

TOSHIBA POWER MOS FET MODULE SILICON N CHANNEL MOS TYPE (L<sup>2</sup>-π-MOS V 4 IN 1)

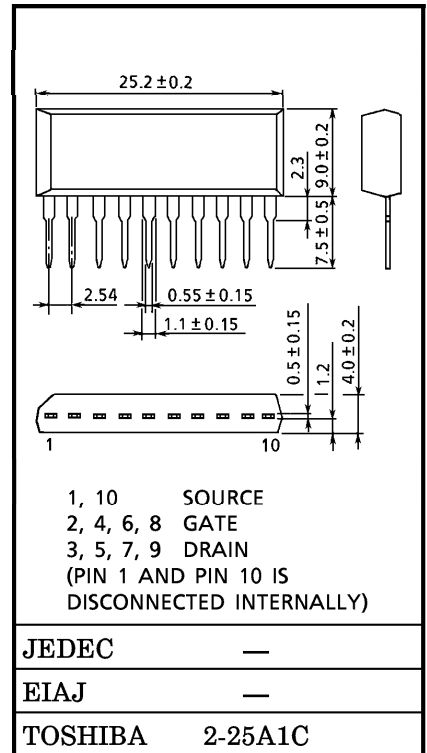
# MP4210

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

INDUSTRIAL APPLICATIONS

Unit in mm

- 4 V Gate Drive Available
- Small Package by Full Molding (SIP 10 Pin)
- High Drain Power Dissipation (4 Devices Operation)  
 :  $P_T = 4 \text{ W}$  ( $T_a = 25^\circ\text{C}$ )
- Low Drain-Source ON Resistance :  $R_{DS(ON)} = 0.12 \Omega$  (typ.)
- High Forward Transfer Admittance :  $|Y_{fs}| = 5.0 \text{ S}$  (typ.)
- Low Leakage Current :  $I_{GSS} = \pm 10 \mu\text{A}$  (max.) ( $V_{GS} = \pm 16 \text{ V}$ )  
 $I_{DSS} = 100 \mu\text{A}$  (max.) ( $V_{DS} = 60 \text{ V}$ )
- Enhancement-Mode :  $V_{th} = 0.8 \sim 2.0 \text{ V}$   
 ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

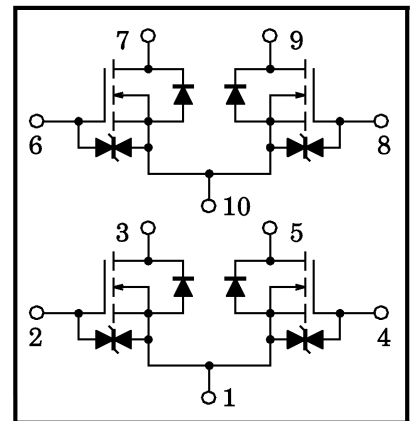


MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	RATING	UNIT
Drain-Source Voltage	$V_{DSS}$	60	V
Drain-Gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	$V_{DGR}$	60	V
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Drain Current	DC	$I_D$	5
	Pulse	$I_{DP}$	20
Drain Power Dissipation (1 Device Operation, $T_a = 25^\circ\text{C}$ )	$P_D$	2.0	W
Drain Power Dissipation (4 Devices Operation, $T_a = 25^\circ\text{C}$ )	$P_{DT}$	4.0	W
Single Pulse Avalanche Energy*	$E_{AS}$	129	mJ
Avalanche Current	$I_{AR}$	5	A
Repetitive Avalanche Energy**	1 Device Operation	$E_{AR}$	0.2
	4 Devices Operation	$E_{ART}$	0.4
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	$-55 \sim 150$	$^\circ\text{C}$

Weight : 2.1 g (typ.)

ARRAY CONFIGURATION



Note ;

- \* Avalanche energy (single pulse) applied condition  
 $V_{DD} = 25 \text{ V}$ , Starting  $T_{ch} = 25^\circ\text{C}$ ,  $L = 7 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 5 \text{ A}$
- \*\* Repetitive rating ; Pulse Width Limited by maximum channel temperature.

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

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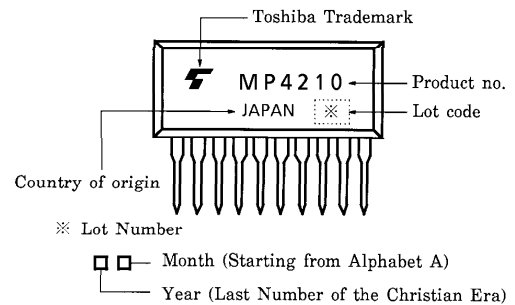
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**THERMAL CHARACTERISTICS**

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

**MARKING**



**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

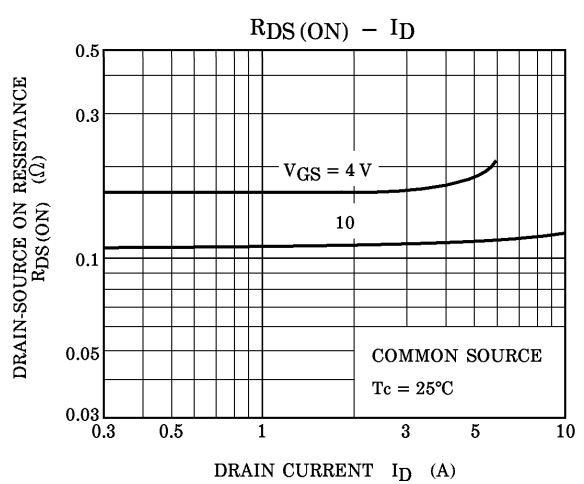
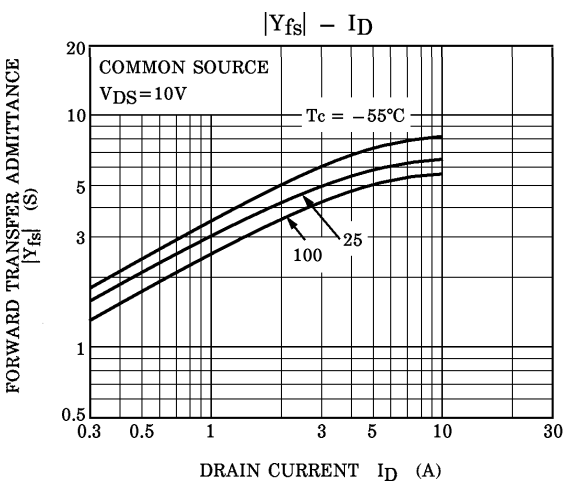
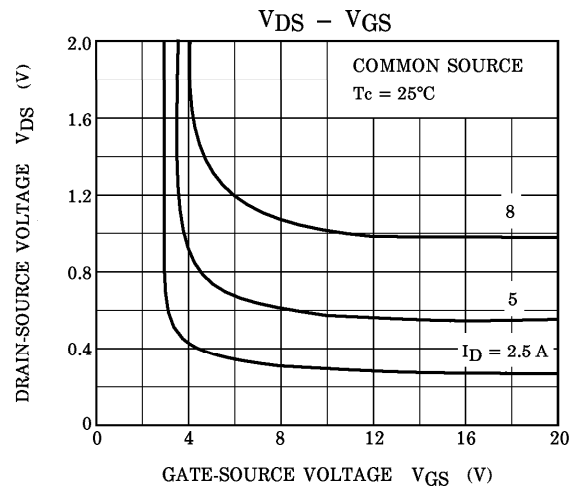
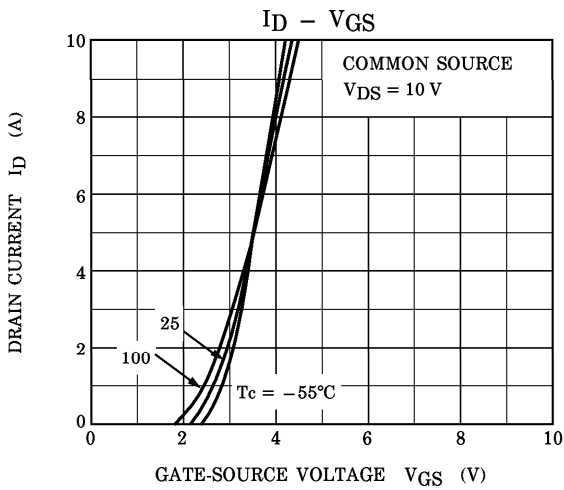
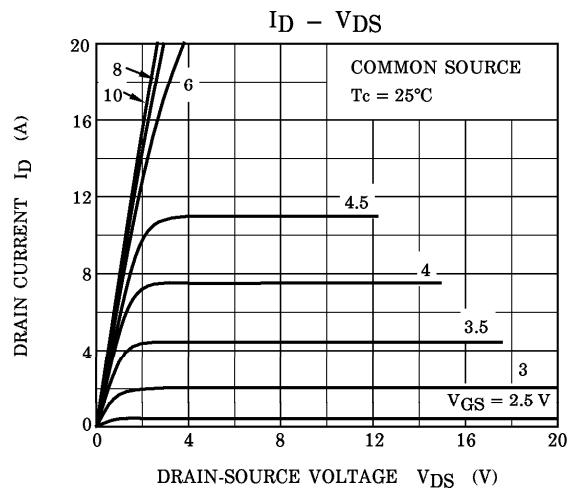
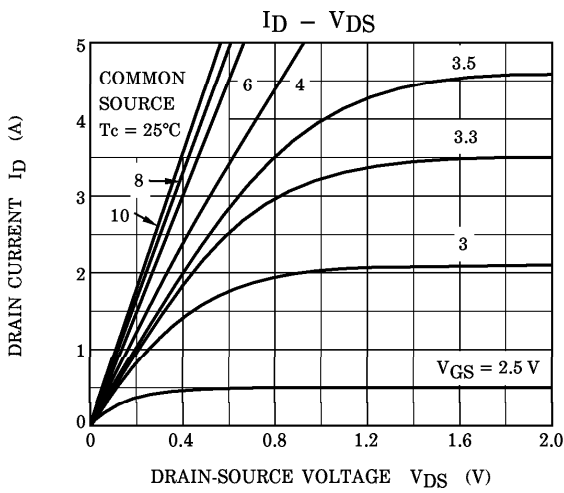
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±10	μA
Drain Cut-off Current		I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	—	—	100	μA
Drain-Source Breakdown Voltage		V(BR)DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	60	—	—	V
Gate Threshold Voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	0.8	—	2.0	V
Drain-Source ON Resistance		R <sub>D(S)ON</sub>	V <sub>GS</sub> = 4 V, I <sub>D</sub> = 2.5 A	—	0.21	0.32	Ω
			V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.5 A	—	0.12	0.16	
Forward Transfer Admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.5 A	3.0	5.0	—	S
Input Capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V f = 1 MHz	—	370	—	pF
Reverse Transfer Capacitance		C <sub>rss</sub>		—	60	—	
Output Capacitance		C <sub>oss</sub>		—	180	—	
Switching Time	Rise Time	t <sub>r</sub>		—	18	—	ns
	Turn-on Time	t <sub>on</sub>		—	25	—	
	Fall Time	t <sub>f</sub>		—	55	—	
	Turn-off Time	t <sub>off</sub>		V <sub>IN</sub> : t <sub>r</sub> , t <sub>f</sub> < 5 ns, Duty ≤ 1%, t <sub>w</sub> = 10 μs	—	170	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q <sub>g</sub>	V <sub>DD</sub> ≐ 48 V, V <sub>GS</sub> = 10 V	—	12	—	nC
Gate-Source Charge		Q <sub>gs</sub>	I <sub>D</sub> = 5 A	—	8	—	
Gate-Drain ("Miller") Charge		Q <sub>gd</sub>		—	4	—	

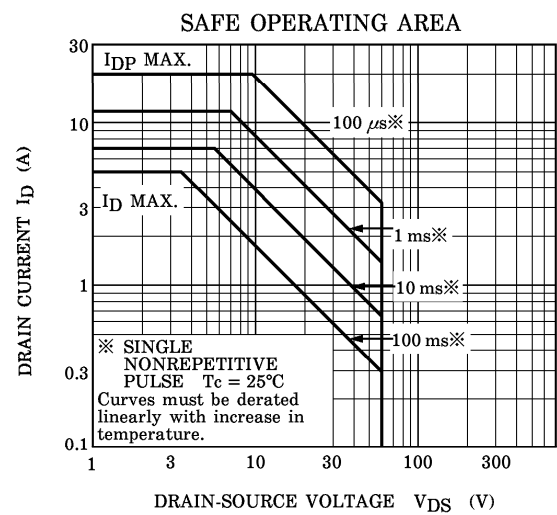
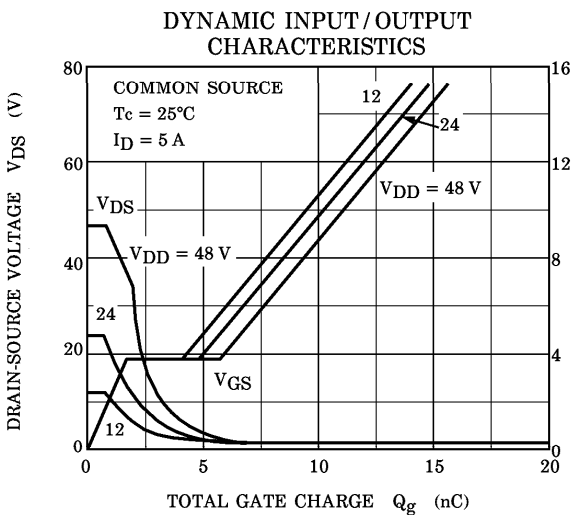
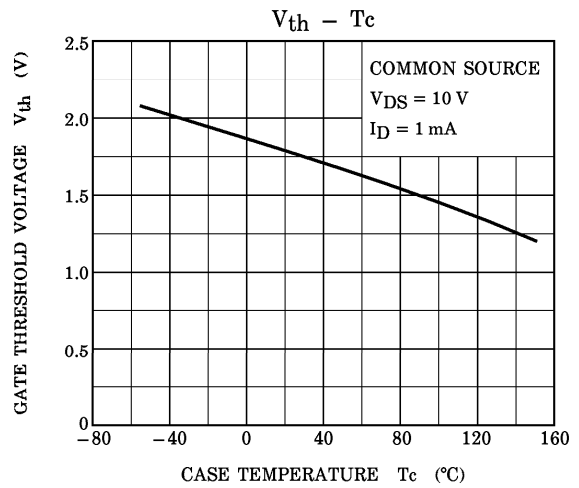
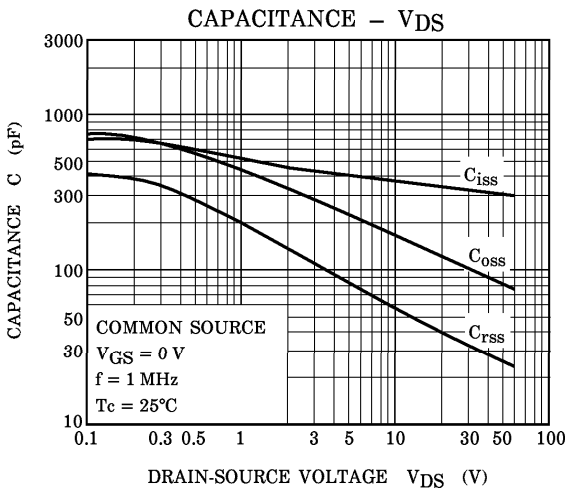
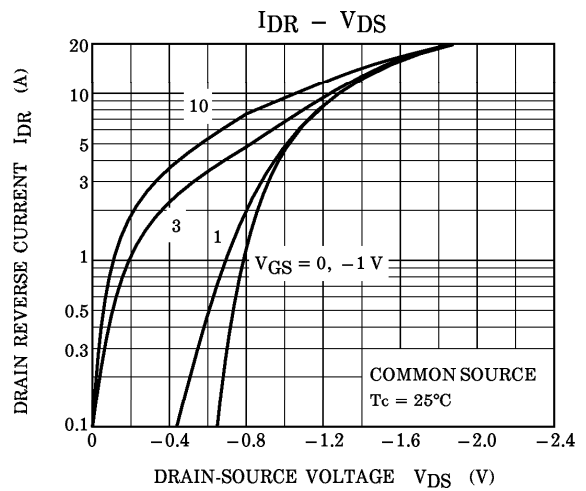
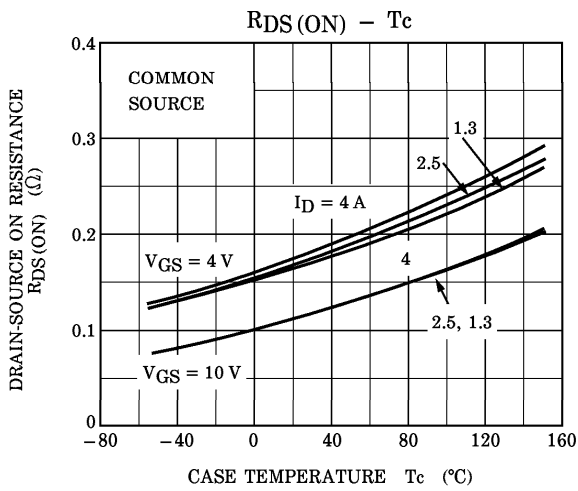
**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)**

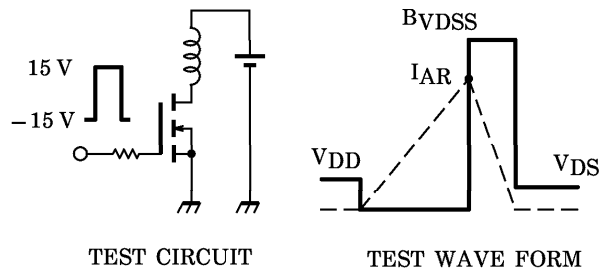
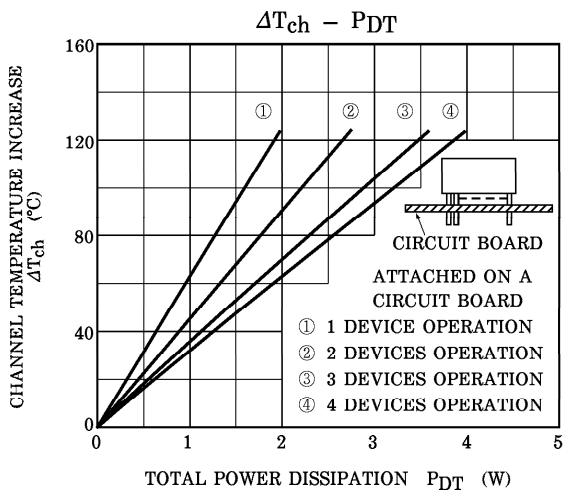
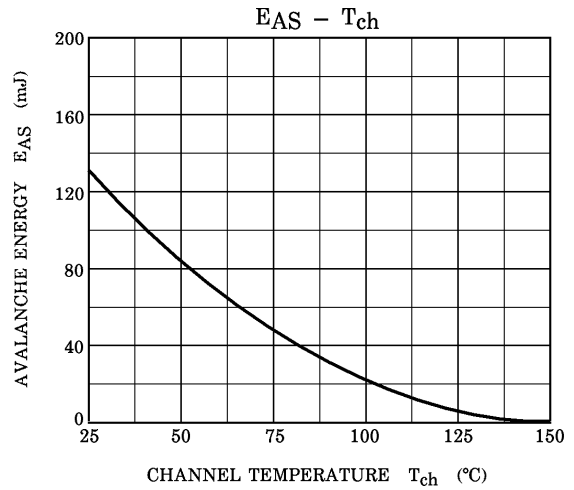
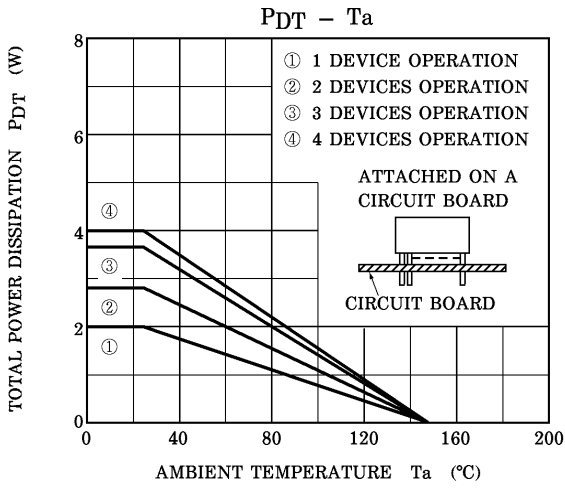
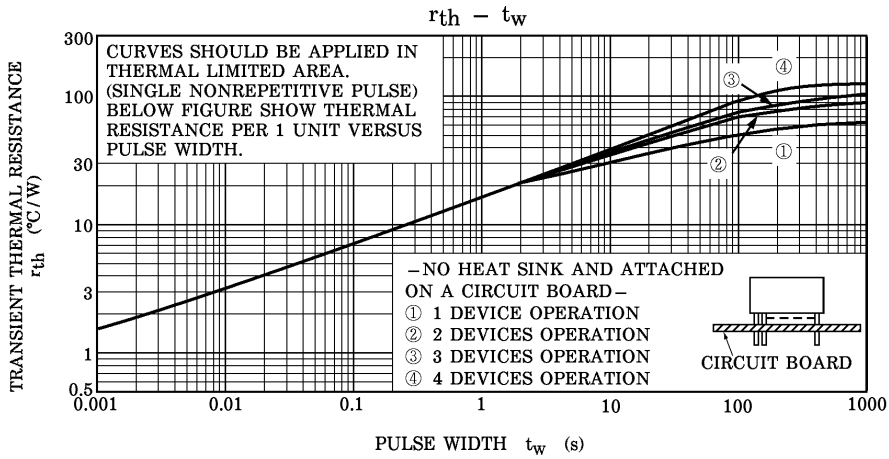
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I <sub>DR</sub>	—	—	—	5	A
Pulse Drain Reverse Current	I <sub>DRP</sub>	—	—	—	20	A
Diode Forward Voltage	V <sub>DSF</sub>	I <sub>DR</sub> = 5 A, V <sub>GS</sub> = 0 V	—	—	-1.7	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>DR</sub> = 5 A, V <sub>GS</sub> = 0 V	—	70	—	ns
Reverse Recovery Charge	Q <sub>rr</sub>	dI <sub>DR</sub> / dt = 50 A / μs	—	0.1	—	μC

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Peak  $I_{AR} = 5\text{ A}$ ,  $R_G = 25\ \Omega$   
 $V_{DD} = 25\text{ V}$ ,  $L = 7\text{ mH}$

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