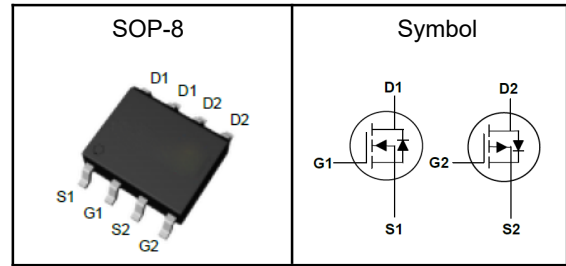


**60V N+P-Channel MOSFET**
**Features**

- High Speed Power Switching
- Reliable and Rugged
- ROHS Compliant
- 100% Avalanche Tested

**Applications**

- Power Management in Desktop Computer
- DC/DC Converters

**Pin Description**


	N-ch	P-ch	
$V_{DSS}$	60	-60	V
$R_{DS(ON)-Typ}$	33	75	m $\Omega$
$I_D$	5.1	-3.7	A

**Absolute Maximum Ratings** ( $T_A=25^{\circ}C$ , Unless Otherwise Noted)

Symbol	Parameter	N-Ch	P-Ch	Unit
$V_{DSS}$	Drain-Source Voltage	60	-60	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$T_J$	Maximum Junction Temperature	-55 to 150		$^{\circ}C$
$T_{STG}$	Storage Temperature Range	-55 to 150		$^{\circ}C$
$I_{DM}^{①}$	Pulse Drain Current Tested	20	-14	A
$I_D$	Continuous Drain Current	5.1	-3.7	A
$P_D$	Maximum Power Dissipation	2	2	W
$E_{AS}$	Avalanche Energy, Single pulse	12	16	mJ

**Thermal Characteristics**

Symbol	Parameter	Rating	Unit
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	62.5	$^{\circ}C/W$

Note ① : Max. current is limited by bonding wire.

Note ② : UIS tested and pulse width are limited by maximum junction temperature 150 $^{\circ}C$ .

Note ③ : Surface Mounted on 1in<sup>2</sup> FR-4 board with 1oz.



**60V N+P-Channel MOSFET**

**N-ch Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$ , Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Static Electrical Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=48V, V_{GS}=0V$	---	---	1	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	2	3	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS}=10V, I_D=5A$	---	33	40	m $\Omega$
		$V_{GS}=4.5V, I_D=4A$	---	37	48	m $\Omega$
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	3	---	$\Omega$
$C_{iss}$	Input Capacitance	$V_{DS}=30V, V_{GS}=0V, \text{Freq.}=1\text{MHz}$	---	670	---	pF
$C_{oss}$	Output Capacitance		---	70	---	
$C_{rss}$	Reverse Transfer Capacitance		---	35	---	
$T_{d(on)}$	Turn-on Delay Time	$V_{DD}=30V, V_{GS}=10V, I_D=1A, R_G=6\Omega$	---	8	---	nS
$T_r$	Turn-on Rise Time		---	6	---	
$T_{d(off)}$	Turn-off Delay Time		---	23	---	
$T_f$	Turn-off Fall Time		---	6	---	
$Q_g$	Total Gate Charge	$V_{DS}=30V, V_{GS}=10V, I_D=5A$	---	14	---	nC
$Q_{gs}$	Gate-Source Charge		---	2.6	---	
$Q_{gd}$	Gate-Drain Charge		---	2.2	---	
<b>Source-Drain Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S=1A, V_{GS}=0V$	---	---	1.3	V
$t_{rr}$	Reverse Recovery Time	$I_F=5A, di/dt=100A/\mu s$	---	20	---	nS
$Q_{rr}$	Reverse Recovery Charge		---	20	---	nC

Note ④: Pulse test (pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ ).

Note ⑤: Guaranteed by design, not subject to production testing.



**60V N+P-Channel MOSFET**

**P-ch Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$ , Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Static Electrical Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-60	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-48V, V_{GS}=0V$	---	---	-1	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	---	-2.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS}=-10V, I_D=-3.7A$	---	75	95	$m\Omega$
		$V_{GS}=-4.5V, I_D=-2A$	---	95	130	$m\Omega$
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	10	---	$\Omega$
$C_{iss}$	Input Capacitance	$V_{DS}=-30V, V_{GS}=0V, Freq.=1MHz$	---	500	---	pF
$C_{oss}$	Output Capacitance		---	66	---	
$C_{rss}$	Reverse Transfer Capacitance		---	32	---	
$T_{d(on)}$	Turn-on Delay Time	$V_{DD}=-30V, V_{GS}=-10V, I_D=-1A, R_G=6\Omega$	---	7.5	---	nS
$T_r$	Turn-on Rise Time		---	4	---	
$T_{d(off)}$	Turn-off Delay Time		---	38	---	
$T_f$	Turn-off Fall Time		---	28	---	
$Q_g$	Total Gate Charge	$V_{DS}=-30V, V_{GS}=-10V, I_D=-3.7A$	---	12	---	nC
$Q_{gs}$	Gate-Source Charge		---	1.3	---	
$Q_{gd}$	Gate-Drain Charge		---	1.5	---	
<b>Source-Drain Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S=-1A, V_{GS}=0V$	---	---	-1.1	V
$t_{rr}$	Reverse Recovery Time	$I_F=-3.7A, dI_F/dt=100A/\mu s$	---	20	---	nS
$Q_{rr}$	Reverse Recovery Charge		---	15	---	nC

Note ④: Pulse test (pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ ).

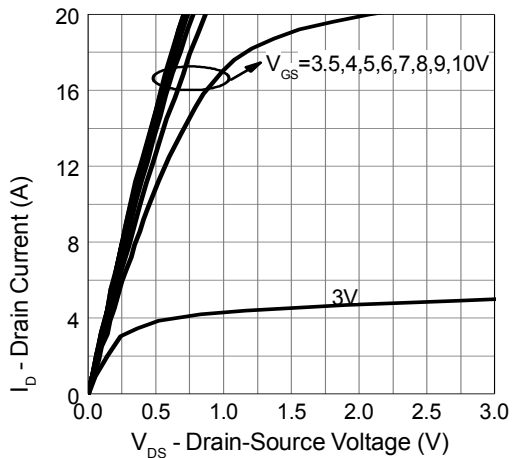
Note ⑤: Guaranteed by design, not subject to production testing.



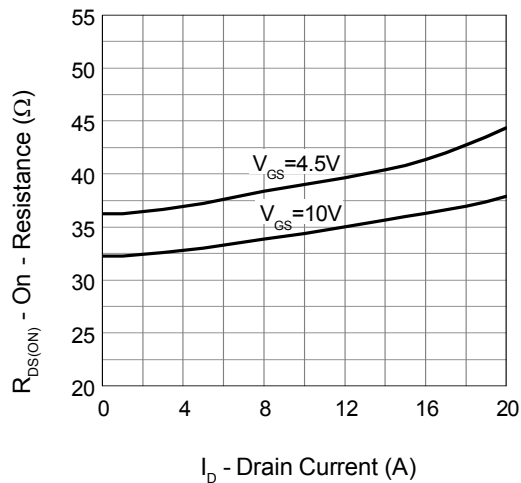
60V N+P-Channel MOSFET

N-ch Typical Characteristics

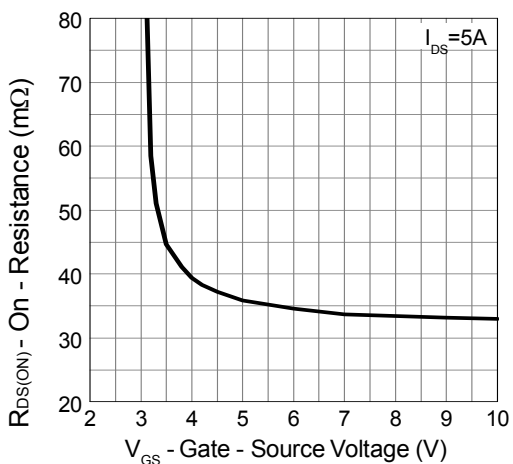
Output Characteristics



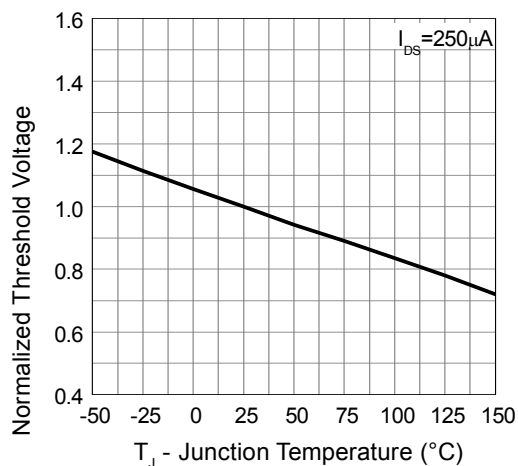
Drain-Source On Resistance



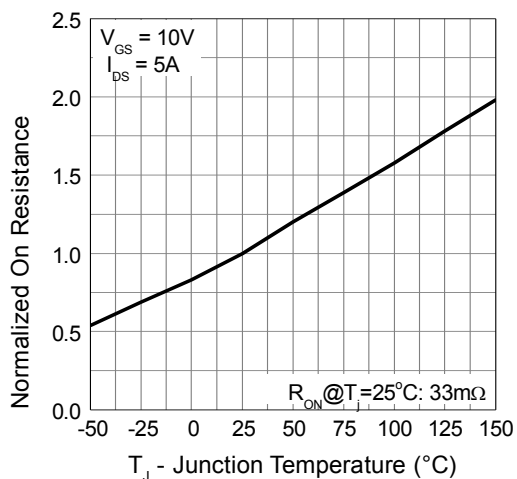
Transfer Characteristics



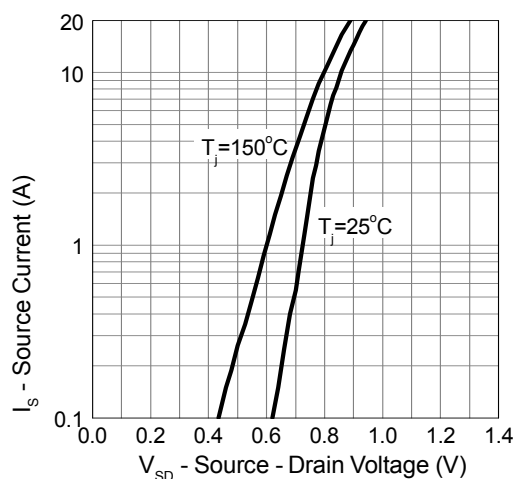
Gate Threshold Voltage



Drain-Source On Resistance



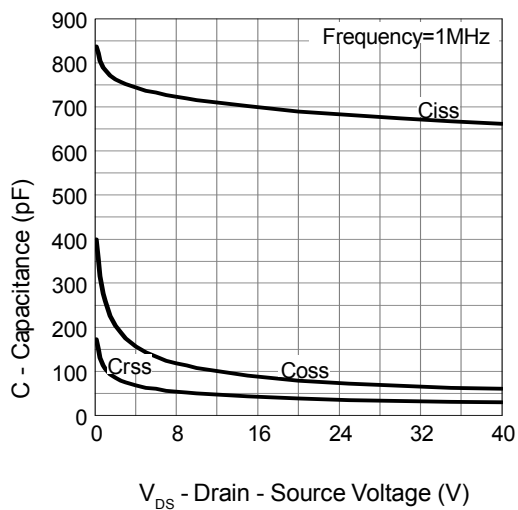
Source-Drain Diode Forward



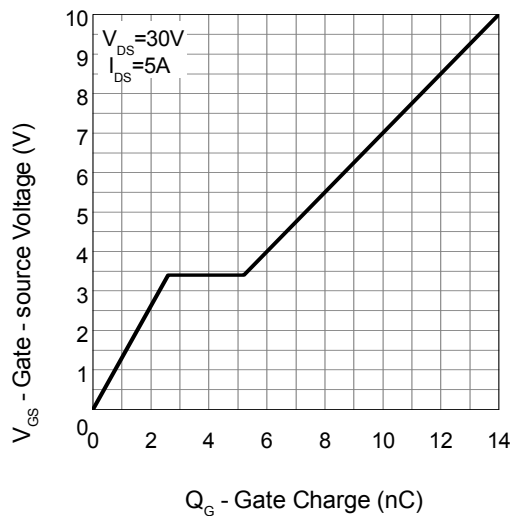


60V N+P-Channel MOSFET

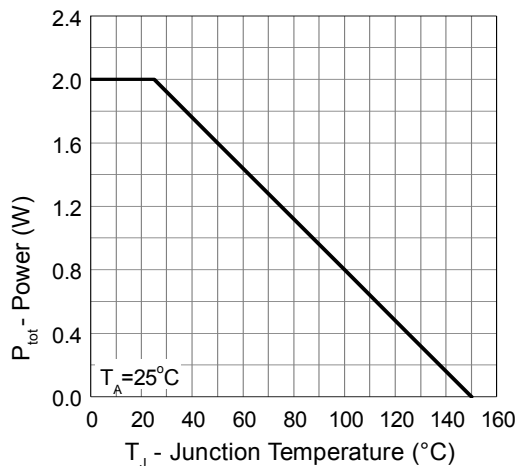
Capacitance



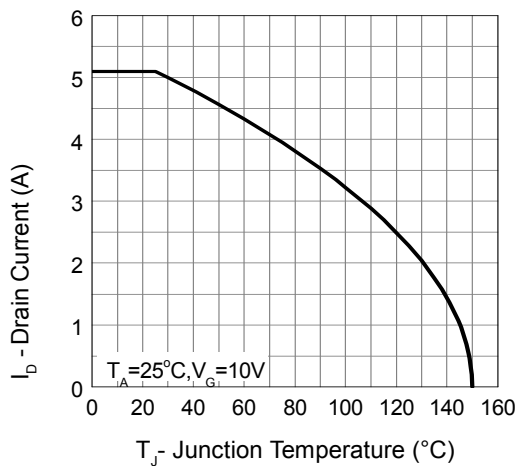
Gate Charge



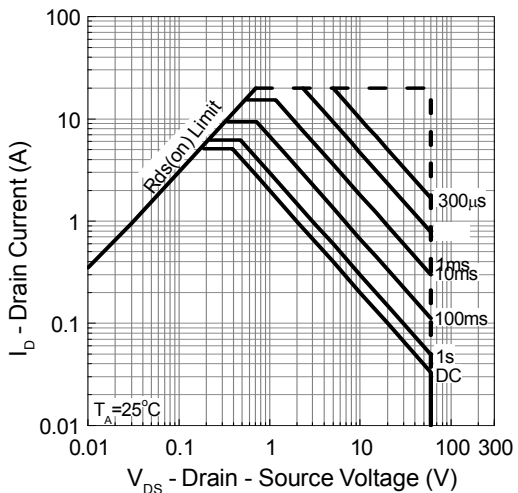
Power Dissipation



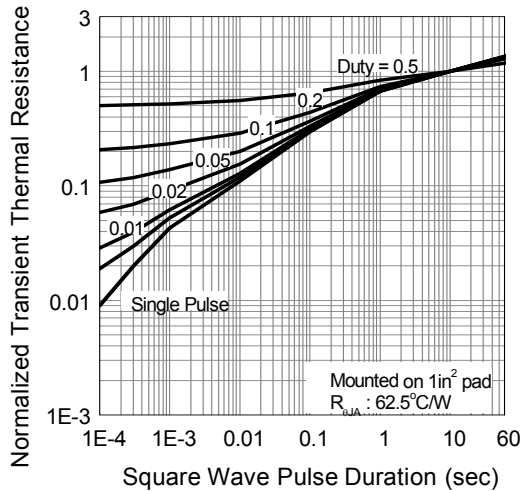
Drain Current

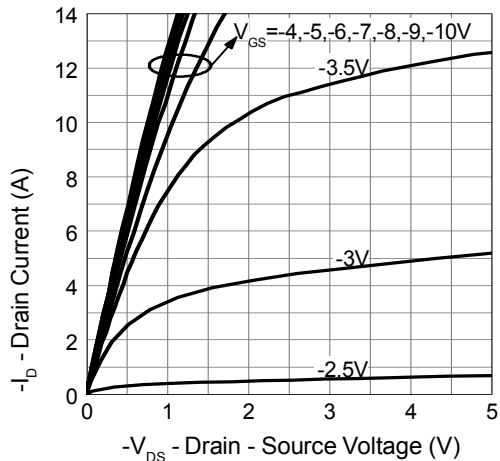
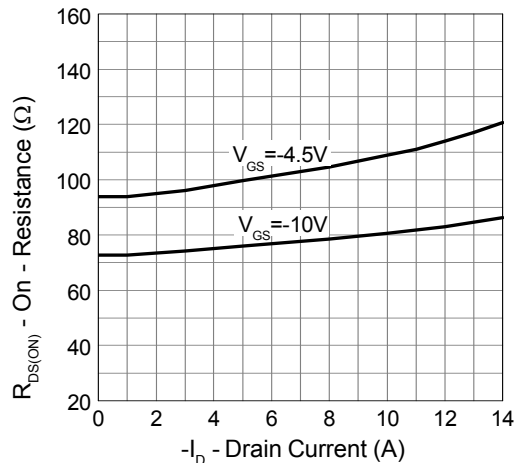
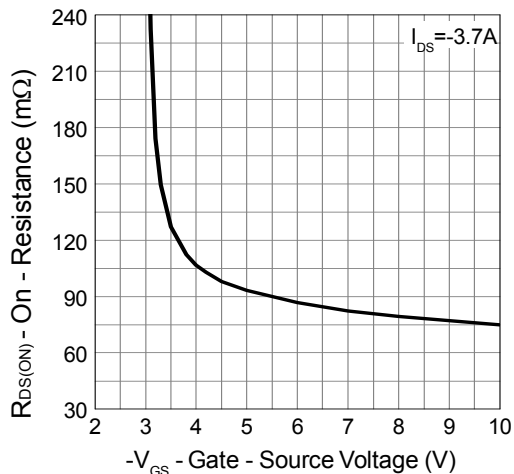
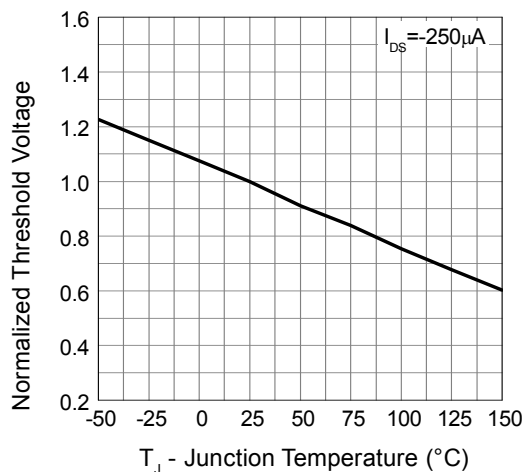
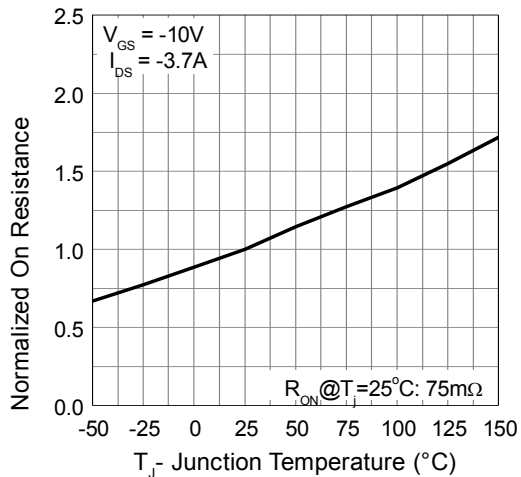
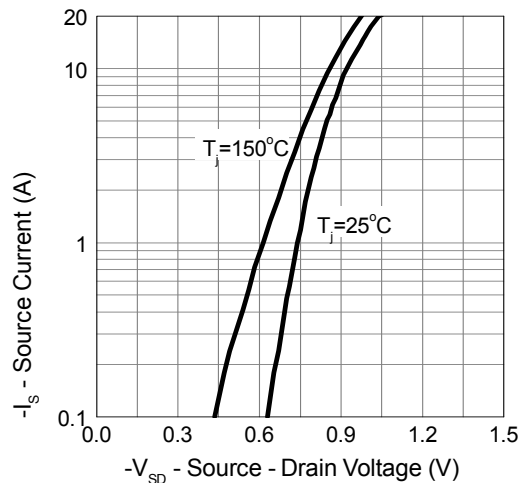


Safe Operation Area



Thermal Transient Impedance

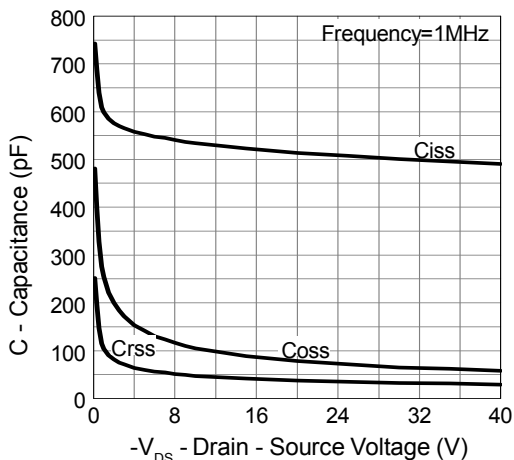


**60V N+P-Channel MOSFET**
**P-ch Typical Characteristics**
**Output Characteristics**

**Drain-Source On Resistance**

**Transfer Characteristics**

**Gate Threshold Voltage**

**Drain-Source On Resistance**

**Source-Drain Diode Forward**


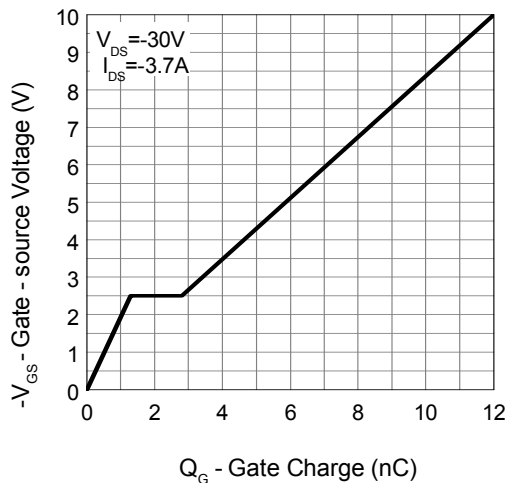


60V N+P-Channel MOSFET

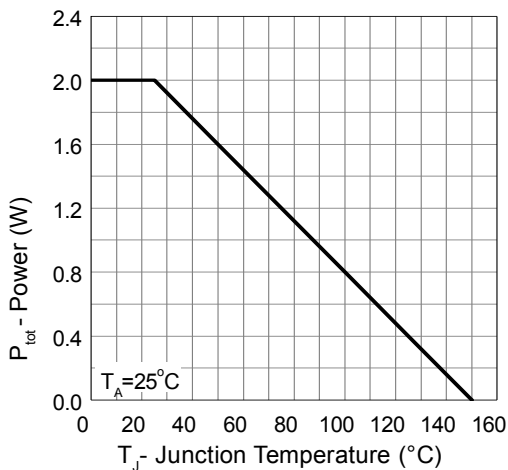
Capacitance



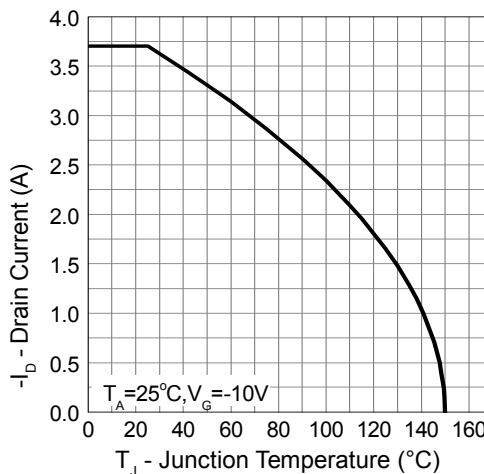
Gate Charge



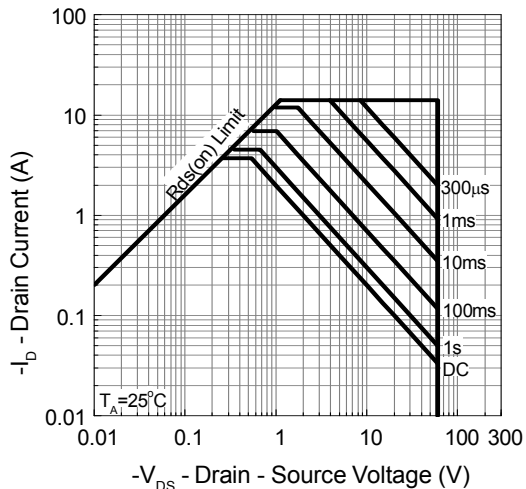
Power Dissipation



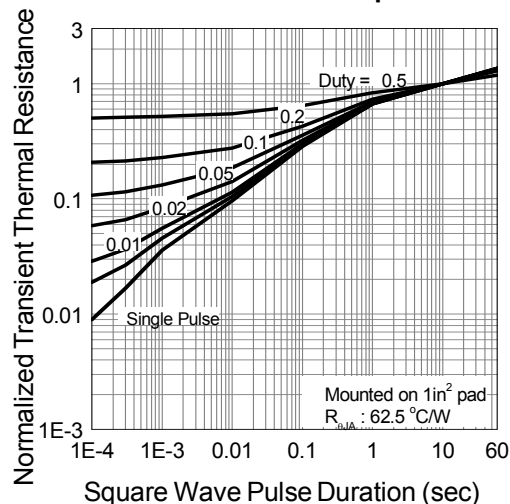
Drain Current

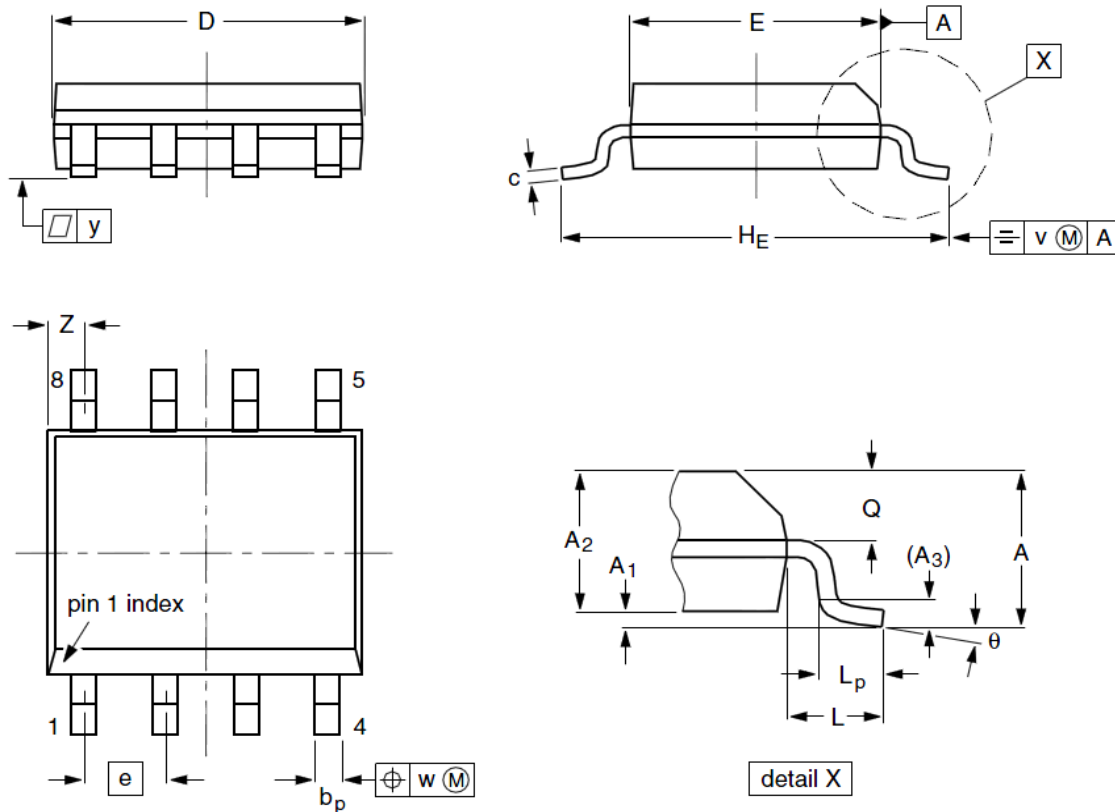


Safe Operation Area



Thermal Transient Impedance



**60V N+P-Channel MOSFET**
**SOP-8 Package Outline Dimensions**


Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
<b>A</b>	1.35	1.55	1.75	<b>A<sub>1</sub></b>	0.10	0.18	0.25
<b>A<sub>2</sub></b>	1.25	1.45	1.65	<b>A<sub>3</sub></b>	--	0.25	--
<b>b<sub>p</sub></b>	0.36	0.42	0.51	<b>c</b>	0.19	0.22	0.25
<b>D</b>	4.70	4.92	5.10	<b>E</b>	3.80	3.90	4.00
<b>e</b>	--	1.27	--	<b>H<sub>E</sub></b>	5.80	6.00	6.20
<b>L</b>	--	1.05	--	<b>L<sub>p</sub></b>	0.40	0.68	1.00
<b>Q</b>	0.60	0.65	0.73	<b>v</b>	--	0.25	--
<b>w</b>	--	0.25	--	<b>y</b>	--	0.10	--
<b>Z</b>	0.30	0.50	0.70	<b>θ</b>	0°		8°