

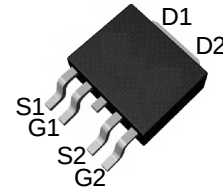
Features

- N-Channel
60V/15A,
 $R_{DS(ON)} = 24m\Omega(\text{typ.}) @ V_{GS} = 10V$
 $R_{DS(ON)} = 28m\Omega(\text{typ.}) @ V_{GS} = 4.5V$
- P-Channel
-60V/-15A,
 $R_{DS(ON)} = 65m\Omega(\text{typ.}) @ V_{GS} = -10V$
 $R_{DS(ON)} = 82m\Omega(\text{typ.}) @ V_{GS} = -4.5V$
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

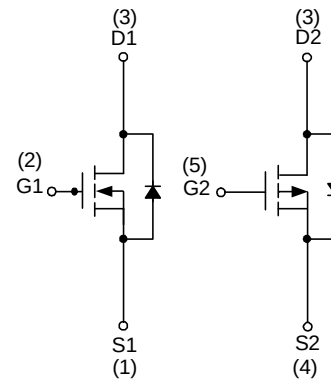
Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems.

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		60	-60	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	10	-7.5	A
I _D	Continuous Drain Current	T _C =25°C	15	-15	
		T _C =100°C	12.8	-9.7	
P _D	Maximum Power Dissipation	T _C =25°C	35.7	44.6	
		T _C =100°C	14.2	17.8	
R _{θJC}	Thermal Resistance-Junction to Case		3.5	2.8	°C/W
I _D	Continuous Drain Current	T _A =25°C	8.5	-5.7	A
		T _A =70°C	6.8	-4.6	
I _{DM} ^a	Pulsed Drain Current	T _C =25°C	80 *	-60 *	
P _D ^b	Power Dissipation	T _A =25°C	6.25	6.25	W
		T _A =70°C	4	4	
R _{θJA} ^c	Thermal Resistance-Junction to Ambient	t ≤ 10s	20	20	°C/W
		Steady State	60	60	
I _{AS} ^d	Avalanche Current, Single pulse	L=0.5mH	8	-10	A
E _{AS} ^d	Avalanche Energy, Single pulse	L=0.5mH	16	25	mJ

Note * : Limited by package.

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

Note b : $t < 10\text{s}$.

Note c : $R_{\theta JA}$ steady state $t=100\text{s}$. $R_{\theta JA}$ is measured with the device mounted on 1in^2 , FR-4 board with 2oz. Copper.

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

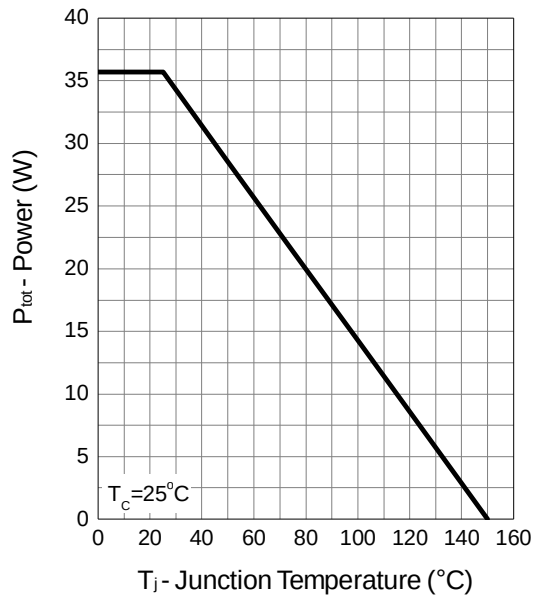
N Channle **Electrical Characteristics** ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	N Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	60	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =48V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1	1.9	3	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)}	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =10A	-	24	30	mΩ
		V _{GS} =4.5V, I _{DS} =8A	-	28	35	
Diode Characteristics						
V _{SD}	Diode Forward Voltage	I _{SD} =5A, V _{GS} =0V	-	0.8	1.3	V
t _{rr}	Reverse Recovery Time	I _{DS} =12A, dI _{SD} /dt=100A/μs	-	20	-	ns
Q _{rr}	Reverse Recovery Charge		-	20	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V,V _{DS} =0V,F=1MHz	-	2.8	5.6	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =30V, Frequency=1.0MHz	-	540	700	pF
C _{oss}	Output Capacitance		-	56	-	
C _{rss}	Reverse Transfer Capacitance		-	26	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =30V, R _L =30Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	10	18	ns
t _r	Turn-on Rise Time		-	6	11	
t _{d(OFF)}	Turn-off Delay Time		-	21	38	
t _f	Turn-off Fall Time		-	5	9	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =30V, V _{GS} =4.5V, I _{DS} =12A	-	5.5	-	nC
Q _g	Total Gate Charge	V _{DS} =30V, V _{GS} =10V, I _{DS} =12A	-	11.5	16	
Q _{gs}	Gate-Source Charge		-	2.3	-	
Q _{gd}	Gate-Drain Charge		-	2.2	-	
Q _{gth}	Threshold Gate Charge		-	1.9	-	

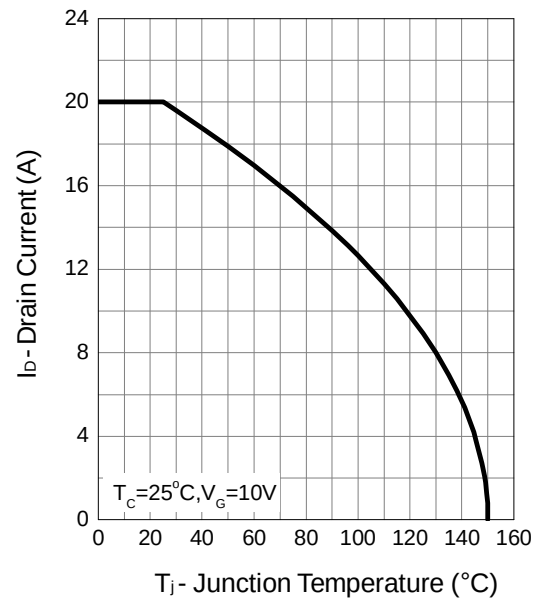
Note e : Guaranteed by design, not subject to production testing.

N Channel Typical Operating Characteristics

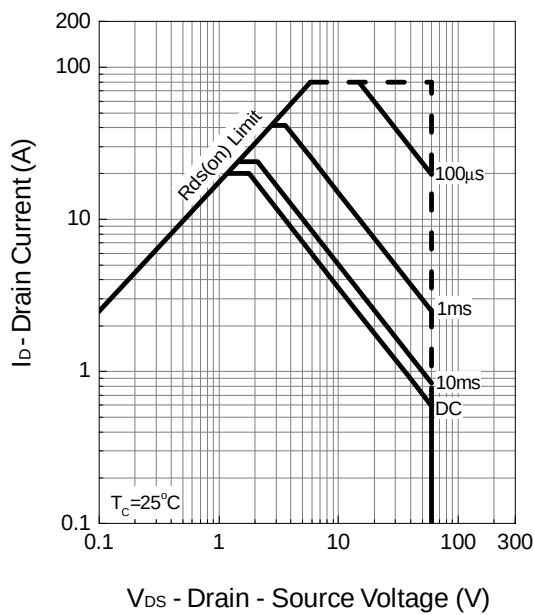
Power Dissipation



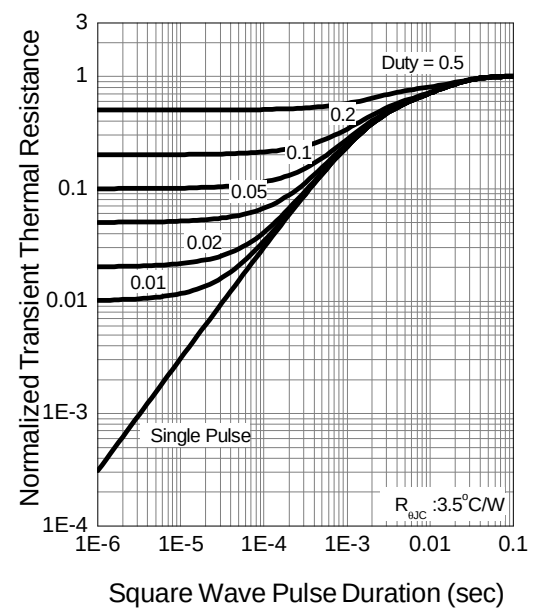
Drain Current



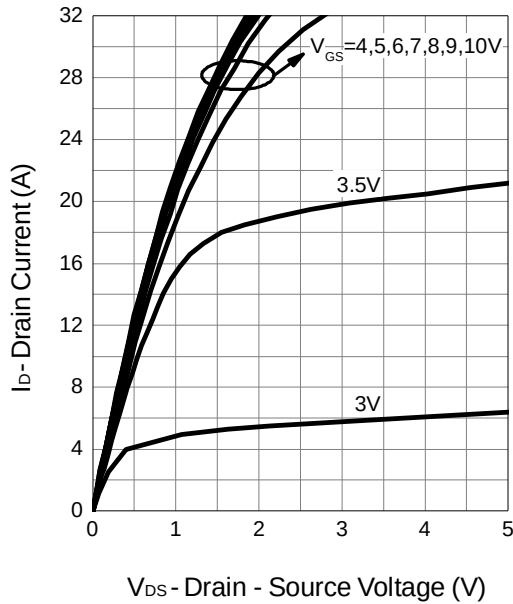
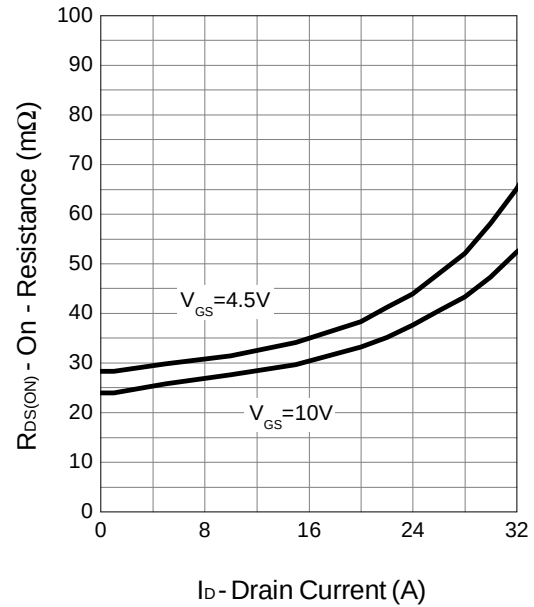
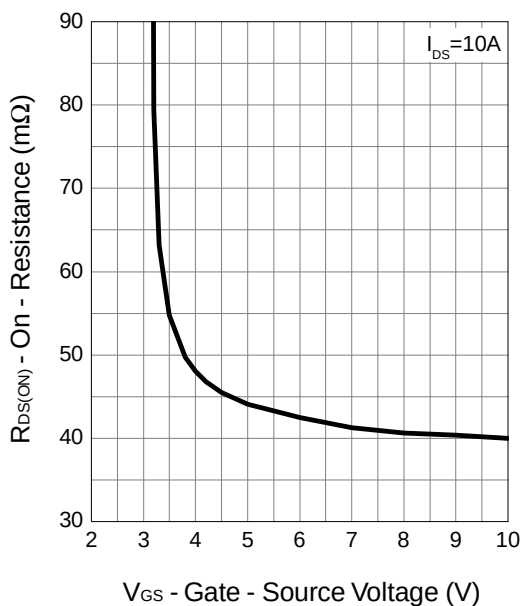
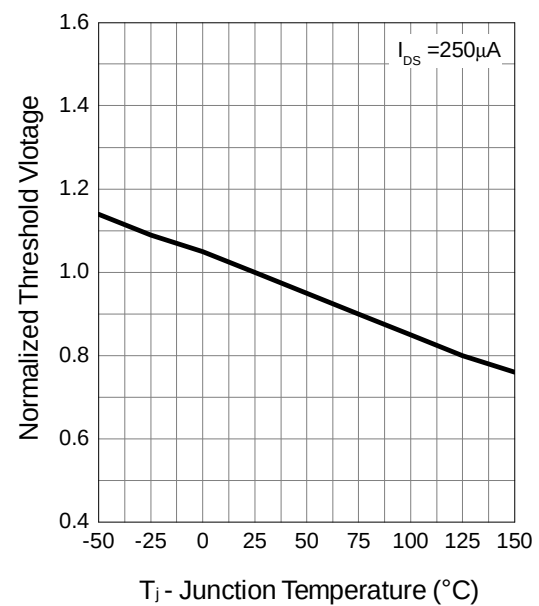
Safe Operation Area



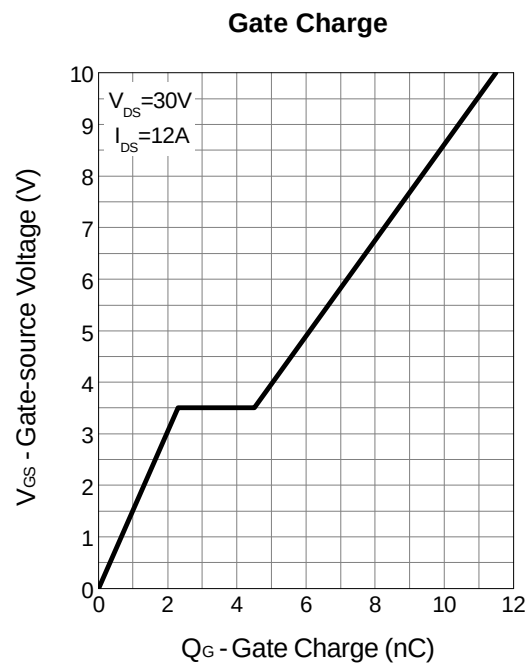
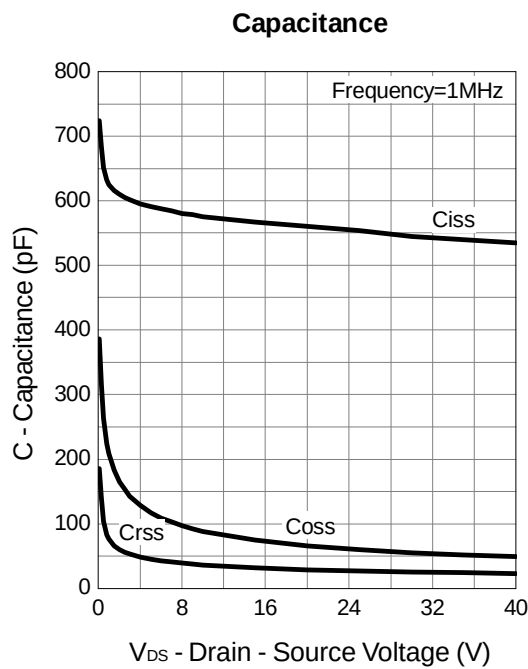
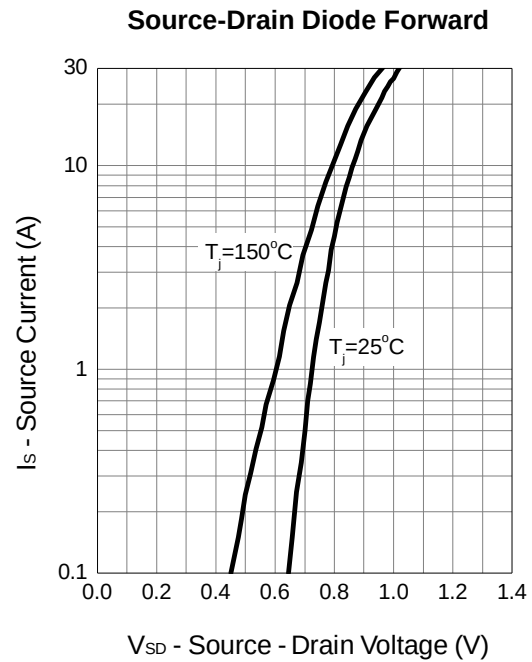
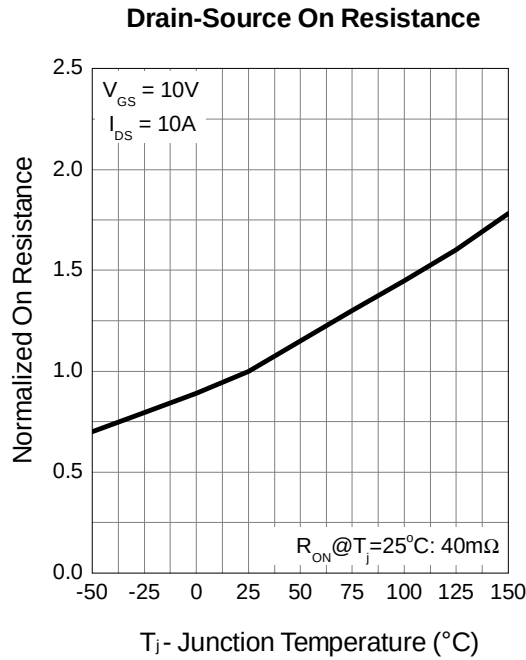
Thermal Transient Impedance



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.)



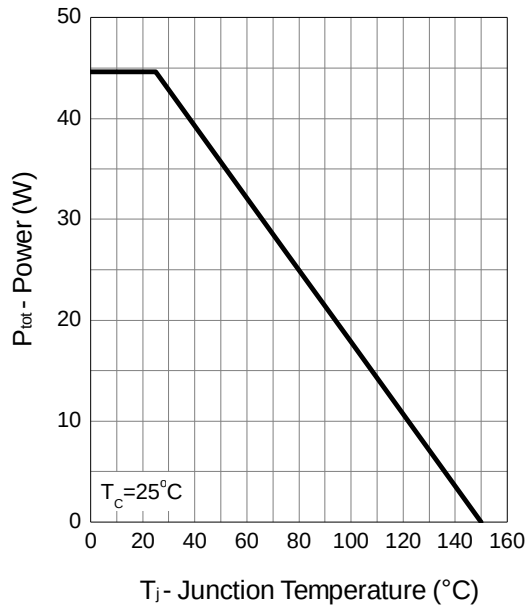
P Channle Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	P Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =-250μA	-60	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-48V, V _{GS} =0V	-	-	-1	μA
		T _J =85°C	-	-	-30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-1	-1.9	-3	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)}	Drain-Source On-state Resistance	V _{GS} =-10V, I _{DS} =-7.5A	-	65	78	mΩ
		V _{GS} =-4.5V, I _{DS} =-6.5A	-	82	107	
Diode Characteristics						
V _{SD}	Diode Forward Voltage	I _{SD} =-1A, V _{GS} =0V	-	-0.7	-1	V
t _{rr}	Reverse Recovery Time	I _{DS} =-7.5A,	-	18	-	ns
Q _{rr}	Reverse Recovery Charge	dI _{SD} /dt=100A/μs	-	13	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	10	20	Ω
C _{iSS}	Input Capacitance	V _{GS} =0V, V _{DS} =-30V, Frequency=1.0MHz	-	530	690	pF
C _{oSS}	Output Capacitance		-	66	-	
C _{rSS}	Reverse Transfer Capacitance		-	36	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-30V, R _L =30Ω, I _{DS} =-1A, V _{GEN} =-10V, R _G =6Ω	-	8	15	ns
t _r	Turn-on Rise Time		-	4.5	8	
t _{d(OFF)}	Turn-off Delay Time		-	40	72	
t _f	Turn-off Fall Time		-	27	49	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =-30V, V _{GS} =-4.5V, I _{DS} =-7.5A	-	6	-	nC
Q _g	Total Gate Charge	V _{DS} =-30V, V _{GS} =-10V, I _{DS} =-7.5A	-	12	17	
Q _{gs}	Gate-Source Charge		-	1.2	-	
Q _{gd}	Gate-Drain Charge		-	3.6	-	
Q _{gth}	Threshold Gate Charge		-	1	-	

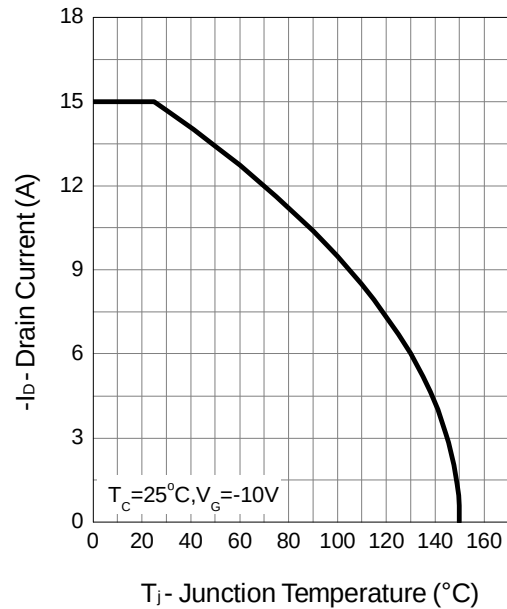
Note e : Guaranteed by design, not subject to production testing.

P Channel Typical Operating Characteristics (Cont.)

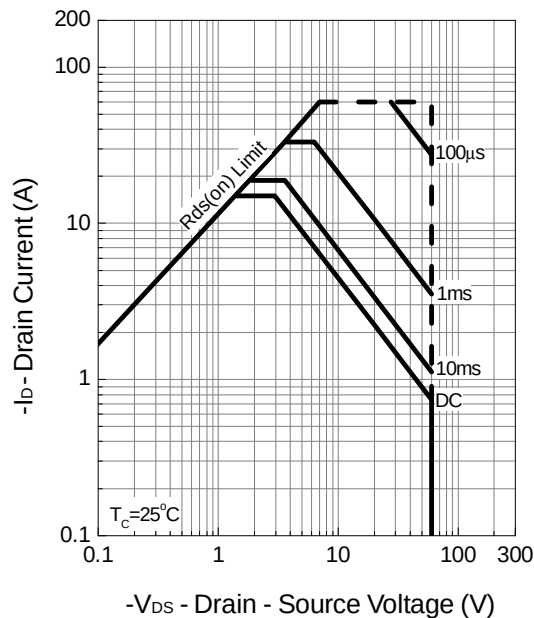
Power Dissipation



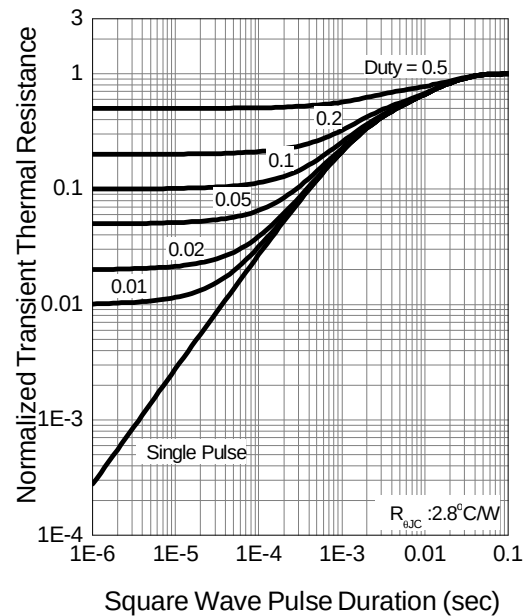
Drain Current



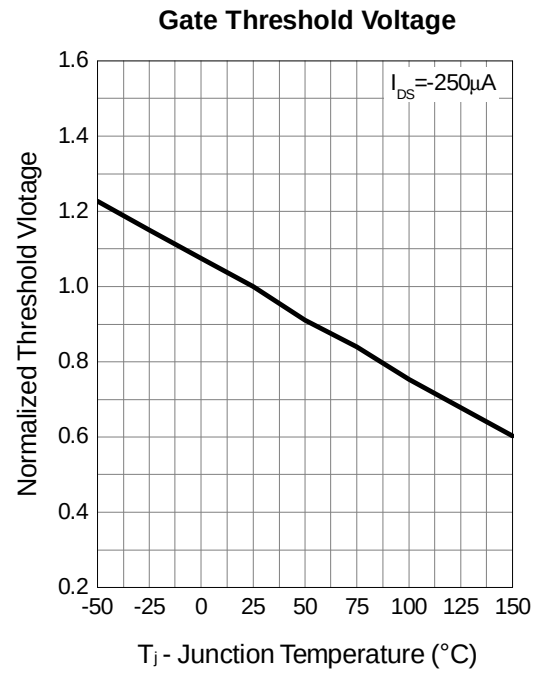
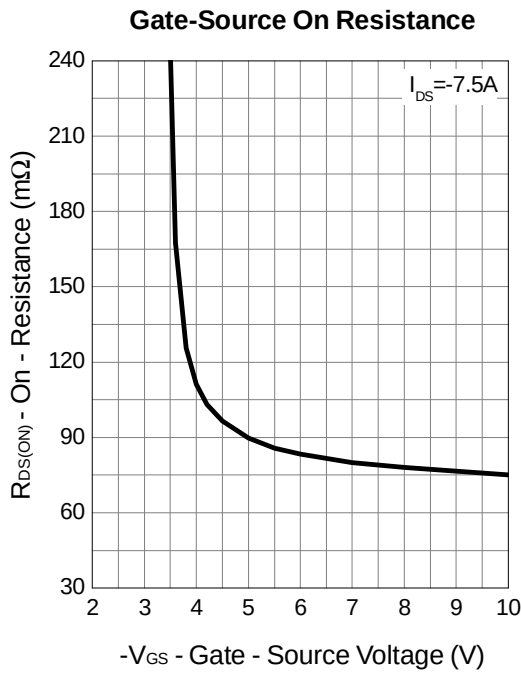
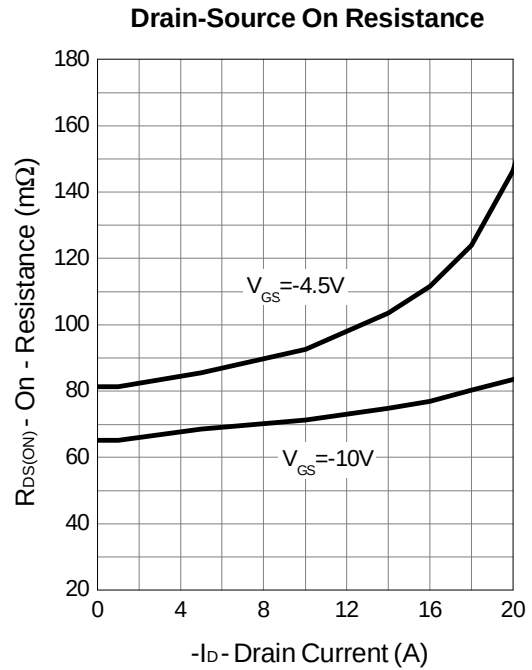
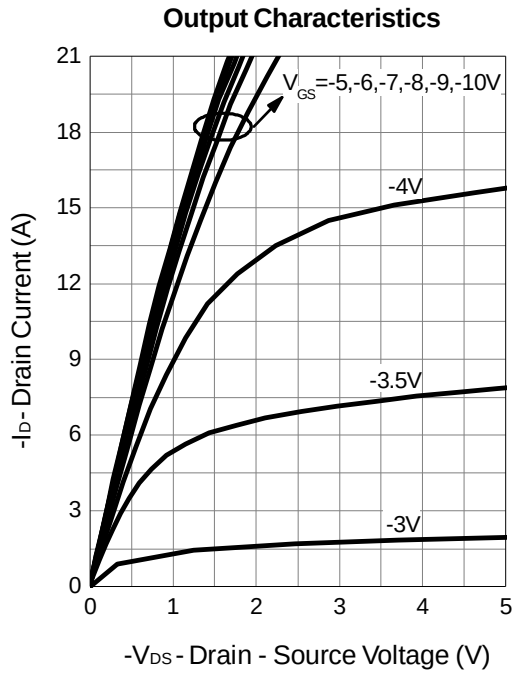
Safe Operation Area



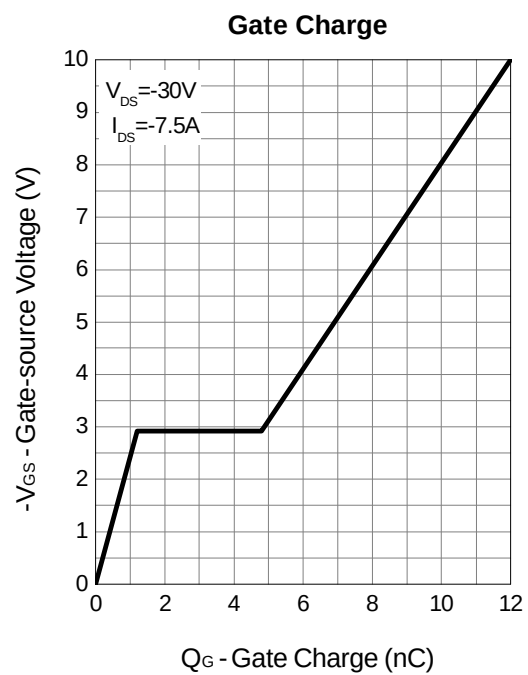
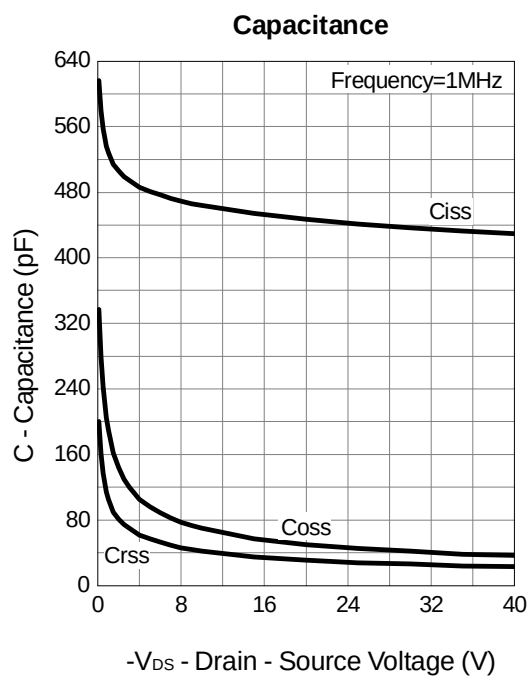
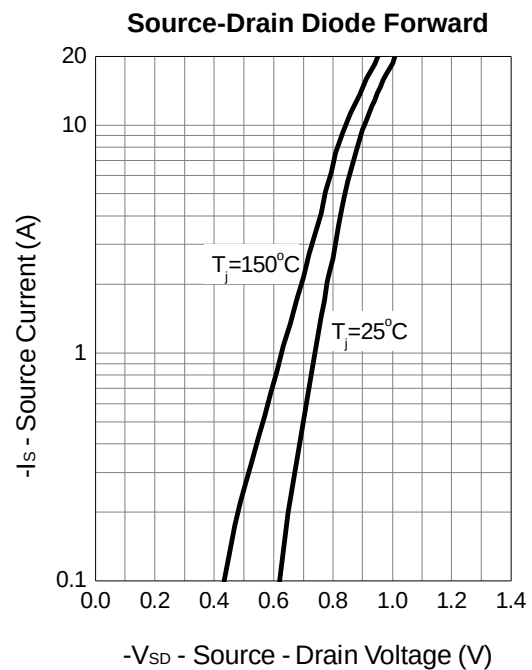
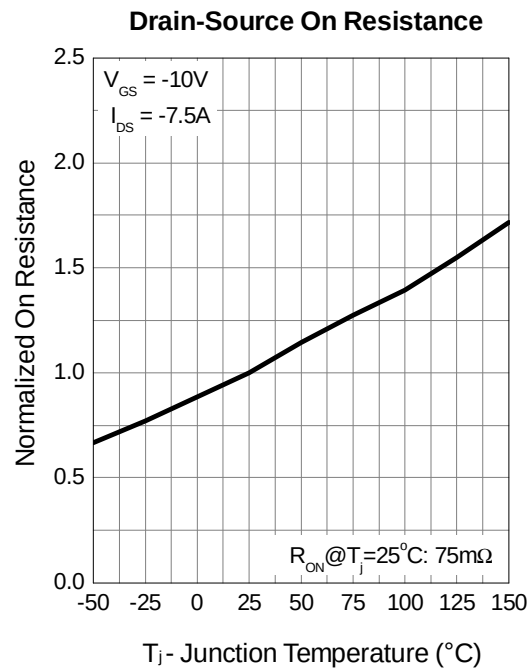
Thermal Transient Impedance



P Channel Typical Operating Characteristics (Cont.)

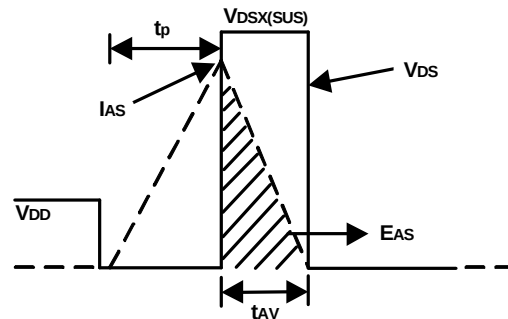
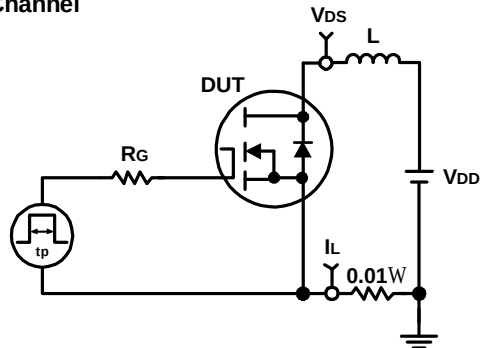


P Channel Typical Operating Characteristics (Cont.)

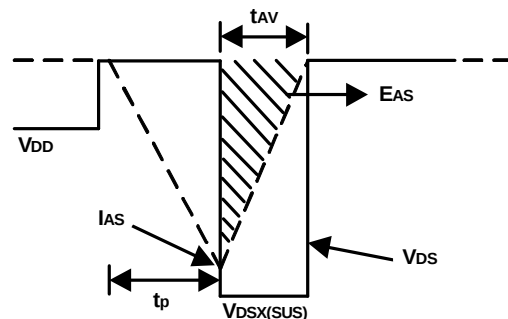
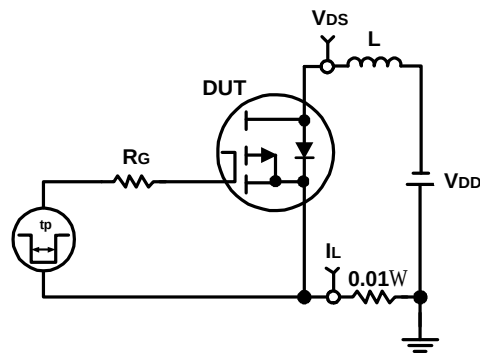


Avalanche Test Circuit and Waveforms

N Channel

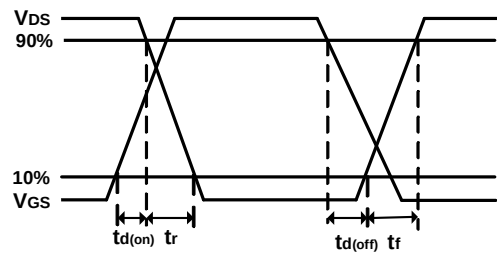
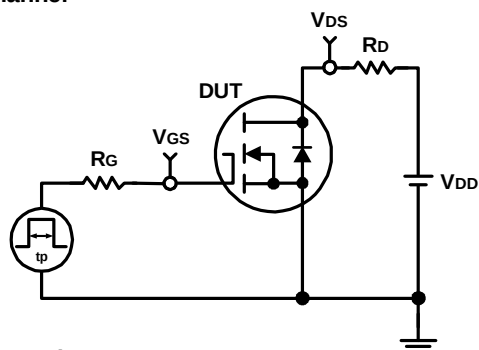


P Channel

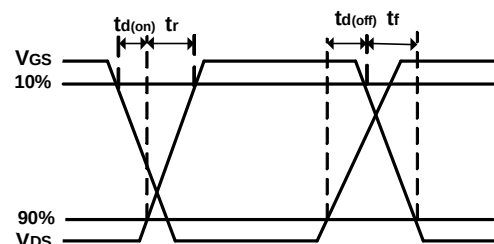
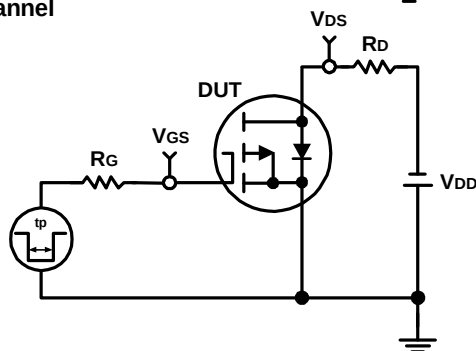


Switching Time Test Circuit and Waveforms

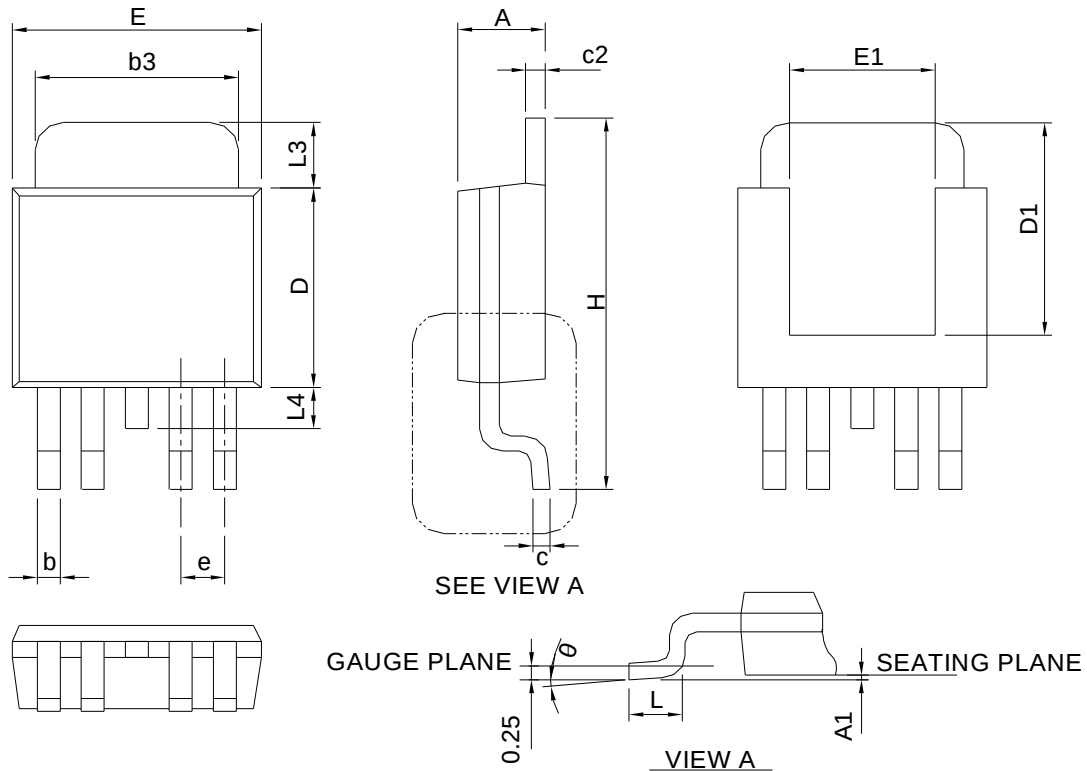
N Channel



P Channel

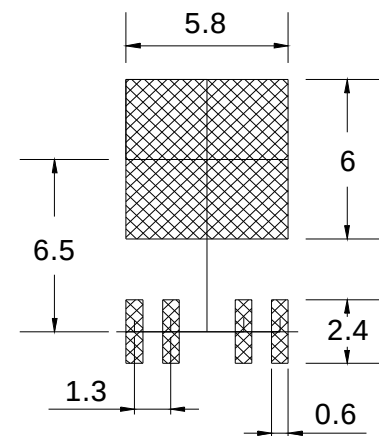


Package Information

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