

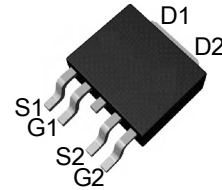
Features

- **N Channel**
30V/12A,
 $R_{DS(ON)} = 14m\Omega$ (typ.) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 17m\Omega$ (typ.) @ $V_{GS} = 4.5V$
- **P Channel**
-30V/-12A,
 $R_{DS(ON)} = 24m\Omega$ (typ.) @ $V_{GS} = -10V$
 $R_{DS(ON)} = 32m\Omega$ (typ.) @ $V_{GS} = -4.5V$
- 100% UIS + R_g Tested
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

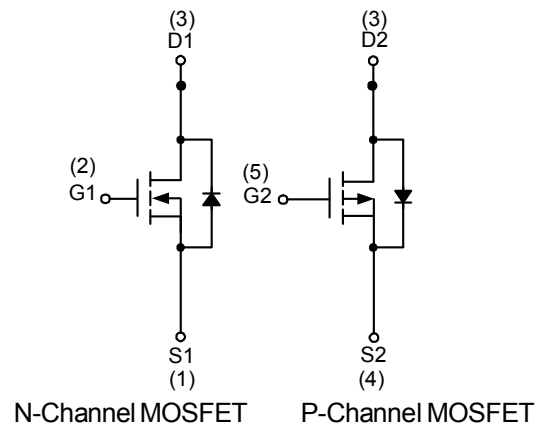
Applications

- Synchronous Rectification.
- Motor Fan Control.
- High Current, High Speed Switchin.
- H-bridge and Inverter.

Pin Description



Top View of TO-252-4



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		30	-30	V	
V _{GSS}	Gate-Source Voltage		±20	±20	V	
T _J	Maximum Junction Temperature		175		°C	
T _{STG}	Storage Temperature Range		-55 to 175		°C	
I _S	Diode Continuous Forward Current	T _C =25°C	12*	-10	A	
I _{DP} ^a	Pulse Drain Current Tested	V _{GS} =10V(N), V _{GS} =-10V(P)	48*	-48*	A	
I _D	Continuous Drain Current		T _C =25°C	12*	-12*	A
			T _C =70°C	12*	-12*	
P _D	Maximum Power Dissipation	T _C =25°C	24	24	W	
		T _C =70°C	16	16		
R _{θJC}	Thermal Resistance-Junction to Case	Steady State	6.25	6.25	°C/W	
I _D	Continuous Drain Current	T _A =25°C	12*	-11.5	A	
		T _A =70°C	12*	-9.6		
P _D	Maximum Power Dissipation	T _A =25°C	7.5	7.5	W	
		T _A =70°C	5.25	5.25		
R _{θJA} ^b	Thermal Resistance-Junction to Ambient	t ≤ 10s	20	20	°C/W	
		Steady State	60	60		
I _{AS} ^c	Avalanche Current, Single pulse	L=0.5mH	9	-9	A	
E _{AS} ^c	Avalanche Energy, Single pulse	L=0.5mH	20	20	mJ	

Note * : Max. current is limited by bonding wire.

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

Note b : $R_{\theta JA}$ steady state $t=999\text{s}$. $R_{\theta JA}$ is measured with the device mounted on 1in^2 , FR-4 board with 2oz. Copper.

Note c : UIS tested and pulse width limited by maximum junction temperature 175°C (initial temperature $T_J=25^\circ\text{C}$).

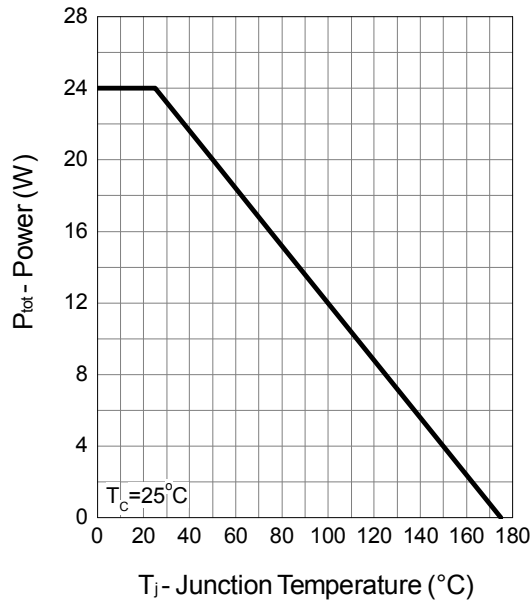
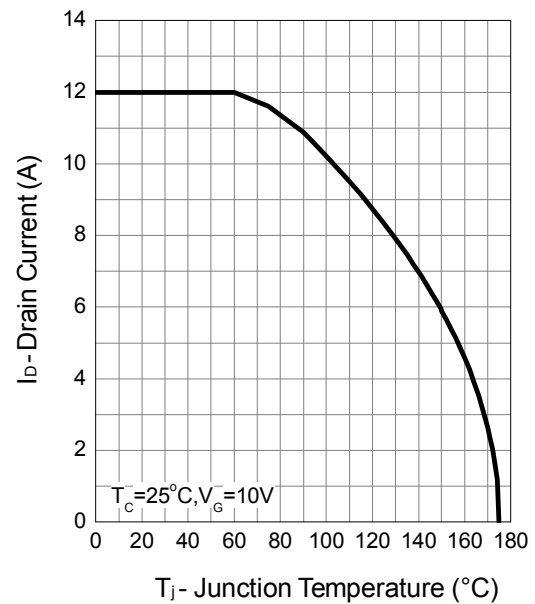
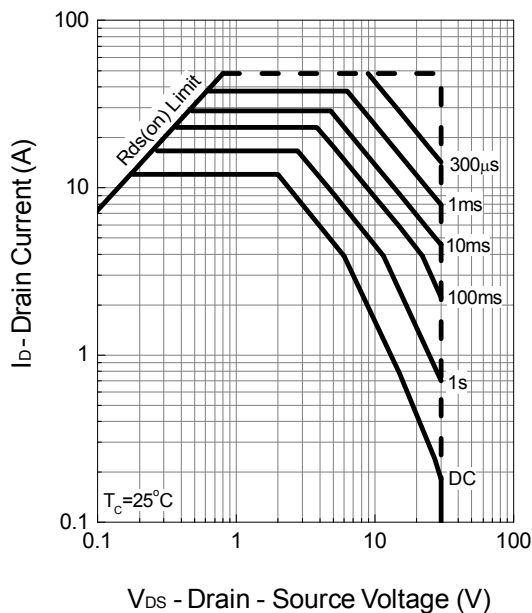
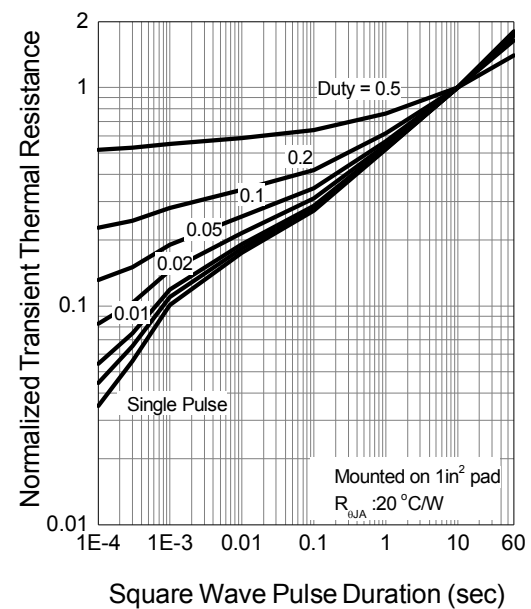
N Channel Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	N Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1.3	1.8	2.3	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} =8A	-	14	18.4	mΩ
		V _{GS} =4.5V, I _{DS} =5A	-	17	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} =8A, dI _{SD} /dt=100A/μs	-	10	-	ns
Q _{rr}	Reverse Recovery Charge		-	3.5	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V,V _{DS} =0V,F=1MHz	-	1.7	3.4	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, Frequency=1.0MHz	-	545	708	pF
C _{oss}	Output Capacitance		-	95	-	
C _{rss}	Reverse Transfer Capacitance		-	55	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =15V, R _L =15Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	6	-	ns
t _r	Turn-on Rise Time		-	8.6	-	
t _{d(OFF)}	Turn-off Delay Time		-	16	-	
t _f	Turn-off Fall Time		-	3.6	-	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =10V, I _{DS} =8A	-	10.8	16	nC
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =4.5V, I _{DS} =8A	-	5.2	7.8	
Q _{gth}	Threshold Gate Charge		-	0.6	-	
Q _{gs}	Gate-Source Charge		-	1	-	
Q _{gd}	Gate-Drain Charge		-	2.8	-	

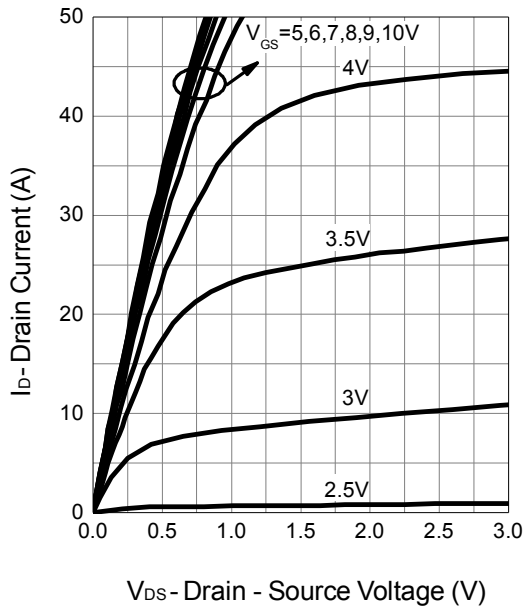
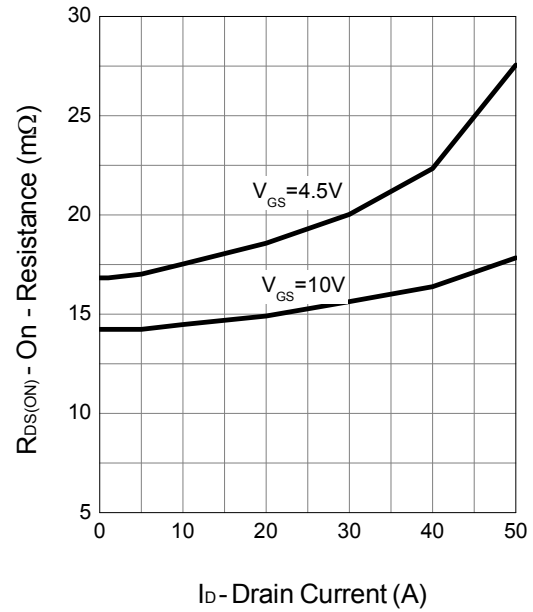
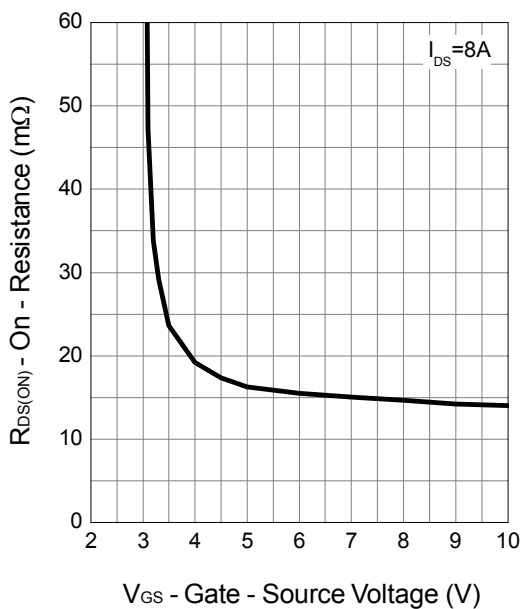
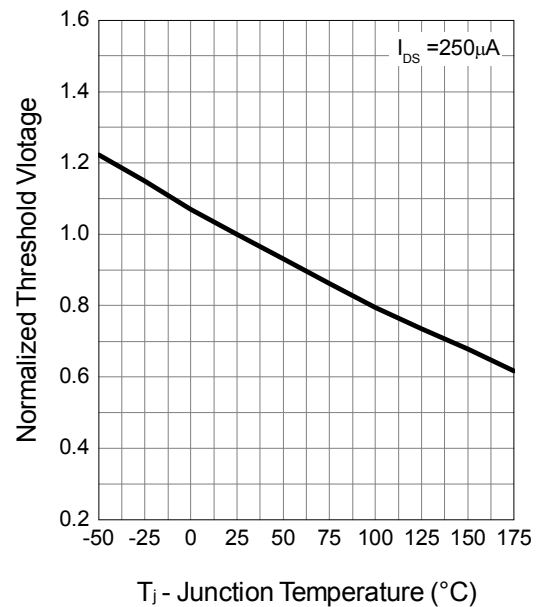
Note d : Pulse test ; pulse width≤300μs, duty cycle≤2%.

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

N Channel Typical Operating Characteristics

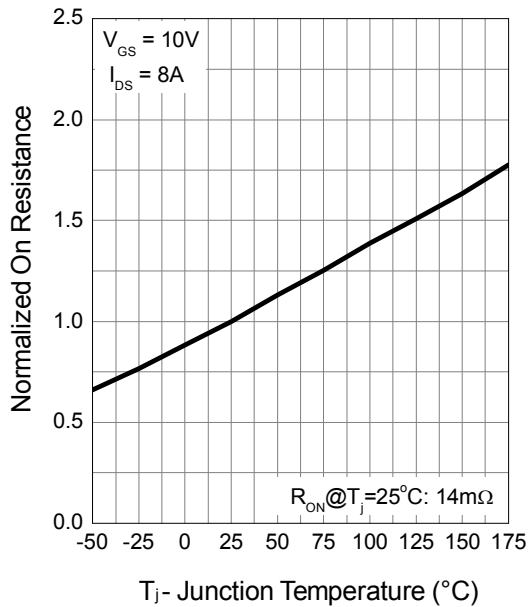
Power Dissipation

Drain Current

Safe Operation Area

Thermal Transient Impedance


N Channel Typical Operating Characteristics (Cont.)

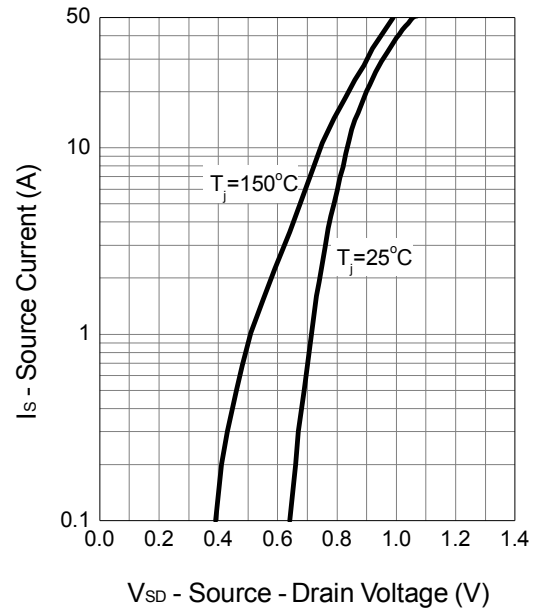
Output Characteristics

Drain-Source On Resistance

Gate-Source On Resistance

Gate Threshold Voltage


N Channel Typical Operating Characteristics (Cont.)

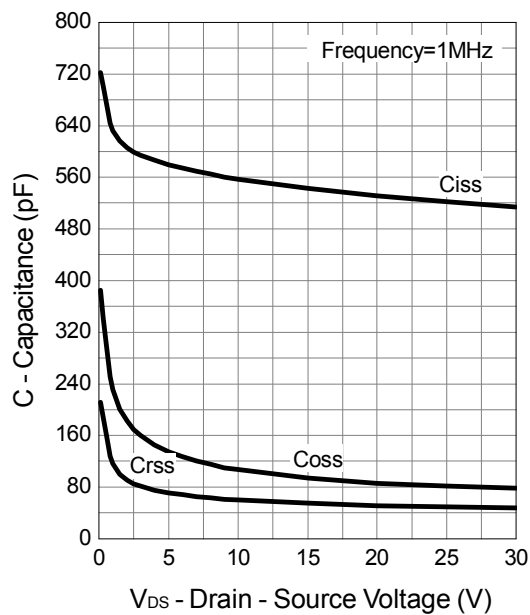
Drain-Source On Resistance



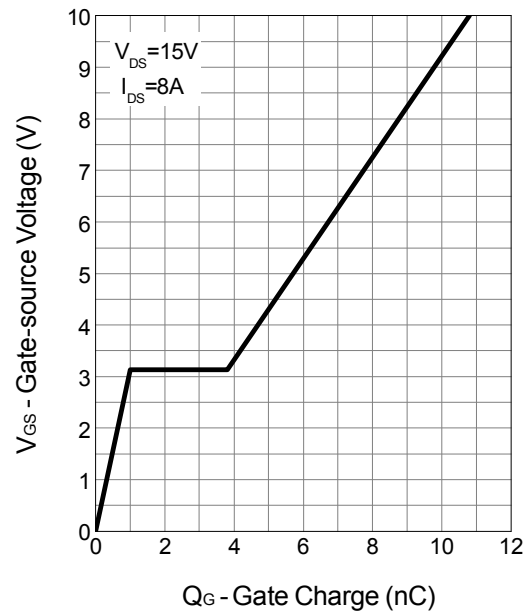
Source-Drain Diode Forward



Capacitance



Gate Charge



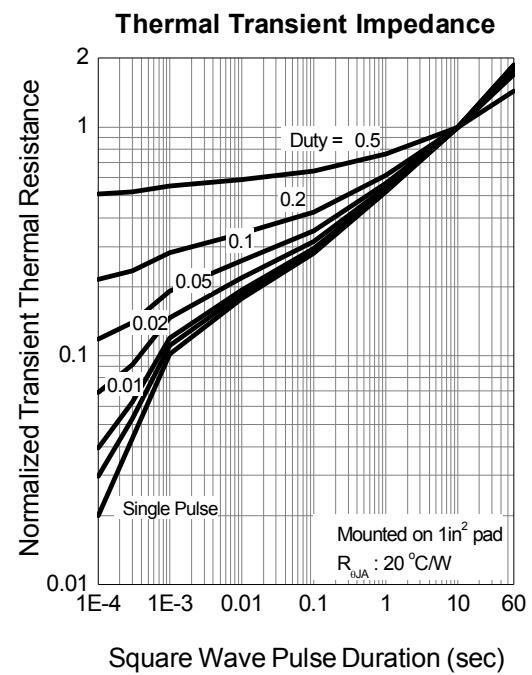
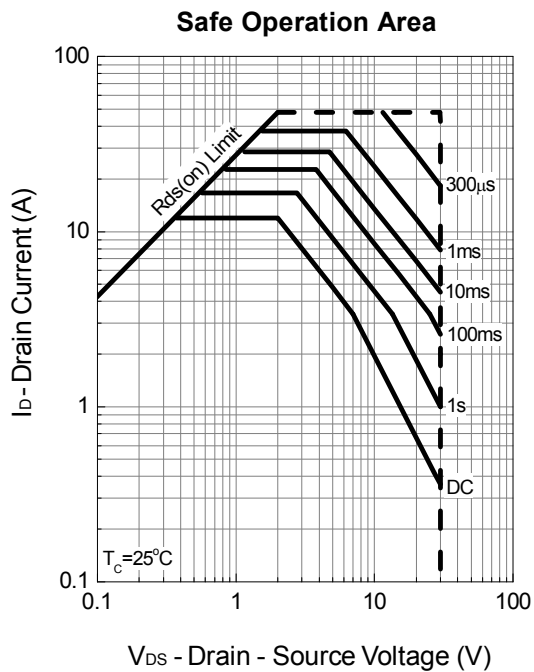
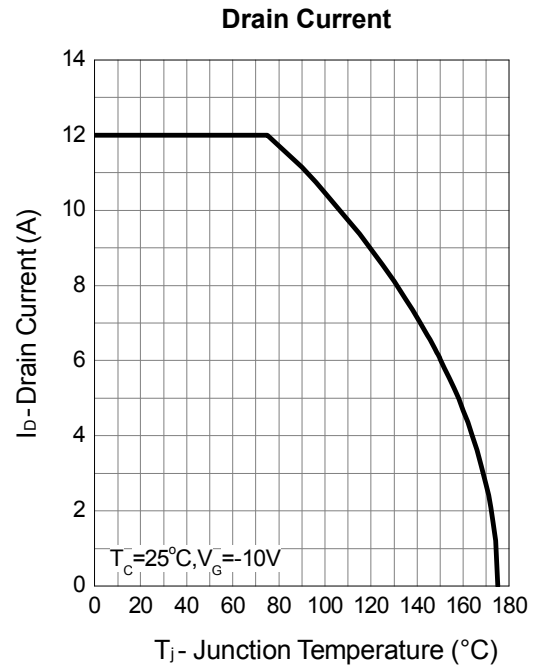
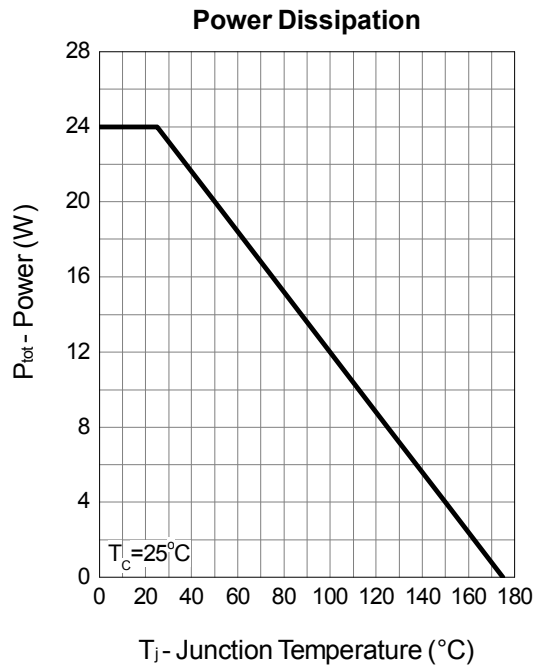
P Channel Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	P Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =-250μA	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-24V, V _{GS} =0V	-	-	-1	μA
		T _J =85°C	-	-	-30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-1.3	-1.8	-2.3	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} =-12A	-	24	33.5	mΩ
		V _{GS} =-4.5V, I _{DS} =-5A	-	32	44	
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} =-12A, dI _{SD} /dt=100A/μs	-	11	-	ns
Q _{rr}	Reverse Recovery Charge		-	4	-	nC
Dynamic Characteristics ^e						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	3.3	6.6	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V, Frequency=1.0MHz	-	580	754	pF
C _{oss}	Output Capacitance		-	105	-	
C _{rss}	Reverse Transfer Capacitance		-	72	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-15V, R _L =15Ω, I _{DS} =-1A, V _{GEN} =-10V, R _G =6Ω	-	8.7	-	ns
t _r	Turn-on Rise Time		-	10	-	
t _{d(OFF)}	Turn-off Delay Time		-	22	-	
t _f	Turn-off Fall Time		-	9	-	
Gate Charge Characteristics ^e						
Q _g	Total Gate Charge	V _{DS} =-15V, V _{GS} =-10V, I _{DS} =-12A	-	13	-	nC
Q _{gs}	Gate-Source Charge		-	1	-	
Q _{gd}	Gate-Drain Charge		-	4	-	

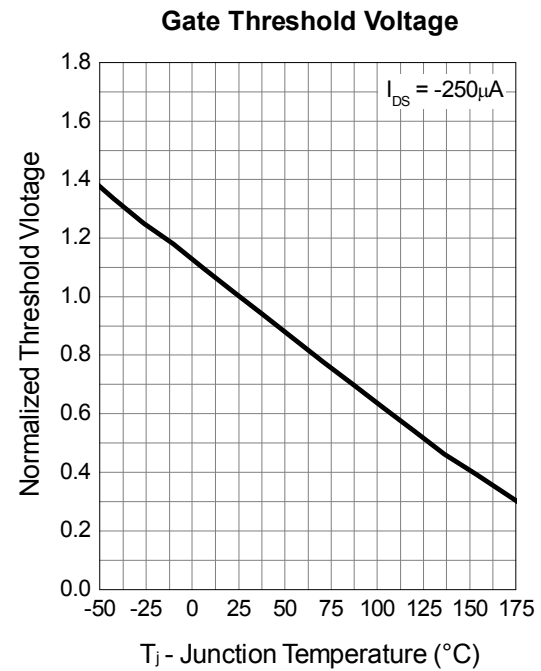
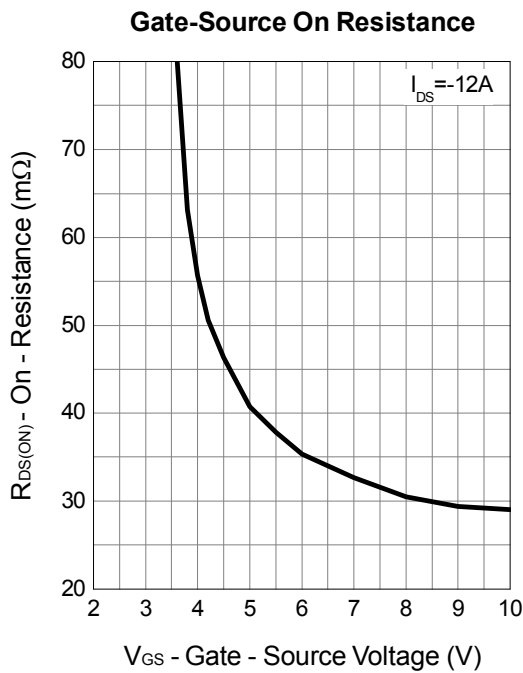
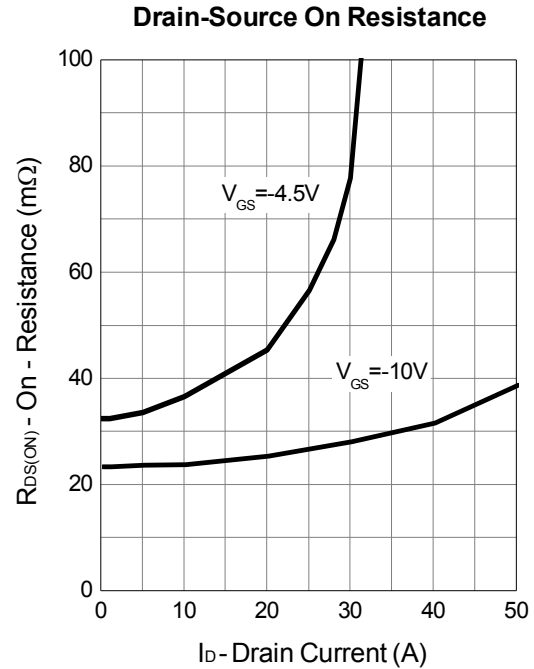
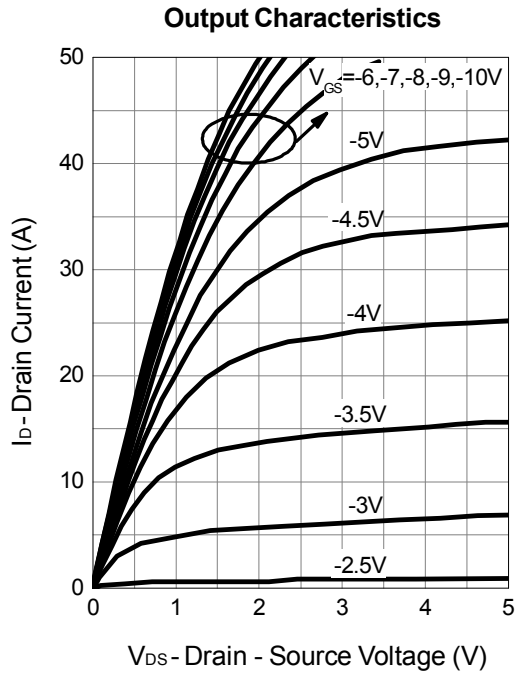
Note d : Pulse test; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

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

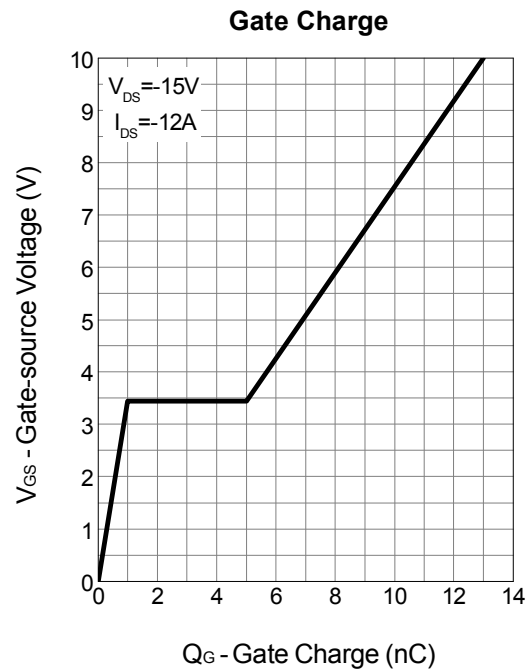
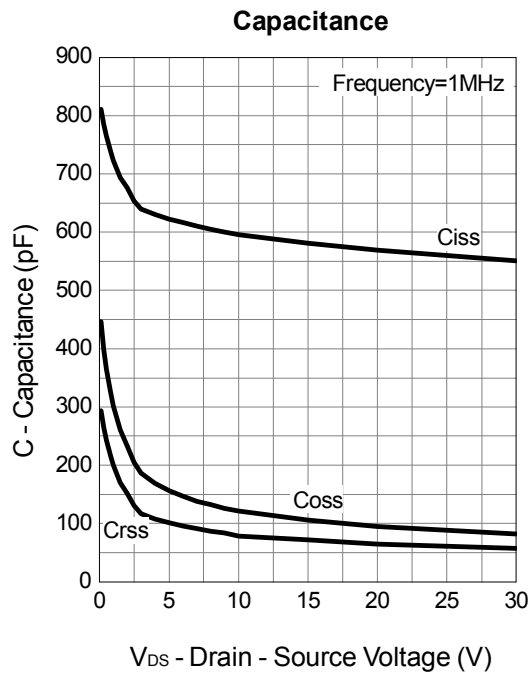
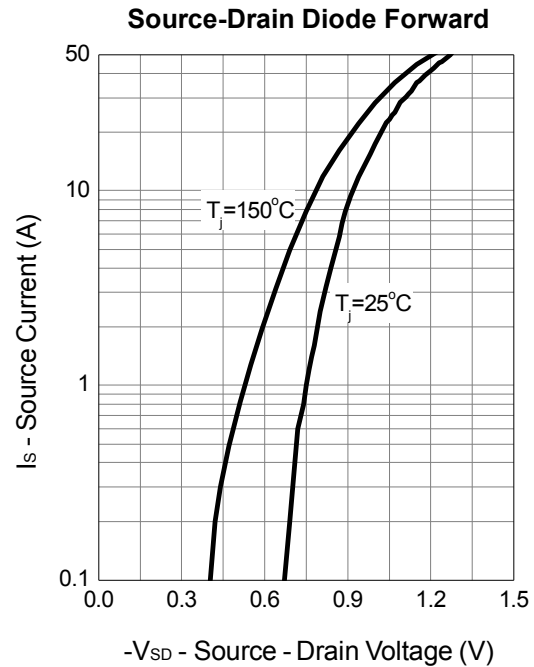
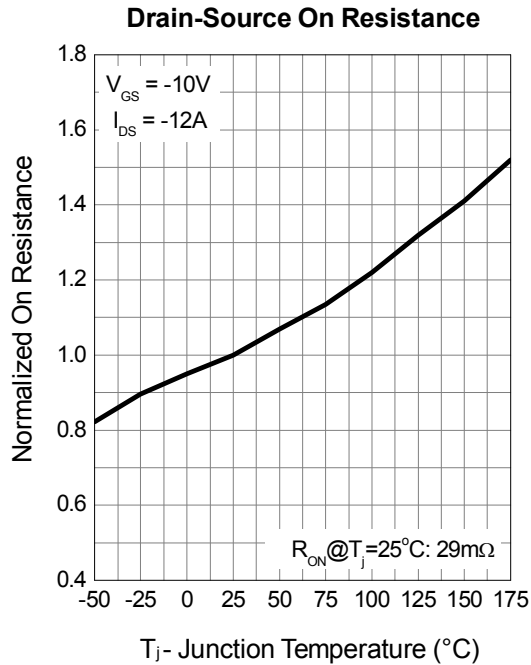
P Channel Typical Operating Characteristics



P Channel Typical Operating Characteristics (Cont.)

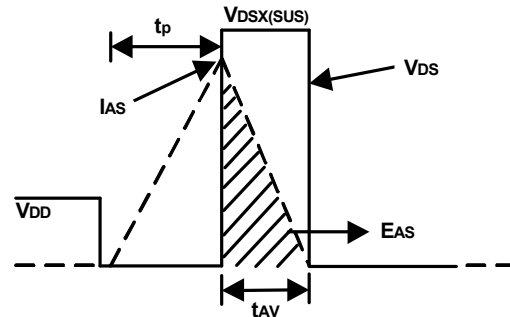
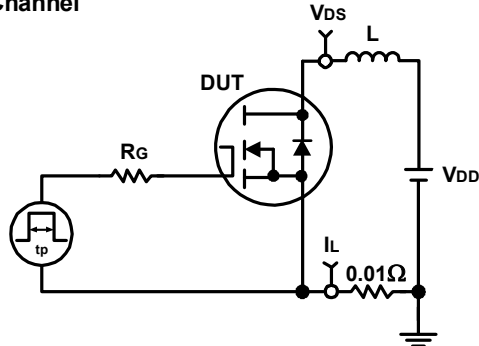


P Channel Typical Operating Characteristics (Cont.)

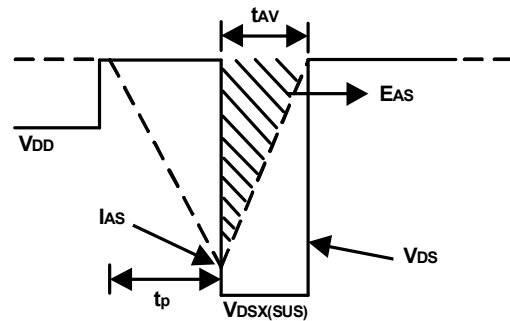
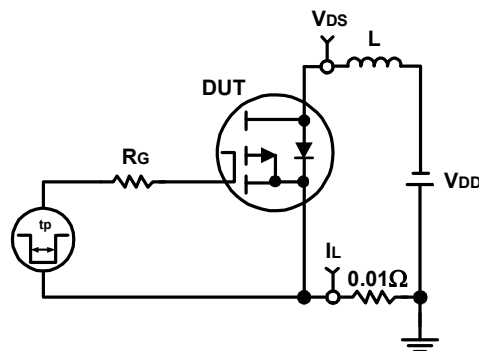


Avalanche Test Circuit and Waveforms

N Channel

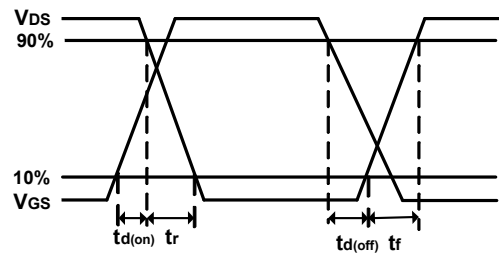
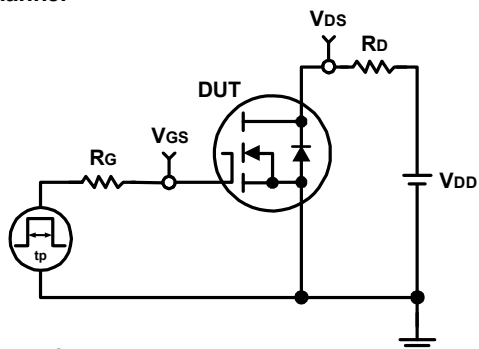


P Channel

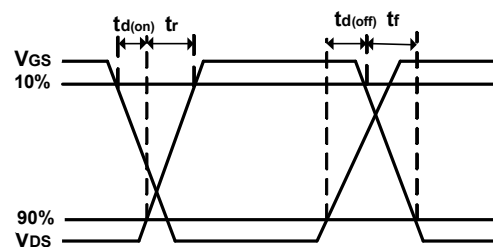
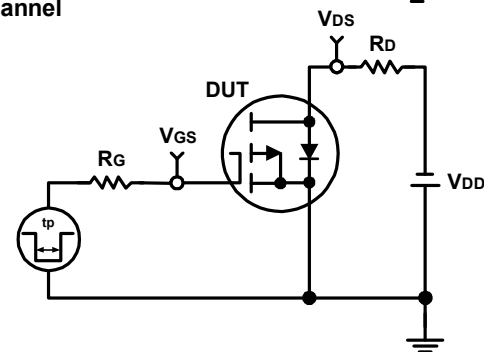


Switching Time Test Circuit and Waveforms

N Channel

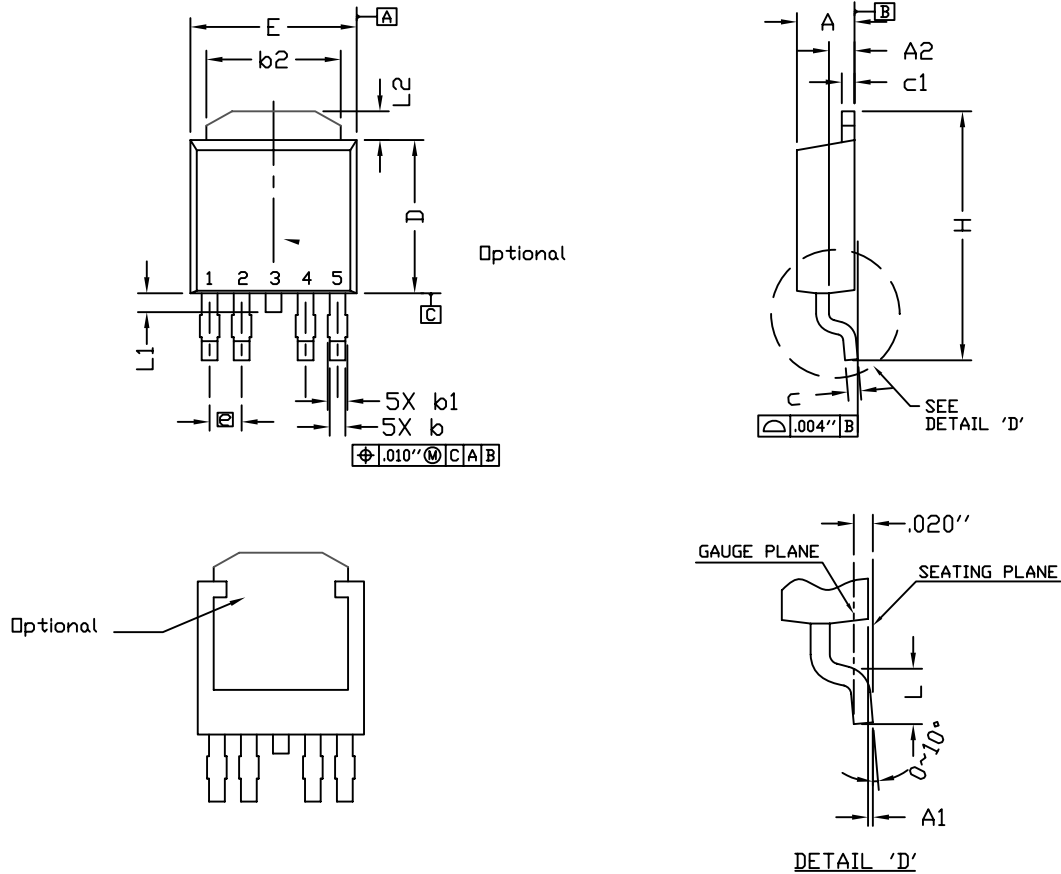


P Channel

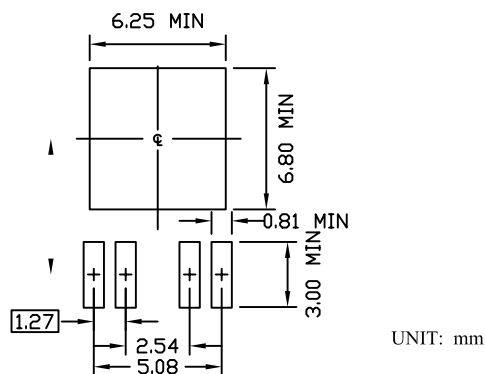


Package Information

TO-252-4



RECOMMENDED LAND PATTERN



NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. DIMENSION L IS MEASURED IN GAUGE PLANE.
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED.
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. REFER TO JEDEC TO-252 (AD).

SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.184	2.286	2.388	0.086	0.090	0.094
A1	0.000	----	0.127	0.000	----	0.005
A2	0.889	----	1.143	0.035	----	0.045
b	0.508	----	0.711	0.020	----	0.028
b1	0.584	----	0.787	0.023	----	0.031
b2	4.953	----	5.461	0.195	----	0.215
c	0.457	0.508	0.610	0.018	0.020	0.024
c1	0.457	----	0.610	0.018	----	0.024
D	5.969	6.096	6.223	0.235	0.240	0.245
E	6.350	6.604	6.731	0.250	0.260	0.265
e	1.270 BSC.			0.050 BSC.		
H	9.398	----	10.414	0.370	----	0.410
L	1.270	----	2.032	0.050	----	0.080
L1	----	----	1.016	----	----	0.040
L2	0.889	----	1.270	0.035	----	0.050