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

MP4201

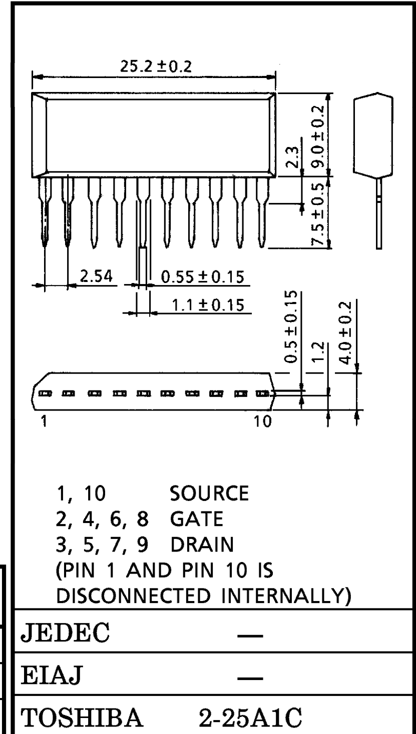
HIGH POWER, HIGH SPEED SWITCHING APPLICATIONS

HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING

- 4V Gate Drive Available
- 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 : $R_{DS (ON)} = 0.33\Omega$ (Typ.)
- Low Leakage Current : $I_{GSS} = \pm 5\mu A$ (Max.) ($V_{GS} = \pm 16V$)
  $I_{DSS} = 100\mu A$ (Max.) ($V_{DS} = 120V$)
- Enhancement-Mode : $V_{th} = 0.8 \sim 2.0V$ ($I_D = 1mA$)

INDUSTRIAL APPLICATIONS

Unit in mm



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

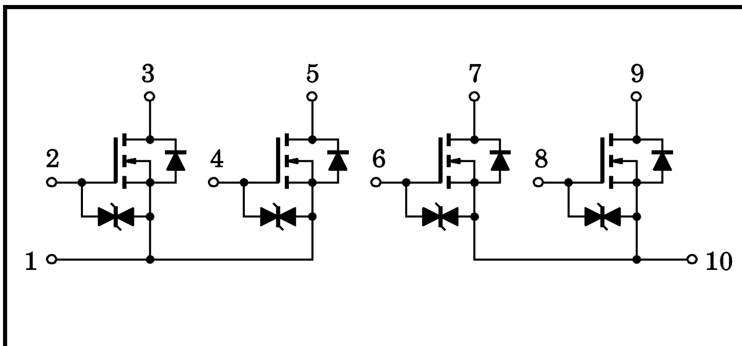
JEDEC	—
EIAJ	—
TOSHIBA	2-25A1C

Weight : 2.1g (Typ.)

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Drain-Source Voltage	V_{DSS}	120	V
Gate-Source Voltage	V_{GSS}	±20	V
Drain Current	I_D	3	A
Peak Drain Current	I_{DP}	6	A
Drain Power Dissipation (1 Device Operation)	P_D	2.0	W
Drain Power Dissipation (4 Devices Operation)	P_{DT}	4.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature Range	T_{stg}	−55~150	°C

ARRAY CONFIGURATION



961001EAA2

- 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.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

THERMAL CHARACTERISTICS

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

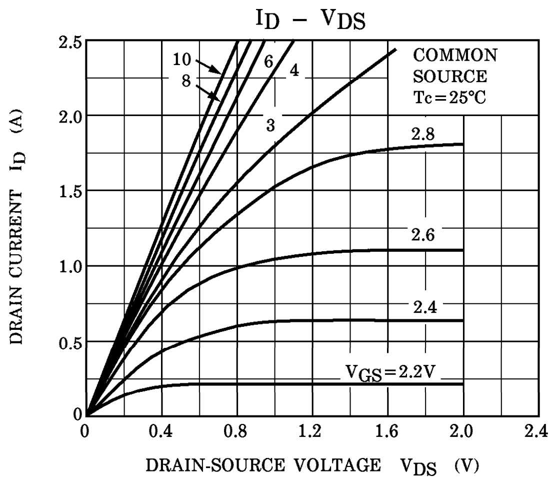
This Transistor is an Electrostatic Sensitive Device. Please Handle with Caution.

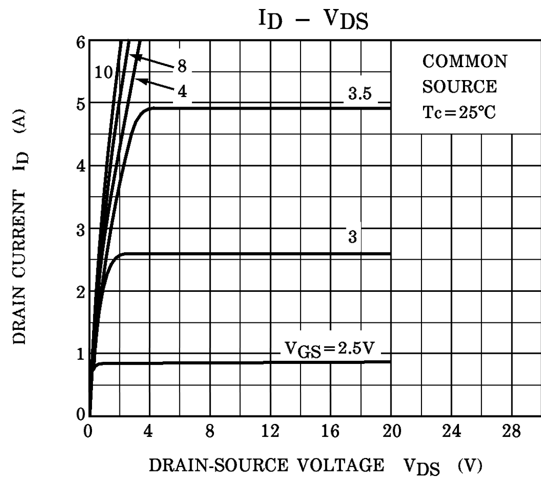
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

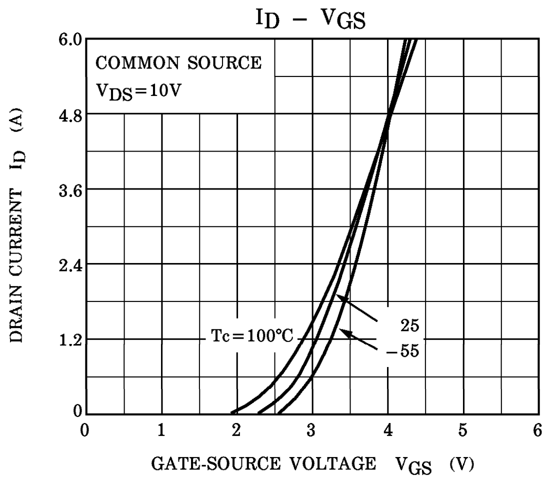
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	$V_{GS} = \pm 16V$, $V_{DS} = 0$	—	—	±5	μA
Drain Cut-off Current		I_{DSS}	$V_{DS} = 120V$, $V_{GS} = 0$	—	—	100	μA
Drain-Source Breakdown Voltage		$V_{(BR)\,DSS}$	$I_D = 10mA$, $V_{GS} = 0$	120	—	—	V
Gate Threshold Voltage		V_{th}	$V_{DS} = 10V$, $I_D = 1mA$	0.8	—	2.0	V
Forward Transfer Admittance		$\lvert Y_{fs} \rvert$	$V_{DS} = 10V$, $I_D = 1.5A$	1.5	3.2	—	S
Drain-Source ON Resistance		$R_{DS\,(ON)}$	$I_D = 1.5A$, $V_{GS} = 4V$	—	0.42	0.74	Ω
		$R_{DS\,(ON)}$	$I_D = 1.5A$, $V_{GS} = 10V$	—	0.33	0.45	
Input Capacitance		C_{iss}	$V_{DS} = 10V$, $V_{GS} = 0$, $f = 1MHz$	—	350	—	pF
Reverse Transfer Capacitance		C_{rss}		—	35	—	
Output Capacitance		Coss		—	155	—	
Switching Time	Rise Time	t_r	10V, 0, V_{IN}, 10μs, 50Ω, $I_D = 1.5A$, V_{OUT}, 40Ω, $V_{DD} \doteqdot 60V$; V_{IN} : t_r, $t_f < 5ns$, Du. ≦ 1%	—	6	—	ns
	Turn-on Time	t_{on}		—	12	—	
	Fall Time	t_f		—	40	—	
	Turn-off Time	t_{off}		—	100	—	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	$I_D = 3A$, $V_{GS} = 10V$, $V_{DD} = 96V$	—	11	—	nC
Gate-Source Charge		Q_{gs}		—	7	—	
Gate-Drain ("Miller") Charge		Q_{gd}		—	4	—	

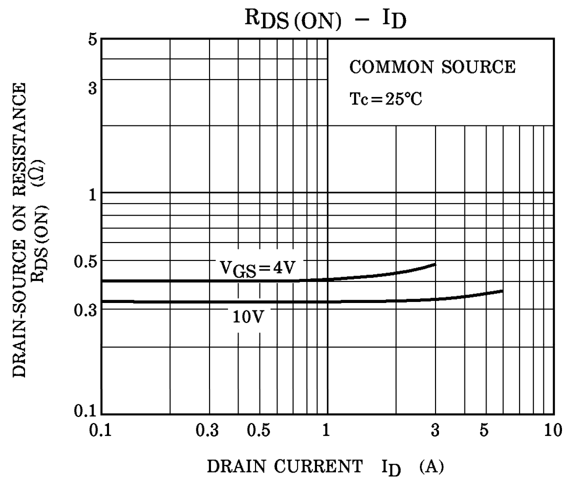
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

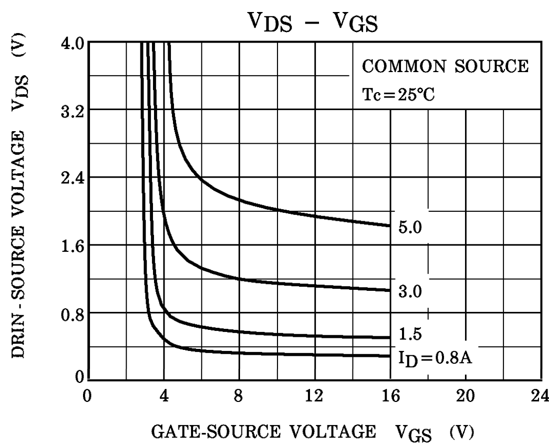
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Drain Reverse Current	I_{DR}	—	—	—	3	A
Peak Drain Reverse Current	I_{DRP}	—	—	—	6	A
Diode Forward Voltage	V_{DSF}	$I_{DR} = 3A$, $V_{GS} = 0$	—	−0.9	−1.5	V
Reverse Recovery Time	t_{rr}	$I_{DR} = 3A$, $V_{GS} = 0$,	—	130	—	ns
Reverse Recovery Charge	Q_{rr}	$dI_{DR} / dt = -20A / \mu s$	—	0.14	—	μC

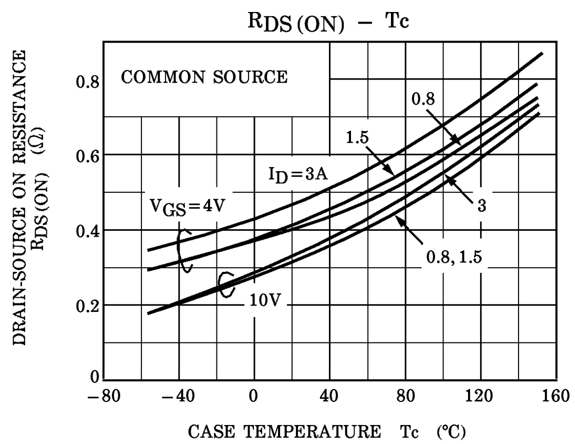

ID – VDS
COMMON SOURCE Tc=25°C
10
8
6
4
3
2.8
2.6
2.4
VGS=2.2V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0
0.5
1.0
1.5
2.0
2.5
0.4
0.8
1.2
1.6
2.0
2.4

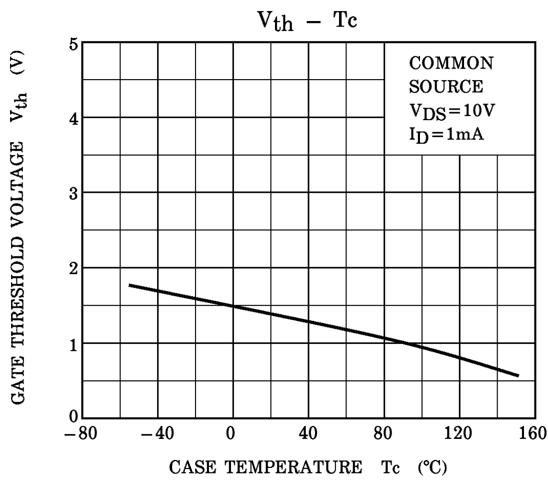

ID – VDS
COMMON SOURCE Tc=25°C
10
8
4
3.5
3
VGS=2.5V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0
1
2
3
4
5
6
8
12
16
20
24
28

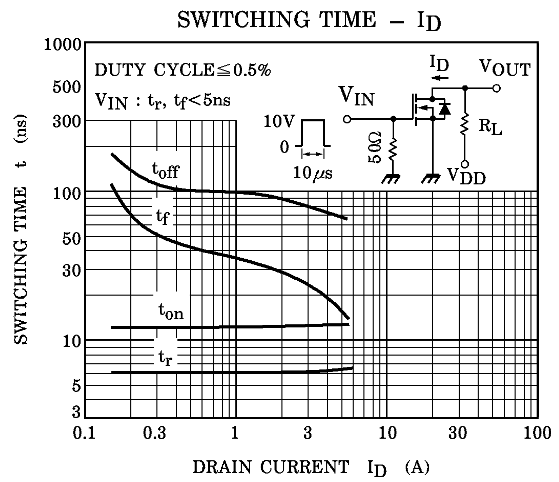

ID – VGS
COMMON SOURCE VDS=10V
Tc=100°C
25
−55
DRAIN CURRENT ID (A)
GATE-SOURCE VOLTAGE VGS (V)
0
1.2
2.4
3.6
4.8
6.0
1
2
3
4
5
6

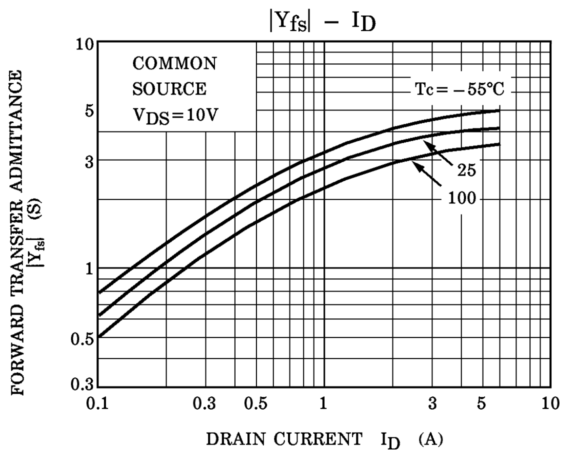

RDS (ON) – ID
COMMON SOURCE Tc=25°C
VGS=4V
10V
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
DRAIN CURRENT ID (A)
0.1
0.3
0.5
1
3
5
10

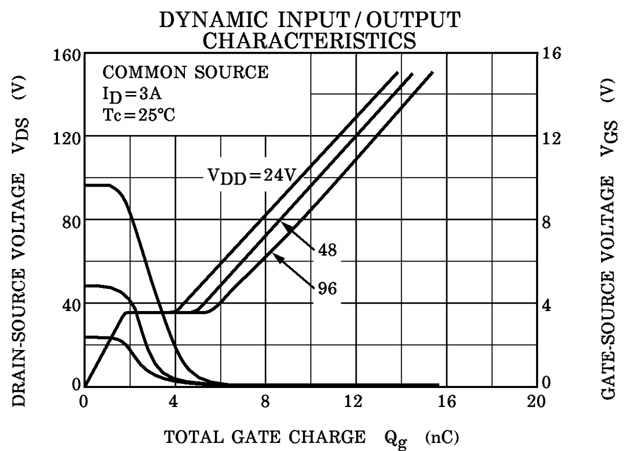

VDS – VGS
COMMON SOURCE Tc=25°C
5.0
3.0
1.5
ID=0.8A
DRIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
0
0.8
1.6
2.4
3.2
4.0
4
8
12
16
20
24

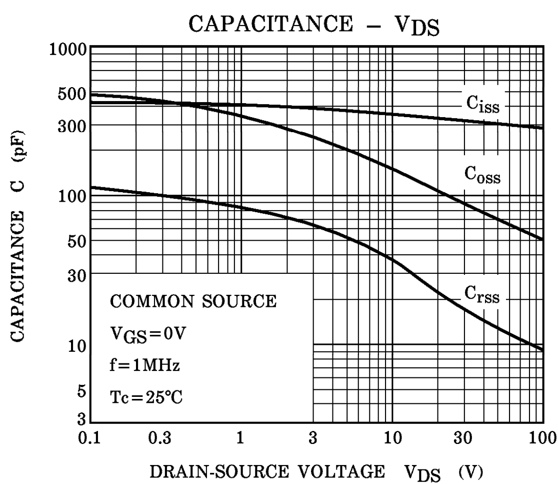

RDS (ON) – Tc
COMMON SOURCE
0.8
1.5
ID=3A
VGS=4V
3
0.8, 1.5
10V
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
CASE TEMPERATURE Tc (°C)
0
0.2
0.4
0.6
0.8
−80
−40
0
40
80
120
160

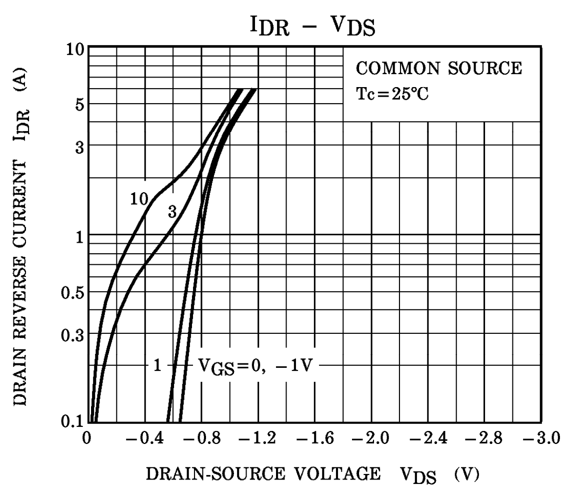

Vth – Tc
COMMON SOURCE
VDS=10V
ID=1mA
GATE THRESHOLD VOLTAGE Vth (V)
CASE TEMPERATURE Tc (°C)

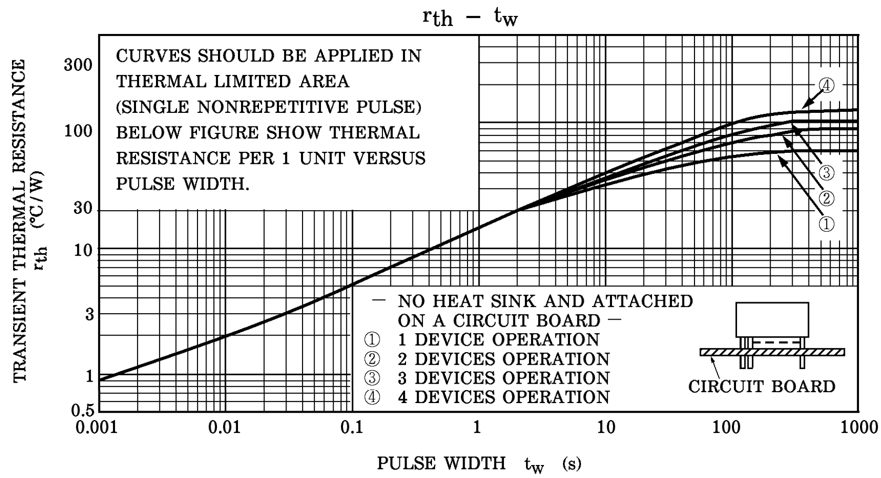

SWITCHING TIME – ID
DUTY CYCLE≦0.5%
VIN : tr, tf<5ns
toff
tf
ton
tr
SWITCHING TIME t (ns)
DRAIN CURRENT ID (A)

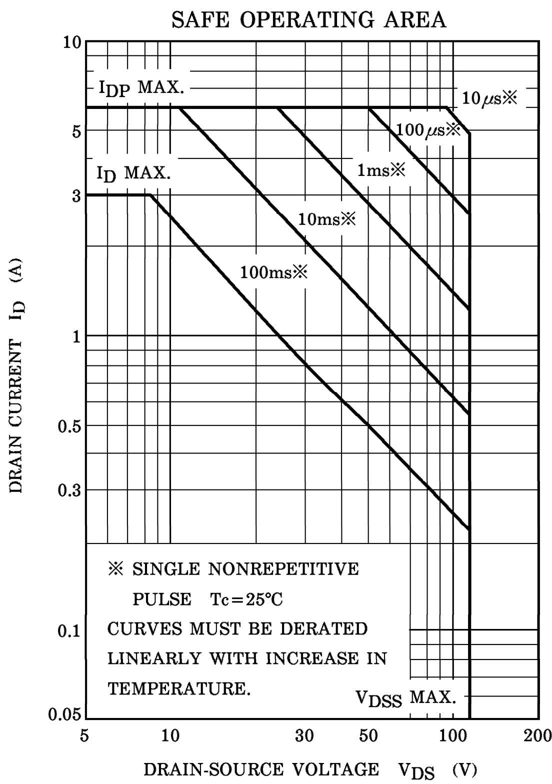

|Yfs| – ID
COMMON SOURCE
VDS=10V
Tc=−55°C
25
100
FORWARD TRANSFER ADMITTANCE |Yfs| (S)
DRAIN CURRENT ID (A)

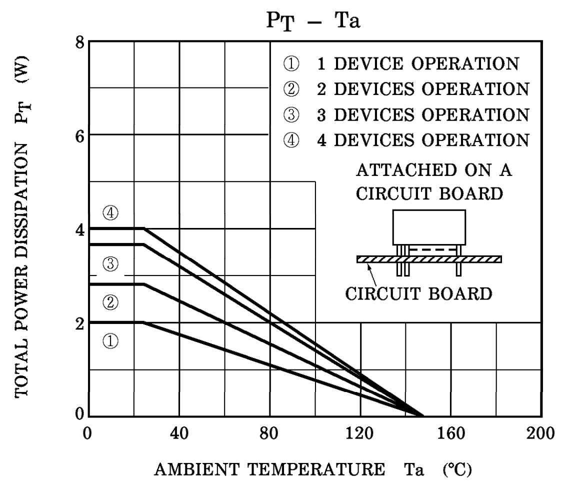

DYNAMIC INPUT / OUTPUT CHARACTERISTICS
COMMON SOURCE
ID=3A
Tc=25°C
VDD=24V
48
96
DRAIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
TOTAL GATE CHARGE Qg (nC)

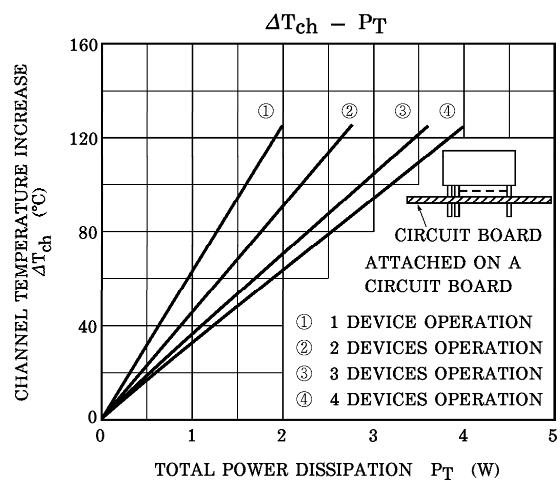

CAPACITANCE – VDS
Ciss
Coss
Crss
COMMON SOURCE
VGS=0V
f=1MHz
Tc=25°C
CAPACITANCE C (pF)
DRAIN-SOURCE VOLTAGE VDS (V)


IDR – VDS
COMMON SOURCE
Tc=25°C
10
3
1
VGS=0, −1V
DRAIN REVERSE CURRENT IDR (A)
DRAIN-SOURCE VOLTAGE VDS (V)


rth – tw
CURVES SHOULD BE APPLIED IN THERMAL LIMITED AREA (SINGLE NONREPETITIVE PULSE) BELOW FIGURE SHOW THERMAL RESISTANCE PER 1 UNIT VERSUS PULSE WIDTH.
— NO HEAT SINK AND ATTACHED ON A CIRCUIT BOARD —
① 1 DEVICE OPERATION
② 2 DEVICES OPERATION
③ 3 DEVICES OPERATION
④ 4 DEVICES OPERATION
CIRCUIT BOARD
TRANSIENT THERMAL RESISTANCE rth (°C/W)
PULSE WIDTH tw (s)


SAFE OPERATING AREA
IDP MAX.
ID MAX.
10μs※
100μs※
1ms※
10ms※
100ms※
※ SINGLE NONREPETITIVE PULSE Tc=25°C
CURVES MUST BE DERATED LINEARLY WITH INCREASE IN TEMPERATURE.
VDSS MAX.
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)


PT – 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 PT (W)
AMBIENT TEMPERATURE Ta (°C)


ΔTch – PT
CIRCUIT BOARD
ATTACHED ON A CIRCUIT BOARD
① 1 DEVICE OPERATION
② 2 DEVICES OPERATION
③ 3 DEVICES OPERATION
④ 4 DEVICES OPERATION
CHANNEL TEMPERATURE INCREASE ΔTch (°C)
TOTAL POWER DISSIPATION PT (W)