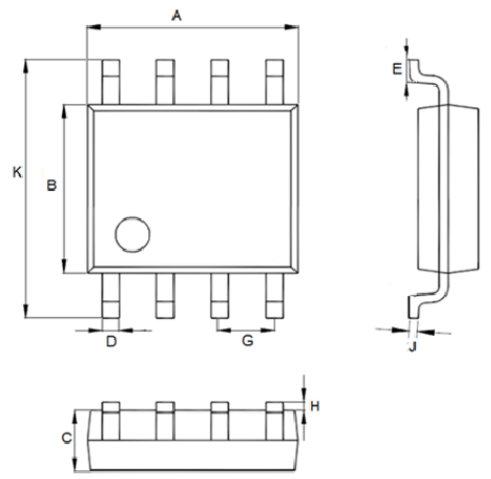
P+N-Channel Enhancement Mode MOSFET

Primary characteristics				
Symbol	**Parameter**	**Value**		**Unit**
		N-ch.	**P-ch.**	
I_D	Continuous drain current (T_C=25°C)	9.7	9.2	A
V_{DSS}	Drain source voltage	40	40	V
R_{DSON}	Static drain-source ON resistance	27	70	mΩ MAX

Case dimensions



SOP-8

Unit		A	B	C	D	E	G	H	J	K
mm	MIN	4.8	3.8	1.3	0.3	0.4	1.17	0.1	0.1	5.8
	MAX	5.2	4.2	1.5	0.5	1.0	1.37	0.3	0.3	6.2

Features

- **SOP-8** case for easy automatic insertion
- Pb-free and **RoHS** compliant
- Reliable and rugged
- Molding compound: UL Flammability Classification Rating 94V-0
- Terminals: matte tin-plated leads; solderability-per MIL-STD-202, Method 208

Applications

- Portable equipment application
- Synchronous rectification
- Motor control

Maximum ratings (T_A = 25°C unless otherwise noted)					
Characteristic		**Symbol**	**Value**		**Unit**
			N-channel	**P-channel**	
Drain-source voltage		V_{DSS}	40	40	V
Gate-source voltage		V_{GSS}	±20	±20	V
Continuous drain current (T_C=25°C)	T_C=25°C	I_D	9.7	9.2	A
	T_C=100°C		6.2	5.8	
Pulsed drain current [1)]		I_{DM}	39	36.8	A
Power Dissipation		P_D	3.4	7.8	W
Single pulse avalanche energy [2)]		E_{AS}	18	20	mJ
Thermal resistance junction-to-air		$R_{\theta JA}$	37	16	°C/W
Operating junction temperature range		T_J, T_{STG}	-55 ~ 150		°C

N-channel

Electrical characteristics (T_A = 25°C)

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Drain-source breakdown voltage	V_{GS}=0V, I_D=250µA	V_{DSS}	40	-	-	V
Zero gate voltage drain current	V_{DS}=40V, V_{GS}=0V	I_{DSS}	-	-	1.0	µA
Gate body leakage current	V_{GS}=±20V, V_{DS}=0V	I_{GSS}	-	-	±100	nA
Gate threshold voltage [3]	V_{DS}=V_{GS}, I_D=250µA	$V_{GS(TH)}$	1.0	-	2.5	V
Drain-source on-state resistance [3]	V_{GS}=10V, I_D=4.0A	$R_{DS(ON)}$	-	-	21	mΩ
	V_{GS}=4.5V, I_D=3.0A		-	-	27	

Dynamic electrical characteristics

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Input capacitance	V_{DS}=20V, V_{GS}=0V, f=1.0MHz	C_{ISS}	-	882	-	pF
Output capacitance		C_{OSS}	-	77.6	-	
Reverse transfer capacitance		C_{RSS}	-	61.7	-	
Turn ON delay time	V_{DD}=20V, V_{GS}=10V, I_D=8.0A, R_G=3.0Ω, R_L=1.0Ω	$t_{d(ON)}$	-	10	-	ns
Turn ON rise time		t_r	-	12	-	
Turn OFF delay time		$t_{d(OFF)}$	-	32	-	
Turn OFF fall time		t_f	-	8.0	-	

Switching characteristics [3], [4]

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Total gate-charge	V_{DD}=20V, V_{GS}=10V, I_D=5.0A	Q_G	-	10	-	nC
Gate to source charge		Q_{GS}	-	1.7	-	
Gate to drain (Miller) charge		Q_{GD}	-	2.0	-	

Source-drain diode characteristics

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Diode forward voltage	I_{SD}=8.0A, V_{GS}=0V	V_{SD}	-	-	1.2	V
Reverse recovery time	I_S=8.0A, V_{GS}=0V, di/dt=100A/µs	t_{rr}	-	17	-	ns
Reverse recovery charge		Q_{rr}	-	10	-	nC

Notes:
1) Repetitive rating: pulse width limited by maximum junction temperature
2) E_{AS} condition: T_J=25°C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=25Ω
3) I_{SD}≤I_{MAX}, di/dt=100A/µs, V_{DD}≤BV_{DSS}, starting T_J=25°C
4) Pulse test: pulse width ≤300µs, duty cycle ≤2%

P-channel

Electrical characteristics (T_A = 25°C)

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Drain-source breakdown voltage	V_{GS}=0V, I_D=250µA	V_{DSS}	40	-	-	V
Zero gate voltage drain current	V_{DS}=40V, V_{GS}=0V	I_{DSS}	-	-	1.0	µA
Gate body leakage current	V_{GS}=±20V, V_{DS}=0V	I_{GSS}	-	-	±100	nA
Gate threshold voltage [3]	V_{DS}=V_{GS}, I_D=250µA	$V_{GS(TH)}$	1.0	-	2.5	V
Drain-source on-state resistance [3]	V_{GS}=10V, I_D=5.0A	$R_{DS(ON)}$	-	-	55	mΩ
	V_{GS}=4.5V, I_D=4.0A		-	-	70	

Dynamic electrical characteristics

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Input capacitance	V_{DS}=20V, V_{GS}=0V, f=1.0MHz	C_{ISS}	-	931	-	pF
Output capacitance		C_{OSS}	-	96	-	
Reverse transfer capacitance		C_{RSS}	-	72	-	
Turn ON delay time	V_{DD}=20V, V_{GS}=10V, I_D=5.0A, R_G=2.5Ω	$t_{d(ON)}$	-	7.2	-	ns
Turn ON rise time		t_r	-	14	-	
Turn OFF delay time		$t_{d(OFF)}$	-	21	-	
Turn OFF fall time		t_f	-	8.1	-	

Switching characteristics [3], [4]

Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Total gate-charge	V_{DD}=20V, V_{GS}=10V, I_D=3.0A	Q_G	-	18	-	nC
Gate to source charge		Q_{GS}	-	3.2	-	
Gate to drain (Miller) charge		Q_{GD}	-	3.8	-	

Source-drain diode characteristics

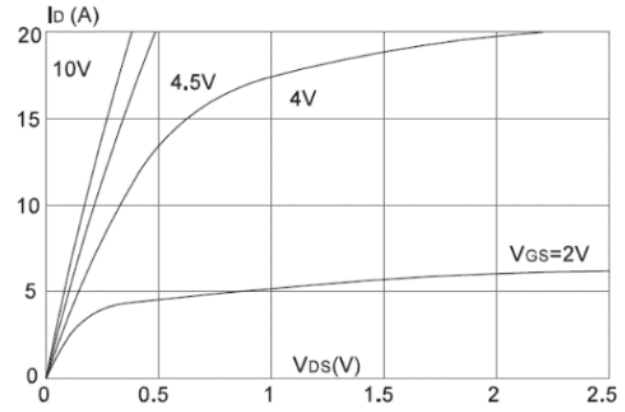
Characteristic	Test condition	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Diode forward voltage	I_{SD}=5.0A, V_{GS}=0V	V_{SD}	-	-	1.2	V
Reverse recovery time	I_S=5.0A, V_{GS}=0V, di/dt=100A/µs	t_{rr}	-	26	-	ns
Reverse recovery charge		Q_{rr}	-	18	-	nC

Notes:
1) Repetitive rating: pulse width limited by maximum junction temperature
2) E_{AS} condition: T_j=25°C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=25Ω
3) I_{SD}≤I_{MAX}, di/dt=100A/µs, V_{DD}≤BV_{DSS}, starting T_j=25°C
4) Pulse test: pulse width ≤300µs, duty cycle ≤2%

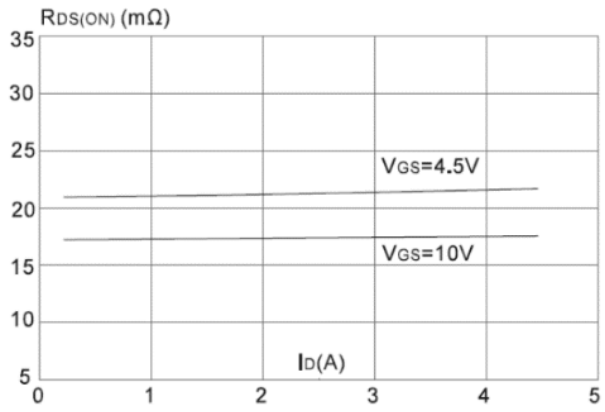
N-channel

Typical characteristics

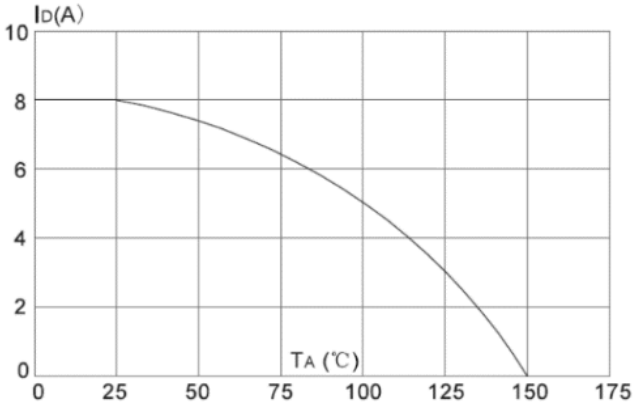
Output characteristics



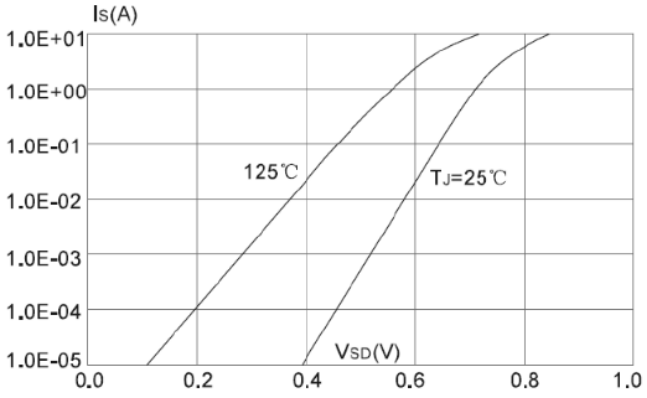
On-resistance vs. drain current and gate voltage



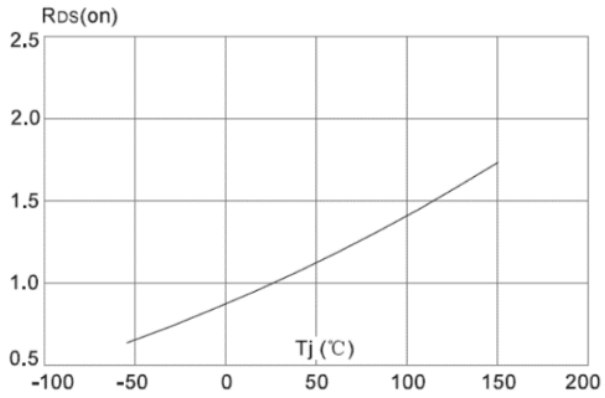
Maximum continuous drain current vs. ambient temperature



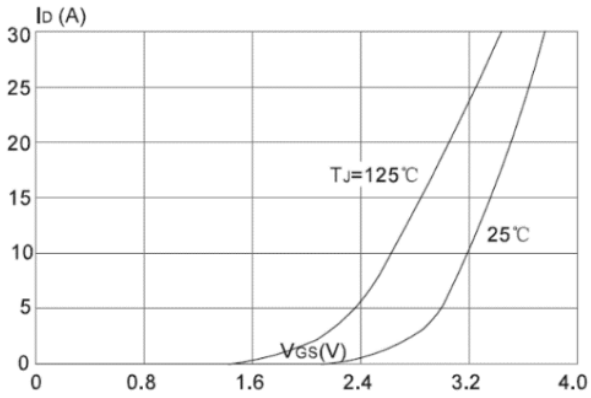
Body-diode characteristics

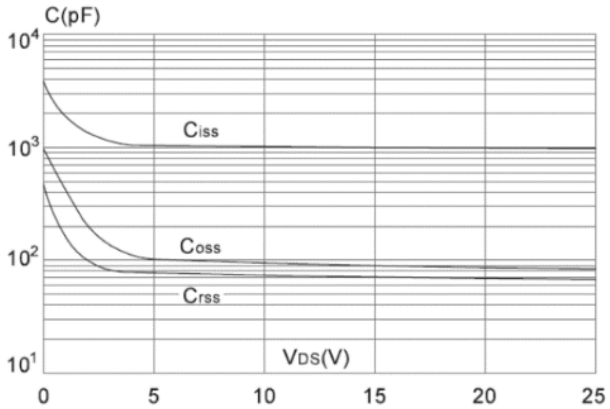
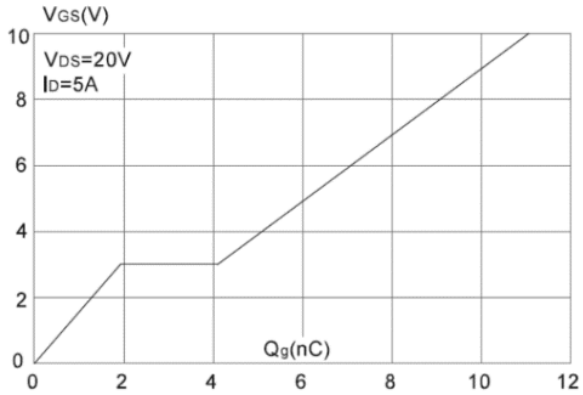
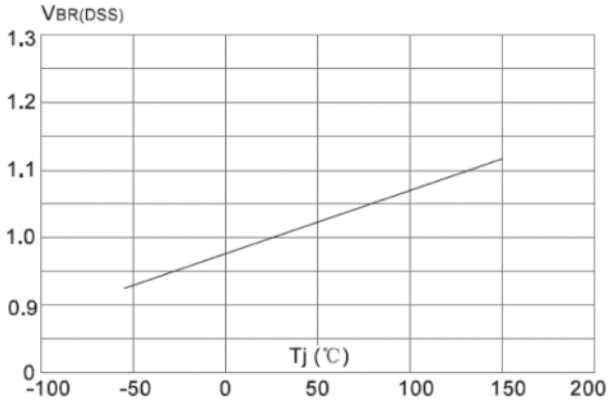
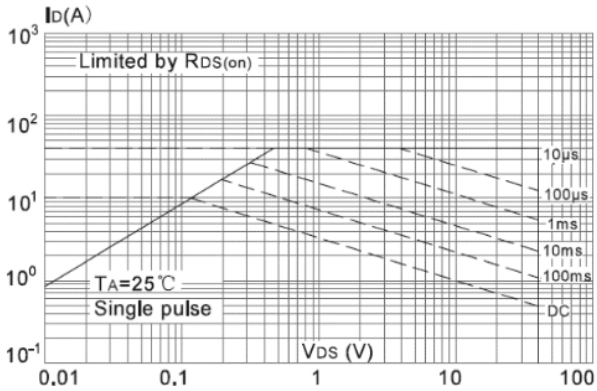


ON resistance vs. junction temperature



Transfer characteristics

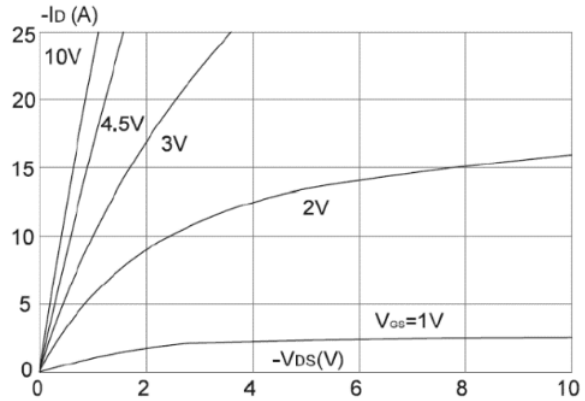


N-channel	
Typical characteristics	
Capacitance characteristics	**Gate-charge characteristics**
	
Breakdown voltage vs. junction temperature	**Safe operating area**
	

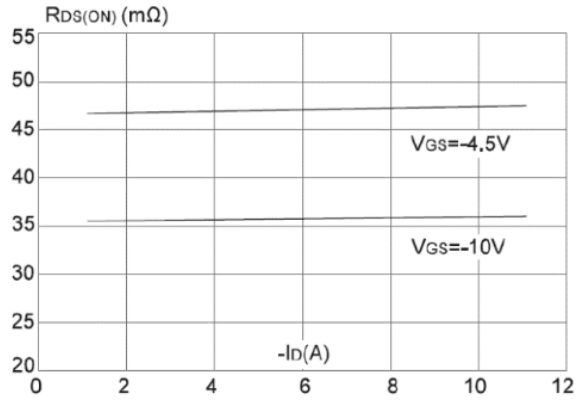
P-channel

Typical characteristics

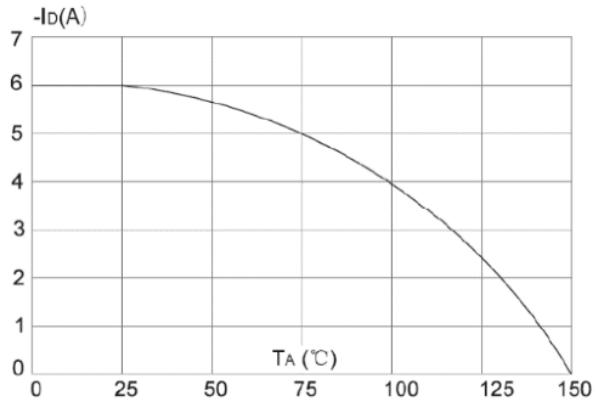
Output characteristics



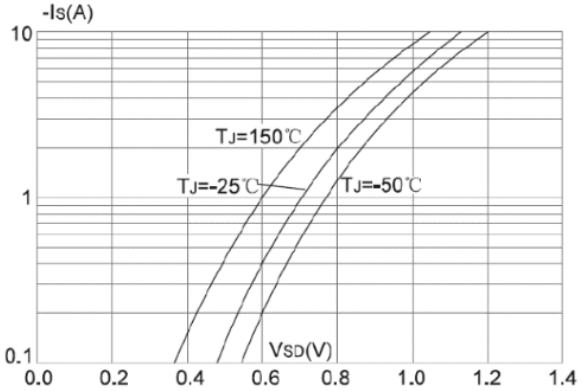
On-resistance vs. drain current and gate voltage



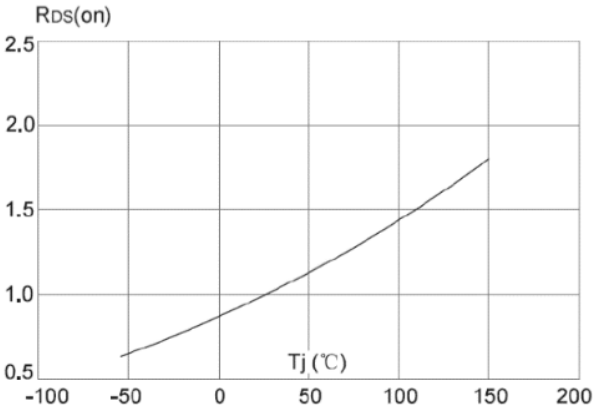
Maximum continuous drain current vs. ambient temperature



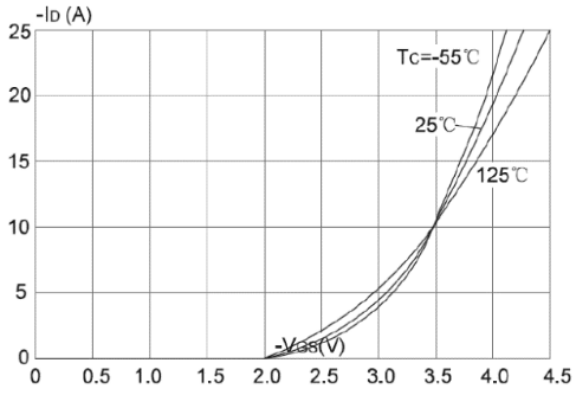
Body-diode characteristics

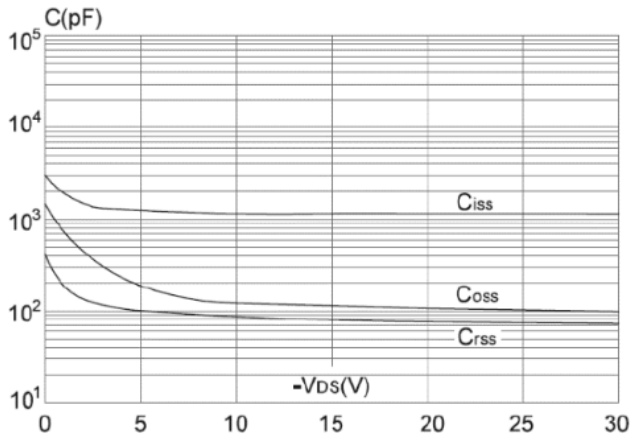
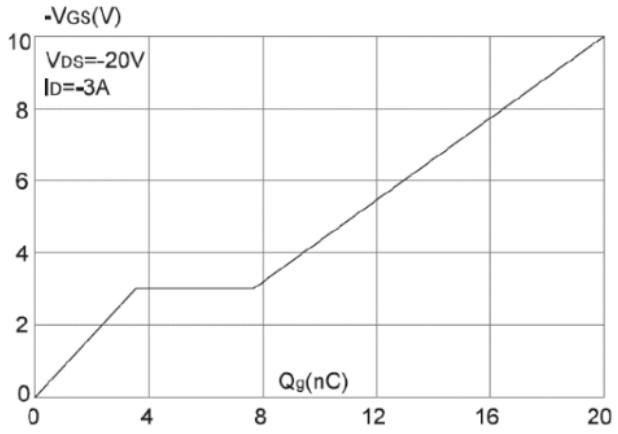
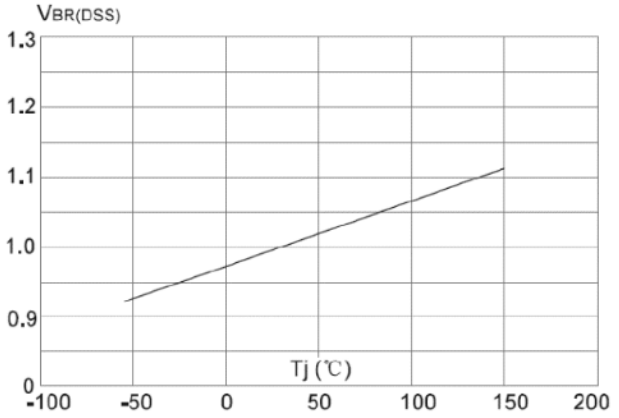
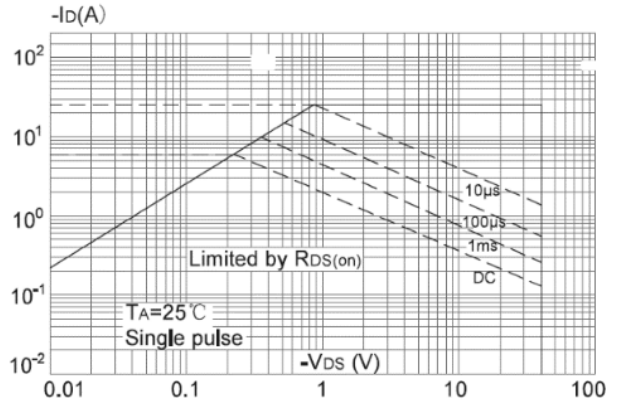


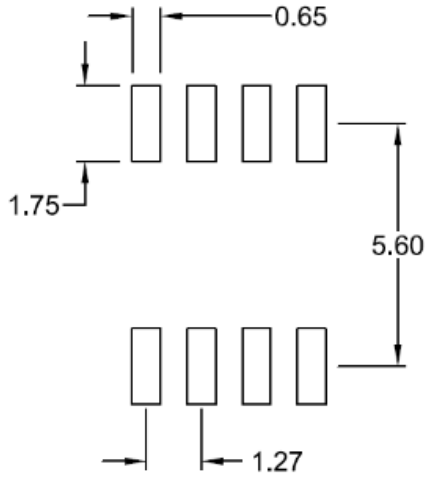
ON resistance vs. junction temperature



Transfer characteristics



P-channel	
Typical characteristics	
Capacitance characteristics	**Gate-charge characteristics**
	
Breakdown voltage vs. junction temperature	**Safe operating area**
	

Suggested soldering pad layout

SOP-8

Ordering information			
Part Number	**Package**	**Shipping Quantity**	**Dimensions**
GAKSH4402-S8	SOP-8	**4000 pcs / tape & reel**	---

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