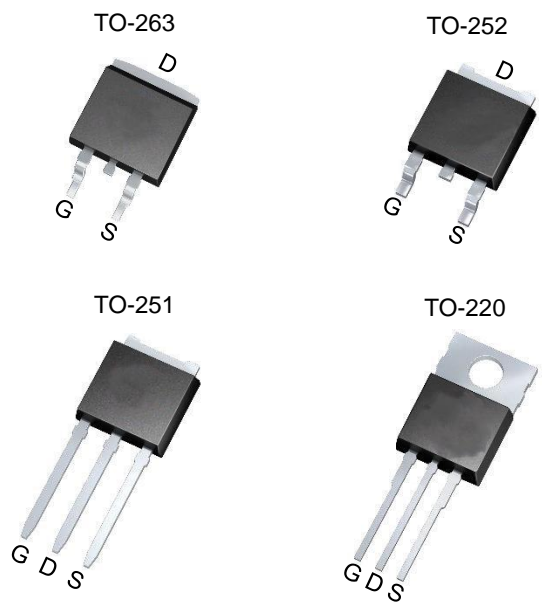
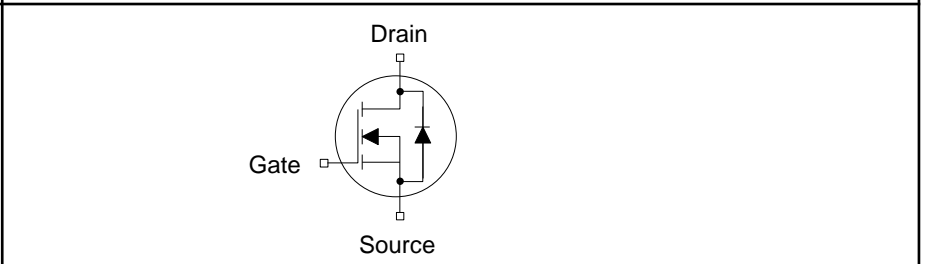




## 60V N-Channel Power MOSFET

<p><b>Features</b></p> <ul style="list-style-type: none"> <li>• Low FOM <math>R_{DS(on)} \times Q_{gd}</math></li> <li>• 100% avalanche tested</li> <li>• Easy to use/drive</li> <li>• RoHS compliant</li> </ul>	
--	--

<p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• DC/DC Converter</li> <li>• Battery Protection Charge/Discharge</li> <li>• Load Switch</li> <li>• Synchronous Rectification</li> </ul>
---



### Key Performance Parameters

Parameter	Value	Unit
$V_{DS@T_c=25^\circ C}$	60	V
$R_{DS(on),max@10V}$	17	mΩ
$R_{DS(on),max@4.5V}$	23	mΩ
$Q_{g,typ}$	40	nC
$I_D@T_c=25^\circ C$	50	A
$I_{D,pulse}$	200	A
$E_{AS}^{1)}$	98	mJ

### Device Marking and Package Information

Device	Package	Marking
E50N06	TO-263	BCE5N06
D50N06	TO-252	BCD5N06
H50N06	TO-251	BCH5N06
T50N06	TO-220	BCT5N06

**60V N-Channel Power MOSFET**

<b>Absolute Maximum Ratings</b> $T_A = 25^\circ\text{C}$ , unless otherwise noted			
Parameter	Symbol	Values	Unit
Drain-Source Voltage( $V_{GS}=0\text{V}$ )	$V_{DS}$	60	V
Continuous Drain Current <sup>2)</sup>	$I_D$	$T_C = 25^\circ\text{C}$	50
		$T_C = 100^\circ\text{C}$	32
Pulsed Drain Current <sup>3)</sup>	$I_{D,pulse}$	200	A
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Single Pulse Avalanche Energy <sup>1)</sup>	$E_{AS}$	98	mJ
Power Dissipation	$P_D$	62.5	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

<b>Thermal Resistance</b>			
Parameter	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{thJC}$	2	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	62	$^\circ\text{C}/\text{W}$

**Notes**

- 1)  $L=0.5\text{mH}$ ,  $V_{DD}=30\text{V}$ , Start  $T_J=25^\circ\text{C}$ .
- 2) Limited by maximum junction temperature.
- 3) Repetitive Rating: Pulse width limited by maximum junction temperature.



## 60V N-Channel Power MOSFET

Electrical Characteristics $T_J = 25^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	60	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60V$ $V_{GS} = 0V, T_J = 25^{\circ}\text{C}$	--	--	1	$\mu A$
		$V_{DS} = 60V$ $V_{GS} = 0V, T_J = 125^{\circ}\text{C}$	--	--	100	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.2	1.8	2.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 20A$	--	13.5	17	$m\Omega$
		$V_{GS} = 4.5V, I_D = 20A$	--	18	23	$m\Omega$
Gate Resistance	$R_G$	$f = 1.0\text{MHz}$ open drain	--	1.4	--	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V, V_{DS} = 30V$ $f = 1.0\text{MHz}$	--	1889	--	$\mu F$
Output Capacitance	$C_{oss}$		--	113	--	
Reverse Transfer Capacitance	$C_{rss}$		--	92	--	
Total Gate Charge	$Q_g$	$V_{DS} = 30V, I_D = 20A$ $V_{GS} = 10V$	--	40	--	nC
Gate-Source Charge	$Q_{gs}$		--	7.8	--	
Gate-Drain Charge	$Q_{gd}$		--	8.3	--	
Gate Plateau Voltage	$V_{plateau}$		--	3.7	--	V
Turn-on Delay Time	$t_{d(on)}$	$V_{DS} = 30V, V_{GS} = 10V$ $R_G = 3\Omega, I_D = 20A$	--	13	--	ns
Turn-on Rise Time	$t_r$		--	25	--	
Turn-off Delay Time	$t_{d(off)}$		--	60	--	
Turn-off Fall Time	$t_f$		--	9	--	
<b>Drain-Source Body Diode Characteristics</b>						
Body Diode Forward Voltage	$V_{SD}$	$T_J = 25^{\circ}\text{C}, I_{SD} = 20A$ $V_{GS} = 0V$	--	--	1.2	V
Continuous Diode Forward Current	$I_S$		--	--	50	A
Reverse Recovery Time	$t_{rr}$	$I_F = 20A, di_F/dt = 100A/\mu s$	--	29	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	21	--	nC



# 60V N-Channel Power MOSFET

Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

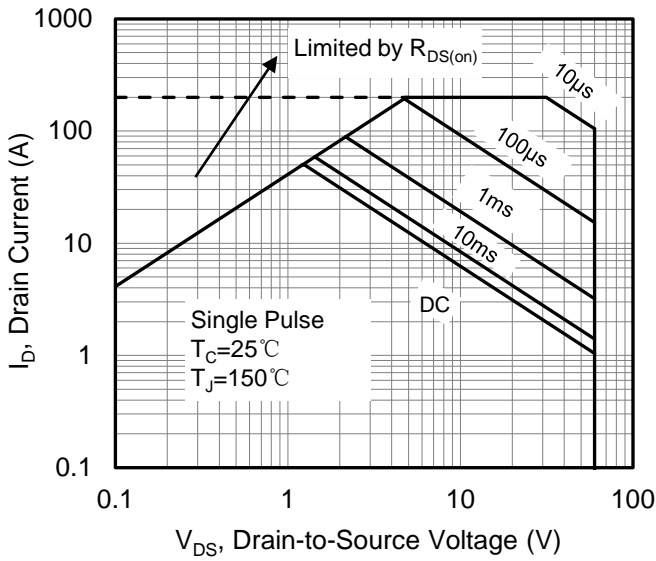


Figure 1. Maximum Safe Operating Area

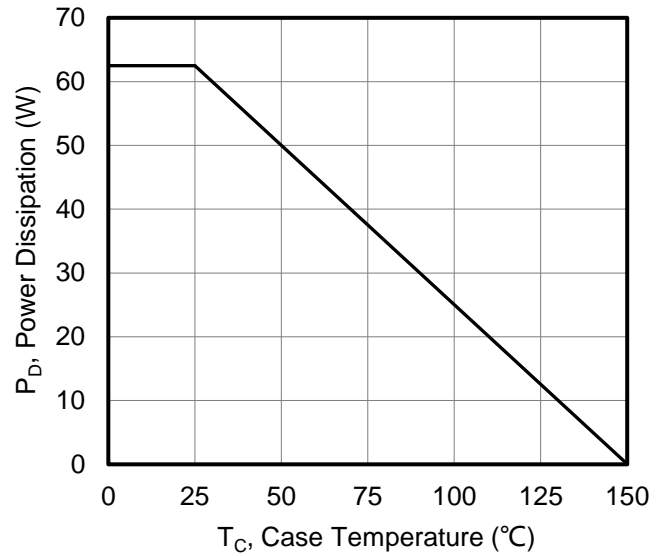


Figure 2. Maximum Power Dissipation vs. Case Temperature

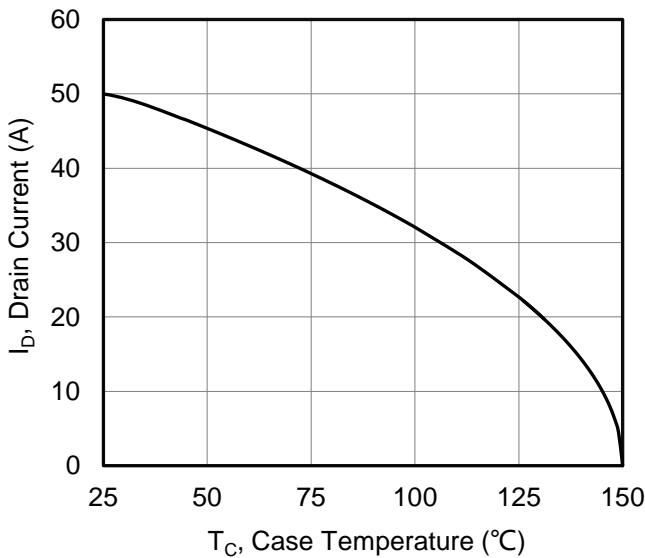


Figure 3. Maximum Continuous Drain Current vs. Case Temperature

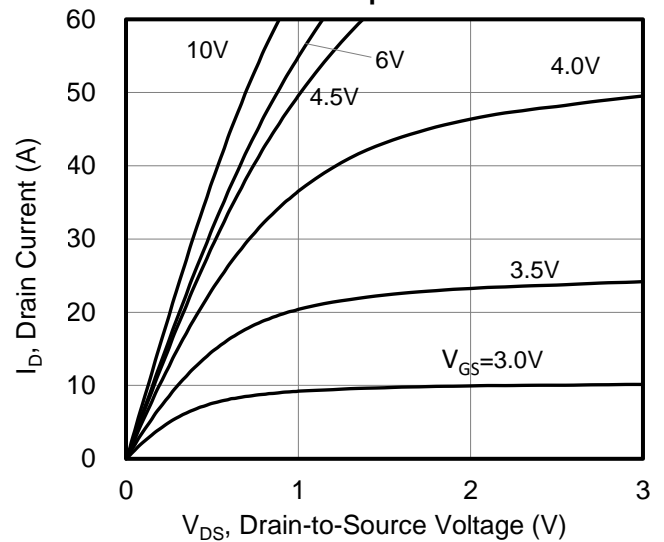


Figure 4. Typical output Characteristics

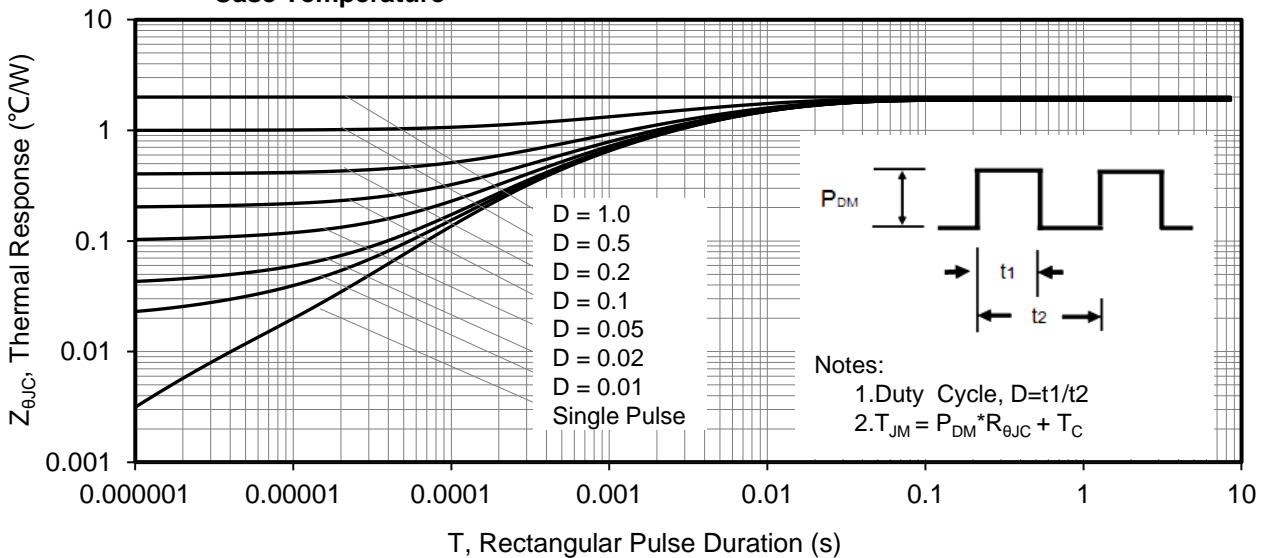


Figure 5. Maximum Effective Thermal Impedance, Junction to Case



# 60V N-Channel Power MOSFET

Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

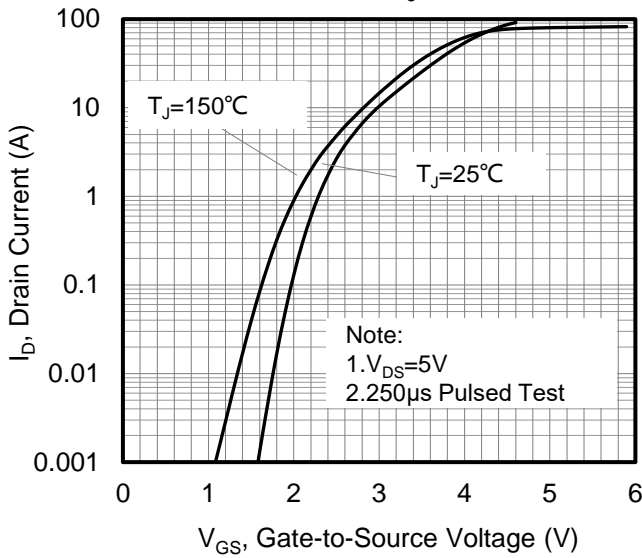


Figure 6. Typical Transfer Characteristics

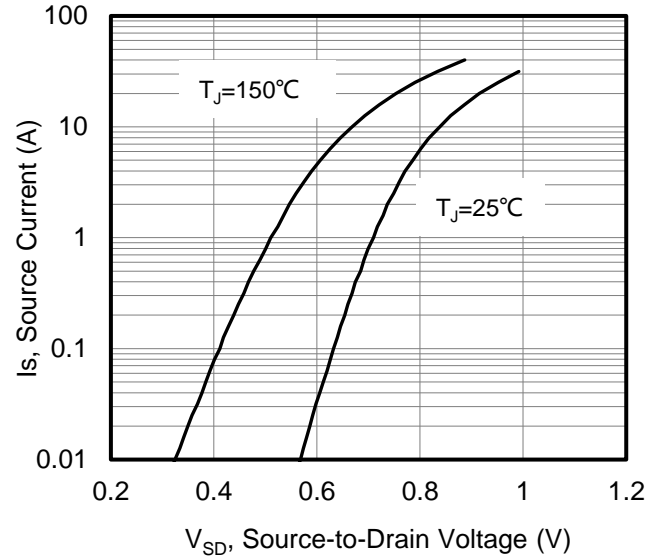


Figure 7. Typical Body Diode Transfer Characteristics

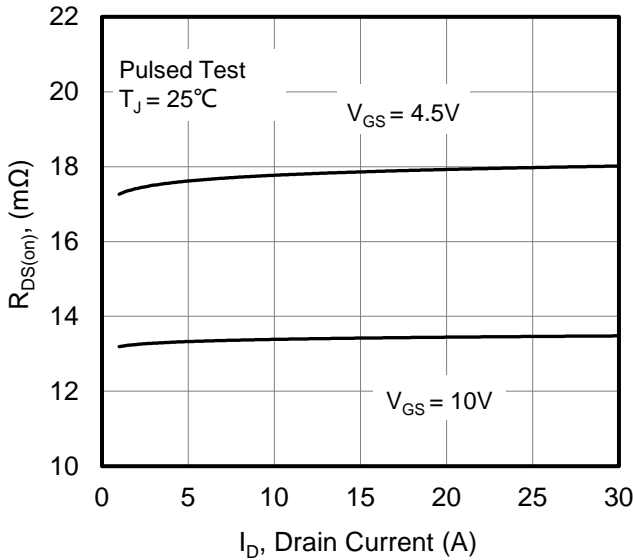


Figure 8. Drain-to-Source On Resistance vs Drain Current

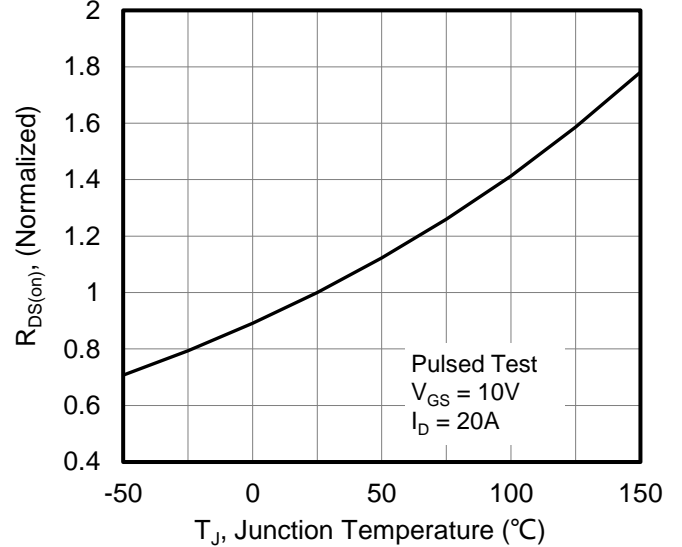


Figure 9. Normalized On Resistance vs Junction Temperature

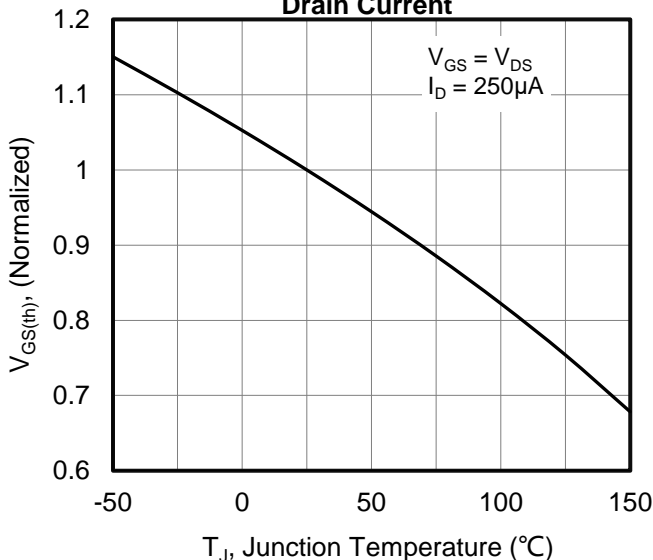


Figure 10. Normalized Threshold Voltage vs Junction Temperature

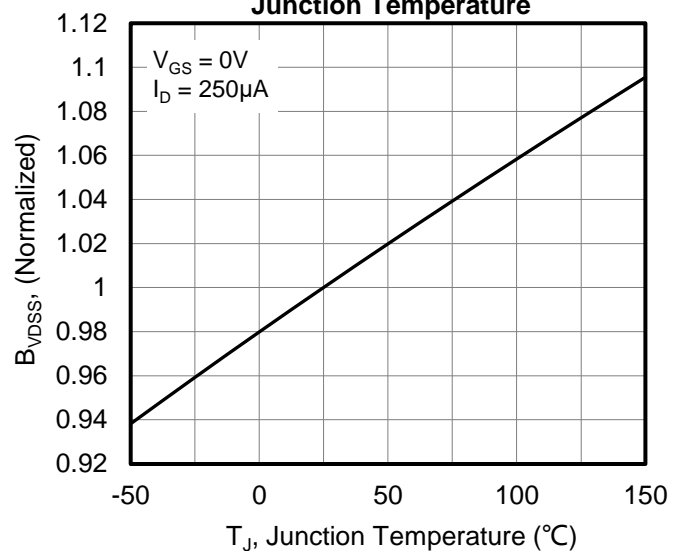


Figure 11. Normalized Breakdown Voltage vs Junction Temperature



# 60V N-Channel Power MOSFET

Typical Characteristics  $T_j = 25^\circ\text{C}$ , unless otherwise noted

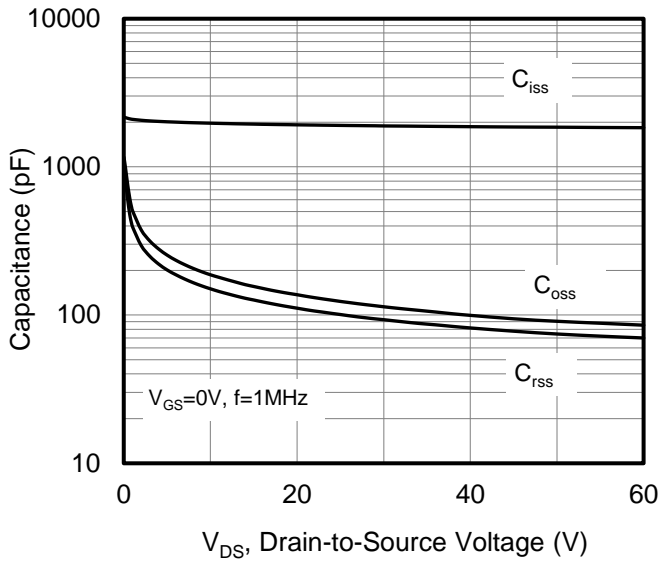


Figure 12. Capacitance Characteristics

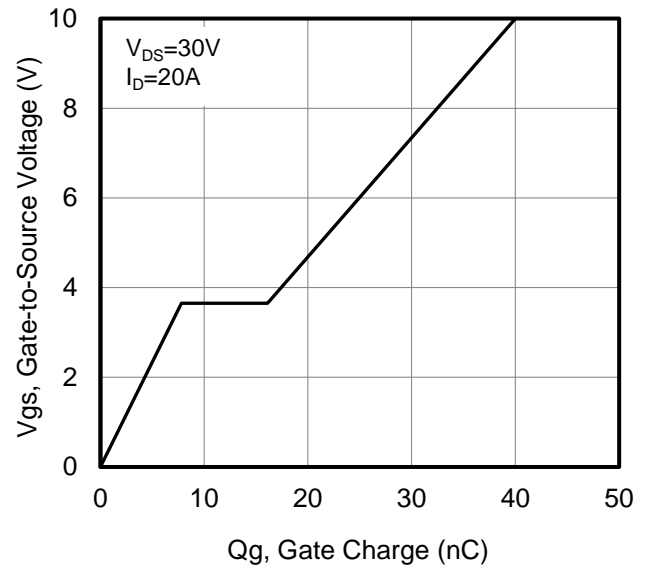


Figure 13. Typical Gate Charge vs Gate to Source Voltage



# 60V N-Channel Power MOSFET

Figure A: Gate Charge Test Circuit and Waveform

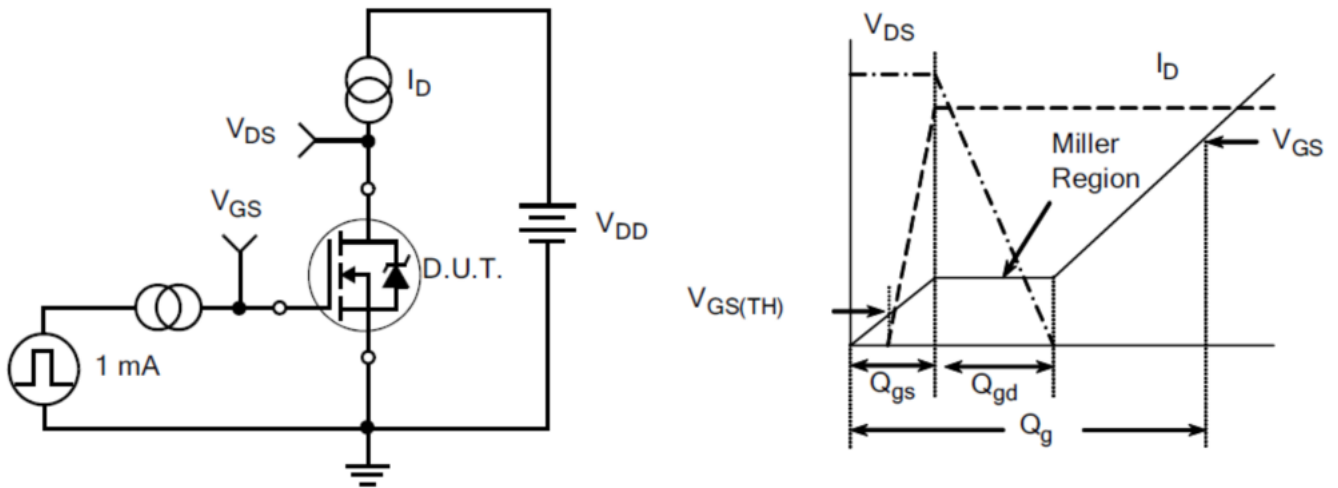


Figure B: Resistive Switching Test Circuit and Waveform

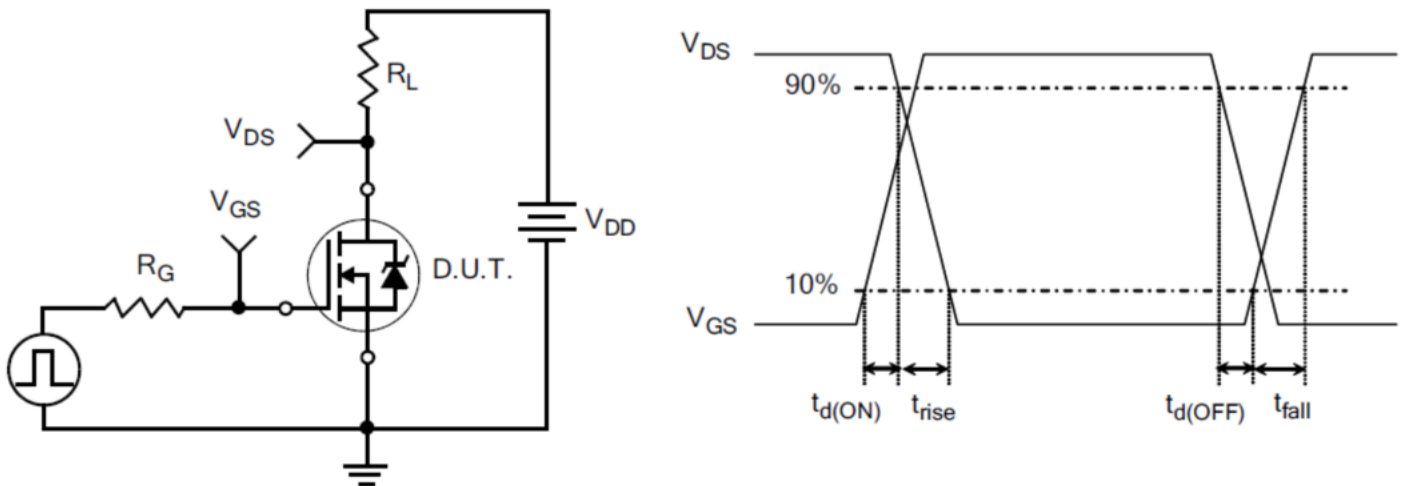
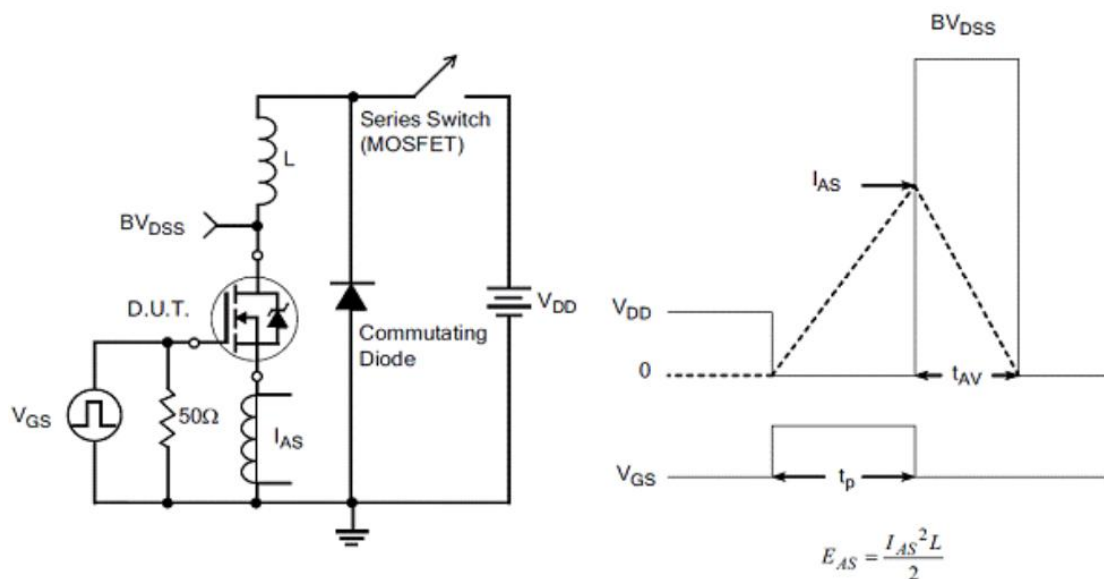


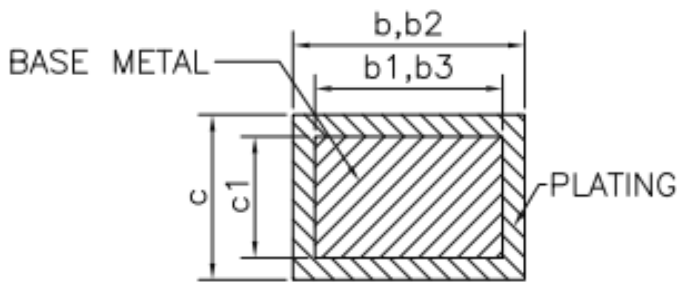
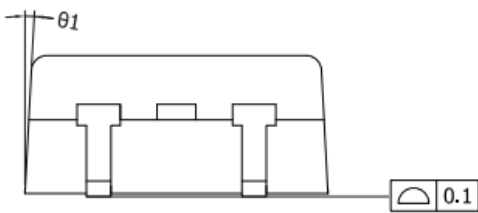
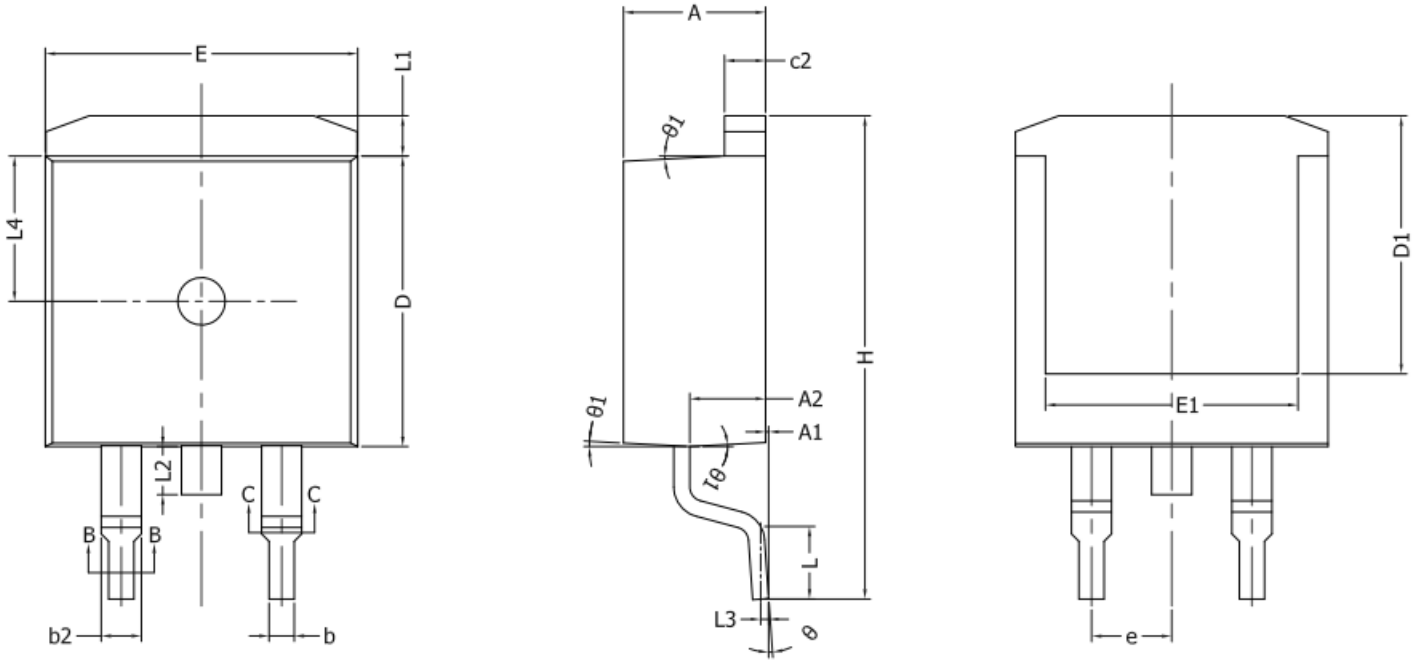
Figure C: Unclamped Inductive Switching Test Circuit and Waveform





# 60V N-Channel Power MOSFET

## Outlines TO-263 Package



SECTION B-B&C-C

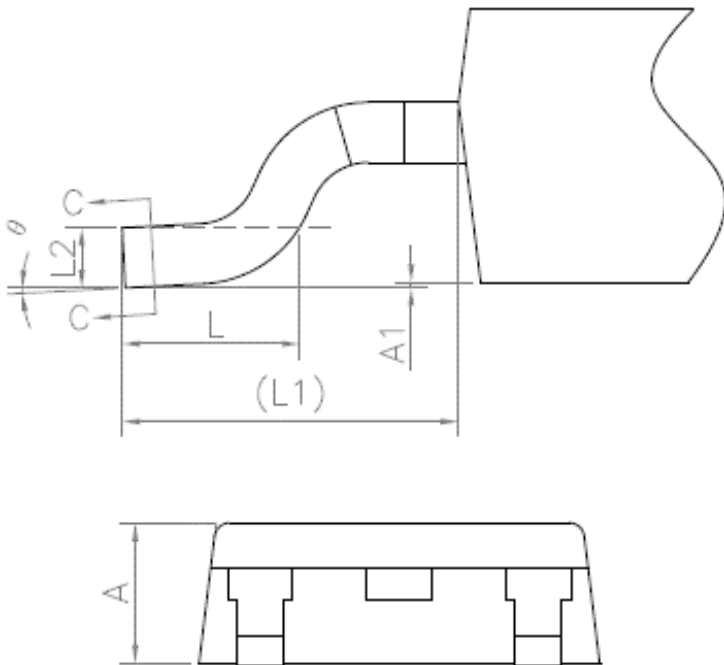
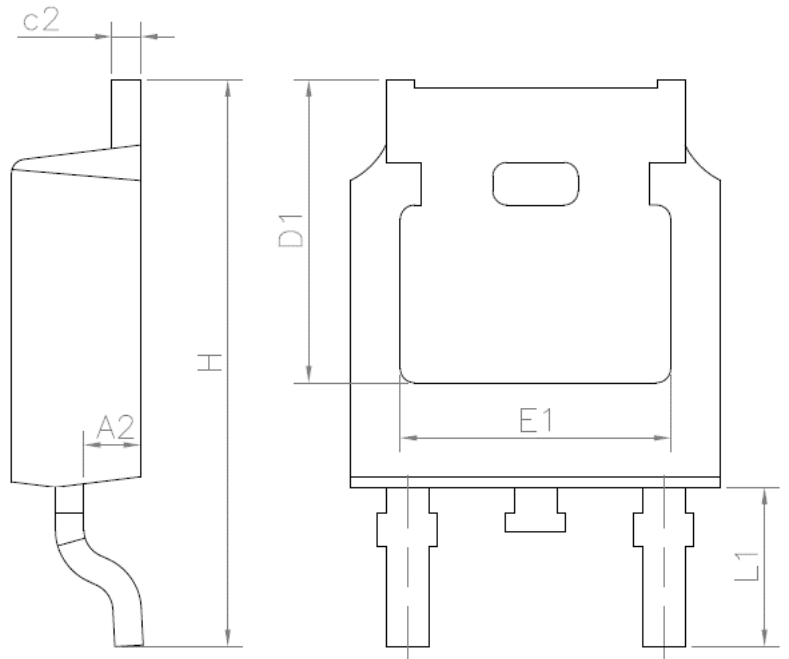
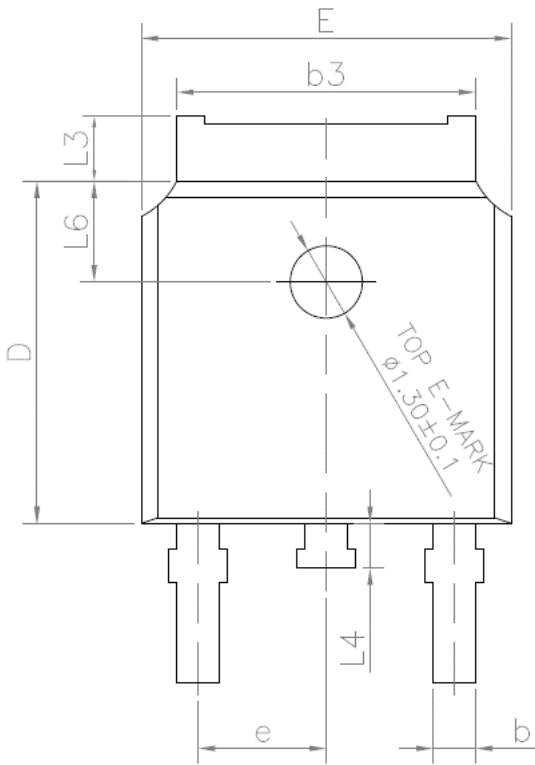
SYMBOL	MIN	NOM	MAX
A	4.4	4.5	4.6
A1	0	0.1	0.25
A2	2.2	2.4	2.6
b	0.76	--	0.89
b1	0.75	0.8	0.85
b2	1.23	--	1.37
b3	1.22	1.27	1.32
c	0.47	--	0.6
c1	0.46	0.51	0.56
c2	1.25	1.3	1.35
D	9.1	9.2	9.3
D1	8	--	--
E	9.8	9.9	10
E1	7.8	--	--
e	2.54 BSC		
H	14.9	15.3	15.7
L	2	2.3	2.6
L1	1.17	1.27	1.4
L2	--	--	1.75
L3	0.25 BSC		
L4	4.60 REF		
θ	0°	--	8°
θ1	1°	3°	5°





# 60V N-Channel Power MOSFET

## Outlines TO-252 Package

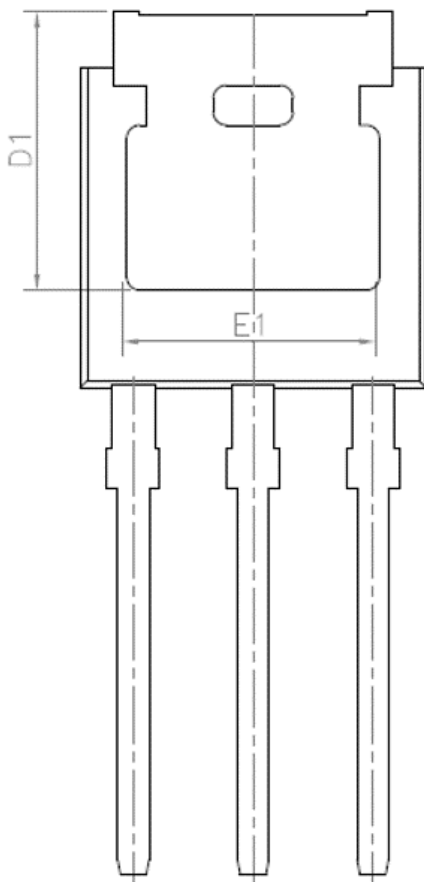
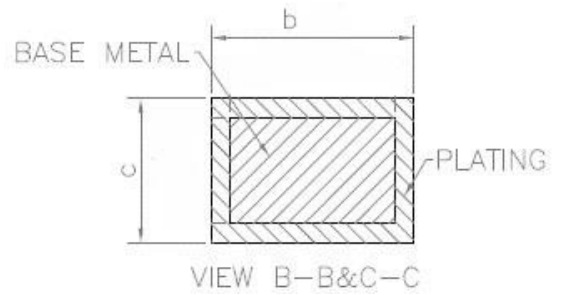
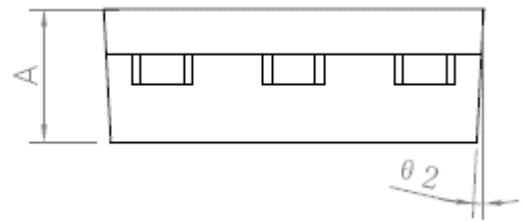
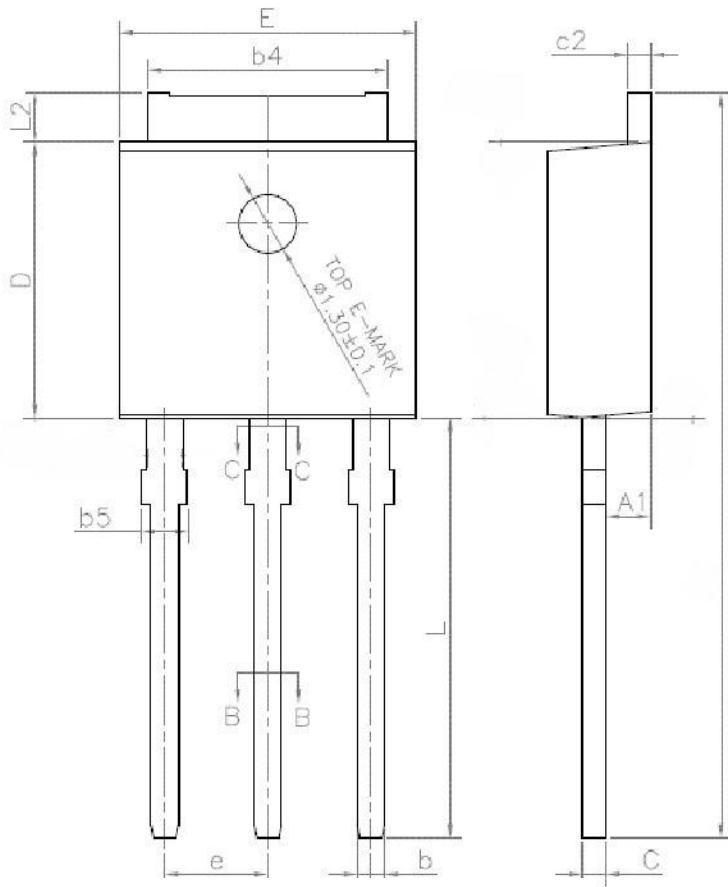


SYMBOL	MIN	NOM	MAX
A	2.2	2.3	2.4
A1	0	--	0.2
A2	0.9	1.035	1.17
b	0.645	--	0.9
b3	5.13	5.326	5.46
c	0.43	--	0.61
c2	0.41	--	0.61
D	5.98	6.1	6.22
D1	5.244	--	--
E	6.4	6.6	6.73
E1	4.63	--	--
e	2.186	2.286	2.386
H	9.4	10.04	10.5
L	1.38	1.5	1.75
L1	2.6	2.872	3
L2	0.5	0.509	0.52
L3	0.88	--	1.28
L4	0.5	--	1
L6	1.5	1.7	1.95
θ	0°	--	10°



# 60V N-Channel Power MOSFET

## Outlines TO-251 Package

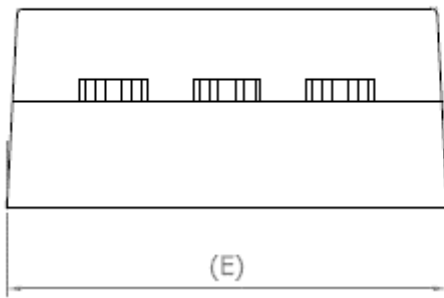
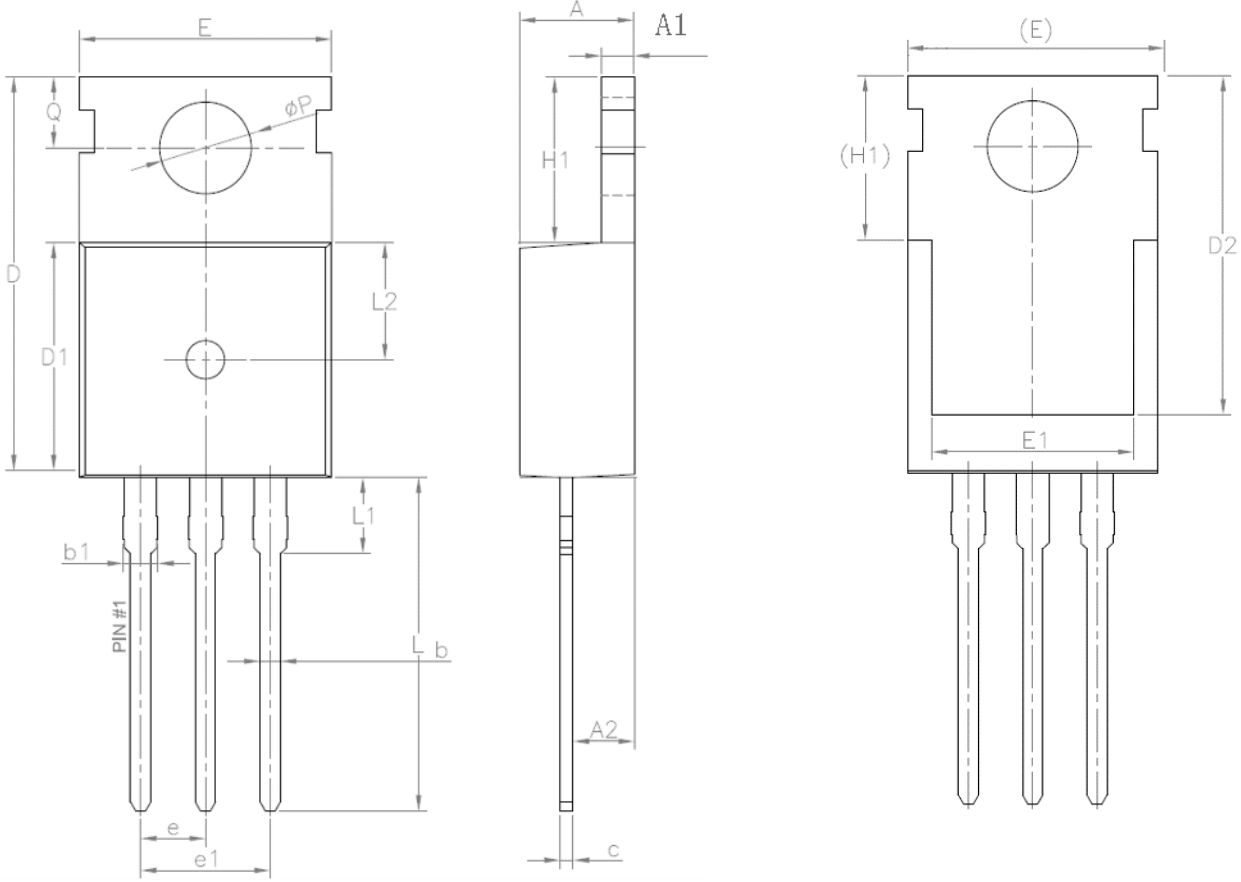


SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.90	1.04	1.17
b	0.56	--	0.90
b4	5.20	5.33	5.46
b5	--	--	1.05
c	0.43	--	0.61
c2	0.43	--	0.61
D	5.98	6.10	6.22
D1	5.2	--	--
E	6.40	6.60	6.73
E1	4.60	--	--
e	2.24	2.29	2.34
e1	4.47	4.57	4.67
H	16.18	16.50	16.82
L	9	9.35	9.65
L2	0.88	1.05	1.28



# 60V N-Channel Power MOSFET

## Outlines TO-220 Package



SYMBOL	MIN	NOM	MAX
A	4.37	4.535	4.7
A1	1.25	1.3	1.4
A2	2.2	2.4	2.6
b	0.7	---	0.95
b1	1.17	---	1.47
c	0.45	0.5	0.6
D	15.1	15.65	16.1
D1	8.8	9.15	9.4
D2	11.8	---	---
E	9.7	9.95	10.3
E1	7	---	---
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.5	6.85
L	12.75	13.29	13.8
L1	---	---	3.5
ΦP	3.4	3.67	3.8
Q	2.6	---	3

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[PJMF280N60E1\\_T0\\_00201](#) [PJMF600N65E1\\_T0\\_00201](#) [PJMF900N65E1\\_T0\\_00201](#)