

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

# TPCP8204

Portable Equipment Applications  
Motor Drive Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance:  $R_{DS(ON)} = 38\text{ m}\Omega$  (typ.)  
( $V_{GS}=10\text{V}$ )
- High forward transfer admittance:  $|Y_{fs}| = 8\text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10\text{ }\mu\text{A}$  ( $V_{DS} = 30\text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3\text{ to }2.5\text{ V}$  ( $V_{DS} = 10\text{ V}$ ,  $I_D = 1\text{ mA}$ )

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

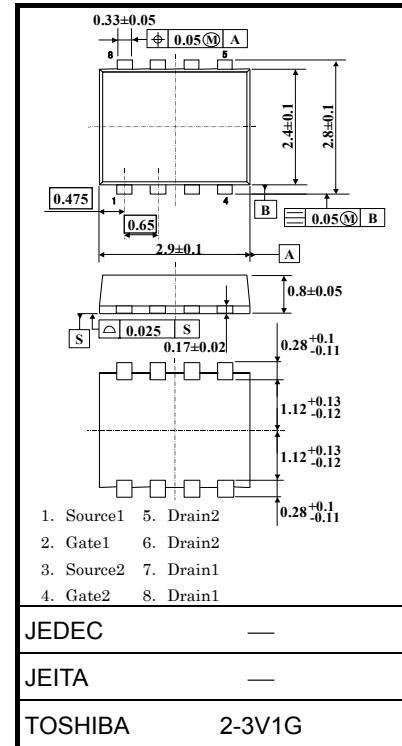
Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	30	V
Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )		$V_{DGR}$	30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	4.2	A
	Pulse (Note 1)	$I_{DP}$	16.8	
Drain power dissipation ( $t = 5\text{ s}$ ) (Note 2a)	Single-device operation (Note 3a)	$P_D$ (1)	1.48	W
	Single-device value at dual operation (Note 3b)	$P_D$ (2)	1.23	
Drain power dissipation ( $t = 5\text{ s}$ ) (Note 2b)	Single-device operation (Note 3a)	$P_D$ (1)	0.58	
	Single-device value at dual operation (Note 3b)	$P_D$ (2)	0.36	
Single pulse avalanche energy (Note 4)		$E_{AS}$	2.86	mJ
Avalanche current		$I_{AR}$	2.1	A
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		$E_{AR}$	0.009	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55~150	$^\circ\text{C}$

Note: For Notes 1 to 6, refer to 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).

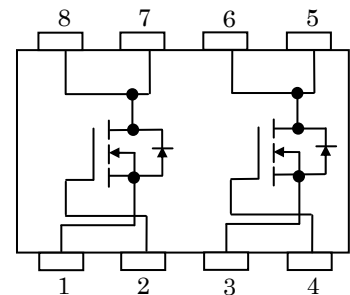
This transistor is an electrostatic-sensitive device. Handle with caution.

Unit: mm

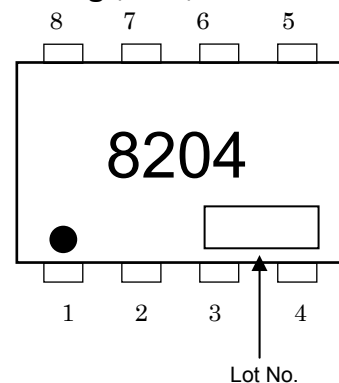


Weight: 0.017 g (typ.)

## Circuit Configuration



## Marking (Note 6)

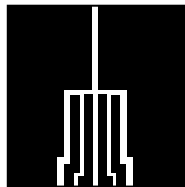


## Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 s) (Note 2a)	Single-device operation (Note 3a)	R <sub>th (ch-a)</sub> (1)	84.5	°C/W
	Single-device value at dual operation (Note 3b)	R <sub>th (ch-a)</sub> (2)	101.6	
Thermal resistance, channel to ambient (t = 5 s) (Note 2b)	Single-device operation (Note 3a)	R <sub>th (ch-a)</sub> (1)	215.5	°C/W
	Single-device value at dual operation (Note 3b)	R <sub>th (ch-a)</sub> (2)	347.2	

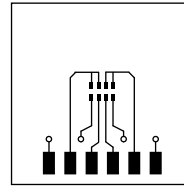
Note 1: The channel temperature should not exceed 150°C during use.

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 shown are for a single device. (During single-device operation, power is only applied to one device.)

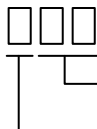
b) The power dissipation and thermal resistance values shown are for a single device. (During dual operation, power is evenly applied to both devices.)

Note 4: V<sub>DD</sub> = 24 V, T<sub>ch</sub> = 25°C (initial), L = 0.5 mH, R<sub>G</sub> = 25 Ω, I<sub>AR</sub> = 2.1 A

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

Note 6: ● on the lower left of the marking indicates Pin 1.

※ Weekly code (3 digits):



Week of manufacture

(01 for the first week of the year, continuing up to 52 or 53)

Year of manufacture

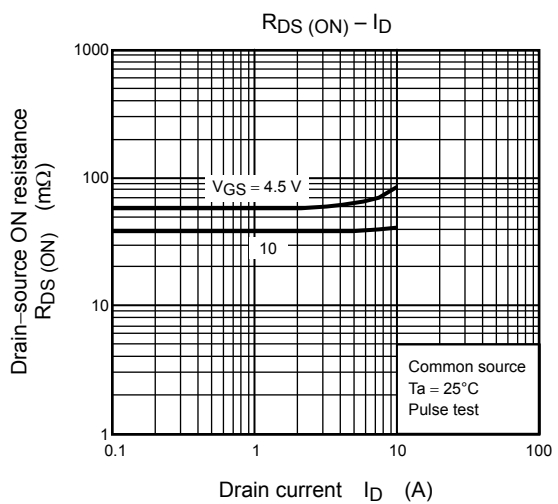
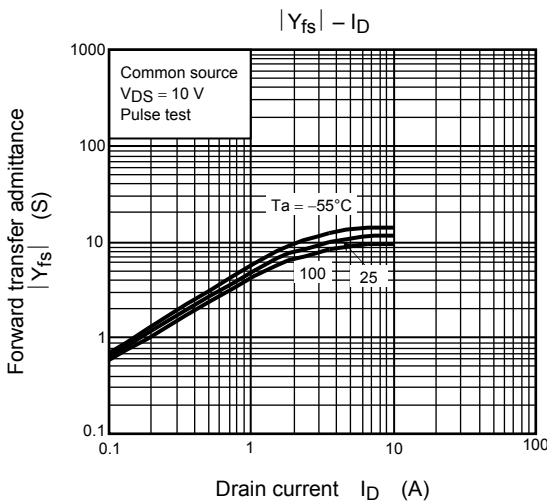
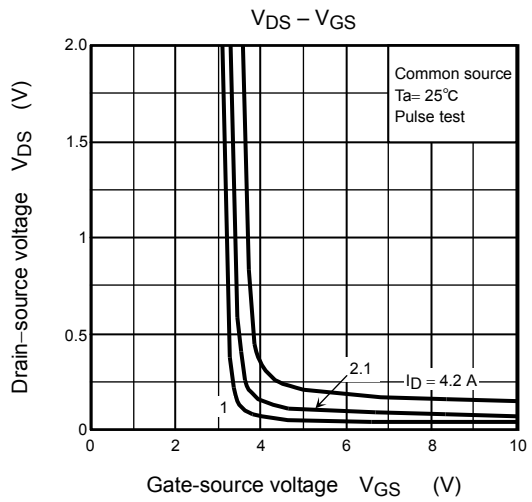
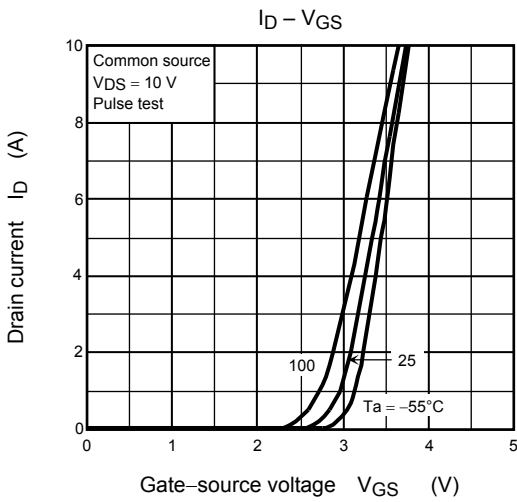
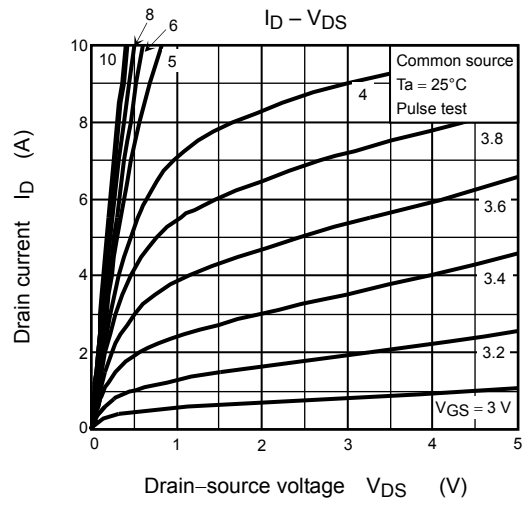
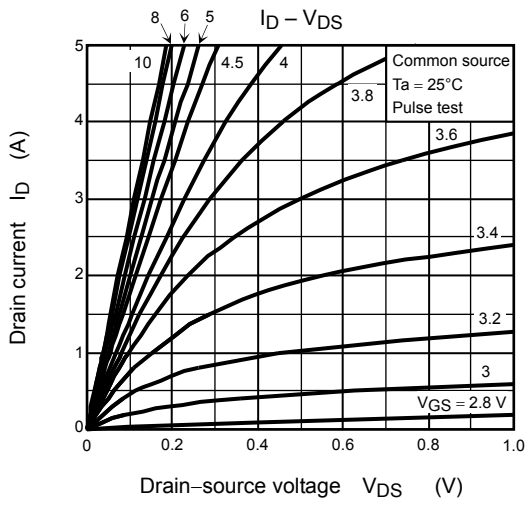
(The last digit of the calendar year)

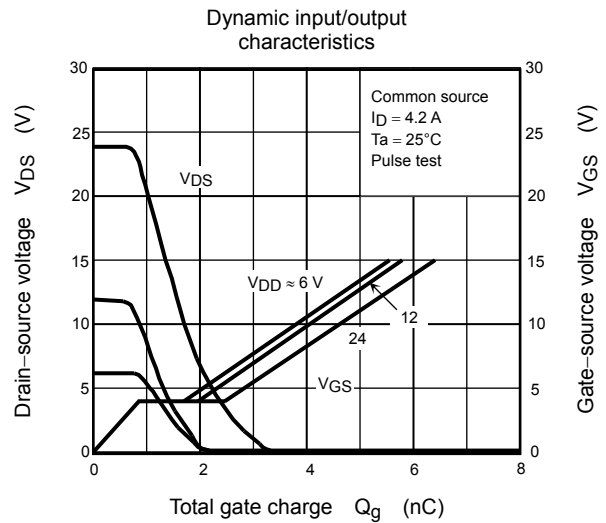
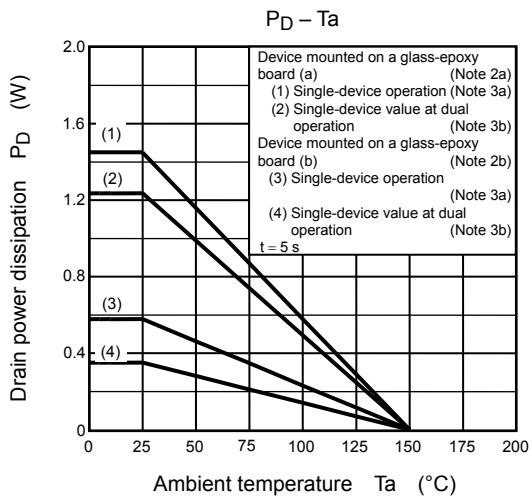
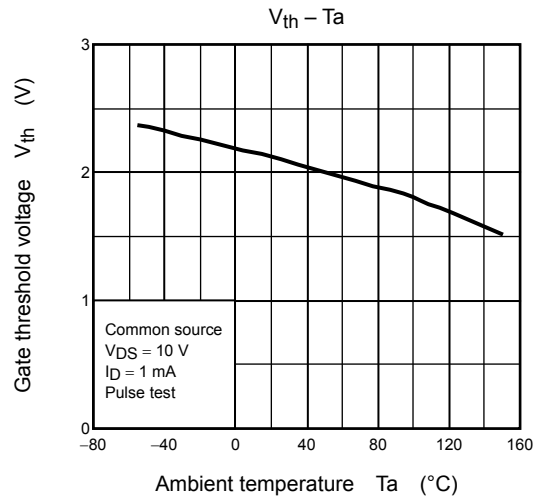
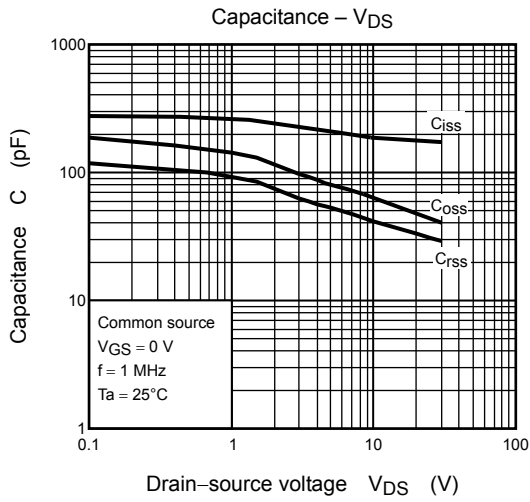
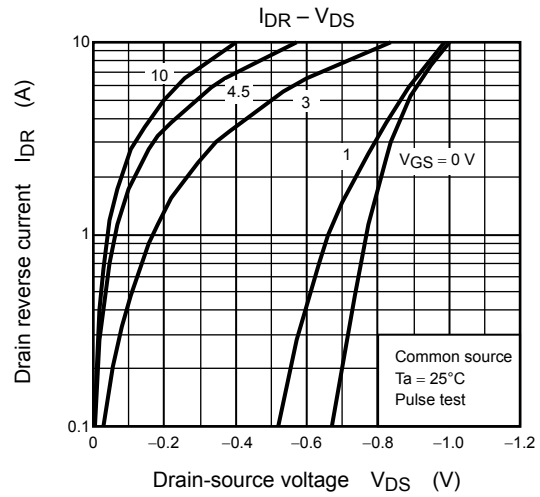
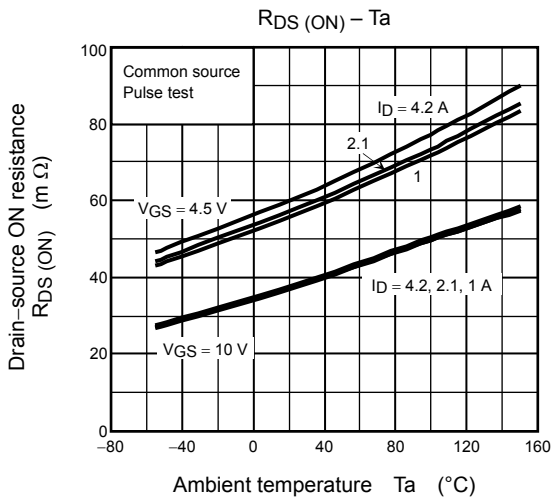
## Electrical Characteristics (Ta = 25°C)

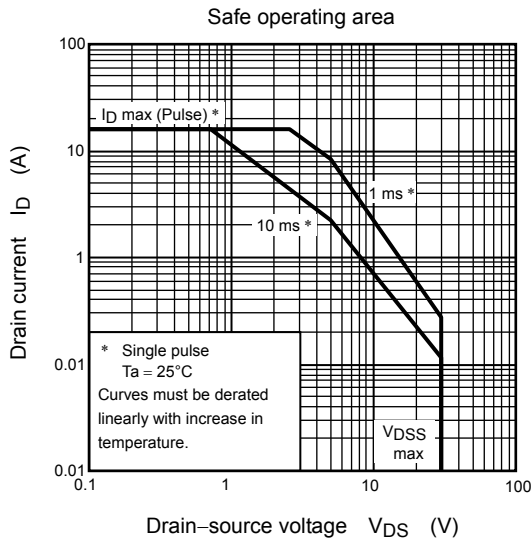
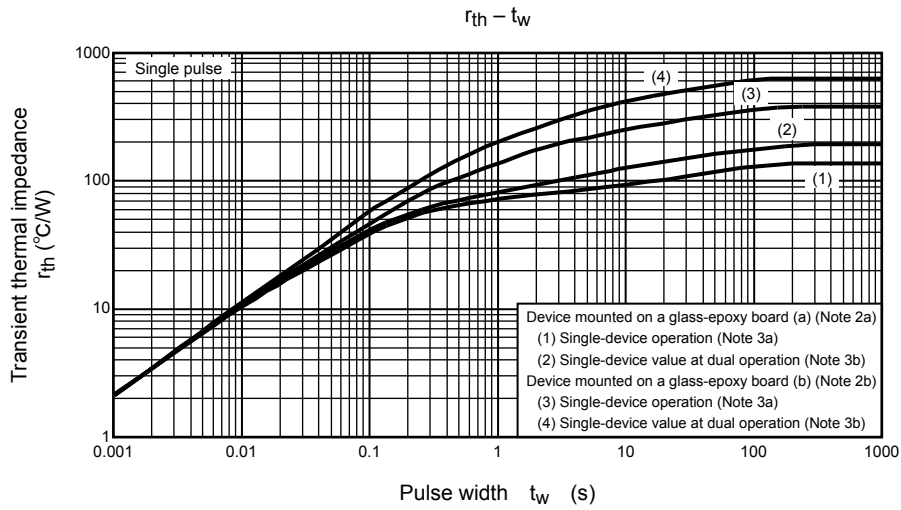
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 100$	nA
Drain cut-off current		$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	30	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	10	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.3	—	2.5	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 2.1\text{ A}$	—	58	77	m $\Omega$
			$V_{GS} = 10\text{ V}, I_D = 2.1\text{ A}$	—	38	50	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2.1\text{ A}$	4	8	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	190	—	pF
Reverse transfer capacitance		$C_{rss}$		—	45	—	
Output capacitance		$C_{oss}$		—	65	—	
Switching time	Rise time	$t_r$	<p><math>V_{GS}</math> 10 V, 0 V  <math>I_D = 2.1\text{ A}</math>  <math>R_L = 7.14\Omega</math>  <math>V_{DD} \approx 15\text{ V}</math></p>	—	4.5	—	ns
	Turn-on time	$t_{on}$		—	9.0	—	
	Fall time	$t_f$		—	3.0	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	12.0	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 4.2\text{ A}$	—	4.6	—	nC
Gate-source charge 1		$Q_{gs1}$		—	0.7	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	1.4	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	16.8	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 4.2\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V







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