

# ICE22N60

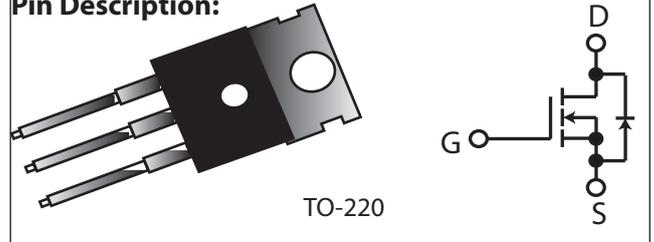
## N-Channel Enhancement Mode MOSFET

### Features:

- Low  $r_{DS(on)}$
- Ultra Low Gate Charge
- High dv/dt Capability
- High Unclamped Inductive Switching (UIS) Capability
- High Peak Current Capability
- Increased Transconductance Performance
- Optimized Design For High Performance Power Systems

Product Summary			
$I_D$	$T_A = 25^\circ\text{C}$	22A	Max
$V_{(BR)DSS}$	$I_D = 250\mu\text{A}$	650V	Min
$r_{DS(ON)}$	$V_{GS} = 10\text{V}$	0.14 $\Omega$	Typ
$Q_g$	$V_{DS} = 480\text{V}$	82nC	Typ

### Pin Description:



### Maximum Ratings @ $T_j = 25^\circ\text{C}$ , Unless Otherwise Specified

Symbol	Parameter	Value	Unit	Conditions
$I_D$	Continuous Drain Current	22	A	$T_C = 25^\circ\text{C}$
$I_{D, \text{pulse}}$	Pulsed Drain Current	82	A	$T_C = 25^\circ\text{C}$
$E_{AS}$	Avalanche Energy, Single Pulse	690	mJ	$I_D = 11.5\text{A}$
$I_{AR}$	Avalanche Current, Repetitive	10	A	Limited by $T_{j, \text{max}}$
dv/dt	MOSFET dv/dt Ruggedness	50	V/ns	$V_{DS} = 480\text{V}, I_D = 22\text{A}, T_j = 125^\circ\text{C}$
$V_{GS}$	Gate Source Voltage	$\pm 20$	V	Static
		$\pm 30$		AC (f>Hz)
$P_{\text{tot}}$	Power Dissipation	208	W	$T_C = 25^\circ\text{C}$
$T_j, T_{\text{stg}}$	Operating and Storage Temperature	-55 to +150	$^\circ\text{C}$	
	Mounting Torque	60	Ncm	M 2.5 screws

Symbol	Parameter	Values			Unit	Conditions
		Min	Typ	Max		

### Thermal Characteristics

$R_{thJC}$	Thermal Resistance, Junction to Case	-	-	0.6	$^\circ\text{C}/\text{W}$	Leaded
$R_{thJA}$	Thermal Resistance, Junction to Ambient	-	-	62		
$T_{\text{sold}}$	Soldering Temperature, Wave Soldering Only Allowed At Leads	-	-	260	$^\circ\text{C}$	1.6mm (0.063in.) from Case for 10s

### Electrical Characteristics @ $T_j = 25^\circ\text{C}$ , Unless Otherwise Specified

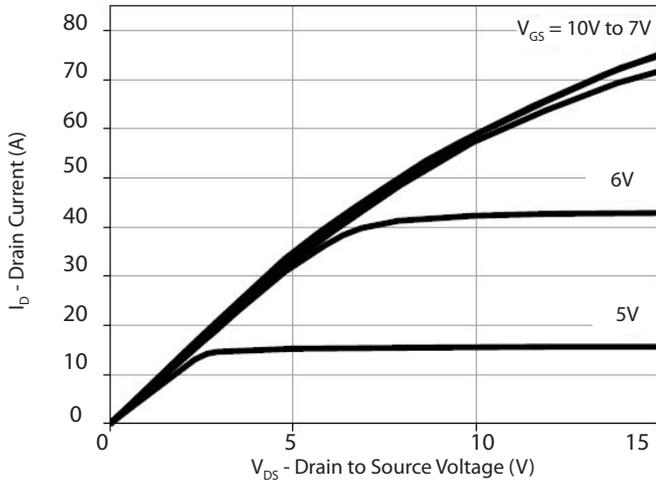
Static Characteristics						
$V_{(BR)DSS}$	Drain to Source Breakdown Voltage	600	650	-	V	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	2.5	3	3.5		$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
$I_{DSS}$	Zero Gate Voltage Drain Current	-	0.1	1	$\mu\text{A}$	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}, T_j = 25^\circ\text{C}$
		-	-	100		$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}, T_j = 150^\circ\text{C}$
$I_{GSS}$	Gate Source Leakage Current	-	-	100	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
$R_{DS(on)}$	Drain to Source On-State Resistance	-	0.14	0.16	$\Omega$	$V_{GS} = 10\text{V}, I_D = 11\text{A}, T_j = 25^\circ\text{C}$
		-	0.4	-		$V_{GS} = 10\text{V}, I_D = 11\text{A}, T_j = 150^\circ\text{C}$
$R_{GS}$	Gate Resistance	-	4	-	$\Omega$	f = 1 MHz, open drain

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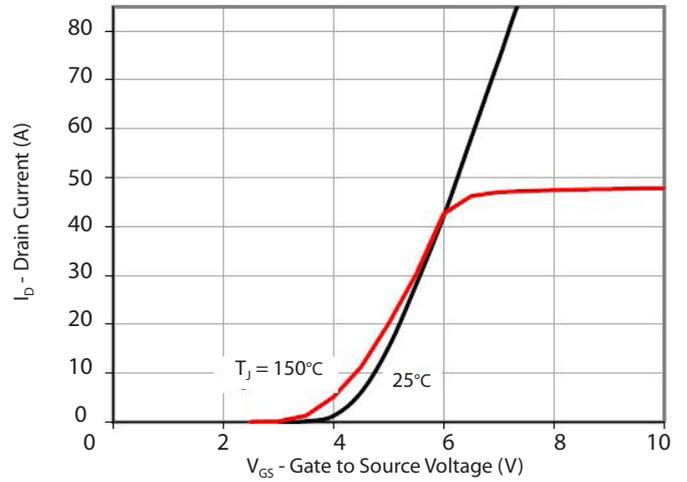
Symbol	Parameter	Values			Unit	Conditions
		Min	Typ	Max		
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	-	2650	-	pF	$V_{GS} = 0V, V_{DS} = 25V, f = 1\text{ MHz}$
$C_{oss}$	Output Capacitance	-	780	-		
$C_{rss}$	Reverse Transfer Capacitance	-	50	-		
$C_{oss}$	Output Capacitance	-	80	-		$V_{GS} = 0V, V_{DS} = 100V, f = 1\text{ MHz}$
$g_{fs}$	Transconductance	-	20	-	S	$V_{DS} = >2 * I_D * R_{DS}, I_D = 11A$
$t_{d(on)}$	Turn-on Delay Time	-	10	-	nS	$V_{DS} = 380V, V_{GS} = 10V, I_D = 22A, R_G = 4\Omega$ (External)
$T_r$	Rise Time	-	5	-		
$t_{d(off)}$	Turn-off Delay Time	-	67	-		
$t_f$	Fall Time	-	4.5	-		
<b>Gate Charge Characteristics</b>						
$Q_{gs}$	Gate to Source Charge	-	16	-	nC	$V_{DS} = 480V, I_D = 22A, V_{GS} = 10V$
$Q_{gd}$	Gate to Drain Charge	-	30	-		
$Q_g$	Gate Charge Total	-	82	-		
$V_{plateau}$	Gate Plateau Voltage	-	5	-	V	
<b>Reverse Diode</b>						
$V_{SD}$	Diode Forward Voltage	-	1.0	1.2	V	$V_{GS} = 0V, I_S = I_F$
$t_{rr}$	Reverse Recovery Time	-	423	-	ns	$V_{RR} = 480V, I_S = I_F, d_{IF}/d_t = 100\text{ A}/\mu\text{S}$
$Q_{rr}$	Reverse Recovery Charge	-	8	-	$\mu\text{C}$	
$I_{rm}$	Peak Reverse Recovery Current	-	34	-	A	

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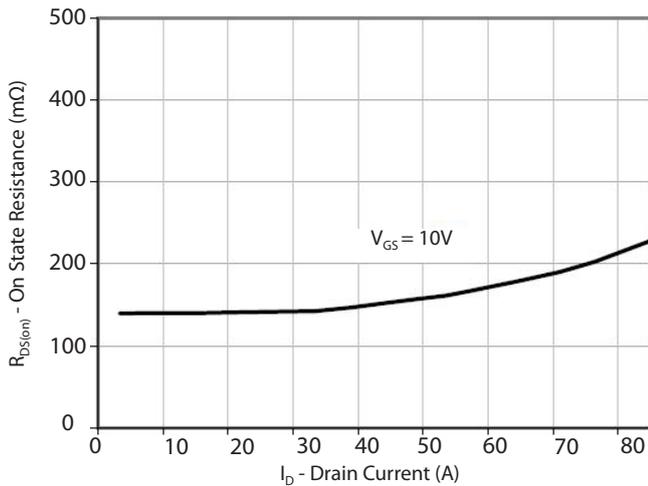
Output Characteristics



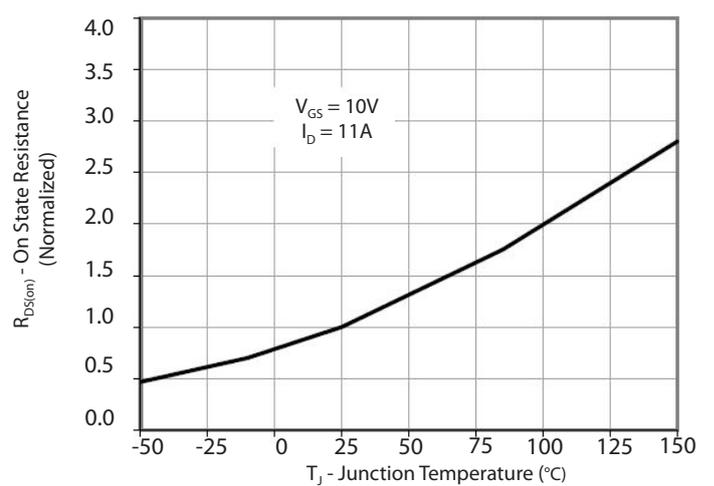
Transfer Characteristics



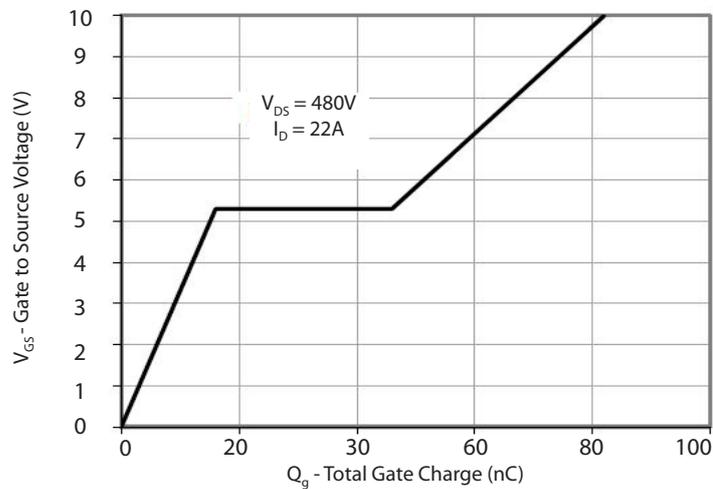
On State Resistance vs Drain Current



On Resistance vs Junction Temperature

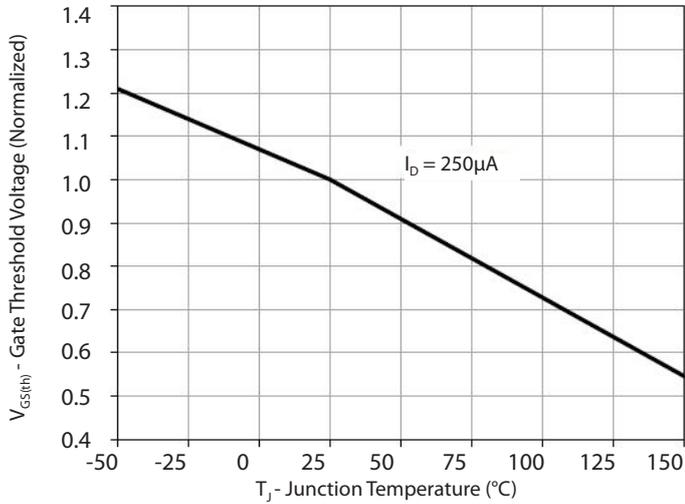


Gate Charge

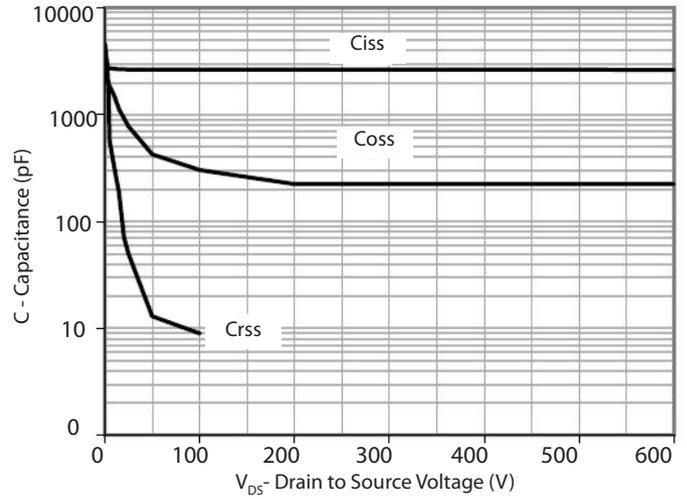


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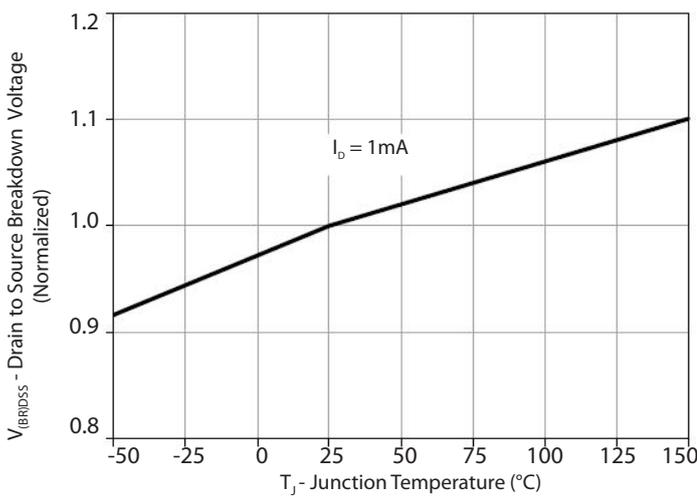
Gate Threshold Voltage vs. Junction Temperature



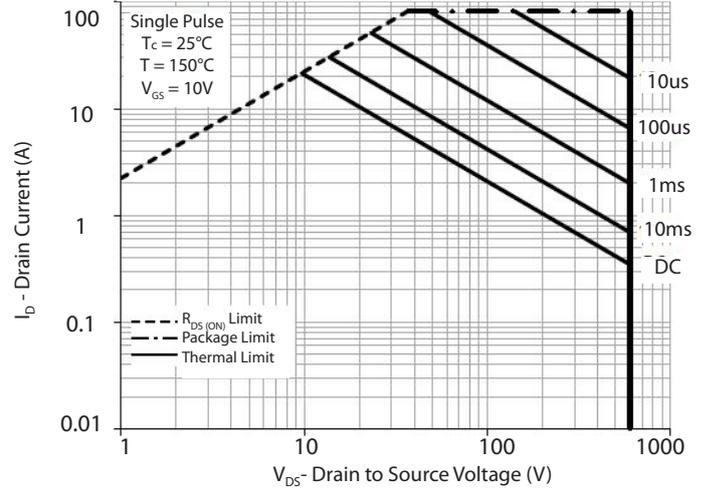
Capacitance



Drain to Source Breakdown Voltage vs. Junction Temperature



Maximum Rate Forward Biased Safe Operating Area



Transient Thermal Response - Junction to Case

