

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

# TPCM8004-H

High-Efficiency DC-DC Converter Applications

Notebook PC Applications

Portable Equipment Applications

Unit: mm

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 5.0 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 7.3 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 60 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.5 \text{ to } 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

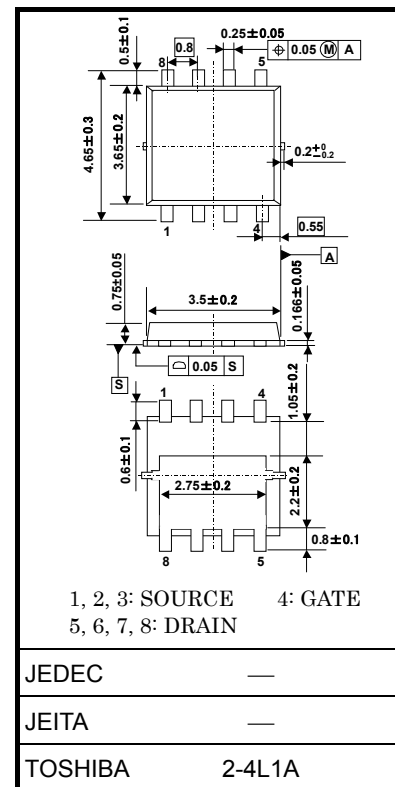
## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristic		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)	$I_D$	24	A
	Pulsed (Note 1)	$I_{DP}$	72	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	30	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)		$P_D$	2.3	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)		$P_D$	1.0	W
Single-pulse avalanche energy (Note 3)		$E_{AS}$	75	mJ
Avalanche current		$I_{AR}$	24	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	3.0	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ\text{C}$

Note: For Notes 1 to 4, refer to the next page.

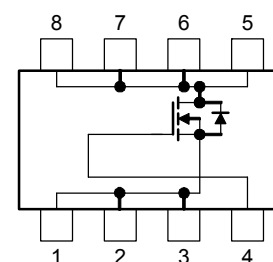
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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



Weight: 0.028 g (typ.)

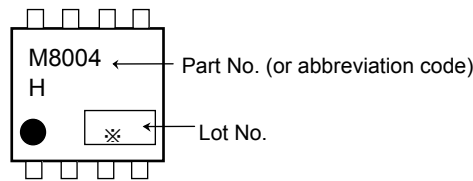
## Circuit Configuration



Thermal Characteristics

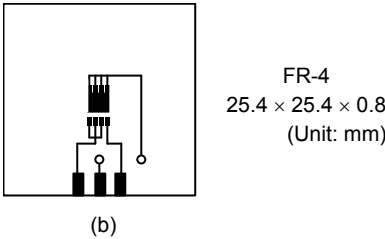
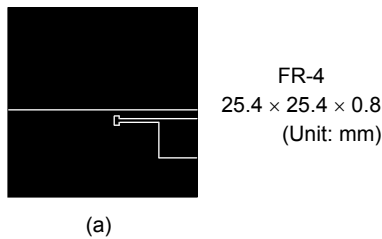
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case ( $T_c = 25^{\circ}\text{C}$ )	$R_{th\ (ch-c)}$	4.17	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\ \text{s}$ ) (Note 2a)	$R_{th\ (ch-a)}$	55	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\ \text{s}$ ) (Note 2b)	$R_{th\ (ch-a)}$	125	$^{\circ}\text{C/W}$

Marking (Note 5)



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

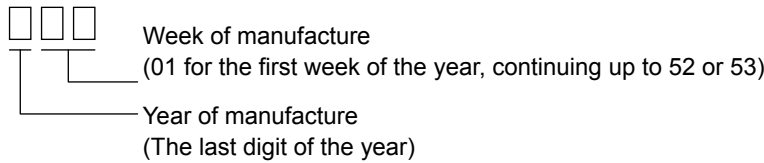
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



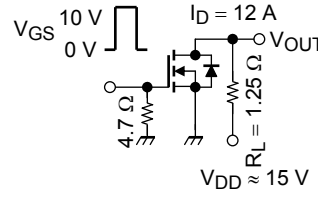
Note 3:  $V_{DD} = 24\ \text{V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 100\ \mu\text{H}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 24\ \text{A}$

Note 4: Repetitive rating: pulse width limited by maximum channel temperature

Note 5: \* Weekly code: (Three digits)

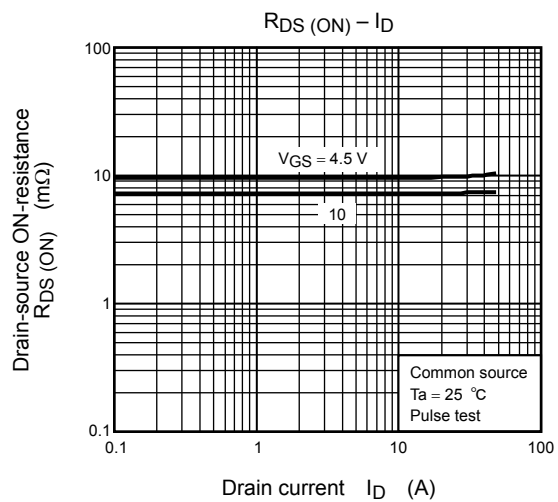
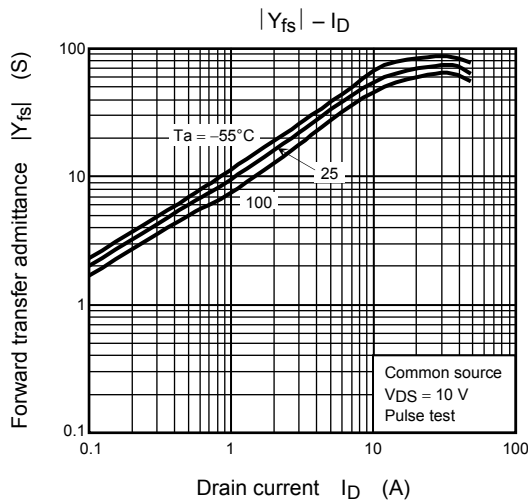
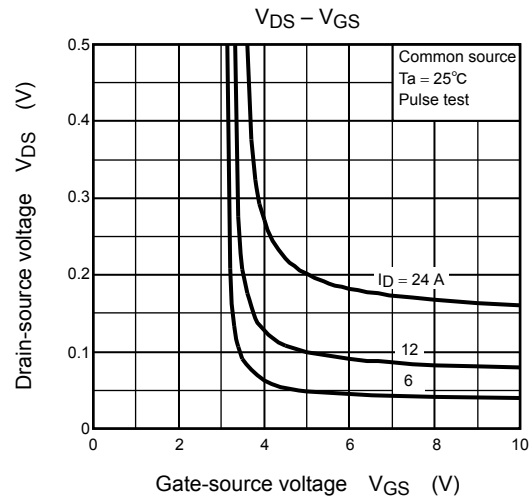
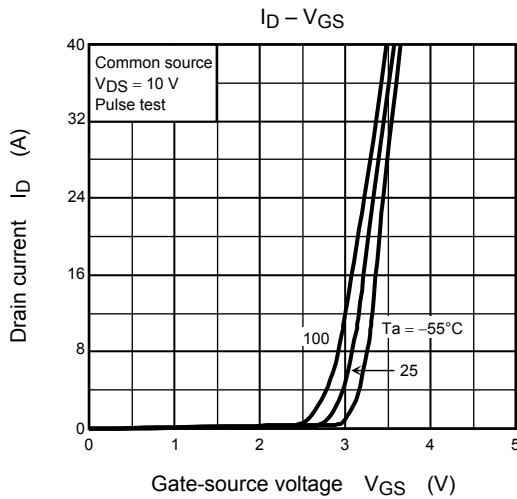
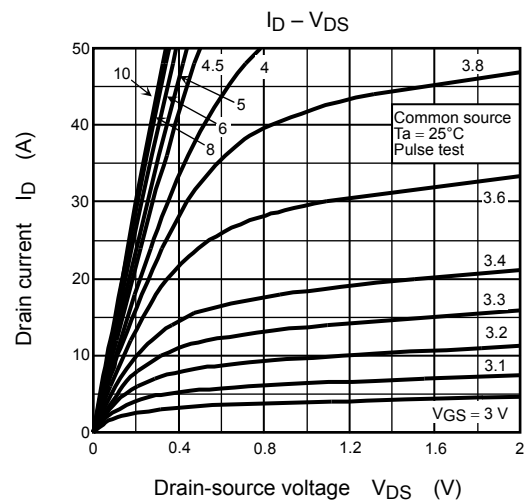
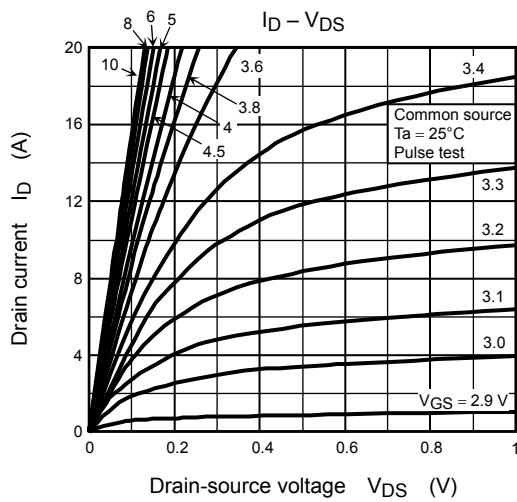


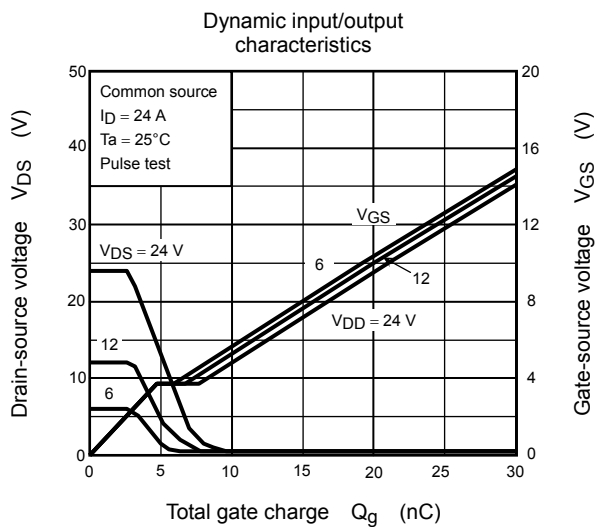
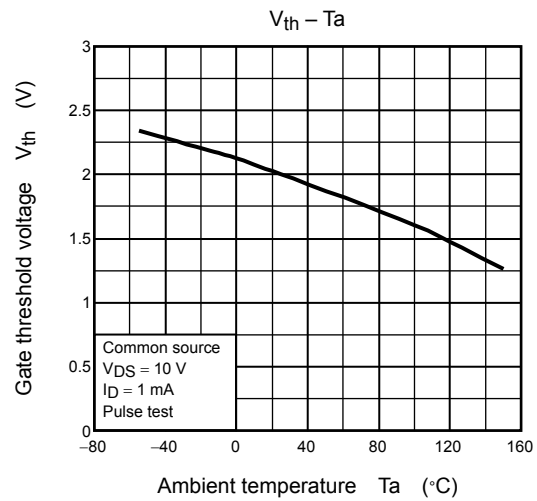
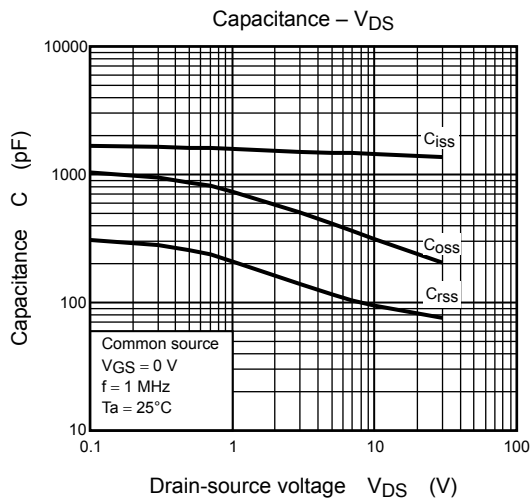
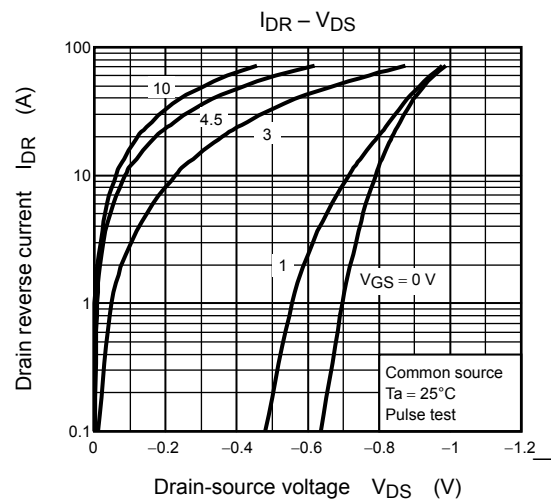
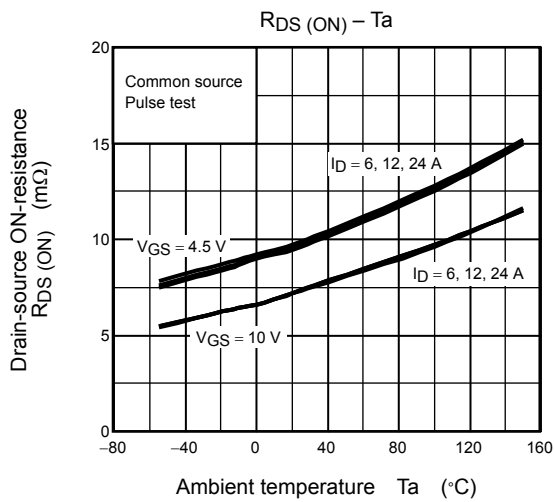
**Electrical Characteristics (Ta = 25°C)**

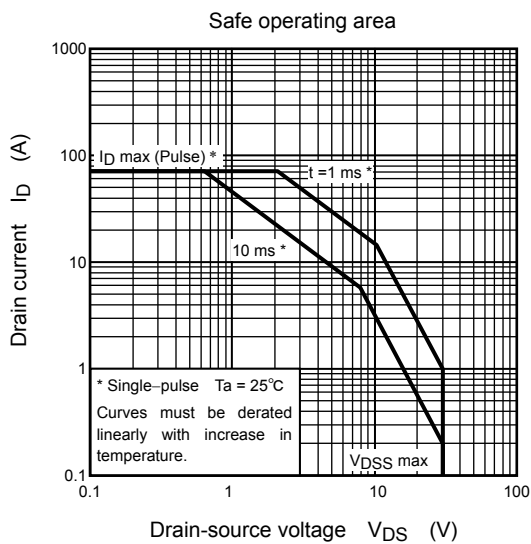
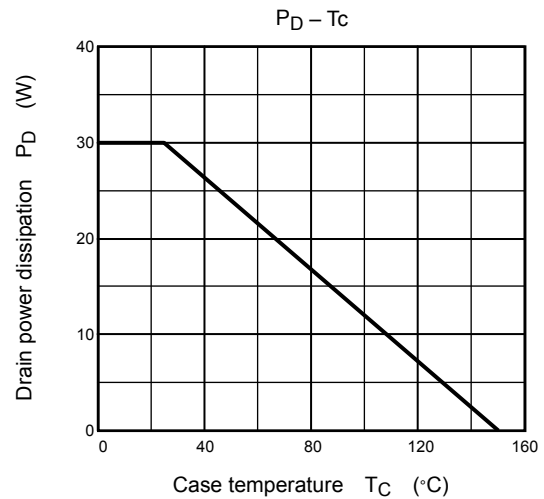
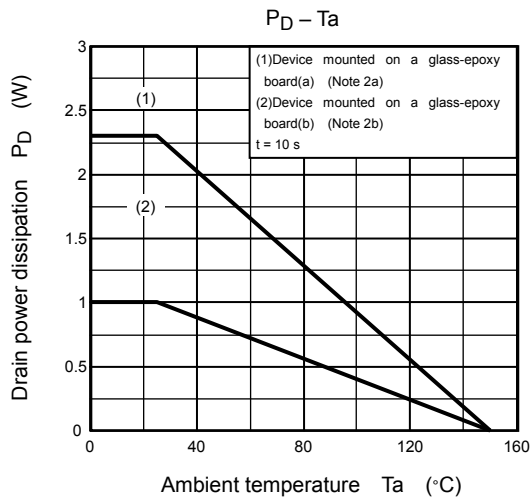
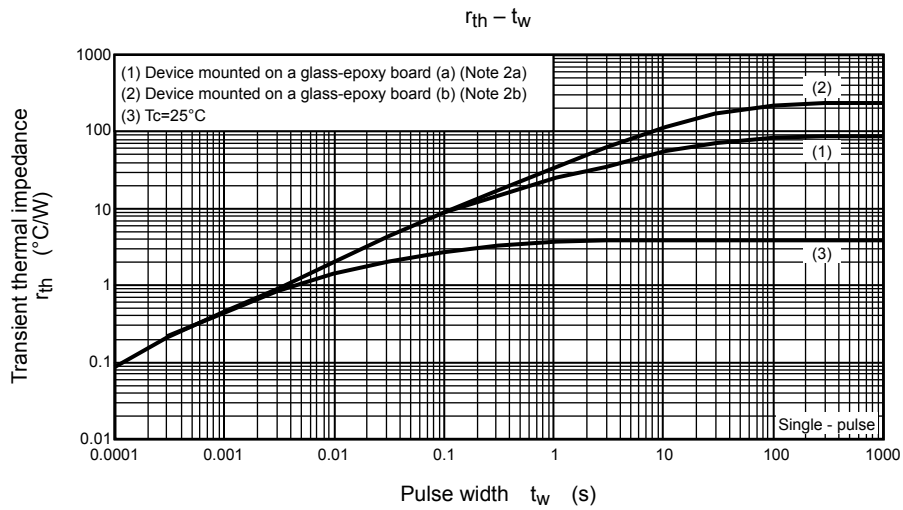
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	—	—	±100	nA
Drain cutoff current		I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage		V <sub>(BR)</sub> DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	30	—	—	V
		V <sub>(BR)</sub> DSX	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = −20 V	15	—	—	
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.5	—	2.5	V
Drain-source ON-resistance		R <sub>DS</sub> (ON)	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 12 A	—	9.6	13.4	mΩ
			V <sub>GS</sub> = 10 V, I <sub>D</sub> = 12 A	—	7.3	11.0	
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 12 A	30	60	—	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	1433	2150	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	83	125	
Output capacitance		C <sub>oss</sub>		—	303	—	
Gate resistance		R <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 5 MHz	—	1.0	1.5	Ω
Switching time	Rise time	t <sub>r</sub>	 <p>Duty ≤ 1%, t<sub>w</sub> = 10 μs</p>	—	2.8	—	ns
	Turn-on time	t <sub>on</sub>		—	9.3	—	
	Fall time	t <sub>f</sub>		—	3.4	—	
	Turn-off time	t <sub>off</sub>		—	21	—	
Total gate charge (gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 24 A	—	21	—	nC
			V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 24 A	—	11	—	
Gate-source charge 1		Q <sub>gs1</sub>	V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 24 A	—	4.7	—	
Gate-drain (“Miller”) charge		Q <sub>gd</sub>		—	3.0	—	
Gate switch charge		Q <sub>SW</sub>		—	5.0	—	

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	72	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 24 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V







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