

TOSHIBA Field Effect Transistor Silicon P, N Channel MOS Type (U-MOS IV / U-MOS III)

TPCP8402

Portable Equipment Applications

Motor Drive Applications

DC-DC Converter Applications

- Lead(Pb)-Free
- Low drain-source ON resistance : P Channel $R_{DS(ON)} = 60 \text{ m}\Omega$ (typ.)
N Channel $R_{DS(ON)} = 38 \text{ m}\Omega$ (typ.)
- High forward transfer admittance : P Channel $|Y_{fs}| = 6.0 \text{ S}$ (typ.)
N Channel $|Y_{fs}| = 7.0 \text{ S}$ (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 $V_{th} = -0.8 \text{ to } -2.0 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)
N Channel $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

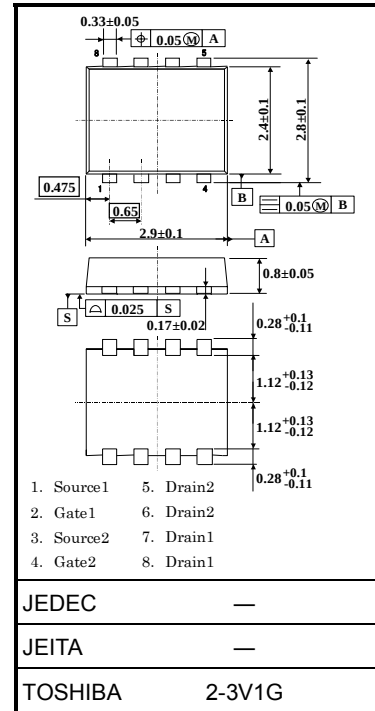
Characteristics		Symbol	Rating		Unit
Drain-source voltage		V_{DSS}	-30	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	-30	30	V
Gate-source voltage		V_{GSS}	± 20	± 20	V
Drain current	DC (Note 1)	I_D	-3.4	4.2	A
	Pulse (Note 1)	I_{DP}	-13.6	16.8	
Drain power dissipation ($t = 5 \text{ s}$) (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		$^\circ\text{C}$
Storage temperature range		T_{stg}	-55~150		$^\circ\text{C}$

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.).

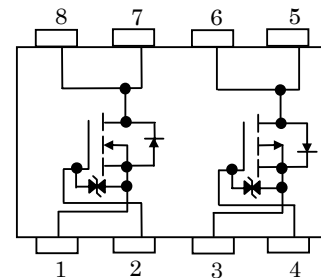
This transistor is an electrostatic-sensitive device. Handle with caution.

Unit: mm

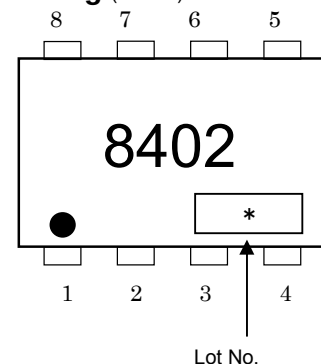


Weight: 0.017 g (typ.)

Circuit Configuration



Marking (Note 6)

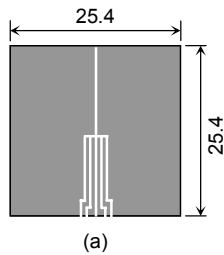


Thermal Characteristics

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	

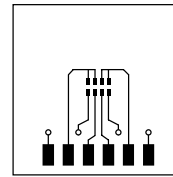
Note 1: The channel temperature should not exceed 150°C during use.

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



(a)

FR-4
25.4 × 25.4 × 0.8
(Unit: mm)



(b)

FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

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.)

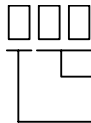
b) The power dissipation and thermal resistance values shown are for a single device. (During dual operation, power is evenly applied to both devices.)

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):



Week of manufacture

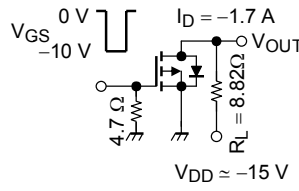
(01 for the first week of the year, continuing up to 52 or 53)

Year of manufacture

(The last digit of the calendar year)

P-ch

Electrical Characteristics (Ta = 25°C)

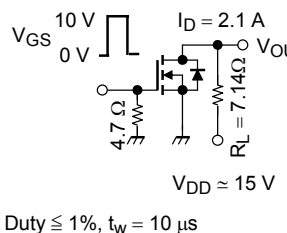
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I _{DSS}	V _{DS} = -30 V, V _{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = -10 mA, V _{GS} = 0 V	-30	—	—	V
		V (BR) DSX	I _D = -10 mA, V _{GS} = 20 V	-15	—	—	
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} = -4.5 V, I _D = -1.7 A	—	80	105	mΩ
			V _{GS} = -10 V, I _D = -1.7 A	—	60	72	
Forward transfer admittance		Y _{fs}	V _{DS} = -10 V, I _D = -1.7 A	3.0	6.0	—	S
Input capacitance		C _{iSS}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	—	600	—	pF
Reverse transfer capacitance		C _{rSS}		—	60	—	
Output capacitance		C _{oSS}		—	70	—	
Switching time	Rise time	t _r	 V_{GS} 0 V -10 V I_D = -1.7 A V_{OUT} 4.7 Ω R_L = 8.82 Ω V_{DD} ≈ -15 V Duty ≤ 1%, t_w = 10 μs	—	5.3	—	ns
	Turn-on time	t _{on}		—	12	—	
	Fall time	t _f		—	8.4	—	
	Turn-off time	t _{off}		—	34	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ -24 V, V _{GS} = -10 V, I _D = -3.4 A	—	14	—	nC
Gate-source charge 1		Q _{gs1}		—	1.4	—	
Gate-drain ("miller") charge		Q _{gd}		—	2.7	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	-13.6	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -3.4 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

N-ch

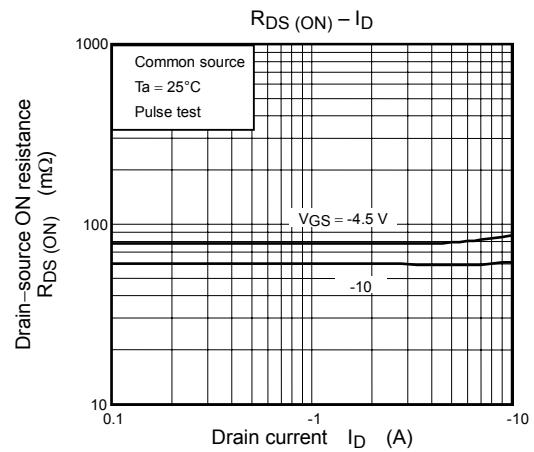
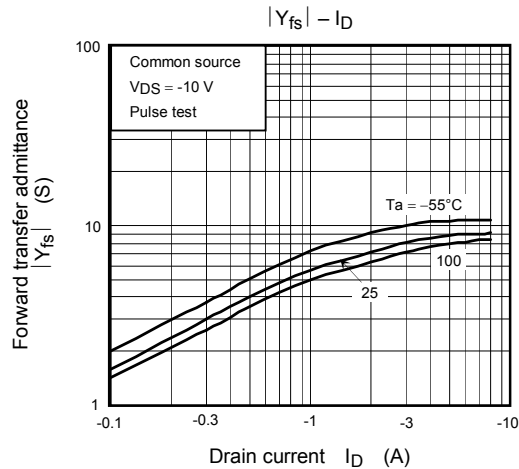
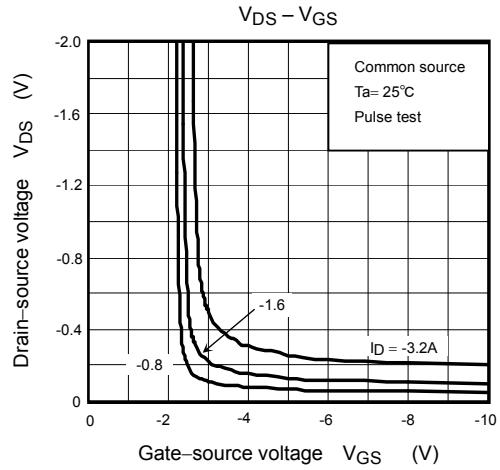
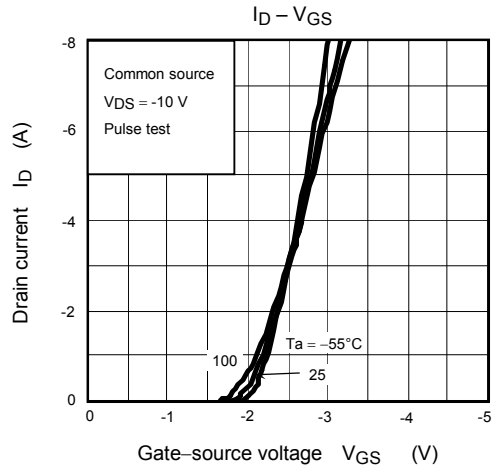
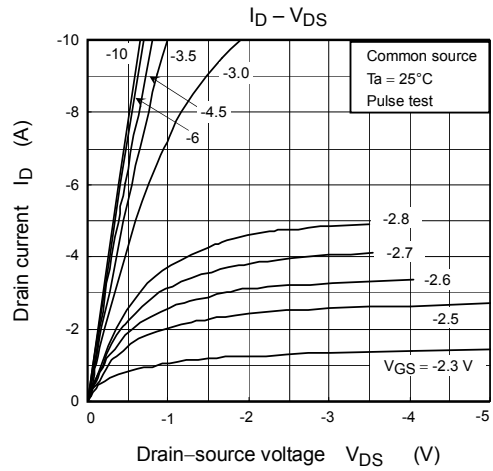
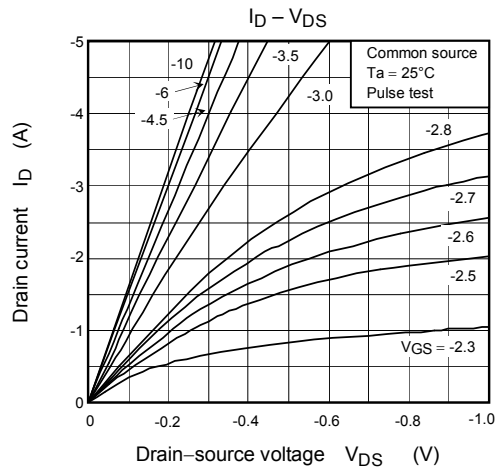
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 10	μA
Drain cut-off current		I_{DSS}	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	μA
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		$R_{DS(ON)}$	$V_{GS} = 4.5 \text{ V}, I_D = 2.1 \text{ A}$	—	58	77	m Ω
			$V_{GS} = 10 \text{ V}, I_D = 2.1 \text{ A}$	—	38	50	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 2.1 \text{ A}$	3.5	7.0	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	470	—	pF
Reverse transfer capacitance		C_{rss}		—	60	—	
Output capacitance		C_{oss}		—	80	—	
Switching time	Rise time	t_r	 $V_{DD} \approx 15 \text{ V}$ Duty $\leq 1\%$, $t_w = 10 \mu\text{s}$	—	5.2	—	ns
	Turn-on time	t_{on}		—	8.3	—	
	Fall time	t_f		—	4.0	—	
	Turn-off time	t_{off}		—	22	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}$	—	10	—	nC
Gate-source charge 1		Q_{gs1}		—	1.7	—	
Gate-drain (“miller”) charge		Q_{gd}		—	2.4	—	

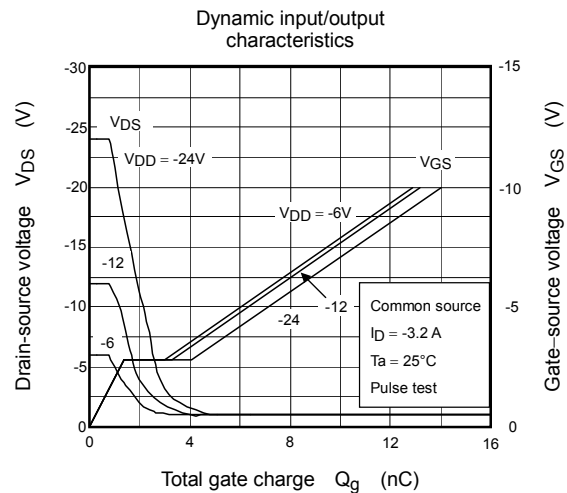
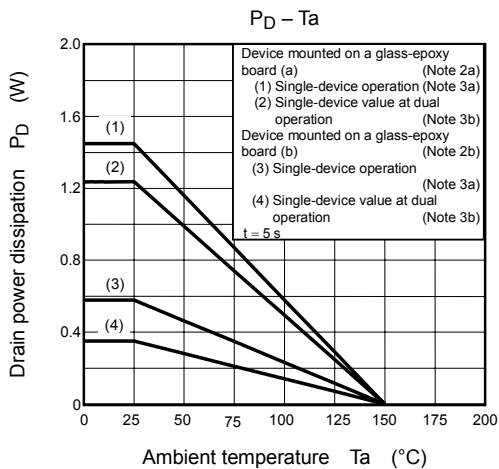
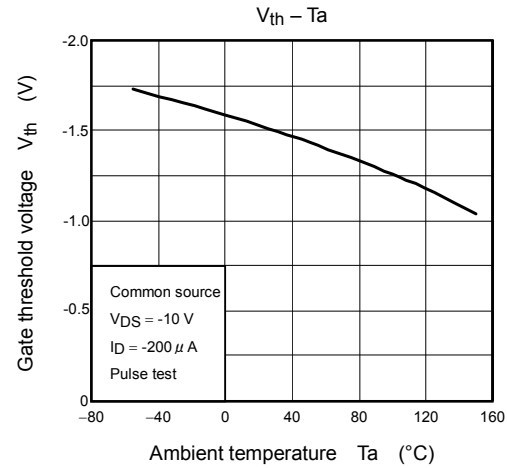
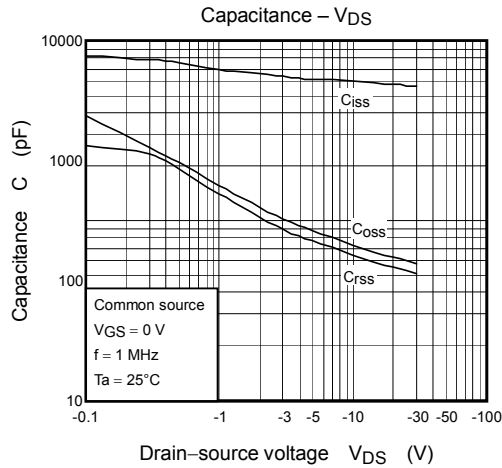
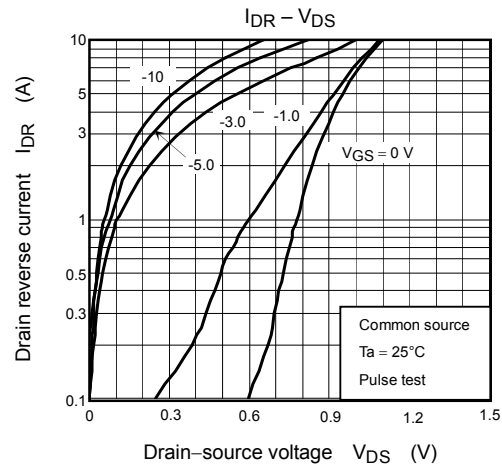
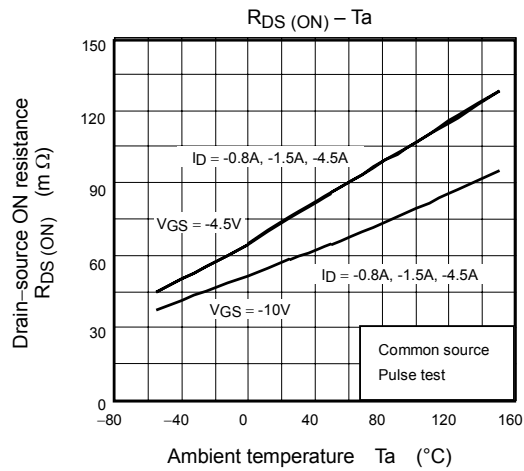
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	16.8	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 4.2 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V

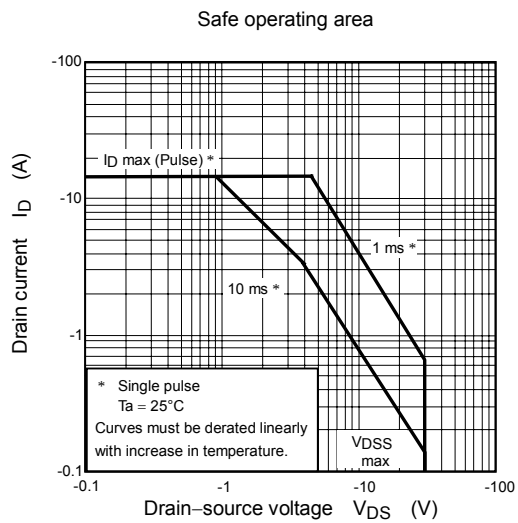
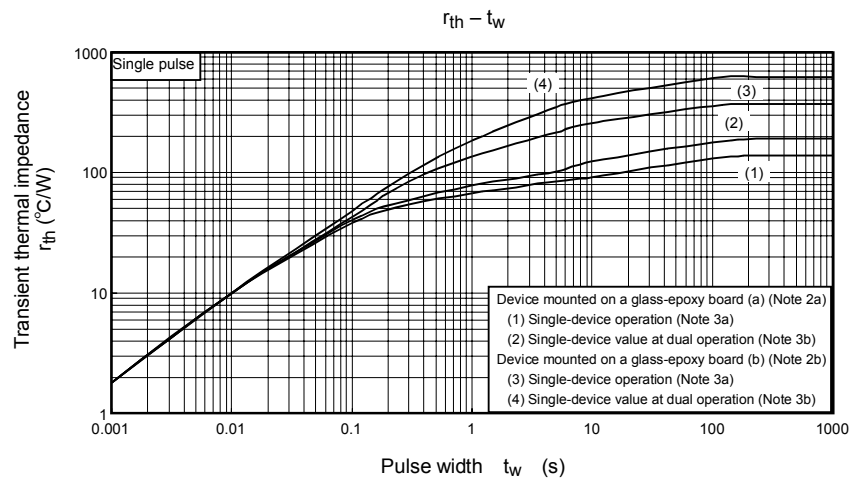
P-ch



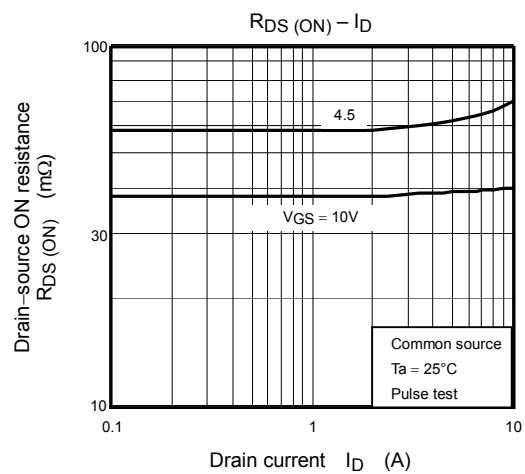
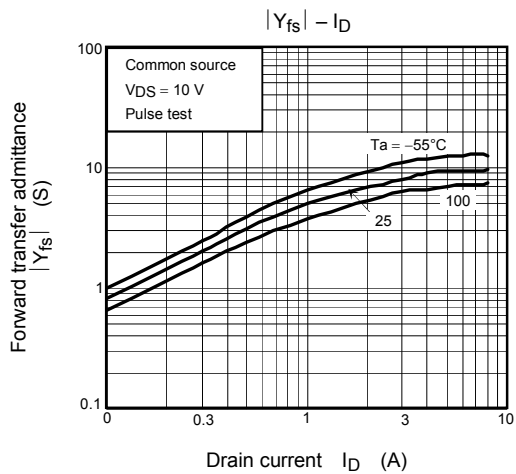
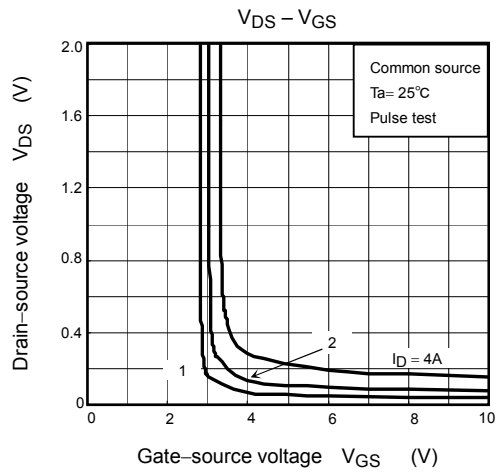
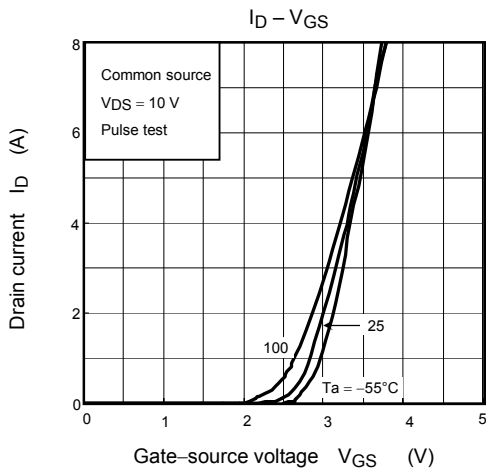
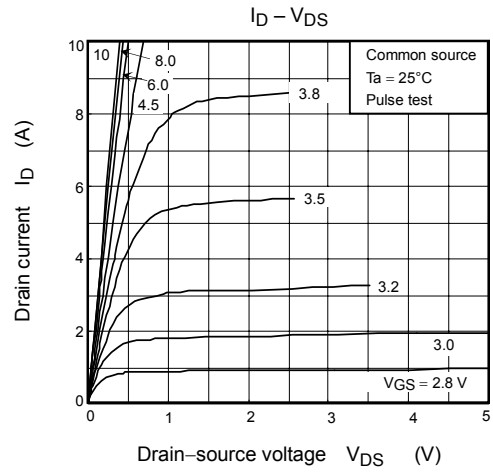
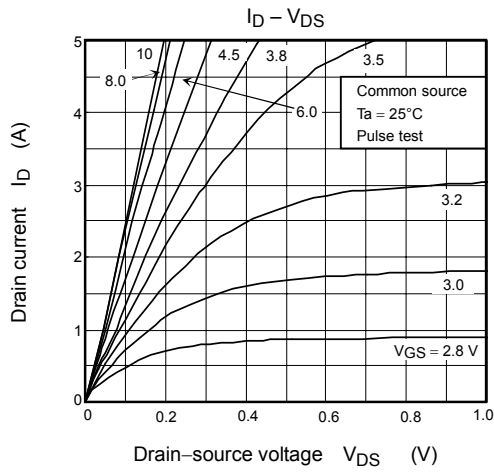
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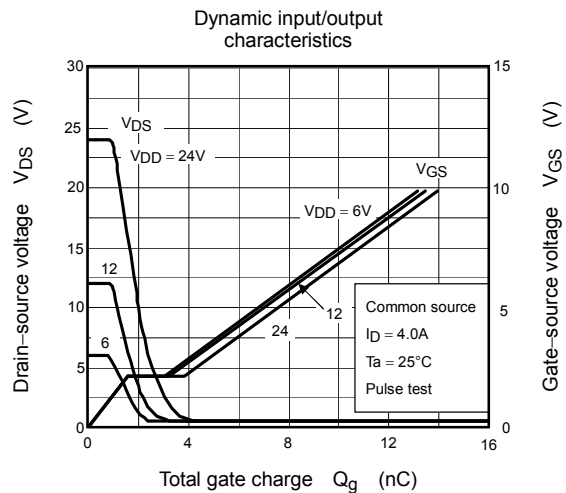
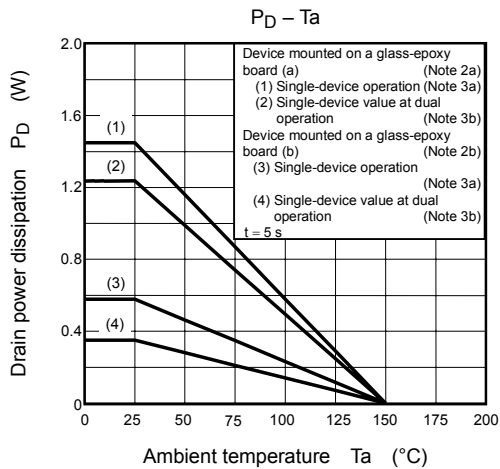
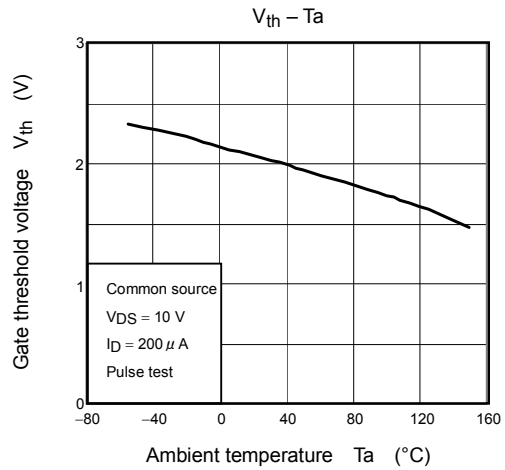
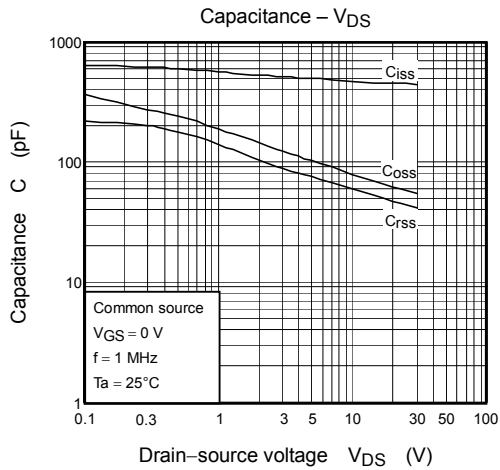
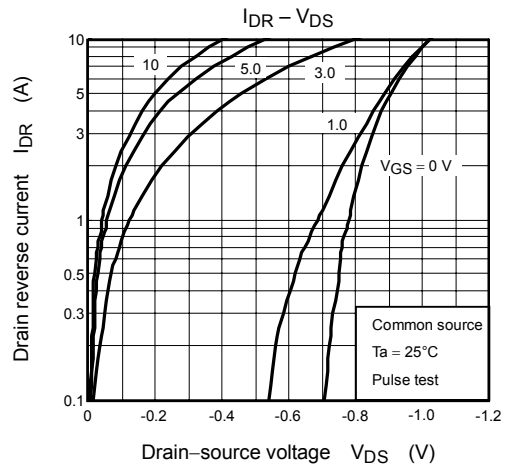
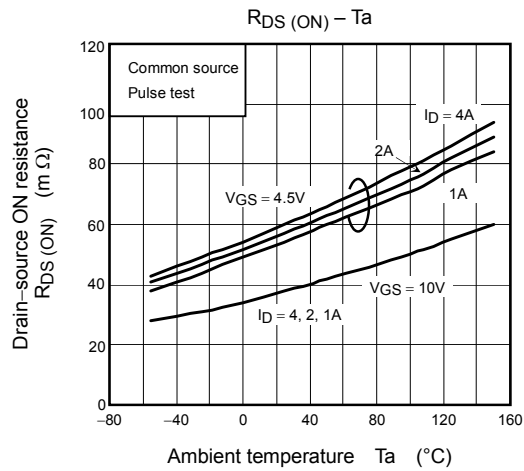
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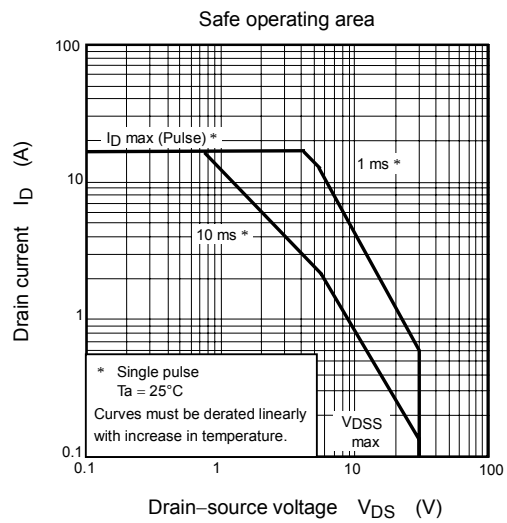
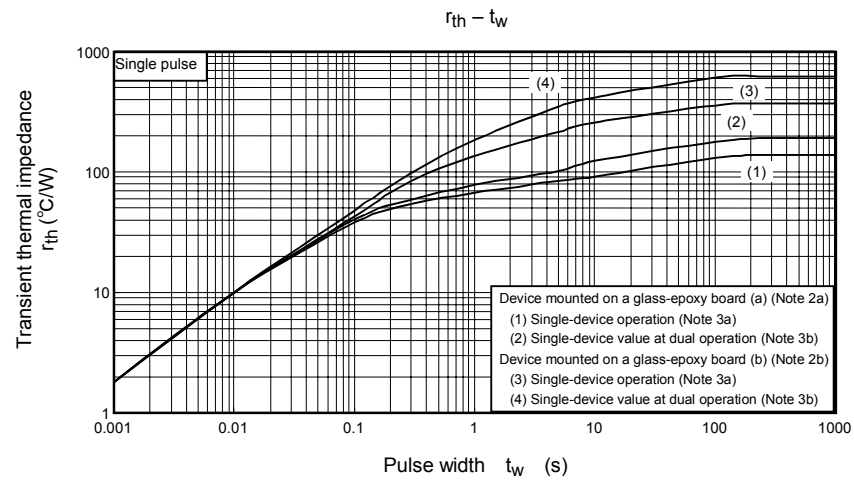
N-ch



N-ch



N-ch



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