



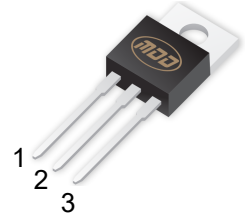
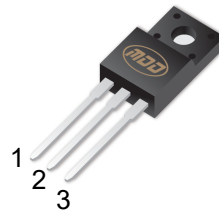
# MDD10N65F/MDD10N65P

## 650V N-Channel Enhancement Mode MOSFET

$V_{DS}$	650 V
$I_D(T_c=25^\circ\text{C})$	10A
$R_{DS(on),max}$	1Ω@ $V_{GS}=10V$
$Q_{g,typ}$	34.2nC

TO-220F-3L

TO-220-3L



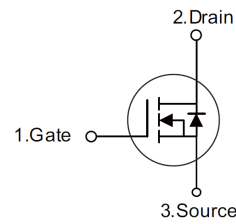
### General Features

- Ultra low gate charge
- Low reverse transfer Capacitance
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

### Application

- High efficiency switch mode power supplies
- Electronic lamp ballasts based on half bridge
- LED power supplies

### Equivalent Circuit



### Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	±30	V
Continuous Drain Current	$I_D$	10	A
Pulsed Drain Current(Note 1)	$I_{DM}$	40	A
Avalanche Energy Single Pulsed (Note 2)	$E_{AS}$	500	mJ
Continuous diode forward current	$I_S$	10	A
Diode pulse current	$I_{S,pulse}$	40	A
Peak Diode Recovery dv/dt (Note 3)	dv/dt	5	V/ns
Power Dissipation TO-220F	$P_D$	40	W
Power Dissipation TO-220/TO-252		130	W
Junction Temperature	$T_J$	150	°C
Storage Temperature	$T_{stg}$	-55 ~ 150	°C

### Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO-220F	TO-220	
Thermal resistance, Junction-to-case	$R_{\theta JC}$	3.13	0.96	°C/W
Thermal resistance, Junction-to-ambient	$R_{\theta JA}$	110	62.5	°C/W

- Notes:**
1. Pulse width limited by maximum junction temperature.
  2. L=10mH,  $I_{AS} = 10A$ , Starting  $T_j = 25^\circ\text{C}$ .
  3.  $I_{SD} = 10A$ ,  $di/dt \leq 100A/\mu s$ ,  $V_{DD} \leq BV_{DS}$ , Starting  $T_j = 25^\circ\text{C}$ .



# MDD10N65F/MDD10N65P

650V N-Channel Enhancement Mode MOSFET

**Ta = 25°C unless otherwise specified**

Symbol	Parameter	Condition	Min	Typ	Max	Unit	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	650	--	--	V	
$I_{GSS}$	Gate-Source Leakage Current	Forward	$V_{GS}=30V, V_{DS}=0V$	--	--	100	nA
		Reverse	$V_{GS}=-30V, V_{DS}=0V$	--	--	-100	nA
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=650V, V_{GS}=0V$	--	--	1	$\mu A$	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V	
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS}=10V, I_D=5A$	--	0.81	1.0	$\Omega$	

## Dynamic Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$C_{iss}$	Input Capacitance	$V_{DS}=25V$ $V_{GS}=0V$ $f=1MHz$	--	1622		pF
$C_{oss}$	Output Capacitance		--	144.2		pF
$C_{rss}$	Reverse Transfer Capacitance		--	6.8		pF
$Q_g$	Total Gate Charge	$V_{DS}=520V,$ $V_{GS}=10V,$ $I_D=10A$ (Note1,2)	--	8.8	--	nC
$Q_{gs}$	Gate Source Charge		--	12.89	--	nC
$Q_{gd}$	Gate Drain Charge		--	34.2	--	nC

## Switching Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{d(on)}$	Turn on Delay Time	$V_{DS}=325V,$ $I_D=10A,$ $R_G=10\Omega$ (Note1,2)	--	--	14.16	ns
$t_r$	Turn on Rise Time		--	--	34.64	ns
$t_{d(off)}$	Turn Off Delay Time		--	--	65.72	ns
$t_f$	Turn Off Fall Time		--	--	16.04	ns

## Source Drain Diode Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$I_{SD}$	Source drain current(Body Diode)		--	--	10	A
$I_{SM}$	Pulsed Current		--	--	40	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$I_S=10A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Body Diode Reverse Recovery Time	$V_R=325$ $I_F=10A,$ $-dI_F/dt=100A/\mu s$	--	418.8	--	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		--	3.40	--	$\mu C$

### Notes:

- 1.Pulse test ; Pulse width $\leq 300\mu s$ , duty cycles $\leq 2\%$ .
- 2.Essentially independent of operating temperature.



# MDD10N65F/MDD10N65P

650V N-Channel Enhancement Mode MOSFET

## Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

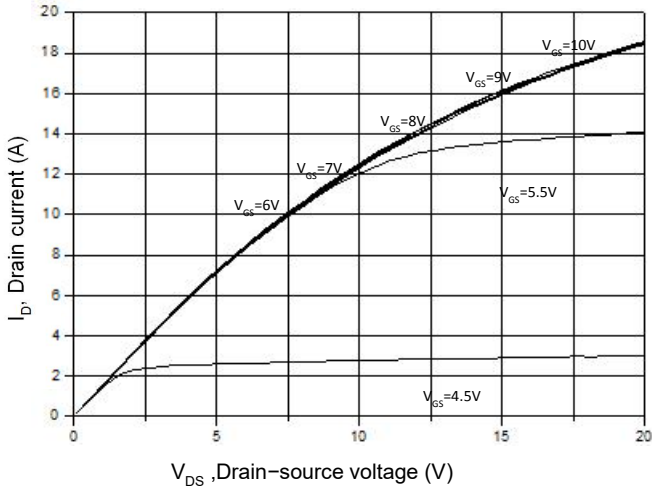


Figure 2. Transfer Characteristics

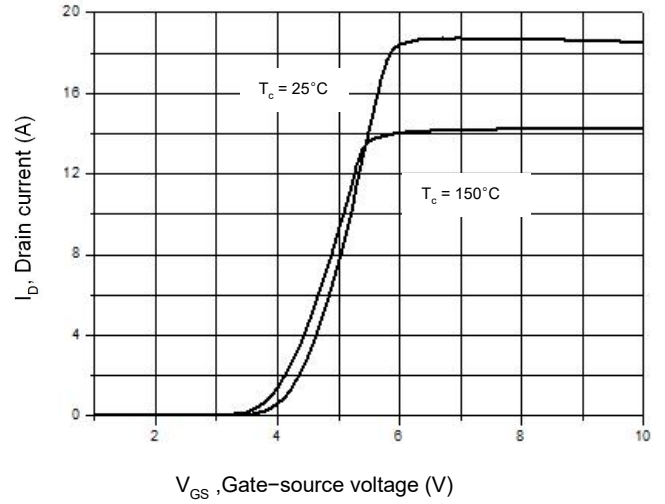


Figure 3. On-Resistance Variation vs. Drain Current

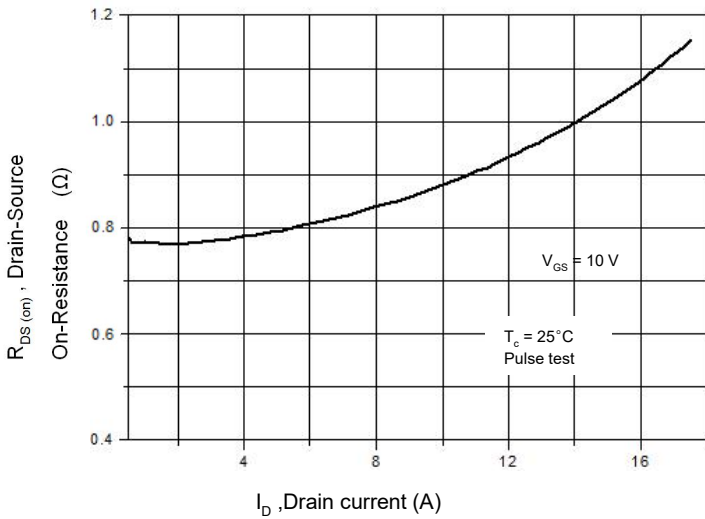


Figure 4. Threshold Voltage vs. Temperature

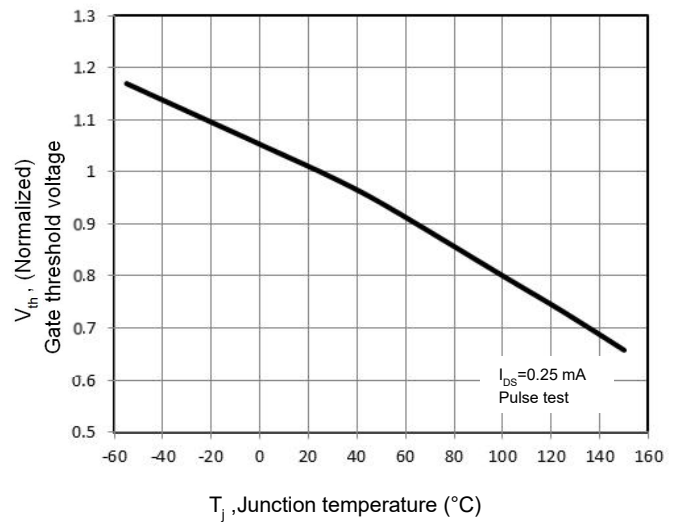


Figure 5. Breakdown Voltage vs. Temperature

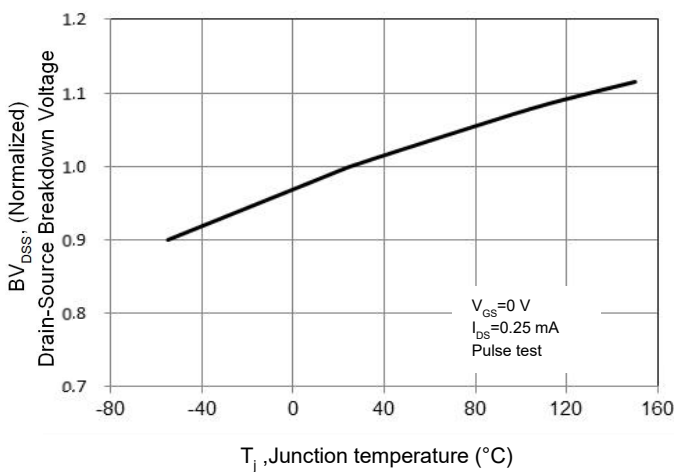
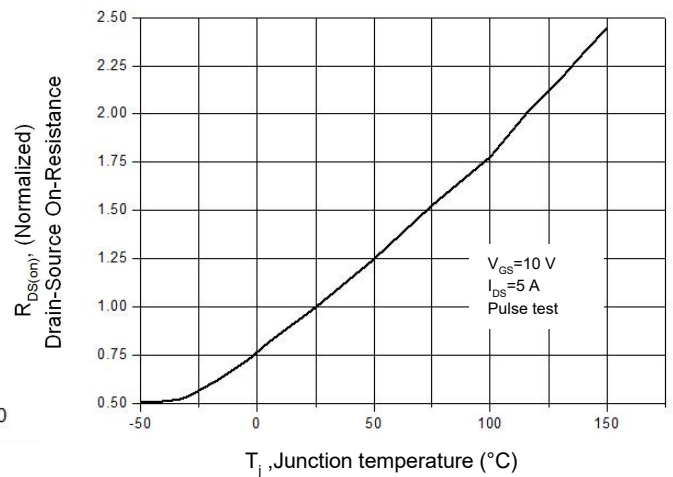


Figure 6. On-Resistance vs. Temperature





# MDD10N65F/MDD10N65P

## 650V N-Channel Enhancement Mode MOSFET

Figure 7. Capacitance Characteristics

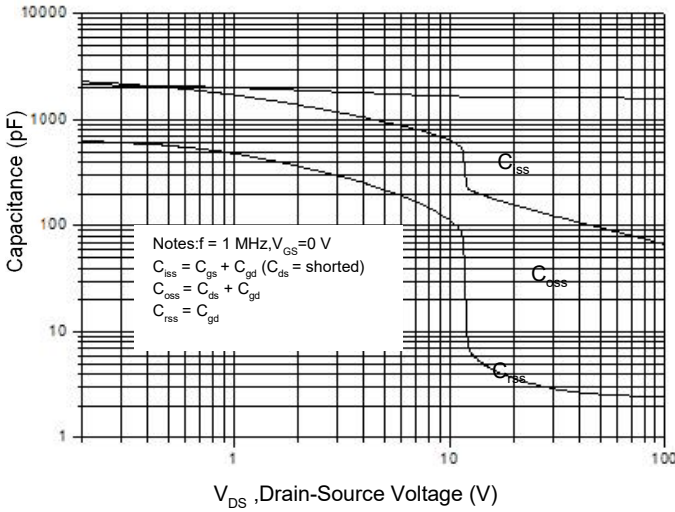


Figure 8. Gate Charge Characteristics

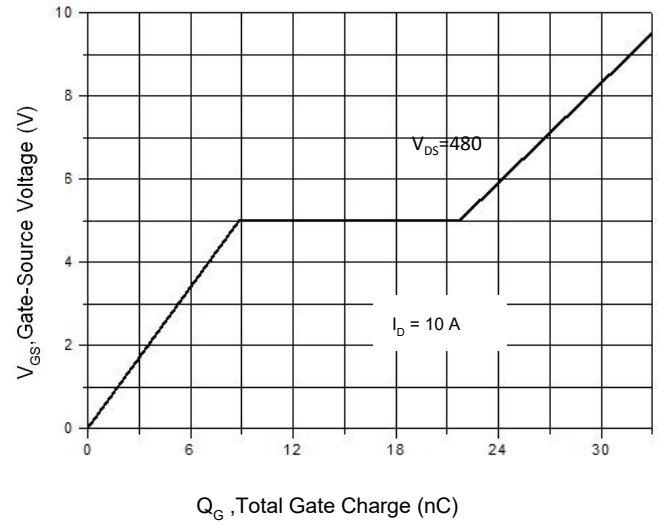


Figure 9. Maximum Safe Operating Area TO-220F

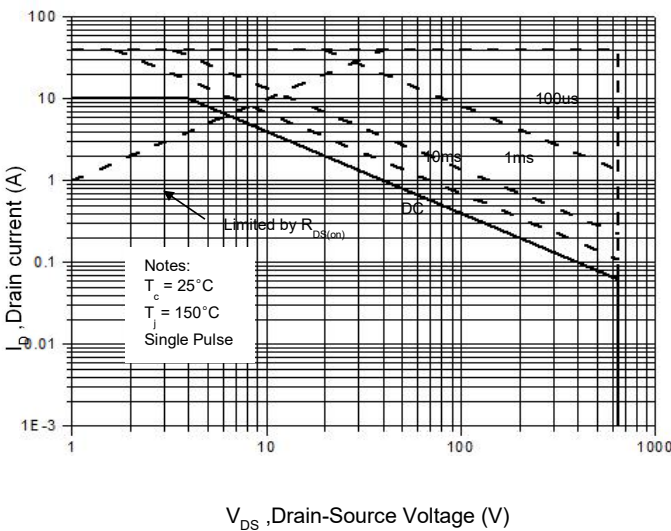


Figure 10. Maximum Safe Operating Area TO-220

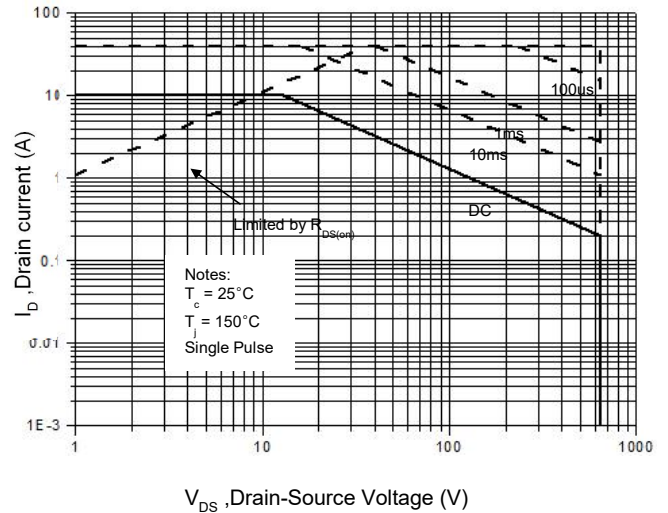


Figure 11. Power Dissipation vs. Temperature TO-220F

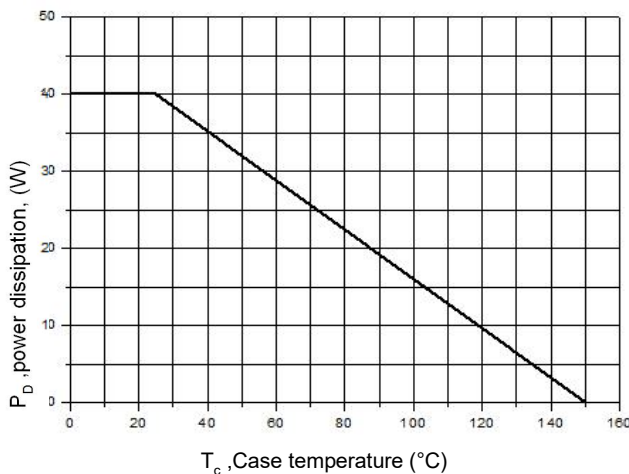


Figure 12. Power Dissipation vs. Temperature TO-220

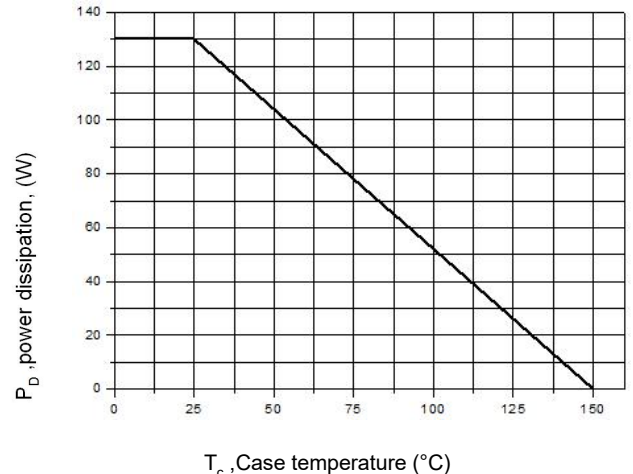


Figure 13. Continuous Drain Current vs. Temperature

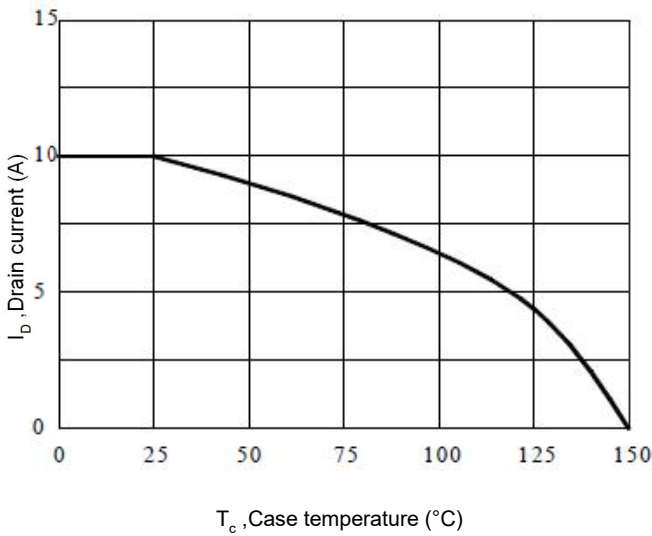


Figure 14. Body Diode Transfer Characteristics

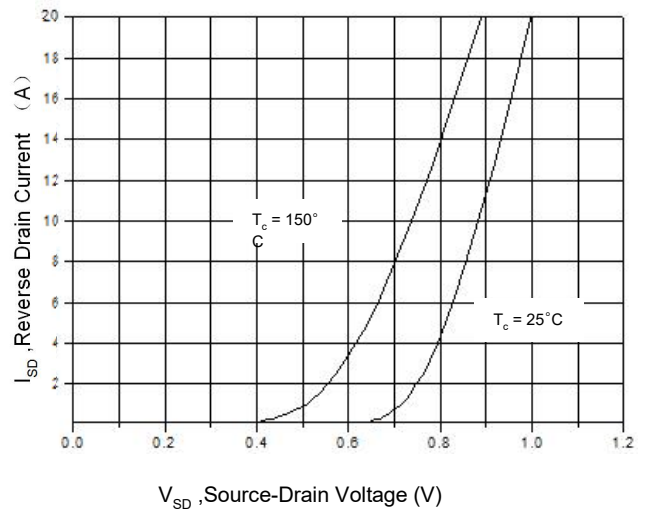


Figure 15 Transient Thermal Impedance, Junction to Case, TO-220F

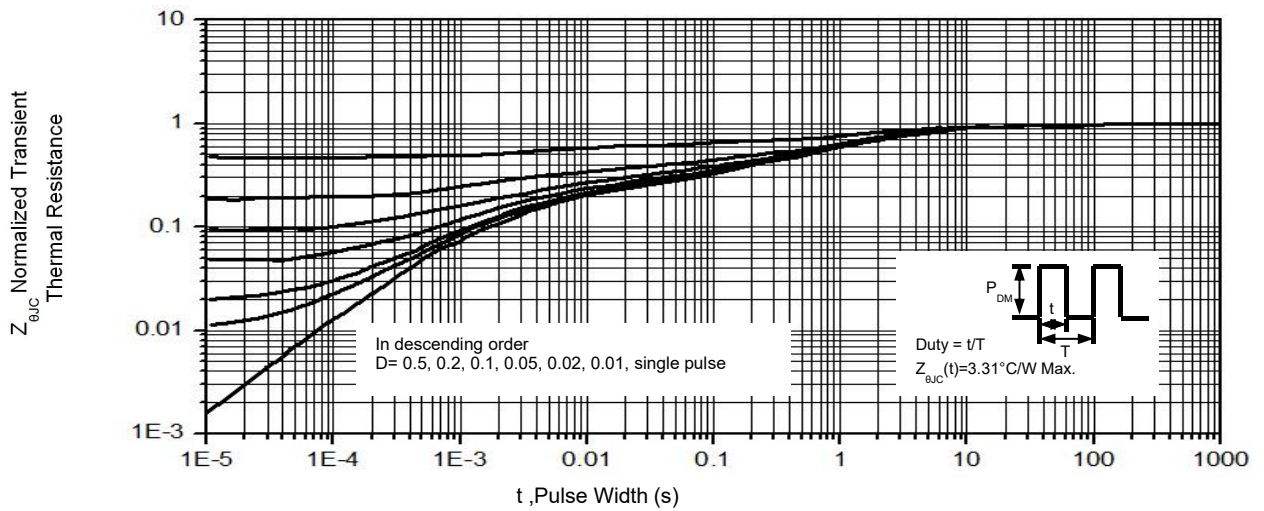
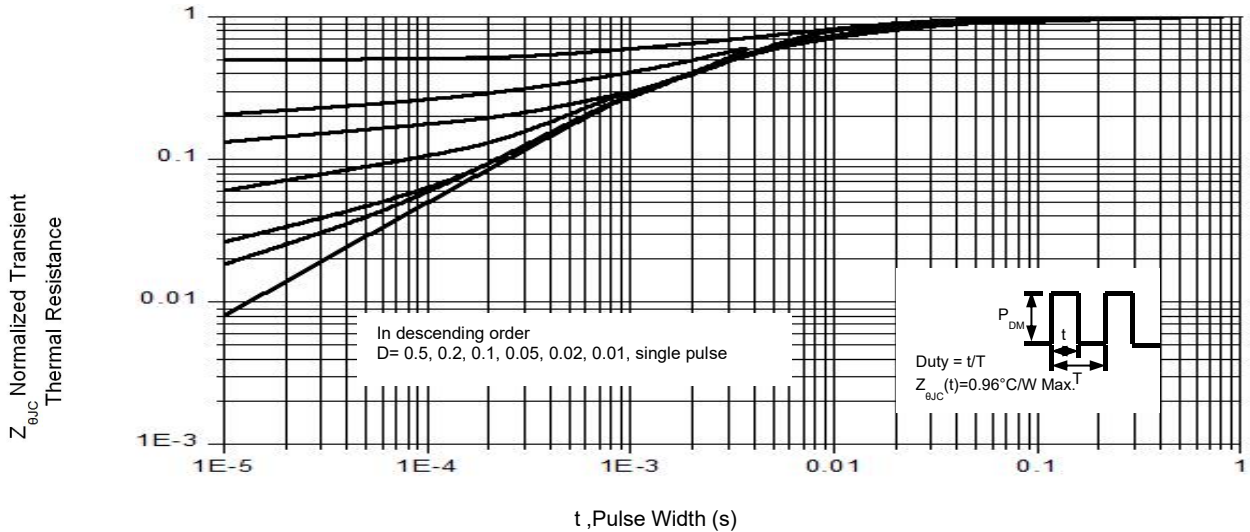
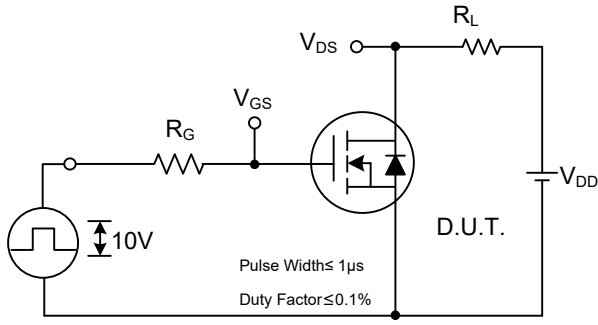
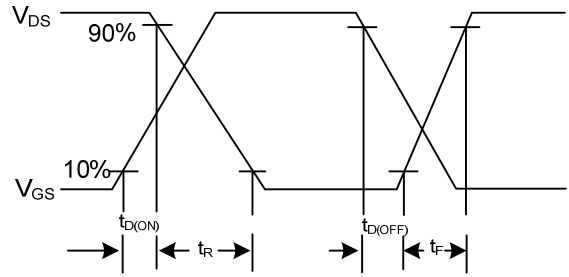


Figure 16. Transient Thermal Impedance, Junction to Case, TO-220

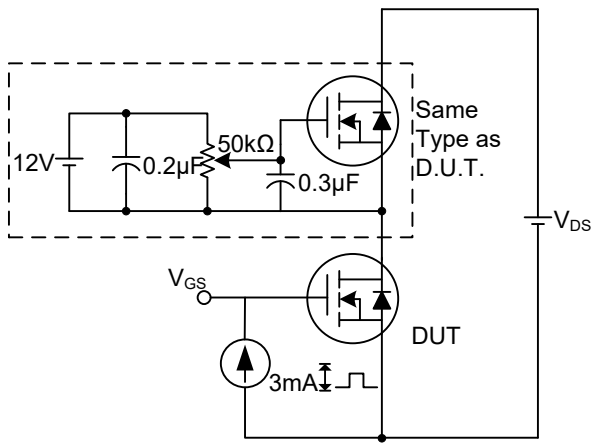




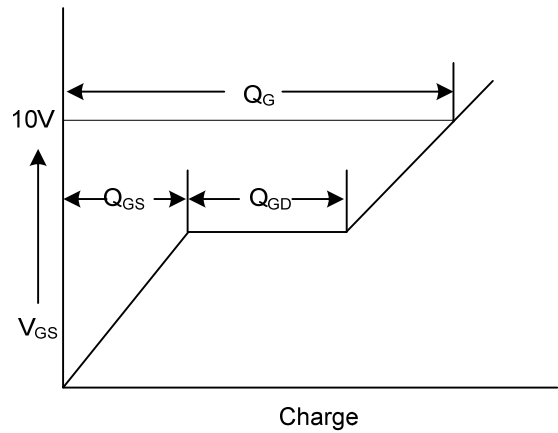
**Switching Test Circuit**



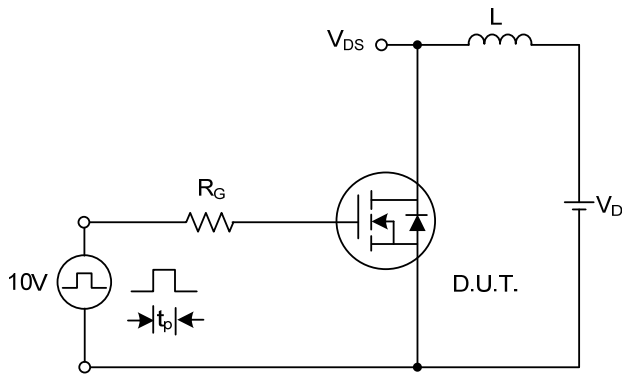
**Switching Waveforms**



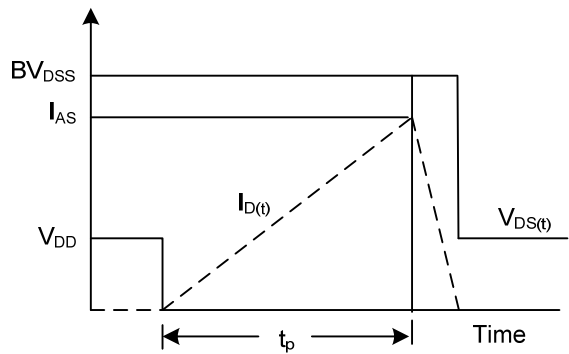
**Gate Charge Test Circuit**



**Gate Charge Waveform**



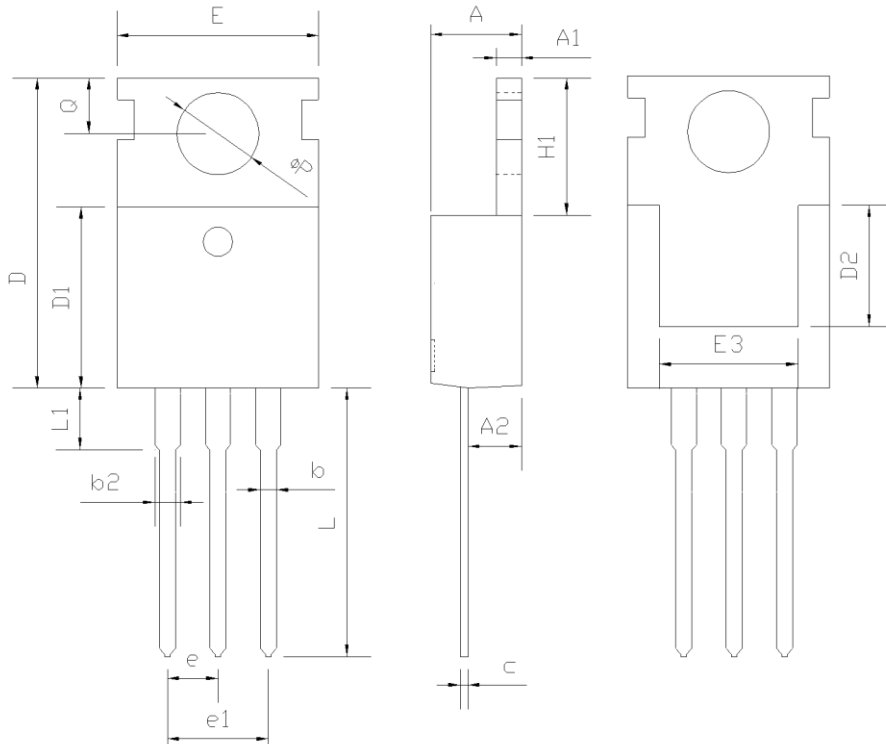
**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

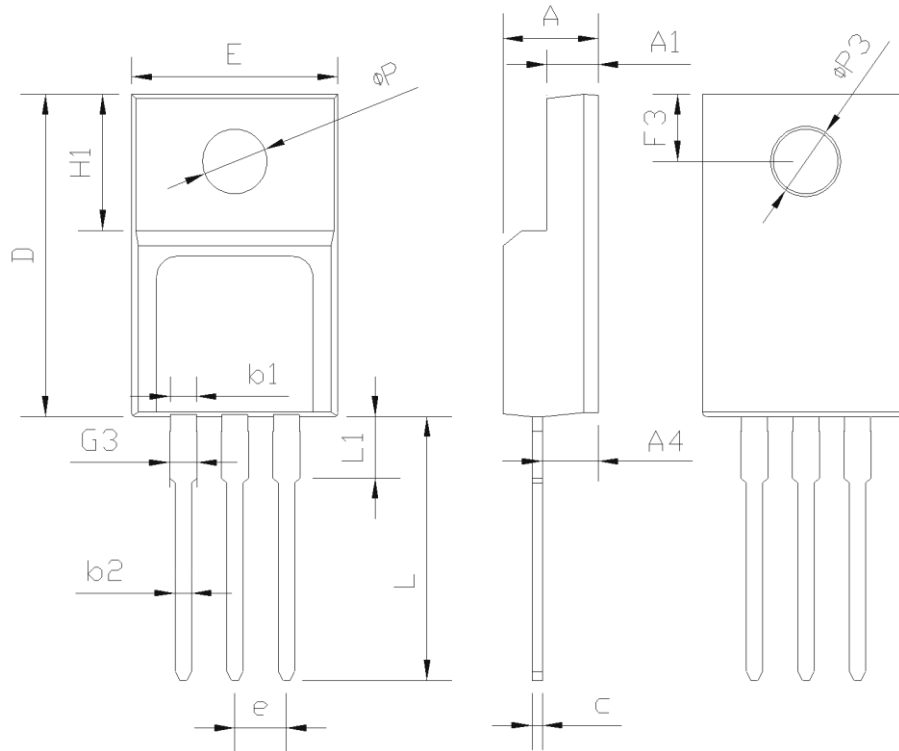
The curve above is for reference only.

### Mechanical Dimensions for TO-220-3L



SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

### Mechanical Dimensions for TO-220F-3L



SYMBOL	mm		
	MIN	NOM	MAX
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.88	3.03	3.18
ΦP	3.03	3.18	3.38
ΦP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

### Package Marking and Ordering Information

Part Number	Marking	Package	Units/Tube	Units/Reel
MDD7N65F	7N65F	TO-220F	50	
MDD7N65P	7N65P	TO-220-3L	50	





# MDD10N65F/MDD10N65P

650V N-Channel Enhancement Mode MOSFET

## Important Notice and Disclaimer

Microdiode Electronics (shenzhen) reserves the right to make changes to this document and its products and specifications at any time without notice. Customers should obtain and confirm the latest product information and specifications before final design, purchase or use.

Microdiode Electronics (shenzhen) makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, not does Microdiode Electronics (shenzhen) assume any liability for application assistance or customer product design. Microdiode Electronics (shenzhen) does not warrant or accept any liability with products which are purchased or used for any unintended or unauthorized application.

No license is granted by implication or otherwise under any intellectual property rights of Microdiode Electronics (shenzhen).

Microdiode Electronics (shenzhen) products are not authorized for use as critical components in life support devices or systems without express written approval of Microdiode Electronics (shenzhen).