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

TPC8401

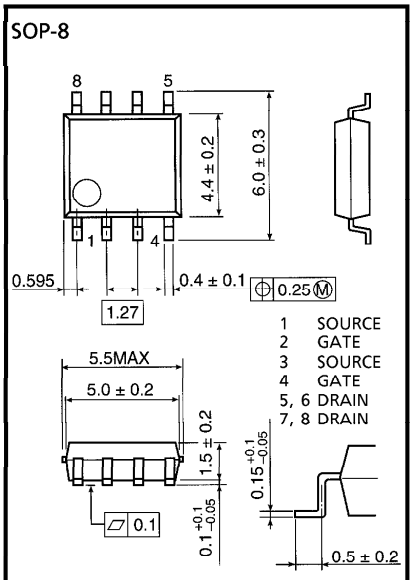
HIGH SPEED, HIGH VOLTAGE SWITCHING APPLICATIONS

DC-DC CONVERTER, RELAY DRIVE AND MOTOR DRIVE APPLICATIONS

INDUSTRIAL APPLICATIONS

- Low Drain-Source ON Resistance
  : P CANNEL $R_{DS\,(ON)}$ = 23 mΩ (Typ.)
  N CANNEL $R_{DS\,(ON)}$ = 15 mΩ (Typ.)
- High Forward Transfer Admittance
  : P CANNEL $|Y_{fs}|$ = 7 S (Typ.)
  N CANNEL $|Y_{fs}|$ = 12 S (Typ.)
- Low Leakage Current
  : P CANNEL I_{DSS} = −10 μA (V_{DS} = −30 V)
  N CANNEL I_{DSS} = 10 μA (V_{DS} = 30 V)
- Enhancement-Mode: P CANNEL V_{th} = −0.8~−2.5 V
  (V_{DS} = −10 V, I_D = −1 mA)
  N CANNEL V_{th} = 0.8~2.5 V
  (V_{DS} = 10 V, I_D = 1 mA)

Unit in mm

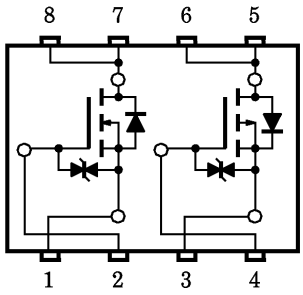


JEDEC	—
EIAJ	—
TOSHIBA	2-6J1A

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING		UNIT
			P CANNEL	N CANNEL	
Drain-Source Voltage		V_{DSS}	−30	30	V
Drain-GateVoltage (R_{GS} = 20 kΩ)		V_{DGR}	−30	30	V
Gate-Source Voltage		V_{GSS}	±20	±20	V
Drain Current	DC	I_D	−4.5	4.5	A
	Pulse	I_{DP}	−18	18	A
Drain Power Dissipation (Tc = 25°C)		P_D	2.0		W
Channel Temperature		T_{ch}	150		°C
Storage Temperature Range		T_{stg}	−55~150		°C

CIRCUIT CONFIGURATION



THERMAL CHARACTERISTICS

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

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

961001EAA1

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

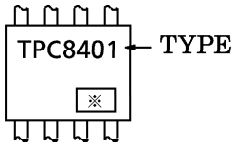
CHARACTERISTIC	SYMBOL	P / N	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current	I_{GSS}	P, N	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain Cut-Off Current	I_{DSS}	P	V_{DS} = −30 V, V_{GS} = 0 V	—	—	−10	μA
		N	V_{DS} = 30 V, V_{GS} = 0 V	—	—	10	
Drain-Source Breakdown Voltage	$V_{(BR)\ DSS}$	P	I_D = −10 mA, V_{GS} = 0 V	−30	—	—	V
		N	I_D = 10 mA, V_{GS} = 0 V	30	—	—	
	$V_{(BR)\ DSX}$	P	I_D = 10 mA, V_{GS} = 20 V	15	—	—	
		N	I_D = −10 mA, V_{GS} = −20 V	−15	—	—	
Gate Threshold Voltage	V_{th}	P	V_{DS} = −10 V, I_D = −1 mA	−0.8	—	−2.5	V
		N	V_{DS} = 10 V, I_D = 1 mA	0.8	—	2.5	
Drain-Source ON Resistance	$R_{DS\ (ON)}$	P	V_{GS} = −4 V, I_D = −1.8 A	—	40	65	mΩ
			V_{GS} = −10 V, I_D = −1.8 A	—	23	39	
		N	V_{GS} = 4 V, I_D = 1.8 A	—	21	37	
			V_{GS} = 10 V, I_D = 1.8 A	—	15	21	
Forward Transfer Admittance	$\|Y_{fs}\|$	P	V_{DS} = −10 V, I_D = −1.8 A	3.5	7	—	S
		N	V_{DS} = 10 V, I_D = 1.8 A	6	12	—	
Input Capacitance	C_{iss}	P	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	970	—	pF
		N	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1700	—	
Reverse Transfer Capacitance	C_{rss}	P	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	180	—	
		N	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	260	—	
Output Capacitance	C_{oss}	P	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	370	—	
		N	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	380	—	
Switching Time	t_r	P	V_{GS} = −10 V, I_D = −1.8 A R_L = 8.3 Ω	—	17	—	ns
		N	V_{GS} = 10 V, I_D = 1.8 A R_L = 8.3 Ω	—	10	—	
	t_{on}	P	V_{GS} = −10 V, I_D = −1.8 A R_L = 8.3 Ω	—	20	—	
		N	V_{GS} = 10 V, I_D = 1.8 A R_L = 8.3 Ω	—	20	—	
	t_f	P	V_{GS} = −10 V, I_D = −1.8 A R_L = 8.3 Ω	—	75	—	
		N	V_{GS} = 10 V, I_D = 1.8 A R_L = 8.3 Ω	—	35	—	
	t_{off}	P	V_{GS} = −10 V, I_D = −1.8 A R_L = 8.3 Ω	—	160	—	ns
		N	V_{GS} = 10 V, I_D = 1.8 A R_L = 8.3 Ω	—	120	—	

CHARACTERISTIC	SYMBOL	P / N	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Switching Time	t_r	P	V_{GS} = −10 V, I_D = −1.8 A, R_L = 8.3 Ω	—	17	—	ns
		N	V_{GS} = 10 V, I_D = 1.8 A, R_L = 8.3 Ω	—	10	—	
	t_{on}	P	V_{GS} = −10 V, I_D = −1.8 A, R_L = 8.3 Ω	—	20	—	
		N	V_{GS} = 10 V, I_D = 1.8 A, R_L = 8.3 Ω	—	20	—	
	t_f	P	V_{GS} = −10 V, I_D = −1.8 A, R_L = 8.3 Ω	—	75	—	
		N	V_{GS} = 10 V, I_D = 1.8 A, R_L = 8.3 Ω	—	35	—	
	t_{off}	P	V_{GS} = −10 V, I_D = −1.8 A, R_L = 8.3 Ω	—	160	—	ns
		N	V_{GS} = 10 V, I_D = 1.8 A, R_L = 8.3 Ω	—	120	—	

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

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

MARKING



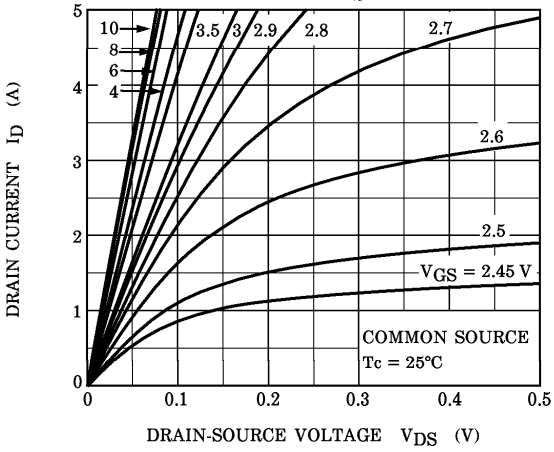
※ Lot Number

□□ Month (Starting from Alphabet A)

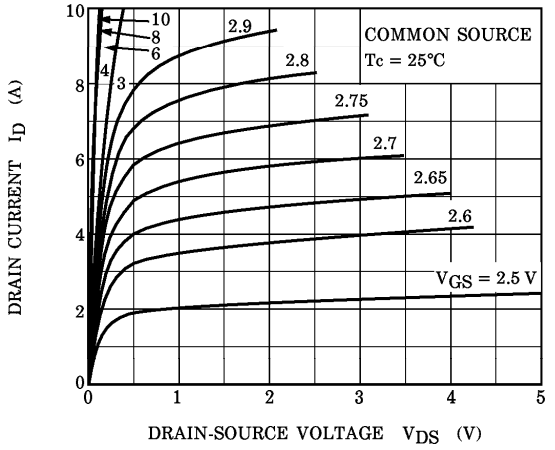
Year (Last Number of the Christian Era)

N-ch

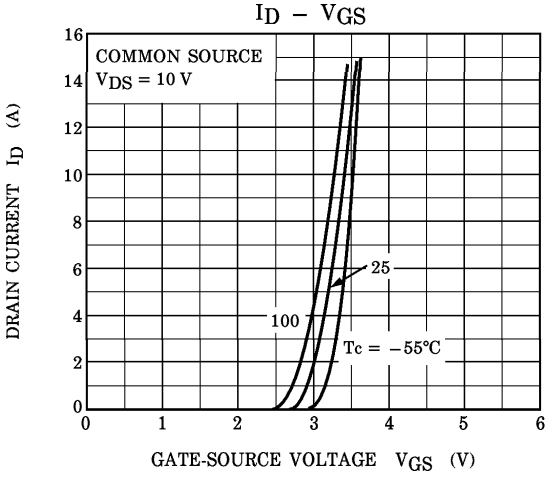
$I_D - V_{DS}$



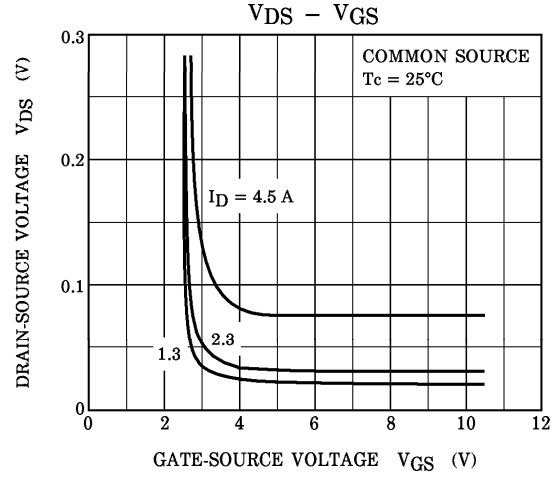
$I_D - V_{DS}$



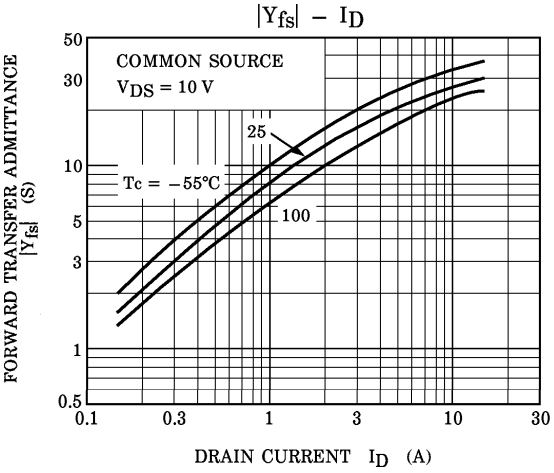
$I_D - V_{GS}$



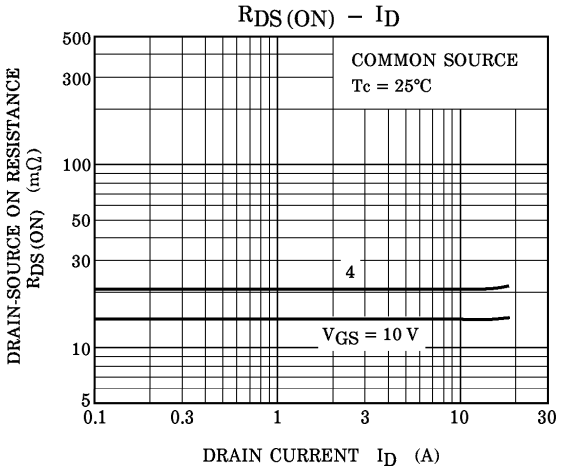
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$

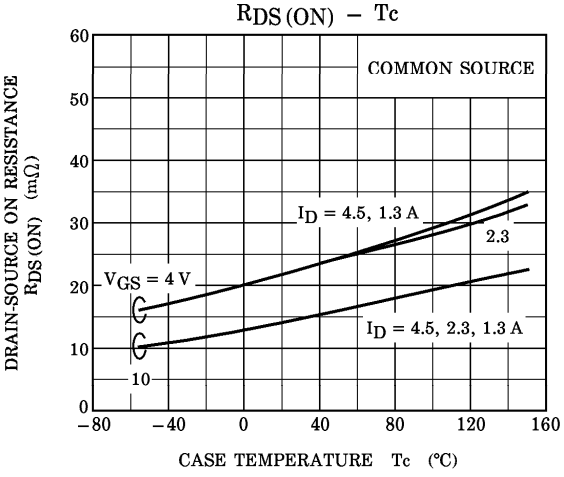


$R_{DS\,(ON)} - I_D$

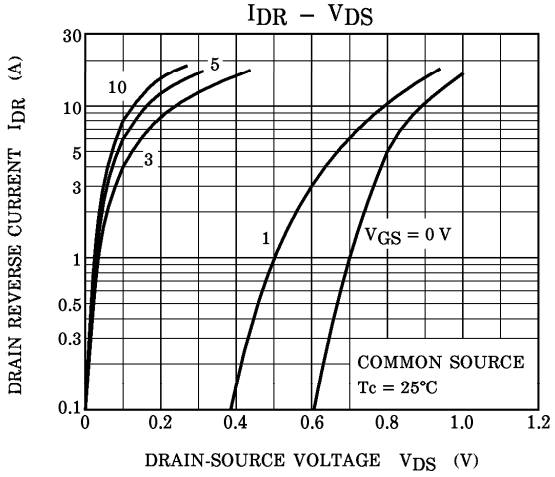


N-ch

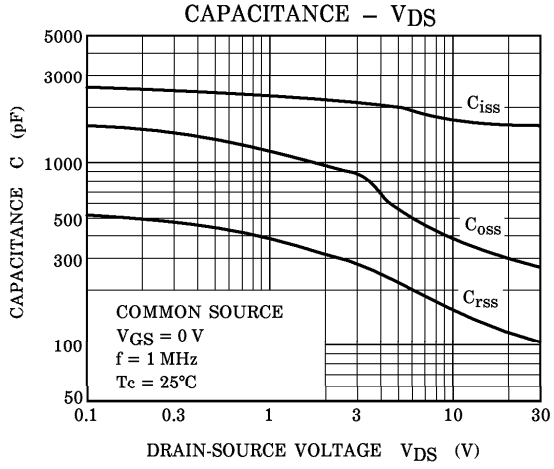
$R_{DS\,(ON)}$ – Tc



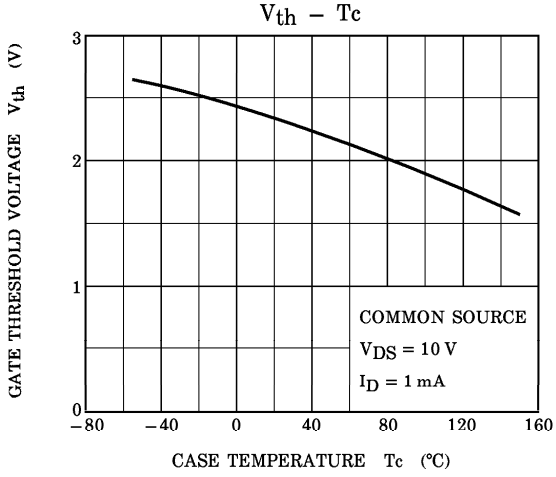
I_{DR} – V_{DS}



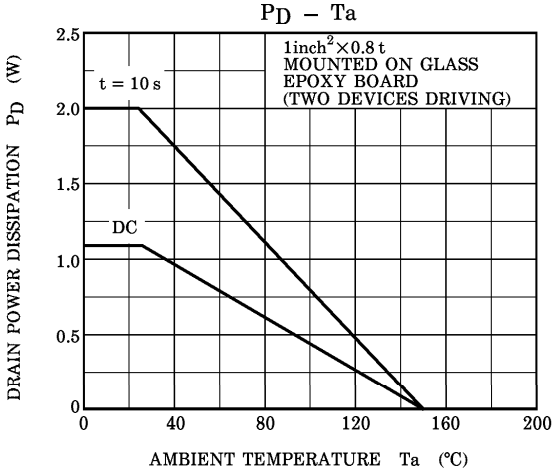
CAPACITANCE – V_{DS}



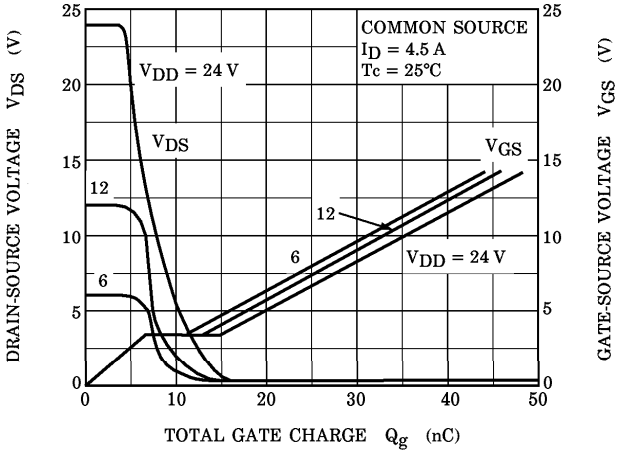
V_{th} – Tc



P_D – Ta

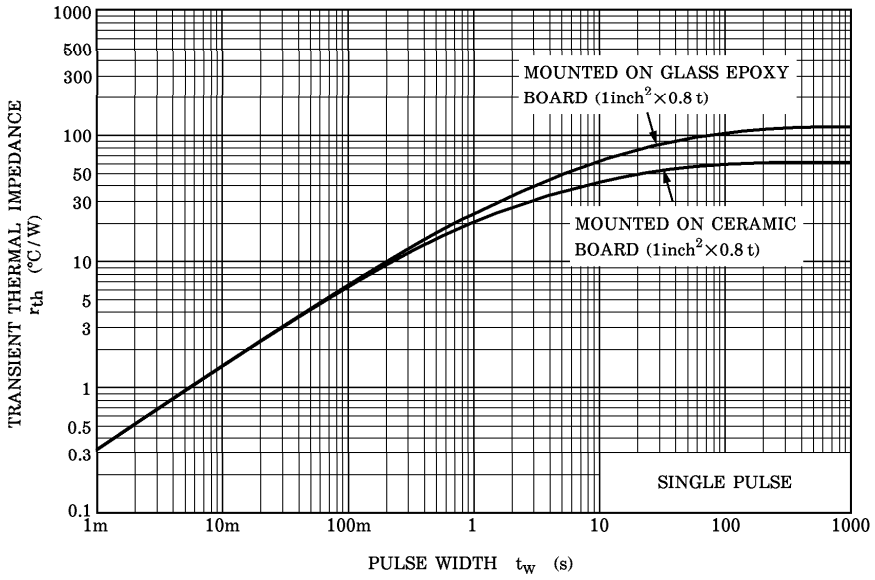


DYNAMIC INPUT / OUTPUT CHARACTERISTICS

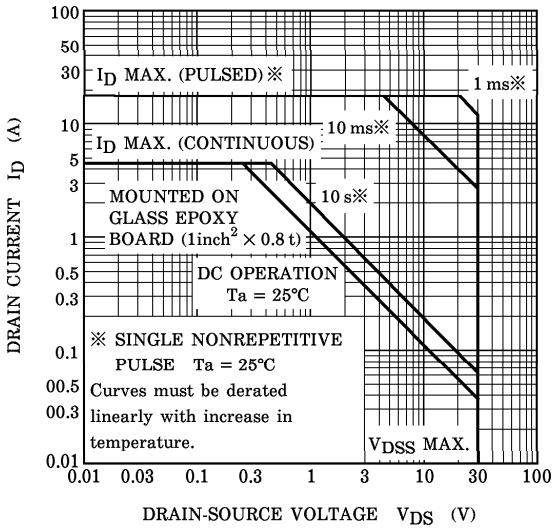


N-ch

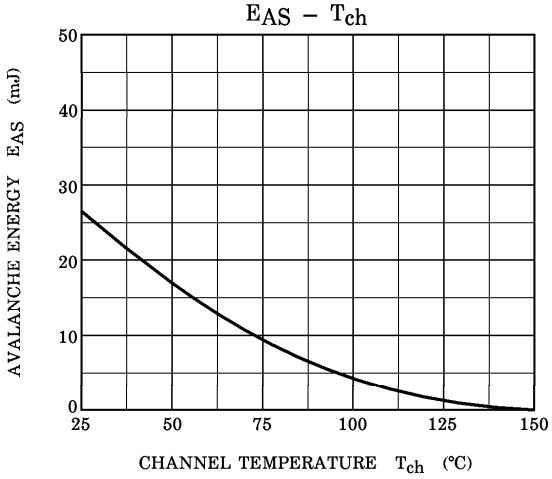
r_{th} – t_w

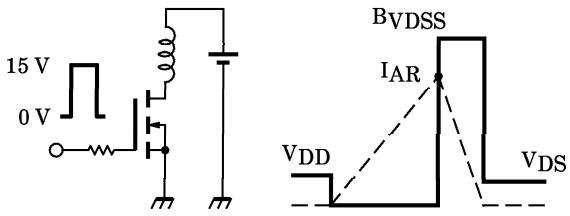


SAFE OPERATING AREA



E_{AS} – T_{ch}





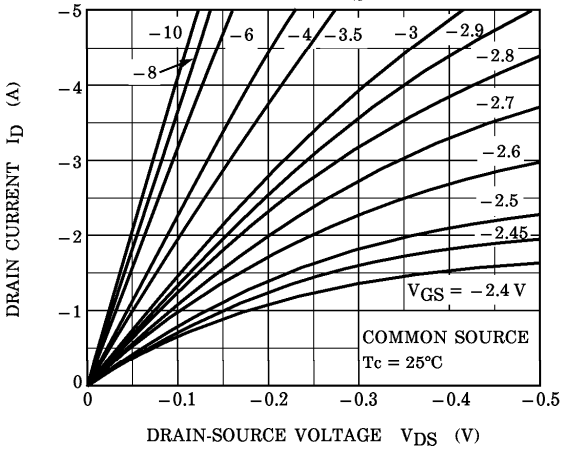
TEST CIRCUIT WAVE FORM

Peak I_{AR} = 4.5 A, R_G = 25 Ω
V_{DD} = 24 V, L = 1.0 mH

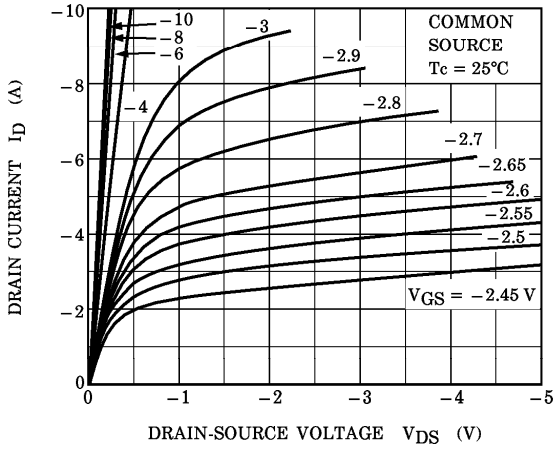
$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

P-ch

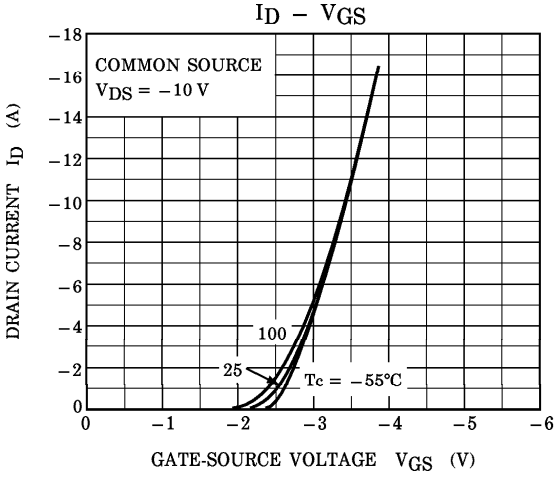
$I_D - V_{DS}$



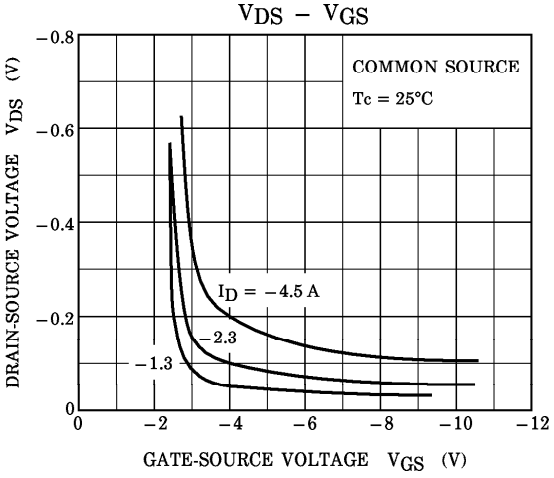
$I_D - V_{DS}$



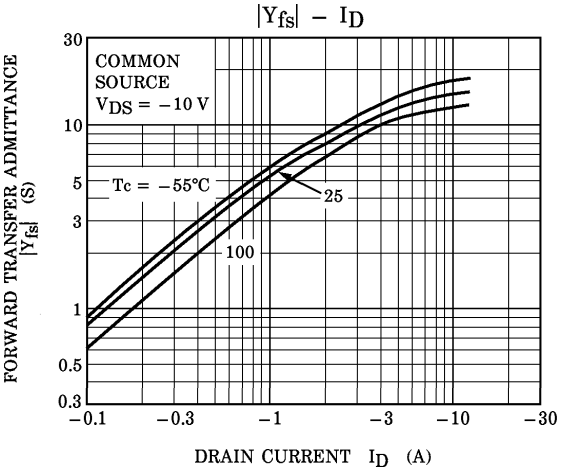
$I_D - V_{GS}$



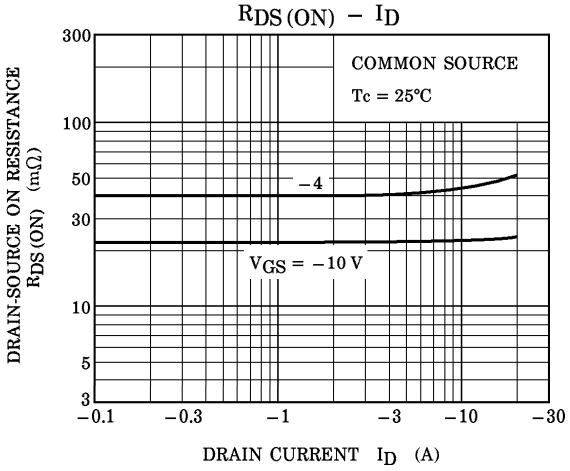
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$

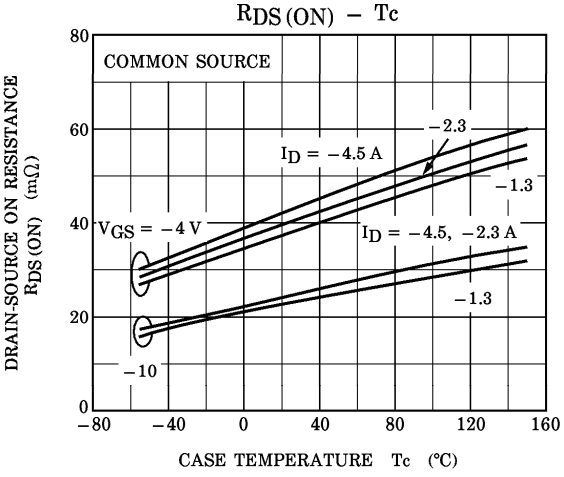


$R_{DS\,(ON)} - I_D$

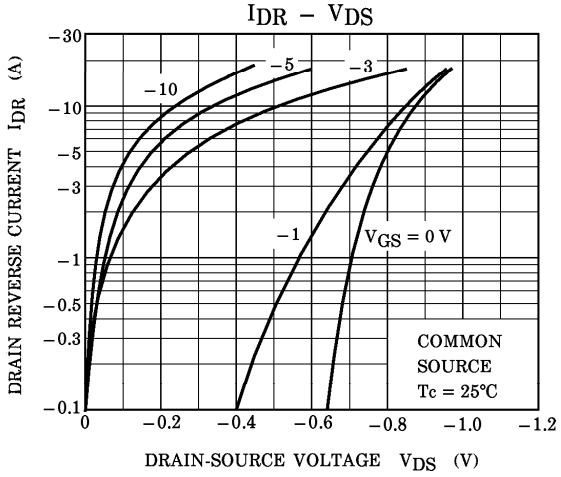


P-ch

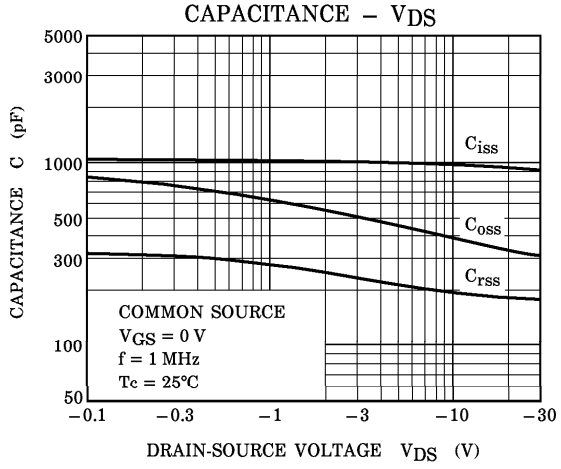
$R_{DS\,(ON)}$ – Tc



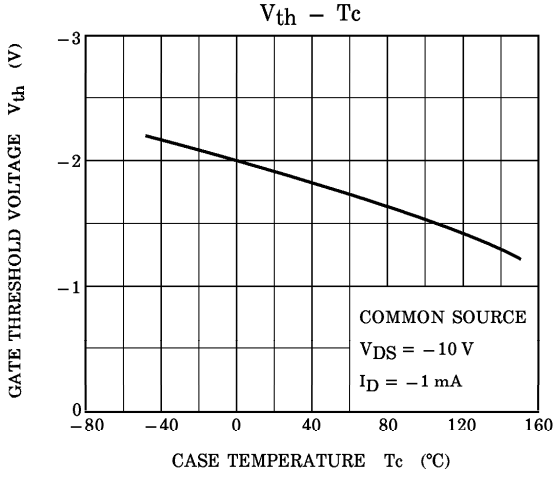
I_{DR} – V_{DS}



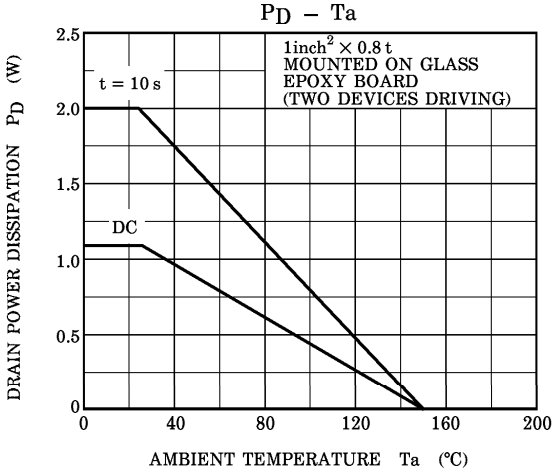
CAPACITANCE – V_{DS}



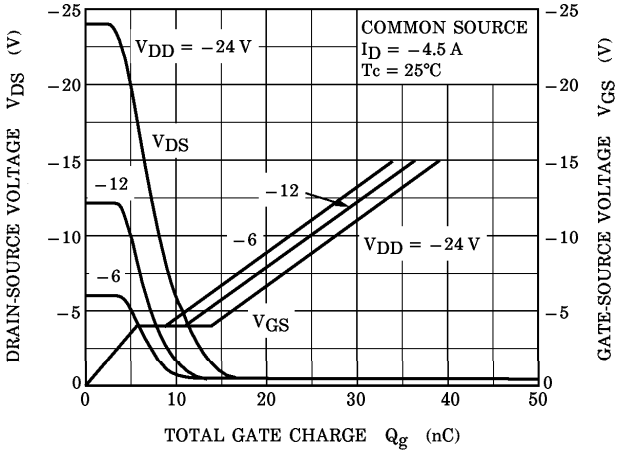
V_{th} – Tc



P_D – Ta

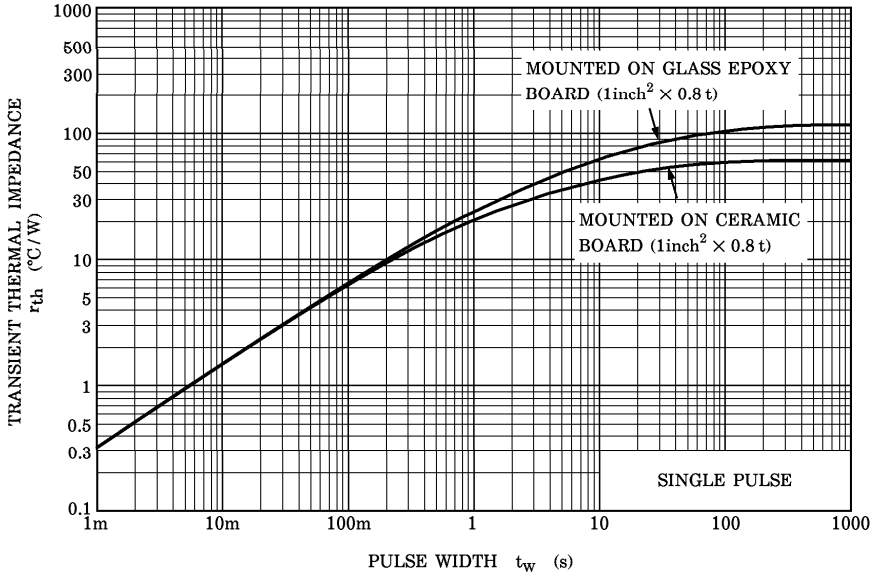


DYNAMIC INPUT / OUTPUT CHARACTERISTICS

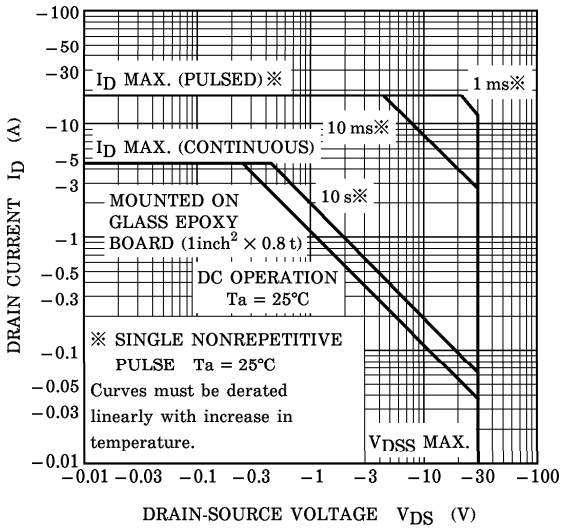


P-ch

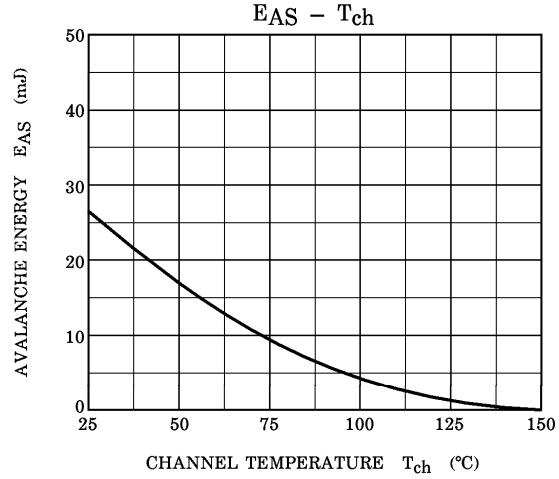
$r_{th} - t_w$

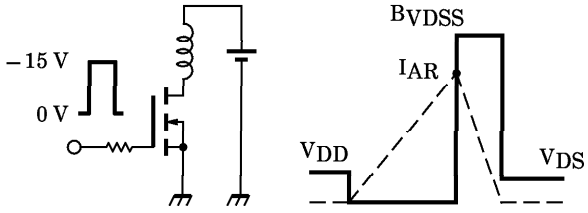


SAFE OPERATING AREA



$E_{AS} - T_{ch}$





TEST CIRCUIT WAVE FORM

Peak $I_{AR} = -4.5$ A, $R_G = 25\ \Omega$
$V_{DD} = -24$ V, L = 1.0 mH

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