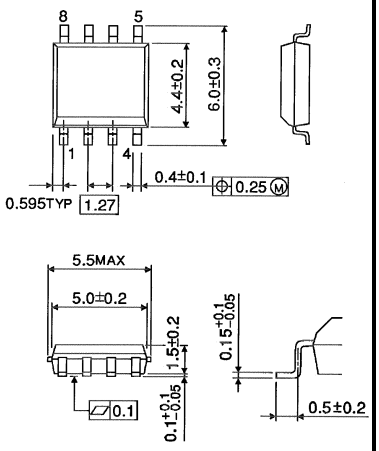
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (High Speed U−MOS)

TPC8005−H

High Speed and High Efficiency DC−DC Converters
Lithium Ion Battery Applications
Portable Equipment Applications
Notebook PC Applications

- Small footprint due to small and thin package
- High speed switching : 60% speed up (compare with current type)
- Small gate charge : Qg = 20 nC (typ.)
- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 13 mΩ (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 16 S (typ.)
- Low leakage current : I_{DSS} = 10 μA (max) (V_{DS} = 30 V)
- Enhancement−mode : V_{th} = 1.3~2.5 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



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

JEDEC	—
JEITA	—
TOSHIBA	2-6J1B

Weight: 0.080 g (typ.)

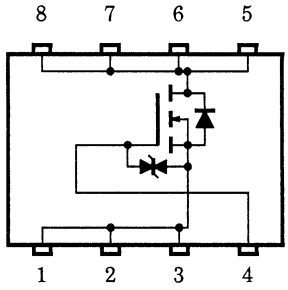
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	11	A
	Pulse (Note 1)	I_{DP}	44	
Drain power dissipation (t = 10 s) (Note 2a)		P_D	2.4	W
Drain power dissipation (t = 10 s) (Note 2b)		P_D	1.0	W
Single pulse avalanche energy (Note 3)		E_{AS}	157	mJ
Avalanche current		I_{AR}	11	A
Repetitive avalanche energy (Note 2a) (Note 4)		E_{AR}	0.24	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

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

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

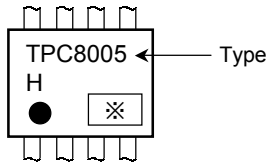
Circuit Configuration



Thermal Characteristics

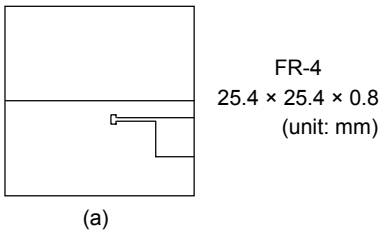
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th\ (ch\text{-}a)}$	52.1	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th\ (ch\text{-}a)}$	125	°C/W

Marking (Note 5)

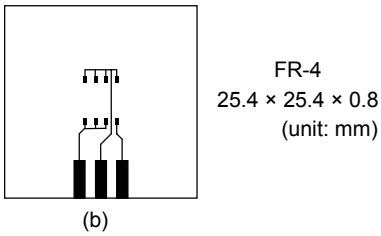


Note 1: Please use devices on condition that the channel temperature is below 150°C.

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



(a)



(b)

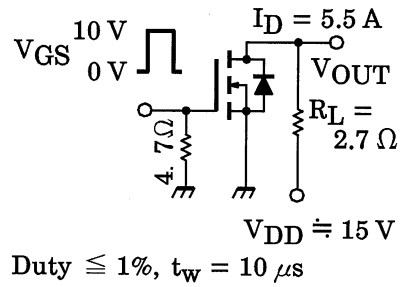
Note 3: V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = 11 A

Note 4: Reptitve rating; pulse width limited by maximum channel temperature

Note 5: ● on lower left of the marking indicates Pin 1.

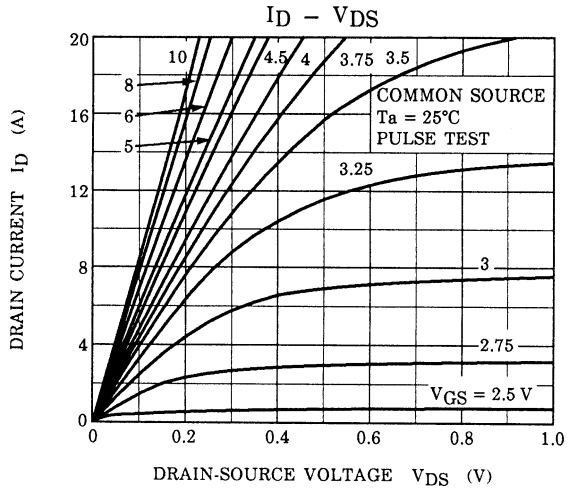
※ shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

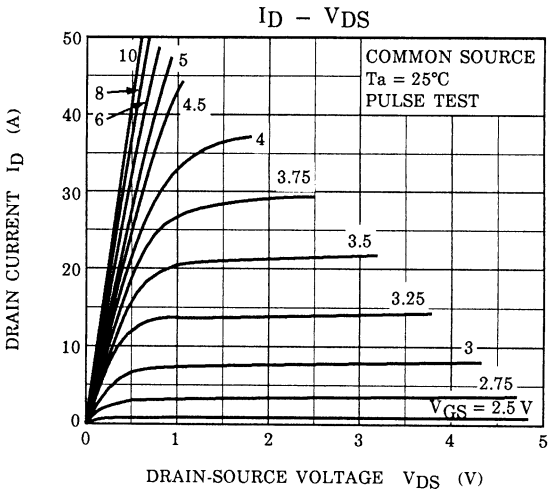
Electrical Characteristics (Ta = 25°C)

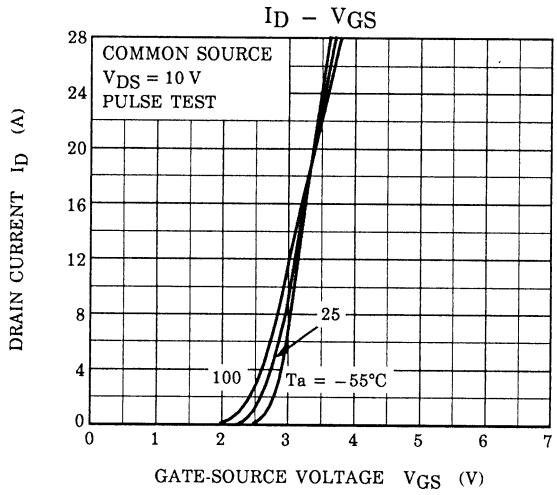
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut−off current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	—	—	10	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	30	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −20 V	15	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.3	—	2.5	V
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 4.5 V, I_D = 5.5 A	—	23	27	mΩ
		$R_{DS\ (ON)}$	V_{GS} = 10 V, I_D = 5.5 A	—	13	16	mΩ
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 5.5 A	8	16	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1150	—	pF
Reverse transfer capacitance		C_{rss}		—	140	—	
Output capacitance		C_{oss}		—	400	—	
Switching time	Rise time	t_r		—	4	—	ns
	Turn−on time	t_{on}		—	12	—	
	Fall time	t_f		—	8	—	
	Turn−off time	t_{off}		—	40	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ 24 V, V_{GS} = 10 V, I_D = 11 A	—	20	—	nC
Gate−source charge		Q_{gs}		—	15	—	
Gate−drain (“miller”) charge		Q_{gd}		—	5	—	

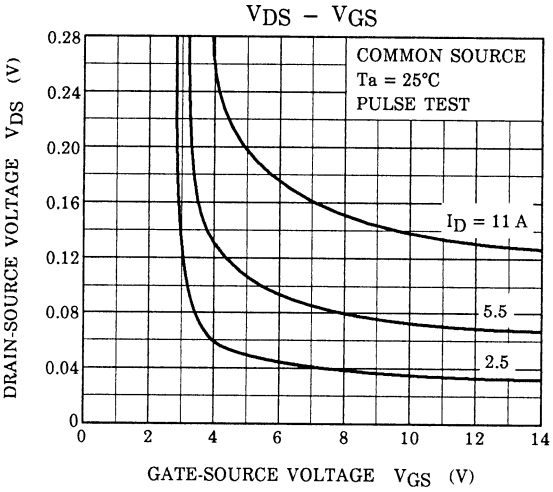
Source−Drain Ratings and Characteristics (Ta = 25°C)

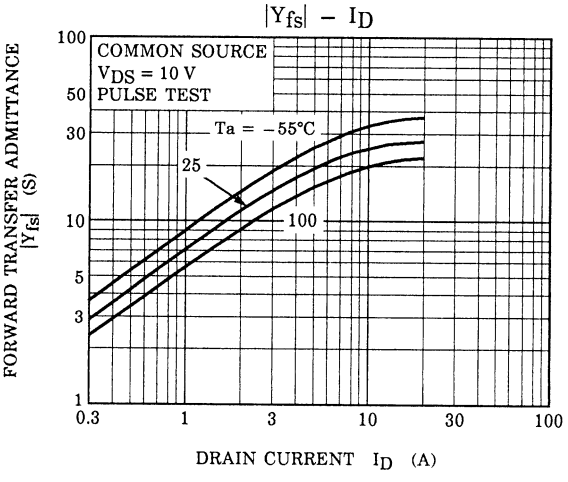
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	44	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 11 A, V_{GS} = 0 V	—	—	−1.2	V

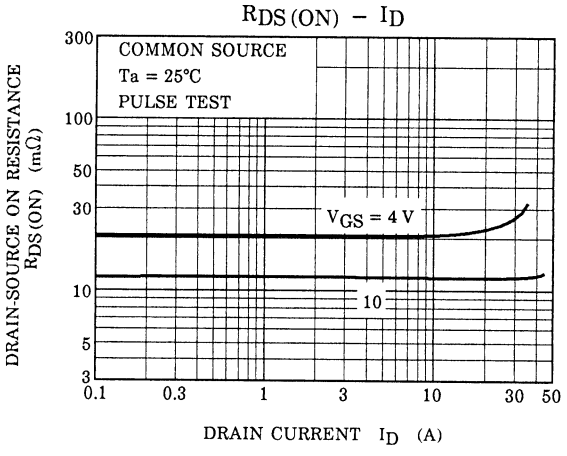

I_D – V_{DS}
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
10
8
6
5
4.5
4
3.75
3.5
3.25
3
2.75
V_{GS} = 2.5 V


I_D – V_{DS}
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
10
8
6
5
4.5
4
3.75
3.5
3.25
3
2.75
V_{GS} = 2.5 V

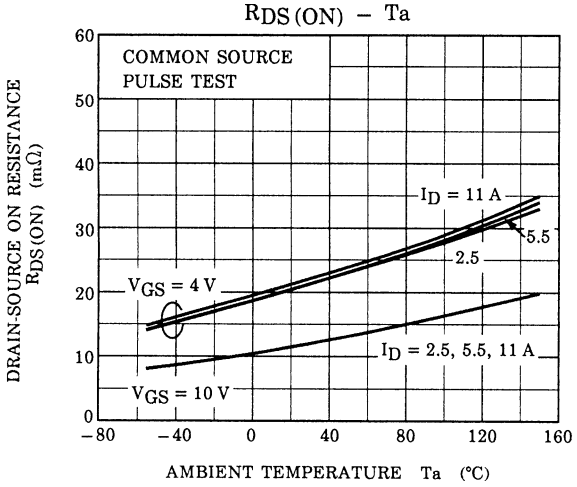

I_D – V_{GS}
DRAIN CURRENT I_D (A)
GATE-SOURCE VOLTAGE V_{GS} (V)
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
25
100
Ta = −55°C


V_{DS} – V_{GS}
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
I_D = 11 A
5.5
2.5

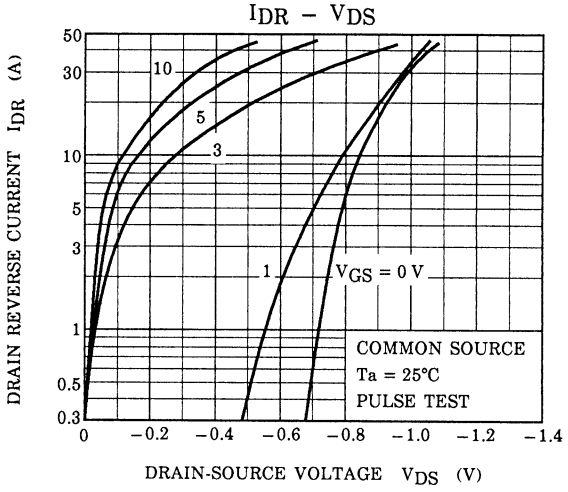

$|Y_{fs}|$ – I_D
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT I_D (A)
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
Ta = −55°C
25
100


$R_{DS\,(ON)}$ – I_D
DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (mΩ)
DRAIN CURRENT I_D (A)
COMMON SOURCE
Ta = 25°C
PULSE TEST
V_{GS} = 4 V
10

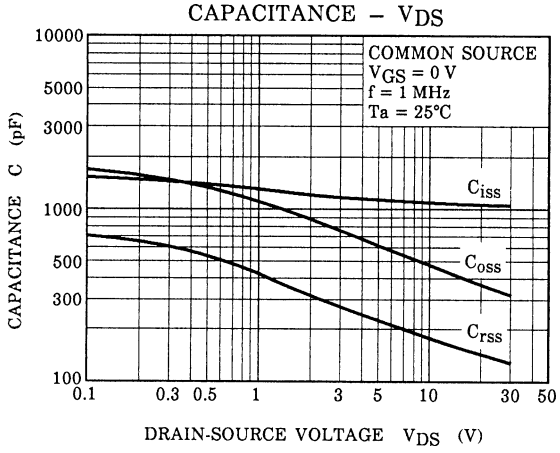
$R_{DS(ON)}$ – Ta



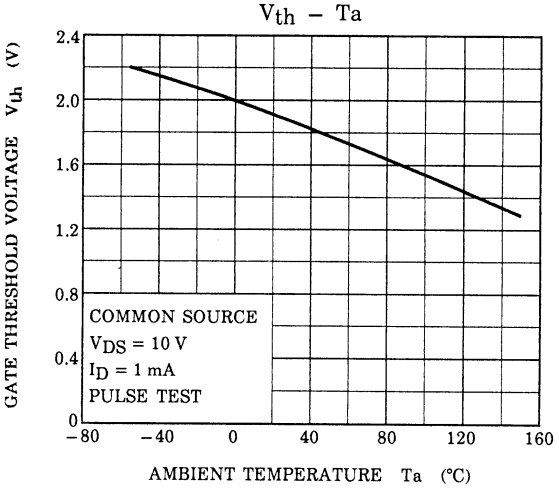
I_{DR} – V_{DS}



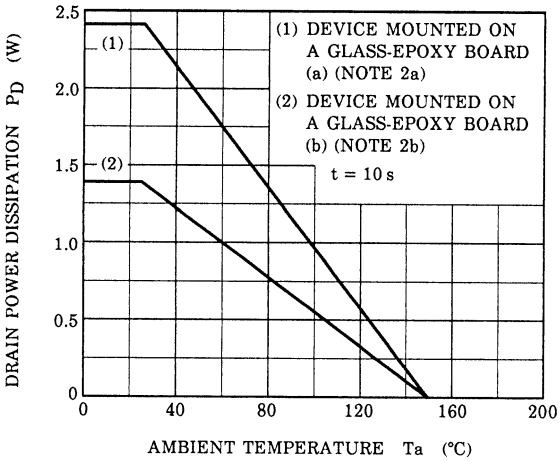
CAPACITANCE – V_{DS}



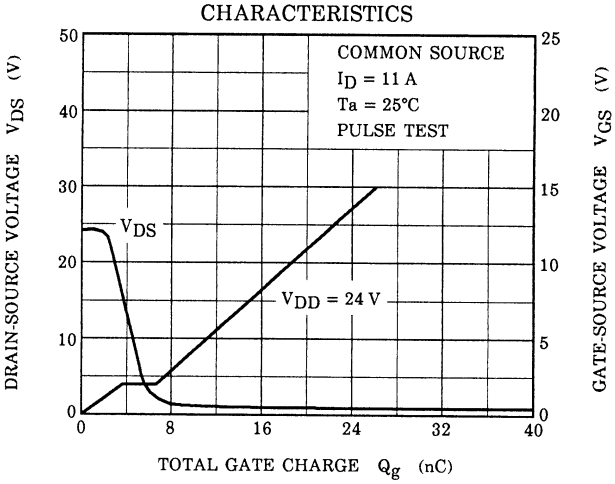
V_{th} – Ta



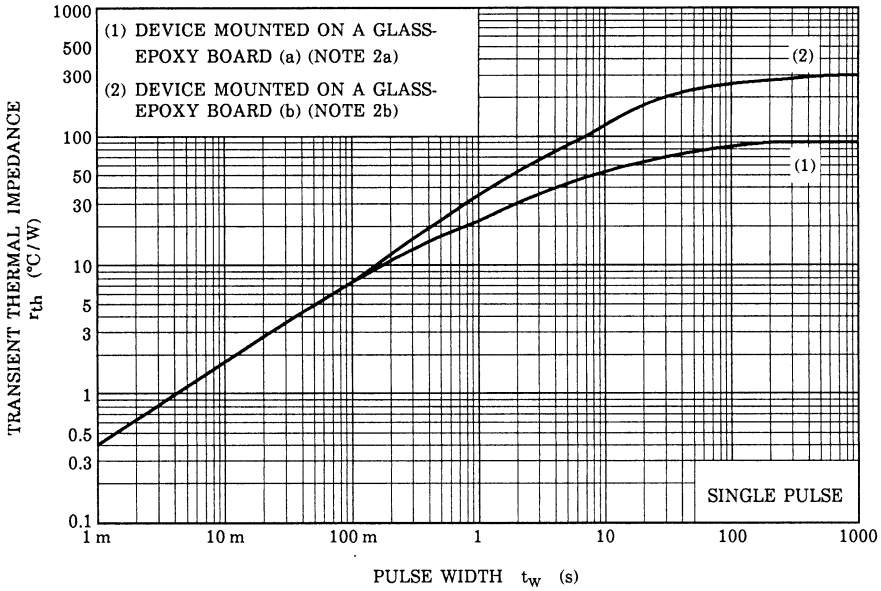
P_D – Ta



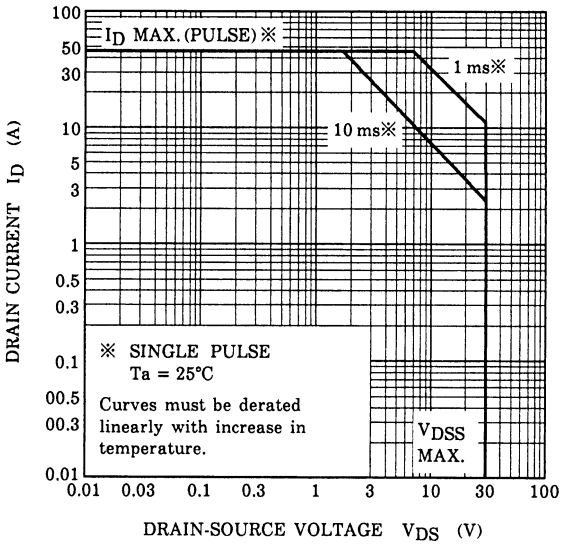
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



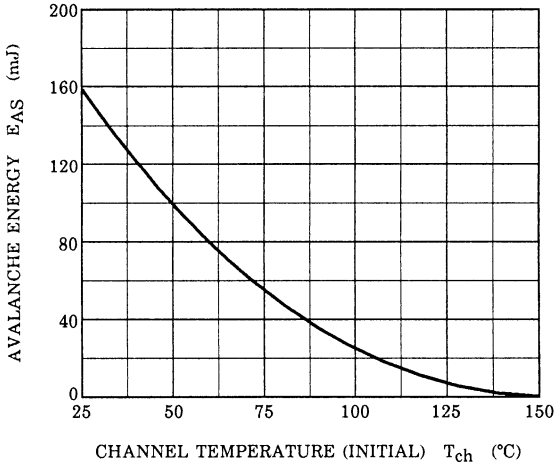
r_{th} – t_w

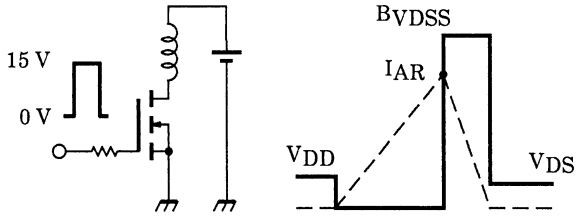


SAFE OPERATING AREA



E_{AS} – T_{ch}





TEST CIRCUIT WAVE FORM

T_{ch} = 25°C (Initial)
Peak I_{AR} = 11 A, R_G = 25 Ω
V_{DD} = 24 V, L = 1.0 mH

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}}\right)$$

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000707EAA

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