

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type ( $L^2$ - $\pi$ -MOSVI)

# TPC8301

Lithium Ion Battery Applications  
Portable Equipment Applications  
Notebook PCs

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

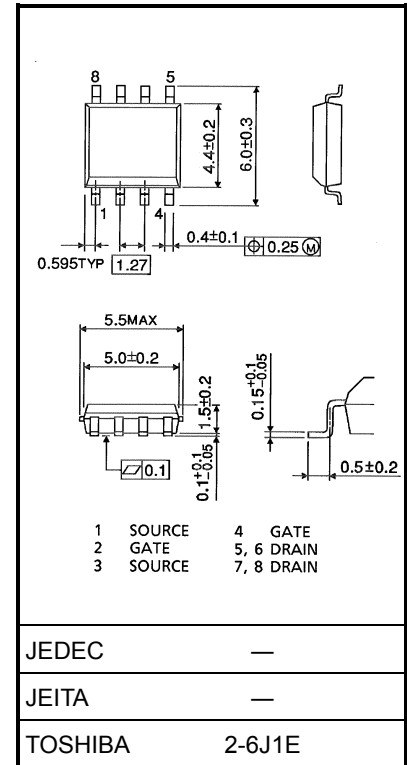
## Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	-30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	-30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	D C (Note 1)	$I_D$	-3.5	A
	Pulse (Note 1)	$I_{DP}$	-14	
Drain power dissipation ( $t = 10 \text{ s}$ ) (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 ( $t = 10 \text{ s}$ ) (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	
Storage temperature range		$T_{stg}$	-55 ~ 150	

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

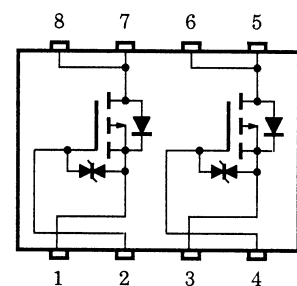
This transistor is an electrostatic sensitive device. Please handle with caution.

Unit: mm



Weight: 0.080 g (typ.)

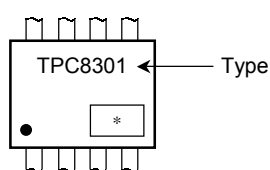
## Circuit Configuration



## Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s)	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)	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	

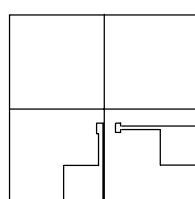
## Marking



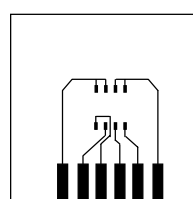
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2:

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



(a)



(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.)

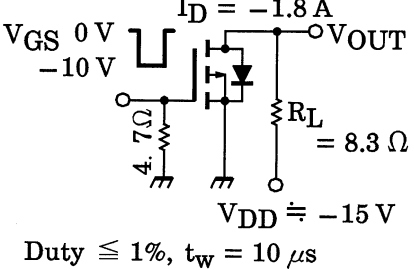
Note 4:  $V_{DD} = -24$  V,  $T_{ch} = 25^{\circ}\text{C}$  (Initial),  $L = 1.0$  mH,  $R_G = 25$   $\Omega$ ,  $I_{AR} = -3.5$  A

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

Note 6: • on lower left of the marking indicates Pin 1.

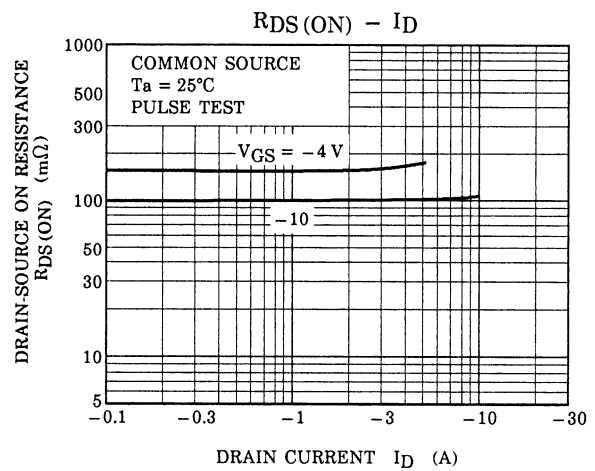
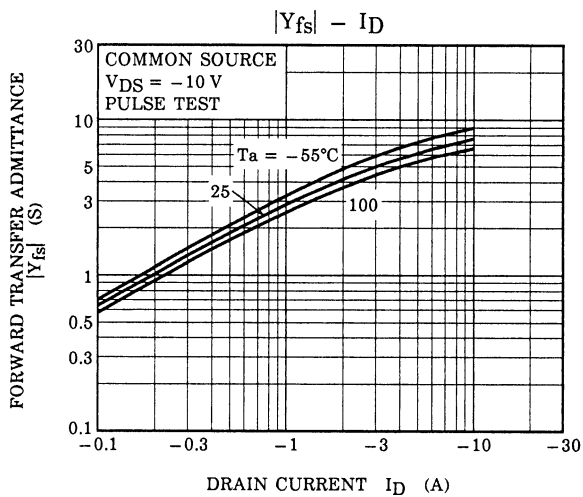
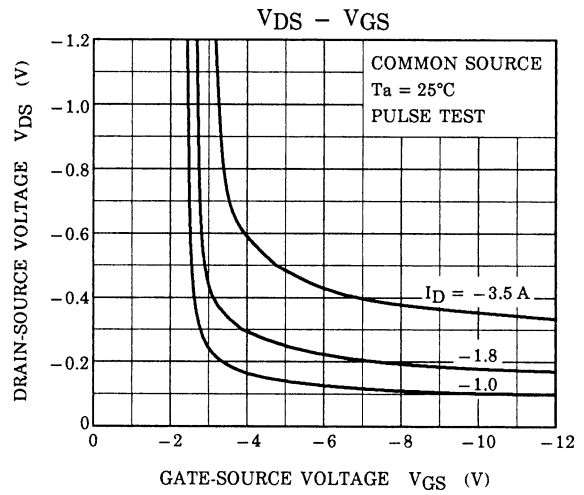
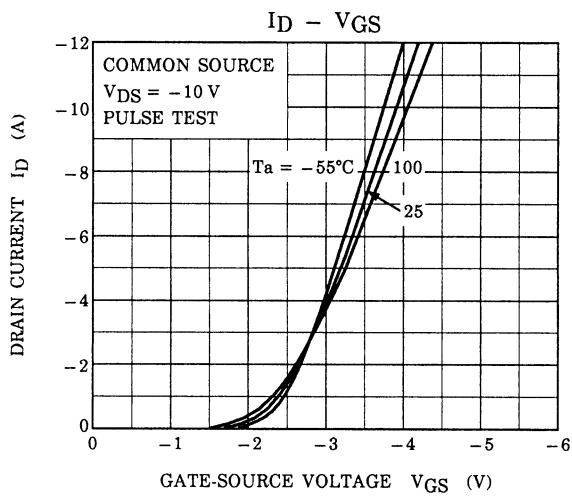
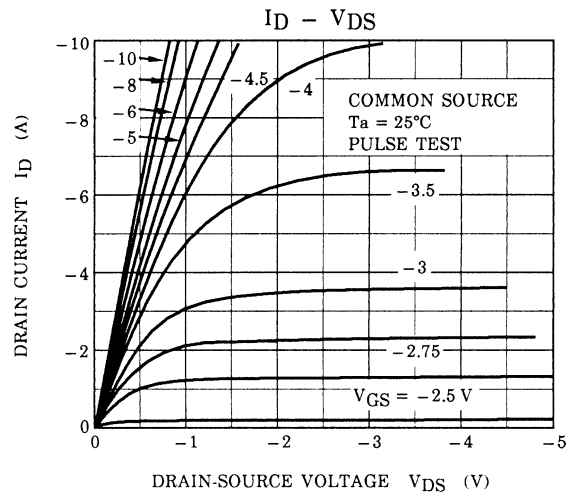
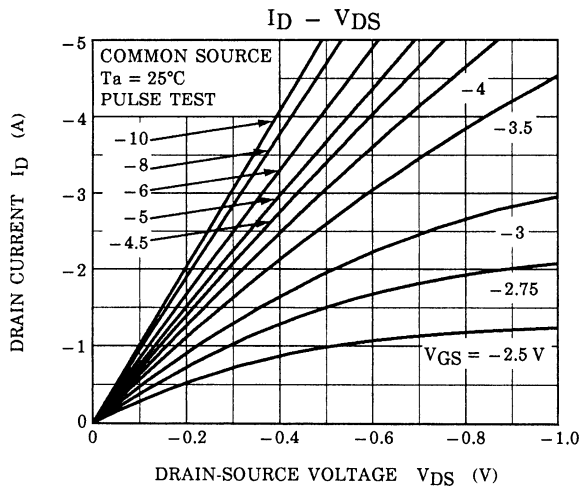
\* shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

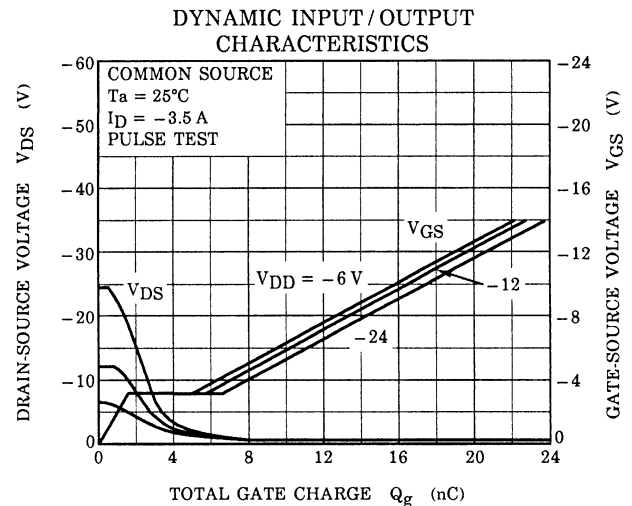
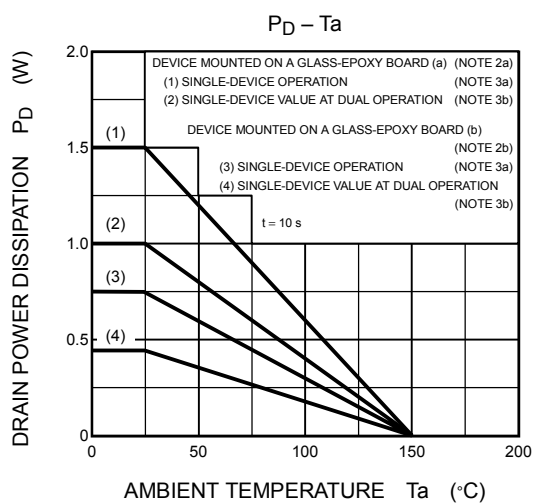
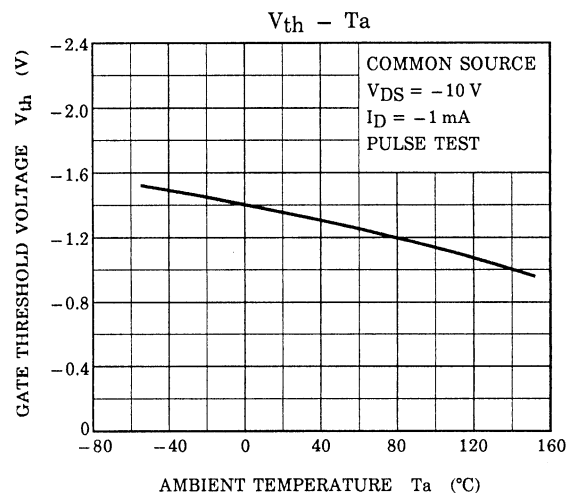
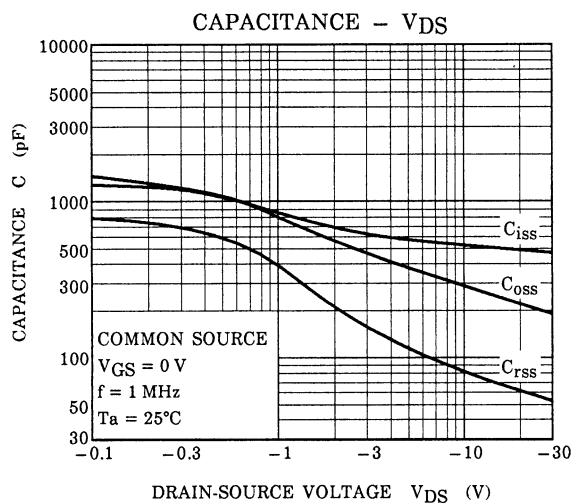
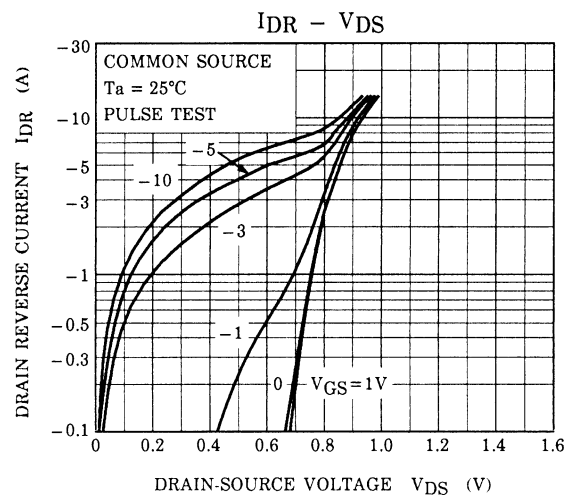
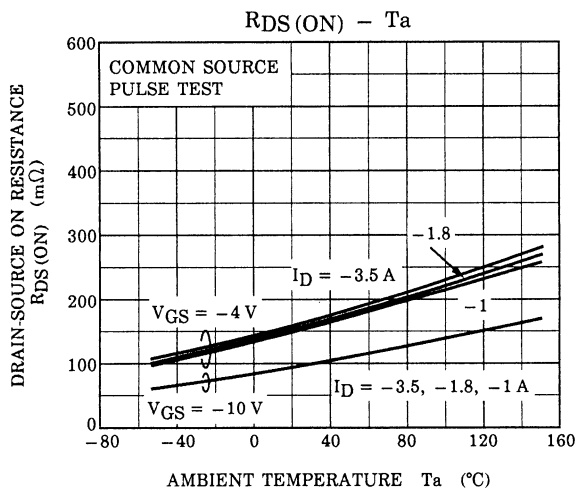
## Electrical Characteristics (Ta = 25°C)

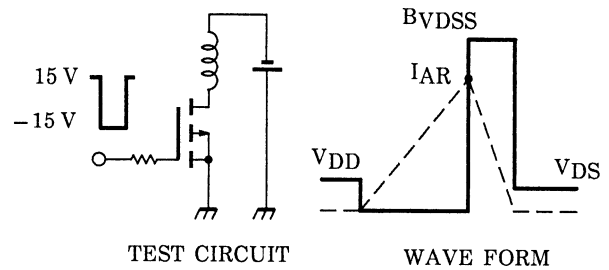
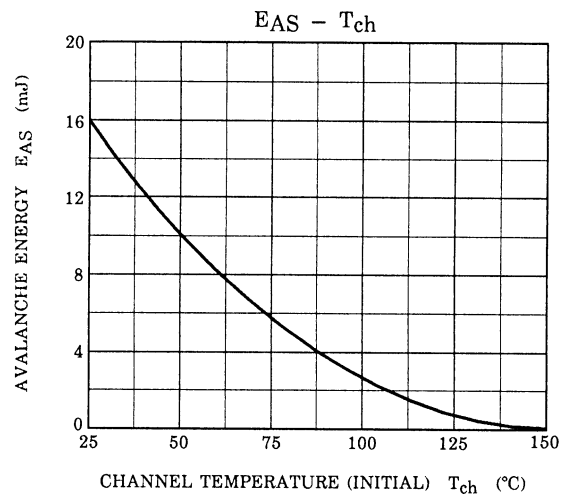
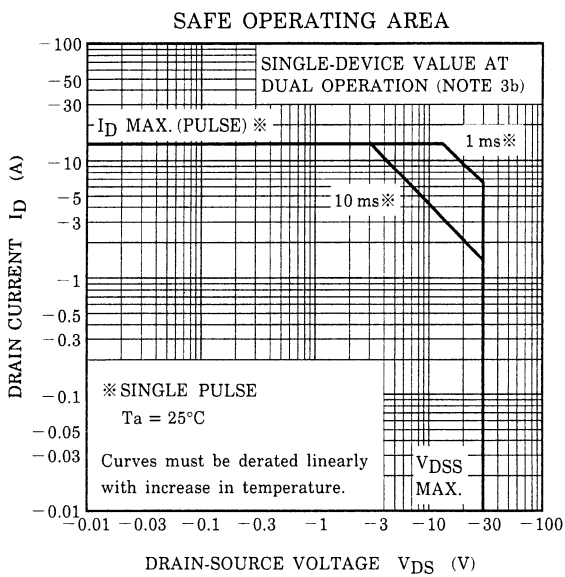
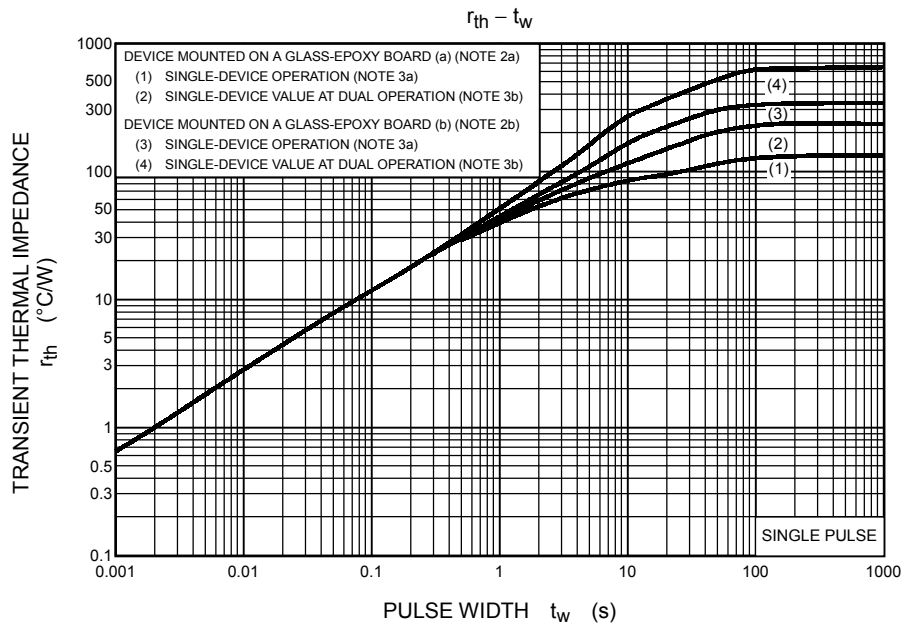
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = -30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$	-30	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = -10 \text{ V}, I_D = -1 \text{ mA}$	-0.8	—	-2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4 \text{ V}, I_D = -1.8 \text{ A}$	—	155	190	m $\Omega$
		$R_{DS(ON)}$	$V_{GS} = -10 \text{ V}, I_D = -1.8 \text{ A}$	—	95	120	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10 \text{ V}, I_D = -1.8 \text{ A}$	2	4	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	540	—	pF
Reverse transfer capacitance		$C_{rss}$		—	80	—	
Output capacitance		$C_{oss}$		—	290	—	
Switching time	Rise time	$t_r$	 <p> <math>V_{GS} \begin{cases} 0 \text{ V} \\ -10 \text{ V} \end{cases}</math>  <math>I_D = -1.8 \text{ A}</math>  <math>R_L = 8.3 \Omega</math>  <math>V_{DD} \approx -15 \text{ V}</math>  <math>\text{Duty} \leq 1\%, t_W = 10 \mu\text{s}</math> </p>	—	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)		$Q_g$	$V_{DD} \approx -24 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -3.5 \text{ A}$	—	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)		$V_{DSF}$	$I_{DR} = -3.5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V







$T_{ch} = 25^\circ\text{C}$  (Initial)  
 Peak  $I_{AR} = -3.5\text{ A}$ ,  $R_G = 25\ \Omega$   $E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left( \frac{BVDSS}{BVDSS - V_{DD}} \right)$   
 $V_{DD} = -24\text{ V}$ ,  $L = 1.48\text{ mH}$

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