

## LLC Current Resonant Mode Controller ICs **MCZ5207SG**

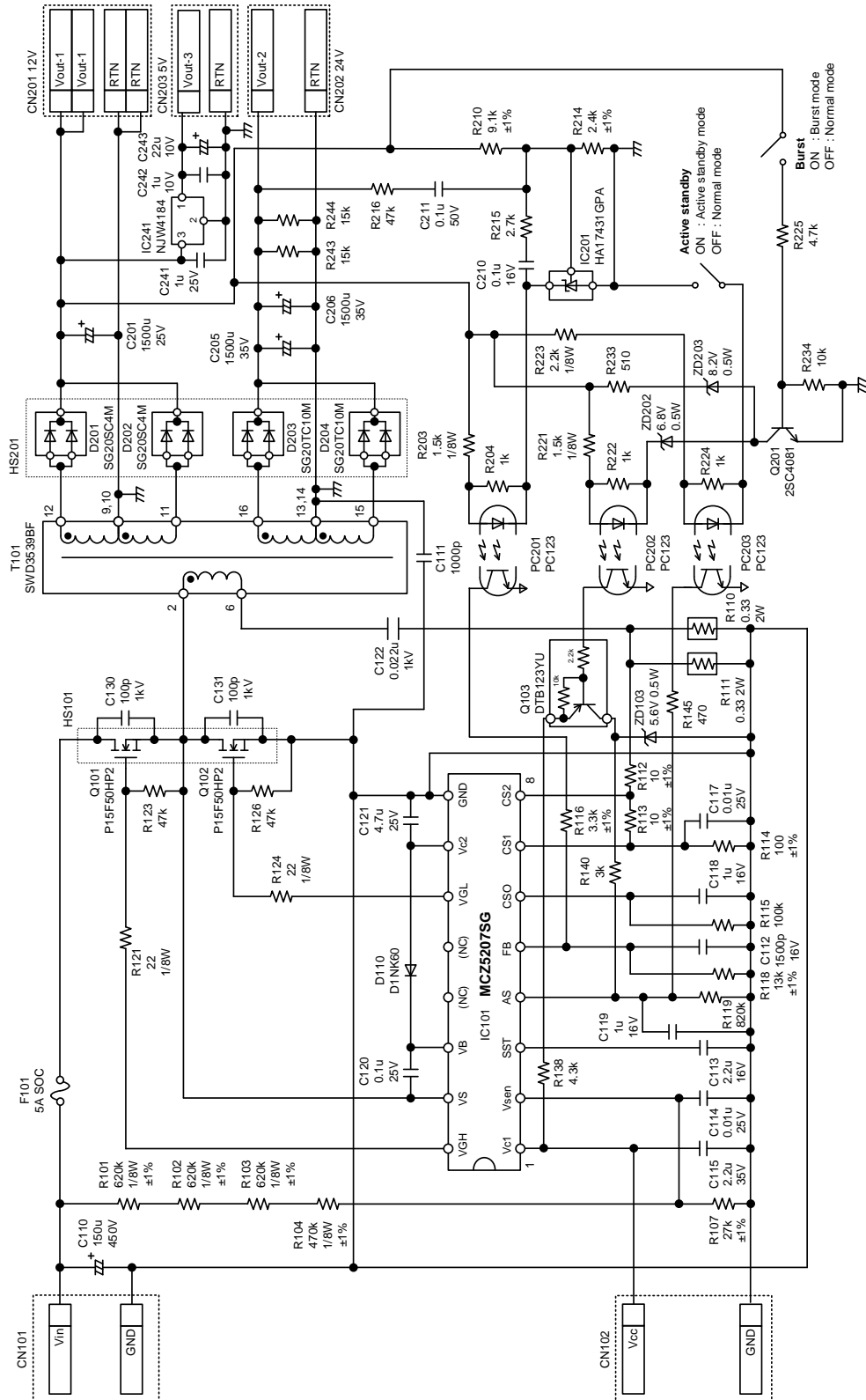
**Input voltage : DC 360 ~ 420V**

Output	Voltage [V]	Output Current [A]		
		min	typ	max
1	+12	0.0	4.5	5.0
2	+24	0.0	4.0	6.0
3	+5V	0.025	0.025	0.025
Total Power [W]		0.1	150.1	204.1

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Reference circuit diagram



**Bill Of Material**

No.	Type	Qt'y	Spec	Model Name	Vendor	Remarks
F101	Fuse	1	5A			-
T101	LLC Transformer	1		SWD3539BF	TAMURA	-
IC101	Control IC	1		MCZ5207SG	SHINDENGEN	-
IC201	Shunt Regulator	1		HA17431GPA	RENESAS	-
IC241	Low Drop Out Regulator	1		NJW4184	JRC	-
PC201	Opto Coupler	1		PC123	SHARP	-
PC202	Opto Coupler	1		PC123	SHARP	-
PC203	Opto Coupler	1		PC123	SHARP	-
Q101	Power MOSFET	1	500V 15A	P15F50HP2	SHINDENGEN	-
Q102	Power MOSFET	1	500V 15A	P15F50HP2	SHINDENGEN	-
Q103	Digital Transistor	1		DTB123YU	ROHM	-
Q201	Small Signal BJT(NPN)	1		2SC4081	ROHM	-
D110	FRD	1	600V 0.8A	D1NK60	SHINDENGEN	-
D201	SBD	1	40V 20A	SG20SC4M	SHINDENGEN	-
D202	SBD	1	40V 20A	SG20SC4M	SHINDENGEN	-
D203	SBD	1	100V 20A	SG20TC10M	SHINDENGEN	-
D204	SBD	1	100V 20A	SG20TC10M	SHINDENGEN	-
ZD103	Zenor diode	1	0.5W 5.6V			-
ZD202	Zenor diode	1	0.5W 6.8V			-
ZD203	Zenor diode	1	0.5W 8.2V			-
C110	Electrolytic Capacitor	1	450V 150uF		Rubycon	-
C111	Y-Capacitor	1	AC250V 1000pF			-
C112	MLCC	1	16V 1500pF			-
C113	MLCC	1	16V 2.2uF			-
C114	MLCC	1	25V 0.01uF			-
C115	MLCC	1	35V 2.2uF			-
C117	MLCC	1	25V 0.01uF			-
C118	MLCC	1	16V 1uF			-
C119	MLCC	1	16V 1uF			-
C120	MLCC	1	25V 0.1uF			-
C121	MLCC	1	25V 4.7uF			-
C122	Film Capacitor	1	1kV 0.022uF	FL1000HP223	SHINYEI	-
C130	Disk Ceramic Capacitor	1	1kV 100pF	CC45SL3AD101JYNNA	TDK	-
C131	Disk Ceramic Capacitor	1	1kV 100pF	CC45SL3AD101JYNNA	TDK	-
C201	Electrolytic Capacitor	1	25V 1500uF		Rubycon	-
C205	Electrolytic Capacitor	1	35V 1500uF		Rubycon	-
C206	Electrolytic Capacitor	1	35V 1500uF		Rubycon	-
C210	MLCC	1	16V 0.1uF			-
C211	MLCC	1	50V 0.1uF			-
C241	MLCC	1	25V 1uF			-
C242	MLCC	1	10V 1uF			-
C243	Electrolytic Capacitor	1	10V 22uF		Rubycon	-

**Bill Of Material**

No.	Type	Qt'y	Spec	Model Name	Vendor	Remarks
R101	Chip Resistor	1	1/8W 620kΩ			1%
R102	Chip Resistor	1	1/8W 620kΩ			1%
R103	Chip Resistor	1	1/8W 620kΩ			1%
R104	Chip Resistor	1	1/8W 470kΩ			1%
R107	Chip Resistor	1	1/10W 27kΩ			1%
R110	Metal Plate Resistor	1	2W 0.33Ω			-
R111	Metal Plate Resistor	1	2W 0.33Ω			-
R112	Chip Resistor	1	1/10W 10Ω			1%
R113	Chip Resistor	1	1/10W 10Ω			1%
R114	Chip Resistor	1	1/10W 100Ω			1%
R115	Chip Resistor	1	1/10W 100kΩ			-
R116	Chip Resistor	1	1/10W 3.3kΩ			1%
R118	Chip Resistor	1	1/10W 13kΩ			1%
R119	Chip Resistor	1	1/10W 820kΩ			-
R121	Chip Resistor	1	1/8W 22Ω			-
R123	Chip Resistor	1	1/10W 47kΩ			-
R124	Chip Resistor	1	1/8W 22Ω			-
R126	Chip Resistor	1	1/10W 47kΩ			-
R138	Chip Resistor	1	1/10W 4.3kΩ			-
R140	Chip Resistor	1	1/10W 3kΩ			-
R145	Chip Resistor	1	1/10W 470Ω			-
R203	Chip Resistor	1	1/8W 1.5kΩ			-
R204	Chip Resistor	1	1/10W 1kΩ			-
R210	Chip Resistor	1	1/10W 9.1kΩ			1%
R214	Chip Resistor	1	1/10W 2.4kΩ			1%
R215	Chip Resistor	1	1/10W 2.7kΩ			-
R216	Chip Resistor	1	1/10W 47kΩ			-
R221	Chip Resistor	1	1/8W 1.5kΩ			-
R222	Chip Resistor	1	1/10W 1kΩ			-
R223	Chip Resistor	1	1/8W 2.2kΩ			-
R224	Chip Resistor	1	1/10W 1kΩ			-
R225	Chip Resistor	1	1/10W 4.7kΩ			-
R233	Chip Resistor	1	1/10W 510Ω			-
R234	Chip Resistor	1	1/10W 10kΩ			-
R243	Chip Resistor	1	1/8W 15kΩ			-
R244	Chip Resistor	1	1/8W 15kΩ			-
HS101	Heat Sink	1				-
HS201	Heat Sink	1				-
SW201	Switch	1				-
SW202	Switch	1				-

※ Select HS101 and HS201 that meet your company's usage conditions.

## LLC Transformer

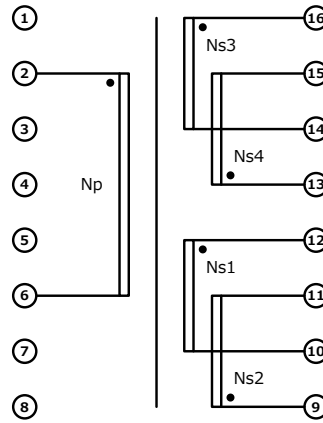
$V_{in}$ = DC390V±30V       $f_{min}$ = 70kHz  
 $P_o$ = 150W(typ)

Inductance (Np)	2-6pin	403μH	10kHz
Leakage Inductance (Np)	2-6pin	108μH	10kHz

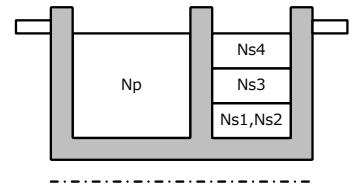
Core  
SWD3539BF      Material : -      Manufacturer : TAMURA

Bobbin  
SWD3539BF      Pin Number : 16      Manufacturer : TAMURA

### < Pin assignment >



### < Structure drawing >



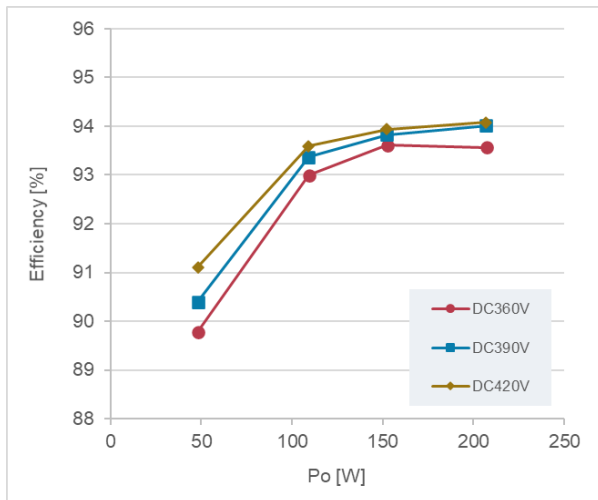
### < Winding Specifications >

Winding Order	Current Name	Pin Number		Turn [T]	diameter [mm dia]	Material	Output		Notes
		Start	End				Voltage	Current	
1	Np	2	6	38	0.06×130p	Litz/1UEW	-	-	Aligned Winding
2	Ns1	12	10	2	0.08×120p	Litz/1UEW	12V	4.50 A	Bifilar Aligned Winding
3	Ns2	9	11	2	0.08×120p	Litz/1UEW			
4	Ns3	16	14	4	0.08×120p	Litz/1UEW	24V	4.00 A	Aligned Winding
5	Ns4	13	15	4	0.08×120p	Litz/1UEW			

## Efficiency

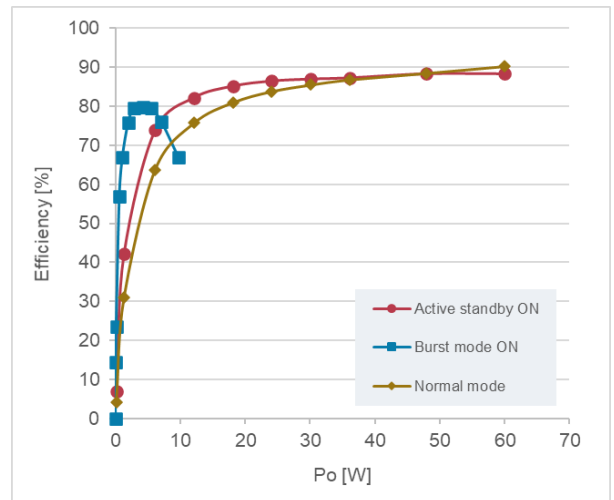
### Medium ~ Heavy load Efficiency

$V_{c1}$ =16V



### Standby mode Efficiency

$V_{in}$ =DC390V  
 $V_{c1}$ =16V

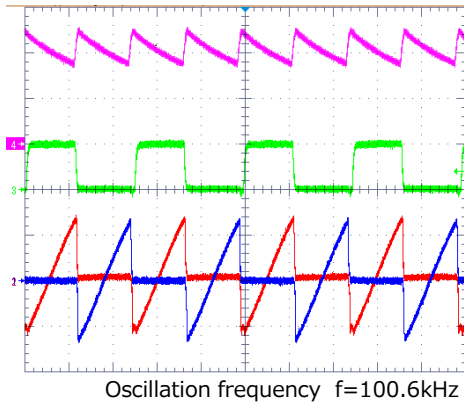


**Operation waveform**

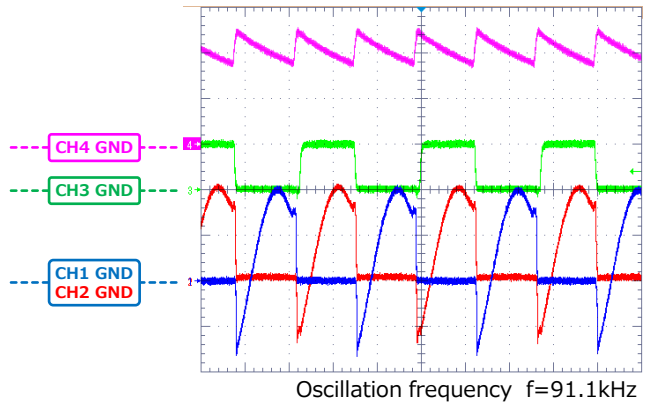
**Photo.1 Normal condition waveform**

CH1	: High side MOSFET $I_{DH}$	1A/div
CH2	: Low side MOSFET $I_{DL}$	1A/div
CH3	: Low side MOSFET $V_{GL}$	10V/div
CH4	: F/B terminal voltage	2V/div
Time		: 4 $\mu$ s/div

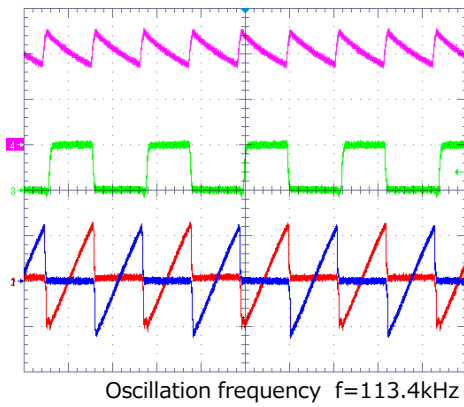
**DC360V Minimum load**



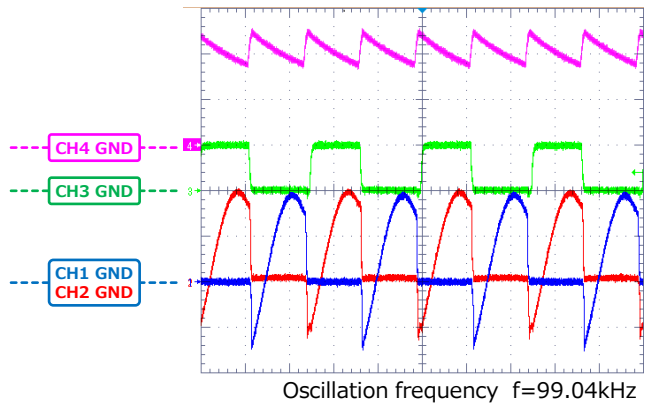
**DC360V Typical load**



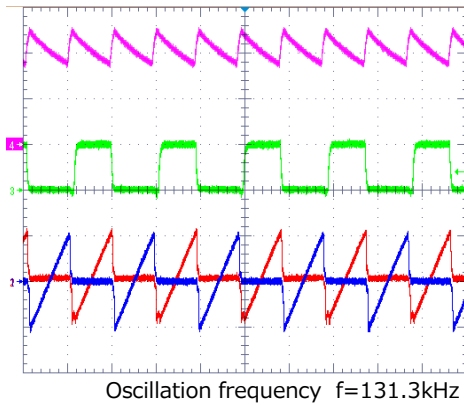
**DC390V Minimum load**



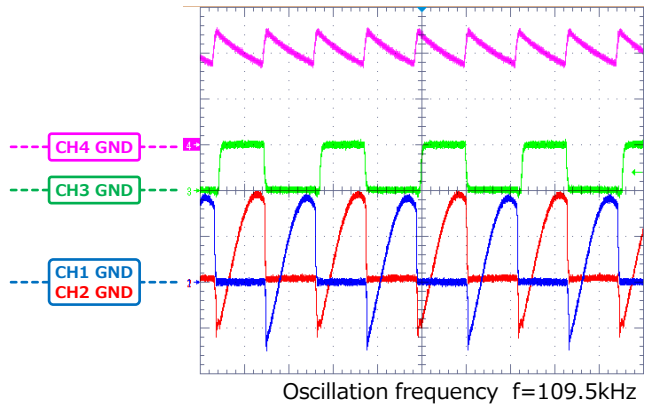
**DC390V Typical load**



**DC420V Minimum load**



**DC420V Typical load**



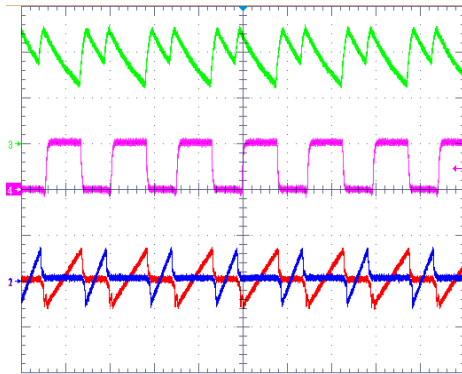
Operation waveform

Photo.2 Active standby mode waveform

Vin=DC390V

CH1 : High side MOSFET  $I_{DH}$  1A/div  
 CH2 : Low side MOSFET  $I_{DL}$  1A/div  
 CH3 : F/B terminal voltage 2V/div  
 CH4 : Low side MOSFET  $V_{GL}$  10V/div  
 Time : 4us/div

24V/0A 12V/0.1A 5V/25mA



24V/0A 12V/2A 5V/25mA

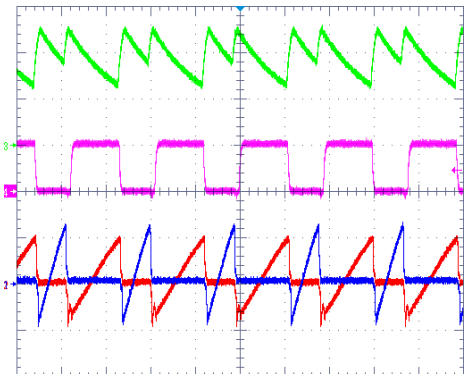
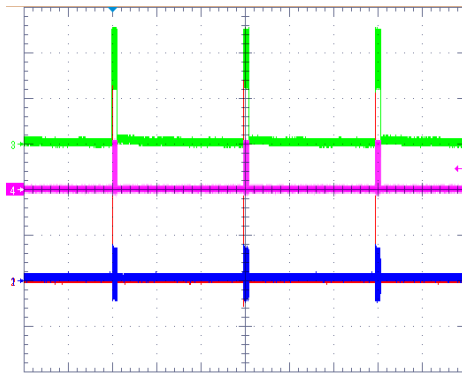


Photo.3 Burst mode waveform

Vin=DC390V

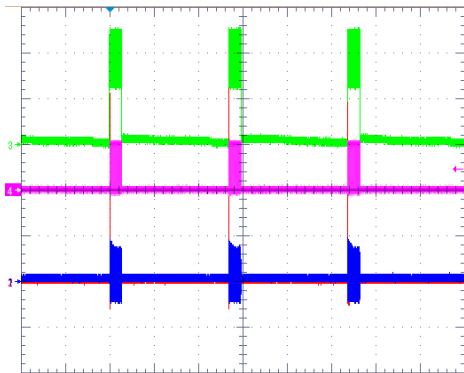
CH1 : High side MOSFET  $I_{DH}$  1A/div  
 CH2 : Low side MOSFET  $I_{DL}$  1A/div  
 CH3 : F/B terminal voltage 2V/div  
 CH4 : Low side MOSFET  $V_{GL}$  10V/div

24V/0A 12V/0A 5V/25mA

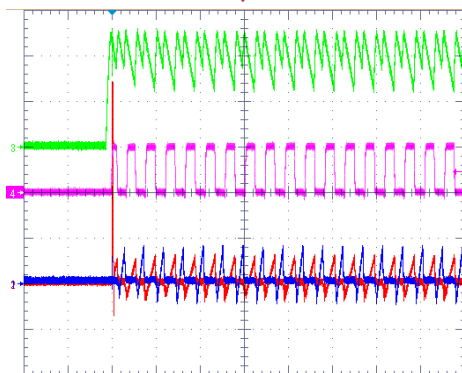


Zoom ↓ 20ms/div

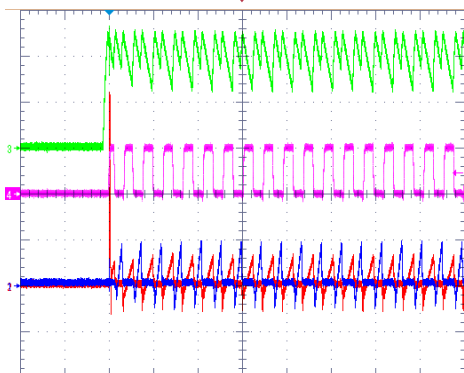
24V/0A 12V/0.1A 5V/25mA



Zoom ↓ 10ms/div



10us/div



10us/div



## Temperature

IC voltage      Vc1=16V  
 Output current    12V/4.5A  
                       24V/4A  
                       5V/25mA

### DC360V

	High side MOSFET	Low side MOSFET	transformer Np	transformer Ns	24V Output Diode	12V Output Diode
Temperature T [°C]	54.5	55.9	70.2	71.5	64.7	65.0
Temperature rise ΔT [deg.]	24.5	25.9	40.2	41.5	34.7	35.0

### DC390V

	High side MOSFET	Low side MOSFET	transformer Np	transformer Ns	24V Output Diode	12V Output Diode
Temperature T [°C]	51.0	52.4	69.5	69.8	62.6	62.7
Temperature rise ΔT [deg.]	21.0	22.4	39.5	39.8	32.6	32.7

### DC420V

	High side MOSFET	Low side MOSFET	transformer Np	transformer Ns	24V Output Diode	12V Output Diode
Temperature T [°C]	53.7	54.0	67.5	68.5	61.4	61.7
Temperature rise ΔT [deg.]	23.7	24.0	37.5	38.5	31.4	31.7