

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

TPCS8213

Lithium Ion Battery Applications

- Small footprint due to a small and thin package
- Low drain-source ON-resistance: $R_{DS(ON)} = 8.4 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 13 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 20 \text{ V}$)
- Enhancement-mode: $V_{th} = 0.5 \sim 1.4 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 200 \text{ }\mu\text{A}$)
- Common drain

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

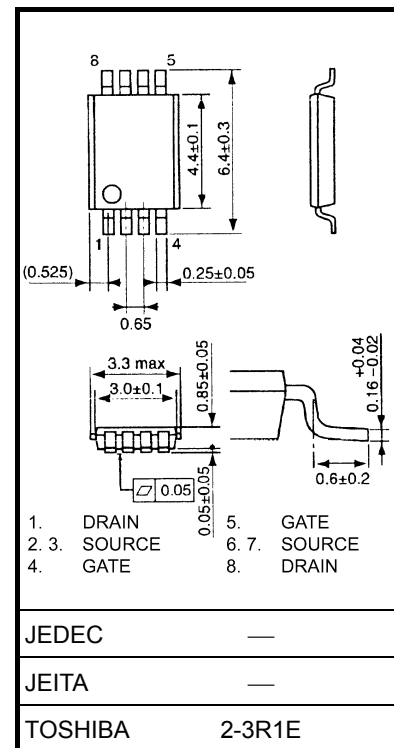
Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	20	V
Gate-source voltage		V_{GSS}	± 12	V
Drain current	DC (Note 1)	I_D	6	A
	Pulse (Note 1)	I_{DP}	24	
Drain power dissipation ($t = 10 \text{ s}$) (Note 2a)	Single-device 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 ($t = 10 \text{ s}$) (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}	9.4	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	$^\circ\text{C}$
Storage temperature range		T_{stg}	$-55 \sim 150$	$^\circ\text{C}$

Note: For Notes 1 to 5, see the next page.

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.).

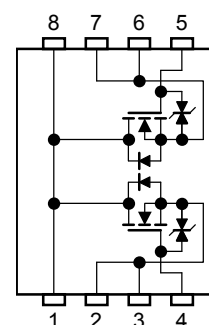
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.035 g (typ.)

Circuit Configuration



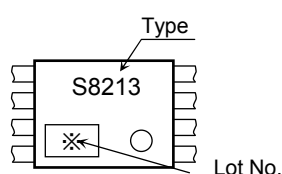
WARNING

【Handling Precaution for Power MOSFET in use of Protection Circuit for Battery Pack】
Flame-retardant resins of UL94-V0 flammability class are used in packages, however, they are not noncombustible. Use a unit, for example PTC Thermistor, which can shut off the power supply if a short-circuit occurs. If the power supply is not shut off on the occurring short-circuit, a large short-circuit current will flow continuously, which may cause the device to catch fire or smoke.

Thermal Characteristics

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

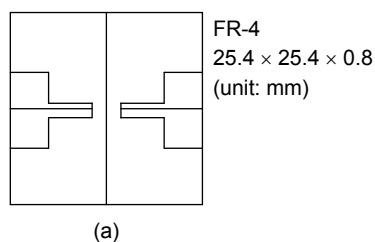
Marking (Note 6)



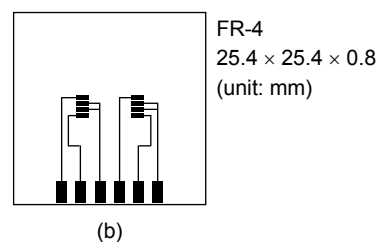
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2:

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



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



Note 3:

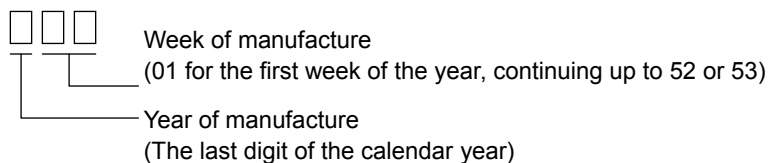
- The power dissipation and thermal resistance values are shown for a single device.
(During single-device operation, power is applied to one device only.)
- The power dissipation and thermal resistance values are shown for a single device.
(During dual operation, power is applied to both devices evenly.)

Note 4: $V_{DD} = 16$ V, $T_{ch} = 25^{\circ}\text{C}$ (initial), $L = 0.2$ mH, $R_G = 25\ \Omega$, $I_{AR} = 6$ A

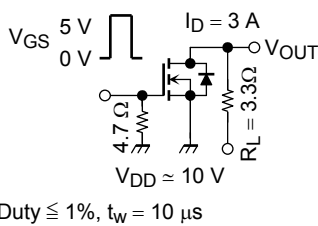
Note 5: Repetitive rating: pulse width limited by max channel temperature

Note 6: The circle "o" on lower right of the marking indicates Pin 1.

* Weekly code (three digits):

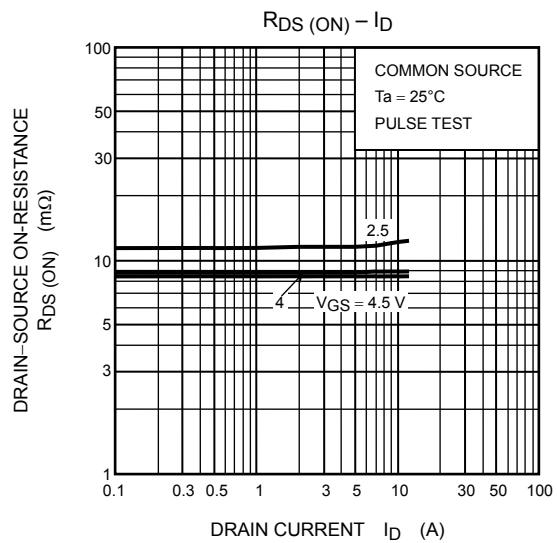
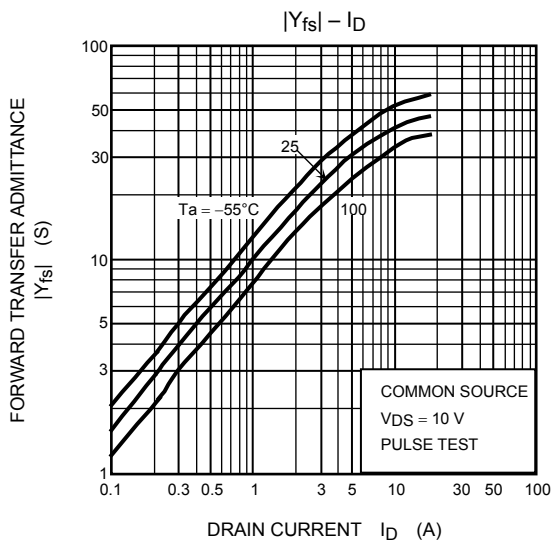
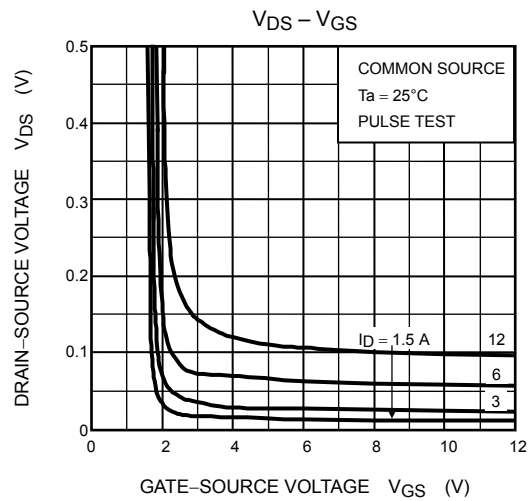
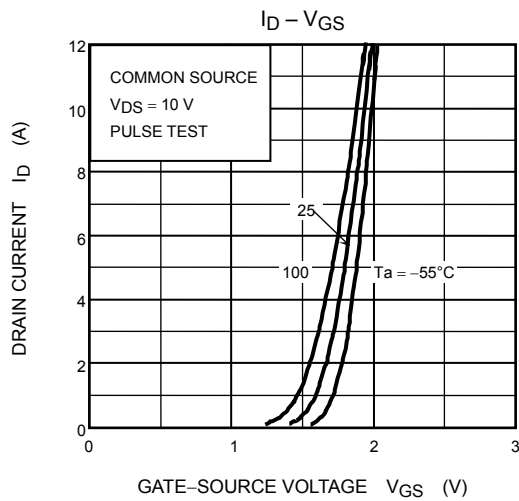
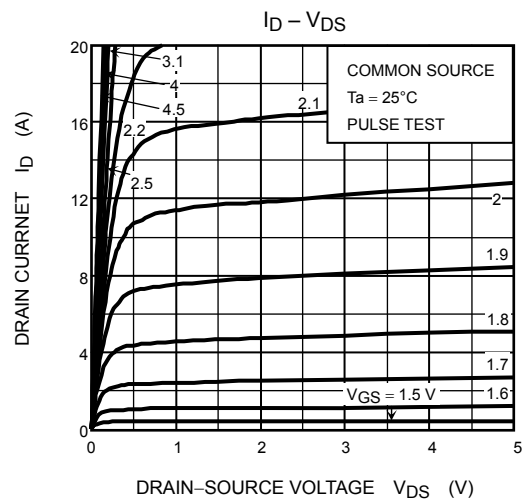
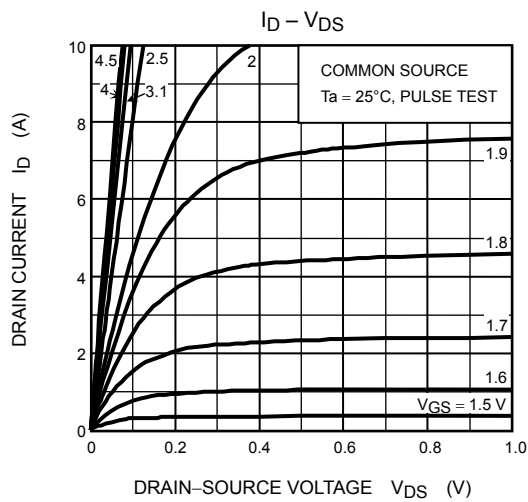


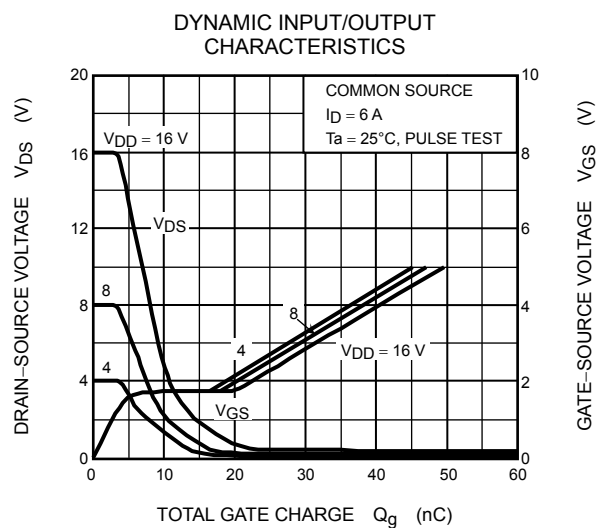
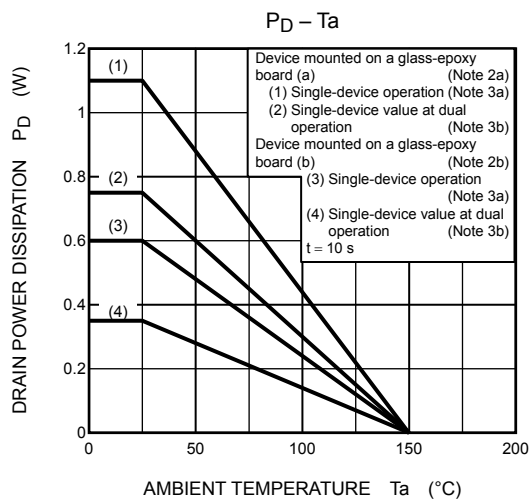
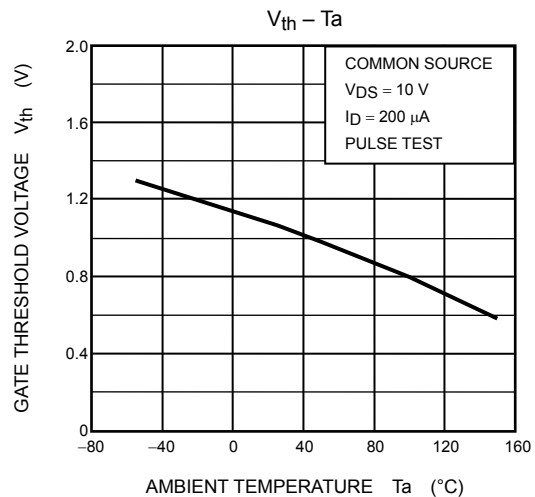
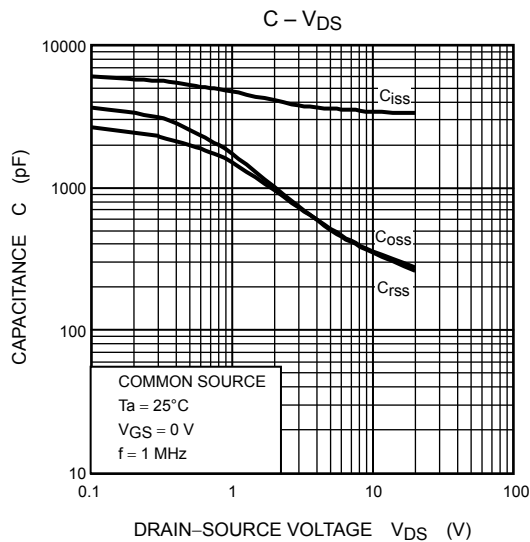
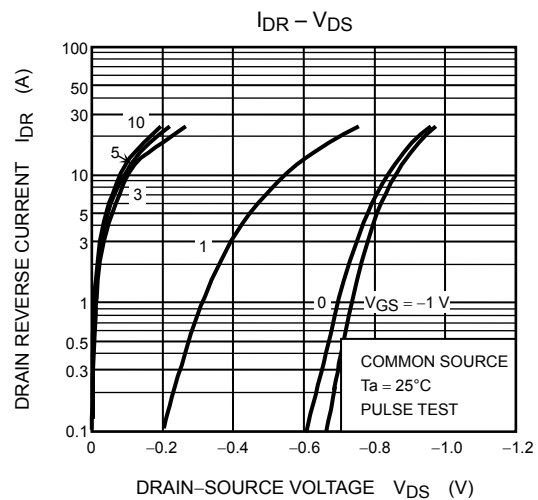
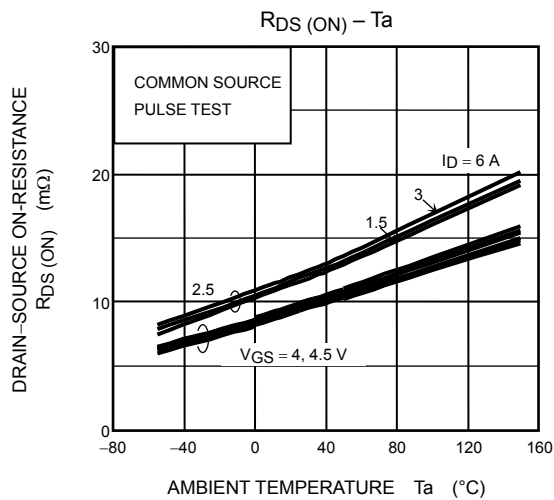
Electrical Characteristics (Ta = 25°C)

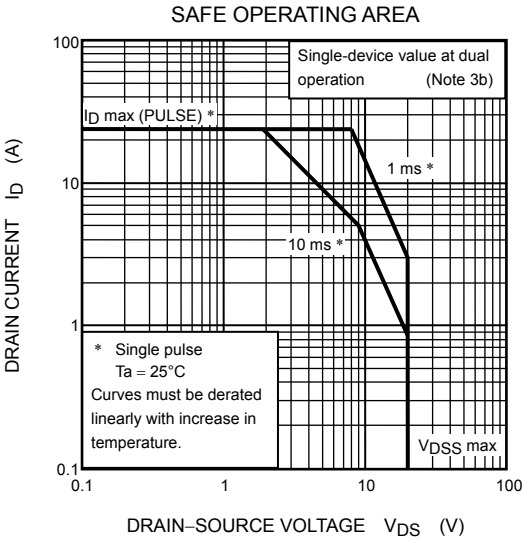
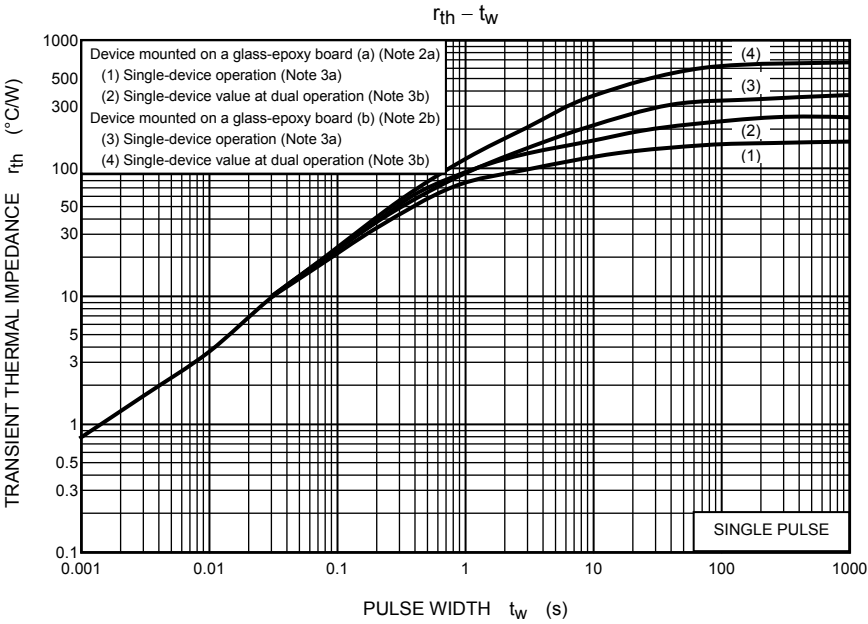
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±10 V, V _{DS} = 0 V	—	—	±10	μA
Drain cutoff current		I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage	V _(BR) DSS	I _D = 10 mA, V _{GS} = 0 V	20	—	—	V	
	V _(BR) DSX	I _D = 10 mA, V _{GS} = -12 V	8	—	—		
Gate threshold voltage		V _{th}	V _{DS} = 10 V, I _D = 200 μA	0.5	—	1.4	V
Drain-source ON-resistance		R _{DS} (ON)	V _{GS} = 2.5 V, I _D = 4.2 A	—	11	18	mΩ
			V _{GS} = 4.0 V, I _D = 4.8 A	—	8.7	13	
			V _{GS} = 4.5 V, I _D = 4.8 A	—	8.4	12	
Forward transfer admittance		Y _{fs}	V _{DS} = 10 V, I _D = 3.0 A	6.5	13	—	S
Input capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	3140	—	pF
Reverse transfer capacitance		C _{rss}		—	385	—	
Output capacitance		C _{oss}		—	425	—	
Switching time	Rise time	t _r		—	20	—	ns
	Turn-on time	t _{on}		—	30	—	
	Fall time	t _f		—	23	—	
	Turn-off time	t _{off}		—	84	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ 16 V, V _{GS} = 5 V, I _D = 6 A	—	49	—	nC
Gate-source charge 1		Q _{gs1}		—	6	—	
Gate-drain (“Miller”) charge		Q _{gd}		—	13	—	

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

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







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20070701-EN

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