CE6601 Series

Low Dropout Regulator

VOLTAGE:	2.5~60	V

CURRENT:	150	mA

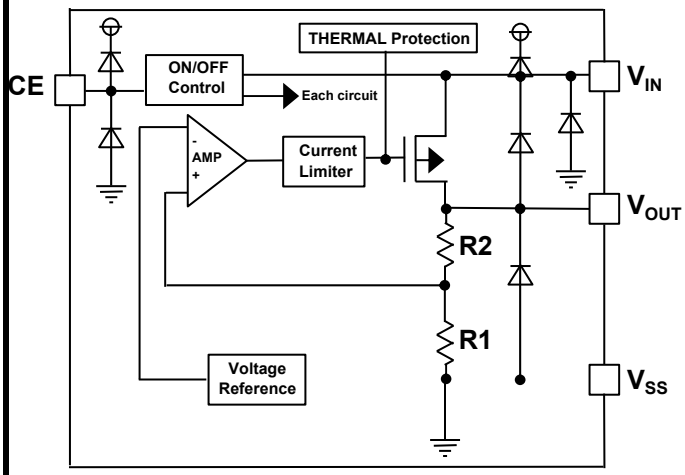
INTRODUCTION

The CE6601 series are a group of positive voltage regulators manufactured by CMOS technologies with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The CE6601 series can deliver 150mA output current and allow an input voltage as high as 60V. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

FEATURES

- Low Quiescent Current: 3uA
- Operating Voltage Range: 2.5V~60V
- Output Current: 150mA
- Low Dropout Voltage:500mV@50mA(VOUT=3.3V)
- Output Voltage: 1.2~ 12V
- High Accuracy: ±2%,±1%(Typ.)
- High Power Supply Rejection Ratio:80dB@1kHz
- Low Output Noise: $27xV_{OUT}$ μVRMS (10Hz~100kHz)
- Excellent Line and Load Transient Response
- Built-in Current Limiter, Short-Circuit Protection
- Over-Temperature Protection(OTP)

INTERNAL BOX DIAGRAM



MODEL DIFINITION

CE6601 ①②③④

DESIGNATOR	SYMBOL	DESCRIPTION
①	A B	Standard With Shutdown Function
②	Integer	Output Voltage,e.g 3.3V=33 5.0V=50 12.0V=120
③	M/ MC/ MY P/PT/PL G	Package:SOT-23 Package:SOT-89 Package:SOT-223
④	- 1	2% Accuracy 1% Accuracy

APPLICATIONS

- Wireless Communication Equipments
- Portable Audio Video Equipments
- Car Navigation Systems
- LAN Cards
- Ultra Low Power Microcontroller
- Cordless Phones
- Radio control systems
- Laptop, Palmtops and PDAs
- Single-lens reflex DSC
- PC peripherals with memory

MARKING

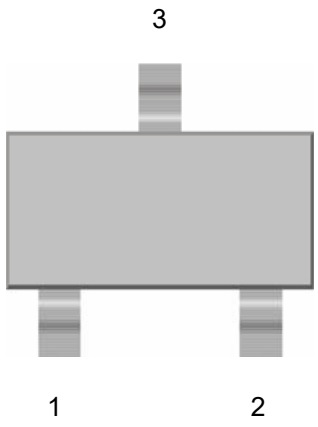
Model	Marking
CE6601 ①②③④	Model code+Data Code

CE6601 Series

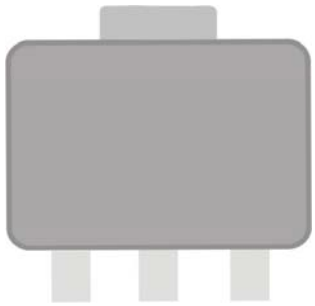
Low Dropout Regulator

Package Diagram And Pins

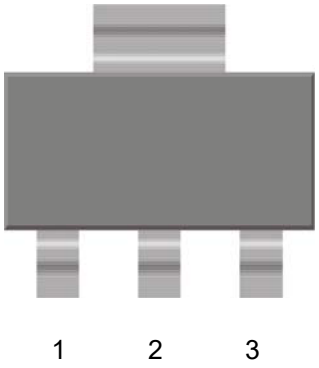
SOT-23



SOT-89



SOT-223



Pin Definition And Description

Package And PIN NUMBER							Pin Definition	
SOT-23			SOT-89			SOT-223	PIN NAME	FUNCTION
MC	MY	M	PT	PL	P	G		
3	3	1	2	2	1	1	V_{SS}	Ground
2	1	2	1	3	3	3	V_{OUT}	Output
1	2	3	3	1	2	2	V_{IN}	Power input

CE6601 Series

Low Dropout Regulator

Pb-Free RoHS COMPLIANT

ABSOLUTE MAXIMUM RATINGS(Note 1)

Parameter	Test Conditions	Symbol	RATINGS	Unit
Input Voltage(Note 2)		V_{IN}	-0.3~65	V
Output Voltage(Note 2)		V_{OUT}	-0.3~15	V
CE Pin Voltage(2)		V_{CE}	-0.3~V_{IN}+0.3	V
Output Current		I_{OUT}	400	mA
Maximum Power Dissipation	SOT-23-3/SOT-23-55	P_D	400	mW
	TO-92		500	
	SOT-89-3/SOT-89-5		600	
	SOT-89-3/SOT-89-5 (VDIF=21V,VOUT=5.0V)		1200	
	SOT-223		800	
	ESOP-8		1500	

THERMAL CHARACTERISTICS

Parameter	Test Conditions	Symbol	Max.	Unit
Operating Temperature range		T_A	-40 to +125	°C
Junction Temperature		T_J	-40 to +150	°C
Storage Temperature		T_{STG}	-55 to +150	°C
Lead Temperature(Soldering, 10 sec)		T_{SOLDER}	260	°C
ESD Rating: Human Body Model (Note 3)		HBM	≥ 2	kV
ESD Rating: Machine Model (Note 3)		MM	≥ 200	V

Note:

1.Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.

2.All voltages are with respect to network ground terminal.

3.ESD testing is performed according to the respective JESD22 JEDEC standard. The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin.

CE6601 Series

Low Dropout Regulator

Electrical Characteristcs (Ta=25℃ Unless Otherwise Specified)

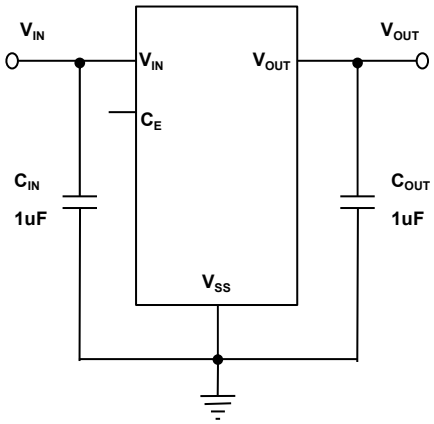
CE6601 Series(V_{CE}=V_{IN}=V_{OUT}+ 2V, C_{IN}= C_{OUT} = 1μF

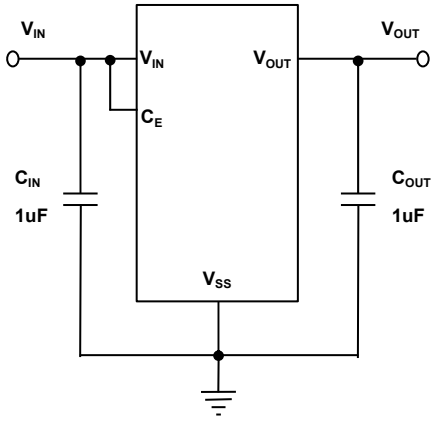
PARAMETER	Condition	Symbol	Min.	Typ.(Note5)	Max.	Unit
Input Voltage		V_{IN}	2.5	-	60	V
Output Voltage Range		V_{OUT}	1.2	-	12	V
DC Output Accuracy	I_{OUT}=1mA		-2	-	2	%
			-1	-	1	%
Dropout Voltage	I_{OUT}=50mA,V_{OUT}=3.3V	V_{DIF}	-	500	-	mV
Supply Current	I_{OUT}=0A,V_{OUT}≤5.0V	I_{SS}	-	3	6	uA
	I_{OUT}=0A,V_{OUT}>5.0V			5	10	
Standby Current	CE = V_{SS}	I_{STBY}	-	0.1	0.5	uA
Line Regulation	Iout=10mA, V_{OUT}+1V≤V_{IN}≤18V	$\frac{\Delta V_{OUT}}{(V_{OUT} x \Delta V_{IN})}$	-	0.01	0.3	%/V
Load Regulation	V_{IN}= V_{OUT}+1V, 1mA≤I_{OUT}≤100mA	ΔVout	-	10	-	mV
Temperature Coefficient	I_{OUT}=10mA, -40°C<T_A<125°C	$\frac{\Delta V_{OUT}}{V_{OUT} x \Delta T_A}$	-	50	-	ppm/°C
Output Current Limit	V_{OUT}= 0.5x$V_{OUT(Normal)}$, V_{IN}=5V	I_{LIM}	150	250	-	mA
Short Current	V_{OUT} =V_{SS}	I_{SHORT}	-	20	-	mA
Power Supply Rejection Ratio	I_{OUT}=50mA 100Hz	PSRR	-	75	-	dB
	1KHZ		-	80	-	
	10KHZ		-	60	-	
	100KHZ		-	45	-	
Output Noise Voltage	BW=10Hz to 100kHz	V_{ON}	-	27 x V_{OUT}	-	uV_{RMS}
Thermal Shutdown Temperature		T_{SD}	-	170	-	°C
Thermal Shutdown Hysteresis		ΔT_{SD}	-	20	-	°C
CE "High" Voltage		$V_{CE"H"}$	1.5	-	V_{IN}	V
CE "Low" Voltage		$V_{CE"L"}$	-	-	0.3	V

CE6601 Series

Low Dropout Regulator

TYPICAL APPLICATION CIRCUIT





External Components List

Symbol	Description
C_{IN}	1.0μF or more
C_{OUT}	1.0μF or more, 10μF is recommended

APPLICATION INFORMATION

Selection of Input/ Output Capacitors

Phase compensation is provided to secure operation even when the load current is varied.For this purpose, use a 1.0μF or more output capacitor (COUT) with good frequency characteristics and proper ESR (Equivalent Series Resistance).Connect a 1.0μF or more input capacitor (CIN) between the VIN pin and the VSS pin as close as possible to the pins.The value of the output overshoot or undershoot transient response varies depending on the value of the output capacitor.When selecting the output capacitor, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

In the design of portable devices the ceramic capacitors are often chosen because of their small size, low equivalent series resistance (ESR) and high RMS current capability. Also,designers have been looking to ceramic capacitors due to shortages of tantalum capacitors.

Unfortunately, using ceramic capacitors for input filtering can cause problems. Applying a voltage step to a ceramic capacitor causes a large current surge that stores energy in the inductances of the power leads. A large voltage spike is created when the stored energy is transferred from these inductances into the ceramic capacitor. These voltages pikes can easily be twice the amplitude of the input voltage step.

Many types of capacitors can be used for input by passing, however, caution must be exercised when using multilayer ceramic capacitors (MLCC).Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, high voltage transients can be generated under some start-up conditions, such as connecting the LDO input to a live power source. Adding a 3Ω resistor in series with an X5R ceramic capacitor will minimizepower source. Adding a 3Ω resistor in series with an X5R ceramic capacitor will minimize start-up voltage transients.

CE6601 Series

Low Dropout Regulator

Pb Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

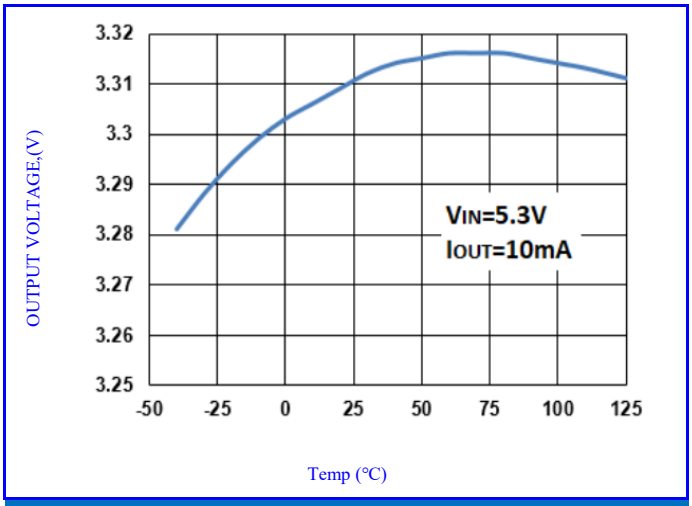


Fig.1-OUTPUT VOLTAGE VS. TEMPERATURE

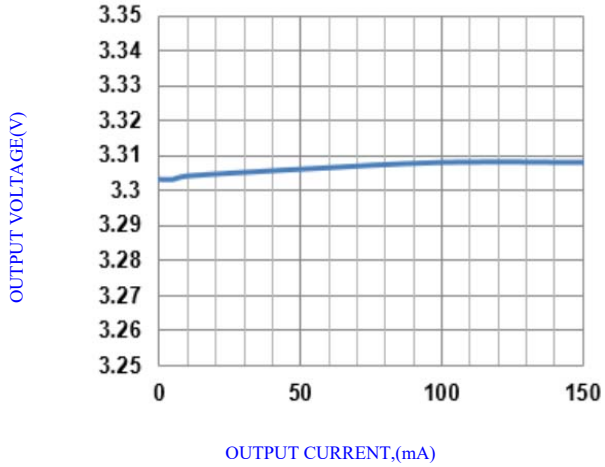


Fig.2-OUTPUT VOLTAGE VS. OUTPUT CURRENT

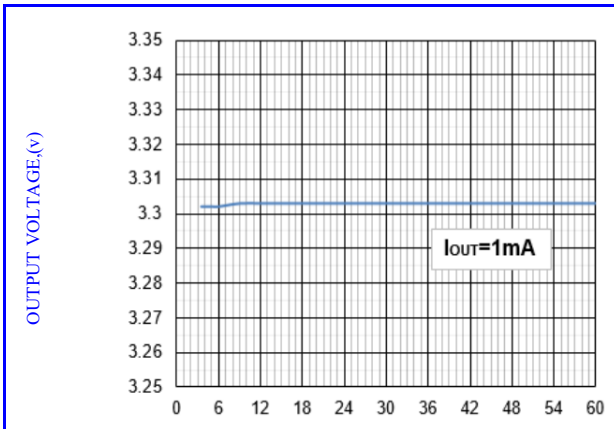


Fig.3-OUTPUT VOLTAGE VS. INPUT VOLTAGE

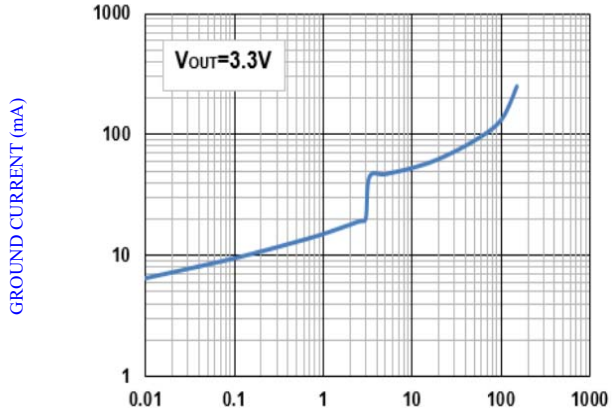


Fig.4-GROUND CURRENT VS. LOAD CURRENT

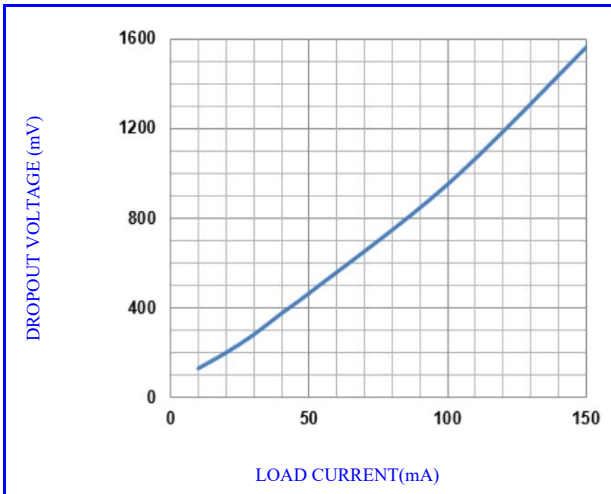


Fig.5-MAX. DROPOUT VOLTAGE VS. LOAD CURRENT

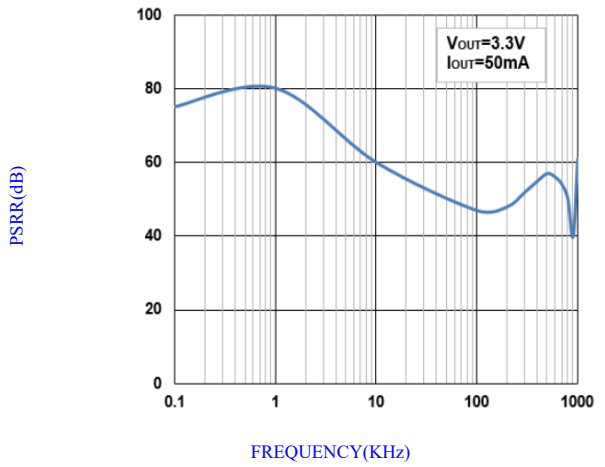
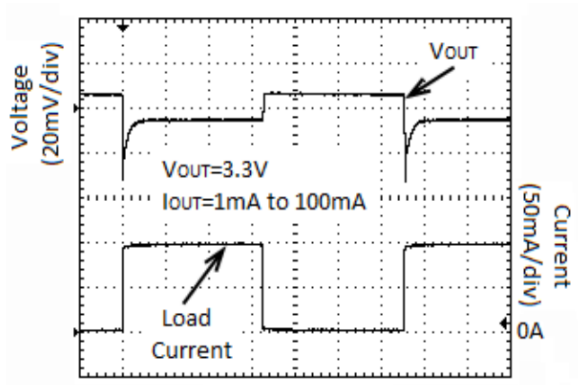


Fig.6-PSRR VS. FREQUENCY

CE6601 Series

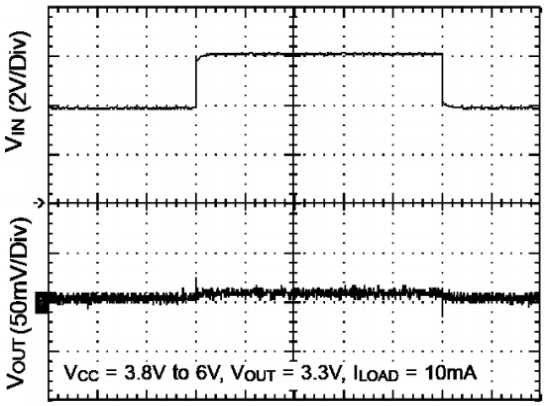
Low Dropout Regulator

Typical Characteristics Curves



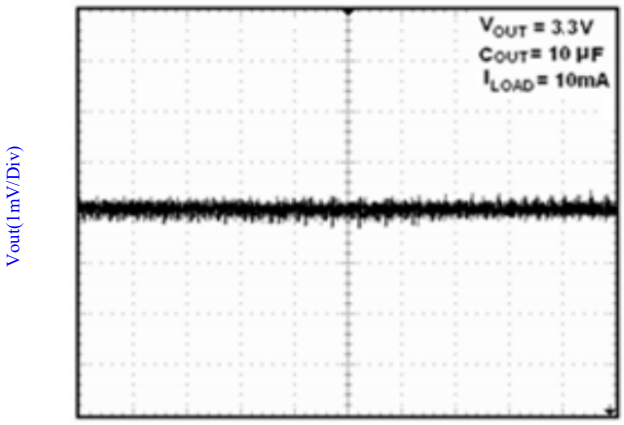
TIME(250uS/Div)

Fig.7-LOAD TRANSIENT RESPONSE



TIME(1mS/Div)

Fig.8- LINE TRANSIENT RESPONSE



TIME(200uS/Div)

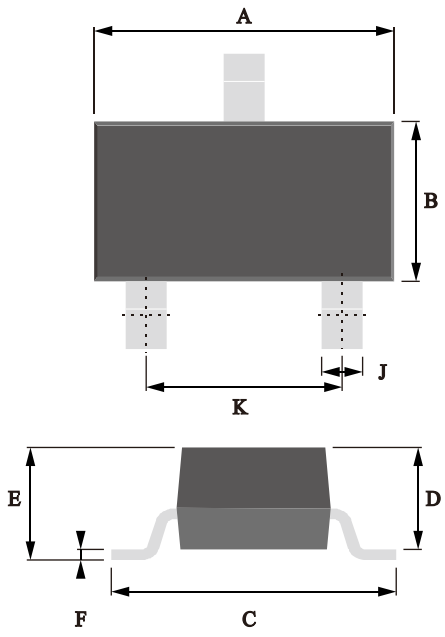
Fig.9- OUTPUT NOISE 10Hz to 100KHz

CE6601 Series

Low Dropout Regulator

Pb-Free RoHS COMPLIANT

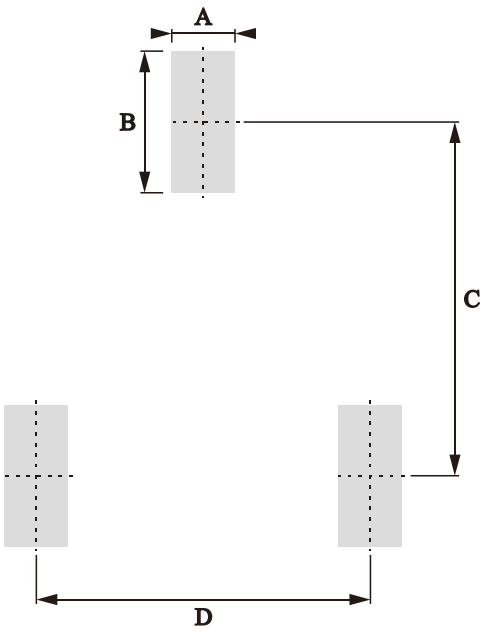
OUTLINE DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.80	-	3.20	0.1102	-	0.1260
B	1.15	-	1.45	0.0453	-	0.0571
C	2.25	-	2.65	0.0886	-	0.1043
D	0.85	-	1.15	0.0335	-	0.0453
E	0.90	-	1.20	0.0354	-	0.0472
F	0.08	-	0.18	0.0031	-	0.0071
J	0.30	-	0.50	0.0118	-	0.0197
K	1.70	-	2.10	0.0669	-	0.0827

RECOMMEDNED LAYOUT DRAWINGS



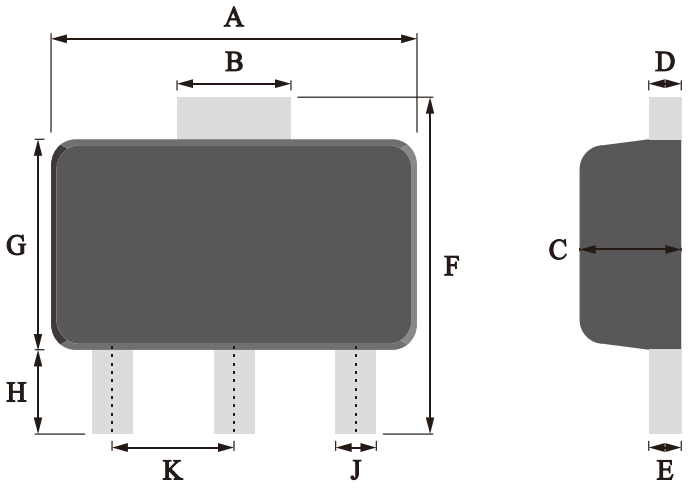
SOT-23

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	0.60	-	-	0.0000	-
B	-	0.80	-	-	0.0315	-
C	-	2.00	-	-	0.0787	-
D	-	1.90	-	-	0.0748	-

CE6601 Series

Low Dropout Regulator

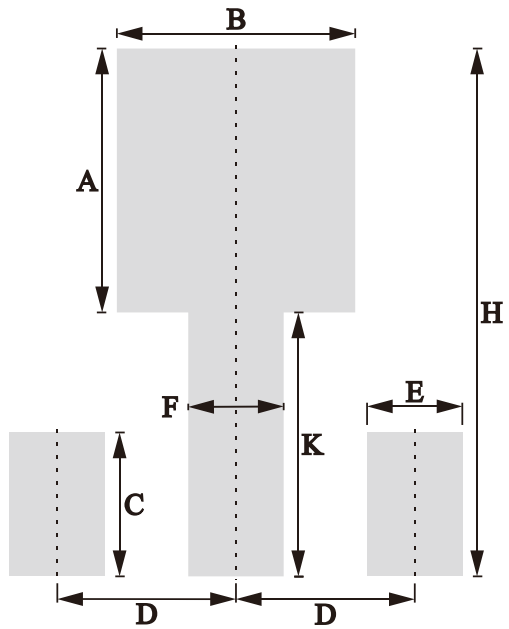
OUTLINE DRAWINGS



SOT-89

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.00	-	5.00	0.1575	-	0.1969
B	1.40	-	1.80	0.0551	-	0.0709
C	1.25	-	1.75	0.0492	-	0.0689
D	0.20	-	0.60	0.0079	-	0.0236
E	0.20	-	0.60	0.0079	-	0.0236
F	3.60	-	4.40	0.1417	-	0.1732
G	2.20	-	2.80	0.0866	-	0.1102
H	0.80	-	1.20	0.0315	-	0.0472
J	0.30	-	0.70	0.0118	-	0.0276
K	1.25	-	1.75	0.0492	-	0.0689

RECOMMEDNED LAYOUT DRAWINGS



SOT-89

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	2.20	-	-	0.0866	-
B	-	2.00	-	-	0.0787	-
C	-	1.20	-	-	0.0472	-
D	-	1.50	-	-	0.0591	-
E	-	0.80	-	-	0.0315	-
F	-	0.80	-	-	0.0315	-
H	-	47.00	-	-	1.8504	-
K	-	2.20	-	-	0.0866	-

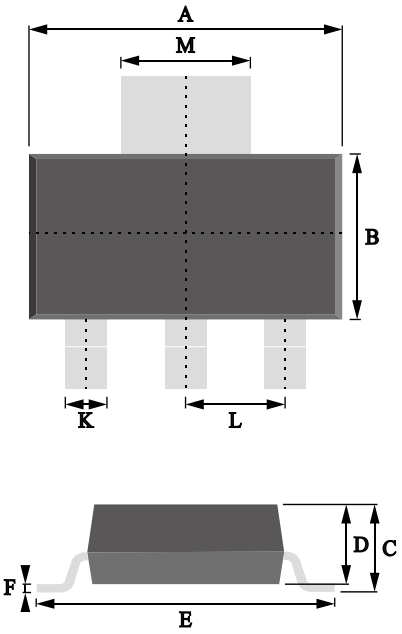
CE6601 Series

Low Dropout Regulator

Pb-Free RoHS COMPLIANT

OUTLINE DRAWINGS

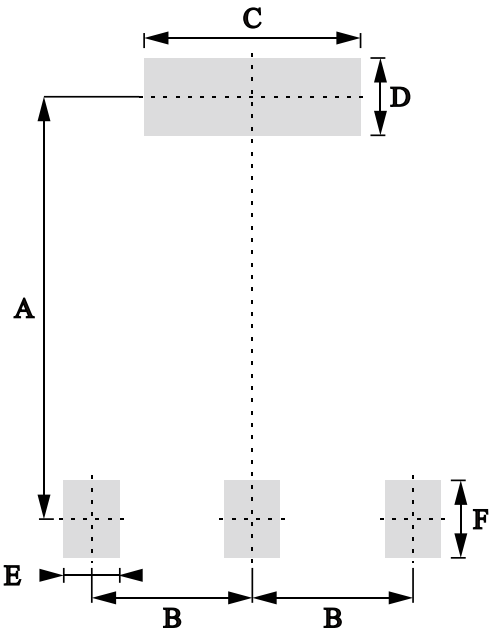
SOT-223



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.05	-	6.60	0.2382	-	0.2598
B	3.30	-	3.70	0.1299	-	0.1457
C	1.45	-	1.85	0.0571	-	0.0728
D	1.40	-	1.80	0.0551	-	0.0709
E	6.70	-	7.20	0.2638	-	0.2835
F	0.20	-	0.40	0.0079	-	0.0157
K	0.55	-	0.85	0.0217	-	0.0335
L	2.10	-	2.50	0.0827	-	0.0984
M	2.85	-	3.25	0.1122	-	0.1280

RECOMMEDNED LAYOUT DRAWINGS

SOT-223



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	6.00	-	-	0.0000	-
B	-	2.30	-	-	0.0906	-
C	-	3.10	-	-	0.1220	-
D	-	1.10	-	-	0.0433	-
E	-	0.80	-	-	0.0315	-
F	-	1.10	-	-	0.0433	-

CE6601 Series

Low Dropout Regulator

Pb-Free RoHS COMPLIANT

PACKING INFORMATION

Package Type	Package Code	Productor Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
SOT-23	P1	0.008	7" Reel	3000	45000	180000
SOT-89	P1	0.055	7" Reel	1000	10000	40000
SOT-223	P1	0.19	13" Reel	2500	5000	50000

CE6601 Series

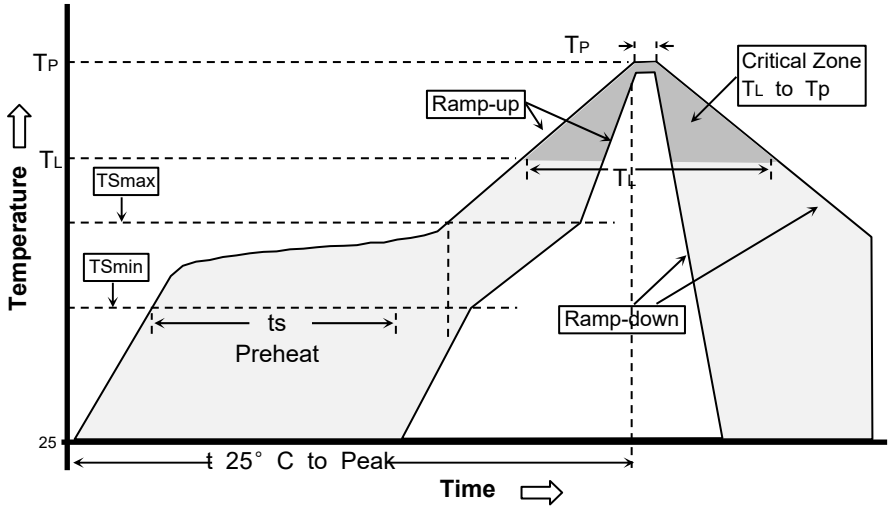
Low Dropout Regulator

Pb Pb-Free RoHS COMPLIANT

Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(TS min) −Temperature Max(TS max) −Time(ts min to ts max)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (TL) − Time (tL)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak Temperature(TP)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

CE6601 Series

Low Dropout Regulator

Pb-Free RoHS COMPLIANT

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