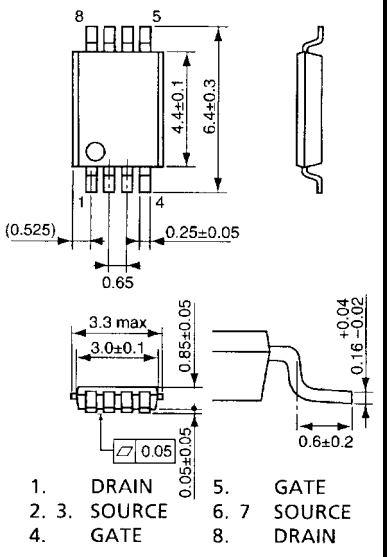
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOS II)

TPCS8205

Lithium Ion Battery Applications
Portable Equipment Applications
Notebook PCs

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 30 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 10 S (typ.)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 20 V)
- Enhancement-mode: V_{th} = 0.5~1.2 V (V_{DS} = 10 V, I_D = 200 μA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3R1E

Weight: 0.035 g (typ.)

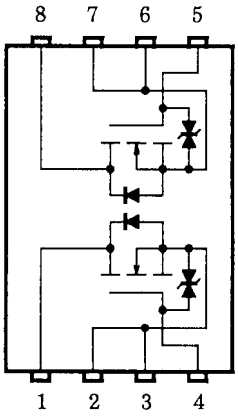
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Drain-gate voltage (R_{GS} = 20kΩ)		V_{DGR}	20	V
Gate-source voltage		V_{GSS}	±12	V
Drain curren	D C (Note 1)	I_D	5	A
	Pulse (Note 1)	I_{DP}	20	
Drain power dissipation (t = 10s) (Note 2a)	Single-device operation (Note 3a)	$P_{D\ (1)}$	1.1	W
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	0.5	
Drain power dissipation (t = 10s) (Note 2b)	Single-device operation (Note 3a)	$P_{D\ (1)}$	0.6	W
	Single-device value at dual operation (Note 3b)	$P_{D\ (2)}$	0.35	
Single pulse avalanche energy (Note 4)		E_{AS}	32.5	mJ
Avalanche current		I_{AR}	5	A
Repetitive avalanche energy Single-device value at operation (Note 2a, Note 3b, Note 5)		E_{AR}	0.05	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.

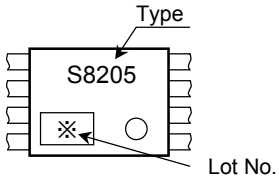
Circuit Configuration



Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10s) (Note 2a)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	114	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	250	
Thermal resistance, channel to ambient (t = 10s) (Note 2b)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	208	
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	357	

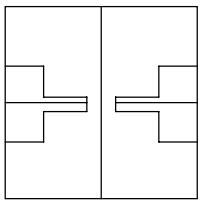
Marking (Note 6)



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

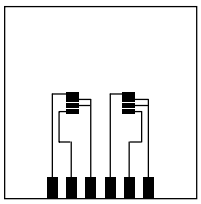
Note 2:

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



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

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



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

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.)

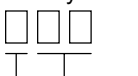
b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.)

Note 4: V_{DD} = 16 V, T_{ch} = 25°C (Initiaal), L = 1.0 mH, R_G = 25 Ω, I_{AR} = 5.0 A

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

Note 6: ○ on lower right of the marking indicates Pin 1.

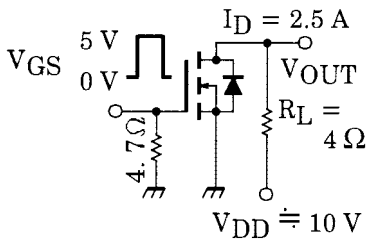
※ Weekly code: (Three digits)



Week of manufacture
(01 for first week of year, continues up to 52 or 53)

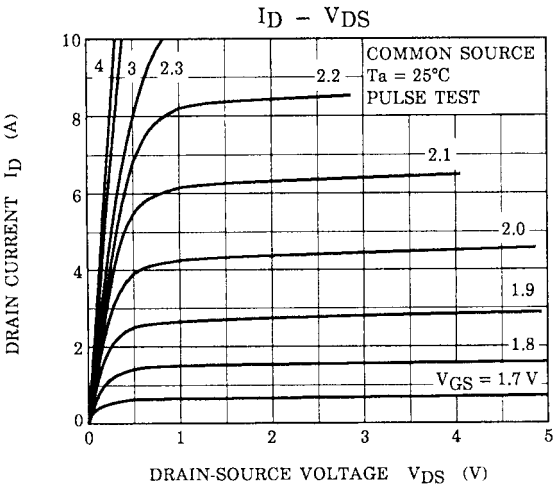
Year of manufacture
(One low-order digits of calendar year)

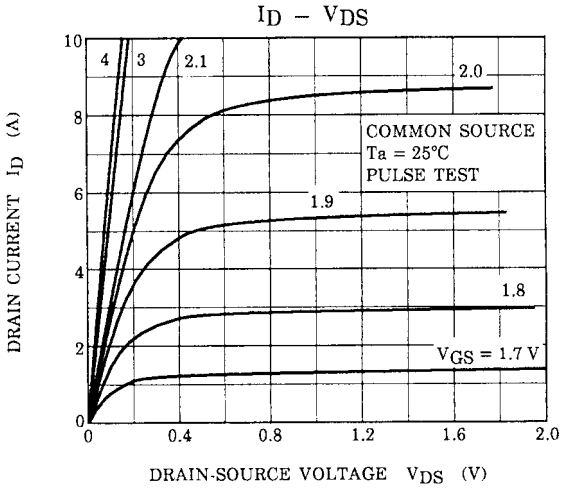
Electrical Characteristics (Ta = 25°C)

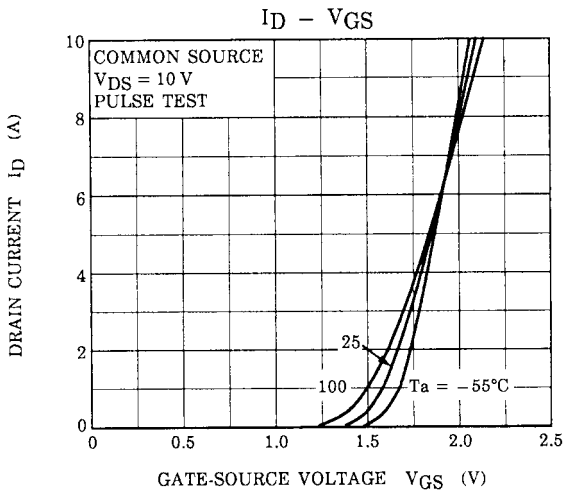
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −12 V	8	—	—	
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 200 μA	0.5	—	1.2	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 2.0 V, I_D = 3.5 A	—	60	90	mΩ
		$R_{DS\ (ON)}$	V_{GS} = 2.5 V, I_D = 3.5 A	—	40	60	
		$R_{DS\ (ON)}$	V_{GS} = 4 V, I_D = 4 A	—	30	45	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 2.5 A	5	10	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	760	—	pF
Reverse transfer capacitance		C_{rss}		—	110	—	pF
Output capacitance		C_{oss}		—	130	—	pF
Switching time	Rise time	t_r		—	7	—	ns
	Turn-ON time	t_{on}		—	13	—	
	Fall time	t_f		—	13	—	
	Turn-OFF time	t_{off}		—	49	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≈ 16 V, V_{GS} = 5 V, I_D = 5 A	—	11	—	nC
Gate-source charge		Q_{gs}		—	8	—	nC
Gate-drain (“miller”) charge		Q_{gd}		—	3	—	nC

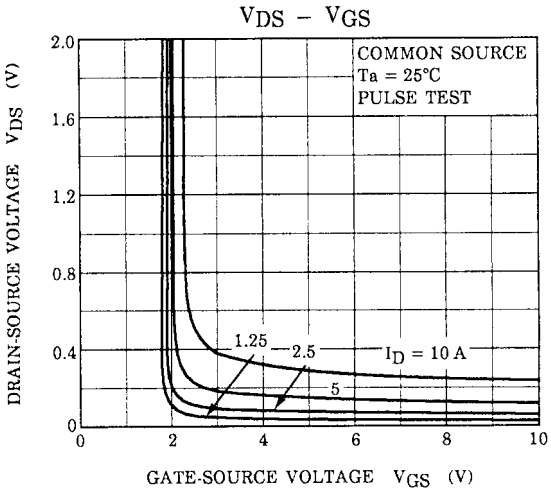
Source-Drain Ratings and Characteristics (Ta = 25°C)

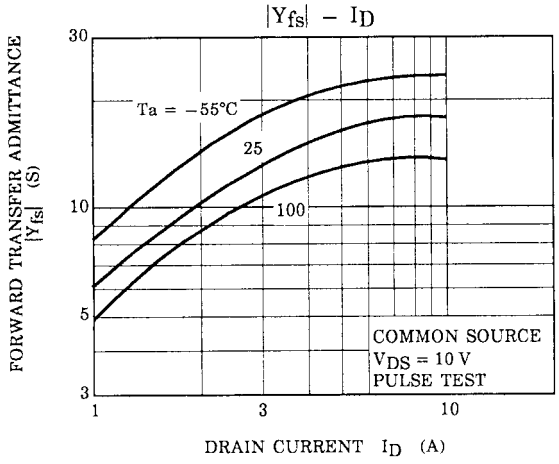
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	20	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 5 A, V_{GS} = 0 V	—	—	−1.2	V

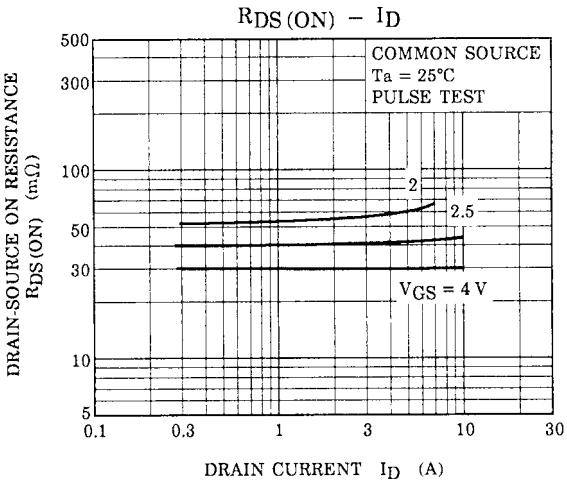

I_D – V_{DS}
COMMON SOURCE
Ta = 25°C
PULSE TEST
4
3
2.3
2.2
2.1
2.0
1.9
1.8
V_{GS} = 1.7 V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)


I_D – V_{DS}
COMMON SOURCE
Ta = 25°C
PULSE TEST
4
3
2.1
2.0
1.9
1.8
V_{GS} = 1.7 V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)

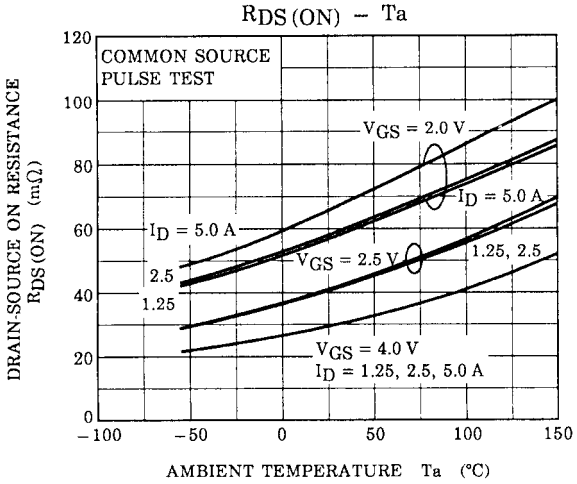

I_D – V_{GS}
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
25
100
Ta = −55°C
DRAIN CURRENT I_D (A)
GATE-SOURCE VOLTAGE V_{GS} (V)


V_{DS} – V_{GS}
COMMON SOURCE
Ta = 25°C
PULSE TEST
1.25
2.5
5
I_D = 10 A
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)

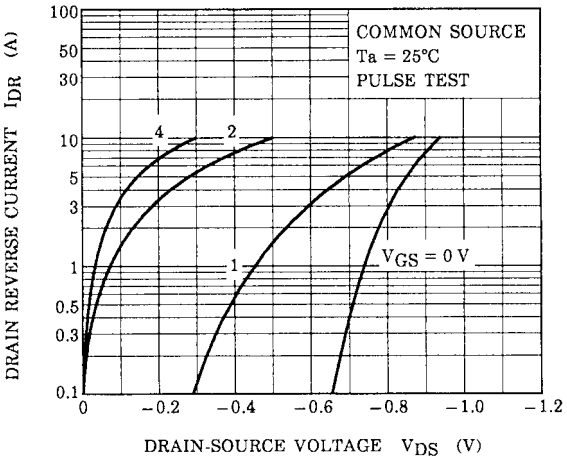

$|Y_{fs}|$ – I_D
Ta = −55°C
25
100
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT I_D (A)


$R_{DS\,(ON)}$ – I_D
COMMON SOURCE
Ta = 25°C
PULSE TEST
2
2.5
V_{GS} = 4 V
DRAIN-SOURCE ON RESISTANCE $R_{DS\,(ON)}$ (mΩ)
DRAIN CURRENT I_D (A)

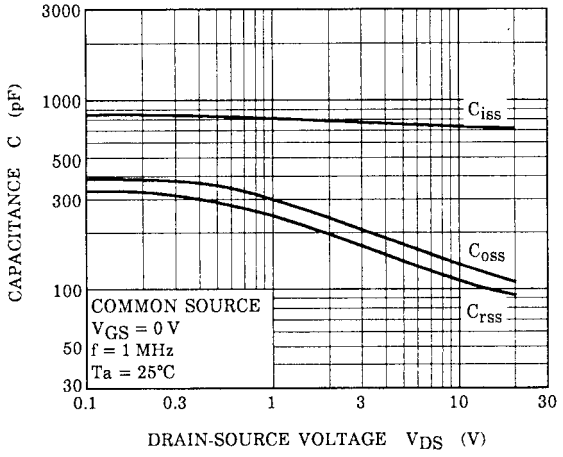
$R_{DS\,(ON)}$ – Ta



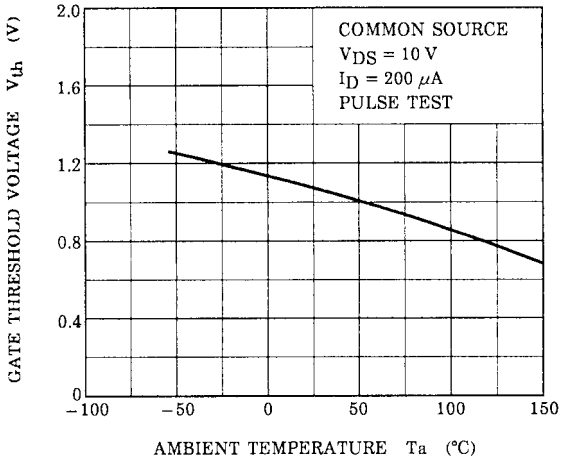
I_{DR} – V_{DS}



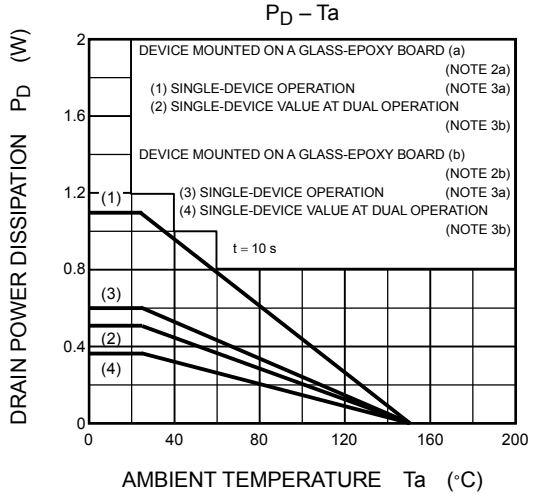
CAPACITANCE – V_{DS}



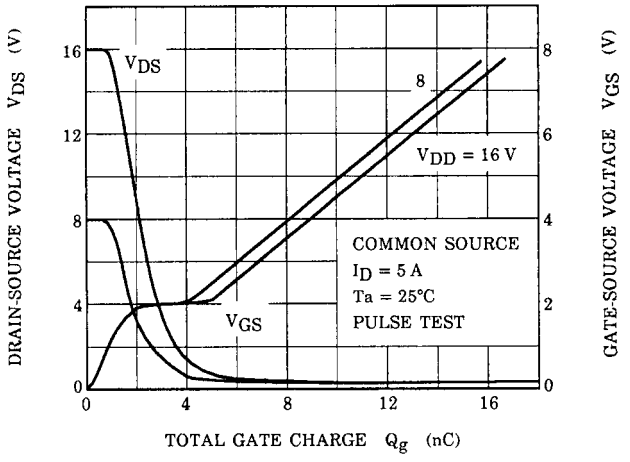
V_{th} – Ta



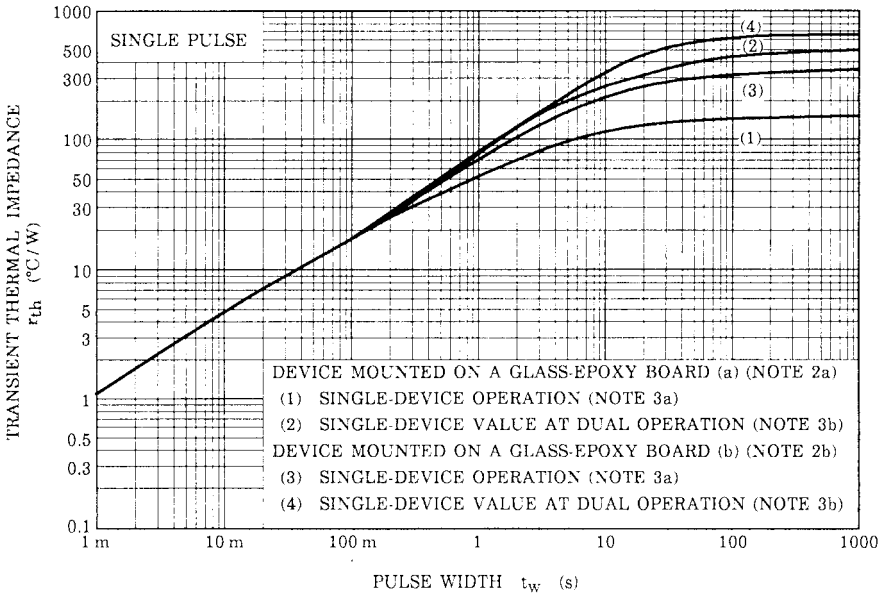
P_D – Ta



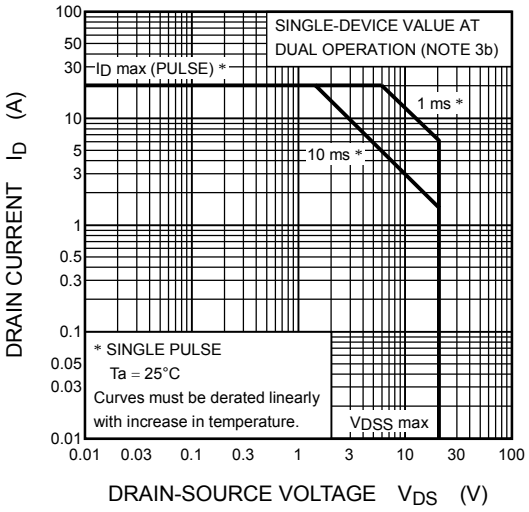
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



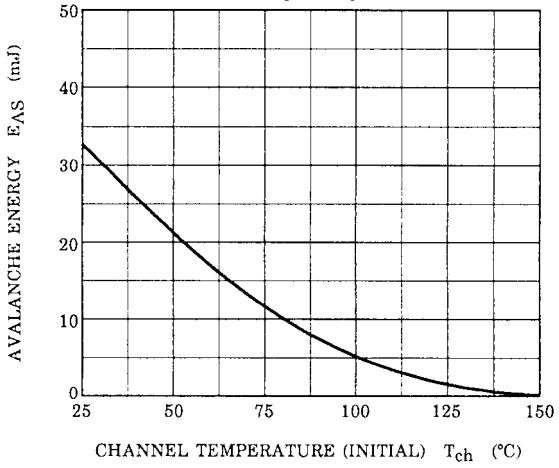
r_{th} – t_w

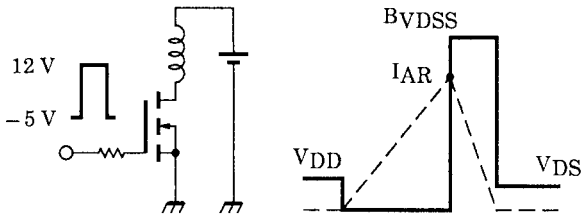


SAFE OPERATING AREA



E_{AS} – T_{ch}





TEST CIRCUIT WAVE FORM

T_{ch} = 25°C (Initial)
Peak I_{AR} = 5 A, R_G = 25 Ω
V_{DD} = 16 V, L = 1.0 mH

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

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