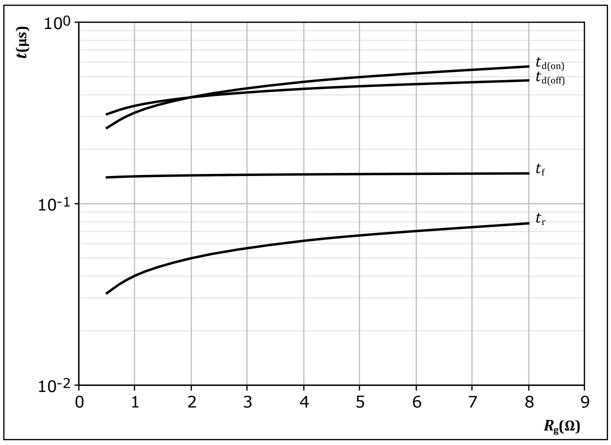
With an inductive load at

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

figure 62. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



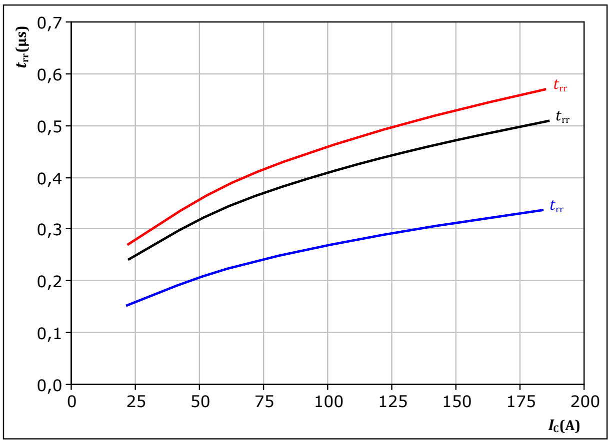
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

figure 63. **IGBT**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

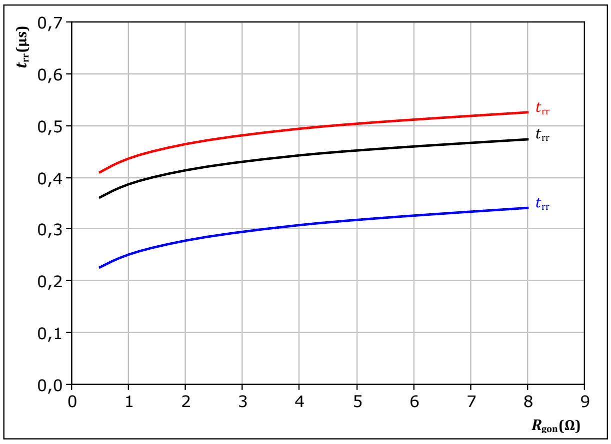
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 64. **IGBT**

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 =	100	A

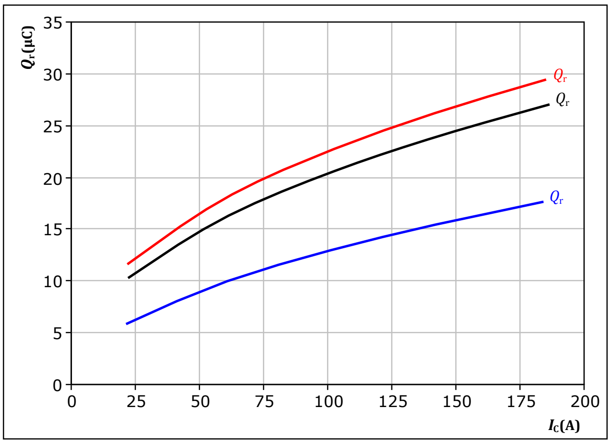
T_j: 25 °C, 125 °C, 150 °C

DC-Link Switching Characteristics

figure 65. **IGBT**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



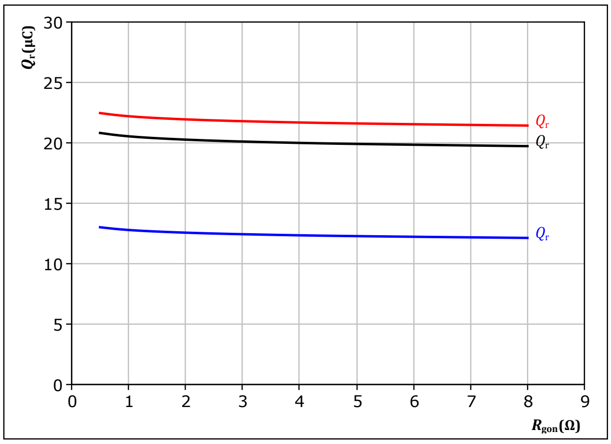
With an inductive load at

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

figure 66. **IGBT**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



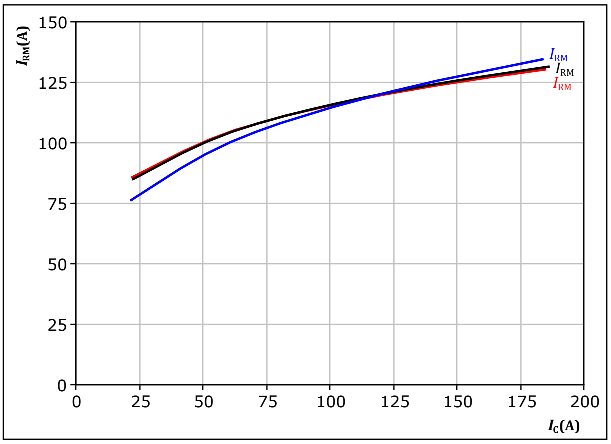
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 67. **IGBT**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



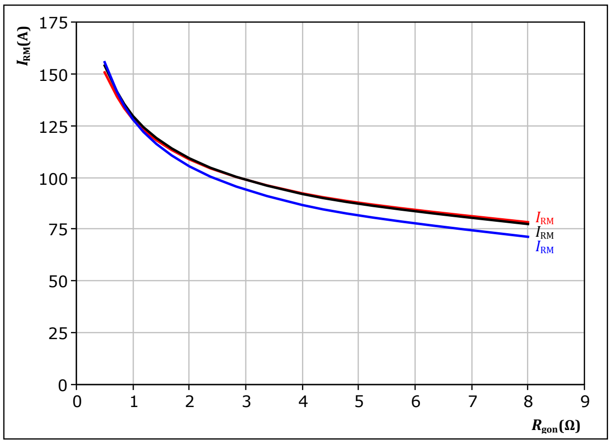
With an inductive load at

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

figure 68. **IGBT**

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

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



With an inductive load at

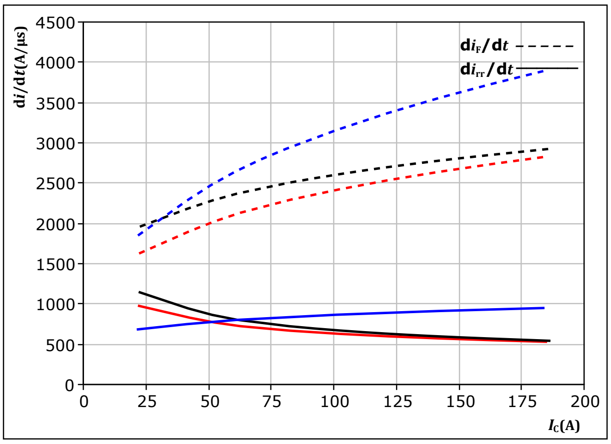
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

DC-Link Switching Characteristics

figure 69. **IGBT**

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)



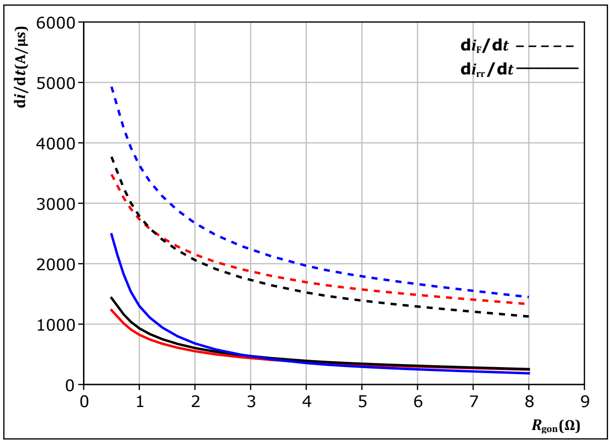
With an inductive load at

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

figure 70. **IGBT**

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})



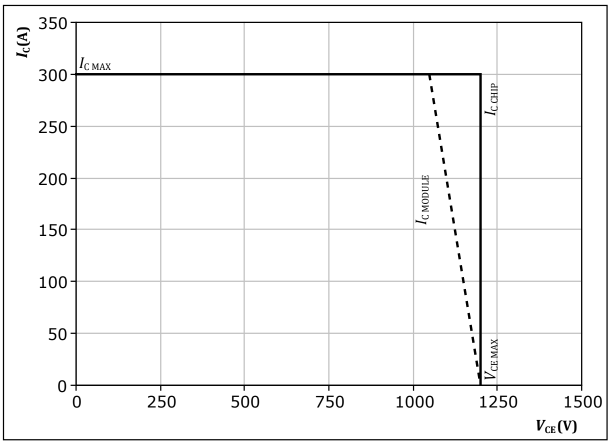
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 71. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})

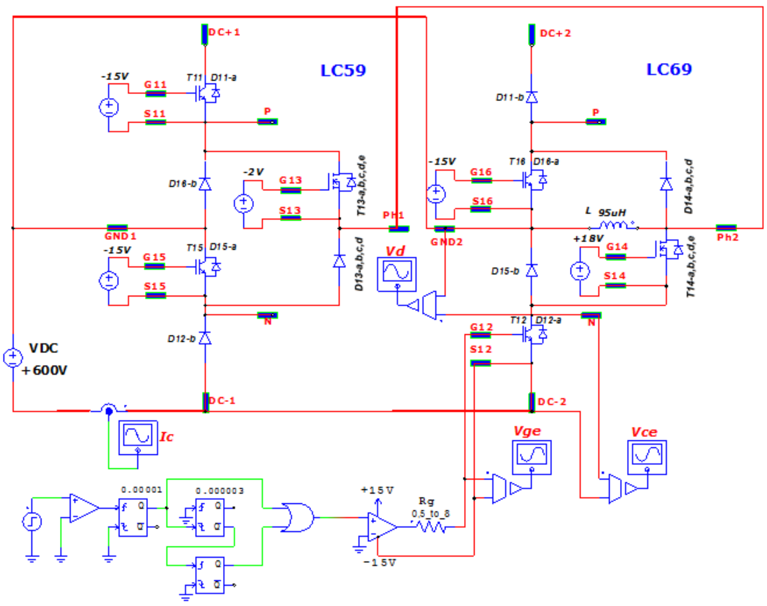


At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

DC-Link Measurement Circuit

figure 1.

DC-LINK SWITCH



Switching Definitions

figure 72. **IGBT**

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

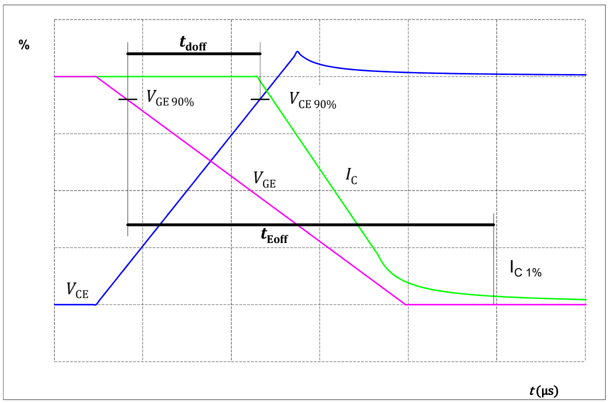


figure 73. **IGBT**

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

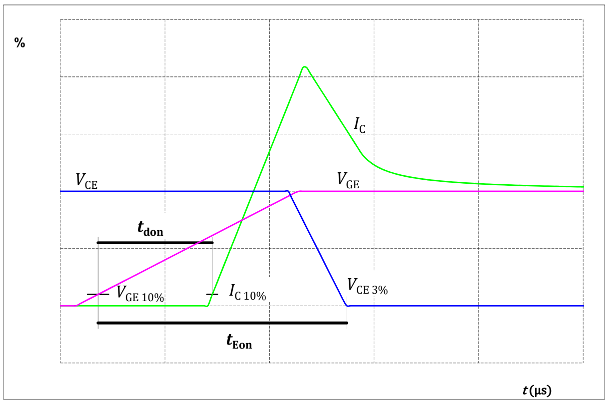


figure 74. **IGBT**

Turn-off Switching Waveforms & definition of t_f

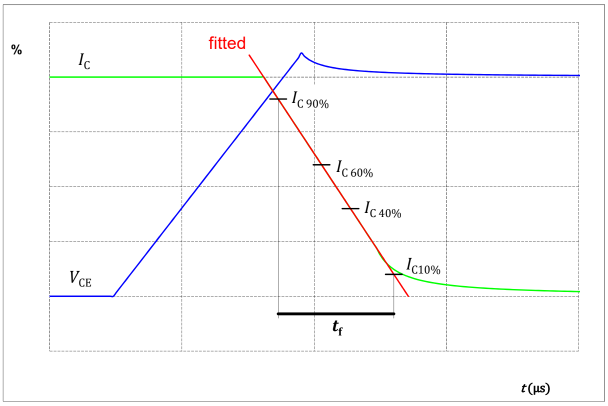
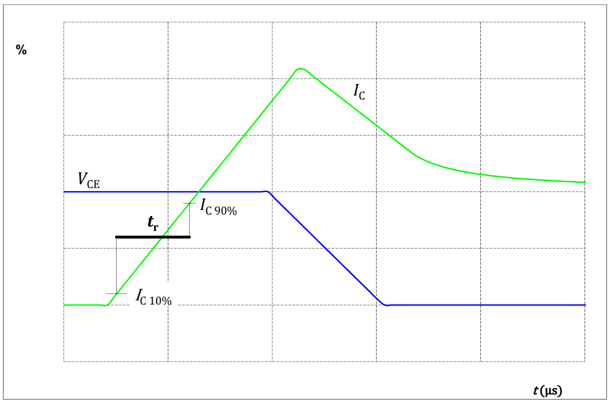


figure 75. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 76.	FWD

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

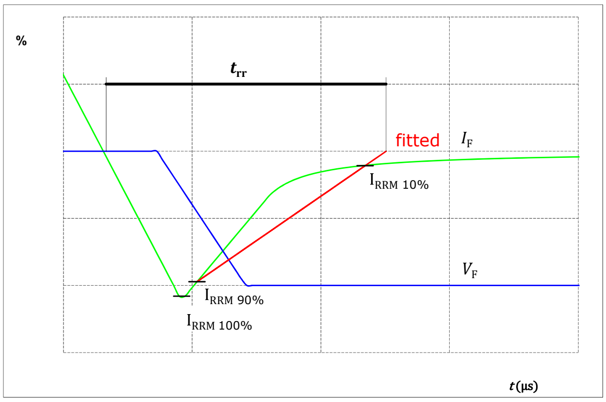
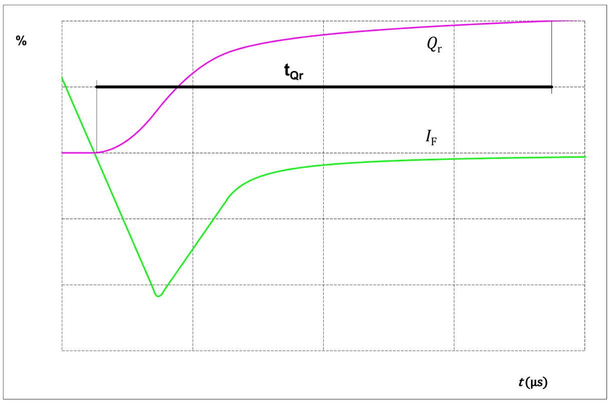


figure 77.	FWD

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



10-PG12NAB008ME-LC59F66T
10-PG12NAC008ME-LC69F66T

datasheet

Ordering Code

Version	Ordering Code
Without thermal paste	10-PG12NAB008ME-LC59F66T
With thermal paste	10-PG12NAB008ME-LC59F66T-/3/

Marking

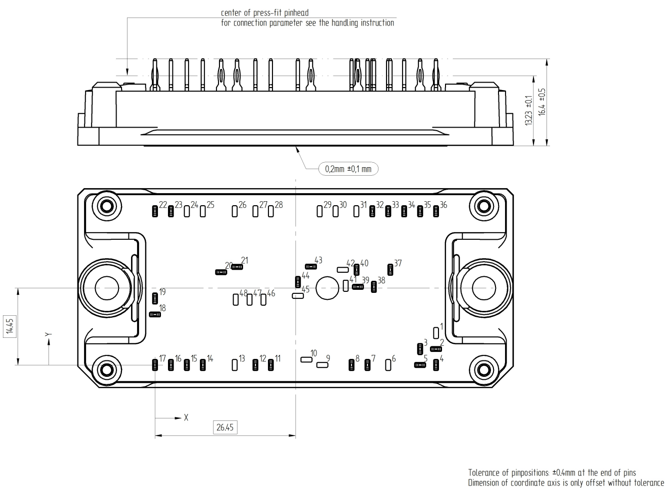
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

High Side Module 10-PG12NAB008ME-LC59F66T

Outline

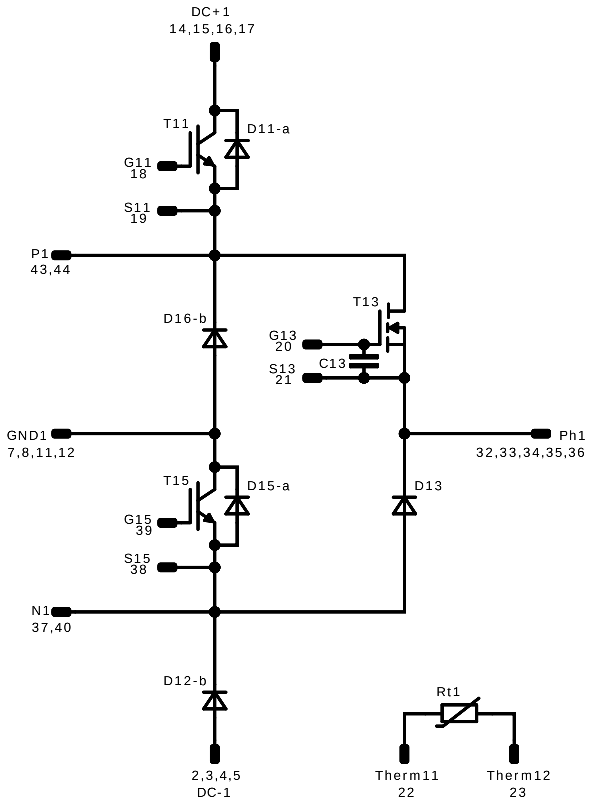
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
1	not assembled			25	not assembled		
2	52,9	3	DC-1	26	not assembled		
3	49,9	3	DC-1	27	not assembled		
4	52,9	0	DC-1	28	not assembled		
5	49,9	0	DC-1	29	not assembled		
6	not assembled			30	not assembled		
7	40	0	GND1	31	not assembled		
8	37	0	GND1	32	40,9	28,9	Ph1
9	not assembled			33	43,9	28,9	Ph1
10	not assembled			34	46,9	28,9	Ph1
11	21,8	0	GND1	35	49,9	28,9	Ph1
12	18,9	0	GND1	36	52,9	28,9	Ph1
13	not assembled			37	44,3	17,9	N1
14	9	0	DC+1	38	41,2	14,7	S15
15	6	0	DC+1	39	38,2	14,7	G15
16	3	0	DC+1	40	37,95	17,9	N1
17	0	0	DC+1	41	not assembled		
18	0	9,5	G11	42	not assembled		
19	0	12,5	S11	43	29,35	18,5	P1
20	12,45	17,45	G13	44	26,9	15,6	P1
21	15,45	18,45	S13	45	not assembled		
22	0	28,9	Therm11	46	not assembled		
23	3	28,9	Therm12	47	not assembled		
24	not assembled			48	not assembled		



High Side Module 10-PG12NAB008ME-LC59F66T

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T13	MOSFET	1200 V	8 mΩ	AC Switch	
D13	FWD	1200 V	60 A	AC Diode	
D16-b	FWD	1200 V	150 A	Neutral Point Diode	
T15	IGBT	1200 V	150 A	Neutral Point Switch	
D12-b	FWD	1200 V	100 A	DC-Link Diode	
D15-a	FWD	1200 V	15 A	Neutral Point Switch Prot. Diode	
T11	IGBT	1200 V	150 A	DC-Link Switch	
D11-a	FWD	1200 V	100 A	DC-Link Switch Prot. Diode	
C13	Capacitor	25 V		Capacitor (GS)	
Rt1	Thermistor			Thermistor	

Ordering Code

Version	Ordering Code
Without thermal paste	10-PG12NAC008ME-LC69F66T
With thermal paste	10-PG12NAC008ME-LC69F66T-/3/

Marking

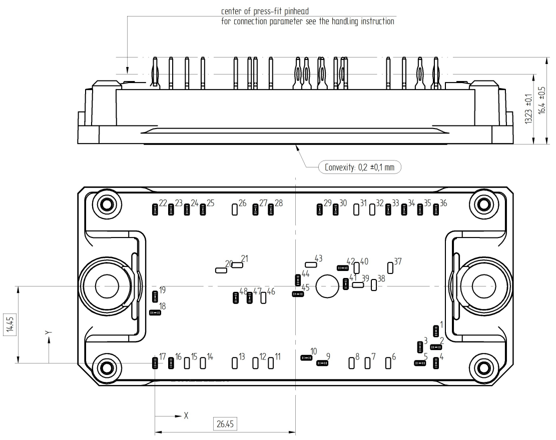
	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Low Side Module 10-PG12NAC008ME-LC69F66T

Outline

Pin table [mm]

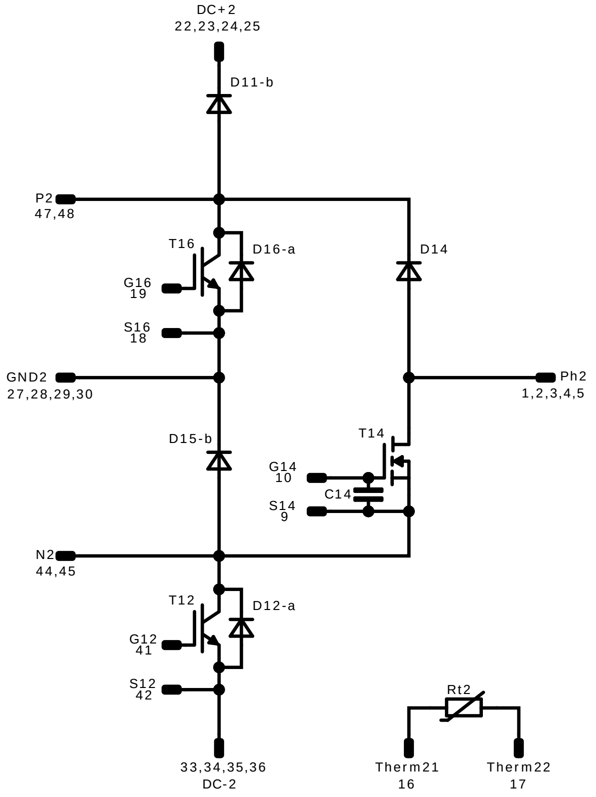
Pin	X	Y	Function	Pin	X	Y	Function
1	52,9	6	Ph2	25	9	28,9	DC+2
2	52,9	3	Ph2	26	not assembled		
3	49,9	3	Ph2	27	18,9	28,9	GND2
4	52,9	0	Ph2	28	21,8	28,9	GND2
5	49,9	0	Ph2	29	31	28,9	GND2
6	not assembled			30	34	28,9	GND2
7	not assembled			31	not assembled		
8	not assembled			32	not assembled		
9	31,5	0	S14	33	43,9	28,9	DC-2
10	28,5	1	G14	34	46,9	28,9	DC-2
11	not assembled			35	49,9	28,9	DC-2
12	not assembled			36	52,9	28,9	DC-2
13	not assembled			37	not assembled		
14	not assembled			38	not assembled		
15	not assembled			39	not assembled		
16	3	0	Therm21	40	not assembled		
17	0	0	Therm22	41	35,9	14,9	G12
18	0	9,5	S16	42	35,35	17,9	S12
19	0	12,5	G16	43	not assembled		
20	not assembled			44	26,9	15,6	N2
21	not assembled			45	26,9	13	N2
22	0	28,9	DC+2	46	not assembled		
23	3	28,9	DC+2	47	17,8	12,3	P2
24	6	28,9	DC+2	48	15,2	12,3	P2



Tolerance of pinpositions ±0,4mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Low Side Module 10-PG12NAC008ME-LC69F66T

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T14	MOSFET	1200 V	8 mΩ	AC Switch	
D14	FWD	1200 V	60 A	AC Diode	
T16	IGBT	1200 V	150 A	Neutral Point Switch	
D11-b	FWD	1200 V	100 A	DC-Link Diode	
D16-a	FWD	1200 V	15 A	Neutral Point Switch Prot. Diode	
T12	IGBT	1200 V	150 A	DC-Link Switch	
D15-b	FWD	1200 V	150 A	Neutral Point Diode	
D12-a	FWD	1200 V	100 A	DC-Link Switch Prot. Diode	
C14	Capacitor	25 V		Capacitor (GS)	
Rt2	Thermistor			Thermistor	

Vincotech

10-PG12NAB008ME-LC59F66T
10-PG12NAC008ME-LC69F66T

datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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
10-PG12NAx008ME-LCx9F66T-D1-14	29 Sep. 2020		