

STARPOWER

SEMICONDUCTOR

SiC MOSFET

MD10HFS75N5HT_B29

750V/1.0m Ω 2 in one-package

General Description

STARPOWER MOSFET Power Module provides very low $R_{DS(on)}$ as well as optimized intrinsic diode. It's designed for the applications such as hybrid and electric vehicle.

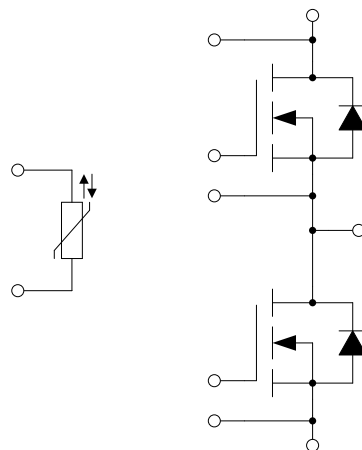
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Low inductance case avoid oscillations
- Isolated copper pinfin baseplate using Si_3N_4 AMB technology

Typical Applications

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

Equivalent Circuit Schematic



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

Symbol	Description	Value	Unit
V_{DSS}	Drain-Source Voltage	750	V
V_{GSSmax}	Gate-Source Voltage	-8/+16	V
V_{GSSop}	Gate-Source Voltage	-4...0/+15	V
I_{D}	Drain Current @ $T_{\text{vj}}=175^{\circ}\text{C}$	998	A
P_{D}	Maximum Power Dissipation @ $T_F=65^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	1250	W

Body Diode

Symbol	Description	Value	Unit
I_{S}	Source Current @ $T_{\text{vj}}=175^{\circ}\text{C}$	425	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2700	V

MOSFET Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=820\text{A}, V_{GS}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.10		$\text{m}\Omega$
		$I_D=820\text{A}, V_{GS}=15\text{V}, T_{vj}=175^{\circ}\text{C}$		1.55		
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=225\text{mA}, V_{DS}=V_{GS}, T_{vj}=25^{\circ}\text{C}$		2.4		V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			500	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=15\text{V}, V_{DS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			2000	nA
R_{Gint}	Internal Gate Resistance			1.22		Ω
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=450\text{V}, f=100\text{kHz}$		61.7		nF
C_{oss}	Output Capacitance			5.53		nF
C_{rss}	Reverse Transfer Capacitance			0.25		nF
Q_g	Total Gate Charge	$I_D=820\text{A}, V_{DS}=470\text{V}, V_{GS}=-4/+15\text{V}$		3.32		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=450\text{V}, I_D=820\text{A}, R_G=5.1\Omega, L_S=16\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=25^{\circ}\text{C}$		233		ns
t_r	Rise Time			164		ns
$t_{d(off)}$	Turn-Off Delay Time			390		ns
t_f	Fall Time			69		ns
E_{on}	Turn-On Switching Loss			46.9		mJ
E_{off}	Turn-Off Switching Loss			28.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=450\text{V}, I_D=820\text{A}, R_G=5.1\Omega, L_S=16\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=150^{\circ}\text{C}$		269		ns
t_r	Rise Time			167		ns
$t_{d(off)}$	Turn-Off Delay Time			516		ns
t_f	Fall Time			91		ns
E_{on}	Turn-On Switching Loss			48.0		mJ
E_{off}	Turn-Off Switching Loss			34.1		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=450\text{V}, I_D=820\text{A}, R_G=5.1\Omega, L_S=16\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=175^{\circ}\text{C}$		280		ns
t_r	Rise Time			171		ns
$t_{d(off)}$	Turn-Off Delay Time			563		ns
t_f	Fall Time			109		ns
E_{on}	Turn-On Switching Loss			48.5		mJ
E_{off}	Turn-Off Switching Loss			36.6		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	$I_{SD}=410\text{A}, V_{GS}=-4\text{V}, T_J=25^\circ\text{C}$		4.40		V
		$I_{SD}=410\text{A}, V_{GS}=-4\text{V}, T_J=175^\circ\text{C}$		3.90		

NTC Characteristics $T_F=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_1=100^\circ\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_F=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		5.5		nH
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per MOSFET) $\Delta V/\Delta t=3.3\text{ L/min}, T_F=65^\circ\text{C}$		0.080		K/W
M	Terminal Connection Torque, Screw M5	3.6		4.4	N.m
	Mounting Torque, Screw M5	5.4		6.6	
G	Weight of Module		220		g

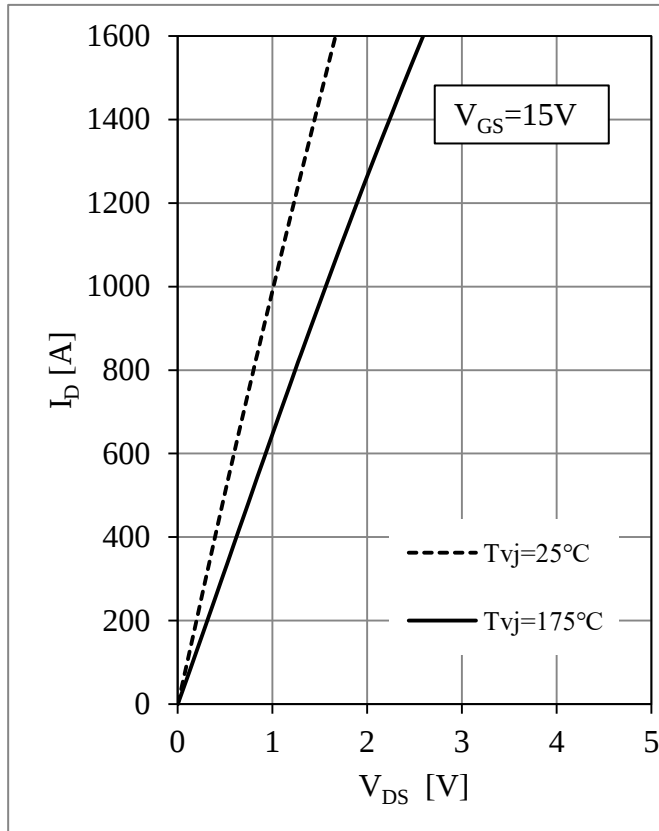


Fig 1. MOSFET Output Characteristics

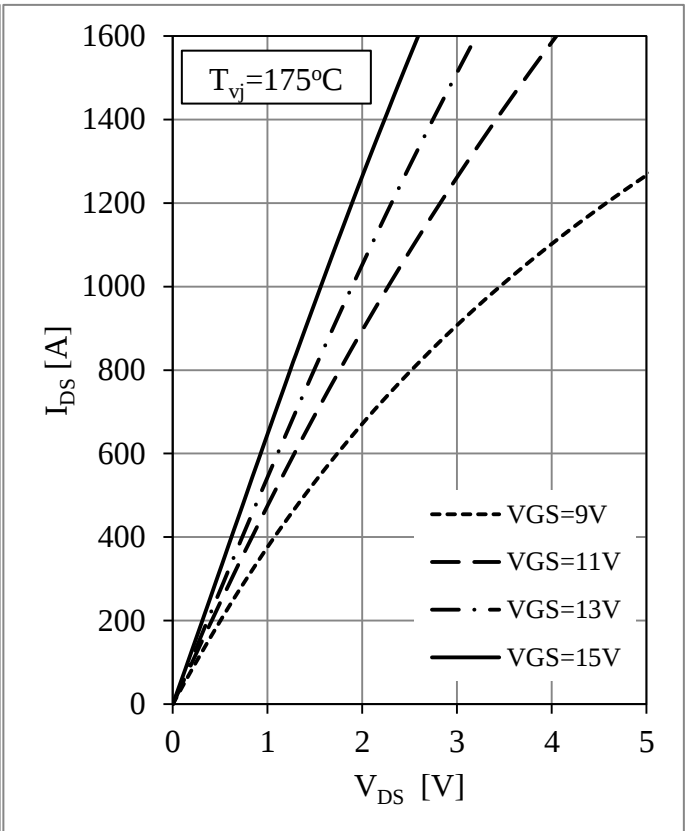


Fig 2. MOSFET Output Characteristics

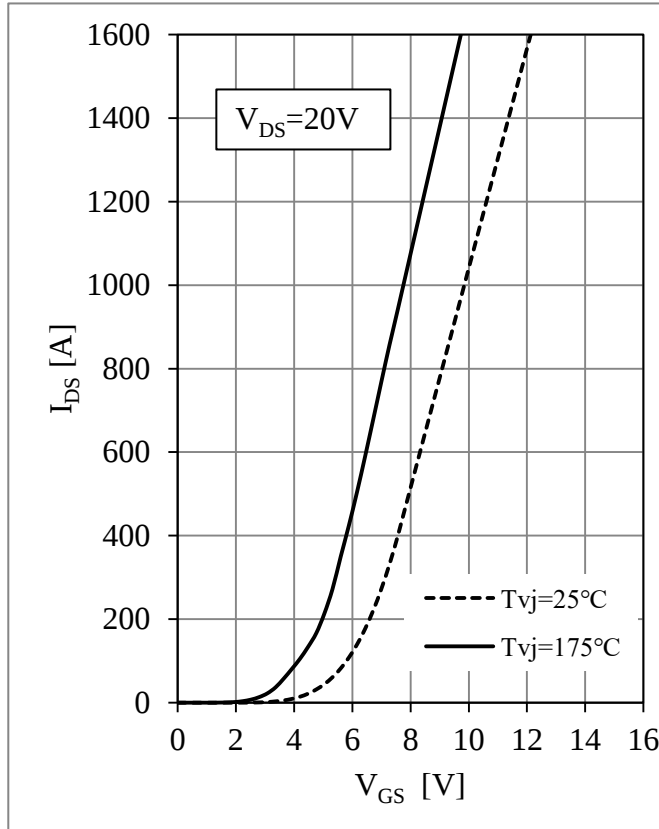
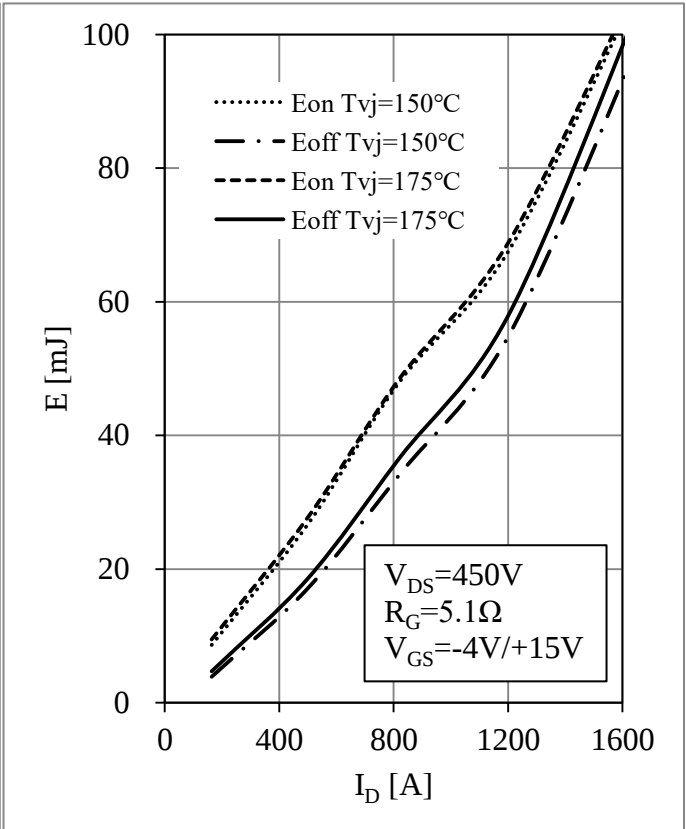


Fig 3. MOSFET Transfer Characteristics

Fig 4. MOSFET Switching Loss vs. I_{DS}

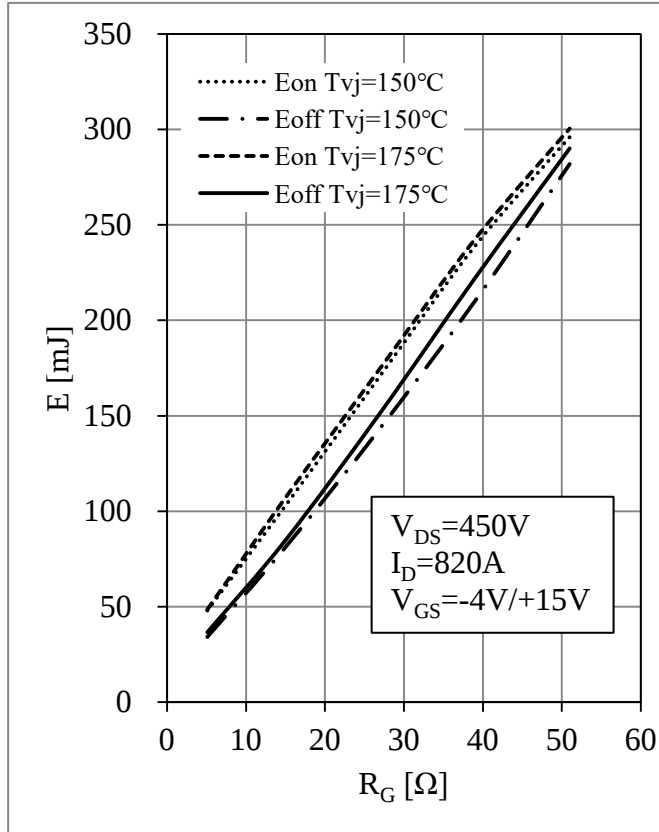
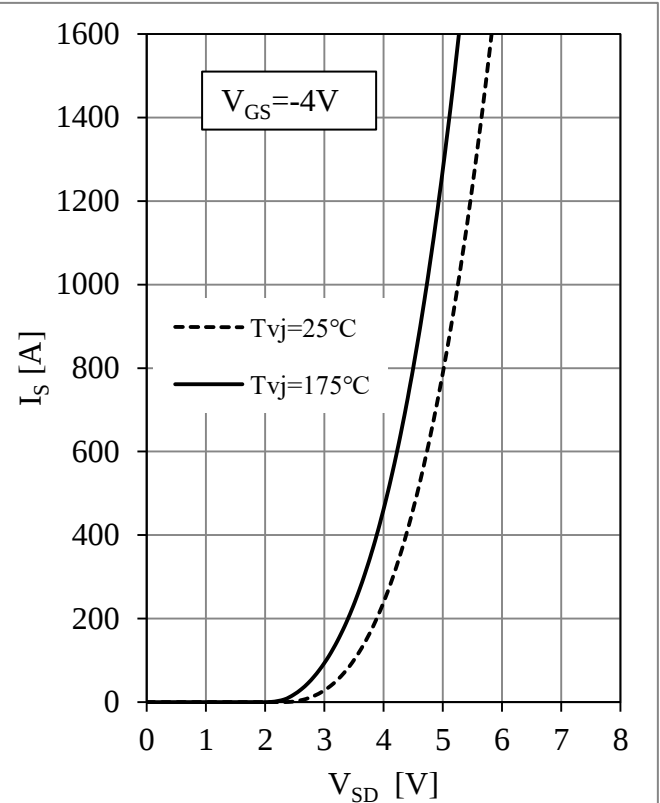
Fig 5. MOSFET Switching Loss vs. R_G 

Fig 6. Body Diode Characteristics

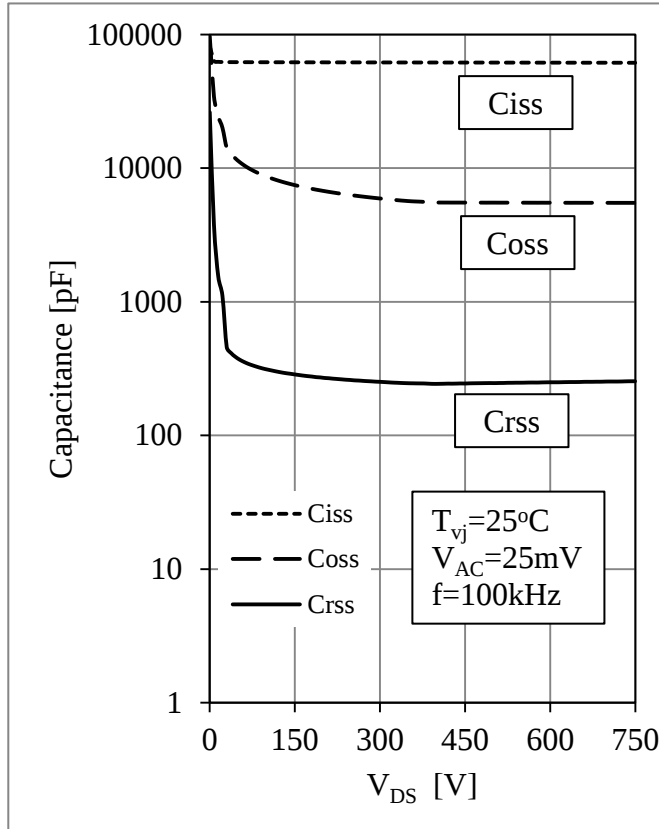
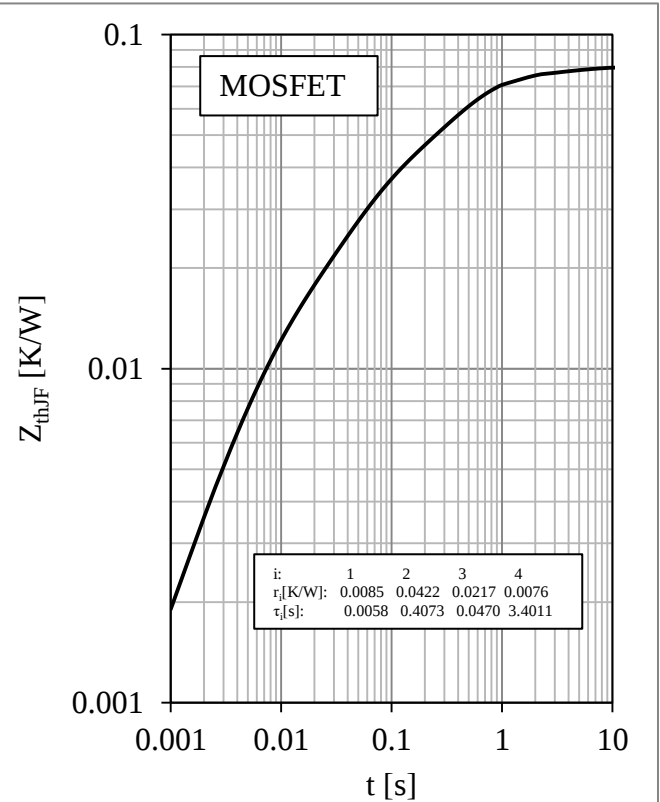
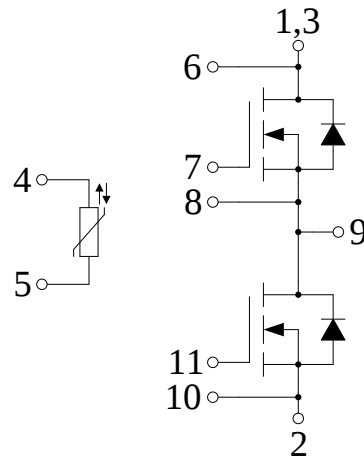
Fig 7. Capacitance vs. V_{DS} 

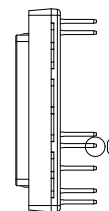
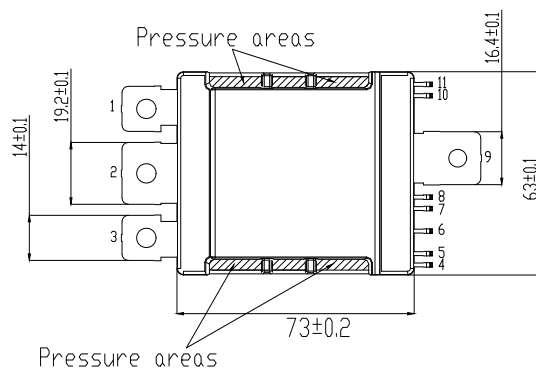
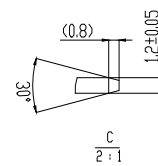
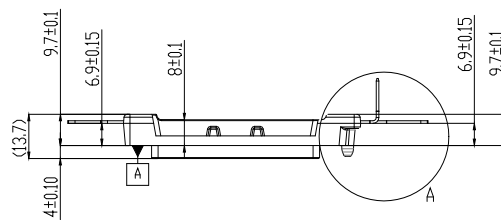
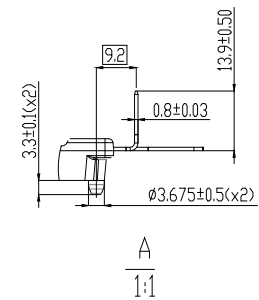
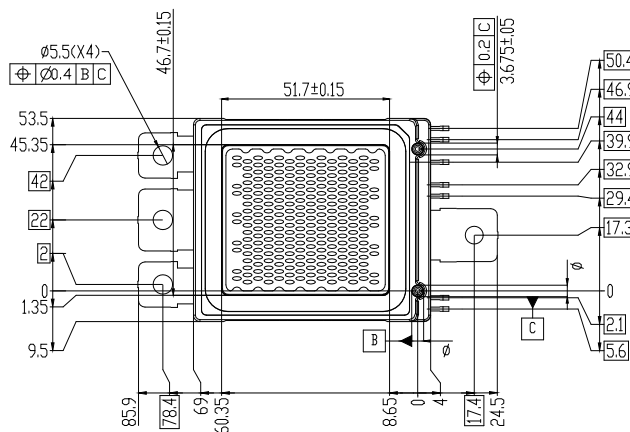
Fig 8. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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