

## N-Channel Enhancement Mode MOSFET

### 1. Product Information

#### 1.1 Features

- ☒ Surface-mounted package
- ☒ Advanced trench cell design

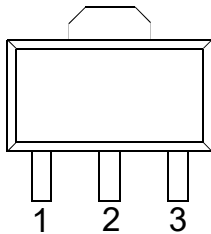
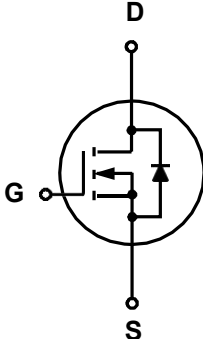
#### 1.2 Applications

- ☒ LCD TV appliances  
☒ LCDM appliances
- ☒ High power inverter system

#### 1.3 Quick reference

- ☒  $BV \geq 60\text{ V}$   
☒  $P_{tot} \leq 25\text{ W}$   
☒  $I_D \leq 20\text{ A}$
- ☒  $R_{DS(ON)} \leq 15\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
☒  $R_{DS(ON)} \leq 25\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$

### 2. Pin Description

Pin	Description	Simplified Outline	Symbol
1	Gate(G)		
2	Drain(D)		
3	Source(S)		

Top View  
SOT89

## 3. Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	Drain-Source Voltage	$T_C = 25\text{ }^{\circ}\text{C}$	-	60	V
$V_{GS}$	Gate-Source Voltage	$T_C = 25\text{ }^{\circ}\text{C}$	-	$\pm 20$	V
$I_D$	Drain Current ( DC )	$T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	20	A
		$T_C = 100\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	13	A
$I_{DM}^{*,***}$	Drain Current ( Pulsed )	$T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	30	A
$P_{tot}$	Drain power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	-	25	W
$T_{stg}$	Storage Temperature		-55	150	$^{\circ}\text{C}$
$T_J$	Junction Temperature		-	150	$^{\circ}\text{C}$
$I_S$	Continuous-Source Current	$T_C = 25\text{ }^{\circ}\text{C}$	-	24	A
$R_{\theta JA}^{**}$	Thermal Resistance- Junction to Ambient		-	30	$^{\circ}\text{C/W}$
$R_{\theta JC}^{**}$	Thermal Resistance- Junction to Case		-	1.5	

Notes:

\* Pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

\*\* Mounted on Large Heat Sink

\*\*\* limited by bonding wire

## 4. Marking Information

Product Name	Marking
SN60N15Q	<div>SN60N15Q</div> <div>YWWXXX</div> <div>YWW: Date Code</div>

## 5. Ordering Code

Product Name	Package	Reel Size	Tape width	Quantity	Note
SN60N15Q	SOT89			1000	

Note: NHCX defines “ Green ” as lead-free ( RoHS compliant ) and halogen free ( Br or Cl does not exceed 900 ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500 ppm by weight; Follow IEC 61249-2-21 and IPC / JEDEC J-STD-020C )

## 6. Electrical Characteristics ( $T_A=25^\circ$ Unless Otherwise Noted )

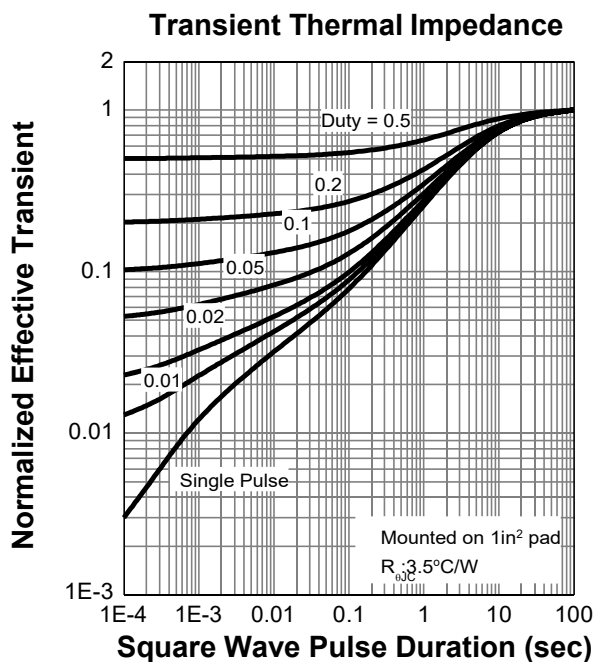
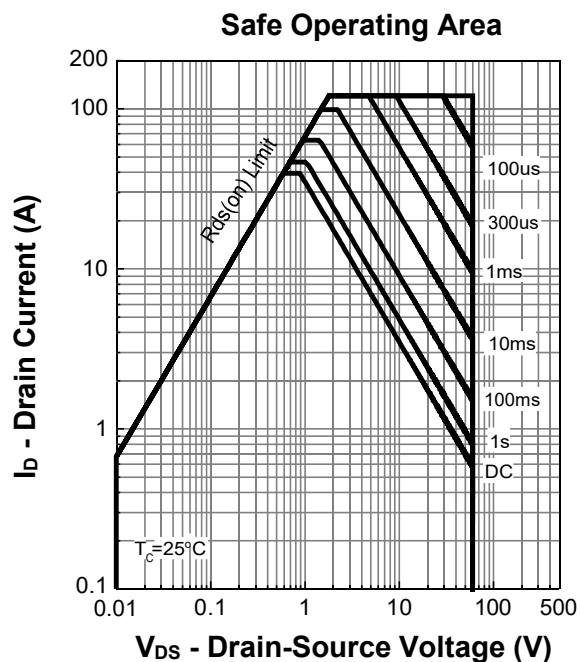
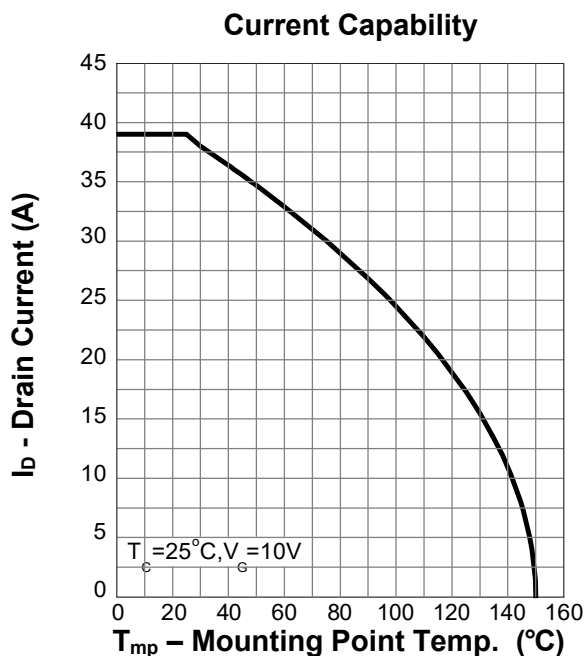
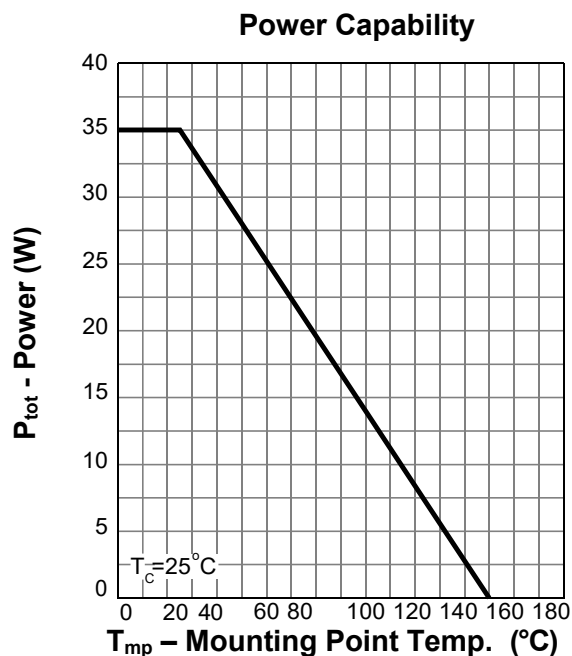
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>DS</sub> = 250 μA	60	-	-	V
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = 250 μA	1.5	-	2.5	V
I <sub>DSS</sub>	Drain Leakage Current	V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V	-	-	1	μA
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	On-State Resistance	V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 12 A	-	12	15	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>DS</sub> = 8 A	-	19	25	
Diode Characteristics						
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> = 12 A, V <sub>GS</sub> = 0 V	-	-	1.3	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>DS</sub> = 12 A, V <sub>GS</sub> = 0 V di <sub>SD</sub> /dt = 100 A/μs	-	31	-	nS
Q <sub>rr</sub>	Reverse Recovery Charge		-	11	-	μC
Dynamic Characteristics <sup>b</sup>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 30 V Frequency = 1 MHz	-	757	-	pF
C <sub>oss</sub>	Output Capacitance		-	340	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	28	-	
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DS</sub> = 30 V, V <sub>GEN</sub> = 10 V, R <sub>G</sub> = 4.5 Ω, R <sub>L</sub> = 2.5 Ω, I <sub>DS</sub> = 12 A	-	6.2	-	nS
t <sub>r</sub>	Turn-on Rise Time		-	23	-	
t <sub>d(off)</sub>	Turn-off Delay Time		-	13	-	
t <sub>f</sub>	Turn-off Fall Time		-	17	-	
Gate Charge Characteristics <sup>b</sup>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 12 A	-	15	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	3.6	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	3.6	-	

Notes:

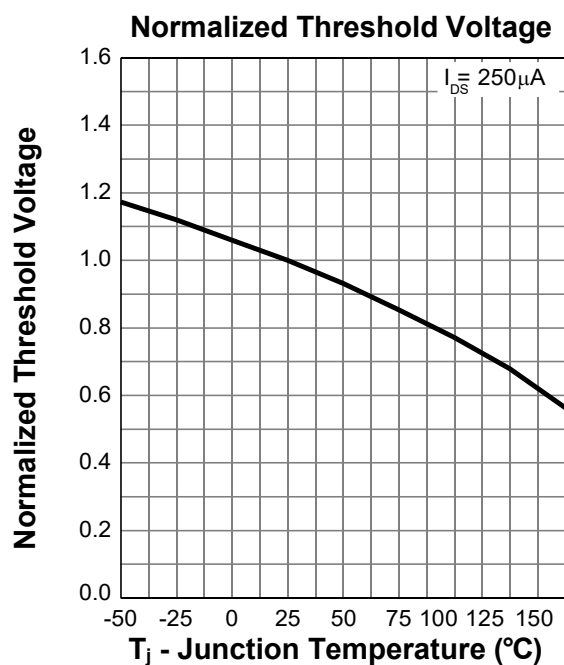
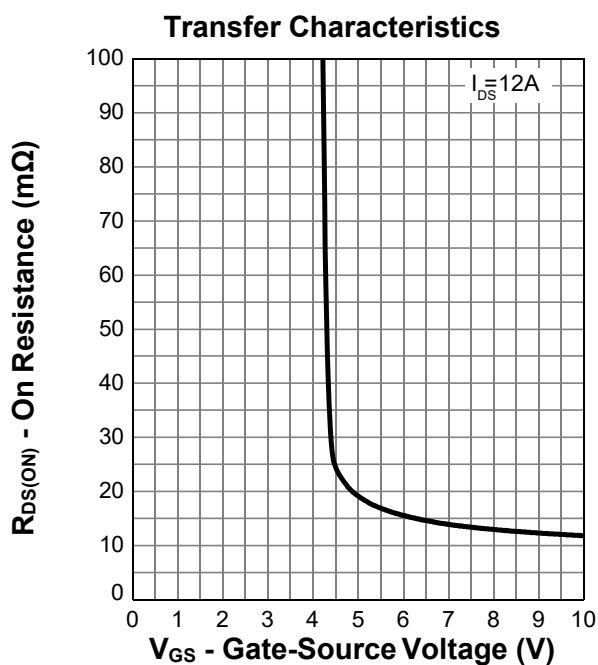
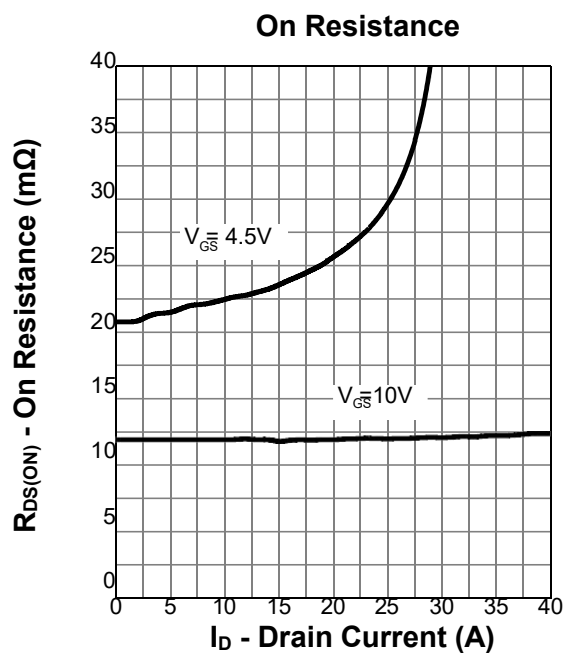
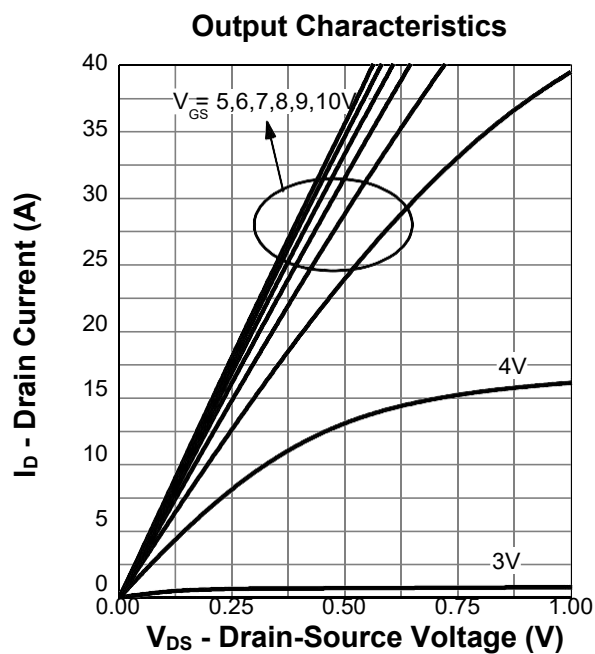
a : Pulse test ; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

b : Guaranteed by design, not subject to production testing

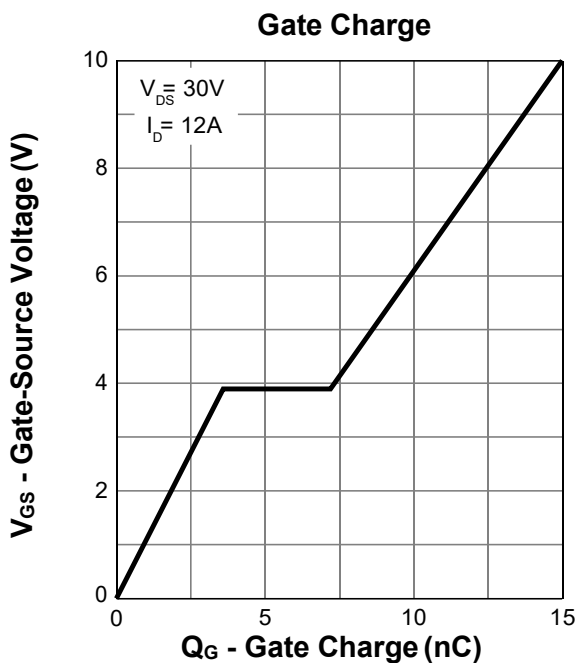
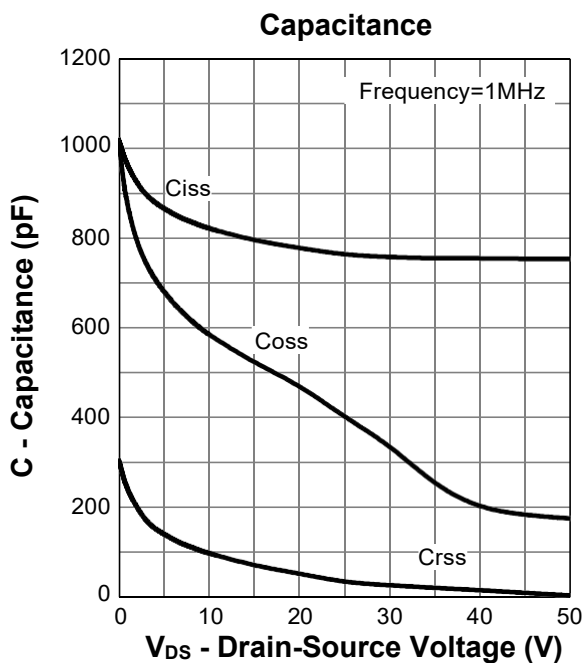
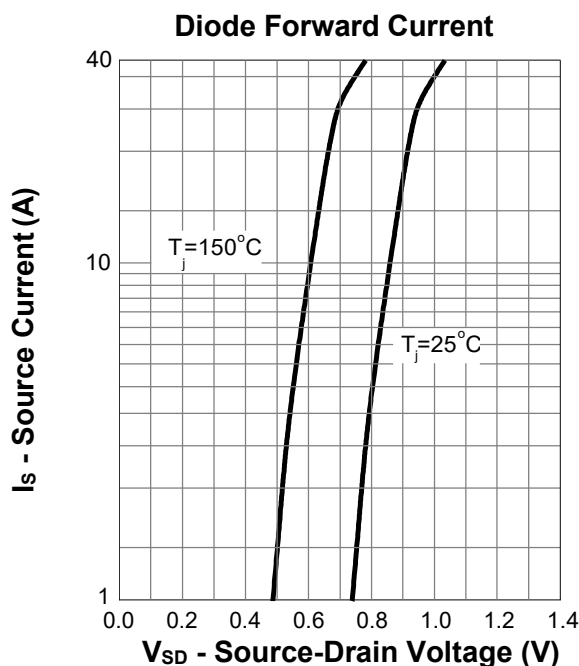
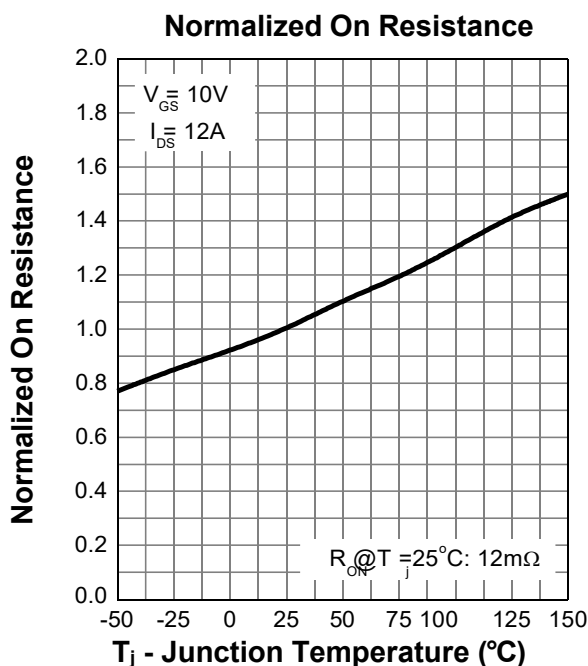
## 7. Typical Characteristics



## 7. Typical Characteristics (cont.)

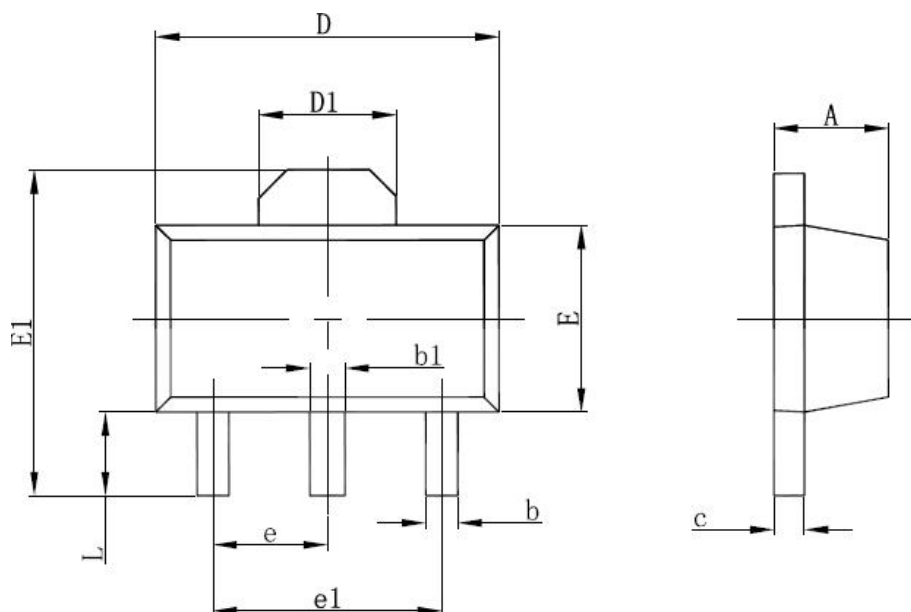


## 7. Typical Characteristics (cont.)



## 8.Package Dimensions

SOT89--3



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047