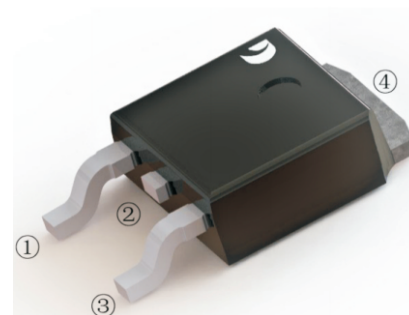


9A, 200V N-CHANNEL POWER MOSFET

TO-252W

DESCRIPTION

The D9N20 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.



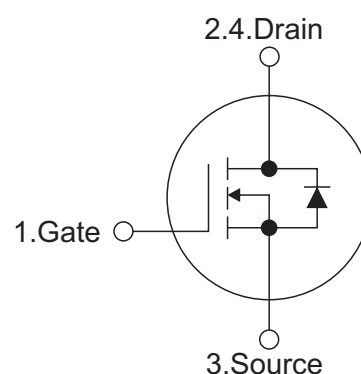
Features

- $R_{DS(ON)} \leq 0.4 \Omega @ V_{GS}=10V, I_D=4.5A$
- 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}	200	V
Gate-Source Voltage	V_{GSS}	± 30	V
Continuous Drain Current	I_D	9	A
Pulsed Drain Current (Note 2)	I_{DM}	36	A
Avalanche Energy Single Pulsed (Note 3)	E_{AS}	180	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	2.1	V/ns
Power Dissipation	P_D	74	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. $L = 1mH, V_{DD} = 50V, R_G = 20 \Omega$, Starting $T_J = 25^\circ C$

4. $ISD \leq 9A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, 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}	2.31	°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)

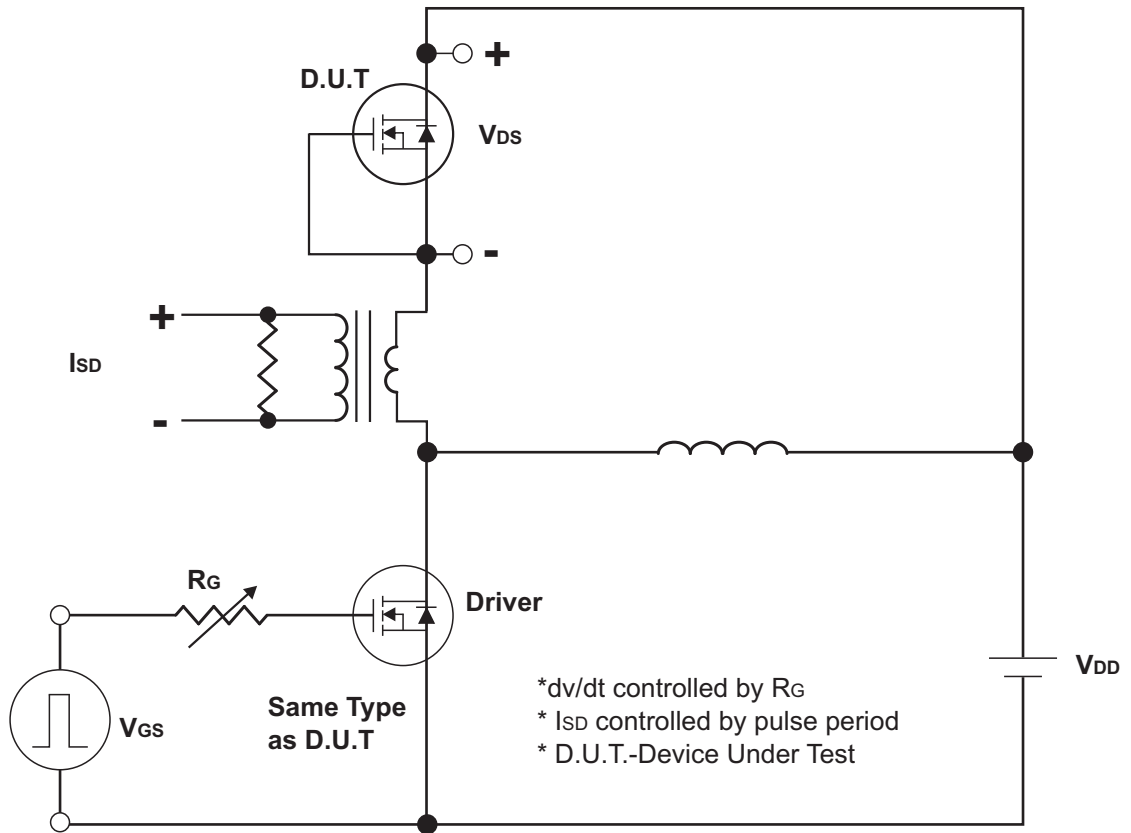
PARAMETER		Symbols	TEST CONDITIONS	Min	Typ	Max	Units	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{DS}=0V, I_D=250\mu A$	200			V	
Drain-Source Leakage Current		I_{DSS}	$V_{DS}=200V, V_{GS}=0V$			120	nA	
Gate- Source Leakage Current	Forward	I_{GSS}	$V_{GS}=30V, V_{DS}=0V$			100	nA	
	Reverse		$V_{GS}=-30V, V_{DS}=0V$			-100		
ON CHARACTERISTICS								
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.8		2	V	
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=4.5A$		0.36	0.38	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C_{ISS}	$V_{DS}=25V,$ $V_{GS}=0V,$ $f=1.0MHz$		1000		pF	
Output Capacitance		C_{OSS}				90		pF
Reverse Transfer Capacitance		C_{RSS}				12		pF
SWITCHING CHARACTERISTICS								
Total Gate Charge (Note 1)		Q_G	$V_{DS}=160V, V_{GS}=10V,$ $I_D=9A, I_G=1mA$ (NOTE1,2)		31		nC	
Gate-Source Charge		Q_{GS}				3.3		nC
Gate-Drain Charge		Q_{GD}				16.5		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	$V_{DS}=100V, V_{GS}=10V,$ $I_D=9A, R_G=20\Omega$ (NOTE1,2)		35		ns	
Turn-On Rise Time		t_R				20		ns
Turn-Off Delay Time		$t_{D(OFF)}$				150		ns
Turn-Off Fall Time		t_F				36		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS								
Maximum Body-Diode Continuous Current		I_S				9	A	
Maximum Body-Diode Pulsed Current		I_{SM}				36	A	
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	$I_S=9A, V_{GS}=0V$			1.4	V	
Reverse Recovery Time (Note 1)		t_{rr}	$I_S=9A, V_{GS}=0V,$			370	ns	
Reverse Recovery Charge		Q_{rr}	$di/dt=100A/\mu s$			0.95	μC	

Notes:

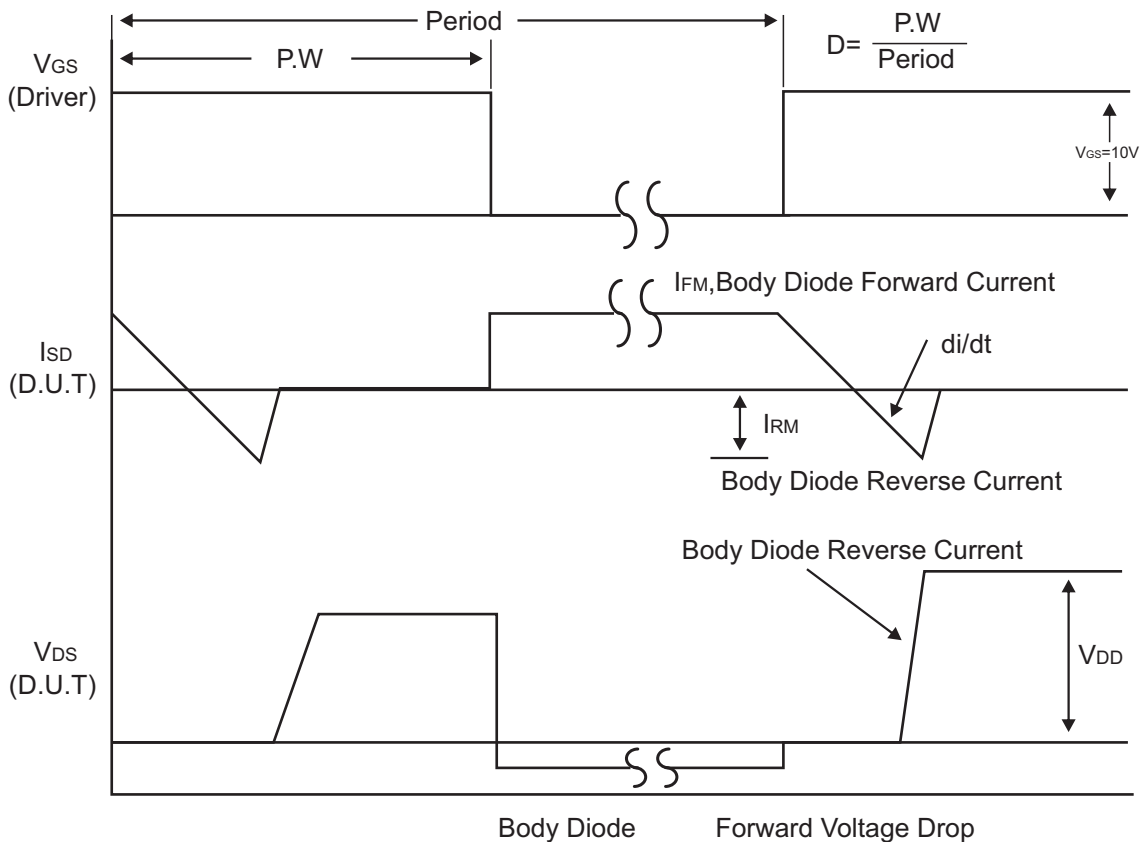
1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.



Test Circuits and waveforms



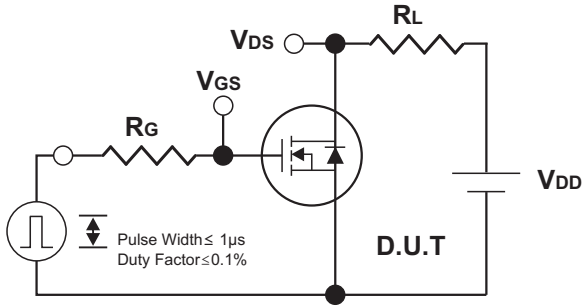
Peak Diode Recovery dv/dt Test Circuit



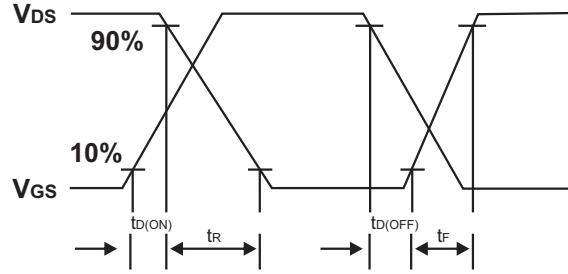
Peak Diode Recovery dv/dt Waveforms



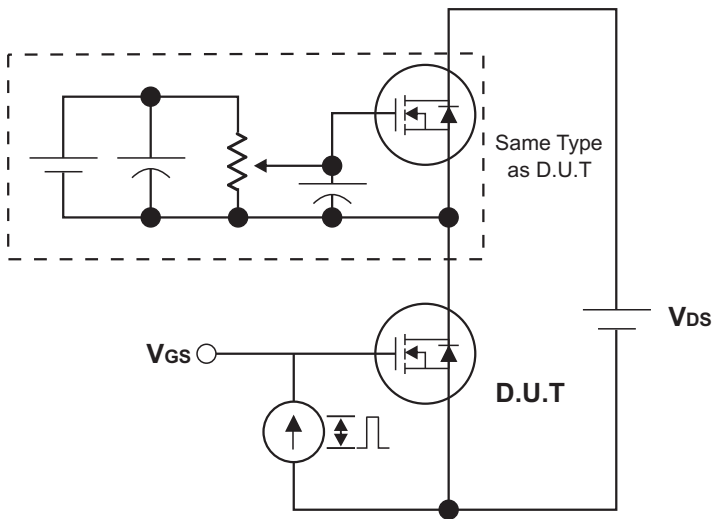
Test Circuits and waveforms



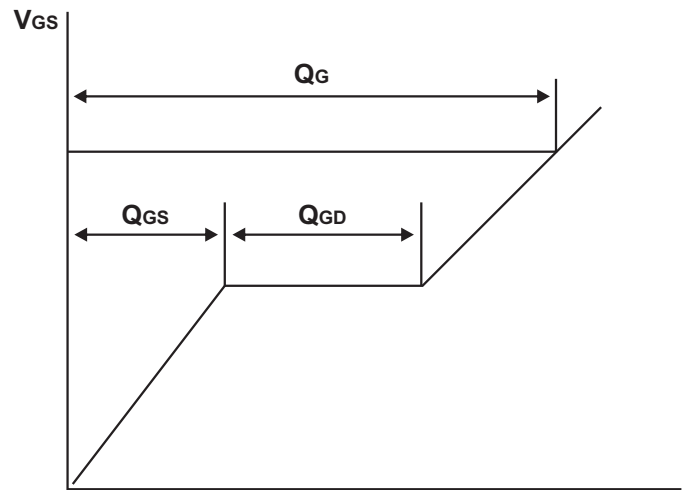
Switching Test Circuit



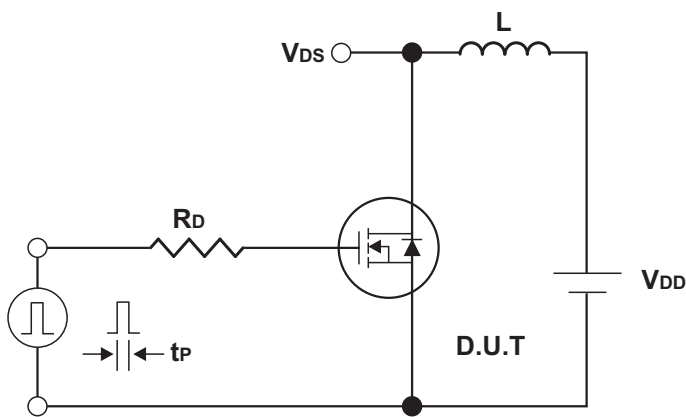
Switching Waveforms



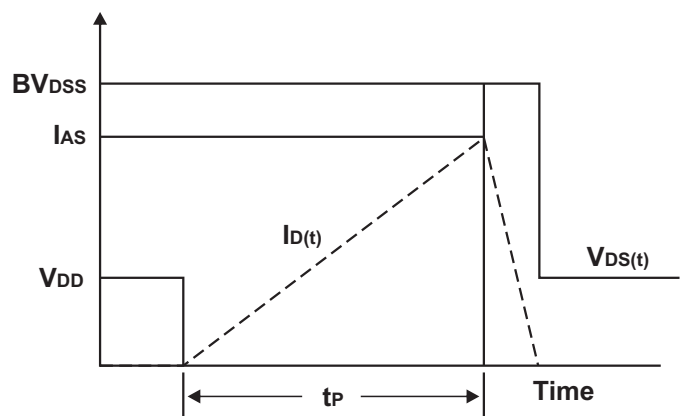
Gate Charge Test Circuit



Charge
Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



Typical Characteristics

Fig.1 Drain Current vs. Gate-Source Voltage

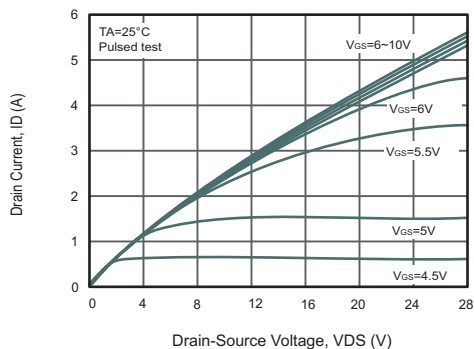


Fig.2 Drain-Source On-Resistance vs. Gate-Source Voltage

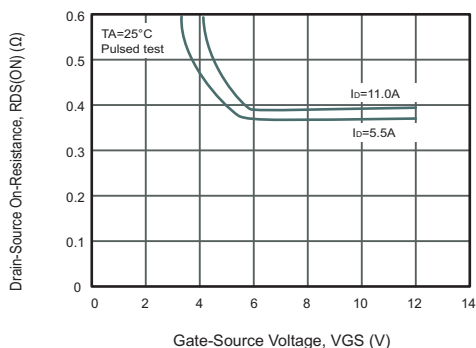


Fig.3 Gate Charge Characteristics

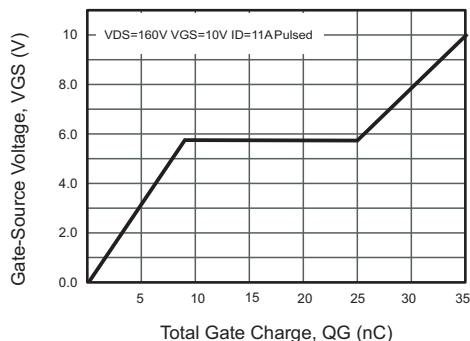


Fig.4 Capacitance Characteristics

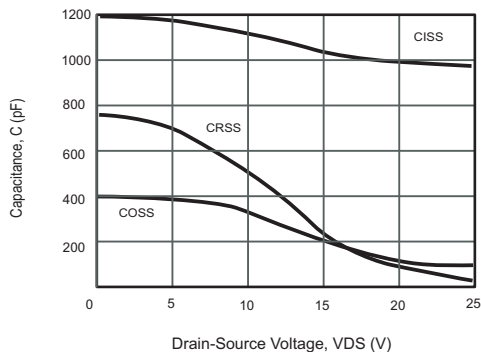


Fig.5 Drain-Source On-Resistance vs. Junction Temperature

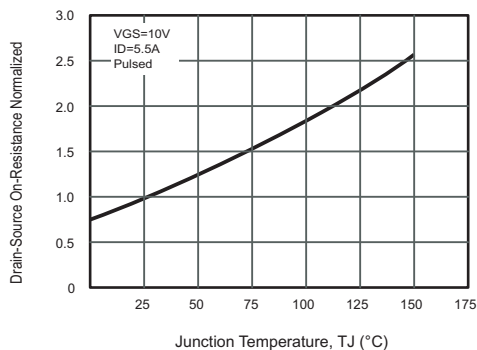


Fig.6 Breakdown Voltage vs. Junction Temperature

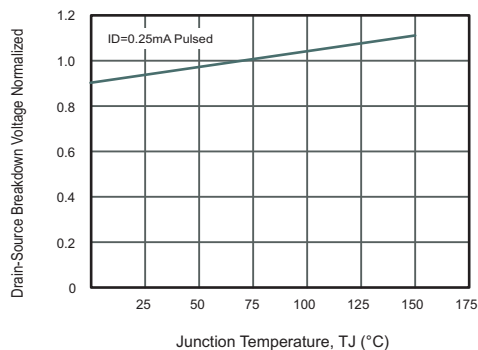


Fig.7 Gate Threshold Voltage vs. Junction Temperature

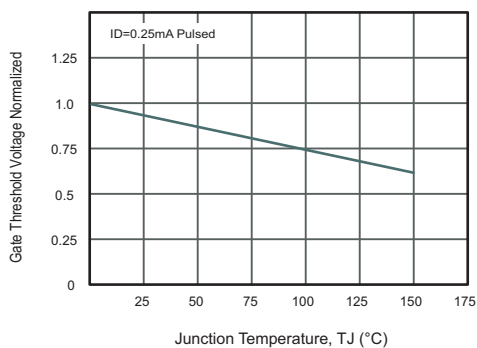
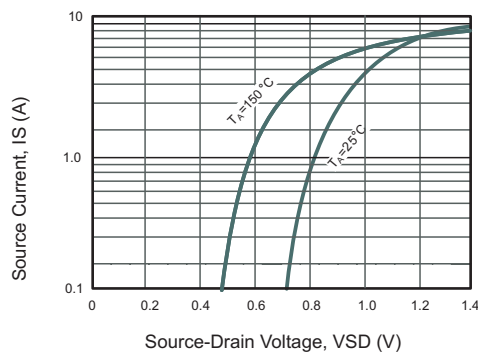


Fig.8 Source Current vs. Source-Drain Voltage





Typical Characteristics

Fig.9 Drain Current vs. Gate-Source Voltage

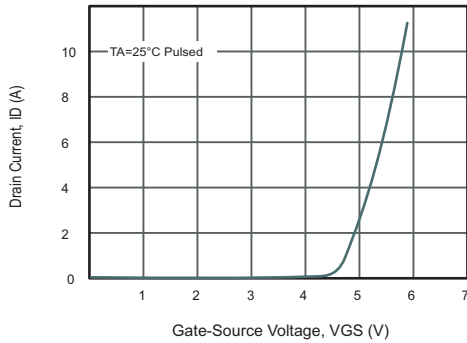


Fig.10 Drain-Source On-Resistance vs. Drain Current

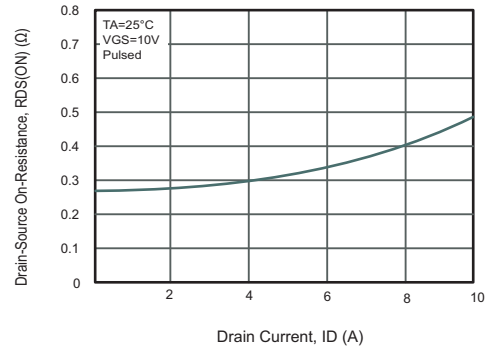


Fig.11 Drain Current vs. Junction Temperature

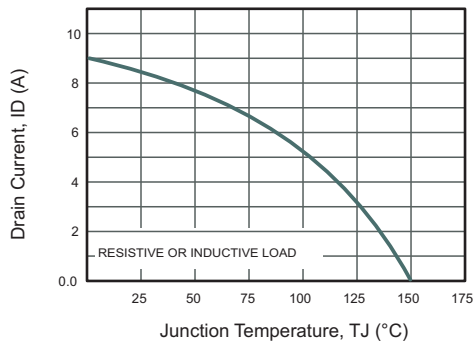


Fig.12 Power Dissipation vs. Junction Temperature

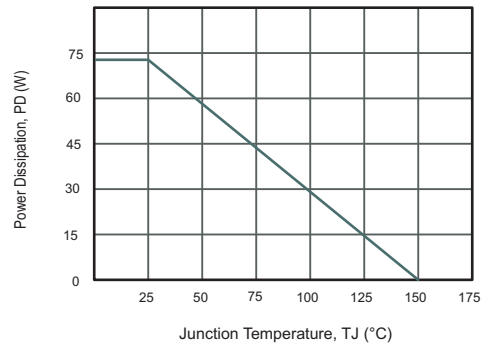
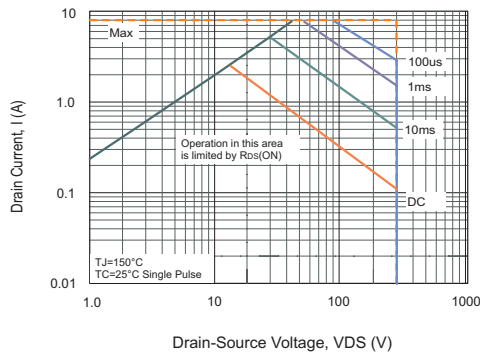
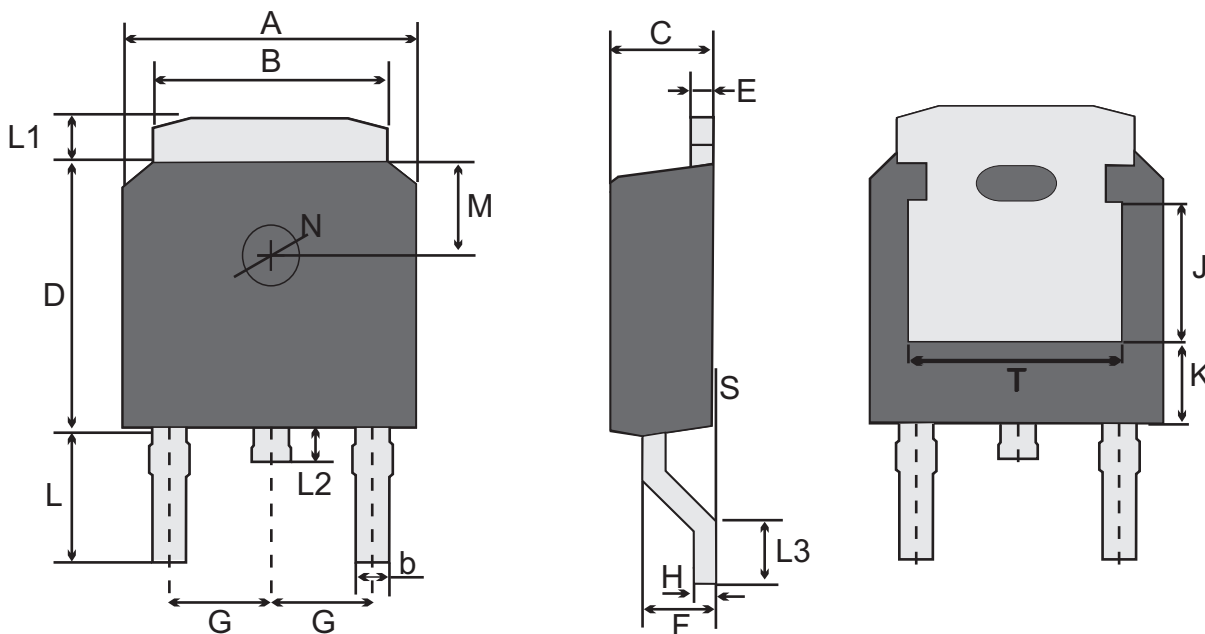


Fig.13 Safe Operating Area





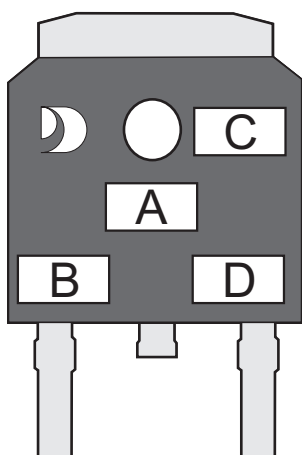
TO-252W(D-PAK) Package Outline Dimensions



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	2.8	1.0	0.8	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	110	39	31	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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