

## -40A,-40V P-CHANNEL POWER MOSFET

### Description

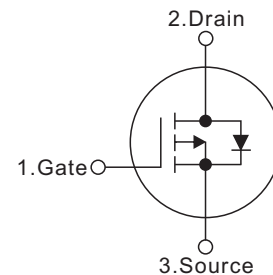
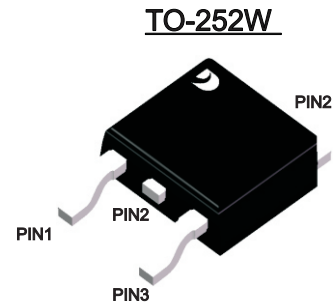
The Modle uses advanced trench technology and design to provide excellent RDS(on) with low gate charge. It can be used in a wide variety of applications.

### Features

- RDS(ON) < 13mΩ @ VGS=-10V, ID=-20A
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

### Mechanical data

- Case: TO-252W
- Approx. Weight: 0.33g ( 0.012oz)
- RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".



### Absolute Maximum Ratings (ta=25°C, Unless Otherwise Specified)

Parameter	Symbols	Ratings	Units
Drain-Source Voltage	V <sub>DSS</sub>	-40	V
Gate-Source Voltage	V <sub>GSS</sub>	±20	V
Continuous Drain Current	I <sub>D</sub>	-40 -26	A
Pulsed Drain Current Tc=25 °C	I <sub>DM</sub>	-160	A
Avalanche energy, single pulse(Note 1)	E <sub>AS</sub>	144	mJ
Power dissipation Tc=25 °C	P <sub>tot</sub>	41.6	W
Operating junction and storage temperature	T <sub>j</sub> ,T <sub>stg</sub>	-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 = 0.5mH, VDD = 50V, RG = 25 Ω, Starting T<sub>J</sub> = 25°C

### Thermal Resistance

Parameter	Symbols	Ratings	Units
Thermal resistance, junction – case.	R <sub>thJC</sub>	1.2	°C/W
Thermal resistance, junction – ambient(min. footprint)	R <sub>thJA</sub>	63	°C/W



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

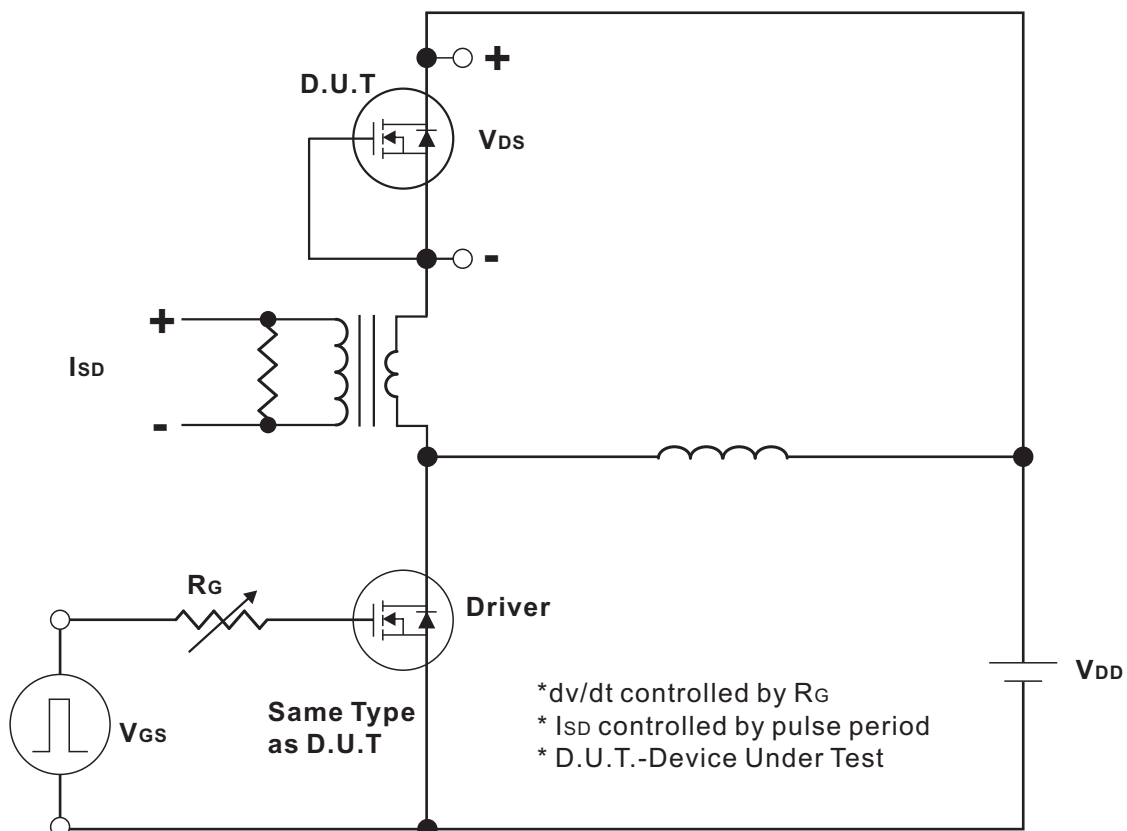
Parameter	Symbols	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-40			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V$			-1.0	$\mu A$
Gate- Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0		-2.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-20A$		10	13	m $\Omega$
Transconductance	$g_{fs}$	$V_{DS}=-10V, I_D=-10A$		40		S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=-25V,$		2700		pF
Output Capacitance	$C_{OSS}$	$V_{GS}=0V,$		350		pF
Reverse Transfer Capacitance	$C_{RSS}$	$f=1.0MHz$		256		pF
Gate resistance	$R_G$			3		$\Omega$
<b>Switching Characteristics</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=-20V, V_{GS}=-10V,$		42		nC
Gate-Source Charge	$Q_{GS}$	$I_D=-20A(NOTE 1,2)$		7.3		nC
Gate-Drain Charge	$Q_{GD}$			8.5		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DS}=-20V, V_{GS}=-10V,$		10		ns
Turn-On Rise Time	$t_R$	$R_G=3\Omega, I_D=-20A$		21		ns
Turn-Off Delay Time	$t_{D(OFF)}$	(NOTE 1,2)		53		ns
Turn-Off Fall Time	$t_F$			29		ns
<b>Drain-source Diode Characteristics And Maximum Ratings</b>						
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_{SD}=-20A, V_{GS}=0V$			1.2	V
Diode continuous forward current	$I_S$				-45	A
Reverse Recovery time	$t_{rr}$	$V_{GS}=-200V, I_{SD}=-20A$		8		nS
Reverse Recovery Charge	$Q_{rr}$	$di/dt=200A/\mu s$		165		nC

Notes:

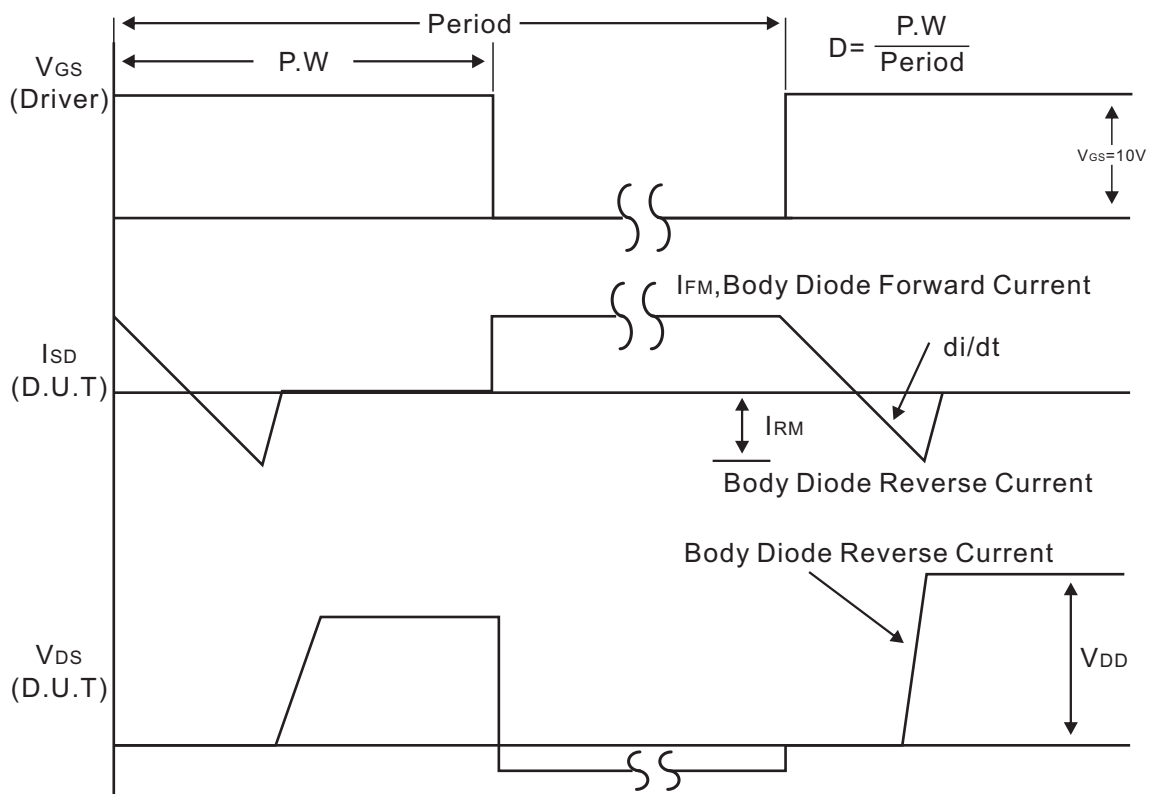
1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .
2. Essentially independent of operating temperature.



### Test Circuits and waveforms



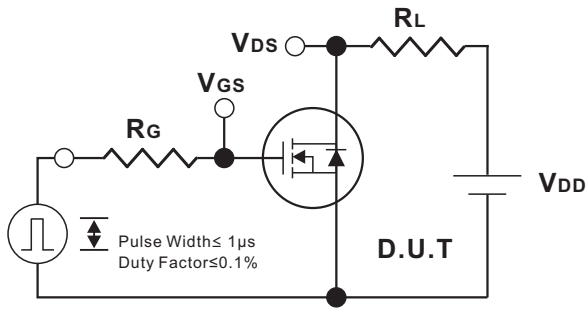
Peak Diode Recovery dv/dt Test Circuit



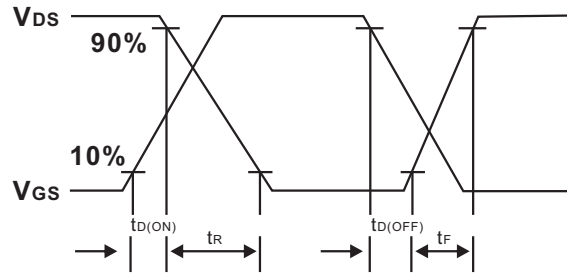
Peak Diode Recovery dv/dt Waveforms



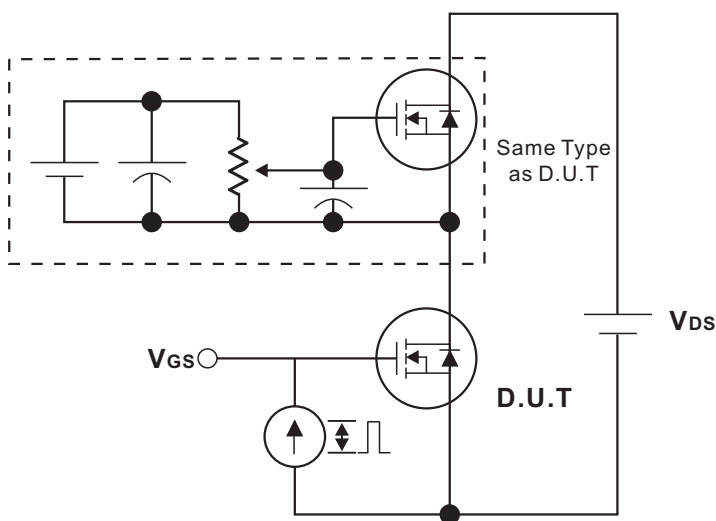
### Test Circuits and waveforms



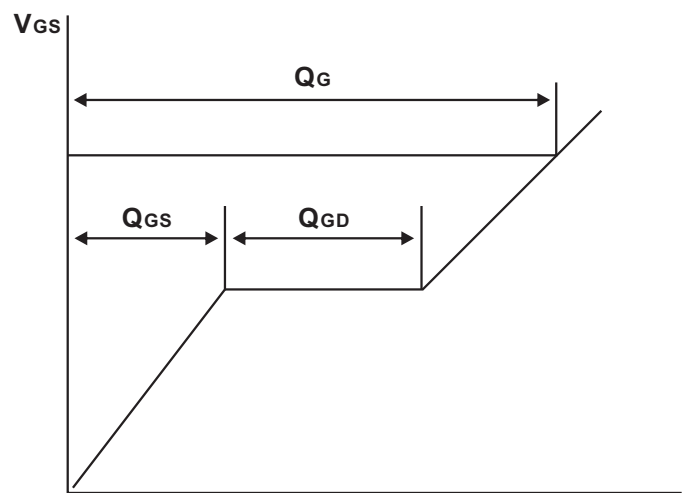
Switching Test Circuit



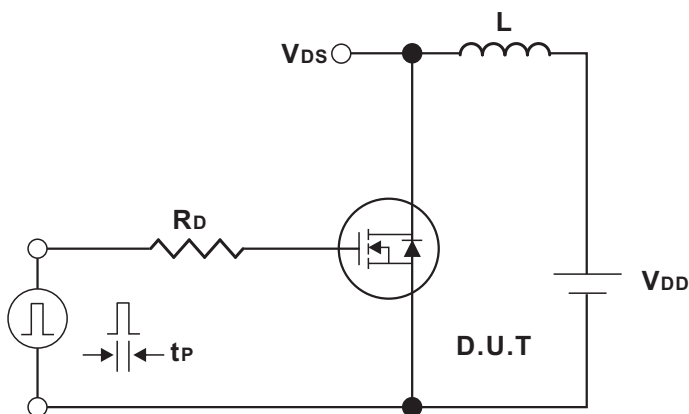
Switching Waveforms



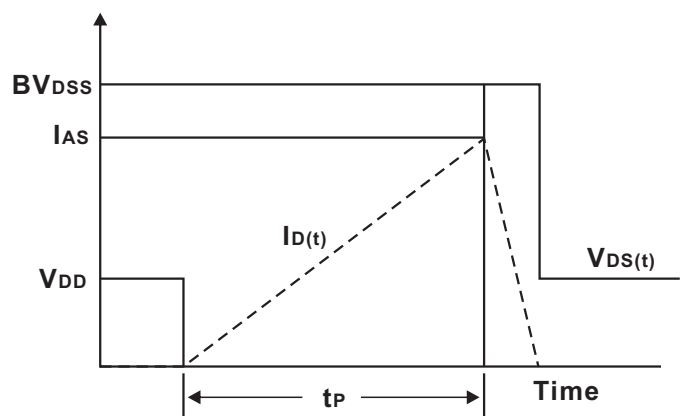
Gate Charge Test Circuit



Charge  
Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



### Typical Characteristics

Fig.1 Output characteristics

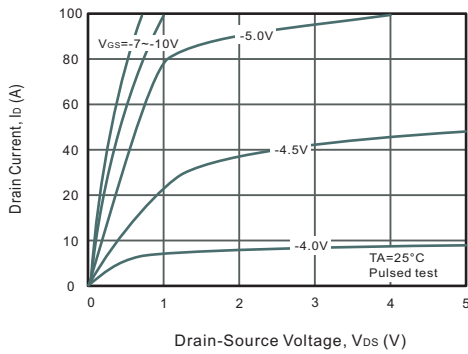


Fig.2 Power Dissipation

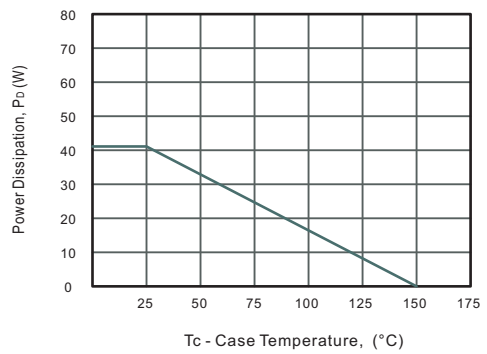


Fig.3 Drain Current Derating

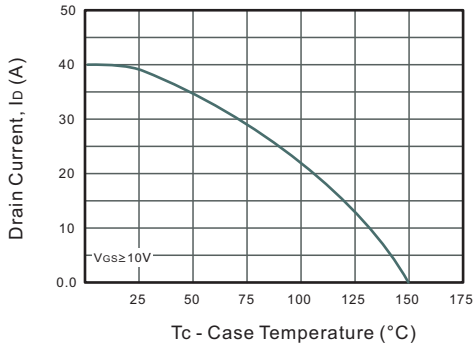


Fig.4 Drain-Source On-Resistance vs. Drain Current

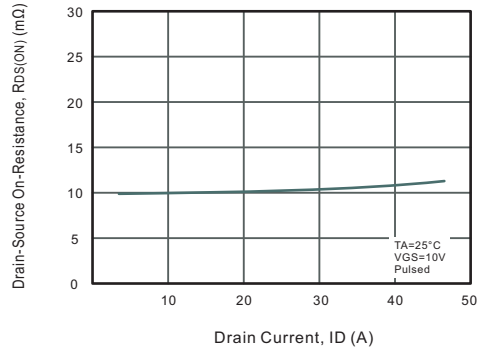


Fig.5 Gate Threshold Voltage vs. Junction Temperature

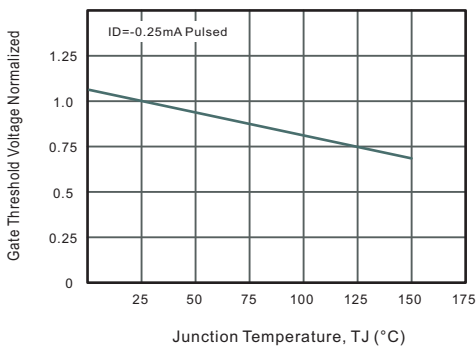


Fig.6 Body-diode Forward Characteristics

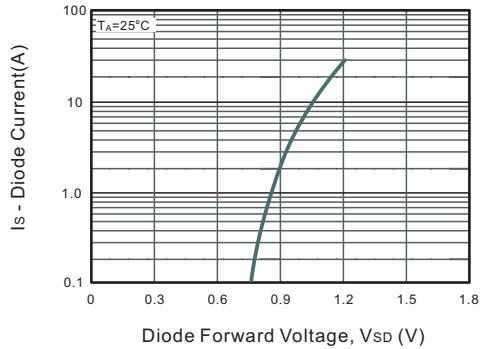


Fig.7 Drain-Source On-Resistance vs. Junction Temperature

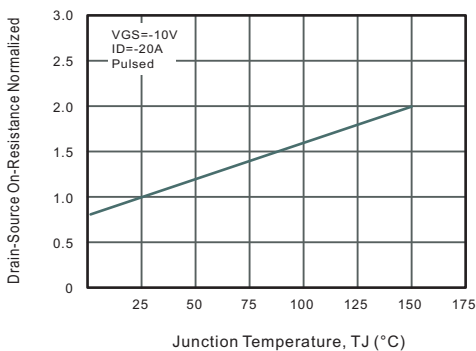
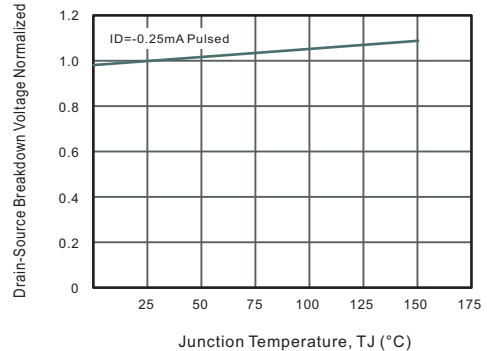


Fig.8 Breakdown Voltage vs. Junction Temperature





### Typical Characteristics

Fig.9 Capacitance Characteristics

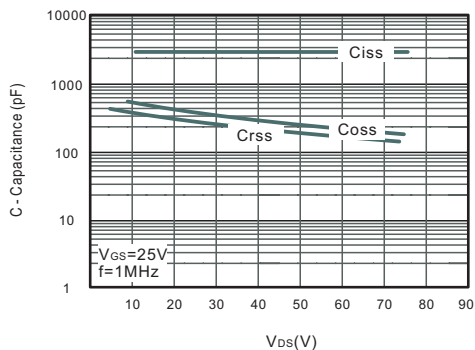


Fig.10 Gate Charge Characteristics

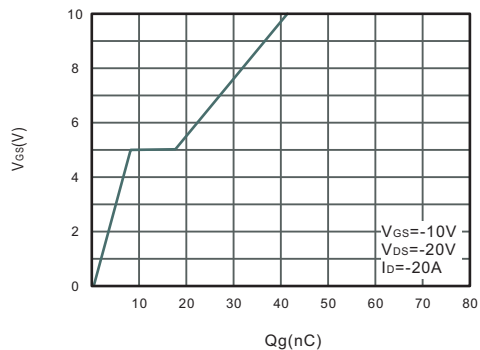


Fig.11 Safe Operating Area

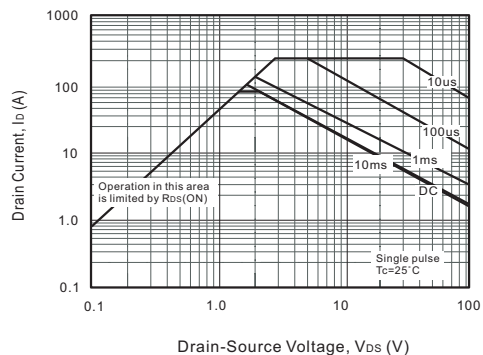
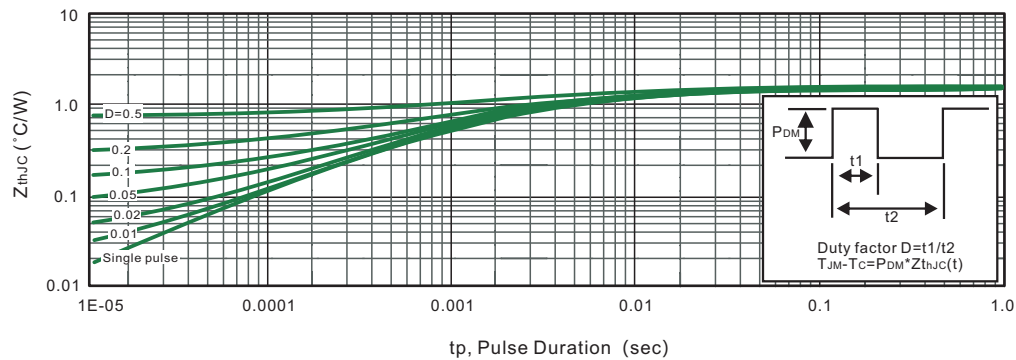
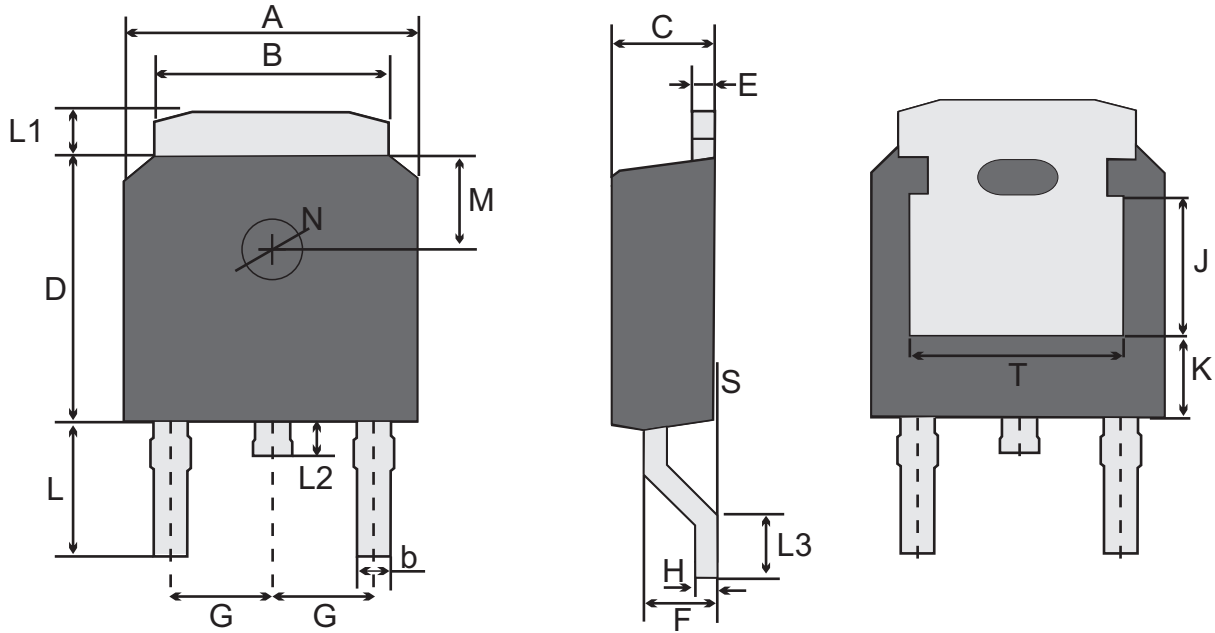


Fig.12 Max. Transient Thermal Impedance





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**

Type number	Marking code
D10RP40R	D10RP40R



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