

MOSFETs Silicon N-Channel MOS (DTMOSVI)

TK055U60Z5

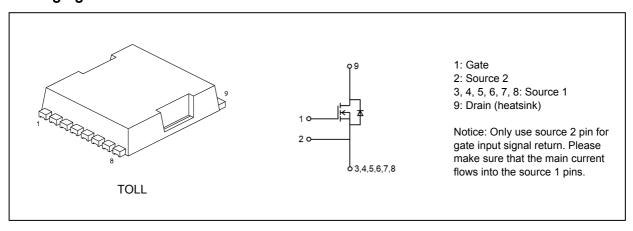
1. Applications

· Switching Voltage Regulators

2. Features

- (1) Fast reverse recovery time: $t_{rr} = 140 \text{ ns (typ.)}$
- (2) Low drain-source on-resistance: $R_{DS(ON)} = 0.048 \Omega$ (typ.)
- (3) High-speed switching properties with the lower capacitance.
- (4) Enhancement mode: $V_{th} = 3.5$ to 4.5 V ($V_{DS} = 10$ V, $I_D = 1.69$ mA)

3. Packaging and Internal Circuit



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	40	Α
Drain current (pulsed)		(Note 1)	I _{DP}	160	
Power dissipation	(T _c = 25 °C)		P _D	270	W
Single-pulse avalanche energy		(Note 2)	E _{AS}	901	mJ
Single-pulse avalanche current			I _{AS}	6	Α
Reverse drain current (DC)		(Note 1)	I _{DR}	40	
Reverse drain current (pulsed)		(Note 1)	I _{DRP}	160	
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.

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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).

Start of commercial production



5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance		0.462	°C/W

Note 1: Ensure that the channel temperature does not exceed 150 °C.

Note 2: V_{DD} = 90 V, T_{ch} = 25 °C (initial), L = 44.3 mH, I_{AS} = 6 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}	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±1	μА
Drain cut-off current	I _{DSS}	V _{DS} = 600 V, V _{GS} = 0 V	_	_	100	
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 = 1.69 mA	3.5	_	4.5	
Drain-source on-resistance	R _{DS(ON)}	V _{GS} = 10 V, I _D = 15 A		0.048	0.055	Ω

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

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance		C _{iss}	$V_{DS} = 300 \text{ V}, V_{GS} = 0 \text{ V}, f = 100 \text{ kHz}$	_	3750	_	pF
Reverse transfer capacitance		C _{rss}		_	3.2	_	
Output capacitance		C _{oss}		_	85	_	
Effective output capacitance (energy related)	(Note 3)	C _{o(er)}	V _{DS} = 0 to 400 V, V _{GS} = 0 V	_	140	_	
Effective output capacitance (time related)	(Note 4)	C _{o(tr)}		_	1020	_	
Gate resistance		r _g	V _{DS} = OPEN , f = 1 MHz	_	2.6	_	Ω
Switching time (rise time)		t _r	See Fig. 6.2.1	_	24	_	ns
Switching time (turn-on time)		t _{on}		_	61	_	
Switching time (fall time)		t _f		_	4.3	_	
Switching time (turn-off time)		t _{off}		_	110	_	
MOSFET dv/dt ruggedness		dv/dt	$V_{DS} \le V_{DSS}, I_D \le 20 A$	110	_	_	V/ns

Note 3: $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 V to 400 V. Note 4: $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 V to 400 V.

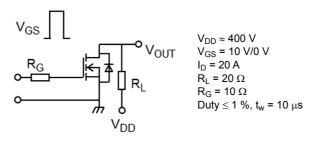


Fig. 6.2.1 Switching Time Test Circuit

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	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 40 \text{ A}$	ı	66	I	nC
Gate-source charge 1	Q _{gs1}		_	23		
Gate-drain charge	Q_{gd}		_	20		



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

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	V _{DSF}	I _{DR} = 40 A, V _{GS} = 0 V	_	_	-1.7	V
Reverse recovery time (Note 5	t _{rr}	V _{DD} = 400 V,	_	140	224	ns
Reverse recovery charge	Q _{rr}	I _{DR} = 20 A, V _{GS} = 0 V -dI _{DR} /dt = 100 A/μs	_	0.87	_	μС
Peak reverse recovery current	Irr	- αι _{ΙΟΚ} ιαι – 100 <i>Α</i> νμο	_	12.5	_	Α
Diode dv/dt ruggedness	dv/dt	$V_{DD} \le 400 \text{ V}, I_{DR} \le 20 \text{ A}, V_{GS} = 0 \text{ V}$	70	_	_	V/ns

Note 5: Defined by design.

7. Marking (Note)

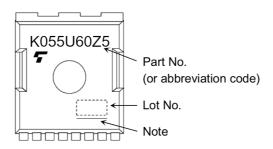


Fig. 7.1 Marking

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.



8. Characteristics Curves (Note)

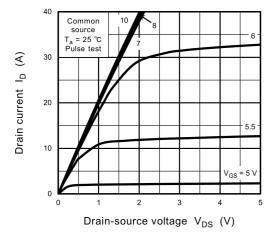


Fig. 8.1 I_D - V_{DS}

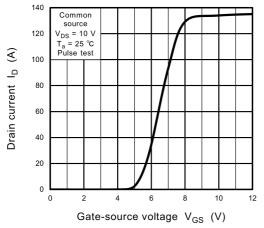


Fig. 8.3 I_D - V_{GS}

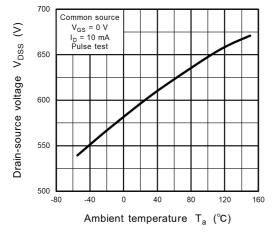


Fig. 8.5 V_{DSS} - T_a

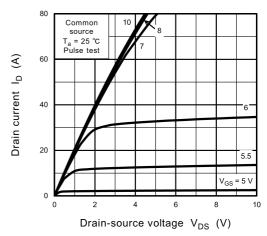


Fig. 8.2 I_D - V_{DS}

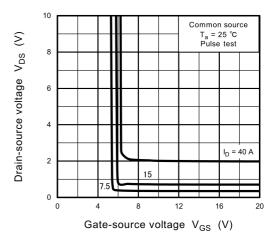


Fig. 8.4 V_{DS} - V_{GS}

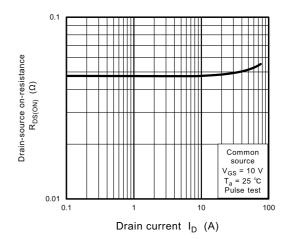


Fig. 8.6 R_{DS(ON)} - I_D



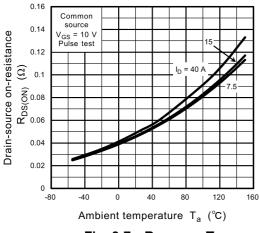
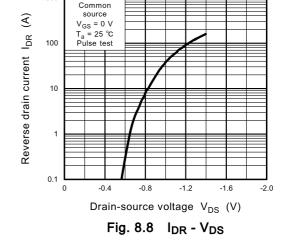


Fig. 8.7 RDS(ON) - Ta



1000

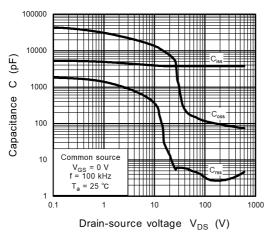


Fig. 8.9 C - V_{DS}

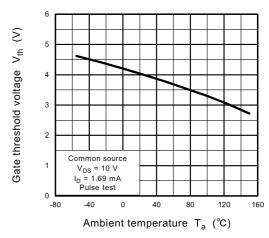


Fig. 8.10 V_{th} - T_a

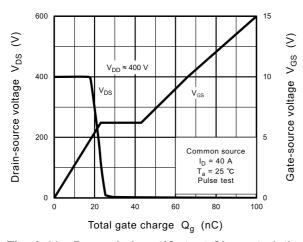


Fig. 8.11 Dynamic Input/Output Characteristics

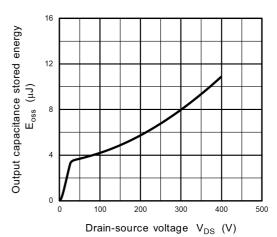


Fig. 8.12 E_{OSS} - V_{DS}



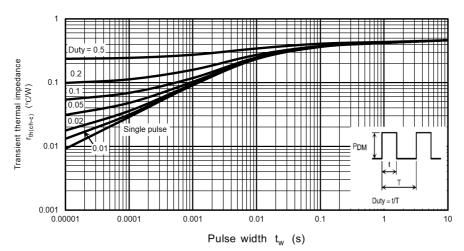


Fig. 8.13 r_{th} - t_w (Guaranteed Maximum)

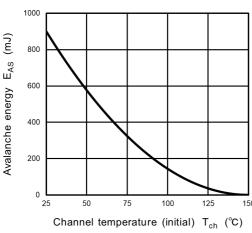
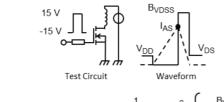


Fig. 8.14 E_{AS} - T_{ch} (Guaranteed Maximum)



$$V_{DD} = 90 \text{ V, L} = 44.3 \text{ mH}$$
 $E_{AS} = \frac{1}{2} \cdot \text{L} \cdot I_{AS}^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$

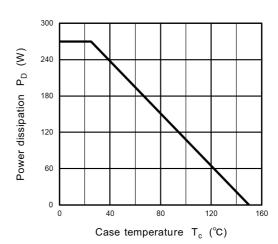


Fig. 8.15 P_D - T_c (Guaranteed Maximum)

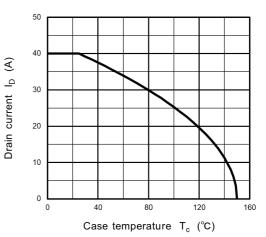


Fig. 8.17 I_D - T_c (Guaranteed Maximum)

Fig. 8.16 Test Circuit/Waveform



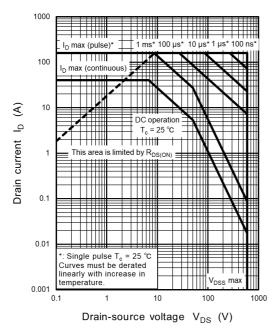


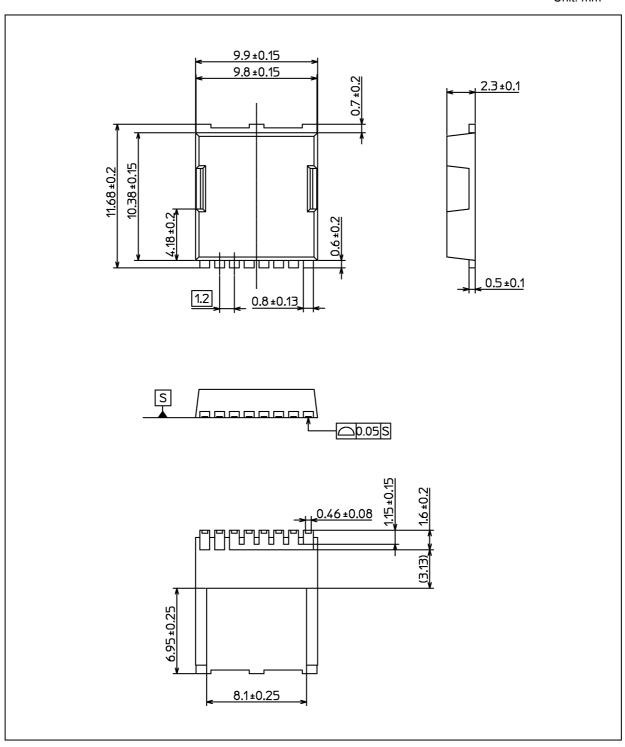
Fig. 8.18 Safe Operating Area (Guaranteed Maximum)

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



Package Dimensions

Unit: mm



Weight: 0.75 g (typ.)

Package Name(s)	
TOSHIBA: 2-10AF1A	
Nickname: TOLL	

Rev.2.0



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