

MOSFETs Silicon N-channel MOS (U-MOSIV)

TK100F04K3L

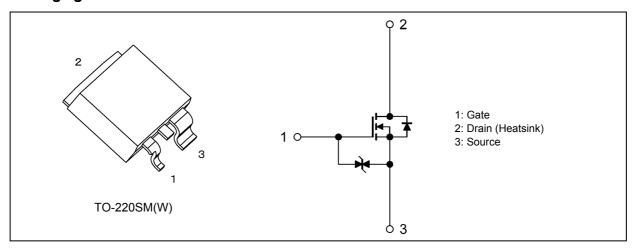
1. Applications

- Switching Voltage Regulators
- · DC-DC Converters
- · Motor Drivers

2. Features

- (1) Low drain-source on-resistance: $R_{DS(ON)} = 2.5 \text{ m}\Omega$ (typ.) ($V_{GS} = 10 \text{ V}$)
- (2) Low leakage current: $I_{DSS} = 10 \mu A \text{ (max) (V}_{DS} = 40 \text{ V)}$
- (3) Enhancement mode: $V_{th} = 2.0$ to 3.0 V ($V_{DS} = 10$ V, $I_D = 1$ mA)

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings (Note) (Ta = 25°C unless otherwise specified)

Characteristics			Rating	Unit
Drain-source voltage		V_{DSS}	40	V
Gate-source voltage		V_{GSS}	±20	
Drain current (DC)	(Note 1)	I _D	100	Α
Drain current (pulsed)	(Note 1)	I _{DP}	300	
Power dissipation (T _c =	: 25°C)	P_D	180	W
Single-pulse avalanche energy	(Note 2)	E _{AS}	125	mJ
Avalanche current		I _{AR}	100	Α
Channel temperature	(Note 3)	T _{ch}	175	°C
Storage temperature	(Note 3)	T _{stg}	-55 to 175	

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.

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).



5. Thermal Characteristics

Characteristics		Max	Unit
Channel-to-case thermal resistance	R _{th(ch-c)}	0.83	°C/W

Note 1: Ensure that the channel temperature does not exceed 175°C.

Note 2: V_{DD} = 25 V, T_{ch} = 25°C (initial), L = 13 μ H, R_{G} = 25 Ω , I_{AR} = 100 A

Note 3: The definitions of the absolute maximum channel and storage temperatures are based on AEC-Q101.

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.



6. Electrical Characteristics

6.1. Static Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I _{GSS}	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±10	μА
Drain cut-off current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	_	_	10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = 10 mA, V _{GS} = 0 V	40	_	_	٧
Drain-source breakdown voltage (Note 4)	V _{(BR)DSX}	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	20	_	_	
Gate threshold voltage	V_{th}	V _{DS} = 10 V, I _D = 1 mA	2.0	_	3.0	
Drain-source on-resistance	R _{DS(ON)}	V _{GS} = 6 V, I _D = 50 A	_	3.0	4.5	mΩ
		V _{GS} = 10 V, I _D = 50 A	_	2.5	3.0	

Note 4: If a reverse bias is applied between gate and source, this device enters $V_{(BR)DSX}$ mode. Note that the drain-source breakdown voltage is lowered in this mode.

6.2. Dynamic Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	_	4980	_	pF
Reverse transfer capacitance	C _{rss}		_	680	_	
Output capacitance	C _{oss}		_	1100	_	
Switching time (rise time)	t _r	See Fig. 6.2.1	_	21	_	ns
Switching time (turn-on time)	t _{on}		_	23	_	
Switching time (fall time)	t _f		_	31	_	
Switching time (turn-off time)	t _{off}		_	95	_	

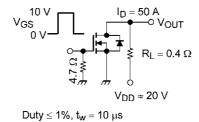


Fig. 6.2.1 Switching Time Test Circuit

6.3. Gate Charge Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 100 \text{ A}$	1	105	1	nC
Gate-source charge	Q_{gs}			60		
Gate-drain charge	Q_{gd}		_	45		

6.4. Source-Drain Characteristics (T_a = 25°C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Reverse drain current (DC)	(Note 5)	I _{DR}		_	_	100	Α
Reverse drain current (pulsed)	(Note 5)	I _{DRP}	_		_	300	
Diode forward voltage		V _{DSF}	I _{DR} = 100 A, V _{GS} = 0 V	_	_	-1.2	V
Reverse recovery time		t _{rr}	I _{DR} = 100 A, V _{GS} = 0 V	_	61	_	ns
Reverse recovery charge		Q _{rr}	-dI _{DR} /dt = 50 A/μs	-	49		nC

Note 5: Ensure that the channel temperature does not exceed 175°C.



7. Marking (Note)

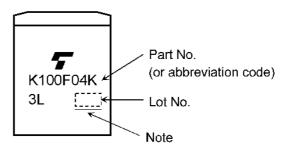


Fig. 7.1 Marking

Note: A line under a Lot No. identifies the indication of product Labels.

Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

 ${\it Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS}$

compatibility of Product.

The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on

the restriction of the use of certain hazardous substances in electrical and electronic equipment.



8. Moisture-Proof Packing

This device is packed in a moisture-proof laminated aluminum bag.

8.1. Precautions for Transportation and Storage (Note)

- (1) Avoid excessive vibration during transportation.
- (2) Do not toss or drop the packed devices to avoid ripping of the bag.
- (3) After opening the moisture-proof bag, the devices should be assembled within two weeks in an environment of 5°C to 30°C and RH70% or below. Perform reflow at most twice.
- (4) The moisture-proof bag may be stored unopened for up to 24 months at 5°C to 30°C and RH90% or below.
- (5) If, upon opening the bag, the moisture indicator card shows humidity of 30% or above (the color of the 30% dot has changed from blue to pink) or the expiration date has passed, the devices should be baked as follows:

Baking conditions: 125°C for 48 hours.

Note: Since the tape materials are not heat-proof, devices should be placed on either heat-proof trays or aluminum magazines when baking.



Fig. 8.1.1 Humidity Indicator

The humidity indicator shows an approximate ambient humidity at 25°C. If the ambient humidity is below 30%, the color of all the indicator dots is blue. If, upon opening the bag, the color of the 30% dot has changed from blue to pink, the devices should be baked before assembly.

9. Characteristics Curves (Note)

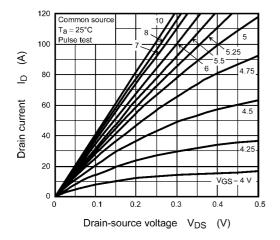


Fig. 9.1 $I_D - V_{DS}$

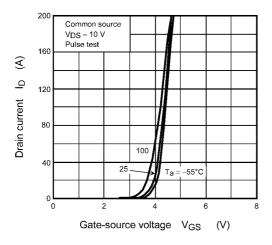


Fig. 9.3 I_D - V_{GS}

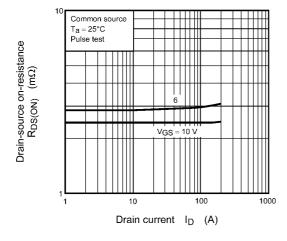


Fig. 9.5 R_{DS(ON)} - I_D

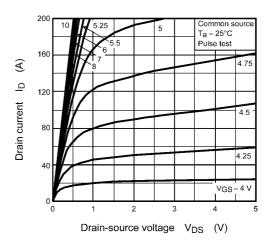


Fig. 9.2 I_D - V_{DS}

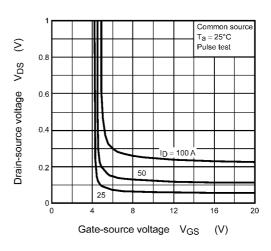


Fig. 9.4 V_{DS} - V_{GS}

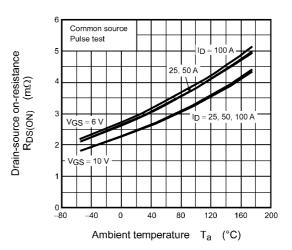


Fig. 9.6 R_{DS(ON)} - T_a

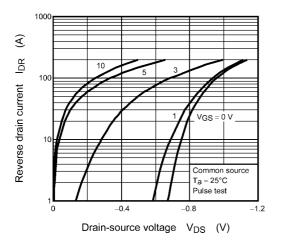


Fig. 9.7 IDR - VDS

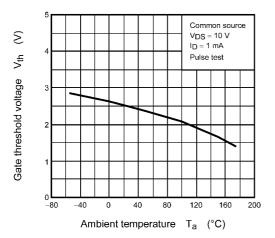


Fig. 9.9 V_{th} - T_a

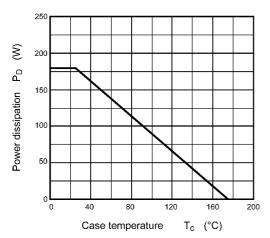


Fig. 9.11 P_D - T_c (Guaranteed Maximum)

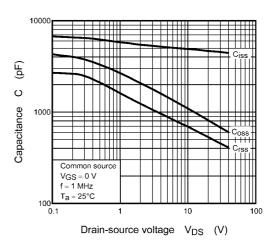


Fig. 9.8 Capacitance - V_{DS}

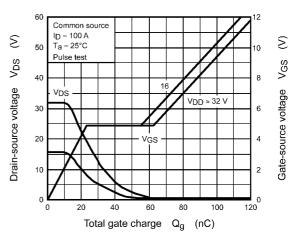


Fig. 9.10 Dynamic Input/Output Characteristics

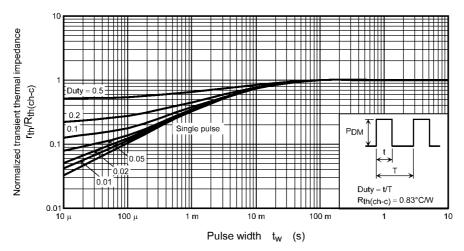


Fig. 9.12 r_{th}/R_{th(ch-c)} - t_w (Guaranteed Maximum)

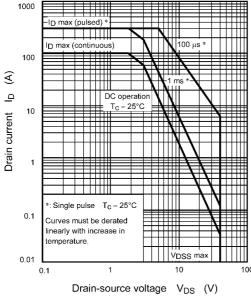


Fig. 9.13 Safe Operating Area (Guaranteed Maximum)

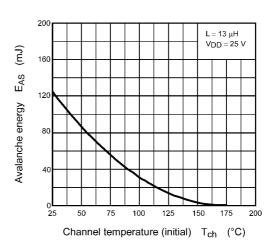


Fig. 9.14 E_{AS} - T_{ch} (Guaranteed Maximum)

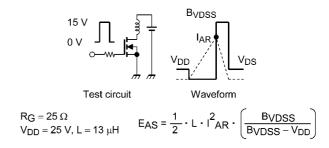


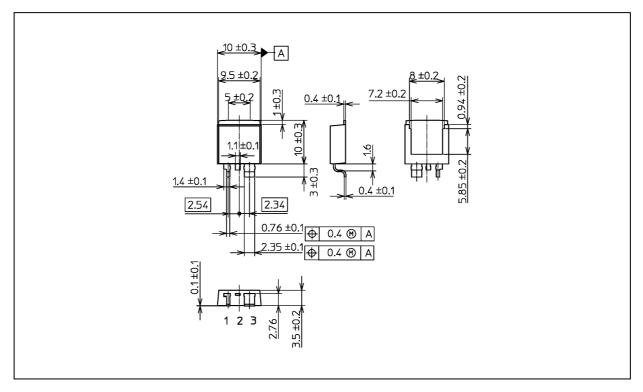
Fig. 9.15 Test Circuit/Waveform

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



Package Dimensions

Unit: mm



Weight: 1.07 g (typ.)

Package Name(s)	
TOSHIBA: 2-10W1S	
Nickname: TO-220SM(W)	



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