600V/15A Trench FS II Fast IGBT

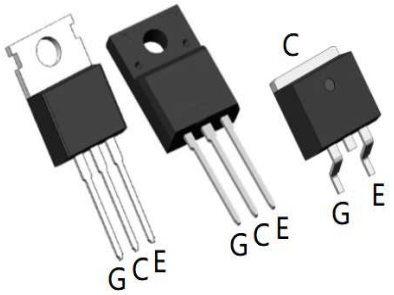
Features

* VCE=600V, IC=15A
* Trench-FSII Technology Offering:
* Very Low VCE(SAT)=1.7V (Typ.)
* High Speed Switching
* Positive Temperature Coefficient in VCE(SAT)
* Very Tight Parameter Distribution
* High Ruggedness, Temperature Stable Behavior
* TO-263-2L/TO-220-3L/TO-220F Packages

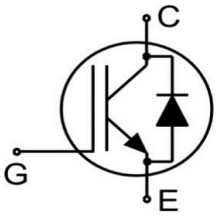
Applications

* Air Condition
* Inverters
* Motor Drivers

Pin Description and Schematic



TO-220-3L TO-220F TO-263-2L



Schematic Diagram

Package Marking And Ordering Information

Device	Marking	Device Package	Quantity
SWGB15T60T/TR	SWGB15T60T	TO-263-2L	2500pcs/reel
SWGB15T60B/BP	SWGB15T60B	TO-220-3L	1000pcs/Box
SWGB15T60F/BP	SWGB15T60F	TO-220F	1000pcs/Box

ABSOLUTE MAXIMUM RATINGS (TC = 25'C UNLESS OTHERWISE NOTED)

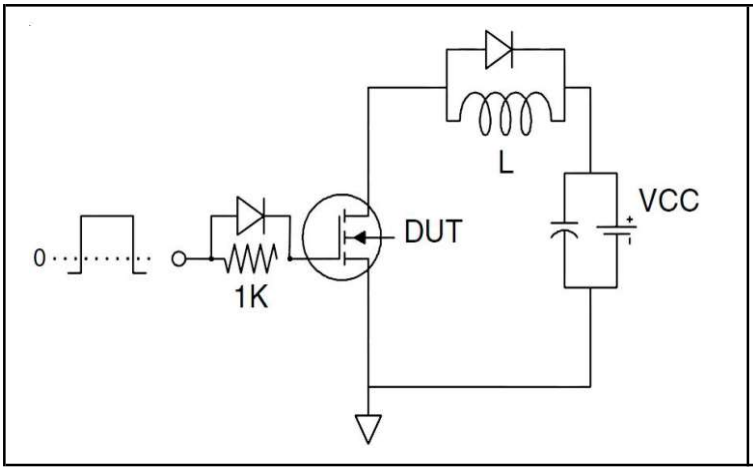
Parameter		Symbol	TO-220-3L /TO-263-2L	TO-220F	Unit
Collector-Emitter Breakdown Voltage		VCES	600		V
Gate-Emitter Voltage		VGES	±30		V
DC Collector Current, Limited by TJMAX	TC=25'C	IC	30	30*	A
	TC=100'C		15	15*	
Pulsed Collector Current, tP limited by TJMAX		Icpuls	45	45*	A
Turn off safe Operating Area VCE=600V, TJ=150'C		-	45	45*	A
Diode Continuous Forward Current @TC=100'C		IF	15	15*	A
Diode Maximum Forward Current		IFM	45	45*	A
Power Dissipation	TC=25'C	Ptot	105	34	W
	TC=100'C		42	13.6	W
Short Circuit Withstand Time, VGE=15V, VCE≤400V		TSC	3		us
Maximum Lead Temperature for Soldering Purpose		TL	260		'C
Operating Junction and Storage Temperature Range		TJ, Tstg	-55 to 150		'C
IGBT Thermal Resistance, Junction-Case		RQJC	1.19	3.67	'C/W
Diode Thernal Resistance, Junction-Case		RQJC	2.12	3.97	'C/W
Thermal Resistance, Junction-to-Ambient(Maximum)		RQJA	62	78	'C/W

Note * Pulse width ttp<=380us, δ<=2%

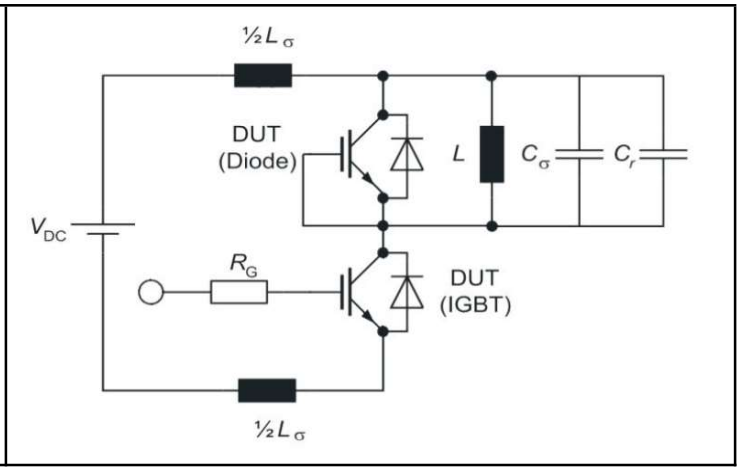
Electrical Characteristics (TA = 25'C unless otherwise noted)

Parameter	Symbol	Test Conditions	SWGB15T60B/F/T			Unit
			Min	Typ	Max	
Static Characteristics						
Collector-Emitter Breakdown Voltage	$B_{(BR)CES}$	V_{GE}=0V, I_{CE}=1mA	600	-	-	V
Collector-Emitter Leakage Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	-	-	4	uA
Gate to Emitter Forward Leakage	$I_{GES(F)}$	V_{CE}=0V, V_{GE}=+30V	-	-	100	uA
Gate to Emitter Reverse Leakage	$I_{GES(R)}$	V_{CE}=0V, V_{GE}=-30V	-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=15A, T_J=25'C	-	1.7	1.9	V
		V_{GE}=15V, I_C=10A, T_J=100'C	-	1.9	-	V
Gate-Threshold Voltage	$V_{GE(th)}$	V_{GE}=V_{CE}, I_C=1mA	4.0	5.0	6.0	V
Dynamic Characteristics						
Input Capacitance	C_{ies}	V_{CE}=25V, V_{GE}= 0V F=1MHz	-	1635	-	pF
Onput Capacitance	C_{oes}		-	50	-	
Reverse Transfer Capacitance	C_{res}		-	30	-	
Total Gate Charge	Q_g	V_{CC}=480V,I_C=15A, V_{GE}= 15V	-	63	-	nC
Gate to Emitter Charge	Q_{ge}		-	15	-	
Gate to Collector Charge	Q_{gc}		-	26	-	
Short Circuit Collector Current Max. 1000, Short Circuit Time Between short circuits:>=1S	$I_{C(SC)}$	V_{GE}=15V, t_{sc}<=3us, V_{CC}=400V, T_j<=150'C	-	82	-	A
Switching Characteristic						
Turn-On Delay Time	$t_{d(ON)}$	V_{CC}=400V,I_C=15A, V_{GE}=0/15V, R_G=5Ω, Inductive Load	-	16	-	ns
Rise Time	t_r		-	12	-	
Turn-Off Delay Time	$t_{d(OFF)}$		-	124	-	
Fall Time	t_f		-	12	-	
Turn-on Switching Loss	E_{on}		-	0.25	-	mJ
Turn-off Switching Loss	E_{off}		-	0.12	-	
Total Switching Loss	E_{ts}		-	0.37	-	
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{FM}	I_F=15A	-	1.5	1.7	V
Reverse Recovery Time	T_{rr}	I_F=15A di/dt=200A/us	-	170	-	nS
Reverse Recovery Current	I_{rrm}		-	6.5	-	A
Reverse Recovery Charge	Q_{rr}		-	0.7	-	uC
Pulse width t_{tp}<=380us, δ<=2%						

Test Circuit

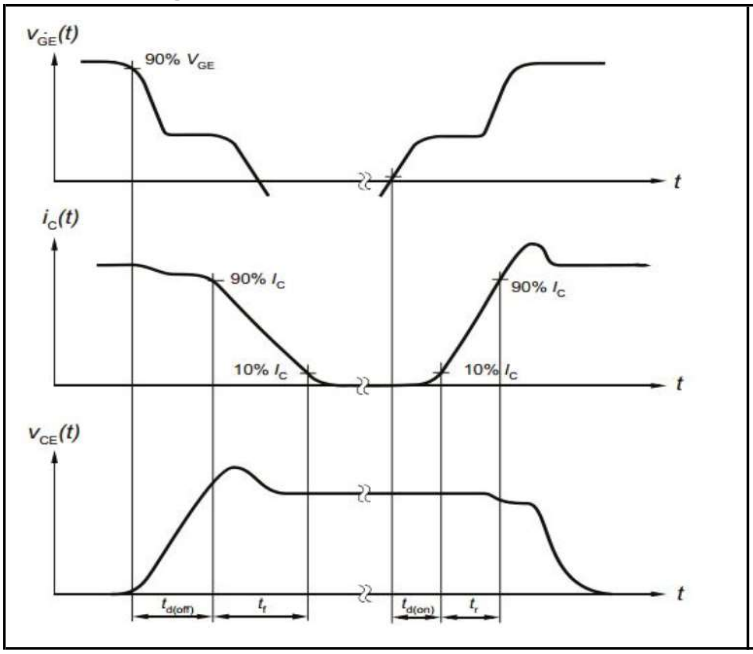


1). Gate Charge Test Circuit

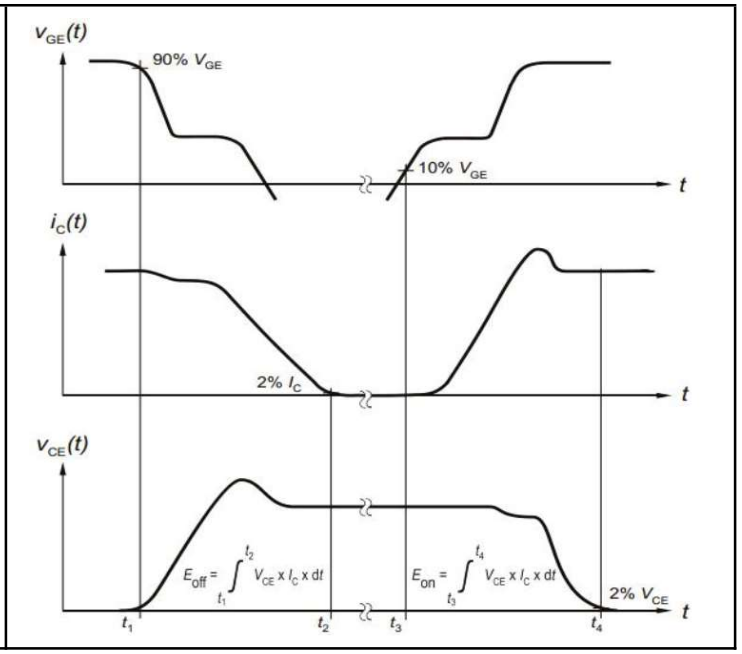


2). Switch Time Test Circuit

Switching Characteristics

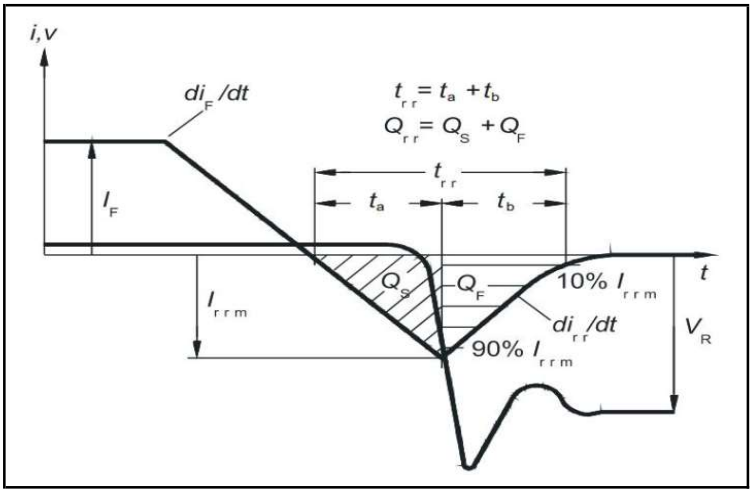


3). Definition of Switching times



4). Definition of Switching Losses

Definition of Diode Switching Characteristics



5) Definition of Diode Switching ChaDefinition of Diode Switching Characteristics

Typical Characteristics (TJ = 25'C unless otherwise noted)

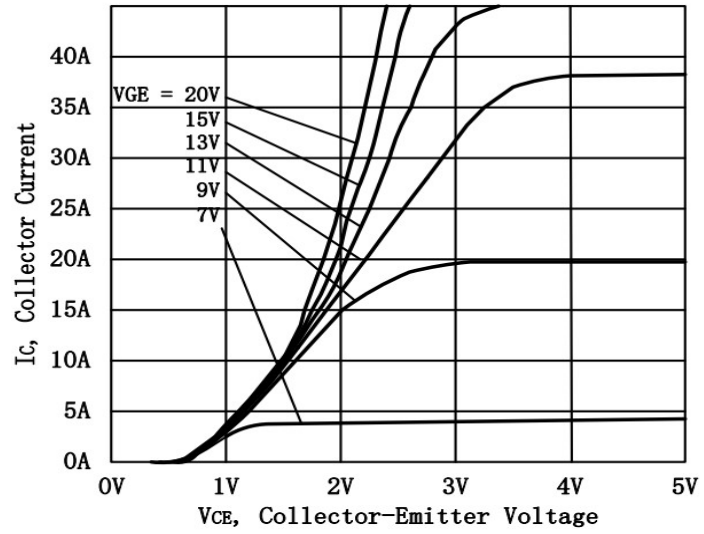


Figure. 1 Output Characteristics

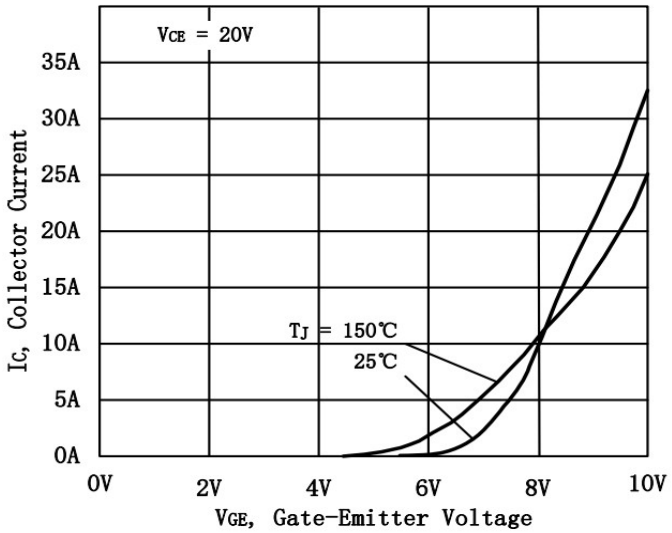


Figure. 2 Transfer Characteristics

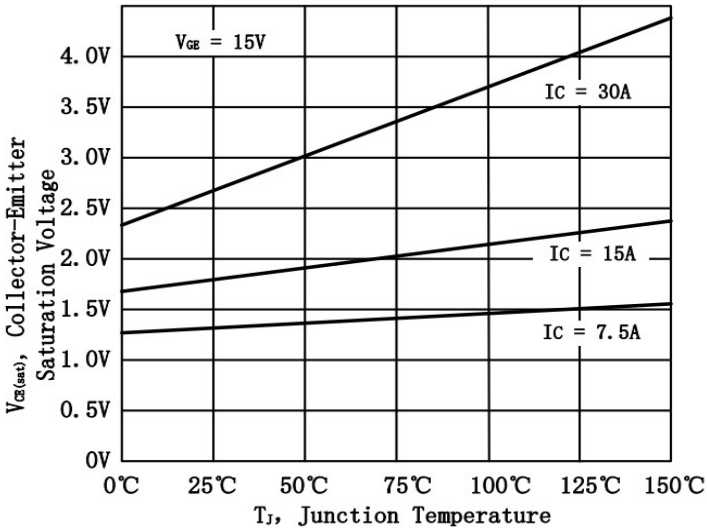


Figure. 3 VCEsat vs. Case Temperature

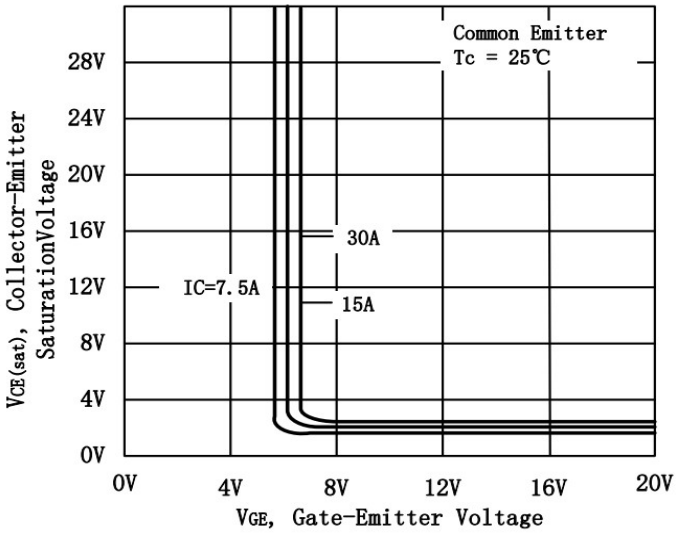


Figure. 4 Saturation Voltage vs. VGE

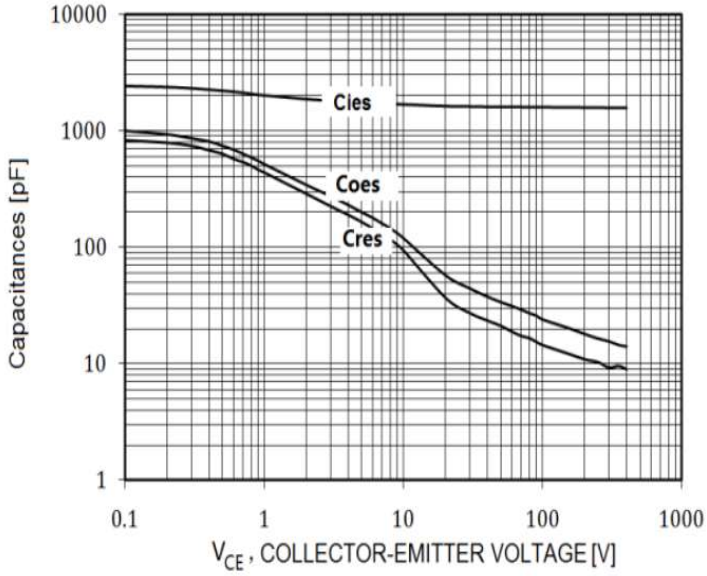


Figure. 5 Capacitance Characteristics

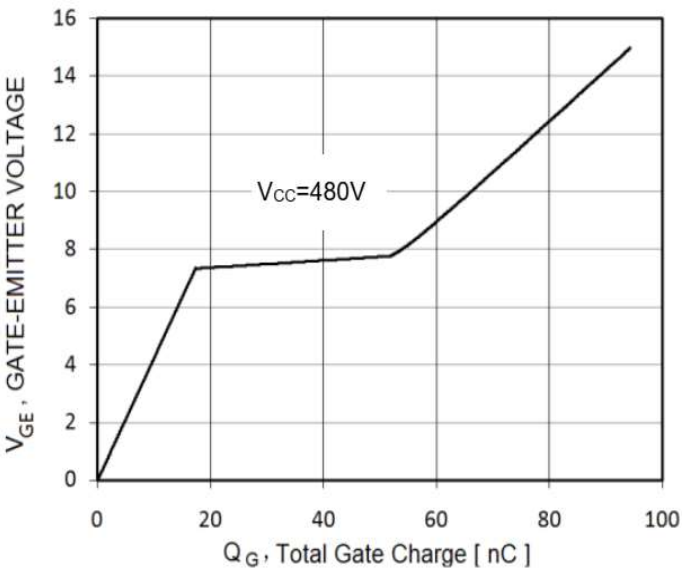


Figure. 6 Gate Charge Waveform

Typical Characteristics (Con.)

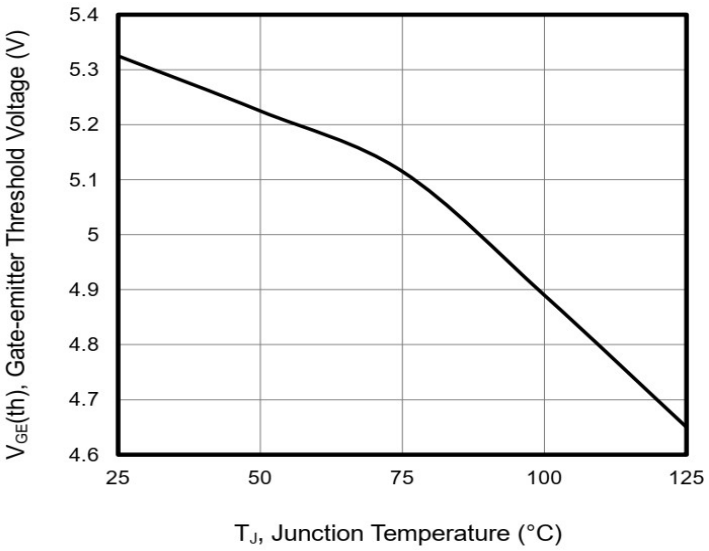


Figure. 7 Gate-emitter Threshold Voltage as a Function of Junction Temperature

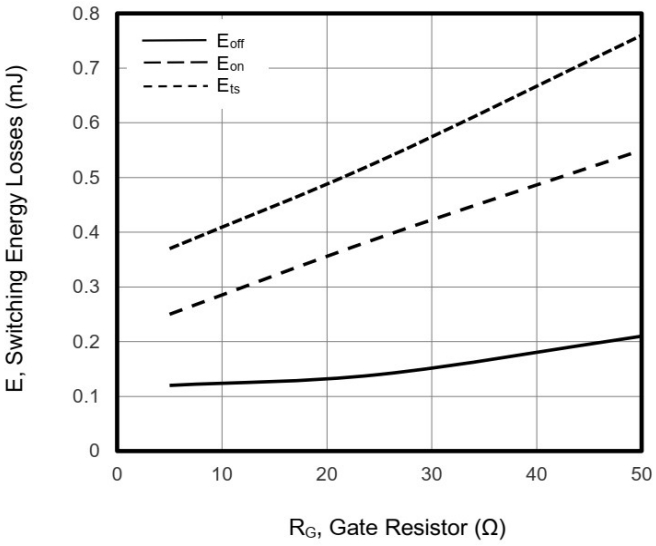


Figure. 8 Typical Switching Times as a Function of Gate Resistor

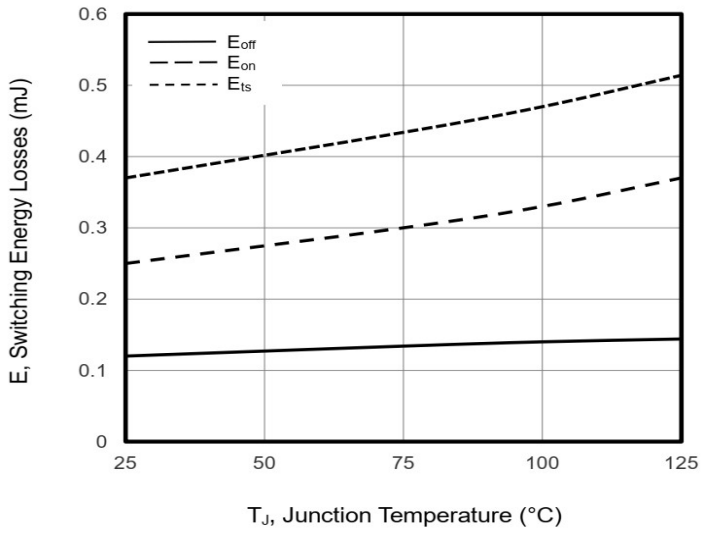


Figure. 9 Typical Switching Times as a function of Junction Temperature

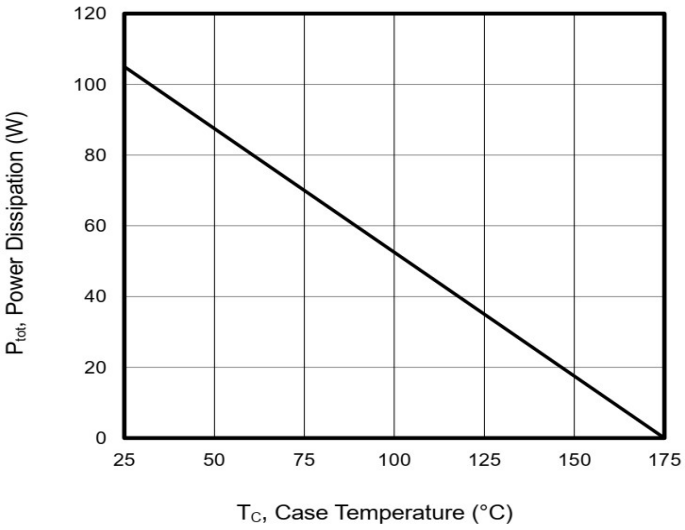


Figure. 10 Power Dissipation as a function of Case Temperature

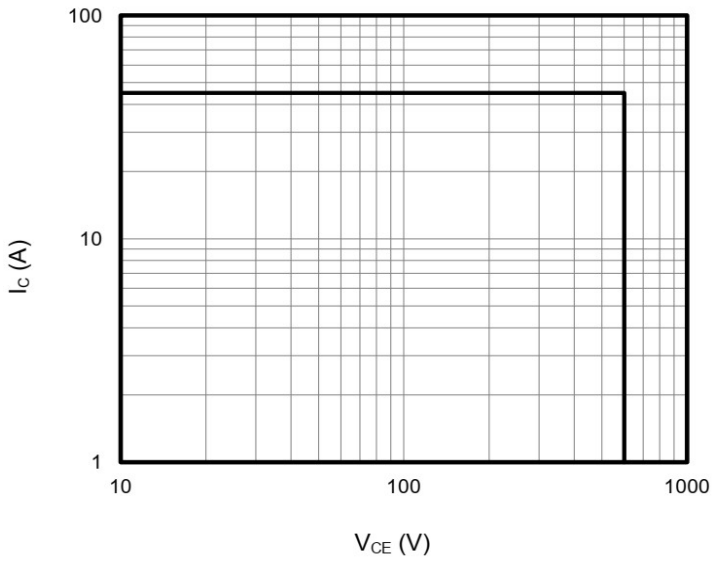


Figure. 11 Reverse Bias SOA

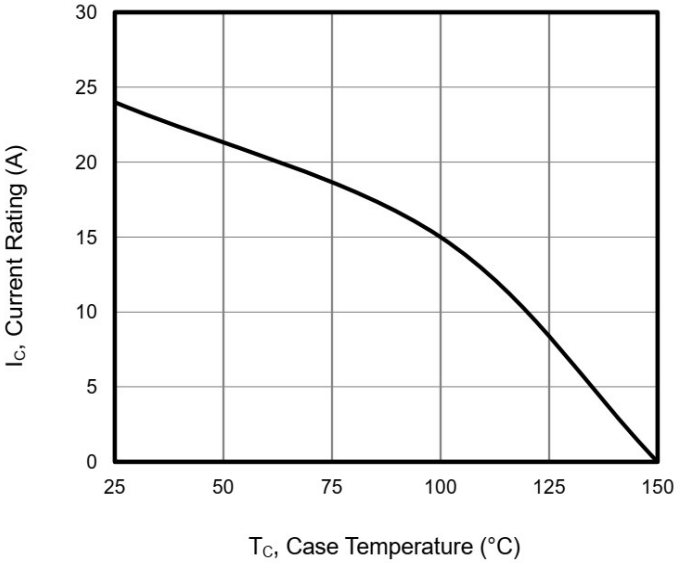


Figure. 12 Current De-rating

Typical Characteristics (Con.)

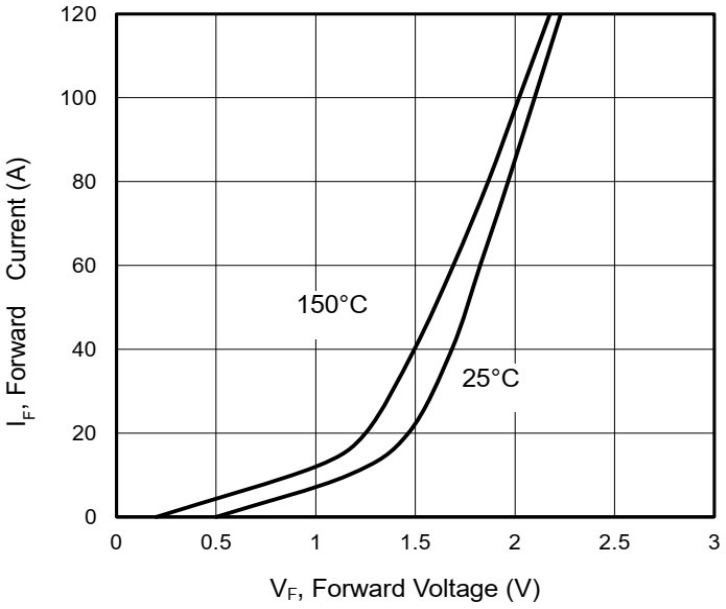


Figure. 13 Forward Characteristics

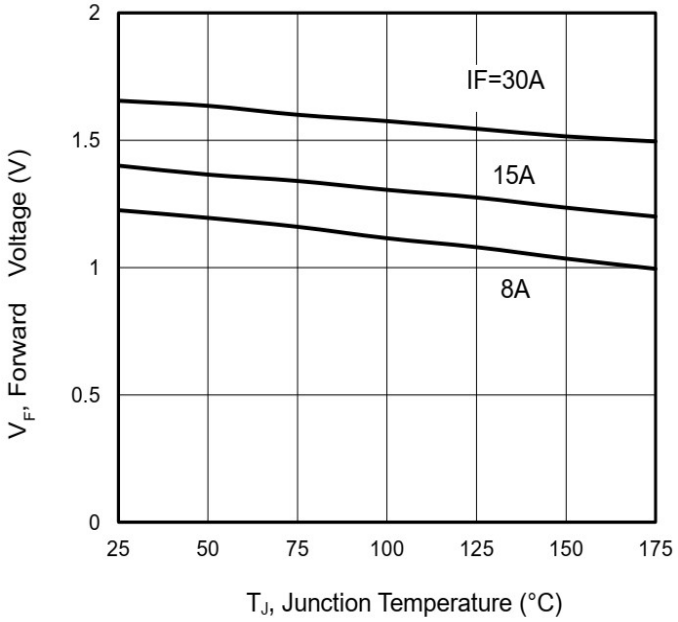
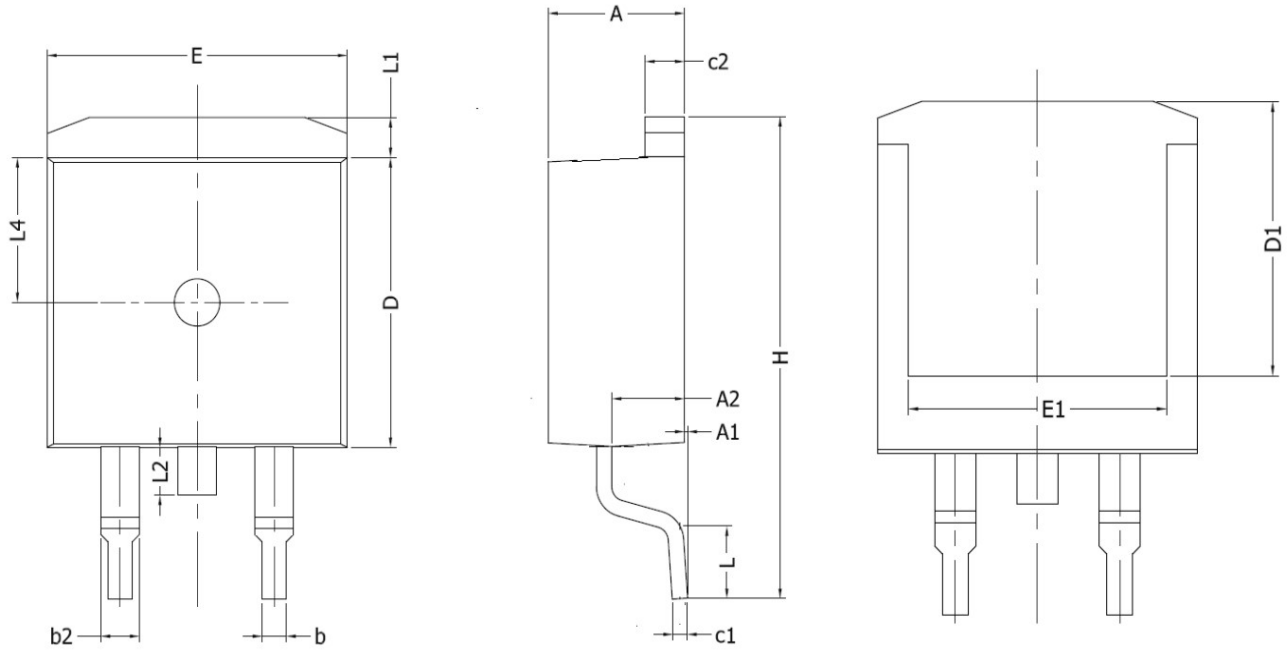


Figure. 14 VF vs. temperature

Packaging Information

(T) PKG: TO-263-2LPackage

unit : mm

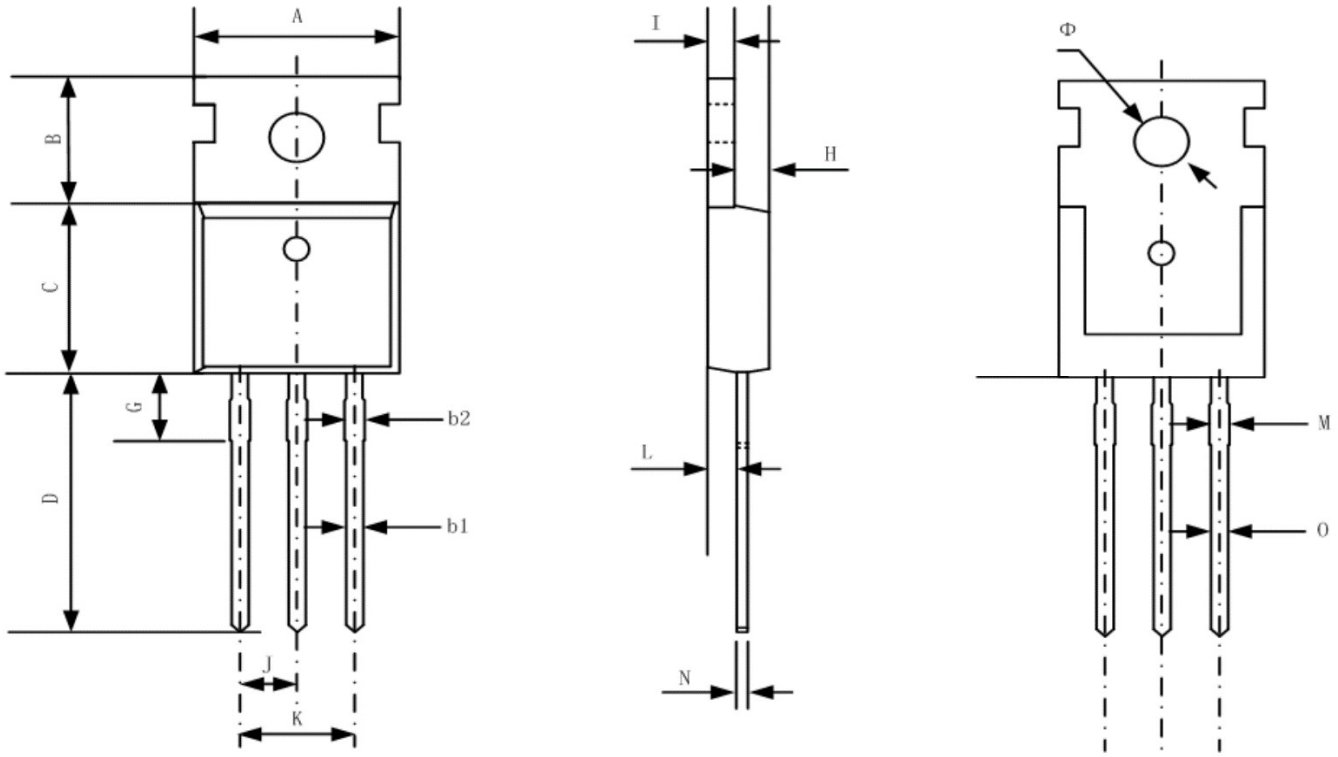


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.17	0.18
A1	0.00	0.25	0.00	0.01
A2	2.20	2.60	0.09	0.10
b	0.76	0.89	0.03	0.04
b2	1.23	1.37	0.05	0.05
C	0.47	0.60	0.02	0.02
c1	0.46	0.56	0.02	0.02
c2	1.25	1.35	0.05	0.05
D	0.91	0.93	0.04	0.04
D1	8.00	-	0.31	-
E	9.80	10.00	0.39	0.39
E1	7.80	-	0.31	-
e	2.54BSC		0.10BSC	
H	14.90	15.70	0.59	0.62
L	2.00	2.60	0.08	0.10
L1	1.17	1.40	0.05	0.06
L2	-	1.75	-	0.07
L4	4.60REF		0.18REF	

Packaging Information (Con.)

(B) PKG: TO-220-3L Package

unit : mm

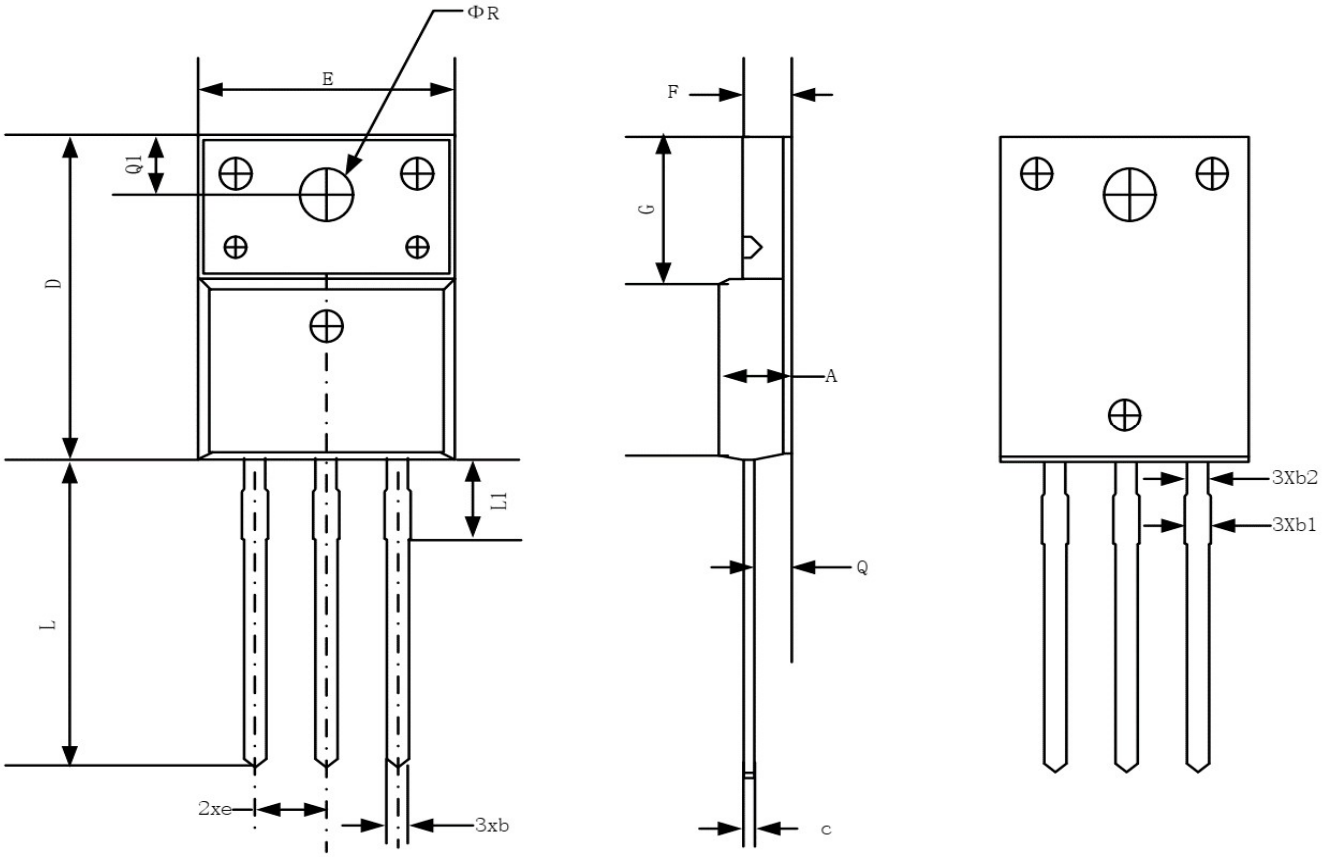


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.70	10.20	0.38	0.40
B	6.30	6.70	0.25	0.26
C	9.00	9.47	0.35	0.37
D	12.78	13.38	0.50	0.53
G	2.65 REF		0.104 REF	
H	3.00	3.40	0.12	0.13
I	1.25	1.40	0.05	0.06
J	2.40	2.70	0.09	0.11
K	5.00	5.15	0.20	0.20
L	2.20	2.60	0.09	0.10
M	1.25	1.45	0.05	0.06
N	0.45	0.60	0.02	0.02
O	0.70	0.90	0.03	0.04
Φ	3.6 REF		0.142 REF	

Packaging Information (Con.)

(F) PKG: TO-220F Package

unit : mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.83	0.18	0.19
b	0.70	0.91	0.03	0.04
b1	1.20	1.47	0.05	0.06
b2	1.10	1.38	0.04	0.05
c	0.45	0.63	0.02	0.02
D	15.67	16.07	0.62	0.63
e	2.54 BSC		0.10 BSC	
E	9.96	10.36	0.39	0.41
F	2.34	2.74	0.09	0.11
G	6.48	6.90	0.26	0.27
L	12.68	13.30	0.50	0.52
L1	3.13	3.50	0.12	0.14
Q	2.56	2.93	0.10	0.12
Q1	3.20	3.40	0.13	0.13
ΦR	3.08	3.28	0.12	0.13