TOSHIBA Field Effect Transistor Silicon P-Channel MOS Type (U-MOS III)

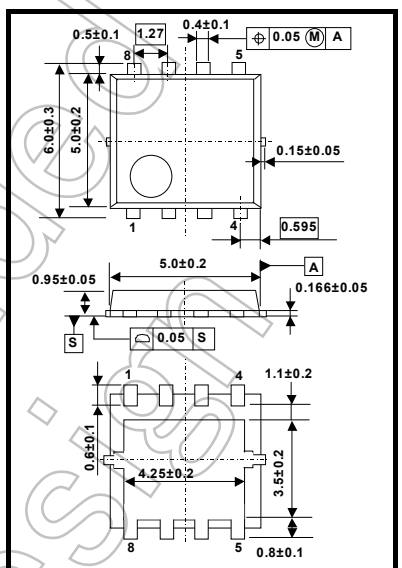
TPCA8104

High-Side Switching Applications

Portable Equipment Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 11 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 50 S (typ.)
- Low leakage current: I_{DSS} = -10 μA (max) (V_{DS} = -60 V)
- Enhancement mode: V_{th} = -0.8 to -2.0 V (V_{DS} = -10 V, I_D = -1 mA)

Unit: mm



1, 2, 3: Source 4: Gate
5, 6, 7, 8: Drain

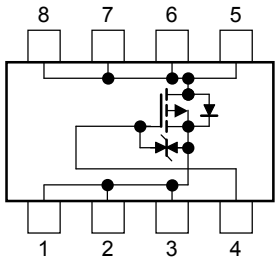
JEDEC	—
JEITA	—
TOSHIBA	2-5Q1A

Weight: 0.080 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	-60	V
Drain-gate voltage (R_{GS} = 20 kΩ)			V_{DGR}	-60	V
Gate-source voltage			V_{GSS}	±20	V
Drain current	DC	(Note 1)	I_D	-40	A
	Pulse	(Note 1)	I_{DP}	-120	
Drain power dissipation (Tc = 25°C)			P_D	45	W
Drain power dissipation (t = 10 s)		(Note 2a)	P_D	2.8	
Drain power dissipation (t = 10 s)		(Note 2b)	P_D	1.6	
Single-pulse avalanche energy		(Note 3)	E_{AS}	116	mJ
Avalanche current			I_{AR}	-40	A
Repetitive avalanche energy (Tc = 25°C)		(Note 4)	E_{AR}	4.5	mJ
Channel temperature			T_{ch}	150	°C
Storage temperature range			T_{stg}	−55 to 150	°C

Circuit Configuration



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

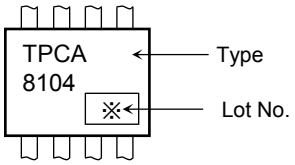
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

Thermal Characteristics

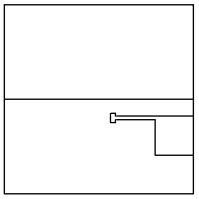
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case (Tc = 25°C)	$R_{th\ (ch\text{-}c)}$	2.78	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th\ (ch\text{-}a)}$	44.6	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th\ (ch\text{-}a)}$	78.1	

Marking (Note 5)



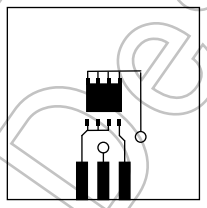
Note 1: The channel temperature should not exceed 150°C during use.

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)



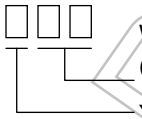
FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(b)

Note 3: V_{DD} = -24 V, T_{ch} = 25°C (initial), L = 0.1 mH, R_G = 25 Ω, I_{AR} = -40 A

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

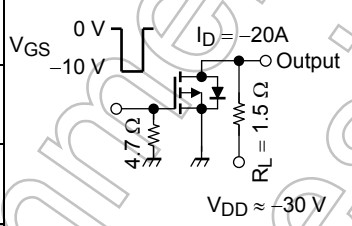
Note 5: * Weekly code (three digits):



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)

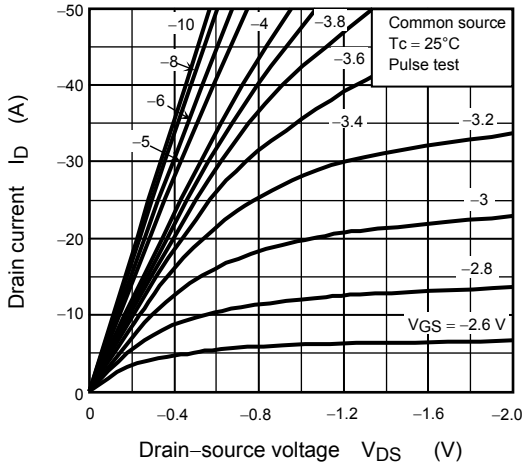
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cutoff current		I_{DSS}	V_{DS} = −60 V, V_{GS} = 0 V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−60	—	—	V
		$V_{(BR)\ DSX}$	I_D = −10 mA, V_{GS} = 20 V	−35	—	—	
Gate threshold voltage		V_{th}	V_{DS} = −10 V, I_D = −1 mA	−0.8	—	−2.0	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	V_{GS} = −4 V, I_D = −20 A	—	17	24	mΩ
			V_{GS} = −10 V, I_D = −20 A	—	11	16	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −20 A	25	50	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	4300	—	pF
Reverse transfer capacitance		C_{rss}		—	450	—	
Output capacitance		C_{oss}		—	600	—	
Switching time	Rise time	t_r		—	10	—	ns
	Turn-on time	t_{on}		—	20	—	
	Fall time	t_f		—	60	—	
	Turn-off time	t_{off}		—	200	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≈ −48 V, V_{GS} = −10 V, I_D = −40 A	—	90	—	nC
Gate-source charge 1		Q_{gs1}		—	16	—	
Gate-drain (“Miller”) charge		Q_{gd}		—	28	—	

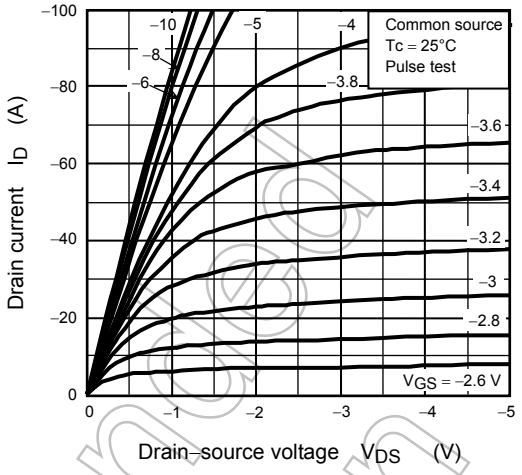
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−120	A
Forward voltage (diode)		V_{DSF}	I_{DR} = −40 A, V_{GS} = 0 V	—	—	1.2	V

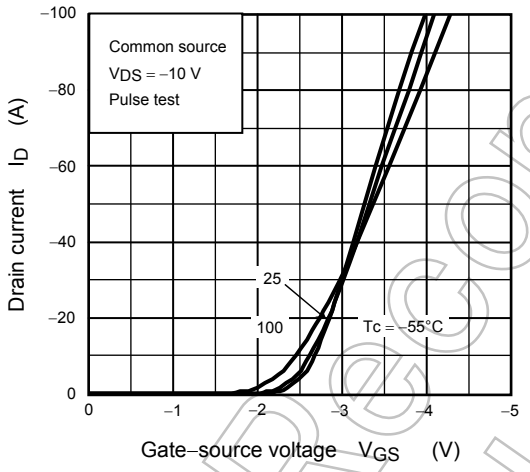
$I_D - V_{DS}$



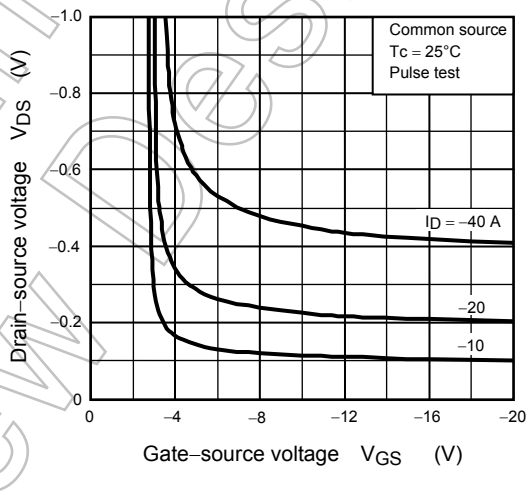
$I_D - V_{DS}$



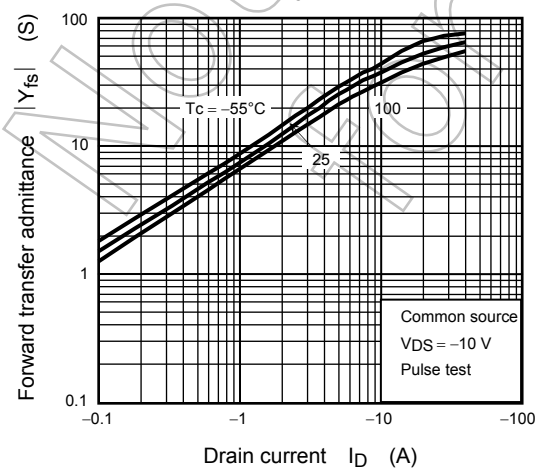
$I_D - V_{GS}$



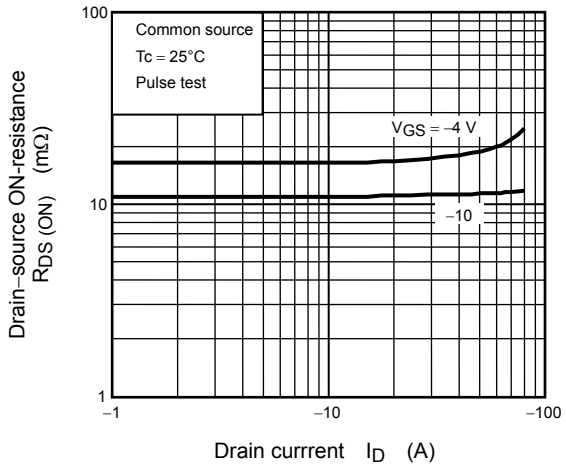
$V_{DS} - V_{GS}$



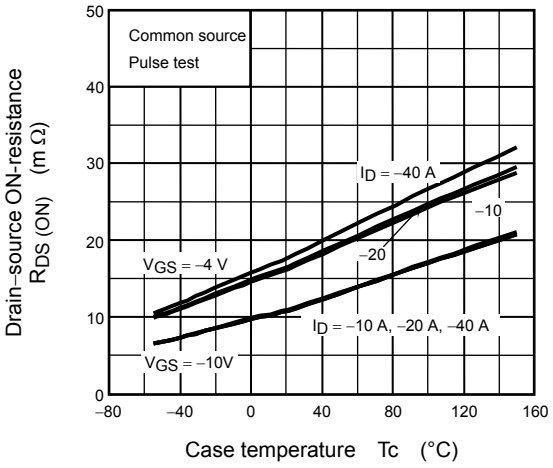
$|Y_{fs}| - I_D$



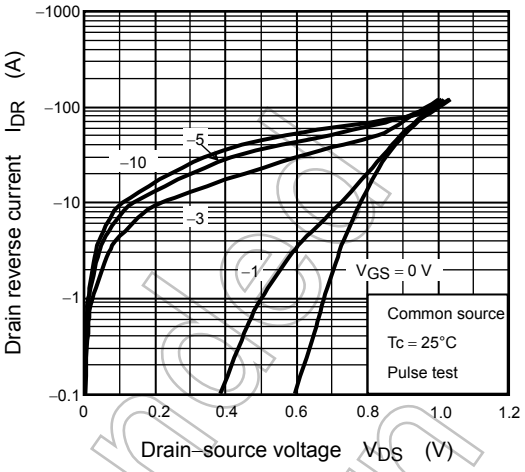
$R_{DS\ (ON)} - I_D$



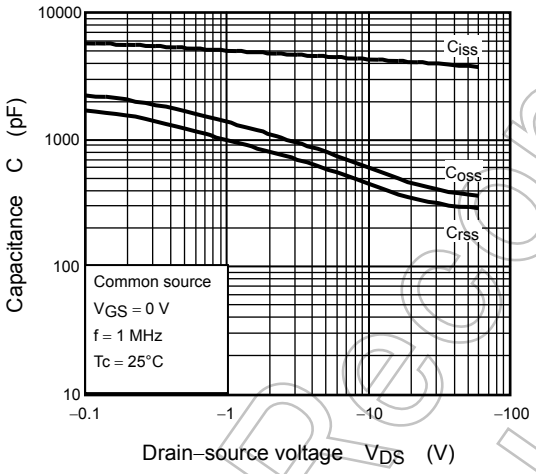
$R_{DS\ (ON)}$ – Tc



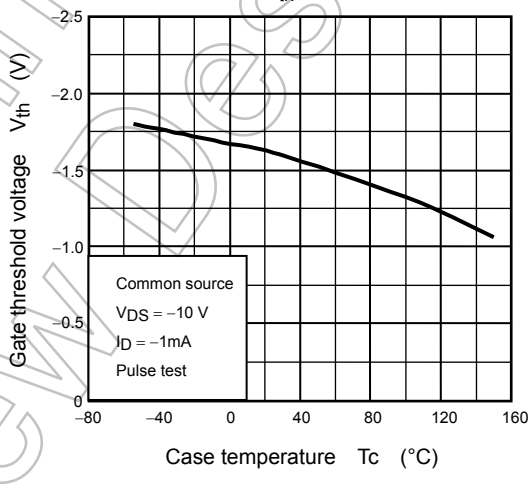
I_{DR} – V_{DS}



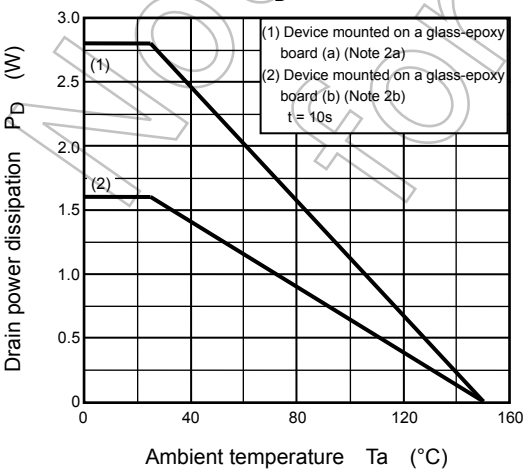
C – V_{DS}



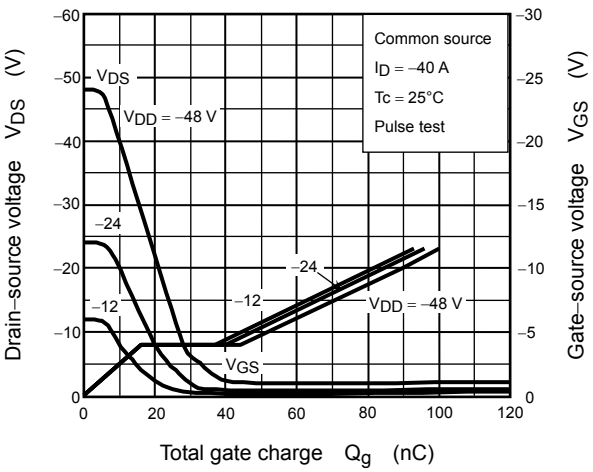
V_{th} – Tc



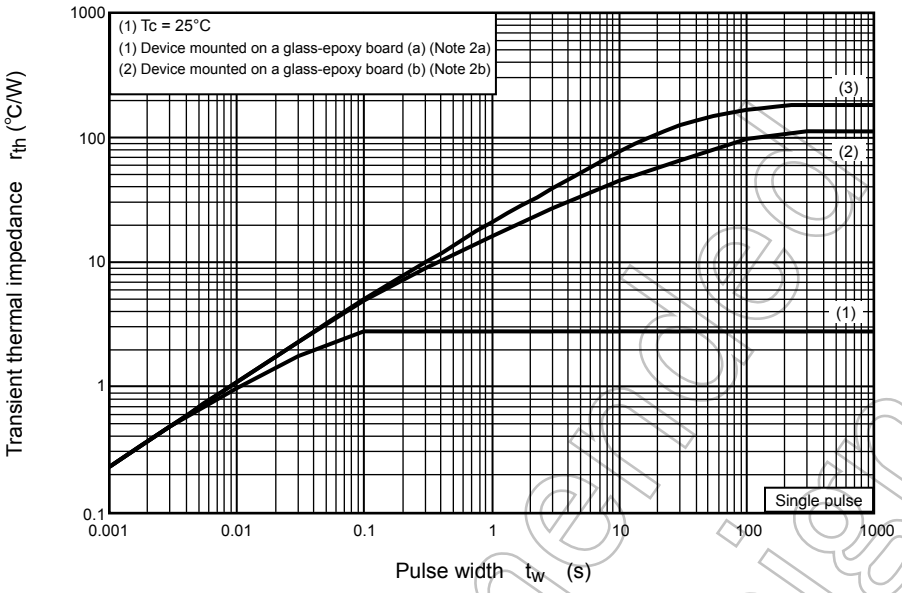
P_D – Ta



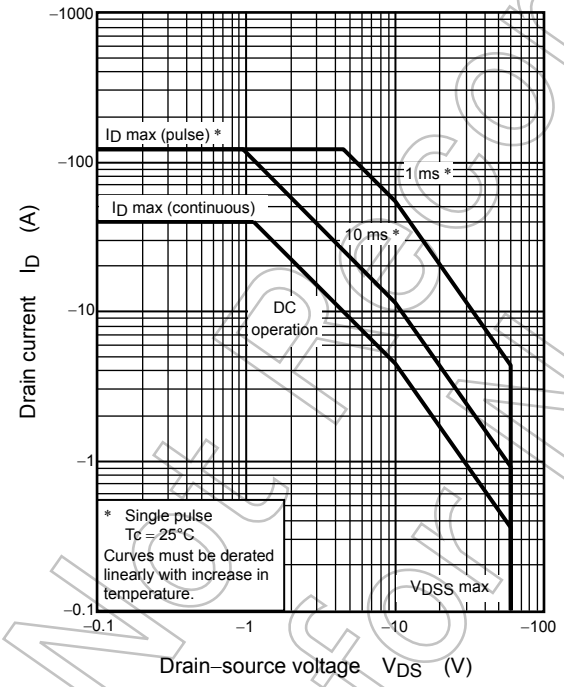
Dynamic input/output characteristics



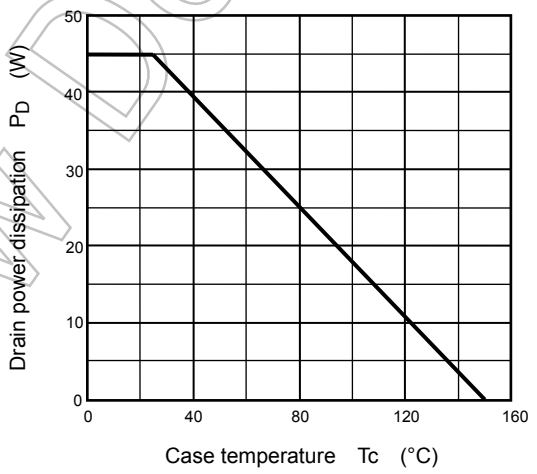
$r_{th} - t_w$



Safe operating area



P_D – Tc



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