

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (DTMOS )

## TK20D60U

### Switching Regulator Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 0.165$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 12$  S (typ.)
- Low leakage current:  $I_{DSS} = 100$   $\mu$ A ( $V_{DS} = 600$  V)
- Enhancement-mode:  $V_{th} = 3.0\sim 5.0$  V ( $V_{DS} = 10$  V,  $I_D = 1$  mA)

### Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	600	V
Gate-source voltage		$V_{GSS}$	$\pm 30$	V
Drain current	DC (Note 1)	$I_D$	20	A
	Pulse (t = 1 ms) (Note 1)	$I_{DP}$	40	
Drain power dissipation (Tc = 25°C)		$P_D$	190	W
Single pulse avalanche energy (Note 2)		$E_{AS}$	144	mJ
Avalanche current (Note 3)		$I_{AR}$	20	A
Repetitive avalanche energy		$E_{AR}$	19	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55~150	°C

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).

### Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	0.658	°C/W
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	83.3	°C/W

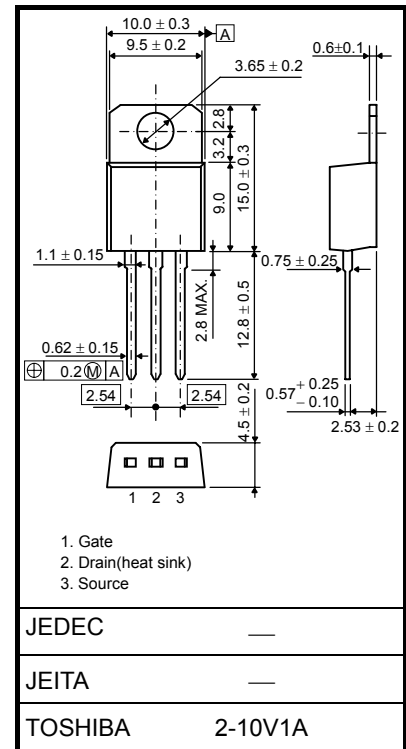
Note 1: Please use devices on conditions that the channel temperature is below 150°C.

Note 2:  $V_{DD} = 90$  V,  $T_{ch} = 25$ °C (initial),  $L = 0.63$  mH,  $R_G = 25$   $\Omega$ ,  $I_{AR} = 20$  A

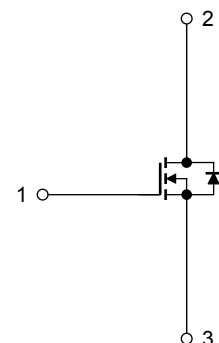
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

This transistor is an electrostatic sensitive device. Please handle with caution.

Unit: mm



Weight : 1.35 g (typ.)



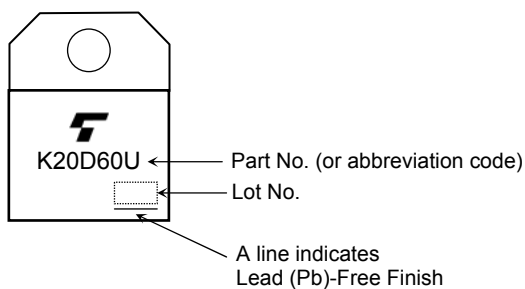
## Electrical Characteristics (Ta = 25°C)

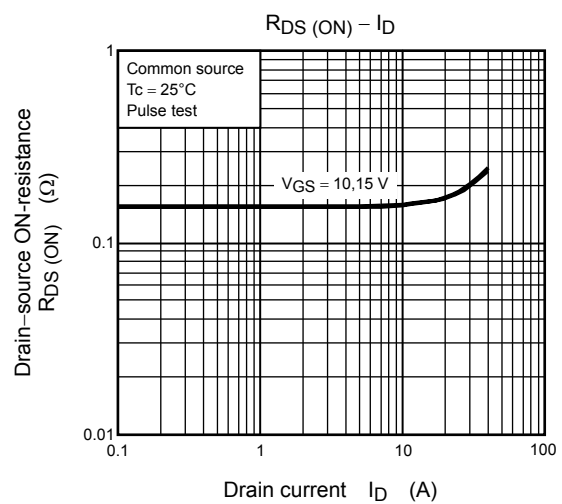
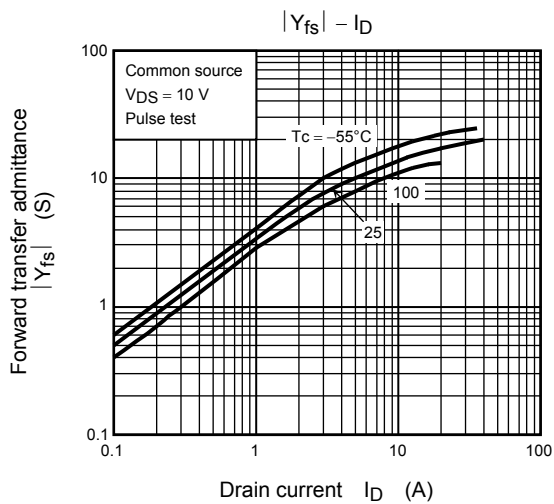
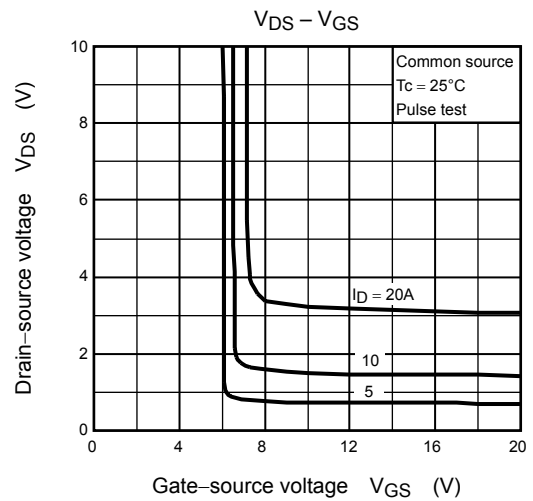
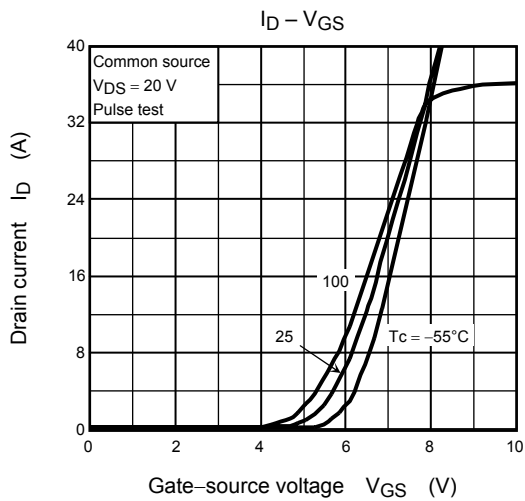
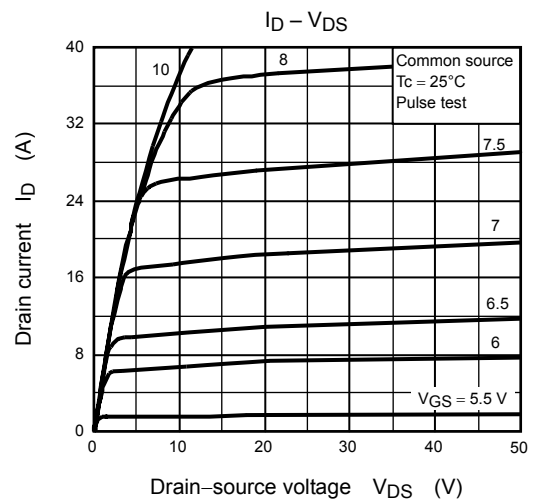
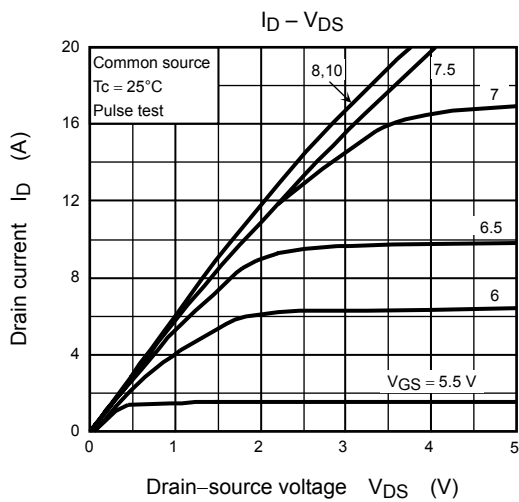
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 1$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	600	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	3.0	—	5.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	—	0.165	0.19	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$	3.0	12	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1470	—	pF
Reverse transfer capacitance		$C_{rss}$		—	150	—	
Output capacitance		$C_{oss}$		—	3500	—	
Switching time	Rise time	$t_r$	<p><math>I_D = 10\text{ A}</math> <math>V_{GS} = 10\text{ V}</math> <math>50\ \Omega</math> <math>R_L = 30\ \Omega</math> <math>V_{DD} \approx 300\text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	40	—	ns
	Turn-on time	$t_{on}$		—	80	—	
	Fall time	$t_f$		—	12	—	
	Turn-off time	$t_{off}$		—	100	—	
Total gate charge		$Q_g$	$V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	—	27	—	nC
Gate-source charge		$Q_{gs}$		—	16	—	
Gate-drain charge		$Q_{gd}$		—	11	—	

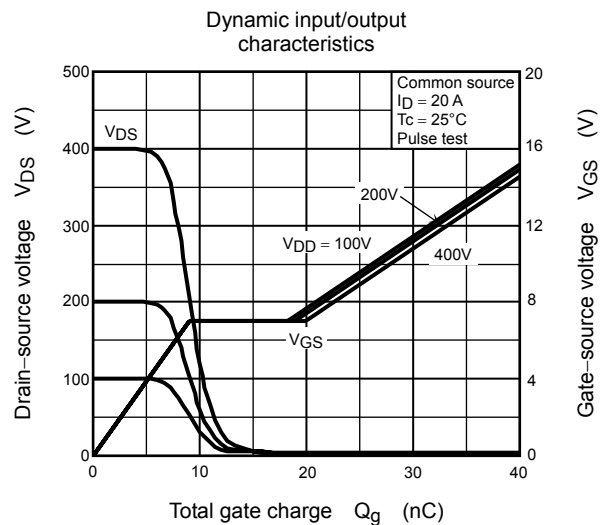
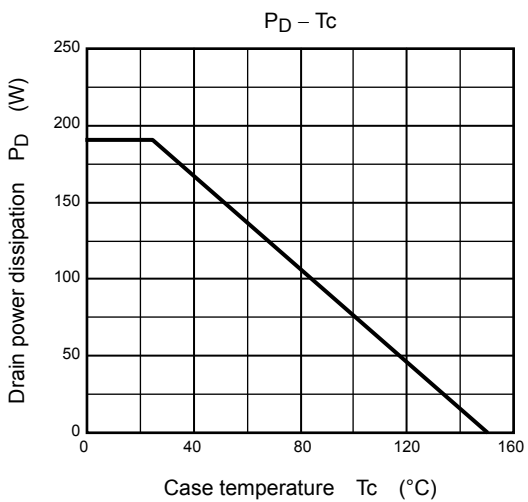
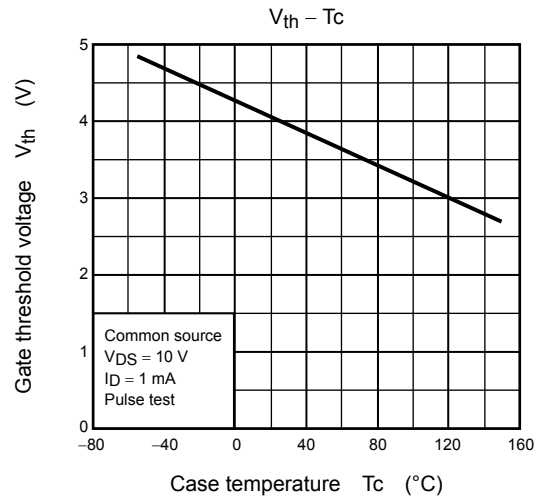
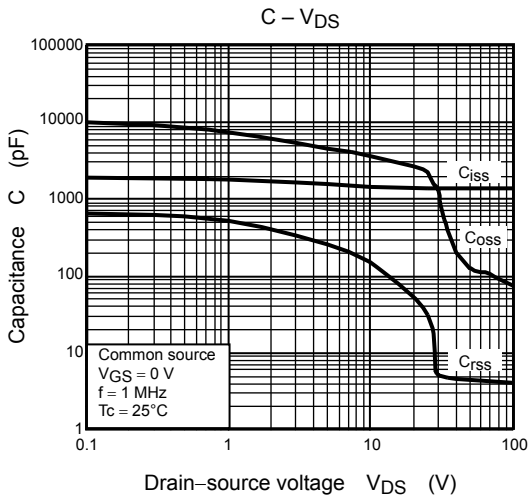
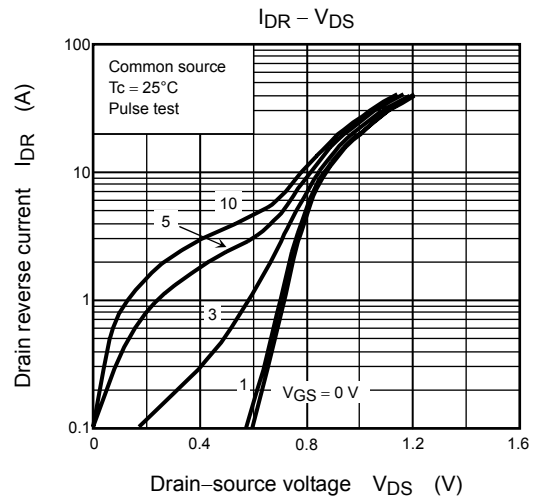
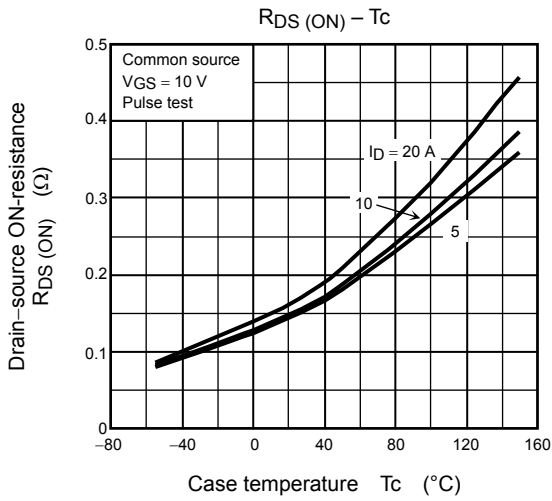
## Source-Drain Ratings and Characteristics (Ta = 25°C)

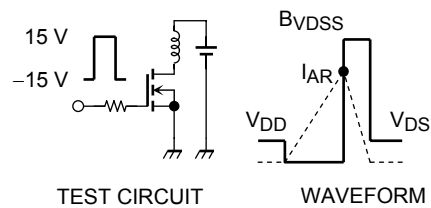
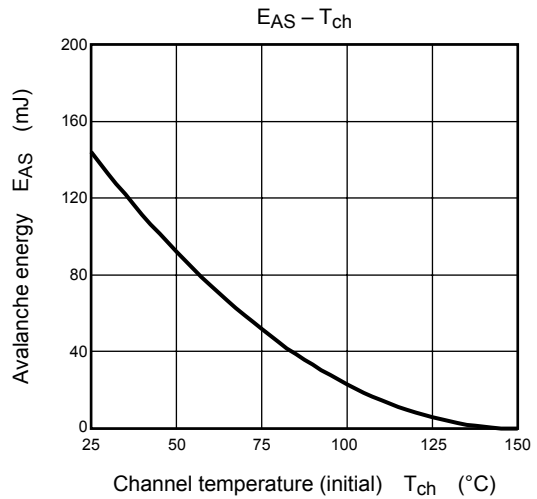
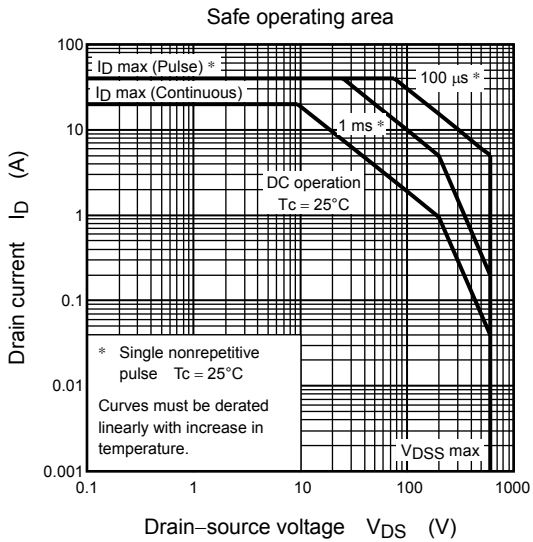
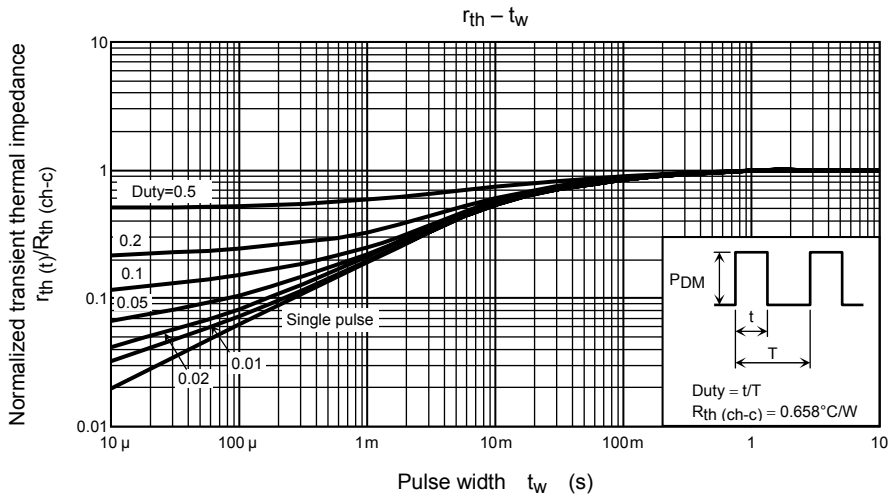
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)		$I_{DR}$	—	—	—	20	A
Pulse drain reverse current (Note 1)		$I_{DRP}$	—	—	—	40	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time		$t_{rr}$	$I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V},$	—	450	—	ns
Reverse recovery charge		$Q_{rr}$	$dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	8.1	—	$\mu\text{C}$

## Marking









$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 0.63 \text{ mH}$$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left( \frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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