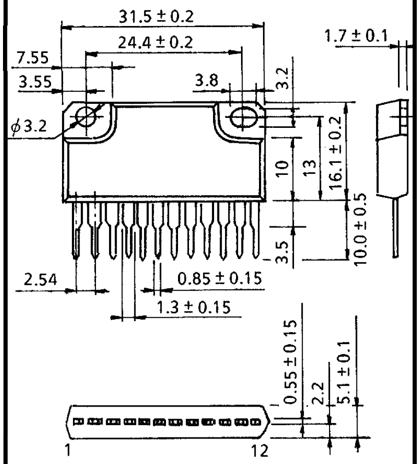
TOSHIBA POWER MOS FET MODULE SILICON N CHANNEL MOS TYPE (L^2-π-MOSV 4 IN 1)

MP4711

HIGH POWER, HIGH SPEED SWITCHING APPLICATIONS
FOR PRINTER HEAD PIN DRIVER AND PULSE MOTOR DRIVER
FOR SOLENOID DRIVER

INDUSTRIAL APPLICATIONS

Unit in mm



MOS FET		DIODE	
1, 5, 8, 12	GATE	2, 4, 9, 11	ANODE
2, 4, 9, 11	DRAIN	3, 10	CATHODE
6, 7	SOURCE		

JEDEC	—
EIAJ	—
TOSHIBA	2-32B1G

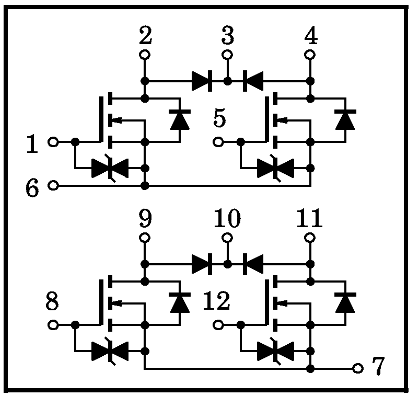
Weight : 6.0 g (typ.)

- 4 V Gate Drive Available
- Package with Heat Sink Isolated to Lead (SIP 12 Pin)
- High Drain Power Dissipation (4 Devices Operation)
  : P_T = 36 W (Tc = 25°C)
- Low Drain-Source ON Resistance : $R_{DS\,(ON)}$ = 0.17 Ω (typ.)
- High Forward Transfer Admittance : $|Y_{fs}|$ = 4.5 S (typ.)
- Low Leakage Current : I_{GSS} = ±10 μA (max.) (V_{GS} = ±16 V)
  I_{DSS} = 100 μA (max.) (V_{DS} = 100 V)
- Enhancement-Mode : V_{th} = 0.8~2.0 V
  (V_{DS} = 10 V, I_D = 1 mA)

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSS}	100	V
Drain-Gate Voltage (R_{GS} = 20 kΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC	I_D	5	A
	Pulse	I_{DP}	20	
Drain Power Dissipation (1 Device Operation, Ta = 25°C)		P_D	3.0	W
Drain Power Dissipation (4 Devices Operation)	Ta = 25°C	P_{DT}	5.0	W
	Tc = 25°C		36	
Single Pulse Avalanche Energy*		E_{AS}	180	mJ
Avalanche Current		I_{AR}	5	A
Repetitive Avalanche Energy**	1 Device Operation	E_{AR}	0.3	mJ
	4 Devices Operation	E_{ART}	0.5	
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

ARRAY CONFIGURATION



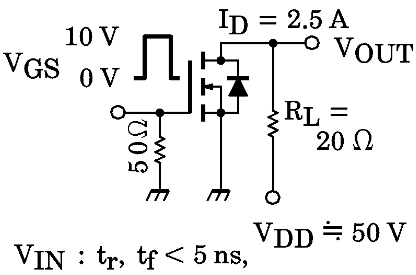
Note ;
* Avalanche energy (single pulse) applied condition
V_{DD} = 25 V, Starting T_{ch} = 25°C, L = 11.6 mH, R_G = 25 Ω, I_{AR} = 5 A
** Repetitive rating ; Pulse Width Limited by maximum channel temperature.

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

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance of Channel to Ambient (4 Devices Operation, Ta = 25°C)	$\Sigma R_{th\ (ch\text{-}a)}$	25	°C / W
Thermal Resistance of Channel to Case (4 Devices Operation, Tc = 25°C)	$\Sigma R_{th\ (ch\text{-}c)}$	3.47	°C / W
Maximum Lead Temperature for Soldering Purposes (3.2 mm from Case for t = 10 s)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 16\ V$, $V_{DS} = 0\ V$	—	—	±10	μA
Drain Cut-off Current	I_{DSS}	$V_{DS} = 100\ V$, $V_{GS} = 0\ V$	—	—	100	μA
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 10\ mA$, $V_{GS} = 0\ V$	100	—	—	V
Gate Threshold Voltage	V_{th}	$V_{DS} = 10\ V$, $I_D = 1\ mA$	0.8	—	2.0	V
Drain-Source ON Resistance	$R_{DS\ (ON)}$	$V_{GS} = 4\ V$, $I_D = 2.5\ A$	—	0.22	0.30	Ω
		$V_{GS} = 10\ V$, $I_D = 2.5\ A$	—	0.17	0.23	
Forward Transfer Admittance	$\lvert Y_{fs} \rvert$	$V_{DS} = 10\ V$, $I_D = 2.5\ A$	2.0	4.5	—	S
Input Capacitance	C_{iss}	$V_{DS} = 10\ V$, $V_{GS} = 0\ V$, f = 1 MHz	—	500	—	pF
Reverse Transfer Capacitance	C_{rss}		—	80	—	
Output Capacitance	C_{oss}		—	190	—	
Switching Time — Rise Time	t_r	 V_{IN} : t_r, $t_f < 5\ ns$, Duty ≦ 1%, $t_w = 10\ \mu s$	—	17	—	ns
Switching Time — Turn-on Time	t_{on}		—	25	—	
Switching Time — Fall Time	t_f		—	50	—	
Switching Time — Turn-off Time	t_{off}		—	195	—	
Total Gate Charge (Gate-Source Plus Gate-Drain)	Q_g	$V_{DD} \doteqdot 80\ V$, $V_{GS} = 10\ V$, $I_D = 5\ A$	—	22	—	nC
Gate-Source Charge	Q_{gs}		—	15	—	
Gate-Drain ("Miller") Charge	Q_{gd}		—	7	—	

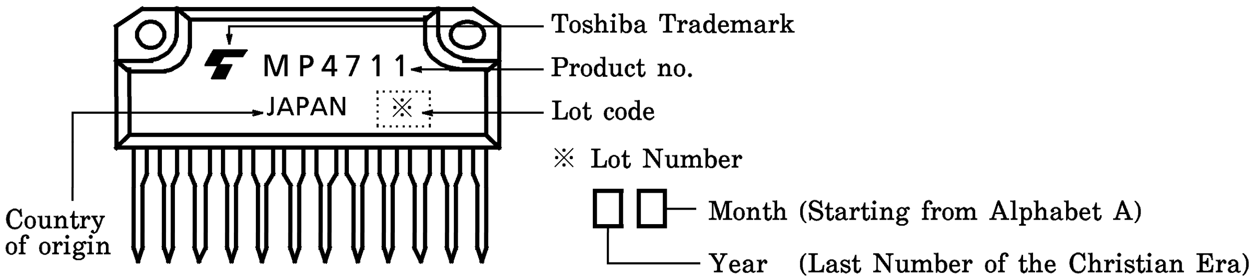
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

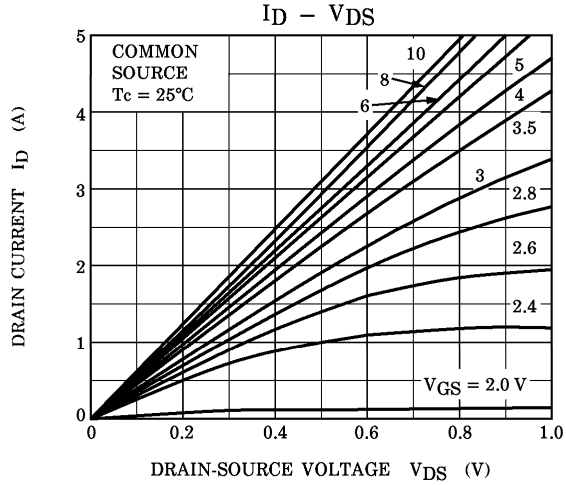
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I_{DR}	—	—	—	5	A
Pulse Drain Reverse Current	I_{DRP}	—	—	—	20	A
Diode Forward Voltage	V_{DSF}	$I_{DR} = 5\ A$, $V_{GS} = 0\ V$	—	—	−1.7	V
Reverse Recovery Time	t_{rr}	$I_{DR} = 5\ A$, $V_{GS} = 0\ V$, $dI_{DR} / dt = 50\ A / \mu s$	—	160	—	ns
Reverse Recovery Charge	Q_{rr}		—	0.28	—	μC

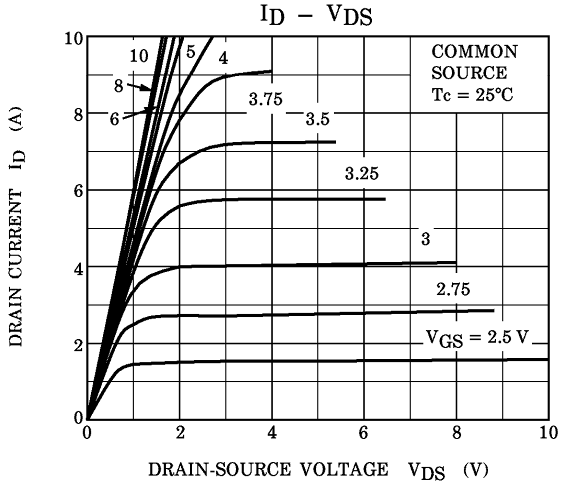
FLYBACK-DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

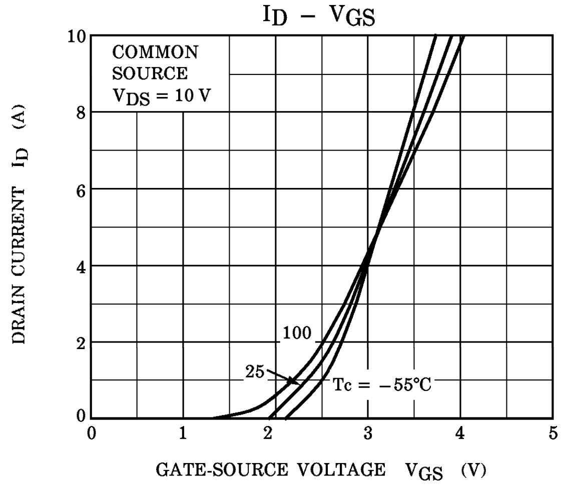
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Current	I_{FM}	—	—	—	5	A
Reverse Current	I_R	$V_R = 100\ V$	—	—	0.4	μA
Reverse Voltage	V_R	$I_R = 100\ \mu A$	100	—	—	V
Forward Voltage	V_F	$I_F = 2\ A$	—	—	2.3	V

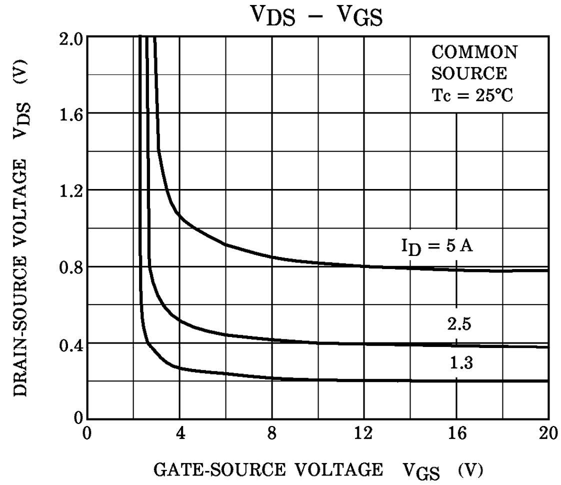
MARKING

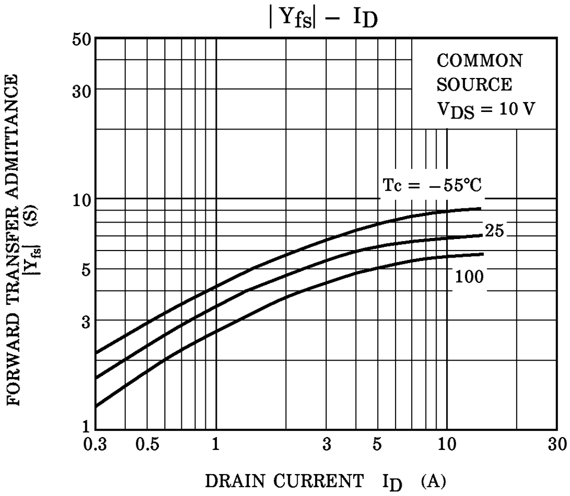


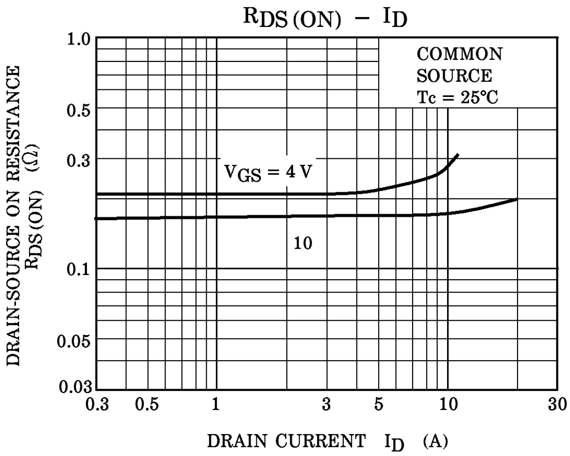

ID – VDS
COMMON SOURCE
Tc = 25°C
10
8
6
5
4
3.5
3
2.8
2.6
2.4
VGS = 2.0 V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5


ID – VDS
COMMON SOURCE
Tc = 25°C
10
8
6
5
4
3.75
3.5
3.25
3
2.75
VGS = 2.5 V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0
2
4
6
8
10

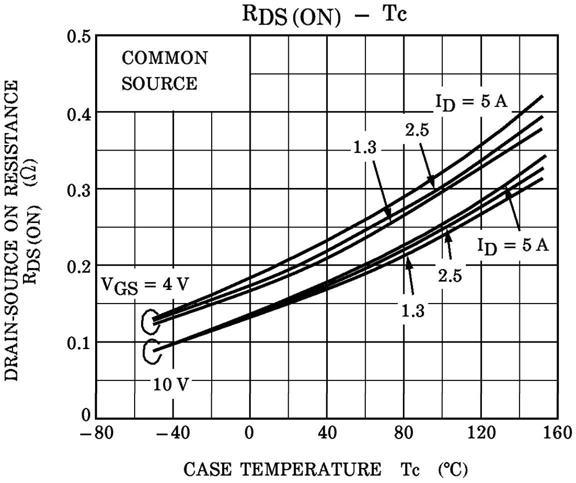

ID – VGS
COMMON SOURCE
VDS = 10 V
100
25
Tc = −55°C
DRAIN CURRENT ID (A)
GATE-SOURCE VOLTAGE VGS (V)
0
1
2
3
4
5
6
8
10


VDS – VGS
COMMON SOURCE
Tc = 25°C
ID = 5 A
2.5
1.3
DRAIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
0
0.4
0.8
1.2
1.6
2.0
4
8
12
16
20

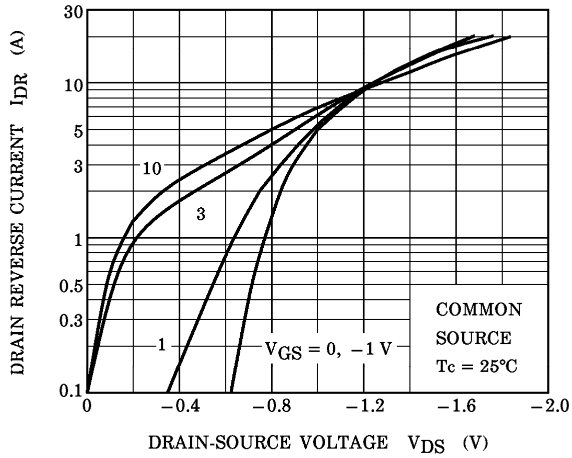

|Yfs| – ID
COMMON SOURCE
VDS = 10 V
Tc = −55°C
25
100
FORWARD TRANSFER ADMITTANCE |Yfs| (S)
DRAIN CURRENT ID (A)
1
3
5
10
30
50
0.3
0.5


RDS (ON) – ID
COMMON SOURCE
Tc = 25°C
VGS = 4 V
10
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
DRAIN CURRENT ID (A)
0.03
0.05
0.1
0.3
0.5
1.0
1
3
5
10
30

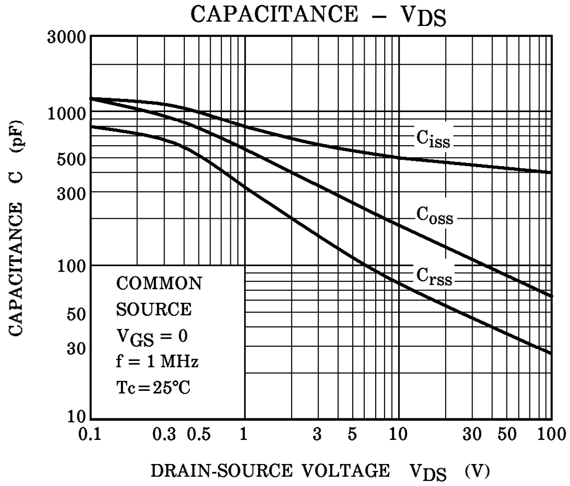
RDS (ON) – Tc



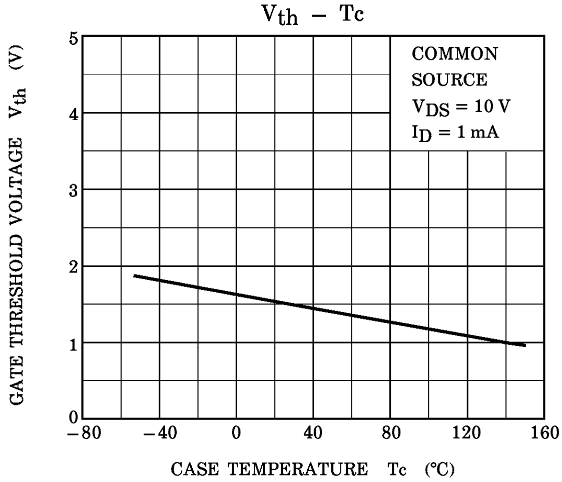
IDR – VDS



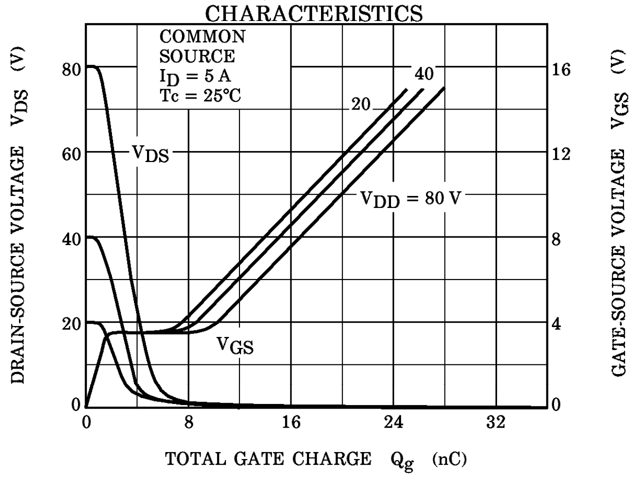
CAPACITANCE – VDS



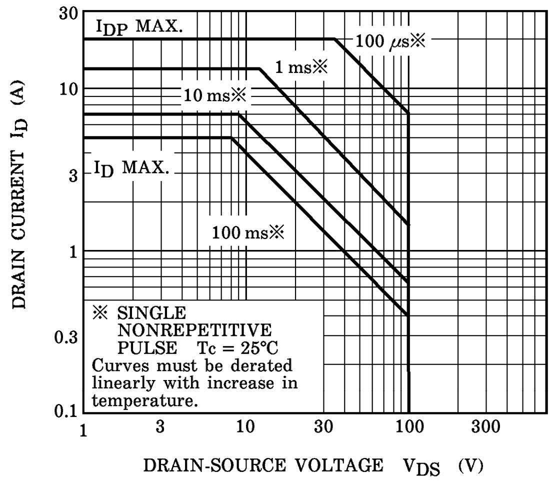
Vth – Tc



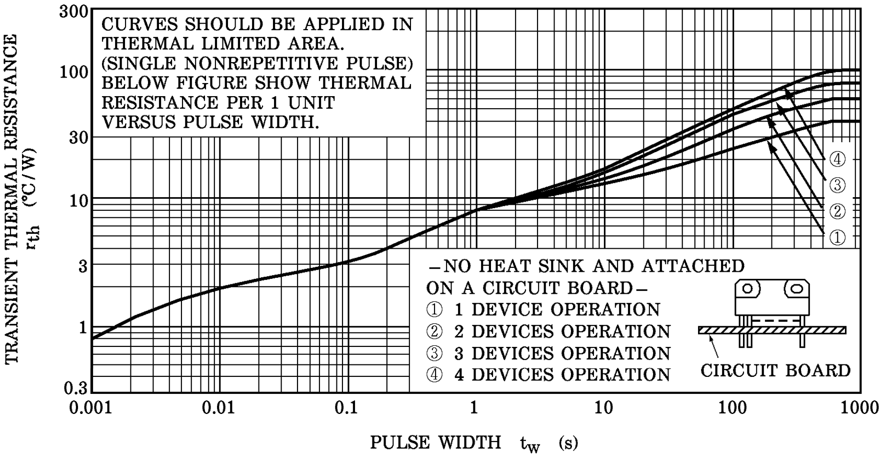
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



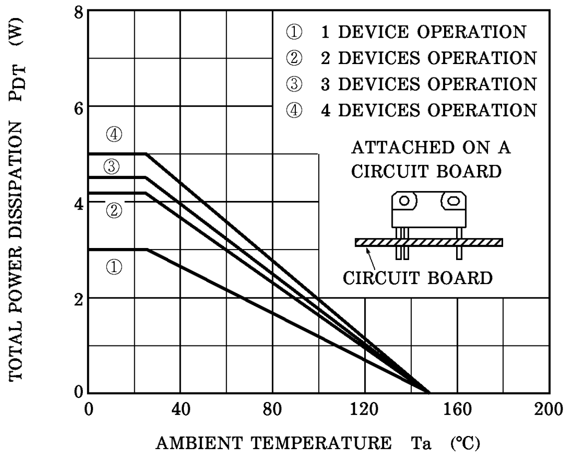
SAFE OPERATING AREA



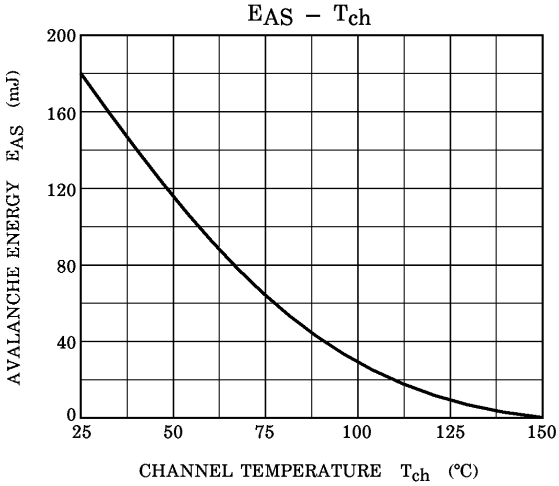
$r_{th} - t_w$



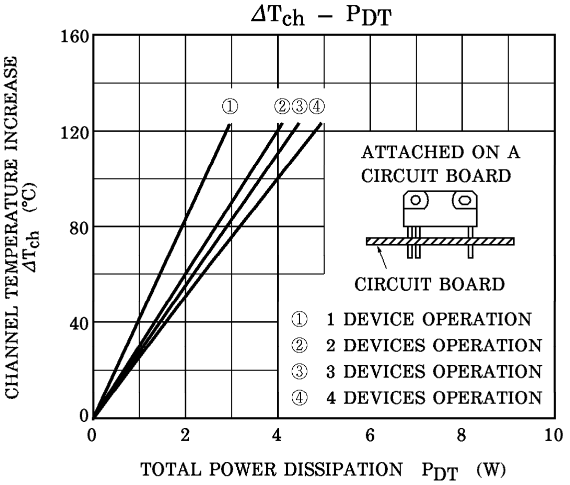
$P_{DT} - Ta$

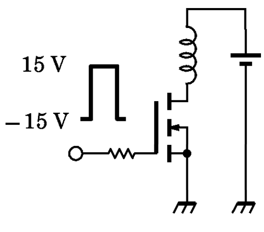


$E_{AS} - T_{ch}$

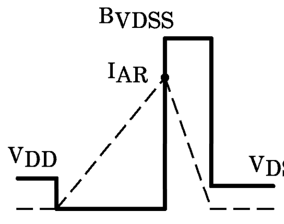


$\Delta T_{ch} - P_{DT}$





TEST CIRCUIT



TEST WAVE FORM

Peak $I_{AR} = 5\ A$, $R_G = 25\ \Omega$
$V_{DD} = 25\ V$, $L = 11.6\ mH$

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