

Silicon P-Channel Power MOSFET

Description

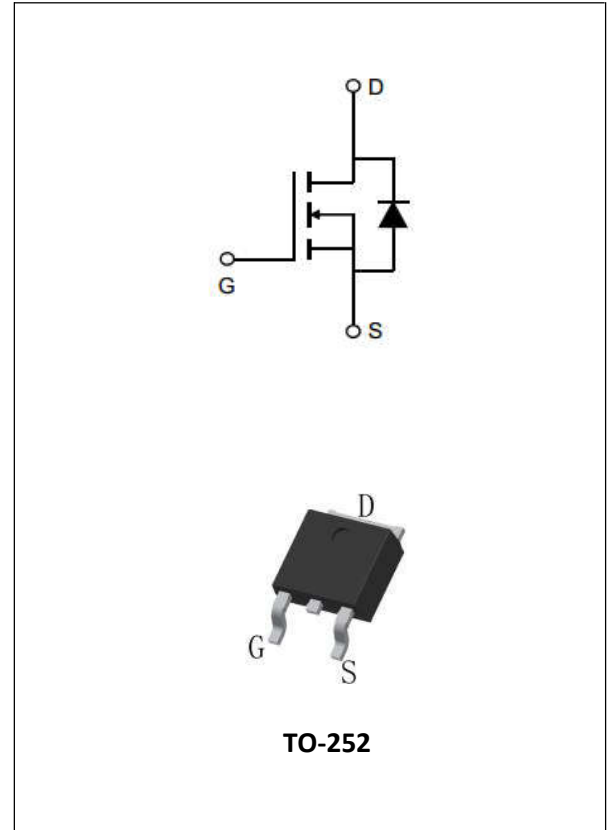
The MDT15P04D uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. It can be used in a wide variety of applications.

KEY CHARACTERISTICS

- ① $V_{DS} = -40V, I_D = -15A$
- ② $R_{DS(ON)} < 35m\Omega @ V_{GS} = -10V$ $R_{DS(ON)} < 45m\Omega @ V_{GS} = -4.5V$
- ③ High density cell design for lower R_{dson}
- ④ Fully characterized avalanche voltage and current
- ⑤ Good stability and uniformity with high E_{AS}
- ⑥ Excellent package for good heat dissipation

Application

- ① Power switching application
- ② Hard switched and High frequency circuits
Uninterruptible power supply



ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
MDT15P04D	TO-252	MDT15P04D	Reel

Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-40	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	-15	A
Drain Current-Pulsed ^(Note 1)	I_{DM}	-60	A
Maximum Power Dissipation($T_c=25^\circ C$)	P_D	50	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (TO-252)	$R_{\theta JC}$	3.0	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient (SOP-8)	$R_{\theta JA}$	57	$^\circ C/W$

Electrical Characteristics (TA=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-40V, V_{GS}=0V$	-	-	-1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-1.5	-2.4	V
Drain-Source On-State Resistance ^(Note 2)	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-7.5A$	-	29	35	m Ω
		$V_{GS}=-4.5V, I_D=-5A$	-	34	45	
Forward Transconductance	g_{FS}	$V_{DS}=-5V, I_D=-15A$	-	10	-	S
Dynamic Characteristics ^(Note 3)						
Input Capacitance	C_{iss}	$V_{DS}=-20V, V_{GS}=0V,$ $f=1.0MHz$	-	930	-	pF
Output Capacitance	C_{oss}		-	85	-	pF
Reverse Transfer Capacitance	C_{rss}		-	35	-	pF
Switching Characteristics ^(Note 3)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-20V, R_L=-1\Omega,$ $V_{GS}=-10V, R_{GEN}=3\Omega$	-	8	-	ns
Turn-on Rise Time	t_r		-	4	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	32	-	ns
Turn-Off Fall Time	t_f		-	7	-	ns
Total Gate Charge	Q_g	$V_{DS}=-20V, I_D=-15A$ $V_{GS}=-10V$	-	25	-	nC
Gate-Source Charge	Q_{gs}		-	3	-	nC
Gate-Drain Charge	Q_{gd}		-	7	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=-15A$	-	-	-1.2	V

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
3. Guaranteed by design, not subject to production.

Characteristics Curves

Figure 1 Output Characteristics

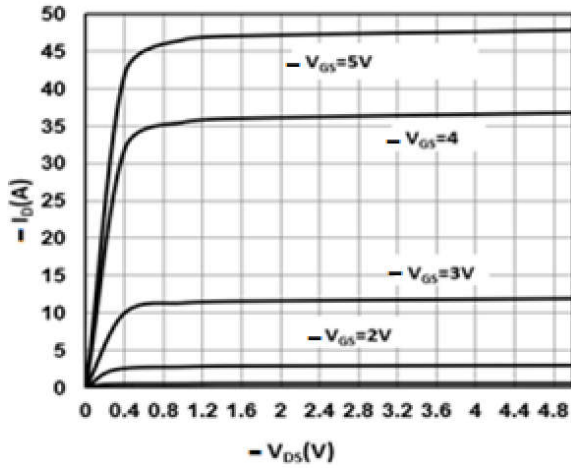


Figure 2 Transfer Characteristics

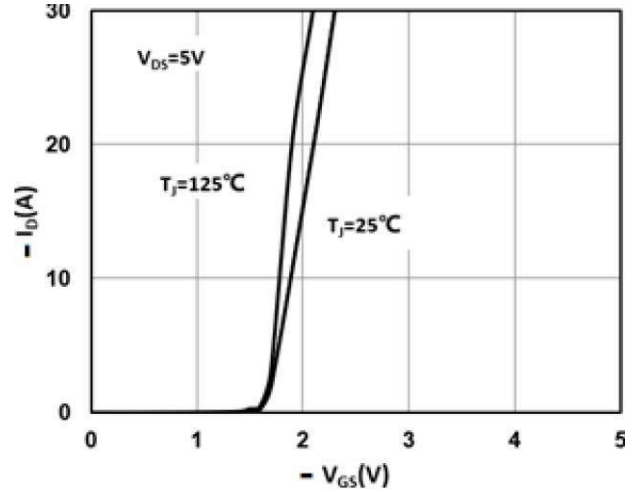


Figure 3 On-Resistance vs. I_D and V_{GS}

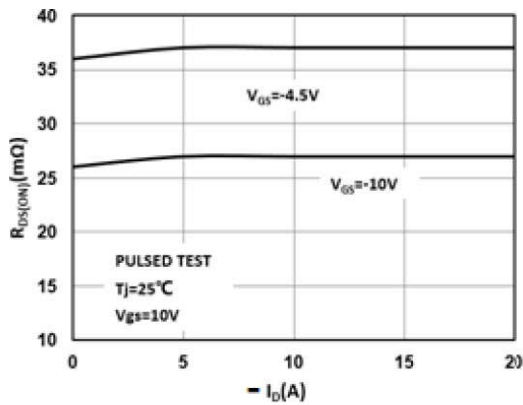


Figure 4 On-Resistance vs. Junction Temperature

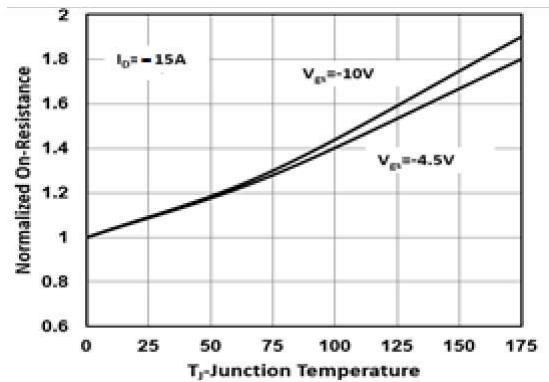


Figure 5 On-Resistance vs. V_{GS}

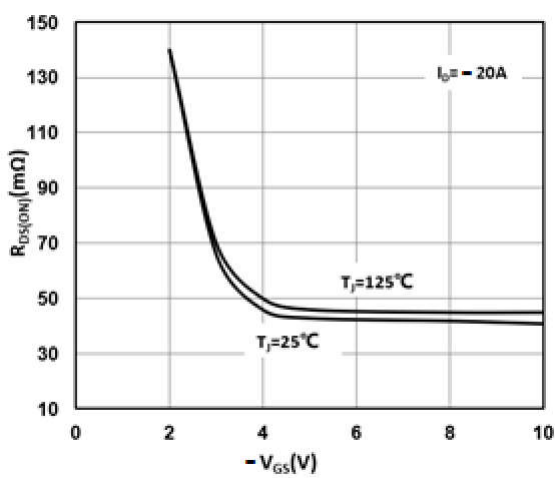


Figure 6 Body Diode Forward Voltage

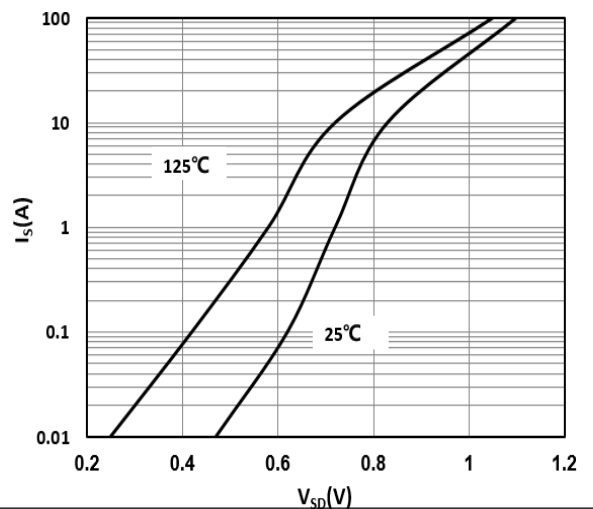


Figure 7 Gate-Charge Characteristics

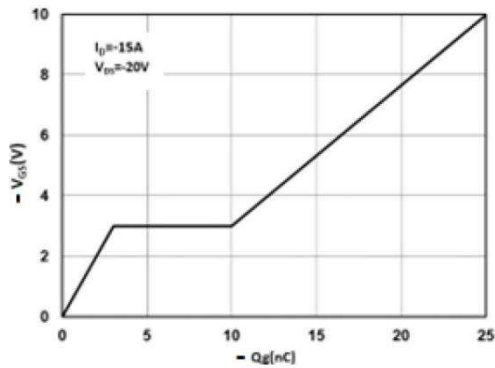


Figure 8 Capacitance Characteristics

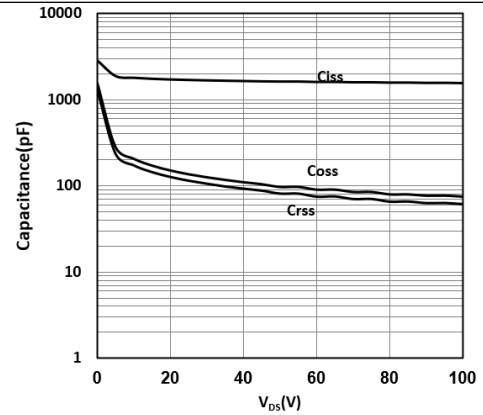


Figure 9 Maximum Forward Biased Safe Operation Area(TO-252)

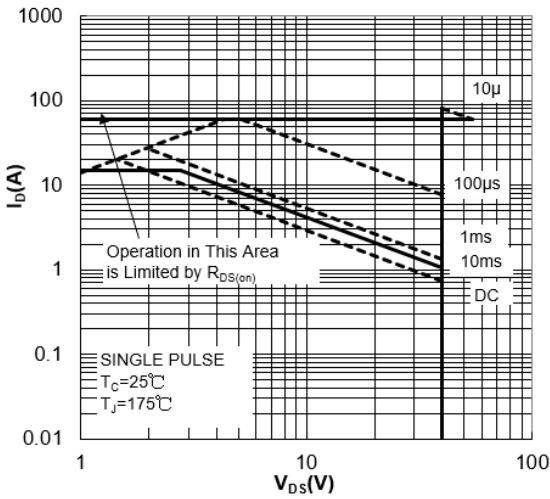


Figure 10 Single Pulse Power Rating Junction-to-Ambient(TO-252)

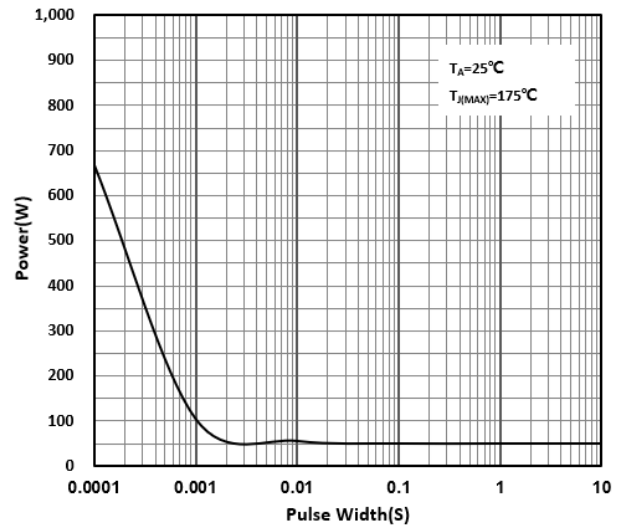


Figure 11 Normalized Maximum Transient Thermal Impedance(TO-252)

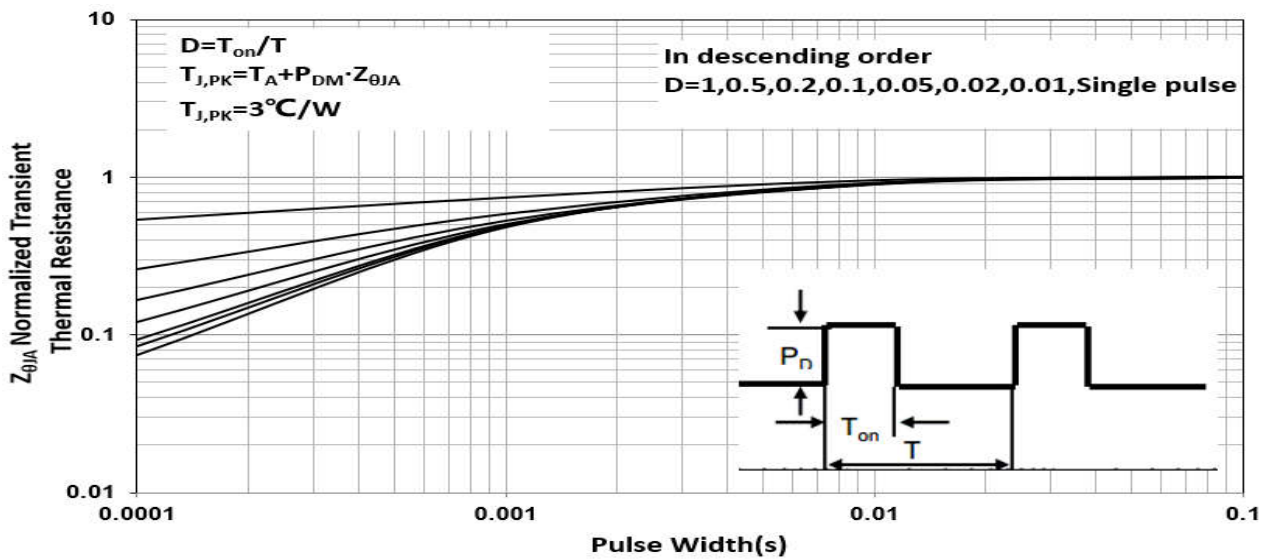


Figure 9 Maximum Forward Biased Safe Operation Area(SOP-8)

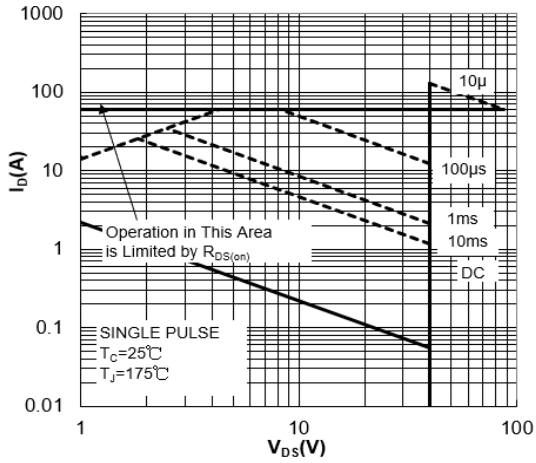


Figure 10 Single Pulse Power Rating Junction-to-Ambient(SOP-8)

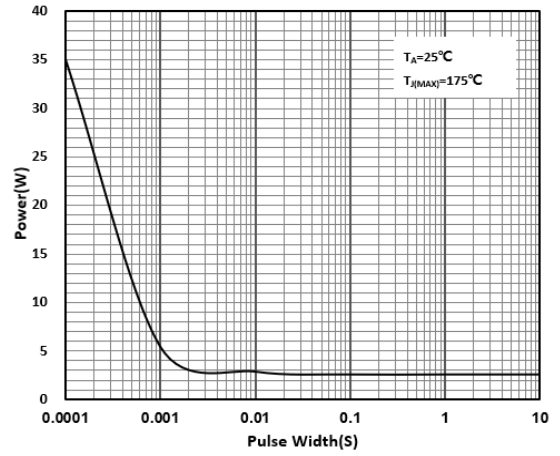
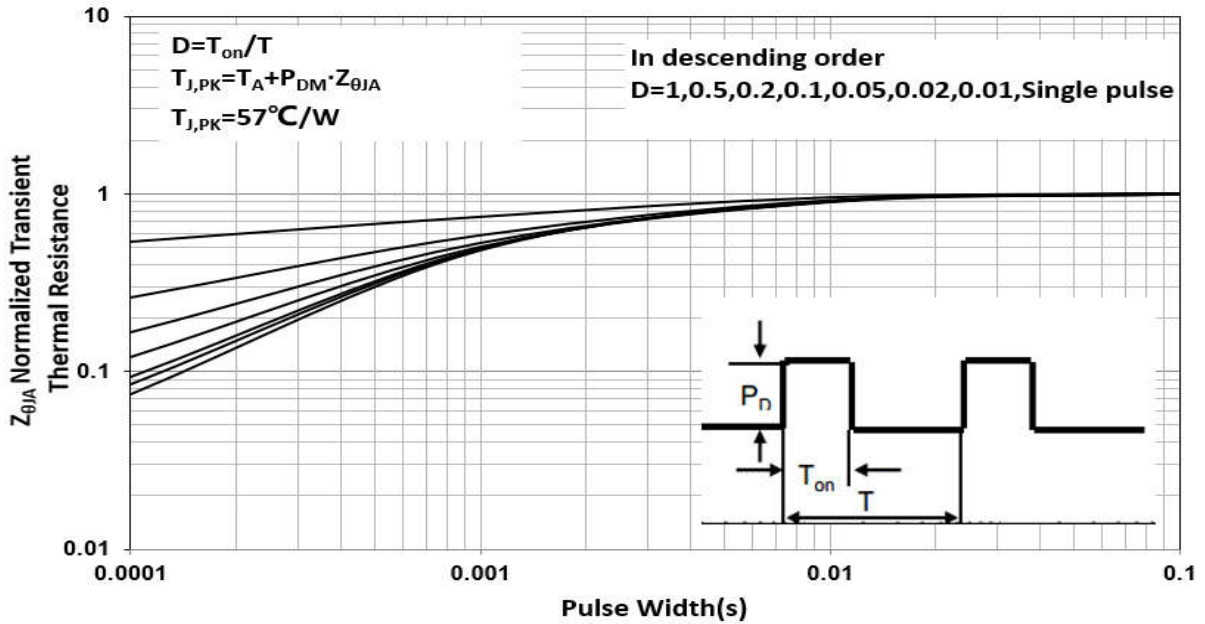
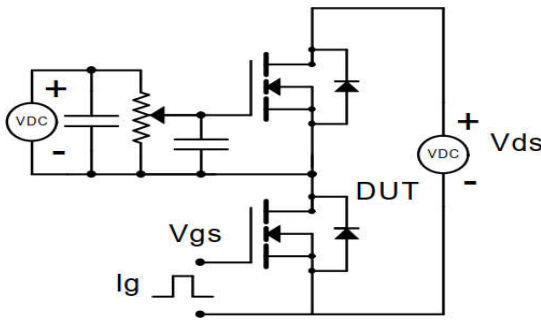
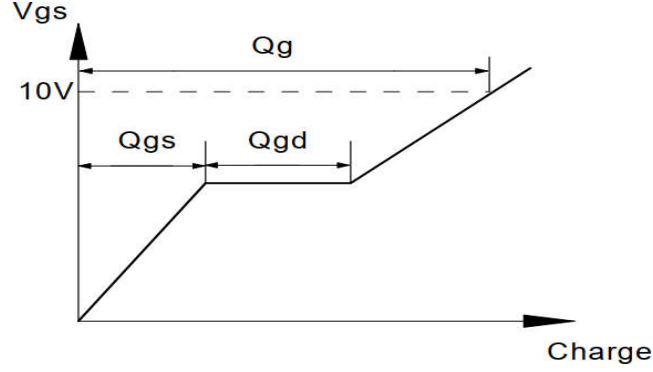
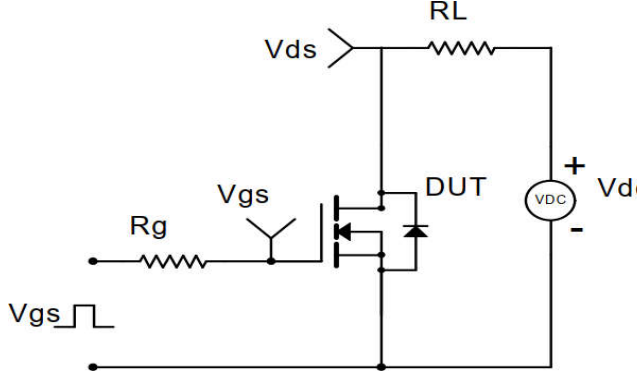
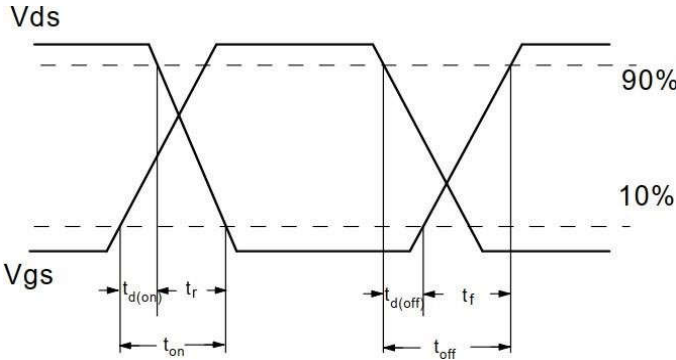
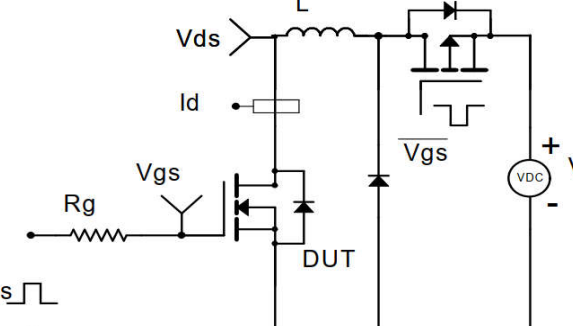
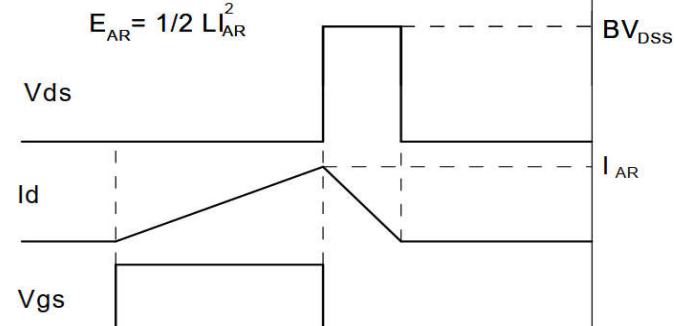
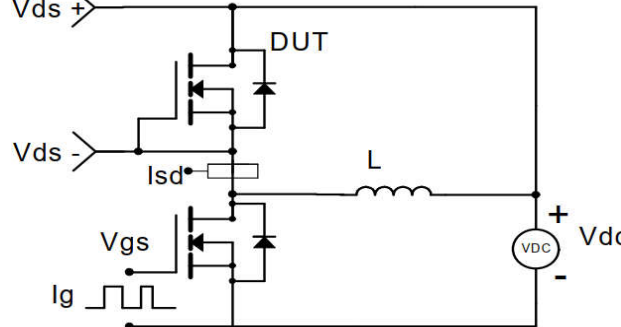
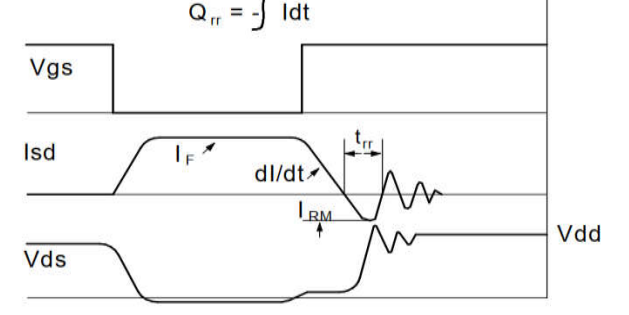


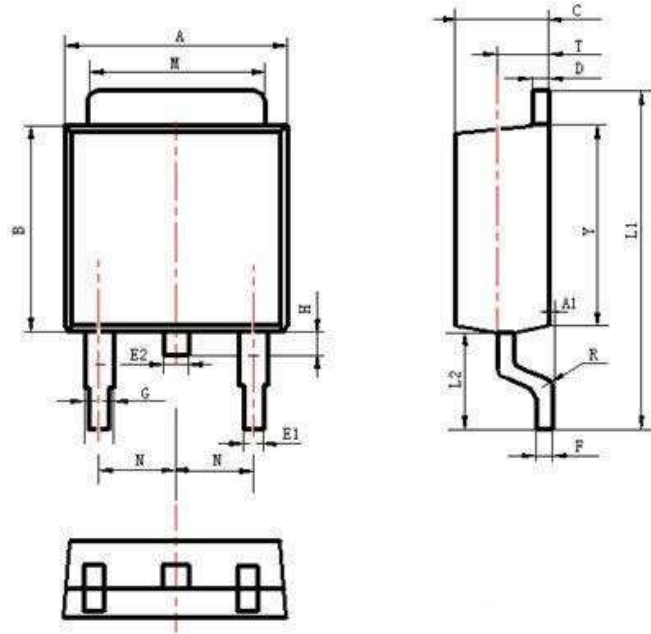
Figure 11 Normalized Maximum Transient Thermal Impedance(SOP-8)



Test Circuit and Waveform

Gate Charge Test Circuit	Gate Charge Test Waveform
 <p>The diagram shows a MOSFET (DUT) with its gate connected to a pulse generator through a gate resistor R_g. The drain is connected to a load resistor and a DC source V_{DC}. The source is grounded. A gate current I_g pulse is applied to the gate.</p>	 <p>The waveform shows the gate voltage V_{gs} over time. It starts at 0V, rises linearly to 10V, remains constant for a duration Q_{gs}, falls linearly to 0V for a duration Q_{gd}, and then remains at 0V. The total gate charge is Q_g.</p>
Resistive Switching Test Circuit	Resistive Switching Test Waveforms
 <p>The diagram shows a MOSFET (DUT) with its gate connected to a pulse generator through a gate resistor R_g. The drain is connected to a load resistor R_L and a DC source V_{DC}. The source is grounded.</p>	 <p>The waveforms show V_{ds} and V_{gs} over time. V_{gs} is a square wave. V_{ds} shows the switching transient. Key parameters are $t_{d(on)}$, t_r, t_{on}, $t_{d(off)}$, t_r, and t_{off}. The voltage levels are marked at 90% and 10%.</p>
Unclamped Inductive Switching (UIS) Test Circuit	Unclamped Inductive Switching (UIS) Test Waveforms
 <p>The diagram shows a MOSFET (DUT) with its gate connected to a pulse generator through a gate resistor R_g. The drain is connected to an inductor L and a diode. The source is grounded. A DC source V_{DC} is connected to the drain.</p>	 <p>The waveforms show V_{ds}, I_d, and V_{gs} over time. V_{gs} is a square wave. I_d shows the current through the inductor. V_{ds} shows the voltage across the MOSFET during switching. The energy $E_{AR} = 1/2 L I_{AR}^2$ is indicated. The maximum drain-source voltage is BV_{DSS} and the average current is I_{AR}.</p>
Diode Recovery Test Circuit	Diode Recovery Test Waveforms
 <p>The diagram shows a MOSFET (DUT) with its gate connected to a pulse generator through a gate resistor R_g. The drain is connected to a diode and an inductor L. The source is grounded. A DC source V_{DC} is connected to the drain.</p>	 <p>The waveforms show V_{gs}, I_{sd}, and V_{ds} over time. V_{gs} is a square wave. I_{sd} shows the current through the diode. V_{ds} shows the voltage across the MOSFET during switching. The reverse recovery time t_{rr} is indicated. The reverse current I_{RM} and the diode recovery charge $Q_{rr} = -\int I_{sd} dt$ are also shown.</p>

Package Description



Items	Values(mm)	
	MIN	MAX
A	6.30	6.90
A1	0	0.13
B	5.70	6.30
C	2.10	2.50
D	0.30	0.60
E1	0.60	0.90
E2	0.70	1.00
F	0.30	0.60
G	0.70	1.20
L1	9.60	10.50
L2	2.70	3.10
H	0.60	1.00
M	5.10	5.50
N	2.09	2.49
R	0.3	
T	1.40	1.60
Y	5.10	6.30

TO-252 Package



NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. MOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shenzhen Minos reserves the right to make changes in this specification sheet and is subject to change without prior notice.

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