

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (π -MOSVI)

2SK4012

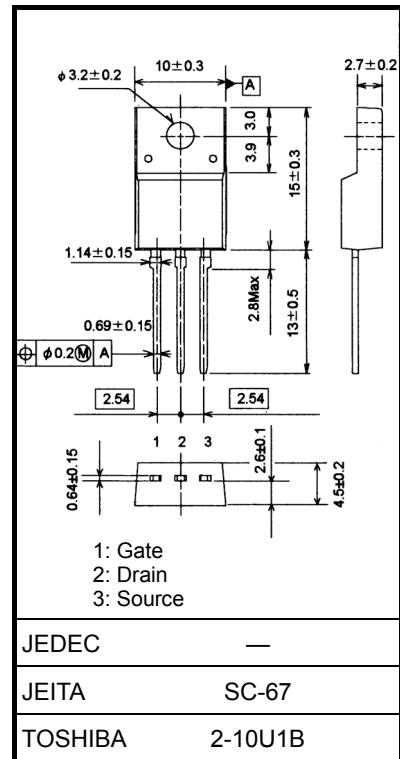
Switching Regulator Applications

Unit: mm

- Low drain-source ON-resistance : $R_{DS\ (ON)} = 0.33\ \Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 8.5\ S$ (typ.)
- Low leakage current : $I_{DSS} = 100\ \mu A$ (max) ($V_{DS} = 500\ V$)
- Enhancement mode : $V_{th} = 2.0\sim4.0\ V$ ($V_{DS} = 10\ V$, $I_D = 1\ mA$)

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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	500	V
Drain-gate voltage ($R_{GS} = 20\ k\Omega$)	V_{DGR}	500	V
Gate-source voltage	V_{GSS}	± 30	V
Drain current	DC (Note 1) I_D	13	A
	Pulse (Note 1) I_{DP}	52	A
Drain power dissipation ($T_c = 25^\circ C$)	P_D	45	W
Single-pulse avalanche energy (Note 2)	E_{AS}	1170	mJ
Avalanche current	I_{AR}	13	A
Repetitive avalanche energy (Note 3)	E_{AR}	4.5	mJ
Channel temperature	T_{ch}	150	$^\circ C$
Storage temperature range	T_{stg}	-55~150	$^\circ C$



Weight: 1.7 (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

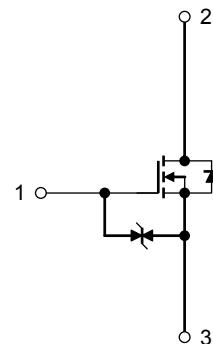
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th\ (ch-c)}$	2.78	$^\circ C / W$
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	62.5	$^\circ C / W$

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

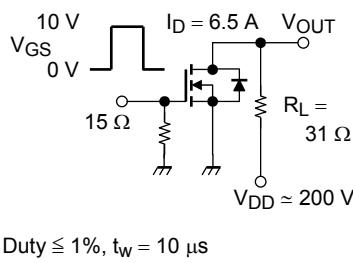
Note 2: $V_{DD} = 90\ V$, $T_{ch} = 25^\circ C$ (initial), $L = 11.8\ mH$, $R_G = 25\ \Omega$, $I_{AR} = 13\ A$

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

This transistor is an electrostatic-sensitive device. Handle with care.



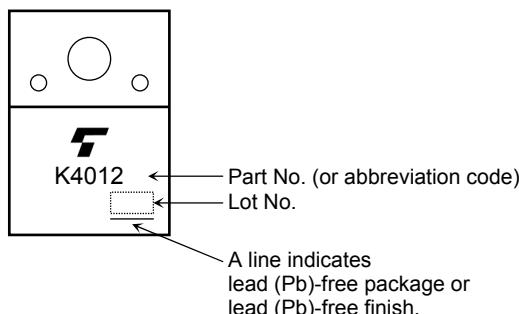
Electrical Characteristics (Ta = 25°C)

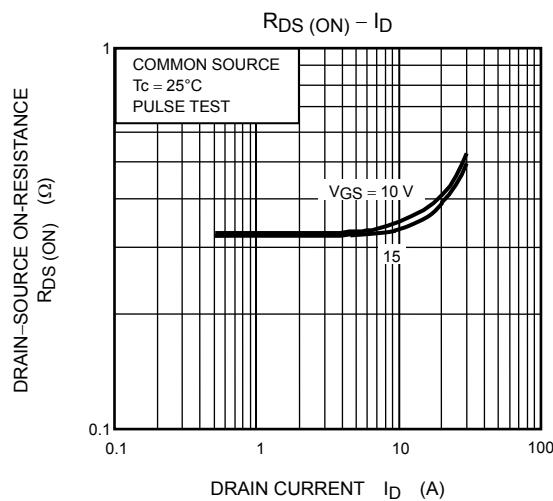
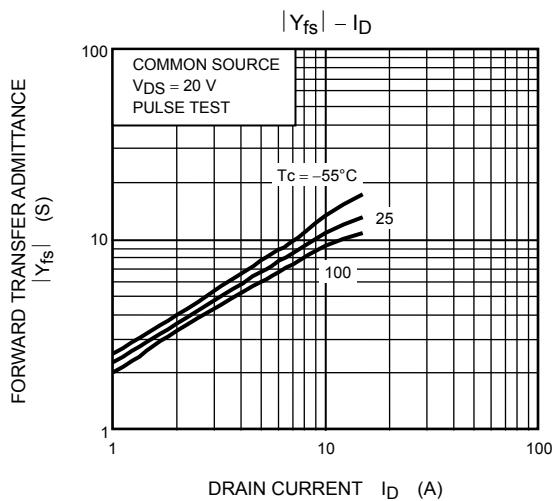
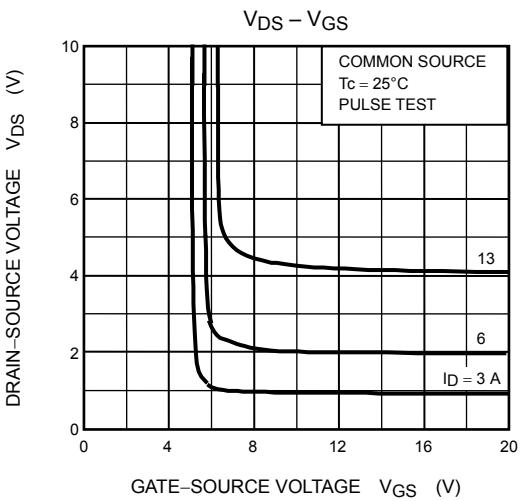
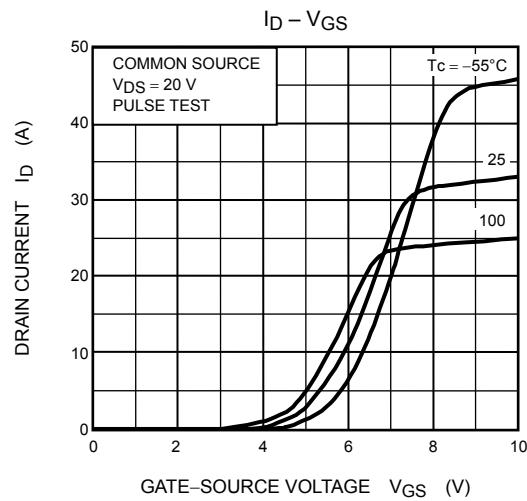
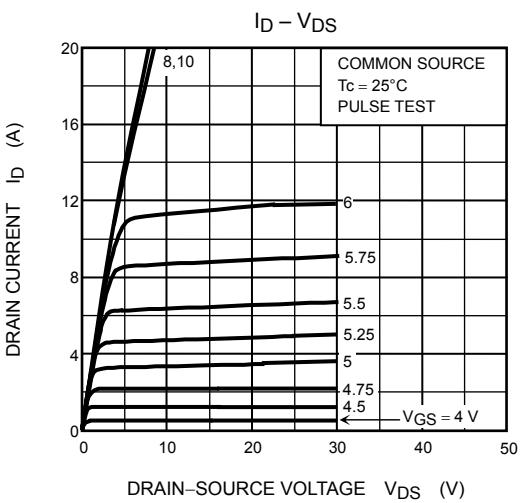
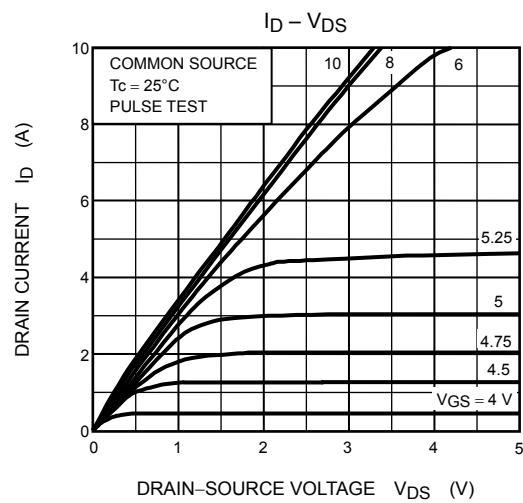
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Gate leakage current	I _{GSS}	V _{GS} = ±25 V, V _{DS} = 0 V	—	—	±10	µA	
Gate-source breakdown voltage	V (BR) GSS	I _G = ±10 µA, V _{DS} = 0 V	±30	—	—	V	
Drain cutoff current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V	—	—	100	µA	
Drain-source breakdown voltage	V (BR) DSS	I _D = 10 mA, V _{GS} = 0 V	500	—	—	V	
Gate threshold voltage	V _{th}	V _{DS} = 10 V, I _D = 1 mA	2.0	—	4.0	V	
Drain-source ON-resistance	R _D S (ON)	V _{GS} = 10 V, I _D = 6.5 A	—	0.33	0.4	Ω	
Forward transfer admittance	Y _{fs}	V _{DS} = 10 V, I _D = 6.5 A	4.0	8.5	—	S	
Input capacitance	C _{iss}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	—	2400	—	pF	
Reverse transfer capacitance	C _{rss}		—	18	—		
Output capacitance	C _{oss}		—	220	—		
Switching time	Rise time	t _r	 Duty ≤ 1%, t _W = 10 µs	—	25	—	ns
	Turn-on time	t _{on}		—	70	—	
	Fall time	t _f		—	10	—	
	Turn-off time	t _{off}		—	95	—	
Total gate charge (gate-source plus gate-drain)	Q _g	V _{DD} ≈ 400 V, V _{GS} = 10 V, I _D = 13 A	—	50	—	nC	
Gate-source charge	Q _{gs}		—	30	—		
Gate-drain ("Miller") charge	Q _{gd}		—	20	—		

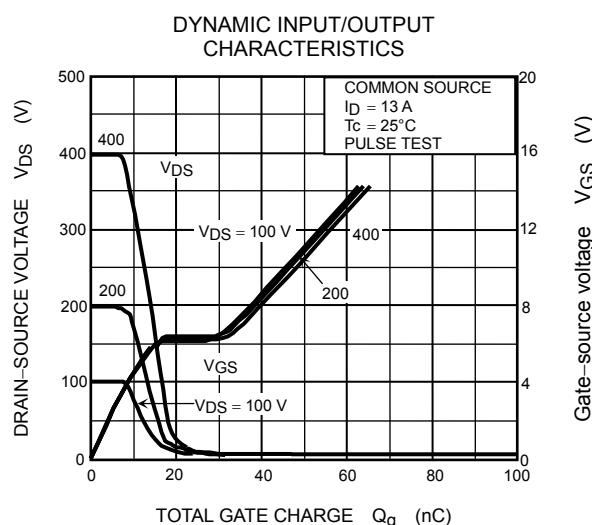
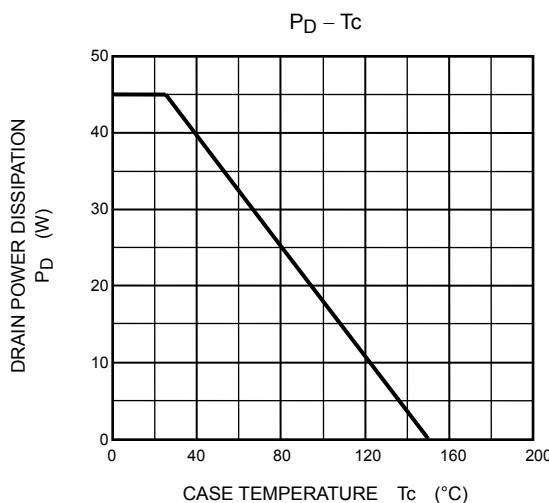
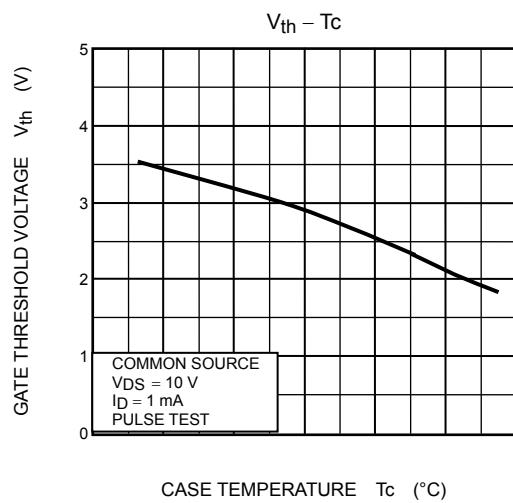
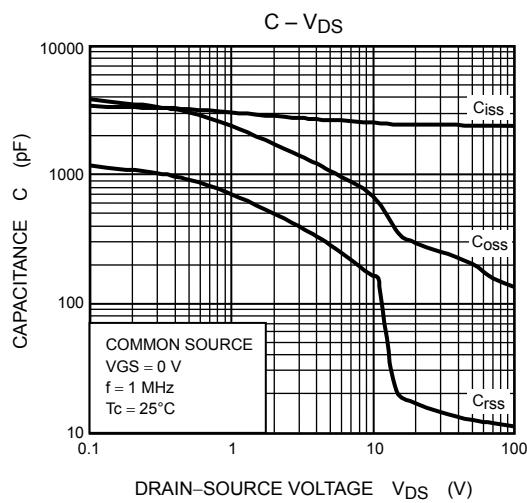
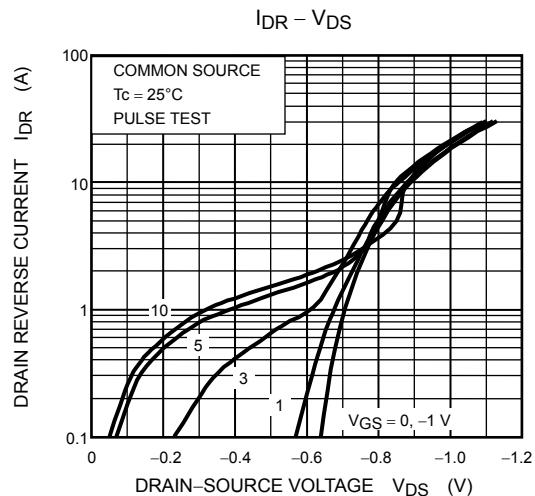
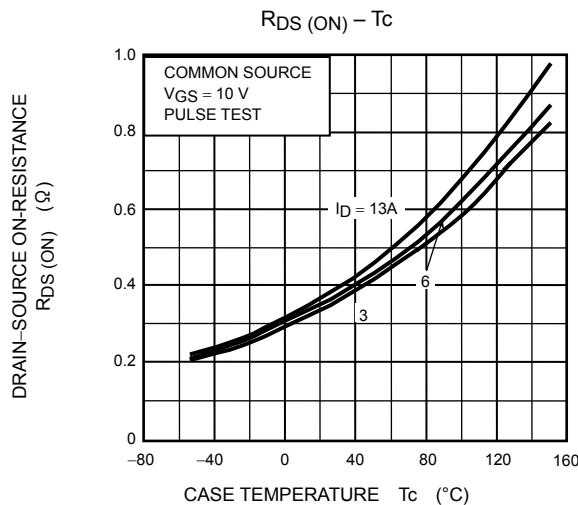
Source-Drain Ratings and Characteristics (Ta = 25°C)

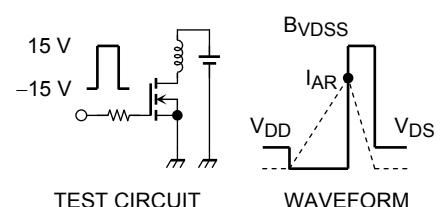
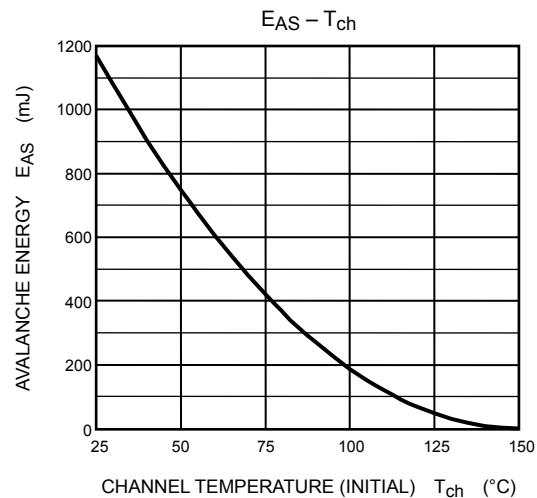
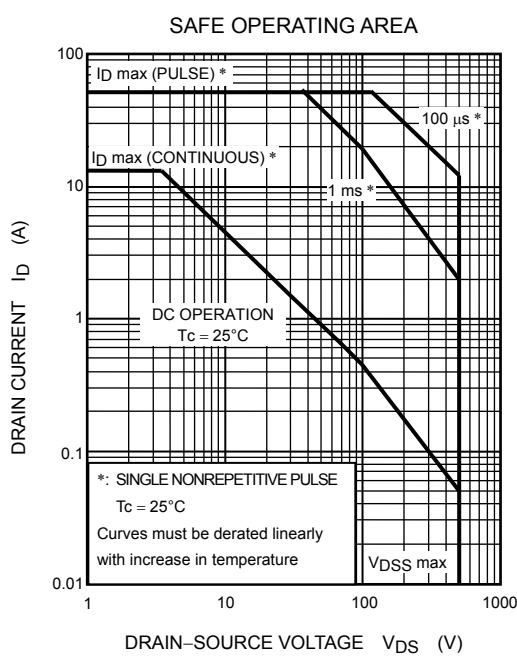
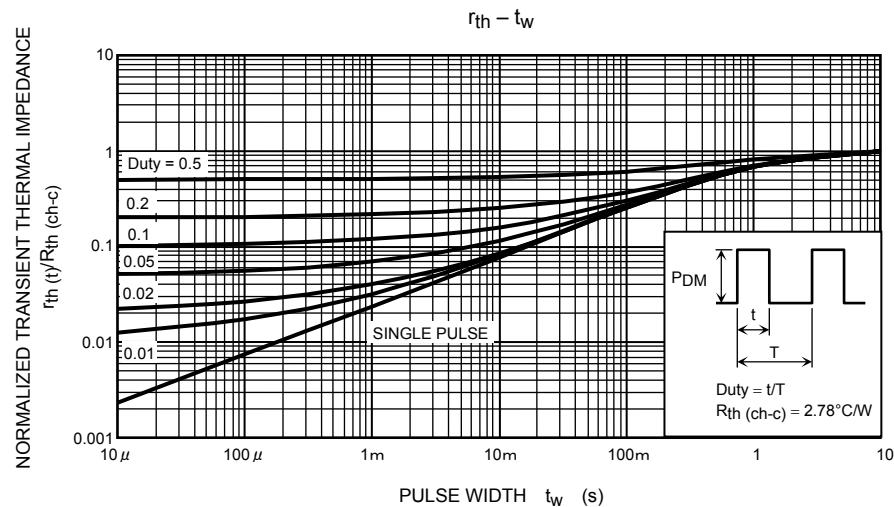
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I _{DR}	—	—	—	13	A
Pulse drain reverse current (Note 1)	I _{DRP}	—	—	—	52	A
Forward voltage (diode)	V _{DSF}	I _{DR} = 13 A, V _{GS} = 0 V	—	—	-1.7	V
Reverse recovery time	t _{rr}	I _{DR} = 13 A, V _{GS} = 0 V dI _{DR} / dt = 100 A / µs	—	1000	—	ns
Reverse recovery charge	Q _{rr}		—	11	—	µC

Marking









$$R_G = 25\ \Omega$$

$$V_{DD} = 90\ \text{V}, L = 11.8\ \text{mH}$$

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

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