TOSHIBA POWER MOS FET MODULE SILICON N & P CHANNEL MOS TYPE (L^2-π-MOSⅣ 4 IN 1)

MP4207

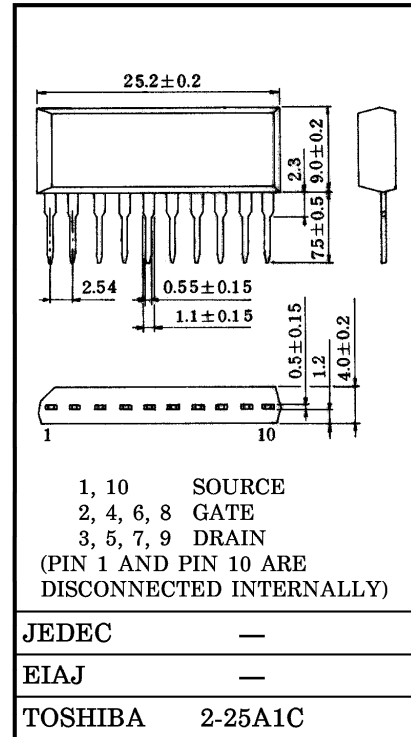
INDUSTRIAL APPLICATIONS

Unit in mm

○ HIGH POWER HIGH SPEED SWITCHING APPLICATIONS.

○ H-SWITCH DRIVER

- 4-Volt Gate Drive.
- Small Package by Full Molding. (SIP 10 Pin)
- High Drain Power Dissipation. (4 Devices Operation)
  : $P_T = 4W$ @Ta = 25°C
- Low Drain-Source ON Resistance
  : $R_{DS(ON)} = 90m\Omega$ TYP. (Nch)
  : $R_{DS(ON)} = 170m\Omega$ TYP.(Pch)
- Low Leakage Current : $I_{GSS} = \pm 10\mu A$ (Max.) @$V_{GS} = \pm 16V$
  : $I_{DSS} = 100\mu A$ (Max.) @$V_{DS} = 60V$
- Enhancement-Mode : $V_{th} = 0.8 \sim 2.0V$ @I_D = 1mA



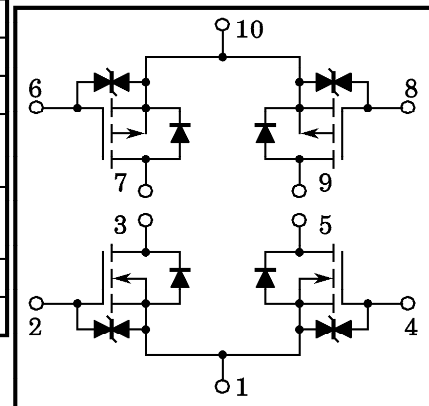
1, 10 SOURCE
2, 4, 6, 8 GATE
3, 5, 7, 9 DRAIN
(PIN 1 AND PIN 10 ARE DISCONNECTED INTERNALLY)

JEDEC	—
EIAJ	—
TOSHIBA	2-25A1C

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING		UNIT
		Nch	Pch	
Drain-Source Voltage	V_{DSS}	60	−60	V
Gate-Source Voltage	V_{GSS}	±20	±20	V
Drain Current	I_D	5	−5	A
Peak Drain Current	I_{DP}	10	−10	A
Drain Power Dissipation (1 Device Operation, Ta = 25°C)	P_D	2.0		W
Drain Power Dissipation (4 Devices Operation, Ta = 25°C)	P_T	4.0		W
Channel Temperature	T_{ch}	150		°C
Storage Temperature Range	T_{stg}	−55~150		°C

ARRAY CONFIGURATION



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Thermal Resistance of Channel to Ambient (4 Devices Operation, Ta = 25°C)	$\Sigma R_{th(ch-a)}$	31.2	°C / W
Maximum Lead Temperature for Soldering Purposes (3.2mm from Case for 10 second)	T_L	260	°C

THIS TRANSISTOR IS AN ELECTROSTATIC SENSITIVE DEVICE. PLEASE HANDLE WITH CAUTION.

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● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

ELECTRICAL CHARACTERISTICS ($Ta = 25°C$) (Nch MOS FET)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	$V_{GS} = \pm 16V$, $V_{DS} = 0$	—	—	±10	μA
Drain Cut-off Current		I_{DSS}	$V_{DS} = 60V$, $V_{GS} = 0$	—	—	100	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	$I_D = 10mA$, $V_{GS} = 0$	60	—	—	V
Gate Threshold Voltage		V_{th}	$V_{DS} = 10V$, $I_D = 1mA$	0.8	—	2.0	V
Forward Transfer Admittance		$\|Y_{fs}\|$	$V_{DS} = 10V$, $I_D = 2.5A$	3.0	6.0	—	S
Drain-Source ON Resistance		$R_{DS(ON)}$	$I_D = 2.5A$, $V_{GS} = 4V$	—	135	200	mΩ
Drain-Source ON Resistance		$R_{DS(ON)}$	$I_D = 2.5A$, $V_{GS} = 10V$	—	90	130	mΩ
Input Capacitance		C_{iss}	$V_{DS} = 10V$, $V_{GS} = 0$, $f = 1MHz$	—	500	900	pF
Reverse Transfer Capacitance		C_{rss}		—	90	180	pF
Output Capacitance		C_{oss}		—	290	500	pF
Switching Time	Rise Time	t_r	10V, 0, 10μs, V_{IN}, $I_D = 2.5A$, V_{OUT}, 50Ω, 12Ω, $V_{DD} \doteqdot 30V$	—	20	40	ns
	Turn-on Time	t_{on}		—	60	120	
	Fall Time	t_f		—	80	160	
	Turn-off Time	t_{off}	V_{IN} : t_r, $t_f < 5ns$ Du. ≦ 1% ($Z_{OUT} = 50\Omega$)	—	300	600	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	$I_D = 5A$, $V_{GS} = 10V$ $V_{DD} = 48V$	—	20	40	nC
Gate-Source Charge		Q_{gs}		—	14	—	nC
Gate-Drain ("Miller") Charge		Q_{gd}		—	6	—	nC

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYPE	MAX.	UNIT
Drain Reverse Current	I_{DR}	—	—	—	5	A
Peak Drain Reverse Current	I_{DRP}	—	—	—	10	A
Diode Foward Voltage	V_{DSF}	$I_{DR} = 5A$, $V_{GS} = 0$	—	—	−1.5	V
Reverse Recovery Time	t_{rr}	$I_{DR} = 5A$, $V_{GS} = 0$ $dI_{DR} / dt = -50A / \mu s$	—	140	—	ns
Reverse Recovery Charge	Q_{rr}		—	0.4	—	μC

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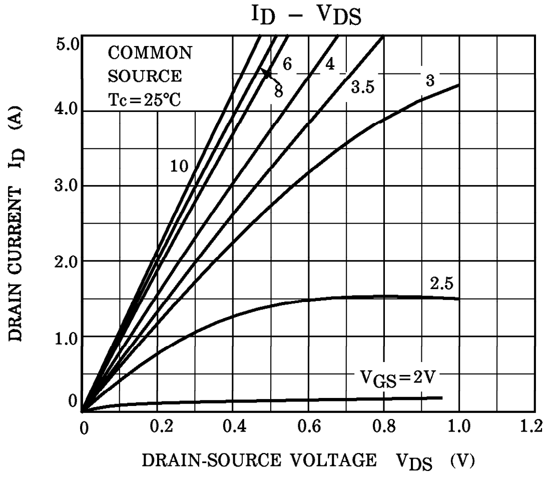
ELECTRICAL CHARACTERISTICS ($Ta = 25°C$) (Pch MOS FET)

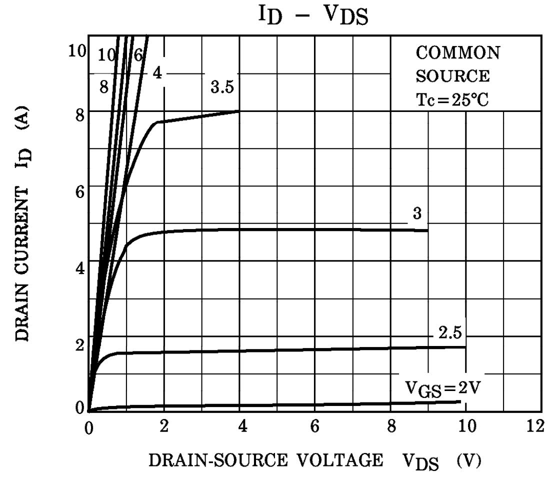
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	$V_{GS} = \pm 16V$, $V_{DS} = 0$	—	—	±10	μA
Drain Cut-off Current		I_{DSS}	$V_{DS} = -60V$, $V_{GS} = 0$	—	—	−100	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	$I_D = -10mA$, $V_{GS} = 0$	−60	—	—	V
Gate Threshold Voltage		V_{th}	$V_{DS} = -10V$, $I_D = -1mA$	−0.8	—	−2.0	V
Forward Transfer Admittance		$\|Y_{fs}\|$	$V_{DS} = -10V$, $I_D = -2.5A$	1.0	2.0	—	S
Drain-Source ON Resistance		$R_{DS(ON)}$	$I_D = -2.5A$, $V_{GS} = -4V$	—	250	400	mΩ
Drain-Source ON Resistance		$R_{DS(ON)}$	$I_D = -2.5A$, $V_{GS} = -10V$	—	170	250	mΩ
Input Capacitance		C_{iss}		—	500	720	pF
Reverse Transfer Capacitance		C_{rss}	$V_{DS} = -10V$, $V_{GS} = 0$, $f = 1MHz$	—	90	150	pF
Output Capacitance		C_{oss}		—	290	420	pF
Switching Time	Rise Time	t_r	$I_D = -2.5A$; 0; −10V; V_{IN}; V_{OUT}; 10μs; 50Ω; 12Ω; $V_{DD} \fallingdotseq -30V$	—	120	240	ns
	Turn-on Time	t_{on}		—	130	260	
	Fall Time	t_f	入力：t_r, $t_f < 5ns$	—	80	160	
	Turn-off Time	t_{off}	Du. ≦ 1% ($Z_{OUT} = 50\Omega$)	—	200	400	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g		—	22	45	nC
Gate-Source Charge		Q_{gs}	$I_D = -5A$, $V_{GS} = -10V$, $V_{DD} = -48V$	—	14	—	nC
Gate-Drain ("Miller") Charge		Q_{gd}		—	8	—	nC

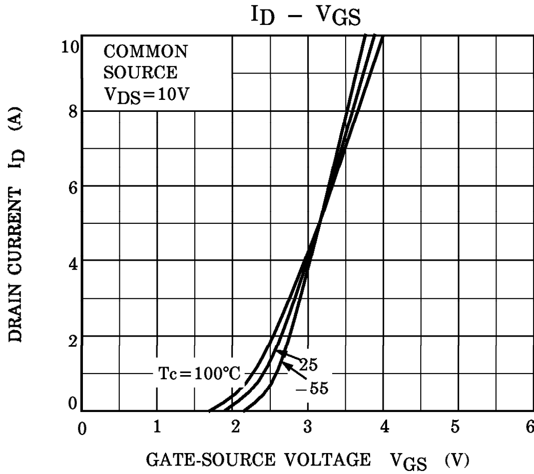
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($Ta = 25°C$)

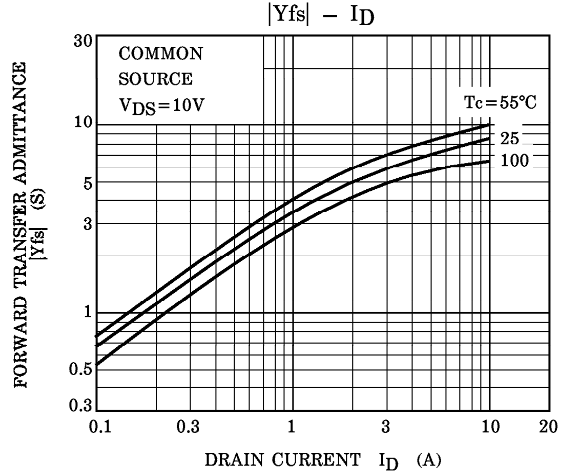
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYPE	MAX.	UNIT
Drain Reverse Current	I_{DR}	—	—	—	−5	A
Peak Drain Reverse Current	I_{DRP}	—	—	—	−10	A
Diode Foward Voltage	V_{DSF}	$I_{DR} = -5A$, $V_{GS} = 0$	—	—	1.5	V
Reverse Recovery Time	t_{rr}	$I_{DR} = -5A$, $V_{GS} = 0$	—	120	—	ns
Reverse Recovery Charge	Q_{rr}	$dI_{DR}/dt = -50A/\mu s$	—	0.24	—	μC

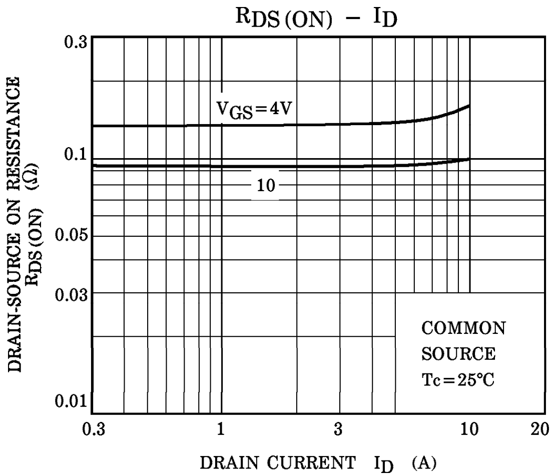
Nch FET

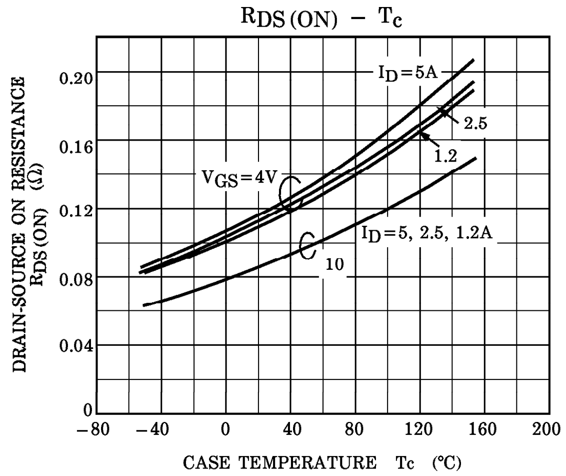




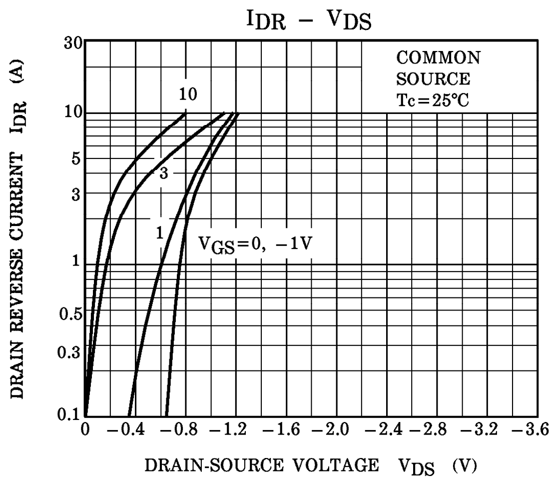


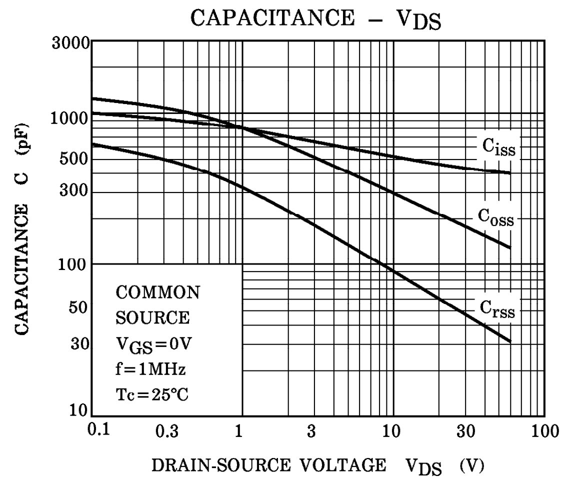


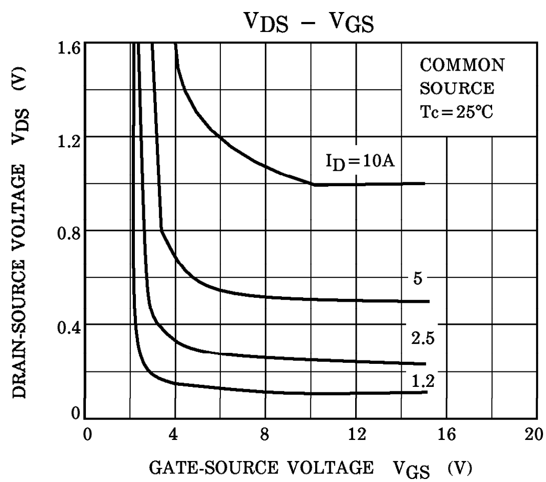


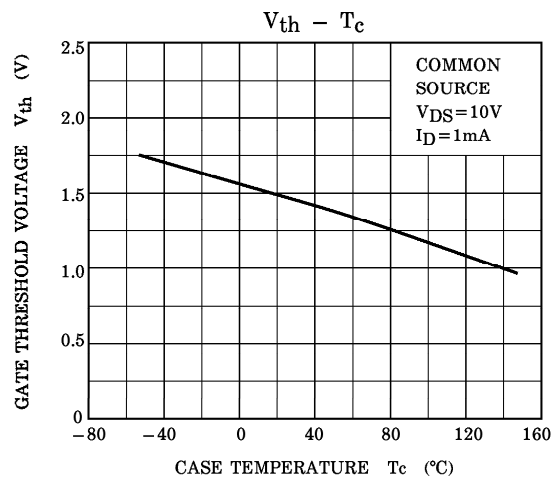


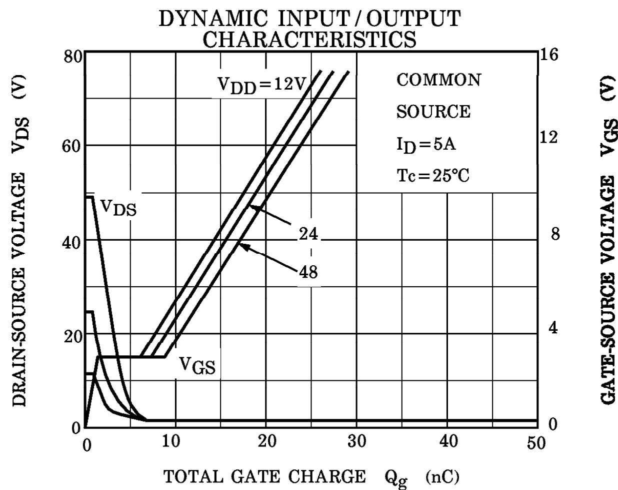
Nch FET



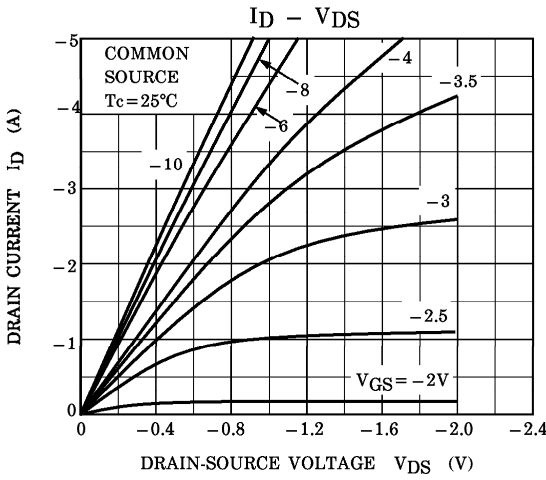


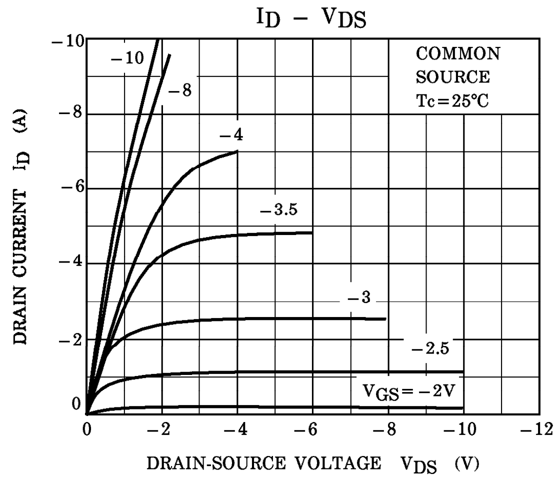


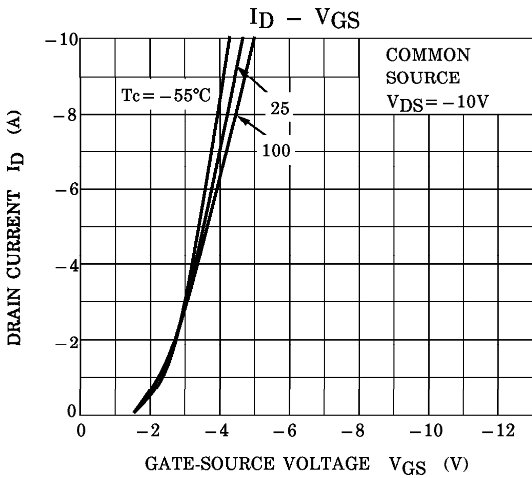


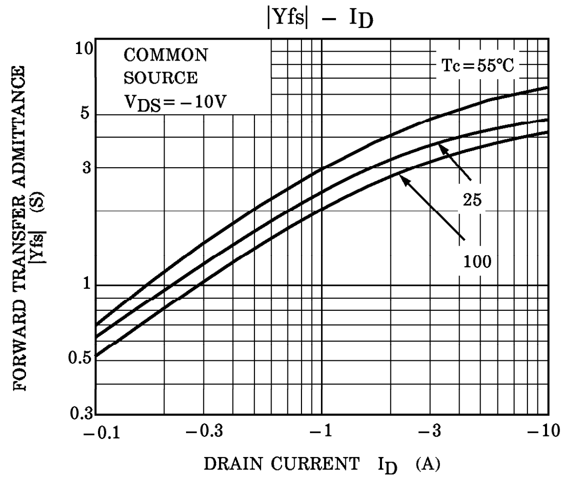


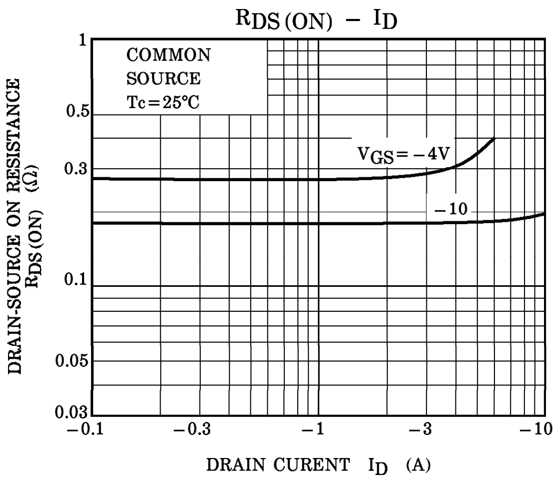
Pch FET

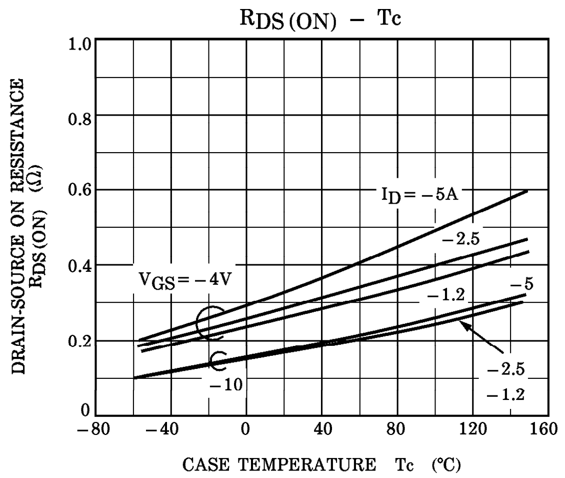




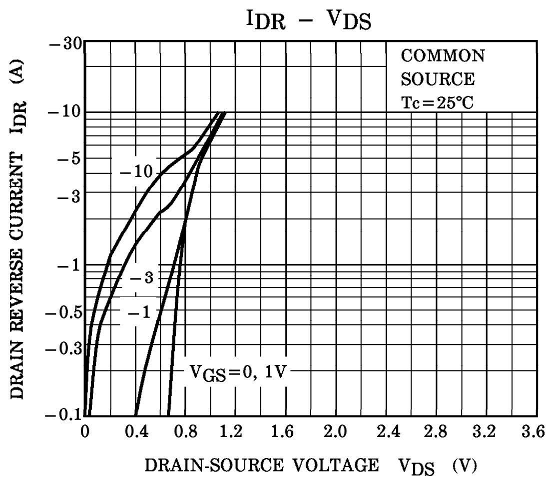


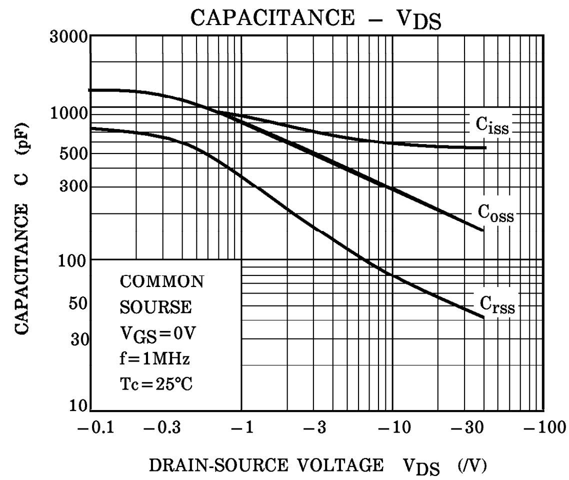


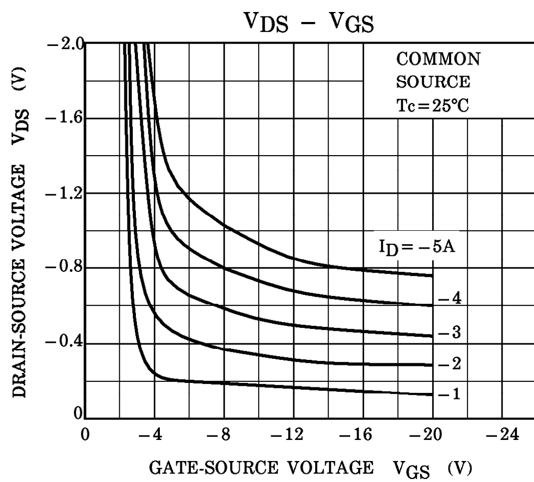


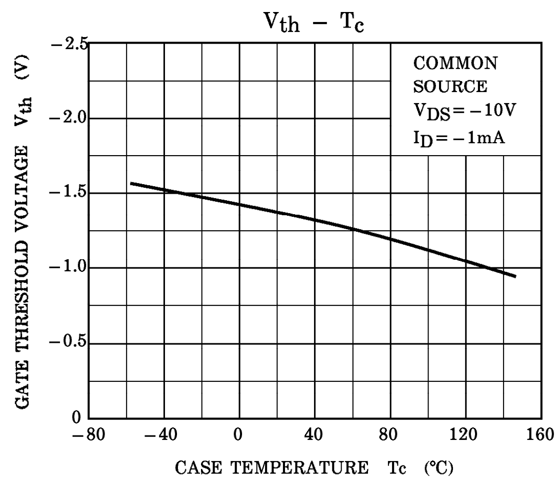


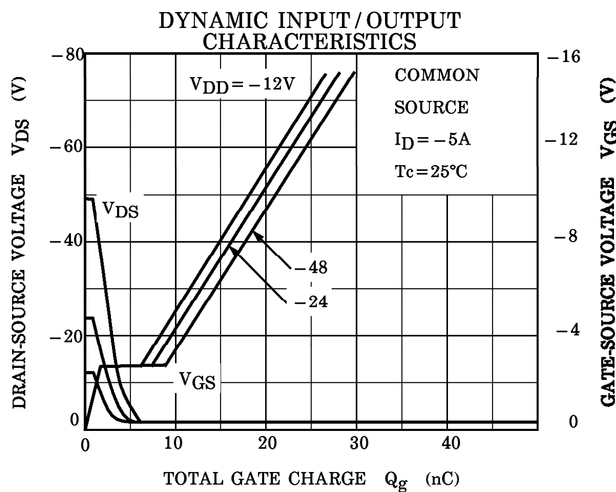
Pch FET

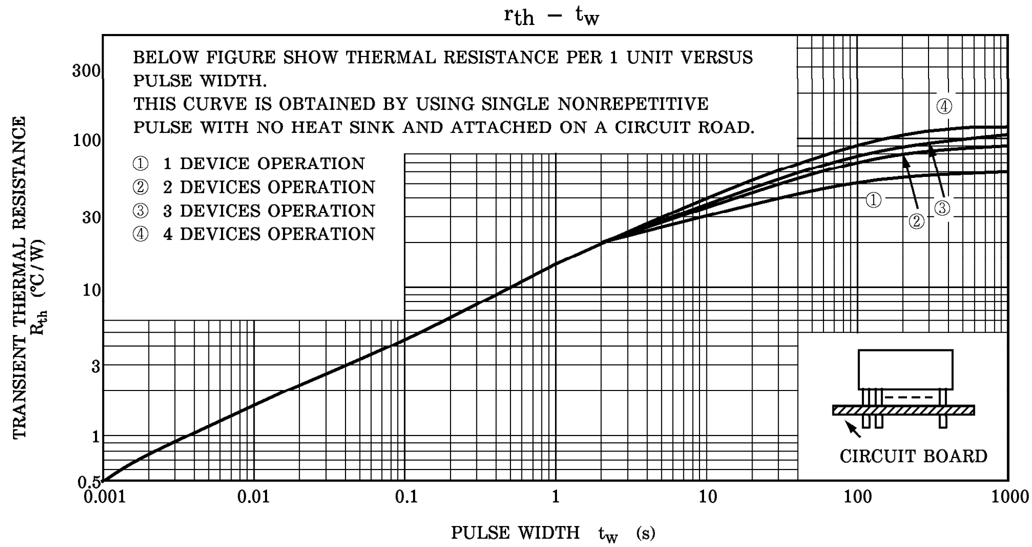




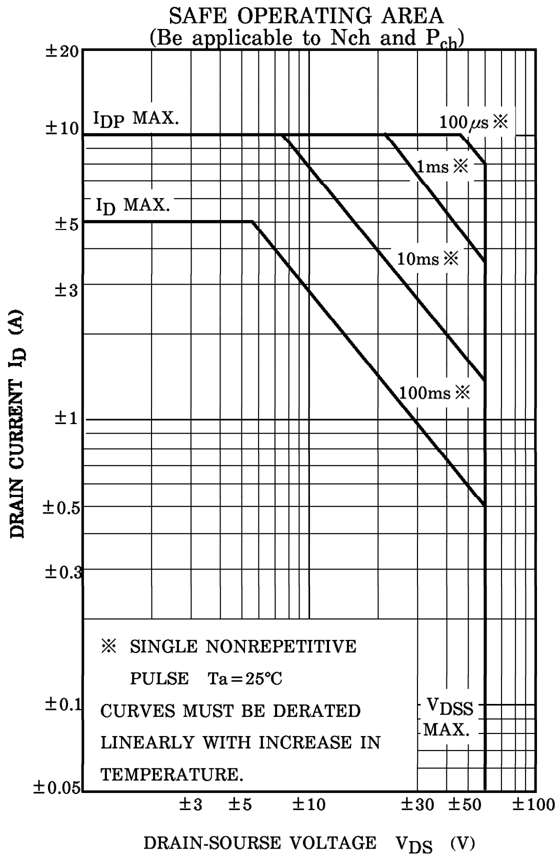




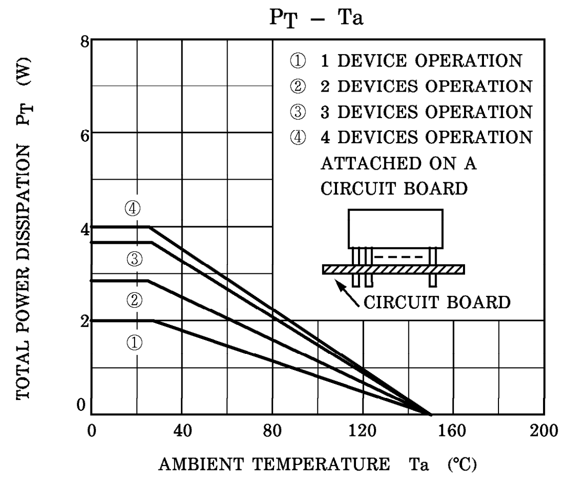




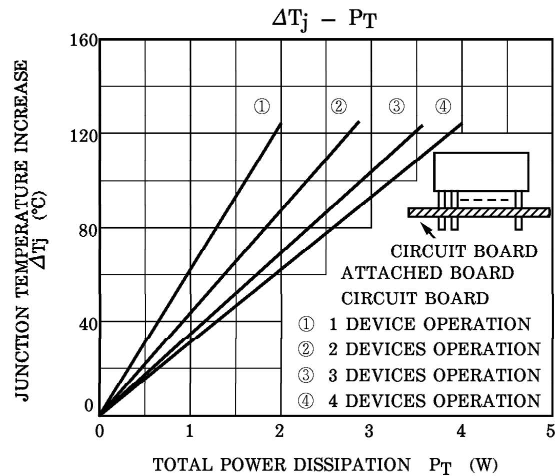
r_{th} – t_w
BELOW FIGURE SHOW THERMAL RESISTANCE PER 1 UNIT VERSUS PULSE WIDTH.
THIS CURVE IS OBTAINED BY USING SINGLE NONREPETITIVE PULSE WITH NO HEAT SINK AND ATTACHED ON A CIRCUIT ROAD.
① 1 DEVICE OPERATION
② 2 DEVICES OPERATION
③ 3 DEVICES OPERATION
④ 4 DEVICES OPERATION
CIRCUIT BOARD
TRANSIENT THERMAL RESISTANCE R_{th} (°C/W)
PULSE WIDTH t_w (s)



SAFE OPERATING AREA
(Be applicable to Nch and P_{ch})
I_{DP} MAX.
I_D MAX.
100μs ※
1ms ※
10ms ※
100ms ※
※ SINGLE NONREPETITIVE PULSE Ta = 25°C
CURVES MUST BE DERATED LINEARLY WITH INCREASE IN TEMPERATURE.
V_{DSS} MAX.
DRAIN CURRENT I_D (A)
DRAIN-SOURSE VOLTAGE V_{DS} (V)



P_T – Ta
① 1 DEVICE OPERATION
② 2 DEVICES OPERATION
③ 3 DEVICES OPERATION
④ 4 DEVICES OPERATION
ATTACHED ON A CIRCUIT BOARD
CIRCUIT BOARD
TOTAL POWER DISSIPATION P_T (W)
AMBIENT TEMPERATURE Ta (°C)



ΔT_j – P_T
CIRCUIT BOARD
ATTACHED BOARD CIRCUIT BOARD
① 1 DEVICE OPERATION
② 2 DEVICES OPERATION
③ 3 DEVICES OPERATION
④ 4 DEVICES OPERATION
JUNCTION TEMPERATURE INCREASE ΔT_j (°C)
TOTAL POWER DISSIPATION P_T (W)