

STARPOWER

SEMICONDUCTOR

SiC MOSFET

DM88S12T6

1200V/8.8 mΩ Mosfet without Diode

General Description

STARPOWER provides a MOSFET Power Discrete with ultra low conduction loss as well as low switching loss.

They are designed for the applications such as hybrid and electric vehicle.

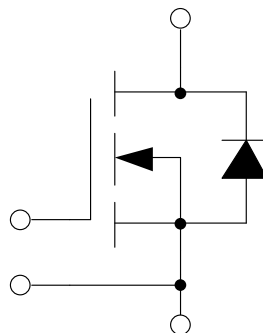
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Chip sintering technology
- Low inductance case avoid oscillations
- Isolated heatsink using Si_3N_4 AMB technology
- ROHS

Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**Mosfet**

Symbol	Description	Value	Unit
V_{DSS}	Drain-Source Voltage	1200	V
V_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Current @ $T_C=85^{\circ}\text{C}$	200	A
I_{DM}	Pulsed Drain Current	400	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	1127	W

Body Diode

Symbol	Description	Value	Unit
I_F	Source Current @ $T_C=85^{\circ}\text{C}$	152	A

Discrete

Symbol	Description	Values	Unit
T_{vjop}	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
T_S	Soldering Temperature, 1.6mm from case for 10s	260	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

Mosfet Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=152\text{A}, V_{GS}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		8.80		$\text{m}\Omega$
		$I_D=152\text{A}, V_{GS}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		13.2		
		$I_D=152\text{A}, V_{GS}=15\text{V}, T_{vj}=175^{\circ}\text{C}$		14.6		
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=41.8\text{mA}, V_{DS}=V_{GS}, T_{vj}=25^{\circ}\text{C}$	1.8	2.5	3.6	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			64	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			500	nA
R_{Gint}	Internal Gate Resistance			1.15		Ω
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=1000\text{V}, f=100\text{kHz}$		12.1		nF
C_{oss}	Output Capacitance			0.44		nF
C_{rss}	Reverse Transfer Capacitance			0.02		nF
Q_g	Total Gate Charge	$I_D=145\text{A}, V_{DS}=800\text{V}, V_{GS}=-4/+15\text{V}$		366		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=200\text{A}, R_{Gon}=10\Omega, R_{Goff}=15\Omega, L_S=40\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=25^{\circ}\text{C}$		20		ns
t_r	Rise Time			82		ns
$t_{d(off)}$	Turn-Off Delay Time			134		ns
t_f	Fall Time			69		ns
E_{on}	Turn-On Switching Loss			14.0		mJ
E_{off}	Turn-Off Switching Loss			5.21		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=200\text{A}, R_{Gon}=10\Omega, R_{Goff}=15\Omega, L_S=40\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=150^{\circ}\text{C}$		23		ns
t_r	Rise Time			69		ns
$t_{d(off)}$	Turn-Off Delay Time			180		ns
t_f	Fall Time			88		ns
E_{on}	Turn-On Switching Loss			14.7		mJ
E_{off}	Turn-Off Switching Loss			6.63		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=200\text{A}, R_{Gon}=10\Omega, R_{Goff}=15\Omega, L_S=40\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=175^{\circ}\text{C}$		24		ns
t_r	Rise Time			67		ns
$t_{d(off)}$	Turn-Off Delay Time			197		ns
t_f	Fall Time			92		ns
E_{on}	Turn-On Switching Loss			14.8		mJ
E_{off}	Turn-Off Switching Loss			6.64		mJ

Body Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	$I_S=73\text{A}, V_{GS}=-4\text{V}, T_{vj}=25^\circ\text{C}$		4.15		V
		$I_S=73\text{A}, V_{GS}=-4\text{V}, T_{vj}=150^\circ\text{C}$		3.65		
		$I_S=73\text{A}, V_{GS}=-4\text{V}, T_{vj}=175^\circ\text{C}$		3.60		
t_{rr}	Reverse Recovery Time	$V_R=800\text{V}, I_S=200\text{A},$ $-di/dt=2250\text{A}/\mu\text{s}, L_S=40\text{nH},$ $V_{GS}=-4\text{V}, T_{vj}=25^\circ\text{C}$		50		ns
Q_r	Diode Reverse Recovery Charge			1.25		μC
I_{rrm}	Peak Reverse Recovery Current			44		A
E_{rec}	Reverse Recovery Energy			0.21		mJ
t_{rr}	Reverse Recovery Time	$V_R=800\text{V}, I_S=200\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, L_S=40\text{nH},$ $V_{GS}=-4\text{V}, T_{vj}=150^\circ\text{C}$		58		ns
Q_r	Diode Reverse Recovery Charge			2.05		μC
I_{rrm}	Peak Reverse Recovery Current			60		A
E_{rec}	Reverse Recovery Energy			0.40		mJ
t_{rr}	Reverse Recovery Time	$V_R=800\text{V}, I_S=200\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, L_S=40\text{nH},$ $V_{GS}=-4\text{V}, T_{vj}=175^\circ\text{C}$		59		ns
Q_r	Diode Reverse Recovery Charge			2.28		μC
I_{rrm}	Peak Reverse Recovery Current			66		A
E_{rec}	Reverse Recovery Energy			0.46		mJ

Discrete Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per Mosfet)		0.116	0.133	K/W

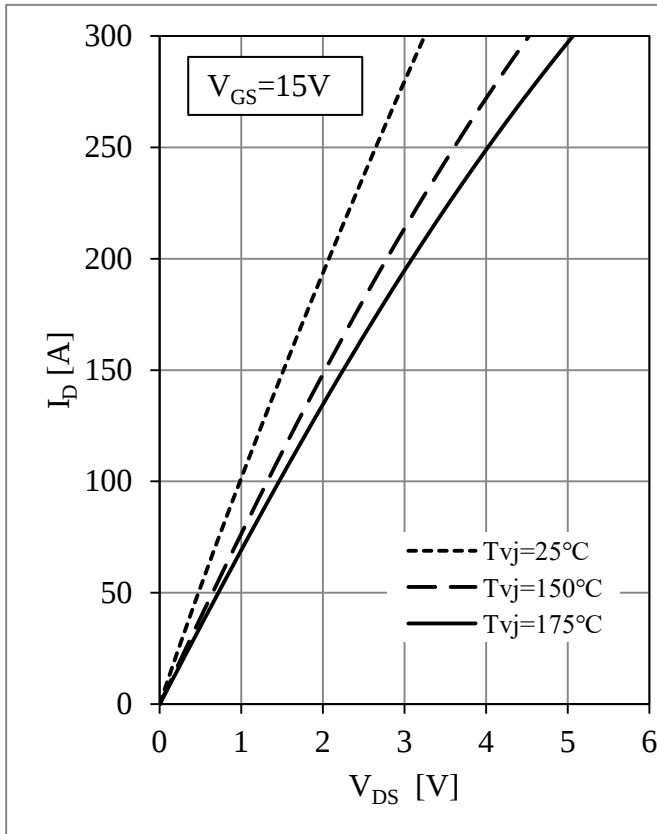


Fig 1. MOSFET Output Characteristics

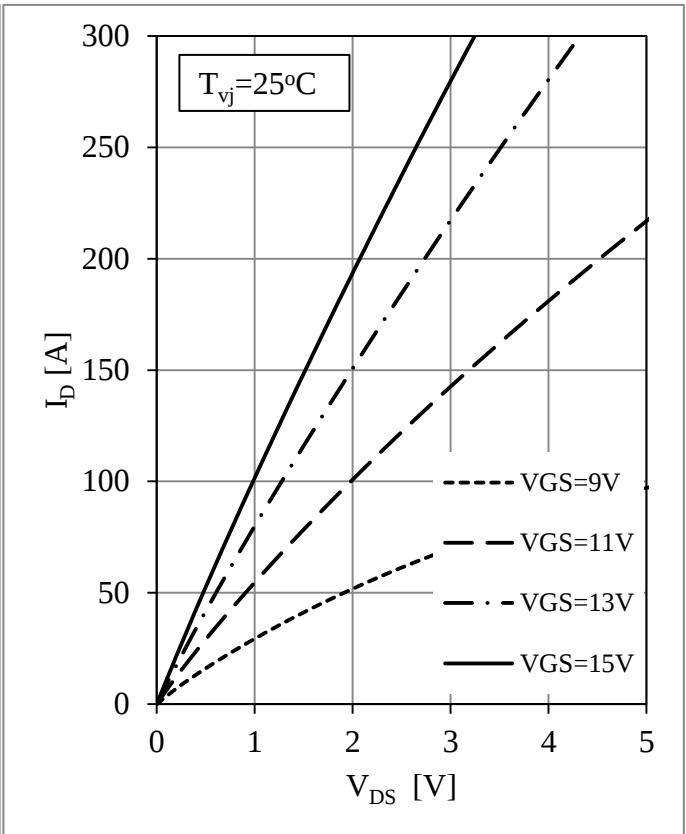


Fig 2. MOSFET Output Characteristics

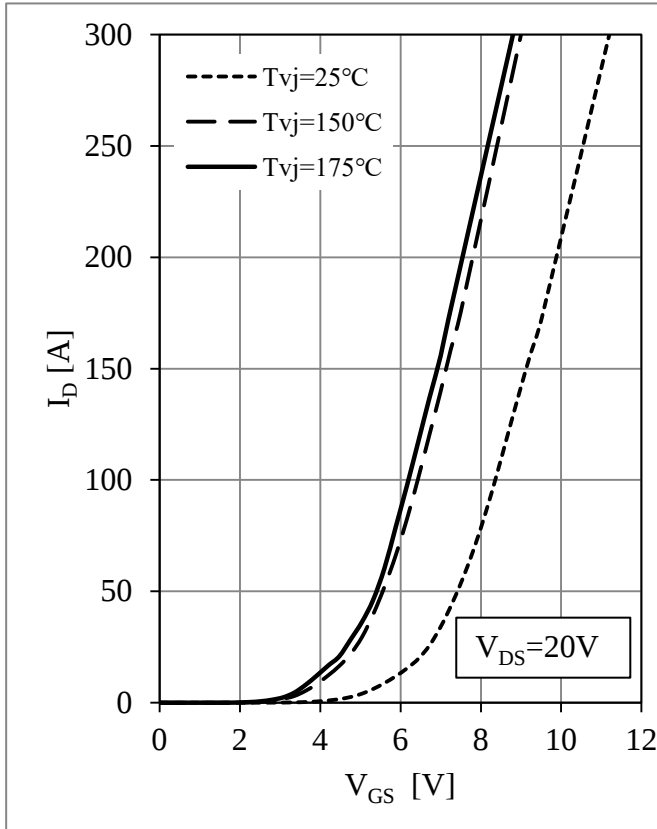
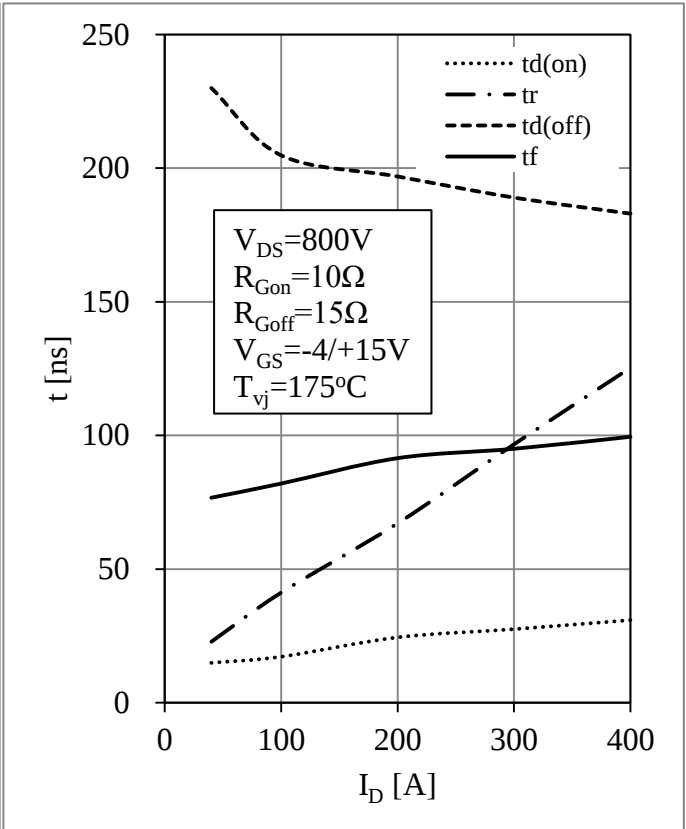
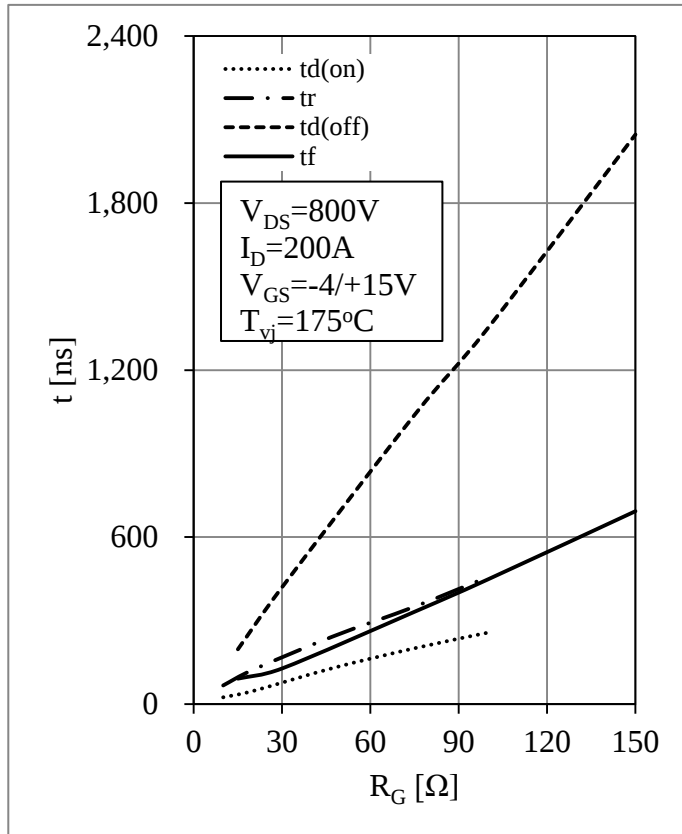
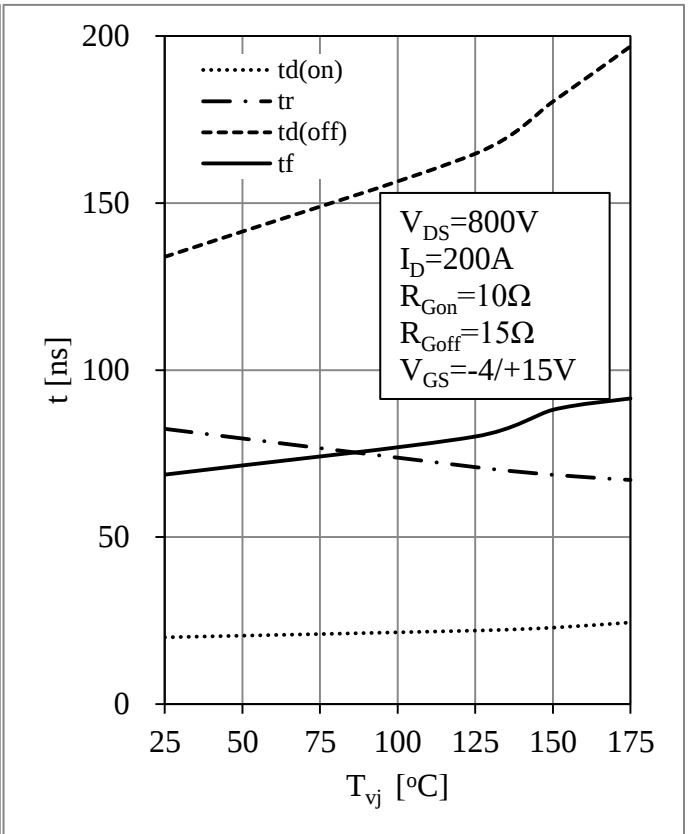
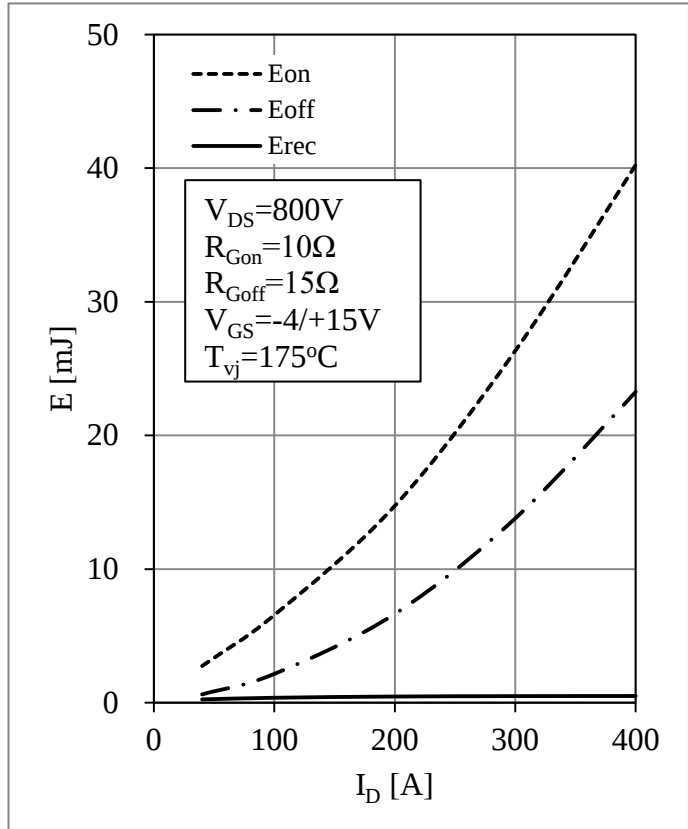
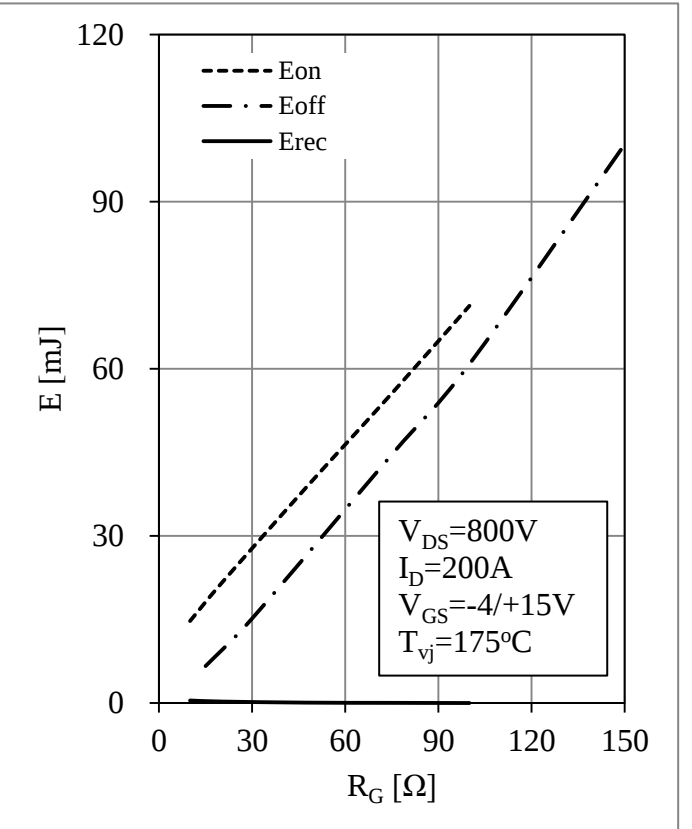


Fig 3. MOSFET Transfer Characteristics

Fig 4. MOSFET Switching Times as I_{DS}

Fig 5. MOSFET Switching Times as. R_G Fig 6. MOSFET Switching Times vs. T_{vj} Fig 7. Switching Energy Loss vs. I_{DS} Fig 8. Switching Energy Loss vs. R_G

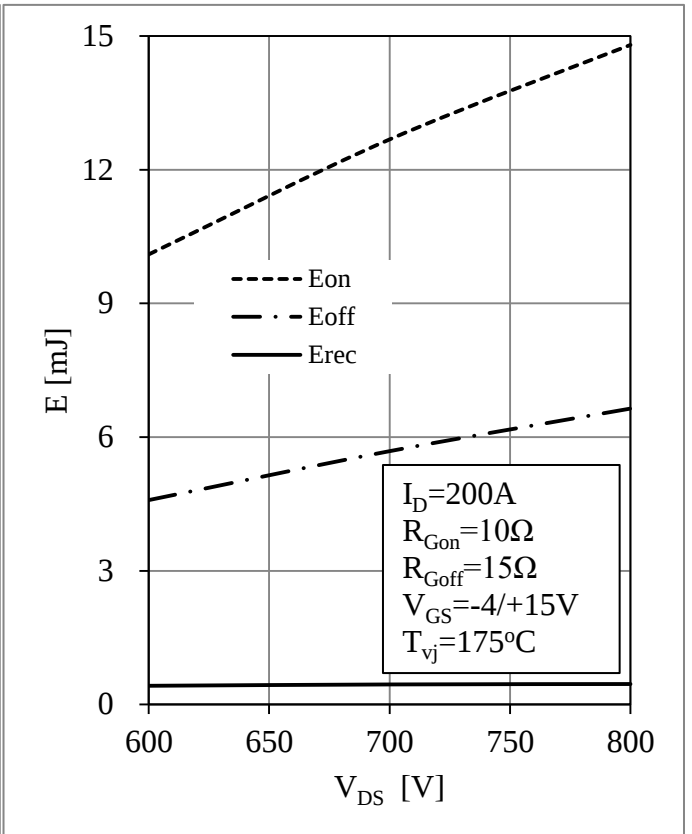
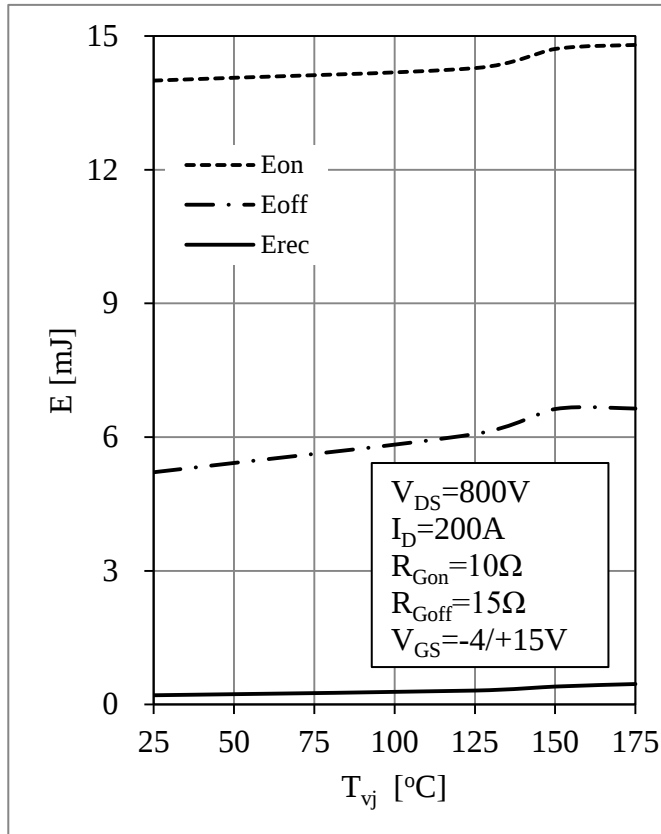
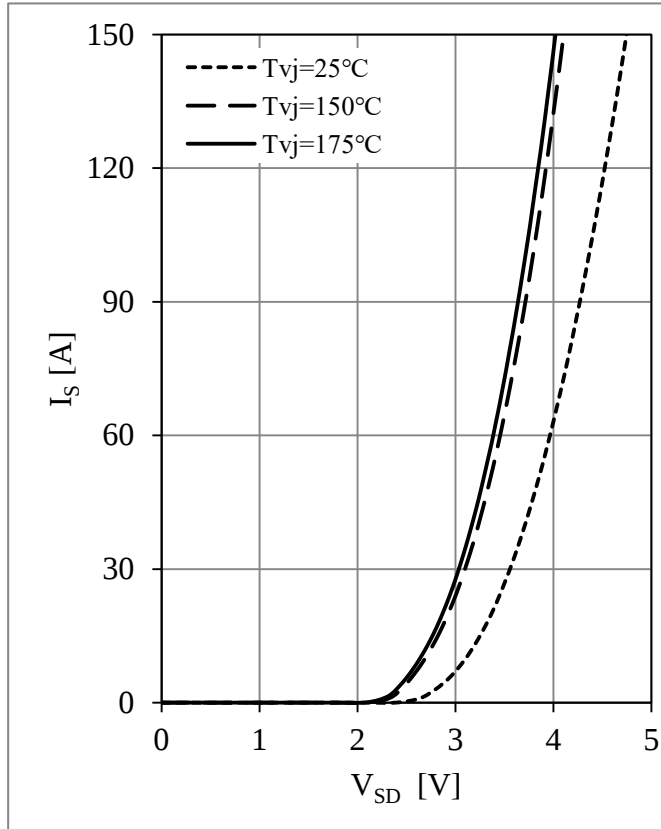
Fig 9. Switching Energy Loss vs. T_{vj} Fig 10. Switching Energy Loss vs. V_{DS} 

Fig 11. Body Diode Characteristics

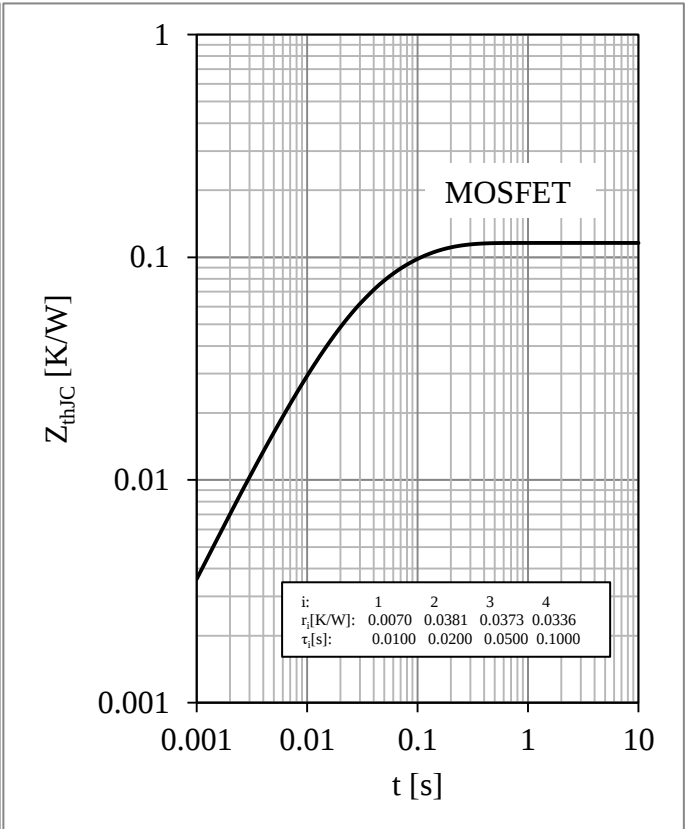
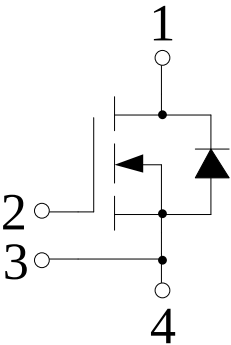


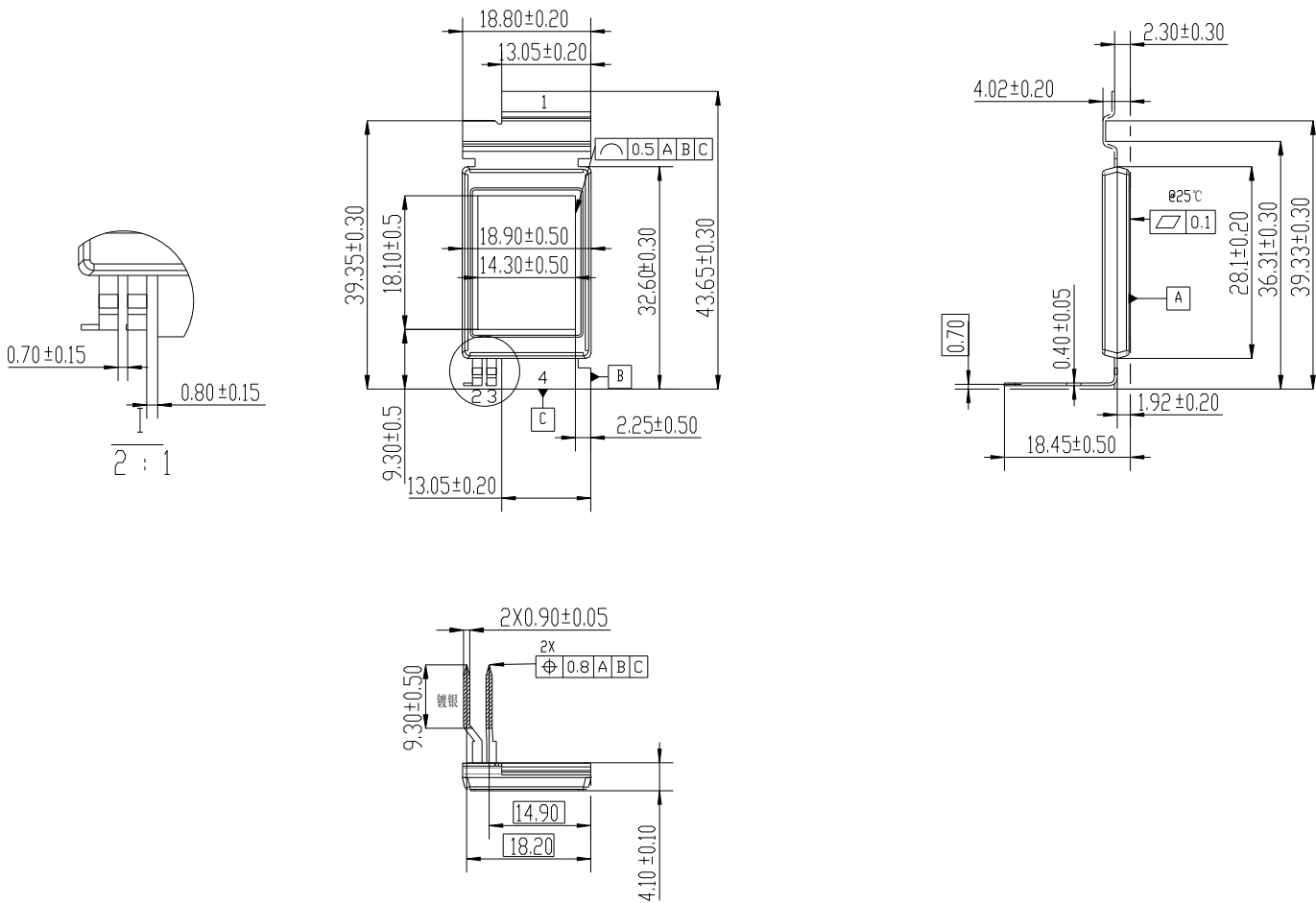
Fig 12. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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