

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

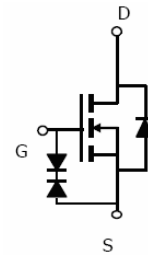
The NCE1012E uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

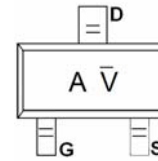
- $V_{DS} = 20V, I_D = 0.6A$   
 $R_{DS(ON)} < 350m\Omega @ V_{GS}=4.5V$   
 $R_{DS(ON)} < 500m\Omega @ V_{GS}=2.5V$   
 $R_{DS(ON)} < 700m\Omega @ V_{GS}=1.8V$   
ESD Rating : HBM 2000V
- High power and current handling capability
- Lead free product is acquired
- Gate-Source ESD protection

### Application

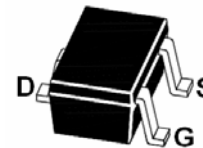
- Battery operated systems
- Load/ power switching cell phones pagers
- Power supply converter circuits



Schematic diagram



Marking and pin assignment



SOT-523 top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
A $\bar{V}$	NCE1012E	SOT-523	Ø180mm	8 mm	3000units

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Drain Current-Continuous	$I_D$	0.6	A
Drain Current-Pulsed <sup>(Note 1)</sup>	$I_{DM}$	4	A
Maximum Power Dissipation	$P_D$	0.3	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	417	$^\circ C/W$
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### Electrical Characteristics ( $T_A=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20	22	-	V

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=16V, V_{GS}=0V$	-	0.3	100	nA
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 4.5V, V_{DS}=0V$	-	-	$\pm 1$	$\mu A$
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.5	0.75	1.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=0.6A$	-	210	350	m $\Omega$
		$V_{GS}=2.5V, I_D=0.5A$	-	310	500	m $\Omega$
		$V_{GS}=1.8V, I_D=0.35A$	-	550	700	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=0.5A$	-	1	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS} = 10 V, V_{GS} = 0 V,$ $F = 1.0 MHz,$	-	60	-	pF
Output Capacitance	$C_{oss}$		-	15	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	5	-	pF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 10 V, R_L = 47\Omega$ $V_G = 4.5 V, R_G = 10\Omega$	-	5	-	nS
Turn-on Rise Time	$t_r$		-	5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	$t_f$		-	11	-	nS
Total Gate Charge	$Q_g$	$V_{DS} = 10 V, V_{GS} = 4.5 V,$ $I_D = 250 mA$	-	750	-	pC
Gate-Source Charge	$Q_{gs}$		-	75	-	pC
Gate-Drain Charge	$Q_{gd}$		-	225	-	pC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=0.6A$	-	0.75	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	0.6	A

### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ C$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $\leq 10s$  thermal resistance rating.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics

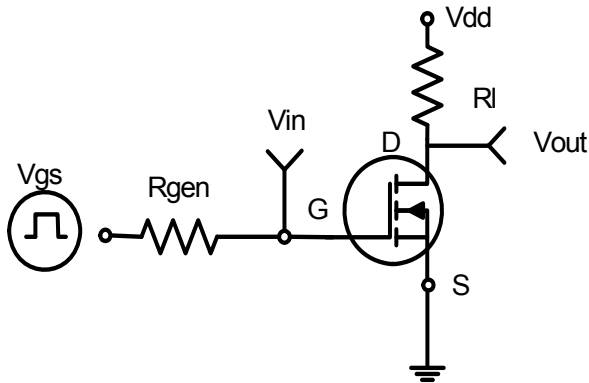


Figure 1: Switching Test Circuit

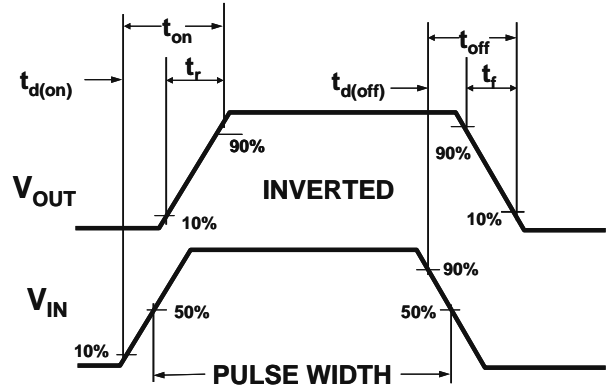


Figure 2: Switching Waveforms

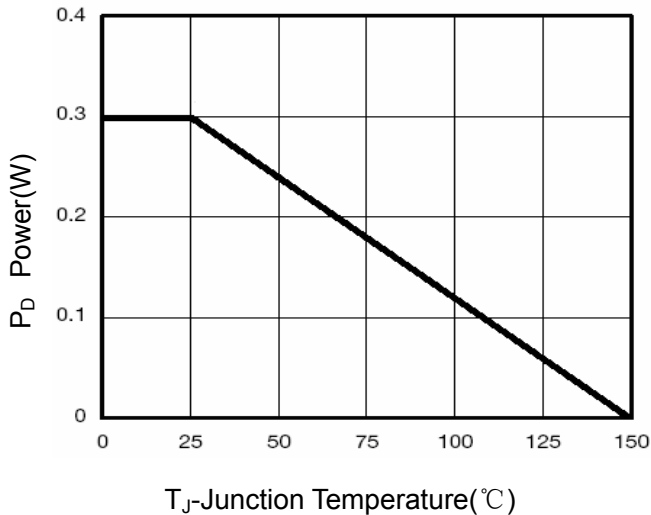


Figure 3 Power Dissipation

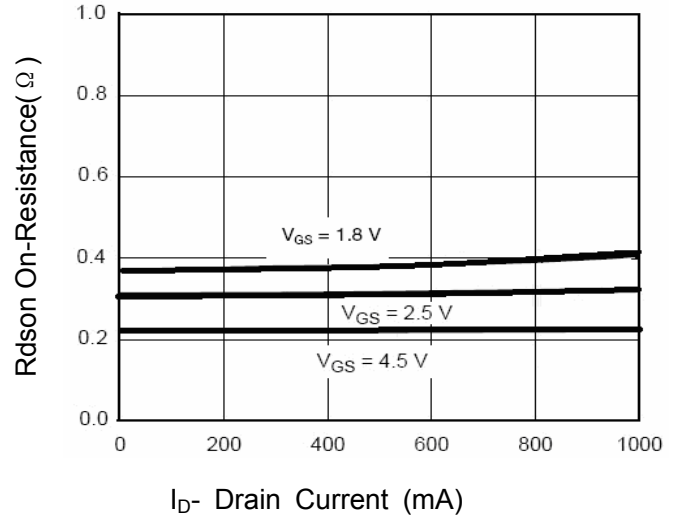


Figure 4 Drain-Source On-Resistance

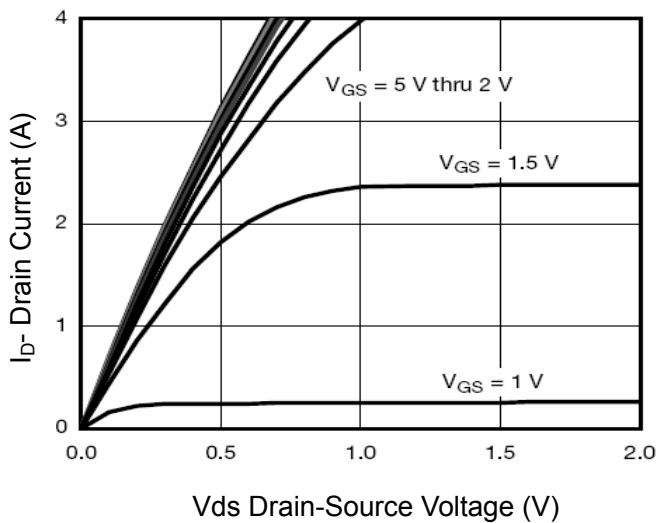


Figure 5 Output Characteristics

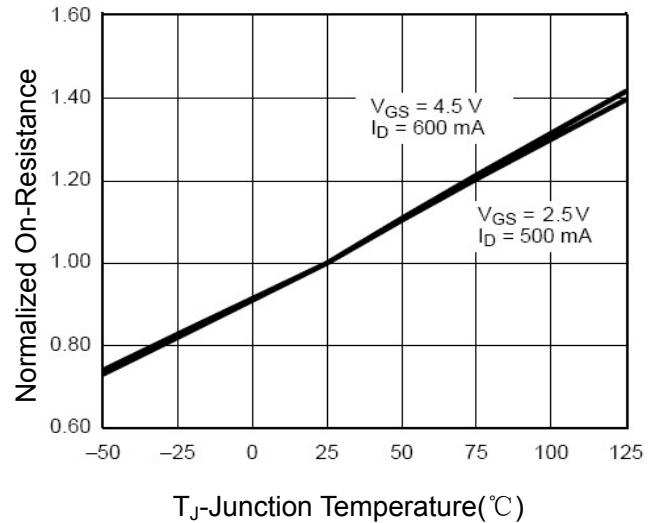
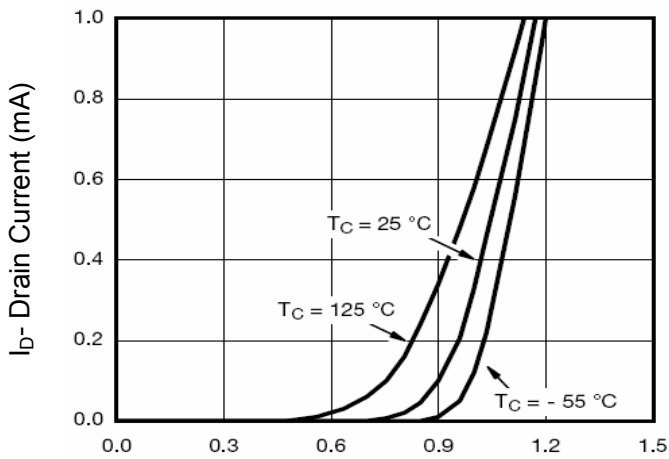
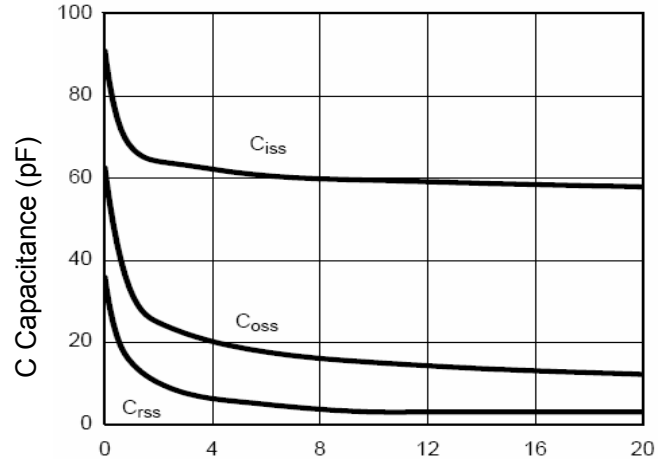


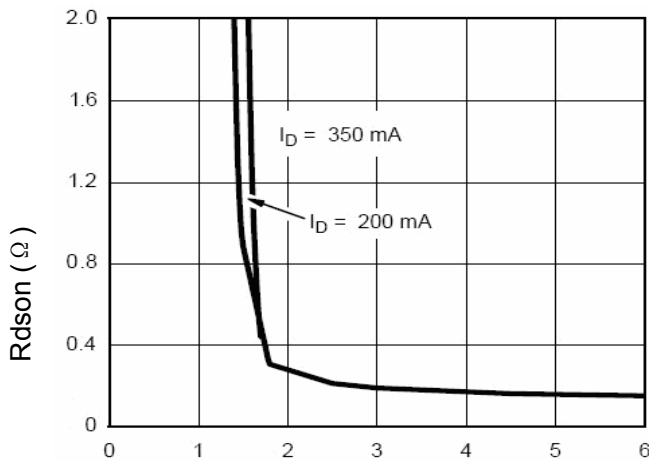
Figure 6 Drain-Source On-Resistance



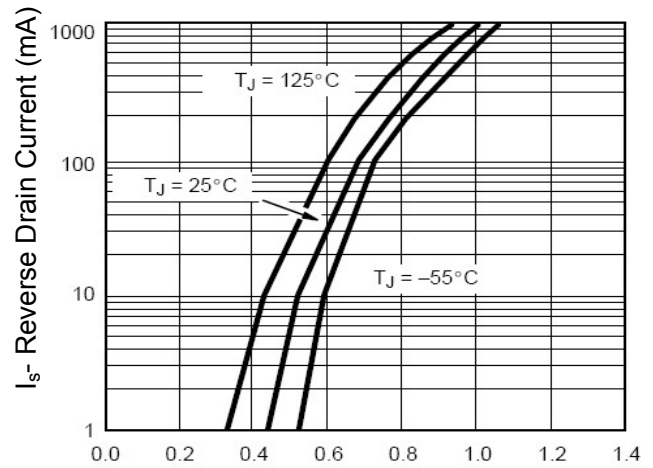
Vgs Gate-Source Voltage (V)  
**Figure 7 Transfer Characteristics**



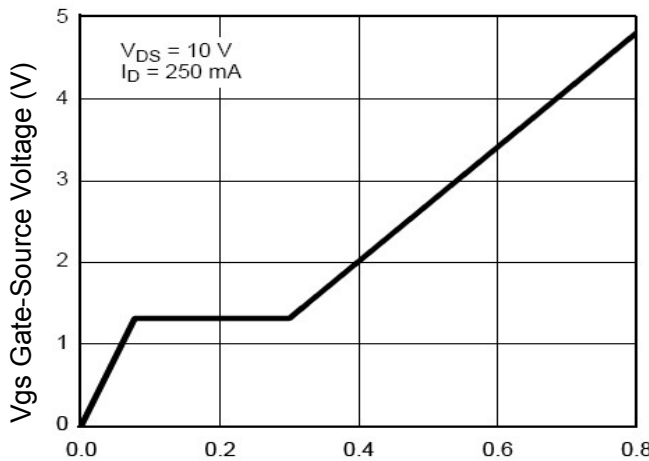
Vds Drain-Source Voltage (V)  
**Figure 8 Capacitance vs Vds**



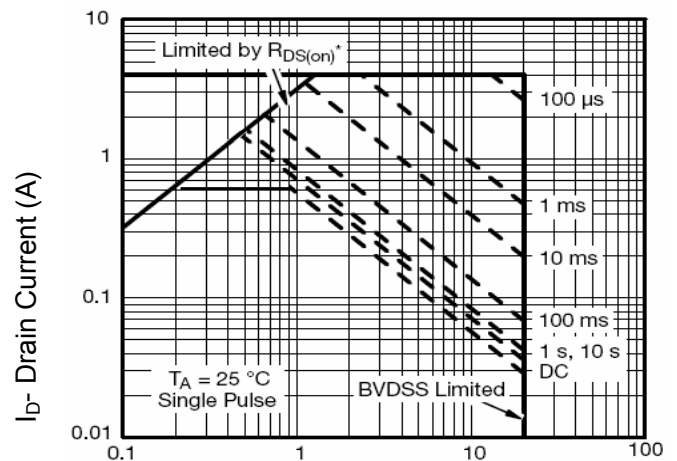
Vgs Gate-Source Voltage (V)  
**Figure 9 Rdson vs Vgs**



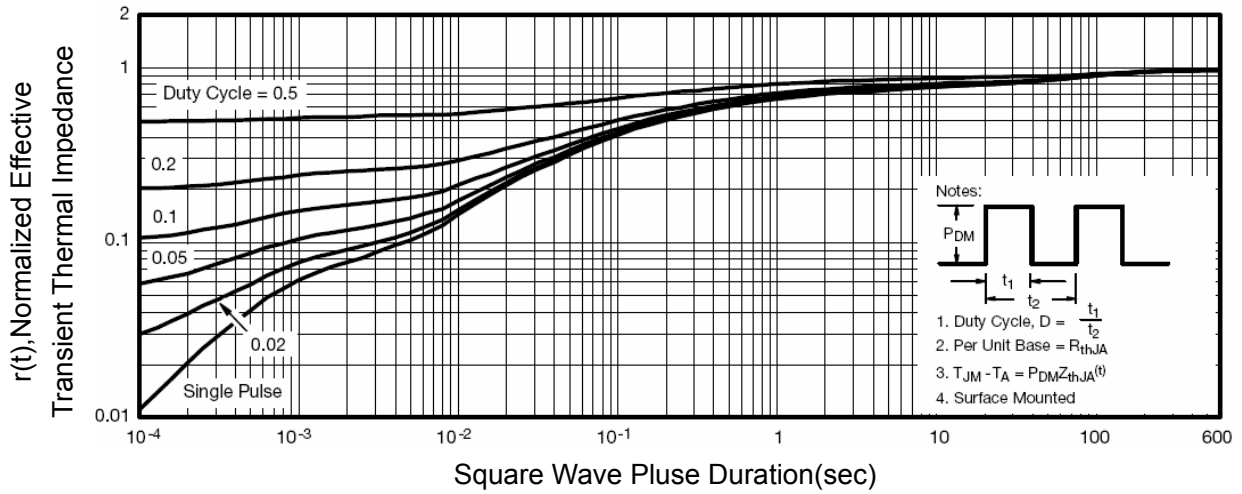
Vds Drain-Source Voltage (V)  
**Figure 10 Source-Drain Diode Forward**



Qg Gate Charge (nC)  
**Figure 11 Gate Charge**

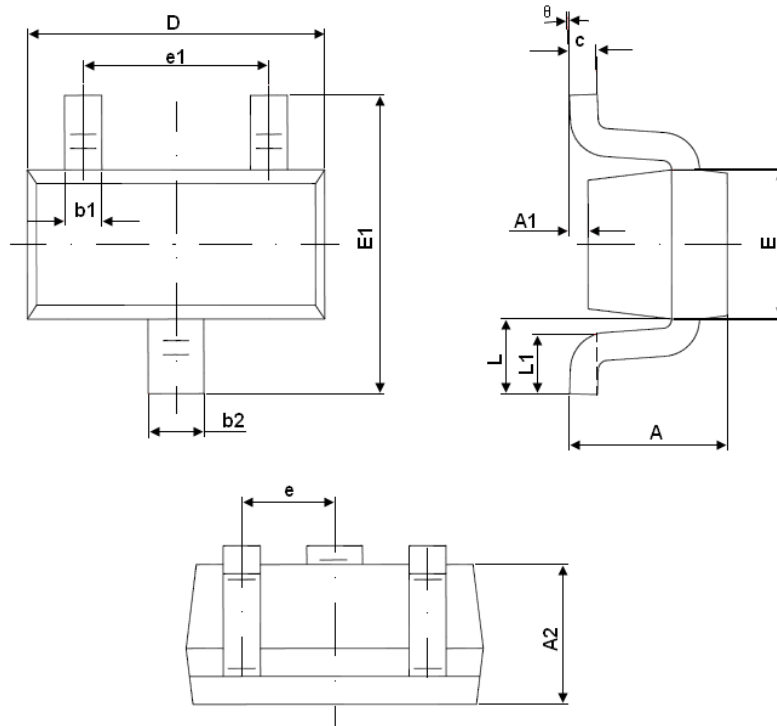


Vds Drain-Source Voltage (V)  
**Figure 12 Safe Operation Area**



**Figure 13 Normalized Maximum Transient Thermal Impedance**

## SOT-523 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b1	0.150	0.250	0.006	0.010
b2	0.250	0.350	0.010	0.014
c	0.100	0.200	0.004	0.008
D	1.500	1.700	0.059	0.067
E	0.700	0.900	0.028	0.035
E1	1.450	1.750	0.057	0.069
e	0.500 TYP.		0.020 TYP.	
e1	0.900	1.100	0.035	0.043
L	0.400REF.		0.016REF.	
L1	0.260	0.460	0.010	0.018
$\theta^\circ$	0°	8°	0°	8°

### Notes

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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