

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

TPCS8214

Lithium Ion Battery Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS(ON)} = 10.5\text{m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 10\text{S}$ (typ.)
- Low leakage current: $I_{DSS} = 10\ \mu\text{A}$ (max) ($V_{DS} = 30\ \text{V}$)
- Enhancement mode: $V_{th} = 0.5\sim 1.4\ \text{V}$ ($V_{DS} = 10\ \text{V}$, $I_D = 200\ \mu\text{A}$)
- Common drain

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage ($R_{GS} = 20\ \text{k}\Omega$)		V_{DGR}	30	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: (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5): See the next page.

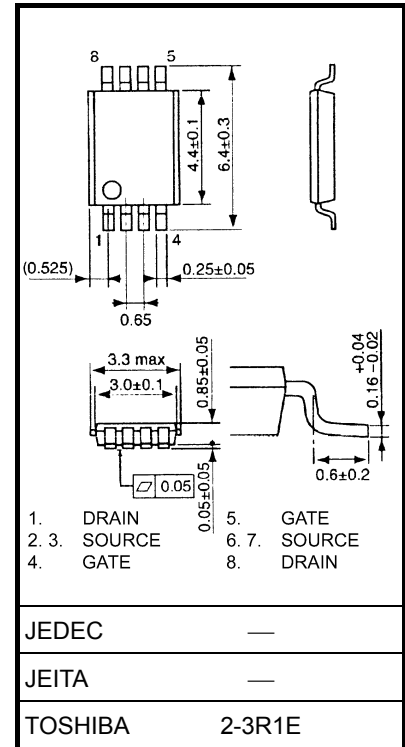
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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. Please handle with caution.

WARNING

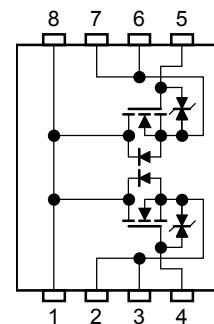
【Handling Precaution for Power MOSFET in use of Protection Circuit for Battery Pack】
 Flame-retardant resins of UL94-V0 flammability class are used in packages, however, they are not noncombustible. Use a unit example PTC Thermistor, which can shut off the power supply if a short-circuit occurs. If the 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.

Unit: mm



Weight: 0.035 g (typ.)

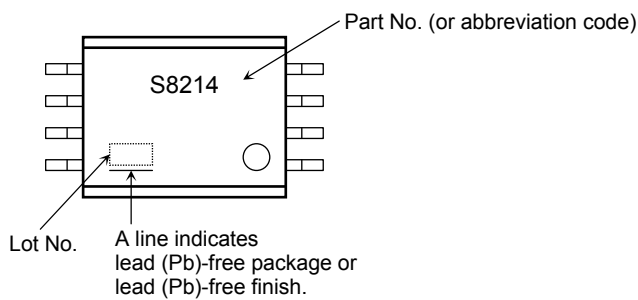
Circuit Configuration



Thermal Characteristics

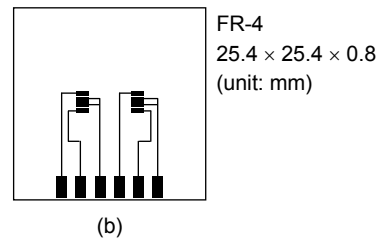
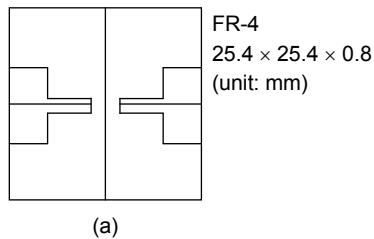
Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	114	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	167	
Thermal resistance, channel to ambient (t = 10 s)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$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

Marking (Note 6)



Note 1: 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)



Note 3:

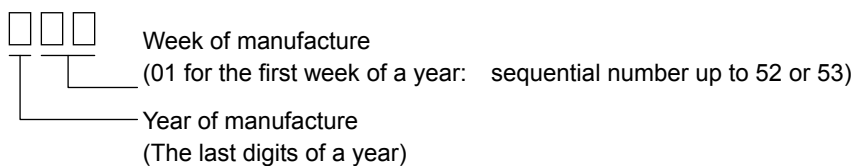
- a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.)
- b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both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

Note 4: $V_{DD} = 24\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.2\text{mH}$, $R_G = 25\ \Omega$, $I_{AR} = 6\text{ A}$

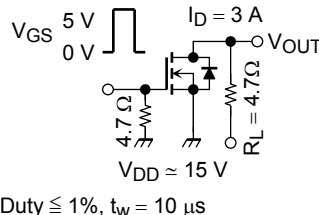
Note 5: Repetitive rating: pulse width limited by max channel temperature

Note 6: ○ on lower right of the marking indicates Pin 1.

※ Weekly code: (Three digits)

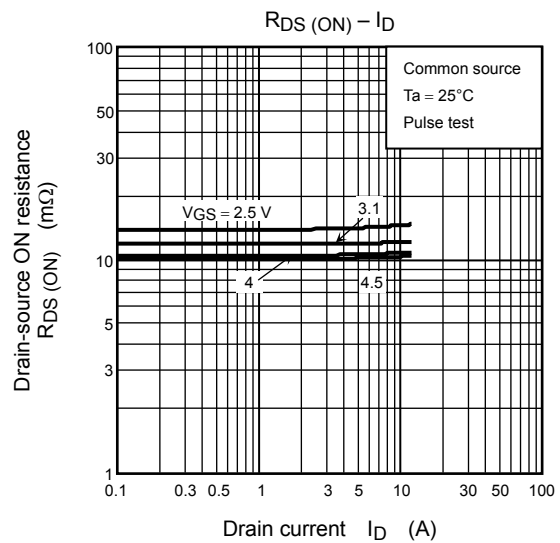
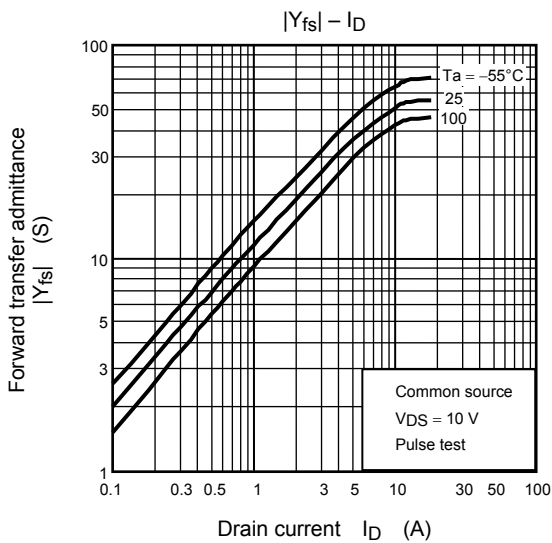
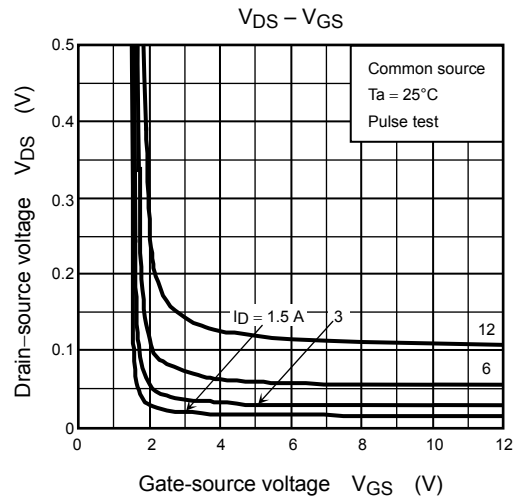
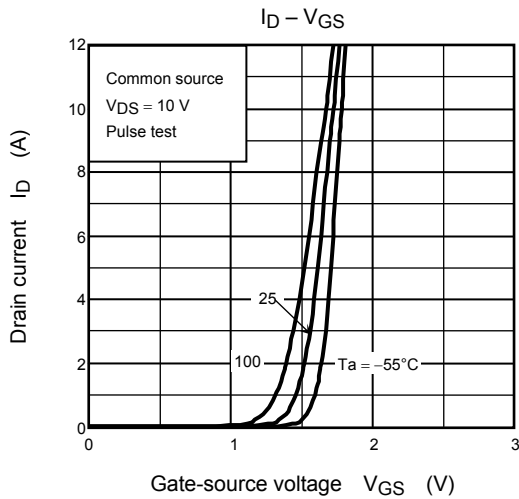
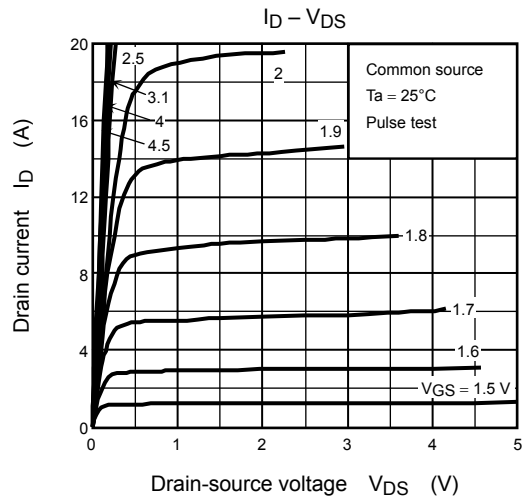
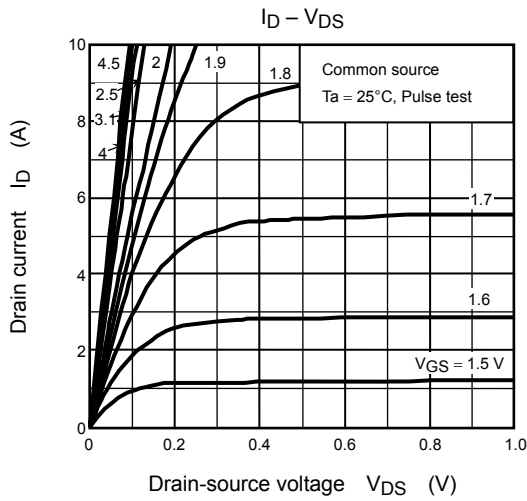


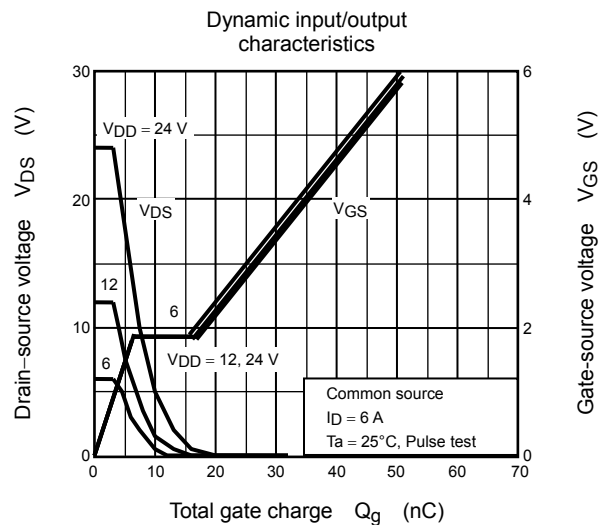
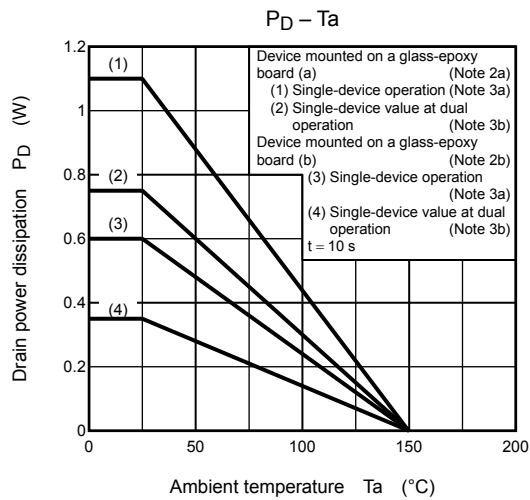
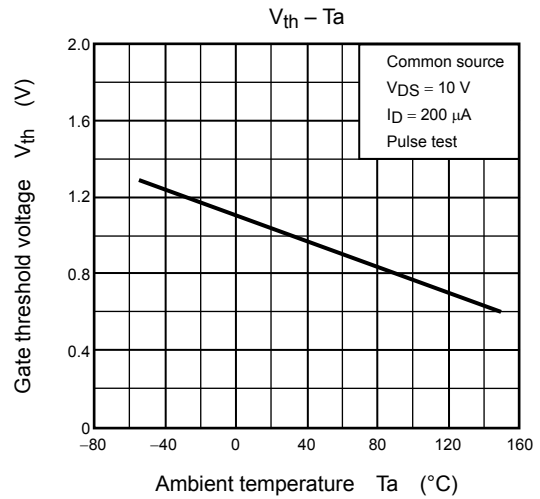
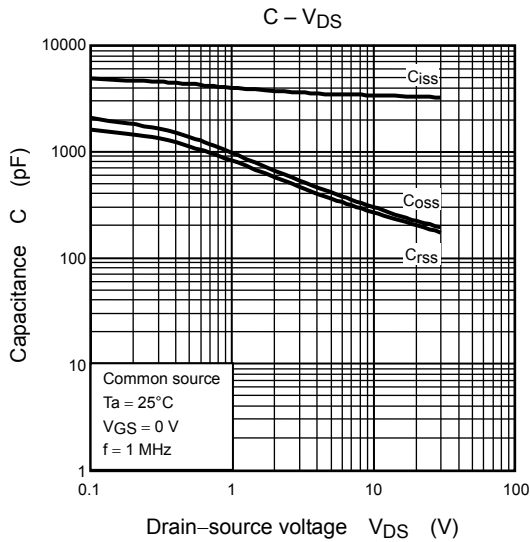
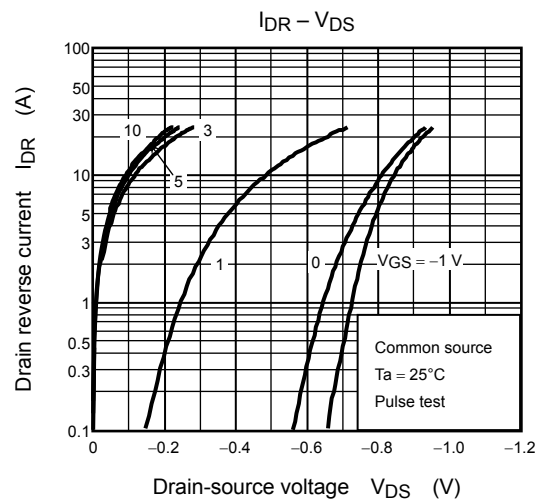
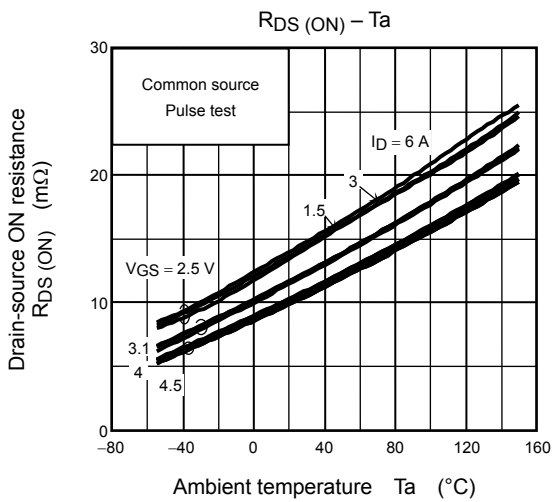
Electrical Characteristics (Ta = 25°C)

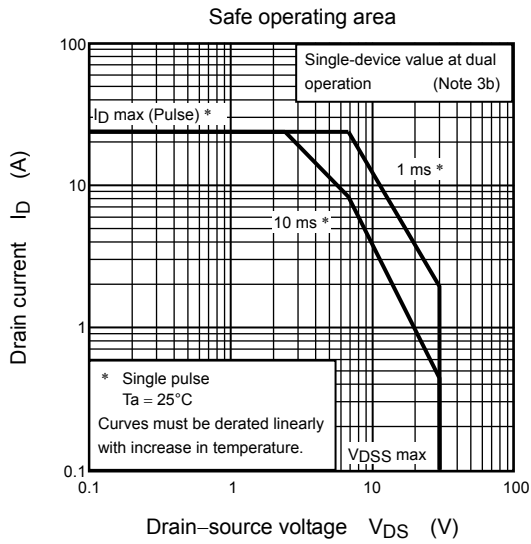
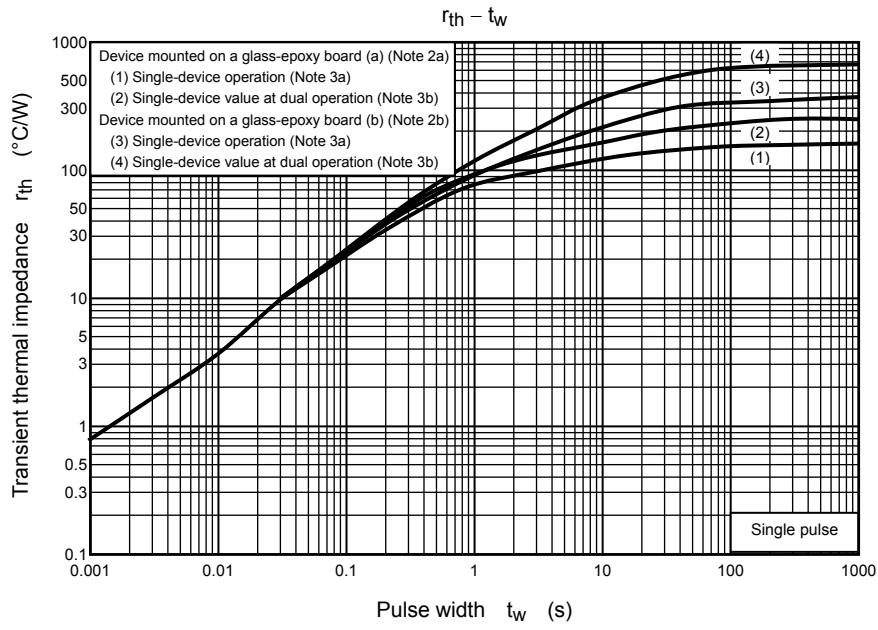
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 10\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cut-OFF current		I_{DSS}	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	30	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -12\text{ V}$	15	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 200\ \mu\text{A}$	0.5	—	1.4	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 2.5\text{ V}, I_D = 4.2\text{ A}$	—	12.5	18.5	m Ω
			$V_{GS} = 4.0\text{ V}, I_D = 4.8\text{ A}$	—	11	13.5	
			$V_{GS} = 4.5\text{ V}, I_D = 4.8\text{ A}$	—	10.5	13	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 3.0\text{ A}$	5	10	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	3240	—	pF
Reverse transfer capacitance		C_{rss}		—	285	—	
Output capacitance		C_{oss}		—	315	—	
Switching time	Rise time	t_r		—	21	—	ns
	Turn-ON time	t_{on}		—	33	—	
	Fall time	t_f		—	15	—	
	Turn-OFF time	t_{off}		—	66	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 24\text{ V}, V_{GS} = 5\text{ V}, I_D = 6\text{ A}$	—	42	—	nC
Gate-source charge 1		Q_{gs1}		—	7	—	
Gate-drain ("miller") charge		Q_{gd}		—	14	—	

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}	$I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V







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