MSN6504D

650V(D-S) N-Channel Enhancement Mode Power MOS FET

General Features

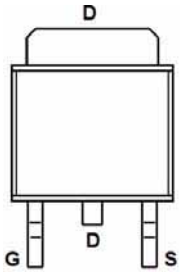
- V_{DS} =650V,I_D =4A
  $R_{DS(ON)}$ <2.5 Ω @ V_{GS}=10V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

RoHS Compliant

Lead Free

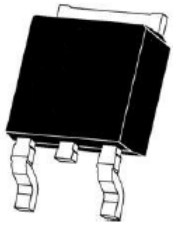
Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

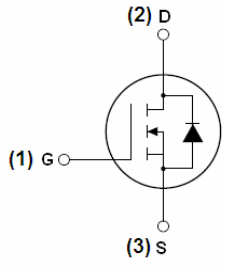


Marking and pin assignment

PIN Configuration



TO-252-2L top view



Schematic diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MSN6504D	MSN6504D	TO-252	-	-	2500PCS

Absolute Maximum Ratings (T_C=25℃unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	±30	V
Drain Current-Continuous	I_D	4	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	3.2	A
Pulsed Drain Current	I_{DM}	16	A
Maximum Power Dissipation	P_D	50	W
Derating factor		0.45	W/℃
Single pulse avalanche energy (Note 5)	E_{AS}	260	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 150	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case (Note 2)	$R_{\theta JC}$	2.6	℃/W

Electrical Characteristics (T_C=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250μA	650		-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=650V,V_{GS}=0V	-	-	10	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±30V,V_{DS}=0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	2		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=2.0A	-	2.1	2.5	Ω
Forward Transconductance	g_{FS}	V_{DS}=40V,I_D=2A	-	4.0	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{lss}	V_{DS}=25V,V_{GS}=0V, F=1.0MHz	-	520	-	PF
Output Capacitance	C_{oss}		-	70	-	PF
Reverse Transfer Capacitance	C_{rss}		-	8	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=325V,I_D=4A,R_L=25Ω V_{GS}=10V,R_G=2.5Ω	-	13	-	nS
Turn-on Rise Time	t_r		-	45	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	t_f		-	35	-	nS
Total Gate Charge	Q_g	V_{DS}=520V,I_D=4A, V_{GS}=10V	-	15	-	nC
Gate-Source Charge	Q_{gs}		-	3.4	-	nC
Gate-Drain Charge	Q_{gd}		-	7.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V,I_S=4.0A	-		1.4	V
Diode Forward Current (Note 2)	I_S		-	-	4.0	A
Reverse Recovery Time	t_{rr}	TJ = 25°C, IF = 4.0A di/dt = 100A/μs (Note3)	-	300	-	nS
Reverse Recovery Charge	Qrr		-	1.5	-	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E_{AS} condition: j=25℃,V_{DD}=50V,V_G=10V,L=0.5mH,Rg=25Ω

Typical Electrical and Thermal Characteristics (Curves)

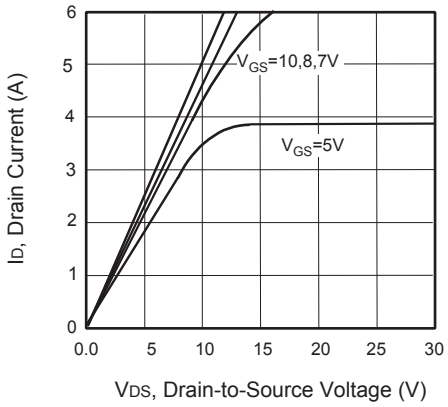


Figure 1. Output Characteristics

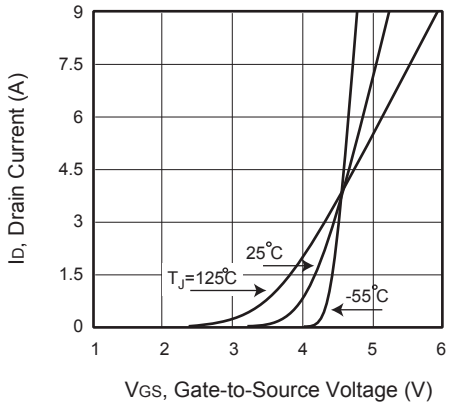


Figure 2. Transfer Characteristics

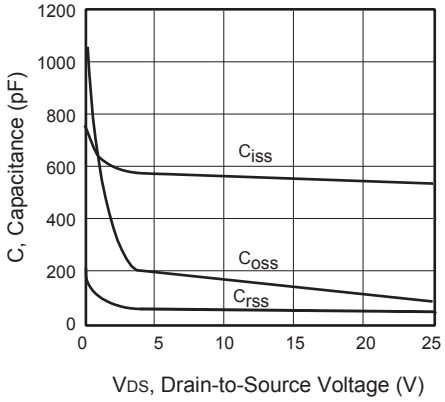


Figure 3. Capacitance

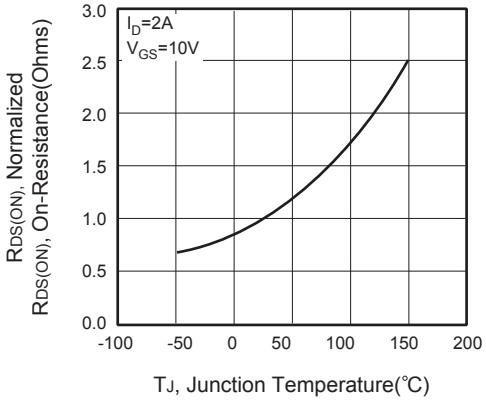


Figure 4. On-Resistance Variation with Temperature

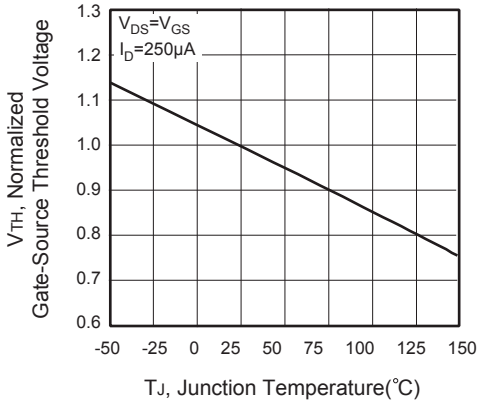


Figure 5. Gate Threshold Variation with Temperature

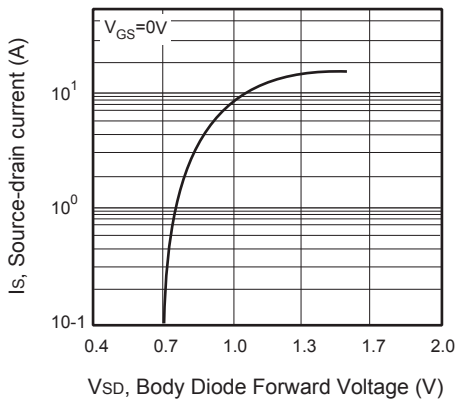


Figure 6. Body Diode Forward Voltage Variation with Source Current

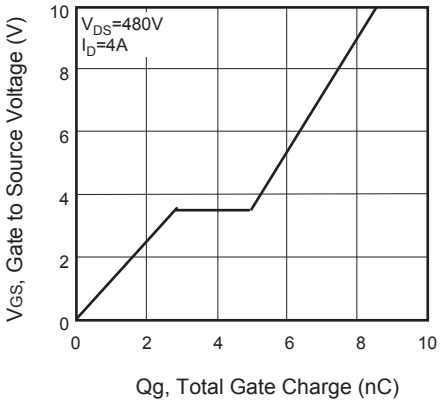


Figure 7. Gate Charge

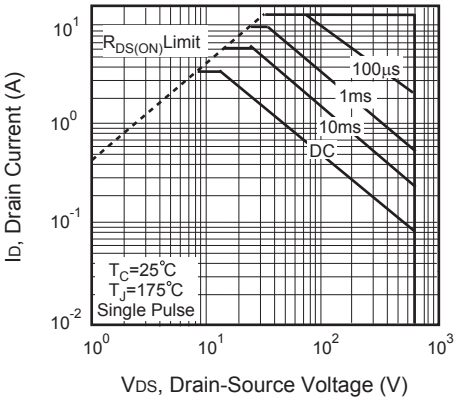


Figure 8. Maximum Safe Operating Area

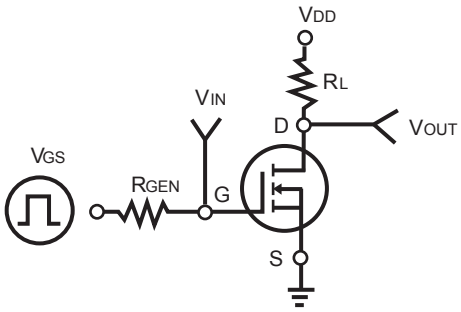


Figure 9. Switching Test Circuit

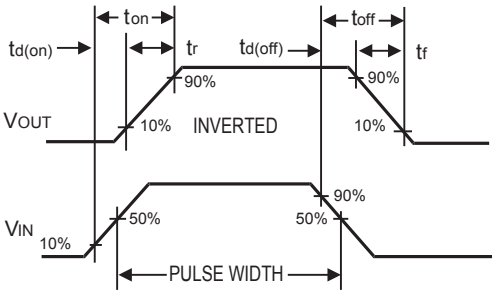


Figure 10. Switching Waveforms

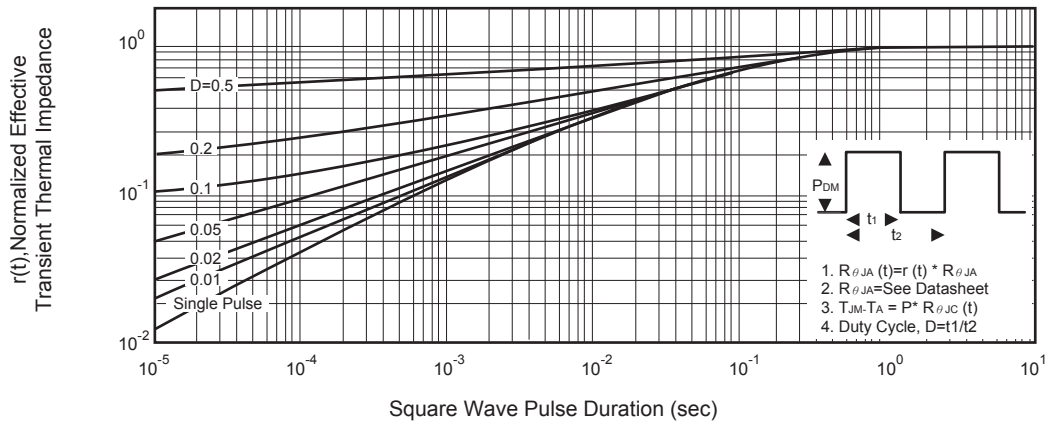
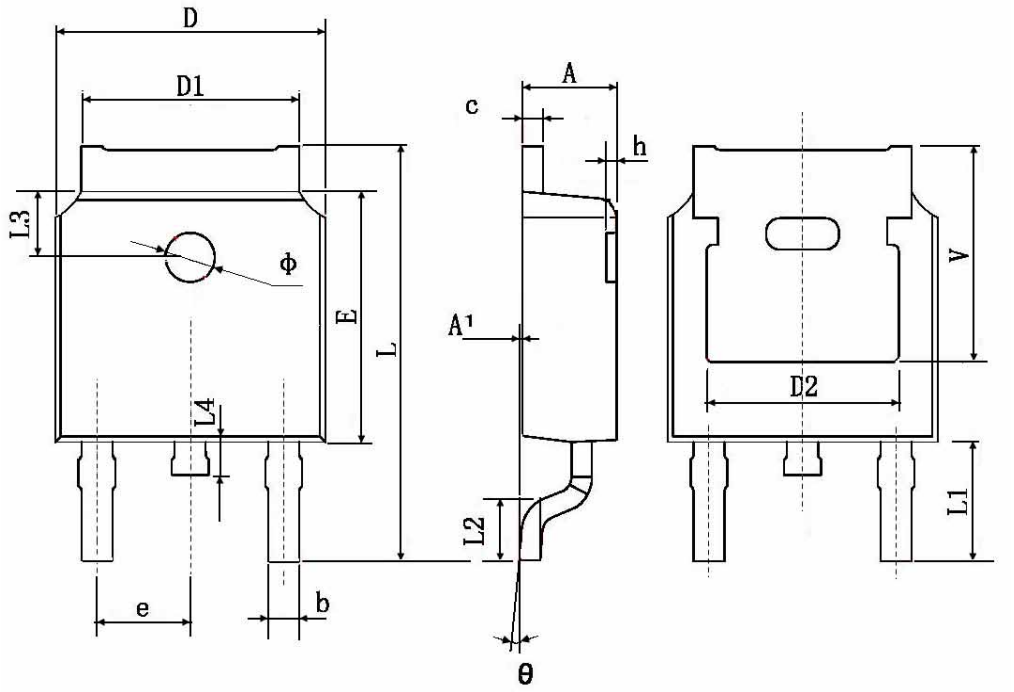


Figure 11. Normalized Thermal Transient Impedance Curve

TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	