TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSIII)

TPCS8204

Lithium Ion Battery Applications
Notebook PC Applications
Portable Equipment Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 13 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 15 S (typ.)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 20 V)
- Enhancement-mode: V_{th} = 0.5~1.2 V (V_{DS} = 10 V, I_D = 200 μA)

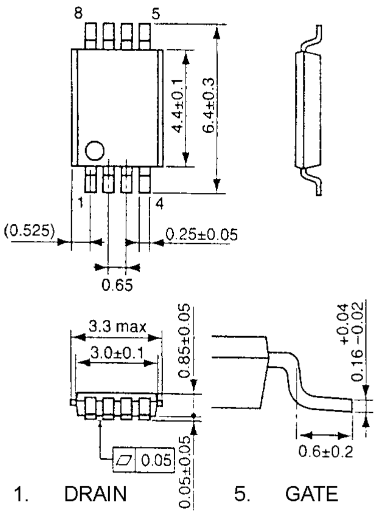
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	20	V
Gate-source voltage		V_{GSS}	±12	V
Drain current	DC (Note 1)	I_D	6	A
	Pulse (Note 1)	I_{DP}	24	
Drain power dissipation (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$P_{D\ (1)}$	1.1	W
	Single-device value at dual operation (Note 3b)	$P_{D\ (2)}$	0.75	
Drain power dissipation (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$P_{D\ (1)}$	0.6	W
	Single-device value at dual operation (Note 3b)	$P_{D\ (2)}$	0.35	
Single pulse avalanche energy (Note 4)		E_{AS}	46.8	mJ
Avalanche current		I_{AR}	6	A
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		E_{AR}	0.075	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Note: For (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5), please refer to the next page.

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

Unit: mm

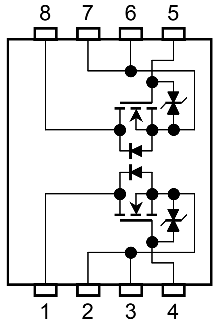


1. DRAIN
2. 3. SOURCE
4. GATE
5. GATE
6. 7. SOURCE
8. DRAIN

JEDEC	—
JEITA	—
TOSHIBA	2-3R1E

Weight: 0.035 g (typ.)

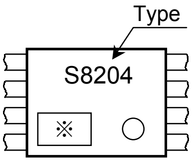
Circuit Configuration



Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	114	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	167	
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	208	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	357	

Marking (Note 6)

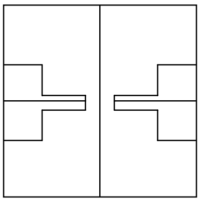


Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2:

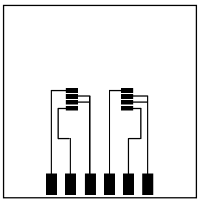
a) Device mounted on a glass-epoxy board (a)

b) Device mounted on a glass-epoxy board (b)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(b)

Note 3:

a) The power dissipation and thermal resistance values are shown for a single device. (During single-device operation, power is only applied to one device.)

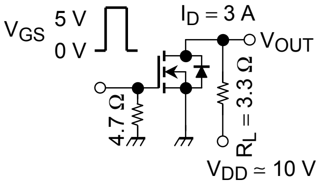
b) The power dissipation and thermal resistance values are shown for a single device. (During dual operation, power is evenly applied to both devices.)

Note 4: V_{DD} = 16 V, T_{ch} = 25°C (initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = 6 A

Note 5: Repetitive rating; pulse width limited by maximum channel temperature

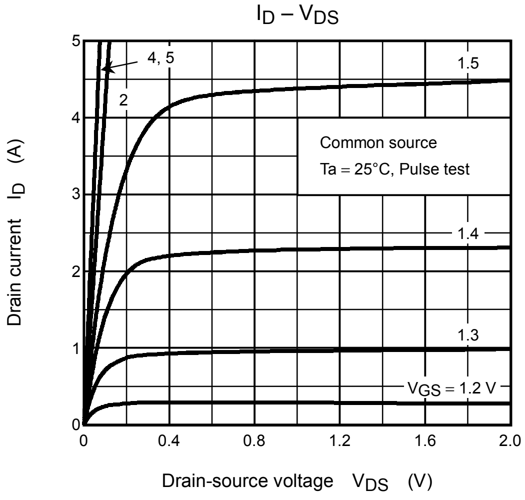
Note 6: • on lower left of the marking indicates Pin 1.
* shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

Electrical Characteristics (Ta = 25°C)

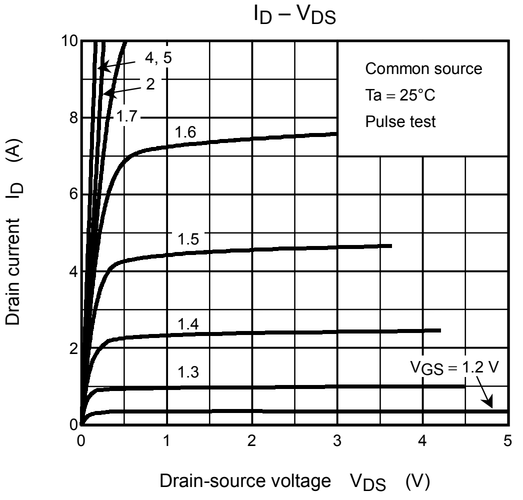
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −12 V	8	—	—	
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 200 μA	0.5	—	1.2	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 2.0 V, I_D = 4.2 A	—	24	35	mΩ
			V_{GS} = 2.5 V, I_D = 4.2 A	—	18	22	
			V_{GS} = 4.0 V, I_D = 4.8 A	—	13	17	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 3.0 A	7.5	15	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	2160	—	pF
Reverse transfer capacitance		C_{rss}		—	210	—	
Output capacitance		C_{oss}		—	230	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10 μs	—	5	—	ns
	Turn-ON time	t_{on}		—	13	—	
	Fall time	t_f		—	10	—	
	Turn-OFF time	t_{off}		—	53	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 16 V, V_{GS} = 5 V, I_D = 6 A	—	22	—	nC
Gate-source charge 1		Q_{gs1}		—	4	—	
Gate-drain ("miller") charge		Q_{gd}		—	5	—	

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

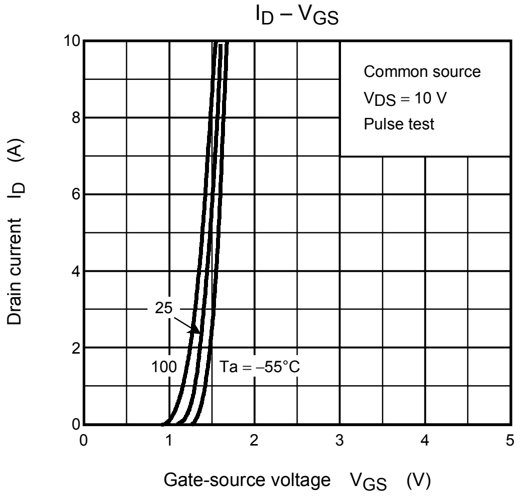
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	24	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 6 A, V_{GS} = 0 V	—	—	−1.2	V



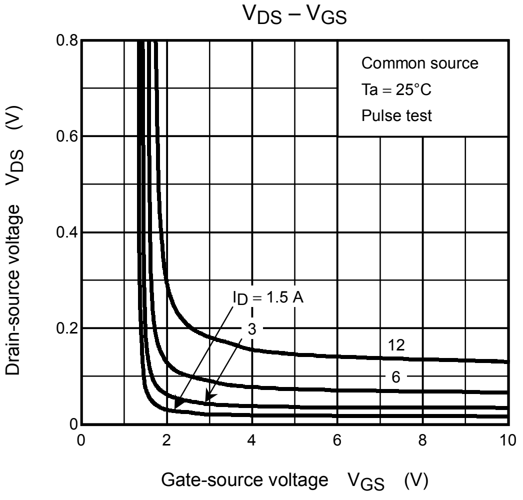
I_D – V_{DS}



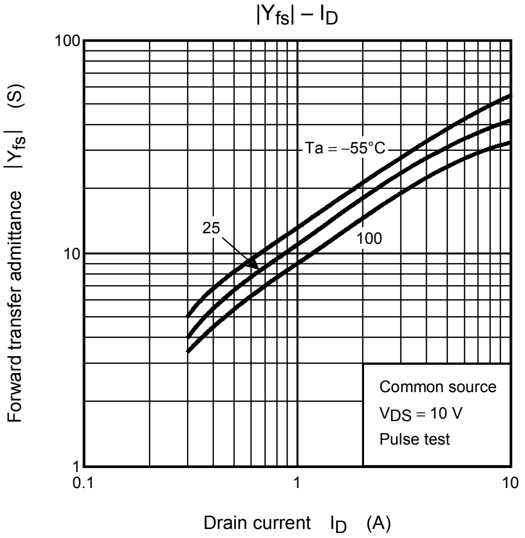
I_D – V_{DS}



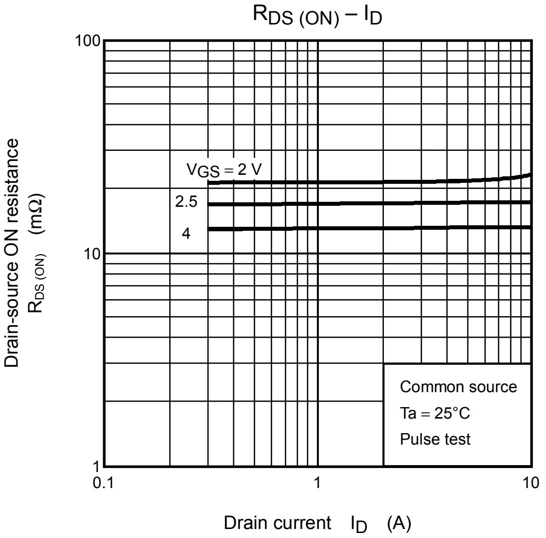
I_D – V_{GS}



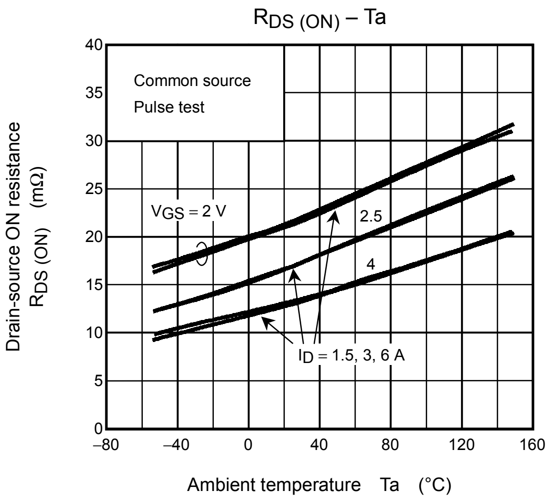
V_{DS} – V_{GS}

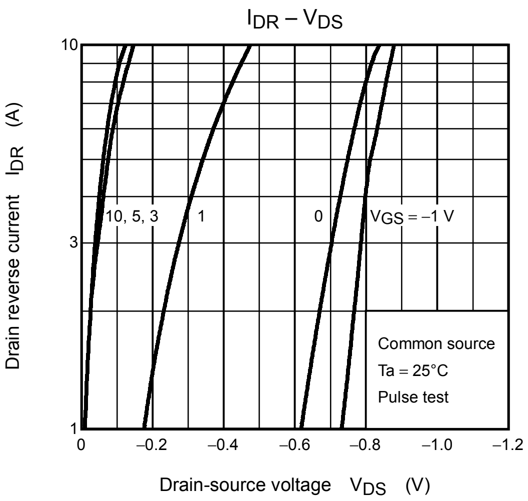


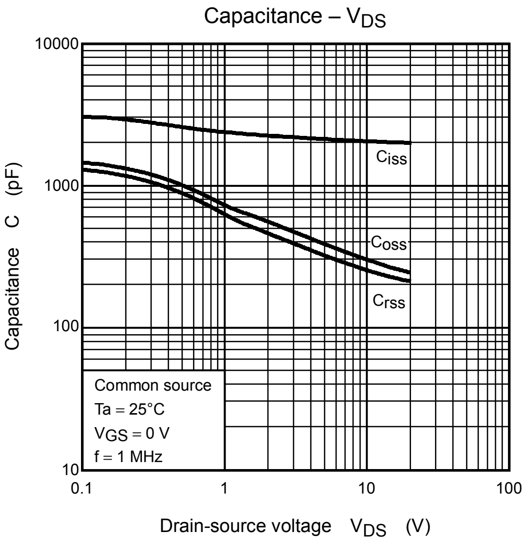
$|Y_{fs}|$ – I_D

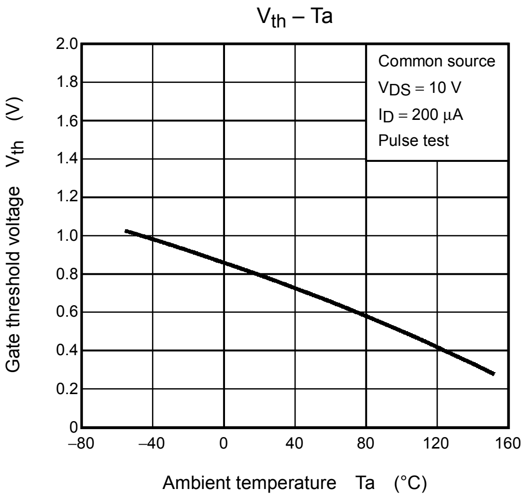


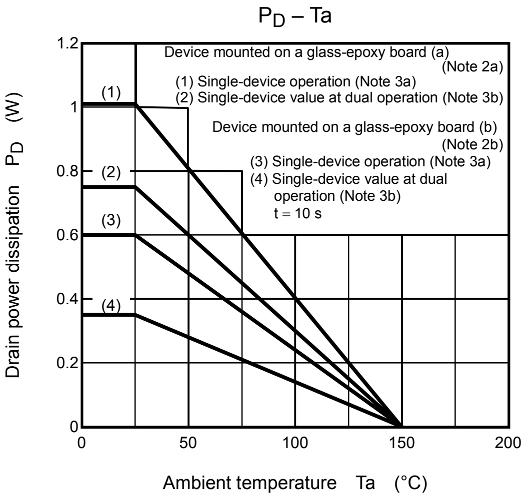
$R_{DS\ (ON)}$ – I_D

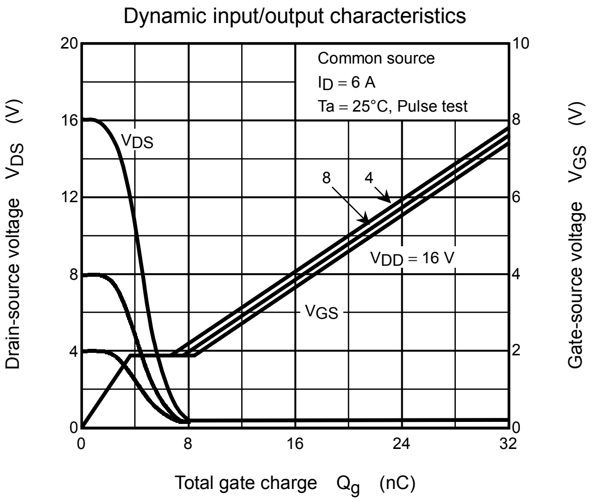

$R_{DS\,(ON)}$ – Ta

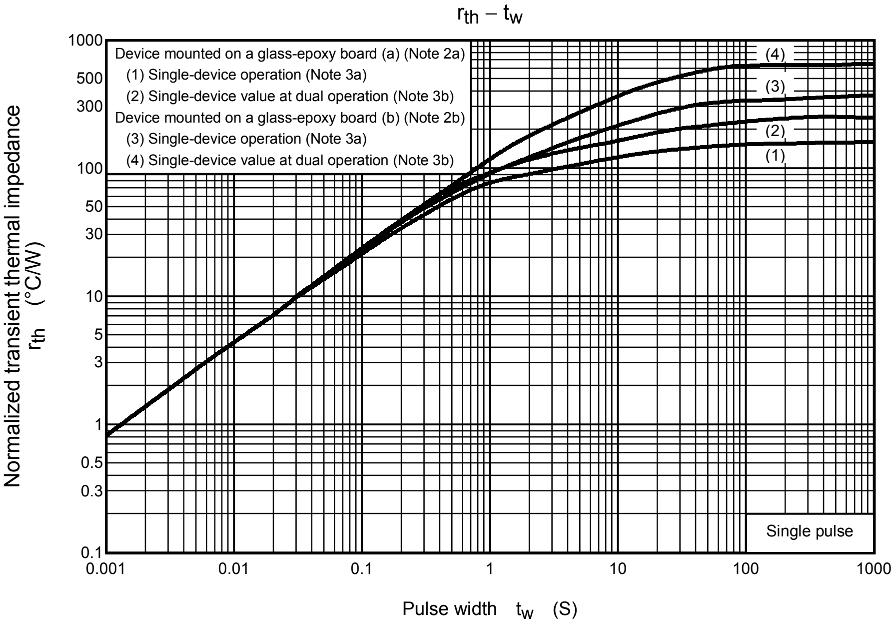

I_{DR} – V_{DS}

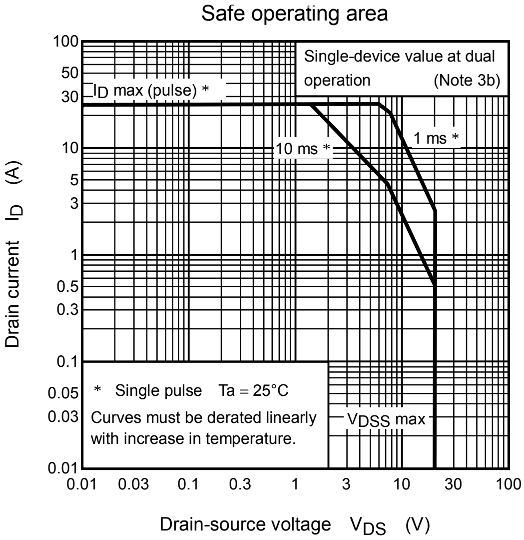

Capacitance – V_{DS}


V_{th} – Ta


P_D – Ta


Dynamic input/output characteristics


$r_{th} – t_w$
Device mounted on a glass-epoxy board (a) (Note 2a)
(1) Single-device operation (Note 3a)
(2) Single-device value at dual operation (Note 3b)
Device mounted on a glass-epoxy board (b) (Note 2b)
(3) Single-device operation (Note 3a)
(4) Single-device value at dual operation (Note 3b)
(4)
(3)
(2)
(1)
Single pulse
Normalized transient thermal impedance r_{th} (°C/W)
1000
500
300
100
50
30
10
5
3
1
0.5
0.3
0.1
0.001
0.01
0.1
1
10
100
1000
Pulse width t_w (S)


Safe operating area
Single-device value at dual operation (Note 3b)
I_D max (pulse) *
10 ms *
1 ms *
* Single pulse Ta = 25°C
Curves must be derated linearly with increase in temperature.
V_{DSS} max
Drain current I_D (A)
100
50
30
10
5
3
1
0.5
0.3
0.1
0.05
0.03
0.01
0.01
0.03
0.1
0.3
1
3
10
30
100
Drain-source voltage V_{DS} (V)

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