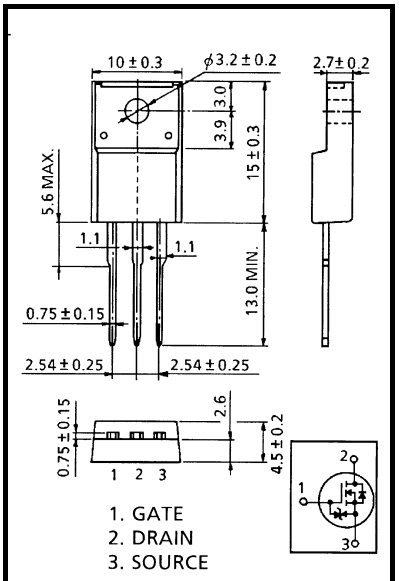
2SK3236

Switching Regulator Applications, DC-DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 13.5 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 42 S (typ.)
- Low leakage current: I_{DSS} = 100 μA (max) (V_{DS} = 60 V)
- Enhancement model: V_{th} = 1.3 to 2.5 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



JEDEC	—
JEITA	SC-67
TOSHIBA	2-10R1B

Weight: 1.9 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	60	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	60	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	35	A
	Pulse (Note 1)	I_{DP}	105	
Drain power dissipation (Tc = 25°C)		P_D	30	W
Single pulse avalanche energy (Note 2)		E_{AS}	68	mJ
Avalanche current		I_{AR}	35	A
Repetitive avalanche energy (Note 3)		E_{AR}	3.0	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 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	$R_{th\ (ch\text{-}c)}$	4.16	°C/W
Thermal resistance, channel to ambient	$R_{th\ (ch\text{-}a)}$	62.5	°C/W

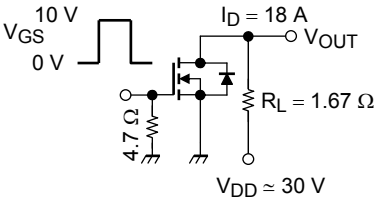
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: V_{DD} = 50 V, T_{ch} = 25°C, L = 40 μH, R_G = 25 Ω, I_{AR} = 35 A

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

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

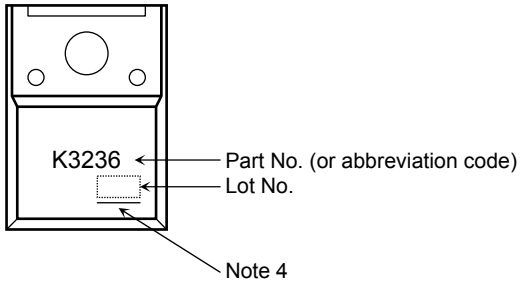
Electrical Characteristics (Ta = 25°C)

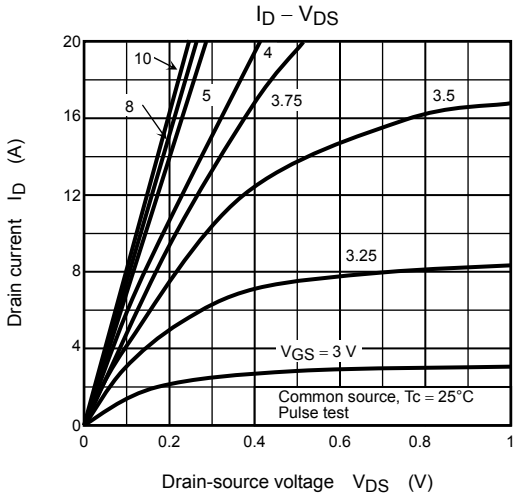
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	60	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.3	—	2.5	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 4 V, I_D = 18 A	—	22	36	mΩ
			V_{GS} = 10 V, I_D = 18 A	—	13.5	20	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 18 A	21	42	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	2300	—	pF
Reverse transfer capacitance		C_{rss}		—	220	—	
Output capacitance		C_{oss}		—	370	—	
Switching time	Rise time	t_r		—	9	—	ns
	Turn-ON time	t_{on}		—	23	—	
	Fall time	t_f		—	20	—	
	Turn-OFF time	t_{off}		—	100	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 48 V, V_{GS} = 10 V, I_D = 35 A	—	52	—	nC
Gate-source charge		Q_{gs}		—	37	—	
Gate-drain (“miller”) charge		Q_{gd}		—	15	—	

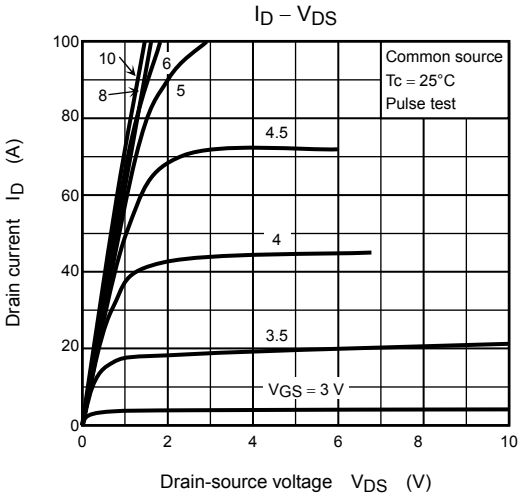
Source-Drain Ratings and Characteristics (Ta = 25°C)

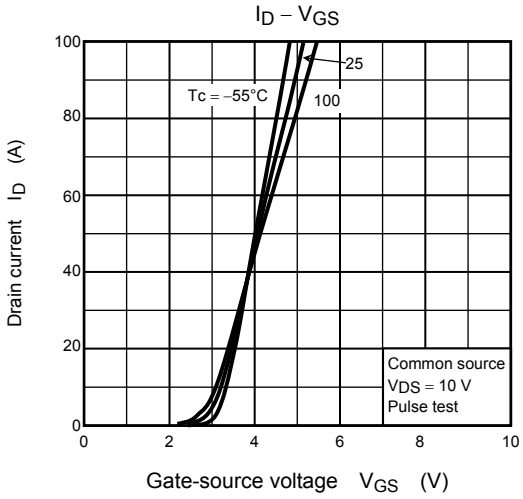
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	35	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	105	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 35 A, V_{GS} = 0 V	—	—	−1.7	V
Reverse recovery time	t_{rr}	I_{DR} = 35 A, V_{GS} = 0 V, dI_{DR}/dt = 50 A/μs	—	60	—	ns
Reverse recovery charge	Q_{rr}		—	81	—	nC

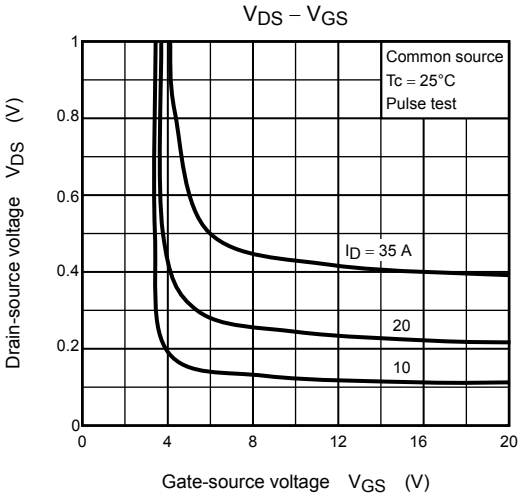
Marking

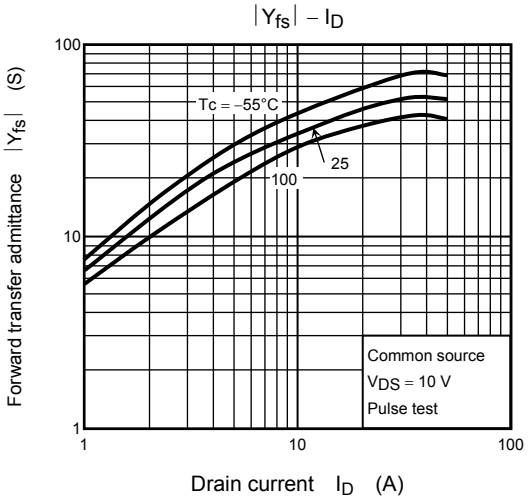


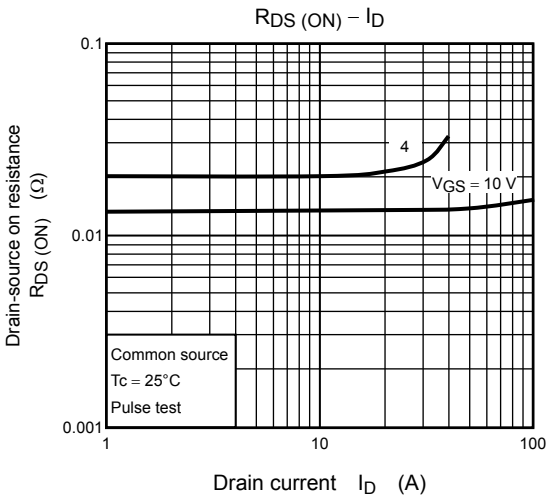

$I_D - V_{DS}$
Drain current I_D (A)
Drain-source voltage V_{DS} (V)
10
8
5
4
3.75
3.5
3.25
V_{GS} = 3 V
Common source, Tc = 25°C
Pulse test


$I_D - V_{DS}$
Drain current I_D (A)
Drain-source voltage V_{DS} (V)
10
8
6
5
4.5
4
3.5
V_{GS} = 3 V
Common source
Tc = 25°C
Pulse test

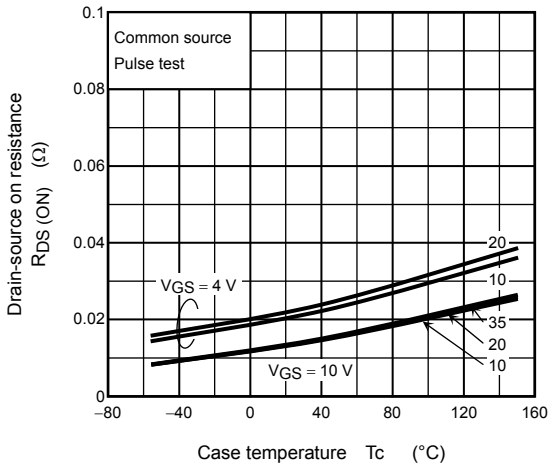

$I_D - V_{GS}$
Drain current I_D (A)
Gate-source voltage V_{GS} (V)
25
Tc = −55°C
100
Common source
V_{DS} = 10 V
Pulse test


$V_{DS} - V_{GS}$
Drain-source voltage V_{DS} (V)
Gate-source voltage V_{GS} (V)
Common source
Tc = 25°C
Pulse test
I_D = 35 A
20
10

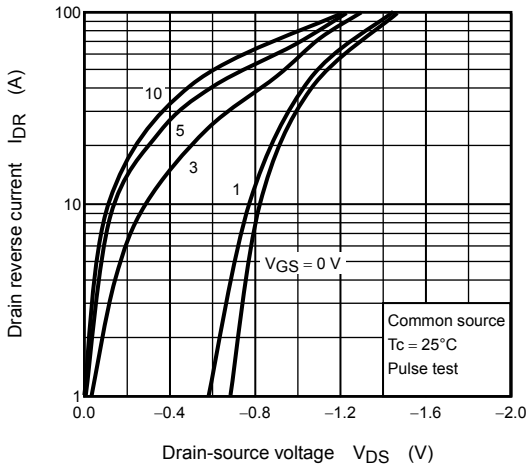

$|Y_{fs}| - I_D$
Forward transfer admittance $|Y_{fs}|$ (S)
Drain current I_D (A)
Tc = −55°C
25
100
Common source
V_{DS} = 10 V
Pulse test


$R_{DS\ (ON)} - I_D$
Drain-source on resistance $R_{DS\ (ON)}$ (Ω)
Drain current I_D (A)
4
V_{GS} = 10 V
Common source
Tc = 25°C
Pulse test

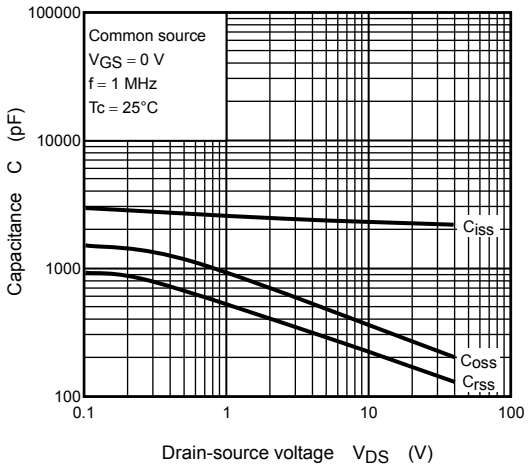
$R_{DS\ (ON)}$ – Tc



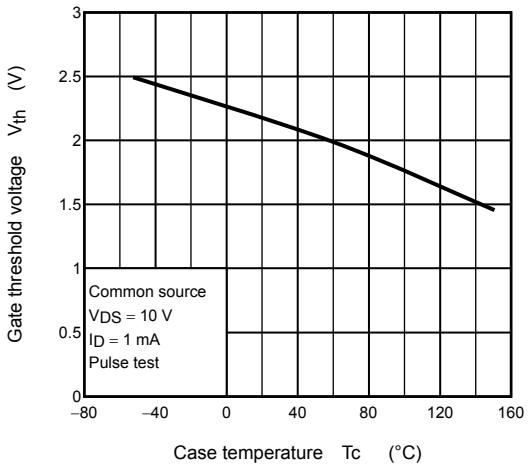
I_{DR} – V_{DS}



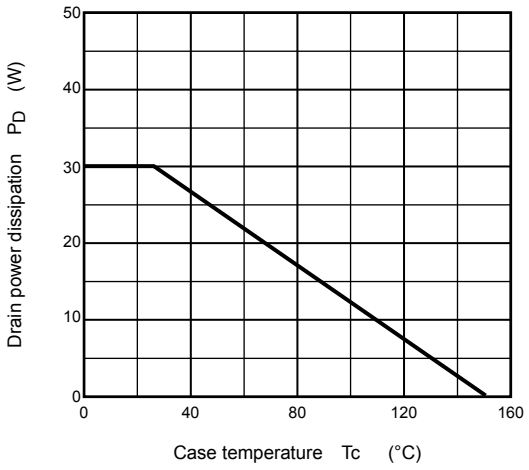
Capacitance – V_{DS}



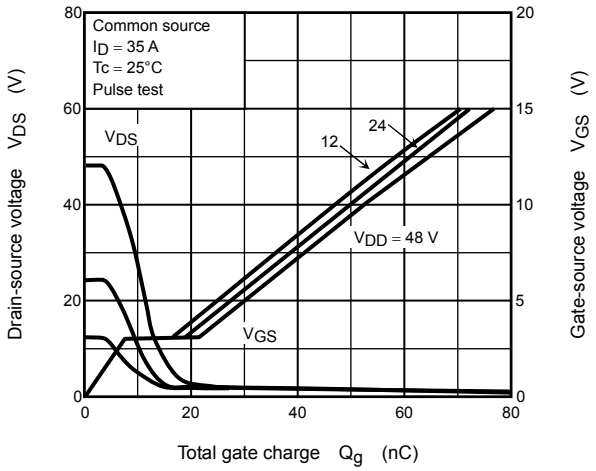
V_{th} – Tc



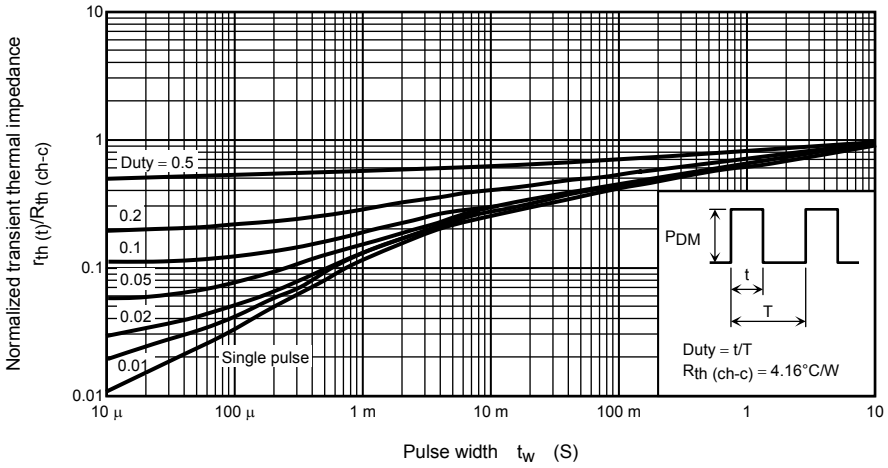
P_D – Tc



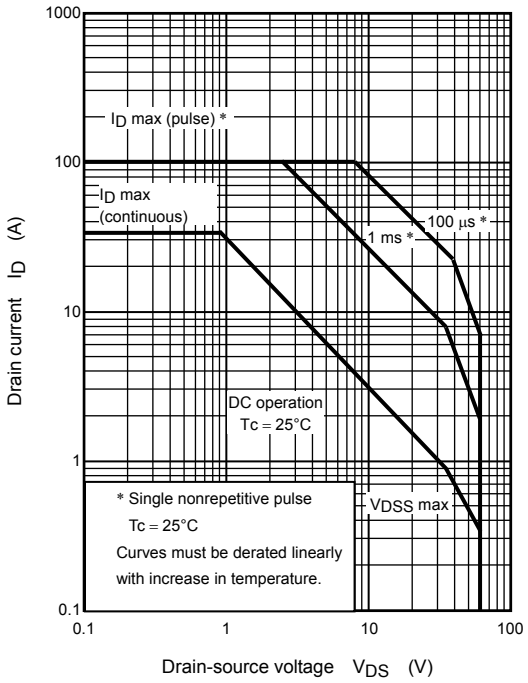
Dynamic input/output characteristics



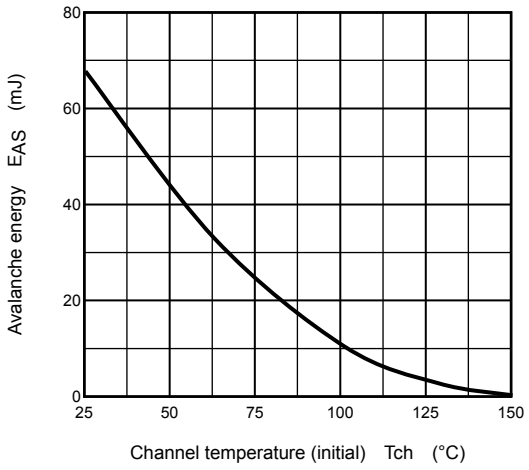
$r_{th} - t_w$

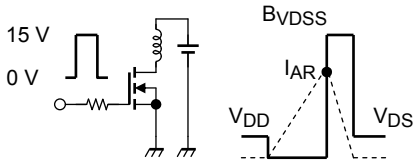


Safe operating area



$E_{AS} - T_{ch}$





Test circuit Wave form

$R_G = 25\ \Omega$
$V_{DD} = 50$ V, L = 40 μH

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

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