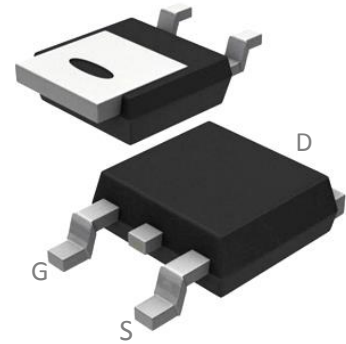


## P-Channel Enhancement Mode MOSFET

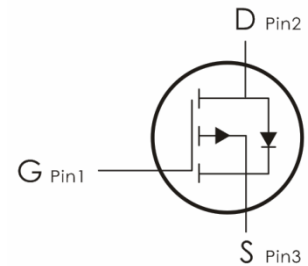
### Description:

This P-Channel MOSFET uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge. It can be used in a wide variety of applications.



### Features:

- 1)  $V_{DS}=-60V, I_D=-50A, R_{DS(ON)}<29m\Omega @ V_{GS}=-10V$
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra  $R_{DS(ON)}$ .
- 5) Excellent package for good heat dissipation.



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	-60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current	-50	A
	Continuous Drain Current-TC=100 °C	-30	
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	-144	
$E_{AS}$	Single Pulse Avalanche Energy <sup>2</sup>	196	mJ
$P_D$	Power Dissipation	79	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	°C

### Thermal Characteristics:

Symbol	Parameter	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.9	°C/W

**Package Marking and Ordering Information:**

Part NO.	Marking	Package
NCE60P50K	60P50K	TO-252

**Electrical Characteristics:** ( $T_C=25^\circ\text{C}$  unless otherwise noted)

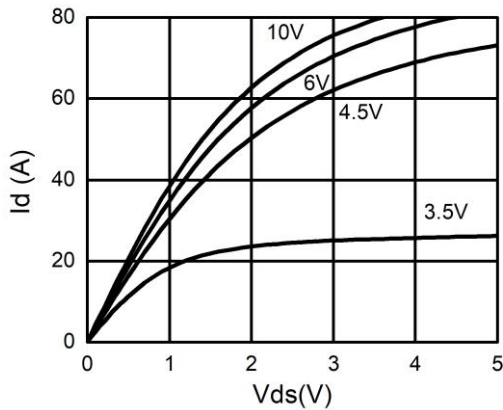
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\ \mu\text{A}$	-60	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS}=0V, V_{DS}=-60V$	---	---	-1	$\mu\text{A}$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0A$	---	---	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	GATE-Source Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$	-1	-1.8	-2.5	V
$R_{DS(on)}$	Drain-Source On Resistance <sup>②</sup>	$V_{GS}=-10V, I_D=-15A$	---	24	29	m $\Omega$
		$V_{GS}=-4.5V, I_D=-10A$	---	30.4	39	
$G_{FS}$	Forward Transconductance	$V_{DS}=-5V, I_D=-15A$	---	35	---	S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=-25V, V_{GS}=0V, f=1\text{MHz}$	---	4025	---	pF
$C_{oss}$	Output Capacitance		---	133	---	
$C_{rss}$	Reverse Transfer Capacitance		---	97	---	
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=-30V$ $R_{GEN}=3\ \Omega, V_{GS}=-10V$	---	12	---	ns
$t_r$	Rise Time		---	9	---	ns
$t_{d(off)}$	Turn-Off Delay Time		---	63	---	ns
$t_f$	Fall Time		---	13	---	ns
$Q_g$	Total Gate Charge	$V_{GS}=-10V, V_{DS}=-30V,$ $I_D=-20A$	---	53	---	nC
$Q_{gs}$	Gate-Source Charge		---	10	---	nC
$Q_{gd}$	Gate-Drain "Miller" Charge		---	12	---	nC
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Source-Drain Diode Forward Voltage <sup>3</sup>	$V_{GS}=0V, I_S=-15A, T_J=25^\circ\text{C}$	---	-0.88	-1.2	V
$I_S$	Continuous Drain Current	$V_D=V_G=0V$	---	-30	---	V
$I_{SM}$	Pulsed Drain Current	$V_D=V_G=0V$	---	-144	---	V

$t_{rr}$	Reverse Recovery Time	$I_{sd}=-20A, V_{GS}=0V$ $.dI/dt=-500A/\mu s$	---	26	---	ns
$Q_{rr}$	Reverse Recovery Charge		---	29	---	nc

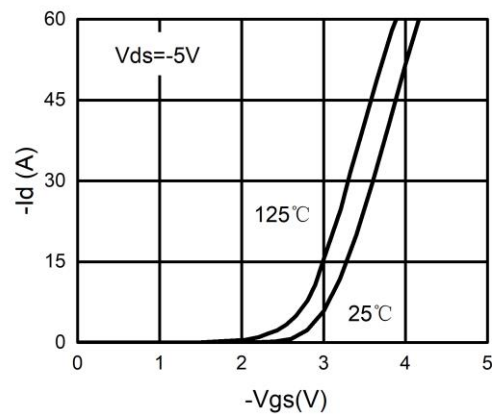
**Notes:**

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature.
2. $E_{AS}$  condition:  $T_J=25^\circ C, V_{DD}=40V, V_G=-10V, R_g=25\Omega, L=0.5mH$ .
- 3.Repetitive Rating: Pulse width limited by maximum junction temperature.

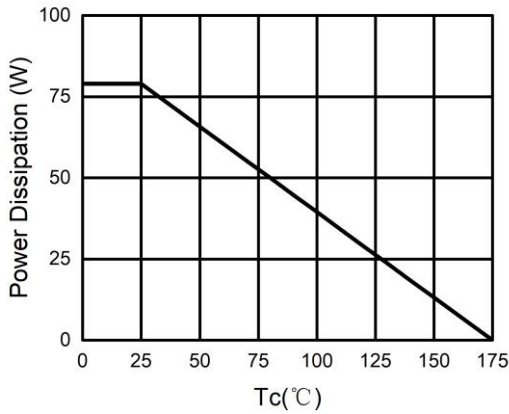
**Typical Characteristics:** ( $T_c=25^\circ C$  unless otherwise noted)



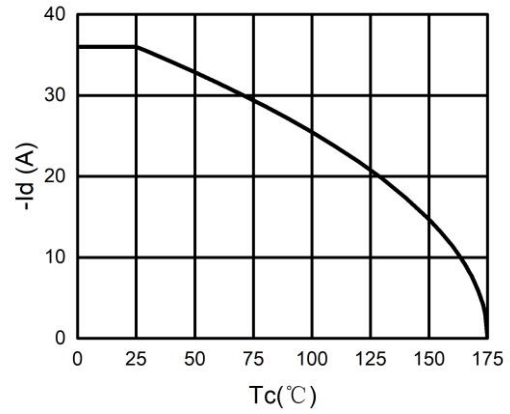
**Figure 1. Output Characteristics**



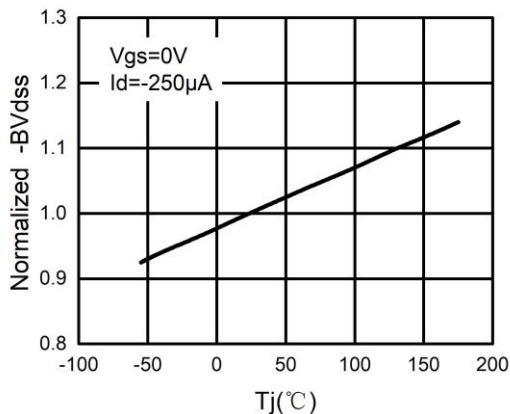
**Figure 2. Transfer Characteristics**



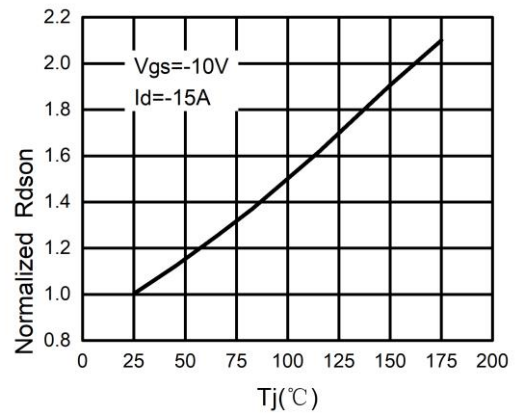
**Figure 3. Power Dissipation**



**Figure 4. Drain Current**



**Figure 5.  $BV_{DSS}$  vs Junction Temperature**



**Figure 6.  $R_{DS(ON)}$  vs Junction Temperature**

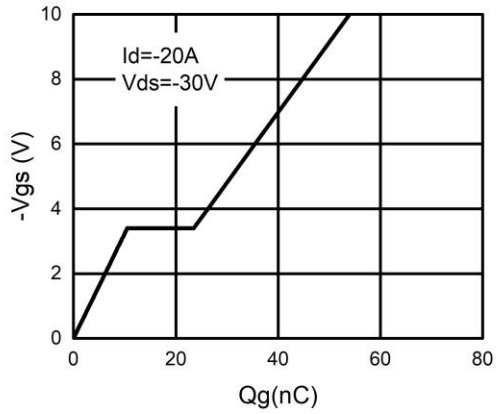


Figure 7. Gate Charge Waveforms

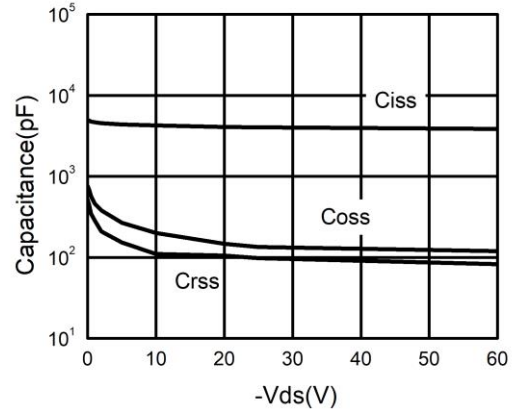


Figure 8. Capacitance

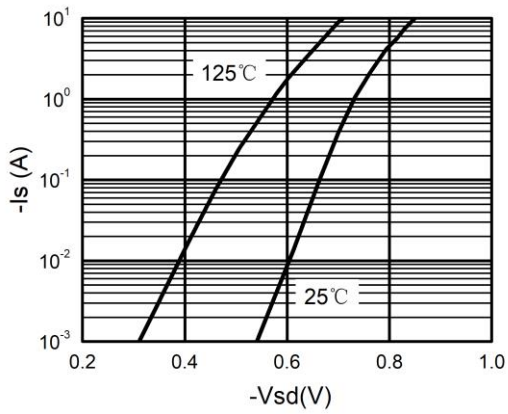


Figure 9. Body-Diode Characteristics

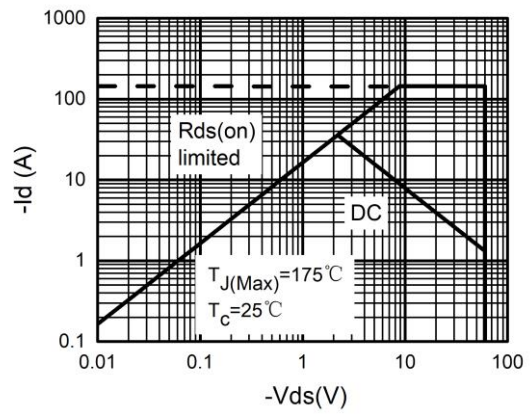


Figure 10. Maximum Safe Operating Area