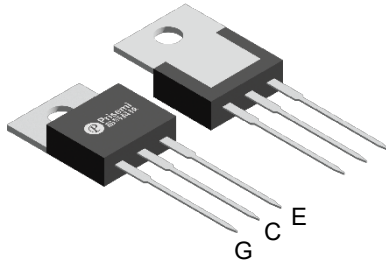
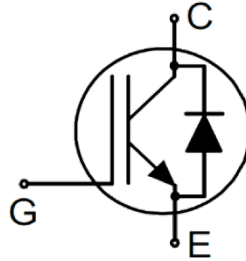
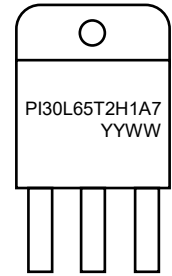


Insulate-Gate Bipolar Transistor
Description

TO-220

Circuit Diagram

Marking (Top View)
Features

- High Ruggedness Performance
- 10μs Short Circuit Capability
- Positive $V_{CE(sat)}$ Temperature Coefficient
- High Efficiency for Motor Control
- Excellent Current Sharing in Parallel Operation
- RoHS Compliant

Applications

- Home Appliances
- General Inverter
- Motor Drives

Absolute maximum rating@25°C

Parameter		Symbol	Value	Units
Collector-Emitter Voltage		V_{CE}	650	V
Gate-Emitter Voltage		V_{GE}	± 20	V
Collector Current	$T_c = 25^\circ\text{C}$	I_C	60	A
	$T_c = 100^\circ\text{C}$		30	
Pulsed Collector Current		I_{CM}	120	A
Diode Current	$T_c = 100^\circ\text{C}$	I_F	30	A
Diode Pulsed Current		I_{FM}	80	A
Power Dissipation	$T_c = 25^\circ\text{C}$	P_D	187	W
	$T_c = 100^\circ\text{C}$		93	
Operating Junction Temperature		T_{VJ}	-40~+175	°C
Storage Temperature		T_{STG}	-55~+150	°C
Short circuit time		T_{SC}	10	us

Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE}=0V, I_{CE}=250\mu A$	650	-	-	V	
C-E Leakage Current	I_{CES}	$V_{GE}=0V, V_{CE}=650V$	-	-	50	μA	
G-E Leakage Current	I_{GES}	$V_{GE}=20V$	-	-	100	nA	
		$V_{GE}=-20V$	-	-	-100		
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	5.3	5.7	5.9	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=30A, V_{GE}=15V$	$T_{VJ}=25^\circ C$	-	1.7	-	V
			$T_{VJ}=175^\circ C$	-	2.2	-	
Diode forward voltage	V_F	$I_C=30A$	$T_{VJ}=25^\circ C$	-	1.4	-	V
			$T_{VJ}=175^\circ C$	-	1.2	-	
Input Capacitance	C_{ies}	$V_{CE}=30V, V_{GE}=0V, f=1MHz$	-	1978	-	pF	
Output Capacitance	C_{oes}		-	100	-		
Reverse Transfer Capacitance	C_{res}		-	23	-		
Total Gate Charge	Q_g	$V_{CC}=520V, I_C=30A, V_{GE}=15V$	-	103	-	nC	
Turn-on Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=30A, V_{GE}=15V, R_G=10\Omega, \text{Inductive Load}$	-	30	-	ns	
Rise Time	t_r		-	39	-		
Turn-off Delay Time	$t_{d(off)}$		-	151	-		
Fall Time	t_f		-	29	-		
Turn-on Energy Loss	E_{on}	$V_{CC}=400V, I_C=30A, V_{GE}=15V, R_G=10\Omega, \text{Inductive Load}$	-	0.95	-	mJ	
Turn-off Energy Loss	E_{off}		-	0.60	-		
Total Switching Loss	E_{st}		-	1.55	-		
Diode Reverse Recovery Time	T_{rr}	$V_R=400V, I_F=30A, di/dt=550A/\mu s$	-	105	-	ns	
Diode Reverse Recovery Charge	Q_{rr}		-	876	-	nC	
Diode Reverse Recovery Current	I_{rm}		-	16	-	A	

Insulate-Gate Bipolar Transistor

PI30L65T2H1A7

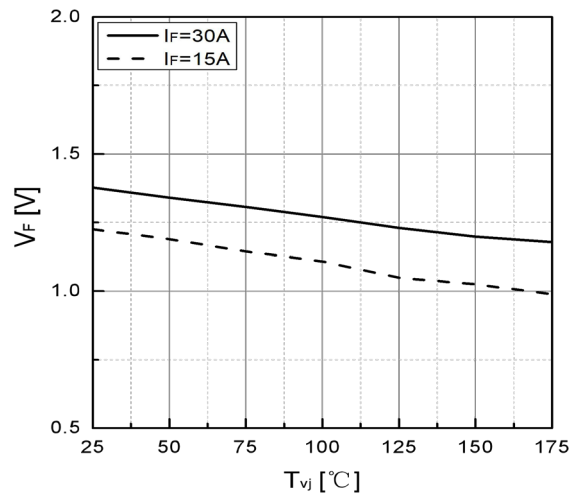
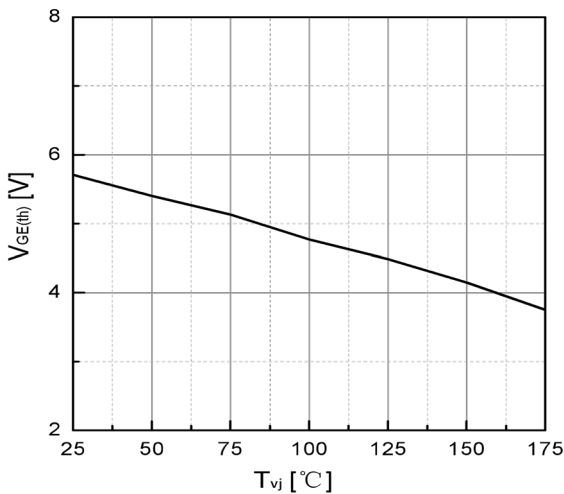
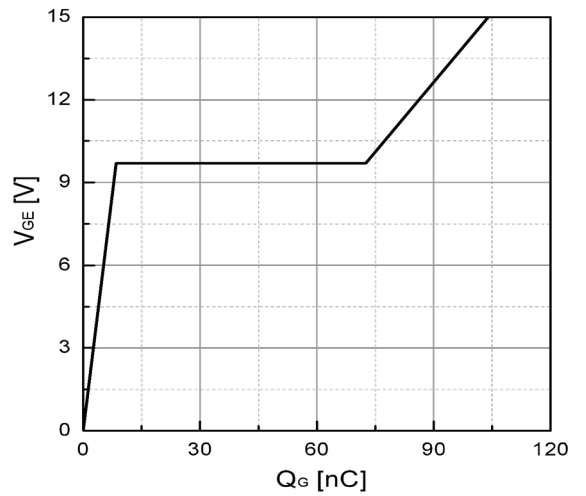
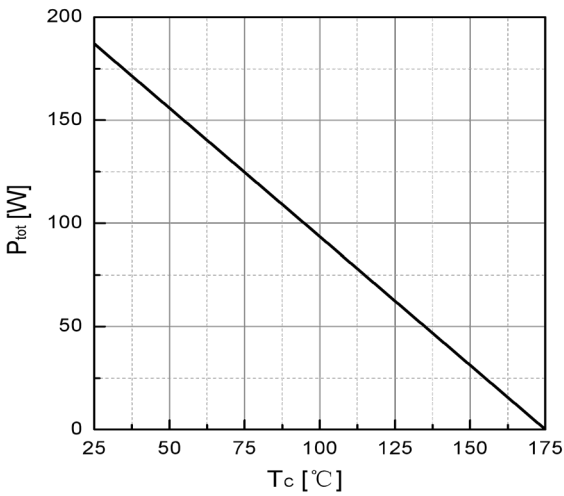
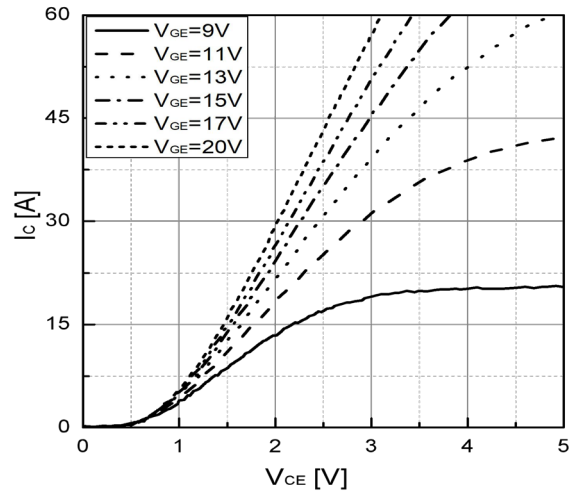
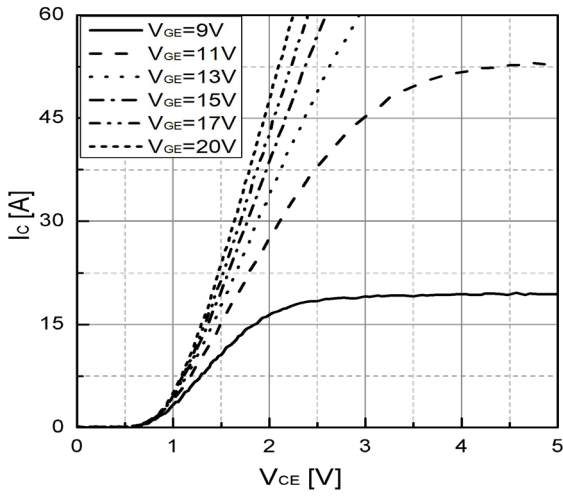
Electrical characteristics per line@175°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Turn-on Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=30A,$ $V_{GE}=15V, R_G=10\Omega,$ Inductive Load	-	28	-	ns
Rise Time	t_r		-	40	-	
Turn-off Delay Time	$t_{d(off)}$		-	169	-	
Fall Time	t_f		-	71	-	
Turn-on Energy Loss	E_{on}	$V_{CC}=400V, I_C=30A,$ $V_{GE}=15V, R_G=10\Omega,$ Inductive Load	-	1.5	-	mJ
Turn-off Energy Loss	E_{off}		-	0.8	-	
Total Switching Loss	E_{st}		-	2.3	-	
Diode Reverse Recovery Time	T_{rr}	$V_R=400V, I_F=30A,$ $di/dt=550A/\mu s$	-	171	-	ns
Diode Reverse Recovery Charge	Q_{rr}		-	2650	-	nC
Diode Reverse Recovery Current	I_{rm}		-	26	-	A

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Units
Thermal Resistance, IGBT Junction-Ambient	$R_{th(J-A)}$	-	-	40	K/W
Thermal Resistance, IGBT Junction to Case	$R_{th(J-C)}$	-	-	0.8	K/W
Thermal Resistance, FRD Junction to Case	$R_{th(J-C)}$	-	-	1.8	K/W

Typical Characteristics



Typical Characteristics

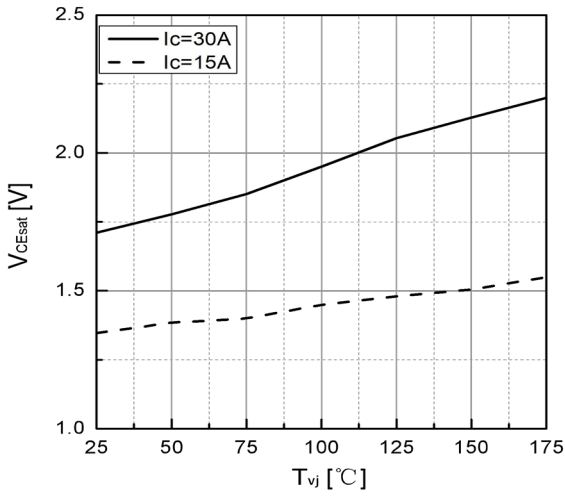


Fig 7. Typical V_{CEsat} vs T_{VJ}

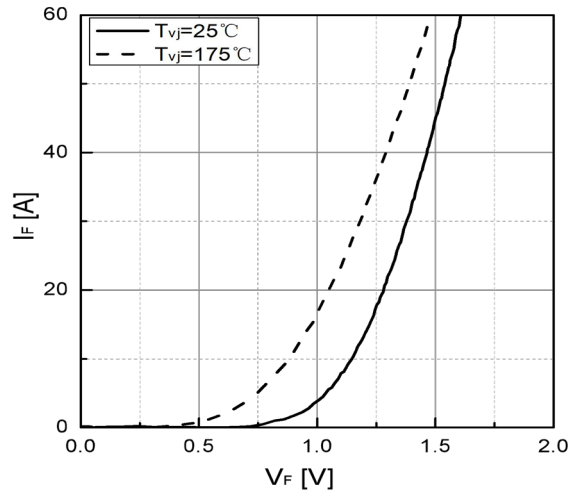


Fig 8. Typical I_F vs V_F

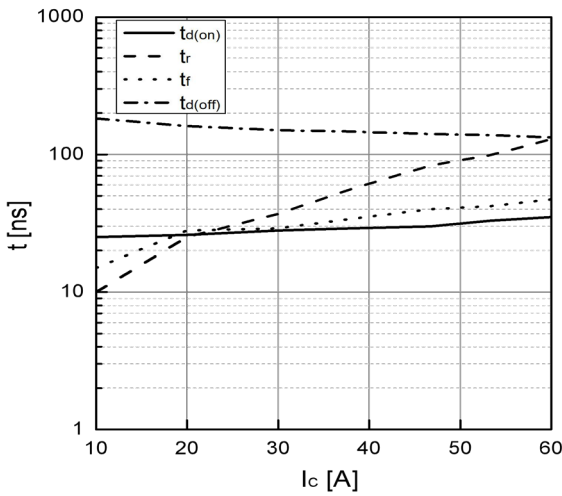


Fig 9. Typical switching time vs I_c

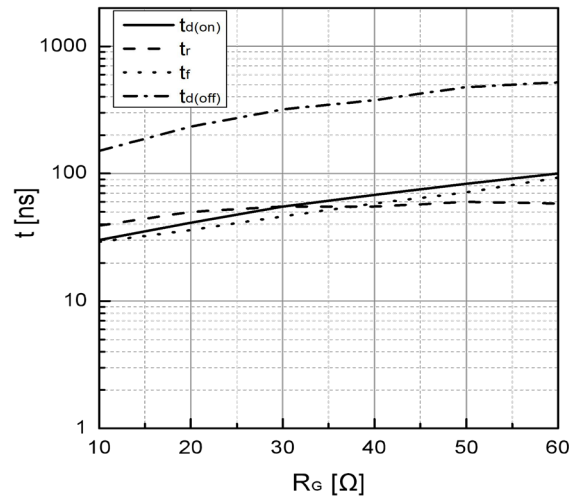


Fig 10. Typical switching time vs R_G

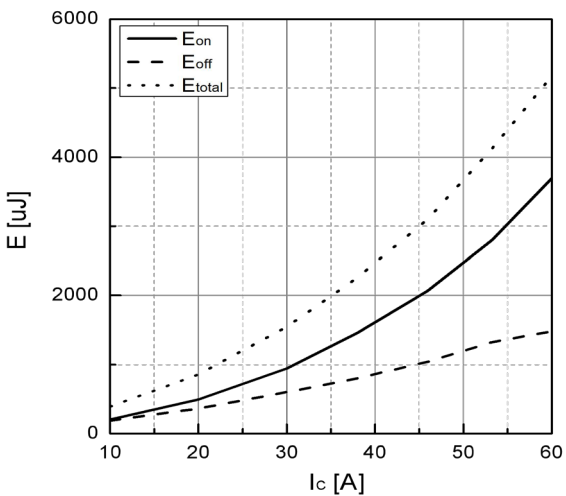


Fig 11. Typical switching energy losses vs I_c

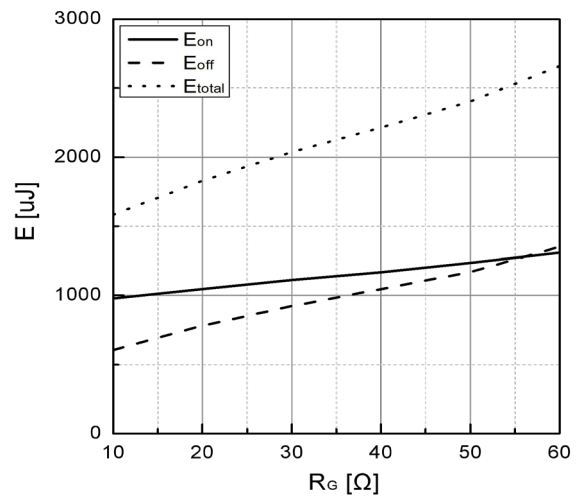
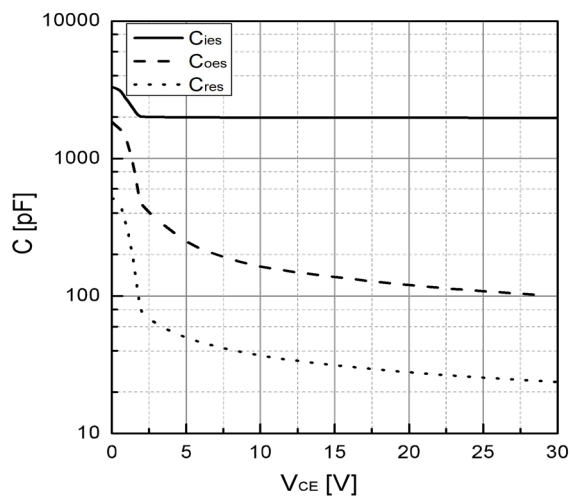


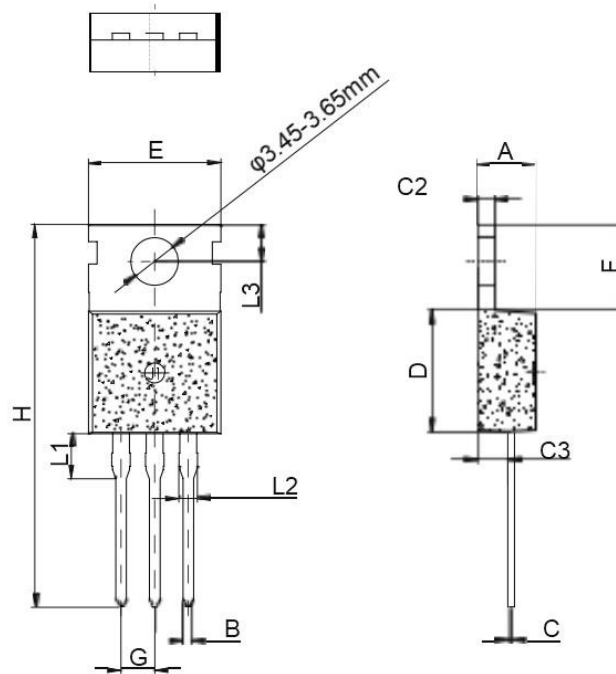
Fig 12. Typical switching energy losses vs R_G

Typical Characteristics




**Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)**

Product Dimension (TO-220)



Dim	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40	-	4.60	0.173	-	0.181
B	0.70	-	0.90	0.028	-	0.035
C	0.45	-	0.60	0.018	-	0.024
C2	1.23	-	1.32	0.048	-	0.052
C3	2.20	-	2.60	0.087	-	0.102
D	8.90	-	9.90	0.350	-	0.390
E	9.90	-	10.3	0.390	-	0.406
F	6.30	-	6.90	0.248	-	0.272
G	-	2.54	-	-	0.100	
H	28.0		29.8	1.102	-	1.173
L1	-	3.39	-	-	0.133	
L2	1.14	-	1.70	0.045	-	0.067
L3	2.65	-	2.95	0.104	-	0.116


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