10-FE06PPA020SJ-LJ01B08Z

datasheet

***flow*PIM 1 + PFC** | **600 V / 20 A**

Topology features

- 3x Shunts
- Converter + 2-leg interleaved PFC + Inverter
- On-board Capacitors
- Open Emitter configuration
- Temperature sensor

Component features

- 5us short circuit withstand time
- High speed switching
- Low EMI
- Short tail current

Housing features

- Base isolation: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

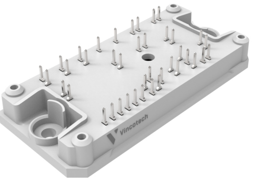
Target applications

- Embedded Drives
- Industrial Drives

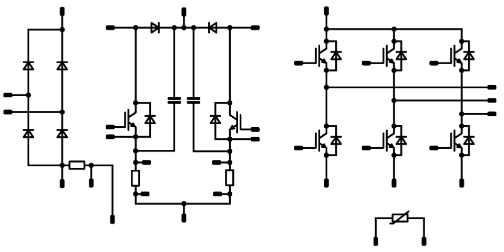
Types

- 10-FE06PPA020SJ-LJ01B08Z

flow 1 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}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	24	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	57	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 400 V	T_j = 150 °C	5	μs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	30 (1)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	48	W
Maximum junction temperature	T_{jmax}			175	°C

(1) limited by I_{FRM}

Parameter	Symbol	Conditions		Value	Unit
PFC Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	27	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	25	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	48	W
Maximum junction temperature	T_{jmax}			175	°C
PFC Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	12 (2)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	38	W
Maximum junction temperature	T_{jmax}			175	°C

(2) limited by I_{FRM}

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	50	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	270	A
Surge current capability	I^2t			365	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	64	W
Maximum junction temperature	T_{jmax}			150	°C
PFC Shunt					
DC current	I			20	A
Power dissipation	P_{tot}		T_c = 70 °C	2	W
Operation Temperature	T_{op}			-65 … 170	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Shunt				
DC current	I		20	A
Power dissipation	P_{tot}	T_c = 70 °C	2	W
Operation Temperature	T_{op}		-65 ... 170	°C
Capacitor (PFC)				
Maximum DC voltage	V_{MAX}		630	V
Operation Temperature	T_{op}		-55 ... 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			>12,7	mm
Clearance			8,18	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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00028	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150		1,83 2,06 2,12	1,8(3)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			100	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		700		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		24		pF
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,67		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	350	20	25 125 150		60,32 59,2 59,36		ns
Rise time	t_r	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	350	20	25 125 150		30,08 31,2 31,2		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	350	20	25 125 150		86,88 107,36 111,84		ns
Fall time	t_f	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	350	20	25 125 150		22,21 38,32 43,74		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,559 µC Q_{rFWD}=1,21 µC Q_{rFWD}=1,48 µC	±15	350	20	25 125 150		0,414 0,55 0,588		mWs
Turn-off energy (per pulse)	E_{off}		±15	350	20	25 125 150		0,229 0,369 0,403		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				15	25 125 150	1,25	1,76 1,66 1,61	1,95(3)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,99		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=537 A/µs d*i*/d*t*=702 A/µs d*i*/d*t*=573 A/µs	±15	350	20	25 125 150		6,64 9,71 10,67		A
Reverse recovery time	t_{rr}					25 125 150		198,64 271,14 309,91		ns
Recovered charge	Q_r					25 125 150		0,559 1,21 1,48		µC
Reverse recovered energy	E_{rec}					25 125 150		0,138 0,303 0,378		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		30,78 67,04 68,48		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
PFC Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0002	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150		1,54 1,69 1,74	2,22[3]	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		1200		pF
Output capacitance	C_{oes}							30		pF
Reverse transfer capacitance	C_{res}							5		pF
Gate charge	Q_g	V_{CC} = 520 V	15		20	25		48		nC
Thermal										
Thermal resistance junction to sink[4]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,7		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	400	20	25 125 150		17 19 13		ns
Rise time	t_r					25 125 150		9 11 9		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		99 115 120		ns
Fall time	t_f					25 125 150		8,08 13,64 10,32		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,307 µC Q_{rFWD}=0,491 µC Q_{rFWD}=0,612 µC				25 125 150		0,315 0,36 0,47		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,064 0,146 0,11		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
PFC Diode										
Static										
Forward voltage	V_F				20	25 125 150		1,81 1,8 1,76	2,22[3]	V
Reverse leakage current	I_R	V_r = 650 V				25			1,28	µA
Thermal										
Thermal resistance junction to sink[4]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,96		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=2664 A/µs di/dt=2094 A/µs di/dt=2443 A/µs	0/15	400	20	25 125 150		15,35 19,92 24		A
Reverse recovery time	t_{rr}					25 125 150		32,73 40,14 41,74		ns
Recovered charge	Q_r					25 125 150		0,307 0,491 0,612		µC
Reverse recovered energy	E_{rec}					25 125 150		0,06 0,109 0,097		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		848,64 985,81 965,97		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
PFC Sw. Protection Diode										
Static										
Forward voltage	V_F				6	25 125 150	1,23	1,72 1,58 1,54	1,87(3)	V
Reverse leakage current	I_R	V_r = 650 V				25			0,1	µA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,53		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,27 1,27	1,3(3) 1,37(3)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			20 1500	µA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,1		K/W
PFC Shunt										
Static										
Resistance	R							5		mΩ
Tolerance							-1		1	%
Temperature coeficient	tc							110		ppm/K

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	
Shunt										
Static										
Resistance	R							5		mΩ
Tolerance							-1		1	%
Temperature coeficient	tc							110		ppm/K
Capacitor (PFC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		33		nF
Tolerance							-5		5	%
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	

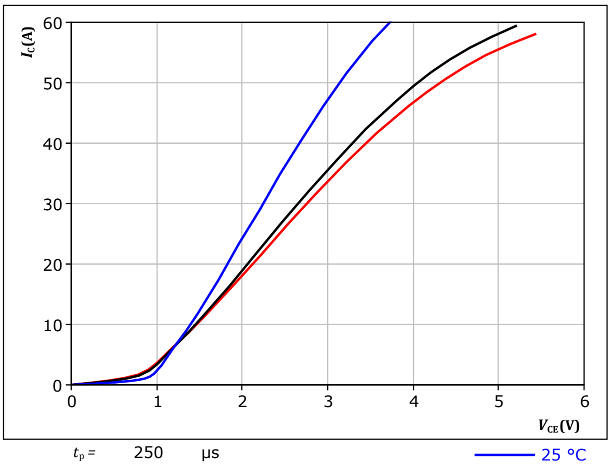
(3) Value at chip level
(4) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

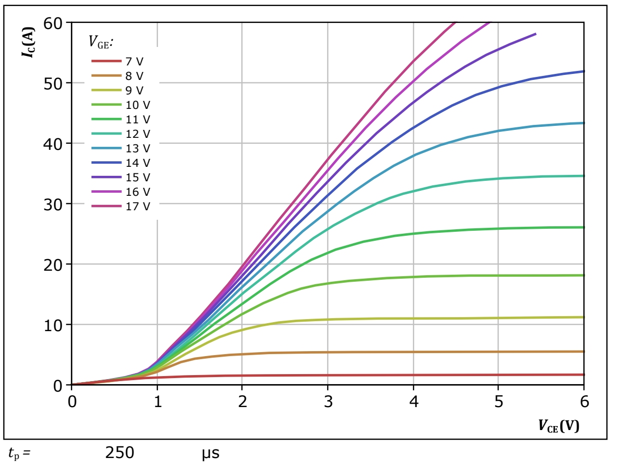


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

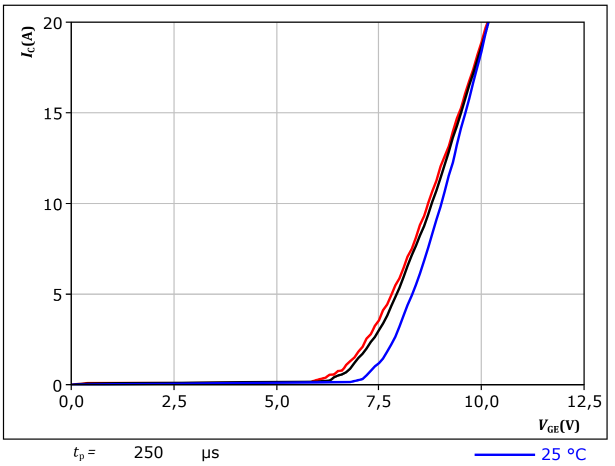


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

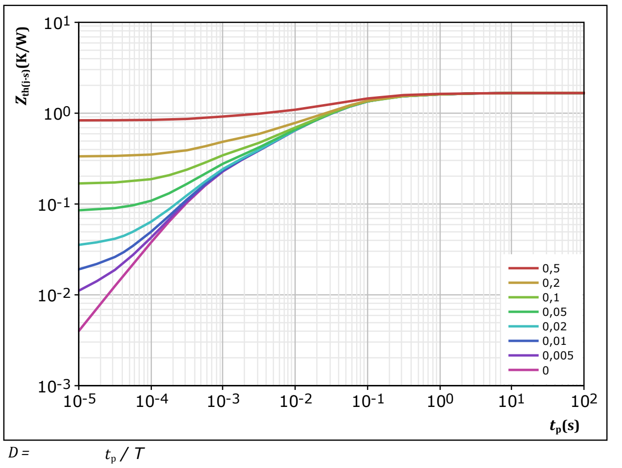


t_p = 250 µs
V_{CE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 1,667 K/W

IGBT thermal model values

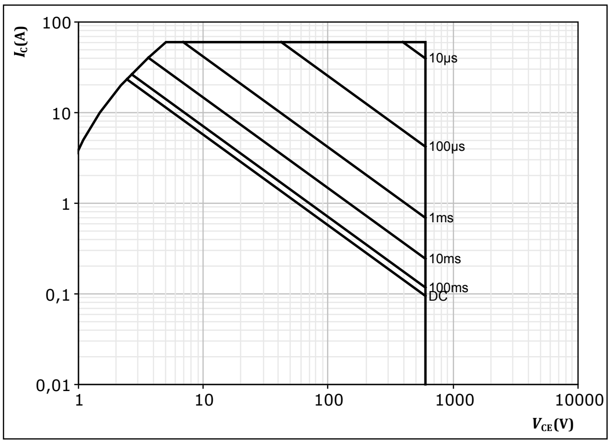
R (K/W)	τ (s)
8,37E-02	1,97E+00
1,98E-01	2,51E-01
7,72E-01	5,06E-02
4,11E-01	7,66E-03
2,02E-01	6,07E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



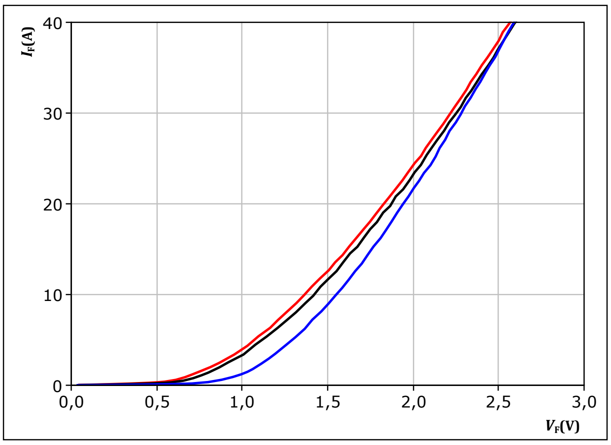
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



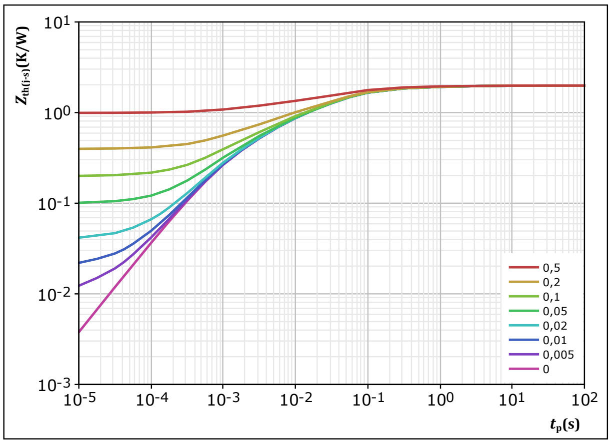
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,985 K/W

FWD thermal model values

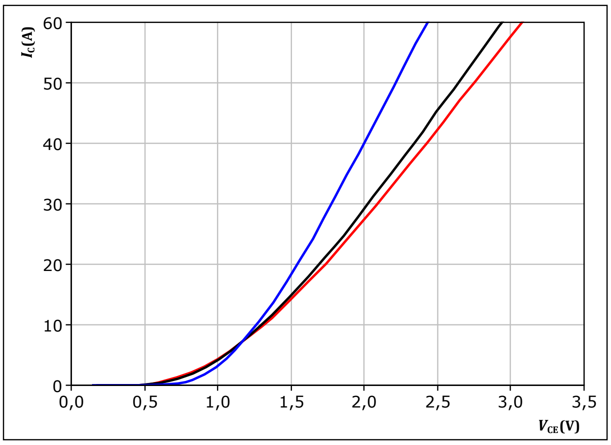
R (K/W)	τ (s)
8,91E-02	2,42E+00
2,69E-01	2,03E-01
8,60E-01	4,06E-02
5,20E-01	6,04E-03
2,47E-01	9,13E-04

PFC Switch Characteristics

figure 8. IGBT

Typical output characteristics

I_C = f(V_{CE})

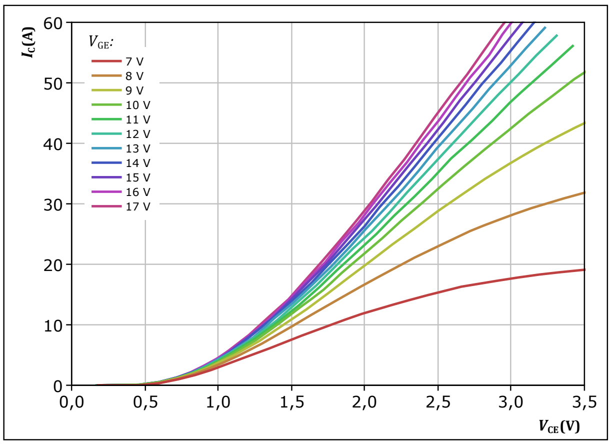


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 9. IGBT

Typical output characteristics

I_C = f(V_{CE})



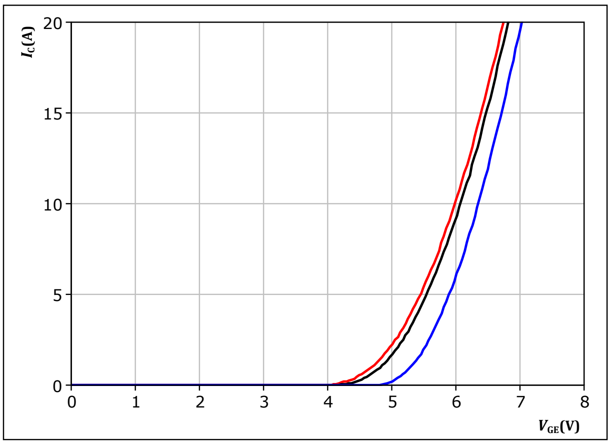
t_p =	250	µs
T_j =	150	°C

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

figure 10. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

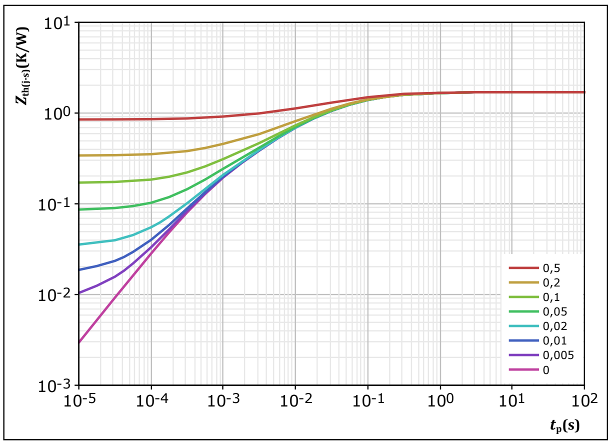


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 11. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,698	K/W

IGBT thermal model values

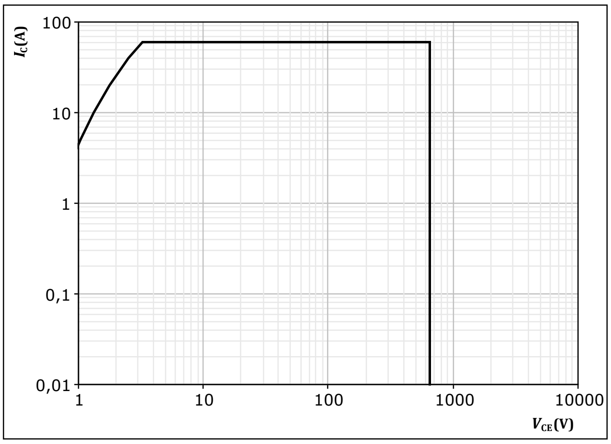
R (K/W)	τ (s)
1,45E-01	7,07E-01
5,50E-01	8,69E-02
5,51E-01	2,05E-02
3,26E-01	4,56E-03
1,26E-01	6,55E-04

PFC Switch Characteristics

figure 12.	IGBT

Safe operating area

I_C = f(V_{CE})



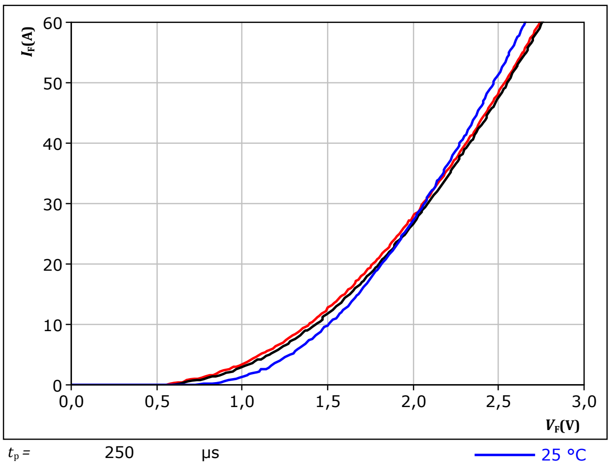
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



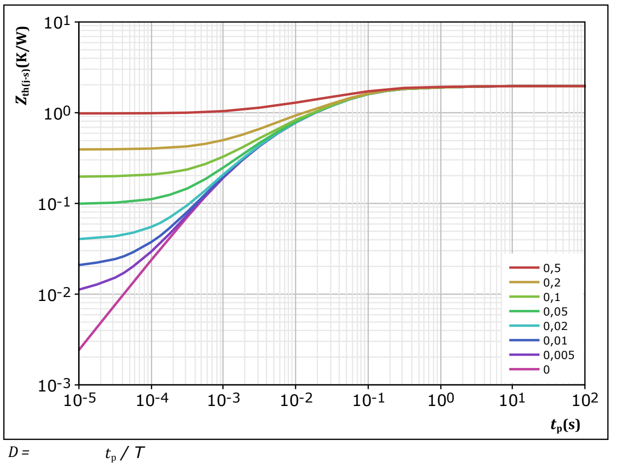
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,964 K/W

FWD thermal model values

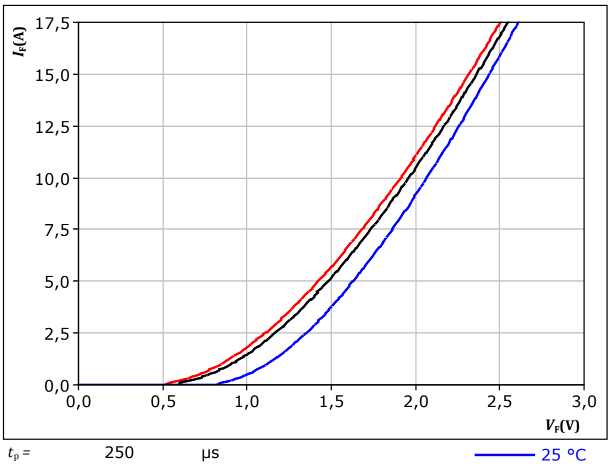
R (K/W)	τ (s)
1,07E-01	1,92E+00
3,62E-01	1,49E-01
7,68E-01	4,26E-02
5,43E-01	7,00E-03
1,84E-01	1,27E-03

PFC Sw. Protection Diode Characteristics

figure 15. FWD

Typical forward characteristics

$I_F = f(V_F)$



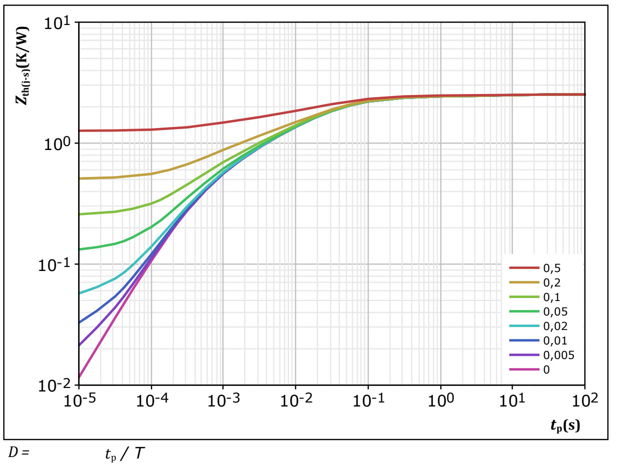
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,527 K/W

FWD thermal model values

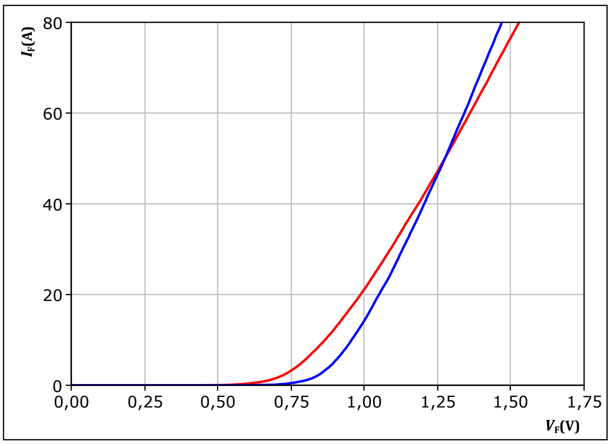
R (K/W)	τ (s)
9,24E-02	9,29E+00
1,75E-01	3,21E-01
7,31E-01	4,97E-02
7,14E-01	1,16E-02
4,89E-01	2,11E-03
3,27E-01	3,78E-04

Rectifier Diode Characteristics

figure 17. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



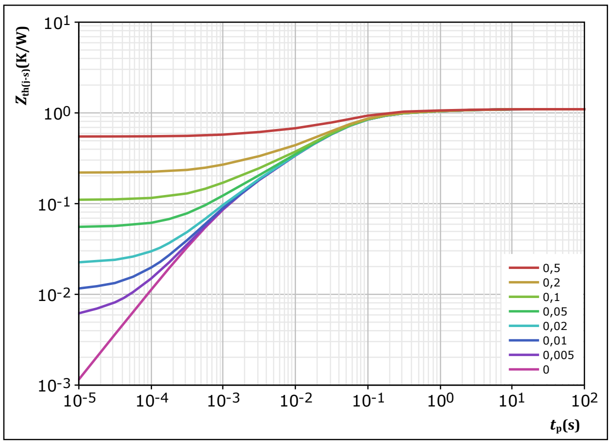
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 18. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,098 K/W

Rectifier thermal model values

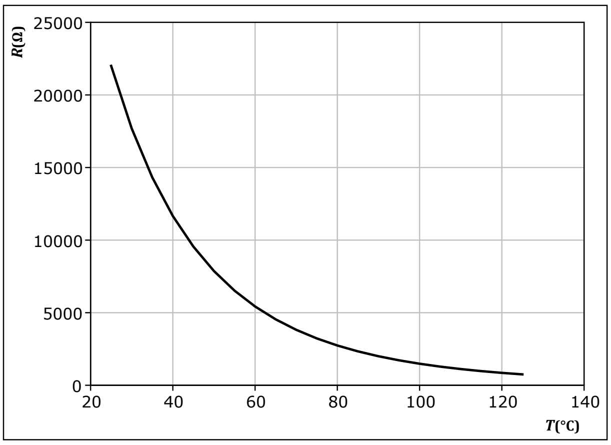
R (K/W)	τ (s)
4,35E-02	3,78E+00
9,34E-02	6,17E-01
3,79E-01	8,75E-02
3,82E-01	2,72E-02
1,24E-01	5,56E-03
7,66E-02	1,02E-03

Thermistor Characteristics

figure 19. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

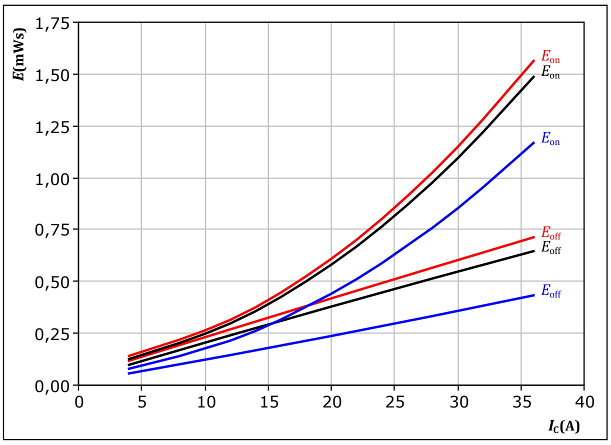


Inverter Switching Characteristics

figure 20. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



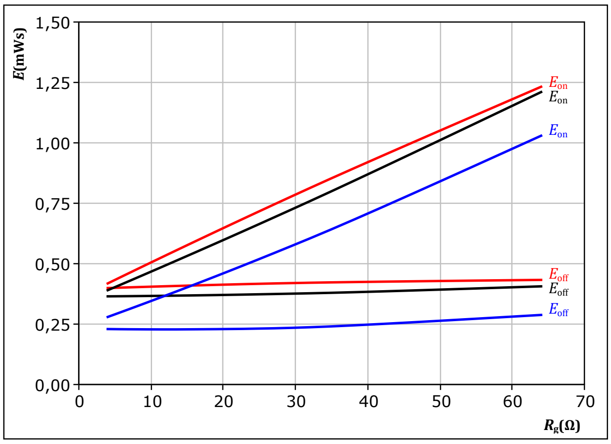
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 21. **IGBT**

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

E = f(R_g)



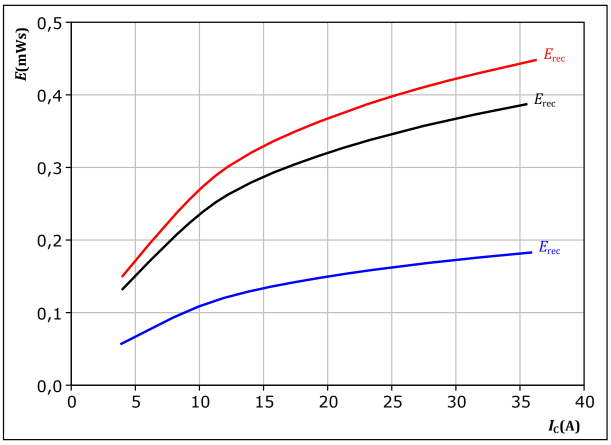
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

figure 22. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



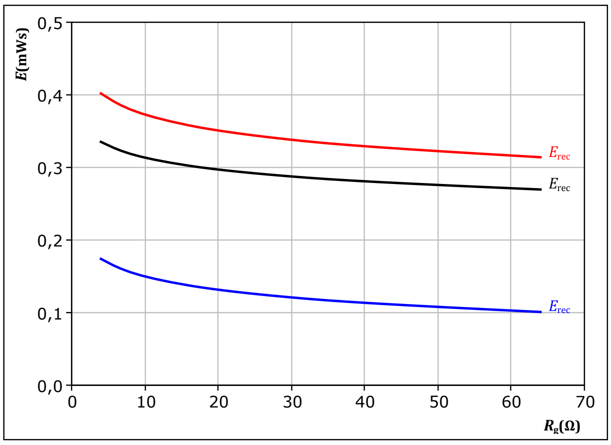
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 23. **FWD**

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

E_{rec} = f(R_g)



With an inductive load at

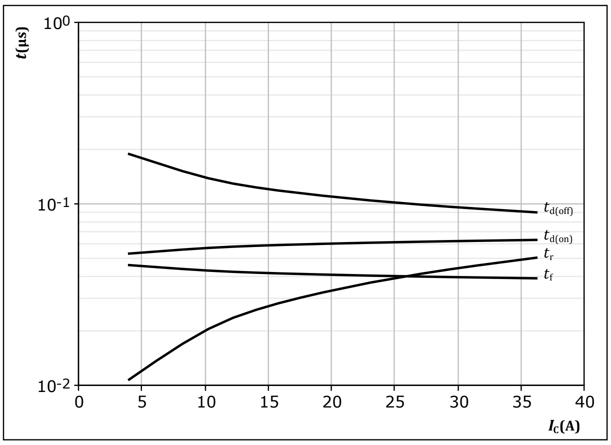
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

Inverter Switching Characteristics

figure 24. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



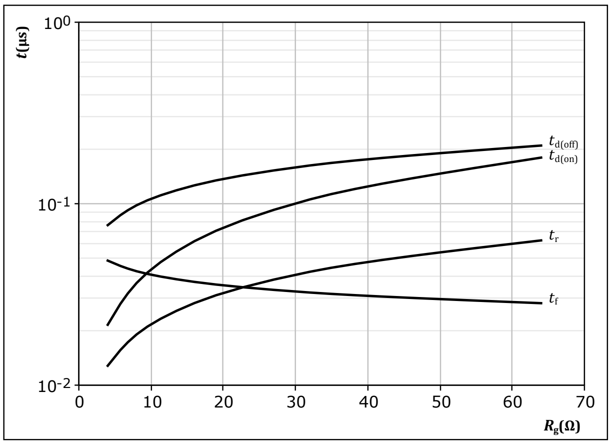
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 25. **IGBT**

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

$t = f(R_g)$



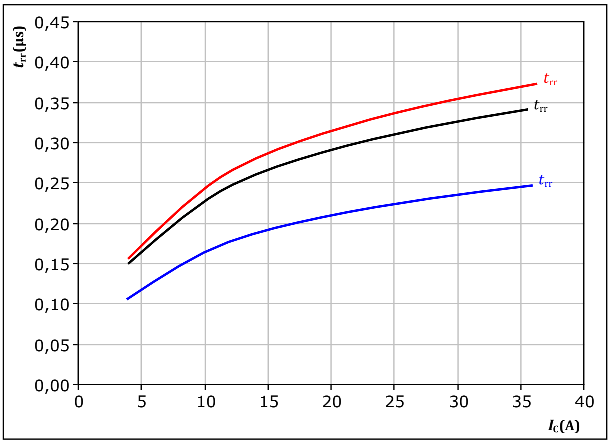
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	20	A

figure 26. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

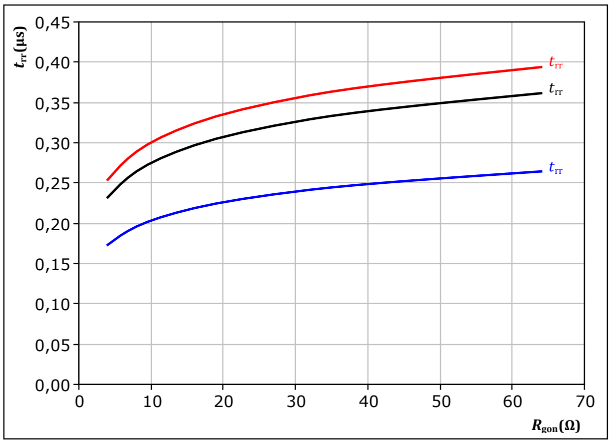
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 27. **FWD**

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

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



With an inductive load at

V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	20	A

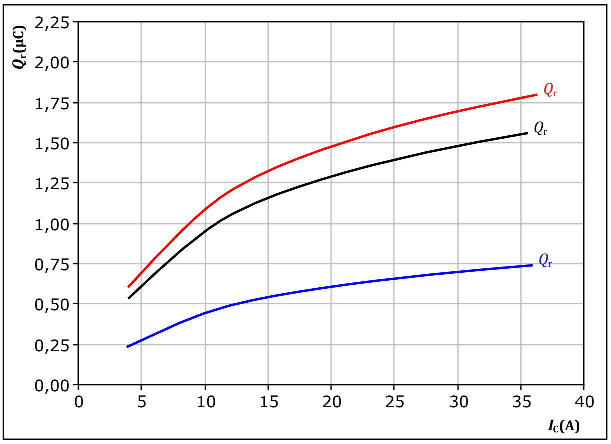
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 28. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



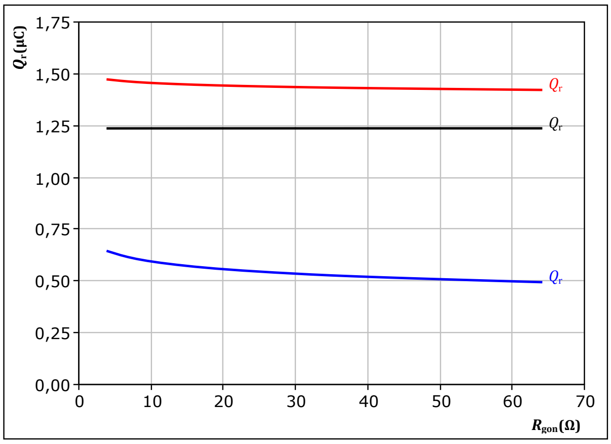
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 29. **FWD**

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

Q_r = f(R_{gon})



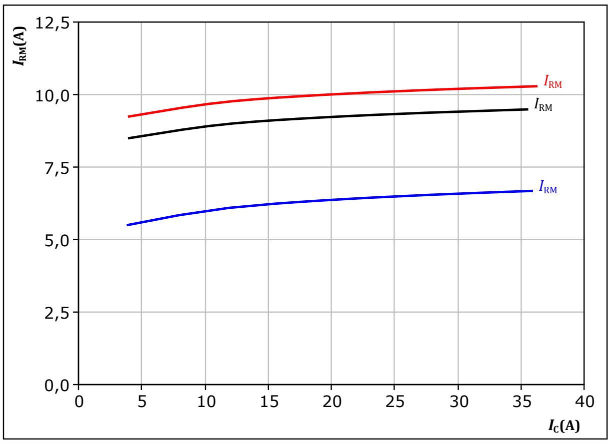
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

figure 30. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



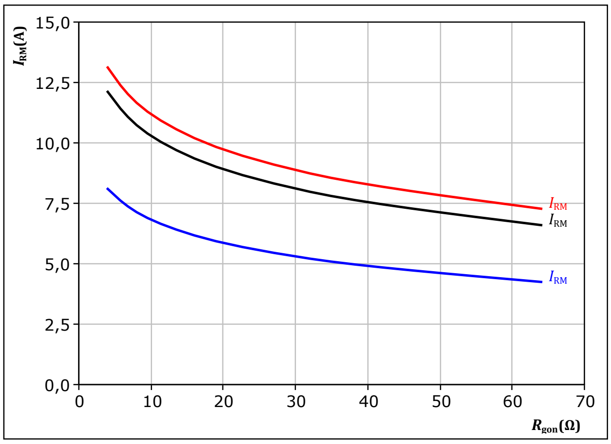
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 31. **FWD**

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

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



With an inductive load at

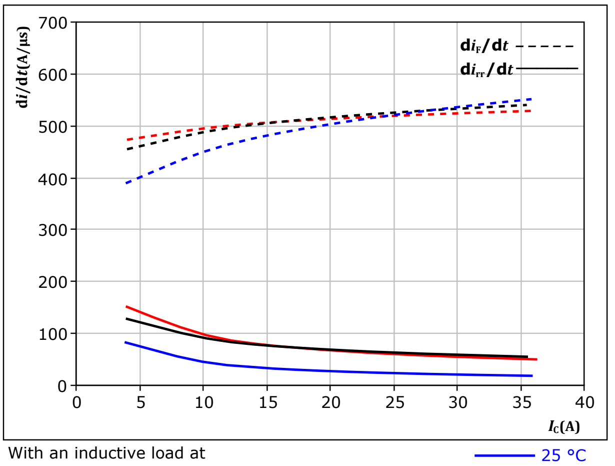
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

Inverter Switching Characteristics

figure 32. **FWD**

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

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



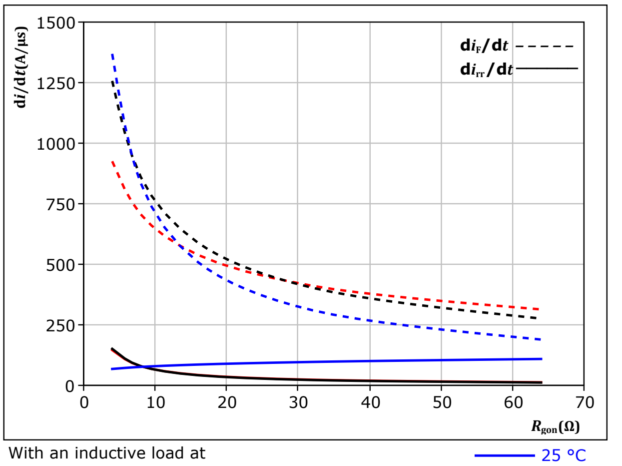
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 33. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor

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



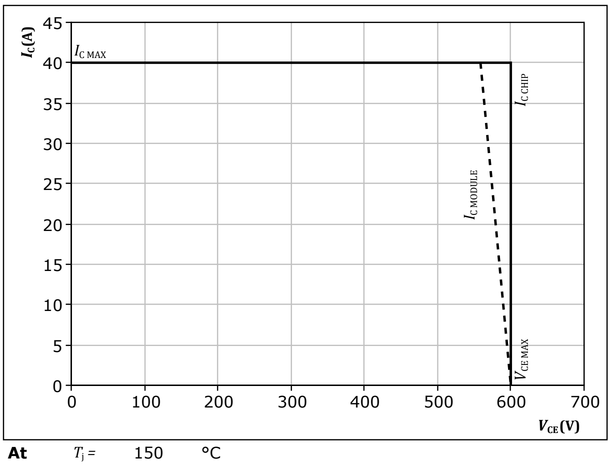
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

figure 34. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



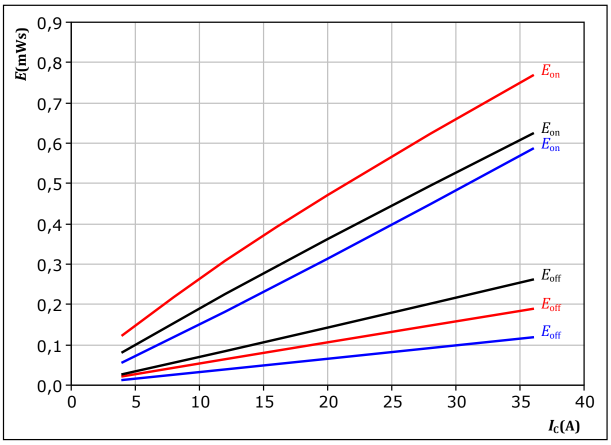
At	T_j =	150	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

PFC Switching Characteristics

figure 35.	**IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



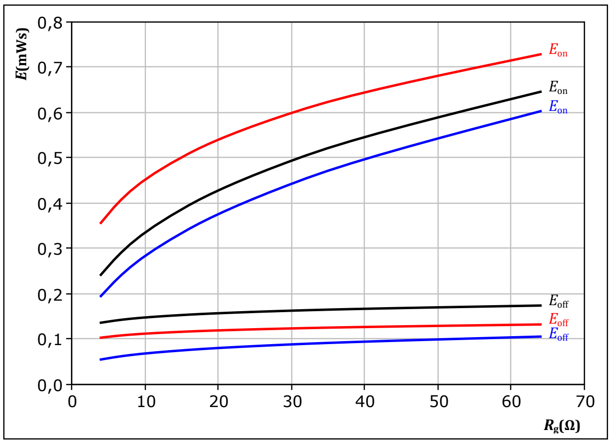
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 36.	**IGBT**

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

E = f(R_g)



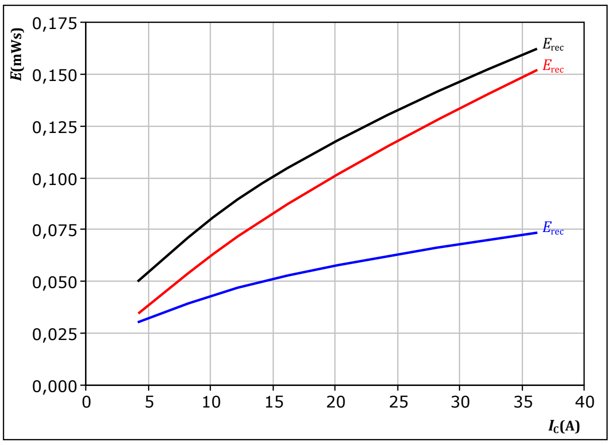
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	20	A		150 °C

figure 37.	**FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



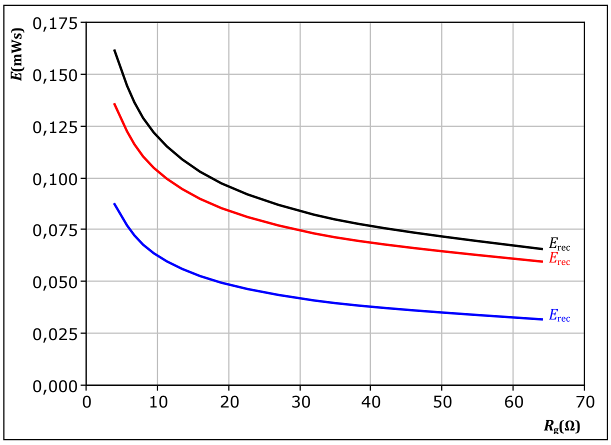
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 38.	**FWD**

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

E_{rec} = f(R_g)



With an inductive load at

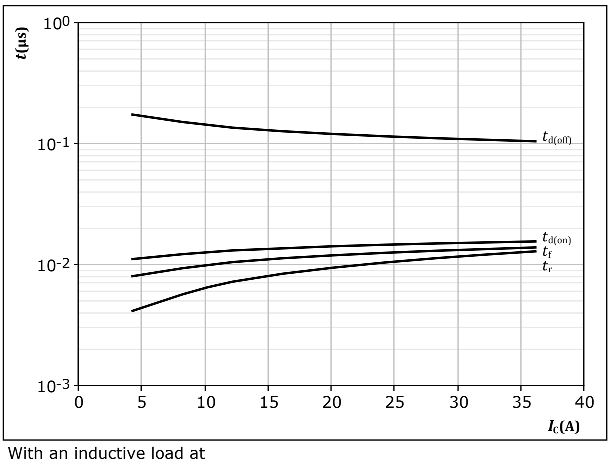
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	20	A		150 °C

PFC Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



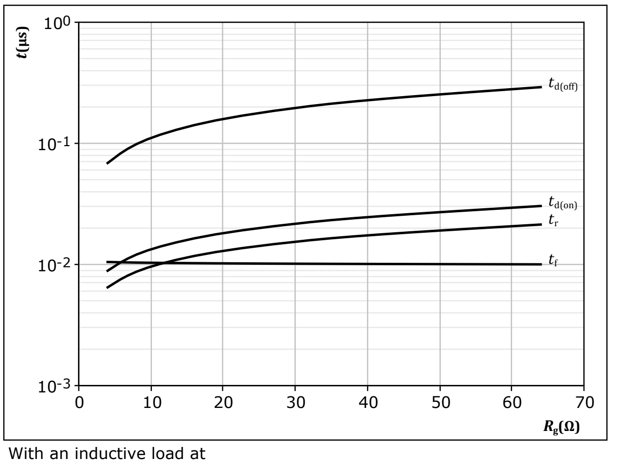
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 40. **IGBT**

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

$t = f(R_g)$



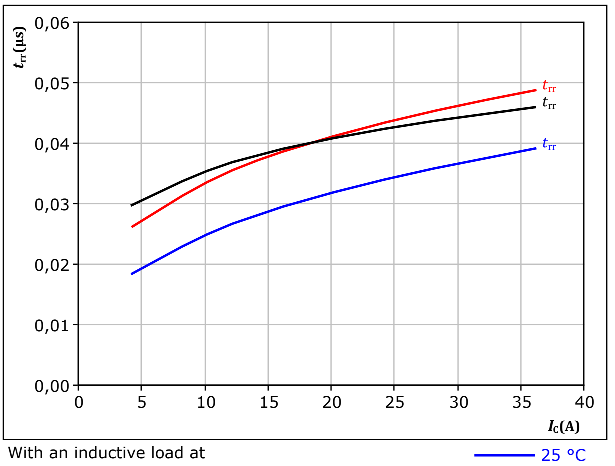
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	20	A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

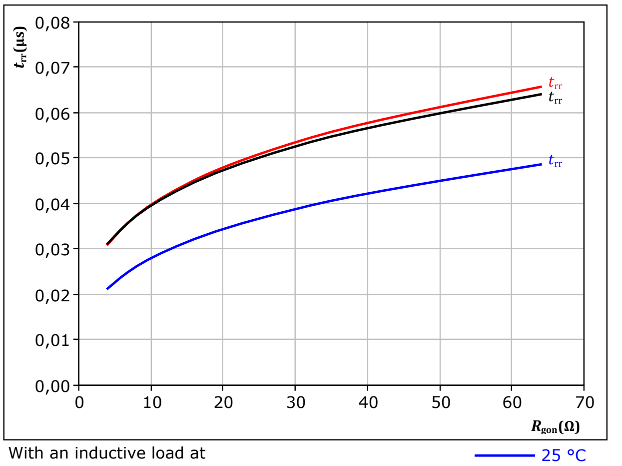
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 42. **FWD**

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

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



With an inductive load at

V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	20	A

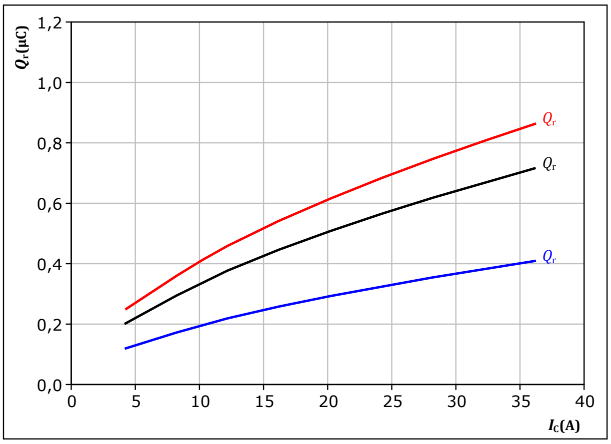
T_j: 25 °C, 125 °C, 150 °C

PFC Switching Characteristics

figure 43. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



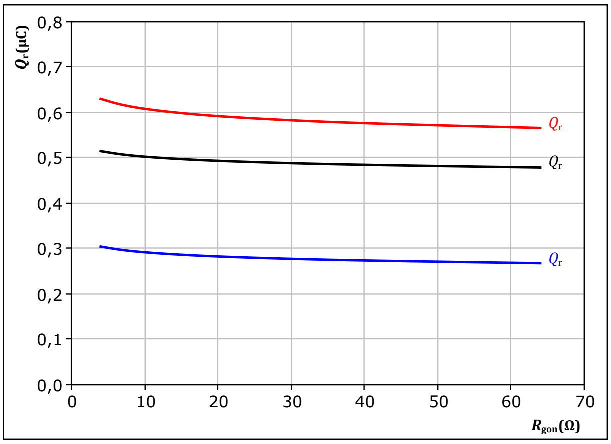
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 44. FWD

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

Q_r = f(R_{gon})



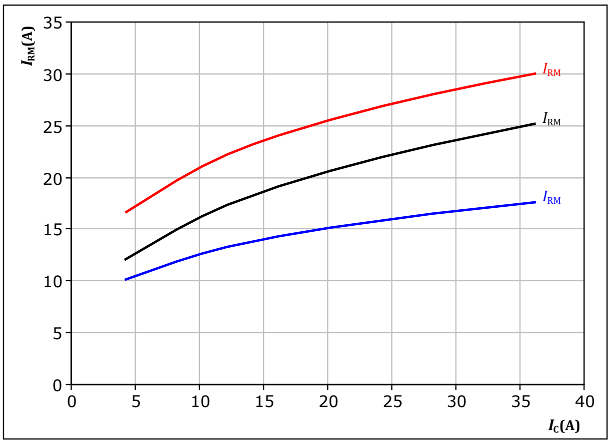
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	20	A		150 °C

figure 45. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



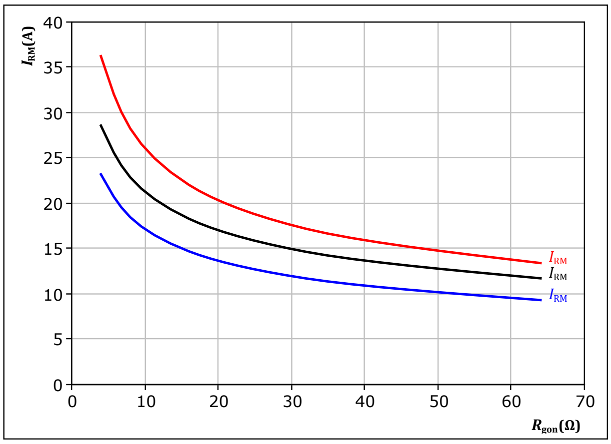
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 46. FWD

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

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



With an inductive load at

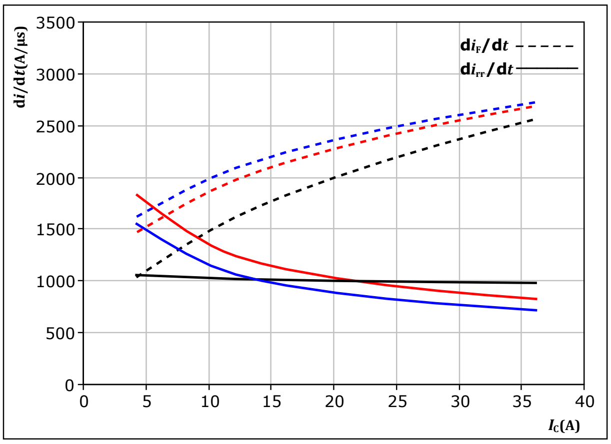
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	20	A		150 °C

PFC Switching Characteristics

figure 47. **FWD**

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

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



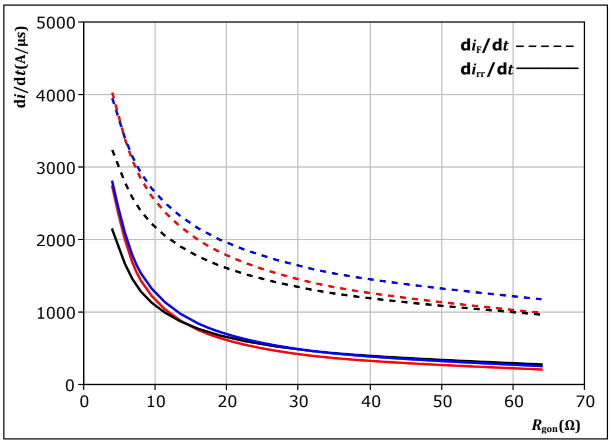
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 48. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor

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



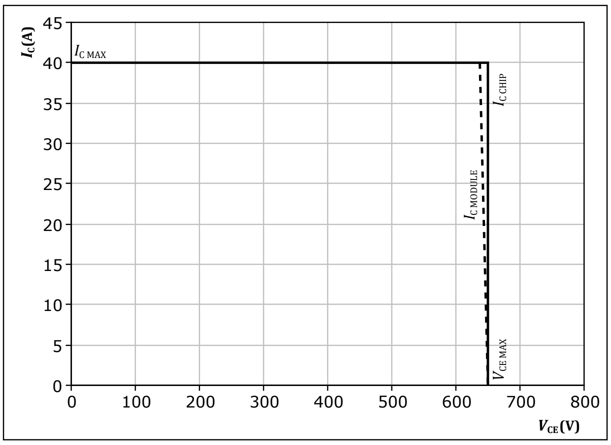
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	20	A		150 °C

figure 49. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Switching Definitions

figure 50. **IGBT**

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

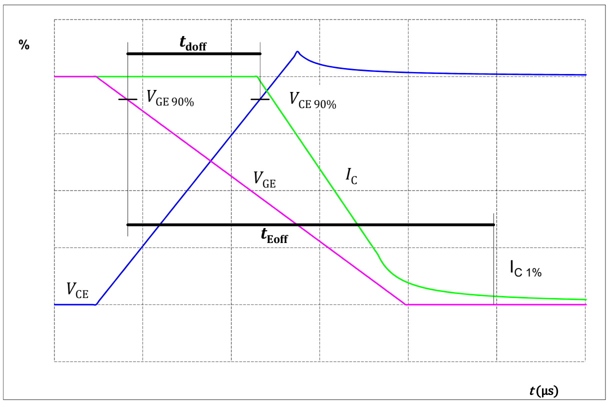


figure 51. **IGBT**

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

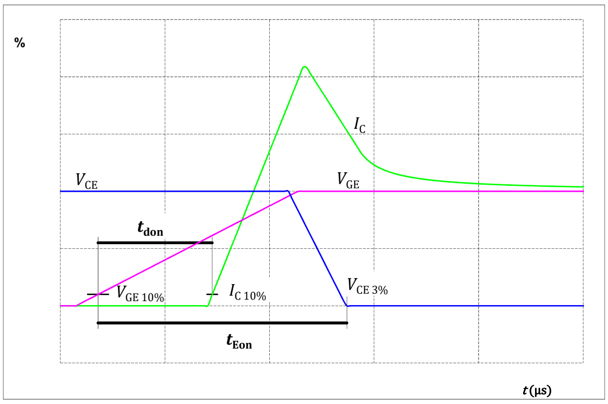


figure 52. **IGBT**

Turn-off Switching Waveforms & definition of t_f

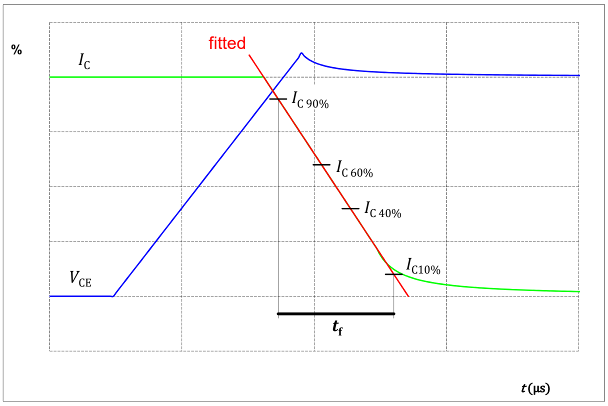
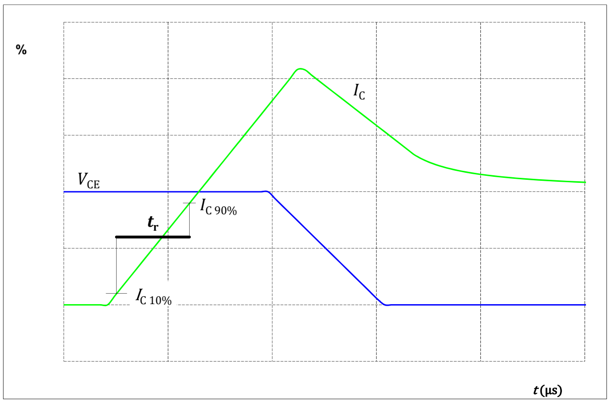


figure 53. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 54. **FWD**

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

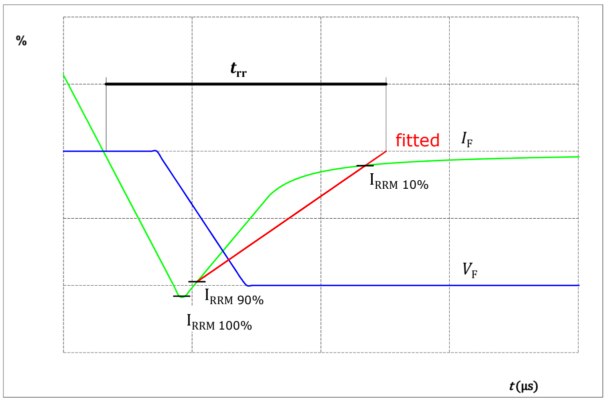
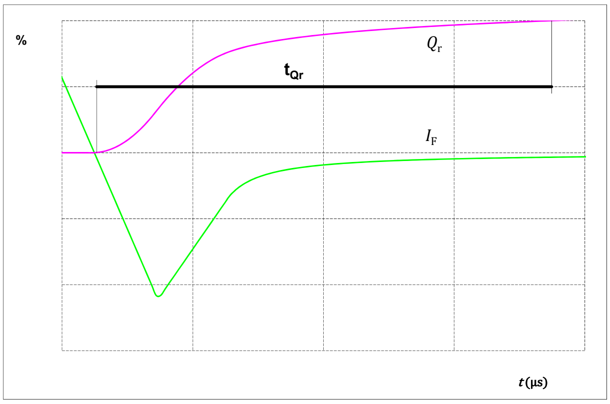


figure 55. **FWD**

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



Ordering Code

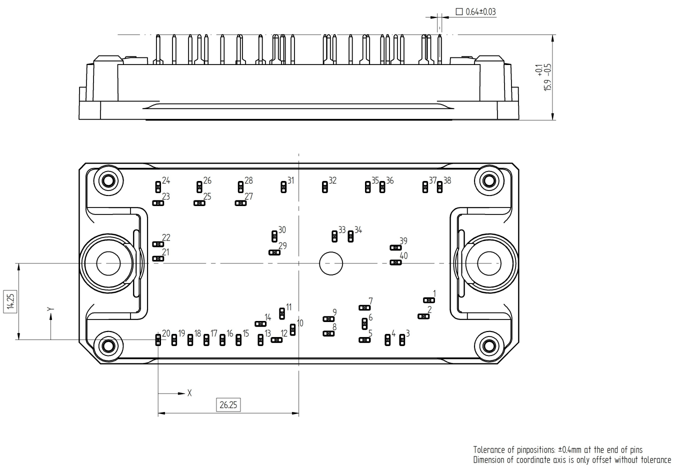
Version	Ordering Code
Without thermal paste	10-FE06PPA020SJ-LJ01B08Z
With thermal paste (5,2 W/mK, PTM6000HV)	10-FE06PPA020SJ-LJ01B08Z-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FE06PPA020SJ-LJ01B08Z-/3/

Marking

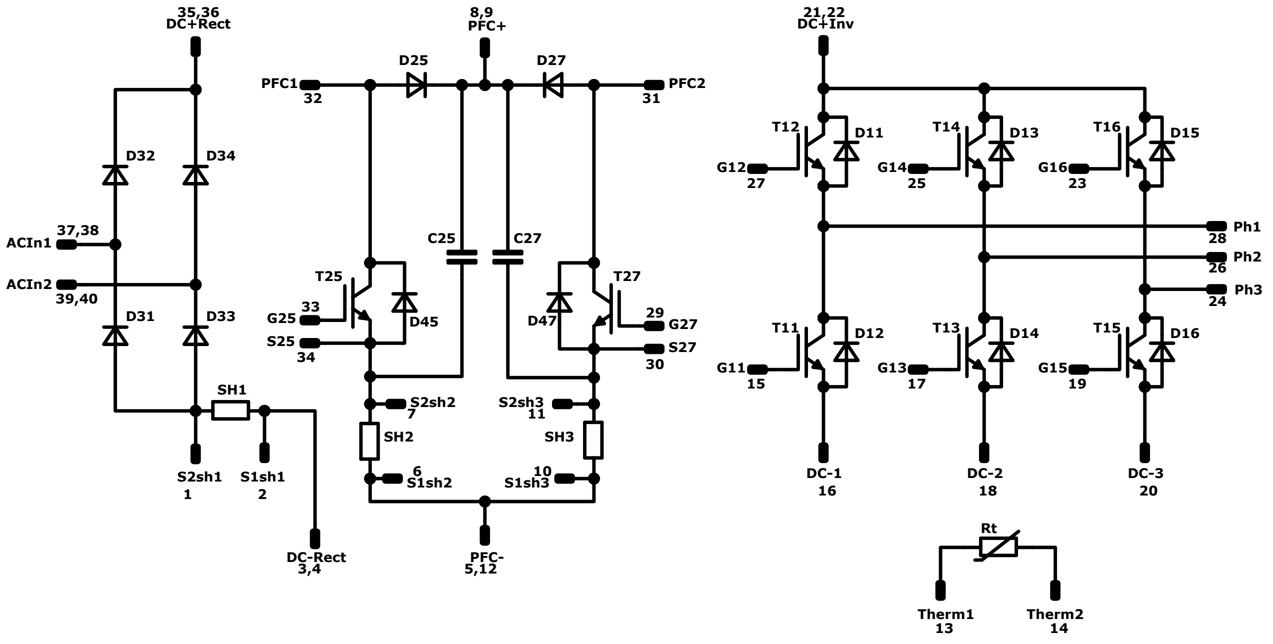
	**Text**	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
		NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	50,5	7,4	S2sh1
2	49,5	4,4	S1sh1
3	45,5	0	DC-Rect
4	42,8	0	DC-Rect
5	38,5	0	PFC-
6	38,5	3	S1sh2
7	38,5	6	S2sh2
8	31,8	1,2	PFC+
9	31,8	3,9	PFC+
10	25,1	1,9	S1sh3
11	23,1	4,9	S2sh3
12	22,1	0	PFC-
13	19,1	0	Therm1
14	19,1	3	Therm2
15	15	0	G11
16	12	0	DC-1
17	9	0	G13
18	6	0	DC-2
19	3	0	G15
20	0	0	DC-3
21	0	15,15	DC+Inv
22	0	17,85	DC+Inv
23	0	25,5	G16
24	0	28,5	Ph3
25	7,7	25,5	G14
26	7,7	28,5	Ph2
27	15,4	25,5	G12
28	15,4	28,5	Ph1
29	21,7	16,3	G27
30	21,7	19,3	S27
31	23,4	28,5	PFC2
32	31,1	28,5	PFC1
33	32,9	19,3	G25
34	35,9	19,3	S25
35	39,1	28,5	DC+Rect
36	41,8	28,5	DC+Rect
37	49,8	28,5	ACIn1
38	52,5	28,5	ACIn1
39	44,3	17,2	ACIn2
40	44,3	14,45	ACIn2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	20 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	15 A	Inverter Diode	
T25, T27	IGBT	650 V	20 A	PFC Switch	
D25, D27	FWD	650 V	20 A	PFC Diode	
D45, D47	FWD	650 V	6 A	PFC Sw. Protection Diode	
D31, D32, D33, D34	Rectifier	1600 V	31 A	Rectifier Diode	
SH1	Shunt			PFC Shunt	
SH2, SH3	Shunt			Shunt	
C25, C27	Capacitor	630 V		Capacitor (PFC)	
Rt	Thermistor			Thermistor	

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.

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