

# TPCP8402

Portable Equipment Applications  
Motor Drive Applications  
DC-DC Converter Applications

- Lead(Pb)-Free
- Low drain-source ON resistance : P Channel RDS (ON) = 60 mΩ (typ.)  
N Channel RDS (ON) = 38 mΩ (typ.)
- High forward transfer admittance : P Channel  $|Y_{fs}|$  = 6.0 S (typ.)  
N Channel  $|Y_{fs}|$  = 7.0 S (typ.)
- Low leakage current : P Channel  $Id_{SS}$  = -10 μA ( $V_{DS}$  = -30 V)  
N Channel  $Id_{SS}$  = 10 μA ( $V_{DS}$  = 30 V)
- Enhancement mode  
: P Channel  $V_{th}$  = -0.8 to -2.0 V ( $V_{DS}$  = -10 V,  $Id$  = -1mA)  
N Channel  $V_{th}$  = 1.3 to 2.5 V ( $V_{DS}$  = 10 V,  $Id$  = 1mA)

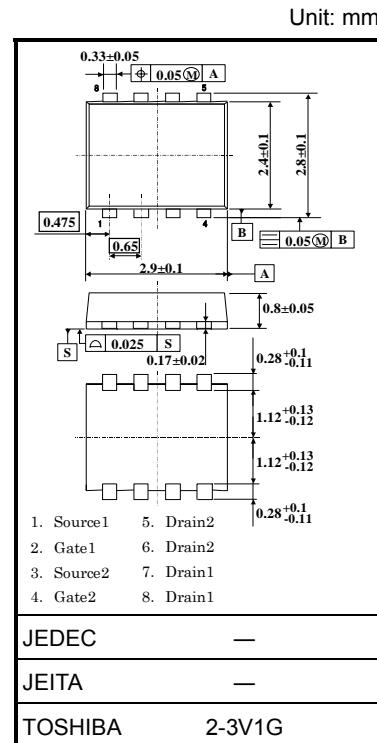
## Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating		Unit
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)	$I_D$	-3.4	4.2	A
	Pulse (Note 1)	$I_{DP}$	-13.6	16.8	
Drain power dissipation ( $t = 5 \text{ s}$ ) (Note 2a)	Single-device operation (Note 3a)	$P_D$ (1)	1.48	1.48	W
	Single-device value at dual operation (Note 3b)	$P_D$ (2)	1.23	1.23	
Drain power dissipation ( $t = 5 \text{ s}$ ) (Note 2b)	Single-device operation (Note 3a)	$P_D$ (1)	0.58	0.58	
	Single-device value at dual operation (Note 3b)	$P_D$ (2)	0.36	0.36	
Single pulse avalanche energy (Note 4)		$E_{AS}$	0.75	2.86	mJ
Avalanche current		$I_{AR}$	-1.7	2.1	A
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		$E_{AR}$	0.12		mJ
Channel temperature		$T_{ch}$	150		°C
Storage temperature range		$T_{stg}$	-55~150		°C

Note: For Notes 1 to 6, refer to the next page.

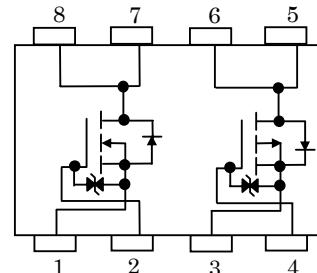
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

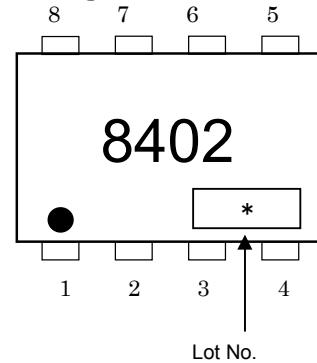


Weight: 0.017 g (typ.)

## Circuit Configuration



## Marking (Note 6)

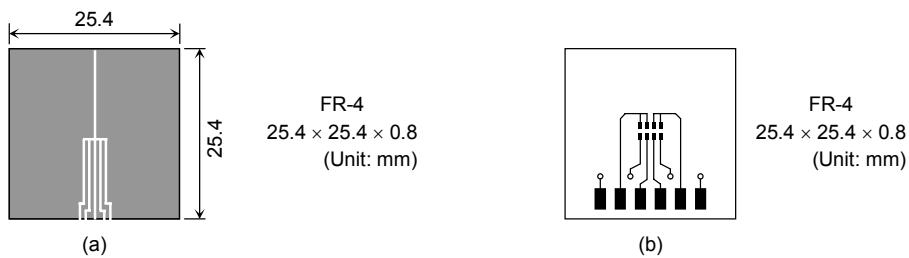


## Thermal Characteristics

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



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.)

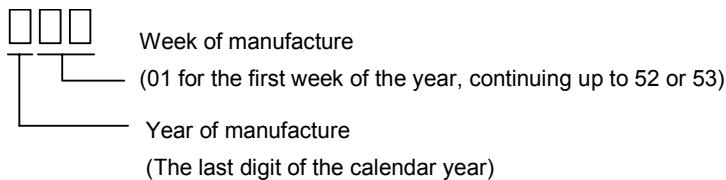
b) The power dissipation and thermal resistance values shown are for a single device.  
(During dual operation, power is evenly applied to both devices.)

Note 4: P Channel:  $V_{DD} = -24$  V,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.2$  mH,  $R_G = 25 \Omega$ ,  $I_{AR} = -1.7$  A  
N Channel:  $V_{DD} = 24$  V,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5$  mH,  $R_G = 25 \Omega$ ,  $I_{AR} = 2.1$  A

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

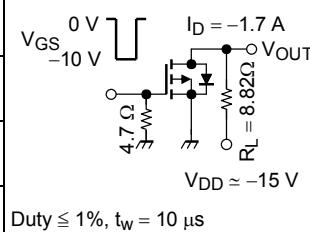
Note 6: ● on the lower left of the marking indicates Pin 1.

※ Weekly code (3 digits):



P-ch

## Electrical Characteristics (Ta = 25°C)

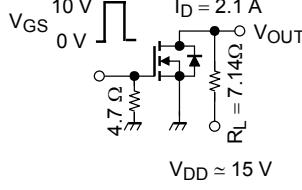
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±10	μA
Drain cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> = -30 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage	V <sub>(BR) DSS</sub>	I <sub>D</sub> = -10 mA, V <sub>GS</sub> = 0 V	-30	—	—	V
	V <sub>(BR) DSX</sub>	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	-0.8	—	-2.0	V
Drain-source ON resistance	R <sub>DS (ON)</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -1.7 A	—	80	105	mΩ
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -1.7 A	—	60	72	
Forward transfer admittance	Y <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1.7 A	3.0	6.0	—	S
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	600	—	pF
Reverse transfer capacitance	C <sub>rss</sub>		—	60	—	
Output capacitance	C <sub>oss</sub>		—	70	—	
Switching time	Rise time	t <sub>r</sub>		—	5.3	—
	Turn-on time	t <sub>on</sub>		—	12	—
	Fall time	t <sub>f</sub>		—	8.4	—
	Turn-off time	t <sub>off</sub>		—	34	—
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> = -3.4 A	—	14	—	nC
Gate-source charge 1	Q <sub>gs1</sub>		—	1.4	—	
Gate-drain ("miller") charge	Q <sub>gd</sub>		—	2.7	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	I <sub>DRP</sub>	—	—	—	-13.6	A
Forward voltage (diode)	V <sub>DSF</sub>	I <sub>DR</sub> = -3.4 A, V <sub>GS</sub> = 0 V	—	—	1.2	V

N-ch

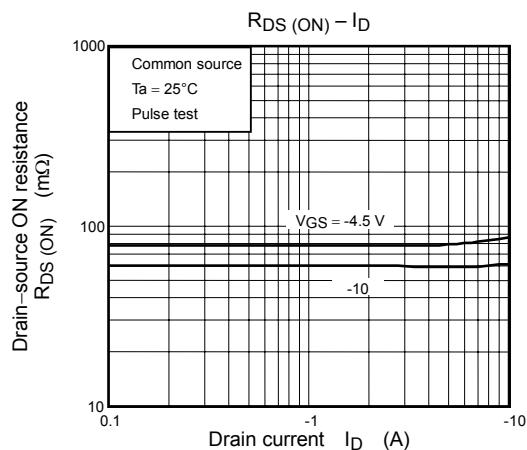
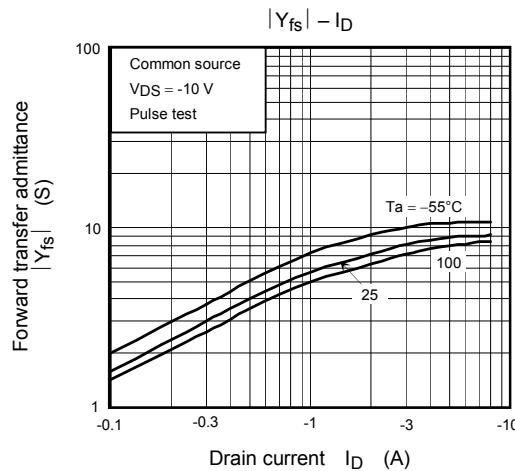
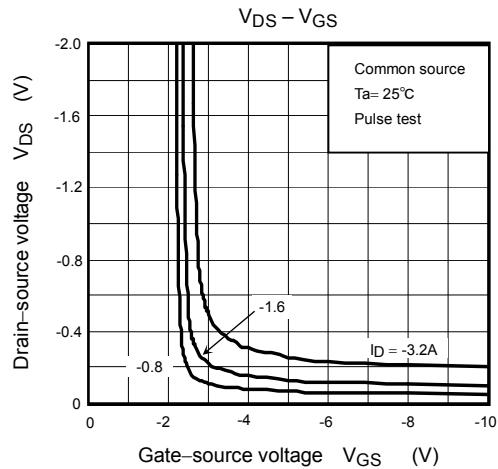
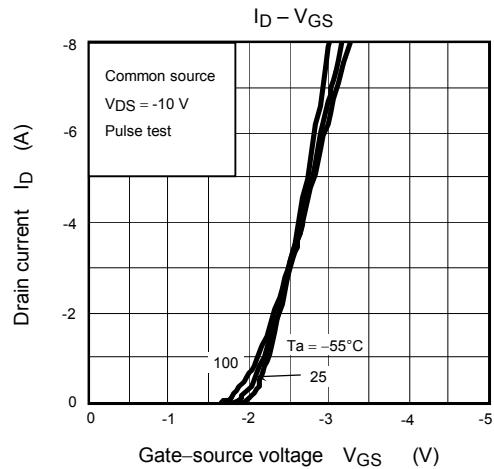
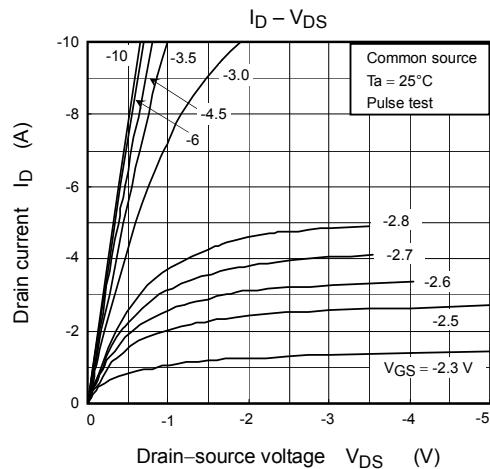
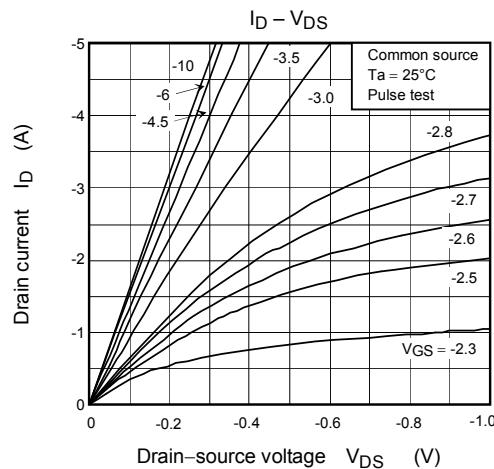
## Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±10	µA
Drain cut-off 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) DSS</sub>	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	30	—	—	V
	V <sub>(BR) DSX</sub>	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	1.3	—	2.5	V
Drain-source ON resistance	R <sub>DSS (ON)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.1 A	—	58	77	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.1 A	—	38	50	
Forward transfer admittance	Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.1 A	3.5	7.0	—	S
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	470	—	pF
Reverse transfer capacitance	C <sub>rss</sub>		—	60	—	
Output capacitance	C <sub>oss</sub>		—	80	—	
Switching time	Rise time	t <sub>r</sub>		—	5.2	ns
	Turn-on time	t <sub>on</sub>		—	8.3	
	Fall time	t <sub>f</sub>		—	4.0	
	Turn-off time	t <sub>off</sub>		—	22	
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> = 6 A	—	10	—	nC
Gate-source charge 1	Q <sub>gs1</sub>		—	1.7	—	
Gate-drain ("miller") charge	Q <sub>gd</sub>		—	2.4	—	

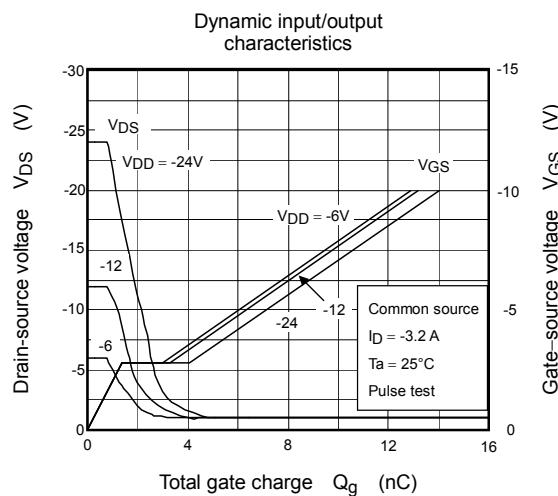
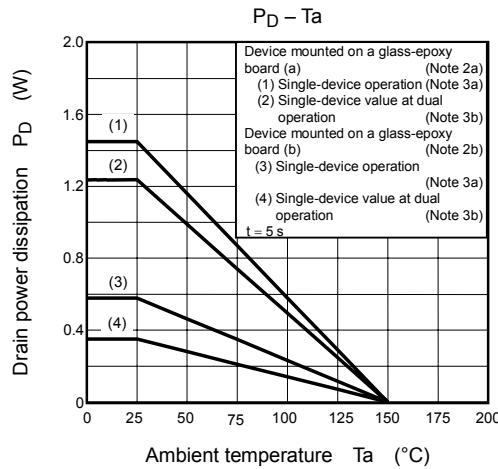
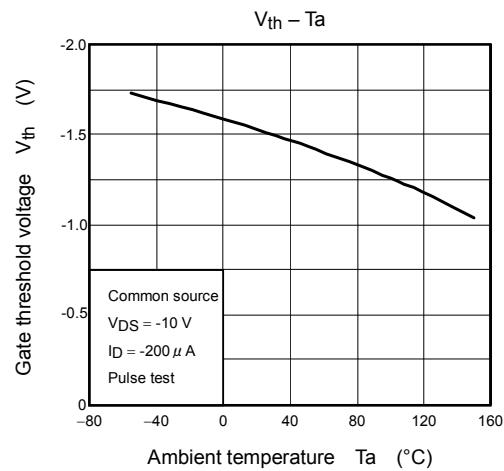
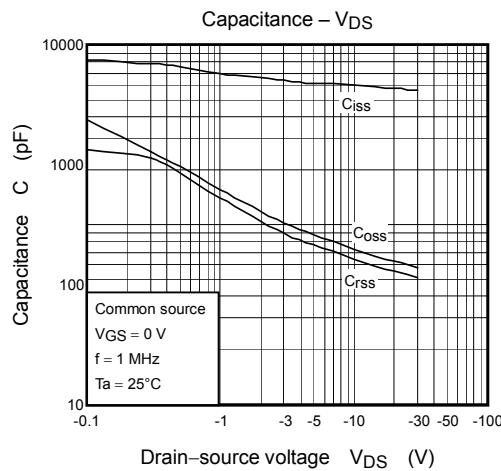
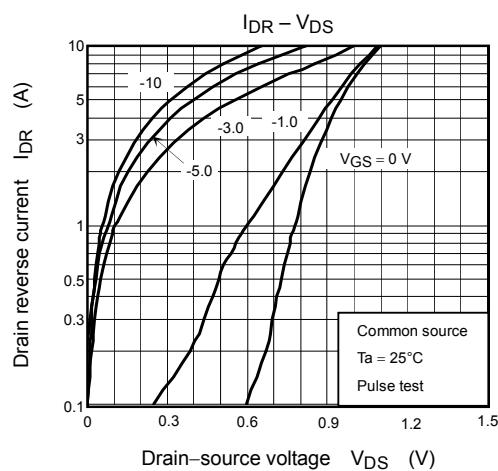
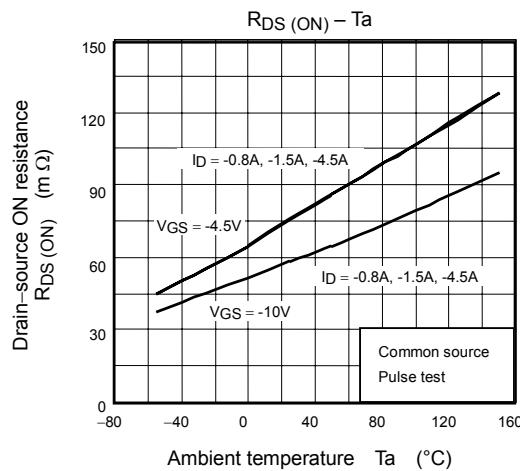
## Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	I <sub>DRP</sub>	—	—	—	16.8	A
Forward voltage (diode)	V <sub>DSF</sub>	I <sub>DR</sub> = 4.2 A, V <sub>GS</sub> = 0 V	—	—	-1.2	V

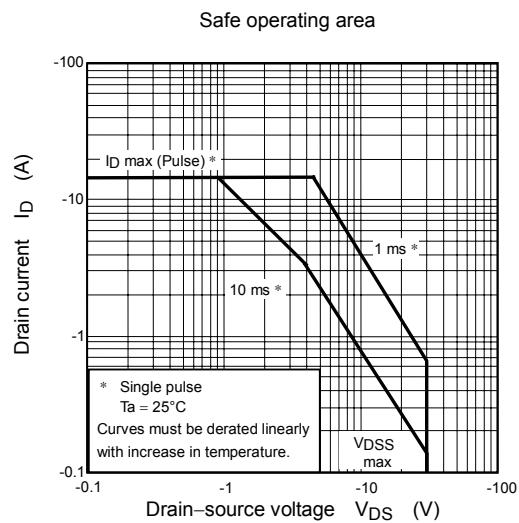
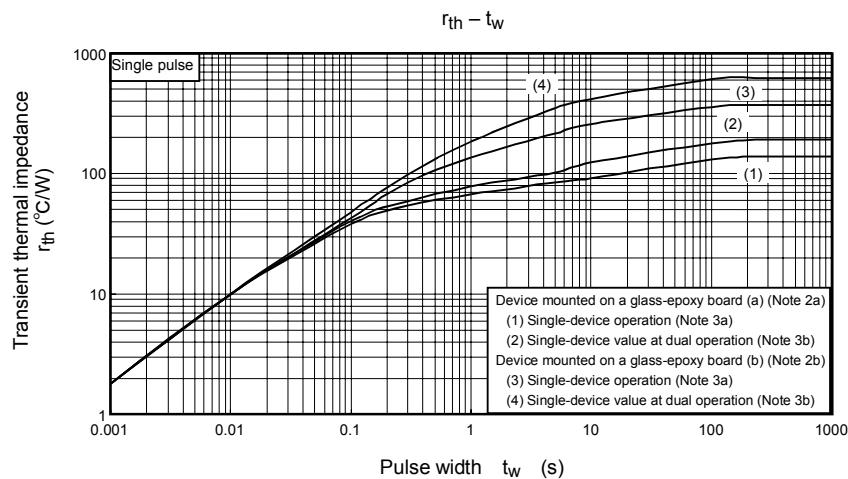
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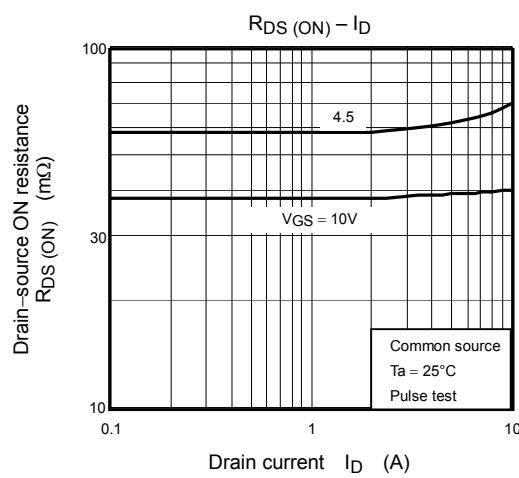
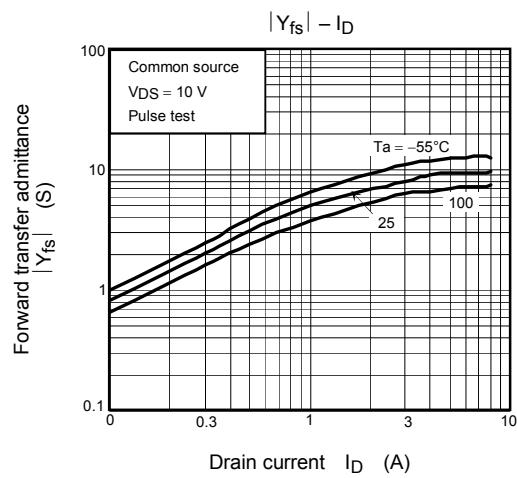
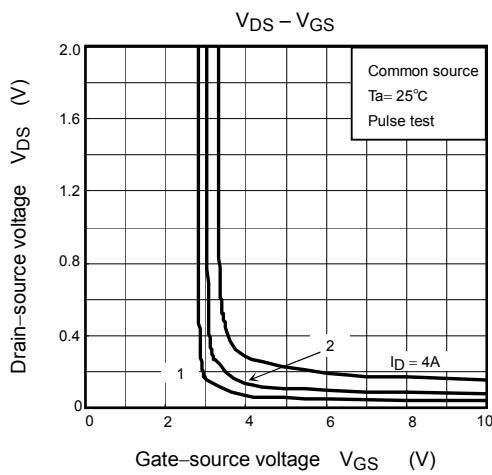
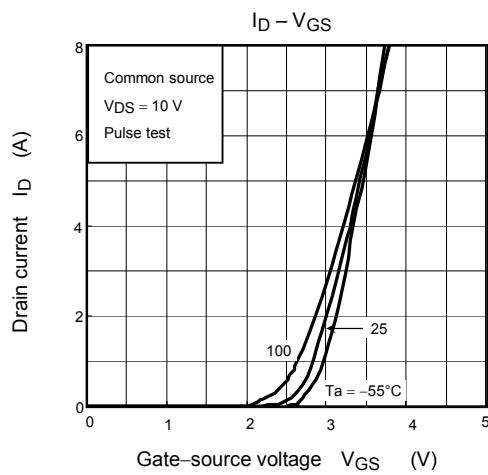
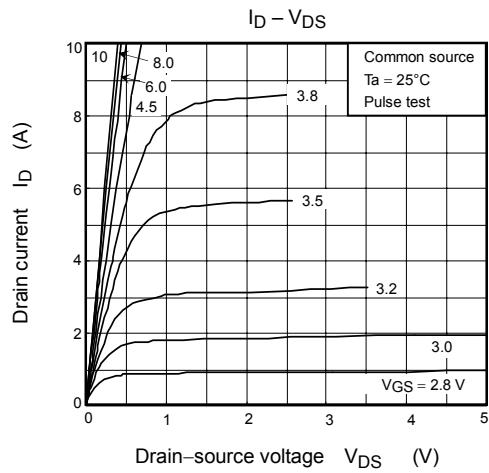
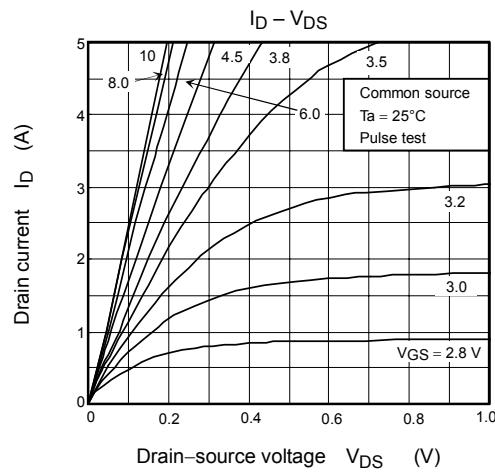
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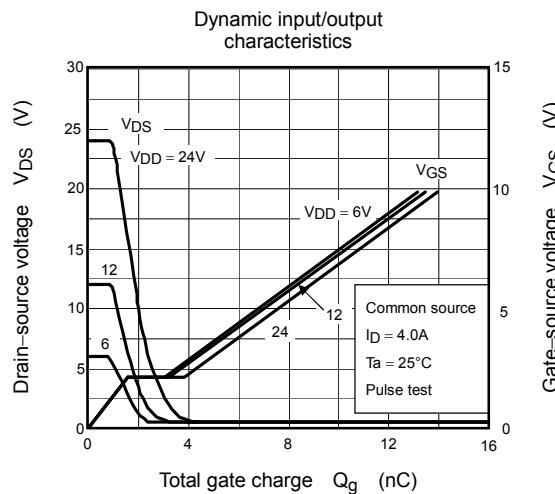
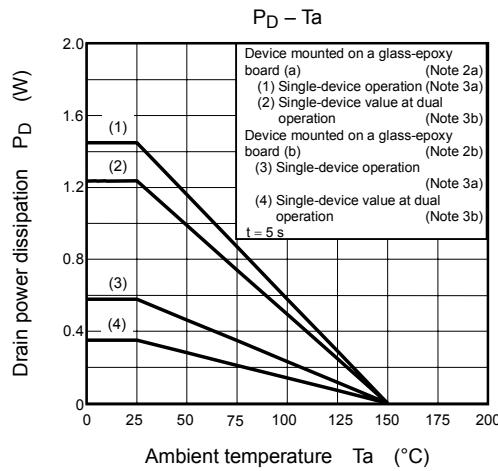
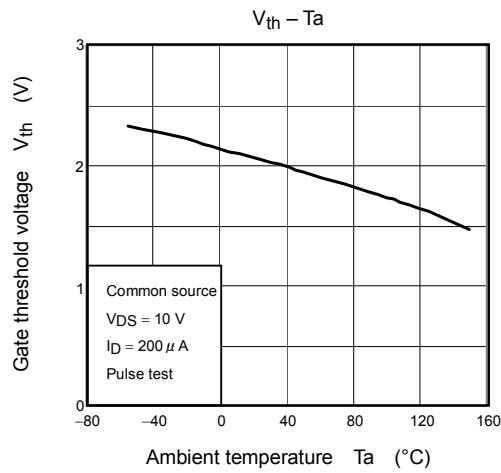
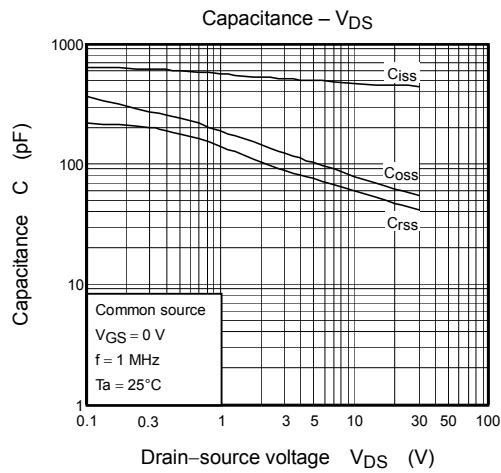
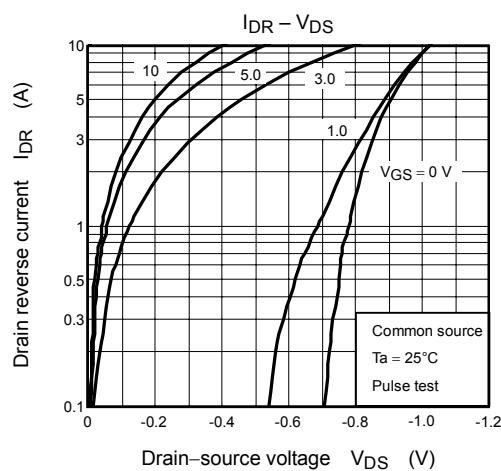
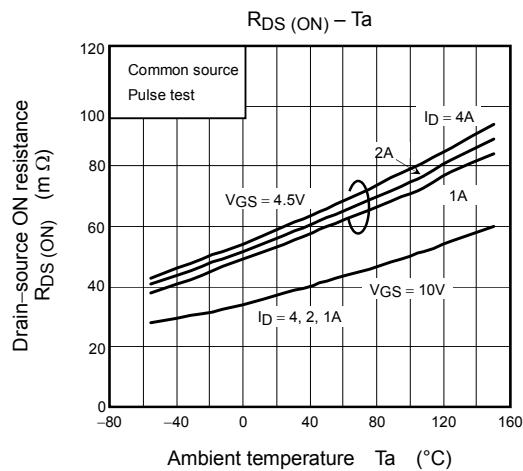
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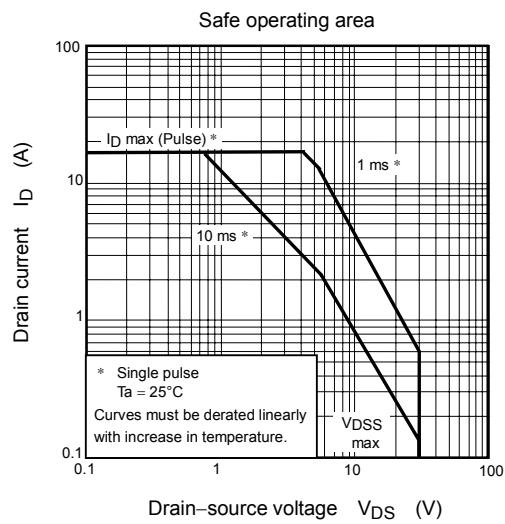
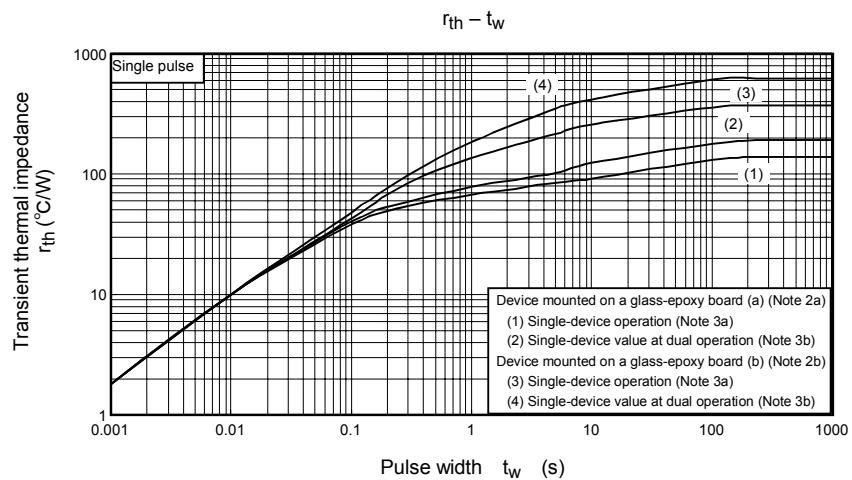
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