TOSHIBA CMOS Linear Integrated Circuit Silicon Monolithic

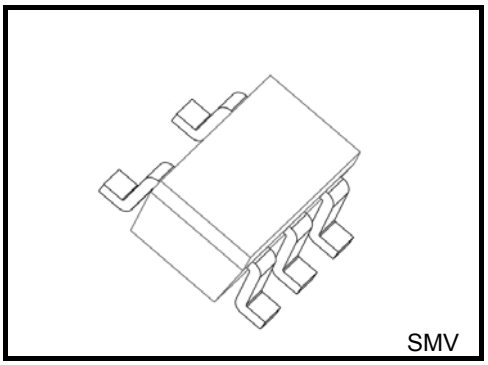
TCK106AF, TCK107AF, TCK108AF

1.0 A Load Switch IC with Slew Rate Control Driver in Small Package

The TCK106AF, TCK107AF and TCK108AF are load switch ICs for a general power management with slew rate control driver, featuring low switch ON resistance and wide input voltage operation from 1.1 to 5.5 V.

Switch ON resistance is only 63 mΩ typical at V_{IN} = 5.0 V, I_{OUT} = -0.5 A condition and output current is available on 1.0 A. TCK107AF and TCK108AF feature output auto-discharge function.

These devices are available in SMV (2.8 mm x 2.9 mm Typ.) package.



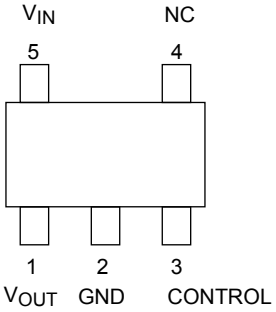
SMV (SOT-25)(SC-74A) : 16 mg (Typ.)

Feature

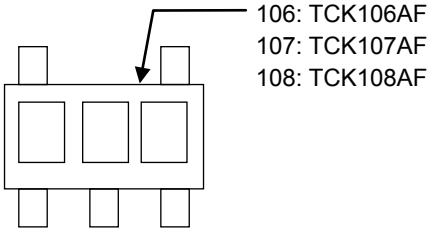
- Low ON resistance :
  R_{ON} = 63 mΩ (Typ.) at V_{IN} = 5.0 V, I_{OUT} = -0.5 A
  R_{ON} = 71 mΩ (Typ.) at V_{IN} = 3.3 V, I_{OUT} = -0.5 A
  R_{ON} = 101 mΩ (Typ.) at V_{IN} = 1.8 V, I_{OUT} = -0.5 A
  R_{ON} = 175 mΩ (Typ.) at V_{IN} = 1.2 V, I_{OUT} = -0.2 A
  R_{ON} = 223 mΩ (Typ.) at V_{IN} = 1.1 V, I_{OUT} = -0.2 A
- Low Quiescent current
  I_Q = 110 nA (Typ.) at V_{IN} = 5.5 V, I_{OUT} = 0 mA
- High output current: I_{OUT} = 1.0 A
- Wide input voltage operation: V_{IN} = 1.1 to 5.5 V
- Built in Slew rate control driver
- Built in Auto-discharge (TCK107AF and TCK108AF)
- Active High and Pull down connection between CONTROL and GND (TCK106AF and TCK107AF)
- Active Low (TCK108AF)
- General purpose package SMV(SOT-25) (SC-74A)

Pin Assignment (top view)

SMV(SOT-25)(SC-74A)



Top marking



Start of commercial production
2016-01

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating			Unit
Input voltage	V_{IN}	-0.3 to 6.0			V
Control voltage	V_{CT}	-0.3 to 6.0			V
Output voltage	V_{OUT}	-0.3 to V_{IN} +0.3		(Note1)	V
Output current	I_{OUT}	DC	1.0		A
		Pulse	1.5	(Note2)	
Power dissipation	P_D	200		(Note3)	mW
		580		(Note4)	
Operating temperature range	T_{opr}	−40 to 85			°C
Junction temeperature	Tj	150			°C
Storage temperature	T_{stg}	−55 to 150			°C

Note : Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: V_{IN} +0.3 ≤ 6.0 V

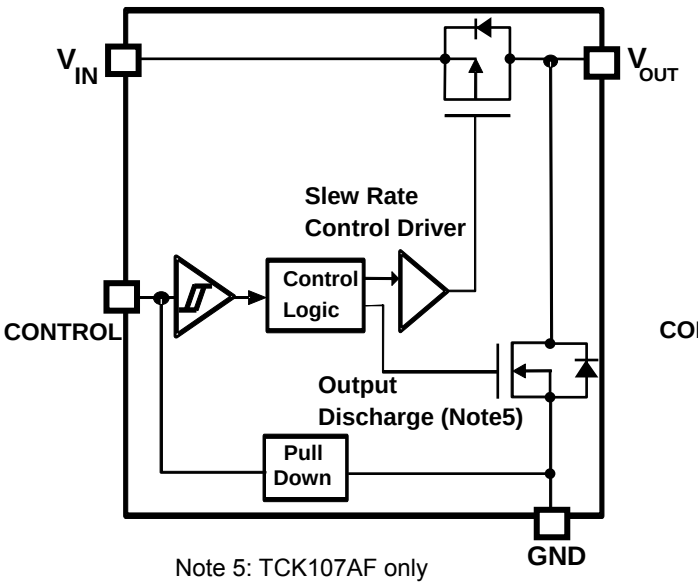
Note 2: 1 ms pulse, 1% duty cycle

Note 3: Unit Rating

Note 4: Rating at mounting on a board (FR4 board: 25.4 mm x 25.4 mm x 1.6 mm)

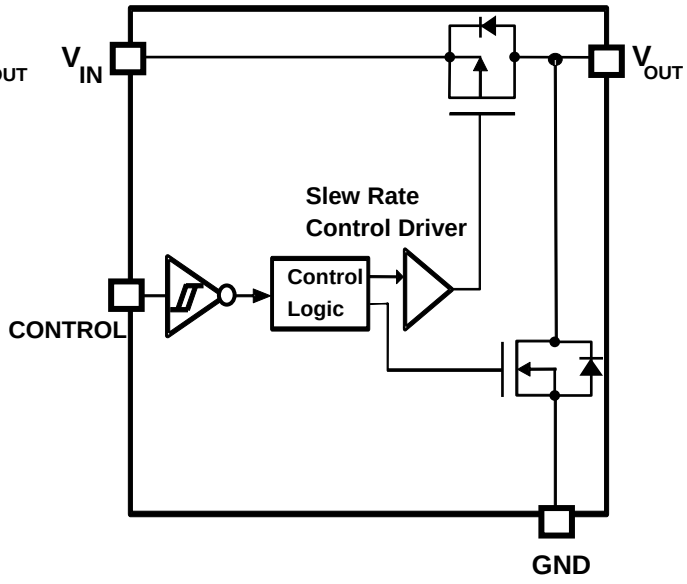
Block Diagram

TCK106AF, TCK107AF



Note 5: TCK107AF only

TCK108AF



Operating conditions

Characteristics	Symbol	Condition	Min	Max	Unit
Input voltage	V_{IN}	—	1.1	5.5	V
Output current	I_{OUT}	—		1.0	A
CONTROL High-level input voltage	V_{IH}	1.1 V ≤ V_{IN} ≤ 5.5 V	0.9	—	V
CONTROL Low-level input voltage	V_{IL}		—	0.4	V

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics	Symbol	Test Condition		Min	Typ.	Max	Unit
Quiescent current (ON state)	I_Q	V_{IN} = V_{CT} = 5.5 V, I_{OUT} = 0 mA	TCK106AF TCK107AF	—	110	230	nA
		V_{IN} = 5.5 V, V_{CT} = 0 V, I_{OUT} = 0 mA	TCK108AF				
Standby current (OFF state)	$I_{Q(OFF)}$	V_{IN} = 5.5 V, V_{CT} = 0 V, V_{OUT} = OPEN (Note6)	TCK106AF TCK107AF	—	65	150	nA
		V_{IN} = V_{CT} = 5.5 V, V_{OUT} = OPEN (Note6)	TCK108AF				
OFF-state switch current	$I_{SD(OFF)}$	V_{IN} = 5.5 V, V_{CT} = 0 V, V_{OUT} = GND	TCK106AF TCK107AF	—	14	1000	nA
		V_{IN} = V_{CT} = 5.5 V, V_{OUT} = GND	TCK108AF				
On resistance	R_{ON}	V_{IN} = 5.0 V, I_{OUT} = -0.5 A		—	63	90	mΩ
		V_{IN} = 3.3 V, I_{OUT} = -0.5 A		—	71	105	
		V_{IN} = 1.8 V, I_{OUT} = -0.5 A		—	101	155	
		V_{IN} = 1.2 V, I_{OUT} = -0.2 A		—	175	270	
		V_{IN} = 1.1 V, I_{OUT} = -0.2 A		—	223	—	
Discharge on resistance	R_{SD}	— (TCK107AF and TCK108AF)		—	100	—	Ω

Note 6: Except $I_{SD(OFF)}$ OFF-state switch current

AC Characteristics (Ta = 25°C)

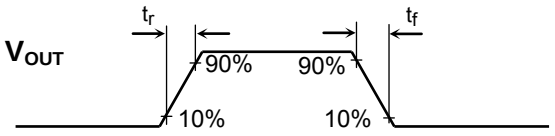
V_{IN} = 1.2 V

Characteristics	Symbol	Test Condition (Figure 1)		Min	Typ.	Max	Unit
V_{OUT} rise time	t_r	R_L = 500 Ω, C_L = 0.1 μF		—	290	—	μs
V_{OUT} fall time	t_f	R_L = 500 Ω, C_L = 0.1 μF	TCK107AF TCK108AF	—	30	—	μs
			TCK106AF	—	104	—	
Turn on delay	t_{ON}	R_L = 500 Ω, C_L = 0.1 μF		—	305	—	μs
Turn off delay	t_{OFF}	R_L = 500 Ω, C_L = 0.1 μF		—	5	—	μs

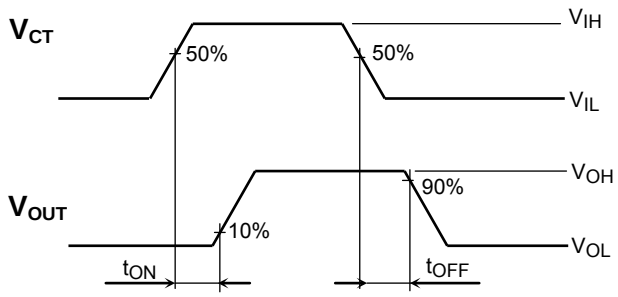
V_{IN} = 3.3 V

Characteristics	Symbol	Test Condition (Figure 1)		Min	Typ.	Max	Unit
V_{OUT} rise time	t_r	R_L = 500 Ω, C_L = 0.1 μF		—	130	—	μs
V_{OUT} fall time	t_f	R_L = 500 Ω, C_L = 0.1 μF	TCK107AF TCK108AF	—	25	—	μs
			TCK106AF	—	110	—	
Turn on delay	t_{ON}	R_L = 500 Ω, C_L = 0.1 μF		—	100	—	μs
Turn off delay	t_{OFF}	R_L = 500 Ω, C_L = 0.1 μF		—	10	—	μs

AC Waveform



TCK106AF, TCK107AF



TCK108AF

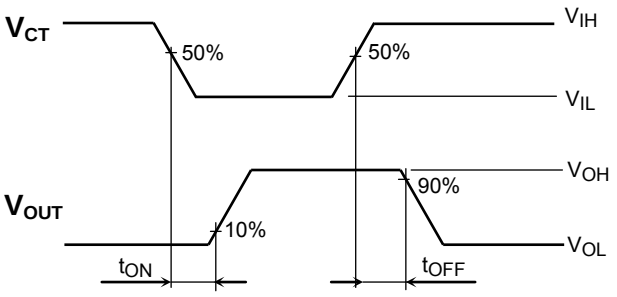
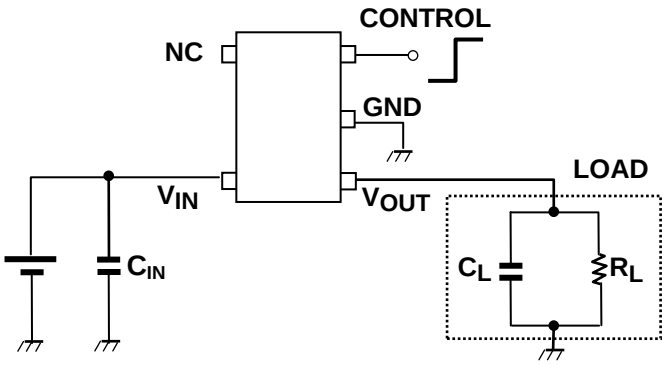


Figure 1 t_r, t_f, t_{ON}, t_{OFF} Waveforms

Application Note

1. Application circuit example (top view)

The figure below shows the recommended configuration for TCK106AF, TCK107AF and TCK108AF.



Part number	Control voltage	IC Operation
TCK106AF TCK107AF	HIGH	ON
	LOW	OFF
	OPEN	OFF
TCK108AF	HIGH	OFF
	LOW	ON

1) Input capacitor

An input capacitor (C_{IN}) is not necessary for the guaranteed operation of TCK106AF, TCK107AF and TCK108AF. However, it is recommended to use input capacitors to reduce voltage drop due to sharp changes in output current and also for improved stability of the power supply. When used, place C_{IN} as close to V_{IN} pin to improve stability of the power supply. Also, due to the C_{IN} selected, $V_{IN} < V_{OUT}$ may occur, causing a reverse current to flow through the body diode of the pass-through p-ch MOSFET of the load switch IC. In this case, a higher value for C_{IN} as compared to C_L is recommended.

2) Output capacitor

An output capacitor (C_{OUT}) is not necessary for the guaranteed operation of TCK106AF, TCK107AF and TCK108AF. However, there is a possibility of overshoot or undershoot caused by output load transient response, board layout and parasitic components of load switch IC. In this case, an output capacitor with C_{OUT} more than 0.1μF is recommended.

3) Control pin

A control pins for TCK106AF and TCK107AF are both Active High and TCK108AF is Active Low. These controls both the pass-through p-ch MOSFET and the discharge n-ch MOSFET (except TCK106AF), operated by the control voltage and Schmitt trigger. When the control voltage level is High (Low; TCK108AF), p-ch MOSFET is ON state and n-ch MOSFET is OFF state. When control voltage level is Low (High; TCK108AF), and the state of the MOSFETs is reversed. Also, pull down resistance equivalent to a few MΩ is connected between CONTROL and GND, thus the load switch IC is in OFF state even when CONTROL pin is OPEN(except TCK108AF). In addition, CONTROL pin has a tolerant function such that it can be used even if the control voltage is higher than the input voltage.

2. Power Dissipation

Both unit and board-mounted power dissipation ratings for TCK106AF, TCK107AF and TCK108AF are available in the Absolute Maximum Ratings table.

Power dissipation is measured on the board shown below.

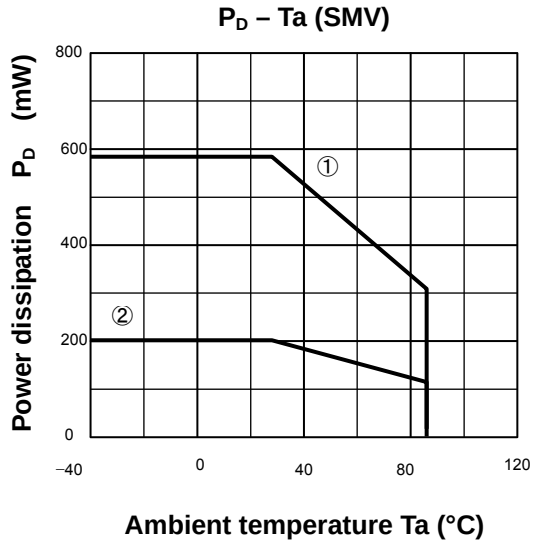
①: Rating at mounting on a board

Board material: FR4 board

Board dimension: 25.4 mm × 25.4 mm × 1.6 mm

Copper area: 645 mm^2

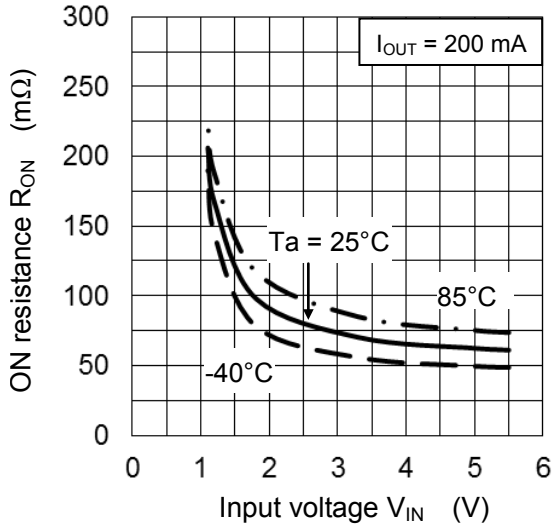
②: Unit Rating



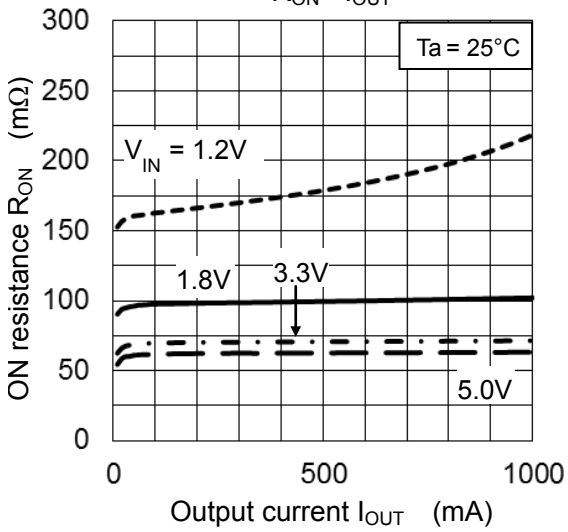
Please allow sufficient margin when designing a board pattern to fit the expected power dissipation. Also take into consideration the ambient temperature, input voltage, output current etc and applying the appropriate derating for allowable power dissipation during operation.

Representative Common Characteristics

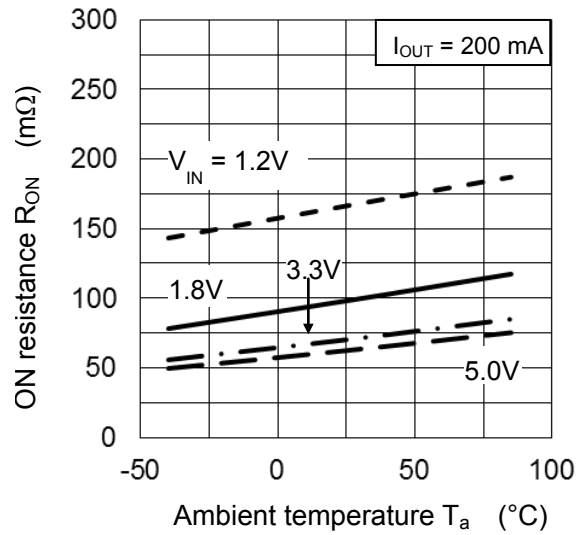
R_{ON} - V_{IN}



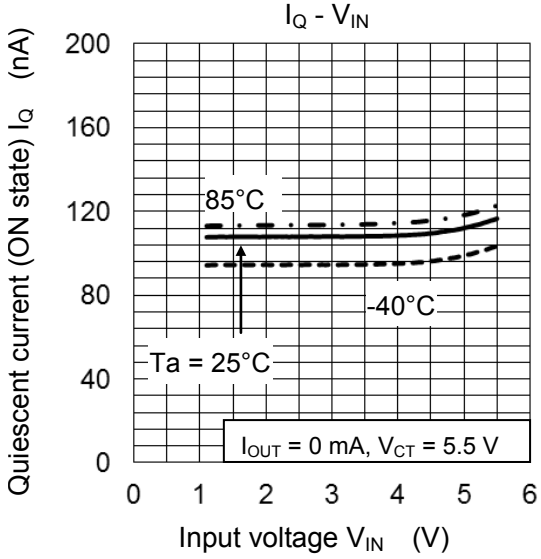
R_{ON} - I_{OUT}



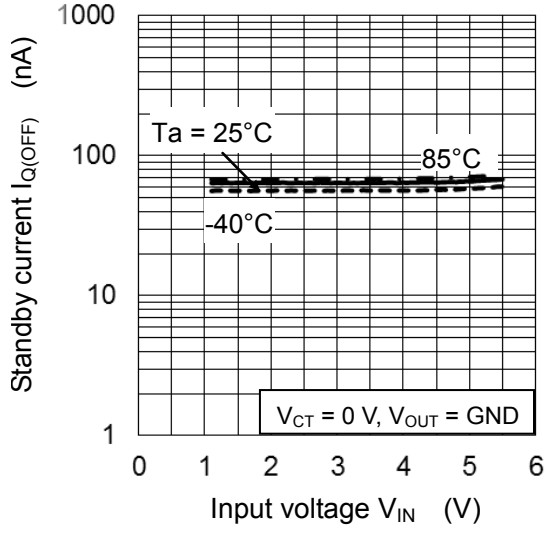
R_{ON} - T_a



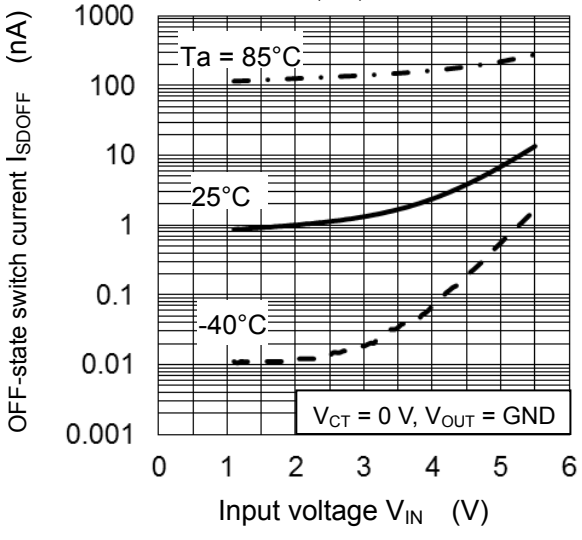
I_Q - V_{IN}



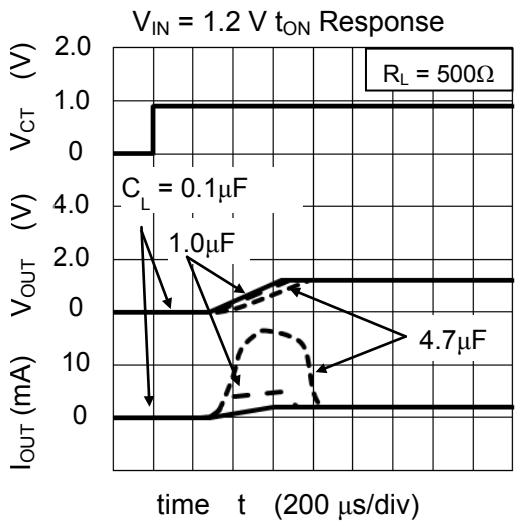
$I_{Q(OFF)}$ - V_{IN}

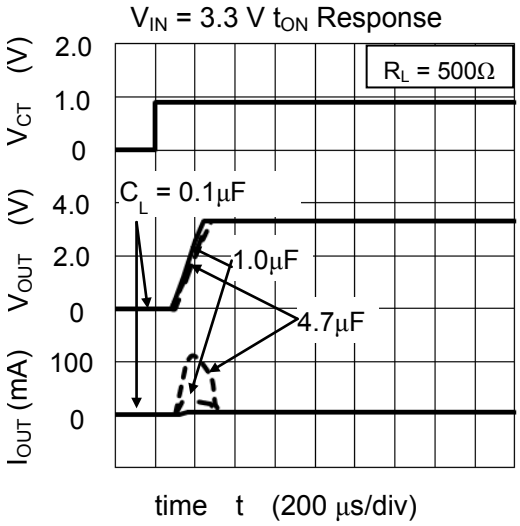


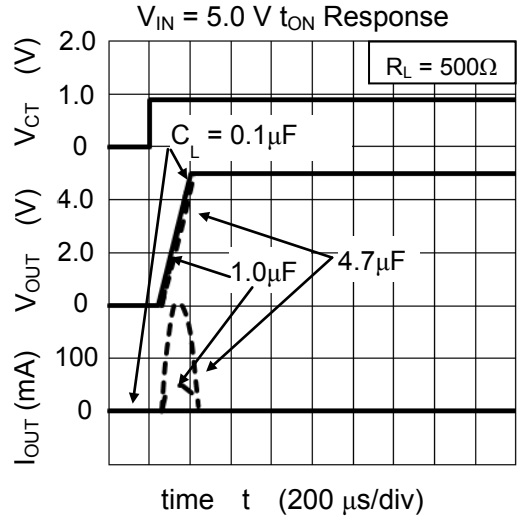
$I_{SD(OFF)}$ - V_{IN}



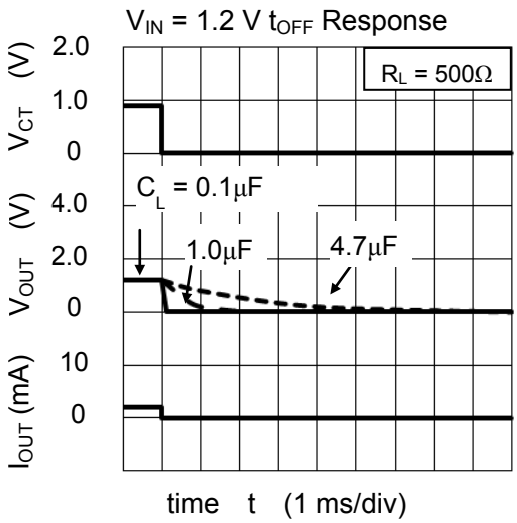
TCK107AF t_{ON} Response

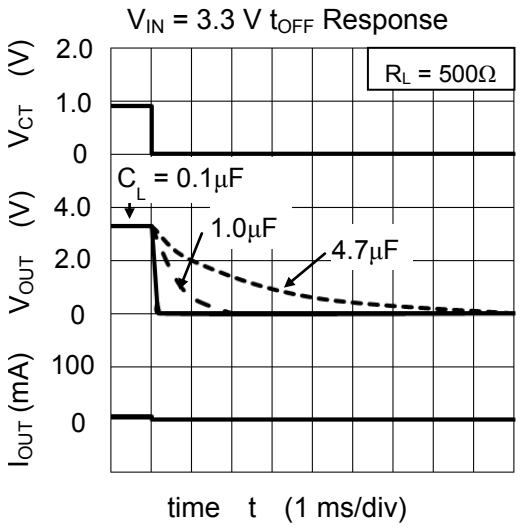


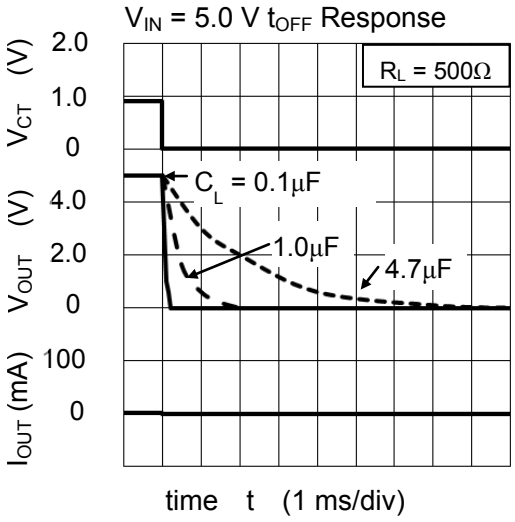




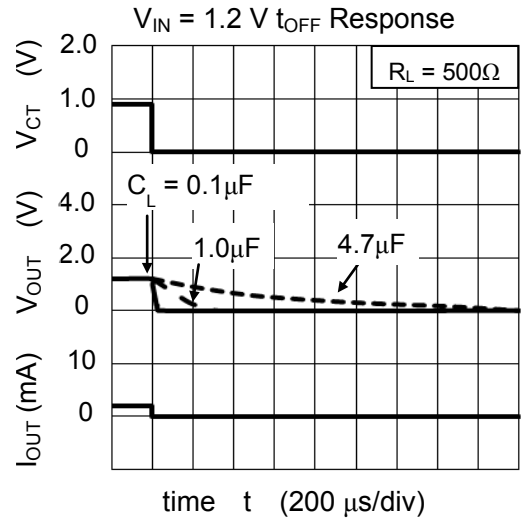
TCK106AF t_{OFF} Response

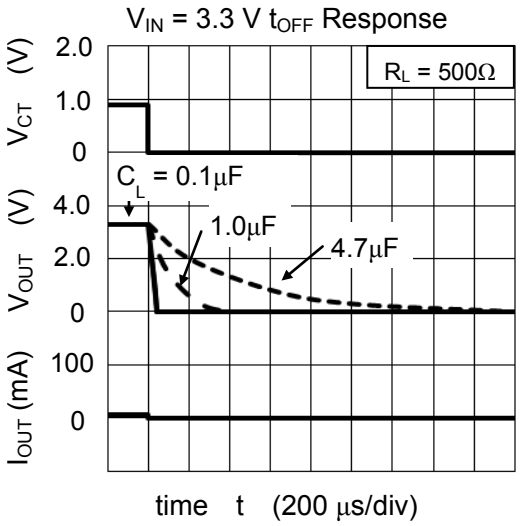


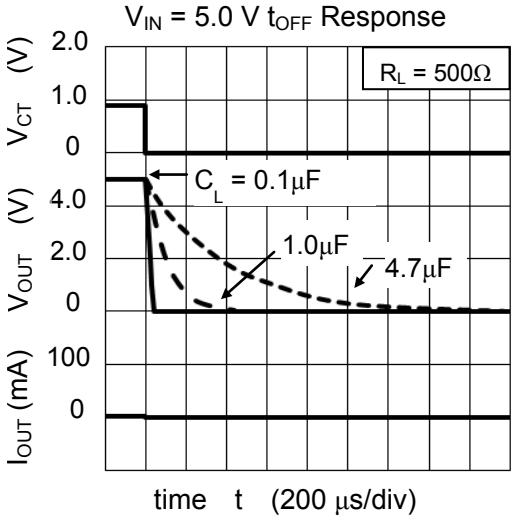




TCK107AF t_{OFF} Response

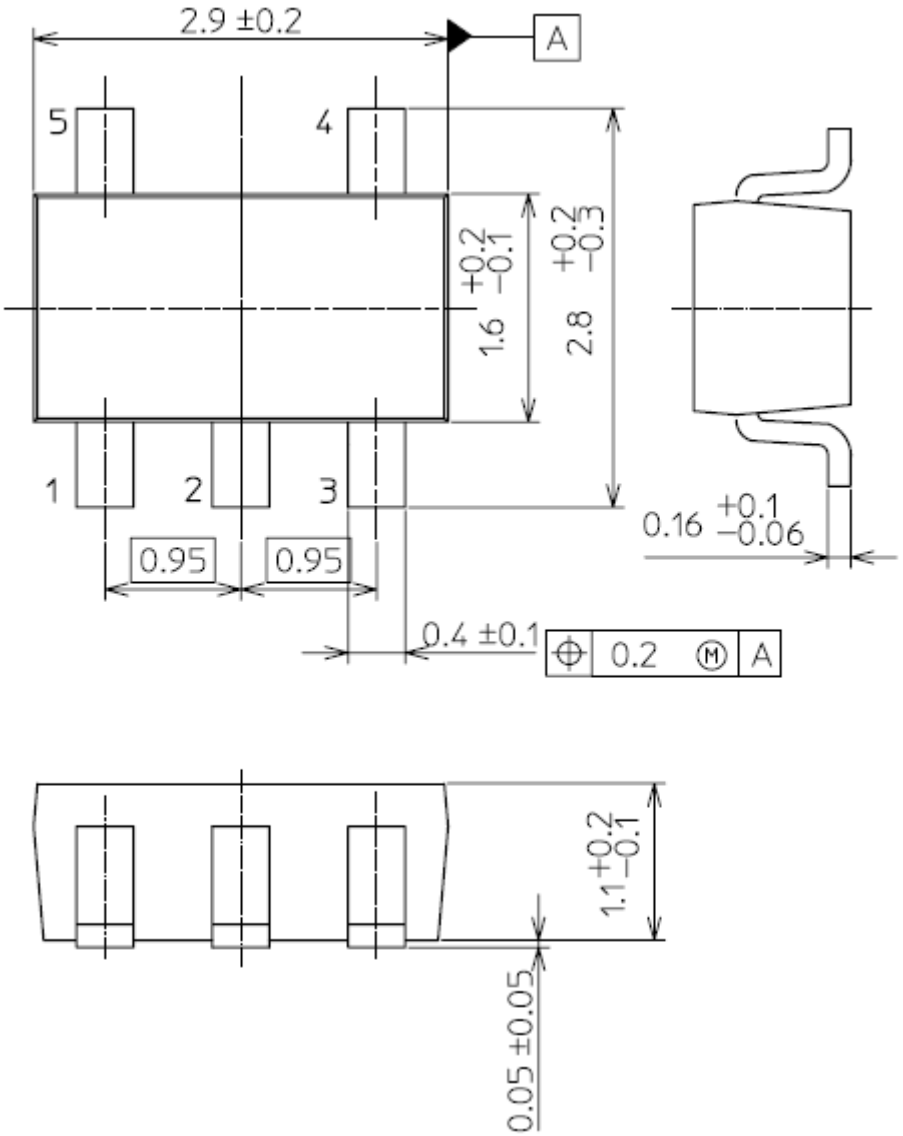






Package dimension

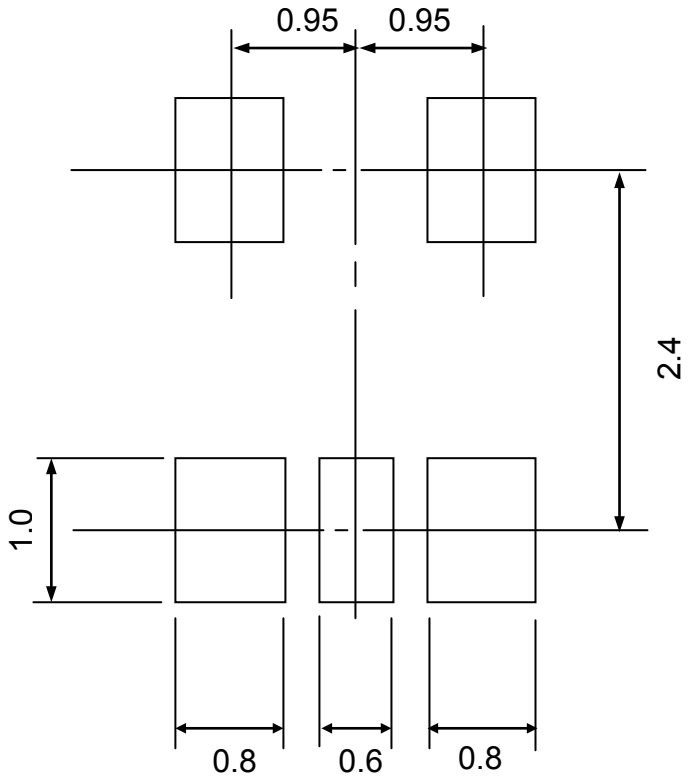
SMV (SOT-25)(SC-74A) **Unit: mm**



Weight : 16mg (Typ.)

Land pattern dimensions (for reference only)

Unit: mm



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- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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