



## 12A650V N-CHANNEL POWER MOSFET

TO-252W(Prefix :D)

### Description

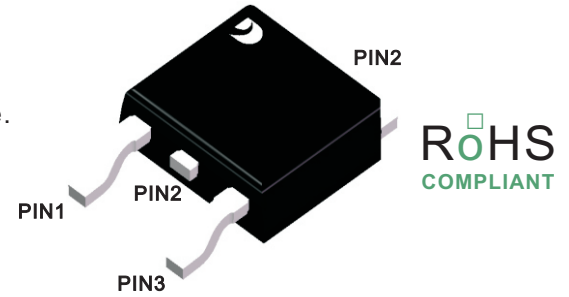
The power MOSFET using advanced **super junction** technology that can realize very low on-resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of Low EMI to designers as well as low switching loss.

### Features

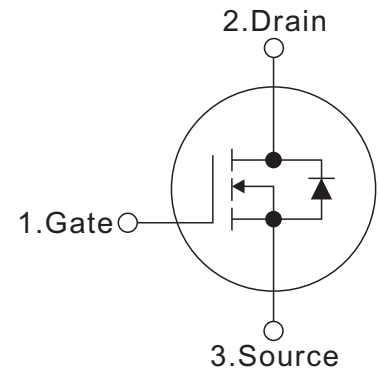
- $R_{DS(ON)} \leq 0.36 \Omega @ V_{GS}=10V, I_D=6A$
- Fast switching capability
- Low On-Resistance

### Mechanical data

- Case: TO-252W
- pprox. Weight: 0.329g (0.012oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".



### SYMBOL



### Packing Marking And Ordering Information

Device Package	Device	Marking	Packing Type	QTY Per Reel	Inner box	Per Carton
TO-252W	D65R360TM	D65R360TM	Reel	2,500 Pcs	5,000 Pcs	25,000 Pcs

### 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 $T_c=25^\circ C$ $T_c=100^\circ C$	$I_D$	12 9	A
Pulsed Drain Current (Note 2)	$I_{DM}$	45	A
Avalanche Energy Single Pulsed (Note 3)	$E_{AS}$	125	mJ
Power Dissipation ( $T_c = 25^\circ C$ )	$P_D$	55	W
Operating junction and storage temperature	$T_J, T_{STG}$	-55 ~ +150	$^\circ C$

### Thermal Resistance

Parameter	Symbols	Ratings	Units
Thermal resistance, junction – case.	$R_{thJC}$	2.3	$^\circ C/W$
Thermal resistance, junction – ambient(min. footprint)	$R_{thJA}$	63	$^\circ C/W$

#### 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.  $I_{AS}=5A, L=10mH, V_{DD}=50V, R_G=25\Omega, \text{Starting } T_J=25^\circ C$



Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)

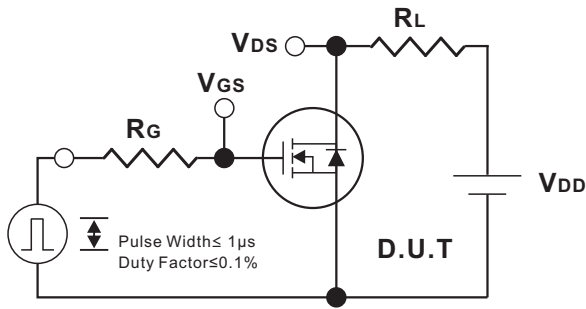
Parameter	Symbols	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	650			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$			1	$\mu A$
Gate- Source Leakage Current	Forward	$I_{GSS}$			100	$nA$
	Reverse				-100	
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=6A$		0.29	0.36	$\Omega$
Transconductance	$g_{fs}$	$V_{DS}=20V, I_D=6A$		3.8		S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V,$ $V_{GS}=0V,$ $f=1.0MHz$		565		$pF$
Output Capacitance	$C_{OSS}$			1098		$pF$
Reverse Transfer Capacitance	$C_{RSS}$			55		$pF$
Gate resistance	$R_G$			19		$\Omega$
<b>Switching Characteristics</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=640V, V_{GS}=10V,$ $I_D=12A$ (NOTE1,2)		23		$nC$
Gate-Source Charge	$Q_{GS}$			6.7		$nC$
Gate-Drain Charge	$Q_{GD}$			5.5		$nC$
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DS}=400V, I_D=6A$ $R_G=10\Omega, V_{GS}=10V$ (NOTE1,2)		21		ns
Turn-On Rise Time	$t_R$			32		ns
Turn-Off Delay Time	$t_{D(OFF)}$			102		ns
Turn-Off Fall Time	$t_F$			32		ns
<b>Drain-Source Diode Characteristics And Maximum Ratings</b>						
Maximum Body-Diode Continuous Current	$I_S$				12	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_{SD}=12A, V_{GS}=0V$			1.2	V
Reverse Recovery Time (Note 1)	$t_{rr}$	$I_F=12A$ $di/dt=200A/\mu s$		260		ns
Reverse Recovery Charge	$Q_{rr}$				3.3	

Notes:

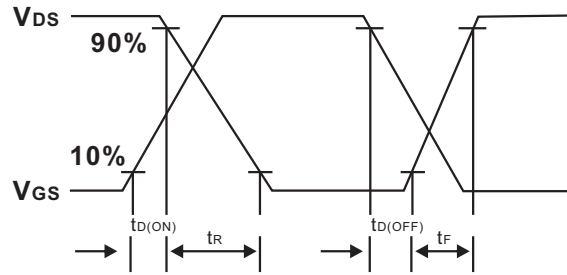
1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .
2. Essentially independent of operating temperature.



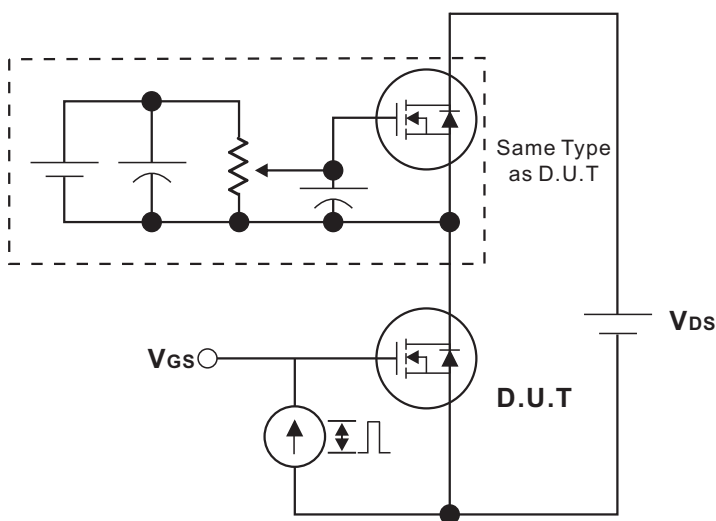
Test Circuits and waveforms



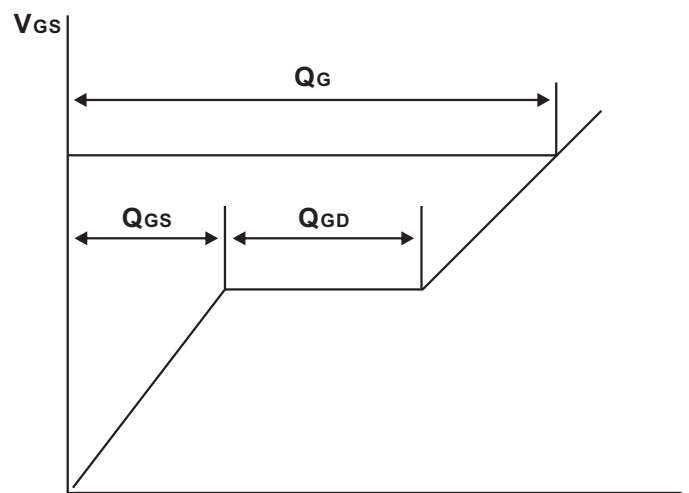
Switching Test Circuit



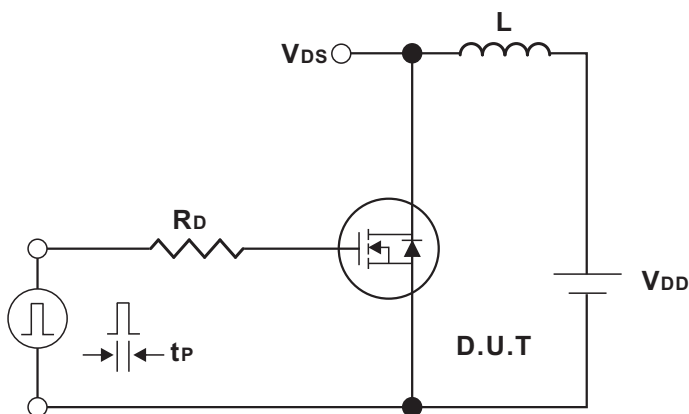
Switching Waveforms



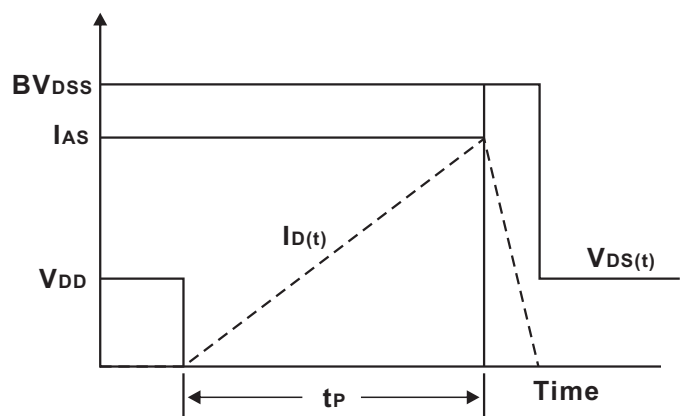
Gate Charge Test Circuit



Charge  
Gate Charge Waveform



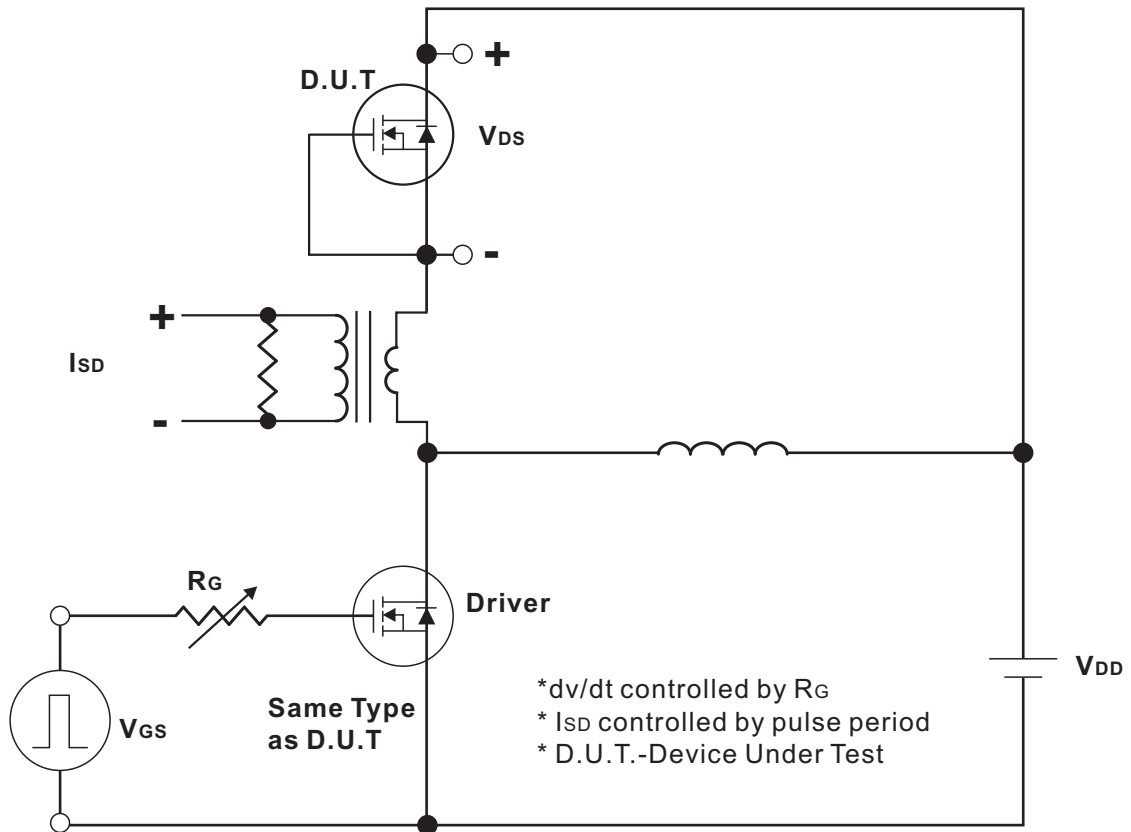
Unclamped Inductive Switching Test Circuit



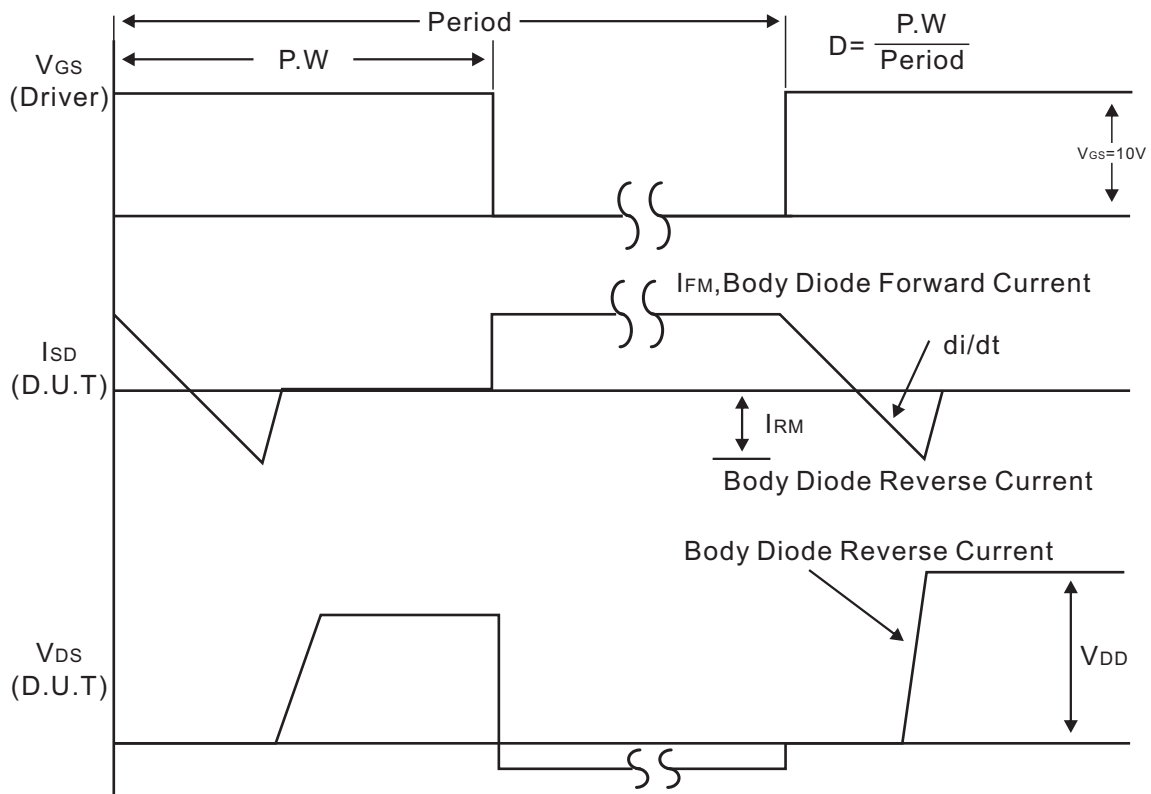
Unclamped Inductive Switching Waveforms



Test Circuits and waveforms



Peak Diode Recovery dv/dt Test Circuit



Body Diode Forward Voltage Drop  
Peak Diode Recovery dv/dt Waveforms



### Typical Characteristics

Fig.1 Output characteristics

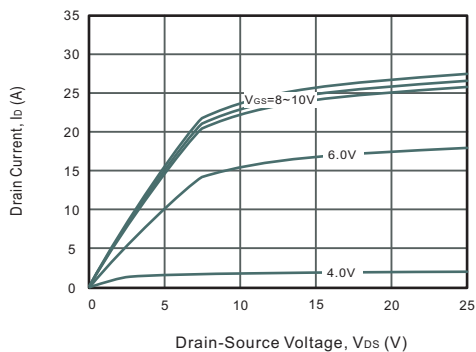


Fig.2 Power Dissipation

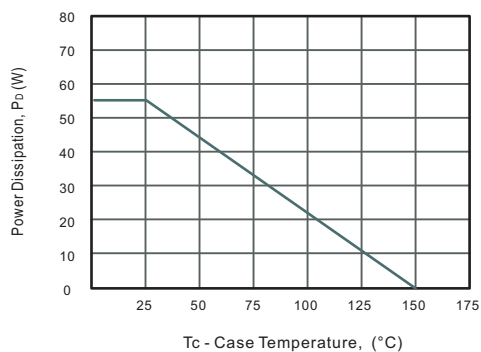


Fig.3 Drain Current Derating

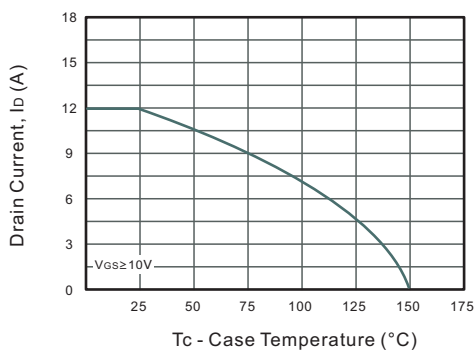


Fig.4 Drain-Source On-Resistance vs. Drain Current

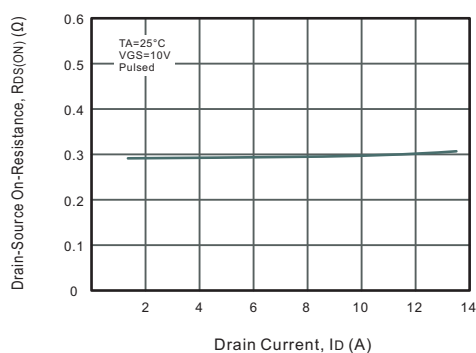


Fig.5 Gate Threshold Voltage vs. Junction Temperature

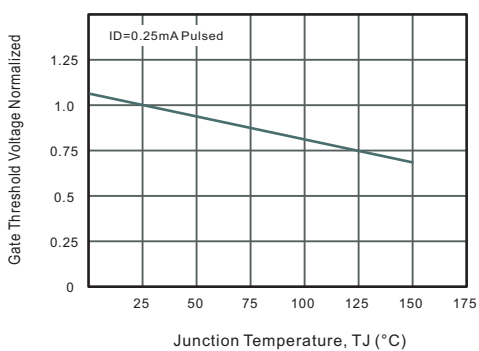


Fig.6 Body-diode Forward Characteristics

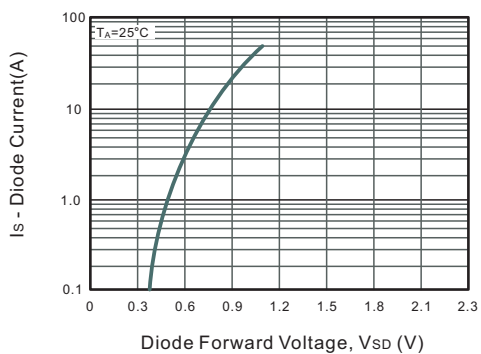


Fig.7 Drain-Source On-Resistance vs. Junction Temperature

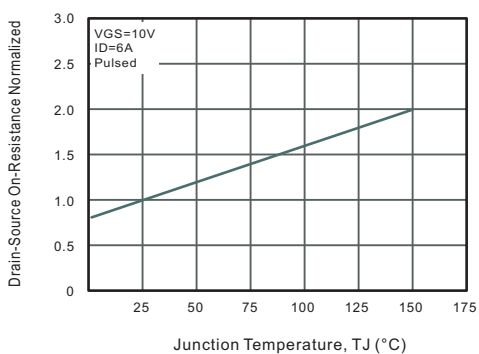
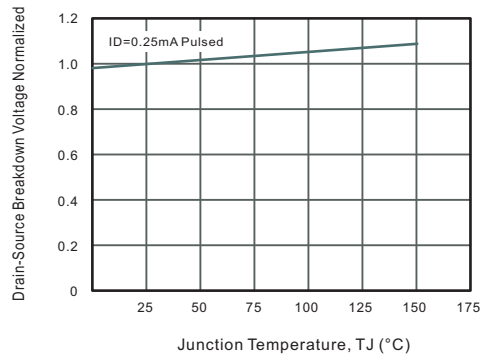


Fig.8 Breakdown Voltage vs. Junction Temperature





### Typical Characteristics

Fig.9 Capacitance Characteristics

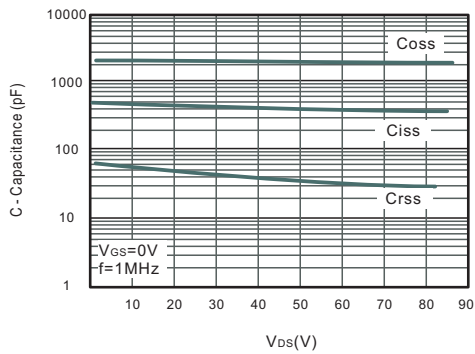


Fig.10 Gate Charge Characteristics

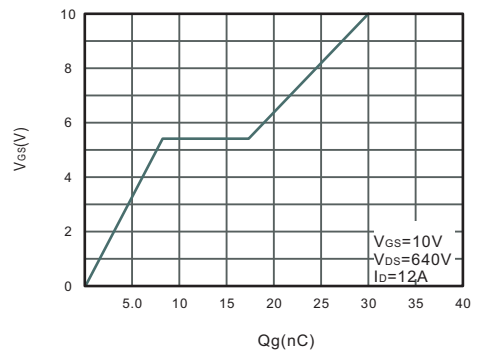


Fig.11 Safe Operating Area

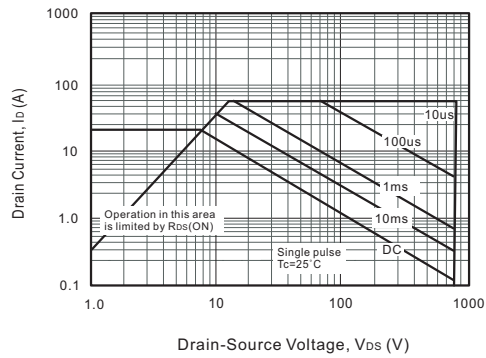
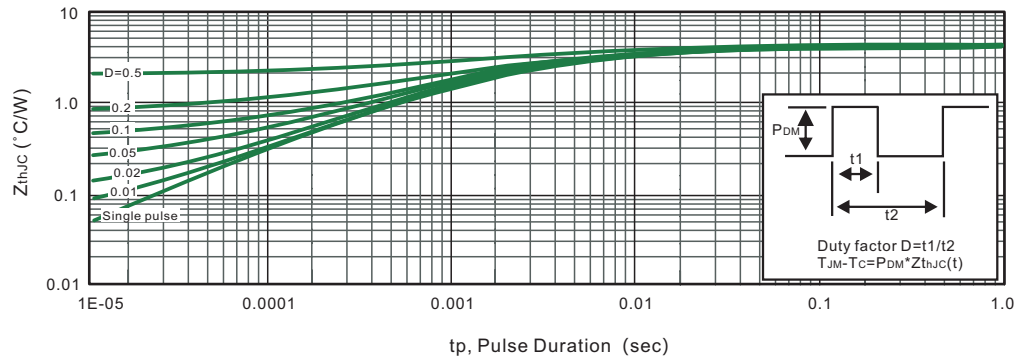
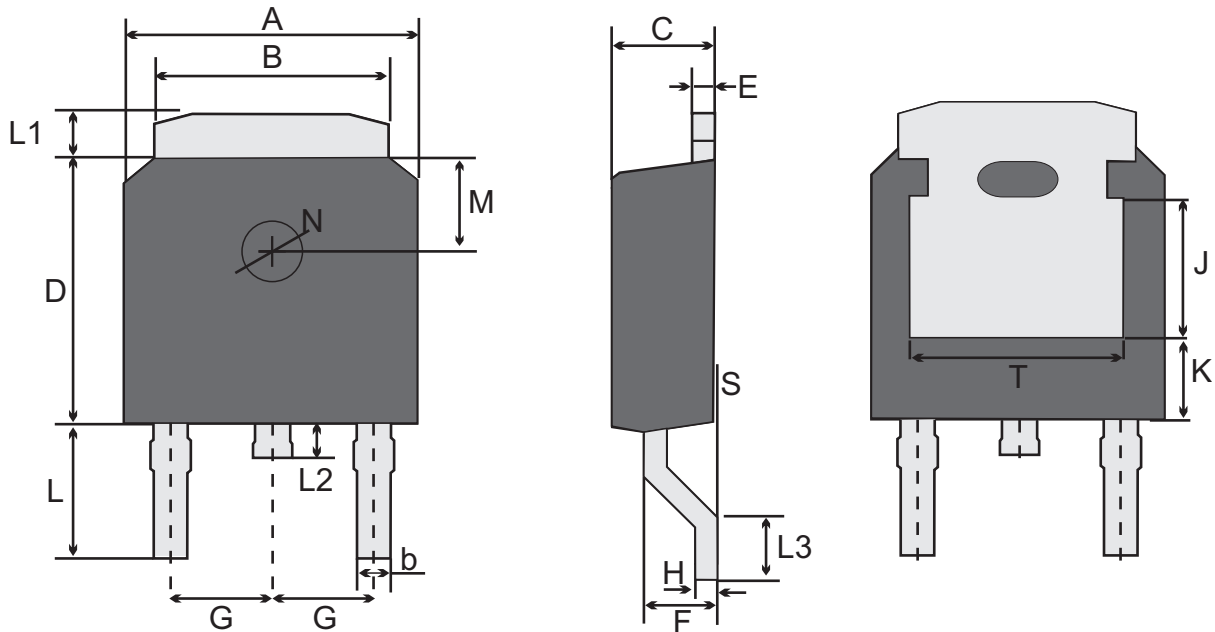


Fig.12 Max. Transient Thermal Impedance





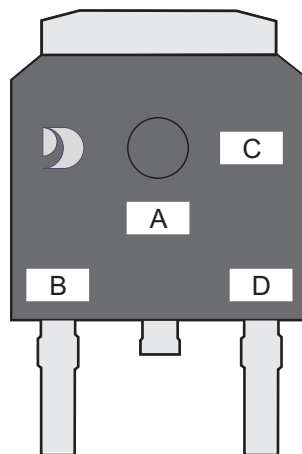
TO-252W(D-PAK) Package Outline Dimensions



TO-252W(D-PAK) Mechanical data

UNIT		A	B	b	C	D	E	F	G	H	L	L1	L2	L3	S	M	N	J	T	K
mm	max	6.7	5.53	0.86	2.5	6.3	0.61	1.87	2.3 typ.	0.55	3.0	1.2	1.0	1.75	0.23	1.8 typ.	1.3 typ.	3.2 ref.	4.83 ref.	1.8 ref.
	typ	6.6	5.33	0.76	2.3	6.1	0.51	1.57		0.50	2.8	1.0	0.8	1.30	0.15					
	min	6.3	5.13	0.66	2.1	5.9	0.41	1.27		0.45	2.6	0.8	0.6	1.0	/					
mil	max	264	218	34	98	248	24	74	91 typ.	22	118	47	39	69	9.1	71 typ.	51 typ.	126 ref.	190 ref.	71 ref.
	typ	260	210	30	91	240	20	62		20	110	39	31	51	5.9					
	min	248	202	26	83	232	16	50		18	102	31	24	39	/					

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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