

### Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	$I_D$
40V	13mΩ@10V	23A
	16mΩ@4.5V	
-40V	22mΩ@-10V	-20A
	31mΩ@-4.5V	

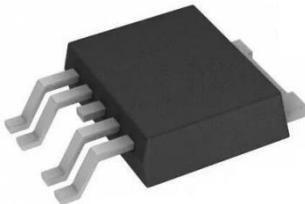
### Feature

- High power and current handling capability
- Lead free product is acquired
- Surface mount package

### Application

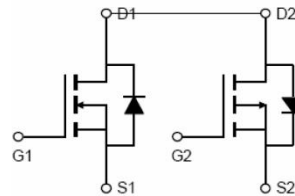
- Battery Protection
- Load Switch
- Power Management

### Package

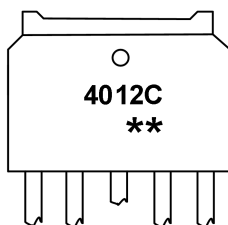


TO-252-4L

### Circuit diagram



### Marking



**4012C** =Device Code  
**\*\*** =Week Code.

**Absolute maximum ratings (Ta=25°C unless otherwise noted)**

Parameter	Symbol	Value		Unit
		N-Channel	P-Channel	
Drain-Source Voltage	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current	$I_D$	23	-20	A
Pulsed Drain Current	$I_{DM}$	92	-80	A
Maximum Power Dissipation	$T_C=25^\circ\text{C}$ $P_D$	41		W
Thermal Resistance from Junction to Cassette( $t \leq 10\text{s}$ )	$R_{\theta JC}$	3.1		$^\circ\text{C}/\text{W}$
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	-55 To 150	$^\circ\text{C}$

**N-Channel Electrical characteristics (Ta=25°C, unless otherwise noted)**

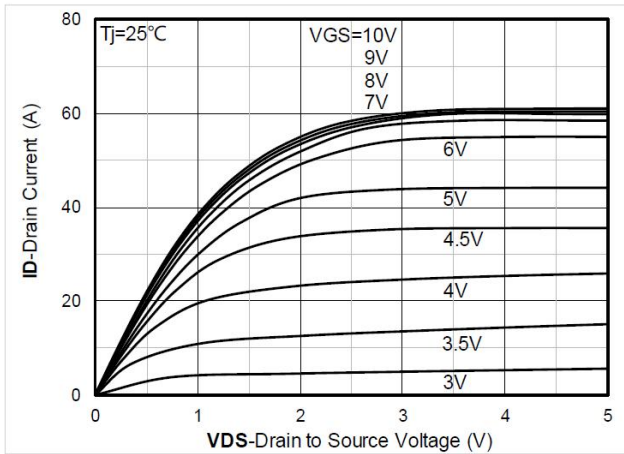
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	40	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	1	1.5	2.0	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}, I_D = 7\text{A}$	-	13	17	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 6\text{A}$	-	16	22	m $\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1434	-	PF
Output Capacitance	$C_{oss}$			91	-	PF
Reverse Transfer Capacitance	$C_{rss}$			75	-	PF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_d(on)$	$V_{DD} = 20\text{V}, V_{GS} = 10\text{V}, R_G = 3.3\Omega, I_D = 7\text{A}$		7.8	-	nS
Turn-on Rise Time	$t_r$			10.7	-	nS
Turn-Off Delay Time	$t_d(off)$			25.8	-	nS
Turn-Off Fall Time	$t_f$			4.6	-	nS
Total Gate Charge	$Q_g$	$V_{DS} = 32\text{V}, V_{GS} = 4.5\text{V}, I_D = 7\text{A}$		25	-	nC
Gate-Source Charge	$Q_{gs}$			6.3	-	nC
Gate-Drain Charge	$Q_{gd}$			4.6	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{V}, I_S = 1\text{A}, T_J = 25^\circ\text{C}$			1	V

**P-Channel Electrical characteristics (T<sub>A</sub>=25 °C, unless otherwise noted)**

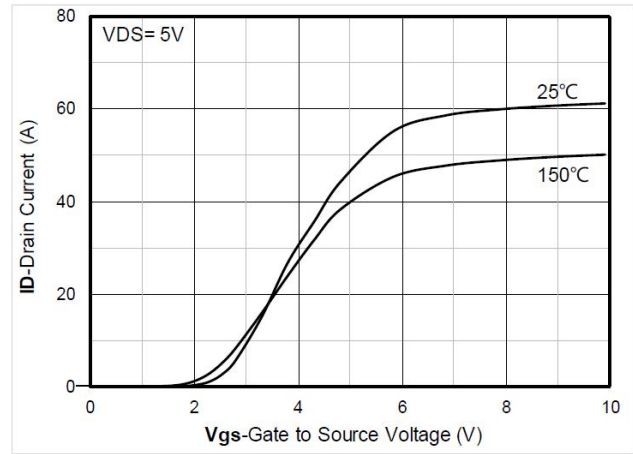
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V	-	-	-1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V	-	-	±100	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0	-1.5	-2.0	V
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -5A	-	22	28	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -4A	-	31	41	mΩ
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1MHz	-	1415	-	PF
Output Capacitance	C <sub>oss</sub>		-	204	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	112	-	PF
<b>Switching Characteristics</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -15V, V <sub>GS</sub> = -10V, R <sub>G</sub> = 3.3 Ω, I <sub>D</sub> = -1A	-	11	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	16.7	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	35	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	19	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -15V, V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -1A	-	23.5	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	3.4	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	4.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A, T <sub>J</sub> = 25°C	-	-	-1.2	V

**Notes:**

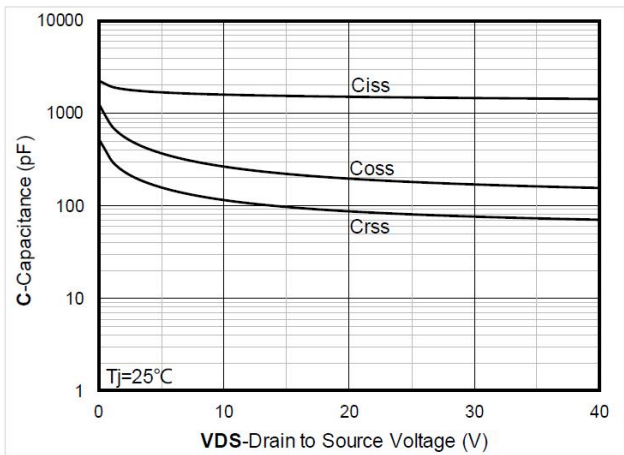
**N-Channel Typical Characteristics**



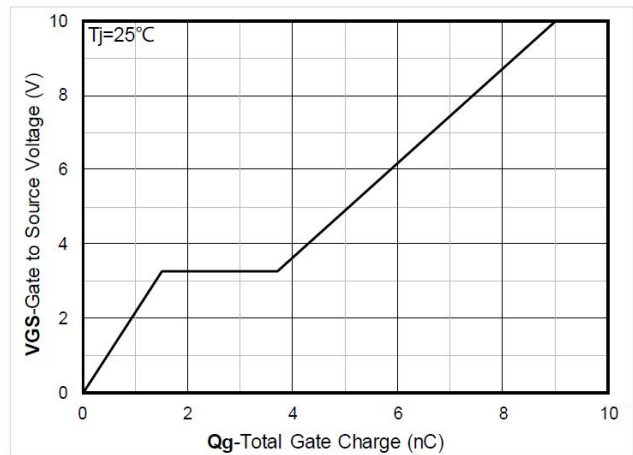
Output Characteristics



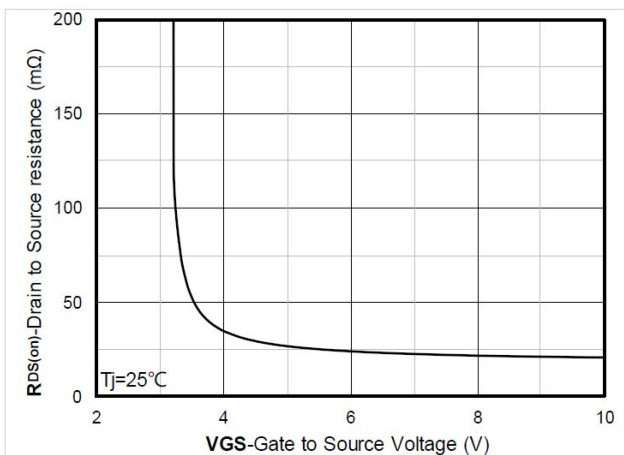
Transfer Characteristics



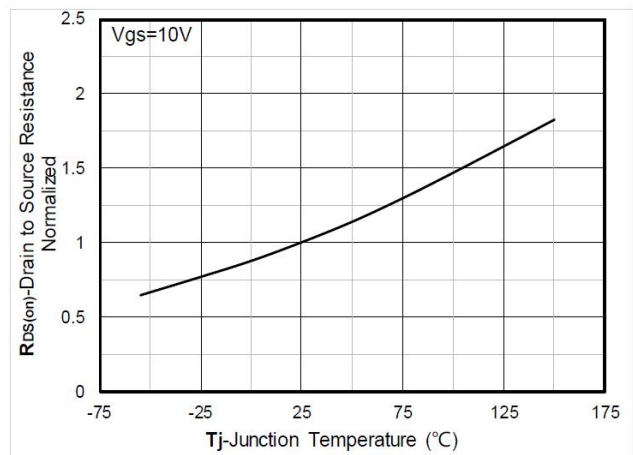
Capacitance Characteristics



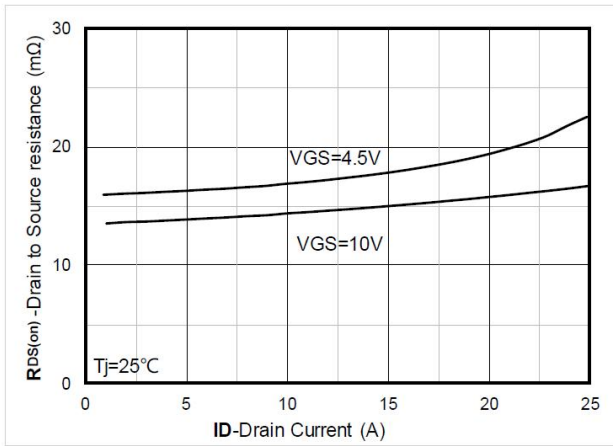
Gate Charge



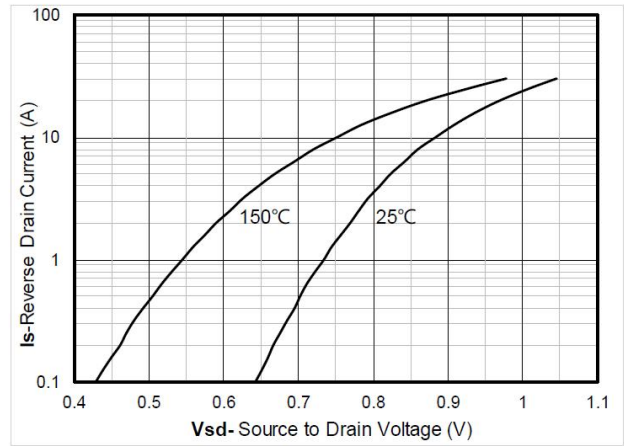
On-Resistance vs Gate to Source Voltage



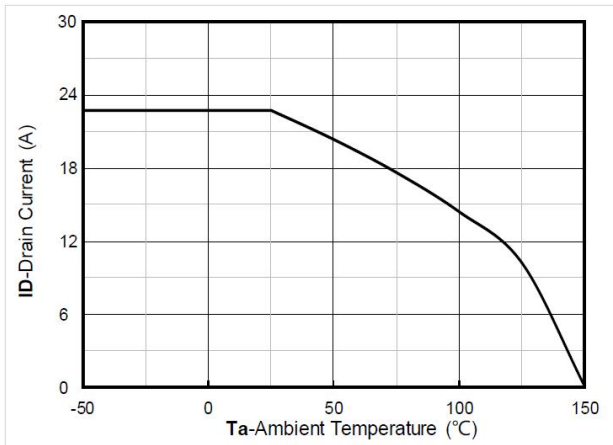
Normalized On- Resistance



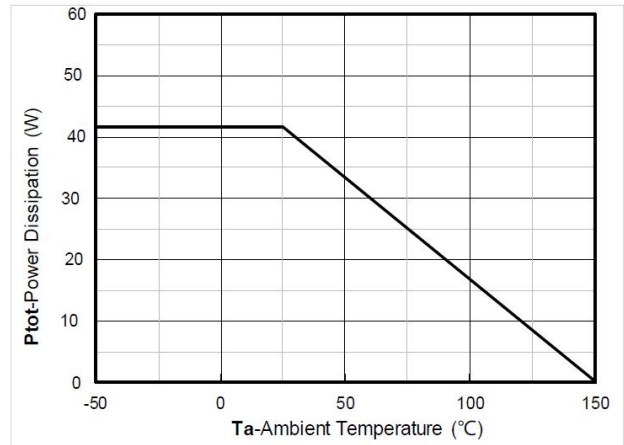
RDS(on) VS Drain Current



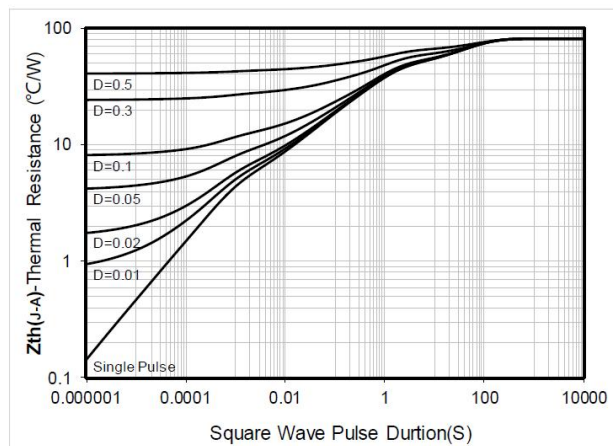
Forward characteristics of reverse diode



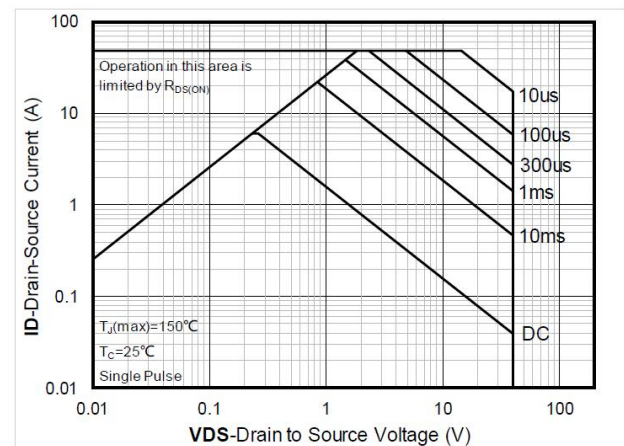
Current dissipation



Power dissipation

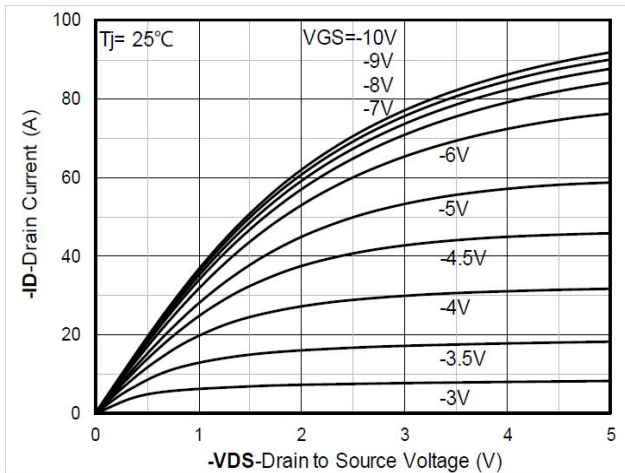


Maximum Transient Thermal Impedance

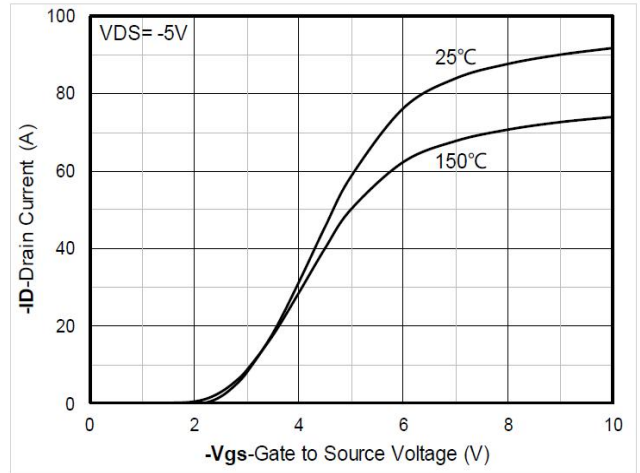


Safe Operation Area

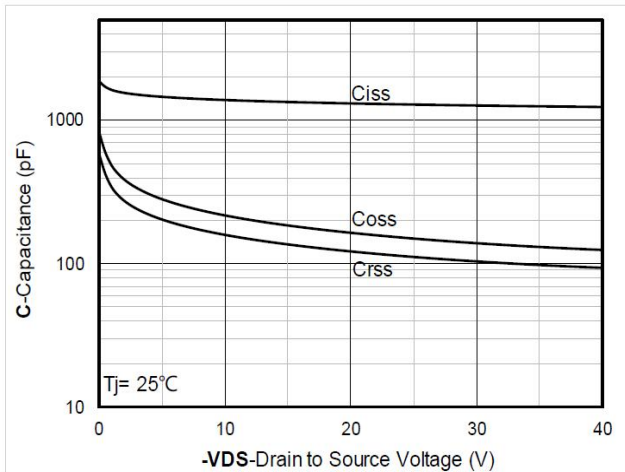
**P-Channel Typical Characteristics**



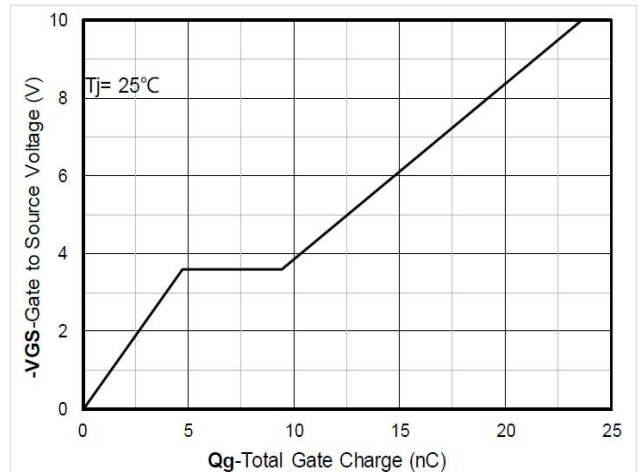
Output Characteristics



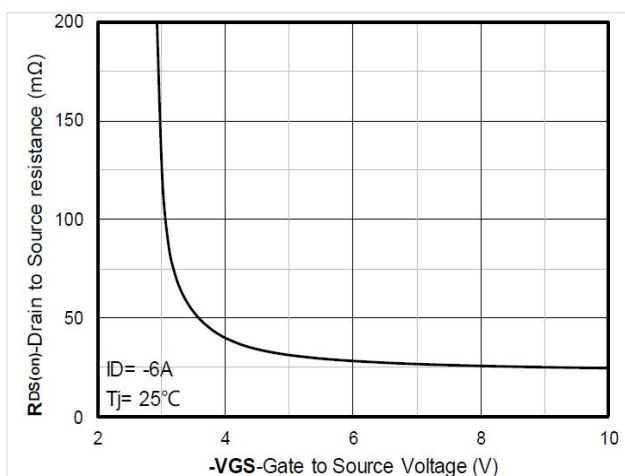
Transfer Characteristics



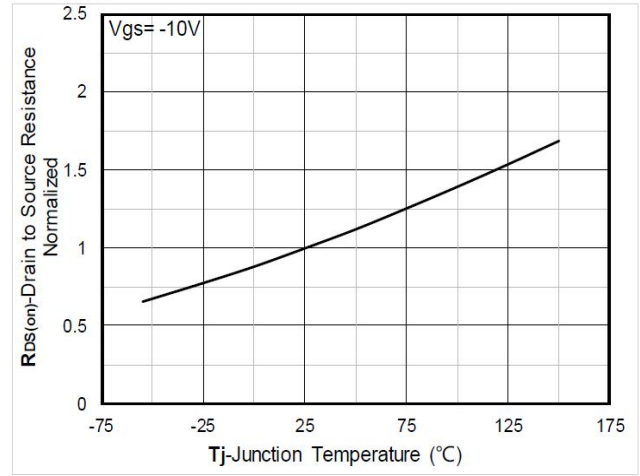
Capacitance Characteristics



Gate Charge

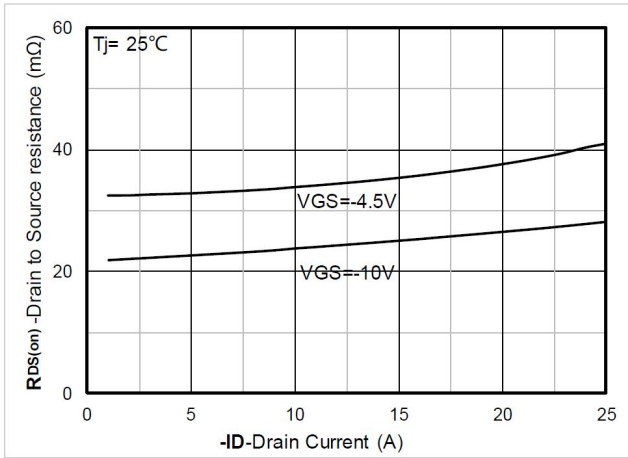


On-Resistance vs Gate to Source Voltage



Normalized On-Resistance

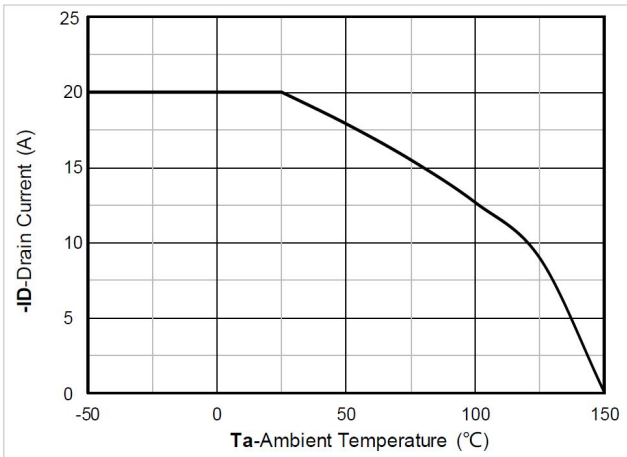




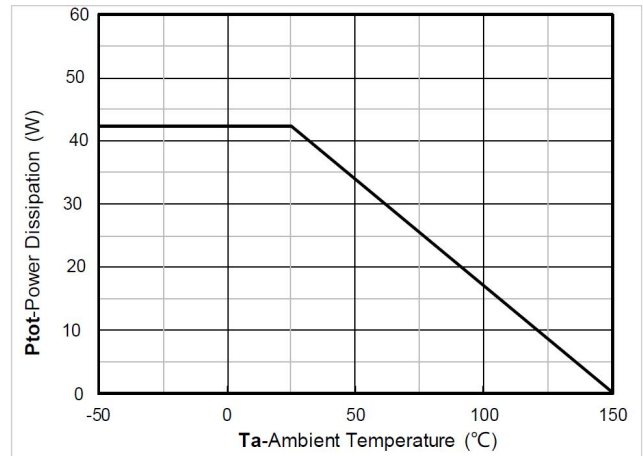
RDS(on) VS Drain Current



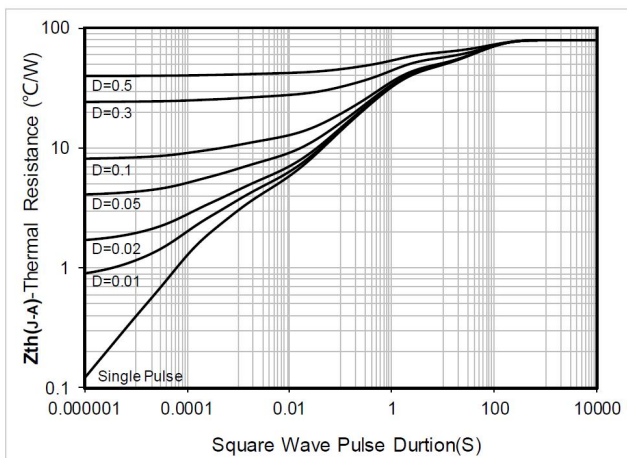
Forward characteristics of reverse diode



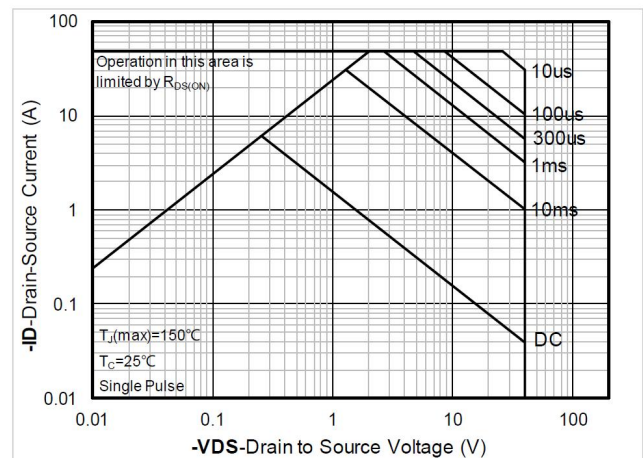
Current dissipation



Power dissipation



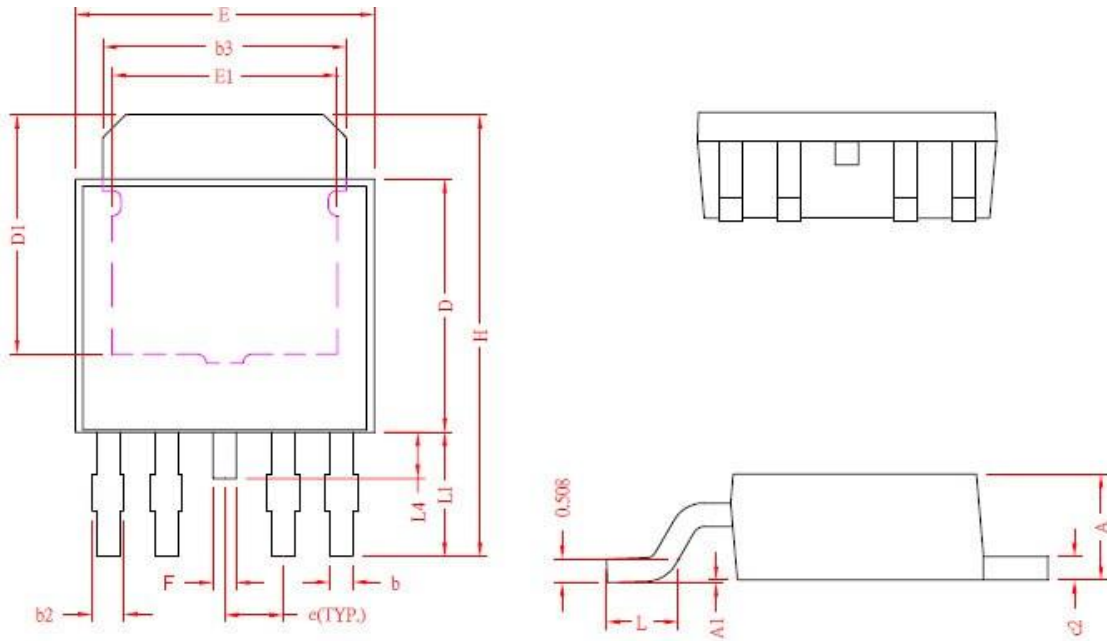
Maximum Transient Thermal Impedance



Safe Operation Area



TO-252-4L Package Information



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	2.20	2.40
A1	0	0.15
b	0.40	0.60
b2	0.50	0.80
b3	5.20	5.50
c2	0.45	0.55
D	5.40	5.80
D1	4.57	-
E	6.40	6.80
E1	3.81	-
e	1.27REF.	
F	0.40	0.60
H	9.40	10.20
L	1.40	1.77
L1	2.40	3.00
L4	0.80	1.20



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