IC DATA SHEET

DUAL LDO REGULATOR WITH ON/OFF SWITCH
TK740xx

MEETING YOUR NEEDS
TOKO, INC.

TK740xxM

Dual Low Drop-Out regulator with independent on/off switches

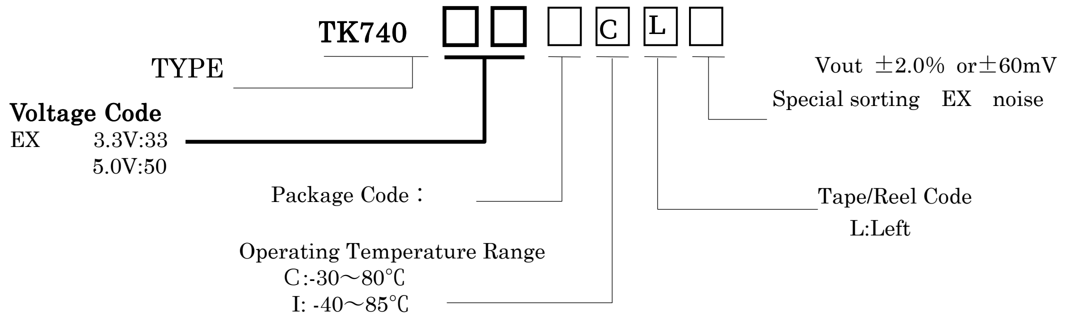
Features

- 2Ch Low Drop-Out regulator built into one package
- Independent on/off Switch for each LDO regulator (high on)
- Ability to set out put voltage by external resistors
- Wide operating voltage range（1.8V～14.5V）
- Very good Ripple Rejection Ratio（84dB）
- Very small Drop Out Voltage Side A 90mV / 100mA：160mV /200mA
  Side B 80mV / 50mA：135mV / 100mA
  （A side // B side）:Vdrop=70mV/100mA：125mV/200mA：180mV/300mA
- Very small quiescent current (45μA /ch)
- High output voltage accuracy（±60mV or±2.0% Iout＝5mA 1.3V～5.0V）
- Low value output capacitor requirements for stability (CL_{Min} =0.1μF)
- Operates with Low ESR ceramic capacitors in most applications
- Built-in reverse bias voltage protection. Built-in thermal / short circuit current protection.
- Wide operating ambient temperature range (-40℃ to +85℃)
- SOT23L 8-pin surface mount package

Description

The TK740xx is an integrated circuit with a silicon monolithic bipolar structure. The regulator is of the low saturation voltage output type with very little quiescent current (45μA/ch)
The TK740xx Dual Ultra Low-Drop-Out regulator operates from a 1.8V to 14.5V input supply voltage range. The A- Side delivers up to 200mA output current and the B-Side delivers up to 120mA output current over the full temperature range.
The TK740xx features very high stability in both DC and AC. The capacitor on the output side provides stable operation with 0.1μF with 1.8V≦Vout. A capacitor of any type can be used; however, the larger this capacitor is, the better the overall characteristics are.
The TK740xx makes it very suitable for portable and battery powered applications. TK740xx has independent on/off control functions. The internal switches can each be controlled by electric levels.
The device is in the ON State when the control pin is pulled to a logic high level. An internal PNP pass transistor is used to achieve a low dropout voltage of 90mV (typ.) at 50mA load current. The TK740xx has an exceptionally low quiescent current of 45 μA at no load and 0.4mA with a 50mA load. The standby current is typically 100pA. The internal thermal shutdown circuitry limits the junction temperature to below 150℃. The load current is internally monitored and the device will be shutdown by a short circuit or excessive current condition at the output. The TK740xx provides low noise performance by using the external noise bypass capacitor Cfb. The output voltage can be changed by using external resistors. A special good point is the ripple rejection ratio. A value of 80dB at 1KHz and 83dB at 400Hz can be obtained.

Ordering Information



Boldface type applies **Standard Voltage.**

V OUT	V CODE	V OUT	V CODE	V OUT	V CODE	V OUT	V CODE
1.5 v	15	2.5 v	25	3.5 v	35	4.5 v	45
1.6	16	2.6	26	3.6	36	4.6	46
1.7	17	2.7	27	3.7	37	**4.7**	**47**
1.8	18	**2.8**	**28**	**3.8**	**38**	4.8	48
1.9	19	**2.9**	**29**	3.9	39	4.9	49
2.0	**20**	**3.0**	**30**	**4.0**	**40**	**5.0**	**50**
2.1	21	3.1	31	4.1	41		
2.2	22	**3.2**	**32**	4.2	42		
2.3	23	**3.3**	**33**	4.3	43		
2.4	24	3.4	34	4.4	44		

Please contact your authorized Toko representative for voltage availability

Absolute Maximum Ratings

Ta=25℃

Parameter	Symbol	Rating	Unit
Supply voltage	Vcc	-0.4～16	V
Storage Temperature Range	Tstg	-55～150	℃
Reverse Bias	VR Max	-0.4～10	V
Control pin	Vcont	-0.4～Vop	V
Power Dissipation	Pd Max	Internal limited	(Mounted on board ≠ 600mW)
Thermal protection	Ohp	140	℃
Operating Condition			
Temperature Range	Top	−30～80(−40～85)	℃ Ta
Voltage Range	Vop	1.8～14.5	V
Short circuit current: Side A	Ishort	430	mA
Short circuit current: Side B	Ishort	330	mA (fold-down protection.)

Electrical Characteristics(C rank)

Vtest=Vout$_{Typ}$+1v；Vcont=1.8V（Ta=25 ℃）

	Parameter	Symbol	Condition	Min	Typ	Max	Unit
Common	Output voltage	Vout	Refer to Table 1 Iout=5mA				
Common	Line Regulation	LinReg	Vtest=Vout$_{Typ}$+1v～to increase 5V ; Iout=5mA Vtest-Max 18V		0.0	5.0	mV
Common	Quiescent current	Iq	Iout=0mA Except Icont		45	75	μA
Common	Standby current	Istandby	Vcc=10V Off mode		0.0	0.1	μA
Common	Feedback term. Volt	Vfb		1.11	1.19	1.29	V
Common	on/off control		Pull down resistor for control terminal isn't built in.				
Common	Control current	Icont	Vcont=1.8V On mode		1.8	5	μA
Common	Control voltage	Vcont	Output On	1.8			V
Common			Output Off			0.8	V
Side A	Load regulation Note 1	LoaReg	Iout=5mA～100mA		(14)	(30)	mV
Side A			Iout=5mA～200mA		(33)	(70)	
Side A	Drop out voltage	Vdrop	I out=100mA		90	150	mV
Side A			I out=150mA		125	180	
Side A			I out=200mA		160	250	
Side A	Drop out voltage	Vdrop	**1.3V≦Vout≦2.0V：No regulation** Because of Vop$_{Min}$=1.8V				
Side A	Max. output current	Iout$_{Max}$	Vout: 10% Down point、Note 2	290	380		mA
Side B	Load regulation: Note 1	LoaReg	Iout=5mA～100m		(17)	(40)	mV
Side B	Drop out voltage	Vdrop	I out=50mA		80	125	mV
Side B			I out=100mA		135	220	
Side B	Drop out voltage	Vdrop	**1.3V≦Vout≦2.0V No regulation** Because of Vop$_{Min}$=1.8V				
Side B	Max output current	out$_{Max}$	Vout: 10% Down point、Note 2	190	280		mA
	Vout Temp. coefficient	ΔVo/Ta	I o=5mA Reference Value 70 PPM/℃				

The operation of -30℃-80℃ is guaranteed in the design by a usual inspection.

Note 1: This value depends on the output voltage. (It is a value of Vout=3V device. The value of details is described to individual specifications)

Note 2:The output current is limited by the power dissipation of the total of both sides.

Parameters with only typical values are just reference. (Not guaranty)

General Note: Limits are guaranteed by production testing or correction techniques using Statistical Quality Control (SQC) methods. Unless otherwise noted. Vtest=Vout$_{Typ}$+1v ; IL=1mA（Tj=25 ℃）The operation of -30℃-80℃ is guaranteed in the design by a usual inspection.

General Note: Exceeding the "Absolute Maximum Rating " may damage the device

General Note: Ripple rejection is approximately 84dB

「Vnois=0.8Vp-p,1KHz,Vin=Vout$_{Typ}$+1.5v,Io=10mA」［CL=1.0μF tantalum Cap. Cfb =4700pF］

Electrical Characteristics (I rank)

Limits in standard typeface are for Ta=25, bold typeface applies over the −40℃ to+85℃ Ambient temperature range. **Operational Voltage Range is (2.1V≦Vop≦14V).** Unless otherwise noted. Vtest=$Vout_{Typ}$+1v；Iout=1mA（Ta=25 ℃）

Bold values indicate −40℃≦Ta≦85℃

	Parameter	Symbol	Condition	Min	Typ	Max	Unit
	Output voltage	Vout	Refer Table 2 Io=5mA				
	Line Regulation	LinReg	Vtest=$Vout_{Typ}$+1v～to increase 5V ；Iout=5mA Vtest-Max 18V		0.0	5.0 7	mV
	Quiescent current	Iq	Iout=0mA Except Icont		45	75 95	μA
	Standby current	Istandby	Vcc=10V Off mode		0.0	0.1 3	μA
	Feedback term. Volt	Vfb		1.10	1.19	1.30	V
		on/off control	Pull down resistor for control terminal isn't built in.				
	Control current	Icont	Vcont=1.8V ON mode		1.8	5 7	μA
	Control voltage	Vcont	Output ON	1.8 2.0			V
			Output OFF			0.8 0.6	V
Side A	Load regulation Note 1	LoaReg	Iout=5mA～100mA		(14)	(30) 39	mV
Side A			Iout=5mA～200mA		(33)	(70) (90)	
Side A	Drop out voltage	Vdrop	I out=100mA		90	150 180	mV
Side A			I out=150mA		125	180 230	
Side A			I out=200mA		160	250 300	
Side A	Drop out voltage	Vdrop	**1.3V≦Vout≦2.0V：No regulation** Because of Vop_{Min}=2.1V				
Side A	Max output current	$Iout_{Max}$	Vout: 10% Down point、Note 2	290 250	380		mA
			out_{Max}				
Side B	Load regulation Note 1	LoaReg	Iout=5mA～100mA		(17)	(40) 50	mV
Side B	Drop out voltage	Vdrop	I o=50mA		80	125 175	mV
Side B			I o=100mA		135	220 280	
Side B	Drop out voltage	Vdrop	**1.3V≦Vout≦2.0V No regulation** Because of Vop_{Min}=2.1V				
Side B	Max output current	$Iout_{Max}$	Vout: 10% Down point、Note 2	190 150	280		mA
	Vout Temp. coefficient	ΔVo/Ta	Vout Temp. coefficient I o=5mA Reference Value 70PPM/℃				

Note 1: This value depends on the output voltage.

(It is a value of Vout=3V device. The value of details is described to individual specifications.)

Note 2:The output current is limited by the power dissipation of the total of both sides.

Parameters with only typical values are just reference. (Not guaranty)

General Note: Limits are guaranteed by production testing or correction techniques using Statistical Quality Control (SQC) methods. Unless otherwise noted. Vtest=$Vout_{Typ}$+1v；IL=1mA（Tj=25 ℃）The operation of -30℃-80℃ is guaranteed in the design by a usual inspection.

General Note: Exceeding the "Absolute Maximum Rating " may damage the device

General Note: Ripple rejection is approximately 84dB

「Vnois=0.8Vp-p,1KHz,Vin=$Vout_{Typ}$+1.5v,Io=10mA」 ［CL=1.0μF tantalum Cap. Cfb =4700pF］

TABLE 1

C rank device output voltage list (Ta=25℃ Iout=5mA)

Output Voltage	Voltage Code	Vout Min	Vout Max	Test Voltage	Output Voltage	Voltage Code	Vout Min	Vout Max	Test Voltage
1.3V	13	1.240V	1.360V	2.4V	3.4V	34	3.232V	3.468V	4.4V
1.4	14	1.340	1.460	2.4	3.5	35	3.430	3.570	4.5
1.5	15	1.440	1.560	2.5	3.6	36	3.528	3.672	4.6
1.6	16	1.540	1.660	2.6	3.7	37	3.626	3.774	4.7
1.7	17	1.650	1.760	2.7	3.8	38	3.724	3.876	4.8
1.8	18	1.740	1.860	2.8	3.9	39	3.822	3.978	4.9
1.9	19	1.870	1.960	2.9	4.0	40	3.920	4.080	5.0
2.0	20	1.940	2.060	3.0	4.1	41	4.018	4.182	5.1
2.1	21	2.040	2.160	3.1	4.2	42	4.116	4.284	5.2
2.2	22	2.140	2.260	3.2	4.3	43	4.214	4.386	5.3
2.3	23	2.240	2.360	3.3	4.4	44	4.312	4.488	5.4
2.4	24	2.340	2.460	3.4	4.5	45	4.410	4.590	5.5
2.5	25	2.440	2.560	3.5	4.6	46	4.508	4.692	5.6
2.6	26	2.540	2.660	3.6	4.7	47	4.606	4.794	5.7
2.7	27	2.640	2.760	3.7	4.8	48	4.704	4.896	5.8
2.8	28	2.740	2.860	3.8	4.9	49	4.802	4.998	5.9
2.9	29	2.840	2.960	3.9	5.0	50	4.900	5.100	6.0
3.0	30	2.940	3.060	4.0					
3.1	31	3.038	3.162	4.1					
3.2	32	3.136	3.264	4.2					
3.3	33	3.234	3.366	4.3					

The output voltage table indicates the standard value when manufactured.

Table 2

I rank device output voltage list (Iout=5mA)

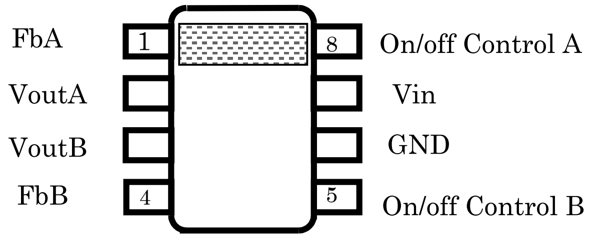
Boldface type applies over the full operating temperature range. (-40℃～85℃)

Iout=5mA

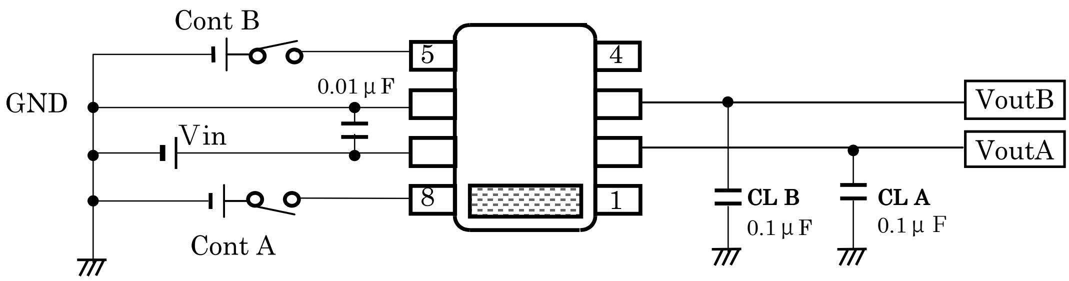
Output Voltage	Voltage Code	Vout Min	Vout Max	Test Voltage	Output Voltage	Voltage Code	Vout Min	Vout Max	Test Voltage
1.8V	18	1.750 **1.720**	1.850 **1.880**	2.8	3.8	38	3.750 V **3.720**	3.850 V **3.880**	4.8 V
2.0V	20	1.950V **1.920**	2.050V **2.080**	3.0	3.9	39	3.850 **3.820**	3.950 **3.980**	4.9
2.1	2.1	2.250 **2.220**	2.150 **2.180**	3.1	4.0	40	3.950 **3.910**	4.050 **4.090**	5.0
2.2	2.2	2.150 **2.120**	2.250 **2.280**	3.2	4.1	41	4.050 **4.009**	4.150 **4.191**	5.1
2.3	2.3	2.260 **2.220**	2.350 **2.380**	3.3	4.2	42	4.150 **4.108**	4.250 **4.292**	5.2
2.4	24	2.350 **2.320**	2.450 **2.480**	3.4V	4.3	43	4.250 **4.197**	4.350 **4.393**	5.3
2.5	25	2.450 **2.420**	2.550 **2.580**	3.5	4.4	44	4.350 **4.306**	4.450 **4.494**	5.4
2.6	26	2.550 **2.520**	2.650 **2.680**	3.6	4.5	45	4.450 **4.405**	4.550 **4.595**	5.5
2.7	27	2.650 **2.620**	2.750 **2.780**	3.7	4.6	46	4.550 **4.504**	4.650 **4.696**	5.6
2.8	28	2.750 **2.720**	2.850 **2.880**	3.8	4.7	47	4.050 **4.606**	4.750 **4.797**	5.7
2.9	29	2.850 **2.820**	2.950 **2.980**	3.9	4.8	48	4.750 **4.702**	4.850 **4.898**	5.8
3.0	30	2.950 **3.920**	3.050 **3.080**	4.0	4.9	49	4.850 **4.801**	4.950 **4.999**	5.9
3.1	31	3.050 **3.020**	3.150 **3.180**	4.1	5.0	50	4.950 **4.900**	5.050 **5.100**	6.0
3.2	32	3.150 **3.120**	3.250 **3.280**	4.2					
3.3	33	3.250 **3.220**	3.350 **3.380**	4.3					
3.4	34	3.350 **3.320**	3.450 **3.480**	4.4					
3.5	35	3.450 **3.420**	3.550 **3.580**	4.5					
3.6 V	36	3.550 3.520	3.650 3.680	4.6					
3.7	37	3.650 **3.620**	3.750 **3.780**	4.7					

The output voltage table indicates the standard value when manufactured.

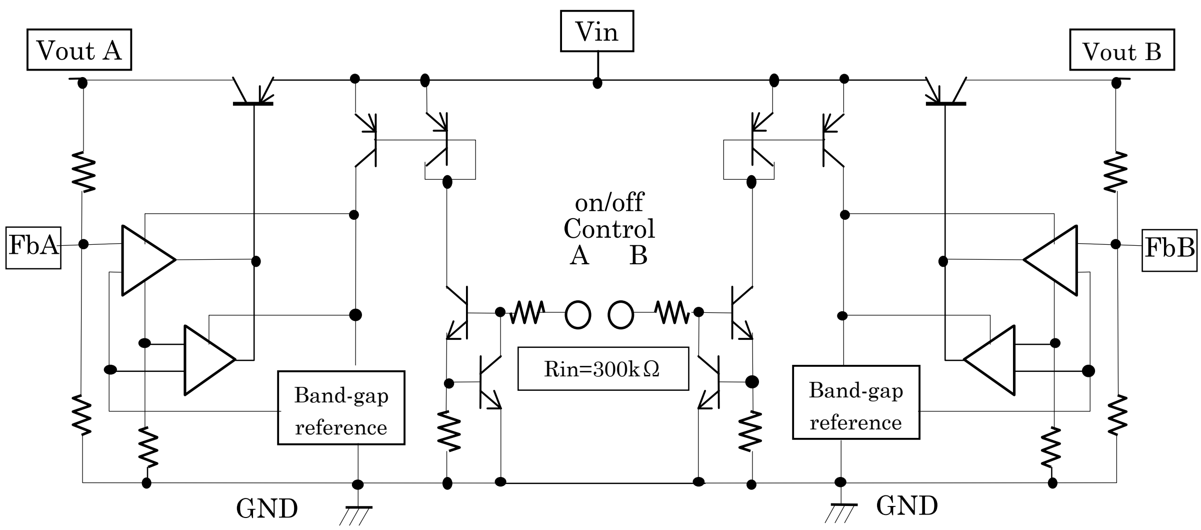
Pin assignment



Test circuit



Block diagram



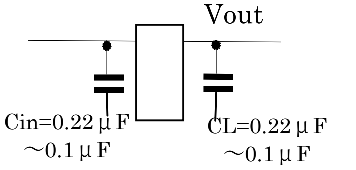
Built in Thermal & Over Current Protection

Input /Output Capacitors

Linear regulators require input and output capacitors in order to maintain the regulator's loop stability. The equivalent series resistance (ESR) of the output capacitor must be in the stable operation area. However, it is recommended to use as large a value of capacitance as is practical. The output noise and the ripple noise decrease as the capacitance value increases.

ESR values vary widely between ceramic and tantalum capacitors. However, tantalum capacitors are assumed to provide more ESR damping resistance, which provides greater circuit stability. This implies that a higher level of circuit stability can be obtained by using tantalum capacitors when compared to ceramic capacitors with similar values.

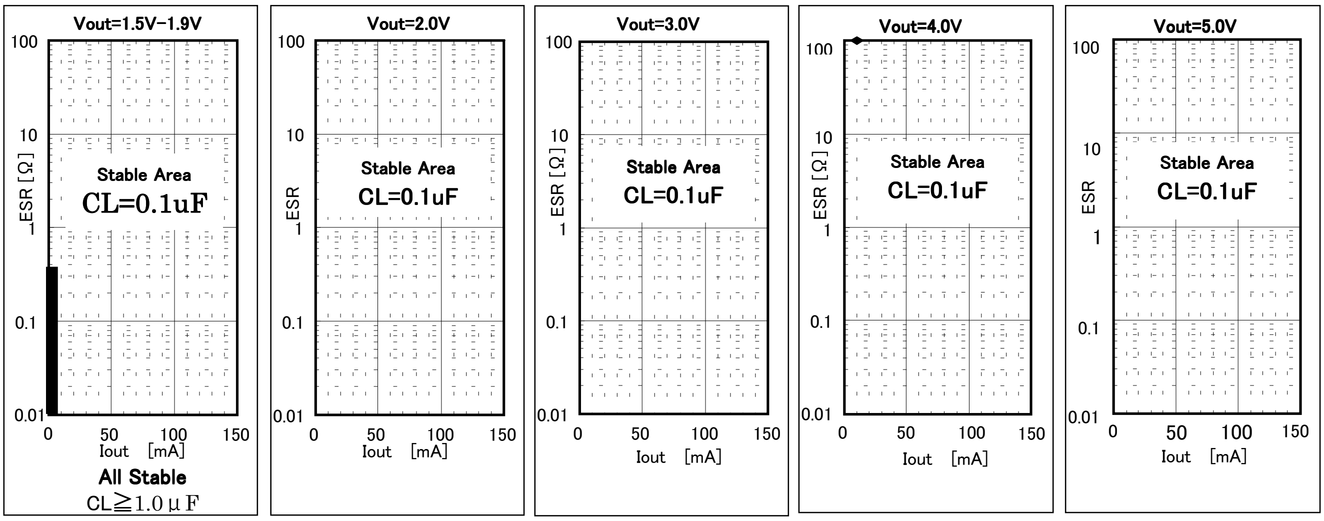
The recommended value：Cin=CL=0.1μF(MLCC) Iout≧0.5mA.



The input capacitor is necessary when the battery is discharged, the power supply impedance increases, or the line distance to the power supply is long. This capacitor might be necessary on each individual IC even if two or more regulator ICs are used. It is not possible to determine this indiscriminately. Please confirm the stability while mounted.

The IC provides stable operation with an output side capacitor of 0.1μF (Vout≧1.8V). If it is 0.1μF or more over the full range of temperature, either a ceramic capacitor or tantalum capacitor can be used without considering ESR. It is not possible to say indiscriminately. Please confirm stability while mounted.

Stable operation area vs. voltage, current, and ESR

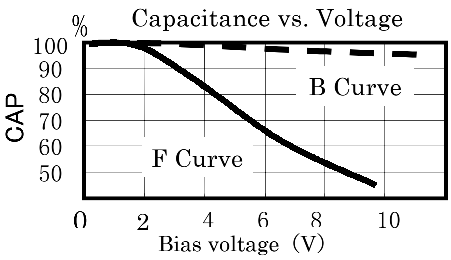


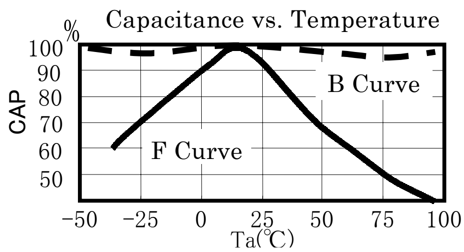
Please increase the output capacitor value when the load current is 5mA or less. The stability of the regulator improves if a big output side capacitor is used (the stable operation area extends.)

For evaluation KYOCERA CM05B104K10AB、CM05B224K10AB、CM105B104K16A、CM105B224K16A、CM21B225K10A
MURATA GRM36B104K10、GRM42B104K10 GRM39B104K25、GRM39B224K10、GRM39B105K6.3

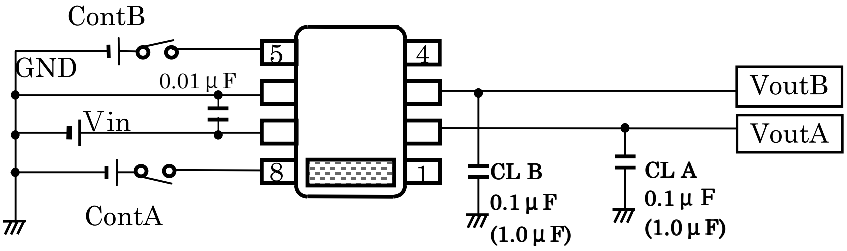
Bias Voltage and Temperature Characteristics of Ceramic Capacitor

Generally, a ceramic capacitor has both a temperature characteristic and a voltage characteristic. Please consider both characteristics when selecting the part. The B curves are the recommend characteristics.





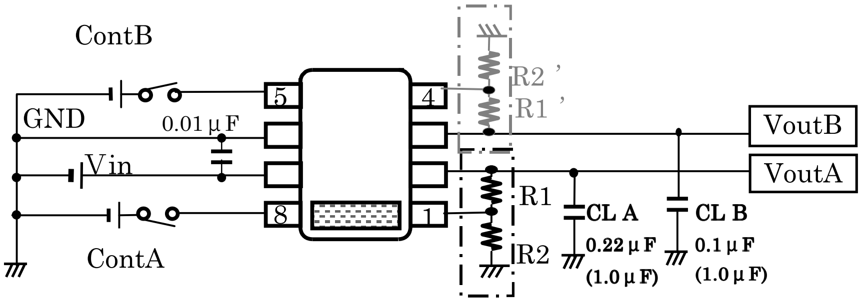
Standard Application



Typically, give the capacitor as large a value as practical in consideration of the temperature characteristic. The output noise and ripple noise decrease with a larger capacitance value. In addition, the response to the output side load change also improves.

Output voltage change

The output voltage on both sides can be set by using R1 and R2. The output voltage is decided by the ratio of R1 and R2. The error of the output voltage usually grows.



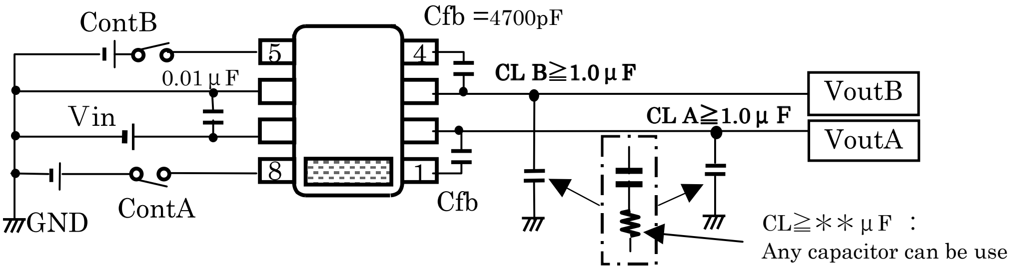
Vout= (R1÷R2 +1) ×1.19

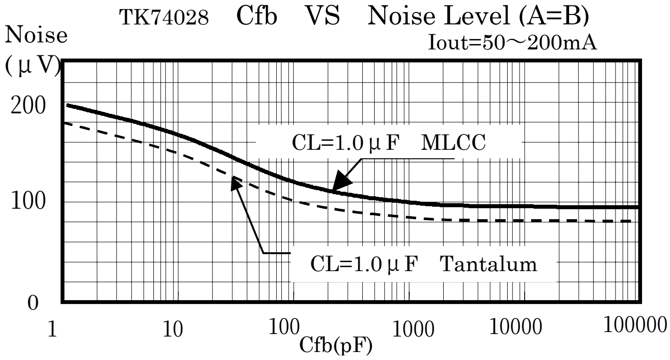
22k ≧ R2

R1(KΩ)=(Vout÷1.19−1)×R2

Noise reduction (Improvement of ripple rejection ratio)

Please connect Cfb with the FbA terminals (1 and 2) and the FbB terminals (3 and 4). It is possible to use Cfb only on the needed side. The tantalum capacitor is the best in this application. A small capacitance is sufficient (0.1 μF, 0.22μF, etc.). When the ceramic capacitor is used, the noise grows in the low current region. If 1.0Ω.(Rs≧1) is connected in series with the ceramic capacitor, the same characteristics as a tantalum capacitor can be obtained. Please adjust the output side capacitor to the value in which stable operation is done over all required temperature ranges. Damage will not be caused by enlarging this value. Increasing this value will decrease the ripple noise and improve the output load transient response. However, the risetime using the on/off control becomes slower. It is possible to use the noise reduction application with the output voltage change application above.

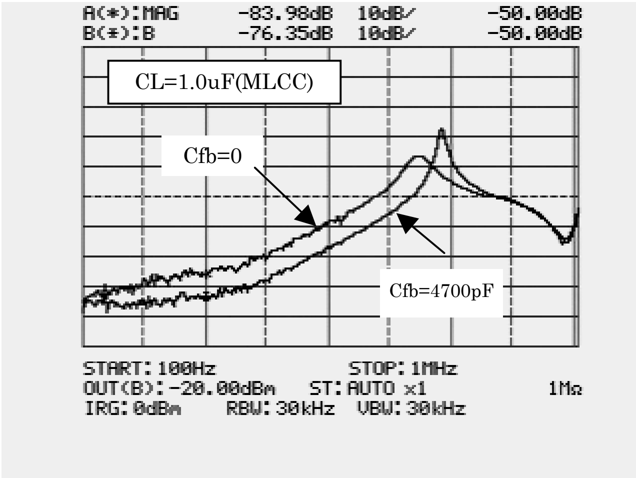


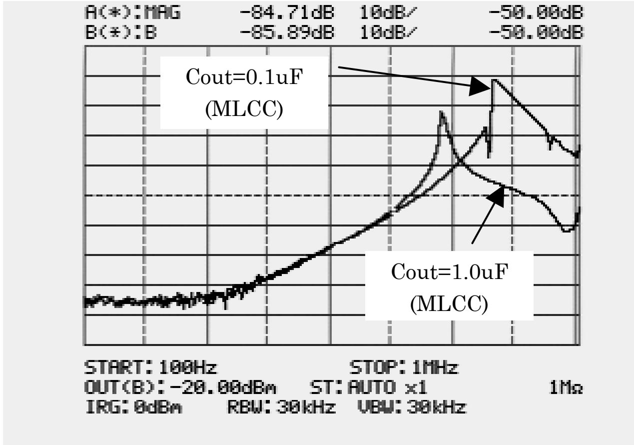


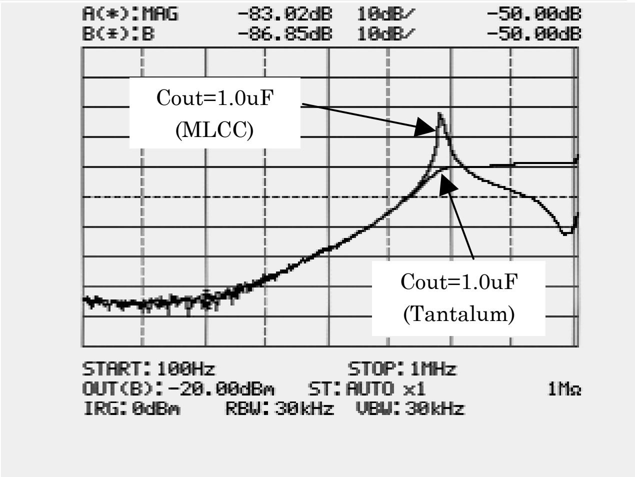
We recommend 4700pF for Cfb

Ripple Rejection (TK74030M)

Condition Vin=4.0V, Vripple=500mVp-p, Cin=0uF, Iout=10mA, Cout=1.0uF(MLCC), Cfb=4700pF

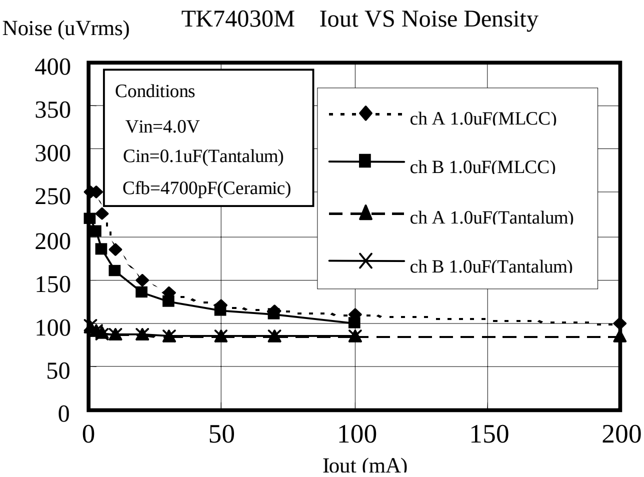


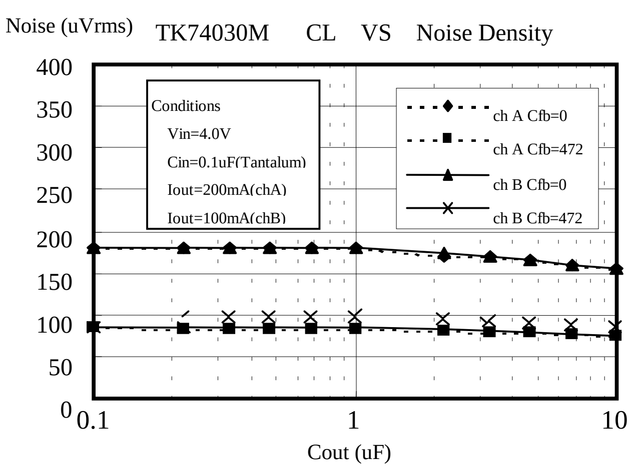




The RR characteristic improves by enlarging the capacitor on the output side. The characteristic of the high frequency area is decided by the characteristic of the output side capacitor.

Output noise





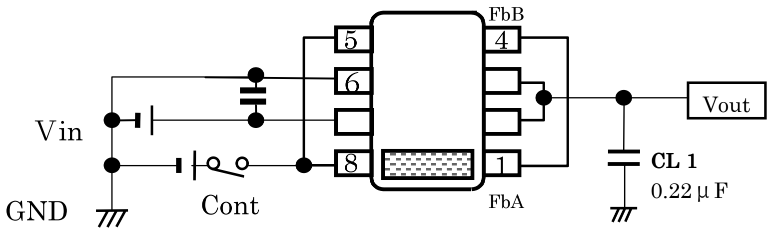
The noise in the low current region decreases when the tantalum capacitor is used.
As for the output side capacitor, a tantalum capacitor of 0.1 μF is recommended.
The characteristic of the capacitor greatly influences the amount of the noise.

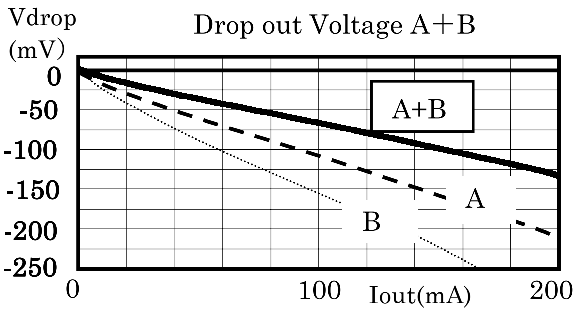
low I/O voltage difference and High current LDO

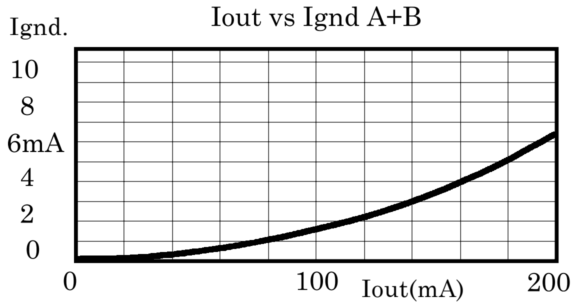
Connect the following terminals: pin5 and pin8, pin1 and pin4, pin2 and pin3.
Vdrop=70mV at 100mA: 125mV at 200mA: 180mV at 300mA is typically obtained.

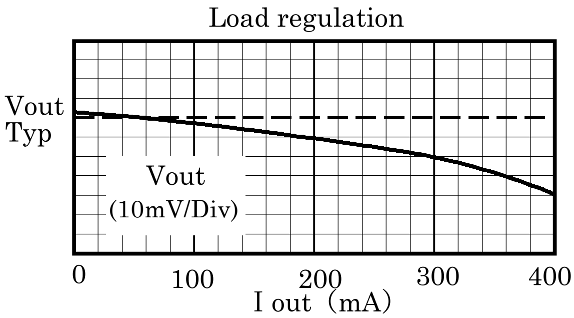
Attention when this application is adopted

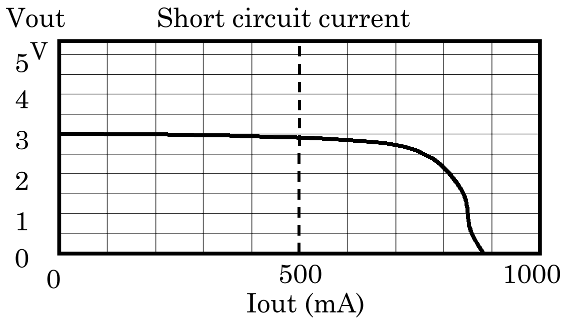
The control current and the no load current double because the A and B circuits are connected in parallel. A very large current flows at the output during a short-circuit. Therefore, there is a possibility of damage by the current. Please note the short-circuit of the output side and GND. The current value that can regularly be delivered is 300-400mA. The output current is limited by the permissible electric power loss of the package. The current cannot be delivered exceeding this. However, a large peak current can be delivered for the pulse load with little generation of heat. The permissible loss increases by improving heat radiation. Please make the copper pattern in the IC part installation as wide as possible.
For instance, the permissible electric power loss increases greatly if the board thermal plane is bonded to the IC. The characteristic of this application is not guaranteed immediately because Toko does not test to this application. The characteristic of this application is almost obtained by guaranteeing the characteristic on the A side and the B side. The difference appears large; use care when designing.





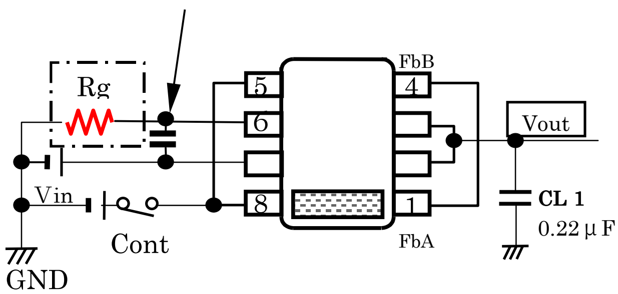


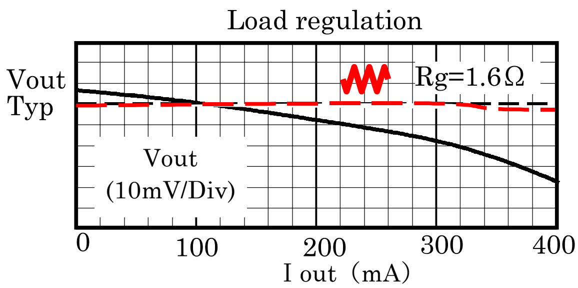




Improvement of load regulation with high current application

Please connect a resistor (Max=1.2—1.6Ω) between pin6 of the TK740xx and GND.
The load regulation is greatly improved. Please enlarge the I/O capacitors.

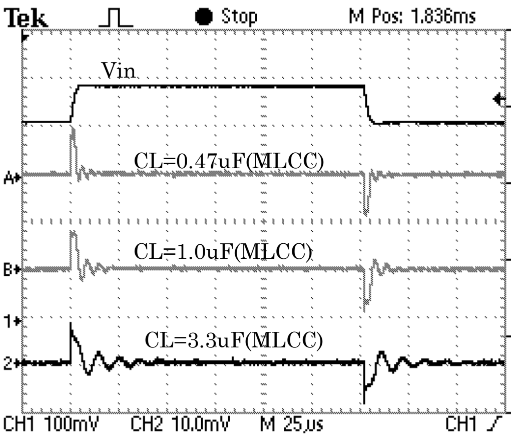


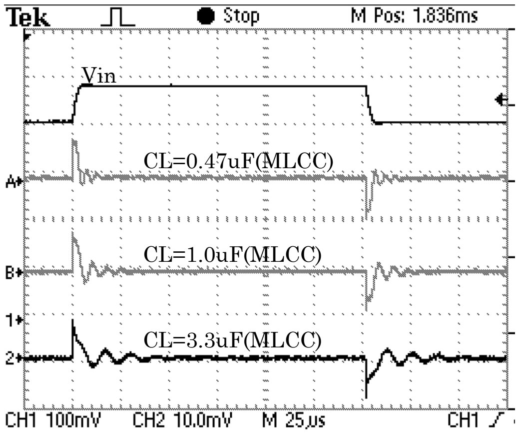


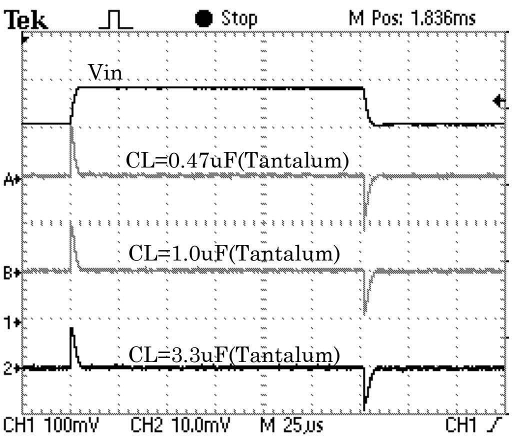
Line Transient

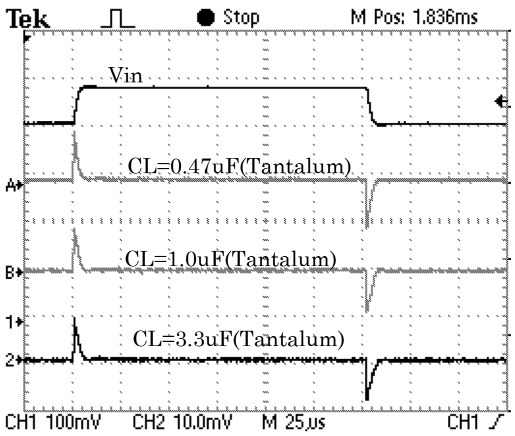
Vin=4→5→4 (V), Cin=1.0uF(MLCC), Cfb=472

A side (Iout=100mA) **B side** (Iout=50mA)







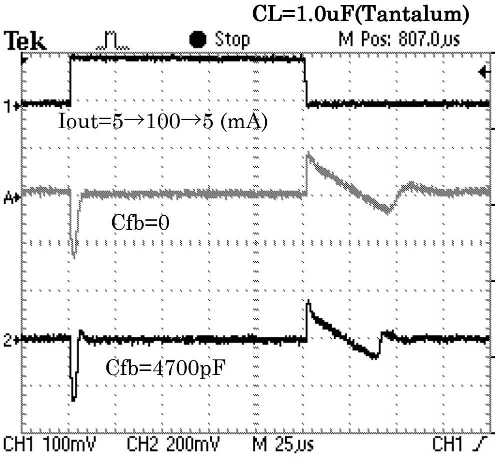


Load Transient

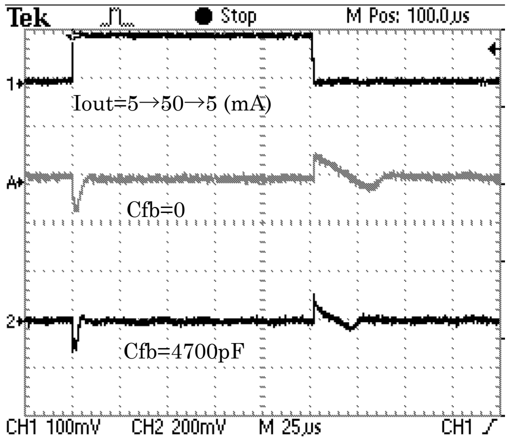
Vin=4V, , Cin=1.0uF(MLCC)

A side (Iout=5-100-5mA) **B side** (Iout=5-50-5mA)

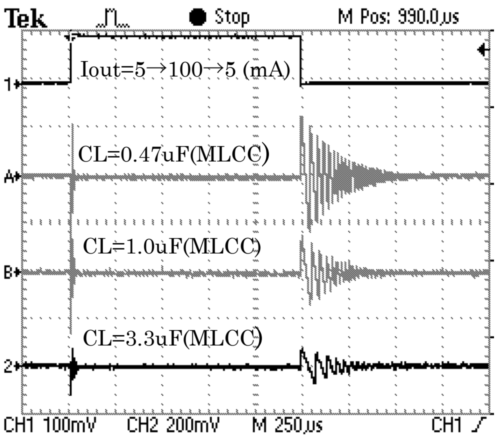
CL=1.0uF(Tantalum)



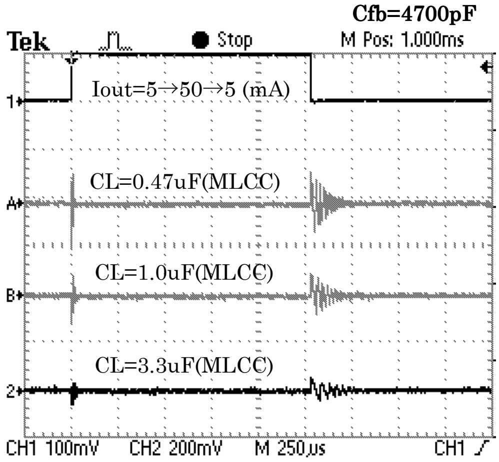
CL=1.0uF(Tantalum)



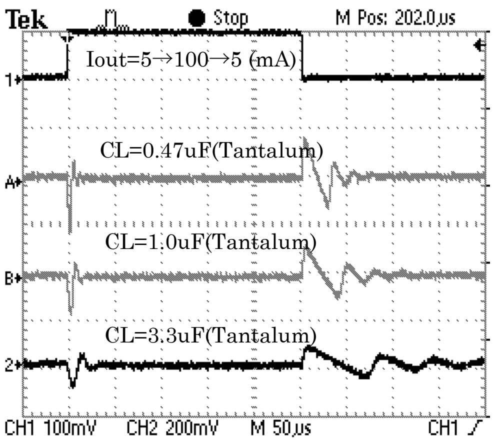
Cfb=4700pF



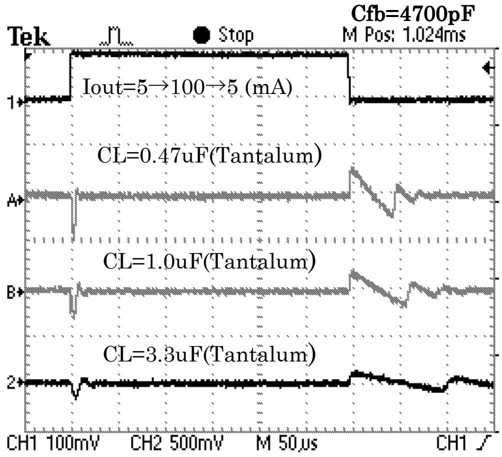
Cfb=4700pF



Cfb=4700pF



Cfb=4700pF

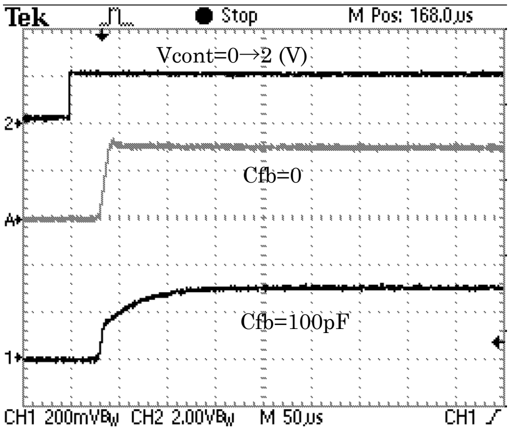


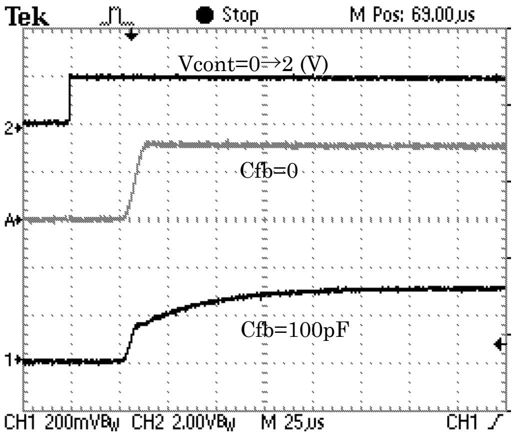
ON/OFF Transient

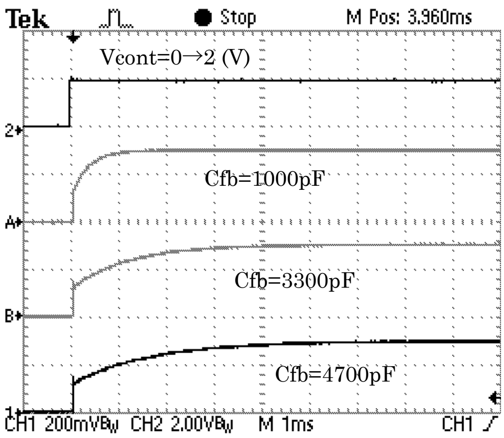
Iout=10mA, Cin=0.11uF(MLCC), CL=1.0uF(MLCC)

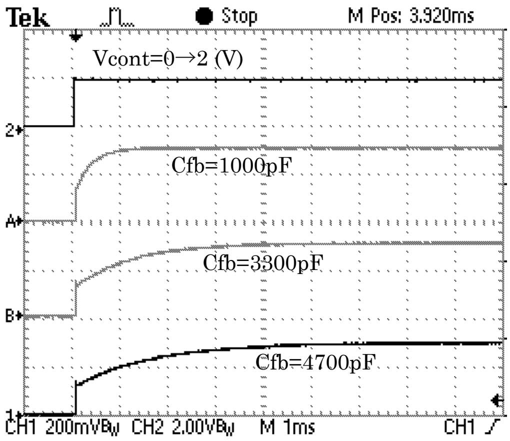
A side

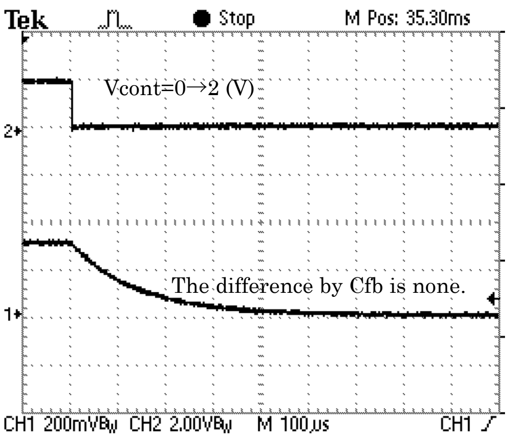
B side

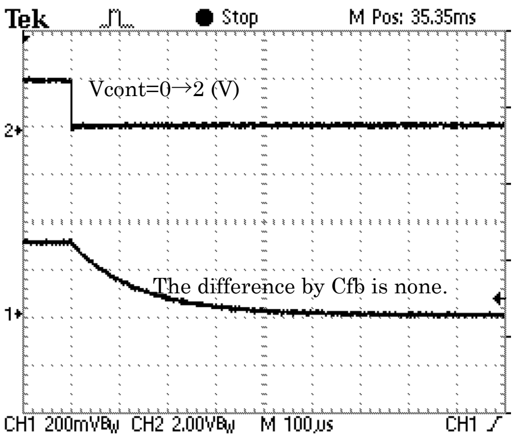








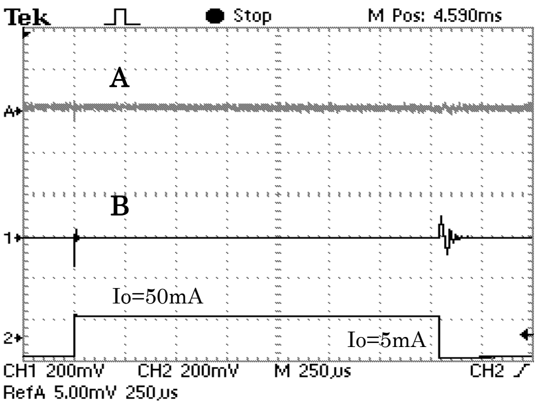




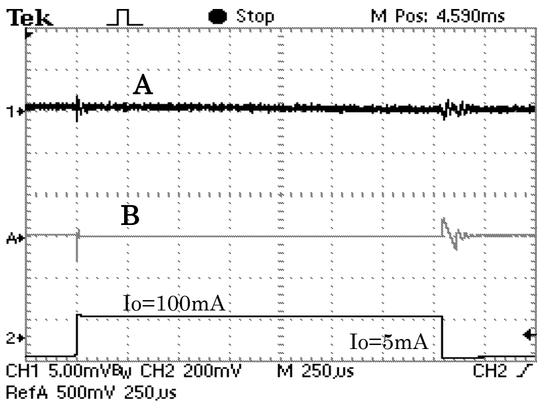
Cross Regulation. Cin=0.1uF CL=1.0uF(MLCC) Cfb=None

The output voltage change of making the load current rapidly change in the A side or B side (in 5-50,5-100,5-200mA steps), compared with the no-change side is observed. The current on the side where the load current is not allowed to change is 5mA constant. The measurement sensitivity on the side without the current change is 5mV/div.: the side with the current change is 200mV/div.

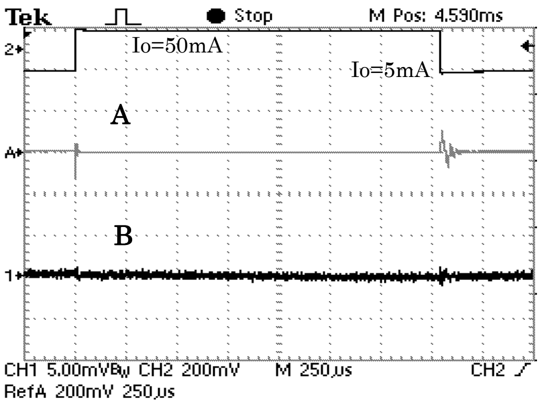
A : 5mA(const) B : 5 → 50mA



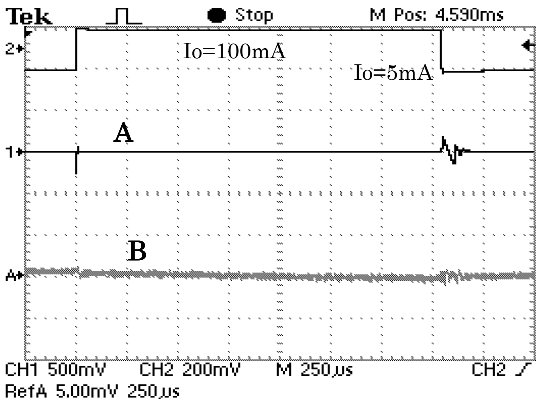
A : 5mA(const) B : 5 → 100mA



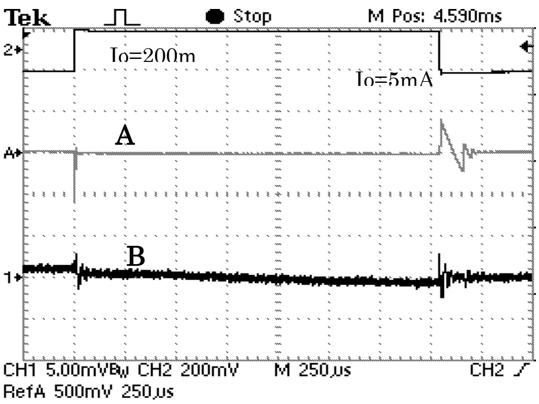
A : 5 → 50mA B : 5mA(const)



A : 5 → 100mA B : 5mA(const)



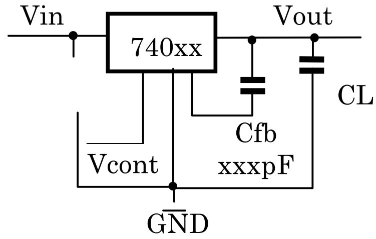
A : 5 → 200mA B : 5mA(const)

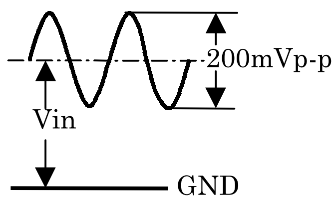


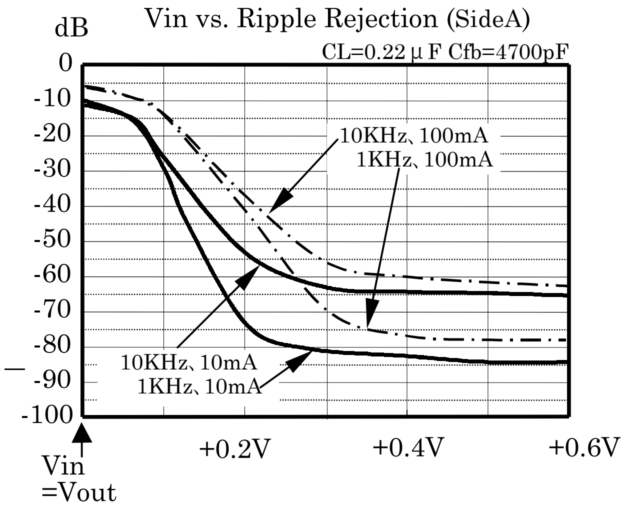
Ripple rejection when I/O voltage difference is few.

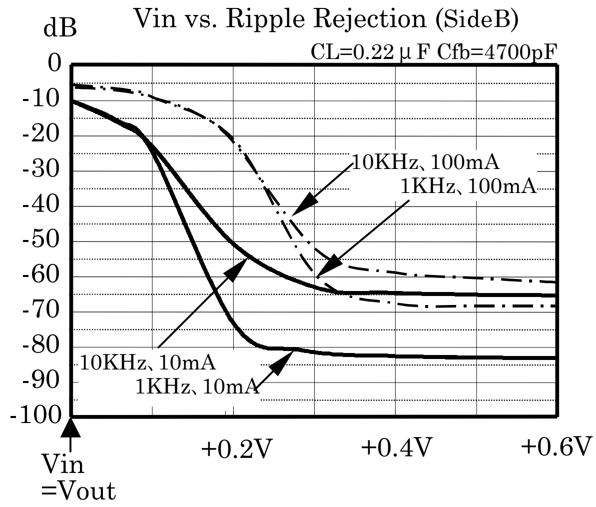
When the difference between the input voltage and the output voltage decreases, the RR characteristic is different in Side A and Side B. The characteristic on the A side (where the power transistor is large) improves.

With CFb

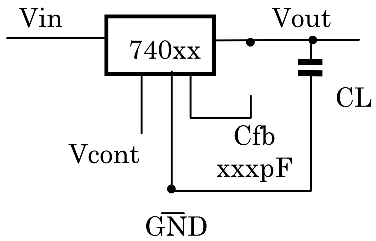


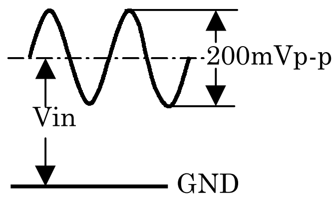


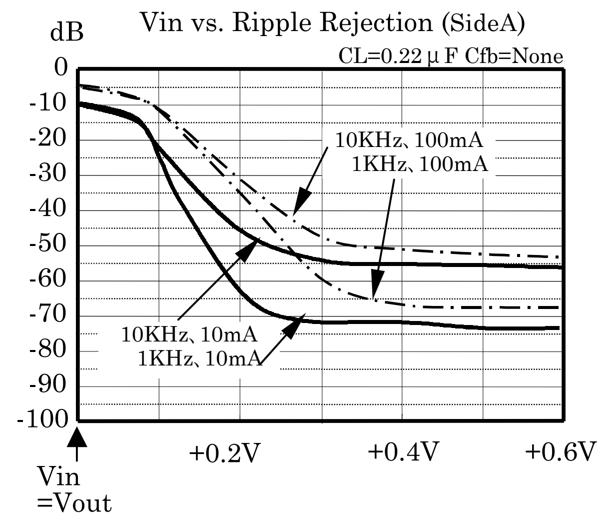


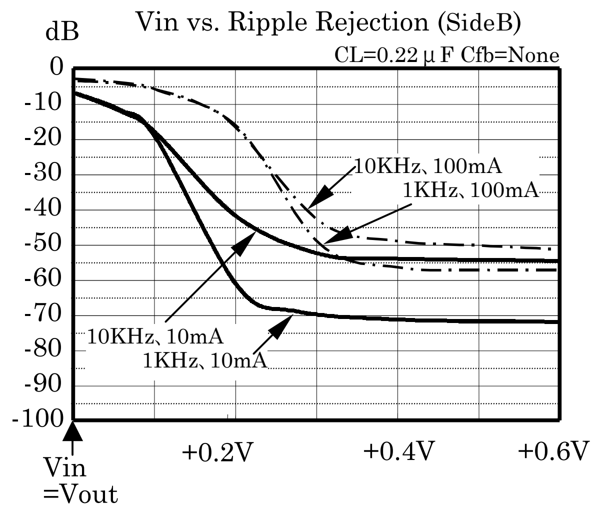


Without Cfb





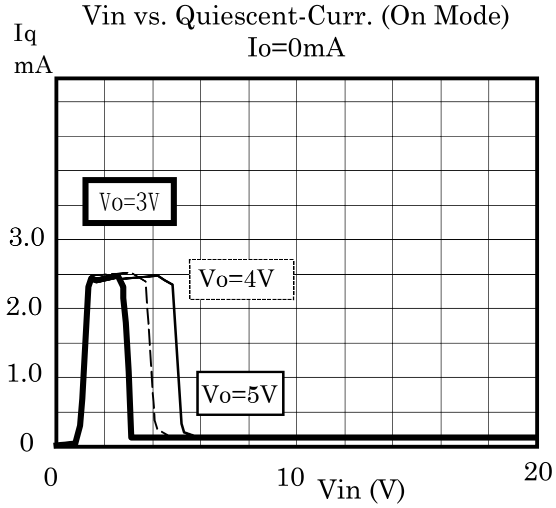




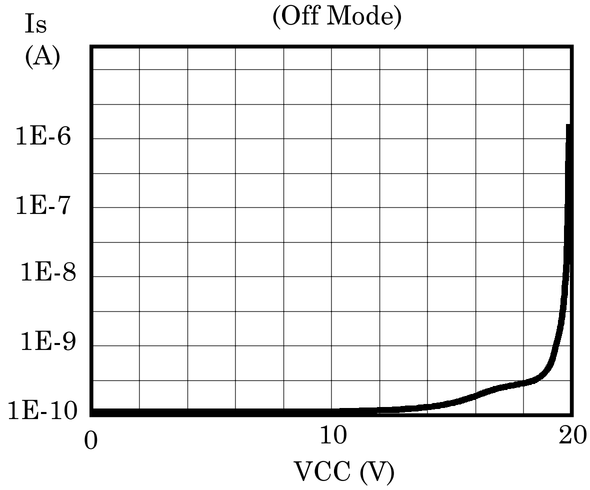
Typical Performance Characteristics

A and B: Common Characteristics

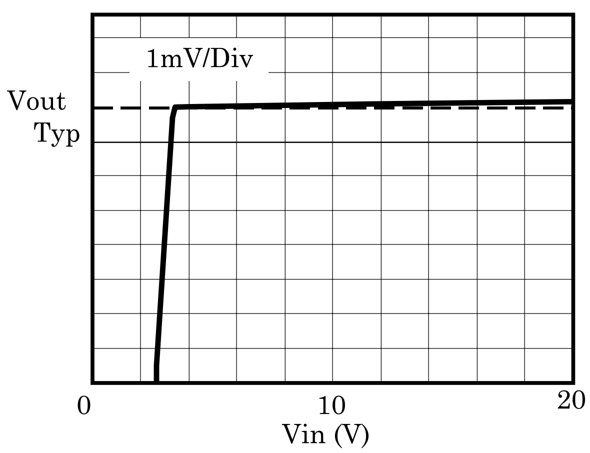
Vin vs. Quiescent-Curr. (On Mode)
Io=0mA



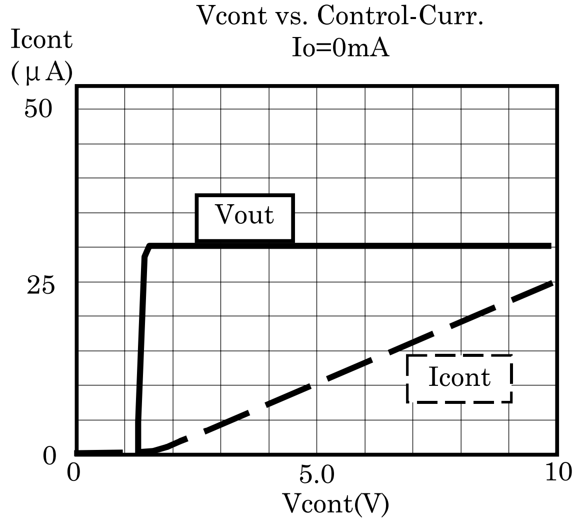
Vin vs. Quiescent-Current.
(Off Mode)



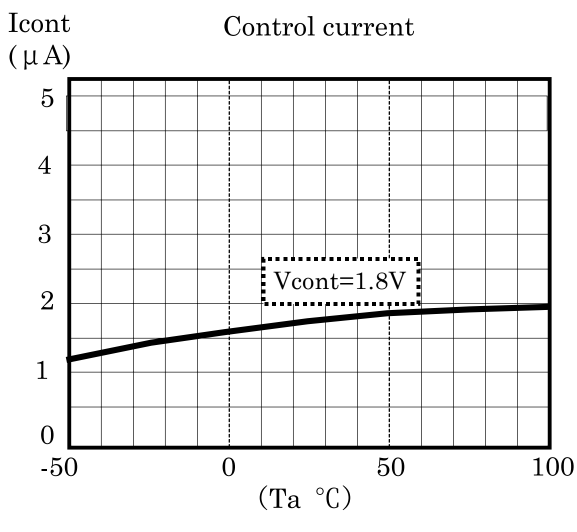
Line Regulation



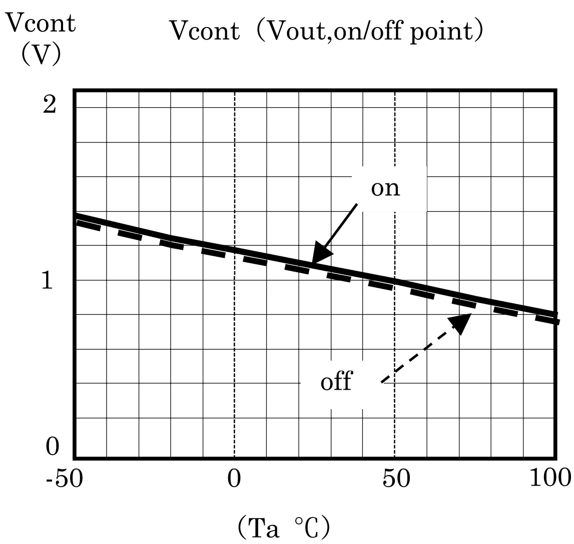
Vcont vs. Control-Curr.
Io=0mA



Control current

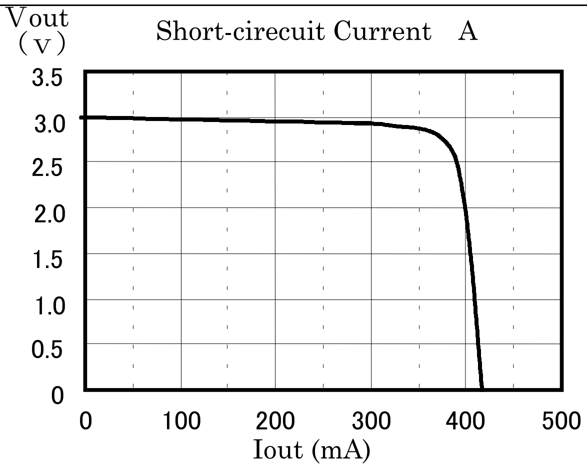


Vcont（Vout,on/off point）

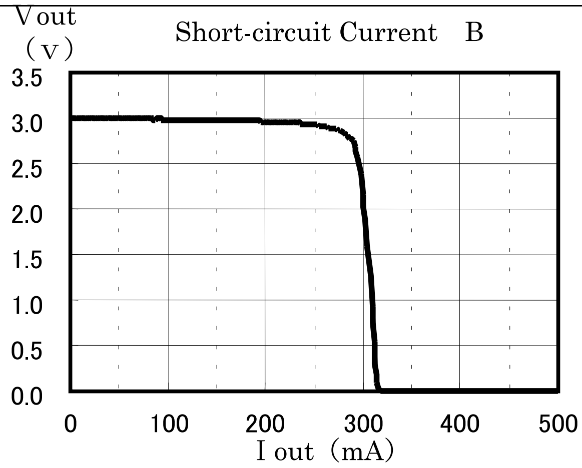


Side A	Side B

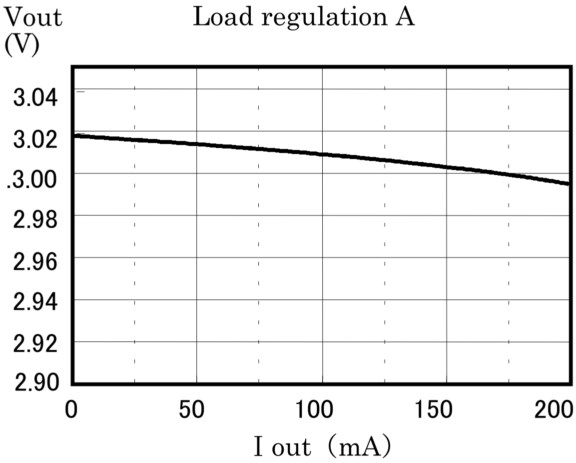
Short-circirecuit Current A



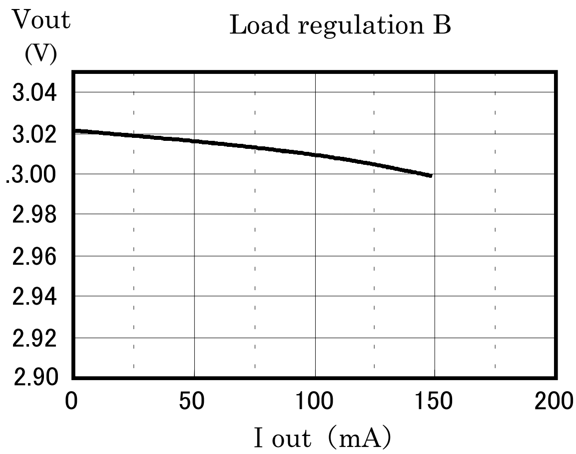
Short-circuit Current B



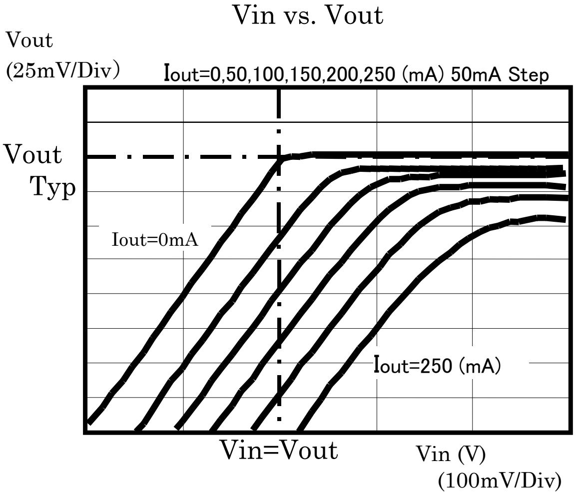
Load regulation A



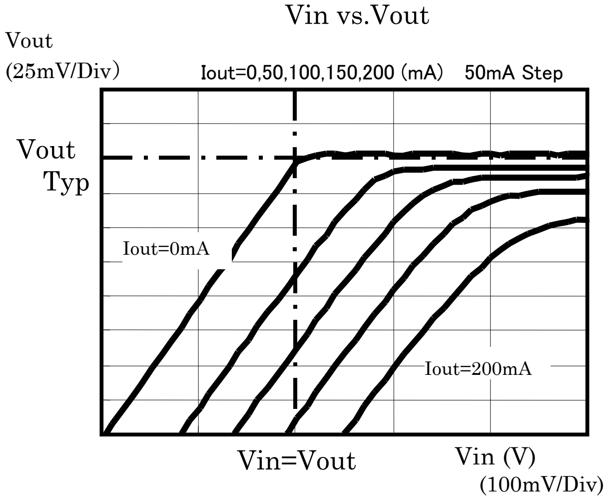
Load regulation B



Vin vs. Vout

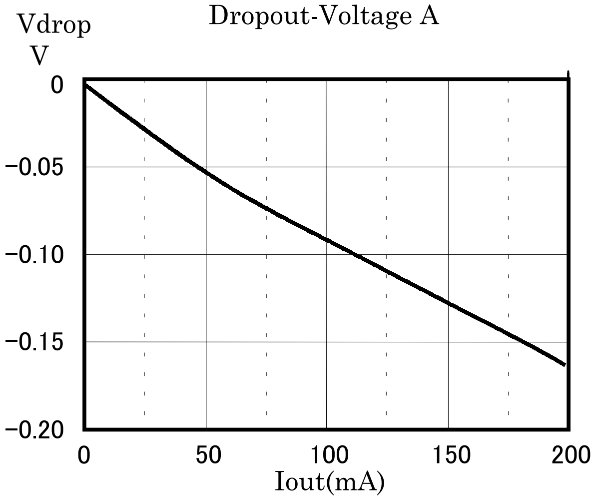


Vin vs.Vout

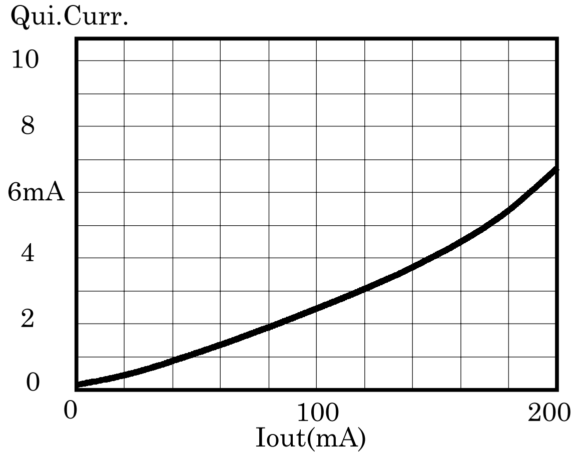


Side A	Side B

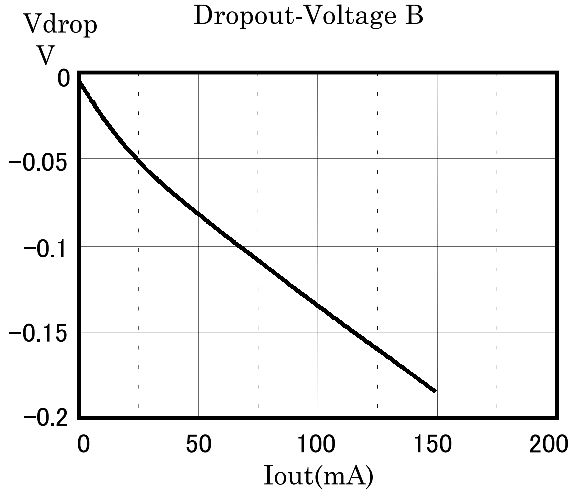
Dropout-Voltage A



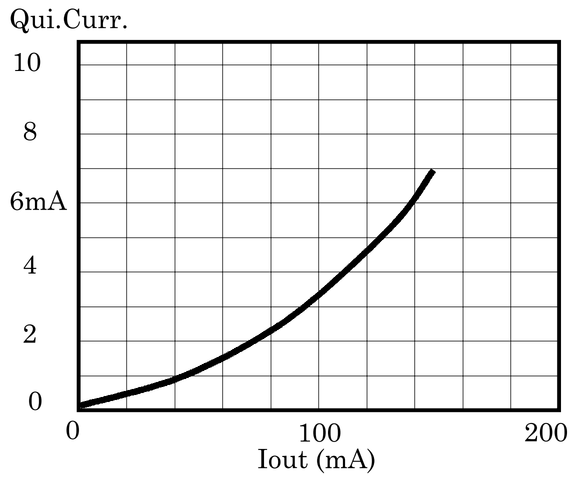
Output-Current vs. GND Current



Dropout-Voltage B



Output-Current vs. GND Current

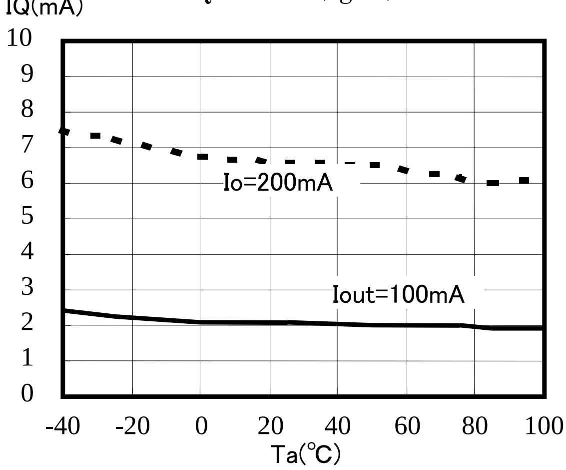


Ambient temperature behavior

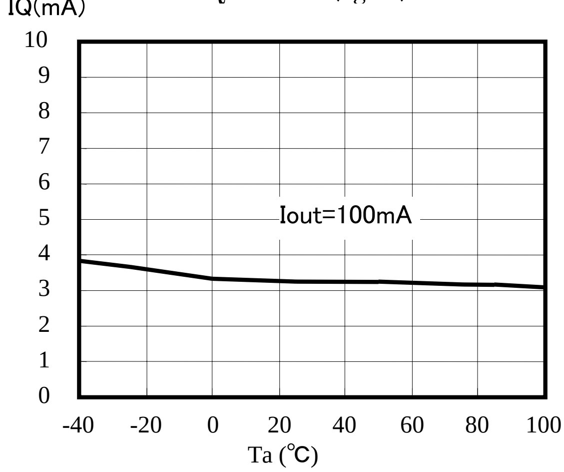
Ta: Ambient temperature

Side A	Side B

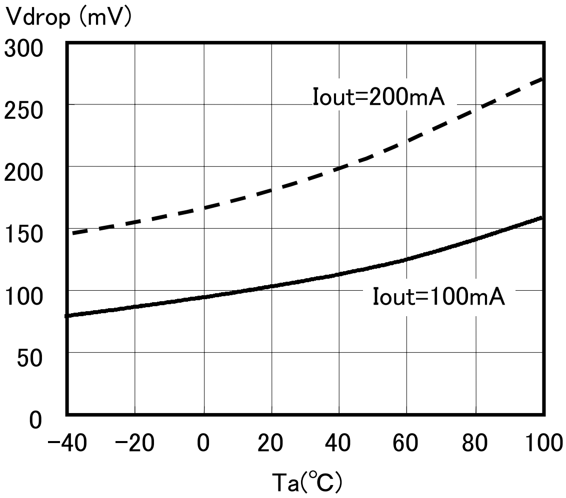
Quiescent(Ignd)



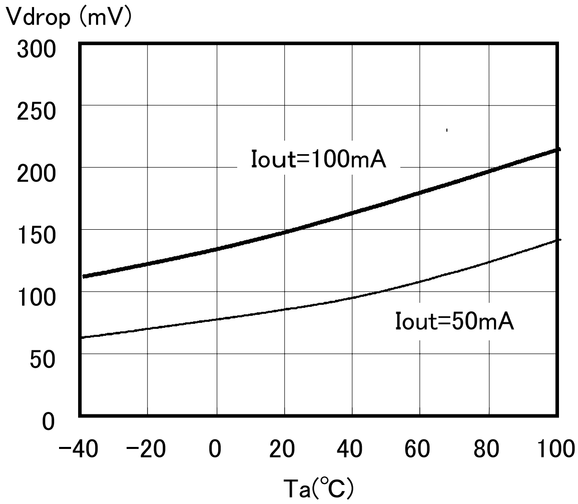
Quiescent(Ignd)



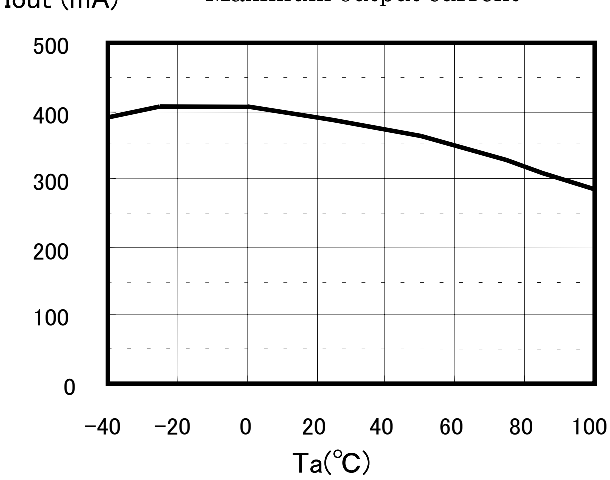
Drop out voltage



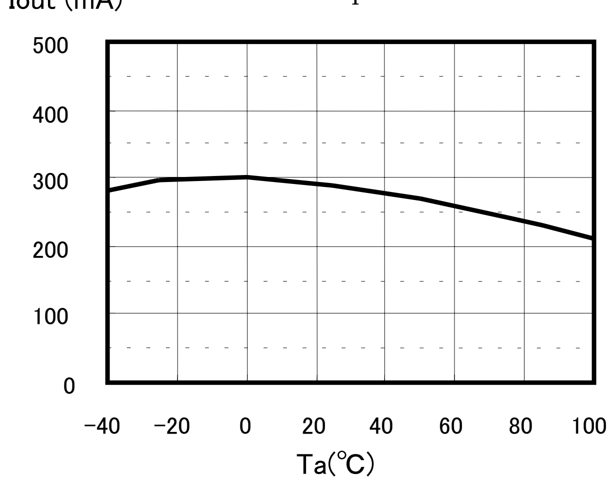
Drop out voltage



Maximum output current



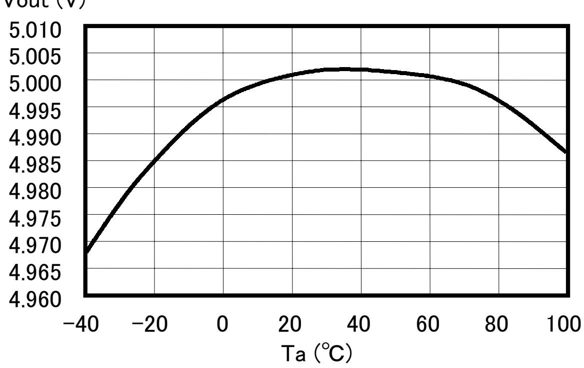
Maximum output current



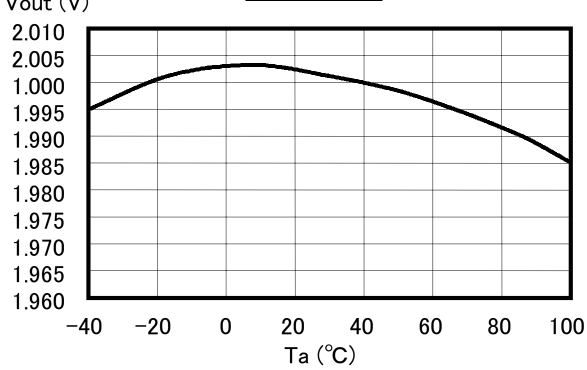
Output Voltage Temperature behavior

(Iout=5mA) Ta: Ambient temperature

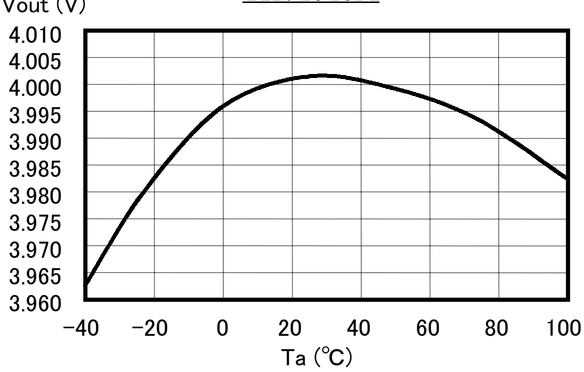
TK74050M



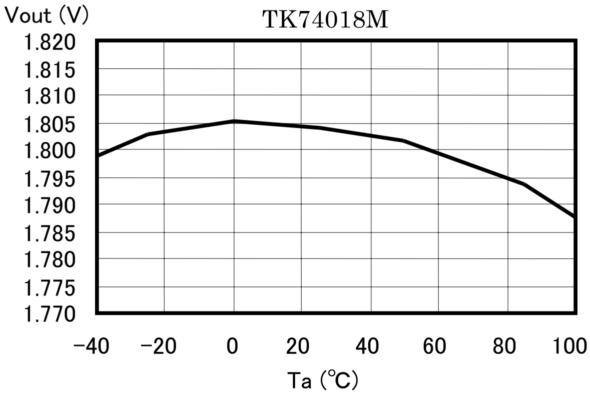
TK74020M



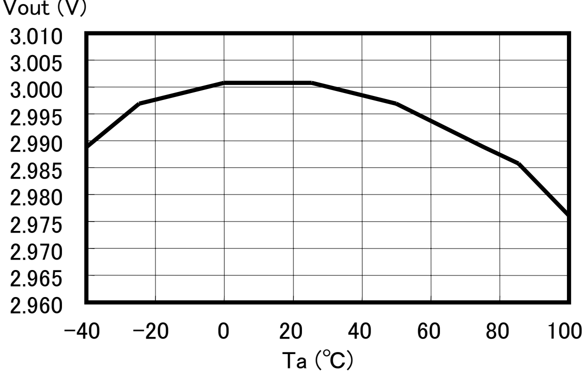
TK74040M



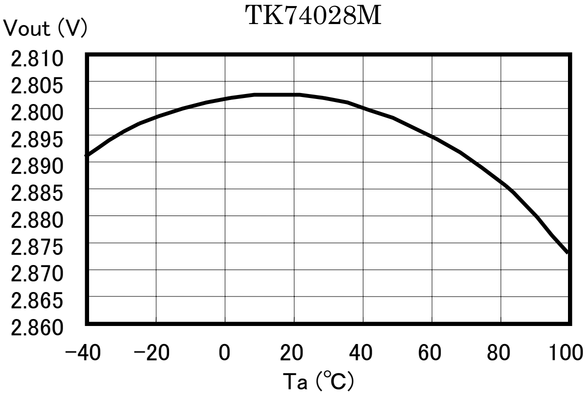
TK74018M



TK74030M



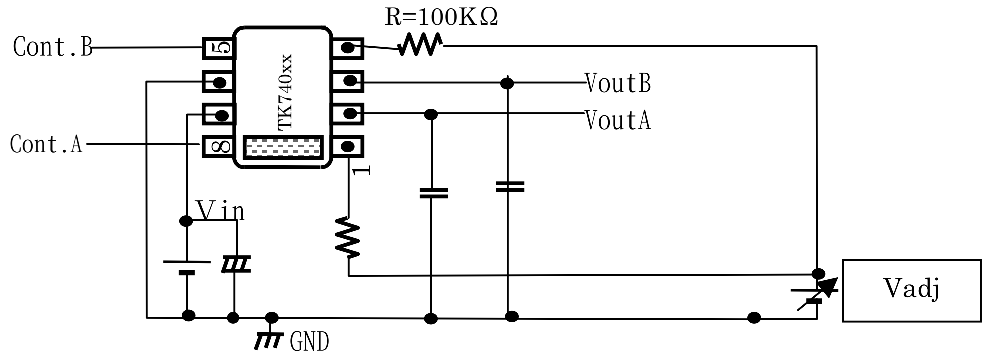
TK74028M



Application

Variable output voltage. Voltage control by an external voltage

When Vadj is raised more than 1.25V, the output voltage falls. Even only one side can be used.。

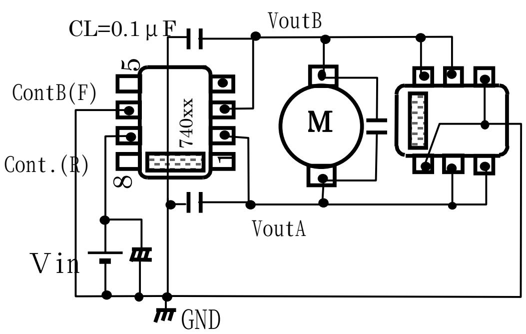


Forward or reversal: Motor drive circuit.

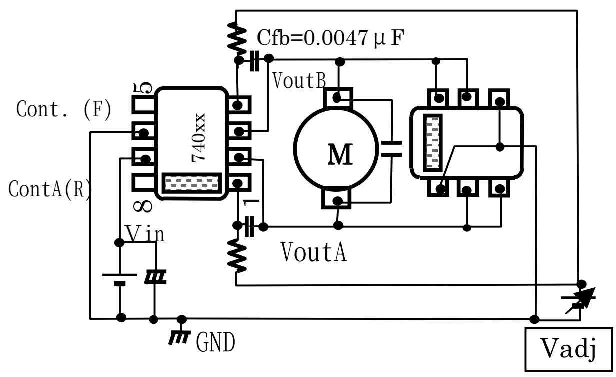
This connection becomes the bridge connection of NPN Tr 2 piece entering Digi-Tr (UMH10N and UMG8N, etc.) and combination PNP-Tr and NPN-Tr. The Motor can be driven by the low saturation type. Therefore, the stability operation is done up to the voltage with few I/O voltage differences. The voltage impressed to the motor comes in changeability. The I/O voltage difference of TK740xx is about 0.17V in IL=150mA. The current when the motor starts is 300mAMax.

Please make to the logic, which becomes off once when the direction of the rotation is switched.

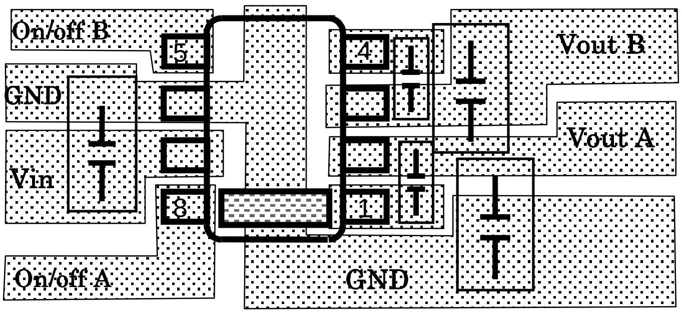
Constant speed (fixed voltage)
Even if the input voltage changes, the voltage impressed to the motor is constant.

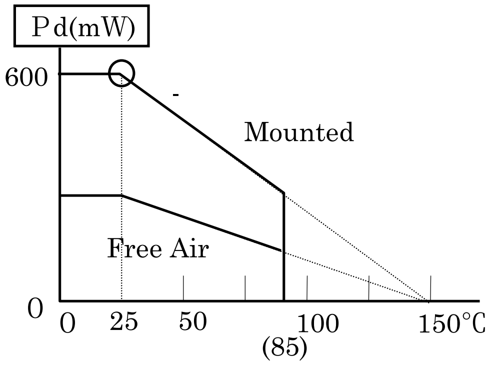


Variable speed (voltage changeability)
When Vadj is raised more than 1.25V, the output voltage falls.



Layout Material：Grass epoxy 20×20mm t=0.8mm





The heat loss is in total of A and B.

Pd=600 mW when mounted as recommended. Derate at 4.8mW/°C for operation above 25°C. The thermal resistance is θja=208℃/W. The package loss is limited at the temperature that the internal temperature sensor works (about 150℃). Therefore, the package loss is assumed to be an internal limitation. There is no heat radiation characteristic of the package unit assumed because of the small size. Heat is carried away by the device being installed on the PCB. This value changes by the material and the copper pattern etc. of the PCB. Enduring losses of about 500mW becomes possible in a lot of applications operating at 25℃.

Determining the thermal resistance when mounted on a PCB.

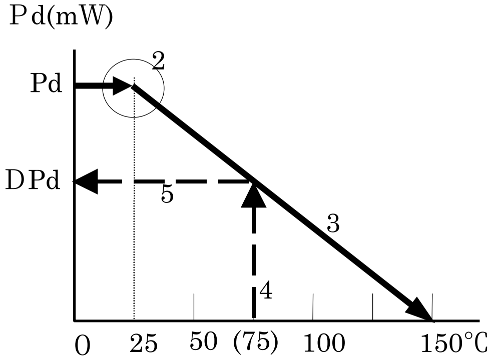
The operating chip junction temperature is shown by
Tj=θja×Pd+Ta. Tj of IC is set to about 140℃.
Pd is a value when the over temperature sensor is made to work.

Ta（Ta=25℃）
150＝θja×pd＋25
θja×Pd＝125
θja＝（125／pd）(℃／mW)

Pd is easily obtained.

Mount the IC on the PCB. Pd becomes Vin×Iin when the output side of the IC is short-circuited.
The input current decreases gradually by the temperature rise of the chip.
Please use the value when the current is steady (thermal equilibrium is reached).
In many cases, heat radiation is good, and Pd becomes 600mW or more。

Pd is obtained by the normal temperature degrees. The current that can be used at the highest operating temperature is obtained from the graph of the figure below.



Procedure (Do when PCB mounted).

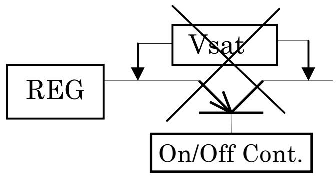
1. Pd is obtained (Vin×Iin when the output side is short-circuited).
2. Pd is plotted on the horizontal line to 25℃.
3. Pd is connected with the point of 150℃ by the straight line (bold face line).
4. A line is extended vertically above the point of the use temperature in the design. For instance, 75℃ is assumed (broken line).
5. Extend the intersection of the derating curve (fat solid line) and (broken line) to the left and read the Pd value.
6. DPd÷(Vinmax—Vout)=Iout (at 75℃)

The maximum current that can be used at the highest operating temperature is:
Iout DPd÷(Vinmax—Vout).

Application hint

On/off Control

It is recommended to turn the regulator Off when the circuit following the regulator is non-operating. A design with a little electric power loss can be implemented. We recommend the use of the on/off control of the regulator without using a high side switch to provide an output from the regulator. A highly accurate output voltage with low voltage drop is obtained.



Because the control current is small, it is possible to control it directly by CMOS logic.

The PULLDOWN resistance is not built into the control terminal.

The noise and the ripple rejection characteristics depend on the capacitance between the Vout to the Fb terminal.

The IC will not be damaged if the capacitor value is increased.

Current boost

For current boost applications, use the products below. A low voltage drop, high current regulator can be easily made.

TK714xx Only the PNP transistor for the current boost is external.

TK732XX (For Iout=10A Max regulator)

Built-in Short circuit protection: a constant current can be set by an external resistor.

Definition of Terms

The output voltage tables are specified with a test voltage of Vin = output voltage Typ+1V.

Output Voltage (Vout)

The output voltage is specified with Vin = output voltage Typ+1V and output current (Iout=5mA).

Maximum Output Current (Iout Max)

The output current is measured when the output voltage decreases to ($Vout_{Typ.} \times 0.9$). The input voltage is (output voltage Typ+1V). The maximum output current is measured in a short time so that it is not influenced by the temperature of the chip.

The output current decreases during low voltage operation.

Please refer to the "Low input voltage-output current" graph for 2.1V or less.

Dropout Voltage (Vdrop)

The dropout voltage is the difference between the input voltage and the output voltage at which point the regulator starts to fall out of regulation. Below this value, the output voltage will fall as the input voltage is reduced. It is dependent upon the load current (Iout) and the junction temperature (Tj).

The input voltage is gradually decreased below the test voltage. It is the voltage difference between the input and the output when the output voltage decreases by 100mV.

Line Regulation（Lin Reg）

Line regulation is the ability of the regulator to maintain a constant output voltage as the input voltage changes. The line regulation is specified as the input voltage is changed from (output voltage Typ+1V) to (output voltage Typ+6V). This measurement is not influenced by the temperature of the IC and is measured in a short time.

Load Regulation（Load Reg)

Load regulation is the ability of the regulator to maintain a constant output voltage as the load current changes. The input voltage is set to (output voltage Typ+1V). The output voltage change is measured as the load current changes from 5 to 100mA and from 5 to 200mA. This measurement is not influenced by the temperature of the IC and is measured in a short time.

Quiescent Current (Iq)

The quiescent current is the current which flows through the ground terminal under no load conditions (Io=0 mA).

Ground Pin Current（Ignd）

The ground pin current is the current which flows through the GND terminal according to load current. It is measured by (input current-output current).

Ripple Rejection（ＲＲ)

Ripple rejection is the ability of the regulator to attenuate the ripple content of the input voltage at the output. It is specified with the input voltage = （Vout＋1.5V), Io=10mA, CL=1.0μF and Cfb=4700pF. An Alternating Current source of (f=1Khz and 500m$V_{p\text{-}p}$) is superimposed to the power-supply voltage. Ripple rejection is the ratio of the ripple content of the output vs. the input and is expressed in dB. It is typically about 84dB at 1kHz. The ripple rejection improves when the value of the capacitor at the noise bypass terminal in the circuit is large. However, the on/off response worsens.

Standby Current

Standby current is the current which flows into the regulator when the control voltage is made 0 volts. It is measured with an input voltage of 8V.

PROTECTION CIRCUITS

Short circuit Sensor

This sensor operates when there is excessive output current. The short circuit sensor protects the device if the output is accidentally shorted to GND. The current flows at the set peak value.

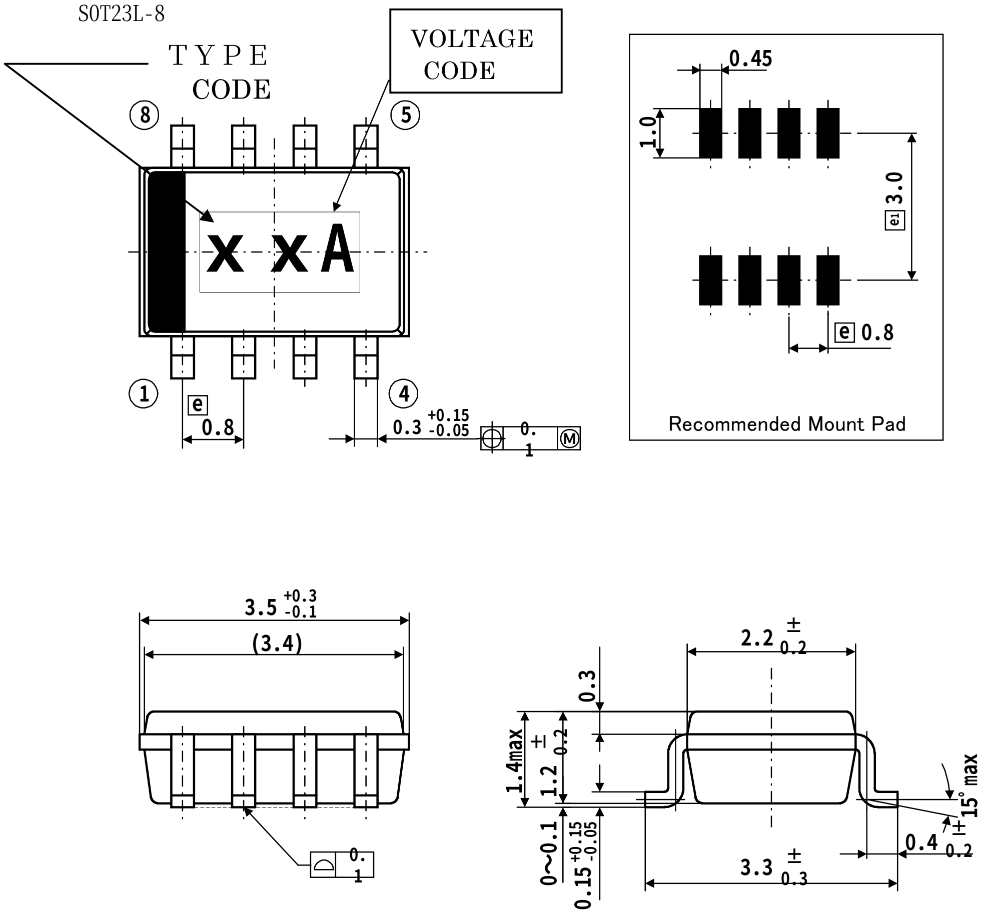
Thermal Sensor

The thermal sensor protects the device if the junction temperature exceeds the safe value (Tj=150 °C). This temperature rise can be caused by extreme heat, excessive power dissipation caused by large output voltage drops, or excessive output current. The regulator will shut off when the temperature exceeds the safe value. As the junction temperature decreases, the regulator will begin to operate again. Under sustained fault conditions, the regulator output will oscillate as the device turns off then resets. Please improve heat radiation or lower the input electric power. When heat radiation is poor, the forecast package loss is not obtained.

ＥＳＤ	MM	200pF	0Ω	200V Min
	HBM	100pF	1.5kΩ	2000V Min

Package outline／Stamps

SOT23L-8



Unit ：mm
General tolerance ：±0.2

Molded Resin with Body	：Epoxy Resin
Lead Frame	：Copper Alloy
Treatment	：Solder Plating(5～15μm)
Marking Method	：Ink or Laser
Weight	：0.024g
Country of origin	：Japan：Korea

Vout	V Code	Vout	V ode	Vout	V Code	Vout	V Code
		2.1 V	21	3.1 V	31	4.1 V	41
		2.2	22	3.2	32	4.2	42
1.3 V	13	2.3	23	3.3	33	4.3	43
1.4	14	2.4	24	3.4	34	4.4	44
1.5	15	2.5	25	3.5	35	4.5	45
1.6	16	2.6	26	3.6	36	4.6	46
1.7	17	2.7	27	3.7	37	4.7	47
1.8	18	2.8	28	3.8	38	4.8	48
1.9	19	2.9	29	3.9	39	4.9	49
2.0	20	3.0	30	4.0	40	5.0	50

The output voltage table indicates the standard value when manufactured.

NOTE

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