

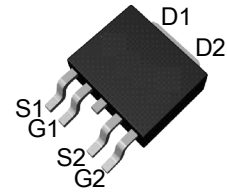
Features

- **N Channel**
40V/28A,
 $R_{DS(ON)} = 14m\Omega$ (Typ.) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 18m\Omega$ (Typ.) @ $V_{GS} = 4.5V$
- **P Channel**
-40V/-25A,
 $R_{DS(ON)} = 30m\Omega$ (Typ.) @ $V_{GS} = -10V$
 $R_{DS(ON)} = 37m\Omega$ (Typ.) @ $V_{GS} = -4.5V$
- 100% UIS Tested
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

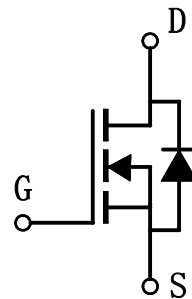
Applications

- For Fan Pre-driver H-Bridge.
- Motor Control.
- Synchronous Rectification.

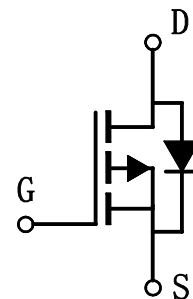
Pin Description



Top View of TO-252-4



N-Channel MOSFET



P-Channel MOSFET

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter		N Channel	P Channel	Unit
Common Ratings					
V _{DSS}	Drain-Source Voltage		40	-40	V
V _{GSS}	Gate-Source Voltage		±20	±20	
T _J	Maximum Junction Temperature		150		°C
T _{STG}	Storage Temperature Range		-55 to 150		
I _S	Diode Continuous Forward Current	T _C =25°C	28	-25	A
I _D	Continuous Drain Current	T _C =25°C	28	-25	
		T _C =100°C	21	-19	
P _D	Maximum Power Dissipation	T _C =25°C	32.9	32.9	W
		T _C =100°C	13.2	13.2	
R _{θJC}	Thermal Resistance-Junction to Case		3.8	3.8	°C/W
R _{θJA}	Thermal Resistance-Junction to Ambient	t ≤ 10s	25	25	°C/W
		Steady State ^c	60	60	
I _{AS} ^b	Avalanche Current, Single pulse	L=0.5mH	10	-10	A
E _{AS} ^b	Avalanche Energy, Single pulse	L=0.5mH	25	25	mJ

Note * : Limited by package.

Note a : Pulse width limited by max. junction temperature.

Note b : UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature $T_J=25^\circ\text{C}$).

Note c : Surface Mounted on 1in^2 pad area, $t = 999\text{sec}$.

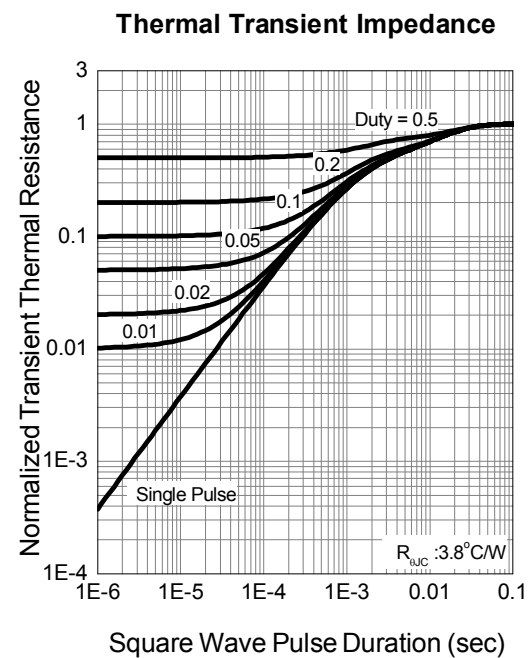
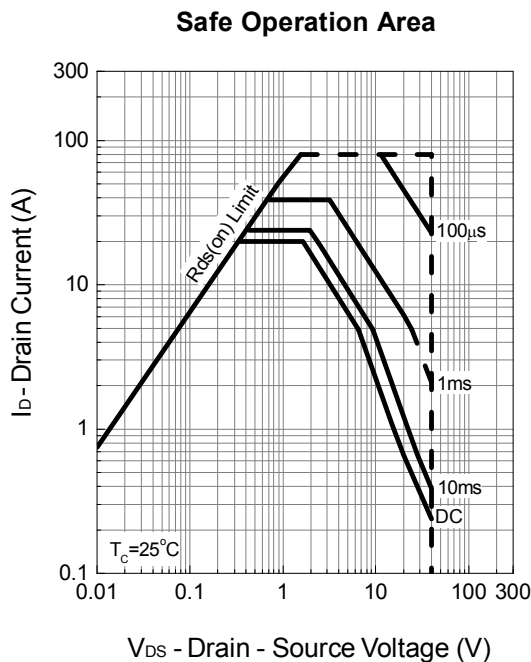
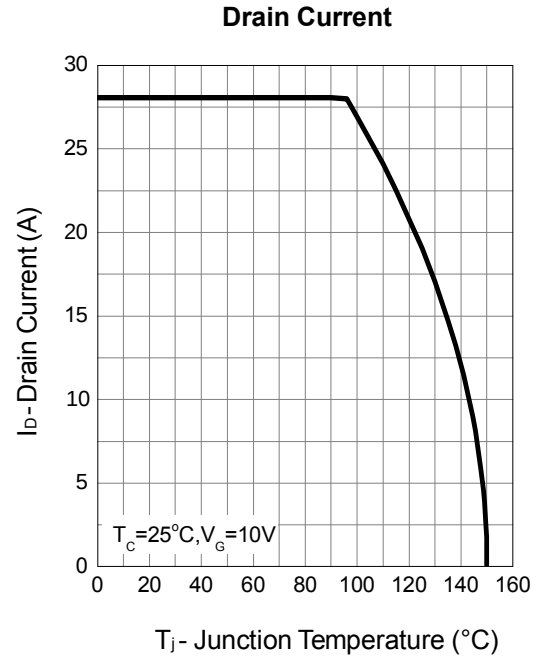
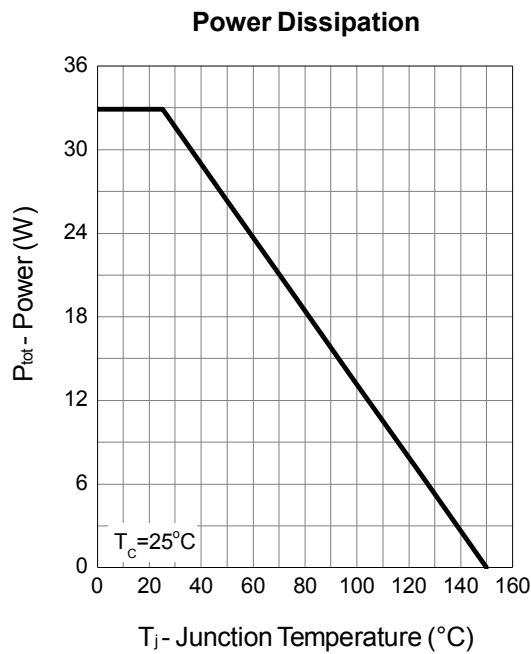
N Channel Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	N Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	40	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =32V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1.5	2	2.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^d	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =10A	-	14	21	mΩ
		V _{GS} =4.5V, I _{DS} =5A	-	18	25	
Diode Characteristics						
V _{SD} ^d	Diode Forward Voltage	I _{SD} =1A, V _{GS} =0V	-	0.75	1.1	V
t _{rr}	Reverse Recovery Time	I _{DS} =10A, dI _{SD} /dt=100A/μs	-	13	-	ns
Q _{rr}	Reverse Recovery Charge		-	8.7	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V,V _{DS} =0V,F=1MHz	-	2.5	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =20V, Frequency=1.0MHz	-	815	-	pF
C _{oss}	Output Capacitance		-	95	-	
C _{rss}	Reverse Transfer Capacitance		-	60	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =20V, R _L =20Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	7.8	-	ns
t _r	Turn-on Rise Time		-	6.9	-	
t _{d(OFF)}	Turn-off Delay Time		-	22.4	-	
t _f	Turn-off Fall Time		-	4.8	-	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =20V, V _{GS} =10V, I _{DS} =10A	-	15.7	22	nC
Q _g	Total Gate Charge	V _{DS} =20V, V _{GS} =4.5V, I _{DS} =10A	-	7.5	10.5	
Q _{gth}	Threshold Gate Charge		-	1.85	-	
Q _{gs}	Gate-Source Charge		-	3.24	-	
Q _{gd}	Gate-Drain Charge		-	2.75	-	

Note d : Pulse test ; pulse width≤300μs, duty cycle≤2%.

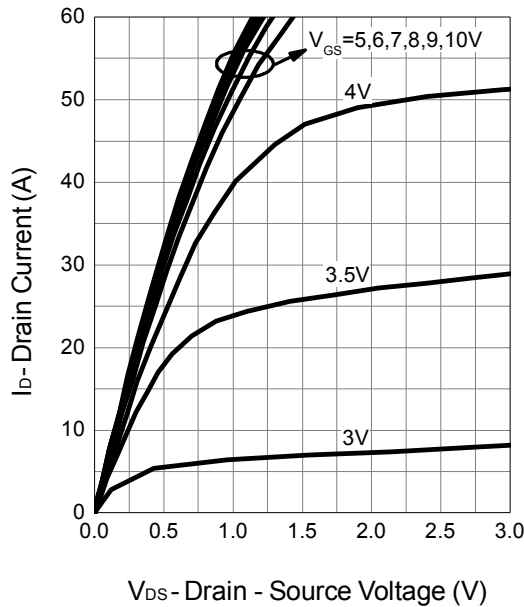
Note e : Guaranteed by design, not subject to production testing.

N Channel Typical Operating Characteristics

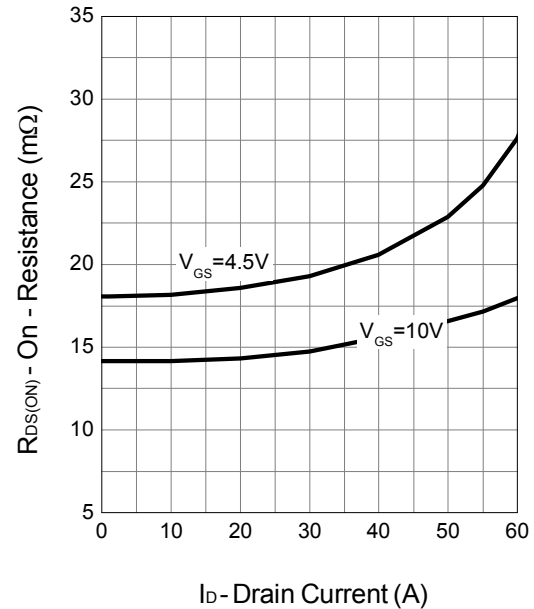


N Channel Typical Operating Characteristics (Cont.)

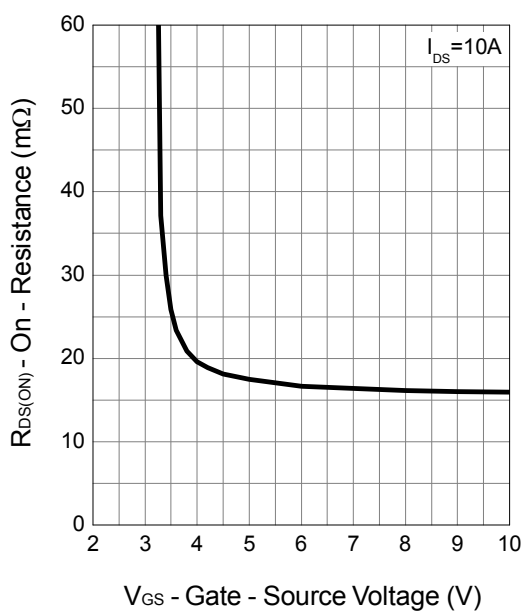
Output Characteristics



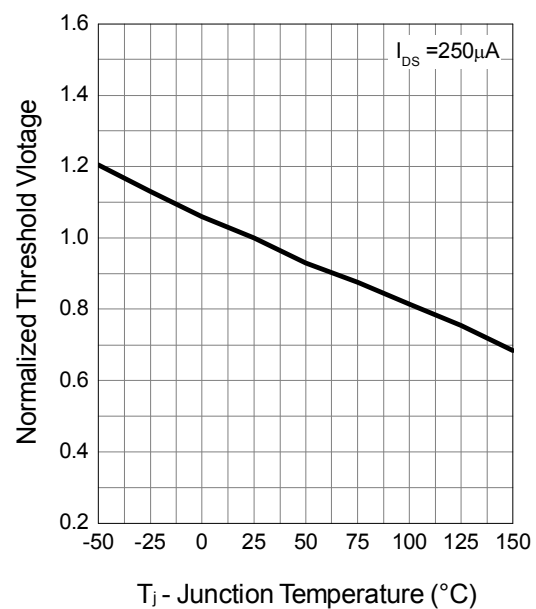
Drain-Source On Resistance



Gate-Source On Resistance

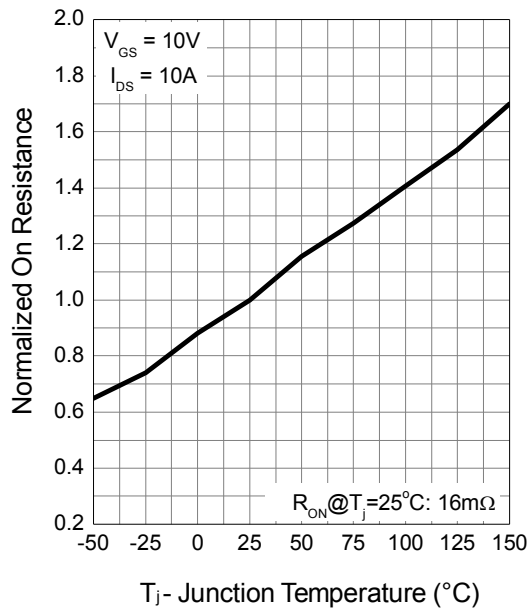


Gate Threshold Voltage

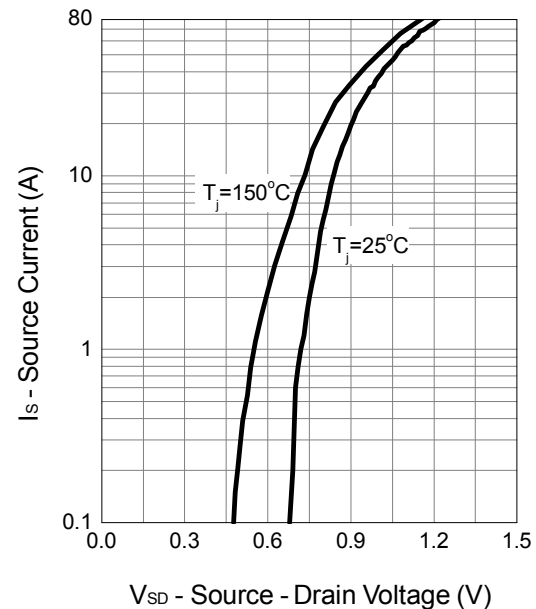


N Channel Typical Operating Characteristics (Cont.)

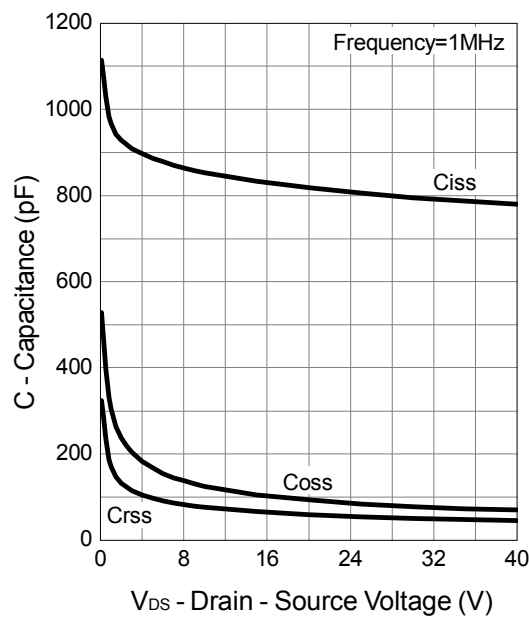
Drain-Source On Resistance



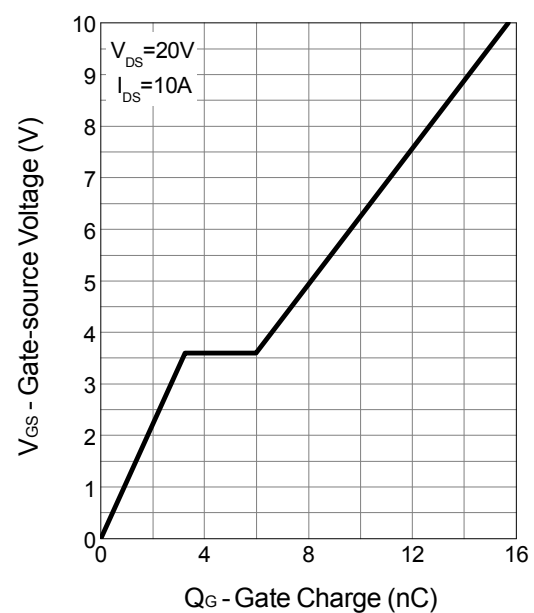
Source-Drain Diode Forward



Capacitance



Gate Charge



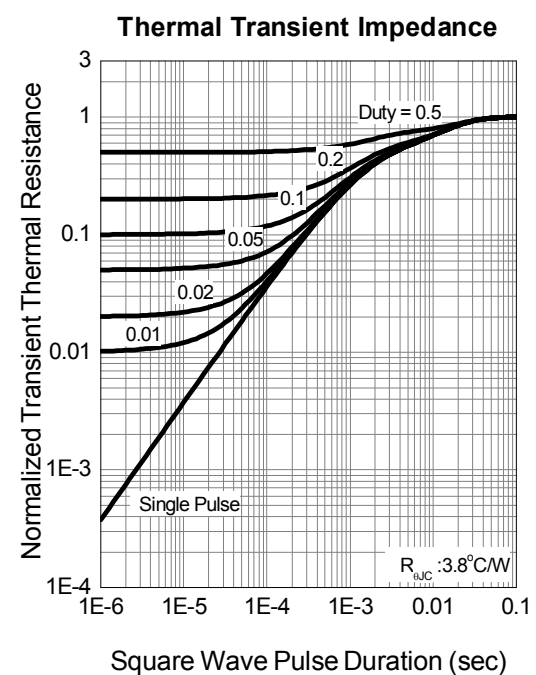
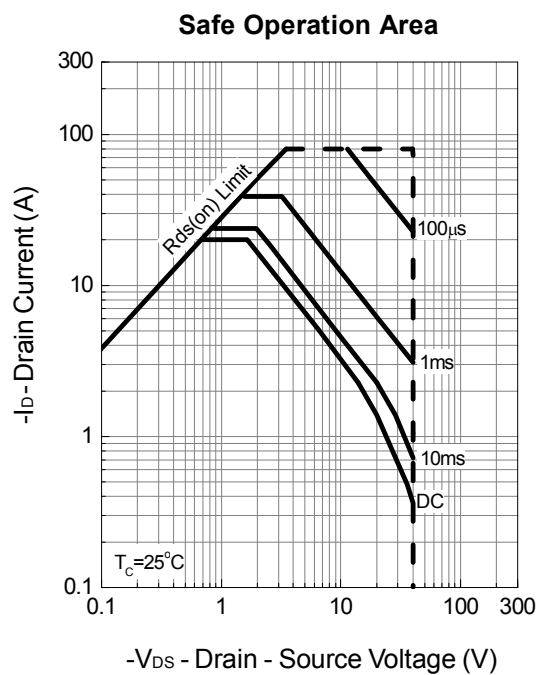
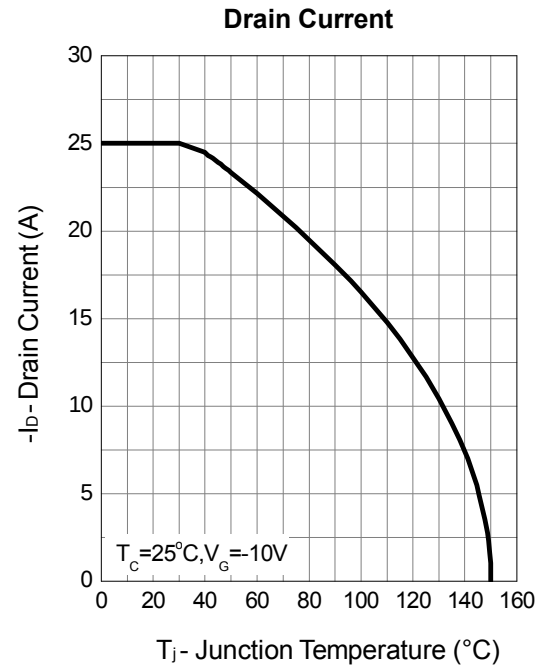
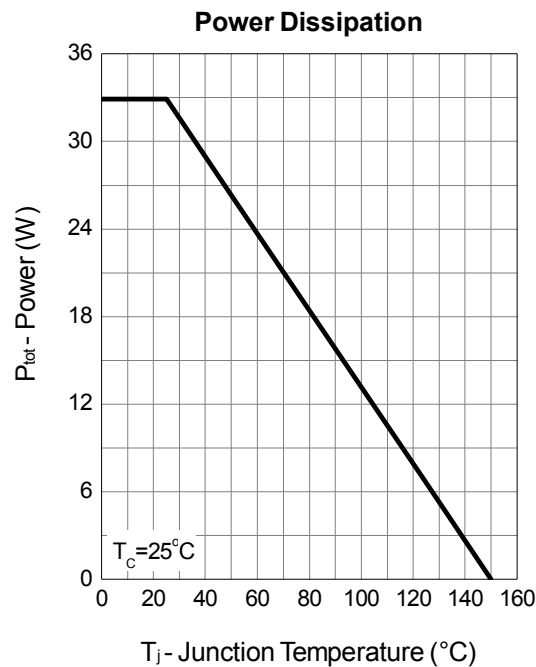
P Channel Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	P Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =-250μA	-40	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-32V, V _{GS} =0V	-	-	-1	μA
		T _J =85°C	-	-	-30	mA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-1.5	-2	-2.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^d	Drain-Source On-state Resistance	V _{GS} =-10V, I _{DS} =-10A	-	30	35	mΩ
		V _{GS} =-4.5V, I _{DS} =-5A	-	37	42	
Diode Characteristics						
V _{SD} ^d	Diode Forward Voltage	I _{SD} =-1A, V _{GS} =0V	-	-0.75	-1	V
t _{rr}	Reverse Recovery Time	I _{DS} =-10A, dI _{SD} /dt= 100A/μs	-	15	-	ns
Q _{rr}	Reverse Recovery Charge		-	8	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	8	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-20V, Frequency=1.0MHz	-	668	-	pF
C _{oss}	Output Capacitance		-	98	-	
C _{rss}	Reverse Transfer Capacitance		-	72	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-20V, R _L =20Ω, I _{DS} =-1A, V _{GEN} =-10V, R _G =6Ω	-	8.7	-	ns
t _r	Turn-on Rise Time		-	7	-	
t _{d(OFF)}	Turn-off Delay Time		-	31	-	
t _f	Turn-off Fall Time		-	17	-	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =-20V, V _{GS} =-10V, I _{DS} =-10A	-	15	-	nC
Q _g	Total Gate Charge	V _{DS} =-20V, V _{GS} =-4.5V, I _{DS} =-10A	-	7.5	-	
Q _{gth}	Threshold Gate Charge		-	1.4	-	
Q _{gs}	Gate-Source Charge		-	2.4	-	
Q _{gd}	Gate-Drain Charge		-	3.5	-	

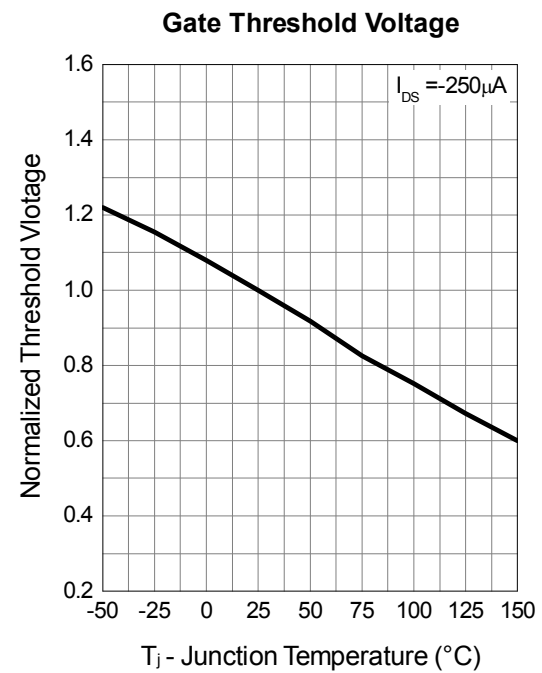
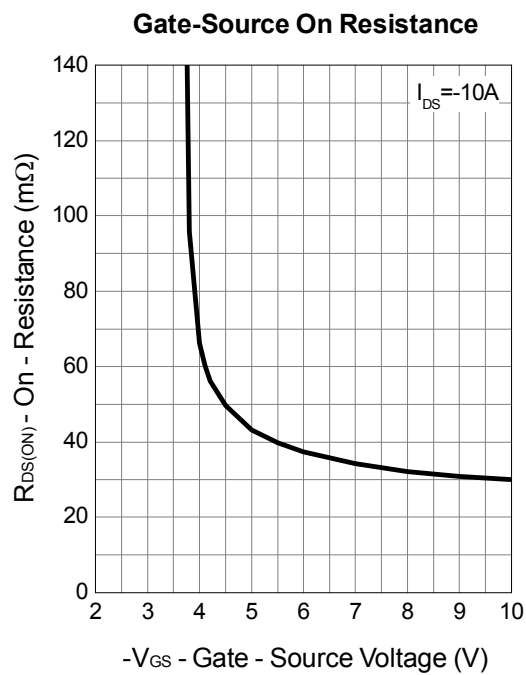
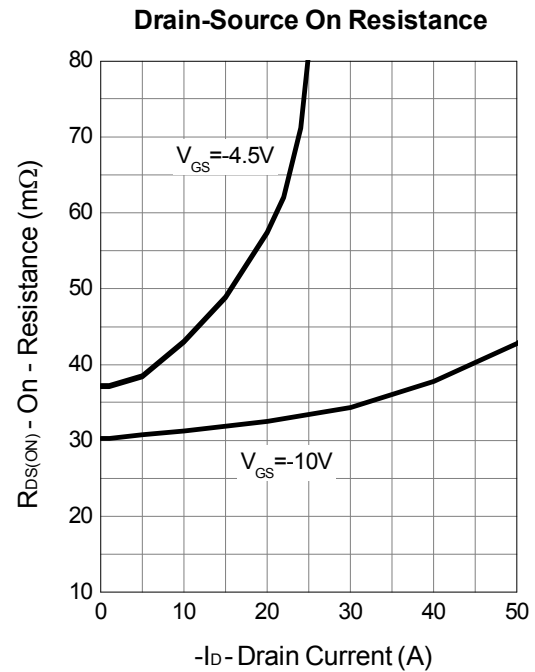
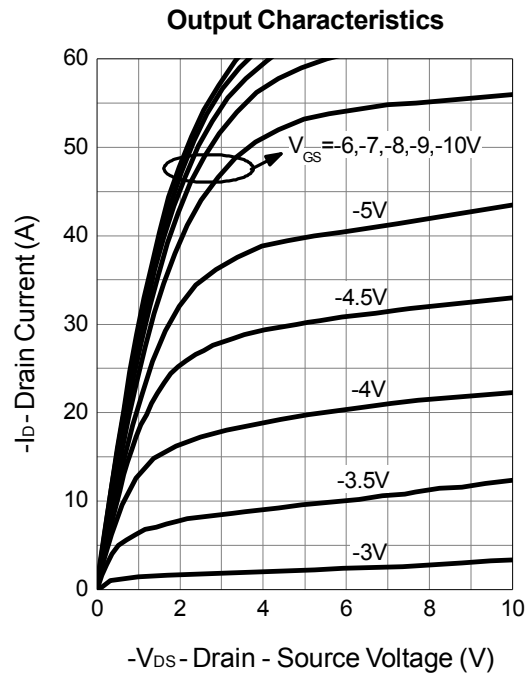
Note d : Pulse test; pulse width≤300μs, duty cycle≤2%.

Note e : Guaranteed by design, not subject to production testing.

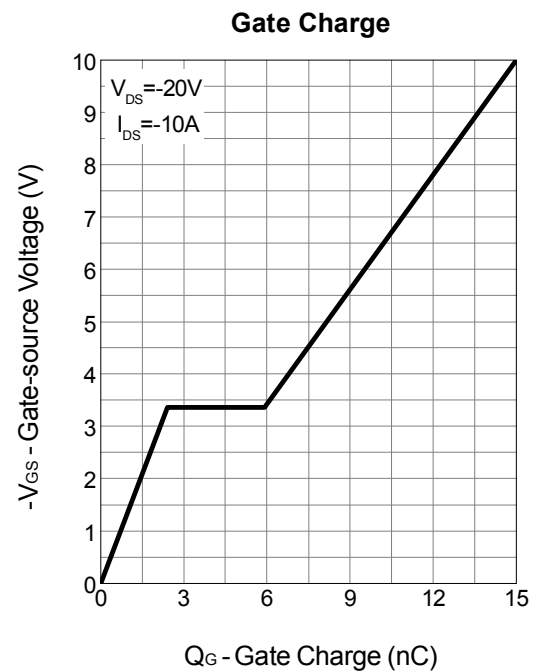
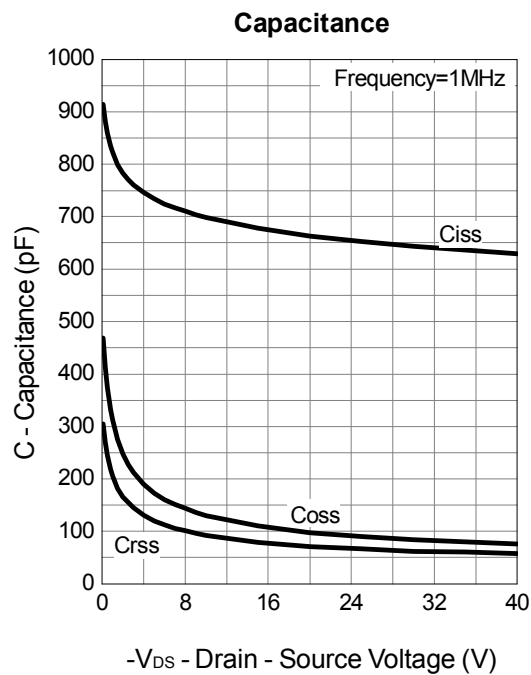
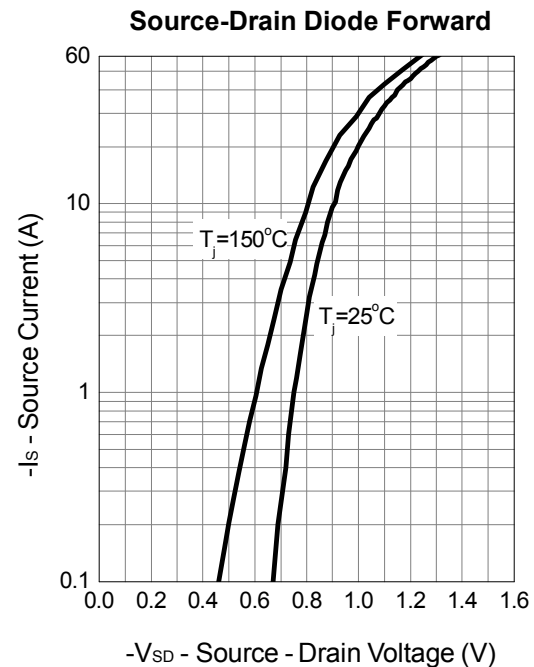
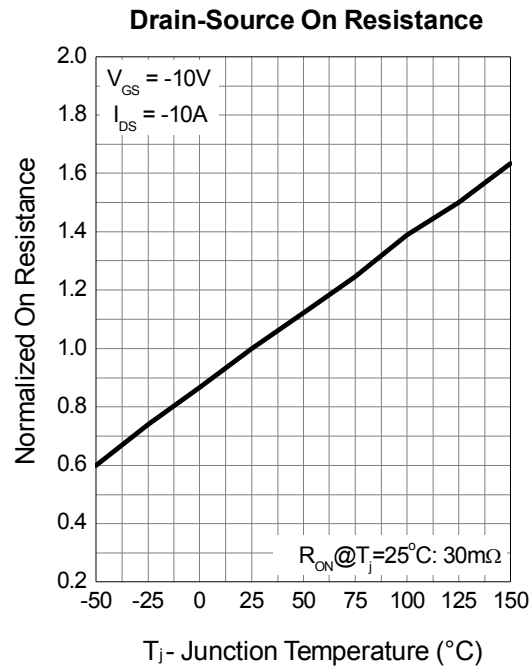
P Channel Typical Operating Characteristics



P Channel Typical Operating Characteristics (Cont.)

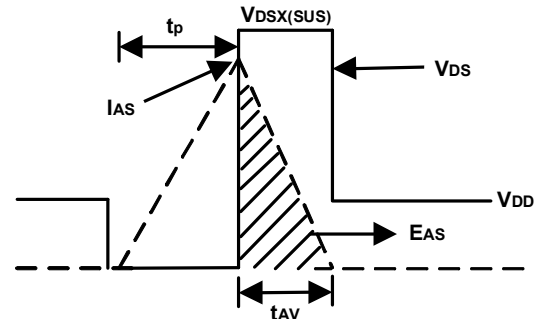
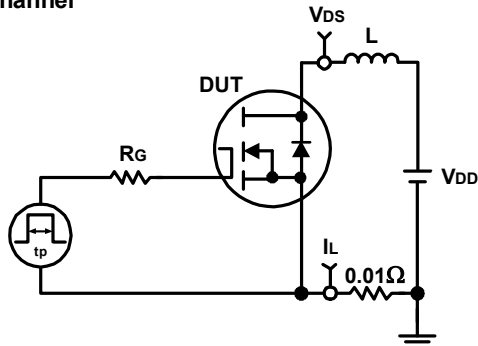


P Channel Typical Operating Characteristics (Cont.)

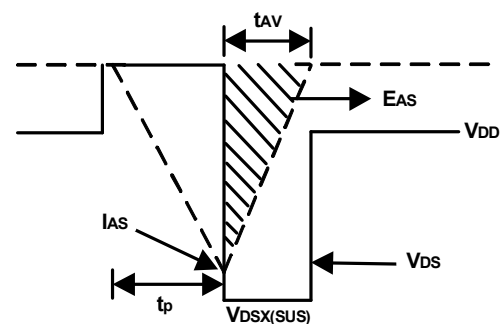
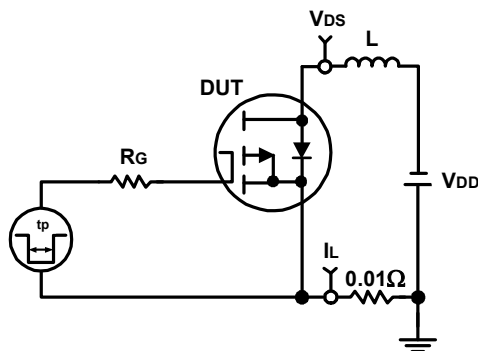


Avalanche Test Circuit and Waveforms

N Channel

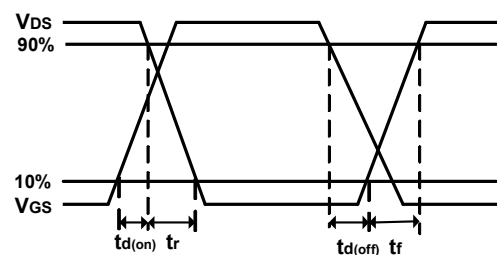
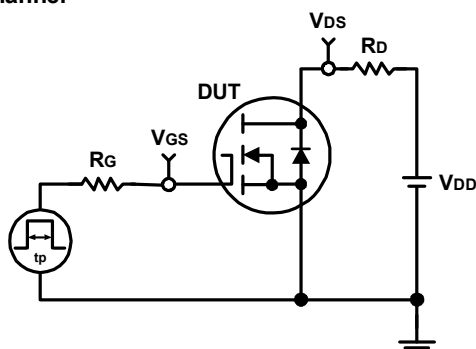


P Channel

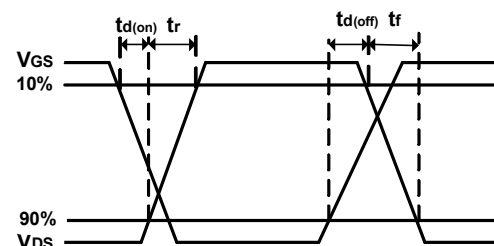
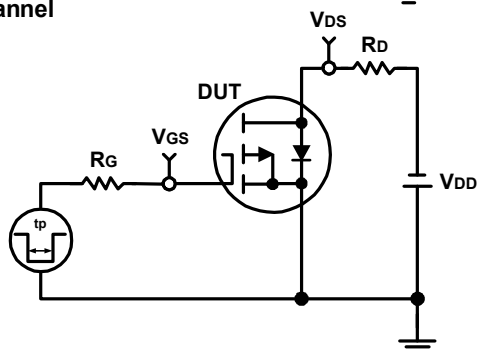


Switching Time Test Circuit and Waveforms

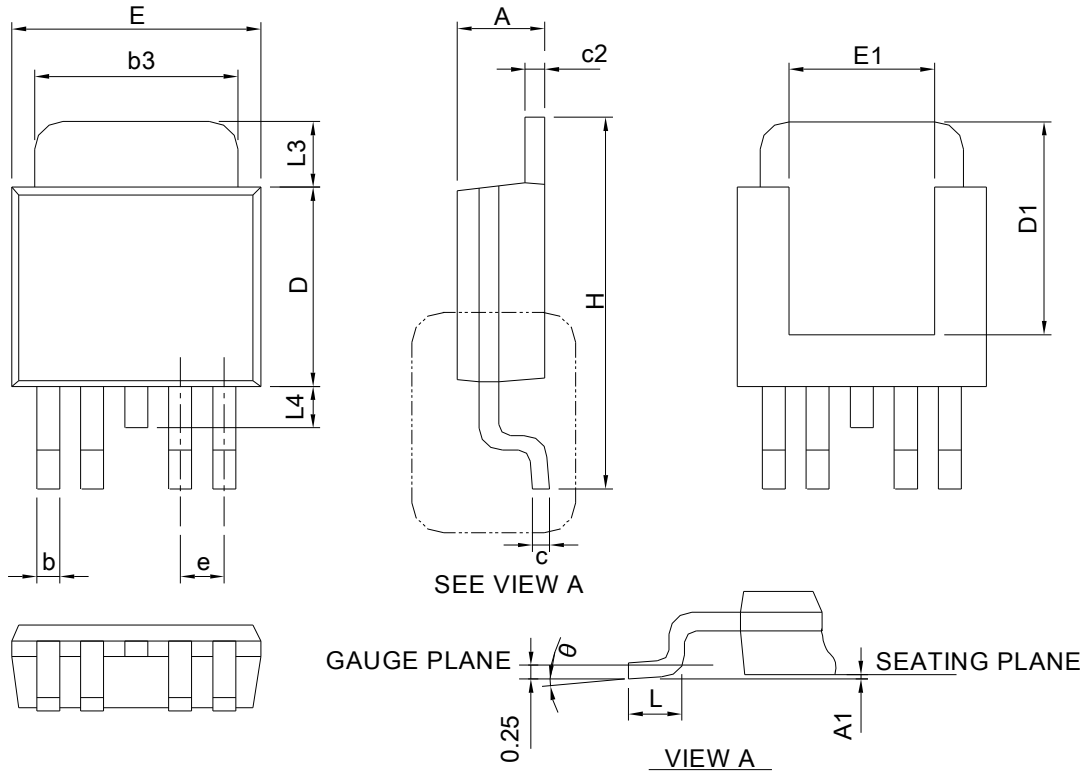
N Channel



P Channel

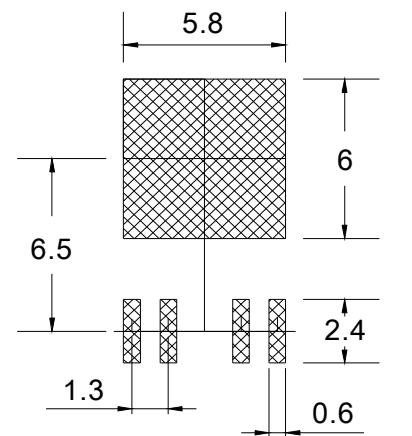


Package Information

TO-252-4


SYMBOL	TO-252-4			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1	-	0.2	-	0.008
b	0.50	0.71	0.020	0.028
b3	4.32	5.46	0.170	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	1.30 BSC		0.051 BSC	
H	9.40	10.41	0.370	0.410
L	1.40	1.78	0.055	0.070
L3	0.89	2.03	0.035	0.080
L4	-	1.02	-	0.040
θ	0°	8°	0°	8°

RECOMMENDED LAND PATTERN



UNIT: mm