



## N and P Channel Enhancement Mode Power MOSFET

### Description

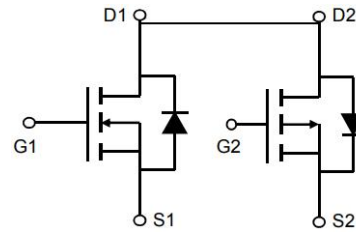
The PE4025KC uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. It can be used in a wide variety of applications.

### General Features

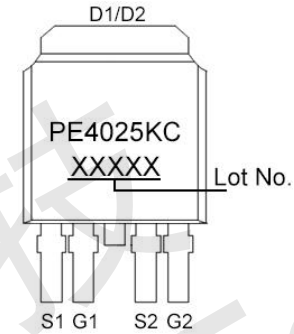
- **N-Channel**
  - $V_{DS} = 40V$ ,  $I_D = 16A$
  - $R_{DS(ON)} < 18m\Omega @ V_{GS}=10V$
  - $R_{DS(ON)} < 25m\Omega @ V_{GS}=4.5V$
- **P-Channel**
  - $V_{DS} = -40V$ ,  $I_D = -13A$
  - $R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$
  - $R_{DS(ON)} < 48m\Omega @ V_{GS}=-4.5V$
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

### Application

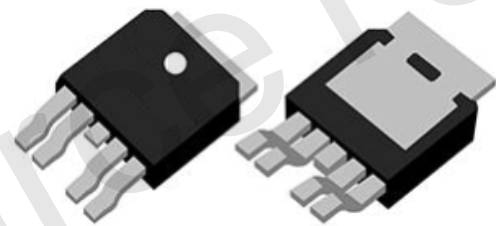
- DC motor
- PWM applications



Schematic diagram



Marking and pin assignment



TO-252-4L

### Absolute Maximum Ratings (TC=25°C unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Drain Current-Continuous (TC=25°C)	$I_D$	16	-13	A
Drain Current-Continuous (TC=100°C)	$I_D$	11	-9	A
Pulsed Drain Current (Note 1)	$I_{DM}$	48	-39	A
Maximum Power Dissipation	$P_D$	27	21	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175		°C

### Thermal Characteristic

Parameter	Symbol	N-Channel	P-Channel	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	5.5	7.1	°C/W



**N-Channel Electrical Characteristics (TC=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.5	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=8A$	-	12.5	18	m $\Omega$
		$V_{GS}=4.5V, I_D=6A$	-	17.5	25	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=8A$	-	25	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	1314	-	pF
Output Capacitance	$C_{oss}$		-	120	-	pF
Reverse Transfer Capacitance (Note 4)	$C_{rss}$		-	88	-	pF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, R_L=1\Omega,$ $V_{GS}=10V, R_G=3\Omega$	-	8.6	-	nS
Turn-on Rise Time	$t_r$		-	3.4	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	$t_f$		-	2.2	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=6A,$ $V_{GS}=10V$	-	22	-	nC
Gate-Source Charge	$Q_{gs}$		-	3.2	-	nC
Gate-Drain Charge	$Q_{gd}$		-	4.2	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=1A$	-	-	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	16	A

**Notes:**

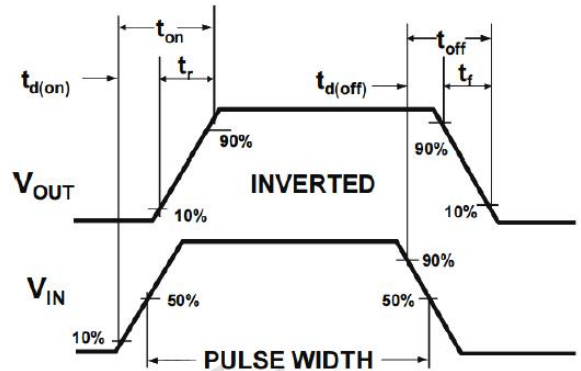
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to product.



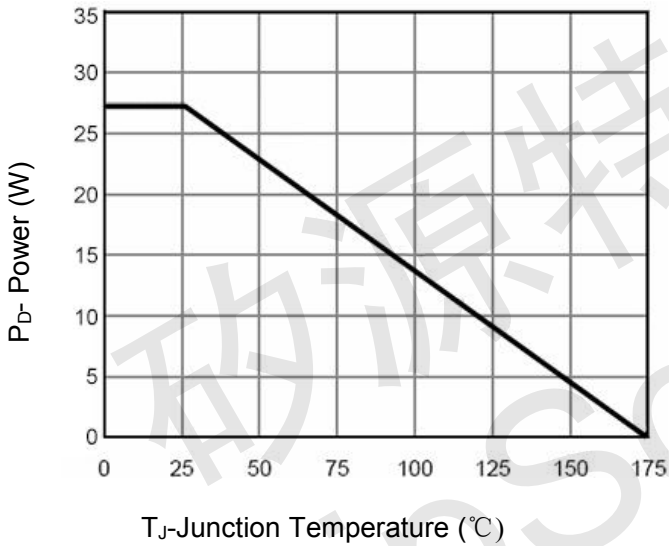
**Typical Electrical and Thermal Characteristics**



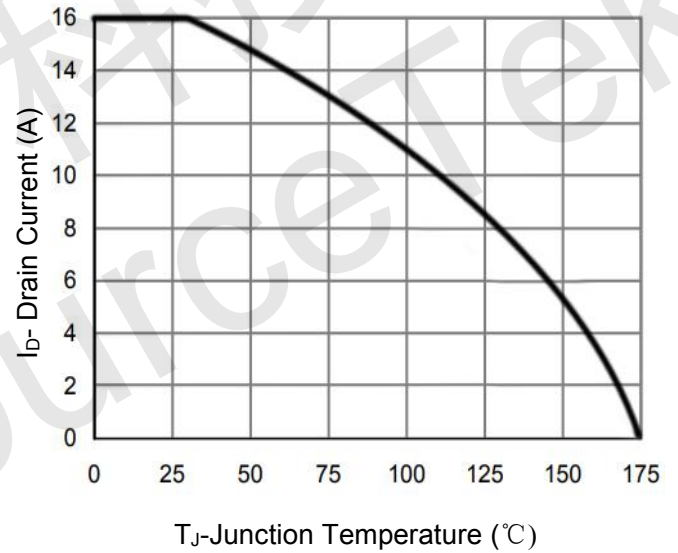
**Figure 1 Switching Test Circuit**



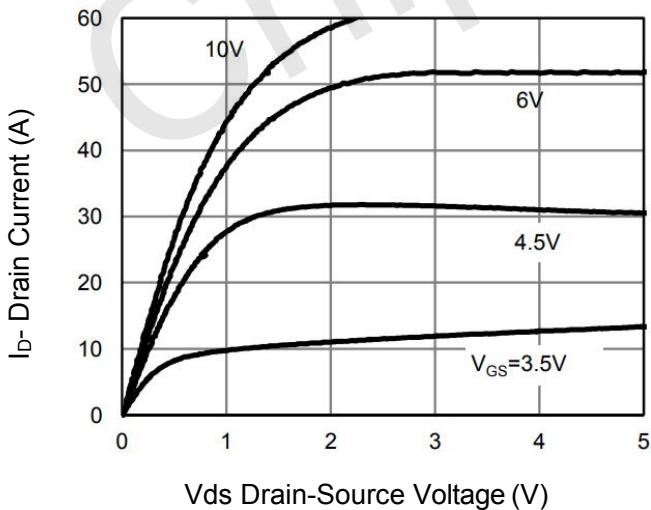
**Figure 2 Switching Waveform**



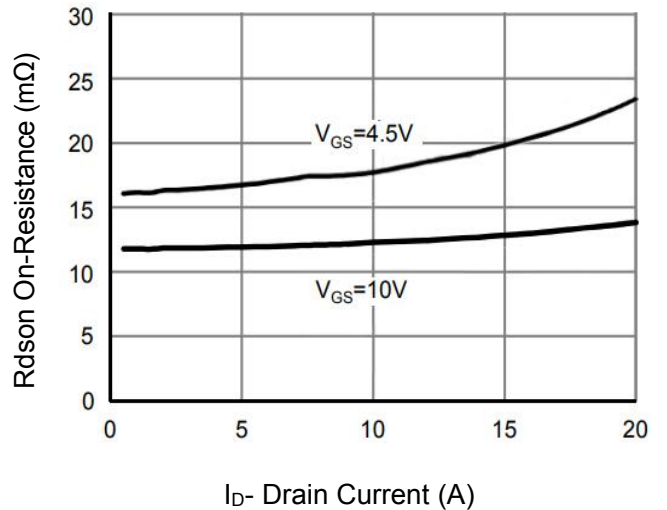
**Figure 3 Power De-rating**



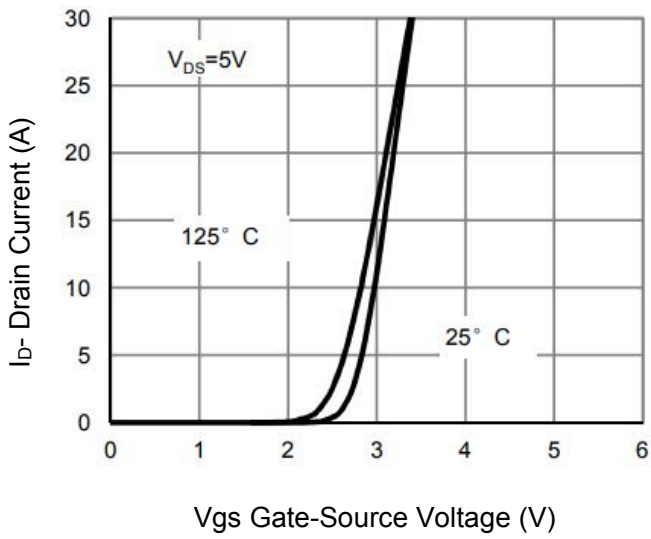
**Figure 4 Drain Current**



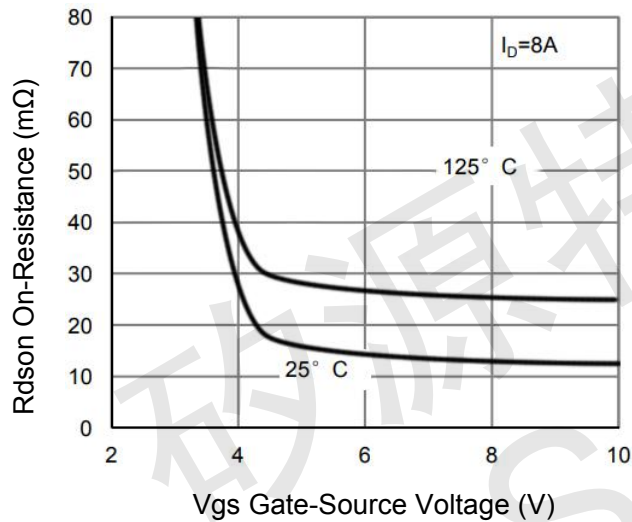
**Figure 5 Output Characteristics**



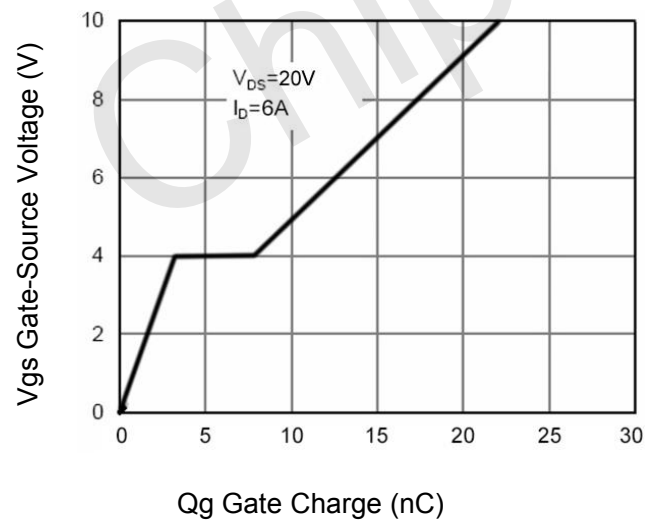
**Figure 6 R<sub>dson</sub> vs Drain Current**



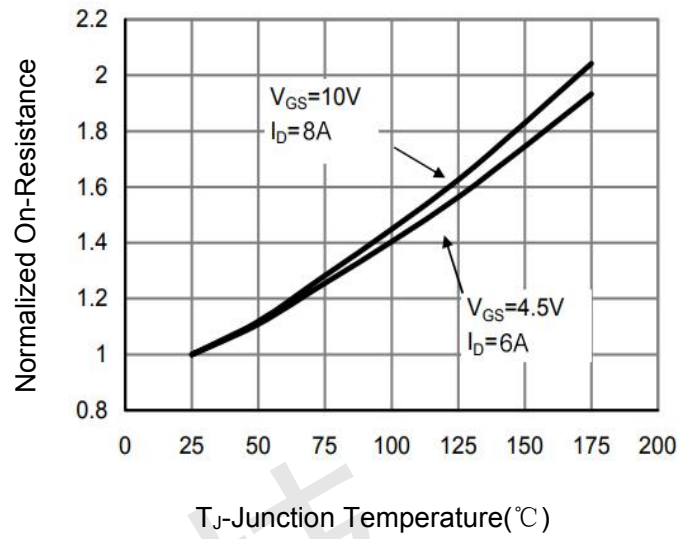
**Figure 7 Transfer Characteristics**



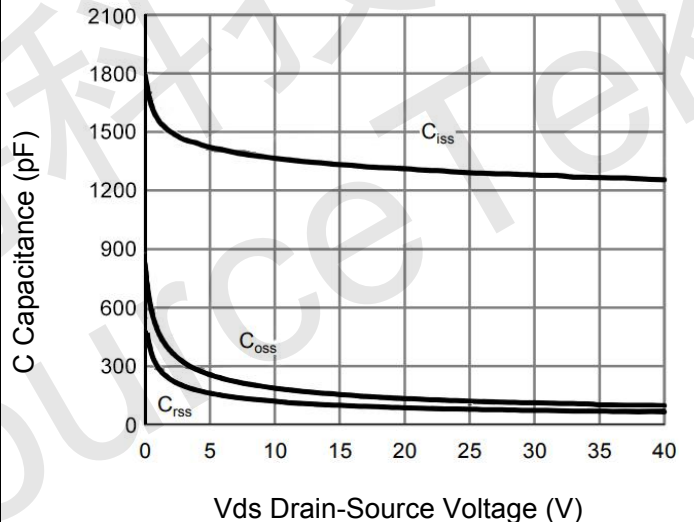
**Figure 9 Rdson vs Vgs**



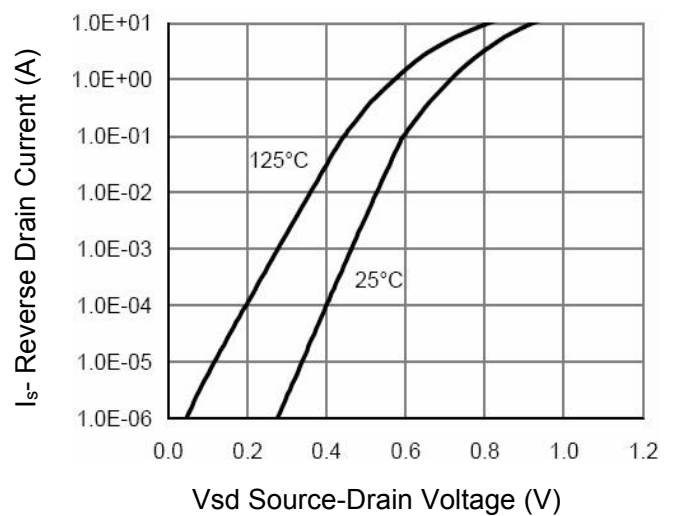
**Figure 11 Gate Charge**



**Figure 8 Rdson vs Junction Temperature**



**Figure 10 Capacitance vs Vds**



**Figure 12 Source- Drain Diode Forward**

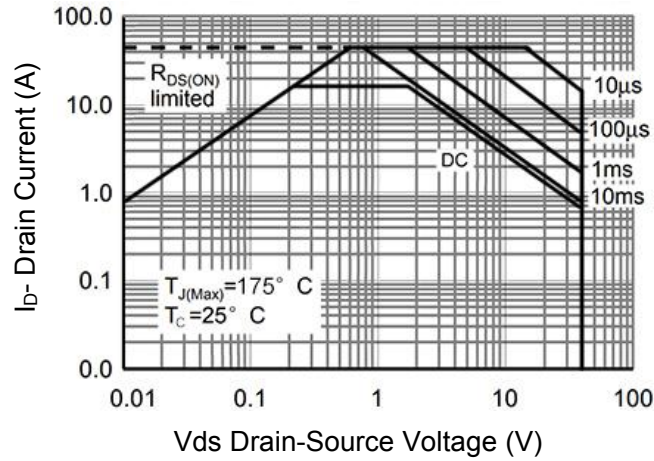


Figure 13 Safe Operation Area

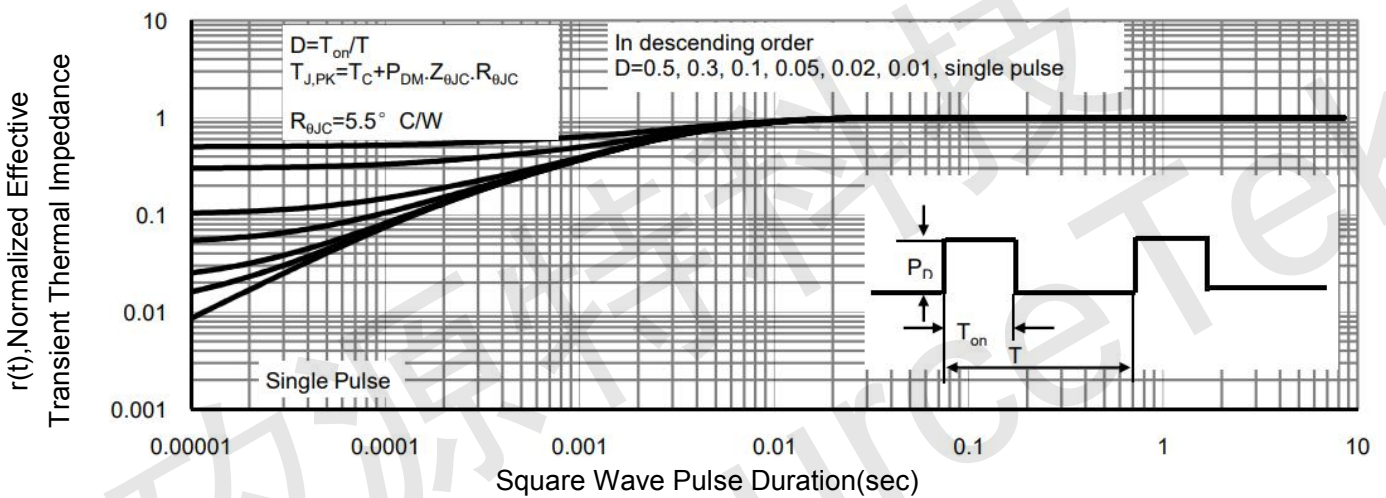


Figure 14 Normalized Maximum Transient Thermal Impedance





**P-Channel Electrical Characteristics (TC=25°C unless otherwise noted)**

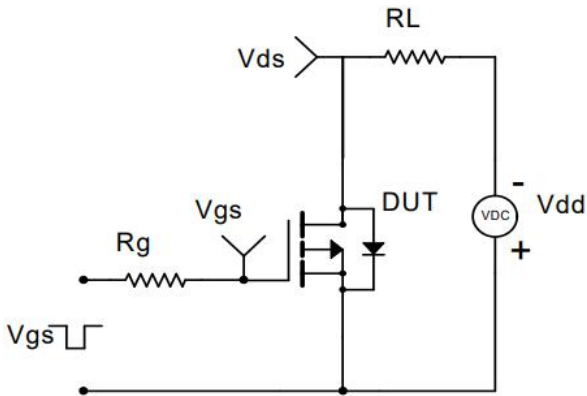
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	-1.8	-2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-7A$	-	24.5	32	m $\Omega$
		$V_{GS}=-4.5V, I_D=-5A$	-	35	48	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-6A$	-	20	-	S
<b>Dynamic Characteristics (Note 4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-20V, V_{GS}=0V,$ $F=1.0MHz$	-	1004	-	pF
Output Capacitance	$C_{oss}$		-	108	-	pF
Reverse Transfer Capacitance (Note 4)	$C_{rss}$		-	80	-	pF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-20V, R_L=1\Omega,$ $V_{GS}=-10V, R_G=3\Omega$	-	19	-	nS
Turn-on Rise Time	$t_r$		-	13	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	49	-	nS
Turn-Off Fall Time	$t_f$		-	4.6	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-20V, I_D=-6A,$ $V_{GS}=-10V$	-	18	-	nC
Gate-Source Charge	$Q_{gs}$		-	2.5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	3.1	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-1A$	-	-	-1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	-13	A

**Notes:**

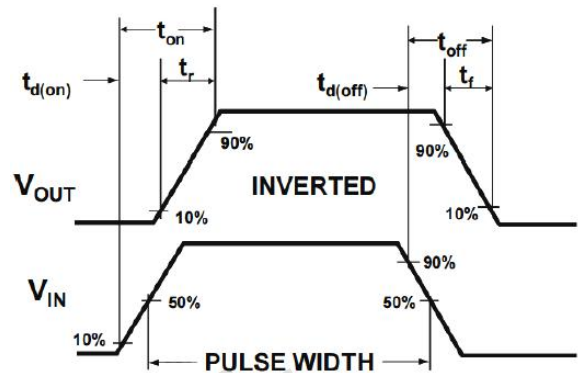
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to product.



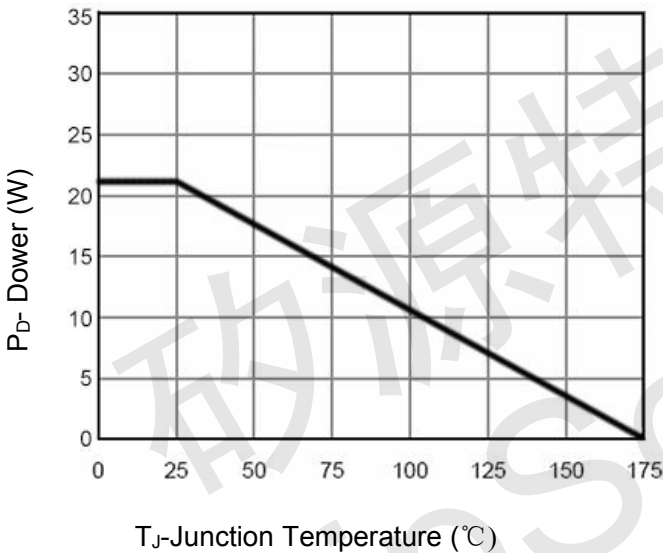
**Typical Electrical and Thermal Characteristics**



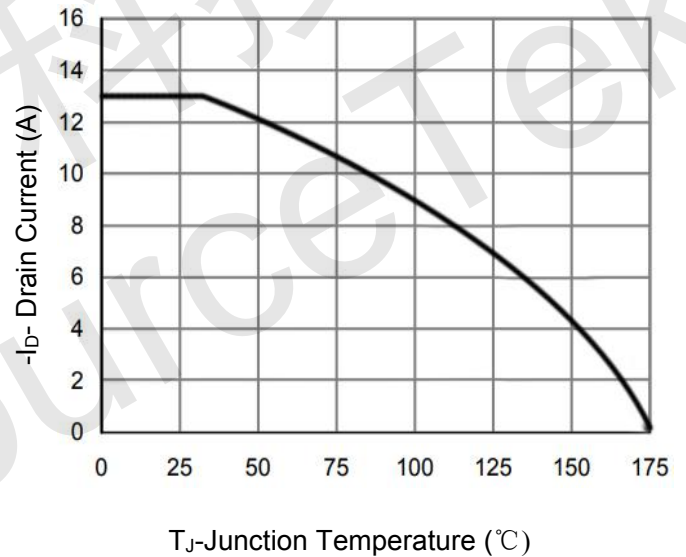
**Figure 1 Switching Test Circuit**



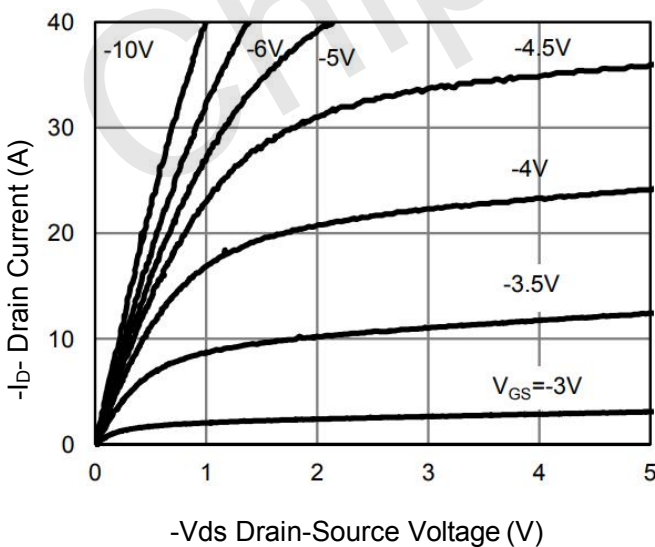
**Figure 2 Switching Waveform**



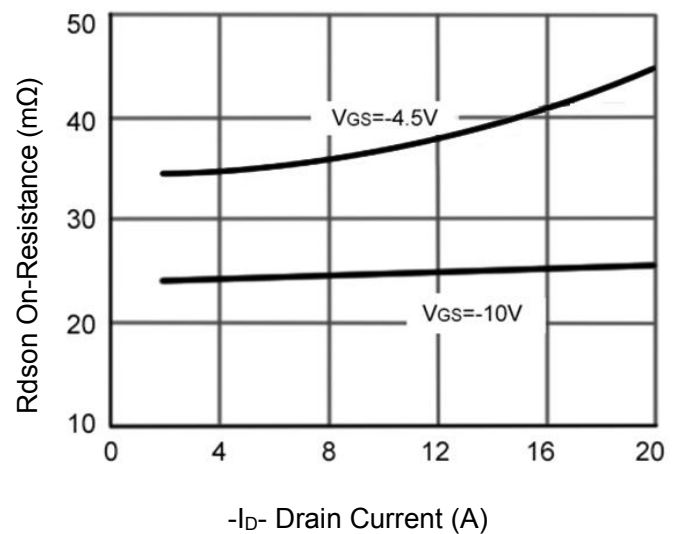
**Figure 3 Power De-rating**



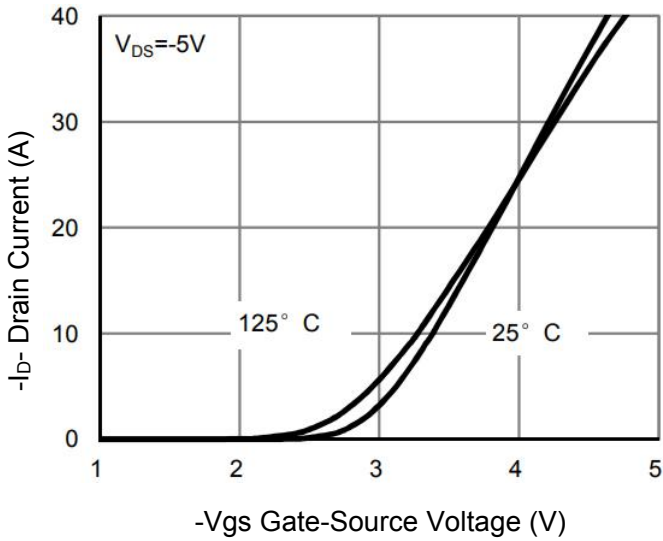
**Figure 4 Drain Current**



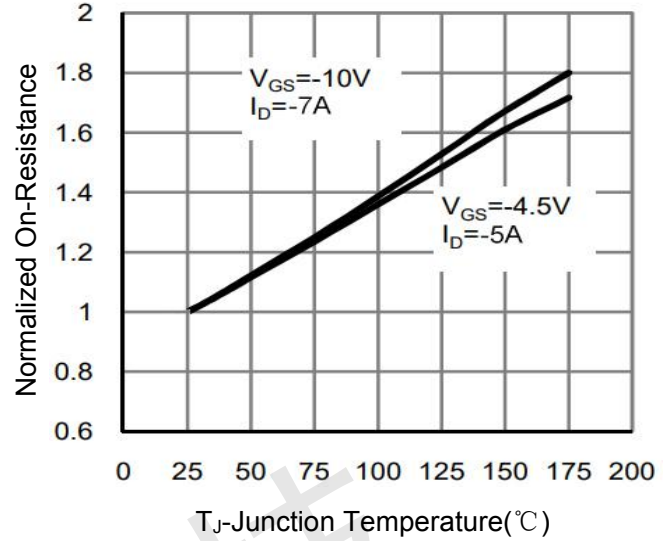
**Figure 5 Output Characteristics**



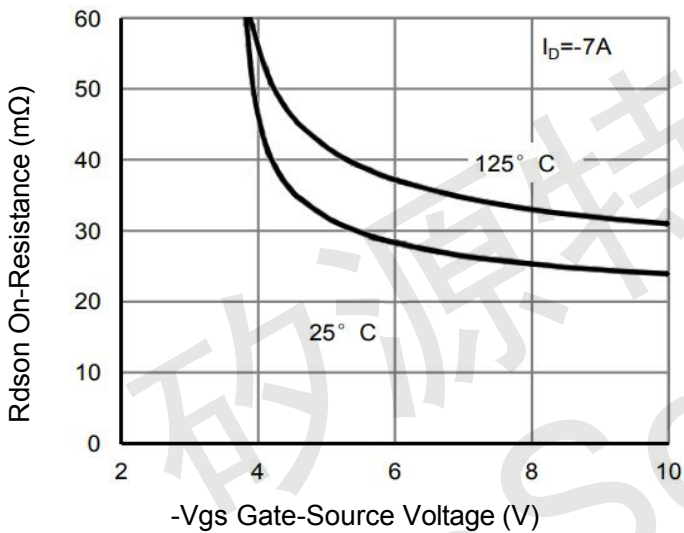
**Figure 6 Rdson vs Drain Current**



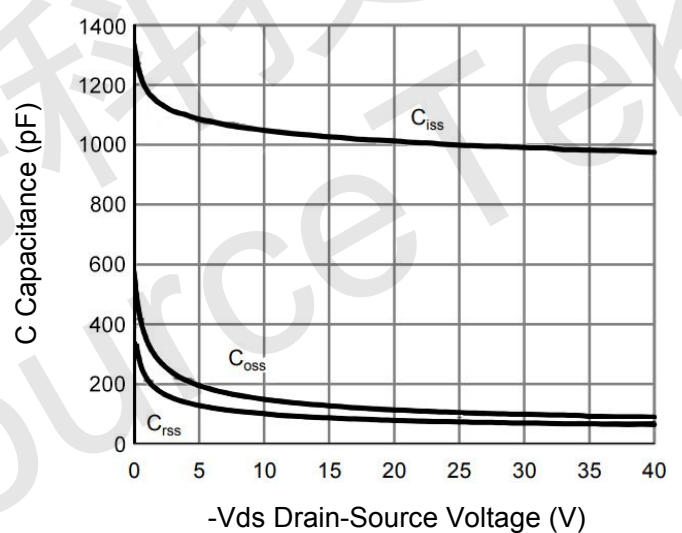
**Figure 7 Transfer Characteristics**



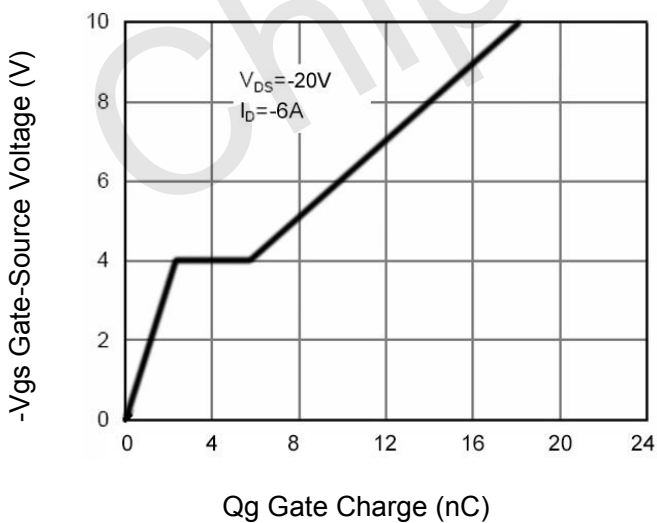
**Figure 8 Rdson vs Junction Temperature**



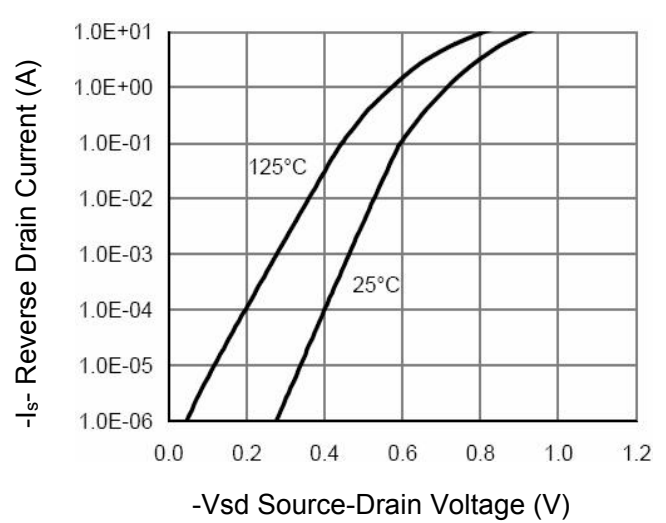
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**



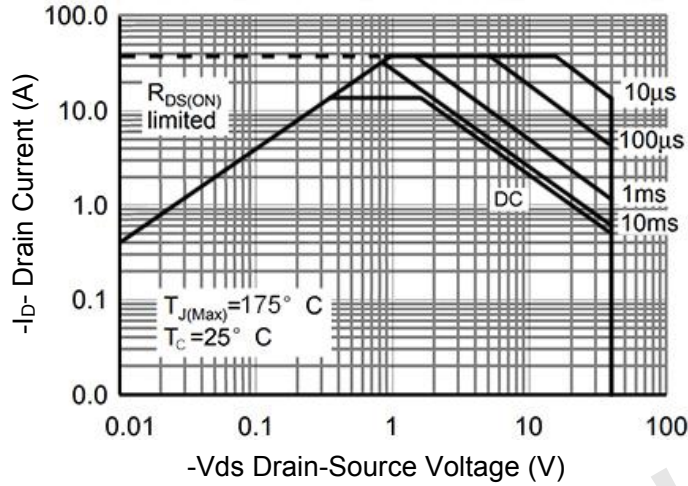


Figure 13 Safe Operation Area

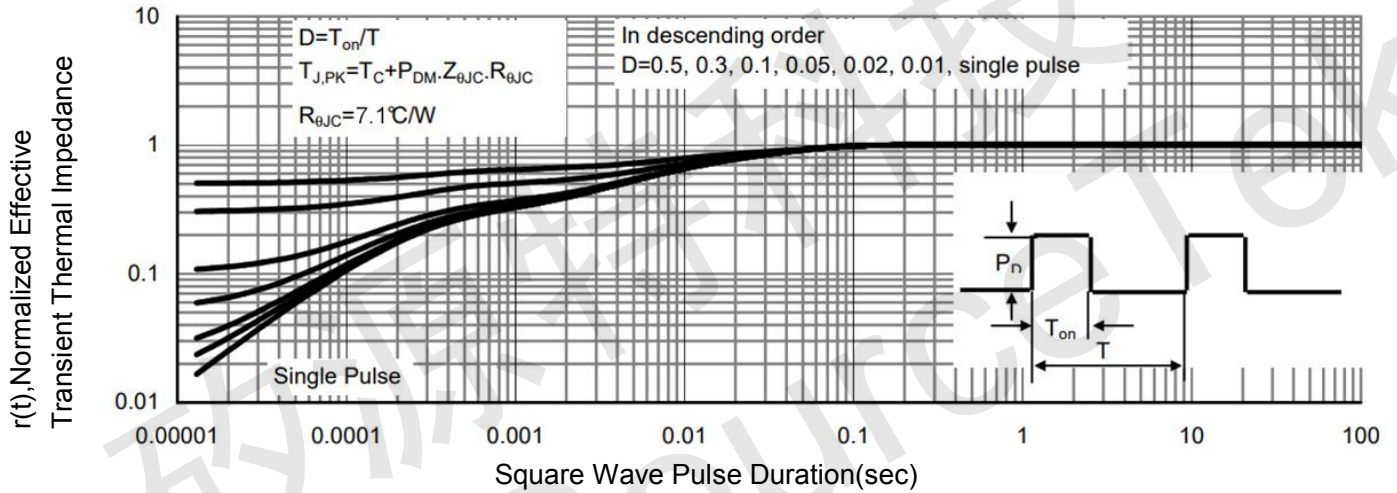
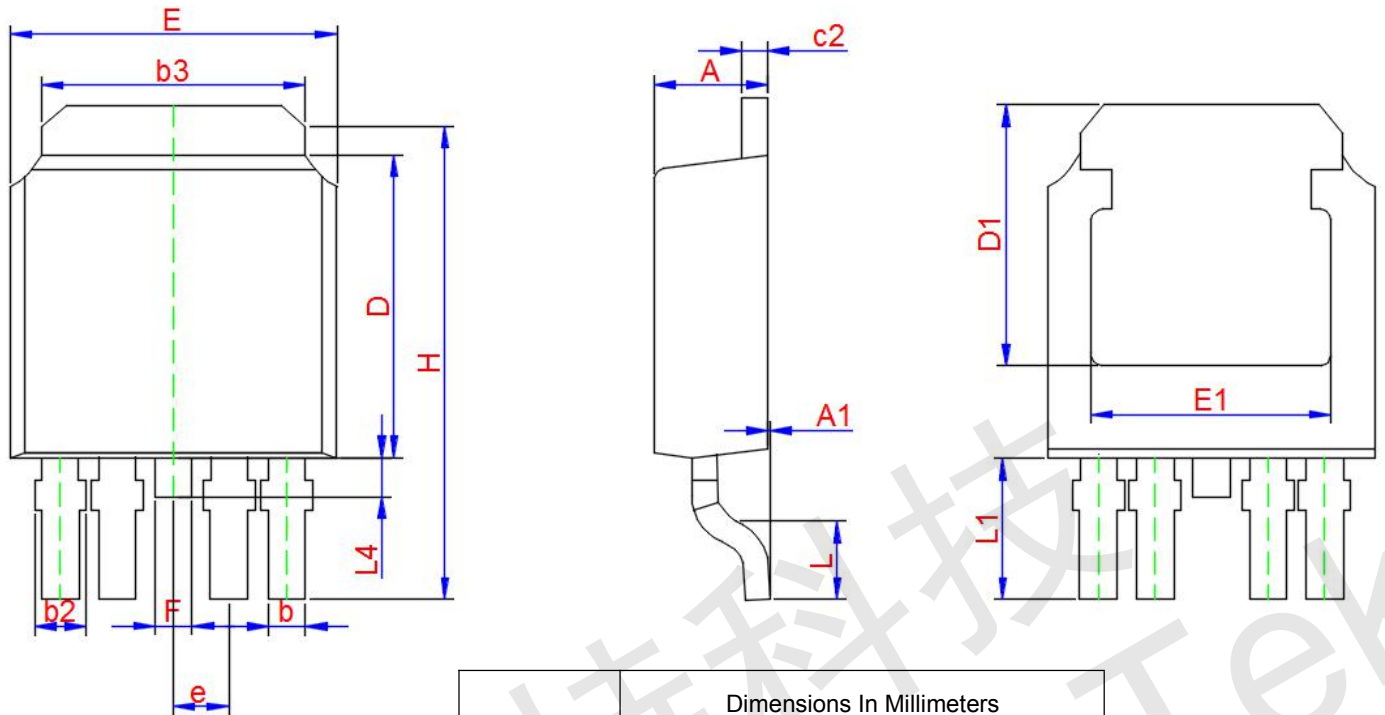


Figure 14 Normalized Maximum Transient Thermal Impedance



**TO-252-4L Package Information**



Symbol	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	2.200	2.300	2.400
A1	0.000	0.080	0.150
b	0.450	0.530	0.600
b2	0.500	0.650	0.800
b3	5.200	5.350	5.500
c2	0.450	0.500	0.550
D	5.400	5.600	5.800
D1	4.570	-	-
E	6.400	6.600	6.800
E1	3.810	-	-
e	1.27TYP.		
F	0.400	0.500	0.600
H	9.400	9.800	10.200
L	1.400	1.590	1.770
L1	2.400	2.700	3.000
L4	0.800	1.000	1.200