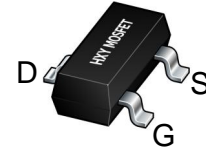




## Description

The NTR1P02 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 load switch or in PWM applications.



**SOT-23**

## General Features

$V_{DS} = -20V, I_D = -2.3A$

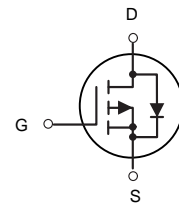
$R_{DS(ON)} < 140m\Omega @ V_{GS} = -4.5V$

$R_{DS(ON)} < 162m\Omega @ V_{GS} = -2.5V$

## Application

PWM applications

Load switch



P-Channel MOSFET

## Package Marking and Ordering Information

Product ID	Pack	Brand	Qty(PCS)
NTR1P02	SOT-23	HXY MOSFET	3000

## Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Symbol	Parameter	Limit	Unit
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current-Continuous	-2.3	A
$I_{DM}$	Drain Current-Pulsed (Note 1)	-10	A
$P_D$	Maximum Power Dissipation	0.7	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 150	°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 2)	178	°C/W



**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  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		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-20V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.7	-1	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-2A$		120	140	m $\Omega$
		$V_{GS}=-2.5V, I_D=-1.8A$		145	162	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-2A$	4	-	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-10V, V_{GS}=0V,$ $F=1.0MHz$	-	285	-	PF
Output Capacitance	$C_{oss}$		-	58	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	32	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-10V, R_L=5\Omega$ $V_{GS}=-4.5V, R_{GEN}=3\Omega$	-	9.8	-	nS
Turn-on Rise Time	$t_r$		-	4.9	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	20.5	-	nS
Turn-Off Fall Time	$t_f$		-	7	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-10V, I_D=-2A,$ $V_{GS}=-4.5V$	-	2.9	-	nC
Gate-Source Charge	$Q_{gs}$		-	0.45	-	nC
Gate-Drain Charge	$Q_{gd}$		-	0.75	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-2A$	-	-	-1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	-2.0	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
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

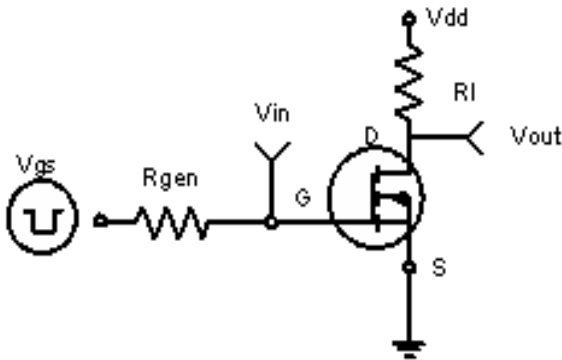


Figure 1: Switching Test Circuit

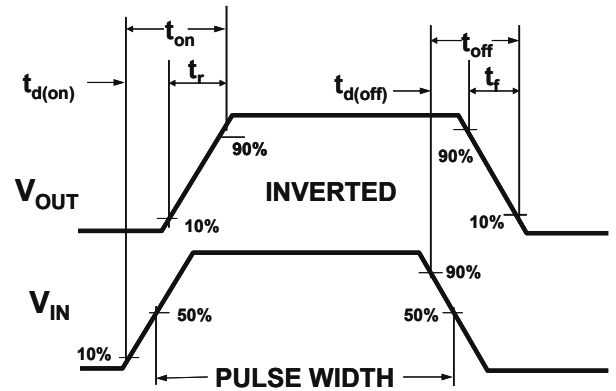
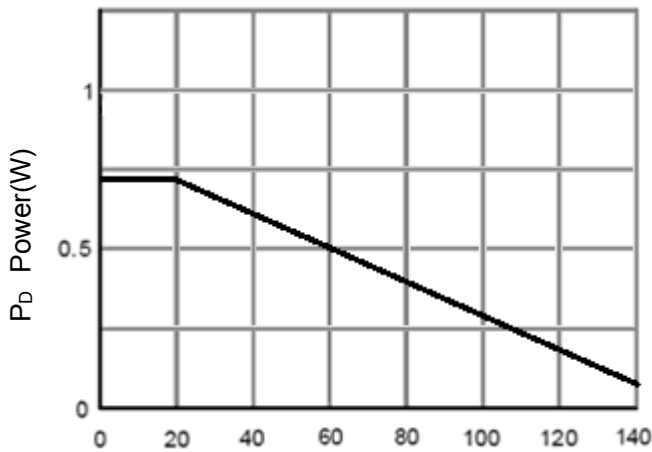
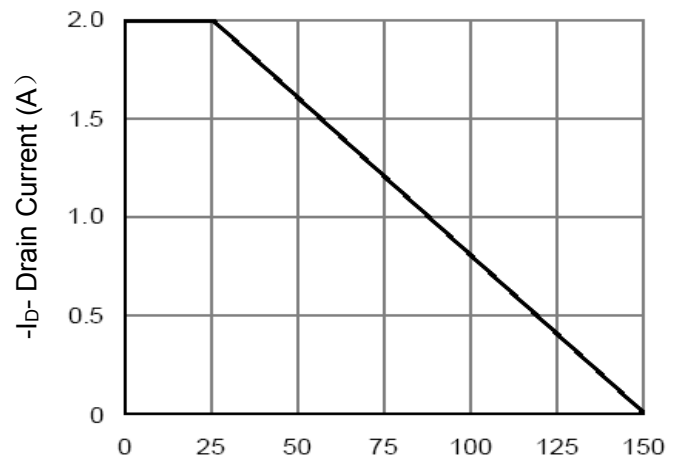


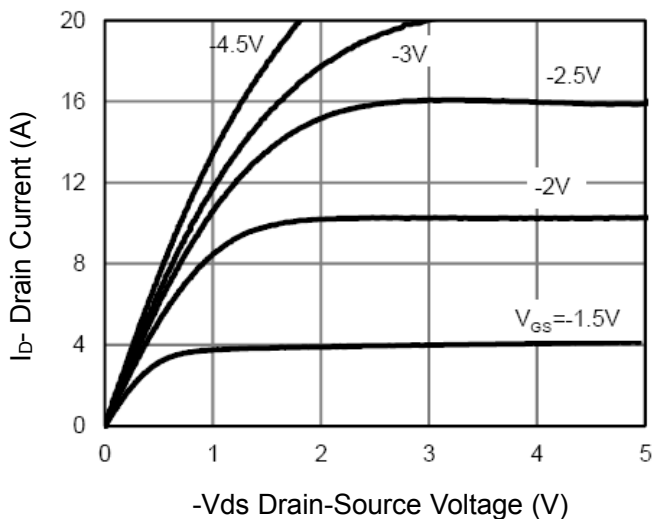
Figure 2: Switching Waveforms



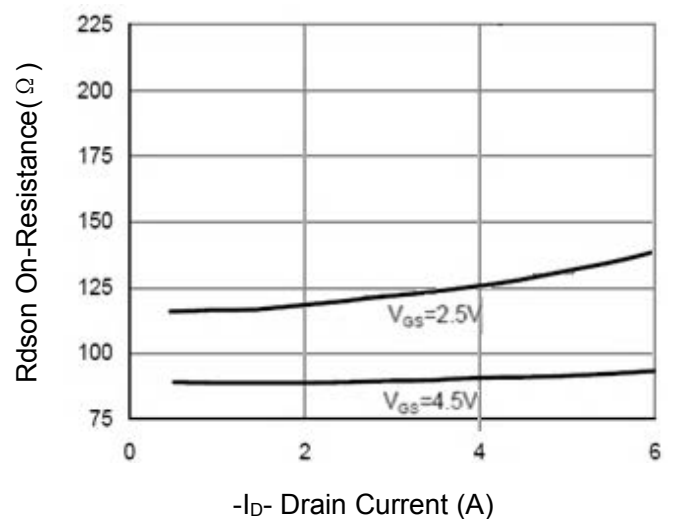
T<sub>J</sub>-Junction Temperature(°C)  
Figure 3 Power Dissipation



T<sub>J</sub>-Junction Temperature(°C)  
Figure 4 Drain Current



-V<sub>ds</sub> Drain-Source Voltage (V)  
Figure 5 Output Characteristics



-I<sub>D</sub>- Drain Current (A)  
Figure 6 Drain-Source On-Resistance

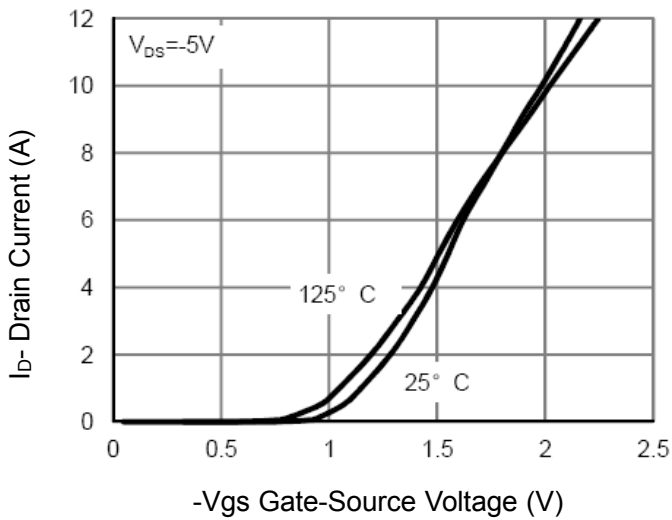


Figure 7 Transfer Characteristics

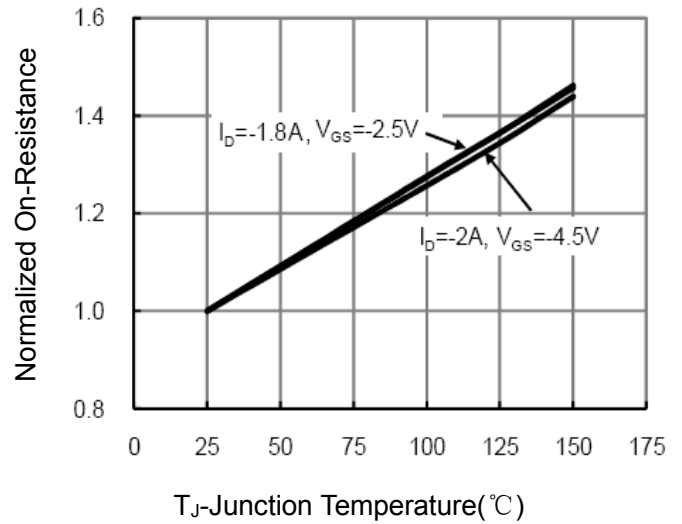


Figure 8 Drain-Source On-Resistance

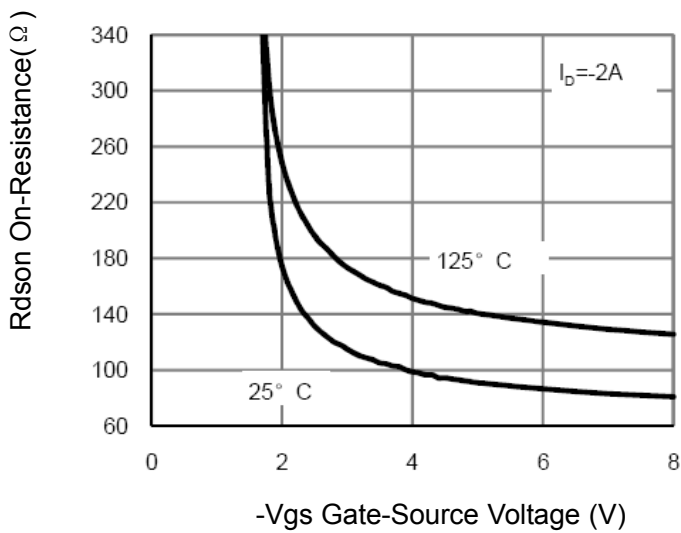


Figure 9 Rdson vs Vgs

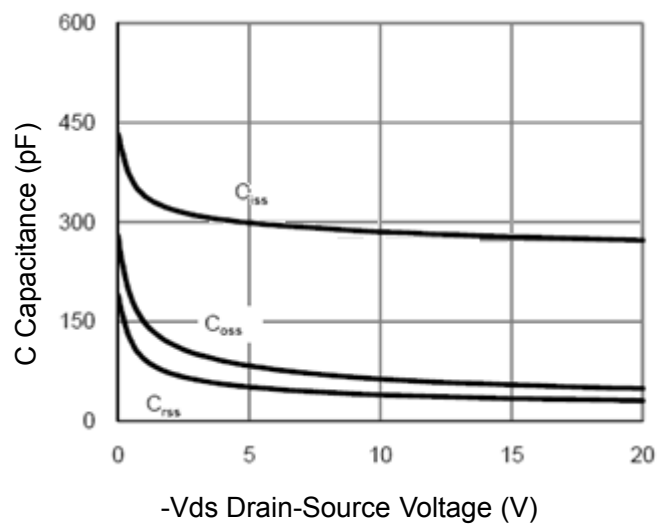


Figure 10 Capacitance vs Vds

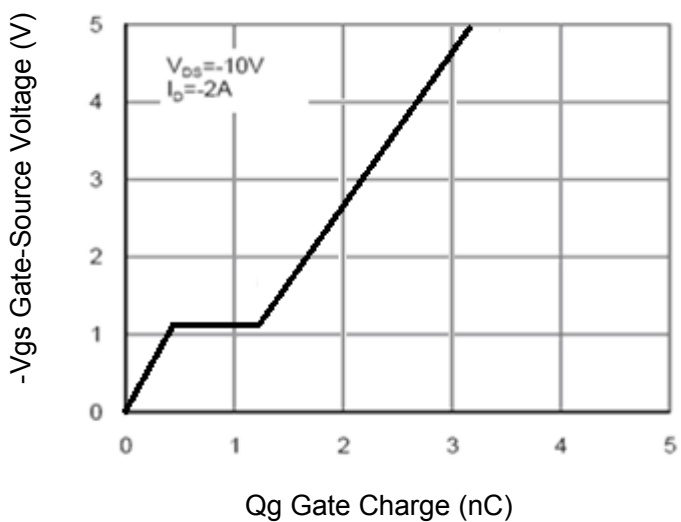


Figure 11 Gate Charge

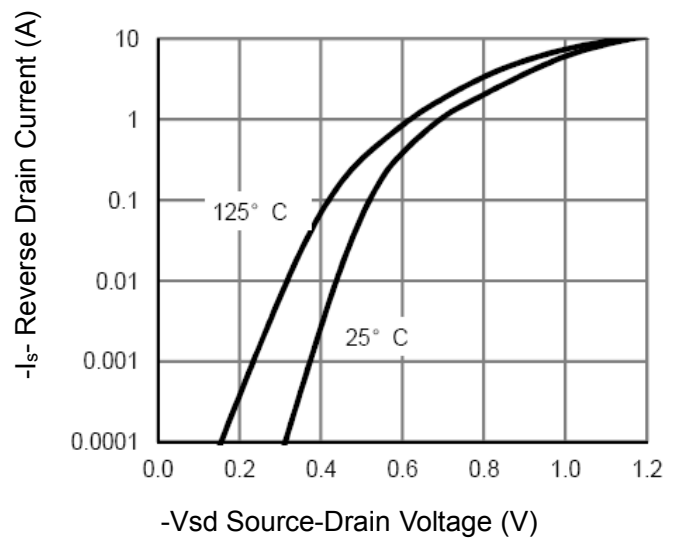


Figure 12 Source- Drain Diode Forward

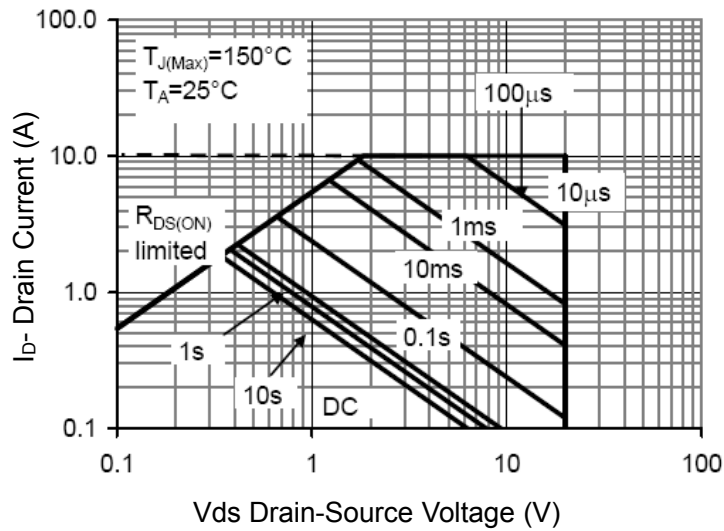


Figure 13 Safe Operation Area

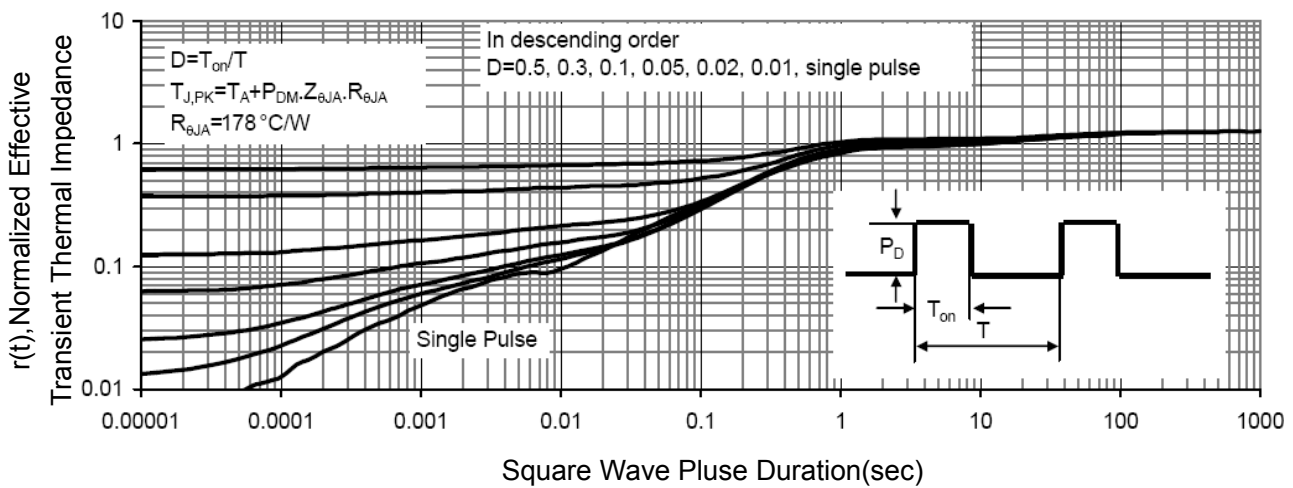
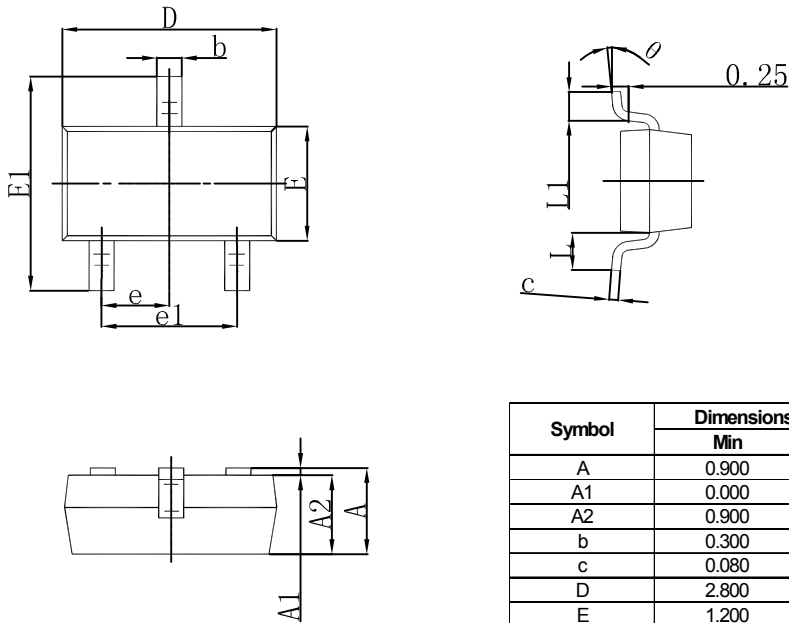


Figure 14 Normalized Maximum Transient Thermal Impedance

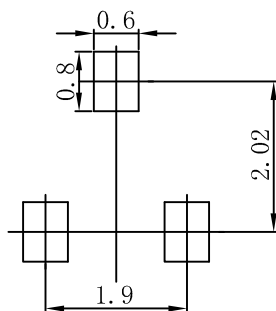


### SOT-23 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

### SOT-23 Suggested Pad Layout



- Note:
1. Controlling dimension: in millimeters.
  2. General tolerance:  $\pm 0.05\text{mm}$ .
  3. The pad layout is for reference purposes only.



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