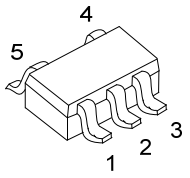
UR6223

CMOS IC

BUILT-IN INRUSH CURRENT PROTECTION，300mA HIGH SPEED LDO VOLTAGE REGULATOR



SOT-25

X2DFN1010-4

■ DESCRIPTION

The **UR6223** series is a high speed LDO regulator that features high accurate, low noise, high ripple rejection, low dropout and low power consumption. The series consists of a voltage reference, an error amplifier, a driver transistor, a current limiter, a phase compensation circuit, a thermal shutdown circuit and an inrush current protection circuit.

The CE function enables the circuit to be in stand-by mode by inputting low level signal. In the stand-by mode, the series enables the electric charge at the output capacitor CL to be discharged via the internal switch, and as a result the V_{OUT} pin quickly returns to the V_{SS} level. The output stabilization capacitor C_L is also compatible with low ESR ceramic capacitors.

The output voltage is selectable in 0.05V increments within the range of 1.2V to 4.0V which fixed by laser trimming technologies. The over current protection circuit and the thermal shutdown circuit are built-in. These two protection circuits will operate when the output current reaches current limit level or the junction temperature reaches temperature limit level.

■ APPLICATIONS

*Digital still cameras
*Camera modules
*IC recorders
*Bluetooth
*Wireless LAN
*Cell phone

■ FEATURES

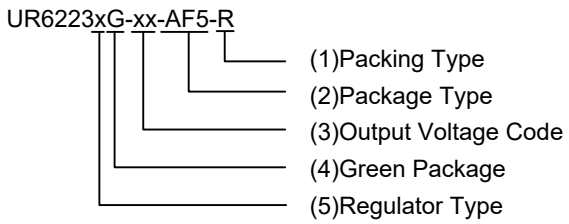
* Maximum Output Current : 300mA
* Stand-by Current: 0.1μA (Typ.)
* Low Dropout Voltage: 0.2V (Typ.) (I_{OUT} = 300mA)
* Excellent Line Regulation: 0.01%/V (Typ.)
* High Ripple Rejection (Typ.) (f = 1kHz)
  70dB @ $V_{OUT(T)}$ < 2.5V
  65dB @ $V_{OUT(T)}$ ≥ 2.5V
* Output Voltages: 2.0~4.0V(Accuracy ± 1%)
  1.2~1.95V(Accuracy ± 20mV)
  0.05V increments

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment					Packing
Lead Free	Halogen Free		1	2	3	4	5	
UR6223xL-xx-AF5-R	UR6223xG-xx-AF5-R	SOT-25	I	G	C	N	O	Tape Reel
UR6223xL-xx-K04-1010X2-R	UR6223xG-xx-K04-1010X2-R	X2DFN1010-4	O	G	C	I	-	Tape Reel

Notes: 1. xx: Output Voltage, Refer to Marking Information.

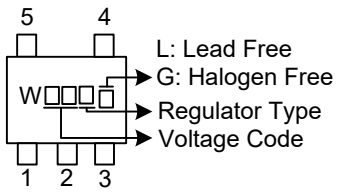
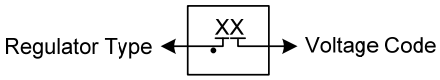
2. Pin Assignment: I: V_{IN} G: V_{SS} C: CE/$\overline{CE}$ N: No Connection O: V_{OUT}



(1) R: Tape Reel
(2) AF5: SOT-25, K04-1010X2: X2DFN1010-4
(3) xx: refer to Marking Information
(4) G: Halogen Free and Lead Free
(5) A: Without Inrush Current Protection, Without CE Pull-down, Without C_L discharge (Semi-Custom)
B: Without Inrush Current Protection, Without CE Pull-down, With C_L discharge (Semi-Custom)
C: Without Inrush Current Protection, With CE Pull-down*, Without C_L discharge (Semi-Custom)
D: Without Inrush Current Protection, With CE Pull-down*, With C_L discharge
E: With Inrush Current Protection, Without CE Pull-down, Without C_L discharge (Semi-Custom)
F: With Inrush Current Protection, Without CE Pull-down, With C_L discharge (Semi-Custom)
G: With Inrush Current Protection, With CE Pull-down*, Without C_L discharge (Semi-Custom)
H: With Inrush Current Protection, With CE Pull-down*, With C_L discharge

Note: * With CE pin pull-down resistor.

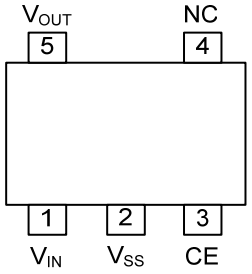
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-25	12: 1.2V 15: 1.5V 18: 1.8V 20: 2.0V 25: 2.5V 28: 2.8V 30: 3.0V 33: 3.3V 40: 4.0V	
X2DFN1010-4	B: 1.2V C: 1.5V D: 1.8V F: 2.0V E: 2.5V G: 2.8V J: 3.0V K: 3.3V L: 4.0V	

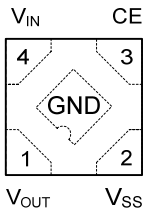
■ PIN DESCRIPTION

PIN NAME	DESIGNATOR	CONDITION
CE	L	$0V \leqq V_{CE} \leqq 0.3V$
	H	$1.0V \leqq V_{CE} \leqq 5.5V$
	OPEN	CE=OPEN

■ PIN CONFIGURATION



SOT-25

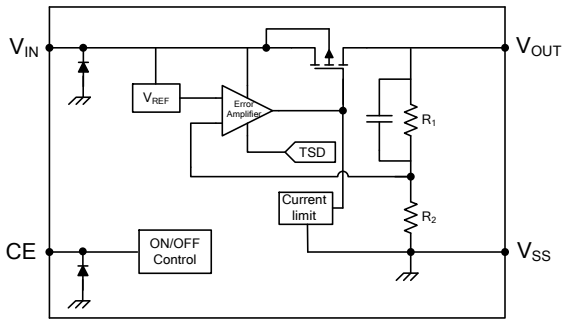


DFN1010-4
(TOP VIEW)

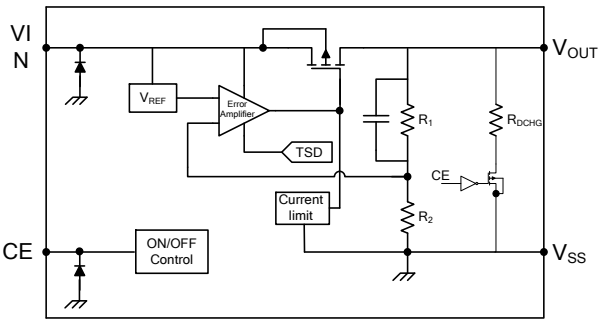
■ PIN DESCRIPTION

PIN NO.		PIN NAME	DESCRIPTION
SOT-25	X2DFN1010-4		
1	4	V_{IN}	Power Input Pin
2	2	V_{SS}	Ground Pin
3	3	CE	ON/OFF Control Pin
4	-	NC	No Connection
5	1	V_{OUT}	Output Pin
-	Exposed Pad	GND	Connect exposed pad to GND

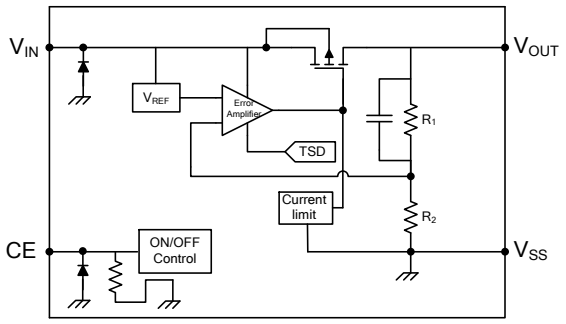
■ BLOCK DIAGRAM



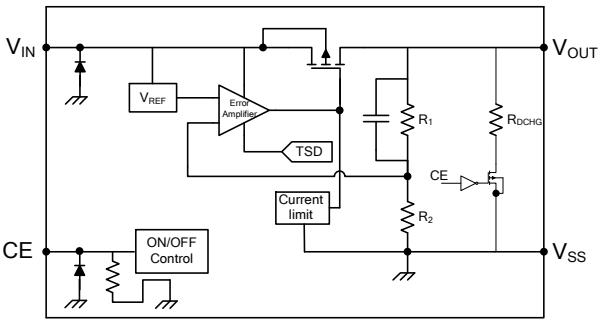
UR6223A



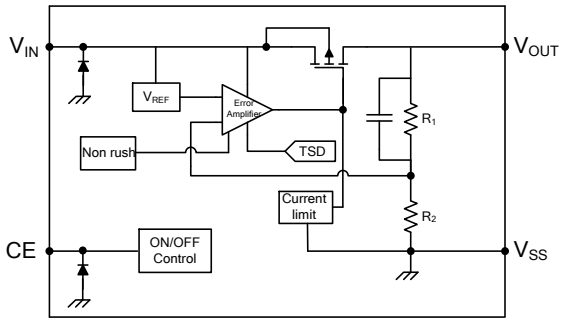
UR6223B



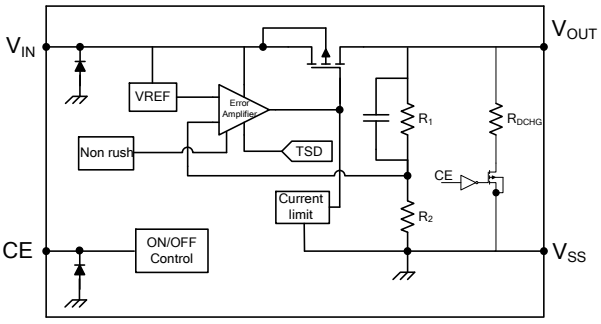
UR6223C



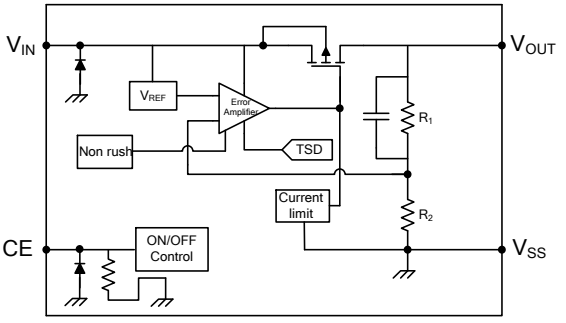
UR6223D



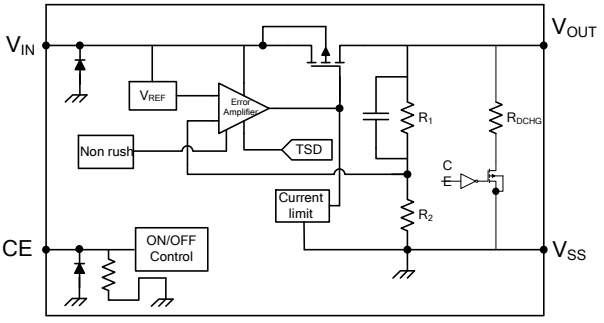
UR6223E



UR6223F



UR6223G



UR6223H

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		V_{IN}	6.0	V
Input Voltage		V_{CE}	6.0	V
Output Voltage		V_{OUT}	V_{SS}-0.3 ~ V_{IN}+0.3	V
Output Current (Note 2)		I_{OUT}	500	mA
Power Dissipation	SOT-25	P_D	300	mW
	X2DFN1010-4		550 (Note 3)	mW
Junction Temperature		T_J	+125	°C
Operating Temperature		T_{OPR}	-40 ~ +85	°C
Storage Temperature		T_{STG}	-55 ~ +125	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. $I_{OUT} \leqq P_D / (V_{IN}-V_{OUT})$
3. Heat Sink Area of PCB for DFN1010-4 is recommended at least 10 mm x 10 mm.

■ ELECTRICAL CHARACTERISTICS

UR6223A/B/C/D/E/F/G/H Series (T_{OPR}=25°C)

PARAMETER	SYMBOL	CIRCUIT	CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage (Note 1)	$V_{OUT(E)}$	1	$V_{OUT(T)} \geqq 2.0V$, $V_{CE}=V_{IN}$, I_{OUT}=10mA	$V_{OUT(T)}\times$ 0.99 (Note 2)	$V_{OUT(T)}$ (Note 2)	$V_{OUT(T)}\times$ 1.01 (Note 2)	V
		1	$V_{OUT(T)}$<2.0V, $V_{CE}=V_{IN}$, I_{OUT}=10mA	$V_{OUT(T)}$- 20mV (Note 2)	$V_{OUT(T)}$ (Note 2)	$V_{OUT(T)}$+ 20mV (Note 2)	V
Maximum Output Current	I_{OUT_MAX}	1	$V_{CE}=V_{IN}$	300			mA
Load Regulation	ΔV_{OUT}	1	$V_{CE}=V_{IN}$, 0.1mA$\leqq I_{OUT} \leqq$300mA		25	45	mV
Dropout Voltage (Note 4)	V_{DIF}	1	Refer to the Electrical Characteristics by Output Voltage				
Supply Current	I_{SS}	2	$V_{CE}=V_{IN}$		100	220	μA
Stand-by Current	ISTB	2	$V_{CE}=V_{SS}$		0.01	0.4	μA
Line Regulation	$\Delta V_{OUT} / (\Delta V_{IN} \times V_{OUT})$	1	$V_{OUT(T)}$+0.5V$\leqq V_{IN} \leqq$5.5V $V_{CE}=V_{IN}$, I_{OUT}=50mA		0.01	0.1	%/V
Input Voltage	V_{IN}	1				5.5	V
Power Supply Rejection Ratio	PSRR	3	$V_{OUT(T)}$ < 2.5V V_{IN}=3.0V_{DC}+0.5Vp-Pac $V_{CE}=V_{OUT(T)}$+1.0V I_{OUT}=30mA, f=1kHz		70		dB
			$V_{OUT(T)} \geq$ 2.5V V_{IN}={$V_{OUT(T)}$+1.0} V_{DC}+0.5Vp-Pac $V_{CE}=V_{OUT(T)}$+1.0V I_{OUT}=30mA, f=1kHz		65		dB
Current Limit	I_{LIM}	1	$V_{CE}=V_{IN}$	310	400		mA
Short Current	ISHORT	1	$V_{CE}=V_{IN}$, $V_{OUT}=V_{SS}$		50		mA
CE High Level Voltage	V_{CEH}	4		1.0			V
CE Low Level Voltage	V_{CEL}	4				0.3	V

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	CIRCUIT	CONDITIONS	MIN	TYP	MAX	UNIT
CE High Level Current (A/B/E/F Type)	I_{CEH}	4	$V_{CE}=V_{IN}=5.5V$	-0.1		0.1	μA
CE High Level Current (C/D/G/H Type)	I_{CEH}	4	$V_{CE}=V_{IN}=5.5V$	1.0	5.5	9.0	μA
CE Low Level Current	I_{CEL}	4	$V_{CE}=V_{SS}$	-0.1		0.1	μA
CL Discharge Resistance (Only B/D/F/H Type)	R_{DCHG}	1	$V_{IN}=5.5V$, $V_{OUT}=2.0V$, $V_{CE}=V_{SS}$		430		Ω
Inrush Current (Only E/F/G/H Type)	I_{rush}	5	$V_{IN}=V_{CE}=5.5V$		150		mA
Thermal Shutdown Detect Temperature	T_{TSD}	1	Junction Temperature		150		°C

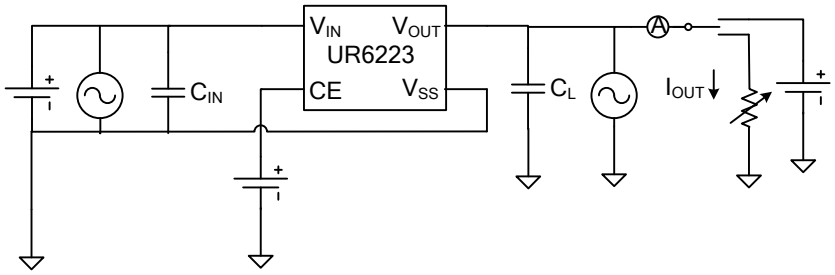
Notes: 1. $V_{OUT(E)}$: Effective output voltage
(i.e. the output voltage when " $V_{OUT(T)}$+1.0V " is provided at the V_{IN} pin while maintaining a certain I_{OUT} value)
2: $V_{OUT(T)}$: Nominal output voltage
3: The standard output voltage is specified in $V_{OUT(T)}$ ± 20mV where $V_{OUT(T)}$ + < 2.0V
4: V_D = { V_{IN1}{5} - V_{OUT1}{6} } (V_{IN1}≧2.5V)
5: V_{IN1}=The input voltage when V_{OUT1} appears as input voltage is gradually decreased
6: V_{OUT1}=A voltage equal to 98% of the output voltage whenever an amply stabilized I_{OUT} {$V_{OUT(T)}$+1.0V} is input
7: Unless otherwise stated regarding input voltage conditions, $V_{IN}=V_{OUT(T)}$ + 1.0V

■ ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE (T_{OPR}=25°C)

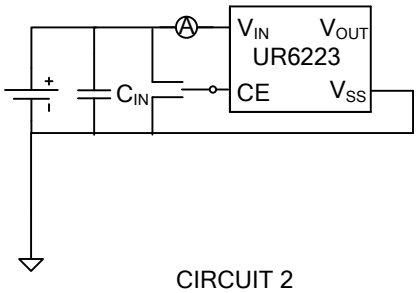
SYMBOL	E-0		E-1	
PARAMETER	OUYPUT VOLTAGE(V)		DROPOUT VOLTAGE(mV)	
NOMINAL OUTPUT VOLTAGE(V)				
V_{OUT} (T)	V_{OUT} (E)		V_{dif}	
	MIN	MAX	TYP	MAX
1.20	1.18	1.22	480	630
1.50	1.48	1.52	420	520
1.80	1.780	1.820	300	410
2.00	1.980	2.020	270	380
2.50	2.475	2.525	240	350
2.80	2.772	2.828	240	350
3.00	2.970	3.030	200	305
3.30	3.267	3.333	200	305
4.00	3.960	4.040	200	305

Note: $V_D=V_{IN1}-V_{OUT1}$, $V_{IN1}=V_{IN}$ when $V_{OUT}=V_{OUT1}$, $V_{OUT1}=V_{OUT}$ (at V_{IN}=4.3V, I_{OUT}=300mA)×98%.

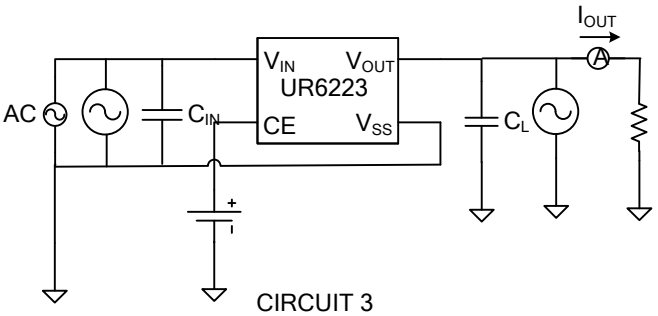
■ TEST CIRCUITS



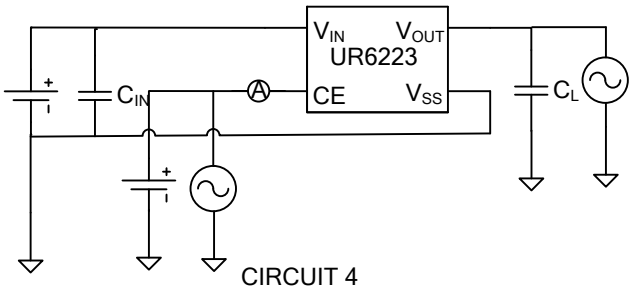
CIRCUIT 1



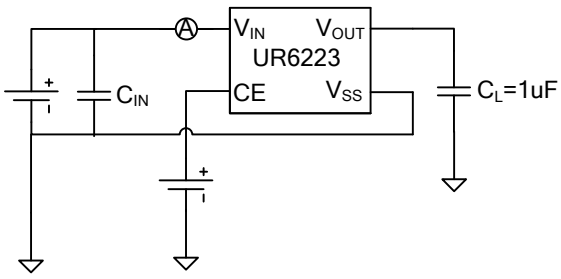
CIRCUIT 2



CIRCUIT 3



CIRCUIT 4



CIRCUIT 5

■ TYPICAL APPLICATION