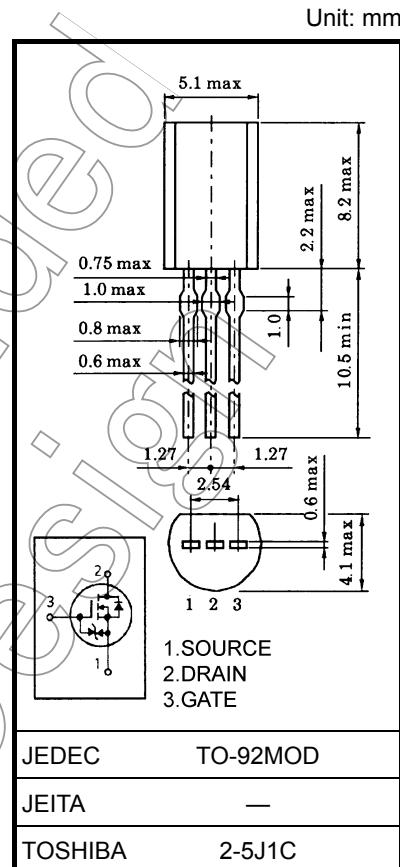


TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $L^2$ - $\pi$ -MOSV)

## 2SK2961

Relay Drive, Motor Drive and DC-DC Converter Application

- Low drain-source ON resistance :  $R_{DS\ (ON)} = 0.2\ \Omega\ (\text{typ.})$
- High forward transfer admittance :  $|Y_{fs}| = 2.0\ S\ (\text{typ.})$
- Low leakage current :  $I_{DSS} = 100\ \mu A\ (\text{max})\ (V_{DS} = 60\ V)$
- Enhancement mode :  $V_{th} = 0.8\ \text{to}\ 2.0\ V\ (V_{DS} = 10\ V, I_D = 1\ mA)$

Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20\ k\Omega$ )	$V_{DGR}$	60	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	A
	Pulse (Note 1)	$I_{DP}$	
Drain power dissipation	$P_D$	0.9	W
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 150	$^\circ\text{C}$

Weight: 0.36 g (typ.)

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

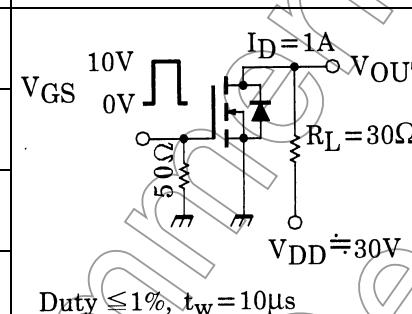
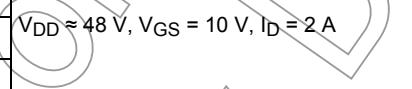
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	138	$^\circ\text{C} / \text{W}$

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

This transistor is an electrostatic-sensitive device.

Please handle with caution.

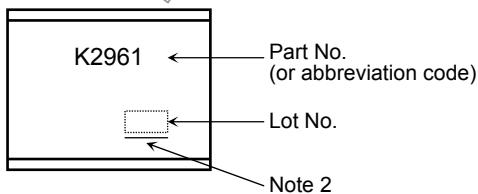
Electrical Characteristics ( $T_a = 25^\circ C$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16 V, V_{DS} = 0 V$	—	—	$\pm 10$	$\mu A$
Drain cut-off current	$I_{DSS}$	$V_{DS} = 60 V, V_{GS} = 0 V$	—	—	100	$\mu A$
Drain-source breakdown voltage	$V_{(BR) DSS}$	$I_D = 10 mA, V_{GS} = 0 V$	60	—	—	V
Gate threshold voltage	$V_{th}$	$V_{DS} = 10 V, I_D = 1 mA$	0.8	—	2.0	V
Drain-source ON resistance	$R_{DS (ON)}$	$V_{GS} = 4 V, I_D = 1.0 A$	—	0.26	0.38	$\Omega$
		$V_{GS} = 10 V, I_D = 1.0 A$	—	0.20	0.27	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10 V, I_D = 1.0 A$	1.0	2.0	—	S
Input capacitance	$C_{iss}$	$V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz$	—	170	—	pF
Reverse transfer capacitance	$C_{rss}$		—	25	—	
Output capacitance	$C_{oss}$		—	75	—	
Switching time	Rise time	$t_r$		—	10	—
	Turn-on time	$t_{on}$		—	15	—
	Fall time	$t_f$		—	50	—
	Turn-off time	$t_{off}$		—	170	—
Total gate charge (gate-source plus gate-drain)	$Q_g$		—	5.8	—	nC
Gate-source charge	$Q_{gs}$		—	4.1	—	
Gate-drain ("miller") Charge	$Q_{gd}$		—	1.7	—	

Source-Drain Ratings and Characteristics ( $T_a = 25^\circ C$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	2.0	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	6.0	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 2 A, V_{GS} = 0 V$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 2 A, V_{GS} = 0 V, dI_{DR} / dt = 50 A / \mu s$	—	45	—	ns
Reverse recovery charge	$Q_{rr}$		—	40.5	—	nC

## Marking

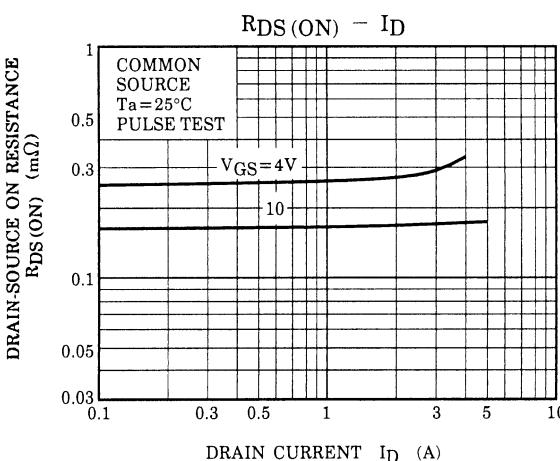
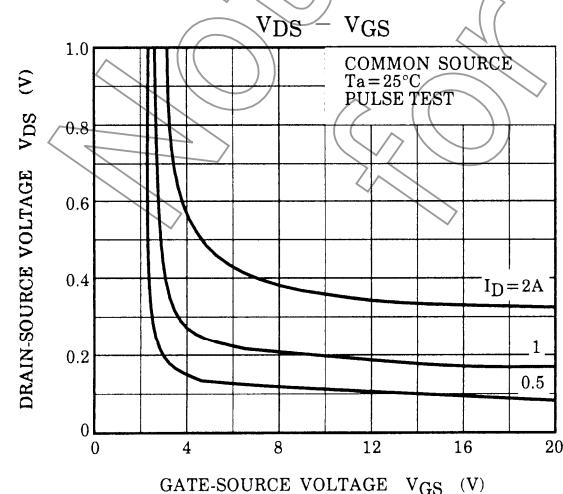
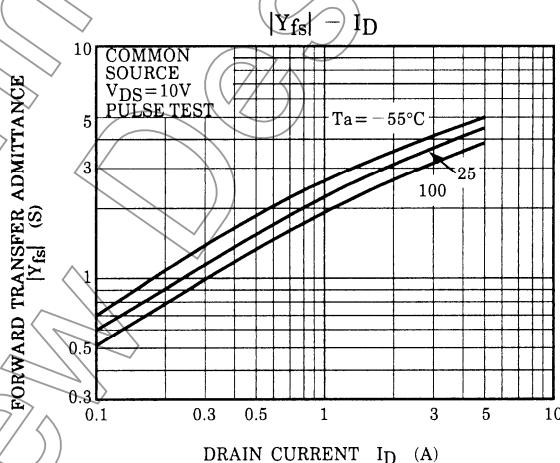
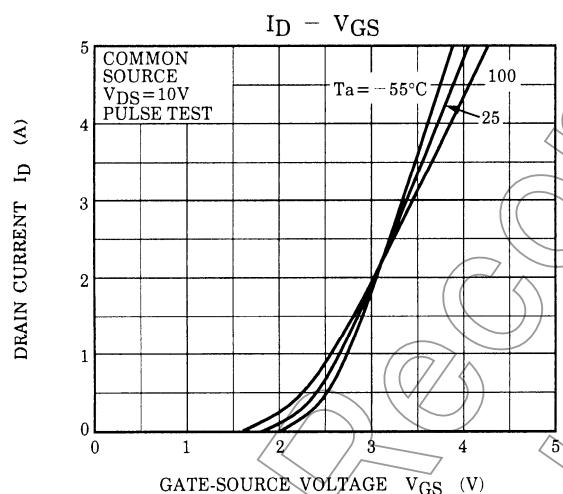
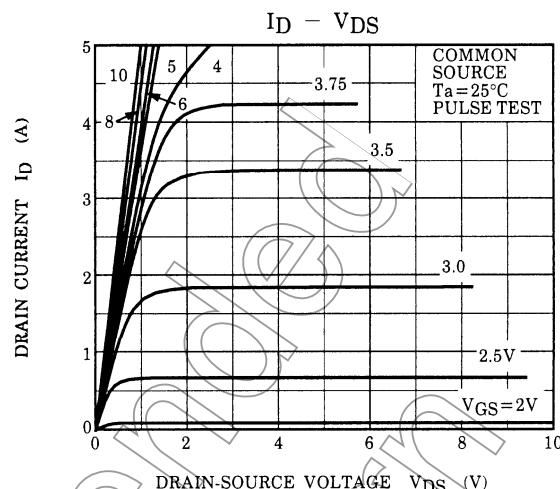
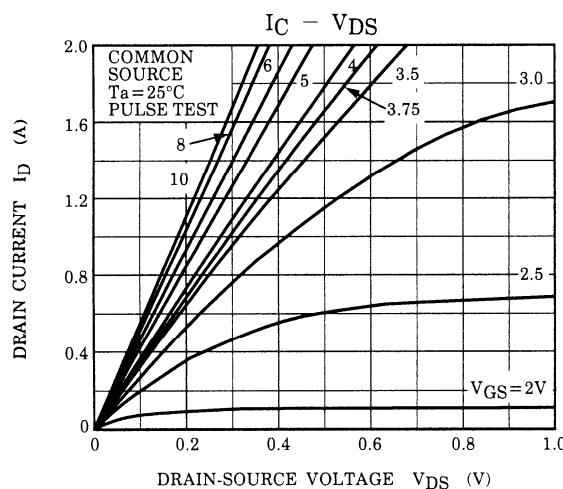


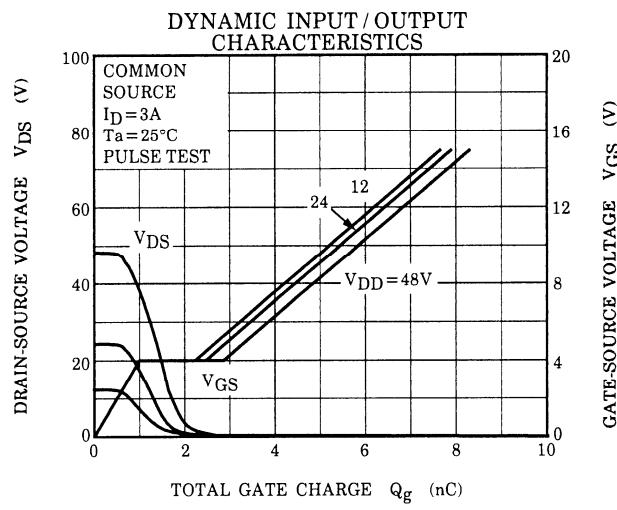
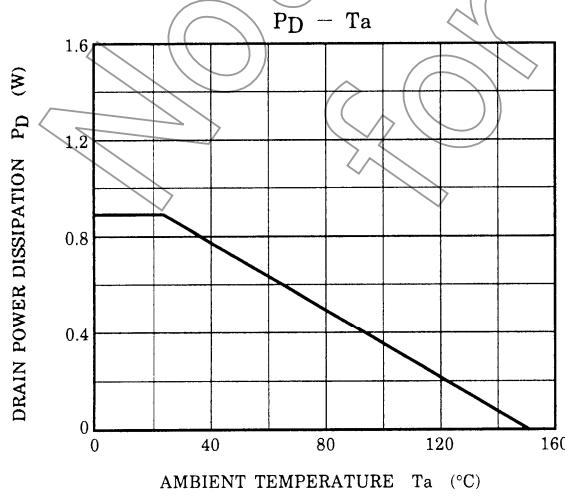
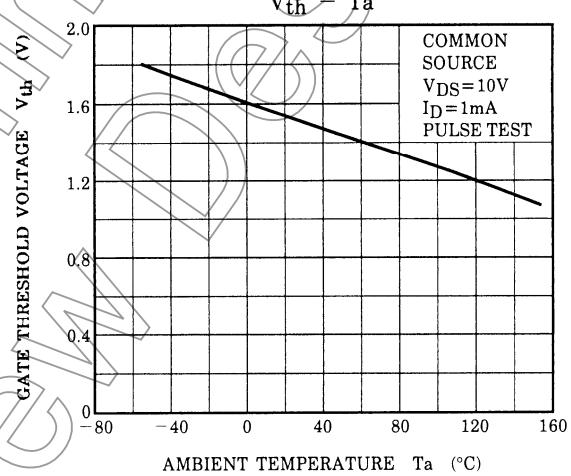
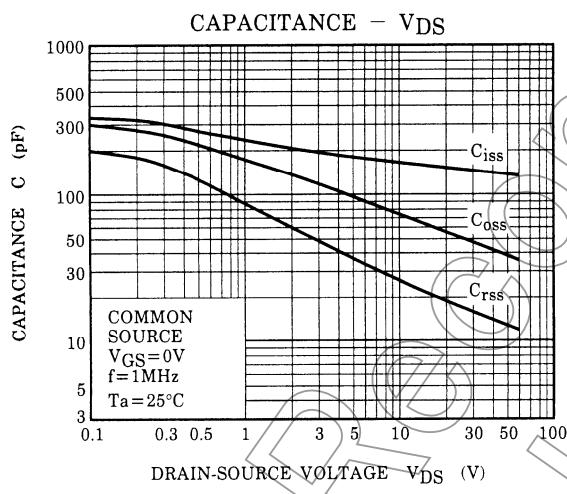
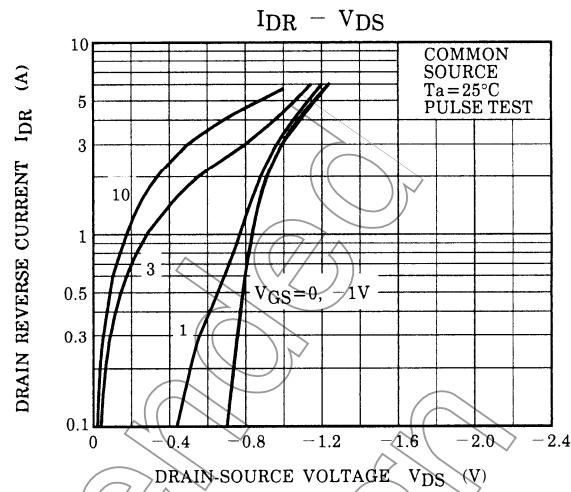
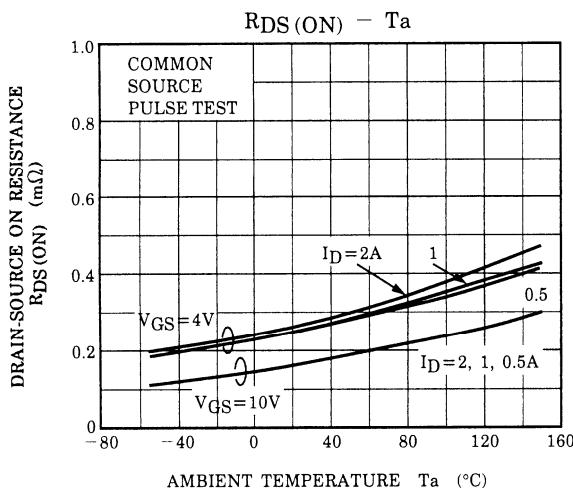
Note 2: A line under a Lot No. identifies the indication of product Labels.

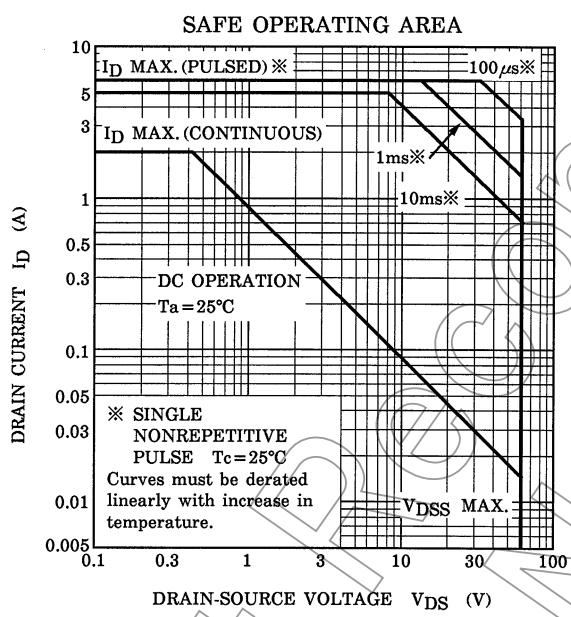
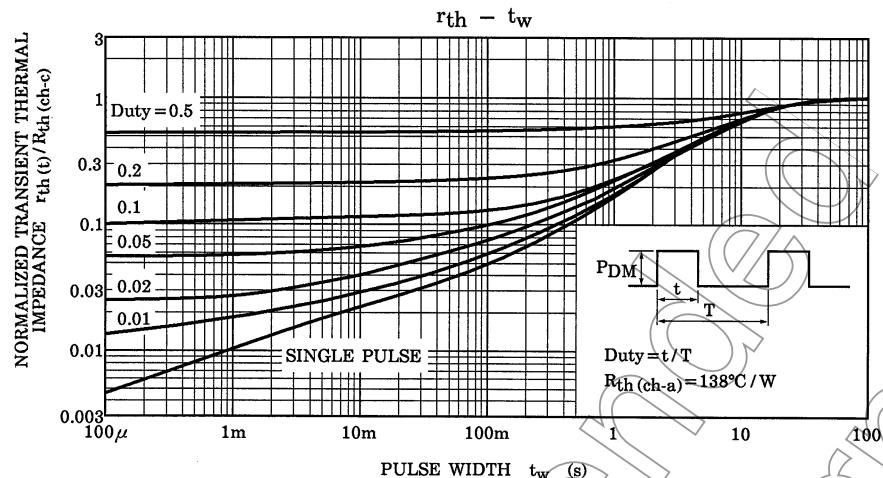
Not underlined: [[Pb]]/INCLUDES > MCV

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

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