

TOSHIBA FIELD EFFECT TRANSISTOR SILICON N, P CHANNEL MOS TYPE (U-MOSII)

TPC8401

LITHIUM ION SECONDARY BATTERY
NOTE BOOK PC
PORTABLE DEVICES

INDUSTRIAL APPLICATIONS
Unit in mm

- Low Drain-Source ON Resistance
: P CHANNEL $R_{DS(ON)} = 27 \text{ m}\Omega$ (Typ.)
N CHANNEL $R_{DS(ON)} = 14 \text{ m}\Omega$ (Typ.)
- High Forward Transfer Admittance
: P CHANNEL $|Y_{fs}| = 7 \text{ S}$ (Typ.)
N CHANNEL $|Y_{fs}| = 8 \text{ S}$ (Typ.)
- Low Leakage Current
: P CHANNEL $I_{DSS} = -10 \mu\text{A}$ ($V_{DS} = -30 \text{ V}$)
N CHANNEL $I_{DSS} = 10 \mu\text{A}$ ($V_{DS} = 30 \text{ V}$)
- Enhancement-Mode
: P CHANNEL $V_{th} = -0.8 \sim -2.0 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)
N CHANNEL $V_{th} = 0.8 \sim 2.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC		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}	± 20	± 20	V
Drain Current	DC	I_D	-4.5	6	A
	Pulse	I_{DP}	-18	24	A
Drain Power Dissipation**** ($T_a = 25^\circ\text{C}$)		P_D	2.0		W
Single Pulse Avalanche Energy		E_{AS}	26 **	46.8 ***	W
Avalanche Current		I_{AR}	-4.5	6	W
Repetitive Avalanche Energy*		E_{AR}	0.2		W
Channel Temperature		T_{ch}	150		$^\circ\text{C}$
Storage Temperature Range		T_{stg}	$-55 \sim 150$		$^\circ\text{C}$

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Channel to Ambient****	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

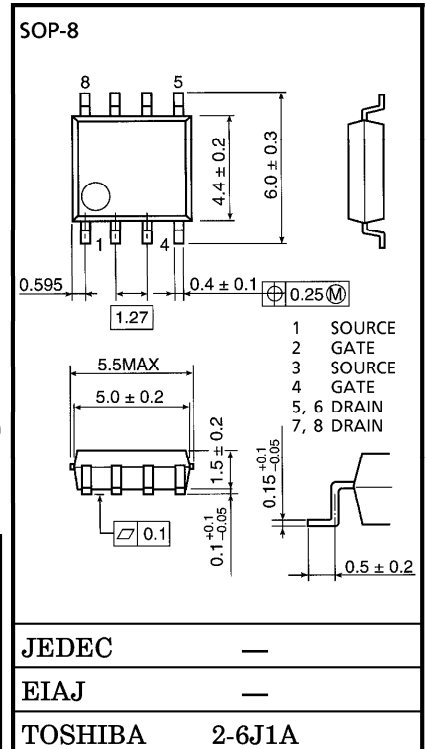
Note ;

- * Repetitive rating ; Pulse Width Limited by Max. Junction temperature.
- ** $V_{DD} = -24 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 1.0 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = -4.5 \text{ A}$
- *** $V_{DD} = 24 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 1.0 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 6.0 \text{ A}$
- **** Drive operation ; Mount on glass epoxy board [$1 \text{ inch}^2 \times 0.8 \text{ t}$]
in the two devices driving ($t = 10 \text{ s}$)

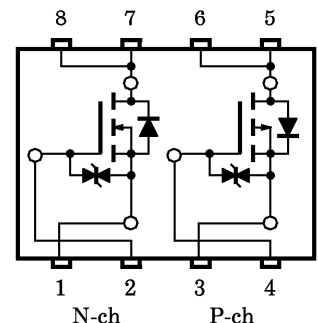
This transistor is an electrostatic sensitive device. Please handle with caution.

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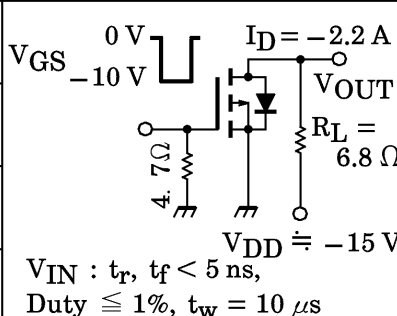


CIRCUIT CONFIGURATION



P-ch

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

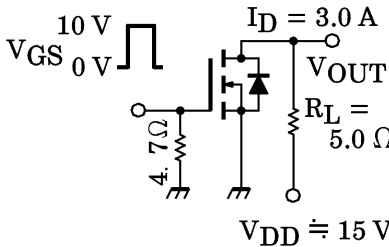
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain Cut-Off Current		I _{DSS}	V _{DS} = −30 V, V _{GS} = 0 V	—	—	−10	μA
Drain-Source Breakdown Voltage		V _{(BR) DSS}	I _D = −10 mA, V _{GS} = 0 V	−30	—	—	V
		V _{(BR) 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 V, I _D = −2.2 A	—	55	65	mΩ
		R _{DS (ON)}	V _{GS} = −10 V, I _D = −2.2 A	—	27	35	
Forward Transfer Admittance		Y _{fs}	V _{DS} = −10 V, I _D = −2.2 A	3.5	7	—	S
Input Capacitance		C _{iss}	V _{DS} = −10 V, V _{GS} = 0 V, f = 1 MHz	—	970	—	pF
Reverse Transfer Capacitance		C _{rss}		—	180	—	
Output Capacitance		C _{oss}		—	370	—	
Switching Time	Rise Time	t _r		—	17	—	ns
	Turn-On Time	t _{on}		—	20	—	
	Fall Time	t _f		—	75	—	
	Turn-Off Time	t _{off}		—	160	—	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q _g	V _{DD} ≐ −24 V, V _{GS} = −10 V I _D = −4.5 A	—	28	—	nC
Gate-Source Charge		Q _{gs}		—	16	—	
Gate-Drain (“Miller”) Charge		Q _{gd}		—	12	—	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I_{DR}	—	—	—	-4.5	A
Pulse Drain Reverse Current	I_{DRP}	—	—	—	-18	A
Diode Forward Voltage	V_{DSF}	$I_{DR} = -4.5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

N-ch

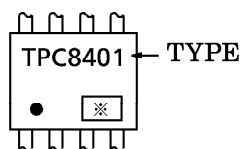
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain 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	—	2.5	V
Drain-Source ON Resistance		R _{DS} (ON)	V _{GS} = 4 V, I _D = 3 A	—	21	32	mΩ
		R _{DS} (ON)	V _{GS} = 10 V, I _D = 3 A	—	14	21	mΩ
Forward Transfer Admittance		Y _{fs}	V _{DS} = 10 V, I _D = 3 A	4	8	—	S
Input Capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	1700	—	pF
Reverse Transfer Capacitance		C _{rss}		—	260	—	
Output Capacitance		C _{oss}		—	380	—	
Switching Time	Rise Time	t _r	 V _{IN} : t _r , t _f < 5 ns Duty ≤ 1%, t _w = 10 μs	—	10	—	ns
	Turn-On Time	t _{on}		—	20	—	
	Fall Time	t _f		—	35	—	
	Turn-Off Time	t _{off}		—	120	—	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q _g	V _{DD} ≐ 24 V, V _{GS} = 10 V I _D = 6 A	—	40	—	nC
Gate-Source Charge		Q _{gs}		—	28	—	
Gate-Drain (“Miller”) Charge		Q _{gd}		—	12	—	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I_{DR}	—	—	—	6	A
Pulse Drain Reverse Current	I_{DRP}	—	—	—	24	A
Diode Forward Voltage	V_{DSF}	$I_{DR} = 6 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V

MARKING

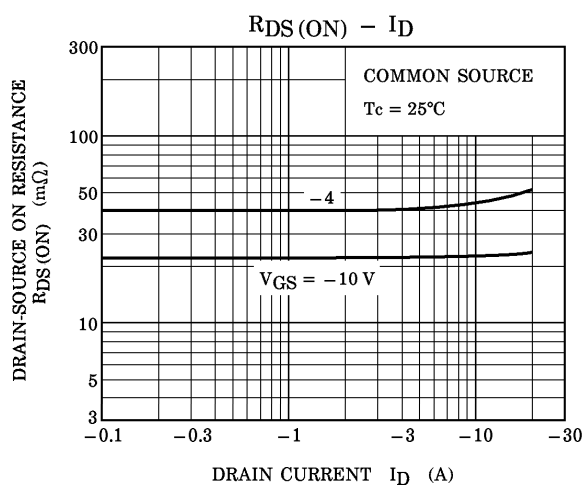
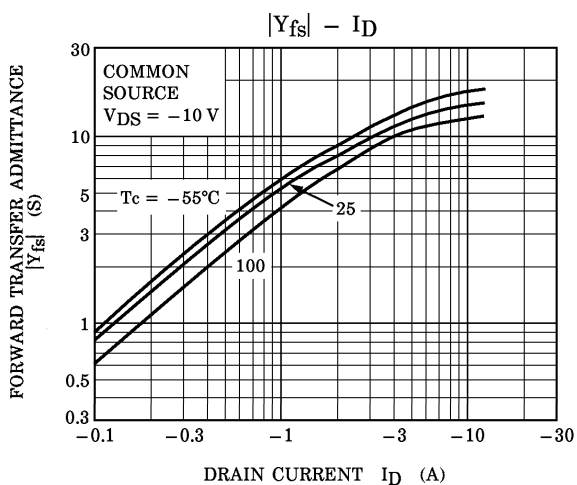
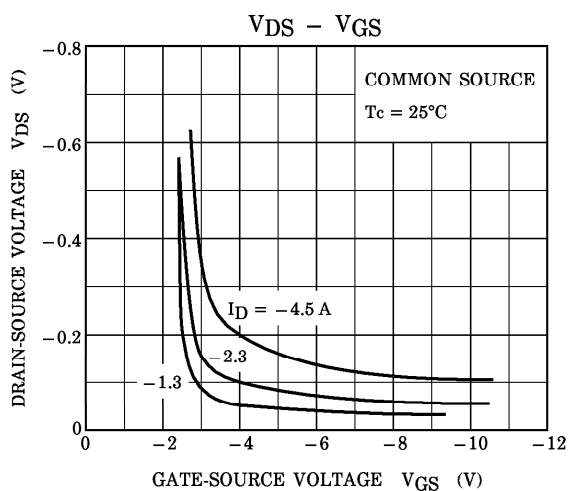
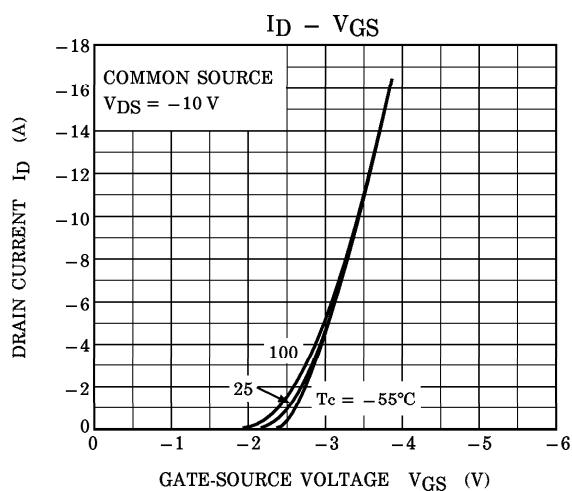
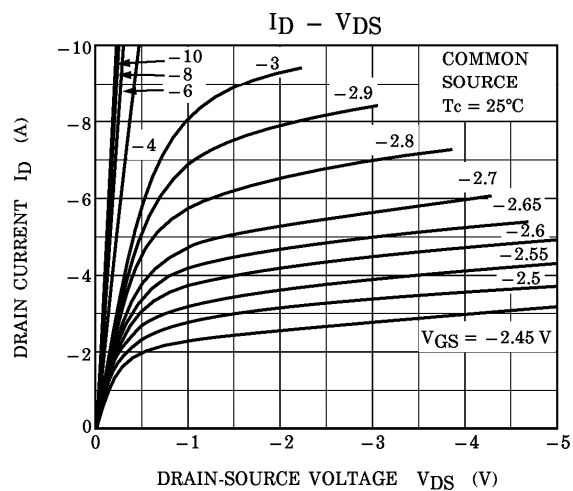
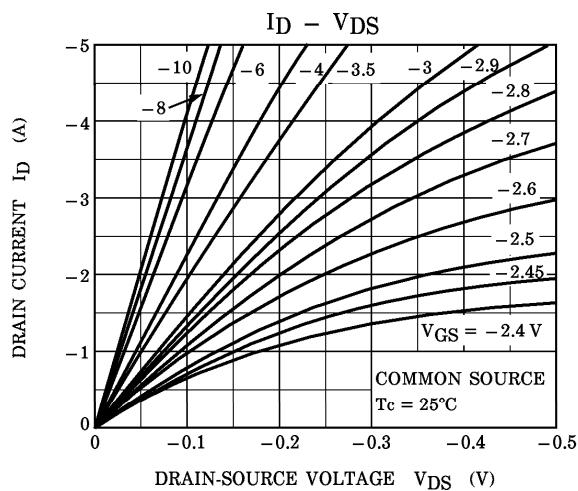


※ Lot Number

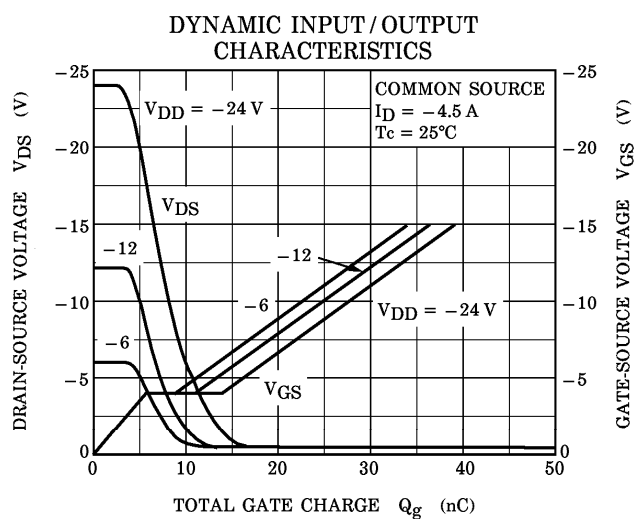
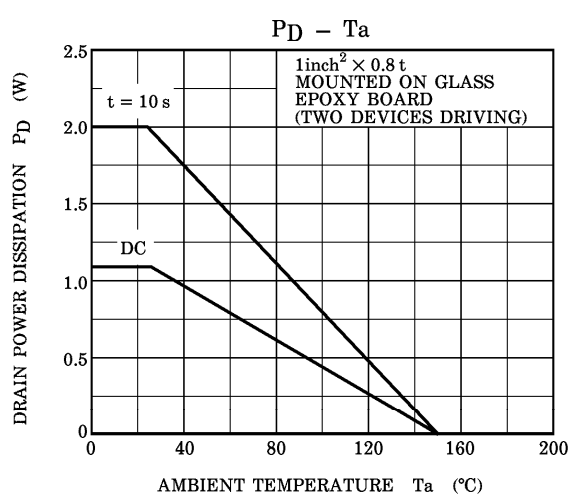
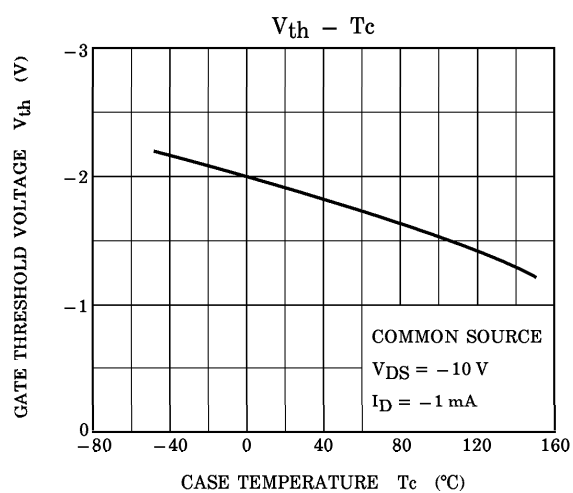
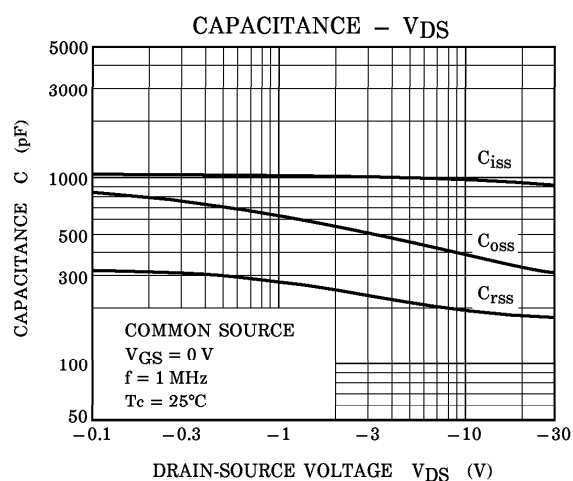
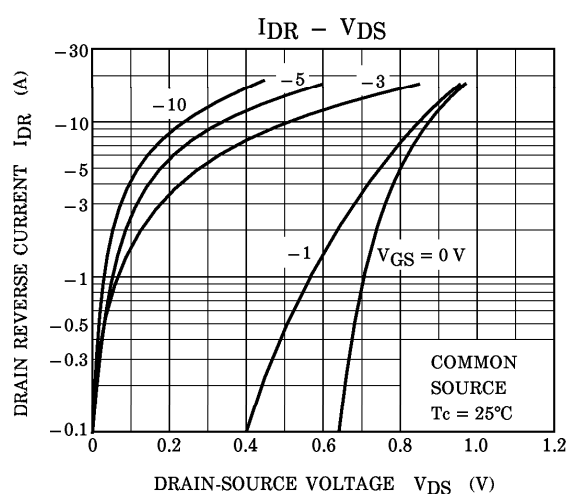
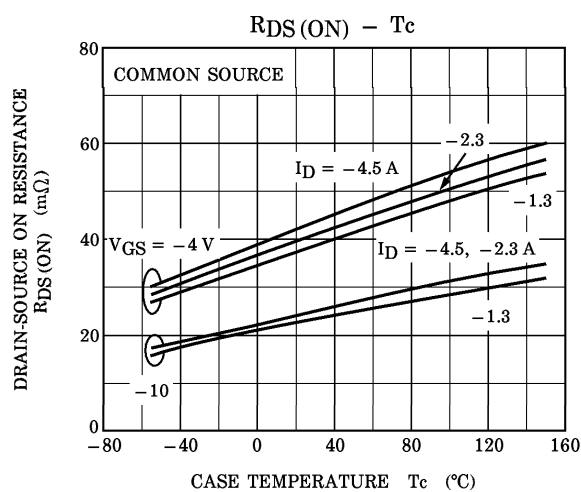
 — Month (Starting from Alphabet A)

 — Year (Last Number of the Christian Era)

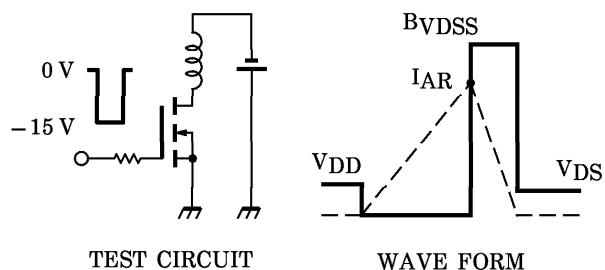
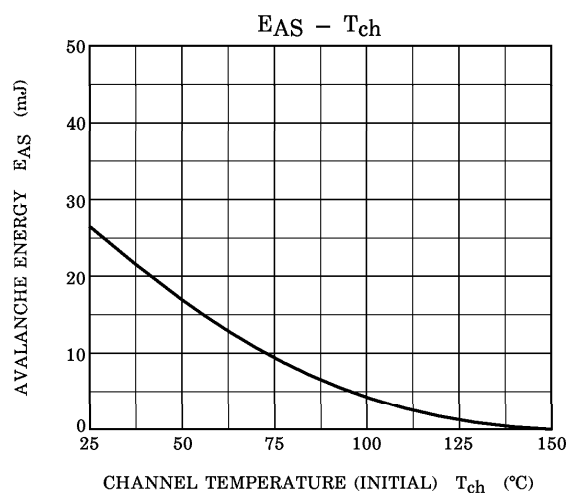
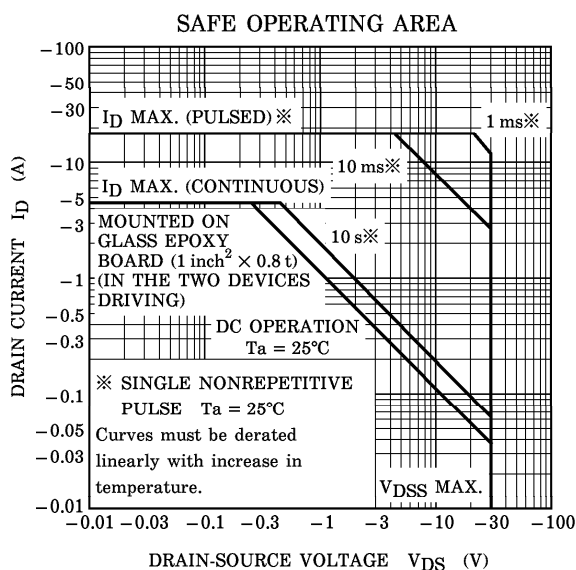
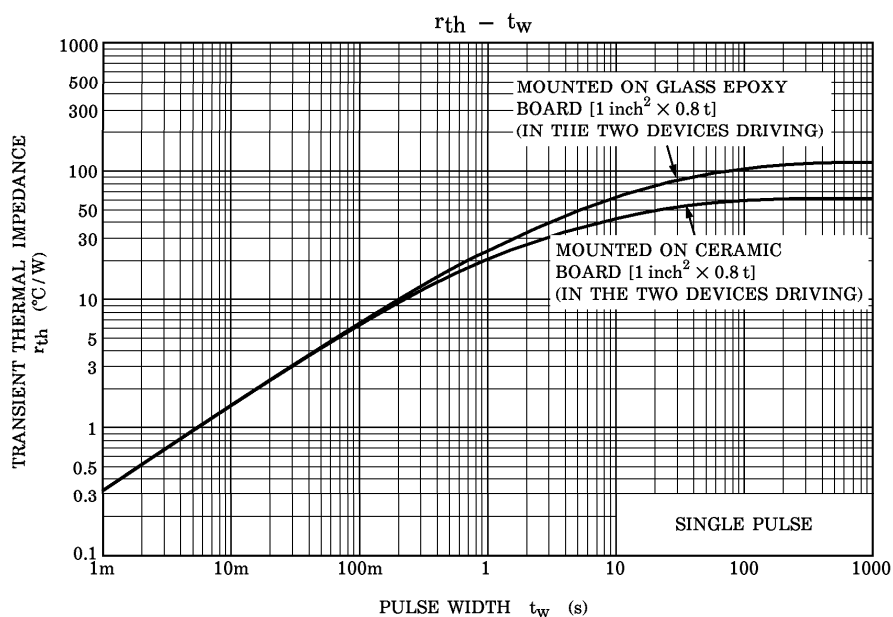
P-ch



P-ch

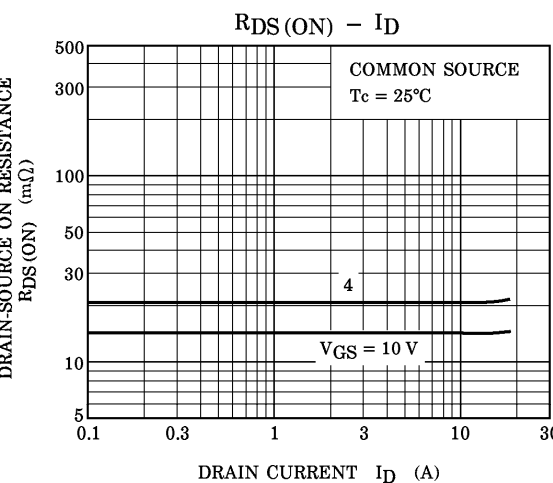
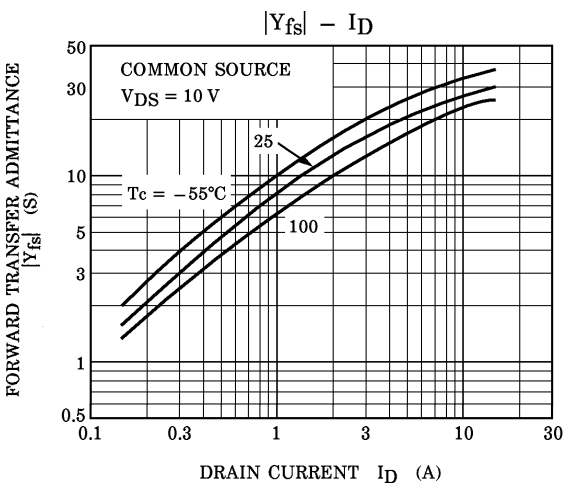
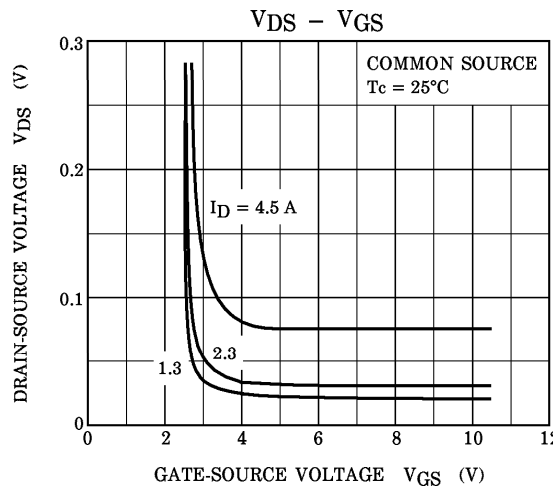
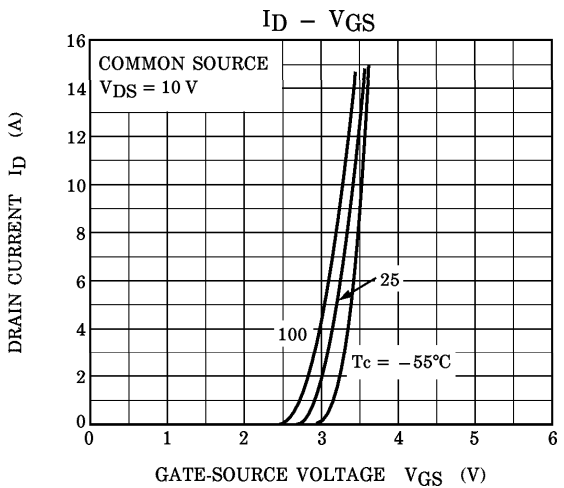
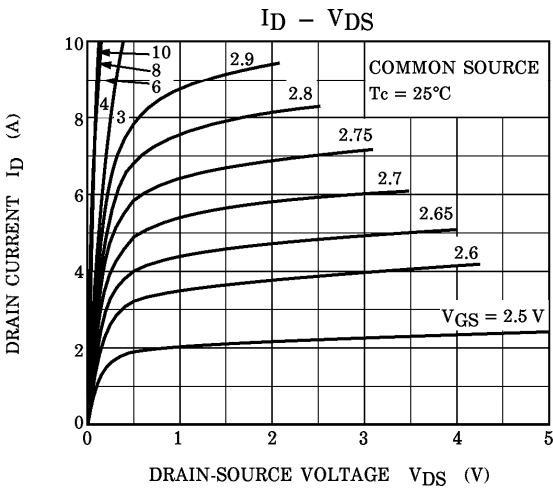
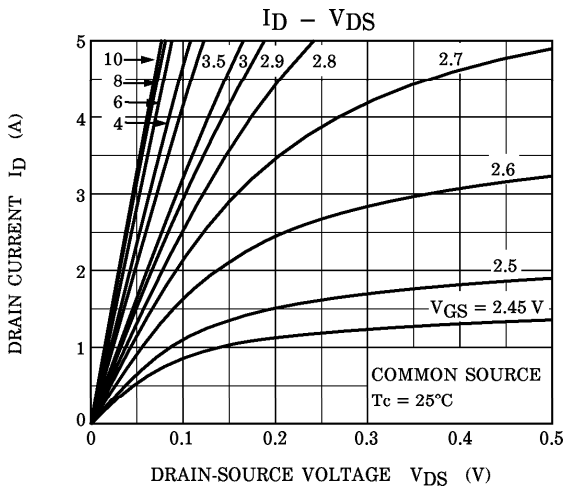


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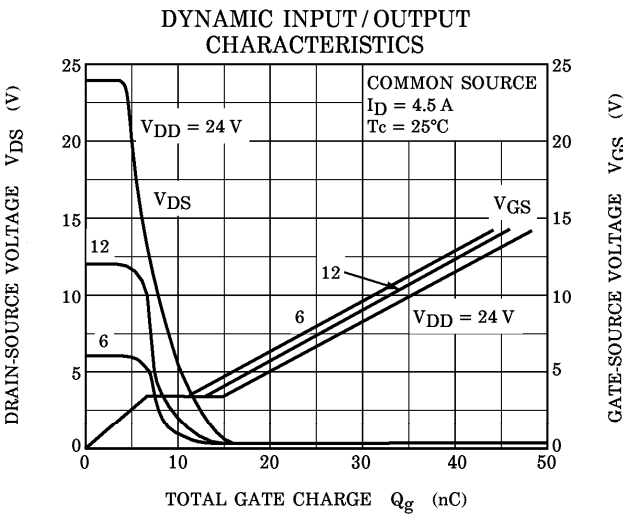
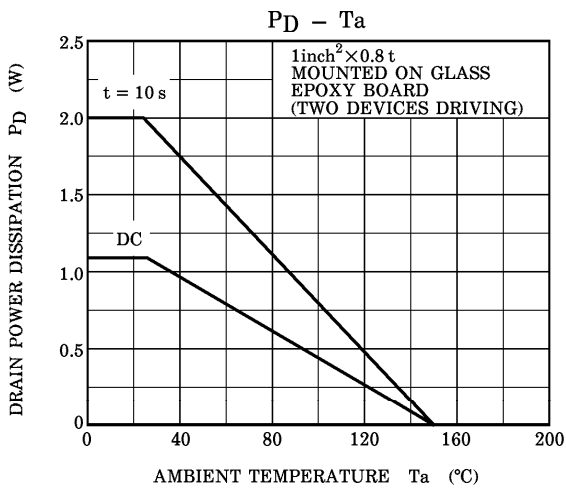
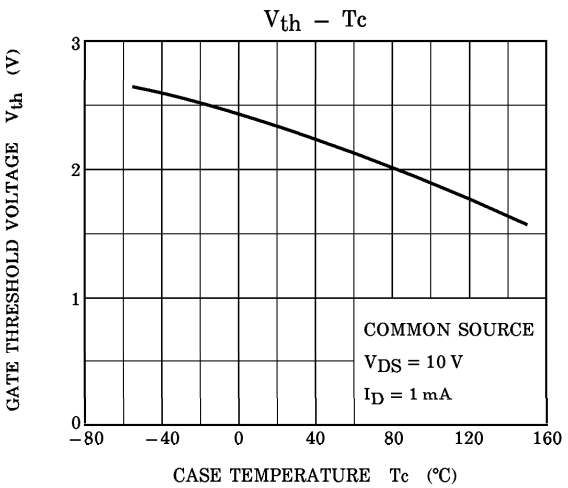
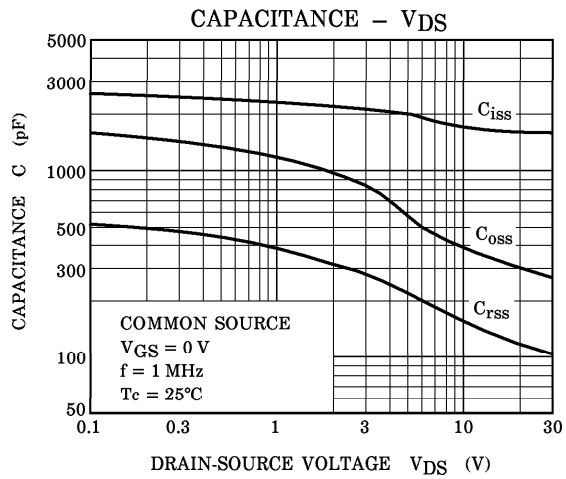
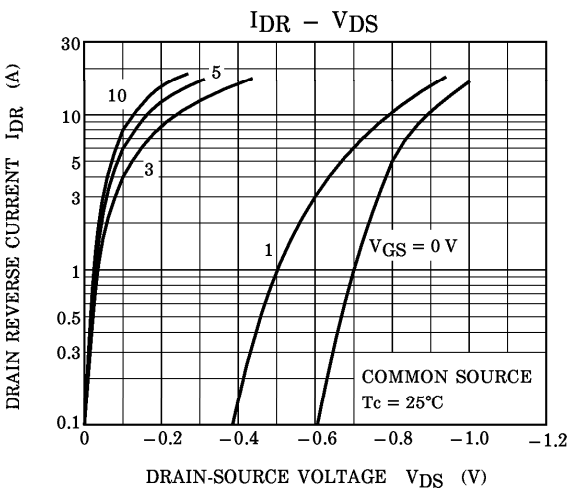
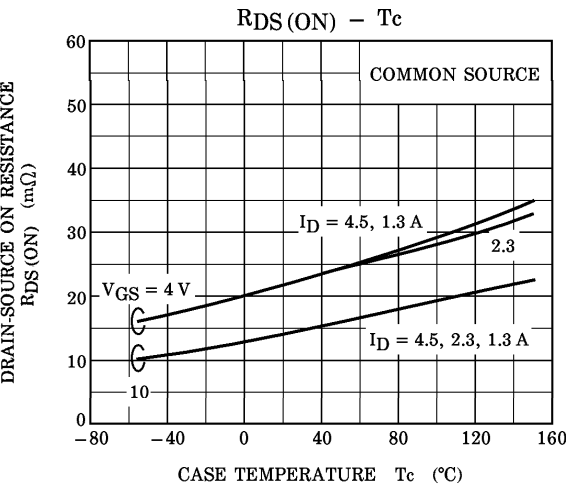


Peak $I_{AR} = -4.5 \text{ A}$, $R_G = 25 \Omega$ $E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{BVDSS}{BVDSS - V_{DD}} \right)$
 $V_{DD} = -24 \text{ V}$, $L = 1.0 \text{ mH}$

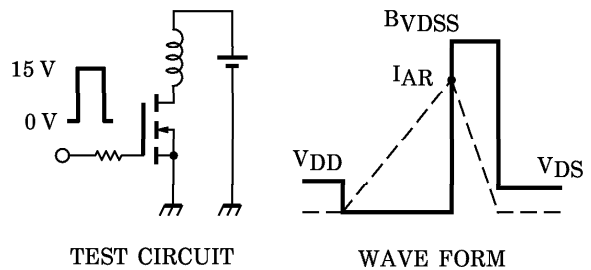
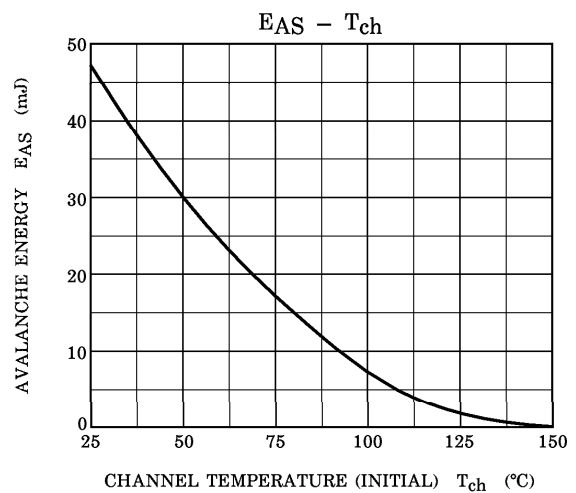
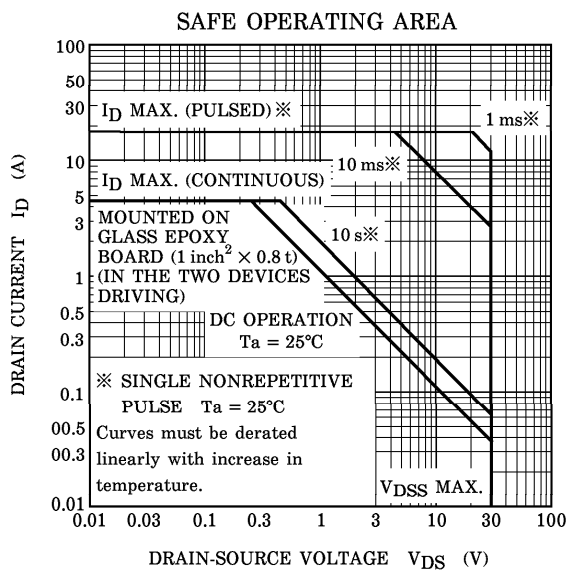
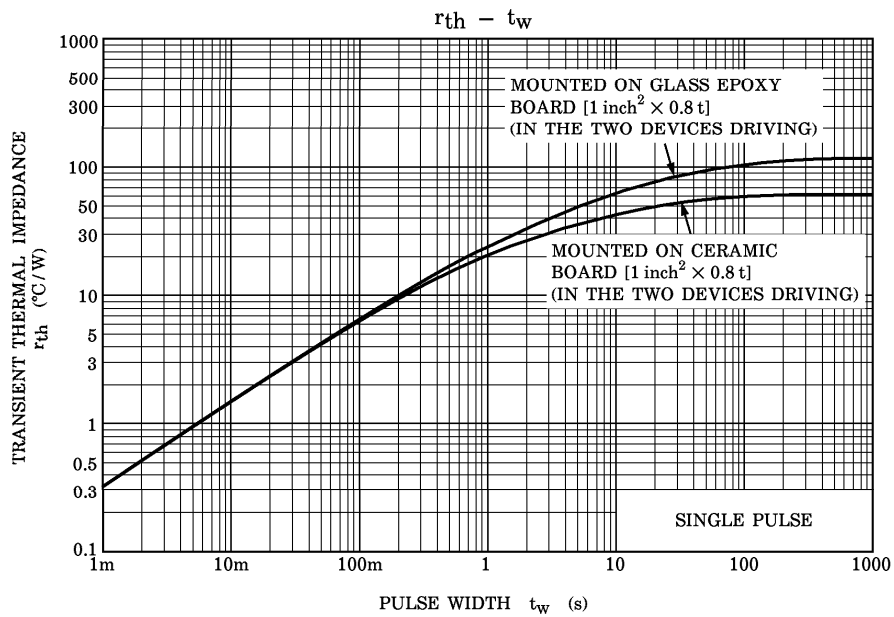
N-ch



N-ch



N-ch



Peak $I_{AR} = 6 \text{ A}$, $R_G = 25 \Omega$
 $V_{DD} = 24 \text{ V}$, $L = 1.0 \text{ mH}$

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