APPLICATION MANUAL

150mA, Capacitor-less, Low I_Q, CMOS LDO Regulator IC
TK637xxAB6

CONTENTS

TOKO

150mA, Capacitor-less, Low I_Q, CMOS LDO Regulator TK637xxAB6

1. DESCRIPTION

The TK637xxAB6 is a CMOS LDO regulator. The packages are the very small 4-bump flip chip.
The IC is designed for portable applications with space requirements.
The IC can supply 150mA output current.
The IC does not require input capacitor, output capacitor, and noise-bypass capacitor.
The IC offers low 10μA quiescent current, and good transient performance.
The output voltage is internally fixed from 1.35V to 4.2V.

2. FEATURES

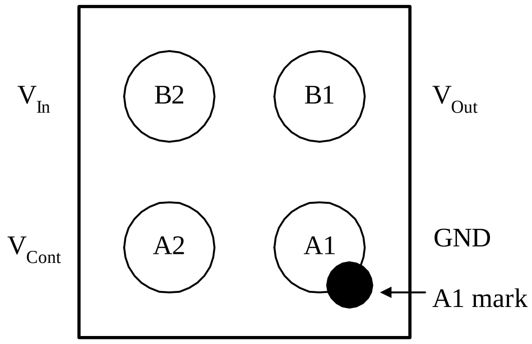
- Capacitor-less
(Without input capacitor, output capacitor, and noise-bypass capacitor)
- Package: FC-4
- Low quiescent current
- Good transient performance
- Thermal and over current protection
- On/Off control
- High accuracy

3. APPLICATIONS

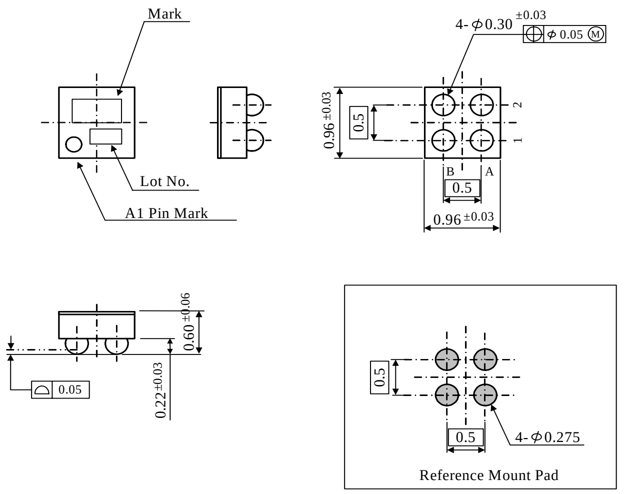
- Mobile Communication
- Battery Powered System
- Any Electronic Equipment

4. PIN CONFIGURATION

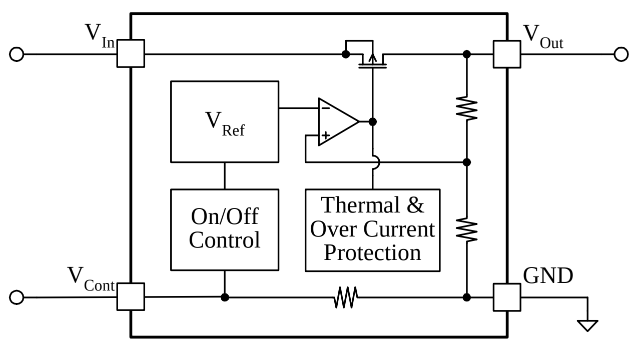
- FC-4 (TK637xxAB6)



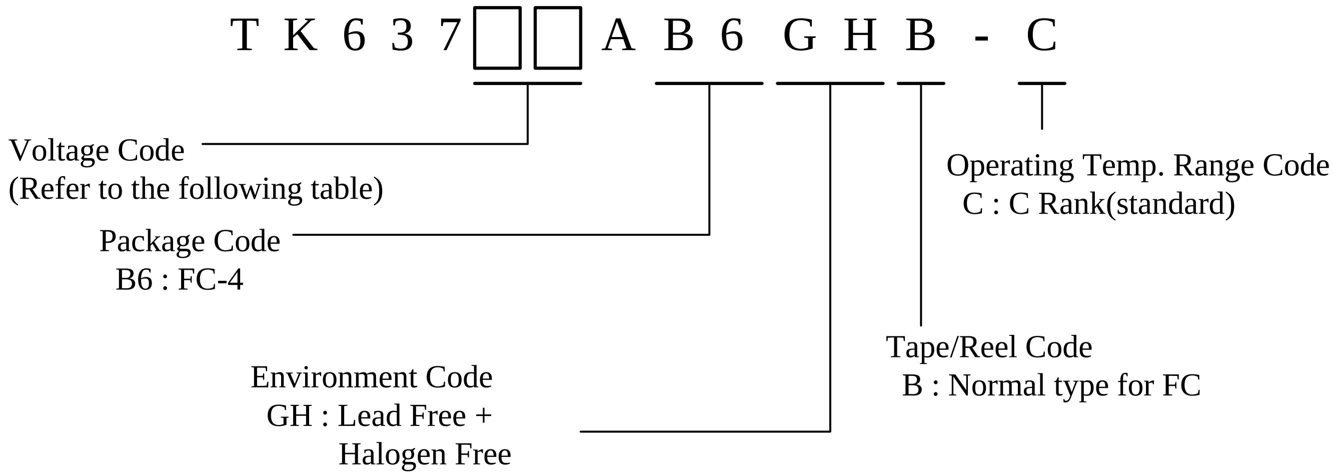
(Top View)



5. BLOCK DIAGRAM



6. ORDERING INFORMATION



Output Voltage	Voltage Code	Output Voltage	Voltage Code	Output Voltage	Voltage Code
1.35V	02	2.8V	28	3.3V	33
1.5V	15	2.85V	01	3.5V	35
1.8V	18	2.9V	29		
2.5V	25	3.0V	30		
2.6V	26	3.1V	31		
2.7V	27	3.2V	32		

*If you need a voltage other than the value listed in the above table, please contact TOKO.

7. ABSOLUTE MAXIMUM RATINGS

T_a=25°C

Parameter	Symbol	Rating	Units	Conditions
Absolute Maximum Ratings				
Input Voltage	$V_{In,MAX}$	-0.3 ~ 7.0	V	
Output pin Voltage	$V_{Out,MAX}$	-0.3 ~ V_{In}+0.3	V	
Control pin Voltage	$V_{Cont,MAX}$	-0.3 ~ 7.0	V	
Storage Temperature Range	T_{stg}	-55 ~ 150	°C	
Power Dissipation	P_D	360	mW	When mounted on a PCB (7mm×8mm×0.8mm), Internal Limited T_j=150°C *
Operating Condition				
Operational Temperature Range	T_{OP}	-40 ~ 85	°C	
Operational Voltage Range	V_{OP}	1.8 ~ 6.0	V	

*1 P_D must be decreased at the rate of 2.9mW for operation above 25°C.
The maximum ratings are the absolute limitation values with the possibility of the IC being damaged.
If the operation exceeds any of these standards, quality cannot be guaranteed.

8. ELECTRICAL CHARACTERISTICS

The parameters with min. or max. values will be guaranteed at T_a=T_j=25°C with test when manufacturing or SQC (Statistical Quality Control) methods. The operation between -40 ~ 85°C is guaranteed by design.

V_{In}=$V_{Out,TYP}$+1V, V_{Cont}=1.2V, T_a=T_j=25°C

Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Output Voltage	V_{Out}	Refer to TABLE 1			V	I_{Out}=5mA
Line Regulation	LinReg	-	0.0	4.0	mV	ΔV_{In}=1V
Load Regulation	LoaReg	Refer to TABLE 2			mV	Refer to TABLE 2
Dropout Voltage *1	V_{Drop}	Refer to TABLE 2			mV	Refer to TABLE 2
Maximum Load Current *2	$I_{Out,MAX}$	200	300	-	mA	V_{Out}=$V_{Out,TYP}$×0.9
Quiescent Current	I_Q	-	10	20	μA	I_{Out}=0mA, V_{Cont}=V_{In}
Standby Current	$I_{Standby}$	-	0.01	0.1	μA	V_{Cont}=0V
GND Pin Current	I_{GND}	-	25	50	μA	I_{Out}=50mA, V_{Cont}=V_{In}
Control Terminal						
Control Current	I_{Cont}	-	0.3	0.6	μA	V_{Cont}=1.2V
Control Voltage	V_{Cont}	1.2	-	-	V	V_{Out} On state
		-	-	0.2	V	V_{Out} Off state

Reference Value						
Output Voltage / Temp.	$\Delta V_{Out}/\Delta T_a$	-	100	-	ppm/°C	I_{Out}=5mA
Output Noise Voltage (TK63728AB6)	V_{Noise}	-	45	-	μVrms	C_{Out}=1.0μF , I_{Out}=30mA , BPF=400Hz~80kHz
Ripple Rejection (TK63728AB6)	RR	-	65	-	dB	C_{Out}=1.0μF , I_{Out}=10mA , f=1kHz
Rise Time (TK63728AB6)	t_r	-	300	-	μs	C_{Out}=1.0μF , V_{Cont} : Pulse Wave (100Hz) , V_{Cont} On → V_{Out}×95% point

***1**: For $V_{Out} \leq$ 1.8V, no regulations.
***2**: The maximum output current is limited by power dissipation.
The maximum load current is the current where the output voltage decreases to 90% by increasing the output current at T_j=25°C, compared to the output voltage specified at V_{In}=$V_{Out,TYP}$+1V. The maximum load current indicates the current at which over current protection turns on.
For all output voltage products, the maximum output current for normal operation without operating any protection is 200mA. Accordingly, LoaReg and V_{Drop} are specified on the condition that I_{Out} is less than 200mA.

General Note
Parameters with only typical values are just reference. (Not guaranteed)
The noise level is dependent on the output voltage, the capacitance and capacitor characteristics.

TABLE 1.

Part Number	Output Voltage		
	MIN	TYP	MAX
	V	V	V
TK63702AB6	1.335	1.350	1.365
TK63715AB6	1.485	1.500	1.515
TK63718AB6	1.782	1.800	1.818
TK63725AB6	2.475	2.500	2.525
TK63726AB6	2.574	2.600	2.626
TK63727AB6	2.673	2.700	2.727
TK63728AB6	2.772	2.800	2.828
TK63701AB6	2.821	2.850	2.879
TK63729AB6	2.871	2.900	2.929
TK63730AB6	2.970	3.000	3.030
TK63731AB6	3.069	3.100	3.131
TK63732AB6	3.168	3.200	3.232
TK63733AB6	3.267	3.300	3.333
TK63735AB6	3.465	3.500	3.535

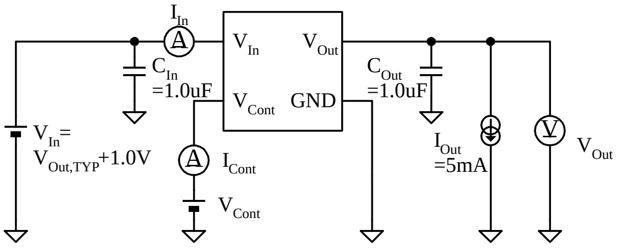
Notice.
Please contact your authorized TOKO representative for voltage availability.

TABLE 2.

Part Number	Load Regulation						Dropout Voltage					
	I_{Out}=1 ~ 50mA		I_{Out}=1 ~ 100mA		I_{Out}=1 ~ 150mA		I_{Out}=50mA		I_{Out}=100mA		I_{Out}=150mA	
	TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX
	mV	mV	mV	mV	mV	mV	mV	mV	mV	mV	mV	mV
TK63702AB6	4	16	7	28	10	40	240	-	480	-	720	-
TK63715AB6	4	16	7	28	11	44	180	-	350	-	530	-
TK63718AB6	4	16	8	32	12	48	130	-	255	-	375	-
TK63725AB6	6	24	10	40	15	60	95	145	185	285	280	425
TK63726AB6	6	24	11	44	16	64	90	140	180	275	270	410
TK63727AB6	6	24	11	44	16	64	90	135	175	265	260	395
TK63728AB6	6	24	11	44	17	68	85	130	165	255	250	380
TK63701AB6	6	24	11	44	17	68	85	125	165	250	245	375
TK63729AB6	6	24	11	44	17	68	80	125	160	245	240	370
TK63730AB6	6	24	12	48	18	72	80	125	160	245	240	370
TK63731AB6	7	28	12	48	18	72	80	125	160	245	240	370
TK63732AB6	7	28	12	48	19	76	80	125	160	245	240	370
TK63733AB6	7	28	13	52	19	76	80	125	160	245	240	370
TK63735AB6	7	28	13	52	20	80	80	125	160	245	240	370

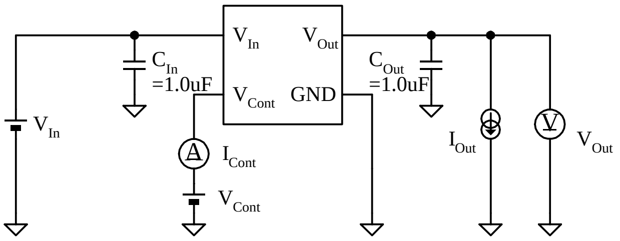
9. TEST CIRCUIT

■ Test circuit for electrical characteristic

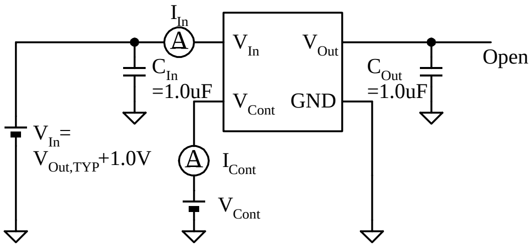


Notice.

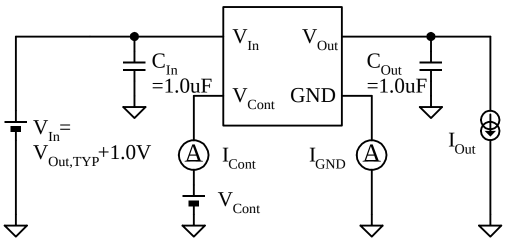
The limit values of the electrical characteristics are determined when C_{In}=1.0μF(Ceramic) and C_{Out}=1.0μF(Ceramic).
But ceramic and/or tantalum capacitors can both be used for C_{In}, and C_{Out}.
This IC does not oscillate without input and output capacitors. The electrical characteristics without input and output capacitors are guaranteed by design., please refer to 12-1 for external capacitor.



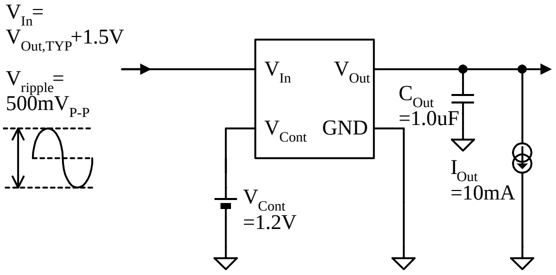
- ΔV_{Out} vs V_{In}
- V_{Drop} vs I_{Out}
- V_{Out} vs I_{Out}
- ΔV_{Out} vs I_{Out}
- ΔV_{Out} vs T_a
- V_{Drop} vs T_a
- $I_{Out,MAX}$ vs T_a
- I_{Cont} vs V_{Cont} , V_{Out} vs V_{Cont}
- I_{Cont} vs T_a
- V_{Cont} vs T_a
- V_{Noise} vs V_{In}
- V_{Noise} vs I_{Out}
- V_{Noise} vs V_{Out}
- V_{Noise} vs Frequency



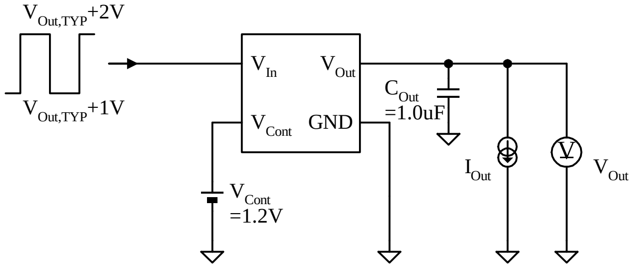
- I_Q vs V_{In}
- $I_{Standby}$ vs V_{In}
- I_Q vs T_a



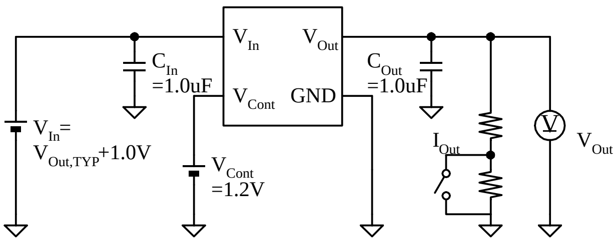
- I_{GND} vs I_{Out}
- I_{GND} vs T_a



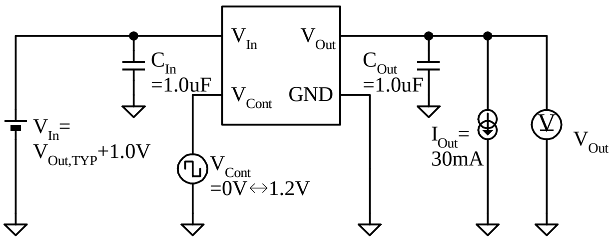
- RR vs V_{In}
- RR vs Frequency
- RR vs Frequency



- Line Transient



- Load Transient

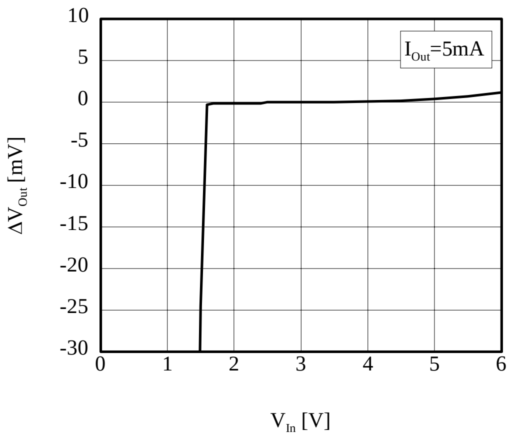


- On/Off Transient

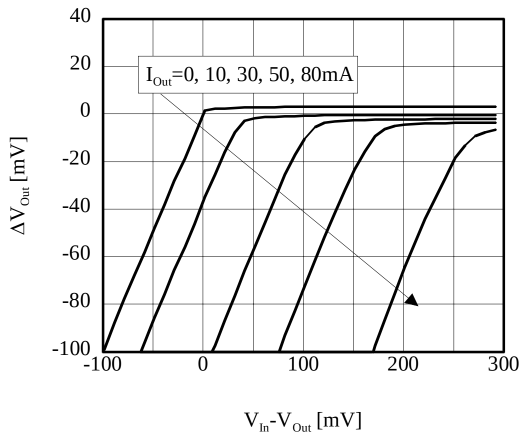
10. TYPICAL CHARACTERISTICS

10-1. DC CHARACTERISTICS

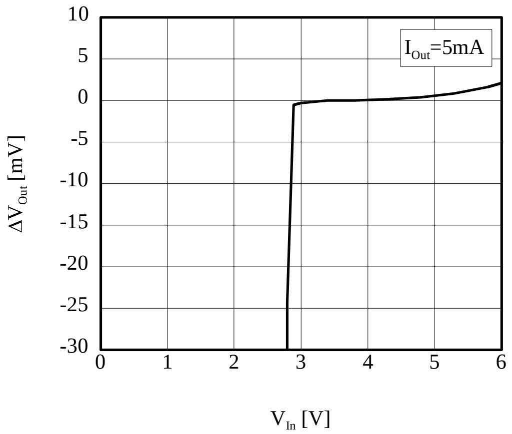
■ ΔV_{Out} vs V_{In} (TK63715AB6)



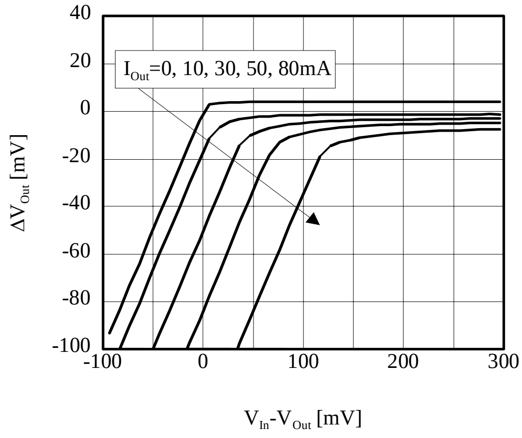
■ ΔV_{Out} vs V_{In} (TK63715AB6)



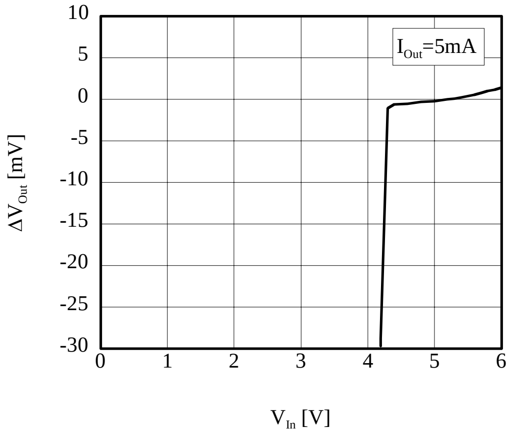
■ ΔV_{Out} vs V_{In} (TK63728AB6)



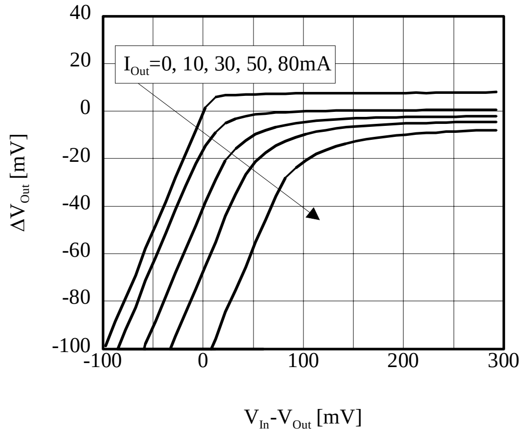
■ ΔV_{Out} vs V_{In} (TK63728AB6)



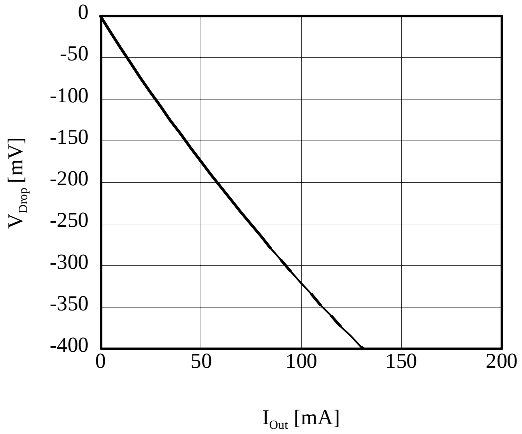
■ ΔV_{Out} vs V_{In} (TK63742AB6)



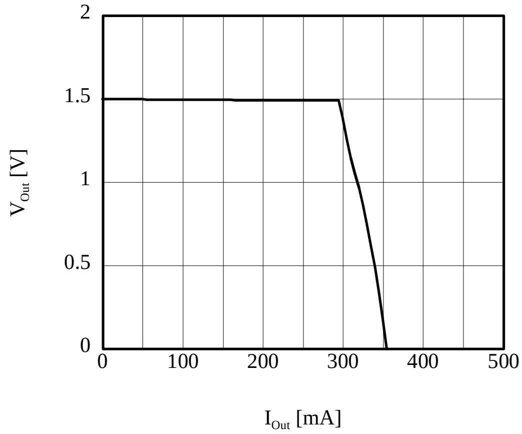
■ ΔV_{Out} vs V_{In} (TK63742AB6)



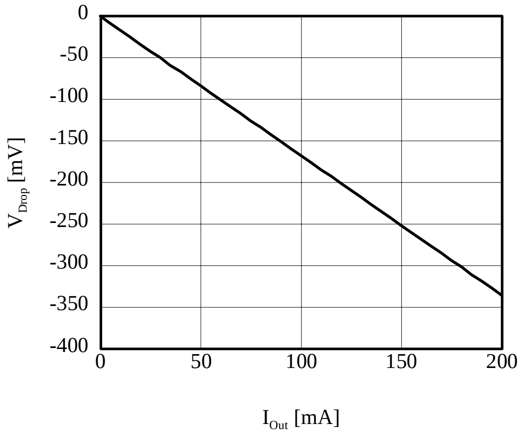
■ V_{Drop} vs I_{Out} (TK63715AB6)



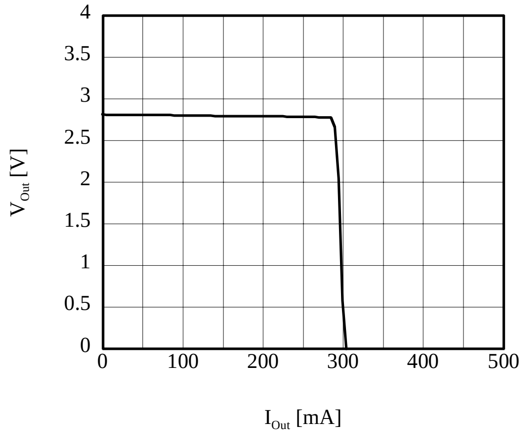
■ V_{Out} vs I_{Out} (TK63715AB6)



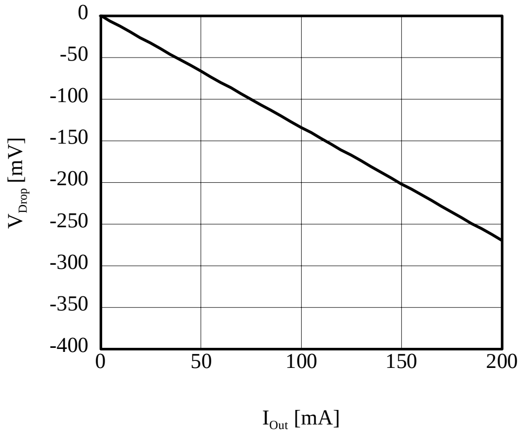
■ V_{Drop} vs I_{Out} (TK63728AB6)



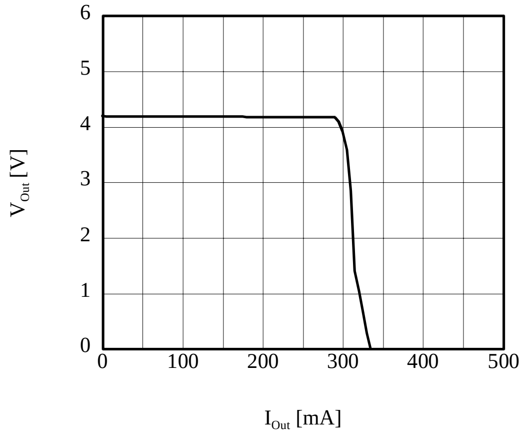
■ V_{Out} vs I_{Out} (TK63728AB6)



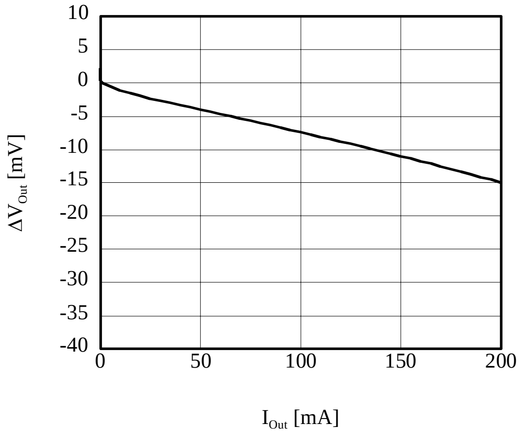
■ V_{Drop} vs I_{Out} (TK63742AB6)



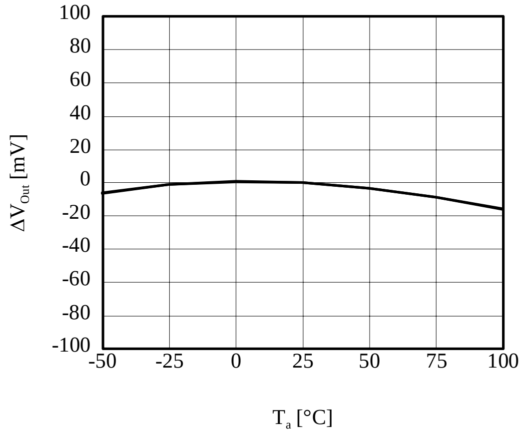
■ V_{Out} vs I_{Out} (TK63742AB6)



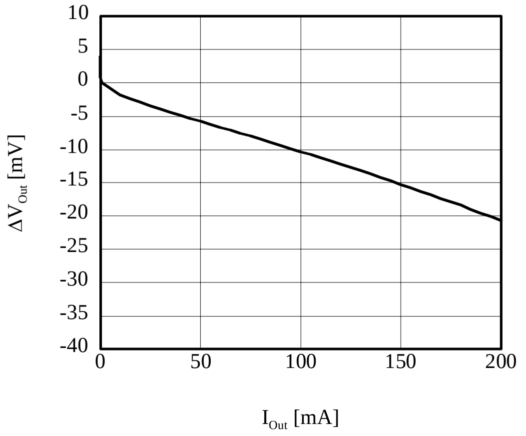
■ ΔV_{Out} vs I_{Out} (TK63715AB6)



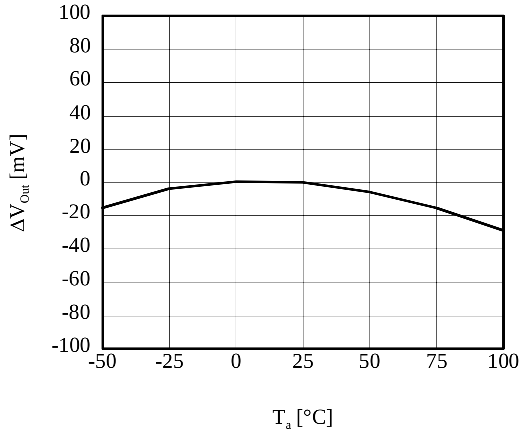
■ ΔV_{Out} vs T_a (TK63715AB6)



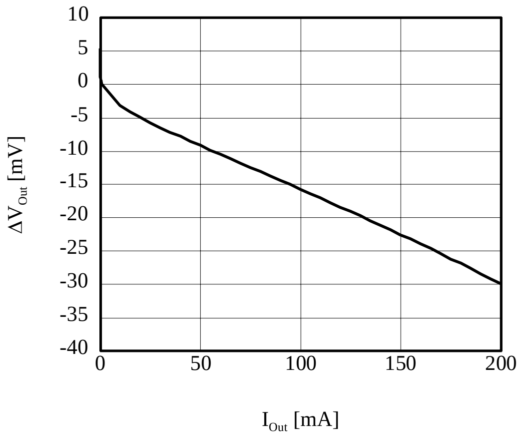
■ ΔV_{Out} vs I_{Out} (TK63728AB6)



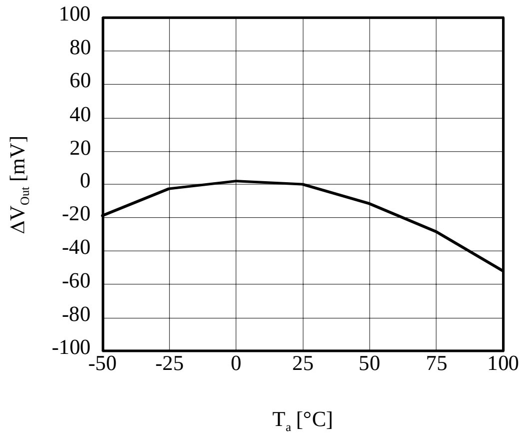
■ ΔV_{Out} vs T_a (TK63728AB6)



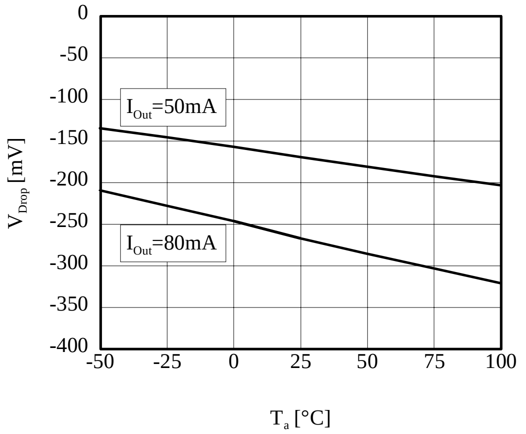
■ ΔV_{Out} vs I_{Out} (TK63742AB6)



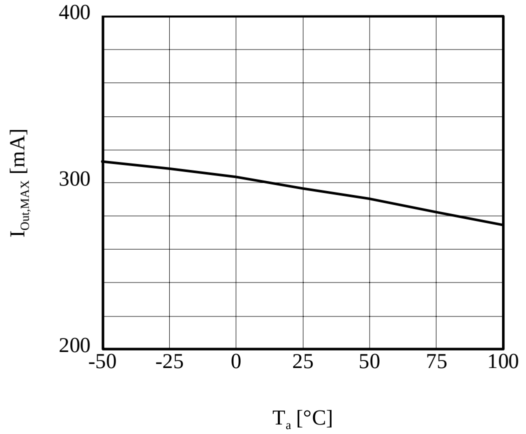
■ ΔV_{Out} vs T_a (TK63742AB6)



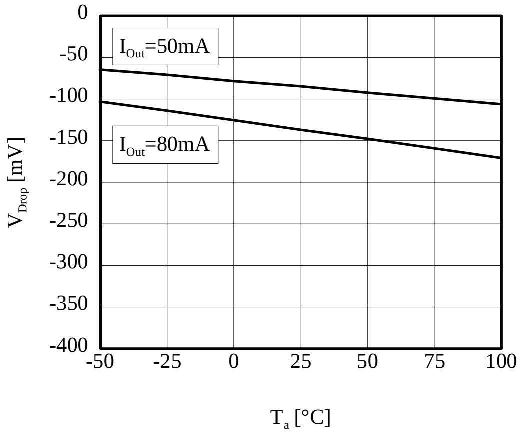
■ V_{Drop} vs T_a (TK63715AB6)



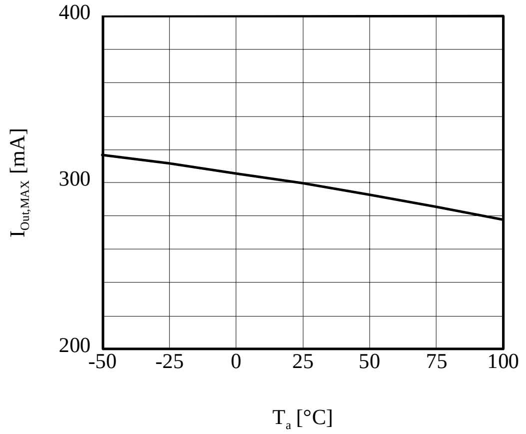
■ $I_{Out,MAX}$ vs T_a (TK63715AB6)



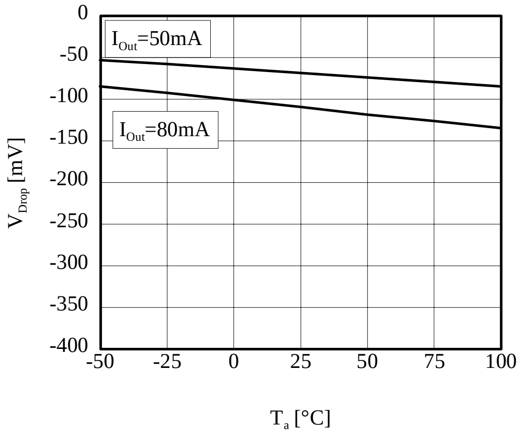
■ V_{Drop} vs T_a (TK63728AB6)



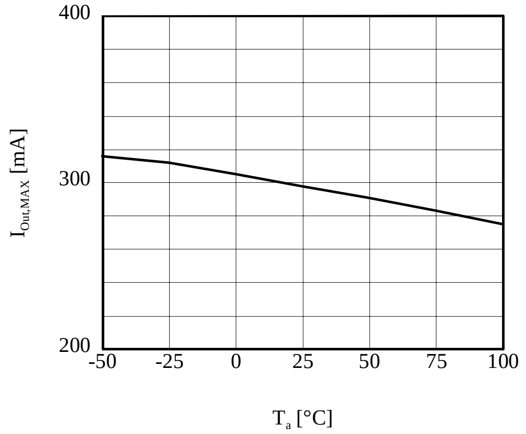
■ $I_{Out,MAX}$ vs T_a (TK63728AB6)



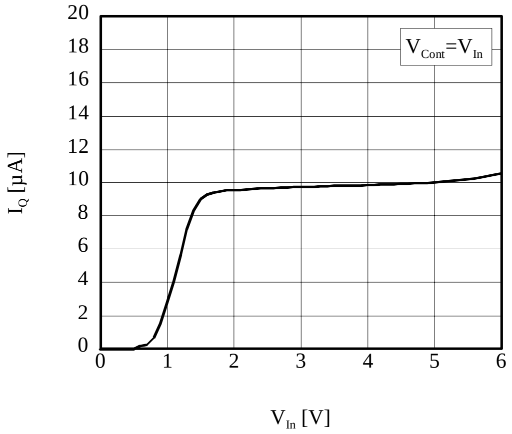
■ V_{Drop} vs T_a (TK63742AB6)



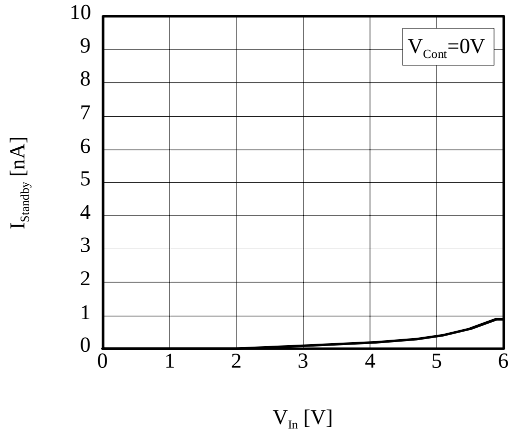
■ $I_{Out,MAX}$ vs T_a (TK63742AB6)



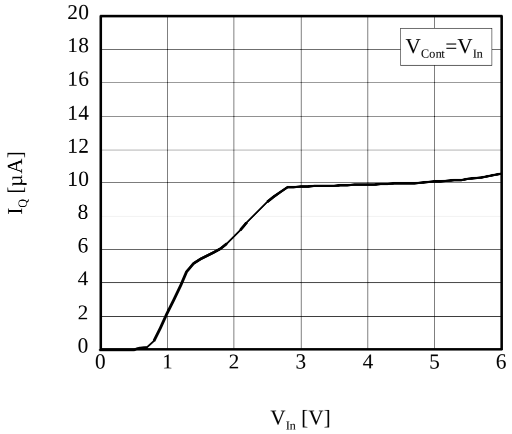
■ I_Q vs V_{In} (TK63715AB6)



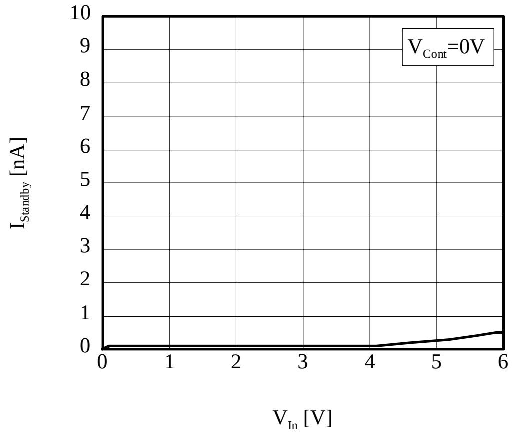
■ $I_{StandBy}$ vs V_{In} (TK63715AB6)



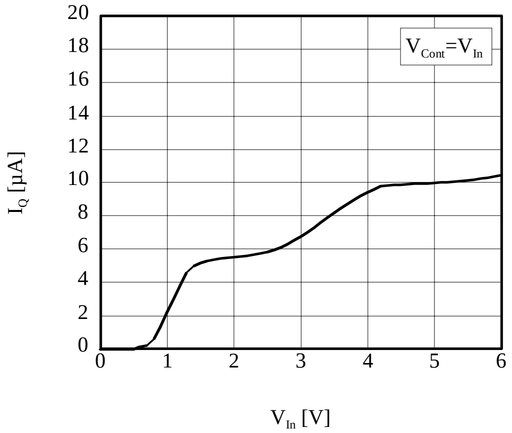
■ I_Q vs V_{In} (TK63728AB6)



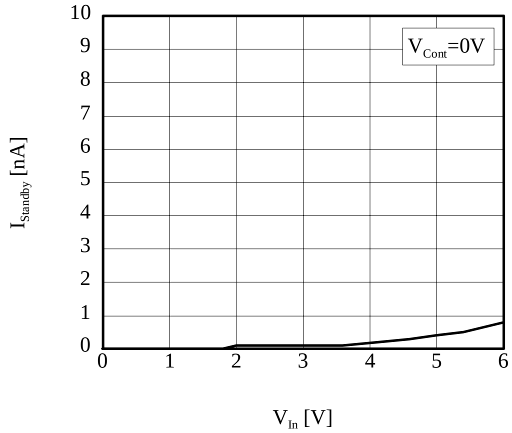
■ $I_{StandBy}$ vs V_{In} (TK63728AB6)



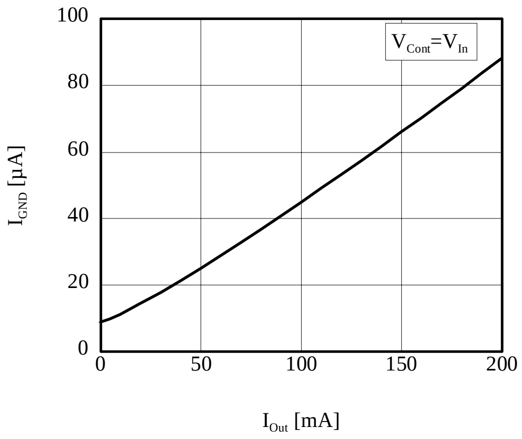
■ I_Q vs V_{In} (TK63742AB6)



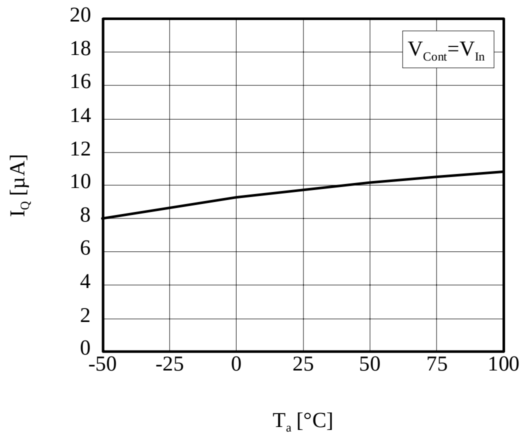
■ $I_{StandBy}$ vs V_{In} (TK63742AB6)



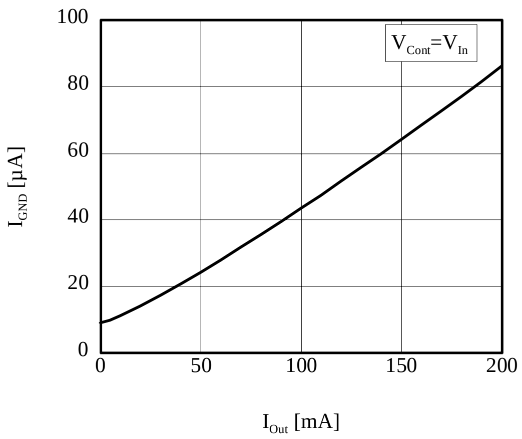
■ I_{GND} vs I_{Out} (TK63715AB6)



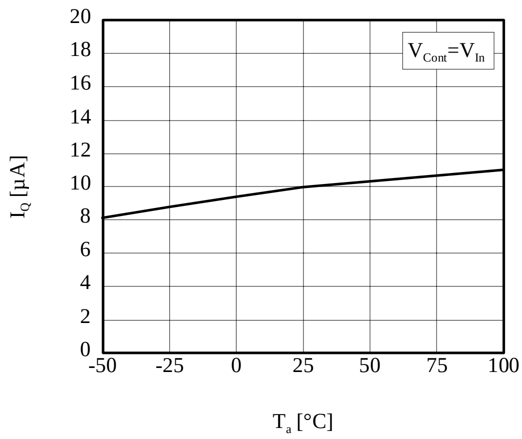
■ I_Q vs T_a (TK63715AB6)



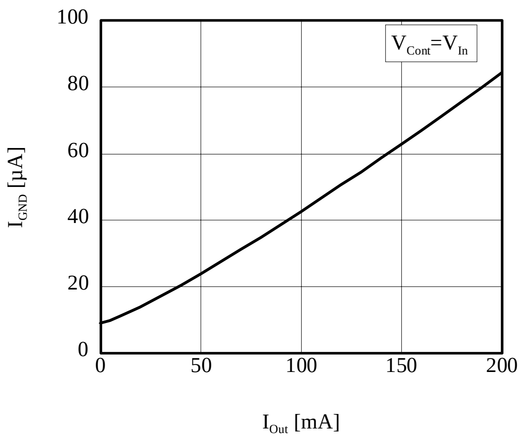
■ I_{GND} vs I_{Out} (TK63728AB6)



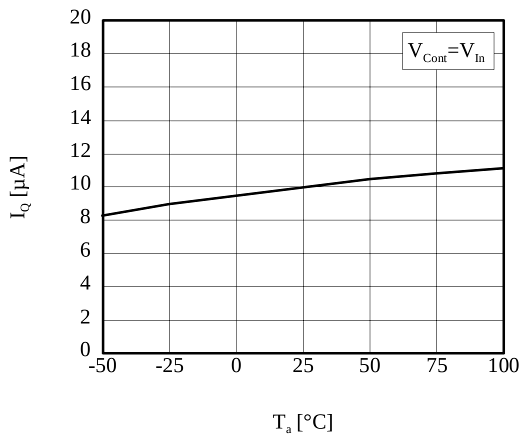
■ I_Q vs T_a (TK63728AB6)



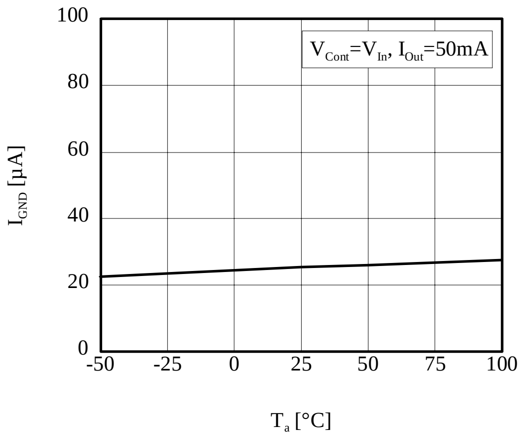
■ I_{GND} vs I_{Out} (TK63742AB6)



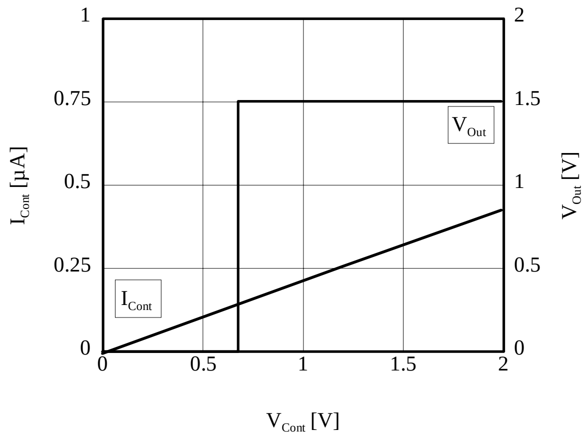
■ I_Q vs T_a (TK63742AB6)



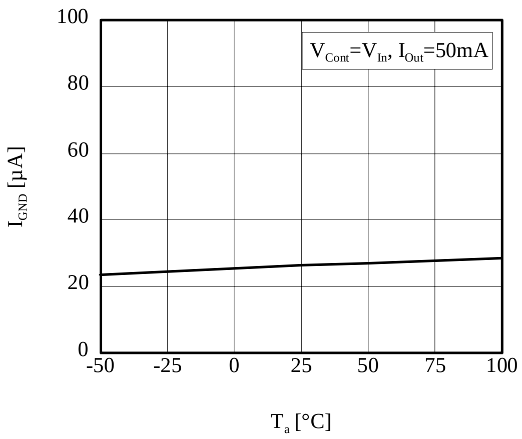
■ I_{GND} vs T_a (TK63715AB6)



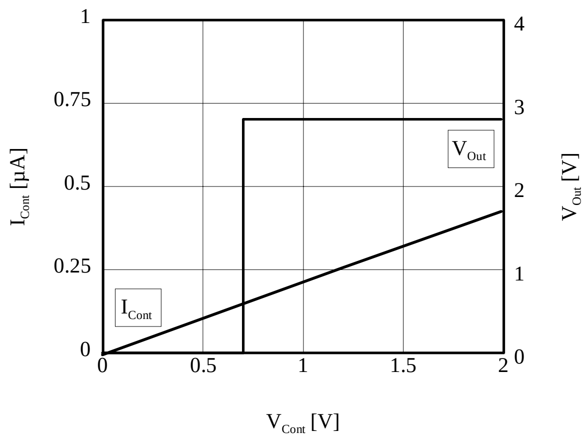
■ I_{Cont} vs V_{Cont}, V_{Out} vs V_{Cont} (TK63715AB6)



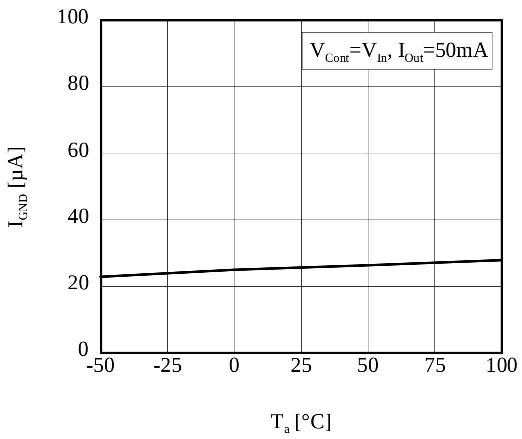
■ I_{GND} vs T_a (TK63728AB6)



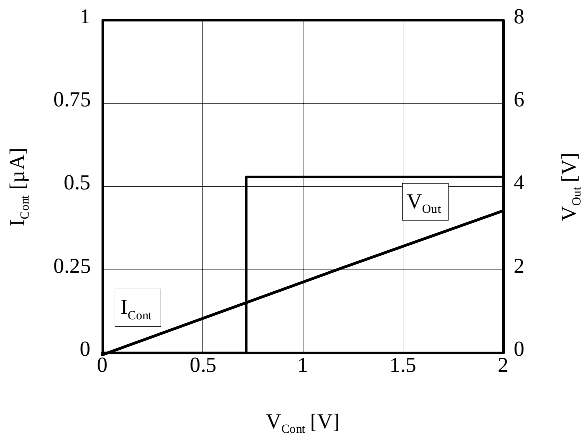
■ I_{Cont} vs V_{Cont}, V_{Out} vs V_{Cont} (TK63728AB6)



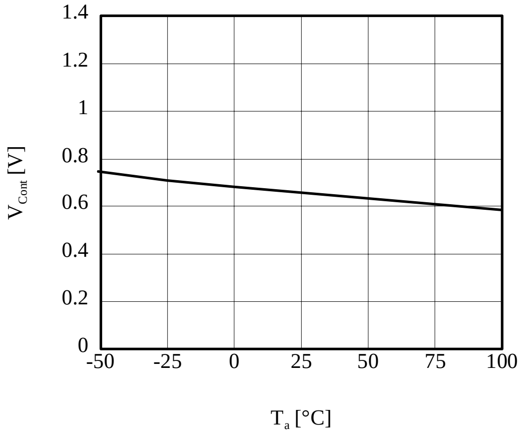
■ I_{GND} vs T_a (TK63742AB6)



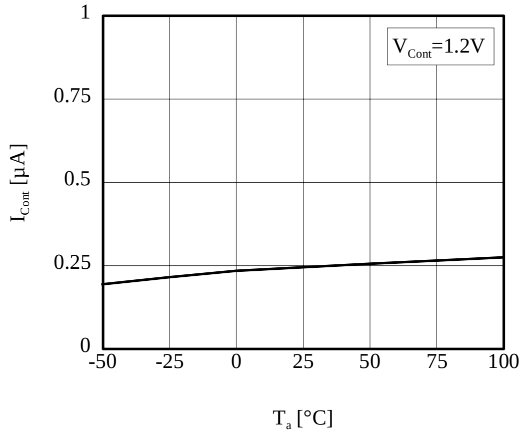
■ I_{Cont} vs V_{Cont}, V_{Out} vs V_{Cont} (TK63742AB6)



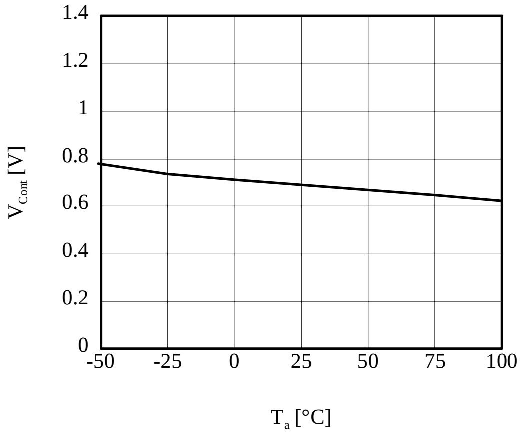
■ V_{Cont} vs T_a (TK63715AB6)



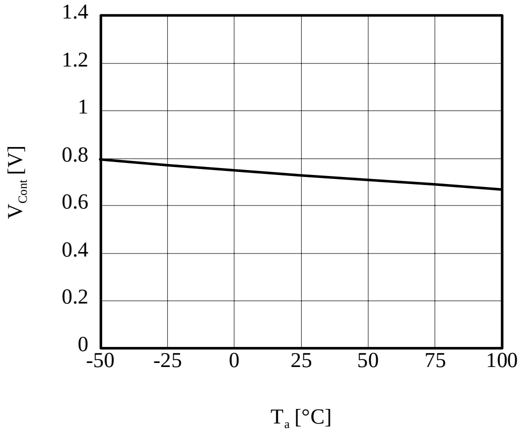
■ I_{Cont} vs T_a (TK637xxAB6)



■ V_{Cont} vs T_a (TK63728AB6)

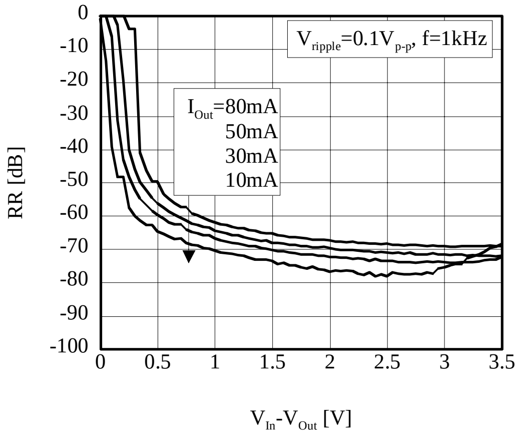


■ V_{Cont} vs T_a (TK63742AB6)

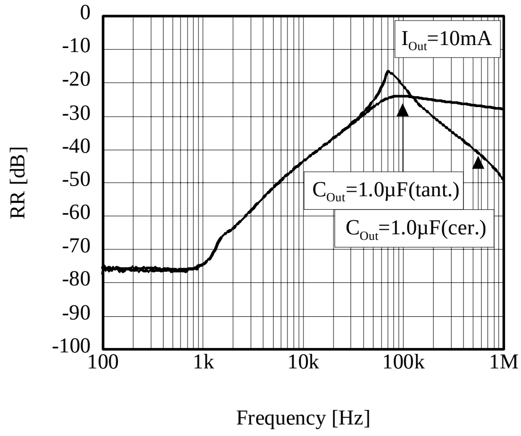


10-2. AC CHARACTERISTICS

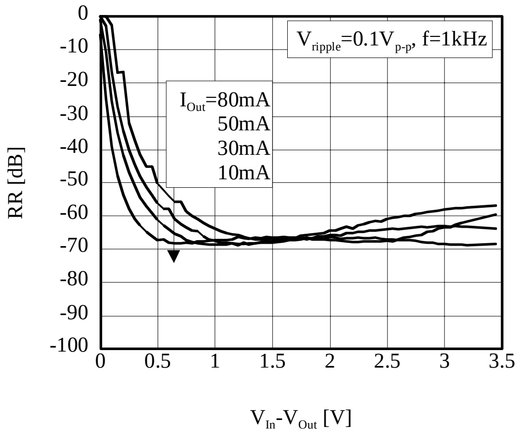
■ RR vs V_{In} (TK63715AB6)



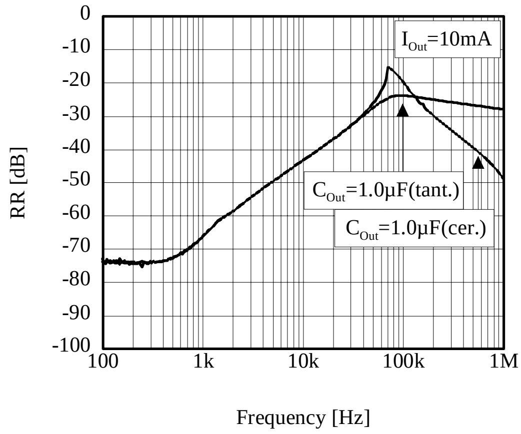
■ RR vs Frequency (TK63715AB6)



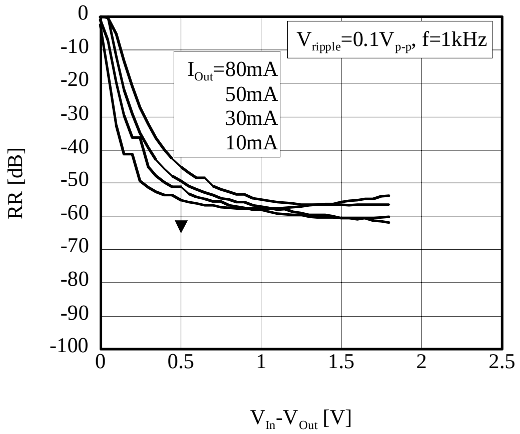
■ RR vs V_{In} (TK63728AB6)



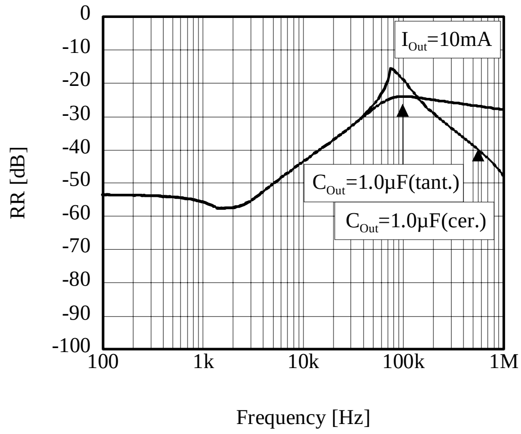
■ RR vs Frequency (TK63728AB6)



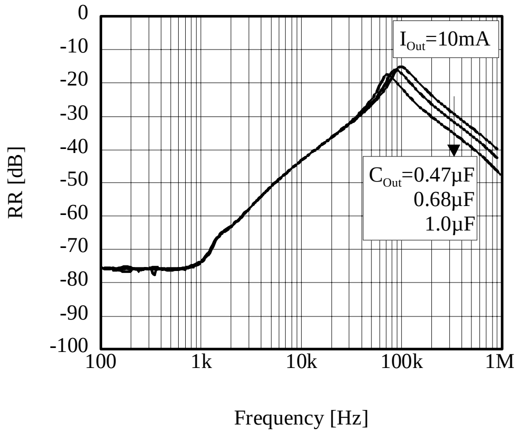
■ RR vs V_{In} (TK63742AB6)



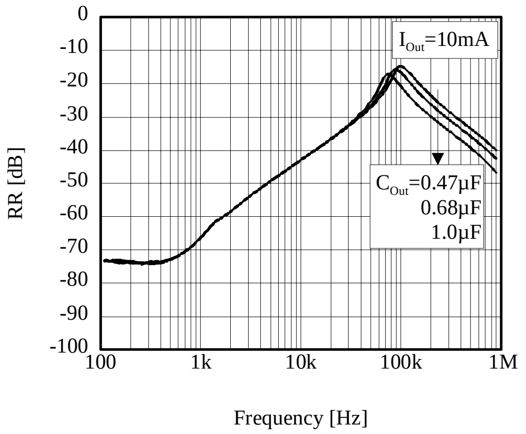
■ RR vs Frequency (TK63742AB6)



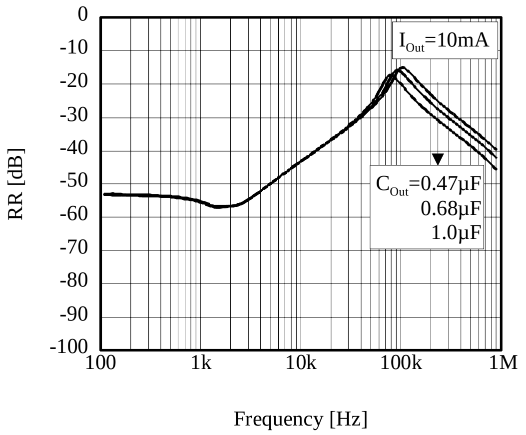
■ RR vs Frequency (TK63715AB6)



■ RR vs Frequency (TK63728AB6)

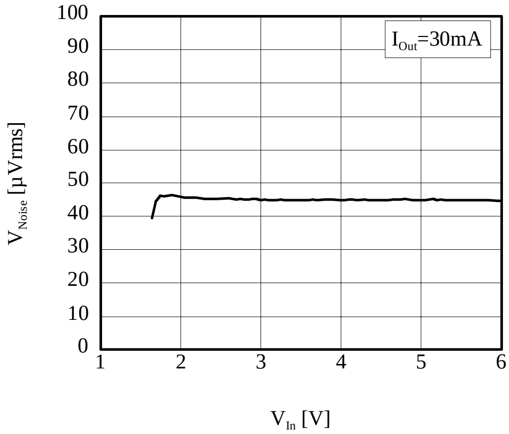


■ RR vs Frequency (TK63742AB6)

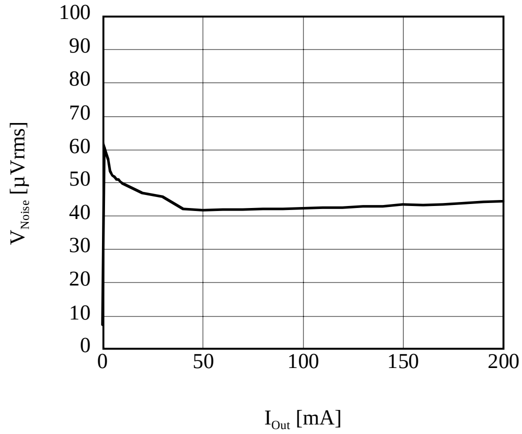


The ripple rejection (RR) characteristic depends on the characteristic and the capacitance value of the capacitor connected to the output side. The RR characteristic of 50kHz or more varies greatly with the capacitor on the output side and PCB pattern. If necessary, please confirm stability of your design.

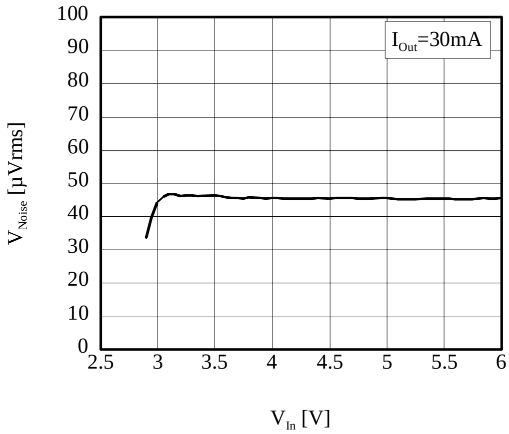
■ V_{Noise} vs V_{In} (TK63715AB6)



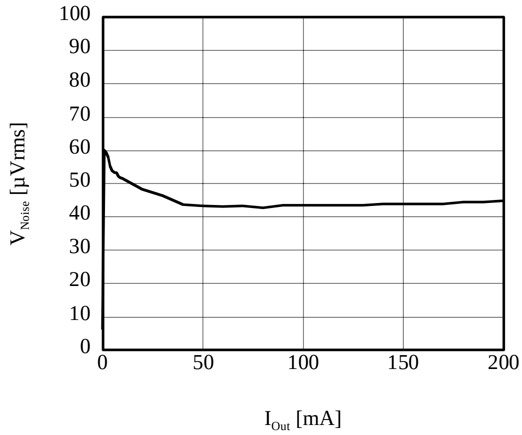
■ V_{Noise} vs I_{Out} (TK63715AB6)



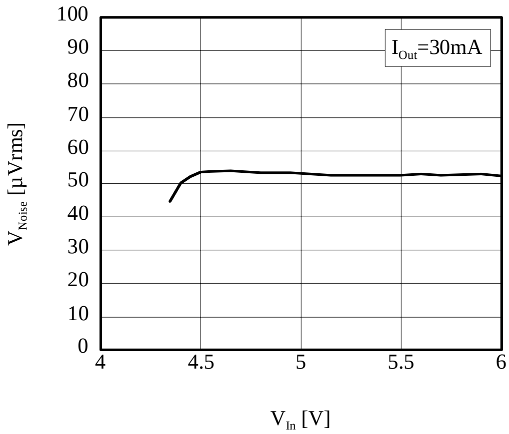
■ V_{Noise} vs V_{In} (TK63728AB6)



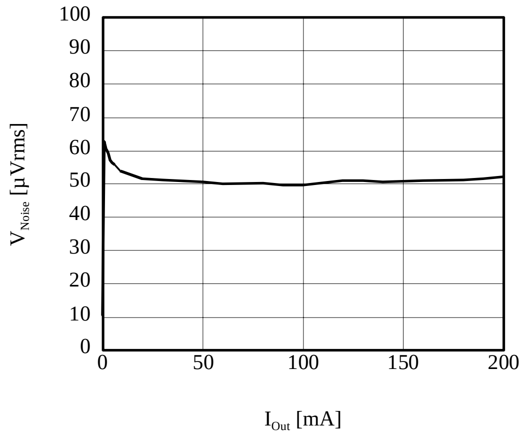
■ V_{Noise} vs I_{Out} (TK63728AB6)



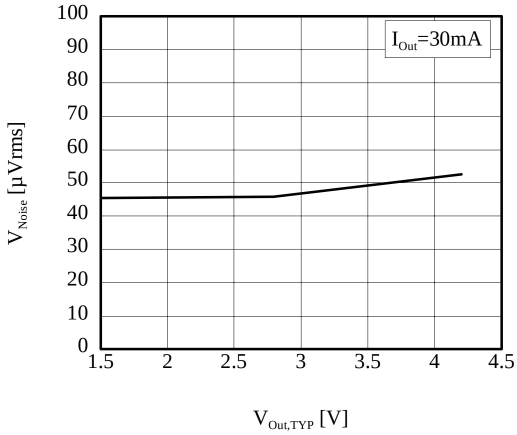
■ V_{Noise} vs V_{In} (TK63742AB6)



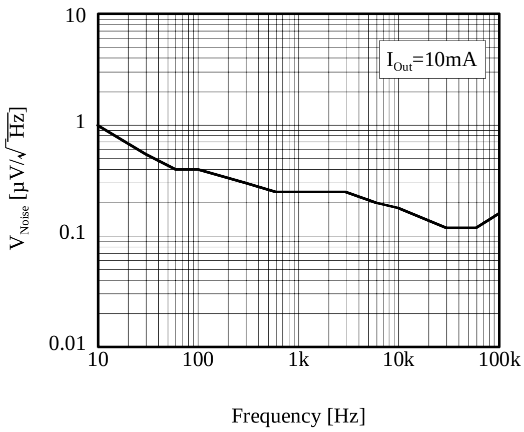
■ V_{Noise} vs I_{Out} (TK63742AB6)



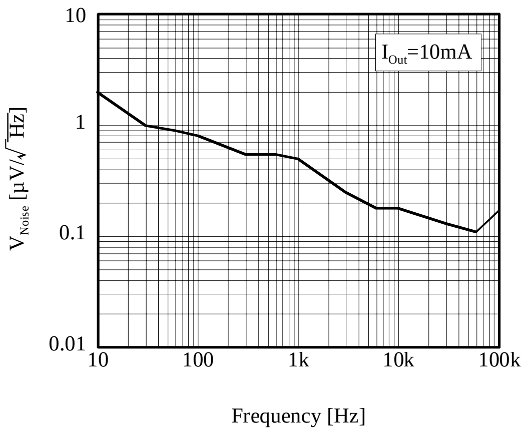
■ V_{Noise} vs $V_{Out,TYP}$ (TK637xxAB6)



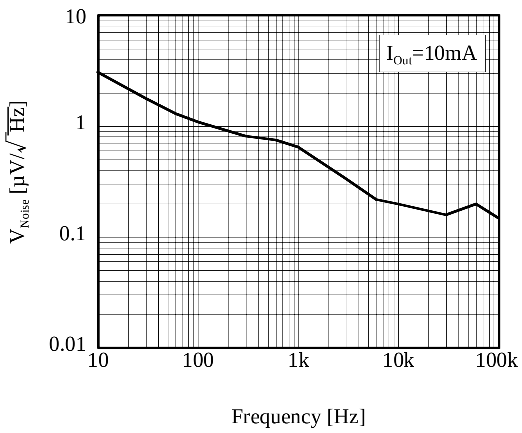
■ V_{Noise} vs Frequency (TK63715AB6)



■ V_{Noise} vs Frequency (TK63728AB6)

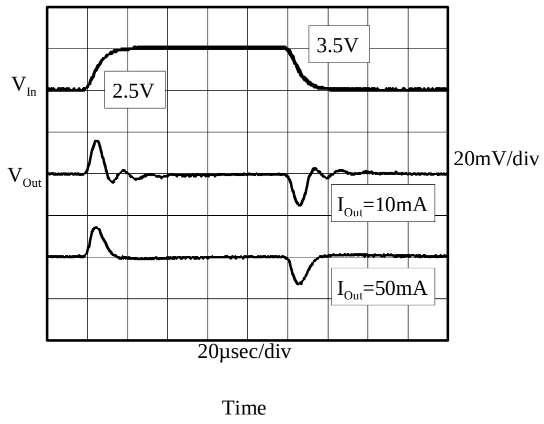


■ V_{Noise} vs Frequency (TK63742AB6)

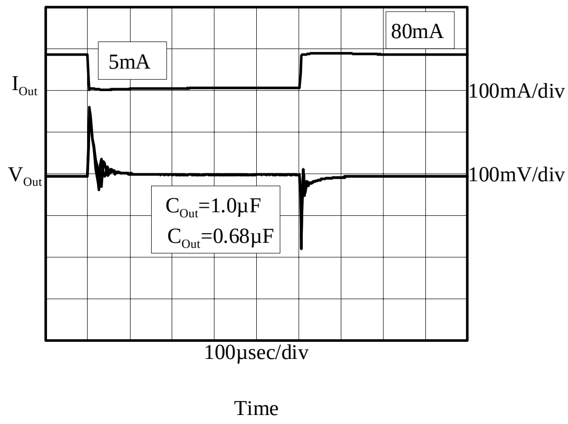


10-3. TRANSIENT CHARACTERISTICS

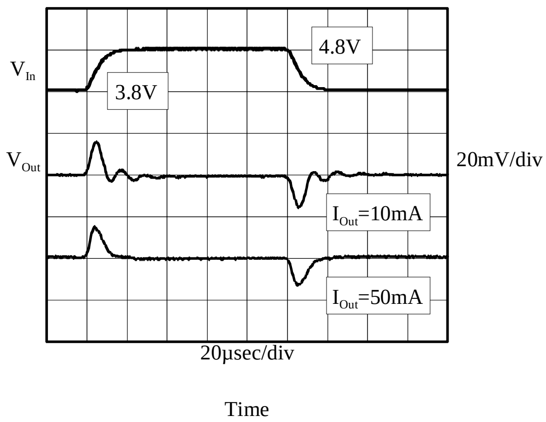
■ Line Transient (TK63715AB6)



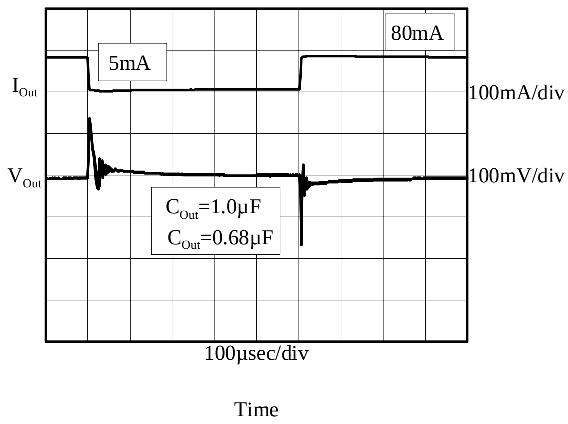
■ Load Transient (I_{Out}=5↔80mA) (TK63715AB6)



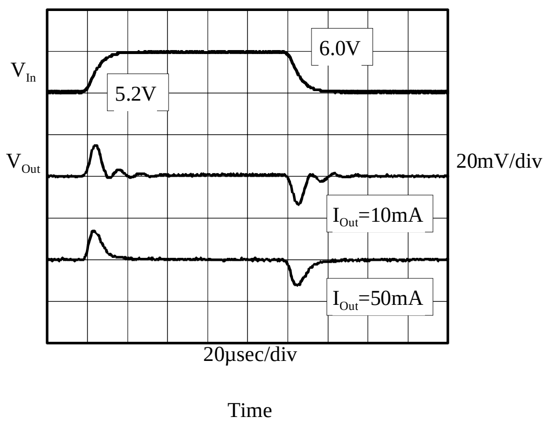
■ Line Transient (TK63728AB6)



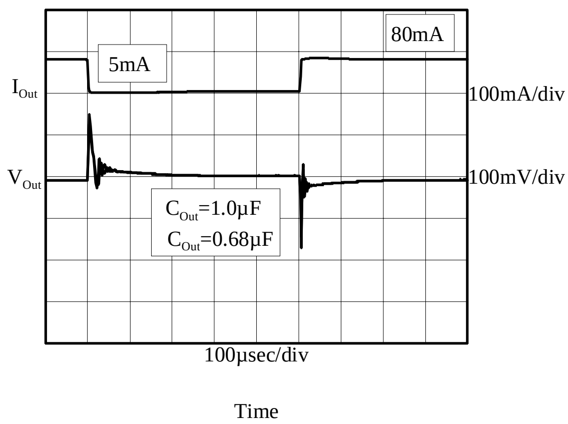
■ Load Transient (I_{Out}=5↔80mA) (TK63728AB6)



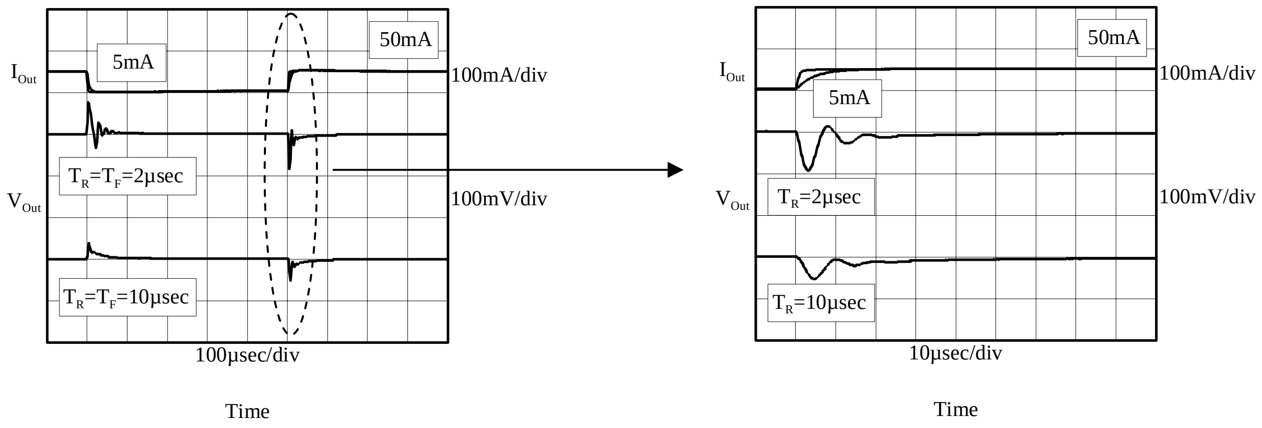
■ Line Transient (TK63742AB6)



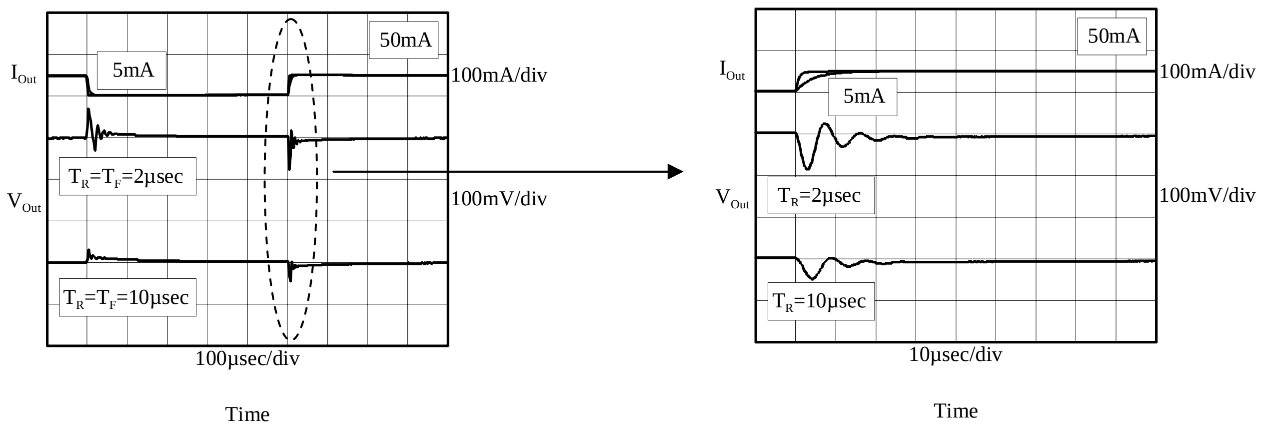
■ Load Transient (I_{Out}=5↔80mA) (TK63742AB6)



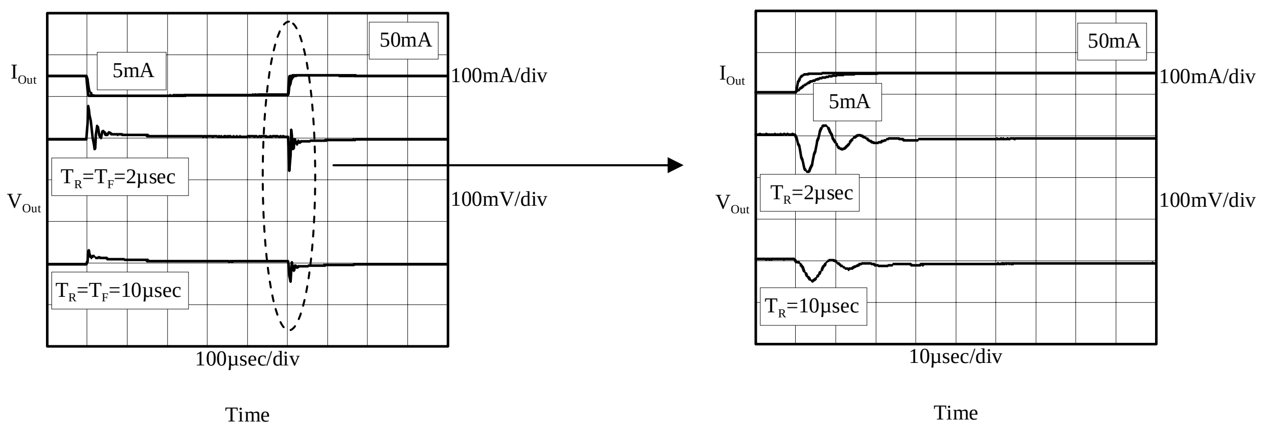
■ Load Transient (I_{Out}=5↔50mA) (TK63715AB6)



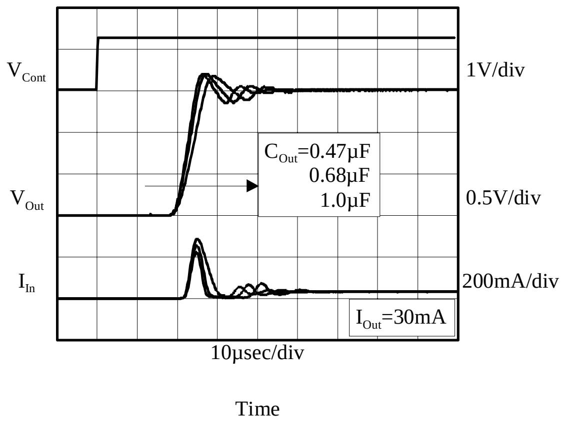
■ Load Transient (I_{Out}=5↔50mA) (TK63728AB6)



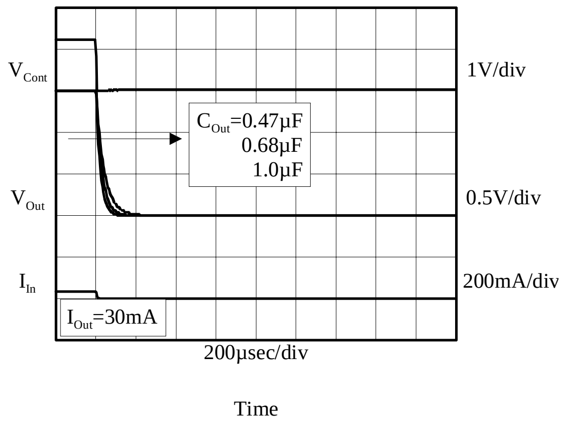
■ Load Transient (I_{Out}=5↔50mA) (TK63742AB6)



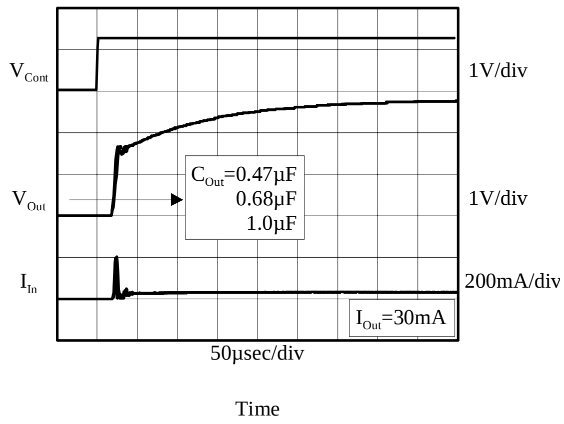
■ On/Off Transient (V_{Cont}=0→1.2V) (TK63715AB6)



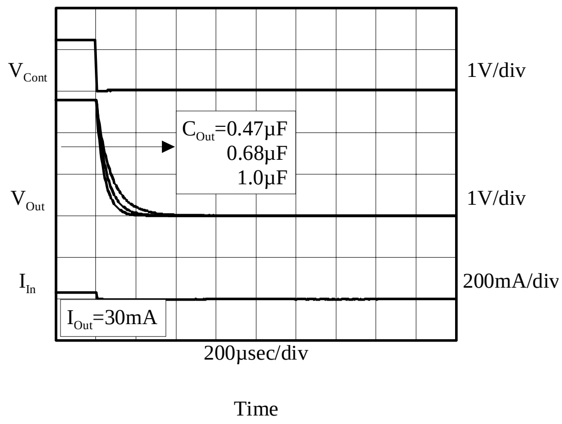
■ On/Off Transient (V_{Cont}=1.2→0V) (TK63715AB6)



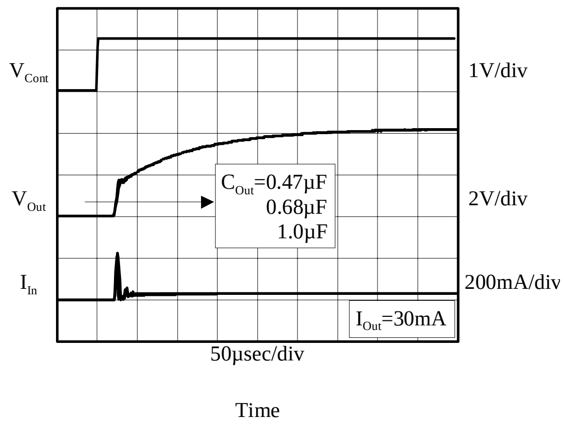
■ On/Off Transient (V_{Cont}=0→1.2V) (TK63728AB6)



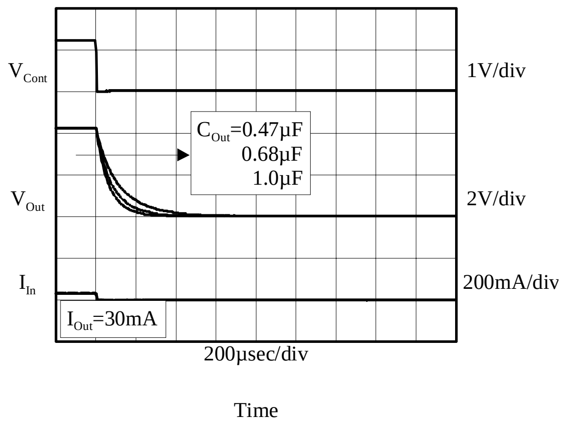
■ On/Off Transient (V_{Cont}=1.2→0V) (TK63728AB6)



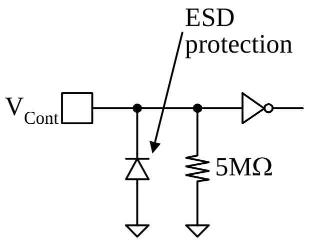
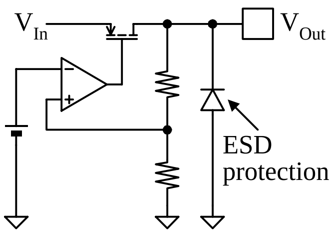
■ On/Off Transient (V_{Cont}=0→1.2V) (TK63742AB6)



■ On/Off Transient (V_{Cont}=1.2→0V) (TK63742AB6)



11. PIN DESCRIPTION

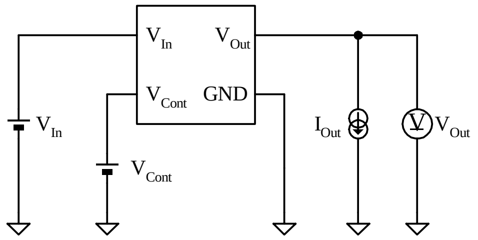
Pin No TK637xxAB6	Pin Description	Internal Equivalent Circuit	Description
A1	GND		GND Terminal
A2	V_{Cont}		Control Terminal V_{Cont} > 1.2V : On V_{Cont} < 0.2V : Off The pull-down resistor (about 5MΩ) is built-in.
B1	V_{Out}		Output Terminal
B2	V_{In}		Input Terminal

12. APPLICATIONS INFORMATION

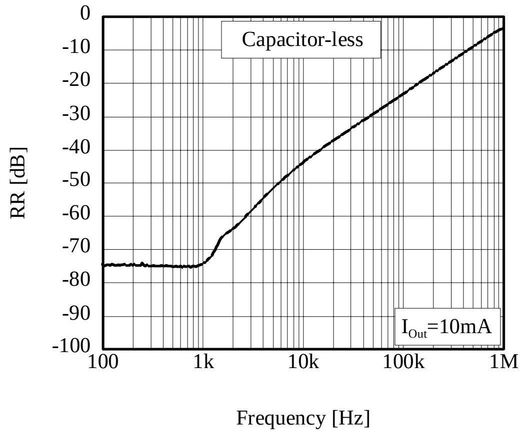
12-1. External Capacitor

General linear regulators require input capacitor and output capacitor in order to maintain the regulator's loop stability.
The TK637xxAB6 provides stable operation without input and output capacitors.
Refer to the following data that measured without input and output capacitors.
The other electrical characteristics are equal to the electrical characteristics when using input and output capacitors.
Transient characteristics (influence of load deviation) improve by using output capacitor (see the "Load Transient" on page 27).
High frequency ripple can not be rejected without input and output capacitors. Therefore, it is recommended that external input and output capacitors be used when high frequency ripple is expected.
Because a situation changes with each application, please confirm to operation in your design.

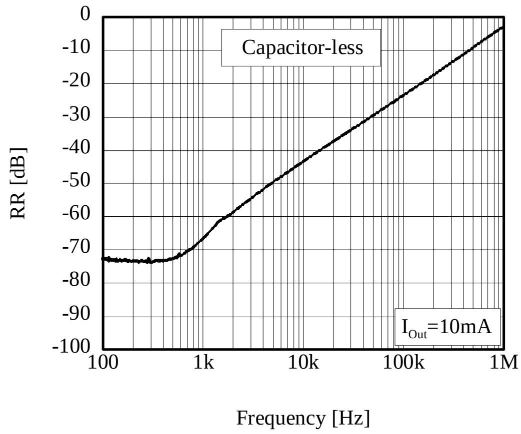
■ Test Circuit (Capacitor-less)



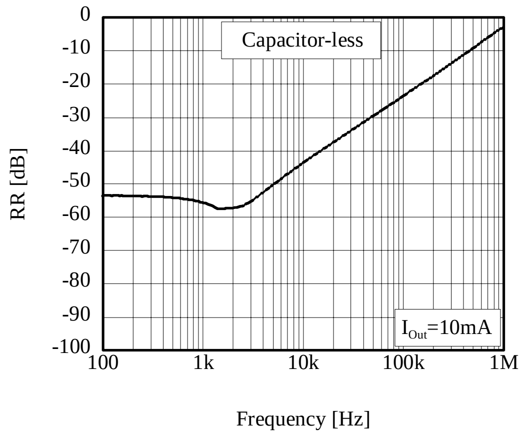
■ RR vs Frequency (TK63715AB6)



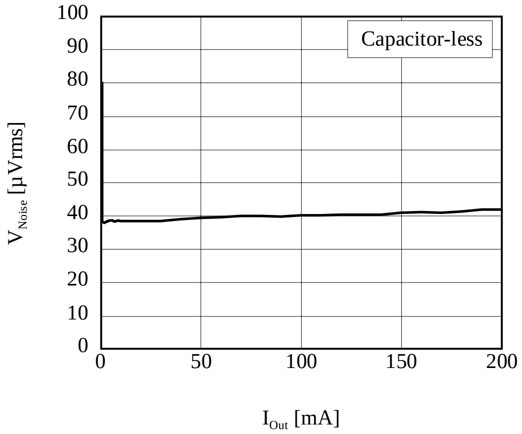
■ RR vs Frequency (TK63728AB6)



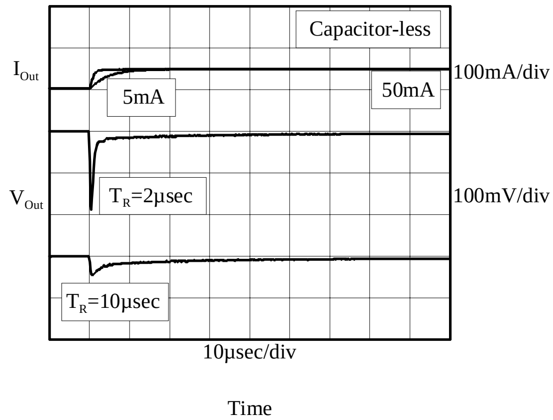
■ RR vs Frequency (TK63742AB6)



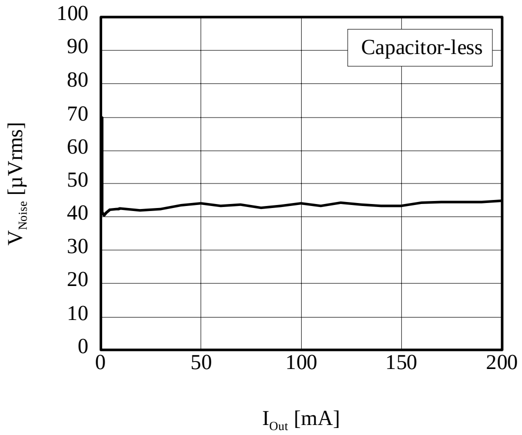
■ V_{Noise} vs I_{Out} (TK63715AB6)



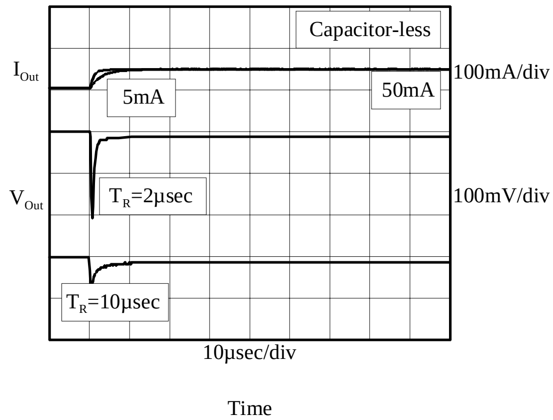
Load Transient (I_{Out}=5→50mA) (TK63715AB6)



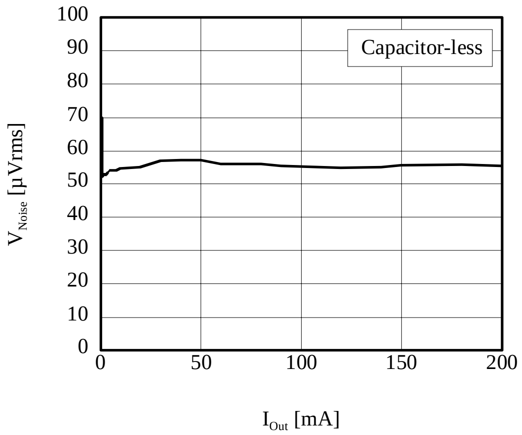
■ V_{Noise} vs I_{Out} (TK63728AB6)



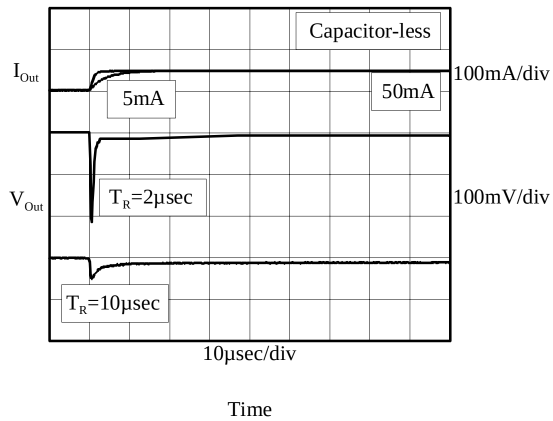
Load Transient (I_{Out}=5→50mA) (TK63728AB6)



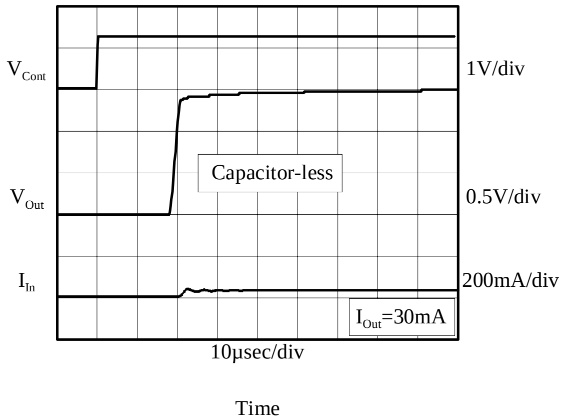
■ V_{Noise} vs I_{Out} (TK63742AB6)



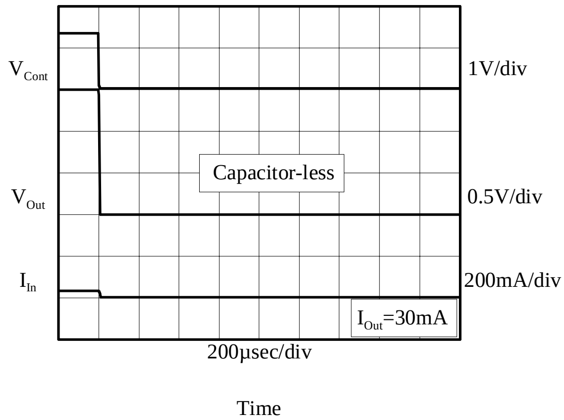
Load Transient (I_{Out}=5→50mA) (TK63742AB6)



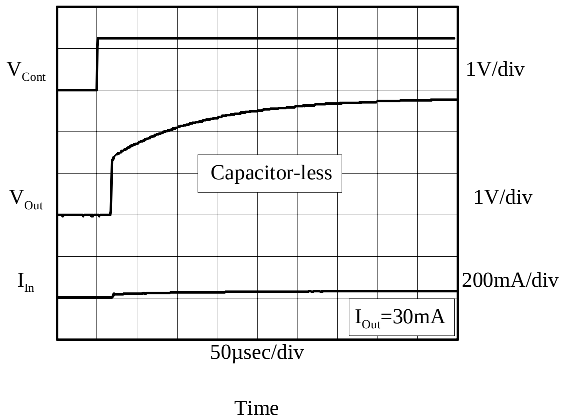
■ On/Off Transient (V_{Cont}=0→1.2V) (TK63715AB6)



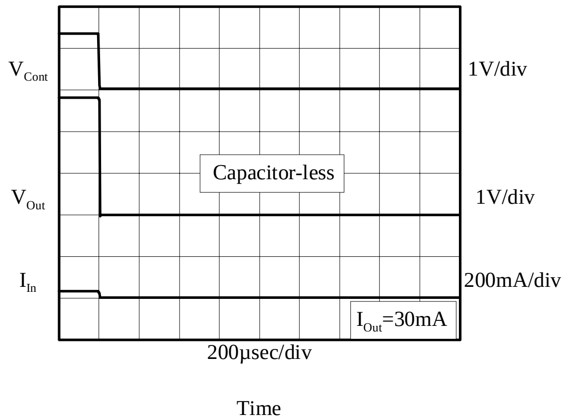
■ On/Off Transient (V_{Cont}=1.2→0V) (TK63715AB6)



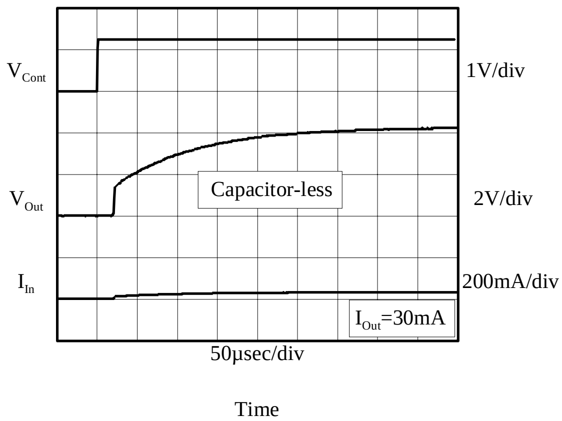
■ On/Off Transient (V_{Cont}=0→1.2V) (TK63728AB6)



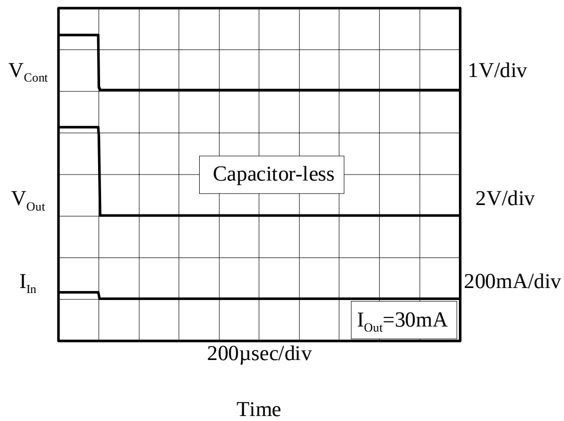
■ On/Off Transient (V_{Cont}=1.2→0V) (TK63728AB6)



■ On/Off Transient (V_{Cont}=0→1.2V) (TK63742AB6)

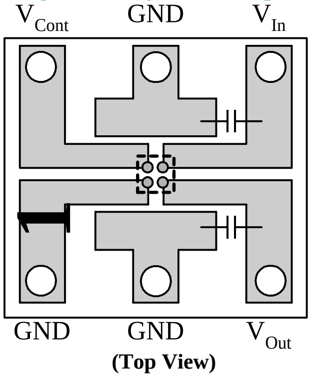


■ On/Off Transient (V_{Cont}=1.2→0V) (TK63742AB6)



12-2. Layout

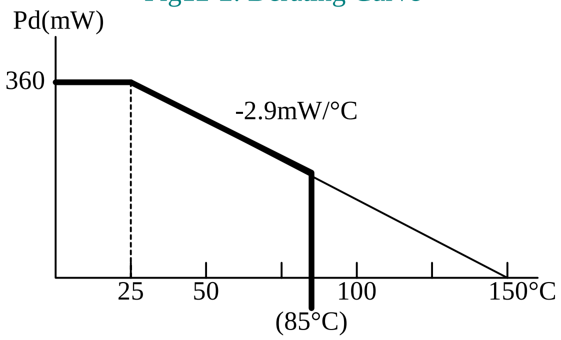
Fig12-1: Layout example



PCB Material : Glass epoxy
Size : 7mm×8mm×0.8mm

Please do derating with 2.9mW/°C at Pd=360mW.

Fig12-2: Derating Curve



The package loss is limited at the temperature that the internal temperature sensor works (about 150°C). Therefore, the package loss is assumed to be an internal limitation. There is no heat radiation characteristic of the package unit assumed because of its small size. Heat is carried away from the device by being mounted on the PCB. This value is directly effected by the material and the copper pattern etc. of the PCB. The losses are approximately 360mW. Enduring these losses becomes possible in a lot of applications operating at 25°C.

The overheating protection circuit operates when the junction temperature reaches 150°C (this happens when the regulator is dissipating excessive power, outside temperature is high, or heat radiation is bad). The output current and the output voltage will drop when the protection circuit operates. However, operation begins again as soon as the output voltage drops and the temperature of the chip decreases.

How to determine the thermal resistance when mounted on PCB

The thermal resistance when mounted is expressed as follows:

$$T_j = \theta_{ja} \times Pd + T_a$$

T_j of IC is set around 150°C. Pd is the value when the thermal sensor is activated.

If the ambient temperature is 25°C, then:

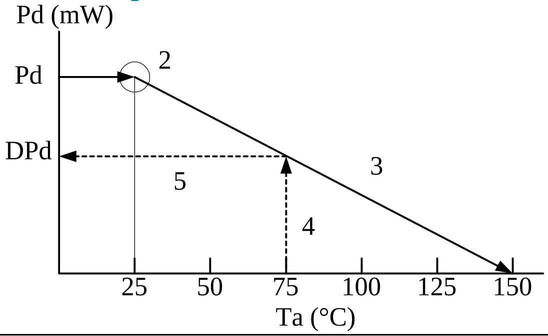
$$150 = \theta_{ja} \times Pd + 25$$

$$\theta_{ja} = 125/Pd \text{ (°C /mW)}$$

Pd is easily calculated.

A simple way to determine Pd is to calculate $V_{In} \times I_{In}$ when the output side is shorted. Input current gradually falls as output voltage rises after working thermal shutdown. You should use the value when thermal equilibrium is reached.

Fig12-3: How to determine DPd



Procedure (When mounted on PCB.)

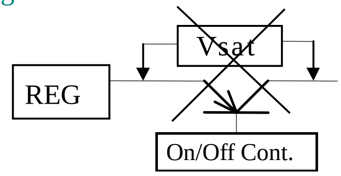
1. Find Pd ($V_{In} \times I_{In}$ when the output side is short-circuited).
2. Plot Pd against 25°C.
3. Connect Pd to the point corresponding to the 150°C with a straight line.
4. In design, take a vertical line from the maximum operating temperature (e.g., 75°C) to the derating curve.
5. Read off the value of Pd against the point at which the vertical line intersects the derating curve. This is taken as the maximum power dissipation DPd.
6. $DPd \div (V_{In,MAX} - V_{Out}) = I_{Out}$ (at 75°C)

The maximum output current at the highest operating temperature will be $I_{Out} \cong DPd \div (V_{In,MAX} - V_{Out})$.
Please use the device at low temperature with better radiation. The lower temperature provides better quality.

12-3. On/Off Control

It is recommended to turn the regulator Off when the circuit following the regulator is not operating. A design with 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.

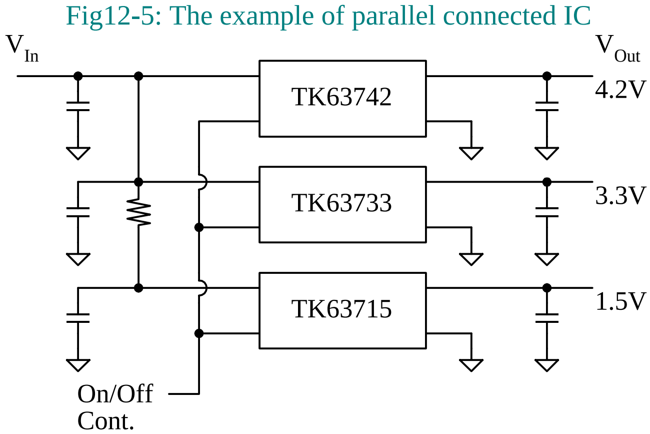
Fig12-4: The use of On/Off control



Control Terminal Voltage ((V$_{Cont}$)	On/Off State
$V_{Cont} > 1.2V$	On
$V_{Cont} < 0.2V$	Off

Parallel Connected On/Off Control

Fig12-5: The example of parallel connected IC



The above figure is multiple regulators being controlled by a single On/Off control signal. There is concern of overheating, because the power loss of the low voltage side IC (TK63715AB6) is large. The series resistor (R) is put in the input line of the low output voltage regulator in order to prevent over-dissipation. The voltage dropped across the resistor reduces the large input-to-output voltage across the regulator, reducing the power dissipation in the device. When the thermal sensor works, a decrease of the output voltage, oscillation, etc. may be observed.

12-4. Influence by Light

When TK637xxAB6 (FC-4) is exposed to strong light, the electrical characteristics change. Please confirm the influence by light in your design.

12-5. Definition of term

Characteristics

♦ Output Voltage (V_{Out})

The output voltage is specified with V_{In}=(V_{OutTYP}+1V) and I_{Out}=5mA.

♦ Maximum Output Current ($I_{Out, MAX}$)

The rated output current is specified under the condition where the output voltage drops to 90% of the value specified with I_{Out}=5mA. The input voltage is set to V_{OutTYP}+1V and the current is pulsed to minimize temperature effect.

♦ Dropout Voltage (V_{Drop})

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 output voltage, the load current, and the junction temperature.

♦ Line Regulation (LinReg)

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 V_{In}=$V_{Out,TYP}$+1V to V_{In}=6V. It is a pulse measurement to minimize temperature effect.

♦ Load Regulation (LoaReg)

Load regulation is the ability of the regulator to maintain a constant output voltage as the load current changes. It is a pulsed measurement to minimize temperature effects with the input voltage set to V_{In}=$V_{Out,TYP}$+1V. The load regulation is specified under an output current step condition of 1mA to 50mA.

♦ 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 500mV$_{P-P}$, 1kHz super-imposed on the input voltage, where V_{In}=$V_{Out,TYP}$+1.5V. Ripple rejection is the ratio of the ripple content of the output vs. input and is expressed in dB.

♦ Standby Current ($I_{Standby}$)

Standby current is the current which flows into the regulator when the output is turned off by the control function (V_{Cont}=0V).

Protections

♦ Over Current Sensor

The over current sensor protects the device when there is excessive output current. It also protects the device if the output is accidentally connected to ground.

♦ Thermal Sensor

The thermal sensor protects the device in case the junction temperature exceeds the safe value (T_j=150°C). This temperature rise can be caused by external heat, excessive power dissipation caused by large input to output voltage drops, or excessive output current. The regulator will shut off when the temperature exceeds the safe value. As the junction temperatures decrease, the regulator will begin to operate again. Under sustained fault conditions, the regulator output will oscillate as the device turns off then resets. Damage may occur to the device under extreme fault.

Please prevent the loss of the regulator when this protection operates, by reducing the input voltage or providing better heat efficiency.

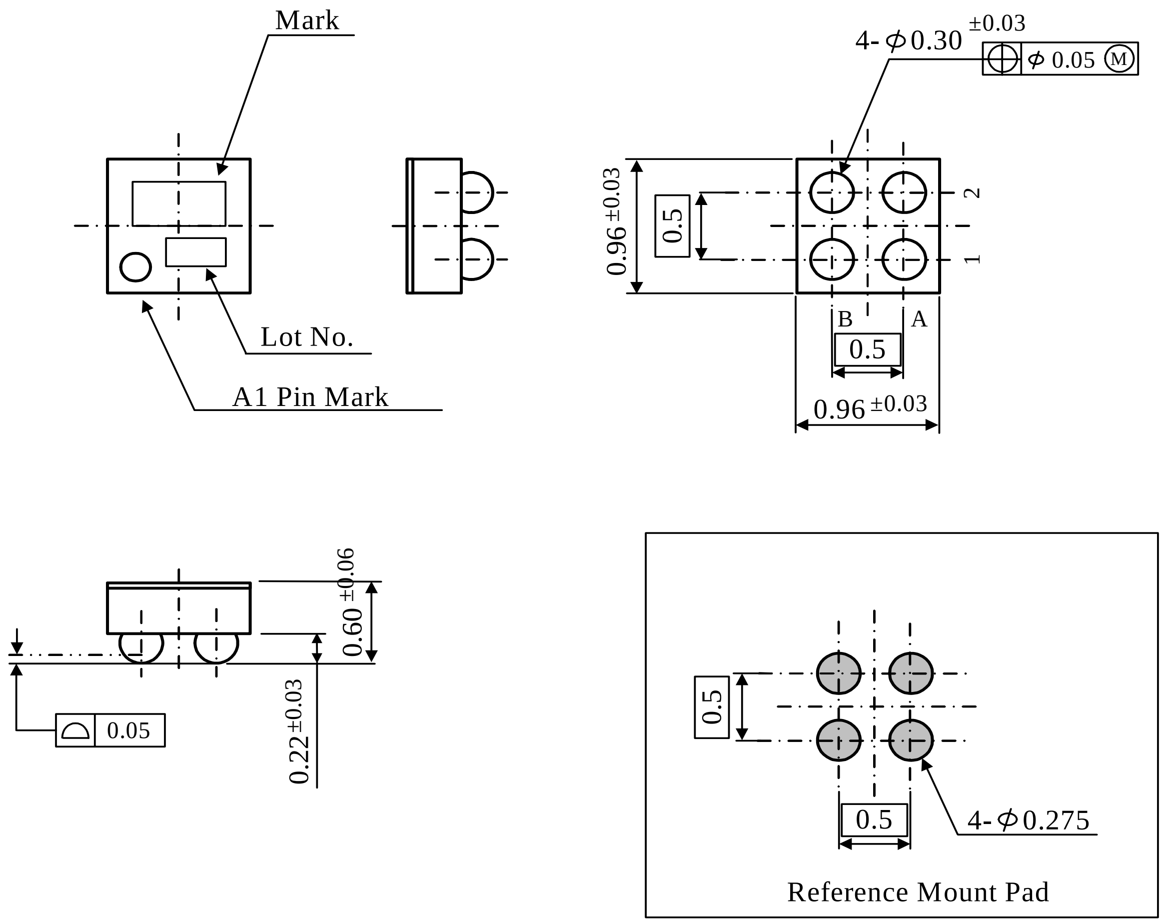
♦ ESD

MM : 200pF 0Ω 150V or more

HBM : 100pF 1.5kΩ 2000V or more

13. PACKAGE OUTLINE

■ 4-bump flip chip : FC-4 (TK637xxAB6)



Unit : mm

Package Structure and Others

Base Material : Si

Terminal Material : Lead Free Solder Bump

Solder Composition : Sn-2.5Ag

Mark Method : Laser

Country of Origin : Japan

Marking

Part Number	Marking Code	Part Number	Marking Code	Part Number	Marking Code
TK63702AB6	D02	TK63728AB6	D28	TK63733AB6	D33
TK63715AB6	D15	TK63701AB6	D01	TK63735AB6	D35
TK63718AB6	D18	TK63729AB6	D29		
TK63725AB6	D25	TK63730AB6	D30		
TK63726AB6	D26	TK63731AB6	D31		
TK63727AB6	D27	TK63732AB6	D32		

14. NOTES

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- Medical devices for measuring blood pressure, pulse, etc., treatment units such as coronary pacemakers and heat treatment units, and devices such as artificial organs and artificial limb systems which augment physiological functions.
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■ None of the ozone depleting substances(ODS) under the Montreal Protocol are used in our manufacturing process.

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