

## -60V P-Channel Enhancement Mode MOSFET

### Description

The AP45P06F/P/T uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = -60V$   $I_D = -45A$

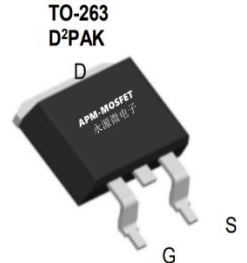
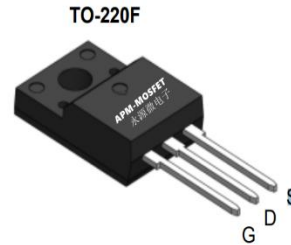
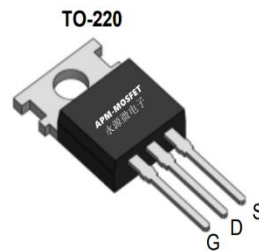
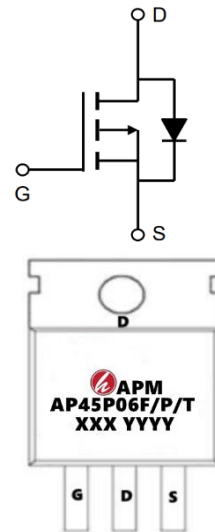
$R_{DS(ON)} < -25m\Omega$  @  $V_{GS} = -10V$  (Type: 20m $\Omega$ )

### Application

Lithium battery protection

Wireless impact

Mobile phone fast charging



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP45P06F	TO-220F-3L	AP45P06F XXX YYYY	1000
AP45P06P	TO-220-3L	AP45P06P XXX YYYY	1000
AP45P06T	TO-263-3L	AP45P06T XXX YYYY	800

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

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $-V_{GS} @ -10V^1$	-45	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $-V_{GS} @ -10V^1$	-28	A
IDM	Pulsed Drain Current <sup>2</sup>	-85	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	113	mJ
IAS	Avalanche Current	47.6	A
$P_D @ T_C = 25^\circ\text{C}$	Total Power Dissipation <sup>4</sup>	52.1	W
TSTG	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	62	$^\circ\text{C/W}$

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R <sub>θJC</sub>	Thermal Resistance Junction-Case <sup>1</sup>	2.4	°C/W
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### Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

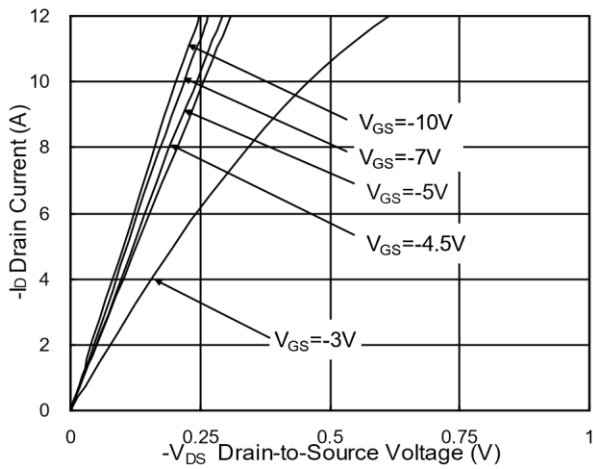
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-60	-68	---	V
ΔBVDSS/ΔT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.035	---	V/°C
RDS(ON)	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A	---	20	25	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-8A	---	26	33	
VGS(th)	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	-1.6	-2.5	V
ΔVGS(th)	VGS(th) Temperature Coefficient		---	4.28	---	mV/°C
IDSS	Drain-Source Leakage Current	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	5	
IGSS	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
gfs	Forward Transconductance	V <sub>DS</sub> =-10V, I <sub>D</sub> =-18A	---	23	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	7	---	Ω
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-20V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-12A	---	25	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	6.7	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	5.5	---	
Td(on)	Turn-On Delay Time	V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-1A	---	38	---	ns
T <sub>r</sub>	Rise Time		---	23.6	---	
Td(off)	Turn-Off Delay Time		---	100	---	
T <sub>f</sub>	Fall Time		---	6.8	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz	---	3635	---	pF
C <sub>oss</sub>	Output Capacitance		---	224	---	
Crss	Reverse Transfer Capacitance		---	141	---	
I <sub>s</sub>	Continuous Source Current <sup>1,5</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-35	A
ISM	Pulsed Source Current <sup>2,5</sup>		---	---	-70	A
VSD	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1	V

#### Note :

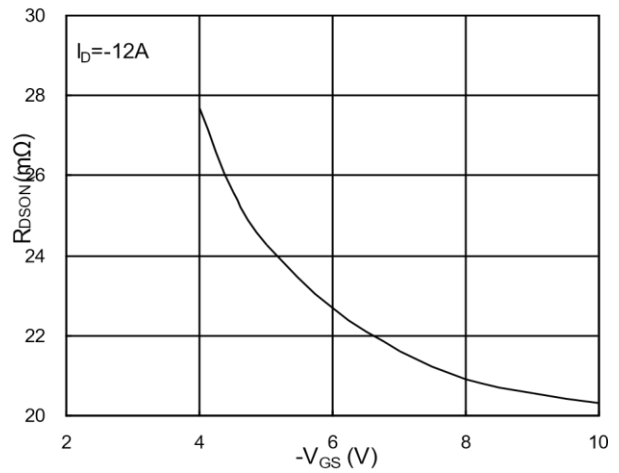
- 1、 The data tested by surface mounted on a 1 inch 2 FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%
- 3、 The EAS data shows Max. rating . The test condition is VDD=-48V,VGS =-10V,L=0.1mH,IAS =-47.6A
- 4、 The power dissipation is limited by 150°C junction temperature
- 5、 The data is theoretically the same as I D and I DM , in real applications , should be limited by total power dissipation.

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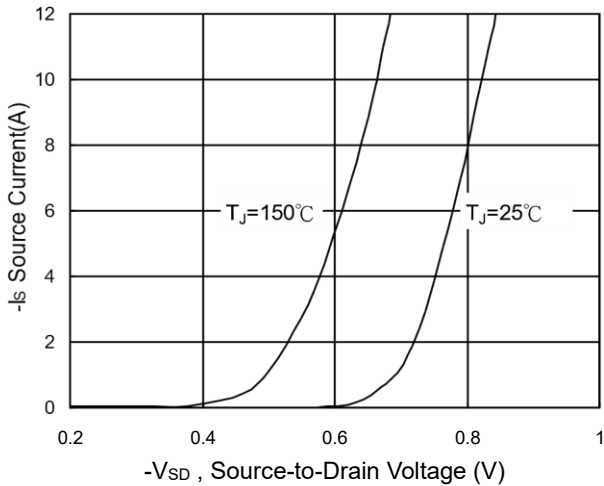
### Typical Characteristics



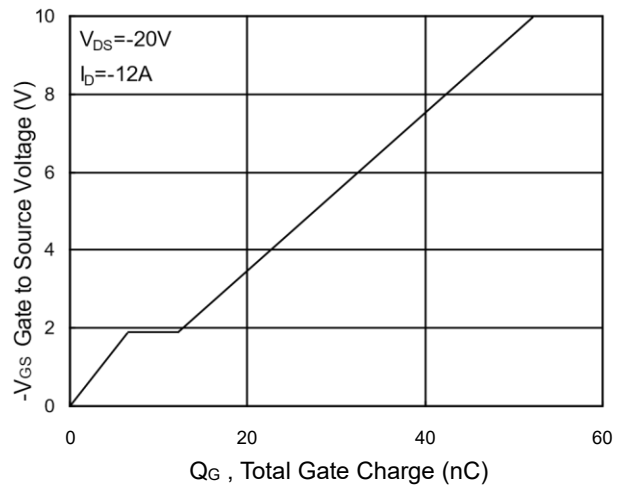
**Fig.1 Typical Output Characteristics**



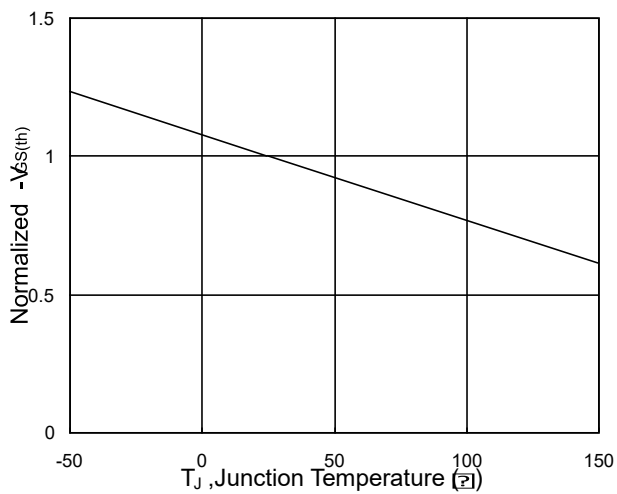
**Fig.2 On-Resistance v.s Gate-Source**



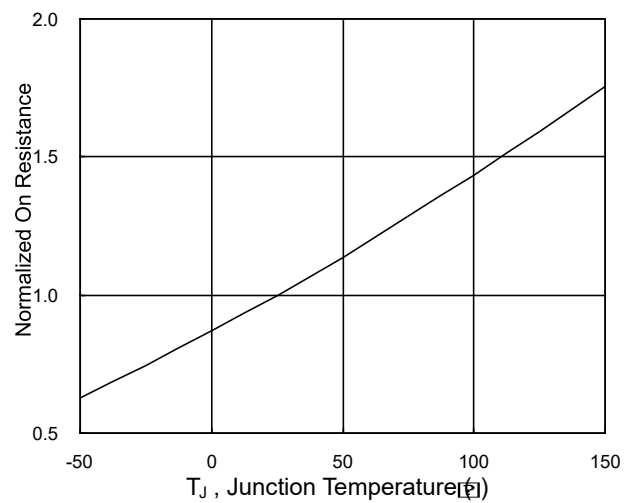
**Fig.3 Forward Characteristics Of Reverse**



**Fig.4 Gate-Charge Characteristics**



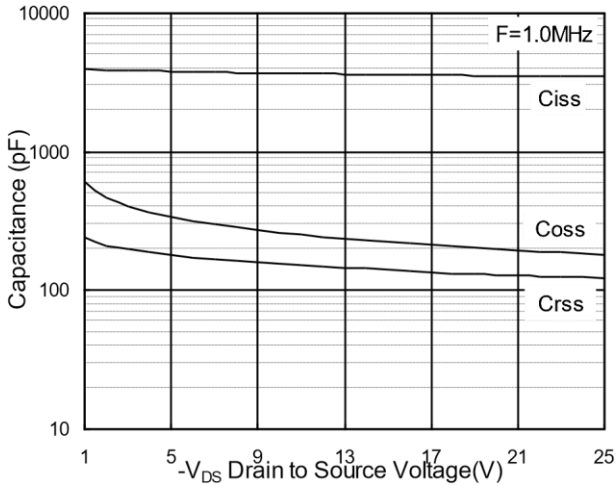
**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**



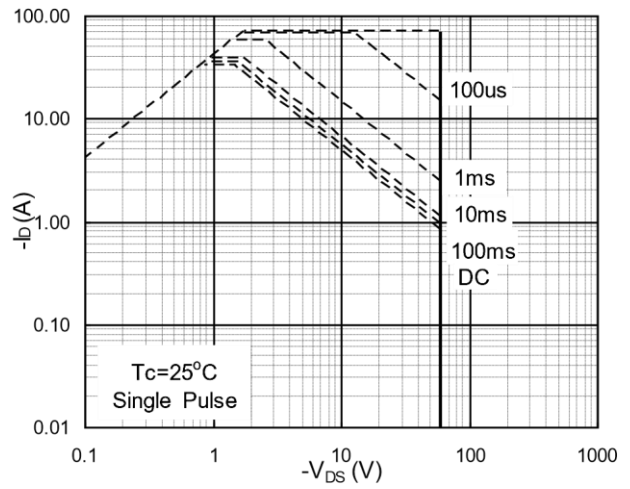
**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**



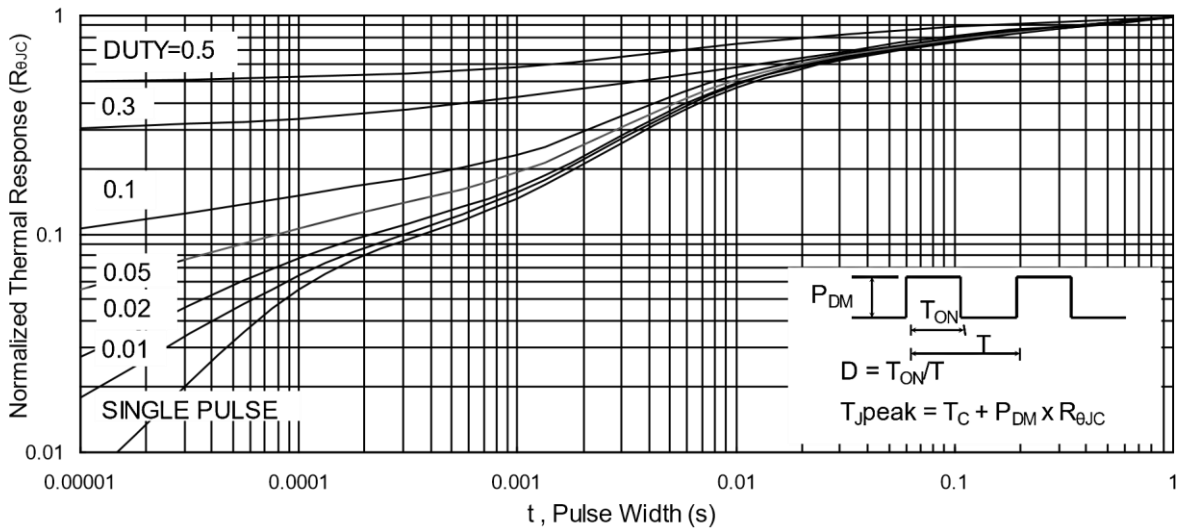
## -60V P-Channel Enhancement Mode MOSFET



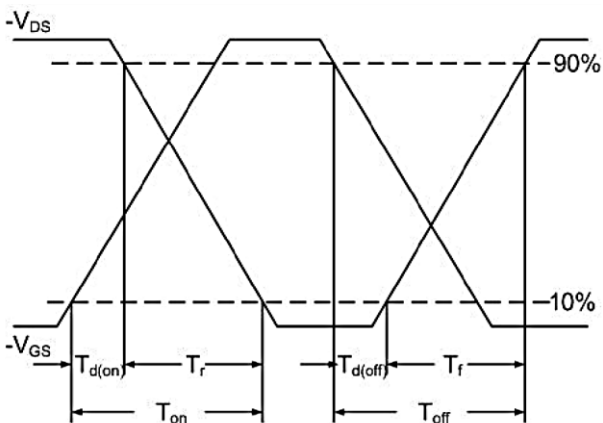
**Fig.7 Capacitance**



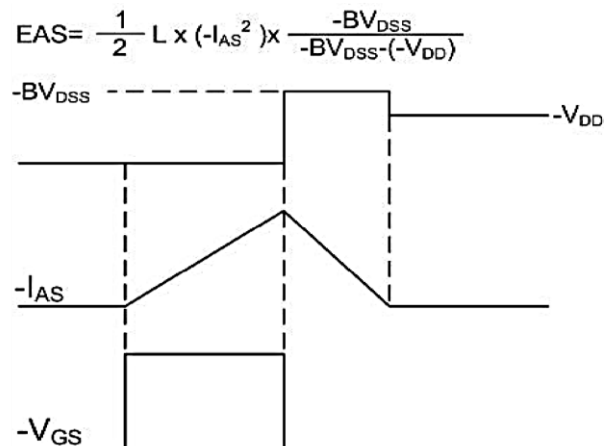
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

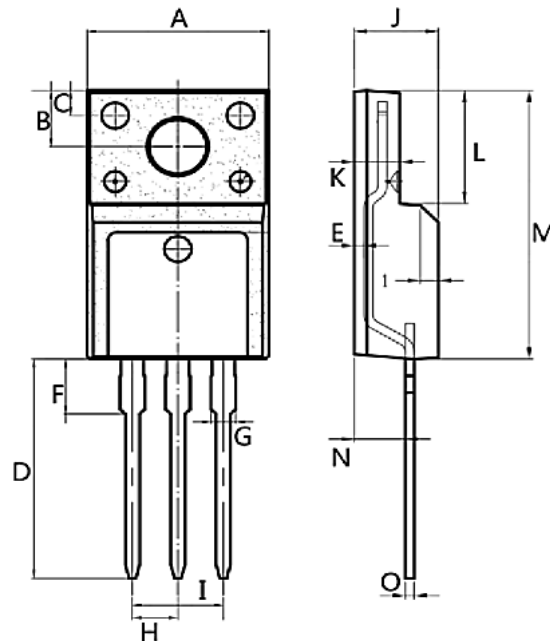


**Fig.10 Switching Time Waveform**



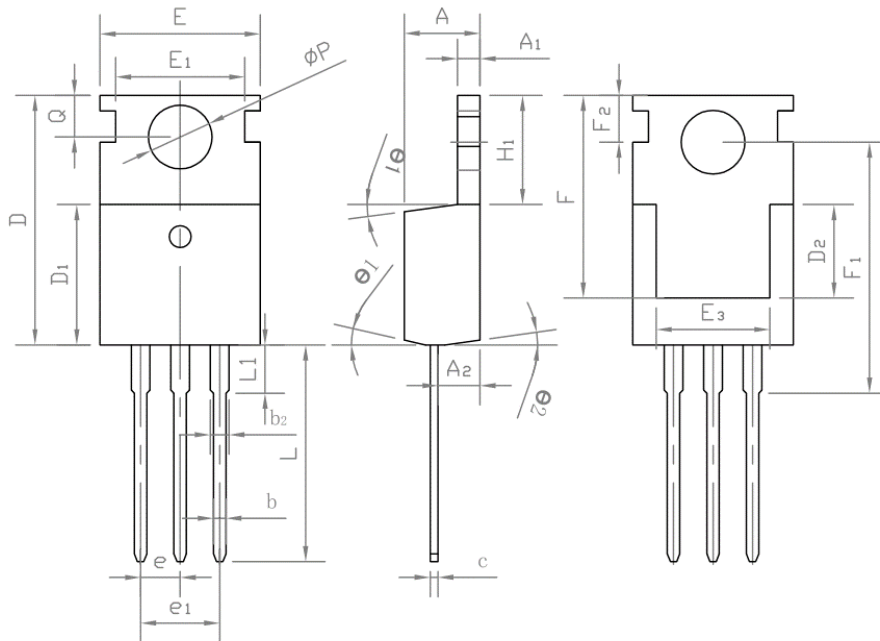
**Fig.11 Unclamped Inductive Waveform**

### Package Mechanical Data-TO-220F-3L-



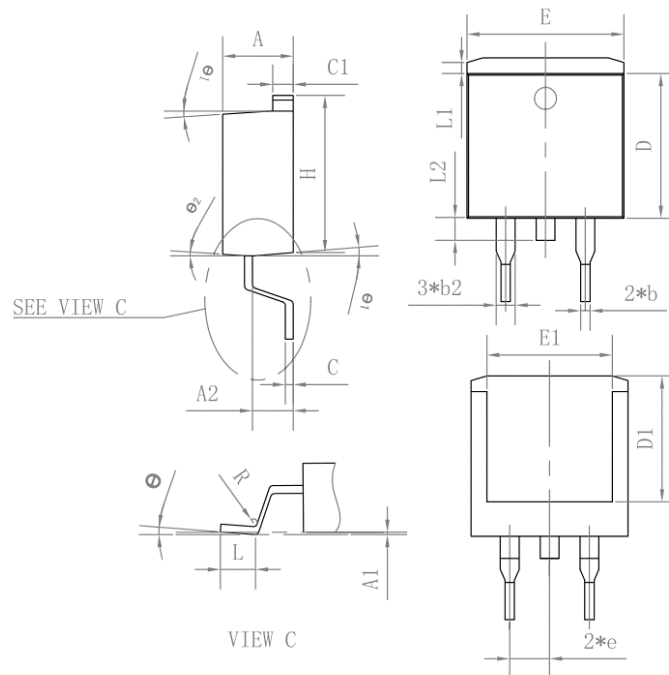
Symbol	Common	
	mm	
	Mim	Max
A	9.9	10.3
B	2.9	3.5
C	1.15	1.45
D	12.75	13.25
E	0.55	0.75
F	3.1	3.5
G	1.25	1.45
H	2.54	
I	5.08	
J	4.55	4.75
K	2.4	2.7
L	6.35	6.75
M	15.0	16.0
N	2.75	3.15
O	0.45	0.60

### Package Mechanical Data-TO-220-3L-SLK



Symbol	Common		
	mm		
	Mim	Nom	Max
A	4.27	4.57	4.87
A1	1.15	1.30	1.45
A2	2.10	2.40	2.70
b	0.70	0.80	1.00
b2	1.17	1.27	1.50
D	0.40	0.50	0.65
D1	8.80	9.10	9.40
D2	5.70	6.70	7.00
E	9.70	10.00	10.30
E1	-	8.70	-
E2	9.63	10.00	10.35
E3	7.00	8.00	8.40
e		0.37	
e1		0.10	
H1	6.00	6.50	6.85
L	12.75	13.50	13.90
L1	-	3.10	3.40
$\Phi p$	3.45	3.60	3.75
Q	2.60	2.80	3.00
$\theta 1$	4°	7°	10°
$\theta 2$	0°	3°	6°
F	13.30	13.50	13.70
F1	15.50	15.90	16.30
F2	2.80	3.00	3.20

### Package Mechanical Data-TO-263-3L-SLK



Symbol	Common		
	mm		
	Mim	Nom	Max
A	4.35	4.47	4.60
A1	0.09	0.10	0.11
A2	2.30	2.40	2.70
b	0.70	0.80	1.00
b2	1.25	1.36	1.50
C	0.45	0.50	0.65
C1	1.29	1.30	9.40
D	9.10	9.20	9.30
D1	7.90	8.00	8.10
E	9.85	10.00	10.20
E1	7.90	8.00	8.10
H	15.30	15.50	15.70
e	-	2.54	-
L	2.34	2.54	2.74
L1	1.00	1.10	1.20
L2	1.30	1.40	1.50
R	0.24	0.25	0.26
θ	0°	4°	8°
θ1	4°	7°	10°
θ2	0°	3°	6°



**-60V P-Channel Enhancement Mode MOSFET****Attention**

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Rve1.0	2021/1/31	Initial release

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