

TOSHIBA Field Effect Transistor Silicon P/N Channel MOS Type  
(P Channel U-MOSII/N Channel U-MOSII)

## TPC8403

Motor Drive Applications

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: P Channel  $R_{DS(ON)} = 45 \text{ m}\Omega$  (typ.)  
N Channel  $R_{DS(ON)} = 25 \text{ m}\Omega$  (typ.)
- High forward transfer admittance: P Channel  $|Y_{fs}| = 6.2 \text{ S}$  (typ.)  
N Channel  $|Y_{fs}| = 7.8 \text{ S}$  (typ.)
- Low leakage current: P Channel  $I_{DSS} = -10 \text{ }\mu\text{A}$  ( $V_{DS} = -30 \text{ V}$ )  
N Channel  $I_{DSS} = 10 \text{ }\mu\text{A}$  ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode  
: P Channel  $V_{th} = -1.0 \sim -2.2 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -1 \text{ mA}$ )  
: N Channel  $V_{th} = 1.3 \sim 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

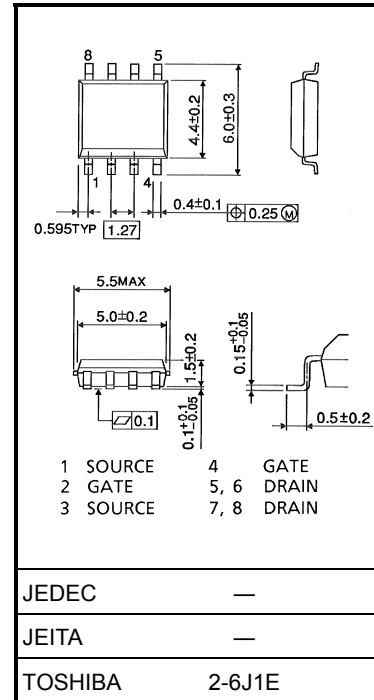
Characteristics	Symbol	Rating		Unit	
		P Channel	N Channel		
Drain-source voltage	$V_{DSS}$	-30	30	V	
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	$V_{DGR}$	-30	30	V	
Gate-source voltage	$V_{GSS}$	$\pm 20$	$\pm 20$	V	
Drain current	DC (Note 1)	$I_D$	-4.5	6	A
	Pulse (Note 1)	$I_{DP}$	-18	24	
Drain power dissipation ( $t = 10\text{s}$ ) (Note 2a)	Single-device operation (Note 3a)	$P_{D(1)}$	1.5	1.5	W
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	1.1	1.1	
Drain power dissipation ( $t = 10\text{s}$ ) (Note 2b)	Single-device operation (Note 3a)	$P_{D(1)}$	0.75	0.75	
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	0.45	0.45	
Single pulse avalanche energy	$E_{AS}$	26.3 (Note 4a)	46.8 (Note 4b)	mJ	
Avalanche current	$I_{AR}$	-4.5	6	A	
Repetitive avalanche energy Single-device value at operation (Note 2a, 3b, 5)	$E_{AR}$	0.11		mJ	
Channel temperature	$T_{ch}$	150		$^\circ\text{C}$	
Storage temperature range	$T_{stg}$	-55~150		$^\circ\text{C}$	

Note: Note 1, Note 2ab, Note 3ab, Note 4and 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).

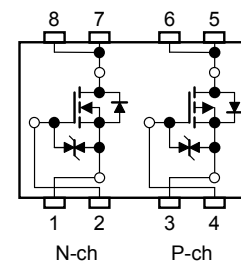
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.080 g (typ.)

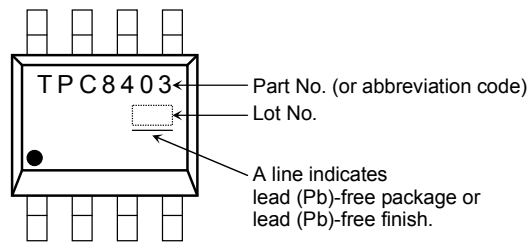
### Circuit Configuration



## Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10s) (Note 2a)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	83.3	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	114	
Thermal resistance, channel to ambient (t = 10s) (Note 2b)	Single-device operation (Note 2a)	$R_{th(ch-a)}(1)$	167	
	Single-device value at dual operation (Note 2b)	$R_{th(ch-a)}(2)$	278	

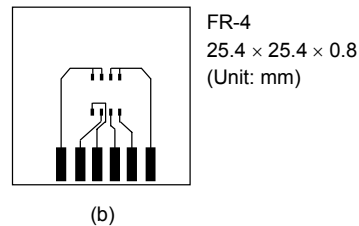
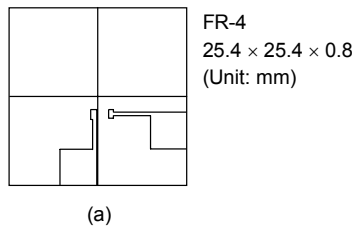
## Marking



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:

- 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.).

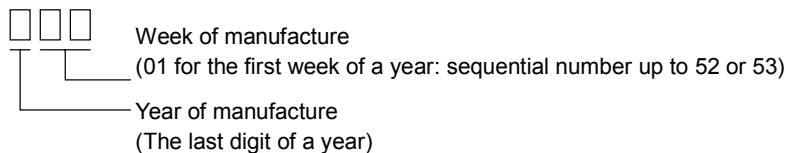
Note 4:

- a)  $V_{DD} = -24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (Initial),  $L = 1.0\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = -4.5\text{ A}$
- b)  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (Initial),  $L = 1.0\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 6.0\text{ A}$

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

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

※ Weekly code: (Three digits)



## P-channel

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
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
		$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 20\text{ V}$	-15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-1.0	—	-2.2	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -2.2\text{ A}$	—	66	90	$\text{m}\Omega$
			$V_{GS} = -10\text{ V}, I_D = -2.2\text{ A}$	—	45	55	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -2.2\text{ A}$	3.1	6.2	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	940	—	pF
Reverse transfer capacitance		$C_{rss}$		—	270	—	
Output capacitance		$C_{oss}$		—	390	—	
Switching time	Rise time	$t_r$		—	13	—	ns
	Turn-ON time	$t_{on}$		—	21	—	
	Fall time	$t_f$		—	25	—	
	Turn-OFF time	$t_{off}$		—	73	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V},$	—	18	—	nC
Gate-source charge 1		$Q_{gs1}$	$I_D = -4.5\text{ A}$	—	4	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	4	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	-18	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -4.5\text{ A}, V_{GS} = 0\text{ V}$	—	—	1.2	V

## N-channel

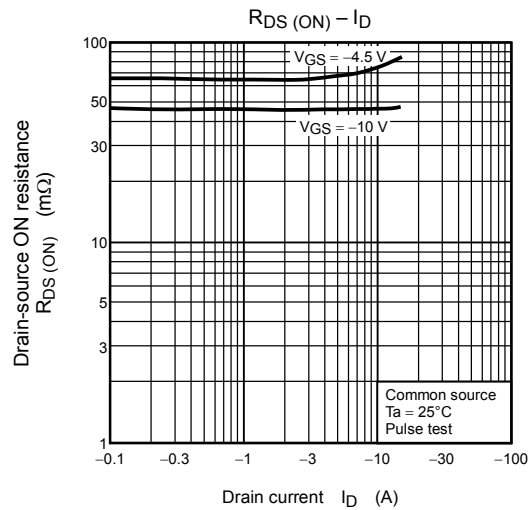
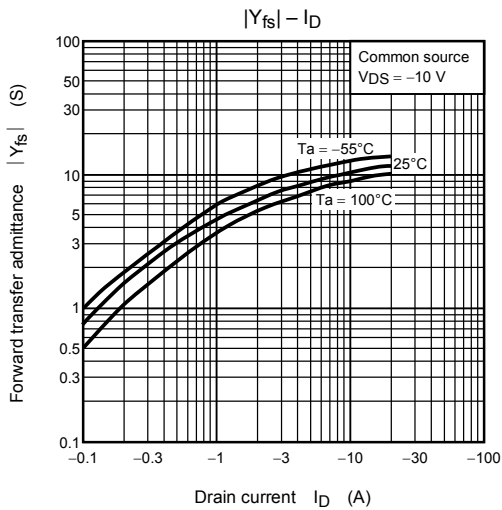
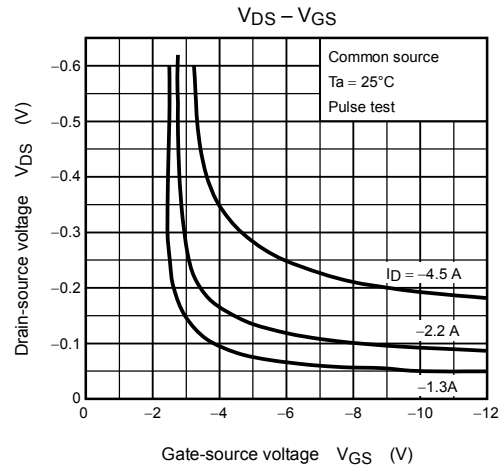
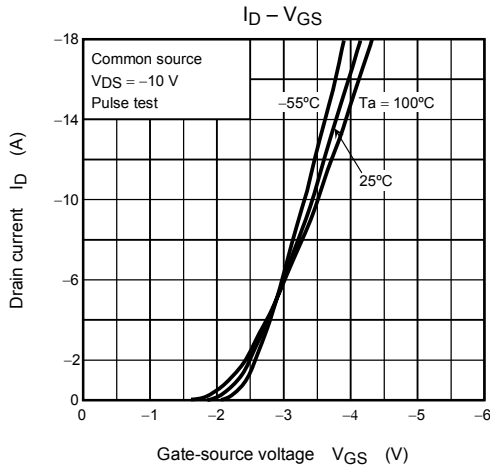
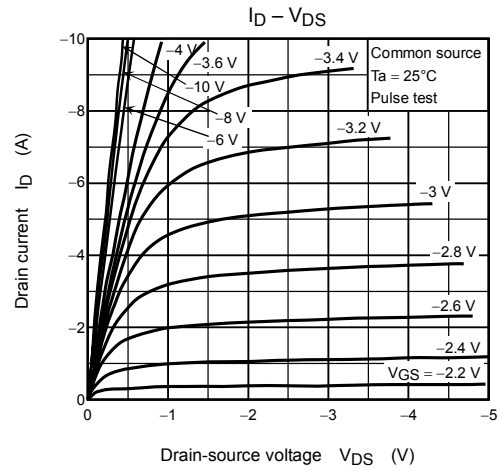
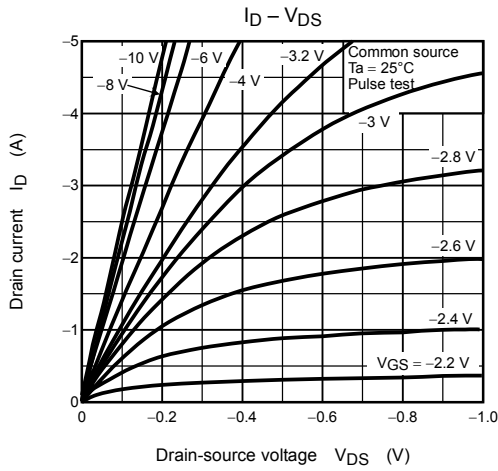
### Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
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
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.3	—	2.5	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 3\text{ A}$	—	38	46	$\text{m}\Omega$
			$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$	—	25	33	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 3\text{ A}$	3.9	7.8	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	850	—	pF
Reverse transfer capacitance		$C_{rss}$		—	180	—	
Output capacitance		$C_{oss}$		—	270	—	
Switching time	Rise time	$t_r$		—	11	—	ns
	Turn-ON time	$t_{on}$		—	18	—	
	Fall time	$t_f$		—	6.5	—	
	Turn-OFF time	$t_{off}$		—	27	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 6\text{ A}$	—	17	—	nC
Gate-source charge 1		$Q_{gs1}$		—	3	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	4	—	

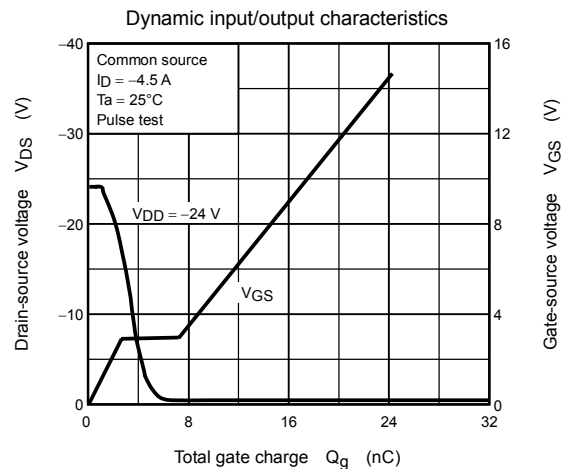
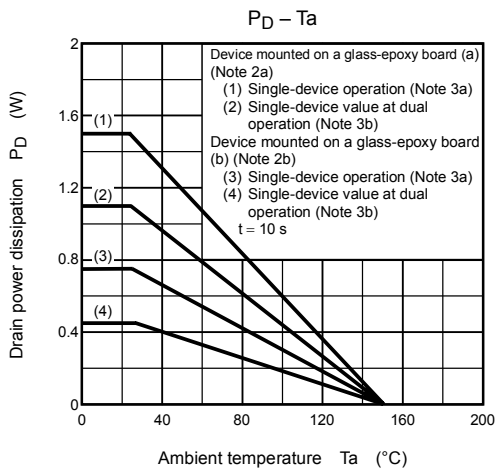
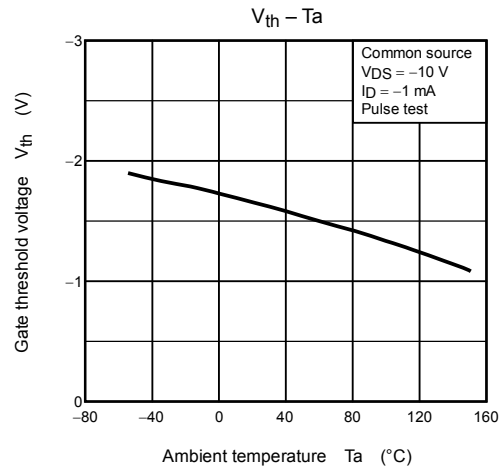
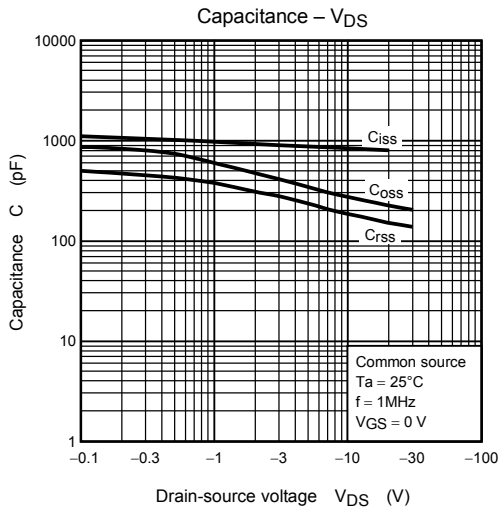
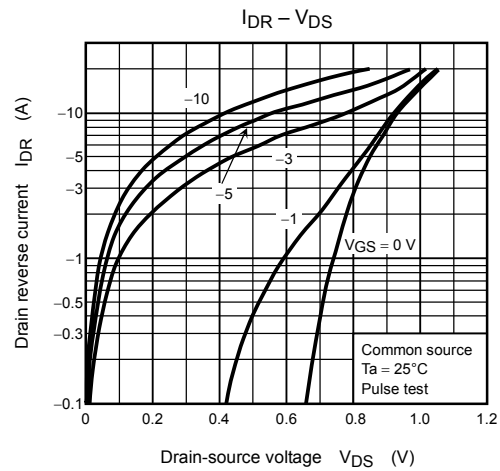
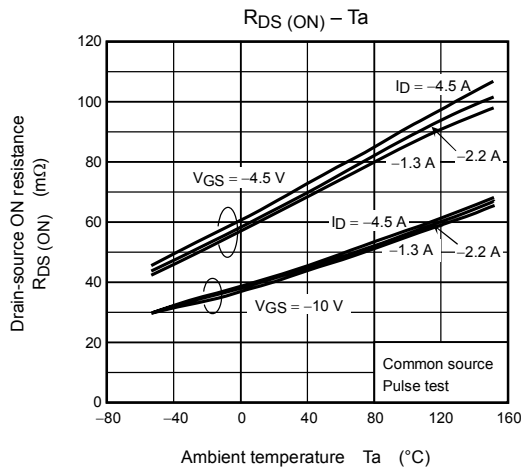
### Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	24	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V

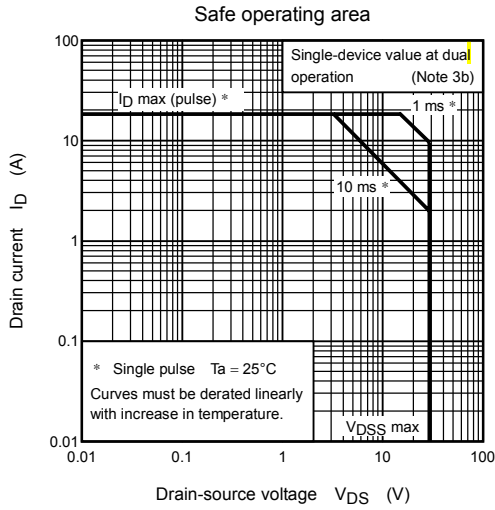
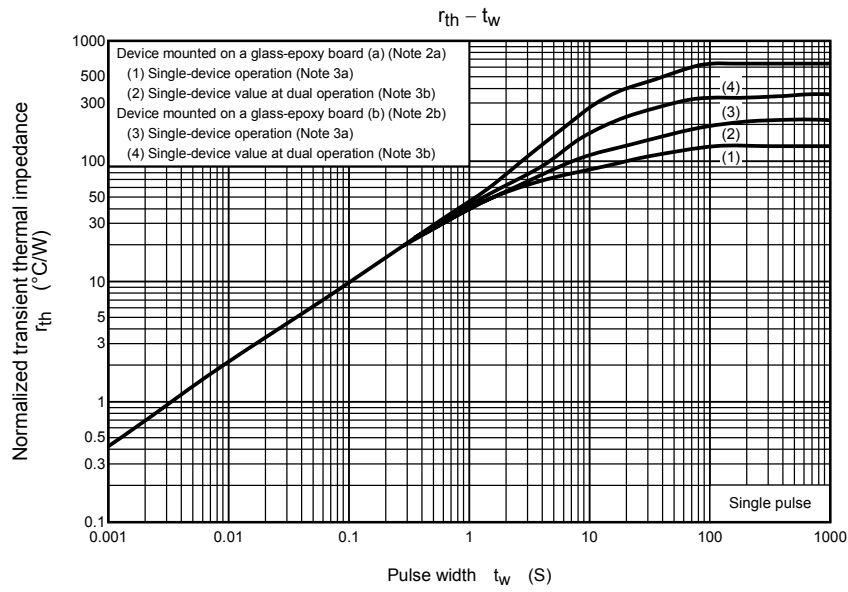
P-channel



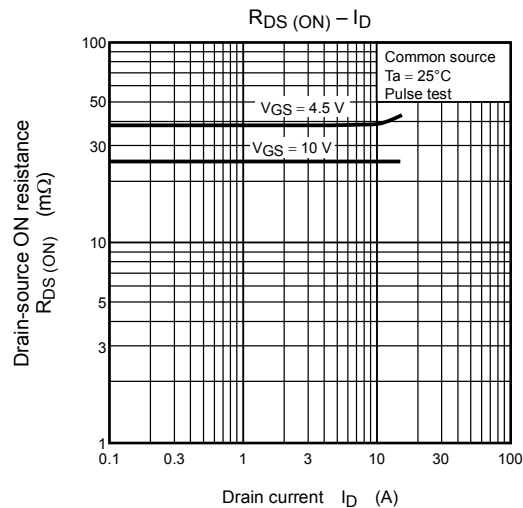
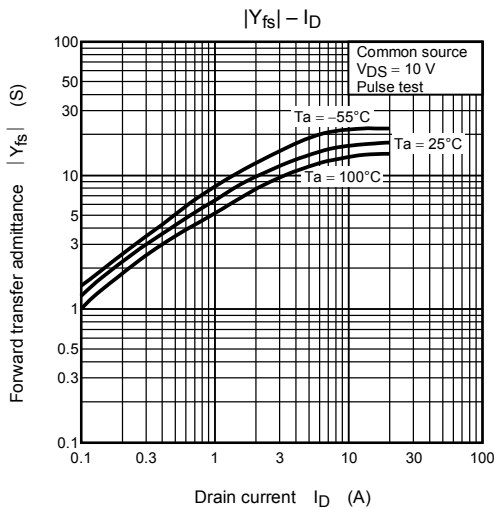
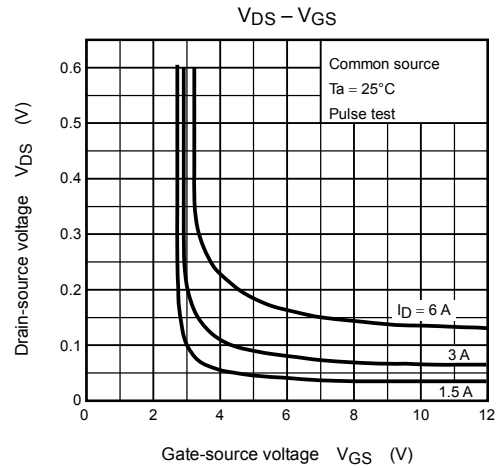
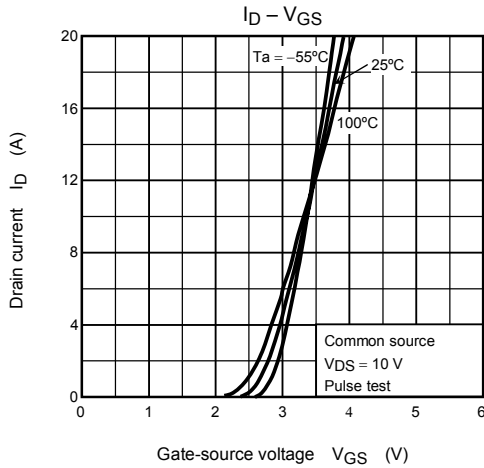
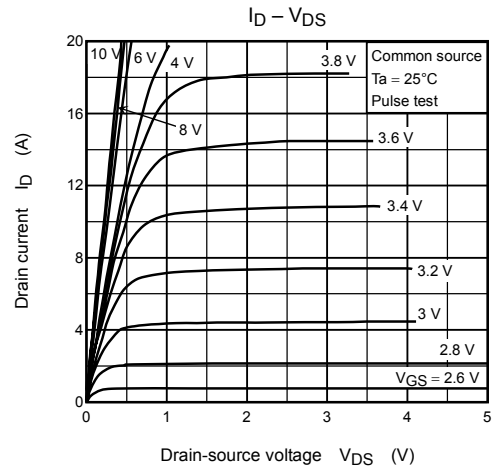
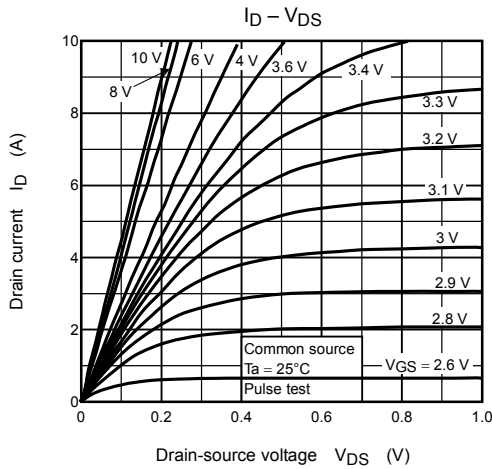
## P-channel



## P-channel

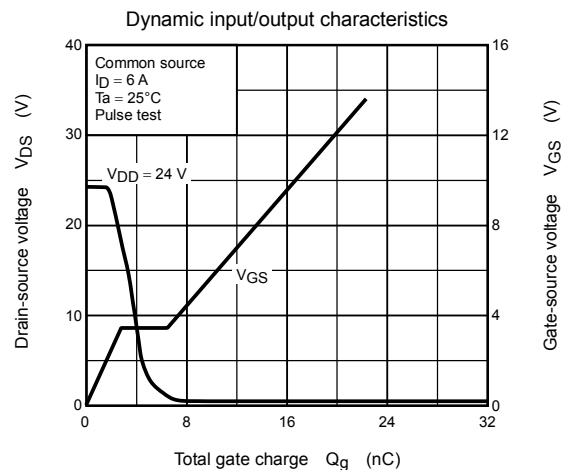
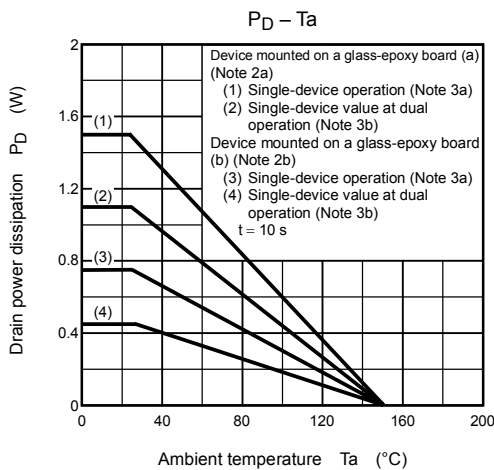
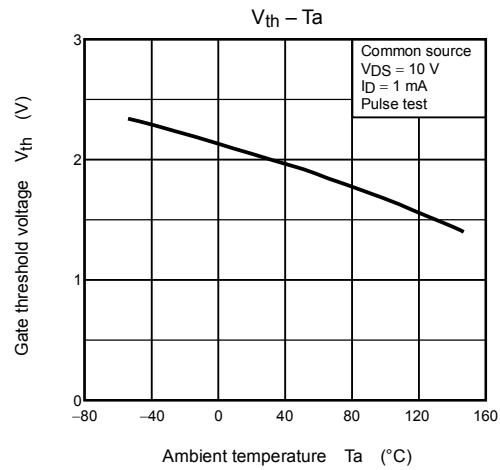
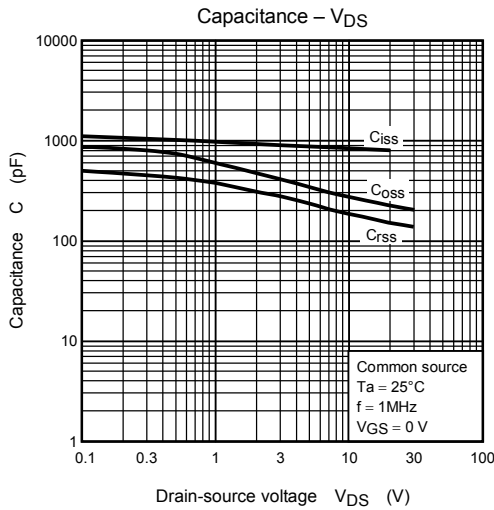
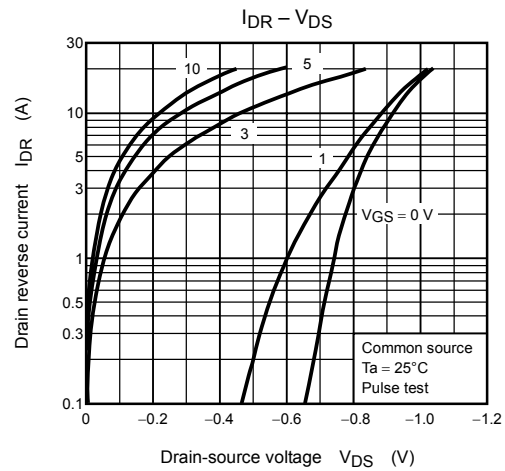
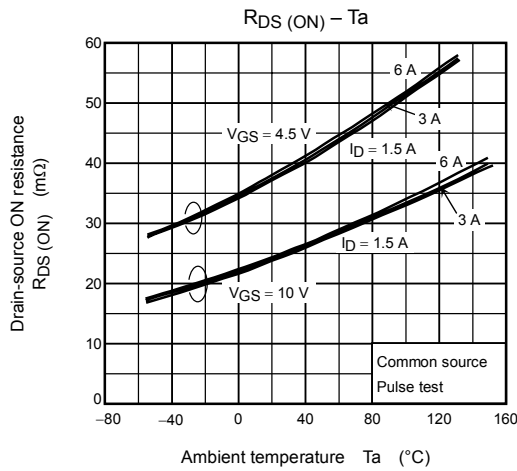


**N-channel**

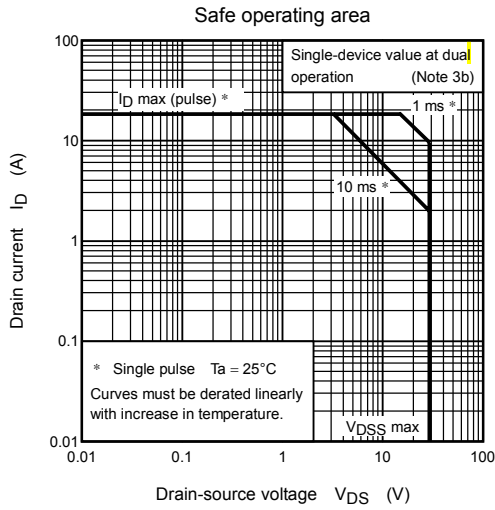
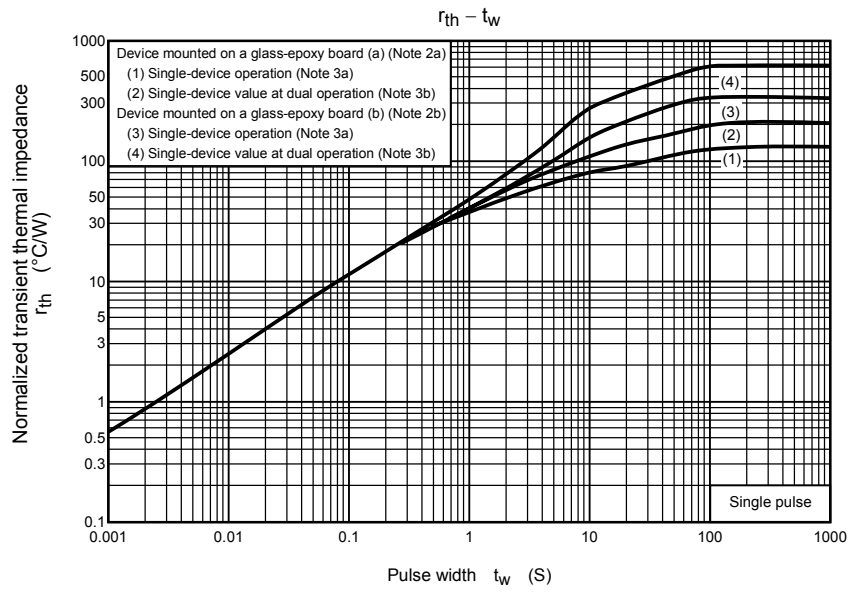




## N-channel



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