

TOSHIBA FIELD EFFECT TRANSISTOR SILICON N CHANNEL MOS TYPE (L<sup>2</sup>-π-MOS V)

# 2SK2311

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS  
 CHOPPER REGULATOR, DC-DC CONVERTER AND SWITCHING  
 REGULATOR APPLICATIONS

- 4V Gate Drive
- Low Drain-Source ON Resistance :  $R_{DS(ON)} = 36m\Omega$  (Typ.)
- High Forward Transfer Admittance :  $|Y_{fs}| = 16S$  (Typ.)
- Low Leakage Current :  $I_{DSS} = 100\mu A$  (Max.) ( $V_{DS} = 60V$ )
- Enhancement-Mode :  $V_{th} = 0.8 \sim 2.0V$  ( $V_{DS} = 10V, I_D = 1mA$ )

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Drain-Source Voltage	$V_{DSS}$	60	V
Drain-Gate Voltage ( $R_{GS} = 20k\Omega$ )	$V_{DGR}$	60	V
Gate-Source Voltage	$V_{GSS}$	±20	V
Drain Current	DC	$I_D$	25 A
	Pulse	$I_{DP}$	100 A
Drain Power Dissipation (Tc = 25°C)	$P_D$	40	W
Single Pulse Avalanche Energy**	$E_{AS}$	156	mJ
Avalanche Current	$I_{AR}$	25	A
Repetitive Avalanche Energy*	$E_{AR}$	3.5	mJ
Channel Temperature	$T_{ch}$	150	°C
Storage Temperature Range	$T_{stg}$	-55~150	°C

**THERMAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Channel To Case	$R_{th(ch-c)}$	3.125	°C/W
Thermal Resistance, Channel To Ambient	$R_{th(ch-a)}$	83.3	°C/W

Note ;

\* Repetitive rating ; Pulse Width Limited by Max. junction temperature.

\*\*  $V_{DD} = 25V$ , Starting  $T_{ch} = 25°C$ ,  $L = 339\mu H$ ,  $R_G = 25\Omega$ ,  $I_{AR} = 25A$

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

**INDUSTRIAL APPLICATIONS**  
 TO-220FL Unit in mm

JEDEC	—
EIAJ	—
TOSHIBA	2-10S1B

TO-220SM Unit in mm

JEDEC	—
EIAJ	—
TOSHIBA	2-10S2B

Weight : 1.5g

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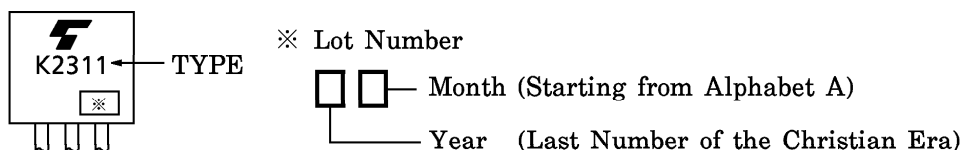
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

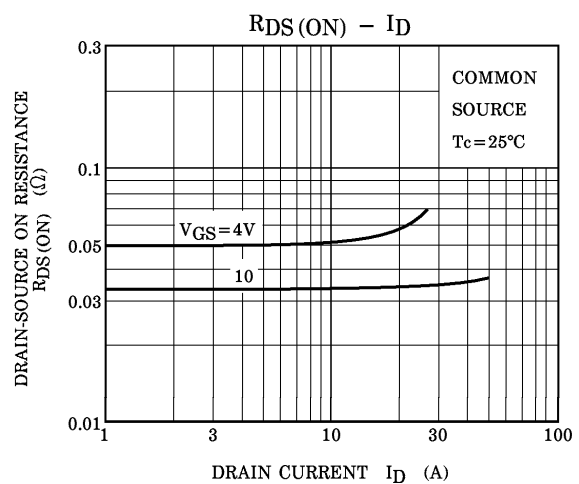
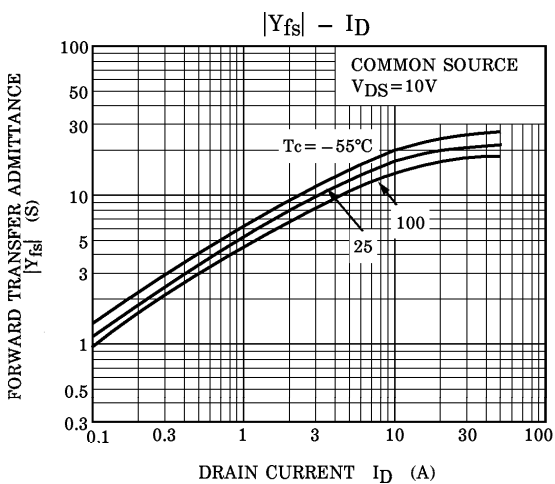
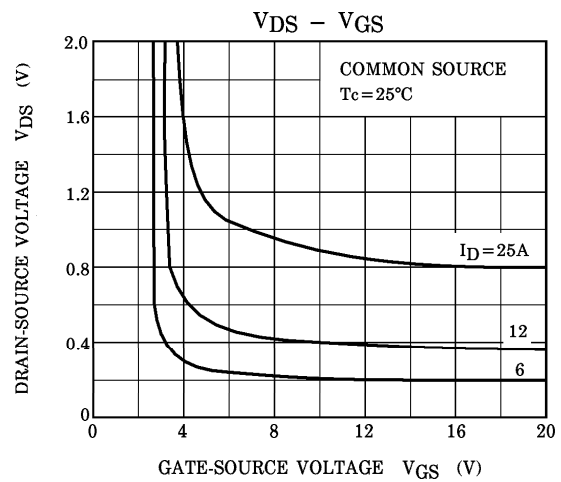
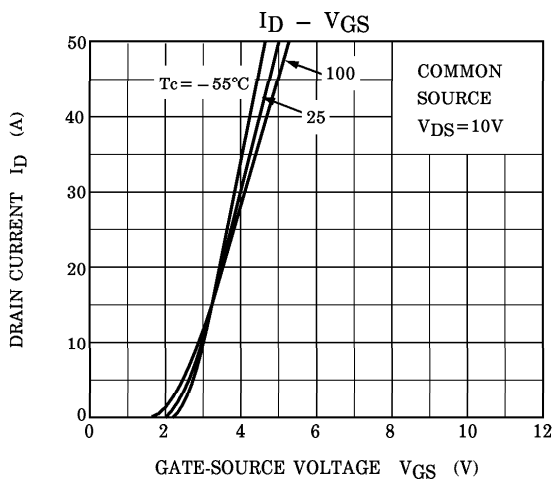
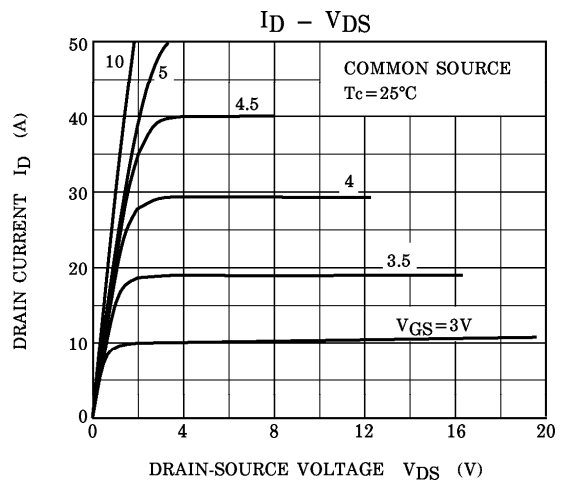
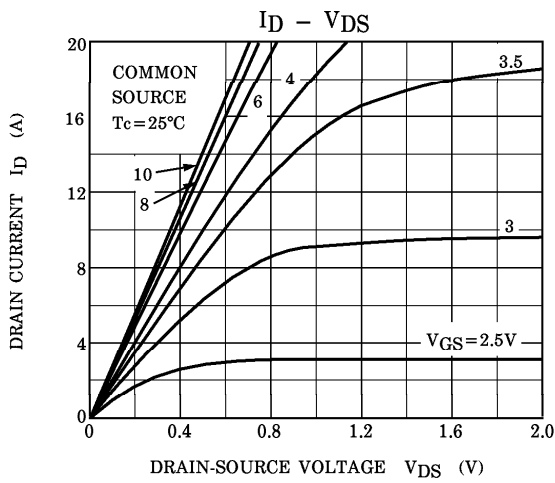
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		$I_{GSS}$	$V_{GS} = \pm 16V, V_{DS} = 0V$	—	—	$\pm 10$	$\mu A$
Drain Cut-off Current		$I_{DSS}$	$V_{DS} = 60V, V_{GS} = 0V$	—	—	100	$\mu A$
Drain-Source Breakdown Voltage		$V(BR)_{DSS}$	$I_D = 10mA, V_{GS} = 0V$	60	—	—	V
Gate Threshold Voltage		$V_{th}$	$V_{DS} = 10V, I_D = 1mA$	0.8	—	2.0	V
Drain-Source ON Resistance		$R_{DS(ON)}$	$V_{GS} = 4V, I_D = 12A$	—	57	80	m $\Omega$
			$V_{GS} = 10V, I_D = 12A$	—	36	46	
Forward Transfer Admittance		$ Y_{fs} $	$V_{DS} = 10V, I_D = 12A$	10	16	—	S
Input Capacitance		$C_{iss}$	$V_{DS} = 10V, V_{GS} = 0V, f = 1MHz$	—	1000	—	pF
Reverse Transfer Capacitance		$C_{rss}$		—	200	—	
Output Capacitance		$C_{oss}$		—	550	—	
Switching Time	Rise Time	$t_r$	<p><math>I_D = 12A</math> <math>V_{GS} = 10V, 0V</math> <math>R_L = 2.5\Omega</math> <math>V_{DD} \doteq 30V</math></p>	—	20	—	ns
	Turn-on Time	$t_{on}$		—	30	—	
	Fall Time	$t_f$		—	55	—	
	Turn-off Time	$t_{off}$		$V_{IN} : t_r, t_f < 5ns,$ $Duty \leq 1\%, t_w = 10\mu s$	—	130	
Total Gate Charge (Gate-Source Plus Gate-Drain)		$Q_g$	$V_{DD} \doteq 48V, V_{GS} = 10V$ $I_D = 25A$	—	38	—	nC
Gate-Source Charge		$Q_{gs}$		—	25	—	
Gate-Drain ("Miller") Charge		$Q_{gd}$		—	13	—	

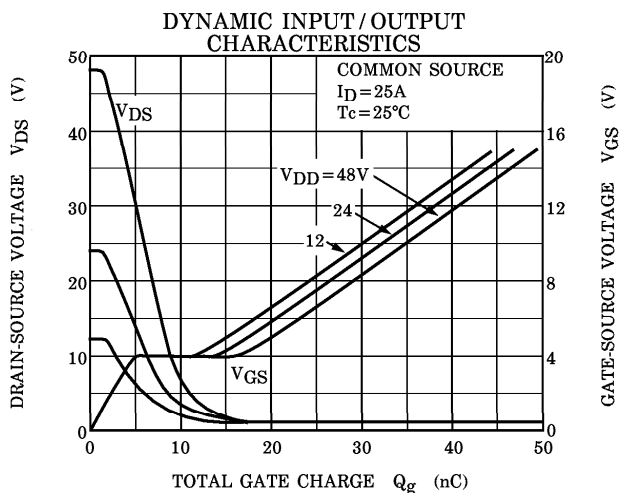
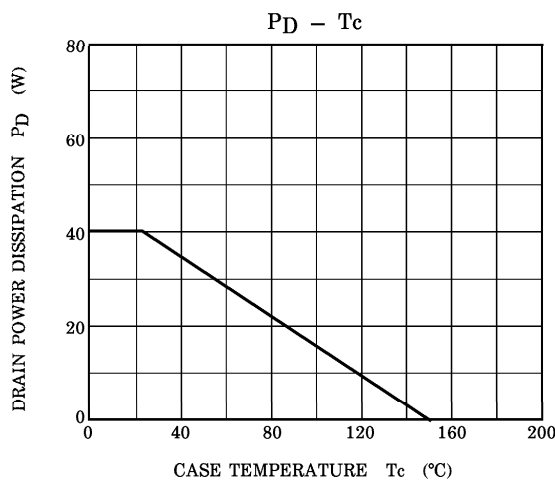
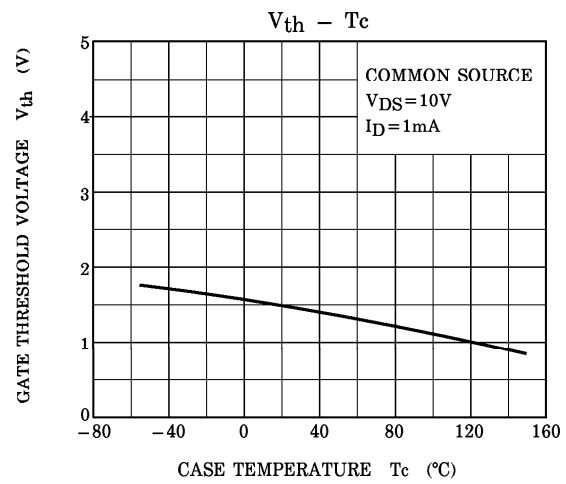
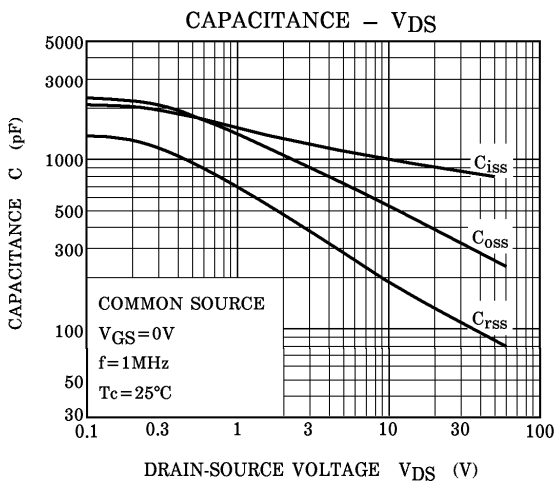
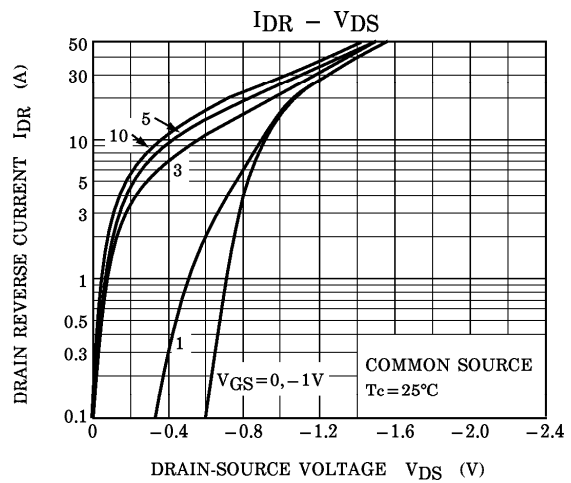
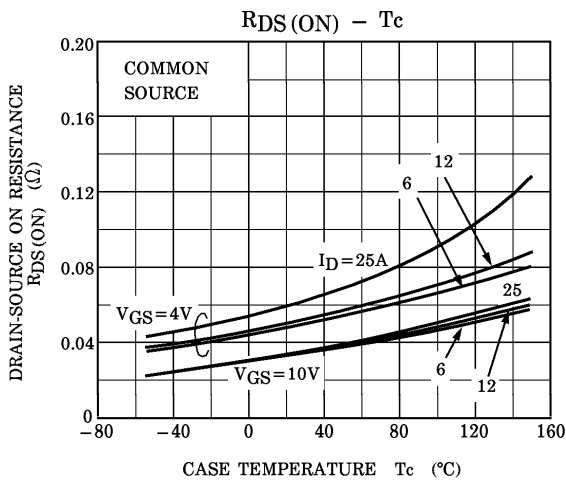
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

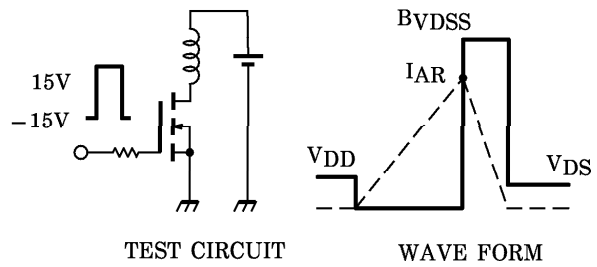
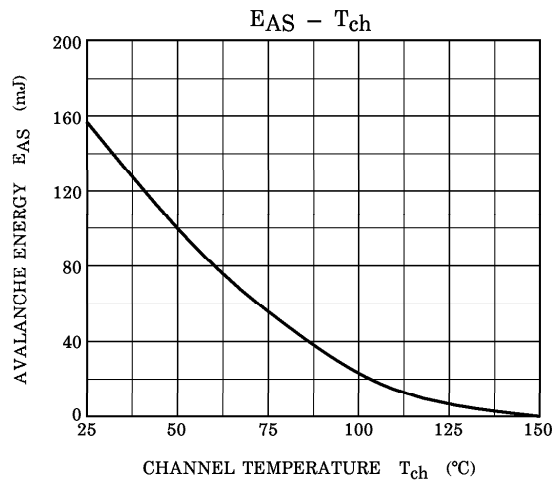
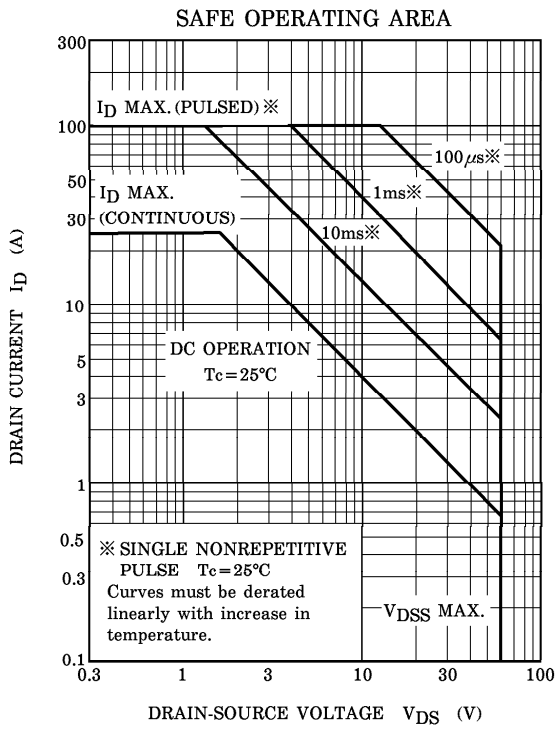
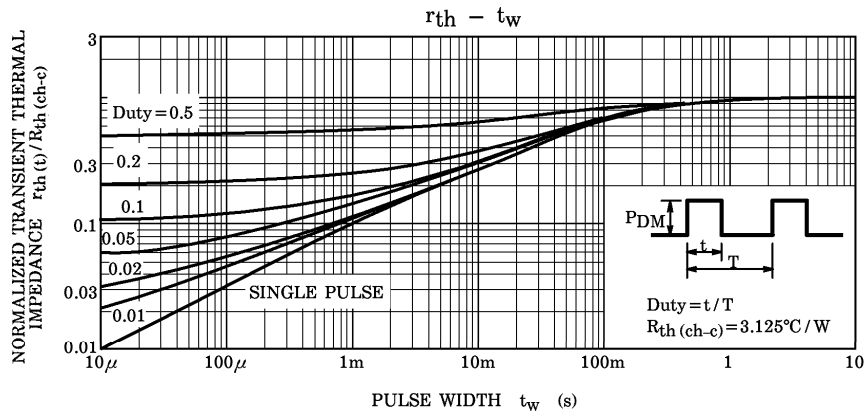
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	$I_{DR}$	—	—	—	25	A
Pulse Drain Reverse Current	$I_{DRP}$	—	—	—	100	A
Diode Forward Voltage	$V_{DSF}$	$I_{DR} = 25A, V_{GS} = 0V$	—	—	-1.8	V
Reverse Recovery Time	$t_{rr}$	$I_{DR} = 25A, V_{GS} = 0V$	—	50	—	ns
Reverse Recovery Charge	$Q_{rr}$	$dI_{DR} / dt = 50A / \mu s$	—	35	—	$\mu C$

MARKING









Peak  $I_{AR} = 25A$ ,  $R_G = 25\Omega$   
 $V_{DD} = 25V$ ,  $L = 339\mu H$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left( \frac{BVDSS}{BVDSS - V_{DD}} \right)$$