

■ N-Channel Enhancement MOSFET

■ High Speed Switching Applications

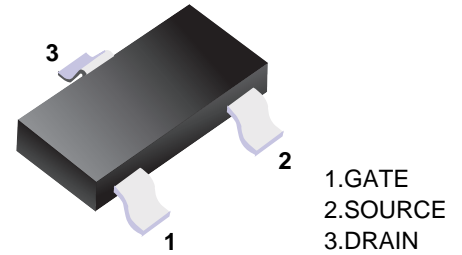
- ESD protected gate
- Low ON-resistance

$R_{DS(on)} = 2.8 \Omega$  (typ.) (@ $V_{GS} = 10 V$ )

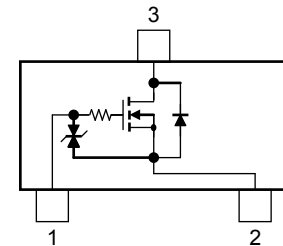
$R_{DS(on)} = 3.1 \Omega$  (typ.) (@ $V_{GS} = 5 V$ )

$R_{DS(on)} = 3.2 \Omega$  (typ.) (@ $V_{GS} = 4.5 V$ )

■ Marking Code: NJ



■ Simplified outline(SOT-23)



Equivalent Circuit (top view)

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

Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Gate-source voltage		$V_{GSS}$	± 20	V
Drain current (Note1)	DC	$I_D$	200	mA
	Pulse	$I_{DP}$ (Note 2)	760	
Power dissipation		$P_D$ (Note 3)	320	mW
		$P_D$ (Note 4)	1000	
Channel temperature		$T_{ch}$	150	°C
Storage temperature		$T_{stg}$	-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).

Note 1: The channel temperature should not exceed 150°C during use.

Note 2: Pulse width ≤ 10 μs, Duty ≤ 1%

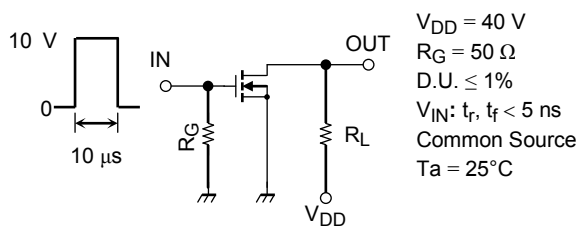
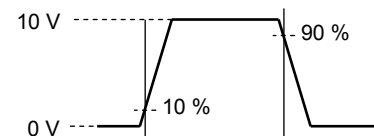
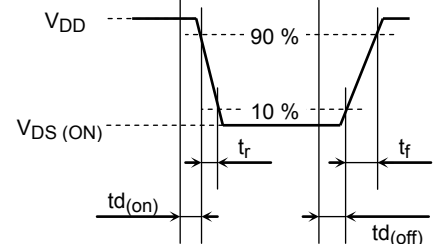
Note 3: Mounted on an FR4 board  
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.42 mm<sup>2</sup> × 3)

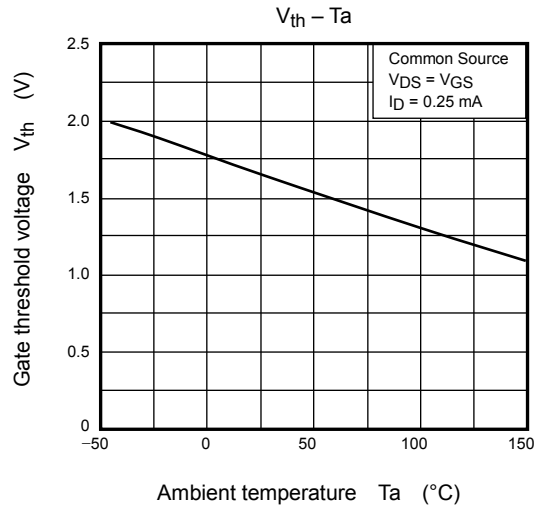
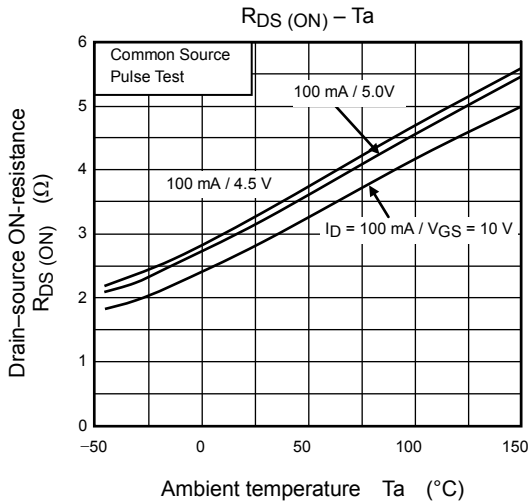
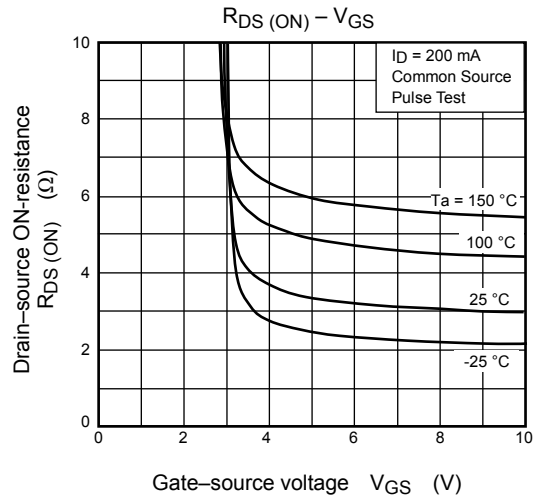
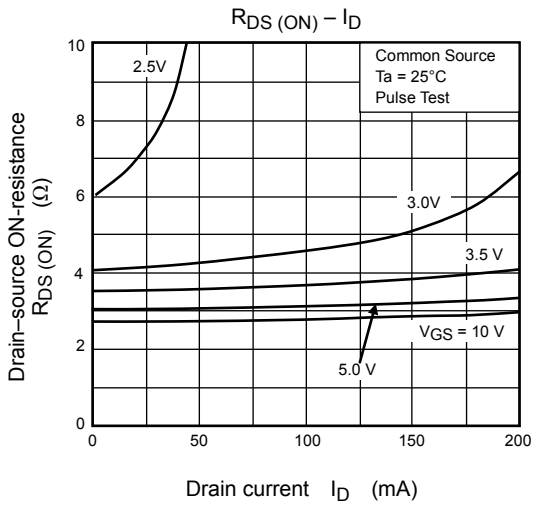
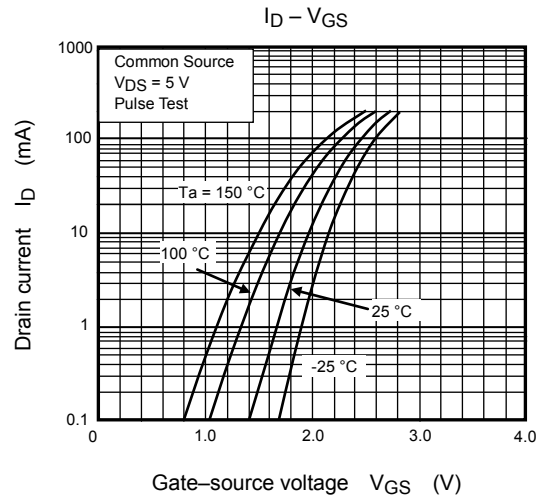
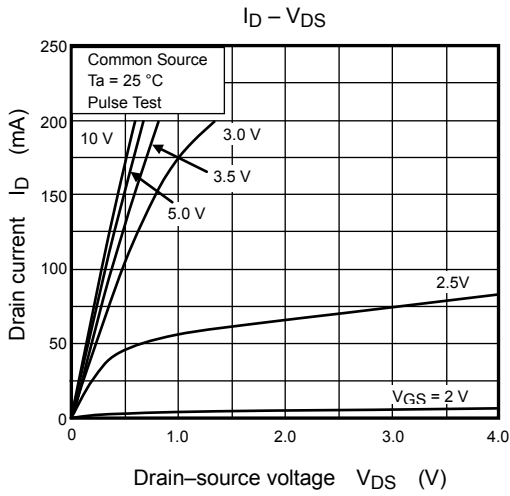
Note 4: Mounted on an FR4 board  
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

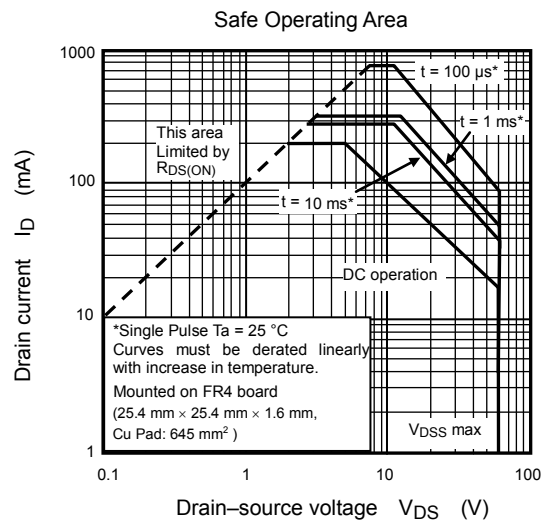
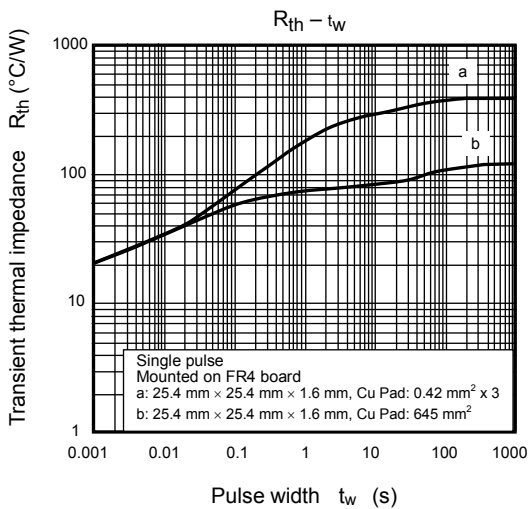
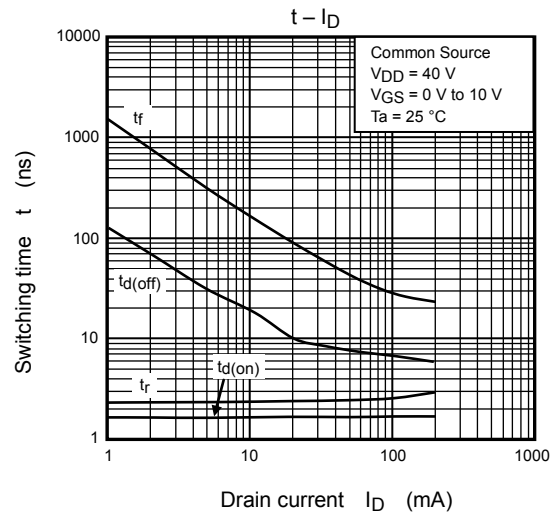
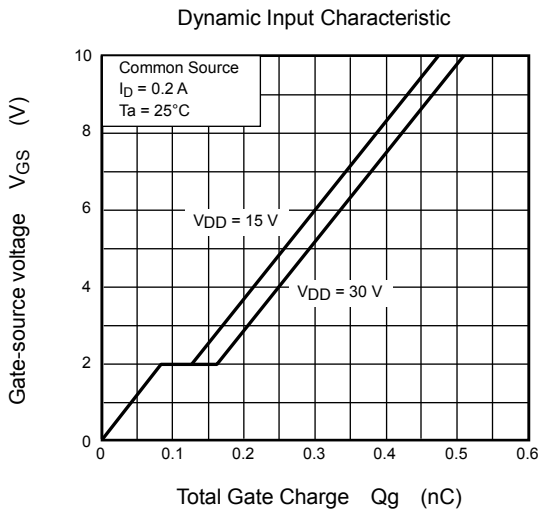
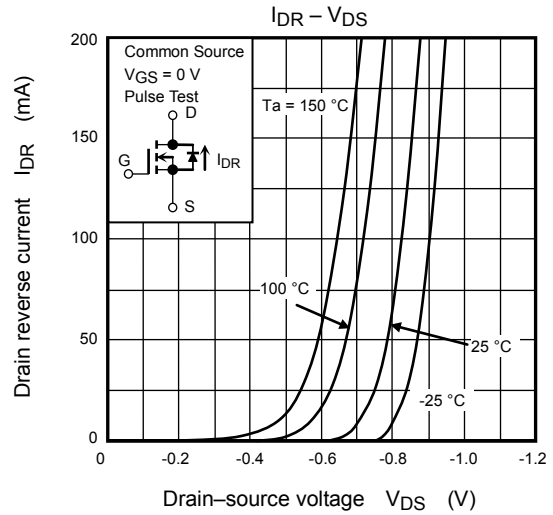
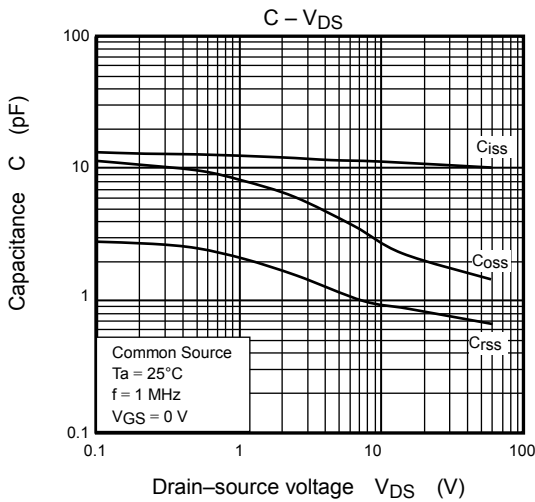
**Electrical Characteristics (Ta = 25°C, Otherwise specified)**

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 250 \mu A, V_{GS} = 0 V$	60	—	—	V	
Drain cutoff current	$I_{DSS}$	$V_{DS} = 60 V, V_{GS} = 0 V$	—	—	1	$\mu A$	
		$V_{DS} = 60 V, V_{GS} = 0 V, T_j = 150^\circ C$	—	—	200		
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16 V, V_{DS} = 0 V$	—	—	$\pm 2$	$\mu A$	
		$V_{GS} = \pm 10 V, V_{DS} = 0 V$	—	—	$\pm 0.5$		
		$V_{GS} = \pm 5 V, V_{DS} = 0 V$	—	—	$\pm 0.1$		
Gate threshold voltage	$V_{th}$	$I_D = 250 \mu A, V_{DS} = V_{GS}$	1.1	—	2.1	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10 V, I_D = 200 mA$ (Note 5)	—	450	—	mS	
Drain-source ON-resistance	$R_{DS(ON)}$ (Note 5)	$I_D = 100 mA, V_{GS} = 10 V$	—	2.8	3.9	$\Omega$	
		$I_D = 100 mA, V_{GS} = 10 V, T_j = 150^\circ C$	—	5.4	8.1		
		$I_D = 100 mA, V_{GS} = 5 V$	—	3.1	4.4		
		$I_D = 100 mA, V_{GS} = 4.5 V$	—	3.2	4.7		
Total Gate Charge	$Q_{G(tot)}$	$V_{DS} = 30 V, I_D = 200 mA$ $V_{GS} = 4.5 V$	—	0.27	0.35	nC	
Gate-Source Charge	$Q_{GS}$		—	0.08	—		
Gate-Drain Charge	$Q_{GD}$		—	0.08	—		
Input capacitance	$C_{iss}$	$V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz$	—	11	17	pF	
Output capacitance	$C_{oss}$		—	3	—		
Reverse transfer capacitance	$C_{rss}$		—	0.7	—		
Switching time	Turn-on delay time	$t_{d(on)}$	$V_{DD} = 40 V, I_D = 160 mA$ $V_{GS} = 0 V \text{ to } 10 V, R_G = 50 \Omega$	—	2	4	ns
	Rise time	$t_r$		—	3	—	
	Turn-off delay time	$t_{d(off)}$		—	7	14	
	Fall time	$t_f$		—	24	—	
Drain-source forward voltage	$V_{DSF}$	$I_D = -115 mA, V_{GS} = 0 V$ (Note 5)	—	-0.87	-1.2	V	

Note 5: Pulse test

**Switching Time Test Circuit**
**(a) Test Circuit**

**(b)  $V_{IN}$** 

**(c)  $V_{OUT}$** 


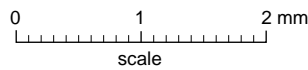
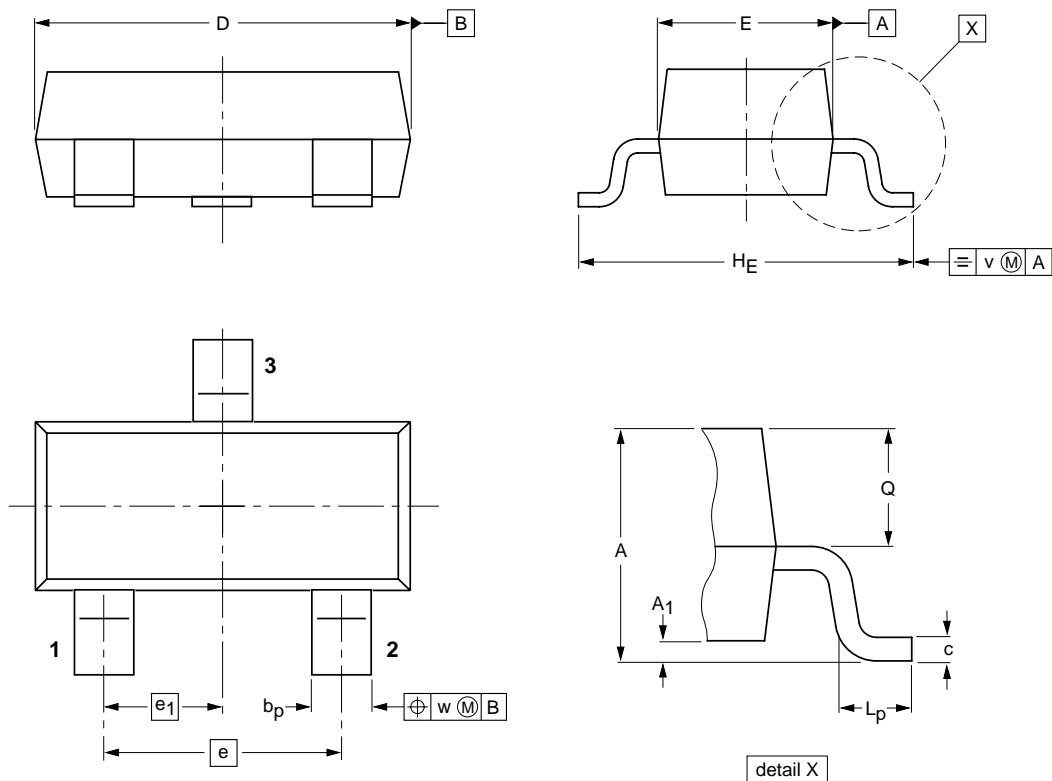




Note: The above characteristics curves are presented for reference only and not guaranteed by production test.

**Package Outline**

**SOT-23**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A	A <sub>1</sub> max.	b <sub>p</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

**Summary of Packing Options**

Package	Packing Description	Packing Quantity	Industry Standard
SOT-23	Tape/Reel, 7" reel	3000	EIA-481-1