

MOSFETs Silicon N-channel MOS (U-MOSIV)

TK60S06K3L

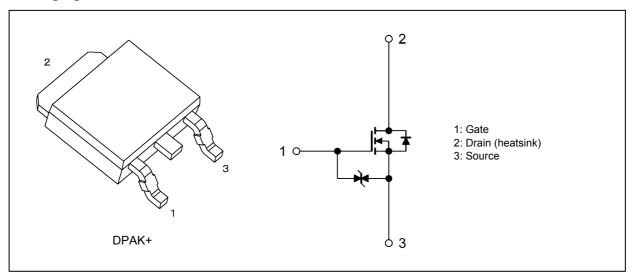
1. Applications

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

2. Features

- (1) AEC-Q101 qualified
- (2) Low drain-source on-resistance: $R_{DS(ON)}$ = 6.4 m Ω (typ.) (V $_{GS}$ = 10 V)
- (3) Low leakage current: $I_{DSS} = 10 \mu A \text{ (max) (V}_{DS} = 60 \text{ V)}$
- (4) 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	Symbol	Rating	Unit	
Drain-source voltage		V_{DSS}	60	V
Gate-source voltage		V_{GSS}	±20	
Drain current (DC)	(Note 1)	I _D	60	Α
Drain current (pulsed)	(Note 1)	I _{DP}	120	
Power dissipation (T _c = 29	5°C)	P_D	88	W
Single-pulse avalanche energy	(Note 2)	E _{AS}	89	mJ
Avalanche current		I _{AR}	60	Α
Channel temperature	(Note 3)	T _{ch}	175	ç
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)}	1.7	°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 = 34 μ H, R_{G} = 1 Ω , I_{AR} = 60 A

Note 3: The definitions of the absolute maximum channel and storage temperatures are qualified per 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} = 60 V, V _{GS} = 0 V	_	_	10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = 10 mA, V _{GS} = 0 V	60	_	_	V
	V _{(BR)DSX}	I _D = 10 mA, V _{GS} = -20 V	40	_	_	
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 = 30 A	_	7.7	12.3	mΩ
		V _{GS} = 10 V, I _D = 30 A	_	6.4	8.0	

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	_	2900	_	pF
Reverse transfer capacitance	C _{rss}		_	280	_	
Output capacitance	C _{oss}		_	460	_	
Switching time (rise time)	t _r	See Figure 6.2.1.	_	11	_	ns
Switching time (turn-on time)	t _{on}		_	24	_	
Switching time (fall time)	t _f		_	13	_	
Switching time (turn-off time)	t _{off}		_	60	_	

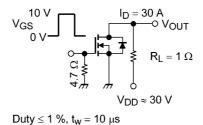


Fig. 6.2.1 Switching Time Test Circuit

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	$V_{DD} \approx 48 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 60 \text{ A}$	-	60	_	nC
Gate-source charge	Q_{gs}		_	39	_	
Gate-drain charge	Q_{gd}		_	21	_	

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 4)	I _{DR}	_	_	_	60	Α
Reverse drain current (pulsed)	(Note 4)	I _{DRP}	_	_	_	120	
Diode forward voltage		V _{DSF}	I _{DR} = 60 A, V _{GS} = 0 V	_	_	-1.2	V
Reverse recovery time		t _{rr}	I _{DR} = 60 A, V _{GS} = 0 V	_	52	_	ns
Reverse recovery charge		Q _{rr}	-dI _{DR} /dt = 50 A/μs	_	44		nC

Note 4: Ensure that the channel temperature does not exceed 175°C.



7. Marking (Note)

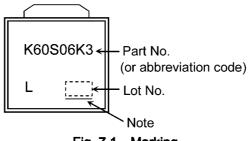


Fig. 7.1 Marking

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]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Rev.4.0

8. Characteristics Curves (Note)

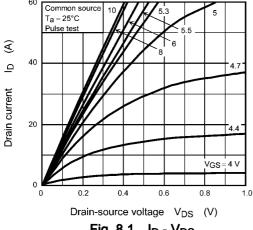


Fig. 8.1 I_D - V_{DS}

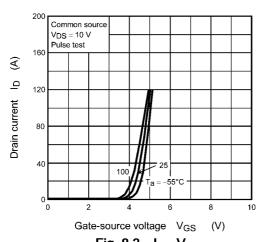


Fig. 8.3 I_D - V_{GS}

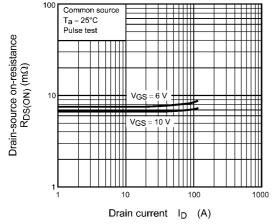


Fig. 8.5 $R_{DS(ON)}$ - I_D

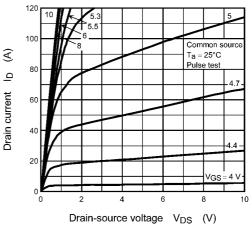


Fig. 8.2 I_D - V_{DS}

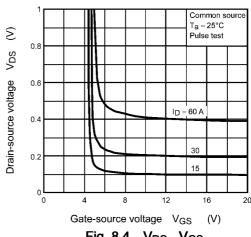


Fig. 8.4 V_{DS} - V_{GS}

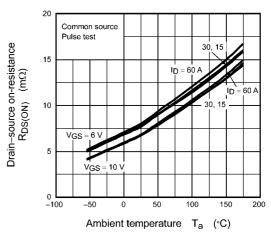


Fig. 8.6 $R_{DS(ON)}$ - T_a

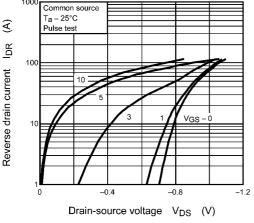


Fig. 8.7 IDR - VDS

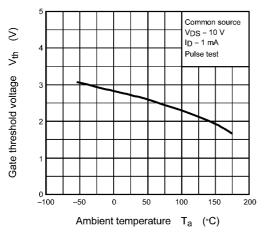
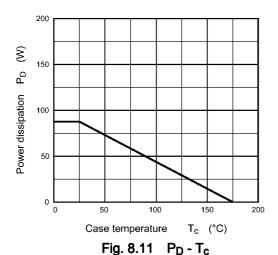


Fig. 8.9 V_{th} - T_a



(Guaranteed Maximum)

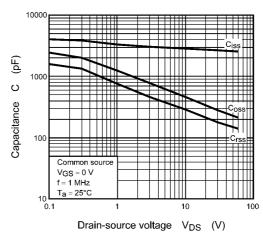


Fig. 8.8 Capacitance - V_{DS}

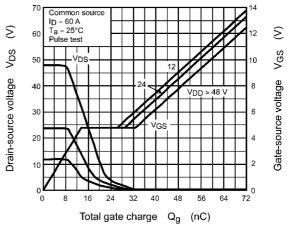


Fig. 8.10 Dynamic Input/Output Characteristics

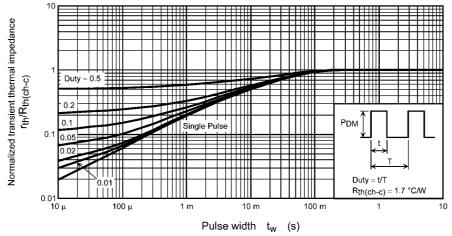


Fig. 8.12 $r_{th}/R_{th(ch-c)} - t_w$ (Guaranteed Maximum)

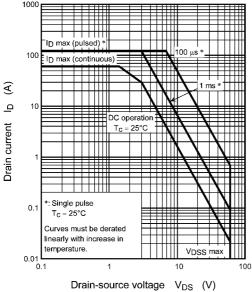


Fig. 8.13 Safe Operating Area (Guaranteed Maximum)

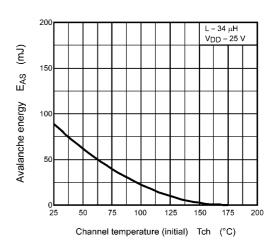


Fig. 8.14 E_{AS} - T_{ch} (Guaranteed Maximum)

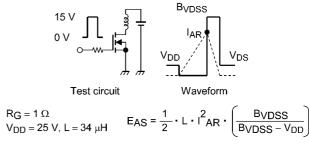


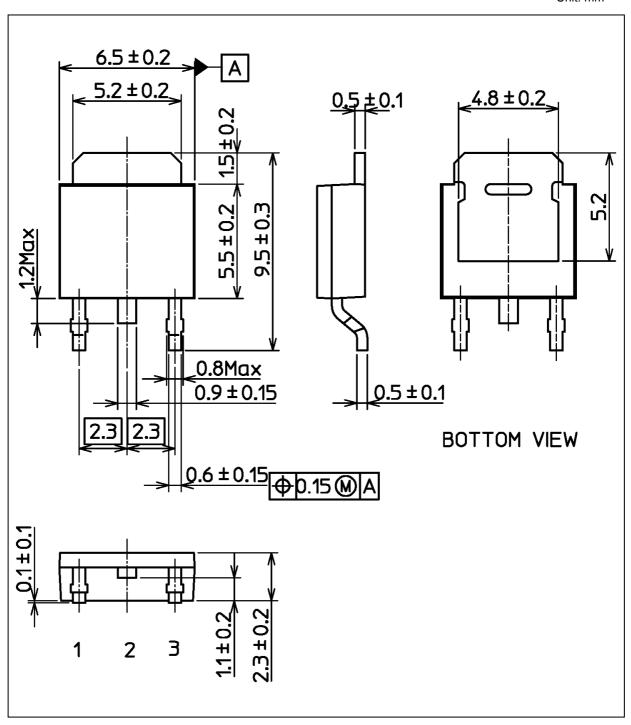
Fig. 8.15 Test Circuit/Waveform

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



Package Dimensions

Unit: mm



Weight: 0.36 g (typ.)

Package Name(s)	
TOSHIBA: 2-7M1A	
Nickname: DPAK+	



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