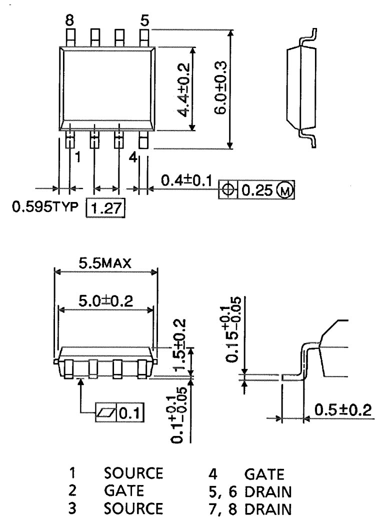
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L^2−π−MOSVI)

TPC8301

Lithium Ion Battery Applications
Portable Equipment Applications
Notebook PCs

Unit: mm



JEDEC	―
JEITA	―
TOSHIBA	2-6J1E

Weight: 0.080 g (typ.)

- Small footprint due to small and thin package
- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 95 mΩ (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 4 S (typ.)
- Low leakage current : I_{DSS} = −10 μA (max) (V_{DS} = −30 V)
- Enhancement−mode : V_{th} = −0.8~ −2.0 V (V_{DS} = −10 V, I_D = −1 mA)

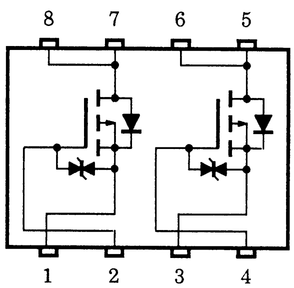
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	−30	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−30	V
Gate−source voltage		V_{GSS}	±20	V
Drain current	D C (Note 1)	I_D	−3.5	A
	Pulse (Note 1)	I_{DP}	−14	
Drain power dissipation (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$P_{D\ (1)}$	1.5	W
	Single-devece value at dual operation (Note 3b)	$P_{D\ (2)}$	1.0	
Drain power dissipation (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$P_{D\ (1)}$	0.75	W
	Single-devece value at dual operation (Note 3b)	$P_{D\ (2)}$	0.45	
Single pulse avalanche energy (Note 4)		E_{AS}	16	mJ
Avalanche current		I_{AR}	−3.5	A
Repetitive avalanche energy (Note 2a, Note 3b, Note 5)		E_{AR}	0.10	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Note: For (Note 1), (Note 2a), (Note 2b), (Note 3a), (Note 3b), (Note 4) and (Note 5), please refer to the next page.

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

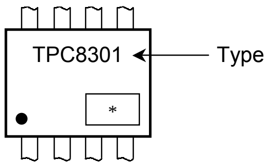
Circuit Configuration



Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$R_{th\ (ch-a)\ (1)}$	83.3	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch-a)\ (2)}$	125	
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$R_{th\ (ch-a)\ (1)}$	167	
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch-a)\ (2)}$	278	

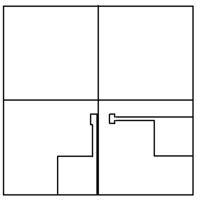
Marking



Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2:

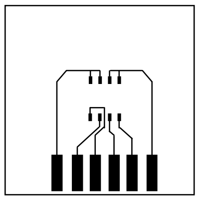
a) Device mounted on a glass-epoxy board (a)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(a)

b) Device mounted on a glass-epoxy board (b)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(b)

Note 3:

a) The power dissipation and thermal resistance values are shown for a single device
(During single-device operation, power is only applied to one device.)

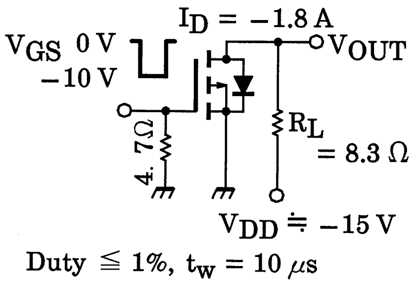
b) The power dissipation and thermal resistance values are shown for a single device
(During dual operation, power is evenly applied to both devices.)

Note 4: V_{DD} = −24 V, T_{ch} = 25°C (Initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = −3.5 A

Note 5: Repetitive rating: pulse width limited by maximum channel temperature

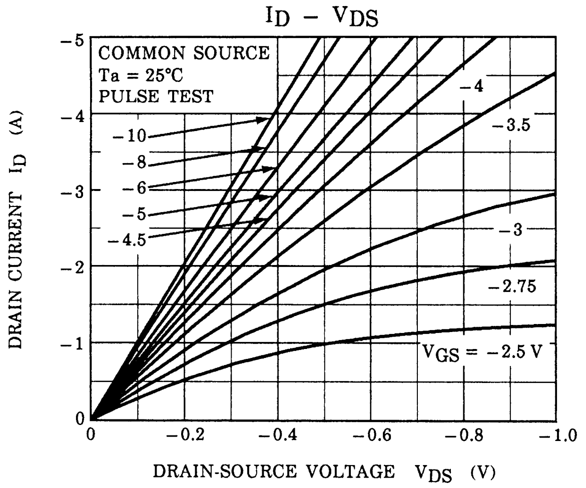
Note 6: • on lower left of the marking indicates Pin 1.
* shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

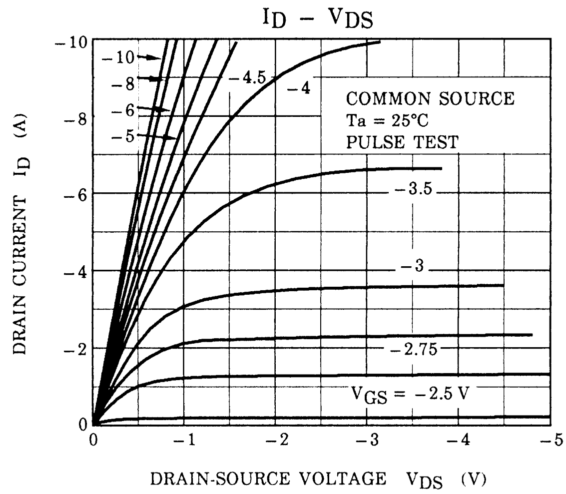
Electrical Characteristics (Ta = 25°C)

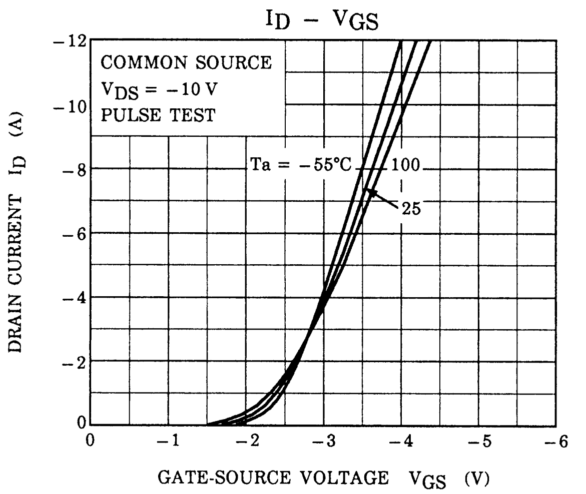
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut−OFF current		I_{DSS}	V_{DS} = −30 V, V_{GS} = 0 V	—	—	−10	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−30	—	—	V
Gate threshold voltage		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 = −1.8 A	—	155	190	mΩ
		$R_{DS\ (ON)}$	V_{GS} = −10 V, I_D = −1.8 A	—	95	120	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −1.8 A	2	4	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	540	—	pF
Reverse transfer capacitance		C_{rss}		—	80	—	
Output capacitance		C_{oss}		—	290	—	
Switching time	Rise time	t_r		—	11	—	ns
	Turn−ON time	t_{on}		—	17	—	
	Fall time	t_f		—	11	—	
	Turn−OFF time	t_{off}		—	70	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ −24 V, V_{GS} = −10 V, I_D = −3.5 A	—	18	—	nC
Gate−source charge		Q_{gs}		—	13	—	
Gate−drain (“miller”) charge		Q_{gd}		—	5	—	

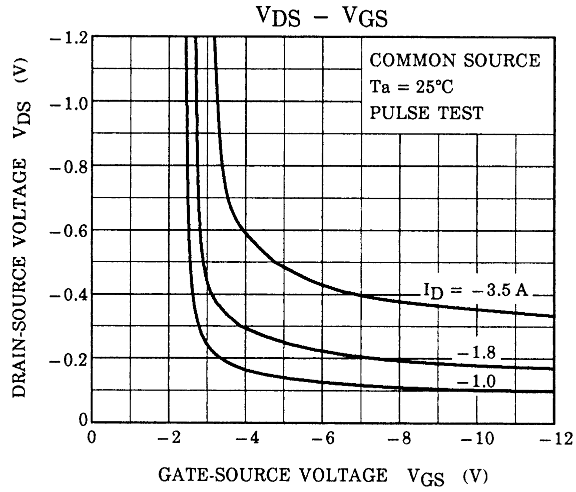
Source−Drain Ratings and Characteristics (Ta = 25°C)

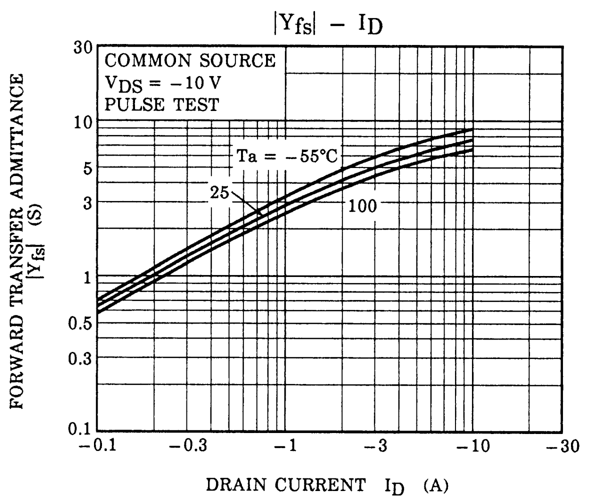
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−14	A
Forward voltage (diode)		V_{DSF}	I_{DR} = −3.5 A, V_{GS} = 0 V	—	—	1.2	V

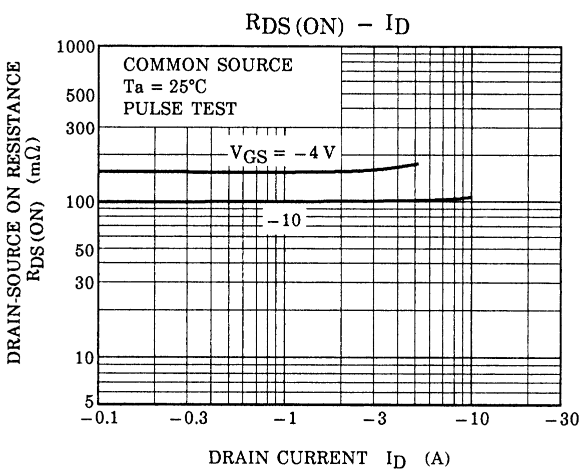

ID – VDS
COMMON SOURCE
Ta = 25°C
PULSE TEST
−10
−8
−6
−5
−4.5
−4
−3.5
−3
−2.75
VGS = −2.5 V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0 −0.2 −0.4 −0.6 −0.8 −1.0
0 −1 −2 −3 −4 −5


ID – VDS
COMMON SOURCE
Ta = 25°C
PULSE TEST
−10
−8
−6
−5
−4.5
−4
−3.5
−3
−2.75
VGS = −2.5 V
DRAIN CURRENT ID (A)
DRAIN-SOURCE VOLTAGE VDS (V)
0 −1 −2 −3 −4 −5
0 −2 −4 −6 −8 −10

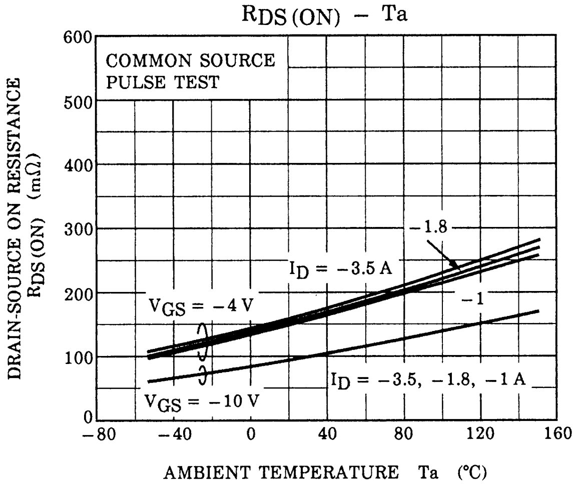

ID – VGS
COMMON SOURCE
VDS = −10 V
PULSE TEST
Ta = −55°C
100
25
DRAIN CURRENT ID (A)
GATE-SOURCE VOLTAGE VGS (V)
0 −1 −2 −3 −4 −5 −6
0 −2 −4 −6 −8 −10 −12


VDS – VGS
COMMON SOURCE
Ta = 25°C
PULSE TEST
ID = −3.5 A
−1.8
−1.0
DRAIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
0 −2 −4 −6 −8 −10 −12
0 −0.2 −0.4 −0.6 −0.8 −1.0 −1.2

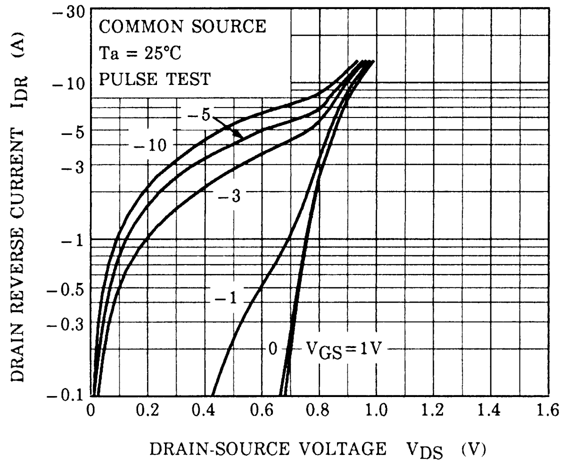

|Yfs| – ID
COMMON SOURCE
VDS = −10 V
PULSE TEST
Ta = −55°C
25
100
FORWARD TRANSFER ADMITTANCE |Yfs| (S)
DRAIN CURRENT ID (A)
−0.1 −0.3 −1 −3 −10 −30
0.1 0.3 0.5 1 3 5 10 30


RDS (ON) – ID
COMMON SOURCE
Ta = 25°C
PULSE TEST
VGS = −4 V
−10
DRAIN-SOURCE ON RESISTANCE RDS (ON) (mΩ)
DRAIN CURRENT ID (A)
−0.1 −0.3 −1 −3 −10 −30
5 10 30 50 100 300 500 1000

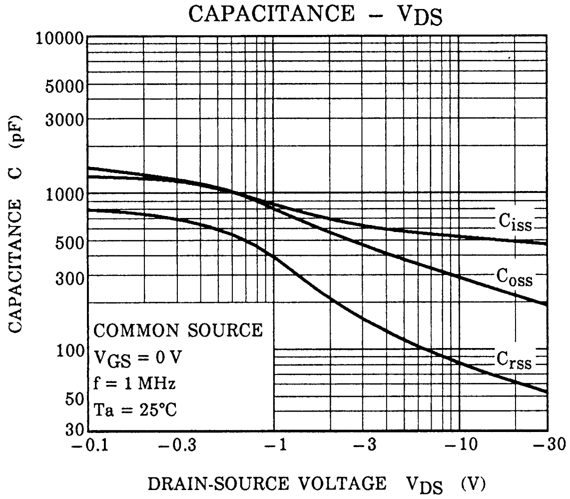
$R_{DS(ON)}$ – Ta



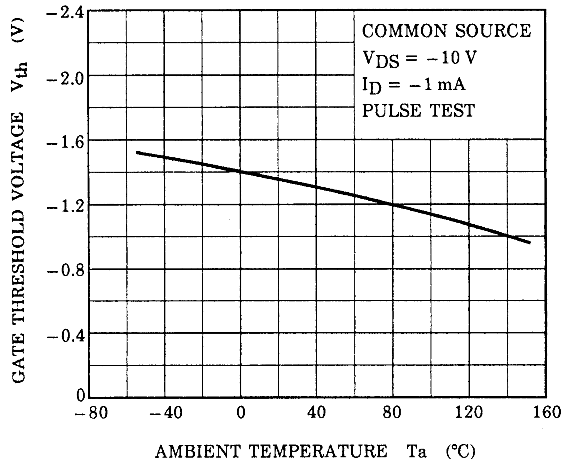
I_{DR} – V_{DS}



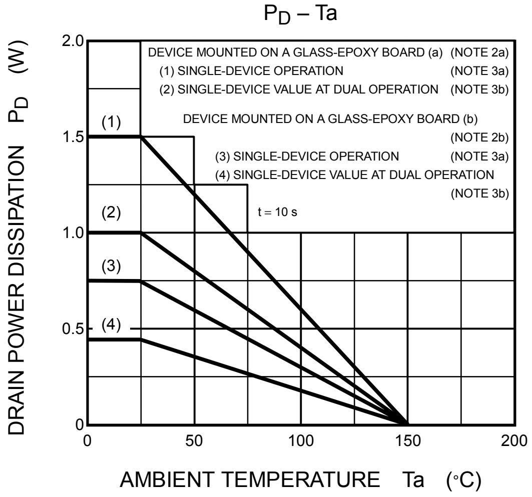
CAPACITANCE – V_{DS}



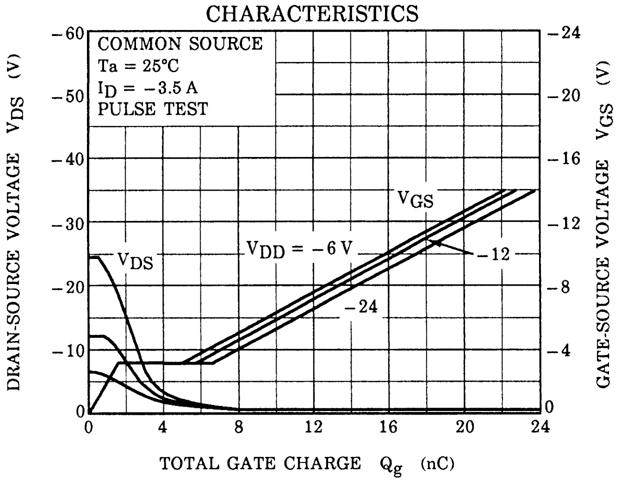
V_{th} – Ta

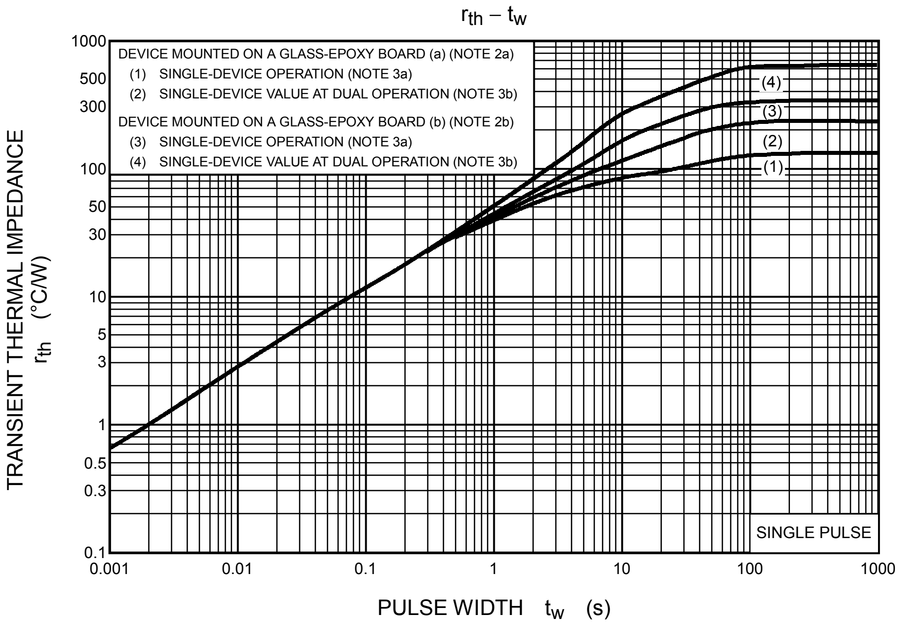


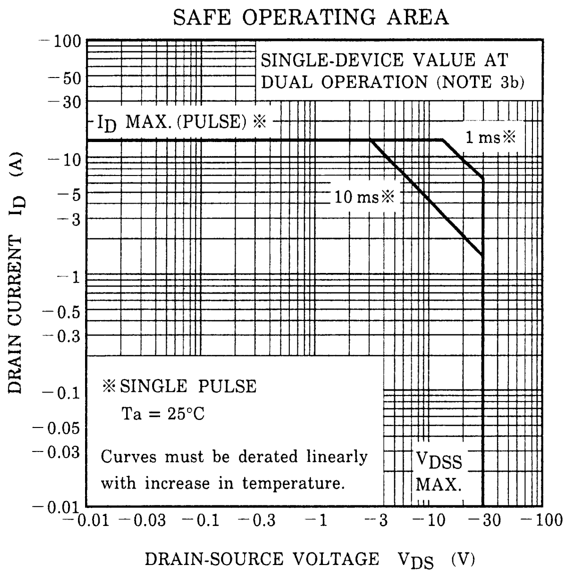
P_D – Ta

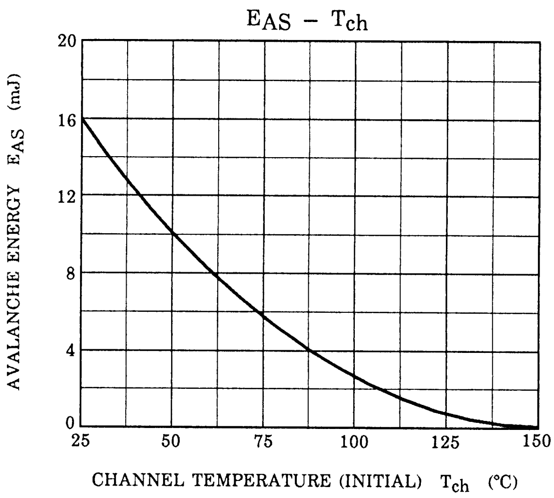


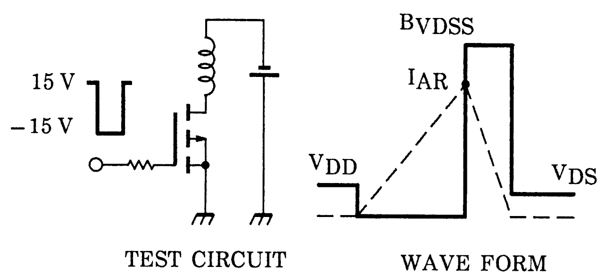
DYNAMIC INPUT / OUTPUT CHARACTERISTICS











T_{ch} = 25°C (Initial)
Peak I_{AR} = −3.5 A, R_G = 25 Ω
V_{DD} = −24 V, L = 1.48 mH

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

RESTRICTIONS ON PRODUCT USE

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