MOSFETs Silicon N-Channel MOS (DTMOSIV)

# TK20J60W5

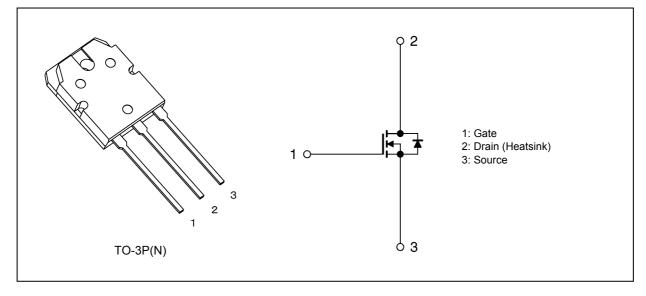
#### 1. Applications

Switching Voltage Regulators

#### 2. Features

- (1) Fast reverse recovery time:  $t_{rr} = 110$  ns (typ.)
- (2) Low drain-source on-resistance:  $R_{DS(ON)} = 0.15 \Omega$  (typ.) by used to Super Junction Structure : DTMOS
- (3) Easy to control Gate switching
- (4) Enhancement mode:  $V_{th}$  = 3 to 4.5 V ( $V_{DS}$  = 10 V,  $I_D$  = 1 mA)

#### 3. Packaging and Internal Circuit



#### 4. Absolute Maximum Ratings (Note) ( $T_a = 25^{\circ}C$ unless otherwise specified)

Characteristics			Symbol	Rating	Unit
Drain-source voltage			V <sub>DSS</sub>	600	V
Gate-source voltage			V <sub>GSS</sub>	±30	
Drain current (DC)	(N	ote 1)	I <sub>D</sub>	20	А
Drain current (pulsed)	(N	ote 1)	I <sub>DP</sub>	80	
Power dissipation (	(T <sub>c</sub> = 25°C)		PD	165	W
Single-pulse avalanche energy	(N	ote 2)	E <sub>AS</sub>	200	mJ
Avalanche current			I <sub>AR</sub>	5	А
Reverse drain current (DC)	(N	ote 1)	I <sub>DR</sub>	20	
Reverse drain current (pulsed)	(N	ote 1)	I <sub>DRP</sub>	80	
Channel temperature			T <sub>ch</sub>	150	°C
Storage temperature			T <sub>stg</sub>	-55 to 150	
Mounting torque			TOR	0.8	N · m

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 <sub>th(ch-c)</sub>	0.757	°C/W
Channel-to-ambient thermal resistance	R <sub>th(ch-a)</sub>	50	

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

Note 2:  $V_{DD}$  = 90 V,  $T_{ch}$  = 25°C (initial), L = 14 mH,  $R_G$  = 25  $\Omega$ ,  $I_{AR}$  = 5 A

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

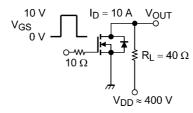
#### 6. Electrical Characteristics

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

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I <sub>GSS</sub>	$V_{GS}$ = ±30 V, $V_{DS}$ = 0 V	_	_	±1	μA
Drain cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V	_	_	100	
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	600	—	—	V
Gate threshold voltage	V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	3	_	4.5	
Drain-source on-resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		0.15	0.175	Ω

#### 6.2. Dynamic Characteristics ( $T_a = 25^{\circ}C$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 300 V, V <sub>GS</sub> = 0 V, f = 1 MHz	_	1800	_	pF
Reverse transfer capacitance	C <sub>rss</sub>	]		5.5	_	
Output capacitance	C <sub>oss</sub>	1		45	_	
Effective output capacitance	C <sub>o(er)</sub>	$V_{DS}$ = 0 to 400 V, $V_{GS}$ = 0 V		70	_	
Gate resistance	r <sub>g</sub>	V <sub>DS</sub> = OPEN, f = 1 MHz		1.5	_	Ω
Switching time (rise time)	tr	See Figure 6.2.1		45		ns
Switching time (turn-on time)	t <sub>on</sub>	]		90	_	
Switching time (fall time)	t <sub>f</sub>	]		6	_	
Switching time (turn-off time)	t <sub>off</sub>	1	_	100	_	
MOSFET dv/dt ruggedness	dv/dt	V <sub>DD</sub> = 0 to 400 V, I <sub>D</sub> = 10 A	50	_	_	V/ns



Duty  $\leq$  1 %, t<sub>w</sub> = 10  $\mu$ s

#### Fig. 6.2.1 Switching Time Test Circuit

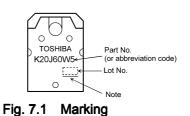
#### 6.3. Gate Charge Characteristics ( $T_a = 25^{\circ}C$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Qg	$V_{DD}\approx 400 \text{ V},  V_{GS} \text{ = } 10  \text{V},  \text{I}_{D} \text{ = } 20  \text{A}$	_	55	—	nC
Gate-source charge 1	Q <sub>gs1</sub>			17	_	
Gate-drain charge	Q <sub>gd</sub>		_	33	_	

#### 6.4. Source-Drain Characteristics ( $T_a = 25^{\circ}C$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	V <sub>DSF</sub>	I <sub>DR</sub> = 20 A, V <sub>GS</sub> = 0 V	_	_	-1.7	V
Reverse recovery time	t <sub>rr</sub>	I <sub>DR</sub> = 10 A, V <sub>GS</sub> = 0 V	_	110	176	ns
Reverse recovery charge	Q <sub>rr</sub>	-dI <sub>DR</sub> /dt = 100 A/μs	_	0.6	_	μC
Peak reverse recovery current	l <sub>rr</sub>			10		А
Diode dv/dt ruggedness	dv/dt	$I_{DR}$ = 10 A, $V_{GS}$ = 0 V, $V_{DD}$ = 400 V	50	_		V/ns

#### 7. Marking



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

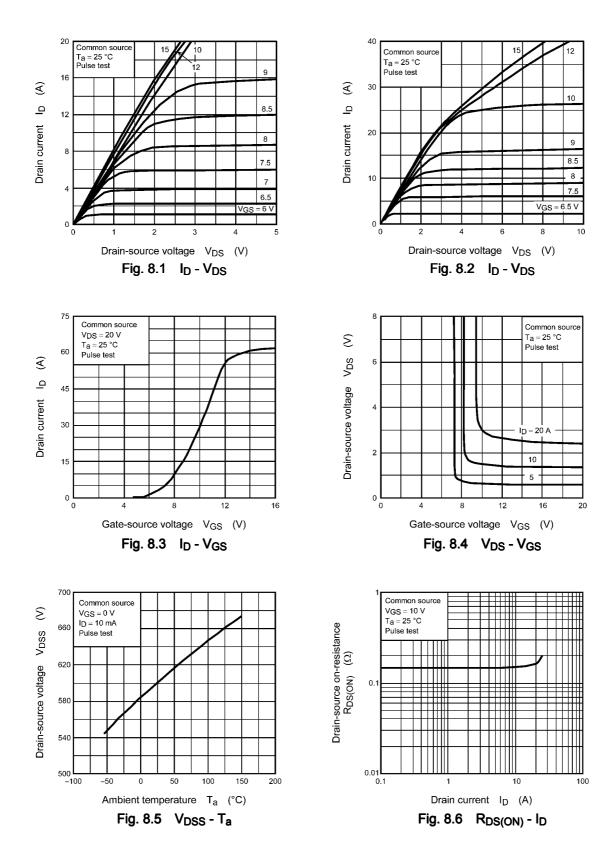
 Not underlined:
 [[Pb]]/INCLUDES > MCV

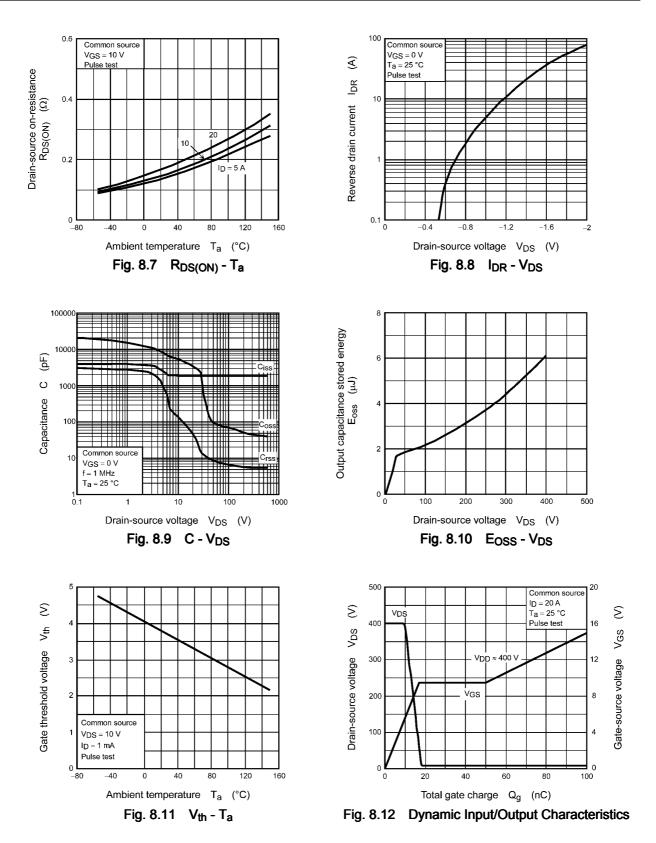
 Underlined:
 [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

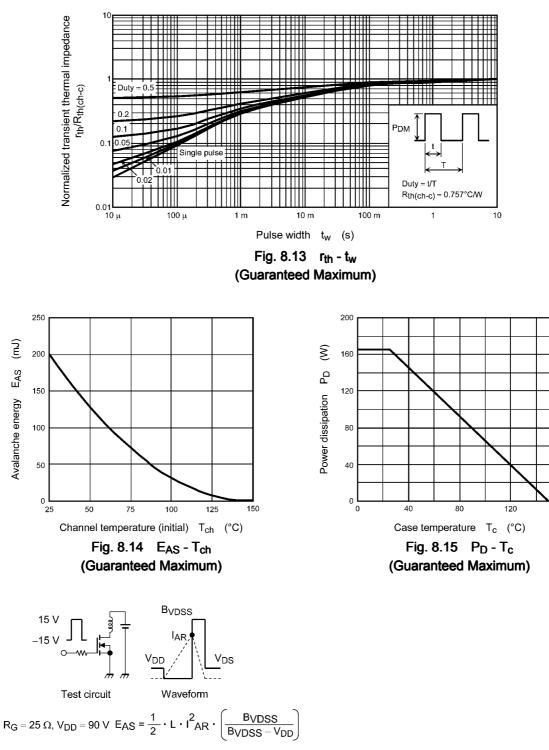
 Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

 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)

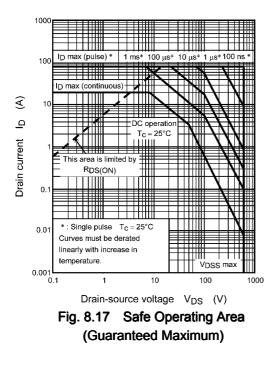








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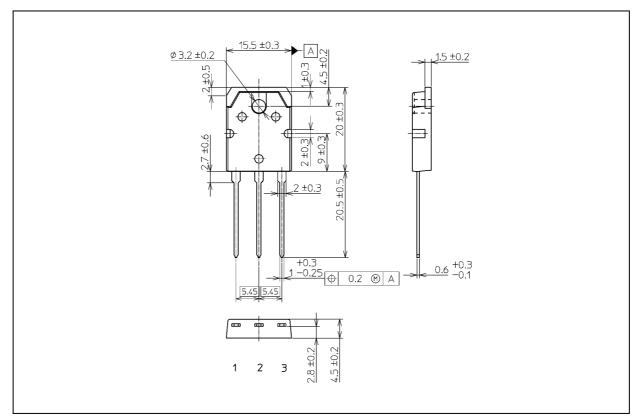


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### TK20J60W5

### Package Dimensions

Unit: mm



#### Weight: 4.6 g (typ.)

Package Name(s)	
JEITA: SC-65	
TOSHIBA: 2-16C1S	
Nickname: TO-3P(N)	

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