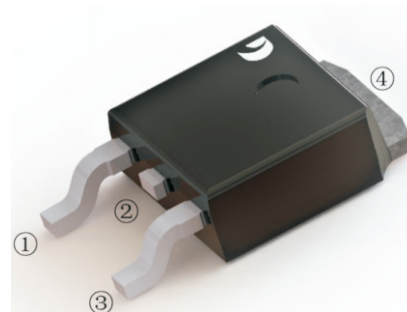


## 4A, 650V N-CHANNEL POWER MOSFET

TO-252W

### DESCRIPTION

The D4N65 is a high voltage power MOSFET combines advanced trench MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.



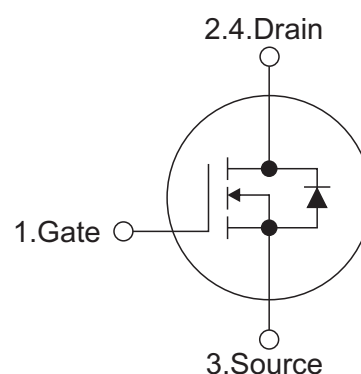
### Features

- $R_{DS(ON)} \leq 2.6 \Omega$  @  $V_{GS}=10V, I_D=2.0A$
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

### Mechanical data

- Case: TO-252W
- Approx. Weight: 0.315g (0.011oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".

### SYMBOL



### ABSOLUTE MAXIMUM RATINGS (TA=25°C, unless otherwise specified)

PARAMETER	Symbols	RATINGS	Units
Drain-Source Voltage	$V_{DSS}$	650	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	4	A
Pulsed Drain Current (Note 2)	$I_{DM}$	16	A
Avalanche Energy Single Pulsed (Note 3)	$E_{AS}$	173	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	2.1	V/ns
Power Dissipation	$P_D$	32	W
Operation Junction Temperature and Storage Temperature	$T_j, T_{stg}$	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3.  $L = 30mH, I_{AS} = 3.4A, V_{DD} = 50V, R_G = 25 \Omega$ , Starting  $T_J = 25^\circ C$

4.  $ISD \leq 4A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ C$

### THERMAL DATA

PARAMETER	Symbols	RATINGS	Units
Junction to Ambient	$R_{thJA}$	63	°C/W
Junction to Case	$R_{thJC}$	4	°C/W

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.



**ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)**

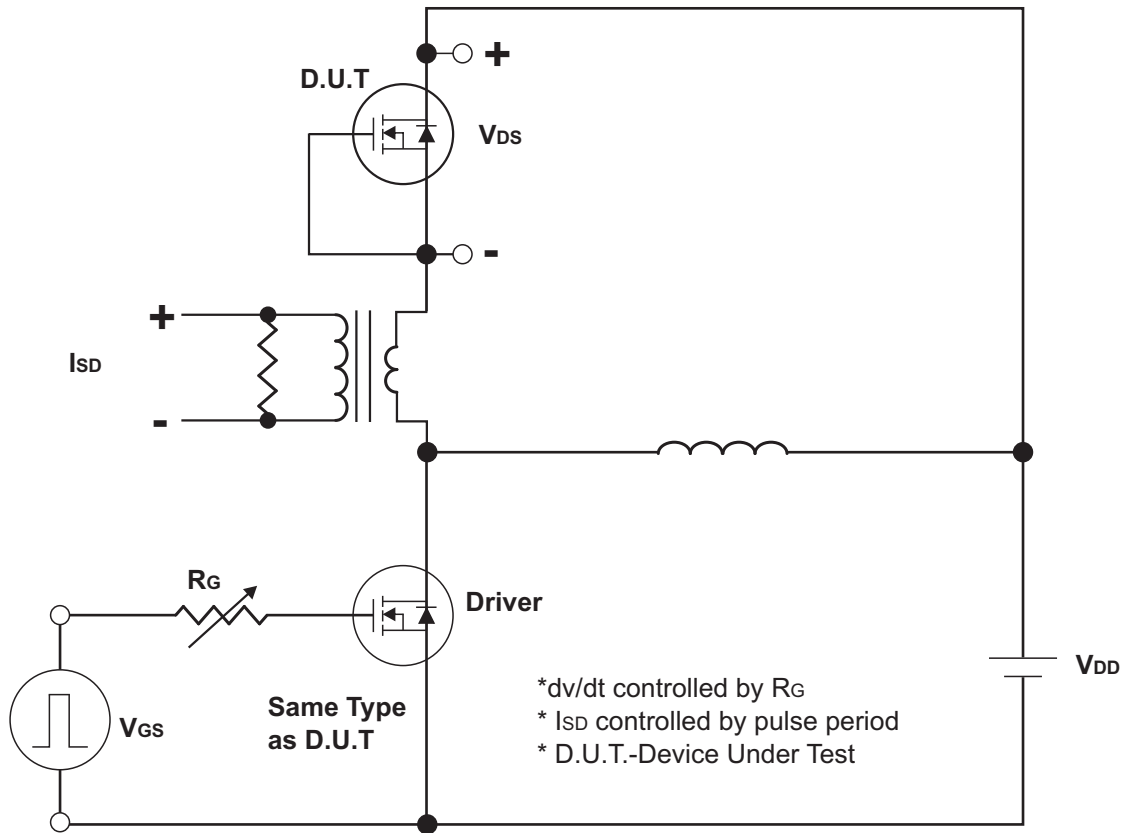
PARAMETER		Symbols	TEST CONDITIONS	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{DS}=0V, I_D=250\mu A$	650			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$			10	$\mu A$
Gate- Source Leakage Current	Forward	$I_{GSS}$	$V_{GS}=30V, V_{DS}=0V$			100	nA
	Reverse		$V_{GS}=-30V, V_{DS}=0V$			-100	
<b>ON CHARACTERISTICS</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=2.0A$			2.7	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance		$C_{ISS}$	$V_{DS}=25V,$ $V_{GS}=0V,$ $f=1.0MHz$		560		pF
Output Capacitance		$C_{OSS}$			55		pF
Reverse Transfer Capacitance		$C_{RSS}$			10		pF
<b>SWITCHING CHARACTERISTICS</b>							
Total Gate Charge (Note 1)		$Q_G$	$V_{DS}=520V, V_{GS}=10V,$ $I_D=4A, I_G=1mA$ (NOTE1,2)		13		nC
Gate-Source Charge		$Q_{GS}$			4		nC
Gate-Drain Charge		$Q_{GD}$			2.2		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	$V_{DS}=100V, V_{GS}=10V,$ $I_D=4A, R_G=25\Omega$ (NOTE1,2)		7		ns
Turn-On Rise Time		$t_R$			16		ns
Turn-Off Delay Time		$t_{D(OFF)}$			36		ns
Turn-Off Fall Time		$t_F$			22		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>							
Maximum Body-Diode Continuous Current		$I_S$				4	A
Maximum Body-Diode Pulsed Current		$I_{SM}$				8	A
Drain-Source Diode Forward Voltage (Note 1)		$V_{SD}$	$I_S=7A, V_{GS}=0V$			1.4	V
Reverse Recovery Time (Note 1)		$t_{rr}$	$I_S=4A, V_{GS}=0V,$		250		ns
Reverse Recovery Charge		$Q_{rr}$	$di/dt=100A/\mu s$		4.5		$\mu C$

Notes:

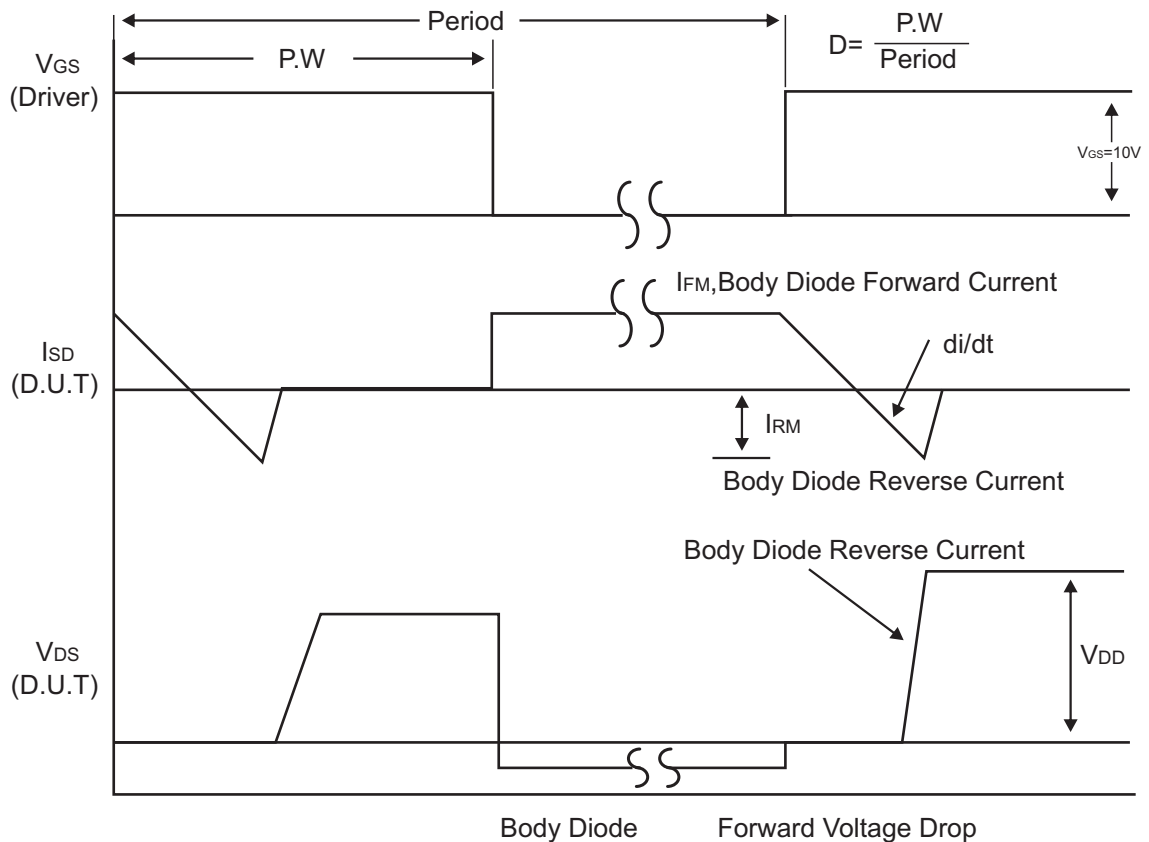
1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .
2. Essentially independent of operating temperature.



Test Circuits and waveforms



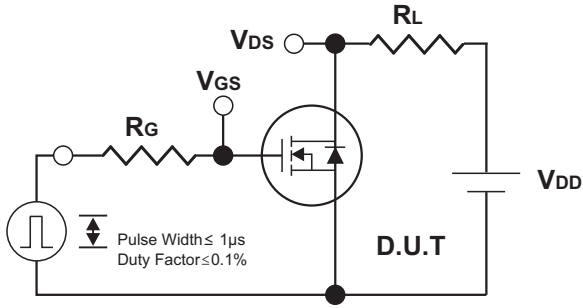
Peak Diode Recovery dv/dt Test Circuit



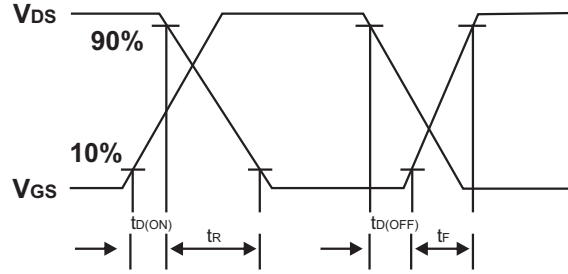
Peak Diode Recovery dv/dt Waveforms



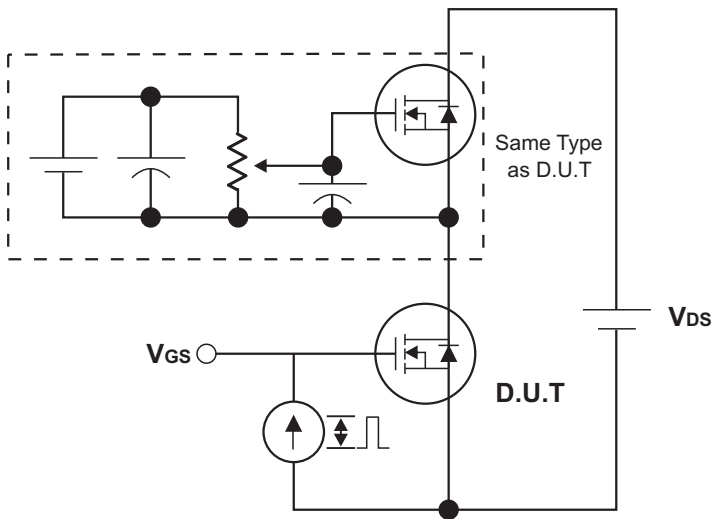
Test Circuits and waveforms



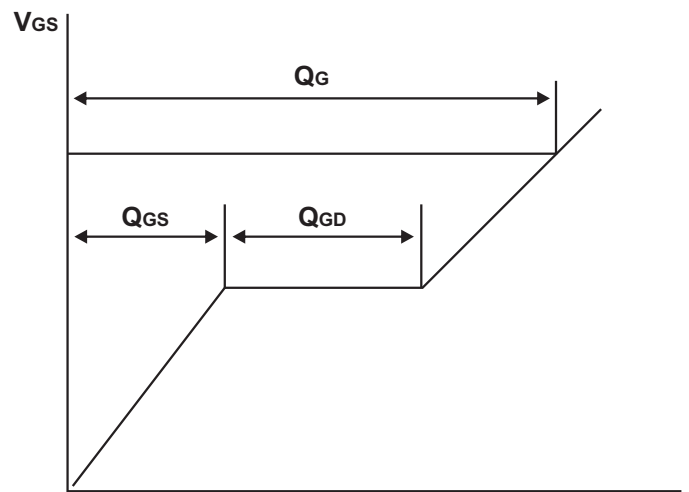
Switching Test Circuit



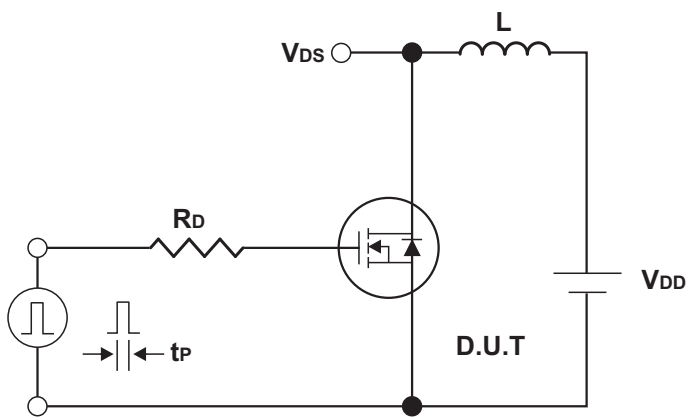
Switching Waveforms



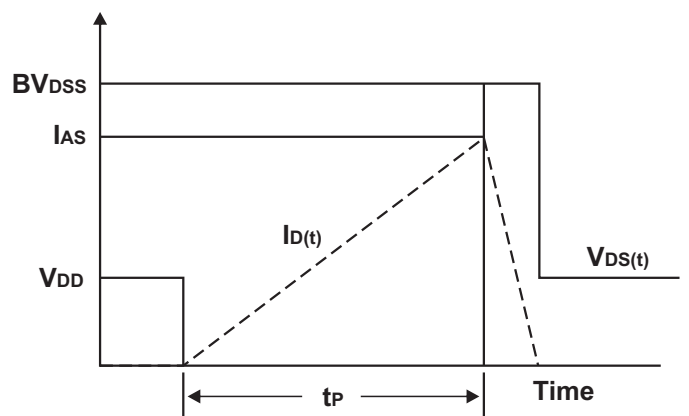
Gate Charge Test Circuit



Charge  
Gate Charge Waveform



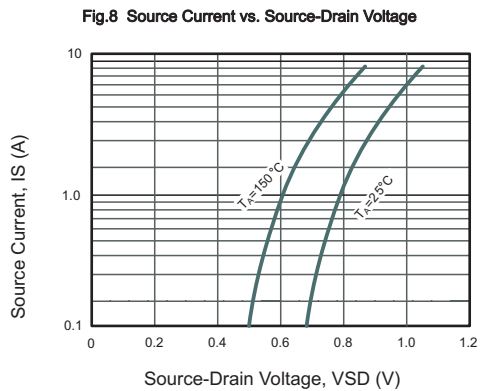
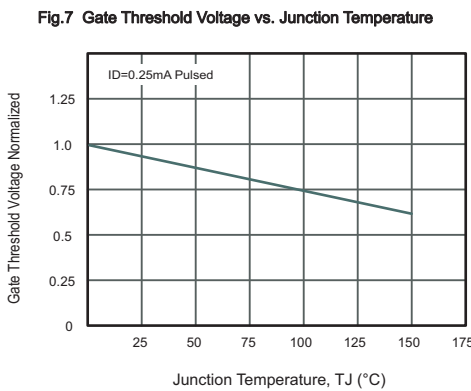
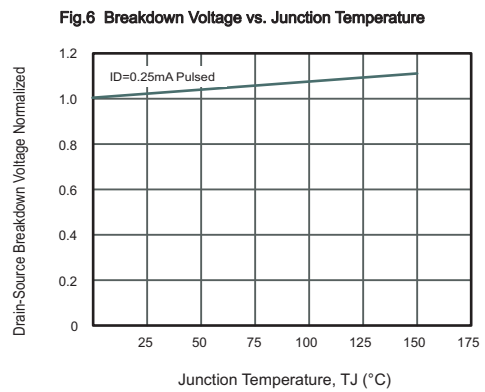
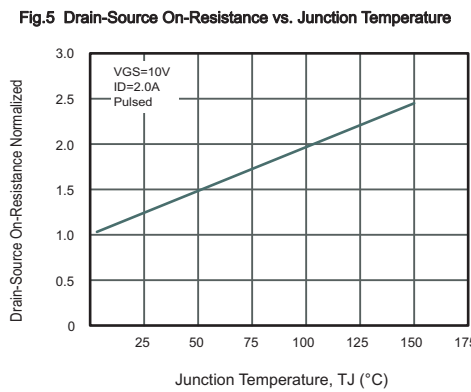
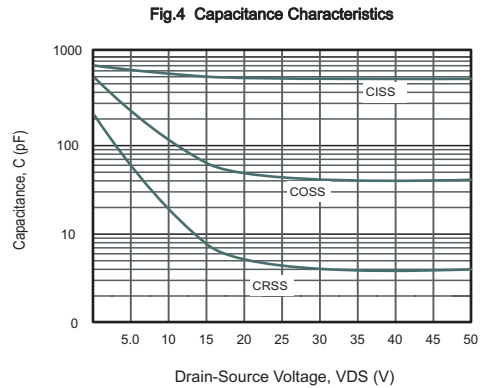
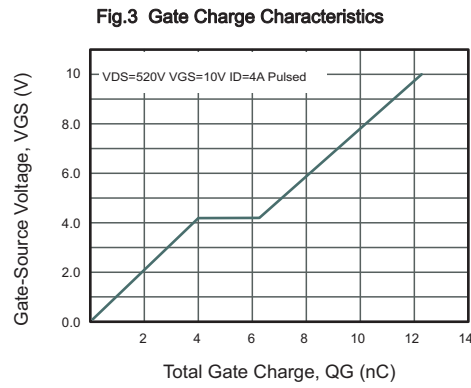
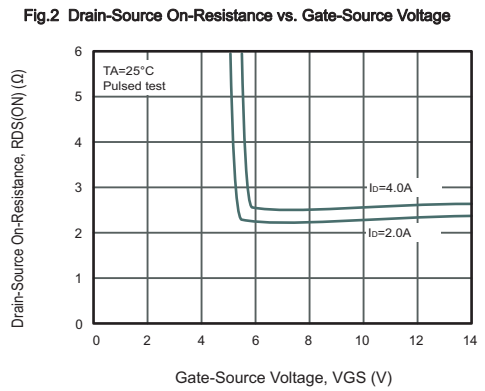
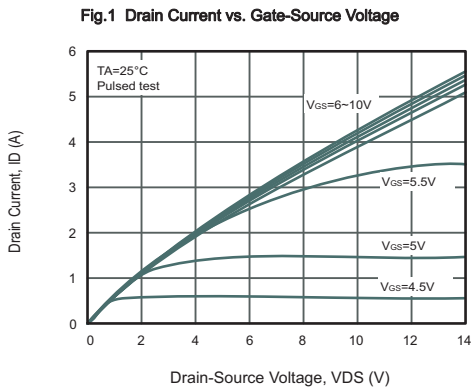
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



### Typical Characteristics





### Typical Characteristics

Fig.9 Drain Current vs. Gate-Source Voltage

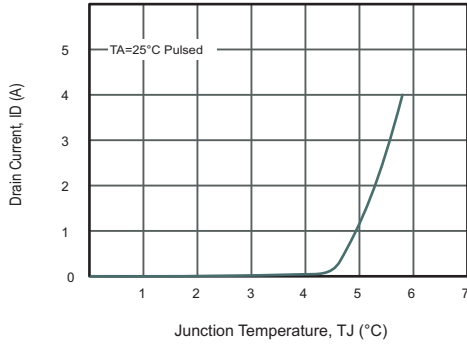


Fig.10 Drain-Source On-Resistance vs. Drain Current

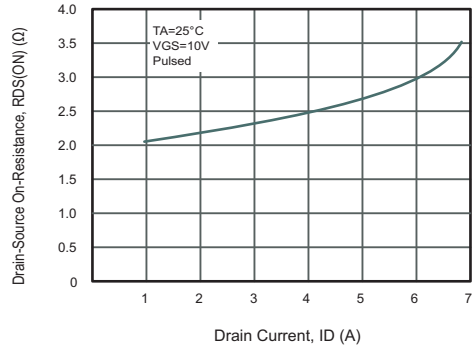


Fig.11 Drain Current vs. Junction Temperature

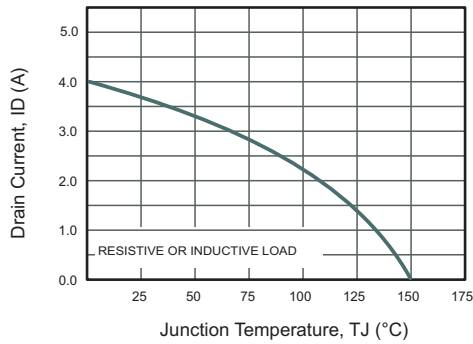


Fig.12 Power Dissipation vs. Junction Temperature

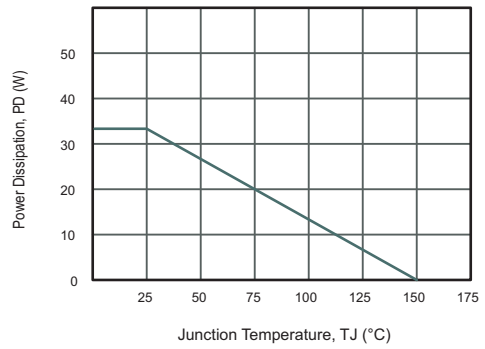
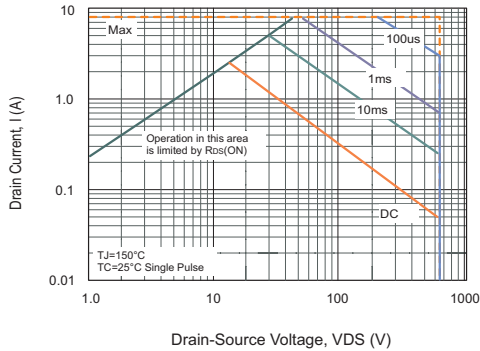
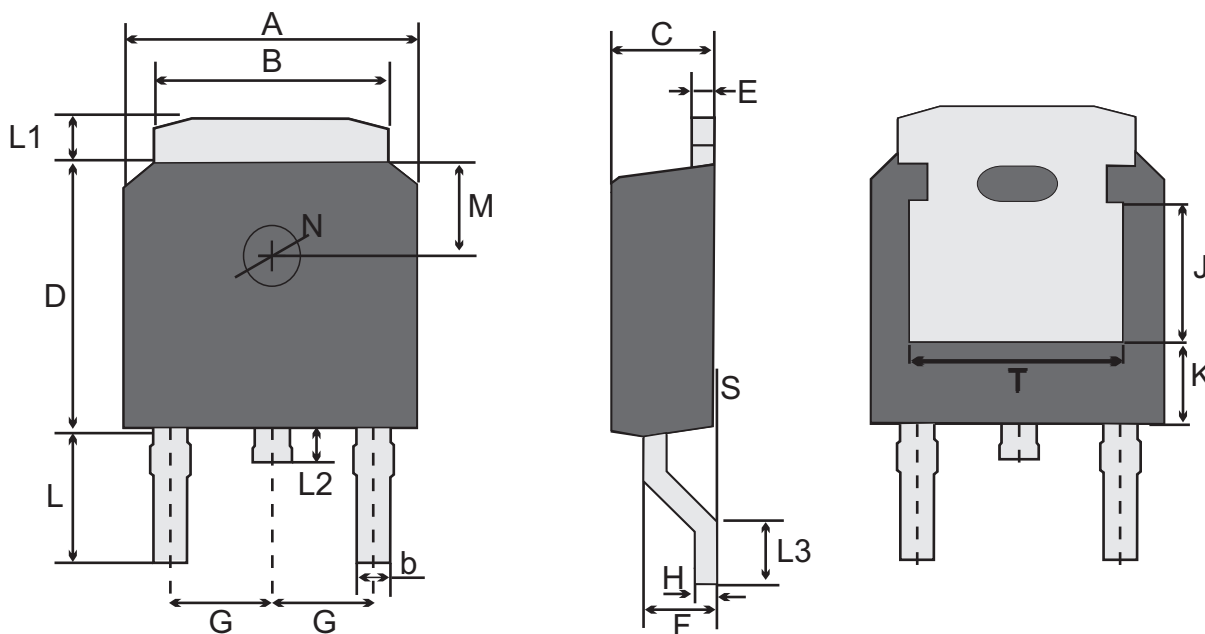


Fig.13 Safe Operating Area





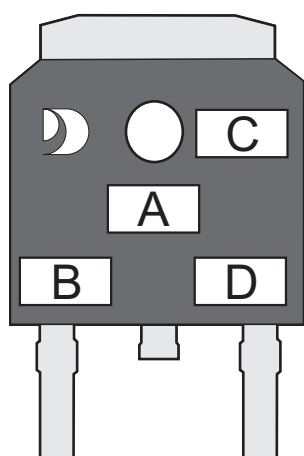
### TO-252W(D-PAK) Package Outline Dimensions



TO-252W(D-PAK) mechanical data

UNIT	A	B	b	C	D	E	F	G	H	L	L1	L2	L3	S	M	N	J	K	T	
mm	max	6.7	5.5	0.8	2.5	6.3	0.6	1.8	2.29 TYPICAL	0.55	3.1	1.2	1.0	1.75	0.1	1.8 TYPICAL	1.3 TYPICAL	3.16 ref.	1.80 ref.	4.83 ref.
	typ	6.6	5.3	0.7	2.3	6.1	0.5	1.5		0.50	2.5	1.0	0.6	1.30	0.08					
	min	6.3	5.1	0.3	2.1	5.9	0.4	1.3		0.45	2.7	0.8	0.6	1.00	0.0					
mil	max	264	217	31	98	248	24	71	90 TYPICAL	22	122	47	39	69	4	71 TYPICAL	51 TYPICAL	124 ref.	71 ref.	190 ref.
	typ	260	209	28	90	240	20	59		20	98	39	24	51	3					
	min	248	201	12	83	232	16	51		18	106	31	24	55	0					

### MARKING DIAGRAM



- Unmarkable Surfacea
- Marking Composition Field
- A: Marking Area
- B: Lot Code
- C: Additional Information
- D: Date Code (YWW)
- Y: Years(0~9)
- WW: Week



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