MOSFETs Silicon N-Channel MOS (π-MOSⅦ)

TK4P60DB

1. Applications

- Switching Voltage Regulators

2. Features

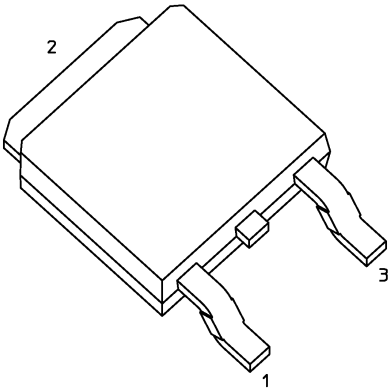
(1) Low drain-source on-resistance : $R_{DS(ON)} = 1.6\ \Omega$ (typ.)

(2) High forward transfer admittance : $|Y_{fs}| = 2.2$ S (typ.)

(3) Low leakage current : $I_{DSS} = 10\ \mu A$ (max) ($V_{DS} = 600$ V)

(4) Enhancement mode : $V_{th} = 2.4$ to 4.4 V ($V_{DS} = 10$ V, $I_D = 1$ mA)

3. Packaging and Internal Circuit



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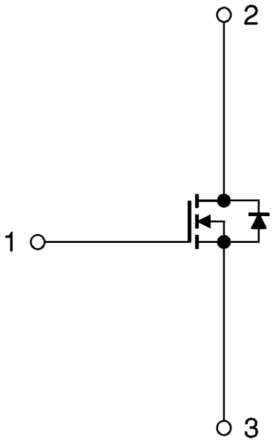


1: Gate
2: Drain (Heatsink)
3: Source

Start of commercial production
2009-12

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	600	V
Gate-source voltage		V_{GSS}	±30	
Drain current (DC)	(Note 1)	I_D	3.7	A
Drain current (pulsed)	(Note 1)	I_{DP}	14.8	
Power dissipation	(T_c = 25 °C)	P_D	80	W
Single-pulse avalanche energy	(Note 2)	E_{AS}	147	mJ
Avalanche current	(Note 3)	I_{AR}	3.7	A
Repetitive avalanche energy	(Note 3)	E_{AR}	8	mJ
Reverse drain current (DC)	(Note 1)	I_{DR}	3.7	A
Reverse drain current (pulsed)	(Note 1)	I_{DRP}	14.8	
Channel temperature		T_{ch}	150	°C
Storage temperature		T_{stg}	-55 to 150	

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	Symbol	Max	Unit
Channel-to-case thermal resistance	$R_{th(ch-c)}$	1.56	°C/W
Channel-to-ambient thermal resistance	$R_{th(ch-a)}$	125	

Note 1: Ensure that the channel temperature does not exceed 150 °C.
Note 2: V_{DD} = 90 V, T_{ch} = 25 °C (initial), L = 18.7 mH, R_G = 25 Ω, I_{AR} = 3.7 A
Note 3: Repetitive rating; pulse width limited by maximum channel temperature.

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

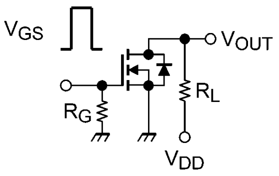
6. Electrical Characteristics

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	V_{GS} = ±30 V, V_{DS} = 0 V	—	—	±1	μA
Drain cut-off current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D = 10 mA, V_{GS} = 0 V	600	—	—	V
Gate threshold voltage	V_{th}	V_{DS} = 10 V, I_D = 1 mA	2.4	—	4.4	
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 1.9 A	—	1.6	2	Ω
Forward transfer admittance	$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 1.9 A	0.6	2.2	—	S

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	—	540	—	pF
Reverse transfer capacitance	C_{rss}		—	3	—	
Output capacitance	C_{oss}		—	60	—	
Switching time (rise time)	t_r	See Fig.6.2.1	—	18	—	ns
Switching time (turn-on time)	t_{on}		—	40	—	
Switching time (fall time)	t_f		—	8	—	
Switching time (turn-off time)	t_{off}		—	55	—	



V_{DD} ≈ 200 V
V_{GS} = 0 V / 10 V
I_D = 1.9 A
R_L = 105 Ω
R_G = 50 Ω
Duty ≤ 1 %, t_w = 10 μs

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	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	V_{DD} ≈ 400 V, V_{GS} = 10 V, I_D = 3.7 A	—	11	—	nC
Gate-source charge	Q_{gs}		—	6	—	
Gate-drain charge	Q_{gd}		—	5	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage	V_{DSF}	I_{DR} = 3.7 A, V_{GS} = 0 V	—	—	-1.7	V
Reverse recovery time	t_{rr}	I_{DR} = 3.7 A, V_{GS} = 0 V, -di/dt = 100 A/μs	—	1000	—	ns
Reverse recovery charge	Q_{rr}		—	5.5	—	μC

7. Marking

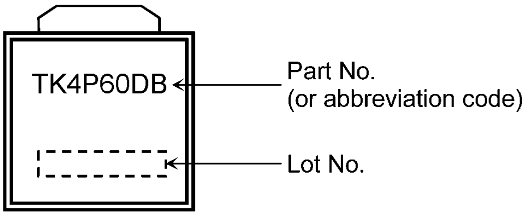


Fig. 7.1 Marking