




**SPECIFICATION SHEET**

<b>SPECIFICATION SHEET NO.</b>	Q0721- TO252MDD4N65DS
<b>DATE</b>	July. 21, 2023
<b>REVISION</b>	A0
<b>DESCRIPTION</b>	SMD Plastic-Encapsulate MOSFETS, TO -252 series, 3 Pins MDD4N65D Type, 650V N-Channel Enhancement Mode MOSFET Drain-Source Voltage: 650V, Continuous Drain Current 4.0A Junction Temperature: +150°C, Package in Tape/Reel, 2500pcs/13" Reel RoHS/RoHS III compliant
<b>CUSTOMER</b>	
<b>CUSTOMER PART NUMBER</b>	
<b>CROSS REF. PART NUMBER</b>	
<b>ORIGINAL PART NUMBER</b>	MDD4N65D
<b>PART CODE</b>	TO252MDD4N65DS

<b>VENDOR APPROVE</b>			
Issued/Checked/Approved			
DATE: July. 21, 2023			

<b>CUSTOMER APPROVE</b>	
DATE:	

7/21/2023

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**MAIN FEATURE**

- Ultra Low Gate Charge
- Low Reverse Transfer Capacitance
- Fast Switching Capability
- Avalanche Energy Tested
- Improved dv/dt Capability and High Ruggedness



**APPLICATION**

- High Efficiency Switch Mode Power Supplies
- Electronic Lamp Ballasts Based On Half Bridge
- LED Power Supplies

**RFQ**  
Request For Quotation

**PART CODE GUIDE**

TO252	MDD	4N65	DS
1	2	3	4

- 1) **TO252**: SMD Plastic-Encapsulate MOSFETS, TO-252 series, 3 pins
- 2) **MDD**: Original Supplier QC Code
- 3) **4N65**: Main Specification code for I<sub>D</sub>: 4A , N: N-Channel and V<sub>DS</sub> : 650V
- 4) **DS**: Internal Control Code, (A~Z or 1~9 or Blank) or custom parametric data

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

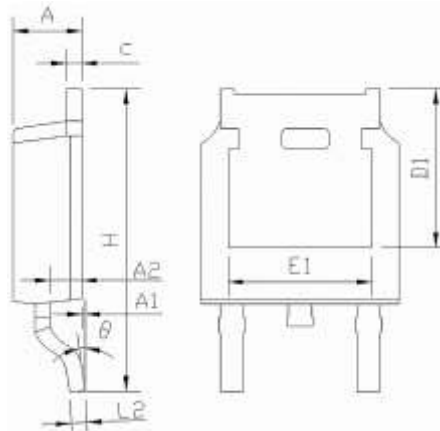
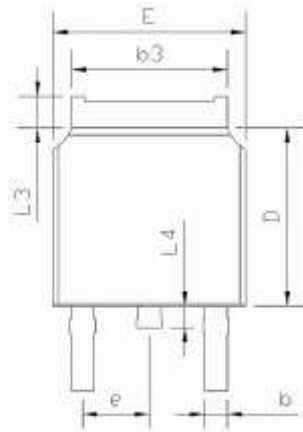
**DIMENSION (Unit: Inch/mm)**

Image for reference



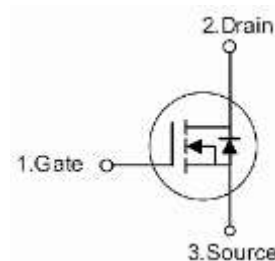
Marking: 4N65D

TO-252



Symbol	Value ( mm )		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286 BSC		
H	9.40	10.1	10.5
L2	0.51 BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
theta	0°	-	8°

**EQUIVALENT CIRCUIT DIAGRAM**



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**
**650V N-CHANNEL ENHANCEMENT MODE MOSFET**

V (BR)DSS	I D (TC+ 25°C)	R DS (on),max	Q g,typ
650V	4A	2.8 Ω @ VGS=10V	12 nC

**ABSOLUTE MAX. RATINGS AT (Ta=25 °C unless otherwise specified)**

Parameter	SYMBOLS	VALUE	UNIT
Drain-Source Voltage	V DS	650	V
Gate-Source Voltage	V GS	±30	V
Continuous Drain Current	I D	4.0	A
Pulsed Drain Current(Note 1)	I D	16	A
Avalanche Energy Single Pulsed (Note 2)	E AS	198	mJ
Continuous diode forward current	I S	4	A
Diode pulse current	I S,pulse	16	A
Peak Diode Recovery dv/dt (Note 3)	dv/dt	5.0	V/ns
Power Dissipation (TO-252)	P D	77	W
Junction Temperature	T J	+150	°C
Storage Temperature Range	T STG	-55 ~ +150	°C

**THERMAL CHARACTERISTICS**

Parameter	SYMBOLS	VALUE (TO-252)	UNIT
Thermal resistance, Junction-to-case	R θJC	1.62	°C/W
Thermal resistance, Junction-to-ambient	R θJA	110	°C/W

Notes:

1. Pulse width limited by maximum junction temperature. 2. L=10mH, I AS = 6.3A, Starting T j= 25°C.
3. I SD = 4A, di/dt≤100A/us, VDD≤BVDS, Starting Tj= 25°C.

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**
**MOSFET ELECTRICAL CHARACTERISTICS AT Ta=25 °C (unless otherwise specified)**

Parameter		SYMBOLS	VALUE			UNIT	Condition
			Min.	Typ.	Max.		
Drain-Source Breakdown Voltage		V (BR) DSS	650	-	-	V	VGS=0V I D=250μA
Gate-Source Leakage Current	Forward	I GSS	-	-	100	nA	VGS=30V, VDS=0V
	Reverse		-	-	-100	nA	VGS=-30V, VDS=0V
Drain-Source Leakage Current		I DSS	-	-	1	μA	VDS=650V, VGS=0V
Gate Threshold Voltage		V GS(TH)	2.0	-	4.0	V	VDS=VGS, ID=250μA
Drain-Source On-State Resistance		R DS (ON)	-	2.5	2.8	Ω	VGS=10V, IDS=2A

**DYNAMIC ELECTRICAL CHARACTERISTICS**

Parameter		SYMBOLS	VALUE			UNIT	Condition
			Min.	Typ.	Max.		
Input Capacitance		C iss	-	600	-	pF	V DS=25V V GS=0V f =1MHz
Output Capacitance		C oss	-	55	-		
Reverse Transfer Capacitance		C rss	-	3.2	-		
Total Gate Charge		Q g	-	12	-	nC	VDS=520V V GS =10V ID=4A (Note1, 2)
Gate Source Charge		Q gs	-	3.2	-		
Gate Drain Charge		Q gd	-	5.1			

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**
**SWITCHING CHARACTERISTICS**

Parameter	SYMBOLS	VALUE			UNIT	Condition
		Min.	Typ.	Max.		
Turn on Delay Time	t <sub>d(on)</sub>	-		12	ns	V <sub>DD</sub> =325V I <sub>D</sub> =4A R <sub>G</sub> = 10Ω
Turn on Rise Time	t <sub>r</sub>	-		31		
Turn Off Delay Time	t <sub>d(off)</sub>	-		42		
Turn Off Fall Time	t <sub>f</sub>	-		15		

**SOURCE DRAIN DIODE CHARACTERISTICS**

Parameter	SYMBOLS	VALUE			UNIT	Condition
		Min.	Typ.	Max.		
Source drain current (Body Diode)	I <sub>SD</sub>	-	-	4	A	
Pulsed Current	I <sub>SM</sub>	-	-	16	A	
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	-	0.8	1.5	V	I <sub>S</sub> =4A, V <sub>GS</sub> =0V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	-	282	-	ns	V <sub>R</sub> =400 I <sub>F</sub> =4A, -diF/dt =100A/μs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	-	1.4	-	uC	

Notes:

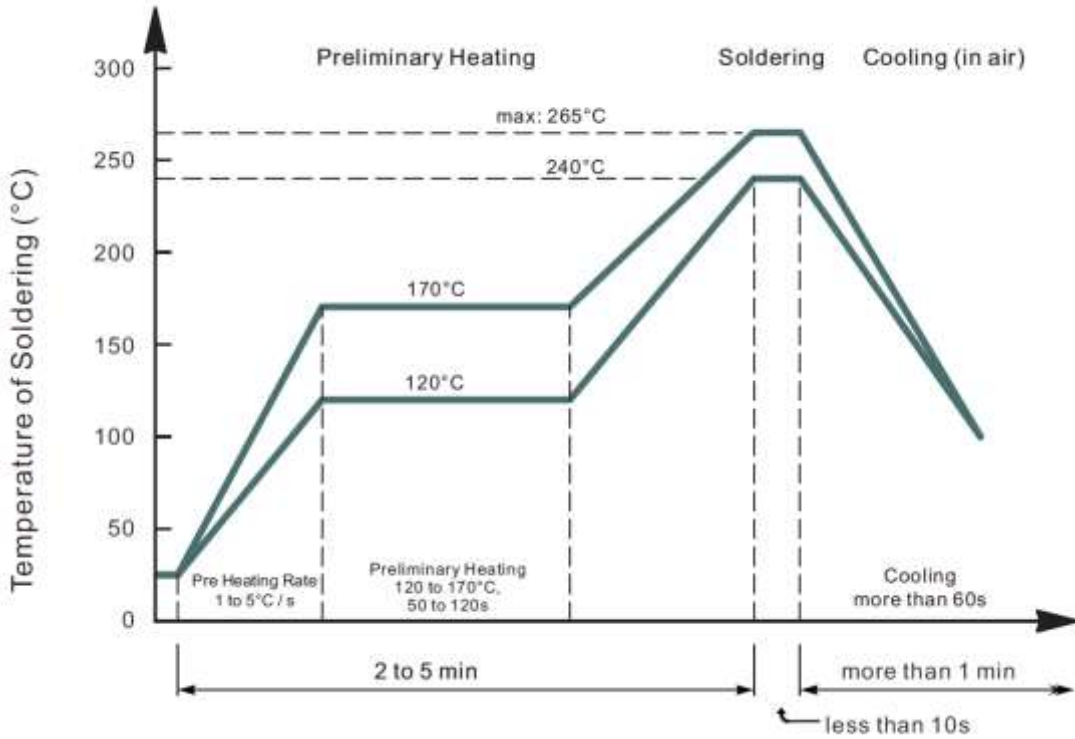
1. Pulse test ; Pulse width ≤ 300us, duty cycle ≤ 2%. 2. Essentially independent of operating temperature.

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**
**RELIABILITY**

Number	Experiment Items	Experiment Method And Conditions	Reference Documents
1	Solder Resistance Test	Test 260°C± 5°C for 10 ± 2 sec. Immerse body into solder 1/16" ± 1/32"	MIL-STD-750D METHOD-2031.2
2	Solderability Test	230°C ±5°C for 5 sec.	MIL-STD-750D METHOD-2026.1 0
3	Pull Test	1 kg in axial lead direction for 10 sec.	MIL-STD-750D METHOD-2036.4
4	Bend Test	0.5Kg Weight Applied To Each Lead, Bending Arcs 90 °C ± 5 °C For 3 Times	MIL-STD-750D METHOD-2036.4
5	High Temperature Reverse Bias Test	TA=100°C for 1000 Hours at VR=80% Rated VR	MIL-STD-750D METHOD-1038.4
6	Forward Operation Life Test	TA=25°C Rated Average Rectified Current	MIL-STD-750D METHOD-1027.3
7	Intermittent Operation Life Test	On state: 5 min with rated IRMS Power Off state: 5 min with Cool Forced Air. On and off for 1000 cycles.	MIL-STD-750D METHOD-1036.3
8	Pressure Cooker Test	15 PSIG, TA=121°C, 4 hours	MIL-S-19500 APPENOIXC
9	Temperature Cycling Test	-55°C~+125°C; 30 Minutes For Dwelled Time 5 minutes for transferred time. Total: 10 cycles.	MIL-STD-750D METHOD-1051.7
10	Thermal Shock Test	0°C for 5 minutes., 100°C for 5minutes, Total: 10 cycles	MIL-STD-750D METHOD-1056.7
11	Forward Surge Test	8.3ms Single Sale Sine-wave One Surge.	MIL-STD-750D METHOD-4066.4
12	Humidity Test	TA=65°C, RH=98% for 1000 hours.	MIL-STD-750D METHOD-1021.3
13	High Temperature Storage life Test	150°C for 1000 Hours	MIL-STD-750D METHOD-1031.5

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**SUGGESTED REFLOW PROFILE (For Reference Only)**



- Recommended peak temperature is over 245°C, If peak temperature is below 245 °C, you may adjust the following parameters; time length of peak temperature (longer), time length of soldering (longer), thickness of solder paste (thicker)
- Welding shall not exceed 2 times
- Remark: lead free solder paste (96.5 sn/3.0 Ag/0.5Cu)



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 1. Typical Output Characteristics

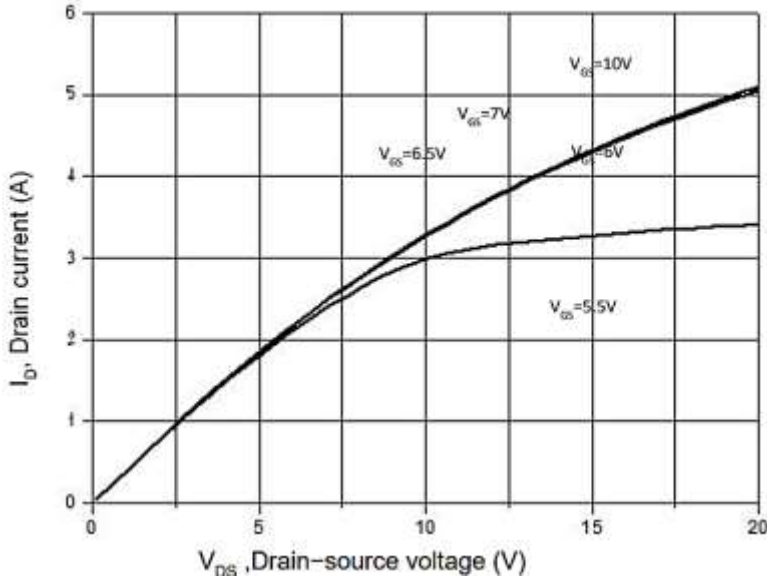
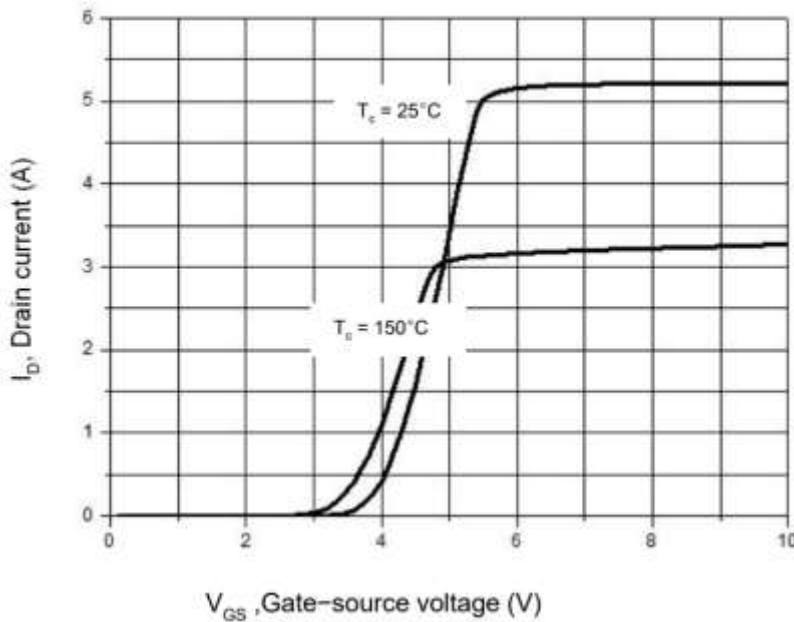


Figure 2. Transfer Characteristics



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 3. On-Resistance Variation vs. Drain Current

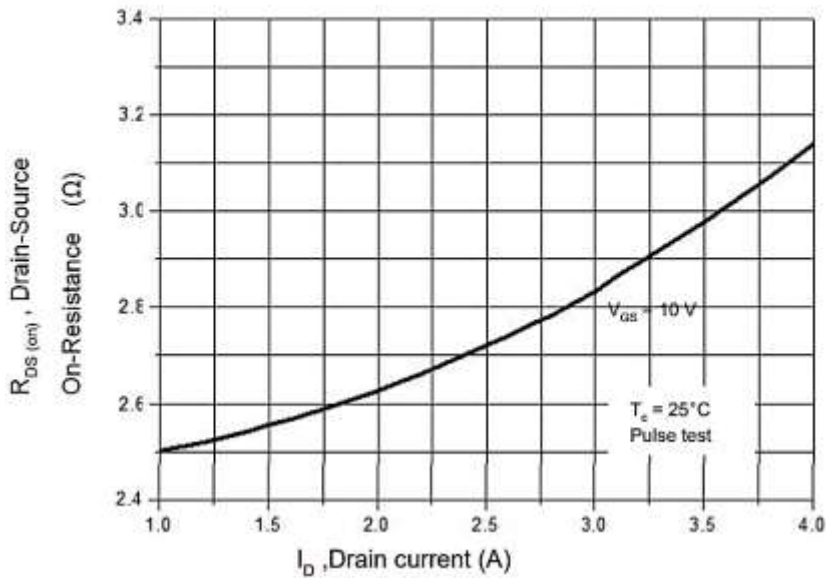
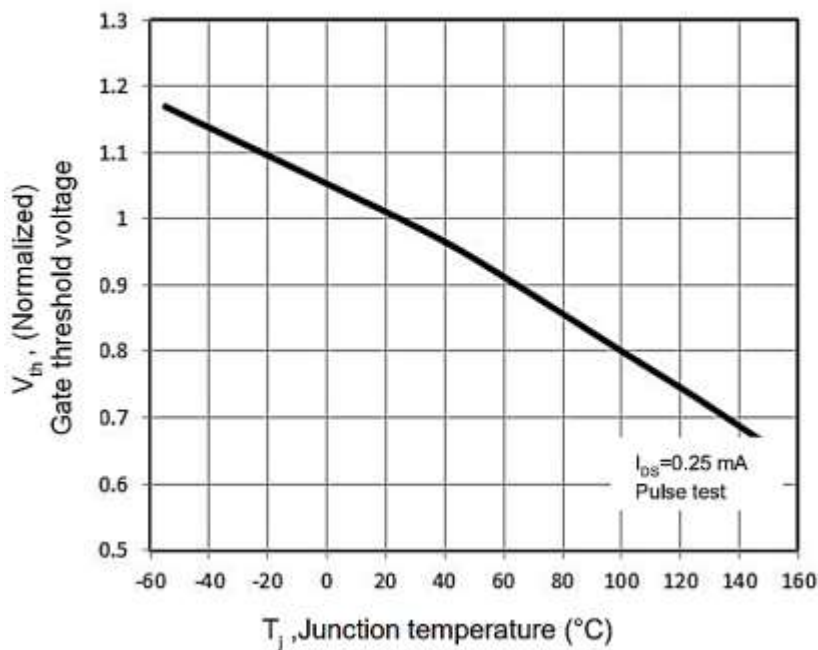


Figure 4. Threshold Voltage vs. Temperature



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 5. Breakdown Voltage vs. Temperature

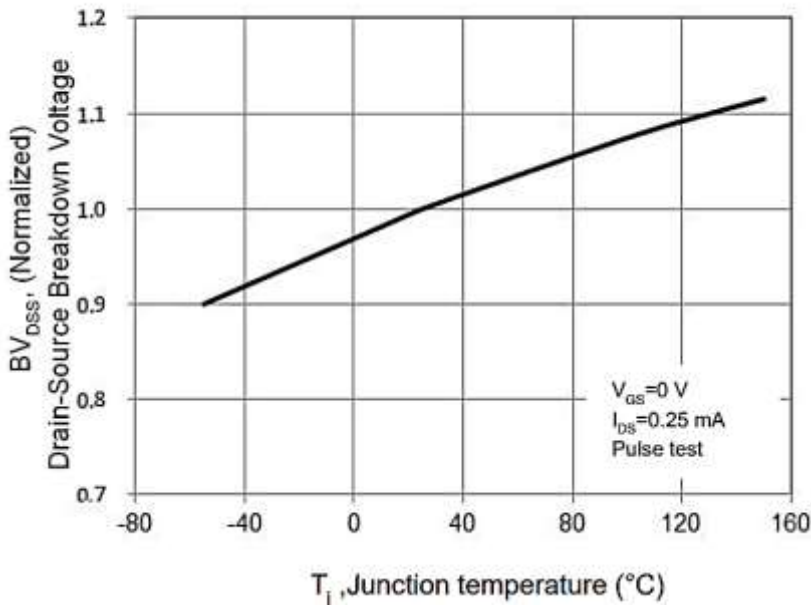
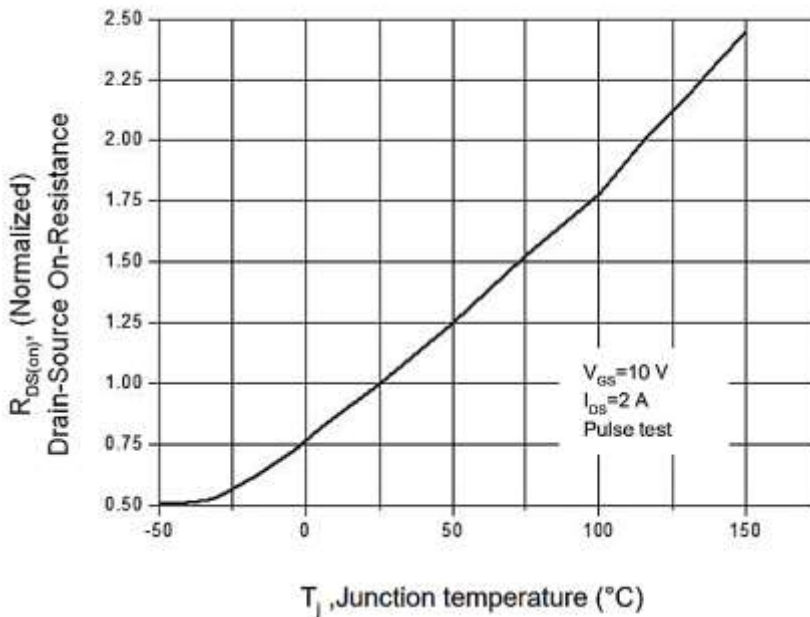


Figure 6. On-Resistance vs. Temperature



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 7. Capacitance Characteristics

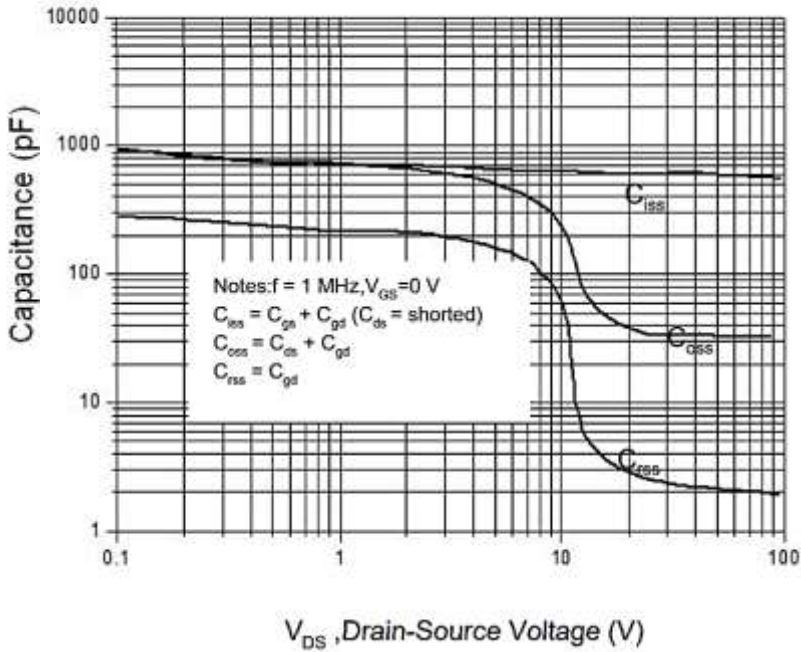
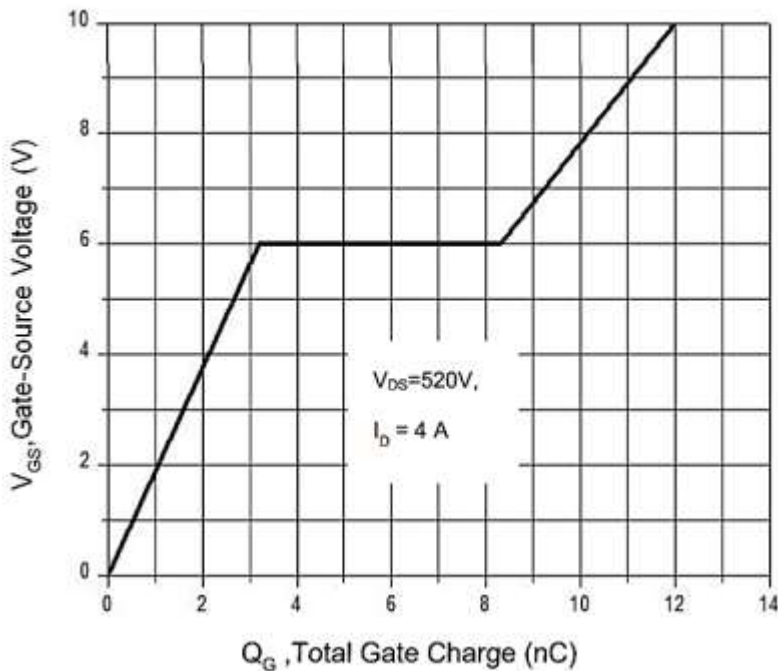


Figure 8. Gate Charge Characterist



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 9. Maximum Safe Operating

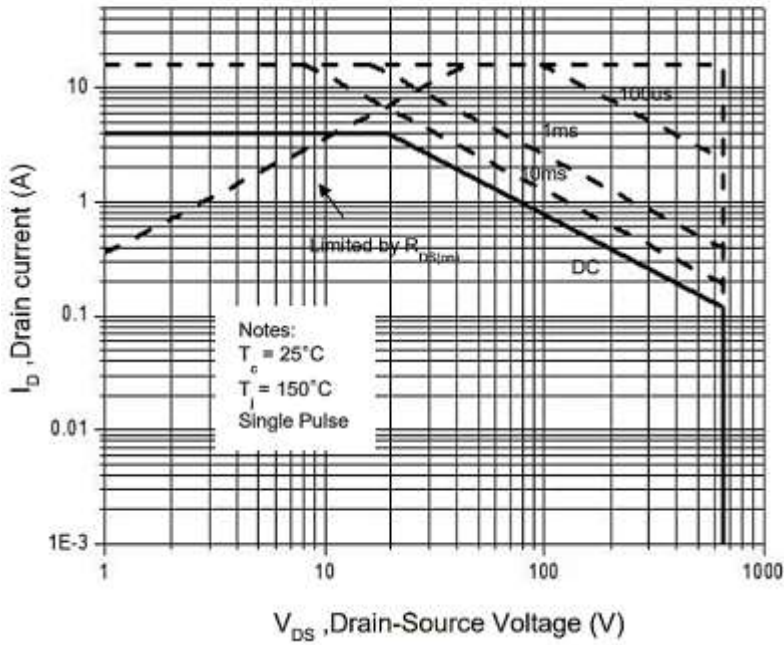
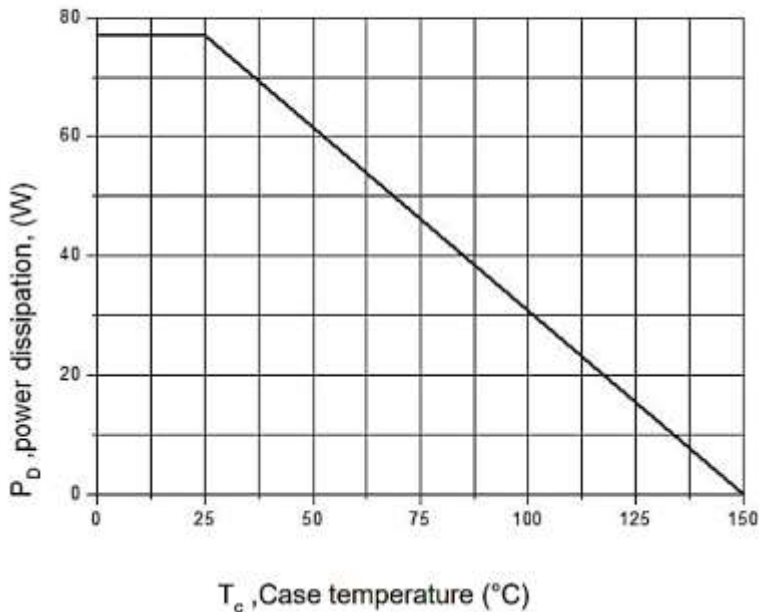


Figure 10. Power Dissipation vs. Temperature



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

Figure 11. Continuous Drain Current vs. Temperature

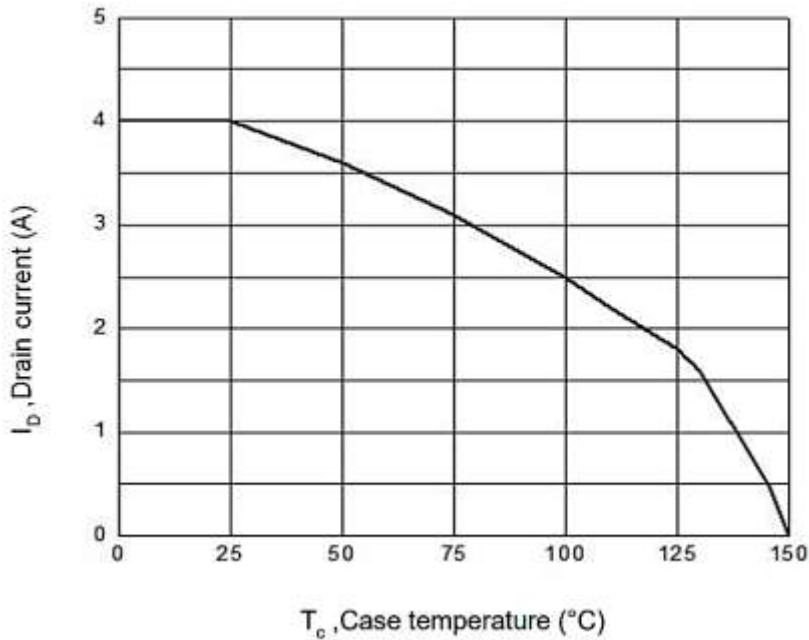
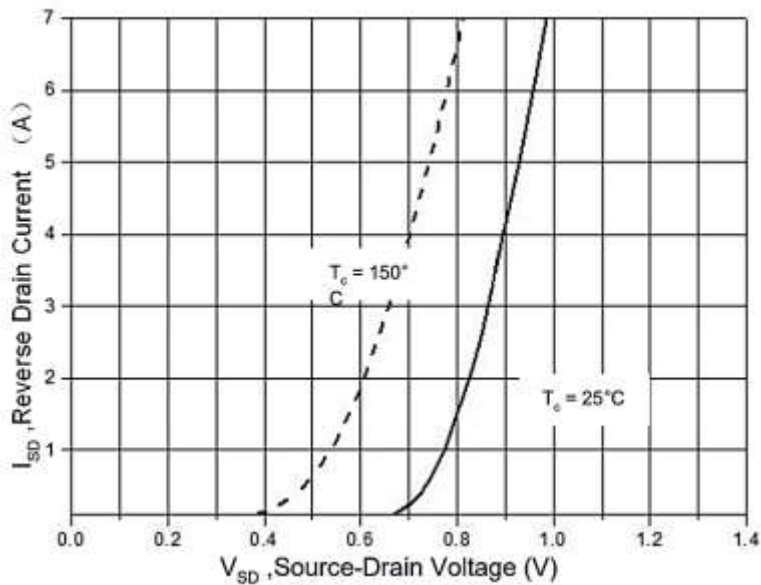


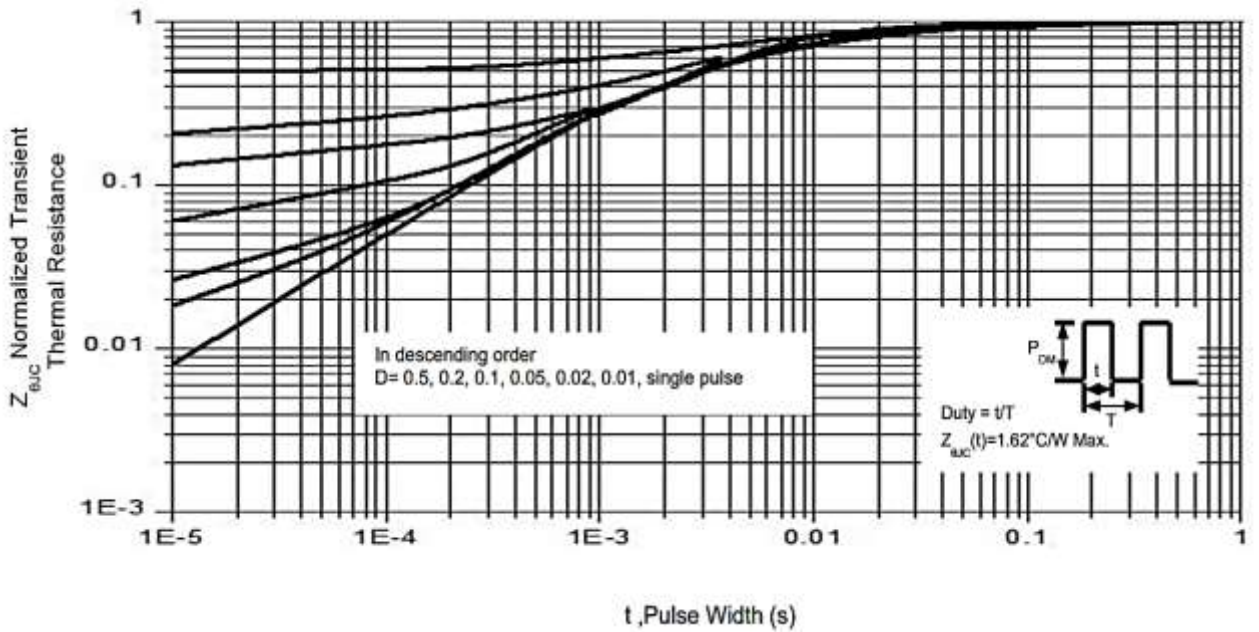
Figure 12. Body Diode Transfer Characteristics



**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**ELECTRICAL CHARACTERISTICS DIAGRAMS (For Reference Only)**

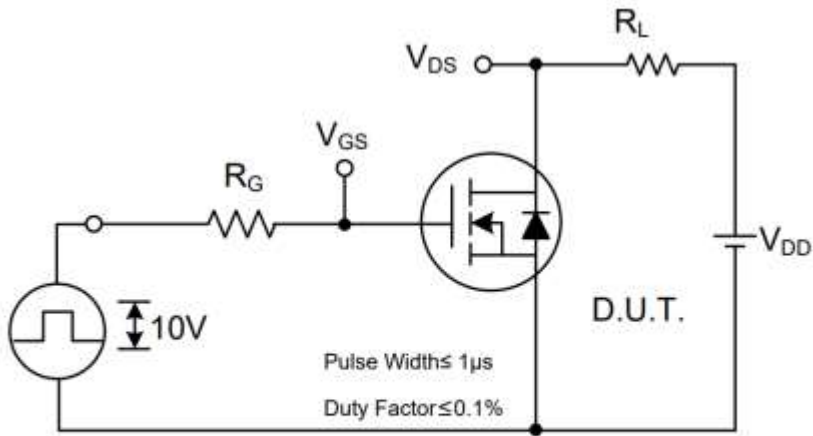
Figure 13. Transient Thermal Impedance, Junction to Case,



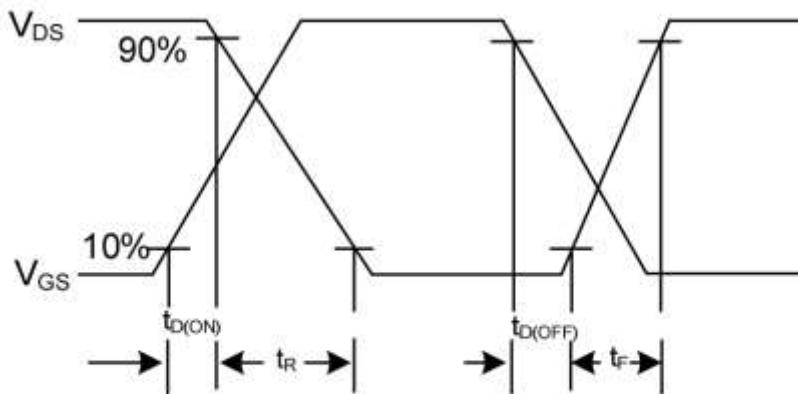


**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

TEST CIRCUIT AND WAVEFORMS CURVE (For Reference Only)



**Switching Test Circuit**

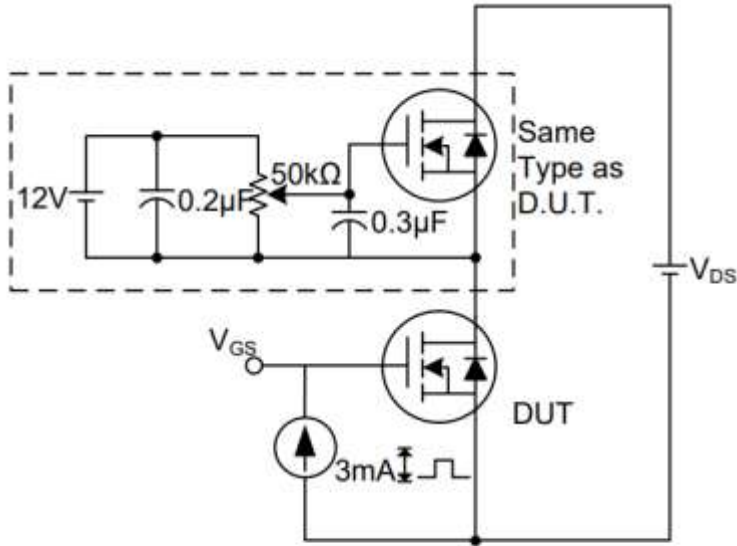


**Switching Waveforms**

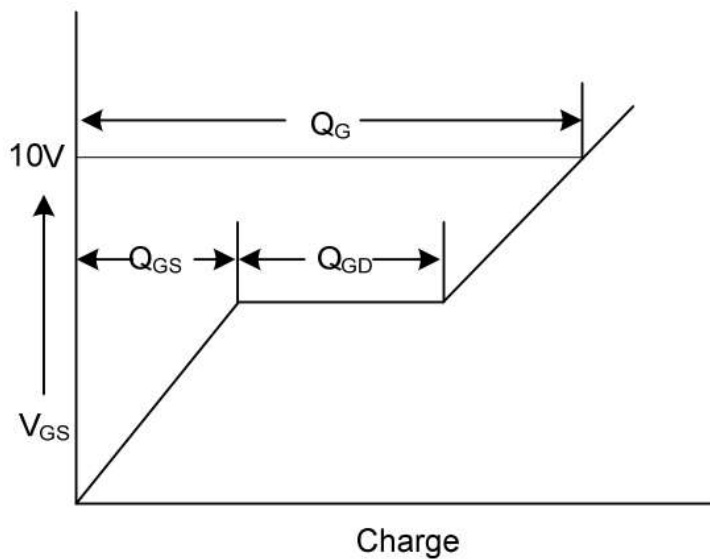


**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

TEST CIRCUIT AND WAVEFORMS CURVE (For Reference Only)



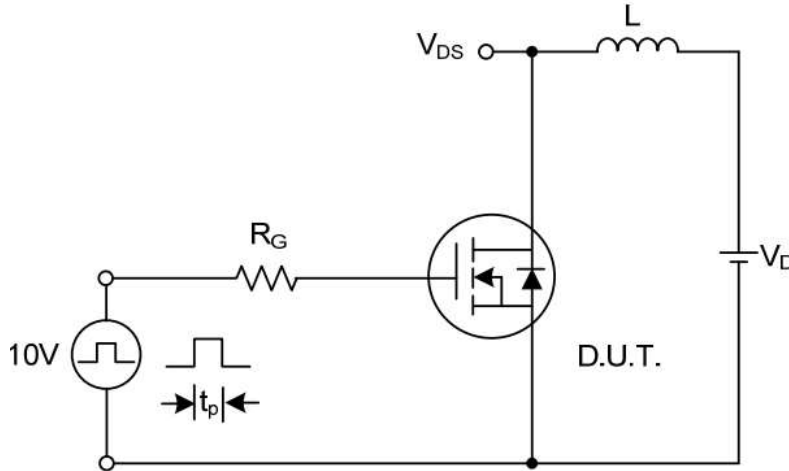
**Gate Charge Test Circuit**



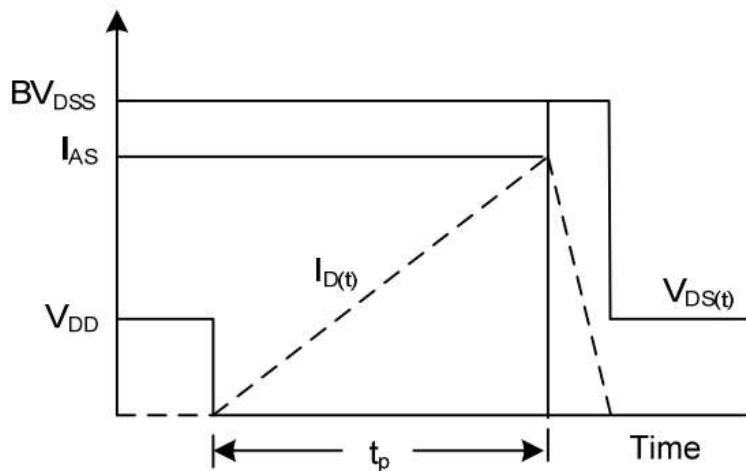
**Gate Charge Waveform**

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

TEST CIRCUIT AND WAVEFORMS CURVE (For Reference Only)



**Unclamped Inductive Switching Test Circuit**

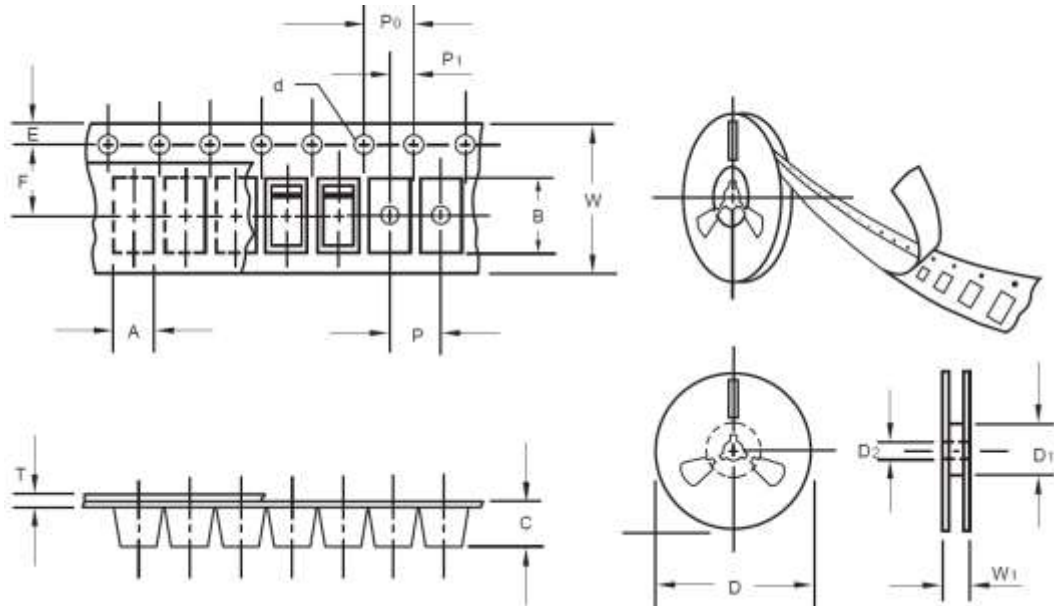


**Unclamped Inductive Switching Waveforms**

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**TAPE/REEL For Reference Only (Unit: mm)**

All Devices are packed in accordance with EIA standard RS-481-A and specifications.



Item	Symbol	Tolerance	TO-252
Carrier width	A	0.1	6.15
Carrier Length	B	0.1	8.41
Carrier Depth	C	0.1	2.42
Sprocket hole	d	0.05	1.50
13" Reel outside diameter	D	2.0	330.00
13" Reel inner diameter	D1	Min.	50.00
7" Reel outside diameter	-	-	-
7" Reel inner diameter	-	-	-
Feed hole diameter	D2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	7.50
Punch hole pitch	P	0.1	8.00
Sprocket hole pitch	P0	0.1	4.00
Embossment center	P1	0.1	2.00
Overall tape thickness	T	0.1	0.25
Tape width	W	0.3	16.00
Reel width	W1	1.0	16.50

**SMD PLASTIC-ENCAPSULATE MOSFETS TO-252 SERIES**

**PACKAGE For Reference Only**

Case Code	TO- 252
Reel Size	13"
Reel Size	330 mm
SPQ/Reel	2500 pcs
Qty. /Box	5000 pcs
G.W/Box	3 lbs

**DISCLAIMER**

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