

# MT3013N3

## 30V Complementary Power MOSFET

### Features

- N-Channel  
30V/20A  
 $R_{DS(ON)} = 7m\Omega$  (typ) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 11m\Omega$  (typ) @  $V_{GS} = 4.5V$
- P-Channel  
-30V/-19A  
 $R_{DS(ON)} = 13m\Omega$  (typ) @  $V_{GS} = -10V$   
 $R_{DS(ON)} = 19m\Omega$  (typ) @  $V_{GS} = -4.5V$
- RoHS Compliant

### General Description

This complementary MOSFET device is produced using Mos-tech's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

### Applications

- DC-DC converter
- Power management
- LCD backlight inverter

### Absolute Maximum Ratings

Symbol	Parameter	N-CH	P-CH	Units
V <sub>DSS</sub>	Drain-Source Voltage	30	-30	V
V <sub>GSS</sub>	Gate-Source Voltage	± 20	± 20	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a)	20	-19	A
	- Pulsed	51	-47	
P <sub>D</sub>	Power Dissipation for Dual Operation	18		W
	Power Dissipation for Single Operation (Note 1a)	3.6		
	(Note 1b)	2.2		
	(Note 1c)	3.1		
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150		°C

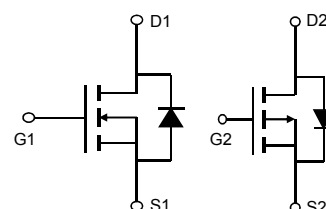
### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	75	$^{\circ}C/W$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	45	$^{\circ}C/W$



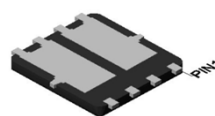
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### Simplified Schematic

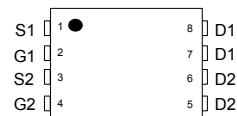


### MARKING DIAGRAM & PIN ASSIGNMENT

DFN3X3-8L



Top View



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

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	N-CH P-CH	30 -30	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$	N-CH P-CH	-	21 -13	-	mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$	N-CH P-CH	-	-	1 -1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	N-CH P-CH	-	-	$\pm 100$ $\pm 100$	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	N-CH P-CH	1 -1	1.6 -1.5	2.8 -2.8	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$	N-CH P-CH	-	-3.6 -3.6	-	mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 3.0\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 2.0\text{ A}$	N-CH	- -	7 11	10 16	m $\Omega$
		$V_{GS} = -10\text{ V}, I_D = -3.0\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.0\text{ A}$	P-CH	- -	13 19	19 29	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$ $V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	N-CH P-CH	20 -19	-	-	A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 4.5\text{ A}$ $V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$	N-CH P-CH	-	19 15	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	N-CH $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	N-CH P-CH	-	652 81	-	pF
$C_{oss}$	Output Capacitance	P-CH	N-CH P-CH	-	46 23	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	N-CH P-CH	-	73 36	-	pF

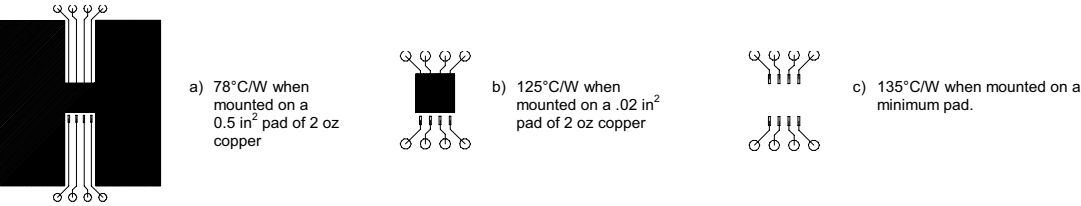
**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	N-CH $V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 1\text{ }\Omega$	N-CH P-CH	-	4 6	-	ns
$t_r$	Turn-On Rise Time		N-CH P-CH	-	7.8 14	-	ns
$t_{d(off)}$	Turn-Off Delay Time	P-CH $V_{DD} = -10\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 1\text{ }\Omega$	N-CH P-CH	-	23 28	-	ns
$t_f$	Turn-Off Fall Time		N-CH P-CH	-	8 13	-	ns
$Q_g$	Total Gate Charge	N-CH $V_{DS} = 10\text{ V}, I_D = 4.5\text{ A}, V_{GS} = 10\text{ V}$	N-CH P-CH	-	22 25	-	nC
$Q_{gs}$	Gate-Source Charge	P-CH	N-CH P-CH	-	1.2 0.9	-	nC
$Q_{gd}$	Gate-Drain Charge	$V_{DS} = -10\text{ V}, I_D = -3.5\text{ A}, V_{GS} = -10\text{ V}$	N-CH P-CH	-	2.5 1.9	-	nC

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

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>							
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		N-CH P-CH	-	-	1.4 -1.4	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1\text{ A}$ (Note 2) $V_{GS} = 0\text{ V}, I_S = -3.5\text{ A}$ (Note 2)	N-CH P-CH	-	0.8 -0.9	-	V

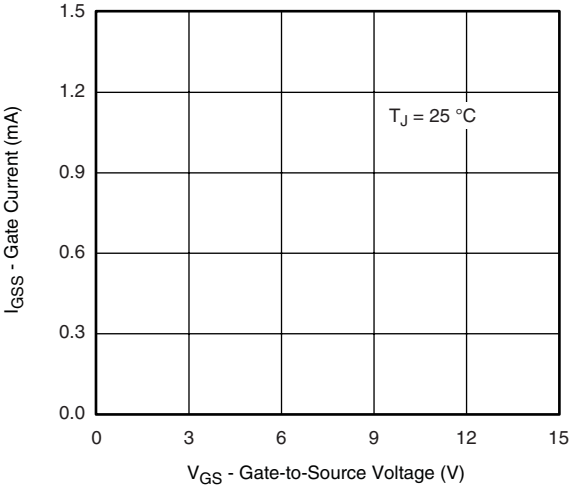
**Notes:**  
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



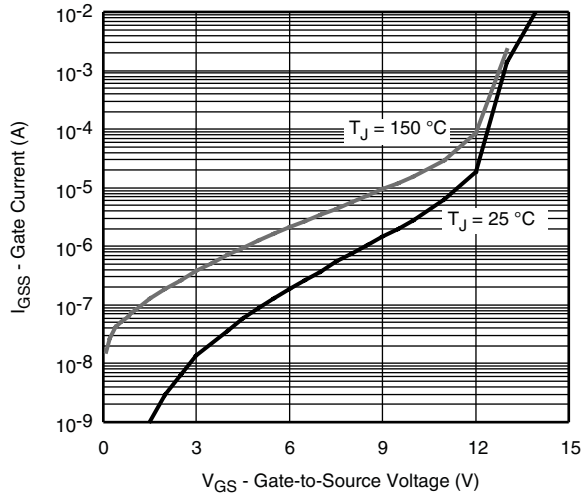
Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

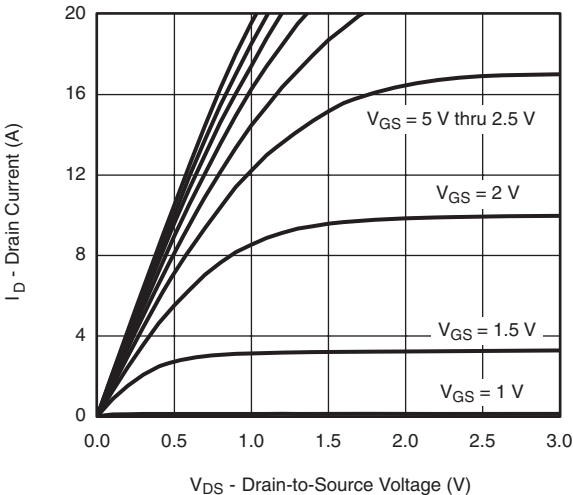
# **TYPICAL CHARACTERISTICS P-CH**



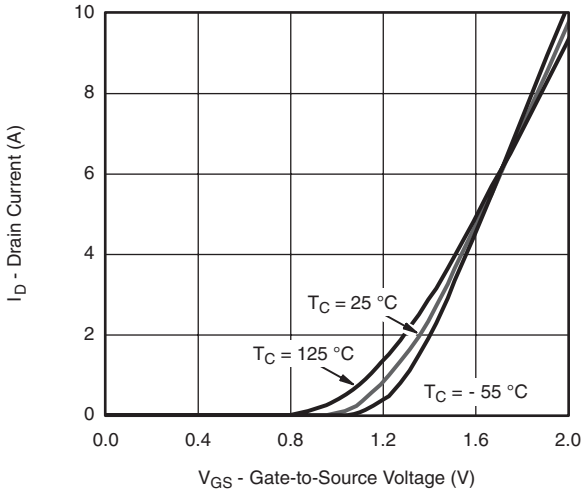
**Figure 1 Gate Current vs. Gate-Source Voltage**



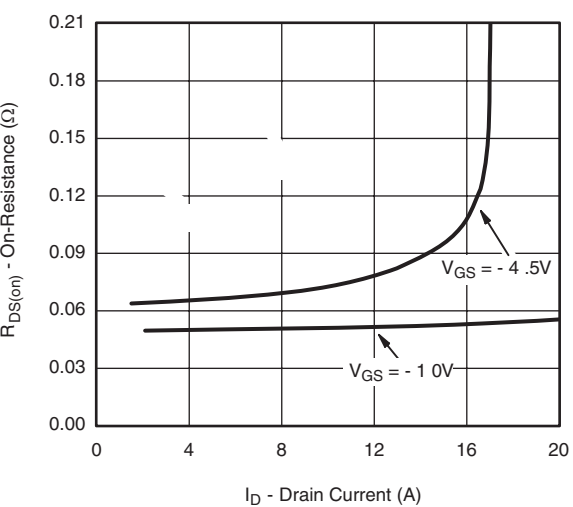
**Figure 2 Gate Current vs. Gate-Source Voltage**



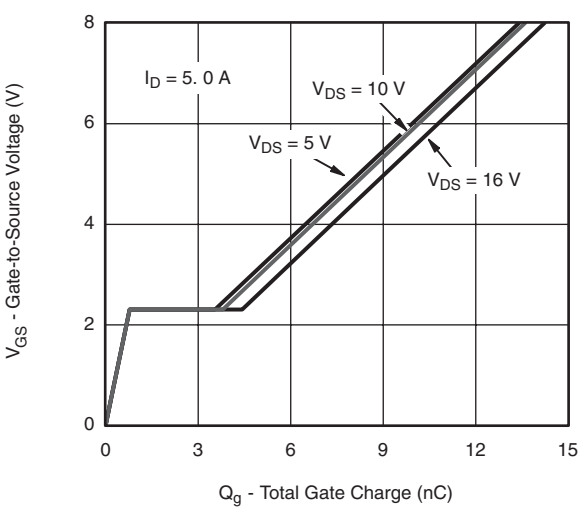
**Figure 3 Output Characteristics**



**Figure 4 Transfer Characteristics**



**Figure 5 On-Resistance vs. Drain Current**



**Figure 6 Gate Charge**

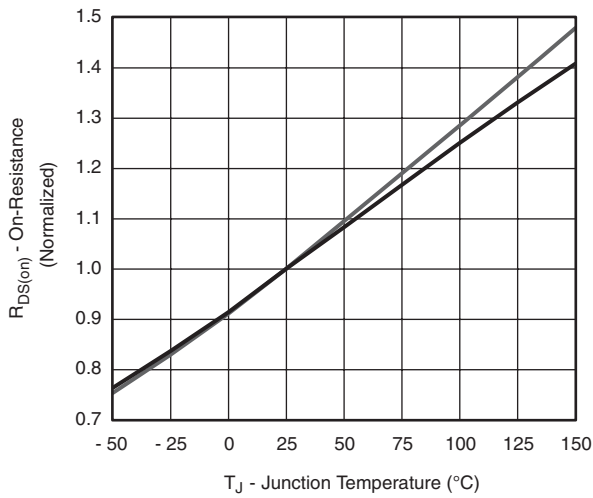


Figure 7 On-Resistance vs. Junction Temperature

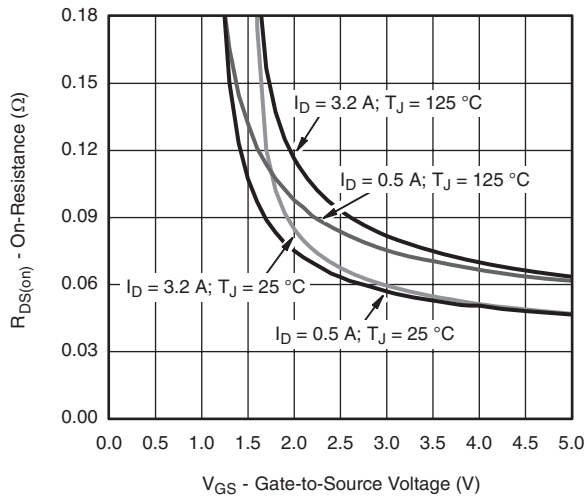


Figure 9 On Resistance VS. Gate-to-Source Voltage

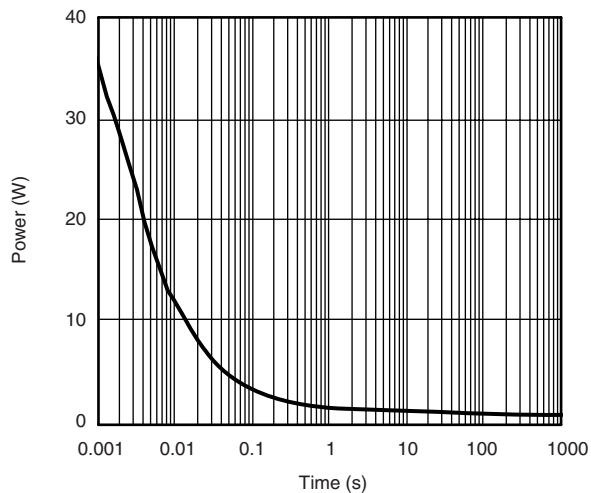


Figure 11 Single Pulse Power, Junction-to-Ambient

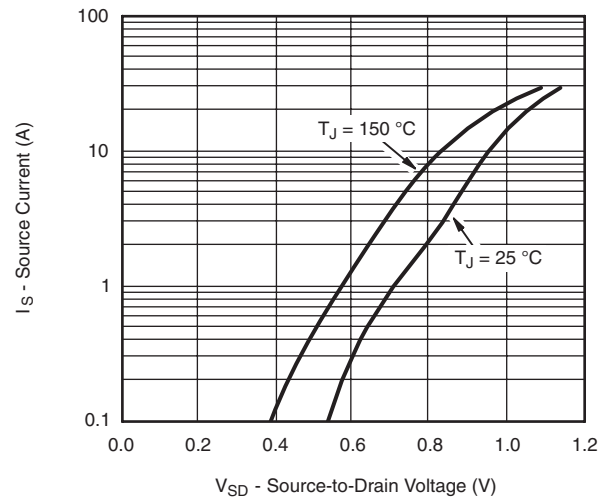


Figure 8 Source-Drain Diode Forward Voltage

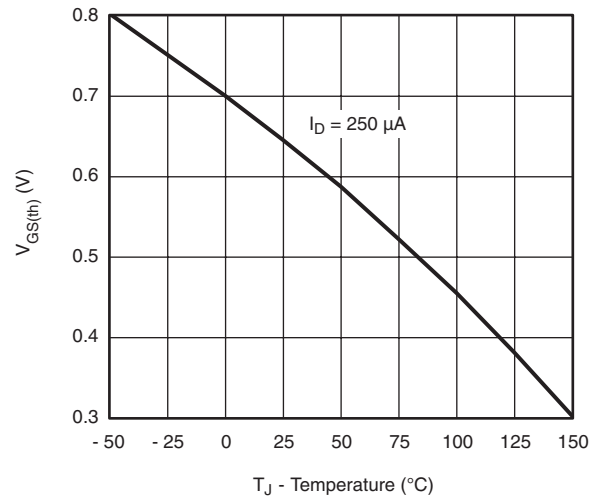
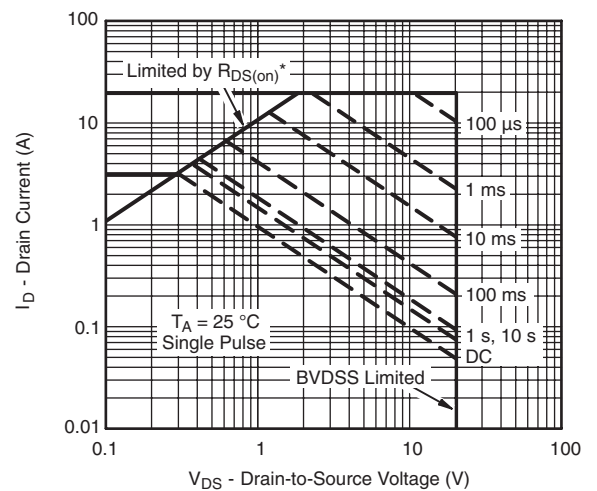
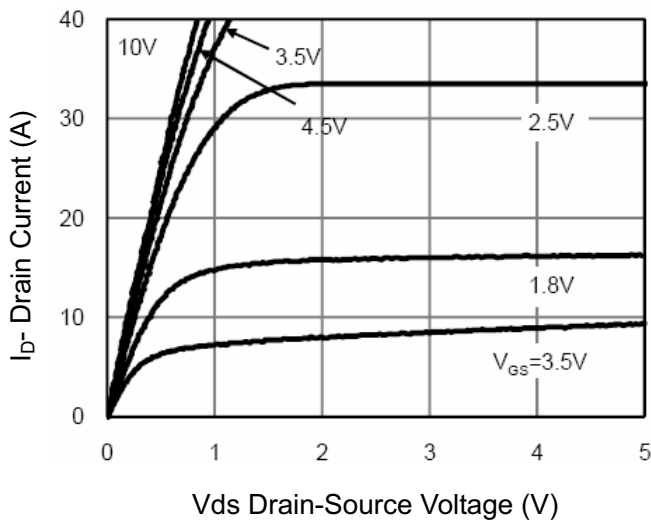
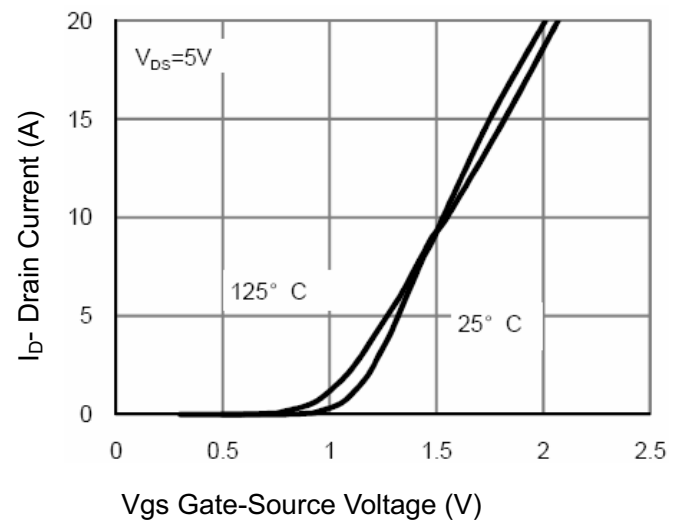
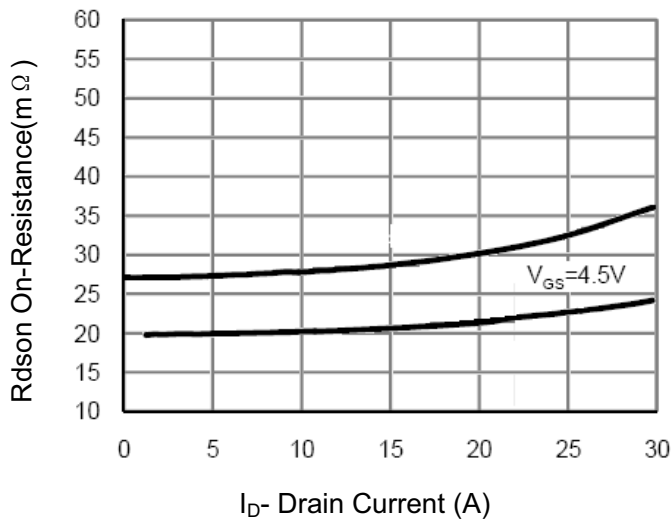
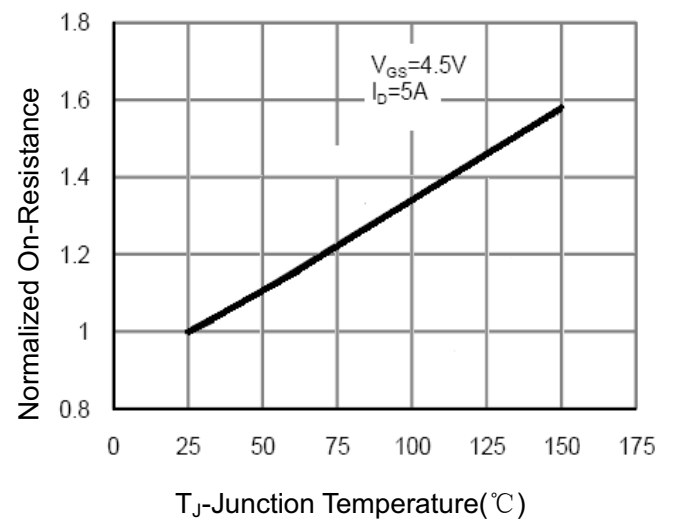
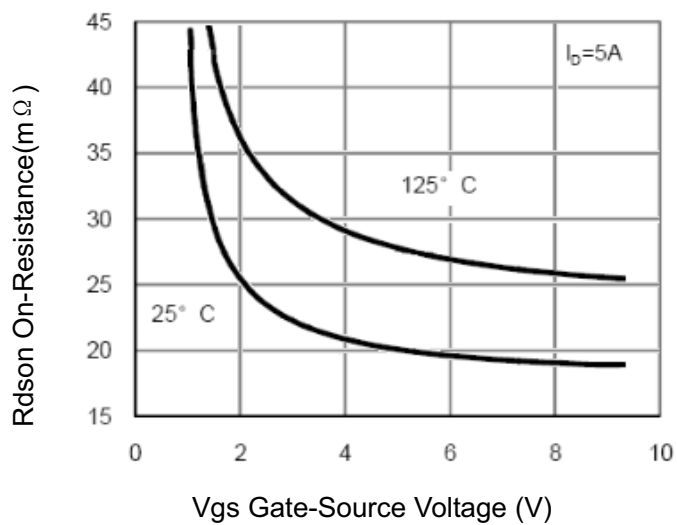
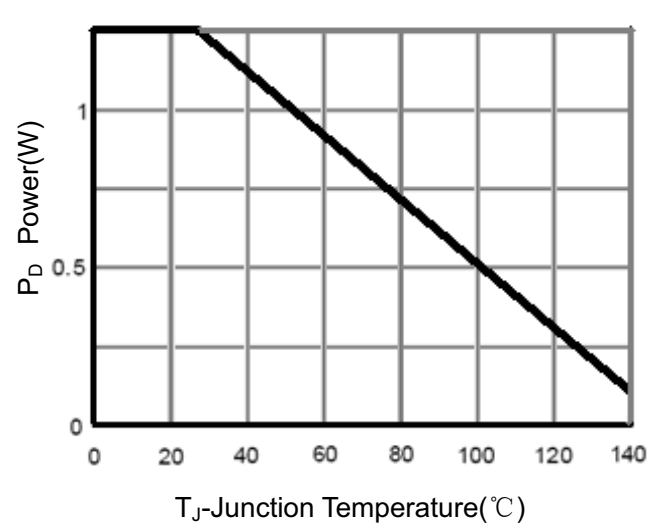


Figure 10 Threshold Voltage



\*  $V_{GS} > \text{minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$   
 Figure 12 Safe Operating Area, Junction-to-Ambient

**Typical Characteristics: N-CH****Figure 1 Output Characteristics****Figure 2 Transfer Characteristics****Figure 3 Drain-Source On-Resistance****Figure 4 Drain-Source On-Resistance****Figure 5 Rdson vs Vgs**

### Typical Characteristics: N-CH

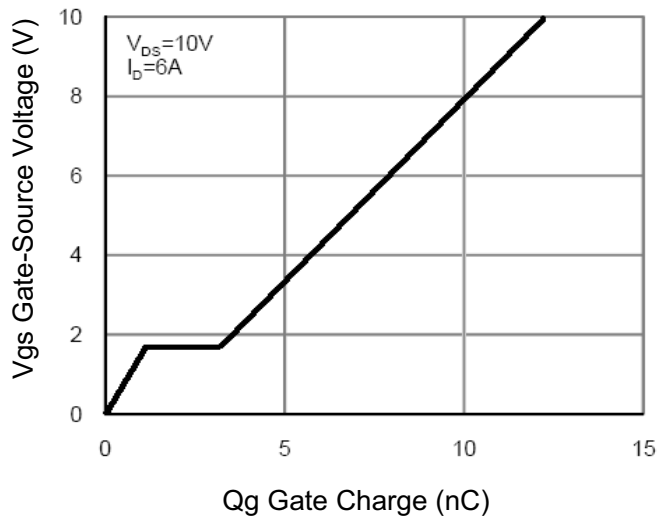


Figure 7 Gate Charge

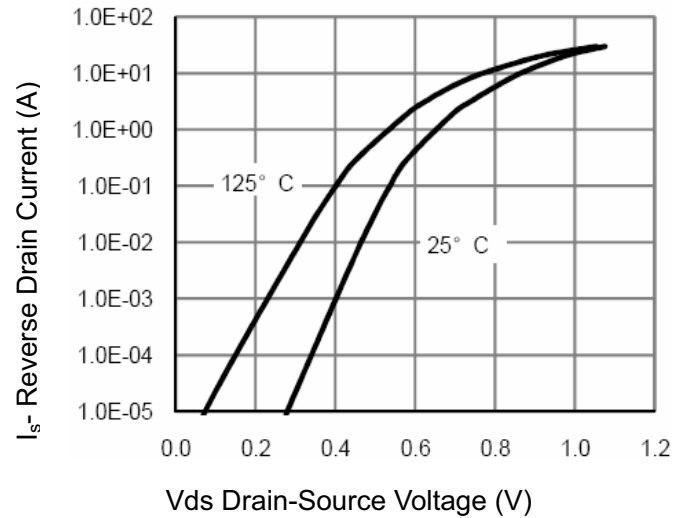


Figure 8 Source- Drain Diode Forward

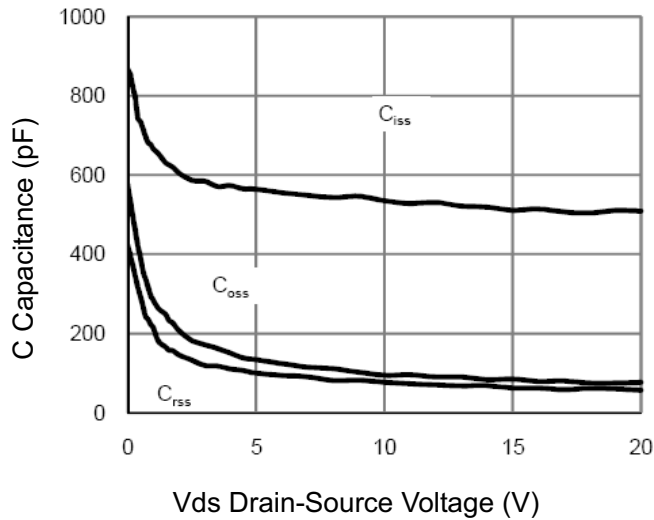


Figure 9 Capacitance vs Vds

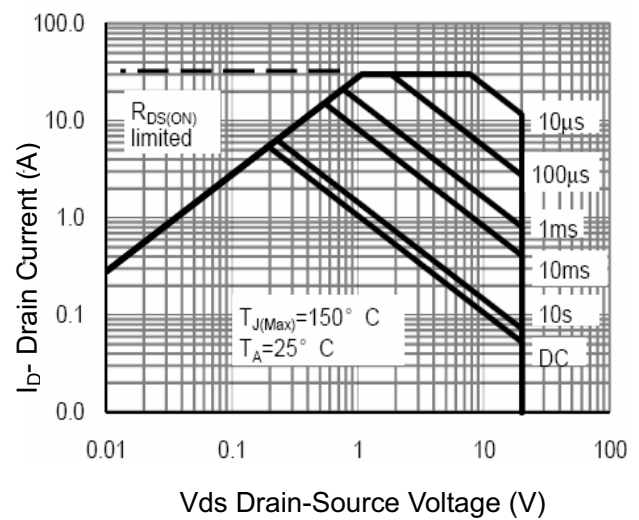


Figure 10 Safe Operation Area

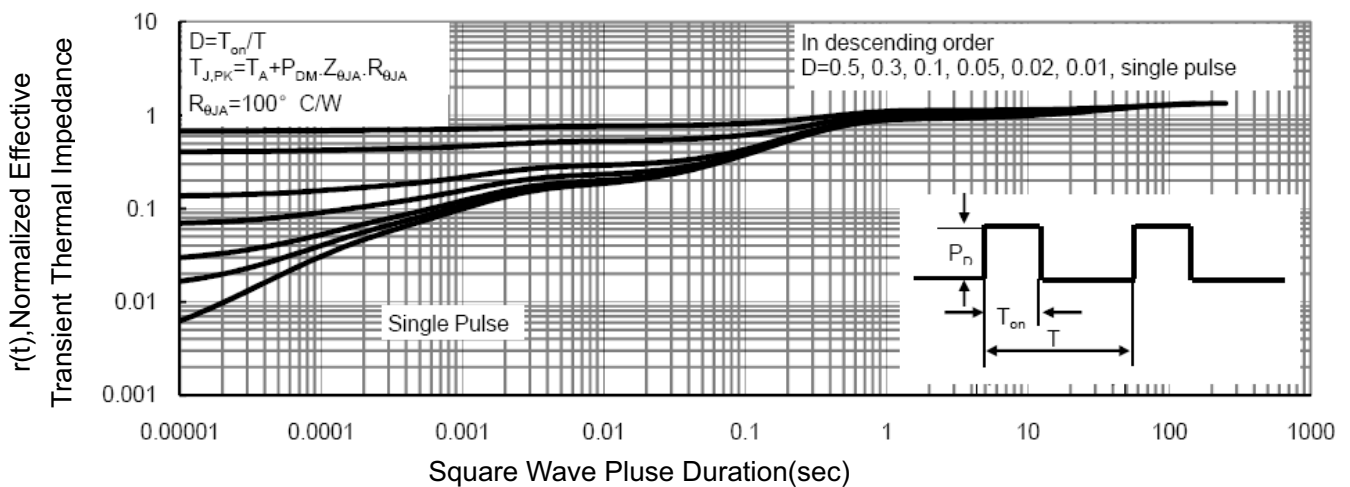
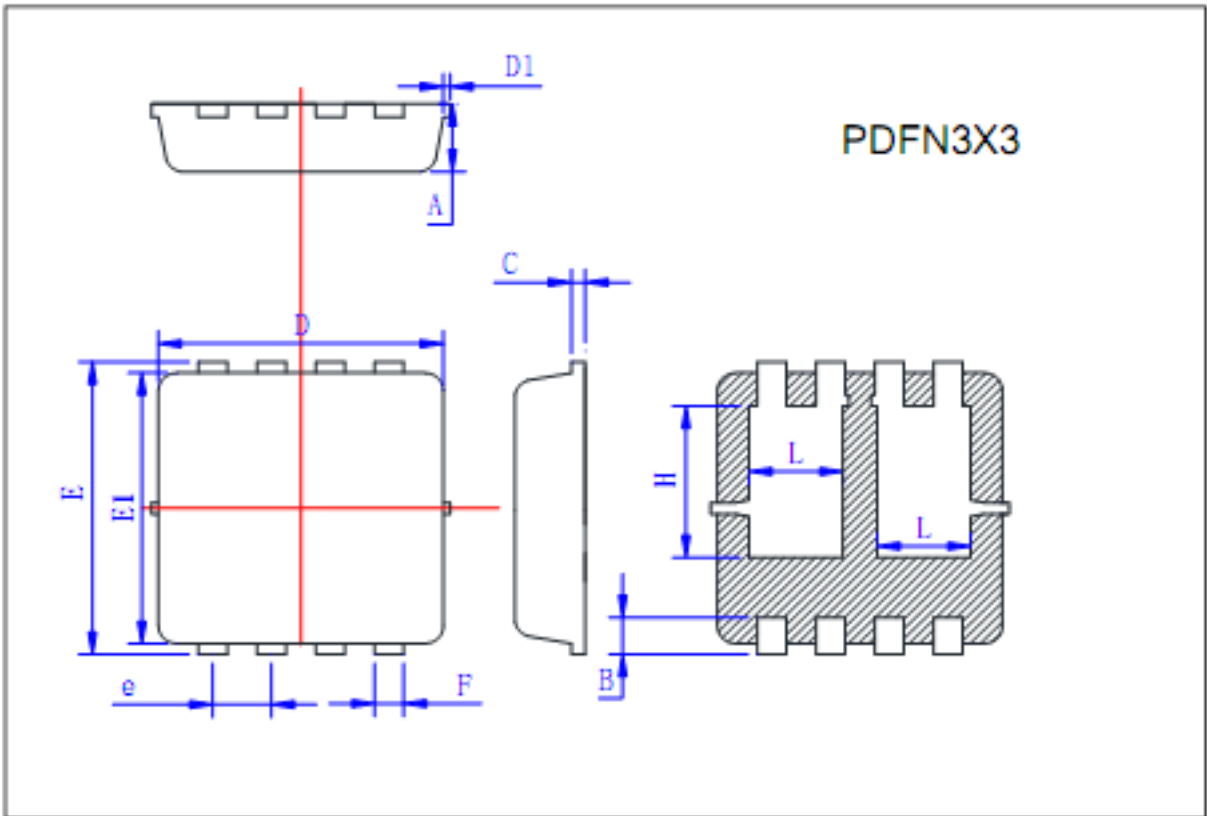


Figure 11 Normalized Maximum Transient Thermal Impedance



Symbol	Min	Typ	Max
A	0.725	0.775	0.825
B	0.28	0.38	0.48
C	0.13	0.15	0.20
D	3.05	3.15	3.25
D1			0.10
E	3.25	3.35	3.45
E1	3.0	3.1	3.2
e	0.60	0.65	0.70
F	0.27	0.32	0.37
H	1.63	1.73	1.83
L	0.93	1.03	1.13



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11. 如果把本资料所记载的产品从其载体设备上卸下, 有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时, 请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时, 本公司将不承担任何责任。
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### Keep safety first in your circuit designs!

1. MOS-TECH Semiconductor Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.  
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.