

## N-Channel MOSFET 650V, 7A, RDS(ON)<1.4

### General Description and Features

- Superior Avalanche Rugged Technology
- Robust Gate Oxide Technology
- Excellent Switching Characteristics
- Low Gate Charge
- Extended Safe Operating Area
- Lower RDS(ON): 1.13Ω(Typical) @ VGS = 10V
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant
- JEDEC Qualification



### ABSOLUTE MAXIMUM RATINGS (Ta=25 °C)

Symbol	Parameter	Value	Unit	
BV <sub>DSS</sub>	Drain-Source Voltage	650	V	
BV <sub>GSS</sub>	Gate-Source Voltage	±30	V	
I <sub>D</sub>	Drain Current continuous Tc=25°C	7	A	
I <sub>DM</sub>	Drain Current - pulse	28	A	
P <sub>D</sub>	Power Dissipation	Tc=25°C	57	W
		Derated above 25°C	0.37	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 ~ +150	°C	
T <sub>L</sub>	Maximum Lead Temperature for Soldering	260	°C	

### Thermal Characteristics

Symbol	Parameter	TO-251/TO-252	Unit
R <sub>θJC</sub>	Thermal Resistance ,Junction to Case	2.55	°C/W
R <sub>θJA</sub>	Thermal Resistance ,Junction to Ambient	62.5	°C/W

### Electrical Characteristics(Tc=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
<b>Off state characteristics</b>						
BV <sub>DSS</sub>	Drain to Source breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	650			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V, T <sub>c</sub> =25°C			1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V			±100	nA

On state characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	$I_D=250\mu A, V_{GS}=V_{DS}$	2.0		4.0	V
$R_{DS(on)}$	Drain to Source On-Resistance	$I_D=3.5A, V_{GS}=10V$		1.13	1.6	$\Omega$
$G_{fs}$	Forward Transconductance	$V_{DS}=15V, I_D=3.5A$		8		S
Dynamic characteristics						
$C_{iss}$	Input Capacitance	$V_{DS}=25V, V_{GS}=0V, f=1MHz$		1200	1600	pF
$C_{oss}$	Output Capacitance			100	150	pF
$C_{rss}$	Reverse Transfer Capacitance			18	24	pF
Switching characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=325V, I_D=7A$ $V_{GS}=10V, R_G=25\Omega$ (Note 1,2)		35	80	ns
$t_r$	Rise Time			79	165	ns
$t_{d(off)}$	Turn-Off Delay Time			80	160	ns
$t_f$	Fall Time			52	120	ns
$Q_g$	Total Gate Charge	$V_{DD}=520V, I_D=7A$ $V_{GS}=10V$ (Note 1,2)		30	—	nC
$Q_{gs}$	Gate to Emitter Charge			6.5	—	nC
$Q_{gd}$	Gate to Collector Charge			13	—	nC
Source Drain Diode Characteristics						
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				7	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current				28	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$I_S=7A, V_{GS}=0V$			1.4	V
$t_{rr}$	Diode Reverse Recovery Time	$I_S=7A, V_{GS}=0V$ $di/dt=100A/\mu S$		320		ns
$Q_{rr}$	Diode Reverse Recovery Charge				2.4	

Note:

1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

2. Essentially Independent of operating Temperature Typical Characteristics

## Ratings and Characteristic Curves

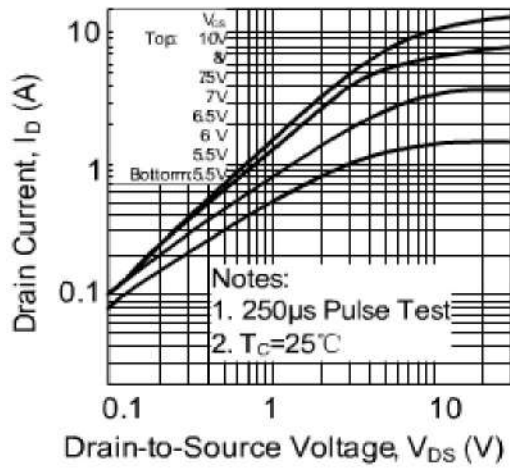


Fig.1 Output Characteristics

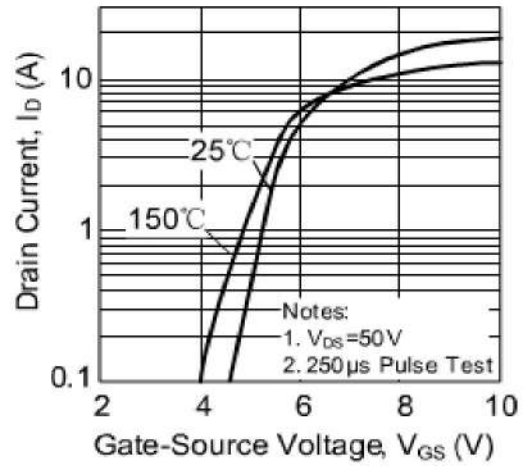


Fig.2 Transfer Characteristics

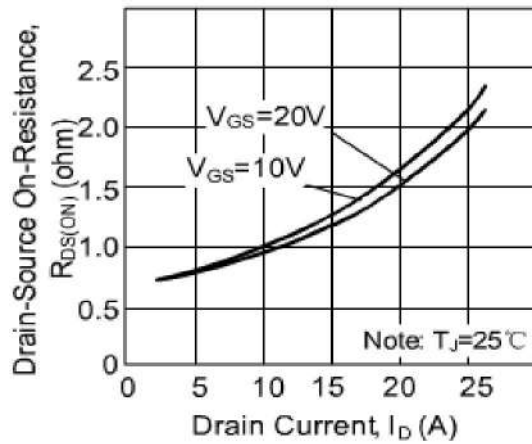


Fig.3 On-Resistance Variation vs. Drain Current and Gate Voltage

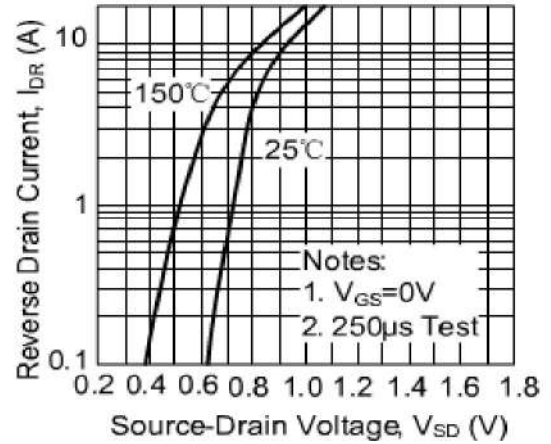


Fig.4 Body Diode Forward Voltage vs. Source Current and Temperature

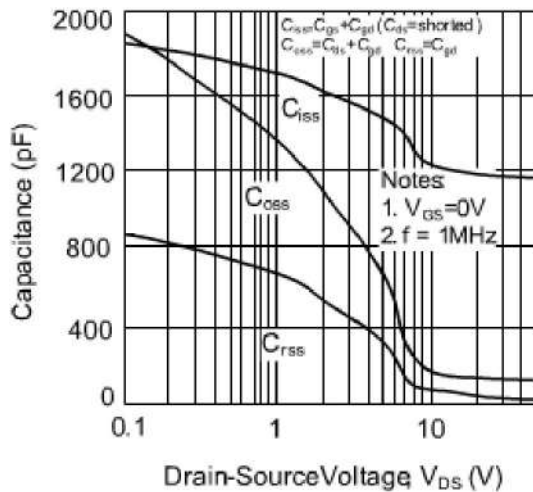


Fig.5 Capacitance Characteristics

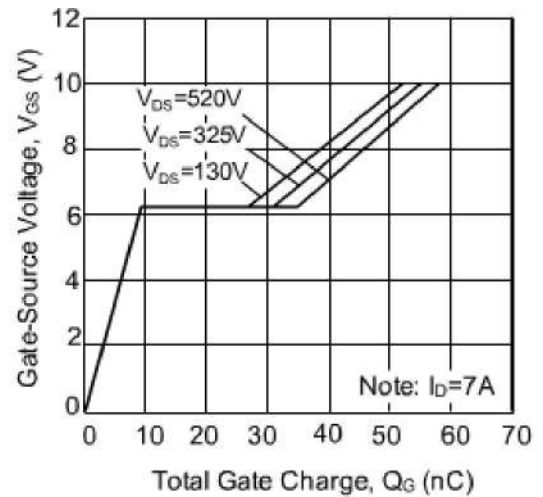


Fig.6 Gate Charge Characteristics

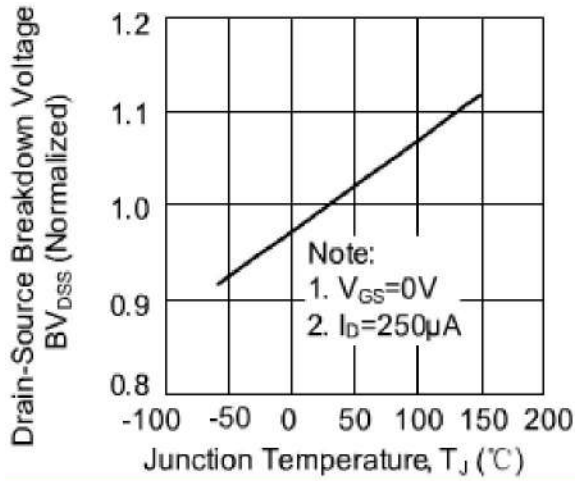


Fig.7 Breakdown Voltage Variation vs. Temperature

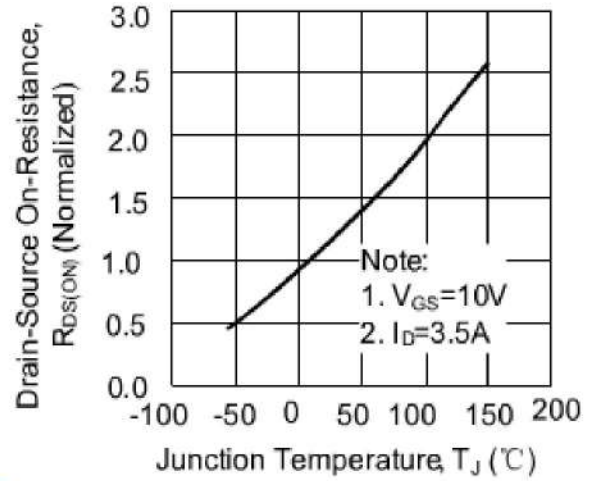


Fig.8 On-Resistance Variation vs. Temperature

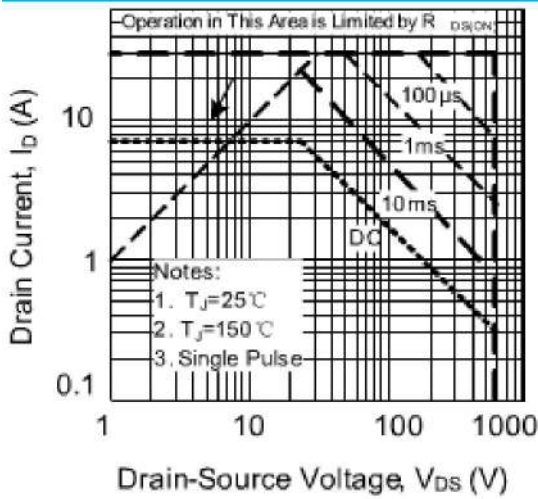


Fig.9 Maximum Safe Operating Area

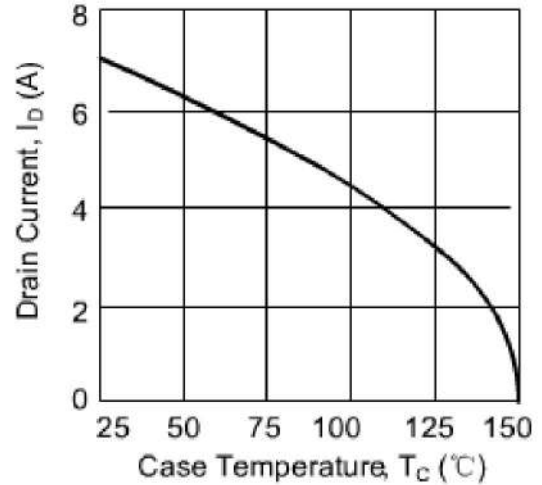


Fig.10 Maximum Drain Current vs. Case Temperature

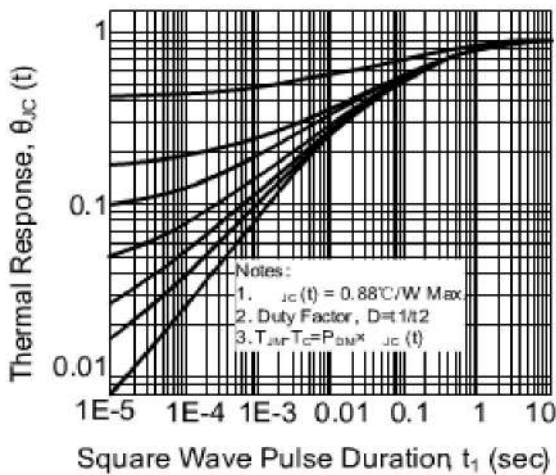
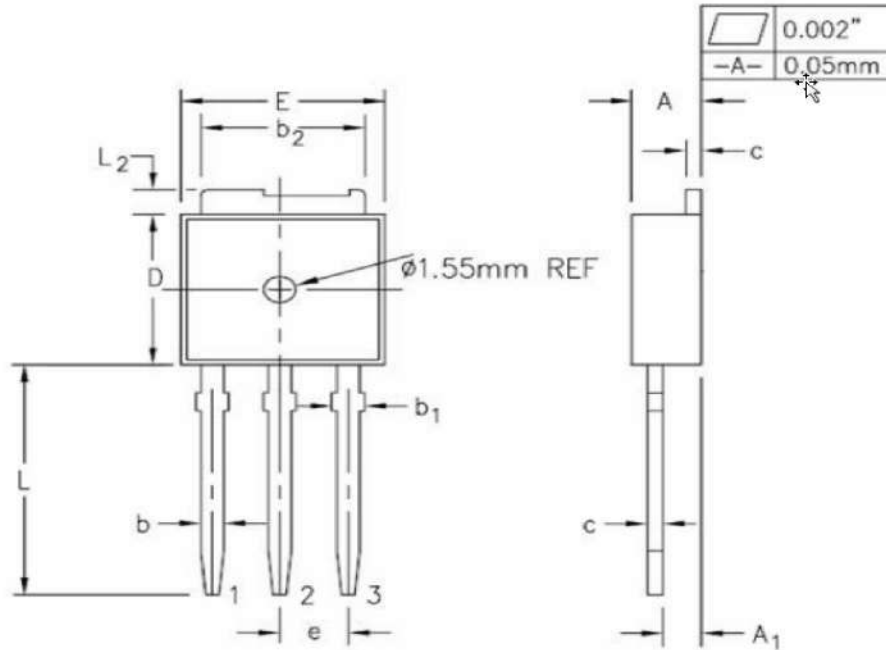


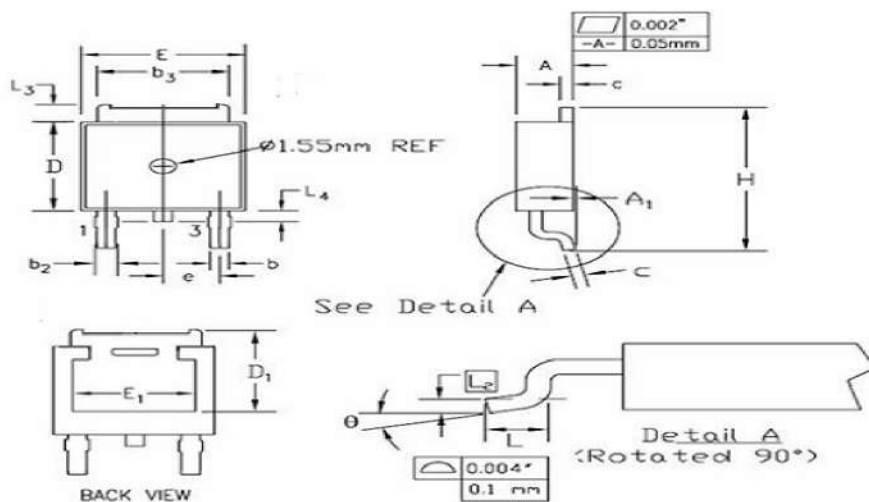
Fig.11 Transient Thermal Response Curve

### TO-251 POD



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.086	0.094	2.19	2.38	
A1	0.041	0.048	1.04	1.23	
b	0.025	0.035	0.64	0.89	
b1	0.027	0.039	0.69	0.92	
b2	0.206	0.216	5.23	5.48	
c	0.018	0.024	0.46	0.61	
D	0.241	0.249	6.12	6.32	
E	0.250	0.265	6.35	6.73	
e	0.090 TYP.		2.28 TYP.		
L	0.350	0.380	8.89	9.65	
L2	0.035	0.050	0.89	1.27	

### TO-252 POD



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.086	0.094	2.19	2.38	
A1	-	0.005	-	0.13	
b	0.025	0.035	0.64	0.89	
b2	0.033	0.045	0.84	1.14	
b3	0.205	0.215	5.21	5.46	
c	0.018	0.024	0.46	0.61	
D	0.241	0.249	6.12	6.32	
D1	0.205	-	5.21	-	
E	0.250	0.265	6.35	6.73	
E1	0.190	-	4.83	-	
e	0.090 BSC.		2.29 BSC.		
H	0.380	0.410	9.65	10.41	
L	0.055	0.070	1.40	1.78	
L2	0.020 BSC.		0.51 BSC.		
L3	0.035	0.050	0.89	1.27	
L4	0.025	0.040	0.64	1.01	
$\theta$	0°	8°	0°	8°	