5-V Low-Drop Fixed Voltage Regulator

Functional Description

The IZE4278 (functional equivalent of TLE4278 G Infineon) is a monolithic integrated low-drop fixed-voltage regulator 5V/150mA with low current consumption and additional functions for automotive electronics The IZE4278 is available in chip form and suitable for assembly in SO-20 package.

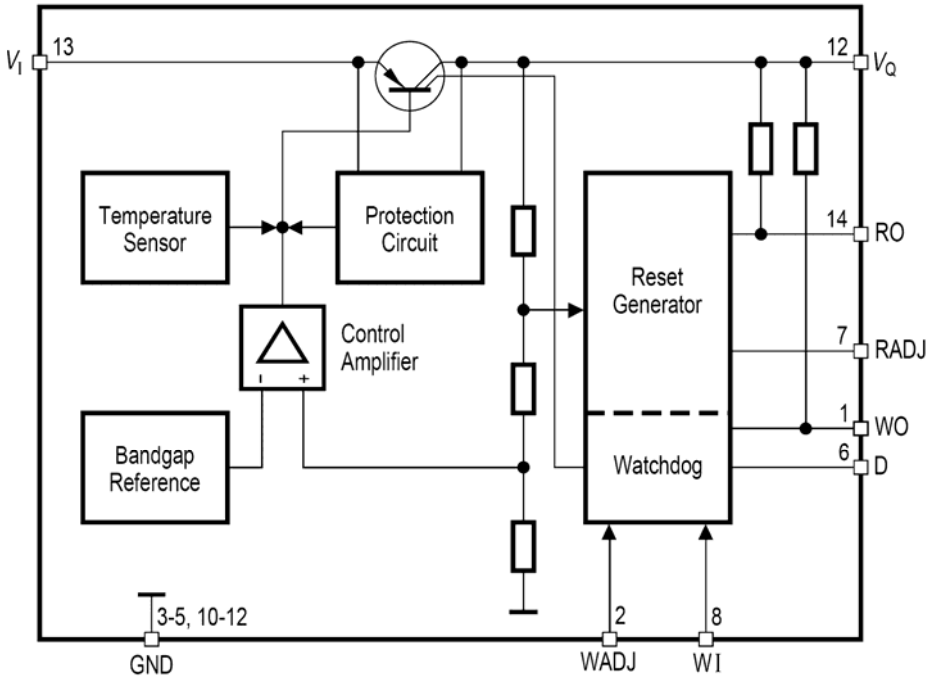
The IZE4278 provides output positive voltage 5V ± 2 % (under load current up to 150mA and supply voltage range 6 to 28V) and 5V ± 4 % (under load current up to 50mA and supply voltage range 28 to 45V)/ Drop voltage not exceed 0,5V under load current 100mA. The IZE4278 is steady to overvoltage of both (positive and negative) polarities, short-circuit of output to ground., contain internal limiting circuit of load current and thermal shutdown. It is equipped with additional functions such as reset, reset parameters adjustment, watchdog circuit with input of activation threshold adjustment.

The IZE 4278 can be used in power supply sources of electronic devices and particularly in automotive electronics

Features

- Precision output voltage5V ± 2%
- Very low current consumption
- Low-drop voltage
- Watchdog
- Adjustable watchdog activating threshold
- Settable reset threshold
- Overheating protection
- Reverse polarity protection
- Short-circuit proof
- Wide temperature range 40 to +125°C
- Suitable for use in automotive electronics

Block diagram.



Pin & Pad Definitions and Functions

Pin number (SO-20)	Pad number	Symbol	Function
01	06	WO	Watchdog Output
02	07	WADJ	Watchdog Adjust
05	08	GND	Ground
09	09	D	Reset Delay
10	10	RADJ	Reset Switching Threshold Adjust
11	11	WI	Watchdog Input
12	12, 13	U_Q	Output
19	01	U_I	Input
20	02	RO	Reset Output

Operating Range & Absolute Maximum Ratings

Parameter	Symbol	Unit	Operating Range		Maximum Ratings	
			min.	max.	min.	max.
Junction temperature,	T_J	°C	-40*	125	-40*	150
Storage temperature,	T_{stg}	°C	-	-	-50	150
Input voltage	U_I	V	6	45	-42	46
Input current	I_I	mA	-	Internally limited	-	Internally limited
Common pin current	I_{GND}	mA	-	-	-100	50
Output voltage	U_Q	V	4,8	5,2	-1	25
Output current	I_Q	mA	-	Internally limited	-	Internally limited
Reset pin output voltage	U_{RO}	V	-	-	-0.3	25
Reset pin output current	I_{RO}	mA	-	-	- 5	5
Watchdog output voltage	U_{WO}	V	-	-	-0.3	25
Watchdog output current	I_{WO}	mA	-	-	- 5	5
Reset delay pin output voltage	U_D	V	-	-	-0.3	7
Reset delay pin output current	I_D	mA	-	-	-2	2
Reset adjustment pin input voltage	U_{RADJ}	V	-	-	-0.3	7
Reset adjustment pin input current	I_{RADJ}	mA	-	-	-	Internally limited
Watchdog input voltage	U_{WI}	V	-	-	-0.3	7
Watchdog input current	I_{WI}	mA	-	-	-	Internally limited
Watchdog adjustment input voltage	U_{WADJ}	V	-	-	-0.3	7

Parameter	Symbol	Unit	Operating Range		Maximum Ratings	
			min.	max.	min.	max.
Watchdog adjustment input current	I_{WADJ}	mA	-	-	-	Internally limited
Thermal resistance junction-case (for conventional case SO-20)	$R_{th\ jc}$	°C/W	-	25**	-	25**
Thermal resistance junction-ambient (for conventional case SO-20)	$R_{th\ ja}$	°C/W	-	160**	-	160**

* Indicated value of ambient temperature

** $R_{th\ ja}$ - Thermal resistance junction-ambient °C/W. (for device without heat sink)

Thermal resistance junction-ambient for device without heat sink $R_{th\ ja}$, °C/W, calculated by formula

$$R_{th\ ja} = R_{th\ jc} + R_{th\ ca}\ , \quad (1)$$

где $R_{th\ jc}$ - thermal resistance junction-case, °C/W. Aproximately $R_{th\ jc}$ = 25 °C/W

$R_{th\ ca}$ - thermal resistance case-ambient, °C/W.

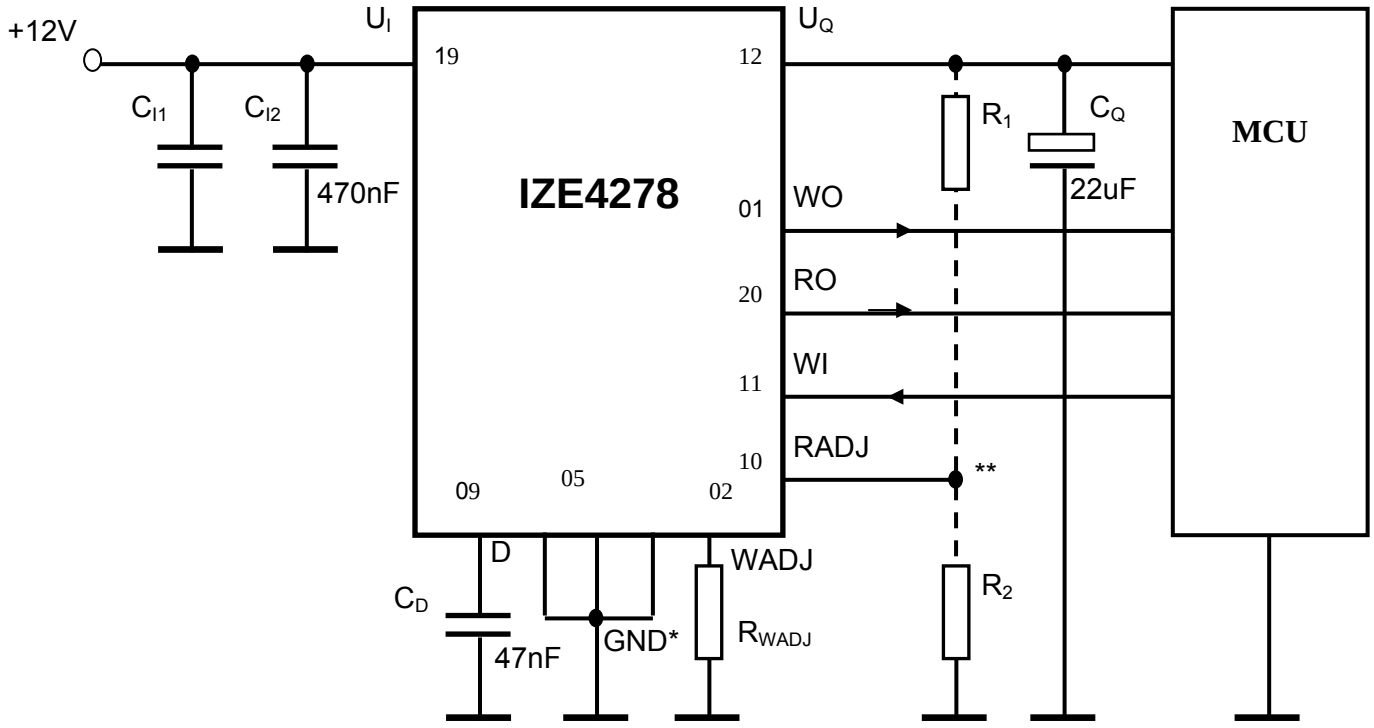
Heat sink, application mode & ambient temperature have to provide junction temperature not more then $T_J \le 125\ ^0$C.

Total power P_{tot}, W, dissipated by device for ambient temperature T_A, calculated by formula

$$P_{tot} = (125 - T_A) / R_{th\ ja}\ , \quad (2)$$

125 (^{0}C) –maximum permissible junction temperature

Application diagram



* Cooling surface.

** Can be bridged to GND.

Pin numbers is indicated for conventional case SO-20.

Electric parameters

(U_I=13,5 V, -40 °C ≤ T_J ≤ 125 °C , unless specified)

Parameter, unit	Symbol	Mode[1]	Value		Note
			min	max	
Output voltage, V	U_Q	6 V ≤ U_I ≤ 28 V 1 mA ≤ I_Q ≤ 150 mA	4,9	5,1	
		28 V ≤ U_I ≤ 45 V 1 mA ≤ I_Q ≤ 50 mA	4,8	5,2	
Maximum output current, mA	I_{Qmax}	4,8 V ≤ U_Q ≤ 5,2 V	200	-	
Consumption current, mA, $I_q = I_I - I_Q$	I_q	I_Q = 0 mA, T_J = 25 °C	-	0,2	
		I_Q = 0 mA, T_J = 85 °C	-	0,23	
		I_Q = 150 mA	-	12	
Drop voltage, V	U_{Dr}	I_Q = 150 mA	-	0,5	2
Load regulation, mV	$\Delta U_{Q(I)}$	5 mA ≤ I_Q ≤ 150 mA V_I = 6 V	-	|-30|	
Supply voltage regulation, mV	$\Delta U_{Q(U)}$	6 V ≤ U_I ≤ 28 V I_Q = 5 mA	-	20	
Reset generator					
Reset threshold voltage,V	U_{RT}	U_{RADJ}= 0 V	4.5	4.8	
Reset headroom, mV	$\Delta U_{Q,RT}$	I_Q = 10mA	180	-	
Reset adjustment threshold voltage, V	U_{RADJTH}	U_Q ≥ 3.5 V	1.28	1.45	
Reset low level output voltage, V	U_{ROL}	Rext =10 kOhm on U_Q U_Q ≥ 1 B	-	0.4	
Reset high level output voltage, V	U_{ROH}		4.5	-	
Reset output circuit resistance, kOhm	R_{RO}		20	46	
Charging current, uA	I_d	U_D = 1.0 B	2	8	
Threshold voltage of switching reset output to high level state, V	U_{DU}		1.5	2.3	
Threshold voltage of switching reset output to low level state, V	U_{DRL}		0.2	0.4	
Switch-off delay, ms	t_d	C_D = 47 nF	12	28	
Switch-on delay, us	t_{RR}	C_D = 47 nF	0.4	2.0	
Watchdog					
Activation threshold voltage, V	U_{WADJ}		1.28	1.45	
Current ratio	I_Q / I_{WADJ}	I_Q ≤ 10 mA	650	800	
Slew rate, V/us	U_{WI}	From 20% to 80% U	5	-	
Low level output voltage, V	U_{WOL}	Rext =10 kOhm on U_Q	-	0.4	
High level watchdog output voltage, V	U_{WOH}		4.5	-	
Watchdog output circuit resistance, kOhm	R_{WO}		20	46	

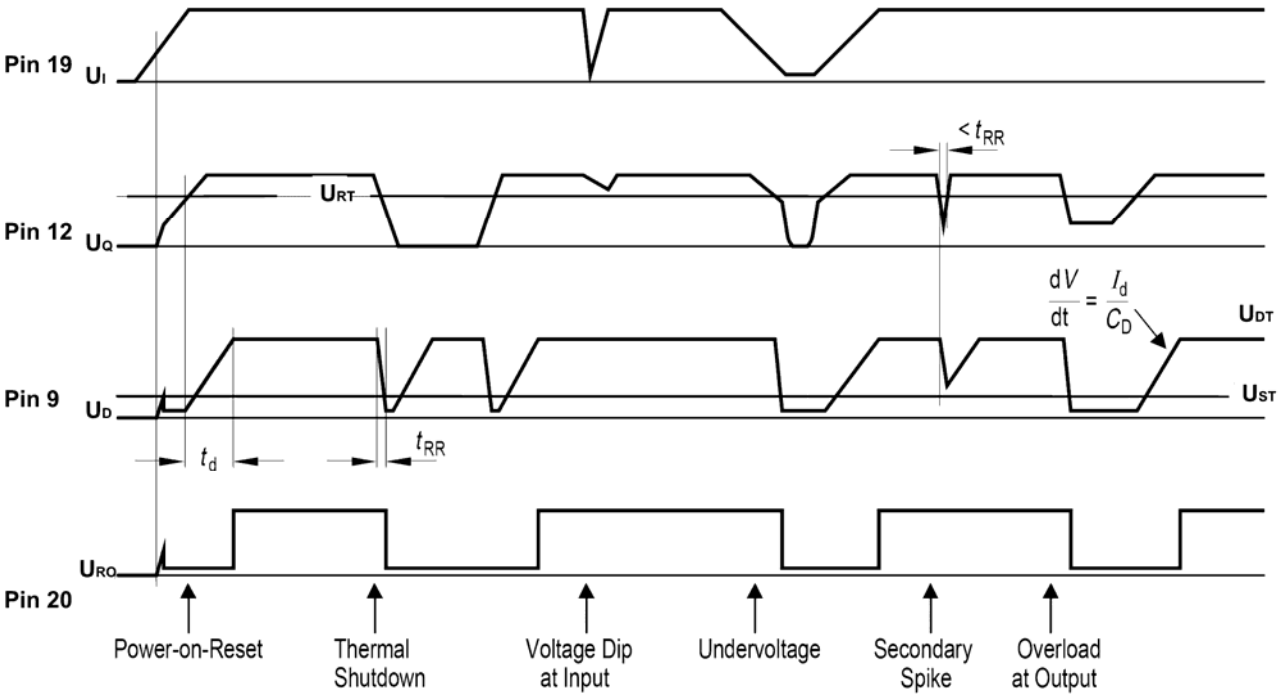
Parameter, unit	Symbol	Mode[1]	Value		Note
			min	max	
Charging current, uA	I_d	U_D = 1.0 V	2	8	
Discharging current, uA	I_{dis}	U_D = 1.0 V	0.6	2.0	
Threshold voltage of switching watchdog output to high level state, V	$U_{DU(W)}$		1.5	2.3	
Threshold voltage of switching watchdog output to low level state, V	U_{DWL}		0.5	0.9	
Watchdog output pulse period, ms	T_{WP}	C_D = 47 nF	42	80	
Watchdog output low level pulse duration, ms	t_{WR}	$U_Q \geq U_{RT}$	7	19	
Watchdog output high level pulse duration, ms	T_{WT}	C_D = 47 nF	35	61	

Notes:

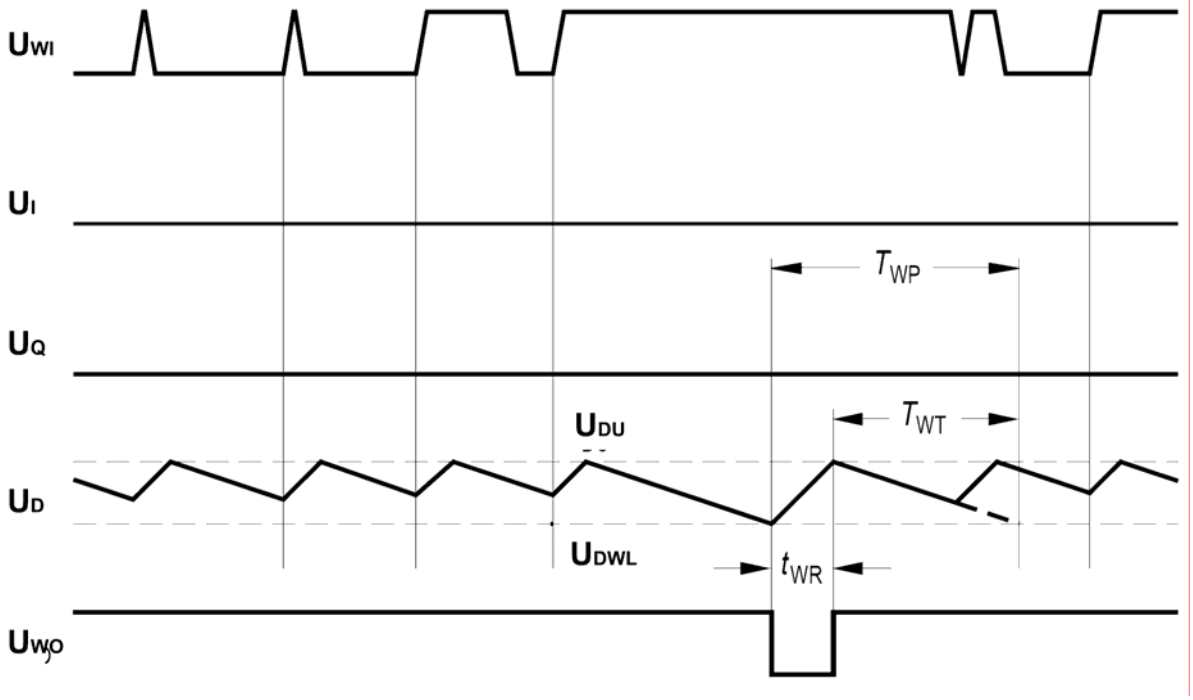
1. Measurements of electric parameters have execute with connected input capacitors C_{I1} = 1000 uF, C_{I2} = 470 nF and output capacitor C_Q = 10 uF.

2 Measurements of drop-out voltage $U_{Dr} = U_I - U_Q$ executed, when output voltage decreased on 100 mV relatively received nominal value at U_I = 13,5 V

Reset timing diagram (watchdog disabled)



Timing diagram on watchdog function



Pulse time T_{WP}, ms, is calculated by formula (3)

$$T_{WP} = \frac{(U_{DU} - U_{DWL}) \cdot (I_{dis} + I_d)}{I_{dis} \cdot I_d} \cdot C_D, \quad (3)$$

U_{DU} – top level of voltage swing , V;
U_{DWL} - bottom level of voltage swing in the presence of reset output pulses, V;
I_{dis} – discharge current, uA;
I_d - charge current, uA;
C_D – capacity in accordance with application diagram

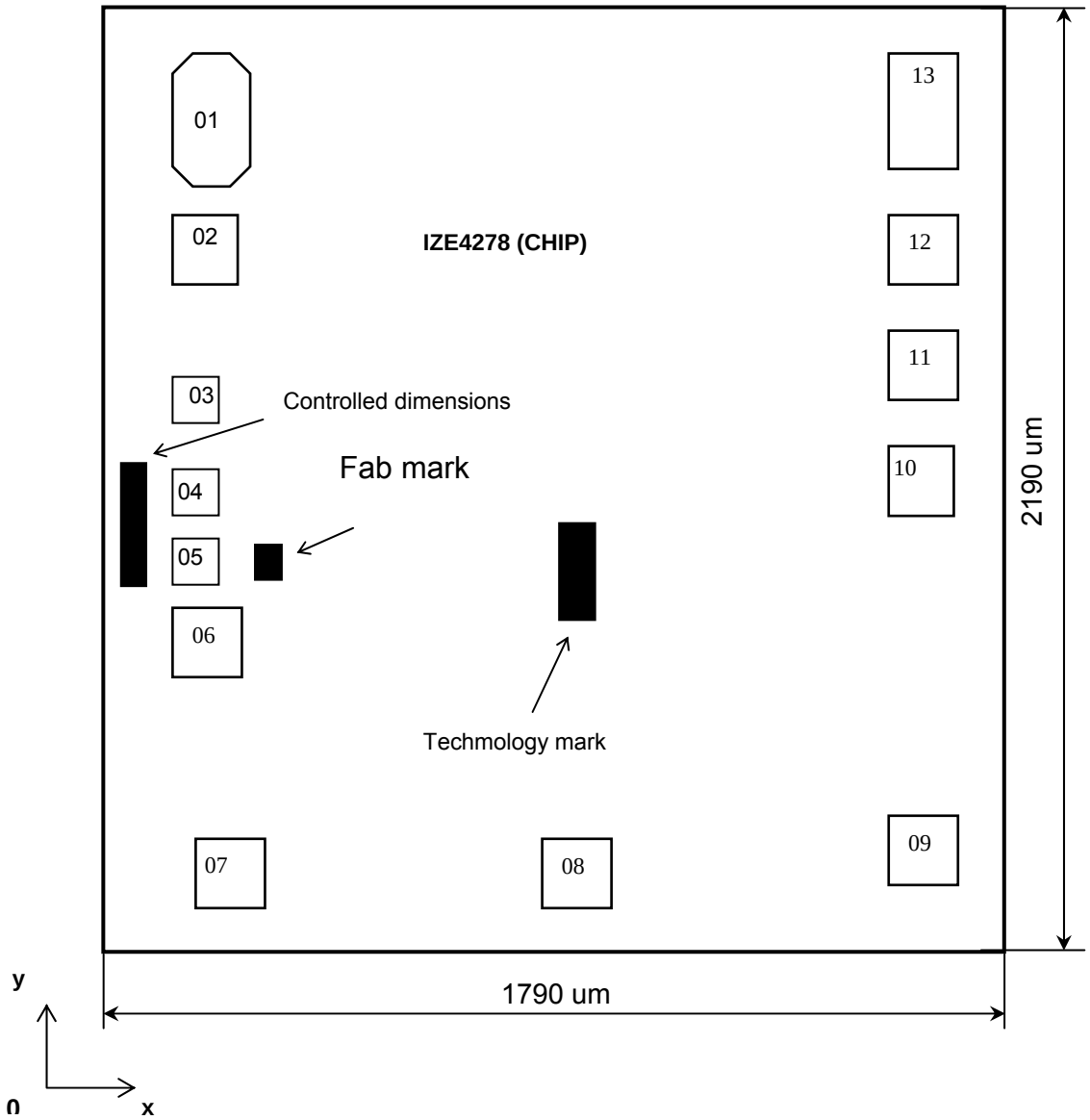
Complete charge time of capacity t_{WR}, us, is calculated by formula (4)

$$t_{WR} = \frac{U_{DU} - U_{DWL}}{I_d} \cdot C_D. \quad (4)$$

Complete discharge time of capacity t_{WR}, us, is calculated by formula (5)

$$T_{WT} = \frac{U_{DU} - U_{DWL}}{I_{dis}} \cdot C_D. \quad (5)$$

Chip diagram



Contact pad position

Pad number	Contact pad coordinates				Pade size
	Left bottom corner		Right top corner		
	X, um	Y, um	X, um	Y, um	
01	110	1825	222	2005	112x180
02	110	1654	222	1766	112x112
03	124	1185	204	1265	80x80
04	124	969	204	1049	80x80
05	124	829	204	909	80x80
06	132	605	244	717	112x112
07	208,5	135,5	320,5	247,5	112x112
08	920	131	1032	243	112x112
09	1551	210,5	1663	322,5	112x112
10	1551,5	1101	1663,5	1213	112x112
11	1548,5	1341,5	1660,5	1453,5	112x112
12	1572,5	1595,5	1684,5	1707,5	112x112
13	1571	1831	1683	2011	112x180