

N-Channel 600-V (D-S) Super Junction MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	600	
$R_{DS(on)}$ (Ω) at 25 °C	$V_{GS} = 10$ V	0.19
Q_g max. (nC)	106	
Q_{gs} (nC)	14	
Q_{gd} (nC)	33	
Configuration	Single	

FEATURES

- Reduced t_{rr} , Q_{rr} , and I_{RRM}
- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Low switching losses due to reduced Q_{rr}
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

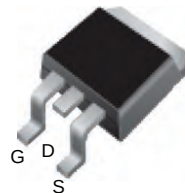


RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

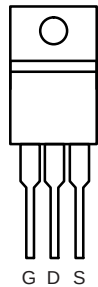
- Telecommunications
 - Server and telecom power supplies
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Consumer and computing
 - ATX power supplies
- Industrial
 - Welding
 - Battery chargers
- Renewable energy
 - Solar (PV inverters)
- Switch mode power supplies (SMPS)

D²PAK (TO-263)



VBL16R20

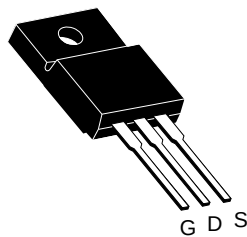
TO-220AB



Top View

VBM16R20

TO-220 FULLPAK



Top View

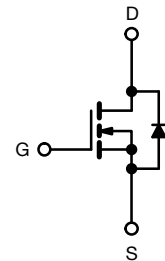
VBMB16R20

TO-247AC



Top View

VBP16R20



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current ($T_J = 150$ °C)	V_{GS} at 10 V	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed Drain Current ^a	I_{DM}	53	
Linear Derating Factor		1.7	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	367	mJ
Maximum Power Dissipation	P_D	208	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	°C
Drain-Source Voltage Slope	dV/dt	37	V/ns
Reverse Diode dV/dt ^d		31	
Soldering Recommendations (Peak Temperature) ^c	for 10 s	300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 5.1$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

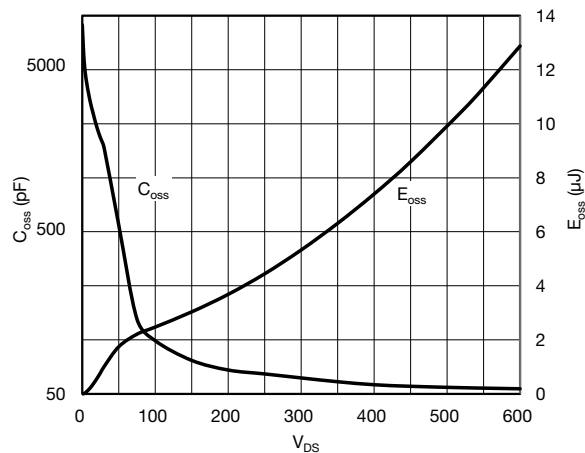
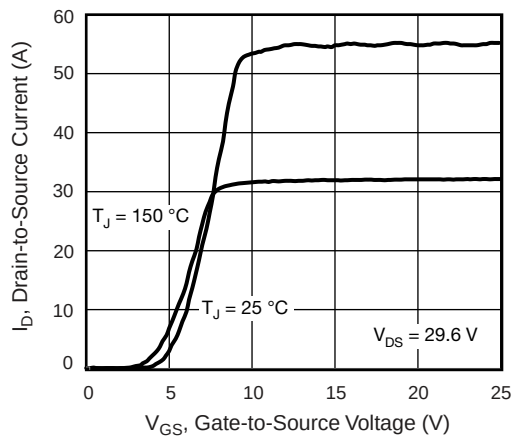
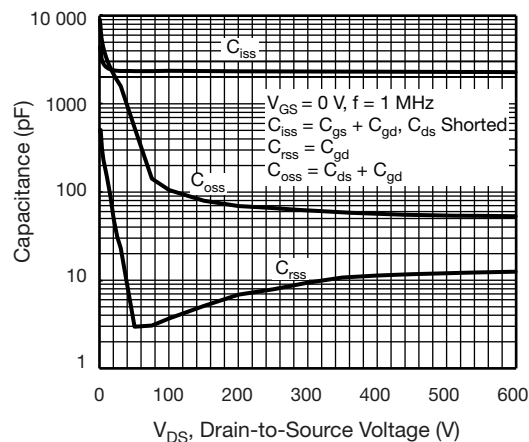
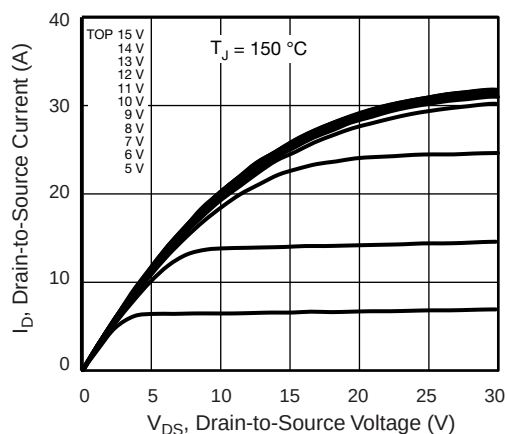
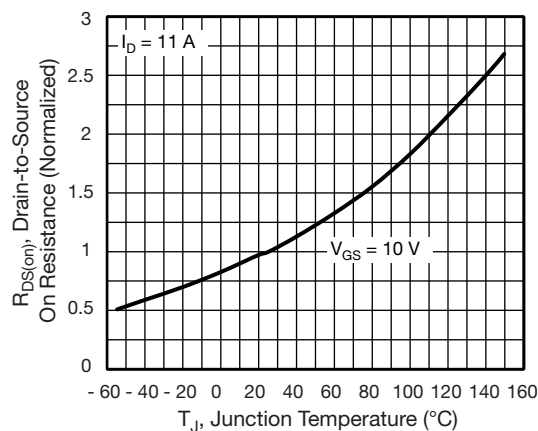
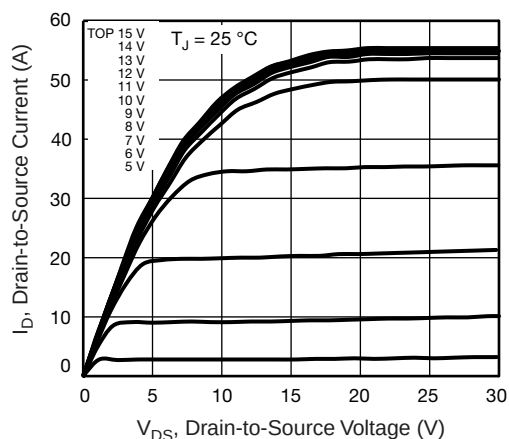
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.5	

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)									
PARAMETER		SYMBOL		TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static									
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA			600	-	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA			-	0.67	-	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA			2	-	4	-	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V			-	-	± 100	-	nA
		V _{GS} = ± 30 V			-	-	± 1	-	μA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 520 V, V _{GS} = 0 V			-	-	1	-	μA
		V _{DS} = 520 V, V _{GS} = 0 V, T _J = 125 °C			-	-	500	-	μA
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 11 A		-	0.19	-	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 30 V, I _D = 11 A			-	7.0	-	-	S
Dynamic									
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz			-	2322	-	-	pF
Output Capacitance	C _{oss}				-	105	-	-	
Reverse Transfer Capacitance	C _{rss}				-	4	-	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 520 V, V _{GS} = 0 V			-	84	-	-	pF
Effective Output Capacitance, Time Related ^b	C _{o(tr)}				-	293	-	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 11 A, V _{DS} = 520 V		-	71	106	-	nC
Gate-Source Charge	Q _{gs}				-	14	-	-	
Gate-Drain Charge	Q _{gd}				-	33	-	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 520 V, I _D = 11 A, V _{GS} = 10 V, R _g = 9.1 Ω			-	22	44	-	ns
Rise Time	t _r				-	34	68	-	
Turn-Off Delay Time	t _{d(off)}				-	68	102	-	
Fall Time	t _f				-	42	84	-	
Gate Input Resistance	R _g	f = 1 MHz, open drain			-	0.78	-	-	Ω
Drain-Source Body Diode Characteristics									
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 			-	-	21	-	A
Pulsed Diode Forward Current	I _{SM}				-	-	53	-	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 11 A, V _{GS} = 0 V			-	0.9	1.2	-	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 11 A, dI/dt = 100 A/μs, V _R = 25 V			-	160	-	-	ns
Reverse Recovery Charge	Q _{rr}				-	1.2	-	-	μC
Reverse Recovery Current	I _{RRM}				-	14	-	-	A

Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



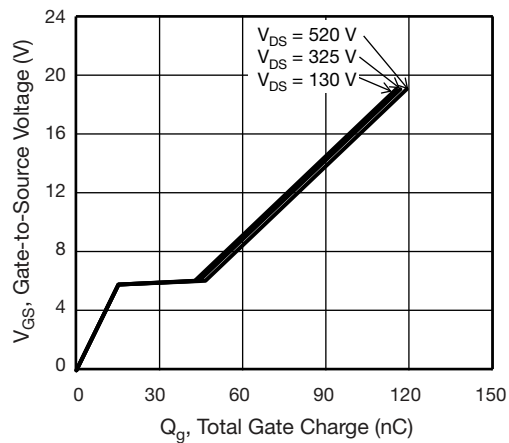


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

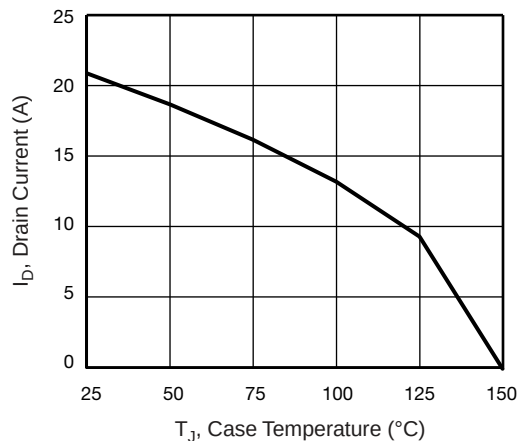


Fig. 10 - Maximum Drain Current vs. Case Temperature

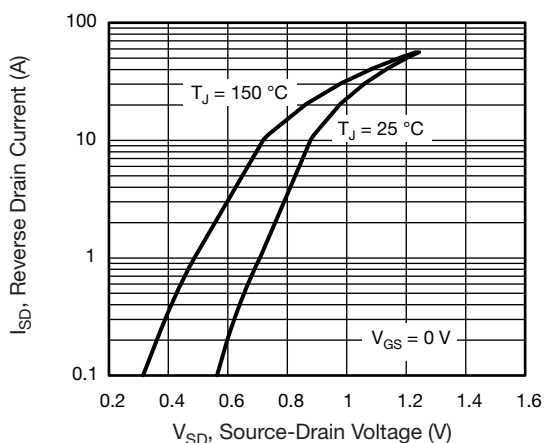


Fig. 8 - Typical Source-Drain Diode Forward Voltage

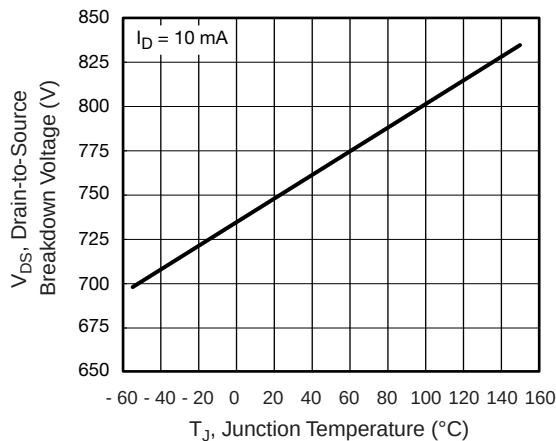


Fig. 11 - Temperature vs. Drain-to-Source Voltage

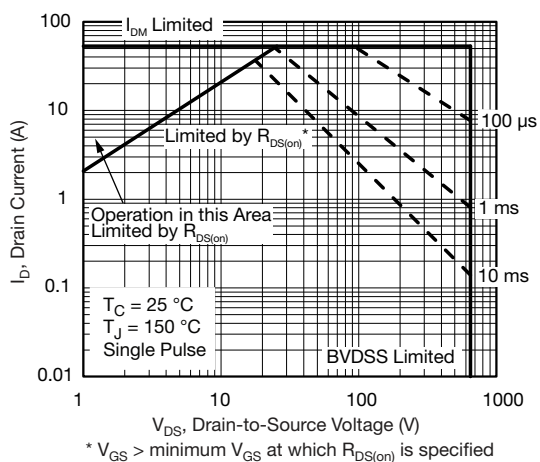


Fig. 9 - Maximum Safe Operating Area

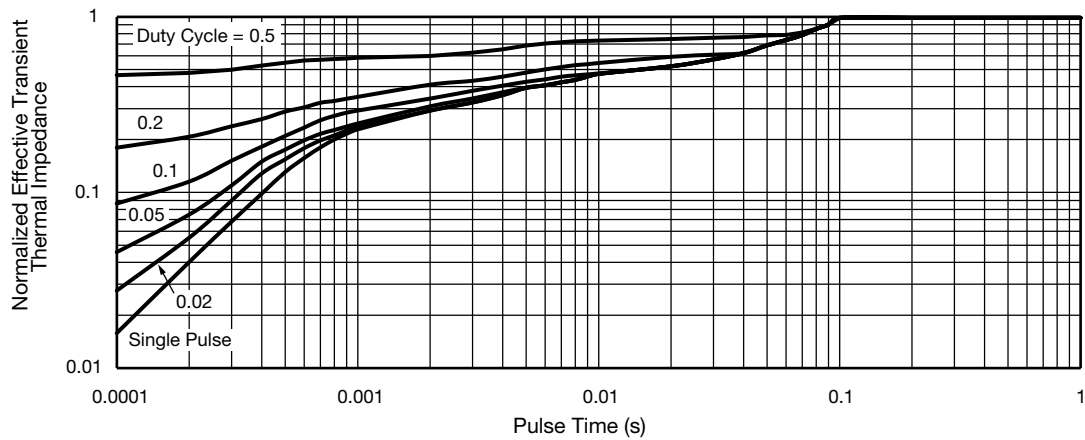


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

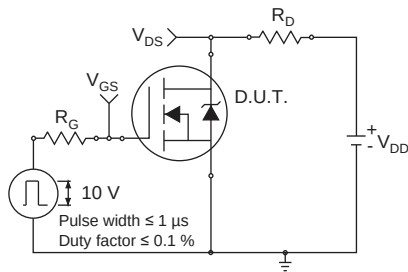


Fig. 13 - Switching Time Test Circuit

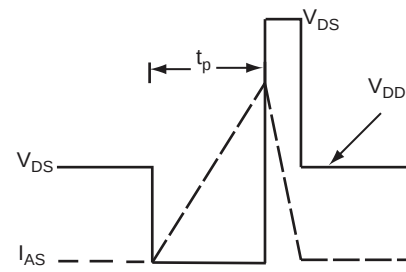


Fig. 16 - Unclamped Inductive Waveforms

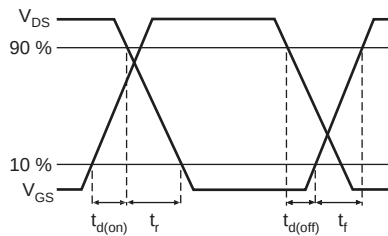


Fig. 14 - Switching Time Waveforms

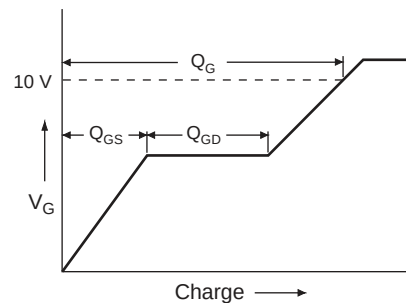


Fig. 17 - Basic Gate Charge Waveform

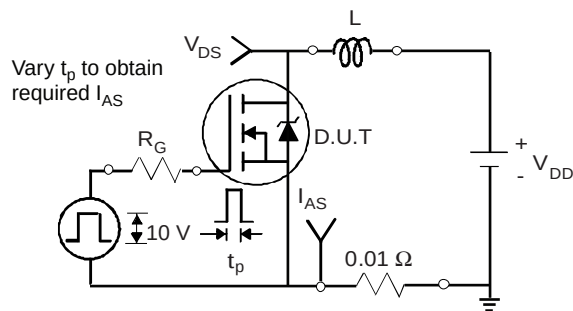


Fig. 15 - Unclamped Inductive Test Circuit

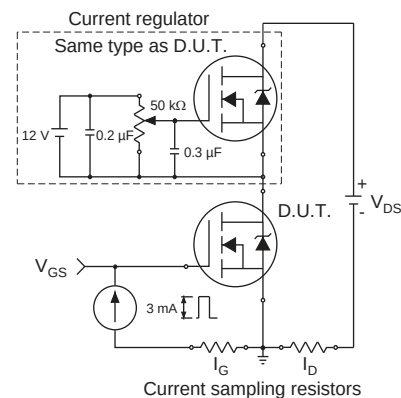
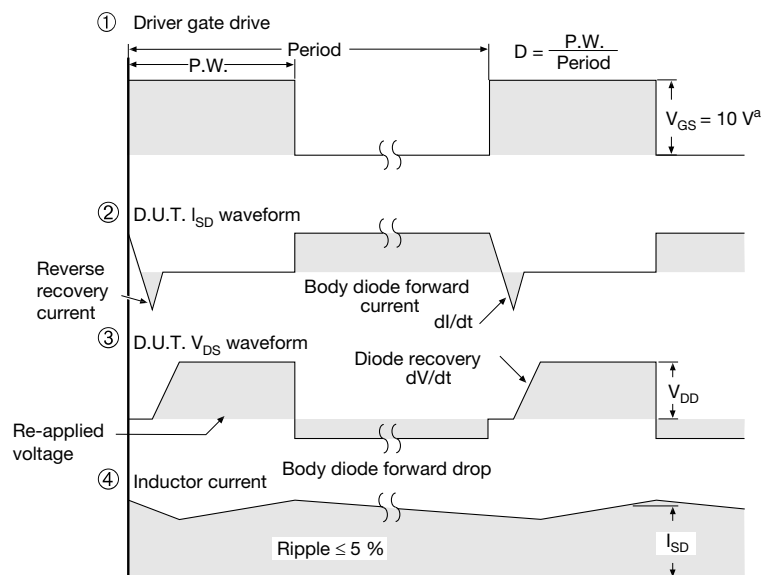
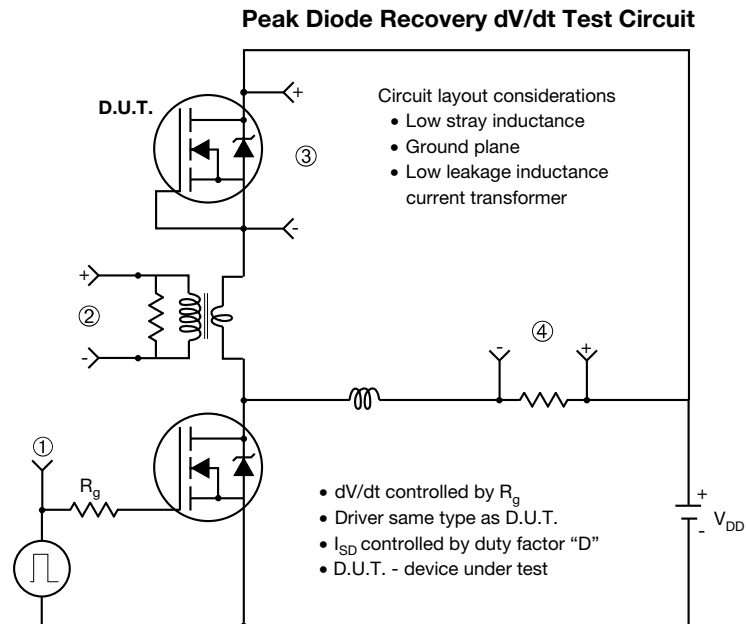


Fig. 18 - Gate Charge Test Circuit

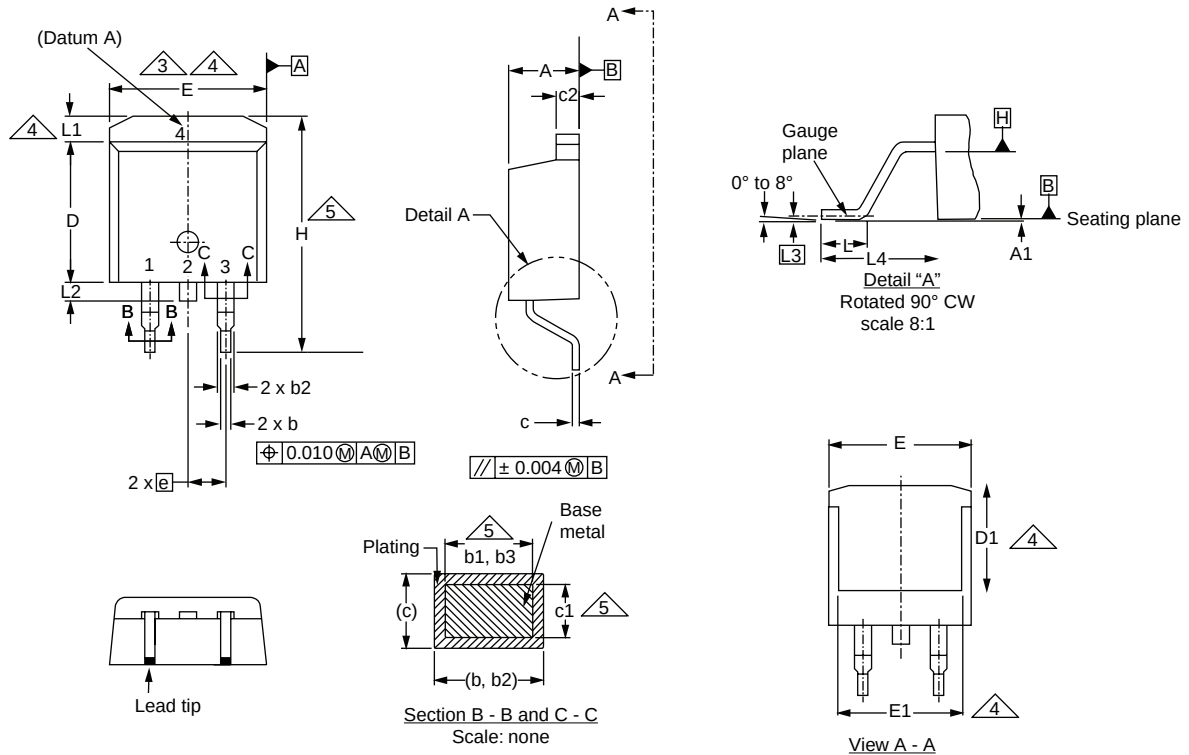


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

TO-263AB (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

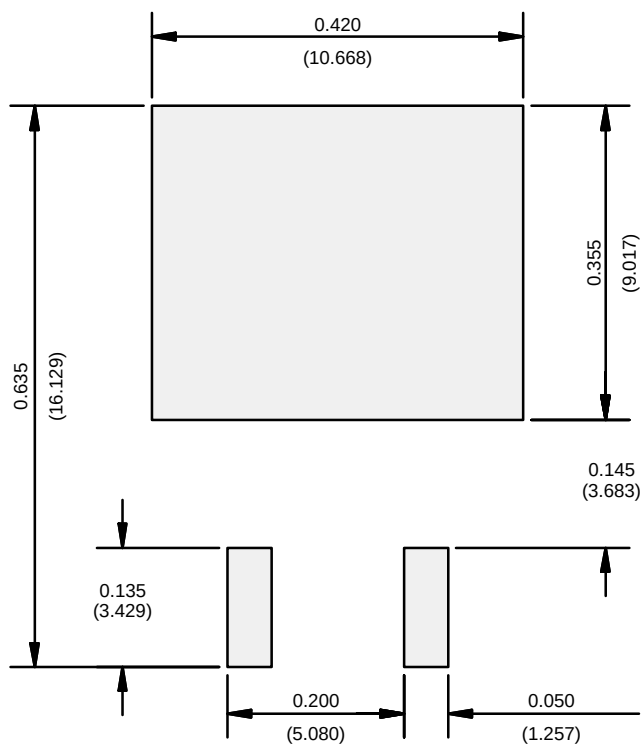
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

ECN: S-82110-Rev. A, 15-Sep-08
DWG: 5970

Notes

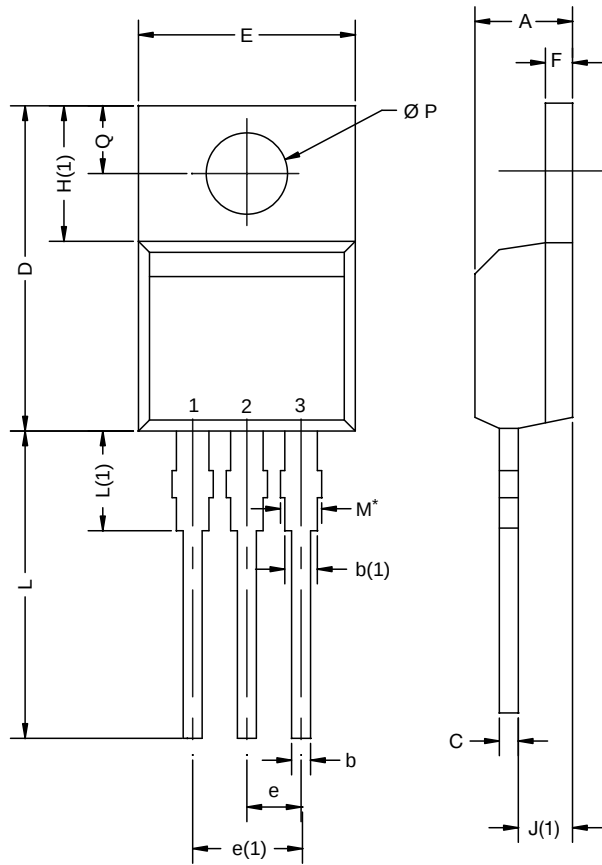
1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

TO-220AB

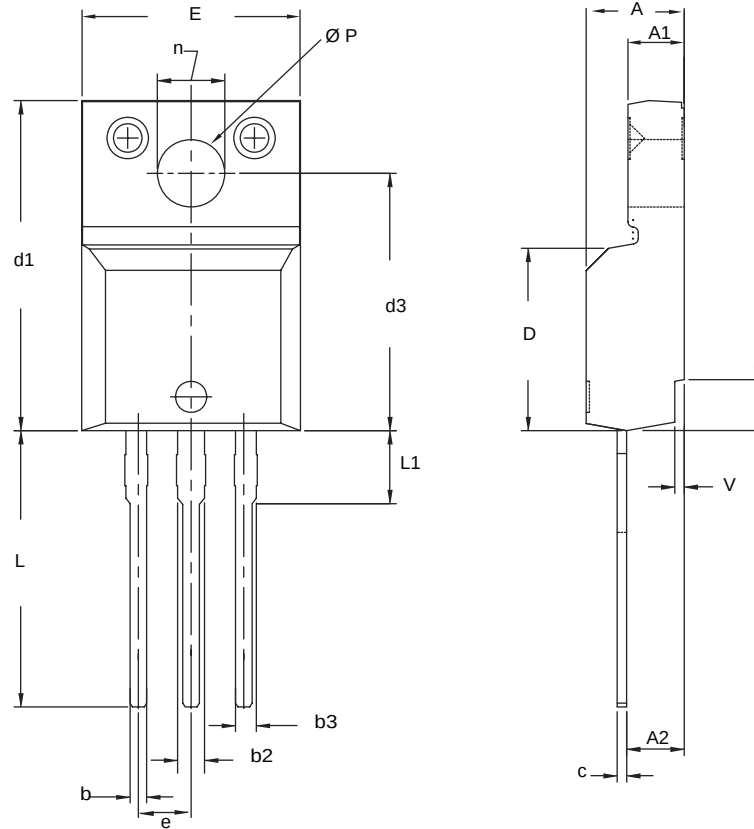


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118
ECN: X12-0208-Rev. N, 08-Oct-12 DWG: 5471				

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

TO-220 FULLPAK (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, 26-Oct-09
DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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