

MOSFETs Silicon N-Channel MOS (U-MOSVI-H)

TK50P03M1

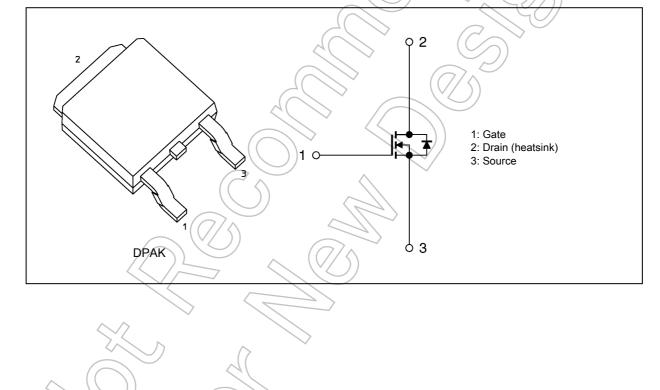
1. Applications

- Switching Voltage Regulators
- · Motor Drivers
- Power Management Switches

2. Features

- (1) High-speed switching
- (2) Low gate charge: $Q_{SW} = 8.2 \text{ nC (typ.)}$
- (3) Low drain-source on-resistance: $R_{DS(ON)} = 5.8 \text{ m}\Omega$ (typ.) ($V_{GS} = 10 \text{ V}$)
- (4) Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 30 V)
- (5) Enhancement mode: $V_{th} = 1.3 \text{ to } 2.3 \text{ V } (V_{DS} = 10 \text{ V}, I_D = 0.2 \text{ mA})$

3. Packaging and Internal Circuit



Start of commercial production

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

Characteristic	Symbol	Rating	Unit		
Drain-source voltage			V _{DSS}	30	V
Gate-source voltage			V _{GSS}	±20	
Drain current (DC)		(Note 1)	I _D	50	Α
Drain current (pulsed)		(Note 1)	I _{DP}	150	
Power dissipation	(T _c = 25°C)		P _D	47	W
Single-pulse avalanche energy		(Note 2)	E _{AS}	65	mJ
Single-pulse avalanche current			IAS	50	Α
Channel temperature			T _{ch}	150	℃
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	(V/)	R _{th(ch-c)}	2.65	°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} = 24 V, T_{ch} = 25°C (initial), L = 20 μ H, R_G = 25 Ω , I_{AS} = 50 A

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}	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±0.1	μΑ
Drain cut-off current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V		_	10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = 10 mA, V _{GS} = 0 V	30	_		V
	V _{(BR)DSX}	I _D = 10 mA, V _{GS} = -20 V	15) ~		
Gate threshold voltage	V_{th}	V _{DS} = 10 V, I _D = 0.2 mA	1.3	<u> </u>	2.3	
Drain-source on-resistance	R _{DS(ON)}	V _{GS} = 4.5 V, I _D = 25 A	/	7.5	9.8	mΩ
		V _{GS} = 10 V, I _D = 25 A)	5.8	7.5	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C _{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		1700		pF
Reverse transfer capacitance	C _{rss}	((//5)	_((125	_	
Output capacitance	C _{oss}		7	380) —	
Gate resistance	r _g	V _{DS} = 10 V, V _{GS} = 0 V, f = 5 MHz		17/	3.3	Ω
Switching time (rise time)	t _r	See Figure 6.2.1.		20	_	ns
Switching time (turn-on time)	t _{on}		//-//	25		
Switching time (fall time)	t _f			22		
Switching time (turn-off time)	t _{off}		リー	64	_	

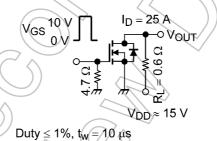


Fig. 6.2.1 Switching Time Test Circuit

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

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus	Q_g	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 50 \text{ A}$		25.3		nC
gate-drain)		$V_{DD} \approx 24 \text{ V}, V_{GS} = 5 \text{ V}, I_{D} = 50 \text{ A}$		13.3		
Gate-source charge 1	Q _{gs1}	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 50 \text{ A}$		6.3		
Gate-drain charge	Q_{gd}			4.6		
Gate switch charge	Q _{SW}			8.2		

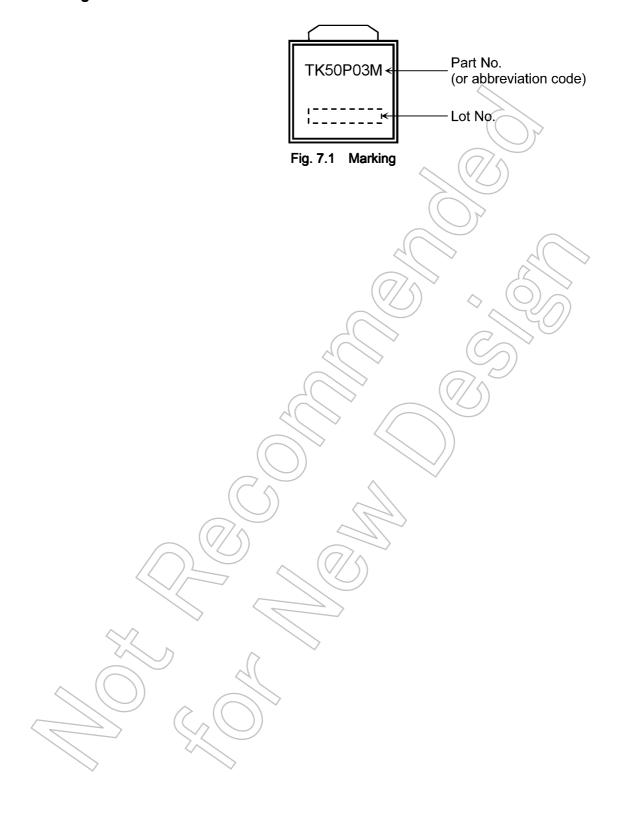
6.4. Source-Drain Characteristics (T_a = 25°C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Reverse drain current (pulsed) (N	Note 3)	I_{DRP}	_	_	_	150	Α
Diode forward voltage		V_{DSF}	$I_{DR} = 50 \text{ A}, V_{GS} = 0 \text{ V}$		_	-1.2	V

Note 3: Ensure that the channel temperature does not exceed 150°C.



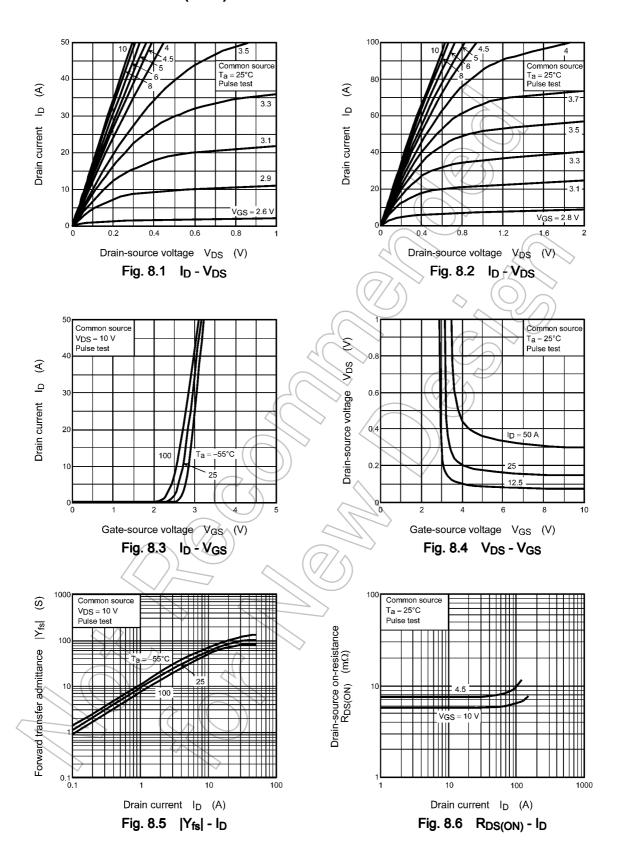
7. Marking



Rev.5.0



8. Characteristics Curves (Note)





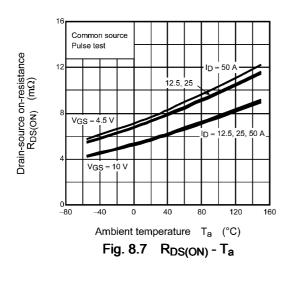
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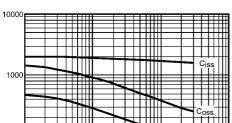
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Capacitance

Common source

 $V_{GS} = 0 V$ f = 1 MHz $T_{a} = 25$ °C





Drain-source voltage V_{DS} (V)



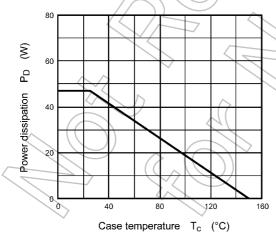


Fig. 8.11 P_D - T_c (Guaranteed Maximum)

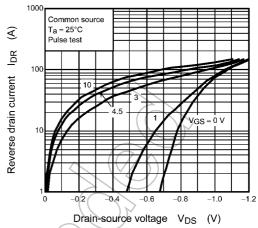


Fig. 8.8 IDR - VDS

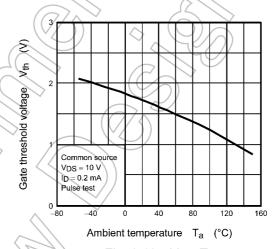


Fig. 8.10 V_{th} - T_a

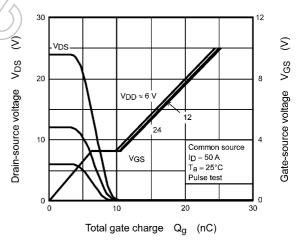
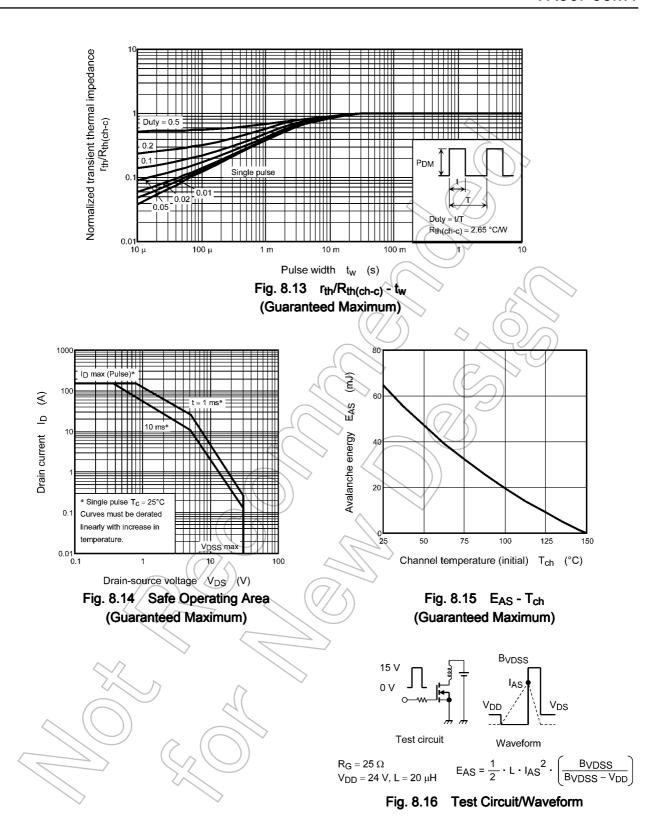


Fig. 8.12 Dynamic Input/Output Characteristics



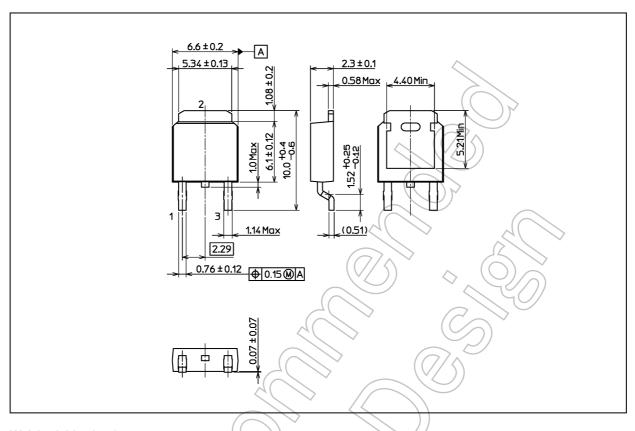


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

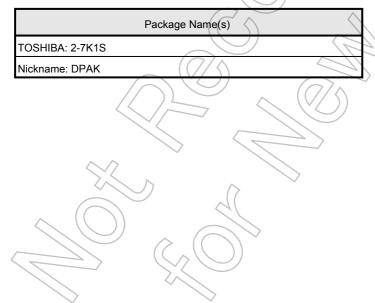


Package Dimensions

Unit: mm



Weight: 0.36 g (typ.)





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